



HEARTBEAT FITNESS REPAIR

BIOMEDICAL DIVISION • CLINICAL CALIBRATION & SAFETY PROTOCOL

Factory-trained biomedical engineering for hospital, clinical & commercial fitness equipment

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Clinical Calibration & Safety Protocol

Standard Operating Procedure for Elliptical, Cross-Trainer & Recumbent Stepper Equipment

DOCUMENT ID: HFR-SOP-BIO-006

REVISION: 2.1 (Clinical Grade)

EFFECTIVE DATE: August 2026

SERVICE REGION: Tampa Bay Metro

STANDARDS: Clinical PM & Audit Trail

1. CLINICAL GOVERNANCE & PATIENT SAFETY MANDATE

In cardiac and orthopedic rehabilitation environments, low-impact ellipticals and recumbent steppers (including NuStep and SciFit clinical units) deliver a prescribed resistance workload calibrated to a patient's target Metabolic Equivalent of Task (MET) and heart rate zone. A resistance system drawing 12 watts of actual output when the console indicates 10 watts alters the patient's real cardiovascular workload beyond their clinician-set threshold, introducing unmonitored strain and invalid diagnostic data. Heartbeat's Biomedical Division enforces rigid dual-reading tolerances (As-Found vs. As-Left) to ensure all facility resistance systems maintain hospital-grade calibration and liability compliance.

2. FOUR-STEP BIOMEDICAL PREVENTIVE MAINTENANCE & CALIBRATION PROTOCOL

STEP 1 Baseline Specification Mapping

Identify machine OEM factory tolerance thresholds from clinical service documentation. Benchmark target parameters including resistance/watt curves, electromagnetic brake air-gap spec, and stride pivot tolerances.

STEP 2 Multi-Point Operational Dynamic Verification

Perform dynamic physical testing across graduated resistance tiers: verify actual watt output against console display at low, medium, and high resistance levels. Confirm stride motion carries zero lateral play at the arm and stabilizer pivots.

STEP 3 Dual-Reading Calibration & Mechanical Alignment

Where resistance output has drifted beyond permissible clinical thresholds ($\pm 3\%$ watt accuracy), enter console engineering mode to adjust brake air gap and recalibrate the resistance potentiometer. Both As-Found and As-Left readings are formally recorded.

STEP 4 Clinical Audit Trail & Certification Sign-Off

Affix tamper-evident calibration certification tags with asset ID, technician initials, and due date. Generate a digital service report cataloging resistance accuracy, pivot bushing wear, and grounding integrity.

CRITICAL CLINICAL ACCEPTANCE TOLERANCES

- **Resistance / Watt Accuracy:** $\pm 3\%$ of console-indicated output across full range
- **Stride Lateral Play:** Zero measurable play at arm and stabilizer pivots
- **Sensor Air Gap:** 1.5 mm to 2.5 mm brake-to-flywheel clearance, no physical contact

SAFETY CONDEMNATION CRITERIA: Any device exhibiting grounding resistance $> 0.5 \Omega$, measurable lateral play at the main stride pivot, or failing emergency stop response must be immediately tagged CONDEMNED / OUT OF SERVICE.

- **Emergency Braking:** Immediate stop response, < 1.5 sec shutoff on E-stop or handle release
- **Electrical Grounding:** Direct dedicated circuit; strictly zero GFCI nuisance trips
- **Pivot Bushing Wear:** Zero measurable lateral play at full stride extension

● 3. STEP-BY-STEP TECHNICAL CONSOLE CALIBRATION SEQUENCE (RESISTANCE SYSTEMS)

STEP	PROCEDURAL ACTION & CONSOLE INTERACTION	VERIFICATION PARAMETER	TECHNICAL TOLERANCES & NOTES
1	Enter Calibration Mode: Power down fully. Press & hold [Mode] and [Resistance +] simultaneously, then power on.	Console displays 'Engineering Mode' or flashes a service prompt.	Confirm unit is fully unloaded before entering calibration.
2	Configure Resistance Units: Toggle to select Watts or resistance-level display.	Display shows 'Watts' or programmed level scale.	Must match hospital protocol resistance units.
3	Verify Brake Air Gap: Remove access panel; measure brake-to-flywheel clearance with a feeler gauge.	Gap measures within 1.5 mm to 2.5 mm.	Gap drift is the leading cause of silent resistance error.
4	Set Resistance Range: Confirm minimum and maximum programmable resistance levels against OEM spec.	Displays 'Min Level' then 'Max Level' matching spec.	Critical for low-resistance cardiac rehab protocols.
5	Execute Automated Self-Calibration: Press [Start]. Unit cycles through resistance tiers automatically.	Resistance ramps through low, medium, and max levels in sequence.	Takes 60–120 seconds; do not interrupt the cycle.
6	Apply Calibrated Load Verification: Use a calibrated watt meter at each tier; compare to console-displayed value.	Reading within ±3% of console-indicated output at all tiers.	Document As-Found value before any adjustment.
7	Verify Pivot & Stabilizer Play: Grip each arm and pedal; check for lateral movement at full extension.	Zero measurable play at any pivot point.	Any play detected requires bushing service before sign-off.

● 4. CLINICAL FIELD VERIFICATION CHECKLIST & EQUIPMENT AUDIT LOG

ASSET ID / TAG	EQUIPMENT MAKE & MODEL	SERIAL NUMBER	PIVOT PLAY	GROUNDING (<0.5Ω)	AS-FOUND RESISTANCE	AS-LEFT RESISTANCE	CLINICAL STATUS
PT-ER-01	NuStep Recumbent Stepper	NS-T5XR-410	✓ PASS	0.10 Ω PASS	Level 4: -12W	Calibrated ±2W	CERTIFIED
PT-EL-02	SciFit Recumbent Elliptical	SF-E7-2291	✓ PASS	0.14 Ω PASS	18W / drift +9%	20W / ±2%	CERTIFIED
PT-EL-05	Precor EFX Cross-Trainer	PC-EFX-8814	Play at 0.4mm	0.09 Ω PASS	22W / drift +6%	Bushing replaced	TAGGED / OK
[Blank Log]			[] PASS [] FAIL	___ Ω [] PASS	___ W	___ W	[] PASS [] COND

LEAD BIOMEDICAL FIELD ENGINEER

Name: _____

Certification ID: _____

Signature: _____

HOSPITAL / FACILITY CLINICAL DIRECTOR

Facility Name: _____

Authorizing Sign: _____

Inspection Date: _____

CALIBRATION AUDIT TRAIL STATUS

Compliance: Annual PM Protocol Complete

Next Due Date: _____

Emergency Dispatch: 727-512-5120

SCHEDULE CERTIFIED BIOMEDICAL SERVICE

Heartbeat Fitness Repair's Biomedical Division performs this full calibration and safety protocol on-site, with a complete clinical audit trail for facility compliance records.

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