



StairMaster Stepper/Freeclimber Technical Manual



Important Safety Information

The following pages are intended to educate service technicians on the basic maintenance and service actions for the StairMaster Stepper / Freeclimber. By following the enclosed instructions and maintenance schedule, you will extend the life of your equipment and help ensure it will withstand hours of use in your home/facility.

Before working on this equipment, pay attention to the following warnings:

- Read and understand the complete Owner's Manual.
- Keep Owner's Manual for future reference.
- Read and understand all warnings on this machine. If at any time the Warning stickers become loose, unreadable or dislodged, contact Customer Service for replacement stickers.
- Keep children away from this machine. Monitor them closely when near the machine. Parts that move and appear dangerous to adults can appear safe to children.
- Consult a physician before you start an exercise program. Stop exercising if you feel pain or tightness in your chest, become short of breath, or feel faint. Contact your doctor before you use the machine again. Use the values calculated or measured by the machine's computer for reference purposes only.
- Before each use, examine this machine for loose parts or signs of wear. Do not use if found in this condition. Pay special attention to the steps. Contact Customer Service for repair information.
- Maximum user weight limit: 350lbs. (159kgs). Do not use if you are over this weight.
- Do not wear loose clothing or jewelry. This machine contains moving parts.
- Set up and operate this machine on a solid, level, horizontal surface.
- Do not step off the machine until the Steps have fully stopped.
- Do not operate this machine outdoors or in moist or wet locations.
- Keep at least 19.7"(0.5m) on each side of the machine clear. This is the recommended safe distance for access and passage around and emergency dismounts from the machine. Keep third parties out of this space when machine is in use.
- Do not over exert yourself during exercise. Operate the machine in the manner described in this manual.
- When the machine is put in a studio or club environment, it can only be used in areas where access and control of the machine is managed by approved staff. The degree of management depends on the user's ability to recognize and prevent danger to third parties during the exercise movement.

To decrease risk of burns, fire, electric shock, or injury to persons:

- An appliance must not be left unattended when plugged in. Unplug from outlet when not in operation and before you put on or remove parts.
- Close supervision is necessary when this appliance is used by or near children or disabled persons.
- Use this appliance only for its intended use as described in this manual. Do not use attachments that are not recommended by the manufacturer.
- Do not operate this appliance if it has a damaged cord or plug, if it is not working correctly, if it has been dropped or damaged, or fallen into water. Return the appliance to a service center for examination and repair.
- Keep the cord away from heated surfaces.
- Do not drop or put any object into any opening.
- Do not use outdoors.
- To disconnect, turn all controls to the off position, then remove plug from outlet.



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Freeclimber



Technical Specs

Product Dimensions	68" H x 43" L x 27" W (173cm H x 110cm L x 69cm W)
Product Weight	155 lbs (70 kg)
Max User Weight	350 lbs (159 kg)
Power Requirements	Input Voltage 100-240 VAC 50/60 Hz 100 VA
Display	Three choices of displays. 1) 10" Touch Screen Console with integrated TV Tuner (TSE-1) and 2) 10" Touch Screen Console (TS-1) and 3) Backlit LCD Console (D-1).
TV Option	15.6" digital television with HD capabilities (SMV-1)
Workouts	10 programs - Quick Start, Manual, Fat Burner, Calorie Burner, Speed Intervals, Custom Intervals, Random Intervals, Heart Rate Intervals, Calorie Goal, Heart Rate Zone Trainer
Fitness Tests	Multi-stage Fit Test, CPAT Fire Fit Test and WFI StepMill® Test
Drive System	Electronically controlled alternator with chain drive precisely controls the pedal descent allowing a wide range of users to exercise smoothly within their comfort zones
Step Action	Patented, independent pedal geometry with four-bar linkage keeps pedals level ensuring a safe, biomechanically correct movement
Step Range	1" to 14" (2.5cm to 36cm)
Step Rate	26 to 174 steps/minute
Heart Rate Monitoring	Polar® compatible wireless; contact sensors

US Commercial Warranty

Frame	15 Years
Parts	3 Years
Labor	1 Year

Note: Warranty terms are for U.S. only and vary by region. Contact the distributor in your country and region.



Technical Specs

Product Dimensions	68" H x 43" L x 27" W (173cm H x 110cm L x 69cm W)
Product Weight	155 lbs (70 kg)
Max User Weight	300 lbs (136 kg)
Power Requirements	Input Voltage 100-240 VAC 50/60 Hz 100 VA
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Legacy Steppers SC 916



4600 PT



4400 CL



Specifications:

- Resistance Levels: 20
- Step Rate: 24 to 162 steps/minute
- Heart Rate Monitoring: Polar-compatible wireless
- Computer Display Type: C51 custom LCD
- Workouts: 10 Programs - quick start, manual, fat burner, calorie burner, speed intervals, heart rate zone trainer, etc
- Fitness Tests: Multi-stage Fit Test and CPAT Fire Fit Test
- Product Dimensions: 42" L x 27" W x 68" H
- Product Weight: 150 pounds
- Console Accessories: Reading rack, water bottle holder and accessory tray
- Maximum User Weight: 300 pounds

Specifications:

- Resistance Levels: 20
- Step Rate: 24 to 162 steps/minute
- Heart Rate Monitoring: Polar-compatible wireless
- Computer Display Type: C40 custom LCD
- Workouts: 6 Programs - quick start, manual, fat burner, calorie burner, speed intervals, heart rate zone trainer
- Fitness Tests: Multi-stage Fit Test and CPAT Fire Fit Test
- Product Dimensions: 44" L x 32" W x 69" H
- Product Weight: 155 pounds
- Console Accessories: Reading rack, water bottle holder and accessory tray
- Maximum User Weight: 300 pounds

Specifications:

- Resistance Levels: 20
- Step Rate: 24 to 162 steps/minute
- Heart Rate Monitoring: Polar-compatible wireless
- Computer Display Type: C40 custom LCD
- Workouts: 6 Programs - quick start, manual, fat burner, calorie burner, speed intervals, heart rate zone trainer
- Fitness Tests: Multi-stage Fit Test and CPAT Fire Fit Test
- Product Dimensions: 44" L x 22" W x 69" H
- Product Weight: 126 pounds
- Console Accessories: Reading rack, water bottle holder and accessory tray
- Maximum User Weight: 300 pounds



Tools

# Units	Tool	Suggested Manufacturer	Minimum Specifications
1	Multi-meter	Various	Digital, Continuity,
1	Socket Set, SAE	Various	1/4" - 5/8"
1	Socket Set, Metric	Various	4mm - 21mm
1	Socket driver	Various	
1	Open end wrenches, SAE	Various	1/4" - 3/4"
1	Open end wrenches, Metric	Various	4mm - 17mm
1	Hex Bit Socket Set, SAE	Various	5/64 - 3/8
1	Hex Bit Socket Set, Metric	Various	4mm - 14mm
1	Adjustable Wrench	Various	
1	Torque Wrench	Various	
1	Torque Wrench	Various	
1+	Screwdriver Set, Phillips	Various	
1+	Screwdriver Set, Flat	Various	
1+	Snap Ring Removal Tool	Various	
1	Tape Measure	Various	
1	Ball Peen Hammer	Various	10 oz
1+	Rubber Mallet	Various	
1	USB - Flash Drive	Various	1 GB
4	Motorcycle straps, adjustable	Various	
1	Loctite 680	Various	
1	1' Jumper wire w/ alligator clips	Various	
50	zip ties	Various	4'
50	zip ties	Various	8'



Preventative Maintenance

Cleaning

1. Inspect the frame for any rust, bubbling, or paint chips during the daily cleaning. The salt in perspiration can damage the unpainted surfaces.
2. Do not use glass cleaners or any other household cleaners on the console. Clean the console daily with a water-dampened cloth and wipe dry after cleaning.
3. Clean the exterior of the machine daily using soap and water or a diluted, non-mineral based household cleaner such as Fantastik/Simple Green.

Maintenance Schedule

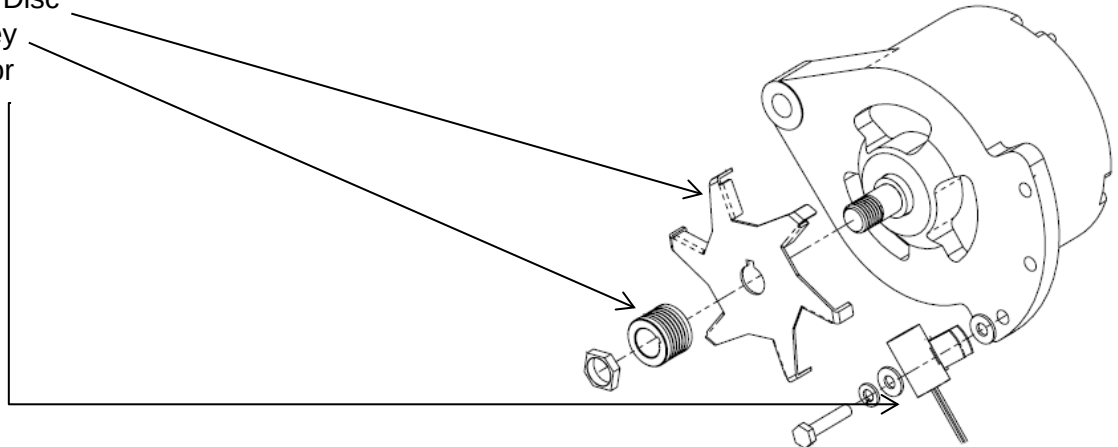
General Maintenance	Daily	Weekly	Monthly	Comments
Check Safety & Warning Labels	X			
Spot Check Step Chains	X			
Alternator Belt Tension			X	Tension to 30-45 in/lbs
Lubrication				
Drive & Step Chains			X (or every 300 hrs)	30W Motor Oil
Leveling & Pedal Arm Shafts			X (or every 900 hrs)	Multi-Purpose Grease
Spring Pulley & Pedal Shafts			X (or every 900 hrs)	Multi-Purpose Grease
Cleaning				
Clean Console	X			Clean with a water dampened cloth & wipe dry after cleaning
Clean Lower Side Covers	X			Clean exterior with soap & water or diluted household cleaner
Clean & Lubricate Pedal Springs		X		Clean, then wipe with lightly oil-soaked rag

Resistance system

Resistance is applied to the steps of the machine by use of an alternator. The RPM sensor attaches to the alternator and reads the sensor disc to measure the RPMs of the alternator. The resistance system (alternator) connects the gearing system, or 1st and 2nd reduction pulleys of the machine via poly-V belt.

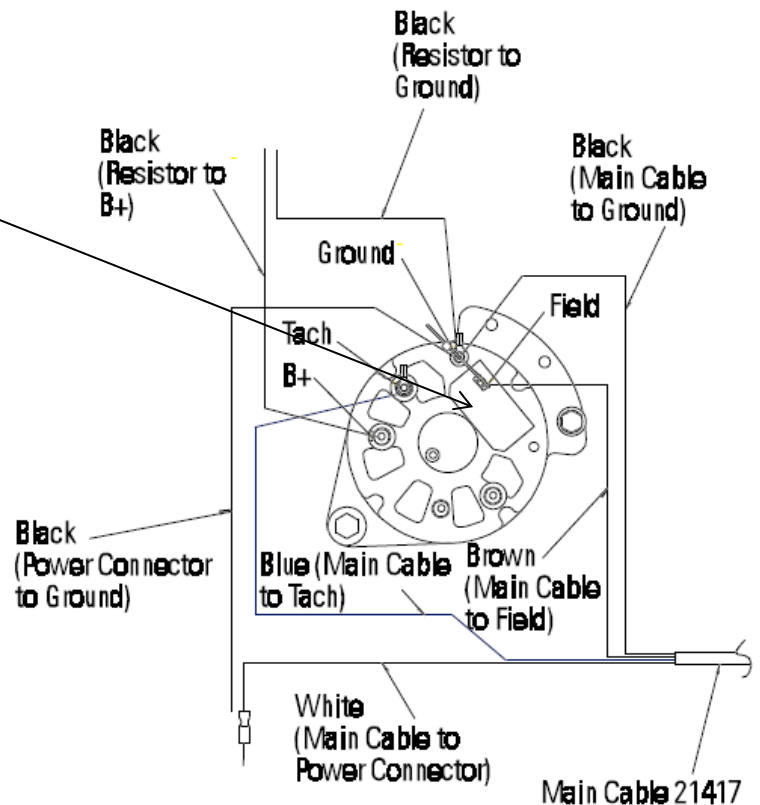
Pulley Side of Alternator

- Left side of machine
- RPM Sensor Disc
- Alt. Belt Pulley
- Speed Sensor



Wire Side of Alternator

- Right side of machine
- Wire Connection Posts
- Brush Assembly (Field)





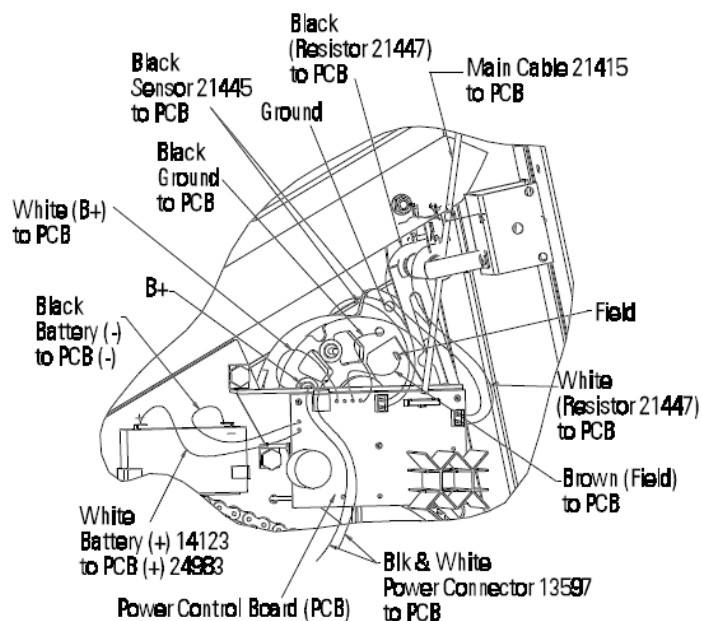
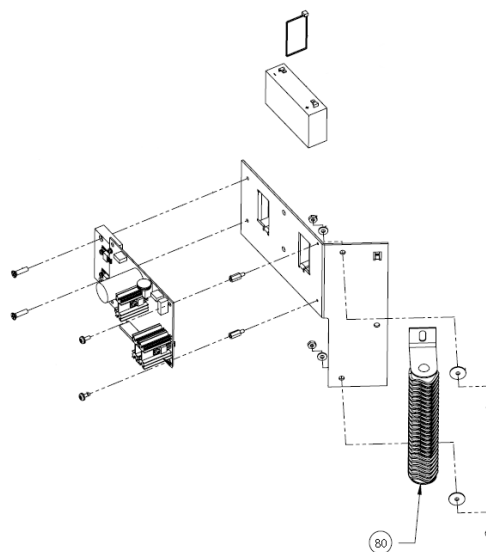
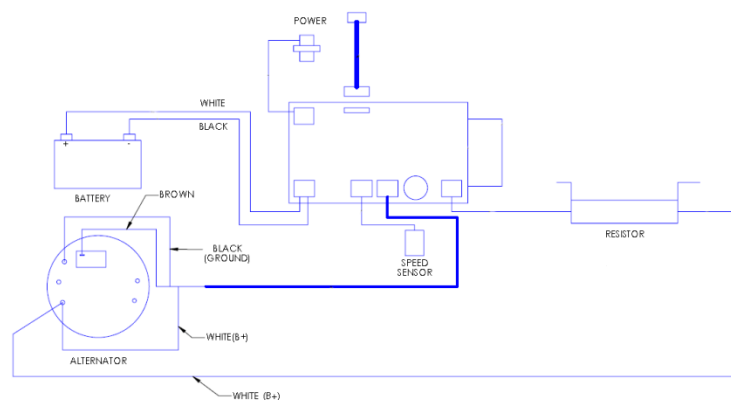
Power System

The Freeclimber is self-powered (cordless) with a rechargeable battery back-up. Unless using the TS-1, or TSE-1 touchscreen console, the Freeclimber can be operated without plugging in the external power supply. If using previously mentioned consoles, the machine must be connected to power using the adapter.

If, however, the console flickers during operation or the console display does not light up while using the machine, then use the external power supply to recharge the battery back-up. The external power supply is supplied with the unit and plugs into a standard 115 volt, 15 amp outlet, or a 220 volt, 10 amp outlet. (All major voltage plugs are available.) The plug-in for the external power supply is located in the front of the machine at the base.

Plug the wall pack external power supply into the connector and charge the battery for approximately 24 hours and then recheck it. It is okay to use the machine while the external power supply is connected. The console will power on as user starts to move the pedals of the machine, and will stay lit for up to 60 seconds in pause mode. The console will power off after 60 seconds of stopping exercise. The console will power on and remain powered whenever the external power supply is connected.

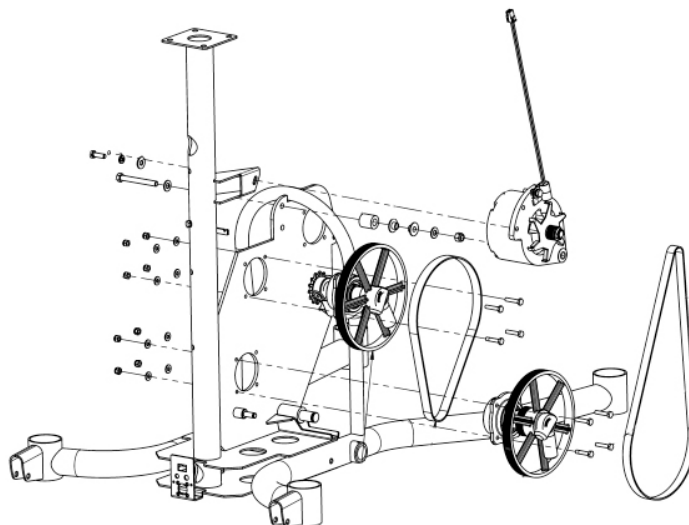
Side View Wiring Specifics



Drive System

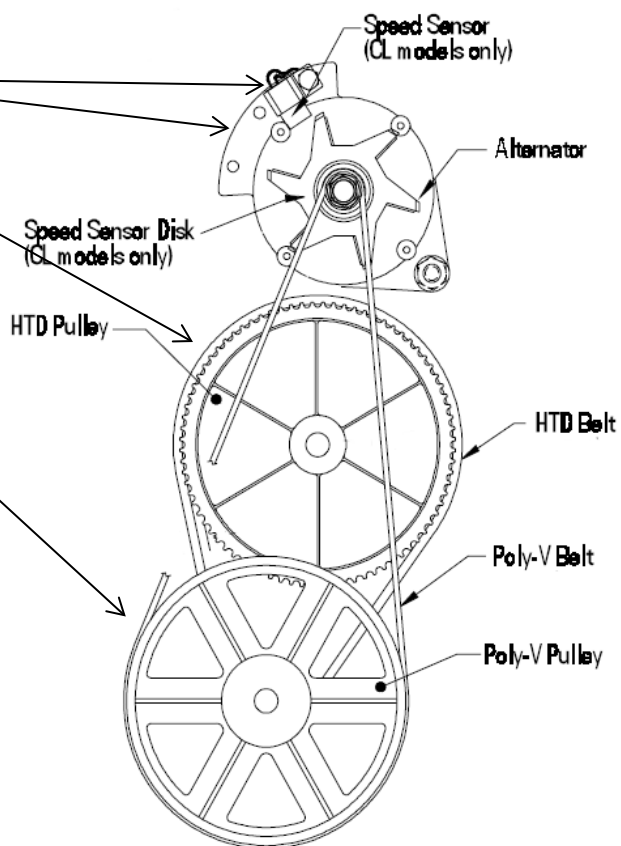
Stepper Drive System

- Alternator
- Speed Sensor
- 1st Reduction
- 2nd Reduction
- Drive Hub Assembly



Stepper Drive/Belt System Side View

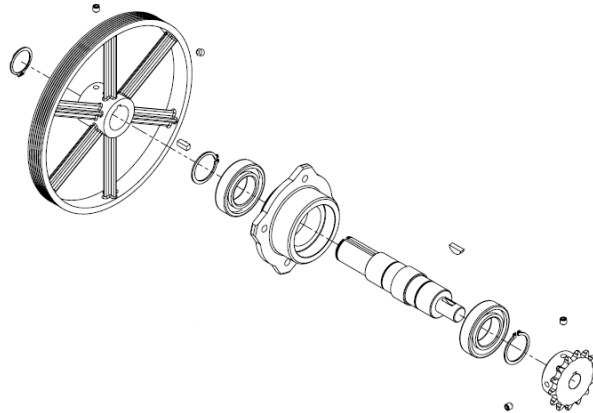
- Alternator
- Speed Sensor
- 1st Reduction, legacy machines used a HTD, or ribbed belt to connect to 2nd reduction. Current models use Poly-V belt and pulley.
- 2nd Reduction / Eccentric Hub



Drive System

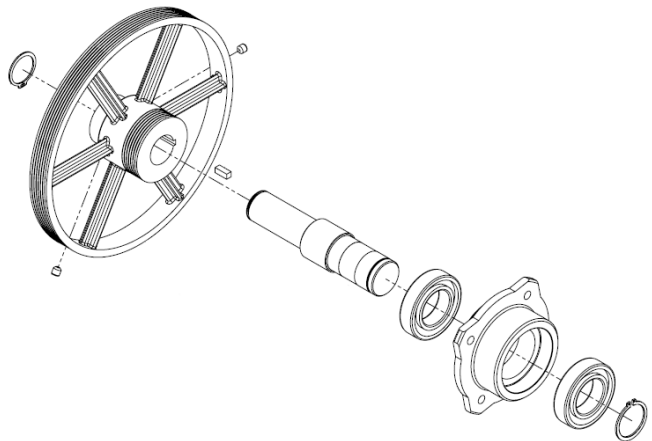
1st Reduction Pulley & Shaft

- First pulley, located directly under alternator.
- Legacy machines used a HTD, or ribbed belt to connect to 2nd reduction. Current models use Poly-V belt and pulley.
- Connects to 2nd Reduction Pulley by belt
- Outside right sprocket connects 1st Reduction Sprocket to the Drive Hub Assembly via drive chain



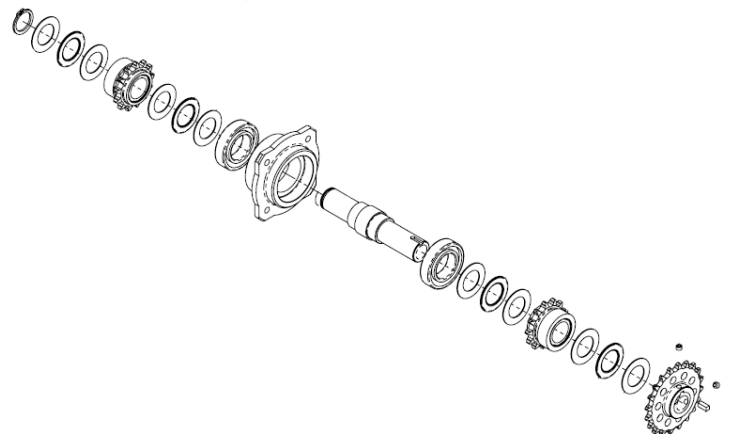
2nd Reduction Pulley & Shaft

- Second or lower pulley, located directly under the 1st Reduction pulley.
- Steps up the stepping speed by a factor of about nineteen, in order to drive the Alternator at the required speed.
- Outer belt connects to Alternator Pulley
- Inner belt connects to 1st Reduction Pulley



Drive Hub Assembly

- Clutch shaft and one-way bearings
- The right and left sprockets of the Drive Hub Assy are not interchangeable. The internal bearings act as clutches, transmitting force on the down stroke of the pedal and then allowing the pedal to return.
- Left & Right side sprockets for pedal chains
- Outside right sprocket connects Drive Hub Assembly to 1st Reduction Sprocket with a drive chain

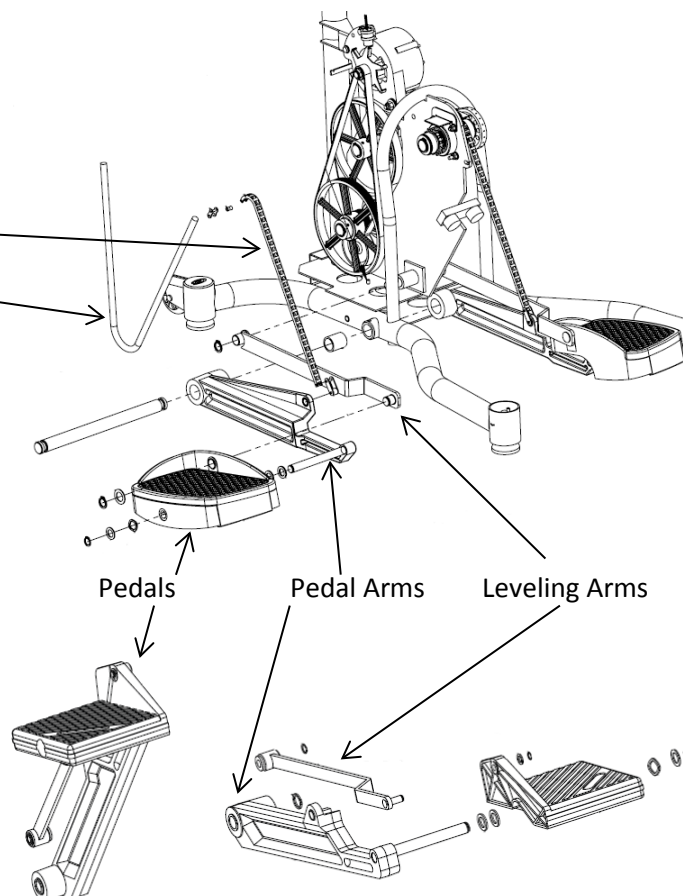




Step System

SC916, SC5, and Freeclimber Step Hardware

- Pedals
- Pedal Arms
- Leveling Arms
- Connection hardware
- Step Chains
- Pedal Return Springs



4400 & 4600 Step Hardware

- Pedals
- Pedal Arms
- Leveling Arms
- Connection hardware

Lower Board Update

An investigation of abnormal battery drain reports has led to a change in the electrical system used on the SC5 and newer machines. To maximize performance, the battery and Lower Control Board (LCB) have been enhanced.

Should you have a drained battery on an SC5 before serial number 155005DAY12340116, you must replace the LCB and battery together to the new 7.2 VDC set up.

Legacy 6 VDC Battery PN#: 14123	New 7.2 VDC Battery PN#: 055-0209
Legacy 6 VDC Lower Board PN#: 13092	New 7.2 VDC Lower Board PN#: 055-0210
	NOTE: To determine the version of the LCB, locate the green sticker on the LCB. The old version of the LCB is labeled " PC K1N". The new version of LCB is labeled " PC N1N".



Mechanical Adjustments:

1. Remove alternator belt and inspect for cracks, fraying or any other unusual or excessive wear.
2. Spin alternator pulley to check bearings and check pulley for wear.
3. Remove belts and inspect for cracks, fraying or any other unusual or excessive wear.
4. Spin Eccentric Shaft Assy to check bearings and inspect for excessive wear.
5. Remove the drive chain and inspect for frozen links. Check that the transmission drive sprocket set-screw is tight.
6. Spin First Reduction Shaft Assy to check bearings and inspect for excessive wear.
7. Remove step chains/return springs from frame and inspect the chains for frozen links. Make sure step chain connection points pivot freely and have no vertical play.
8. Remove pedals, pedal arms and leveling arms. Lubricate shafts accordingly.
9. Inspect Drive Hub assembly for wear.
10. Verify that drive sprockets freewheel in the forward direction and lock in the other direction.
11. Check drive shaft for radial endplay and excessive side to side play (more than 1/8")

Alternator Belt Tension Adjustment

1. Remove the bottom cover.
2. Loosen the adjustment bolt that mounts the alternator to the slotted alternator brace and the pivot adjusting bolt and nut. Swing the alternator down.
3. Adjust the inner belt tension so that you have 1/4 inch (0.6 cm) of side-to-side play with fingertip pressure. The bottom shaft is mounted in an eccentric hub. To adjust the tension:
 - Loosen and remove the four bolts and nyloc nuts from the hub.
 - Turn the hub one hole clockwise.
 - Install and tighten the four bolts and nyloc nuts.
 - Verify the inner belt tension.
4. Install the outer Poly-V belt. Make sure it is centered on the pulleys.
5. Pivot the alternator up or down as necessary to allow 1/4" (0.6 cm) of belt deflection with fingertip pressure at the center of the vertical portion of either side of the belt.
6. Tighten the alternator adjustment bolt. Verify 1/4" (0.6 cm) of play in the belt and reinstall the machine's covers.
7. Test the machine for proper operation.

Alternator Brush Replacement

1. Remove user-right side cover
2. Remove brown wire from W3 (FLD BRN) post of alternator.
3. Loosen 1/4" bolts on W3 post, or alternator brush assembly
4. Verify brush length and quality. We recommend replacing brushes that are 1/4" or less.



Step Chains / Return Spring Replacement

1. Support the pedal arm. Unhook the pedal arm return spring from the spring hanger. Lift the step chain up and off the clutch sprocket and lower the pedal arm to the floor.
2. Detach the spring from the step chain by removing the master link. The spring-chain connector is in good condition if it has an hour glass shape. Replace a worn spring-chain connector.
3. Remove the double-pitch master link and bearing sleeve assembly from the step chain connection point on the pedal arm.
4. Remove the master link from the spring-chain connection.
5. Check to ensure that the spring pulley turns freely and is not worn excessively. Replace spring pulley as necessary.
6. To reinstall the spring, connect it to the end of the step chain using the master link.
7. Connect the double-pitch master link and bearing sleeve assembly from the step chain connection point on the pedal arm.
8. Route the spring under the spring pulley that is fastened to the spring pulley shaft.
9. Hook the end of the pedal arm return spring onto the spring hanger.
10. Test the machine for proper operation

Pedal Replacement

1. Remove the snap ring and flat washer from the leveling arm pin and the pedal shaft.
2. Slide the pedal off the shaft.
3. Clean the pedal shaft and leveling arm pin with a dry cloth. Lubricate the pedal shaft and the leveling arm pin with a thin coat of multipurpose grease.
4. Reverse the procedures to reinstall the pedal.

Leveling Arm Replacement

1. Remove the machine's covers.
2. Remove the snap ring that secures the leveling arm to the leveling arm shaft.
3. Slide or gently tap the leveling arm off the shaft.
4. Clean the shaft and the pin with a cloth dampened with 30W motor oil before reassembly.
5. Reverse the removal instructions to reinstall the leveling arm.



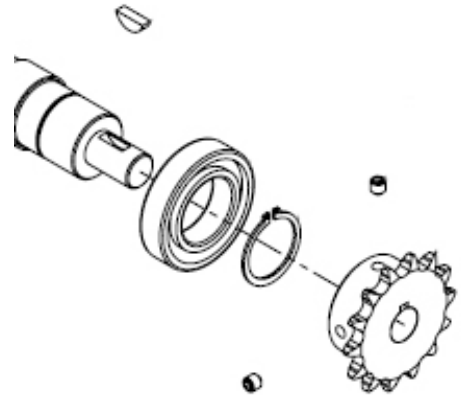
Drive Hub Assembly

1. Support the pedal arm. Unhook the pedal arm return spring from the spring hanger. Lift the step chain up and off the clutch sprocket and lower the pedal arm to the floor. Repeat on the other side.
2. Remove the drive chain.
3. Remove the sprocket and the other small parts from the left side of the hub assembly.
4. Slide the drive shaft to the right, out of the hub assembly. If you remove the right-hand clutch sprocket from the drive shaft, do not confuse it with the left-hand clutch sprocket.
5. Loosen and remove the two remaining bolts and nuts that hold the hub assembly to the frame. Remove the hub assembly.
6. Inspect the drive shaft, the bushings, the thrust washers, and clutch sprockets for excessive wear or pitting. Replace worn-out components.
7. To reinstall the hub assembly, carefully reverse the disassembly procedures. Be sure that the right- and left-hand clutch sprockets are positioned correctly; the wide shoulder of the sprocket should be facing away from the hub on both sides.
8. **Chain Tension.** SC916, SC5, and Freeclimbers have fixed hubs that mount the shaft to the machine and are not adjustable for chain tension.

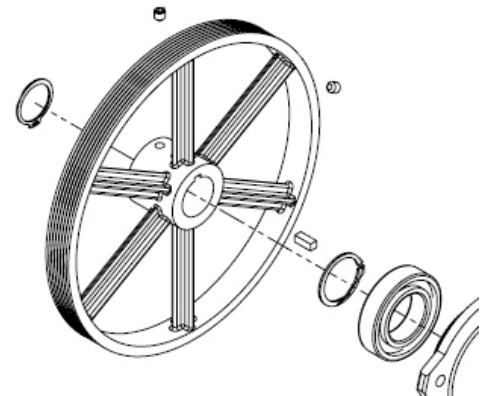
For legacy steppers, the drive shaft is mounted in an eccentric hub. Rotate the hub so the marked hole is in the 12 o'clock position, lining up four holes in the hub with the four holes in the frame. Use this hub position when reinstalling the drive chain since the distance between the drive and transmission shafts is at a minimum. The hub is in the proper position when the drive chain has a total of 1 to 1-1/2" (2.5 to 4.0 cm) of play at the slackest point. As the drive chain stretches with use, increase the chain tension (and the distance between the two shafts) by rotating the hub counterclockwise. The distance between the two shafts is greatest when the marked hole in the hub is at the 8 o'clock position.

1st Reduction Replacement

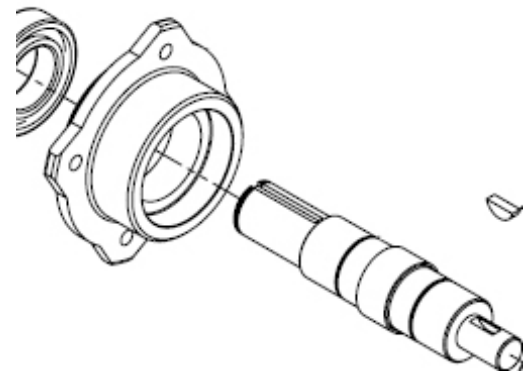
1. Remove the machine's covers.
2. Remove the drive chain from the sprocket and belt from the pulley.
3. Loosen the two set screws that hold the sprocket to the shaft.
4. Remove sprocket and note the key/clocking pin.
5. Once the sprocket is off, remove the external snap ring.



6. On the pulley side of the machine, loosen and remove the set screws and key for the pulley.
7. Remove the external snap ring holding the pulley to the shaft and remove the pulley.
8. Once the pulley is off, remove the internal snap ring.



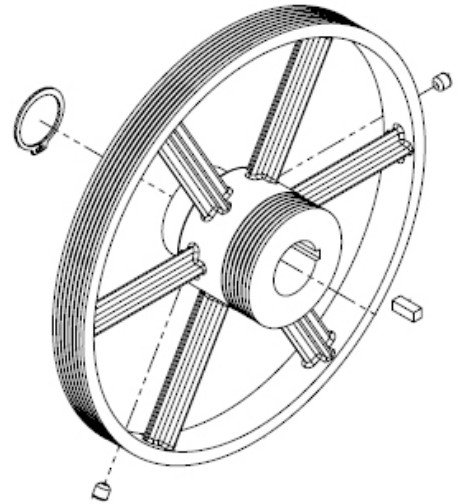
9. Loosen and remove the four nyloc nuts and bolts from the hub.



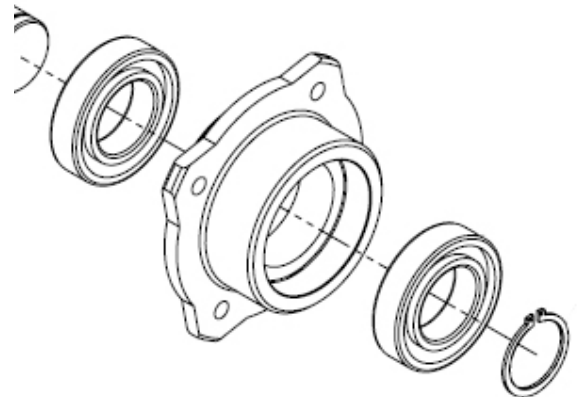
10. Hold onto the sprocket-side and pull the shaft out of the hub.
11. Reassemble in the reverse order. Ensure the belts are properly tensioned; refer to the "Alternator Belt Adjustment" section.

2nd Reduction Replacement

1. Remove the machine's covers.
2. Remove the belt from the outer pulley to the alternator and the inner pulley to the 1st reduction.
3. Loosen and remove the set screws and key for the pulley.
4. Remove the external snap ring holding the pulley to the shaft and remove the pulley.



5. Remove external snap ring from right-side of the assembly.
6. Loosen and remove the four nyloc nuts and bolts from the hub.



7. Remove the assembly from the frame.
8. Reassemble in the reverse order. Ensure the belts are properly tensioned; refer to the "Alternator Belt Adjustment" section.



Consoles

7000 PT / 4400 / 4600



C5 Console

- Red LED Readout
- Non-replacable overlay
- Repair/Exchange through National Gym Supply



C40 Console – Blue Faced Overlay

- Blue LCD Readout
- Console PN#: 055-0034
- Replacable overlay: PN# - SM27780-001, SM27790, SM27779
- Display Board PN#: SM40070-001
- Process Board PN#: SM27130
- Menu map available



C40 Console – Gray Faced Overlay

- Blue LCD Readout
- Console PN#: 055-0034
- Replacable overlay PN#: SM25673, SM27790, SM27779
- Display Board PN#: SM40070-001
- Process Board PN#: SM27130
- Menu map available



SM916 / SC916



C51/C52 LCD Console

- Blue LCD Readout
- Console PN#: 003-3625
- Replacable overlay PN#: SM40468
- Menu map available

SM5 / SC5



D1 LCD Console

- Blue LCD Readout
- Console PN#: 050-0035
- Replacable overlay PN#: 050-0287
- USB port for software upload
- Menu map available



TS-1 / TSE-1 Console

- Touchscreen (TS-1) PN#: 050-0129
- TV Optional (TSE-1) PN#: 050-0034
- Require use of power adapter for consistent power to the console.
- USB port for software upload
- Ipod connector for use with iDevice
- Menu map available



Gauntlet / Freeclimber



D1 LCD Console (Black)

- Blue LCD Readout
- Console PN#: 050-0035-35
- Replacable overlay PN#: 050-0287
- USB port for software upload
- Menu map available



TS-1 / TSE-1 Console (Black)

- Touchscreen (TS-1) PN#: 050-0129-35
- TV Optional (TSE-1) PN#: 050-0034-35
- Require use of power adapter for consistent power to the console.
- USB port for software upload
- Menu map available



Troubleshooting

1. No Resistance When Stepping

- Verify alternator brush length.
 - Make sure the brushes are not worn
- Run alternator test if brushes look good
- Verify speed sensor gap and proper connection to lower board.
- Check belt tension on the alternator Poly-V belt.
- Verify ground wire from console to machine chassis is attached.

2. No Resistance From Alternator

Perform the Positive Output to Field test on the Alternator

- Place a short wire with alligator clips on the B+ and the field (FLD) terminals of the alternator.
- Step on the machine for approximately 10 – 15 seconds.
- If resistance is achieved during this time the alternator has correct current flow.
- If no resistance is achieved, replace the alternator.

3. Slipping/No Resistance, but on one side only

- The Drive Hub clutch sprocket may be bad on whichever side is slipping and may need to be replaced.

4. Battery Test

- For legacy machines (up to serial # 155005DAY12340116 on the SC5):
 - Use a voltmeter to verify battery voltage is a minimum of 6.1 VDC under load.
 - Plug into power supply for 24 – 48 hours if voltage is below 6.1 VDC.
- For Current machines (serial # 155005DAY12340116 on the SC5 and forward):
 - Use a voltmeter to verify battery voltage is a minimum of 7.2 VDC
 - Plug into power supply for 24 – 48 hours if voltage is below 7.2 VDC.

5. Resistor Test

- Unplug the load resistor from the power control board and set your voltmeter to Ohms. Place one lead from the voltmeter on each of the threaded posts on the load resistor. Replace the load resistor if the voltmeter does not read 2.5 Ohms ($\pm 10\%$).

6. HR Not Reading Accurately

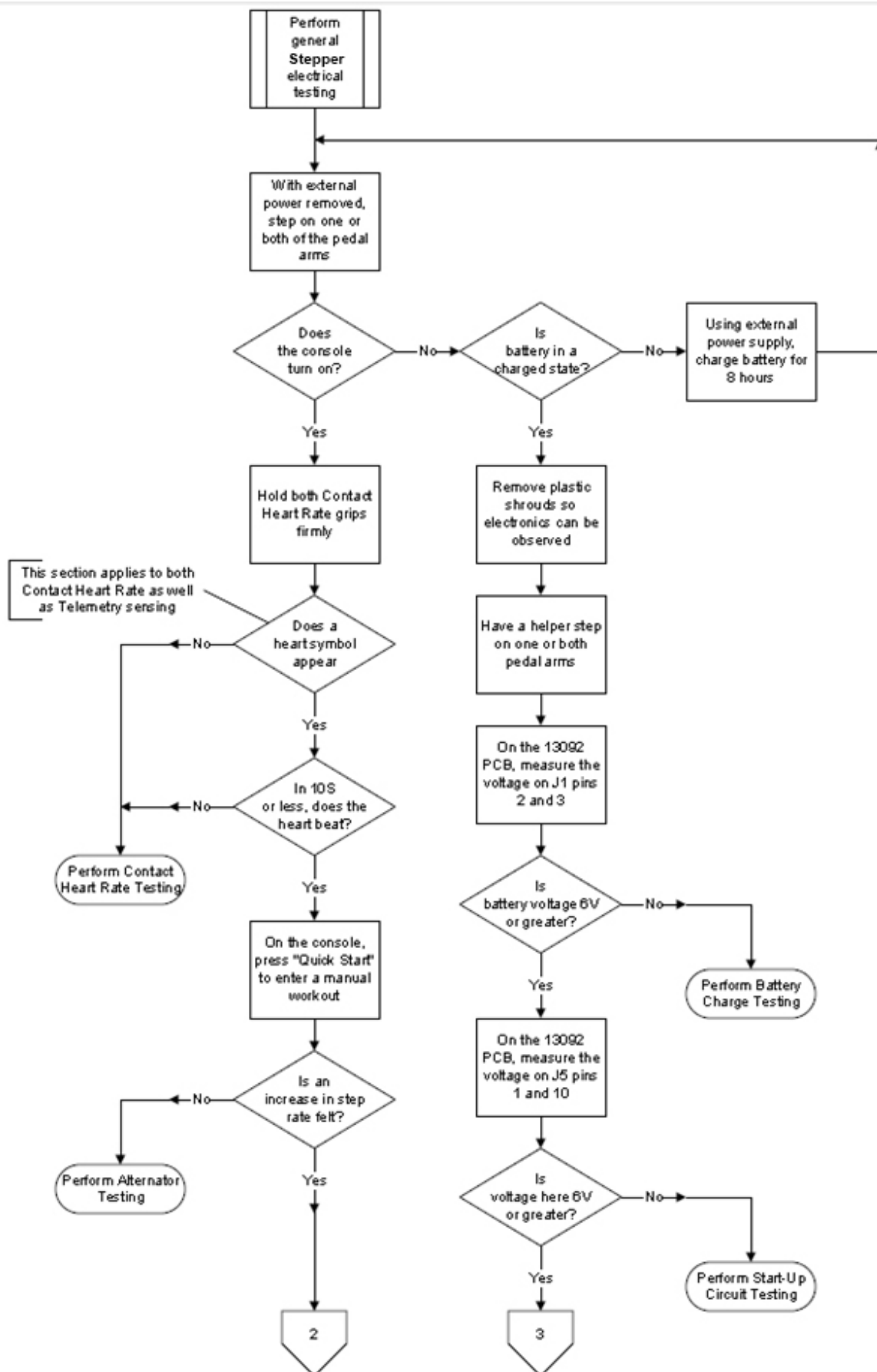
- Check to see if HR Wires are plugged in to the Console.
- Check voltage on Heart Rate plate
 - Anything above 2 volts is good
 - Ground connector on bottom and positive on top
 - If under 2 volts take plates off and check wires directly
- How clean are the plates?

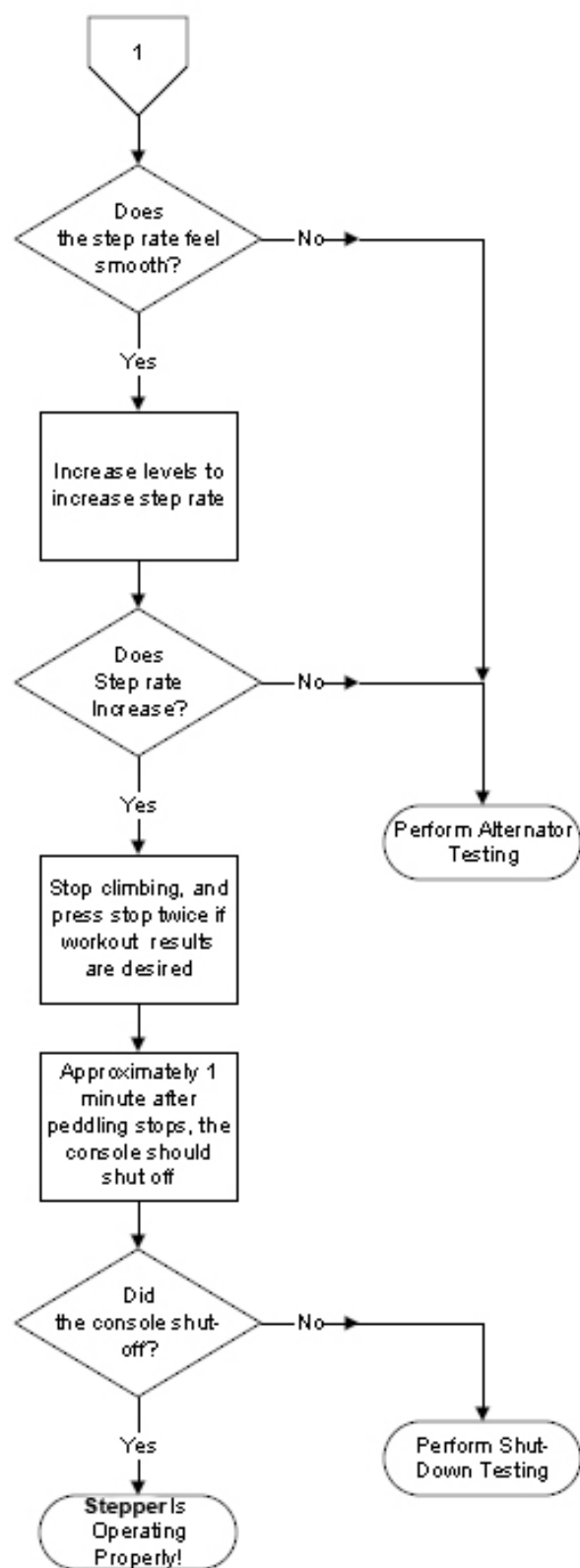


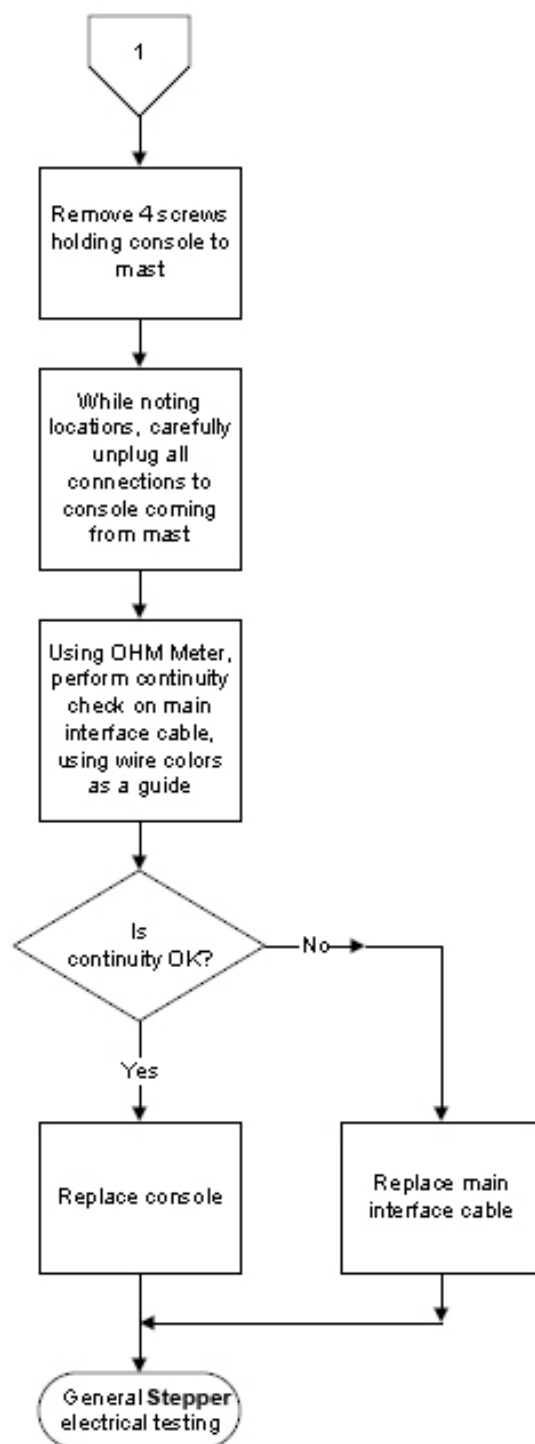
7. **Unit Doesn't Power Up / No Display and Unit Not Powering Up**

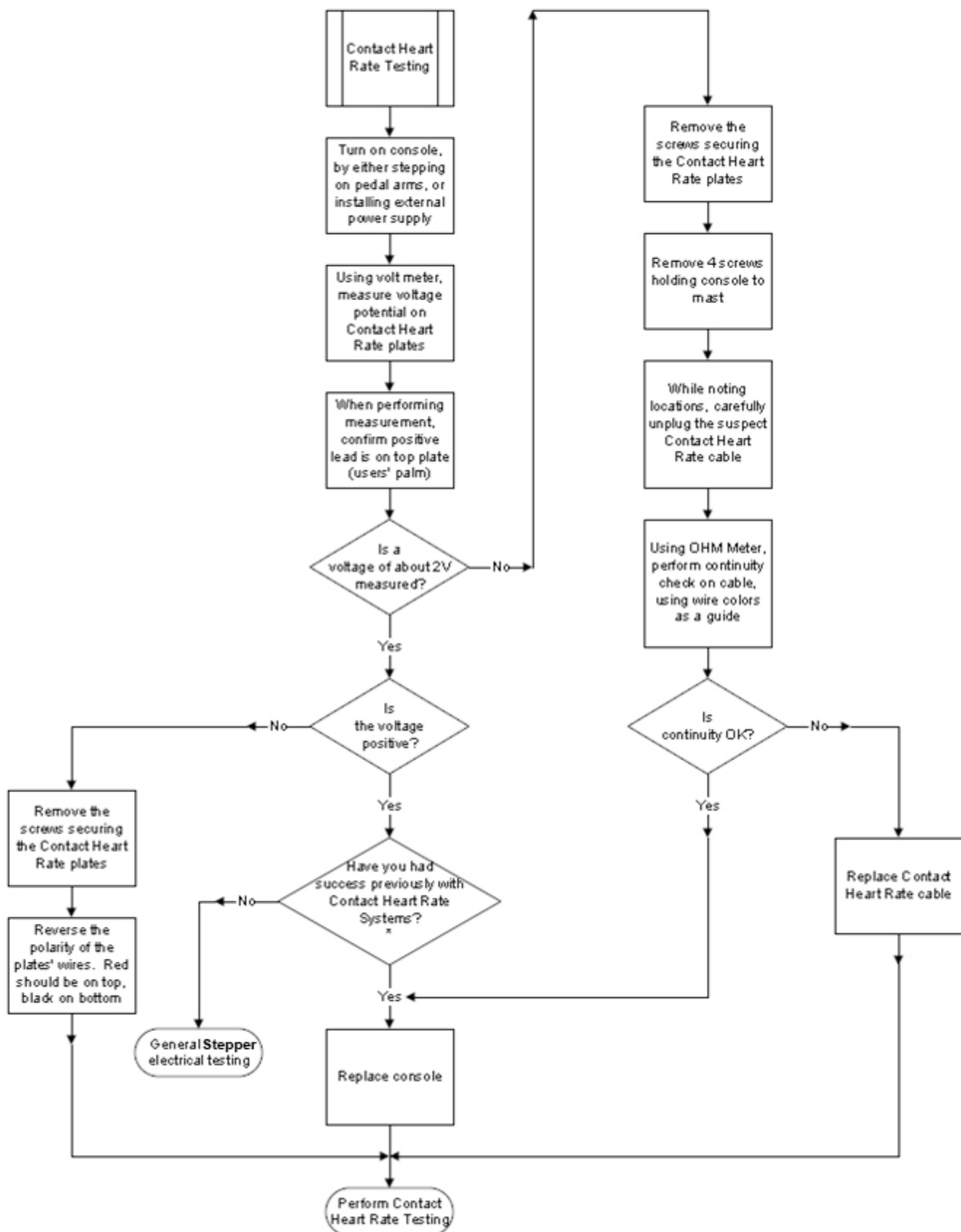
A common misconception about battery powered units, is that it only requires you to step on the pedals to power the console; when in fact the speed sensor plays a major role in powering the console. If you step on the pedals and they fall to the floor due to the console not powering up so there is no resistance, you should check the speed sensor as well as the battery.

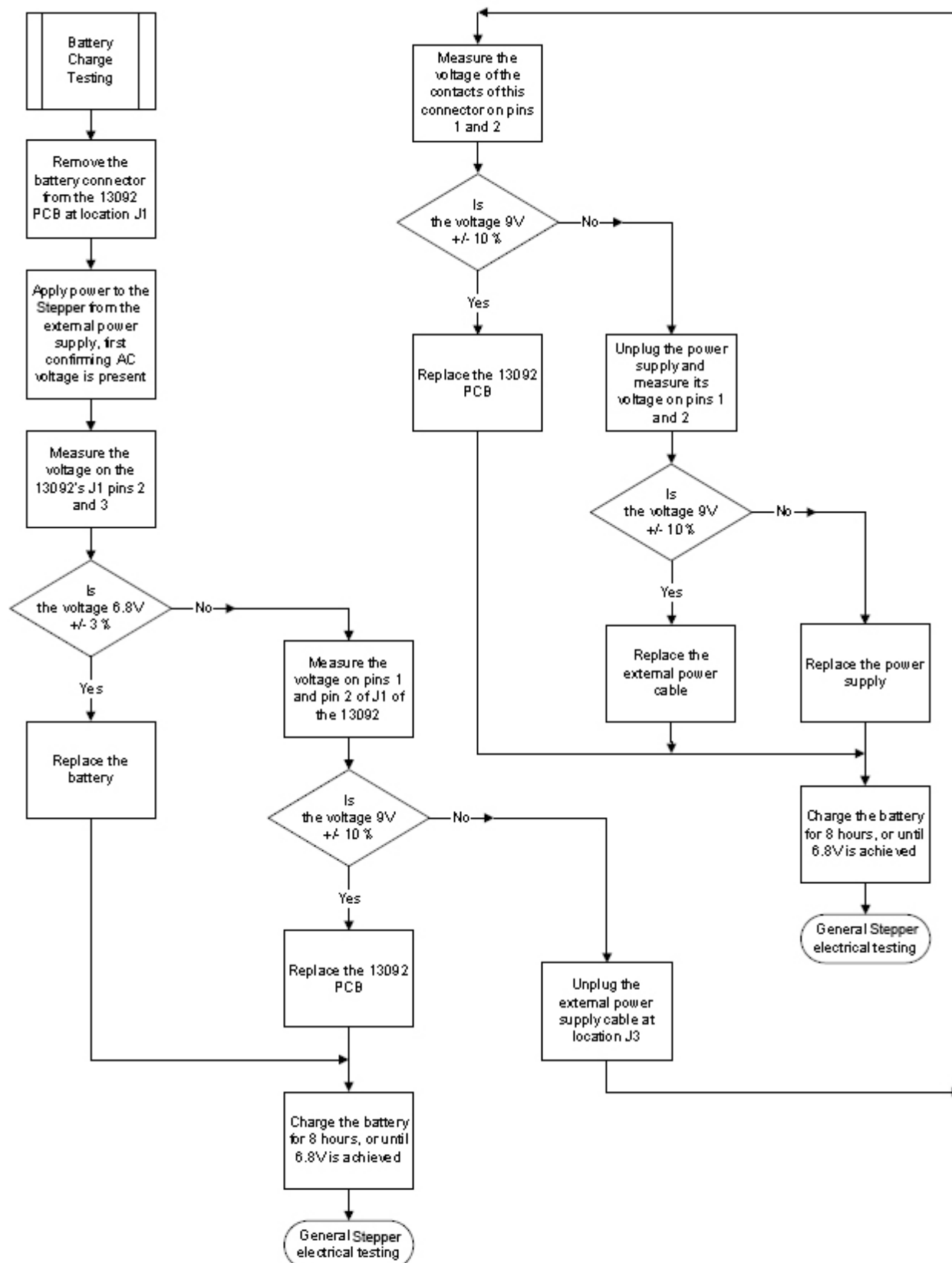
- Test the battery voltage. Set your volt meter to read DC voltage (if your meter has ranges, use a range appropriate for the 6 / 7.2 volt battery being tested).
- Place your volt meter leads to the battery terminals and have your assistant step on the pedals.
- The reading should be above 6 / 7.2 VDC. (If your reading is negative, reverse your meter leads)
- If the battery voltage is below 6 / 7.2 VDC, it should be recharged or replaced.
- The speed sensor is mounted to the alternator and reads the speed sensor disc when the unit is pedaled producing an AC voltage. The voltage from the speed sensor can be tested at the connection of the speed sensor to the lower control board. The connection is a red and black wire. Using AC setting on your volt meter at its lowest range, place the red lead to the red wire and the black lead to the black wire. Make sure the leads of the volt meter are making a good connection. Now step on the unit and verify the voltage from the speed sensor. A good speed sensor will produce about 3 VAC before the console powers up.
- If the voltage is not correct, inspect the adjustment of the speed sensor. It may be necessary to adjust the sensor closer to the speed sensor disc. Proper gap of the speed sensor to the disc is about the thickness of a business card.
- Retest unit after making speed sensor adjustment.











Due to requiring many pieces of test equipment, this procedure does not test the complete functionality of the charger but rather its final "float" state. If the battery voltage is less than 3V, no more than 50mA is applied. From 3V to 6.8V current control applies nearly .5A until voltage control or float state is entered. Batteries can only be tested under load. Even if it measures 6V or more unloaded, it can still produce little or no voltage under load as a defective battery's internal impedance increases.



Alternator / Resistance Testing

The colored connections to the alternator are as follows:

White-B+, Alternator output voltage
Brown-Field, Alternator Control Current
Black-Ground, Alternator return

Prior to proceeding with tests perform continuity checks on the alternator **cable**, and confirm **cable** is securely fastened to the alternator and the lower board. Resistance over gravity is performed by the alternator in the Stepper/Freeclimber. When a user first steps on the pedal arms, and prior to starting a workout, the console should be enabling full field current to the alternator. Field current is enabled by asserting the signal at TP11 to 5V. At this time, initial field current is provided by the internal battery. The alternator's B+ should rise as a result of this, but its voltage will depend on the weight of the user. Resistance is achieved by the oppositions of internal magnetic fields when field current is applied. The user's weight will affect the alternator's RPM under this condition, and under full field current conditions the voltage is not controlled. For an average weight user, a 6V to 8V level on B+ would be a normal condition.

Once a user starts a workout, the console controls the alternator's field current attempting to maintain the desired step rate. Again, this accomplished on TP11, and this signal is Pulse Width Modulated (PWM) from 0V to 5V. If the step rate is fast, the console will assert TP11 high longer, if the step rate is slow, it will assert TP11 low longer. When TP11 is high, the alternator field current is limited current limited to 3.25A. So regardless of the voltage measured at B+, 3.25A is the maximum field current available. When TP11 is low, no field current should flow.

The only situation where a PWM signal would not be present on TP11 during a workout is if a very light weight person was attempting to achieve a step rate that could not be achieved by their weight overcoming the frictional resistance of the system. In this case, the console would keep TP11 low (no field current, or no induced resistance).

During workouts when step rates of 25 Steps/Minute are targeted, the alternator's B+ increases as a function of speed and user weight. For high level workouts with heavy weight users, B+ levels of 40V could be witnessed. Once B+ exceeds 7V, battery maintenance and self-sustaining power console power will be provided. If the alternator's B+ is not powering on but the console is, first confirm TP11 is 5V. If it is, and no resistance is felt, measure the field voltage with respect to ground. If this measurement is 5V or greater, with no reading from B+, replace the alternator. If maximum resistance is always felt, determine if TP11 is ever being driven low. If TP11 is driven low and full field current exists, suspect a defective lower board. If TP11 never goes low, suspect a bad console or shorted interface **cable**.

If no field voltage is detected, and if the console is on and configured as a stepper, measure the alternator's field resistance. Unplug the alternator from the lower board's J4, and measure the resistance from the brown wire to the black wire. 4ohms is typical for Prestolite units. If this is 4ohms or more, replace the lower board. If it's way less or shorted, replace the alternator. If the step rate or B+ voltage are sporadic, first look for loose connections. This type of problem could be caused by a defective alternator or lower board. If a known/good lower board unit is available it will be the easiest component to replace. If the problem goes away, confirm the other PCB still causes sporadic behavior, and the problem was not in fact a loose connection.

The external 2.5ohm load resistor acts as a resistive ballast on the alternator. Once B+'s level exceeds 16V, this 2.5ohm load is switched onto B+. The resistance of the load can be confirmed by an ohm meter. If a known workout condition exists that drives B+ above 16V, confirm a voltage is measured across this 2.5ohm load. If it is not, check its **cable** continuity to the lower board and B+. If the continuity checks out okay or if the voltage across the resistor always measures the value of B+, replace the lower board.



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