

**Elco Motor Yachts
AC Electric Drive Systems
Installation Instructions**

For Models

EP- 600, 36 VDC	70 Amps DC
EP- 1200, 48 VDC	105 Amps DC
EP- 2000, 72 VDC	110 Amps DC
EP- 4000, 108 VDC	150 Amps DC
EP- 7000, 108 VDC	265 Amps DC
EP-10000, 144 VDC	295 Amps DC

Version 2.0 – February 11, 2013

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The Elco Electric Drive System

Elco brings reliability, durability, and high efficiency together with ease of installation and ease of use.

Please take time to read these instructions carefully and completely before attempting to install and sea trial the Elco Electric Drive System.

*In order to avoid risk of personal **INJURY** or damage to the control equipment, **READ THIS MANUAL VERY CAREFULLY**. If after reading these instructions doubt exists, contact an Elco Motor Yachts representative for clarification.*

This manual is valid only for the systems listed on the front page.

This manual contains the instructions you need to safely install your electric drive system. As with any motor, there is the possibility of injury. Preparing yourself with knowledge is the best way to avoid injury.

The description and specifications contained herein were in effect at the time this manual was approved for printing. Elco Motor Yachts' policy is one of continual improvement, and we reserve the right to discontinue models at any time, to change specifications, designs, and methods of procedure without notice and without incurring obligation.

*Please contact Elco Motor Yachts at **877-411-ELCO (3526)** or **518-945-2200** with any questions.*

Elco believes safety is of the utmost importance and recommends that anyone installing, operating, maintaining or servicing Elco products, work with due care, common sense and heed the safety information contained herein and where posted via safety decals on system components. The safety decals should be kept clean and replaced when they become damaged or unreadable. If a part is replaced that has a safety decal affixed to it, the decal shall also be replaced when the new part is installed.

Safety Alert Symbols and Safety Signal Words



This is the Safety Alert Symbol. It appears in safety statements throughout this manual. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



INDICATES AN IMMINENTLY HAZARDOUS SITUATION. IF NOT AVOIDED, WILL RESULT IN SERIOUS INJURY OR DEATH. THIS DECAL WILL HAVE A RED BACKGROUND.



INDICATES A POTENTIALLY HAZARDOUS SITUATION. IF NOT AVOIDED, MAY RESULT IN MINOR OR MODERATE INJURY. IT MAY ALSO ALERT AGAINST UNSAFE PRACTICES. THIS DECAL WILL HAVE A YELLOW BACKGROUND.



INDICATES A POTENTIALLY HAZARDOUS SITUATION. IF NOT AVOIDED, MAY RESULT IN SERIOUS INJURY OR DEATH. THIS DECAL WILL HAVE AN ORANGE BACKGROUND.



INDICATES INFORMATION THAT RELATES DIRECTLY OR INDIRECTLY TO THE SAFETY OF PERSONNEL, THE UNIT/SYSTEM, OR THE ENVIRONMENT.

1.1 General

Safety begins with common sense and careful practices. Lack of common sense and carelessness can and will cause cuts, burns, mutilation and other bodily injuries or death. This section contains general safety precautions and guidelines to reduce/prevent risk of personal injury. The owner/user of this system should not operate it until this manual is read and understood.

1.2 Pre-Installation



THE FOLLOWING SAFETY MESSAGES CONTAIN DANGER LEVEL HAZARDS.

- **NEVER PERMIT ANYONE TO OPERATE THIS SYSTEM WITHOUT PROPER TRAINING FIRST.**
- **ONLY AUTHORIZED AND QUALIFIED PERSONNEL SHOULD OPERATE THIS SYSTEM.**
- **READ AND UNDERSTAND THIS MANUAL BEFORE OPERATION TO ENSURE SAFE OPERATING AND MAINTENANCE PRACTICES ARE FOLLOWED.**
- **READ, UNDERSTAND, AND OBEY ALL DANGERS, WARNINGS, CAUTIONS, AND OPERATING INSTRUCTIONS ON THE MACHINE/SYSTEM AND IN THIS MANUAL.**
- **USE THE ELECTRIC DRIVE SYSTEM IN A MANNER WHICH IS WITHIN THE SCOPE OF ITS INTENDED APPLICATION AS SET BY ELCO.**
- **SEE OR CONTACT AN ELCO REPRESENTATIVE FOR ADDITIONAL INFORMATION OR TRAINING.**
- **PERFORM PRE-OPERATION CHECKS AND INSPECTIONS DESCRIBED IN THIS MANUAL.**

1.3 During Installation, Operation, Maintenance and Servicing



THE FOLLOWING SAFETY MESSAGES CONTAIN WARNING LEVEL HAZARDS.



SHOCK HAZARD

- ELECTRIC SHOCK HAZARD DUE TO ELCO ELECTRIC DRIVE SYSTEM VOLTAGES.
- USE CARE WHEN INSPECTING AND HANDLING COMPONENTS. ISOLATE POWER SOURCES WHEN PERFORMING MAINTENANCE.



EXPLOSION HAZARD

- EXPLOSIVE HAZARD DUE TO HYDROGEN GAS GENERATION FROM BATTERIES.
- KEEP AREA AROUND BATTERIES OR BATTERY COMPARTMENT WELL VENTILATED.
- KEEP SPARKS, OPEN FLAMES, AND ANY OTHER FORM OF IGNITION OUT OF THE AREA.



FIRE HAZARD

- UNDERSIZED WIRING SYSTEMS CAN CAUSE AN ELECTRICAL FIRE.
- USE ONLY ABYC OR EQUIVALENT APPROVED WIRING TO WIRE BATTERIES TO THE ELCO ELECTRIC DRIVE SYSTEM.

SECTION 1 – SAFETY PRECAUTIONS

1.3 During Installation, Operation, Maintenance and Servicing (continued)



SEVERE HAZARD

- ROTATING COMPONENTS CAN CAUSE SEVERE INJURY OR DEATH.
- NEVER WEAR JEWELRY, UNBUTTONED CUFFS, TIES, OR LOOSE FITTING CLOTHING WHEN WORKING NEAR FREEWHEELING OR POWERED ROTATING OUTPUT SHAFTING OUTSIDE THE DRIVE BOX.
- ALWAYS TIE HAIR BACK WHEN WORKING NEAR FREEWHEELING OR POWERED ROTATING OUTPUT SHAFTING OUTSIDE THE DRIVE BOX.
- KEEP HANDS, FEET, AND TOOLS AWAY FROM ALL MOVING PARTS.



ALCOHOL/ DRUG HAZARD

- NEVER OPERATE THE ELCO ELECTRIC DRIVE SYSTEM OR THE VESSEL WHILE UNDER THE INFLUENCE OF ALCOHOL AND/OR DRUGS.



EXPOSURE HAZARD

- ALWAYS WEAR APPLICABLE PERSONAL PROTECTION EQUIPMENT (PPE) APPROPRIATE FOR THE OPERATION OR MAINTENANCE TO BE PERFORMED.

1.3 During Installation, Operation, Maintenance and Servicing (continued)

 **WARNING**

- **MODIFICATION OR ALTERATION OF THE ELCO ELECTRIC DRIVE SYSTEM OR ITS COMPONENTS SHALL BE MADE ONLY WITH WRITTEN PERMISSION FROM THE MANUFACTURER.**

 **CAUTION**

- **ENSURE WORK AREAS AND OPERATION AREAS ARE ADEQUATELY ILLUMINATED.**
- **ALWAYS USE APPROPRIATE TOOLS FOR MAINTENANCE OR TASKS.**
- **THE ELCO ELECTRIC DRIVE SYSTEM CONTAINMENT BOX IS TO BE OPENED ONLY BY PERSONNEL AUTHORIZED BY ELCO.**
- **ALWAYS MAINTAIN LABELS AND REPLACE IF MISSING, TORN, OR FADED. CONTACT AN ELCO REPRESENTATIVE FOR ORDERING AND/OR REPLACEMENT INFORMATION.**
- **HANDLING AND MANEUVERING CHARACTERISTICS OF THE THROTTLE CONTROL AND VESSEL RESPONSE ARE DIFFERENT FOR EVERY VESSEL. CAREFULLY TEST AND LEARN THE CHARACTERISTICS OF YOUR PARTICULAR VESSEL USING THE ELCO ELECTRIC DRIVE SYSTEM IN ORDER TO BE COMFORTABLE WITH THE MANNER IN WHICH YOUR VESSEL HANDLES.**

1.3 During Installation, Operation, Maintenance and Servicing (continued)

NOTICE

- **IT IS IMPORTANT TO PERFORM ALL CHECKS LISTED IN THIS MANUAL AT REGULAR INTERVALS. PERIODIC CHECKS ASSIST IN PREVENTING UNEXPECTED DOWNTIME AND HELP EXTEND THE LIFE OF YOUR ELCO ELECTRIC DRIVE SYSTEM.**
- **ALWAYS BE ENVIRONMENTALLY RESPONSIBLE. FOLLOW EPA OR OTHER GOVERNMENTAL GUIDELINES FOR DISPOSAL OF BATTERIES OR HAZARDOUS MATERIALS.**

SECTION 2 – INSTALLATION RECOMMENDATIONS

2.1 General

These instructions are intended as general guidelines for the installation of an Elco Electric Drive System (“Elco Drive”). Reading them carefully and using them to plan and complete each task will be of great benefit now and over the lifetime of the Elco Drive.

A well-planned installation generally saves time and results in a better working final product. In planning the installation, provide for accessibility, maintenance, cleaning, component replacement and rapid access to key components such as fuses and batteries, as this will save installation time and increase system reliability once the Elco Drive is placed into service.

If questions arise at any point during the planning, installation and testing phases, or during general use, please call Elco Motor Yachts at 518-945-2200 for technical support.

2.2 Standard System Components

Elco AC Electric Drive assembly models shown below with optional adjustable vibration isolator mounts and shaft couplings.



Patent Pending

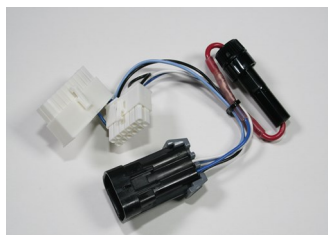
SECTION 2 – INSTALLATION RECOMMENDATIONS

2.2 Standard System Components (continued)

Engage IV (mono-chrome display, standard on EP-600, 1200, 2000 and 4000), **Engage VII** (full color display, standard on EP-7000 and 10000), **Adapters** for Engage IV and VII, **Variable Speed Controller**, **Key Switch**, **Power ON Lamp**, **Power Boost Button**, **15 foot multi-conductor cable** and **Anderson Power Connector**.



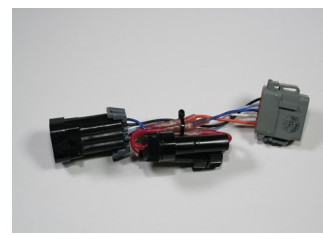
Engage IV



Engage IV Adapter



Engage VII



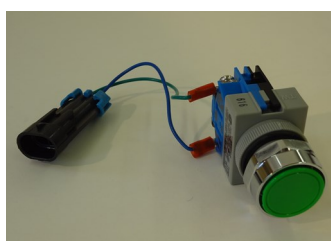
Engage VII Adapter



Key Switch



Power ON Lamp*



Power Boost Button



Variable Speed Controller



15-foot Multi-Conductor Cable



Anderson Power Connector

** The Power ON Lamp is shipped without the leads inserted into the plug receptacle to facilitate mounting. Install plug receptacle AFTER mounting the lamp because the hole required for the Power On Lamp is smaller than the receptacle.*

These parts are unique to the Elco Drive and have been included as part of the system. The standard instrument panel cable length is 15 feet, unless a custom length was specified. Elco recommends securing the multi-conductor cable neatly from point to point. If the cable is too short, an extension cable may be purchased from Elco. Anderson Power connector provided to plug battery cables to Anderson Connector on drive.

Elco advises that all American Boat and Yacht Council (ABYC) guidelines be closely followed in the layout and installation of the battery bank and that only “marine grade” wiring and connectors be used. Marine grade wire should have a minimum Type III (Class K) rating, which will be extremely flexible, highly stranded and tinned with a 105 degree C temperature rating on the insulation. In addition, all cables should be grouped together whenever possible to cancel stray magnetic fields and enclosed in convoluted flexible conduit (commonly referred to as “loom”). Please refer to your system drawings to determine the cable pathways you will need to layout. Battery conductors and flexible conduits are available from marine product suppliers.

2.3 *Installation Tools and Materials*

Tools

The installation may be performed using the following tools:

- Assorted screwdrivers
- Wire crimpers
- English hex wrench set
- Wire strippers
- Adjustable pliers
- Cable cutter
- Heat gun
- Drill & bits
- Clamp-on DC ammeter
- Volt-Ohm meter
- Tape measure

Installation Materials Required but Not Provided with System

The following typical installation materials are required and/or recommended to make a complete and workmanlike installation:

- Black UV-resistant wire ties with mounting holes
- 3/4" and 1" stainless steel pan head self-tapping screws
- Convoluted split loom to enclose battery and charger wiring
- Battery tie-down straps
- Water dispersing/antioxidant spray

SECTION 2 – INSTALLATION RECOMMENDATIONS

2.4 Installation Procedures

The following procedures should always be followed during the installation:



WARNING

- **NEVER WORK ON 120/240-VOLT AC SYSTEMS WHEN ENERGIZED.**



CAUTION

- **USE EXTREME CAUTION WHEN WORKING ON BATTERIES. WEARING PROPER EYE PROTECTION IS RECOMMENDED. REMOVE ALL METAL JEWELRY WHENEVER WORKING ON THE ELECTRICAL SECTION.**

- Each termination should be lightly sprayed with a water dispersing antioxidant prior to crimping. For all connections, use heat shrink tubing with adhesive lining. Use a heat gun to seal connectors. The goal is to make durable connections having low electrical resistance, and waterproof.
- Take care that wire strippers or knives do not nick or cut any of the conductors when removing the insulation.
- Always double-check each crimp with a sharp and firm tug.
- When making connections to the lead posts of the battery bank, clean the terminals until you are sure that virgin lead (without any oxidation) is present. Also clean the copper lug with a Scotch pad. After making the connection and ensuring it is tight, lightly spray the antioxidant so it will draw into any voids via capillary attraction. The post may then be wiped off and coated with a battery corrosion prevention compound.
- Current carrying conductors must be secured every 18" by means of a suitable method per ABYC E-11.14.6.9 recommendations. Wire routing must be above bilge water in locations protected from dripping, exposures to the weather, spray and oil. Route wires in positions that limit the chance of physical damage, and never run a wire across a sharp edge.
- Conductors that may be exposed to physical damage shall be protected by self-draining loom, conduit, tape, raceways, or other equivalent protection. Conductors passing through bulkheads or structural members shall be protected to minimize insulation damage such as chafing or pressure displacement. Conductors shall also be routed clear of sources of chafing such as steering cable and linkages, motor shafts, and control connections. (ABYC E-11.14.6.7)
- Provide strain relief for wires at bolted terminals.

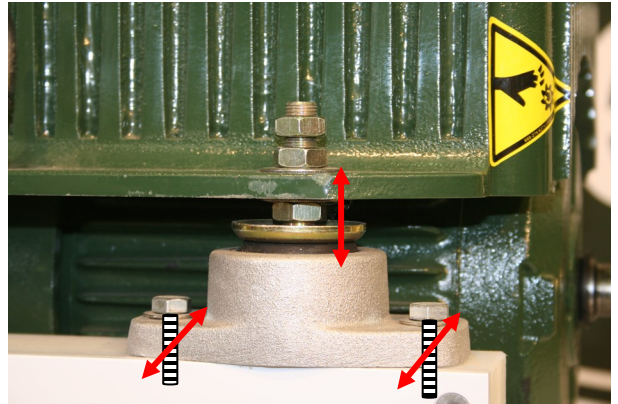
SECTION 2 – INSTALLATION RECOMMENDATIONS

2.5 Installation Instructions

All instructions provided below are based upon generally accepted practices. Drawings to illustrate specific battery layouts for various Elco Drives have been included in this manual on pages 22-26.

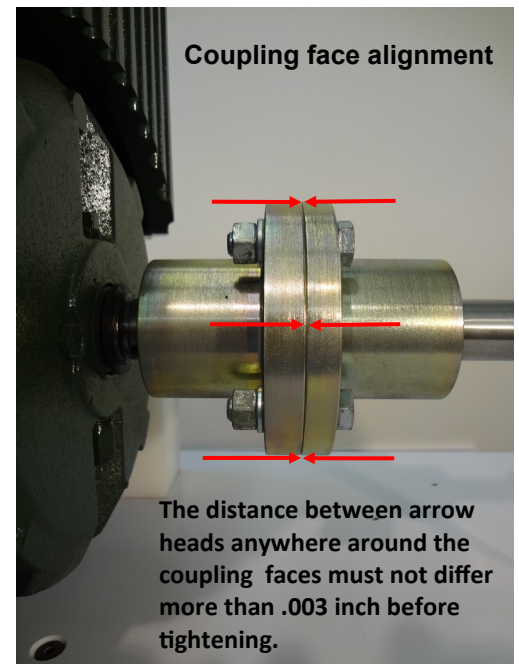
1. Elco Drive Installation

- The Elco Drive should be mounted on engine stringers above the normally expected water level in the bilge. Each adjustable vibration isolator (shown below) has two slotted mounting holes to accommodate anchoring bolts. Adjust the isolators to allow alignment of the motor assembly to the drive shaft coupling **before** drilling and bolting isolators to the stringers. Positioning of the fasteners through the center of the slotted holes will allow the greatest flexibility in final alignment.
- When all four mounts are in place, the motor may be angled to the shaft by turning the lowest nut on each of the four mounts. Do not tighten the upper nuts until final alignment is achieved.



2. Shaft Coupling

- The mechanical power from the Elco Drive is transmitted to the propeller shaft through a matched set of coupling halves.
- Shaft couplings require precision alignment to form a perfectly straight line of motor shaft and prop shaft. An improperly aligned shaft will result in noise, vibration, or both and can shorten motor life.
- With the shaft in place, the Elco Drive should be positioned and fastened into its intended location. Before bolting, care must be taken to assure that the prop coupling half is perfectly perpendicular to the prop shaft. Turn the motor at slow speed to observe that the coupling spins in balance without wobble.
- The Elco Drive will be in alignment when the faces of the two halves of the propeller coupling are parallel within .003 of an inch or less. Use a feeler gauge or dial indicator to check all around the two faces. Turn the vibration isolator leveling bolts to make adjustments until the two faces are in alignment.



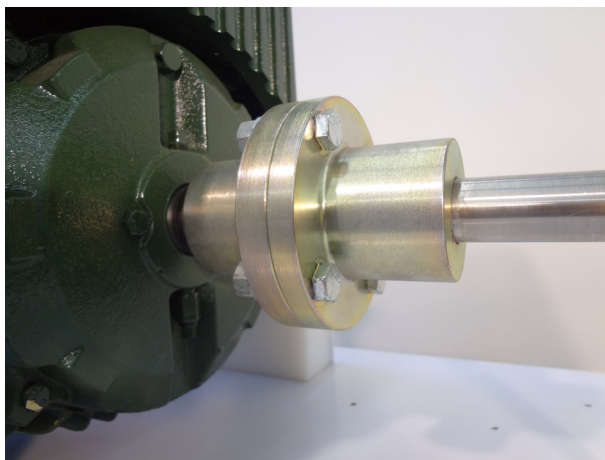
SECTION 2 – INSTALLATION RECOMMENDATIONS

2.5 Installation Instructions (continued)

2. Shaft Coupling (continued)

- If you have to loosen the top nut on the vibration isolator mount, you must be sure to re-tighten the nut and then re-check the alignment. Extra care at this time will pay off in terms of future performance.
- Do not attempt to bring the two faces of the coupling together by “pulling forward” the propeller shaft. When the Elco Drive is in perfect alignment, bolt the two halves of the coupling together. The propeller shaft should turn easily. If not, check for misalignment or over-tightened packing.

NOTE: The EP-600, EP-1200 and EP-2000 have 1” motor shafts. The EP-4000, EP-7000 and EP-10000 have 1.25” motor shafts.



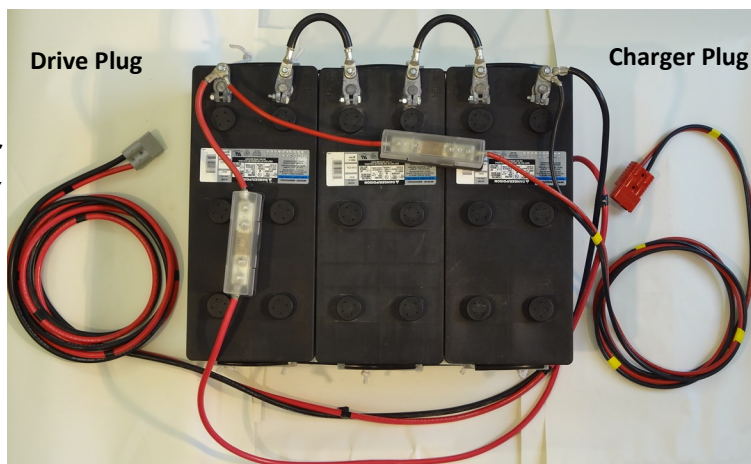
Typical four-inch, four-bolt, coupling set to mate motor shaft and propeller shaft.

3. Batteries

WARNING: For vessels being repowered to electric propulsion, weight redistribution must be considered when placing batteries. Uneven distribution of weight can change the handling, buoyancy or center of gravity of the vessel. Elco recommends consulting with knowledgeable marine professionals before making weight distribution changes.

- Battery banks must be planned by a competent marine electrician, preferably certified by the ABYC for Electric. Suggested configurations for battery banks are shown in the system drawings on pages 22-26 of this manual. The batteries should be securely tied down to battery trays with ledgers that prevent battery shifting. A capsized boat must be able to keep its battery bank fully secured. Generally, ledgers that prevent shifting, plus a single, heavy strap rated for twice the battery weight, drawn tightly and secured on each battery will allow this requirement to be met. Exposed battery terminals must be protected from coming in contact with metal objects by installing a physical barrier or by using insulating terminal caps.

Hookup illustration (not installation) for three batteries in series. The grey receptacle plugs into the Elco Drive. The red receptacle plugs into the Charger. Note both circuits are equipped with fuse protection.



SECTION 2 – INSTALLATION RECOMMENDATIONS

2.5 Installation Instructions (continued)

4. Charging

- The charging system (optional equipment) requires mounting in a dry, drip-proof area with good ventilation. The charging system must be protected from physical damage, such as might occur if gear is stored near the charging system. If gear is stored in the vicinity of the chargers, a physical barrier must be constructed to protect the charging system components. Allow for at least two inches of space on the top, bottom, front and sides of the mounting plate. If the charger is mounted on a wood, fiberglass or similar thermally insulating surface, the charger must have an air space on the backside. This air space can be achieved with spacers or washers around the mounting screws, which provide about 3/8" of clearance. The charging panels supporting the chargers must be able to withstand a minimum of 75 pounds of force in any direction without any deformation or movement. Elco is not responsible for charging system damage.



Un-mounted charger above equipped with Anderson receptacle (red plug) for charging batteries (see photo on page 15). The three unconnected leads go into a plug for either 240VAC or 120VAC, or may be wired directly into the AC circuit protection panel.

5. Outlets

Marine grade outlets powered from the AC panel sub-circuit should be mounted near the charging panels so that the charger's cords reach without strain. Follow ABYC guidelines for proper circuit protection and wire sizes.

6. Bonding/Grounding

Please reference ABYC E-11 and T-30 guidelines.

The battery wiring to the Elco Drive, as well as other active wiring, should be isolated from the boat ground/bonding system. The aluminum motor enclosure, which is electrically isolated, should be connected to the boat ground/bonding system with a marine grade green jacketed wire of the appropriate wire gauge, Ref. to E-11 and T-30, but not less than AWG # 8.

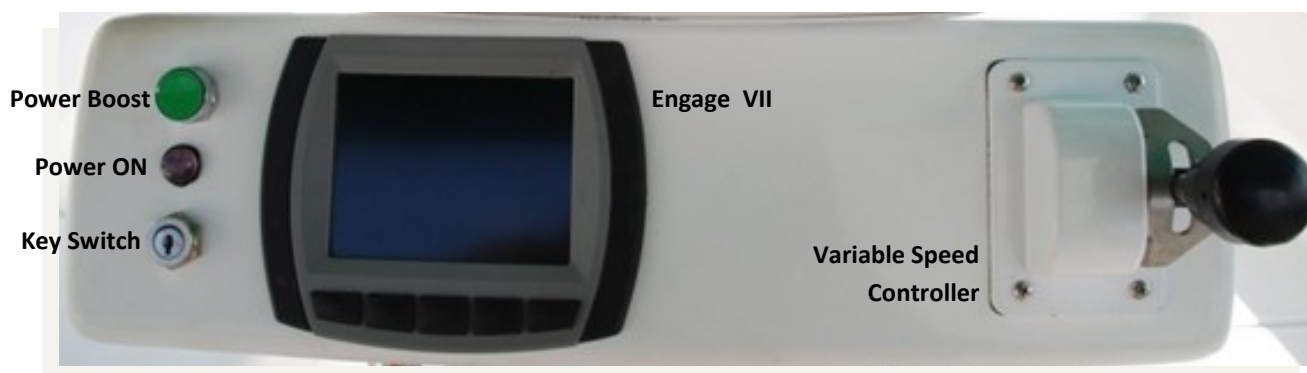


SECTION 2 – INSTALLATION RECOMMENDATIONS

2.5 Installation Instructions (continued)

7. Installing Controls and Instruments

- The Engage IV or VII, Variable Speed Controller, Key Switch, Power ON Lamp and Power Boost Button should all be mounted vertically or at an angle to a instrument panel housing to prevent standing water on the panel. The top edge of the Engage IV or VII must be sealed with a sealant such as RTV to prevent water incursion. Refer to the Engage factory installation instructions for more detailed information on installing this component. Two-foot cable extensions are available for components if needed. Note: *Power ON Lamp should be mounted before installing the plug to the bare leads as shipped.*



**Above: Typical NavPod installation. NavPod slopes to allow moisture and water to run off.
Below: Rear view of NavPod mounted to Edson pedestal. A water tight seal and sloped back should prevent water incursion.**



SECTION 2 – INSTALLATION RECOMMENDATIONS

2.5 Installation Instructions (continued)

8. Cable Installation

- Pathways should be carefully planned and well laid out with bundles grouped in close proximity whenever possible to reduce stray magnetic fields. The instrument panel cable that plugs into the motor assembly should not be located in close proximity to any power cables, including the battery leads going to the motor assembly. Care should be taken to place cable paths in areas, which remain dry and are not subjected to physical damage, strain or poor support. Once organized, a cable group should be inserted in flexible plastic conduit (loom) prior to installation. All wires must be marine grade.
- Conductors that may be exposed to physical damage must be protected by self-draining loom, conduit, tape, raceways, or other equivalent protection. Conductors passing through bulkheads or structural members must be protected to minimize insulation damage such as chafing or pressure displacement. Conductors must also be routed clear of sources of chafing such as steering cable and linkages, motor shafts, and control connections. (ABYC E-11.14.6.7)
- Current carrying conductors must be secured every 18" by means of a suitable method (ABYC E-11.14.6.9.)
- Wire routing must be above bilge water in locations protected from dripping, exposures to weather, spray and oil.



- The 15-foot multi-conductor cable terminates in a polarized plug that connects to the main motor assembly enclosure.
- If the instrument panel harness is not long enough, contact Elco to purchase an extension.

3.1 Pre-launch testing

1. Before powering up the drive, check the motor mounts, propeller shaft and all other components in the mechanical power transmission system to be sure that they are clear, turn freely and are lubricated.
2. Put the Variable Speed Controller in the NEUTRAL position. Insert the key into the key switch and turn it to the ON position. The Power ON Lamp should be illuminated and the voltmeter function of the Battery monitor should show the state of discharge as a percentage.
3. The charging system should now be enabled and tested. Turn the Key Switch to the OFF position. Be sure that when shore power is plugged in, the charger outlets are energized and have the correct polarity. Then, with the dock side breaker turned OFF and the boat side breaker ON, plug in the chargers. Turn the dockside breaker to ON and observe the chargers which should display the charging function. At this point observe a charging cycle to verify that the system is working properly and that the batteries are fully charged for sea trials.
4. Finally, test the drive to make sure the shaft turns freely and without vibration at various speeds. With power on, slowly increase the motor speed through the full range briefly. Do not operate for sustained periods. Water is necessary to lubricate underwater bearings.

Once you have successfully completed the initial system startup, you are ready for the sea trials.



It is critically important that the correct propeller be used with your Elco EP Drive. Propeller pitch directly affects current consumption, RPMs and ultimately, vessel speed. An incorrect propeller can cause excessive current flow which may cause significant and irreversible damage your motor, which would not be covered by your Elco warranty. Read the following sections carefully and call your Elco Service Team with any questions.

4.1 Initial In-Water Test

Once Section 3 is completed and the vessel is launched and it is verified there are no leaks, sea trials of the Elco Drive may be performed. *NOTE: It is recommended to have a chase boat in the area for the first test so that if problems occur, the system may be shut down and the boat assisted back to the dock.*

1. After casting off from the dock, gently move the Variable Speed Controller out of NEUTRAL in either FORWARD or REVERSE. The motor should start to turn in whichever direction is selected (UP for forward, DOWN for reverse).
2. With the Key Switch ON, slowly advance the Variable Speed Controller FORWARD and observe the ammeter. At about 2/3 power, the ammeter should indicate a current flow which is less than the maximum rated current for the system. *NOTE: the maximum rate current for each system is listed on the front cover of this manual.* Back off the Variable Speed Controller until the current is between 10% and 20% less than the system's maximum rated current and allow the system to run for about 30 minutes while staying near to shore or the chase boat. During this initial trial period, have a second person visually check each and every power connection and system component for overheating or any abnormal condition. If overheating or abnormal conditions are observed, turn off the drive and tow the vessel back to the dock.
3. After this test period return to the dock and re-check all connections for overheating of power connections at fuses, disconnects, and batteries using a hand held optical temperature sensor or other appropriate, safe means. If any connections measure more than approximately 35C or 65F above the ambient temperature within the boat, correct the problem and repeat the 30 minute test. *Do not proceed beyond this step until a successful 30-minute test is achieved.*


4.2 Efficiency Test

After the initial test has been successfully completed, the Elco Drive is ready to head out for a second sea trial to test for efficiency. This test should not be overlooked as the speed and range of the vessel is optimized by using the correct propeller.

1. Once free of the dock, the vessel should be set up for either a long, straight run or in a large circle.
2. To ensure the motor is operating at the correct amperage relative to hull speed, proper propeller pitch needs to be verified. While underway, use the Engage and a GPS to measure speed, RPMs and Amps. Slowly increase the Variable Speed Controller setting to approximately 25%, 50%, 75%, 100% and read the motor RPMs, current, and vessel speed at each setting using a GPS. Record the data into the table on page 21. Also record the pitch and diameter of the propeller being used. If the vessel is being tested in waters with a current, or there is any wind, it is recommended that two sets of data be recorded - one set going in direction of current or wind, another set in the exact opposite direction.

Call an Elco service advisor with this information, who will suggest a correct propeller.

4.2 Efficiency Test (continued)

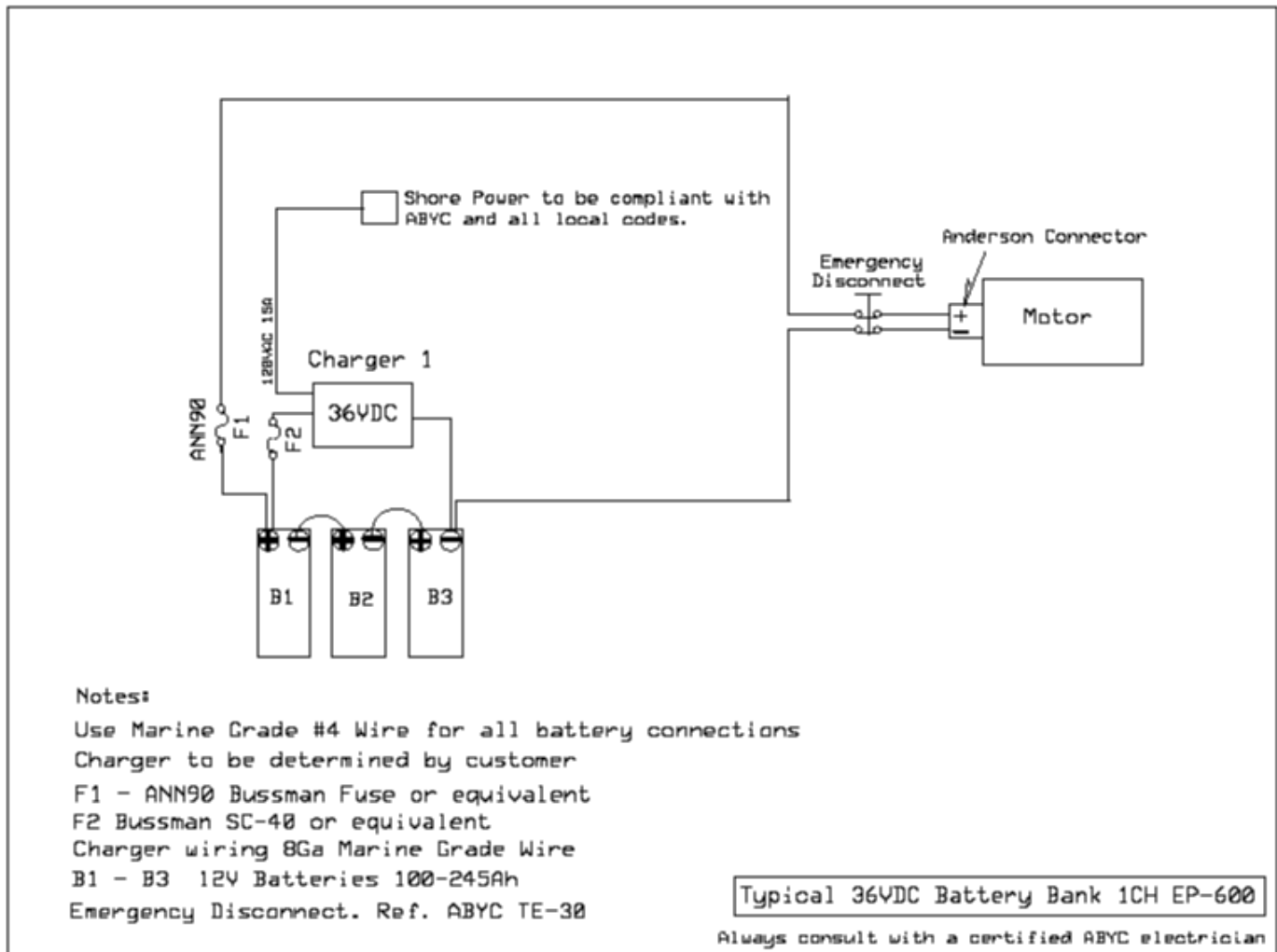
Data record to verify correct AMPERAGE relative to HULL SPEED					
Increasing Variable Speed Control					
	25%				100%
GPS SPEED					
RPM					
AMPS					

NOTE: At full power the current displayed on the center gauge of the instrument panel should be approximately 75% of the maximum operating current rating for the system. When the Power Boost Button is pressed, in most cases the current will exceed the maximum acceptable operating current since this is a short-term condition.

3. If the system does not load up to approximately 75% of maximum current (under loading), or if the system is overloading or reaching full load before full power is applied and protecting itself by limiting the current flow electronically, propeller pitch may need to be increased or decreased respectively. At this point, if there are any questions about the load on the propulsion system, please call an Elco service advisor for guidance with the data collected in hand.
4. Sea trials should continue until the drive has been observed to perform properly under various load conditions, all mechanical systems are observed performing adequately and all electrical connections and operations are observed to be functioning properly. After each sea trial, the charging system should be plugged into a properly grounded outlet to recharge the batteries. After the first discharge, adequate time should be allowed to monitor the recharge cycle to assure the chargers are operating properly. If you have not yet done so, refer to the Operations and Maintenance Manual for guidelines pertaining to battery charging system operation.
5. The final step for sea trials is to head out for a long run with fully-charged batteries. Be sure that you have read and understand all documentation, battery capacity and that running times have been established. Operate the vessel long enough to discharge battery bank down 75% to about 25% state of charge. Before, during and after this run, follow this Installation Manual to verify that the Elco Drive is operating properly and to become familiar with the operation of the boat.

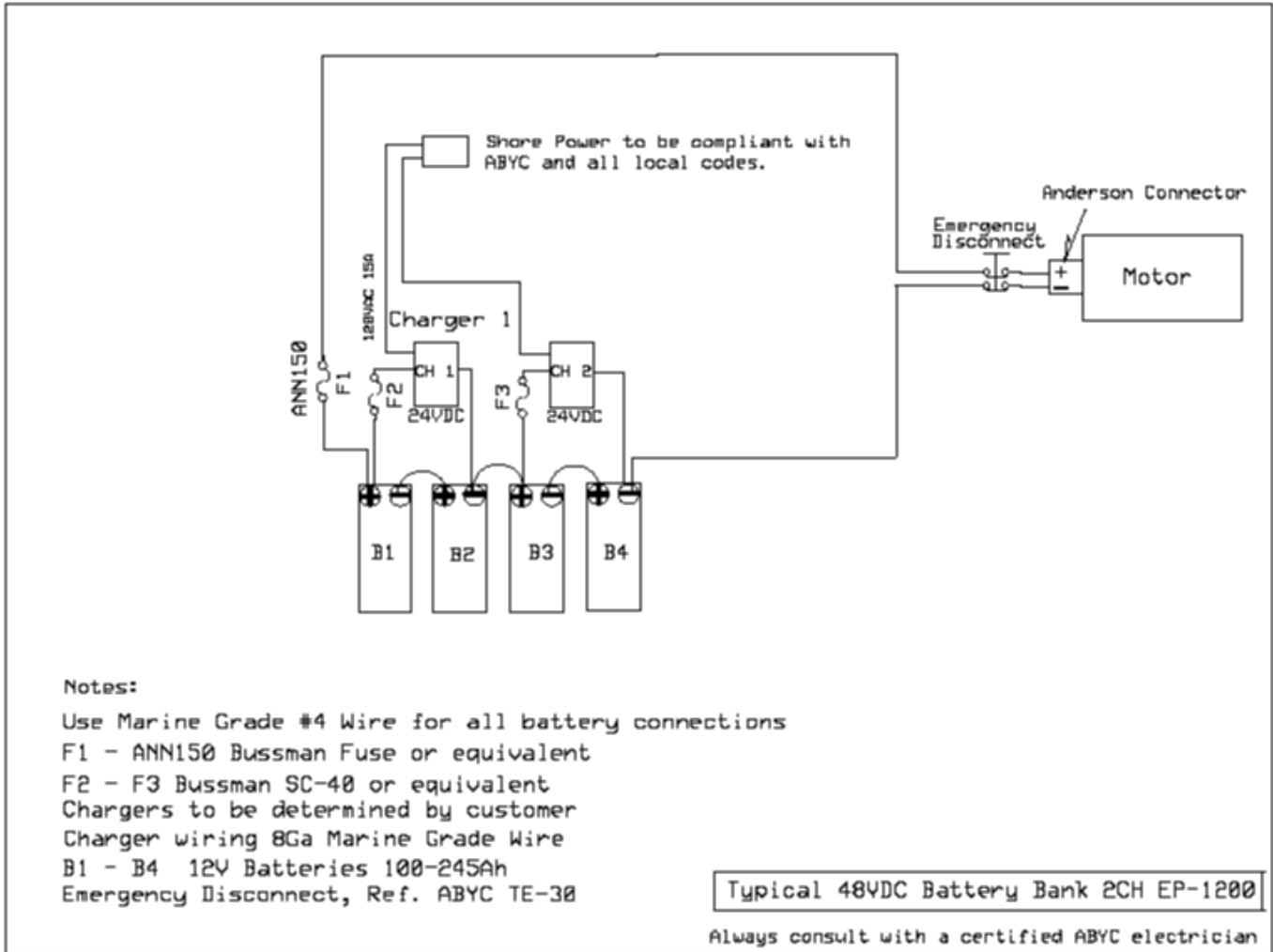
SECTION 5 — Typical Charging and Battery Diagrams

5. Typical Battery Configuration — 36 Volt DC



Notes:

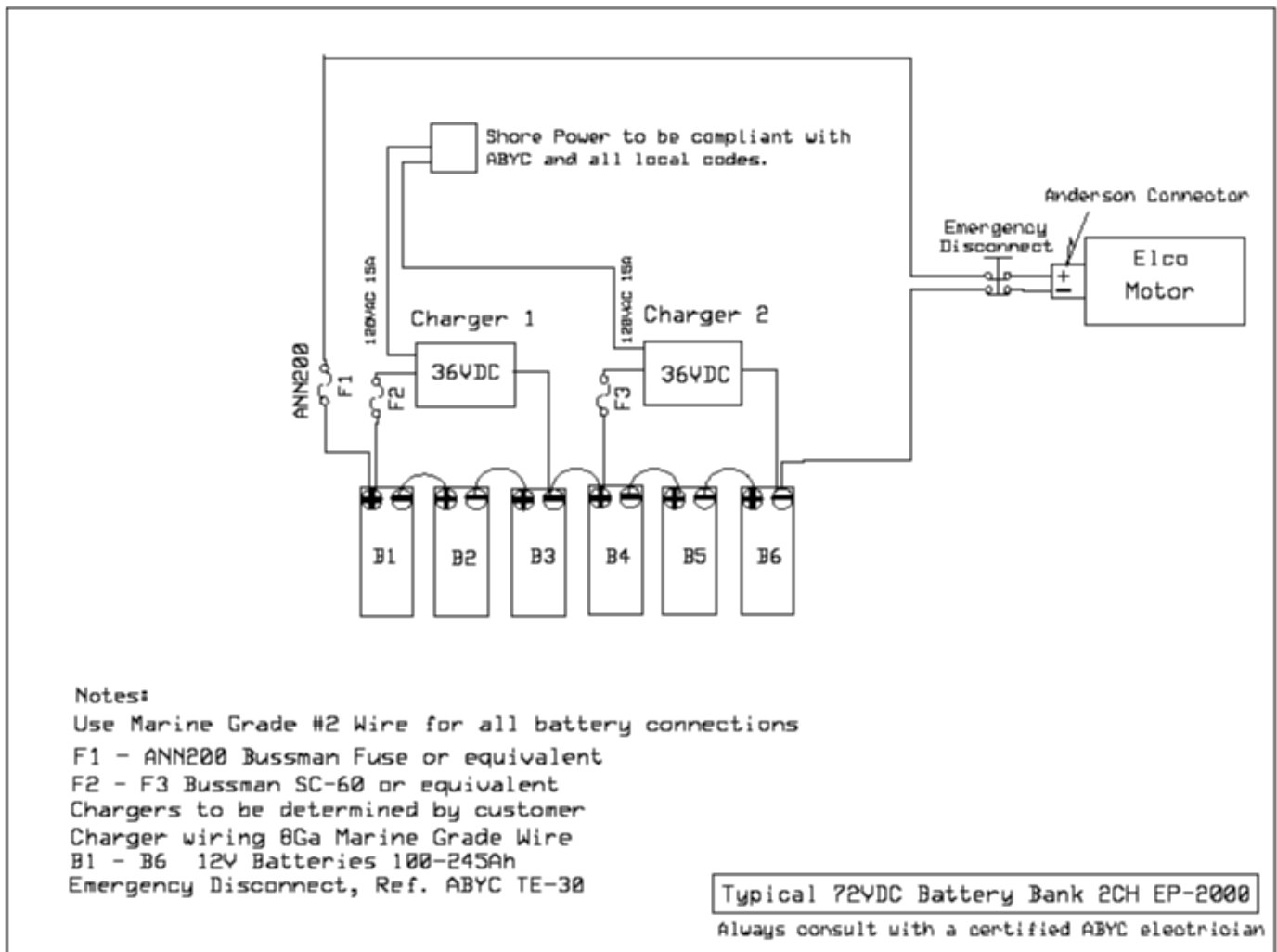
5. Typical Battery Configuration — 48 Volt DC



Notes:

SECTION 5 — Typical Charging and Battery Diagrams

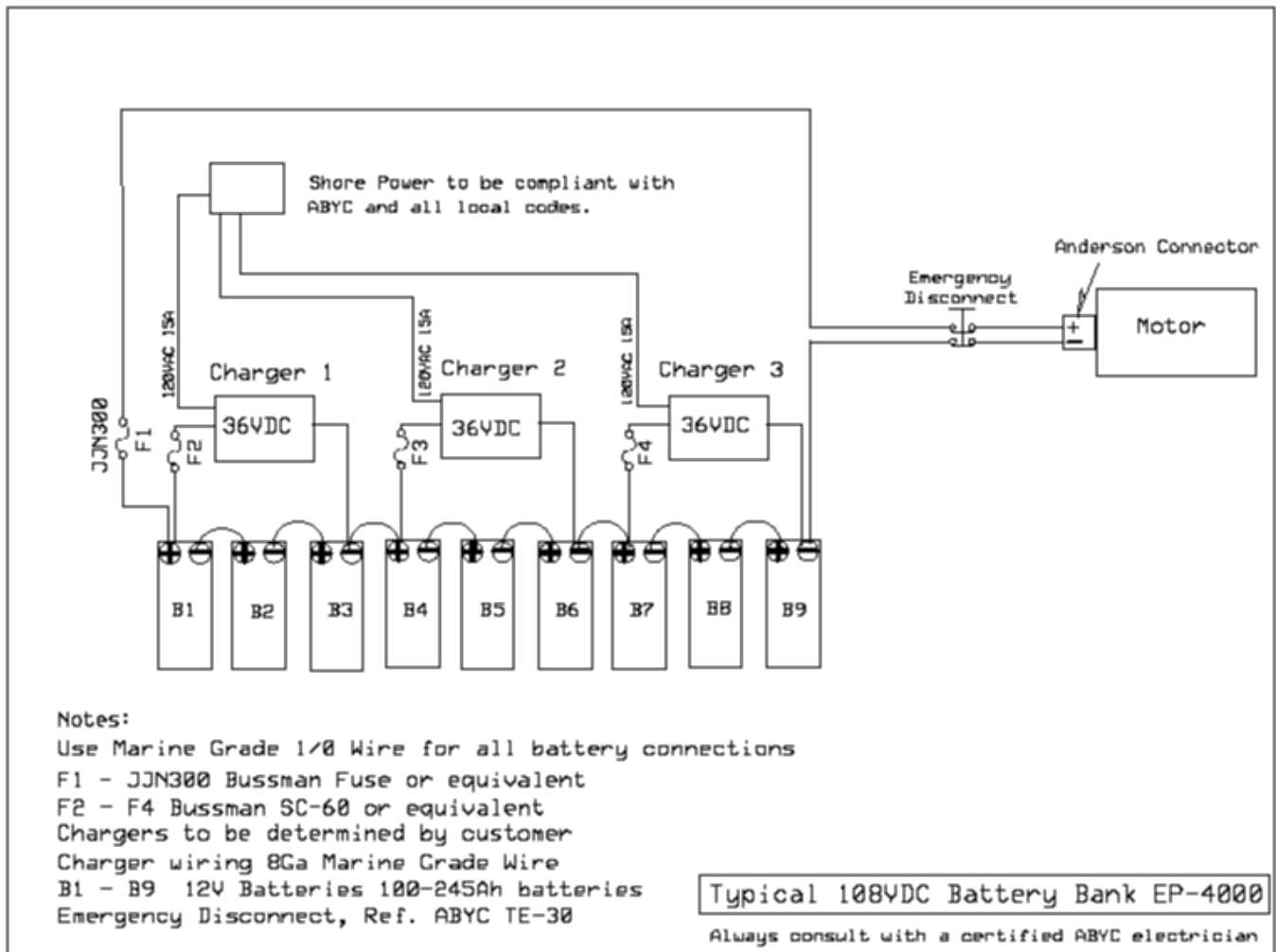
5. Typical Battery Configuration — 72 Volt DC



Notes:

SECTION 5 — Typical Charging and Battery Diagrams

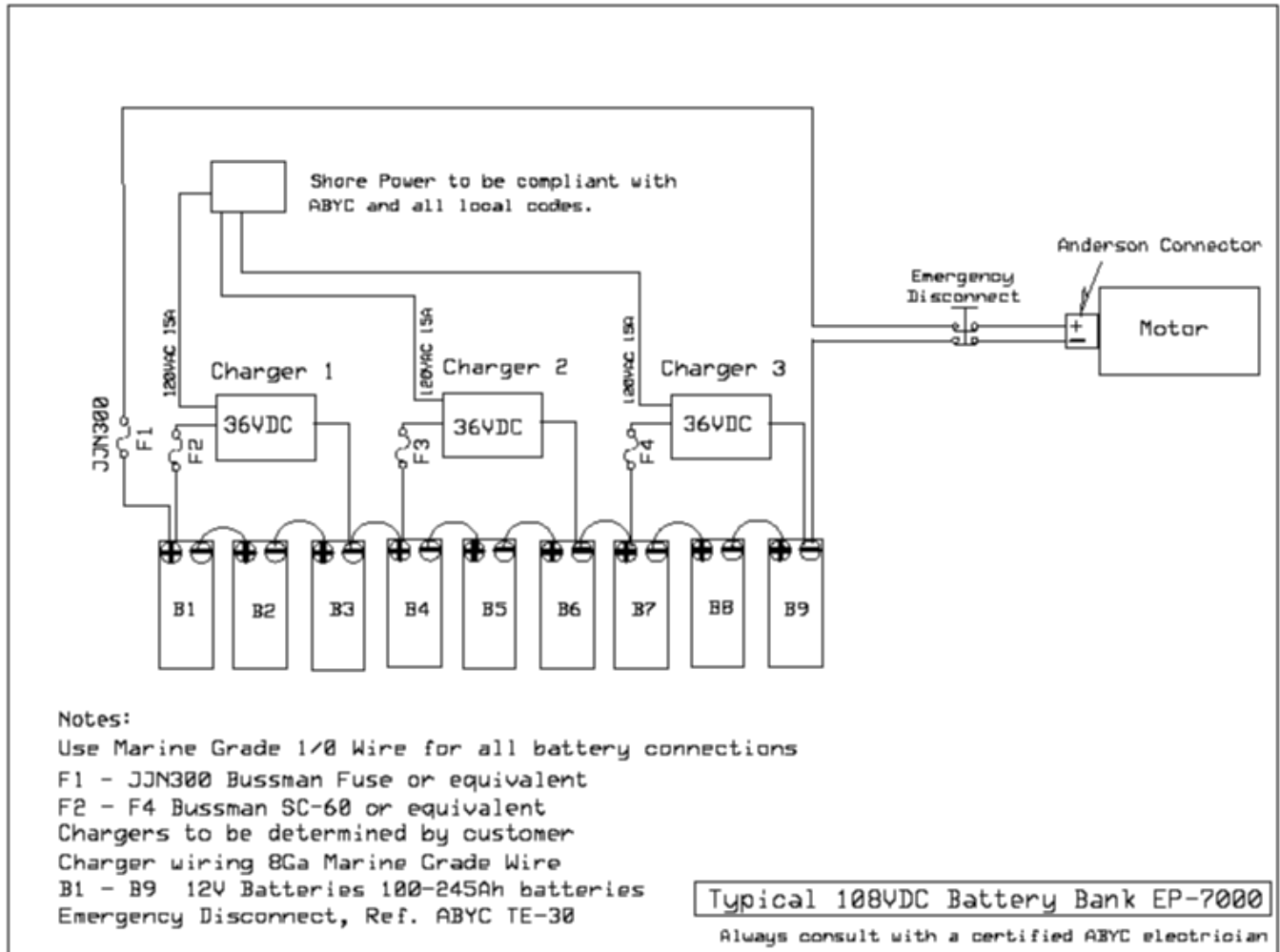
5. Typical Battery Configuration — 108 Volt DC



Notes:

SECTION 5 — Typical Charging and Battery Diagrams

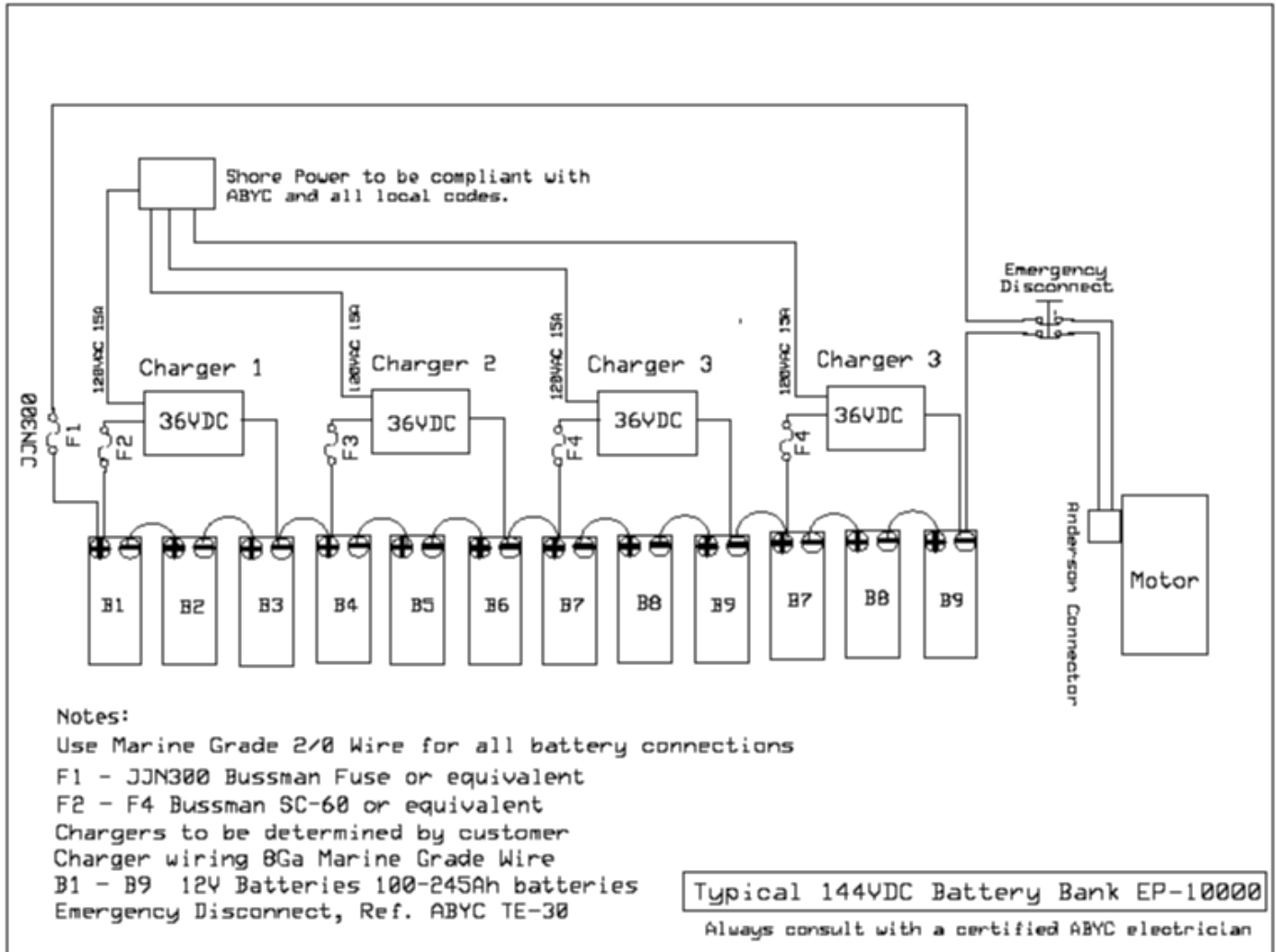
5. Typical Battery Configuration — 108 Volt DC



Notes:

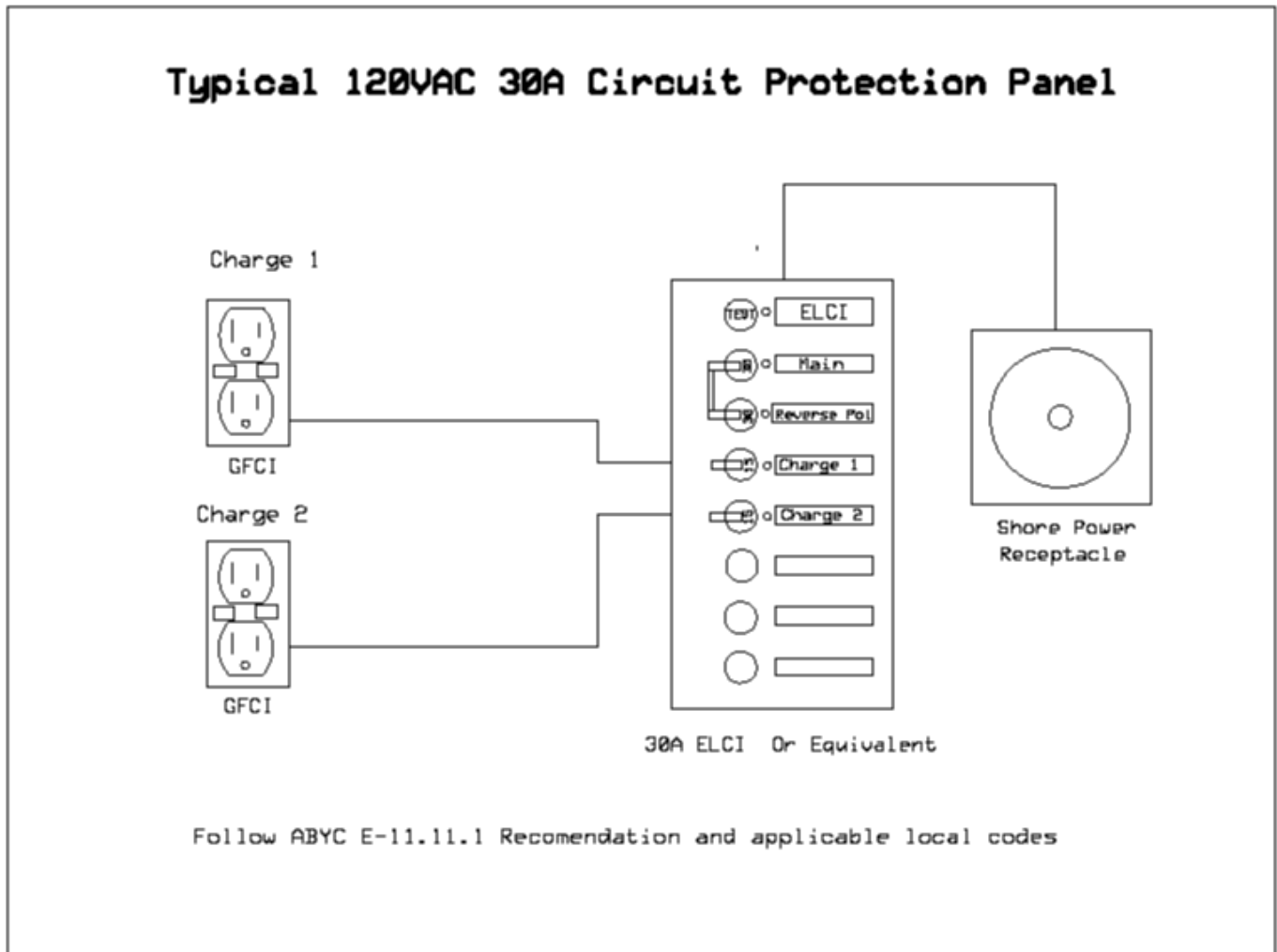
SECTION 5 — Typical Charging and Battery Diagrams

5. Typical Battery Configuration — 144 Volt DC



Notes:

5.1 Typical AC Circuit Protection Configuration



Notes:

Final Steps

Any wear and tear, which has taken place during the installation, should be addressed with touch-up paint, cleaning and wiping as needed.

Notes:



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