

**///FASTRESPONSE**

# SERVICE MANUAL

**KOHLER**  
GENERATORS

# Table of Contents

|                                                    | Page |                                                 | Page |
|----------------------------------------------------|------|-------------------------------------------------|------|
| <b>Safety Precautions</b> .....                    | i    | <b>Section 4.</b>                               |      |
| <b>Introduction</b> .....                          | iii  | <b>Generator Troubleshooting</b> .....          | 4-1  |
| <b>Service Assistance</b> .....                    | iii  | Power Scanner .....                             | 4-1  |
| <b>Section 1.</b>                                  |      | Generator Functions.....                        | 4-3  |
| <b>Fast-Response Concepts</b> .....                | 1-1  | <b>Section 5.</b>                               |      |
| General .....                                      | 1-1  | <b>Generator Disassembly-Reassembly</b> .....   | 5-1  |
| System .....                                       | 1-1  | Disassembly .....                               | 5-1  |
| Capabilities .....                                 | 1-1  | Reassembly .....                                | 5-4  |
| <b>Section 2.</b>                                  |      | <b>Section 6.</b>                               |      |
| <b>Operation</b> .....                             | 2-1  | <b>Wiring Diagrams</b> .....                    | 6-1  |
| Controls .....                                     | 2-1  | <b>Appendix A.</b>                              |      |
| Indicators .....                                   | 2-1  | <b>Main Generator Field Resistance</b> .....    | A-1  |
| Prestart Checks .....                              | 2-3  | <b>Appendix B.</b>                              |      |
| Starting .....                                     | 2-3  | <b>Uniboard for Controller Lower Tray</b> ..... | B-1  |
| Stopping .....                                     | 2-3  | <b>Appendix C.</b>                              |      |
| Emergency Stopping .....                           | 2-4  | <b>Uniboard to Decision Maker II (Dec-II)</b>   |      |
| Resetting .....                                    | 2-4  | <b>Tray Conversion</b> .....                    | C-1  |
| <b>Section 3.</b>                                  |      |                                                 |      |
| <b>Controller and Engine Troubleshooting</b> ..... | 3-1  |                                                 |      |
| Fast Check .....                                   | 3-1  |                                                 |      |
| Fast Check Features .....                          | 3-1  |                                                 |      |
| Fast Check Operations .....                        | 3-1  |                                                 |      |
| Engine and Electrics .....                         | 3-9  |                                                 |      |



# Safety Precautions

A Generator Set, like any other electro-mechanical device can pose potential dangers to life and limb if improperly maintained or imprudently operated. The best safeguards against accident are to be ever mindful of the potential dangers and to always use good common sense. In the interest of safety, some general precautions relating to operating of a Generator Set are presented below. Keep these in mind.

## WARNING

**LETHAL EXHAUST GAS!** The engine powering your generator discharges deadly carbon monoxide as part of the exhaust gas when operating. Carbon monoxide is particularly dangerous in that it is odorless and colorless. Keep in mind that it can cause death if inhaled for even a short period of time. Never operate the generator set inside a building unless the exhaust gas is piped safely outside. Never operate in any area where exhaust gas could accumulate and seep back inside an occupied building. Avoid breathing exhaust fumes when working on or near the generator set.

## WARNING

**EXPLOSIVE BATTERY GASES!** The gases generated by a battery being charged are highly explosive. Do not smoke or permit flame or spark to occur near a battery at any time, particularly when it is being charged. Avoid contacting terminals with tools, etc., to prevent burns and to prevent sparks that could cause an explosion. Remove wristwatch, rings, and any other jewelry before handling battery. Any compartment containing batteries should be well ventilated to prevent accumulation of explosive gases. To avoid sparks, do not disturb battery charger connections while battery is being charged and always turn charger off before disconnecting.

## WARNING

**UNIT STARTS WITHOUT NOTICE!** Units with Automatic Transfer Switches start automatically. Potential injury or electrocution can result. Turn Generator Master Switch on controller to OFF position, and remove battery cables (remove negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator.

## WARNING

**EXCESSIVE NOISE!** Never operate without adequate muffler or with faulty exhaust system—exposure to excessive noise is not only tiring but can lead to impairment of hearing.

## WARNING

**HIGH VOLTAGE!** Remember that the function of a generator set is to produce electricity and whenever electrical energy is present, there is the potential danger of electrocution. Keep everyone, especially children, away from the set while it is running and take precautions to prevent unqualified personnel from tampering with or attempting to operate your generator set. Have the set and electrical circuits serviced only by qualified specialists. Wiring should be inspected frequently—replace leads that are frayed or in poor condition. Be sure that generator is properly grounded. Do not operate electrical equipment when standing in water, on wet ground, or when your hands are wet.

## WARNING

**DANGEROUS ACID!** Avoid contact with battery electrolyte. It contains acid which can eat holes in clothing, burn skin, and cause permanent damage to eyes. Always wear splash-proof safety goggles when working around the battery. If battery electrolyte is splashed in the eyes or on skin, immediately flush the affected area for 15 minutes with large quantities of clean water. In the case of eye contact, seek immediate medical aid. Never add acid to a battery once the battery has been placed in service. Doing so may result in dangerous spattering of electrolyte.

## WARNING

**DANGEROUS FUELS!** Use extreme caution when handling, storing, and using fuels—all fuels are highly explosive in a vapor state. Store fuel in a well-ventilated area away from spark producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running to prevent spilled fuel from igniting on contact with hot parts or from ignition spark. Keep fuel lines and connections tight and in good condition—don't replace flexible fuel lines with rigid lines. Flexible sections are used to avoid breakage due to vibration. Should any fuel leakage, fuel accumulation, or electrical sparks be noted, **DO NOT OPERATE GENERATOR SET.** Have systems repaired by qualified specialists before resuming generator operation. Additional precautions should be taken when using the following fuels:

**Gasoline** - Store gasoline only in approved red containers clearly marked GASOLINE. Don't store gasoline in any occupied building.

**Propane (LP)** - Adequate ventilation is mandatory. Propane is heavier than air; install gas detectors low in room. Inspect detectors often.

**Natural Gas** - Adequate ventilation is mandatory. Natural gas rises; install gas detectors high in room. Inspect detectors often.

 **WARNING**

**ELECTRICAL SHOCK!** Battery can cause electrical burns and shocks. Exercise reasonable care when working near the battery to avoid electrical connections through tools. Remove wristwatch, rings, and any other jewelry.

 **WARNING**

**HOT COOLANT!** Engine coolant is pressurized and hot enough to cause severe burns. If generator set is equipped with a coolant recovery tank, check coolant level at tank. If necessary to check coolant level at radiator or surge tank (on city-water or remote radiator-cooled sets), place a rag over the cap and turn slowly to release pressure, before removing cap.

 **WARNING**

**MOVING PARTS!** Keep hands, hair, necktie, loose clothing, and test leads well away from moving parts, as serious injury could result from entanglement. Never run generator set with guards, covers, or screens removed.

 **WARNING**

**FLASH FIRE!** To avoid the possibility of a flash fire, do not smoke or permit flame or spark to occur near carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuel or fuel vapors.

 **WARNING**

**BACKFIRE!** A sudden backfire can cause serious burns. Keep hands and face away from the carburetor when the air cleaner is removed.

 **WARNING**

**EXPLOSIVE GASES!** Remove AC power plug from outlet or turn off AC supply before connecting or disconnecting charger clips to battery terminals to avoid sparks igniting explosive battery gases.

 **WARNING**

**FIRE OR EXPLOSION!** Do not clean air cleaner bowl with gasoline or equivalent inflammable liquids because of danger of fire or explosion.

 **WARNING**

**DANGER OF ELECTROCUTION!** The following procedure requires that the generator set be running while adjustments are made. Avoid contacting electrical connections with adjustment tool. Remove wristwatch, rings, and jewelry that can cause short circuits. Do not touch electrical equipment when standing in water, on wet ground, or when your hands are wet.

 **WARNING**

**HIGH VOLTAGE!** Disconnect set from load by opening line circuit breaker, or by disconnecting generator output leads from transfer switch and heavily taping ends of leads. The GENERATOR SAFEGUARD BREAKER MUST NOT BE USED IN PLACE OF LINE CIRCUIT BREAKER! If high voltage is transferred to load during test, personal injury and equipment damage may result.

 **WARNING**

**UNINTENTIONAL STARTING!** To prevent remote starting, unplug P3 connector at rear of controller. Place Generator Master Switch on controller to OFF position, and remove battery cables (negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator.

 **WARNING**

**HIGH VOLTAGE!** Before starting generator set with generator end cover removed, place black electrical tape over LED of circuit board mounted on end of generator end bracket. Ceiling voltage will result if photo transistor is exposed to outside light.

 **WARNING**

**HIGH VOLTAGE!** When testing photo transistor board, keep all other light sources away. Otherwise, dangerous ceiling voltage may result.

 **WARNING**

**HIGH VOLTAGE!** Be sure that foil side of photo transistor board, end of shaft, and threaded holes are clean and free of metal particles and chips. Dangerous HIGH VOLTAGE may result. AC voltmeter must show proper output before generator may be reconnected to load.

 **WARNING**

**HIGH VOLTAGE!** Use high voltage test only as directed. High voltage may cause personal injury, damage equipment, or lead to future failures. Follow manufacturer's instructions when operating tester.

 **WARNING**

**HOT PARTS!** Exciter armature will get hot if armature is shorted. Avoid touching armature!

 **WARNING**

**FIRE HAZARD!** Spilled fuel may ignite on contact with hot engine parts. Wipe up all spilled fuel after bleeding system.

 **WARNING**

**HOT PIPING!** An engine gets hot while running and exhaust system components get extremely hot. Do not work on generator set until unit is allowed to cool.

## **WARNING**

**DANGER OF ELECTROCUTION!** When the generator is used for standby power, use of an automatic transfer switch is required to prevent inadvertent interconnection of standby and other sources of power. In some states and/or localities it is illegal to operate a standby generator without an automatic transfer switch. Failure to install an automatic transfer switch will cause "backfeed" into utility transmission lines and can cause serious injury or death.

## **Introduction**

This manual covers concept, operation, troubleshooting, and repair of Kohler Fast-Response generators and controls. Engine service and parts information is available separately for particular models and specs.

## **Service Assistance**

Contact your Kohler Generator Distributor to obtain additional service information for particular models. See Yellow Page listing under **Generators-Electric**. Supply Model, Specification, Serial, and Engine Serial numbers from generator nameplate for complete engine service manual and generator set parts list.



# Section 1

## FAST-RESPONSE CONCEPTS

### General

A Kohler Fast-Response set is easily understood as a rotating-field generator, and a smaller rotating armature generator turned by a common shaft. The main, rotating field generator supplies AC power to load circuits, while the rotating armature (exciter) generator supplies DC to excite the main generator's field. See Figure 1-1.

### System

Fast-Response begins with the smaller, exciter generator. Permanent magnet fields allow exciter current to be produced without dependence upon the main generator's AC output. Exciter current is rectified and controlled by the FR Activator and passed to the main generator field. See Figure 1-2. AC is then available to load circuits.

Changes in AC load demand are sensed by the voltage regulator. Signals from the regulator pass through a light emitting diode (LED)/photo transistor optical coupling

(at end of generator shaft) to the FR Activator. Excitation current is controlled by the voltage regulator and FR Activator to maintain proper field strength and main generator output voltage. See Figure 1-2.

### Capabilities

#### Response Time

Fast-Response systems deliver proper exciter current to the main field within 0.05 seconds of a change in load demand.

#### Short Circuit Performance

When a short occurs in the load circuit(s) being served, output voltage drops to a low level until short is removed, and amperage momentarily rises to 600-1000% of the generator's rated current. The FR activator sends full exciter power to the main field. The generator then sustains up to

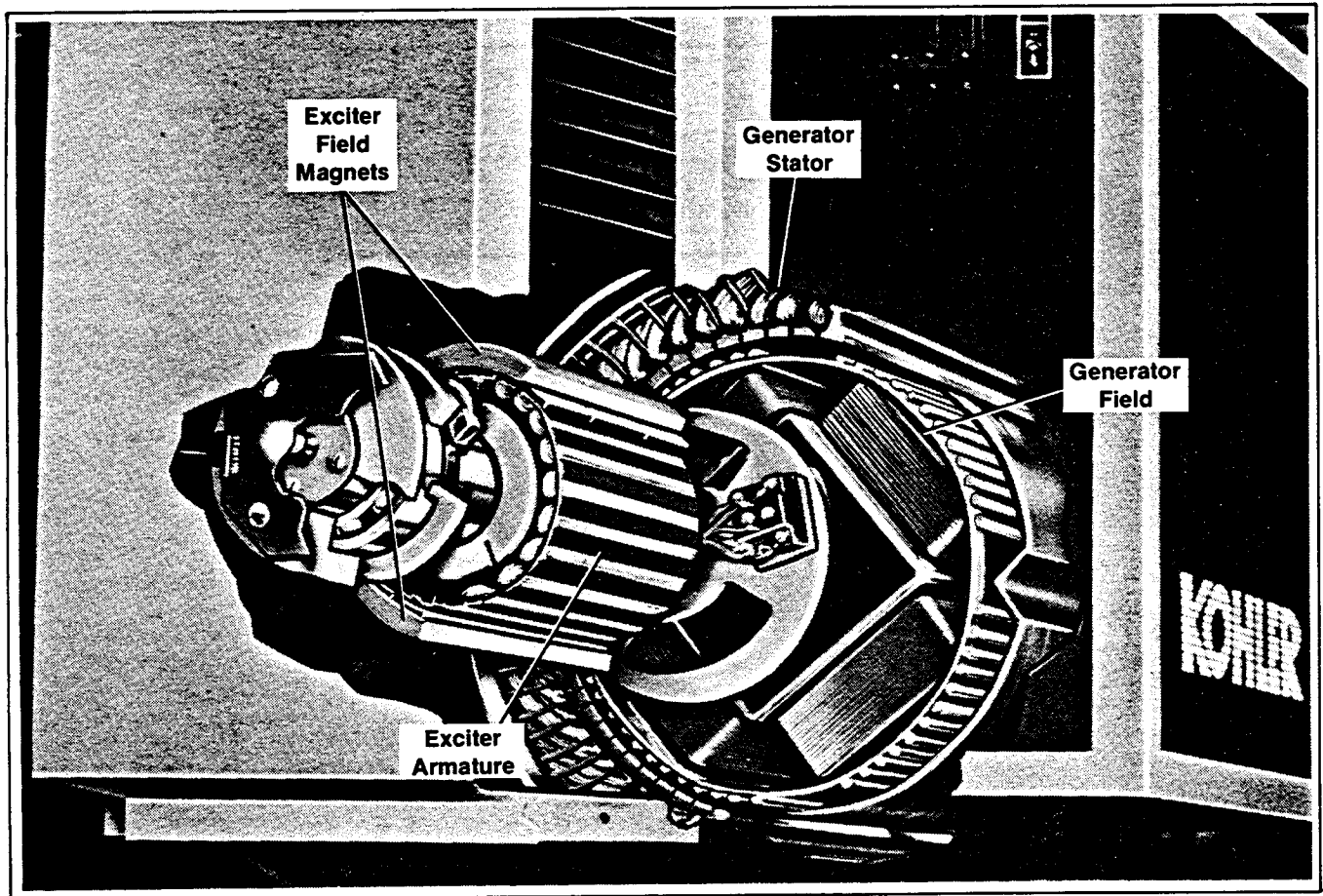


Figure 1-1. Generator Cutaway

## Capabilities (Continued)

300% of its rated amperage. Sustained high current will cause properly rated load circuit fuses/breakers to open,

or generator safeguard breaker to trip. The Safeguard breaker serves to collapse the generator's main field in the event of a sustained heavy overload or short circuit.

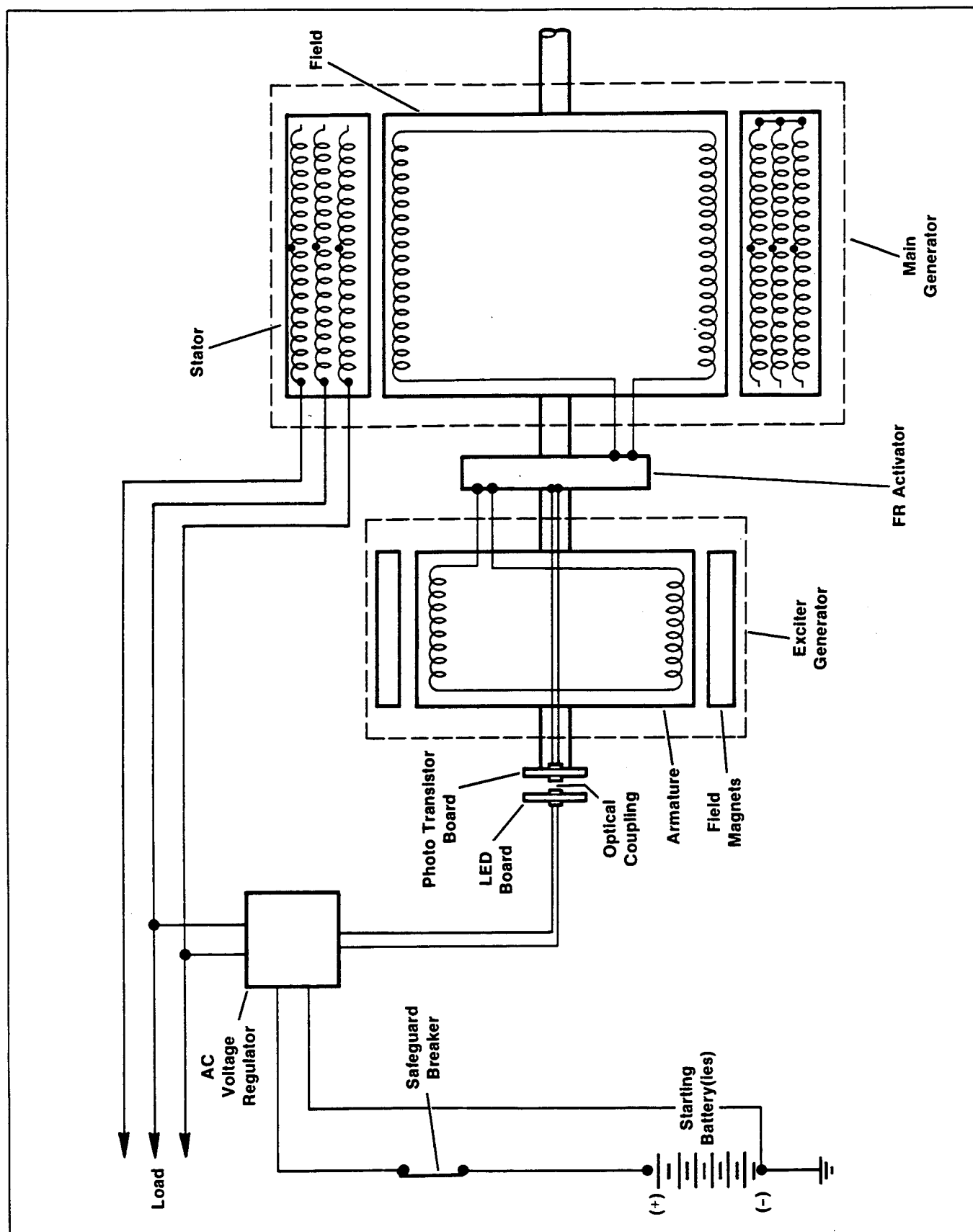


Figure 1-2. Fast Response Schematic

## Section 2

# OPERATION

### Controls — Figures 2-1, 2-2

- **Selector Switch** (Voltmeter-Ammeter) — selects generator output circuits to be measured. If switched to a point with three circuit lead labels, voltage is measured between the upper two leads and amperage on the lower lead. If switched to a point with two circuit labels, voltage only is measured. With switch in OFF position, AC voltmeter and ammeter will not register.

#### NOTE

Indicated switch positions will vary among single and three phase models with different voltages.

- **Regulator Rheostat** — used to fine-adjust generator output voltage.
- **Lamp Test** — used to test indicator lamps.
- **Reset** — must be pressed to allow engine restart after fault shut-down or emergency stop.

- **Emergency Stop** — will shut down generator set immediately.
- **Generator Switch** — AUTO position, allows start-up by automatic transfer or remote start-stop switch. TEST position, used for exercise runs or for normal start-up without automatic transfer switch. CENTER OFF position, used to prevent automatic start-up while servicing set, making non-emergency manual stops, or resetting system.

#### NOTE

Switch in CENTER OFF position will prevent start-up by automatic transfer or remote start-stop switch.

### Indicators

- **Frequency Meter** — measures frequency (HERTZ) of generator output voltage.

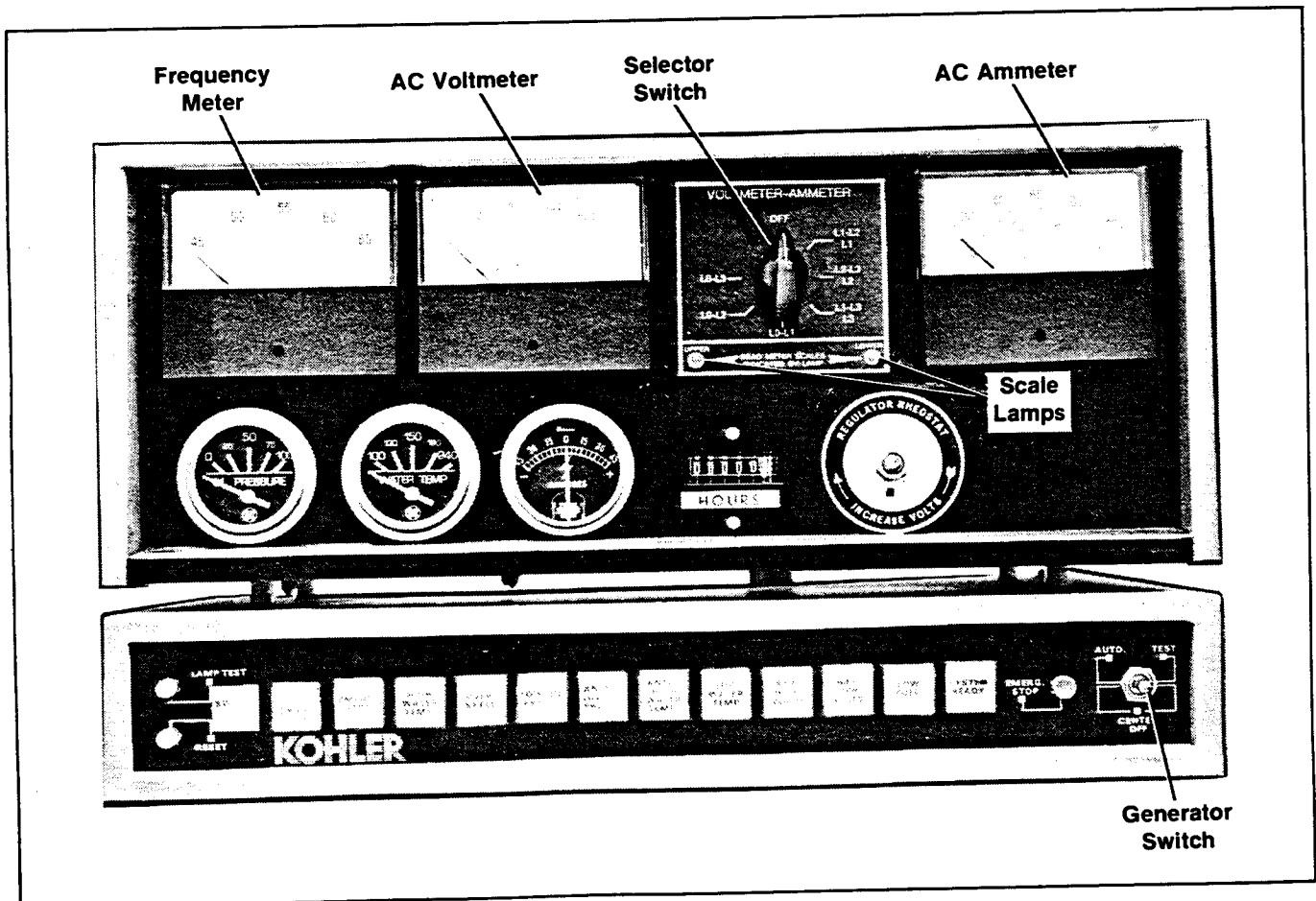


Figure 2-1. Decision Maker

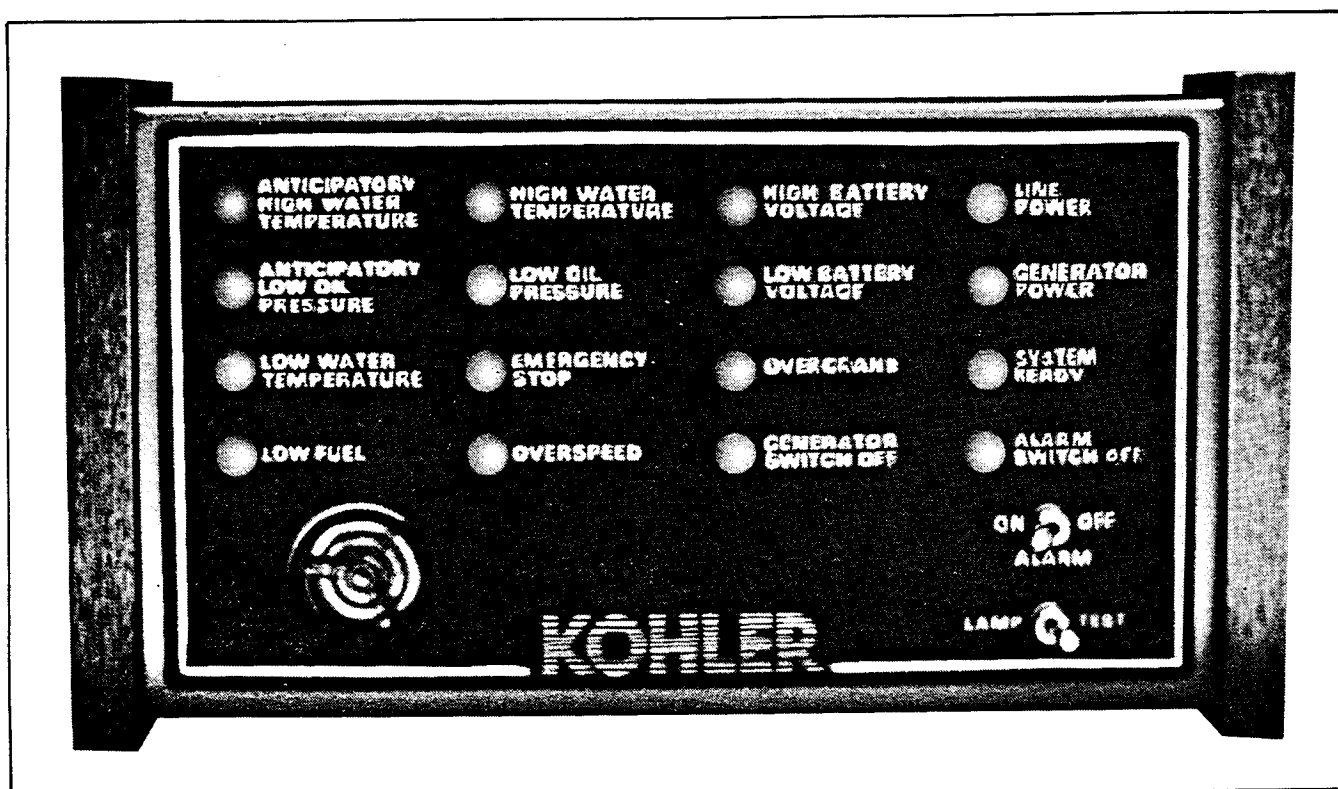


Figure 2-2. Decision Monitor (remote annunciator) Option

## Indicators (Continued)

- **AC Voltmeter** — measures voltage across output leads indicated by selector switch.
- **Scale Lamps (upper lower)** — indicate voltmeter and/or ammeter scales to be read.
- **AC Ammeter** — measures amperage from output leads indicated by selector switch.
- **Oil Pressure** — measures engine oil pressure.
- **Water Temperature** — measures engine coolant temperature.
- **DC Ammeter** — measures charge/discharge rates of engine alternator and starting battery(ies).
- **Hourmeter** — records total generator set operating hours for reference in maintenance scheduling.
- **Switch Off** — lamp flashes when generator switch is in CENTER OFF position. Lamp will not light when LAMP TEST button is pushed and generator switch is in AUTO or TEST position.
- **Overcrank** — lamp lights if engine fails to start within preset cranking period.
- **Emerg. Stop** — lamp lights if EMERG. STOP button has been pushed.
- **High Water Temp.** — lamp lights if set has shut down due to high engine coolant temperature.
- **Overspeed** — lamp lights if set shuts down due to overspeed.
- **Low Oil Press.** — lamp lights if set shuts down due to loss of engine oil pressure.
- **Antic. Low Oil Press.\*** — lamp lights if engine oil pressure approaches shut-down level.
- **Antic. High Water Temp.\*** — lamp lights if engine coolant temperature approaches shut-down level.
- **Low Water Temp.\*** — lamp lights if optional engine block heater is not working and/or water temperature may be too low (below 70° F, 21° C) for 10-second start-up.
- **Bat. High Volts\*** — lamp lights if battery or charging voltage exceeds normal (will also light if over voltage occurs due to battery charger malfunction while set is not operating).
- **Bat. Low Volts\*** — lamp lights if battery or charging voltage drops below normal (will also light if under voltage occurs due to battery or charger malfunction while set is not operating).
- **Low Fuel\*** — lamp lights if fuel tank level approaches empty.
- **System Ready\*** — lamp lights when GENERATOR SWITCH is in AUTO or TEST positions and system senses no faults.

\* Optional

## Decision Monitor (remote annunciator) Option Indicators

Decision Monitors have the same lamp indicators as the Decision Maker Controller, plus the following (See Figure 2-2):

- **Line Power** — indicates commercial utility power in use.
- **Generator Power** — indicates generator power in use.
- **Alarm Switch Off** — indicates ALARM switch in OFF position.
- **Alarm Switch** — controls alarm horn on Decision Monitor.
- **Alarm Horn** — sounds if any fault or anticipatory condition occurs.

An alarm horn and alarm horn switch may be installed on the generator set.

## Prestart Checks

The following items should be checked before each start-up of manually controlled generator sets or at regular intervals on sets equipped with Automatic Transfer Panels which automatically start and stop the generator set.

### WARNING

**UNIT STARTS WITHOUT NOTICE!** Units with Automatic Transfer Switches start automatically. Potential injury or electrocution can result. Turn Generator Master Switch on controller to OFF position, and remove battery cables (remove negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator.

- OIL LEVEL:** Check and add oil as necessary to bring the level up to the full mark on the dipstick.
- COOLANT LEVEL:** (radiator, and heat exchanger cooled sets): Allow engine to cool. Remove the filler cap and add coolant as needed to bring the level up to the full point. CAUTION: Remove filler cap slowly.
- DRIVE BELTS:** Make visual check of radiator fan, water pump, and battery charging alternator belts to make sure they are tight and in good condition. See engine operation manual for adjustments.

- AIR CLEANER:** Inspect components to make sure they are tight and in proper position.
- FUEL LEVEL:** Make sure there is an adequate supply — keep tanks full to allow operation for extended periods.
- BATTERY:** Check connections and level of electrolyte inside battery — add distilled water as needed.

### NOTE

Battery negative (-) connection must be made to a good ground.

- EXHAUST SYSTEM:** Check to make sure components are tight and in good condition.
- OPERATING AREA:** Check to make sure no obstructions block the flow of cooling air. Also make sure that the area is clean, and that rags, tools, etc., are not left on or near the generator set. Clean the intake and outlet screens.

- LAMP TEST:** Press the lamp test button and check to make sure all lamps on your controller and annunciator are working.

## Starting (See Figure 2-3)

### Test

Use generator switch TEST position to test run generator set, or for normal start-up if set is not connected to an automatic transfer or remote start-stop switch.

Moving switch into TEST position will initiate cyclic cranking (2 to 20 second periods) for up to 75 seconds to start engine.

### Automatic

Use generator switch AUTO position to allow start-up from an automatic transfer switch or remote start-stop switch.

## Stopping (See Figure 2-3)

Use generator switch CENTER OFF position to make non-emergency manual stops.

1. Disconnect load from generator set.
2. Move generator switch to CENTER OFF position. Set will stop after 5-minute (approx.) cool-down period.

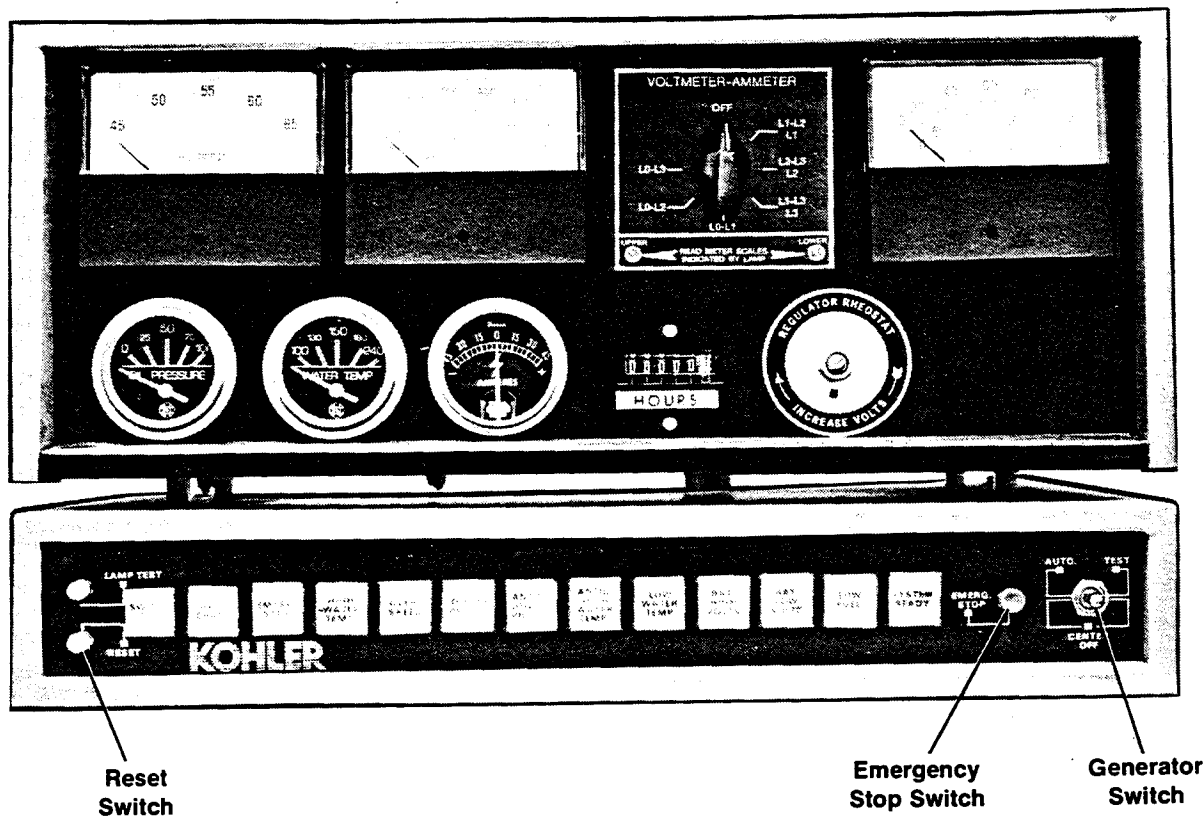


Figure 2-3. Emergency Stop Switch and Generator Switch Positions

## Emergency Stopping

Press EMERG. STOP switch for immediate shut-down.

## Resetting

The generator set will shut down automatically under the following fault conditions:

- Overcrank
- High water temperature
- Overspeed
- Low oil pressure

### CAUTION

Failure to place generator switch in CENTER OFF position may allow accidental start-up by pushing RESET button!

### To Restart:

1. Move generator switch to CENTER OFF position.
2. Correct cause of fault shut-down.
3. Press RESET switch (fault indicator light will go off).
4. Move generator switch to necessary position (AUTO or TEST) for start-up.

## Section 3

# CONTROLLER AND ENGINE TROUBLESHOOTING

### Fast Check

The Fast Check is an engine simulator for testing and troubleshooting Fast-Response controller lower trays.

### Fast Check Features (See Figure 3-1)

Engine conditions are simulated by the following engine switch positions:

- **OFF** – engine not running
- **CRANK** – battery voltage switched to starter
- **RUN** – engine running
- **OVERSPEED** button – engine overspeed

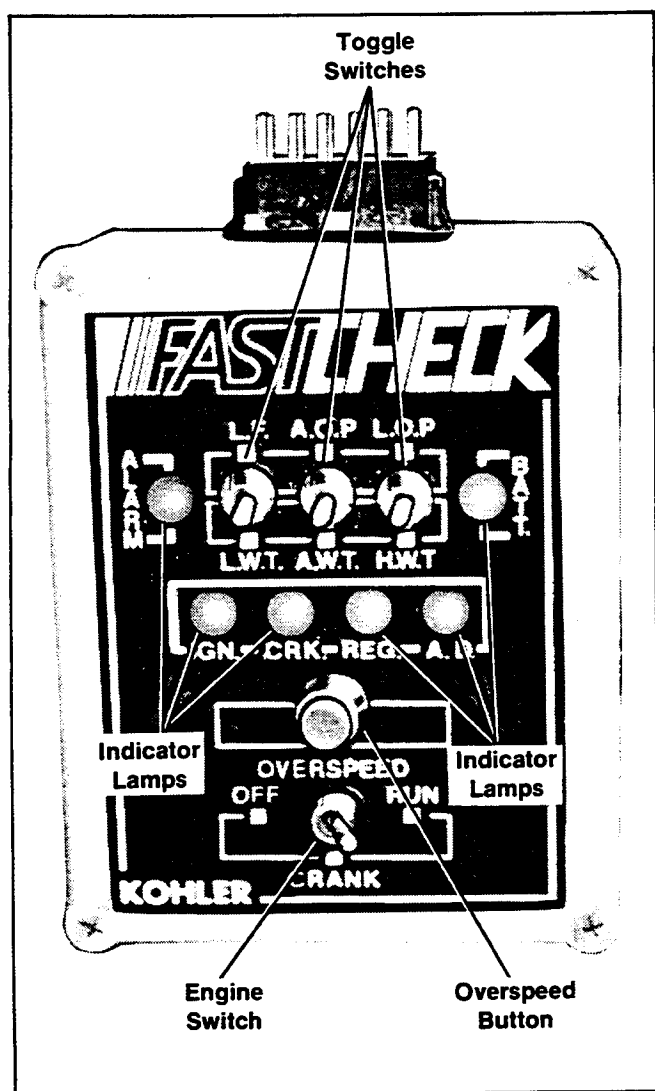


Figure 3-1. Fast Check

Lamps:

- **IGN.** – (ignition) lamp shows
  - battery voltage supplied to ignition, fuel valves, water valve (city water-cooled sets)
  - lights during cranking and running
- **CRK.** – (crank) lamp shows
  - battery voltage switched to starter (engine not necessarily turning)
  - lights only during “on-crank” cycles
- **REG.** – (regulator) lamp shows
  - battery voltage supplied to generator’s AC voltage regulator
  - lights during cranking and running
- **A.D.** (anti-diesel, fuel shut-off solenoid) lamp – lights during normal or fault shut-down or any non-run condition.
- **ALARM** lamp – lights when engine fault is simulated by one of three upper toggle switches or OVERSPEED button
- **BATT.** (battery) lamp – lights when test battery(ies) or DC power supply is live and properly connected.

Upper toggle switch positions:

- **L.F.** – low fuel
- **L.W.T.** – low engine water temperature
- **A.O.P.** – anticipatory (low) oil pressure
- **A.W.T.** – anticipatory (high) water temperature
- **L.O.P.** – low oil pressure
- **H.W.T.** – high water temperature

### Fast Check Operation

The Fast Check may be used to:

- test controller lower tray on generator set when troubleshooting start-up problems
- test, troubleshoot, and adjust lower tray when removed from controller

## Fast Check (Continued)

### Equipment required:

- Fast Check and harness (B-291930 and 287870)
- Variable low-voltage DC power supply; 0-50 volt, 3 amp minimum current, 0.5% maximum output voltage ripple at 30 volts DC
- Stopwatch

### NOTE

When troubleshooting lower tray, remove from controller to inspect parts and wiring for damage, corrosion and moisture. Make any needed repairs before testing.

### NOTE

To prevent water from collecting in lower cabinet, remove 4 screws holding top cabinet to lower, and lift away upper cabinet. Apply sealer around bases of 4 nylon posts, and reinstall upper cabinet.

### NOTE

Trays with B-version circuit boards have nylon daughter board securing pegs. When replacing board, compress peg detent barbs and carefully lift board to remove.

See Figure 3-11 for lower tray connections.

### NOTE

If lower tray uses uni-board, check wiring and connections. Replace complete board if faulty. See Appendix B to install uni-board.

### To Connect Fast Check:

1. Unplug harness connectors from P1, P2 and P3 plugs at rear of controller.

2. Connect P1 and P2 connectors of Fast Check harness to P1 and P2 connectors at rear of controller. Connectors are keyed to prevent misconnection. See Figure 3-2.

3. Push plastic harness connector onto plug at top of Fast Check.

4. Move controller's generator switch to CENTER OFF. See Figure 3-3.

5. Move Fast Check engine switch to OFF.

6. Clip red (+) and black (-) harness leads to battery(ies) or DC power supply of proper voltage for generator set (12 or 24 volt). See BATT rating on nameplate. Generator set's batteries may be used if accessible and fully charged.

BATT and A.D. lamps of Fast Check should light if red (+) and black (-) harness leads are properly connected.

> SWITCH OFF lamp on controller should flash,

- if not, push LAMP TEST button on controller.

- if other lamps do not light, check/replace 3 amp fuse at rear of controller, and/or replace bulbs as needed. See Figure 3-4.

- if fuse is good and other lamps light when LAMP TEST button is pushed, but SWITCH OFF lamp does not flash,

- check or fix regulator board pin connections

OR

- replace regulator board
- REPEAT TEST

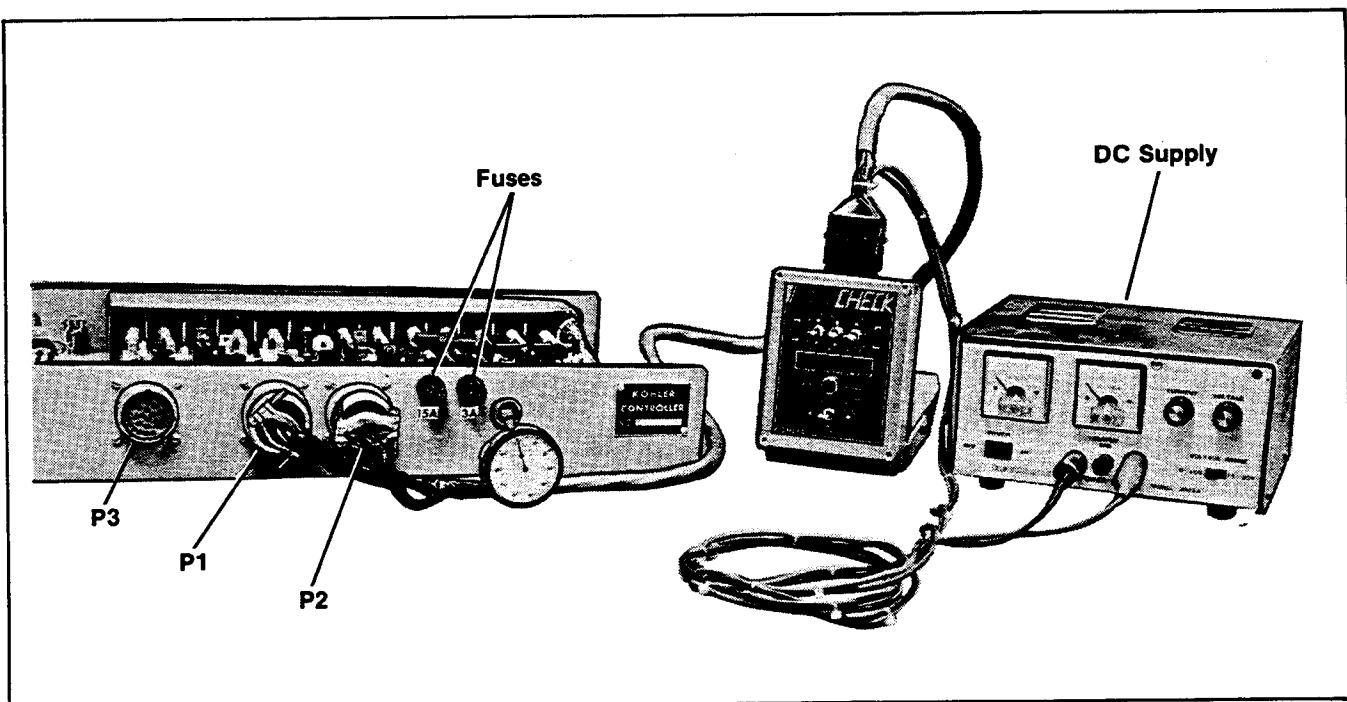


Figure 3-2. Fast Check Connection



## Fast Check (Continued)

To check controller's ability to stop a start-up attempt if starter locks or does not engage (to prevent starter burn-out and battery drain):

1. Be sure Fast Check engine switch is OFF
2. Move controller's generator switch to TEST
  - > IGN., CRK., and REG. lamps of Fast Check should light (CRK should light for around 10 seconds)
    - If not,
      - fix regulator board pin connections or replace board
      - fix mother board connections or replace board
      - REPEAT TEST
    - If CRK. lamp alone does not light (voltage not conducted to starter circuit):
      - fix main control board pin connections or replace board
      - fix cyclic cranking board pin connections or replace board
      - fix mother board connections or replace board
      - fix 1 CR relay wiring or replace relay
      - REPEAT TEST
    - If IGN. or REG. lamps do not light,
      - fix main control board pin connections or replace board
      - fix mother board connections or replace board
      - fix CR relay wiring or replace relay
      - REPEAT TEST
  - > CRK. lamp should go out (for around 15 seconds), then light again for a second cranking cycle.
  - > After second cranking cycle, IGN., CRK. and REG. lamps should go out (after around 35 seconds of "cyclic cranking"). OVERCRANK lamp on controller plus A.D. and ALARM lamps on Fast Check should light.
    - If not,
      - fix main control board pin connections or replace board
      - fix regulator board pin connections or replace board
      - fix mother board connections or replace board
      - REPEAT TEST
3. Reset System
  - Move controller's generator switch to CENTER OFF
  - Press RESET button

To test main control board's ability to stop a start-up attempt if starter works but engine will not run:

1. Be sure Fast Check's engine switch is OFF.
2. Move controller's generator switch to TEST. See NOTE following.
3. Move Fast Check's engine switch to CRANK and **start stopwatch**.

### NOTE

Main control boards numbered A-284931 give a re-start cranking delay of about 20 seconds after generator switch is moved from CENTER OFF (CRK. lamp on Fast Check may not light immediately when engine switch is moved to CRANK). If this delay is too long, replace board with B-284931. New board will give delay of 1-2 seconds.

- > IGN., CRK., and REG. lamps on Fast Check should light to show "on-crank" cycle. CRK. lamp will go out during "off-crank" cycles.
  - > After 40-75 seconds of cyclic cranking, IGN., CRK. and REG. lamps on Fast Check should go out; ALARM and A.D. lamps on Fast Check, plus OVERCRANK lamp on controller should light, **stop stopwatch**.
    - If cyclic cranking does not stop after 40-75 seconds,
      - replace main control board
      - REPEAT TEST
4. Reset System
    - Move Fast Check engine switch to OFF.
    - Move controller's generator switch to CENTER OFF.
    - Press RESET button.

To test normal start-up ability:

1. Move controller's generator switch to TEST.
2. Move Fast Check engine switch to CRANK. IGN., CRK., and REG. lamps should light after restart time delay.
3. Move Fast Check engine switch to RUN.
  - > CRK. lamp should go out
    - If CRK. lamp does not go out,
      - replace main control board
      - REPEAT TEST

To test safety features:

1. Low fuel (hospital option) — hold first toggle switch up to L.F.
  - > LOW FUEL lamp on controller and ALARM lamp on Fast Check should light as long as switch is held.

- If LOW FUEL lamp does not light
    - check bulb with LAMP TEST or replace bulb
    - fix hospital board pin connections or replace board
    - REPEAT TEST
2. Lower water temperature (hospital and prealarm options) — hold first toggle switch down to L.W.T.
- > LOW WATER TEMP. lamp on controller and ALARM lamp on Fast Check should light as long as switch is held.
  - If LOW WATER TEMP lamp does not light,
    - check bulb with LAMP TEST or replace bulb
    - fix lamp driver board pin connections or replace board
    - fix mother board connections or replace board
    - REPEAT TEST
3. Anticipatory low oil pressure (hospital and prealarm options) — hold second toggle switch up to A.O.P.
- > ANTIC. LOW OIL PRESS. lamp on controller and ALARM lamp on Fast Check should light as long as switch is held.
  - If ANTIC. LOW OIL PRESS. lamp does not light,
    - Check bulb with LAMP TEST or replace bulb
    - fix lamp driver board pin connections or replace board
    - fix mother board connections or replace board
    - REPEAT TEST
4. Anticipatory high water temperature (hospital and prealarm options) — hold second toggle switch down to A.W.T.
- > ANTIC. HIGH WATER TEMP. lamp on controller and ALARM lamp on Fast Check should light as long as switch is held.
  - If ANTIC. HIGH WATER TEMP. lamp does not light,
    - check bulb with LAMP TEST or replace bulb
    - fix lamp driver board pin connections or replace board
    - fix mother board connections or replace board
    - REPEAT TEST
5. Low oil pressure — hold third toggle switch up to L.O.P. and **start stopwatch**.
- > In 20-60 seconds, LOW OIL PRESS. lamp on controller should light, **stop stopwatch**.
  - > ALARM and A.D. lamps on Fast Check should light to show engine shut-down (IGN. and REG. should be out).

- If low oil pressure shut-down does not show,
  - check LOW OIL PRESS. lamp with LAMP TEST or replace bulb
  - fix lamp driver board pin connections or replace board
  - fix main control board pin connections or replace board
  - fix mother board connections or replace board
  - REPEAT TEST

#### Reset system

- Move Fast Check engine switch to OFF.
- Move controller's generator switch to CENTER OFF.
- Push RESET button on controller.
- Move Fast check engine switch to RUN.

#### 6. High water temperature — hold third toggle switch down to H.W.T. and **start stopwatch**.

- > In 3-6 seconds HIGH WATER TEMP. lamp on controller should light; **stop stopwatch**.
- > ALARM and A.D. lamps on Fast Check should light to show engine shut-down (IGN. and REG. should be out).
- If high water temperature shut-down does not show within 6 seconds,
  - check HIGH WATER TEMP. lamp with LAMP TEST or replace bulb
  - fix lamp driver board pin connections or replace board
  - fix mother board connections or replace board.
  - Reset System and REPEAT TEST

#### Reset System:

- Move Fast Check engine switch to OFF.
- Move controller's generator switch to CENTER OFF.
- Push RESET button on controller.
- Move controller's generator switch to TEST.
- Move Fast Check engine switch to RUN.

#### 7. Overspeed — push and hold OVERSPEED button on Fast Check

- > OVERSPEED lamp on controller should light; ALARM and A.D. lamps on Fast Check should light (IGN. and REG. should be out).
- If not, turn OVERSPEED pot on lamp driver board clockwise until OVERSPEED lamp on controller lights along with ALARM and A.D. on Fast Check (showing shut-down). See Figure 3-5.
- If lamps do not show shut-down after adjusting pot,
  - check OVERSPEED lamp with LAMP TEST or replace bulb

## Fast Check (Continued)

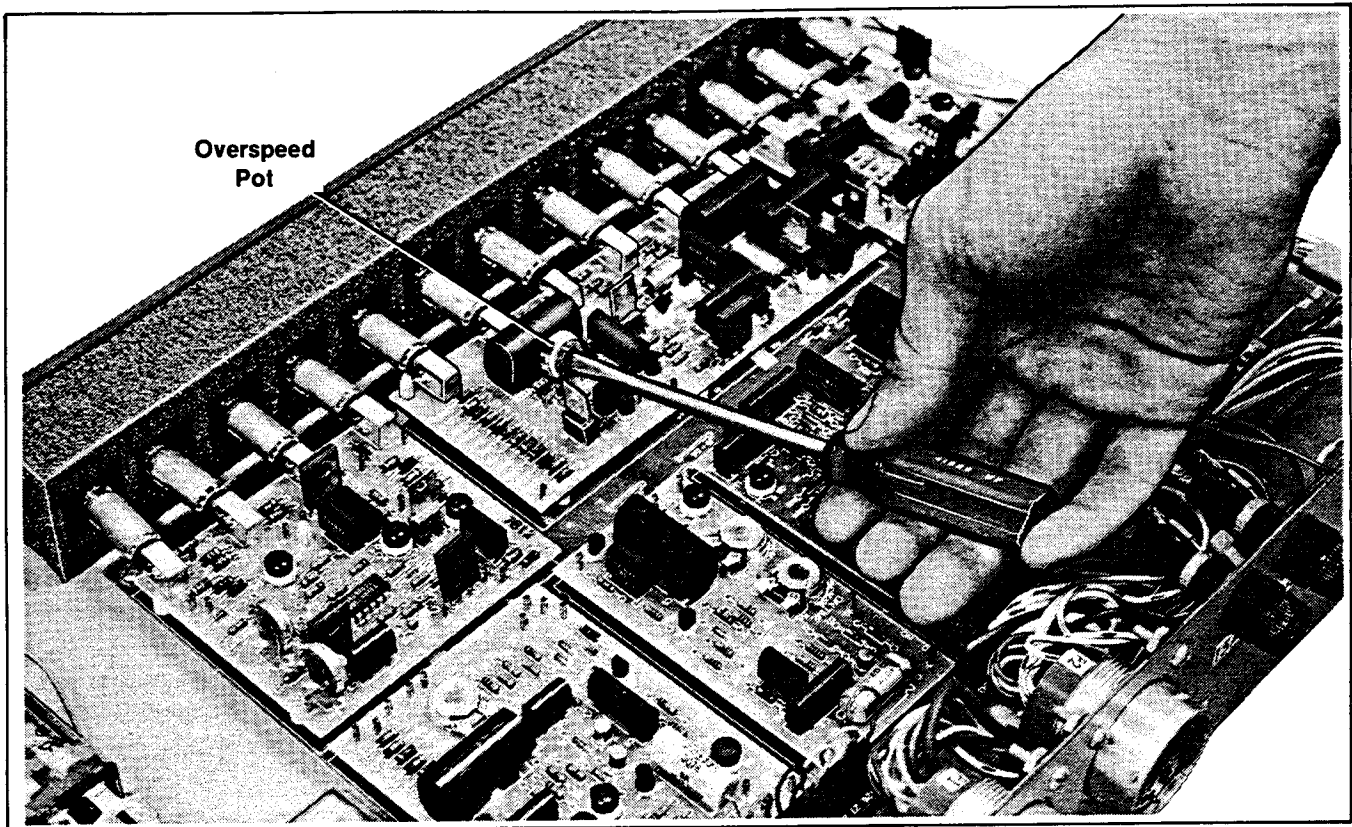


Figure 3-5. Adjusting Overspeed Pot

- fix lamp driver board pin connections or replace board
- fix main control board pin connections or replace board
- fix mother board connections or replace board
- Reset System and REPEAT TEST

### NOTE

Make final adjustment to OVERSPEED Pot by manually overspeeding engine to 70 Hz for 60 Hz sets, and 60 Hz for 50 Hz sets. Adjust pot to cause shut-down at proper frequency.

#### Reset System:

- Move Fast Check engine switch to OFF.
- Move controller's generator switch to CENTER OFF.
- Push RESET button on controller.

To test normal shut-down delay:

1. Move controller's generator switch to TEST.
2. Move Fast Check engine switch to RUN. Wait until IGN. and REG. lights of Fast Check are on.
3. Move generator switch to CENTER OFF and **start stopwatch**.

> In 4-6 minutes IGN. and REG. lamps on Fast Check should go out to show shut-down.

- If not,

- carefully turn TIME ADJ. pot on timer board counterclockwise to adjust delay and retest. See Figure 3-6.

To adjust "on-crank" time as needed for engine starting under usual conditions:

1. Move Fast Check engine switch to CRANK.
2. Move controller's generator switch to TEST and **start stopwatch**.

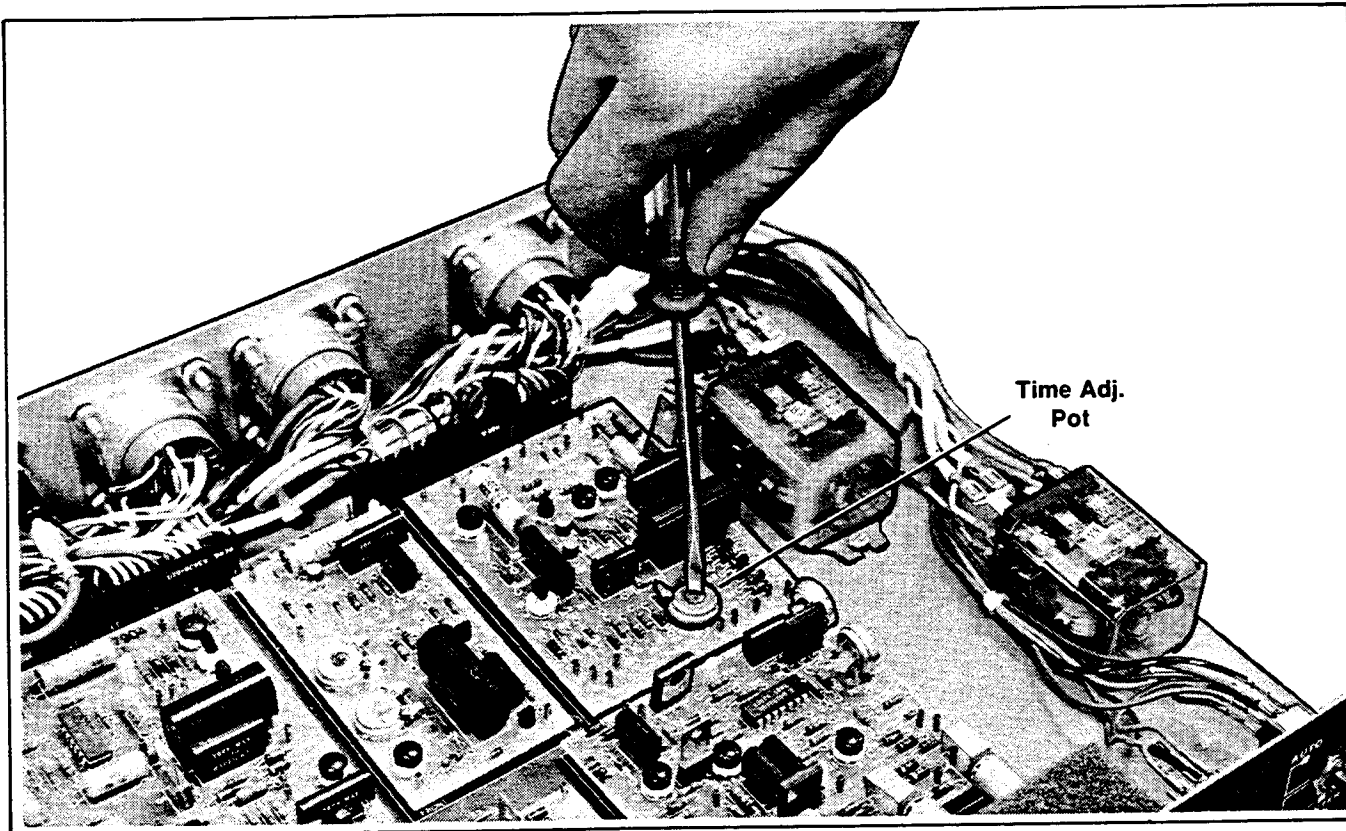


Figure 3-6. Time Adj. Pot Adjustment

3. **Stop stopwatch** when CRK. lamp on Fast Check goes out.
4. Adjust ON TIME pot on cyclic cranking board as needed. See Figure 3-7.
5. Move Fast Check engine switch to OFF.
6. REPEAT TEST to recheck "on-crank" time.

To adjust "off-crank" time to allow "engine" to stop turning between "on-crank" cycles (if engine would not start in preceding "on-crank" cycle):

1. Move Fast Check engine switch to CRANK.
2. Move controller's generator switch to TEST.
3. **Start stopwatch** when CRK. lamp on Fast Check goes out.
4. **Stop stopwatch** when CRK. lamp relights.
5. Adjust OFF TIME pot on cycle cranking board as necessary. See Figure 3-7.
6. REPEAT test to recheck "off-crank" time.

To test and adjust high/low battery voltage and system ready indicators (hospital option):

1. Connect red (+) and black (-) Fast Check harness leads to positive (+) and negative (-) terminals of variable-voltage DC power supply. Place controller's generator switch in AUTO position and Fast Check engine switch in OFF position.

2. Slowly turn DC supply voltage up until BAT. HIGH VOLTS lamp on controller lights. DC supply voltmeter should read about 15 volts for 12 volt systems and about 30 volts for 24 volt systems.

3. Slowly turn DC supply voltage down until BAT. LOW VOLTS lamp on controller lights. DC supply voltmeter should read about 11 volts for 12 volt systems and 22 volts for 24 volt systems.

If adjustments are needed, continue as follows:

4. Turn HIGH VOLT ADJ. pot on hospital board fully counterclockwise (turn from outside of board).

5. Set DC power supply to 14 volts for 12 volt systems or 28 volts for 24 volt systems.

BAT. HIGH VOLTS on controller should be "on"; SYSTEM READY "off"

6. Slowly turn HIGH VOLT ADJ. pot clockwise until BAT. HIGH VOLTS goes out, and SYSTEM READY lights. See Figure 3-8.

## Fast Check (Continued)

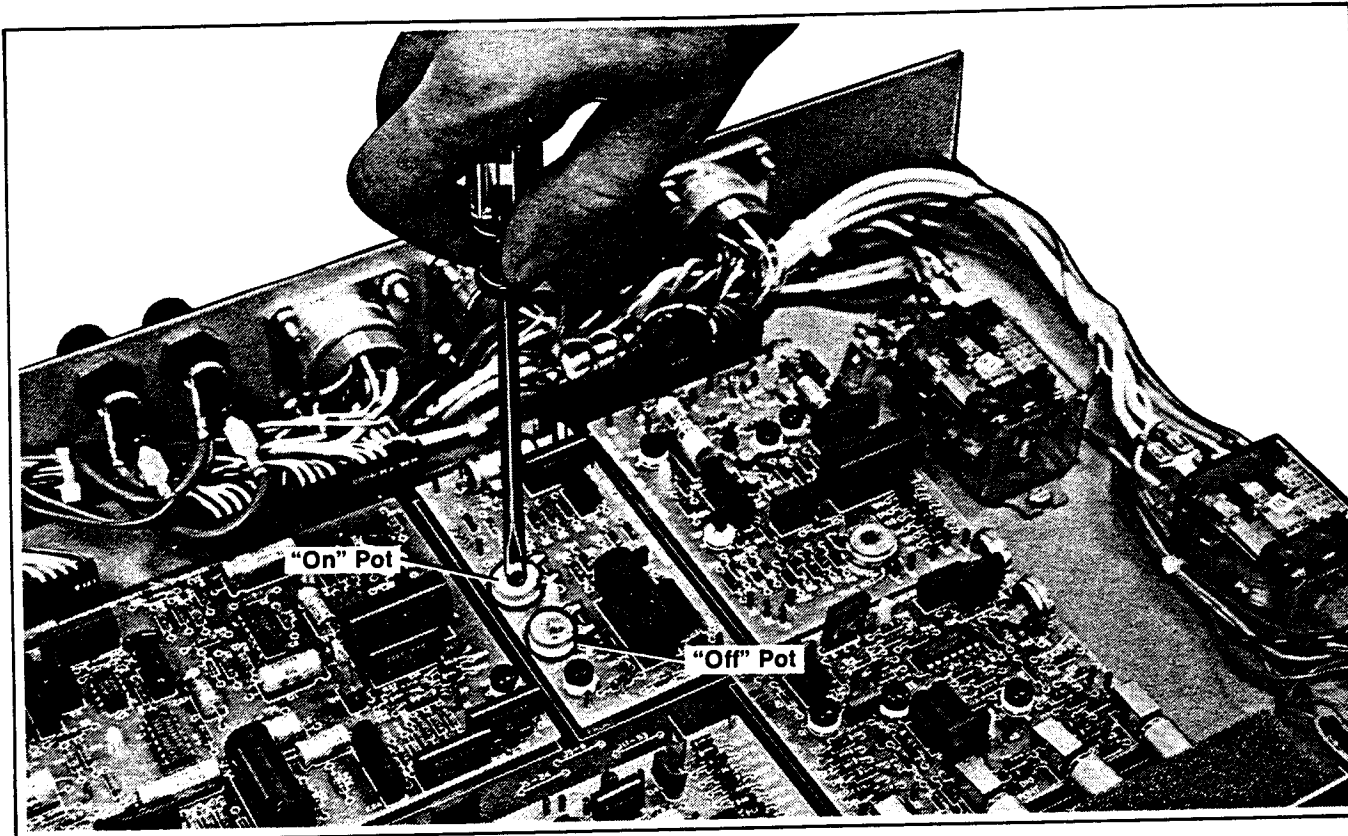


Figure 3-7. "On-Off Crank" Pot Adjustment

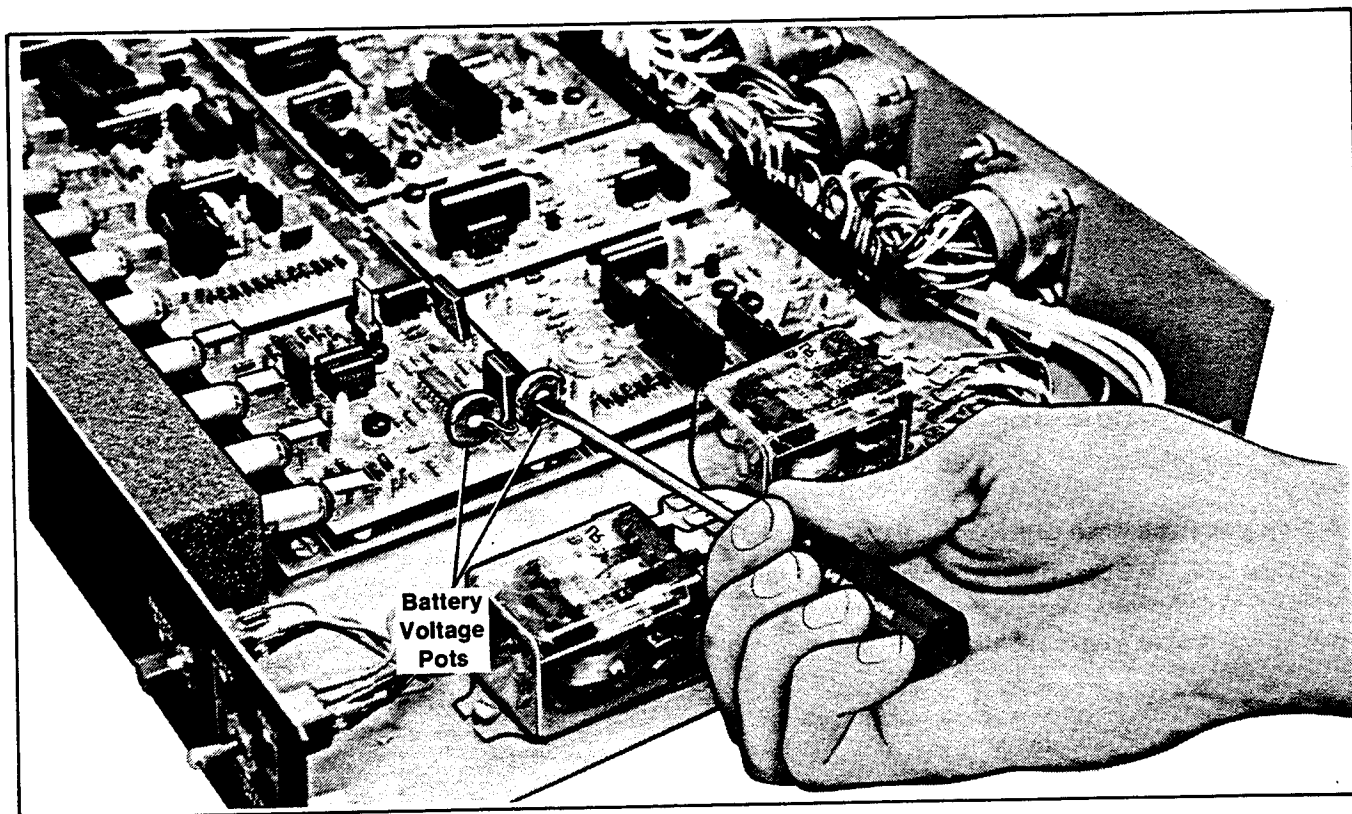


Figure 3-8. Battery Volt Indicator Adjustment  
(Hospital Option)

7. Slowly turn HIGH VOLT ADJ. pot counterclockwise until BAT. HIGH VOLTS lights, and SYSTEM READY goes out.

8. Turn LOW VOLT ADJ. pot counterclockwise to stop.

9. Set DC power supply to 10 volts for 12 volt systems, or 20 volts for 24 volt systems.

BAT. LOW VOLTS should be "out"; SYSTEM READY, "on".

10. Slowly turn LOW VOLT ADJ. pot clockwise until BAT. LOW VOLTS lights and SYSTEM READY goes out.

- If any indicator lamps do not work check with LAMP TEST and replace bulbs as necessary.
- If any indicator lamps do not work, or adjustments cannot be made,
  - fix hospital board pin connections or replace board
  - fix mother board connections or replace board

11. Vary DC voltage below and above described levels and observe indicators. Repeat tests. Make final adjustments if needed.

## Engine & Electrics

### **⚠ WARNING**

**UNINTENTIONAL STARTING!** To prevent remote starting, unplug P3 connector at rear of controller. Place Generator Master Switch on controller to OFF position, and remove battery cables (negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator.

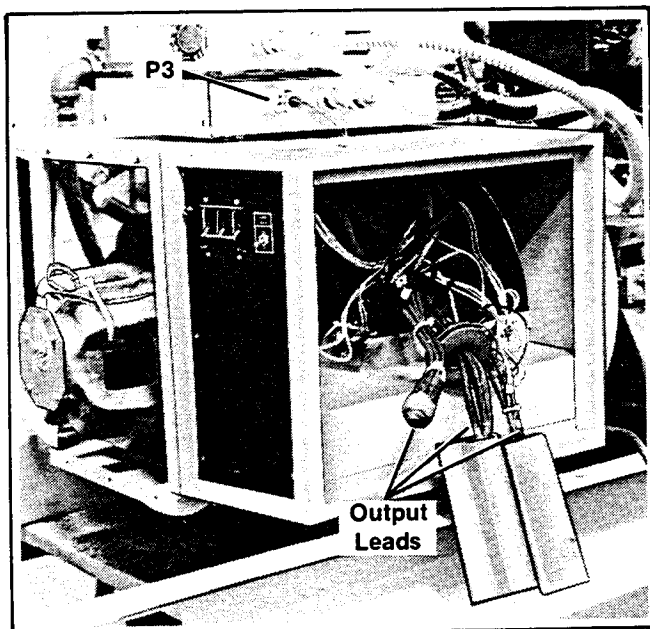


Figure 3-9. Insulate Output Leads

### **NOTE**

Remote annunciator will not work with P3 unplugged.

### **⚠ WARNING**

**HIGH VOLTAGE!** Disconnect set from load by opening line circuit breaker, or by disconnecting generator output leads from transfer switch and heavily taping ends of leads. The GENERATOR SAFEGUARD BREAKER MUST NOT BE USED IN PLACE OF LINE CIRCUIT BREAKER! If high voltage is transferred to load during test, personal injury and equipment damage may result.

### **⚠ WARNING**

**HIGH VOLTAGE!** Before starting generator set with generator end cover removed, place black electrical tape over LED of circuit board mounted on end of generator end bracket. Ceiling voltage will result if photo transistor is exposed to outside light.

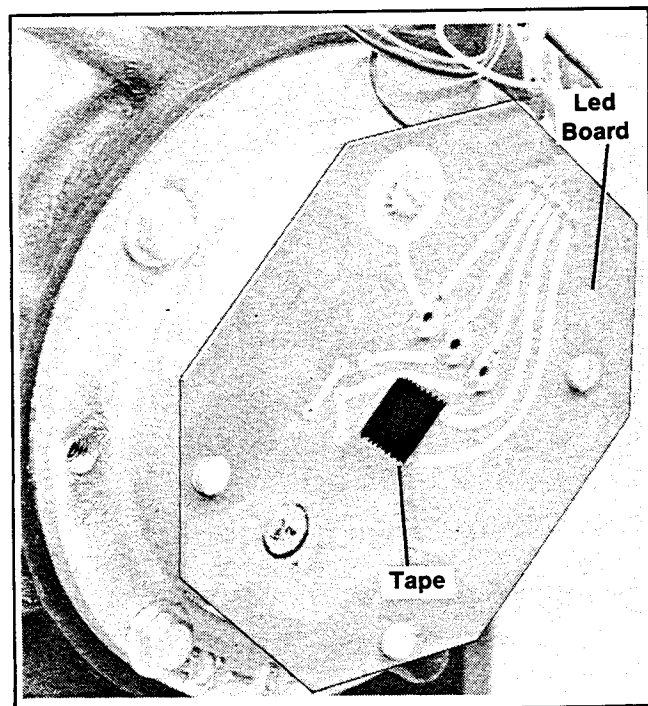


Figure 3-10. Tape LED Board

### **If Engine Will Not Start**

### **⚠ WARNING**

**ELECTRICAL SHOCK!** Battery can cause electrical burns and shocks. Exercise reasonable care when working near the battery to avoid electrical connections through tools. Remove wristwatch, rings, and any other jewelry.

## Engine & Electrics (Continued)

Check battery(ies)

1. Test with hydrometer and/or voltmeter.
2. Check battery connections.
3. Check BAT. HIGH/LOW VOLTS indicators on controller (hospital option).
4. Check battery charger adjustment:
  - Set charger to supply 1MA for each Amp Hour (Ah) of one battery. With multimeter set on DCMA 500 scale, and generator set stopped, check for any additional current draws by controller, governor or options. Adjust charger as needed for battery(ies) and additional current draws.

### NOTE

SYSTEM READY indicator (hospital) option will draw up to 275MA. Remote annunciator (Decision Monitor option) will draw up to 75 MA additional.

Check engine start and run functions

See Figure 3-11. For interconnections on specific models, see Section 6. Check 15 amp fuse at rear of controller. Fuse may be blown due to:

- shorted choke or circuit
- shorted anti-diesel solenoid, fuel valve, gas valve, or circuit
- shorted injector pump, fuel pump, or circuit
- shorted oil pressure gauge, sender or circuit
- shorted water temperature gauge, sender or circuit
- shorted water valve or circuit (city-water cooled sets)
- shorted ignition coil or circuit
- shorted automatic change over relay or circuit (LP/natural gas sets)
- shorted starter solenoid or circuit

Make repairs as needed.

Check continuity from disconnected P1 harness connector to engine functions (see Figure 3-11):

- Circuit 70: ignition and running including
  - choke
  - anti-diesel solenoid
  - injector pump
  - ignition coil
- Circuit 71: cranking, C relay
- Circuit N: ground at starter

If OVERCRANK is indicated, correct starter problem.

### If Engine Starts But Shuts Down

Check fuel supply

If OVERSPEED is indicated,

- Adjust engine governor to run set at rated HERTZ
- Adjust OVERSPEED pot on controller's lamp driver board (Figure 3-12) slowly turn pot clockwise until engine shuts down (at 70 Hz for 60 Hz sets, or 60 Hz for 50 Hz sets).

If OVERCRANK is indicated and engine shuts down 30-45 seconds after start,

(Safeguard breaker "on")

- set speed sensor air gap at 0.020 in. (0.508 mm) between shaft's surface and sensor, or actuator projection and sensor, depending on model. See Figure 3-13.
- repair speed sensor wiring, including shield — leads 2, 16 and 24 to P2 connector at rear of controller.
- manually overspeed engine to check speed sensor
- if set will not shut down, replace speed sensor.

If engine starts and runs, but starter re-engages with no fault indicated on controller,

(Safeguard breaker "off")

- set speed sensor air gap at 0.020 in. (0.508 mm). See Figure 3-13.
- repair speed sensor wiring, including shield — leads 2, 16 and 24 to P2 connector at rear of controller.
- manually overspeed set to check speed sensor.
- if set will not shut-down, replace speed sensor.

If HIGH WATER TEMP. or LOW OIL PRESS. is indicated,

- correct engine problem.

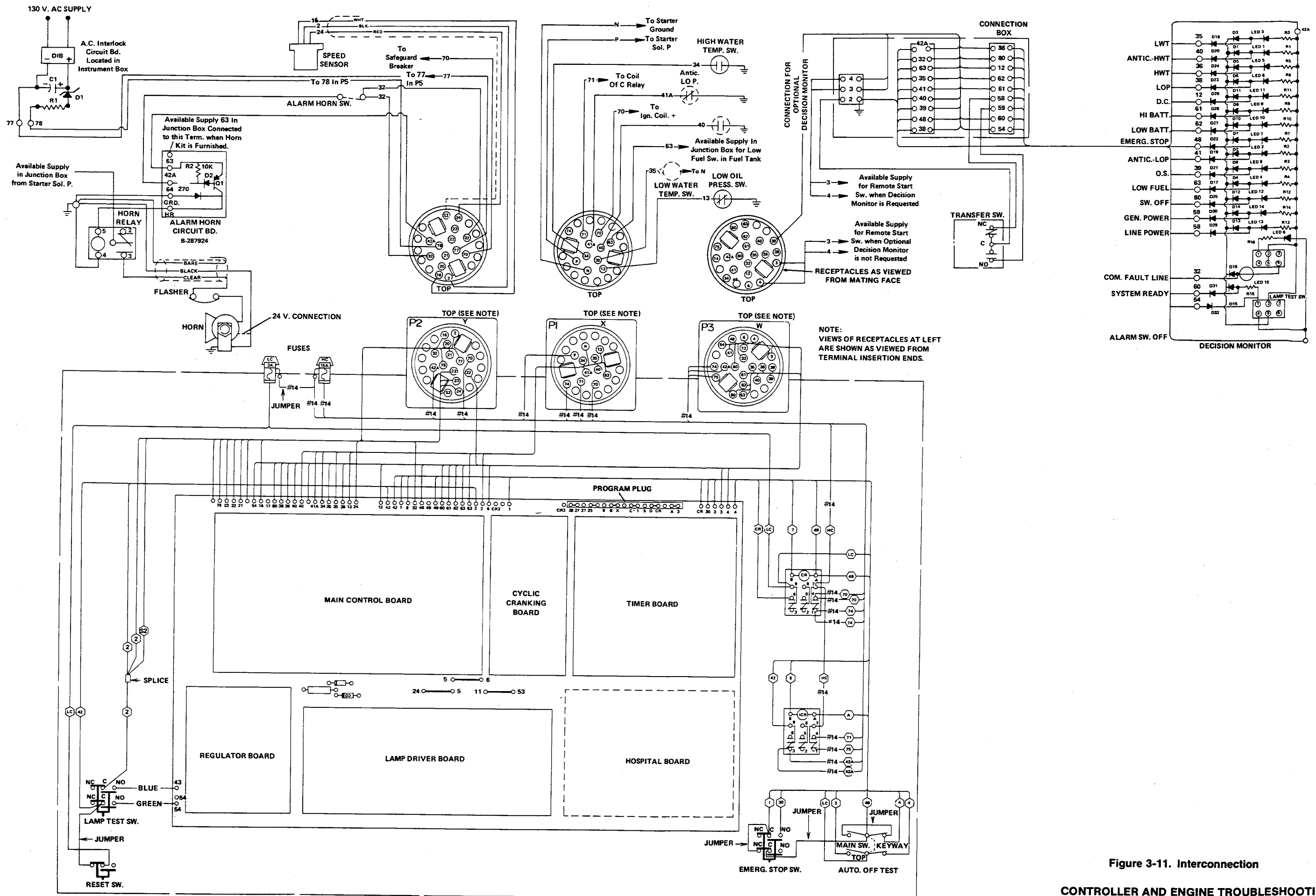


Figure 3-11. Interconnection

CONTROLLER AND ENGINE TROUBLESHOOTING

3-11

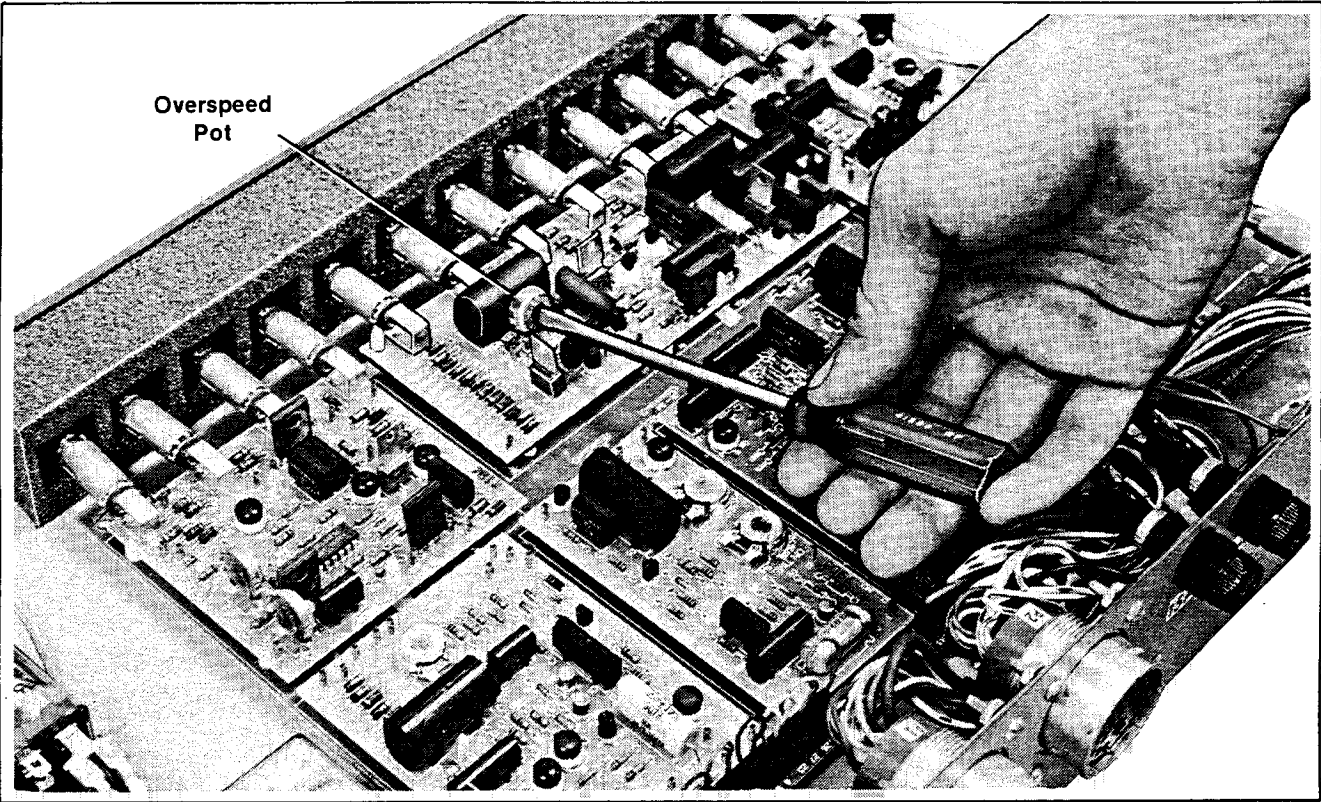


Figure 3-12. Overspeed Pot Adjustment

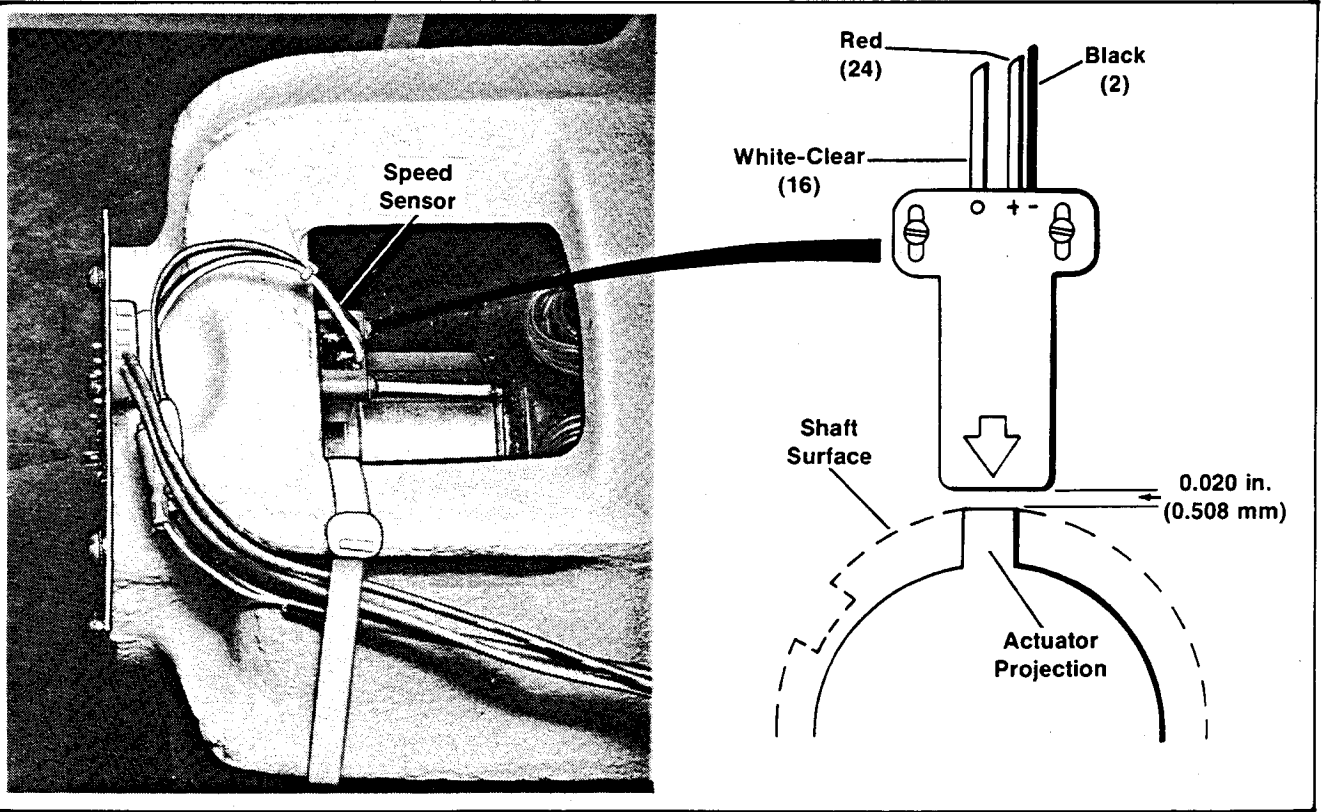


Figure 3-13. Speed Sensor

## Section 4

# GENERATOR TROUBLESHOOTING

### Power Scanner

The Power Scanner function of the FR Activator (power module) gives a visual troubleshooting aid showing generator exciter and output performance. See Figure 4-1.

#### NOTE

If FR Activator does not have Power Scanner, use AC meters on controller when troubleshooting.

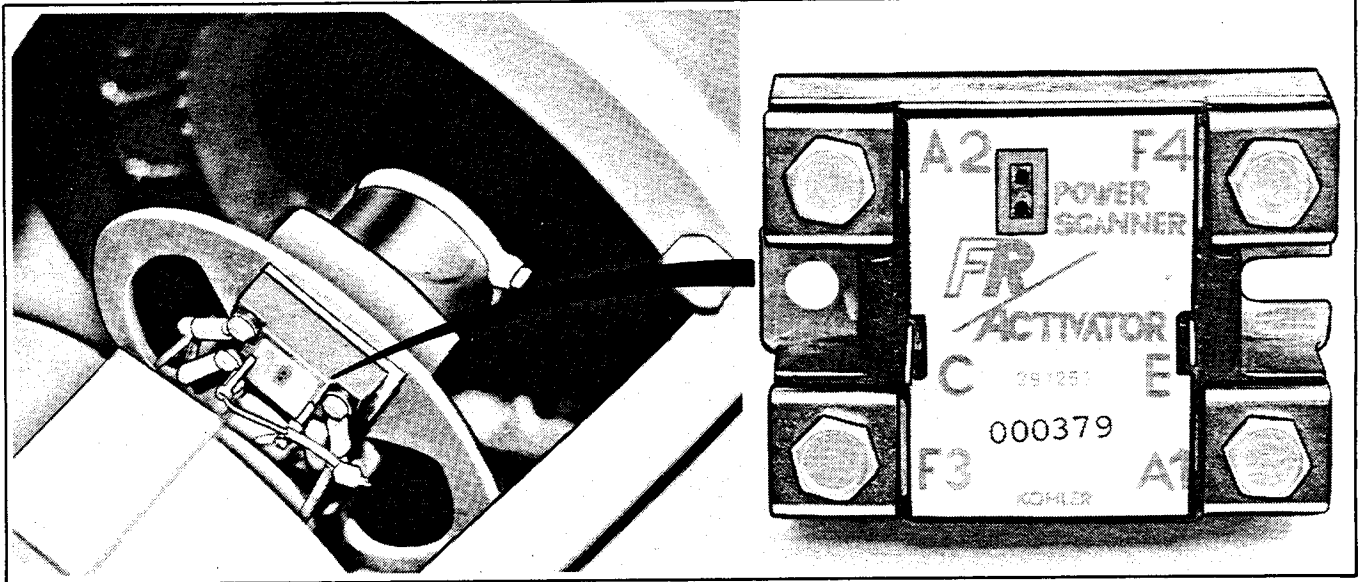


Figure 4-1. FR Activator

#### ⚠ WARNING

**HIGH VOLTAGE!** Disconnect set from load by opening line circuit breaker, or by disconnecting generator output leads from transfer switch and heavily taping ends of leads. The GENERATOR SAFEGUARD BREAKER MUST NOT BE USED IN PLACE OF LINE CIRCUIT BREAKER! If high voltage is transferred to load during test, personal injury and equipment damage may result.

#### ⚠ WARNING

**UNINTENTIONAL STARTING!** To prevent remote starting, unplug P3 connector at rear of controller. Place Generator Master Switch on controller to OFF position, and remove battery cables (negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator.

#### NOTE

Remote annunciator will not work with P3 unplugged.

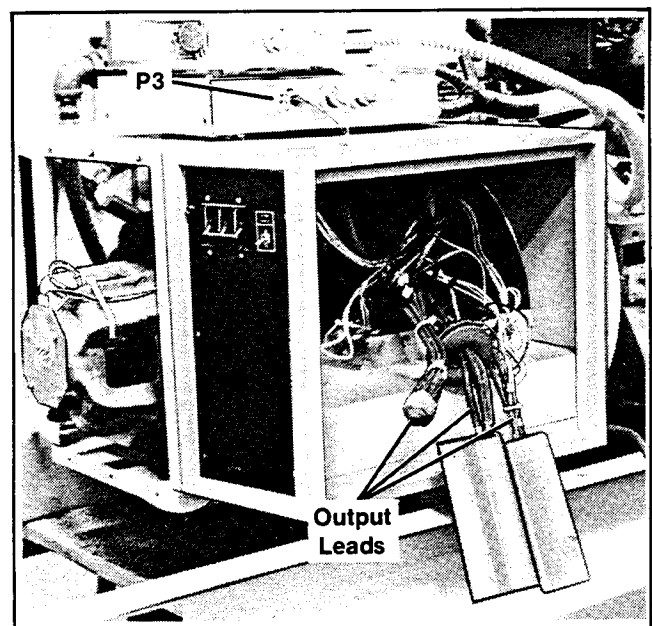


Figure 4-2. Insulate Output Leads

## Power Scanner (Continued)

### WARNING

**HIGH VOLTAGE!** Before starting generator set with generator end cover removed, place black electrical tape over LED of circuit board mounted on end of generator end bracket. Ceiling voltage will result if photo transistor is exposed to outside light.

To View Power Scanner:

1. STOP ENGINE. Move controller's generator switch to CENTER OFF and wait for engine shutdown.
2. Remove left-hand louvered panel from the generator end cover. Loosen 3 upper and 3 lower capscrews holding end cover to generator housing.
3. Lift end cover to remove.
4. Tape LED on circuit board.

### Power Scanner Patterns

During generator operation, the FR Activator travels with the rotor shaft to have the Power Scanner show red and green circular light segment patterns. View scanner patterns looking into each of four openings of end bracket casting.

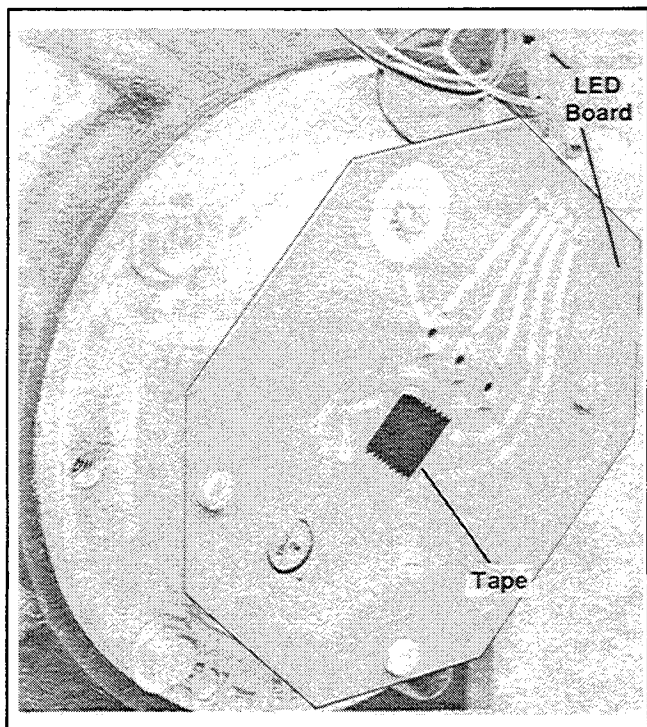


Figure 4-3. Tape LED Board

Normal (See Figure 4-4)

- Full green ring with segments evenly spaced.
- Red ring of four groups of evenly spaced segments — heavier loads will show more red segments.

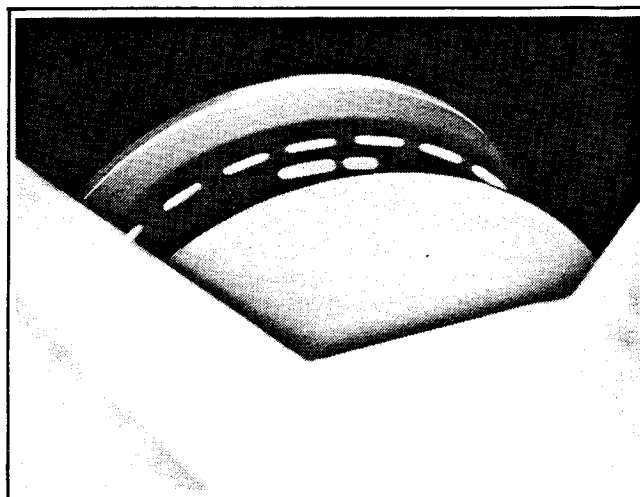


Figure 4-4. Normal Pattern (Low Load)

No generator output (See Figure 4-5)

- Full green shows voltage from exciter armature to FR Activator.
- No red shows exciter voltage not passing to main generator field.

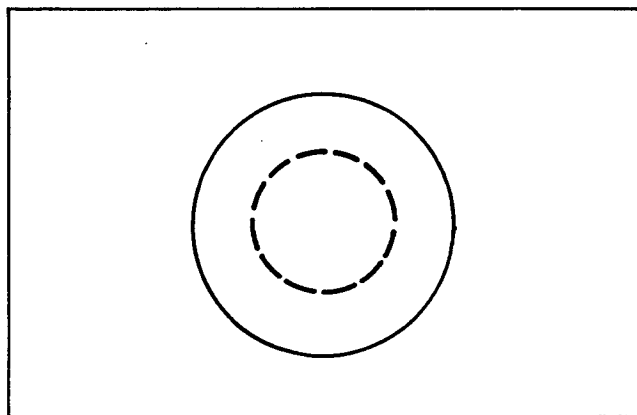
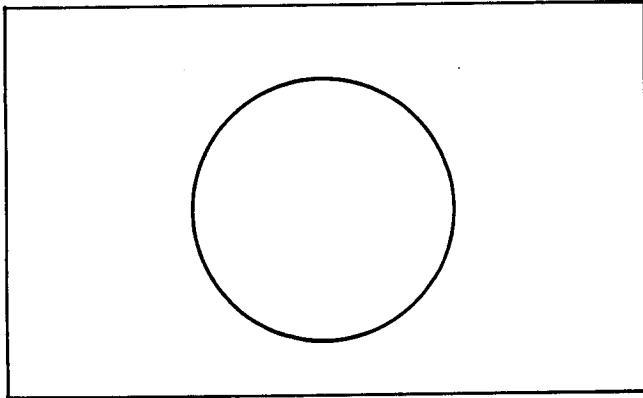


Figure 4-5. Full Green Only

**No generator output (See Figure 4-6)**

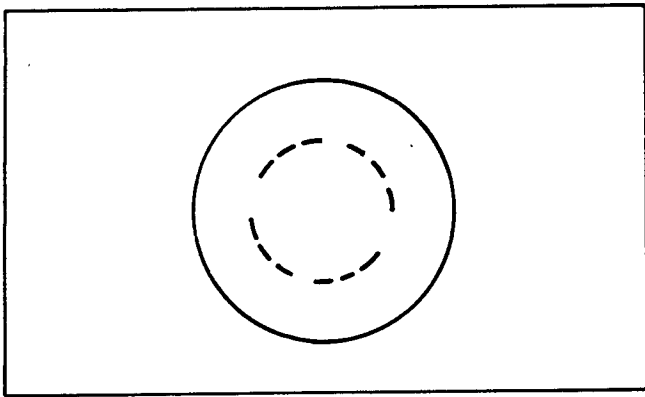
- **No green** shows no voltage from exciter armature to FR Activator.



**Figure 4-6. No Green**

**No generator output (See Figure 4-7)**

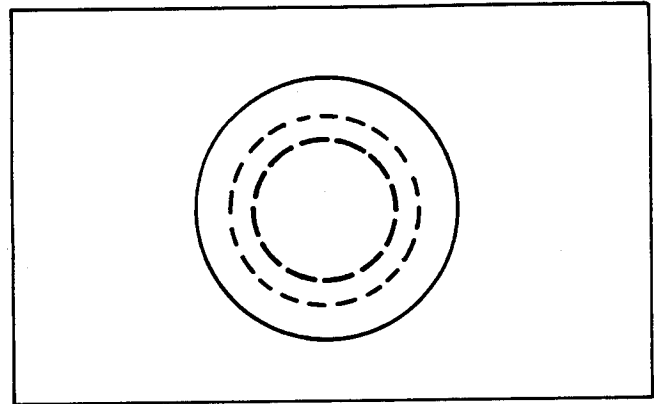
- **Partial green** shows low voltage from exciter armature to FR Activator.
- **Partial red** may also show.



**Figure 4-7. Partial Green**

**Overload or high output voltage (See Figure 4-8)**

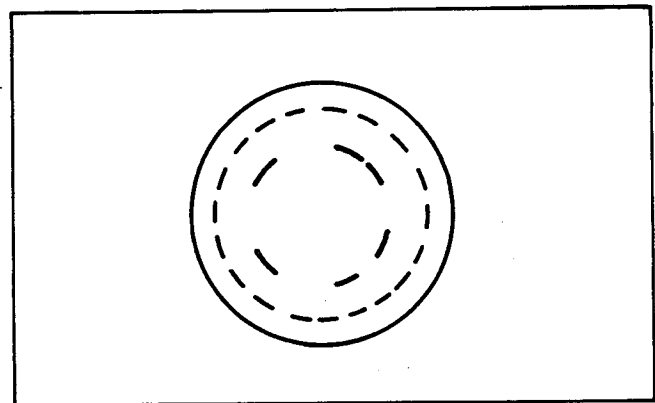
- **Full green** shows voltage from exciter armature.
- **Full red** shows exciter voltage sent to main field.



**Figure 4-8. Full Green/Full Red**

**Low generator output (See Figure 4-9)**

- **Full green** (shows voltage from exciter armature).
- **Partial red** with missing segments (segments unequal in 4 groups).



**Figure 4-9. Full Green/Partial Red**

## Generator Functions

**⚠ WARNING**

**HIGH VOLTAGE!** Disconnect set from load by opening line circuit breaker, or by disconnecting generator output leads from transfer switch and heavily taping ends of leads. The GENERATOR SAFEGUARD BREAKER MUST NOT BE USED IN PLACE OF LINE CIRCUIT BREAKER! If high voltage is transferred to load during test, personal injury and equipment damage may result.

**NOTE**

See Figure 4-10 when using the following procedures.

## Generator Functions (Continued)

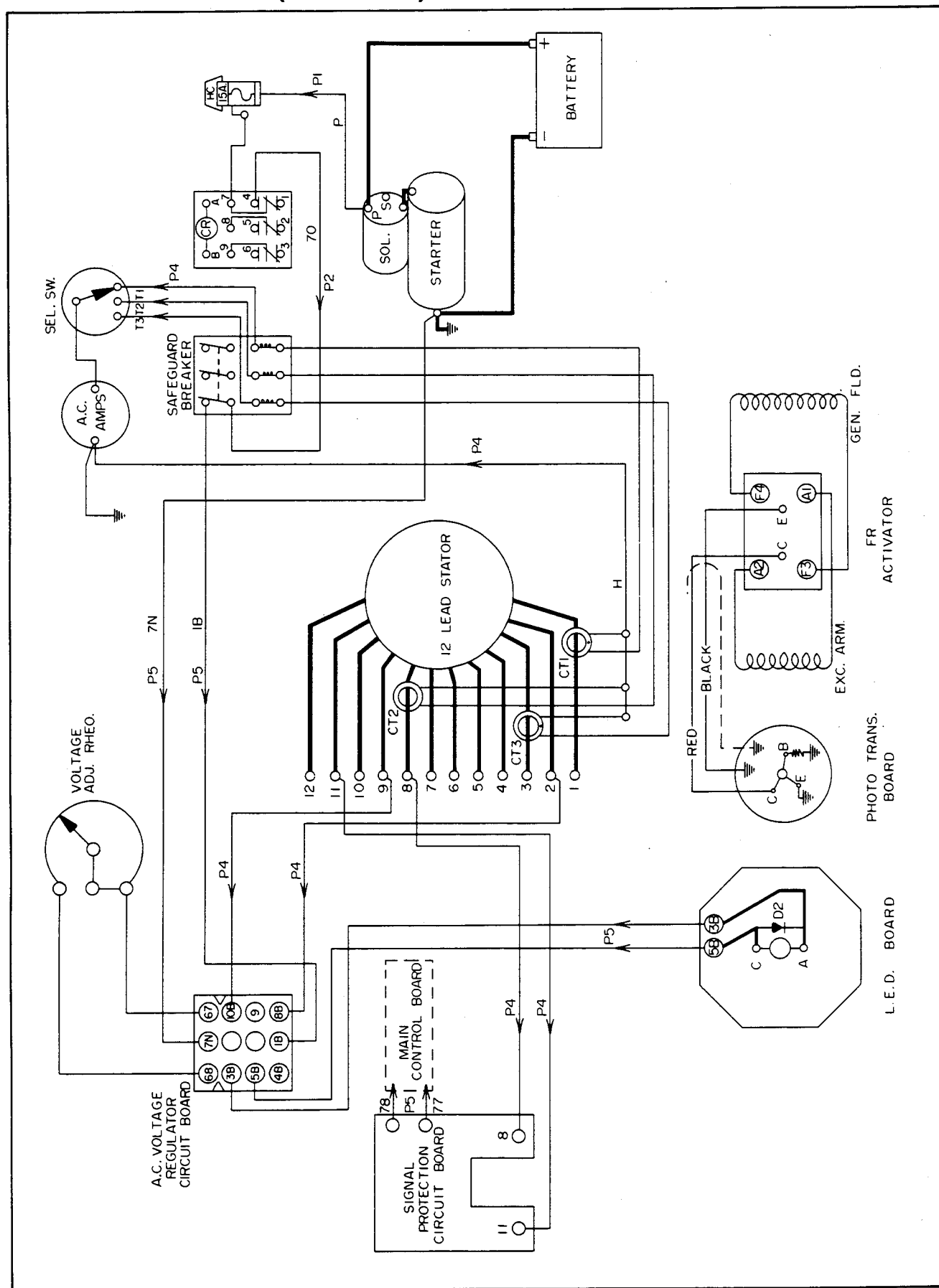


Figure 4-10. AC Voltage Control

**No AC output — full green/no red**

- > Safeguard breaker open. Close it, and with set running, check AC voltmeter for proper output voltage.

**⚠ WARNING**

**HIGH VOLTAGE!** When testing photo transistor board, keep all other light sources away. Otherwise, dangerous ceiling voltage may result.

- > If proper voltage does not show,
  - remove LED board and shine bright flashlight on exposed photo transistor. AC voltmeter should show ceiling voltage.
- > If red scanner pattern does not show,
  - Stop set. Disconnect red and black photo transistor board leads from C and E terminals of FR Activator.
  - Clip red and black leads to ohmmeter (+) and (-). Meter should read 300 K Ohms or higher.
  - Shine bright flashlight on photo transistor; meter should read 5K Ohms or lower.
  - If ohmmeter does not respond, replace photo transistor board/harness assembly. REPEAT TEST.

**⚠ WARNING**

**HIGH VOLTAGE!** Be sure that foil side of photo transistor board, end of shaft, and threaded holes are clean and free of metal particles and chips. Dangerous HIGH VOLTAGE may result. AC voltmeter must show proper output before generator may be reconnected to load.

- Reconnect red and black photo transistor board leads to C and E terminals of FR Activator. Start set, shine bright flashlight on photo transistor. AC voltmeter should show ceiling voltage, and return to normal when flashlight is removed.
- > If AC voltage does not show, stop set. Replace FR Activator and REPEAT TEST.
- > If tests show photo transistor board and FR Activator to be good, but proper voltage does not show when LED board is installed and connected,
  - Check for 2-6 DC volts across 3B (+) and 5B (-) of LED board with set running and safeguard breaker closed. See Figure 4-12.
  - If voltage shows, stop set and replace LED board.

**NOTE**

Remove plastic sleeve from LED on back of new board before mounting new board.

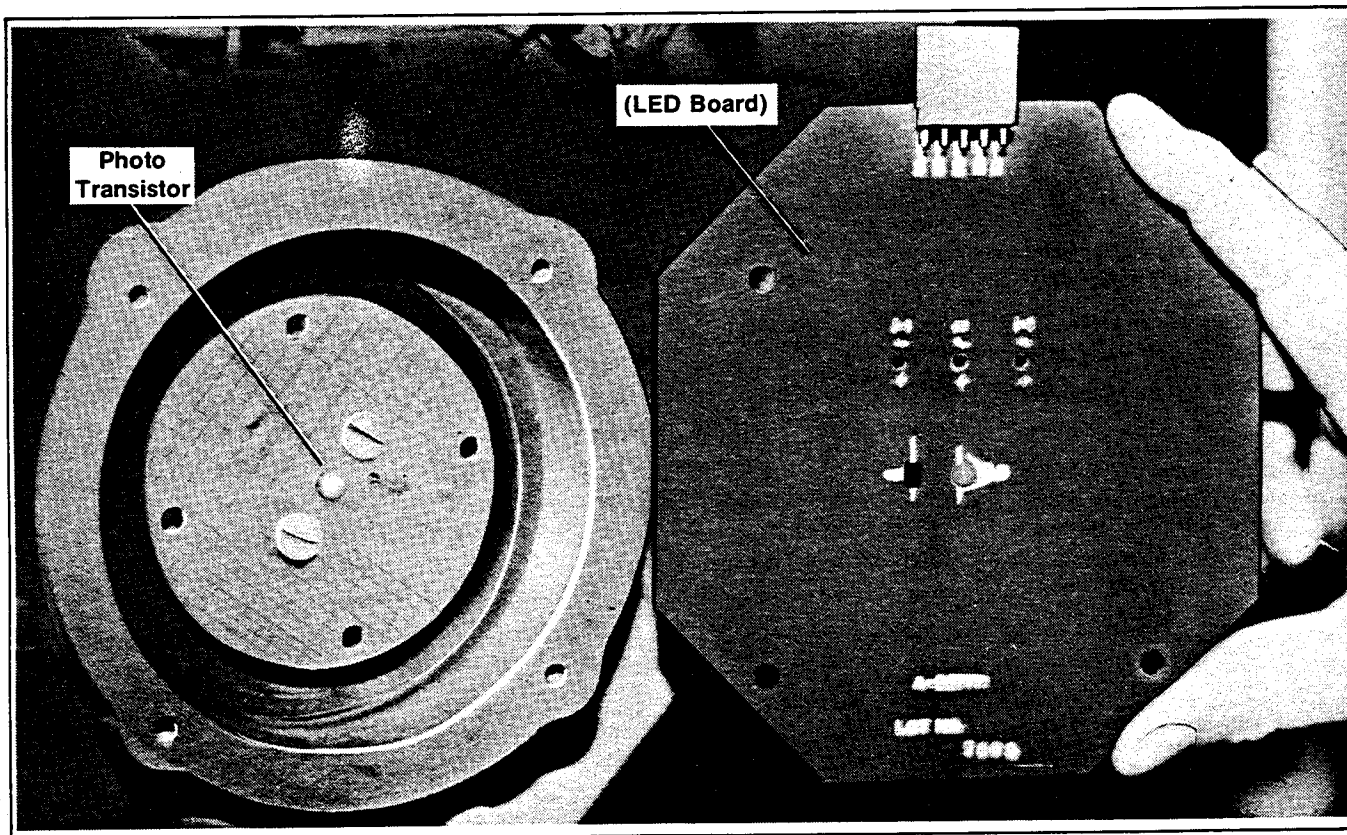


Figure 4-11. Photo Transistor Board

## Generator Functions (Continued)

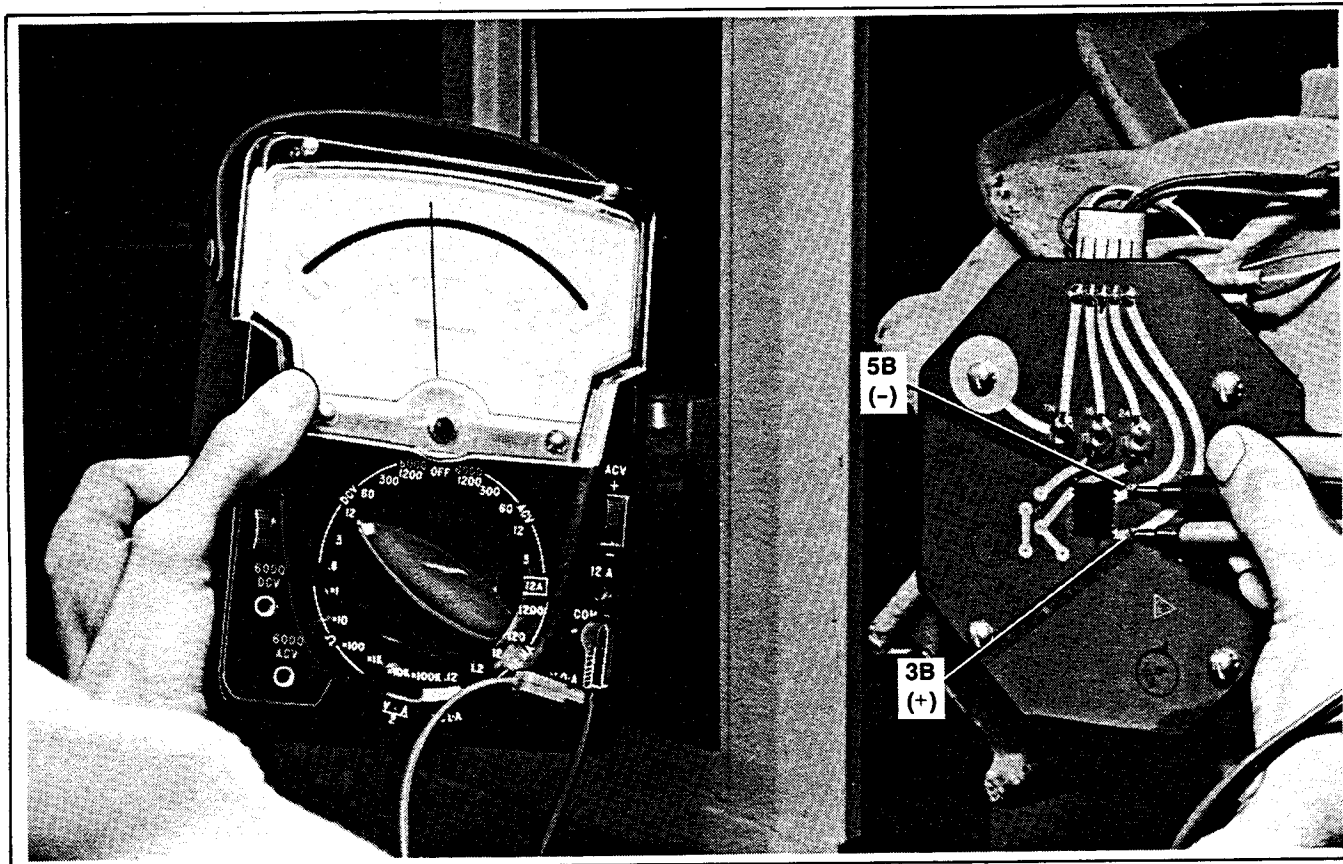


Figure 4-12. LED Board Voltage Check

- Start set and look for proper AC voltage.
- > If DC voltage does not show at LED board,
  - Check voltages at voltage regulator board (in controller upper cabinet) with set running and safeguard breaker closed. See Figure 4-13.
  - Set's battery voltage (12 or 24 DC volts) should show across R-16 and R-19 resistors. Voltage across R20 should be 4.3 for 12 volt sets and 9.1 for 24 volt sets.
- > If proper voltages show at voltage regulator board,
  - Stop set and remove harness plugs from LED board and voltage regulator board. Check wiring between sockets 3B and 6, 5B and 9 (includes P5 connector at rear of upper cabinet) for short, grounded or open circuit. See Figure 4-14.
  - Repair or replace wiring as necessary. Start set and look for proper AC voltage.
- > If proper voltages do not show at voltage regulator board,
  - Disconnect harness plug from voltage regulator board and run set with safeguard breaker closed.
- Check for battery voltage (12 or 24 DC volts) across sockets 2(-) and 11(+) of harness plug.
- > If battery voltage shows at harness plug, but proper voltages at board resistors and/or proper AC voltage does not show when harness is connected to voltage regulator board, replace board. REPEAT TESTS and look for proper AC voltage.
- > If battery voltage does not show at voltage regulator board harness plug, stop set.
  - Check continuity from harness plug socket 2 to ground (circuit includes P5 connector at rear of upper cabinet).
  - Check continuity from harness plug socket 11 to terminal 4 of CR relay with Safeguard breaker closed (circuit includes P5 and P2 connectors at rear of controller).
  - Repair or replace wiring or safeguard breaker as necessary.
  - Restart set and look for proper AC voltage.

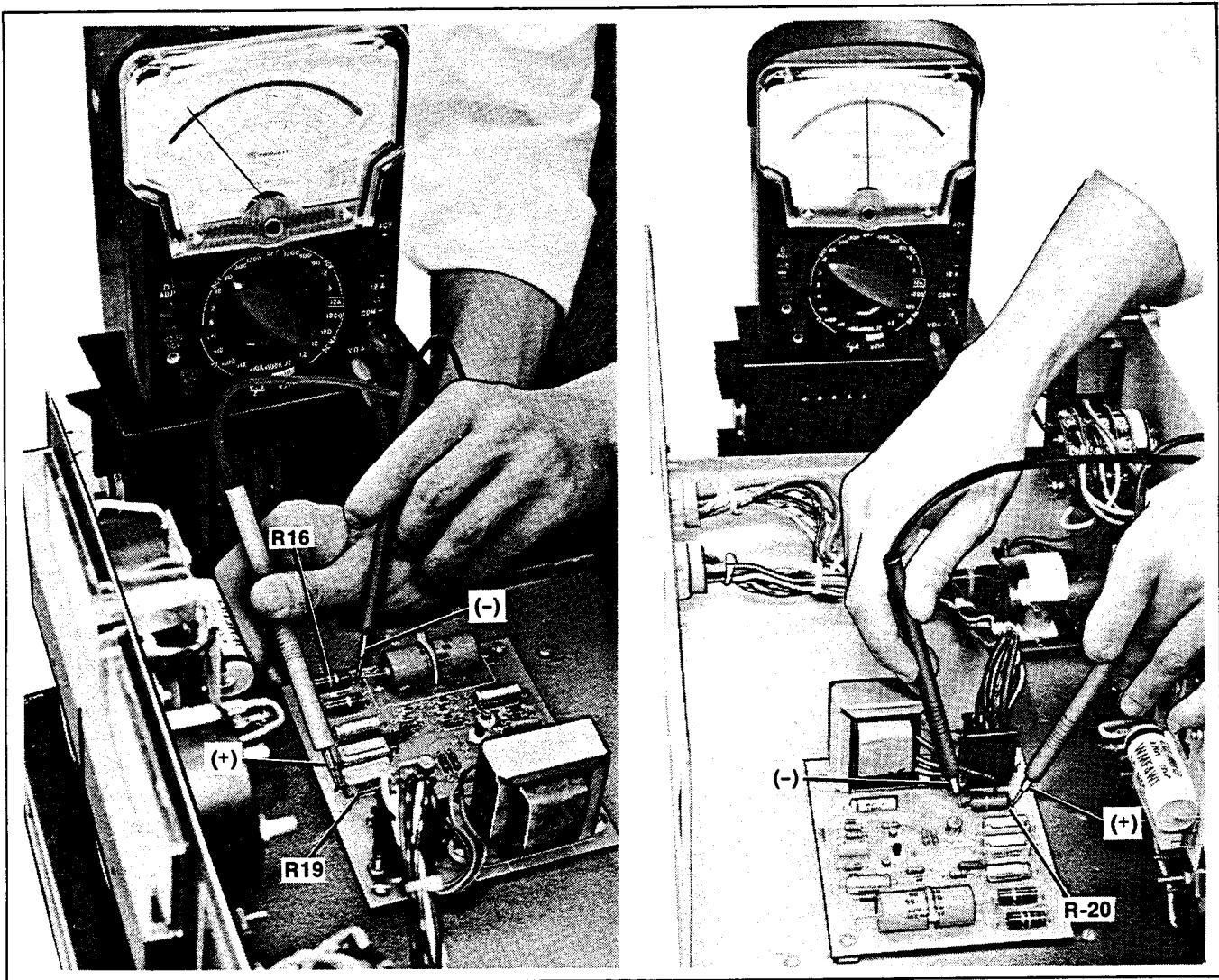


Figure 4-13. Voltage Regulator Board DC Voltage Check

#### Varying AC output voltage — varying green and red

- > Intermittent exciter voltage
  - Stop set
  - Check A1 and A2, F3 and F4 connections to FR Activator for tightness.
  - Restart set. Check for proper AC output voltage and scanner patterns.
  - If output voltage varies, stop set, disconnect A1 and A2 leads from FR Activator, leaving leads tied to shaft or heat sink.

#### **⚠ WARNING**

**HIGH VOLTAGE!** Use high voltage test only as directed. High voltage may cause personal injury, damage equipment, or lead to future failures. Follow manufacturer's instructions when operating tester.

- Apply 1,500 AC volts to either A1 or A2 lead and shaft for **not-more-than one second**.
- Repair A1 or A2 leads if test shows leads shorted to ground.

## Generator Functions (Continued)

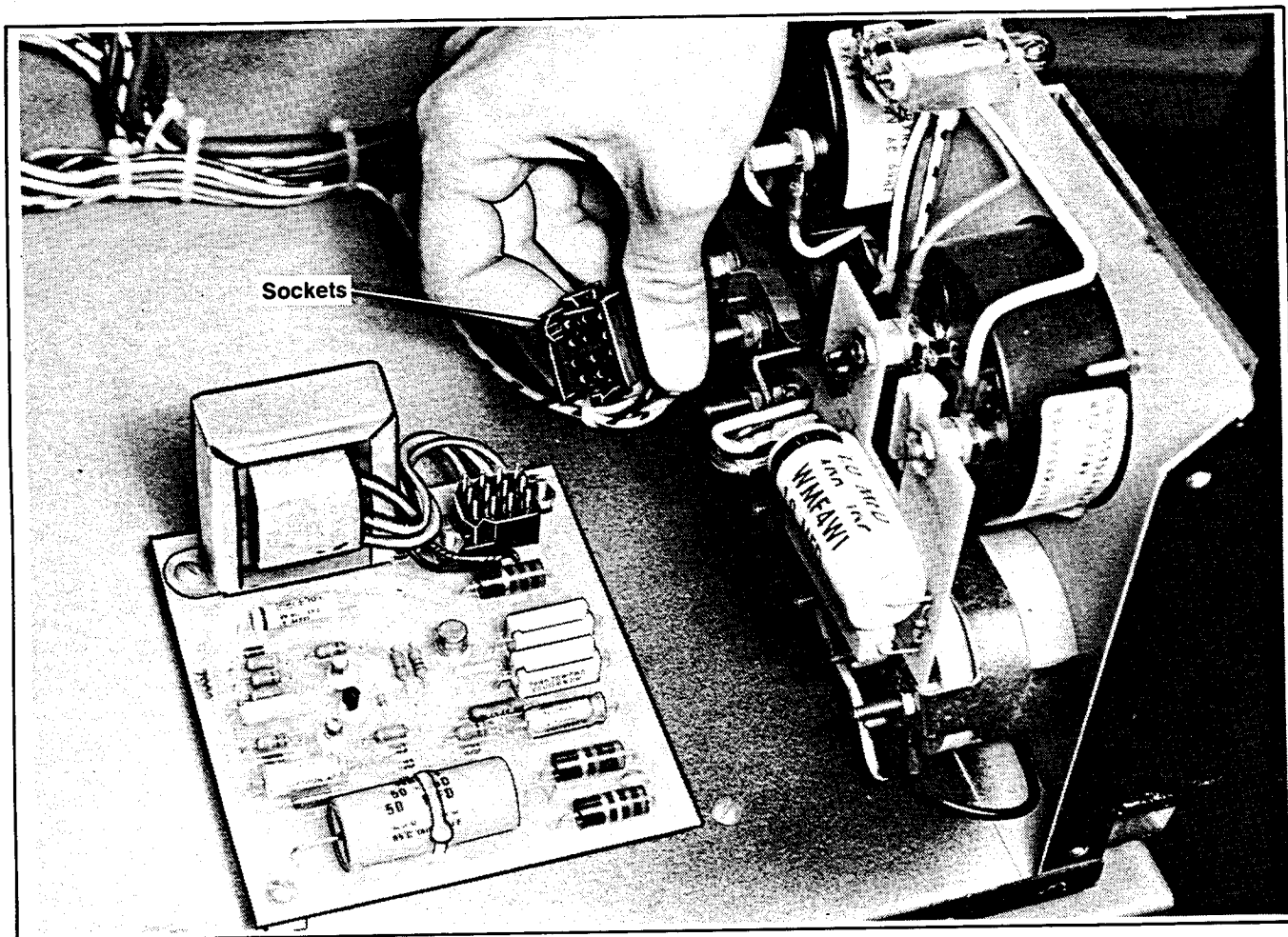


Figure 4-14. Harness Plugs

- Solder and insulate splices. Use new sleeving when tying leads to shaft or heat sink.
- Replace exciter armature if test shows armature shorted to ground.
- Repair leads or replace exciter armature if continuity check shows open condition across A1 and A2 leads.

### No AC output — no green

- > Open exciter armature or A1, A2 leads
  - Stop set. Disconnect A1 and A2 leads from FR Activator.
  - Check continuity across A1 and A2 leads.
  - Repair A1 and A2 leads if damaged or open. Solder and insulate splices. Use new sleeving when tying leads to shaft or heat sink.
  - Replace exciter armature if test shows open windings.
  - Restart set. Check for proper AC voltage and scanner patterns.

- > Shorted or grounded exciter armature
  - Stop set.

### ⚠ WARNING

**HOT PARTS!** Exciter armature will get hot if armature is shorted. Avoid touching armature!

- Disconnect A1 and A2 leads from FR Activator, leaving leads tied to shaft or heat sink.

### ⚠ WARNING

**HIGH VOLTAGE!** Use high voltage test only as directed. High voltage may cause personal injury, damage equipment, or lead to future failures. Follow manufacturer's instructions when operating tester.

- Apply 1,500 AC volts to either A1 or A2 lead and shaft for **not-more-than one second**.
- Repair A1 or A2 leads if test shows leads shorted to ground. Solder and insulate splices. Use new sleeving when tying leads to shaft or heat sink.

## GENERATOR TROUBLESHOOTING

- Replace exciter armature if test shows armature shorted or grounded.
- > FR Activator Shorted
  - Stop set. Replace FR Activator.
  - Restart set; look for proper AC voltage.

#### NOTE

Shorted generator field will cause FR Activator failure.

- > Generator Field Shorted
  - Stop set. Check field resistance as described in Appendix A.
  - Replace FR Activator and generator field if shorted.
  - Restart set; look for proper AC voltage.

#### No AC output — full green and full red

- > Check for open field
  - Stop set. Disconnect F3 and F4 leads from FR Activator and check continuity across leads.
  - Repair F3 and F4 leads. Solder splices and use new insulation as necessary or replace field.

#### High AC output voltage — full green and full red with safeguard breaker open OR closed

- > Photo transistor board or harness shorted
  - Stop set. Disconnect C (red) and E (black) leads from FR Activator.
  - Restart set and check AC voltage.
    - If AC voltage does not show, stop set and replace photo transistor board/harness assembly.

#### WARNING

**HIGH VOLTAGE!** Be sure that foil side of photo transistor board, end of shaft, and threaded holes are clean and free of metal particles and chips. Dangerous HIGH VOLTAGE may result. AC voltmeter must show proper output before generator may be reconnected to load.

- Restart set and check AC voltmeter for proper output.

#### High or erratic AC output — full green, erratic-to-full red with safeguard breaker closed only.

- > Open or poor voltage-sensing circuit
  - Start set. Check AC voltage across red wires near harness connector on voltage regulator board. See Figure 4-15.

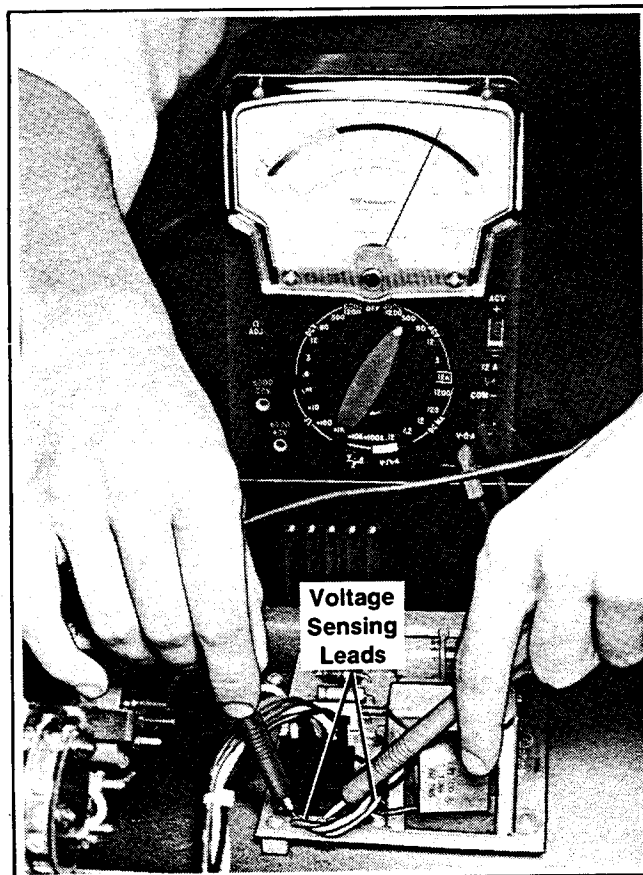


Figure 4-15. Voltage Regulator Board AC Voltage Check

Voltmeter should read 150 volts on 600-volt sets; 208 or 240 volts on others.

- If very low or erratic voltage shows, stop set,
  - Check wiring from sockets 4 and 10 of disconnected voltage regulator board harness plug to stator terminals 3B and 2B on 600-volt sets or stator leads 9 and 2 on others. Circuit includes P4 connector at rear of upper cabinet.
  - Repair or replace wiring or connections as necessary.
  - Reconnect voltage regulator board.

## Generator Functions (Continued)

- Restart set. Recheck AC voltage at voltage regulator board as shown in Figure 4-15. AC voltmeter must show proper output.
- > Shorted or faulty photo transistor board/harness assembly.
  - Stop set. Disconnect C (red) and E (black) leads from FR Activator.
    - Use ohmmeter to check for intermittent shorts between C and E leads.
    - Use ohmmeter to check for intermittent “opens” between end of bare ground/shield wire and shaft.

### NOTE

Wiggle photo transistor board harness near splice to board when checking for shorts or “opens”.

- Replace photo transistor board/harness assembly as necessary.

### WARNING

**HIGH VOLTAGE!** Be sure that foil side of photo transistor board, end of shaft, and threaded holes are clean and free of metal particles and chips. Dangerous HIGH VOLTAGE may result. AC voltmeter must show proper output before generator may be reconnected to load.

- Restart set. Look for proper AC voltage.

## Section 5

# GENERATOR DISASSEMBLY-REASSEMBLY

### CAUTION

Any cranes, hoists, or other devices used in disassembly or reassembly must be rated for weight of generator set. See table following for approximate dry weights of various models. Check generator set name plate for weight of any model not listed.

| KW  | MODEL<br>Engine-Fuel    | WEIGHT |        |
|-----|-------------------------|--------|--------|
|     |                         | Lbs.   | (Kg)   |
| 30  | Gas-Gasoline            | 1470   | ( 668) |
|     | Diesel                  | 1495   | ( 679) |
| 45  | Gas-Gasoline            | 1900   | ( 863) |
|     | Diesel                  | 1960   | ( 890) |
| 55  | Gas-Gasoline            | 2035   | ( 924) |
| 60  | Diesel                  | 2140   | ( 972) |
| 70  | Gas-Gasoline (Chrysler) | 2095   | ( 952) |
|     | (Ford)                  | 2009   | ( 913) |
| 75  | Diesel (D4800)          | 2734   | (1242) |
|     | (D3400T)                | 2100   | ( 954) |
| 85  | Gas-Gasoline            | 2650   | (1203) |
| 100 | Diesel                  | 2895   | (1315) |
| 125 | Diesel                  | 4000   | (1816) |
| 130 | Diesel                  | 4010   | (1821) |
| 150 | Diesel                  | 4465   | (2028) |
| 230 | Diesel                  | 5874   | (2668) |
| 250 | Diesel                  | 6425   | (2917) |
| 260 | Diesel                  | 5990   | (2720) |

### ⚠ WARNING

**UNIT STARTS WITHOUT NOTICE!** Units with Automatic Transfer Switches start automatically. Potential injury or electrocution can result. Turn Generator Master Switch on controller to OFF position, and remove battery cables (remove negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator.

### ⚠ WARNING

**ELECTRICAL SHOCK!** Battery can cause electrical burns and shocks. Exercise reasonable care when working near the battery to avoid electrical connections through tools. Remove wristwatch, rings, and any other jewelry.

### ⚠ WARNING

**HOT PIPING!** An engine gets hot while running and exhaust system components get extremely hot. Do not work on generator set until unit is allowed to cool.

## Disassembly

1. Disconnect and remove starting batteries from work area to prevent fire hazard. Disconnect any AC accessories such as battery charger, block heater, and fuel transfer pump.
2. Shut off fuel supply. Drain fuel system as necessary, emptying fuel into proper containers. Remove any fuel containers from work area to prevent fire hazard. Ventilate work area to clear fumes.
3. Disconnect fuel, cooling, and exhaust systems as necessary to tilt generator set. Disconnect output leads or load circuit cables at generator.
4. Disconnect all controller-to-engine and engine-to-generator harnesses and wiring, including alarm horn circuit board connector, LED board and connector, and speed sensor. Enclosure and controller may be removed as unit.
5. Unplug C (red) and E (black) leads from FR Activator. Remove photo transistor board and harness.
6. Loosen generator end bearing retainers, if so equipped. See Figure 5-1.

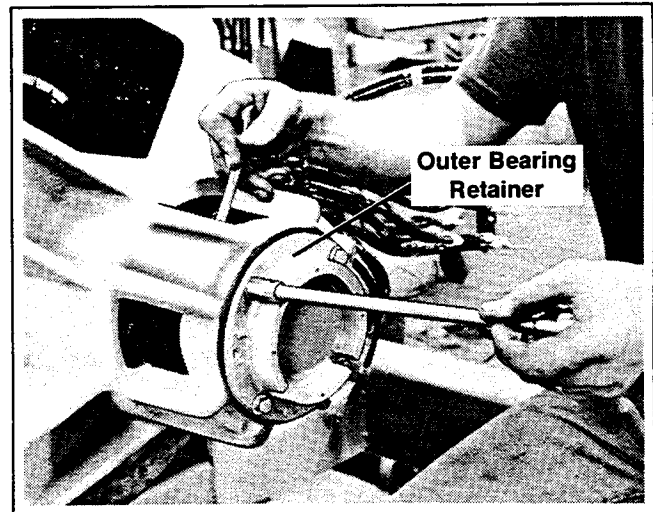


Figure 5-1. Loosening Bearing Retainers

7. Remove bolts from generator vibro-mounts.
8. Suspend generator at both ends and raise with hoist, as shown in Figure 5-2, to lift generator off of vibro-mounts.
9. Place wood blocks under flywheel housing to support engine; lower, allowing flywheel housing to rest on blocks.
10. Remove bolts holding adapter to flywheel housing. See Figure 5-3. Remove nuts or bolts holding fan and drive discs to flywheel.

## Disassembly (Continued)

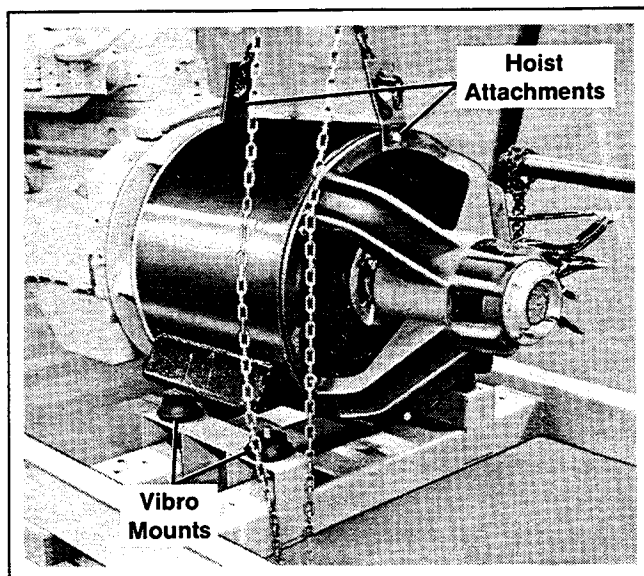


Figure 5-2. Hoisting Generator End



Figure 5-3. Removing Adapter Bolts

11. If studs hold drive discs to flywheel, work drive discs over studs to separate generator from engine.
12. Set generator horizontally on floor. Remove slings or chains.
13. Hook hoist to adapter and suspend generator assembly. See Figure 5-4.

### GENERATOR DISASSEMBLY-REASSEMBLY 5-2

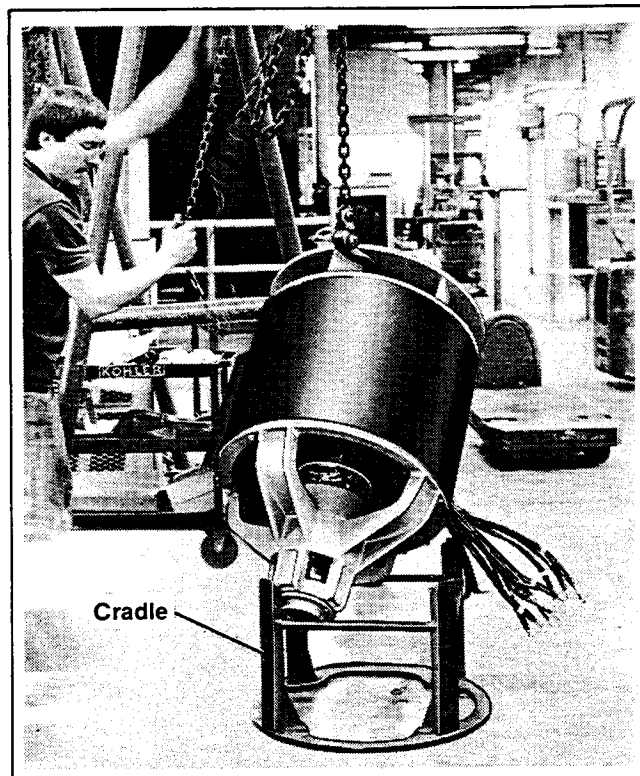


Figure 5-4. Hoisting Generator Assembly

14. Lower generator assembly to rest in suitable cradle as shown in Figure 5-5.
15. Remove adapter, if separate, drive discs and fan.

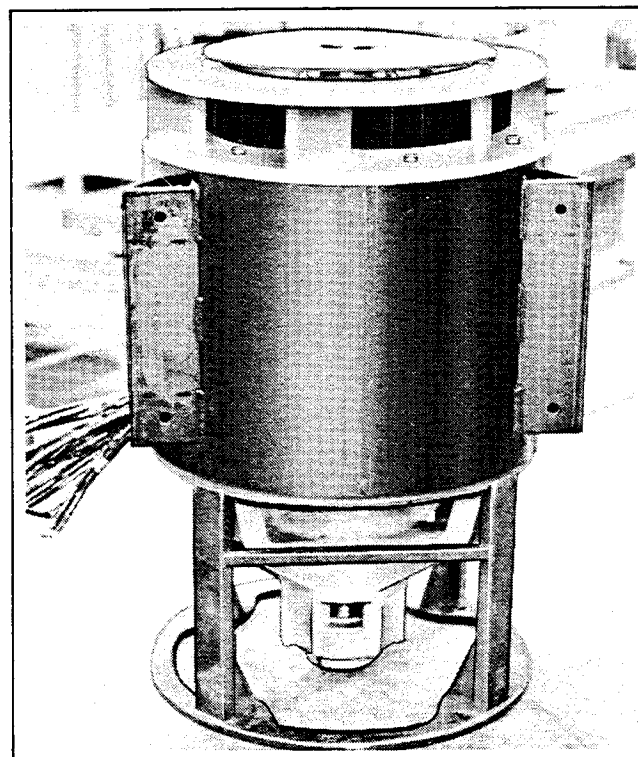
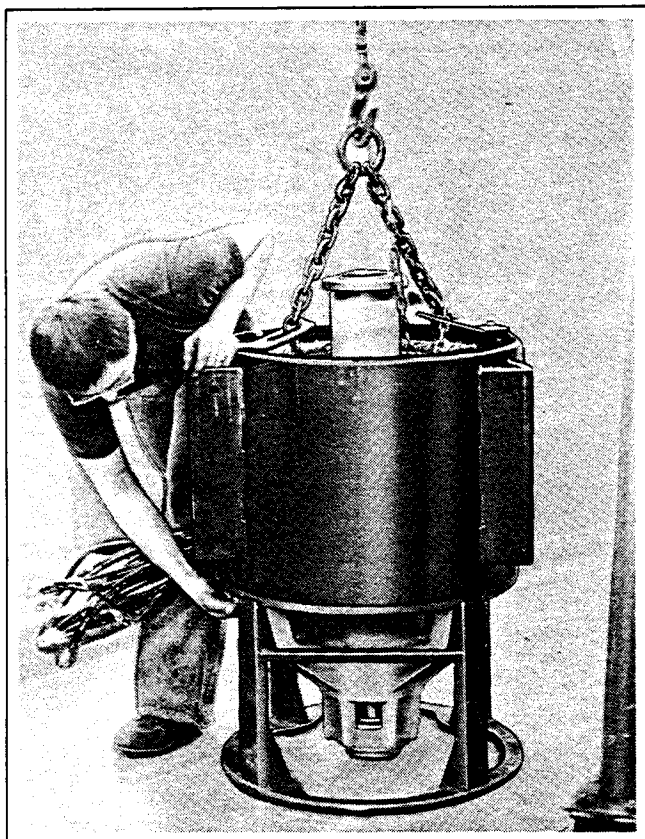


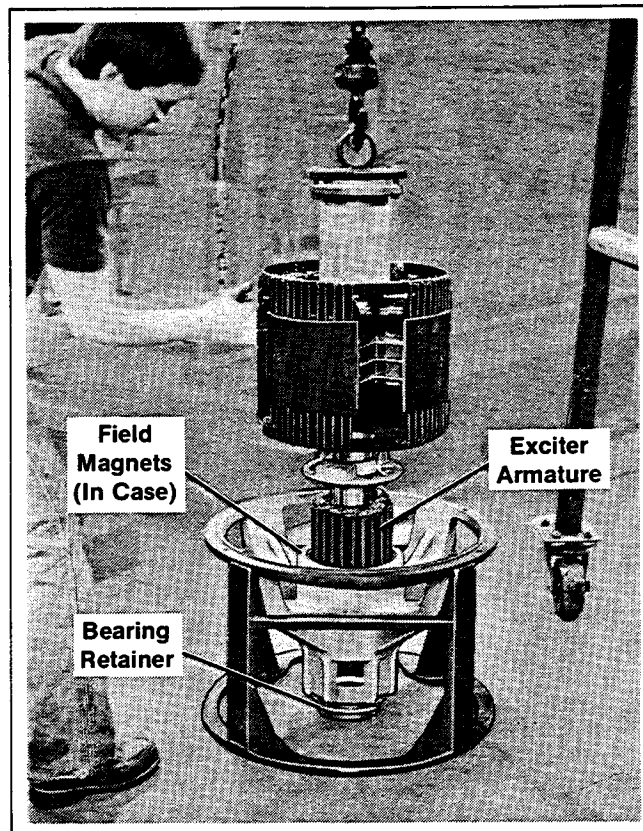
Figure 5-5. Cradled Generator Assembly

16. Fasten chains and hoist to stator. Remove bolts holding stator to end bracket. See Figure 5-6.
17. Raise stator to remove, taking care not to damage stator laminations or rotor.

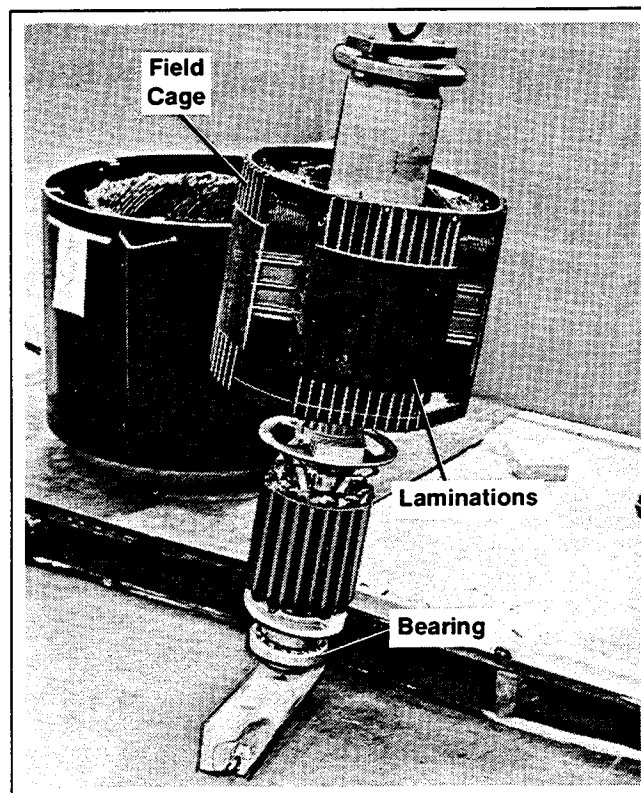


**Figure 5-6. Preparing to Remove Stator**

18. Fasten lifting eye and hoist hook to rotor flange. If so equipped, remove nuts and bolts holding bearing retainers to end bracket. Hoist rotor to remove. Take care not to damage exciter armature or exciter field magnets. See Figure 5-7.
19. Lower rotor allowing bearing end to rest on wood block as shown in Figure 5-8. Slowly lower rotor to horizontal position taking care not to damage field cage or laminations.



**Figure 5-7. Removing Rotor**



**Figure 5-8. Rotor Handling**

## Reassembly

1. Place end bracket in suitable cradle as shown in Figure 5-9. Be sure outer bearing retainer or snap ring is in position. Outer bearing retainer, if so equipped, should be in position with bolts in place.

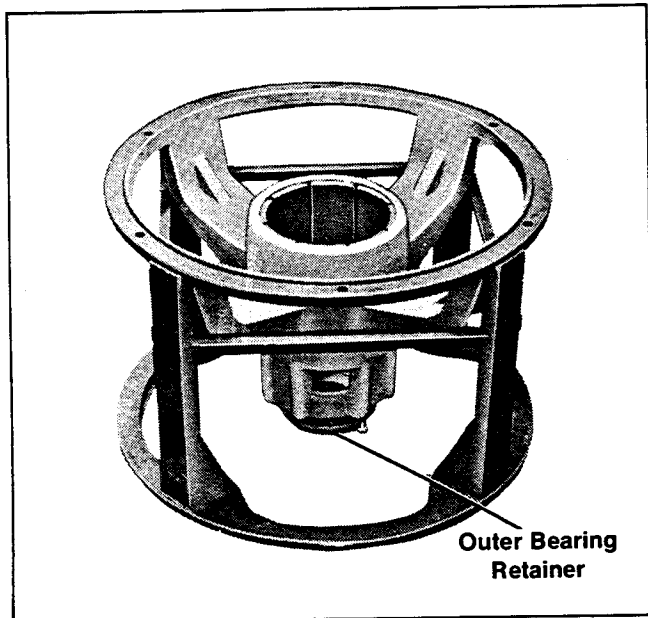


Figure 5-9. Cradled End Bracket

2. Raise rotor allowing bearing end to rest on wood block as shown in Figure 5-10.

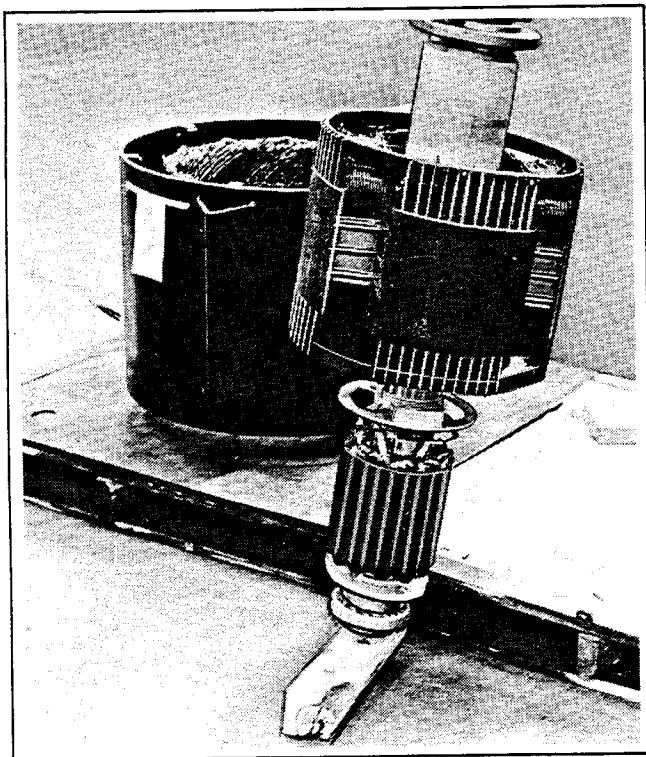


Figure 5-10. Rotor Handling

3. Suspend rotor over end bracket. Lower rotor into end bracket taking care not to damage exciter armature or field magnets. Position end bracket to guide rotor end bearing into end bracket. See Figure 5-11. Fasten both bearing retainers to end bracket, if equipped, *but do not final tighten*.

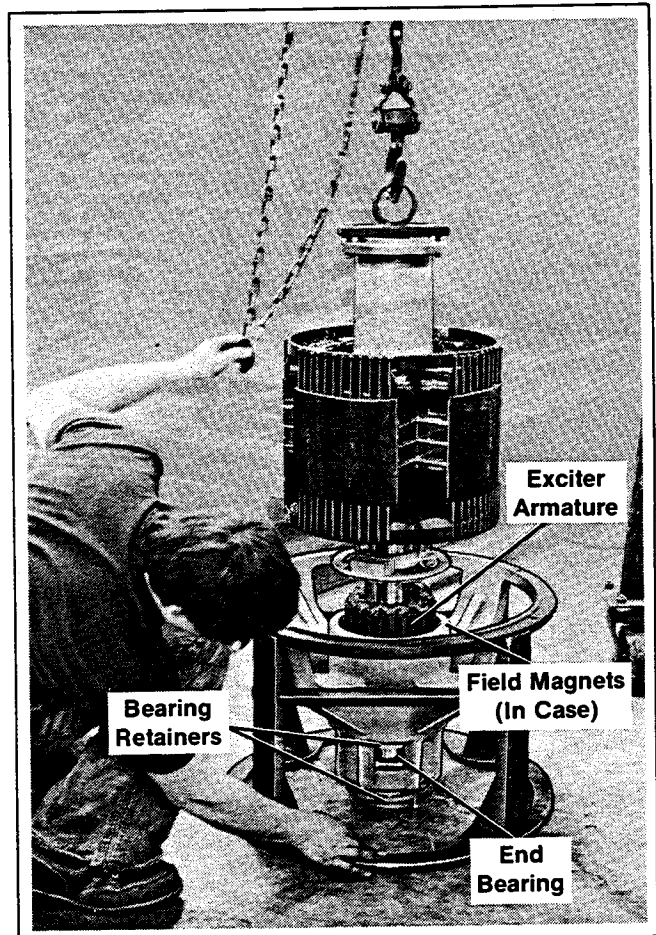


Figure 5-11. Lowering Rotor

4. Suspend stator and lower over rotor taking care not to damage stator windings and laminations or rotor.
5. Lower stator to within 1/2 to 1/4 in. (12.7-6.4 mm) of end bracket. Turn stator to position, and start bolts to hold end bracket to stator. Lower stator onto end bracket and tighten bolts. See Figure 5-12.

### NOTE

For models with speed sensor mounting holes in end bracket, mount stator to end bracket as shown in Figure 5-13.

6. Place fan over end of rotor. Fasten drive discs to rotor flange. Torque drive disc bolts to 80 ft. lbs. (11.06 Kg-m).
7. Fasten adapter to stator, if separate, and final tighten.

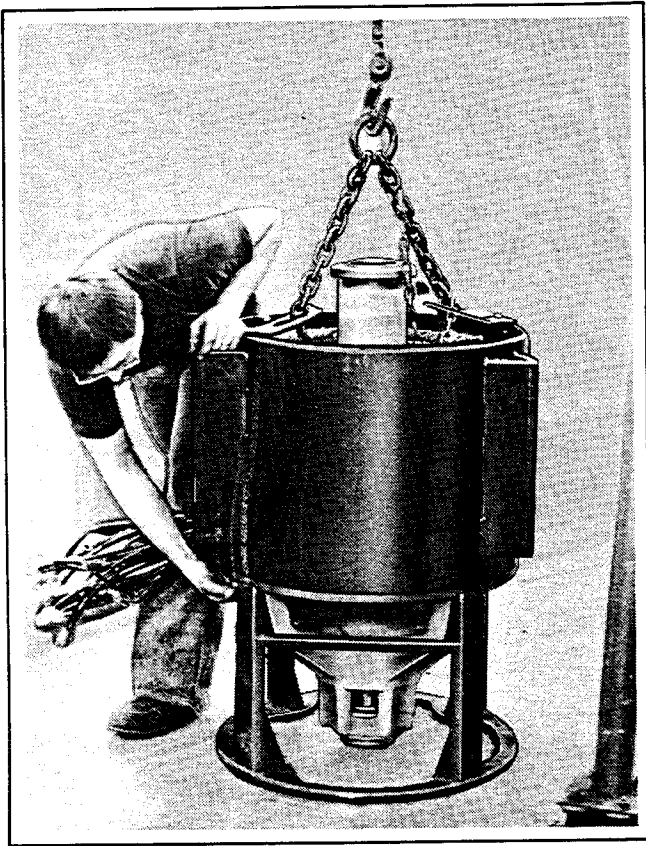


Figure 5-12. Positioning Stator

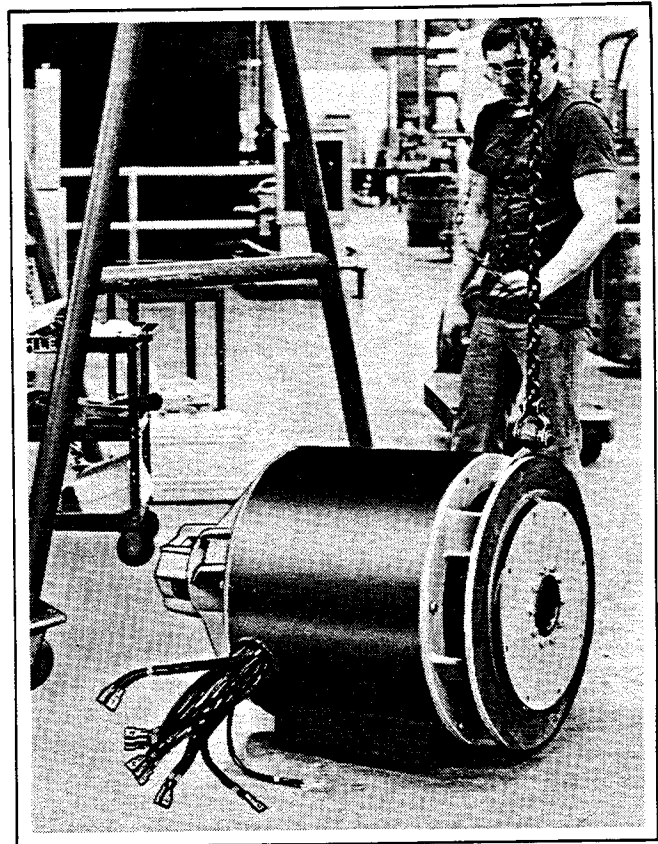


Figure 5-14. Generator Handling

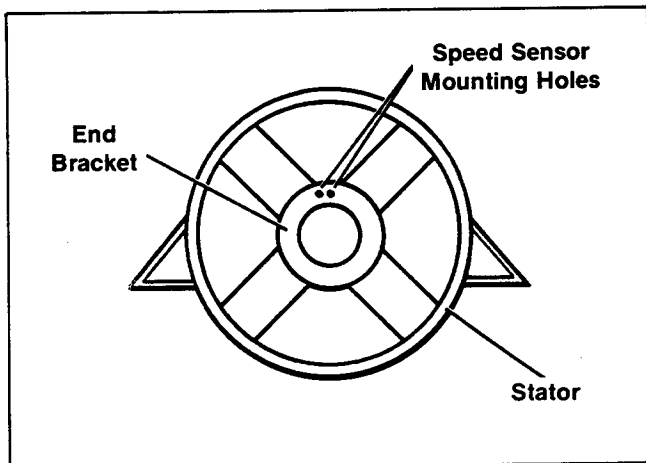


Figure 5-13. End Bracket Position

8. Hoist assembled generator by adapter and set on side taking care not to damage end bracket or stator. See Figure 5-14.
9. If bolts are used to fasten drive discs to flywheel, guide pins should be used to align flywheel with drive discs. Make guide pins by removing heads from two properly sized and threaded bolts, leaving approximately 1 in. (25.4 mm) of unthreaded shank to protrude from flywheel face. Thread guide pins into flywheel as shown in Figure 5-15.

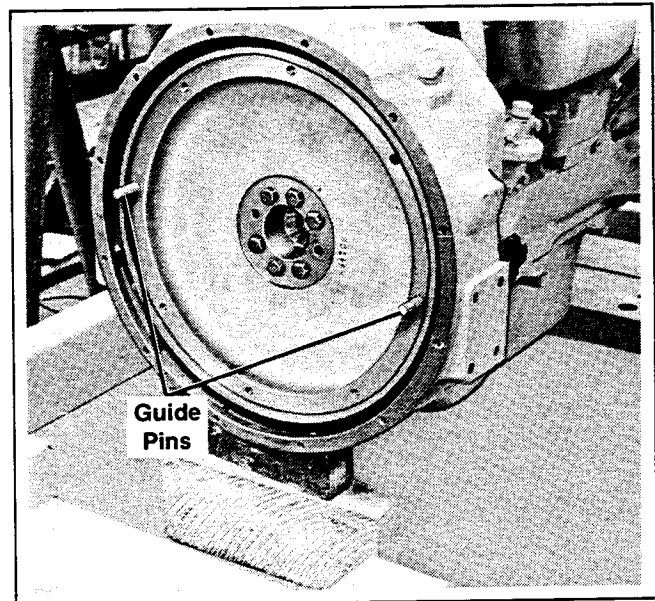


Figure 5-15. Guide Pin Placement (If Used)

- If studs are used to fasten drive discs to flywheel, be sure all studs are threaded into flywheel.
10. Suspend assembled generator in level position as shown in Figure 5-16. Turn flywheel to align studs or guide pins with drive discs.

## Reassembly (Continued)

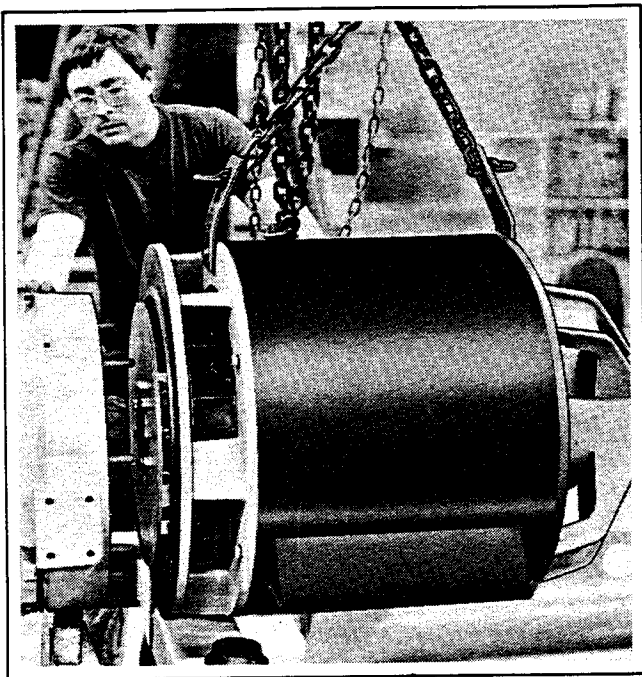


Figure 5-16. Positioning Generator

11. Move generator as necessary to work drive discs and fan over guide pins or studs. See Figure 5-17. Fasten drive discs and fan to flywheel with two bolts or nuts at opposite holes or studs.
12. Move generator as necessary to align adapter and flywheel housing. Fasten and final tighten adapter to flywheel housing. See Figure 5-18.
13. Hoist generator and engine slightly and remove blocks from under flywheel housing. Lower generator to align and rest on vibro-mounts. Tighten generator to mounting. See Figure 5-19.
14. Remove chains or slings used to suspend generator. Final tighten end bracket to stator.
15. Final tighten fan and drive discs to flywheel. Insert bar through fan blades to turn and hold engine and rotor.

### CAUTION

Be sure to remove guide pins if used, and replace with proper bolts and lockwashers.

### NOTE

On 125-260 KW models, end bearing must be packed if rotor or end bearing has been replaced. Remove outer bearing retainer to expose bearing and pack with #2 EP bearing grease.

Speed sensor mounting boss on inner bearing retainer must be positioned at top.

16. Final tighten bearing retainers to end bracket.
17. Complete reassembly reversing steps 1 through 5 of Disassembly.

## GENERATOR DISASSEMBLY-REASSEMBLY

5-6



Figure 5-17. Coupling Drive Discs to Flywheel

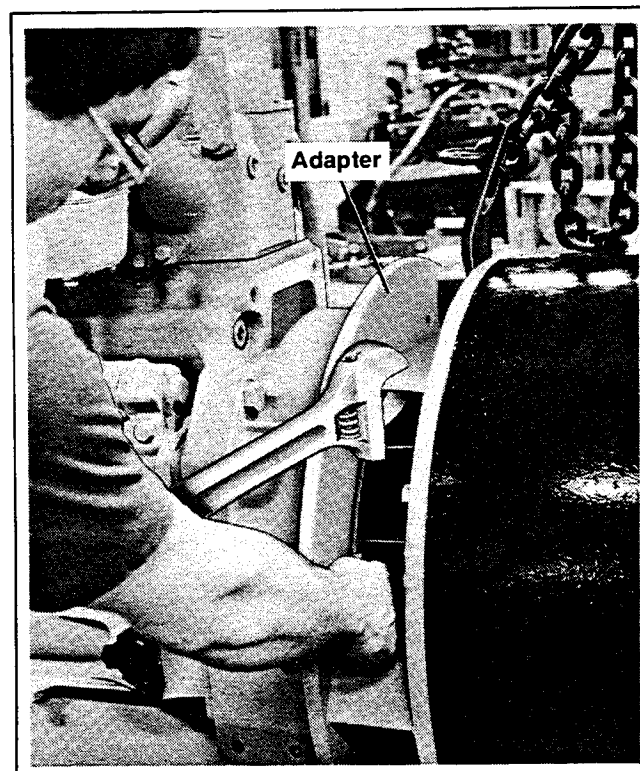


Figure 5-18. Coupling Flywheel Housing to Adapter

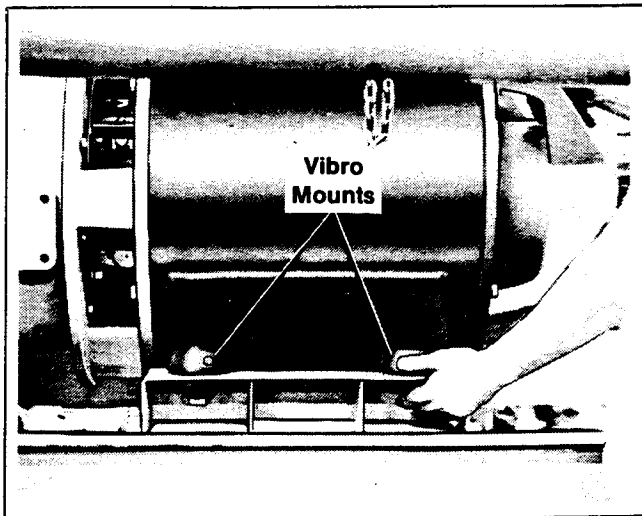


Figure 5-19. Mounting Generator

**⚠ WARNING**

**HIGH VOLTAGE!** Be sure that foil side of photo transistor board, end of shaft, and threaded holes are clean and free of metal particles and chips. Dangerous HIGH VOLTAGE may result. AC voltmeter must show proper output before generator may be reconnected to load.

**NOTE**

Set speed sensor air gap 0.020 in. (0.508 mm) when remounting. See Figure 5-20.

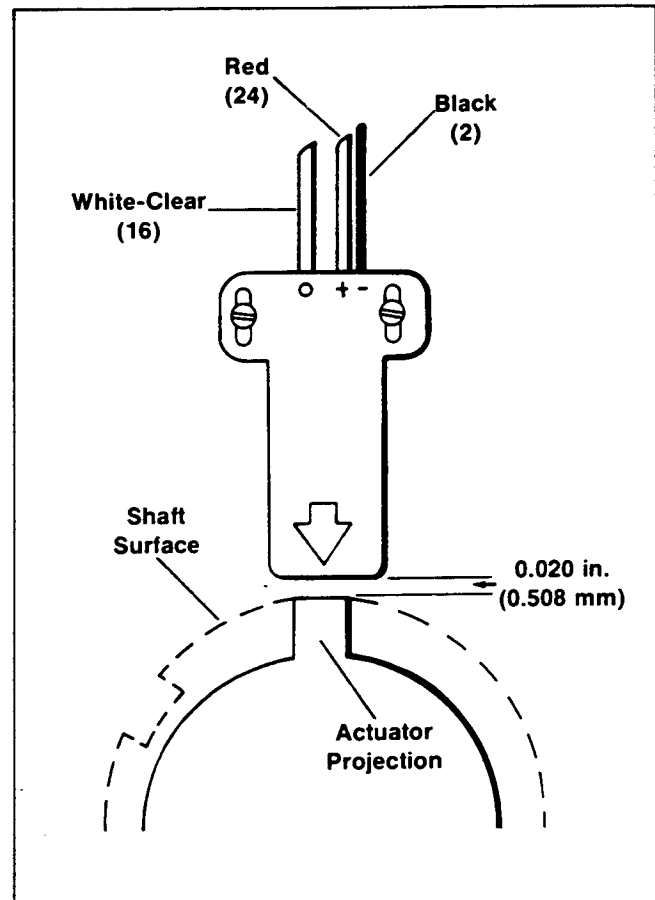


Figure 5-20. Speed Sensor Air Gap

Section 6

WIRING DIAGRAMS

Model Voltage Code

(As shown by second-to-last numeral of model number.)

| Code | Voltage | Phase | Wires |
|------|---------|-------|-------|
| 0    | 120/240 | 3     | 4     |
| 5    | 240     | 3     | 3     |
| 6    | 120/240 | 1     | 3     |
| 7    | 277/480 | 3     | 4     |
| 8    | 120/208 | 3     | 4     |
| 9    | 347/600 | 3     | 4     |
| 10   | Triple: |       |       |
|      | 120/240 | 1     | 3     |
|      | 277/480 | 3     | 4     |
|      | 120/208 | 3     | 4     |

Diagrams

| UPPER CABINET                  |                                                                                           |              |      |
|--------------------------------|-------------------------------------------------------------------------------------------|--------------|------|
| Voltage Code                   |                                                                                           | Page         |      |
| 0, 5, 7, 8, 9                  |                                                                                           | 6-2          |      |
| 6                              |                                                                                           | 6-3          |      |
| 10                             |                                                                                           | 6-4          |      |
| CONTROLLER TO ENGINE-GENERATOR |                                                                                           |              |      |
| Model                          |                                                                                           | Voltage Code | Page |
| KW                             | Engine                                                                                    |              |      |
| 30-60                          | White-Hercules<br>(60Kw w/D3000T engine)                                                  | 0            | 6-5  |
|                                |                                                                                           | 5, 7, 8      | 6-6  |
|                                |                                                                                           | 6            | 6-7  |
|                                |                                                                                           | 9            | 6-8  |
| 70<br>85                       | Ford/Chrysler<br>I-H                                                                      | 0            | 6-9  |
|                                |                                                                                           | 5, 7, 8      | 6-10 |
|                                |                                                                                           | 6            | 6-11 |
|                                |                                                                                           | 9            | 6-12 |
| 60-125                         | White-Hercules<br>w/battery charging<br>regulator in alternator<br>(60Kw w/D3300T engine) | 0            | 6-13 |
|                                |                                                                                           | 5, 7, 8      | 6-14 |
|                                |                                                                                           | 6            | 6-15 |
|                                |                                                                                           | 9            | 6-16 |
| 100                            | White-Hercules<br>w/separate battery<br>charging regulator                                | 0            | 6-17 |
|                                |                                                                                           | 5, 7, 8      | 6-18 |
|                                |                                                                                           | 6            | 6-19 |
|                                |                                                                                           | 9            | 6-20 |
| 125-175                        | John Deere<br>(125 & 175 24-V)<br>(130 & 150 12-V)                                        | 0 (12-V)     | 6-21 |
|                                |                                                                                           | 0 (24-V)     | 6-22 |
|                                |                                                                                           | 5, 7, 8      | 6-23 |
|                                |                                                                                           | 6            | 6-24 |
|                                |                                                                                           | 9            | 6-25 |
| 250                            | Allis-Chalmers                                                                            | 0            | 6-26 |
|                                |                                                                                           | 5, 7, 8      | 6-27 |
|                                |                                                                                           | 6            | 6-28 |
|                                |                                                                                           | 9            | 6-29 |
| 190-260                        | Cummins                                                                                   | 0            | 6-30 |
|                                |                                                                                           | 5, 7, 8      | 6-31 |
|                                |                                                                                           | 6            | 6-32 |
|                                |                                                                                           | 9            | 6-33 |
| 30-100                         |                                                                                           | 10           | 6-34 |

# LEAD COLORS

|                |                |
|----------------|----------------|
| ⑤-BLUE/WHITE   | ⑦-YELLOW/GREEN |
| ⑧-BLACK        | ⑧-WHITE/BLACK  |
| ⑩-RED/BLUE     | ⑨-RED          |
| ⑥-WHITE/PURPLE | ⑩-GRAY         |
| ⑥-BLACK/GREEN  | ⑩-WHITE/BLACK  |
| ⑦-WHITE/GREEN  | ⑩-RED          |
| ⑦-ORANGE/GREEN | ⑩-BLUE/RED     |
| ⑦-BROWN/YELLOW | ⑩-ORANGE/BLACK |
| ⑩-BLUE/ORANGE  | ⑩-RED/ORANGE   |
| ⑩-GREEN/YELLOW | ⑩-PURPLE/WHITE |
| ⑩-BROWN/ORANGE | ⑩-YELLOW/BLUE  |
| ⑩-WHITE/PINK   | ⑩-ORANGE/RED   |
| ⑩-BROWN/WHITE  | ⑩-YELLOW/PINK  |

## Upper Cabinet

3Ø, 4-wire, 600-volt

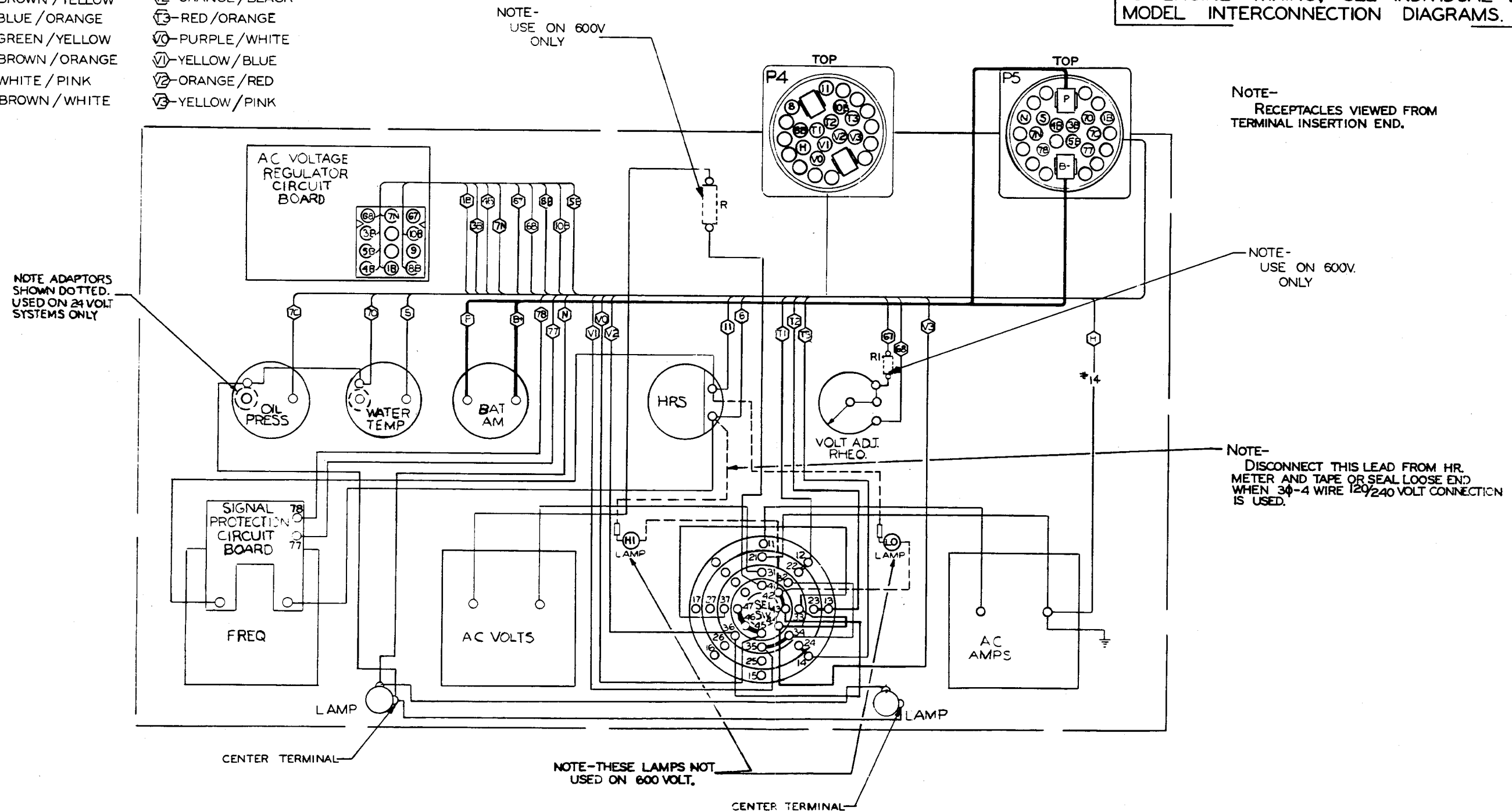
3Ø, 4-wire, 120/240-volt

3Ø, 4-wire, 120/208-volt

3Ø, 4-wire, 277-480-volt

3Ø, 3-wire, 240-volt

FOR COMPLETE DIAGRAM OF CONTROLLER TO ENGINE WIRING, SEE INDIVIDUAL ENGINE MODEL INTERCONNECTION DIAGRAMS.



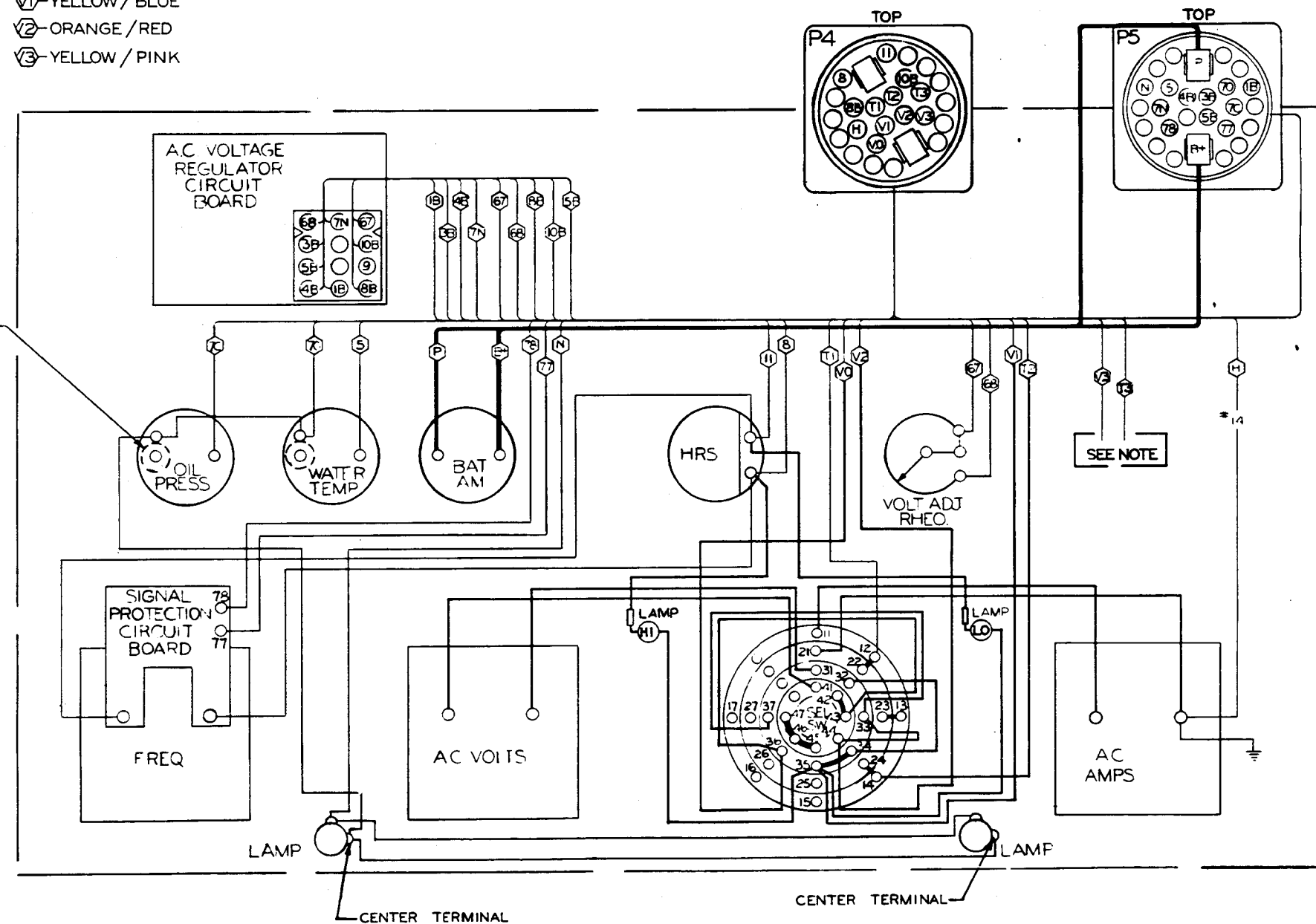
# LEAD COLORS

|                    |                    |
|--------------------|--------------------|
| 5- BLUE / WHITE    | 70- YELLOW / GREEN |
| 8- BLACK           | 71- WHITE / BLACK  |
| 11- RED / BLUE     | 72- RED            |
| 67- WHITE / PURPLE | 73- GRAY           |
| 68- BLACK / GREEN  | 74- WHITE / BLACK  |
| 70- WHITE / GREEN  | 75- RED            |
| 77- ORANGE / GREEN | 76- BLUE / RED     |
| 78- BROWN / YELLOW | 77- ORANGE / BLACK |
| 18- BLUE / ORANGE  | 78- RED / ORANGE   |
| 32- GREEN / YELLOW | 79- PURPLE / WHITE |
| 52- BROWN / ORANGE | 80- YELLOW / BLUE  |
| 62- WHITE / PINK   | 81- ORANGE / RED   |
| 82- BROWN / WHITE  | 83- YELLOW / PINK  |

FOR COMPLETE DIAGRAM OF CONTROLLER TO ENGINE WIRING, SEE INDIVIDUAL ENGINE MODEL INTERCONNECTION DIAGRAMS.

## Upper Cabinet 1Ø, 3-wire, 120/240 volt

NOTE-ADAPTORS SHOWN DOTTED, USED ON 24 VOLT SYSTEMS ONLY



NOTE—  
RECEPTACLES VIEWED FROM  
TERMINAL INSERTION END.

NOTE—  
LEADS V3 AND T3 ARE NOT  
CONNECTED OR USED, TAPE OR  
SEAL ENDS TO AVOID ACCIDENTAL  
MISCONNECTIONS AND SHORT  
CIRCUITS.

# LEAD COLORS

|                 |                  |
|-----------------|------------------|
| 5-BLUE/WHITE    | 71-YELLOW/GREEN  |
| 8-BLACK         | 72-WHITE/BLACK   |
| 11-PED/BLUE     | 8-PED            |
| 57-WHITE/PURPLE | 11-GRAY          |
| 68-BLACK/COFFIN | 11-WHITE/BLACK   |
| 71-WHITE/GREEN  | 12-PED           |
| 77-ORANGE/GREEN | 11-BLUE/PED      |
| 78-BROWN/YELLOW | 12-ORANGE/BLACK  |
| 119-BLUE/ORANGE | 12-PED/ORANGE    |
| 53-GREEN/YELLOW | 119-PURPLE/WHITE |
| 53-BROWN/ORANGE | 121-YELLOW/BLUE  |
| 50-WHITE/PINK   | 122-ORANGE/PED   |
| 119-BROWN/WHITE | 123-YELLOW/PINK  |
| 88-WHITE/PINK   |                  |

## Triple-Voltage

1Ø, 3-wire, 120/240-volt

3Ø, 4-wire, 120/208-volt

3Ø, 4-wire, 277/480-volt

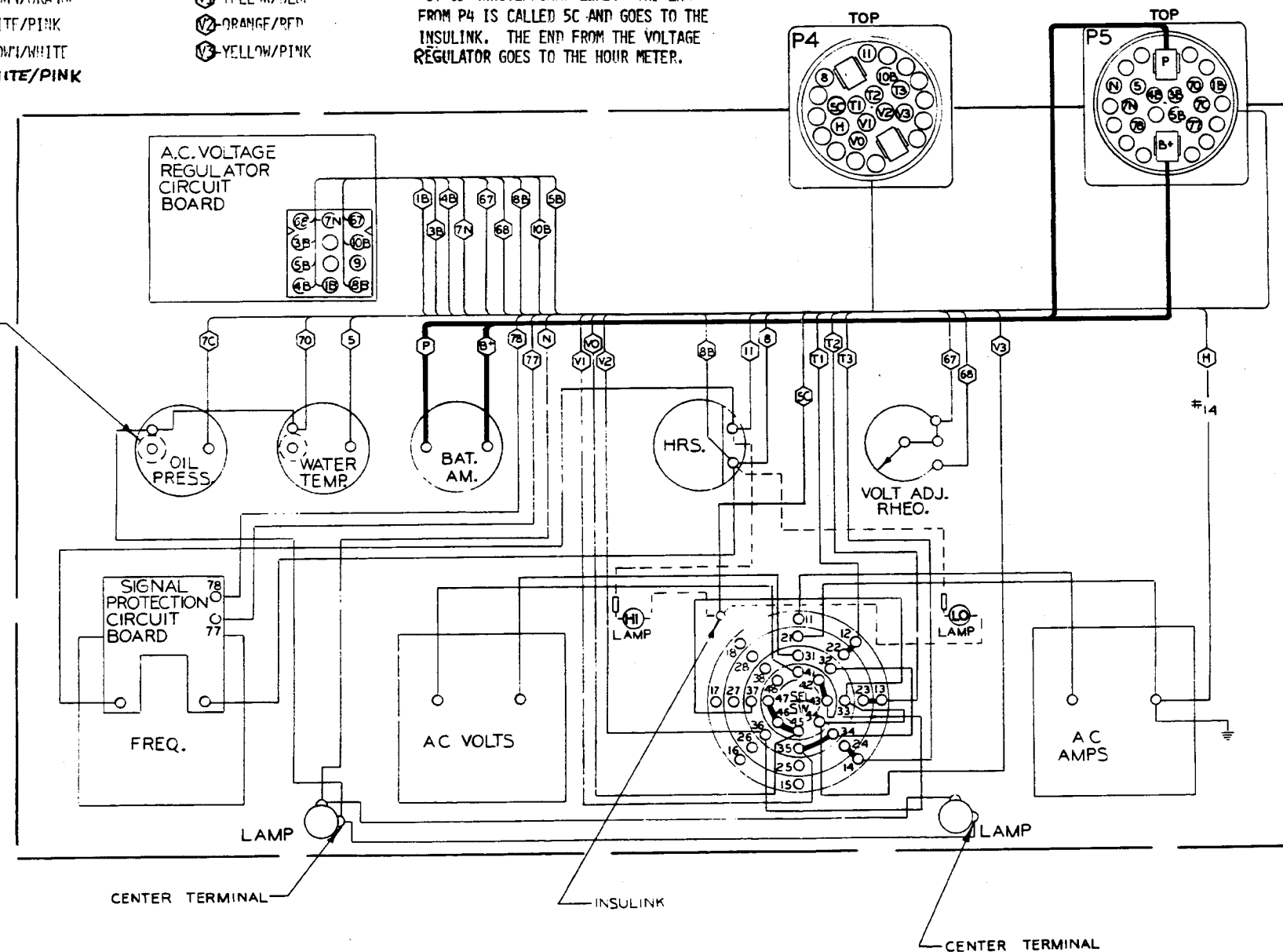
NOTE: RECEPTACLES VIEWED FROM  
TERMINAL INSERTION END

NOTE:

CUT 88 (WHITE/PINK) LEAD. THE END  
FROM P4 IS CALLED SC AND GOES TO THE  
INSULINK. THE END FROM THE VOLTAGE  
REGULATOR GOES TO THE HOUR METER.

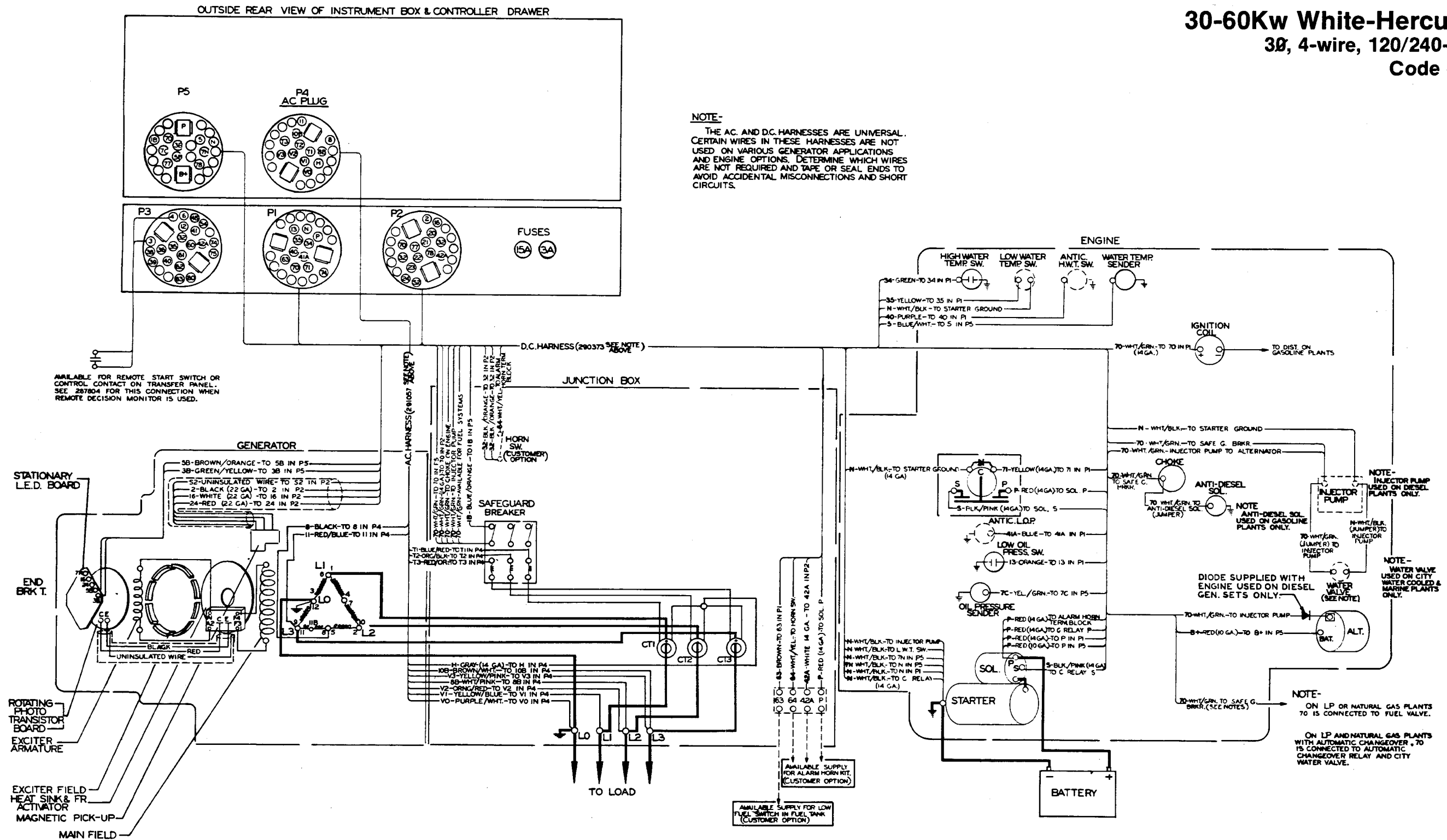
FOR COMPLETE DIAGRAM OF CONTROLLER  
TO ENGINE WIRING, SEE INTERCONNECTION  
DIAGRAM.

NOTE-ADAPTORS  
SHOWN DOTTED,  
USED ON 24 VOLT  
SYSTEMS ONLY

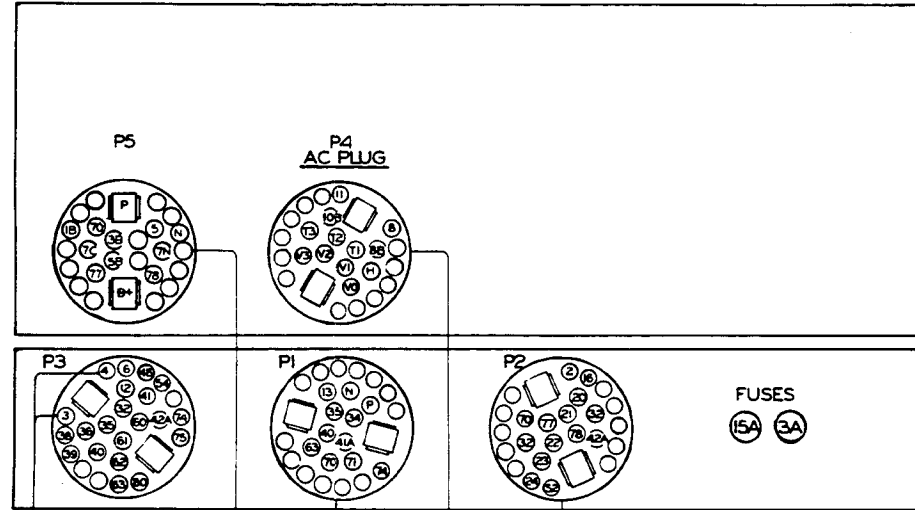


WIRING DIAGRAM

**30-60Kw White-Hercules**  
**3Ø, 4-wire, 120/240-volt**  
**Code — 0**



OUTSIDE REAR VIEW OF INSTRUMENT BOX & CONTROLLER DRAWER



## 30-60Kw White-Hercules

3Ø, 4-wire, 120/208-volt

3Ø, 4-wire, 277/480-volt

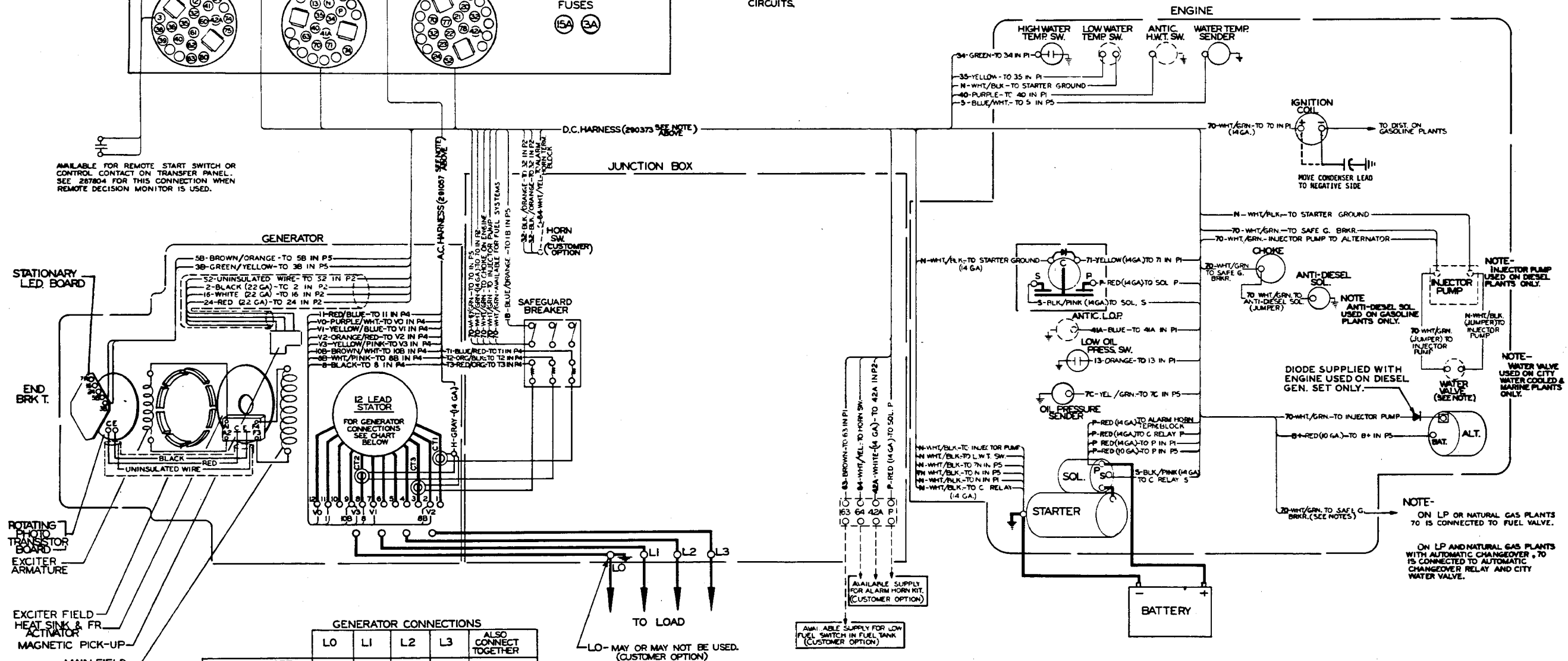
3Ø, 3-wire, 240-volt

Code — 5, 7, 8

### NOTE-

THE AC AND D.C. HARNESSES ARE UNIVERSAL. CERTAIN WIRES IN THESE HARNESSES ARE NOT USED ON VARIOUS GENERATOR APPLICATIONS AND ENGINE OPTIONS. DETERMINE WHICH WIRES ARE NOT REQUIRED AND TAPE OR SEAL ENDS TO AVOID ACCIDENTAL MISCONNECTIONS AND SHORT CIRCUITS.

AVAILABLE FOR REMOTE START SWITCH OR CONTROL CONTACT ON TRANSFER PANEL. SEE 287804 FOR THIS CONNECTION WHEN REMOTE DECISION MONITOR IS USED.

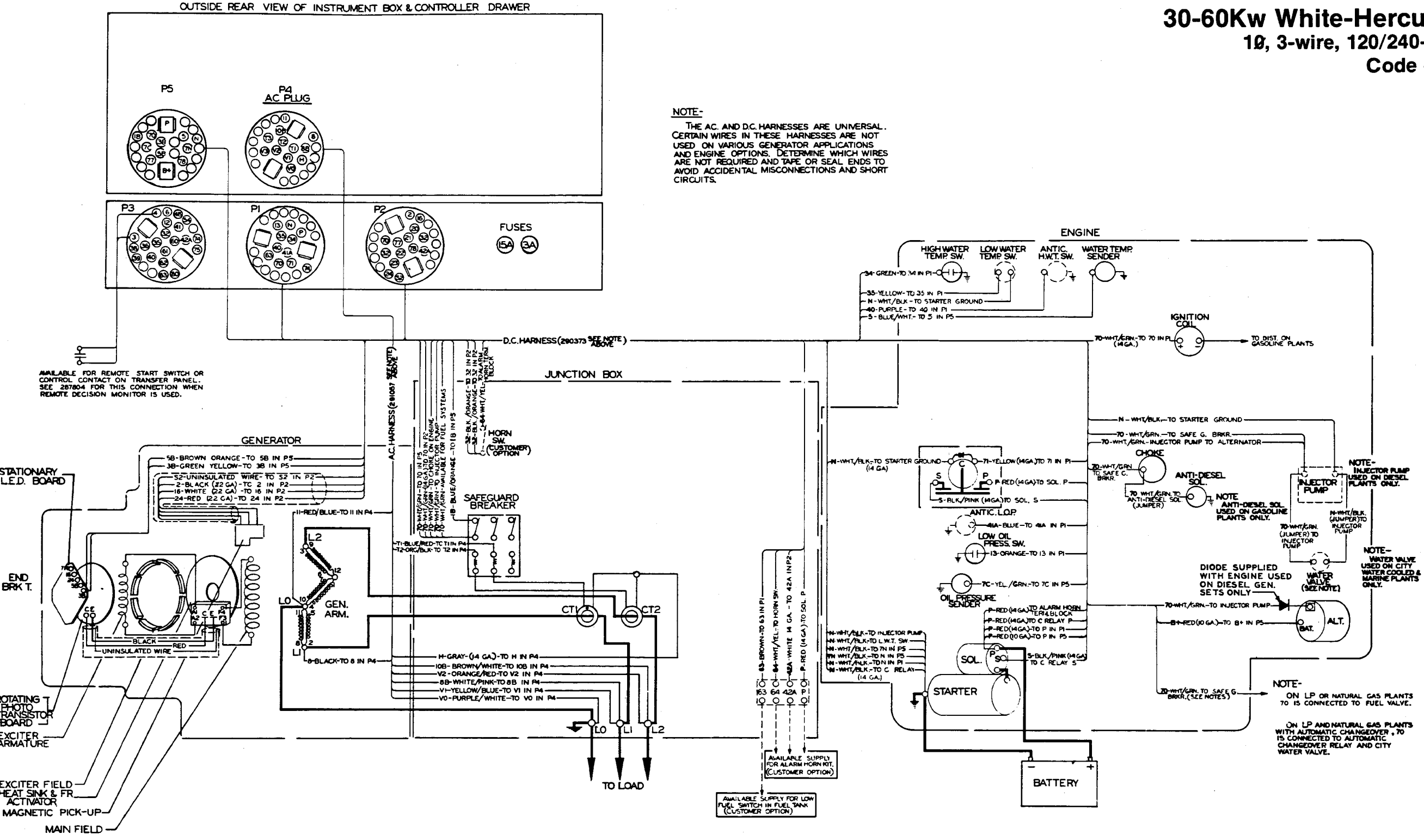


GENERATOR CONNECTIONS

|                                    | L0              | L1  | L2  | L3  | ALSO CONNECT TOGETHER |
|------------------------------------|-----------------|-----|-----|-----|-----------------------|
| 3Ø-4 WIRE 277/480                  | 5,10,12         | 1   | 8   | 3   | 4&7, 2&11, 6&9        |
| 3Ø-4 WIRE 120/208 OR 3Ø-3 WIRE-240 | 4,5,6, 10,11&12 | 1&7 | 2&8 | 3&9 |                       |

IF IT IS NOT DESIRED TO READ THE NEUTRAL ON STRAIGHT 240 VOLT DISCONNECT LEAD V0 FROM 12.

# 30-60Kw White-Hercules 1Ø, 3-wire, 120/240-volt Code — 6

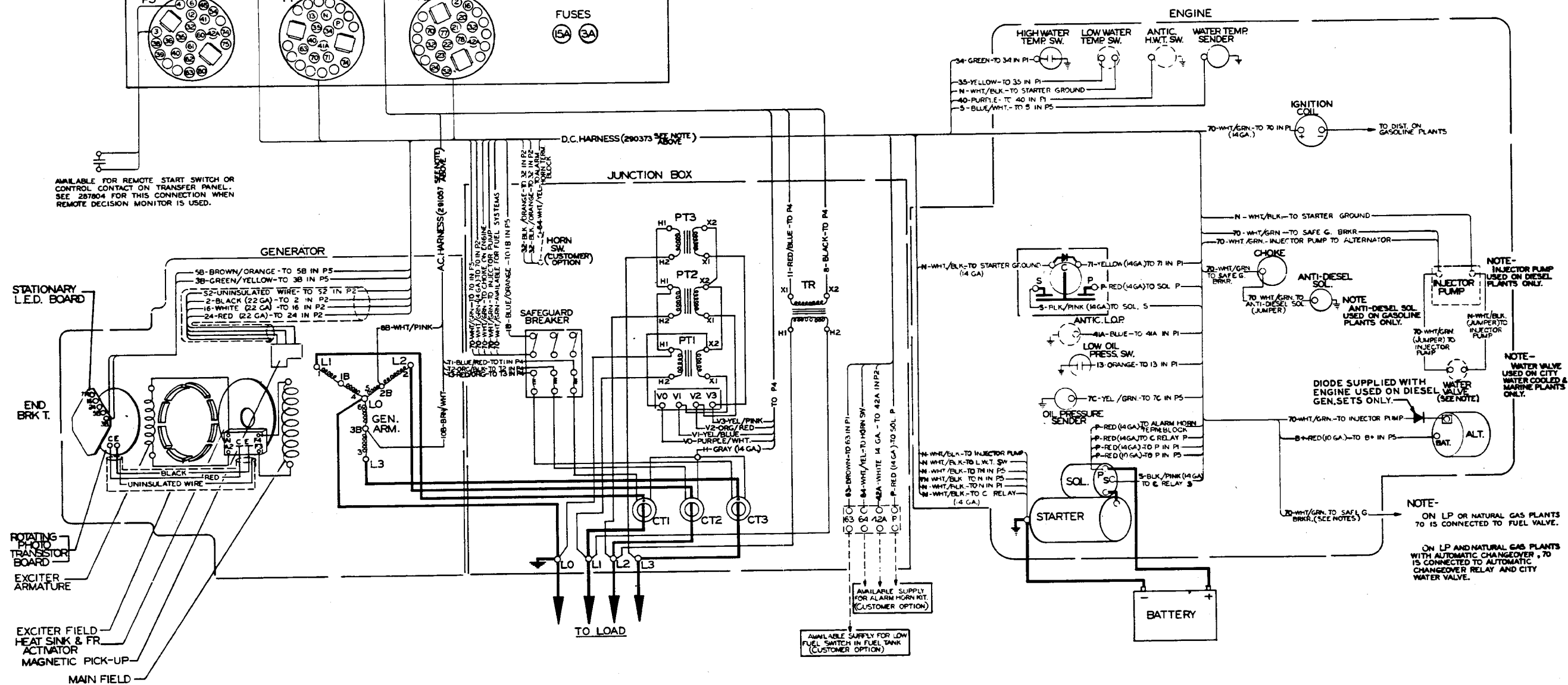


OUTSIDE REAR VIEW OF INSTRUMENT BOX & CONTROLLER DRAWER

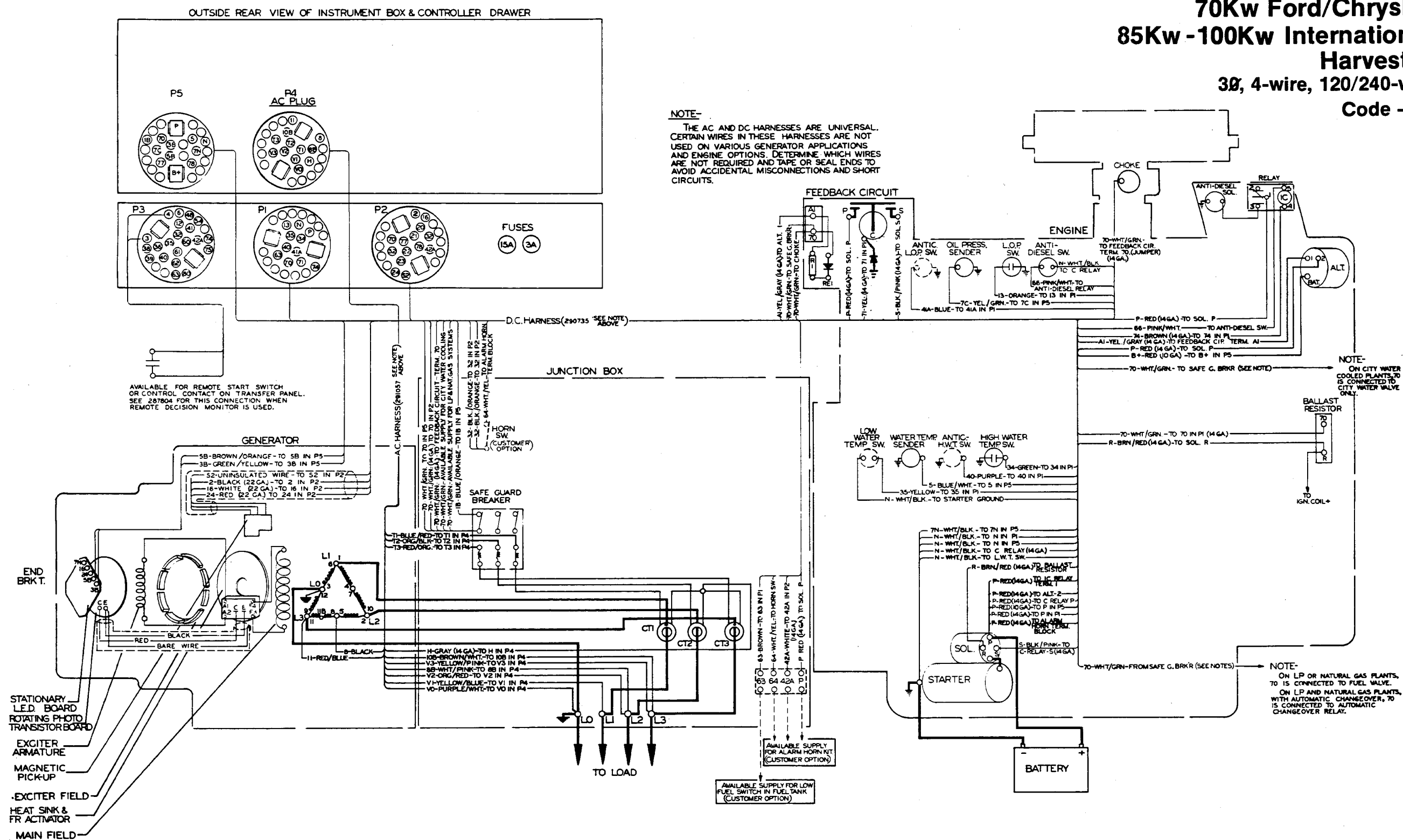
# 30-60Kw White-Hercules 3Ø, 4-wire, 600-volt Code — 9

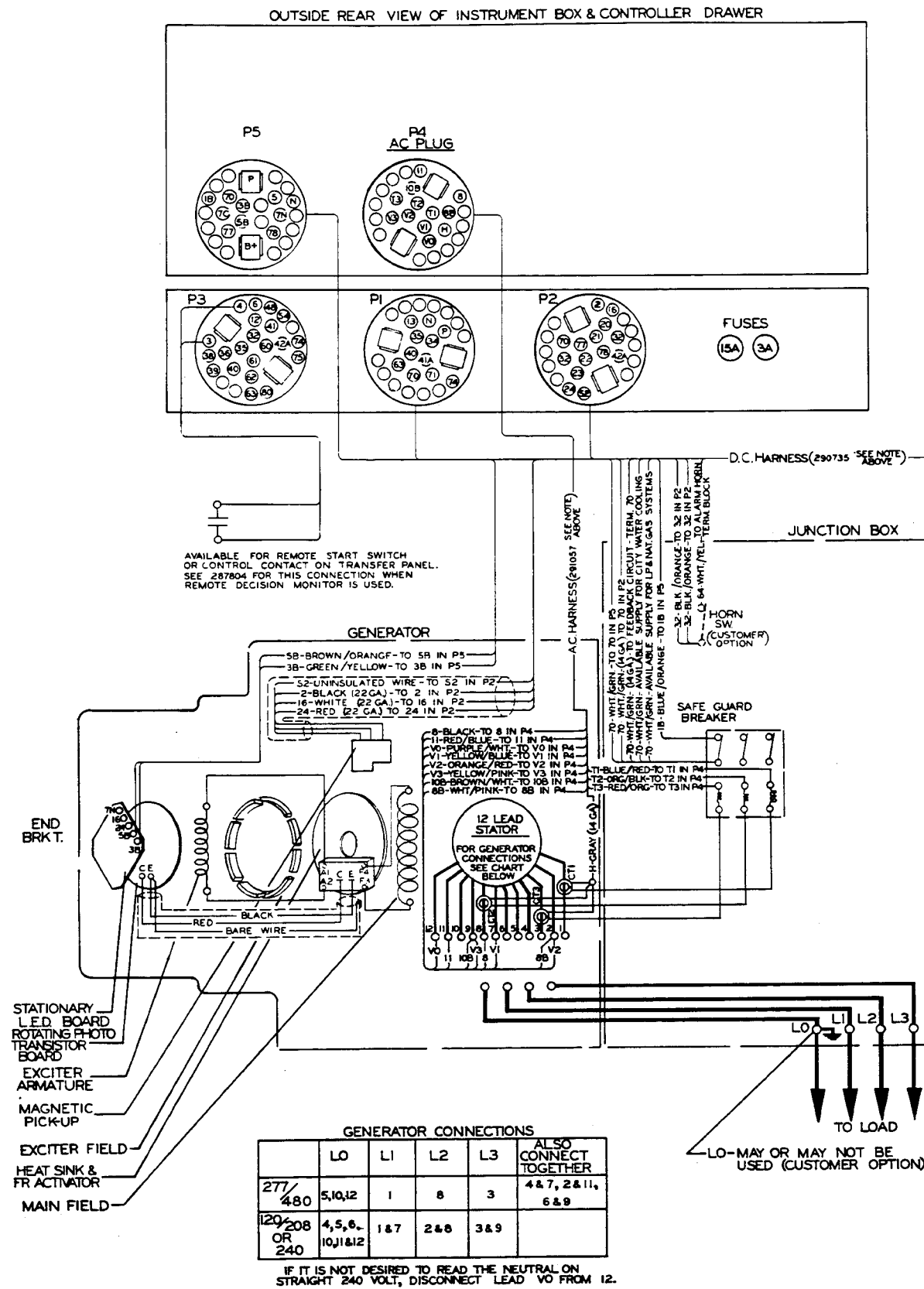
## NOTE:-

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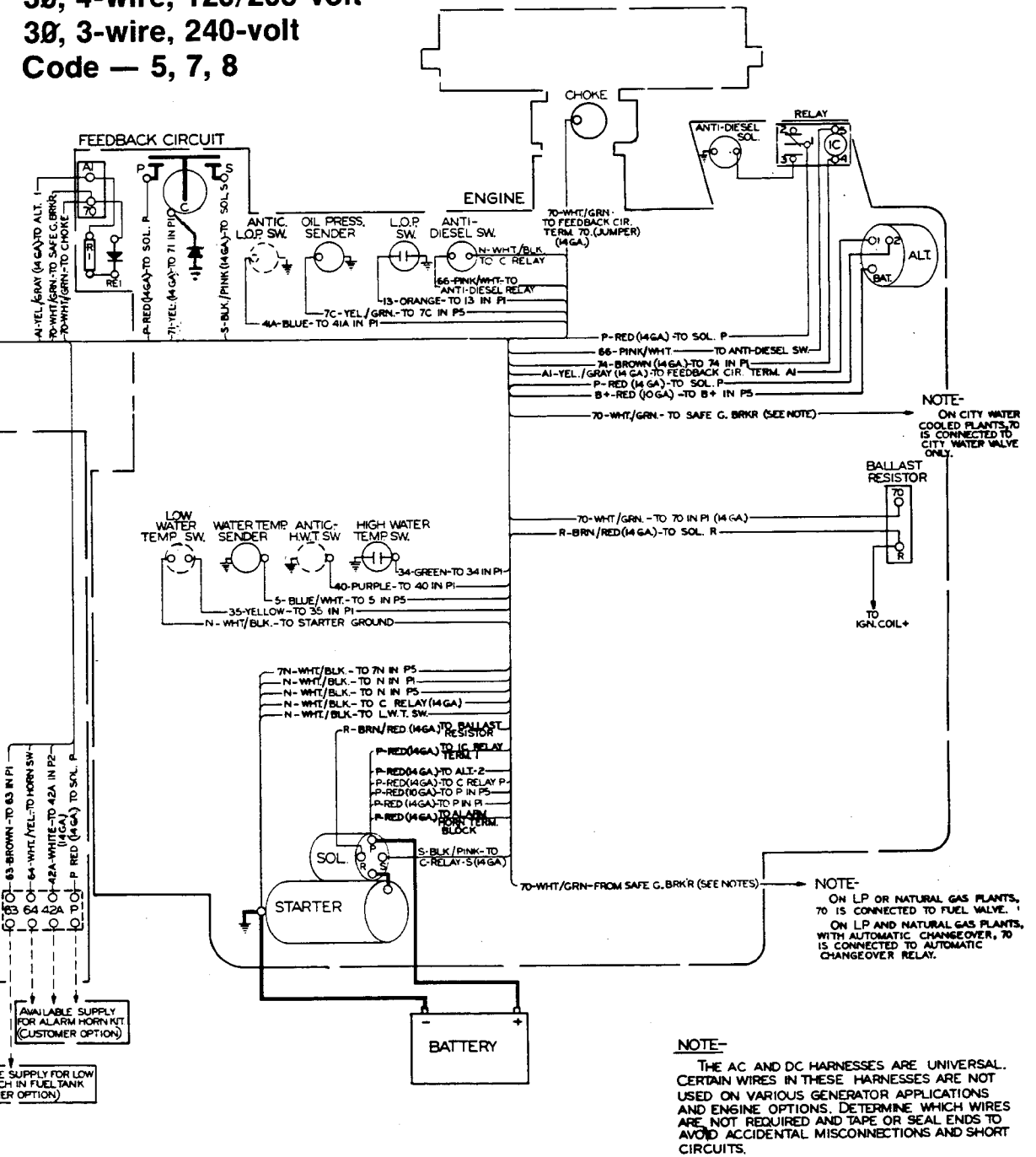


**70Kw Ford/Chrysler  
85Kw -100Kw International  
Harvester  
3Ø, 4-wire, 120/240-volt  
Code — 0**

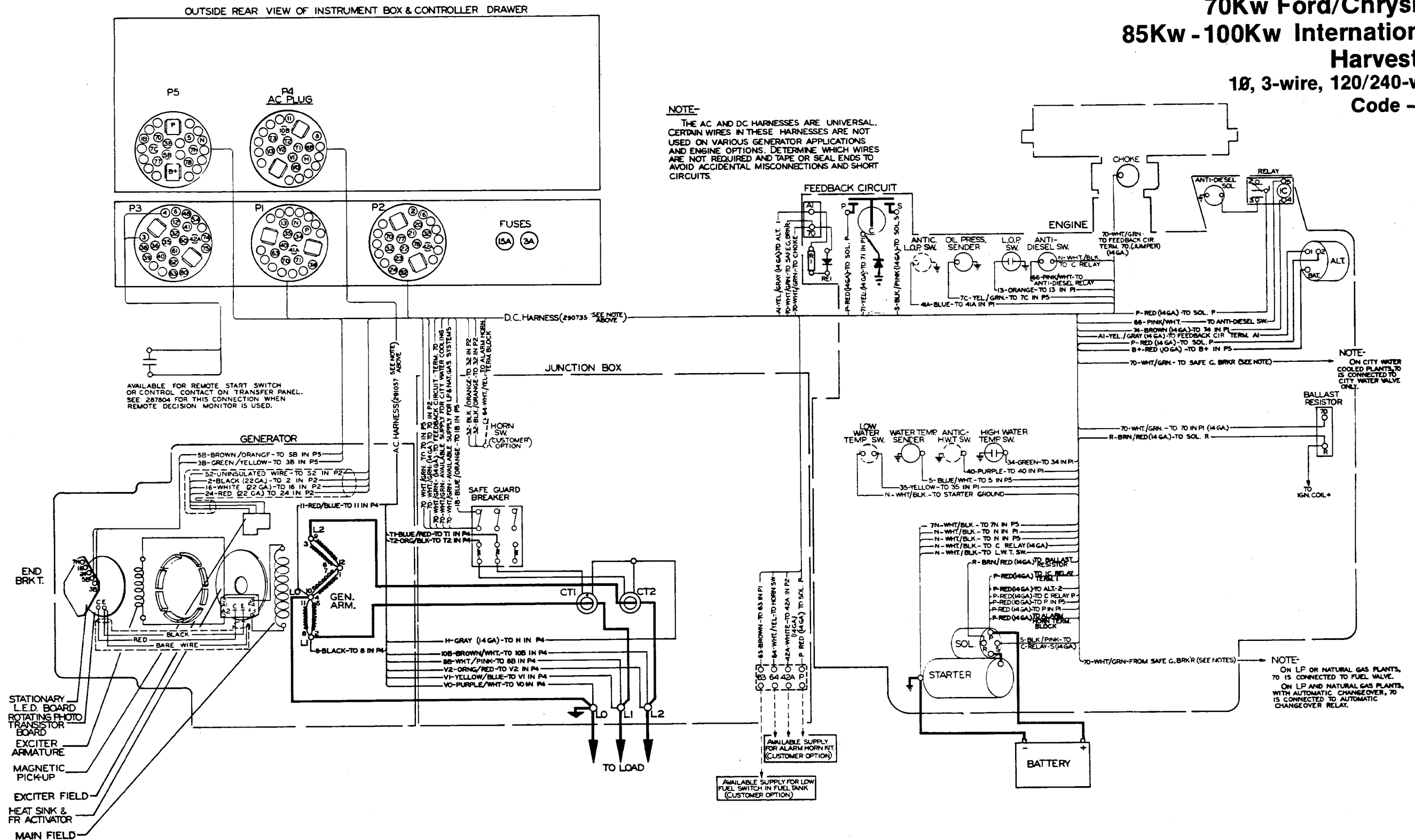




**70Kw Ford/Chrysler**  
**85Kw - 100Kw International Harvester**  
 3Ø, 4-wire, 277/480-volt  
 3Ø, 4-wire, 120/208-volt  
 3Ø, 3-wire, 240-volt  
 Code — 5, 7, 8

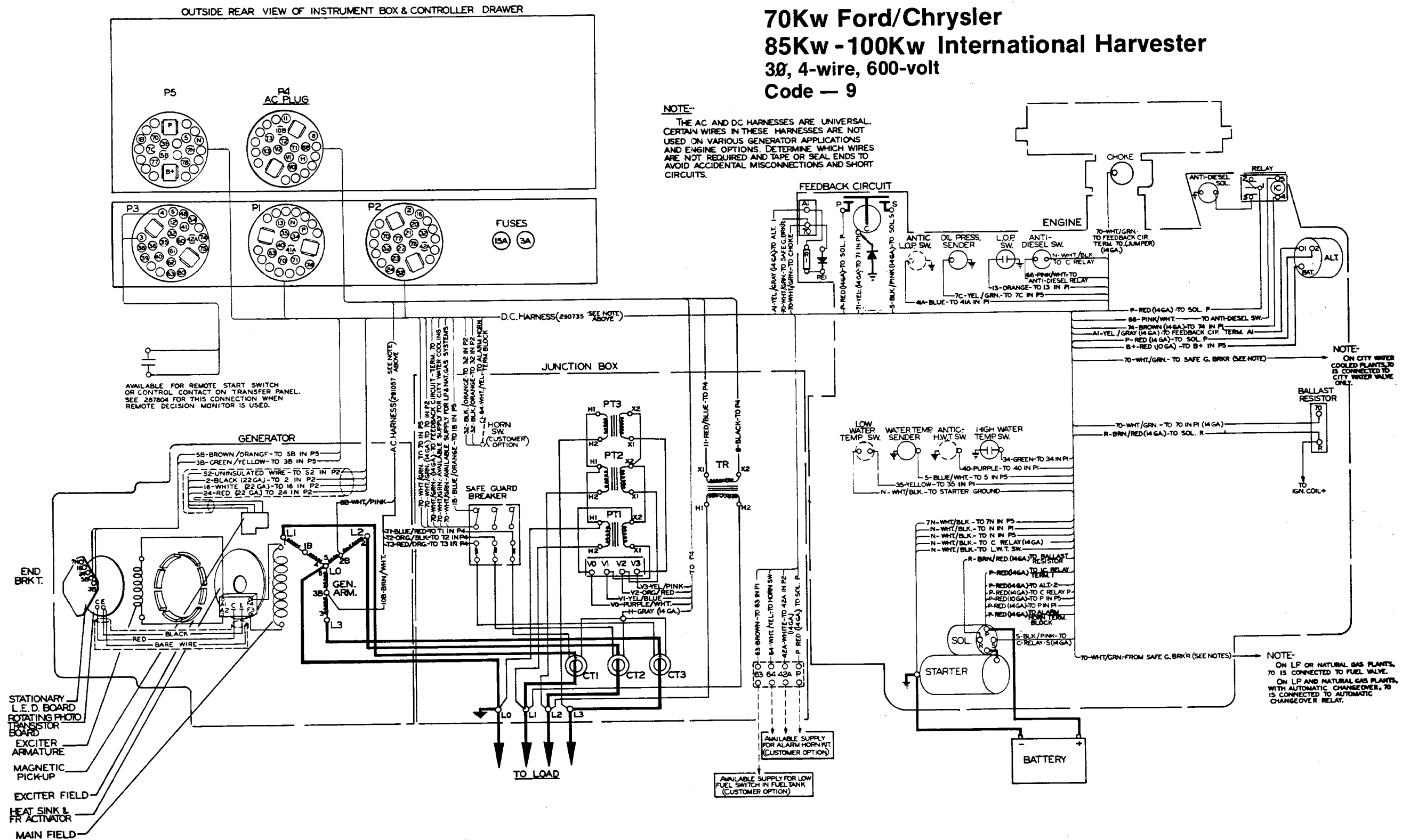


**70Kw Ford/Chrysler  
85Kw - 100Kw International  
Harvester  
1Ø, 3-wire, 120/240-volt  
Code — 6**

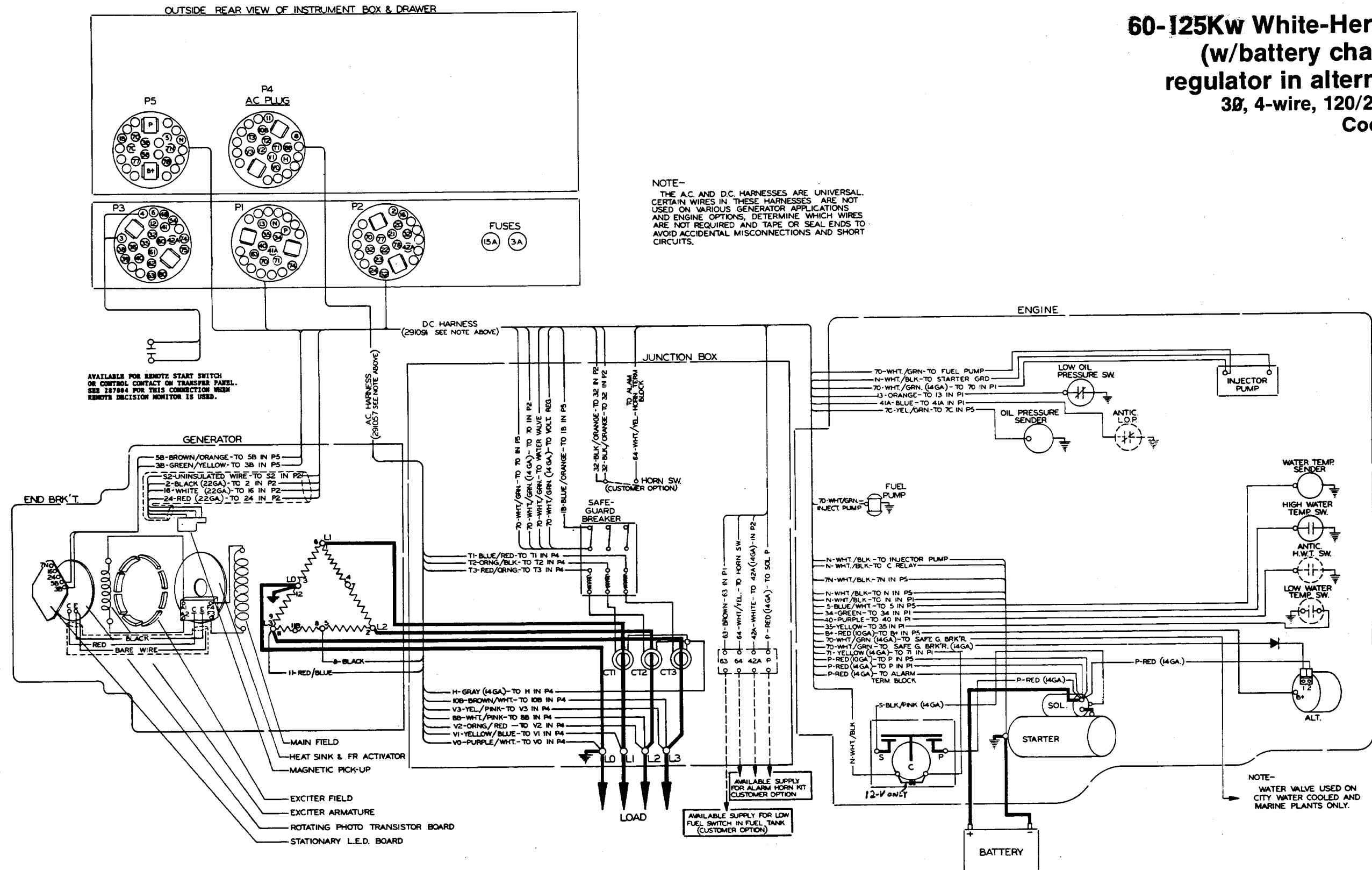


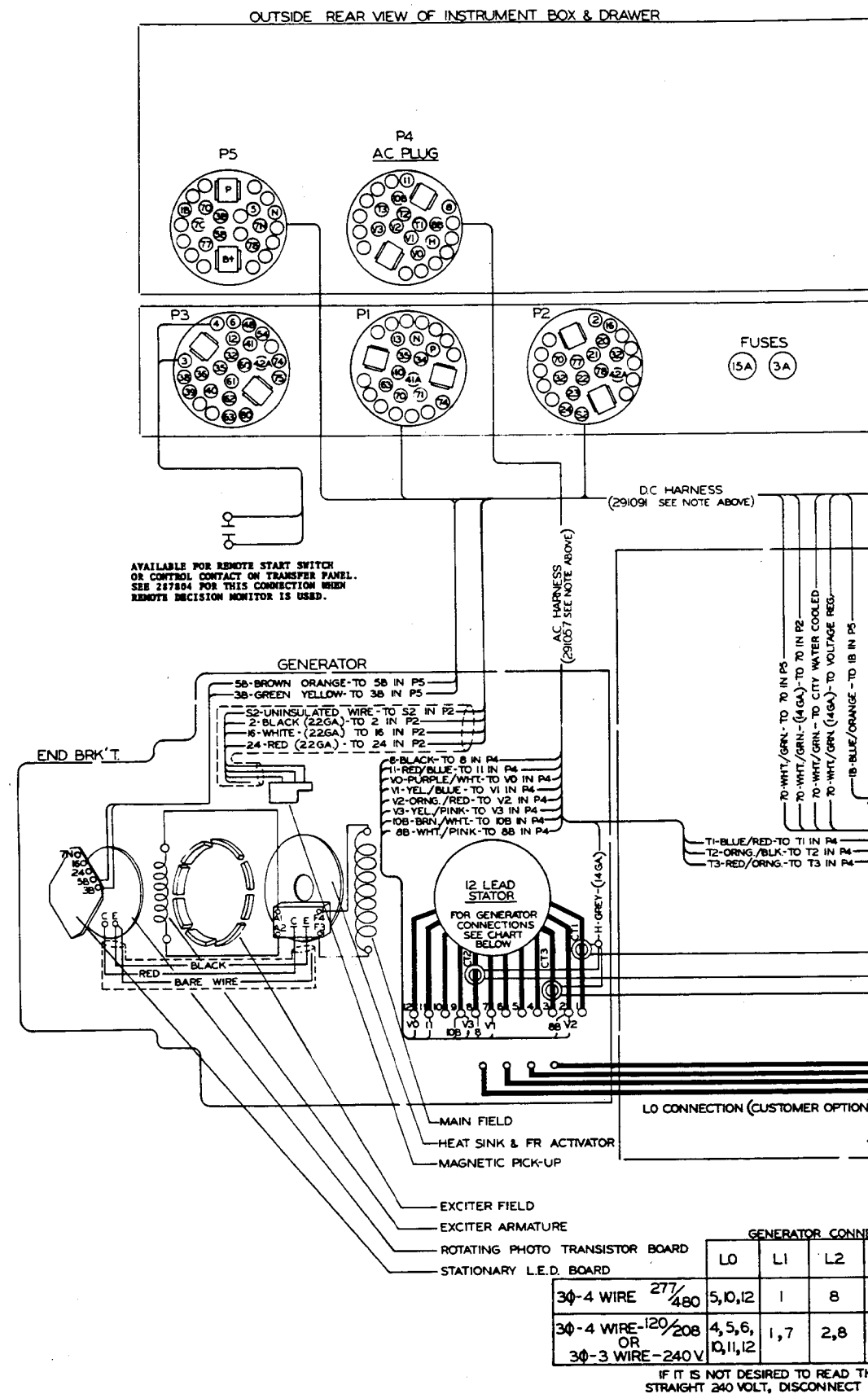
**70Kw Ford/Chrysler**  
**85Kw -100Kw International Harvester**  
 3Ø, 4-wire, 600-volt  
 Code — 9

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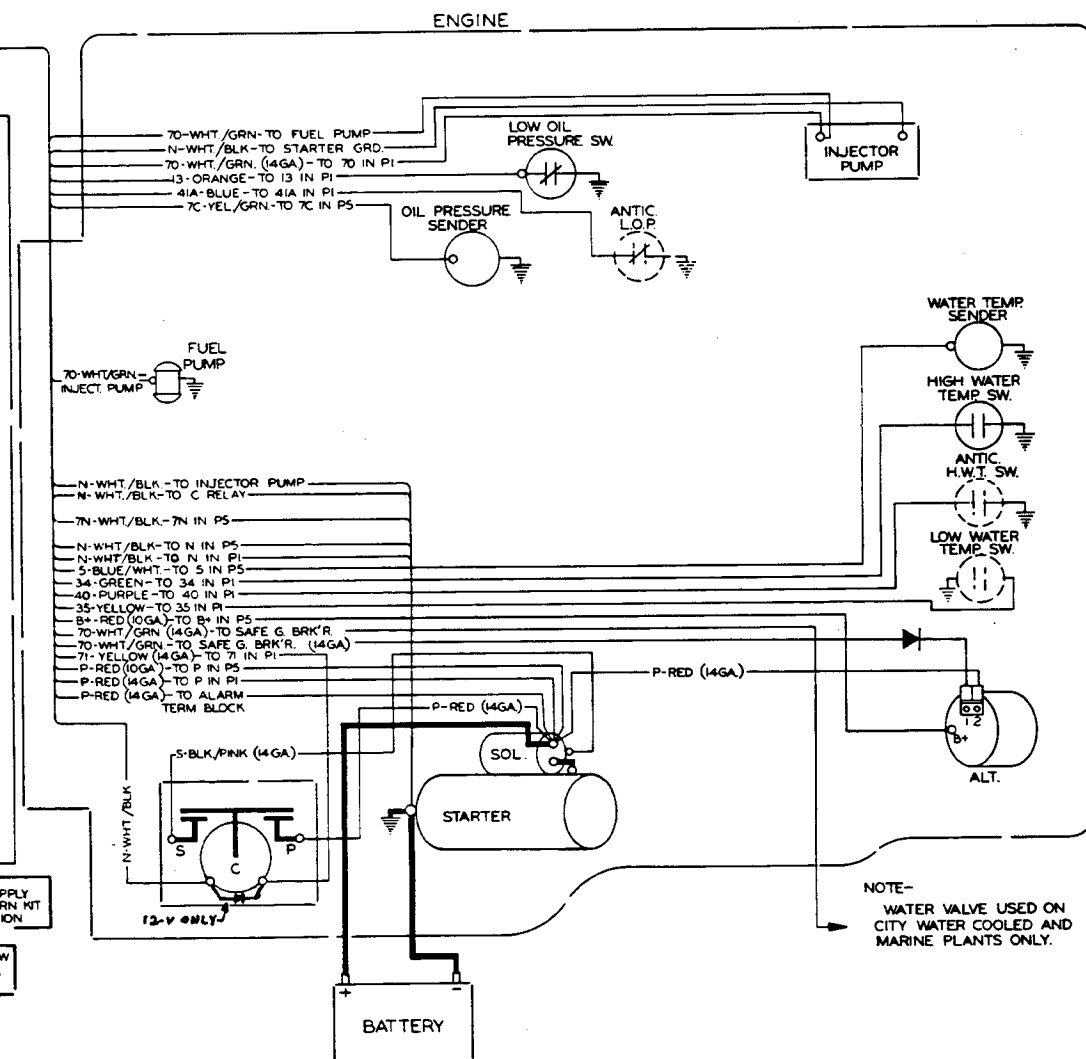
**60-125Kw White-Hercules**  
**(w/battery charging**  
**regulator in alternator)**  
**3Ø, 4-wire, 120/240-volt**  
**Code — 0**



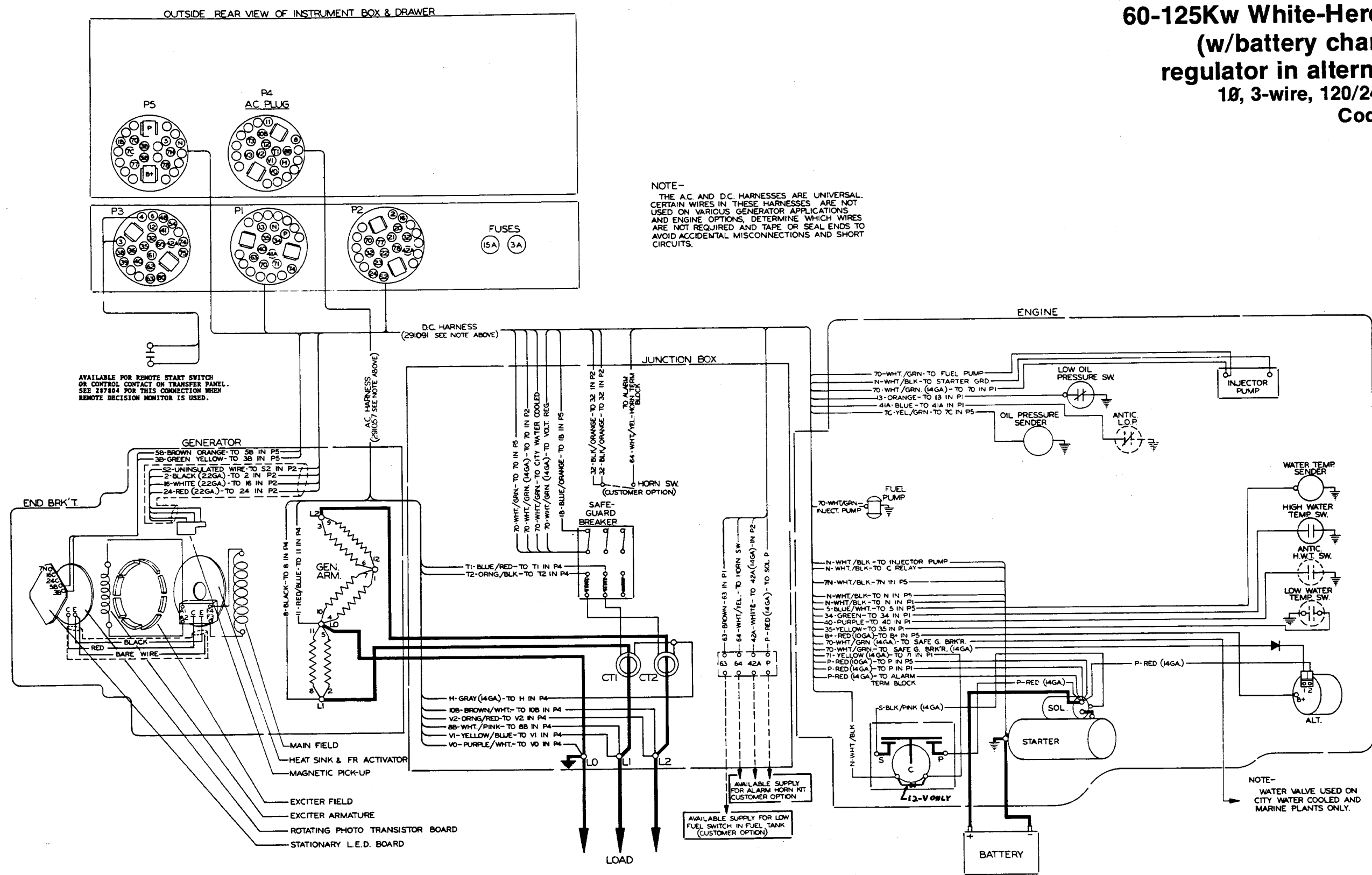


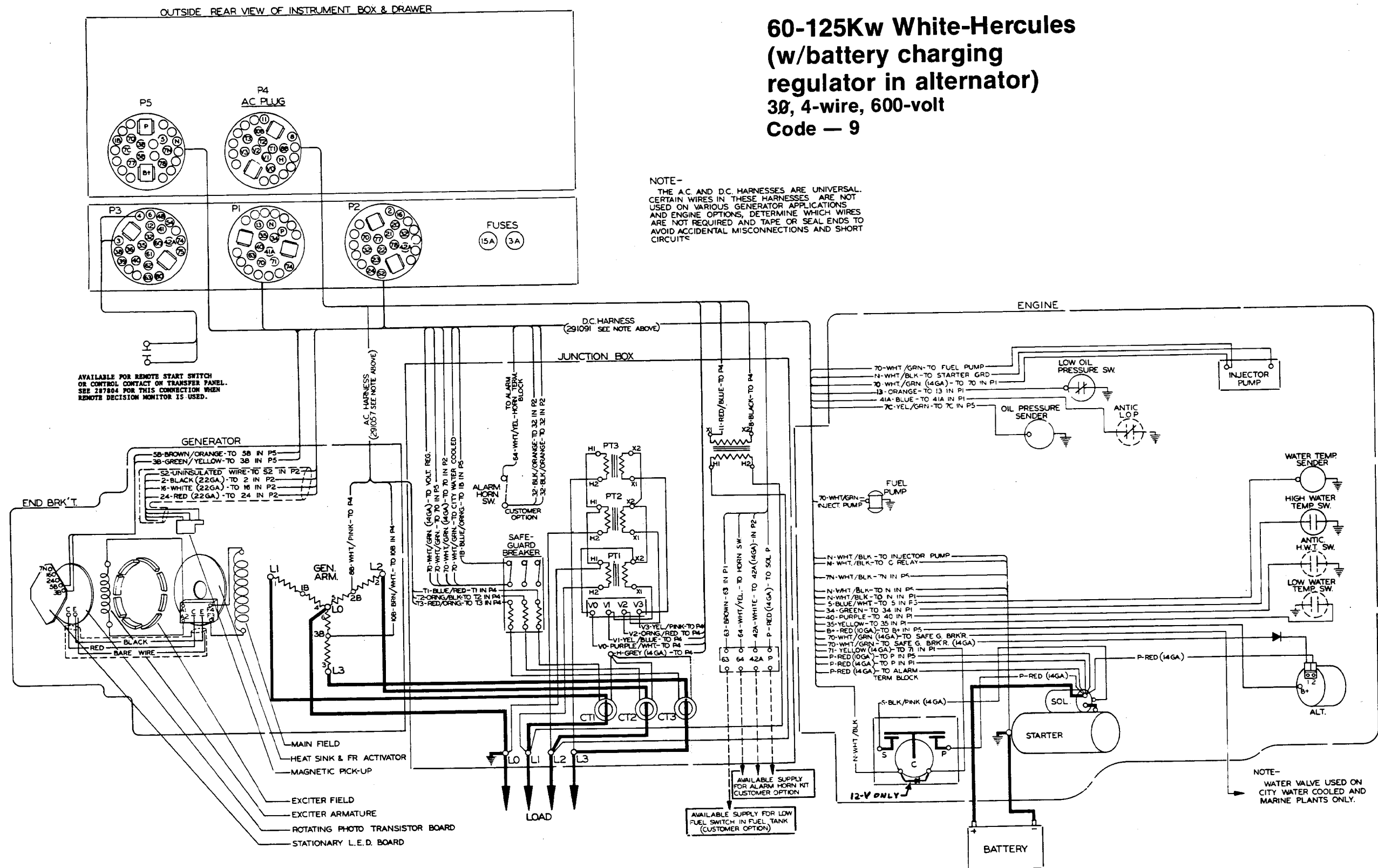
**60-125Kw White-Hercules**  
**(w/battery charging**  
**regulator in alternator)**  
**30, 4-wire, 277/480-volt**  
**30, 4-wire, 120/208-volt**  
**30, 3-wire, 240-volt**  
**Code — 5, 7, 8**

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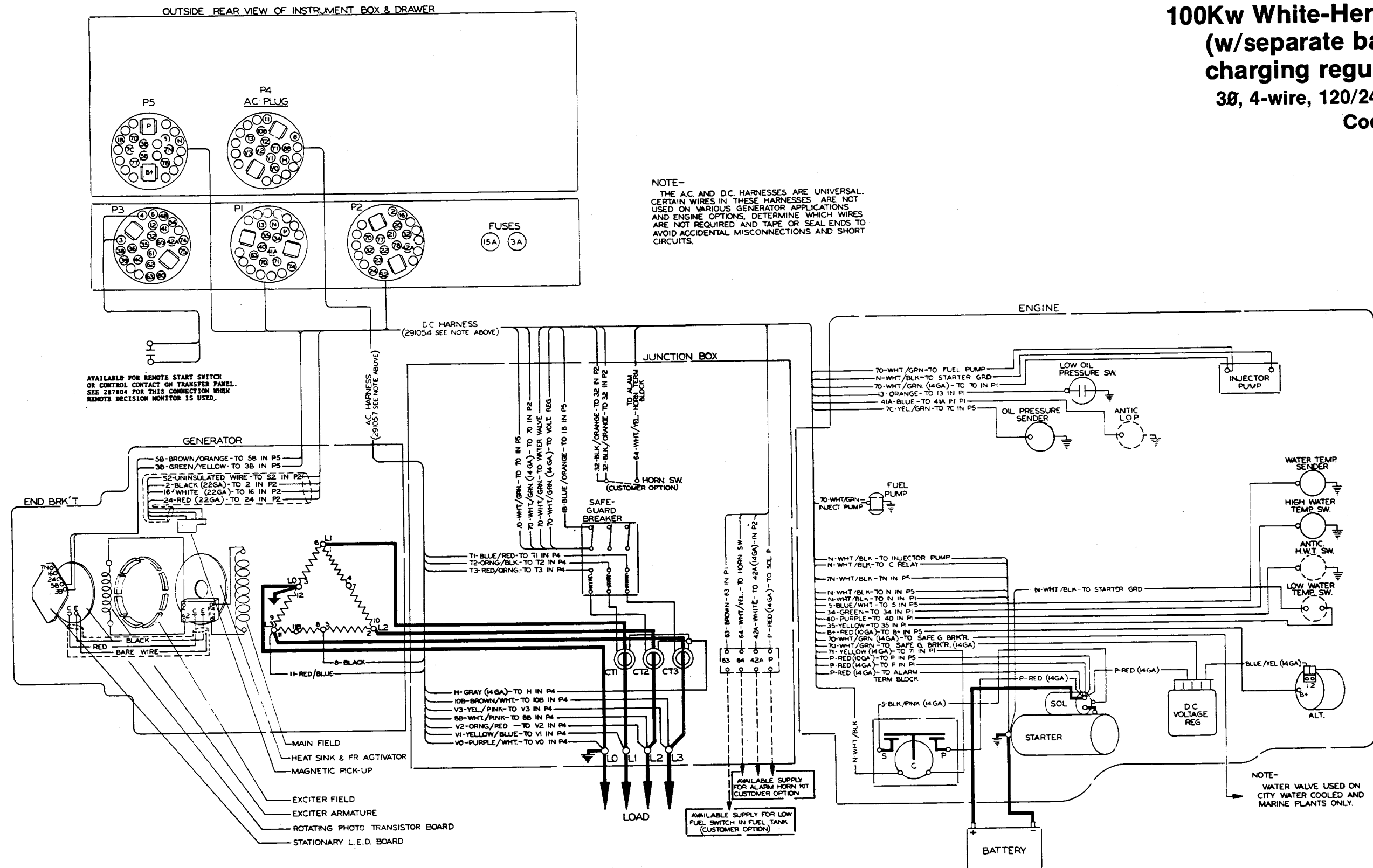


**60-125Kw White-Hercules**  
**(w/battery charging**  
**regulator in alternator)**  
**1Ø, 3-wire, 120/240-volt**  
**Code — 6**

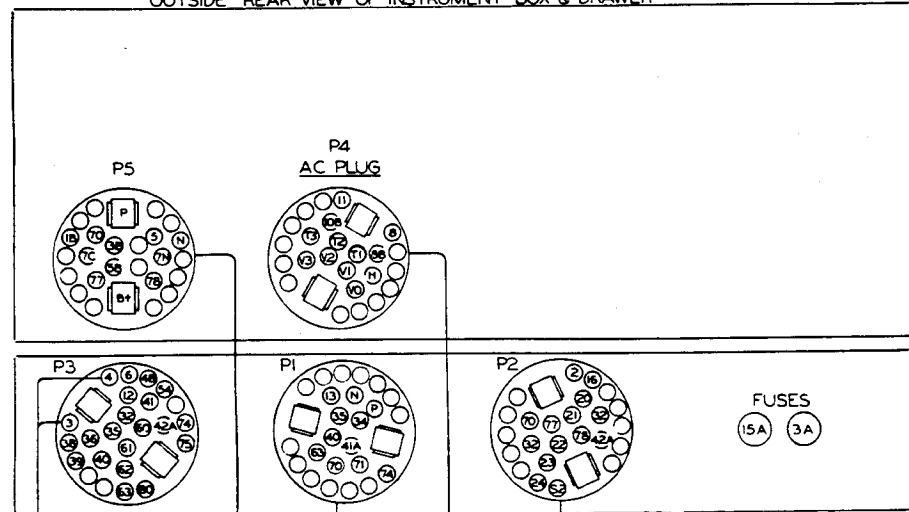




**100Kw White-Hercules**  
**(w/separate battery**  
**charging regulator)**  
**3Ø, 4-wire, 120/240-volt**  
**Code — 0**



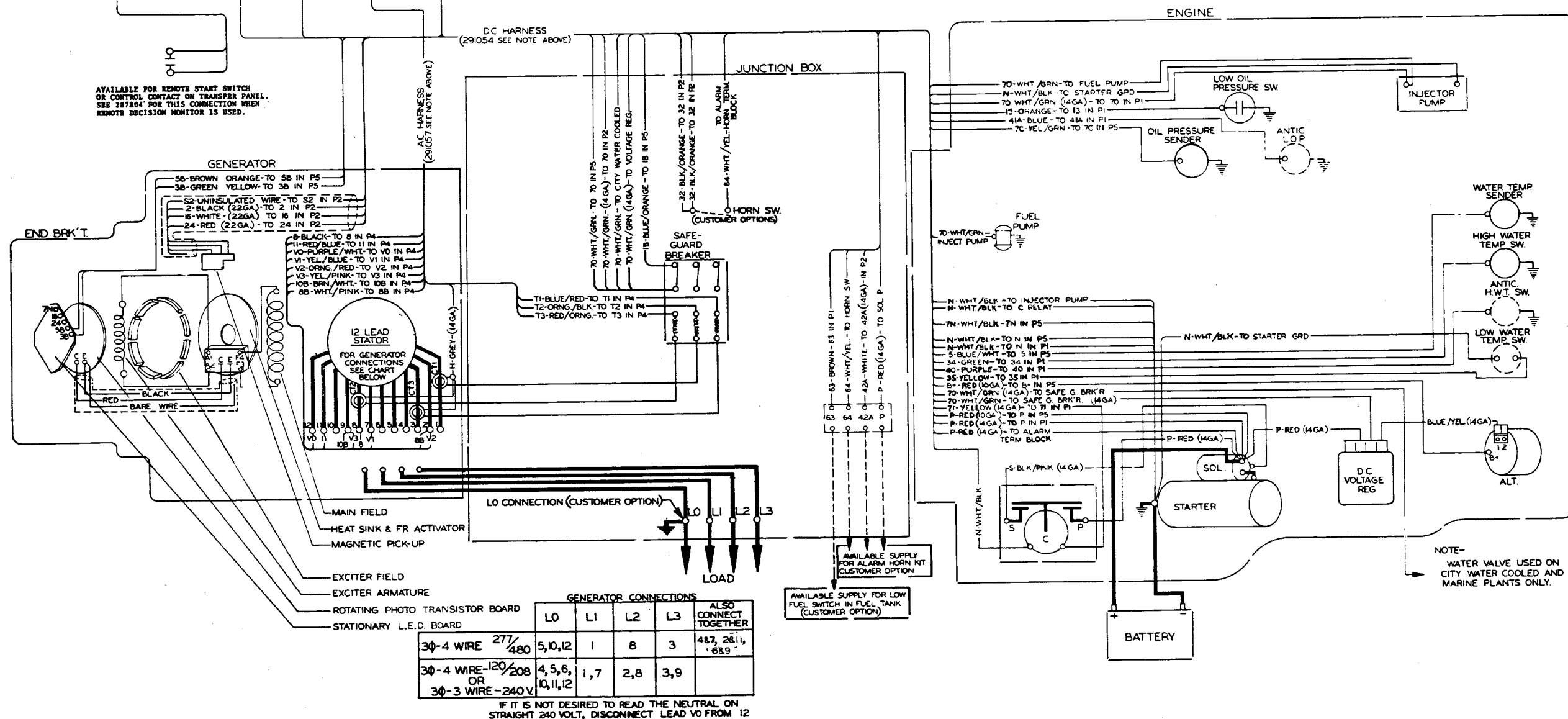
OUTSIDE REAR VIEW OF INSTRUMENT BOX & DRAWER



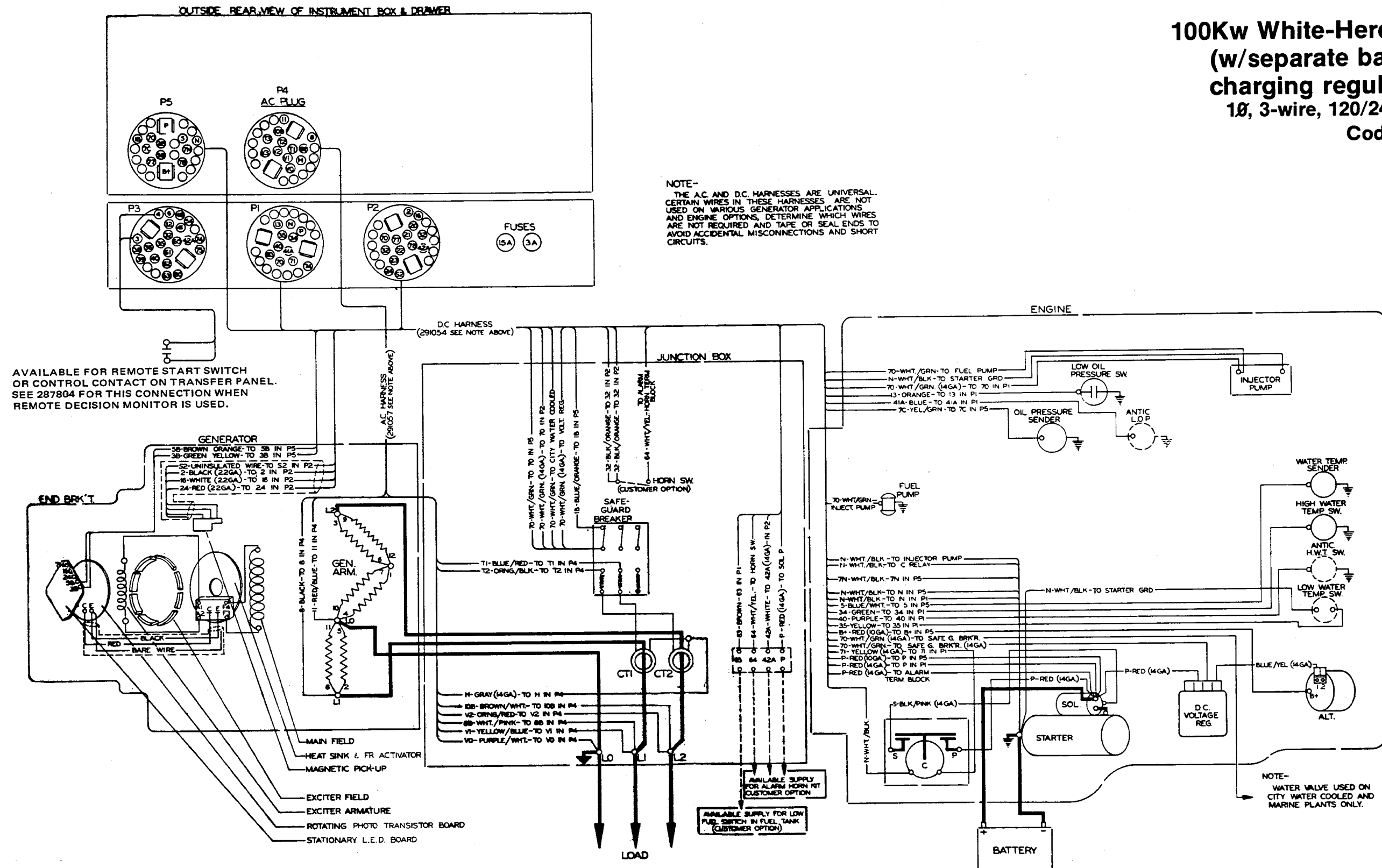
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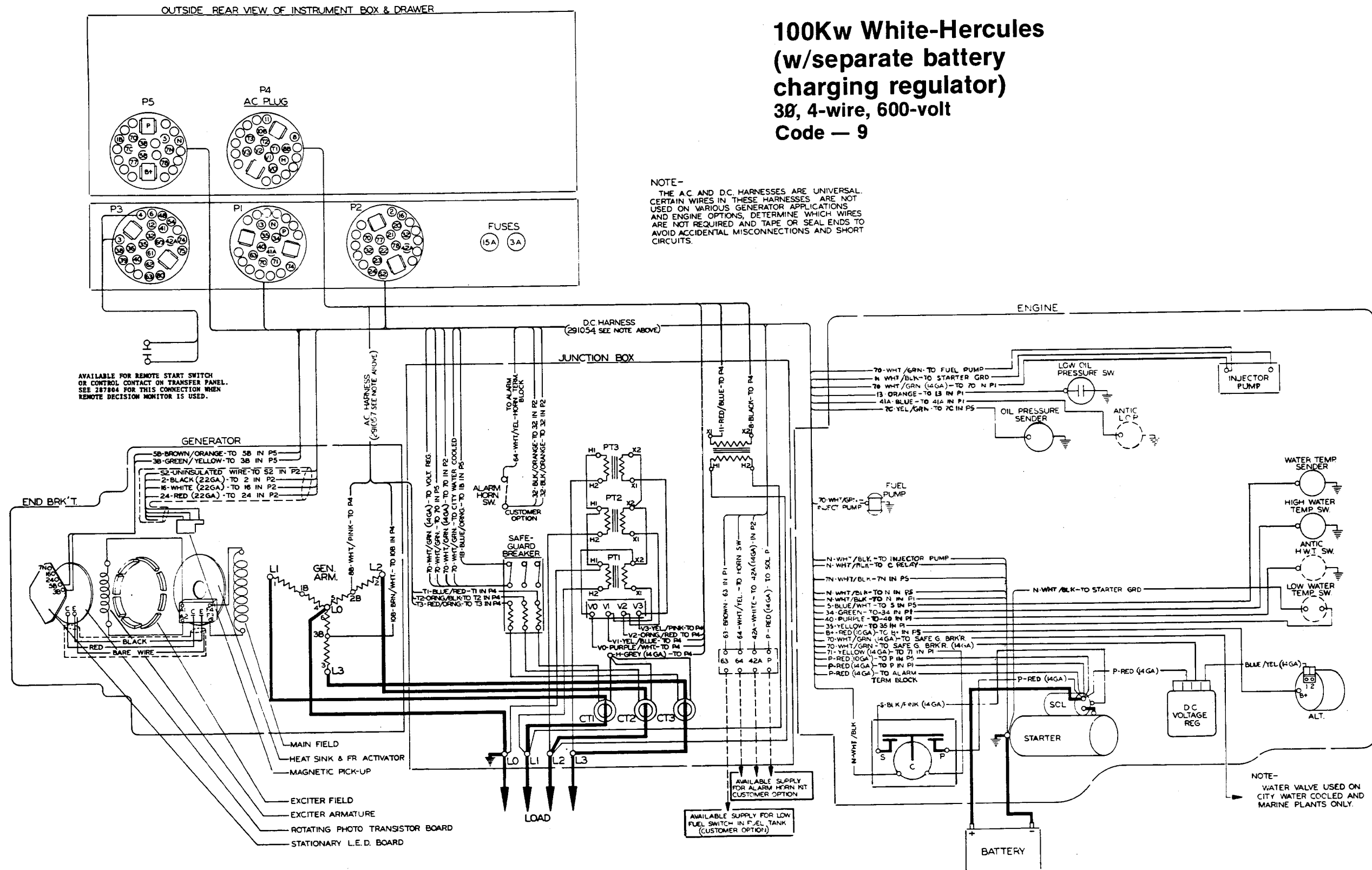
**100Kw White-Hercules**  
**(w/separate battery**  
**charging regulator)**  
**3Ø, 4-wire, 277/480-volt**  
**3Ø, 4-wire, 120/208-volt**  
**3Ø, 3-wire, 240-volt**  
**Code — 5, 7, 8**

AVAILABLE FOR REMOTE START SWITCH OR CONTROL CONTACT ON TRANSFER PANEL. SEE 287894 FOR THIS CONNECTION WHEN REMOTE DECISION MONITOR IS USED.

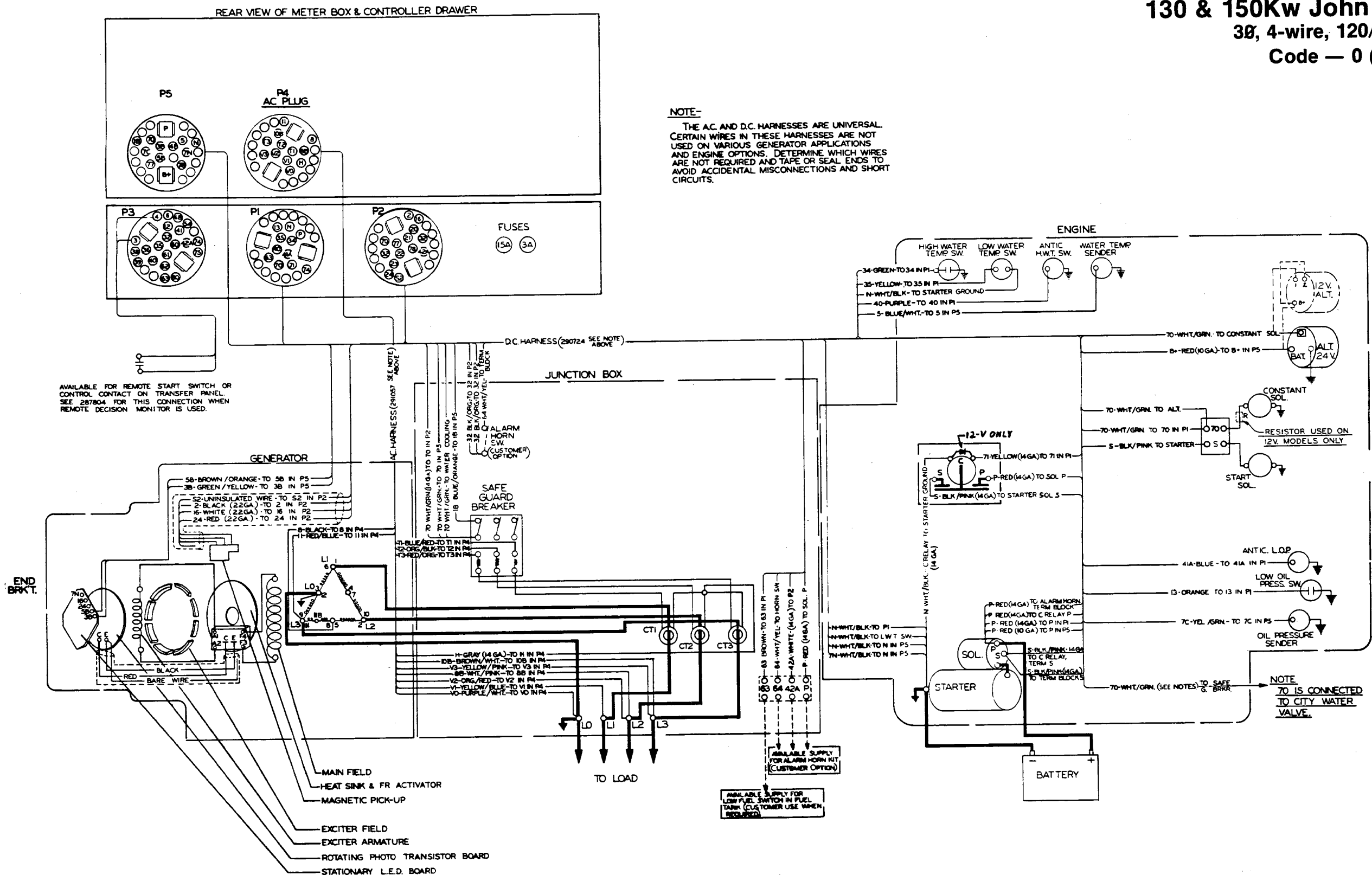


**100Kw White-Hercules**  
**(w/separate battery**  
**charging regulator)**  
**1Ø, 3-wire, 120/240-volt**  
**Code — 6**





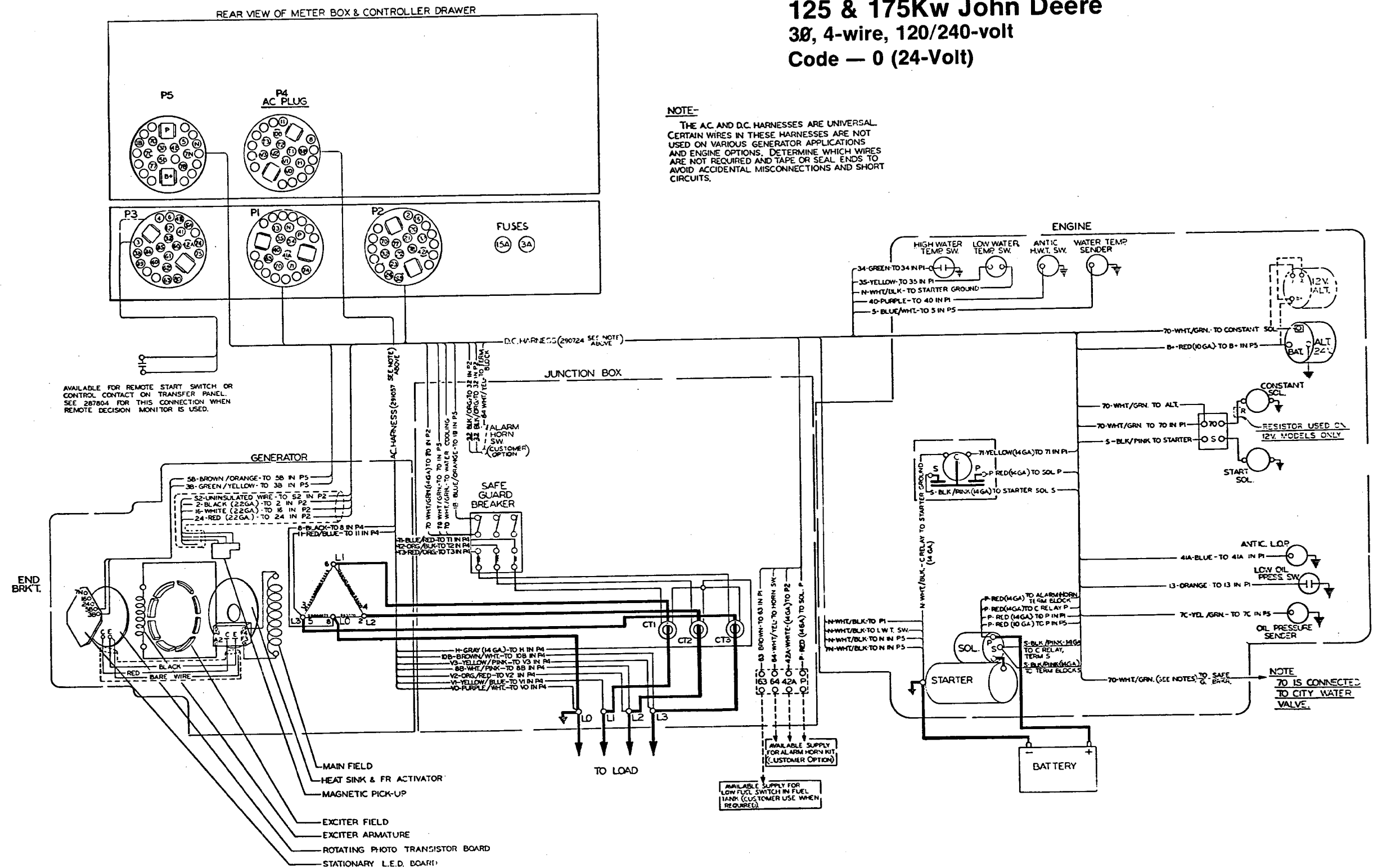
# 130 & 150Kw John Deere 3Ø, 4-wire, 120/240-volt Code — 0 (12-Volt)



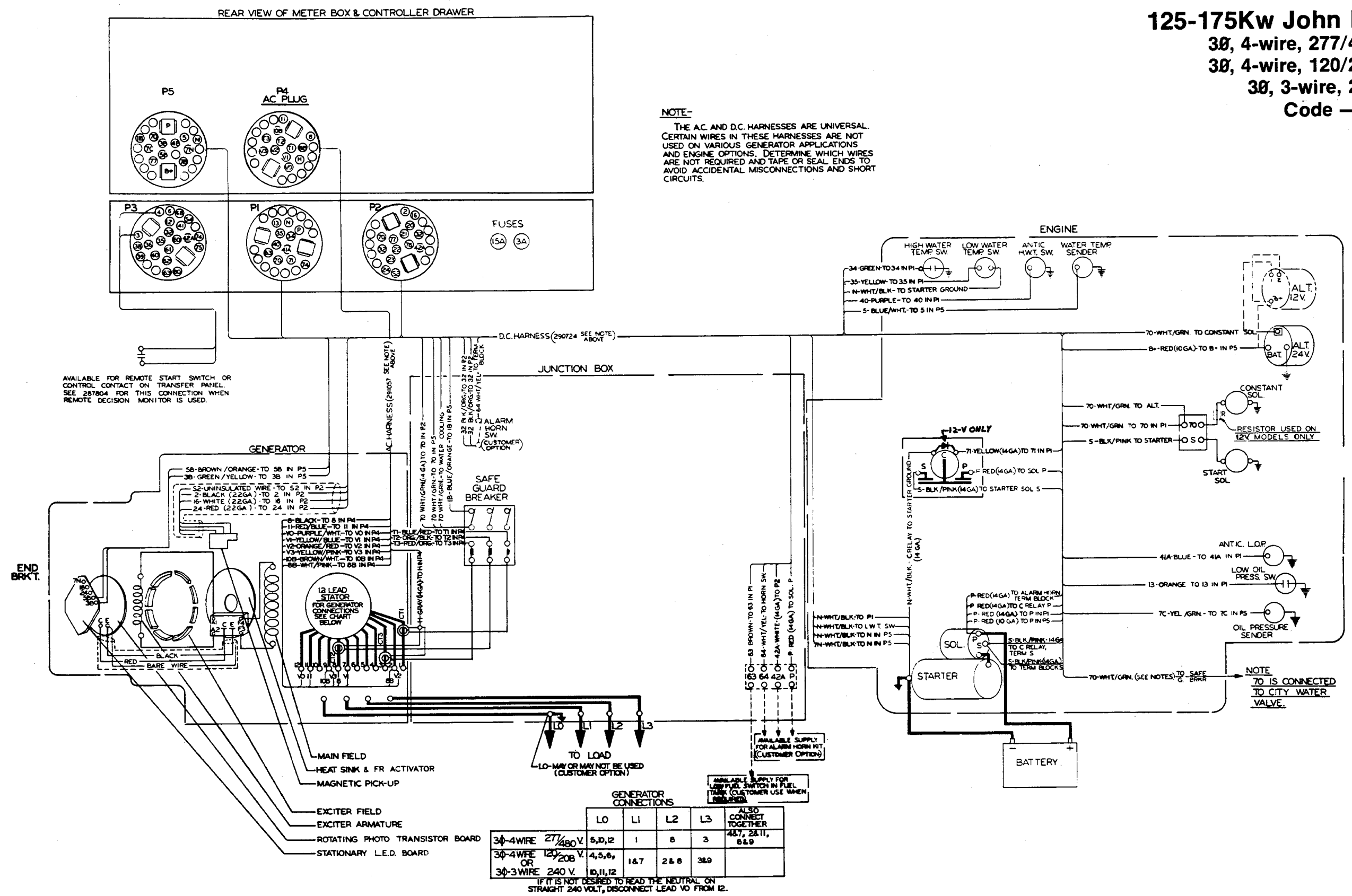
# 125 & 175Kw John Deere 3Ø, 4-wire, 120/240-volt Code — 0 (24-Volt)

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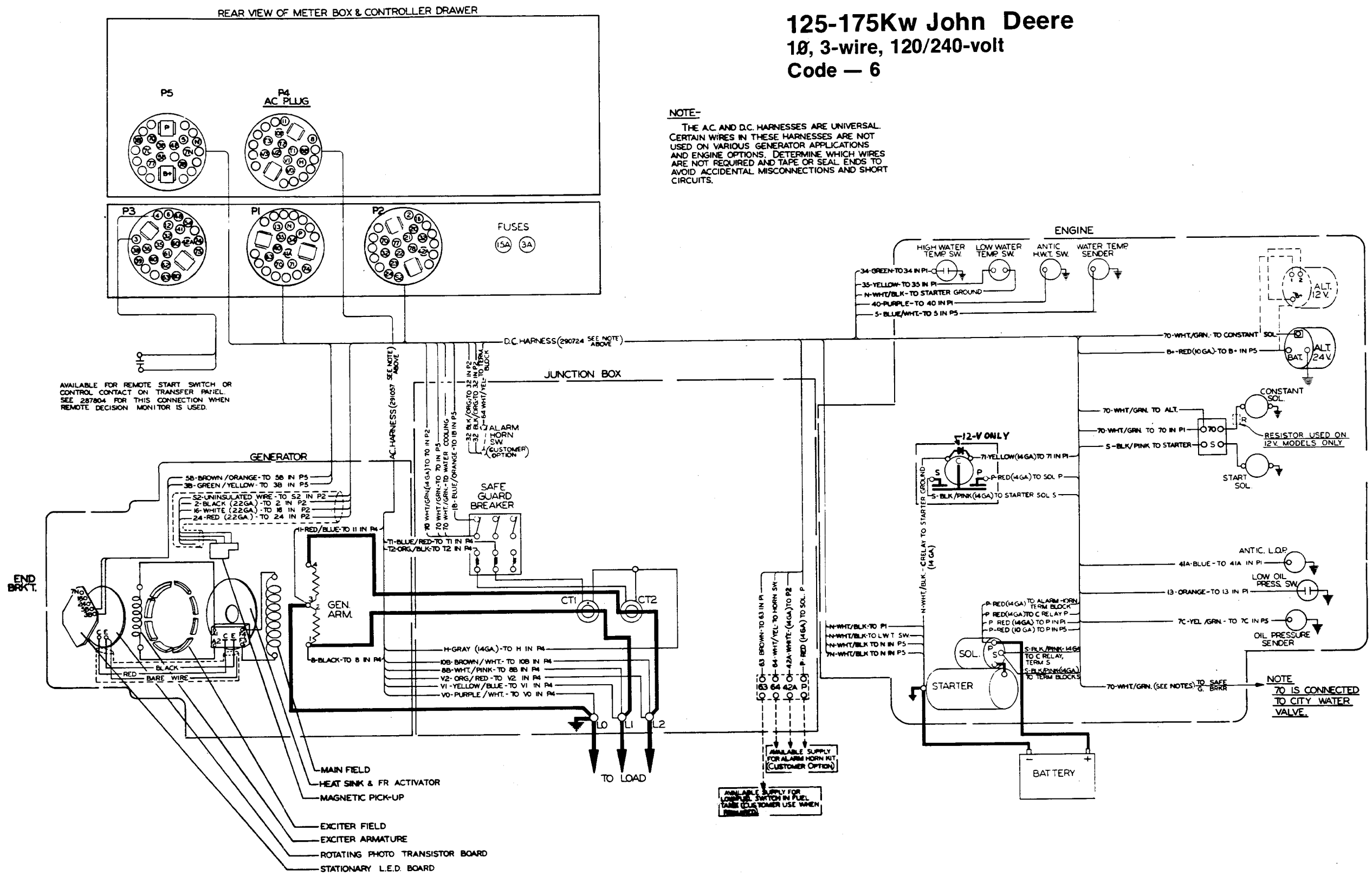


**125-175Kw John Deere**  
**3Ø, 4-wire, 277/480-volt**  
**3Ø, 4-wire, 120/208-volt**  
**3Ø, 3-wire, 240-volt**  
**Code — 5, 7, 8**

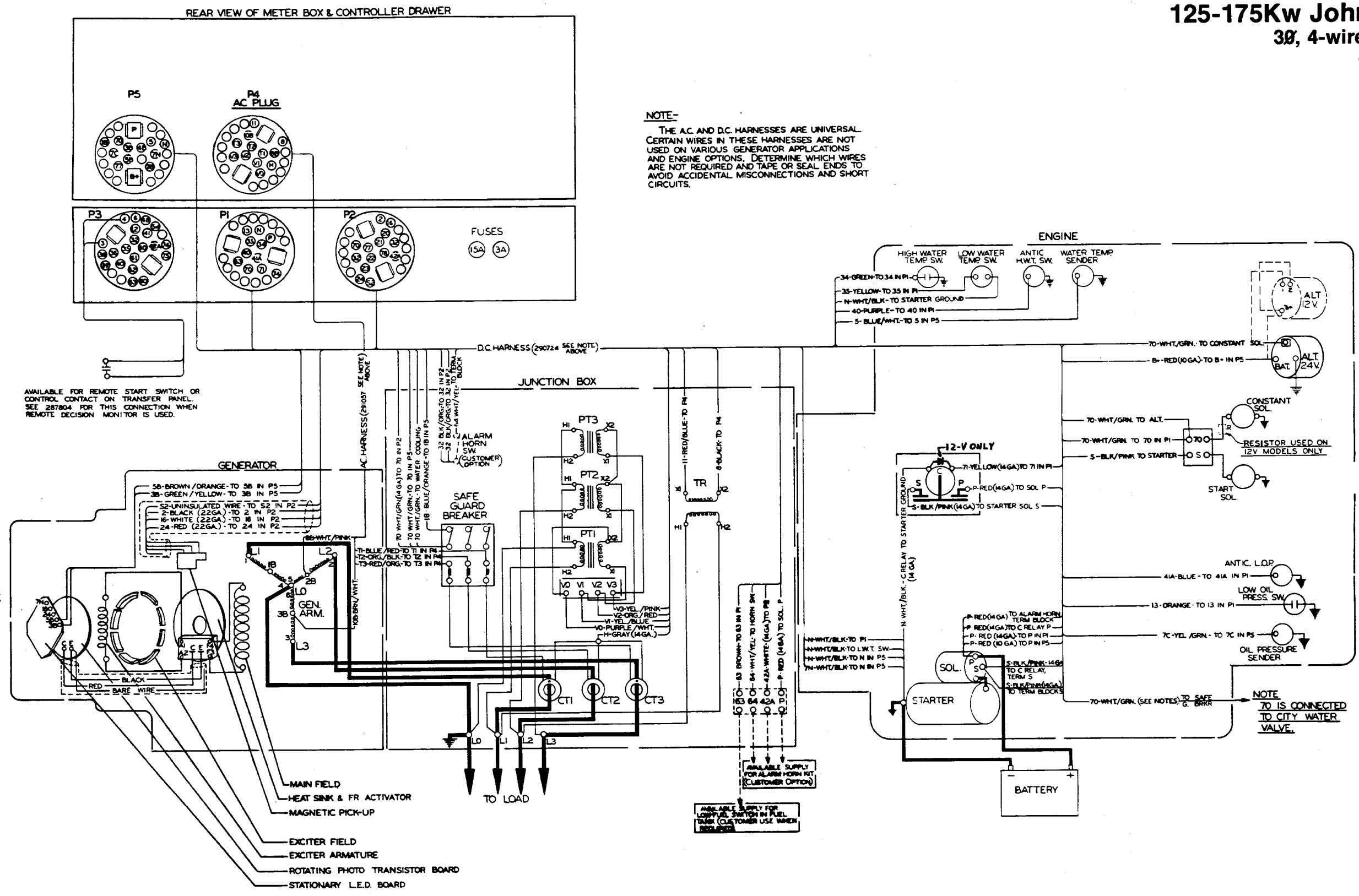


# 125-175Kw John Deere 1Ø, 3-wire, 120/240-volt Code — 6

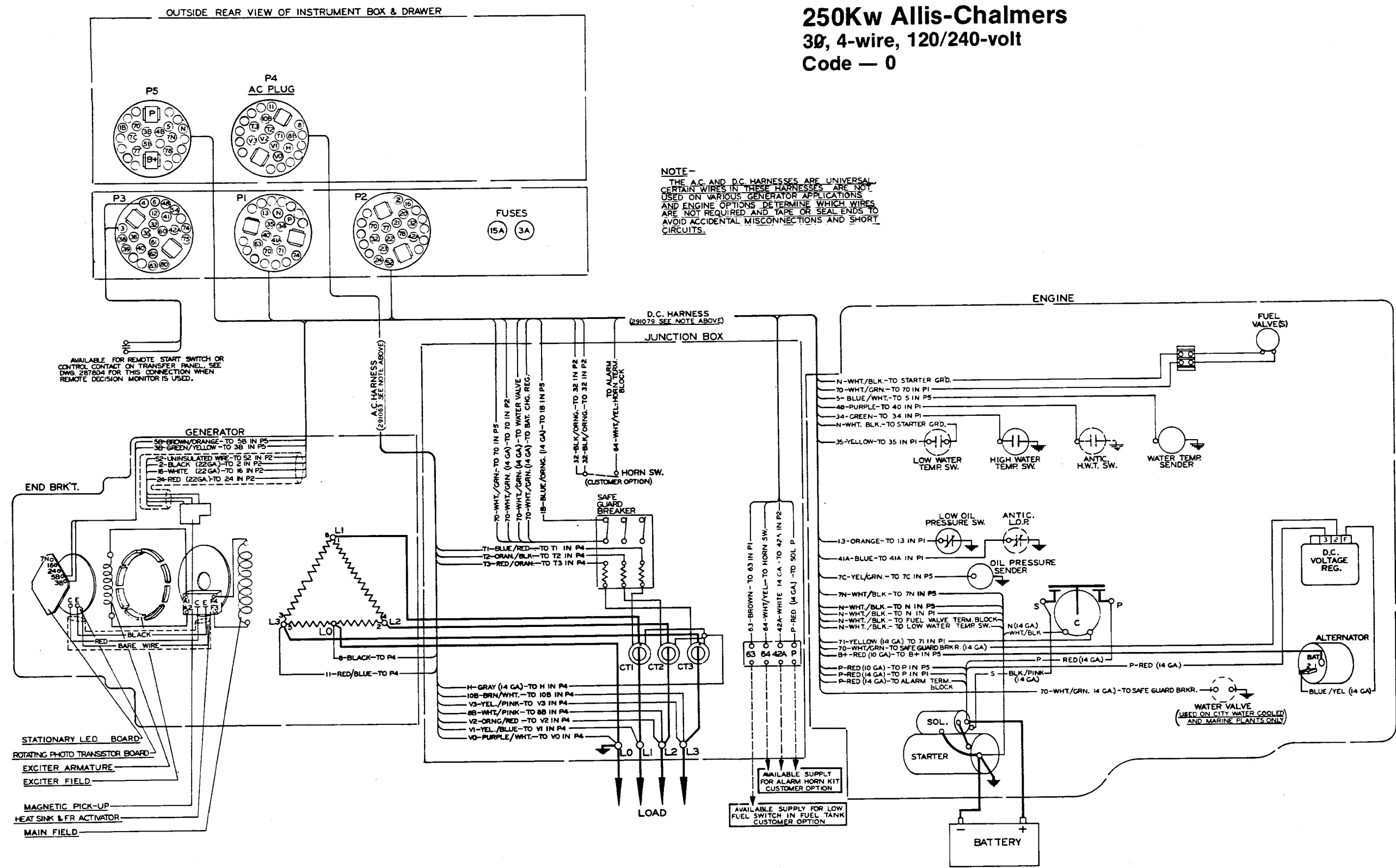
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AVOID ACCIDENTAL MISCONNECTIONS AND SHORT  
CIRCUITS.



# 125-175Kw John Deere 3Ø, 4-wire, 600-volt Code — 9

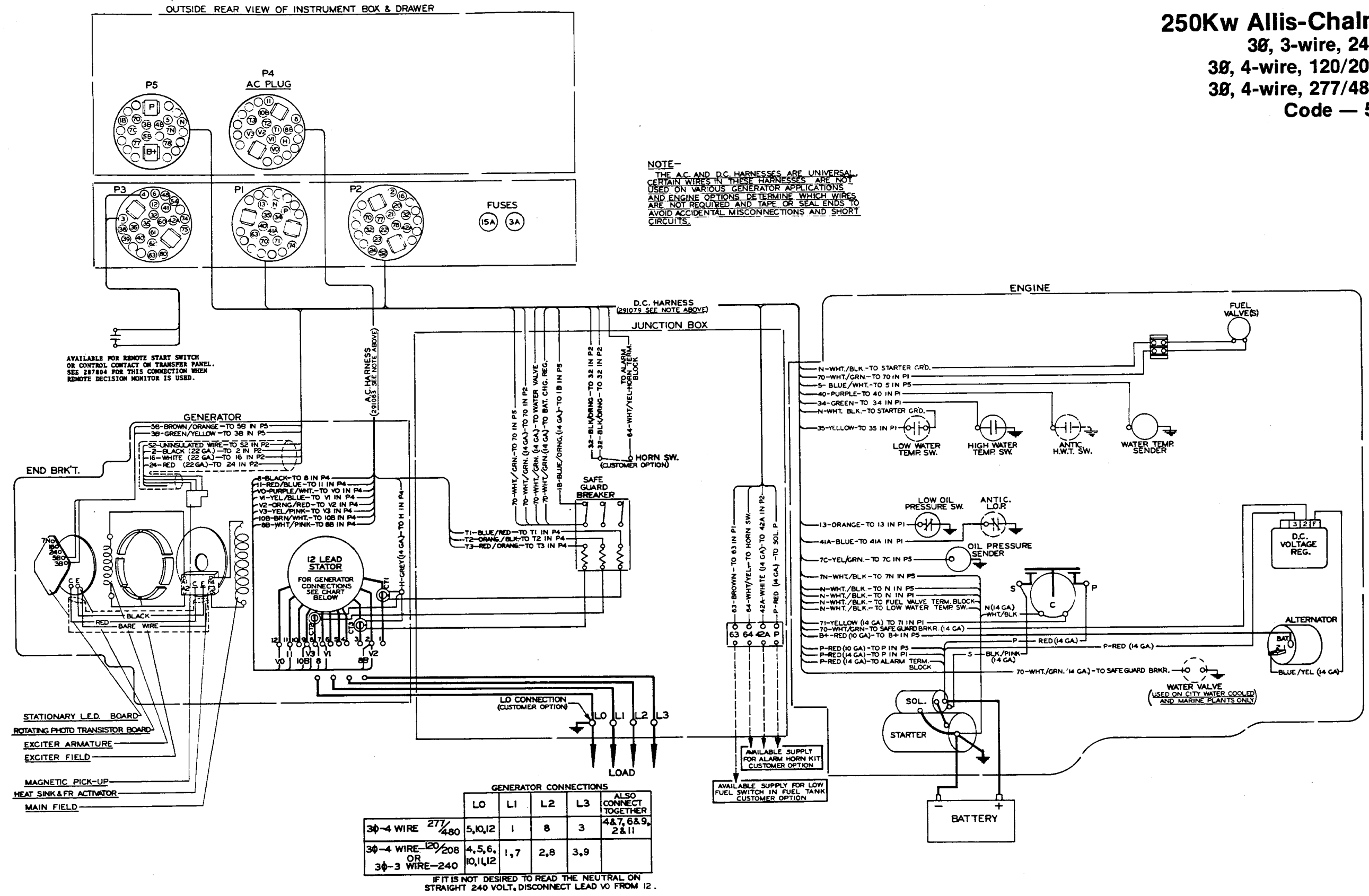


# 250Kw Allis-Chalmers 3Ø, 4-wire, 120/240-volt Code — 0



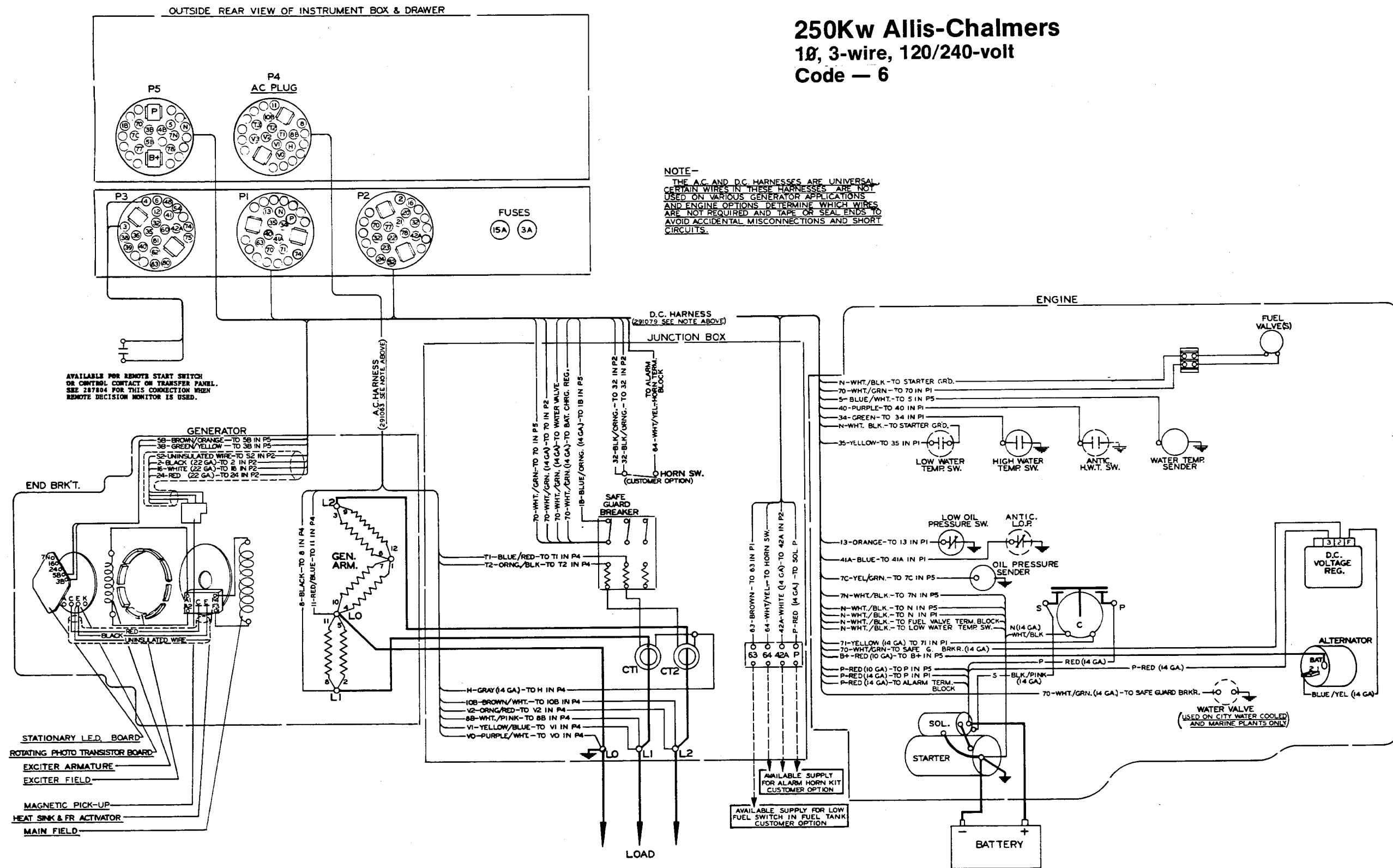
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**250Kw Allis-Chalmers**  
 3Ø, 3-wire, 240-volt  
 3Ø, 4-wire, 120/208-volt  
 3Ø, 4-wire, 277/480-volt  
 Code — 5, 7, 8

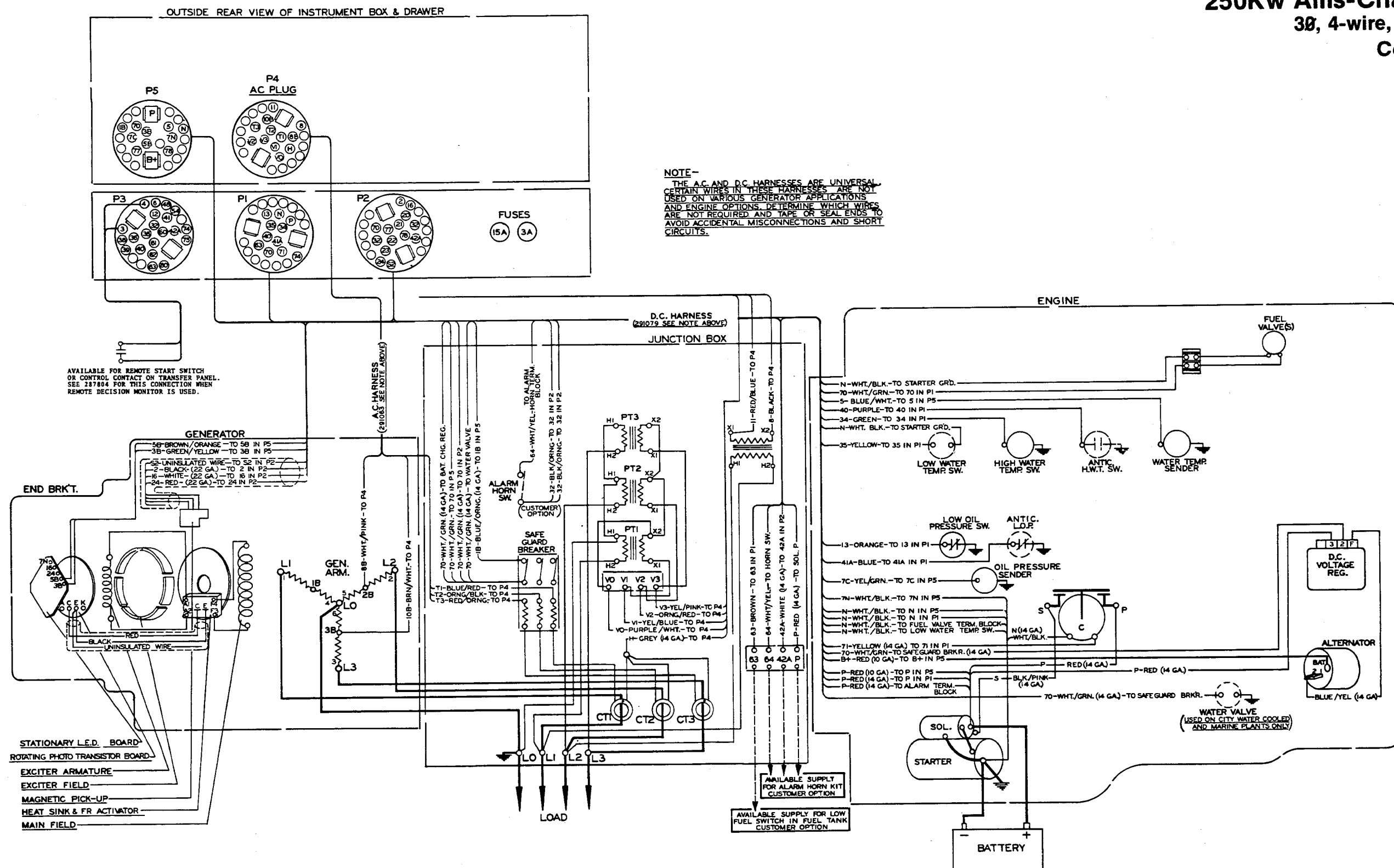


**250Kw Allis-Chalmers**  
**1Ø, 3-wire, 120/240-volt**  
**Code — 6**

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CIRCUITS.

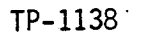


**250Kw Allis-Chalmers**  
**3Ø, 4-wire, 600-volt**  
**Code — 9**

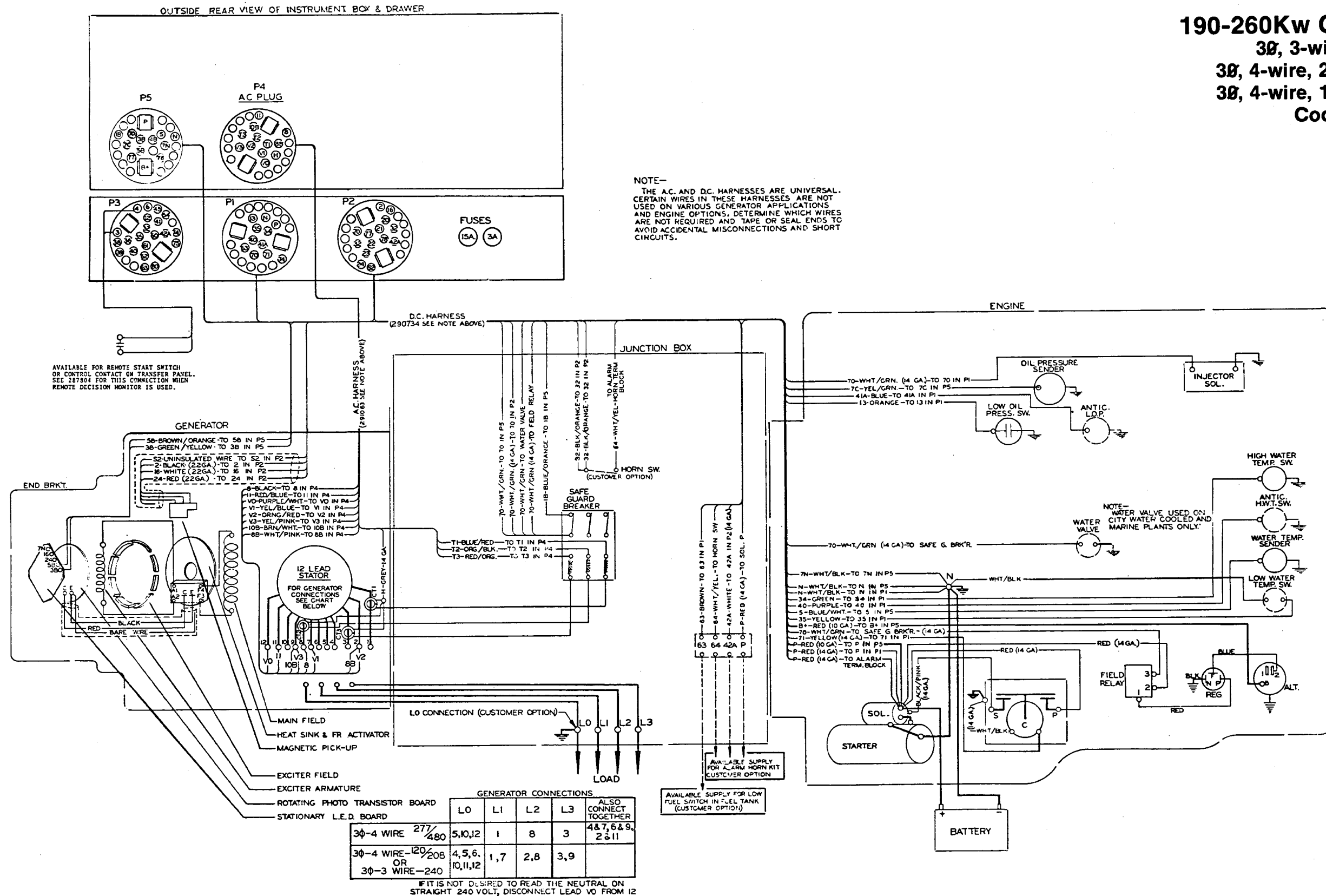


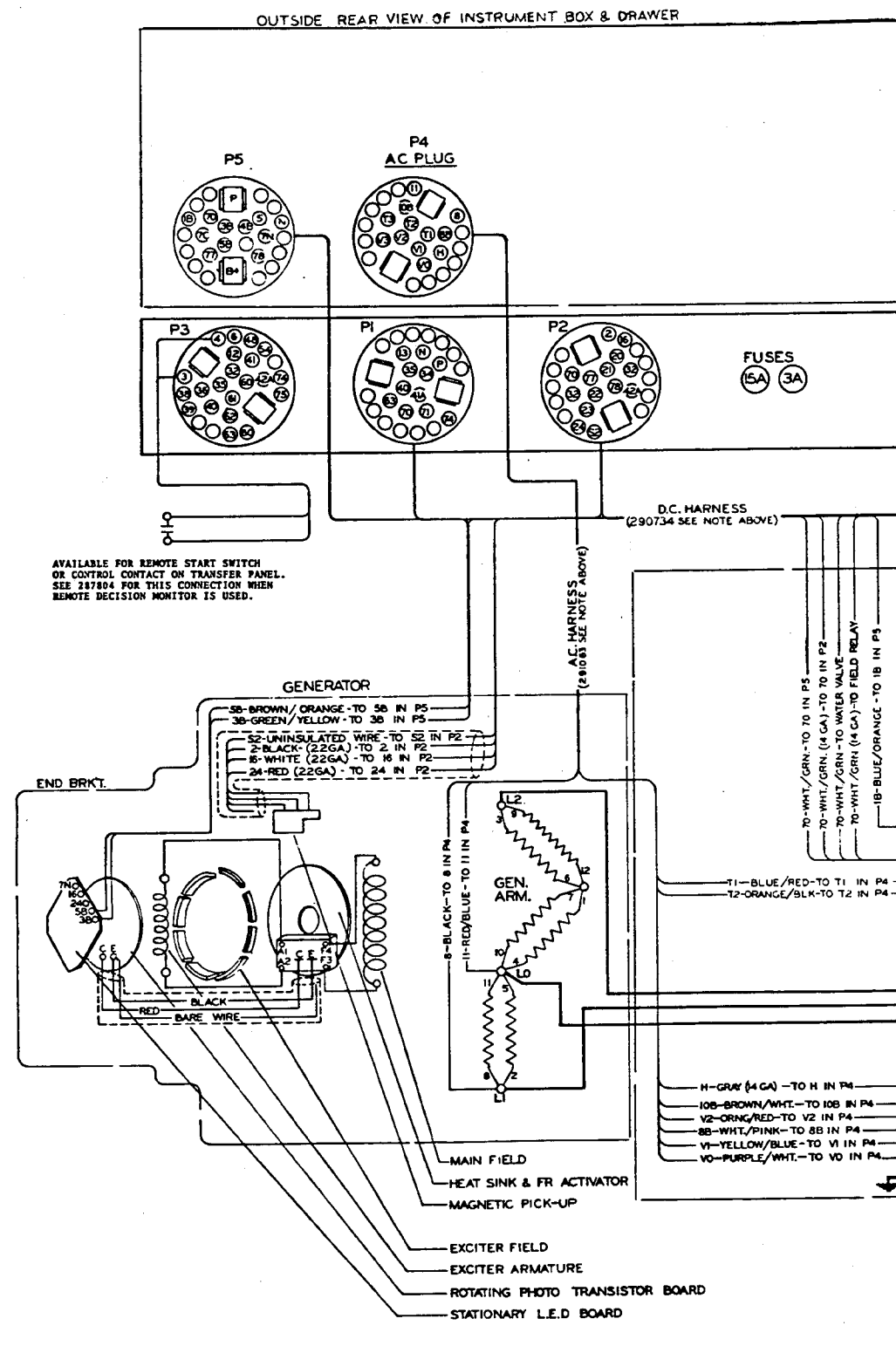
## WIRING DIAGRAMS

6-30



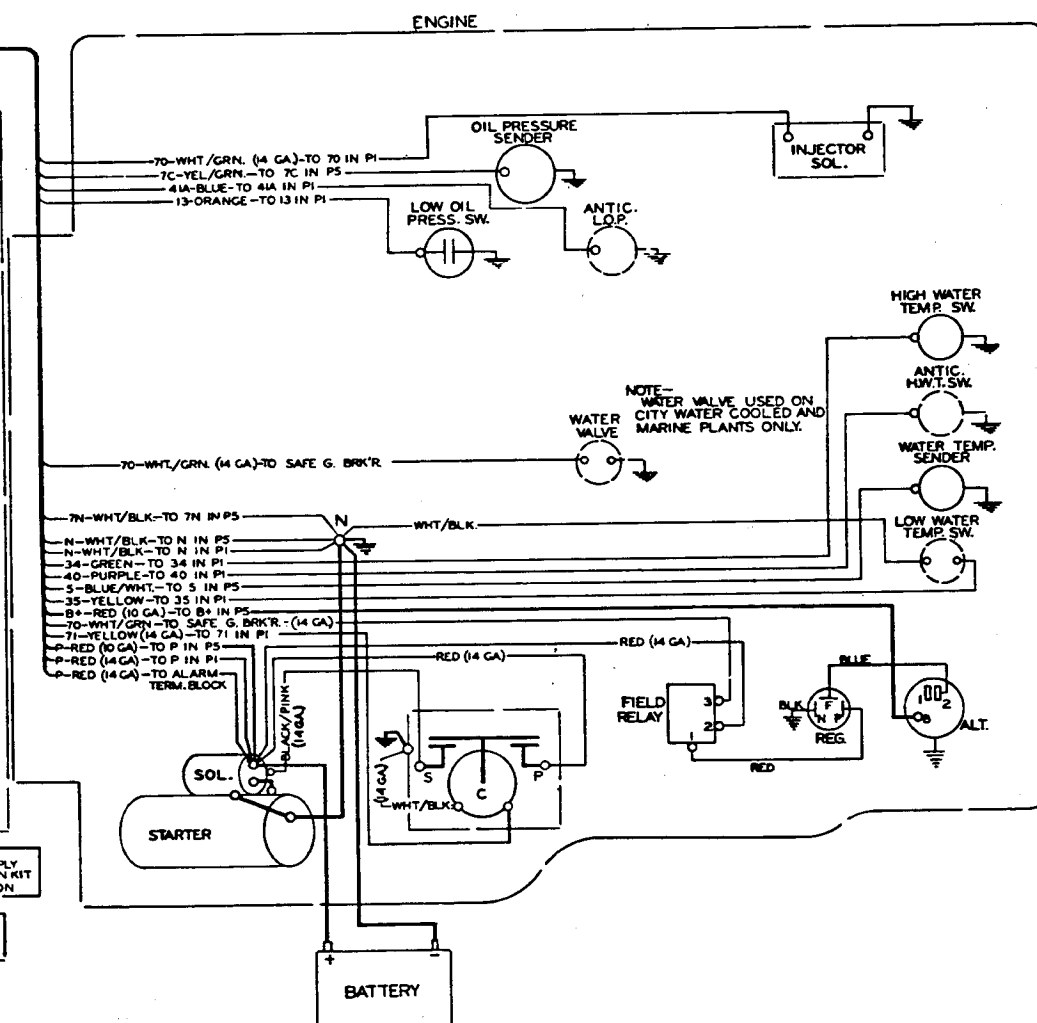
**190-260Kw Cummins**  
**3Ø, 3-wire, 240-volt**  
**3Ø, 4-wire, 277/480-volt**  
**3Ø, 4-wire, 120/208-volt**  
**Code — 5, 7, 8**



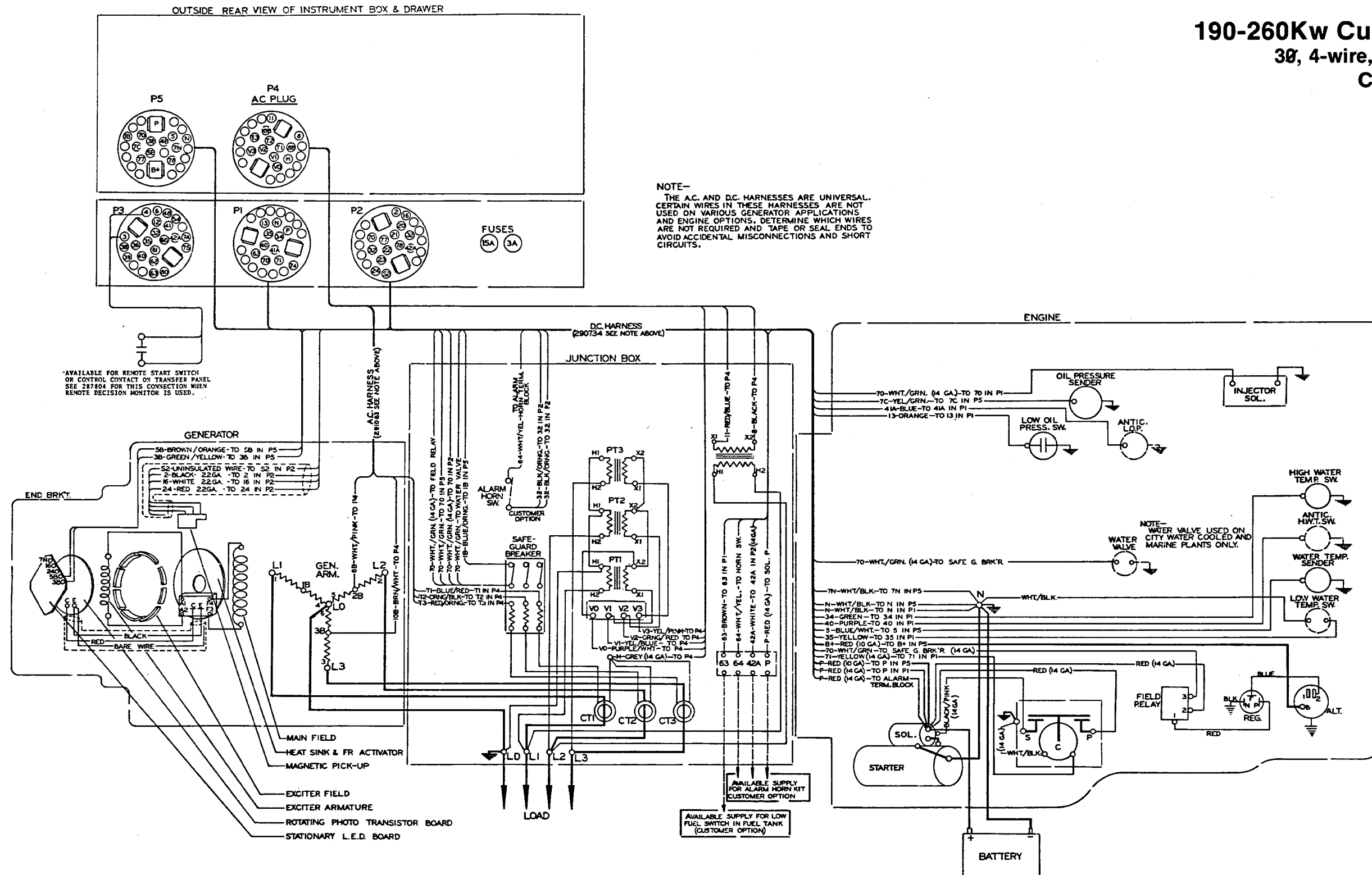


# 190-260Kw Cummins 1Ø, 3-wire, 120/240-volt Code — 6

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**190-260Kw Cummins**  
**3Ø, 4-wire, 600-volt**  
**Code — 9**

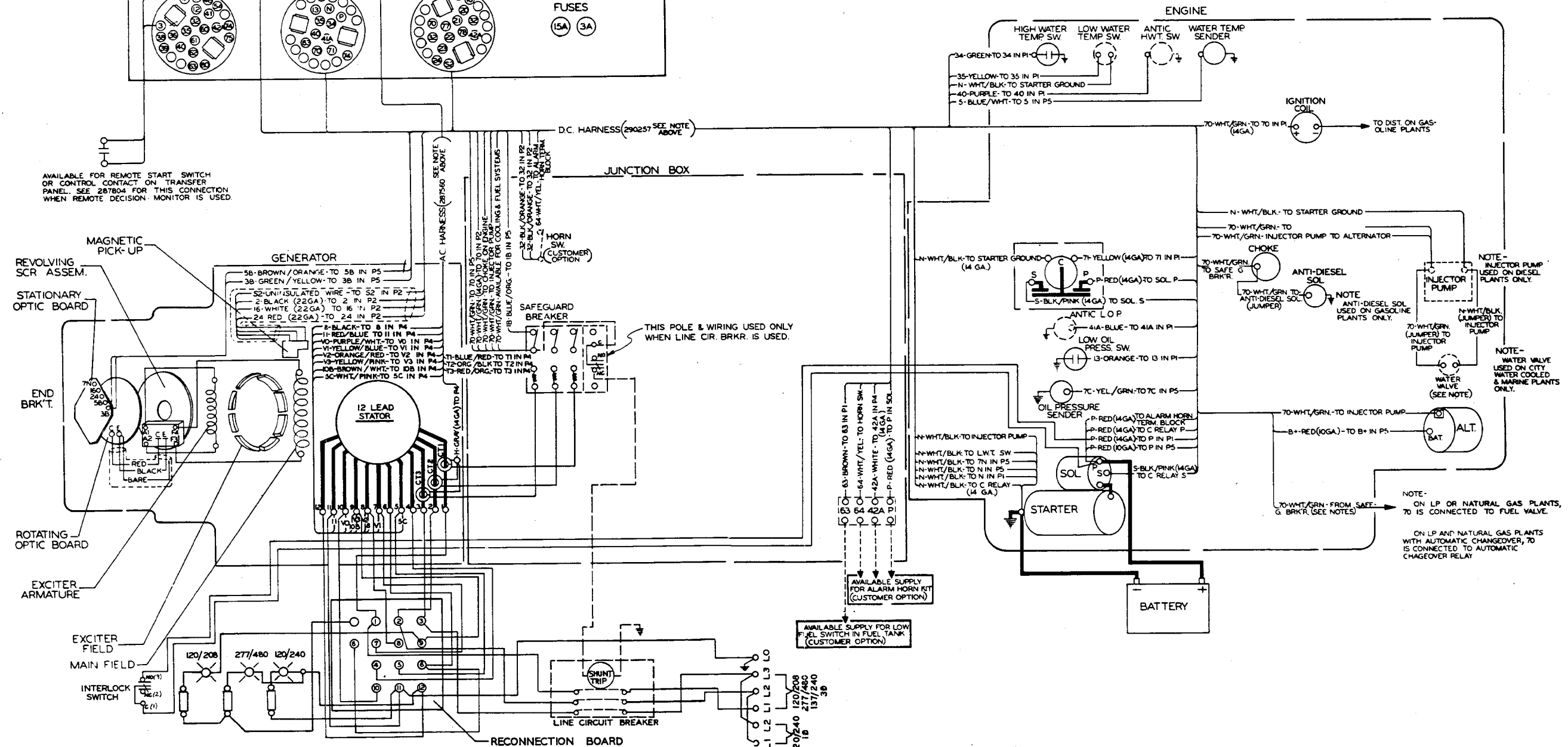


OUTSIDE REAR VIEW OF INSTRUMENT BOX & CONTROLLER DRAWER

**30-100Kw  
Triple-Voltage**  
3Ø, 277/480-volt  
3Ø, 120/208-volt  
1Ø, 120/240-volt  
Code — 10

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## NOTES

# Appendix A

## MAIN GENERATOR FIELD RESISTANCE

Fast-Response field resistance should measure 2-3  $\Omega$ . Measurements should be made using a high-quality meter, with good connections to F3 and F4 leads, for proper readings. F3 and F4 leads must be disconnected from the FR Activator.

Resistances given above were obtained using a Kelvin double bridge at room temperature — 68° F (20° C). Variations in wire temperature will cause variations in resistance.

Field resistances may also vary up to  $\pm 5\%$  due to wire tolerances and variations in field coil windings.

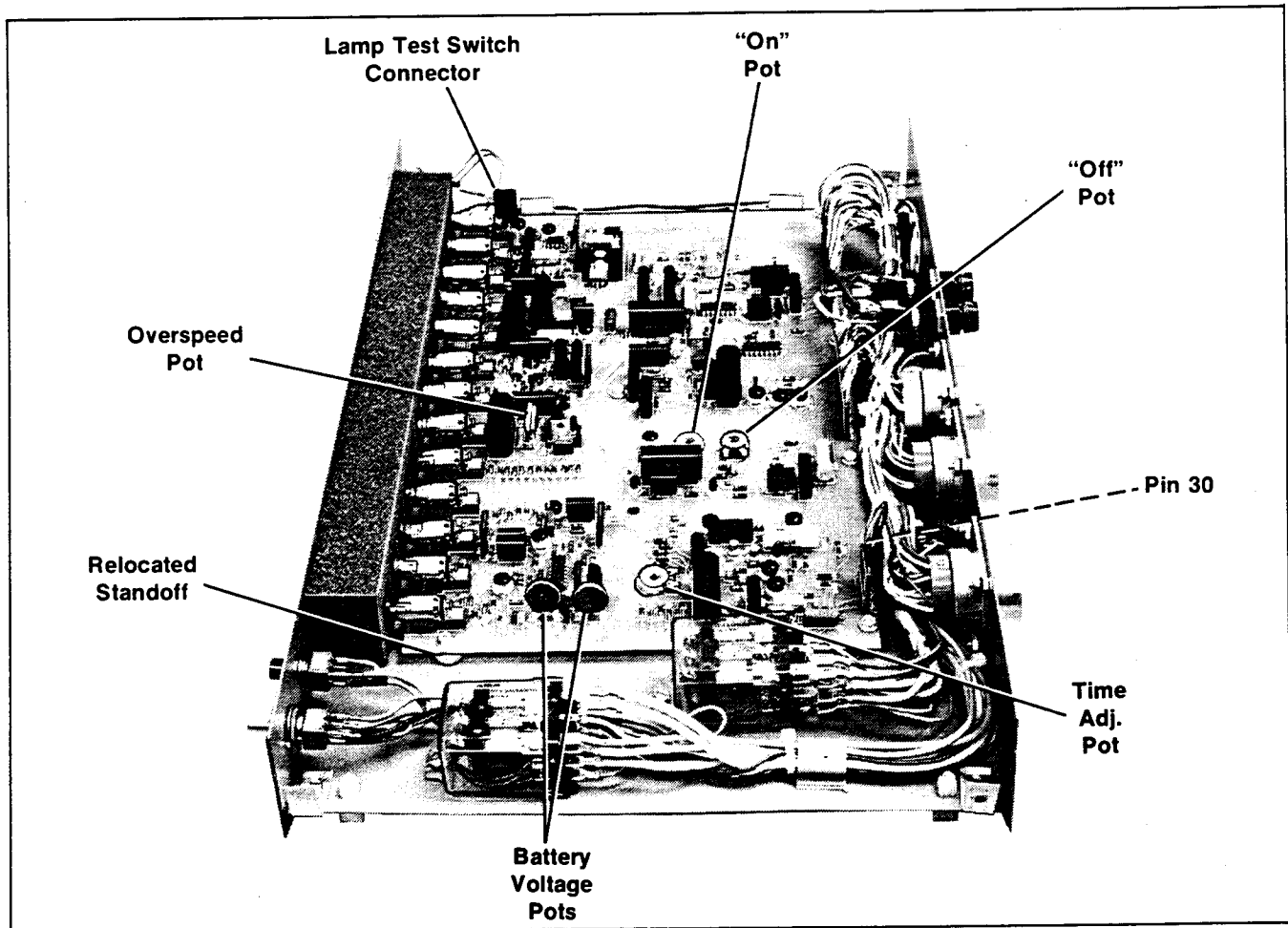
### NOTES

## NOTES

# Appendix B

## UNIBOARD FOR CONTROLLER LOWER TRAY

Complete mother-daughter circuit board assemblies may be replaced with uniboard as shown below.



### To Install Uniboard

1. Unplug LAMP TEST switch connector (blue and green wires) from mother board.
2. Unplug 3 harness connectors at back edge of mother board.
3. Remove 7 screws holding mother board to tray and lift mother-daughter board assembly from tray.
4. Remove right front nylon board-mounting standoff from tray. Drill a 5/16 in. (8mm) hole in tray to align with corresponding hole in new circuit board. Push standoff into new hole.
5. Transfer lamp bulbs to sockets on uniboard as necessary. Mount board assembly to tray with 7 screws.
6. Connect LAMP TEST switch connector to board (See Figure) - blue wire to pin 43; green to pin 54.
7. Connect two long harness connector to rows of pins at back edge of board. Connect small harness connector leaving end pin 30 exposed.
8. Test with Fast Check before reinstalling tray in controller.

## NOTES

## Appendix C

### Uniboard to Decision Maker II (Dec-II) Tray Conversion for Fast-Response I Generator Sets Installation and Operation

|     | Uniboard                            |                      | Decision Maker II    |           |
|-----|-------------------------------------|----------------------|----------------------|-----------|
|     | Tray No.                            | Board No.            | Controller Assy. No. | Kit No.   |
| 12V | A-291779 (NFPA)<br>A-291850 (Basic) | C-291492<br>C-291849 | A-292315             | PA-292780 |
| 24V | A-291780 (NFPA)<br>A-291870 (Basic) | C-291492<br>C-291849 | A-292335             | PA-292781 |

The conversion kit eliminates the uniboard tray and provides a complete Decision Maker II tray assembly to make interchange a simple procedure. See Figure 1 and use the following procedure. Keep this instruction for future reference.

#### INSTALLATION PROCEDURE

#### WARNING

**UNIT STARTS WITHOUT NOTICE!** Units with Automatic Transfer Switches start automatically. Potential injury or electrocution can result. Turn Generator Master Switch on controller to OFF position, and remove battery cables (remove negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator.

1. Place controller master switch to OFF Position. Disconnect battery of generator set, negative lead first.
2. Remove four screws, lock washers, and washers on lower controller enclosure and slide out uniboard tray by grasping P1, P2, and P3 connectors. Once the tray back panel clears enclosure, remove P1, P2, and P3 connectors. While sliding out tray, it may be necessary to tilt tray in order to clear mounting hardware of upper controller.
3. JUMPER OPTIONS: Cut J1 on main circuit board for 60-second continuous cranking. Cut J2 on main circuit board for 50 Hz operation.

#### NOTE

On kits ordered for 24 Volt operation, jumper J4 is sent from the factory already cut.

4. If the factory HI/LO battery voltage adjustments are not to be used or are suspected to be incorrect, proceed as follows: otherwise omit Step 4.

- a. Connect Fast Check on Decision Maker II tray connectors and variable DC voltage power supply.
- b. Move generator master switch to AUTO position. SYSTEM READY lamp should go on.
- c. Slowly turn DC supply voltage up until BAT. HIGH VOLTS lamp goes on. DC supply voltmeter should read about 15 Volts for 12 Volt systems and about 30 Volts for 24 Volt systems. If adjustment is needed, turn DC supply to desired HI voltage and turn Pot. R42 just to the point where the BAT. HIGH VOLTS lamp goes on.
- d. Slowly turn DC supply voltage down until BAT. LOW VOLTS lamp goes on. DC supply voltmeter should read about 11 Volts for 12 Volt systems and 22 Volts for 24 Volt systems. If adjustment is needed, turn DC supply to desired LO voltage and turn Pot. R25 just to the point where the BAT. LOW VOLTS lamp goes on.
- e. Seal Pots. R25 and R42 with insulating varnish or equivalent.
- f. Disconnect Fast Check from Decision Maker II tray connectors and DC power supply.
5. Slide in Decision Maker II tray. Tilt tray slightly to clear mounting hardware of upper controller.
6. Install four screws, lock washers, and washers to secure Decision Maker II tray to enclosure.
7. Connect P1, P2, and P3 connectors to Decision Maker II tray.
8. Check that the controller master switch is in the OFF position. Reconnect battery, negative lead last.

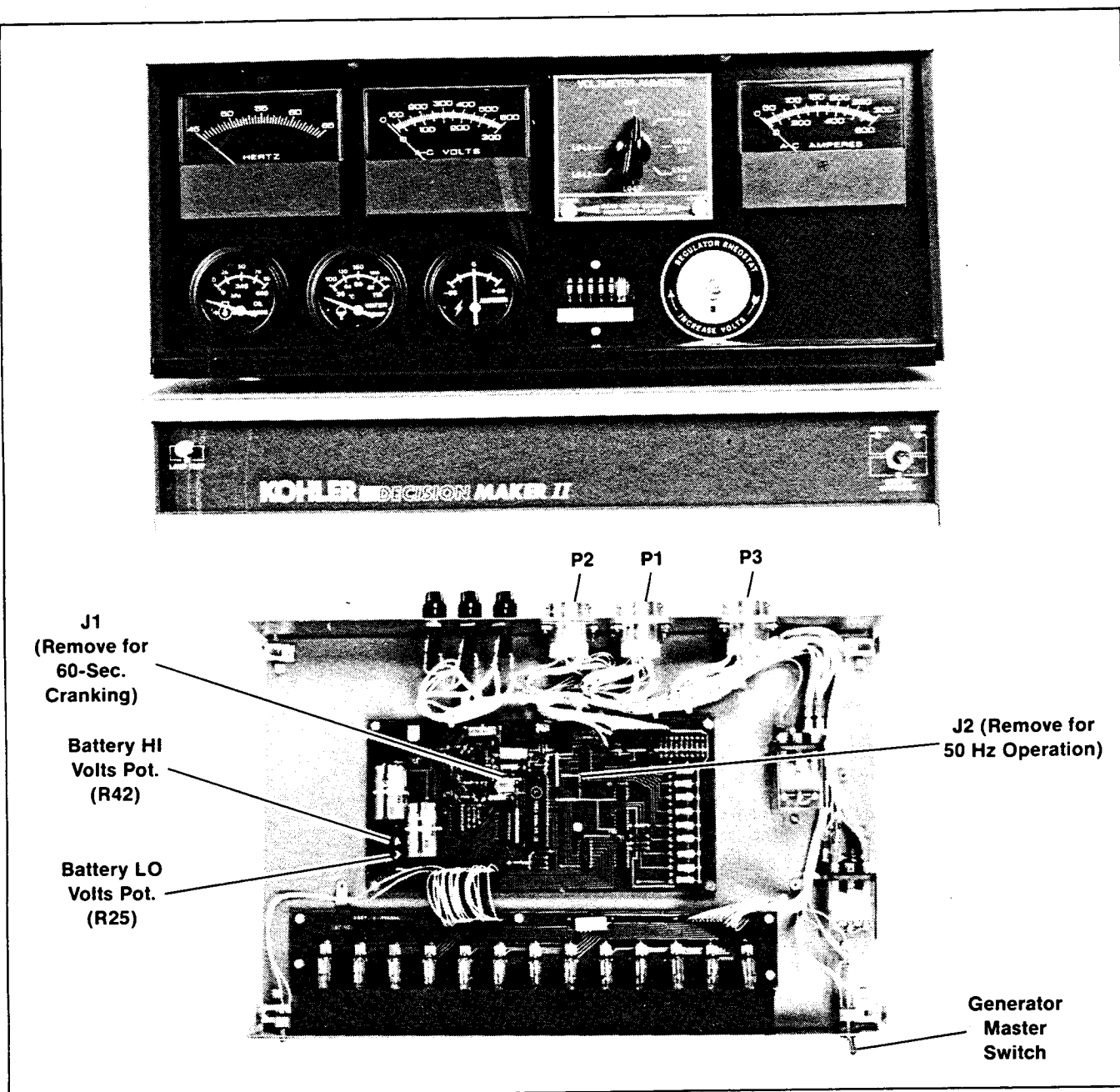


Figure 1. Fast-Response I Controller with Decision Maker II Microprocessor Tray

## OPERATION AND FEATURES

For identification of components, see Figure 2; for an explanation of their function refer to the following paragraphs.

### LAMPS:

1. Switch Off — lamp flashes when generator master switch is in the OFF/RESET position. Lamp will not light when generator master switch is in the AUTO or TEST position.

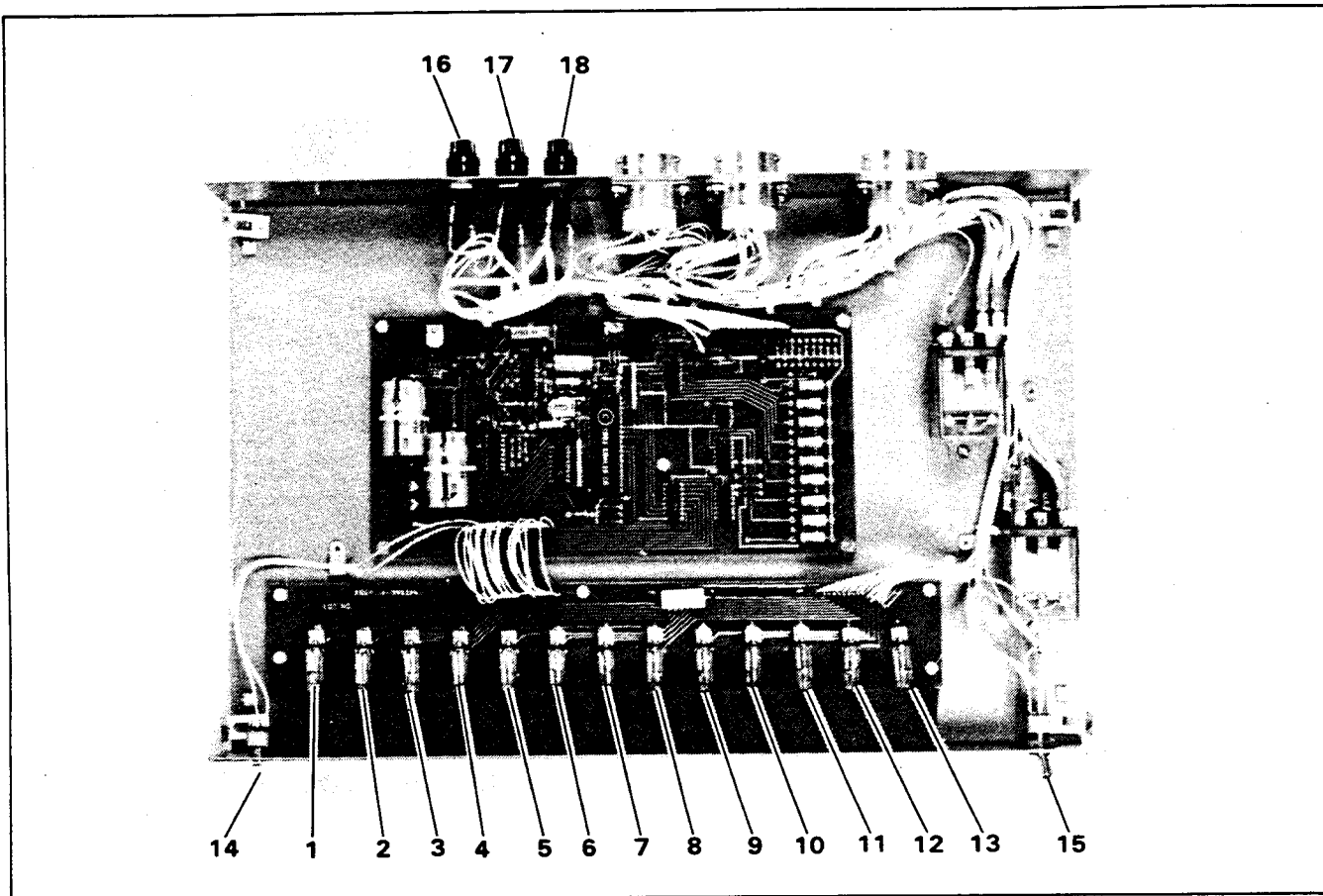
### 2. Overcrank

— cranking stops and overcrank lamp will light if engine does not start after 60 seconds.

— lamp will light after 25 seconds of attempted cranking if starter or engine will not turn.

— lamp will light and engine will stop after starting and 25 seconds running without speed sensor signal.

Overcrank Flashing — lamp will flash if speed sensor fails during a normal run. Engine will keep running.



**Figure 2. Decision Maker II Microprocessor Base Tray**

3. Emergency Stop — lamp lights if emergency stop has been made or if overvoltage device (if equipped) has shut down. See "Emergency Stopping" following.
4. High Water Temperature — lamp lights if set has shut down due to high engine coolant temperature.
5. Overspeed — lamp lights if set shuts down due to overspeed.
6. Low Oil Pressure — lamp lights if set shuts down due to loss of engine oil pressure.
7. Anticipated Low Oil Pressure (if equipped) — lamp lights if engine oil pressure approaches shutdown level.
8. Anticipated High Water Temperature (if equipped) — lamp lights if engine coolant temperature approaches shutdown level.
9. Low Water Temperature (if equipped) — lamp lights if optional engine block heater is not working and/or temperature may be too low (below 70° F, 21° C) for 10-second start-up.
10. Battery High Volts—lamp lights if battery or charging voltage exceeds 15 Volts for 12-Volt systems; 30 Volts for 24-Volt systems (will also light if overvoltage

occurs due to battery charger malfunction while set is not operating).

11. Battery Low Volts—lamp lights if battery or charging voltage drops below 11 Volts for 12-Volt systems; 22 Volts for 24-Volt systems (will also light if undervoltage occurs due to battery or charger malfunction while set is not operating).
12. Low Fuel (if equipped)—lamp lights if fuel tank level approaches empty.
13. System Ready—lamp lights when Generator Master Switch is in the AUTO or TEST position and system senses NO faults.

#### **SWITCHES:**

14. Lamp Test — used to test indicator lamps.
15. Generator Master Switch—3-position AUTO, CENTER OFF/RESET, and TEST switch. AUTO position allows start-up by automatic transfer switch or remote start-stop switch connected to controller terminals 3 and 4. CENTER OFF/RESET position will stop the generator set regardless of the cool-down time delay. The master switch must be in the AUTO position for the cool-down time delay to function.

### NOTE

If engine stop is signaled by a remote switch or Automatic Transfer Switch, the generator set will keep running for a cool-down cycle of 5 minutes.

TEST position will start the generator set locally.

### FUSES:

16. 4-Amp—protects remote annunciator circuit, lamp circuit board, and alarm horn circuit (if equipped).
17. 1-Amp—protects the main circuit board and the CR and 1CR relay coils.
18. 15-Amp—protects engine DC and primary starting circuits.

### NOTE

Earlier models utilize a 3 Amp. fuse to protect remote annunciator and alarm horn circuits (if equipped). A 4 Amp. fuse protects control and lamp circuit boards, and control relay coils.

### EMERGENCY STOPPING

Turn generator master switch to OFF/RESET, or operate remote emergency stop switch (if equipped), for immediate shutdown.

### FAULT SHUT-DOWNS

The generator set will shut down automatically under the following fault conditions:

Overcrank: See "Overcrank" preceding.

High Temperature: Shutdown occurs 4 seconds after fault.

### CAUTION

High temperature shutdown will not function if proper coolant level is not maintained.

### NOTE

High temperature and low oil pressure shutdowns are overridden during the first 30 seconds after start-up.

Low Oil Pressure: Shutdown occurs 4 seconds after fault.

### CAUTION

Low oil pressure shutdown is not intended to provide protection against low oil level. Check for proper oil level at engine dipstick.

Overspeed: Unit shuts down immediately, if governed frequency exceeds 70 Hz on 60 Hz sets, or 60 Hz on 50 Hz sets.

Overvoltage (if equipped): Unit will shut down after approximately one second of 15% or more over nominal voltage. EMERG. STOP lamp will light.

### CAUTION

Sensitive equipment may suffer damage in less than one second of an overvoltage condition. On-line equipment requiring faster shutdowns should have its own overvoltage protection.

### RESETTING

Use the following procedure to restart set after a fault shutdown.

1. Move generator master switch to OFF/RESET position.
2. Disconnect generator set from load with line circuit breaker or automatic transfer switch.
3. Correct cause of fault shutdown.
4. Move Generator Master Switch to TEST position for start-up.
5. Verify that cause of shutdown has been corrected.
6. Reconnect to load.
7. Move Generator Master Switch to proper position (AUTO or TEST) for start-up.





# KOHLER GENERATORS

TP-5044 10/88  
Printed in U.S.A.

KOHLER CO. KOHLER, WISCONSIN 53044