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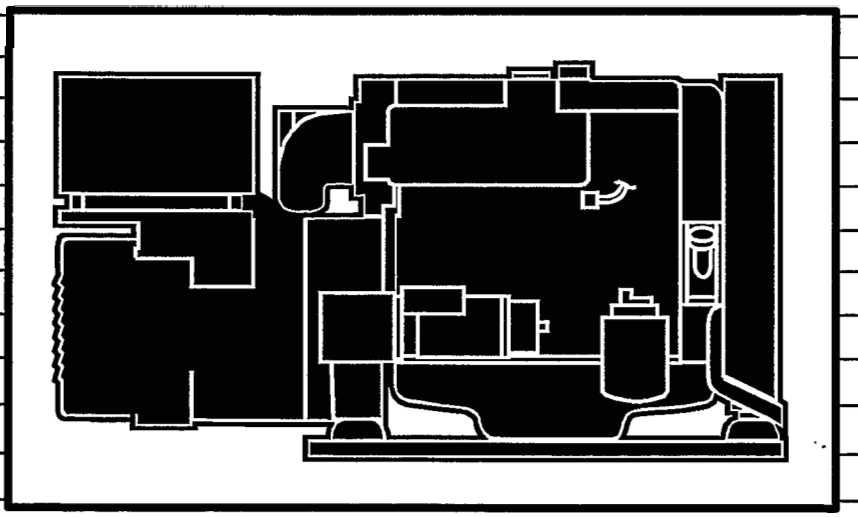
Onan

MARINE
Service Manual

MDL3
MDL4
MDL6



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Safety Precautions

Before operating the generator set, read the Operator's Manual and become familiar with it and your unit. **Safe and efficient operation can be achieved only if the unit is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

Throughout this manual you will notice symbols which alert you to potentially dangerous conditions to the operator, service personnel, or the equipment itself.

⚠DANGER ***This symbol warns of immediate hazards which will result in severe personal injury or death.***

⚠WARNING ***This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.***

⚠CAUTION ***This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.***

FUEL, ENGINE OIL, AND FUMES ARE FLAMMABLE AND TOXIC. Fire, explosion, and personal injury can result from improper practices.

- Benzene and lead, found in some gasoline, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline, take care not to ingest, breathe the fumes, or contact gasoline.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Do not fill fuel tanks with the engine running. Do not smoke around the generator set area. Wipe up any oil or gas spills. Do not leave oily rags in engine compartment or on the generator set. Keep this and surrounding area clean.
- Inspect fuel system before each operation and periodically while running.
- Equip the engine fuel supply with a positive fuel shutoff.
- Always disconnect the battery ground (–) lead first and reconnect it last. Make sure you connect the battery correctly. A direct short across the battery terminals can cause an explosion. Do not smoke while servicing batteries. Hydrogen gas given off during charging is very explosive.
- Keep a fire extinguisher available in or near the engine compartment and in other areas throughout the vessel. Use the correct extinguisher for the area. For most types of fires, an extinguisher rated ABC by the NFPA is available and suitable for use on all types of fires except alcohol.

EXHAUST GASES ARE DEADLY

- Provide adequate ventilation. Equip the bilge with a power exhauster.
- Be sure propulsion and generator set engine exhaust systems are free of leaks. Perform thorough, periodic inspections of the exhaust system and repair leaks immediately. Exhaust gases are deadly.
- Never sleep in the vessel with the generator set running unless the vessel is equipped with an operating carbon monoxide detector.

HOT COOLANT CAN CAUSE SEVERE PERSONAL INJURY

- Hot coolant is under pressure. Do not loosen the coolant pressure cap while the engine is hot. Let the engine cool before opening the pressure cap.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not remove any belt guards or covers with the generator set running.
- Keep hands and loose clothing away from moving parts. Do not wear jewelry while servicing any part of the generator set.
- Never step on the generator set (as when entering or leaving the engine compartment). It can stress and break unit components, possible resulting in dangerous operating conditions. . . from leaking fuel, leaking exhaust fumes, etc.
- Before performing any maintenance on the generator set, disconnect its batteries to prevent accidental starting. do not disconnect or connect battery cables if fuel vapors are present. Ventilate the generator set compartment or bilge thoroughly with the power exhauster.

ELECTRICAL SHOCK WILL CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not make adjustments in the control panel or on engine with unit running. High voltages are present. Work that must be done while unit is running should be done only by qualified service personnel standing on dry surfaces to reduce shock hazard.
- DO NOT CONNECT THE GENERATOR SET TO THE PUBLIC UTILITY OR TO ANY OTHER ELECTRICAL POWER SYSTEM. Electrocution or damage to property can occur at a site remote from the boat where line or equipment repairs are being made if the set is connected to the power system. An approved transfer switch must be used if more than one power source is to be made available to service the boat.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe. M8

Copy and post these suggestions in potential hazard areas of the vessel.

Table of Contents

Section 1. Introduction

ABOUT THIS MANUAL

This manual covers troubleshooting and repair information for the generator and control. Refer to a separate engine service manual 934-0750 when servicing the engine.

This manual has separate sections for the generator and voltage regulator, engine control, and associated wiring diagrams. While the wiring diagrams at the end of the manual are included to help trace or isolate problems, it is suggested that service personnel use the wiring diagrams shipped with the unit for troubleshooting.

Repair information for solid state printed circuit boards is not extensive because they lend themselves more to replacement than repair. Application of meters or hot soldering irons to printed circuit boards by other than qualified personnel can cause unnecessary and expensive damage.

Repair of the printed circuit boards is not recommended except by the factory. A return and exchange service has been initiated whereby faulty printed circuit boards can be returned to the Distributor and exchanged for good units. For more information, contact your Onan Distributor.

⚠CAUTION ***High voltage (Megger) testing or high potential (high pot) testing of generator windings can cause damage to solid state components. Isolate these components before testing.***

TEST EQUIPMENT

Most of the test procedures in this manual can be performed with an AC-DC multimeter such as a Simpson Model 260 VOM or a digital VOM. Some other instruments to have available are:

- Megger or Insulation Resistance Meter
- Onan Multitester
- Wheatstone Bridge
- Jumper Leads
- Load Test Panel
- Variac
- AC Voltmeter
- DC Voltmeter
- Frequency Meter
- Tachometer or Strobotach

See Tool Catalog 900-0019.

Several troubleshooting guides are included in this manual to help the serviceperson locate the cause of various malfunctions. Note that some malfunctions might have several possible causes. For this reason, the service person may have to investigate several problem areas in order to isolate the source of the malfunction. Because of the complexity of the product, a troubleshooting chart cannot list every malfunction and cause. In some situations, the serviceperson will have to rely on experience and a knowledge of the product to locate the problem and service as required.

SAFETY CONSIDERATIONS

Always consider the safety aspects of any service procedure. Generator sets present several hazards that the serviceperson must be aware of to safely complete the job. Read through the safety precautions listed on the inside cover and familiarize yourself with the various hazards shown in Table 1-1. Once the hazards are known, approach the job with a safety conscious attitude. Being safety conscious is the most effective way to avoid injury to yourself or others. Reduce the chance that an accident will occur by adopting the following safeguards.

Safeguards to Avoid Hazards

- *Use Personal Protection* - Protect your body by wearing appropriate safety equipment. Protective clothing includes safety shoes, gloves, safety glasses, and hard hats. Leave rings and jewelry off and do not wear loose clothing that might get caught on equipment.

- *Work to Reduce the Hazard* - The workshop area and all pieces of equipment used can contribute to reducing the hazard potential. Keep guards and shields in place on machinery and maintain equipment in good working condition. Store flammable liquids in approved containers, or other ignition source. Keep the workshop clean and well-lighted, and provide adequate ventilation. Keep fire extinguishers and safety equipment nearby and be prepared to respond to an emergency.

TABLE 1-1
HAZARDS AND THEIR SOURCE

- Fire and Explosions
  - —Leaking or spilled fuel
  - —Hydrogen gas from battery
  - —Oily rags improperly stored
  - —Flammable liquids improperly stored
- Burns
  - —Hot exhaust pipes
  - —Hot engine and generator surfaces
  - —Electrical short in DC wiring system
- Poisonous Gases
  - —Carbon monoxide from faulty exhaust pipes, joints, or hangers
  - —Operating generator set where exhaust gases can accumulate
- Electrical Shock (AC)
  - —Improper generator set load connections
  - —Faulty vessel wiring
  - —Faulty electrical appliance
  - —Faulty generator set wiring
  - —Working in damp conditions
  - —Jewelry touching electrical components
- Rotating Machinery
  - —Jewelry or loose clothing catching in moving parts
- Slippery Surfaces
  - —Leaking or spilled oil
- Heavy Objects
  - —Removing generator set from vessel
  - —Removing heavy components

- *Develop Safe Work Habits* - Unsafe actions are identified as the cause of most accidents involving the use of tools and machines. Be familiar with the equipment and know how to use it safely. Use the correct tool for the job and check its condition before starting. Observe the warnings and cautions in this manual and take special precautions when working around electrical equipment. Do not work alone if possible and do not take risks.

Be prepared if an accident does occur. Numerous agencies such as the Red Cross and your local police and fire departments offer basic courses in first aid, mouth-to-mouth resuscitation, and fire control. Take advantage of these offerings so you are ready to respond when an accident happens. Learn to be safety conscious and make safe practices a part of your work routine. Do not work when tired or after consuming any alcohol or drug that makes the operation of equipment unsafe.

GENERATOR SET REMOVAL

Service should be performed at location whenever possible due to the generator set size and weight. Some service procedures may require removal from the vessel. While there are many variations, the generator set is usually located in the bilge, and sometimes with limited service space.

Because of the variety of installations, it is not possible to specify exact removal procedures for any one set. If a satisfactory method cannot be determined, contact the vessel manufacturer to obtain their recommendations.

⚠WARNING ***Generator sets are heavy and can result in severe personal injury or death if dropped during removal. Use adequate lifting devices to provide sufficient support. Keep hands, feet and body clear while lifting.***

⚠WARNING

INCORRECT SERVICE OR REPLACEMENT OF PARTS CAN RESULT IN SEVERE PERSONAL INJURY AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.

Section 2. Generator/Voltage Regulator

GENERATOR DESCRIPTION

The YD generator (Figure 2-1) is a four-pole, revolving field, brushless exciter design with drip-proof construction. Single and three phase generators are available for both 50 and 60 hertz models.

The generator rotor is directly coupled to the engine flywheel with a flexible drive disc (engine speed determines generator output voltage and frequency). A centrifugal blower on the drive disc circulates generator cooling air which is drawn in through the end bell and discharged through an outlet in the blower end.

A ball bearing in the end bell supports the outer end of the rotor shaft. The end bell is attached with four studs that thread into the generator adapter casting. The brushless exciter stator mounts in the end bell while the exciter rotor and its rotating diode assemblies mount on the generator rotor shaft. Within the end bell, leads F1(+) and F2(-) from the exciter stator winding are connected to the output terminals of the voltage regulator.

In addition to the AC output (load) leads, control wires exit from the generator housing. The number of wires depends upon the model and options (see Figure 2-2).

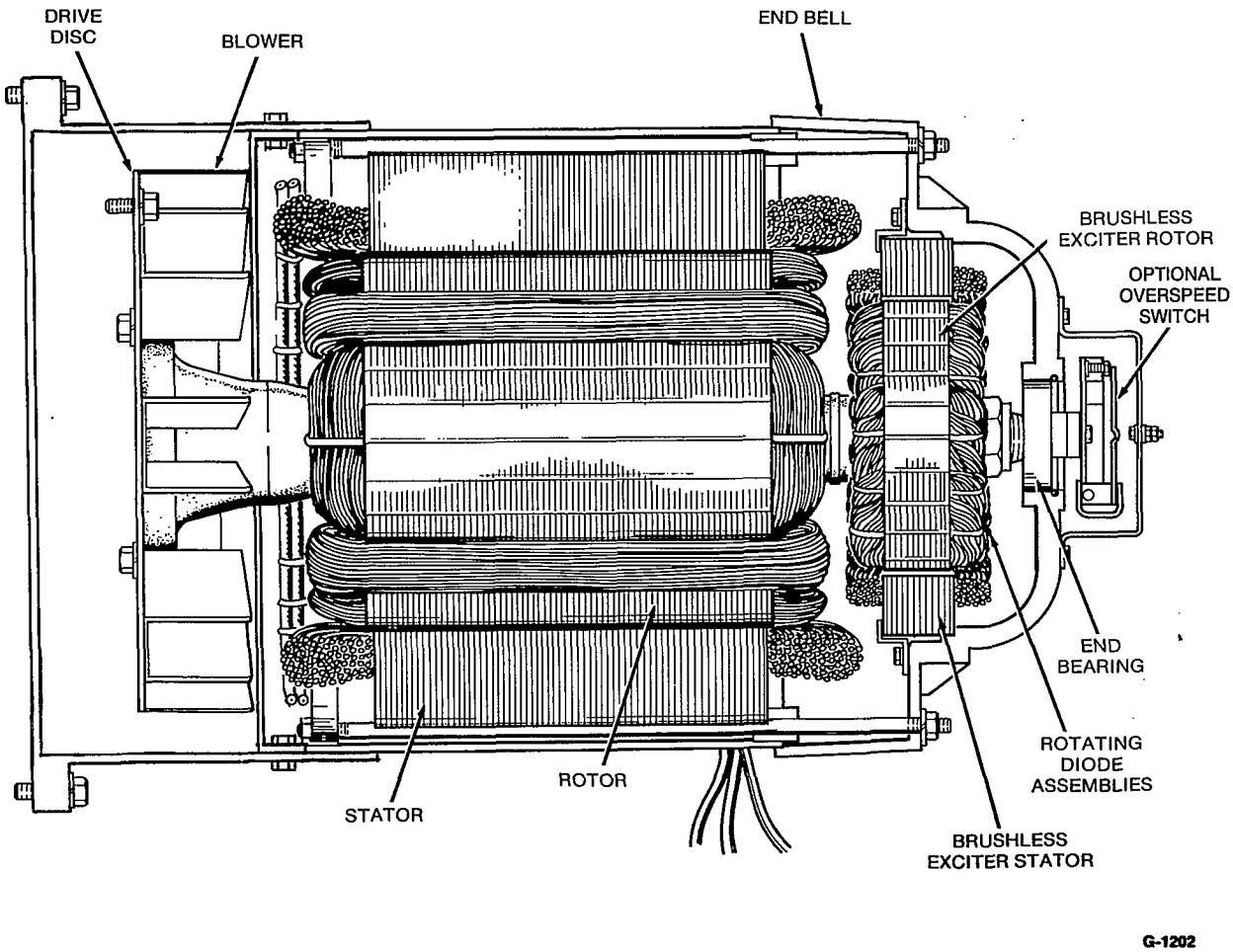
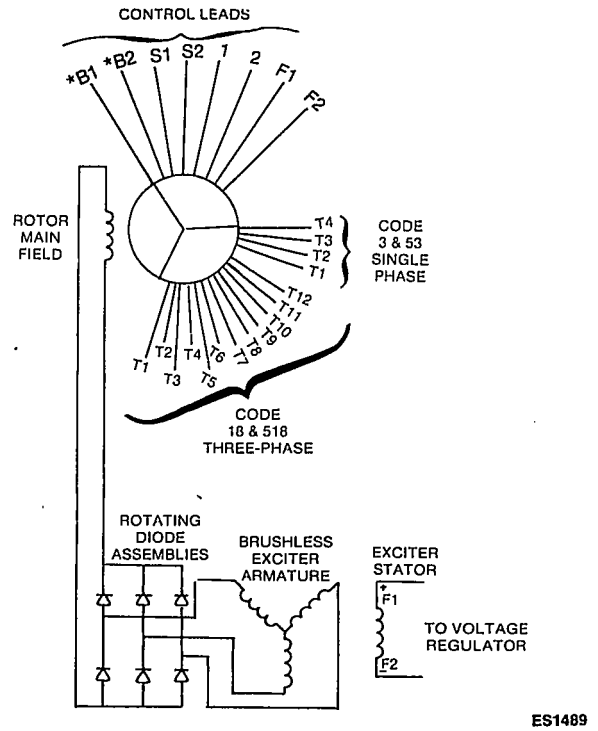


FIGURE 2-1. TYPICAL YD SERIES GENERATOR



* - USED ONLY ON 12- AND 24-VOLT SYSTEMS

FIGURE 2-2. SINGLE AND THREE PHASE GENERATOR SCHEMATIC (COMPOSITE)

GENERATOR OPERATION

Operation of the generator involves the stator, voltage regulator, exciter stator and rotor, rotating diode assemblies, and the main rotor. See Figure 2-3. A permanent magnet embedded in one exciter field pole begin the voltage build-up process as the generator set starts. Single-phase AC voltage, taken from one of the stator windings, is fed to the voltage regulator as a reference for maintaining the generator output voltage. DC voltage output from the voltage regulator is fed into the brushless exciter stator.

The exciter rotor produces three-phase AC voltage that is converted to DC by the rotating diode assemblies. The resultant DC voltage excites the main rotor winding to produce the stator output voltage for the AC load.

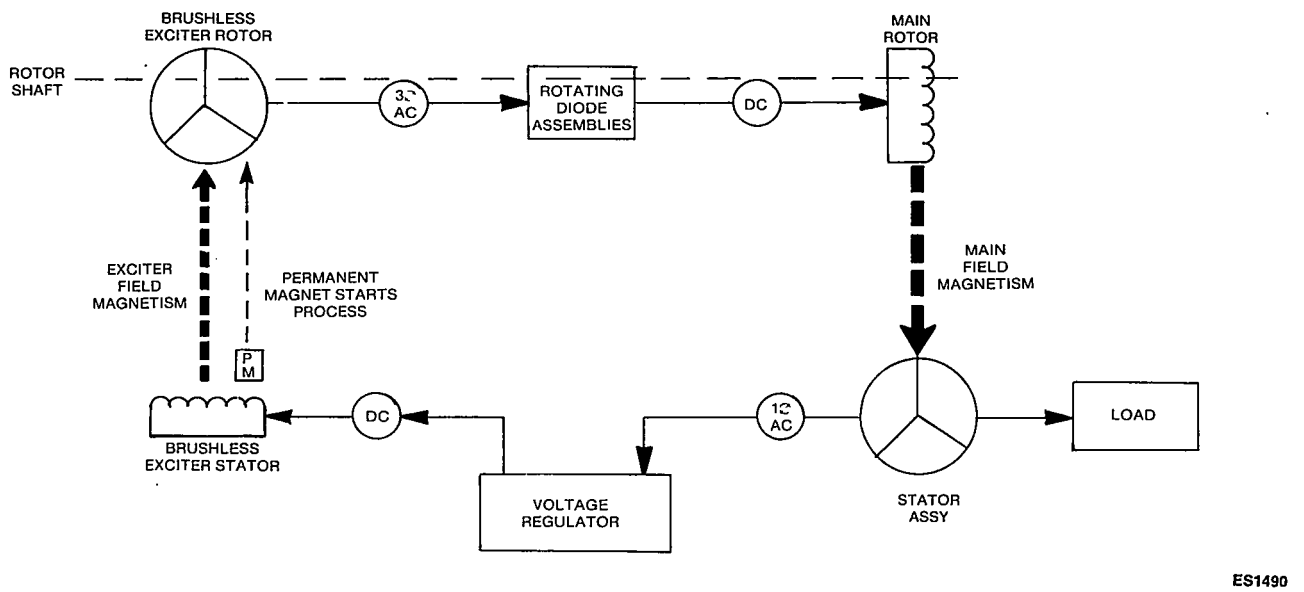


FIGURE 2-3. EXCITATION BLOCK DIAGRAM

VOLTAGE REGULATOR

The voltage regulator controls the output of the generator so that a constant voltage is maintained under varying load conditions. There are two types of voltage regulators used on these sets-transformer and electronic (solid state). The description and operation of each type is covered separately.

Transformer Voltage Regulator

The transformer voltage regulator is standard equipment on all single-phase generator sets. It is located inside the generator set control box. A typical transformer and a schematic showing circuit application is shown in Figure 2-4. The transformer provides a feedback loop from the output of the generator to its exciter.

The number of primary windings and secondary taps will change for 50 hertz and different model applications. See individual model wiring diagrams at the rear of this manual.

The transformer primary is connected in series with the generator output leads making it a current boost winding for the secondary. Separate coils in the primary allow the generator to be reconnected for other voltages without causing an output voltage unbalance.

The transformer secondary is in the exciter circuit and connected through a diode bridge. The diode bridge converts AC to DC for the exciter. Thus the exciter DC boost current is dependent upon the primary/load current.

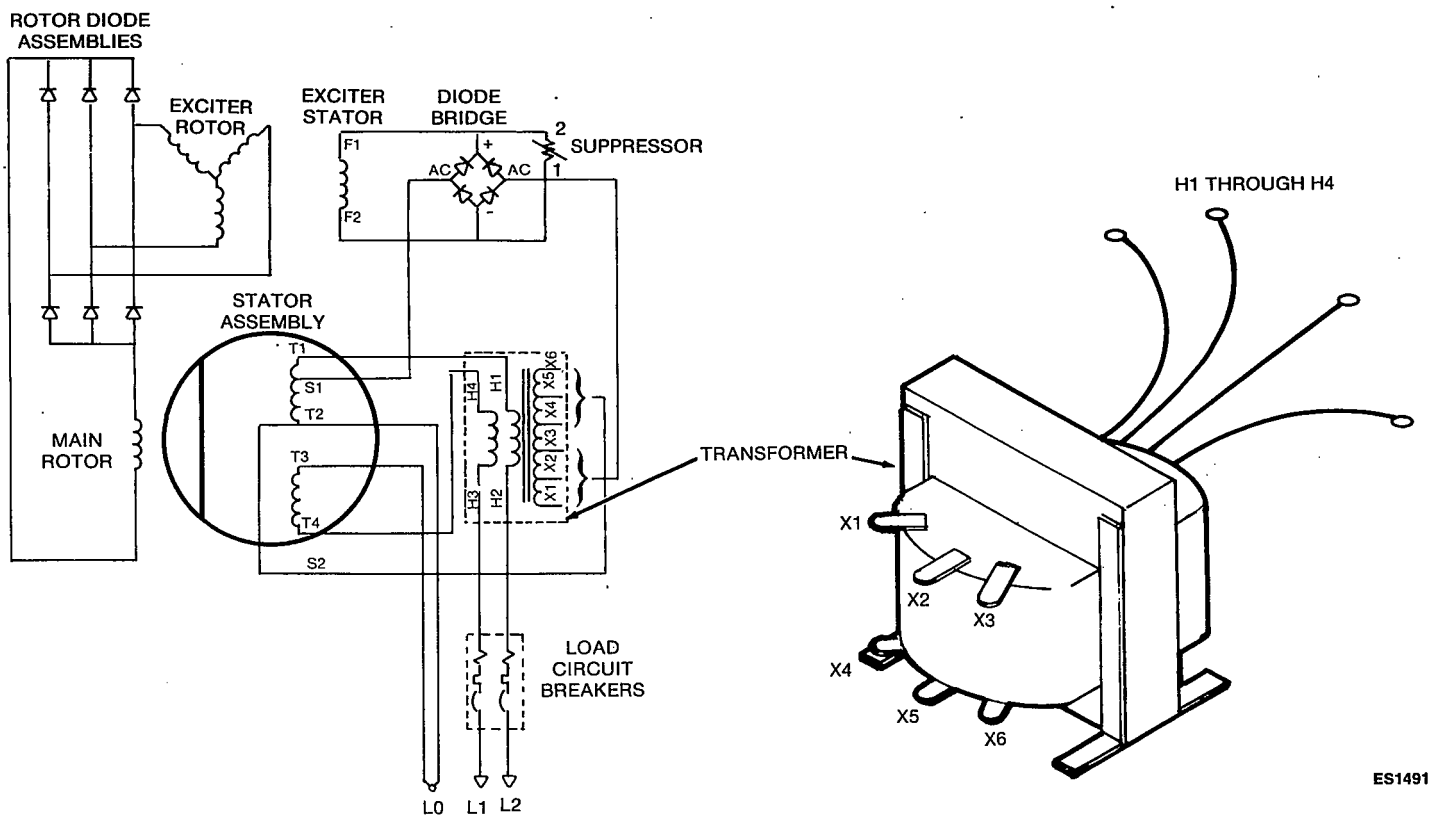


FIGURE 2-4. TYPICAL TRANSFORMER AND CIRCUIT APPLICATION

Electronic Voltage Regulator

Electronic Voltage Regulator is standard equipment on all three phase generator sets, and is optional for single phase sets. Basic components consist of the following and are shown in Figure 2-5.

- Regulator Board Assembly
- Voltage Reference Transformer T21
- Commutating Reactor L21

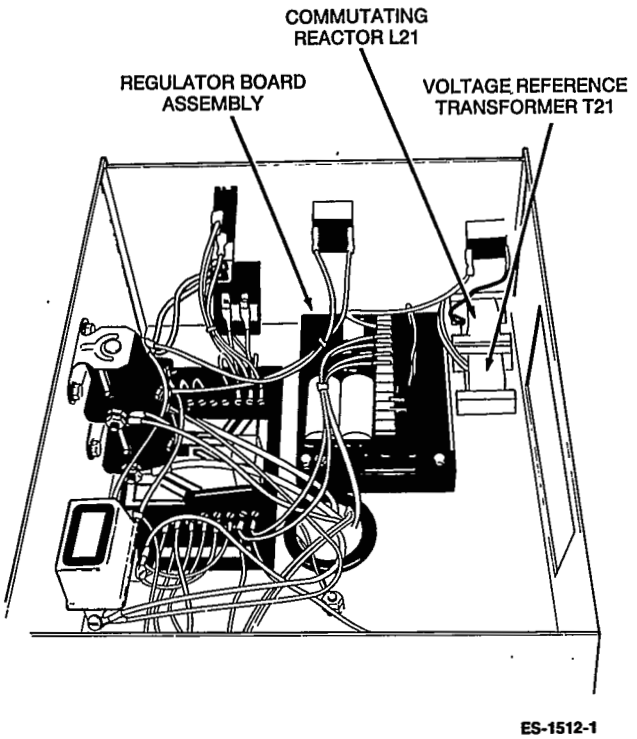


FIGURE 2-5. ELECTRONIC REGULATOR ASSEMBLY

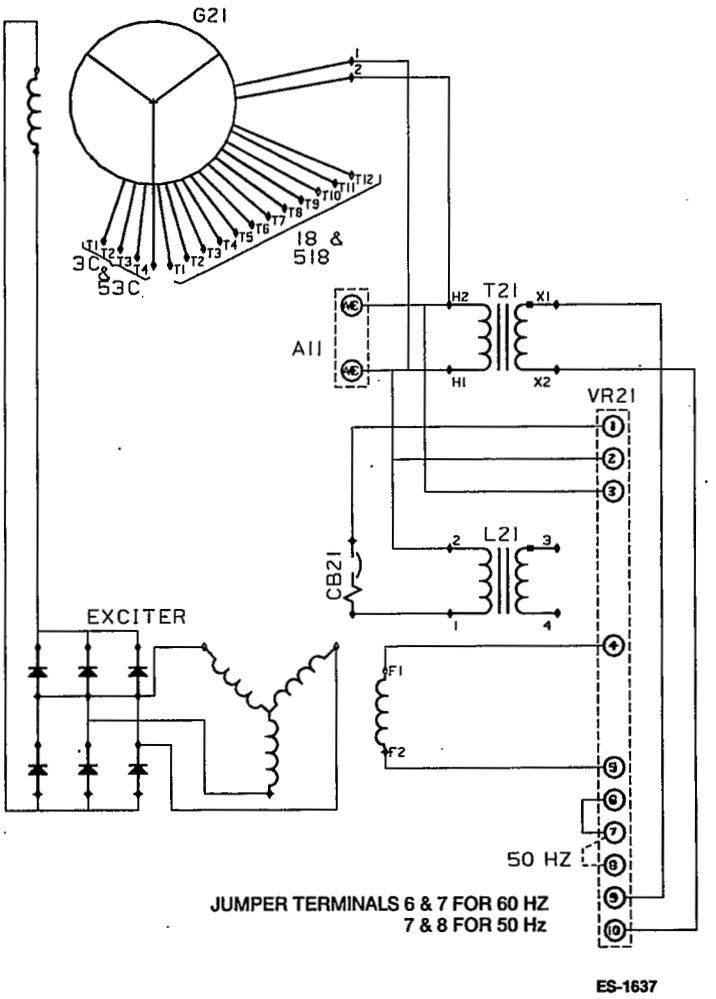


FIGURE 2-6. ELECTRONIC REGULATOR WIRING DIAGRAM

The electronic regulator provides better voltage regulation than the transformer type. It is recommended when powering non-linear SCR loads (usually associated with solid-state equipment).

Only the basic functions of the regulator are described. Current from one of the generator stator windings is supplied to the primary side (H1 and H2) of voltage reference transformer T21. See Figure 2-6 wiring diagram. AC in the secondary windings (X1 and X2) is supplied as a reference voltage to the regulator circuit board.

A rise or fall in the generator stator output voltage produces a corresponding change in the transformer secondary.

The generator stator is also connected to the commutating reactor L21. Reactor L21 is a choke used to produce a uniform AC wave to the circuit board AC input terminal VR21-1.

During operation, the regulator circuit board responds to changes in the reference voltage supplied by transformer T21. These changes raise or lower the DC output voltage produced for field excitation which results in stable output for the load.

GENERATOR SERVICE

The following sections describe the disassembly and reassembly procedures for the generator.

Disassembly

1. Disconnect the battery cables to prevent accidental starting of the generator set while servicing.

   ⚠WARNING ***Accidental starting of the set can cause severe personal injury or death. Disconnect the battery cables when repairs are made to the engine, controls, or generator.***

2. Remove cover from the control box and disconnect all stator leads. If control has load circuit breakers, disconnect leads at breaker. If lead markings do not clearly identify reconnection, mark leads with tape.
3. Remove end bell cover and remove field leads F1 and F2. If unit has an overspeed switch and battery charging components, disconnect leads at these components.
4. Remove load wires and flexible conduit from control box.
5. Remove capscrews securing the control box mounting saddle to the stator. The control box and saddle is removed as an assembly.
6. Pull stator leads through opening in bottom of control box and saddle as they are lifted free from stator. Do not disconnect any engine DC control wires in the control box.
7. Set control box and saddle on top of engine.
8. Remove overspeed switch/bracket assembly from the end bell.
9. Remove the end bell stud nuts and slide off the end bell and exciter stator. It may be necessary to pry or jar the assembly loose from the main stator assembly.
10. Use a hoist and safe lifting device (stator handling tongs, nylon lifting strap or chain and lift hooks) to support the stator assembly.
11. Remove stator assembly being careful not to touch or drag it on the rotor. Place stator on its side in the horizontal position.
12. Remove the two-section air baffle from the generator adapter.
13. Using a hoist and sling to support the rotor, carefully remove the capscrews that attach the drive disk to the engine flywheel (Figure 2-8).
14. Remove the rotor assembly and place upon wood block in the horizontal position. The drive disk and fan should not be resting on anything or distortion may occur.
15. Remove bolts that hold the drive disk and fan to the rotor shaft.
16. Use a gear puller to remove the end bearing from the rotor shaft (Figure 2-7).

    ⚠CAUTION ***The end bearing will be damaged if pulled on the outer race. If reused, the bearing must be pulled on the inner race.***

17. Clamp the rotor in a fixed position and remove the exciter rotor lock nut.
18. Remove the generator field leads from the exciter rotor and slide the exciter off the rotor shaft.

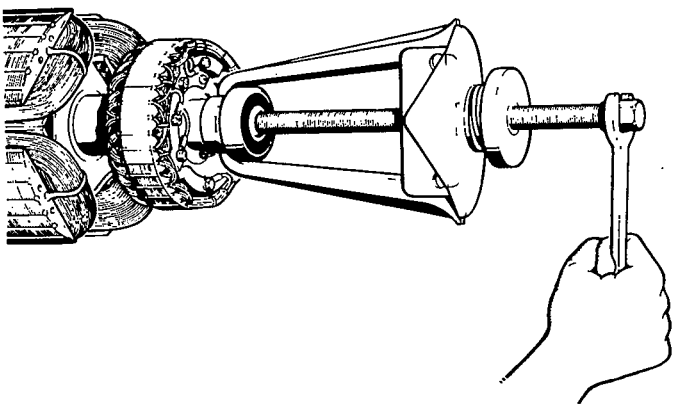


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FIGURE 2-7. END BEARING REMOVAL

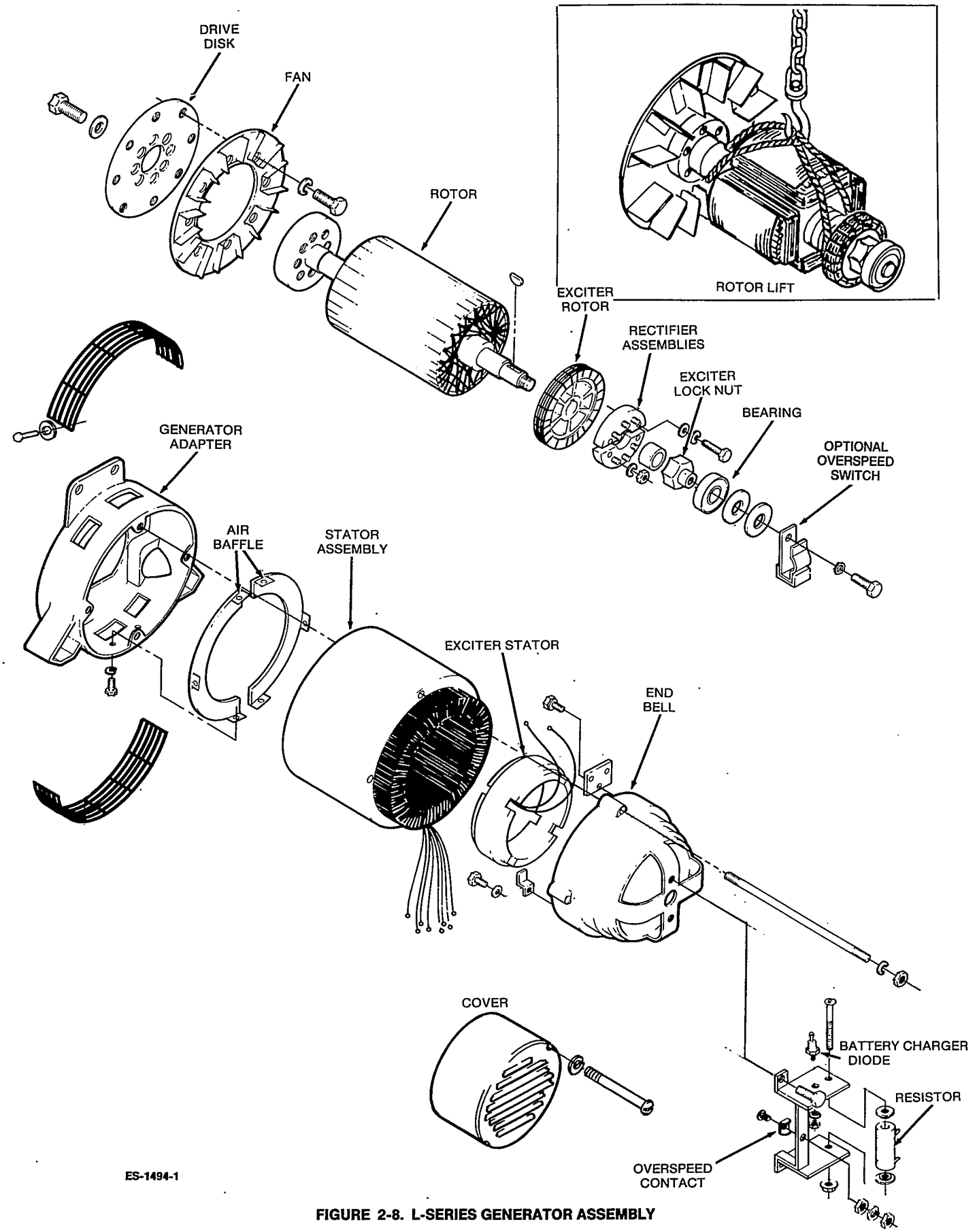


FIGURE 2-8. L-SERIES GENERATOR ASSEMBLY

Reassembly

1. Slide the exciter rotor over the generator shaft and woodruff key. Install the exciter nut and apply torque values shown in Figure 2-9.
2. Connect generator field leads to F1+ and F2- terminals on exciter assembly. Torque to values shown.
3. Press the end bearing onto the rotor shaft.
4. Assemble rotor fan and drive disk to the engine flywheel. Use a hoist and sling to support rotor. Be sure the drive disk is assembled with the chamfer on the flywheel side. Apply torque values shown in Figure 2-9.
5. Install air baffle.
6. Using a hoist and safe lifting device, carefully move the stator into position over the rotor. The leads should exist in the top position.
7. Install the end bell stud bolts through the stator and into the generator adapter.
8. Apply a thin film of Molykote grease to mating surfaces of the end bearing and the end bearing hole. Install end bell assembly on the stator with the generator lead opening at top position.
9. Torque end bell stud nuts to 20 ft lbs. (27 N•m).
10. Using a lead hammer tap the end bell at the horizontal and vertical plane to relieve stress. Retorque end bell stud nuts.
11. Feed stator and control leads through opening in control box and saddle and secure saddle to the generator.
12. Install the overspeed switch bracket assembly to the end bell.
13. Connect all applicable control leads (F1, F2, overspeed, battery charging, etc.) and verify that all connections are secure.
14. Install the end bell cover.
15. Connect the stator wires to the load wires.
16. Connect the negative (-) battery cable and test generator operation.

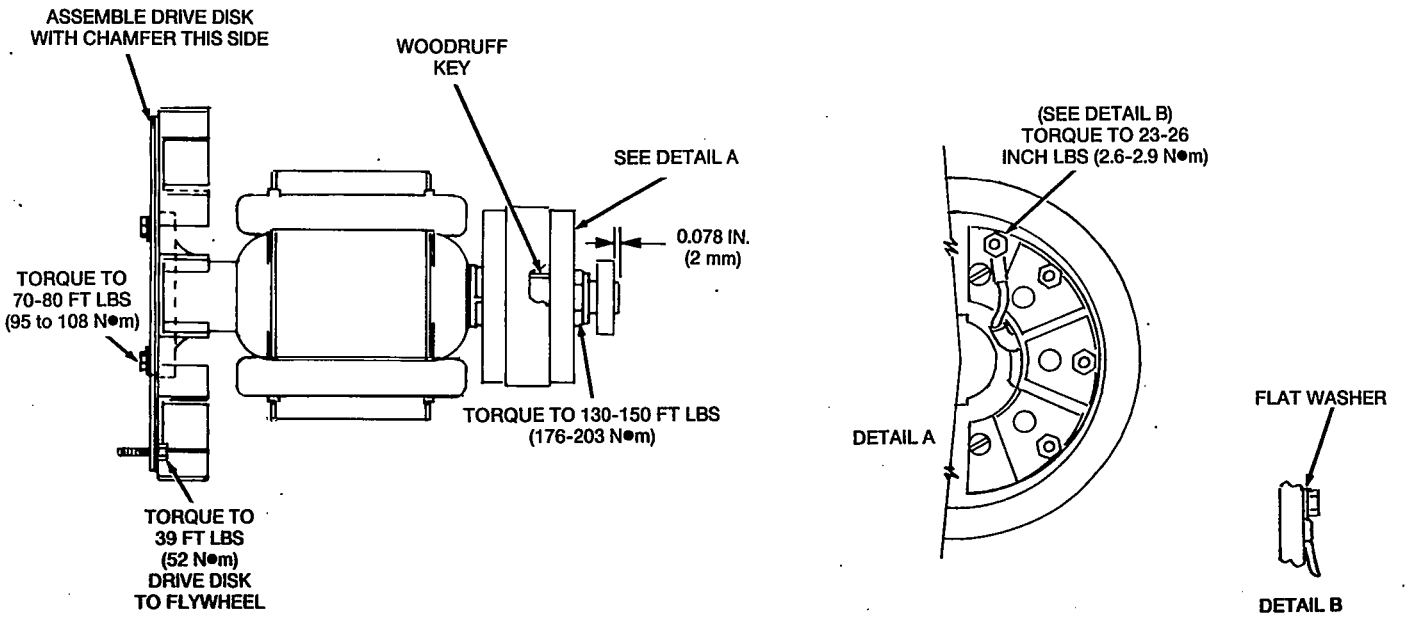


FIGURE 2-9. ROTOR ASSEMBLY AND TORQUE VALUES

Section 3.
Generator/Regulator Troubleshooting

PREPARATION

A few simple checks and a proper troubleshooting procedure can locate the probable source of trouble and reduce down time.

- Check all modifications, repairs, replacements performed since last satisfactory operation of set to ensure that connection of generator leads are correct. A loose wire connection, overlooked when installing a replacement part could cause problems. An incorrect connection, an opened circuit breaker, or a loose connection on printed circuit board are all potential malfunction areas to be eliminated by a visual check.

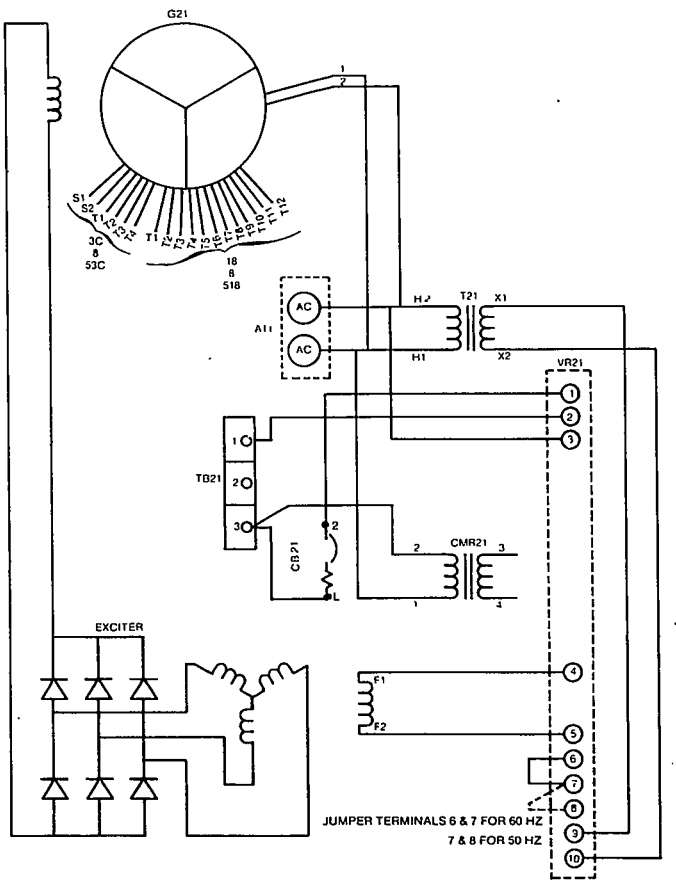
TROUBLESHOOTING PROCEDURES

This section contains service information for single and three phase generators using transformer and electronic voltage regulators. Determine the problem and then refer to the appropriate flow chart (A,B,C,D, or E) for troubleshooting procedures.

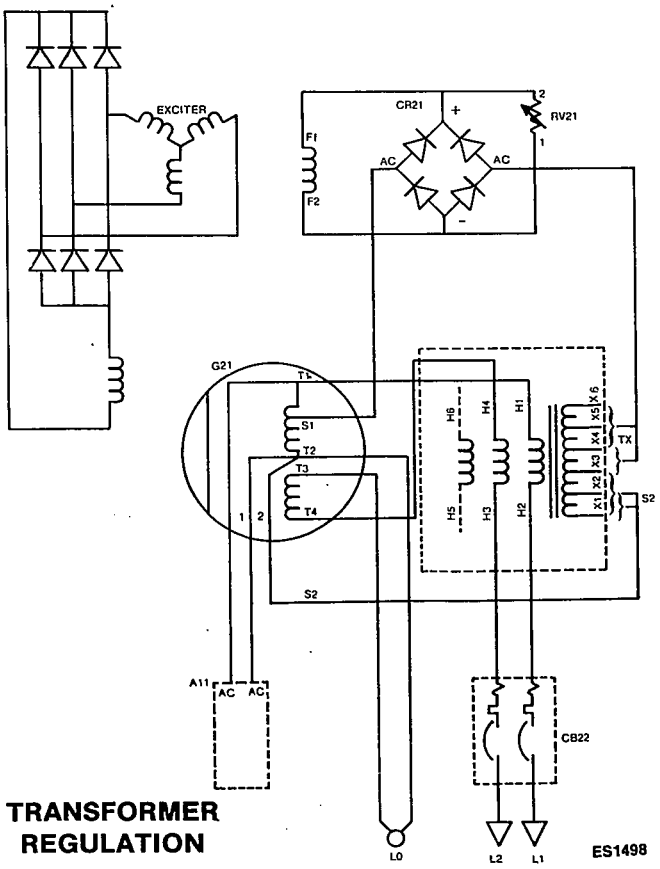
A. NO AC OUTPUT VOLTAGE AT RATED ENGINE RPM.
B. UNSTABLE OUTPUT VOLTAGE, ENGINE SPEED STABLE
C. OUTPUT VOLTAGE TOO HIGH OR LOW
D. EXCITER FIELD BREAKER TRIPS
E. UNBALANCED GENERATOR OUTPUT VOLTAGE

To troubleshoot a problem, start at upper-left corner of the chart related to problem, and answer all questions either YES or NO. Follow the chart until the problem is found, performing referenced Adjustment and Test procedures following the Flow Charts.

Referenced components in the Flow Charts and Adjustment and Test procedures can be found on the electrical schematic (Figure 3-1) and on assembly drawings and wiring diagrams.



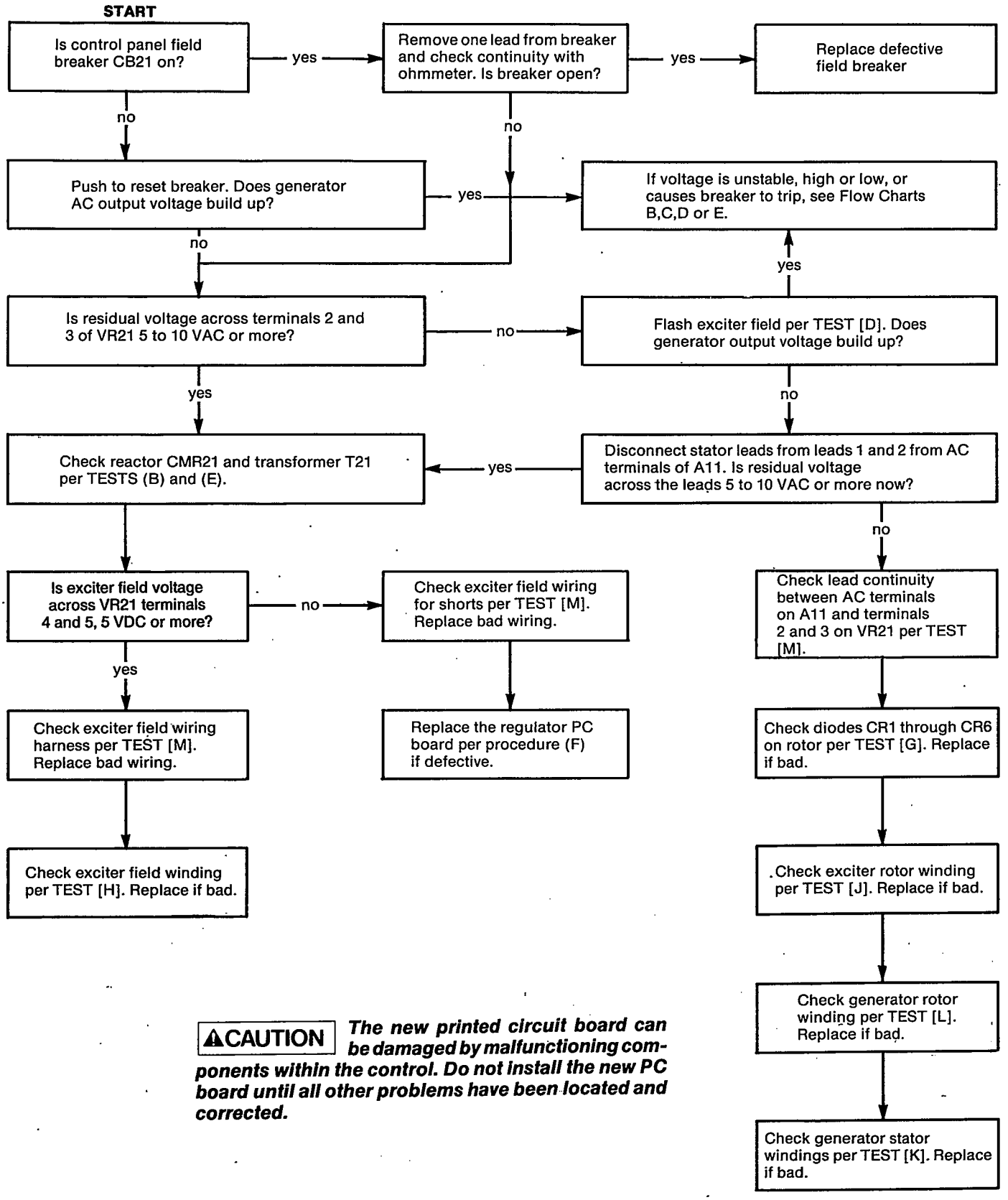
ELECTRONIC REGULATION



TRANSFORMER REGULATION

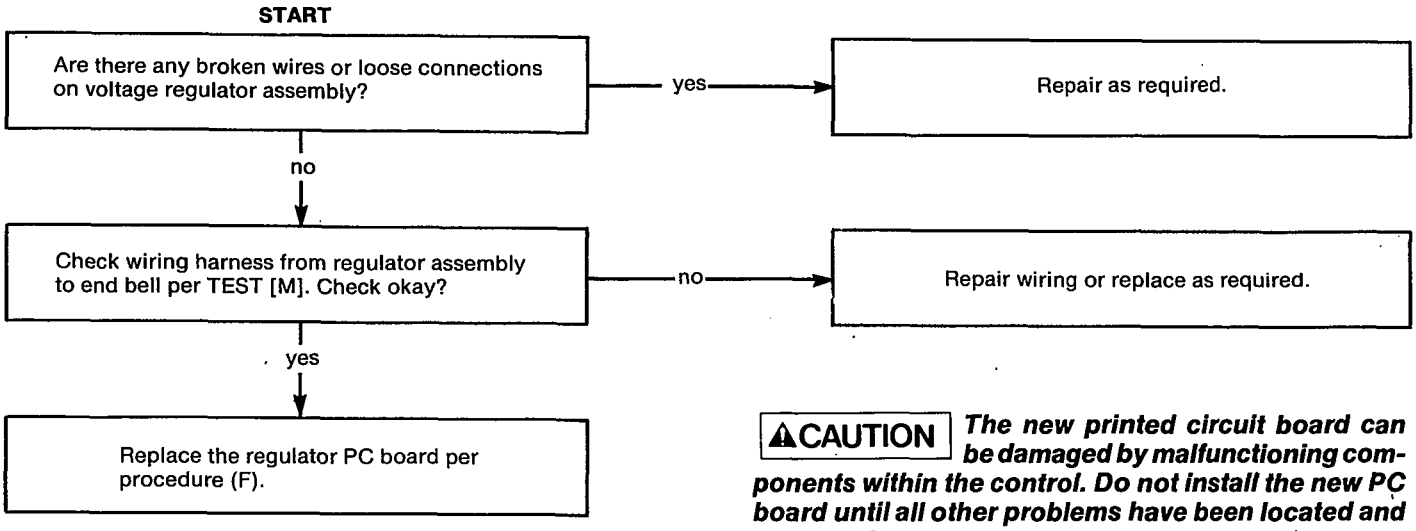
FIGURE 3-1. TYPICAL SCHEMATICS-ELECTRONIC AND TRANSFORMER REGULATION

ELECTRONIC VOLTAGE REGULATOR
FLOW CHART A. NO AC OUTPUT VOLTAGE AT RATED ENGINE RPM



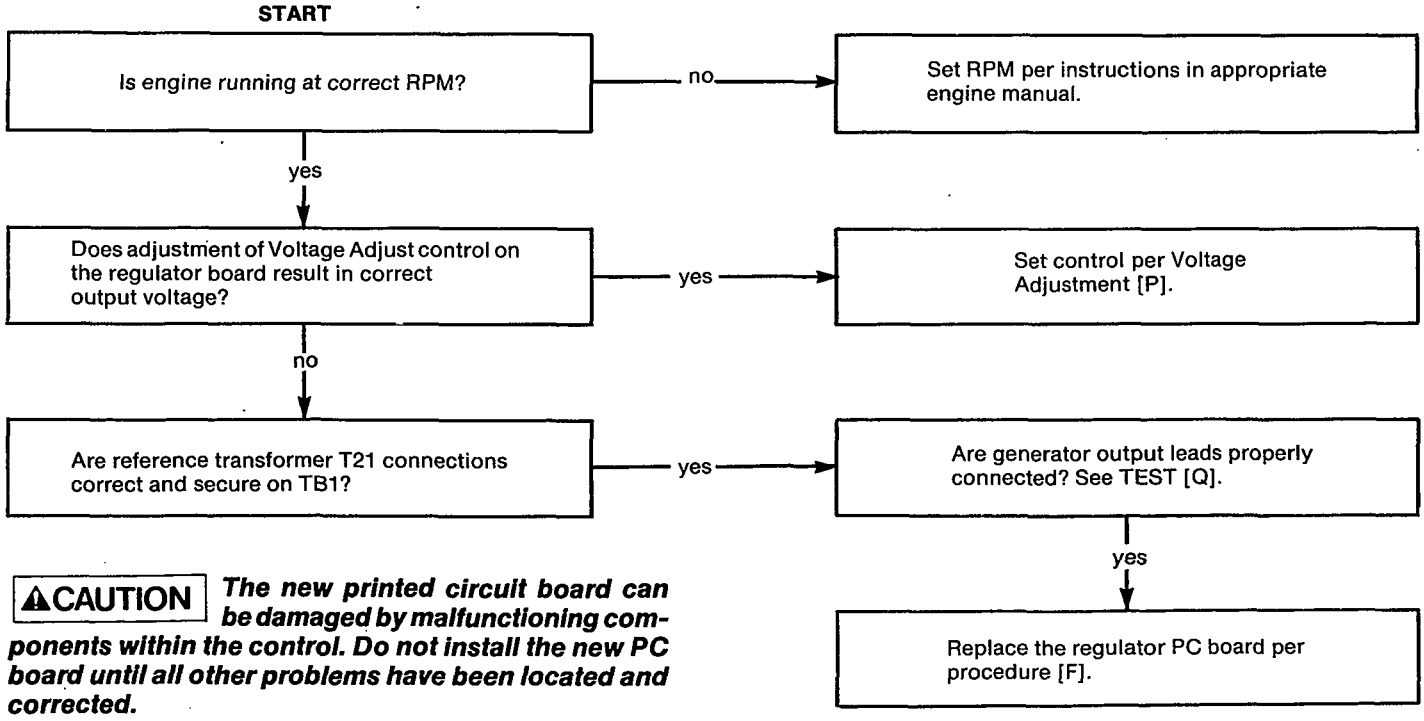
⚠CAUTION ***The new printed circuit board can be damaged by malfunctioning components within the control. Do not install the new PC board until all other problems have been located and corrected.***

ELECTRONIC VOLTAGE REGULATOR
FLOW CHART B. UNSTABLE VOLTAGE, ENGINE SPEED STABLE



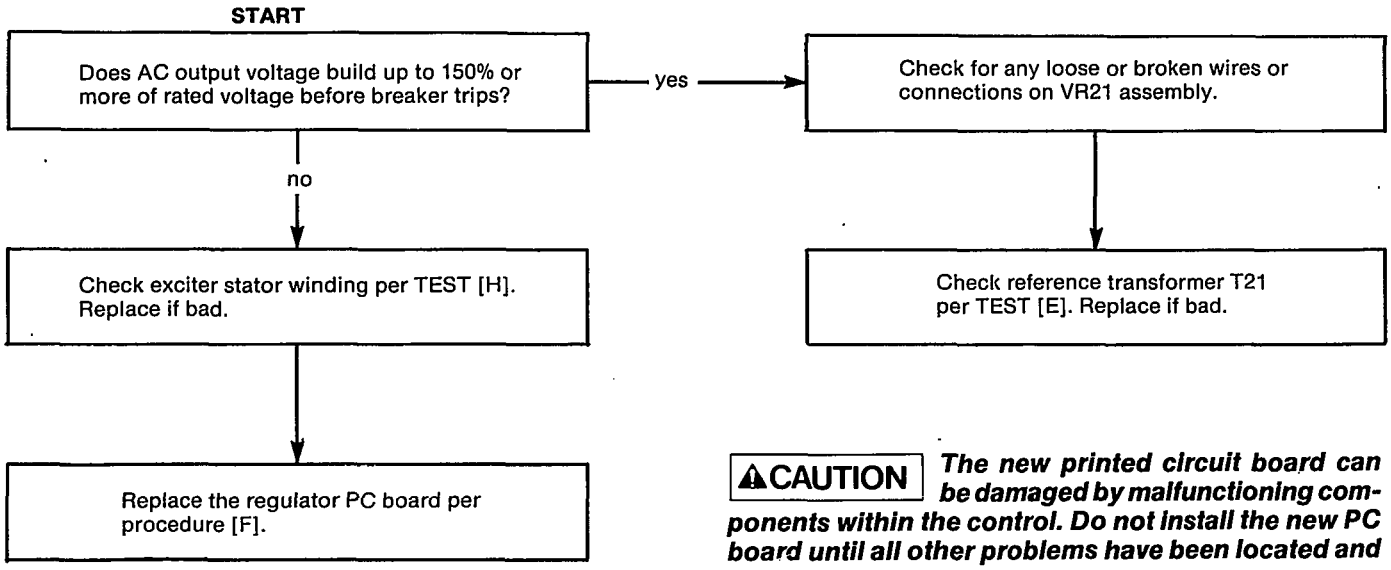
⚠CAUTION ***The new printed circuit board can be damaged by malfunctioning components within the control. Do not install the new PC board until all other problems have been located and corrected.***

ELECTRONIC VOLTAGE REGULATOR
FLOW CHART C. OUTPUT VOLTAGE TOO HIGH OR LOW



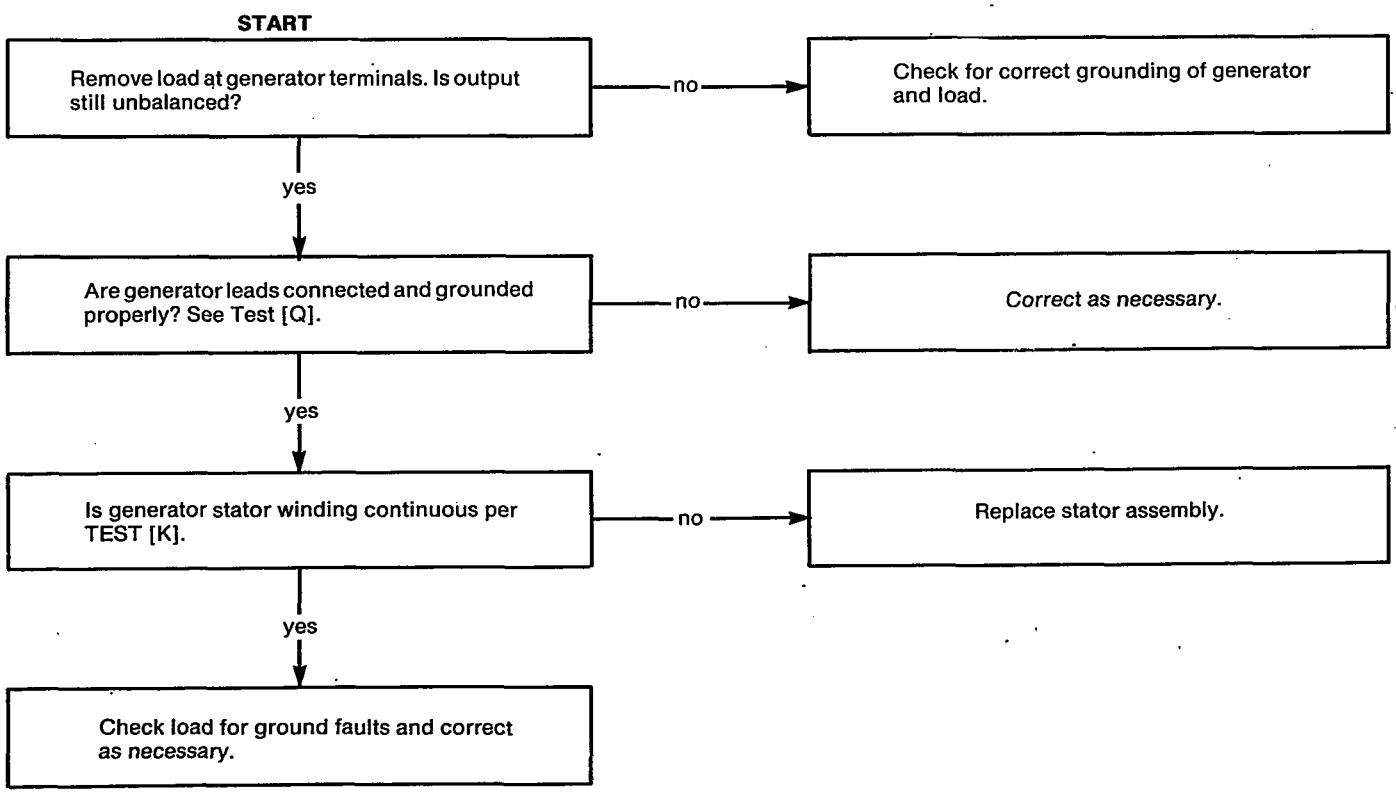
⚠CAUTION ***The new printed circuit board can be damaged by malfunctioning components within the control. Do not install the new PC board until all other problems have been located and corrected.***

ELECTRONIC VOLTAGE REGULATOR
FLOW CHART D. FIELD BREAKER TRIPS

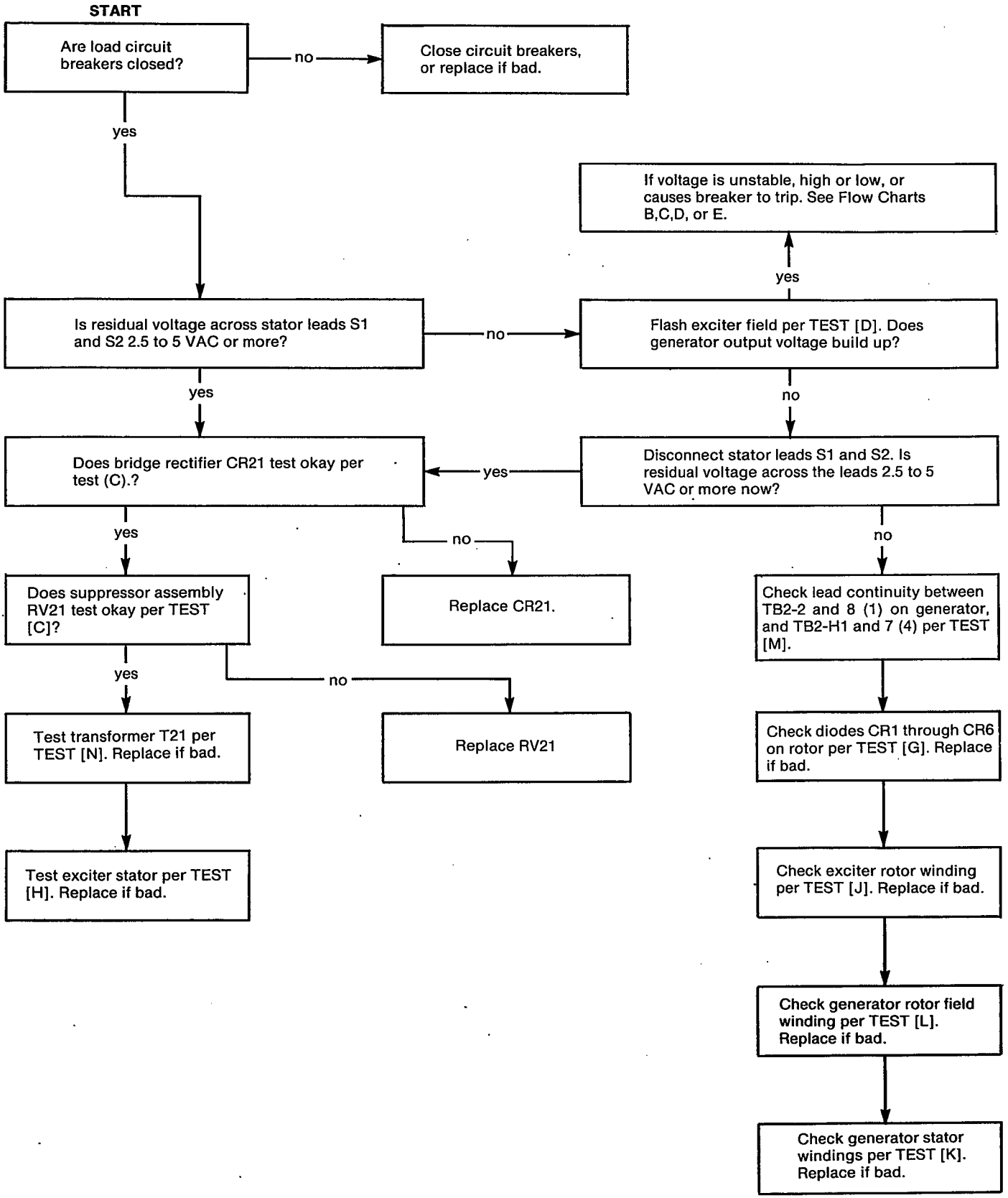


⚠CAUTION ***The new printed circuit board can be damaged by malfunctioning components within the control. Do not install the new PC board until all other problems have been located and corrected.***

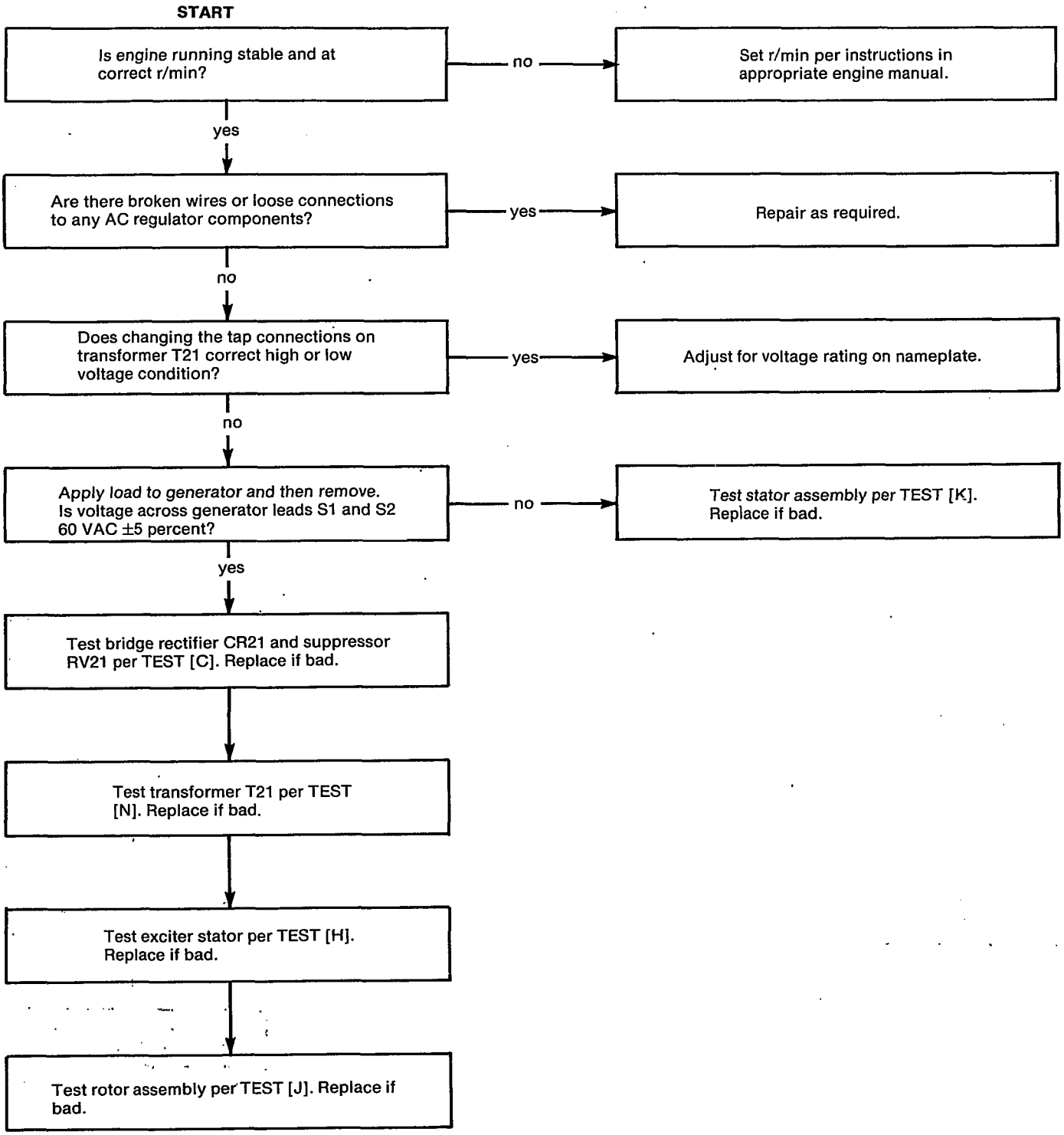
TRANSFORMER AND ELECTRONIC VOLTAGE REGULATOR
FLOW CHART E. UNBALANCED GENERATOR OUTPUT VOLTAGE



TRANSFORMER VOLTAGE REGULATOR
FLOW CHART A. NO AC OUTPUT VOLTAGE AT RATED ENGINE RPM



TRANSFORMER VOLTAGE REGULATOR
FLOW CHART B. OUTPUT VOLTAGE TOO HIGH, TOO LOW, OR UNSTABLE



Section 4. Generator/Regulator Tests

GENERAL

All of the following Adjustments and Tests can be performed without disassembly of the generator. They should be used for testing generator regulator components in conjunction with the troubleshooting flow charts in Section 3.

[A]

TESTING AC RESIDUAL VOLTAGE

Test for residual AC voltage if there is no AC power output from the generator. Check between generator leads 1 and 2 (electronic regulation controls), between S1 and S2 (transformer regulation controls). See Figure 3-1. Residual voltage should be as follows:

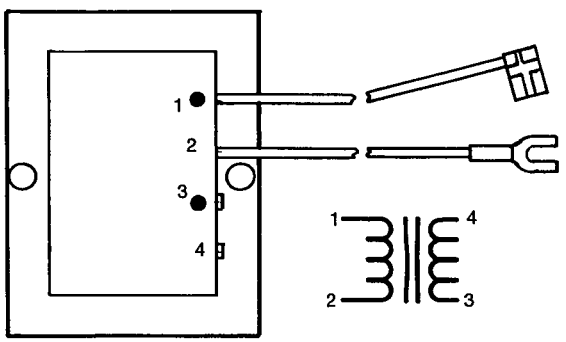
Electronic Regulation 5 to 10 VAC (or *more).
Transformer Regulation 2.5 to 5 VAC (or *more).
*Residual output can be 35 to 50 VAC.

[B]

TESTING COMMUTATING REACTOR

The commutating reactor is shown in Figure 4-1. It is referenced L21 on the schematics. Only one winding of the reactor (leads 1 and 2) is used on these model series. Remove reactor leads from terminal board for testing.

Resistance across 1 and 2 should be 330 to 390 milliohm at 77°F (25°C). Resistance between winding and the reactor frame should be infinity.



ES1500

FIGURE 4-1. COMMUTATING REACTOR

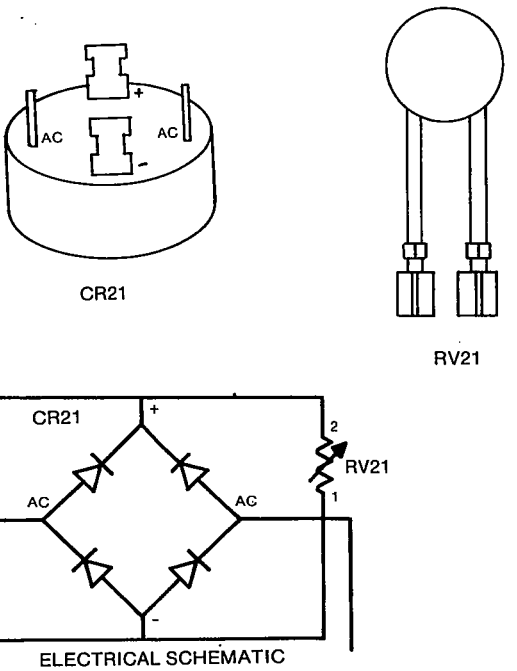
[C]

TESTING RECTIFIER BRIDGE CR21 AND SUPPRESSOR RV21

The rectifier bridge and suppressor are located within the control box of transformer regulated sets. The bridge contains four diodes as shown in Figure 4-2. They are encapsulated within a hermetically sealed block, and failure of any diode means replacement of the entire bridge.

Disconnect wires from the bridge prior to testing. Check forward resistance with an ohmmeter on the R x 1 scale; reverse resistance on the R x 10K scale. Forward resistance should be 6 to 50 ohms, and reverse resistance infinity.

If CR21 is defective, the suppressor RV21 should also be replaced. RV21 should have infinite ohmmeter readings in both directions.



ES1501

FIGURE 4-2. RECTIFIER BRIDGE, SUPPRESSOR ASSEMBLY

[D]

FLASHING THE FIELD

If output voltage does not build up it may be necessary to restore residual magnetism by flashing the field. Assemble a 12-volt storage battery, 10-amp fuse, momentary-on switch, and diode as shown in Figure 4-3.

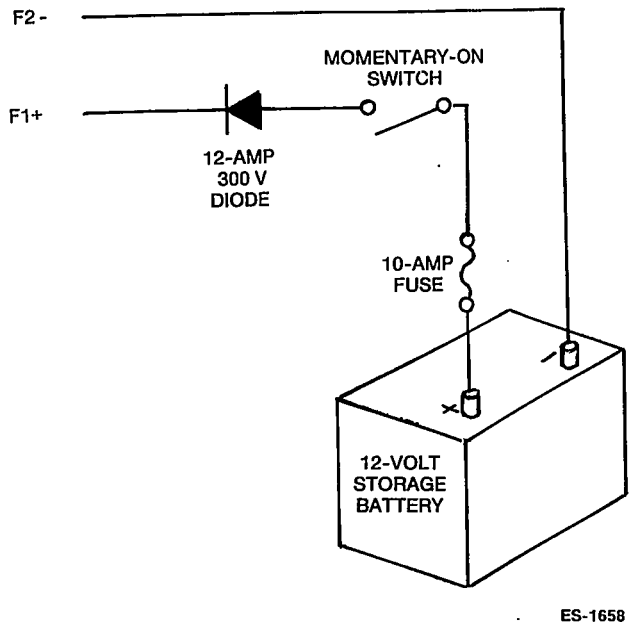


FIGURE 4-3. FIELD FLASHING CIRCUIT

Start the generator set and operate at normal speed. Connect the positive lead to the F1 (+) exciter stator lead, and the negative lead to the F2 (-) exciter lead. Close the switch just long enough for the generator output voltage to build up.

⚠CAUTION ***Incorrect flashing procedure can damage the voltage regulator. Do not keep excitation circuitry connected longer than 5 seconds.***

[E]

TESTING REFERENCE TRANSFORMER

The reference transformer has four leads; two primary leads marked H1 and H2 and two secondary leads marked X1 and X2. See Figure 4-4. Resistance readings are made with leads disconnected. The resistance of either coil should be 100 ohms ± 10% at 75°F (25°C). Resistance between leads and transformer frame should be infinity.

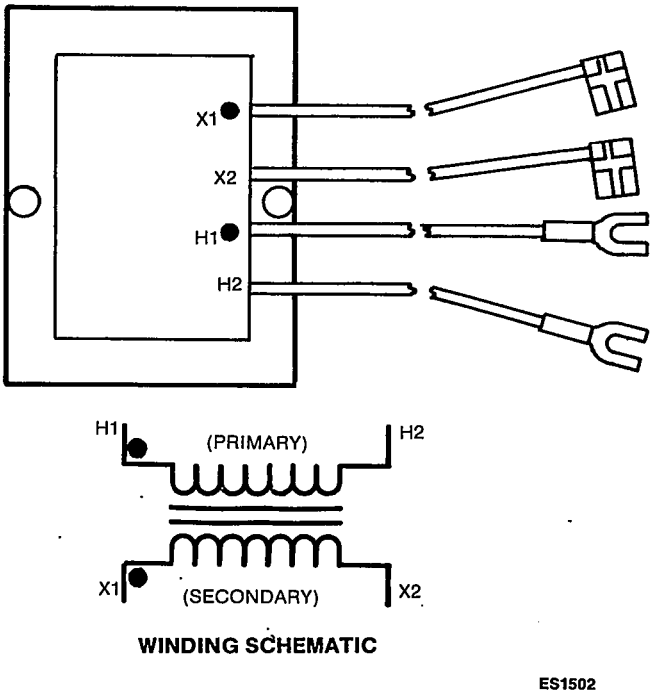


FIGURE 4-4. REFERENCE TRANSFORMER

[F]

VR21 REPLACEMENT

Use the following procedure for replacing the voltage regulator PC board or VR chassis.

1. Stop engine.
2. Disconnect and if necessary, label wires. Refer to AC control wiring diagram.
3. Remove four screws at corners.
4. Remove old PC board.
5. Install new PC board; secure with four screws.
6. Reconnect wires removed in step 2 at proper terminals.

Set voltage as outlined in test (P) "Voltage Adjustment".

[G]

TESTING ROTATING RECTIFIERS

Two different rectifier assemblies make up the rotating rectifier bridge assembly, Figure 4-5. Using an accurate ohmmeter, test each CR using negative and positive polarities. Test rectifiers as follows:

1. Disconnect all leads from assembly to be tested.
2. Connect one test lead to F1+ stud and connect other lead to CR1, CR2, and CR3 in turn; record resistance value of each rectifier.
3. Connect one lead to F2- stud and connect other lead to CR4, CR5, and CR6 in turn; record resistance valve of each rectifier.
4. Reverse ohmmeter leads from steps 2 and 3 and record resistance value of each rectifier F1+ to CR1, CR2, and CR3 and F2- to CR4, CR5, and CR6.
5. All the resistance readings should be high in one test and low in the other test. If any reading is high or low in both tests, rectifier assembly is defective.
6. Replace defective rectifier assembly with new identical part.

Use 23 to 26 inch lbs (2.6 to 2.9 N•m) torque when replacing nuts of F1+ and F2-, CR1, CR2, CR3, CR4, CR5, and CR6.

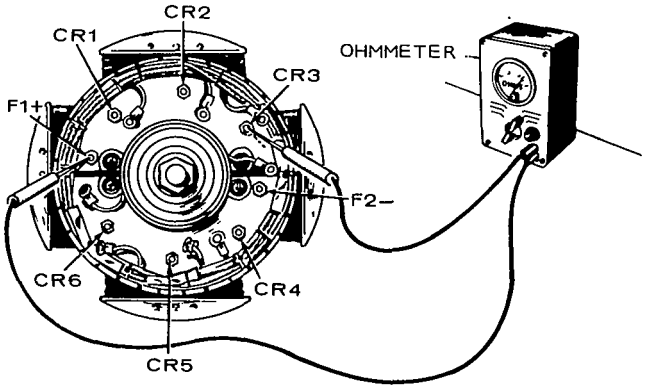


FIGURE 4-5. TESTING ROTATING RECTIFIERS

[H]

TESTING EXCITER STATOR

Test the exciter stator (Figure 4-6) for open or shorted windings and grounds as follows:

Testing for Open or Shorted Windings

Disconnect F1+ and F2- exciter field leads from terminal block in generator end bell. The resistance between field leads should be 13 to 16 ohms on MDL6 and MDL4 series sets, and 11 to 14 ohms on MDL3 series sets at 77°F (25°C).

Testing for Grounds

Connect ohmmeter between either field lead and exciter stator laminations. Use ohmmeter set at the highest resistance range. Resistance must be one megohm (1,000,000 ohms) or greater.

The preferred test is with a Megger or insulation resistance meter that applies 500 VDC or more to the test leads. Readings should be 100,000 ohms or greater.

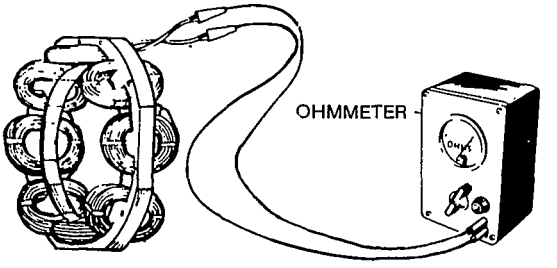


FIGURE 4-6. MEASURING EXCITER STATOR RESISTANCE

[J]

TESTING EXCITER ROTOR

Test the exciter rotor (Figure 4-7) for open or shorted windings or grounds as follows:

Testing for Open or Shorted Windings

Use a Wheatstone Bridge or digital ohmmeter for this test. Disconnect main rotor field leads which connect to rotating rectifier assemblies at F1+ and F2-. Disconnect lead wires from diodes CR1, CR2, CR3, CR4, CR5 and CR6. Test between exciter lead pairs T1-T2, T2-T3, and T1-T3. Resistance at 77°F (25°C) should be 581 to 710 milliohms on MDL6 and MDL4 series generators, and 486 to 594 milliohms on MDL3 series generators.

Testing for Grounds

Connect leads of ohmmeter between any CR lead and exciter rotor laminations. Use an ohmmeter set at the highest resistance range. An ohmmeter reading less than one megohm (1,000,000 ohms) indicates defective ground insulation.

The preferred test is with a Megger or insulation resistance meter that applies 500 VDC or more to the test leads. Be sure all exciter leads are disconnected from the diodes. Readings should be 100,000 ohms or greater.

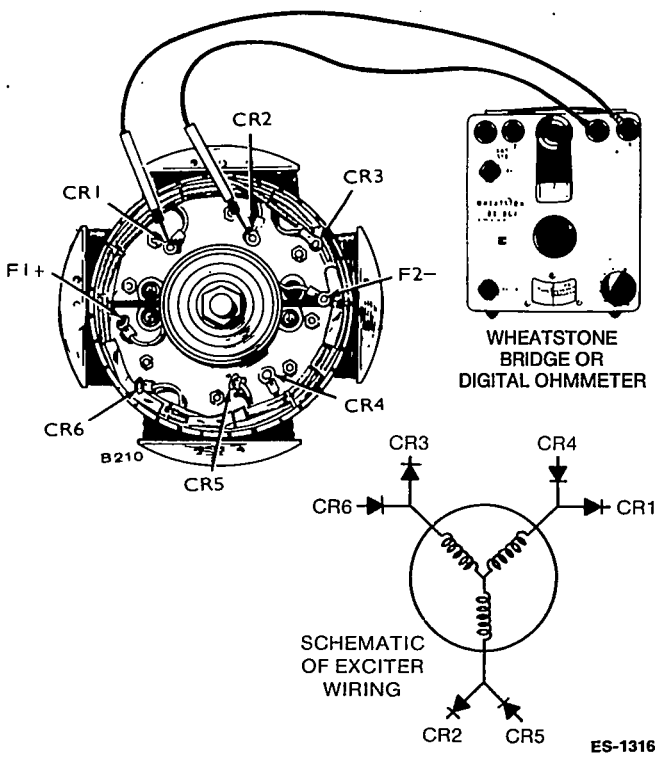


FIGURE 4-7. TESTING EXCITER ROTOR

[K]

TESTING GENERATOR STATOR

Using proper test equipment, check the stator for grounds, opens, and shorts in the windings.

Testing for Grounds

Some generators have ground connections to the frame. Check wiring diagram. All stator leads must be isolated for testing.

Use a Megger or insulation resistance meter which applies 500 VDC or more to the test leads. Test each stator winding for short to laminations. A reading less than 100,000 ohms indicates a questionable stator. Oven dry the stator and retest.

Testing for Open or Shorted Windings

Test for continuity between coil leads shown in Figure 4-8; all pairs should have equal resistance. Use an accurate instrument for this test such as a Kelvin Bridge or digital ohmmeter. Resistance values at 77°F (25°C) are given in Table 4-1.

If any windings are shorted, open or grounded, replace the stator assembly. Before replacing the assembly, check the leads for broken wires or insulation.

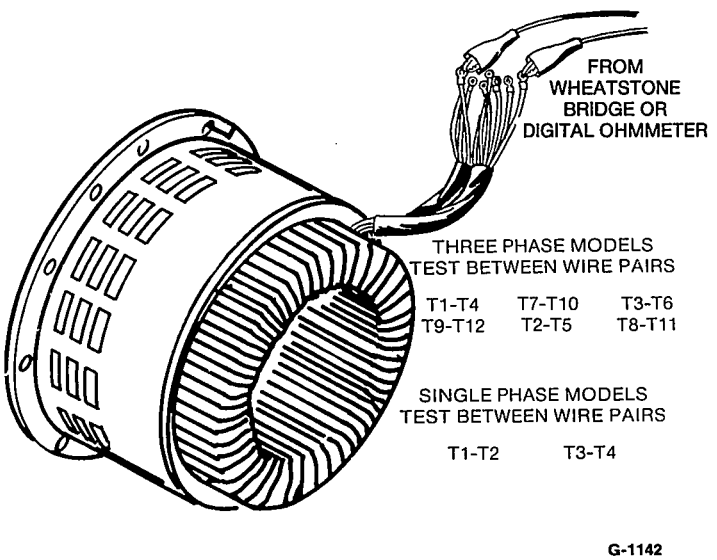


FIGURE 4-8. TESTING STATOR WINDINGS

TABLE 4-1. STATOR RESISTANCE VALUES IN MILLIOHMS, ±10%

kW RATING AND MODEL		VOLTAGE CODE				
50 HERTZ	60 HERTZ	18	518	3C	53C 120/240	53B 110/220
10.0MDL3 12.0MDL3			200		95	
	12.5MDL3 15.0MDL3	220		80		
16.0MDL4			183		61	
	20.0MDL4	158		37		
25.0MDL6			84		29	27
	30.0MDL6	72		25		

[L]

TESTING GENERATOR ROTOR

For these tests, use a Megger or insulation resistance meter which applies 500 VDC or more to the test leads.

Testing for Grounds

Check for grounds between each rotor lead and the rotor shaft, Figure 4-9. Perform tests as follows:

1. Remove rotor leads F1+ and F2- from the rotating rectifier assemblies.
2. Connect test leads between F1+ and rotor shaft. Meter should register 100,000 ohms or greater.
3. If less than 100,000 ohms, rotor is questionable. Oven dry the rotor and retest.
4. Replace a grounded rotor with a new identical part.

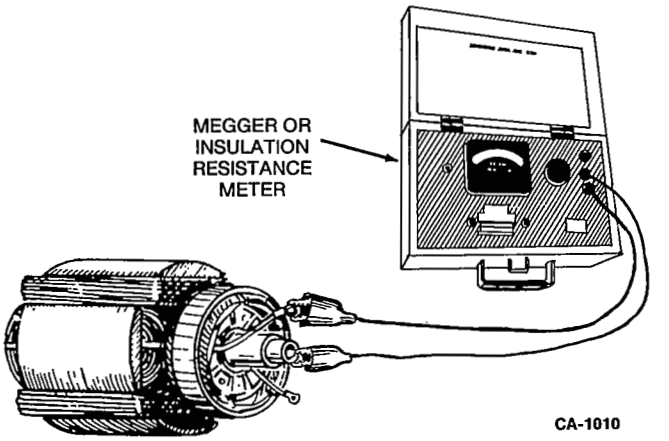


FIGURE 4-9. TESTING ROTOR FOR GROUNDS

Testing for Open or Shorted Windings

Perform tests as follows:

1. Remove rotor leads F1+ and F2- from rotating rectifier assemblies.
2. Using ohmmeter, check resistance between F1 and F2 leads, Figure 4-10.

   The resistance values at 77°F (25°C) should be as shown in Table 4-2. If not, replace defective rotor with new, identical part.

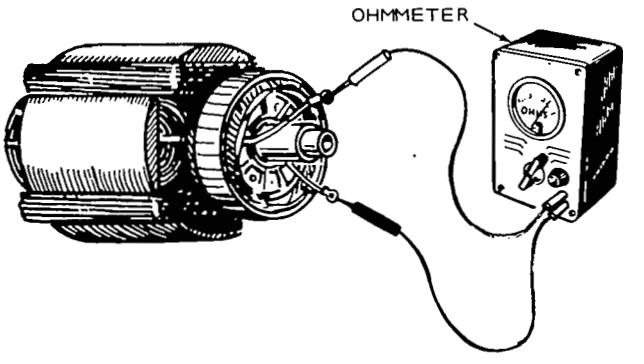


FIGURE 4-10. TESTING ROTOR FOR AN OPEN CIRCUIT

TABLE 4-2. ROTOR RESISTANCE VALUES

Model	Ohms Resistance	
	Code 3 & 53	Code 18 & 518
MDL3	2.40	2.40
MDL4	1.98	2.75
MDL6	2.91	2.91

[M]

WIRING HARNESS CHECK

Carefully check wiring harnesses as follows:

1. Inspect all wires for breaks, loose connections, and reversed connections. Refer to applicable wiring diagram.
2. Remove wires from terminals at each end and using an ohmmeter, check each wire end to end for continuity or opens.
3. Using an ohmmeter, check each wire against each of the other wires and to ground for possible shorts or insulation breaks under areas covered by wrapping material.
4. Reconnect or replace wires according to applicable wiring diagram.

[N]

TESTING REGULATING TRANSFORMER T21

Regulating transformer T21 is used only on single phase generators. It consists of a multi-coil primary and a multi-tapped secondary. Figure 4-11 shows a typical transformer. Some transformers may have up to three coils in the primary and six taps on the secondary.

DC resistance of windings at 77°F (25°C) are shown in Table 4-3. Resistance between primary and secondary and the transformer frame should be over 100,000 ohms when measured with a Megger or insulation resistance meter. The part number is stamped on the transformer.

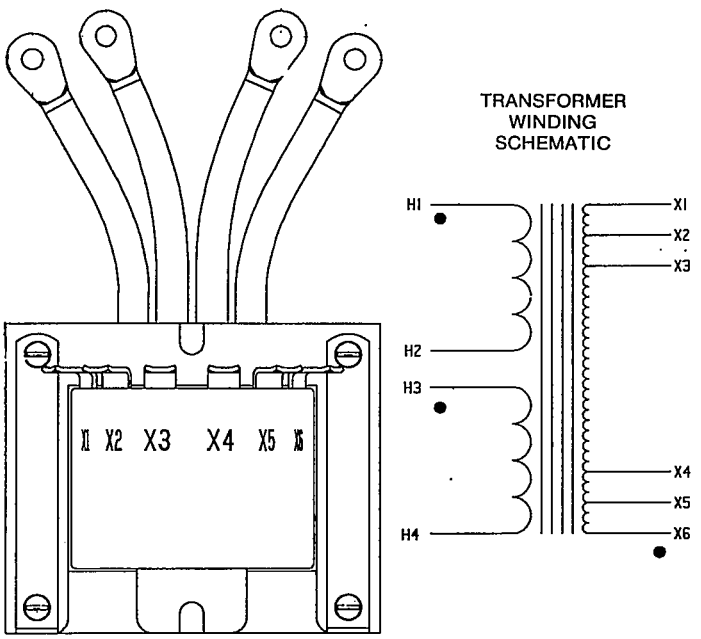


FIGURE 4-11. TYPICAL REGULATING TRANSFORMER

TABLE 4-3. TRANSFORMER RESISTANCE VALUES IN OHMS

WINDING	TRANSFORMER PART NO.			
	315-0552	315-0553	315-0649-1 (60 Hz)	315-0649-2 50 (Hz)
Primary H1-H2	.0013 ± .0002	.0015 ± .0002	.0004 ± .0001	.0005 ± .0001
H3-H4	.0013 ± .0002	.0015 ± .0002	.0004 ± .0001	.0005 ± .0001
H5-H6	N.A.	N.A.	N.A.	N.A.
Secondary X1-X6	1.45 ± .01	1.45 ± .01	N.A.	N.A.
X1-X5	1.34 ± .01	1.34 ± .01	1.62 ± .01	1.62 ± .01
X1-X4	1.22 ± .01	1.22 ± .01	1.51 ± .01	1.51 ± .01
X1-X3	.102 ± .01	.102 ± .01	.105 ± .01	.105 ± .01
X1-X2	.052 ± .01	.052 ± .01	.053 ± .01	.053 ± .01

N.A. (Not Applicable)

[P]
VOLTAGE ADJUSTMENT

This test supplies information for adjusting the transformer and electronic regulators. When checking output voltage, be sure the generator set has stabilized and is running at the correct speed (frequency). Adjusting the transformer regulator is done with the set stopped, the electronic regulator with the set running.

⚠WARNING ***Accidental starting of the set can cause severe personal injury or death. Disconnect the battery cables when repairs are made to the engine, controls, or generator.***

Transformer Voltage Regulator

The transformer regulator circuit supplies a feedback voltage (dependent on load) to the exciter stator. Voltage adjustment is made by changing tap connections on the transformer. When replacement is necessary, install leads to the same terminals of the new transformer. To change voltage, refer to the model wiring diagram or the generator reconnection diagrams under Test [Q].

Electronic Voltage Regulator

With the generator set running, set the Voltage Adjust potentiometer on the regulator board assembly for correct voltage. See Figure 4-12.

⚠CAUTION ***Do not adjust the other potentiometer (Volts/Hz Adjust) as it is difficult to reset for proper operation. It is factory set using special calibration equipment.***

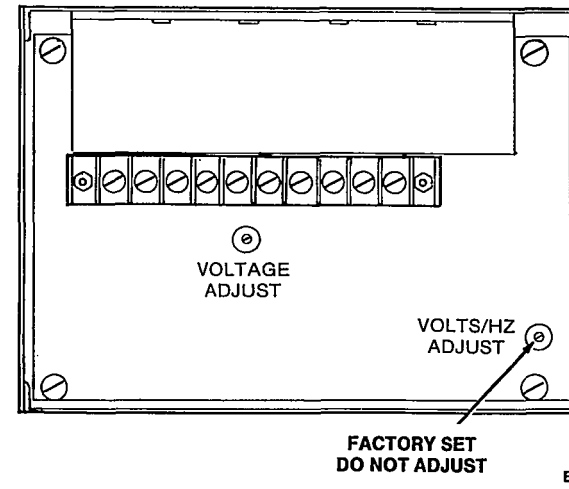
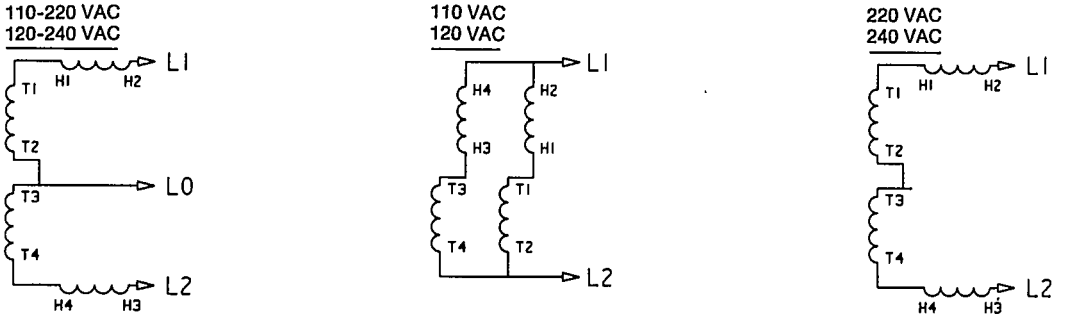


FIGURE 4-12. ELECTRONIC REGULATOR BOARD

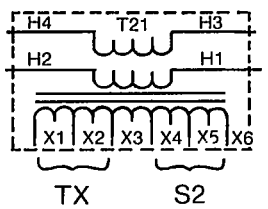
[Q]
RECONNECTION

Generator reconnection is dependent upon the nameplate code. Figure 4-13 shows reconnection possibilities. Data is also found on the individual model AC wiring diagrams in Section 7 of this manual.

Transformer Regulation
Voltage Codes 3C, 53C and 53B



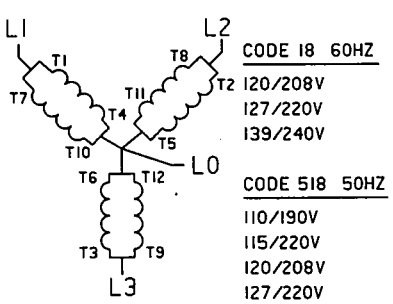
To Adjust Output Voltage, Move Taps on T21 According to Following Chart.

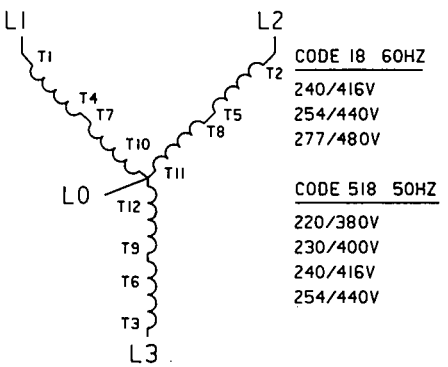


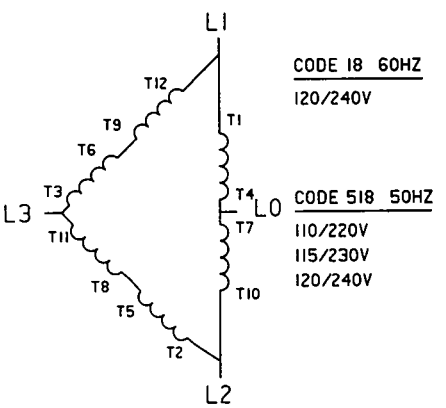
STANDARD TAP POSITION BY DASH NO.	TAP POSITION		OUTPUT VOLTAGE ADJUSTMENT
	TX	S2	
	X3	X4	↑ INCREASE
	X2	X4	
	X1	X4	
-06,-03,-05 (110/220)	X3	X5	
-04	X2	X5	
-01,-05 (120/240)	X1	X5	
	X3	X6	↓ DECREASE
-02	X2	X6	
	X1	X6	

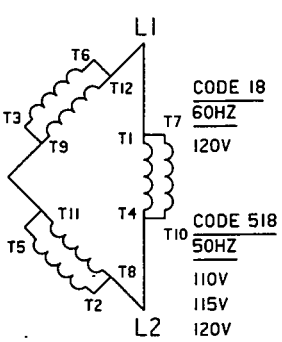
DASH NO	MODEL NO
-01	60HZ (MDL4)
-02	50HZ (MDL4)
-03	60HZ (MDL3)
-04	60HZ (MDL6)
-05	50HZ (MDL6)
-06	60HZ-(12.5MDL3)

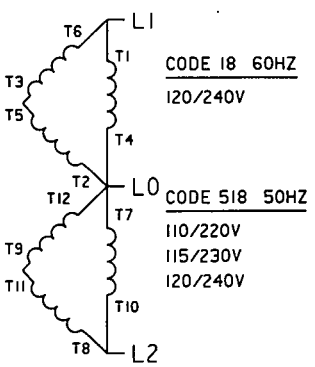
Electronic Regulation
Voltage Codes 3C and 53C, 18 and 518



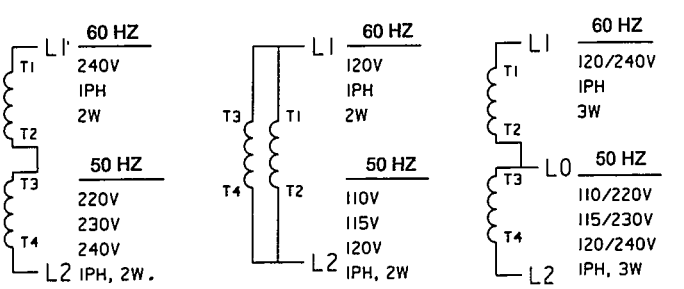








Codes 3C 60 Hz; 53C, 53B, 50 Hz



For 50 Hz Sets, Use Jumper on VR21 From Terminal 7 to 8

FIGURE 4-13. GENERATOR RECONNECTION DIAGRAMS

ES-1389-1

Section 5. Engine Control

GENERAL

The engine control system includes all functions that relate to the operation of the engine. This includes starting and stopping, instrumentation, monitoring for fault conditions, and battery charging.

The following is a description of the engine controls as found on the MDL series marine generator sets.

MDL CONTROL

Gauges/Meters and Switches

DC Voltmeter (Optional, 12- and 24- Volt Only): Monitors B+ voltage useful to determine battery condition and charge system operation. See Figure 5-1.

Coolant Temperature Gauge (Optional 12- and 24- Volt Only): Shows engine coolant temperature. The gauge is wired to a sensor on the engine and has a range of 100° to 250°F (40° to 121°C).

Oil Pressure Gauge (Optional): Shows engine lubricating oil pressure. The gauge has a range of 0 to 100 psi (0 to 700 kPa) and is connected to an engine sensor.

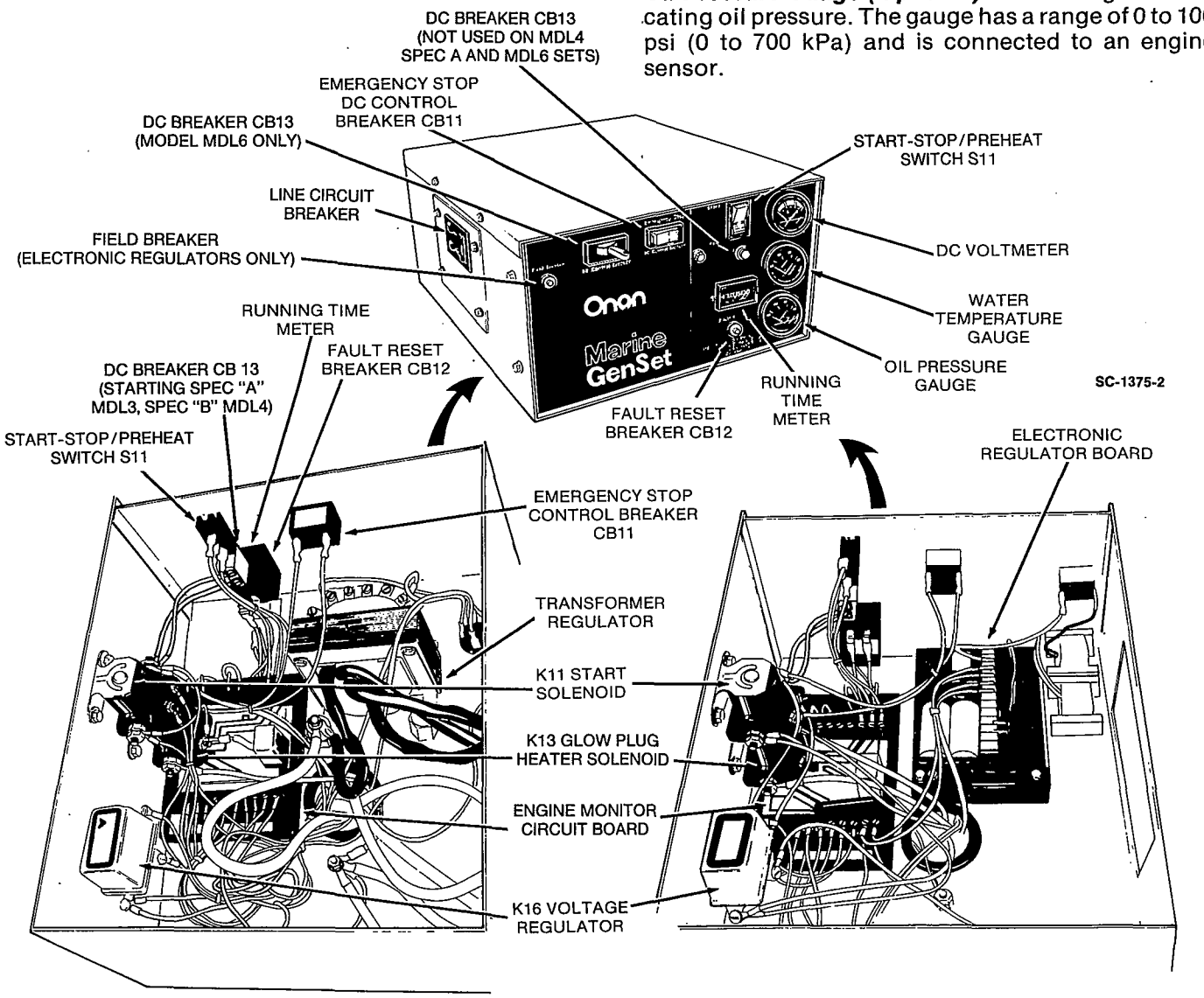


FIGURE 5-1. TYPICAL MDL SERIES CONTROL BOX

Start/Stop/Switch: Starts and stops the unit locally.

Fault Reset Breaker CB12: A manual reset breaker that shuts down the engine for low oil pressure, high coolant temperature, high exhaust temperature, overspeed or low coolant level (optional).

Emergency Stop DC Control Breaker CB11: a 15A ampere breaker providing protection to the control box wiring and remote wiring from short circuits or overload. Also serves as an emergency stop switch.

DC Breaker CB13: This breaker connects B+ to the control and opens if a short or overload occurs. Spec A MDL4 units had a fuseholder F1 as shown in Figure 5-2.

Control Components

The following describes the basic engine control components and how they function.

Engine Monitor Circuit Board: A printed circuit board that monitors all engine control system functions. This includes starting, stopping, and fault system operation. A terminal board is included for making remote connections. See Figure 5-1.

Two relays are soldered to the monitor circuit board and are not serviceable. Power Relay K12 connects and maintains battery B+ to the control meters and fuel solenoid during operation. Starter Protection Relay K15 is an AC operated relay. When the start switch is actuated, B+ is connected to the K11 start solenoid through K15 NC contacts until the generator output reaches about 90 volts AC. At 90 volts AC, K15 activates and disconnects the starter.

F1 In-Line Fuse: A 50-ampere strip fuse is used on Spec A MDL4 model only, Figure 5-2. The fuse connects B+ to the control and opens if a short or overload occurs in the control. This fuse is replaced with a DC breaker (CB13) on all later models.

K1 Fuel Solenoid: An integral part of the fuel injection pump. It opens the fuel control valve when the start/-stop switch is placed in the Start position.

K11 Start Solenoid: Located over the engine monitor circuit board (above K13 glow plug heater solenoid). It connects battery B+ to the start solenoid, K13 heater solenoid, fuel solenoid and meters during cranking.

K13 Glow Plug Heater Solenoid: Located directly above the monitor circuit board. Connects B+ to the engine glow plugs during cranking. It is energized by K11 start solenoid.

K14 Fuel Solenoid Relay: **(Only on model 12MDL3P3A sets with a serial number at or above 368826 and all other MDL sets with a serial number at or above 374372):** It is energized only during cranking and connects B+ to fuel solenoid K1 and fault breaker CB12 circuits.

K16 Voltage Regulator: Located within the control box (see Figure 5-1). It is a two-step regulator used on 12- and 24-volt systems only. The regulator contacts are connected to the tap of resistor R1.

Engine Sensors

The following briefly describes the engine mounted sensors and switches, and how they protect the engine from unfavorable operating conditions.

All safety sensors (switches) close to ground if abnormal operating conditions exist and trip the fault breaker CB12 to stop the engine. See Figure 5-2.

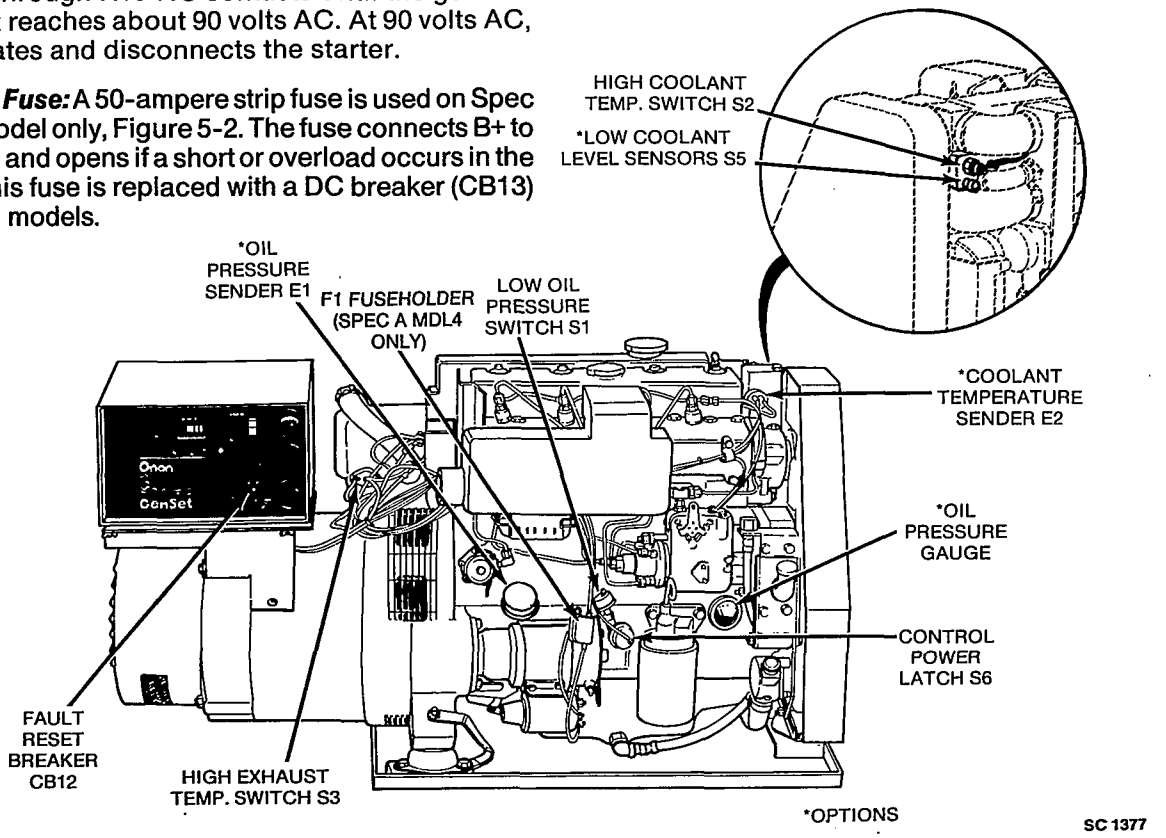


FIGURE 5-2. FAULT SENSOR LOCATION (MDL4 SPEC "A" SHOWN)

Resistance units and switches in the monitoring and shutdown systems are sealed units and are not repairable. When replacing a sensor, do not use a substitute item since resistance units are matched to the gauge they supply. Cutoff switches are close tolerance parts made for a specific application.

Oil Pressure Monitors

Refer to Figure 5-2 for the location of the oil pressure sensors.

Oil Pressure Sender E1: The sender resistance changes with oil pressure and results in a reading on the oil pressure meter. The meter range is 0 to 100 psi (0 to 700 kPa).

Low Oil Pressure Switch S1: This switch closes if oil pressure drops to 14 psi (97 kPa), activating the fault breaker and stopping the engine.

Control Power Latch (S6): This oil pressure switch closes at 5 psi (34 kPa) and provides a latch function for the control circuits. When closed, the switch supplies a ground path for relay K12 on the engine monitor board.

Oil Pressure Gauge (Mechanical, Optional): This gauge connects directly to the engine oil line on the side of engine. It has a range of 0 to 100 psi (0 to 700 kPa).

Engine Temperature Monitors

Refer to Figure 5-2 for the location of the engine coolant temperature sensors.

Temperature Sender E2 (Optional): The resistance of the sender unit changes with the engine coolant temperature and causes a reading on the Water Temp meter. The meter range is 100° to 250°F (40° to 121°C).

High Engine Temperature Switch S2: This switch closes if the coolant temperature rises to 222°F (106°C), stopping the engine and activating the Fault Breaker CB12.

High Exhaust Temperature Switch S3: The high exhaust temperature switch is mounted on the exhaust elbow and closes on temperature rise above 190°F (88°C). It will open again when temperature reaches about 165°F (74°C) and functions to protect exhaust system hoses.

Low Coolant Level S5 (Optional): This electronic sensor completes the fault circuit if coolant level falls below the sensor's location on engine. It provides an added level of engine protection.

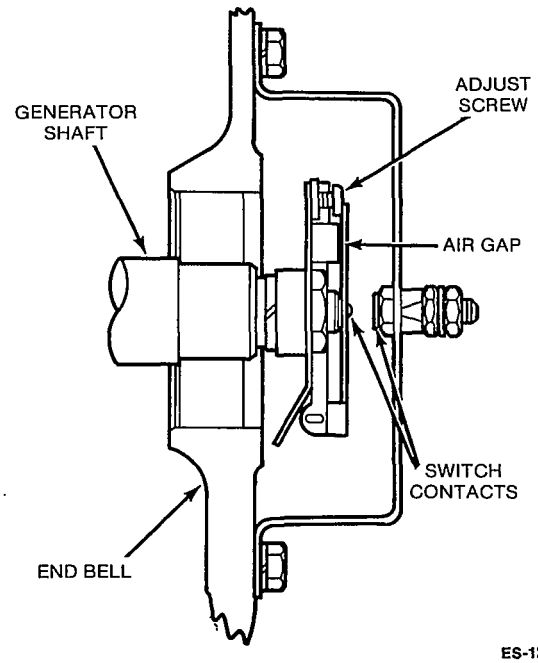


FIGURE 5-3. OPTIONAL OVERSPEED SWITCH S4

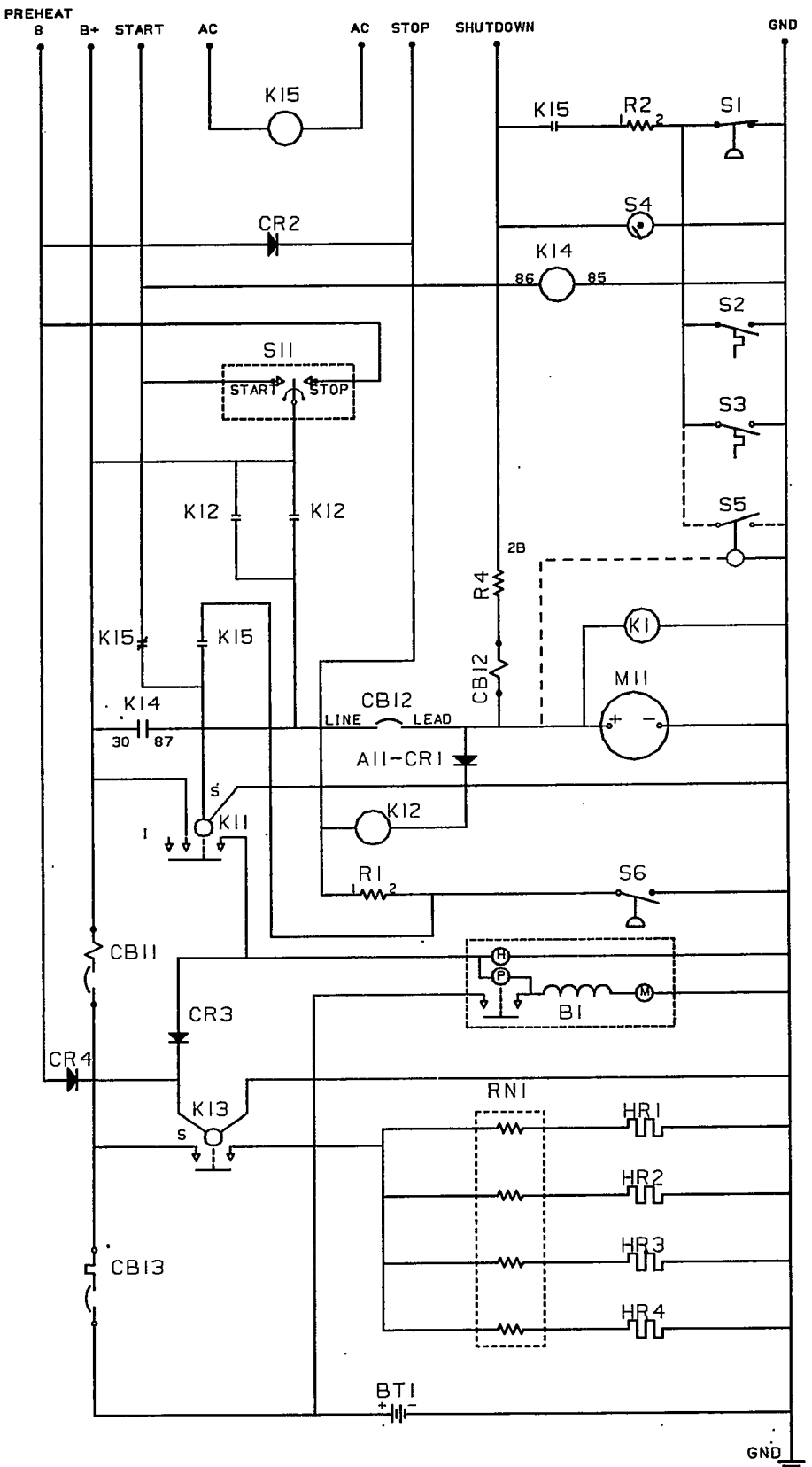
Overspeed Switch (Optional)

The mechanical overspeed switch S4 is mounted on the rear of the generator shaft as shown in Figure 5-3. It is factory adjusted to close and shut down 60 hertz units at 2200 r/min ± 90 r/min; 50 hertz units at 1900 r/min ± 90 r/min. An overspeed condition grounds the shutdown circuit on the Engine Monitor Board and trips the fault breaker. After the problem is corrected, starting will not occur until the fault breaker is reset.

If necessary, the speed range can be corrected by turning the adjusting screw thereby changing the magnetic air gap (see Figure 5-3). An accurate tachometer or strobotach is needed to check the overspeed trip point after adjustment is made. The air gap must not be less than 0.005 inch (0.13 mm).

Control Operation

Dependable, trouble-free operation of the control system should be the major concern of generator set service personnel. Service personnel must thoroughly understand how the controls operate, know how to check for troubles, and know how to make the proper adjustments, replacements, or repairs in a reasonable amount of time.



NOTE: This schematic represents the engine control for model 12MDL3P3A sets with a serial number at or above 368826 and all other MDL sets with a serial number at or above 374372. Refer to Section 7.

FIGURE 5-4. TYPICAL MDL SERIES SCHEMATIC, 12 VDC

Prior to starting the generator set, check the fuel supply, engine oil level, and all battery connections for loose or broken wires.

Figure 5-4 shows a typical schematic for the circuits described in the following Preheat, Starting, Start-Disconnect and Stopping sequences. Relay contact references normally open (NO) and normally closed (NC) refer to position of contacts with the unit at rest (not energized).

Preheat Sequence: The preheat circuit is turned on when switch S11 is held in the Stop position. This action places B+ on the anode of diode CR2 which conducts and energizes preheat relay K13. The K13 contacts connect B+ from the battery through CB13 to the engine heaters.

Starting Sequence: The start circuit is completed by S11 in the Start position. This action connects battery B+ through the K15 NC contacts to diode CR3 and K13 heater solenoid, B1 starter solenoid, CB12 fault breaker, K1 fuel solenoid and engine monitor circuits.

On model 12MDL3P3A sets with a serial number at or above 368826 and on all other MDL sets with a serial number at or above 374372, fuel solenoid K1 is energized through contacts 30/87 of fuel solenoid relay K14.

As the engine starts, oil pressure closes S6 and completes the ground circuit through resistor A11-R1 for the K12 power relay. The closing of K12 dual contacts completes the B+ running circuit to CB12 fault breaker and K1 fuel solenoid.

Start-Disconnect Sequence: As the generator gains speed and output voltage, K15 starter protection relay energizes at about 90 VAC. The K15 NC contact opens and de-energizes K11 start solenoid; the K15 NO contact closes and provides another ground path for K12 coil (through K11) similar to S6.

De-energizing K11 disconnects B+ from the starter solenoid to stop cranking, and from the K13 heater solenoid to disconnect glow plug heaters.

Stopping Sequence: Placing S11 in the Stop position puts B+ on the ground side of K12 power relay. This causes K12 to de-energize and disconnect B+ from CB12 and the K1 fuel solenoid. De-energizing K1 shuts off the fuel flow and stops the engine.

Fault Shutdown: Fault breaker CB12 opens to stop the engine anytime a fault sensor closes the circuit to ground. The fault sensors as shown in Figure 5-4 are:

- S1 low oil pressure
- S2 high coolant temperature
- S3 high exhaust temperature
- S4 overspeed
- S5 low coolant level option

CB12 should not be reset for starting until fault is located and corrected.

Remote Control (Optional): The generator set may be operated from a remote switch wired to the control panel. Installation instructions are furnished with the kit.

Control Troubleshooting

The information in this section is divided into three flow charts. Determine the problem and then refer to the appropriate flow chart (A, B, or C) for the troubleshooting procedures.

A. Engine does not crank.
B. Engine cranks but does not start.
C. Engine starts but stops after running several seconds.

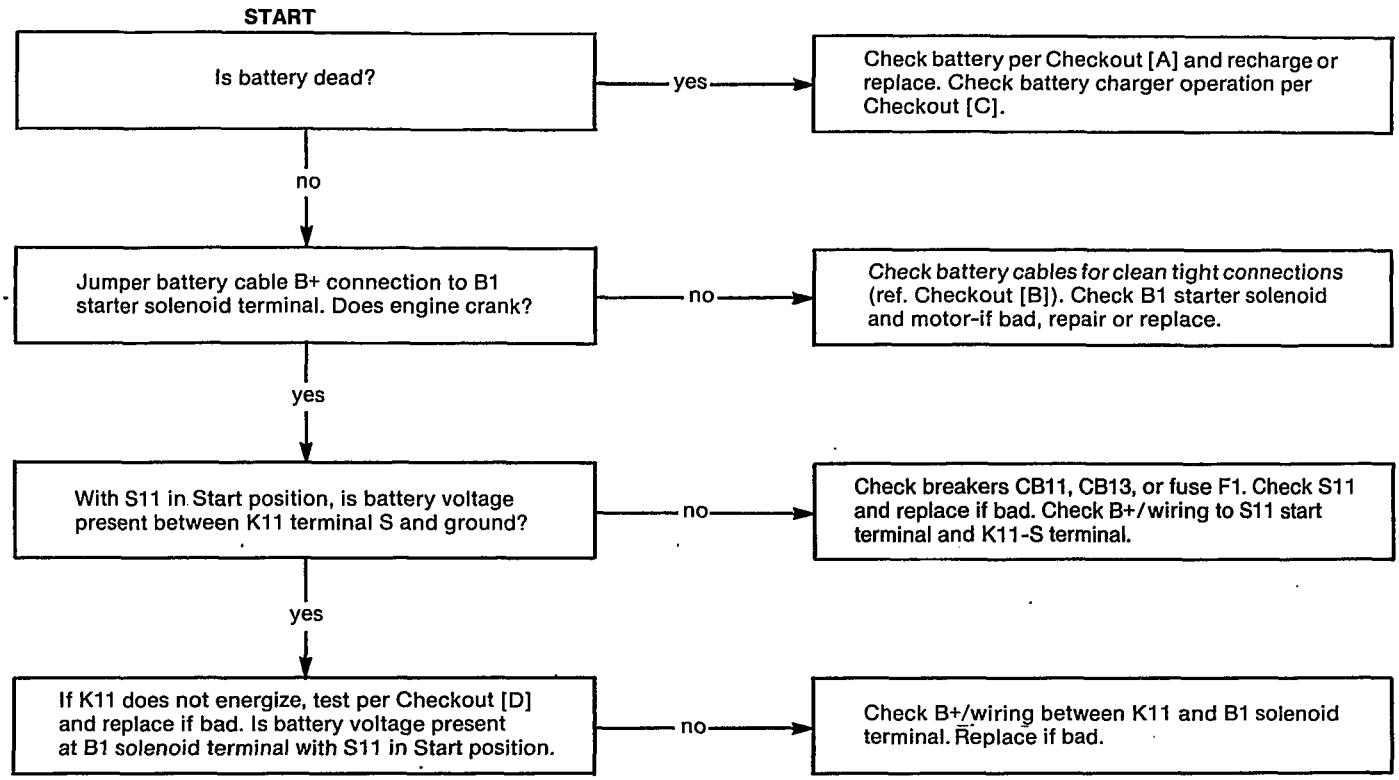
Before starting a troubleshooting procedure, make a few simple checks that may expose the problem and cut down on troubleshooting time.

- Check all modifications, repairs and replacements performed since last satisfactory operation of set. A loose wire connection overlooked when installing a replacement part could cause problems. An incorrect connection, an opened switch or circuit breaker, or a loose plug-in are all potential problems that can be eliminated by a visual check.

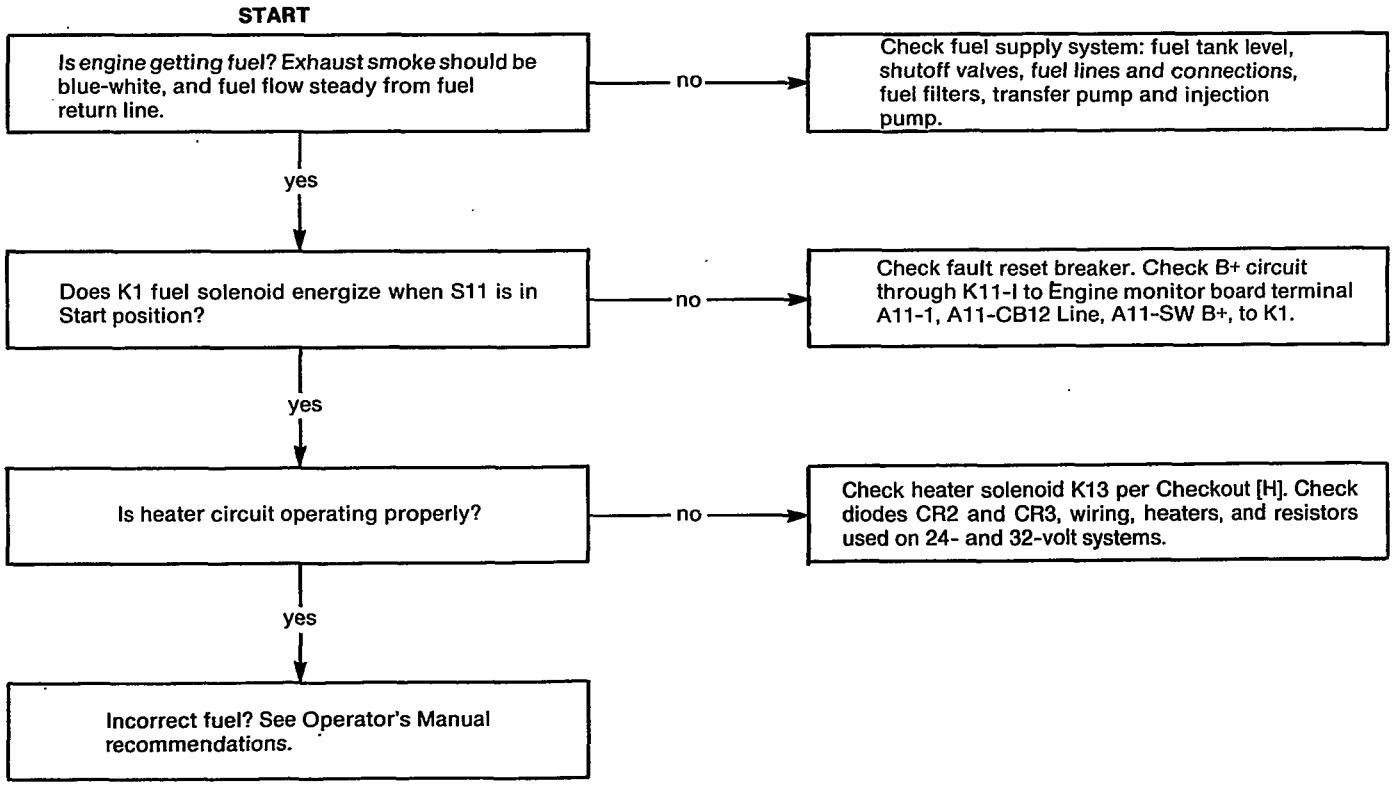
- Unless absolutely sure that panel instruments are accurate, use portable test meters for troubleshooting.

To troubleshoot a problem, start at the upper-left corner of chart and answer all questions either YES or NO. Follow the chart until the problem is found, performing referenced adjustment or test procedures. Refer to Figures 5-1 through 5-4 for locating control components, leads, terminals and other check points.

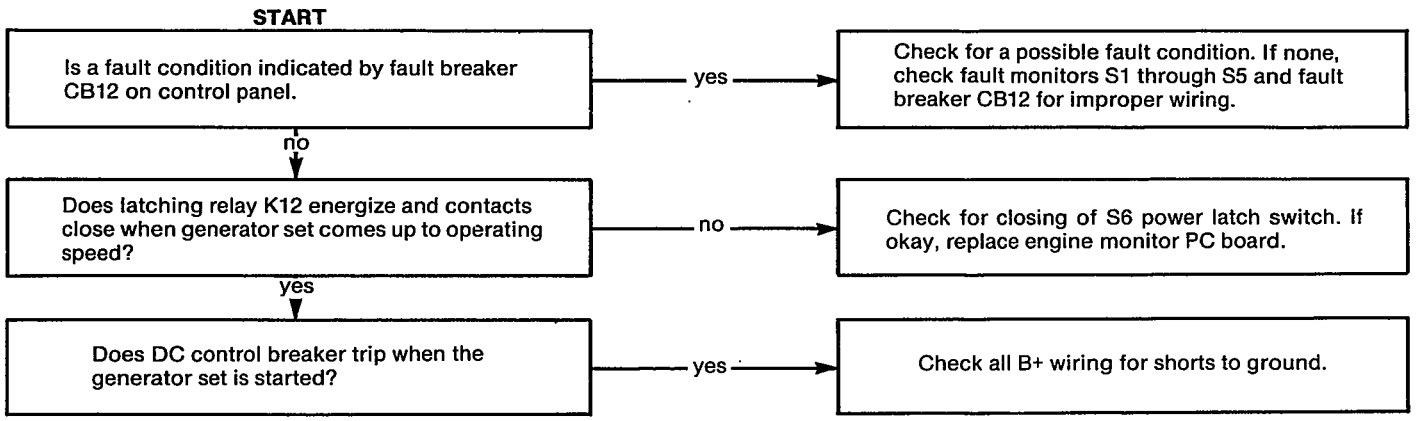
FLOW CHART A. ENGINE DOES NOT CRANK



FLOW CHART B. ENGINE CRANKS BUT DOES NOT START



FLOW CHART C. ENGINE STARTS BUT STOPS AFTER RUNNING SEVERAL SECONDS



Section 6
Engine Control Adjustments/Tests

GENERAL

The following component checkouts are referenced in the Control Troubleshooting flow charts. They are an aid to isolating circuit problems caused by faulty engine control components. Disconnect leads before testing components.

[A]

BATTERY CHECKOUT

Check charge condition of the battery with a hydrometer. The electrolyte specific gravity should be about 1.260 for a fully charged battery at 80°F (27°C). If not, add distilled water to keep electrolyte at proper level and recharge the battery. If battery will not recharge, replace it.

If battery loses excess water, the charge rate may be too high. Likewise, if battery state of charge is not maintained, the charge rate may be too low.

[B]

BATTERY CABLE CHECKOUT

With the starter motor operating, check the voltage drops (1) from the battery negative post (not the cable clamp) to the cylinder block, (2) from the battery positive post to the battery terminal stud on the solenoid. Normally, each of these should be less than 0.3 volt. If extra long battery cables are used, slightly higher voltage drops may result. Thoroughly clean all connections in any part of the circuit showing excessive voltage drop.

[C]

BATTERY CHARGING CHECKOUT

With the engine running, check the DC voltmeter (control option). A 12-volt system should be 13.5 to 15 volts; a 24-volt system should be 27 to 30 volts.

On MDL-series generator sets the power source is a winding CW1 on the stator assembly (except 32-volt systems). The charging rate/voltage is determined by a two-step voltage regulator K16. The opening and closing voltages of K16 at 70°F (21°C) should be as follows:

System Voltage	Opening	Closing
12-volt	14.25to 14.75	12.30 to 12.80
24-volt	28.60 to 29.60	24.60 to 25.60

If voltage is incorrect, check wiring/connections and components in the charging circuit such as CR1 rectifier, R1 resistor and CW1 stator winding.

Improper output may be caused by poor terminal connections, broken wires, defective battery, bad regulator or alternator. The charge circuit is protected by a circuit breaker CB13, or by a fuse F1 on Spec "A" MDL4 models.

[D]

SOLENOID CHECKOUT

1. Apply battery positive (B+) to the terminal marked S.
2. Connect a ground wire to the solenoid mounting bracket. Solenoid should activate.
3. If the contacts are good, battery voltage should be read between terminal I and ground. The voltage drop measured across the contacts should never exceed one volt in circuit application.

[E]

RELAY CHECKOUT

1. Connect relay coil voltage across relay coil terminals. Relay should activate if coil is okay.
2. Connect voltage source to one side of relay contacts.
3. Connect a voltmeter to other side of relay contact and voltage source. If voltage appears when relay energizes, contact is okay. The voltage reading appears in reverse order when checking normally closed (NC) contacts.

[F]

FUEL SOLENOID CHECKOUT

If there is fuel to the injection pump, but no fuel at injection nozzle, the fuel solenoid may be defective.

To check solenoid operation, watch for solenoid actuation when B+ is applied (start switch in start or run position. If there is no actuation when B+ is applied, the fuel solenoid must be replaced. Likewise, when B+ is removed, the solenoid must de-activate.

[G]

SWITCH CHECKOUT

1. Remove battery B+ cable.
2. Place ohmmeter leads across switch.
3. Open and close switch while observing the ohmmeter. A normally open (NO) switch should have infinite resistance when open and continuity when closed. A normally closed (NC) switch should have continuity when closed and infinite resistance when open.
4. Replace switch if defective.

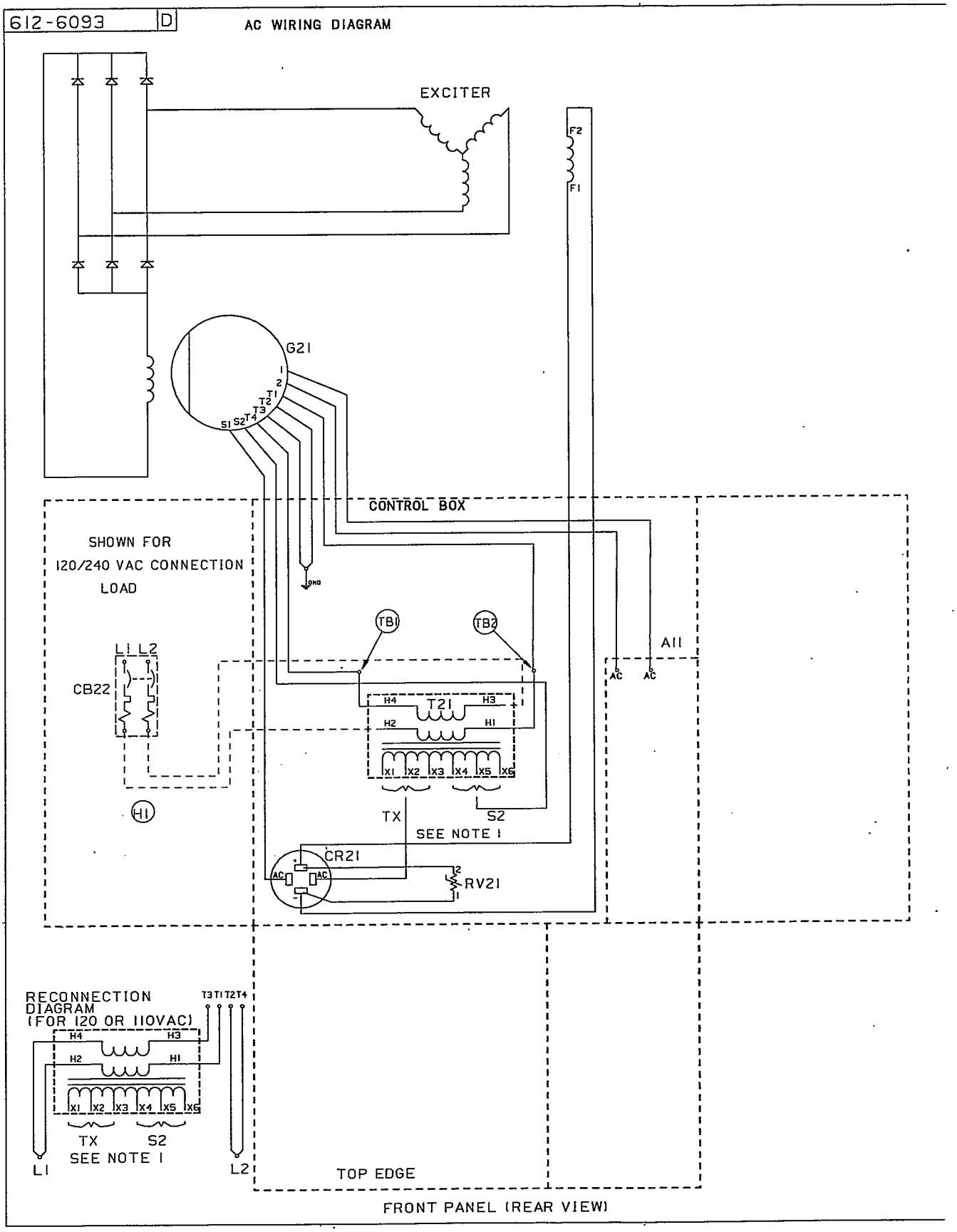
[H]

SOLENOID CHECKOUT

1. Apply battery positive (B+) to the terminal marked S.
2. Connect a ground wire to the terminal marked I. Solenoid should activate.
3. Continuity should be read across the two large terminals while solenoid is activated.

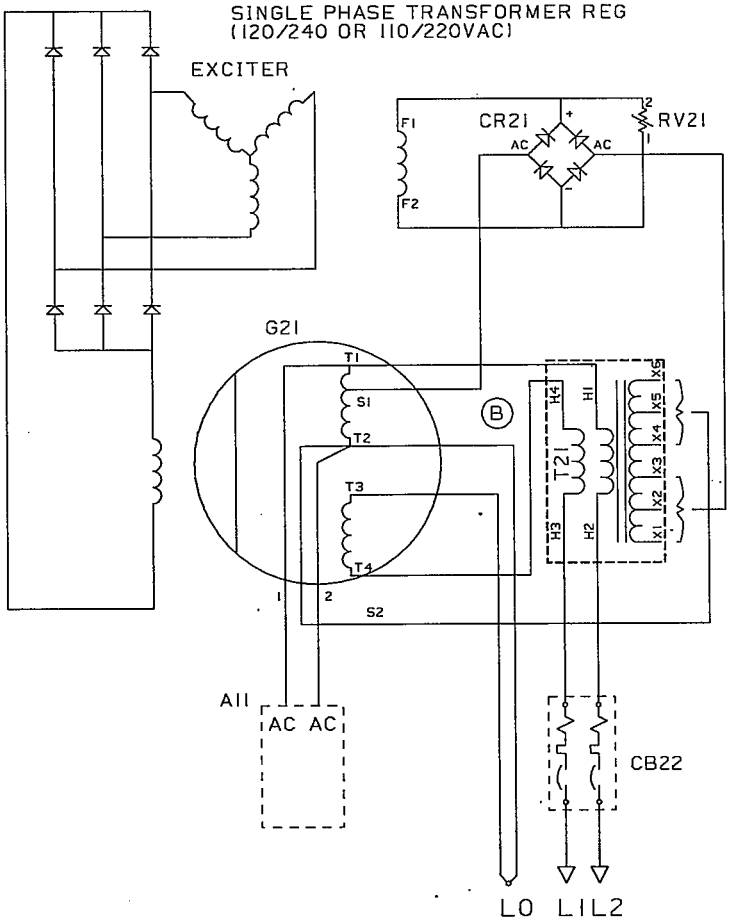
Section 7. Wiring Diagrams

The electrical schematics and wiring diagrams that apply to the generator sets covered in this manual are listed below.



SINGLE PHASE AC CONTROL, TRANSFORMER REGULATION

AC SCHEMATIC
SINGLE PHASE TRANSFORMER REG
(120/240 OR 110/220VAC)



Parts List (Ref. Only)	
Ref. Des.	**Description**
A11	PCB Assy - Engine Monitor
CB22	Circuit Breaker (Load)
CR21	Bridge - Rectifier
G21	Generator (AC)
TB1,2	Standoff - Insulator
RV21	Suppressor Assy
T21	Transformer - Assy

NOTES:
1. TO ADJUST OUTPUT VOLTAGE, MOVE TAPS ON T21 ACCORDING TO FOLLOWING CHART.

STANDARD TAP POSITION BY DASH NO.	TAP POSITION		OUTPUT VOLTAGE ADJUSTMENT
	TX	S2	
	X3	X4	↑ INCREASE
	X2	X4	
	X1	X4	
-06,-03,-05(110/220)	X3	X5	
-04	X2	X5	
-01,-05 (120/240)	X1	X5	
	X3	X6	↓ DECREASE
-02	X2	X6	
	X1	X6	

2. UNLESS OTHERWISE NOTED, ALL COMPONENTS ARE SHOWN IN THE DE-ENERGIZED POSITION.
3. DASHED LINES INDICATE WHEN USED.
4. INSTALL STRAP UNDER CONTROL BETWEEN THE 5/16 WELD NUT NEAR CENTER HOLE AND BOLT ATTACHING 301-7951 PLATE TO FRONT LEFT MOUNTING ISOLATOR USING ONE 856-0008 UNDER EACH END OF STRAP.

ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE
28,167	K	1	ADD -06 (MDL3)	WH	[illegible]	5-16-86
27717	J	1	ADD -04 & -05 (MDL6)	WH	JC	2-17-86
26,736	H	1	DEL T1 & T4 LABELS	ADG	EE	8-2-85
26418	G	1	ADDED -03 (MDL3)	WH	JC	7-17-85
		3	ADDED 821-0014 QTY 1	SLS	MM	3-13-84
		2	ADDED 856-0008 QTY 2	SLS	MM	3-13-84
23,852	F	1	EDITED NOTE 4	SLS	MM	3-13-84
21,443	E		ADDED SILKSCREEN TO -01,-02	GH	MM	2-21-83
21,425	D		REV CHART PER ER	SLS	LN	1-24-83
21,289	C		ADDED 337-0049, STRAP	SLS	JR	12-20-82
21,289	B		REVERSED H3 & H4 ON T21	SLS	JR	12-20-82
21,289	A		ADDED NOTE 4	SLS	JR	12-20-82
20,697	-		NEW RELEASE			

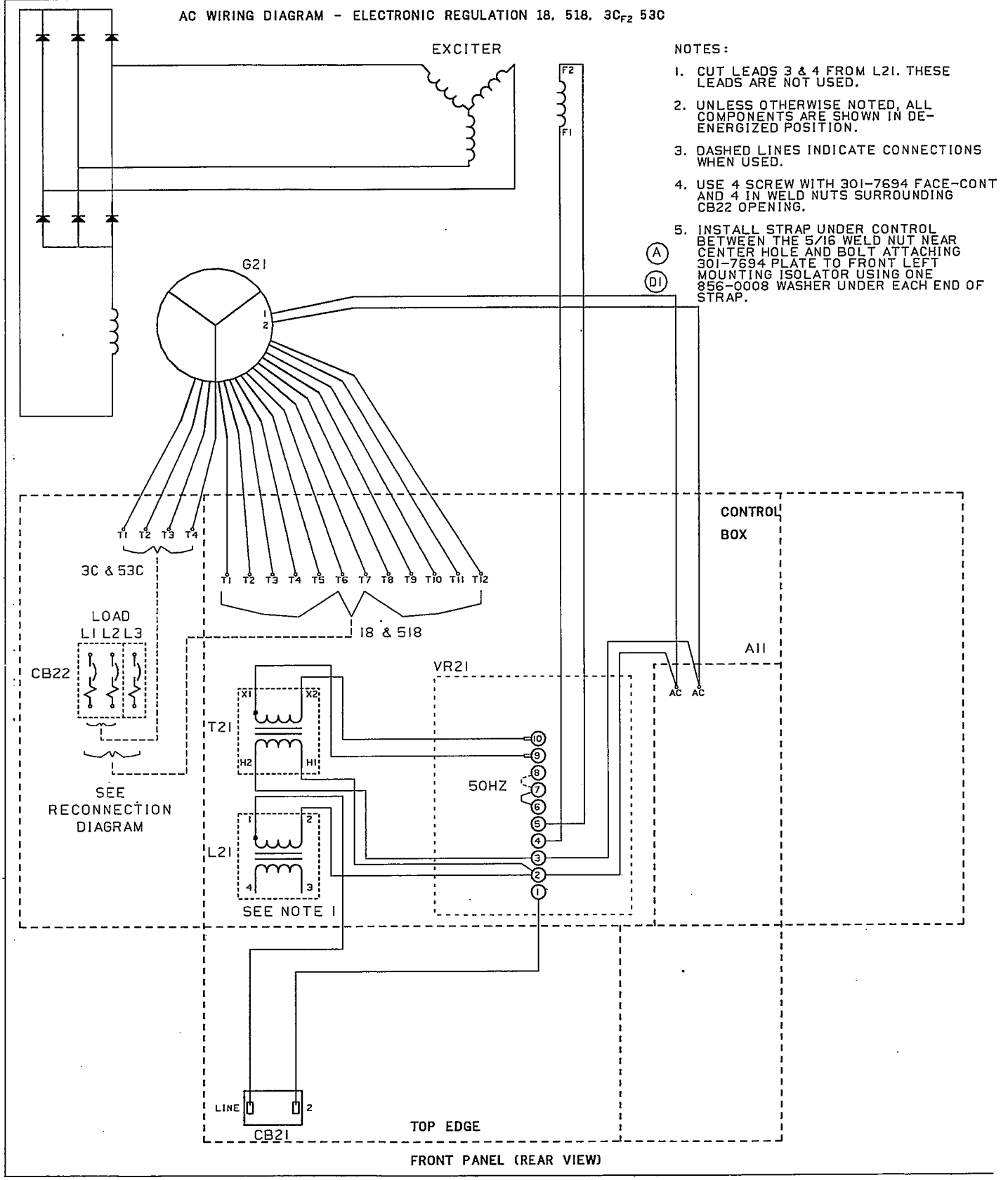
CADD SYSTEM DWG

SAMP REL	DASH NO	MODEL NO
PROD REL SLS 9-30-82	-01	60HZ (MDL4)
	-02	50HZ (MDL4)
	-03	60HZ (MDL3)
	-04	60HZ (MDL6)
PROD REL	-05	50HZ (MDL6)
	-06	60HZ (12.5MDL3)
PARTS PO		MDL3/MDL4/MDL6

ONAN CORPORATION MINNEAPOLIS MINNESOTA
DATE 9-29-82 | DR MCM | ENGR SLS | CKR LN
TITLE: CONTROL-GEN SET AC (1PH-5% REG
SIMILAR TO | DWG NO. 612-6093 | SHT 1 OF 1 | DWG SIZE D

612-6094 D

AC WIRING DIAGRAM - ELECTRONIC REGULATION 18, 518, 3C$_{F2}$ 53C



NOTES:

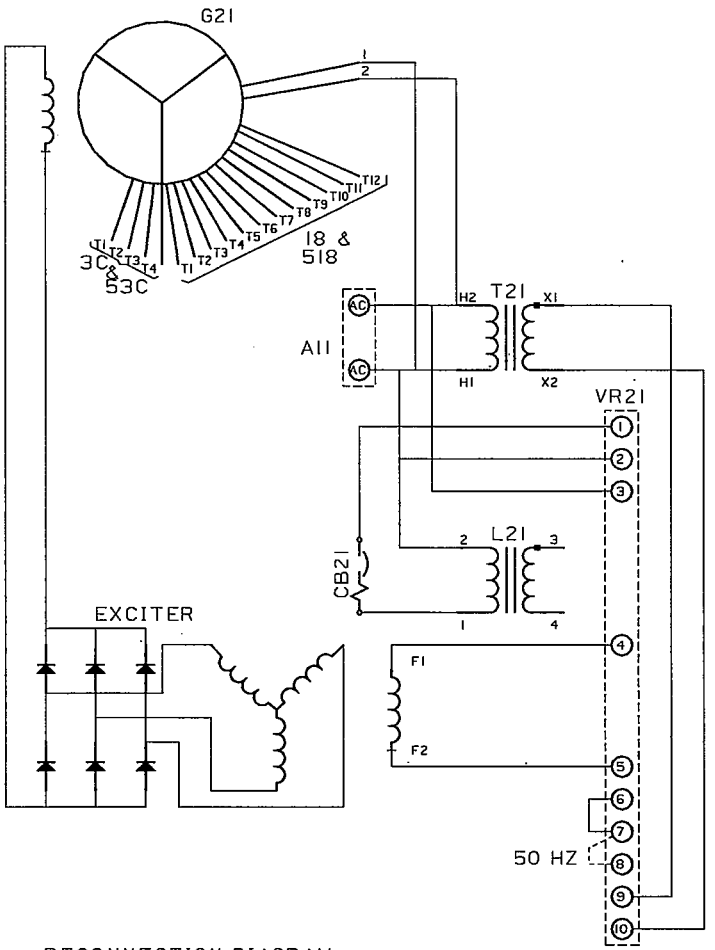
1. CUT LEADS 3 & 4 FROM L21. THESE LEADS ARE NOT USED.
2. UNLESS OTHERWISE NOTED, ALL COMPONENTS ARE SHOWN IN DE-ENERGIZED POSITION.
3. DASHED LINES INDICATE CONNECTIONS WHEN USED.
4. USE 4 SCREW WITH 301-7694 FACE-CONT AND 4 IN WELD NUTS SURROUNDING CB22 OPENING.
5. INSTALL STRAP UNDER CONTROL BETWEEN THE 5/16 WELD NUT NEAR CENTER HOLE AND BOLT ATTACHING 301-7694 PLATE TO FRONT LEFT MOUNTING ISOLATOR USING ONE 856-0008 WASHER UNDER EACH END OF STRAP.

SINGLE AND THREE PHASE AC CONTROL, ELECTRONIC REGULATION

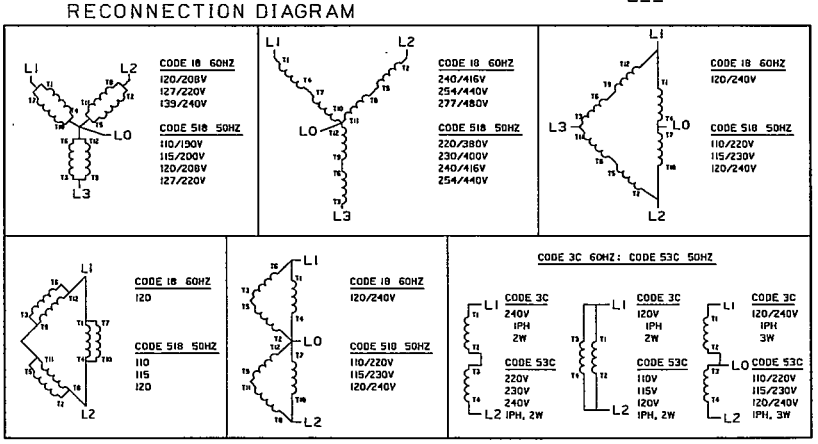
AC SCHEMATIC – ELECTRONIC REG

VOLTAGE CODES (18 & 518, 3C &53C)

Parts List (Ref. Only)	
Ref. Des.	**Description**
A11	PCB Assy - Engine Monitor
CB21	Circuit Breaker - Mag (3A)
CB22	Circuit Breaker - Load
G21	Generator (AC)
L21	Reactor Assy - Com
T21	Transformer - Volt Ref
VR21	Regulator Assy - Voltage



RECONNECTION DIAGRAM



ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE
		2	ADDED 98-5535(B)			5-5-86
28133	G	1	ADDED -06 (MDL3)			5-5-86
27716	F	1	ADDED -04 & -05 (MDL6)	WH	JC	2-26-86
26418	E	1	ADDED -03 (MDL3)	WH	JC	7-17-85
		3	ADDED 821-0014 QTY 1	SLS	MM	3-13-84
		2	ADDED 856-0008 QTY 2	SLS	MM	3-13-84
23,852	D	1	EDITED NOTE 5	SLS	MM	3-13-84
21,443	C		ADDED SILKSCREEN TO -01,-02	GH	MM	2-21-83
21,289	B		ADDED 337-0049 STRAP	SLS	JR	12-20-82
21,289	A		ADDED NOTE 5	SLS	JR	12-20-82
20,697	–		NEW RELEASE			

CADD SYSTEM DWG (G1)

SAMP REL	DASH NO	MODEL NO
	-01	60 HZ (MDL4)
	-02	50 HZ (MDL4)
	-03	50 HZ (MDL3)
PROD SLS REL 9-30-82	-04	60 HZ (MDL6)
	-05	50 HZ (MDL6)
PROD REL	-06	60 HZ (MDL3)

MDL3/MDL4/MDL6

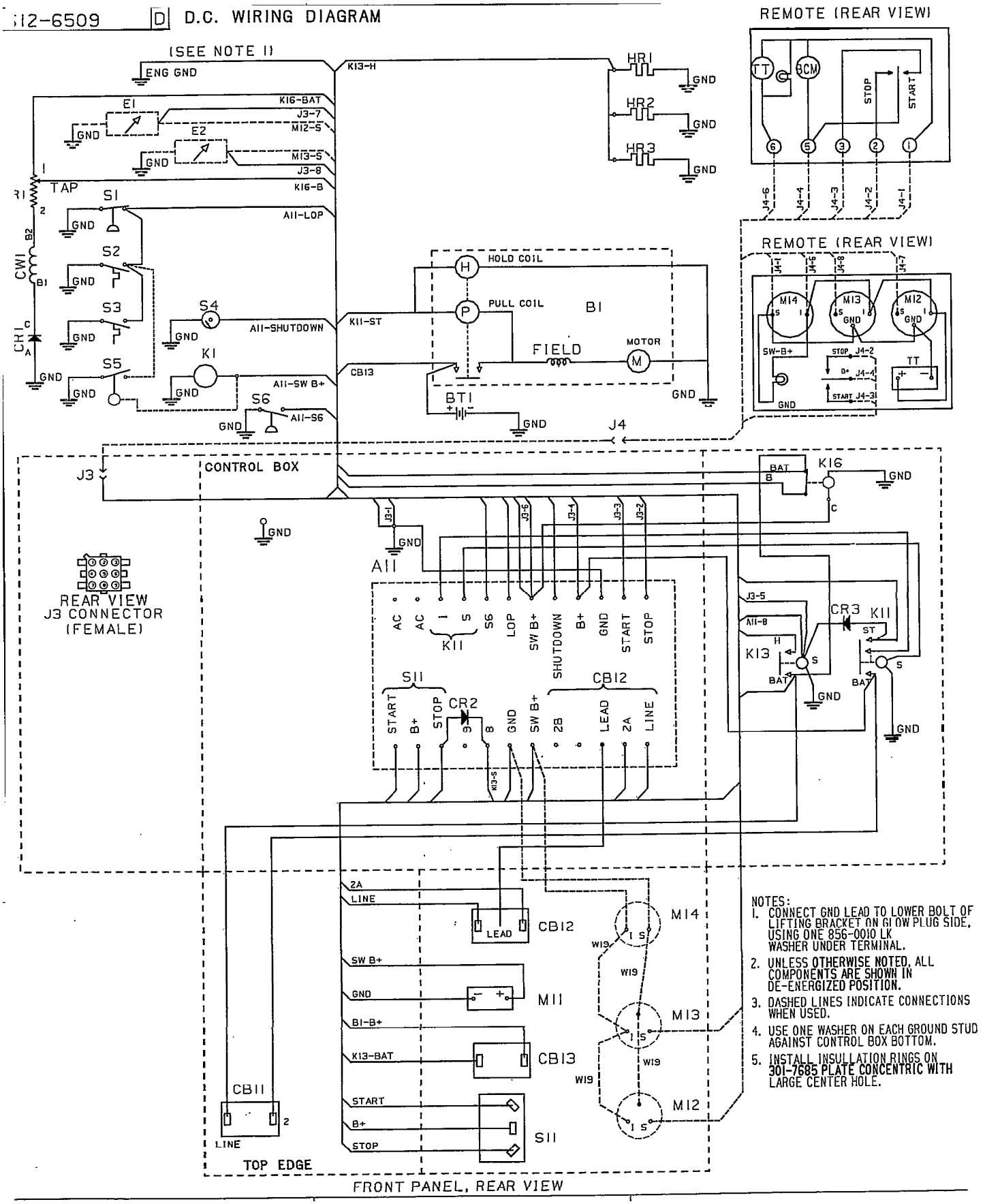
PARTS PO

Onan — ONAN CORPORATION MINNEAPOLIS MINNESOTA

DATE 9-29-82 | DR MCM | ENGR SLS | CKR LN

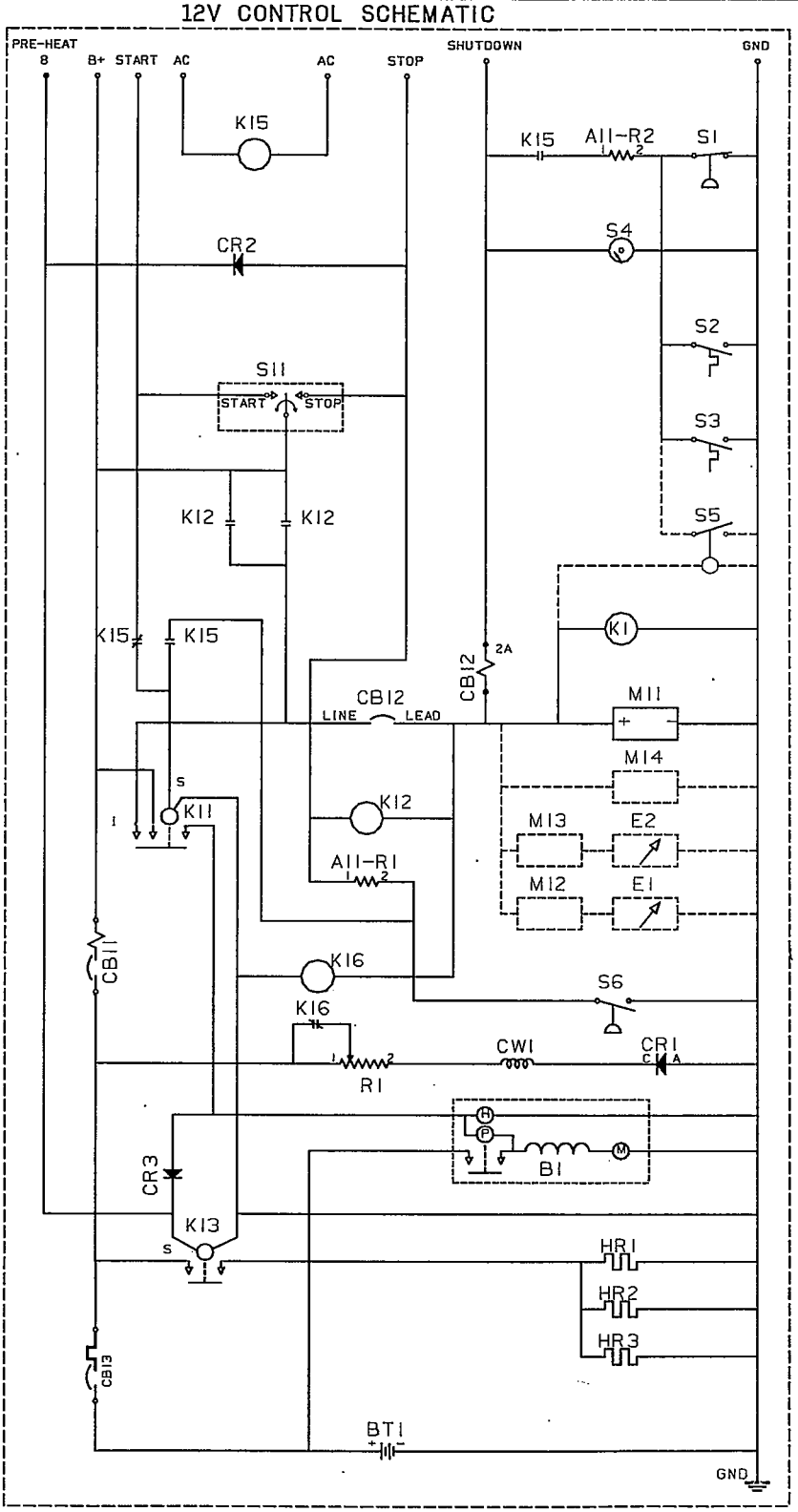
TITLE: CONTROL-GEN SET AC(1&3PH-2%REG)

SIMILAR TO | DWG NO. 612-6094 | SHT 1 OF 1 | DWG SIZE D



MDL3 12-VOLT DC CONTROL W/GAUGES; STARTING SPEC "A"

12V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
A11-R1	Resistor, K12
A11-R2	Resistor, LOP Timing
B1	Starter & Solenoid
BT1	Battery, 12-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR1	Rectifier, Batt. Charging
CR2	Rectifier, Stop
CR3	Rectifier, Blocking
CW1	Winding, Batt. Charging
E1	Sender, Oil Pressure
E2	Sender, Coolant Temp.
HR1-3	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K15	Relay, Starter Protect
K16	Regulator, Voltage 2-Step
M11	Meter, Time Totalizing
M12	Meter, Oil Pressure
M13	Meter, Coolant Temp
M14	Meter, Volt
R1	Resistor, Battery Charging
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE
31,895	B	1	WAS CR1 AND CR2	WH	JC	4-11-88
31,592	A	1	PRODUCTION RELEASE	WH	JC	2-23-88

CADD SYSTEM DWG

SAMP REL

PROD REL

PROD REL WMH

DASH NO: -01, -02

MODEL NO: STD W/GAUGES

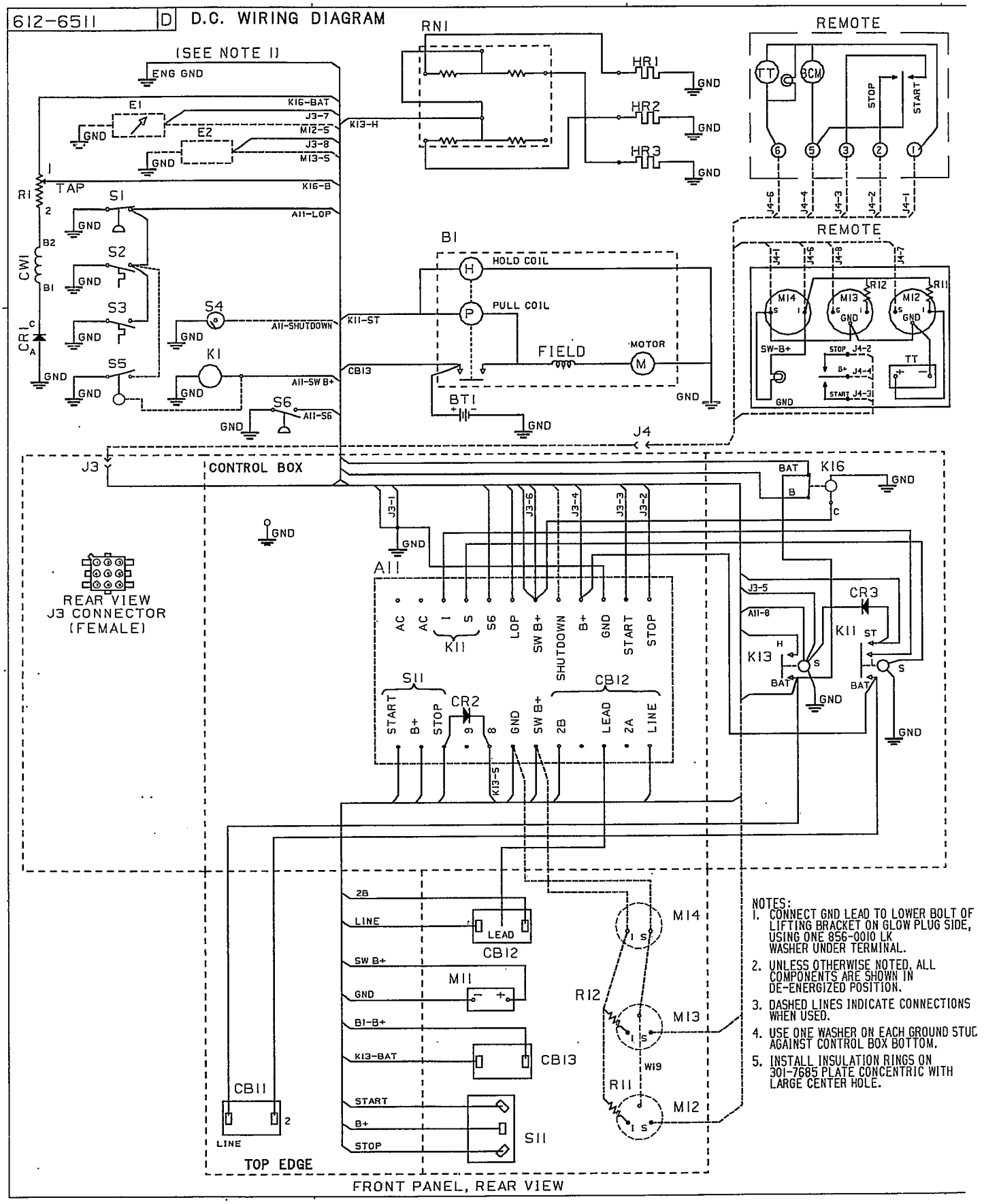
MDL3

Onan — ONAN CORPORATION MINNEAPOLIS MINNESOTA

DATE 2-23-88 | DR DFO | ENGR W/MK | CKR

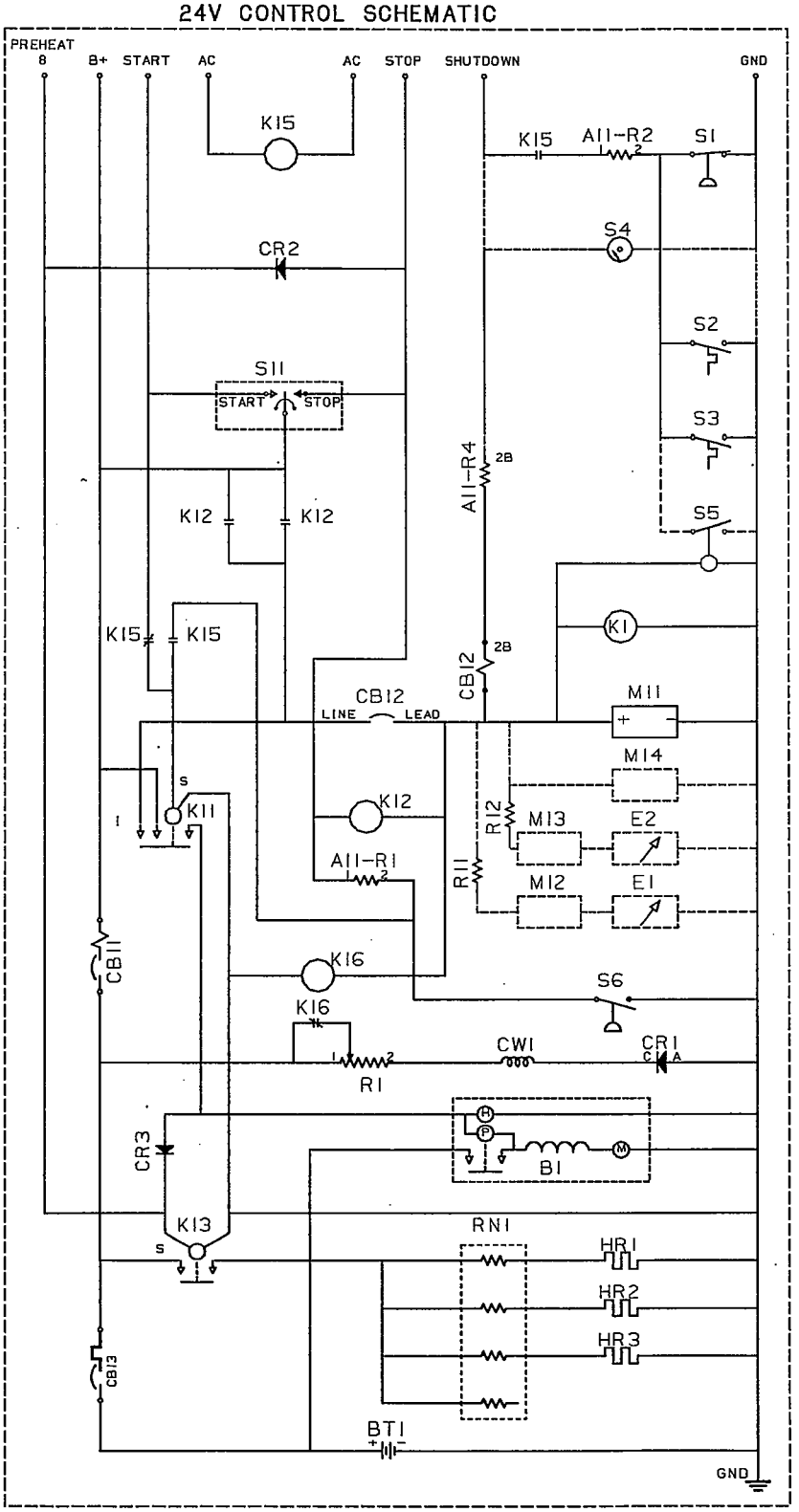
TITLE: CONTROL-GEN SET DC (12V)

SIMILAR TO 612-6396 | DWG NO. 612-6509 | SHT 1 OF 1 | DWG SIZE D



MDL3 24-VOLT DC CONTROL W/GAUGES

24V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
A11-R1	Resistor, K12
A11-R2	Resistor, LOP Timing
B1	Starter & Solenoid
BT1	Battery, 24-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR1	Rectifier, Batt. Charging
CR2	Rectifier, Stop
CR3	Rectifier, Blocking
CW1	Winding, Batt. Charging
E1	Sender, Oil Pressure
E2	Sender, Coolant Temp.
HR1-3	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K15	Relay, Starter Protect
K16	Regulator, Voltage 2-Step
M11	Meter, Time Totalizing
M12	Meter, Oil Pressure
M13	Meter, Coolant Temp
M14	Meter, Volt
R1	Resistor, Battery Charging
RN1	Resistor Network
R11, 12	Resistor, Meter
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE
31,707	A	1	PRODUCTION RELEASE	WX	GS	4-04-88

CADD SYSTEM DWG

SAMP REL
PROD REL WMX
PROD REL

DASH NO: -01, -02

MODEL NO: STD W/GAUGES

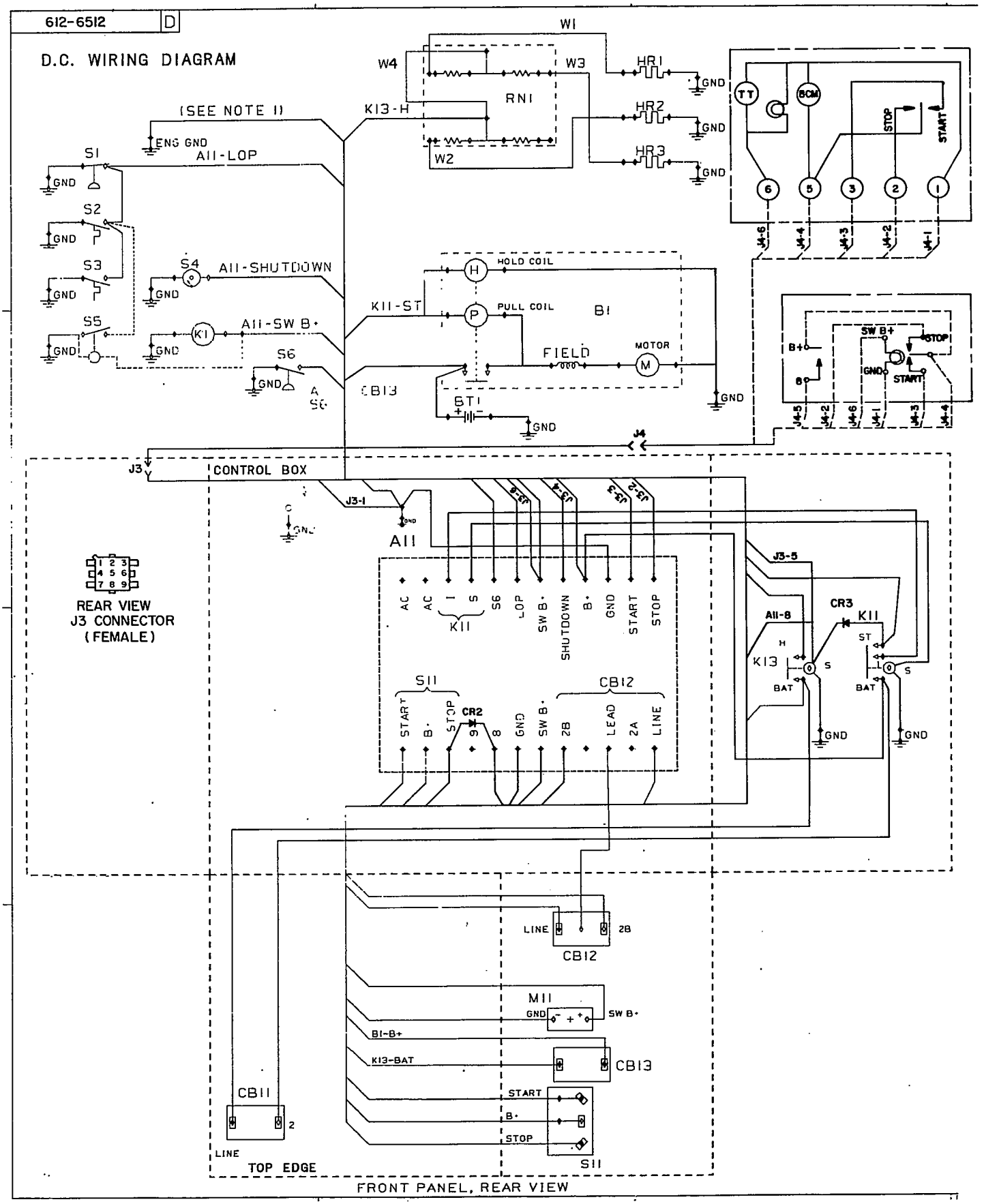
PARTS PO: MDL3

Onan — ONAN CORPORATION MINNEAPOLIS MINNESOTA

DATE 4-04-88 | DR DFO | ENGR WMX | CKR GS

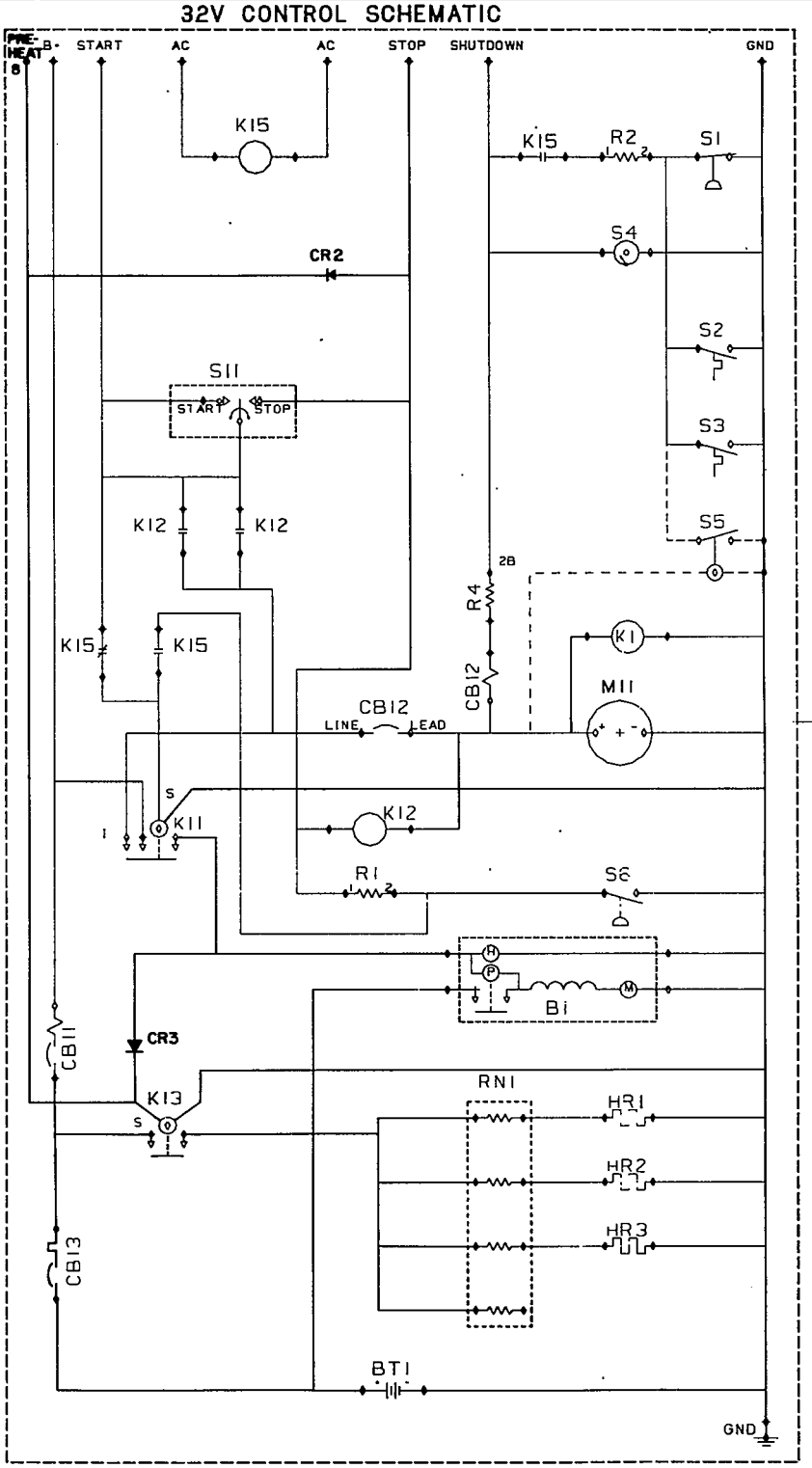
TITLE: CONTROL-GEN SET DC (24V)

SIMILAR TO 612-6443 | DWG NO. 612-6511 | SHT 1 OF 1 | DWG SIZE D



MDL3 32-VOLT DC STANDARD CONTROL

32V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
B1	Starter & Solenoid
BT1	Battery, 32-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR2	Rectifier, Stop
CR3	Rectifier, Blocking
CW1	Winding, Batt. Charging
HR1-3	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K15	Relay, Starter Protect
M11	Meter, Time Totalizing
R1	Resistor, (K12)
R2	Resistor (LOP Timing)
R4	Resistor, Current Limit
RN1	Resistor Network
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

NOTES:
1. CONNECT GND LEAD TO LOWER BOLT OF LIFTING BRACKET ON GLOW PLUG SIDE USING 1 856-0010 LK WASHER UNDER TERM.
2. UNLESS OTHERWISE NOTED, ALL COMPONENTS ARE SHOWN IN DE-ENERGIZED POSITION.
3. DASHED LINES INDICATE CONNECTIONS WHEN USED.
4. USE ONE WASHER ON EACH GROUND STUD AGAINST CONTROL BOX BOTTOM.
5. INSTALL INSULATION RINGS ON 301-7685 PLATE CONCENTRIC WITH LARGE CENTER HOLE.

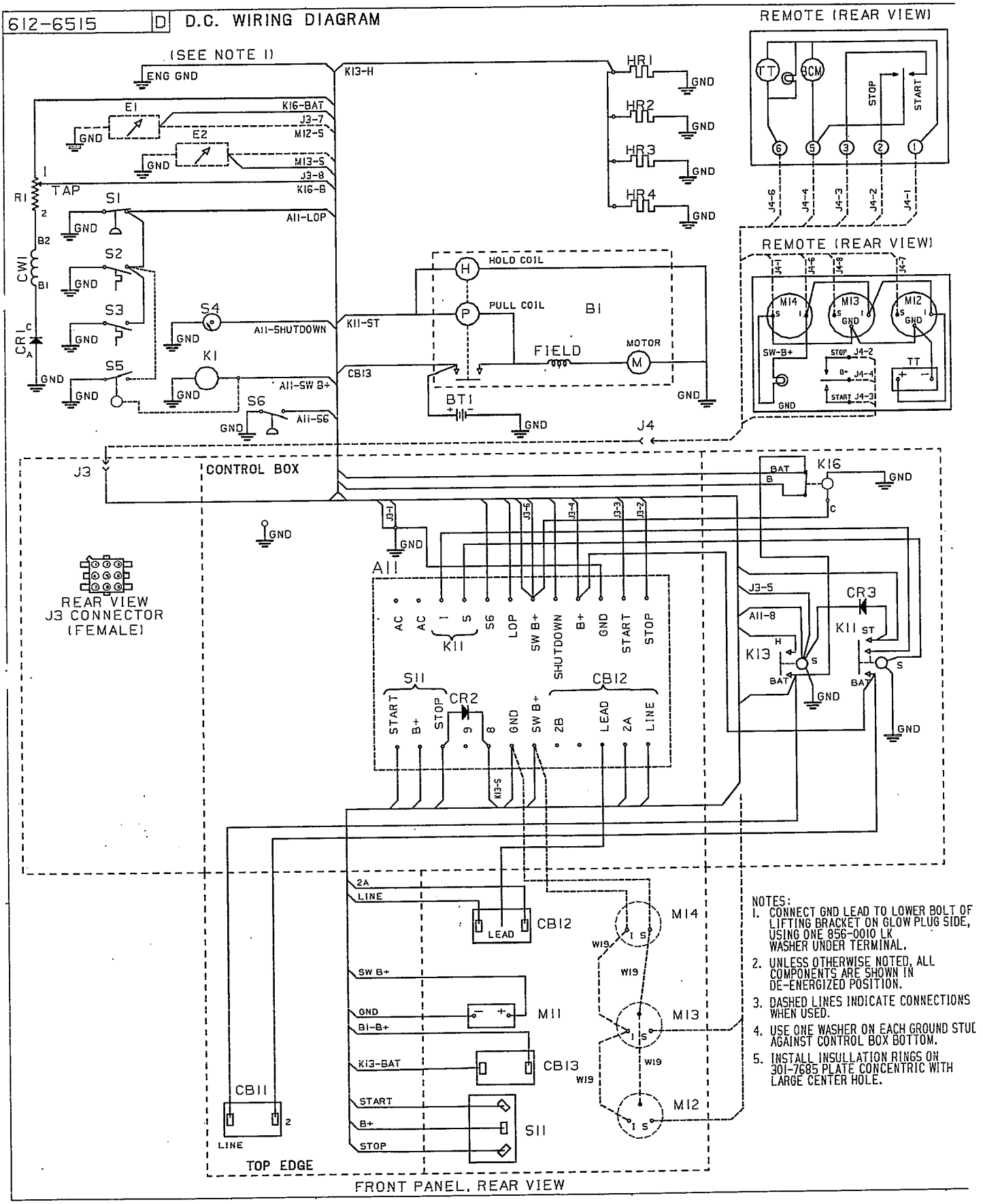
SAMP REL	DASH NO	MODEL NO
PROD REL WMX	-01	STD
PROD REL		
	PARTS PO	MDL3

Onan — BHAN CORPORATION MINNEAPOLIS MINNESOTA

DATE 3-22-88 | DR JC | ESN WN | CK GS

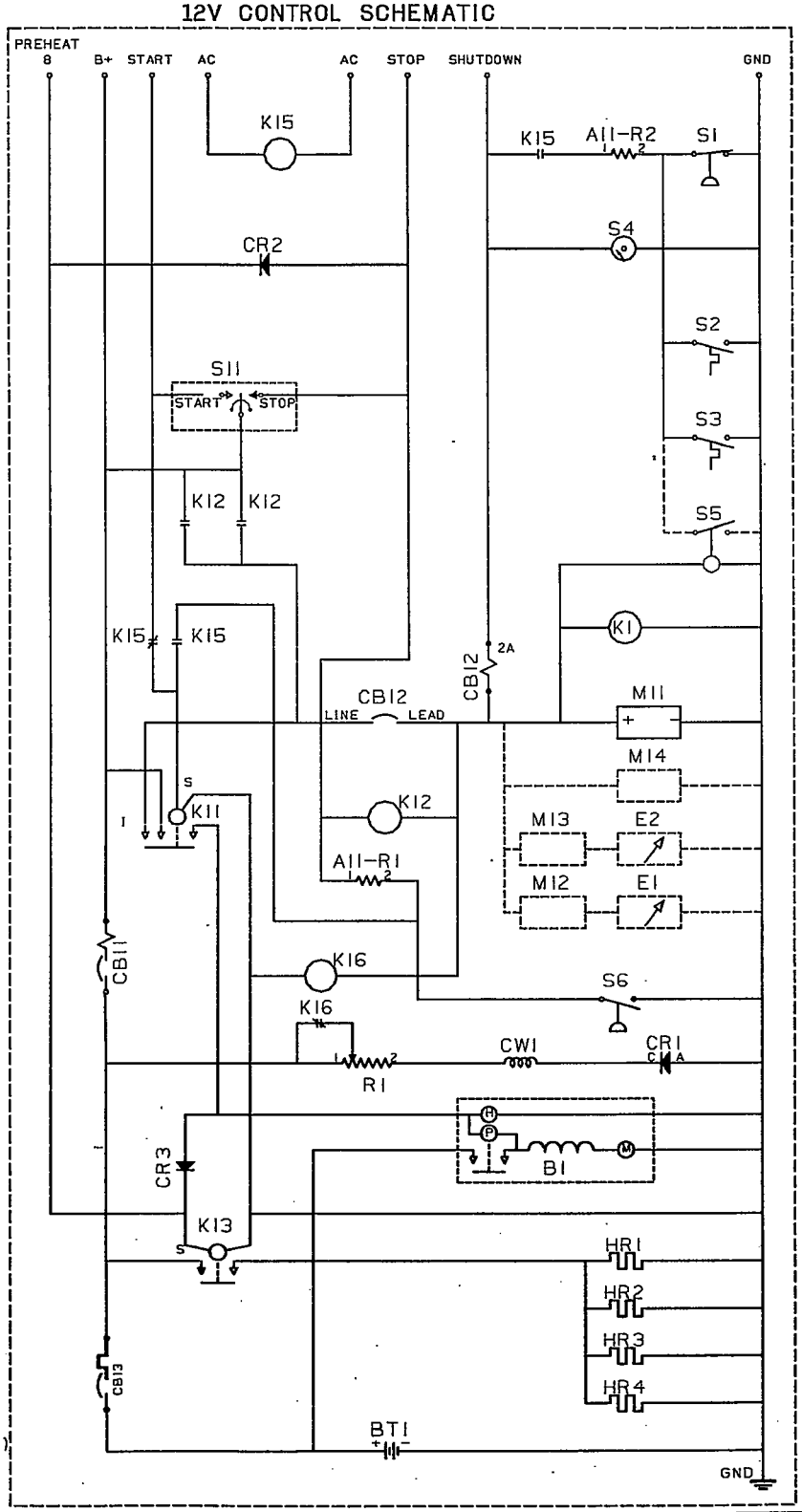
TITLE: CONTROL-GEN SET DC (32V)

SIMILAR TO 612-6457 | DWG NO. 612-6512 | SHT 1 OF 1 | SIZE D



MDL4 12-VOLT DC STD. CONTROL W/GAUGES; START SPEC "B"

12V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
A11-R1	Resistor, K12
A11-R2	Resistor, LOP Timing
B1	Starter & Solenoid
BT1	Battery, 12-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR1	Rectifier, Batt. Charging
CR2	Rectifier, Stop
CR3	Rectifier, Blocking
CW1	Winding, Batt. Charging
E1	Sender, Oil Pressure
E2	Sender, Coolant Temp.
HR1-4	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K15	Relay, Starter Protect
K16	Regulator, Voltage 2-Step
M11	Meter, Time Totalizing
M12	Meter, Oil Pressure
M13	Meter, Coolant Temp
M14	Meter, Volt
R1	Resistor, Battery Charging
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

CADD SYSTEM DWG

ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE
31,707	A	1	PRODUCTION RELEASE	WH	GS	4-01-88

SAMP REL | PROD REL WMH | PROD REL

DASH NO: -01, -02

MODEL NO: STD W/GAUGES

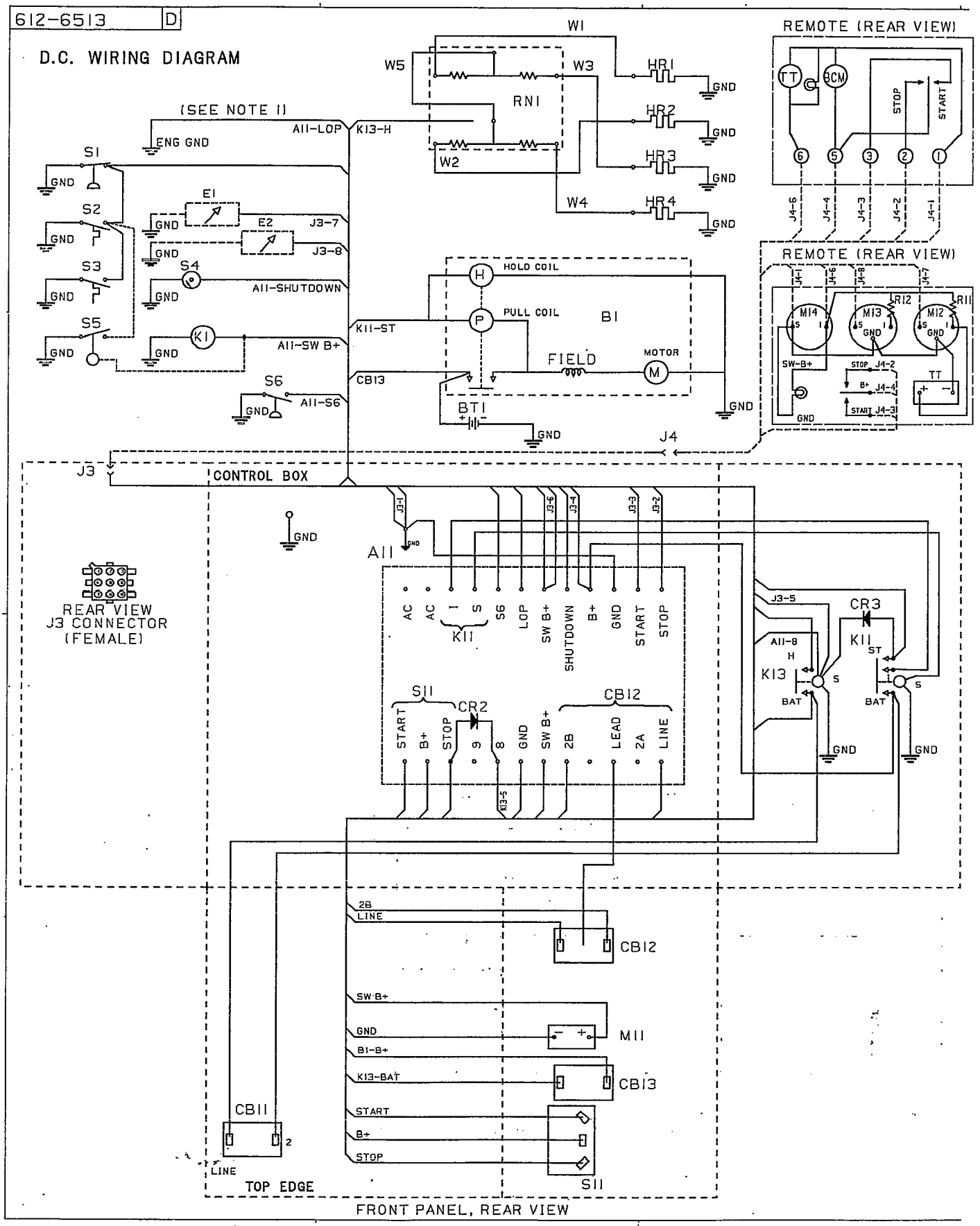
PARTS PO: MDL4

Onan — ONAN CORPORATION MINNEAPOLIS MINNESOTA

DATE 4-01-88 | DR DFO | ENGR WMH | CKR GS

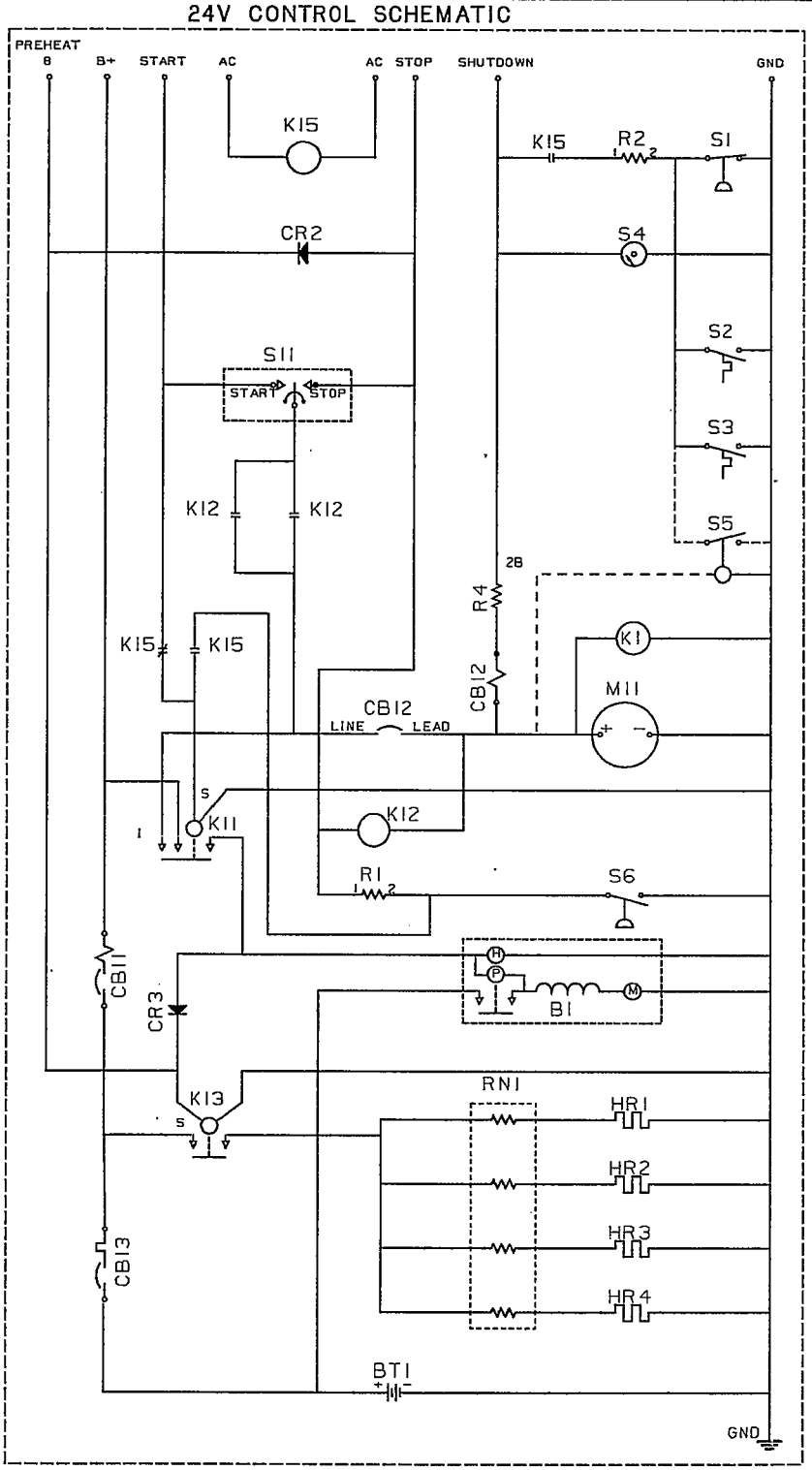
TITLE: CONTROL-GEN SET DC (12V)

SIMILAR TO 612-6372 | DWG NO. 612-6515 | SHT 1 OF 1 | DWG SIZE D



MDL4 24-VOLT DC STD. CONTROL; STARTING SPEC "B"

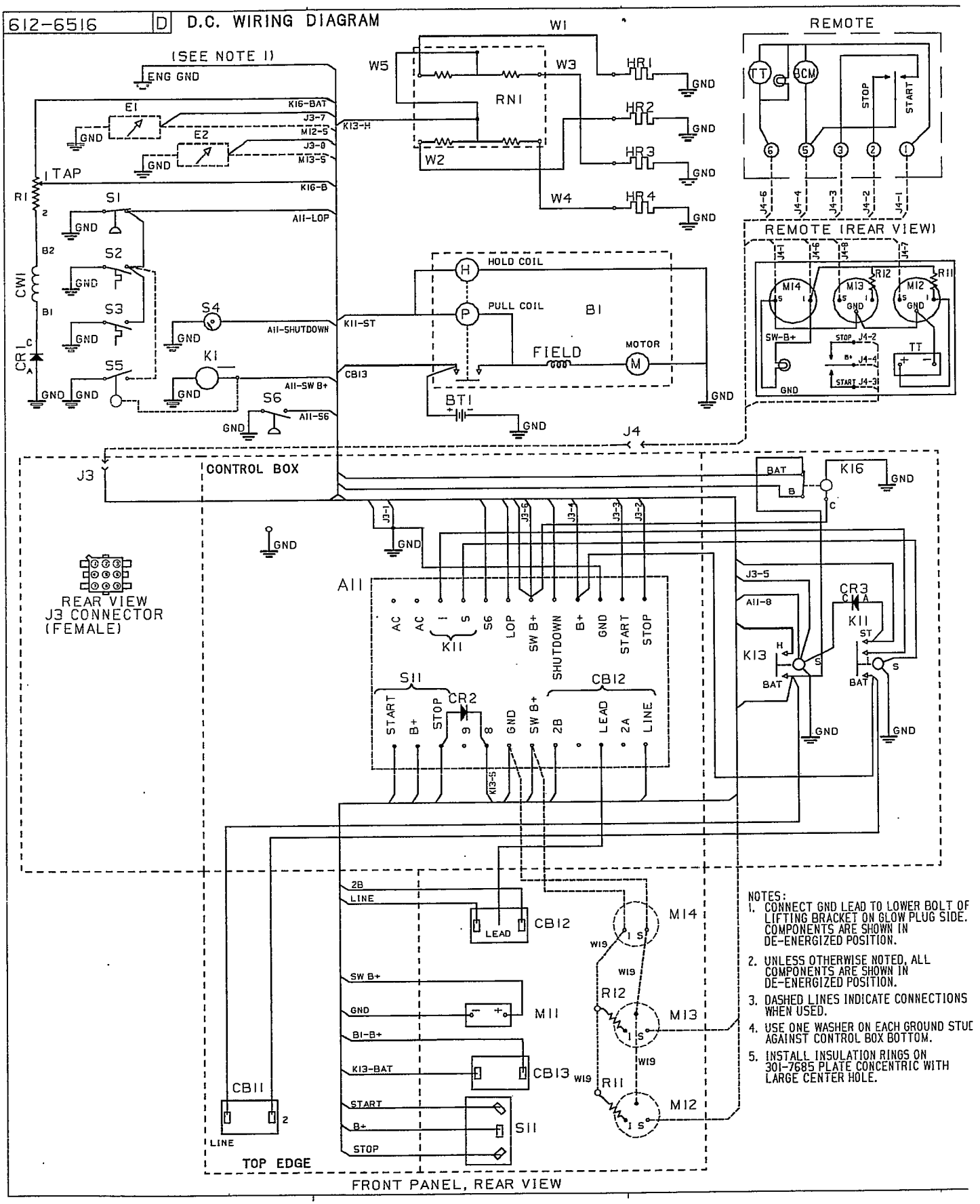
24V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
A11-R1	Resistor, K12
B1	Starter & Solenoid
BT1	Battery, 24-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR2	Rectifier, Stop
CR3	Rectifier, Blocking
E1	Sender, Oil Pressure
E2	Sender, Coolant Temp.
HR1-4	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K15	Relay, Starter Protect
M11	Meter, Time Totalizing
M12	Meter, Oil Pressure
M13	Meter, Coolant Temp
M14	Meter, Volt
R1	Resistor, Battery Charging
R2	Resistor, LOP Timing
R4	Resistor, Current Limit
RN1	Resistor, Network
R11, 12	Resistor, Meter
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

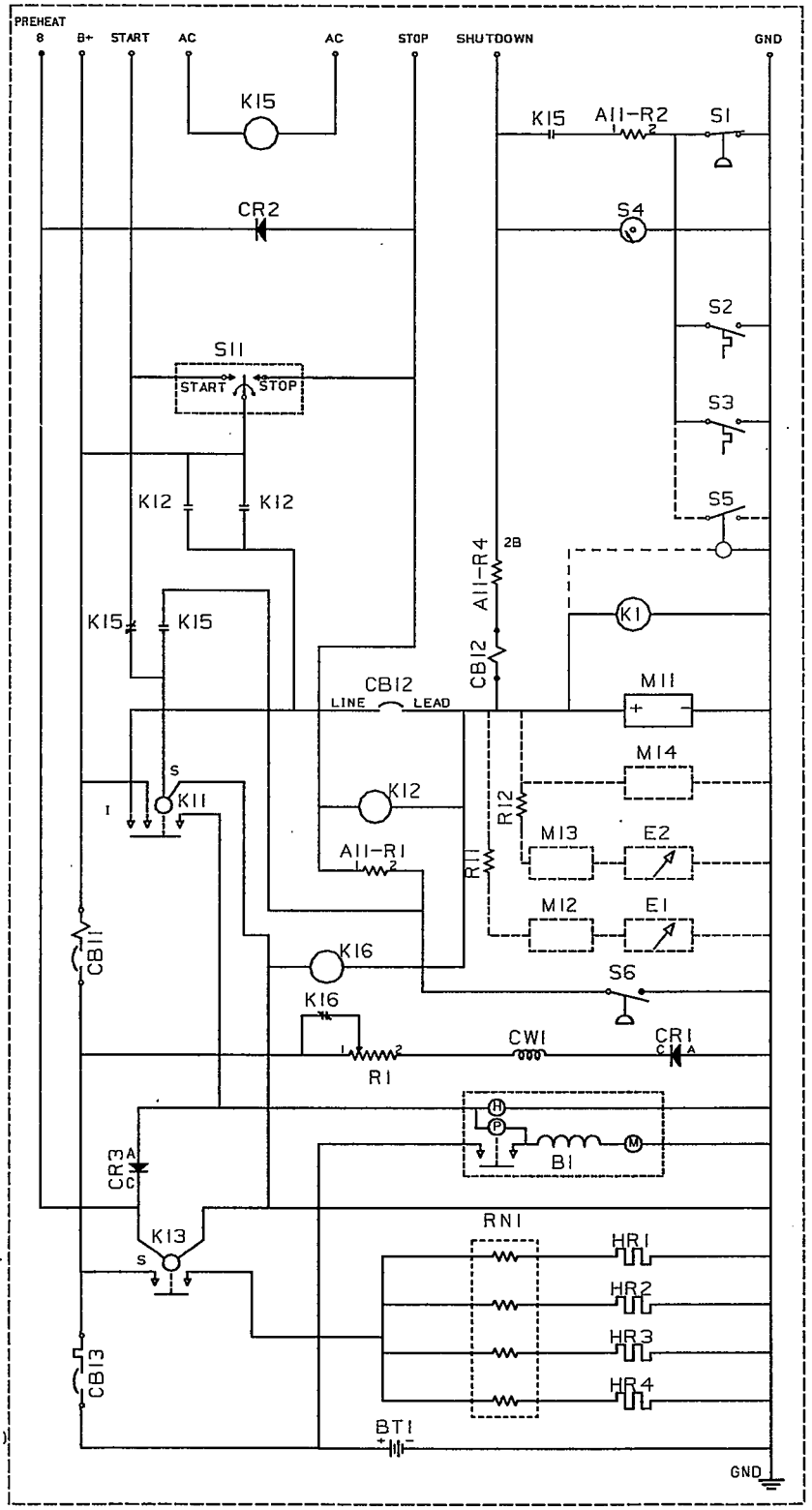
CADD SYSTEM DWG

SAMP REL	DASH NO	MODEL NO	Onan CORPORATION MINNEAPOLIS MINNESOTA
PROD REL WMH	-01	STD	DATE 3-23-88 DR DFO ENGR WMH CKR GS
PROD REL			TITLE CONTROL-GEN SET DC (24V)
	PARTS PO	MDL4	SIMILAR TO 612-6373 DWG NO. 612-6513 SHT 1 OF 1 DWG SIZE D



MDL4 24-VOLT DC STD. CONTROL W/GAUGES: START SPEC "B"

24V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
A11-R1	Resistor, K12
A11-R2	Resistor, LOP Timing
A11-R4	Resistor, Current Limit
B1	Starter & Solenoid
BT1	Battery, 24-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR1	Rectifier, Batt. Charging
CR2	Rectifier, Stop
CR3	Rectifier, Blocking
CW1	Winding, Batt. Charging
E1	Sender, Oil Pressure
E2	Sender, Coolant Temp.
HR1-4	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K15	Relay, Starter Protect
K16	Regulator, Voltage 2-Step
M11	Meter, Time Totalizing
M12	Meter, Oil Pressure
M13	Meter, Coolant Temp
M14	Meter, Volt
R1	Resistor, Battery Charging
R2	Resistor, LOP Timing
R4	Resistor, Current Limit
RN1	Resistor, Network
R11, 12	Resistor, Meter
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

CADD SYSTEM DWG

ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE
31,707	A	1	PRODUCTION RELEASE	WMK	GS	3-22-88

SAMP REL
PROD REL WMK
PROD REL

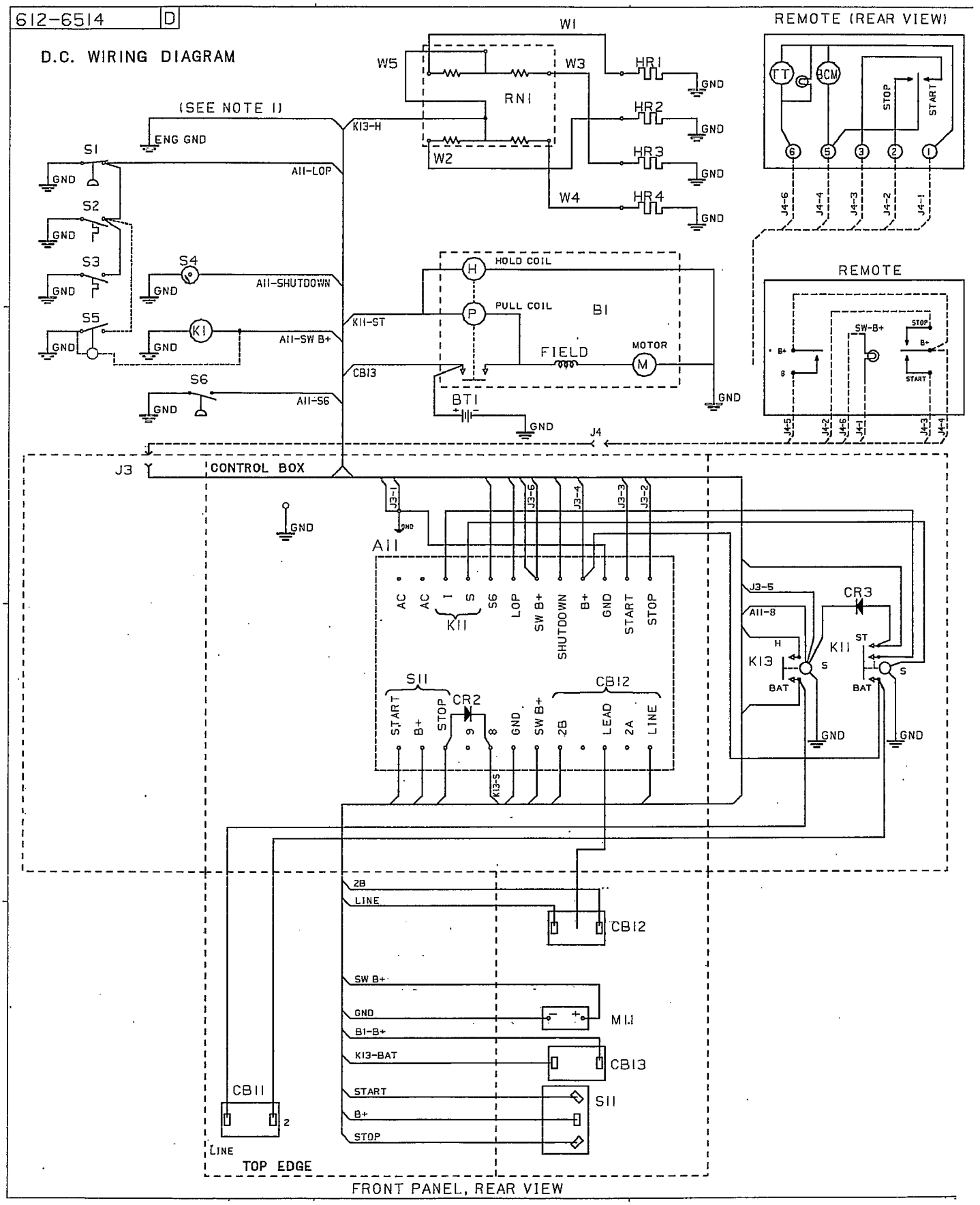
DASH NO: -01, -02
MODEL NO: STD, W/GAUGES
PARTS PO: MDL4

Onan — ONAN CORPORATION MINNEAPOLIS MINNESOTA

DATE 4-01-88 | DR DFO | ENGR WMK | CKR GS

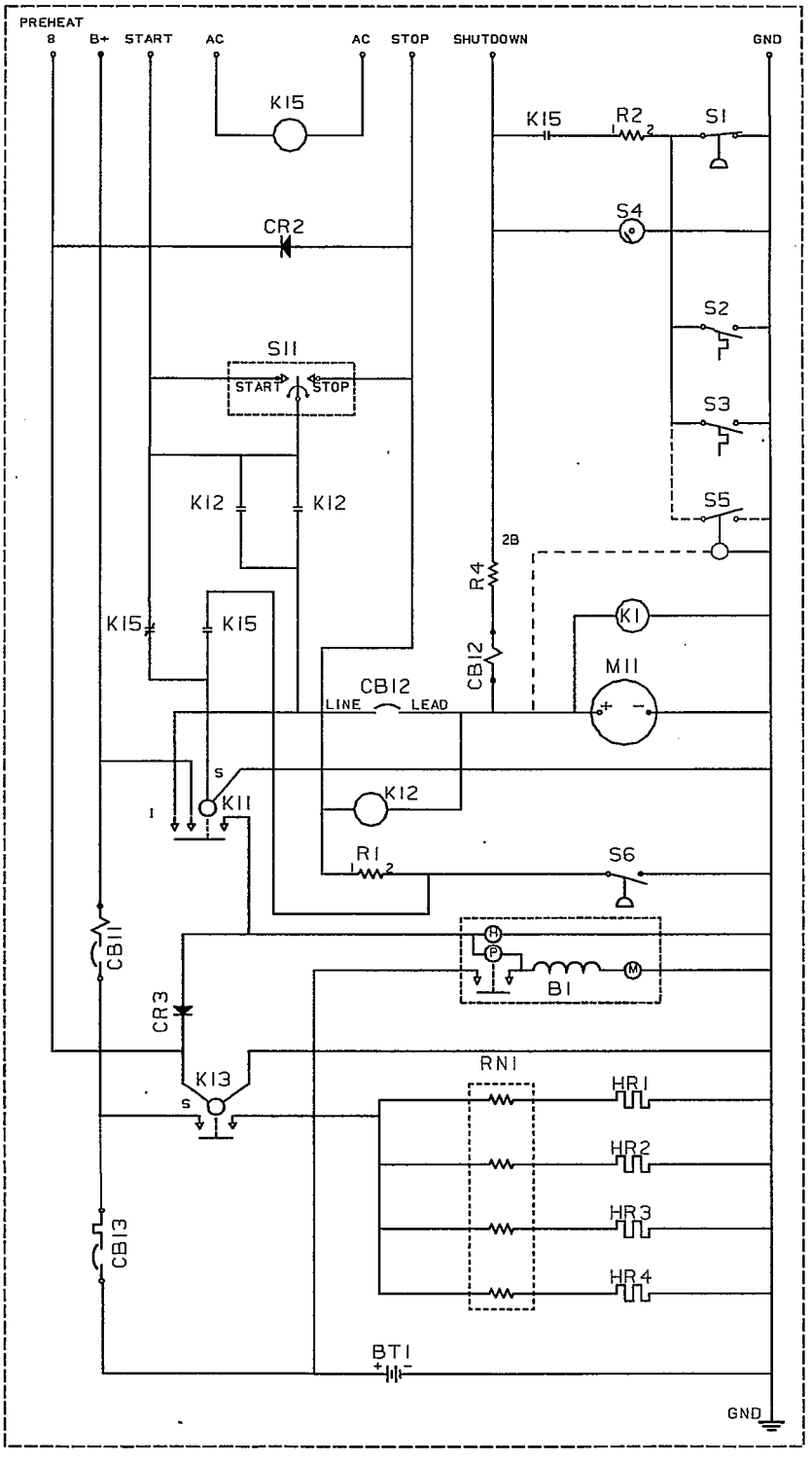
TITLE: CONTROL-GEN SET DC (24V)

SIMILAR TO 612-6374 | DWG NO. 612-6516 | SHT 1 OF 1 | DWG SIZE D



MDL4 32-VOLT DC STD. CONTROL; STARTING SPEC "B"

32V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
B1	Starter & Solenoid
BT1	Battery, 32-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR2	Rectifier, Stop
CR3	Rectifier, Blocking
HR1-4	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K15	Relay, Starter Protect
M11	Meter, Time Totalizing
R1	Resistor, Battery Charging
R2	Resistor, LOP Timing
R4	Resistor, Current Limit
RN1	Resistor Network
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

NOTES:
1. CONNECT GND LEAD TO LOWER BOLT OF LIFTING BRACKET ON GLOW PLUG SIDE USING 1 856-0010 LK WASHER UNDER TERM.
2. UNLESS OTHERWISE NOTED, ALL COMPONENTS ARE SHOWN IN DE-ENERGIZED POSITION.
3. DASHED LINES INDICATE CONNECTIONS WHEN USED.
4. USE ONE WASHER ON EACH GROUND STUD AGAINST CONTROL BOX BOTTOM.
5. INSTALL INSULATION RINGS ON 301-7685 PLATE CONCENTRIC WITH LARGE CENTER HOLE.

ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE
31,707	A	1	PRODUCTION RELEASE	WMS	GS	4-07-88

CADD SYSTEM DWG

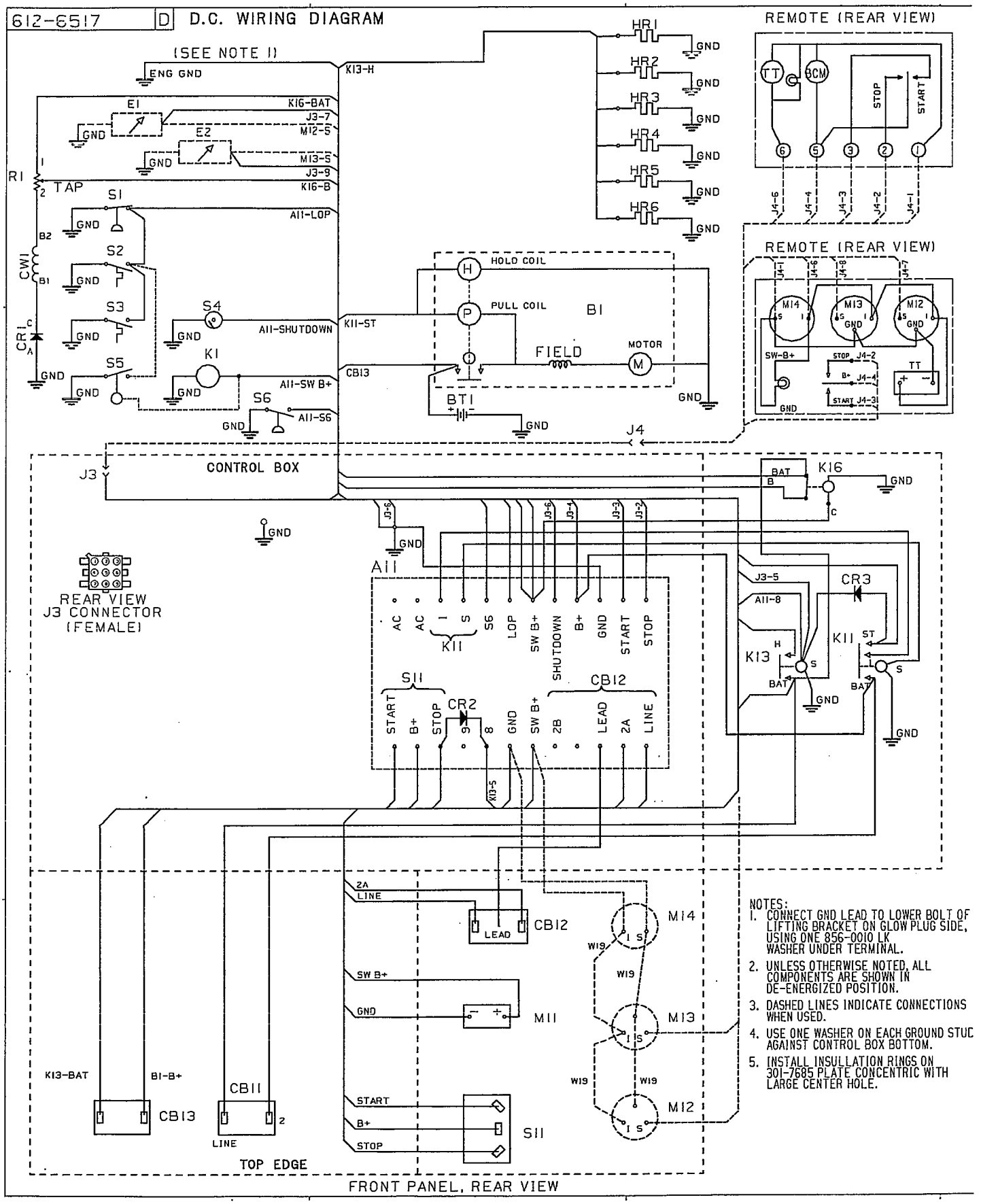
SAMP REL	DASH NO	MODEL NO
PROD REL WMK	-01	STD
PROD REL		
	PARTS PO	MDL4

Onan — ONAN CORPORATION MINNEAPOLIS MINNESOTA

DATE 4-07-88 DR DFO ENGR WMK CKR GS

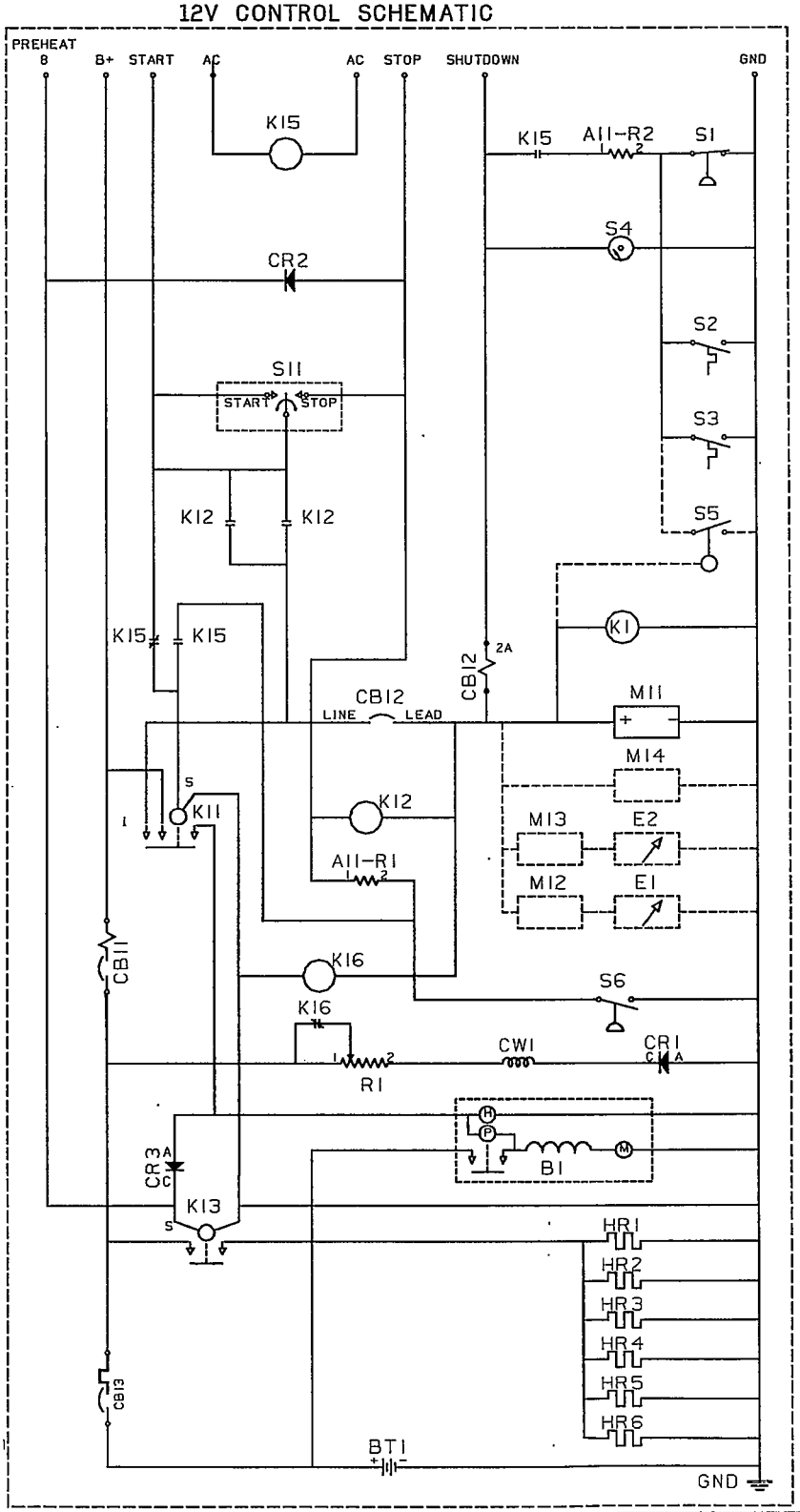
TITLE CONTROL-GEN SET DC (32V)

SIMILAR TO 612-6375 | DWG NO. 612-6514 | SHT 1 OF 1 | DWG SIZE D



MDL6 12-VOLT DC CONTROL W/GAUGES

12V CONTROL SCHEMATIC



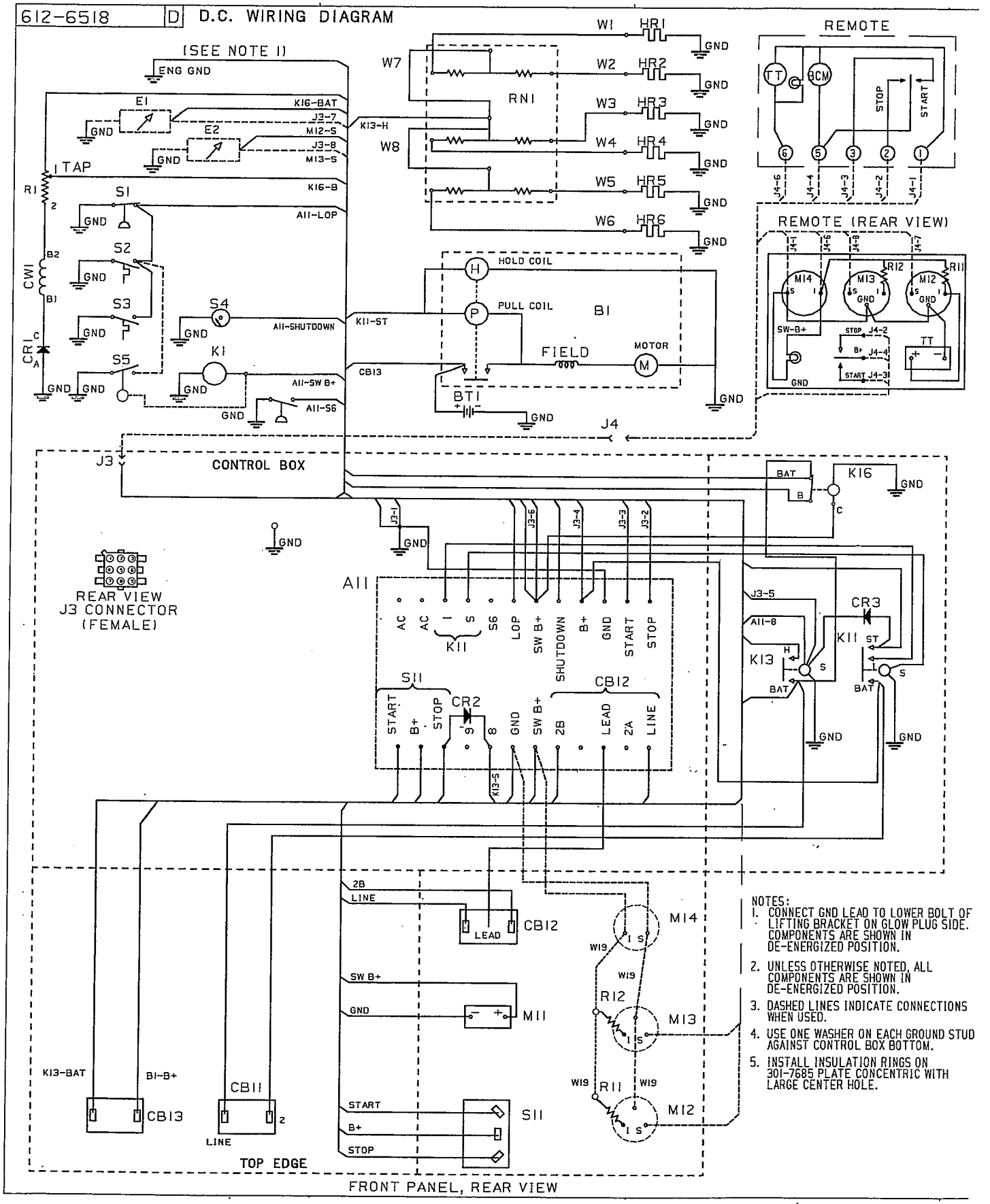
Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
A11-R1	Resistor, K12
A11-R2	Resistor, LOP Timing
B1	Starter & Solenoid
BT1	Battery, 12-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR1	Rectifier, Batt. Charging
CR2	Rectifier, Stop
CR3	Rectifier, Blocking
CW1	Winding, Batt. Charging
E1	Sender, Oil Pressure
E2	Sender, Coolant Temp.
HR1-6	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K15	Relay, Starter Protect
K16	Regulator, Voltage 2-Step
M11	Meter, Time Totalizing
M12	Meter, Oil Pressure
M13	Meter, Coolant Temp
M14	Meter, Volt
R1	Resistor, Battery Charging
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

CADD SYSTEM DWG

ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE
31,707	A	1	PRODUCTION RELEASE	WMX	GS	3-19-88

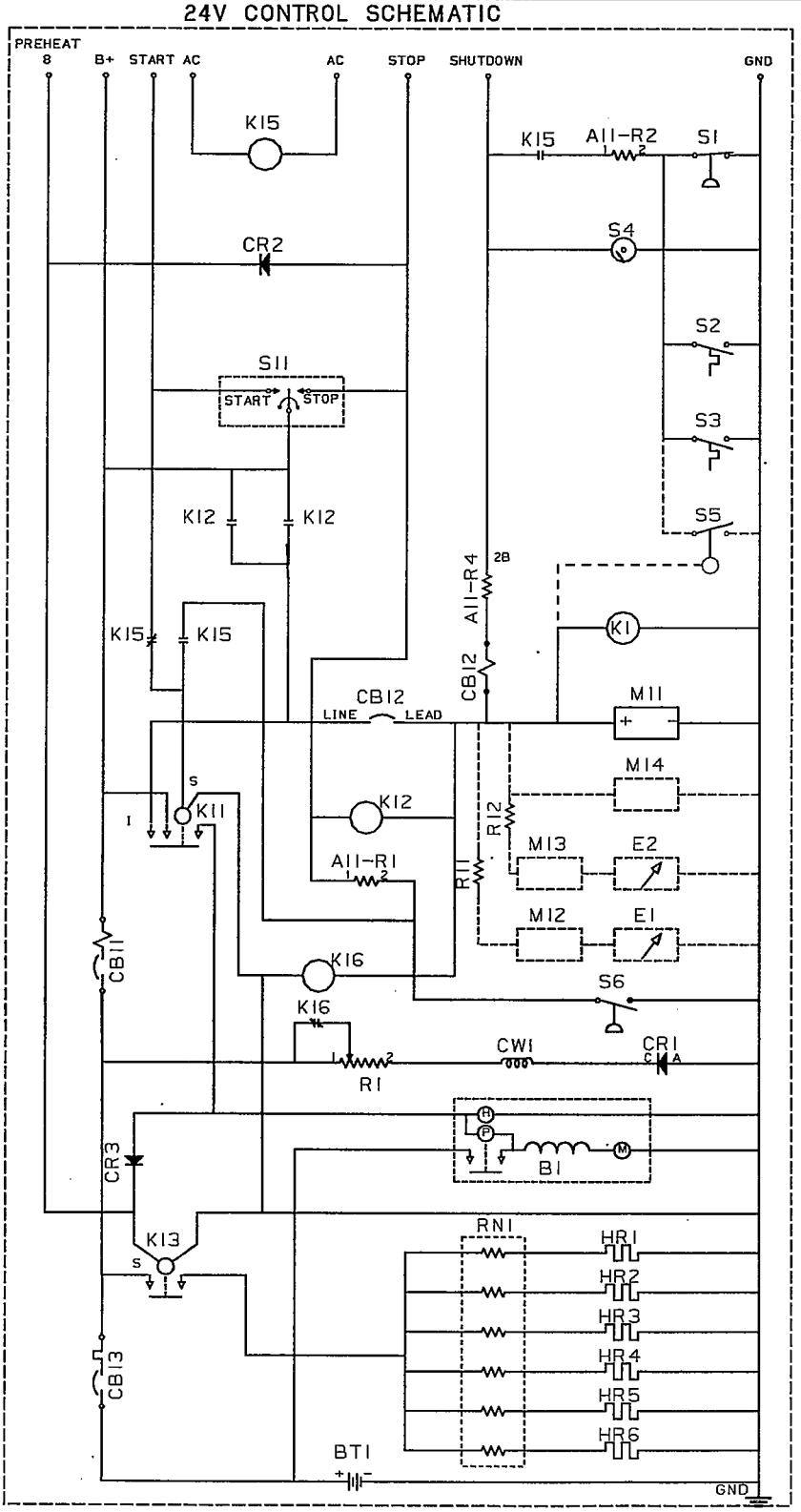
SAMP REL
PROD REL WMX
PROD REL
DASH NO -01 -02
MODEL NO STD W/GAUGES
MDL6
PARTS PO

Onan — ONAN CORPORATION MINNEAPOLIS MINNESOTA
DATE 3-19-88 DR DFO ENGR WMX CKR GS
TITLE CONTROL-GEN SET DC (12V)
SIMILAR TO 612-6425
DWG NO. 612-6517
SHT 1 OF 1
DWG SIZE D



MDL6 24-VOLT DC CONTROL W/GAUGES

24V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
A11-R1	Resistor, K12
A11-R2	Resistor, LOP Timing
A11-R4	Resistor, Current Limit
B1	Starter & Solenoid
BT1	Battery, 24-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR1	Rectifier, Batt. Charging
CR2	Rectifier, Stop
CR3	Rectifier, Blocking
CW1	Winding, Batt. Charging
E1	Sender, Oil Pressure
E2	Sender, Coolant Temp.
HR1-6	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K15	Relay, Starter Protect
K16	Regulator, Voltage 2-Step
M11	Meter, Time Totalizing
M12	Meter, Oil Pressure
M13	Meter, Coolant Temp
M14	Meter, Volt
R1	Resistor, Battery Charging
RN1	Resistor Network
R11, 12	Resistor, Meter
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

CADD SYSTEM DWG

ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE
31,707	A	1	PRODUCTION RELEASE	WMH	GS	4-07-88

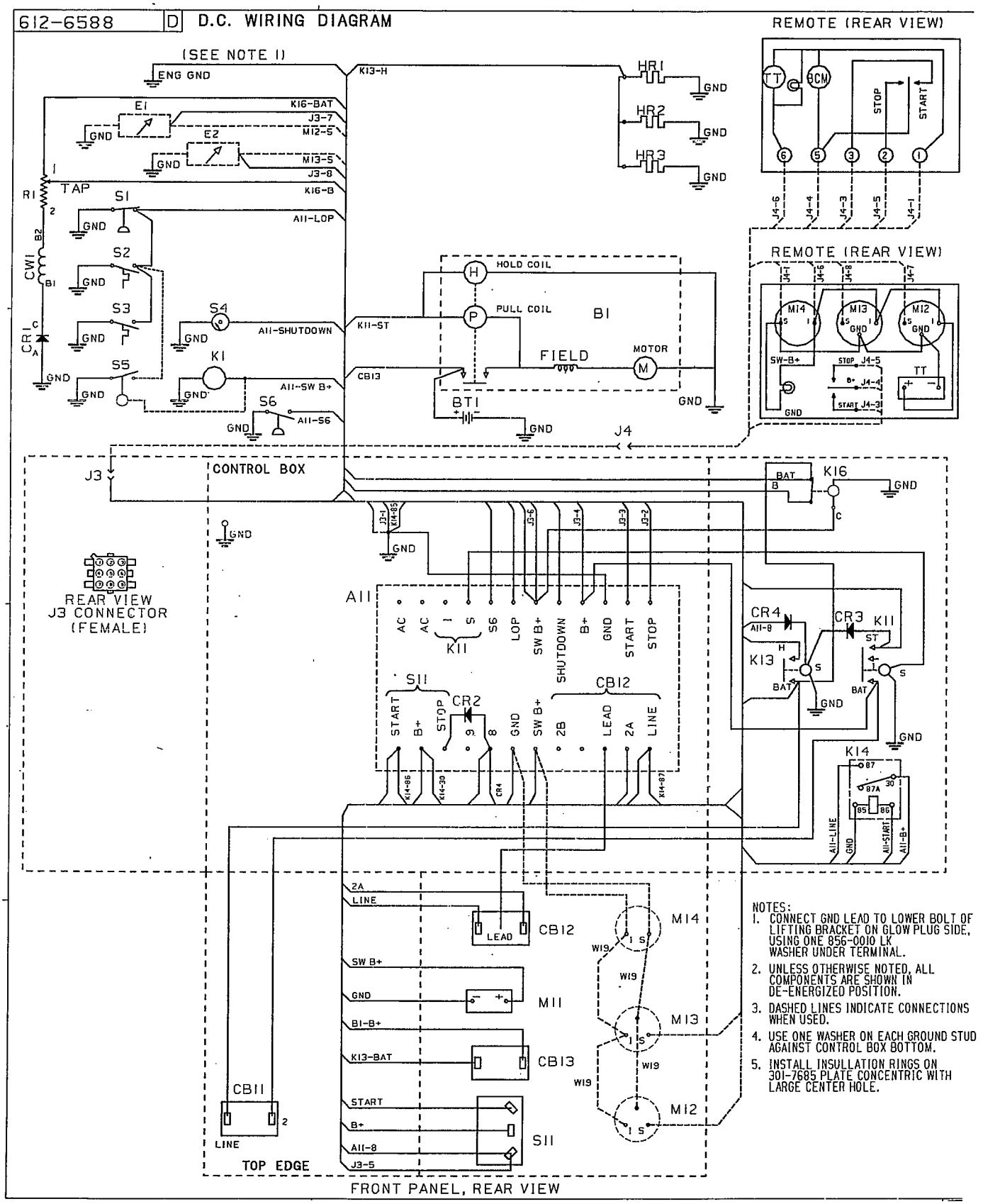
SAMP REL	DASH NO	MODEL NO
PROD REL WMH	-01	STD
PROD REL	-02	W/GAUGES
PARTS PO		MDL6

Onan — ONAN CORPORATION MINNEAPOLIS MINNESOTA

DATE 4-07-88 | DR DFO | WMH | GS

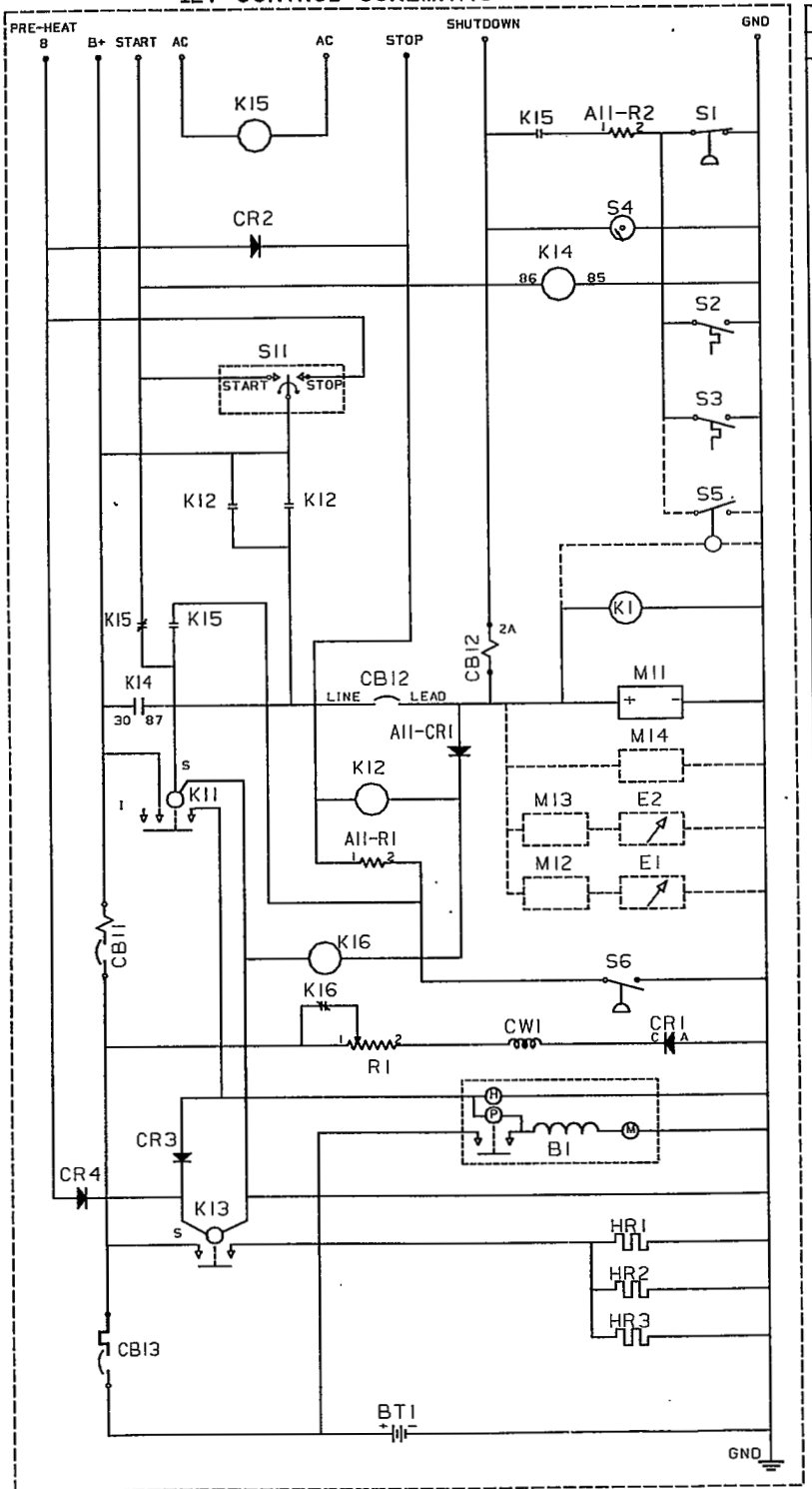
TITLE: CONTROL-GEN SET DC (24V)

SIMILAR TO 612-6426 | DWG NO. 612-6518 | SHT 1 OF 1 | DWG SIZE D



MDL3 12-VOLT DC CONTROL W/GAUGES; STARTING SPEC "A"

12V CONTROL SCHEMATIC

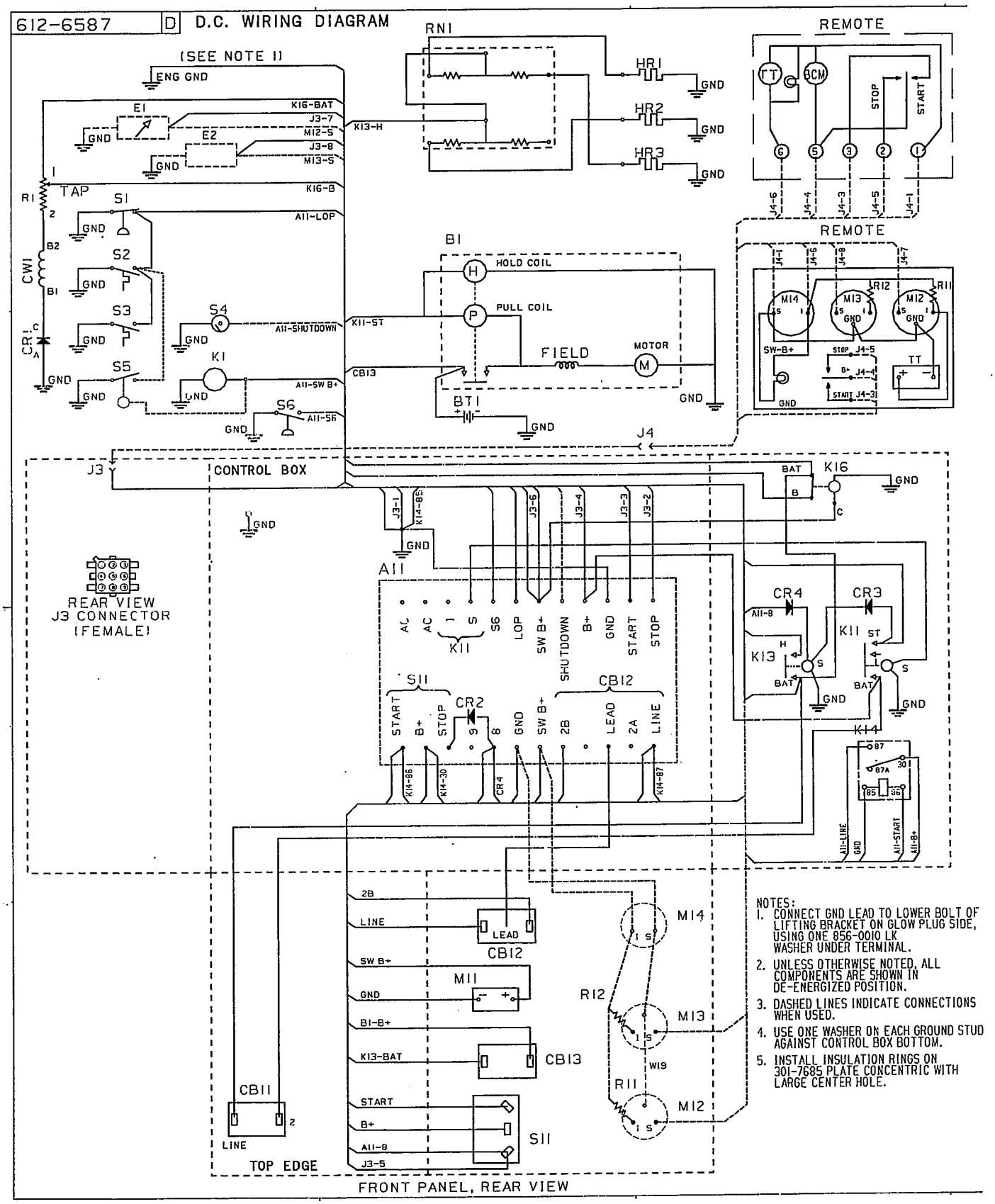


Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
A11-R1	Resistor, K12
A11-R2	Resistor, LOP Timing
B1	Starter & Solenoid
BT1	Battery, 12-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR1	Rectifier, Batt. Charging
CR2	Rectifier, Stop
CR3, CR4	Rectifier, Blocking
CW1	Winding, Batt. Charging
E1	Sender, Oil Pressure
E2	Sender, Coolant Temp.
HR1-3	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K14	Relay, Fuel Solenoid
K15	Relay, Starter Protect
K16	Regulator, Voltage 2-Step
M11	Meter, Time Totalizing
M12	Meter, Oil Pressure
M13	Meter, Coolant Temp
M14	Meter, Volt
R1	Resistor, Battery Charging
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

CADD SYSTEM DWG

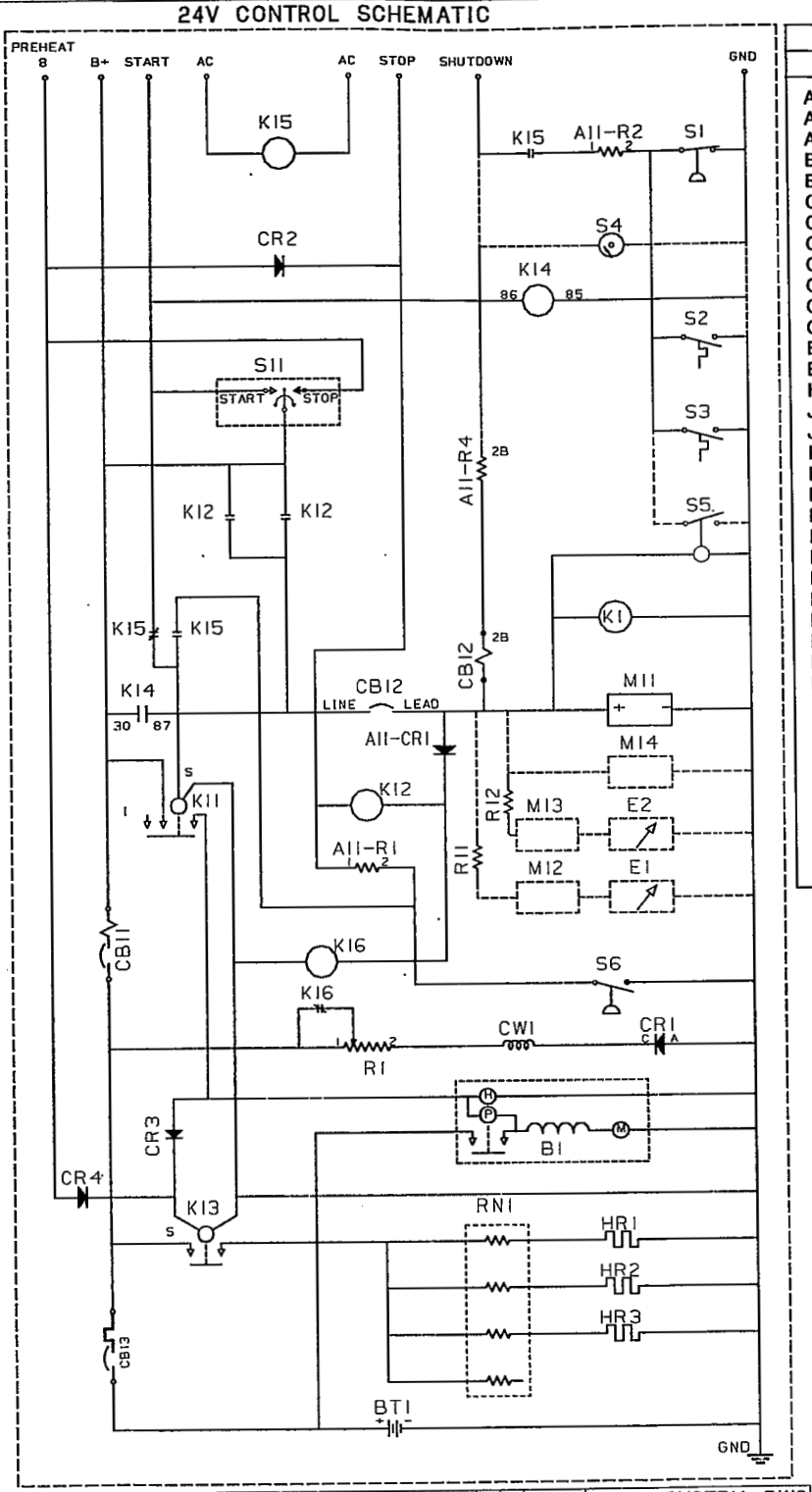
36,330	A	1	PRODUCTION RELEASE	WMH	PGW	6-05-90	
ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE	

SAMP REL	DASH NO	MODEL NO	Onan — ONAN CORPORATION MINNEAPOLIS MINNESOTA
PROD REL	-01	STD	DATE 6-05-90 DR DFO ENGR WMH CKR PGW
PROD REL WMH	-02	W/GAUGES	TITLE CONTROL-GEN SET DC (12V)
PARTS PD		MDL3	SIMILAR TO 612-6509 DWG NO. 612-6588 SHT 1 OF 1 DWG SIZE D



MDL3 24-VOLT DC CONTROL W/GAUGES

24V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
A11-R1	Resistor, K12
A11-R2	Resistor, LOP Timing
B1	Starter & Solenoid
BT1	Battery, 24-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR1	Rectifier, Batt. Charging
CR2	Rectifier, Stop
CR3, CR4	Rectifier, Blocking
CW1	Winding, Batt. Charging
E1	Sender, Oil Pressure
E2	Sender, Coolant Temp.
HR1-3	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K14	Relay, Fuel Solenoid
K15	Relay, Starter Protect
K16	Regulator, Voltage 2-Step
M11	Meter, Time Totalizing
M12	Meter, Oil Pressure
M13	Meter, Coolant Temp
M14	Meter, Volt
R1	Resistor, Battery Charging
RN1	Resistor Network
R11, 12	Resistor, Meter
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

CADD SYSTEM DWG

ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE
36,330	A	1	PRODUCTION RELEASE		RW	6-05-90

SAMP REL

PROD REL WMJ

PROD REL

DASH NO: -01, -02

MODEL NO: STD W/GAUGES

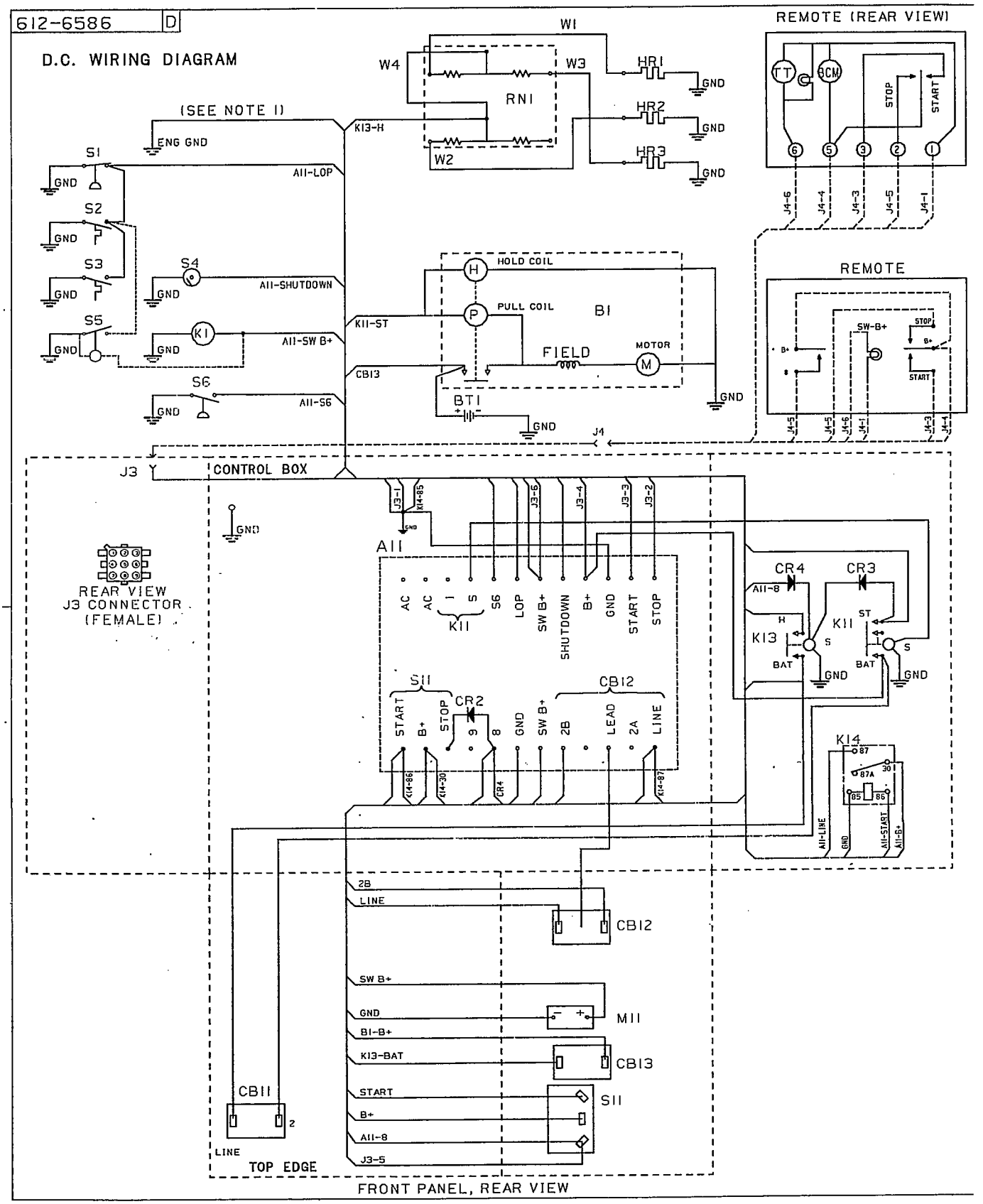
PARTS PO: MDL3

Onan — ONAN CORPORATION MINNEAPOLIS MINNESOTA

DATE 6-05-90 | DR DFO | ENGR | CKR RW

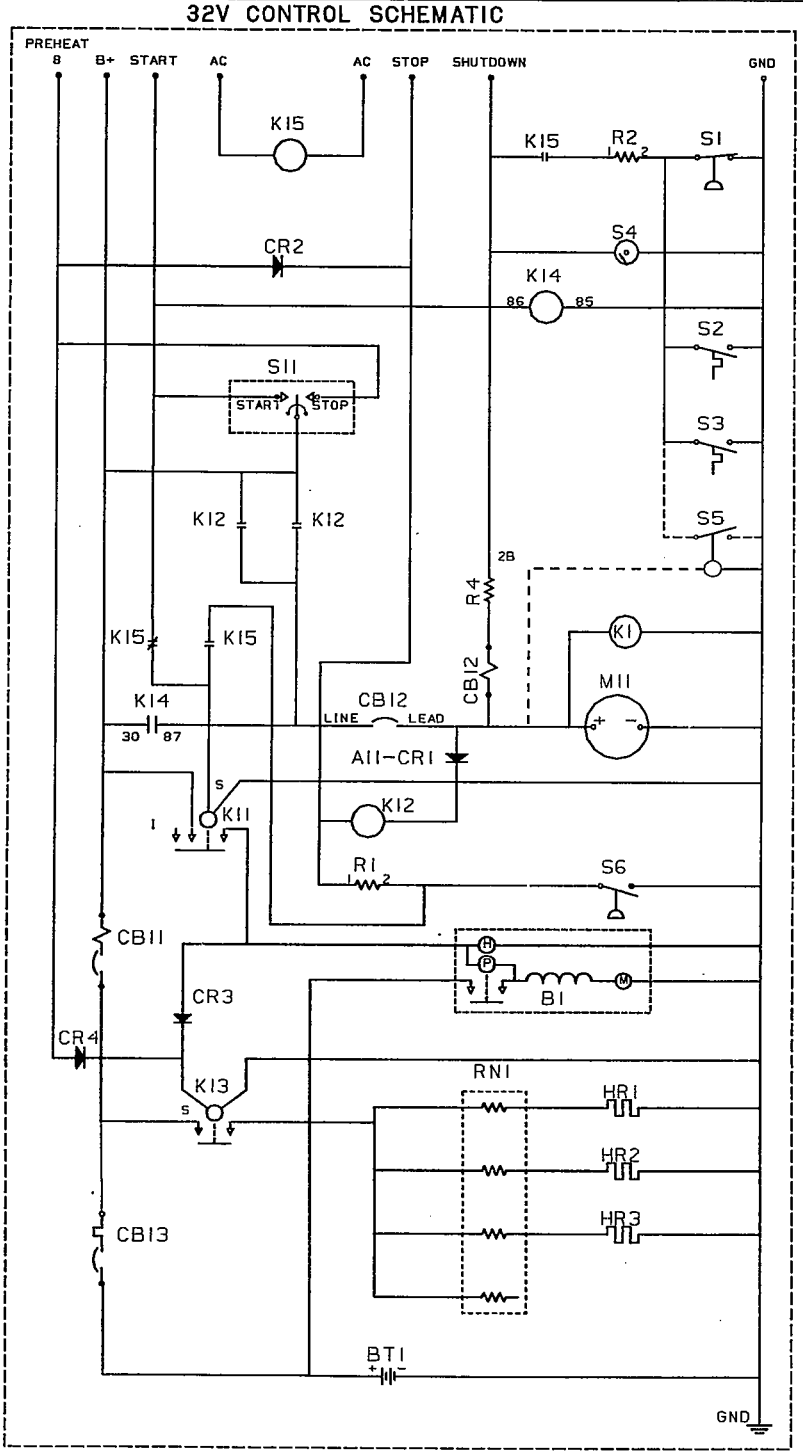
TITLE: CONTROL-GEN SET DC (24V)

SIMILAR TO 612-6511 | DWG NO. 612-6587 | SHT 1 OF 1 | DWG SIZE D



MDL3 32-VOLT DC STD. CONTROL

32V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
B1	Starter & Solenoid
BT1	Battery, 32-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR2	Rectifier, Stop
CR3, CR4	Rectifier, Blocking
CW1	Winding, Batt. Charging
HR1-3	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K14	Relay, Fuel Solenoid
K15	Relay, Starter Protect
M11	Meter, Time Totalizing
R1	Resistor, (K12)
R2	Resistor (LOP Timing)
R4	Resistor, Current Limit
RN1	Resistor Network
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

NOTES:
1. CONNECT GND LEAD TO LOWER BOLT OF LIFTING BRACKET ON GLOW PLUG SIDE USING 1 856-0010 LK WASHER UNDER TERM.
2. UNLESS OTHERWISE NOTED, ALL COMPONENTS ARE SHOWN IN DE-ENERGIZED POSITION.
3. DASHED LINES INDICATE CONNECTIONS WHEN USED.
4. USE ONE WASHER ON EACH GROUND STUD AGAINST CONTROL BOX BOTTOM.
5. INSTALL INSULATION RINGS ON 301-7685 PLATE CONCENTRIC WITH LARGE CENTER HOLE.

ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE
36,330	A	1	PRODUCTION RELEASE	WMK	RW	6-06-90

CADD SYSTEM DWG

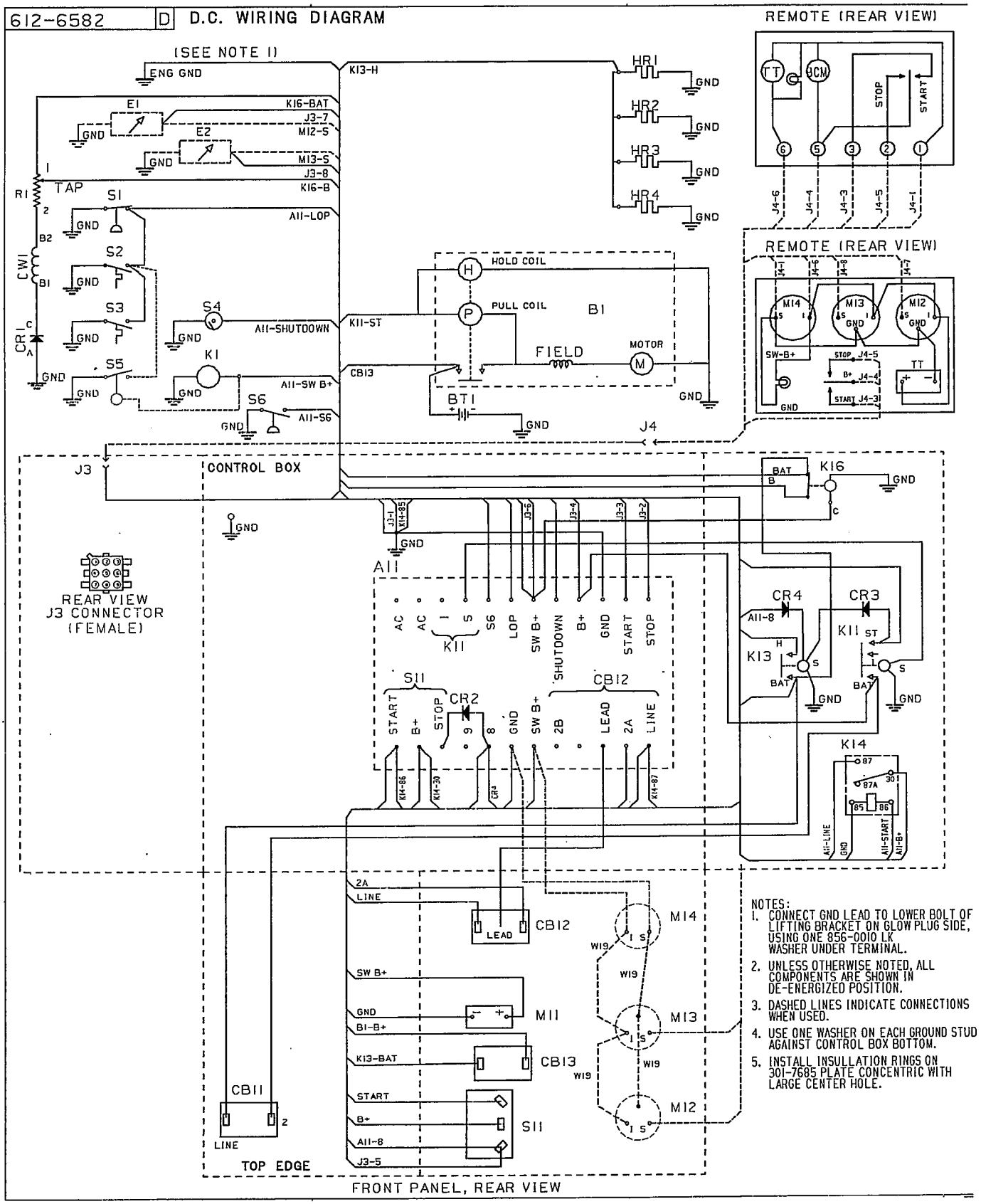
SAMP REL	DASH NO	MODEL NO
PROD REL WMK	-01	STD
PROD REL		
	PARTS PO	MDL3

Onan — ONAN CORPORATION MINNEAPOLIS MINNESOTA

DATE 6-06-90 DR DFO ENGR WMK CKR RW

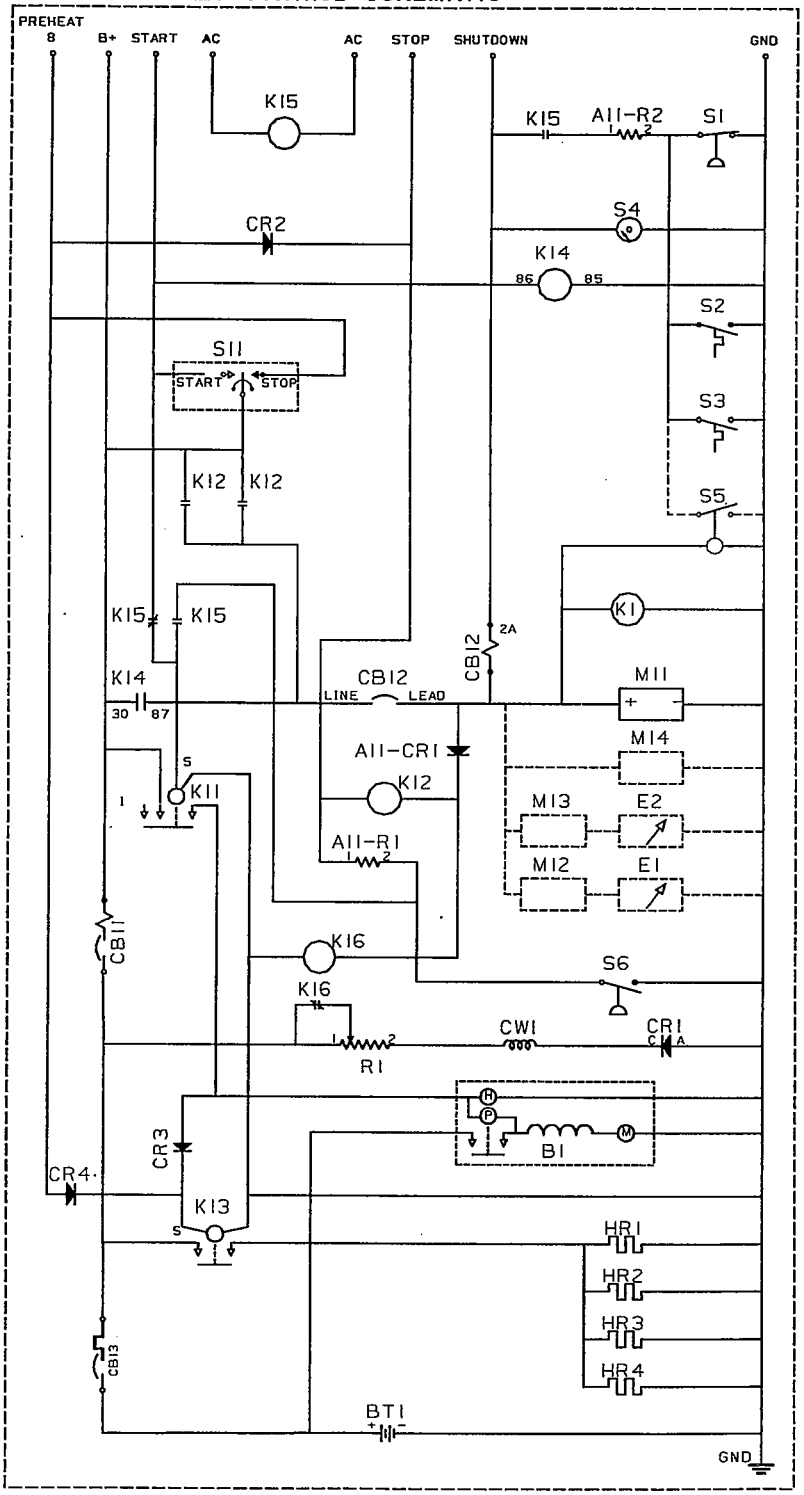
TITLE: CONTROL-GEN SET DC (32V)

SIMILAR TO 612-6511 | DWG NO. 612-6586 | SHT 1 OF 1 | DWG SIZE D



MDL4 12-VOLT DC STD. CONTROL W/GAUGES; STARTING SPEC "B"

12V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
A11-R1	Resistor, K12
A11-R2	Resistor, LOP Timing
B1	Starter & Solenoid
BT1	Battery, 12-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR1	Rectifier, Batt. Charging
CR2	Rectifier, Stop
CR3, CR4	Rectifier, Blocking
CW1	Winding, Batt. Charging
E1	Sender, Oil Pressure
E2	Sender, Coolant Temp.
HR1-4	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K14	Relay, Fuel Solenoid
K15	Relay, Starter Protect
K16	Regulator, Voltage 2-Step
M11	Meter, Time Totalizing
M12	Meter, Oil Pressure
M13	Meter, Coolant Temp
M14	Meter, Volt
R1	Resistor, Battery Charging
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

CADD SYSTEM DWG

ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE	
36,330	A	1	PRODUCTION RELEASE			6-06-90	

SAMP REL
PROD REL WMH
PROD REL

DASH NO
-01
-02

MODEL NO
STD
W/GAUGES

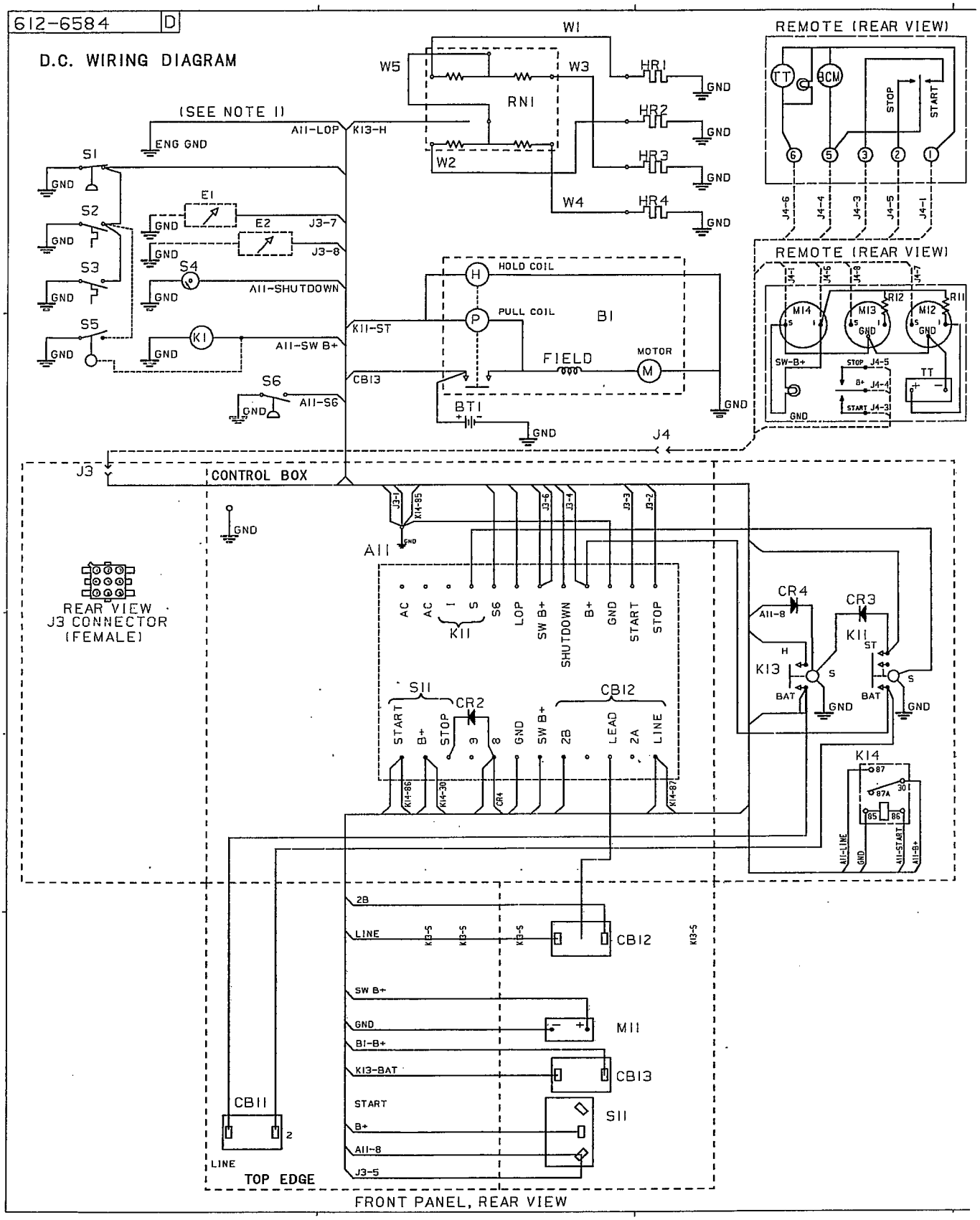
MDL4

Onan — ONAN CORPORATION MINNEAPOLIS MINNESOTA

DATE 6-06-90 DR DFO CHKR

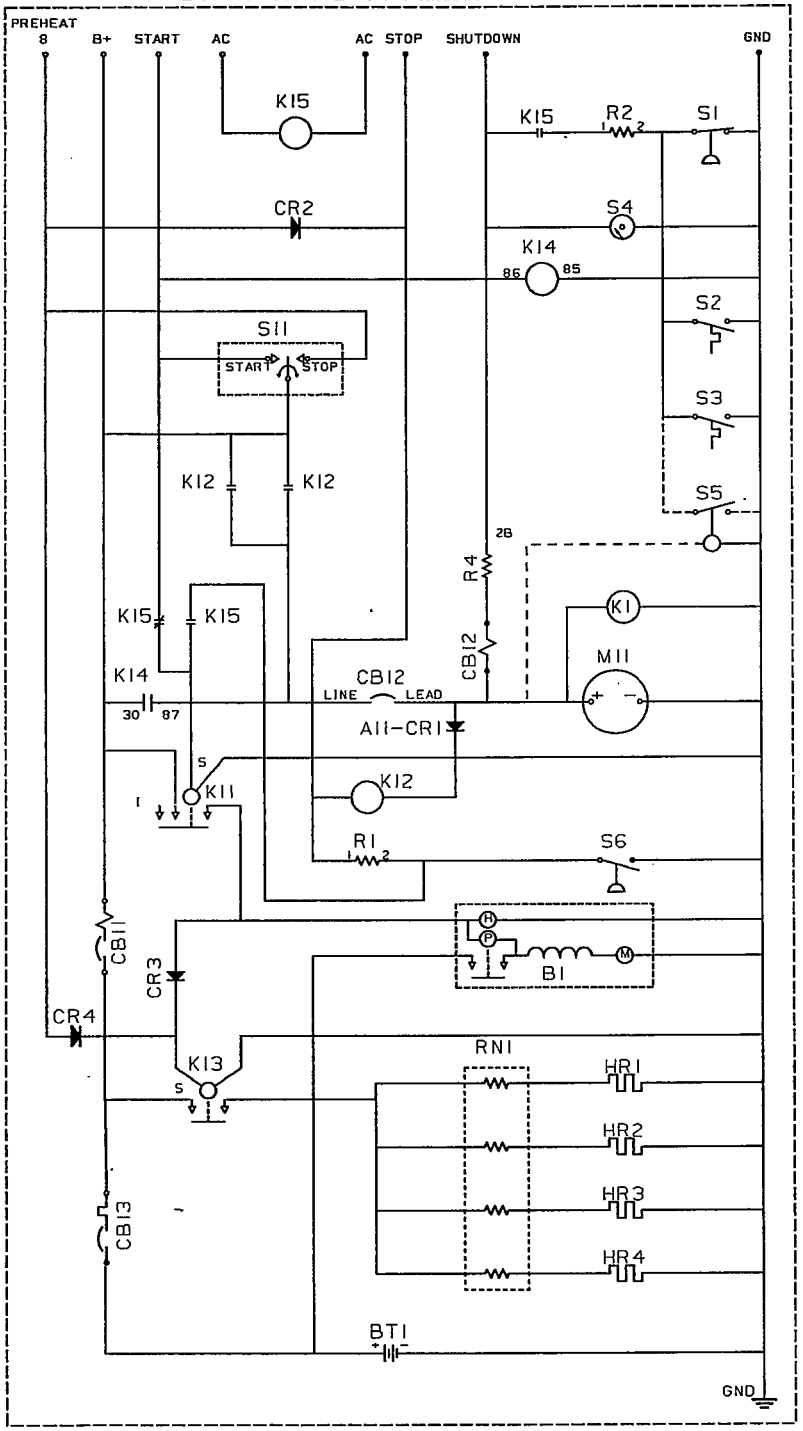
TITLE
CONTROL-GEN SET DC (12V)

SIMILAR TO 612-6515
DWG NO. 612-6582
SHT 1 OF 1
DWG SIZE D



MDL4 24-VOLT DC STD. CONTROL; STARTING SPEC "B"

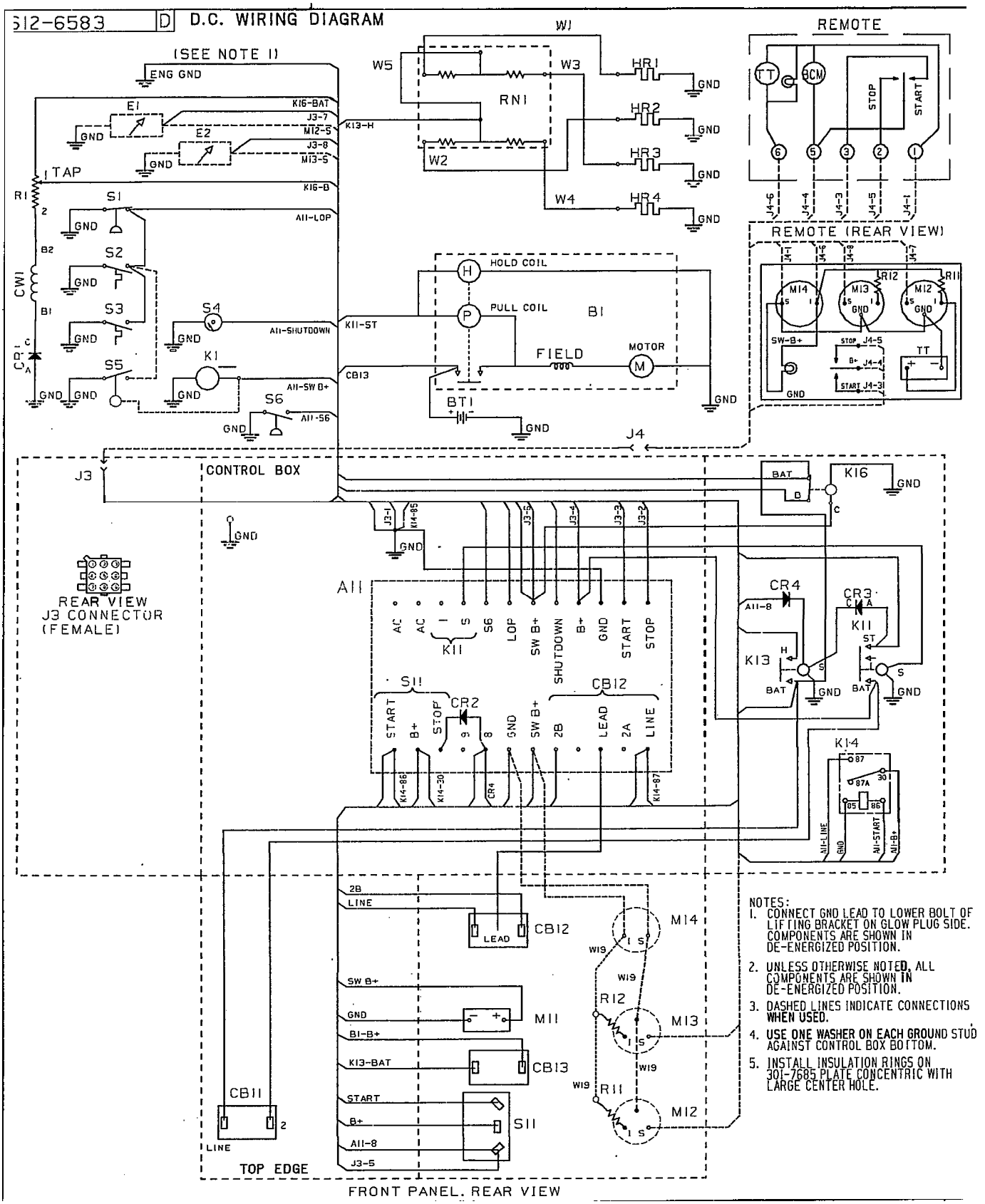
24V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
A11-R1	Resistor, K12
B1	Starter & Solenoid
BT1	Battery, 24-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR2	Rectifier, Stop
CR3, CR4	Rectifier, Blocking
E1	Sender, Oil Pressure
E2	Sender, Coolant Temp.
HR1-4	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K14	Relay, Fuel Solenoid
K15	Relay, Starter Protect
M11	Meter, Time Totalizing
M12	Meter, Oil Pressure
M13	Meter, Coolant Temp
M14	Meter, Volt
R1	Resistor, Battery Charging
R2	Resistor, LOP Timing
R4	Resistor, Current Limit
RN1	Resistor, Network
R11, 12	Resistor, Meter
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

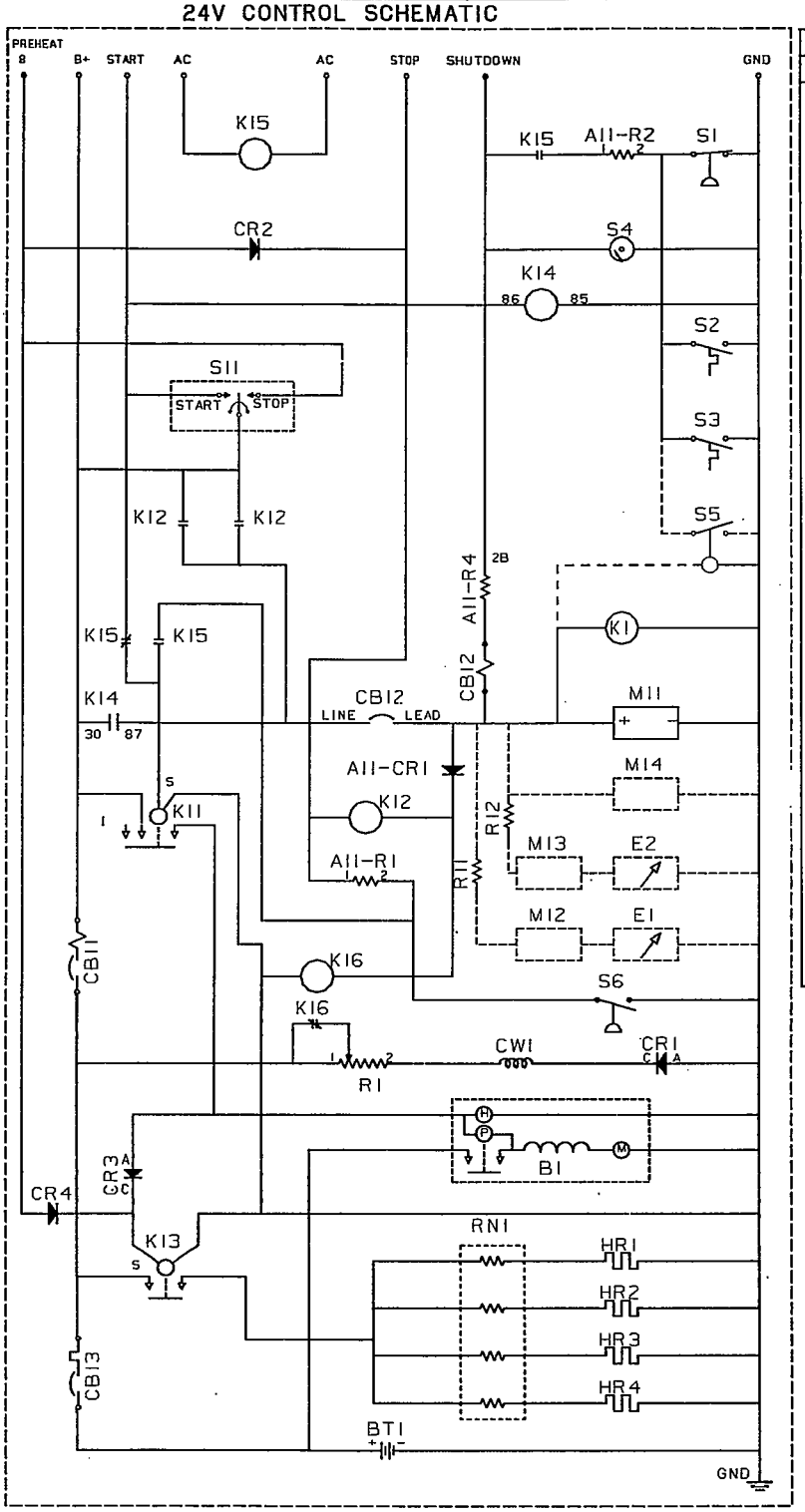
CADD SYSTEM DWG

SAMP REL	DASH NO	MODEL NO	Onan CMM CORPORATION MINNEAPOLIS MINNESOTA
PROD REL WMH	-01	STD	DATE 6-06-90 DR DFO ENGR KR
PROD REL			TITLE CONTROL-GEN SET DC (24V)
	PARTS PO	MDL4	SIMILAR TO 612-6513 DWG NO. 612-6584 SHT 1 OF 1 DWG SIZE D



MDL4 24-VOLT DC STD. CONTROL W/GAUGES; STARTING SPEC "B"

24V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
A11-R1	Resistor, K12
A11-R2	Resistor, LOP Timing
A11-R4	Resistor, Current Limit
B1	Starter & Solenoid
BT1	Battery, 24-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR1	Rectifier, Batt. Charging
CR2	Rectifier, Stop
CR3, CR4	Rectifier, Blocking
CW1	Winding, Batt. Charging
E1	Sender, Oil Pressure
E2	Sender, Coolant Temp.
HR1-4	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K14	Relay, Fuel Solenoid
K15	Relay, Starter Protect
K16	Regulator, Voltage 2-Step
M11	Meter, Time Totalizing
M12	Meter, Oil Pressure
M13	Meter, Coolant Temp
M14	Meter, Volt
R1	Resistor, Battery Charging
R2	Resistor, LOP Timing
R4	Resistor, Current Limit
RN1	Resistor, Network
R11, 12	Resistor, Meter
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

CADD SYSTEM DWG

SAMP REL	DASH NO	MODEL NO
PROD REL WMN	-01	STD
PROD REL	-02	W/GAUGES
	PARTS PO	MDL4

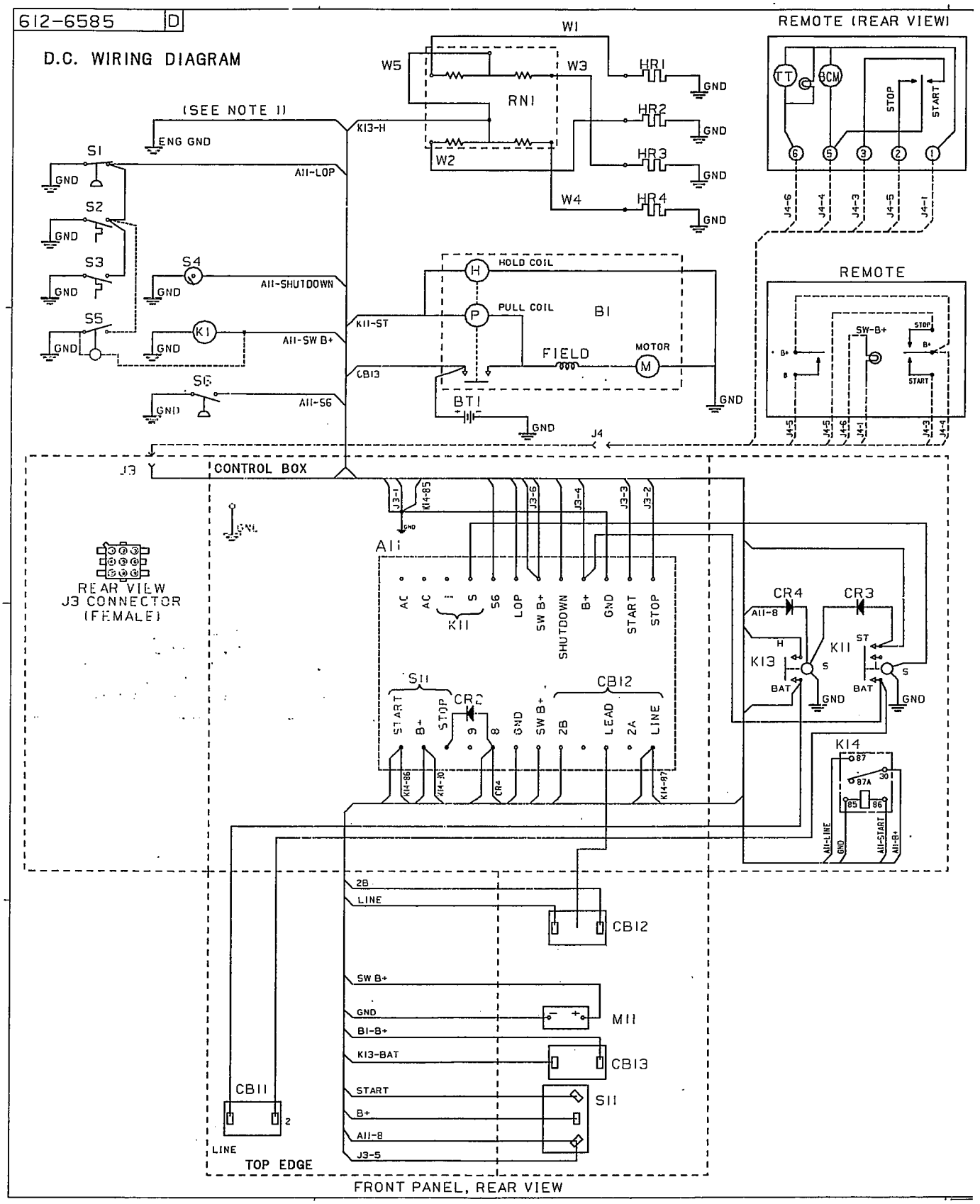
Onan — ONAN CORPORATION MINNEAPOLIS MINNESOTA

DATE 6-06-90 | DR DFO | ENGR WMN | CKR RW

TITLE: CONTROL-GEN SET DC (24V)

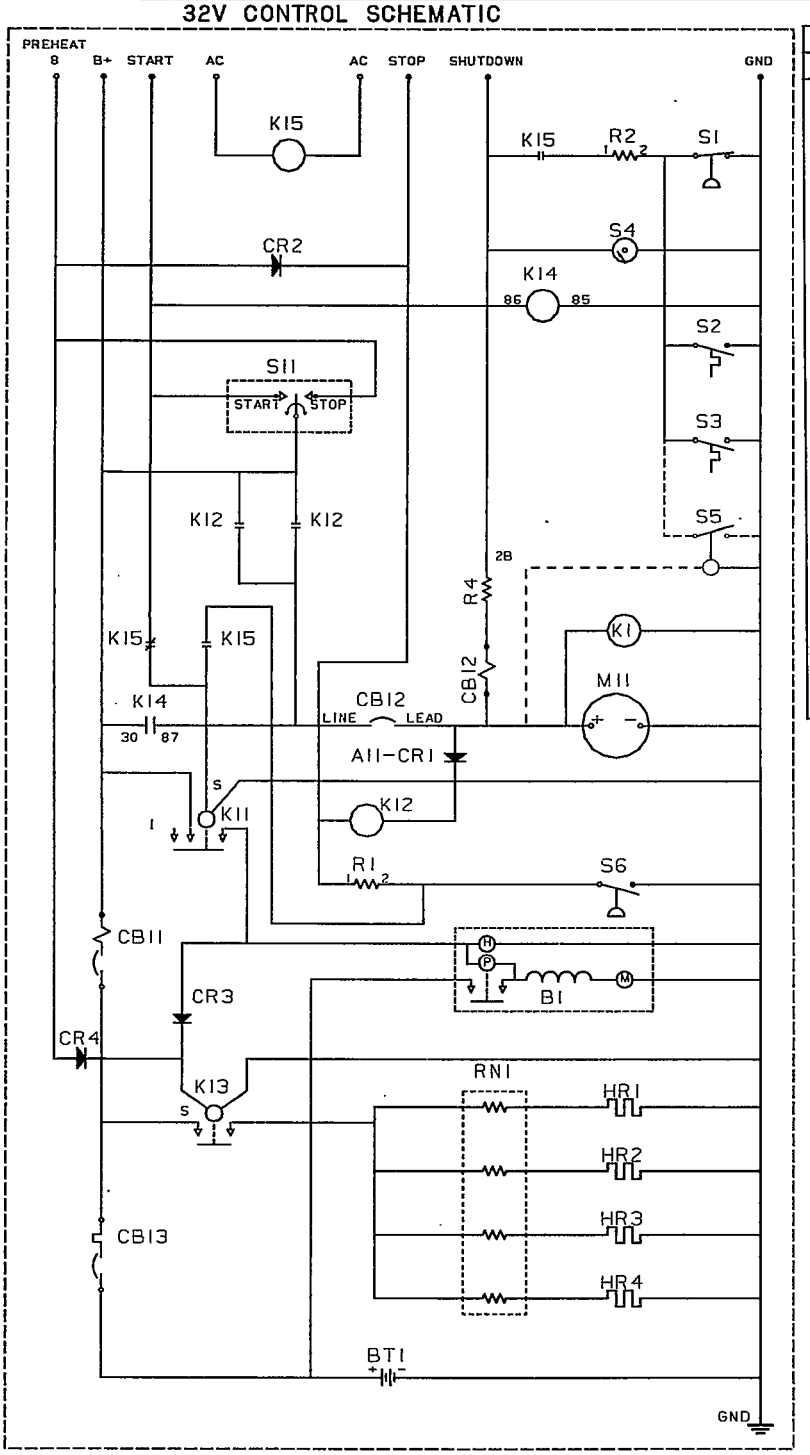
SIMILAR TO 612-6516 | DWG NO. 612-6583 | SHT 1 OF 1 | DWG SIZE D

ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE
36,330	A	1	PRODUCTION RELEASE	WN	RW	6-06-90



MDL4 32-VOLT DC STD. CONTROL; STARTING SPEC "B"

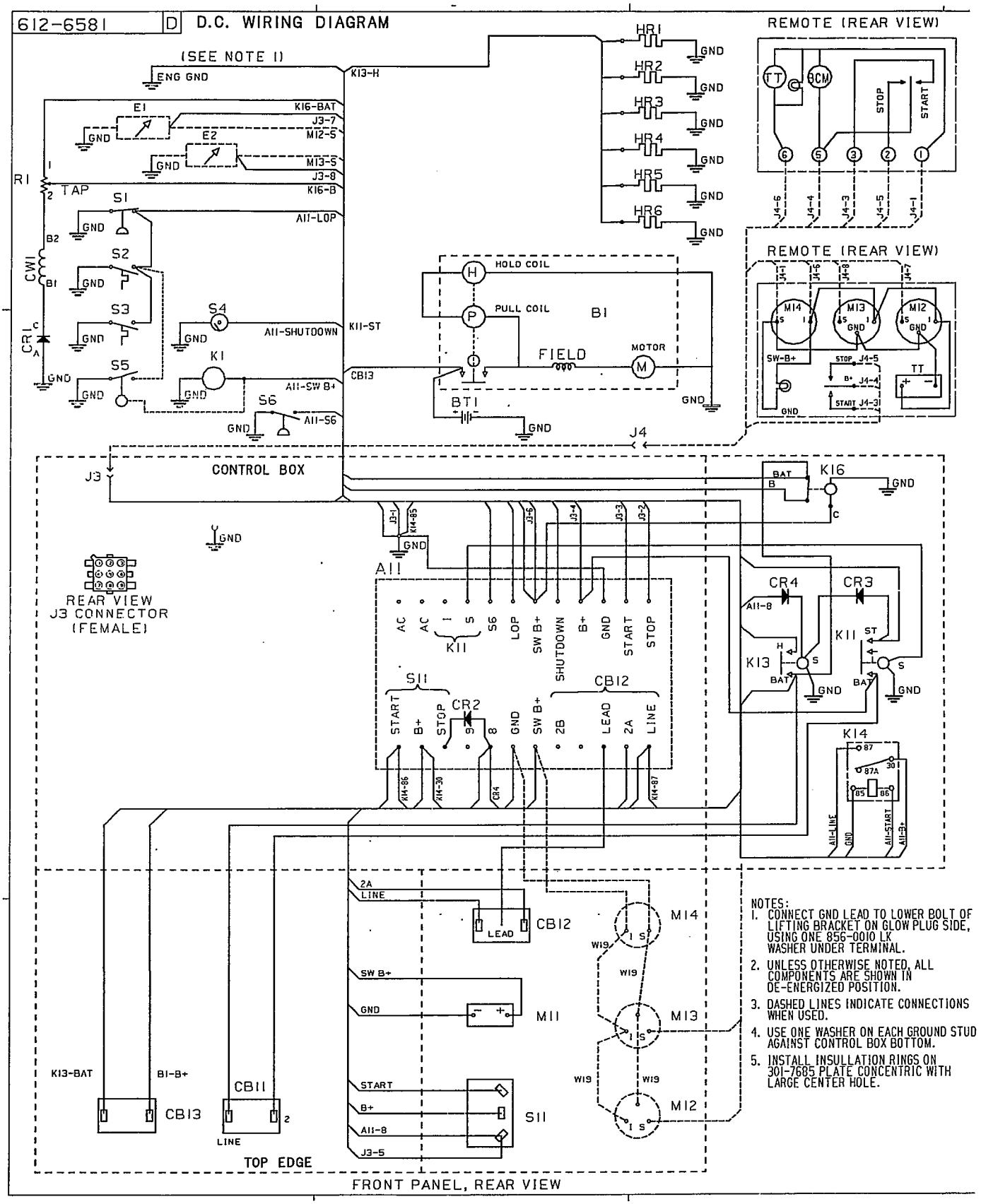
32V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
B1	Starter & Solenoid
BT1	Battery, 32-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR2	Rectifier, Stop
CR3, CR4	Rectifier, Blocking
HR1-4	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K14	Relay, Fuel Solenoid
K15	Relay, Starter Protect
M11	Meter, Time Totalizing
R1	Resistor, Battery Charging
R2	Resistor, LOP Timing
R4	Resistor, Current Limit
RN1	Resistor Network
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

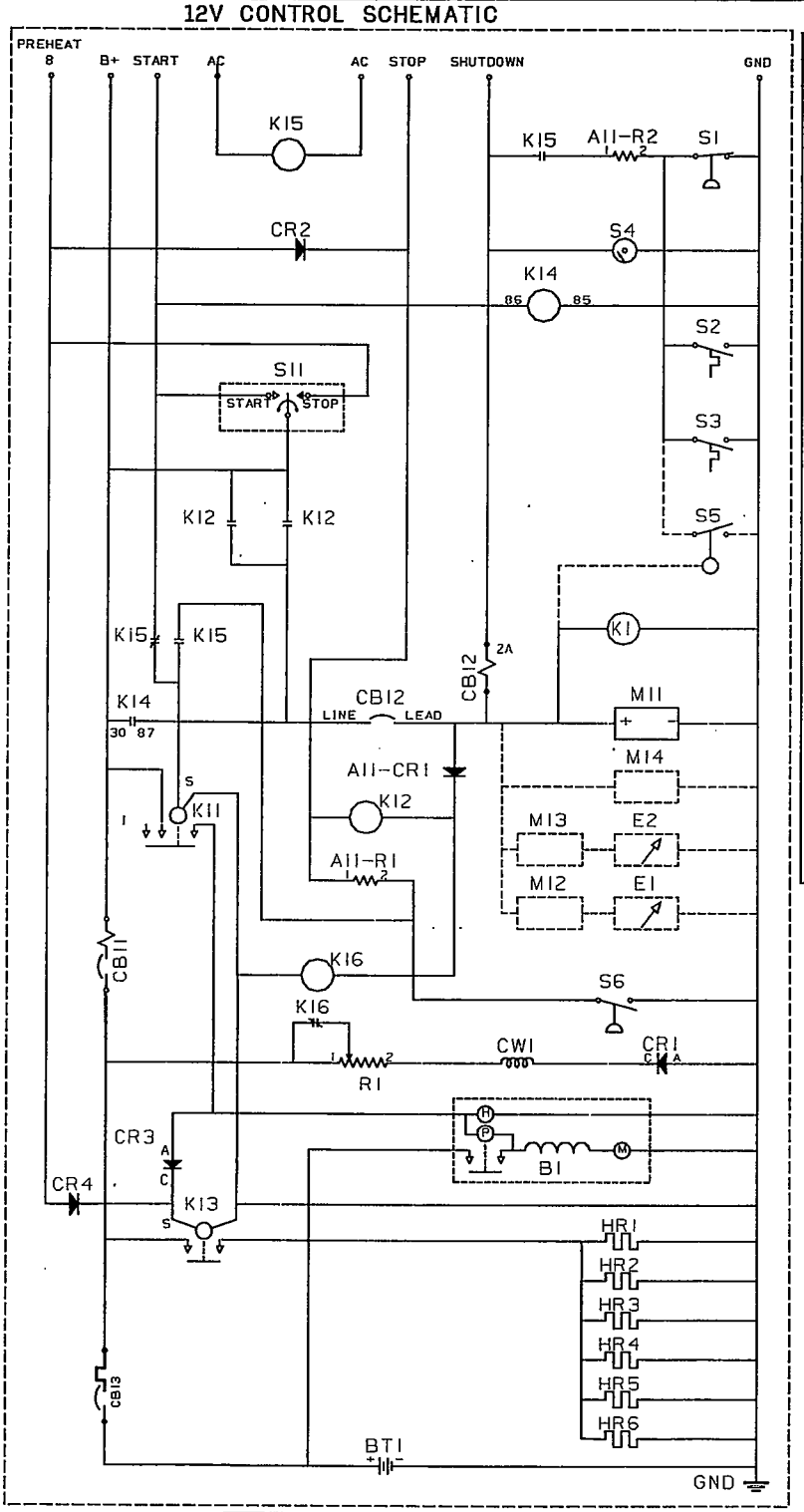
CADD SYSTEM DWG

SAMP REL	DASH NO	MODEL NO	Onan CUMMINS CORPORATION MINNEAPOLIS MINNESOTA
PROD REL WMH	-01	STD	DATE 6-06-90 DR DFO ENGR WMH CKR
PROD REL			TITLE CONTROL-GEN SET DC (32V)
PARTS PD		MDL4	SIMILAR TO 612-6514 DWG NO. 612-6585 SHT 1 OF 1 DWG SIZE D



MDL6 12-VOLT DC CONTROL W/GAUGES

12V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
A11-R1	Resistor, K12
A11-R2	Resistor, LOP Timing
B1	Starter & Solenoid
BT1	Battery, 12-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR1	Rectifier, Batt. Charging
CR2	Rectifier, Stop
CR3, CR4	Rectifier, Blocking
CW1	Winding, Batt. Charging
E1	Sender, Oil Pressure
E2	Sender, Coolant Temp.
HR1-6	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K14	Relay, Fuel Solenoid
K15	Relay, Starter Protect
K16	Regulator, Voltage 2-Step
M11	Meter, Time Totalizing
M12	Meter, Oil Pressure
M13	Meter, Coolant Temp
M14	Meter, Volt
R1	Resistor, Battery Charging
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

CADD SYSTEM DWG

ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE
36,330	A	1	PRODUCTION RELEASE	WN	RW	6-06-90

SAMP REL | PROD REL WMN | PROD REL

DASH NO: -01, -02

MODEL NO: STD W/GAUGES

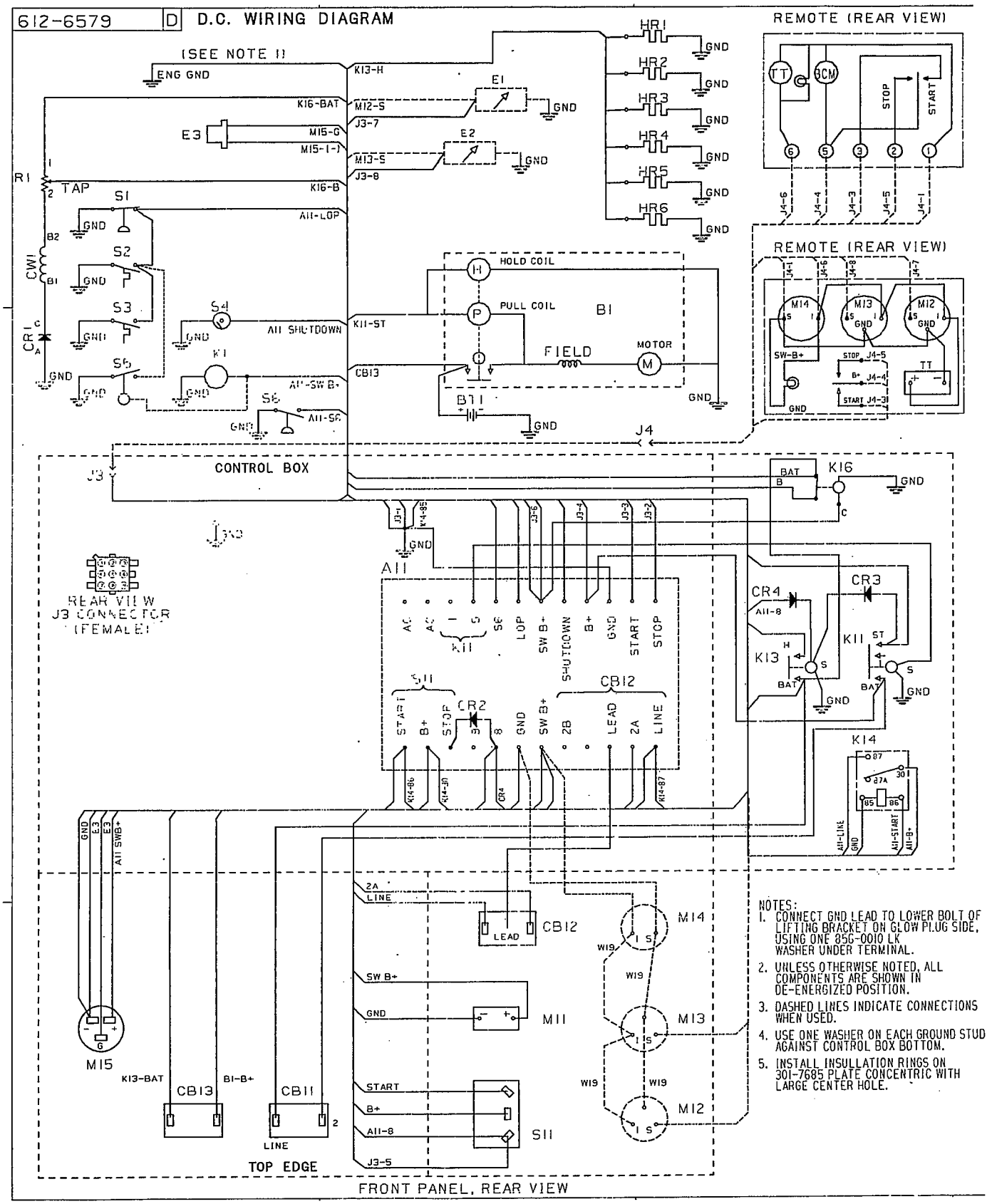
PARTS PD: MDL6

Onan — ONAN CORPORATION MINNEAPOLIS MINNESOTA

DATE 6-06-90 | DR DFO | ENGR WN | CKR RW

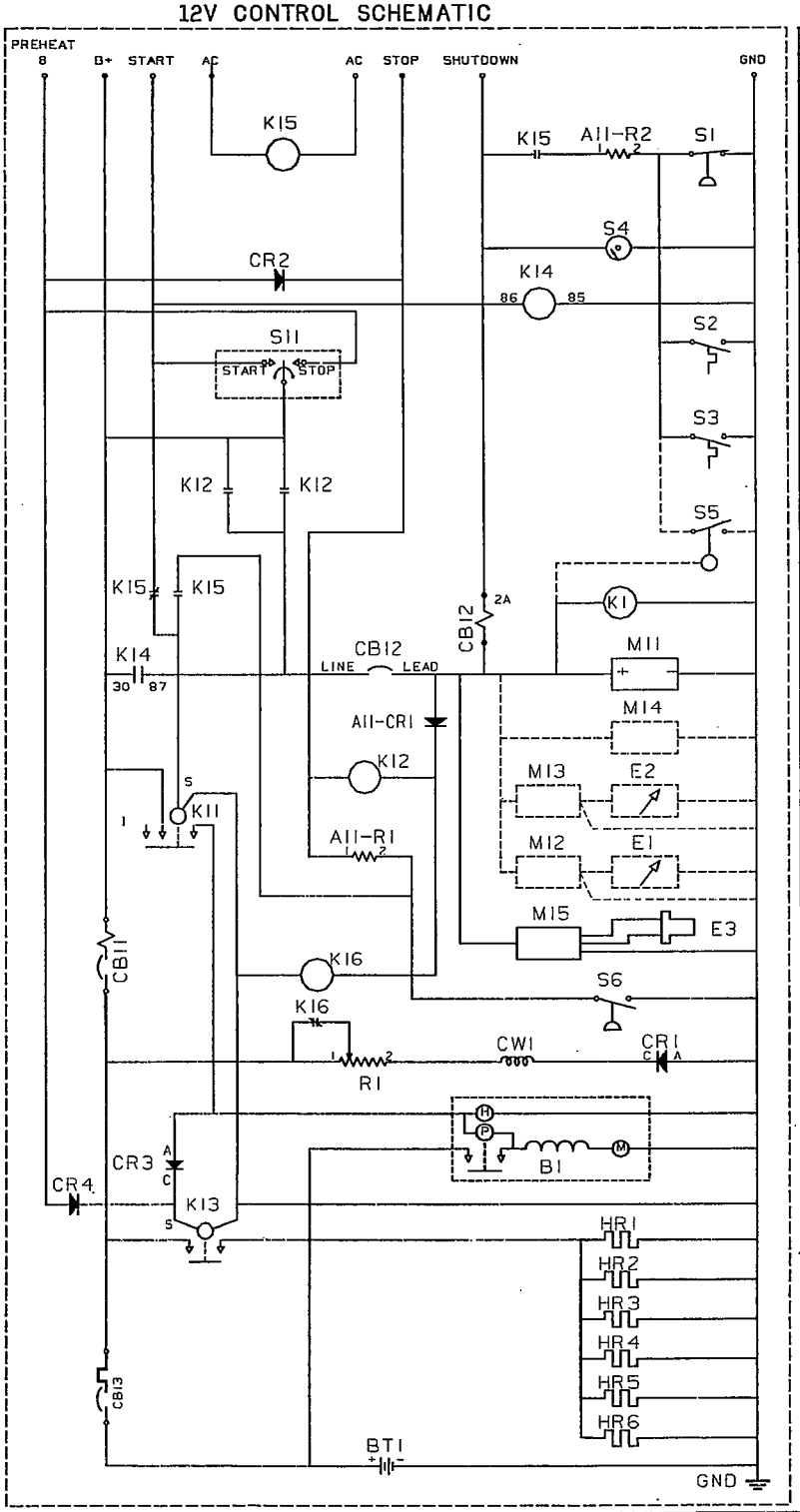
TITLE: CONTROL-GEN SET DC (12V)

SIMILAR TO 612-6517 | DWG NO. 612-6581 | SHT 1 OF 1 | SIZE D



MDL6 12-VOLT DC CONTROL W/GAUGES AND TACHOMETER

12V CONTROL SCHEMATIC



Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
A11-R1	Resistor, K12
A11-R2	Resistor, LOP Timing
B1	Starter & Solenoid
BT1	Battery, 12-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR1	Rectifier, Batt. Charging
CR2	Rectifier, Stop
CR3, CR4	Rectifier, Blocking
CW1	Winding, Batt. Charging
E1	Sender, Oil Pressure
E2	Sender, Coolant Temp.
E3	Sensor, Speed (Mag)
HR1-6	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K14	Relay, Fuel Solenoid
K15	Relay, Starter Protect
K16	Regulator, Voltage 2-Step
M11	Meter, Time Totalizing
M12	Meter, Oil Pressure
M13	Meter, Coolant Temp
M14	Meter, Volt
M15	Tachometer
R1	Resistor, Battery Charging
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

CADD SYSTEM DWG

ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE
36,330	A	1	PRODUCTION RELEASE	WH	PW	6-06-90

SAMP REL
PROD REL WH PW
PROD REL

DASH NO: -01 W/GAUGES; -02 MDL6

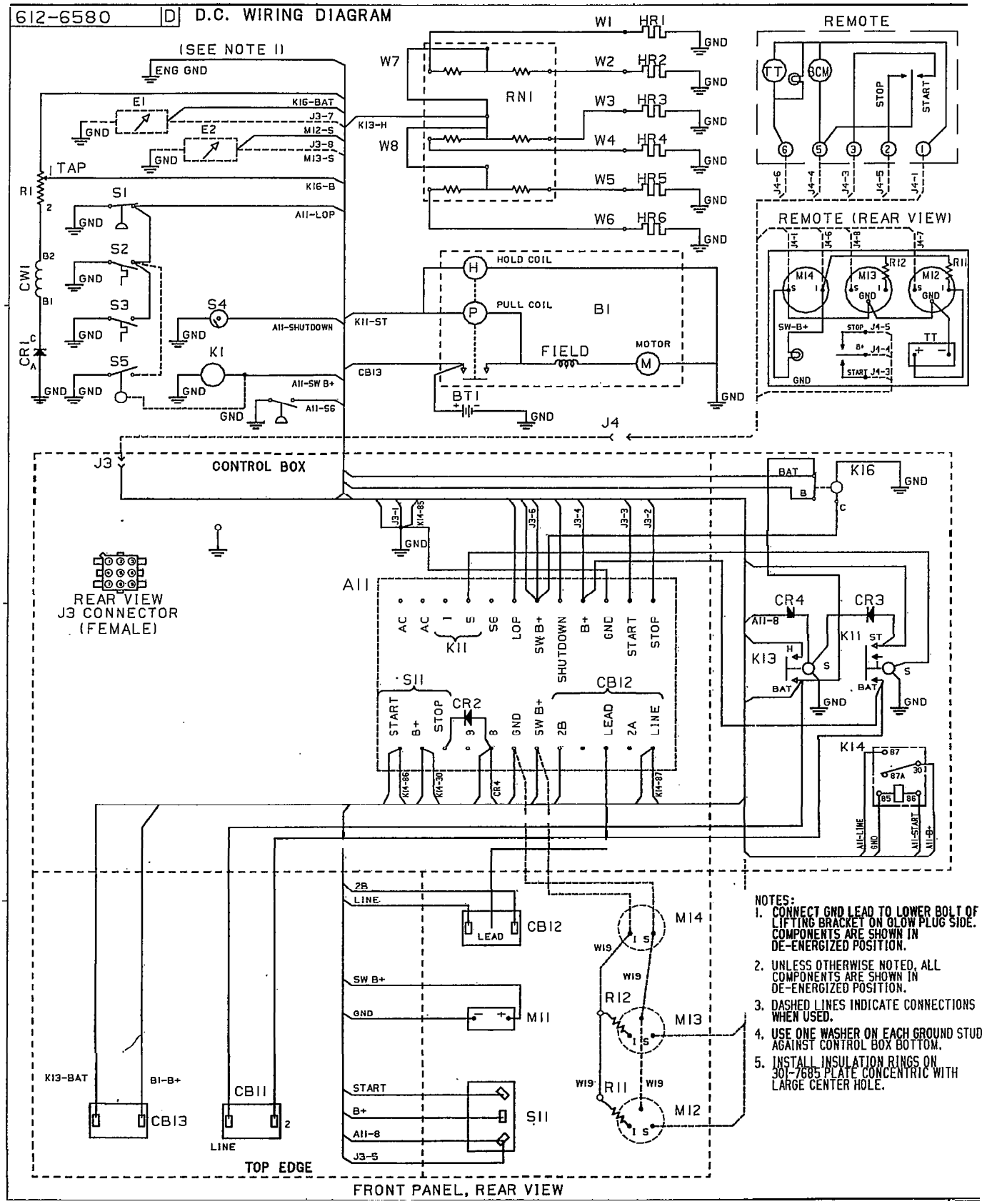
MODEL NO: STD

Onan — ONAN CORPORATION MINNEAPOLIS MINNESOTA

DATE 6-06-90 DR DFO ENGR WH CKR PW

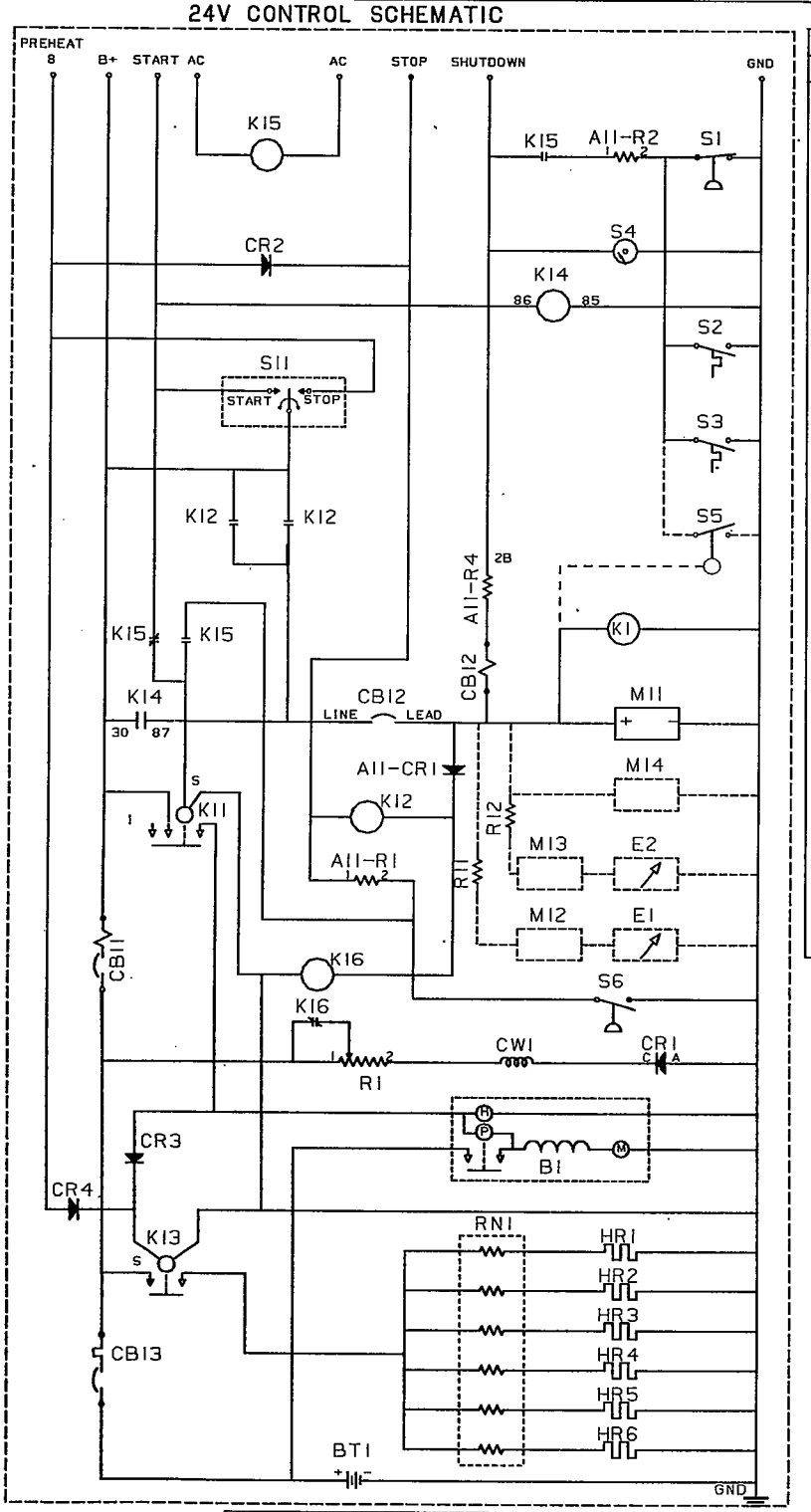
TITLE: CONTROL-GEN SET DC (12V)

SIMILAR TO 612-6530 | DWG NO. 612-6579 | SHT 1 OF 1 | DWG SIZE D



MDL6 24-VOLT DC CONTROL W/GAUGES

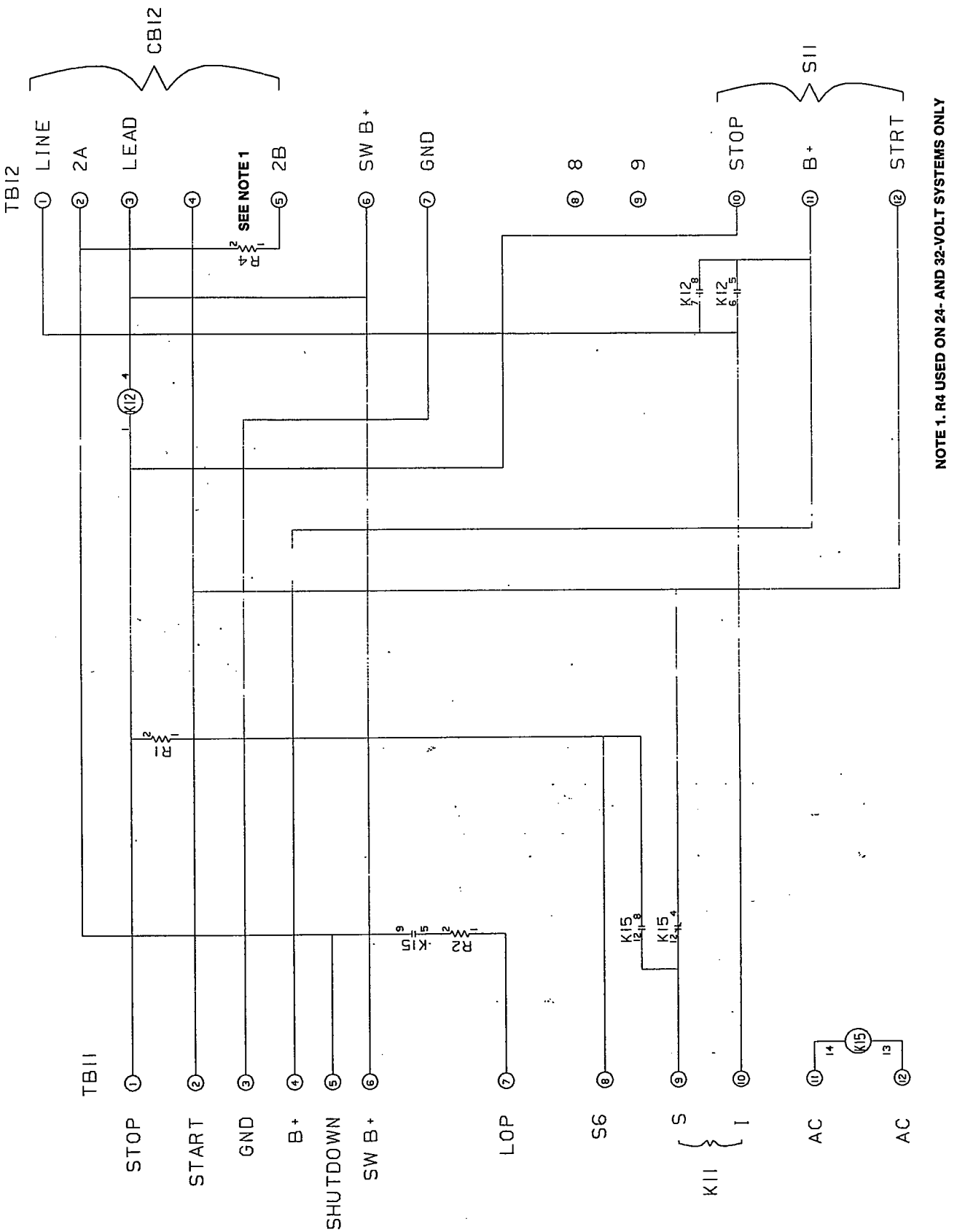
24V CONTROL SCHEMATIC



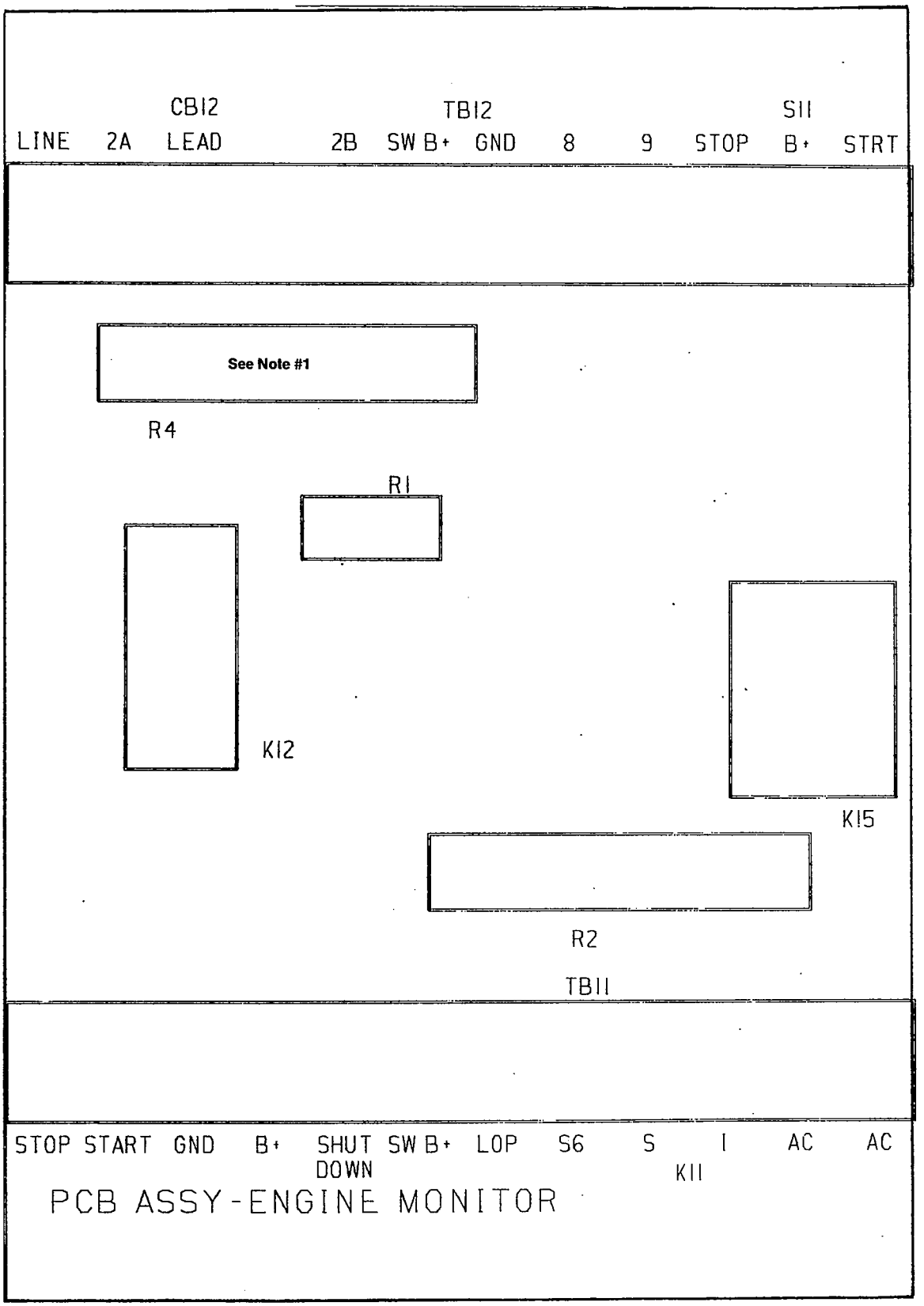
Component Description	
Ref. Des.	**Description**
A11	Engine Monitor PCB
A11-R1	Resistor, K12
A11-R2	Resistor, LOP Timing
A11-R4	Resistor, Current Limit
B1	Starter & Solenoid
BT1	Battery, 24-Volt
CB11	Ckt. Breaker, Control
CB12	Ckt. Breaker, Fault
CB13	Ckt. Breaker, Power
CR1	Rectifier, Batt. Charging
CR2	Rectifier, Stop
CR3, CR4	Rectifier, Blocking
CW1	Winding, Batt. Charging
E1	Sender, Oil Pressure
E2	Sender, Coolant Temp.
HR1-6	Heater, Glow Plug
J3	Connector, Harness
J4	Connector, Remote Control
K1	Fuel Solenoid
K11	Relay, Start Solenoid
K12	Relay, Power
K13	Relay, Heater
K14	Relay, Fuel Solenoid
K15	Relay, Starter Protect
K16	Regulator, Voltage 2-Step
M11	Meter, Time Totalizing
M12	Meter, Oil Pressure
M13	Meter, Coolant Temp
M14	Meter, Volt
R1	Resistor, Battery Charging
RN1	Resistor Network
R11, 12	Resistor, Meter
S1	Switch, Low Oil Press.
S2	Switch, High Cool Temp.
S3	Switch, High Exh. Temp.
S4	Switch, Overspeed
S5	Switch, Low Coolant Level
S6	Switch, Power Latch
S11	Switch, Start, Stop/Preheat

CADD SYSTEM DWG

36,330	A	1	PRODUCTION RELEASE	WMH	PGW	6-06-90	SAMP REL	DASH NO	MODEL NO	Onan CUMMINS ONAN CORPORATION MINNEAPOLIS MINNESOTA	
ER NO.	LTR	NO.	REVISION	ENG	CKR	DATE	PROD REL WMH	-01	STD	DATE 6-06-90	DR DFO WMH PGW
							PROD REL	-02	W/GAUGES	TITLE CONTROL-GEN SET DC (24V)	
									MDL6	SIMILAR TO 612-6518	DWG NO. 612-6580 SHT 1 OF 1 DWG SIZE D



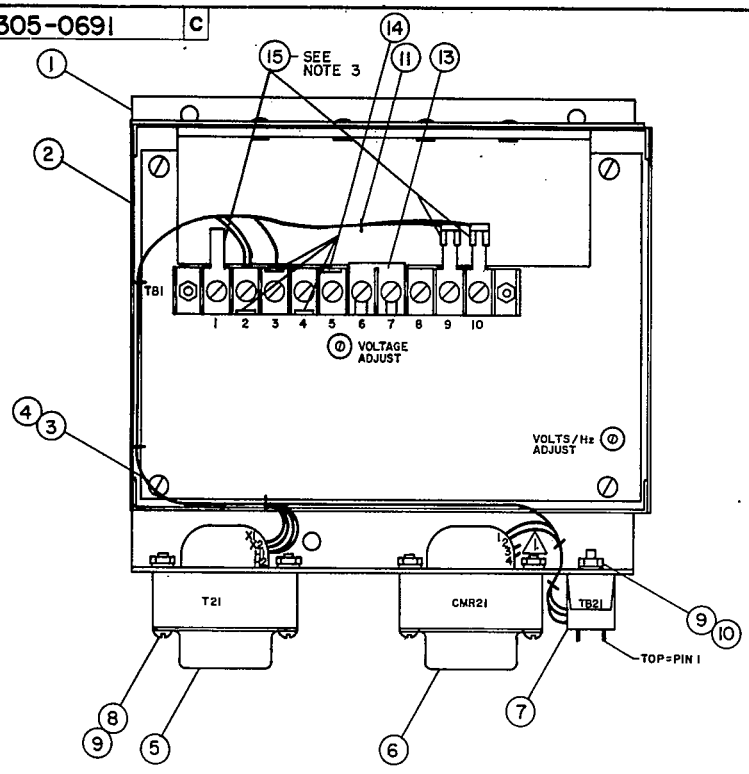
ENGINE MONITOR PCB SCHEMATIC 12-, 24-, 32-VOLT SYSTEMS



Note #1 - Used on 24- and 32-Volt Systems Only

ENGINE MONITOR PCB ASS'Y 12-, 24-, 32-VOLT SYSTEMS

305-0691 C



ER	LET	REVISION	ZONE	DR	ENG	CHK	DATE
20405	-	PROD RLSE					
21628	A	ADDED NOTE 3.	2C	JSP		JP	2-21-83
21628	B	ITEM 15 WAS 332-2106	2B	JSP		JP	2-21-83
22520	C	ITEM 15 QTY WAS 1	1-B	RJ		JP	10-13-83
27364	D	REVISED NOTE 3 PER ER	1-C	BG		BG	11-22-85

WIRING TABULATION			
FROM STATION NO	TO STATION NO	LEAD FIND NO	
T21-X1	TB1-9	—	
T21-X2	TB1-10	—	
T21-H1	TB1-2	—	
T21-H2	TB1-3	—	
CMR21-1	TB21-1	—	
CMR21-2	TB21-3	—	
TB1-2	TB21-1	12	
TB1-6	TB1-7	13	
TB1-7	TB1-8	13	50 Hz ONLY

NOTES:

1. CUT CMR21-3 & -4 OFF AT REACTOR.
2. EXTERNAL CONNECTIONS
   CIRCUIT BREAKER
   TB21-3, TB1-1
   GENERATOR
   TB1-2, TB1-3
   FIELD
   F1-TB1-4
   F2-TB1-5
3. TO PREVENT SHORTING AGAINST REGULATOR ASSEMBLY COVER, VERIFY THAT TERMINAL TABS (ITEM 15) ARE NOT BENT UP.

(A) (D1)

305-0691 C

ITEM	PART NO.	BUILT	QTY.	DESCRIPTION OR MATERIAL
(C)(B) 15	332-2617	P	3	TERMINAL-TAB .187
14	332-1564	A	4	TERMINAL-TAB .250
13	332-2605	P	1	JUMPER-TERMINAL
12	336-9525	A	1	LEAD
11	332-0942	P	7	TIE-CABLE
10	812-0063	-	2	SCREW-RHM (6-32 x 1/2)
9	870-0183	-	6	NUT-HEX W/ET (6-32)
8	812-0070	-	4	SCREW-RHM (6-32 x 1-1/4)
7	332-1655	A	1	TERMINAL BLOCK
6	315-0391	C	1	REACTOR ASSY-COMM
5	315-0386	C	1	TRANSFORMER-VOLTAGE REF
4	853-0003	-	4	WASHER-ET LK (#6)
3	812-0071	-	4	SCREW-RHM (6-32 x 1-1/2)
2	305-0688	D	1	REGULATOR ASSY-VOLTAGE
1	301-3719	C	1	PANEL-VOLT RGLTR MTG

TOLERANCES UNLESS OTHERWISE SPECIFIED: MM / INCH; .X ± / .XX ± / .XXX ± / .XXXX ±; HOLES +0.15 −0.05 / +.006 −.002; ANGLES ±; SCALE 1/1

NEXT ASSY: SIM TO 305-0543 C

Third Angle Projection

305-0691 C

SERIAL FROM

	INITIAL	DATE
DR	MRD	3-8-82
CHK	JR	8-12-82
ENGR		
SAMP REL		
PROD REL	JP	
PROD REL		

Onan Corporation Minneapolis Minnesota

REGULATOR ASSY-VOLTAGE

YD (ENVIR PROT) 305-0691 C

FORM 8806

Onan

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Telex: 275477
Fax: 612-574-8087