



**PT20-EC
PT20-ECRR
PT25-EC
PT25-ECRR**

**Operators
Manual**

Power Technology Southeast, Inc.
634 State Road #44 Leesburg, FL 34748-8103
◆ (352) 365-2777 ◆ Fax (352) 787-5545 ◆

FORWARD

You are now the proud owner of a Power Technology Generator powered by a Kubota engine. This engine is a product of Kubota's quality engineering and manufacturing. The engine is made with fine materials and manufactured under the strictest quality control standards and will assure you long satisfactory service. To obtain the best use of your engine, please read this manual carefully. It will help you become familiar with the operation of the engine and contains many helpful hints regarding engine maintenance. Continuing improvements and advancements in product design may have caused changes to your engine, which are not included in this manual.

Please contact Power Technology's Customer Service Department for latest information on your Kubota engine or for the number of your local Kubota dealer.

TO OUR CUSTOMERS

Thank you for your purchase of a Power Technology Generator. The information contained in this manual applies to PT20-EC, PT20-ECRR, PT25-EC, and PT25-ECRR generators. In the event you experience a problem with your generator please contact the sales dealer, one of our authorized service centers or Power Technology's Customer Service Department directly at 1-800-760-0027 from 8:00 a.m. to 5:00 p.m. EST. Please have the generator model and serial numbers available when you call. This will help expedite service and parts to you. Parts may be obtained directly through Power Technology and shipped the same day if ordered by 3:00 p.m. EST. If required, a Major Service Manual may be ordered through Power Technology's Customer Service Department.

Generator Model Number _____

Generator Serial Number _____

POWER TECHNOLOGY SOUTHEAST, INC.
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(352) 365-2777
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www.PowerTech-Gen.com



Limited Warranty on Power Technology Generators designated "EC" installed in entertainer type coaches

Power Technology Southeast, Inc. warrants to you, the original purchaser, that each product of our manufacturer is free from defects in materials, and workmanship. That each generator will deliver its rated output as indicated on the POWER TECHNOLOGY NAMEPLATE, if properly installed, serviced, and operated under normal conditions in accordance with Power Technology's instructions.

PPA-WARRANTY WILL BE IN EFFECT FOR THE FOLLOWING PERIOD

3 years from in-service date or 5000 operating hours- whichever comes first. Parts and labor, including removal and reinstallation to repair a warrantable failure, are covered for 1 year from date in service or 2000 hours whichever ever comes first. Parts and labor to repair a warrantable failure of any system other than the engine are covered for 2 years from date in service or 4000 hours whichever comes first. Parts only to repair a warrantable failure of any system other than the engine are covered for 3 years from date in service or 5000 hours whichever comes first. Any warrantable repairs beyond the 1 year 2000 hour period must be performed at Powertech's service facility in Nashville Tennessee or customer's service facility in greater Nashville area.

PPB-WHAT POWER TECHNOLOGY WILL DO

Power Tech will at our option, repair or replace any part covered by this warranty which becomes defective or otherwise fails under normal use and service during the term of this warranty at no charge for parts or labor.

PPC-WHAT YOU MUST DO TO OBTAIN WARRANTY SERVICE

During 1yr/2000hr warranty you must deliver the coach to an authorized or recognized Power Tech Service facility or in case of Engine repairs you may use any authorized Kubota dealer. After 1yr or 2000 hours all parts and labor must come from the Power Tech Service Group in Nashville, TN.

PPD-THIS WARRANTY DOES NOT COVER

- 1-Defects, malfunctions or failure resulting from accidents, abuse, misuse, improper servicing, lack of performance of required maintenance service or normal wear.
- 2-Products which have been subjected to alteration, modification neglect, or unauthorized repairs.
- 3-Replacement of filters, belts, hoses, antifreeze or lubricants
- 4-Electrical items damaged by welding or jump starting
- 5-Damaged caused by contaminated oil, bad fuel, use of ether or any starting fluid, rust contaminates in fuel system or improper mixture of antifreeze and water.

- 6-The replacement of complete assembly (unless prior approval has been granted by Power Tech). Components must be disassembled and repaired as necessary
- 7-Overtime labor requested by customer
- 8-Starting batteries
- 9-Damage caused by water entering engine by any means
- 10-Failure of fuel system components due to impurities in the fuel, routine fuel system maintenance and fuel filter replacement
- 11-Any damage caused by overheating that is not a direct result of a defect in material or workmanship
- 12-Any generator not application approved
- 13-Any damage caused by failure to immediately correct a known or suspected engine, generator or accessory problem
- 14-Travel time and mileage for a unit that cannot come to an authorized Power Tech Service Center
- 15-Loss of generator excitation due to prolonged storage
- 16-Any damage attributed to an external LOW BATTERY CONTROL MONITORING or AUTO GEN START SYSTEM

PPE-GENERAL CONDITIONS

- 1-This warranty is the sole property of the original owner/user
- 2-Warranty is valid within the 48 States
- 3-Warranty does not cover any products or parts not purchased from Power Tech
- 4-Problems arising from improper installation are the responsibility to the installer and are not covered by Power Tech warranty
- 5-Power Technology reserves the right to make design and model changes without any obligation to change units or parts previously manufactured
- 6-Warranty registration card must be completed and mailed to Power Tech to validate the Warranty

PPF-THIS IS THE ONLY EXPRESS WARRANTY ON POWER TECHNOLOGY PRODUCTS

No person, agent or dealer is authorized to give any warranties on behalf of Power Technology Southeast, Inc., and not to assume for Power Tech any other liability in connection with any of its products unless made in writing and signed by an Officer of Power Technology Southeast, Inc.

IN NO EVENT WILL WE BE LIABLE FOR LOSS OF USE, LOSS OF PROFITS, INCONVENIENCE, COMMERCIAL LOSS OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES WHATSOEVER

Any repair considered for WARRANTY consideration must be PRE AUTHORIZED by Powertech's service department and an authorization number obtained

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SECTION 1 “SAFETY”


SAFE OPERATION _____


1-4

Observe Safety Instructions
Wear Safety Clothing
Check Before Operating the Engine
Keep Area Around the Engine Clean
Safe Handling of Fuel and Lubricants
Exhaust Gases and Fire Prevention
Escaping Fluids
Cautions Against Burns and Battery Explosion
Keep Hands and Body Away From Rotating Parts
Anti-Freeze and Disposal of Fluids
Conducting Safety Checks and Maintenance



This symbol, the industry’s “Safety Alert Symbol”, is used throughout this manual and on labels attached the machine itself. It warns of the potential for personal injury. It is essential that you carefully read the instructions and safety regulations before you attempt to assemble or use this unit.

 **WARNING:** Indicates a potentially hazardous situation, which may possibly result in serious injury or possible death.

 **CAUTION:** Indicates a potentially hazardous situation, which may possibly result in minor injury.

IMPORTANT: Indicates that equipment or property damage may result if instructions are not followed.

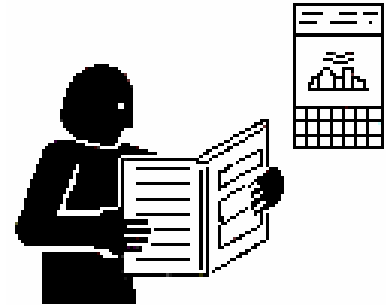
NOTE: Indicates helpful information.

SAFE OPERATION

Cautious operation is your best insurance against an accident. Read and understand this section carefully before operating the engine. All operators, no matter how knowledgeable they may be, should read this and other related manuals before operating the engine or any equipment attached to it. It is the owner's responsibility to instruct all operators in safe operation. Be sure to observe the following for safe operation.

OBSERVE SAFETY INSTRUCTIONS

- Read, understand and follow this “OPERATORS MANUAL” and “LABELS ON THE ENGINE” before starting and operating the engine.
- Learn how to operate and work safely. Know your equipment and its limitations. Always keep the engine in good condition.
- Before allowing other people to use your engine, explain how to operate and have them read this manual before operation.
- DO NOT modify the engine. UNAUTHORIZED MODIFICATIONS to the engine may impair the function and/or safety and affect engine life.



WEAR SAFETY CLOTHING

- DO NOT wear loose, torn or bulky clothing around machinery. Entanglement in rotating parts, controls or projections may cause personal injury.
- Use additional safety items, e.g. hardhat, eye protection, gloves, etc., as appropriate or required.
- DO NOT operate machinery or equipment while under the influence of alcohol, medication, or other drugs, or while fatigued.
- DO NOT wear radio or music headphones while operating engine.



CHECK BEFORE OPERATING THE ENGINE

- If the engine is malfunctioning DO NOT operate until repairs are made.
- Be sure all guards and shields are in place before operating the engine. Replace any that are damaged or missing.
- Check to see that the area around the engine is clear of foreign objects before starting.
- Always keep the engine at least 3 feet (1 meter) away from buildings or other facilities.
- DO NOT allow children or livestock to approach the machine while in operation.
- DO NOT start the engine by shorting across starter terminals.



KEEP AREA AROUND THE ENGINE CLEAN

- Be sure to stop the engine before cleaning.
- Keep the engine clean and free of accumulated dirt, grease and trash.
- DO NOT stop the engine without idling; Temperatures around the engine rises suddenly. Keep the engine idling for about 5 minutes before stopping.



SAFE HANDLING OF FUEL AND LUBRICANTS

- Always stop the engine before refueling or lubricating.
- DO NOT smoke or allow flames or sparks in your working area. Fuel is extremely flammable and explosive. Never store flammable liquids in the engine compartment.
- Refuel at a well-ventilated and open place. If fuel or lubricants spill, clean up immediately and properly dispose of.
- DO NOT mix gasoline or alcohol with diesel fuel. The mixture can cause a fire.



EXHAUST GASES AND FIRE PREVENTION

- Engine exhaust fumes can be very harmful if allowed to accumulate. Be sure to run the engine in a well-ventilated area where there are no people or livestock near by.
- The exhaust gas from the muffler is very hot. To prevent a fire, do not expose dry grass, oil or any other combustible materials to exhaust gas. Keep the engine and mufflers clean all the time.
- To avoid a fire, be alert for leaks of flammables from hoses and lines. Be sure to check for leaks from hoses and pipes, such as fuel and hydraulic by following the maintenance check list.
- To avoid a fire, do not short across power cables and wires. Check to see that all power cables and wires are in good condition. Keep all power connections clean. Bare wire or frayed insulation can cause a dangerous electrical shock and personal injury.

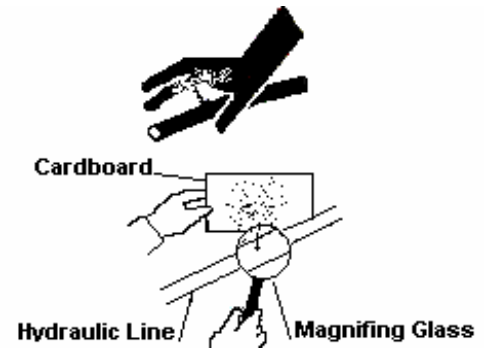


CALIFORNIA *Proposition 65 Warning*

Diesel Engine Exhaust and some
of it's constituents are known by the
State of California
to cause
Cancer, Birth Defects and Other
Reproductive harm.

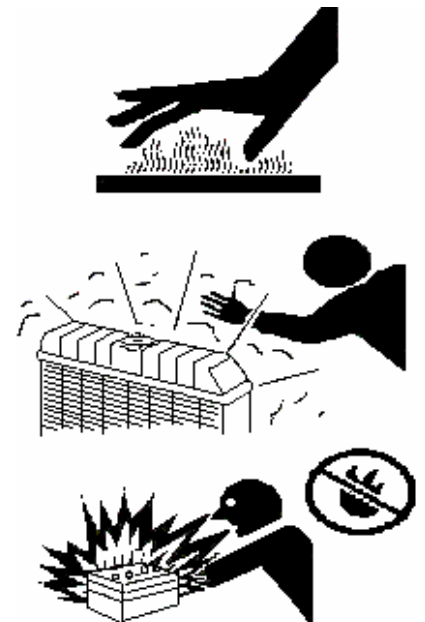
ESCAPING FLUIDS

- Relieve all pressure in the air, oil and cooling systems before any lines, fittings or related items are removed or disconnected.
- Be alert for possible pressure release when disconnecting any dev from a system that is pressurized. DO NOT check for pressure leaks with your hands. High-pressure oil or fuel can cause personal injury.
- Escaping hydraulic fluid under pressure has sufficient force to penetrate skin causing serious personal injury.
- Fluid escaping from pinholes may be invisible. Use a piece of cardboard or wood to search for suspected leaks: do not use hands and body. Use safety goggles or other eye protection when checking for leaks.
- If injured by escaping fluid, see a medical doctor immediately. This fluid can produce gangrene or severe allergic reaction.



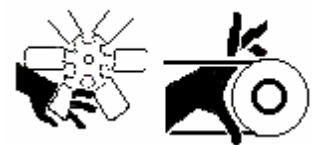
CAUTIONS AGAINST BURNS AND BATTERY EXPLOSION

- To avoid burns, be alert for hot components during operation and just after the engine has been shut off. Such as the muffler, muffler cover, radiator, piping, engine body, coolants, engine oil, etc.
- DO NOT remove the radiator cap while the engine is running or immediately after stopping. Wait approximately ten minutes for the radiator to cool before removing the cap.
- Be sure the radiator drain valve / petcock and hose clamps are tighten. Check radiator pressure cap and oil fill cap before operating the engine.
- The battery presents an explosive hazard. When the battery is being activated, hydrogen and oxygen gases are extremely explosive.
- Keep sparks and open flames away from the battery, especially during charging. DO NOT strike a match near the battery.
- DO NOT check a batteries charge by placing a metal object across the terminals. Use a voltmeter or hydrometer.
- DO NOT charge a battery if frozen, it may possibly explode. Frozen batteries must be warm up to at least 61°F (16°C) before charging.



KEEP HANDS AND BODY AWAY FROM ROTATING PARTS

- Keep your hands and body away from all rotating parts, such as cooling fan, v-belts, pulleys and flywheel. Contact with these rotating parts can cause serious personal injury.
- Be sure to stop the engine before adjusting belt tension or checking the cooling fan.
- DO NOT run the engine without safety guards installed. Be sure the safety guards are properly aligned and securely fastened before operating the engine.



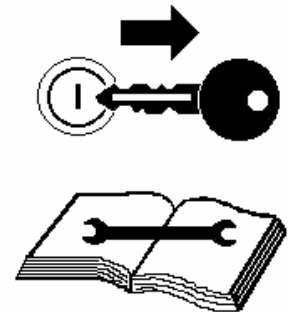
ANTI-FREEZE AND DISPOSAL OF FLUIDS

- Anti-freeze contains toxic chemicals. Wear rubber gloves when handling anti-freeze. In case of contact with skin, wash immediately to avoid personal injury.
- DO NOT mix different types of Anti-freeze. The mixture can produce a chemical reaction resulting in the formation of harmful substances. Only use anti-freeze that is recommended and approved by Caterpillar.
- Be mindful of the environment. Before draining any fluids, be prepared to dispose of them in a manner consistent with environmental protection regulations in your location.
- When draining fluids from the engine, use appropriate containers to hold the different fluids, do not mix fuel, oil or coolant together.
- Dispose of spent filter cartridges and batteries properly.
- DO NOT pollute the soil, or any water source. Never pour fluids down a drain.



CONDUCTING SAFETY CHECKS AND MAINTENANCE

- When performing safety checks or engine service, be sure the engine is level and well supported. Use approved stands designed for this type of service. DO NOT service an engine that is only supported by a lift jack or hoist.
- Detach the battery from the engine before conducting service. Put a “DO NOT OPERATE!” tag in the key switch to avoid accidental starting.
- To avoid sparks from an accidental short circuit always disconnect the 12V DC power at the battery.
- Be sure to stop the engine and remove the key when conducting daily and periodic maintenance, servicing and cleaning.
- Check or conduct maintenance after the engine, radiator, muffler, or muffler cover has cooled off completely.
- Always use the appropriate tools and jig-fixtured when performing any service work. Be sure to understand and follow the instructions included with these tools.
- Use ONLY correct engine barring techniques for manually rotating the engine. DO NOT attempt to rotate the engine by pulling or prying on the cooling fan and V-belt. Serious personal injury or damage to the cooling fan may occur.
- Replace fuel hoses and hose clamps every 2 years or earlier whether they are damaged or not. They are made of rubber and are aged gradually.
- When service is performed with two or more people present, take care to perform all work safely. Be aware of their location especially when starting the engine.
- Keep a first aid kit and fire extinguisher handy at all times.



SECTION 2

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PRE-OPERATION CHECK

ENGINE BREAK-IN PERIOD

During the engine break-in period, observe the following recommendations:

1. Change the engine oil and oil filter cartridge after the first 50 hours of operation. (See “ENGINE OIL” in ENGINE MAINTENANCE SERVICE SCHEDULE).
2. In ambient temperature above 32°F (0°C) approximately 3-5 minutes without a load is sufficient for engine warm up. Allow additional warm up time when temperatures are below 32°F (0°C) before placing an operating load on the engine.

DAILY CHECK

To prevent future engine problems from occurring, it is important to know and keep track of the engines condition. Below are items to be Inspected and Checked on a daily basis.

CAUTION:

To avoid personal injury:

- Be sure all safety shields and guards are attached to the engine when operating.
 - To prevent a fire hazard, keep foreign materials, fuel and oil away from the battery, wiring, muffler and engine. Check and clear them daily. Be aware of the muffler and exhaust gas heat underneath the engine compartment, this heat may ignite grass or other flammable materials.
 - Follow all safety precautions as outlined in the “SAFE OPERATION” section.
1. For accurate readings the engine should be on level ground when checking engine fluids.
 2. Check fluids before starting the engine. (Cold Engine)
 - Lubrication System: Check Engine oil level
Check for Engine oil leaks
 - Cooling System: Check coolant level and condition
Check for coolant leaks
Check for proper installation of the radiator cap
 - Fuel System: Check for sufficient quantity of fuel
Check for fuel leaks
 3. Check engine after starting. (Warm Engine)
 - Proper Operation: Check for easy engine start
Check for fluid leaks
Check for abnormal engine noises
Check for abnormal exhaust gas



**Power Controller Module
(PCM)
And Display
(PCMD)**



Feature Summary

The PowerTech PCM controls all of the start and run processes and characteristics of any PowerTech generator. The features of the application are:

Internal Ambient Temperature Sensor

Provides an on-board temperature sensor.

Oil Pressure Sensor / Switch Input

Allows input from an external oil pressure sensor or switch. Will shut down the generator if sufficient pressure is not detected after a start-up period.

Coolant Sensor / Switch Input

Allows input from an external coolant temperature sensor or switch. Will shut down the generator if extreme temperature is detected.

Auxiliary (Generic) Shutdown Switch Input

Allows input from any external active low (ground) switch. An active state of this switch will shut down the generator immediately.

DC Power Supply Voltage Measurement

Measures the voltage level of the DC power supply. The DC voltage is monitored for a minimum and will shutdown the Generator if it falls below a threshold (configuration parameter). This is also reported on the PCM.

AC Output Voltage Measurement

Measures the voltage level of the AC output. This information is monitored to detect limit conditions. It also is reported on the PCM. Over and Under Voltage conditions are reported.

AC Output Current Measurement

Measures the current level of the AC output. The data is reported on the PCM and is used for current, wattage, and load measurement.

AC Output Frequency Measurement

Measures the frequency level of the AC output. This info is monitored to detect a valid start as well as limit conditions. It also is reported on the PCM. Over and Under Frequency conditions are reported.

Warm Start

Adjusts the Pre-Heat glow plug activation time according to the coolant temperature.

One-Touch Remote Start Trigger

In addition to control via PCM, the unit will respond to an active high digital input. The unit can be configured to either start or stop in response to activation of a momentary switch or a toggle switch.

Blink Code Fault Reporting

Simple diagnostic data is available through blink codes on a dedicated active high output. The PCM state as well as fault codes are displayed.

Event Recording

A portion of non-volatile memory is dedicated to recording diagnostic and other events. If a clock is available on the network, the time and date of the event is included. Events include diagnostic messages, starts, stops, and configuration changes. Total event capacity is roughly 2,000 events.

Load Profiling

The unit records the total amount of time the generator spends in each of several load intervals. The information is recorded each time the generator stops, showing the usage profile for that specific cycle.

AGS

Automatic Generator Starting for low battery voltage. Programmable at the factory voltage threshold and run time. Unit can sense genset battery voltage or any other battery voltage as required. Enabled or disabled by an external switch.

Ignition Sensing

Will shutdown genset or prevents genset from starting if DC voltage is applied from any external source. (Example: vehicle ignition, shore power sensor, or transfer switch, etc...)

Operating Behavior

Starting

The generator starts in response to the “START” button being depressed for 1 second. The PCM goes into the Pre-Heat State, followed by the Cranking State, then finally, the Running State. The PCM attempts to start the generator a specific number of times (configuration parameter) before declaring a Fault. The shutdown inputs are checked before the start is attempted. If any of these inputs are active, the start process is aborted.

See the following sections for more detailed information about each state.

Stopping

The generator stops in response to the “START” button being depressed for 1 second. All relays are returned to their reset condition (OFF). Inputs to the PCM are not actively monitored, except the Start/Stop Button. The LED is turned off. The PCM enters the Idle State.

Power Cycle/Reset

If the power to the PCM is cycled, it will immediately shut down all relay outputs, stopping the generator. The unit will start with all fault and status flags reset. There may be a pause of several seconds before all the configuration information is processed and the unit is ready to accept input.

Idle State

The Idle State is the initial state of the PCM after a Power Cycle/Reset. The PCM returns to this state after a Stop Command. The LED is not lit.

Pre-Heat State

The Pre-Heat State is necessary to energize the Glow Plugs for the Cranking State. The Fuel Pump is active. The duration of this state is determined by using the coolant temperature according to the formula:

< 23 °F	cranking time = 15 seconds
23 °F – 50 °F	cranking time = 8 seconds
> 50 °F	cranking time = 5 seconds

The LED blinks.

Cranking State

The Cranking State attempts to start the generator combustion. The starter and fuel pump are active. Successful sustaining combustion is determined by measuring the AC Line 1 output frequency. The LED blinks.

Running State

After an initial “ignore” time (configuration parameter), inputs are monitored for out-of-bounds limits and, if needed, a shutdown command is issued. The LED is lit.

Fault State

The Fault State is entered if an input reaches an out-of-bounds limit. The generator is immediately stopped. A Power Cycle/Reset is required to exit the Fault state. The LED blinks the Fault Code(s) (see next section).

Automatic Generator Start (AGS)

The Automatic Generator Start (AGS) allows the generator to start based upon the battery level. The trigger voltage is configurable via a configuration parameter. The entire feature can be enabled/disabled by a configuration parameter. The AGS feature is currently disabled, by default.

Safety Monitoring And Shutdown

The PCM monitors inputs for safety limitations which might damage the generator. If any input is outside of the safe operating range, the generator is immediately shutdown and the PCM enters the FAULT state. The PCM remains in the FAULT state until a power cycle or reset occurs. The shutdown reason is displayed by blinking the LED.

The thresholds used in determining faults are set by configuration parameters.

These inputs are only monitored when the generator is in the RUNNING state. Before starting the generator, the following inputs are checked to see whether a start should be attempted: High Coolant Temperature, Auxiliary switch, Ignition Sense, DC Voltage and High Ambient Temperatures.

These inputs are averaged over 0.6 seconds to help eliminate noise and settling issues. This averaging helps to eliminate falsely signaled shutdowns.

Shutdown Reasons

Fault Reason	Fault Code	Description
Failure to Start	1	The generator was not able to start.
High Coolant Temperature	2	The generator coolant temperature has reached a high threshold.
Low Oil Pressure	3	The generator oil pressure has reached a critically low pressure.
High Ambient (Air) Temperature	4	The PCM measures an ambient air temperature above a specific threshold. NOTE: Temperature inside the Control Box.
AC Fault	5	A Fault with the AC was detected.
DC Fault	6	A Fault with the DC (Battery) was detected.
Auxiliary Input Active	7	The Auxiliary input is active.
Sensor Malfunction	8	One of the sensors has malfunctioned..
Ignition Sense	9	Ignition Sense is active.

The fault codes are displayed on the LED by blinking a number of times equal to the fault code, then going dark for two seconds. Multiple fault codes are displayed in the order that they have occurred. This cycle repeats until the fault is cleared by a power cycle, reset or via RV-C.

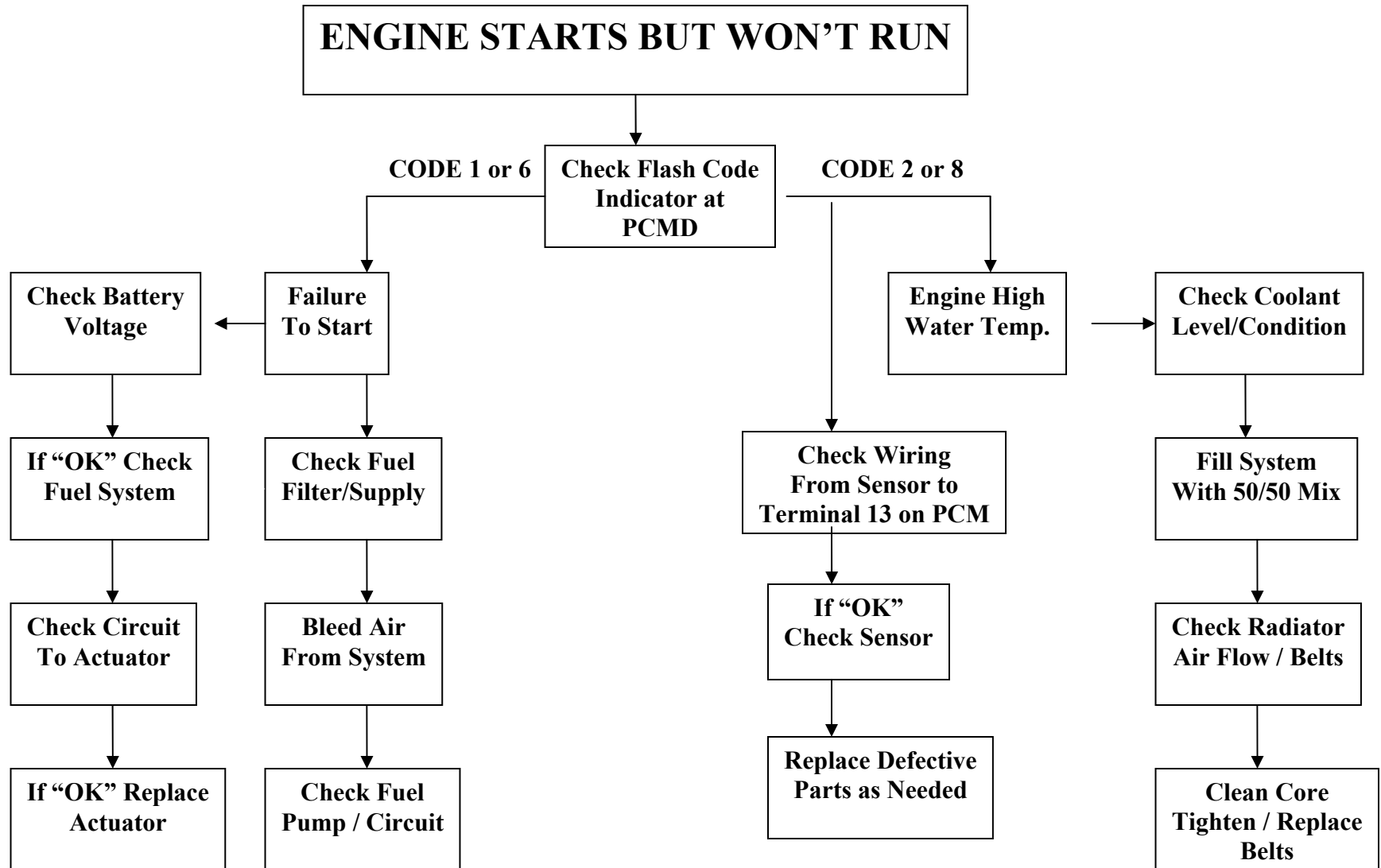
LED Sequences

The LED on the Start Button is used to communicate the state of the generator in addition to any fault conditions. The PCM states are different from the Fault Codes in that the states are displayed continuously (i.e. no two second pause).

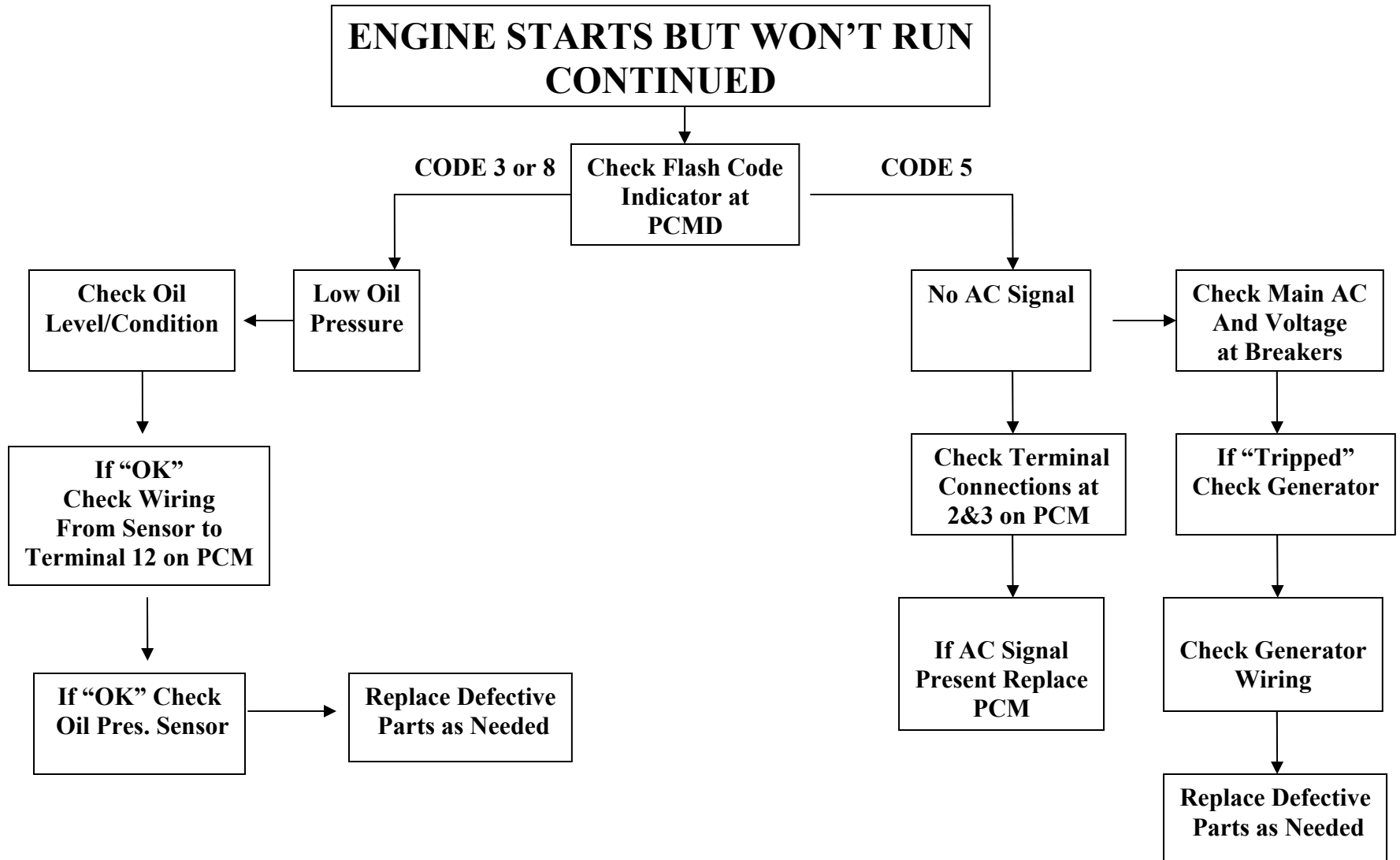
PCM State

PCM State	LED	Notes
Idle State	off	
Pre-Heat	Blink (25% duty cycle)	
Cranking State	Blink (50% duty cycle)	
Running State	on	
Fault State	<various>	See "Shutdown Reasons" Section

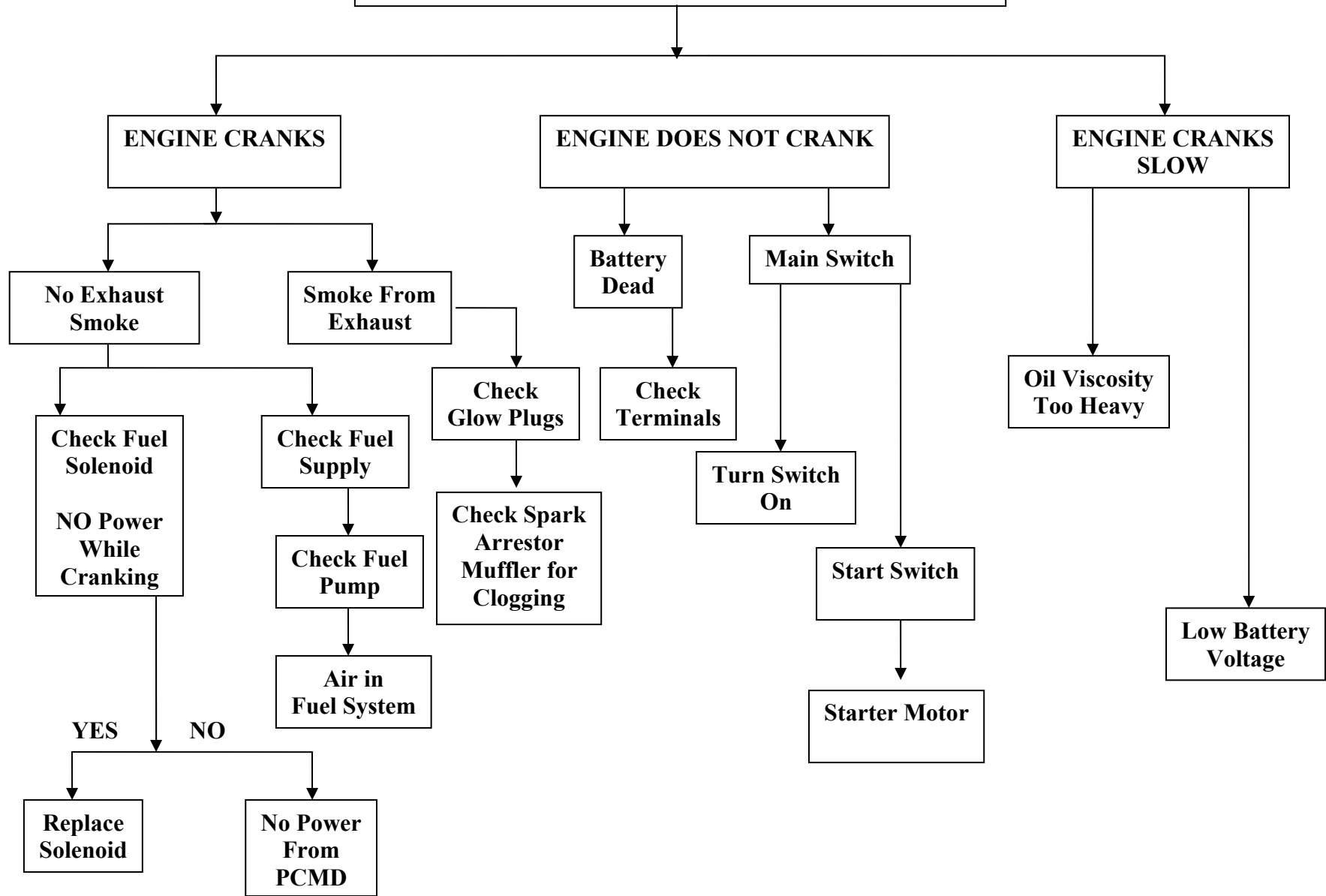
ENGINE TROUBLE SHOOTING



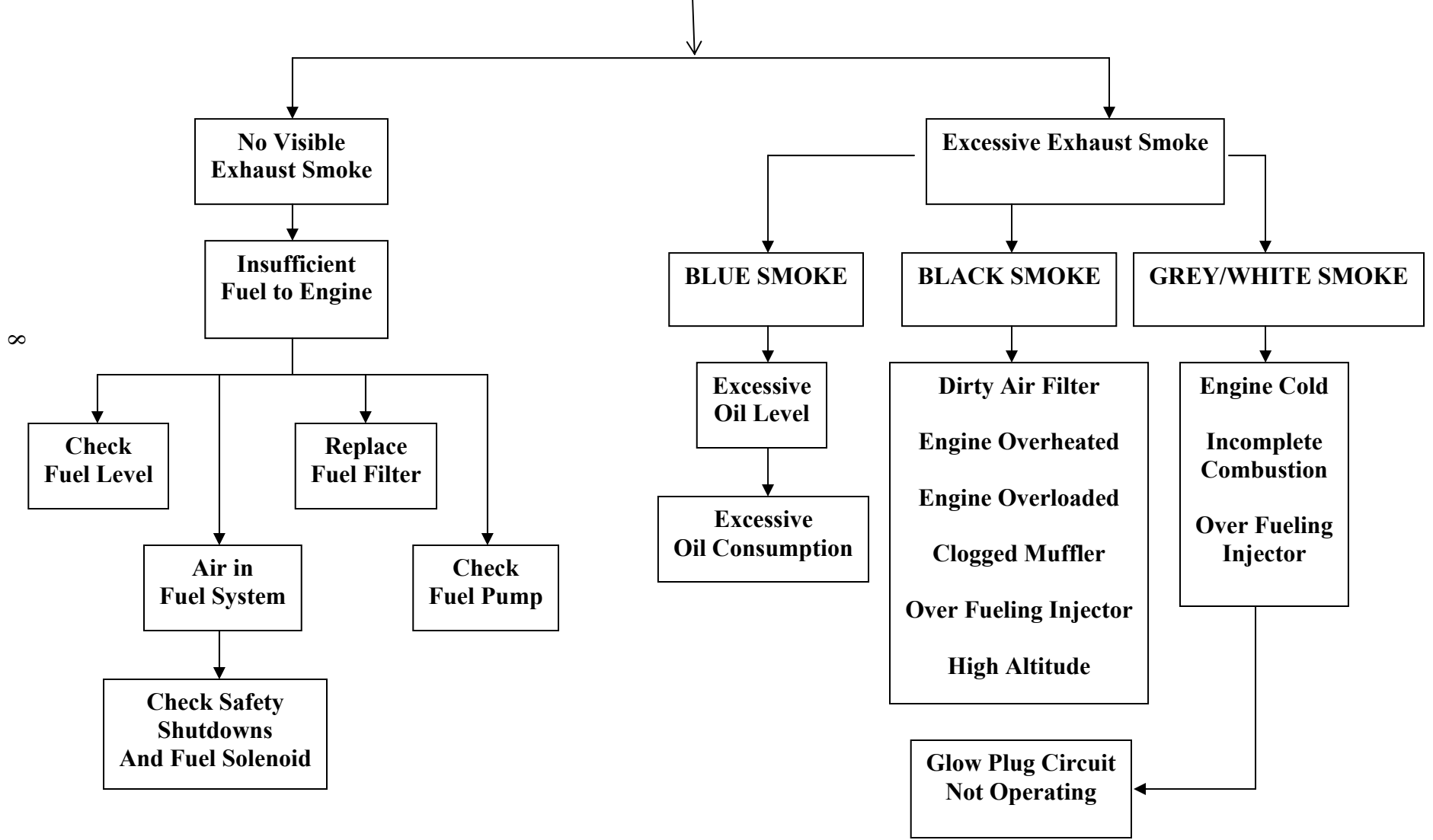
ENGINE TROUBLE SHOOTING



ENGINE WILL NOT START

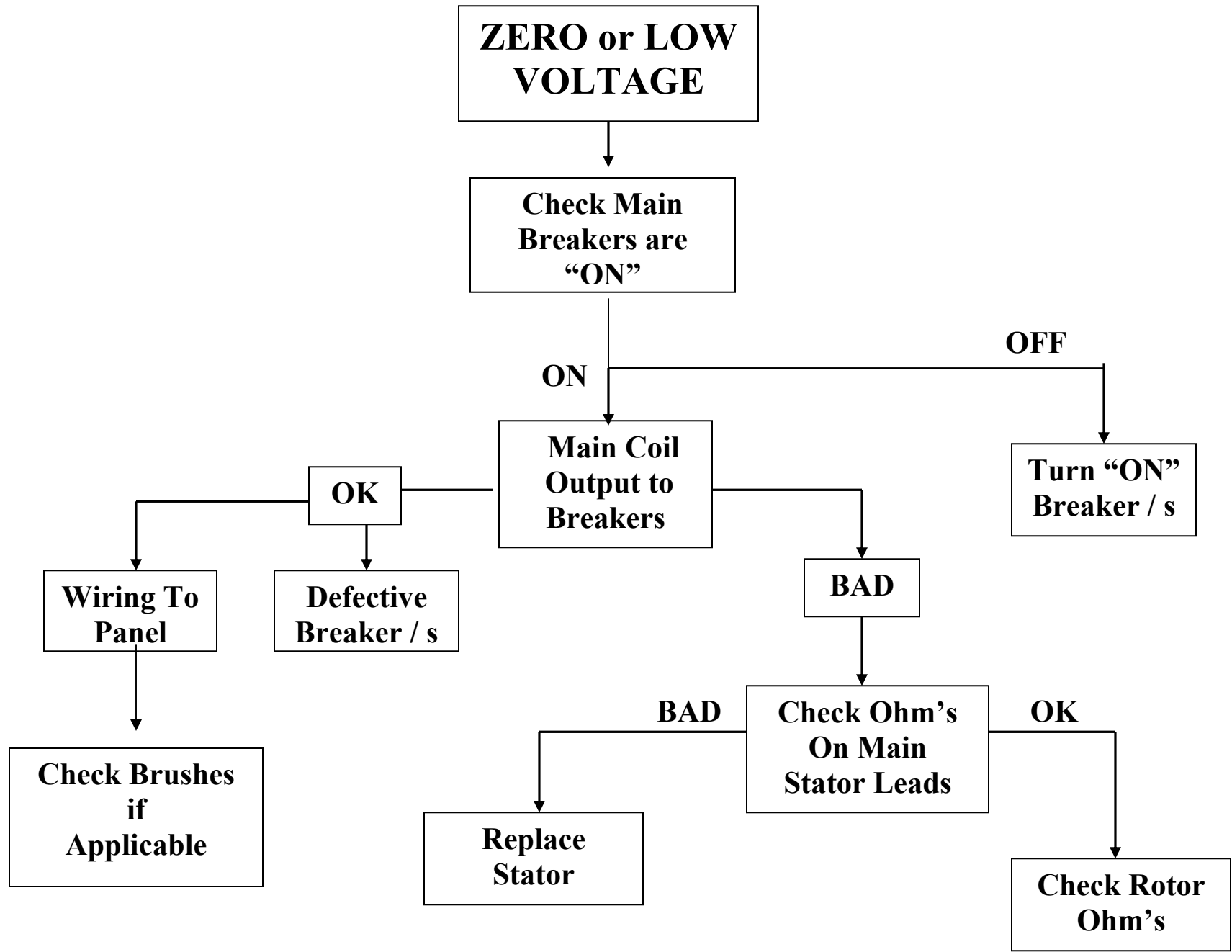


ENGINE RUNS ROUGH OR SLOW

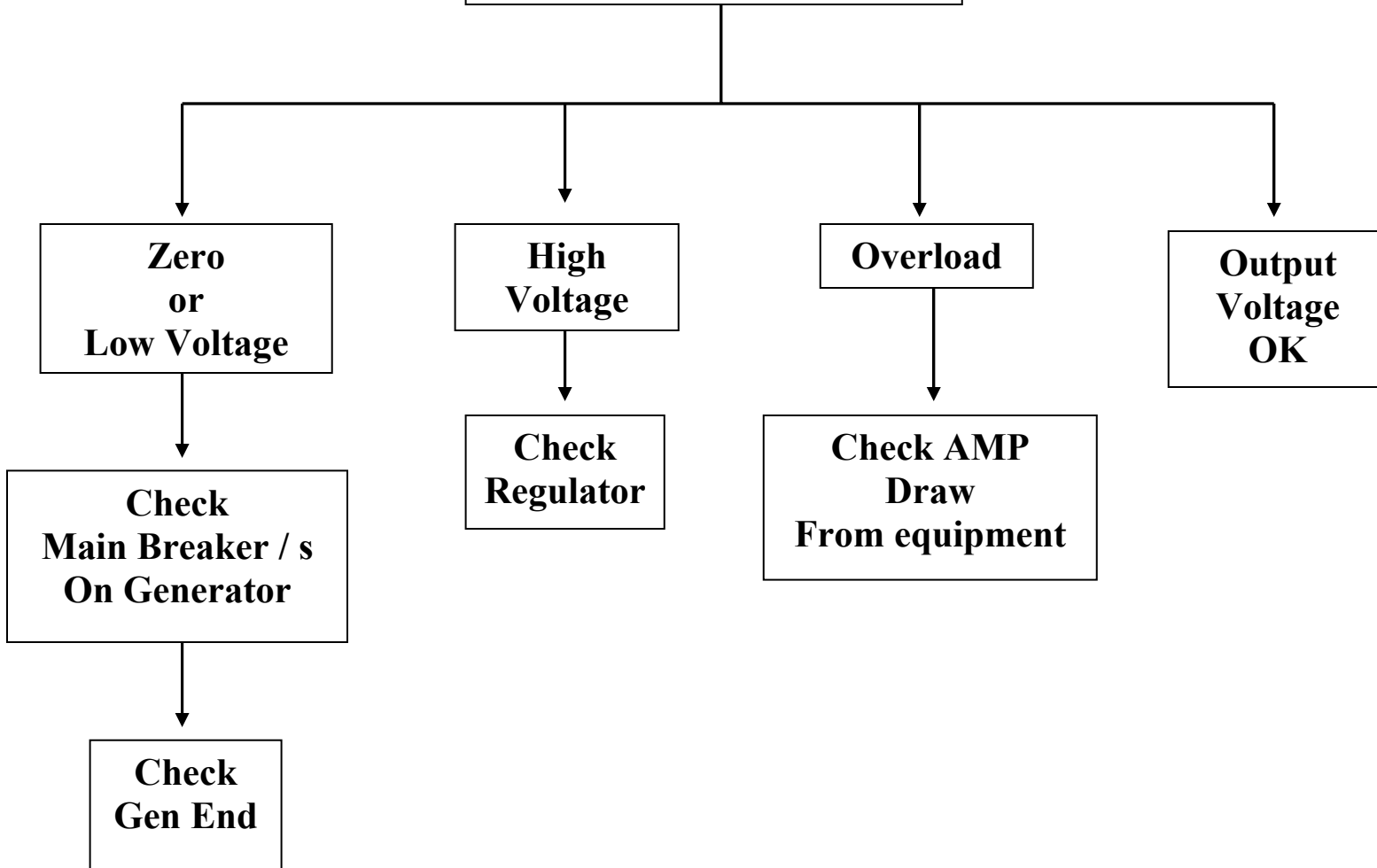


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VOLTAGE TEST



OVERLOAD CONDITION

Check AMP Draw

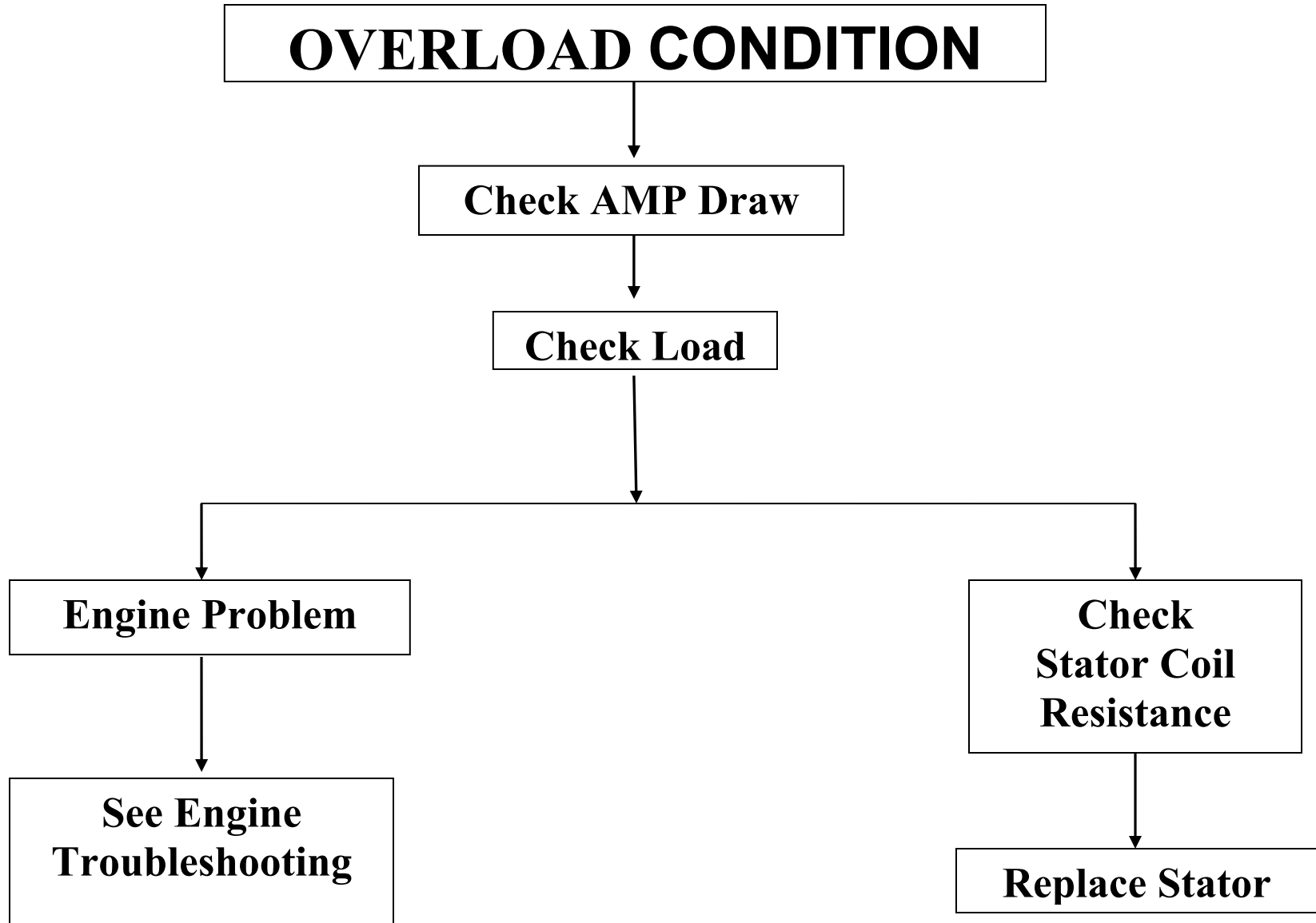
Check Load

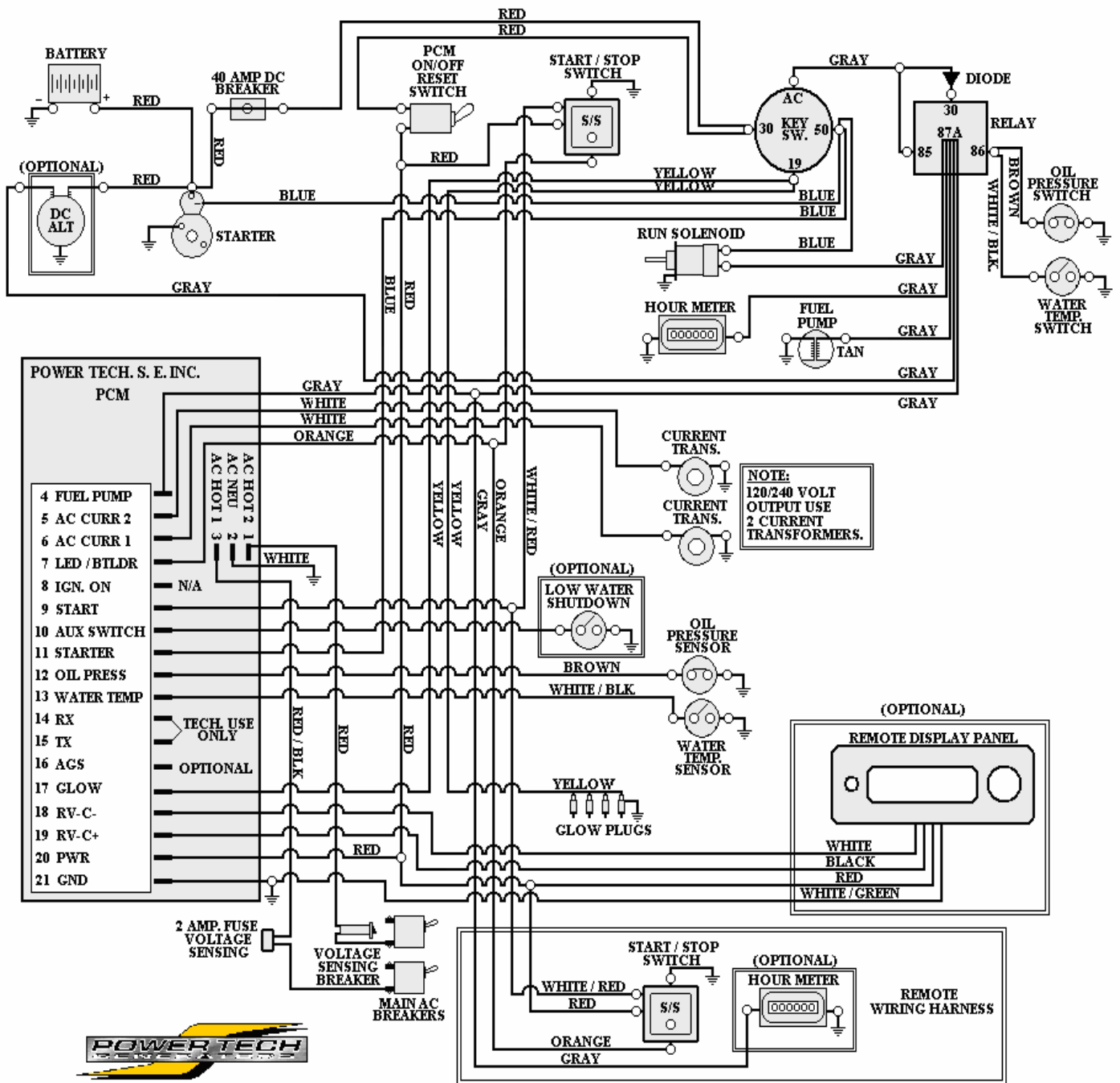
Engine Problem

See Engine
Troubleshooting

Check
Stator Coil
Resistance

Replace Stator





POWER TECH
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 634 STATE ROAD 44
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 (352) 365-2777 FAX (352) 787-5545

12 VOLT DC POWER CONTROL MODULE WIRING SCHEMATIC

ENGINE SPECIFICATIONS

<u>MODEL</u>	<u>V2203-M</u>	<u>V2003-M-T</u>
Air Induction	Naturally Aspirated	Turbo-Charged
Continuous Output	32.5 HP @ 1800 rpm	36.6 HP @ 1800 rpm
Cubic Capacity	134.07 in ³ (2.19L)	121.99 in ³ (2.19L)
Bore and Stroke	3.43 x 3.64 (87x92.4mm)	3.27 x 3.64 (83x92.4mm)
Cylinder Arrangement	4 In-Line	4 In-Line
Firing Order	1-3-4-2	1-3-4-2
Compression Ratio	23:1	22:1
Engine Oil Capacity	8.5 qts. (8.04L) API Class CF	8.5 qts. (8.04L) API Class CF
Fuel and Type	Diesel 4 Cycle	Diesel 4 Cycle
Minimum Fuel Consumption	See Specification Chart	See Specification Chart

SERVICE PARTS

Power Technology Part

Filters:

Oil ----- 01FO091
 Fuel ----- 08FF081
 Air with Plastic Canister----- 04FA2E1

Belts:

With Alternator ----- 03BF0203

Engine Maintenance Service Schedule

Maintenance Service Item	*See Note	Daily	Every 150 Hours	Every 500 Hours	Every 1000 Hours	Remarks
Engine Oil Level Deterioration & Leakage		X				
Engine Oil Change	*		X			Or Once a Year
Oil Filter Change	*		X			Or Once a Year
Coolant Level		X				
Coolant Leakage		X				
Coolant Change					X	Or Once a Year
Fuel Level		X				As Necessary
Fuel Leakage		X				
Fuel Filter Replacement				X		Or Once a Year
Air Filter Replacement	**			X		Or Once a Year
Damaged Worn Or Loose Belts		X				Or Every Two Years
Replace Fuel Hoses					X	Or Every Two Years
Check Radiator Hoses & Clamps				X		Once a Year
Abnormal Engine Noise		X				
Abnormal Generator Noise		X				
Muffler Condition		X				
Exhaust Gas Condition		X				

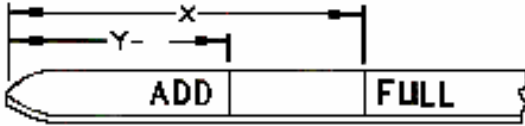
* Engine oil and filter must be changed after the first 50 hours of operation. Then every 150 hours or once a year whichever comes first.

** Air filter replacement interval will vary depending on operating conditions. Adverse conditions may require frequent service.

NOTE: Under normal operation items such as Belts, Hoses and Filters are not covered by Power Technology Southeast, Inc. Limited Warranty.

ENGINE OIL MAINTENANCE

CHECKING ENGINE OIL LEVEL



(Y) “ADD” mark. (X) “FULL” mark.

1. Maintain the engine oil level between “ADD” mark and “FULL” mark on oil level gauge. Do not fill crankcase above “FULL” mark.

2. Remove the oil filler cap and add oil, if necessary. Clean the oil filler cap. Install the oil filler cap.

The refill capacities for the engine crankcase reflect the approximate capacity of the crankcase or sump plus a standard oil filter. Auxiliary oil filter systems will require additional oil.

LUBRICATING OIL SPECIFICATION

Use only good quality lubricating oil, which meets the following Specification

API Class
CF
Engine Oil

KUBOTA V2203-M & V2003-M-T ENGINE REFILL CAPACITY

Crankcase Oil Sump and Filter 8.5 Qts. (8.04L)

LUBRICATING OIL VISCOSITY RECOMMENDATIONS

The minimum ambient temperature during cold engine start-up and the maximum ambient temperature during engine operation determine the proper SAE viscosity grade of oil.

Refer to the Engine Oil Viscosity Table below (Minimum Temperature) in order to determine the required oil viscosity for starting an engine in cold conditions.

Refer to the Engine Oil Viscosity Table below (Maximum Temperature) in order to select the oil viscosity for engine operation at the highest ambient temperature that is anticipated.

Ambient Temperature	Oil Viscosity
Above 25°C (77°F)	SAE 10W-30 SAE 30 or SAE 10W-40
0 to 25°C (32° to 77°F)	SAE 10W-30 SAE 20 or SAE10W-40
Below 0°C (32°F)	SAE 10W-30 SAE 10W or SAE 10W-40

ENGINE COOLANT MAINTENANCE

COOLANT RECOMMENDATIONS

For optimum performance, Power Technology recommends a 1:1 mixture of water / glycol.

NOTE: Use a mixture that will provide protection against the lowest ambient temperature.

NOTE: 100 percent pure glycol will freeze at a temperature of -23°C (-9°F).

Most conventional heavy-duty coolant / antifreezes use Ethylene Glycol. Propylene Glycol may also be used in a 1:1 mixture with water. Ethylene and Propylene Glycol provide similar protection against freezing and boiling. See the tables below.

ETHYLENE GLYCOL

	Freeze	Boil
<u>Concentration</u>	<u>Protection</u>	<u>Protection</u>
50 Percent	-36°C (-33°F)	106°C (223°F)
60 Percent	-51°C (-60°F)	111°C (232°F)

PROPYLENE GLYCOL

	Freeze	Boil
<u>Concentration</u>	<u>Protection</u>	<u>Protection</u>
50 Percent	-29°C (-20°F)	106°C (223°F)

NOTE: Do not use Propylene Glycol in concentrations that exceed 50 percent glycol because of Propylene Glycol's reduced heat transfer capability. Use Ethylene Glycol in conditions that require additional protection against boiling or freezing.

CHECKING RADIATOR COOLANT LEVEL

Remove the radiator cap after the engine has completely cooled and check to see that coolant reaches the supply port.

1. Fill to the bottom of the fill neck and check after every 25 hours of operation.

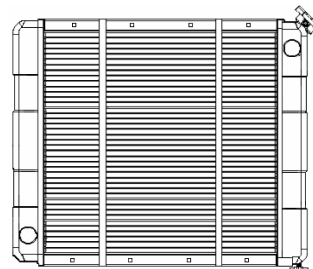
COOLANT SERVICE LIFE

<u>Coolant Type</u>	<u>Service Life</u>
Commercial Heavy-Duty Coolant/Antifreeze that Meets "ASTM D5345"	3000 Service Hours or Two Years
Commercial Heavy-Duty Coolant/Antifreeze that Meets "ASTM D4985"	3000 Service Hours or One Year

NOTE: Do not use a commercial coolant/antifreeze that only meets the ASTM D3306 or D4656 specification. This type of coolant/antifreeze is made for light duty automotive applications.

CHECKING RESERVOIR TANK COOLANT LEVEL

(At a Minimum of 25 Hours of Operation) Ensure that the coolant level of the radiator reservoir tank is between the upper limit (FULL) and the lower limit (LOW) on the side of the reservoir tank.



CLEANING RADIATOR CORE

Visually inspect the core for any obstructions such as dirt or debris. Use running water to clean particles from between fins.

IMPORTANT: Never use hard objects to clean radiator core, damage to core could result.

