



BRISBANE CITY COUNCIL

OPERATION and MAINTENANCE MANUALS

For

BRISBANE WATER SEWAGE PUMP STATION SP243 Birkin Road

Manuals Prepared by:

S E Power Equipment
47 Proprietary Street
Tingalpa, Qld 4173
Phone No. 07 3890 1744

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**Project No: 15016
REVISION A: May 2005**

**OPERATION and MAINTENANCE MANUALS**

Revision Status

Revision	Date	Initials	Comments
A	06-05-05	JP	Issued for approval

Prepared by: Jim Pringle

Date: ____/____/____

Reviewed
Project Manager: _____

Date: ____/____/____

SP243 Birkin Road.doc



OPERATION and MAINTENANCE MANUALS

LOCATION: SP243 Birkin Road			
ENGINE		ALTERNATOR	
JOHN DEERE:	6068TF258	STAMFORD:	434C
SERIAL NO:	753599	SERIAL NO:	X04J390007/1
SEPE SERIAL NO: 0505009			TANK CAPACITY 450
kWm 115	RUN kVA 147.5	START kVA 275	C/B FRAME 250

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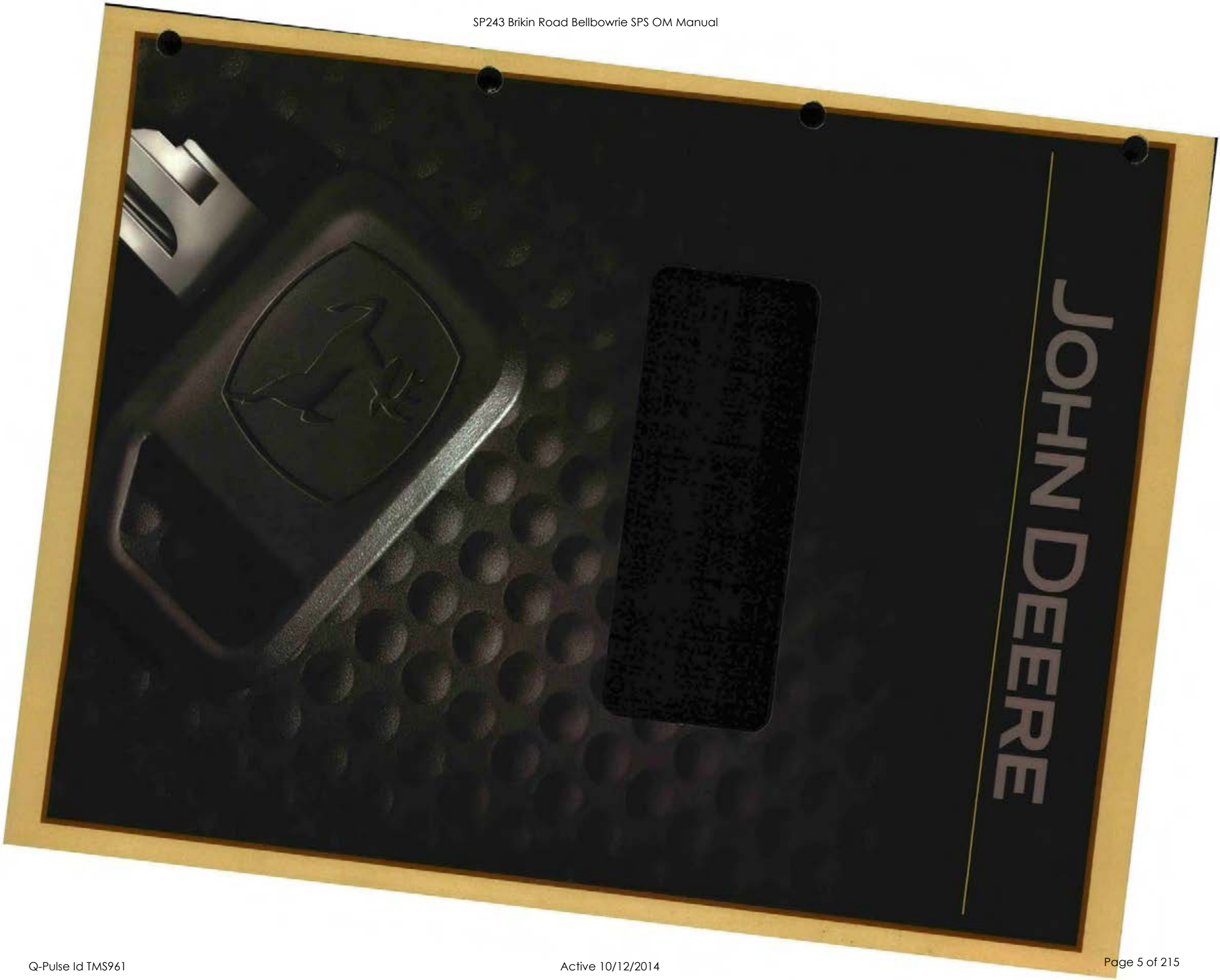
Section 7. Test Reports



OPERATION and MAINTENANCE MANUALS

INSTRUCTIONS FOR USE

1. Units placed on concrete slab.
2. Cable pit to be under switchboard section of unit (rear).
3. Attach hold down / anti-theft chains to location points at rear of unit (beside switchboard).
4. Check engine lube oil level.
5. Check engine coolant level.
6. Check the battery is connected and the electrolyte level is correct.
7. Connect cables to plugs via colour-coded sequence.
8. Connect power inlet socket (240V).
9. Connect communication socket.
10. Connect pump station control socket.
11. Check fuel level (mechanical gauge beside fill point).
12. Refer to section 6, Functional Description for start/run and connection procedure.
13. Remember **SAFETY** is important **ALWAYS** wear your Personal Protection Equipment (PPE)





Power Units for Gensets (Saran) 2.9L/4039/4.5/6.8L (128/008/158/258)

OPERATOR'S MANUAL Power Units for Gensets (Saran) 2.9L/4039/4.5/6.8L (128/008/158/258)

OMCD16564 Issue A3 (ANGLAIS)

CALIFORNIA Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

If this product contains a gasoline engine:

WARNING

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

The State of California requires the above two warnings.

John Deere Usine De Saran
(This manual replaces OMCD16564 (03JAN00))
European Version
Printed in Germany

Introduction

Foreword

THIS MANUAL COVERS the following engines for generator sets:

ENGINE FAMILY	ENGINE MODEL
300-SERIES	CD3029DF128
	CD3029TF158
	CD4039DF008
	CD4039TF008
POWERTECH®	CD4045DF158
	CD4045HF158
	CD4045TF158
	CD4045TF258
	CD6068HF158
	CD6068HF258
	CD6068TF158
	CD6068TF258

READ THIS MANUAL carefully to learn how to operate and service your engine correctly. Failure to do so could result in personal injury or equipment damage.

THIS MANUAL SHOULD BE CONSIDERED a permanent part of your engine and should remain with the engine when you sell it.

MEASUREMENTS IN THIS MANUAL are given in metric. Use only correct replacement parts and fasteners. Metric and inch fasteners may require a specific metric or inch wrench.

WRITE ENGINE SERIAL NUMBERS and option codes in the spaces indicated in the Record Keeping Section. Accurately record all the numbers. Your dealer also needs these numbers when you order parts. File the identification numbers in a secure place off the engine or machine.

RIGHT-HAND AND LEFT-HAND sides are determined by standing at the drive or flywheel end (rear) of the engine and facing toward the front of the engine.

SETTING FUEL DELIVERY beyond published factory specifications or otherwise overpowering will result in loss of warranty protection for this engine.

Information relative to emissions regulations

Depending on final destination, this engine can meet the emissions regulations according to the US Environmental Protection Agency (EPA), California Air Resources Board (CARB) and for Europe, the Directive 97/68/EC relating the measures against the emissions of gaseous and particulates pollutants from internal combustion engines. In this case an emission label is stuck on the engine.

Emission regulations prohibit tampering with the emission-related components listed below which would render that component inoperative or to make any adjustment on the engine beyond published specifications. It is also illegal to install a part or component where the principal effect of that component is to bypass, defeat, or render inoperative any engine component or device which would affect the engine conformance to the emissions regulations. To summarize, it is illegal to do anything except return the engine to its original published specifications.

List of emission-related components:

- Fuel injection pump
- Intake manifold
- Turbocharger
- Charge air cooling system
- Piston

CALIFORNIA PROPOSITION 65 WARNING
Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.

POWERTECH is a trademark of Deere & Company

DPSG,CD03523,1 -19-10DEC02-1/1

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All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

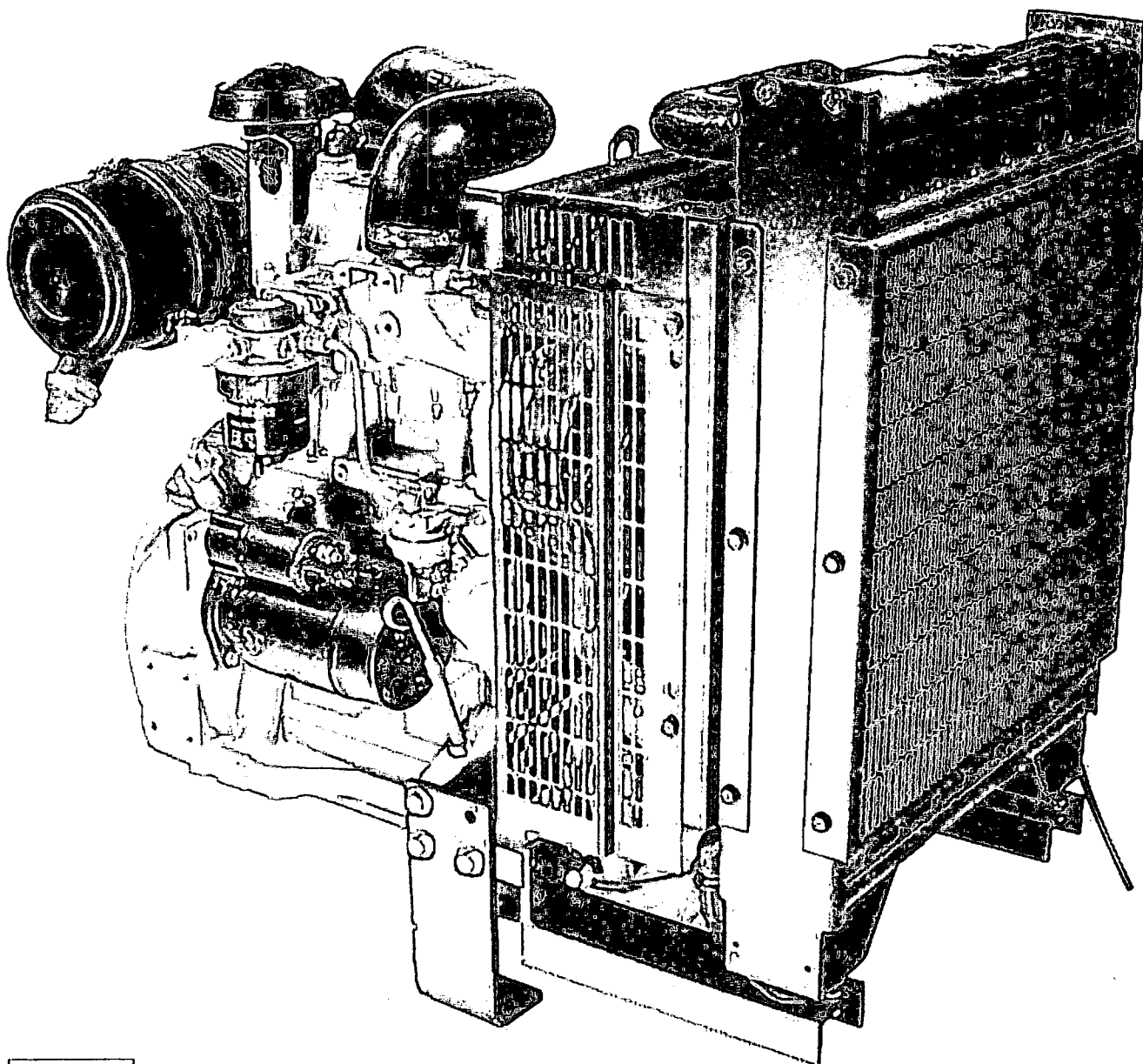
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European Office Mannheim
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A John Deere ILLUSTRATION® Manual

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Identification Views

Identification views



CD30840

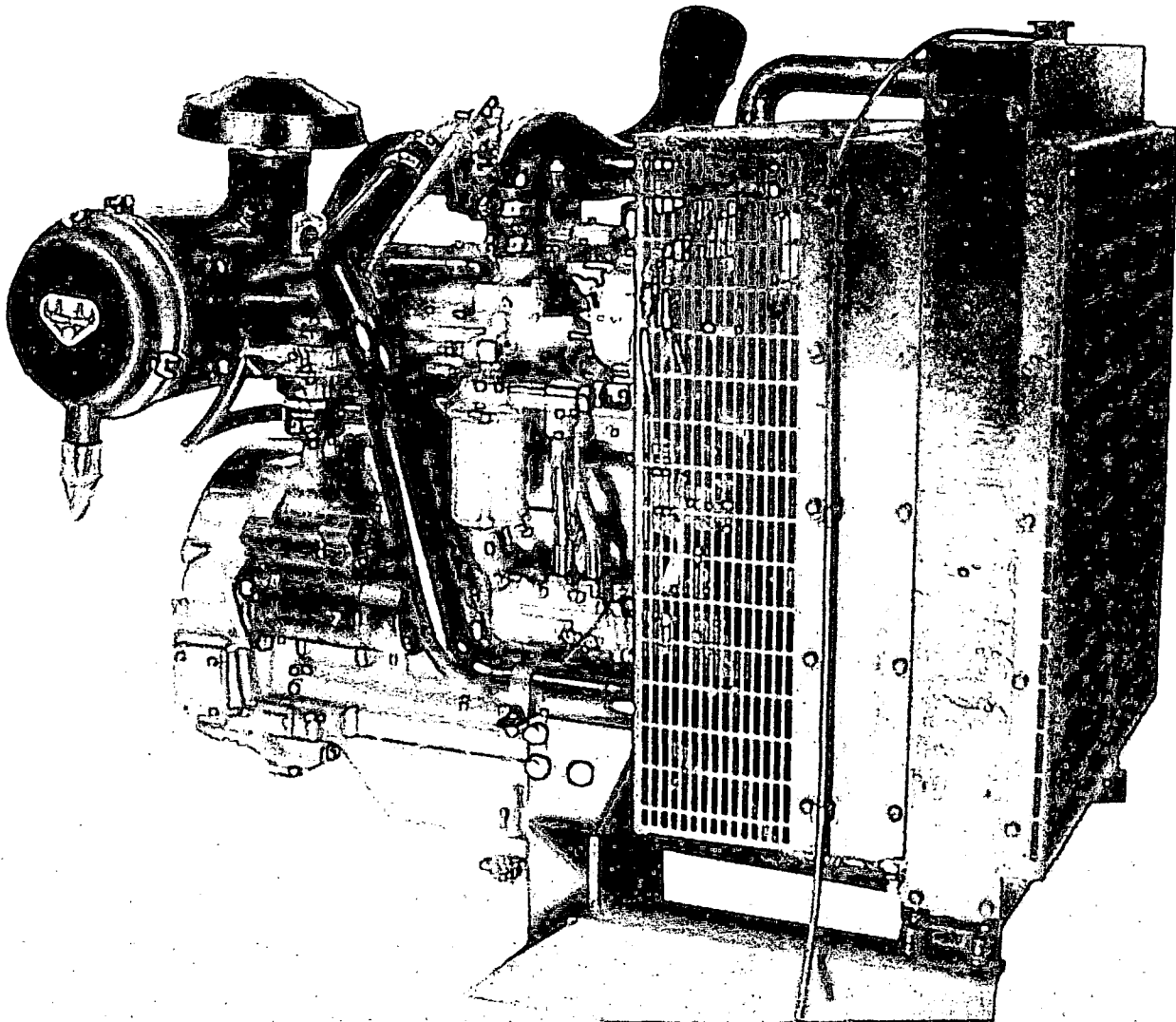
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DPSG,CD03523,3 -19-10DEC02-1/3

CD30840 -LIN-10JAN03

Identification Views



CD30841

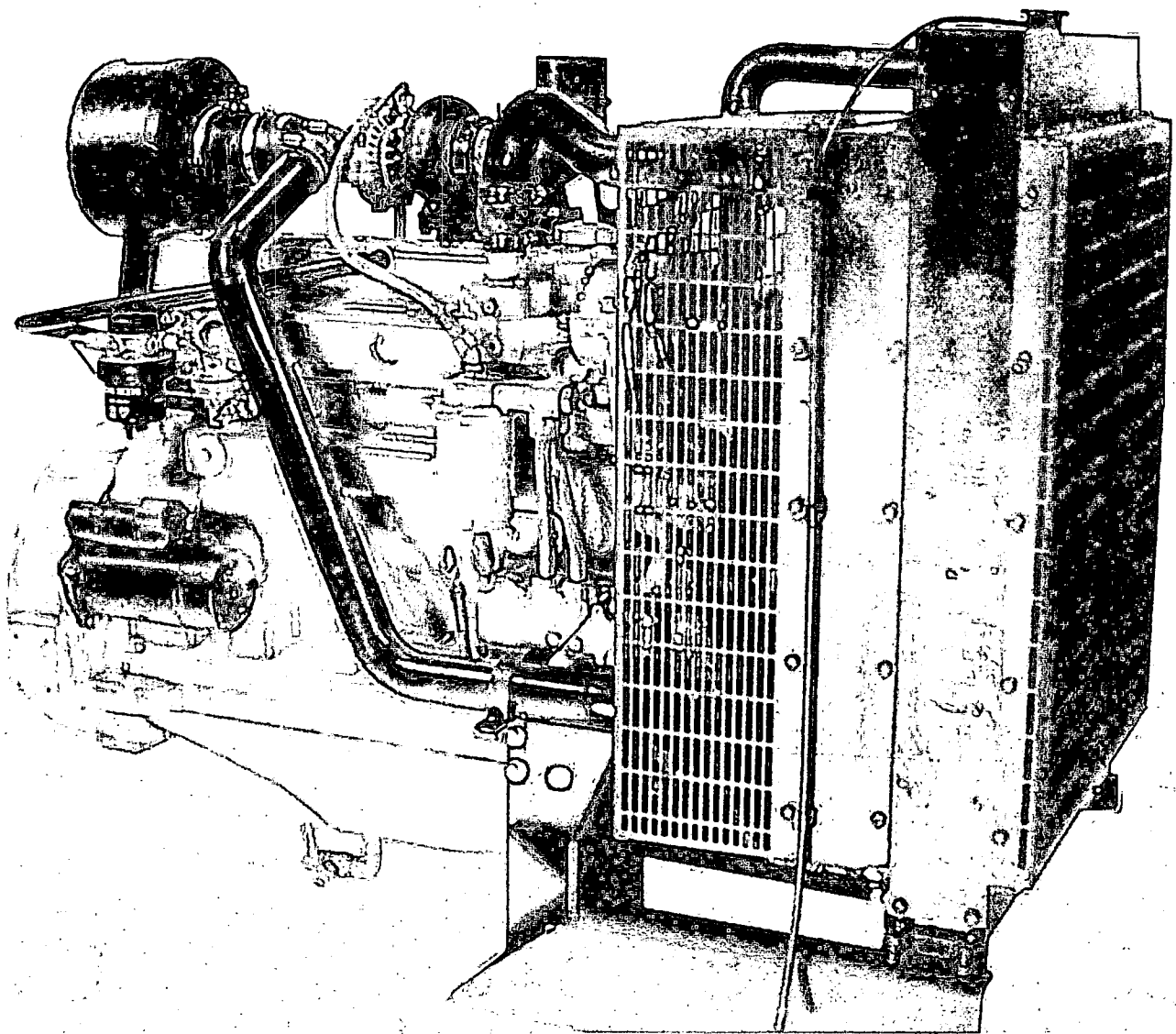
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DPSG.CD03523.3 -19-10DEC02-2/3

CD30841 -LIN-10JAN03

Identification Views



CD30842

6068HF258

DPSG,CD03523.3 -19-10DEC02-3/3

CD30842 -19-10 JAN03

Maintenance Records

Using maintenance records

To obtain the best performance, economy and service life from your engine, ensure service is carried out according to this present manual and recorded in the following pages. It is recommended that your engine Distributor or your Dealer carry out this service work and stamp the appropriate case.

Keeping an accurate account of all service performed on your engine will give more value to the machine when resell it.

John Deere oils and coolants have been formulated to give maximum protection and performance to your engine. We recommend only genuine John Deere service products and replacement parts.

To protect your rights under the warranty ensure all scheduled services are carried out and recorded. If your engine is covered by extended warranty, it is important to maintain this record for the duration of the warranty.

DPSG,CD03523,6 -19-05JUL99-1/1

100 Hours of operation

- ☐ Engine oil, drain
- ☐ Engine oil filter, replace
- ☐ Hose connections, check

Number of hours:

Date:

Job done by:

Observation:

Dealer or distributor stamp

DPSG,CD03523,7 -19-05JUL99-1/1

*Maintenance Records***500 Hours of operation**

- ☐ Engine oil, drain
- ☐ Engine oil filter, replace
- ☐ Fuel filter, replace
- ☐ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)
- ☐ Valve clearance, adjust (300-Series)

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp
---	--------------	-----------------------------

DPSG,CD03523,8 -19-05JUL99-1/1

1000 Hours of operation

- ☐ Engine oil, drain
- ☐ Engine oil filter, replace
- ☐ Fuel filter, replace
- ☐ Check belt and tensioning system
- ☐ Crankcase vent tube, clean
- ☐ Air intake system, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp
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DPSG,CD03523,9 -19-05JUL99-1/1

Maintenance Records**1500 Hours of operation**

- ☐ Engine oil, drain
- ☐ Engine oil filter, replace
- ☐ Fuel filter, replace
- ☐ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)
- ☐ Valve clearance, adjust (300-Series)

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

DPSG,CD03523,10 -19-05JUL99-1/1

2000 Hours of operation

- | | |
|---|---|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Cooling system, drain and flush (if COOL-GARD is not used) |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Valve clearance, adjust (POWERTech) |
| <input type="checkbox"/> Fuel filter, replace | <input type="checkbox"/> Air intake system, check |
| <input type="checkbox"/> Check belt and tensioning system | <input type="checkbox"/> Vibration damper, check |
| <input type="checkbox"/> Crankcase vent tube, clean | |

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

DPSG,CD03523,59 -19-16AUG99-1/1

*Maintenance Records***2500 Hours of operation**

- | | |
|---|---|
| <input type="checkbox"/> Engine oil, drain
<input type="checkbox"/> Engine oil filter, replace
<input type="checkbox"/> Fuel filter, replace
<input type="checkbox"/> Belt, check tension and wear (300-Series and POWERTech with manual tensioner)
<input type="checkbox"/> Valve clearance, adjust (300-Series) | <input type="checkbox"/> Cooling system, drain and flush (if COOL-GARD is used) |
|---|---|

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp
---	--------------	-----------------------------

DPSG,CD03523,60 -19-16AUG99-1/1

3000 Hours of operation

- | | |
|--|---|
| <input type="checkbox"/> Engine oil, drain
<input type="checkbox"/> Engine oil filter, replace
<input type="checkbox"/> Fuel filter, replace
<input type="checkbox"/> Check belt and tensioning system
<input type="checkbox"/> Crankcase vent tube, clean | <input type="checkbox"/> Air intake system, check |
|--|---|

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp
---	--------------	-----------------------------

DPSG,CD03523,61 -19-16AUG99-1/1

*Maintenance Records***3500 Hours of operation**

- ☐ Engine oil, drain
- ☐ Engine oil filter, replace
- ☐ Fuel filter, replace
- ☐ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)
- ☐ Valve clearance, adjust (300-Series)

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

DPSG,CD03523,62 -19-16AUG99-1/1

4000 Hours of operation

- | | |
|---|---|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Cooling system, drain and flush (if COOL-GARD is not used) |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Valve clearance, adjust (POWERTech) |
| <input type="checkbox"/> Fuel filter, replace | <input type="checkbox"/> Air intake system, check |
| <input type="checkbox"/> Check belt and tensioning system | <input type="checkbox"/> Vibration damper, check |
| <input type="checkbox"/> Crankcase vent tube, clean | |

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

DPSG,CD03523,63 -19-16AUG99-1/1

*Maintenance Records***4500 Hours of operation**

- | | |
|--|---|
| <input type="checkbox"/> Engine oil, drain
<input type="checkbox"/> Engine oil, drain
<input type="checkbox"/> Fuel filter, replace
<input type="checkbox"/> Belt, check tension and wear (300-Series and POWERTech with manual tensioner)
<input type="checkbox"/> Valve clearance, adjust (300-Series) | <input type="checkbox"/> Vibration damper, replace (6 cyl.) |
|--|---|

Number of hours:

Observation:

Dealer or distributor stamp

Date:

Job done by:

DPSG,CD03523,64 -19-16AUG99-1/1

5000 Hours of operation

- | | |
|--|---|
| <input type="checkbox"/> Engine oil, drain
<input type="checkbox"/> Engine oil filter, replace
<input type="checkbox"/> Fuel filter, replace
<input type="checkbox"/> Check belt and tensioning system
<input type="checkbox"/> Crankcase vent tube, clean | <input type="checkbox"/> Injection nozzles, replace
<input type="checkbox"/> Air intake system, check
<input type="checkbox"/> Cooling system, drain and flush (when COOL-GARD is used) |
|--|---|

Number of hours:

Observation:

Dealer or distributor stamp

Date:

Job done by:

DPSG,CD03523,65 -19-16AUG99-1/1

*Maintenance Records***5500 Hours of operation**

- ☐ Engine oil, drain
- ☐ Engine oil filter, replace
- ☐ Fuel filter, replace
- ☐ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)
- ☐ Valve clearance, adjust (300-Series)

Number of hours:

Observation:

Dealer or distributor stamp

Date:

Job done by:

DPSG,CD03523,66 -19-16AUG99-1/1

6000 Hours of operation

- ☐ Engine oil, drain
- ☐ Engine oil filter, replace
- ☐ Fuel filter, replace
- ☐ Check belt and tensioning system
- ☐ Crankcase vent tube, clean
- ☐ Cooling system, drain and flush (if COOL-GARD is not used)
- ☐ Valve clearance, adjust (POWERTech)
- ☐ Air intake system, check
- ☐ Vibration damper, check

Number of hours:

Observation:

Dealer or distributor stamp

Date:

Job done by:

DPSG,CD03523,67 -19-16AUG99-1/1

*Maintenance Records***6500 Hours of operation**

- ☐ Engine oil, drain
- ☐ Engine oil filter, replace
- ☐ Fuel filter, replace
- ☐ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)
- ☐ Valve clearance, adjust (300-Series)

Number of hours:

Observation:

Dealer or distributor stamp

Date:

Job done by:

DPSG,CD03523,68 -19-16AUG99-1/1

7000 Hours of operation

- ☐ Engine oil, drain
- ☐ Engine oil filter, replace
- ☐ Fuel filter, replace
- ☐ Check belt and tensioning system
- ☐ Crankcase vent tube, clean
- ☐ Air intake system, check

Number of hours:

Observation:

Dealer or distributor stamp

Date:

Job done by:

DPSG,CD03523,69 -19-16AUG99-1/1

*Maintenance Records***7500 Hours of operation**

- | | |
|--|---|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Cooling system, drain and flush (if COOL-GARD is used) |
| <input type="checkbox"/> Engine oil filter, replace | |
| <input type="checkbox"/> Fuel filter, replace | |
| <input type="checkbox"/> Belt, check tension and wear (300-Series and POWERTech with manual tensioner) | |
| <input type="checkbox"/> Valve clearance, adjust (300-Series) | |

Number of hours:

Observation:

Dealer or distributor stamp

Date:

Job done by:

DPSG,CD03523,70 -19-16AUG99-1/1

8000 Hours of operation

- | | |
|---|---|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Cooling system, drain and flush (if COOL-GARD is not used) |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Valve clearance, adjust (POWERTech) |
| <input type="checkbox"/> Fuel filter, replace | <input type="checkbox"/> Air intake system, check |
| <input type="checkbox"/> Check belt and tensioning system | <input type="checkbox"/> Vibration damper, check |
| <input type="checkbox"/> Crankcase vent tube, clean | |

Number of hours:

Observation:

Dealer or distributor stamp

Date:

Job done by:

DPSG,CD03523,71 -19-16AUG99-1/1

*Maintenance Records***8500 Hours of operation**

- ☐ Engine oil, drain
- ☐ Engine oil filter, replace
- ☐ Fuel filter, replace
- ☐ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)
- ☐ Valve clearance, adjust (300-Series)

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp
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DPSG,CD03523,72 -19-16AUG99-1/1

9000 Hours of operation

- ☐ Engine oil, drain
- ☐ Engine oil filter, replace
- ☐ Fuel filter, replace
- ☐ Check belt and tensioning system
- ☐ Crankcase vent tube, clean
- ☐ Air intake system, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp
---	--------------	-----------------------------

DPSG,CD03523,73 -19-16AUG99-1/1

Maintenance Records**9500 Hours of operation**

- ☐ Engine oil, drain
- ☐ Engine oil filter, replace
- ☐ Fuel filter, replace
- ☐ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)
- ☐ Valve clearance, adjust (300-Series)

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

DPSG,CD03523,74 -19-16AUG99-1/1

10000 Hours of operation

- | | |
|---|--|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Cooling system, drain and flush |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Valve clearance, adjust (POWERTech) |
| <input type="checkbox"/> Fuel filter, replace | <input type="checkbox"/> Thermostat, replace |
| <input type="checkbox"/> Check belt and tensioning system | <input type="checkbox"/> Vibration damper, check |
| <input type="checkbox"/> Crankcase vent tube, clean | <input type="checkbox"/> Injection nozzles, replace |
| <input type="checkbox"/> Air intake system, check | |

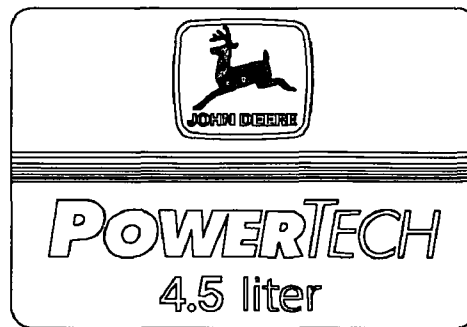
Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

DPSG,CD03523,75 -19-16AUG99-1/1

Record Keeping

POWERTech® medallion

A medallion is located on the rocker arm cover which identifies each engine as a John Deere POWERTECH® engine.

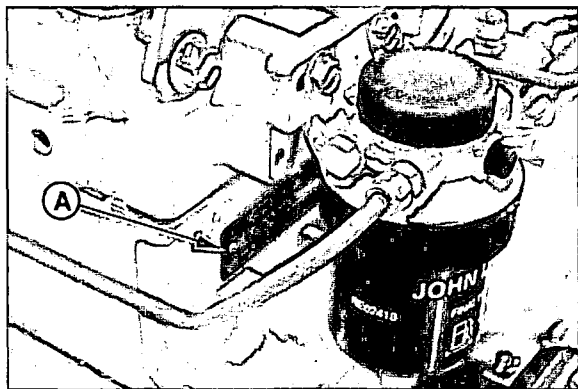


RG8041 -UN-15JAN99

POWERTECH is a trademark of Deere & Company

DPSG,CD03523,11 -19-05JUL99-1/1

Engine serial number plate

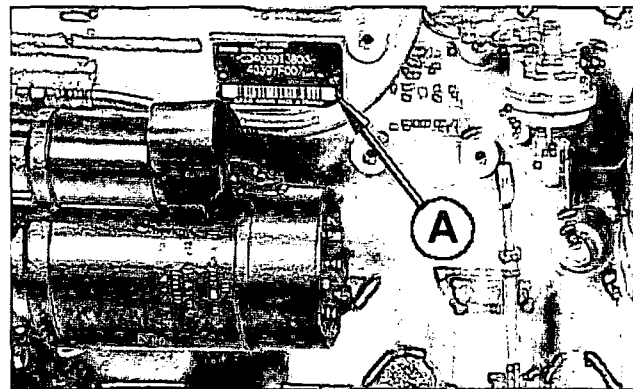


RG8007 -UN-15JAN99

POWERTech engine

Each engine has a 13-digit John Deere serial number. The first two digits identify the factory that produced the engine:

"CD" indicates the engines was built in Saran, France



CD30746 -UN-24SEP99

300-Series engine

Your engine's serial number plate (A) is located on the right-hand side of cylinder block behind the fuel filter for POWERTech engines and near the fuel supply pump on 300-Series engines.

DPSG,CD03523,12 -19-05JUL99-1/1

Record Keeping

Record engine serial number

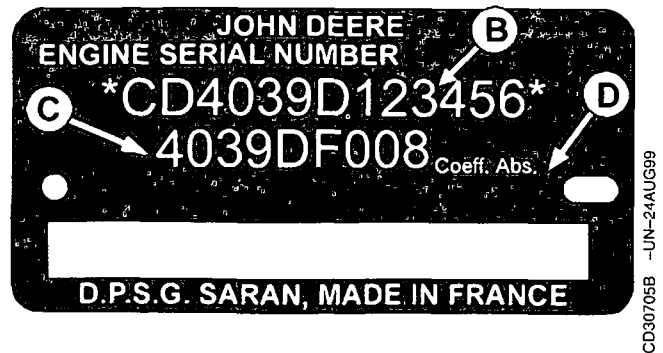
Record all of the numbers and letters found on your engine serial number plate in the spaces provided below.

This information is very important for repair parts or warranty information.

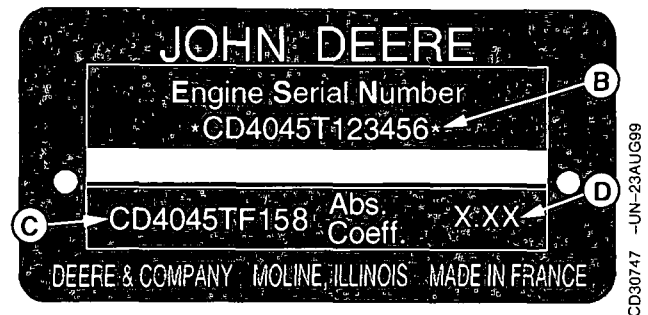
Engine Serial Number (B)

Engine Model Number (C)

Coefficient of Absorption Value (D)



300-Series engine plate



POWERTech engine plate

DPSG,CD03523,13 -19-05JUL99-1/1

Record Keeping

Engine option codes



CD30746A -JUN-26AUG99

Engine option code label

In addition to the serial number plate, OEM engines have an engine option code label affixed to the rocker arm cover. These codes indicate which of the engine options were installed on your engine at the factory. When in need of parts or service, furnish your authorized servicing dealer or engine distributor with these numbers.

An additional sticker may be also delivered (in a plastic bag attached to the engine or inserted in the machine documentation). It is recommended to stick this option code list sticker either:

- On this page of your Operator's manual below this section.
- or
- On the "Engine Owner's Warranty" booklet under the title OPTION CODES (Engine manufacturing configuration).

NOTE: *The Machine Manufacturer may have already stuck it at a specific accessible place (inside the enclosure or close to a maintenance area).*

The engine option code label includes an engine base code (A). This base code must also be recorded along with the option codes. At times it will be necessary to furnish this base code to differentiate two identical option codes for the same engine model.

The first two digits of each code identify a specific group, such as alternators. The last two digits of each

code identify one specific option provided on your engine, such as a 12-volt, 55-amp alternator.

NOTE: *These option codes are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.*

If an engine is ordered without a particular component, the last two digits of that functional group option code will be 99, 00, or XX. The list on the next page shows only the first two digits of the code numbers. For future reference such as ordering repair parts, it is important to have these code numbers available. To ensure this availability, enter the third and fourth digits shown on your engine option code label in the spaces provided on the following page.

Continued on next page

DPSG_CD03523_14 -19-05JUL99-1/2

Record Keeping

NOTE: *NOTE: Your engine option code label may not contain all option codes if an option has been added after the engine left the producing factory.*

If option code label is lost or destroyed, consult your servicing dealer or engine distributor selling the engine for a replacement.

Option Codes	Description	Option Codes	Description
Engine Base Code: _____			
11 _____	Rocker Arm Cover	45 _____	Balancer Shaft
12 _____	Oil Filler Neck	46 _____	Cylinder Block With Liners and Camshaft
13 _____	Crankshaft Pulley	47 _____	Crankshaft and Bearinds
14 _____	Flywheel Housing	48 _____	Connecting Rods and Pistons
15 _____	Flywheel	49 _____	valve Actuating Mechanisms
16 _____	Fuel Injection Pump	50 _____	Oil Pump
17 _____	Air inlet	51 _____	Cylinder Head With Valves
18 _____	Air cleaner	52 _____	Auxiliary Gear Drive
19 _____	Oil pan	54 _____	Oil heater
20 _____	Coolant pump	55 _____	Shipping stand
21 _____	Thermostat Cover	56 _____	Paint Option
22 _____	Thermostat	57 _____	Water Coolant Inlet
23 _____	Fan Drive	59 _____	Oil Cooler
24 _____	Fan Belt	60 _____	Add-on Auxiliary Drive Pulley
25 _____	Fan	62 _____	Alternator Mounting
26 _____	Engine Coolant Heater	64 _____	Exhaust Elbow
27 _____	Radiator	65 _____	Turbocharger
28 _____	Exhaust Manifold	66 _____	Temperature Switch
29 _____	Ventilator System	67 _____	Electronic Tachometer Sensor
30 _____	Starting Motor	68 _____	Damper
31 _____	Alternator	69 _____	Engine Serial Number Plate
32 _____	Instrument Panel	74 _____	Air conditioner Compressor Mounting
35 _____	Fuel Filter	75 _____	Air Restriction Indicator
36 _____	Front Plate	76 _____	Oil Pressure Switch
37 _____	Fuel Transfer Pump	86 _____	fan Pulley
39 _____	Thermostat Housing	87 _____	Automatic Belt Tensioner
40 _____	Oil Dipstick	88 _____	Oil Filter
41 _____	Belt Driven Front Auxiliary Drive	91 _____	Special Equipment (Factory Installed)
43 _____	Starting Aid	97 _____	Special Equipment (Fied Installed)
44 _____	Timing Gear Cover with Gears	98 _____	Shipping

DPSG,CD03523,14 -19-05JUL99-2/2

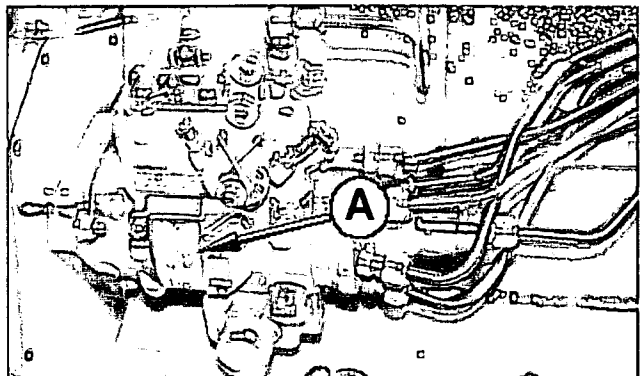
Record fuel injection pump model number

Record the fuel injection pump model and serial information found on the serial number plate (A).

Model No. _____ RPM _____

Manufacturer's No. _____

Serial No. _____



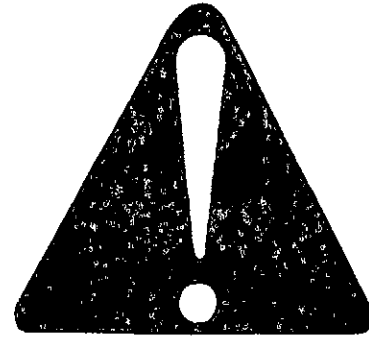
DPSG,CD03523,15 -19-07JUL99-1/1

Safety

Recognize Safety Information

This is a safety-alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

Follow recommended precautions and safe operating practices.



DX,ALERT -19-29SEP98-1/1

T81389 -UN-07DEC88

Understand Signal Words

A signal word—DANGER, WARNING, or CAUTION—is used with the safety-alert symbol. DANGER identifies the most serious hazards.

DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.



▲ WARNING

▲ CAUTION

DX,SIGNAL -19-03MAR93-1/1

TS187 -19-30SEP88

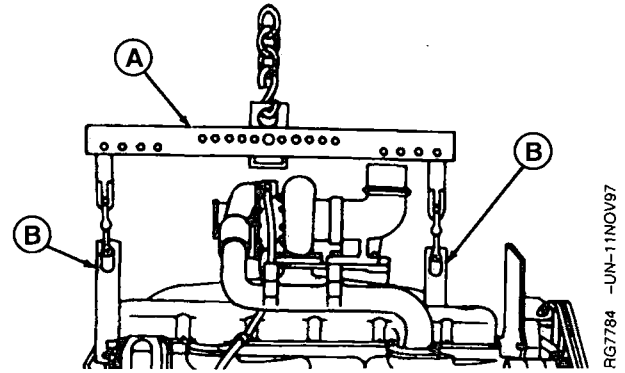
Safety

Engine lifting procedure



CAUTION: The only recommended method for lifting the engine is with JDG23 Engine Lifting Sling (A) and safety approved lifting straps (B) that come with engine. Use extreme caution when lifting and NEVER permit any part of the body to be positioned under an engine being lifted or suspended.

Lift engine with longitudinal loading on lifting sling and lifting straps only. Angular loading greatly reduces lifting capacity of sling and straps



RG7784 -UN-11NOV97

NOTE: If engine does not have lifting straps, universal straps can be procured through service parts under part numbers JD-244-1 and JD-244-2.

1. If not equipped, install lifting straps and torque to 200 N•m (145 lb-ft).
2. Attach JDG23 Engine Lifting Sling (A) to engine lifting straps (B) and overhead hoist.

IMPORTANT: Lifting straps are designed to lift the engine and accessories such as radiator, air filter and other small components. If larger components, such as power take-off, transmission, generator air compressor... etc, are attached to engine, the lifting straps provided with engine or through parts channel are not intended for this purpose. Technician is responsible for providing adequate lifting devices under these situations. See machine manuals for additional information on removing engine from machine.

3. Carefully move engine to desired location.

Safety

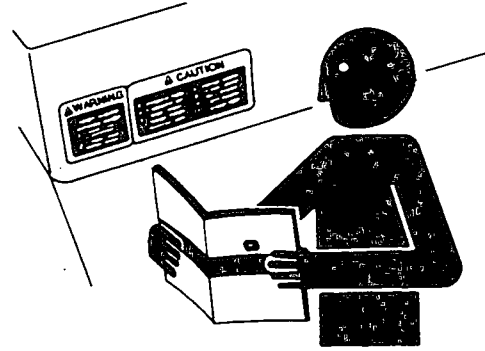
Follow Safety Instructions

Carefully read all safety messages in this manual and on your machine safety signs. Keep safety signs in good condition. Replace missing or damaged safety signs. Be sure new equipment components and repair parts include the current safety signs. Replacement safety signs are available from your John Deere dealer.

Learn how to operate the machine and how to use controls properly. Do not let anyone operate without instruction.

Keep your machine in proper working condition. Unauthorized modifications to the machine may impair the function and/or safety and affect machine life.

If you do not understand any part of this manual and need assistance, contact your John Deere dealer.



TS201 -UN-23AUG88

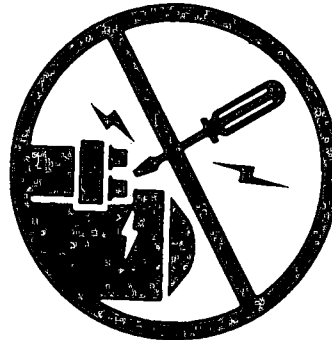
DX,READ -19-03MAR93-1/1

Prevent Machine Runaway

Avoid possible injury or death from machinery runaway:

Do not start engine by shorting across starter terminals. Machine will start in gear if normal circuitry is bypassed.

NEVER start engine while standing on ground. Start engine only from operator's seat, with transmission in neutral or park.



TS177 -UN-11JAN89

DX,BYPAS1 -19-29SEP98-1/1

Safety

Handle Fuel Safely—Avoid Fires

Handle fuel with care: it is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks.

Always stop engine before refueling machine. Fill fuel tank outdoors.

Prevent fires by keeping machine clean of accumulated trash, grease, and debris. Always clean up spilled fuel.



TS202 -UN-23AUG88

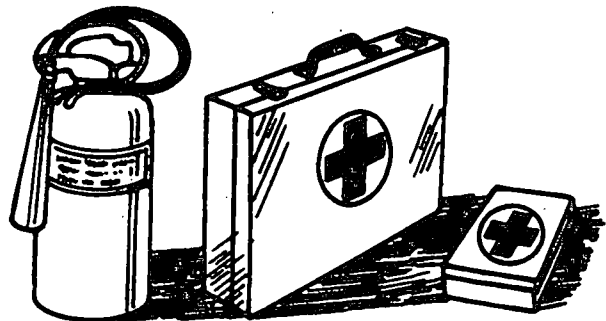
DX,FIRE1 -19-03MAR93-1/1

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



TS291 -UN-23AUG88

DX,FIRE2 -19-03MAR93-1/1

Handle Starting Fluid Safely

Starting fluid is highly flammable.

Keep all sparks and flame away when using it. Keep starting fluid away from batteries and cables.

To prevent accidental discharge when storing the pressurized can, keep the cap on the container, and store in a cool, protected location.

Do not incinerate or puncture a starting fluid container.



TS1356 -UN-18MAR92

DX,FIRE3 -19-16APR92-1/1

Safety

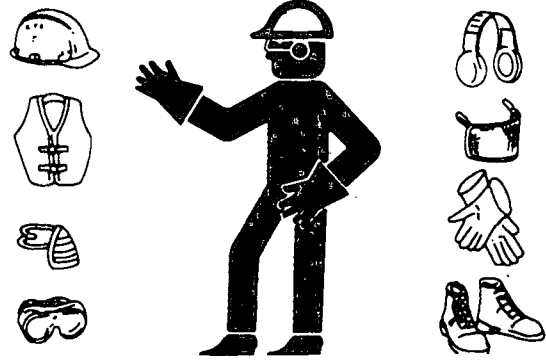
Wear Protective Clothing

Wear close fitting clothing and safety equipment appropriate to the job.

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.



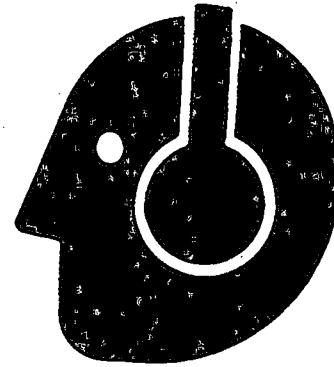
TS206 -UN-23AUG88

DX,WEAR -19-10SEP90-1/1

Protect Against Noise

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



TS207 -UN-23AUG88

DX,NOISE -19-03MAR93-1/1

Safety

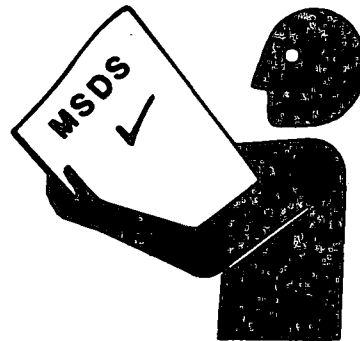
Handle Chemical Products Safely

Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.

Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

(See your John Deere dealer for MSDS's on chemical products used with John Deere equipment.)



TS1132 -UN-26NOV90

DX,MSDS,NA -19-03MAR93-1/1

Stay Clear of Rotating Drivelines

Entanglement in rotating driveline can cause serious injury or death.

Keep master shield and driveline shields in place at all times. Make sure rotating shields turn freely.

Wear close fitting clothing. Stop the engine and be sure the PTO driveline is stopped before making adjustments or performing any type service on the engine or PTO-driven equipment.



TS1644 -UN-22AUG95

CD,PTO -19-12SEP95-1/1

Safety

Practice Safe Maintenance

Understand service procedure before doing work. Keep area clean and dry.

Never lubricate, service, or adjust machine while it is moving. Keep hands, feet, and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Lower equipment to the ground. Stop the engine. Remove the key. Allow machine to cool.

Securely support any machine elements that must be raised for service work.

Keep all parts in good condition and properly installed. Fix damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.

On self-propelled equipment, disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

On towed implements, disconnect wiring harnesses from tractor before servicing electrical system components or welding on machine.



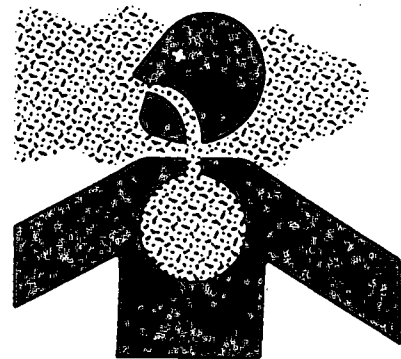
TS218 -JUN-23AUG88

DX,SERV -19-17FEB99-1/1

Work In Ventilated Area

Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.



TS220 -JUN-23AUG88

DX,AIR -19-17FEB99-1/1

Safety

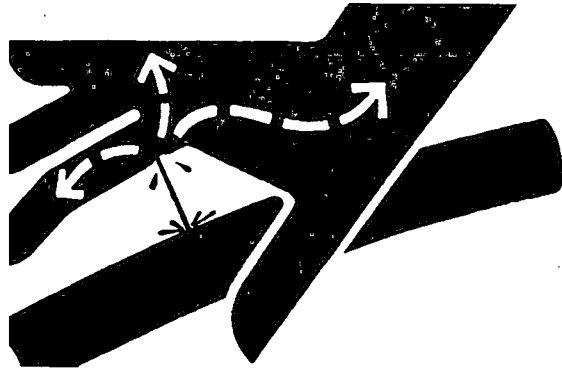
Avoid High-Pressure Fluids

Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.



X9811 -UN-23AUG88

DX,FLUID -19-03MAR93-1/1

Avoid Heating Near Pressurized Fluid Lines

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area.



TS953 -UN-15MAY90

DX,TORCH -19-03MAR93-1/1

Safety

Remove Paint Before Welding or Heating

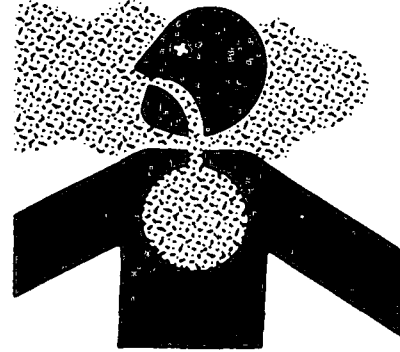
Avoid potentially toxic fumes and dust.

Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or heating:

- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.



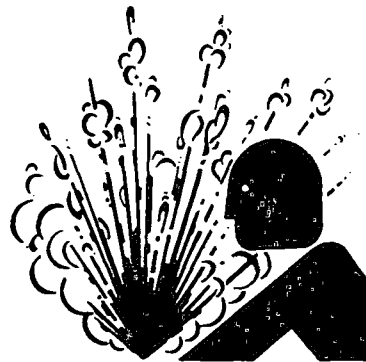
TS220 -UN-23AUG88

DX,PAINT -19-03MAR93-1/1

Service Cooling System Safely

Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.



TS281 -UN-23AUG88

DX,RCAP -19-04JUN90-1/1

Safety

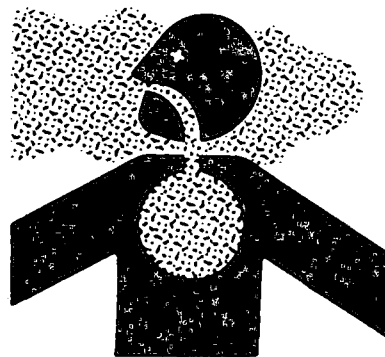
Avoid Harmful Asbestos Dust

Avoid breathing dust that may be generated when handling components containing asbestos fibers. Inhaled asbestos fibers may cause lung cancer.

Components in products that may contain asbestos fibers are brake pads, brake band and lining assemblies, clutch plates, and some gaskets. The asbestos used in these components is usually found in a resin or sealed in some way. Normal handling is not hazardous as long as airborne dust containing asbestos is not generated.

Avoid creating dust. Never use compressed air for cleaning. Avoid brushing or grinding material containing asbestos. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If not available, apply a mist of oil or water on the material containing asbestos.

Keep bystanders away from the area.



TS220 -UN-23AUG88

DX,DUST -19-15MAR91-1/1

Dispose of Waste Properly

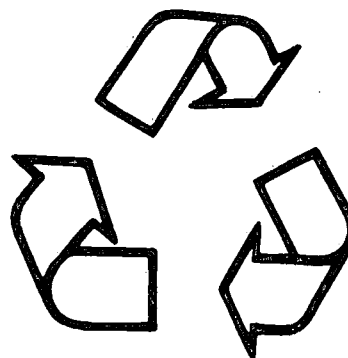
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Air conditioning refrigerants escaping into the air can damage the Earth's atmosphere. Government regulations may require a certified air conditioning service center to recover and recycle used air conditioning refrigerants.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.



TS1133 -UN-26NOV90

DX,DRAIN -19-03MAR93-1/1

Fuels, Lubricants and Coolant

Diesel Fuel

Consult your local fuel distributor for properties of the diesel fuel available in your area.

In general, diesel fuels are blended to satisfy the low temperature requirements of the geographical area in which they are marketed.

Diesel fuels specified to EN 590 or ASTM D975 are recommended.

In all cases, the fuel shall meet the following properties:

Cetane number of 40 minimum. Cetane number greater than 50 is preferred, especially for temperatures below -20°C (-4°F) or elevations above 1500 m (5000 ft).

Cold Filter Plugging Point (CFPP) below the expected low temperature OR **Cloud Point** at least 5°C (9°F) below the expected low temperature.

Fuel lubricity should pass a minimum of 3100 gram load level as measured by the BOCLE scuffing test.

Sulfur content:

- Sulfur content should not exceed 0.5%. Sulfur content less than 0.05% is preferred.
- If diesel fuel with sulfur content greater than 0.5% sulfur content is used, reduce the service interval for engine oil and filter by 50%.
- DO NOT use diesel fuel with sulfur content greater than 1.0%.

Bio-diesel fuels may be used ONLY if the fuel properties meet DIN 51606 or equivalent specification.

DO NOT mix used engine oil or any other type of lubricant with diesel fuel.

DX,FUEL1 -19-24JAN00-1/1

Handling and Storing Diesel Fuel



CAUTION: Handle fuel carefully. Do not fill the fuel tank when engine is running.

DO NOT smoke while you fill the fuel tank or service the fuel system.

Fill the fuel tank at the end of each day's operation to prevent condensation and freezing during cold weather.

IMPORTANT: The fuel tank is vented through the filler cap. If a new filler cap is required, always replace it with an original vented cap.

When fuel is stored for an extended period or if there is a slow turnover of fuel, add a fuel conditioner to stabilize the fuel and prevent water condensation. Contact your fuel supplier for recommendations.

DX,FUEL4 -19-18MAR96-1/1

*Fuels, Lubricants and Coolant***Diesel Engine Break-In Oil**

New engines are filled at the factory with John Deere **ENGINE BREAK-IN OIL**. During the break-in period, add John Deere **ENGINE BREAK-IN OIL** as needed to maintain the specified oil level.

Change the oil and filter after the first 100 hours of operation of a new or rebuilt engine.

After engine overhaul, fill the engine with John Deere **ENGINE BREAK-IN OIL**.

If John Deere **ENGINE BREAK-IN OIL** is not available, use a diesel engine oil meeting one of the following during the first 100 hours of operation:

- API Service Classification CE

- ACEA Specification E1

After the break-in period, use John Deere **PLUS-50®** or other diesel engine oil as recommended in this manual.

IMPORTANT: Do not use **PLUS-50** oil or engine oils meeting API CH-4, API CG4, API CF4, ACEA E3, or ACEA E2 performance levels during the first 100 hours of operation of a new or rebuilt engine. These oils will not allow the engine to break-in properly.

PLUS-50 is a registered trademark of Deere & Company.

DX.ENGIL4 -19-24JAN00-1/1

Fuels, Lubricants and Coolant

Diesel Engine Oil

Use oil viscosity based on the expected air temperature range during the period between oil changes.

The following oil is preferred:

- John Deere PLUS-50®

The following oil is also recommended:

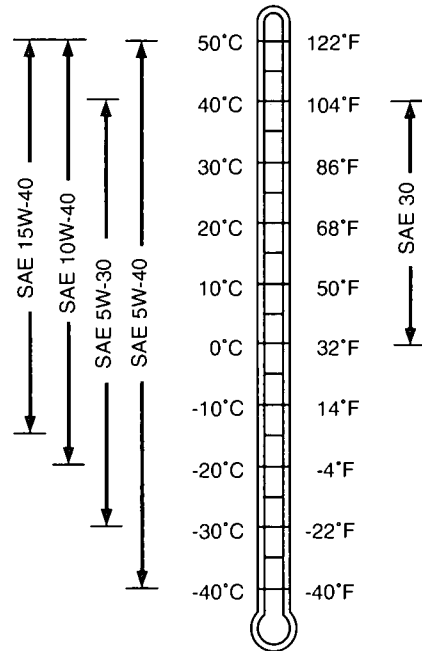
- John Deere TORQ-GARD SUPREME®

Other oils may be used if they meet one or more of the following:

- API Service Classification CH-4
- API Service Classification CG-4
- API Service Classification CF-4
- ACEA Specification E3
- ACEA Specification E2

Multi-viscosity diesel engine oils are preferred.

If diesel fuel with sulfur content greater than 0.5% is used, reduce the service interval by 50%.



TS1688 -UN-05OCT01

PLUS-50 is a registered trademark of Deere & Company.

TORQ-GARD SUPREME is a registered trademark of Deere & Company

CD,ENOIL -19-19DEC02-1/1

Lubricant Storage

Your equipment can operate at top efficiency only when clean lubricants are used.

Use clean containers to handle all lubricants.

Whenever possible, store lubricants and containers in an area protected from dust, moisture, and other contamination. Store containers on their side to avoid water and dirt accumulation.

Make certain that all containers are properly marked to identify their contents.

Properly dispose of all old containers and any residual lubricant they may contain.

DX,LUBST -19-18MAR96-1/1

*Fuels, Lubricants and Coolant***Mixing of Lubricants**

In general, avoid mixing different brands or types of oil. Oil manufacturers blend additives in their oils to meet certain specifications and performance requirements.

Mixing different oils can interfere with the proper functioning of these additives and degrade lubricant performance.

Consult your John Deere dealer to obtain specific information and recommendations.

DX,LUBMIX -19-18MAR96-1/1

Diesel Engine Coolant

The engine cooling system is filled to provide year-round protection against corrosion and cylinder liner pitting, and winter freeze protection to -37°C (-34°F).

John Deere COOL-GARD is preferred for service.

If John Deere COOL-GARD is not available, use a low silicate ethylene glycol or propylene glycol base coolant concentrate in a 50% mixture of concentrate with quality water.

The coolant concentrate shall be of a quality that provides cavitation protection to cast iron and aluminum parts in the cooling system. John Deere COOL-GARD meets this requirement.

Freeze protection

A 50% mixture of ethylene glycol engine coolant in water provides freeze protection to -37°C (-34°F).

A 50% mixture of propylene glycol engine coolant in water provides freeze protection to -33°C (-27°F).

If protection at lower temperatures is required, consult your John Deere dealer for recommendations.

Water quality

Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended for mixing with ethylene glycol and propylene glycol base engine coolant concentrate.

IMPORTANT: Do not use cooling system sealing additives or antifreeze that contains sealing additives.

IMPORTANT: Do not mix ethylene glycol and propylene glycol base coolants.

DX,COOLB -19-16NOV01-1/1

*Fuels, Lubricants and Coolant***Operating in Warm Temperature Climates**

John Deere engines are designed to operate using glycol base engine coolants.

Always use a recommended glycol base engine coolant, even when operating in geographical areas where freeze protection is not required.

IMPORTANT: Water may be used as coolant *in emergency situations only.*

Foaming, hot surface aluminum and iron corrosion, scaling, and cavitation will occur when water is used as the coolant, even when coolant conditioners are added.

Drain cooling system and refill with recommended glycol base engine coolant as soon as possible.

DX,COOL5 -19-18MAR96-1/1

Operating the Engine

Break-in period

Within first 100 hours of operation

During the first 100 hours of operation, avoid overloading, excessive idling and no-load operation.

See ENGINE BREAK-IN OIL for eventual addition of oil.

NOTE: During the break-in period a higher-than-usual oil consumption should be considered as normal.

After first 100 hours of operation

After the first 100 hours, drain the crankcase and

change the oil filter (see CHANGING ENGINE OIL AND FILTER). Fill crankcase with seasonal viscosity grade oil (see DIESEL ENGINE OIL).

Check tension of alternator belt.

Check connections of air intake hoses.

Check for proper tightening of cap screws all around the engine.

DPSG,CD03523,17 -19-09JUL99-1/1

Starting the engine



CAUTION: Before starting engine in a confined building, install proper outlet exhaust ventilation equipment. Always use safety approved fuel storage and piping.

2. Open the fuel supply shut-off valve, if equipped.

3. Activate the starter motor switch to crank the engine and release it as soon as engine starts.

NOTE: Do not operate the starter motor more than 20 seconds at a time.

NOTE: If temperature is below 0° C (32° F), it may be necessary to use cold weather starting aids (See COLD WEATHER OPERATION).

1. Perform all prestarting checks outlined in Maintenance/Daily Section.

DPSG,CD03523,18 -19-09JUL99-1/4

Cold weather operation

Depending on equipment, various cold weather starting aid are available to assist in starting the engine at temperature below 0° C (32° F).

Continued on next page

DPSG,CD03523,19 -19-09JUL99-1/4

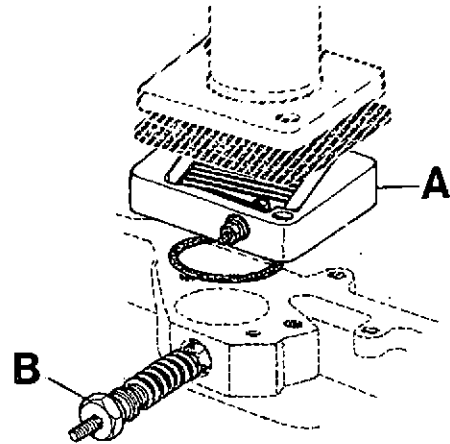
Operating the Engine

Air intake heater

Air intake heater is either a grid-type (A) for POWERTech engines or a glow plug-type (B) for 300-Series engines installed in the air intake channel.

CAUTION: NEVER use Ether Starting Fluid when air intake heater is used to start the engine.

Activate the heating element (preheater position) for 30 seconds maximum then start the engine.



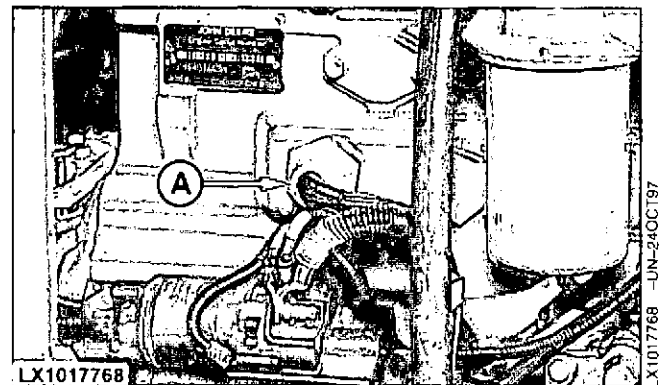
CD30750 -UN-03SEP99

DPSG,CD03523,19 -19-09JUL99-2/4

Coolant heater

Connect plug of coolant heater (A) to a proper power source (110 or 220 V).

At an ambient temperature of -15°C (5°F), the heater process takes approximately 2 hours. Extend heating period if ambient temperature is lower.



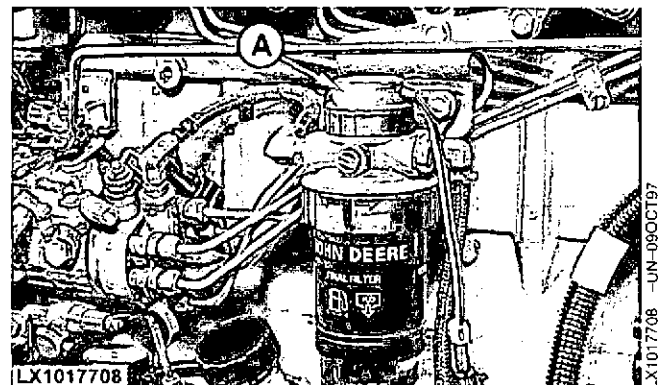
LX1017768

LX1017768 -UN-24OCT97

DPSG,CD03523,19 -19-09JUL99-3/4

Fuel preheater

Fuel preheater (A) switches ON and OFF automatically in relation with the ambient temperature.



LX1017708

LX1017708 -UN-09OCT97

DPSG,CD03523,19 -19-09JUL99-4/4

Operating the Engine

Using a booster battery or charger

A 12-volt booster battery can be connected in parallel with battery(ies) on the unit to aid in cold weather starting. ALWAYS use heavy duty jumper cables.

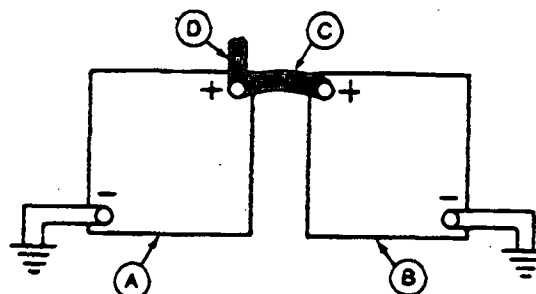
CAUTION: Gas given off by battery is explosive. Keep sparks and flames away from battery. Before connecting or disconnecting a battery charger, turn charger off. Make last connection and first disconnection at a point away from battery. Always connect **NEGATIVE (-)** cable last and disconnect this cable first.

IMPORTANT: Be sure polarity is correct before making connections. Reversed polarity will damage electrical system. Always connect positive to positive and negative to ground. Always use 12-volt booster battery for 12-volt electrical systems and 24-volt booster battery(ies) for 24-volt electrical systems.

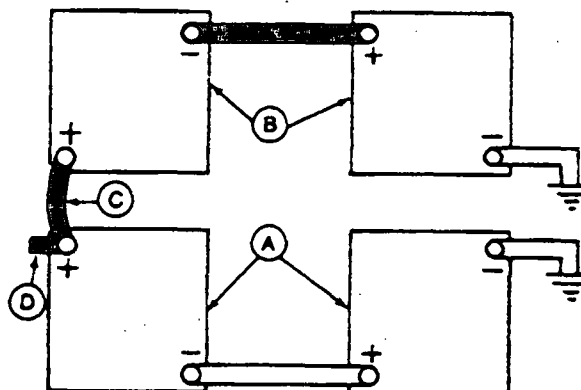
1. Connect booster battery or batteries to produce the required system voltage for your engine application.

NOTE: To avoid sparks, **DO NOT** allow the free ends of jumper cables to touch the engine.

2. Connect one end of jumper cable to the **POSITIVE (+)** post of the booster battery.
3. Connect the other end of the jumper cable to the **POSITIVE (+)** post of battery connected to starter.
4. Connect one end of the other jumper cable to the **NEGATIVE (-)** post of the booster battery.
5. ALWAYS complete the hookup by making the last connection of the **NEGATIVE (-)** cable to a good ground on the engine frame and away from the battery(ies).
6. Start the engine. Disconnect jumper cables immediately after engine starts. Disconnect **NEGATIVE (-)** cable first.



12-Volt System



24-Volts System

A—12-Volt Machine battery (ies)
B—12-Volt Booster battery (ies)
C—Booster cable
D—Cable to starter motor

TS204 -UN-23AUG88

RG4678 -UN-14DEC88

RG4698 -UN-14DEC88

Operating the Engine

Engine operation

Warming engine

Operate engine at high idle for 1 to 2 minutes before applying the load.

NOTE: *This procedure does not apply to standby generator sets where the engine is loaded immediately upon reaching rated speed.*

Normal engine operation

Compare engine coolant temperature and engine oil pressure with specifications below:

Specification

Minimum oil pressure at full load rated speed ¹ —Pressure.....	275 kPa (2.75 bar) (40 psi)
Coolant temperature range—	
Temperature	82°—94°C (180°—202°F)

Stop engine immediately if coolant temperature is above or oil pressure below specifications or if there are any signs of part failure. Symptoms that may be early signs of engine problems could be:

- Sudden loss of power
- Unusual noise or vibration
- Excessive black exhaust

- Excessive fuel consumption
- Excessive oil consumption
- Fluid leaks

Recommendation for turbocharger engines

Should the engine stalls when operating under load, IMMEDIATELY restart it to prevent overheating of turbocharger components.

Idling engine

Avoid excessive engine idling. Prolonged idling may cause the engine coolant temperature to fall below its normal range. This, in turn, causes crankcase oil dilution, due to incomplete fuel combustion, and permits formation of gummy deposits on valves, pistons, and piston rings. It also promotes rapid accumulation of engine sludge and unburned fuel in the exhaust system. If an engine will be idling for more than 5 minutes, stop and restart later.

NOTE: *Generator set applications have the governor locked at a specified speed and do not have a slow idle function. These engines idle at no load governed speed (fast idle).*

¹Oil at normal operating temperature of 115°C (240°F).

Standby power units

To assure that your engine will deliver efficient standby operation when needed, start engine and run at rated speed (with 50%—70% load) for 30 minutes every 2

weeks. DO NOT allow engine to run extended period of time with no load.

Operating the Engine

Stopping the engine

1. Before stopping, run engine for at least 2 minutes at fast idle and no load.
2. Stop the engine.

DPSG,CD03523,23 -19-09JUL99-1/1

Maintenance

Observe service interval

Using hour meter as a guide, perform all services at the hourly intervals indicated on following pages. At each scheduled maintenance interval, perform all previous maintenance operations in addition to the ones specified. Keep a record of hourly intervals and services performed using charts provided in Maintenance Records Section.

IMPORTANT: Recommended service intervals are for normal operating conditions. Service **MORE OFTEN** if engine is operated under adverse conditions. Neglecting maintenance can result in failures or permanent damage to the engine.

DPSG,CD03523,24 -19-09JUL99-1/1

Use correct fuels, lubricants and coolant

IMPORTANT: Use only fuels, lubricants, and coolants meeting specifications outlined in Fuels, Lubricants, and Coolant Section when servicing your John Deere Engine.

Consult your John Deere engine distributor, servicing dealer or your nearest John Deere Parts Network for recommended fuels, lubricants, and coolant. Also available are necessary additives for use when operating engines in tropical, arctic, or any other adverse conditions.



TS100 -UN-23AUG88

DPSG,CD03523,25 -19-09JUL99-1/1

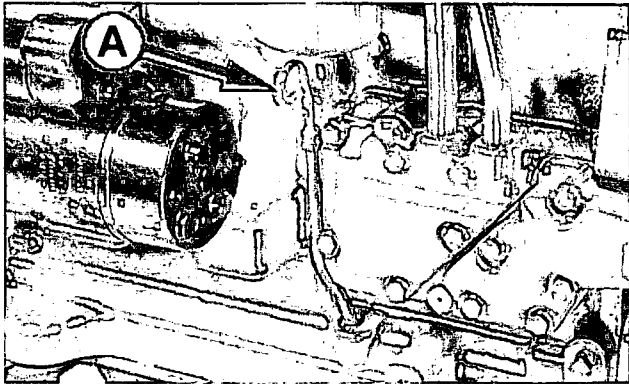
Maintenance

Maintenance interval chart

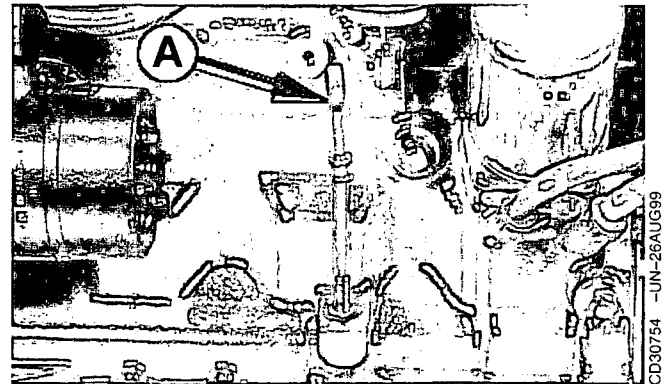
Item	10 H / daily	500 H	1000 H / 1 year	2000 H / 2 years	2500 H / 3 years	As required
Check engine oil and coolant level	•					
Check air filter restriction indicator ^a	•					
Change engine oil and filter ^b		•				
Replace fuel filter element		•				
Check belt tension and automatic tensioner ^c		•	•			
Check and adjust valve clearance ^d			•	•		
Clean crankcase vent tube			•			
Check air intake hoses, connections and system			•			
Pressure test cooling system			•			
Check vibration damper (6 cyl.) ^e				•		
Check engine speed and speed drop governor				•		
Drain and flush cooling system ^f				•	•	
Drain water and sediment from fuel filter						•
Clean filter element (see note a)						•
Test thermostat and injection nozzles (see your dealer) ^g						•
^a Clean air filter element when restriction indicator is red. Replace filter element after 6 cleanings or once a year.						
^b Change oil and filter after the first 100 hours of operation, then every 500 hours thereafter. Change oil and filter at least once a year.						
^c Check belt tension every 500 hours on 300-Series engines and on POWERTech engines with manual tensioner. Check automatic belt tensioner every 1000 hours/1 year on POWERTech engines when equipped.						
^d Have your authorized servicing dealer or engine distributor adjust valve clearance as follows. After the first 500 hours of operation then every 1000 hours thereafter on 300-Series engines. Every 2000 hours on POWERTech engines.						
^e Have your authorized dealer or engine distributor replace the vibration damper every 4500 hours/5 years.						
^f Drain and flush cooling system every 2500 hours/3 years when John Deere COOL-GARD coolant is used. Otherwise every 2000 hours/2 years.						
^g Contact your dealer when thermostat or injection nozzles are suspected to be defective. Replace injection nozzles every 5000 hours and thermostat every 10000 hours.						

Maintenance/Daily or every 10 hours

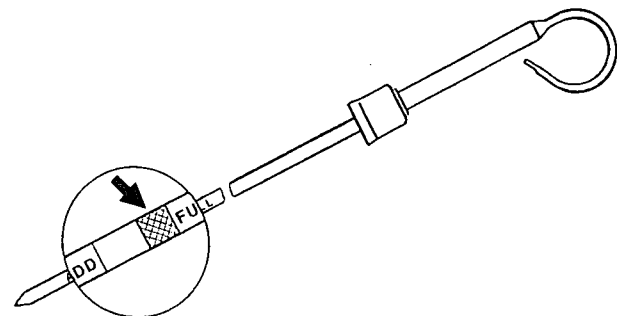
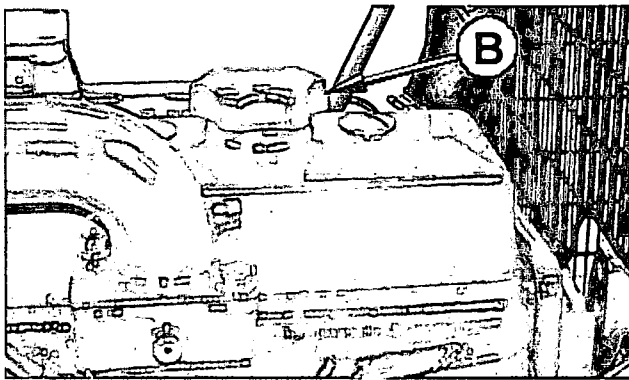
Daily prestarting checks



POWERTech engine



300-Series engine



FD000047

Do the following **BEFORE STARTING THE ENGINE** for the first time each day:

IMPORTANT: DO NOT add makeup oil until the oil level is **BELOW** the add mark.

1. Check engine oil level on dipstick (A). Add as required, using seasonal viscosity grade oil. (See

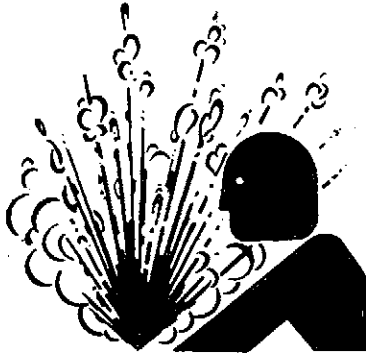
DIESEL ENGINE OIL). Add oil at rocker arm cover filler cap (B).

IMPORTANT: DO NOT fill above the crosshatch area. Oil levels anywhere within crosshatch are considered in the acceptable operating range.

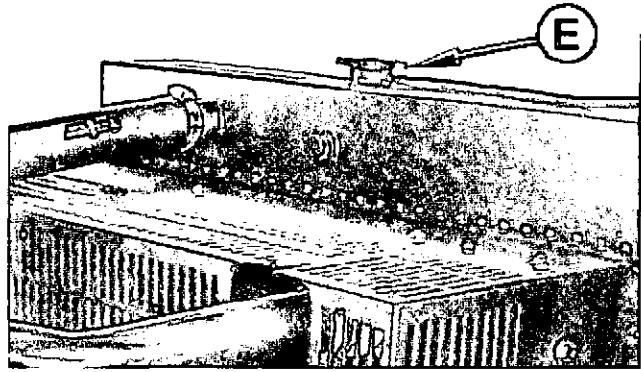
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DPSG,CD03523,27 -19-12JUL99-1/3

Maintenance/Daily or every 10 hours



TS281 -UN-23AUG88



CD30756 -UN-26AUG99

2.



CAUTION: CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Only remove filler cap when engine is cold or when cool enough to touch with bare

hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

Remove radiator cap (E) and check coolant level which should be at bottom of filler neck. Fill radiator with proper coolant solution if level is low. (See DIESEL ENGINE COOLANT). Check overall cooling system for leaks.

DPSG,CD03523,27 -19-12JUL99-2/3

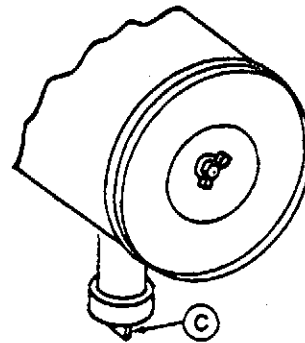
3. If air filter has a dust unloader valve (C), squeeze valve tip to release any trapped dirt particles.

4. Check air intake restriction indicator (D). When indicator is red, air filter needs to be cleaned.

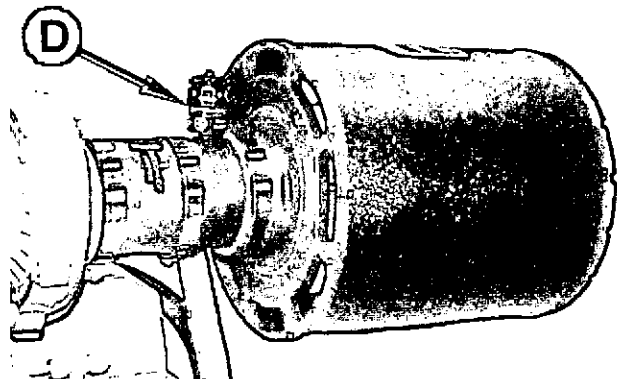
IMPORTANT: Maximum air intake restriction is 6.25 kPa (0.06 bar) (1.0 psi) (25 in. H₂O). A clogged air cleaner element will cause excessive intake restriction and a reduced air supply to the engine.

5. Make a thorough inspection of the engine compartment.

NOTE: Wipe all fittings, caps, and plugs before performing any maintenance to reduce the chance of system contamination.



RG4687 -UN-20DEC88



CD30757 -UN-26AUG99

DPSG,CD03523,27 -19-12JUL99-3/3

Maintenance/500 hours

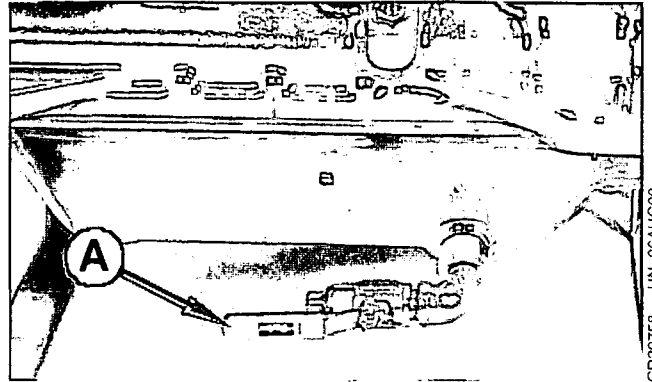
Changing engine oil and filter

NOTE: Change engine oil and filter for the first time after 100 hours maximum of operation, then every 500 hours thereafter. Change oil and filter at least once a year.

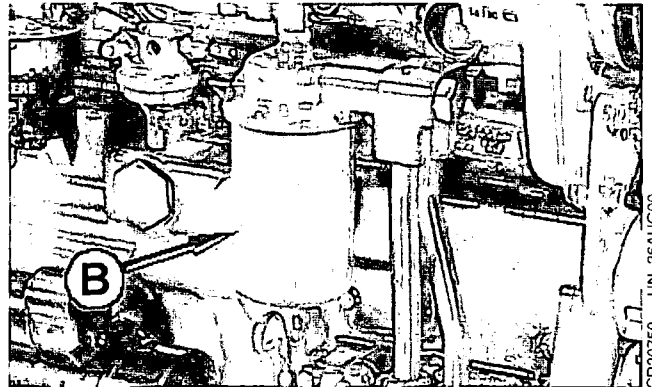
1. Run engine approximately 5 minutes to warm up oil. Shut engine off.
2. Open oil pan drain plug valve (A).
3. Drain crankcase oil from engine while warm.
4. Remove and discard oil filter element (B) using a suitable filter wrench.
5. Remove oil filter packing and clean filter mounting pad.

IMPORTANT: Filtration of oils is critical to proper lubrication. Always change filter regularly. Use filter meeting John Deere performance specifications.

6. Oil new packing and install new filter element (RE506178). Hand tighten element according to values printed on filter element. If values are not provided, tighten element approximately 3/4 — 1-1/4 turn after packing contacts filter housing. DO NOT overtighten filter element.
7. Close oil pan drain valve.

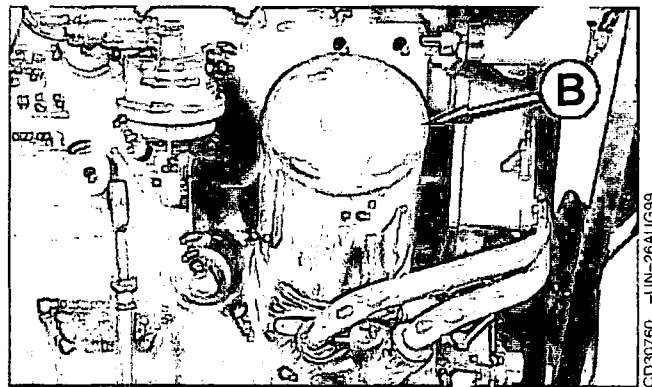


CD30758 -UN-26AUG99



CD30759 -UN-26AUG99

POWERTEch engine



CD30760 -UN-26AUG99

300-Series engine

Continued on next page

DPSG,CD03523,29 -19-19DEC02-1/2

Maintenance/500 hours

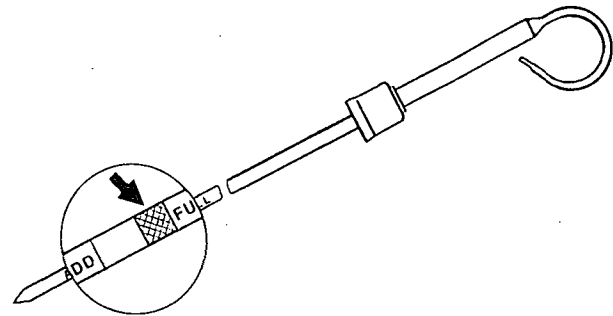
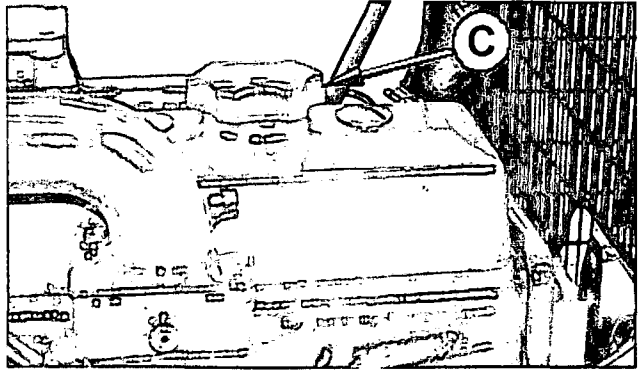
8. Fill engine crankcase with correct John Deere engine oil through rocker arm cover opening (C). See DIESEL ENGINE OIL Section for determining correct engine oil.

To determine the correct oil fill quantity for your engine, see ENGINE CRANKCASE OIL FILL QUANTITIES in the Specifications Section.

NOTE: Crankcase oil capacity may vary slightly. ALWAYS fill crankcase to full mark or within crosshatch on dipstick, whichever is present. DO NOT overfill.

IMPORTANT: Immediately after completing any oil change, crank engine for 30 seconds without permitting engine to start. This will help insure adequate lubrication to engine components before engine starts.

9. Start engine and run to check for possible leaks.
10. Stop engine and check oil level after 10 minutes. If necessary, top up.

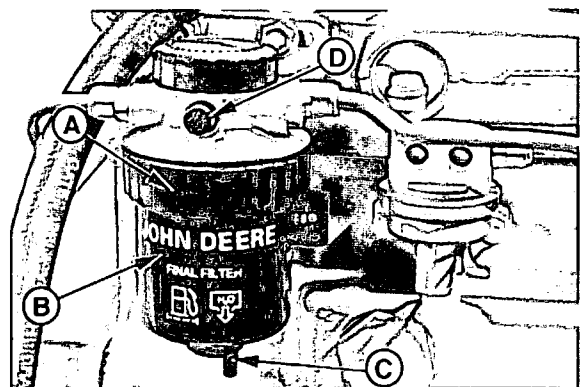


DPSG,CD03523,29 -19-19DEC02-2/2

Replacing fuel filter element



X9811 -UN-23AUG88



RG7721 -UN-15JAN99

A—Retaining ring

B—Filter element

C—Drain plug

D—Bleed plug



CAUTION: CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If any fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

1. Thoroughly clean fuel filter assembly and surrounding area.
2. Loosen drain plug (C) and drain fuel into a suitable container.

NOTE: Lifting up on retaining ring as it is rotated helps to get it past raised locators.

3. Firmly grasp the retaining ring (A) and rotate it clockwise 1/4 turn. Remove ring with filter element (B).

IMPORTANT: Do not dump the old fuel into the new filter element. This could cause fuel injection problem.

A plug is provided with the new element for plugging the used element.

4. Inspect filter mounting base for cleanliness. Clean as required.

NOTE: Raised locators on fuel filter canister must be indexed properly with slots in mounting base for correct installation.

5. Install new filter element dry onto mounting base. Be sure element is properly indexed and firmly seated on base. It may be necessary to rotate filter for correct alignment.
6. Install retaining ring onto mounting base making certain dust seal is in place on filter base. Hand tighten ring (about 1/3 turn) until it "snaps" into the detent. DO NOT overtighten retaining ring.

NOTE: The proper installation is indicated when a "click" is heard and a release of the retaining ring is felt.

7. Bleed the fuel system.

Checking belt (300-SERIES ENGINES)

1. Inspect belt for cracks, fraying, or stretched out areas. Replace as necessary.
2. Check belt tension using one of following methods:

a) Use of JDG529 Tension Gauge (A)

Specification

Belt tension—New belt	578—622 N (130—140 lb-force)
Used belt	378—423 N (85—94 lb-force)

NOTE: Belt is considered used after 10 minutes of operation.

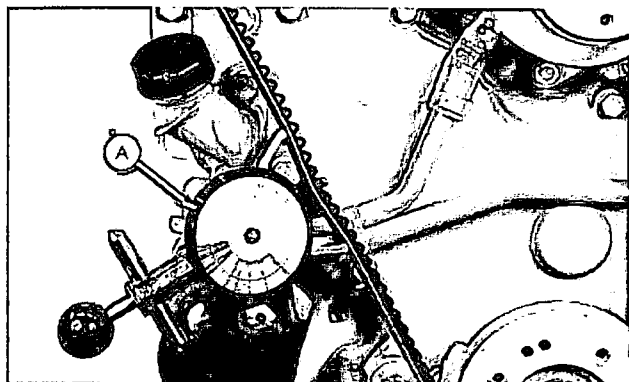
b) Use of tension tester (B) and straightedge (C)

A 89 N (20 lb) force applied halfway between pulleys should deflect belt by 19 mm (0.75 in.).

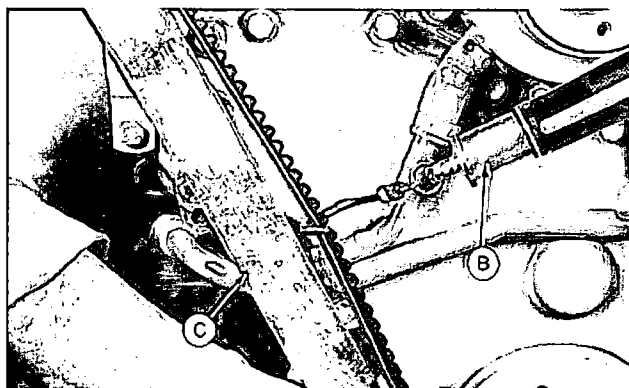
3. If adjustment is necessary, loosen alternator nuts (D) and (E). Pull alternator frame outward until belt is correctly tensioned.

IMPORTANT: Do not pry against the alternator rear frame. Do not tighten or loosen belts while they are hot.

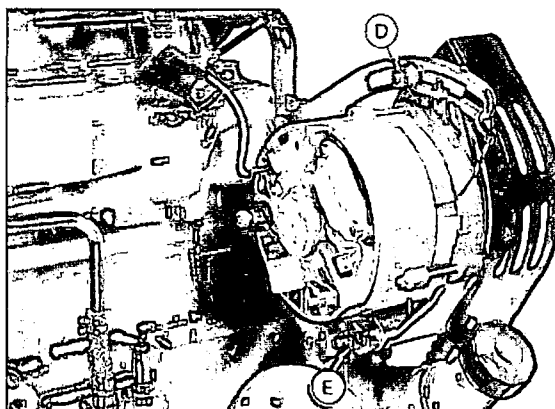
4. Tighten alternator bracket nuts firmly.
5. Run engine for 10 minutes then recheck belt tension.



CD30644 -UN-04MAY98



CD30645 -UN-04MAY98



CD30646 -UN-04MAY98

DPSG,CD03523,31 -19-12JUL99-1/1

Checking belt (POWERTech ENGINES with manual tensioner)

Inspect belts for cracks, fraying, or stretched out areas. Replace if necessary.

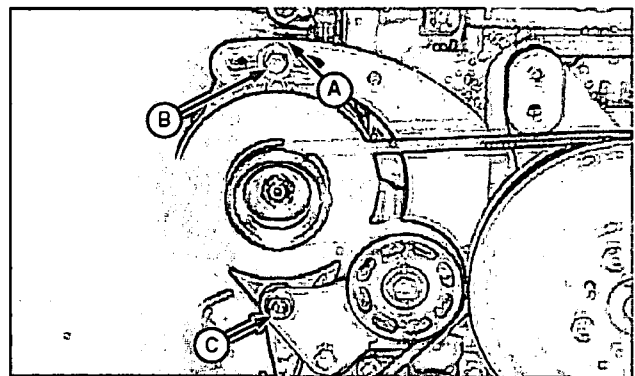
NOTE: Belt adjustment is measured using a gauge stamped on the top edge of the alternator bracket.

1. Loosen cap screws (B) and (C).
2. Slide alternator in slot by hand to remove all excess slack in belt. Scribe a reference mark (D) on line with notch (E) on upper alternator bracket.

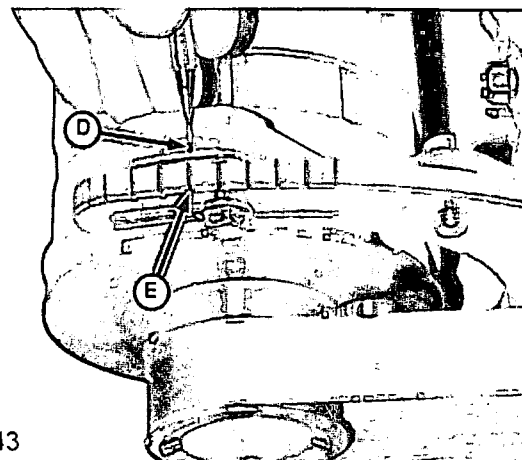
IMPORTANT: Do not pry against alternator rear frame.

3. Using the gauge (A) on the alternator bracket, stretch belt by prying outward on alternator front frame. Stretch the belt 1 gauge unit for a used belt and 1.5 gauge units for a new belt.
4. Tighten cap screws (B) and (C).

- A—Belt gauge
B—Cap screw
C—Cap screw
D—Reference mark
E—Alternator upper bracket notch



Belt manual tensioner on POWERTech engine



CD30843

Reference marks

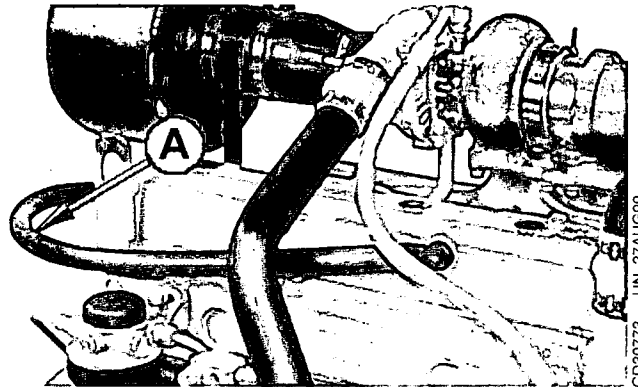
DPSG,CD03523,57 -19-19DEC02-1/1

Maintenance/1000 hours/1 year

Cleaning crankcase vent tube

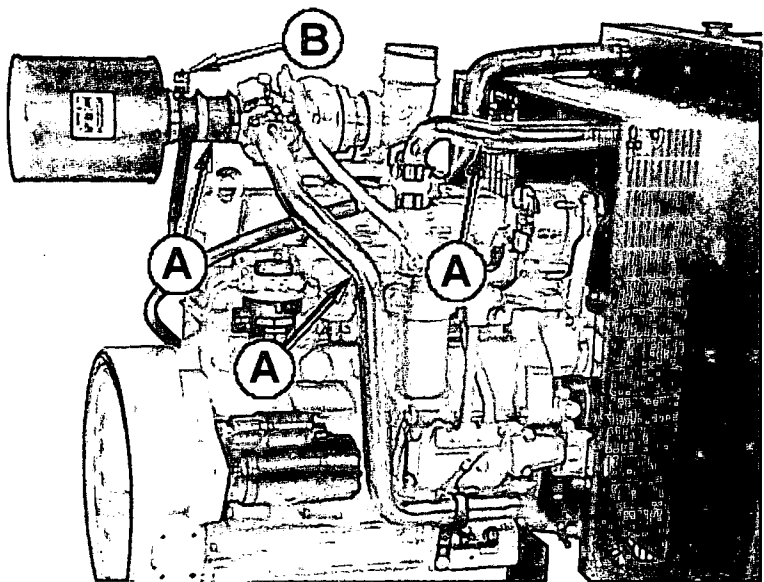
If you operate the engine in dusty conditions, clean the tube at shorter intervals.

1. Remove and clean crankcase vent tube (A).
2. Install the vent tube. Be sure the O-ring fits correctly in the rocker arm cover for elbow adapter. Tighten hose clamp securely.



DPSG,CD03523,32 -19-12JUL99-1/1

Checking air intake system



IMPORTANT: The air intake system must not leak. Any leak, no matter how small, may result in engine failure due to abrasive dirt and dust entering the intake system.

1. Inspect all intake hoses (piping) for cracks. Replace as necessary.
2. Check clamps on piping (A) which connect the air filter, engine and, if present, turbocharger and air-to-air radiator. Tighten clamps as necessary.
3. Test air restriction indicator (B) for proper operation. Replace indicator as necessary.

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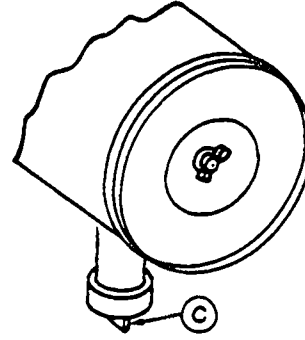
DPSG,CD03523,33 -19-12JUL99-1/2

Maintenance/1000 hours/1 year

4.

If engine has a rubber dust unloader valve (C), inspect the valve on bottom of air filter for cracks or plugging. Replace as necessary.

5. Service air filter as necessary.



DPSG,CD03523,33 -19-12JUL99-2/2

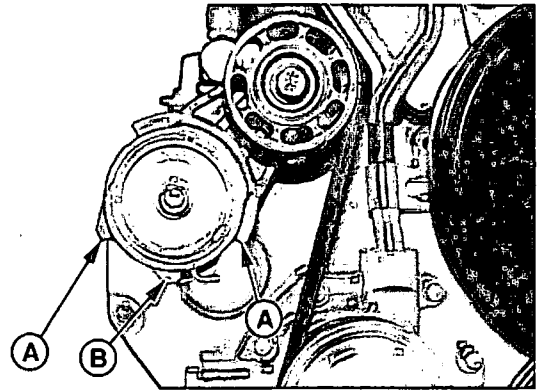
RG4687 -UN-20DEC88

Checking automatic belt tensioner (POWERTech ENGINES)

Belt drive systems equipped with automatic (spring) belt tensioners cannot be adjusted or repaired. The automatic belt tensioner is designed to maintain proper belt tension over the life of the belt. If tensioner spring tension is not within specification, replace tensioner assembly.

- **Checking belt wear**

The belt tensioner is designed to operate within the limit of arm movement provided by the cast stops (A and B) when correct belt length and geometry is used. If the tensioner stop on swing arm (A) is hitting the fixed stop (B), check mounting brackets (alternator, belt tensioner, idler pulley, etc.) and the belt length. Replace belt as needed (see REPLACING FAN AND ALTERNATOR BELTS).



RG8098 -UN-18NOV97

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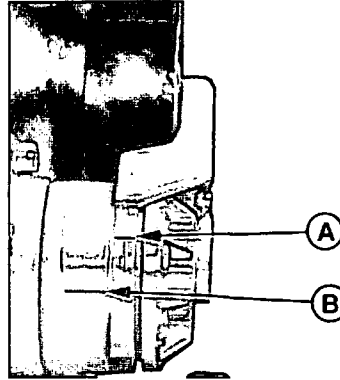
DPSG,CD03523,34 -19-20DEC02-1/2

Maintenance/1000 hours/1 year

• Checking tensioner spring tension

A belt tension gauge will not give an accurate measure of the belt tension when automatic spring tensioner is used. Measure tensioner spring tension using a torque wrench and procedure outlined below:

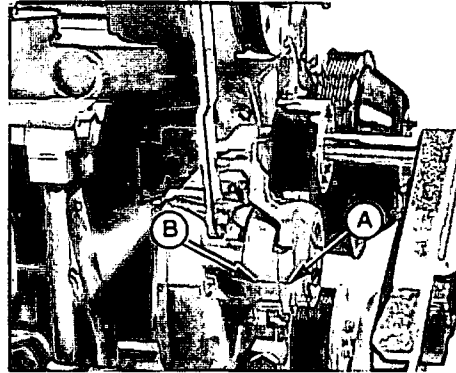
- Release tension on belt using a breaker bar and socket on tension arm. Remove belt from pulleys.
- Release tension on tension arm and remove breaker bar.
- Put a mark (A) on swing arm of tensioner as shown.
- Measure 21 mm (0.83 in.) from (A) and put a mark (B) on tensioner mounting base.



Marks on tensioner

NOTE: Threads on belt tensioner roller cap screw are **LEFT-HAND** threads.

- Install torque wrench on roller cap screw so that it is aligned with center of roller and tensioner as shown. Rotate the swing arm using a torque wrench until marks (A and B) are aligned.
- Record torque wrench measurement and compare with specification below. Replace tensioner assembly as required.



Align marks

Specification

Spring—Force..... 18—22 N•m (13—16 lb-ft)

RG7977 -UN-14NOV97

RG12054 -UN-08JAN02

DPSG,CD03523,34 -19-20DEC02-2/2

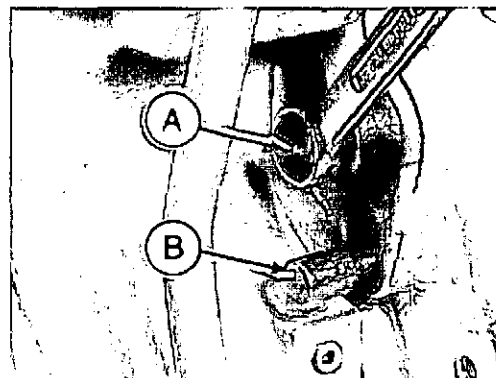
Maintenance/1000 hours/1 year

Check and adjust engine valve clearance (300-SERIES ENGINES)

NOTE: Valve clearance must be adjusted after the first 500 hours of operation, then every 1000 hours thereafter.

Adjust engine valve clearance as follows or have your authorized servicing dealer or engine distributor adjust the engine valve clearance.

1. Remove rocker arm cover and crankcase vent tube.
2. Using JDE83 or JDG820 Flywheel Turning Tool (A), rotate engine flywheel in running direction (clockwise viewed from water pump) until No.1 piston (front) has reached top dead center (TDC) on compression stroke. Insert timing pin JDE81-4 or JDG1571 (B) into flywheel bore.



CO30544 -UN-19MAY98

DPSG,CD03523.35 -19-20DEC02-1/4

3. Check and adjust valve clearance to specifications according to following procedures.

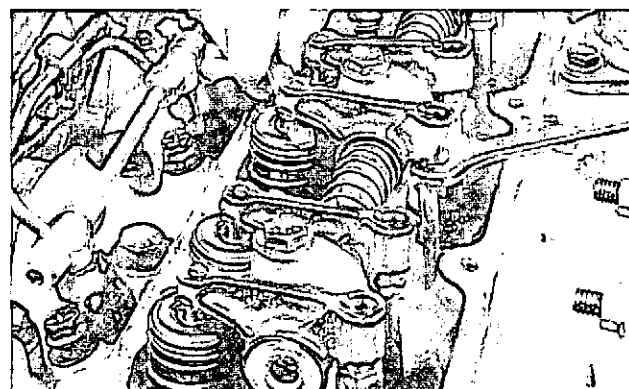
Specification

Valve clearance (engine cold)—

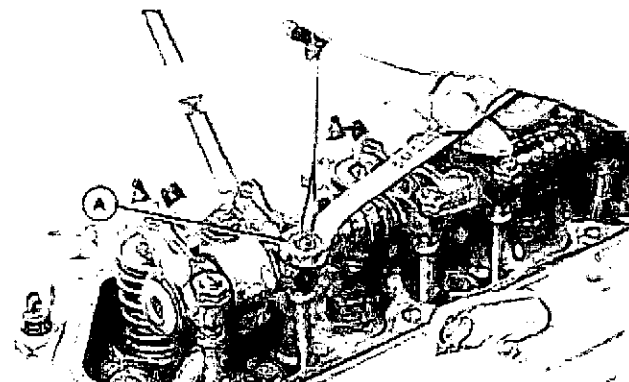
Intake.....	0.35 mm (0.014 in.)
Exhaust.....	0.45 mm (0.018 in.)

NOTE: If rocker arm is equipped with adjusting screw and jam nut (A), tighten jam nut to 27 N•m (20 lb-ft) after adjusting valve clearance.

4. Reinstall rocker arm cover and crankcase vent tube.



CO30545 -UN-19MAY98



RG6307 -UN-03AUG92

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DPSG,CD03523.35 -19-20DEC02-2/4

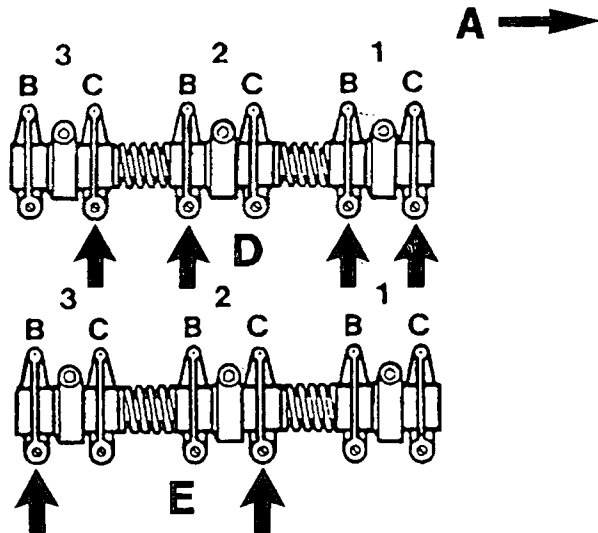
Maintenance/1000 hours/1 year

• 3-Cylinder Engine:

NOTE: Firing order is 1-2-3

- Lock No. 1 piston at TDC compression stroke (D).
- Adjust valve clearance on No. 1 and 2 exhaust valves and No.1 and 3 intake valves.
- Rotate flywheel 360°. Lock No. 1 piston at TDC exhaust stroke (E).
- Adjust valve clearance on No. 3 exhaust valve and No. 2 intake valve.

A—Front of engine
B—Exhaust valve
C—Intake valve
D—No.1 Piston at TDC compression stroke
E—No.1 Piston at TDC exhaust stroke



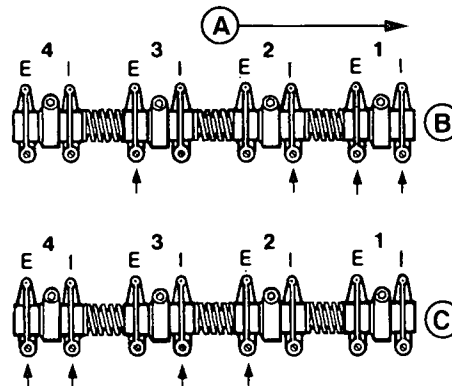
CD30549 -UN-16JUN98

DPSG,CD03523,35 -19-20DEC02-3/4

• 4-Cylinder Engine:

NOTE: Firing order is 1-3-4-2

- Lock No. 1 piston at TDC compression stroke (B).
- Adjust valve clearance on No. 1 and 3 exhaust valves and No.1 and 2 intake valves.
- Rotate flywheel 360°. Lock No. 4 piston at TDC compression stroke (C).
- Adjust valve clearance on No. 2 and 4 exhaust valves and No. 3 and 4 intake valves.

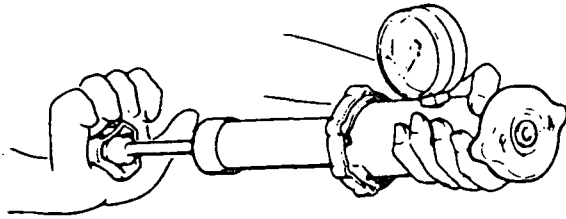


A—Front of engine
B—No.1 Piston at TDC compression stroke
C—No.4 Piston at TDC compression stroke
E—Exhaust valve
I—Intake valve

RG4776 -UN-31OCT97

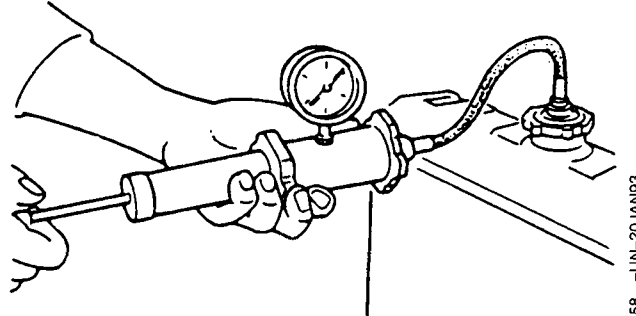
DPSG,CD03523,35 -19-20DEC02-4/4

Pressure testing cooling system



Test radiator cap

RG6557 -UN-20JAN93



Test cooling system

RG6558 -UN-20JAN93



CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engines. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

Test Radiator Cap

1. Remove radiator cap and attach to D05104ST tester as shown.
2. Pressurize cap to specification listed. Gauge should hold pressure for 10 seconds within the normal range if cap is acceptable.

If gauge does not hold pressure, replace radiator cap.

Specification

Radiator Cap Calibration—

Pressure..... 70 kPa (0.7 bar) (10psi) for 10 seconds minimum

3. Remove the cap from gauge, turn it 180°, and retest cap to confirm measurement.

Test Cooling System

NOTE: Engine should be warmed up to test overall cooling system.

1. Allow engines to cool, then carefully remove radiator cap.
2. Fill radiator with coolant to the normal operating level.

IMPORTANT: DO NOT apply excessive pressure to cooling system, doing so may damage radiator and hoses.

3. Connect gauge and adapter to radiator filler neck. Pressurize cooling system to specification listed for radiator cap.
4. With pressure applied, check all cooling system hose connections, radiator, and overall engine for leaks.

If leakage is detected, correct as necessary and pressure test system again.

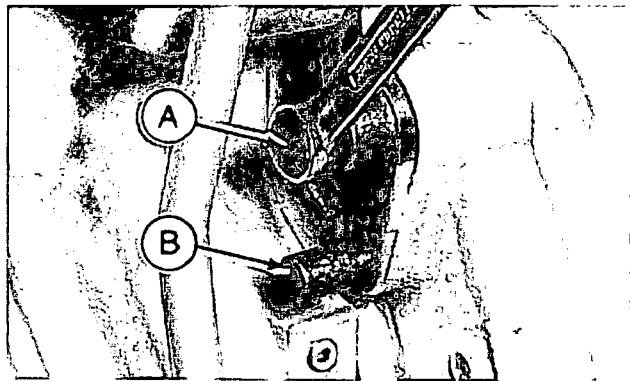
If no leakage is detected, but the gauge indicated a drop in pressure, coolant may be leaking internally within the system or at the block-to-head gasket. Have your engine distributor or servicing dealer correct this problem immediately.

Maintenance/2000 hours/2 years

Check and adjust engine valve clearance (POWERTech ENGINE)

Adjust engine valve clearance as follows or have your authorized servicing dealer or engine distributor adjust the engine valve clearance.

1. Remove rocker arm cover and crankcase vent tube.
2. Using JDE83 or JDG820 Flywheel Turning Tool (A), rotate engine flywheel in running direction (clockwise viewed from water pump) until No.1 piston (front) has reached top dead center (TDC) on compression stroke. Insert timing pin JDE81-4 (B) into flywheel bore.



CD30544 -UN-19MAY98

DPSG,CD03523,36 -19-13JUL99-1/4

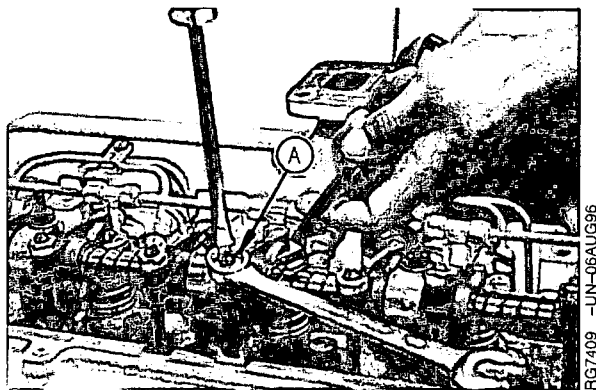
3. Check and adjust valve clearance to specifications according to following procedures.

Specification

Valve clearance (engine cold)—

Intake	0.35 mm (0.014 in.)
Exhaust.....	0.45 mm (0.018 in.)

4. If valves need adjusting, loosen the locknut on rocker arm adjusting screw. Turn adjusting screw until feeler gauge slips with a slight drag. Hold the adjusting screw from turning with screwdriver and tighten locknut to 27 N•m (20 lb-ft). Recheck clearance again after tightening locknut. Readjust clearance as necessary.
5. Reinstall rocker arm cover and crankcase vent tube.



RG/409 -UN-06AUG96

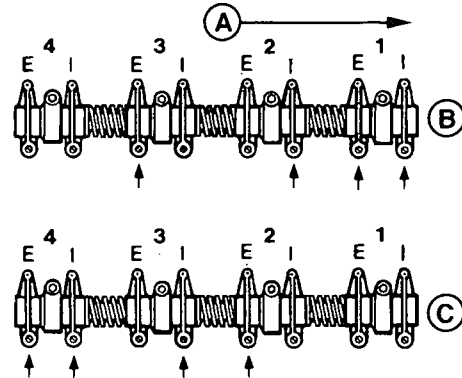
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DPSG,CD03523,36 -19-13JUL99-2/4

• 4-Cylinder Engine:

NOTE: Firing order is 1-3-4-2

- Lock No. 1 piston at TDC compression stroke (B).
- Adjust valve clearance on No. 1 and 3 exhaust valves and No. 1 and 2 intake valves.
- Rotate flywheel 360°. Lock No. 4 piston at TDC compression stroke (C).
- Adjust valve clearance on No. 2 and 4 exhaust valves and No. 3 and 4 intake valves.



A—Front of engine
 B—No.1 Piston at TDC compression stroke
 C—No.4 Piston at TDC compression stroke
 E—Exhaust valve
 I—Intake valve

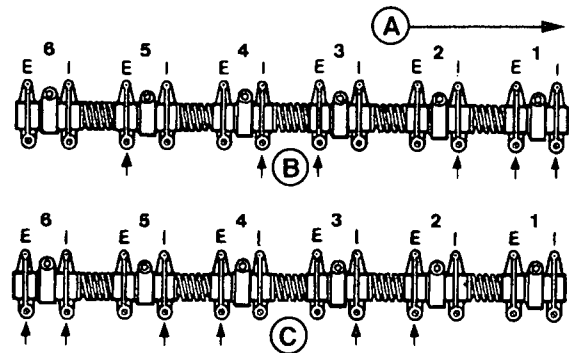
RG4776 -UN-31OCT97

DPSG,CD03523,36 -19-13JUL99-3/4

• 6-Cylinder Engine:

NOTE: Firing order is 1-5-3-6-2-4.

- Lock No. 1 piston at TDC compression stroke (B).
- Adjust valve clearance on No. 1, 3, and 5 exhaust valves and No. 1, 2, and 4 intake valves.
- Rotate flywheel 360°. Lock No. 6 piston at TDC compression stroke (C).
- Adjust valve clearance on No. 2, 4, and 6 exhaust valves and No. 3, 5, and 6 intake valves.



A—Front of engine
 B—No.1 Piston at TDC compression stroke
 C—No.6 Piston at TDC compression stroke
 E—Exhaust valve
 I—Intake valve

RG4777 -UN-31OCT97

DPSG,CD03523,36 -19-13JUL99-4/4

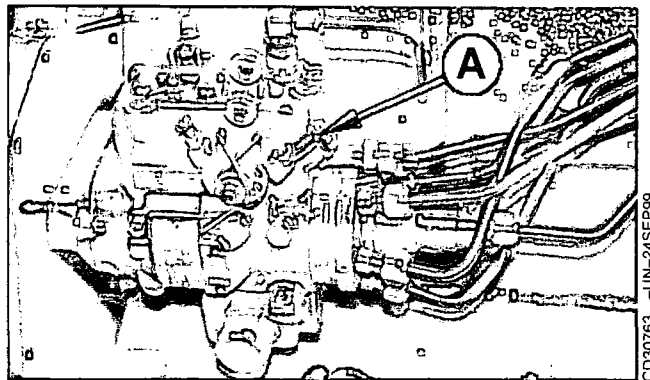
Checking engine speed

NOTE: Most engines for generator set application (1500 rpm for 50 Hz or 1800 rpm for 60 Hz) run only at fast idle and therefore they do not have slow idle.

Specification

Fast idle—50 Hz Generator set	1550—1580 rpm
60 Hz Generator set	1865—1890 rpm

NOTE: Fast idle is settled by the factory then the idle adjusting screw (A) is sealed to prevent from tampering. Fast idle adjustment can only be done by an authorized fuel system agent.



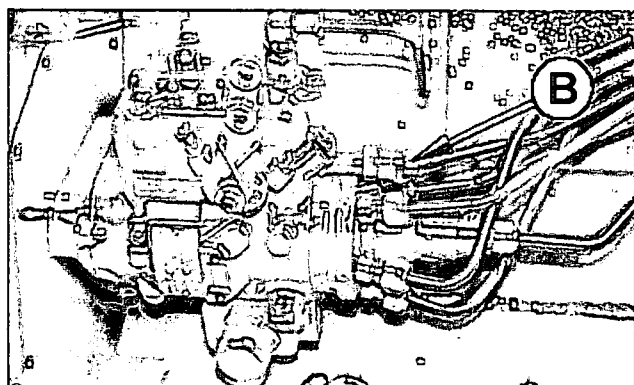
CD30763 -UN-24SEP99

DPSG,CD03523,38 -19-13JUL99-1/1

Adjust speed droop governor

1. Warm engine to normal operating temperature.
2. Run engine at fast idle.
3. Apply full load.
4. If specified power cannot be obtained, turn screw (B) to adjust droop until obtention of the requested power.

NOTE: If surging exits upon removing the load, turn screw (B) clockwise to eliminate.



CD30764 -UN-24SEP99

DPSG,CD03523,39 -19-13JUL99-1/1

Checking crankshaft vibration damper (6-CYLINDER ENGINE ONLY)

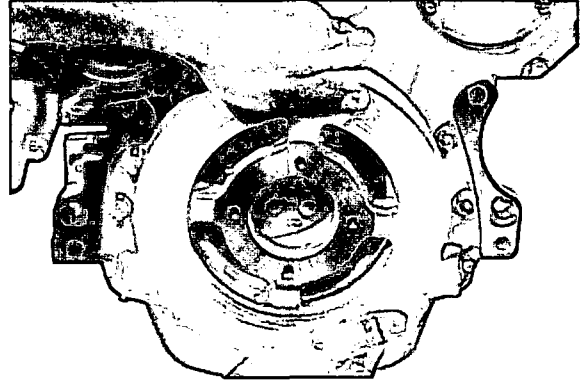
1. Remove belts (shown removed).
2. Grasp vibration damper with both hands and attempt to turn it in both directions. If rotation is felt, damper is defective and should be replaced.

IMPORTANT: The vibration damper assembly is not repairable and should be replaced every 4500 hours or 5 years, whichever occurs first.

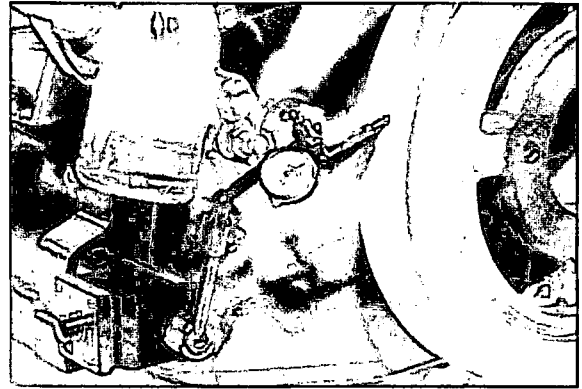
3. Check vibration damper radial runout by positioning a dial indicator so probe contacts damper outer diameter.
4. With engine at operating temperature, rotate crankshaft using JDG820 or JDE83 Flywheel Turning Tool.
5. Note dial indicator reading. If runout exceeds specifications given below, replace vibration damper.

Specification

Damper—Maximum radial runout 1.50 mm (0.060 in.)



RG8018 -UN-15JAN99



RG7508 -UN-23NOV97

DPSG,CD03523,40 -19-13JUL99-1/1

Maintenance/2500 hours/3 years

Drain and flush cooling system

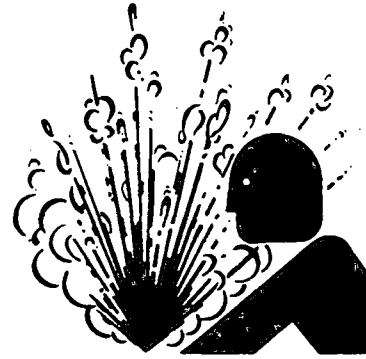
NOTE: Drain and flush cooling system every 2500 hours/3 years when John Deere COOL-GARD coolant is used. Otherwise every 2000 hours/2 years



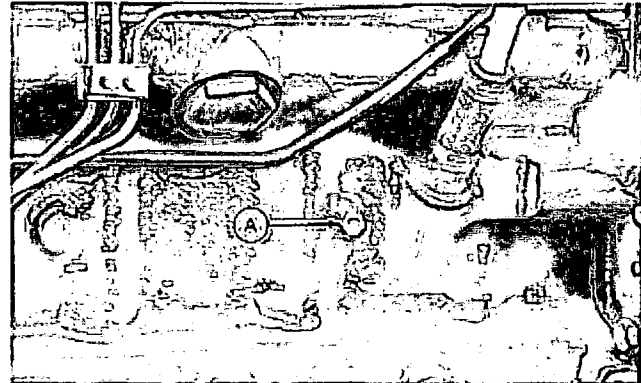
CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

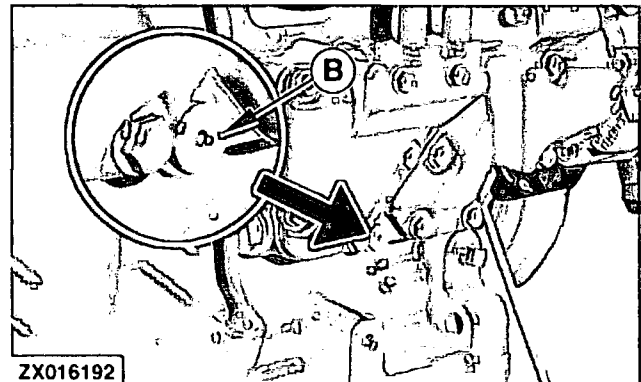
1. Slowly open the radiator cap.
2. Remove engine block drain plug (A).
3. On POWERTech engines, remove oil cooler housing drain plug (B).
4. Open radiator drain valve (C). Drain all coolant from radiator.
5. Close all drain orifices after coolant has drained.
6. Fill the cooling system with clean water. Run engine until water passes through the thermostat to stir up possible rust or sediment.
7. Stop engine and immediately drain the water from system before rust and sediment settle.
8. After draining water, close all drain orifices and fill the cooling system with cleaning product such as PMCC2610 or PMCC2638 Cooling System Cleaners available from your John Deere Dealer. Follow manufacturer's directions on label.
9. After cleaning the cooling system, drain cleaner and fill with water to flush the system. Run engine until water passes through the thermostat, then drain out flushing water.



TS281 -UN-23AUG88

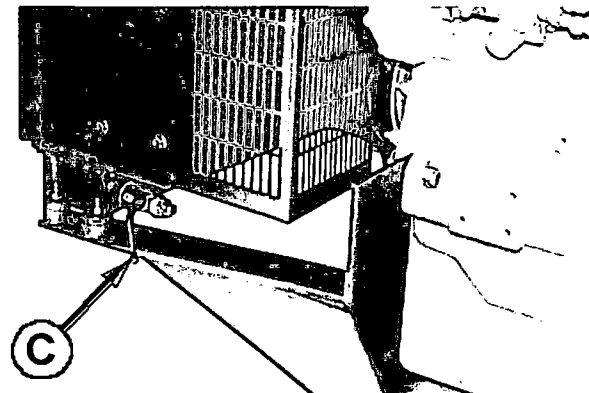


RG4894 -UN-14DEC88



ZX016192

ZX016192 -UN-11JAN99



CD30765 -UN-27AUG99

Continued on next page

DPSG,CD03523,41 -19-02JAN03-1/3

Maintenance/2500 hours/3 years

10. Check cooling system hoses for proper condition.
Replace as necessary.
11. Close all drain orifices and fill the cooling system with specified coolant (see DIESEL ENGINE COOLANT).

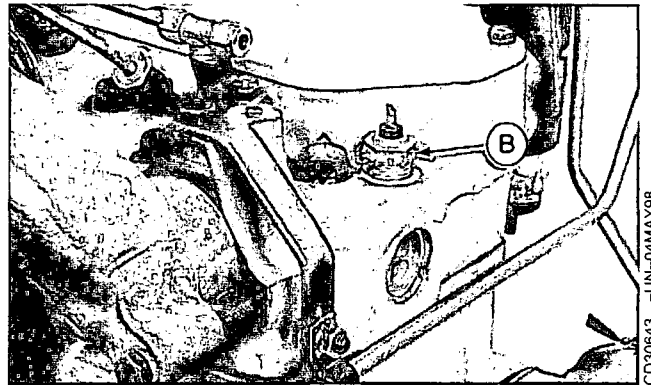
Specification

Cooling system capacity—

CD3029DF128.....	14.5 L (15.5 qt)
CD3029TF158.....	14.5 L (15.5 qt)
CD4039DF008.....	16.5 L (17.5 qt)
CD4039TF008.....	16.5 L (17.5 qt)
CD4045DF158.....	20 L (21 qt)
CD4045HF158.....	28 L (29.5 qt)
CD4045TF158.....	25 L (26.5 qt)
CD4045TF258.....	25 L (26.5 qt)
CD6068HF158.....	32 L (34 qt)
CD6068HF258.....	32 L (34 qt)
CD6068TF158.....	28 L (29.5 qt)
CD6068TF258.....	28 L (29.5 qt)

DPSG,CD03523,41 -19-02JAN03-2/3

12. When refilling cooling system, loosen temperature sensor (B) or plug at the rear of cylinder head to allow air to escape.
13. Run engine until it reaches operating temperature then check coolant level and entire cooling system for leaks.



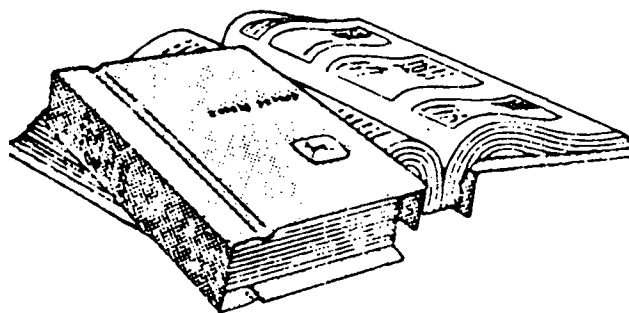
DPSG,CD03523,41 -19-02JAN03-3/3

Maintenance/As required

Additional service information

This manual does not allow a complete repair of your engine. If you want more detailed service information the following publications are available from your regular parts channel.

- PC2451 — Parts Catalog
- CTM3274 — Component Technical Manual for 300-Series engines (English)
- CTM104 — Component Technical Manual for POWERTech base engines (English)
- CTM207 — Component Technical Manual for Mechanical Fuel Systems on POWERTech engines (English)
- CTM67 — Component Technical Manual for OEM Engine accessories (English only)
- CTM77 — Component Technical Manual for Alternators and Starter Motors (English only)



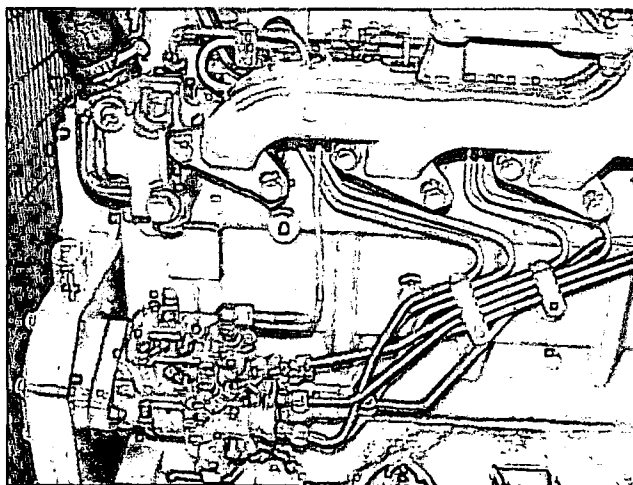
RG4624 -UN-15DEC88

DPSG,CD03523,42 -19-02JAN03-1/1

Do not modify fuel system

IMPORTANT: Modification or alteration of the injection pump, the injection pump timing, or the fuel injectors in ways not recommended by the manufacturer will terminate the warranty obligation to the purchaser.

Do not attempt to service injection pump or fuel injectors yourself. Special training and special tools are required. (See your authorized servicing dealer or engine distributor.)



CD30768 -UN-24SEP99

DPSG,CD03523,43 -19-15JUL99-1/1

Maintenance/As required

Clean or replace air filter (one-piece)

Clean air filter when restriction indicator (A) is red. Air filter can be cleaned up to six times. Thereafter, or at least once a year, it must be replaced.

Proceed as follows:

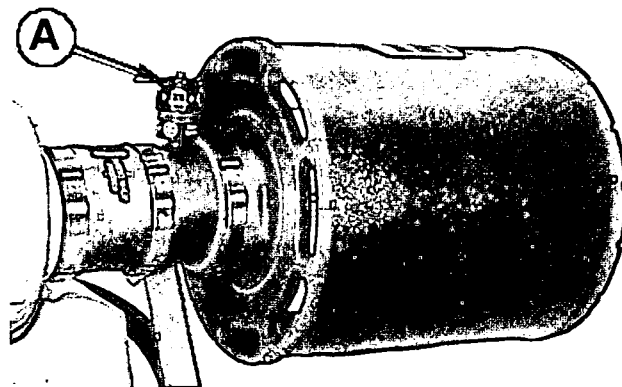
1. Thoroughly clean all dirt around air filter area.
2. Loosen clamp (B) then remove air filter.

IMPORTANT: Never reinstall an air filter which shows evidence of bad condition (punched, dented...) allowing no filtered air to enter the engine.

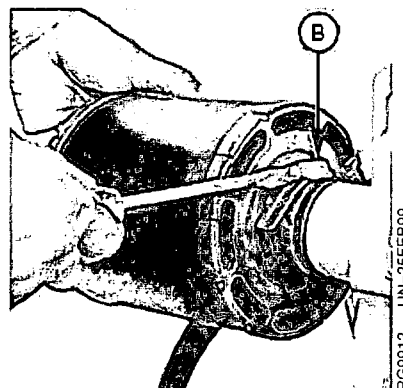
3. Clean air filter with compressed air working from "clean" to "dirty" side.

NOTE: Compressed air must not exceed 6 bar.

4. Mark air filter to keep track of each cleaning operation.
5. Fully depress air restriction indicator reset button and release to reset indicator.
6. Check air system entirely for proper condition (see CHECKING AIR INTAKE SYSTEM).



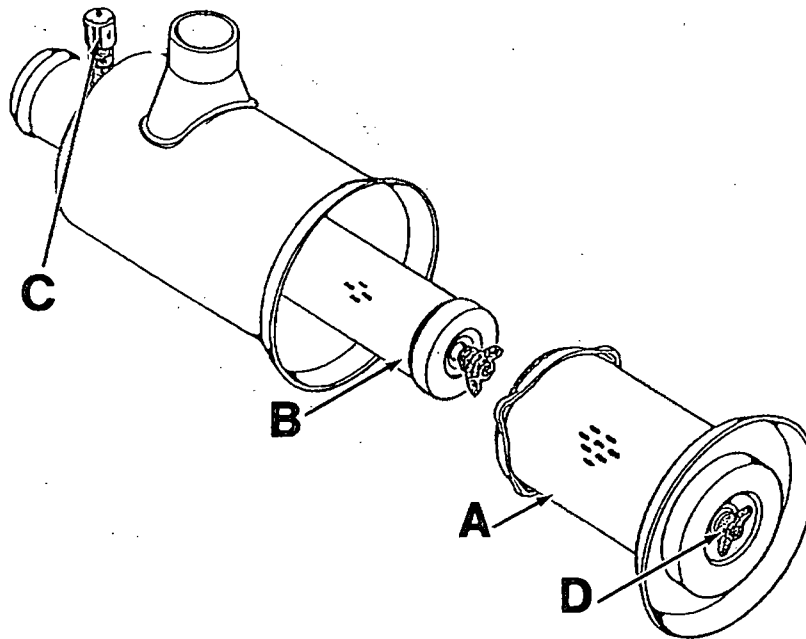
CD30766 -UN-06SEP99



RG9912 -UN-25FEB99

DP5G,CD03523,44 -19-15JUL99-1/1

Maintenance/As required

Clean or replace air filter element

CD30772 -UN-27AUG99

A—Primary element

B—Secondary (safety) element

C—Air restriction indicator

D—Wing nut

Clean air filter when restriction indicator (C) is red. Replace both primary (A) and secondary (B) filter elements every 6 primary element cleaning or at least once a year.

IMPORTANT: If primary element shows evidence of bad condition (punched, dented...), replace both the primary and the secondary elements.

Proceed as follows:

1. Thoroughly clean all dirt around air filter area.
2. Remove wing nut (D) and remove primary element (A) from canister.

IMPORTANT: Do not attempt to clean the secondary (safety) element (B). It must be only replaced as recommended.

3. Thoroughly clean all dirt from inside canister.

4. Clean primary element with compressed air working from "clean" to "dirty" side.

NOTE: Compressed air must not exceed 6 bar.

5. Mark air filter to keep track of each cleaning operation.
6. Fully depress air restriction indicator reset button and release to reset indicator.
7. Check air system entirely for proper condition (see CHECKING AIR INTAKE SYSTEM).

DPSG,CD03523,58 -19-16AUG99-1/1

Maintenance/As required

Replacing fan and alternator belt (POWERtech ENGINES)

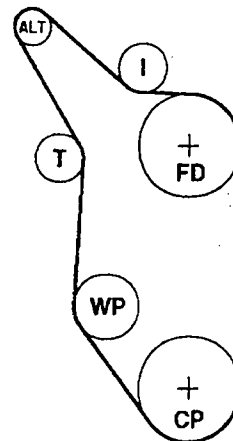
NOTE: Refer to *CHECKING BELT TENSIONER SPRING TENSION AND BELT WEAR* for additional information on the belt tensioner.

1. Inspect belts for cracks, fraying, or stretched out areas. Replace if necessary.
2. On engine with automatic belt tensioner, release tension on belt using a breaker bar and socket on tension arm.

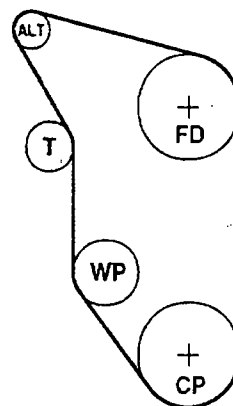
On engine with manual tensioner, loosen cap screws holding the alternator.

3. Remove poly-vee belt from pulleys and discard belt.
4. Install new belt, making sure belt is correctly seated in all pulley grooves. Refer to belt routing at right for your application.
5. Apply tension to belt (See *CHECKING BELT*).
6. Start engine and check belt alignment.

ALT—Alternator
CP—Crank Pulley
FD—Fan Drive
I—Idler Pulley
T—Tensioner
WP—Water Pump



Installation on 4 cyl. engines



Installation on 6 cyl. engines

CD30769 -JUN-01SEP99

CD30770 -JUN-01SEP99

DPSG,CD03523,45 -19-15JUL99-1/1

*Maintenance/As required***Checking fuel filter**

Periodically the fuel filter should be checked for water or debris.

IMPORTANT: Drain water into a suitable container and dispose of properly.

1. Loosen drain plug (B) at bottom of fuel filter two or three turns.
2. Loosen air bleed plug two full turns (A) on fuel filter base and drain water from bottom until fuel starts to drain out.
3. When fuel starts to drain out, tighten drain plug securely.
4. After draining water from the fuel filter, the filter must be primed by bleeding all air from the fuel system. Operate primer lever of the fuel supply pump (C) until fuel flow is free from air bubbles.
5. Tighten bleed plug securely, continue operating hand primer until pumping action is not felt. Push hand primer inward (toward engine) as far as it will go.

If the fuel system needs further bleeding of air, see BLEED FUEL SYSTEM.

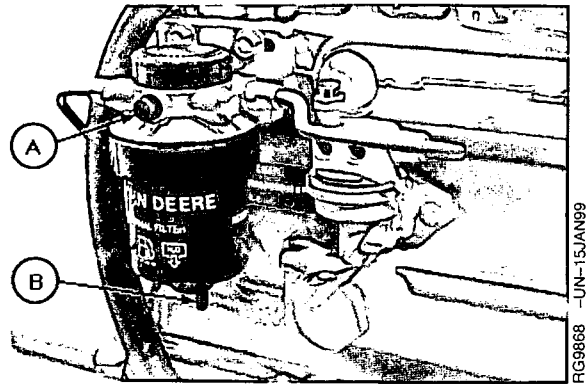


FIG9868 -UN-15/JAN99

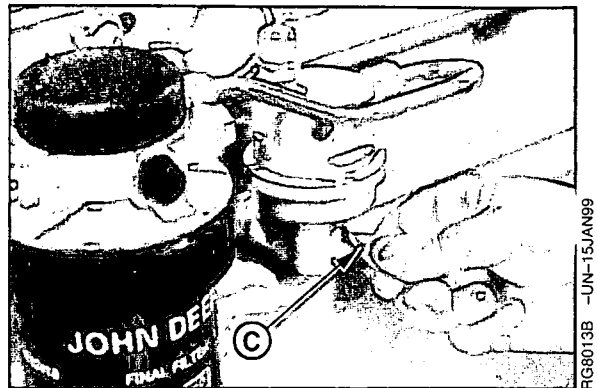


FIG8013B -UN-15/JAN99

DPSG,CD03523,28 -19-12JUL99-1/1

Maintenance/As required

Bleeding the fuel system

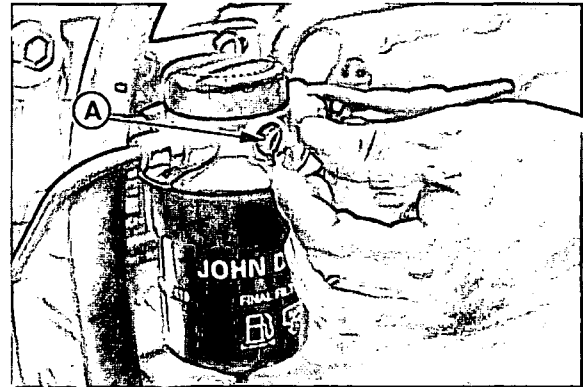
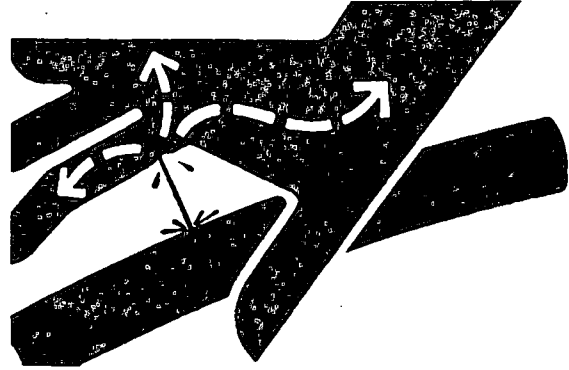
CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

Whenever the fuel system has been opened up for service (lines disconnected or filters removed), it will be necessary to bleed air from the system.

1. Loosen the air bleed vent screw (A) two full turns by hand on fuel filter base.
2. Operate supply pump primer lever (B) until fuel flow is free from air bubbles.
3. Tighten bleed plug securely, continue operating hand primer until pumping action is not felt. Push hand primer inward (toward engine) as far as it will go.
4. Start engine and check for leaks.

If engine will not start, it may be necessary to bleed air from fuel system at fuel injection pump or injection nozzles as explained next.



X9811 -UN-23AUG88

RG7947 -UN-13NOV97

RG8013A -UN-15JAN99

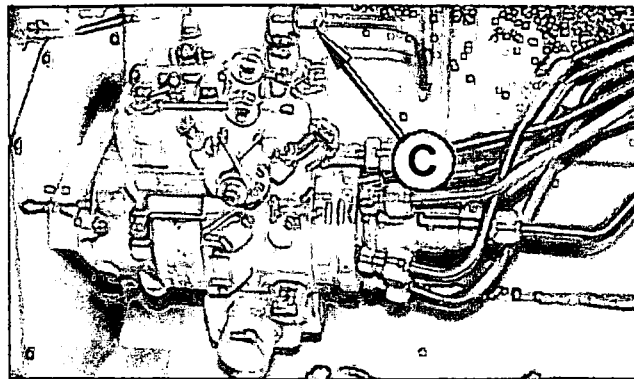
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DPSG.CD03523.46 -19-10AUG99-1/2

Maintenance/As required

- **At Fuel Injection Pump:**

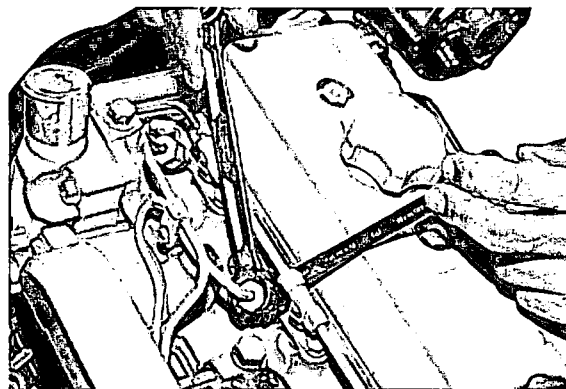
- Slightly loosen fuel return line connector (C) at fuel injection pump.
- Operate fuel supply pump primer lever until fuel, without air bubbles, flows from fuel return line connection.
- Tighten return line connector to 16 N•m (12 lb-ft).
- Leave hand primer in the inward position toward cylinder block.



CD30771 -UN-24SEP99

- **At Fuel Injection Nozzles:**

- Using two open-end wrenches, loosen fuel line connection at injection nozzle.
- Crank engine over with starting motor, (but do not start engine), until fuel free from bubbles flows out of loosened connection. Retighten connection to 27 N•m (20 lb-ft).
- Repeat procedure for remaining injection nozzles (if necessary) until all air has been removed from fuel system.



RG7725 -UN-08JAN97

If engine still will not start, see your authorized servicing dealer or engine distributor.

DPSG,CD03523,46 -19-10AUG99-2/2

Troubleshooting

Engine troubleshooting

Symptom	Problem	Solution
Engine cranks but will not start	Incorrect starting procedure.	Verify correct starting procedure.
	No fuel.	Check fuel in tank and manual shut-off valve.
	Exhaust restricted.	Check and correct exhaust restriction.
	Fuel filter plugged or full of water.	Replace fuel filter or drain water from filter.
	Injection pump not getting fuel or air in fuel system.	Check fuel flow at supply pump or bleed fuel system.
	Faulty injection pump or nozzles.	Consult authorized diesel repair station for repair or replacement.
Engine hard to start or will not start	Engine starting under load.	Remove load.
	Improper starting procedure.	Review starting procedure.
	No fuel.	Check fuel tank.
	Air in fuel line.	Bleed fuel line.
	Cold weather.	Use cold weather starting aids.
	Slow starter speed.	See "Starter Cranks Slowly".
	Crankcase oil too heavy.	Use oil of proper viscosity.
	Improper type of fuel.	Consult fuel supplier; use proper type fuel for operating conditions.
	Water, dirt, or air in fuel system.	Drain, flush, fill, and bleed system.
	Clogged fuel filter.	Replace filter element.
	Dirty or faulty injection nozzles.	Have authorized servicing dealer or engine distributor check injectors.
	Injection pump shut-off not reset.	Turn key switch to "OFF" then to "ON".

Continued on next page

DPSG,CD03523,49 -19-10AUG99-1/5

Troubleshooting

Symptom	Problem	Solution
Engine knocks	Low engine oil level.	Add oil to engine crankcase.
	Injection pump out of time.	See your authorized servicing dealer or engine distributor.
	Low coolant temperature.	Remove and check thermostat.
	Engine overheating.	See "Engine Overheats".
Engine runs irregularly or stalls frequently	Low coolant temperature.	Remove and check thermostat.
	Clogged fuel filter.	Replace fuel filter element.
	Water, dirt, or air in fuel system.	Drain, flush, fill, and bleed system.
	Dirty or faulty injection nozzles.	Have authorized servicing dealer or engine distributor check injectors.
Below normal engine temperature	Defective thermostat.	Remove and check thermostat.
	Defective temperature gauge or sender.	Check gauge, sender, and connections.

Continued on next page

DPSG,CD03523,49 -19-10AUG99-2/5

Troubleshooting

Symptom	Problem	Solution
Lack of power	Engine overloaded.	Reduce load.
	Intake air restriction.	Service air cleaner.
	Clogged fuel filter.	Replace filter elements.
	Improper type of fuel.	Use proper fuel.
	Overheated engine.	See "Engine Overheats".
	Below normal engine temperature.	Remove and check thermostat.
	Improper valve clearance.	See your authorized servicing dealer or engine distributor.
	Dirty or faulty injection nozzles.	Have authorized servicing dealer or engine distributor check injectors.
	Injection pump out of time.	See your authorized servicing dealer or engine distributor.
	Turbocharger not functioning.	See your authorized servicing dealer or engine distributor.
	Leaking exhaust manifold gasket.	See your authorized servicing dealer or engine distributor.
	Defective aneroid control line.	See your authorized servicing dealer or engine distributor.
	Restricted fuel hose.	Clean or replace fuel hose.
	Low fast idle speed.	See your authorized servicing dealer or engine distributor.
Low oil pressure	Low oil level.	Add oil.
	Improper type of oil.	Drain, fill crankcase with oil of proper viscosity and quality.

Continued on next page

DPSG,CD03523,49 -19-10AUG99-3/5

Troubleshooting

Symptom	Problem	Solution
High oil consumption	Crankcase oil too light.	Use proper viscosity oil.
	Oil leaks.	Check for leaks in lines, gaskets, and drain plug.
	Restricted crankcase vent tube.	Clean vent tube.
	Defective turbocharger.	See your authorized servicing dealer or engine distributor.
Engine emits white smoke	Improper type of fuel.	Use proper fuel.
	Low engine temperature.	Warm up engine to normal operating temperature.
	Defective thermostat.	Remove and check thermostat.
	Defective injection nozzles.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
Engine emits black or gray exhaust smoke	Improper type of fuel.	Use proper fuel.
	Clogged or dirty air cleaner.	Service air cleaner.
	Engine overloaded.	Reduce load.
	Injection nozzles dirty.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
	Turbocharger not functioning.	See your authorized servicing dealer or engine distributor.

Continued on next page

DPSG,CD03523,49 -19-10AUG99-4/5

Troubleshooting

Symptom	Problem	Solution
Engine overheats	Engine overloaded.	Reduce load.
	Low coolant level.	Fill radiator to proper level, check radiator and hoses for loose connections or leaks.
	Faulty radiator cap.	Have serviceman check.
	Stretched poly-vee belt or defective belt tensioner.	Check automatic belt tensioner and check belts for stretching. Replace as required.
	Low engine oil level.	Check oil level. Add oil as required.
	Cooling system needs flushing.	Flush cooling system.
	Defective thermostat.	Remove and check thermostat.
	Defective temperature gauge or sender.	Check water temperature with thermometer and replace, if necessary.
	Incorrect grade of fuel.	Use correct grade of fuel.
	Improper type of fuel.	Use proper type of fuel.
High fuel consumption	Clogged or dirty air cleaner.	Service air cleaner.
	Engine overloaded.	Reduce load.
	Improper valve clearance.	See your authorized servicing dealer or engine distributor.
	Injection nozzles dirty.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
	Defective turbocharger.	See your authorized servicing dealer or engine distributor.
	Low engine temperature.	Check thermostat.

Troubleshooting

Electrical troubleshooting

Symptom	Problem	Solution
Undercharged system	Excessive electrical load from added accessories.	Remove accessories or install higher output alternator.
	Excessive engine idling.	Increase engine rpm when heavy electrical load is used.
	Poor electrical connections on battery, ground strap, starter, or alternator.	Inspect and clean as necessary.
	Defective battery.	Test battery.
	Defective alternator.	Test charging system.
Battery uses too much water	Cracked battery case.	Check for moisture and replace as necessary.
	Defective battery.	Test battery.
	Battery charging rate too high.	Test charging system.
Batteries will not charge	Loose or corroded connections.	Clean and tighten connections.
	Sulfated or worn-out batteries.	See your authorized servicing dealer or engine distributor.
	Stretched poly-vee belt or defective belt tensioner.	Adjust belt tension or replace belts.
Starter will not crank	Engine under load	Remove load
	Loose or corroded connections.	Clean and tighten loose connections.
	Low battery output voltage.	See your authorized servicing dealer or engine distributor.
	Faulty start circuit relay.	See your authorized servicing dealer or engine distributor.
	Blown fuse.	Replace fuse.

Continued on next page

DPSG,CD03523,50 -19-10AUG99-1/2

Troubleshooting

Symptom	Problem	Solution
Starter cranks slowly	Low battery output.	See your authorized servicing dealer or engine distributor.
	Crankcase oil too heavy.	Use proper viscosity oil.
	Loose or corroded connections.	Clean and tighten loose connections.
Entire electrical system	Faulty battery connection.	Clean and tighten connections.
	Sulfated or worn-out batteries.	See your authorized servicing dealer or engine distributor.
	Blown fuse.	Replace fuse.

DPSG,CD03523,50 -19-10AUG99-2/2

Storage

Engine storage guidelines

1. John Deere engines can be stored outside for up to three (3) months with no long term preparation IF COVERED BY WATERPROOF COVERING.
2. John Deere engines can be stored in a standard overseas shipping container for up to three (3) months with no long term preparation.
3. John Deere engines can be stored inside, warehoused, for up to six (6) months with no long term preparation.
4. John Deere engines expected to be stored more than six (6) months, long term storage preparation MUST BE taken. (See PREPARING ENGINE FOR LONG TERM STORAGE).

DPSG,CD03523,51 -19-02JAN03-1/1

Preparing engine for long term storage

The following storage preparations are good for long term engine storage up to one year. After that, the engine should be started, warmed up, and retreated for an extended storage period.

IMPORTANT: Any time your engine will not be used for over six (6) months, the following recommendations for storing it and removing it from storage will help to minimize corrosion and deterioration.

1. Change engine oil and replace filter. Used oil will not give adequate protection. (See CHANGING ENGINE OIL AND FILTER).
2. Service air cleaner. (See CLEAN OR REPLACE AIR FILTER).
3. Draining and flushing of cooling system is not necessary if engine is to be stored only for several months. However, for extended storage periods of a year or longer, it is recommended that the cooling system be drained, flushed, and refilled. Refill with appropriate coolant. (See DIESEL ENGINE COOLANT).
4. Fill the fuel tank.
5. Remove fan/alternator belt, if desired.
6. Remove and clean batteries. Store them in a cool, dry place and keep them fully charged.
7. Clean the exterior of the engine with salt-free water and touchup any scratched or chipped painted surfaces with a good quality paint.
8. Coat all exposed (machined) metal surfaces with grease or corrosion inhibitor if not feasible to paint.
9. Seal all openings on engine with plastic bags and tape.
10. Store the engine in a dry protected place. If engine must be stored outside, cover it with a waterproof canvas or other suitable protective material and use a strong waterproof tape.

DPSG,CD03523,53 -19-02JAN03-1/1

Storage

Removing engine from long term storage

Refer to the appropriate section for detailed services listed below or have your authorized servicing dealer or engine distributor perform services that you may not be familiar with.

1. Remove all protective coverings from engine. Unseal all openings in engine and remove covering from electrical systems.
2. Remove the batteries from storage. Install batteries (fully charged) and connect the terminals.
3. Install fan/alternator belt if removed.
4. Check for filled fuel tank.
5. Perform all appropriate prestarting checks. (See DAILY PRESTARTING CHECKS).
6. Crank engine for 20 seconds with starter (do not allow the engine to start). Wait 2 minutes and crank engine an additional 20 seconds to assure bearing surfaces are adequately lubricated.
7. Start engine and run at no load for several minutes. Warm up carefully and check all gauges before placing engine under load.
8. On the first day of operation after storage, check overall engine for leaks and check all gauges for correct operation.

IMPORTANT: DO NOT operate starter more than 30 seconds at a time. Wait at least 2 minutes for starter to cool before trying again.

DPSG,C:D03523,54 -19-02JAN03-1/1

Specifications

General engine specifications

ITEM	UNIT OF MEASURE	3029DF128	3029TF158	4039DF008	4039TF008
Number of Cylinders		3	3	4	4
Fuel		Diesel	Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5	106.5
Stroke	mm	110	110	110	110
Displacement	L	2.9	2.9	3.9	3.9
Compression Ratio		17.8:1	17.8:1	17.8:1	17.8:1
POWER ^a @ 1500 rpm (Prime)	kW (hp)	26 (35)	36 (49)	35 (48)	55 (75)
POWER ^a @ 1500 rpm (Standby)	kW (hp)	30 (41)	40 (54)	38 (52)	61 (83)
POWER ^a @ 1800 rpm (Prime)	kW (hp)	30 (41)	40 (54)	41 (56)	67 (91)
POWER ^a @ 1800 rpm (Standby)	kW (hp)	34 (46)	45 (61)	47 (64)	73 (99)
Width (overall)	mm	582	582	588	588
Length (overall)	mm	888	888	1016	1016
Height (overall)	mm	931	979	960	979
Weight (dry) ^b	kg	345	350	475	487
Engine oil quantity	L	6	8	12	12
Engine coolant quantity	L	14.5	14.5	16.5	16.5

^aWith Fan^bApproximate

Continued on next page

DPSG,CD03523,55 -19-02JAN03-1/3

Specifications

ITEM	UNIT OF MEASURE	4045DF158	4045HF158	4045TF158	4045TF258
Number of Cylinders		4	4	4	4
Fuel		Diesel	Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5	106.5
Stroke	mm	127	127	127	127
Displacement	L	4.5	4.5	4.5	4.5
Compression Ratio		17.6:1	17.0:1	17.0:1	17.0:1
POWER ^a @ 1500 rpm (Prime)	kW (hp)	41 (56)	88 (120)	61 (83)	72 (98)
POWER ^a @ 1500 rpm (Standby)	kW (hp)	42 (57)	96 (131)	68 (92)	80 (109)
POWER ^a @ 1800 rpm (Prime)	kW (hp)	48 (65)	108 (147)	72 (98)	80 (109)
POWER ^a @ 1800 rpm (Standby)	kW (hp)	51 (69)	120 (163)	79 (107)	88 (120)
Width (overall)	mm	606	798	606	652
Length (overall)	mm	1038	1209	1191	1225
Height (overall)	mm	959	1197	1027	1027
Weight (dry) ^b	kg	493	599	505	520
Engine oil quantity	L	8	12	12	12
Engine coolant quantity	L	20	28	25	25
^a With Fan ^b Approximate					
Continued on next page				DPSG,CD03523,55 -19-02JAN03-2/3	

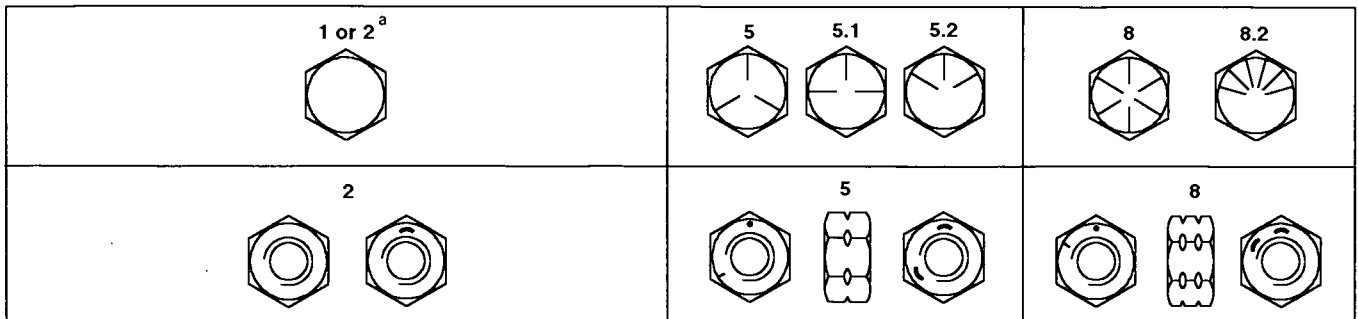
Specifications

ITEM	UNIT OF MEASURE	6068HF158	6068HF258	6068TF158	6068TF258
Number of Cylinders		6	6	6	6
Fuel		Diesel	Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5	106.5
Stroke	mm	127	127	127	127
Displacement	L	6.8	6.8	6.8	6.8
Compression Ratio		17.0:1	17.0:1	17.0:1	17.0:1
POWER ^a @ 1500 rpm (Prime)	kW (hp)	134 (182)	160 (218)	92 (125)	105 (143)
POWER ^a @ 1500 rpm (Standby)	kW (hp)	148 (201)	177 (241)	101 (137)	116 (158)
POWER ^a @ 1800 rpm (Prime)	kW (hp)	164 (223)	179 (243)	108 (147)	124 (169)
POWER ^a @ 1800 rpm (Standby)	kW (hp)	187 (254)	200 (272)	119 (162)	137 (186)
Width (overall)	mm	798	798	652	652
Length (overall)	mm	1500	1500	1364	1364
Height (overall)	mm	1136	1204	1070	1070
Weight (dry) ^b	kg	705	764	651	651
Engine oil quantity	L	20	32	20	20
Engine coolant quantity	L	32	32	28	28
^a With Fan					
^b Approximate					

DPSG,CD03523,55 -19-02JAN03-3/3

Specifications

Unified Inch Bolt and Cap Screw Torque Values



Top, SAE Grade and Head Markings; Bottom, SAE Grade and Nut Markings

Size	Grade 1 (No Mark)		Grade 2 ^a (No Mark)		Grade 5, 5.1 or 5.2		Grade 8 or 8.2	
	Lubricated ^b N•m(lb-ft)	Dry ^c N•m(lb-ft)	Lubricated ^b N•m(lb-ft)	Dry ^c N•m(lb-ft)	Lubricated ^b N•m(lb-ft)	Dry ^c N•m(lb-ft)	Lubricated ^b N•m(lb-ft)	Dry ^c N•m(lb-ft)
1/4	3.8 (2.8)	4.7 (3.5)	6 (4.4)	7.5 (5.5)	9.5 (7)	12 (9)	13.5 (10)	17 (12.5)
5/16	7.7 (5.7)	9.8 (7.2)	12 (9)	15.5 (11.5)	19.5 (14.5)	25 (18.5)	28 (20.5)	35 (26)
3/8	13.5 (10)	17.5 (13)	22 (16)	27.5 (20)	35 (26)	44 (32.5)	49 (36)	63 (46)
7/16	22 (16)	28 (20.5)	35 (26)	44 (32.5)	56 (41)	70 (52)	80 (59)	100 (74)
1/2	34 (25)	42 (31)	53 (39)	67 (49)	85 (63)	110 (80)	120 (88)	155 (115)
9/16	48 (35.5)	60 (45)	76 (56)	95 (70)	125 (92)	155 (115)	175 (130)	220 (165)
5/8	67 (49)	85 (63)	105 (77)	135 (100)	170 (125)	215 (160)	240 (175)	305 (225)
3/4	120 (88)	150 (110)	190 (140)	240 (175)	300 (220)	380 (280)	425 (315)	540 (400)
7/8	190 (140)	240 (175)	190 (140)	240 (175)	490 (360)	615 (455)	690 (510)	870 (640)
1	285 (210)	360 (265)	285 (210)	360 (265)	730 (540)	920 (680)	1030 (760)	1300 (960)
1-1/8	400 (300)	510 (375)	400 (300)	510 (375)	910 (670)	1150 (850)	1450 (1075)	1850 (1350)
1-1/4	570 (420)	725 (535)	570 (420)	725 (535)	1280 (945)	1630 (1200)	2050 (1500)	2600 (1920)
1-3/8	750 (550)	950 (700)	750 (550)	950 (700)	1700 (1250)	2140 (1580)	2700 (2000)	3400 (2500)
1-1/2	990 (730)	1250 (930)	990 (730)	1250 (930)	2250 (1650)	2850 (2100)	3600 (2650)	4550 (3350)

^a Grade 2 applies for hex cap screws (not hex bolts) up to 6 in. (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.

^b "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.

^c "Dry" means plain or zinc plated without any lubrication.

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

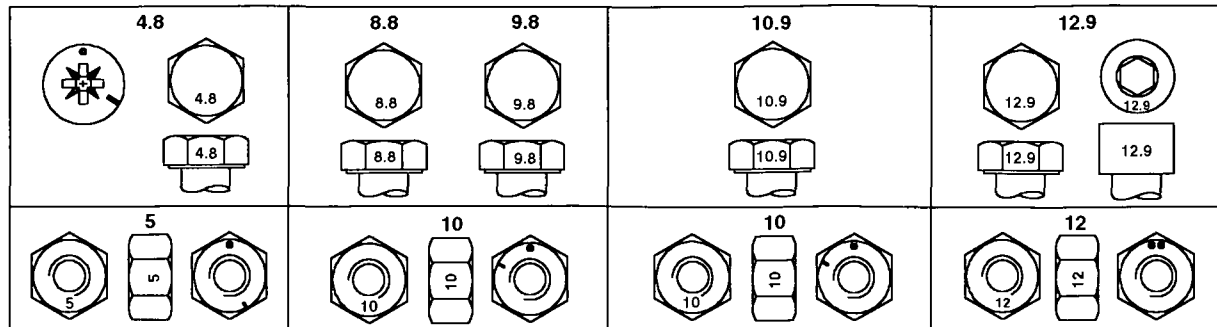
Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

TORQ1A - UN-27SEP99

Specifications

Metric Bolt and Cap Screw Torque Values



Top, Property Class and Head Markings; Bottom, Property Class and Nut Markings

	Class 4.8		Class 8.8 or 9.8		Class 10.9		Class 12.9	
Size	Lubricated ^a N•m(lb-ft)	Dry ^b N•m(lb-ft)	Lubricated ^a N•m(lb-ft)	Dry ^b N•m(lb-ft)	Lubricated ^a N•m(lb-ft)	Dry ^b N•m(lb-ft)	Lubricated ^a N•m(lb-ft)	Dry ^b N•m(lb-ft)
M6	4.7 (3.5)	6 (4.4)	9 (6.6)	11.5 (8.5)	13 (9.5)	16.5 (12.2)	15.5 (11.5)	19.5 (14.5)
M8	11.5 (8.5)	14.5 (10.7)	22 (16)	28 (20.5)	32 (23.5)	40 (29.5)	37 (27.5)	47 (35)
M10	23 (17)	29 (21)	43 (32)	55 (40)	63 (46)	80 (59)	75 (55)	95 (70)
M12	40 (29.5)	50 (37)	75 (55)	95 (70)	110 (80)	140 (105)	130 (95)	165 (120)
M14	63 (46)	80 (59)	120 (88)	150 (110)	175 (130)	220 (165)	205 (150)	260 (190)
M16	100 (74)	125 (92)	190 (140)	240 (175)	275 (200)	350 (255)	320 (235)	400 (300)
M18	135 (100)	170 (125)	265 (195)	330 (245)	375 (275)	475 (350)	440 (325)	560 (410)
M20	190 (140)	245 (180)	375 (275)	475 (350)	530 (390)	675 (500)	625 (460)	790 (580)
M22	265 (195)	330 (245)	510 (375)	650 (480)	725 (535)	920 (680)	850 (625)	1080 (800)
M24	330 (245)	425 (315)	650 (480)	820 (600)	920 (680)	1150 (850)	1080 (800)	1350 (1000)
M27	490 (360)	625 (460)	950 (700)	1200 (885)	1350 (1000)	1700 (1250)	1580 (1160)	2000 (1475)
M30	660 (490)	850 (625)	1290 (950)	1630 (1200)	1850 (1350)	2300 (1700)	2140 (1580)	2700 (2000)
M33	900 (665)	1150 (850)	1750 (1300)	2200 (1625)	2500 (1850)	3150 (2325)	2900 (2150)	3700 (2730)
M36	1150 (850)	1450 (1075)	2250 (1650)	2850 (2100)	3200 (2350)	4050 (3000)	3750 (2770)	4750 (3500)

^a "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.

^b "Dry" means plain or zinc plated without any lubrication.

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class.

Fasteners should be replaced with the same or higher property class. If higher property class fasteners are used, these should only be tightened to the strength of the original.

Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

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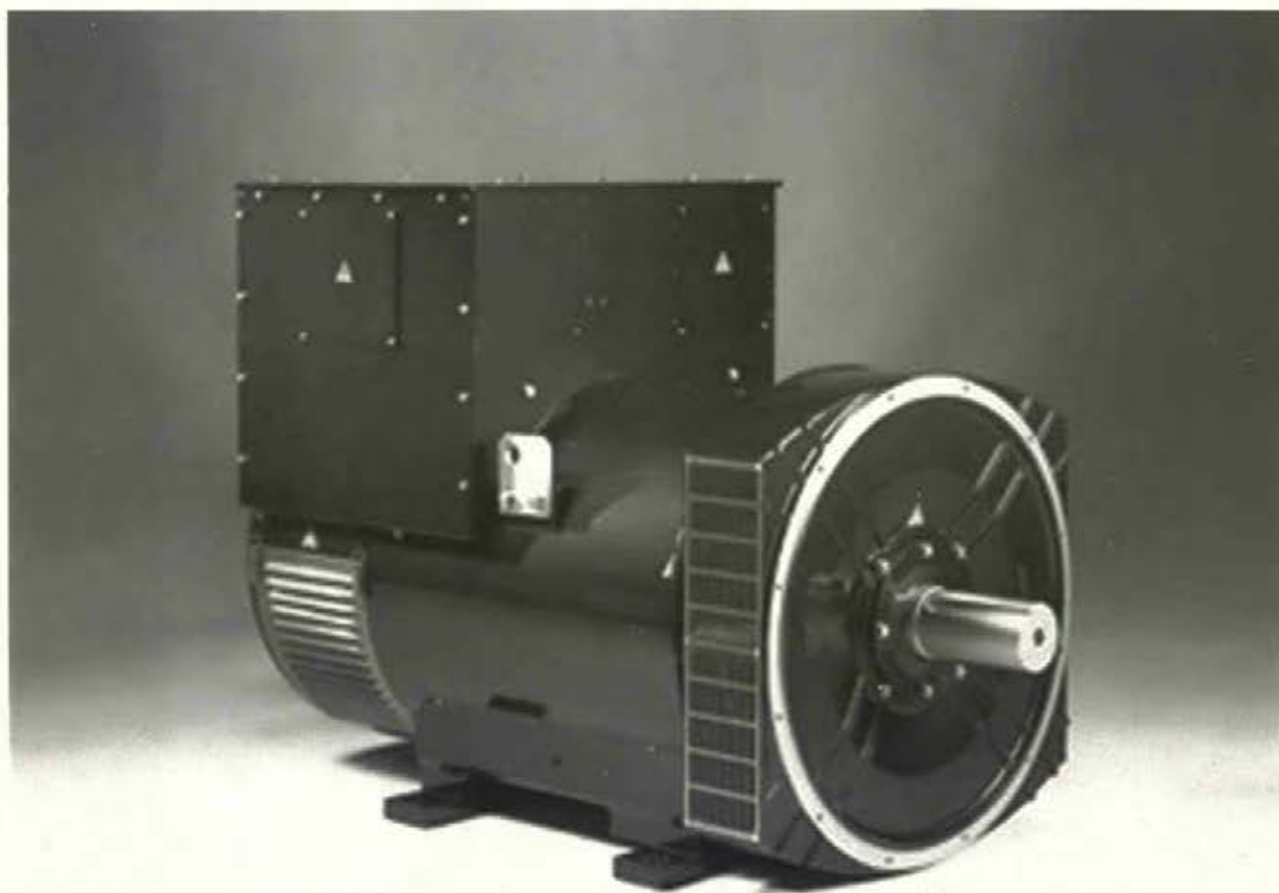
JOHN DEERE

www.JohnDeere.com

Publication No: 2H-056
22nd Edition
02/01

STAMFORD

AC GENERATORS FROM
NEWAGE INTERNATIONAL



Installation, Service & Maintenance Manual

for AC generators with the following prefixes:

HCI; HCM; HCK 4,5,6,7.

SAFETY PRECAUTIONS

Before operating the generating set, read the generating set operation manual and this generator manual and become familiar with it and the equipment.

SAFE AND EFFICIENT OPERATION CAN ONLY BE ACHIEVED IF THE EQUIPMENT IS CORRECTLY OPERATED AND MAINTAINED.

Many accidents occur because of failure to follow fundamental rules and precautions.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH.

Observe all **WARNING/CAUTION** notices.

- Ensure installation meets all applicable safety and local electrical codes. Have all installations performed by a qualified electrician.
- Do not operate the generator with protective covers, access covers or terminal box covers removed.
- Disable engine starting circuits before carrying out maintenance.
- Disable closing circuits and/or place warning notices on any circuit breakers normally used for connection to the mains or other generators, to avoid accidental closure.

Observe all **IMPORTANT, CAUTION, WARNING, and DANGER** notices, defined as:

Important ! Important refers to hazard or unsafe method or practice which can result in product damage or related equipment damage.

Caution ! Caution refers to hazard or unsafe method or practice which can result in product damage or personal injury.



Warning !

Warning refers to a hazard or unsafe method or practice which **CAN** result in severe personal injury or possible death.



Danger !

Danger refers to immediate hazards which **WILL** result in severe personal injury or death.

Due to our policy of continuous improvement, details in this manual which were correct at time of printing, may now be due for amendment. Information included must therefore not be regarded as binding.


Front Cover Photograph

This photograph is representative only. Several variations are available within the range of generators covered by this manual.

FOREWORD

The function of this book is to provide the user of the Stamford generator with an understanding of the principles of operation, the criteria for which the generator has been designed, and the installation and maintenance procedures. Specific areas where the lack of care or use of incorrect procedures could lead to equipment damage and/or personal injury are highlighted, with **WARNING** and/or **CAUTION** notes, and it is important that the contents of this book are read and understood before proceeding to fit or use the generator.

The Service, Sales and technical staff of Newage International are always ready to assist and reference to the company for advice is welcomed.



Warning !

Incorrect installation, operation, servicing or replacement of parts can result in severe personal injury or death, and/or equipment damage.

Service personnel must be qualified to perform electrical and mechanical service.

EC DECLARATION OF INCORPORATION

All Stamford generators are supplied with a declaration of incorporation for the relevant EC legislation, typically in the form of a label as below.

○

EC DECLARATION OF INCORPORATION

IN ACCORDANCE WITH THE SUPPLY OF MACHINERY (SAFETY) REGULATIONS 1992
AND THE SUPPLY OF MACHINERY (SAFETY) (AMENDMENT) REGULATIONS 1994
IMPLEMENTING THE EC MACHINERY DIRECTIVE 89/392/EEC AS AMENDED BY 91/368/EEC.

THIS STAMFORD A.C. GENERATOR WAS
MANUFACTURED BY OR ON BEHALF OF
NEWAGE INTERNATIONAL LTD
BARNACK ROAD STAMFORD LINCOLNSHIRE ENGLAND.

THIS COMPONENT MACHINERY MUST NOT BE PUT INTO SERVICE UNTIL THE
MACHINERY INTO WHICH IT IS TO BE INCORPORATED HAS BEEN DECLARED IN
CONFORMITY WITH THE PROVISIONS OF THE SUPPLY OF MACHINERY (SAFETY)
REGULATIONS 1995/MACHINERY DIRECTIVE.

FOR AND ON BEHALF OF NEWAGE INTERNATIONAL LIMITED

NAME: LAWRENCE HAYDOCK
POSITION: TECHNICAL DIRECTOR
SIGNATURE:

THIS COMPONENT MACHINERY CARRIES THE CE MARK FOR COMPLIANCE WITH THE STATUTORY
REQUIREMENTS FOR THE IMPLEMENTATION OF THE FOLLOWING DIRECTIVES

The EMC Directive 89/336/EEC
This Component Machinery shall not be used in the Residential, Commercial and
WARNING! Light Industrial environment unless it also conforms to the relevant standard
(EN 50081 - 1) REFER TO FACTORY FOR DETAILS

ii) The Low Voltage Directive 73/23/EEC as amended by 93/68/EEC



ELECTROMAGNETIC COMPATIBILITY

Additional Information

European Union

Council Directive 89/336/EEC

For installations within the European Union, electrical products must meet the requirements of the above directive, and Newage ac generators are supplied on the basis that:

- They are to be used for power-generation or related function.
- They are to be applied in one of the following environments:

Portable (open construction - temporary site supply)
 Portable (enclosed - temporary site supply)
 Containerised (temporary or permanent site supply)
 Ship-borne below decks (marine auxiliary power)
 Commercial vehicle (road transport / refrigeration etc)
 Rail transport (auxiliary power)
 Industrial vehicle (earthmoving, cranes etc)
 Fixed installation (industrial - factory / process plant)
 Fixed installation (residential, commercial and light industrial - home / office / health)
 Energy management (Combined heat and power and/or peak lopping)
 Alternative energy schemes

- The standard generators are designed to meet the 'industrial' emissions and immunity standards. Where the generator is required to meet the residential, commercial and light industrial emissions and immunity standards reference should be made to Newage document reference N4/X/011, as additional equipment may be required.
- The installation earthing scheme involves connection of the generator frame to the site protective earth conductor using a minimum practical lead length.
- Maintenance and servicing with anything other than factory supplied or authorised parts will invalidate any Newage liability for EMC compliance.
- Installation, maintenance and servicing is carried out by adequately trained personnel fully aware of the requirements of the relevant EC directives

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SECTION 1

INTRODUCTION

1.1 INTRODUCTION

The HC range of generators is of brushless rotating field design, available up to 660V at 50 Hz or 60 Hz and built to meet BS5000 Part 3 and international standards.

1500 rpm (50Hz) or 1800 rpm (60Hz) 4 pole generators are available from 200kW to 2000kW in four frame sizes - HC4, HC5, HC6 and HC7.

1000 rpm (50Hz) or 1200 rpm (60Hz) 6 pole generators are available from 224kW to 1300kW in two frame sizes - HC6 and HC7.

Frame sizes HC4 and HC5 may be provided with a stator fed excitation system using SX440 or SX421 AVR, or with the permanent magnet generator (PMG) powered excitation system, using the MX341 or MX321 AVR.

Frames HC6 and HC7 are fitted with the PMG system using the MX321 AVR.

1.2 DESIGNATION

H	C	.	I	4	4	4	C	1
H	C	.	M	5	3	4	C	2
H	C	.	I	6	3	4	G	1
H	C	.	I	6	3	6	G	2
H	C	.	M	7	3	4	G	2

GENERATOR TYPE HC

SPECIFIC TYPE K = VOLUTED ADAPTOR
AND UNI-DIRECTIONAL FAN

INDUSTRIAL = (I) OR MARINE = (M)

FRAME SIZE AND CONTROL TYPE ON HC/MV

NUMBER OF POLES 4, OR 6

CORE LENGTH

NUMBER OF BEARINGS 1 OR 2

1.3 SERIAL NUMBER LOCATION

Each generator has its unique serial number stamped in to the upper section of the drive end frame end-ring.

Inside the terminal box two adhesive rectangular labels have been fixed, each carrying the generators unique identity number. One label has been fixed to the inside of the terminal box sheet metal work, and the second label fixed to the main frame of the generator.

1.4 RATING PLATE AND CE MARK

The generator has been supplied with a self adhesive rating plate label to enable fitting after final assembly and painting. It is intended that this label will be stuck to the outside of the non drive end of the terminal box.

A CE Mark label is also supplied loose for fitment after final assembly and painting. This should be attached to an external surface of the Generator at a suitable location where it will not be obscured by the customer's wiring or other fittings. Before fitting the CE Mark label the genset builder must address the requirements of the relevant EC legislation to ensure the compliance of the genset as a whole. CE compliance will also need to be addressed when installed on site.

The surface in the area where a label is to be stuck must be flat, clean, and any paint finish be fully dry before attempting to attach label. Recommended method for attaching label is peel a fold back sufficient of the backing paper to expose some : mm of label adhesive along the edge which is to be located against the sheet metal protrusions. Once this first section of label has been carefully located and stuck into position the backing paper can be progressively removed, as the label is pressed down into position. The adhesive will achieve a permanent bond in 24 hours.

SECTION 2

PRINCIPLE OF OPERATION

2.1 SELF-EXCITED AVR CONTROLLED GENERATORS

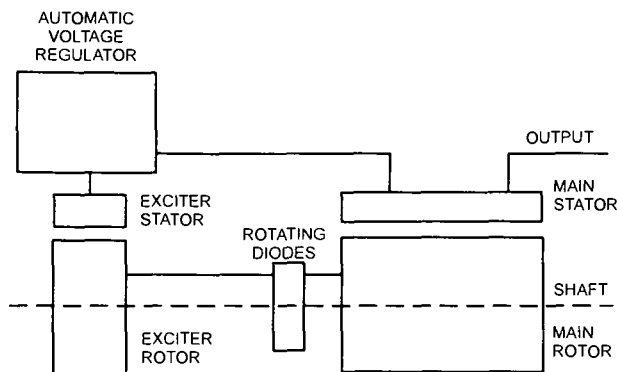


Fig. 1

The main stator provides power for excitation of the exciter field via the SX440 (or SX421) AVR which is the controlling device governing the level of excitation provided to the exciter field. The AVR responds to a voltage sensing signal derived from the main stator winding. By controlling the low power of the exciter field, control of the high power requirement of the main field is achieved through the rectified output of the exciter armature.

The SX440 AVR senses average voltage on two phases ensuring close regulation. In addition it detects engine speed and provides voltage fall off with speed, below a pre-selected speed (Hz) setting, preventing over-excitation at low engine speeds and softening the effect of load switching to relieve the burden on the engine.

The SX421 AVR in addition to the SX440 features has three phase rms sensing and also provides for over voltage protection when used in conjunction with an external circuit breaker (switchboard mounted).

2.2 PERMANENT MAGNET GENERATOR (PMG) EXCITED - AVR CONTROLLED GENERATORS

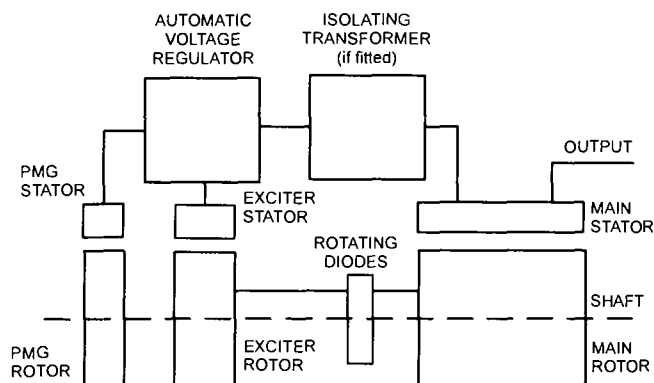


Fig. 2

The permanent magnet generator (PMG) provides power for excitation of the exciter field via the AVR MX341 (or MX321) which is the controlling device governing the level of excitation provided to the exciter field. The AVR responds to a voltage sensing signal derived, via an isolating transformer in the case of MX321 AVR,

from the main stator winding. By controlling the low power of the exciter field, control of the high power requirement of the main field is achieved through the rectified output of the exciter armature.

The PMG system provides a constant source of excitation power irrespective of main stator loading and provides high motor starting capability as well as immunity to waveform distortion on the main stator output created by non linear loads, e.g. thyristor controlled dc motor.

The MX341 AVR senses average voltage on two phases ensuring close regulation. In addition it detects engine speed and provides an adjustable voltage fall off with speed, below a pre-selected speed (Hz) setting, preventing over-excitation at low engine speeds and softening the effect of load switching to relieve the burden on the engine. It also provides over-excitation protection which acts following a time delay, to de-excite the generator in the event of excessive exciter field voltage.

The MX321 provides the protection and engine relief features of the MX341 and additionally incorporates 3 phase rms sensing and over-voltage protection.

The detailed function of all the AVR circuits is covered in the load testing section (subsection 4.7).

2.3 AVR ACCESSORIES

The SX440, SX421, MX341 and MX321 AVRs incorporate circuits which, when used in conjunction with accessories, can provide for parallel operation either with 'droop' or 'astatic' control, VAR/ PF control and in the case of the MX321 AVR, short circuit current limiting.

Function and adjustment of the accessories which can be fitted inside the generator terminal box are covered in the accessories section of this book.

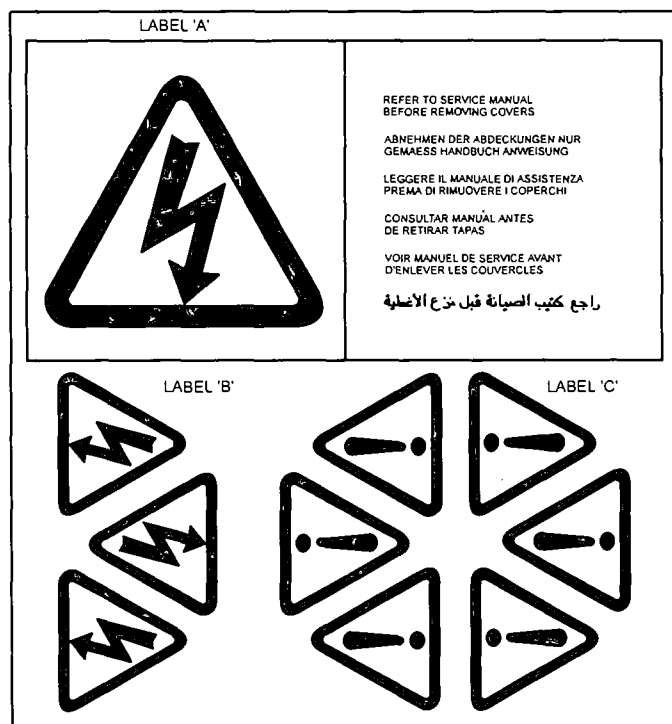
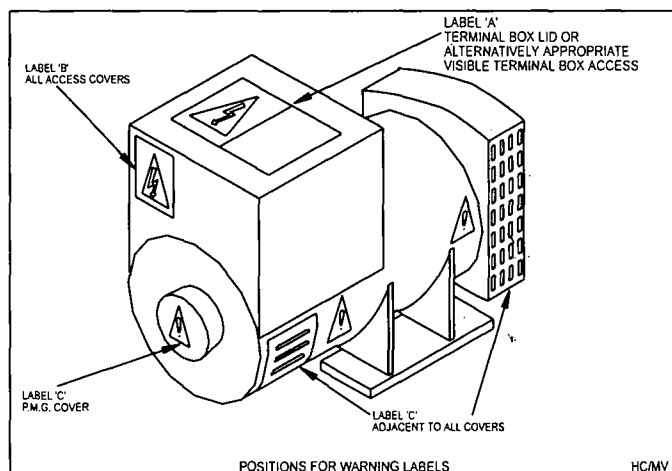
Separate instructions are provided with other accessories available for control panel mounting.

SECTION 3

APPLICATION OF THE GENERATOR

The generator is supplied as a component part for installation in a generating set. It is not, therefore, practicable to fit all the necessary warning/hazard labels during generator manufacture. The additional labels required are packaged with this Manual, together with a drawing identifying their locations. (see below).

It is the responsibility of the generating set manufacturer to ensure that the correct labels are fitted, and are clearly visible.



The generators have been designed for use in a maximum ambient temperature of 40°C, and altitude less than 1000 metres above sea level in accordance with BS5000.

Ambients in excess of 40°C, and altitudes above 1000 metres can be tolerated with reduced ratings - refer to the generator nameplate for rating and ambient.

In the event that the generator is required to operate in an ambient in excess of the nameplate value or at altitudes in excess of 1000 metres above sea level, refer to the factory.

The generators are of air-ventilated screen protected drip-proof design and are not suitable for mounting outdoors unless

adequately protected by the use of canopies. Anti-condensation heaters are recommended during storage and for standby duty to ensure winding insulation is maintained in good condition.

When installed in a closed canopy it must be ensured that the ambient temperature of the cooling air to the generator does not exceed that for which the generator has been rated.

The canopy should be designed such that the engine air intake to the canopy is separated from the generator intake, particularly where the radiator cooling fan is required to draw air into the canopy. In addition the generator air intake to the canopy should be designed such that the ingress of moisture is prohibited, preferably by use of a two stage filter.

The air intake/outlet must be suitable for the air flow given in the following table with additional pressure drops less than or equal to those given below:

Frame	Air Flow		Additional (intake/outlet) Pressure Drop
	50Hz 1500 Rev/Min	60Hz 1800 Rev/Min	
HC4	0.48m³/sec	0.58m³/sec	6mm water gauge
	1030cfm	1240cfm	(0.25")
HCK4	0.68m³/sec	0.83m³/sec	6mm water gauge
	1450cfm	1760cfm	(0.25")
HC5	1.04m³/sec	1.31m³/sec	6mm water gauge
	2202cfm	2708cfm	(0.25")
HCK5	1.23m³/sec	1.59m³/sec	6mm water gauge
	2615cfm	3366cfm	(0.25")
HC6	1.62m³/sec	1.96m³/sec	6mm water gauge
	3420cfm	4156cfm	(0.25")
HC7	2.64m³/sec	3.17m³/sec	6mm water gauge
	5600cfm	6720cfm	(0.25")
HCK7	3.0m³/sec	3.70m³/sec	6mm water gauge
	6550cfm	7860cfm	(0.25")

Table 1

If specified at the time of ordering, HC6 and HC7 generators may be fitted with air filters. Air filters can be supplied factory fitted or as parts for up-fit for the HC4 and HC5 generators. These are oil charged gauze filters and require charging during installation.

Important ! Reduction in cooling air flow or inadequate protection to the generator can result in damage and/or failure of windings.

Dynamic balancing of the generator rotor assembly has been carried out during manufacture in accordance with BS 6861 Part 1 Grade 2.5 to ensure vibration limits of the generator are in accordance with BS 4999 Part 142.

The main vibration frequencies produced by the component generator are as follows:-

4 pole	1500 rpm	25 Hz
	1800 rpm	30 Hz
6 pole	1000 rpm	16.7 Hz
	1200 rpm	20 Hz

3.1 VIBRATION

Vibrations generated by the engine are complex and contain harmonics of 1.5, 3, 5 or more times the fundamental frequency of vibration. The generator will be subjected to this vibration, which will result in the generator being subjected to vibration levels higher than those derived from the generator itself.

Newage generators are designed to withstand the vibration levels encountered on generating sets built to meet the requirements of ISO 8528-9 and BS5000-3. (Where ISO 8528 is taken to be broad band measurements and BS5000 refers to the predominant frequency of any vibrations on the generating set.)

DEFINITION OF BS5000 - 3

Generators shall be capable of continuously withstanding linear vibration levels with amplitudes of 0.25mm between 5Hz and 8Hz and velocities of 9.0mm/s rms between 8 Hz and 200 Hz when measured at any point directly on the carcass or main frame of the machine. These limits refer only to the predominant frequency of vibration of any complex waveform.

DEFINITION OF ISO 8528 - 9

ISO 8528-9 refers to a broad band of frequencies, the broad band is taken to be between 2 Hertz and 300 Hertz. The table below is an example from ISO 8528 - 9 (value 1). This simplified table lists the vibration limits by kVA range and speed for acceptable genset operation.

VIBRATION LEVELS AS MEASURED ON THE GENERATOR				
Engine Speed Min -1	SET OUTPUT kVA	VIBRATION DISPLACEMENT mm (rms)	VIBRATION VELOCITY mm/s (rms)	VIBRATION ACCELERATION m/s ² (rms)
4 POLE 1500 rpm 50 Hz 1800 rpm 60 Hz	≤ 10 kVA	-	-	-
	> 10 but ≤ 50 Kva	0.64	40	25
	> 50 but ≤ 125 kVA	0.4	25	16
	> 125 but ≤ 250 kVA	0.4	25	16
	> 250 kVA	0.32	20	13
6 POLE 1200 rpm 50 Hz 1200 rpm 60 Hz	≥ 250 but ≤ 1250	0.32	20	13
	> 1250	0.29	18	11

The 'Broad band' is taken as 2 Hz - 300 Hz.

Table 2

It is the responsibility of the generating set designer to ensure the alignment of the genset, stiffness of the bedframe and mountings are such that the vibration limits as defined above are met.

If the vibration levels of the generating set are not within the parameters quoted above :-

1. Consult the genset builder. The genset builder should address the genset design to reduce the vibration levels as much as possible.
2. Discuss, with Newage, the impact of not meeting the above levels on both bearing and generator life expectancy.

Important ! Exceeding either of the above specifications will have a detrimental effect on the generating set and in particular on the life of the bearings. (See section on bearings). This will invalidate the generator warranty. If you are in any doubt, contact Newage International Limited.

In standby applications where the running time is limited and reduced life expectancy is accepted, higher levels than specified in BS5000 can be tolerated, up to a maximum of 18mm/sec.

Two bearing generators require a substantial bedplate with engine/generator mounting pads to ensure a good base for accurate alignment. Close coupling of engine to generator can increase the overall rigidity of the set. A flexible coupling, designed to suit the specific engine/generator combination, is recommended to minimise torsional effects.

Alignment of single bearing generators is critical and vibration can occur due to the flexing of the flanges between the engine and generator. A substantial bedplate with engine/generator mounting pads is required.

For the purposes of establishing set design the bending moment at the engine flywheel housing to generator adaptor interface should not exceed that given in the table below:-

FRAME	BENDING MOMENT
4/5	140 kgm. (1000ft.lbs.)
6/7	275 kgm. (2000ft.lbs.)

The maximum bending moment of the engine flange must be checked with the engine manufacturer.

Torsional vibrations occur in all engine-driven shaft systems and may be of a magnitude to cause damage at certain critical speeds. It is therefore necessary to consider the torsional vibration effect on the generator shaft and couplings.

It is the responsibility of the generator set manufacturer to ensure compatibility, and for this purpose drawings showing the shaft dimensions and rotor inertias are available for customers to forward to the engine supplier. In the case of single bearing generators coupling details are included.

Important ! Torsional incompatibility and/or excessive vibration levels can cause damage or failure of generator and/or engine components.

The standard terminal box is arranged for cable entry on the right hand side looking from the non drive end of the generator. If specified at the time of order cable entry may be arranged on the opposite side.

The terminal box is constructed with removable panels for easy adaptation to suit specific glanding requirements. Within the terminal box there are insulated terminals for line and neutral connections and provision for earthing. Additional earthing points are provided on the generator feet.



Warning !

No earth connections are made on the generator and reference to site regulations for earthing must be made. Incorrect earthing or protection arrangements can result in personal injury or death.

The neutral is NOT connected to the frame.

Fault current curves (decrement curves), together with generator reactance data, are available on request to assist the system designer to select circuit breakers, calculate fault currents and ensure discrimination within the load network.



Warning !

Incorrect installation, service or replacement of parts can result in severe personal injury or death, and/or equipment damage. Service personnel must be qualified to perform electrical and mechanical service.

SECTION 4

INSTALLATION - PART 1

4.1 LIFTING



Warning !

Incorrect lifting or inadequate lifting capacity can result in severe personal injury or equipment damage. **MINIMUM LIFTING CAPACITY REQUIRED IS AS INDICATED ON THE LIFTING LABEL.** Generator lifting lugs should not be used for lifting the complete generating set.

Two lifting lugs are provided for use with a shackle and pin type lifting aid. A spreader with chains to ensure that the lift is vertical of suitable length and lifting capacity must be used. Lifting points are designed to position the craneage point as close to the centre of gravity of the generator as possible, but due to design restrictions it is not possible to guarantee that the generator frame will remain horizontal while lifting. Care is therefore needed to avoid personal injury or equipment damage. The correct lifting arrangement is shown on the label attached to the lifting lug. (See sample below).

IMPORTANT

REFER TO SERVICE MANUAL BEFORE REMOVING COVERS. IT IS THE GENERATOR SET MANUFACTURER'S RESPONSIBILITY TO FIT THE SELF ADHESIVE WARNING LABELS SUPPLIED WITH THE GENERATOR. THE LABEL SHEET CAN BE FOUND WITH THE INSTRUCTION BOOK.

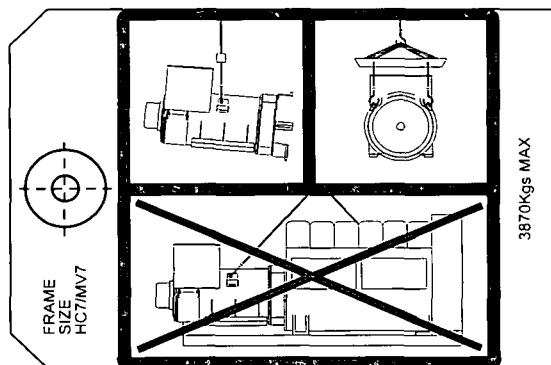


Fig. 3

Single bearing generators are supplied fitted with a rotor retaining bar at the drive end of the shaft. Single bearing generators are also fitted with wooden wedges supporting the fan for transit purposes.

Once the bar is removed to couple the rotor to engine, the rotor is free to move in the frame, and care is needed during coupling and alignment to ensure the frame is kept in the horizontal plane.

4.2 ENGINE TO GENERATOR COUPLING ASSEMBLY

During the assembly of the Generator to the Engine it will be necessary to firstly carefully align, then rotate, the combined Generator rotor - Engine crankshaft assembly, as part of the construction process, to allow location, insertion and tightening of the coupling bolts. This requirement to rotate the combined assemblies exists for both single and two bearing units.

During the construction of single bearing units it is necessary to align the generator's coupling holes with the engine flywheel holes: it is suggested that two diametrically opposite location dowel pins are fitted to the engine flywheel, over which the generator coupling can slide into final location into the engine flywheel spigot recess. The dowels must be removed and replaced by coupling bolts before the final bolt tightening sequence.

While fitting and tightening the coupling bolts it will be necessary to rotate the Engine crankshaft - Generator rotor assembly. Care should be taken to ensure that rotation is carried out in an approved manner that ensures safe working practice when reaching inside the machine to insert or tighten coupling bolts, and that no component of the assembly is damaged by non-approved methods of assembly rotation.

Engine Manufacturers have available a proprietary tool designed to enable manual rotation of the crankshaft assembly. This tool must always be used, having been engineered as an approved method of assembly rotation, by engaging the manually driven pinion with the engine flywheel starter ring-gear.



Danger !

Before working inside the generator, during the aligning and fitting of coupling bolts, care should be taken to lock the assembly to ensure there is no possibility of assembly rotational movement.

4.2.1 TWO BEARING GENERATORS

A flexible coupling should be fitted and aligned in accordance with the coupling manufacturer's instruction.

If a close coupling adaptor is used the alignment of machined faces must be checked by offering the generator up to the engine. Shim the generator feet if necessary. Ensure adaptor guards are fitted after generator/engine assembly is complete. Open coupled sets require a suitable guard, to be provided by the set builder.

Axial loading of the generator bearings should be avoided. Should it be unavoidable contact the factory for advice.

Caution ! Incorrect guarding and/or generator alignment can result in personal injury and/or equipment damage.

4.2.2 SINGLE BEARING GENERATORS TYPES HC & HCK

For transit and storage purposes the generator frame spigot and rotor coupling plates have been coated with a rust preventative. This **MUST BE** removed before assembly to engine.

A practical method for removal of this coating is to clean the mating surface areas with a de-greasing agent based on a petroleum solvent.

Caution ! Care should be taken not to allow any cleaning agent to come into prolonged contact with skin.

Alignment of single bearing generators is critical. If necessary shim the generator feet to ensure alignment of the machined surfaces.

The sequence of assembly to the engine should generally be as follows:

1. On the engine check the distance from the coupling mating face on the flywheel to the flywheel housing mating face. This should be within 0.5mm of nominal dimension. This is necessary to ensure that a thrust is not applied to the ac generator bearing or engine bearing.
2. Check that the bolts securing the flexible plates to the coupling hub are tight and locked into position. Refer to Section 7, subsection 7.5.3.4 for tightening torques.
3. Remove covers from the drive end of the generator to gain access to coupling and adaptor bolts. Check coupling joint interfaces are clean and lubricant free.

4. TYPE HC GENERATORS

Check that coupling discs are concentric with adaptor spigot. This can be adjusted by the use of tapered wooden wedges between the fan and adaptor. Alternatively the rotor can be suspended by means of a rope sling through the adaptor opening.

Offer the generator to engine and engage both coupling discs and housing spigots at same time, pushing generator towards engine until coupling discs are against flywheel face, and housing spigots located.

TYPE HCK GENERATORS

Screw the two supplied location studs into diametrically opposite engine flywheel tapped holes, about the horizontal centre line. Offer the generator to engine, locating rotor coupling discs over the location studs, pushing generator towards engine until housing spigots locate and coupling discs are against flywheel face.

5. Fit housing and coupling bolts taking care to use heavy gauge washers between coupling bolt head and coupling disc. Tighten bolts evenly around assembly sufficiently to ensure correct alignment.

TYPE HCK GENERATORS

Remove location studs and replace with coupling-flywheel bolts.

6. Tighten housing bolts.
- Tighten coupling disc to flywheel bolts. Refer to engine manufacturers manual for correct tightening torque.

8. TYPE HC GENERATORS

Remove rotor aligning aids, either wooden wedges, or the two M10 set screws and sheet metal wear plates.

Caution ! Incorrect guarding and/or generator alignment can result in personal injury and/or equipment damage.

4.3 EARTHING

The generator frame should be solidly bonded to the generating set bedplate. If antivibration mounts are fitted between the generator frame and its bedplate a suitably rated earth conductor (normally one half of the cross sectional area of the main line cables) should bridge across the antivibration mount.



Refer to local regulations to ensure that the correct earthing procedure has been followed.

Warning !

4.4 PRE-RUNNING CHECKS

4.4.1 INSULATION CHECK

Insulation tests should be carried out before running the generating set, both after assembly and after installation on site. (see Section 7.1).

Important ! The windings have been H.V. tested during manufacture and further H.V. testing may degrade the insulation with consequent reduction in operating life. Should it be necessary to demonstrate H.V. testing, for customer acceptance, the tests must be carried out at reduced voltage levels i.e. Test Voltage= 0.8 (2 X Rated Voltage + 1000)

4.4.2 DIRECTION OF ROTATION

4.4.2.1 FAN TYPES.

TYPE HC 4 & 5 GENERATORS.

These machines are fitted with a radial bladed bi-directional fan, operating within a conventional full height air outlet grills.

TYPE HC 6 & 7 GENERATORS.

These machines are fitted with an inclined bladed fan, operating within a conventional full height air outlet grills.

TYPE HCK 4, 5, & 7 GENERATORS.

These machines are fitted with a inclined bladed fan, operating within a voluted drive end adaptor with outlet grills half three machine height. Designed to optimise the fans performance.

4.4.2.2 DIRECTION OF ROTATION

TYPE HCK GENERATORS.

These machines have been designed with an improved cooling fan system, incorporating the voluted fan housing. Therefore these machines are suitable only for clockwise rotation, as viewed from the drive end.

TYPE HC GENERATORS.

These machines can be operated in either direction of rotation.

Phase Rotation

HC generators can rotate efficiently in either direction. However phase rotation is fixed for clockwise rotation as viewed from the drive end. If the generator is to be rotated in a counter-clockwise direction it will be necessary for the customers to adjust their cabling to the output terminals accordingly. Refer to the factory for a reverse wiring diagram.

4.4.3 VOLTAGE AND FREQUENCY

Check that the voltage and frequency levels required for the generating set application are as indicated on the generator nameplate.

HC4/5 generators normally have a 12 ends out reconnectable winding. If it is necessary to reconnect the stator for the voltage required, refer to diagrams in the back of this manual.

4.4.4 AVR SETTINGS

To make AVR selections and adjustments remove the AVR cover and refer to 4.4.4.1, 4.4.4.2, 4.4.4.3 or 4.4.4.4 depending upon type of AVR fitted. Reference to the generator nameplate will indicate AVR type (SX440, SX421, MX341 or MX321).

Most of the AVR adjustments are factory set in positions which will give satisfactory performance during initial running tests. Subsequent adjustment may be required to achieve optimum performance of the set under operating conditions. Refer to 'Load Testing' section for details.

4.4.4.1 TYPE SX440 AVR

The following 'jumper' connections on the AVR should be checked to ensure they are correctly set for the generating set application.

Refer to Fig. 4a for location of selection links.

1. Frequency selection terminals

50Hz operation	LINK C-50
60Hz operation	LINK C-60

2. Stability selection terminals

Frame HC4/5	LINK B-C
Frame HC6/7	LINK A-B

3. Sensing selection terminals

LINK 2-3
LINK 4-5
LINK 6-7

4. Excitation Interruption Link

LINK K1-K2

4.4.4.2 TYPE SX421 AVR

The following 'jumper' connections on the AVR should be checked to ensure they are correctly set for the generating set application.

Refer to Fig. 4b for location of selection links.

1. Frequency selection terminals

50Hz operation	LINK C-50
60Hz operation	LINK C-60

2. Stability selection terminals

Frame HC4/5	LINK B-C
Frame HC6/7	LINK A-B

3. Excitation Interruption Link

Linked at auxiliary terminal block. K1-K2

4.4.4.3 TYPE MX341 AVR

The following 'jumper' connections on the AVR should be checked to ensure they are correctly set for the generating set application.

Refer to Fig. 4c for location of selection links.

4 pole	50Hz operation	LINK 2-3
4 pole	60Hz operation	LINK 1-3
6 pole	50Hz operation	NO LINK
6 pole	60Hz operation	LINK 1-2

2. Stability selection terminals

Frame HC4/5	LINK B-C
Frame HC6/7	LINK A-B

3. Sensing selection terminals

LINK 2-3
LINK 4-5
LINK 6-7

4. Excitation Interruption Link

LINK K1-K2

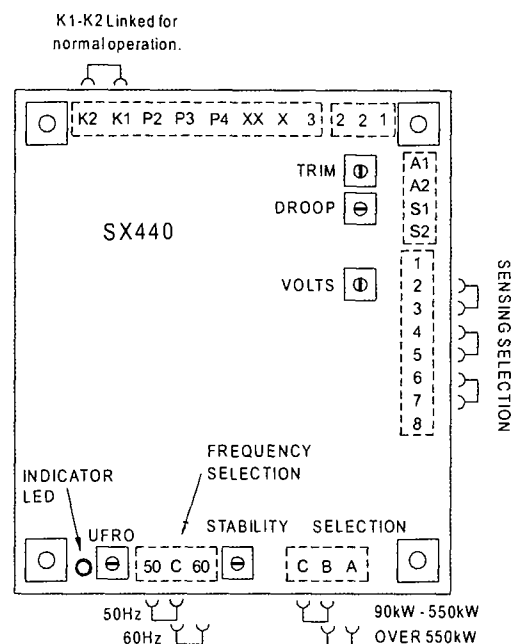


Fig. 4a

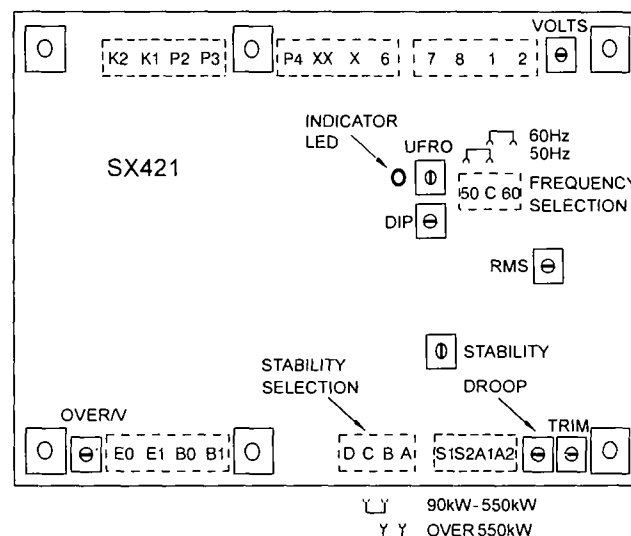


Fig. 4b

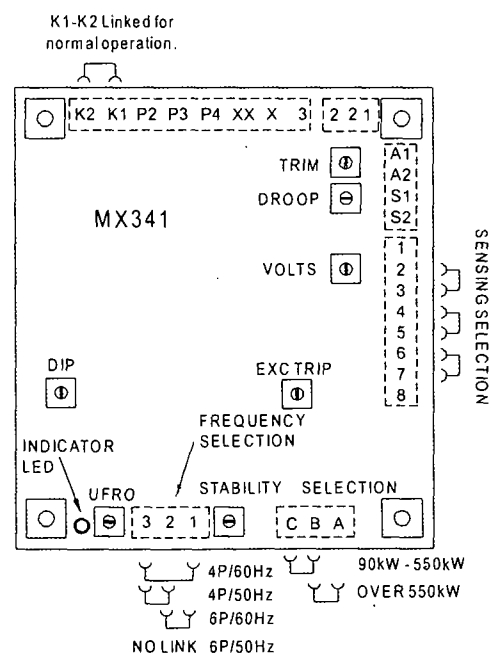


Fig. 4c

4.4.4.4 TYPE MX321 AVR

The following 'jumper' connections on the AVR should be checked to ensure they are correctly set for the generating set application.

Refer to Fig. 4d for location of selection links.

1. Frequency selection terminals

4 pole	50Hz operation	LINK 2-3
4 pole	60Hz operation	LINK 1-3
6 pole	50Hz operation	NO LINK
6 pole	60Hz operation	LINK 1-2

2. Stability selection terminals

Frame HC4/5	LINK B-C
Frame HC6/7	LINK A-B

3. Excitation Interruption Link

Linked at auxiliary terminal block. K1-K2

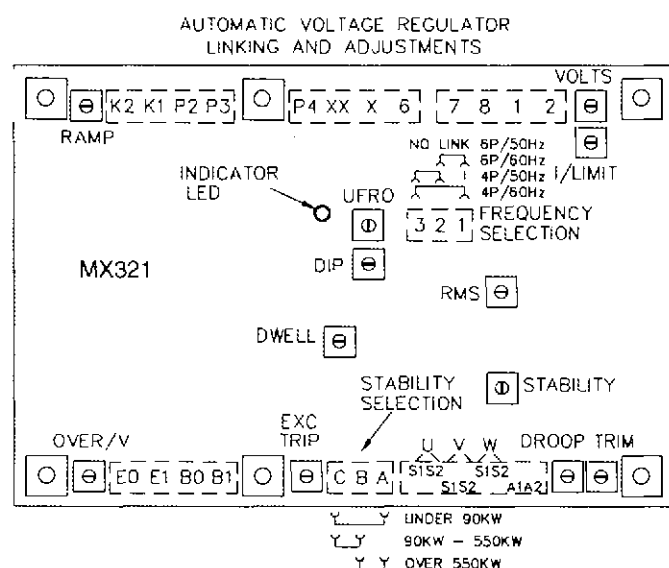


Fig. 4d

4.5 GENERATOR SET TESTING



Warning !

During testing it may be necessary to remove covers to adjust controls exposing 'live' terminals or components. Only personnel qualified to perform electrical service should carry out testing and/or adjustments.

4.5.1 TEST METERING/CABLING

Connect any instrument wiring and cabling required for initial test purposes with permanent or spring-clip type connectors.

Minimum instrumentation for testing should be line - line or line to neutral voltmeter, Hz meter, load current metering and kW meter. If reactive load is used a power factor meter is desirable.

Important ! When fitting power cables for load testing purposes, ensure cable voltage rating is at least equal to the generator rated voltage. The load cable termination should be placed on top of the winding lead termination and clamped between the two nuts provided, on HC4/5 generators.

Caution ! Check that all wiring terminations for internal or external wiring are secure, and fit all terminal box covers and guards. Failure to secure wiring and/or covers may result in personal injury and/or equipment failure.

4.6 INITIAL START-UP



Warning !

During testing it may be necessary to remove covers to adjust controls exposing 'live' terminals or components. Only personnel qualified to perform electrical service should carry out testing and/or adjustments. Refit all access covers after adjustments are completed.

On completion of generating set assembly and before starting the generating set ensure that all engine manufacturer's pre-running procedures have been completed, and that adjustment of the engine governor is such that the generator will not be subjected to speeds in excess of 125% of the rated speed.

Important ! Overspeeding of the generator during initial setting of the speed governor can result in damage to the generator rotating components.

In addition remove the AVR access cover and turn VOLTS control fully anti-clockwise. Start the generating set and run on no-load at nominal frequency. Slowly turn VOLTS control potentiometer clockwise until rated voltage is reached. Refer to Fig. 4a - 4d for control potentiometer location.

Important ! Do not increase the voltage above the rated generator voltage shown on the generator nameplate.

The STABILITY control potentiometer will have been pre-set and should normally not require adjustment, but should this be required, usually identified by oscillation of the voltmeter, refer to Fig. 4a - 4d for control potentiometer location and proceed as follows:-

1. Run the generating set on no-load and check that speed is correct and stable.
2. Turn the STABILITY control potentiometer clockwise, then turn slowly anti-clockwise until the generator voltage starts to become unstable.

The correct setting is slightly clockwise from this position (i.e. where the machine volts are stable but close to the unstable region).

4.7 LOAD TESTING



Warning !

During testing it may be necessary to remove covers to adjust controls exposing 'live' terminals or components. Only personnel qualified to perform electrical service should carry out testing and/or adjustments. Refit all access covers after adjustments are completed.

4.7.1 AVR ADJUSTMENTS

Refer to Fig. 4a - 4d for control potentiometer locations.

Having adjusted VOLTS and STABILITY during the initial start-up procedure, other AVR control functions should not normally need adjustment. If instability on load is experienced recheck stability setting. Refer to subsection 4.6.

If however, poor voltage regulation on-load or voltage collapse is experienced, refer to the following paragraphs on each function to a) check that the symptoms observed do indicate adjustment is necessary, and b) to make the adjustment correctly.

4.7.1.1 UFRO (Under Frequency Roll Off) (AVR Types SX440, SX421, MX341 and MX321)

The AVR incorporates an underspeed protection circuit which gives a voltage/speed (Hz) characteristic as shown:

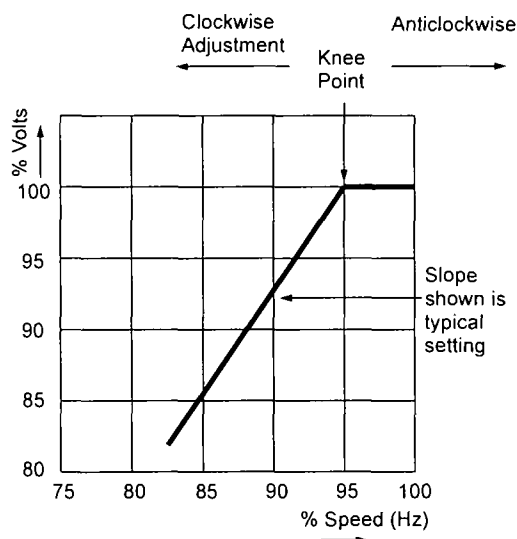


Fig. 5

The UFRO control potentiometer sets the "knee point".

Symptoms of incorrect setting are a) the light emitting diode (LED) indicator, just above the UFRO Control potentiometer, being permanently lit when the generator is on load, and b) poor voltage regulation on load, i.e. operation on the sloping part of the characteristic.

Clockwise adjustment lowers the frequency (speed) setting of the "knee point" and extinguishes the LED. For Optimum setting the LED should illuminate as the frequency falls just below nominal frequency, i.e. 47Hz on a 50Hz generator or 57Hz on a 60Hz generator.

Important ! With AVR Types MX341 and MX321. If the LED is illuminated and no output voltage is present, refer to EXC TRIP and/or OVER/V sections below.

4.7.1.2 EXC TRIP (Excitation Trip) AVR Types MX341 and MX321

An AVR supplied from a permanent magnet generator inherently delivers maximum excitation power on a line to line or line to neutral short circuit. In order to protect the generator windings the AVR incorporates an over excitation circuit which detects high excitation and removes it after a pre-determined time, i.e. 8-10 seconds.

Symptoms of incorrect setting are the generator output collapses on load or small overload, and the LED is permanently illuminated.

The correct setting is 70 volts +/- 5% between terminals X and XX.

4.7.1.3 OVER/V (Over Voltage) AVR Types SX421 and MX321

Over voltage protection circuitry is included in the AVR to remove generator excitation in the event of loss of AVR sensing input.

The MX321 has both internal electronic de-excitation and provision of a signal to operate an external circuit breaker.

The SX421 only provides a signal to operate an external breaker, which **MUST** be fitted if over voltage protection is required.

Incorrect setting would cause the generator output voltage to collapse at no-load or on removal of load, and the LED to be illuminated.

The correct setting is 300 volts +/-5% across terminals E1, E0.

Clockwise adjustment of the OVER/V control potentiometer will increase the voltage at which the circuit operates.

4.7.1.4 TRANSIENT LOAD SWITCHING ADJUSTMENTS AVR Types SX421, MX341 and MX321

The additional function controls of DIP and DWELL are provided to enable the load acceptance capability of the generating set to be optimised. The overall generating set performance depends upon the engine capability and governor response, in conjunction with the generator characteristics.

It is not possible to adjust the level of voltage dip or recovery independently from the engine performance, and there will always be a 'trade off' between frequency dip and voltage dip.

DIP-AVR Types SX421, MX341 and MX321

The dip function control potentiometer adjusts the slope of the voltage/speed (Hz) characteristic below the knee point as shown below:

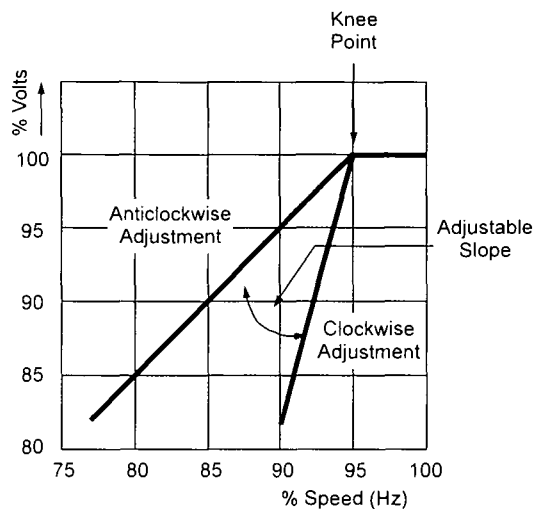


Fig. 6

DWELL-AVR Type MX321

The dwell function introduces a time delay between the recovery of voltage and recovery of speed.

The purpose of the time delay is to reduce the generator kW below the available engine kW during the recovery period, thus allowing an improved speed recovery.

Again this control is only functional below the "knee point", i.e. if the speed stays above the knee point during load switching there is no effect from the DWELL function setting.

Clockwise adjustment gives increased recovery time.

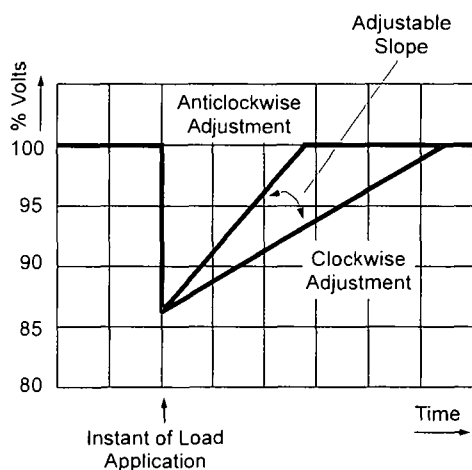


Fig. 7

The graphs shown above are representations only, since it is impossible to show the combined effects of voltage regulator and engine governor performance.



Warning !

Failure to refit covers can result in operator personal injury or death.

4.7.1.5 RAMP AVR Type MX321

The RAMP potentiometer enables adjustment of the time taken for the generator's initial build up to normal rated voltage during each start and run up to speed. The potentiometer is factory set to give a ramp time of three seconds, which is considered to be suitable for most applications. This time can be reduced to one second by turning the pot. fully counter clockwise, and increased to eight seconds by turning the pot. fully clockwise.

4.8 ACCESSORIES

Refer to the "ACCESSORIES" Section of this Manual for setting up procedures related to generator mounted accessories.

If there are accessories for control panel mounting supplied with the generator refer to the specific accessory fitting procedures inserted inside the back cover of this book.

Replace AVR access cover after all adjustments are completed.

SECTION 5

INSTALLATION - PART 2

5.1 GENERAL

The extent of site installation will depend upon the generating set build, e.g. if the generator is installed in a canopied set with integral switchboards and circuit breaker, on site installation will be limited to connecting up the site load to the generating set output terminals. In this case reference should be made to the generating set manufacturer's instruction book and any pertinent local regulations.

If the generator has been installed on a set without switchboard or circuit breaker the following points relating to connecting up the generator should be noted.

5.2 GLANDING

The terminal box is arranged for glanding on the right hand side (or if specifically ordered on the left hand side) viewed from the non drive end. Both panels are removable for drilling/punching to suit glands/or glanding boxes. If single core cables are taken through the terminal box side panel an insulated or non-magnetic gland plate should be fitted.

At entry to the terminal box incoming cables should be supported by a recognised glanding method such that minimum unsupported weight, and no axial force is transferred to the terminal assembly.

Incoming cables external to the terminal box should be supported at a sufficient distance from the centre line of the generating set so as to avoid a tight radius at the point of entry into the terminal box panel, and allow movement of the generator set on its anti-vibration mountings without excessive stress on the cable.

Before making final connections, test the insulation resistance of the windings. The AVR should be disconnected during this test and RTD leads grounded.

A 500V Megger or similar instrument should be used. Should the insulation resistance be less than 5MΩ the windings must be dried out as detailed in the Service and Maintenance section of this manual.

When making connections to the terminals of Frame 4 generators, the incoming cable termination lug should be placed on top of the winding lead termination lug(s) and then clamped with the nut provided.

Important ! To avoid the possibility of swarf entering any electrical components in the terminal box, panels must be removed for drilling.

5.3 TORQUE SETTINGS FOR TERMINAL CONNECTIONS

Pre treatment: Clean plated surfaces with a degreasing agent, then lightly abrade them to remove any tarnish. Don't score the surface.

The **generator torque settings** for all connections, links, CT's, accessories, cables, etc. is 45 Nm.

The **customer output cables** should be connected to the terminals using 8.8 grade steel bolts and associated anti-vibration hardware.

The following table is for your guidance.

FRAME	HOLE SIZE	BOLT SIZE	TORQUE Nm
4	-	12	45
5	13	12	50
6	17	14	70
7	17	16	90

Table 3

Carry out **periodic checks** to ensure the correct torque settings.

5.4 EARTHING

The neutral of the generator is not bonded to the generator frame as supplied from the factory. An earth terminal is provided inside the terminal box adjacent to the main terminals. Should it be required to operate with the neutral earthed a substantial earth conductor (normally equivalent to one half of the section of the line conductors) must be connected between the neutral and the earth terminal inside the terminal box. It is the responsibility of the generating set builder to ensure the generating set bedplate and generator frame are all bonded to the main earth terminal in the terminal box.

Caution ! Reference to local electricity regulations or safety rules should be made to ensure correct earthing procedures have been followed.

5.5 PROTECTION

It is the responsibility of the end user and his contractors/sub-contractors to ensure that the overall system protection meets the needs of any inspectorate, local electricity authority or safety rules, pertaining to the site location.

To enable the system designer to achieve the necessary protection and/or discrimination, fault current curves are available on request from the factory, together with generator reactance values to enable fault current calculations to be made.



Warning !

Incorrect installation and/or protective systems can result in personal injury and/or equipment damage. Installers must be qualified to perform electrical installation work.

5.6 COMMISSIONING

Ensure that all external cabling is correct and that all the generating set manufacturer's pre-running checks have been carried out before starting the set.

Generators fitted with air filters should have the filters charged with oil prior to commissioning. Refer to Service Section for charging procedure (subsection 7.3.2).

The generator AVR controls will have been adjusted during the generating set manufacturer's tests and should normally not require further adjustment.

Should malfunction occur during commissioning refer to Service and Maintenance section 'Fault Finding' procedure (subsection 7.4).

SECTION 6

ACCESSORIES

Generator control accessories may be fitted, as an option, in the generator terminal box. If fitted at the time of supply, the wiring diagram(s) in the back of this book shows the connections. When the options are supplied separately, fitting instructions are provided with the accessory.

The following table indicates availability of accessories with the differing AVRs.

AVR Model	Paralleling Droop or Astatic	Manual Voltage Regulator	VAR/PF Control	Current Limit
SX440	✓	X	✓	X
SX421	✓	X	✓	X
MX341	✓	✓	✓	X
MX321	✓	✓	✓	✓

Table 4

6.1 REMOTE VOLTAGE ADJUST (ALL AVR TYPES)

A remote voltage adjust (hand trimmer) can be fitted.

The remote voltage adjustment potentiometer is connected across AVR terminals 1-2.

These terminals are normally linked.

When the remote voltage adjust potentiometer is used the link across terminals 1-2 must be removed.

On AVR types SX440 and MX341 the link 1-2 is on an adjacent terminal block.

On AVR types SX421 and MX321 the link 1-2 is on the AVR terminals.

6.2 PARALLEL OPERATION

Understanding of the following notes on parallel operation is useful before attempting the fitting or setting of the droop kit accessory.

When operating in parallel with other generators or the mains, it is essential that the phase sequence of the incoming generator matches that of the busbar and also that all of the following conditions are met before the circuit breaker of the incoming generator is closed on to the busbar (or operational generator).

1. Frequency must match within close limits.
2. Voltages must match within close limits.
3. Phase angle of voltages must match within close limits.

A variety of techniques, varying from simple synchronising lamps to fully automatic synchronisers, can be used to ensure these conditions are met.

Once connected in parallel a minimum instrumentation level per generator of voltmeter, ammeter, wattmeter (measuring total power per generator), and frequency meter is required in order to adjust the engine and generator controls to share kW in relation to engine ratings and kVAr in relation to generator ratings.

Important ! Failure to meet conditions 1, 2, and 3 when closing the circuit breaker, will generate excessive mechanical and electrical stresses, resulting in equipment damage.

It is important to recognise that

1. kW are derived from the engine, and speed governor characteristics determine the kW sharing between sets
- and
2. kVAr are derived from the generator, and excitation control characteristics determine the kVAr sharing.

Reference should be made to the generating set manufacturer's instructions for setting the governor controls.

6.2.1 DROOP

The most commonly used method of kVAr sharing is to create a generator voltage characteristic which falls with decreasing power factor (increasing kVAr). This is achieved with a current transformer (C.T.) which provides a signal dependent on current phase angle (i.e. power factor) to the AVR.

The current transformer has a burden resistor on the AVR board, and a percentage of the burden resistor voltage is summed into the AVR circuit. Increasing droop is obtained by turning the DROOP control potentiometer clockwise.

The diagrams below indicate the effect of droop in a simple two generator system:-

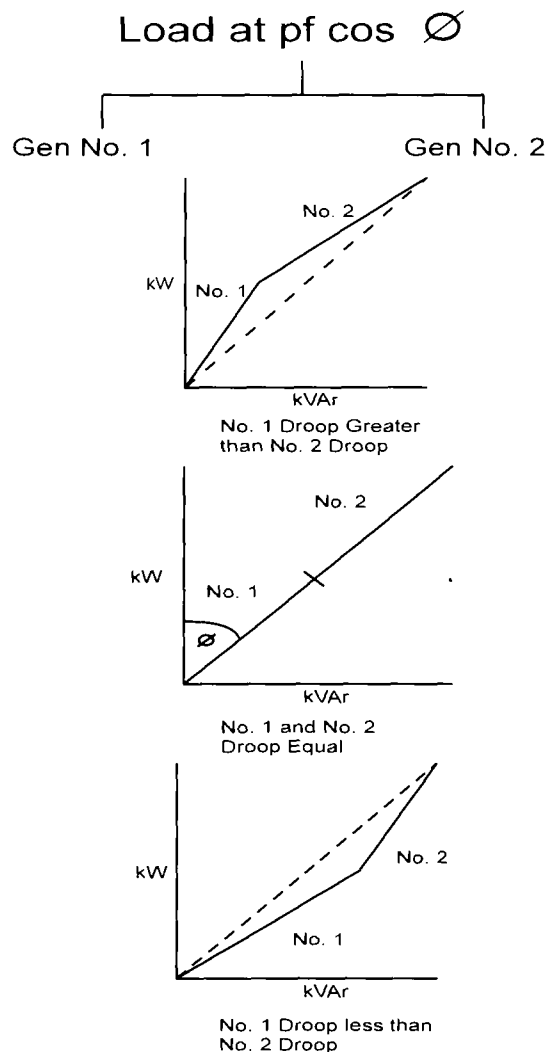


Fig. 8

Generally 5% droop at full load current zero p.f. is sufficient to ensure kVAr sharing.

If the droop accessory has been supplied with the generator it will have been tested to ensure correct polarity and set to a nominal level of droop. The final level of droop will be set during generating set commissioning.

Although nominal droop setting may be factory set it is advisable to go through the setting procedure below.

6.2.1.1 SETTING PROCEDURE

Depending upon available load the following settings should be used - all are based on rated current level.

0.8 P.F. LOAD	(at full load current)	SET DROOP TO 3%
Zero P.F. LOAD	(at full load current)	SET DROOP TO 5%

Setting the droop with low power factor load is the most accurate.

Run each generator as a single unit at rated frequency or rated frequency + 4% depending upon type of governor and nominal voltage. Apply available load to rated current of the generator. Adjust 'DROOP' control potentiometer to give droop in line with above table. Clockwise rotation increases amount of droop. Refer to Fig. 4a - 4d for potentiometer locations.

Note 1)

Reverse polarity of the C.T. will raise the generator voltage with load. The polarities S1-S2 shown on the wiring diagrams are correct for clockwise rotation of the generator looking at the drive end. Reversed rotation requires S1-S2 to be reversed.

Note 2)

The most important aspect is to set all generators equal. The precise level of droop is less critical.

Note 3)

A generator operated as a single unit with a droop circuit set at rated load 0.8 power factor is unable to maintain the usual 0.5% regulation. A shorting switch can be connected across S1-S2 to restore regulation for single running.

Important ! LOSS OF FUEL to an engine can cause its generator to motor with consequent damage to the generator windings. Reverse power relays should be fitted to trip main circuit breaker. LOSS OF EXCITATION to the generator can result in large current oscillations with consequent damage to generator windings. Excitation loss detection equipment should be fitted to trip main circuit breaker.

6.2.2 ASTATIC CONTROL

The 'droop' current transformer can be used in a connection arrangement which enables the normal regulation of the generator to be maintained when operating in parallel.

This feature is only supplied from the factory as a fitted droop kit, however, if requested at the time of order, the diagrams inside the back cover of this book will give the necessary site connections. The end user is required to provide a shorting switch for the droop current transformer secondary.

Important ! When using this connection arrangement a shorting switch is required across each C.T. burden (terminals S1 and S2.) The switch must be closed a) when a generating set is not running and b) when a generating set is selected for single running.

Should the generator be required to be converted from standard droop to 'astatic' control, diagrams are available on request.

The setting procedure is exactly the same as for DROOP. (Subsection 6.2.1.1)

6.3 MANUAL VOLTAGE REGULATOR (MVR) - MX341 and MX321 AVR

This accessory is provided as an 'emergency' excitation system, in the event of an AVR failure.

Powered from a PMG output the unit is manually set, but automatically controls the excitation current, independent of generator voltage or frequency.

The unit is provided with 'MANUAL', 'OFF', 'AUTO' switching facility.

'MANUAL'

- position connects the exciter field to the MVR output. Generator output is then controlled by the operator adjusting the excitation current.

'OFF'

- disconnects the exciter field from both MVR and the normal AVR.

'AUTO'

- connects the exciter field to the normal AVR and the generator output is controlled at the pre-set voltage under AVR control.

6.4 OVERVOLTAGE DE-EXCITATION BREAKER SX421 and MX321 AVR

This accessory provides positive interruption of the excitation power in the event of overvoltage due to loss of sensing or internal AVR faults including the output power device.

With the MX321 AVR this accessory is supplied loose for fitting in the control panel.

In the case of the SX421 the circuit breaker is always supplied and will normally be fitted in the generator.

Important ! When the CB is supplied loose, terminals K1-K2 at the auxiliary terminal block are fitted with a link to enable operation of the AVR. When connecting the circuit breaker this link must be removed.

6.4.1 RESETTING THE EXCITATION BREAKER

In the event of operation of the circuit breaker, indicated by loss of generator output voltage, manual resetting is required. When in the "tripped" state the circuit breaker switch lever shows "OFF". To reset move the switch lever to the position showing "ON".



Danger !

Terminals which are LIVE with the generating set running are exposed when the AVR access cover is removed. Resetting of the circuit breaker must be carried out with the generating set stationary, and engine starting circuits disabled.

When fitted in the generator, access to the breaker is gained by removal of the AVR access cover.

The circuit breaker is mounted on the AVR mounting bracket either to the left or to the right of the AVR depending upon AVR position. After resetting the circuit breaker replace the AVR access cover before restarting the generating set. Should resetting of the circuit breaker not restore the generator to normal operation, refer to subsection 7.5.

6.5 CURRENT LIMIT - MX321 AVR

These accessories work in conjunction with the AVR circuits to provide an adjustment to the level of current delivered into a fault. One current transformer (CT) per phase is fitted to provide current limiting on any line to line or line to neutral fault.

Note: The W phase CT can also provide "DROOP". Refer to 6.2.1.1. for setting droop independent of current limit.

Adjustment means is provided with the "I/LIMIT" control potentiometer on the AVR. Refer to Fig. 4d for location. If current limit transformers are supplied with the generator the limit will be set in accordance with the level specified at the time of order, and no further adjustment will be necessary. However, should the level need to be adjusted, refer to the setting procedure given in 6.5.1.

6.5.1 SETTING PROCEDURE

Run the generating set on no-load and check that engine governor is set to control nominal speed.

Stop the generating set. Remove the link between terminals K1-K2 at the auxiliary terminal block and connect a 5A switch across the terminals K1-K2.

Turn the "I/LIMIT" control potentiometer fully anticlockwise. Short circuit the stator winding with a bolted 3 phase short at the main terminals. An AC current clip-on ammeter is required to measure the winding lead current.

With the switch across K1-K2 open start the generating set.

Close the switch across K1-K2 and turn the "I/LIMIT" control potentiometer clockwise until required current level is observed on the clip-on ammeter. As soon as correct setting is achieved open the K1-K2 switch.

Should the current collapse during the setting procedure, the internal protective circuits of the AVR will have operated. In this event shut down the set and open the K1-K2 switch. Restart the set and run for 10 minutes with K1-K2 switch open, to cool the generator windings, before attempting to resume the setting procedure.

Important ! Failure to carry out the correct COOLING procedure may cause overheating and consequent damage to the generator windings.

6.6 POWER FACTOR CONTROLLER (PFC3)

This accessory is primarily designed for those generator applications where operation in parallel with the mains supply is required.

Protection against loss of mains voltage or generator excitation is not included in the unit and the system designer must incorporate suitable protection.

The electronic control unit requires both droop and kVAr current transformers. When supplied with the generator, wiring diagrams inside the back cover of this manual show the connections and the additional instruction leaflet provided gives details of setting procedures for the power factor controller (PFC3).

The unit monitors the power factor of the generator current and adjusts excitation to maintain the power factor constant.

This mode can also be used to control the power factor of the mains if the point of current monitoring is moved to the mains cables. Refer to the factory for appropriate details.

It is also possible to operate the unit to control kVAr of the generator if required. Refer to the factory for appropriate details.

SECTION 7

SERVICE AND MAINTENANCE

As part of routine maintenance procedures, periodic attention to winding condition (particularly when generators have been idle for a long period) and bearings is recommended. (Refer to subsections 7.1 and 7.2 respectively).

When generators are fitted with air filters regular inspection and filter maintenance is required. (Refer to subsection 7.3).

7.1 WINDING CONDITION



Warning !

Service and fault finding procedures present hazards which can result in severe personal injury or death. Only personnel qualified to perform electrical and mechanical service should carry out these procedures.

Ensure engine starting circuits are disabled before commencing service or maintenance procedures. Isolate any anti-condensation heater supply.

Guidance of Typical Insulation Resistance [IR] Values

The following is offered as general information about IR values and is aimed at providing guidance about the typical IR values for generators from new through to the point of refurbishment.

New Machines

The generators Insulation Resistance, along with many other critical factors, will have been measured during the alternator manufacturing process. The generator will have been transported with an appropriate packaging suitable for the method of delivery to the Generating Set assemblers works. Where we expect it to be stored in a suitable location protected from adverse environmental conditions.

However, absolute assurance that the generator will arrive at the Gen-set production line with IR values still at the factory test levels of above 100 MΩ cannot be guaranteed.

At Generating Set Manufacturers Works

The generator should have been transported and stored such that it will be delivered to the assembly area in a clean dry condition. If held in appropriate storage conditions the generator IR value should typically be 25 MΩ.

If the unused/new generators IR values fall below 10 MΩ then a drying out procedure should be implemented by one of the processes outlined below before being despatched to the end customer's site. Some investigation should be undertaken into the storage conditions of the generator while on site.

Generators in Service

Whilst It is known that a generator will give reliable service with an IR value of just 1.0 MΩ. For a relatively new generator to be so low it must have been subjected to inappropriate operating or storage conditions.

Any temporarily reduction in IR values can be restored to expected values by following one of the drying out procedures.

7.1.1 WINDING CONDITION ASSESSMENT

Caution !

The AVR should be disconnected and the Resistance Temperature Detector (R.T.D.) leads grounded during this test.

The condition of the windings can be assessed by measurement of insulation resistance [IR] between phase to phase, and phase to earth.

Measurement of winding insulation should be carried out: -

1. As part of a periodic maintenance plan.
2. After prolonged periods of shutdown.
3. When low insulation is suspected, e.g. damp or wet windings.

Care should be taken when dealing with windings that are suspected of being excessively damp or dirty. The initial measurement of the [IR] Insulation Resistance should be established using a low voltage (500V) megger type instrument. If manually powered the handle should initially be turned slowly so that the full test voltage will not be applied, and only applied for long enough to very quickly assess the situation if low values are suspected or immediately indicated.

Full megger tests or any other form of high voltage test should not be applied until the windings have been dried out and if necessary cleaned.

Procedure for Insulation Testing

Disconnect all electronic components, AVR, electronic protection equipment etc. Ground the [RTD's] Resistance Temperature Detection devices if fitted. Short out the diodes on the rotating diode assembly. Be aware of all components connected to the system under test that could cause false readings or be damaged by the test voltage.

Carry out the insulation test in accordance with the 'operating instructions for the test equipment.

The measured value of insulation resistance for all windings to earth and phase to phase should be compared with the guidance given above for the various 'life stages' of a generator. The minimum acceptable value must be greater than 1.0 MΩ.

If low winding insulation is confirmed use one or more of the methods, given below, for drying the winding should be carried out.

7.1.2 METHODS OF DRYING OUT GENERATORS

Cold Run

Consider a good condition generator that has not been run for some time, and has been standing in damp, humid conditions. It is possible that simply running the gen set unexcited - AVR terminals K1 K2 open circuit - for a period of say 10 minutes will sufficiently dry the surface of the windings and raise the IR sufficiently, to greater than 1.0 MΩ, and so allow the unit to be put into service.

Blown Air Drying

Remove the covers from all apertures to allow the escape of the water-laden air. During drying, air must be able to flow freely through the generator in order to carry off the moisture.

Direct hot air from two electrical fan heaters of around 1 – 3 kW into the generator air inlet apertures. Ensure the heat source is at least 300mm away from the windings to avoid over heating and damage to the insulation.

Apply the heat and plot the insulation value at half hourly intervals. The process is complete when the parameters covered in the section entitled, 'Typical Drying Out Curve', are met.

Remove the heaters, replace all covers and re-commission as appropriate.

If the set is not to be run immediately ensure that the anti-condensation heaters are energised, and retest prior to running.

Short Circuit Method

NOTE: This process should only be performed by a competent engineer familiar with safe operating practices within and around generator sets of the type in question.

Ensure the generator is safe to work on, initiate all mechanical and electrical safety procedures pertaining to the genset and the site.

Bolt a short circuit of adequate current carrying capacity, across the main terminals of the generator. The shorting link should be capable of taking full load current.

Disconnect the cables from terminals "X" and "XX" of the AVR.

Connect a variable dc supply to the "X" (positive) and "XX" (negative) field cables. The dc supply must be able to provide a current up to 2.0 Amp at 0 - 24 Volts.

Position a suitable ac ammeter to measure the shorting link current.

Set the dc supply voltage to zero and start the generating set. Slowly increase the dc voltage to pass current through the exciter field winding. As the excitation current increases, so the stator current in the shorting link will increase. This stator output current level must be monitored, and not allowed to exceed 80% of the generators rated output current.

After every 30 minutes of this exercise:

Stop the generator and switch off the separate excitation supply, and measure and record the stator winding IR values, and plot the results. The resulting graph should be compared with the classic shaped graph. This drying out procedure is complete when the parameters covered in the section entitled 'Typical Drying Out Curve' are met.

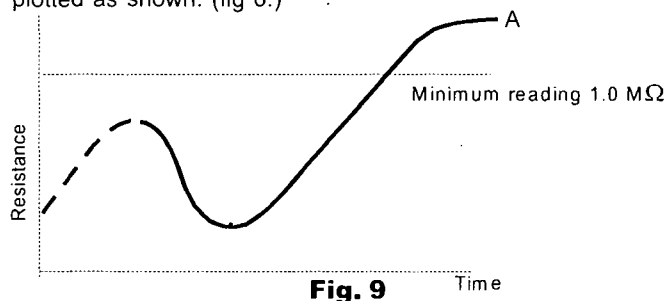
Once the Insulation Resistance is raised to an acceptable level - minimum value 1.0 MΩ – the dc supply may be removed and the exciter field leads "X" and "XX" re-connected to their terminals on the AVR.

Rebuild the genset, replace all covers and re-commission as appropriate.

If the set is not to be run immediately ensure that the anti-condensation heaters are energised, and retest the generator prior to running.

TYPICAL DRYING OUT CURVE

Whichever method is used to dry out the generator the resistance should be measured every half-hour and a curve plotted as shown. (fig 6.)



The illustration shows a typical curve for a machine that has absorbed a considerable amount of moisture. The curve indicates a temporary increase in resistance, a fall and then a gradual rise to a steady state. Point 'A', the steady state, must be greater than 1.0 MΩ. (If the windings are only slightly damp the dotted portion of the curve may not appear).

For general guidance expect that the typical time to reach point 'A' will be:

- 1 hour for a BC16/18,
- 2 hours for a UC22/27
- 3 hours for an HC4,5,6&7

Drying should be continued after point "A" has been reached for at least one hour.

It should be noted that as winding temperature increases, values of insulation resistance may significantly reduce. Therefore, the reference values for insulation resistance can only be established with windings at a temperature of approximately 20°C.

If the IR value remains below 1.0 MΩ, even after the above drying methods have been properly conducted, then a Polarisation Index test [PI] should be carried out.

If the minimum value of 1.0 MΩ for all components cannot be achieved rewinding or refurbishment of the generator will be necessary.

The generator must not be put into service until the minimum values can be achieved.

Important ! The short circuit must not be applied with the AVR connected in circuit. Current in excess of the rated generator current will cause damage to the windings.

After drying out, the insulation resistances should be rechecked to verify minimum resistances quoted above are achieved.

On re-testing it is recommended that the main stator insulation resistance is checked as follows:-

Separate the neutral leads

Ground	V and W	phase and megger	U phase to ground
Ground	U and W	phase and megger	V phase to ground
Ground	U and V	phase and megger	W phase to ground

If the minimum value of 1.0MΩ is not obtained, drying out must be continued and the test repeated.

7.2 BEARINGS

One of two bearing options will be fitted to generators covered by this manual.

Bearing Options		
RC/HCK/HCM	Regreasable*	Sealed for life*†
4	Not available	Standard
5	Optional	Standard
6	Optional	Standard
7	Standard	Not available

Table 5

*All bearings are supplied pre-packed with Kluber Asonic GHY 72 grease.

†Sealed for life bearings are fitted with integral seals and are not regreasable.

BEARING LIFE

Important ! The life of a bearing in service is subject to the working conditions and the environment.

Important ! High levels of vibration from the engine or misalignment of the set will stress the bearing and reduce its service life. If the vibration limits set out in BS 5000-3 and ISO 8528-9 are exceeded bearing life will be reduced. Refer to 'Vibration' below.

Important ! Long stationary periods in an environment where the generator is subject to vibration can cause false brinnelling, which puts flats on the ball and grooves on the races, leading to premature failure.

Important ! Very humid atmospheric or wet conditions can emulsify the grease causing corrosion and deterioration of the grease, leading to premature failure of the bearings.

HEALTH MONITORING OF THE BEARINGS

Newage recommends that the user checks the bearing condition, using monitoring equipment, to determine the state of the bearings. The 'best practice' is to take initial readings as a base line and periodically monitor the bearings to detect a deteriorating trend. It will then be possible to plan a bearing change at an appropriate generating set or engine service interval.

VIBRATION

Newage generators are designed to withstand the vibration levels encountered on generating sets built to meet the requirements of ISO 8528-9 and BS5000-3. (Where ISO 8528 is taken to be broad band measurements and BS5000 refers to the predominant frequency of any vibrations on the generating set.)

DEFINITION of BS5000 - 3

Generators shall be capable of continuously withstanding linear vibration levels with amplitudes of 0.25mm between 5Hz and 8Hz and velocities of 9.0mm/s rms between 8 Hz and 200 Hz when measured at any point directly on the carcass or main frame of the machine. These limits refer only to the predominant frequency of vibration of any complex waveform.

DEFINITION of ISO 8528 - 9

ISO 8528-9 refers to a broad band of frequencies, the broad band is taken to be between 2 Hertz and 300 Hertz. The table below is an example from ISO 8528 - 9 (value 1). This simplified table lists the vibration limits by kVA range and speed for acceptable genset operation.

VIBRATION LEVELS AS MEASURED ON THE GENERATOR				
Engine Speed Min -1	SET OUTPUT kVA	VIBRATION DISPLACEMENT mm (rms)	VIBRATION VELOCITY mm/s (rms)	VIBRATION ACCELERATION m/s ² (rms)
4 POLE 1500 rpm 50 Hz 1800 rpm 60 Hz	≤ 10 kVA	-	-	-
	> 10 but ≤ 50 Kva	0.64	40	25
	> 50 but ≤ 125 kVA	0.4	25	16
	> 125 but ≤ 250 kVA	0.4	25	16
	> 250 kVA	0.32	20	13
6 POLE 1000 rpm 50 Hz 1200 rpm 60 Hz	≥ 250 but ≤ 1250	0.32	20	13
	> 1250	0.29	18	11
The 'Broad band' is taken as 2 Hz - 300 Hz.				

Table 6

Important ! Exceeding either of the above specifications will have a detrimental effect on the life of the bearing. This will invalidate the generator warranty. If you are in any doubt, contact Newage International Limited.

If the vibration levels of the generating set are not within the parameters quoted above :-

1. Consult the genset builder. The genset builder should address the genset design to reduce the vibration levels as much as possible.
2. Discuss, with Newage, the impact of not meeting the above levels on both bearing and generator life expectancy.

Where requested, or deemed necessary, Newage will work with the genset builder in an attempt to find a satisfactory solution.

BEARING 'SERVICE LIFE' EXPECTANCY

Bearing manufacturers recognise that the "service life" of their bearings is dependent upon many factors that are not in their control, they cannot therefore quote a "service life".

Although "service life" cannot be guaranteed, it can be maximised by attention to the generating set design. An understanding of the genset application will also help the user to maximise the service life expectancy of the bearings. Particular attention should be paid to the alignment, reduction of vibration levels, environmental protection, maintenance and monitoring procedures.

Newage does not quote life expectancy figures for bearings, but suggests practicable replacement intervals based on the L10 life of the bearing, the grease and the recommendations of the bearing and grease manufacturers.

For general-purpose applications, providing the vibration levels do not exceed the levels stated in ISO 8528-9* and BS5000-3* and the ambient temperature does not exceed 50°C the following approximations can be applied when planning bearing replacements.

*(see section on vibration)

Sealed for Life Bearings. - Approximately 30,000 hours.

Re-greaseable bearings. - Approximately 40,000 hours.

(Provided the correct maintenance is carried out, and only Kluber Asonic GHY 72 grease is used in all bearings.)

It is important to note that bearings in service, under good operating conditions, can continue to run beyond the recommended replacement period. It should also be remembered that the risk of bearing failure increases with time.

If in doubt about any aspect of the 'bearing life' on generators supplied by Newage International, contact your nearest Newage subsidiary or contact the Stamford factory direct.

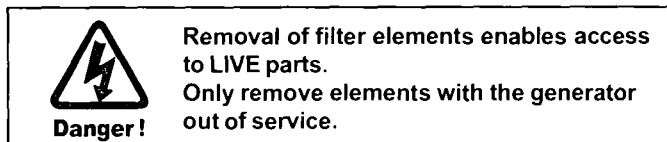
See the back cover for addresses.

7.3 AIR FILTERS

Air filters for the removal of airborne particulate matter (dust) are offered as an addition to the standard build option. Filters on Frame 6 and 7 need to be ordered with the generator but Frame 4 and 5 can have air filters fitted after the generator is built.

Air filters need to be changed with oil before the gen set is put to work (see 7.3.1).

The frequency of filter maintenance will depend upon the severity of the site conditions. Regular inspection of the elements will be required to establish when cleaning is necessary.



7.3.1 CLEANING PROCEDURE

Remove the filter elements from the filter frames. Immerse or flush the element with a suitable degreasing agent until the element is clean.

As an alternative procedure a high pressure water hose with a flat nozzle can be used. Sweep the water spray back and forth across the element from the clean side (fine mesh side of element) holding the nozzle firmly against the element surface. Cold water may be adequate depending upon type of contamination although hot water is preferable.

The element can be inspected for cleanliness by looking through the filter towards the light.

When thoroughly clean, no cloudy areas will be seen. Dry elements thoroughly before attempting to carry out the recharging procedure.

7.3.2 RECHARGING (CHARGING)

Charging is best done by totally immersing the dry element into a dip tank containing "Filterkote Type K" or commercial lubricating oil SAE 20/50. Oils of higher or lower viscosity are not recommended.

Allow elements to completely drain before refitting the elements into the frames and putting into service.

7.4 FAULT FINDING

Important ! Before commencing any fault finding procedures examine all wiring for broken or loose connections.

Four types of excitation control system, involving four types of AVR, can be fitted to the range of generators covered by this manual. The systems can be identified by a combination of AVR type, where applicable, and the last digit of the generator frame size designation. Refer to the generator nameplate then proceed to the appropriate subsection as indicated below:-

DIGIT	EXCITATION CONTROL	SUBSECTION
4	SX440 AVR	7.4.1
4	SX421 AVR	7.4.2
3	MX341 AVR	7.4.3
3	MX321 AVR	7.4.4

7.4.1 SX440 AVR - FAULT FINDING

No voltage build-up when starting set	<ol style="list-style-type: none"> 1. Check link K1-K2. 2. Check speed. 3. Check residual voltage. Refer to subsection 7.4.5. 4. Follow separate excitation test procedure to check generator and AVR. Refer to subsection 7.5.
Unstable voltage either on no-load or with load	<ol style="list-style-type: none"> 1. Check speed stability. 2. Check stability setting. Refer to subsection 4.6.
High voltage either on no-load or with load	<ol style="list-style-type: none"> 1. Check speed. 2. Check that generator load is not capacitive (leading power factor).
Low voltage no-load	<ol style="list-style-type: none"> 1. Check speed. 2. Check link 1-2 or external hand trimmer leads for continuity.
Low voltage on-load	<ol style="list-style-type: none"> 1. Check speed. 2. Check UFRO setting. Refer to subsection 4.7.1.1. 3. Follow separate excitation procedure to check generator and AVR. Refer to subsection 7.5.

Table 7

7.4.2 SX421 AVR - FAULT FINDING

No voltage build-up when starting set	<ol style="list-style-type: none"> 1. Check circuit breaker ON. Refer to subsection 6.4.1. 2. Check speed. 3. Check residual voltage. Refer to subsection 7.4.5. 4. Follow separate excitation test procedure to check generator and AVR. Refer to subsection 7.5.
Unstable voltage either on no-load or with load	<ol style="list-style-type: none"> 1. Check speed stability. 2. Check stability setting. Refer to subsection 4.6.
High voltage either on no-load or with load	<ol style="list-style-type: none"> 1. Check speed. 2. Check link 1-2 or external hand trimmer leads for continuity. Check continuity of leads 7-8 and P3-P2 for continuity. 3. Check that generator load is not capacitive (leading power factor).
Low voltage no-load	<ol style="list-style-type: none"> 1. Check speed. 2. Check link 1-2 or external hand trimmer leads for continuity.
Low voltage on-load	<ol style="list-style-type: none"> 1. Check speed. 2. Check UFRO setting. Refer to subsection 4.7.1.1. 3. Follow separate excitation procedure to check generator and AVR. Refer to subsection 7.5.
Excessive voltage/speed dip on load switching	<ol style="list-style-type: none"> 1. Check governor response. 2. Refer to generating set manual. Check 'DIP' setting. Refer to subsection 4.7.1.4.

Table 8

7.4.3 MX341 AVR - FAULT FINDING

No voltage build-up when starting set	<ol style="list-style-type: none"> 1. Check link K1-K2 on auxiliary terminals. 2. Follow Separate Excitation Test Procedure to check machine and AVR. Refer to subsection 7.5.
Loss of voltage when set running	<ol style="list-style-type: none"> 1. First stop and re-start set. If no voltage or voltage collapses after short time, follow Separate Excitation Test Procedure. Refer to subsection 7.5.
Generator voltage high followed by collapse	<ol style="list-style-type: none"> 1. Check sensing leads to AVR. 2. Refer to Separate Excitation Test Procedure. Refer to subsection 7.5.
Voltage unstable, either on no-load or with load	<ol style="list-style-type: none"> 1. Check speed stability. 2. Check "STAB" setting. Refer to Load Testing section for procedure. Refer to subsection 4.6.
Low voltage on-load	<ol style="list-style-type: none"> 1. Check speed. 2. If correct check "UFRO" setting. Refer to subsection 4.7.1.1.
Excessive voltage/speed dip on load switching	<ol style="list-style-type: none"> 1. Check governor response. Refer to generating set manual. Check "DIP" setting. Refer to subsection 4.7.1.4.
Sluggish recovery on load switching	<ol style="list-style-type: none"> 1. Check governor response. Refer to generating set manual.

Table 9

7.4.4 MX321 AVR - FAULT FINDING

No voltage build-up when starting set	<ol style="list-style-type: none"> 1. Check link K1-K2 on auxiliary terminals. Follow Separate Excitation Test Procedure to check machine and AVR. Refer to subsection 7.5.
Voltage very slow to build up	<ol style="list-style-type: none"> 1. Check setting of ramp potentiometer. Refer to 4.7.1.5
Loss of voltage when set running	<ol style="list-style-type: none"> 1. First stop and re-start set. If no voltage or voltage collapses after short time, follow Separate Excitation Test Procedure. Refer to subsection 7.5.
Generator voltage high followed by collapse	<ol style="list-style-type: none"> 1. Check sensing leads to AVR. 2. Refer to Separate Excitation Test Procedure. Refer to subsection 7.5.
Voltage unstable, either on no-load or with load	<ol style="list-style-type: none"> 1. Check speed stability. 2. Check "STAB" setting. Refer to Load Testing section for procedure. Refer to subsection 4.6.
Low voltage on-load	<ol style="list-style-type: none"> 1. Check speed. 2. If correct check "UFRO" setting. Refer to subsection 4.7.1.1.
Excessive voltage/speed dip on load switching	<ol style="list-style-type: none"> 1. Check governor response. Refer to generating set manual. Check "DIP" setting. Refer to subsection 4.7.1.4.
Sluggish recovery on load switching	<ol style="list-style-type: none"> 1. Check governor response. Refer to generating set manual. Check "DWELL" setting. Refer to Load Testing section 4.7.1.4.

Table 10

7.4.5 RESIDUAL VOLTAGE CHECK

This procedure is applicable to generators with either SX460 or SX440 or SX421 AVR.

With the generator set stationary remove AVR access cover and disconnect leads X and XX from the AVR.

Start the set and measure voltage across AVR terminals P2-P3 on SX440 or SX421 AVR.

Stop the set, and replace leads X and XX on the AVR terminals. If the measured voltage was above 5V the generator should operate normally.

If the measured voltage was under 5V follow the procedure below.

7.4.6 'REFLASHING' TO RESTORE RESIDUAL

Using a 12 volt dc battery as a supply clip leads from battery negative to AVR terminal XX, and from battery positive through a diode to AVR terminal X. See Fig. 7.

Important ! A diode must be used as shown below to ensure the AVR is not damaged.

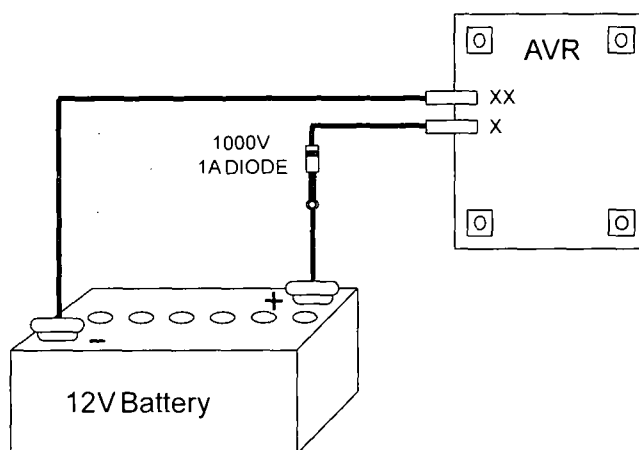


Fig. 7

Important ! If the generating set battery is used for field flashing, the generator main stator neutral must be disconnected from earth.

Restart the set and note output voltage from main stator, which should be approximately nominal voltage, or voltage at AVR terminals P2-P3 on SX440 or SX421 which should be between 170 and 250 volts.

Stop the set and unclip battery supply from terminals X and XX. Restart the set. The generator should now operate normally. If no voltage build-up is obtained it can be assumed a fault exists in either the generator or the AVR circuits. Follow the SEPARATE EXCITATION TEST PROCEDURE to check generator windings, rotating diodes and AVR. Refer to subsection 7.5.

7.5 SEPARATE EXCITATION TEST PROCEDURE

The generator windings, diode assembly and AVR can be checked using the appropriate following section.

7.5.1 GENERATOR WINDINGS, ROTATING DIODES and PERMANENT MAGNET GENERATOR (PMG)

7.5.2 EXCITATION CONTROL TEST.

7.5.1 GENERATOR WINDINGS, ROTATING DIODES and PERMANENT MAGNET GENERATOR (PMG)

Important ! The resistances quoted apply to a standard winding. For generators having windings or voltages other than those specified refer to factory for details. Ensure all disconnected leads are isolated and free from earth.

Important ! Incorrect speed setting will give proportional error in voltage output.

CHECKING PMG

Start the set and run at rated speed.

Measure the voltages at the AVR terminals P2, P3 and P4. These should be balanced and within the following ranges:-

50Hz generators - 170-180 volts

60Hz generators - 200-216 volts

Should the voltages be unbalanced stop the set, remove the PMG sheet metal cover from the non drive end bracket and disconnect the multipin plug in the PMG output leads. Check leads P2, P3, P4 for continuity. Check the PMG stator resistances between output leads. These should be balanced and within

+/-10% of 2.3 ohms. If resistances are unbalanced and/or incorrect the PMG stator must be replaced. If the voltages are balanced but low and the PMG stator winding resistances are correct - the PMG rotor must be replaced.

CHECKING GENERATOR WINDINGS AND ROTATING DIODES

This procedure is carried out with leads X and XX disconnected at the AVR or transformer control rectifier bridge and using a 12 volt d.c. supply to leads X and XX.

Start the set and run at rated speed.

Measure the voltages at the main output terminals U, V and W. If voltages are balanced and within +/-10% of the generator nominal voltage, refer to 7.5.1.1.

Check voltages at AVR terminals 6, 7 and 8. These should be balanced and between 170-250 volts.

If voltages at main terminals are balanced but voltage at 6, 7 and 8 are unbalanced, check continuity of leads 6, 7 and 8. Where an isolating transformer is fitted (MX321 AVR) check transformer windings. If faulty the transformer unit must be replaced.

If voltages are unbalanced, refer to 7.5.1.2.

7.5.1.1 BALANCED MAIN TERMINAL VOLTAGES

If all voltages are balanced within 1% at the main terminals, it can be assumed that all exciter windings, main windings and main rotating diodes are in good order, and the fault is in the AVR or transformer control. Refer to subsection 7.5.2 for test procedure.

If voltages are balanced but low, there is a fault in the main excitation windings or rotating diode assembly. Proceed as follows to identify:-

Rectifier Diodes

The diodes on the main rectifier assembly can be checked with a multimeter. The flexible leads connected to each diode should be disconnected at the terminal end, and the forward and reverse resistance checked. A healthy diode will indicate a very high resistance (infinity) in the reverse direction, and a low resistance in the forward direction. A faulty diode will give a full deflection reading in both directions with the test meter on the 10,000 ohms scale, or an infinity reading in both directions. On an electronic digital meter a healthy diode will give a low reading in one direction, and a high reading in the other.

Replacement of Faulty Diodes

The rectifier assembly is split into two plates, the positive and negative, and the main rotor is connected across these plates. Each plate carries 3 diodes, the negative plate carrying negative biased diodes and the positive plate carrying positive biased diodes. Care must be taken to ensure that the correct polarity diodes are fitted to each respective plate. When fitting the diodes to the plates they must be tight enough to ensure a good mechanical and electrical contact, but should not be overtightened. The recommended torque tightening is 4.06 - 4.74Nm (36-42lb in).

Surge Suppressor

The surge suppressor is a metal-oxide varistor connected across the two rectifier plates to prevent high transient reverse voltages in the field winding from damaging the diodes. This device is not polarised and will show a virtually infinite reading in both directions with an ordinary resistance meter. If defective this will be visible by inspection, since it will normally fail to short circuit and show signs of disintegration. Replace if faulty.

Main Excitation Windings

If after establishing and correcting any fault on the rectifier assembly the output is still low when separately excited, then the main rotor, exciter stator and exciter rotor winding resistances should be checked (see Resistance Charts), as the fault must be in one of these windings. The exciter stator resistance is measured across leads X and XX. The exciter rotor is connected to six studs which also carry the diode lead terminals. The main rotor winding is connected across the two rectifier plates. The respective leads must be disconnected before taking the readings.

Resistance values should be within +/-10% of the values given in the tables below:-

4 POLE GENERATORS			
FRAME SIZE	MAIN ROTOR	EXCITER STATOR	EXCITER ROTOR
4 - 4C	0.91	18	0.136
4 - 4D	1.04	18	0.136
4 - 4E	1.17	18	0.136
4 - 4F	1.35	18	0.136
5 - 4C	1.55	17	0.184
5 - 4D	1.77	17	0.184
5 - 4E	1.96	17	0.184
5 - 4F	2.16	17	0.184
6 - 4G	1.75	17	0.158
6 - 4H	1.88	17	0.158
6 - 4J	2.09	17	0.158
6 - 4K	2.36	17	0.158
7 - 4E	1.27	17	0.096
7 - 4F	1.41	17	0.096
7 - 4G	1.65	17	0.096
7 - 4H	1.77	17	0.096

Table 11

6 POLE GENERATORS			
FRAME SIZE	MAIN ROTOR	EXCITER STATOR	EXCITER ROTOR
6 - 6G	1.12	17	0.2
6 - 6H	1.33	17	0.2
6 - 6J	1.5	17	0.2
6 - 6K	1.75	17	0.2
7 - 6E	2.33	17	0.2
7 - 6F	2.83	17	0.2
7 - 6G	3.25	20	0.28

Table 12

7.5.1.2 UNBALANCED MAIN TERMINAL VOLTAGES

if voltages are unbalanced, this indicates a fault on the main stator winding or main cables to the circuit breaker. NOTE: Faults on the stator winding or cables may also cause noticeable load increase on the engine when excitation is applied. Disconnect the main cables and separate the winding leads U1-U2, (U5-U6), V1-V2, (V5-V6), W1-W2, (W5-W6) to isolate each winding section.

Note:- leads suffixed 5 and 6 apply to 12 wire windings only.

Measure each section resistance - values should be balanced and within +/-10% of the value given below:-

MAIN STATOR SECTION RESISTANCES				
4 POLE GENERATORS				
SECTION RESISTANCES				
FRAME SIZE	WINDING 311 1-2 OR 5-6	WINDING 12 1-2	WINDING 17 1-2 OR 5-6	WINDING 07 1-2
4 - 4C	0.0085	N/A	0.0115	N/A
4 - 4D	0.006	N/A	0.01	N/A
4 - 4E	0.0045	N/A	0.0075	N/A
4 - 4F	0.0037	N/A	0.0055	N/A
5 - 4C	0.0032	N/A	0.0053	N/A
5 - 4D	0.0024	N/A	0.004	N/A
5 - 4E	0.0022	N/A	0.0034	N/A
5 - 4F	0.0019	N/A	0.0025	N/A
6 - 4G	0.0017	0.0034	N/A	0.0055
6 - 4H	0.0013	0.0025	N/A	0.0036
6 - 4J	0.0011	0.0022	N/A	0.003
6 - 4K	0.0085	0.0017	N/A	0.0026
7 - 4E	N/A	0.0016	N/A	0.0026
7 - 4F	N/A	0.0013	N/A	0.002
7 - 4G	N/A	0.0009	N/A	0.0015
7 - 4H	N/A	0.0008	N/A	0.0011

Table 13

6 POLE GENERATORS				
SECTION RESISTANCES				
FRAME SIZE	WINDING 311 1-2 OR 5-6	WINDING 12 1-2	WINDING 17	WINDING 07 1-2
6 - 6G	0.0045	0.009	N/A	0.015
6 - 6H	0.0032	0.0063	N/A	0.01
6 - 6J	N/A	0.0049	N/A	0.007
6 - 6K	0.002	0.0039	N/A	0.006
7 - 6E	N/A	0.0027	N/A	0.0042
7 - 6F	N/A	0.0018	N/A	0.0032
7 - 6G	N/A	0.0014	N/A	0.002

Table 14

Measure insulation resistance between sections and each section to earth.

Unbalanced or incorrect winding resistances and/or low insulation resistances to earth indicate rewinding of the stator will be necessary. Refer to removal and replacement of component assemblies subsection 7.5.3.

7.5.2 EXCITATION CONTROL TEST

7.5.2.1 AVR FUNCTION TEST

All types of AVR's can be tested with this procedure:

1. Remove exciter field leads X & XX (F1 & F2) from the AVR terminals X & XX (F1 & F2).
2. Connect a 60W 240V household lamp to AVR terminals X & XX (F1 & F2).
3. Set the AVR VOLTS control potentiometer fully clockwise.
4. Connect a 12V, 1.0A DC supply to the exciter field leads X & XX (F1 & F2) with X (F1) to the positive.
5. Start the generating set and run at rated speed.
6. Check that the generator output voltage is within +/- 10% of rated voltage.

Voltages at AVR terminals 7-8 on SX460 AVR or P2-P3 on SX440 or SX421 AVR should be between 170 and 250 volts. If the generator output voltage is correct but the voltage on 7-8 (or P2-P3) is low, check auxiliary leads and connections to main terminals.

Voltages at P2, P3, P4 terminals on MX341 and MX321 should be as given in 7.5.1.

The lamp connected across X-XX should glow. In the case of the SX460, SX440 and SX421 AVRs the lamp should glow continuously. In the case of the MX341 and MX321 AVRs the lamp should glow for approximately 8 secs. and then turn off. Failure to turn off indicates faulty protection circuit and the AVR should be replaced. Turning the "VOLTS" control potentiometer fully anti-clockwise should turn off the lamp with all AVR types.

Should the lamp fail to light the AVR is faulty and should be replaced.

Important ! After this test turn VOLTS control potentiometer fully anti-clockwise.

7.5.3 REMOVAL AND REPLACEMENT OF COMPONENT ASSEMBLIES

METRIC THREADS ARE USED THROUGHOUT

Caution ! When lifting single bearing generators, care is needed to ensure the generator frame is kept in the horizontal plane. The rotor is free to move in the frame and can slide out if not correctly lifted. Incorrect lifting can cause serious injury to personnel.

7.5.3.1 ANTI-CONDENSATION HEATERS



Danger !

The external mains electricity supply used to power the anti-condensation heater must be switched off and safely isolated before attempting any work adjacent to the heater, or removal of the non drive end endbracket on which the anti-con heater is mounted. Ensure that the engine is inhibited prior to work in generator.

7.5.3.2 REMOVAL OF PERMANENT MAGNET GENERATOR (PMG)

1. Remove access cover.
2. Disconnect P2, P3, P4 at the multiway connector inside the access cover.

3. Remove the 4 screws and clamps retaining the stator housing (Frames 4, 5 and 6) or the stator pack (Frame 7).
4. Tap the stator pack or housing out of its spigot.

NOTE:

As the highly magnetic rotor will attract the stator core, care must be taken to avoid a contact which may damage the winding.

5. Remove the exciter rotor securing bolt and stow safely and firmly pull the complete rotor assembly from its location.

N.B. Keep the rotor clean and avoid contact with metal dust or particles - preferably place in plastic bag.

Important ! The rotor assembly must not be dismantled.

Re-assembly is a reversal of the above procedure having due regard for the notes below:-

1. Ensure rotor magnet assembly is free of metal pieces or particles.
2. Care is needed to avoid winding damage when re-assembling the stator pack, due to strong magnetic attraction.

7.5.3.3 REMOVAL OF BEARINGS

Important ! Position the main rotor so that a full pole face of the main rotor core is at the bottom. Remove PMG of the stator bore if fitted.

The generators in this manual will be fitted with one of three different bearing arrangements. There may be two different arrangements on a two-bearing generator. (See table 14 & 15)

BEARING OPTIONS FOR DRIVE-END BEARINGS				
	HC4	HC5	HC6	HC7
Regreasable bearings	N/A	OPT	OPT	STD
Sealed for life with a cartridge	STD	STD	STD	N/A
Sealed for life without cartridge	N/A	N/A	N/A	N/A

Table 15

BEARING OPTIONS FOR NON DRIVE-END BEARINGS				
	HC4	HC5	HC6	HC7
Regreasable bearings	N/A	OPT	OPT	STD
Sealed for life with a cartridge	NA	NA	STD	N/A
Sealed for life without cartridge	STD	STD	N/A	N/A

Table 16

Removal of the bearings may be effected either after the rotor assembly has been removed or more simply by removal of endbracket(s).

Be sure to note the location of all components during removal to assist during the assembly process.

BEARING REPLACEMENT

Environment

Every effort must be made to establish a clean area around the generator when removing and replacing bearings. Contamination is a major cause of bearing failures.

Equipment

Suitable cleaning solvent
Bearing puller, two or three leg
Thin protective gloves
Lint free cleaning cloth
Induction heater.

Preparation

Remove PMG if fitted
Remove the lubrication pipework if fitted
Position the rotor so that the full pole face of the main rotor is at the bottom of the stator bore.
Remove the end bracket, see 7.5.3.4 for procedure.

NOTES:

- It is not necessary to remove the rotor.
- Ensure that the bearing contact surfaces shows no sign of wear or corrosion prior to fitting the bearing.
- Never refit used bearings, wave washers or 'O'rings.
- Never refit used bearings, grease flingers, wave washer or 'O' rings.
- Only the outer race should be used to transmit load during assembly (NEVER use the inner race).

REMOVAL OF REGREASABLE BEARINGS

The bearings are a press fit on the shaft and can be removed with standard tooling, i.e. 2 or 3 legged manual or hydraulic bearing pullers.

To remove bearings proceed as follows:

1. Remove 4 screws holding bearing cap.
2. Remove cap.
3. Non drive end - remove wave washer and circlip (single bearing only).
4. Remove bearing cartridge housing complete with bearing (and grease flinger if fitted).
5. Remove bearing from cartridge.
6. Discard the old bearing 'O' rings and wave washer where fitted.

The bearing cap(s) and cartridge(s) must be thoroughly flushed out with clean solvent and checked for wear or damage, before re-assembly. Damaged components should be replaced before refitting the bearing.

ASSEMBLY OF REGREASABLE BEARINGS

NOTE: Gloves must be worn at all times when handling the bearings, grease and solvent.

1. Wipe clean the assembly surface, using cleaning solvent on lint free cloth.
2. Wipe clean: Bearing Cartridge, Wave Washer, Bearing Cap, grease flinger, all re-lubrication pipes and fittings (internal and external). Visually inspect all components after cleaning, for contamination.
3. Place all components on the clean assembly surface. Do not use an air line to blow off excess fluid.
4. Thoroughly clean the external surface of the grease gun nozzle using lint free cloth.

Bearing preparation

1. Remove the bearing from its packaging.
2. Wipe off the preservative oil from the surface of the inner and outer rings - using lint free cloth only.
3. Place the bearing on the clean assembly surface, with the bearing designation marking facing down.

Bearing Assembly (Lubrication, see TABLE 17)

Cartridge:

1. Apply the specified cartridge grease fill quantity to the back face of the bearing housing.
2. Apply a small amount of grease to the grooved sealing surface in the cartridge.
3. Apply anti-fretting lubricant (MP14002 - Klüber Altemp Q NB 50) to the bearing housing circumference. Apply paste in a thin coherent layer by use of a lint free cloth (DO NOT rub in) (use clean protective gloves).
4. Non-drive end - fit new 'O' Rings into the 'O' Ring grooves in the bearing housing circumference.

Bearing:

1. Apply half the specified bearing grease fill quantity (see table 16) to the upper face of the bearing (opposite side to the bearing designation markings).
2. Thumb the applied grease into the bearing, ensuring good penetration into the raceways/balls (use clean protective gloves).

Assemble Bearing into Cartridge

1. Heat the bearing cartridge to 25° C above ambient with an induction heater (Do not exceed 100°C).
2. With greased face of the bearing facing the cartridge bore, assemble the bearing into the bearing housing. Ensure the bearing outer race contacts the location shoulder.

Assemble Bearing onto Shaft

Bearing Cartridge

1. Heat the Bearing and Cartridge assembly to 80°C above ambient with an induction heater.
(use induction heater, no other heat source is suitable)
2. Slide the Bearing and Cartridge assembly over the shaft, pushing it firmly against the bearing seating shoulder.
3. Rotate the assembly (including inner race) 45° in either direction, to provide correct alignment. The bearing must be held firmly in place until it is cool enough to positively self locate.

NOTE: Ensure cartridge is at ambient temp. before assembling bracket.

Cap/Flinger:

Apply the specified cap grease fill quantity to the inside face of the cap (see table 16).

1. Fill the grease exhaust slot with grease.
2. Apply a small amount of grease to the grooved sealing surface in the cap.
3. Fit circlip.
(single bearing only).
4. Heat flinger to 120°C and place on shaft up to the bearing inner race. Hold firmly until positively located.
5. Place wave washer in cap, fit cap to bearing cartridge.

Re-lubrication pipe:

1. Fill pipe and grease nipple with grease.
2. Fit pipe work to machine.

INITIAL LUBRICATION DETAILS, REGREASEABLE BEARINGS							
FRAME	BEARING POSITION	GREASE QUANTITY					
		BEARINGS		CARTRIDGE		CAP	
		CM ³	GRAMS	CM ³	GRAMS	CM ³	GRAMS
5	Non-Drive End	65	58	33	29	33	29
5	Drive End	92	82	46	41	46	41
6	Non-Drive End	121	111	63	56	63	56
6	Drive End	156	139	78	69	78	69
7	Non-Drive End	174	154	87	77	87	77
7	Drive End	208	185	104	92	104	92

Lubricant: Kluber Asonic GHY 72

Table 17

REMOVAL OF GREASED FOR LIFE BEARINGS WITH BEARING CARTRIDGE

The bearings are a press fit on the shaft and can be removed with standard tooling, i.e. 2 or 3 legged manual or hydraulic bearing pullers.

To remove bearings proceed as follows:

1. Remove 4 screws holding bearing cap.
2. Remove cap.
3. Non drive end - remove wave washer and circlip (single bearing only).
4. Remove bearing cartridge housing complete with bearing.
5. Remove bearing from cartridge.
6. Discard the old bearing, 'o' rings and wave washer where fitted.

The bearing cap(s) and cartridge(s) must be thoroughly flushed out with clean solvent and checked for wear or damage, before re-assembly. Damaged components should be replaced before refitting the bearing.

ASSEMBLY OF SEALED FOR LIFE BEARINGS WITH CARTRIDGE

Pre-assembly cleaning.

NOTE: Gloves must be worn at all times when handling the bearings, grease and solvent.

1. Wipe clean the assembly surface, using cleaning solvent on lint free cloth.
2. Wipe clean: Bearing Cartridge and Bearing Cap (internal and external). Visually inspect all components after cleaning, for contamination.
3. Place all components on a clean assembly surface. Do not use an air line to blow off excess fluid.
4. Thoroughly clean the external surface of the grease gun nozzle using lint free cloth.

Bearing preparation:

1. Remove the bearing from its packaging.
2. Wipe off the preservative oil from the surface of the inner and outer rings - using lint free cloth only.
3. Place the bearing on the clean assembly surface, with the bearing designation marking facing down.

Bearing Assembly

Cartridge:

1. Apply anti-fretting lubricant (**MP14002 - Klüber Altemp Q NB 50**) to the bearing housing circumference. Apply paste in a thin coherent layer by use of a lint free cloth (**DO NOT rub in**) (use clean protective gloves).
2. Fit 'O' Rings into the 'O' Ring grooves in the bearing housing circumference.

Assemble Bearing into Cartridge

1. Heat the bearing cartridge to 25° C above the ambient temperature (with an induction heater, do not exceed 100°C) and assemble the new bearing into the cartridge. Ensure that the bearing designation is visible after assembly.
2. With greased face of the bearing facing the cartridge bore, assemble the bearing into the bearing housing. Ensure the bearing outer race contacts the location shoulder.

NOTE: Only the outer race should be used to transmit load during assembly (NEVER use the inner race).

Assemble Bearing and Cartridge onto the Shaft

1. Heat the Bearing and Cartridge assembly to 80°C above ambient.
(use induction heater, no other heat source is suitable)
2. Slide the Bearing and Cartridge assembly over the shaft, pushing it firmly against the bearing seating shoulder.
3. Rotate the assembly (including inner race) 45° in either direction, to provide correct alignment. The bearing must be held firmly in place until it is cool enough to positively self locate.
4. Non drive end only - fit circlip (single bearing only) and wave washer.
5. Fit the bearing cap.
6. Rotate the bearing assembly on the shaft to check for free movement.

Note: Ensure cartridge is at ambient temp. before assembling bracket.

7. Refit the end bracket and PMG where fitted.

SEALED FOR LIFE BEARINGS (WITHOUT CARTRIDGE)

NOTE: Prior to commencement of removal of end bracket ensure rotor is positioned with full pole face at the bottom of the stator bore.

Preparation

1. Remove terminal box lid.
2. Cut cable ties and disconnect exciter leads.
3. Remove bolts from NDE terminal panel and place panel over terminal board with AVR still connected.
4. Remove Permanent Magnet Generator (if fitted) see 7.5.3.2.
5. Remove the rotor retaining circlip (Non drive end - single bearing only) and slack off remaining NDE bracket bolts.
6. Fit 2 off M10x60mm bolts into jacking locations on centre line and replace 2 bolts into end bracket for support as end bracket is removed (be aware of exciter lead and PMG lead, if fitted).
7. If alternator not connected to engine be aware of rotor pulling through stator, to avoid this, place wooden spacer between fan and frame each side at drive end.
8. Use available lifting equipment to remove the bracket.
9. Remove bearing circlip (Non drive end - single bearing only).

BEARING REMOVAL

1. Fit pulley drawers and draw off bearing, ensuring to protect the threaded hole in the end of the main shaft.
2. Heat the Bearing to 80°C above ambient with an induction heater and fit to shaft. (use induction heater, no other heat source is suitable do not exceed 100°C) (ensure shaft and bearing are clean prior to assembly)
3. Replace the bearing circlip (single bearing only).

Replace the Endbracket

1. Remove jacking bolts from end bracket and lift end bracket into position and fit bracket onto bearing (heat bracket if required). Ensure exciter and PMG leads are pulled through and positioned.
2. Lift rotor to align exciter (use piece of wood as lever under shaft through NDE aperture) fit bolts and secure evenly around end bracket to ensure it is correctly aligned.
3. Replace rotor retaining circlip and permanent magnet assembly if fitted, and replace cover.
4. Connect exciter and re-tie all cables into position and re-assemble terminal box.

NOTE: Prior to re-fitting end bracket check exciter electrically and physically to ensure no damaged caused when dismantling.

7.5.3.4 MAIN ROTOR ASSEMBLY

SINGLE BEARING MACHINE

NOTE: On single bearing machines, before removal from, or re-assembly to the prime mover, position the rotor, if possible, such that a full pole face is at bottom dead centre.

1. Remove all access covers and terminal box lid.
2. Disconnect exciter leads X and XX and PMG leads P2-P3-P4 at the auxiliary terminals inside the terminal box.
3. Ensure that these leads are free to come away with the non drive endbracket when removed.
4. Remove the 8 bolts holding the drive end adaptor to the frame.
5. With a rope sling around drive end adaptor, tap adaptor out of its spigot location; guide over fan and remove.
6. If the generator is fitted with a cartridge. Remove the 4 bolts retaining the non drive end bearing cartridge in the non drive end endbracket (outer 4 bolts). (This includes all regreasable options).
7. Remove the 8 bolts securing the non drive end bracket to the frame.
8. Supporting the non drive end bracket with a hoist, insert two M10 bolts in the two holes provided for 'jacking' purposes (on the end bracket horizontal centre line). Screw in the bolts until the end bracket spigot is clear of the locating recess, lower the whole assembly until the main rotor is resting in the stator bore. Still supporting the non drive end bracket, tap the bracket off the non drive end bearing cartridge (taking care that the exciter stator does not foul exciter rotor windings) and remove.
9. To withdraw the rotor from the stator the rotor must be supported by a rope at the drive end and eased out of the stator core until half the main rotor is protruding out of the stator. At this point it is safe to release the weight from the rope sling.
10. Tightly bind a rope sling around the rotor core, and supporting the non drive end of the rotor, guide it clear of the stator.



Warning !

The rope sling may not be at the centre of gravity of the rotor and guidance at the ends of the rotor is essential. THE FULL WEIGHT OF THE ROTOR GIVEN IN THE TABLE BELOW MUST BE SUPPORTED BY THE CRANE AND SLING. If the rotor core is allowed to drop more than a few millimetres at this point, it will make contact with the stator windings and may damage them.

MINIMUM ROTOR ASSEMBLY WEIGHTS

FRAME	WEIGHT
4 - 4 pole	473 kgs
5 - 4 pole	685 kgs
6 - 4 pole	1093 kgs
6 - 6 pole	1050 kgs
7 - 4 pole	1592 kgs
7 - 6 pole	1790 kgs

Re-assembly is a reversal of the above procedure.

Before assembly of a single bearing rotor into stator housing check that the drive discs are not damaged or cracked or showing any other signs of fatigue. Also check that holes in the discs for drive fixing screws are not elongated.

Damaged components must be replaced.

When refitting discs ensure that the number and thickness of discs, and the tightening torque of hub bolts is in accordance with the table below.

Refer to engine manual for torque setting of disc to flywheel bolts.

FRAME	NO. OF DISCS	SINGLE DISC THICKNESS	TOTAL THICKNESS	TIGHTENING TORQUE
4	4	1.2	4.8	48kgm
				479Nm
5	4	1.2	4.8	48kgm
				479Nm
6	6	1.2	7.2	84kgm
				822Nm
7	6	1.2	7.2	84kgm
				822Nm

Table 18

TWO BEARING MACHINES

NOTE:

Position rotor, if possible, such that a full pole face is at bottom dead centre.

The procedure for removal of a two bearing rotor is similar to that outlined for single bearing machines with the exception of Steps 4 and 5 relating to the drive end adaptor.

For removal of this item proceed as follows:-

1. Remove the 8 bolts holding drive end adaptor to frame and 4 bolts retaining bearing cartridge in drive end bracket (outer 4 bolts), if fitted.
2. With rope sling around the shaft extension, supporting the rotor weight tap the drive end bracket spigot out of its locating recess and lower rotor assembly to rest in the stator bore.
3. Take the weight of the drive end bracket on the sling and tap the bracket off the drive end bearing cartridge, guide over the fan and remove.

Re-assembly is a reversal of the above procedure.

7.6 RETURNING TO SERVICE

After rectification of any faults found, remove all test connections and reconnect all control system leads.

Restart the set and adjust VOLTS control potentiometer on AVR by slowly turning clockwise until rated voltage is obtained.

Refit all terminal box covers/access covers and reconnect heater supply.

Caution ! Failure to refit all guards, access covers and terminal box covers can result in personal injury or death.

7.7 MAINTENANCE

Re-lubrication

1. Ensure grease gun nozzle and re-lubrication nipple are free from contaminants or abrasive material.
2. Apply the specified re-lubrication grease fill quantity (see table below) via the grease nipple.
3. Run the machine for 10 minutes to allow excess grease to exhaust.

Check inside the non-drive end PMG cover for expelled grease. Clean out as necessary.

RELUBRICATION DETAILS FOR REGREASABLE BEARINGS				
HC/HCK	BEARING POSITION	GREASE QUANTITY		RELUBRICATION PERIOD
		CM3	GRAMS	
5	Non-DriveEnd	33	29	4,500 Hrs
5	Drive End	46	41	4,500 Hrs
6	Non-Drive End	60	53	4,500 Hrs
6	Drive End	75	66	4,500 Hrs
7	Non-Drive End	85	75	4,500 Hrs
7	Drive End	100	89	4,500 Hrs

Table 19

SECTION 8

SPARES AND AFTER SALES SERVICE

8.1 RECOMMENDED SPARES

Service parts are conveniently packaged for easy identification. Genuine parts may be recognised by the Nupart name.

We recommend the following for Service and Maintenance. In critical applications a set of these service spares should be held with the generator.

1. **Diode Set (6 diodes with Surge Suppressors)**
 HC4/5 RSK5001
 HC6/7 RSK6001

2. **SX440 AVR** E000-24030
SX421 AVR E000-24210
MX321 AVR E000-23212
MX341 AVR E000-23412

3. **Bearings**

PART NUMBERS NON DRIVE-END BEARINGS				
	HC4	HC5	HC6	HC7
Regreasable bearings	N/A	OPT 051-01068	OPT 051-01065	STD 051-01063
Sealed for life with a cartridge	N/A	OPT 051-01068	STD 051-01070	N/A
Sealed for life without cartridge	STD 051-01072	STD 051-01072	N/A	N/A

Table 20

PART NUMBERS FOR DRIVE-END BEARINGS				
	HC4	HC5	HC6	HC7
Regreasable bearings	N/A	OPT 051-01067	OPT 051-01064	STD 051-01062
Sealed for life with a cartridge	STD 051-01070	STD 051-01071	STD 051-01069	N/A
Sealed for life without cartridge	N/A	N/A	N/A	N/A

Table 21

When ordering parts the machine serial number or machine identity number and type should be quoted, together with the part description. For location of these numbers see paragraph 1.3.

Orders and enquiries for parts should be addressed to:

Newage International Ltd.,
 Nupart Department,
 P O Box 17, Barnack Road,
 Stamford,
 Lincolnshire
 PE9 2NB
 England.

Telephone: 44 (0) 1780 484000
 Fax: 44 (0) 1780 766074

Website: www.newagestamford.com

or any of our subsidiary companies listed on the back cover.

8.2 AFTER SALES SERVICE

A full technical advice and on-site service facility is available from our Service Department at Stamford or through our subsidiary companies. A repair facility is also available at our Stamford Works.

This manual is available in the following languages on request:
English, French, German, Italian and Spanish.

Denne manual er til rådighed på følgende sprog: engelsk, fransk, tysk, italiensk og spansk.

Denne håndboken er tilgjengelig på de følgende språkene: engelsk, fransk, tysk, italiensk og spansk.

Sur simple demande, ce manuel vous sera fourni dans l'une des langues suivantes: anglais, français, allemand, italien, espagnol.

Dieses Handbuch ist auf Anfrage in den folgenden Sprachen erhältlich: Englisch, Französisch, Deutsch, Italienisch, Spanisch.

Deze handleiding is op verzoek leverbaar in de volgende talen: Engels, Frans, Duits, Italiaans, Spaans.

Este manual pode também ser obtido nas seguintes línguas: inglês, francês, alemão, italiano e espanhol.

Tämä käsikirja on saatavissa pyynnöstä seuraavilla kielillä: Englanti, ranska, saksa, italia, espanja.

Il presente manuale è disponibile, su richiesta, nelle seguenti lingue: inglese, francese, tedesco, italiano e spagnolo.

Este manual también puede solicitarse en los siguientes idiomas: inglés, francés, alemán, italiano e español.

Αυτό το εγχειρίδιο οδηγιών χρήσεως διατίθεται στις ακόλουθες γλώσσες κατόπιν αιτήσεων: Αγγλικά, Γαλλικά, Γερμανικά, Ιταλικά, Ισπανικά.

A.C. GENERATOR WARRANTY

WARRANTY PERIOD

A.C. Generators

In respect of a.c. generators the Warranty Period is eighteen months from the date when the goods have been notified as ready for despatch by N.I. or twelve months from the date of first commissioning (whichever is the shorter period).

DEFECTS AFTER DELIVERY

We will make good by repair or, at our option, by the supply of a replacement, any fault which under proper use appears in the goods within the period specified above, and is found on examination by us to be solely due to defective material and workmanship; provided that the defective part is promptly returned, carriage paid, with all identification numbers and marks intact, to our works or, if appropriate to the Dealer who supplied the goods.

Any part repaired or replaced, under warranty, will be returned by N.I. free of charge (via sea freight if outside the UK).

We shall not be liable for any expenses which may be incurred in removing or replacing any part sent to us for inspection or in fitting any replacement supplied by us. We shall be under no liability for defects in any goods which have not been properly installed in accordance with N.I. recommended installation practices as detailed in the publications 'N.I. Installation, Service and Maintenance Manual' and 'N.I. Application Guidelines', or which have been improperly stored or which have been repaired, adjusted or altered by any person except ourselves or our authorised agents, or in any second-hand goods, proprietary articles or goods not of our own manufacture although supplied by us, such articles and goods being covered by the warranty (if any) given by the separate manufacturers.

Any claim under this clause must contain fully particulars of the alleged defect, the description of the goods, the date of purchase, and the name and address of the Vendor, the Serial Number (as shown on the manufacturers identification plate) or for Spares the order reference under which the goods were supplied.

Our judgement in all cases of claims shall be final and conclusive and the claimant shall accept our decision on all questions as to defects and the exchange of a part or parts.

Our liability shall be fully discharged by either repair or replacement as above, and in any event shall not exceed the current list price of the defective goods.

Our liability under this clause shall be in lieu of any warranty or condition implied by law as to the quality or fitness for any particular purpose of the goods, and save as expressly provided in this clause we shall not be under any liability, whether in contract, tort or otherwise, in respect of defects in goods delivered or for any injury, damages or loss resulting from such defects or from any work undone in connection therewith.

MACHINE SERIAL NUMBER

NEWAGE INTERNATIONAL LIMITED

REGISTERED OFFICE AND ADDRESS:

PO BOX 17
BARNACK ROAD
STAMFORD
LINCOLNSHIRE
PE9 2NB ENGLAND

Telephone: 44 (0) 1780 484000

Fax: 44 (0) 1780 484100

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SUBSIDIARY COMPANIES



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PO Box 6027, Baulkham Hills Business Centre,
Baulkham Hills NSW 2153.
Telephone: Sydney (61) 2 9680 2299
Fax: (61) 2 9680 1545

2 CHINA: WUXI NEWAGE ALTERNATORS LIMITED
Plot 49-A, Xiang Jiang Road
Wuxi High - Technical Industrial Dev. Zone
Wuxi, Jiangsu 214028
PR of China
Tel: (86) 510 5216212
Fax: (86) 510 5217673

3 GERMANY: NEWAGE ENGINEERS G.m.b.H.
Rotenbrückenweg 14, D-22113 Hamburg.
Telephone: Hamburg (49) 40 714 8750
Fax: (49) 40 714 87520

4 INDIA: C.G. NEWAGE ELECTRICAL LIMITED
C33 Midc, Ahmednagar 414111, Maharashtra.
Telephone: (91) 241 778224
Fax: (91) 241 777494

5 ITALY: NEWAGE ITALIA S.r.l.
Via Triboniano, 20156 Milan.
Telephone: Milan (39) 02 380 00714
Fax: (39) 02 380 03664

6 JAPAN: NEWAGE INTERNATIONAL JAPAN
8 - 5 - 302 Kashima
Hachioji-shi
Tokyo, 192-03
Telephone: (81) 426 77 2881
Fax: (81) 426 77 2884

7 NORWAY: NEWAGE NORGE A/S
Økern Naeringspark, Kabeigt. 5
Postboks 28, Økern, 0508 Oslo
Telephone: Oslo (47) 22 97 44 44
Fax: (47) 22 97 44 45

8 SINGAPORE: NEWAGE ASIA PACIFIC PTE LIMITED
10 Toh Guan Road #05-03
TT International Tradepark
Singapore 608838
Telephone: Singapore (65) 794 3730
Fax: (65) 898 9065
Telex: RS 33404 NEWAGE

9 SPAIN: STAMFORD IBERICA S.A.
Ctra. Fuenlabrada-Humanes, km.2
Poligono Industrial "Los Linares"
C/Pico de Almanzor, 2
E-28970 HUMANES DE MADRID (Madrid)
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Fax: (34) 91 604 81 66

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Fax: (1) 800 863 9243

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Printed in England.

John Deere Cool-Gard[®]
is more than just...

an antifreeze/summer coolant

John Deere Cool-Gard gives you the ultimate

ARE YOU USING THE RIGHT ANTIFREEZE/ SUMMER COOLANT FOR YOUR EQUIPMENT?

Not if you haven't matched the right product to the performance demands of your equipment! Heavy-duty engine cooling systems need special care and protection year-round. Unfortunately, many owners don't service their equipment's cooling systems regularly. Or if they do, they may believe that any automotive antifreeze or summer coolant will do the job.

But that's not true! While most antifreeze/coolants will prevent freeze-up or boil-over, they don't perform adequately in heavy-duty machines. They can't provide the balanced protection your cooling system needs to operate efficiently under extreme pressures and temperatures, and with high volumes of flowing engine coolant. The right engine coolant will protect internal surfaces and components, as well as provide freeze protection and heat transfer properties. Water only is never recommended.

WHY CHOOSE JOHN DEERE COOL-GARD OVER OTHER PRODUCTS

John Deere has specifically engineered a fully formulated, heavy-duty antifreeze/summer coolant to match the performance requirements of our equipment. This is the same antifreeze used in new John Deere machines. **In fact, our engineers highly recommend it for use in all heavy-duty and light-duty diesel and gasoline engines, including automobiles.**

John Deere Cool-Gard is available in two forms — **concentrate**, which must be mixed with water for proper freeze protection, and **pre-mix (ready to use)**, which contains 50 percent demineralized water and has a freeze point of -34° F. (-37° C). Both contain coolant conditioner, anti-corrosion additives, and anti-foaming agents to guard against liner pitting, rust, corrosion, and scaling, and both have a service life of 5 years/5,000 hours.

John Deere Cool-Gard is available in a variety of sizes:

CONCENTRATE:

1-gal. (TY16034) and
55-gal. (TY16035)
330-gal. (TY24503)

PRE-DILUTED:

2½-gal. (TY16036) and
55-gal. (TY16037)
330-gal. (TY24504)



WHAT COULD HAPPEN IF YOU DON'T USE JOHN DEERE COOL-GARD?

Using a low-quality, "bargain" product in your John Deere equipment is risky. Here are some problems that can occur from using a lower grade or automotive type antifreeze.



Rust and corrosion.



Leaking pumps and water pump failures.



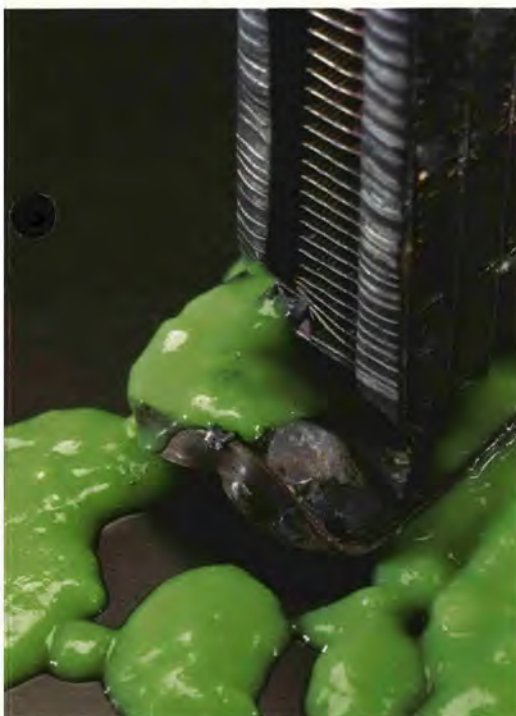
Pitted liner or cavitation erosion.

360° protection for your cooling system!

Using John Deere Cool-Gard can help eliminate the problems shown. In fact, we conducted extensive tests to ensure our product is the right match for your equipment's performance demands.



Plugged radiators, and solder bloom.

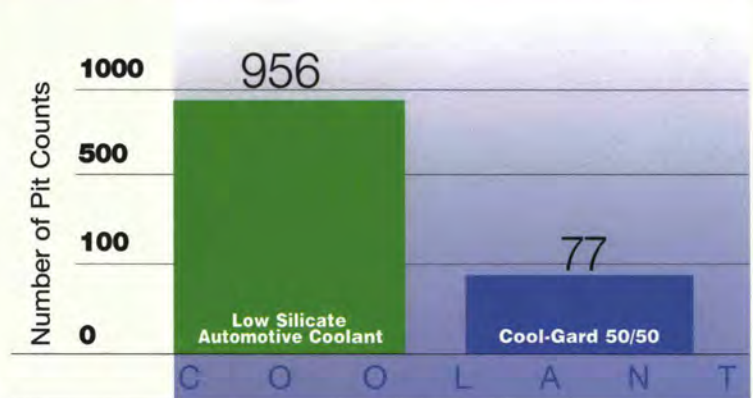


Gelling.

HOW DOES JOHN DEERE COOL-GARD COMPARE?

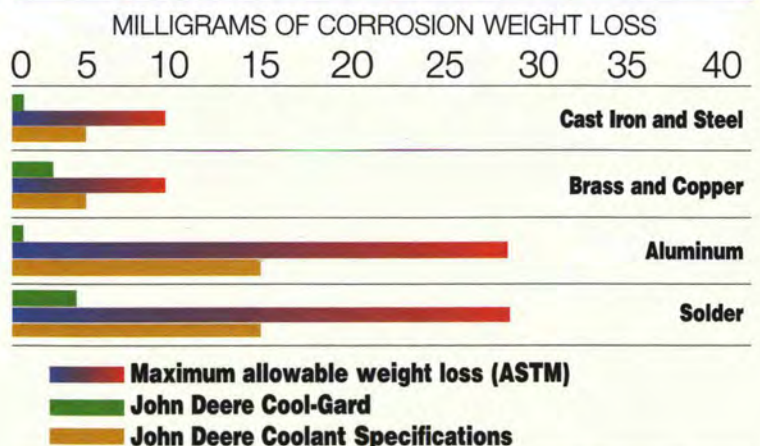
Following are the results of an accelerated heavy-duty engine cavitation test developed by John Deere engineers. This test evaluates the capability of an engine coolant to resist cylinder liner cavitation damage (cavitation is caused by collapsing bubbles within the coolant). The graph below shows the results of a test comparing automotive coolant to Cool-Gard.

CAVITATION DAMAGE



The next chart indicates how well John Deere Cool-Gard protects internal metal parts. Results show the amount of corrosion of different metals in a cooling system, and are based on the weight (in milligrams) of metal loss. (For example: the weight loss for iron and steel would relate to liner and block internal corrosion and scaling.)

CORROSION DAMAGE



The chart above illustrates how John Deere Cool-Gard performs compared to minimum ASTM (American Society of Testing and Materials) standards for engine coolants, which is what many low-cost, low silicate antifreezes meet.

John Deere also conducts extensive field tests. The following pictures clearly show that John Deere's Cool-Gard outperformed its competitors. The pictures also show the results of what happens when water only is used in a cooling system.

After 1500 hours of operation, the liner from the engine protected by John Deere Cool-Gard showed no damage. The liners protected by competitive coolants, or by water only, showed extensive pitting and corrosion.



John Deere Cool-Gard



Competitor "A"



Competitor "B"



Water Only

HOW DOES JOHN DEERE COOL-GARD BENEFIT YOU

- Cool-Gard exceeds all John Deere performance specifications and ASTM requirements. That means it provides the ultimate protection for heavy-duty cooling systems.
- We highly recommend it for use in all heavy-duty and light-duty diesel and gasoline engines, including aluminum engines.
- Has a five-year or 5,000-hour service life in both concentrate and 50/50 pre-mix form, provided service interval maintenance recommendations are followed.

John Deere's formulation includes a balanced blend of ingredients to protect all components.

- Balanced ingredients protect the system from scale deposits and corrosion, extend water pump seal life, and reduce internal pump erosion.
- Special anti-foaming agents enhance heat transfer ability, reduce coolant pump damage and oxidation, and extend corrosion inhibitor life.

John Deere Cool-Gard is a fully-formulated coolant.

- The correct concentration of coolant conditioner is in the system. Note: Always top up with John Deere Cool-Gard Pre-mix 50/50.
- There is no need to add coolant conditioner or supplemental coolant additives at initial fill, or when you refill your system. However, because all engine coolant loses its potency over time, we suggest testing coolant at recommended service intervals or annually using the John Deere Coolant Test Kit (TY16175) or the Coolskan Kit (DSO251) to extend drain intervals. John Deere Liquid Coolant Conditioner should be added when indicated. If your Deere engine cooling systems currently use John Deere Cool-Gard, and if you don't test, we recommend John Deere Liquid Coolant Conditioner at annual service intervals.



JOHN DEERE COOLANT CONDITIONER

John Deere Coolant Conditioner provides excellent protection from liner pitting, scaling, corrosion, and gelling. It is excellent for use in all engine cooling systems requiring a coolant conditioner (supplemental coolant additive).

SPECIAL NOTE: You should always be sure to follow the instructions and recommendations listed in your operator's manual for correct concentrations and service intervals.



John Deere Liquid Coolant Conditioner is available in 16-oz. (TY16004) and 1/2 gal. (TY16005) containers.

Use the best solution for ultimate year-round protection...

JOHN DEERE ANTIFREEZE/SUMMER COOLANT



JOHN DEERE

900-01335

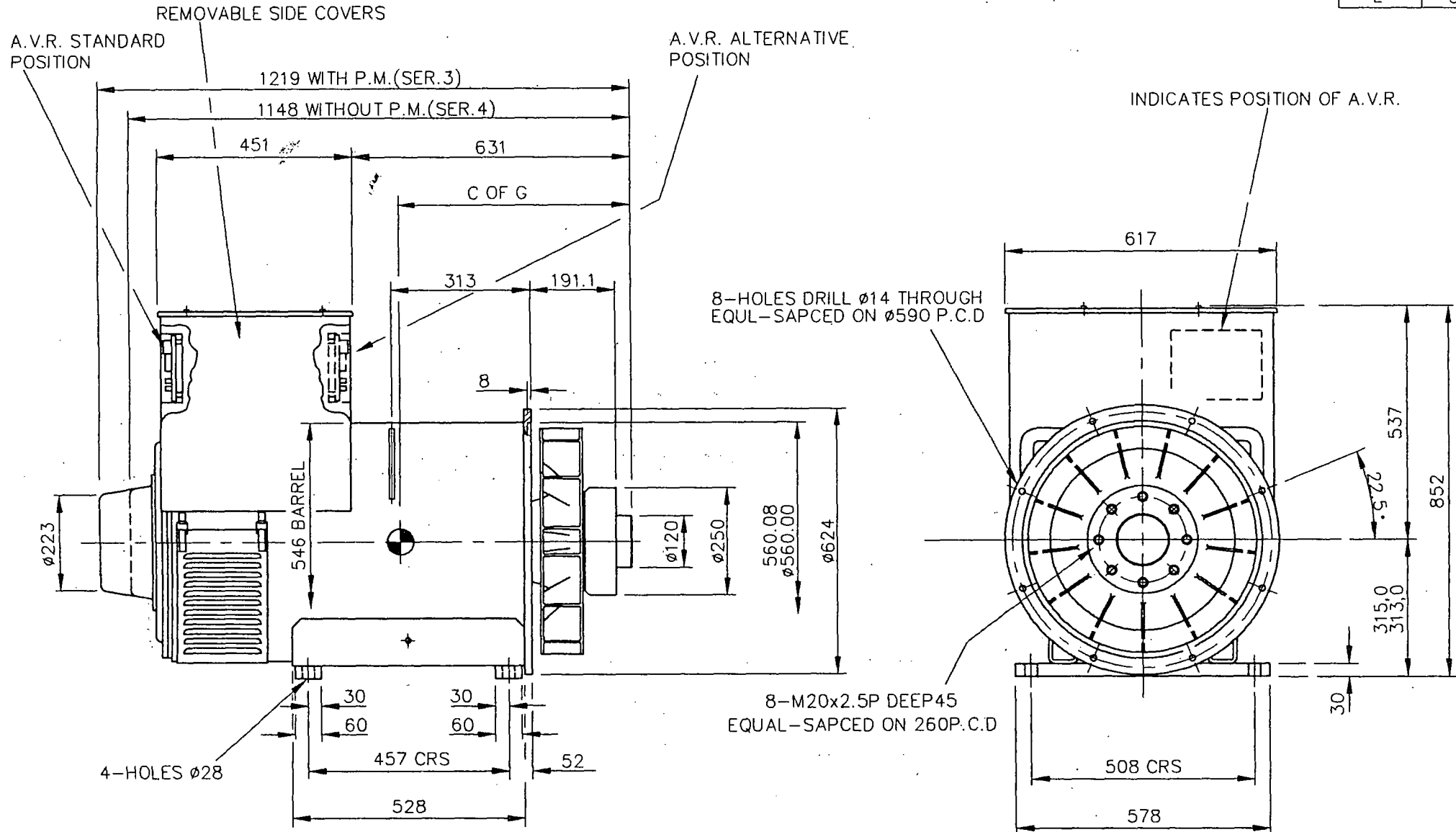
ISSUE
A

IF IN DOUBT - ^CK

DO NOT SCALE

FIRST W.O.

COR ^F	C OF G
C	510
D	530
E	551



NOTE: -
CUSTOMER MAY CUT CABLE ENTRY HOLES AS REQUIRED IN ANY OF THE FOUR
TERMINAL BOX SIDES SUBJECT TO POSITION OF AVR, TERMINALS, ETC.

CERTIFIED PRINT

(ONLY IF SIGNED)

BY

DATE

DRAWN M.Y 04.9.22

CH'D R-2 04.9.22

APP'D

HC4-1CDE ALTERNATOR
NO-ADAPTOR
STANDARD T/BOX

SCALE

1:10

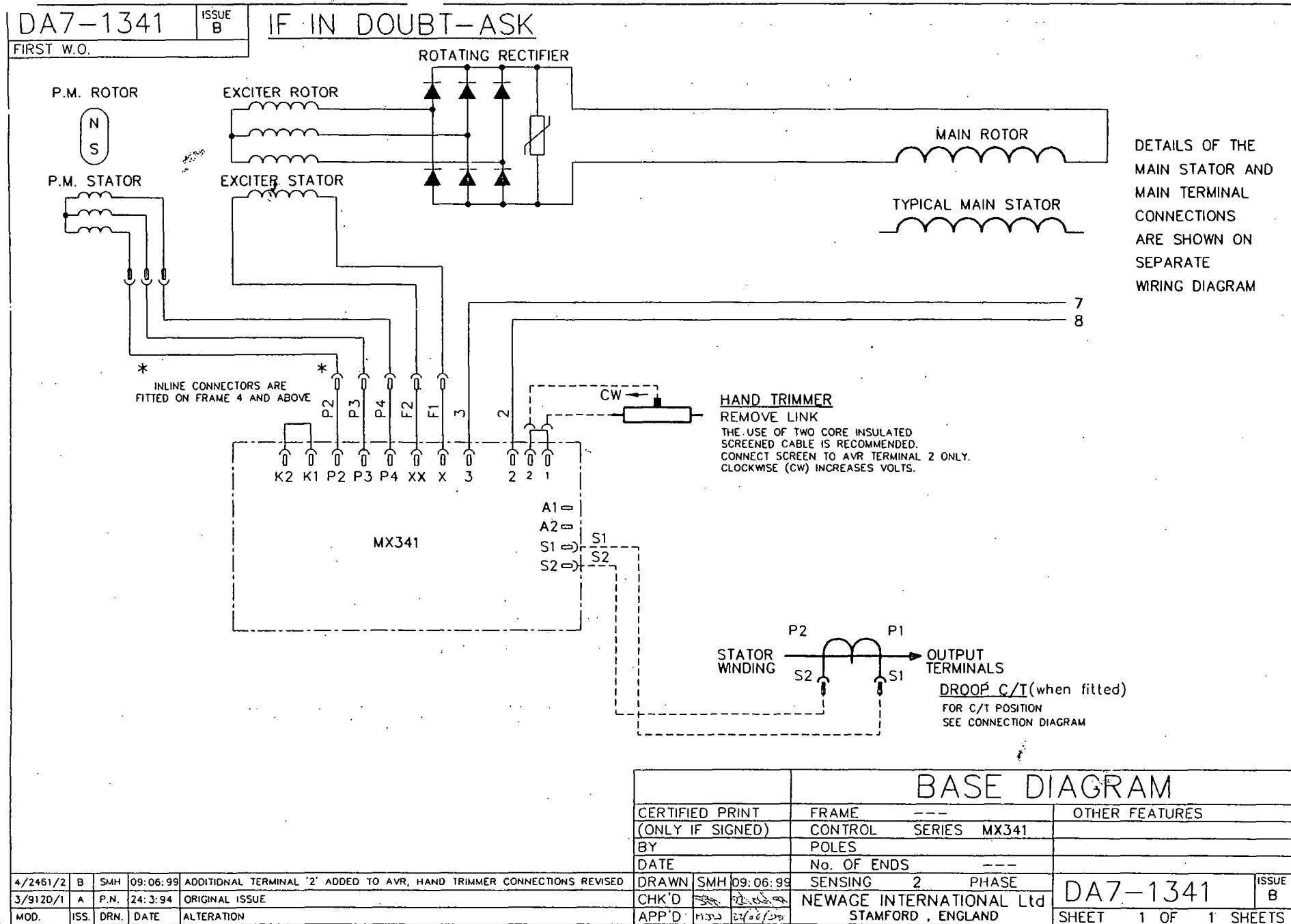
FIRST W.O.

UNIT OF MEASUREMENT
MILLIMETRES (mm)

NEWAGE INTERNATIONAL Ltd
STAMFORD ENGLAND

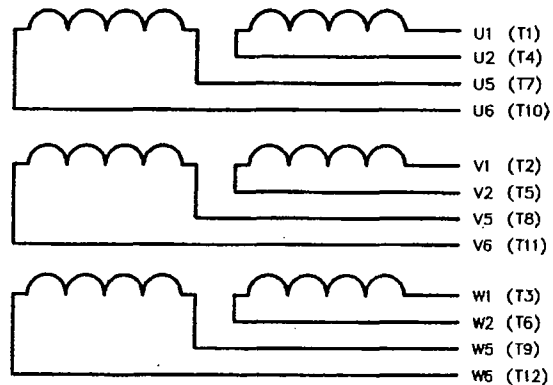
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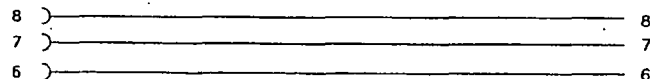


DA7 A100 ISSUE J IF IN DOUBT- SK
FIRST V.V.

MAIN STATOR (12 ENDS)

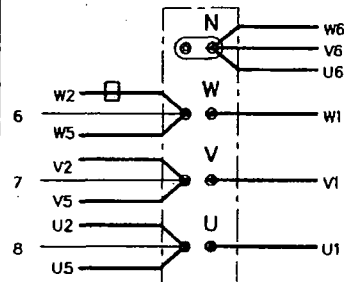


(T1) = NEMA EQUIVALENT

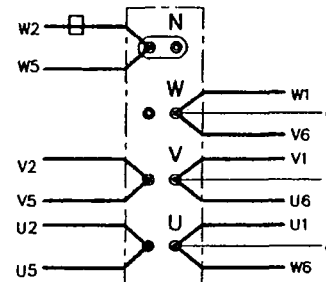
CONNECT TO
AVR

DEPENDENT ON AVR TYPE MULTIPLE LEADS (6,7,8) WILL BE REQUIRED.
LEAD 6 MAY NOT BE REQUIRED
FULL DETAILS ARE SHOWN ON THE BASE DIAGRAM.

MAIN TERMINAL CONNECTIONS

SERIES STAR 3PH 4W
OUTPUT TERMINALS U.V.W.N.

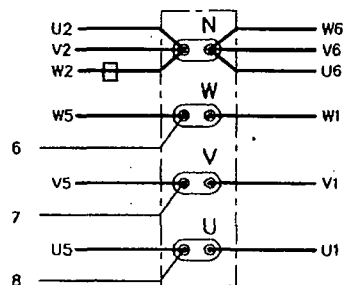
☐ DROOP C/T POSITION (when fitted)
CONNECTIONS ARE SHOWN ON BASE DIAGRAM

SERIES DELTA 3PH 4W
OUTPUT TERMINALS U.V.W.N.

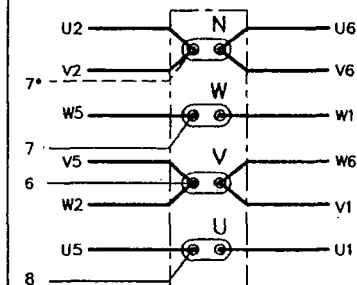
☐ DROOP C/T POSITION (when fitted)
CONNECTIONS ARE SHOWN ON BASE DIAGRAM

ALL CONNECTIONS

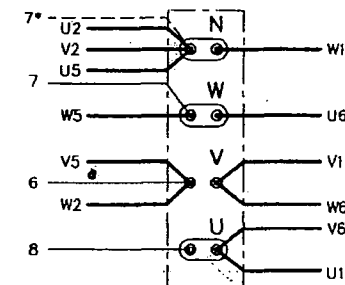
FOR ALTERNATIVE C/T
POSITIONS REFER
TO THE FACTORY

PARALLEL STAR 3PH 4W
OUTPUT TERMINALS U.V.W.N.

☐ DROOP C/T POSITION (when fitted)
CONNECTIONS ARE SHOWN ON BASE DIAGRAM


PARALLEL ZIG ZAG 1PH 3W
OUTPUT TERMINALS HIGH VOLTS U.W.
LOW VOLTS U.N. AND W.N.

7* ALTERNATIVE FOR AVR IN LOW VOLT MODE
DETAILS ARE SHOWN ON BASE DIAGRAM
DROOP NOT AVAILABLE

DOUBLE DELTA 1PH 3 WIRE
OUTPUT TERMINALS HIGH VOLTS U.W.
LOW VOLTS U.N. AND W.N.

7* ALTERNATIVE FOR AVR IN LOW VOLT MODE
DETAILS ARE SHOWN ON BASE DIAGRAM
DROOP NOT AVAILABLE

4/3472/1	J	SMH	29:08:01	ALTERNATIVE C/T POSITION ADDED
3/9964	H	SMH	11:04:95	DOUBLE DELTA CONNECTION - CENTRE POINT CHANGED FROM W TO N
3/9728	G	SMH	13:12:94	DOUBLE DELTA CONNECTION BROUGHT IN LINE WITH STATOR LEAD EXIT POSITIONS
3/9572	F	SMH	17:10:94	OUTPUT TERMINALS - PARALLEL ZIG ZAG AND DOUBLE DELTA CHANGED
3/9324/1	E	SMH	04:07:94	DOUBLE DELTA - NOW IN LINE WITH LINK BOARD VERSION
3/8946/2	O	MLW	25:01:94	PARALLEL ZIG ZAG ADDED
3/8192	A	P.N.	05:01:93	A 3/8192, B 3/8428, C 3/8946/1
MOD.	ISS.	DRN.	DATE	ALTERATION

			CONNECTION DIAGRAM			
CERTIFIED PRINT			FRAME ----		OTHER FEATURES	
(ONLY IF SIGNED)			CONTROL SERIES ----			
BY			POLES			
DATE			No. OF ENDS 12			
DRAWN	P.N.	5:1:93	SENSING 2/3 PHASE		DA7-A100	
CH'D		24/10/01	NEWAGE INTERNATIONAL Ltd		ISSUE J	
APP'D	HJW	23/08/01	STAMFORD . ENGLAND		SHEET 1 OF 1 SHEETS	



GE Fanuc Automation

Programmable Control Products



GE Fanuc Automation

***P.O. Box 8106
Charlottesville, VA 22906***

GFZ-0085

***Series 90TM-30
Programmable Controller
Troubleshooting Guide***



GE Fanuc Automation

Programmable Control Products

Series 90TM-30 Programmable Controller Troubleshooting Guide

GFZ-0085

August 1993

Notice

This document is based on information available at the time of its publication. While efforts have been made to be accurate, the information contained in this document does not purport to cover all details or variations in hardware and software, nor to provide for every contingency in connection with installation, operation and maintenance. This document may describe features not present in all hardware and software systems. GE Fanuc Automation assumes no obligation of notice to holders of this document with respect to changes subsequently made.

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PROMACRO	Series Six	CIMPLICITY
GENet	Logicmaster	Series One
Series 90	CIMPLICITY 90-ADS	Genius
Modelmaster	Series Three	VuMaster
ProLoop	CIMPLICITY PowerTRAC	Series Five
Workmaster	Genius Power TRAC	

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Safety Considerations

General Warnings When Troubleshooting

Stand clear of controlled equipment when power is applied. If the problem is intermittent, sudden unexpected machine motion could occur, causing injury. Also reference NFPA 70E Part II for additional guidelines for safety practices.

Never reach into a machine to operate a switch since unexpected motion could occur, causing injury.

Remove all electrical power at the Main Power Disconnect to ensure total power removal.

Always remove power before inserting or removing modules, or before connecting I/O cabling.

Preface

This guide describes a logical sequence for troubleshooting your Series 90–30 programmable controller. It includes the procedure for changing or adding a EPROM or EEPROM to your CPU. The Series 90–30 PLC is a member of the Series 90™ family of programmable logic controllers from GE Fanuc Automation.

Revisions to this Troubleshooting Guide

This is the first release of this Troubleshooting Guide. Included are models CPU 311, 313, 321, 323, 331 and 341.

Related Publications

Series 90™–30 Programmable Controller Installation Manual (GFK–0356).

Series 90™–30 and 90–20 PLC Hand–Held Programmer User's Manual (GFK–0402)

Logicmaster™ 90 Series 90–30 and 90–20 Programming Software User's Manual (GFK–0466)

Series 90™–30/90–20 Programmable Controllers Reference Manual (GFK–0467)

We Welcome Your Comments and Suggestions

At GE Fanuc Automation, we strive to produce quality technical documentation. After you have used this troubleshooting guide, please take a few moments to write us with your comments and suggestions. Our address is: Manager Technical Publications, GE Fanuc Automation, PO Box 8106, Charlottesville, VA 22906

Drake C. Fink

Sr. Staff Systems Engineer

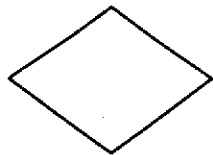
SYMBOLS USED IN THIS GUIDE

BEGIN AT THIS SYMBOL
ON THE FIRST CHART.

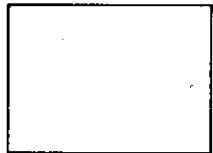


FOLLOW THE PATH WITH
THE CORRECT ANSWER IN
THE DIRECTION OF THE
ARROW

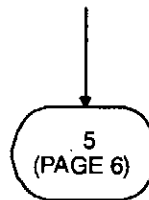
SYMBOLS USED THROUGHOUT THE GUIDE
ARE GEOMETRICALLY CODED



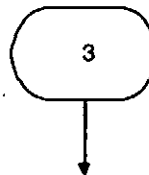
A DIAMOND ASKS A
QUESTION



A RECTANGLE TELLS
YOU TO DO SOMETHING



A NUMBERED BUBBLE WITH
AN ARROW INTO THE BUBBLE
INDICATES THAT THE
PROCEDURE IS CONTINUED
AT A CORRESPONDINGLY
NUMBERED BUBBLE ON THE
INDICATED PAGE NUMBER.



A NUMBERED BUBBLE WITH
AN ARROW OUT OF THE
BUBBLE INDICATES THE
START OF A PROCEDURE ON
THAT PAGE.

Adding or Changing the EEPROM in the 90™-30

Application programs are normally developed in the CPU's RAM memory and executed from RAM memory. If additional program integrity is desired, or operation of the PLC without a battery is desired, an optional EEPROM or EPROM can be installed in a spare socket (labeled PROGRAM PROM) on the Model 311/313 backplane or in a socket on the model 331/341 CPU module. EEPROMs can be written to and read from. EPROMs can be read when installed in the PLC; however, they must be written to using an external PROM programming device.

Following is the procedure for adding or changing the EEPROM or EPROM. For clarity, the term PROM is used to refer to either an EEPROM or an EPROM.

1. Remove power from the system.
2. If 311/313
 - Remove all modules, including the power supply.
 - Remove the plastic cover.
3. If 331/341:
 - Remove CPU from backplane.
 - Remove front plate and bezel. Unsnap circuit board and remove from case.
4. If the socket is the type which has a screw near the top edge (some versions of 311/331), loosen screw at top of PROM socket (CCW twist);
5. If present, remove old PROM from socket. Replace with or install new PROM. Orient the PROM so the end with a notch (the top of the prom) is toward the top edge of the backplane. Pin 1 of the prom is the first pin on the left as you move counter-clockwise from the notch. On the 311/331, correct installation orients the notch toward the screw.
6. When present, tighten screw at top of PROM socket (CW twist).
7. If 311/313:
 - Replace the plastic cover.
 - Replace all modules, including the power supply.
8. If 331 CPU:
 - Assure jumper JP1, located at the bottom of the PROM socket, is in the 1-2 position for EPROM and the 3-2 position for EEPROM. This informs the CPU firmware which type of device is present.
9. If 331/341 CPU:
 - Replace circuit board in case.
 - Reinstall front plate and bezel.
 - Replace CPU in backplane.

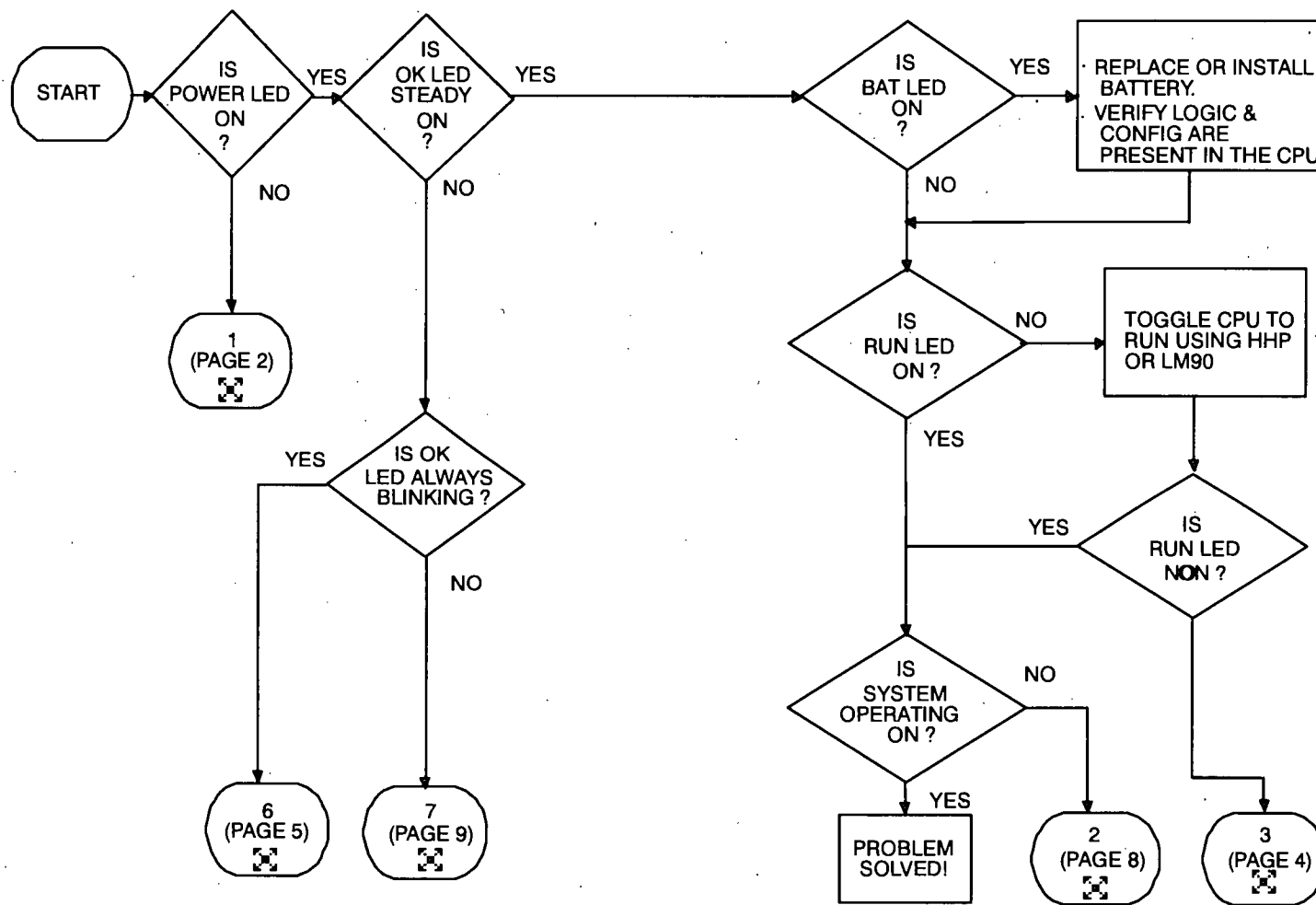
Changing the EEPROM (continued)

10. Apply power. The PLC follows the flowchart found in the "Power-Up Sequence" figure in the Power-Up and Power-Down Section of the *Series 90-30/90-20 Programmable Controllers Reference Manual* (GFK-0467) to determine if a program will be loaded from PROM to RAM.
11. For the EEPROM to be used by the CPU, the CPU configuration must be set to use EEPROM as the "Program Source". You may use the LM90 Configuration software or the HHP to accomplish this.
12. To store the program in RAM, you may use either the Hand-Held Programmer or Logicmaster 90-30, Rev 3.5 or higher. Refer to the instructions in the *HHP User's Manual* (GFK-0402) for HHP. To use Logicmaster 90-30, follow these instructions:
 - Start the LM90-30 Programmer Package
 - Activate the Utilities Menu (F9)
 - Select the EEPROM function (F10)
 - Select the WRITE operation
 - Verify the items you want to write to EEPROM are selected.
 - Press ENTER to start the operation. Refer to the *Logicmaster 90 Series 90-30 and 90-20 Programming Software User's Manual* (GFK-0466) for more information.

Notes and Precautions

1. **WARNING:** Do not discard the lithium–manganese dioxide battery in fire. Do not attempt to discharge the battery. The battery may burst or burn or release hazardous materials. Dispose of the battery as you would any hazardous material.
2. **CAUTION:** After a power fault, the system will come back on in the mode (*STOP, RUN/ENABLED, RUN/DISABLED*) in which it was operating before power loss, unless the power up configuration specifies a particular mode.
3. Not having a battery installed will not prevent the PLC from running. It will generate a PLC fault on power cycle that prevents the PLC from entering *RUN* mode automatically. Clearing this fault will enable the PLC to be placed in *RUN* mode.
4. To short the 'super cap' on a 311/321 PLC:
 - Remove power from the system.
 - Remove all modules, including the power supply.
 - Remove the plastic face plate.
 - Find component C20 along the left edge of the module. This is the 'super cap'. Short the positive (+) and negative (–) leads of this device.
 - Replace the plastic face plate.
 - Replace all modules.
 - Restore power to the system.
5. Supply (input) voltage tolerances for Series 90–30 power supplies:

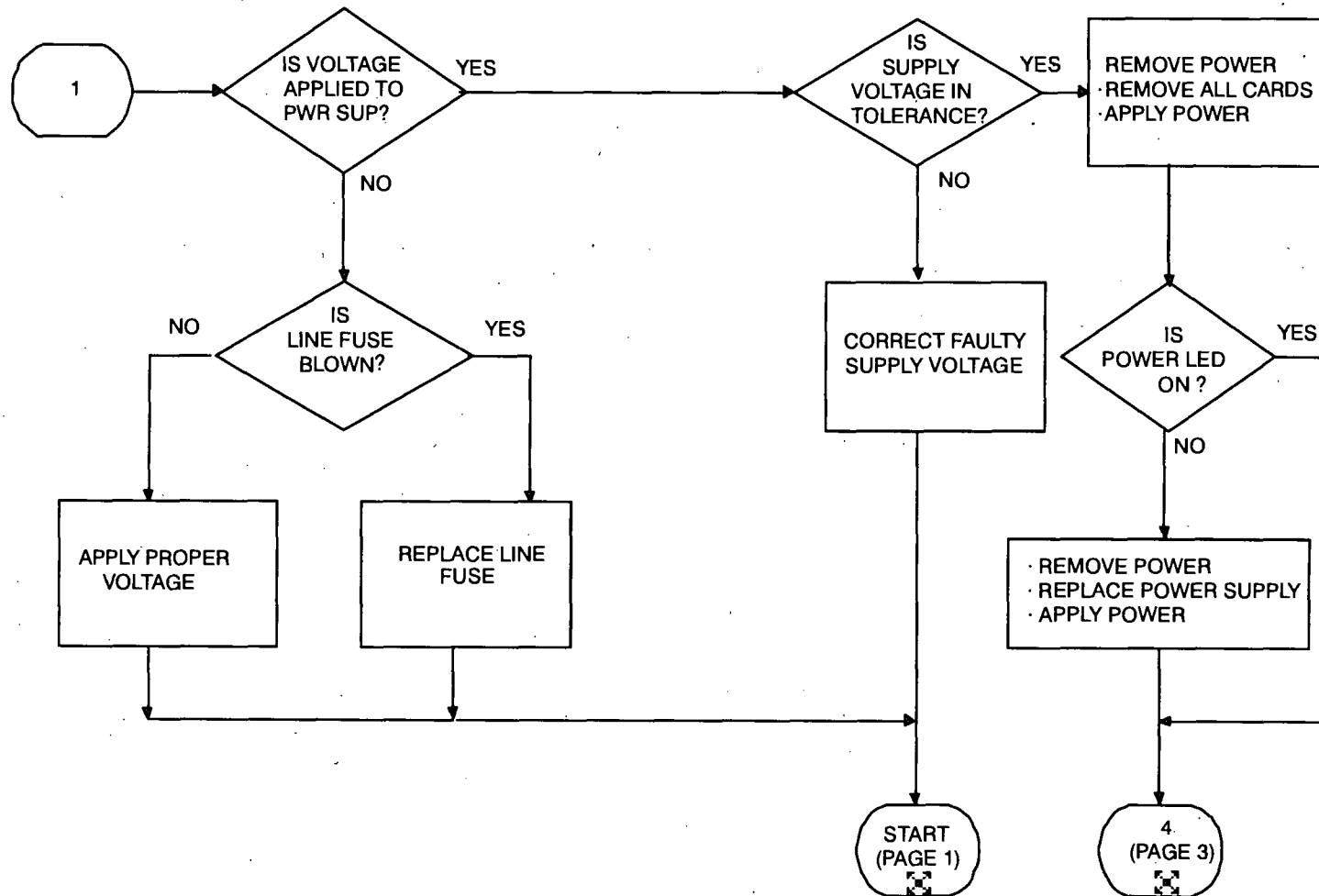
IC693PWR321:	100 to 240 VAC 100 to 250 VDC (125 VDC nominal)
IC693PWR322:	18 to 56 VDC, 21 VDC minimum to start 24 VDC OR 48 VDC nominal
6. Total cable length must not exceed 50 feet between a CPU rack and an expansion rack. Length must not exceed 700 feet between a CPU rack and a remote rack. No termination plug is needed on a one-rack system.



PAGE 1

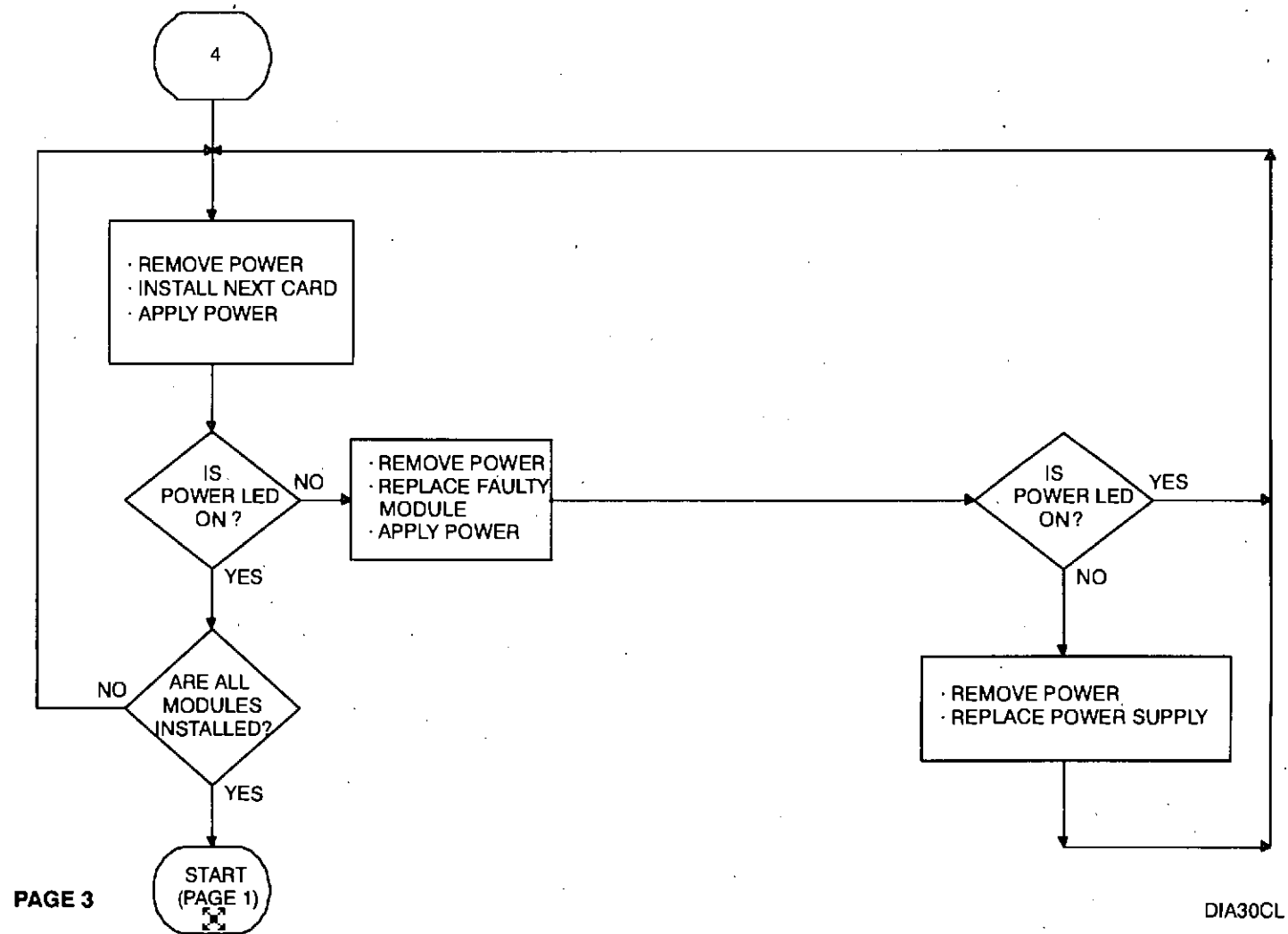
(Refer to the Preface for information on safety considerations, related publications and the symbols used in this guide.)

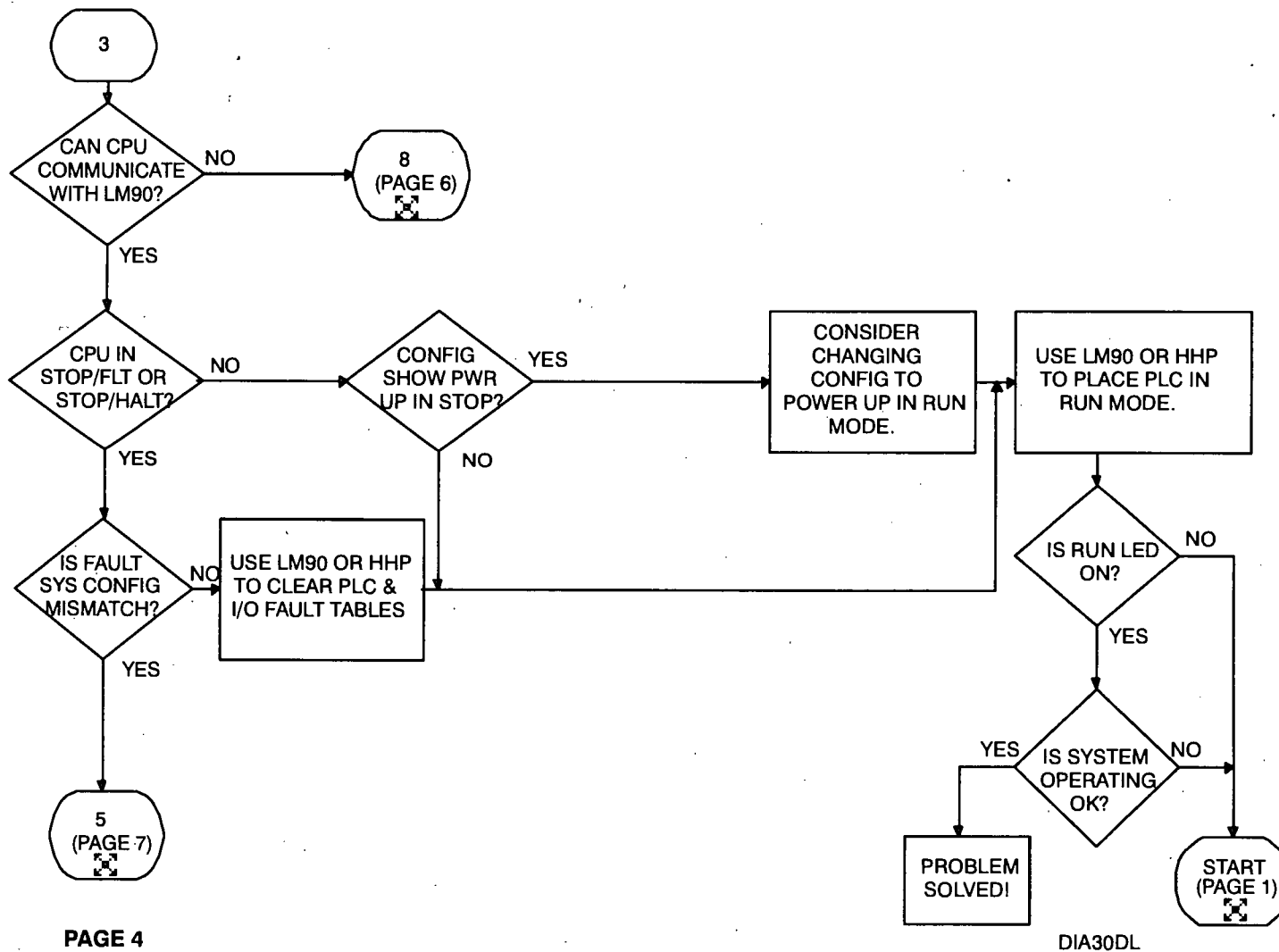
DIA30AL
GFZ-0085

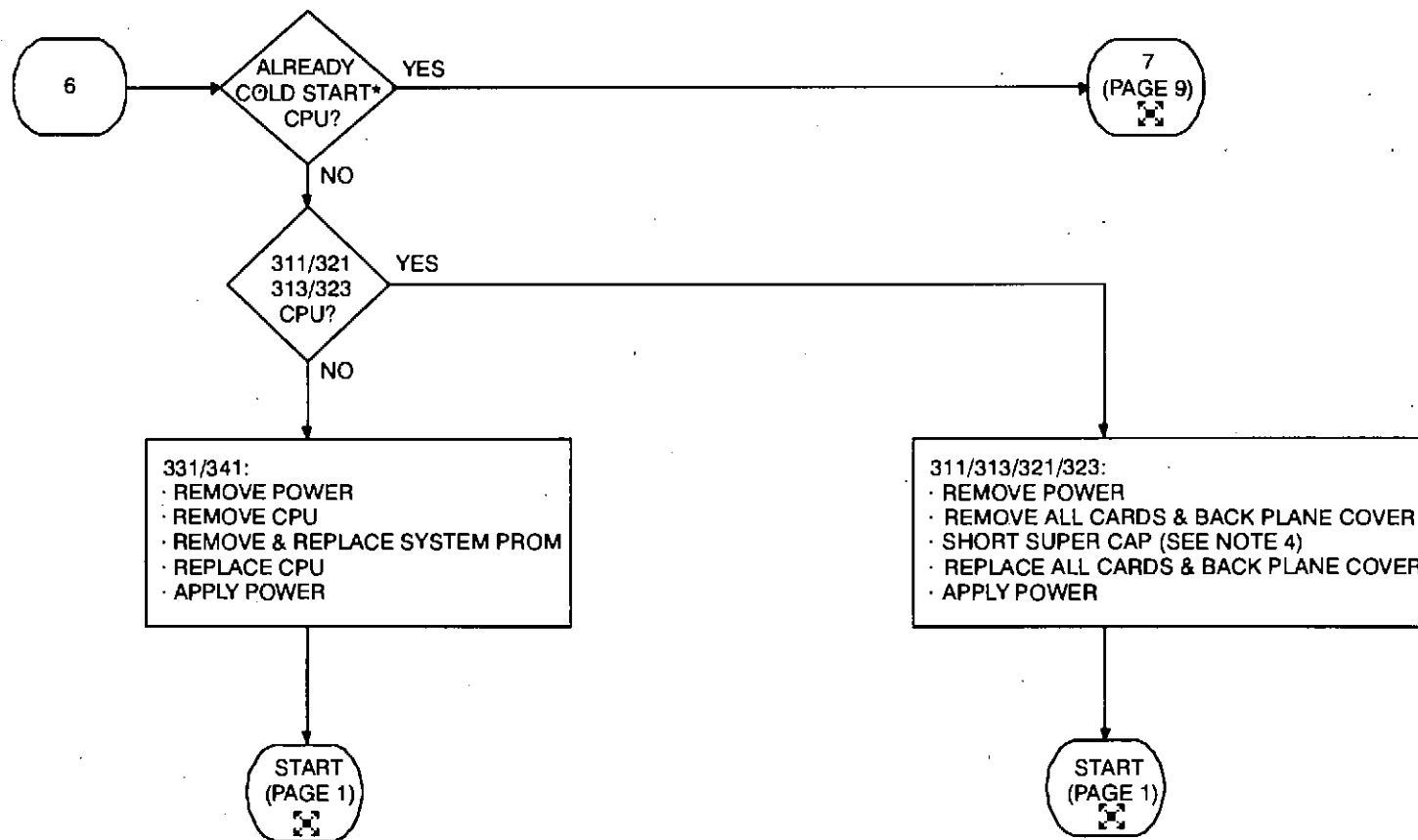


PAGE 2

DIA30BL



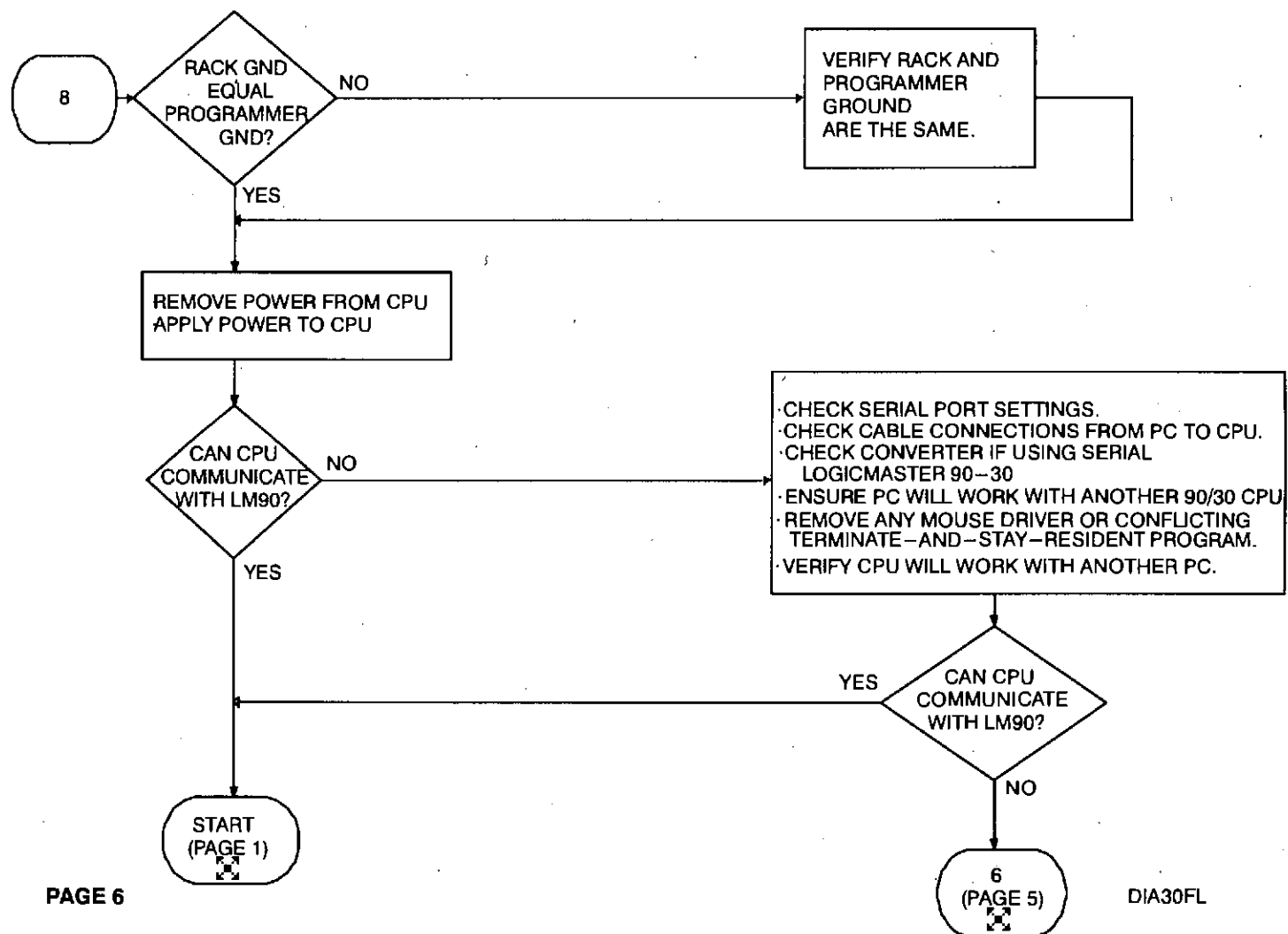


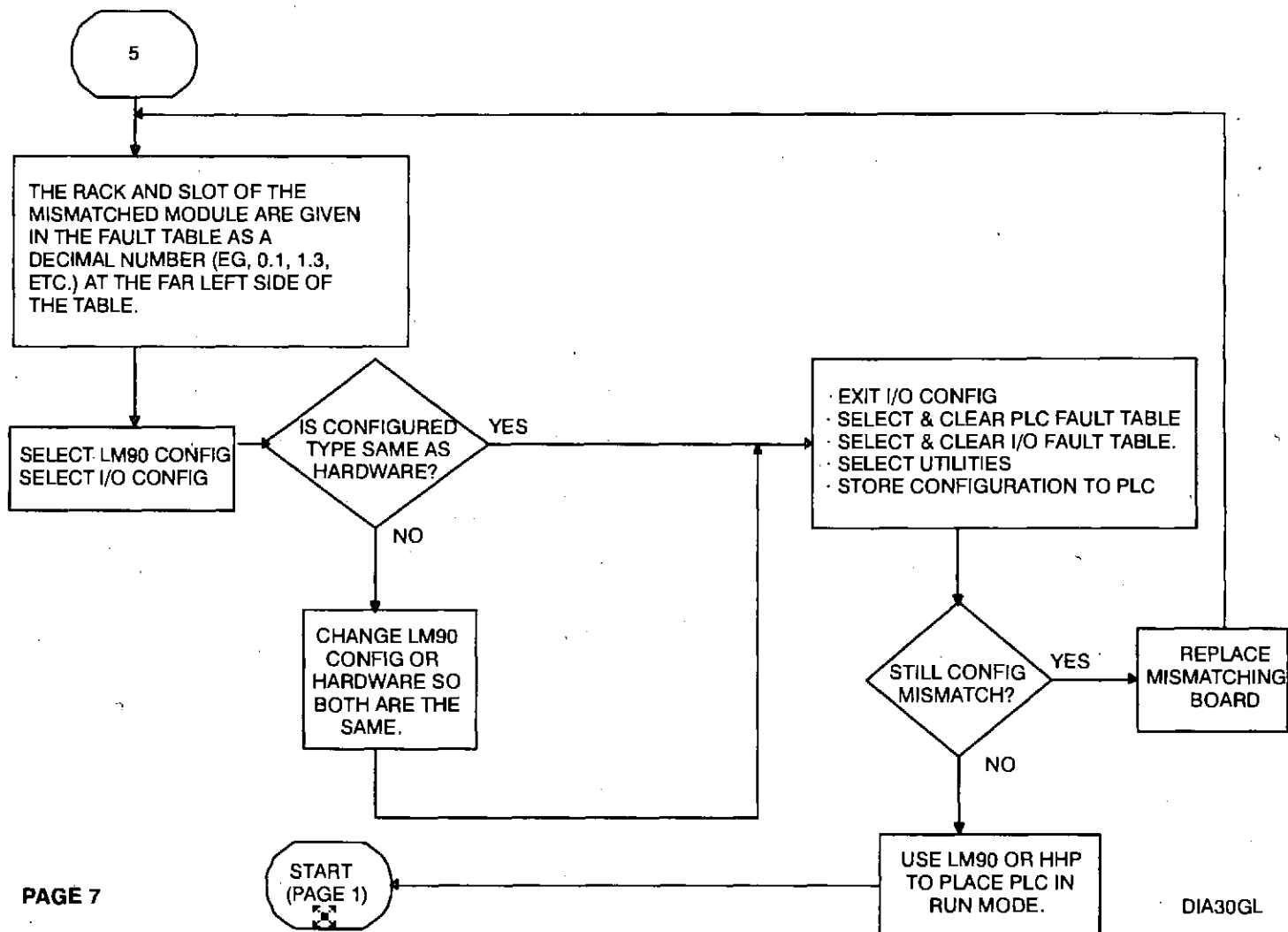


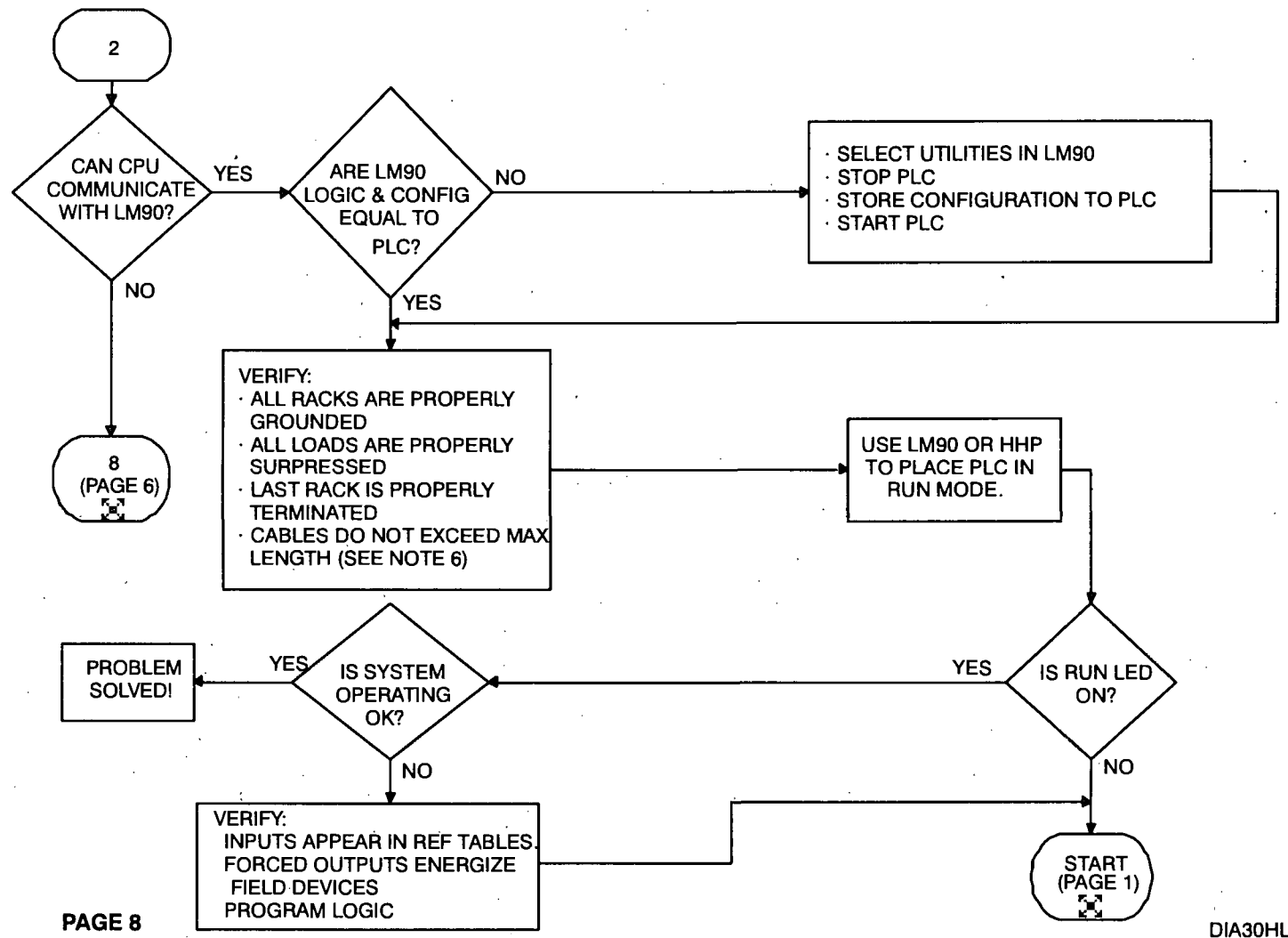
*COLD START DELETES THE CONTENTS OF THE CPU'S MEMORY AND RESTORES COMMUNICATION PARAMETERS (BAUD RATE, PARITY, ETC.) TO THEIR DEFAULT VALUES.

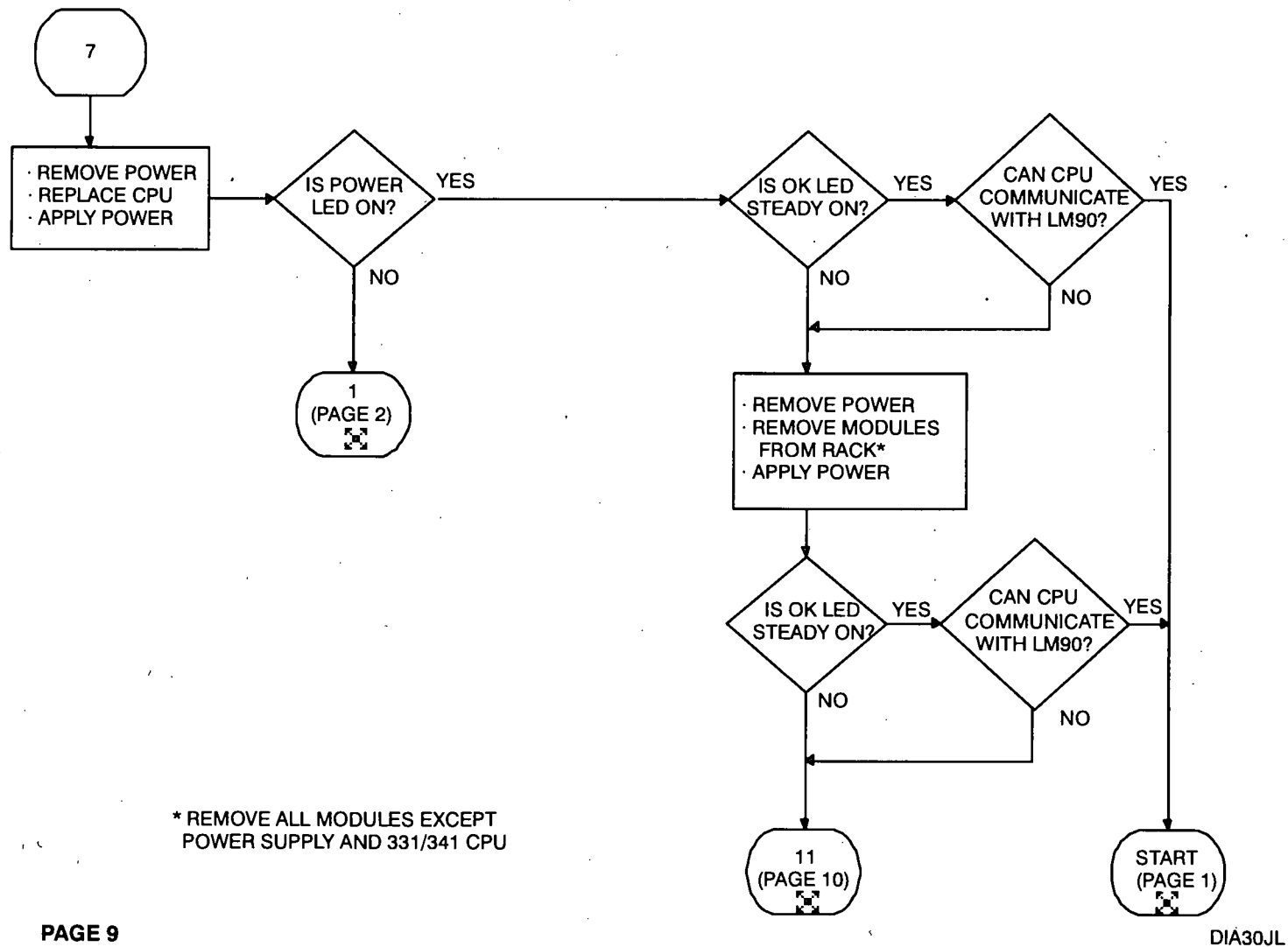
PAGE 5

DIA30EL

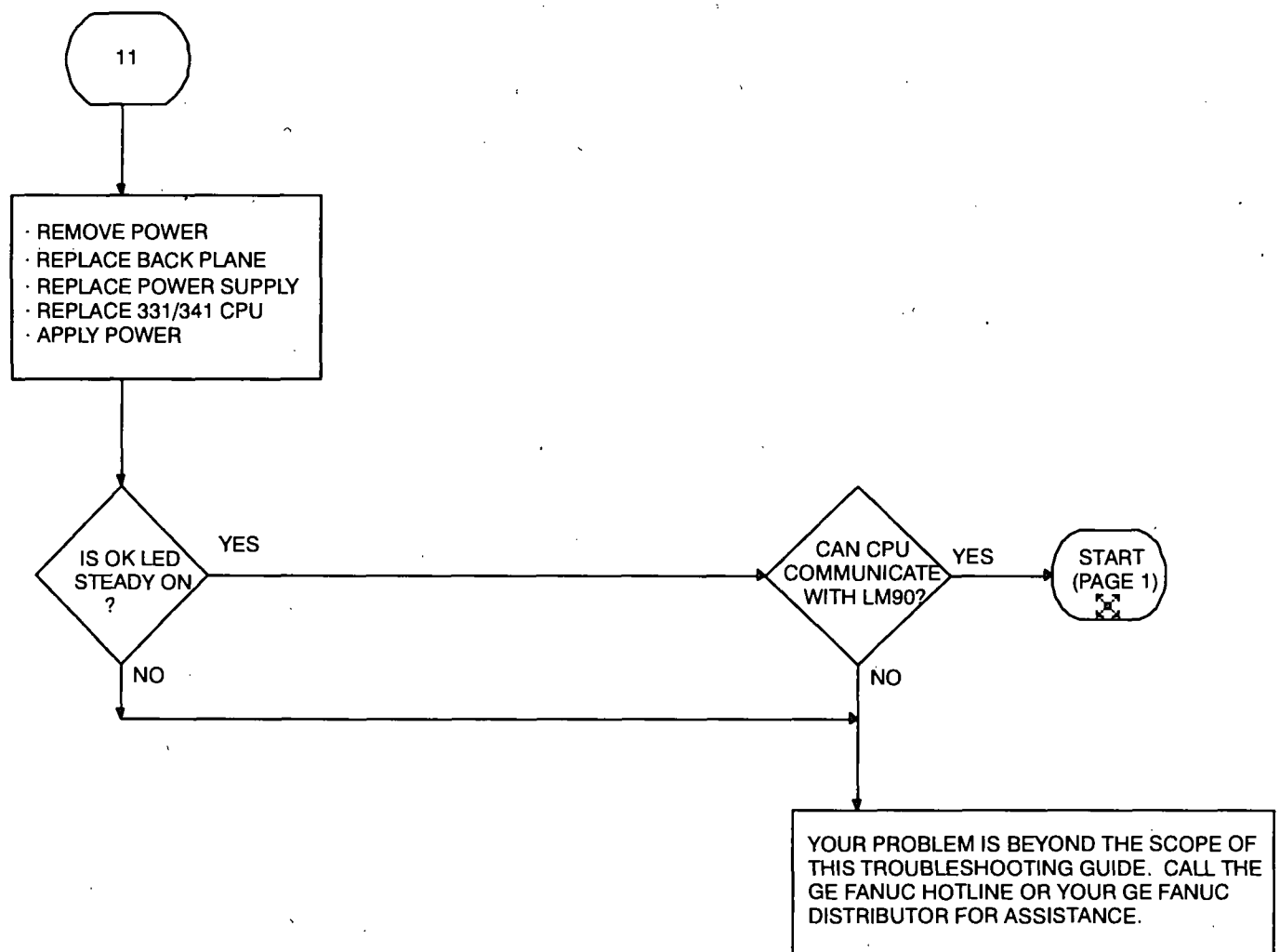








PAGE 9



DIA30KL

PAGE 10



DIESEL STANDBY GENERATOR

LOCAL CONTROL PANEL FUNCTIONAL DESCRIPTION

FOR

BRISBANE WATER

Project No: 15016

May 2005

15016 Functional Description



ABBREVIATIONS

G1 Generator 1 Diesel

15016 Functional Description



1. GENERAL

- 1.1. The PLC for the above operation is a GE Fanuc IC693CPU350. This program has been designed for the use on G1. The operation below controls G1.
- 1.2. A mode selector switch selects how G1 shall operate :
 - 1.2.1. Off
 - 1.2.2. Manual Mode
 - 1.2.3. Test Mode.
 - 1.2.4. Automatic Mode.

2. MANUAL MODE

- 2.1. To operate G1 in MANUAL Mode.
- 2.2. Select this operation by turning the AUTO – TEST – MAN- OFF selector switch to the MANUAL position.
- 2.3. Press the MANUAL START push button to start the generator.
- 2.4. The generator will begin to crank.
 - 2.4.1. If it fails to start within the 10 seconds, the starter motor is stopped and a delay of 10 seconds before it will attempt to restart.
 - 2.4.2. The generator set is allowed 3 attempts to start.
 - 2.4.3. If it fails to start on the third attempt, the generator is locked out on FAIL TO START Alarm.
 - 2.4.4. When the generator starts, the starter motor is stopped by a stop cranking input which measures the speed of the generator.
 - 2.4.5. Once the generator has started, there is a 10 second time delay for the oil pressure to stabilise.
 - 2.4.6. If the oil pressure is not up to pressure after the 10 second time delay, the generator shall shut down on LOW OIL PRESS Alarm.
 - 2.4.7. Once the generator is running there is a 5 second warm up time before it is ready to accept load.



-
- 2.5. To Manual Transfer to Generator in the MANUAL Mode.
 - 2.5.1. Start the generator and wait for the generator to run up to speed and voltage and ready to accept load.
 - 2.5.2. Press the MANUAL TRANSFER TO GEN push button.
 - 2.5.3. The MAINS ATS shall Open.
 - 2.5.4. After a 30 second delay the GEN ATS shall Close.
 - 2.5.5. If the MAINS ATS fails to Open.
 - 2.5.5.1. After a 5 second delay an Alarm shall be generated and the MAINS CONNECTED indicator shall flash to indicate the Alarm.
 - 2.5.5.2. The system shall return back to MAINS ATS operation.
 - 2.5.6. If the GEN ATS fails to Close.
 - 2.5.6.1. After a 5 second delay an Alarm shall be generated and the GENERATOR CONNECTED indicator shall flash to indicate the Alarm.
 - 2.5.6.2. The system shall return back to MAINS ATS operation.
 - 2.6. To Manual Transfer to Mains in the MANUAL Mode.
 - 2.6.1. The GENERATOR ATS is Closed.
 - 2.6.2. Press the MAN TRANSFER TO MAINS push button.
 - 2.6.3. The GEN ATS shall Open.
 - 2.6.4. After a 30 second delay the MAINS ATS shall Close.
 - 2.6.5. If the GEN ATS fails to Open.
 - 2.6.5.1. After a 5 second delay an Alarm shall be generated and the GENERATOR CONNECTED indicator shall flash to indicate the Alarm.
 - 2.6.5.2. The system shall return back to GEN ATS operation.



-
- 2.6.6. If the MAINS ATS fails to Close.
 - 2.6.6.1. After a 5 second delay an Alarm shall be generated and the MAINS CONNECTED indicator shall flash to indicate the Alarm.
 - 2.6.6.2. The system shall return back to GEN ATS operation.
 - 2.7. To stop the generator in the MANUAL Mode.
 - 2.7.1. When the generator is running, it may be stopped by pressing the MANUAL STOP push button.
 - 2.7.2. If the generator is still GEN ATS operation. The MANUAL TRANSFER TO MAINS is initiated.
 - 2.7.3. When the GEN ATS is Open, the generator will enter the cool down time of 1 second.
 - 2.7.4. After the cool down time, the generator will shut down.
 - 2.7.5. Once the generator has shut down there is a 15 second delay before it may be restarted. This is to ensure the engine has mechanically stopped.



3. NON-PERMANENT SITE, MANUAL MODE

- 3.1. To operate G1 in a Non-Permanent Site Location in MANUAL Mode.
- 3.2. Connect the generator cables to the site generator CB ensuring the site generator CB is OFF. See BCC procedures.
- 3.3. A plug with shorting links is required to be installed. It is required to be plugged into the 27 Pin Station Plug.
 - 3.3.1. Pins 11 and 12 are required to be connected. This is to indicate that the Mains ATS is Closed. If they are not connected a MAINS ATS Alarm shall be indicated.
- 3.4. Select from the AUTO – TEST – MAN- OFF selector switch to the MANUAL position.
- 3.5. Press the MANUAL START push button to start the generator.
- 3.6. The generator will begin to crank.
 - 3.6.1. If it fails to start within the 10 seconds, the starter motor is stopped and a delay of 10 seconds before it will attempt to restart.
 - 3.6.2. The generator set is allowed 3 attempts to start.
 - 3.6.3. If it fails to start on the third attempt, the generator is locked out on FAIL TO START Alarm.
 - 3.6.4. When the generator starts, the starter motor is stopped by a stop cranking input which measures the speed of the generator.
 - 3.6.5. Once the generator has started, there is a 10 second time delay for the oil pressure to stabilise.
 - 3.6.6. If the oil pressure is not up to pressure after the 10 second time delay, the generator shall shut down on LOW OIL PRESS Alarm.
 - 3.6.7. Once the generator is running there is a 5 second warm up time before it is ready to accept load.
- 3.7. To connect the generator to the site load.
 - 3.7.1. Manually switch over to the generator supply via the site CB's. See BCC procedures.



-
- 3.7.2. Do not use the MANUAL TRANSFER TO GEN or the MAN TRANSFER TO MAINS push buttons.
 - 3.8. To disconnect the generator from the site load.
 - 3.8.1. Manually switch over to the mains supply via the site CB's. See BCC procedures.
 - 3.8.2. Do not use the MANUAL TRANSFER TO GEN or the MAN TRANSFER TO MAINS push buttons.
 - 3.9. To stop the generator in the MANUAL Mode.
 - 3.9.1. When the generator is running, it may be stopped by pressing the MANUAL STOP push button.
 - 3.9.2. The generator will enter the cool down time of 1 second.
 - 3.9.3. After the cool down time, the generator will shut down.
 - 3.9.4. Once the generator has shut down there is a 15 second delay before it may be restarted. This is to ensure the engine has mechanically stopped.



4. TEST OPERATION

- 4.1. To operate the generator in the TEST Mode.
- 4.2. Select this operation by turning the AUTO – TEST – MAN- OFF selector switch to the TEST position.
- 4.3. If the selector is changed to MAN while the generator is operating on TEST, the system shall change to MANUAL TRANSFER TO GEN.
- 4.4. The generator shall begin to crank.
 - 4.4.1. If it fails to start within the 10 seconds, the starter motor is stopped and a delay of 10 seconds before it will attempt to restart.
 - 4.4.2. The generator is allowed 3 attempts to start.
 - 4.4.3. If it fails to start on the third attempt, the generator is faulted on FAIL TO START Alarm.
- 4.5. When the generator starts, the starter motor is stopped by a stop cranking input which measures the speed of the generator.
- 4.6. The MAINS ATS shall Open.
- 4.7. Once the generator has started, there is a 10 second time delay for the oil pressure to stabilise.
- 4.8. If the oil pressure is not up to pressure after the 10 second time delay, the generator shall shut down on LOW OIL PRESS Alarm.
- 4.9. Once the generator is running there is a 5 second warm up time before it is ready to accept load.
- 4.10. After the warm up time has expired and the MAINS ATS has been open for 30 seconds the GEN ATS shall Close.
- 4.11. If the MAINS ATS fails to Open.
 - 4.11.1. After a 5 second delay an Alarm shall be generated and the MAINS CONNECTED indicator shall flash to indicate the Alarm.
 - 4.11.2. The system shall shut down and return back to MAINS ATS operation.



4.12. If the GEN ATS fails to Close.

4.12.1. After a 5 second delay an Alarm shall be generated and the GENERATOR CONNECTED indicator shall flash to indicate the Alarm.

4.12.2. The system shall shut down and return back to MAINS ATS operation.

4.13. To stop the generator in the TEST Mode.

4.13.1. Select this operation by turning the AUTO – TEST – MAN- OFF selector switch to the AUTO or OFF position.

4.13.2. The GEN ATS shall Open.

4.13.3. After a 30 second delay the MAINS ATS shall Close.

4.13.4. If the GEN ATS fails to Open.

4.13.4.1. After a 5 second delay an Alarm shall be generated and the GENERATOR CONNECTED indicator shall flash to indicate the Alarm.

4.13.4.2. The system shall return back to GEN ATS operation.

4.13.5. If the MAINS ATS fails to Close.

4.13.5.1. After a 5 second delay an Alarm shall be generated and the MAINS CONNECTED indicator shall flash to indicate the Alarm.

4.13.5.2. The system shall return back to GEN ATS operation.

4.13.6. When the GEN ATS is Open, the generator will enter the cool down time of 5 minutes.

4.13.7. After the cool down time, the generator will shut down.

4.13.8. If a Mains Failure occurs during the cool down period the generator shall transfer back to the GENERATOR ATS without shutting down.

4.13.9. Once the generator has shut down there is a 15 second delay before it may be restarted. This is to ensure the engine has mechanically stopped.



5. AUTOMATIC OPERATION

- 5.1. To operate the generator in the AUTO Mode.
- 5.2. Select this operation by turning the AUTO – TEST – MAN- OFF selector switch to the AUTO position.
- 5.3. The Phase Failure Relay from the clients switch board shall give a Start Signal for the generators to run.
- 5.4. The Remote Start Command.
 - 5.4.1. The generator shall begin to crank.
 - 5.4.1.1. If it fails to start within the 10 seconds, the starter motor is stopped and a delay of 10 seconds before it will attempt to restart.
 - 5.4.1.2. The generator is allowed 3 attempts to start.
 - 5.4.1.3. If it fails to start on the third attempt, the generator is faulted on FAIL TO START Alarm.
 - 5.4.2. When the generator starts, the starter motor is stopped by a stop cranking input which measures the speed of the generator.
 - 5.4.3. The MAINS ATS shall Open.
 - 5.4.4. Once the generator has started, there is a 10 second time delay for the oil pressure to stabilise.
 - 5.4.5. If the oil pressure is not up to pressure after the 10 second time delay, the generator shall shut down on LOW OIL PRESS Alarm.
 - 5.4.6. Once the generator is running there is a 5 second warm up time before it is ready to accept load.
 - 5.4.7. After the warm up time has expired and the MAINS ATS has been open for 30 seconds the GEN ATS shall Close.
 - 5.4.8. If the MAINS ATS fails to Open.
 - 5.4.8.1. After a 5 second delay an Alarm shall be generated and the MAINS CONNECTED indicator shall flash to indicate the Alarm.



- 5.4.8.2. The system shall shut down and return back to MAINS ATS operation.
- 5.4.9. If the GEN ATS fails to Close.
 - 5.4.9.1. After a 5 second delay an Alarm shall be generated and the GENERATOR CONNECTED indicator shall flash to indicate the Alarm.
 - 5.4.9.2. The system shall shut down and return back to MAINS ATS operation.
- 5.5. To stop the generator in the AUTO Mode.
 - 5.5.1. The Phase Failure Relay from the clients switch board shall give a Stop Signal for the generators to run.
 - 5.5.2. The Remote Stop Command.
 - 5.5.3. There is a 2 minute proving time for the Phase Failure Relay.
 - 5.5.4. After the 2 minute proving time the GEN ATS shall Open.
 - 5.5.5. After a 30 second delay the MAINS ATS shall Close.
 - 5.5.6. If the GEN ATS fails to Open.
 - 5.5.6.1. After a 5 second delay an Alarm shall be generated and the GENERATOR CONNECTED indicator shall flash to indicate the Alarm.
 - 5.5.6.2. The system shall return back to GEN ATS operation.
 - 5.5.7. If the MAINS ATS fails to Close.
 - 5.5.7.1. After a 5 second delay an Alarm shall be generated and the MAINS CONNECTED indicator shall flash to indicate the Alarm.
 - 5.5.7.2. The system shall return back to GEN ATS operation.
 - 5.5.8. When the GEN ATS is Open, the generator will enter the cool down time of 5 minutes.
 - 5.5.9. After the cool down time, the generator will shut down.
 - 5.5.10. If a Mains Failure occurs during the cool down period the generator shall transfer back to the GENERATOR ATS without shutting down.



5.5.11. Once the generator has shut down there is a 15 second delay before it may be restarted. This is to ensure the engine has mechanically stopped.



6. FAULT OPERATION

6.1. Emergency Stop Operation.

- 6.1.1. Operation of the Emergency Stop push button immediately shuts down the generator and Opens the Generator CB. The Emergency Stop is latched, and requires manual resetting to release the Emergency Stop push button.
- 6.1.2. After the Emergency Stop push button is released, a fault reset will need to be initiated to reset the PLC.

6.2. HIGH HIGH Alarm Operation.

- 6.2.1. The Generator CB is Opened immediately.
- 6.2.2. The generator is shut down immediately.
- 6.2.3. The following alarms will initiate a HIGH HIGH Alarm condition :-
 - 6.2.3.1. Emergency Stop Fault
 - 6.2.3.2. MEN Fault
 - 6.2.3.3. Low Oil Pressure Shutdown Fault, 10 Seconds Startup Delay
 - 6.2.3.4. High Engine Temperature Shutdown Fault, 30 Second Startup Delay
 - 6.2.3.5. Low Radiator Level Fault, 5 Second Delay
 - 6.2.3.6. Over Speed Fault

6.3. HIGH Alarm Operation

- 6.3.1. The Generator CB is Opened immediately.
- 6.3.2. Once the generator circuit breaker is opened, the generator will run through its normal cool down time and shut down.
- 6.3.3. The following alarms will initiate a HIGH Alarm condition:-
 - 6.3.3.1. Generator Under Speed Fault, 5 Second Delay
 - 6.3.3.2. Alternator Under Voltage Fault, 5 Second Delay
 - 6.3.3.3. Alternator Over Voltage Fault, 5 Second Delay



6.3.3.4. Generator CB Tripped Fault

6.3.3.5. Alternator High Temperature Fault, 30 Second Startup Delay

6.4. MEDIUM Alarm Operation.

6.4.1. A Normal Shutdown shall be Initiated.

6.4.2. If the GEN ATS does not Open then the Generator CB is Opened.

6.4.3. The following alarms will initiate a MEDIUM Alarm condition :-

6.4.3.1. Fuel Empty Level Fault, 5 Second Delay

6.4.3.2. Fail To Start Fault, 3 Attempts

6.5. LOW Alarm Operation.

6.5.1. A Warning has occurred on the generator. The generator will not shut down.

6.5.2. The following alarms will initiate a LOW Alarm condition :-

6.5.2.1. Low Oil Pressure Warning Alarm, 10 Seconds Startup Delay

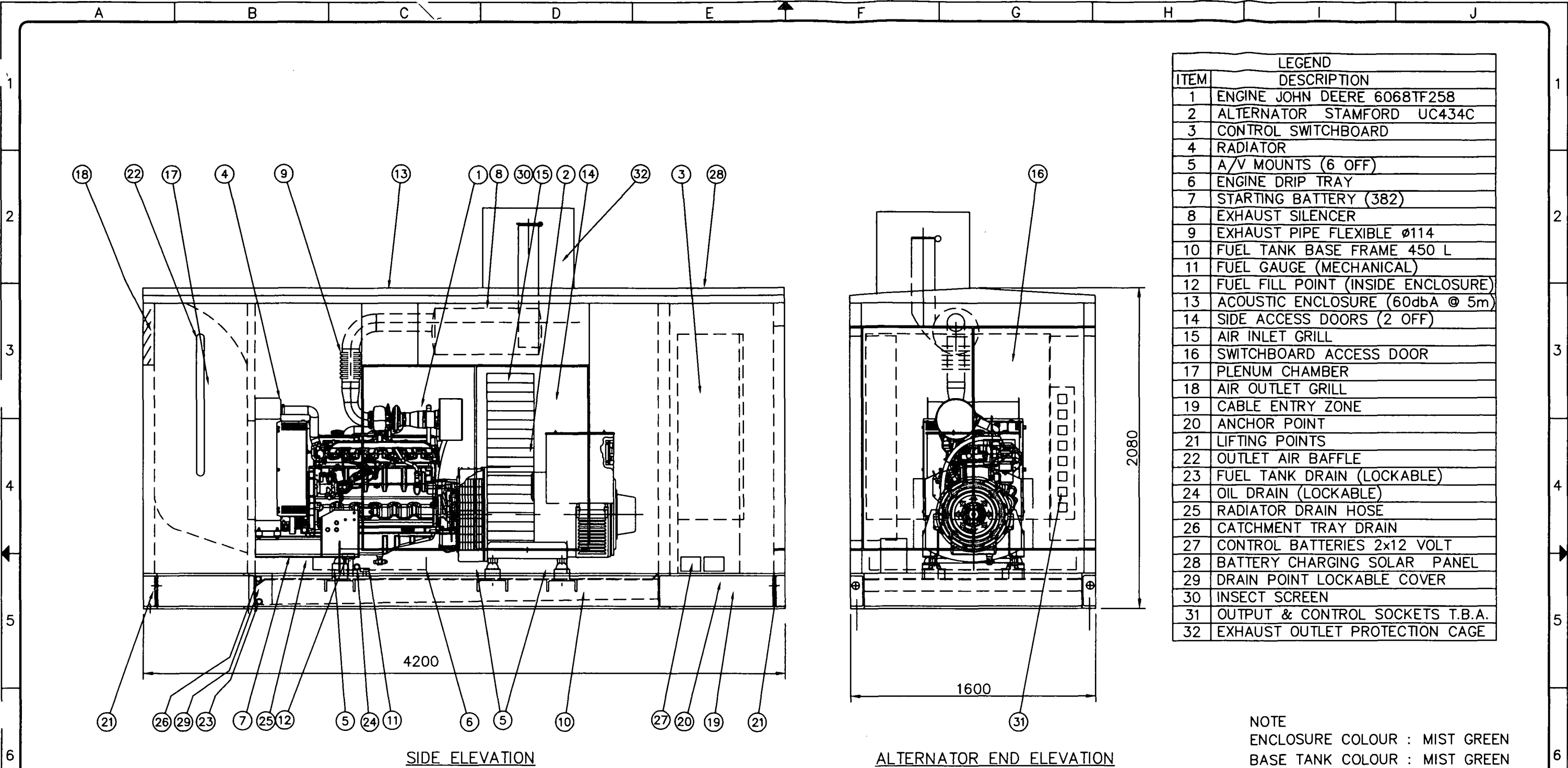
6.5.2.2. High Engine Temperature Warning Alarm, 30 Second Startup Delay

6.5.2.3. Fuel Low Level Alarm, 5 Second Delay

6.5.2.4. Battery Charger AC Supply Failed Alarm, 60 Second Delay

6.5.2.5. Control Battery Low Volts Alarm, 30 Second Delay

6.5.2.6. Start Battery Low Volts Alarm, 60 Second Delay




NOTE
ENCLOSURE COLOUR : MIST GREEN
BASE TANK COLOUR : MIST GREEN

AS BUILT

DESIGN CHECK *[Signature]*

DATE 5-7-05



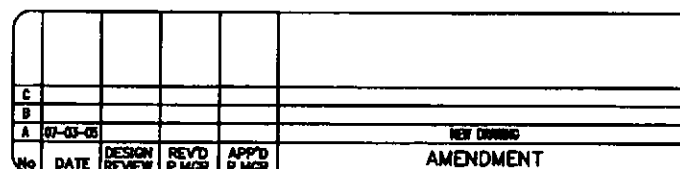
47 PROPRIETARY ST.
TINGALPA
BRISBANE, QLD. 4173
Phone: (07) 3690 1744
Fax: (07) 3390 9723

This document is the property of S.E. Power Equipment and is loaned only for the purpose indicated. Possession of this document does not convey permission to loan, reproduce or copy it in whole or in part or to manufacture the subject matter shown therein. Such permission to be granted only by specific authorisation in writing signed by an officer of S.E. Power Equipment.

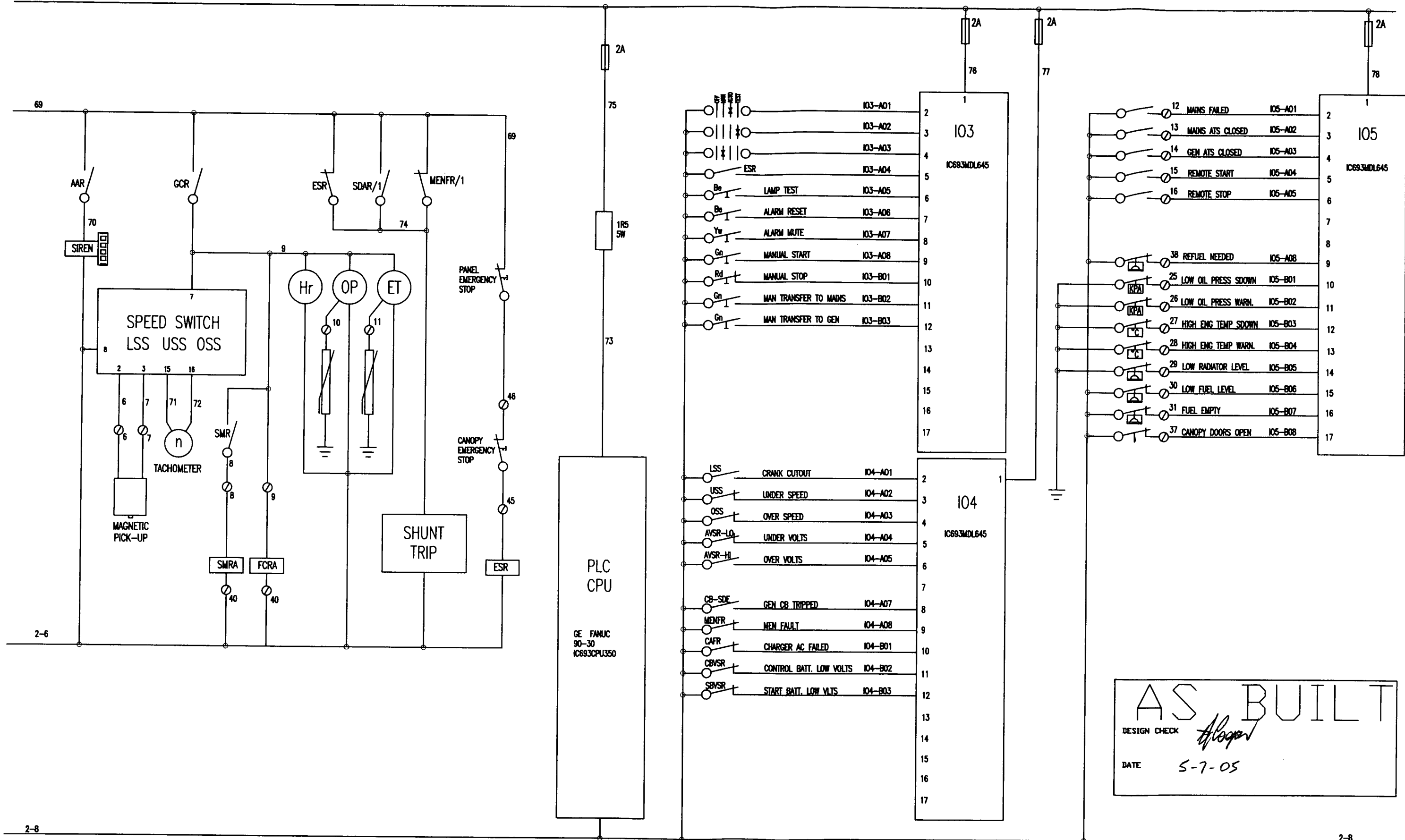
REVISIONS		PRINCIPAL ENGINEER		R.P.E.Q. NO.		DATE		NAME		DATE		JOB FILE		ACAD FILE		SURVEY No.		FIELD BOOK		A.H. DATUM		PROJECT		TITLE		SCALE NTS		N° 1 OF 1 SHEETS		AMEND.	
B 30.03.05 TANK CAPACITY ALTERED		VOR		MANAGER		DATE		DESIGN		---		---		---		---		---		---		BRISBANE WATER SEWAGE PUMP STATION BACKUP GEN SET		SP243 BIRKIN ROAD ARRANGEMENT		---		---		---	
A 06.03.05 INITIAL ISSUE		VOR		ENGINEERING		DATE		DRAWN		VOR		07.03.05		---		---		---		---		---		---		---		---		---	
WOL DATE		AMENDMENT		INITIALS		DATE		CHECKED		---		5-7-05		---		---		---		---		---		---		05.15016-009		---		B	

~~Active 10/12/2014~~

TITLE			
GENERATOR ELECTRICAL SCHEMATIC			
SCALE	NTS	DRAWING No	15016-02
		No IN SET	1 of 15



67



No	DATE	DESIGN REVIEW	REV'D P.MGR	APP'D P.MGR	AMENDMENT
C	15-08-00				PLC VOLT REG. REMOVED AND CONTACT ESR WAS ADDED TO SHUNT TRIP
B	07-03-05				NEW DRAWING
A					

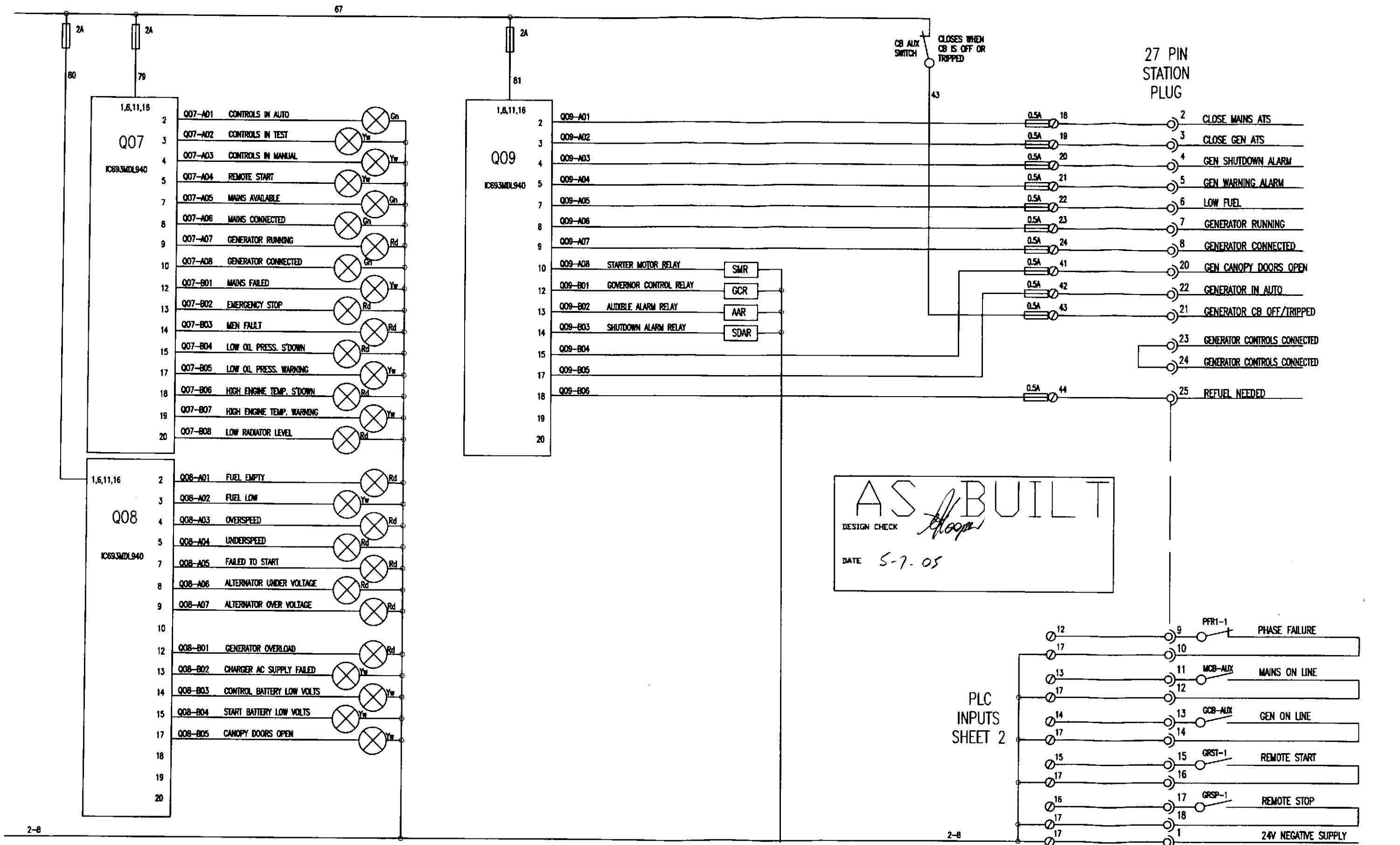


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Active 10/12/2014

CLIENT	BRISBANE WATER		
PROJECT	BRISB. WATER PUMP STATION GENERATOR		
DRAFTER	HJR	DRAFTING CHECK	EPAC
DESIGNED	HJR	DESIGN REVIEW	JOB NUMBER
			4284
			15016

TITLE	GENERATOR ELECTRICAL SCHEMATIC		
SCALE	NTS	DRAWING No	15016-02
		No IN SET	AMDT
		2 of 15	0215



No.	DATE	DESIGN REVIEW	REV'D P.MGR	APP'D P.MGR	AMENDMENT
A	07-03-05				NEW DRAWING

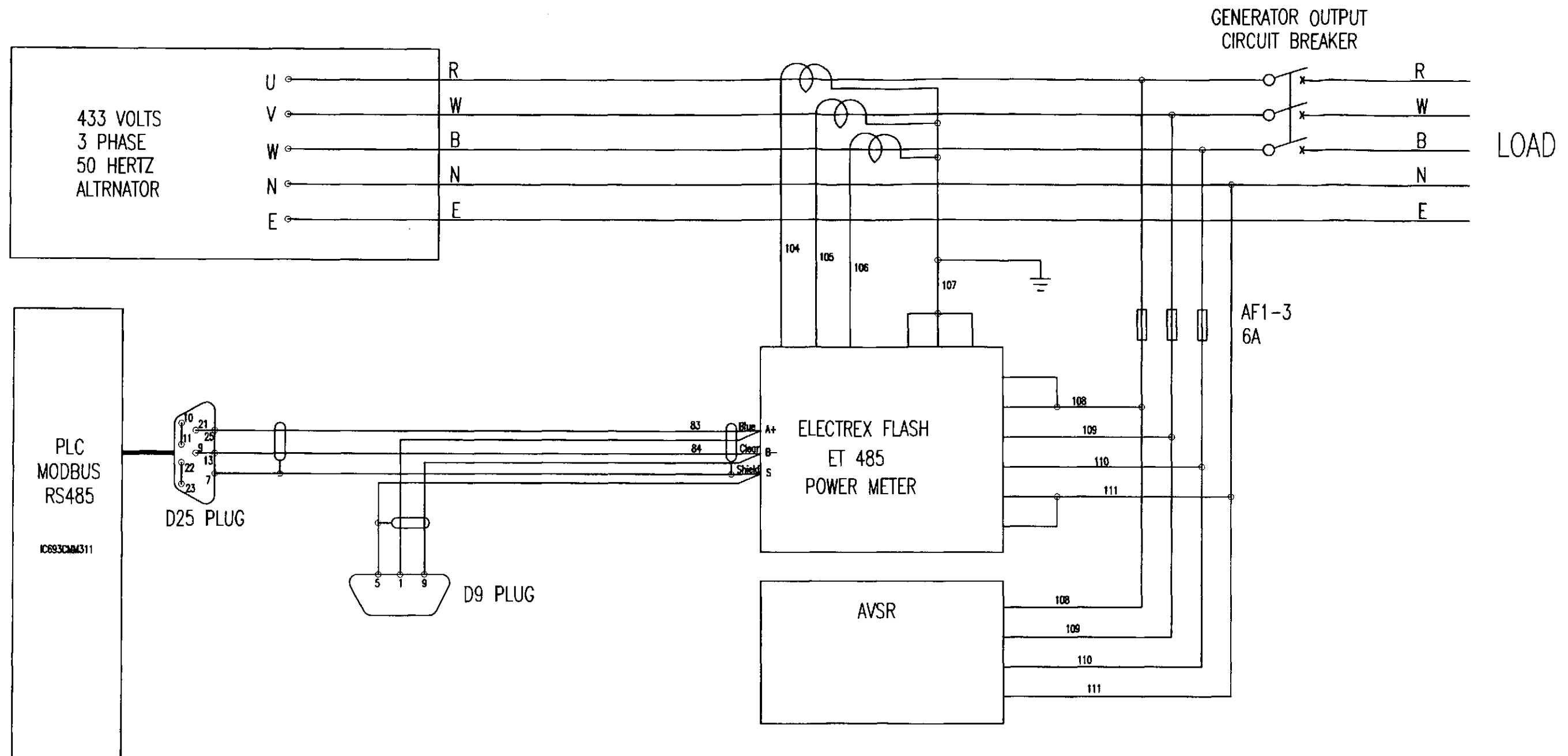


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Active 10/12/2014

CLIENT	BRISBANE WATER
PROJECT	BRISB. WATER PUMP STATION GENERATOR
DRAFTER	HJR
DESIGNED	HJR
DRAFTING CHECK	
DESIGN REVIEW	
SPAC JOB NUMBER	4284
SE POWER JOB NUMBER	15016

TITLE	GENERATOR ELECTRICAL SCHEMATIC
SCALE	NTS
DRAWING No	15016-02
No IN SET	15 of 15
DATE	07-03-05



AS BUILT

DESIGN CHECK *[Signature]*

DATE 5-7-05

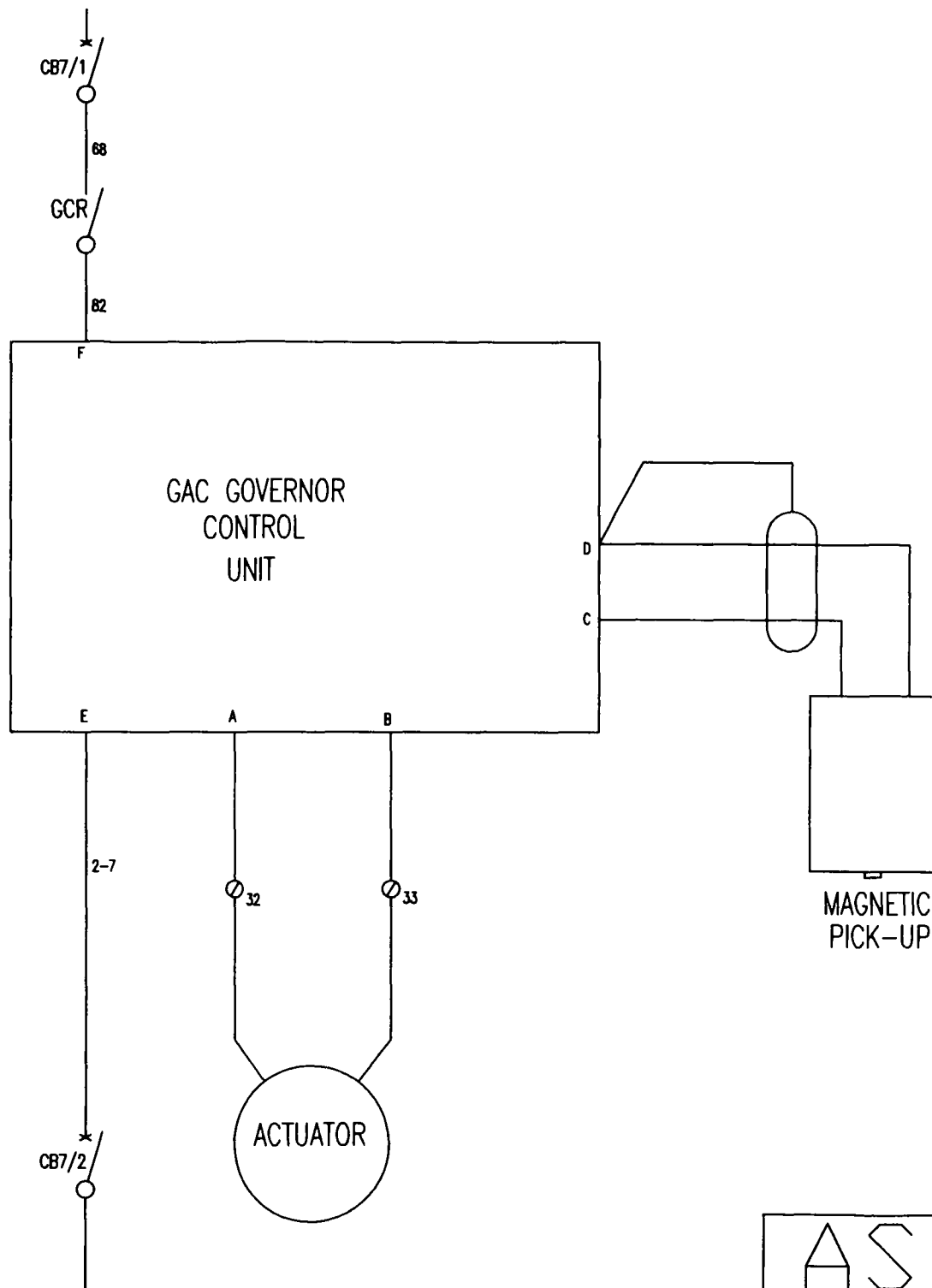
REV	DATE	DESIGN	REVIEW	REV'D	APP'D	AMENDMENT
C						
B						
A	07-05-05					NEW DRAWING



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CLIENT	PROJECT	DRAFTER	DRAWING CHECK	EPAC JOB NUMBER	SE POWER JOB NUMBER
BRISBANE WATER	BRISB. WATER PUMP STATION GENERATOR	HJR	<i>[Signature]</i>	4284	15016

TITLE	SCALE	DRAWING NO	No IN SET	APP'D
ELECTRICAL SCHEMATIC	NTS	15016-02	4 of 5	A



AS BUILT

DESIGN CHECK *[Signature]*

DATE 5-7-05

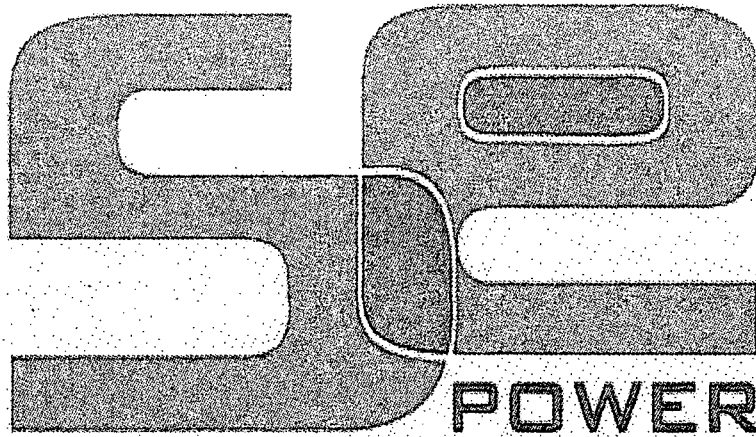
No	DATE	DESIGN REVIEW	REV'D P.MGR	APP'D P.MGR	AMENDMENT
C					
B					
A	07-03-05				NEW DRAWING



47 PROPRIETARY ST.
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Phone: (07) 3890 1744

CLIENT	BRISBANE WATER		
PROJECT	BRISBANE WATER PUMP STATION GENERATOR		
DRAFTER	DRAFTING CHECK	EPAC JOB NUMBER	SE POWER JOB NUMBER
HJR	<i>[Signature]</i>	4284	15016
DESIGNED	DESIGN REVIEW		
HJR	<i>[Signature]</i>		

TITLE	GAC GOVERNOR CONTROLS		
SCALE	NTS	DRAWING No	15016-02
No IN SET	5 of 5	ANY	A



INSPECTION & TEST PLAN

SP243 BIRKIN ROAD

**Generator Sets
For
Brisbane Water
Contract BW. 50081-04/05**

SEPE Document No. ITR 15016

Prepared by S E Power
47 Proprietary St., Tingalpa
Brisbane, Qld, 4173
Telephone: (07) 3890 1744

Document Control

REVISION		PREPARED BY	APPROVED BY
C	18.03.05	Paul Hlavka	Jim Pringle

Initials List

personnel performing tests or signing ITP shall enter their name and sample signature and initials below.

Name	Company	Signature	Initials
------	---------	-----------	----------

DOCUMENT REGISTER

Document No.	Testing	Manufacture / Workshop
010		Fuel Tank and Pipe Testing Schedule
011		Base / Tank Fabrication Procedure
012		Enclosure Fabrication Procedure
013		Engine / Alternator Assembly Procedure
014		Tank Base Assembly Procedure
015		Enclosure Assembly Procedure
	Factory Testing	
016	Electrical Functions Test Sheet	
017	Final Inspection Test Sheet	
018	Factory Load Test	
019	Transient Load Response Test Sheet	
020	Sound Pressure Level Factory Test	
	Site Acceptance Testing	
S016	Electrical Functions Test Sheet	
S017	Final Inspection Test Sheet	
S018	Site Load Test	
S019	Transient Load Response Test Sheet	
S020	Sound Pressure Level Test	

 SECTION

S.E. POWER**ITP and Procedures**

Subject: Brisbane Water

Sheet: 1

1. PURPOSE

- 1.1 Description of methods and processes involved in the Manufacture, Testing and delivery of the Brisbane Water pump station generators including factory testing of the generators resulting in the production of an ITP.

2. SCOPE

- 2.1 Detailed design mechanical G/A and electrical schematic.
- 2.2 Drawing of major components.
- 2.3 Manufacture skid tank base, switchboard and enclosure.
- 2.4 Assembly of skid tank base, switchboard and enclosure as approved in drawing package.
- 2.5 Workshop visual inspection and pre-testing of the works. Including factory testing up to pre commissioning stage.
- 2.6 Site delivery.
- 2.7 Site acceptance testing.

3. REFERENCES

- 3.1 All Design Drawings supplied by S.E. Power.
- 3.2 S.E. Power ITP and factory test sheets.
- 3.3 S.E. Power site acceptance testing document and test sheets.

4. DESCRIPTION

- 4.1 The generators will be tested separately in the workshop.
- 4.2 The installation of the generators will follow the process of, manufacture, painting, assembly and factory testing.

5. PROCEDURE

- 5.1 Drawings for comment - One set of completed drawings for Brisbane Water will be issued for comment.
- 5.2 A schematic showing the calculated design will be issued to Brisbane Water for approval. Following approval of these drawings and return of the "For Comment" drawings, design will proceed.

ECTION

S.E. POWER**ITP and Procedures**

Subject: Brisbane Water

Sheet 1

- 5.3 Fabrication – Following approval to proceed and any amendments notes marked on the drawings that may affect final approval the sheet metal drawings will be issued for construction to the relative supplier.
- 5.4 Purchasing of materials – Major components and associated items will be purchased.
- 5.5 Sheet metal inspection – During construction the generators will be inspected for compliance to the approved drawings and specifications.
- 5.6 Factory Testing – Factory tests to the requirements of S.E. Power's factory test sheets will be fulfilled..
- 5.7 Delivery to site – Delivery to site will be via a specialised contractors for all of the generators..
- 5.8 Installation of generators and cables - By others.
- 5.9 Site acceptance testing – All installed equipment will be tested to the requirements of the specification prior to the starting of commissioning tests.
- 5.10 Site Commissioning – All site commissioning will be carried out by BW staff. and S.E. Power will assist with the operation of generators and controls.

SECTION

S.E. POWER

ITP and Procedures

Sub Inspection and Test Plan

Sheet 1 of 3

INSPECTION AND TEST PLAN – QUALITY STANDARD AS 9001/2002

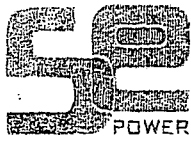
Design, Manufacture and Testing

Client:	Approved By:
Project:	Contract:
Date:	Contract No:
Component:	Site:
Unit: Generators	Technical Spec.

QP No.	Section	Activity	Method or Reference	Acceptance	Inspect		
					SE		BW
1	Drawings	Mechanical Electrical	Specification Standard SE. Procedures	Design Intent			
2	Procurement	Engine Alternator Associated Items	Drawings and Acceptance Practise	Meets Specification and Drawing Components			
3	Manufacturing	Skid Base Enclosures Switchboard	Drawings and Acceptance Practise	Meets Specifications and Drawing Components			
4	Painting	Skid Base Enclosures Switchboard	Specification	Physical Check			
5	Assembly	Skid Base Enclosures Switchboard	SE Procedures	Specification SE Power drawings			
6	Testing	Generator Unit	ITR (Factory Test Sheets)	Specification SE Power drawings			
7	Delivery Site Testing	Place on slab Site acceptance testing	SE SAT Document	As Per Brisbane Water Requirement Specification SE SAT Document acceptance			

Symbols, Abbreviations, Definitions		
O Operational Activity	V Verification	W Work Instruction
BW Brisbane Water	W Witness Point	QP Quality Procedure
SE S.E. Power Equipment	H Hold Point	RC Release Certificate
	X Manufacture Inspection	Hold Point Client Must Inspect
		Witness Point Notify Client of option to inspect item.

N CTION



ELECTRICAL FUNCTION TEST SHEET

AS 3000 WIRING RULES

FACTORY ITP Form 016

CLIENT: B/water
 SERIAL NO: 0505009
 ENGINE TYPE: John Deere 6068TF25P
 ALTERNATOR TYPE: Stamford #34 C
 CONTROLLER TYPE: _____

DATE: 23-5-05
 JOB NO: 15016
 ENG. SERIAL NO: ~~75359~~ 75359
 ALT. SERIAL NO: X04J390007/1

SP 243

GENERATOR CONTROL FUNCTIONS	CODE	COMMENTS
CB Tripped / Alt. Overload		—
Genset Running		ok
MEN Fault		ok
Remote Start / Stop		start ok stop ok
Engine High Temp. Alarm		ok 96 C
Engine High Temp. Shutdown		ok 101
Low Water Level Alarm		ok - shutdown ok
Low Oil Pressure Alarm		ok 20 P.S.I
Low Oil Pressure Shutdown		ok 15 "
Start Fail Alarm		ok
Status Lamps / Controls		ok
Emergency Stop		S/Board ok - genset ok
Lamp Test		ok
Fuel Low — Refill Needed		Low ok - Refill ok
Fuel Empty		Empty ok shutdown ok
Starter Motor Relay		ok
Underspeed Shut Down		ok - 1350
Overspeed Shut Down		ok - 1750
Alarm Shut Down		ok
Alt. Undervolts		ok - 190
Alt. Overvolts		ok - 300
Charger AC Failed		ok
Control Batt. Low Volts		ok
Start Batt. Low Volts		ok
Engine Gauges		ok
Enclosure Doors Open		ok
Alternator High Temperature		—
Audible Alarm / Mute		— N/A
Remote ATS Controls		—

Code:

☐ = Data Recorded

N/A = Not Applicable

N/C = Not Compliant

Signed: G.M. Gregor 23-5-05

Technician Name: _____

FACTORY LOAD TEST REPORT
Form 018

SP 243 Birkin Rd

CLIENT: B/water DATE: 25-5-05
SERIAL NO: 0505009 JOB NO/CONTRACT NO: 15016
ENGINE TYPE: John Deere 6068 TF 258 ENG. SERIAL NO: 753599
ALTERNATOR TYPE: Stamford 434C ALT. SERIAL NO: 2045390007/1
GOVERNOR TYPE: GAC CONTROLLER TYPE: _____
OVERSPEED TYPE: PLC UNDERSPEED TYPE: PLC
SHUTDOWN SOLENOID: GAC ENGINE SHUTDOWN TEMP: 115°C
LOW OIL PRESSURE SHUTDOWN: 15 psi
KVA: 275 kW: 115 A @ UNITY PF: 132

TIME	1:00	1:30	2:00	2:30	3:00				
OIL PRESSURE	500	350	300	280	300				
OIL TEMPERATURE	—	—	—	—	—				
JACKET WATER TEMPERATURE	0	82	85	92	80				
AMPS	0	99	132	146	0				
VOLTS	241	241	241	241	241				
PHASE	417.6	417.4	417.4	418	417.5				
AMBIENT TEMPERATURE	28	28	28	28	28				
Hz	50	50	50	50	50				
LOAD%	0	75%	100%	110%	0				
BATTERY VOLTAGE CURRENT									

Code:

□ = Data Recorded

N/A = Not Applicable

N/C = Not Compliant

Signed: GMM Greger 25-5-05

Technician Name: _____



47 Proprietary Street
Tingalps Qld 4073
Ph. 3890 1744
Fax 3390 9723

TRANSIENT LOAD RESPONSE TEST SHEET

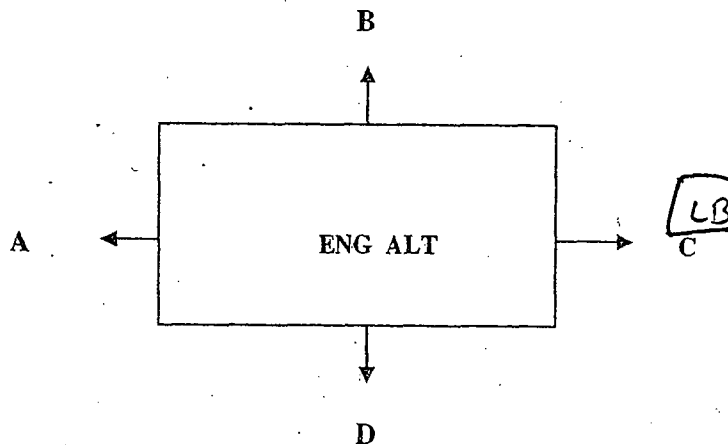
Transient Response for Load Changes: Load pf 0.8

% Change Electrical kW	0-25	0-50	0-75	0-100	100-0	75-0	50-0	25-0
Change in Electrical kW			65	90	90	65		
% Change Hz			2.7	4.1	1.9	1.1		
% Change Volts			1	5	1	1		
Recovery Secs			3	3	2	2		



DIESEL GENERATOR SET SOUND PRESSURE LEVEL FACTORY TEST REPORT

CLIENT: B/water DATE: 31-5-05
JOB NO: 15016 JOB TYPE: _____
ENGINE TYPE: John Deere 6068 TF 258 ALTERNATOR TYPE: Stamford 434C
SOUND PRESSURE LEVEL REQUIRED 60 dbA @ 5 m



NO LOAD					FULL LOAD				
POSITION	1m	3m	5m	7m	POSITION	1m	3m	5m	7m
A			56		A			62	
B			53		B			68	
C			54		C			71	
D			53		D			68	

SITE LOAD TEST REPORT Form 018

CLIENT: B/water 243 Birkin Rd. DATE: 16-6-05
SERIAL NO: 0505009 JOB NO/CONTRACT NO: 15016
ENGINE TYPE: 6068 TF 258 ENG. SERIAL NO: 753599
ALTERNATOR TYPE: 434C ALT. SERIAL NO: X04J390007/1
GOVERNOR TYPE: 6AC CONTROLLER TYPE: _____
OVERSPEED TYPE: PLC UNDERSPEED TYPE: PLC
SHUTDOWN SOLENOID: 6AC ENGINE SHUTDOWN TEMP: 115°C
LOW OIL PRESSURE SHUTDOWN: 15
KVA: 275 KW: 115 A @ UNITY PF: 132

TIME	2:00	2:15							
OIL PRESSURE	450	330							
OIL TEMPERATURE	—	—							
JACKET WATER TEMPERATURE	—	80							
AMPS	—	P1-50 P2-50 P3-50	} 110 starter		218 V				
VOLTS	240	240			246.8V				
PHASE	417	417							
AMBIENT TEMPERATURE	25	93 am 2 pumps (1 run 1 start)			146 stat 218.5 V 238-2 V				
Hz	50.0	50			217-6 254.5				
LOAD%	✓	pump start							
BATTERY VOLTAGE CURRENT	✓	—							

Code: 2 x 30 kw soft start 12 % V.D.
(future 90 kw V.S.D.)

□ = Data Recorded

N/A = Not Applicable

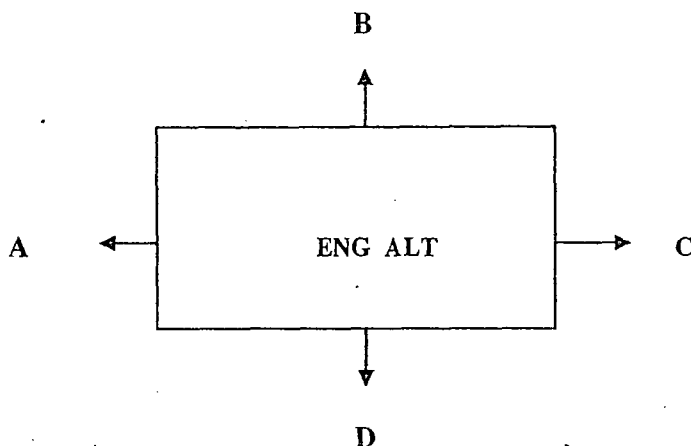
N/C = Not Compliant

Signed: GAMcGregor
Technician Name: _____



DIESEL GENERATOR SET SOUND PRESSURE LEVEL SITE TEST REPORT

CLIENT: B/water 243 Birkin Rd DATE: 16-6-05
 JOB NO: 15016 JOB TYPE: _____
 ENGINE TYPE: 6068 TF 258 ALTERNATOR TYPE: 434 C
 SOUND PRESSURE LEVEL REQUIRED 60 dbA @ 5 m



NO LOAD					FULL LOAD				
POSITION	1m	3m	5m	7m	POSITION	1m	3m	5m	7m
A					A			60	
B					B			59	
C					C			57.5	
D					D			57	



DEEP SEA ELECTRONICS PLC

5103/5

BATTERY
CHARGERIssue 2
VH 5/7/01

DESCRIPTION

The model 5100 series 3 Amp and 5 Amp **battery chargers** are designed for permanent connection to automotive batteries, maintaining them in a fully charged condition without over-charging. The chargers are also capable of rapidly recharging the batteries at a current up to the full rated output. The charger may also be used to supply a standing load attached to the battery. The charger output may be factory set to account for the standing load.

The charger is designed for reliability, ease of installation and accessibility during routine servicing. It features radio frequency suppression and its smooth output **linear mode design** has a low ripple voltage making the charger suitable for use with electronic equipment.

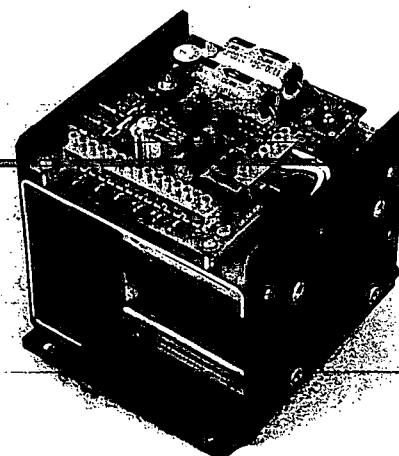
The charger has both **Overload** and **Short Circuit protection** features, achieved by limiting the current to a safe value during these conditions. It will automatically recover after the condition is removed.

If a short circuit or a severe overload is applied such that the voltage falls below four volts for longer than 10 seconds, then the **Charge Fail Alarm** relay will energise and the charge fail contact will close.

If the charger is inadvertently reverse connected to the battery then the fuse-link on the circuit board will rupture. This should be replaced with a 10A quick blow type.

The **electronic control** circuit ensures that the charger can remain operating during engine cranking and running, operating in parallel with the charge alternator where necessary.

The charger features a **boost charge** facility to enable rapid recharging of discharged batteries or to allow periodic equalisation of battery cells. When the 'boost mode select' terminals are connected together the charger output will rise by 0.35V per cell.



CAUTION!

Boost mode must only be used in accordance with the battery manufacturers instructions otherwise cell damage or an increased maintenance requirement will occur.

SPECIFICATION

DC OUTPUT:

12 V DC or 24V DC Nominal (specified on ordering)

AC INPUT:

220 - 250 V AC 50/60Hz (Specified on ordering)

OUTPUT CURRENT:

3Amps or 5Amps electronically limited

(specified on ordering).

OPERATING TEMPERATURE RANGE:

-10 to +60°C

INDICATIONS:

'Charger On' LED.

PROTECTIONS:

Short Circuit, Over Voltage, Over-current, Reverse Polarity, Reverse Power

BOOST MODE:

+0.35V per Cell above Float voltage.

OPERATION:

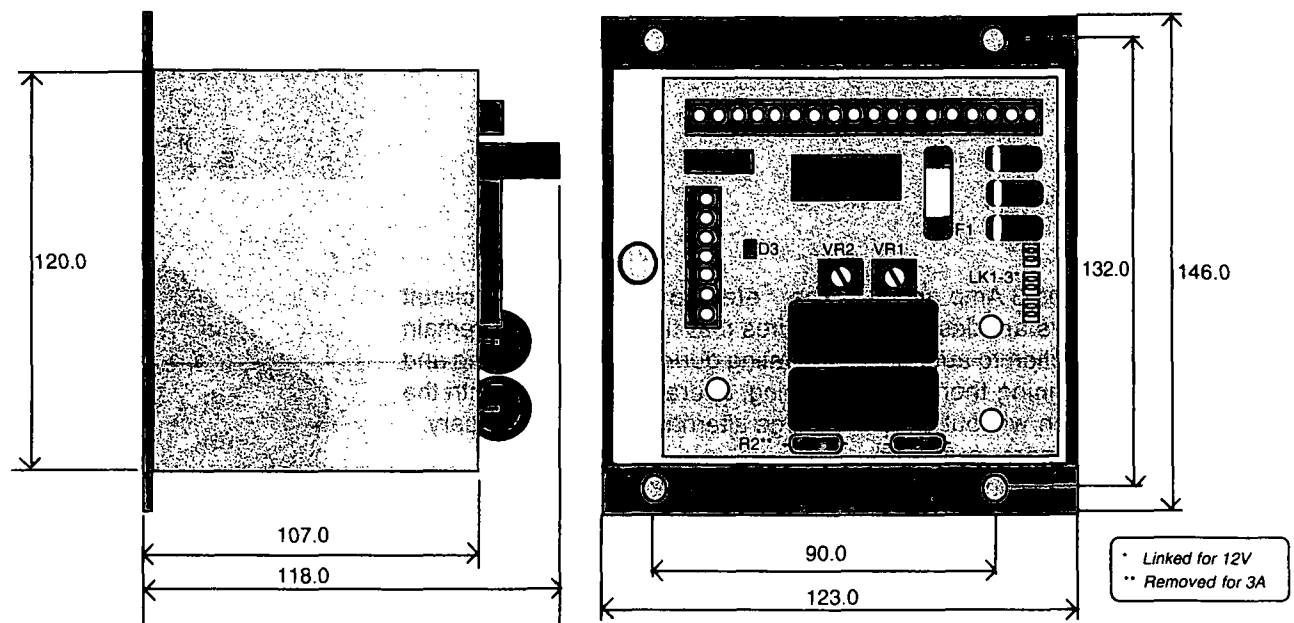
The charger will supply current to the battery until the battery terminal voltage is equal to the set float voltage, at which point only a trickle charge current is present. When the battery voltage falls due to a load being applied and the battery being discharged, the charger will once again supply current to restore the voltage of the battery to the float voltage.



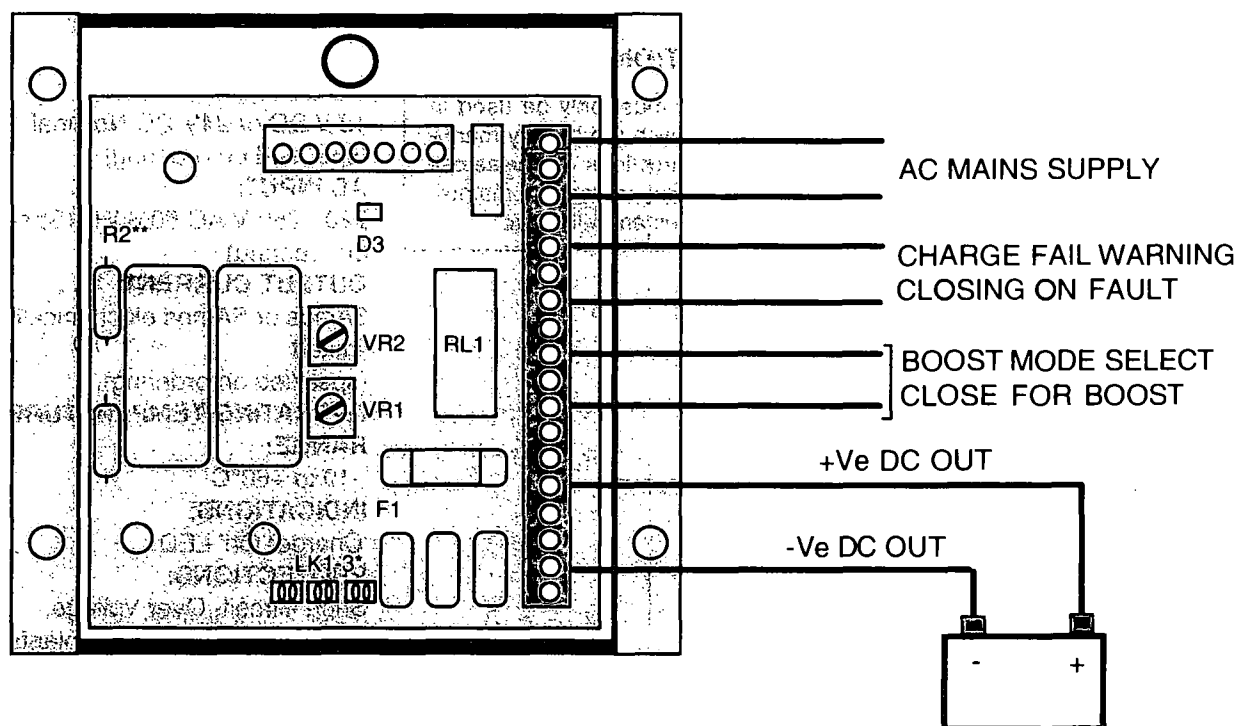
Note

The 'Charger On' LED will illuminate even if the fuse has ruptured.

CASE DIMENSIONS



TYPICAL CONNECTIONS



Battery Type	12Volt	24Volt
Lead Acid	13.7V	27.4V
Planté	13.5V	27.0V
Sealed Lead Acid	13.6V	27.2V
Nicad (9 or 18 Cells)	13.0V	26.0V
Nicad (10 or 20 Cells)	14.5V	29.0V

(These are standard settings. Please ensure that the quoted values are suitable for the intended battery. Refer to battery manufacturer for details.)

Deep Sea Electronics plc

Highfield House, Hunmanby Industrial Estate, North Yorkshire, YO14 0PH, England
Tel: +44 (0) 1723 890099 Fax: +44 (0) 1723 893303 E-mail: sales@deepseapl.com

CE ELECTREX hereby declares that its range of products complies with the EMC requirements of Directive 89/336/EEC and also the requirements regulating the energy measurement instruments CEI EN 61326.

1 SAFETY

This instrument was manufactured and tested in compliance with class 2 IEC 1010 and VDE 411 standards, in accordance with group B VDE 0110 standards for operating voltages lower or equal to 250 VACrms phase neutral.

In order to maintain this condition and to ensure safe operation, the user must comply with the indications and markings contained in the following instructions:

When the instrument is received, before beginning installation, check that it is still intact and no damage was incurred during transport.

Ensure that the operating voltage and mains voltage set are the same and then proceed with installation.

The power supply must not be earth connected.

The instrument is not fitted with a protection fuse on the power supply, thus the installer must care for the protection.

Maintenance and/or repairs must be carried out only by qualified, authorized personnel.

If there is ever the suspicion that safe use is no longer possible, the instrument must be taken out of service and precautions taken against any accidental use.

Operation is no longer safe when:

- 1) There is clearly visible damage.
- 2) The instrument no longer functions.
- 3) After lengthy storage in unfavorable conditions.
- 4) After severe damages incurred during transport.

1.1 OPERATOR SAFETY

Read these instructions carefully before installing and using the instrument

The instrument described in this user manual is intended for use by properly trained staff only. Maintenance and/or repairs must be carried out only by authorized personnel.

For proper, safe use of the instrument and for maintenance and/or repair, it is essential that the persons instructed to carry out these procedures follow normal safety precautions.

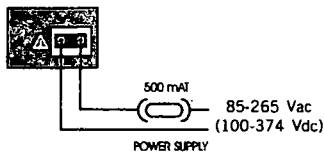
1.2 SYMBOLS

READ THE INSTRUCTION



1.3 POWER SUPPLY

The instrument is fitted with a separated power supply with extended functioning range. The terminals for the power supply are numbered (13 and 14). Max 2,5 mm² cross-section cables must be used.



2 VOLTAGE AND CURRENT MEASUREMENT CONNECTIONS

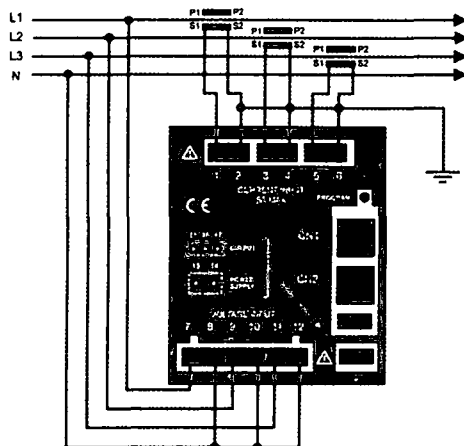
Use cables with max cross-section of 2,5 mm², attach them to the terminals marked with VOLTS INPUT according to the below diagrams. It is necessary to use 3 CT with 5A secondary.

Connect the CT amperometric signal to the terminals marked with CURRENT INPUT according to the below diagrams. Use cables with a cross-section adequate to the CT output and to the distance to be covered. The terminals max cross-section is 2,5 mm².

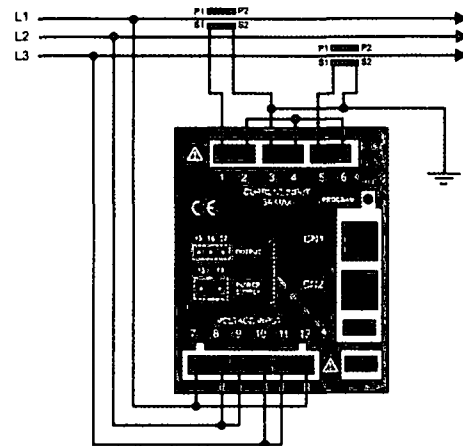
N.B. The CT secondary must always short circuit when it is not connected to the instrument to avoid damages and risks for the operator.

THE PHASE RELATIONSHIP AMONG VOLTAGE AND CURRENT SIGNALS MUST BE CAREFULLY RESPECTED. Disregard of this rule or of the wiring diagram will result in measurement error.

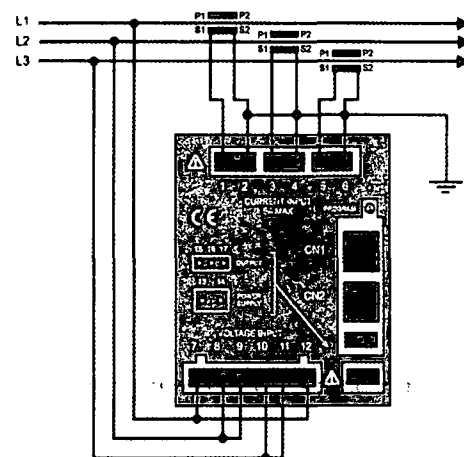
Star Connection



Delta Connection with 2 CTs

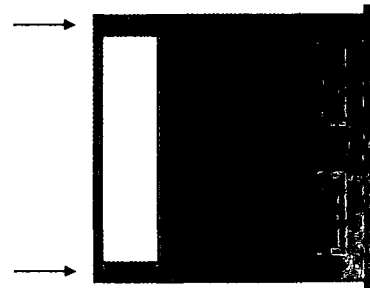


Delta Connection with 3 CTs



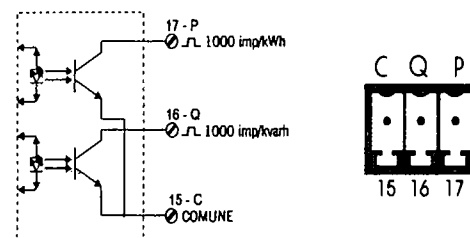
3 FIXING AND LOCKING

The connection terminals of the instrument are held in place by a plastic panel, which must be mounted using four screws (supplied). This set-up will prevent the disconnection of the current measurement terminals.



4 PULSE OUTPUT

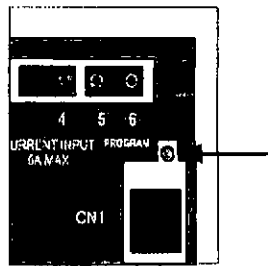
The instrument is fitted with two impulse outputs proportional to the active and reactive power. The max cross-section of the cables to be used is 1,5 mm². Max values 27 Vdc 27 mA. The output location is described in figure.





5 PROGRAMMING MODE

The procedure of instrument's programming allows to set-up the functions' parameters. To access the programming pages a button 'Program' is available at the instrument rear.



With this button it is possible to move from a field to another of a page and then move to next page.

With these 2 buttons it is possible to modify the blinking selected field.

On define field either a functioning parameter or a numerical field.

With this button it is possible to move next page.

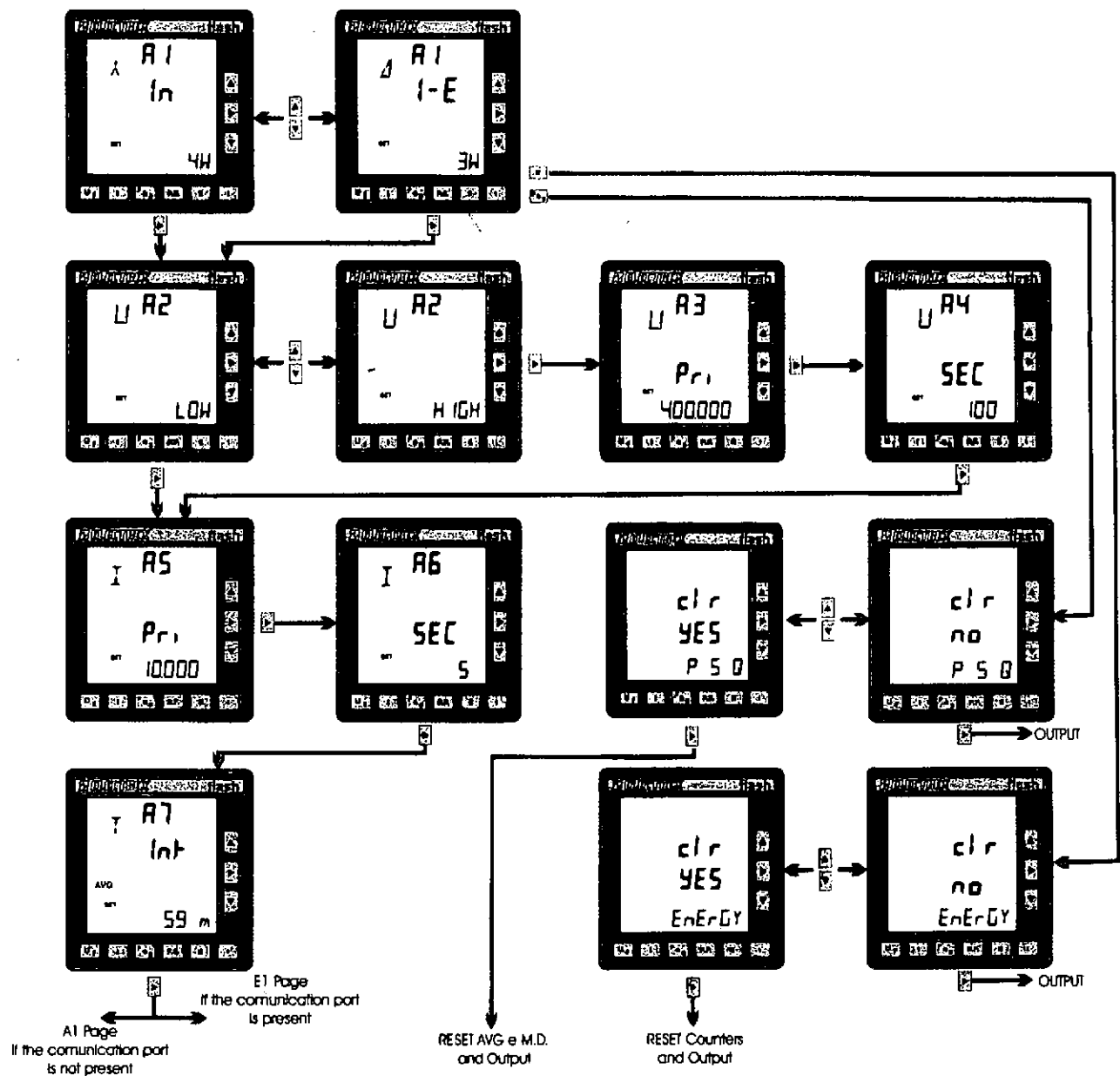
With this button it is possible to go back previous page.

Pressing again the button 'Program' to exit the Set-up allows to memorise parameters.

If at the first programming page, after pressed the button 'Program', on press the button on enter the counter reset page.

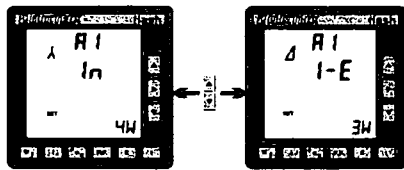
If at the first programming page, after pressed the button 'Program', on press the button on enter the average power reset page and maximum demand reset page.

6 INSTRUMENT SET-UP



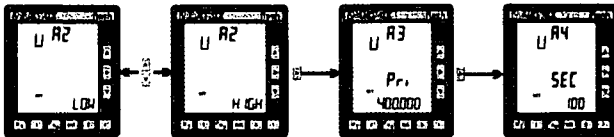
7 INSTRUMENT PROGRAMMING

First programming page allows to set-up network configuration.



At the beginning on choose between just import **In** or import-export system **I-E**.
Then the connection: 4 wires with neutral **4W**, star **A** or 3 wires without neutral, delta **3W**, triangle **A**. Default setting is **4W** and just import **In**.

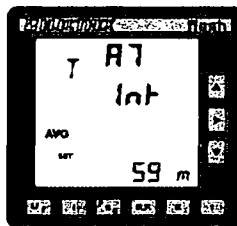
Next page allows set-up Low or High Voltage and parameters of Potential and Current Transformer.



After selecting direct **LOW** on move to page A5, otherwise selecting on move to page A5, otherwise selecting **HIGH** for Medium or High Voltage, next 2 pages allow programming primary **Pr**, and secondary **SEC** voltage transformer with reference to the values printed on VT plate.
Default setting is **LOW**.

Page A5 allows set-up primary **Pr**, and secondary **SEC** current transformer as printed on CT plate. Default setting is Pri=1 and Sec=1.

Next page allows programming the integration time (from 1 up to 60 minutes) for measure of average power and maximum demand.



Programming in the range from 1 to 60 minutes.

8 RS485 PROGRAMMING

WARNING: ALL MODIFICATIONS TO THE SETTINGS OF THE INSTRUMENT BECOME ACTIVE ONLY WHEN EXITING THE SETTING MENU WITH THE "PROGRAM" PUSH BUTTON ON THE BACK.

The COM port setting pages are following the measuring set up pages. To join them use the



push button to go on from one page to the other and the



push button to go back.

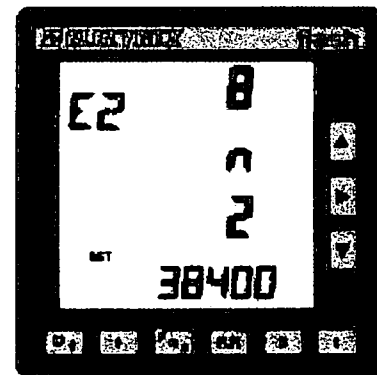
The first page is:



Where:

- E1 is the page identifier.
- 2 is the Modbus Address of the instrument (can be changed)
- 0.10 is a programmable delay in the instrument answer. It is the minimum time from request to answer.
- Modbus protocol communication.

The second page is:



Where:

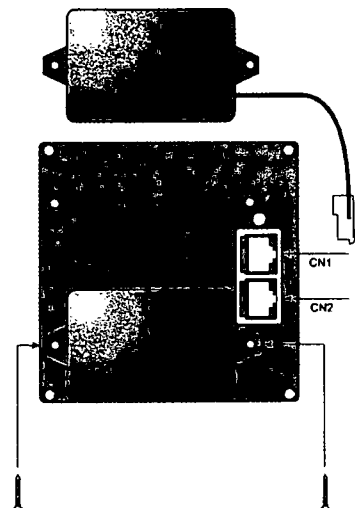
- E2 is the page identifier
- 8 is the number of bit (Fixed)
- n is the parity (n, O, E)
- 2 is the number of stop bit (1 or 2)
- 38400 is the communication baud rate (from 2400 up to 38400)

9 CONNECTING OPTIONAL COMPONENTS

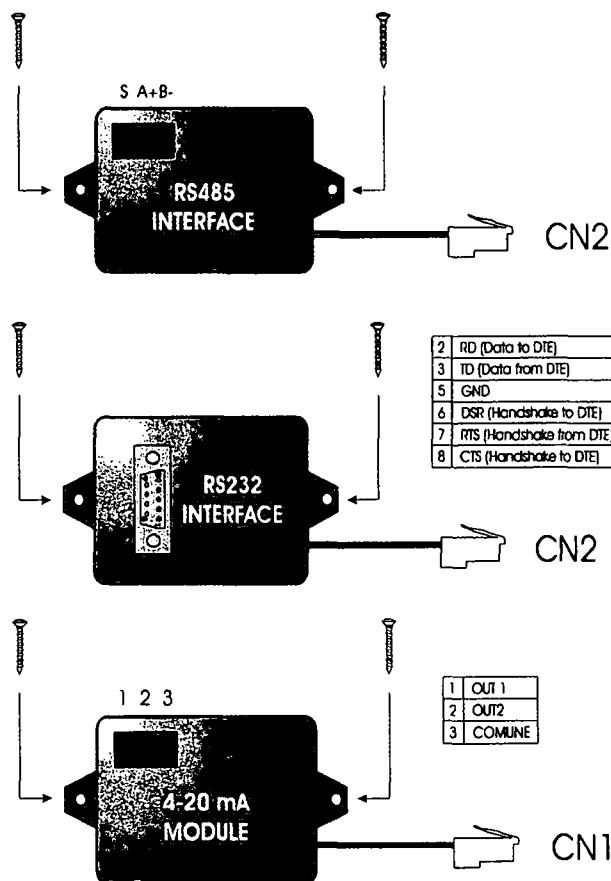


All the options must be inserted with the instrument off

The options of the Flash instrument are fixed mechanically to the back anchor plate of the instrument, where are accessible the RJ45 connectors for the electrical connection. The window concerning the setting of the option characteristics appears only when one of the options is inserted in the instrument.



CN1 = 4-20 mA Module or Hardware Key
CN2 = RS485 Interface or RS232 Interface



10 HARDWARE KEY



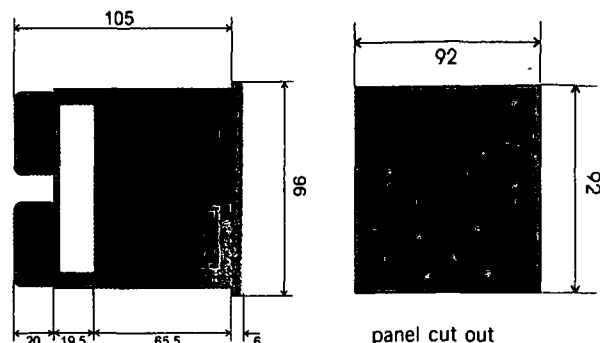
The use of the hardware key allows to the user to add functionalities to the instrument (for example, the key "ET UPGRADE" transforms a Flash in a Flash ET). In order to do so, once the key is inserted into the instrument off, follow the procedure:

- 1) Turn on the instrument and verify if on the display appears "UPG" (if the key is not valid, it is showed an error message "Error");
- 2) Wait for the key reading and check the residual credits number (if the number is zero on the display appears "dEniEd");
- 3) When the instrument is ready to execute the updating, on the display appears "ConFirm" blinking.

Pressing the button , the instrument enables the supplementary functions and updates the key decreasing the credits number.

NOTES: During the updating it is showed "LoAdinG". Pressing any button during the updating, it is showed "AbortEd" and the instrument is not updated. If all the supplementary functions which can be enabled are already active, on the display appears "no nEEd" blinking.

11 DIMENSIONS (MM)



12 TECHNICAL CHARACTERISTICS

Display:	backlit 256 segments 63x65 mm LCD with white electroluminescent lamp.
Measurement sections:	Voltage input: 500 Vrms (max 1,7 crest factor); Input overload: 800 Vrms; max 900 Vrms for 1 second; Current Input: 5 Arms (1,7 crest factor); Input overload: 20 Arms; max 100 Arms for 1 second; 85-265 Vac (100-374 Vdc)
Power supply:	45-65 Hz
Frequency:	Class 1 on the active power in compliance with CEI EN 61036; 0,5% on the voltage and current measurements; RMS up to the 31 st harmonic
Accuracy:	2 digital outputs for impulse or alarms (DIN 43864 27 Vdc 27mA - 1000 Imp./kWh)
Outputs:	Front panel = IP51
Protection level:	from 0°C to +50°C
Temperature Range:	Max 90% without condensate
Humidity:	power counters with resolution 0,0001 kWh up to 99.999.999,9999 kWh (serial)
Counters:	96x96mm panel
Mounting:	



Register your engine for warranty!!

JOHN DEERE ENGINE WARRANTY REGISTRATION

Purchaser's Name _____

MAILING Address _____

City _____ State/Province _____ Postal Code _____ Country _____

Engine Serial Number from **Engine** Serial Number Plate _____

(Required number is made up of two letters then four digits then one letter then six digits. All 13 characters required.)

Date Engine Delivered _____ Engine is _____ Original _____ Replacement

(Required) (Day) (Month) (Year)

Equipment Manufacturer _____ Equipment Description & Model _____

(The equipment, not the engine.)

(What is it? What does the manufacturer call it?)

Does the engine provide the power to **move** the equipment from place to place? _____ Yes _____ No

How will the equipment be used? _____

The John Deere *Operation and Maintenance Manual* for the above engine was received. The warranty, safe operation, and proper servicing of the engine were explained to me. I have received and have read the Engine Owner's Warranty.

Telephone (_____) _____

E-mail Address _____

Purchaser's Signature _____

Date _____

Note: Register via Internet at www.johndeere.com/enginewarranty or this form may be faxed to John Deere at 1-319-292-5844.

For information on your rights to privacy, please see page 2 of the John Deere Engine Owner's Warranty - Worldwide.

Return Address

Affix
First-
Class
Postage

JOHN DEERE POWER SYSTEMS

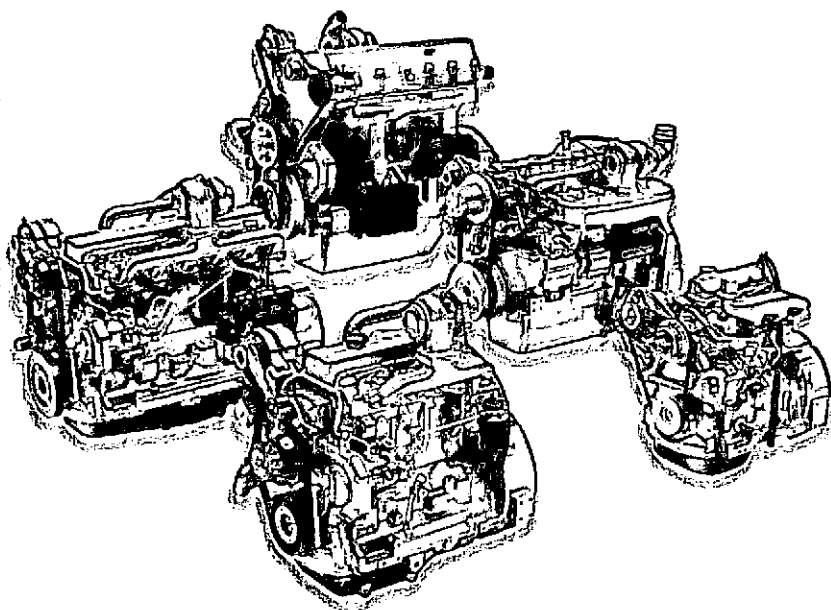
PO BOX 5100

WATERLOO, IA 50704-5100

USA

Engine Owner's Warranty

Worldwide



JOHN DEERE

New John Deere Off-Highway Engines



JOHN DEERE

This booklet focuses on John Deere engines marketed in products manufactured by companies other than John Deere or its affiliates, and on John Deere repower engines in all applications.

Herein appears the original warranty applicable to the engine as delivered to the retail purchaser on or after 1 January 2001. Questions the purchaser might have about warranty and warranty service are addressed herein.

Promptly register your engine on-line at www.johndeere.com/enginewarranty; or mail or fax the tear-off registration form to John Deere.

But first:

- 1. Record the engine's 13-character serial number below:**

(Take from the John Deere Serial Number plate on the side of the engine. It begins with two letters, and must be 13 characters in length; e.g., PE6068T123456.)

- 2. Record the engine's Option Codes on page 13.**

(Take these from the option code label on the engine rocker arm cover.)

- 3. Read this booklet, and store it for handy reference.**

Note: "John Deere" means John Deere Power Systems with respect to users in the United States, John Deere Limited with respect to users in Canada, and Deere & Company or its subsidiary responsible for marketing John Deere equipment in other countries where the user is located.

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Warranty Exclusions	9
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WARRANTY REGISTRATION CARD	Front outside cover
Warranty Transfer Card	Back outside cover

WHEN WARRANTY SERVICE IS NEEDED

While most John Deere engines do not require the attention of an authorized John Deere service dealer during the engine warranty period, the nearest dealer stands ready with genuine parts and trained and equipped personnel should the need arise.

If following the operation and maintenance instructions delivered with the engine/machine are not adequate to correct an engine problem, contact the nearest John Deere service dealer for assistance. Authorized engine service dealers for U.S.A. and Canada can be found at: www.johndeere.com. (Click on "Dealer Locator".) In other countries, contact the machine importer, or John Deere Power Systems in the U.S.A. at telephone number 1-319-292-5871, or fax number 1-319-292-5844; or in France (for Africa, Europe, and the Middle East) at telephone number 33.2.38.82.61.57 or fax number 33.2.38.84.62.66.

When requesting warranty service, the purchaser must be prepared to provide proof that the engine is within the warranty period.

Should the efforts of the dealer contacted not yield satisfactory results, the purchaser should contact the Service Manager in that dealer's John Deere marketing unit. The units are indicated on pages 3-6.

Regardless of the organization contacted, this information is always required: Engine serial number, date of delivery, engine owner, name and location of dealer and specific person contacted, date of contact, nature of engine problem, and outcome of the service dealer contact.

Given that normally it is the dealer contacted who in the end will provide the service required, maintaining a purchaser-dealer relationship of mutual respect from the beginning is always helpful.

PRIVACY NOTICE

At John Deere your privacy is important to us. We collect, use and disclose your personal information in accordance with the John Deere privacy statement. For instance, we collect, use and disclose your personal information to provide you with the products and services that you request; to communicate with you as our customer (e.g. warranty and product improvement programs) and to meet safety and legal requirements; and for marketing and promotional purposes. Sometimes, we may ask our John Deere affiliates, dealers or business partners to do work for us which involves your information. For complete details on your privacy rights and to obtain a copy of the John Deere Privacy Statement, please visit our website at www.JohnDeere.com.

John Deere Marketing Units/Contacts

(See page 7 for use of the numbers in parentheses.)

- | | |
|------------------|--|
| Argentina | <p>(1) Industrias John Deere Argentina S.A.
 Juan Orsetti 481
 (2152) Granadero Baigorria
 Santa Fe
 Tel: 54-341-4101800 Fax: 54-341-4101801
 diesel-arg@johndeere.com</p> |
| Australia | <p>(2) John Deere Limited
 166-170 Magnesium Drive
 Crestmead
 Queensland 4132
 Tel: 61-7-38023286 Fax: 61-7-38036549
 jdlaust@johndeere.com</p> |
| Brazil | <p>(3) John Deere Brasil S.A.
 Av. Jorge A.D. Logemann, 600
 98920-000 - Horizontina - RS
 Tel: 55-55-3537-1322 Fax: 55-55-3537-1035
 diesel-br@johndeere.com</p> |
| Canada | <p>(4) John Deere Limited
 295 Hunter Road
 P.O. Box 1000
 Grimsby, ON L3M 4H5,
 Tel: 905-945-9281 Fax: 905-945-0341</p> |
| China | <p>(5) Deere & Company China Operations
 Beijing Representative Office
 Suite C412 Office Building, Kempinski Hotel
 Beijing Lufthansa Center, No. 50
 Liangmaqiao Road, Chaoyang District
 Beijing 100016
 Tel: 86-10-6463-7936 Fax: 86-10-6463-8078
 dieselcn@johndeere.com</p> |
| France | <p>(6) John Deere France
 10, Rue du Paradis, Ormes
 B. P. 219
 F-45144 St. Jean de la Ruelle CEDEX
 Tel: 33-2-38-72-31-05 Fax: 33-2-38-74-86-65
 jdfr-sav-oem@johndeere.com</p> |

(continued on next page)

John Deere Marketing Units/Contacts (continued)**(See page 7 for use of the numbers in parentheses.)**

- Germany** (7) John Deere Vertrieb
John-Deere-Strasse 10
76646 Bruchsal
Tel: 49-7251-924860 Fax: 49-7251-924869
germanservice@johndeere.com
- Italy** (8) John Deere Italiana
Via G. di Vittorio, 1
I-20060 Vignate (Milano)
Tel: 39-2-95458210 Fax: 39-2-95364013
itservice@johndeere.com
- Mexico** (9) Industrias John Deere S.A. de C.V.
Boulevard Díaz Ordaz N°. 500
Garza García, Nuevo León 66210
Tel: 52-8-336-0828 Fax: 52-8-399-8437
mexicotechnicalservice@johndeere.com
- South Africa** (10) John Deere (Pty) Ltd.
2 Johnson Road
Pretoriusstad
P.O. Box 198
Nigel 1490, Gauteng
Tel: 27-11-365-1000 Fax: 27-11-365-1114
rsa@johndeere.com
- Spain** (11) John Deere Ibérica S.A.
Carretera de Toledo Km. 12.200
Apartado de Correos 10
28900 Getafe (Madrid)
Tel: 34-91-4958353 Fax: 34-91-4958206
spainjohndeere@johndeere.com
- Sweden** (12) Svenska John Deere AB
Hammarvägen 1
23222 Arlöv (Malmö)
Tel: 46-40-534040 Fax: 46-40-434521
swedenservice@johndeere.com

United Kingdom (13) John Deere Ltd.
 Harby Road
 Langar
 Nottingham NG13 9HT
 Tel: 44-1-949-860491 Fax: 44-1-949-860490
 ukservice@johndeere.com

United States (14) John Deere Power Systems
 P.O. Box 5100
 Waterloo, IA 50704-5100
 Tel: 1-319-292-5871 Fax: 1-319-292-5844
 diesel-us@johndeere.com

Other countries: (See page 7 to determine which organization below applies.)

(15) John Deere Central Services, GmbH
 John-Deere-Strasse 10
 D-76646 Bruchsal
 Germany
 Tel: 49-7251-924790 Fax: 49-7251-924789
 48jdinproduct@johndeere.com

(16) John Deere Power Systems
 B. P. 11013
 F-45401 Fleury-les-Aubrais CEDEX
 France
 Tel: 33-2-38-82-61-57 Fax: 33-2-38-84-62-66
 saranservice@johndeere.com

(17) John Deere Power Systems
 P.O. Box 5100
 Waterloo, IA 50704-5100, U.S.A.
 Tel: 1-319-292-5871 Fax: 1-319-292-5844
 diesel-us@johndeere.com

(18) Industrias John Deere S.A. de C.V.
 Boulevard Díaz Ordaz N°. 500
 Garza García, Nuevo León
 66210 México
 Tel: 52-8-336-0828 Fax: 52-8-399-8437
 mexicotechnicalservice@johndeere.com

(continued on next page)

- (19)** John Deere Asia
166-170 Magnesium Drive
Crestmead
Queensland 4132, Australia
Tel: 61-7-38023219 Fax: 61-7-38023131
diesel-as@johndeere.com
- (20)** John Deere Latin America
c/o Industrias John Deere Argentina S.A.
Juan Orsetti 481
(2152) Granadero Baigorria
Santa Fe, Argentina
Tel: 54-341-4101800 Fax: 54-341-4101801
diesel-arg@johndeere.com

The number following each country listed below indicates which of the John Deere marketing units appearing on pages 3-6 should be addressed with inquiries regarding service in that country.

Afghanistan - 15	Djibouti - 15	Libya - 15	Saint John - 20
Albania - 16	Dominica - 20	Liechtenstein - 16	Saint Kitts - 20
Algeria - 16	Dominican Republic - 20	Lithuania - 15	Saint Lucia - 20
American Samoa - 19	Ecuador - 20	Luxembourg - 15	Saint Martin - 20
Andorra - 6	Egypt - 15	Macau - 19	Saint Thomas - 20
Angola - 10	El Salvador - 18	Macedonia - 15	Saint Vincent - 20
Anguilla - 20	Equatorial Guinea - 16	Madagascar - 15	San Marino - 8
Antigua - 20	Eritrea - 16	Madeira Islands - 11	São Tomé & Príncipe - 16
Argentina - 1	Estonia - 15	Malawi - 10	Sarawak - 19
Aruba - 20	Ethiopia - 15	Malaysia - 19	Saudi Arabia - 15
Australia - 2	Faeroe Islands - 15	Maldives - 16	Senegal - 16
Austria - 15	Falkland Islands - 20	Mali - 16	Seychelles - 16
Azerbaijan - 16	Fernando Po - 16	Malta - 16	Sierra Leone - 16
Azores - 11	Fiji - 19	Mariana Islands - 19	Singapore - 19
Bahamas - 20	Finland - 12	Marshall Islands - 19	Slovakia - 15
Bahrain - 16	France - 6	Martinique - 20	Slovenia - 15
Balearic Islands - 11	French Guiana - 20	Mauritania - 16	Solomon Islands - 19
Bangladesh - 19	French Polynesia - 19	Mauritius - 15	Somalia - 16
Barbados - 20	Gabon - 16	Mexico - 9	South Africa - 10
Barbuda - 20	Gambia - 16	Micronesia - 19	Spain - 11
Belarus - 16	Georgia - 16	Moldova - 16	Spanish Guinea - 16
Belgium - 15	Germany - 7	Monaco - 6	Sri Lanka - 19
Belize - 18	Ghana - 16	Mongolia - 19	Sudan - 16
Benin - 16	Gibraltar - 11	Montserrat - 20	Suriname - 20
Bermuda - 14	Greece - 15	Morocco - 15	Swaziland - 10
Bhutan - 16	Greenland - 15	Mozambique - 10	Sweden - 12
Bolivia - 20	Grenada - 20	Myanmar - 19	Switzerland - 15
Bonaire - 20	Grenadines - 20	Namibia - 10	Syria - 16
Bosnia-Herzegovina - 16	Guadeloupe - 20	Nauru - 19	Tahiti - 19
Botswana - 10	Guam - 19	Nepal - 16	Taiwan - 19
Brazil - 3	Guatemala - 18	Netherlands - 15	Tajikistan - 16
Brunei - 19	Guinea - 16	Nevis - 20	Tanzania - 16
Bulgaria - 15	Guinea-Bissau - 16	New Caledonia - 19	Thailand - 19
Burkina Faso - 16	Guyana - 19	New Zealand - 2	Togo - 16
Burundi - 16	Haiti - 20	Nicaragua - 18	Tonga - 19
Cambodia - 19	Honduras - 18	Niger - 16	Transkei - 10
Cameroon - 16	Hungary - 15	Nigeria - 16	Trinidad-Tobago - 20
Canada - 4	Iceland - 15	Norway - 12	Tunisia - 15
Canary Islands - 11	India - 19	Oman - 16	Turkey - 15
Cape Verde Islands - 16	Indonesia - 19	Pakistan - 19	Turkmenistan - 16
Caroline Islands - 19	Iran - 16	Palau - 19	Turks & Caicos Islands - 20
Cayman Islands - 20	Iraq - 16	Panama - 18	Tuvalu - 19
Central African Rep. - 16	Ireland - 13	Papua New Guinea - 19	Uganda - 16
Chad - 16	Israel - 15	Paraguay - 20	Ukraine - 15
Chile - 20	Italy - 8	Peru - 20	United Arab Emirates - 15
China - 5	Jamaica - 20	Philippines - 19	United Kingdom - 13
Colombia - 20	Japan - 19	Poland - 15	United States - 14
Comoro Islands - 16	Jordan - 16	Portugal - 11	Uruguay - 20
Congo, Dem Rep. of - 16	Kazakhstan - 15	Puerto Rico - 20	Uzbekistan - 16
Congo, Rep. of - 16	Kenya - 16	Qatar - 16	Vanuatu - 19
Costa Rica - 18	Kiribati - 19	Reunion - 6	Venezuela - 20
Cote d'Ivoire - 16	Korea - 19	Romania - 15	Viet Nam - 19
Crete - 15	Kuwait - 16	Russia - 15	Virgin Islands - 20
Croatia - 15	Kyrgyzstan - 16	Rwanda - 16	Western Samoa - 19
Cuba - 17	Laos - 19	Saba - 20	Yemen - 16
Curaçao - 20	Latvia - 15	Sabah - 19	Yugoslavia - 15
Cyprus - 16	Lebanon - 15	Saint Bart's - 20	Zambia - 10
Czech Republic - 16	Lesotho - 10	Saint Croix - 20	Zimbabwe - 9
Denmark - 12	Liberia - 16	Saint Eustatius - 20	

JOHN DEERE NEW OFF-HIGHWAY ENGINE WARRANTY

Warranty Duration

Unless otherwise provided in writing by John Deere, John Deere makes the following warranty to the first retail purchaser and each subsequent purchaser (if purchase is made prior to expiration of applicable warranty) of each John Deere new off-highway engine marketed as part of a product manufactured by a company other than John Deere or its affiliates and on each John Deere engine used in an off-highway repower application:

- 12 months, unlimited hours of use, or
- 24 months and prior to the accumulation of 2000 hours of use;

Note: In the absence of a functional hourmeter, hours of use will be determined on the basis of 12 hours of use per calendar day.

Warranty Coverage

This warranty applies to the engine and to integral components and accessories sold by John Deere, and delivered to the first retail purchaser on or after 1 January 2001.

All John Deere-warranted parts and components of John Deere engines which, as delivered to the purchaser, are defective in materials and/or workmanship will be repaired or replaced, as John Deere elects, without charge for parts or engine repair labor, including reasonable costs of labor to remove and reinstall nonengine parts or components of the equipment in which the engine is installed, and, when required, reasonable costs of labor for engine removal and reinstallation, if such defect appears within the warranty period as measured from the date of delivery to the first retail purchaser, if the delivery is reported to John Deere within 30 days of the delivery.

Obtaining Warranty Service

Warranty service must be requested of the nearest authorized John Deere engine service outlet before the expiration of the warranty. An *authorized* service outlet is a John Deere engine distributor, a John Deere engine service dealer, or a John Deere equipment dealer selling and servicing equipment with an engine of the type covered by this warranty. (See "When Warranty Service is Needed" on page 2.)

Authorized service outlets will use only new or remanufactured parts or components furnished or approved by John Deere.

Authorized service locations and the name of the John Deere division or subsidiary making this warranty are listed in the *Parts and Service Directory for John Deere Engines* (stock number DKD376) available through any John

Deere Dealer. Off-highway engine service locations worldwide will also be found on the Internet at www.johndeere.com. (Click on "Where to Buy".)

At the time of requesting warranty service, the purchaser must be prepared to present evidence of the date of delivery of the engine.

John Deere reimburses authorized service outlets for limited travel expenses incurred in making warranty service repairs in non-John Deere applications when travel is actually performed. The limit, as of the date of publication of this booklet, is US\$300.00 or equivalent. If distances and travel times are greater than reimbursed by John Deere, the service outlet will charge the purchaser for the difference.

Warranty Exclusions

John Deere's obligations shall not apply to fuel injection pump and nozzles during the pump and nozzle manufacturer's warranty period on the pump and nozzles, components and accessories which are not furnished or installed by John Deere, nor to failures caused by such items. When the pump manufacturer's warranty is less than the engine warranty, John Deere will reimburse pump repair costs for warrantable-type failures during the remainder of the original engine warranty period, when so documented by the pump manufacturer's approved service outlet.

Purchaser's Responsibilities

The cost of normal maintenance and depreciation.

Consequences of negligence, misuse, or accident involving the engine, or improper application, installation, or storage of the engine.

Consequences of service performed by someone other than a party authorized to perform warranty service, if such service, in John Deere's judgment, has adversely affected the performance or reliability of the engine.

Consequences of any modification or alteration of the engine not approved by John Deere, including, but not limited to, tampering with fuel and air delivery systems.

The effects of cooling system neglect as manifested in cylinder liner, block cavitation ("pitting", "erosion", "electrolysis").

Any premium for overtime labor requested by the purchaser.

Costs of transporting the engine or the equipment in which it is installed to and from the location at which the warranty service is performed, if such costs are in excess of the maximum amount payable to the service location where the warranty service performed at the engine's location.

Costs incurred in gaining access to the engine; i.e., overcoming physical barriers such as walls, fences, floors, decks or similar structures impeding access to the engine, rental of cranes or similar, or construction of ramps or lifts or protective structures for engine removal and reinstallation.

Incidental travel costs including tolls, meals, lodging, and similar.

Service outlet costs incurred in solving or attempting to solve non-warrantable problems.

Services performed by a party other than an authorized John Deere engine service dealer.

Charges by dealers for initial engine start-up and inspection, deemed unnecessary by John Deere when operation and maintenance instructions supplied with the engine are followed.

Costs of interpreting or translating services.

No Representations or Implied Warranty

Where permitted by law, neither John Deere nor any company affiliated with it makes any guaranties, warranties, conditions, representations or promises, express or implied, oral or written, as to the nonoccurrence of any defect or the quality or performance of its engines other than those set forth in this booklet, and DOES NOT MAKE ANY IMPLIED WARRANTY OR CONDITIONS OF MERCHANTABILITY OR FITNESS otherwise provided for in the Uniform Commercial Code or required by any Sale of Goods Act or any other statute. This exclusion includes fundamental terms. In no event will a John Deere engine distributor or engine service dealer, John Deere equipment dealer, or John Deere or any company affiliated with John Deere be liable for incidental or consequential damages or injuries including, but not limited to, loss of profits, loss of crops, rental of substitute equipment or other commercial loss, damage to the equipment in which the engine is installed or for damage suffered by purchaser as a result of fundamental breaches of contract or breach of fundamental terms, unless such damages or injuries are caused by the gross negligence or intentional acts of the foregoing parties.

Remedy Limitation

The remedies set forth in this warranty are the purchaser's exclusive remedies in connection with the performance of, or any breach of guaranty, condition, or warranty in respect of new John Deere engines. In the event the above warranty fails to correct purchaser's performance problems caused by defects in workmanship and/or materials, purchaser's exclusive remedy shall be limited to payment by John Deere of actual damages in an amount not to exceed the cost of the engine.

No Seller's Warranty

No person or entity, other than John Deere, who sells the engine or product in which the engine has been installed makes any guaranty or warranty of its own on any engine warranted by John Deere unless it delivers to the purchaser a separate written guaranty certificate specifically guaranteeing the engine, in which case John Deere shall have no obligation to the purchaser. Neither original equipment manufacturers, engine or equipment distributors, engine or equipment dealers, nor any other person or entity, has any authority to make any representation or promise on behalf of John Deere or to modify the terms or limitations of this warranty in any way.

Replacement Parts Warranty

New John Deere parts installed during engine warranty service are warranted for 90 days (Certain major parts may be warranted for longer periods.) or for the remaining warranty period of the engine, whichever is longer. A new engine replacing a failed engine under warranty is warranted for the remaining warranty period of the original engine.

Warranty Transfer

The remainder of the original engine warranty and the emissions control-related warranty may be transferred to a subsequent owner of the engine. The Engine Warranty Transfer card (the back cover of this booklet) should be used to report the transfer to John Deere.

Purchased Extended Warranty

Extended warranty may be purchased on most engines in many areas of the world. John Deere engine distributors and equipment dealers, and dealers of manufacturers using John Deere engines in their products, have details. John Deere may also be contacted at U.S.A. fax number 1-319-292-5844, or by fax in France at number 33.2.38.84.62.66.

Emissions Warranties

Emissions warranties appear in the operation and maintenance instructions furnished with the engine/machine. **(Warning: Statutes providing severe penalties for tampering with emissions controls may apply at the user's location.)** John Deere may also be contacted at U.S.A. fax number 1-319-292-5844; or by fax in France at number 33.2.38.84.62.66.

LOCAL WARRANTY REQUIREMENTS

Warranties required by local statutes will be furnished by the seller as noted below.

OPTION CODES

(Engine manufacturing configuration)

When in need of engine replacement parts, your authorized John Deere service dealer will need to know the corresponding "Option Codes" for your engine. The option code label on the engine rocker arm cover may become damaged over time. By recording the four-digit codes below when the engine is new, and storing this booklet where it can be found when parts are needed, fast, accurate parts ordering and service will be assured.

Record below all of the four-digit code numbers as they appear on the option code label on the rocker arm cover of your engine. (Not all blanks below will be needed.)

_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Should there be a question about a code, note the engine serial number and call 1-800-JD ENGINE from the U.S.A. or Canada, or fax U.S.A. number 1-319-292-5844; or e-mail at diesel-us@johndeere.com, Attention: Warranty Administration; or fax number 33.2-38-84.62.66, or e-mail at saranservice@johndeere.com, in France.

REGISTERING THE ENGINE FOR WARRANTY

Completion and submission of the John Deere Engine Warranty Registration form (the front outside cover of this booklet) is very important. John Deere will not deny warranty service on an engine within its warranty period if the engine has not been registered. However, registering your engine will assure your servicing dealer that the engine is within the warranty period.

The easiest way to register your engine is via the Internet. Go to web site <https://www.johndeere.com/enginewarranty> You can use the form on the front cover of this booklet to gather the information needed to register the warranty.

Prompt and accurate reporting before warranty service is required enables the authorized John Deere engine service dealer to determine quickly the warranty status of the engine. An engine shown on his computer screen to be in warranty assures the dealer providing the service that John Deere will reimburse him for the warranty service he provides.

Information provided on the form must be legible!

Typing is preferred, but legible handwritten reports are acceptable. "Block" numbers and Roman alphabet letters should be used; i.e.

1 2 3 4 5 6 7 8 9 0

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

All requested information should be given. Much of it contributes to reports, including those required by governments.

Every engine is to be delivered with operation and maintenance instructions. A manual not received should be requested of the engine/machine seller.

The purchaser's telephone number or email address allows John Deere to make contact should there be questions concerning the registration. The purchaser should sign and date the form.

JOHN DEERE USED ENGINE WARRANTY TRANSFER

Original Purchaser's Name _____

MAILING Address _____

City _____ **State/Province** _____ **Postal Code** _____ **Country** _____

New Owner's Name _____

MAILING Address _____

City _____ **State/Province** _____ **Postal Code** _____ **Country** _____

Engine Serial Number from Engine Serial Number Plate _ _ _ _ _

(Required number is made up of two letters then four digits then one letter then six digits. All 13 characters required.)

Date of Change of Ownership _____

Engine Hours of Use at Change of Ownership _____ **(Meter** _____ **Estimate** _____ **)**

Telephone (_____) _____

E-mail Address _____ **New Owner's Signature** _____ **Date** _____

Note: Register via Internet at www.johndeere.com/enginewarranty or this form may be faxed to John Deere at 1-319-292-5844.

For information on your rights to privacy, please see page 2 of the John Deere Engine Owner's Warranty - Worldwide.

Return Address

Affix
First-
Class
Postage

JOHN DEERE POWER SYSTEMS

PO BOX 5100

WATERLOO, IA 50704-5100

USA



JOHN DEERE

JOHN DEERE LIMITED – POWER SYSTEMS

QUALITY CHECK SHEET

CUSTOMER :

SE Power

ADDRESS :

TINGALPA

GOODS ORDERED :

1 x 6068TF258

ENGINE SERIAL # :

CD 6068T753599

CONTROL PANEL SERIAL # :

—

BUILD DETAILS :

Coolant Drained :

Yes / No

Temp Settings :

115

°C

Tacho/Gauges Set : N/A

Yes / No

Oil Pressure :

20

PSI/KPA

Battery Charging :

—

Yes / No

Engine Test Run :

By Whom

Date

DESPATCH CHECKS

Specifications Correct:

Checked By

Date

Packing:

Checked By

Date

Dispatch Details:

Checked By

Date

COMMENTS:

MANUAL SUPPLIED LOOSE

1. The first step is to identify the problem.

2. The second step is to gather information.

3. The third step is to analyze the information.

4. The fourth step is to develop a solution.

1. The first step is to identify the problem.

2. The second step is to gather information.

3. The third step is to analyze the information.

4. The fourth step is to develop a solution.

5. The fifth step is to implement the solution.

6. The sixth step is to evaluate the results.