

OPERATION and MAINTENANCE MANUALS

For

BRISBANE CITY COUNCIL

At

BRISBANE WATER

SEWAGE PUMP STATION

SP239 GOWAN ROAD

Manuals Prepared by:

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

Copyright © 2002 All Rights Reserved

REVISION B: July 2003

Page 1 of 469

Page 2 of 469



OPERATION and MAINTENANCE MANUALS

Revision Status

Revision	Date	Initials	Comments
Α	26/05/03	JP	Issued for approval
В	30/07/03	JP	

	Prepared by: Jim Pringle	Date://
	Reviewed Project Manager:	
1 400	4 Dishara Water OSM CD220 Magualdae	

14291_Brisbane_Water_O&M_SP239_Manual.doc



OPERATION and MAINTENANCE MANUALS

TABLE OF CONTENTS

Section 1. Instructions for use

Section 2. Deutz Operation Manual

Section 3. Deutz Spare Parts Catalogue

Section 4. Stamford Installation, Service & Maintenance Manual

Section 5. PLC - GE Fanuc

Section 6. Functional Description

Section 7. Drawings

Section 8. Test Reports

Page 5 of 469

Q-Pulse Id TMS1079



OPERATION and MAINTENANCE MANUALS

INSTRUCTIONS FOR USE

- 1. Units placed on site using "Hook Truck" (Cleanaway Type) over cable pit.
- 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)

14291_Brisbane_Water_O&M_SP239_Manual.doc

Q-Pulse Id TMS1079

Operation Manual

1015

0297 9684 en

Engine				
Serial Number:			Ļ	

Please enter here the engine serial number. By quoting this number you will help to facilitate dealing with questions concerning Customer Service, Repairs and Spare Parts (see Section 2.1).

In view of continuous design improvements or changes, the technical specifications and the illustrations shown in this Operation Manual are subject to alteration. Reprinting and reproduction, in part or in whole, are subject to our written approval.



Foreword

Dear Customer,

Liquid-cooled DEUTZ engines are designed for a broad spectrum of applications. Consequently, a wide range of variants are offered to meet the specific requirements of each individual case.

Your engine is appropriately equipped for the installation concerned, which means that not all the components described in this Operation Manual are necessarily mounted to your engine.

We have endeavoured to highlight any differences so that you will be able to locate the operating and maintenance instructions relevant to your engine quickly and easily.

Please read this Manual before starting your engine, and always observe the operating and maintenance instructions.

Should you have any inquiries we shall be pleased to provide advice.

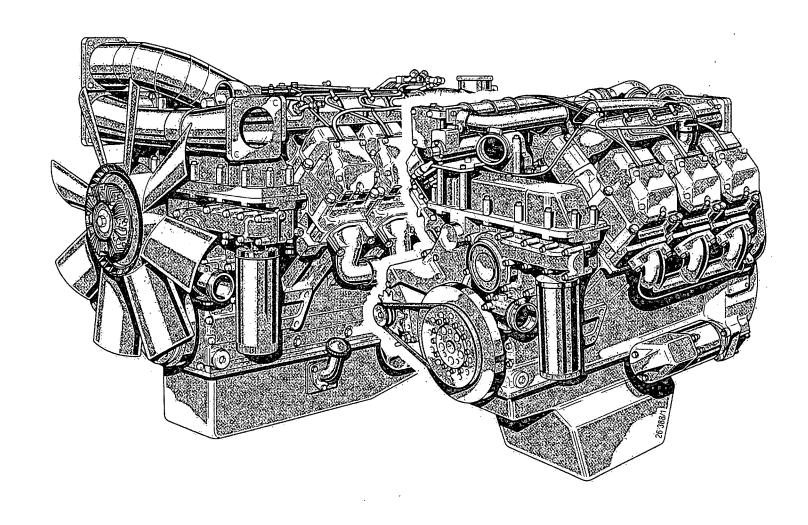
Sincerely,

DEUTZ AG

Table of Contents

1.	General	3.4.1	Mechanical Shutdown	6.3	Cooling System
		3.4.2	Electric Shutdown	6.3.1	Cleaning Intervals
2.	Description of Engine	3.5	Operating Conditions	6.3.2	Draining Cooling System
2.1	Model Designation	3.5.1	Winter Operation	6.3.3	Filling/Bleeding Cooling System
2.1.1	Rating Plate	3.5.2	High Ambient Temperature, High	6.3.4	Cleaning engine
2.1.2	Location of Rating Plate		Altitude	6.4	Combustion Air Cleaner
2.1.3	Engine Serial Number			6.4.1	Cleaning Intervals
2.1.4	Numbering of Cylinders	4.	Operating Media	6.4.2	Dry-Type Air Cleaner
2.2	Engine Illustrations	4.1	Lube Oil	6.4.3	Removing Cyclone-Type Precleaner
2.2.1	Cyl. Bank A BF6 M 1015	4.1.1	Quality Grade	6.4.4	Cleaning Oil Bath Air Cleaner
2.2.2	Cyl. Bank B BF6 M 1015	4.1.2	Viscosity	6.5	Belt Drives
2.2.3	Cyl. Bank A BF8 M 1015	4.2	Fuel	6.5.1	Checking Alternator V-Belt
2.2.4	Cyl. Bank B BF8 M 1015	4.2.1	Quality Grade	6.5.2	Retensioning/Renewing Alternator V-
2.3	Lube Oil Circuit	4.2.2	Winter Grade Fuel	0.0.2	Belt
2.3.1	Lube Oil Circuit Schematic 1015	4.3	Coolant	6.6	Adjustments
_		4.3.1	Water Quality for Coolant Preparation	6.6.1	Checking/Adjusting Valve Clearances
3.	Operation	4.3.2	Coolant Preparation	6:6.1.1	
3.1	Commissioning	4.3.3	Cooling System Protective Agents	6.7	Accessories
3.1.1	Filling in Engine Oil	_	Davidina Maintanana	6.7:1	Battery
3.1.2	Filling Oil Bath Air Cleaner with Engine	5 .	Routine Maintenance	6.7.2	Three-Phase Alternator
0.4.0	Oil	5.1	Maintenance Schedule	6.7.3	Lifting Tackle
3.1.3	Filling the Fuel Tank	5.2	Maintenance Chart	5,77.75	
3.1.4	Filling/Bleeding the Cooling System	5.3	Completed Maintenance Jobs	7.	Troubleshooting
0 1 E	1015	6.	Service and Maintenance	7.1	Diagnosis Chart
3.1.5	Other Preparations	6.1	Lubrication System	_	
3.2	Starting	6.1.1	Oil Change Intervals	8.	Engine Preservation
3.2.1	Electric Starting	6.1.2	Changing Engine Oil, Checking Oil Level	8.1	Preservation
3.3	Monitoring Systems	6.1.3	Renewing Oil Filter	9.	Specification Data
3.3.1	Engine Oil Pressure	6.2	Fuel System	9.1	Engine Specifications and Settings
3.3.2	Coolant Temperature	, 6.2.1	Renewing Fuel Filter	9.1	Torque Wrench Settings
3.3.3	Coolant Level	6.2.2	Change Fuel Leakage Line	9.3	Tools
3.3.4	Lube Oil Level	0,2.2	Onange i dei Leakage Lille	۵.۵	
3.4	Stopping		•	10.	Service

Page 13 of 469



Page 14 of 469

General

DEUTZ Diesel Engines

Care and Maintenance

Service



are the product of many years of research and development. The resulting know-how, coupled with stringent quality standards, guarantee their long service life, high reliability and low fuel consumption.

It goes without saying that DEUTZ Diesel Engines meet the highest standards for environmental protection.

Sound care and maintenance practices will ensure that the engine continues to meet the requirements placed on it. Recommended service intervals must be observed and service and maintenance work carried out conscientiously.

Special care should be taken under abnormally demanding operating conditions.

Please contact one of our authorized service representatives in the event of breakdowns or for spare parts inquiries. Our trained specialists will carry out repairs quickly and professionally, using only genuine spare parts.

Original parts from DEUTZ AG are always produced in accordance with state-of-the-art technology. Please turn to the end of this manual for further service information.

Beware of Running Engine

Shut the engine down before carrying out maintenance or repair work. Ensure that the engine cannot be accidentally started. Risk of accidents. When the work is complete, be sure to refit any nanels and quarks that may have been removed.

When the work is complete, be sure to refit any panels and guards that may have been removed. Never fill the fuel tank while the engine is running. Observe industrial safety regulations when running the engine in an enclosed space or underground.

Safety



This symbol is used for all safety warnings. Please follow them carefully. The attention of operating personnel should be drawn to these safety instructions. General safety

and accident prevention regulations laid down by law must also be observed.

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.

Asbestos



DEUTZ original parts are asbestos-free.

Description of Engine



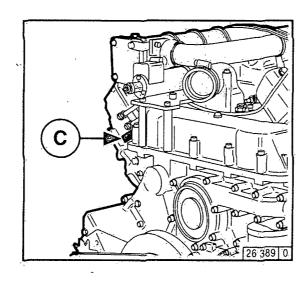
- 2.1 Model Designation2.2 Engine Illustrations
- 2.3 Lube Oil Circuit

Description of Engine

2.1 Model Designation

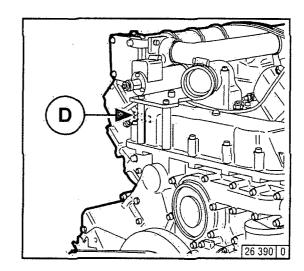


2.1.1 Rating Plate



The rating plate C is affixed to the crankcase.

2.1.2 Location of Rating Plate 2.1.3 Engine Serial Number



The engine serial number is stamped on the crankcase iteself (arrow) and on the rating plate.

The model designation **A**, the engine serial number **B** and the performance data are stamped on the rating plate.

25 611 2

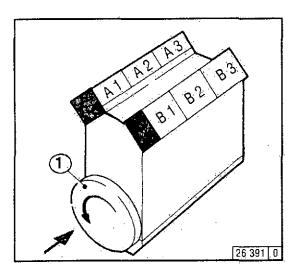
When ordering spare parts, it is essential to quote the model designation and the engine serial number.

2.1 Model Designation

Description of Engine

2.1.4 Numbering of Cylinders





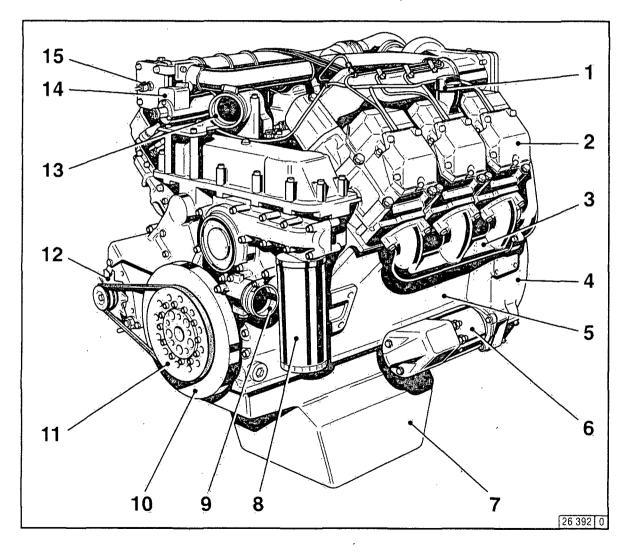
The cylinders are numbered consecutively for either cyl. bank A or B, beginning at flywheel end.

Description of Engine

2.2 Engine Illustration



2.2.1 Cyl. Bank A – BF6M 1015



- 1 Oil filler neck
- 2 Cylinder head
- 3 Exhaust manifold
- 4 SAE housing
- 5 Crankcase
- 6 Starter
- 7 Oil pan
- 8 Oil filter
- 9 Coolant connection from heat exchanger to engine
- 10 Vibration damper
- 11 V-belt pulley
- 12 Alternator
- 13 Coolant connection to heat exchanger
- 14. Solenoid (shutdown solenoid)
- 15 Flame-type heater plug (B-side)

Notes

Warnings to Place on Equipment

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.

Warning in the Manual

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.

or

CALIFORNIA

Proposition 65 Warning

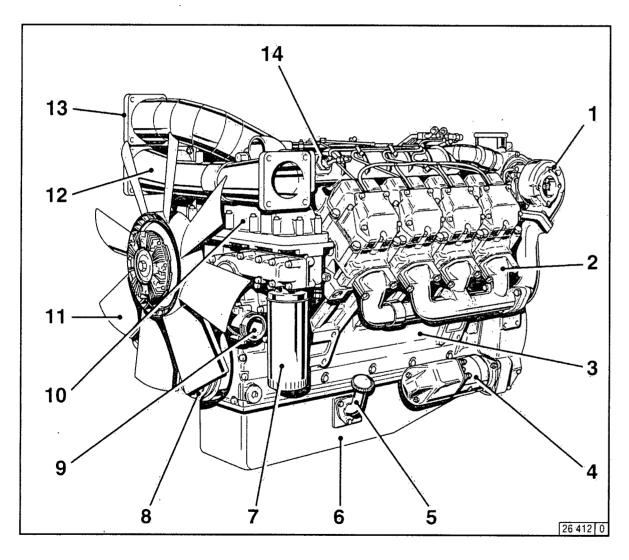
Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Description of Engine

2.2 Engine Illustration



2.2.3 Cyl. Bank A - BF8M 1015



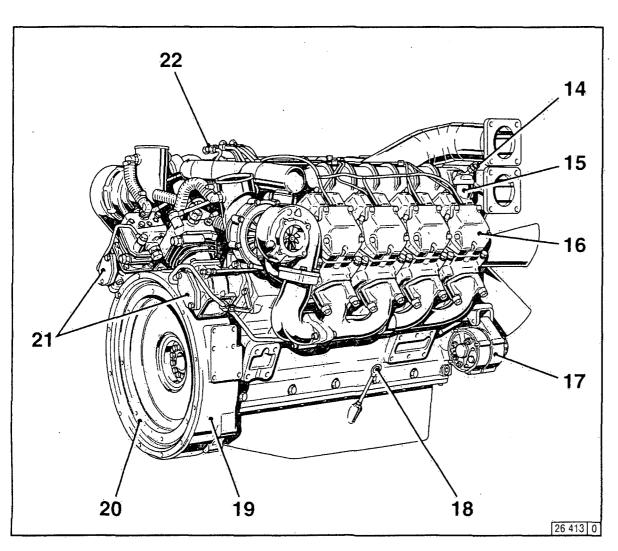
- 1 Exhaust turbocharger
- 2 Exhaust manifold
- 3 Crankcase
- 4 Starter
- 5 Oil filler neck
- 6 Oil pan
- 7 Lube oil filter
- 8 V-belt pulley with vibration damper
- 9 Coolant connection from heat exchanger to engine
- 10 Oil cooler
- 11 Fan
- 12 Exhaust stack
- 13 Charge air pipe to the charge air cooler
- 14 Flame-type heater plug system (B-side)

2.2 Engine Illustration

Description of Engine

2.2.4 Cyl. Bank B - BF8M 1015





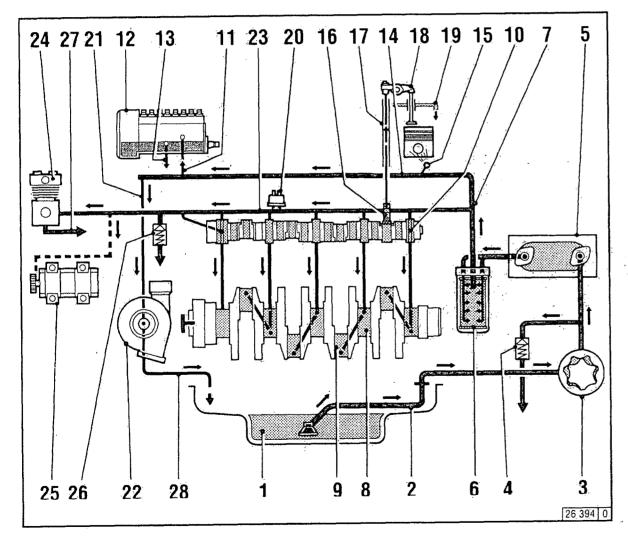
- 14 Flame-type heater plug system (A-side)
- 15 Oil filler neck
- 16 Cylinder head
- 17 Alternator
- 18 Oil dipstick
- 19 SAE housing
- 20 Flywheel
- 21 Compressor
- 22 Fuel connecting line

Description of Engine

2.3 Lube Oil Circuit



2.3.1 Lube Oil Circuit Schematic 1015 Wet Sump Lubrication



- 1 Oil pan
- 2 Intake pipe
- 3 Oil pump
- 4 Overpressure relief valve
- 5 Oil cooler
- 6 Spin-on oil filter
- 7 Main oil bores
- 8 Main bearing
- 9 Big-end bearing
- 10 Camshaft bearing
- 11 Oil supply to injection pump
- 12 Injection pump
- 13. Return line from injection pump to crankcase
- 14 Line to spray nozzle
- 15. Spray nozzle with pressure-holding valve for piston cooling
- 16 Tappet with control groove for pulse lubrication of rocker arms
- 17 Pushrod, oil supply to rocker arm lubrication
- 18 Rocker arm
- 19 Oil return bore in cylinder head to crankcase.
- 20 Oil pressure sensor / oil pressure switch
- 21 Oil line to exhaust turbocharger
- 22 Exhaust turbochärger
- 23 Oil line to compressor (hydr. pump)
- 24 Compressor
- 25 Hydraulic pump
- 26 Pressure-holding valve (adjustable)
- 27 Oil return line from compressor (hydr. pump) to crankcase
- 28 Oil return line from turbocharger to crankcase

Engine Operation



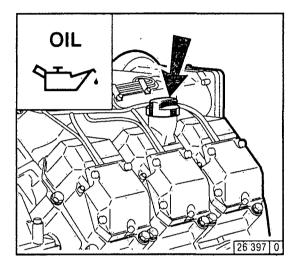
- 3.1 Commissioning
- 3.2 Starting
- 3.3 Monitoring Systems
- 3.4 Stopping
- 3.5 Operating Conditions

Engine Operation

3.1 Commissioning



3.1.1 Filling in Engine Oil

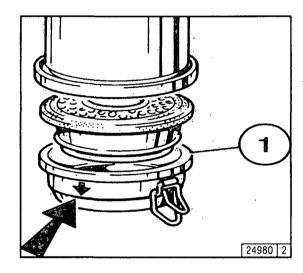


As a rule, the engines are delivered without oil filling.

Fill in lube oil through the oil filler neck (arrow). For oil filling volume, see 9.1.

For oil quality grade and oil viscosity, see 4.1.

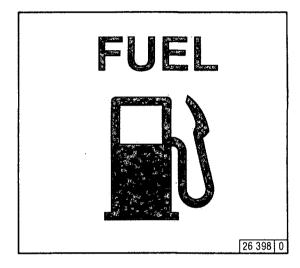
3.1.2 Filling Oil Bath Air Cleaner with Engine Oil



Fill engine oil into bowl 1 of oil bath air cleaner (if fitted) up to the arrow mark.

For oil quality grade and oil viscosity, see 4.1.

3.1.3 Filling the Fuel Tank



Use only commercial-grade diesel fuel. For fuel quality grade, see 4.2.

Use summer- or winter-grade fuel, depending on the ambient temperature.



Never fill oil into the precleaner's dust collector, if provided.



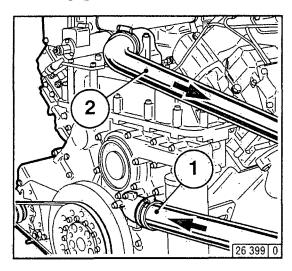
Stop engine before filling the fuel tank!

Observe strict cleanliness! Do not spill any fuel!

3.1 Commissioning

Engine Operation

3.1.4 Filling/Bleeding Cooling System 1015



- Connect coolant inlet 1 and coolant outlet 2 to external coolant tank.
- Fill in coolant into cooling system.
- Start engine and run up to normal operating temperature until thermostat opens (line 2 warms up).
- Check coolant level in external cooling system, top up coolant if necessary.

3.1.5 Other Preparations

• Check battery and battery cable connections, see 6.7.1.

Trial run

 Upon completing the preparations run the engine for a short trial run of about 10 minutes under low load.

During and after trial run

- Check the engine for leaks.

After the engine has been stopped

- Check oil level and top up if necessary, see
 6.1.2
- Retension V-belts, see 6.5.

Breaking-in

During the breaking-in phase, it is recommended to check the oil level twice a day. After the breaking-in phase, checking once a day will be sufficient.



Engine Operation

3.2 Starting



3.2.1 Electric Starting



Before starting, make sure that nobody is standing in the immediate vicinity of the engine or driven machine.

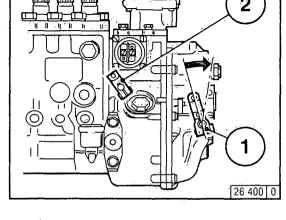
After repair work:

Check whether all removed guards are put back in place and all tools are removed from the engine.

When starting with flame-type heater plugs, do not use any other additional starting aids (e.g. injection with start pilot). Accident hazard!

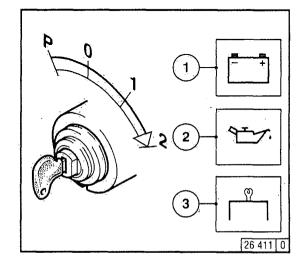
Important: Never start the engine with speed governor removed.

Disconnect battery!



- Disengage the clutch to separate the engine from the driven equipment.
- Move speed control lever 1 in direction of arrow at least to middle speed position.
- Move shutdown lever 2 to "Run" position (opposite direction of arrow, item.1).

without Cold-Starting Aid



- Insert kev.
 - Position 0 = no operating voltage.
- Turn key clockwise.
 - Position 1 = operating voltage,
- Pilot lamps light up.
- Turn key further clockwise against spring action.
 - Position 2 = starting.
- Release key as soon as the engine starts firing.
 - Pilot lamps go out.

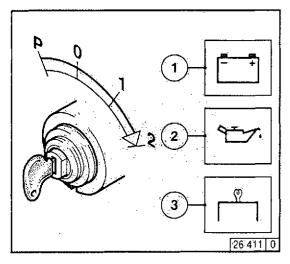
Do not actuate the starter for more than 20 seconds at a time. If the engine does not start, wait one minute before repeating the attempt.

If the engine does not start after two attempts, trace the cause with the aid of the Diagnosis Chart (see 7.1).

3.2 Starting

Engine Operation

with Cold-Starting Aid Flame-Type Heater Plug System



- Insert key.
 - Position 0 = no operating voltage.
- Turn key clockwise.
 - Position 1 = operating voltage,
 - Pilot lamps 1+2+3 light up.
 - Preheat until heater plug indicator 3 blinks, max. 30 seconds.
 - Engine is ready for operation.



Important: The starting process must be carried out within the 30 seconds, otherwise repeat starting attempt.

- Turn key further clockwise against spring action to
 - Position 2 = starting
- Release key as soon as the engine starts firing.
 - Pilot lamps go out.



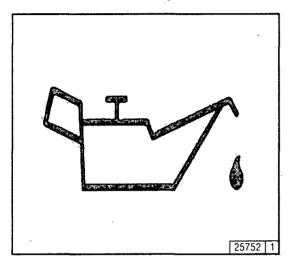
Engine Operation

3.3 Monitoring Systems



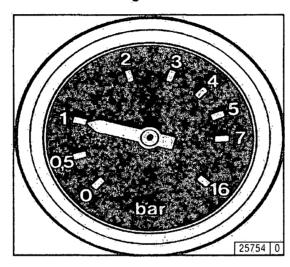
3.3.1 Engine Oil Pressure

Oil Pressure Pilot Lamp



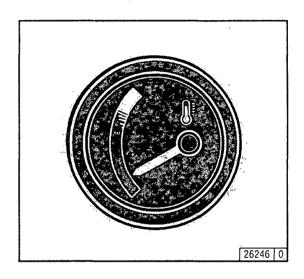
- The oil pressure pilot lamp lights up with operating voltage applied and engine shut off.
- The oil pressure pilot lamp must go out when the engine is running.

Oil Pressure Gauge



• The pointer of the oil pressure gauge must indicate the minimum oil pressure (see 9.1).

3.3.2 Coolant Temperature



◆ The pointer of the temperature indicator should remain in the green sector and enter the yellowgreeen sector only in exceptional cases. If the pointer enters the orange sector, the engine is overheating. Turn it off and establish the cause from the Diagnosis Chart (see 7.1).

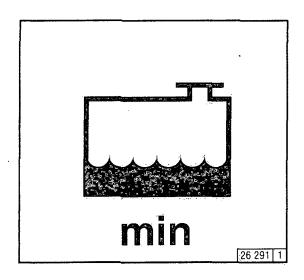
3.3 Monitoring Systems

Engine Operation

3.3.3 Coolant Level

3.3.4 Lube Oil Level





- Lamp of coolant level indicator lights up (contact via float switch/level sensor when min. coolant level has been reached):
 Turn engine off and establish cause from the Diagnosis Chart (see 7.1)
- Functional check of coolant level: Insert key in position 1 or 2 (Float switch or level sensor)
 Pilot lamp lights up for about 2 seconds
 - Coolant level o.k.: lamp goes out
 - Coolant level not o.k.: lamp does not go out.

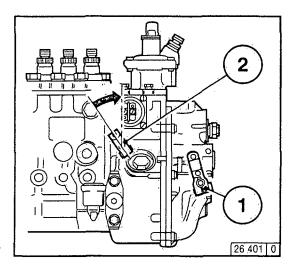
- Lamp of lube oil level indicator lights up (contact via float switch/level sensor when min. lube oil level has been reached):
 Turn engine off and establish cause from the Diagnosis Chart (see 7.1)
- Functional check of lube oil level: Insert key in position 1 or 2 (Float switch or level sensor)
 Pilot: lamp lights up for about 2 seconds
 - Lube oil level o.k.: lamp goes out
 - Lube oil level not o.k.: lamp does not go out.

Engine Operation

3.4 Starting

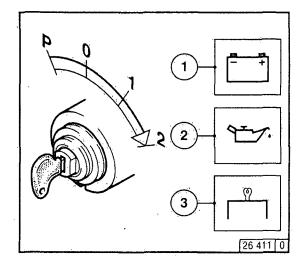


3.4.1 Mechanical Shutdown



- Set speed control lever 1 to low speed position.
- Actuate shutdown lever 2 until engine comes to standstill. Charging-current and oil pressure pilot lamps light up when engine has come to standstill.

3.4.2 Electric Shutdown



Turn key counter-clockwise (to position 0) and pull off. Pilot lamps go out.

3.5 Operating Conditions

Engine Operation

3.5.1 Winter Operation



Lube Oil Viscosity

- Select the oil viscosity (SAE grade) according to the ambient temperature prevailing at the time when the engine is started 4.1.2.
- Keep shorter periods between oil changes when operating at temperatures below -10 °C (+14 °F), see 6.1.1.

Diesel Fuel

 Use winter-grade diesel fuel for operation below 0 °C (+32 °F), see 4.2.2.

Coolant

Set the water / antifreeze mix to suit the lowest temperature likely to occur (max. -35°C / -31°F), see 4.3.1.

Additional Maintenance Jobs

- Drain the sludge from the fuel tank once a week (by undoing the sludge drain plug).
- Adjust the oil filling in the oil bath air cleaner (if fitted) to the prevailing ambient temperature as in the case of engine oil.
- At temperatures below -20 °C (-4 °F) lubricate the flywheel ring gear with low-temperature grease, e.g. Bosch FT 1 V31,

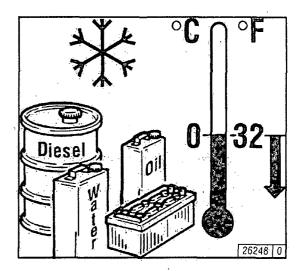
from time to time through the pinion hole (if necessary remove starter).

Cold-Starting Aids

 At temperatures near or below freezing point start with flame-type heater plug, see 3.2.1.
 This not only lowers the starting limit temperature, but proves also useful at temperatures normally not requiring a starting aid.

Battery

- Cold starting requires a good state of charge of the battery, see 6.7.1.
- The starting limit temperature can be lowered by 4-5 °C by heating the battery up to +20 °C (+65 °F). To do so, remove the battery and store in a warm place.



Engine Operation

3.5 Operating Conditions

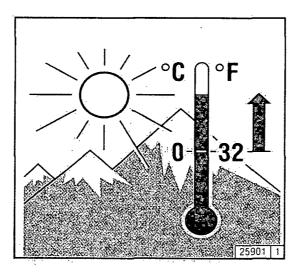


3.5.2 High Ambient Temperature, High Altitude

● With increasing altitude and rising ambient temperatures the density of the air tends to decrease, which affects the maximum power output, the exhaust gas quality, the temperature level and in extreme cases, the starting behaviour. Under transient running conditions, operation is permissible at altitudes up to 1000 meters at ambient temperatures up to 30 °C (86 °F)

If an engine is operated under more severe conditions (at higher altitudes or ambient temperatures) it will be necessary to reduce the injected fuel quantity and thus engine power.

• In case of doubt concerning such engine applications, ask your engine or equipment supplier whether, in the interest of operational reliability, service life and exhaust gas quality (smoke!), an engine derating had been considered necessary, or simply contact your service representative.



Operating Media



- 4.1 Lube Oil
- 4.2 Fuel
- 4.3 Coolant

Page 34 of 469

Operating Media

4.1 Lube Oil



4.1.1 Quality Grade

The lube oil quality grade is defined by specifications. The following lube oil specifications are approved:

API Classification

American Petroleum Institute

Turbocharged engines: CF-4 CG-4 CH-4

ACEA Classification European Engine Oil Sequences.

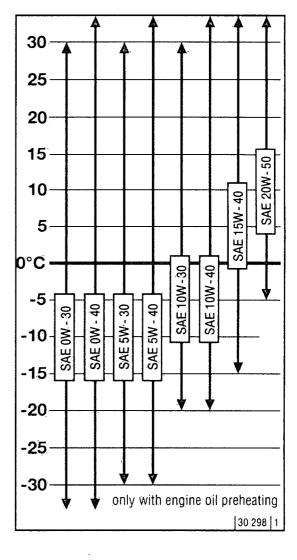
Turbocharged engines: E1- E3-96 + E4-98

4.1.2 Viscosity

The lube oil viscosity of the SAE grade is selected according to the viscosity diagram alongside.

The ambient temperature is decisive for the correct choice. Should the temperatures temporarily fall below the limits of the SAE grade selected, this will merely affect the starting performance, but will not cause any engine damage. The application limits should not be exceeded over lengthy periods of time in order to keep wear down to a minimum.

For all-year application you should use multigrade oils.



4.1 Lube Oil

Operating Media

4.1.2.1 Specific lube oil definitions

Turbocharged engines with uprated power and engines with high loading

The oils listed in enclosure 1 are to be used for the following engines and applications:

- 1015 CP
- all engines in CHP plants
- all engines in gensets operating in parallel with the mains/with each other
- engines in combines with:

These are high-grade oils according to ACEA or API. In addition most of these oils are partly synthetic, some even fully synthetic (5W-40) and thus achieve the thermal stability required for the relevant application and are distinguished by a low tendency to cause deposits in the turbocharger and in the charge air pipes with closed-circuit crankcase breather

Exhaust emission-optimized engines for commercial vehicles as from EURO II and mobile machinery as from level 2. For exhaust emission-optimized engines of all DEUTZ series which meet the following exhaust emission requirements:

- a) as from EURO II the requirements of 88/77/EEC and 91/542/EEC
 - for commercial vehicles in Europe,
- b) as from level 2 the requirements of 97/68/EC, for mobile machinery in Europe
- c) as from level 2 the requirements for US nonroad engines the following oil grades will be permissible:
- ACEA E3-96 and E4-98 for requirements a) and b)
- API CG-4 and CH-4 for application c)

****	Lube	oils for			
engines with uprated power andengines with high loading					
Producer	Type of lube oil	SAE class	Availability		
AGIP	Agip Sigma Ultra TFE	10W-40	worldwide		
AGIP	Autol Valve Ultra FE	10W-40	Germany		
ARAL,GmbH	Aral MegaTurboral	10W-40	worldwide		
ARAL.GmbH	Aral SuperTurboral	5W-30	worldwide		
BAYWA	BayWa Super Truck 1040 MC	10W-40	South Gemany		
BAYWA	BayWa Turbo 4000	10W-40	South Gemany		
Castrol GmbH	Castrol SYNTRUCK	5W÷40	Europe, North America, Brazil Argentina, Australia, South Africa		
Castrol GmbH	Castrol DYNAMAX	7,5W-40	Europe, North America, Brazil Argentina, Australia, South Africa		
CHEVRON	Chevron Delo 400 Synthtic	5W-40	North America		
ESSO ESSO	Essolube XTS 501	10W-40	Europe		
FINA	FINA KAPPA FIRST	5W-30	Europe		
FINA	FINA KAPPA ULTRA	10W-40	Europe		
FUCHS DEA	DEA Cronos Synth	5W-40	Germany, Europe		
FUCHS DEA	DEA Cronos Premium LD	10W-40	Germany, Europe		
FUCHS DEA	Fuchs Titan Cargo MC	10W-40	worldwide:		
FUCHS DEA	Deutz Oel TLL 10W-40 MB	10W-40	Germany		
FUCHS, DEA	DEA Crongs Premium FX	10W-40	Europe:		
FUCHS DEA	Fuchs Titan Unic Plus MC	10W-40	worldwide		
MOBIL OIL	Mobil Delvac 1 SHC	5W-40	Europe, SE Asia, Africa		
MOBIL OIL	Mobil Delvac 1.	5W-40:	worldwide		
MOBIL OIL	Mobil Delvac XHP Extra	10W-40	Europe, SE Asia		
BP OIL International	BP Vanellus HT Extra	10W-40	Europe		
Shell International	Shell Myrina TX./	5W-30	Europe, different		
	Shell Rimula Ultra		description in some country		
Shell International	Shell Myrina TX /	10W-40	Europe, different		
	Shell Rimula Ultra		description in some country		
TOTAL	TOTAL RUBIA TIR 86000	10W-40	worldwide		
Schmierölraffinerie Salzbergen GmbH	Wintershall TFG	10W-40	Europe		

The table will be extended as and when required.



Q-Pulse Id TMS1079 Active 10/12/2014 Page 36 of 469

Operating Media

4.2 Fuel



4.2.1 Quality Grade

Use commercial brands of diesel fuel with a sulfur content of less than 0.5%. If the sulfur content is higher than 0.5%, oil change intervals should be reduced, see 6.1.1.

The following specifications / standards are approved:

- CEN EN 590 or DIN/EN 590
- DIN 51 601 (Feb.1986)
- BS 2869 (1988): A1 and A2
- ASTM D975-88: 1-D and 2-D
- NATO Code F-54 and F-75

The exhaust emission levels determined during certification always refer to the reference fuel specified by the supervising authorities for such certification.

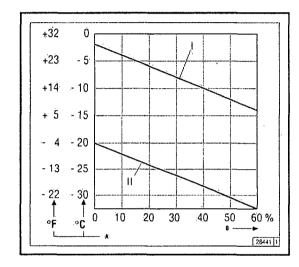
4.2.2 Winter-Grade Fuel

At low temperatures, waxing may occur and clog the fuel system, causing operational trouble. In case of sub-zero (+32 °F) ambient temperatures it is recommended to use winter-grade diesel fuel (down to -1.5 °C = +5 °F). Normally, such fuel is offered at the filling stations in good time before the cold season starts. Diesel fuel containing additives ("Super Diesel") is frequently also on sale for use at temperatures down to -20 °C (-4 °F).

◆ At temperatures below -15 °C (+5 °F) or -20 °C (-4 °F), kerosene should be added to the diesel fuel. The relevant percentages are given in the diagram at the right.

If summer-grade diesel fuel has to be used at temperatures below zero (+32 °F); up to 60% kerosene may be added (see diagram at the right).

In most cases, adequate resistance to cold is also attained by adding a flow improver (fuel additive). Ask your service representative for this.



Illustr	ation legend:
	Summer diesel fuel
	Winter diesel fuel
A,	Ambient temperature
В	Percentage of kerosene added



Diesel fuels must never be mixed with petrol (normal and super grade petrol)!



Mix in tank only! Fill in the appropriate amount of kerosene first, then add the diesel fuel.

4.3 Coolant

Operating Media

4.3.1 Quality of water for coolant in the recirculating water system

The values listed below must not be exceeded. In order to examine the quality of your water, a test case can be ordered from DEUTZ under Order No. 1213 0382.

Water quality	min	max
ph value at 20 °C	6.5	8.5
Chloride ion content	-	100
Sulphate ion content	-	100
Total hardness	3	20

4.3.2 Coolant treatment

In the case of liquid-cooled engines, special attention must be paid to the treatment and control of the coolant, as the engine may otherwise become damaged as a result of corrosion, cavitation and freezing.

The treatment of the coolant is carried out by adding a cooling system protectant to the cooling water.

The cooling system must be continuously monitored, see 5.1. In addition to checking the coolant level, this also involves checking the concentration of the cooling system protectant.

The cooling system protectant concentration can be checked with commercially available testers (example: gefo glycomat[®]).

4.3.3 Cooling system protectants



DEUTZ cooling system protectants must be purchased in drums under Order No. 01011490 (5 litres) or 1221 1500 (210 litres). These are nitrite, amine and phosphate-free, and provide effective protection against corrosion, cavitation and freezing.

If the above mentioned cooling system protectant is unavailable, the following products may be used in exceptional cases.

Manufacturer	Product designation
AVIA	AVIA Antifreeze Extra
ARAL BASE	Ántifreeze Extra Glysantin G 48
DEA	DEA kylarfrostsskydd
SHELL	SHELLGlycoShell

The cooling system protectant in the coolant should not fall below or exceed the following concentration:

Cooling system protectant	Water
max. 45 Vol.%	55%
min. 35 Vol.%	65%

Filling volume, see Chapter 9.1.

The use of other cooling system protectants, e.g. chemical anti-corrosion agents, is possible in exceptional cases. Consult DEUTZ Service.

The use of anti-corrosion oils is not permitted.



If nitrite-based cooling system protectants are mixed with amine-based agents, dangerous nitrosamines are formed.



Cooling system protectants must be disposed of in an environmentally-friendly manner.

Operating Media

4.3 Coolant



	Cooling System Protection														
		Cooling system capacity *) [Liters]													
Protective agent	Protection against freezing to	18	20	22	25	27	30	32	35						
[% by vol.]	[°C]	Protective agent [Liters]													
. 35	-22	6,3	7,0	7,7	8,75	9,5	10,5	11,2	12,3						
40	-28	7,2	8,0	8,8	10	10,8	12	12,8	14						
45	-35	8,1	9,0	9,9	11,3	12,2	13,5	14,4	15,8						
50	-45.	9.0	1:0 4	11	12,5	13.5	1:5	. 16.	17.5						

^{*)} For coolant capacity of your engine, see Section 9.1.
Note: Consult head-office regarding figures in the grey field.

Routine Maintenance



- 5.1 Maintenance Schedule
- **5.2 Maintenance Chart**
- **5.3 Completed Maintenance Jobs**

Routine Maintenance

5.1 Maintenance Schedule



	In Running Hours (Bh)1									eck					
	every									cle	ean		see		
once after 2)	every 10 Bh										renew		section		
	50 or daily 125 250 500 1000 2000					Jób									
	6							100	•			Oil level 9)	6.1.2/ 3.3.4		
₽									•			Visual inspection of engine for leaks			
									•			Oil bath and dry-type air cleaners 3) 4)	6.4.3 /6.4.4		
			3						•			Battery and battery cable connections	6.7.1		
	100	•	0	•		•			•			Cooling system (dep. on engine use) 3) 8)	6.3.1/6.3.2		
		0	0		•	•	700			9		Drain holes in V-space 8)	6.3.1/6.3.4.		
9			0	:•							•	Engine oil (dep. on enginé use) 5)	6.1.1/ 6.1.2		
•			۵	•							•	Oil filter cartridge	6.1.3		
•		30.0			•			3936			•	Fuel filter cartridge	6.2.1		
•	- W				•				•			Valve clearances (readjust if necessary)	6.6.1		
9				•					•			Engine mounts (retighten if necessary)	9.2		
•		34.5		•					9			V-belts (retension if necessary)	6.5.1		
	1200	100							•			Alarm system	3.3		
•					•					0		Fuel prefilter	4.2		
0	****								€			Fastening	9.2		
8	30 m	100			•				0			Flame-type heater plug system 4)			
		V153				● ⁷)		2000			0	Coolant 6)	6.3.2/ 6.3.3		
					000000	4.			•			Coolant additive concentration	4.3.2/ 4.3.3		
1000		1000				1000		2000				Coolant level	3.1.4/ 3.3.3		
			XXX	X 7	•			(A)	•			Hoses / clamps			

The specified engine maintenance times are maximum values. Depending on the operating environment, shorter maintenance intervals may be required. Please observe the operating instructions of the equipment manufacturer.

- 1) Max. permissible guide intervals
- 2) After commissioning of new or overhauled engines
- 3) Clean if necessary, see Section 6.3
- 4) Renew if necessary
 - Service acc. to service indicator if provided

- 5) For oil change intervals, see Section 6.1.1
- 6) Check additive concentration every 500h (antifreeze or chemical corrosion inhibitor)
- 7) or renew every 2 years
- 8) System cleaning
- 9) During run-in period, check 2x daily

5.2 Maintenance Chart

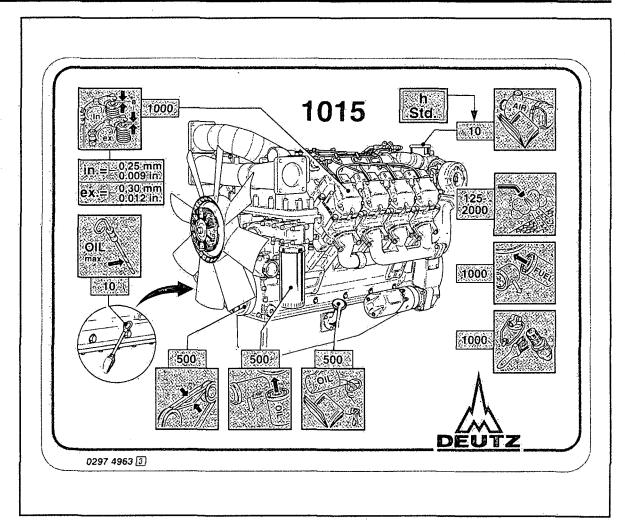
Routine Maintenance

The maintenance chart shown here is supplied as self-adhesive label with each engine. It should be affixed where it can be clearly seen on the engine or driven equipment.

Check that this is the case!

If necessary, ask your engine or equipment supplier for a fresh supply of labels!

Routine maintenance work should be carried out according to the schedule in 5.1.







Stop the engine before carrying out any maintenance work.

Routine Maintenance

5.3 Completed Maintenance Jobs



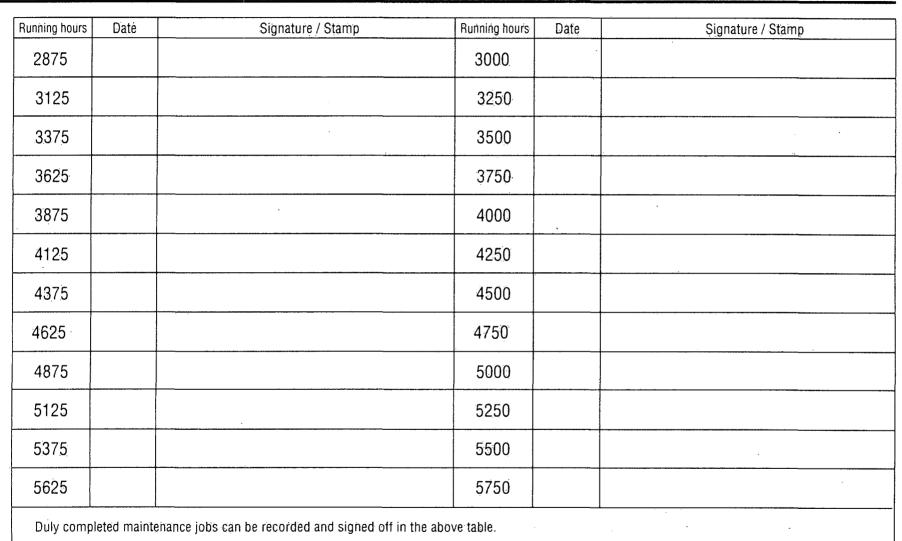
Running hours	Date	Signature / Stamp	Running hours	Date	Signature / Stamp
50-150			_		
125			250		
375			500		
625			750		
875			1000		•
1125			1250		
1375			1500		
1625			1750		
1875			2000		
2115			2250		
2375			2500		·
2625			2750		

^{*} after commissioning of new and overhauled engines

Duly completed maintenance jobs can be recorded and signed off in the above table.

5.3 Completed Maintenance Jobs

Routine Maintenance





Routine Maintenance

5.3 Completed Maintenance Jobs

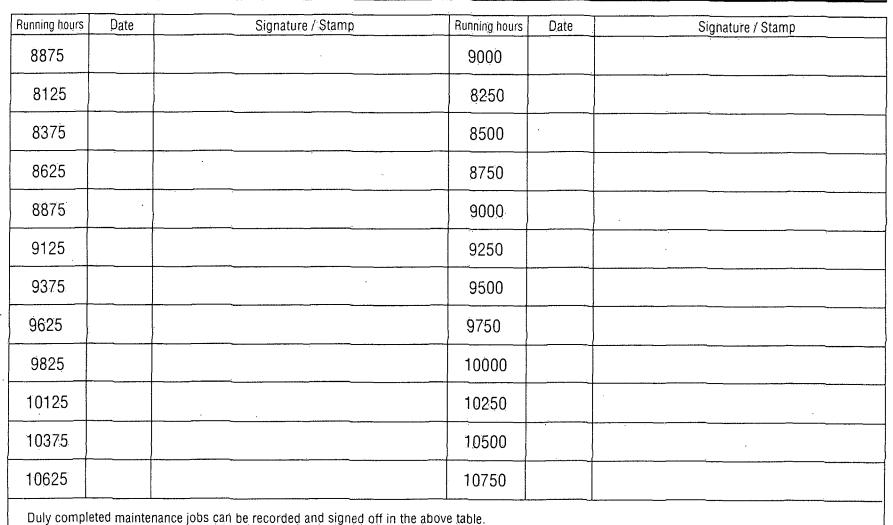


Running hours	Date	Signature / Stamp	Running hours:	Date	Signature / Stamp
5.875			6000		
6125			6250		
6375			6500		
6625			6750		
6875			7000		
7125			7250		,
7375			7500		
7625			7750		
7825		·	8000		
8125			8250		
8375			8500		
8625			8750		

Duly completed maintenance jobs can be recorded and signed off in the above table.

5.3 Completed Maintenance Jobs

Routine Maintenance





Routine Maintenance

5.3 Completed Maintenance Jobs

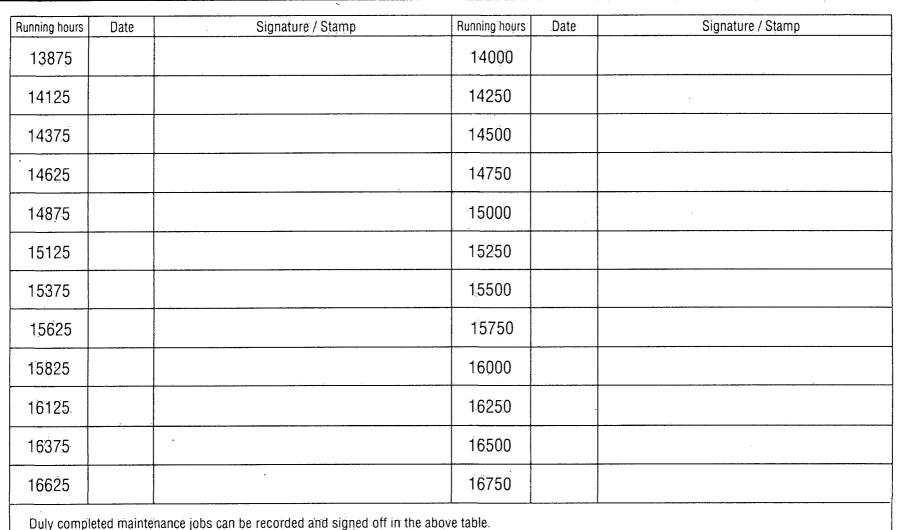


Running hours	Date	Signature / Stamp	Running hours	Date	Signature / Stamp
10875			11000		
11125			11250		
11375			11500		
11625			11750		
11875			12000		
12125			12250		
12375			12500		
12625			12750		
12825			13000		
13125			13250		
13375			13500		
13625		3 500	13750		

Duly completed maintenance jobs can be recorded and signed off in the above table.

5.3 Completed Maintenance Jobs

Routine Maintenance





Page 48 of 469



- **6.1 Lubrication System**
- **6.2 Fuel System**
- **6.3 Cooling System**
- **6.4 Combustion Air Cleaner**
- 6.5 Belt Drives
- 6.6 Adjustments
- 6.7 Accessories

6.1 Lubrication System



6.1.1 Oil Change Intervals

- The first oil change after commissioning or recommissioning following repair work is carried out after 50 running hours.
- The oil change intervals are dependent on :
 - Lube oil quality
 - Sulfur content in the fuel
 - Engine application
- Should, within a year, the engine run less than the hours stated in the table, the oil must be changed at least once a year.
- The table refers to the following conditions:
 - For diesel fuel max. sulfur content > 0.5 % by wt.
 - Continuous ambient temperature down to -10 °C (+14 °F)
- If the sulfur content is > 0.5 to > 1 % or the continuous ambient temperature below -10 °C (+14 °F), the intervals between the oil changes should be halved.
- lacktriangle in the case of fuels containing sulfur > 1 % , ask your service representative.

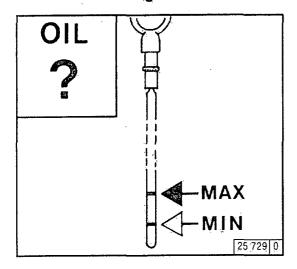
Change the oil with the engine off but still warm (lube oil temperature approx. 80 °C / 176 °F).

			Oil Change Interv	als (running hours)			
E	juipment engi	Moteurs suralimentés					
	API - Klas	ssifikation	CF-4	CG-4/ CH-4			
Oil Grade	ACEA- Kla	ssifikation	E1+E2-96	E3-96/ E4-98			
Lig	ht duty, e.g.:		•				
Road vehicles, crar equipment, rail trac generating sets, pu	nes, constructi ction units, shi mps	on ps,	250	500			
Hea	ivy duty, e.g.:						
Combine harveste road sweepers, w emergency sets, e	inter service e	quipment,	125	250			
			Oil Cange Intervals (km)				
Ec	uipment engi	nes -	Moteurs s	uralimentés			
Qualité d'huile	API - Klas	ssifikation	CF-4.	CG-4/ CH-4			
Quante u nune	ACEA- Kla	ssifikation	E1+E2-96	E3-96/ E4-98			
Service Group							
Į.	< 30 000	20	5 000	10 000			
II) > 30.000 < 100.000		10 000	20 000			
-	>100 000	60	15 000	30 000			

6.1 Lubrication System

Service and Maintenance

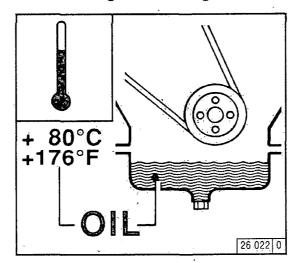
6.1.2 Checking Oil Level / Changing Engine Oil 6.1.2.1 Checking Oil Level



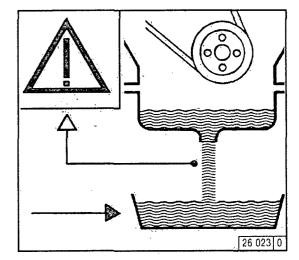
- Ensure that the engine or vehicle is on a level surface.
- Immediately before the oil level is measured, the engine should should be driven at low idling speed for approx. 2 minutes.
- Switch off the engine.
- Pull out the oil dipstick.
- Wipe off with a non-fibrous, clean cloth.
- Insert up to the stop and pull out again.
- Check the oil level and if necessary fill up to the "MAX" level.
 - If the oil level is just above the "MIN" marking, extra oil must be added.

The oil level must not fall below the "MIN" marking.

6.1.2.2 Engine Oil Change



- Ensure that the engine or vehicle is on a level surface.
- Allow the engine to warm up
 Lube oil temperature approx. 80°C.
- Switch off the engine.



- Place oil tray under the engine.
- Unscrew drain plug.
- Drain oil.
- Fit oil drain plug, with the new gasket and tighten firmly (for torque, see 9.2).
- Fill with lube oil.
 - For grade / viscosity, see 4.1
 - For quantity, see 9.1
- Check oil level, see 6.1.2.1



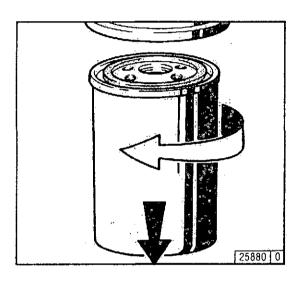
Be careful when draining hot oil – danger of scalds! Do not let used oil run into the soil but catch it in a container ready for



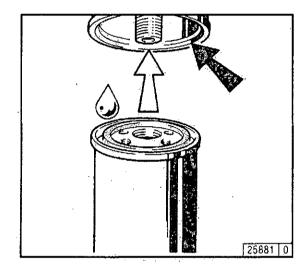
6.1 Lubrication System



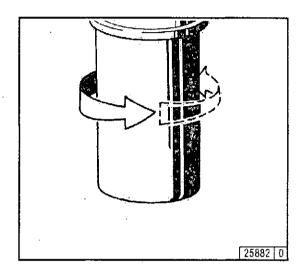
6.1.3 Renewing Oil Filter



- With fitted torsion lock: Loosen screws and slide clamps downwards.
- Undo the oil filter cartridge with commercial tool and spin off.
- Catch any escaping oil.



- Clean sealing surface of the filter carrier if necessary:
- Lightly oil the rubber gasket of the new oil filter cartridge.
- Screw in the new cartridge: finger tight against the gasket.



- Tighten oil filter cartridge tightly by giving a final half turn.
- If a torsion lock is fitted, slide clamps up into position and tighten screws.
- Ocheck oil level, see 6.1.2.
- Check oil pressure, see 3.3.1.
- Check sealing of oil filter cartridge for leaks.



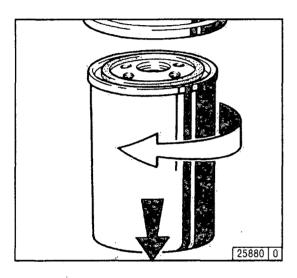
Beware of hot oil: Danger of scalding!

6.2 Fuel System

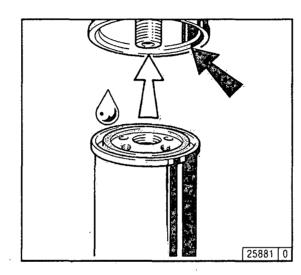
Service and Maintenance

6.2.1 Renewing Fuel Filter

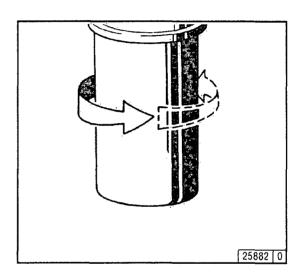




- Close fuel stopcock.
- Undo fuel filter cartridge with commercial tool and spin off.
- Catch any escaping fuel.



- Clean sealing surface of filter carrier if necessary.
- Apply light film of oil or diesel fuel to rubber gasket of new fuel filter cartridge.
- Screw in the cartridge finger tight against the gasket.



- Tighten fuel filter cartridge firmly.
- Open fuel stopcock.
- Check for leaks.



When working on the fuel system, keep open flames away!

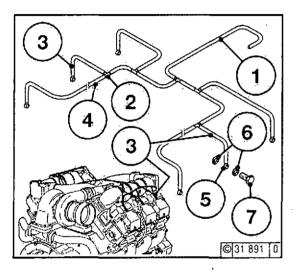
Do not smoke!

Bleeding of the fuel system is not necessary.

6.2 Fuel system



6.2.2 Replace fuel oil leak line



- Close the fuel shut-off valve.
- Remove valve cover.
- Loosen and remove banjo bolts 7.
 Remove rubber hoses 1, 3, 4, unions 2 and 0rings 6 and dispose of in accordance with environmental regulations; banjo union 5 and banjo bolt 7 can be re-used.
- Connect new oil leak line (complete) with banio union 5 to rubber hoses. Fasten oil leak line using existing banjo bolt 7 and two new 0-rings 6.
- Re-fit valve cover.
- Open fuel shut-off valve.
- Check for leaks after start-up.

6.3 Cooling System

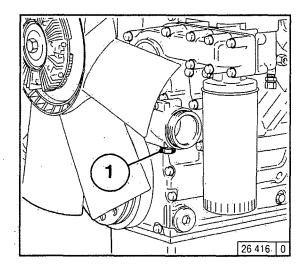
Service and Maintenance

6.3.1 Cleaning Intervals

- The degree of soiling of the cooler units is dependent on the type of engine application.
- The danger of soiling is increased due to residues of oil and fuel on the engine. Check extra carefully, therefore, for leakages when applications involve high dust fallout.
- More severe soiling can occur, e.g. in the case of:
 - Construction site application due to heavily dust-laden air.
- In view of the varying conditions of application, the cleaning intervals must be determined from case to case. The cleaning intervals stated in the table can be taken as guide values.

Chec	king / Cleaning Intervals						
Guide Values (RH)	Engine Application						
2000	Ships, gensets in enclosed spaces, pumps						
1000	Vehicles on paved roads						
500	Mobile gensets						
250	Vehicles on construction sites and unpaved roads, Construction equipment, compressors, underground mining equipment.						
125	Farm equipment						

6.3.2 Draining Cooling System



- Place tray under drain plug 1.
- Remove drain plug 1 and sealing ring below coolant inlet.
- Drain coolant.
- Filling / bleeding as under 6.3.3
- Screw on drain plug 1 with new sealing ring and tighten (see 9.2).
- Check for leaks.



Be careful when draining hot coolant. Danger of scalding! Catch drained coolant and dispose of in accordance with anti-pollution regulations!

6.3.3 Filling / Bleeding Cooling System



Fill with coolant and bleed cooling system according to manufacturer's instructions.

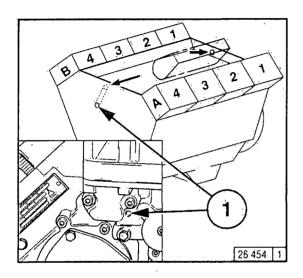
Page 55 of 469

6.3 Cooling System



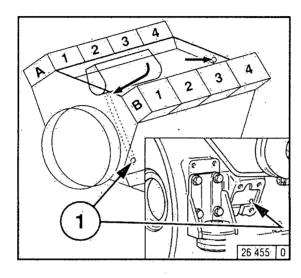
6.3.4 Cleaning engine

- with compressed air



- Blow compressed air onto engine Wash out loosened dirt particles from V-space with water jet:
- Make sure that drain holes 1 of V-space are free.

- with cold cleaning agent



- Spray engine with commercial cold cleansing agent and let stand for about 10 min.
- Then spray clean with strong water jet (do not spray water directly onto sensitive components such as alternator, starter, wiring, electronic components).
- Make sure that drain holes 1 of V-space are free.

 Let engine run up to operating temperature after each wet-cleaning procedure allowing any remaining water to evaporate, thus avoiding corrosion.



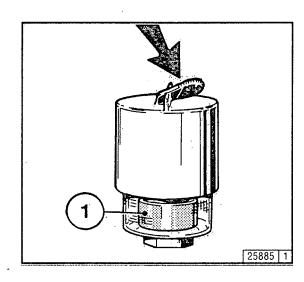
Clean only with engine stationary

6.4 Combustion Air Cleaner

Service and Maintenance

6.4.1 Cleaning Intervals

- The degree of soiling of the combustion air cleaner depends on the amount of dust contained in the air and the size of the filter used. If very dusty air is to be expected, a cyclone-type precleaner can be fitted to the air cleaner.
- Consequently, the cleaning intervals cannot be fixed generally, but have to be determined from case to case.
- When a dry-type air cleaner is used, when indicated by the service indicator or switch.
- Air cleaner servicing is needed when :
 - Service Indicator
 the red sector 1 is fully visible when the engine is off.
 - Service Switch the yellow pilot light comes on when the engine is running.
- After having carried out service work, reset the signal by pressing the button of the service indicator. The service indicator is ready to resume its function.





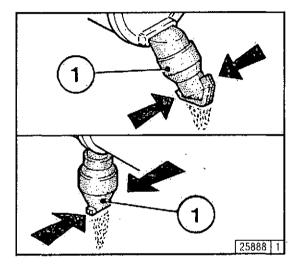
Page 57 of 469

6.4 Combustion Air Cleaner



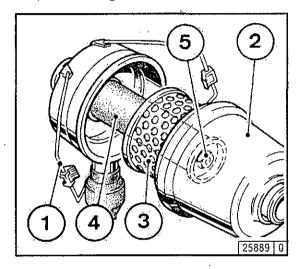
6.4.2 Dry-Type Air Cleaner

Dust Discharge Valve



- Empty dust discharge valve 1 by pressing apart lips of discharge slot as indicated by the arrows.
- Clean discharge slot from time to time.
- Remove any caked dirt by pressing together the upper section of the valve.

Filter Cartridge



- Release fastening clamps 1.
- Take off hood 2 and remove cartridge 3.
- Clean cartridge, replace at least once a year.
- Clean cartridge 3;
 - blow through with dry compressed air (max. 5 bar) from inside to outside, or
 - in difficult cases, tap out, taking care not to damage the cartridge, or
- wash out according to manufacturer's instructions.

- Check cartridge for damage to filter paper (by shining the paper through with a light), and inspect sealing element. Renew if necessaray.
- ◆ After having serviced the filter cartridge five times, or after two years at the latest, renew safety cartridge 4 (never clean!).

To do this, proceed as follows:

- Undo hex, nut 5 and remove cartridge 4.
- Insert new cartridge, insert and tighten hex. nut.
- Install cartridge 3, place hood 2 back in position and secure fastening clamps 1.



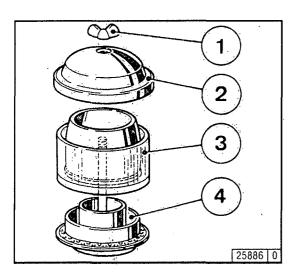
Never clean filter cartridge with petrol (gasoline) or hot liquids!

Page 58 of 469

6.4 Combustion Air Cleaner

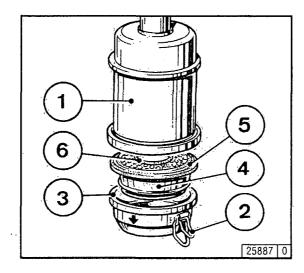
Service and Maintenance

6.4.3 Emptying Cyclone-Type Precleaner



- Undo wing nut 1 and remove cover 2.
- Remove collector bowl 3 from lower section 4 and empty. Remove leaves, straw and other foreign matter from lower section of precleaner.
- Reposition collector bowl 3 onto lower section 4, fasten cover 2 in place by tightening wing nut 1.

6.4.4 Cleaning Oil Bath Air Cleaner



- Turn engine off and wait about 10 minutes for the oil to drain from filter housing 1.
- Release snap clips 2 and remove oil cup 3 together with filter element 4. If necessary, press element out with a screwdriver, taking care not to damage rubber gasket 5.
- Remove dirty oil and sludge. Clean oil cup.
- Clean filter element 4 in diesel fuel and allow to drip-dry.
- Clean filter housing 1 if very dirty.
- Inspect and replace rubber gaskets 5 and 6 if necessary.

- Fill oil cup with engine oil up to the mark (arrow) (for viscosity, see 4.1.2).
- Refit oil cup and element to filter housing and secure with snap clips.



Never clean air cleaner with petrol (gasotine)!

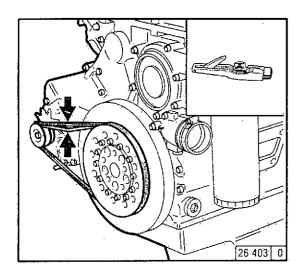
Dispose of old oil in accorrdance with anti-pollution regulations!



6.5 Belt Drives

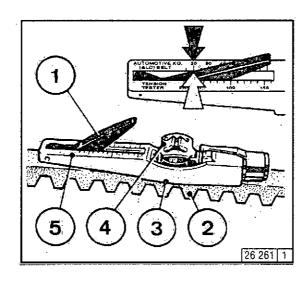


6.5.1 Checking Alternator V-Belt



Checking

- Inspect entire V-belt for damage.
- Renew damaged V-belts.
- After installing new belts, run engine for 15 minutes, then check belt tension.
- Use a belt tension gauge (see 9.3) to check belt tension.
 - Place indicator arm 1 into gauge.
- Position gauge on V-belt 2, midway between the pulleys, with flange 3 on bottom of gauge against the edge of belt.

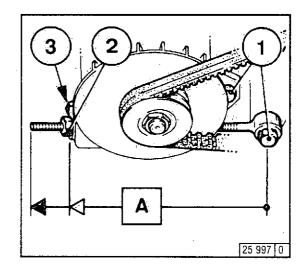


- Press slowly on the black pad 4 at right angles to belt 2 until the spring is heard or felt to trigger.
- Carefully remove the gauge without altering the position of the indicator arm 1.
- Read off the value: Turn the gauge sideways to see the exact spot where the top of the black indicator arm 1 intersects scale 5 (arrow). For settings, see 9.1.
- If necessary, retension belt and measure again.



Check / retension and renew Vbelts only with the engine off. Refit belt guard, if provided.

6.5.2 Retensioning / Renewing Alternator V-Belt



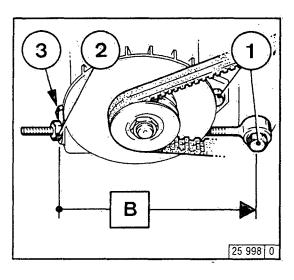
Retensioning

- Slacken hex. bolts 1, 2 and 3.
- Turn lock nut 2 in direction A until correct Vbelt tension is attained.
- Tighten bolts 1, 2 and 3.

6.5 Belt Drives

Service and Maintenance





Renewing

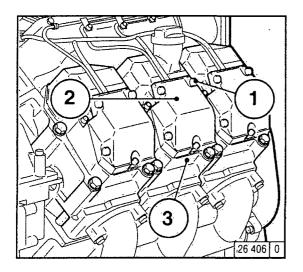
Q-Pulse Id TM\$1079 — --

- Slacken hex. bolts 1, 2 and 3.
- Turn lock nut 2 in direction B as far as it will go. Now the new V-belt can be easily placed in position.
- Tighten bolts 1, 2 and 3 until correct V-belt tension is attained (see Section 6.5.1).

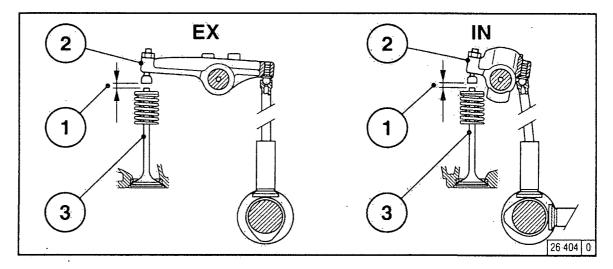
6.6 Adjustments



6.6.1 Checking / Adjusting Valve Clearances



- Before adjusting valve clearance, allow engine to cool down for at least 30 minutes. The oil temperature should be below 80 °C (176 °F).
- Position crankshaft as per schematic, see 6.6.1.1.
- Slacken bolts 1.
- Remove rocker cover 2 together with gasket 3.



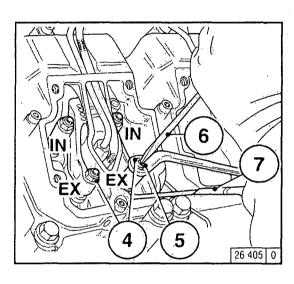
◆ Check valve clearance 1 between rocker arm/ tappet contact face 2 and valve stem 3 with feeler gauge (there should only be a slight resistance when feeler blade is inserted).

For permissible valve clearance, see 9.1.

6.6 Adjustments

Service and Maintenance





- If necessary, adjust valve clearance as follows:
 - Loosen lock nut 4 using wrench 7.
 - Adjust set screw 5 by means of screwdriver
 6 in such a manner that with lock nut 4 tightened (wrench), the correct valve clearance 1 is attained.
- Check the valve clearances at each of the remaining cylinders and adjust if necessary.
- Refit rocker cover (together with new gasket if necessary).

6.6 Adjustments



6.6.1.1 Valve Clearance Adjustment Schematic

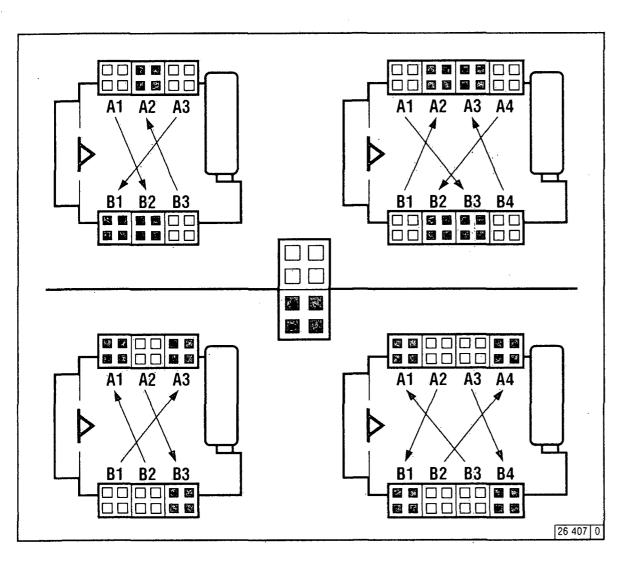
Firing Order BF6M 1015: A1 - B3 - A3 - B2 - A2 - B1 Firing Order BF8M 1015: A1 - B4 - A4 - B1 - B3 - A3 - B2 - A2

Sequence	1	2	3	4	- 5	6		1,	:2	3	. 4	.5	6	7.	8
Valve overlap	A1	В3	A3	B2	A2	B1		A1	B4	A4	B1	В3	A3	B2	A2
Adjusting	B2	A2	B1	A1	В3	А3	3 3	В3	А3	B2	A2	A1	B4	A4	B1

6.6 Adjustments

Service and Maintenance





Adjustment

Turn crankshaft according to sequence shown in the diagram (starting with cyl. 1).

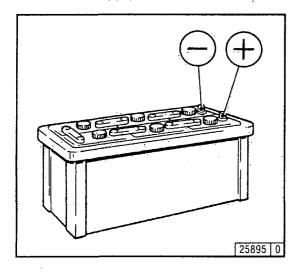
The valves of the relevant cylinder overlap, marked in white, (exhaust valves about to close, inlet valves about to open). Adjust clearance of valves, marked in black, according to schematic. Mark the respective rocker arm with chalk to show that the adjustment has been done.

6.7 Accessories



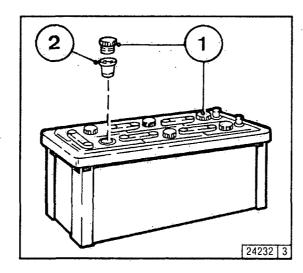
6.7.1 Battery

6.7.1.1 Checking Battery and Cable Connections



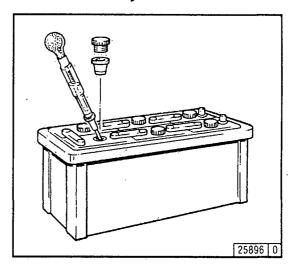
- Keep battery clean and dry.
- Undo soiled terminals.
- Clean battery plus and minus poles and terminals and apply a film of acid-free and acidresistant grease.
- When reconnecting, ensure good contact of terminals. Fasten clamping bolts finger tight.

6.7.1.2 Checking Electrolyte Level



- Remove cell caps 1.
- If electrolyte test elements 2 are fitted:
 The level should be high enough to wet the bottom of these.
- If no such elements are provided:
 Check to make sure that the level is 10-15 mm above the top edge of the plates.
- Top up with distilled water if necessary.
- Fit cell caps back in position.

6.7.1.3 Checking Specific Gravity of Electrolyte



 Measure the specific gravity of the individual cells with a commercial hydrometer.

The measured values (see adjacent table) indicate the state of charge of the battery. During the measurement, the temperature of the electrolyte should preferably read 20 °C.

6.7 Accessories

Service and Maintenance



			Specific G	iravity
in [kg/l]		in [°,Bé (degre	ees Baumé) *]	State of Charge
Normal	Tropics	Normal	Tropics	
1.28	1.23	32	27	Fully charged
1.20	1.12	24	16	Half charged, recharge
1.12	1.08	1.6	11	Discharged, charge up immediately

^{*} Measurement of the specific gravity in °Bé (degrees Baumé) is obsolete and rarely used today.



The gases emitted by the battery are explosive! Avoid formation of sparks in the vicinity of battery, keep away any open flames!

Do not allow acid to come into contact with skin or clothing!

Wear protective goggles!

Do not place tools on battery!

6.7 Accessories

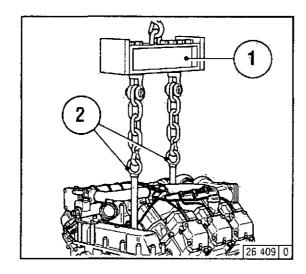


6.7.2 Three-Phase Alternator

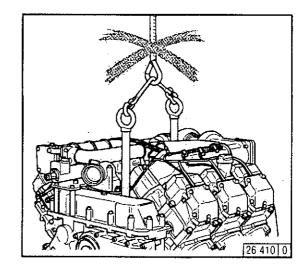
6.7.3 Lifting Tackle

Notes on the three-phase system:

- When the engine is running, never disconnect the cables between battery, alternator and regulator.
- Where it is, however, necessary, to start and operate the engine without battery, disconnect the regulator from the alternator before starting.
- Be sure not to confuse the battery terminals.
- Renew a defective charging pilot light bulb immediately.
- Engine cleaning: Do not spray with water/ steam jet directly against alternator!
 Warm up engine to allow water residues to evaporate.
- Do no loosen connecting cable between battery and alternator during engine operation.
- The habit of touching a lead against frame to check whether it is live must under no circumstances be applied with a three-phase electric system.
- In case of electric welding, connect the earth terminal of the welding unit direct to the part to be welded.



- For transporting the engine, always use the proper lifting tackle.
- Remove lifting tackle.
 - Do not start engine with lifting tackle fitted.





Always use the proper lifting tackle!

Troubleshooting



7.1 Diagnosis Chart

Troubleshooting

7.1 Diagnosis Chart



- If engine problems occur, they frequently have their cause in improper operation or maintenance of the engine.
- So, in case of trouble, always check first whether the operating and maintenance instructions have been observed.
- A helpful Diagnosis Chart is to be found on the opposite page.
- If you cannot identify the cause of the trouble or are unable to rectify it yourself, contact your service representative.



Before starting, make sure that nobody is standing in the immediate vicinity of the engine or driven machine. After repairs:

Important: Never start engine with the speed governor removed.

Disconnect battery terminals!

7.1 Diagnosis Chart

Troubleshooting

Troubles	Remedial Meas	ure
Engine fails (or difficult) to start	Check	P
Engine starts, but runs unevenly or stalls	Adjust.	E
Engine becomes too hot, temperature monitor gives warning (coolant)	Renew	W
Engine gives poor performance	Clean	R
Engine not working on all cylinders	Тор ир	` A
Engine has little or no oil pressure	Lower level	S
Engine oil consumption excessive	Bleed	L
Engine smokes — blue		
- white	The state of the s	
— black		
Causes	Section	1
Not declutched (declutch where possible)	Operation	P
Below start limit temperature		P
● Engine shutdown lever still in stop position (shutdown solenoid defective)		P
Oil level too high		Р
Oil level too low		S
Excessive inclination of engine		P/E
Speed control lever set to middle position		P/E
Dirty air cleaner / defective turbocharger	Combustion Air	P/W
● Air cleaner service switch/indicator defective		P
■ LDA* defective (leaking line)		Р
Charge air pipe leaking		P/W
Coolant pump defective	Cooling System	P/R
● ● Charge air cooler dirty		P/R
Coolant heat exchanger dirty		P/R
Coolant thermostat does not open		P
Battery defective or discharged	Electrics	P

^{*} LDA = manifold pressure compensator





Troubleshooting

7.1 Diagnosis Chart



roubles ingine fails (or difficult) to start					Remedial Measu	ure				
					Check	Р				
Engine starts, but runs unevenly or stalls					Adjust	Ε				
	Engine becomes too hot, temperature monitor gives warning					Renew	W			
	Engine gives poor performance					Cleañ	R			
	Engine not working on all cylinders					Top up	Α			
		Engine has little or no oil pressure					Lower Level	S		
		Engine oil consumption excessive						Bleed	L	
		Engine smokes — blue								
								- white		
								- black		,
							740	Causes	Section	<u> </u>
								Cable connection to starter loose or oxidized	Electrics	Р
								Starter defective or pinion does not engage		Р
•		• •				• •		Incorrect valve clearance	Engine	E
•		• (A.			Leaking injection line		Р
	•							Vent pipe clogged (coolant heat exchanger)		Ρ,
						•		Flame-type heater plug system defective		Р
•	•	• •				• •		Injector defective		P
•	200	• •						Air in fuel system (lack of fuel)		P
•		•						Fuel filter / prefilter contaminate		P/I
				•				Incorrect lube oil SAE class or quality grade	Operating Media	W
•		•				•		Fuel quality grade not corresponding to specification under 4.2.1		P
W.	•						250	Lack of coolant		P /

Engine Preservation



8.1 Preservation

Page 73 of 469

Engine Preservation

8.1 Preservation



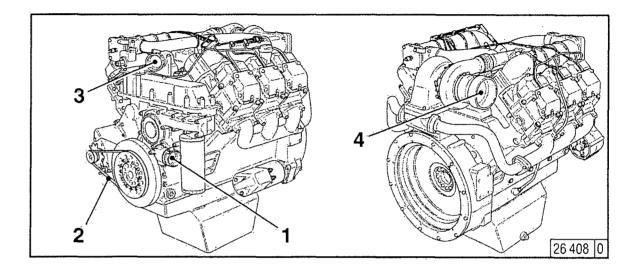
8.1 Preservation

If the engine is to be shut down for an extended period, it is necessary to take preservation measures to prevent rust formation. The preservation measures described here will protect the engine for a period of up to about 6 months. Before reusing the engine, the preservatives must be removed.

- Anti-corrosion oils to Specification:
 - MIL-L 21260B
 - TL 9150-037/2
 - Nato Code C 640 / 642
- Recommended cleansing agent for removing preservatives:
 - Petroleum benzine (hazardous materials class A3)

Preserving the Engine:

- Clean engine (in case of need with cold cleansing agent).
 - Clean cooling system according to manufacturer's instructions.
- Run engine until warm and stop.
- Drain engine oil, see 6.1.2, and fill in anticorrosion oil.
- Drain coolant, see 6.3.3.
- Fill in anti-corrosion agent, see 4.3.3.
- Clean oil bath air cleaner, if provided, see 6.4.3, and fill in anti-corrosion oil.
- Drain fuel from tank.
- Prepare a mixture of 90% diesel fuel and 10% anti-corrosion oil and fill up tank.



- Run engine for about 10 minutes:
- Stop engine.
- Turn engine several times by hand. When turning engine with starter, move shutdown lever to stop position.
- Remove V-belt 2 and store in wrapped condition.
- Spray grooves of V-belt pulleys with anticorrosion agent.
- Close coolant inlet and outlet openings 3 and air intake opening 4.
- Close exhaust discharge opening.

• Drain off anti-corrosion agent, see 6.3.3.

Removing Engine Preservatives:

- Remove anti-corrosion agent from the grooves of the V-belt pulleys.
- Fit V-belt 2. Retension, if necessary, after short period of operation, see 6.5.
- Remove plugs 1, 3 and 4 and plug from exhaust discharge opening.
- Fill in coolant according to instructions of radiator manufacturer.
- Start up engine.

Specification Data



- **9.1 Engine Specifications and Settings**
- **9.2 Torque Wrench Settings**
- 9.3 Tools

Specification Data

9.1 Engine Specifications and Settings



Model 1015		BF6M 1015	BF8M 1015	BF6M 1015 C/CP	BF8M 1015 C/CP		
Number of cylinders		6	8	6	8		
Cylinder arrangement	-		90° Ve	a-angle			
Bore ⁻	[mm]	·	13	32 ————			
Stroke	[mm]	145					
Total displacement	[cm³]	11906		11906	15874		
Compression ratio	[ε <u>]</u>		1				
Working cycle / combustion system	}	4-stroke TC engine/direct injection					
Direction of rotation		counter-clockwise					
Weight incl. cooling system	[approx. kg]	Consult headquarters ————————————————————————————————————					
Weight w/o cooling system acc. to DIN 70020-A	[approx. kg]	830	1060	830	1060		
Engine power	[kW]	190-240 1)	250-320 1)	228-300 1)	304-400 1)		
Speed	[rpm]		1	•			
Valve clearance, engine cold 5)	[mm]	inlet 0.25 + 0.1 / exhaust 0.3 + 0.1					
Injector opening pressure	[bar]	290 bar					
Commencement of delivery	[°CA BTDC]	····	i				
Firing order		1-6-3-5-2-4	_	1-6-3-5-2-4			
W.L. W.A. and San		A1-B3-A3-B2-A2-B1		A1-B3-A3-B2-A2-B1	A1-B4-A4-B1-B3-A3-B2-A2		
V-belt tension:	CD13	tension / retension ²) 450 / 200-350 * ⁵⁰					
Alternator 55 amperes	[N]	450 / 200-350 ***					
Alternator 120 amperes	[N]	550 / 300-450 ± 50					





¹⁾ Engine power, speed, commencement of delivery, etc. are stamped on the rating plate, see 2.1.

²⁾ Retension after running for 15 minutes under load.

9.1 Engine Specifications and Settings

Specification Data

Model 1015		BF6M 1015	BF8M 1015	BF6M 1015 C/CP	BF8M 1015 C/CP		
Gooling system			——liquid-cooled / co	poling system protection—			
Coolant quantity	[approx. lit.]	17 + MFK.	21 + MFK	17 + MFK*	21 + MFK		
Perm. cont. coolant temperature engine outlet	[°C]			max.103	······································		
Temperature difference between			•				
coolant inlet / outlet	[°C]			max.5			
Thermostat starts opening at	[°C]			87 ±2			
Thermostat fully open from	[°C]			-102.			
Coolant pump							
Delivery pressure in	[bar]						
Delivery rate in	[m³/h]	22,5 ⁴⁾	30 ⁴⁾	22,5.4)	30 4)		
Lubrication			forced-f	feed lubrication ————			
SAE oil (see 4.1)	}	15 W 40					
Min. oil pressure with engine warm (120 °C) at low idle / rated speed	[bar]	1,0					
Oil capacity (initial filling) without filter	[approx. lit.]	34 ³⁾	45 ³⁾	34 ³⁾	45 ³⁾		
Oil capacity (initial filling) engine-mounted filter	[approx. lit.]	36* ³⁾	47 * 3)	36* ³⁾	47 * 3)		
Oil capacity (initial filling), separate filter	[approx. lit.]	38 3)	·50 ³⁾	38 ^{. 3)}	50 ⁽³⁾		



³⁾ Approximate figures can vary depending on the design. Decisive is always the upper dipstick mark.

^{4) 3} bar at engine speed n = 2100 rpm⁻¹

⁵⁾ see 6.1.1 (Only synthetic lube oil, see 4.1.2.1)

^{*} MFK Engine radiator

Specification Data

9.2 Torque Wrench Settings



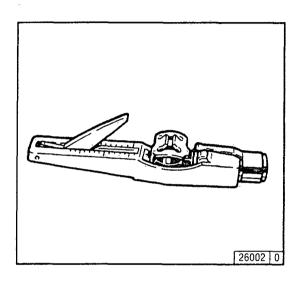
Location	Prel	Preloading [Nm]		Tightening [° deg.]				Total	
	1st Stage	2nd Stage	3rd Stage	1st Stage	2nd Stage	3rd Stage	4th Stage	[Nm]	Notes
Rocker cover	-							22	
Inspection Cover								22	
Rocker arm setscrew								20	
rigid mounting Mount	30			45					
flexible mounting								106	
Air intake manifold								21	
Exhaust manifold								61	
Oil drain plug								100	
Injector mounting							•	60	
Injection line mounting								25	
Oil pan								24	,
Oil filter cartridge		· · · · · · · · · · · · · · · · · · ·						27	engine mounted or separate
Coolant drain plug								38	
Pin-type heater plugs / pipe union								4	

9.3 Tools

Specification Data

V-belt Tension Gauge





The V-belt tension gauge can be obtained under order number 8115 from:

Fa. WILBÄR Postfach 14 05 80 D-42826 Remscheid

Notes

CALIFORNIA PROPOSITION 65 INFORMATION

TO CALIFORNIA CUSTOMERS AND TO CUSTOMERS SELLING DIESEL ENGINE EQUIPMENT INTO OR FOR USE IN CALIFORNIA.

Proposition 65, a California law, requires warnings on products which expose individuals in California to chemicals listed under that law, including certain chemicals in diesel engine exhaust.

<u>Obligations of Manufactures of Diesel-Powered Off-Road Equipment.</u> The California Superior Court has approved either of the following two methods of compliance with Proposition 65 requirements by manufactures of off-road equipment containing diesel engines. (The court order containing these provisions is attached.)

- 1. <u>On-Equipment Warning</u>. Place the warning pictured in attachment 1 on all equipment shipped by you into or for sale in California after January 1, 1996. The warning must be in a location where it is easily visible to the operator of the equipment when (s)he is operating the equipment. The warning must be secured to the equipment. If warnings or operating instructions are provided through a digital display, you may usee that method of providing warning.
- 2. <u>Operator Manual Warning.</u> When the operator manual is next revised or by December 31, 1995 whichever is earlier, place the warning in attachment 2 in the operator manual. The warning may be either printed in the manual or on a sticker.

The warning must appear in one of the following locations:

- Inside The front cover
- Inside the back cover
- Outside the front cover
- Outside the back cover
- As the first page of text

Under either alternative, the warning must appear in the same size, print and format as the attachment selected or be of an equally conspicuous size and format. If the warning is provided in an on-screen display, the warning must contain the language in the attachment and must be provided at the time of or in connection with ignition in the same manner as other safety warnings electronically communicated on screen.

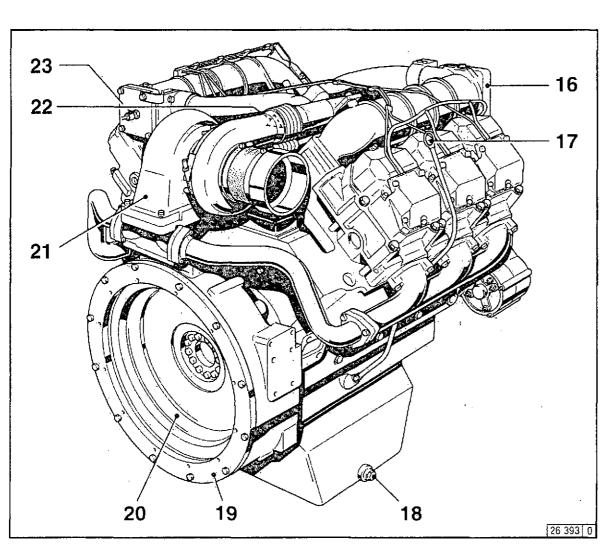
Obligation of Resellers of Diesel Engines. This letter must accompany any loose diesel engine sold in California. Should you have any questions, please call Deutz Corporation Product Support Department.

2.2 Engine Illustration

Description of Engine

2.2.2 Cyl. Bank B - BF6M1015





- 16 Charge air pipe
- 17 Oil dipstick
- 18 Oil drain plug
- 19 SAE housing
- 20 Flywheel
- 21 Exhaust turbocharger
- 22 Injection pump
- 23 Flame-type heater plug (A-side)

Page 82 of 469

Spare Parts Catalogue

BF M 1015/C

0297 7772

DEUTZ

		一
	Dealer's stamp	
L		
Engine Serial No:		
will facilitate d		f your engine. This uestions concern- id spare parts.

This Spare Parts Catalogue is subject to engineering changes necessary for engine advancement. All rights reserved. No part of this publication may be reproduced or multiplied in any form, without our prior permission in writing.

Page 85 of 469

Preface

Dear Customer,

watercooled DEUTZ diesel engines are developed to meet the requirements of a wide range of applications. An extensive program of variant options gives them their high flexibility.

Your engine is custom-made, i.e. specifically equipped for your requirement, which means that not all of the components and assemblies contained in this Catalogue are fitted to your engine.

The greater part of the illustrations does not depict all details, and yet you will find it easy to differentiate between versions and thus to identify the parts pertaining to your engine model. Fig. Item No., Assembly Group No. Engine Serial No. are the codes that infallibly lead to selection of the correct parts.

When placing your order, please observe our ordering hints. This will allow speedy and reliable delivery of the required parts that are based on latest engineering standards.

If there are any questions, please do not hesitate to contact us.

Sincerely,

DEUTZ AG

Preface

DEUTZ Diesel Engines

are products based on long-standing research and development. The deep funds of acquired know-how in conjunction with high quality requirements guarantee that engines leaving our works achieve a long life, high reliability and excellent fuel economy. Naturally, they also attain best ratings as regards environmental protection.

Genuine DEUTZ Parts

are subject to equally stringent quality requirements as the engines themselves. Improvements in engine design certainly also pass into the genuine DEUTZ parts. To ensure that your engine will retain its functions and high reliability, you should use genuine DEUTZ parts only.

DEUTZ Exchange Components

are a cheap alternative. Of course, they are subject to the same high quality requirements as new parts. And as regards functions and reliability, DEUTZ exchange components equal genuine DEUTZ parts.

SERVICE

In case of operational trouble with your equipment or queries about spare parts please turn to your nearest service dealership. Our skilled staff of service experts will trace and remedy any defect quickly, using genuine DEUTZ parts.

Beware of the Running Engine

Be sure to shut down the engine before performing maintenance or repair work. After repair, put back in place any removed panels and guards. When doing work on the running engine, working clothes should fit tightly so that loose ends cannot get caught. Do not run the engine in enclosed rooms – poison hazard.

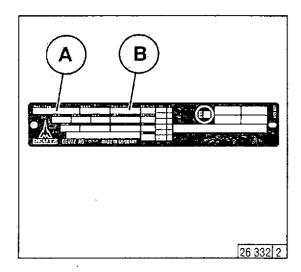
Asbestos



Gaskets used for this engine do not contain asbestos. Please use suitable spare parts when carrying out maintenance and repair work.

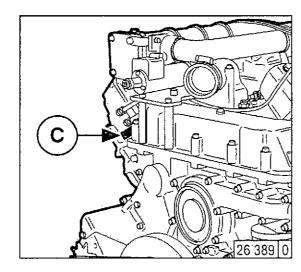
Description of Engine

1. Maker's Nameplate



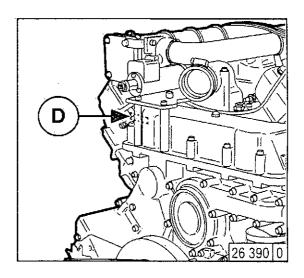
Engine model designation **A**, Engine Ser. No. **B** and the power rating are given on the maker's nameplate. Be sure to state engine model and engine serial number when writing out a parts order.

2. Position of Nameplate



The nameplate **C** is attached to the crankcase.

3. Engine Serial No.



The engine serial No. $\dot{\mathbf{D}}$ is stamped on the crankcase and also on the nameplate.

Ordering spare parts

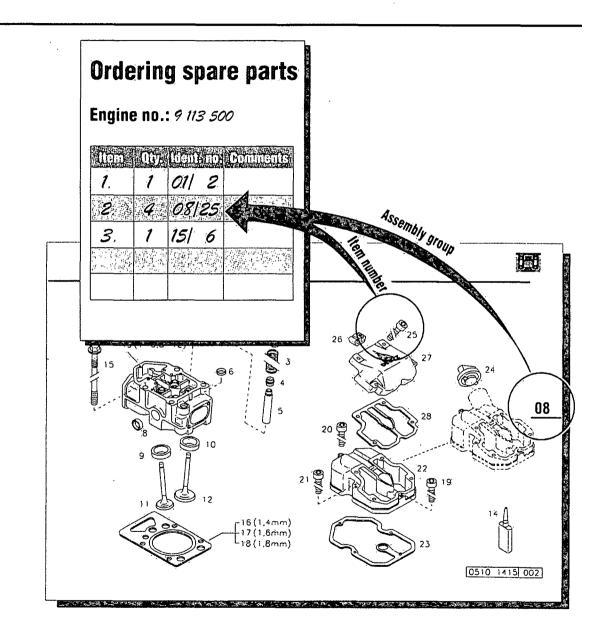
Order information

Please specify the following information when ordering original DEUTZ parts:

- Engine no.
- Ident. no.
- Quantity

Document structure

- The picture diagrams in this spare parts list are sorted according to engine assembly groups.
- Each section is preceded by an overview of the assembly groups.
- The ident. no. 08/25 is made up of the assembly group (e.g. 08) and item number (e.g. 25).



Service

Knowing it's DEUTZ

DEUTZ has always stood for excellence in motor construction, pioneering many developments in the industry. As an independent motor manufacturer, we offer — worldwide — a comprehensive range of diesel and gas motors spanning from 4kW to 7,400kW. Our products are perfectly tailored to meet our customers' individual requirements.

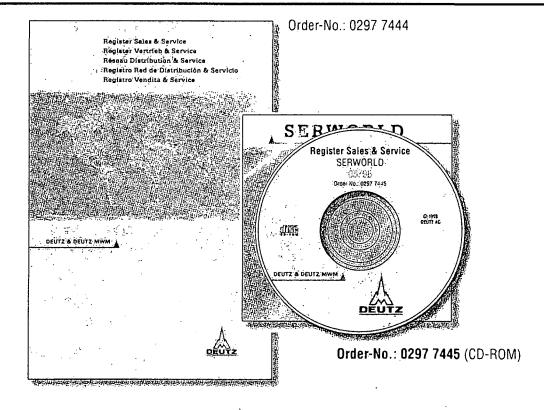
Over 1.4 million DEUTZ and DEUTZ MWM motors do their job reliably all over the world. We are determined to preserve the high standard of performance and dependability of our motors, thus keeping our customers satisfied at all times. Therefore we are represented worldwide through a network of highly competent service partners who will meet the needs of our customers, wherever they are.

This is why DEUTZ is not only the name for motors which pack a lot of inventive genius. DEUTZ also means reliable service and comprehensive support to enhance your motor's performance.

This index Sales & Service offers you an overview of the DEUTZ partners in your vicinity, including the products for which they are responsible and the range of services provided. But even when no direct product responsibility is mentioned, your DEUTZ partner will be happy to help you with expert advice.

The Index is constantly updated. Please ask your DEUTZ service partner for the latest edition.

DEUTZ AG — at your service.



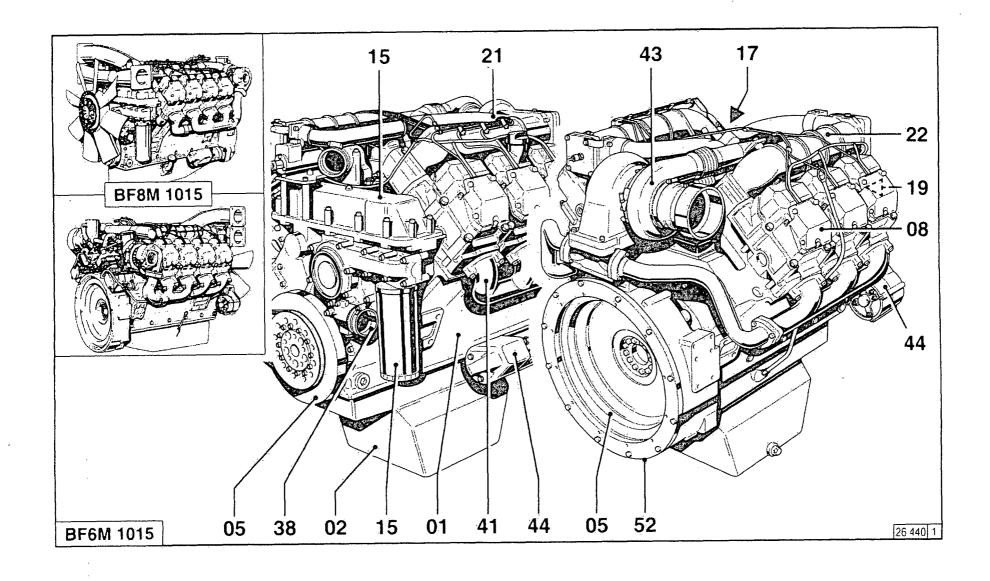
Obtainable from the local service Partner reponsible for you or from:

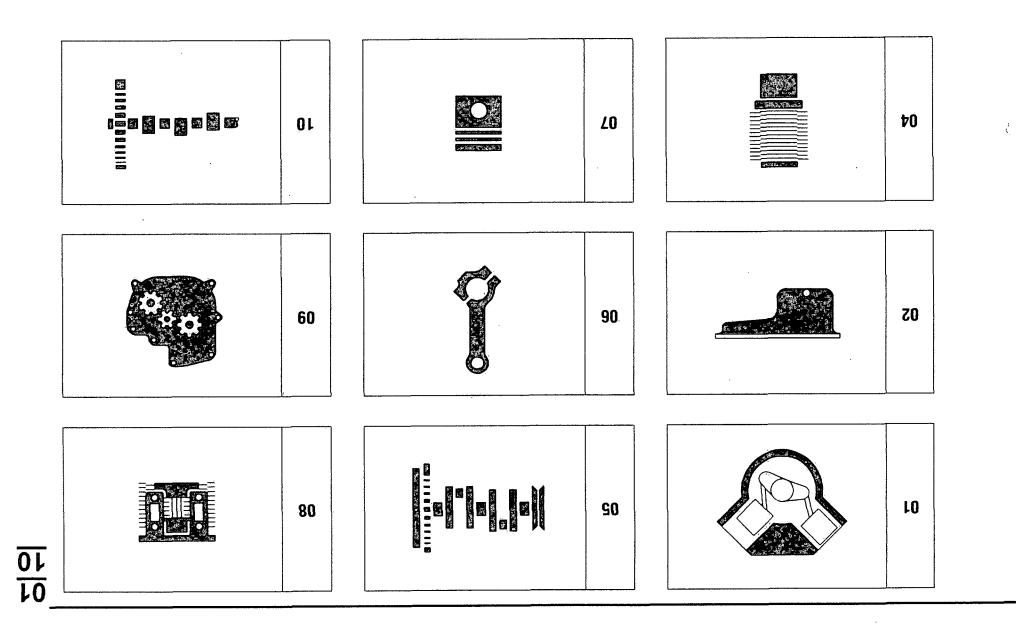
DEUTZ AG Deutz-Mülheimer Str. 147-149 D-51057 Köln

Phone: 0049-221-822-0 Telefax: 0049-221-822-5304. Telex: 8812-0 khd d http://www.deutz.de

Bildtafeln Illustrations **Figures Grabados Quadros de figuras Tavole** Afbeeldingen **Planscher** Illustrationer Kuvat Bilder Διαγράμματα Sekiller Иллюстрации الرسوم والأشكال التوضيحية

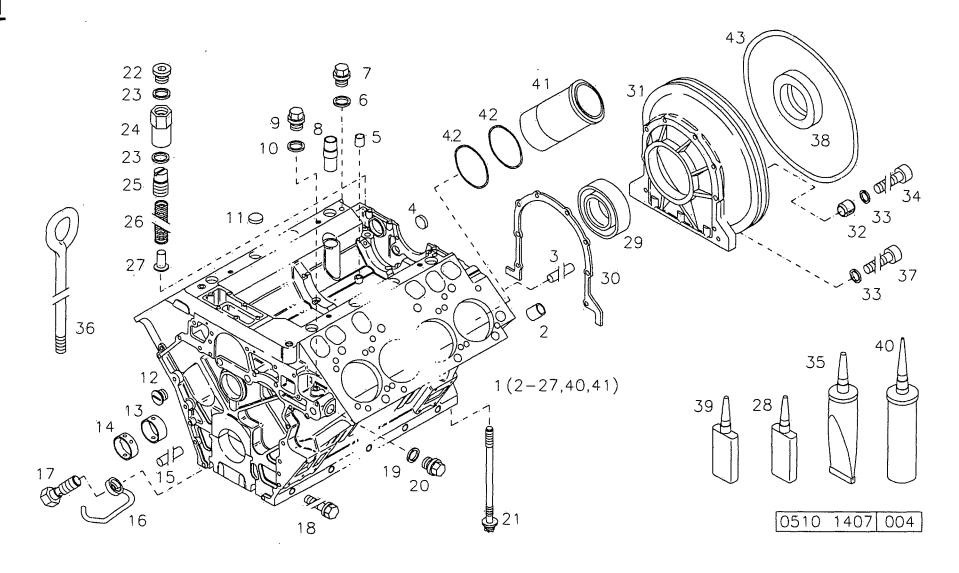
Page 91 of 469





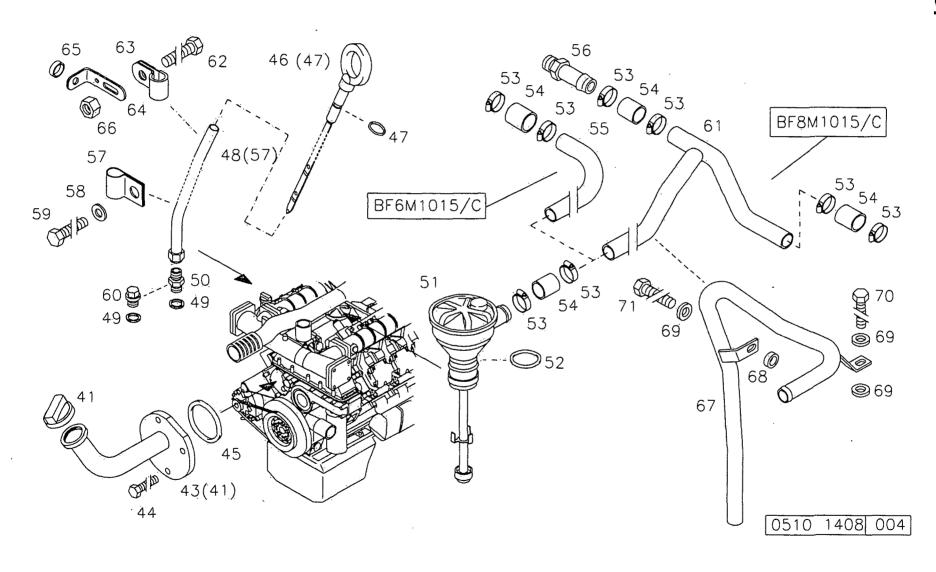
Page 93 of 469



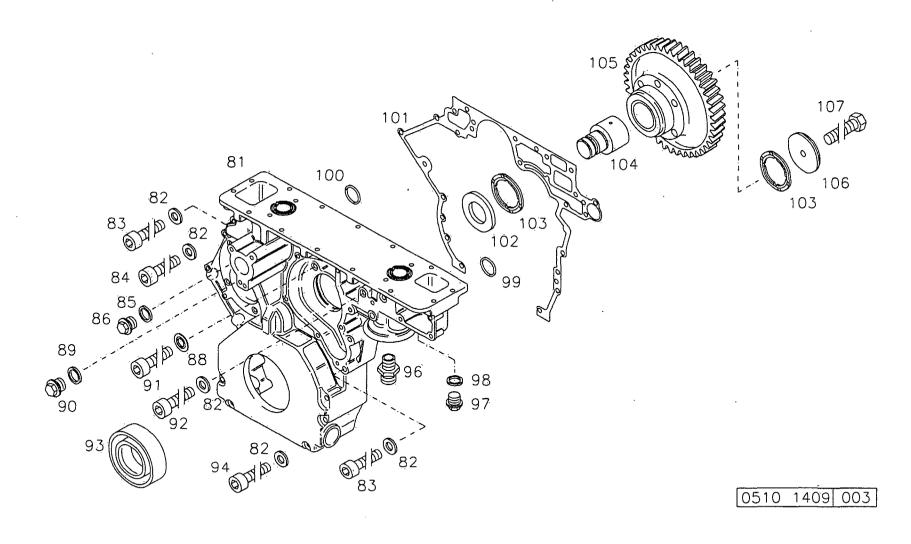




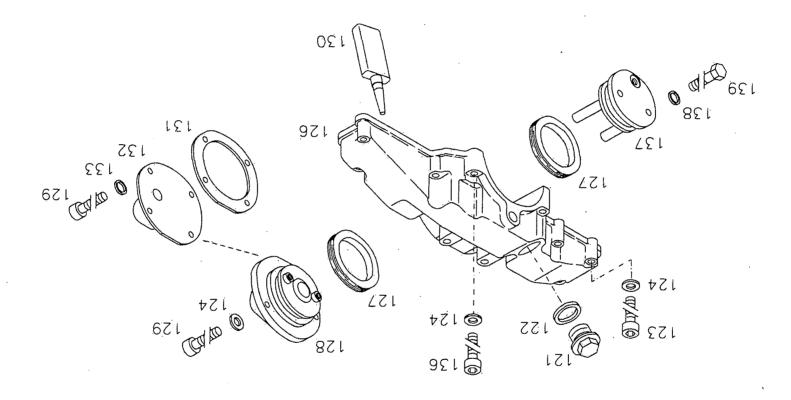








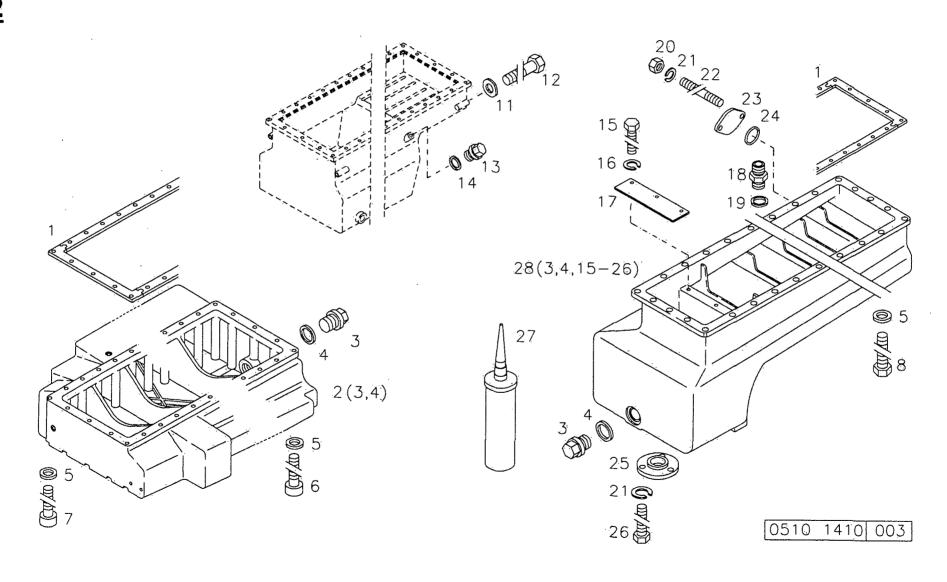
0210 1428 003



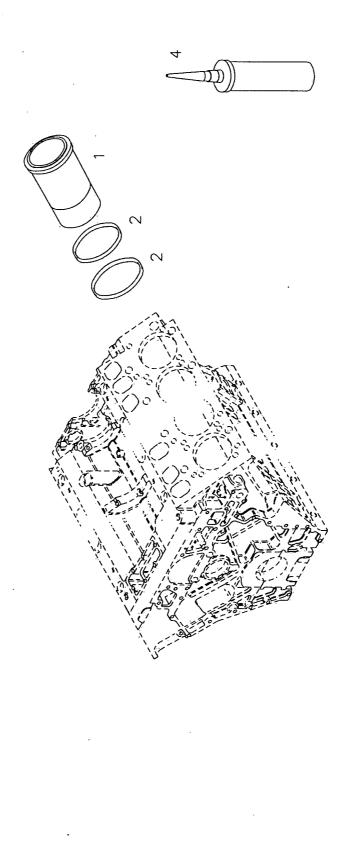




<u>02</u>

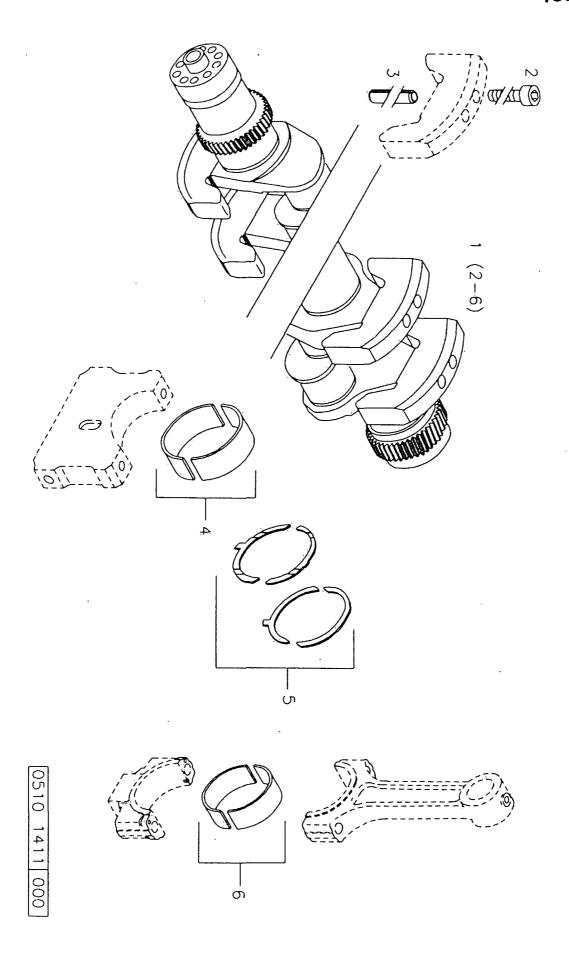


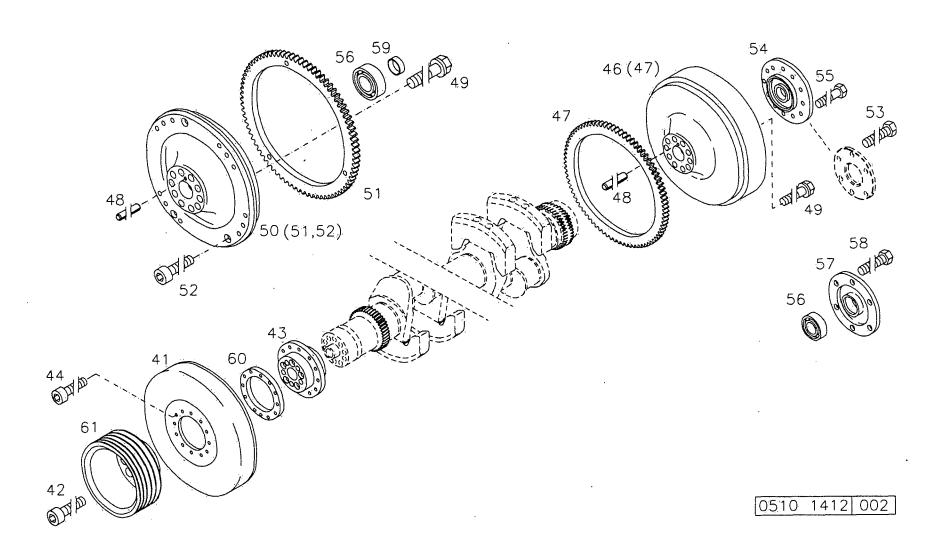




Page 99 of 469

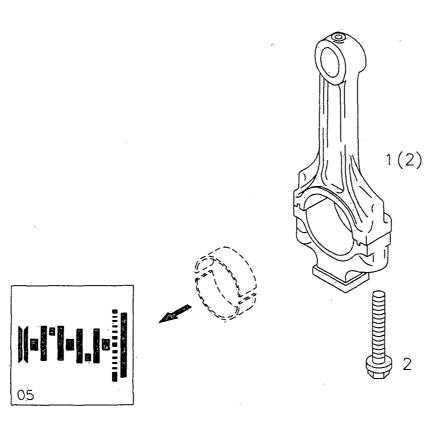






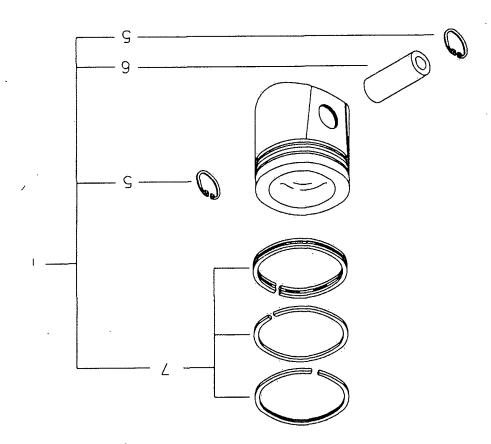


<u>06</u>



0510 1413 002

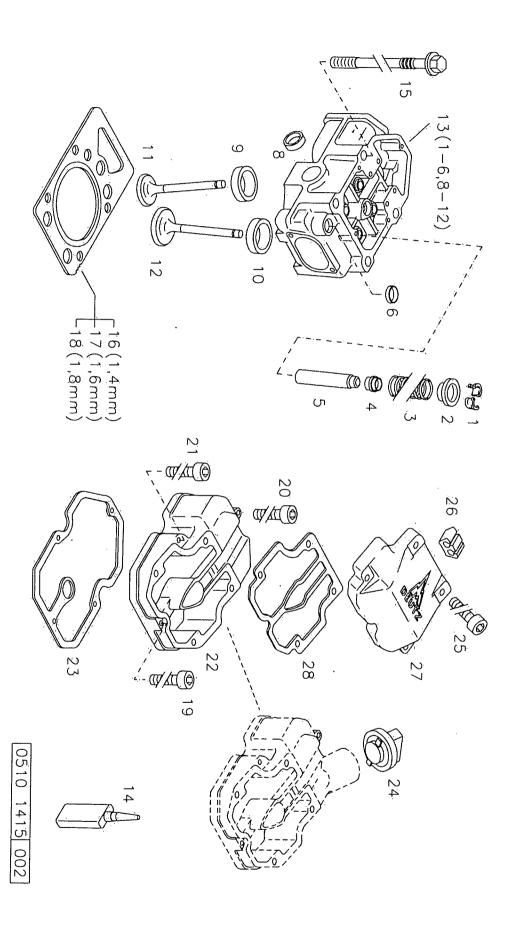
000 1111 0150



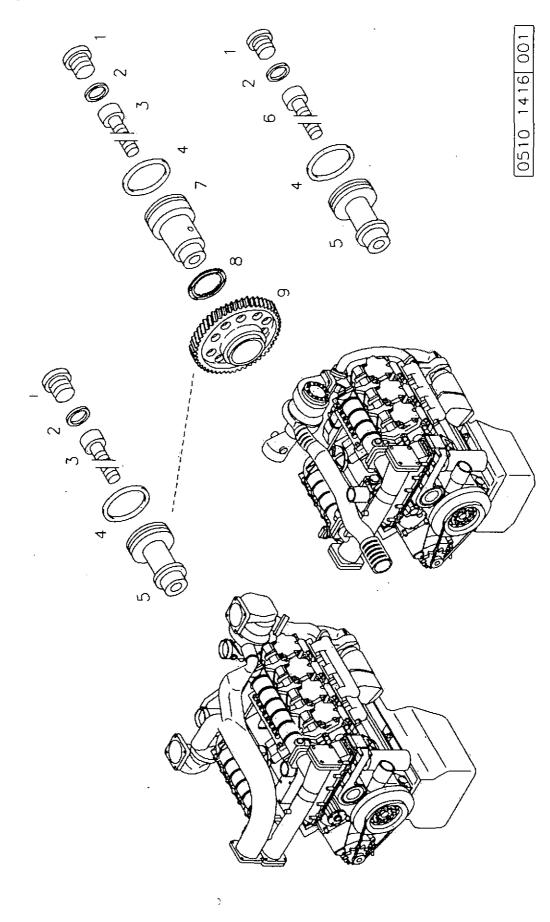
40

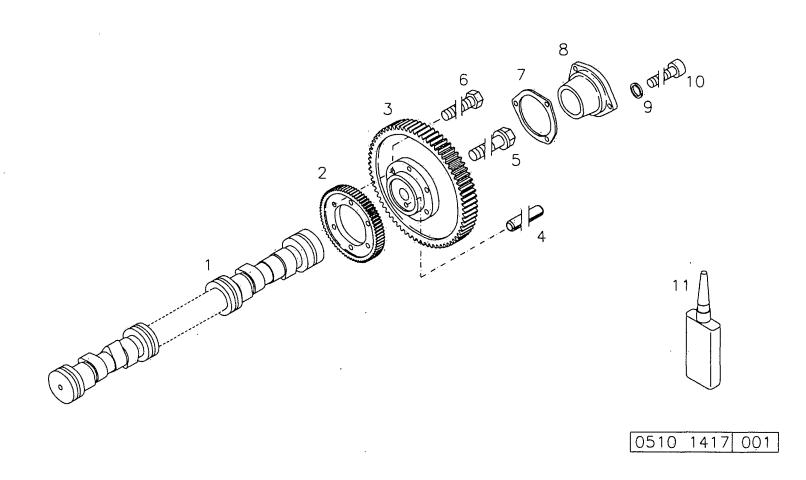


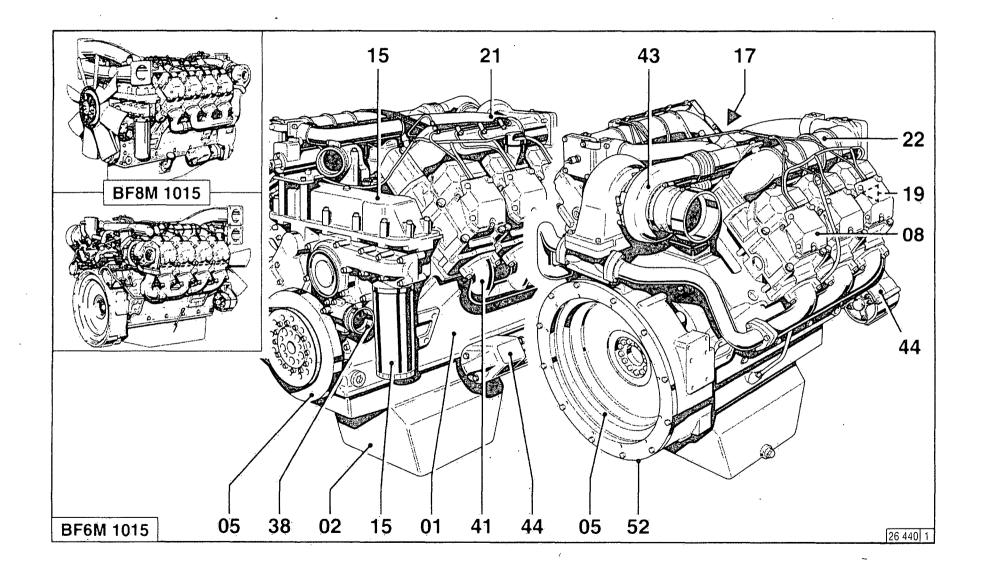




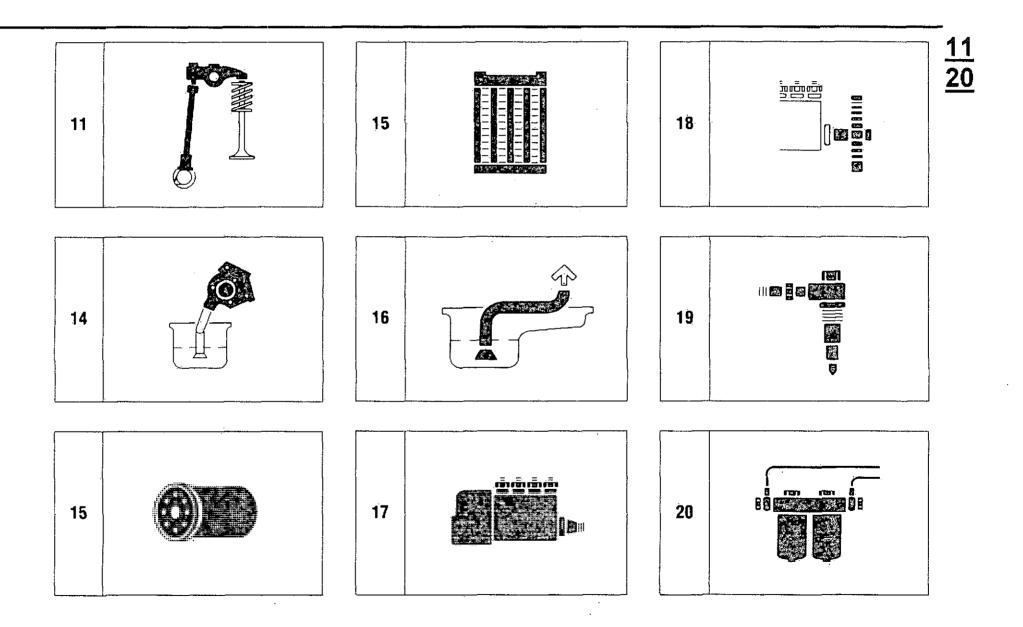




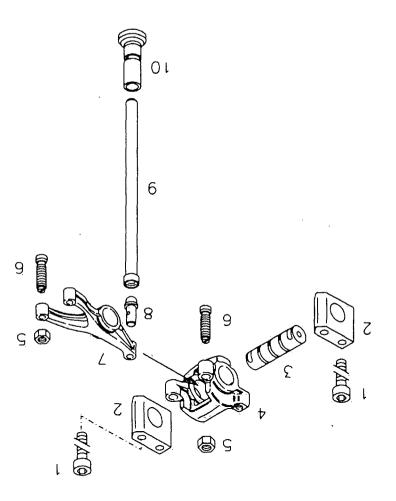




Page 107 of 469

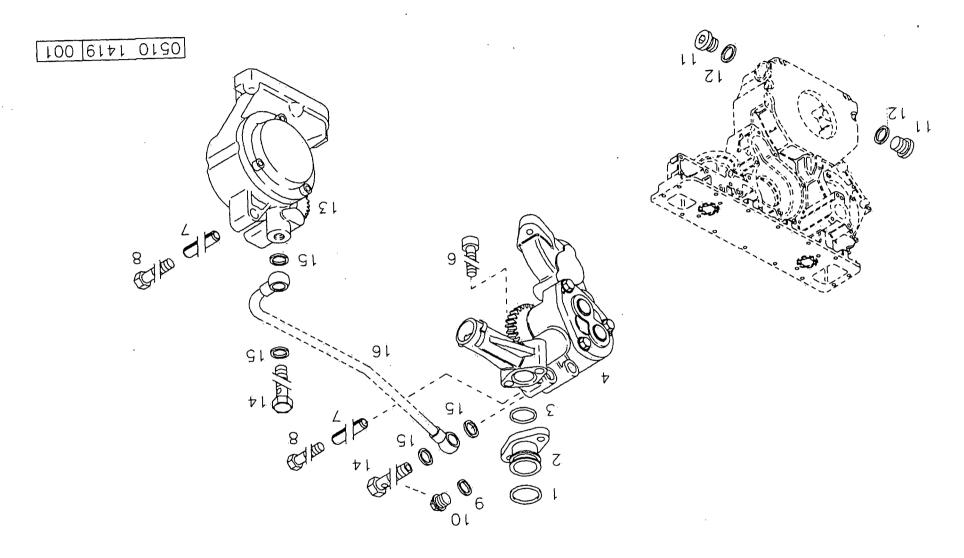


000 8171 0150



II



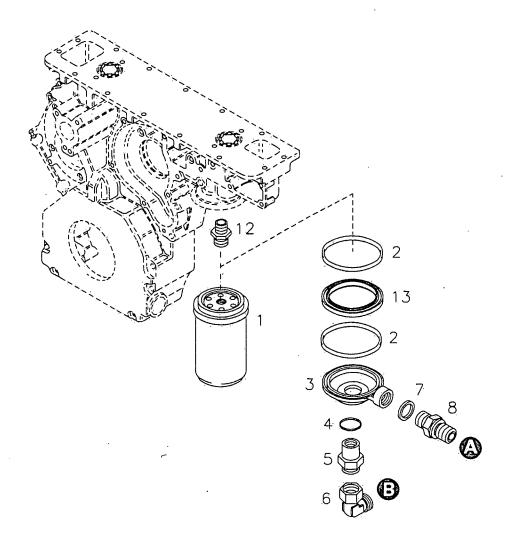


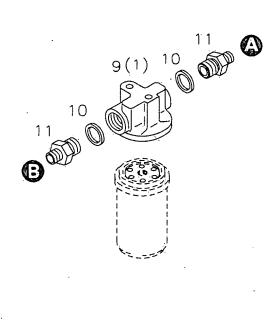
机





<u>15</u>

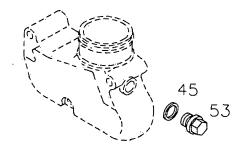


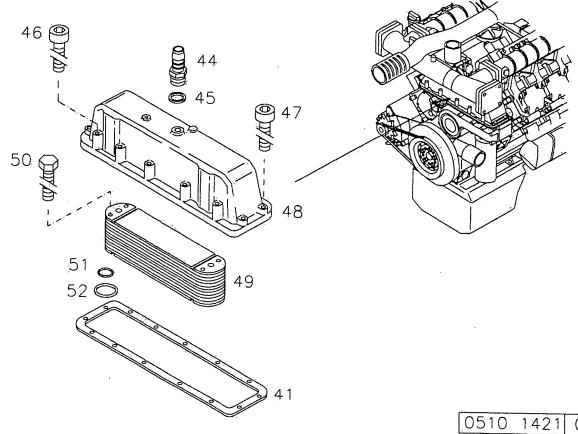


0510 1420 002



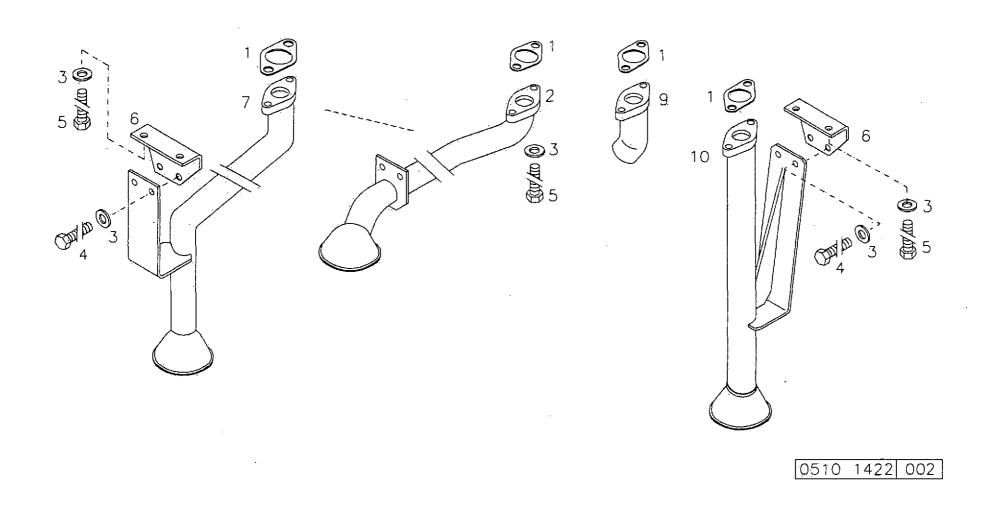






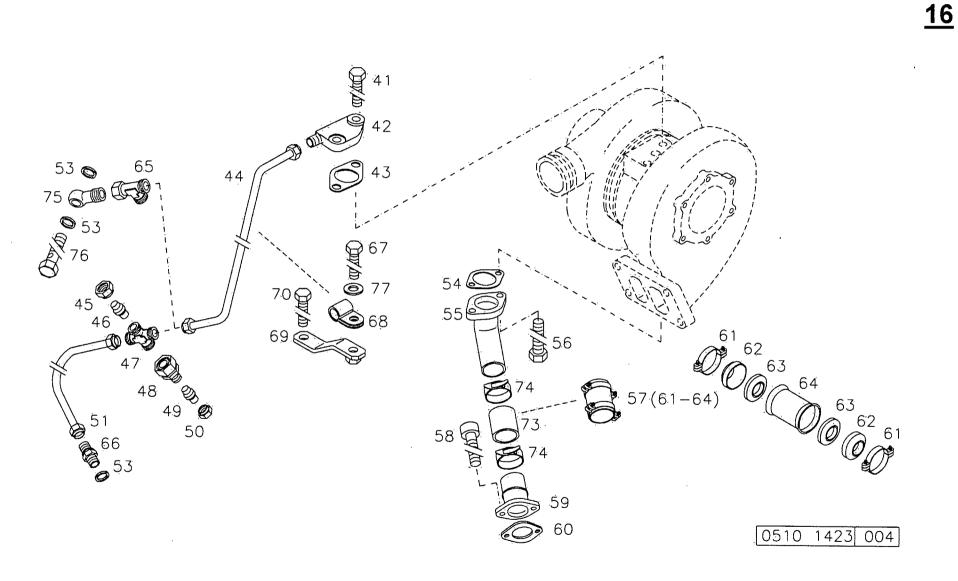


<u>16</u>

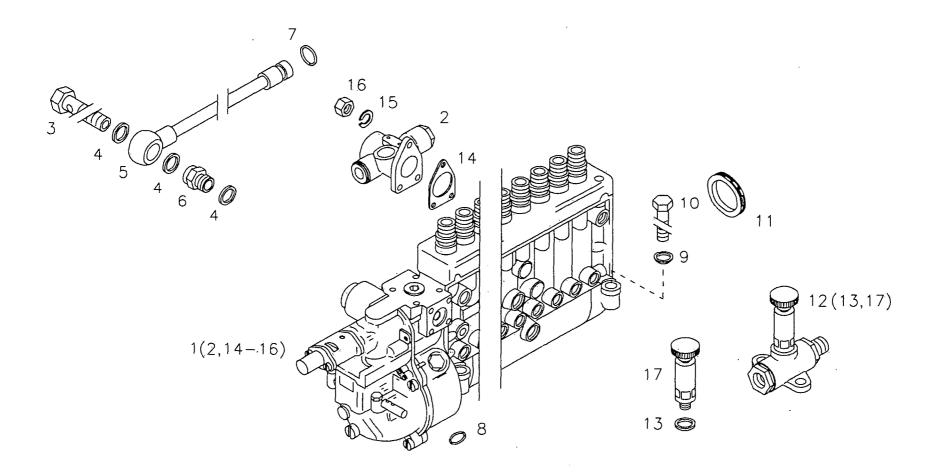








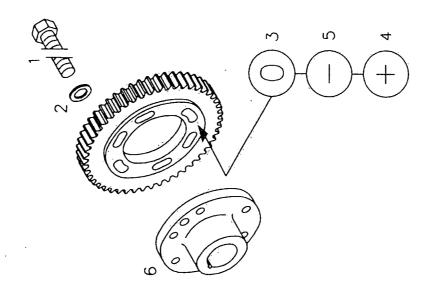




0510 1424 001

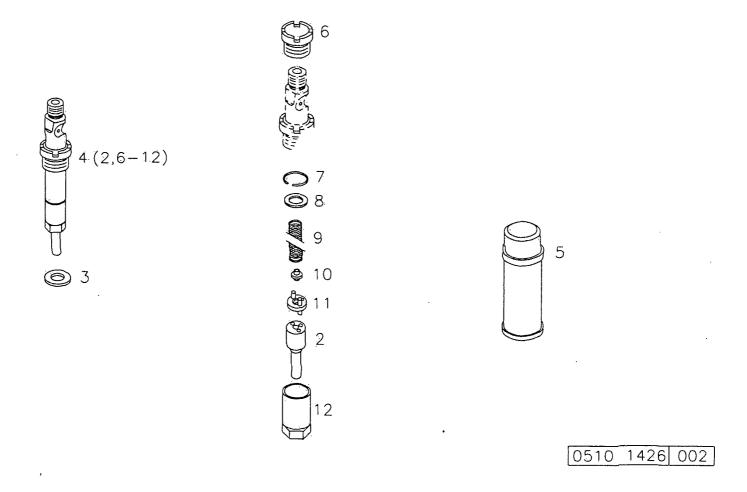


0510 1425 000

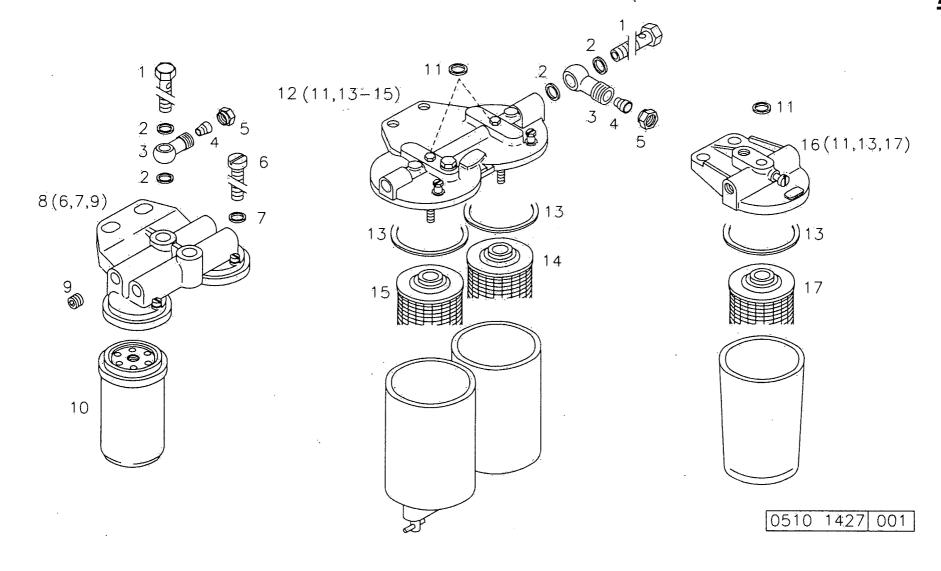


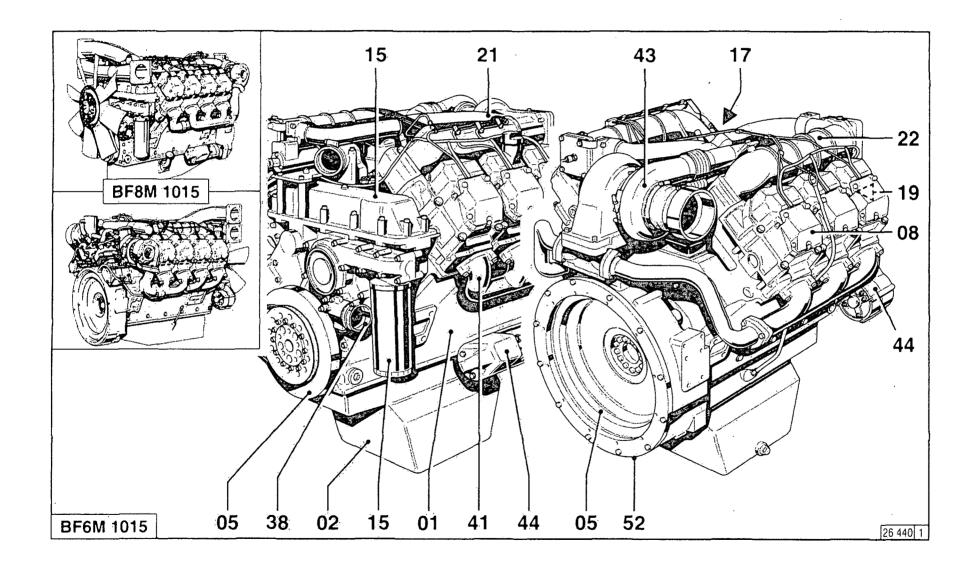


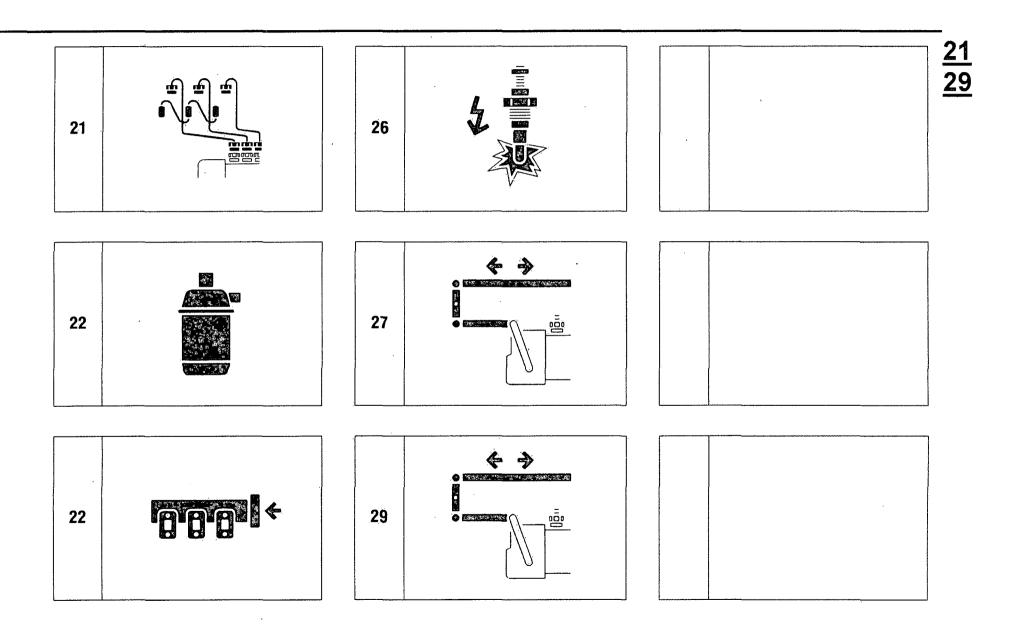
<u>19</u>





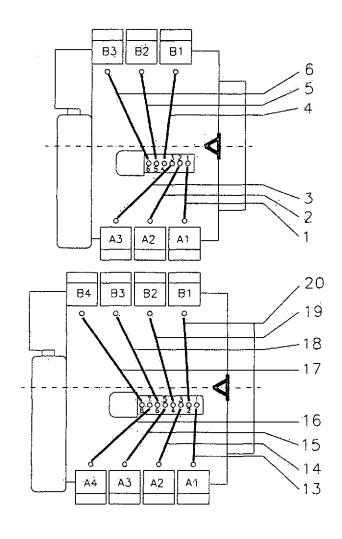


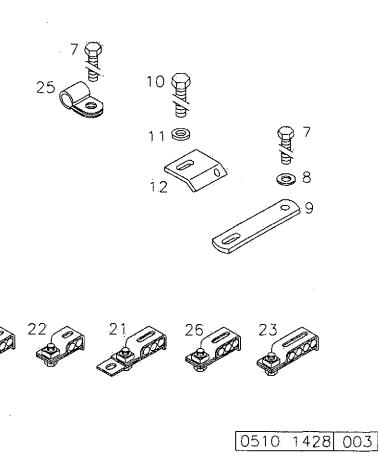






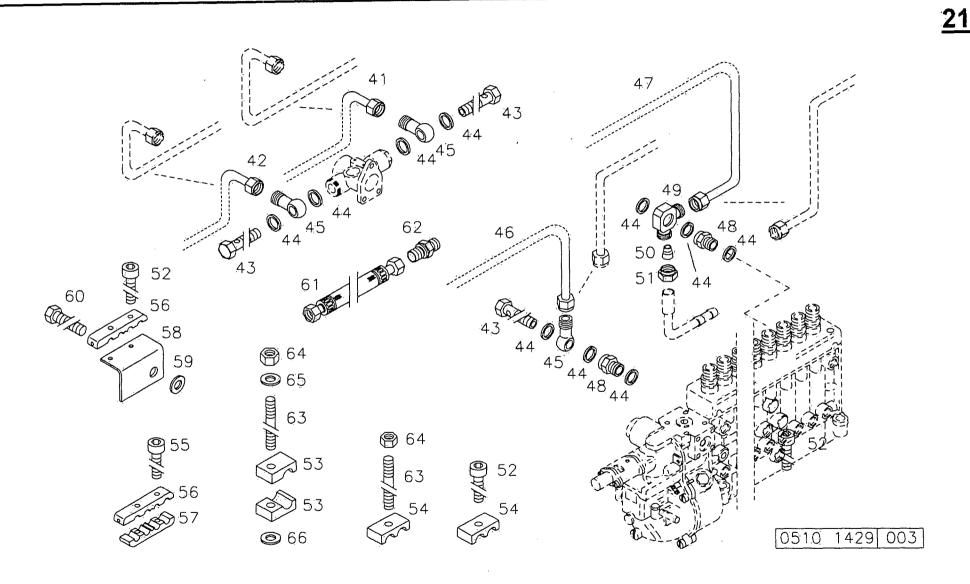
<u>21</u>



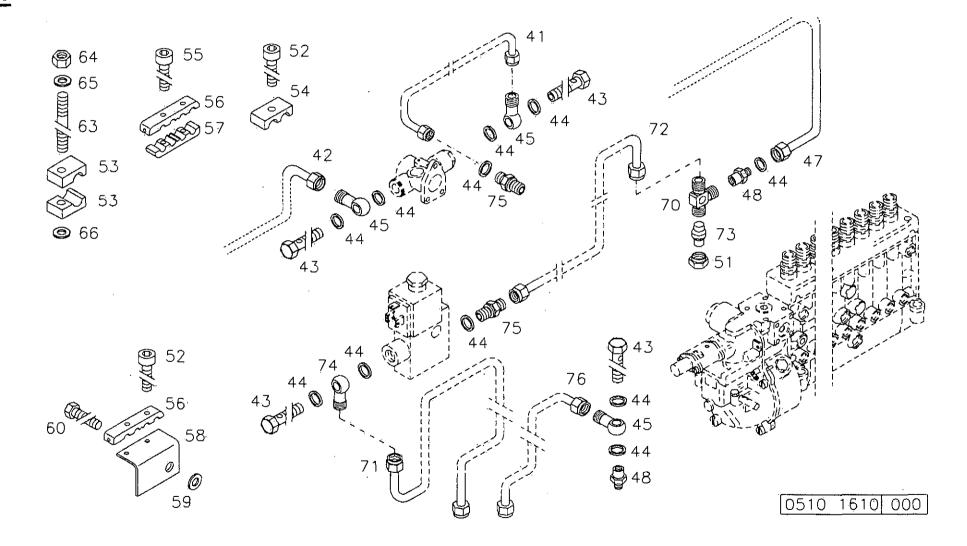






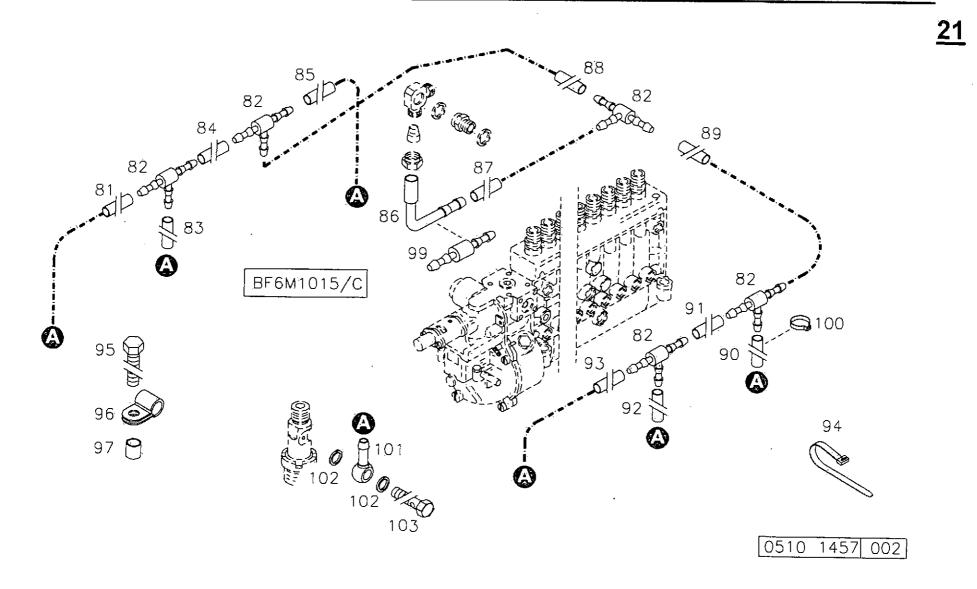






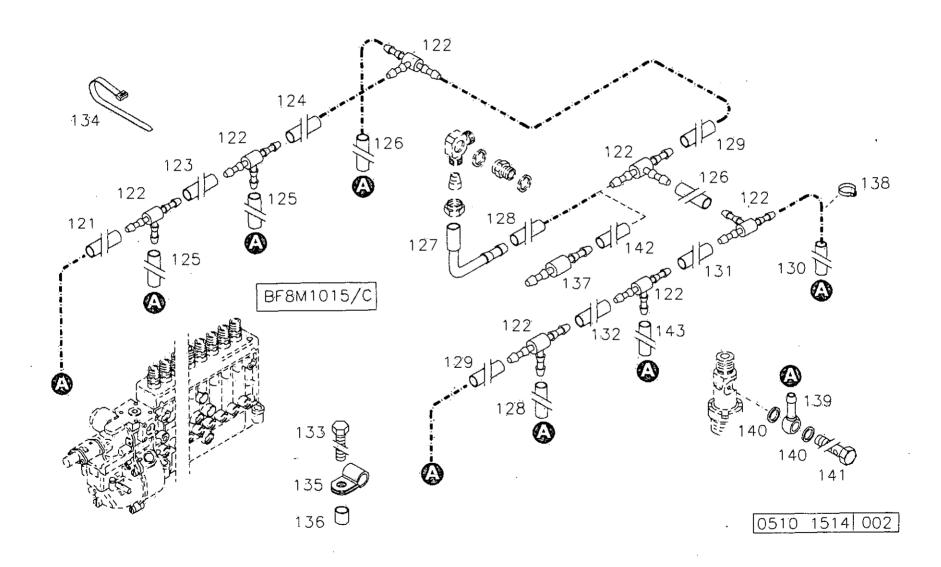


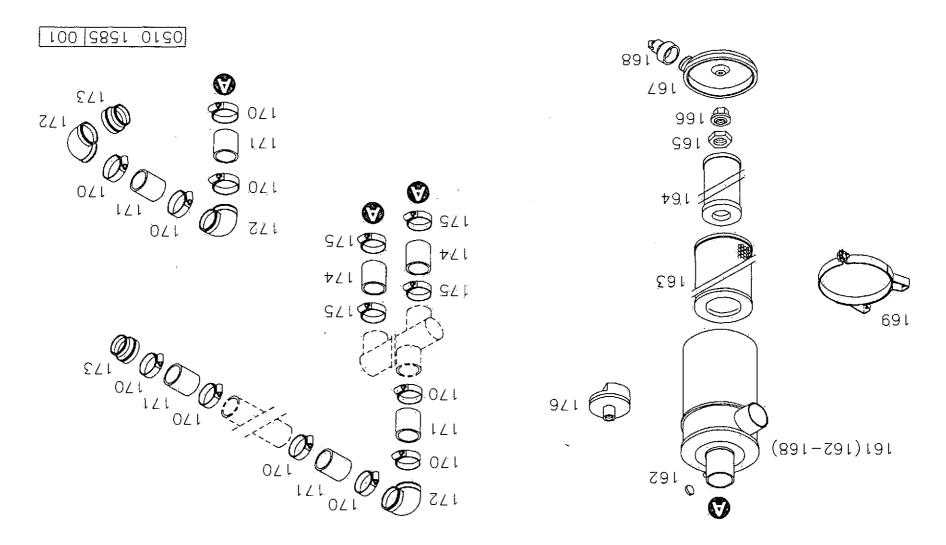






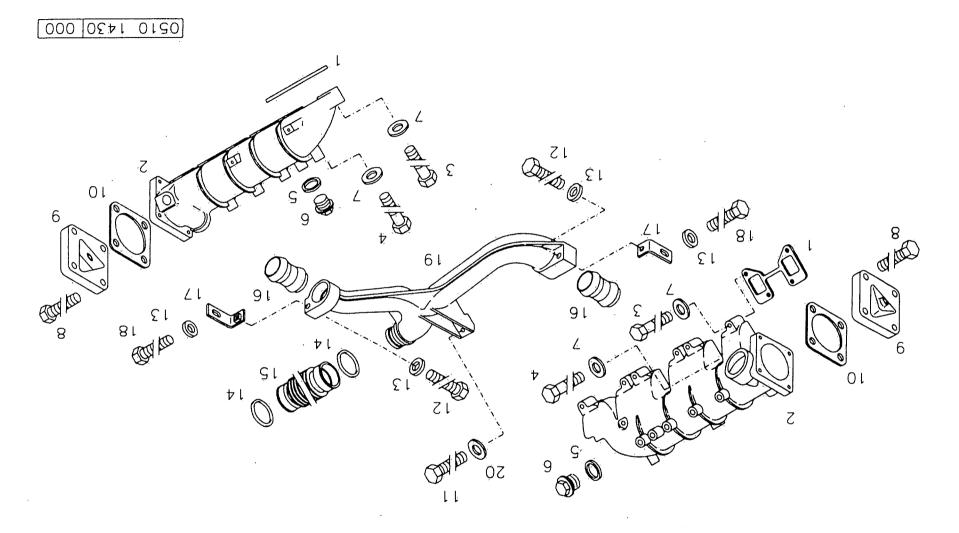
<u>21</u>





<u>77</u>



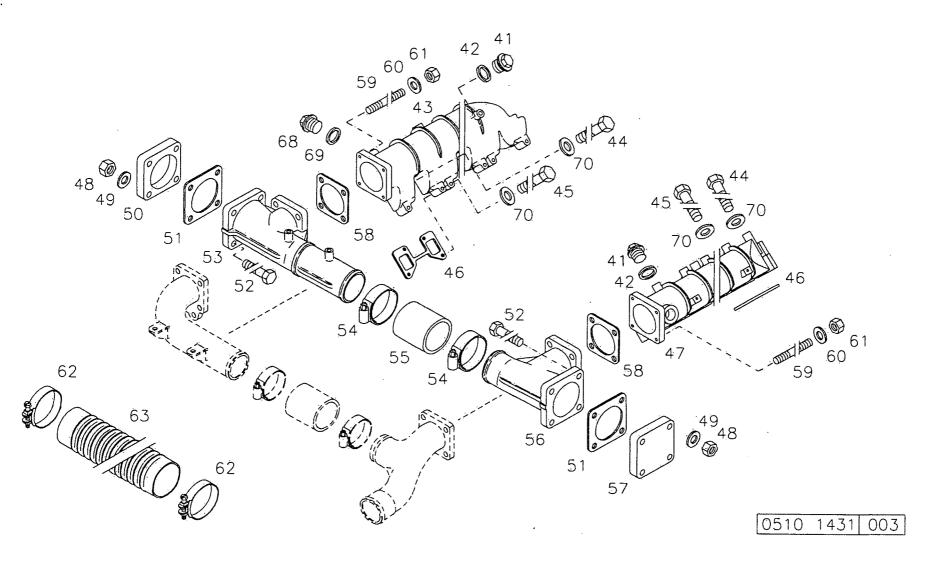




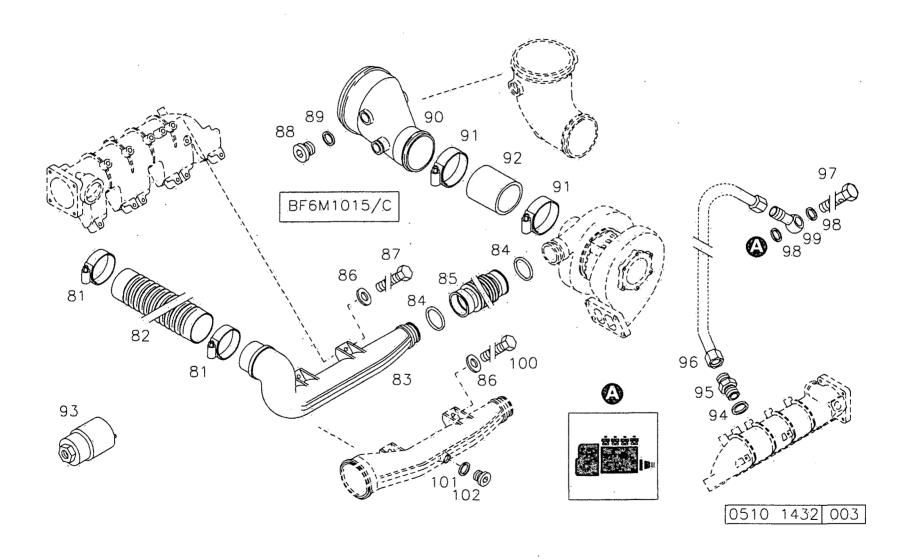




<u>22</u>

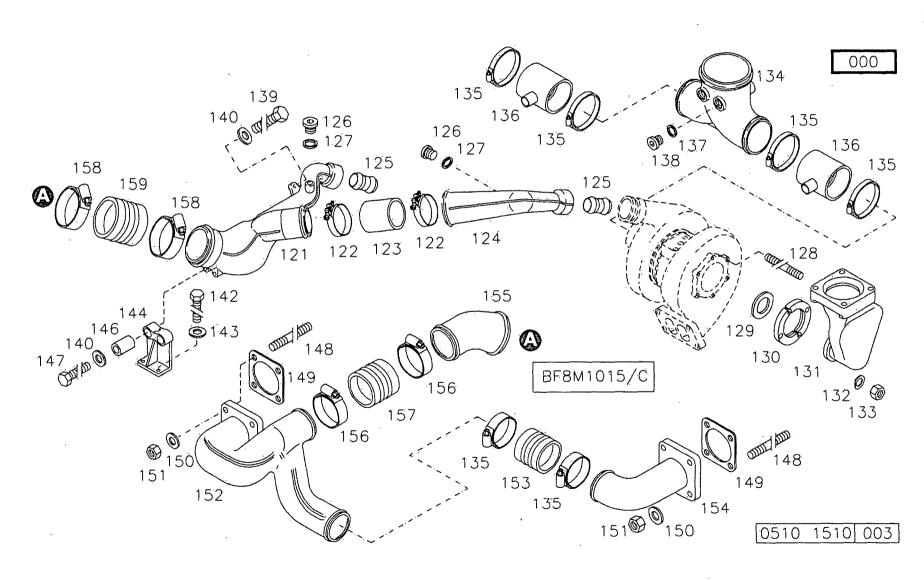


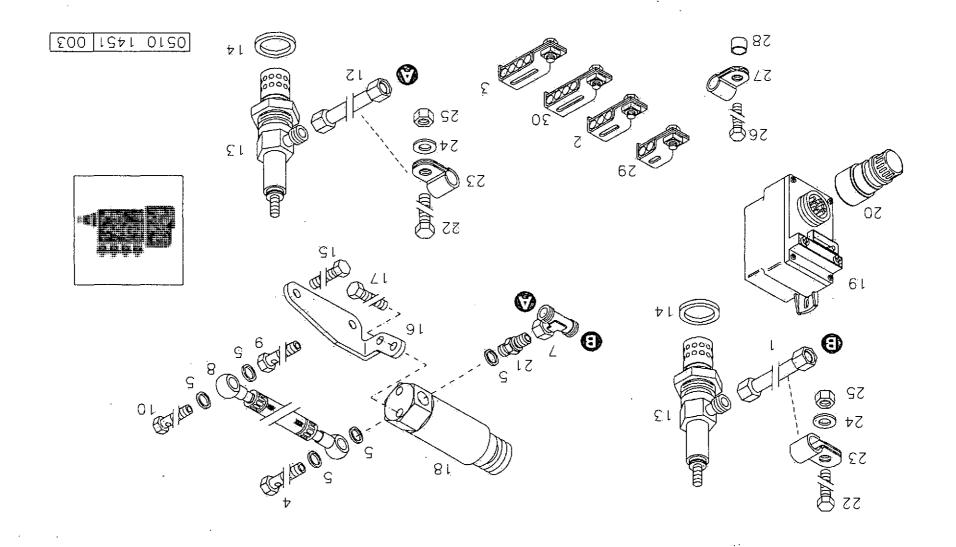






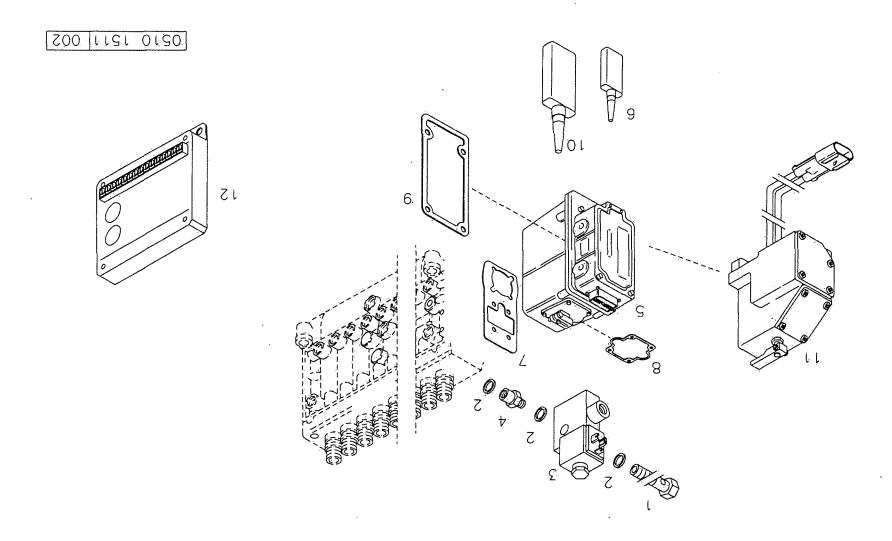
<u>22</u>



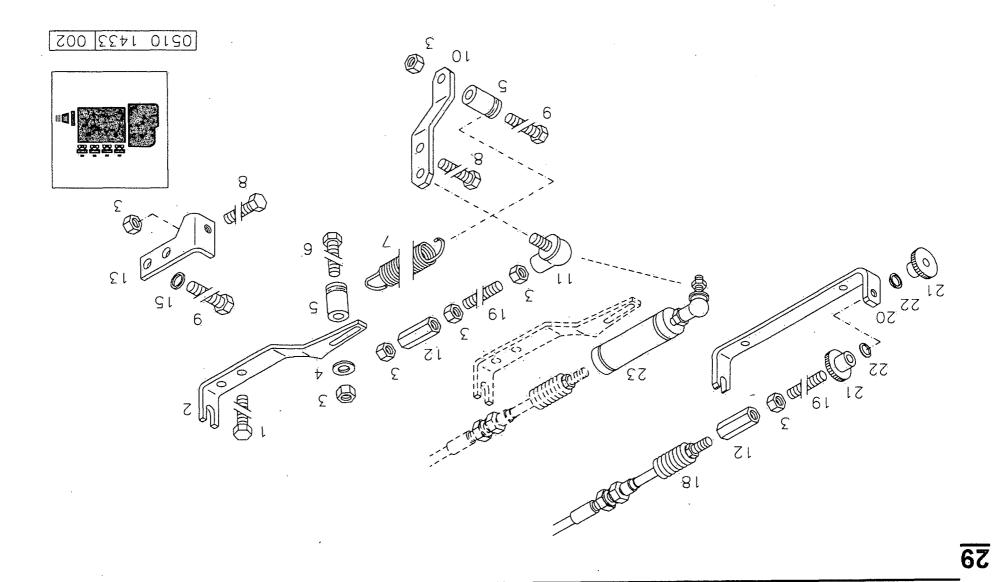


<u>7</u>8





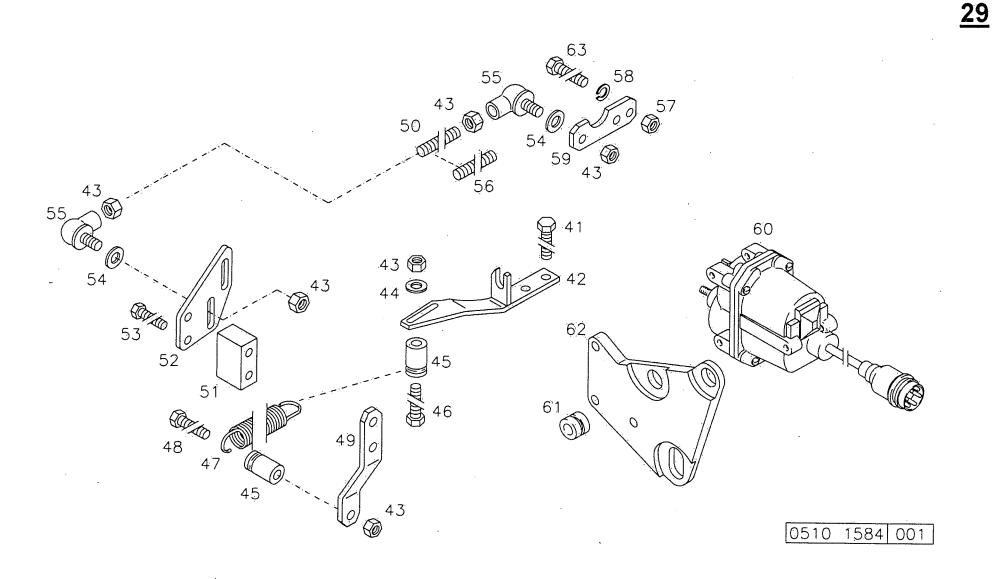


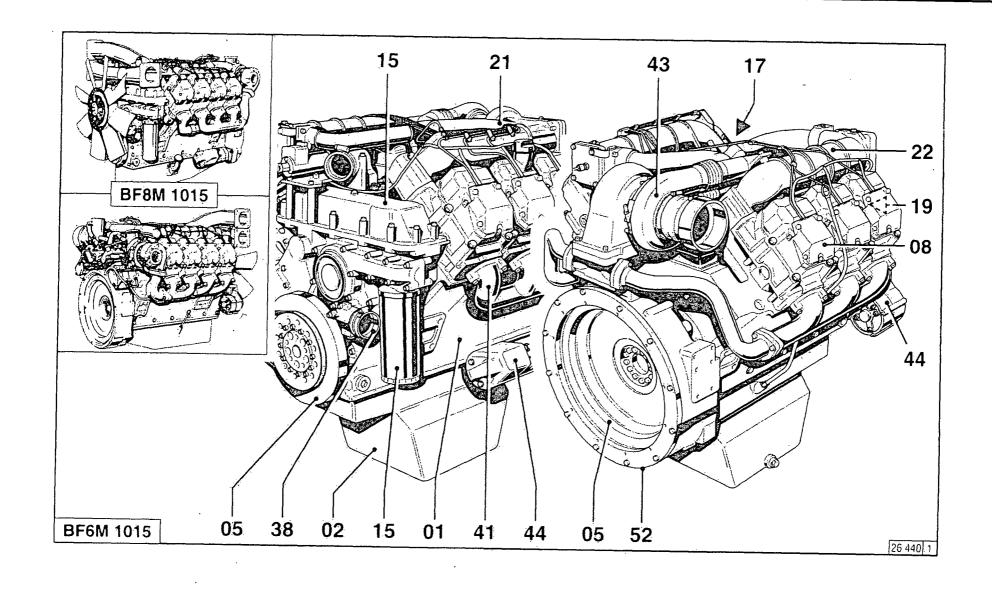




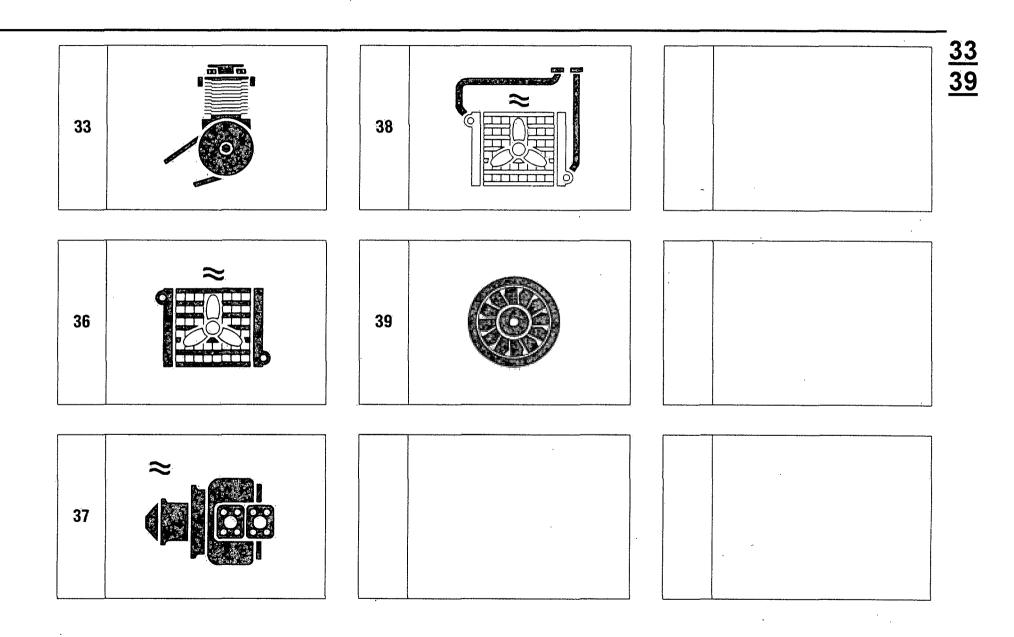








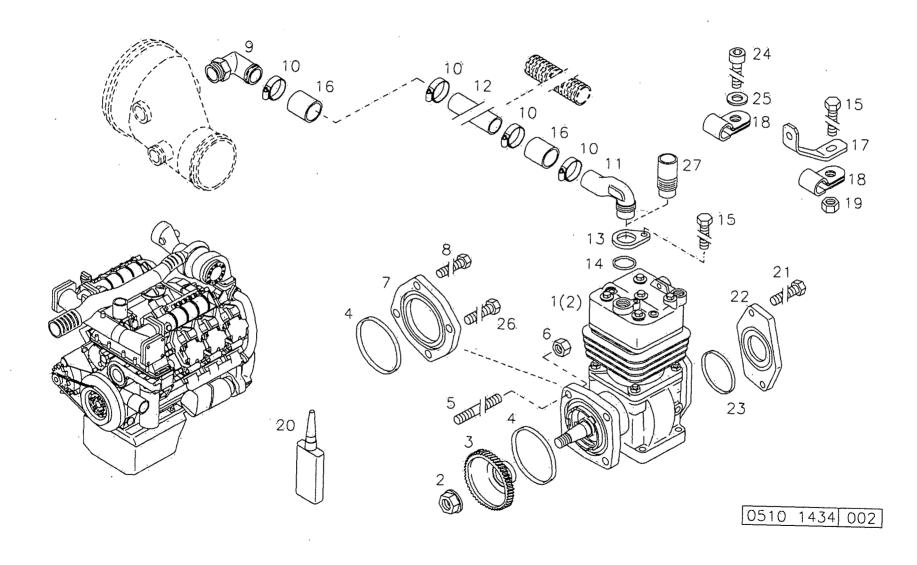
Page 135 of 469



Page 136 of 469

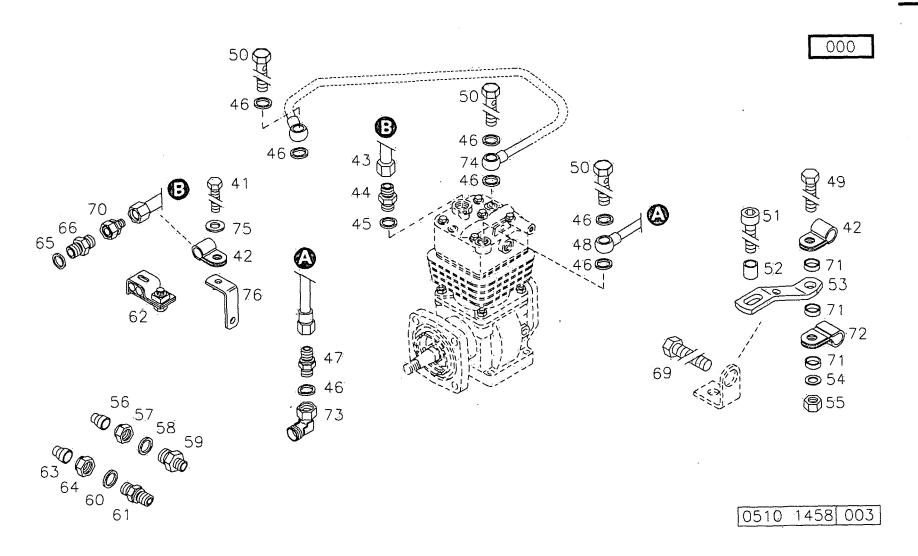


<u>33</u>



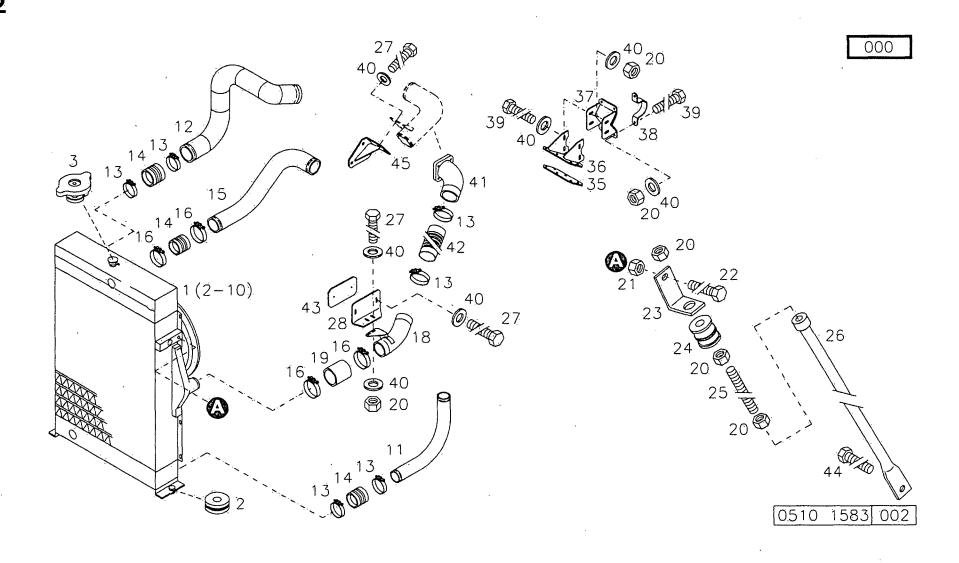




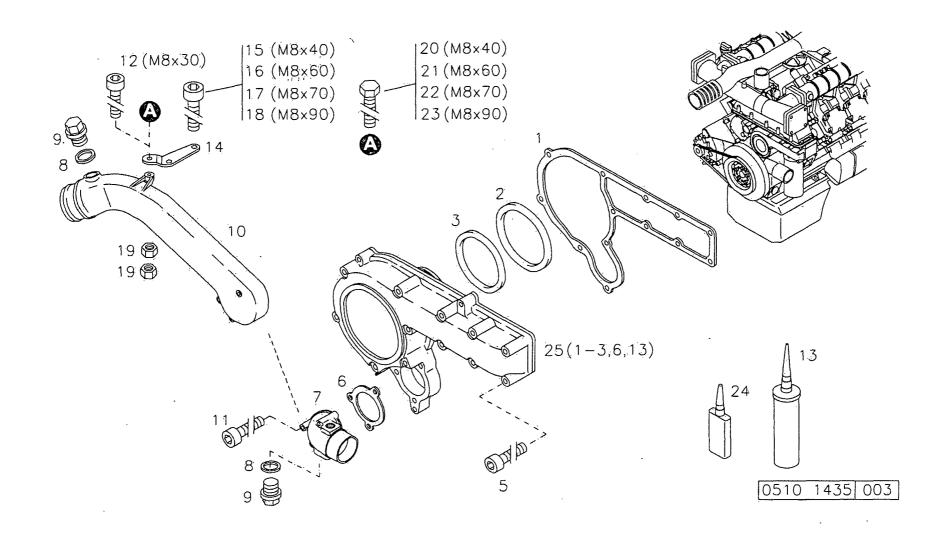




<u>36</u>

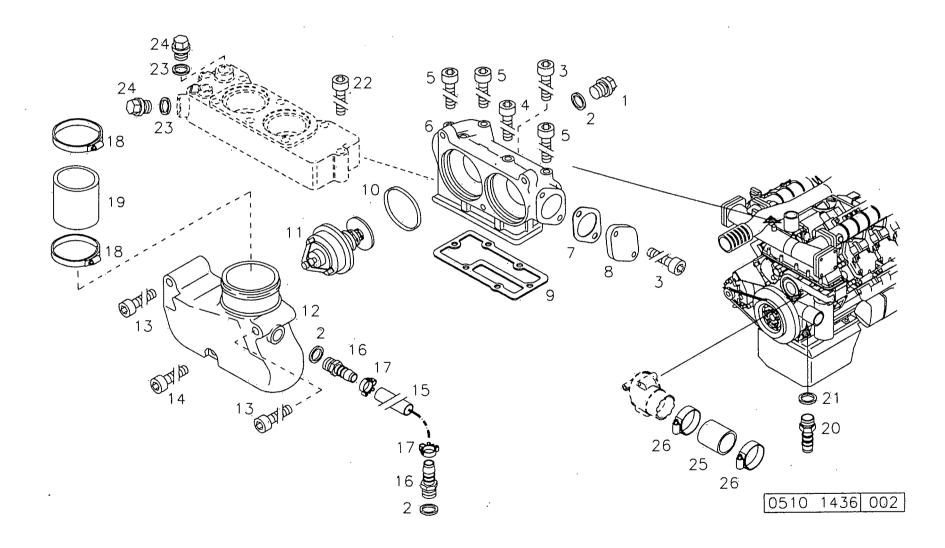


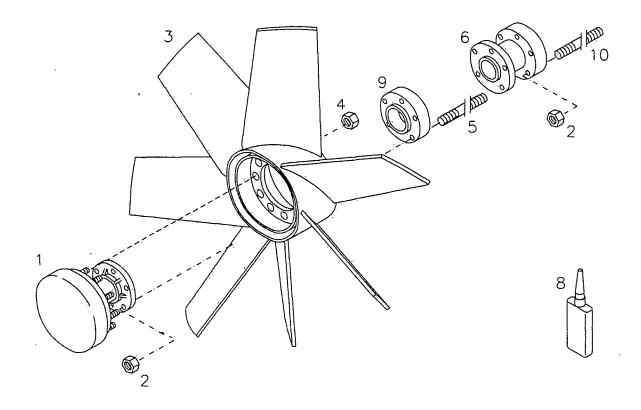






<u>38</u>



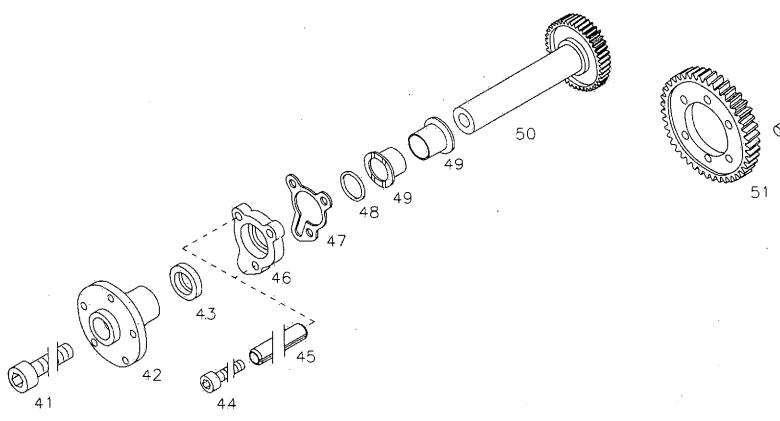


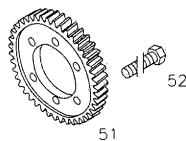
0510 1438 002



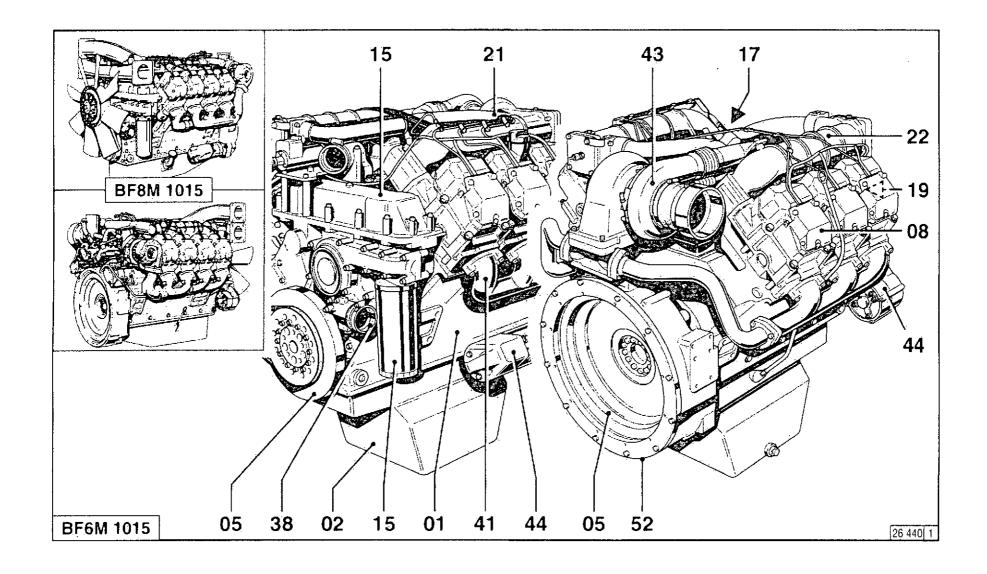


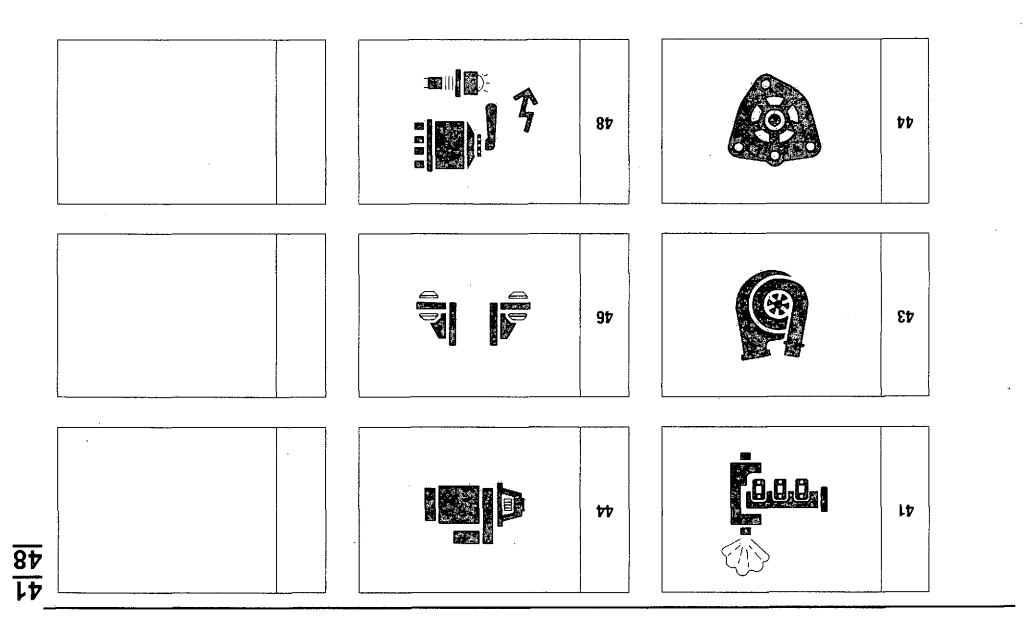






0510 1513 001

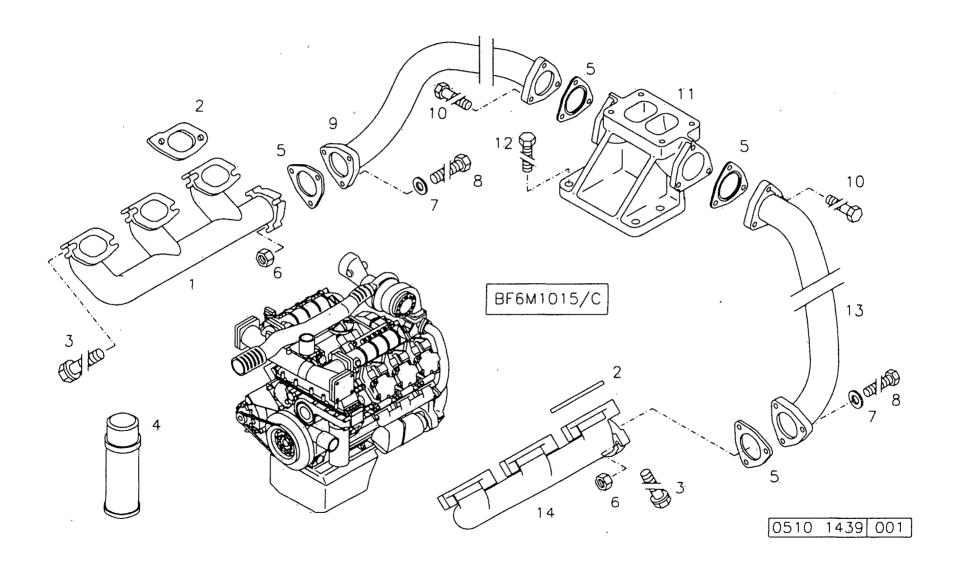




Page 145 of 469

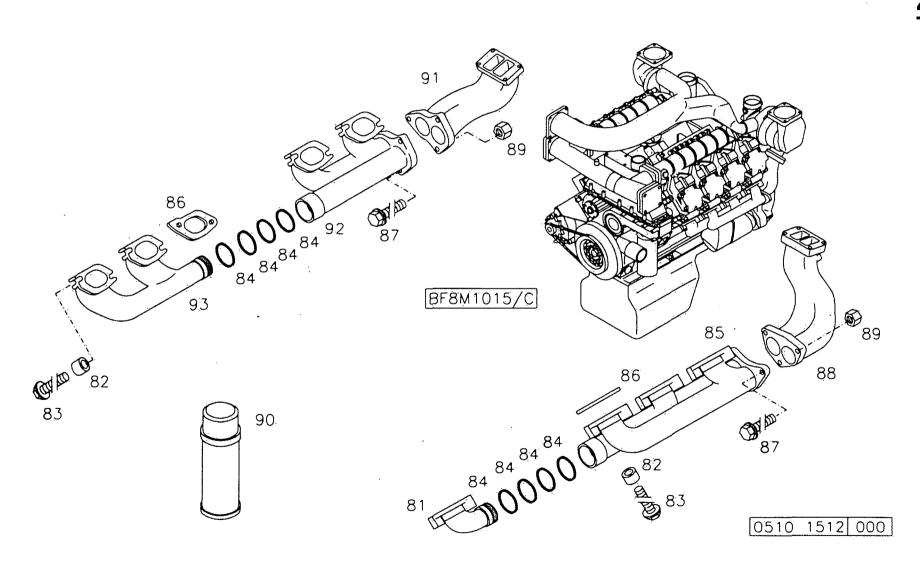


<u>41</u>



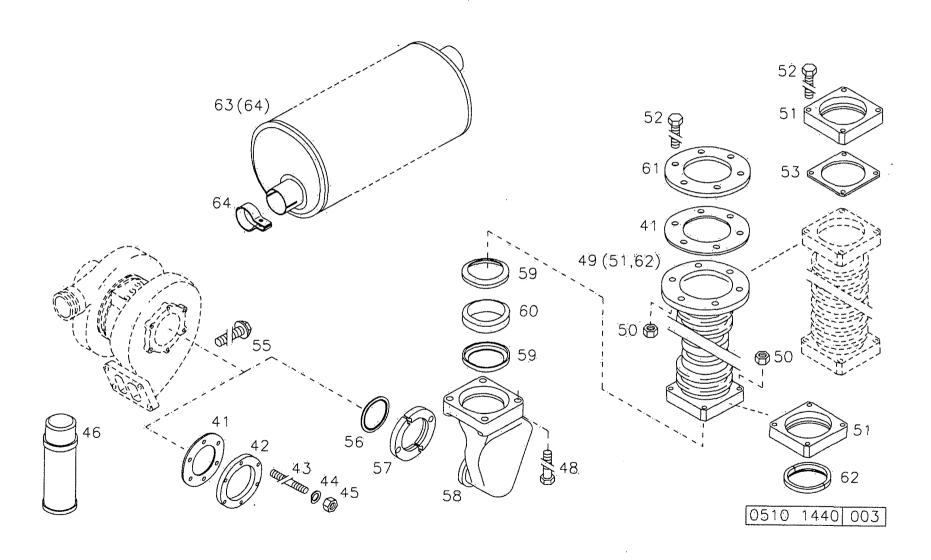




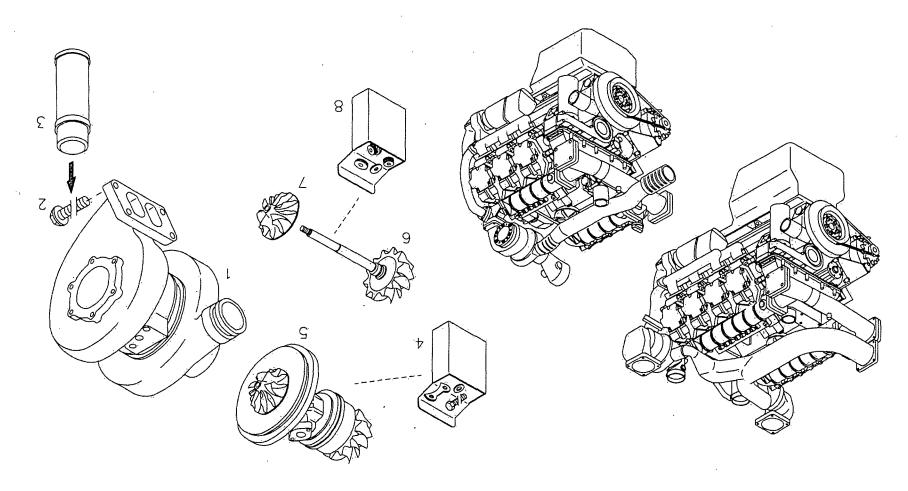




<u>41</u>

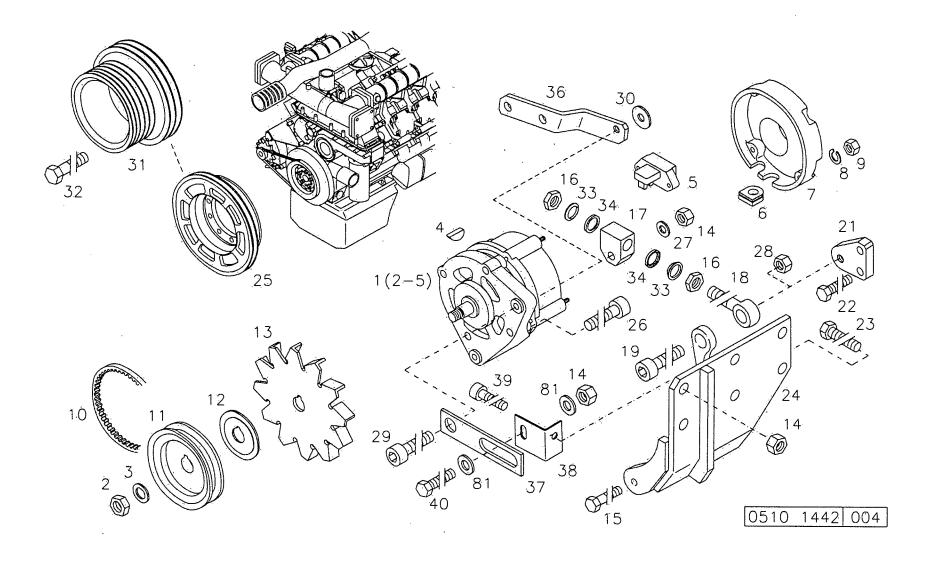


Σ00 lttl 0lS0



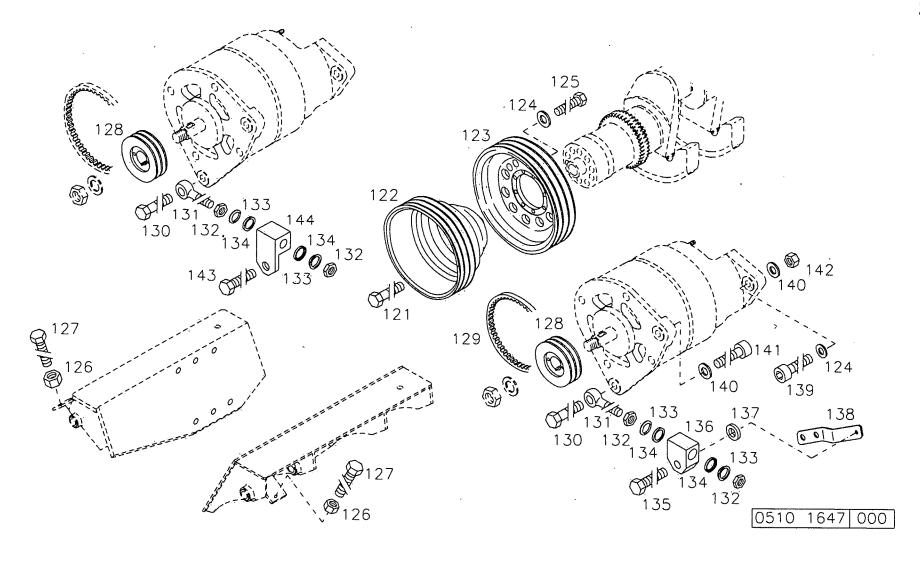




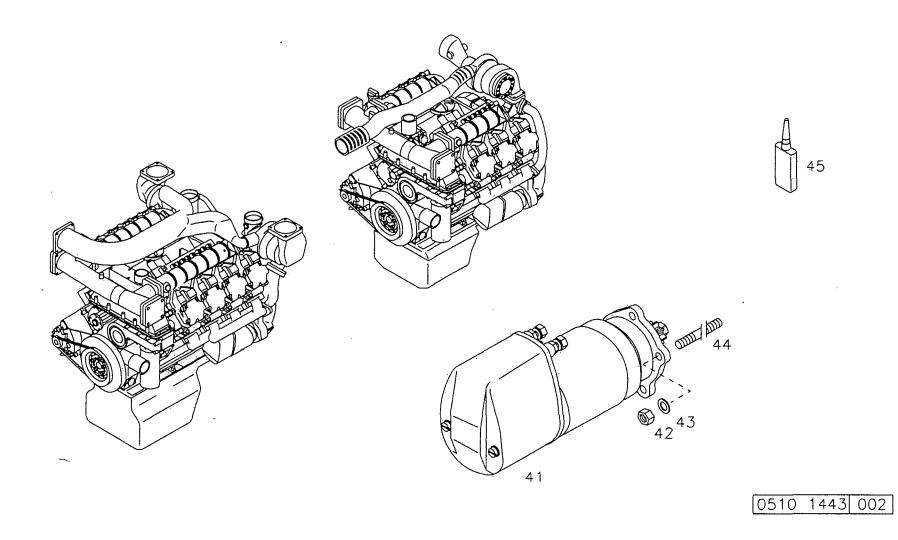






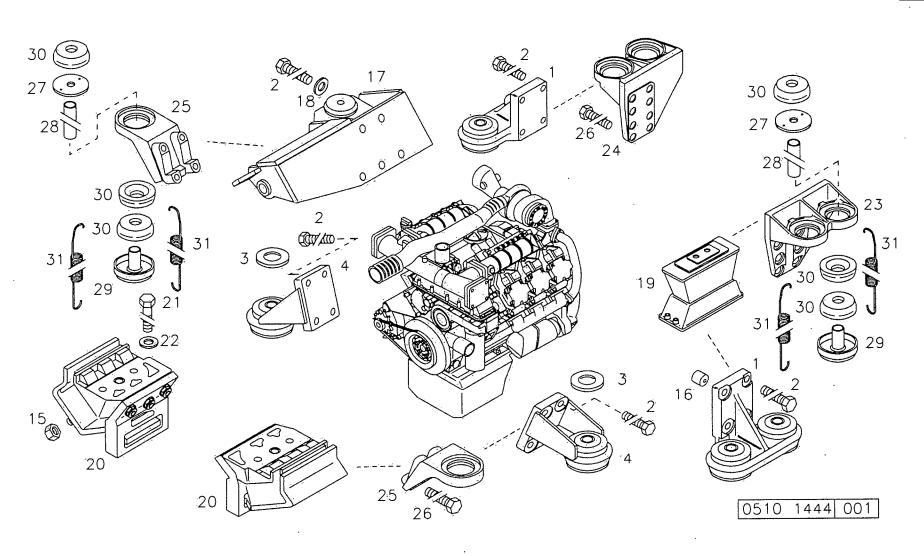






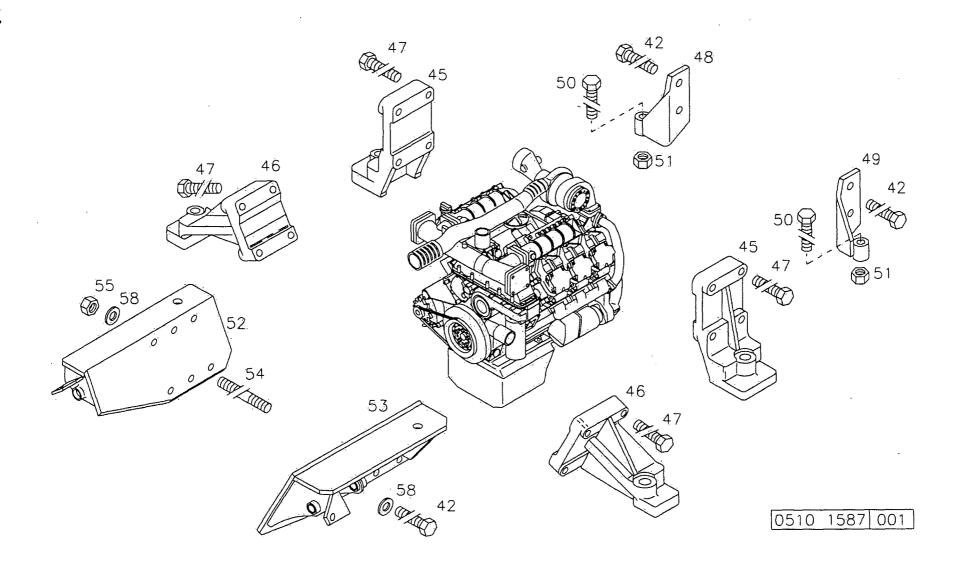






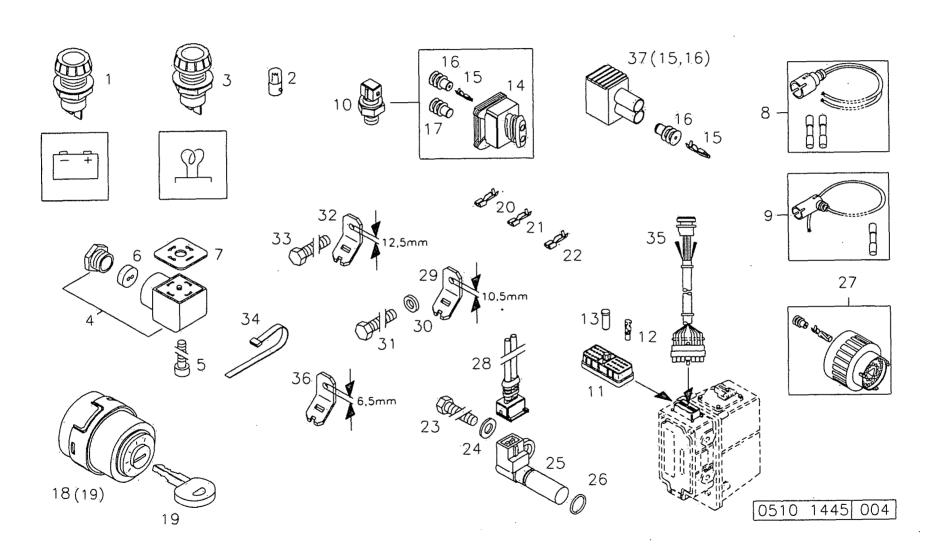


<u>46</u>





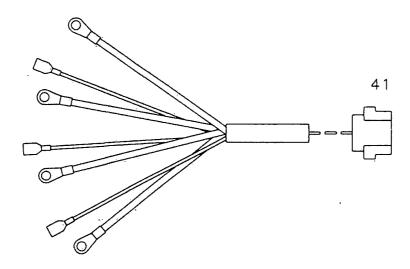
<u>48</u>



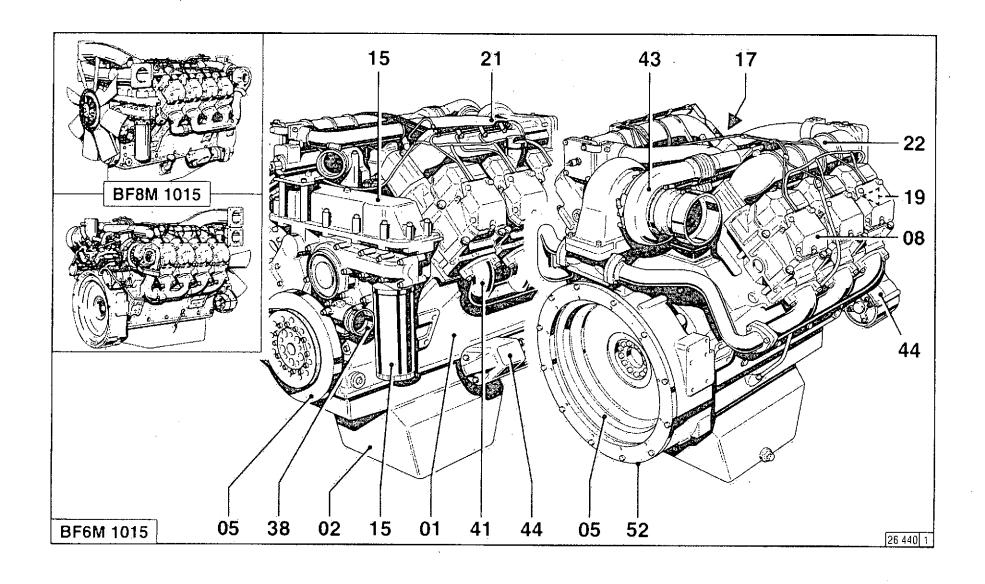
Page 155 of 469

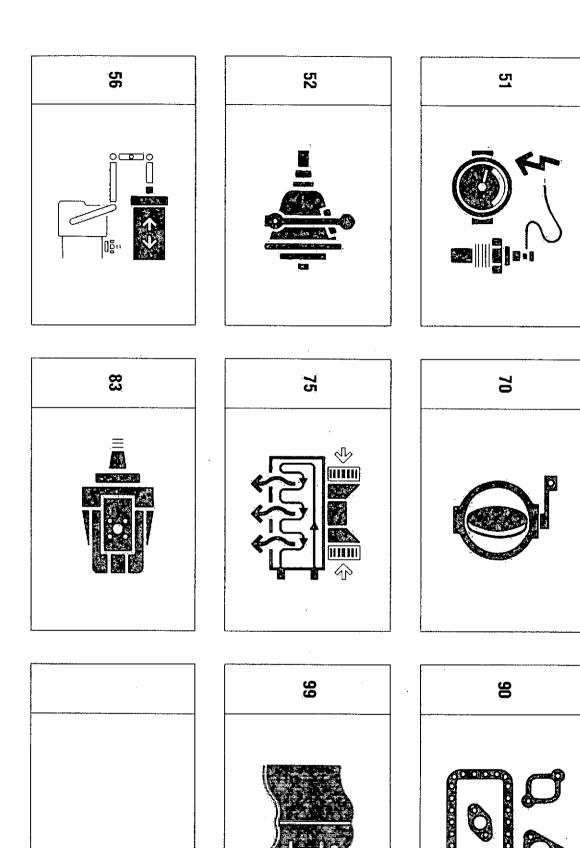


<u>48</u>



0510 1446 000

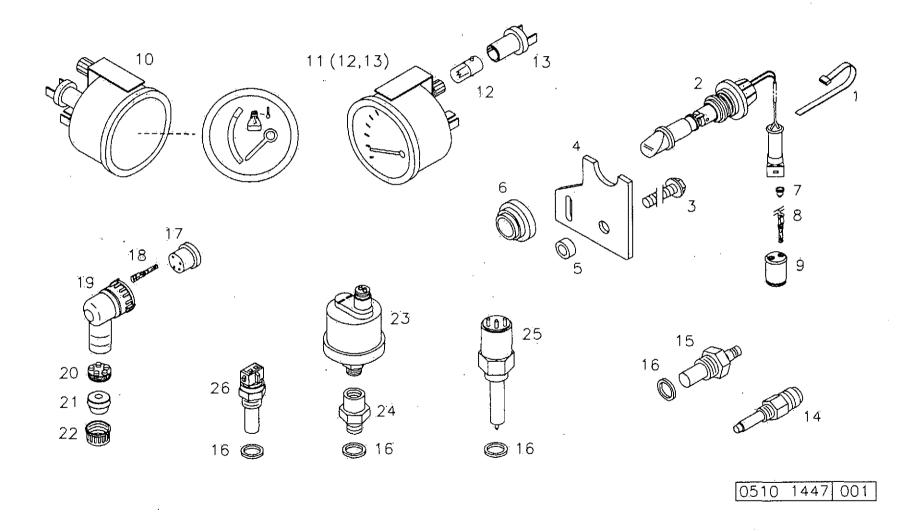




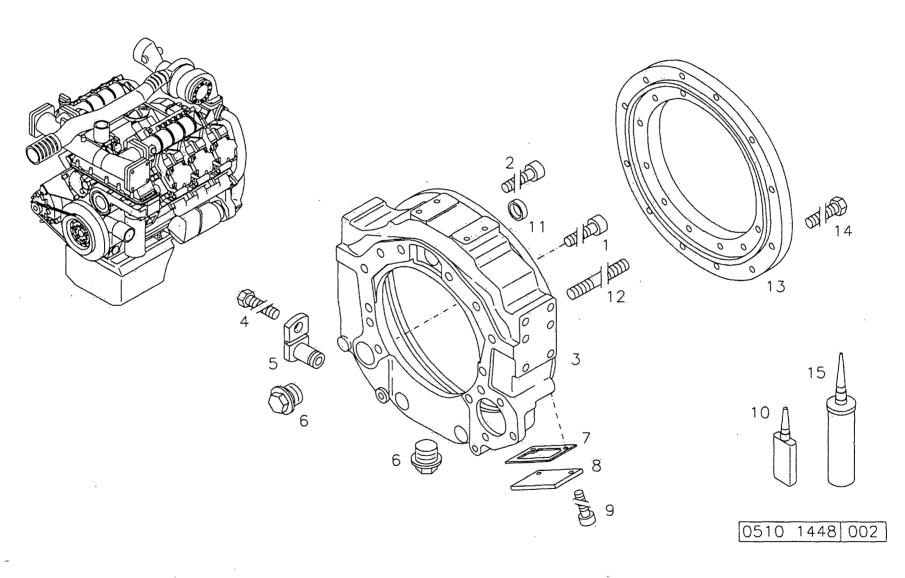
<u>51</u>



<u>51</u>

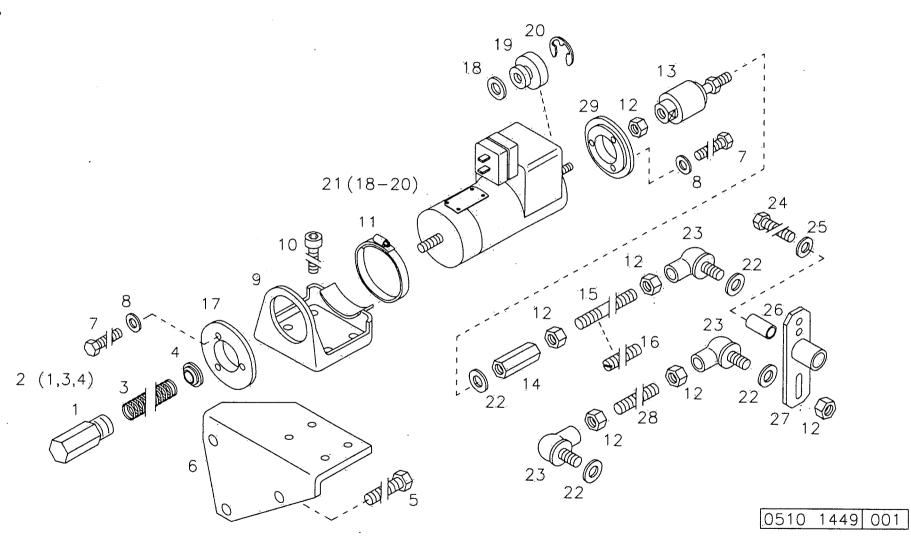






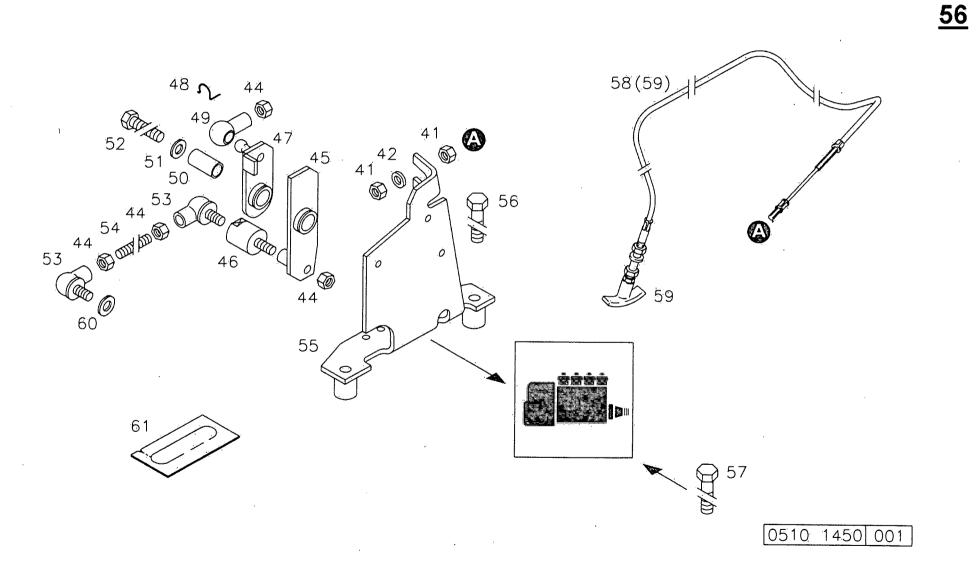


<u>56</u>



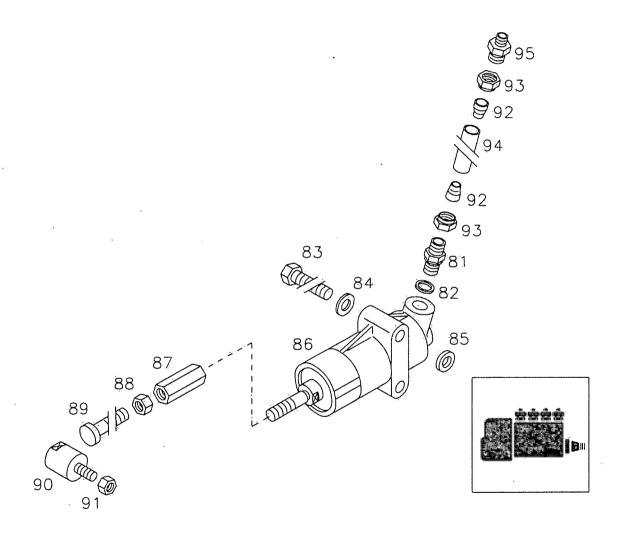
Active 10/12/2014







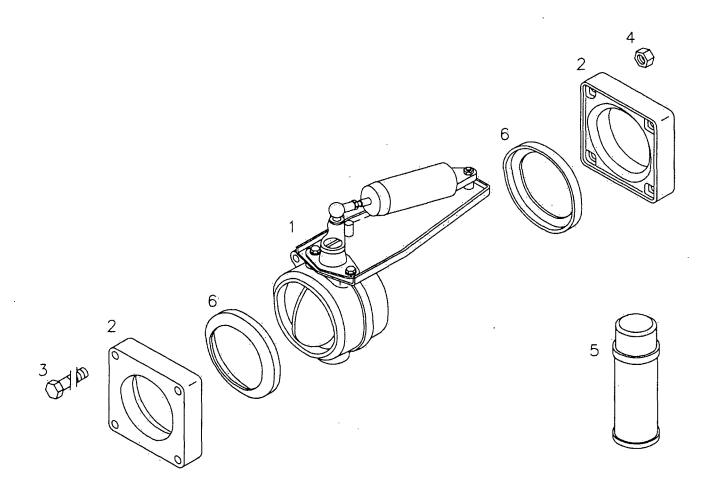
<u>56</u>



0510 1460 001

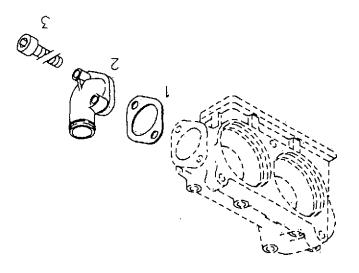


<u>70</u>

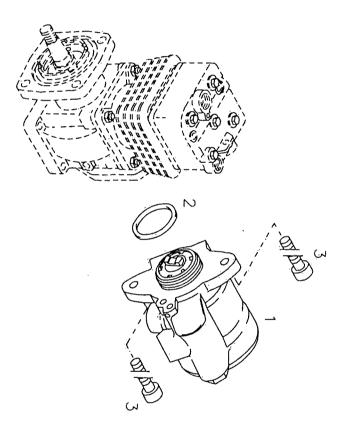


0510 1452 001

000 25+1 0150

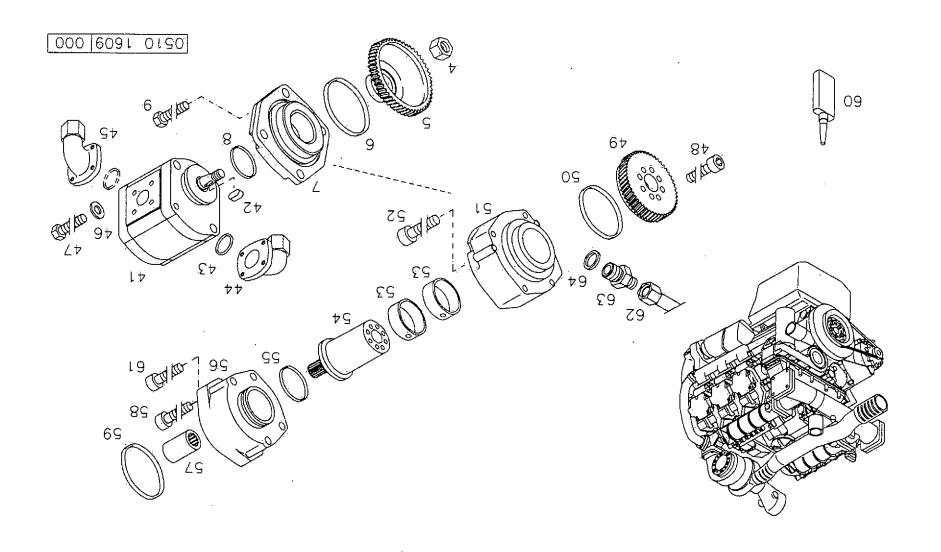






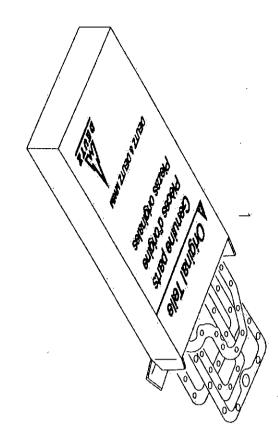
0510 1454 002

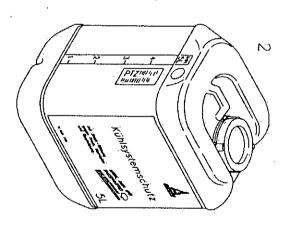










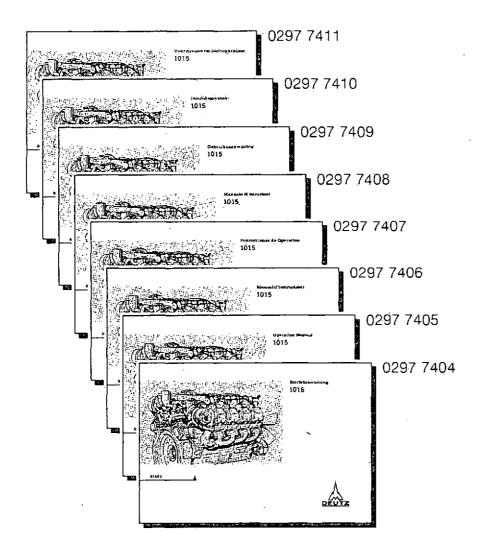


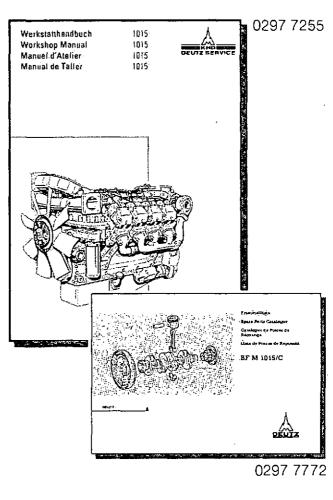
0510 1459 002

00

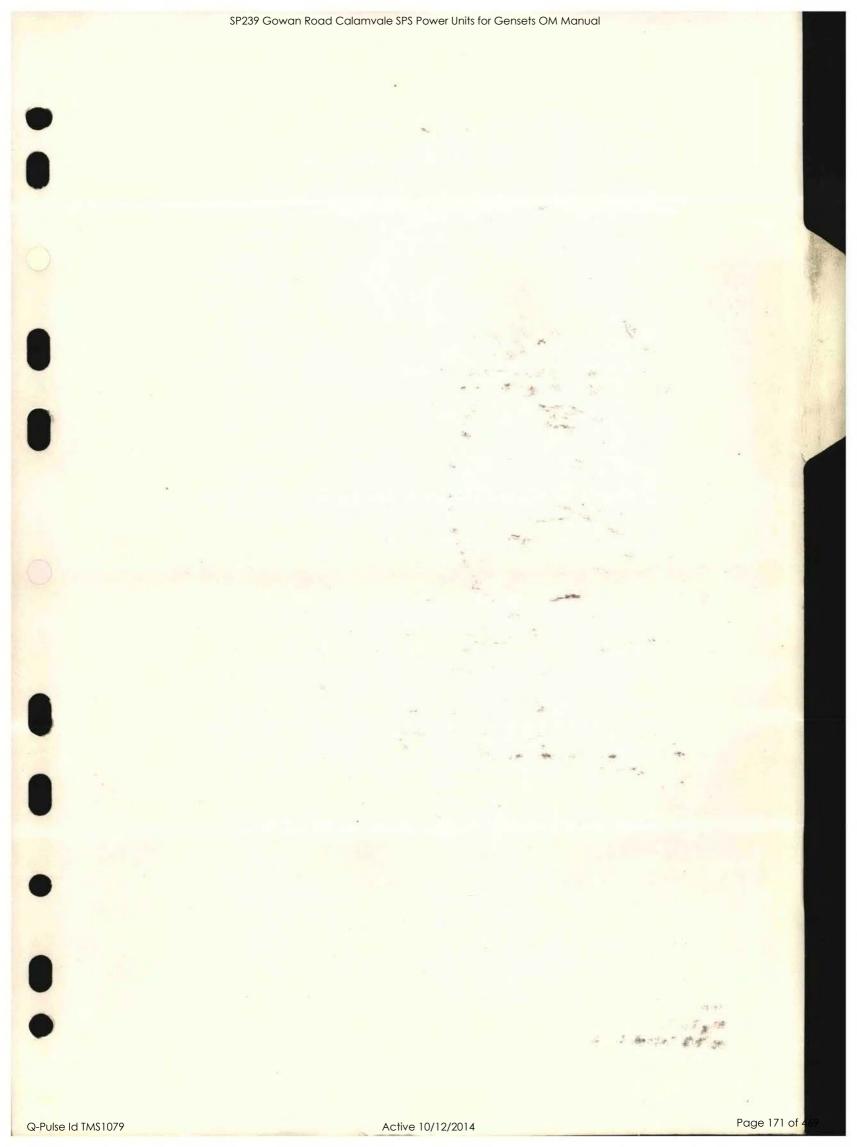


<u>99</u>

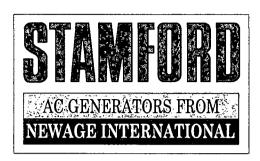


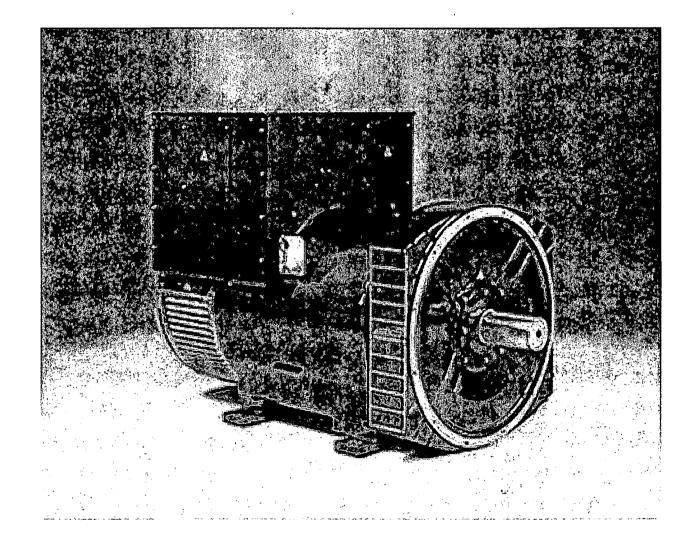


0510 1455 5



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





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



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.



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 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

CONTENTS

SAFETY PRECAUTIONS			IFC
FOREWORD			1
CONTENTS			2&3
SECTION 1		INTRODUCTION	4
	1.1 1.2 1.3 1.4	INTRODUCTION DESIGNATION SERIAL NUMBER LOCATION RATING PLATE AND CE MARK	4 4 4 4
SECTION 2	•	PRINCIPLE OF OPERATION	5
	2.1 2.2 2.3	SELF-EXCITED AVR CONTROLLED GENERATORS PERMANENT MAGNET GENERATOR (PMG) EXCITED - AVR CONTROLLED GENERATORS AVR ACCESSORIES	5 5 5
SECTION 3		APPLICATION OF THE GENERATOR	6
	3.1	VIBRATION	7
SECTION 4		INSTALLATION - PART 1	8
	4.1 4.2 4.2.1 4.2.2 4.3 4.4 4.4.1 4.4.2 4.4.2.1 4.4.2.2 4.4.3 4.4.4 4.4.4.1 4.4.4.2 4.4.4.3 4.4.4.4 4.5 4.5.1 4.6 4.7 4.7.1.1 4.7.1.1 4.7.1.2 4.7.1.3 4.7.1.4 4.7.1.5 4.8	LIFTING ENGINE TO GENERATOR COUPLING ASSEMBLY TWO BEARING GENERATORS SINGLE BEARING GENERATORS TYPES HC & HCK EARTHING PRE-RUNNING CHECKS INSULATION CHECK DIRECTION OF ROTATION FAN TYPES DIRECTION OF ROTATION VOLTAGE AND FREQUENCY AVR SETTINGS TYPE SX440 AVR TYPE SX421 AVR TYPE MX341 AVR TYPE MX321 AVR GENERATOR SET TESTING TEST METERING/CABLING INITIAL START-UP LOAD TESTING AVR ADJUSTMENTS UFRO (Under Frequency Roll Off) (AVR Types SX440, SX421, MX341 and MX321) EXC TRIP (Excitation Trip) OVER/V (Over Voltage) TRANSIENT LOAD SWITCHING ADJUSTMENTS RAMP ACCESSORIES	8 8 8 8 9 9 9 9 9 9 9 9 9 9 9 10 10 11 11 11 12 13 13 14 14
SECTION 5		INSTALLATION - PART 2	14
	5.1 5.2 5.3	GENERAL GLANDING MAXIMUM TORQUE SETTINGS FOR CUSTOMER TERMINAL CONNECTIONS	14 14 14
	5.4 5.5 5.6	EARTHING PROTECTION COMMISSIONING	14 14 14

CONTENTS

SECTION 6		ACCESSORIES	15
	6.1 6.2 6.2.1 6.2.1.1 6.2.2 6.3 6.4. 6.4.1 6.5 6.5.1 6.6	REMOTE VOLTAGE ADJUST (ALL AVR TYPES) PARALLEL OPERATION DROOP SETTING PROCEDURE ASTATIC CONTROL MANUAL VOLTAGE REGULATOR (MVR) - MX341 and MX321 AVR OVERVOLTAGE DE-EXCITATION BREAKER SX421 and MX321 AVR RESETTING THE EXCITATION BREAKER CURRENT LIMIT - MX321 AVR SETTING PROCEDURE POWER FACTOR CONTROLLER (PFC3)	15 15 15 16 16 16 17 17 17
SECTION 7		SERVICE AND MAINTENANCE	18
SECTION 8	7.1 7.1.1 7.1.2 7.2 7.3 7.3.1 7.3.2 7.4 7.4.1 7.4.2 7.4.3 7.4.4 7.4.5 7.4.6 7.5 7.5.1 7.5.1.2 7.5.2 7.5.2 7.5.2 7.5.2 7.5.3 7.5.3.1 7.3.3.2 7.5.3.3 7.5.3.4 7.6 7.7	WINDING CONDITION WINDING CONDITION ASSESSMENT METHODS OF DRYING OUT GENERATORS BEARINGS AIR FILTERS CLEANING PROCEDURE RECHARGING (CHARGING) FAULT FINDING SX440 AVR - FAULT FINDING SX421 AVR - FAULT FINDING MX321 AVR - FAULT FINDING MX321 AVR - FAULT FINDING MX321 AVR - FAULT FINDING RESIDUAL VOLTAGE CHECK 'REFLASHING' TO RESTORE RESIDUAL SEPARATE EXCITATION TEST PROCEDURE GENERATOR WINDINGS, ROTATING DIODES and PERMANENT MAGNET GENERATOR (PMG) BALANCED MAIN TERMINAL VOLTAGES UNBALANCED MAIN TERMINAL VOLTAGES EXCITATION CONTROL TEST AVR FUNCTION TEST REMOVAL AND REPLACEMENT OF COMPONENT ASSEMBLIES ANTI-CONDENSATION HEATERS REMOVAL OF PERMANENT MAGNET GENERATOR (PMG) REMOVAL OF BEARINGS MAIN ROTOR ASSEMBLY RETURNING TO SERVICE MAINTENANCE OF REGREASABLE BEARINGS SPARES AND AFTER SALES SERVICE	18 18 19 21 21 21 21 21 21 21 21 21 21 21 21 21
SECTION 8	· o 4		
	8.1 8.2	RECOMMENDED SPARES AFTER SALES SERVICE	31 31

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.

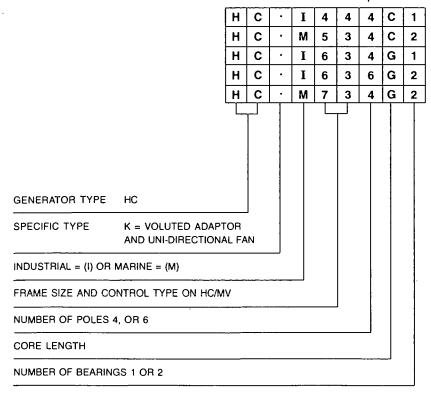
1.2 DESIGNATION

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 and fold back sufficient of the backing paper to expose some 20 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.



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.

SECTION 2

PRINCIPLE OF OPERATION

2.1 SELF-EXCITED AVR CONTROLLED GENERATORS

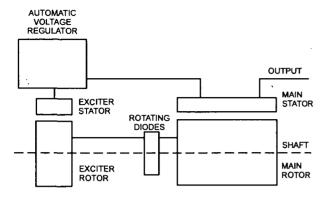


Fig. 1

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

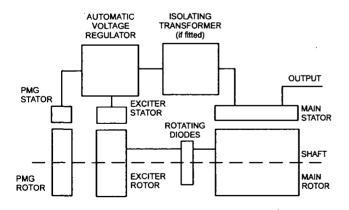


Fig. 2

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.

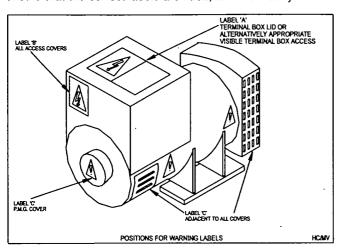
Separate instructions are provided with other accessories available for control panel mounting.

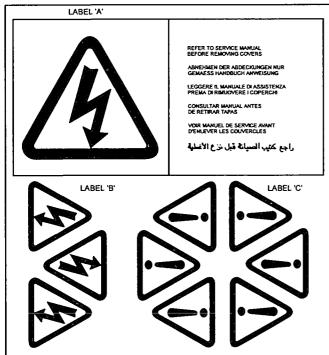
SECTION 3

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:

	Air Flow		Additional	
Frame	50Hz 1500 Rev/Min	60Hz 1800 Rev/Min	(intake/outlet) Pressure Drop	
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	1.96m/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

ibrations 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 and is taken to be between 2 Hertz and 300 Hertz. The table elow 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/s² (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

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 :-

- Consult the genset builder. The genset builder should address the genset design to reduce the vibration levels as much as possible.
- 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.



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.



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



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.



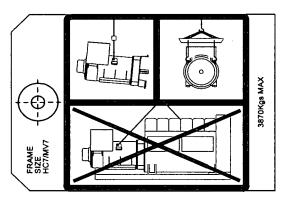


Fig. 3

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 driver 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 <u>MUST BE</u> 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

- 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.

TYPE HC GENERATORS 4.

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 couplingflywheel bolts.

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

TYPE HC GENERATORS 8.

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

Caution!

Incorrect quarding 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.

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.

TYPEHCK 4, 5, & 7 GENERATORS.

These machines are fitted with a inclined bladed fan, operating within a voluted drive end adaptor with outlet grills half thee 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

normal operation. K2 K1 P2 P3 P4 XX X 3 2 DROOP ⊖ SX440 VOLTS OD 3 5 6 <u>L8</u> j FREQUENCY SELECTION INDICATOR LED STABILITY SELECTION UFRO \circ O 0 50 C 60 0 CBA

K1-K2 Linked for

50Hz 🖳

60Hz Y

Fig. 4a

90kW - 550kW

Y OVER 550kW

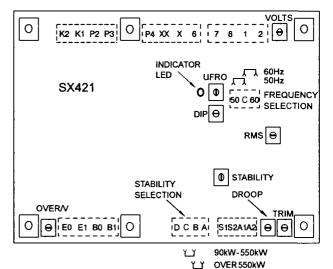


Fig. 4b

K1-K2 Linked for normal operation.

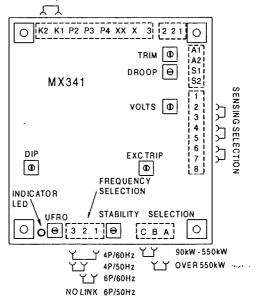


Fig. 4c

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

AUTOMATIC VOLTAGE REGULATOR LINKING AND ADJUSTMENTS

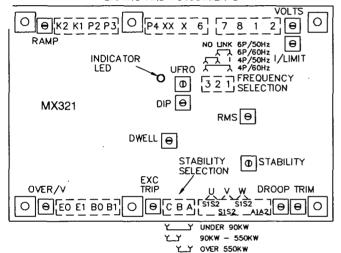


Fig. 4d

4.5 GENERATOR SET TESTING



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



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 prerunning 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



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 startup 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:

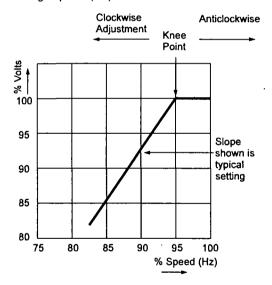


Fig. 5

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:

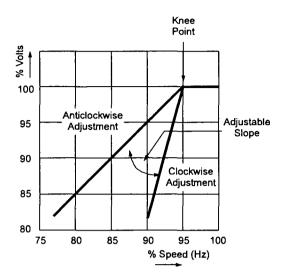


Fig. 6

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.

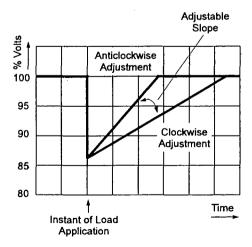


Fig. 7

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



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 $5M\Omega$ 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 antivibration 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/subcontractors 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	~	×	~	×
SX421	~	×	>	×
MX341	~	~	~	×
MX321	~	~	~	J

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

 kW are derived from the engine, and speed governor characteristics determine the kW sharing between sets

and

kVAr are derived from the generator, and excitation control characteristics determine the kVAr sharing.

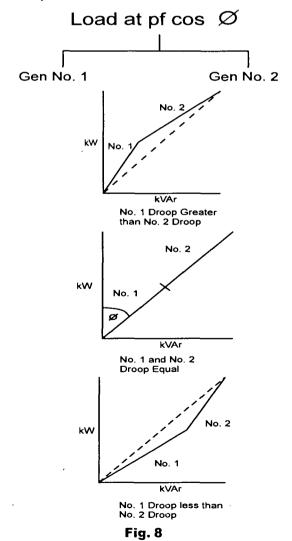
Reference should be made to the generating set manufacturer's instructions for setting the governor controls.

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:-



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 \$X421 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".



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



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 $M\Omega$ 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 $M\Omega$.

If the unused/new generators IR values fall below 10 $M\Omega$ 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 M Ω . 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.
- 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 $\text{M}\Omega$.

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 $M\Omega$, 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 $1-3~\rm kW$ 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 antiondensation 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.

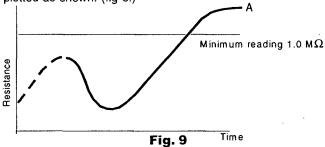
Once the Insulation Resistance is raised to an acceptable level - minimum value 1.0 M Ω - the dc supply may be removed and the exciter field leads "X" and "XX" re-connected to their terminals on the AVR.

Rebuild the genset, replace all covers and re-commission as appropriate.

If the set is not to be run immediately ensure that the anticondensation 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 M Ω . (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 $M\Omega$, 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 $\text{M}\Omega$ 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 $1.0M\Omega$ 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			
нслеклем	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 beautiful and a second a second and a second

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.

Engine SET VIBRATION VIBRATION VIBRATION					
Engine Speed Min -1	OUTPUT kVA	DISPLACEMENT mm (rms)	VELOCITY mm/s (mms)	ACCELERATION m/s² (rms)	
	≤ 10 kVA	-	-	-	
4 DOLE	> 10 but ≤ 50 Kva	0.64	40	25	
4 POLE 1500 rpm 50 Hz 1800 rpm 60 HZ	> 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	

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 :-

- Consult the genset builder. The genset builder should address the genset design to reduce the vibration levels as much as possible.
- 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 airbourne 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.



Removal of filter elements enables access to LIVE parts.

Only remove elements with the generator out of service.

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 pil 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	 Check link K1-K2. Check speed. Check residual voltage. Refer to subsection 7.4.5. Follow separate excitation test procedure to check generator and AVR. Refer to subsection 7.5.
Unstable voltage either on no-load or with load	 Check speed stability. Check stability setting. Refer to subsection 4.6.
High voltage either on no-load or with load	 Check speed. Check that generator load is not capacitive (leading power factor).
Low voltage no-load	 Check speed. Check link 1-2 or external hand trimmer leads for continuity.
Low voltage on-load	 Check speed. Check UFRO setting. Refer to subsection 4.7.1.1. 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	1. 2. 3. 4.	Check circuit breaker ON. Refer to subsection 6.4.1. Check speed. Check residual voltage. Refer to subsection 7.4.5. Follow separate excitation test procedure to check generator and AVR. Refer to subsection 7.5.
Unstable voltage either on no-load or with load	1. 2.	Check speed stability. Check stability setting. Refer to subsection 4.6.
High voltage either on no-load or with load	1. 2. 3.	Check speed. Check link 1-2 or external hand trimmer leads for continuity. Check continuity of leads 7-8 and P3-P2 for continuity. Check that generator load is not capacitive (leading power factor).
Low voltage no-load	1. 2.	Check speed. Check link 1-2 or external hand trimmer leads for continuity.
Low voltage on-load	1. 2. 3.	Check speed. Check UFRO setting. Refer to subsection 4.7.1.1. Follow separate excitation procedure to check generator and AVR. Refer to subsection 7.5.
Excessive voltage/speed dip on load switching	1. 2.	Check governor response. 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	1.	Check link K1-K2 on auxiliary terminals. Follow Separate Excitation Test Procedure to check machine and AVR. Refer to subsection 7.5.
Loss of voltage when set running	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	1. 2.	Check sensing leads to AVR. Refer to Separate Excitation Test Procedure. Refer to subsection 7.5.
Voltage unstable, either on no-load or with load	1. 2.	Check speed stability. Check "STAB" setting. Refer to Load Testing section for procedure. Refer to subsection 4.6.
Low voltage on-load	1. 2.	Check speed. If correct check "UFRO" setting. Refer to subsection 4.7.1.1.
Excessive voltage/speed dip on load switching	1.	Check governor response. Refer to generating set manual. Check "DIP" setting. Refer to subsection 4.7.1.4.
Sluggish recovery on load switching	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	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	1.	Check setting of ramp potentiometer. Refer to 4.7.1.5
Loss of voltage when set running	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	1. 2.	Check sensing leads to AVR. Refer to Separate Excitation Test Procedure. Refer to subsection 7.5.
Voltage unstable, either on no-load or with load	1. 2.	Check speed stability. Check "STAB" setting. Refer to Load Testing section for procedure. Refer to subsection 4.6.
Low voltage on-load	1. 2.	Check speed. If correct check "UFRO" setting. Refer to subsection 4.7.1.1.
Excessive voltage/speed dip on load switching	1.	Check governor response. Refer to generating set manual. Check "DIP" setting. Refer to subsection 4.7.1.4.
Sluggish recovery on load switching	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.

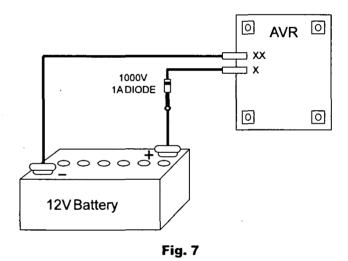
Stop the set, and replace leads X and XX on the AVR terminals.If the measured voltage was above 5V the generator should operate normally.

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.



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

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 endbracket 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

	Tuple 11								
	6 POLE GENERATORS								
FRAME SIZE	I MAIN HOTOH I								
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					
	SEC	CTION RESIST	ANCES			
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

'.5.2.1 AVR FUNCTION TEST

All types of AVR's can be tested with this procedure:

- Remove exciter field leads X & XX (F1 & F2) from the AVR terminals X & XX (F1 & F2).
- Connect a 60W 240V household lamp to AVR terminals X & XX (F1 & F2).
- 3. Set the AVR VOLTS control potentiometer fully clockwise.
- 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.
- 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 erminals.

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



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)

Remove access cover.

Disconnect P2, P3, P4 at the multiway connector inside the access cover.

- Remove the 4 screws and clamps retaining the stator housing (Frames 4, 5 and 6) or the stator pack (Frame 7).
- 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.

- 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:-

- Ensure rotor magnet assembly is free of metal pieces or particles.
- 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		
Reagreasable bearings	N/A	ОРТ	ОРТ	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	нс6	HC7		
Reagreasable bearings	N/A	ОРТ	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.
- Non drive end remove wave washer and circlip (single bearing only).
- Remove bearing cartridge housing complete with bearing (and grease flinger if fitted).
- Remove bearing from cartridge.
- 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.

- Wipe clean the assembly surface, using cleaning solvent on lint free cloth.
- 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.
- Place all components on the clean assembly surface.
 Do not use an air line to blow off excess fluid.
- Thoroughly clean the external surface of the grease gun nozzle using lint free cloth.

Bearing preparation

- 1. Remove the bearing from its packaging.
- 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:

- Apply the specified cartridge grease fill quantity to the back face of the bearing housing.
- Apply a small amount of grease to the grooved sealing surface in the cartridge.
- 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).
- 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).
- 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

Jearing Cartridge

- Heat the Bearing and Cartridge assembly to 80°C above ambient with an induction heater.
 (use induction heater, no other heat source is suitable)
- Slide the Bearing and Cartridge assembly over the shaft, pushing it firmly against the bearing seating shoulder.
- 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).

- Fill the grease exhaust slot with grease.
- Apply a small amount of grease to the grooved sealing surface in the cap.
- Fit circlip.
 (single bearing only).
- 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							
			GREASE QUANTITY					
FRAME	BEARING POSITION	BEARINGS		CARTRIDGE		CAP		
		CMP	GRAMS	CMP	GRAMS	CMP	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.
- Remove cap.
- Non drive end remove wave washer and circlip (single bearing only).
- 4. Remove bearing cartridge housing complete with bearing.
- 5. Remove bearing from cartridge.
- 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.

- Wipe clean the assembly surface, using cleaning solvent on lint free cloth.
- Wipe clean: Bearing Cartridge and Bearing Cap (internal and external). Visually inspect all components after cleaning, for contamination.
- Place all components on a clean assembly surface. Do not use an air line to blow off excess fluid.
- Thoroughly clean the external surface of the grease gun nozzle using lint free cloth.

Bearing preparation:

- 1. Remove the bearing from its packaging.
- 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.

I

Bearing Assembly

Cartridge:

- 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).
- Fit 'O' Rings into the 'O' Ring grooves in the bearing housing circumference.

Assemble Bearing into Cartridge

- 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.
- 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

- Heat the Bearing and Cartridge assembly to 80°C above ambient.
 - (use induction heater, no other heat source is suitable)
- Slide the Bearing and Cartridge assembly over the shaft, pushing it firmly against the bearing seating shoulder.
- 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.
- Non drive end only fit circlip (single bearing only)
 and wave washer.
- 5. Fit the bearing cap.
- Rotate the bearing assembly on the shaft to check for free movement.

Note: Ensure cartridge is at ambient temp, before assembling bracket.

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

- Remove terminal box lid.
- 2. Cut cable ties and disconnect exciter leads.
- Remove bolts from NDE terminal panel and place panel over terminal board with AVR still connected.
- Remove Permanent Magnet Generator (if fitted) see 7.5.3.2.
- Remove the rotor retaining circlip (Non drive end single bearing only) and slack off remaining NDE bracket bolts.
- 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).
- 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.
- Remove bearing circlip (Non drive end single bearing only).

BEARING REMOVAL

- Fit pulley drawers and draw off bearing, ensuring to protect the threaded hole in the end of the main shaft.
- 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

- 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.
- 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.
- Replace rotor retaining circlip and permanent magnet assembly if fitted, and replace cover.
- Connect exciter and re-tie all cables into position and reassemble 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.

- Remove all access covers and terminal box lid.
- Disconnect exciter leads X and XX and PMG leads P2-P3-P4 at the auxiliary terminals inside the terminal box.
- Ensure that these leads are free to come away with the non drive endbracket when removed.
- Remove the 8 bolts holding the drive end adaptor to the frame.
- With a rope sling around drive end adaptor, tap adaptor out of its spigot location; guide over fan and remove.
- 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).
- 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.
- 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.
- Tightly bind a rope sling around the rotor core, and supporting the non drive end of the rotor, guide it clear of the stator.



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		1.0	4.8	48kgm		
	4	1.2	4.0	479Nm		
5	4		1,2	4.0	4.9	48kgm
	4	1.2	4.8	479 N m		
6	6	1.2	7.2	84kgm		
		1.2	1.2	822Nm		
7		1.2	7.2	84kgm		
L_′	6	1.2	1.2	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:-

- 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.
- 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.
- 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.
- Apply the specified re-lubrication grease fill quantity (see table below) via the grease nipple.
- 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					
нонок	BEARING	GREASE C	RELUBRICATION		
	POSITION	СМВ	GRAMS	PERIOD	
5	Non-Drive End	.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 HC6/7 RSK5001 RSK6001

2. SX440 AVR SX421 AVR MX321 AVR

MX341 AVR

E000-24030 E000-24210 E000-23212 E000-23412

. Bearings

PART NUMBERS NON DRIVE-END BEARINGS						
HC4 HC5 HC6 HC7						
Reagreasable 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
Reagreasable bearings	Ν⁄Α	OPT 051-01067	OPT 051-01064	STD 051-010 6 2
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.

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, italie espagnol.	n,
Dieses Handbuch ist auf Anfrage in den folgenden Sprachen erhältlich: Englisch, Französisch, Deutsch, Italienisch, S	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 αιτήσενς: Αγγλικά, Γαλλικ Γερμανικά, Ιταλικά, Ισπανικά.	á

Q-Pulse Id TMS1079

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.

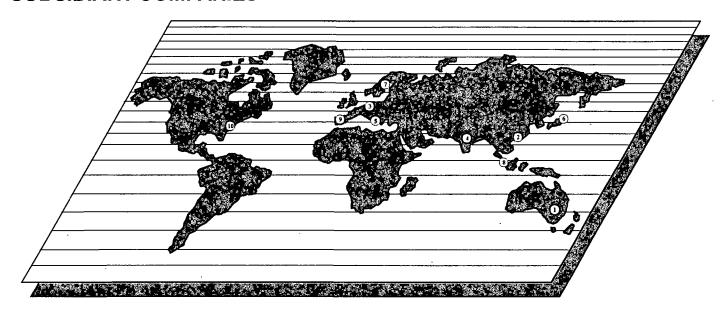
MACHINE SERIAL NUMBER		

NEWAGE INTERNATIONAL LIMITED

REGISTERED OFFICE AND ADDRESS: PO BOX 17 **BARNACK ROAD STAMFORD** LINCOLNSHIRE PE9 2NB ENGLAND

Telephone: 44 (0) 1780 484000 44 (0) 1780 484100 Web site: www.newagestamford.com

SUBSIDIARY COMPANIES



1 AUSTRALIA:

NEWAGE ENGINEERS PTY. LIMITED

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.I.

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) Telephone: Madrid (34) 91 604 8987/8928

Fax: (34) 91 604 81 66

10 U.S.A.:

NEWAGE LIMITED 4700 Main St, N.E.

Fridley

Minnesota 55421

Telephone: (1) 800 367 2764 Fax: (1) 800 863 9243

> © 2000 Newage International Limited Printed in England

SECTIO

Q-Pulse Id TMS1079

Active 10/12/2014

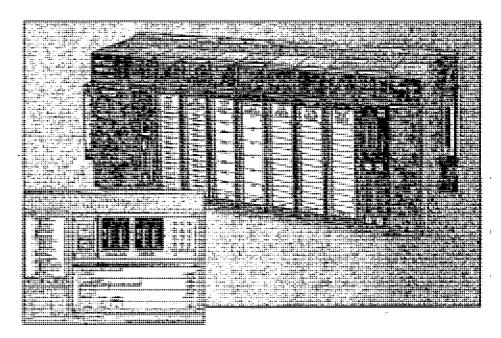
Page 208 of 469



GE Fanuc Automation

Series 90™-30 PLCs

The Series 90^{ma}-30 PLCs are a family of controllers. I/O systems and specialty modules designed to meet the demand for versatile industrial solutions. With its single overall control architecture, the Series 90-30 has been the PLC of record in over 200,000 applications, such as high-speed packaging, material handling, complex motion control, water treatment, continuous emissions monitoring, mining, food processing, elevator control, injection molding and many more.



Thanks to its modular design, the Series 90-30 offers unmatched versatility. Configure just the system you need, saving critical space and reducing cost.

With over 100 I/O modules, the Series 90-30 PLC can be adapted to a wide range of applications.

- . Digital interfaces for push buttons, switches, proximity sensors, relays, contactors and many other devices
- . Analog modules with varying degrees of resolution for flow, temperature or pressure applications
- . Direct connect wiring or remote termination
- Local or remote I/O systems

Series 90-30 Ethernet communications provide a real-time link between the plant floor and the boardroom. You can begin with an Ethernet-enabled CPU, or at a later date, choose from our selection of rack-mounted Ethernet modules. The Series 90-30 Ethernet module supports both SRTP and Modbus TCP/IP application protocols.

The scaleable processing power in the Series 90-30 CPU creates a clear upgrade path. Create the system that's ideal today, while leaving open the option of creating a more powerful system tomorrow — without having to change your application software.

Motion control integrated into the Series 90-30 fosters high performance point-to-point applications.

A variety of Series 90-30 field bus interfaces enables distributed control and/or I/O. Choose from Ethernet EGD, Profibus-DPM Genius*, DeviceNetTM and Interbus-STM modules. Field Bus interface modules are easy to install and quick to configure. Rlug them into an existing system or design a new system around them.

Ease of programming is a strong suit of the Series 90-30. Choose the programming options that meet your needs. Windows based IEC programming, advanced C or State Logic. Floating point math, PID, indirect addressing, array moves and sequencing are just a few of the over 200 instructions available.

The Series 90-30 stands out among small controls for offering redundancy options. The Series 90-30 is the low-cost solution for high availability applications, with redundant CPUs and power supplies.

Easy trouble shooting and machine setup using a handheld PDA. CIMPLICITY Machine Edition Logic Developer PDA software allows you to interface a Palmo handheld device to your Series 90-30 controller. With Logic Developer PDA, you can monitor/change data, view diagnostics, force ON/OFF, and configure machine setup — saving you time and increasing productivity.

Q-Pulse Id TMS1079 Active 10/12/2014 Page 210 of 469

Ordering Information

Description	Catalog Number.	的复数化对抗性 化二氯甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基	Catalog Number	
Discrete Input	IC693MDL230	120 VAC Isolated Input (8 Points)	C693MDL646	24 VOC Input, Neg/Pos Logic, 1 msec Fitter (16 Points)
•		(240 VAC Isolated Input IS Points)		48 VDC Input, Neg/Pos Logic, 1 msec filter, Neg/Pos Logic (16 Points)
Middles	IC693MDL240	120 VAC Input (16 Points)		24 VDC Input, Neg/Pos Logic, 2msec Filter (32 Points)
		THE PARTY OF THE P		
		24 VAC/VDC Input (16 Points)		(\$/12 VDC (TTL) Input, Neg/Pos Lògic, (32 Points)
	(C693MDL632	125 VDC Ingua (B Points)		24 VDC Input, Neg/Pos Logic, 1 ms, (32 Points)
		(24 VOC Input, Neg/Pos Logic (8 Points)	IC693ACC300	Input Simulator Module (8 Points)
J115 #441 # 14 # 1	IC693MDL645	24 VDC Input, Neg/Pos Logic (16 Paints)		<u>ئىلىد ئەسىمىدىدىن بارىم بىرىن بىرىن بىرىن ئىلىنى بىلىن ئارىم ئارىن ئارىن ئارىن ئارىن ئارىن بىرىن بىلىن بىرىن</u>
liscrete Dutput	IC693MDL310	120 VAC Dutput, 0.5 Amp (12 Points)	[ICE93MDL740	12/24 VDC Output, 0.5 Amp. Positive Logic (16 Points)
Modules	.IC693MDL330	120/Z40 VAC Output, 2 Amp (8 Points)	IC593MDL741	12/24 VDC Output, 0.5 Amp. Negative Logic (16 Points)
نغب في ال	IC693MDL340	170 VAC Output, 0.5 Amp (16 Points)	IC693MDL742	12/24 VOC Output, 1 Amp. Positive Logic (16 Points), Fused
	IC693MDL390	120/240 VAC Isofated Output, 2 Amp (5 Points)	1C693MDL748	48 VDC Output, 0.5 Amps, Positive Logic IB Points
	1C693MDL730_	12/24 VDC Output: 2 Amp. Positive Logic (B Points)	IC583MDL750	12/24 VDC Output, Negative Logic (32 Points)
	IC693MDL731	12/24 VDC Output, 2 Amp. Negative Logic 18 Points		12/24 VDC Output, Positive Logic (32 Points)
e* + 1 = 1	11C693MDL732	12/24 VDC Cutput, 0.5 Amp. Positive Logic (8 Points)		5/12/24 VDC (TTL) Output, Negative Logic, I32 Points)
	IC693MDL733	The second of th	IC693MDL753	
10 m	***	12/24 VDC Curpirt, 0.5 Amp, Negative Logic (8 Points)	ILPSOUNTLY 23	12/24 VDC Output, Positive Logic (32 Points)
	1.00	125 VDC Output, (6 Points)	بنيسي ينسب	makerika anta retori makerika mini mengengan mengengan mengengan kalanda mini mengengan mengengan mengengan m
elay Outpur	IC693MDL930	Relay Cutput, Isolated, 4 Arrig (8 Points)	IC693MDL940	Relay Output, 2 Amp (16 Points)
Module	IC693MDL931	Relay Output, 8 Amp Form B/C contacts, Isolated in 2 Groups of 4 (8 Points)	السيسيانيا	Company of the street of the second continues of the s
lixed Discrete	IC693MDR390	Mixed I/O, 24 VOC Input (8 points), Relay Output (8 points)	1C693MAR590	Mixed I/O, 120 VAC Input (8 Points), Relay Dutput (8 Points)
Module				
nalog Input	IC693ALG220	Analog Input; Voltage/Current; 4 Channels	IC693AL6222	Analog Input, Voltage 16 Single/8 Offerential Channels
Modules	IC693ALG221	Arialog Input, Current, 4 Channels		Analog Input; Current, 16 Single Channels
ngamay paragraph as a samp	1C693ALG390	Analog Output, Voltage, 2 Channels		High Density Analog Output (8 Channels)
nalog Dutput	PROPERTY AND ADDRESS OF THE PARTY OF THE PAR		IC593ALG392	uidu neustri vusiod nadni (s rusuueiz)
Modules	IC693ALG391	Analog Output, Current, 2 Channels	لشيرك بثروت حاا	the second secon
Aixed Analog	IC693ALG442	Analog Combo Module 4IN/20UT		figur Sant Campun Santa at an limba can bhaigh agus da ghrigh ga a gu an air agus Sant a ta chuid an ba bac.
Modules		The State was because it is an experience with the company of the	-	to the second
lotion Modules,	IC693APU300,	High Speed Counter (KSC)	IC693APU305	High Speed Counter with Gray Code Encoder or an A QUAD 8 Encoder Input
	IC693APU301	Axis Posttiening Module (APM), 1 Axis	[IC693DSM302	Digital Servo Motion Controller, Z Axis
	1C693APU302	Axis Positioning Module (APM), 2 Axis	ICE93DSM314	Digital Servo Motion Controller, 1-2 Axis of Digital Servo or 1-4 Axis Analog Servo
pecialty		[Solenoid Valve Output (11 Points)24 VOC Output, 0.5 Amp. Positive Logic (5 Points)	THE PROPERTY OF THE PARTY OF TH	the part of the same are also the contract of
	IC693PCM301	் சிக்கிய இரு இவர்களுக்கு வின் கார் நிலது இரு நிறிய நிறு நிறு நிறு நிறு நிறு நிறு நிறு நிறு	IC693TCM3D2	THE PERSON WAS A TOTAL OF THE PERSON OF THE
Modules		Programmable Coprocessor Module, 192 KB (47 KB Basic or C Program), 2 Serial Ports		Temperature Control Module, [8] TC In and [8] 24 VOC Solid State Outputs
	14 11 12 12	Programmable Coprocessor Module, 640 KB 1640 KB Basic or C Programl, 2 Serial Ports	ICH331CM303	Temperature Control Module Extended Temperature Range, (8) TC In and
ar vitaring alogorisations of a vital rose in	IC693PTM100	Power, Transducer, Module, CT and PT Interface (20/240 VAC (0.5m Cable)		(9) 24 VDC Solid State Outputs
ommunications		(Genius Bus Controller (Supports I/O and Datagrams)	1C693P8M200	Profibus DP Master Module
Modules	IC693CMM302	Communication Module, Genius (1 Kbyte) GCM+ (No Dategram Support)	IC693PBM201	Profibus OP Slave Module
	IC693CMM311	Communications Module, CCM, RTU, SNP, and SNPx Protocols	[IC693DNM200_	DeviceNet Master Module
	IC693CMM321	Ethernet Interface TCP/IP Module, 10Mbs (Supports SRTP and Modbus TCP/IP, No EGD)	IC693DNS201	DeviceNet Slave Module
Controllers	IC693CPU311	(5-Slot Base with CPU in Base (6KBytes User Program), Not Expandable	1C693CPU360	CPU 360 Module (240K Bytes Configurable User Memory, 4K VO, 8 Racks),
WIII ONE 1	100.02.1 551			No Built In Serial Ports, Logic Execution is 22msec/K
			Locator non	சென்ன கார்கள் கூறு கார்கள் நின்ற கேற்று கிறியின்றனர். அன்ன கிறிய குண்டியின்ற கிறிய கார்கள் கொண்டு கார்கள் கொண்
	1C693CPU313	5-Slot Base with Turbo CPU in Base (Logic Execution is 6 msec), IK Registers.	IC693CPU363	CPU 383 Module (240KBytes Configurable User Memory 4K I/O, 8 Racks).
	-	(12KBytes Use Program), Not Expandable		2 Built In Serial Ports, Logic Execution is 22msec/K
	IC693CPU323	10-Slot Base with Turbo CPU in Base (Logic Execution is 6 msec) 12Xbytes	IC693CPU364	CPU-364 Module (240KBytes Configurable User Memory 4K t/O, 8 flacks), No Built-In Serial Po
		User Program, Not Expandable		Built-In IOMbs Ethernet, Supports SRTP, Channels and EGO, Logic Execution is 22mser
	IC693CPU350	CPU 350 Module (32KBytes User Memory, 4K I/O, 8 Racks), No Built-In Serial Ports,	IC693CPU374	CPU 374 Module (240XBytes Configurable User Memory), No Built-In Serial Ports,
	1 2	Logic Execution is .72msec/K		Built-In IQ/100Mbs with Built-In Switch, Ethernet Supports SRTP, EGO and No Channel
				Support Logic Execution is 22msec/K
and the second of the second o	1C693CHS391	Base, CPU, 10 Slots, Use, with CPU331/CSE331 and above	IC693CHS397	galaping at a management and a management of the state of
ackplanes .		and the state of t		Base, CPU, 5, Slots (use with CPU331/CSE33) and above)
	IC693CHS392	Base, Expansion, 10 Slots	IC693CHS39B	Base, Expansion, 5 Skots
كسيب لأشيراك	(IC693CHS393	Base, Remore Expansion: 10 Stots (700 ft.)	[IC693CHS399	Base, Remote Expansion, 5 Slots (700 ft.)
ower Supplies	IC693PWR321	Power Supply, 120/240 VAC, 125 VDC, Standard, 30 Watts	IC693PWR332	Power Supply, 12 VOC, High Capacity, 30 Watts
	IC693PWR322	Power Supply, 24/48 VDC, Standard, 30 Watts	IC693ACC340	Redundant Power Supply Base (RPSB) with 0.1 meter cable to connect to Power Supply Adapter Modu
	the second of the second of	Power Supply, 48 VDC, Standard, 30 Watts	ILESSACC341	Redundant Power Supply Base with 0.5 meter cable to connect to Power Supply Adapter Module
	Principal Services Britishers	Power Supply, 120/240 VAC, 125 VDC, High Capacity, 30 Watts	ICSSACC350	Redundant Power Supply Adapter (RPSA) Module. The RPSA replaces the power supply
	1C693PWR331	Power Supply, 24 VDC, High Capacity, 30 Watts		ion a CPU base or expansion base and connects to a Redundant Power Supply Base.
are at a second or a rate of the	NAME OF TAXABLE PARTY.	والمراجع والمنافذ وال	TICCOTON TO	برها بابره سياحه الأمر المنبور والمستحد فيتناه والمواجب والمتقدر بسياب بالمناج والمرام والمرام والمتحد
ccessories	16 5 5 5 5 7	Replacement Battery, CPU & PCM (Qry. 2)	7 T	Rack to Rack Expansion Cable, 2 Meters
	1C693ACC302	High Capacity Battery Pack	IC693CBL302	Rack to Rack Expansion Cable, 15 Meters
		EZ Program Store Rash Device (for CPU374 only)	11C693CBL312	Rack to Hack Expansion Cable, D.15 Meters, Shielded
	IC693ACC310	Filler Module, Blank Slot	IC693CBL313	Rack to Rack Expansion Cable, 8 Meters
	IC693CBL300	Rack to Rack Expansion Cable, 1 Meter		Rack to Rack Expansion Cable, 15 Meters, Shielded
rogramming and	IC645MPP001	Logic Developer - PLC Professional		Logic Developer PDA Softwere Tool with Cable Adepter
		والمراجع والمنافية والمناف		to be a series of the series o
Trouble Shooting	1/C646MPS001	Logic Developer - PLC Standard		



GE Fanuc Automation

GE Fanuc Automation Information Centers

USA and the Americas 1-800-648-2001 or (434) 978-5100 Europe and Middle East (352) 727979-1 Asia Pacific 86-21-3222-4555 O 2003 GE Fanuc Automation Americas, Inc. All Rights Reserved. Series 50, VersaPra and LogicMaster are mademarks and Genius is a registered medemark of GE Fanuc Automation Americas, Inc. Profibus-DP is a trademark of Profibus International DeviceNet is a trademark of the Open DeviceNet Vendor Association, Inc. Interbus-S is a trademark of Phoenic Contact. Windows is a registered trademark of Microsoft Corporation, State Logic is a registered trademark of Adatek, Inc. Palm is a mademark of Palm, Inc.

Additional Resources

For detailed technical specifications and product ordering information, please visit the GE Fanuc e catalog at:

www.gefanuc.com

GFA-148J 10M 06/03



GE Fanuc Automation

Programmable Control Products

Series 90™-30 PLC Installation and Hardware Manual

GFK-0356Q August 2002

Q-Pulse Id TMS1079 Active 10/12/2014 Page 214 of 469

GFL-002

Warnings, Cautions, and Notes as Used in this Publication

Warning

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

Caution

Caution notices are used where equipment might be damaged if care is not taken.

Note

Notes merely call attention to information that is especially significant to understanding and operating the equipment.

This document is based on information available at the time of its publication. While efforts have been made to be accurate, the information contained herein does not purport to cover all details or variations in hardware or software, nor to provide for every possible contingency in connection with installation, operation, or maintenance. Features may be described herein which are 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.

GE Fanuc Automation makes no representation or warranty, expressed, implied, or statutory with respect to, and assumes no responsibility for the accuracy, completeness, sufficiency, or usefulness of the information contained herein. No warranties of merchantability or fitness for purpose shall apply.

The following are trademarks of GE Fanuc Automation North America, Inc.

Alarm Master	Field Control	Modelmaster	Series 90
CIMPLICITY	GEnet	Motion Mate	Series One
CIMPLICITY Control	Genius	PowerMotion	Series Six
CIMPLICITY PowerTRAC	Genius PowerTRAC	ProLoop	Series Three
CIMPLICITY 90-ADS	Helpmate	PROMACRO	VuMaster
CIMSTAR	Logicmaster	Series Five	Workmaster

©Copyright 1998—2002 GE Fanuc Automation North America, Inc. All Rights Reserved. The Series 90-30 PLC and its associated modules have been tested and found to meet or exceed the requirements of FCC Rule, Part 15, Subpart J. The Federal Communications Commission (FCC) requires the following note to be published according to FCC guidelines.

NOTE

This equipment generates, uses, and can radiate radio frequency energy and if not installed in accordance with this instruction manual, may cause harmful interference to radio communications. It has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules, which are designed to provide reasonable protection against harmful interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

The following note is required to be published by the Canadian Department of Communications.

NOTE

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the radio interference regulations of the Canadian Department of Communications.

The following statements are required to appear in the Series 90_-30 Installation Manual and the Series 90_-30 I/O Specifications Manual for Class I Div 2 Hazardous Locations.

- 1. EQUIPMENT LABELED WITH REFERENCE TO CLASS I, GROUPS A, B, C, and D, DIV. 2 HAZARDOUS LOCATIONS IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A, B, C, D OR NON-HAZARDOUS LOCATIONS ONLY.
- 2. WARNING EXPLOSION HAZARD SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2:
- 3. WARNING EXPLOSION HAZARD DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
- 4. ALL UNUSED SLOTS IN ALL BASEPLATES MUST BE POPULATED WITH FILLER MODULES, IC693ACC310, OR EQUIVALENT.

GFK-0356Q

This manual describes the GE Fanuc Series 90-30 Programmable Logic Controller (PLC). It contains a description of hardware components and provides basic hardware installation procedures. The Series 90-30 PLC is a member of the Series 90_ family of Programmable Logic Controllers from GE Fanuc.

For a list of product standards, refer to data sheet GFK-0867B or later, GE Fanuc Approvals, Standards, General Specifications which lists all of the standards for GE Fanuc products. Installation instructions in this manual are provided for installations that do not require special procedures for noisy or hazardous environments. For installations that must conform to more stringent requirements (such as CE Mark), see GFK-1179, Installation Requirements for Conformance to Standards.

What's New in This Manual

- Added the model 374 CPU, which supports connection to an Ethernet network through two built-in 10BaseT/100BaseTx auto-negotiating full-duplex Ethernet ports. Models 364 (release 9.10 and later) and 374 are the only Series 90-30 CPUs that support Ethernet Global Data. Note that the CPU374 is supported only by the Windows®-based programmers.
- Other corrections and clarifications as necessary.

Related Publications

For more information on Series 90-30 products, refer to these publications. (For a publication to product catalog number cross-reference refer to Appendix G):

GFK-0255 - Series 90™ PCM and Support Software User's Manual

GFK-0256 - MegaBasic™ Programming Reference Manual

GFK-0293 - Series 90™ -30 High Speed Counter User's Manual

GFK-0401 - Workmaster® II PLC Programming Unit Guide to Operation

GFK-0402 - Series 90™ -30 and 90-20 PLC Hand-Held Programmer User's Manual

GFK-0412 - Genius® Communications Module User's Manual

GFK-0466 - Logicmaster 90™ Series 90™ -30/20/Micro Programming Software User's Manual

GFK-0467 - Series 90™ -30/20/Micro Programmable Controllers Reference Manual

GFK-0487 - Series 90™ PCM Development Software (PCOP) User's Manual

GFK-0499 - CIMPLICITY® 90-ADS Alphanumeric Display System User's Manual

GFK-0356Q

Q-Pulse Id TMS1079

Preface

- GFK-0582 Series 90™ PLC Serial Communications User's Manual
- GFK-0631 Series 90™ -30 I/O LINK Interface User's Manual
- GFK-0641 CIMPLICITY® 90-ADS Alphanumeric Display System Reference Manual
- GFK-0664 Series 90TM-30 PLC Axis Positioning Module Programmer's Manual
- GFK-0685 Series 90™ Programmable Controllers Flow Computer User's Manual
- GFK-0695 Series 90[™]-30 Enhanced Genius) Communications Module User's Manual
- GFK-0726 Series 90™-30 PLC State Logic Processor User's Guide
- GFK-0732 Series 90™-30 PLC ECLiPS User's Manual
- GFK-0747 Series 90TM-30 PLC OnTOP User's Guide
- GFK-0750 OnTop for Series 90™-30 (State Logic) Program User's Manual
- GFK-0781 Motion Mate™ APM300 for Series 90™-30 PLC Follower Mode User's Manual
- GFK-0823 Series 90™ -30 I/O LINK Master Module User's Manual
- GFK-0828 Series 90™ -30 Diagnostic System User's Manual
- GFK-0840 Motion Mate™ APM300 for Series 90™ -30 PLC Standard Mode User's Manual
- GFK-0867 GE Fanuc Product Agency Approvals, Standards, General Specifications
- GFK-0898 Series 90[™] -30 PLC I/O Module Specifications
- GFK-1028 Series 90[™] -30 I/O Processor Module User's Manual
- GFK-1034 Series 90[™] -30 Genius® Bus Controller User's Manual
- GFK-1037 Series 90™ -30 FIP Remote I/O Scanner User's Manual
- GFK-1056 Series 90™ -30 State Logic Control System User's Manual
- GFK-1186 TCP/IP Ethernet Communications for the Series 90_-30 PLC Station Manager Manual
- GFK-1179 Series 90™ PLC Installation Requirements for Conformance to Standards
- GFK-1464 Motion Mate DSM302 for Series 90™-30 PLCs User's Manual
- GFK-1466 Temperature Control Module for the Series 90™-30 PLC User's Manual
- GFK-1541 TCP/IP Ethernet Communications for the Series 90™ PLC User's Manual

Q-Pulse Id TMS1079

Chapter 1	Overview of the Series 90-30 PLC	1-1
	The Basic Parts of a Series 90-30 PLC	1-1
_	Assembling a Basic Series 90-30 PLC System	
	What else would be needed to make this basic system functional?	
	What if the application requires more than five modules?	
	What if the application requires more than ten modules?	
	What is the Difference Between Expansion and Remote baseplates?	
	What if I need to cover more than 700 feet (213 meters)?	
Chapter 2	Installation	2-1
	Receiving your Products - Visual Inspection	2-1
	Pre-installation Check	
	Warranty Claims	
	Working with Series 90-30 Modules	
	Module Features	
	Installing a Module	
	Removing a Module	
	Installing a Module's Terminal Board	
	Removing a Module's Terminal Board	
	I/O Module Terminal Board Posts	
	Installing and Removing Terminal Boards with Holding Screws	
	Baseplate Mounting	
	Mounting a Baseplate to a Panel	2-8
	Mounting a Baseplate to a 19" Rack	2-8
	Grounding Procedures	2-11
	System Grounding Procedures	2-11
	Ground Conductors	2-11
	Series 90-30 PLC Equipment Grounding	2-12
	Baseplate Safety Grounding	
	Grounding 19" Rack-Mounted Baseplates	
	Programmer Grounding	2-13
	Module Shield Grounding	2-14
	Shield Grounding Information for CPUs with External Port Connections	
	CPU351 and 352 Shield Grounding	
	CPU363, CPU364, and CPU374 Shield Grounding	
	Additional Modules with Shield Grounding Requirements	
	General Wiring Guidelines	
	Discrete I/O Module Connection Methods	
	Connections to I/O Module Terminal Boards	2-18
	Terminal Block Quick Connect Installation for 16-Point Discrete Modules	2-19
	Installation of 32-Point Discrete, 50-Pin Connector Modules	2-19
	Using Weidmuller #912263 Terminal Block	
	Using a Generic Terminal Block or Strip	
	Direct Method	
	Installation of Discrete 32-Point, Dual 24-Pin Connector Modules	
	Using a TBQC	2-20

	with a Generic Terminal Block/Strip	
	Direct Method	
	General Wiring Methods for Analog Modules	
	Analog Input Module Wiring Methods	
	Using a Generic Terminal Block or Strip Direct Method	
	TBQC not Recommended for Analog Modules	
	Analog Output Module Wiring	
	General	2-22
	Using a Generic Terminal Block or Strip	2-22
	Direct Method	2-22
	TBQC not Recommended for Analog Modules	
	AC Power Source Connections	
	AC Input Wiring to AC/DC Power Supplies	
	Power Supply Overvoltage Protection Devices	
	Special Installation Instructions for Floating Neutral (IT) Systems	
	Definition of Floating Neutral Systems	
	Use These Special Installation Instructions for Floating Neutral Systems	
	DC Power Source Connections	2-27
	DC Input Wiring to AC/DC and DC-Only Power Supplies	2-27
	+24 VDC Output (All Supplies)	2-27
	Basic Installation Procedure	2-28
Chapter 3	Baseplates	3-1
	Baseplate Types	3-1
	Common Baseplate Features	3-1
	Two Baseplate Sizes	
	Baseplate Terms	
	CPU Baseplates	
	Embedded CPU Baseplates (Figures 3-2 and 3-3)	
	Modular CPU Baseplates (Figures 3-4 and 3-5)	
	Expansion Baseplates (Figures 3-6 and 3-7)	
	Remote Baseplates (Figures 3-8 and 3-9)	
	I/O Bus Expansion Cables	
	Differences Between Remote and Expansion Racks	
	Mixing Expansion and Remote Baseplates in a System	
	Termination Requirement for Expansion or Remote System	
	Powering Down Individual Expansion or Remote Baseplates	
	Series 90-30 PLC Backplane	
	Rack Number DIP Switch on Expansion and Remote Baseplates	
	Expansion and Remote Baseplates Connection Example	
	Baseplate Mounting Dimensions	
	Embedded CPU (311, 313, and 323) Baseplate Dimensions	
	Modular CPU, Expansion, and Remote Baseplate Dimensions	3-18
		CEV 02560

	Load Ratings, Temperature, and Mounting Position	3-19
	Baseplate Adapter Brackets for 19" Rack Mounting	3-20
	Baseplate Comparison Table	3-22
Chapter 4	Power Supplies	4-1
	Power Supply Categories	4-1
	Power Supply Feature Comparison	4-1
	AC/DC Input Power Supplies	4-2
	IC693PWR321 Standard Power Supply, 120/240 VAC or 125 VDC Input	4-2
	IC693PWR330 High Capacity Power Supply, 120/240 VAC/125 VDC Input	4-4
	Field Wiring Connections for the AC/DC Input Power Supplies	4-5
	Isolated 24 VDC Supply Output Connections	4-6
	DC Input Only Power Supplies	
	IC693PWR322 Standard Power Supply, 24/48 VDC Input	
	Calculating Input Power Requirements for IC693PWR322	
	IC693PWR328 Standard Power Supply, 48 VDC Input	
	Calculating Input Power Requirements for IC693PWR328	
	Input Power/Current Calculation for IC693PWR328 Power Supply	
	IC693PWR331 High Capacity Power Supply, 24 VDC Input	
	Current Derating for Higher Temperatures	
	Calculating Input Power Requirements for IC693PWR331	
	Field Wiring Connections to the DC Input-Only Power Supplies	
	Common Series 90-30 Power Supply Features	
	Status Indicator Lights on all Power Supplies	
	Input Overvoltage Protection Devices	
	Output Voltage Connections to Backplane (All Supplies)	
	Overcurrent Protection (all Supplies)	
	Timing Diagram	
	CPU Serial Port Connector on Power Supply (All Supplies)	
	CPU Serial Port Information	
	Backup Battery for RAM Memory (All Supplies)	
Chapter 5	CPUs	5-1
•	CPU Types for Series 90-30 PLCs	
	Embedded CPUs	5-1
	Modular CPUs	5-2
	General CPU Features	
	Microprocessor	5-3
	CPU Serial Port (Connector on Power Supply)	
	Memory VolatilityRAM Memory	
	RAM Memory Backup/Backup Battery Information	5-5
	Programmable Read-Only Memory (PROM) Types	5-5
	Uses of PROM devices in the 90-30 CPUs	5-5

GFK-0356Q

	U Revision Levels (Versions)	
	er Program Storage Options	
Comparing EPROM an	d EEPROM Features	5-8
Procedure for Creating	an EPROM	5-9
Flash Memory		5-9
Series 90-30 CPU Capa	icities	5-10
-	es (References)	
	Memory Address and a Nickname	
	e Types	
Application Prog	gam Compatibility	5-12
CPU Time-of-Da	ry (TOD) Clock Accuracy	5-12
Breakfree SNP P	rotocol	5-13
350-374 CPUs		5-13
	ith Hand-Held Programmer (HHP) and Memory Card	
	dvanced Features	
	374 CPU Advanced Features	
	50–364 CPUs	
	Hardware Features	
	Jpgrade	
	CPU363 Hardware Features	
	Jpgrade	
	onnection Tab	
	oniection Tab	
Serial Port Front	Panel Connectors	5-20
	s LEDs	
	rted	
•	for CPU351, CPU352, and CPU363 Serial Ports 1 & 2	
	tures	
	Pushbutton	
	nectorsonnection Tab	
	de	
	tures	
	Pushbutton	
	nectors	
	onnection Tab	
	de	
CPU311	Catalog Number IC693CPU311	
CPU313	Catalog Number IC693CPU313	5-29
CPU323	Catalog Number IC693CPU323	5-30
CPU331	Catalog Number IC693CPU331	5-31

Series 90TM 30 PLC Installation and Hardware Manual - August 2002

Backup Battery for RAM Memory (All Supplies) 6-1 Battery Replacement Instructions 6-2 Battery Replacement/Memory Protection Factors 6-3 The Importance of Backing up Your Program 6-3 Factors Affecting Battery Life 6-4 Low Battery Warning Methods 6-4 Operating Without a Memory Backup Battery 6-6 RAM Memory Battery Backup Connection Path 6-8 Super Capacitor Memory Backup 6-8 Maintaining RAM Memory During Storage or Shipment of a CPU 6-9 Modular CPUs 6-9 Embedded CPUs 6-9 Battery Accessory Kit (IC693ACC315) 6-9 Battery Accessory Kit Installation 6-10 External Battery Module (IC693ACC302) 6-10 Batteries in Power Supplies on Expansion or Remote Racks 6-11		CPU340	Catalog Number IC693CPU340	5-32
CPU351 Catalog Number IC693CPU351		CPU341	Catalog Number IC693CPU341	5-33
CPU352 Catalog Number IC693CPU352 5-36 CPU360 Catalog Number IC693CPU360 5-37 CPU363 Catalog Number IC693CPU363 5-38 CPU364 Catalog Number IC693CPU364 5-39 CPU374 Catalog Number IC693CPU364 5-39 CPU374 Catalog Number IC693CPU374 5-40 Chapter 6 Memory Backup/Battery Backup		CPU350	Catalog Number IC693CPU350	5-34
CPU360 Catalog Number IC693CPU360 5-37 CPU363 Catalog Number IC693CPU363 5-38 CPU364 Catalog Number IC693CPU364 5-39 CPU374 Catalog Number IC693CPU364 5-39 CPU374 Catalog Number IC693CPU374 5-40 Chapter 6 Memory Backup/Battery Backup ————————————————————————————————————		CPU351	Catalog Number IC693CPU351	5-35
CPU363 Catalog Number IC693CPU363 5-38 CPU364 Catalog Number IC693CPU364 5-39 CPU374 Catalog Number IC693CPU374 5-40 Chapter 6 Memory Backup/Battery Backup		CPU352	Catalog Number IC693CPU352	5-36
CPU364 Catalog Number IC693CPU364 .5-39 CPU374 Catalog Number IC693CPU374 .5-40 CPU374 CPU37		CPU360	Catalog Number IC693CPU360	5-37
Chapter 6 Memory Backup/Battery Backup		CPU363	Catalog Number IC693CPU363	5-38
Chapter 6 Memory Backup/Battery Backup 6-1 Backup Battery for RAM Memory (All Supplies) 6-1 Battery Replacement Instructions 6-2 Battery Replacement/Memory Protection Factors 6-3 The Importance of Backing up Your Program 6-3 Factors Affecting Battery Life 6-4 Low Battery Warning Methods 6-4 Operating Without a Memory Backup Battery 6-6 RAM Memory Battery Backup Connection Path 6-8 Super Capacitor Memory Backup 6-8 Maintaining RAM Memory During Storage or Shipment of a CPU 6-9 Embedded CPUs 6-9 Embedded CPUs 6-9 Battery Accessory Kit Installation 6-10 External Battery Module (IC693ACC315) 6-9 Batteries in Power Supplies on Expansion or Remote Racks 6-11 Chapter 7 Input/Output Modules 7-1 Basic I/O Module Types 7-2 Discrete I/O Modules 7-2 Standard Density Discrete I/O Module Features 7-2 Wiring Standard Density (16-Point or Less) Discrete Modules 7-4 High Density (CPU364	Catalog Number IC693CPU364	5-39
Backup Battery for RAM Memory (All Supplies)		CPU374	Catalog Number IC693CPU374	5-40
Battery Replacement/Memory Protection Factors	Chapter 6	Memory Backup	Battery Backup	6-1
Battery Replacement/Memory Protection Factors		Backup Battery for I	RAM Memory (All Supplies)	6- 1
The Importance of Backing up Your Program				
Factors Affecting Battery Life Low Battery Warning Methods		Battery Replacemen	t/Memory Protection Factors	6-3
Low Battery Warning Methods		The Importance of I	Backing up Your Program	6-3
Operating Without a Memory Backup Battery		Factors Affecting B	attery Life	6-4
RAM Memory Battery Backup Connection Path 6-8 Super Capacitor Memory Backup 6-8 Maintaining RAM Memory During Storage or Shipment of a CPU 6-9 Modular CPUs 6-9 Embedded CPUs 6-9 Battery Accessory Kit (IC693ACC315) 6-9 Battery Accessory Kit IInstallation 6-10 External Battery Module (IC693ACC302) 6-10 Batteries in Power Supplies on Expansion or Remote Racks 6-11 Chapter 7 Input/Output Modules 7-1 Basic I/O Module Types 7-1 Discrete I/O Module Point Density 7-2 Standard Density Discrete I/O Module Features 7-2 Wiring Standard Density (16-Point or Less) Discrete Modules 7-4 Discrete Relay Output Module Protection 7-4 High Density (32-Point) Discrete I/O Module Features 7-4 Wiring Methods for 32-Point Discrete I/O Modules 7-6 Modules with Single 50-Pin Connector 7-6 Modules with Dual 24-Pin Connector 7-6 Modules with Dual 24-Pin Connector 7-6 Modules with Dual 24-Pin Connector 7-6 Modules Wiring Methods 7-5 Analog Module Wiring Methods 7-5 Analog Output Module Wiring Methods 7-5 Analog Output Module Wiring Methods 7-5 Analog Output Module Wiring Methods 7-15		Low Battery Warnin	ng Methods	6-4
Super Capacitor Memory Backup		Operating Without a	Memory Backup Battery	6-6
Maintaining RAM Memory During Storage or Shipment of a CPU		RAM Memory Batte	ery Backup Connection Path	6-8
Modular CPUs 6-9 Embedded CPUs 6-9 Battery Accessory Kit (IC693ACC315) 6-9 Battery Accessory Kit Installation 6-10 External Battery Module (IC693 ACC302) 6-10 Batteries in Power Supplies on Expansion or Remote Racks 6-11 Chapter 7 Input/Output Modules 7-1 Basic I/O Module Types 7-1 Discrete I/O Module Point Density 7-2 Discrete I/O Module Point Density 7-2 Standard Density Discrete I/O Module Features 7-2 Wiring Standard Density (16-Point or Less) Discrete Modules 7-4 Discrete Relay Output Module Protection 7-4 High Density (32-Point) Discrete Module Features 7-6 Modules with Single 50-Pin Connector 7-6 Modules with Dual 24-Pin Connectors 7-7 Analog Module Features 7-8 Wiring Methods for Analog Modules 7-8 Analog Input Module Wiring Methods 7-5 Analog Output Module Wiring Methods 7-10		Super Capacitor Me	mory Backup	6-8
Embedded CPUs Battery Accessory Kit (IC693ACC315)		Maintaining RA	M Memory During Storage or Shipment of a CPU	6-9
Battery Accessory Kit (IC693ACC315)		Modular	CPUs	6-9
Battery Accessory Kit Installation 6-10 External Battery Module (IC693ACC302) 6-10 Batteries in Power Supplies on Expansion or Remote Racks 6-11 Chapter 7 Input/Output Modules 7-1 Basic I/O Module Types 7-1 Discrete I/O Modules 7-2 Discrete I/O Module Point Density 7-2 Standard Density Discrete I/O Module Features 7-2 Wiring Standard Density (16-Point or Less) Discrete Modules 7-4 Discrete Relay Output Module Protection 7-4 High Density (32-Point) Discrete Module Features 7-4 Wiring Methods for 32-Point Discrete I/O Modules 7-6 Modules with Single 50-Pin Connector 7-6 Modules with Dual 24-Pin Connector 7-7 Analog Module Features 7-8 Wiring Methods for Analog Modules 7-9 Analog Output Module Wiring Methods 7-9				
External Battery Module (IC693ACC302) 6-10 Batteries in Power Supplies on Expansion or Remote Racks 6-11 Chapter 7 Input/Output Modules 7-1 Basic I/O Module Types 7-1 Discrete I/O Modules 7-2 Discrete I/O Module Point Density 7-2 Standard Density Discrete I/O Module Features 7-2 Wiring Standard Density (16-Point or Less) Discrete Modules 7-4 Discrete Relay Output Module Protection 7-4 High Density (32-Point) Discrete Module Features 7-4 Wiring Methods for 32-Point Discrete I/O Modules 7-6 Modules with Single 50-Pin Connector 7-6 Modules with Dual 24-Pin Connector 7-7 Analog Module Features 7-8 Wiring Methods for Analog Modules 7-9 Analog Output Module Wiring Methods 7-9				
Batteries in Power Supplies on Expansion or Remote Racks 6-11 Chapter 7 Input/Output Modules 7-1 Basic I/O Module Types 7-1 Discrete I/O Modules 7-2 Discrete I/O Module Point Density 7-2 Standard Density Discrete I/O Module Features 7-2 Wiring Standard Density (16-Point or Less) Discrete Modules 7-4 Discrete Relay Output Module Protection 7-4 High Density (32-Point) Discrete Module Features 7-4 Wiring Methods for 32-Point Discrete I/O Modules 7-6 Modules with Single 50-Pin Connector 7-6 Modules with Dual 24-Pin Connector 7-8 Wiring Methods for Analog Modules 7-9 Analog Input Module Wiring Methods 7-9 Analog Output Module Wiring Methods 7-9 Analog Output Module Wiring Methods 7-9 Analog Output Module Wiring Methods 7-9	•			
Basic I/O Module Types				
Basic I/O Module Types	Chapter 7	Input/Output Mo	dules	7-1
Discrete I/O Modules				
Standard Density Discrete I/O Module Features 7-2 Wiring Standard Density (16-Point or Less) Discrete Modules 7-4 Discrete Relay Output Module Protection 7-4 High Density (32-Point) Discrete Module Features 7-4 Wiring Methods for 32-Point Discrete I/O Modules 7-6 Modules with Single 50-Pin Connector 7-6 Modules with Dual 24-Pin Connectors 7-7 Analog Module Features 7-8 Wiring Methods for Analog Modules 7-9 Analog Input Module Wiring Methods 7-9 Analog Output Module Wiring 7-10			- ·	
Wiring Standard Density (16-Point or Less) Discrete Modules 7-4 Discrete Relay Output Module Protection 7-4 High Density (32-Point) Discrete Module Features 7-4 Wiring Methods for 32-Point Discrete I/O Modules 7-6 Modules with Single 50-Pin Connector 7-6 Modules with Dual 24-Pin Connectors 7-7 Analog Module Features 7-8 Wiring Methods for Analog Modules 7-9 Analog Input Module Wiring Methods 7-9 Analog Output Module Wiring Methods 7-10		Discrete I/O Mo	odule Point Density	7-2
Wiring Standard Density (16-Point or Less) Discrete Modules 7-4 Discrete Relay Output Module Protection 7-4 High Density (32-Point) Discrete Module Features 7-4 Wiring Methods for 32-Point Discrete I/O Modules 7-6 Modules with Single 50-Pin Connector 7-6 Modules with Dual 24-Pin Connectors 7-7 Analog Module Features 7-8 Wiring Methods for Analog Modules 7-9 Analog Input Module Wiring Methods 7-9 Analog Output Module Wiring Methods 7-10		Standard Densit	y Discrete I/O Module Features	7-2
Discrete Relay Output Module Protection			-	
Wiring Methods for 32-Point Discrete I/O Modules 7-6 Modules with Single 50-Pin Connector 7-6 Modules with Dual 24-Pin Connectors 7-7 Analog Module Features 7-8 Wiring Methods for Analog Modules 7-9 Analog Input Module Wiring Methods 7-9 Analog Output Module Wiring 7-10		_	• •	
Wiring Methods for 32-Point Discrete I/O Modules 7-6 Modules with Single 50-Pin Connector 7-6 Modules with Dual 24-Pin Connectors 7-7 Analog Module Features 7-8 Wiring Methods for Analog Modules 7-9 Analog Input Module Wiring Methods 7-9 Analog Output Module Wiring 7-10		High Density (3	2-Point) Discrete Module Features	74
Modules with Single 50-Pin Connector 7-6 Modules with Dual 24-Pin Connectors 7-7 Analog Module Features 7-8 Wiring Methods for Analog Modules 7-9 Analog Input Module Wiring Methods 7-9 Analog Output Module Wiring 7-10				
Analog Module Features		Modules	with Single 50-Pin Connector	7-6
Wiring Methods for Analog Modules				
Analog Input Module Wiring Methods		-		
Analog Output Module Wiring				
I/O Module Power Supply Current Draw		Analog	Output Module Wiring	7-10
		I/O Module Power S	Supply Current Draw	7-10

GFK-0356Q

Contents

хi

	I/O Module Wire Routing	7-11
	Grouping Modules to Keep Wires Segregated	
	IC693DVM300 Digital Valve Driver Module	7 - 12
	Indicator LEDs	7-12
	DVM Specifications	
	Fuses	
Chapter 8	Option Modules	8-1
	Third-Party Option Modules and the Accompany Program	8-1
	Option Modules Discussed in this Chapter	
	IC693CMM301 Genius Communications Module (GCM)	
	Status LEDs.	
	GCM Documentation	
	IC693CMM302 Enhanced Genius Communications Module (GCM+)	
	Status LEDs	
	GCM+ Documentation	
	IC693BEM331 Genius Bus Controller (GBC)	
	Number of Genius Bus Controllers	
	Status LEDs	
	Compatibility	
	Series 90-30 PLC	
	Series Six PLC	
	Hand-Held Programmer	
	Genius I/O Blocks	
	Genius Bus	
	Diagnostics	
	Datagrams	8-9
	Global Data	8-9
•	Sending Global Data	
	Receiving Global Data	
	Genius Bus Controller Documentation	
	IC693BEM340 FIP Bus Controller (FBC) Module	
	Status LEDs	
	Serial Port	
	FIP Bus Connectors	
	IC693BEM330 FIP Remote I/O Scanner Module	8-12
	Features of the Remote I/O Scanner	8-12
	FIP Bus Interface	8-13
	Module Description	8-13
	Connectors	
	LEDs	
	FIP Remote I/O Scanner Documentation:	
	IC693APU301/302 Motion Mate Axis Positioning Module (APM)	

xii

Series 90TM 30 PLC Installation and Hardware Manual – August 2002

	APM Cables	8-16
	Motion Mate APM Module Documentation	8-16
	IC693DSM302 Motion Mate Digital Servo Module (DSM302)	8-17
	Features.	
	IC693DSM302 Documentation	
	IC693DSM314 Motion Mate Digital Servo Module (DSM314)	
	Features	
	IC693DSM314 Documentation	8-22
	IC693APU300 High Speed Counter (HSC) Module	8-23
	IC693BEM320 I/O LINK Interface (Slave) Module	8-24
	IC693BEM321 I/O LINK Master Module	8-25
	Compatibility	8-26
	IC693APU305 I/O Processor Module	
	Module Features	
	IC693CMM321 Ethernet Interface Module	
	IC693PCM300/301/311 Programmable Coprocessor Module (PCM)	8-31
	IC693CMM311 Communications Coprocessor Module (CMM)	8-34
	IC693ADC311 Alphanumeric Display Coprocessor (ADC)	8-35
	IC693TCM302/303 Temperature Control Modules (TCM)	8-37
	Connections	
	LED Indicators	
	Internal Fuse	
	Comparison of TCM302 and TCM303 Modules	
	IC693PTM100/101 Power Transducer (PTM)	
	Difference Between PTM100 and PTM101	
	Capabilities	
	Operating Modes	
	Automatic Data Transfers Between PTMPM and PLC	
	Compatibility	
	Dimensions	
	PTMPM Indicator LEDs	
	General Mounting Information	
	Baseplate Type and Allowable Number of PTMPM Modules	
	Power Supply Requirement	
	Memory Requirement	
	Configuration	
	Ordering Information	
	Documentation	8-43
Chapter 9	State Logic Products	9-1
	State Logic Overview	9-1
	State Logic Products	9-1
	Baseplates and Power Supply, I/O, and Option Modules	9-1

Contents

GFK-0356Q

Q-Pulse Id TMS1079

	AD693CMM301 State Logic S	erial Communications Module (SCM)	9-4
		ntation	
	_		
	_	essor Module	
	-		
	•		
	~		
		Documentation	
	_		
	Features of State Logic CPUs		
	Model CSE311, CSE313 and CSE323 Embedded CPU Baseplates		
	Model CSE331 and CSE340 Modular CPUs		9-10
	CPU Serial Port Connector on Power Supply		9-11
	Configuring the State Logic	CPUs	9-11
	State Logic CPU Firmware and PROM Configurations		9-13
	State Logic CPU Data Sheets		9-13
	CSE311	Catalog Number IC693CSE311	9-14
	CSE313	Catalog Number IC693CSE313	9-15
	CSE323	Catalog Number IC693CSE323	9-16
	CSE331	Catalog Number IC693CSE331	9-17
	CSE340	Catalog Number IC693CSE340	9-18
Chapter 10	Cables		10-1
		erface to Series 90 CPU (SNP Port) Cable	
	IC690CBL701 PCM, ADC, CN	MM to Workmaster (PC-XT) Cable	10-12
		Installation	
	_	, ADC, CMM Cable	
		, ADC, CMM Cable	
			10-14

Wiring Diagram	10-14
PCM to Programmer Cable Installation	10-15
IC690CBL705 Workmaster II (PS/2) to PCM, ADC, CMM Cable	10-16
Function of cable	10-1 <i>e</i>
Cable Specifications	
Wiring Diagram	10-16
PCM to Programmer Cable Installation	10-17
IC690CBL714A Multidrop Cable	10-18
Purpose	
Specifications	10-18
IC690CBL714A Multi-Drop Cable Wiring Diagram	10-19
Connection Diagrams for IC690CBL714A Cable	10-20
IC693CBL300/301/302/312/313/314 I/O Bus Expansion Cables	10-22
Description	
Cable Lengths	
Function of Cables	
Connecting the Cables	
Important Notes About I/O Bus Expansion Cables	
Cable Application Suggestions Using Standard Cables	
Using Custom Built cables	
Building Custom Length I/O Bus Expansion Cables	
Two Types of Custom Built Cables	
Components Needed to Build Custom Length I/O Bus Expansion Cables	10-24
Expansion Port Pin Assignments	
I/O Expansion Bus Termination	
Shield Treatment	
Alert for Users of Early Remote Baseplate Versions	
Making a 100% Shielded Cable	
Wiring Diagrams	
Application Examples Expansion System Cable Connections	
Remote and Expansion System Cable Connection Example	
IC693CBL303 Hand-Hand Programmer and Converter (IC690ACC900) Cable	
Function of cable	
Cable Specifications	
Wiring Diagram	
Connecting the Cable	10-34
IC693CBL304/305 Port Expansion (WYE) Cables for PCM, ADC, and CMM	10-35
Function of cable	10-35
Cable Specifications	
Wiring Information.	
· ·	
IC693CBL306/307 Extension Cables (50-Pin) for 32 Point Modules	
Function of cable	
Cable Specifications	
IC693CBL308/309 I/O Cables (50-Pin) for 32 Point Modules	10-40
Specifications	10-40
Wiring Information	10-40
- · · · · · · · · · · · · · · · · · · ·	

GFK-0356Q

Contents

ćν

	IC693CBL310 I/O Interface Cable (24-Pin) for 32 Point Modules	10-42
	Function of cable	10-42
	Replacement/Obsolescence Information	10-43
	Connector Depth for Cable IC693CBL310	10-43
	IC693CBL311/317/319/320 I/O Interface Cables for Power Mate APM Module	s 10-45
	Function of cable	10-45
	Specifications	10-45
	Wiring Information	10-46
	IC693CBL315 I/O Interface Cable (24-Pin) for 32 Point Modules	10-49
	Function of cable	10-49
	Building Custom Length Cables for 24-Pin Connectors	10-49
	Replacement/Obsolescence Information	10-51
	Connector Depth for IC693CBL315	
	IC693CBL316 Serial Cable, 9-Pin D-Shell to RJ-11 Connector	10-53
·	Description	10-53
	Typical Applications	10-53
	IC693CBL321/322/323 I/O Faceplate Connector to Terminal Block Connector,	24-Pin10-5
	Function of cable	
	Cable Specifications	
	Connector Depth	
	IC693CBL327/328 I/O Interface Cables with Right Angle 24-Pin Connector	10-57
	Description	10-57
	Applications	10-57
	Specifications	10-58
	Connector Depth for Cables IC693CBL327/328	
	Building Custom Length 24-pin Connector Cables	
	Connector Depth for Custom Built Cables	
	Possible Uses for These Cables (Factory or Custom Built)	
	IC693CBL329/330/331/332/333/334 Cables 24-Pin I/O Faceplate Connector to	
	Block Connector	
	Description	
	Connector Depth	
	Applications	
	IC693CBL340/341 PTM Interface Cables	
	Documentation	10-67
Chapter 11	Programmer Hardware Products	11-1
	Products Discussed in this Chapter	11-1
	IC640WMI310/320 Work Station Interface Boards	
	Replacing Workmaster Computers	
	IC690ACC900 RS-422/RS-485 to RS-232 Converter	
	IC690ACC901 Miniconverter Kit	
	IC693PRG300 Hand-Held Programmer (HHP)	
	HHP Features	
		11-0
i	Series 90™ 30 PLC Installation and Hardware Manual – August 2002	GFK-0356O

	HHP Memory Card (IC693ACC303)	11-6
	HHP Modes of Operation	
	Documentation	
	IC655CCM590 Isolated Repeater/Converter	
	IC690ACC903 Port Isolator	
Chapter 12	System Design	12-1
	Introduction	
	Step 1: Planning Your System	12-1
	Step 2: Determining I/O Requirements	
	Additional I/O Module Selection Factors	
	Step 3: Selecting Option Modules	
	Step 4: Selecting a CPU	
	Step 5: Selecting Baseplates	
	Step 6: Selecting Power Supplies	
	Reducing PLC Module Count by Using Other GE Fanuc Products	
	Designing For Safety	
	Protection From Electrical Shock	
	Fire Prevention	
	Protection From Mechanical Hazards	
	Protection From Electrical Failure	
	Protection From Design Changes or Overrides	
	Safety Documentation	
	Labeling, Guarding, and Lighting Issues	
	Equipment Accessibility Issues	
	Number of Modules Per Series 90-30 PLC System	
	Calculating Power Supply Loading	
	Load Requirements for Hardware Components	
	Power Supply Loading Calculation Examples	
	Scan (Sweep) Time Calculation	
	Major Design Factors Affecting Scan Time	
	Where to Find Scan Time Information	
	Calculating PLC Heat Dissipation	
	System Layout Guidelines	
	Benefits of a Good Layout - Safe, Reliable, and Accessible	
	PLC Rack Location and Clearance Requirement	
	Location of Modules in the PLC Racks	
	Allowable Module Locations	
	Series 90-30 PLC Layout Example	
	PLC Mounting Position	
	Recommended Upright Mounting Orientation	
	Derated Horizontal Mounting Orientation	12-21

GFK-0356Q

Contents

xvii

Chapter 13	Maintenance and Troubleshooting	13-1
	Troubleshooting Features of Series 90-30 Hardware	13-1
	Indicator Lights (LEDs) and Terminal Board	
	Module LED Indicators	13-2
•	Troubleshooting Features of Programming Software	13-3
	Ladder Screens	13-3
	Configuration Screens	13-3
	Fault Tables	13-3
	System Status References	13-3
	Reference Tables	13-4
	Override feature	13-4
	Sequential Event Recorder (SER), DOIO functional instruction	13-4
	Replacing Modules	13-5
	Series 90-30 Product Repair	13-5
	Module Fuse List	13-6
	Spare/Replacement Parts	13-7
	Preventive Maintenance Suggestions	13-8
	Getting Additional Help and Information	
Appendix A	Serial Ports and Cables	A-1
	RS-422 Interface	A-1
	Cable and Connector Specifications	A-2
	Series 90 PLC Serial Port	A-3
	Workmaster Serial Port	A-4
	RS-232/RS-485 Converter	A-7
	IC690ACC901 Miniconverter Kit	A-7
	IC690ACC900 Obsolete Converter	A-7
	Serial Cable Diagrams	A-8
	RS-232 Point-to-Point Connections	A-8
	RS-422 Point-to-Point Connection	A-10
	Multidrop Connections	A-10
Appendix B	IC690ACC900 Converter	B-1
	Features	B-1
	Functions	
	Location in System	
	Installation	B-2
	Cable Description	B-3
	RS-232 Interface Pin Assignments	
	RS-422/RS-485 Interface Pin Assignments	
	Logic Diagram	B-6
	Jumper Configuration	
xviii	Series 90™_30 PLC Installation and Hardware Manual – August 2002	GFK-0356Q

	Example of Cable Configurations	B-9
Appendix C	IC655CCM690 Isolated Repeater/Converter	
	Description of the Isolated Repeater/Converter	C-1
	Logic Diagram of the Isolated Repeater/Converter	
	Pin Assignments for the Isolated Repeater/Converter	C-4
	System Configurations	
	Simple Multidrop Configuration	
	Complex Multidrop Configuration	
	Rules for Using Repeater/Converters in Complex Networks	
	Cable Diagrams	
Appendix D	IC690ACC901 Miniconverter Kit	D-1
	Description of Miniconverter	D-1
	Pin Assignments	D-2
	Pin Assignments, RS-232 Port	
	Pin Assignments, RS-422 Port	D-2
	System Configurations	D-3
	Cable Diagrams (Point-To-Point)	D-3
Appendix E	IC690ACC903 Port Isolator	E-1
	Connectors	E-2
	Logic Diagram	E-3
	Installation	E-4
	Specifications	E-7
Appendix F	Calculating Series 90-30 Heat Dissipation	F-1
	Overview	
	Information Required	F-1
	Procedure	F-2
	Step 1: Basic Method to Calculate Module Dissipation	F-2
	Step 2: Calculation for PLC Power Supplies	
	Step 3: Output Calculations for Discrete Output Modules	
•	Step 4: Input Calculations for Discrete Input Modules	
	Step 5: Final Calculation	
	Other Information Related to Enclosure Sizing	F-6
Appendix G	Catalog Number to Publication Cross-Reference	
	General System Information	
	Analog I/O Modules	
	Baseplates	
	Communications Modules	G-3

	CPU Modules, CPU311-CPU341	G-3
	CPU Modules, CPU350 - CPU374	G-4
	Digital Valve Driver Module	G-5
	Discrete I/O Modules	G-5
	Genius Modules	G-6
	Motion Modules	G-6
	Other Option Modules	G-6
	Power Supply Modules	G-7
	Programming Device	G-7
	State Logic Products	
	Publication Revision Letters	
	Other Sources of Information	
Appendix H	Terminal Block Quick Connect Components	H-1
	Terminal Block Quick Connect Components for 16-Point Modules	
	Terminal Blocks	
	Cable Current Rating	
	Cable Selection and Cross-Reference	H-3
	I/O Face Plate for 16-Point Modules	H-3
	I/O Face Plate Installation	H-3
	Module Wiring Information	H-4
	Cable Information	H-4
	Connector Pin Orientation and Connection to Module Terminal	H-5
	Terminal Block Information	H-5
	IC693ACC329 TBQC Terminal Block	
	IC693ACC330 TBQC Terminal Block	
	IC693ACC331 TBQC Terminal Block IC693ACC332 TBQC Terminal Block	
	IC693ACC333 TBQC Terminal Block	
	Terminal Block Quick Connect Components for 32-Point Modules	
	Terminal Block	
	Cable Selection and Cross-Reference	
	Cable Current Rating	
	Cable Data	
	Terminal Block Data	
	IC693ACC337 TBQC Terminal Block	
Appendix I	SNP Multidrop	I-1
	SNP Multidrop Overview	I-1
	Multidrop Cables	I-2
	Limitations	I-2
	Cable and Connector Specifications	I-2
	MultiDrop Cable Wiring Diagram	7.0

Q-Pulse Id TMS1079

Series 90TM 30 PLC Installation and Hardware Manual – August 2002

	SNP Multidrop Examples	1-4
	Configuring and Connecting a Programmer to a Multidrop Network	I-5
	Assigning a PLC SNP ID to a PLC with Logicmaster	
	Connecting your Logicmaster Programmer to a PLC on a Multidrop System	I-6
	SNP Multidrop Troubleshooting	
Appendix J	Ethernet Transceivers	J-1
	IC649AEA102 Ethernet 10BASE-T Transceiver	J-1
	Power Requirement	
	LED Indicator Lights	
•	IC649AEA103 Ethernet 10BASE2 Transceiver	
	Power Requirement	
	LED Indicator Light	
Appendix K	Tables and Formulas	K-1
•	AWG to Metric Wire Size Conversion	K-2
	Temperature Conversion	
•	Formulas	
	Conversion Information	K-4
•	English and Metric Equivalents	K-5
Appendix L	44A420084-001 EMI Line Filter	L-1
	44A720084-001 Optional EMI Line Filter	L-1
	44 A 720084-001 Line Filter Mounting Dimensions	

GFK-0356Q

Contents

xxi

Figure 1-1. Five-Slot CPU Baseplate	1-3
Figure 1-2. Power Supply Module	1-3
Figure 1-3. CPU Module	1-4
Figure 1-4. I/O Module	1-4
Figure 1-5. Assembling the System	1-5
Figure 1-6. A Basic System	1-6
Figure 1-7. Ten-Slot Rack	1-6
Figure 1-8. I/O Bus Expansion Cable	1-7
Figure 1-9. Connecting Expansion and Remote Baseplates	1-8
Figure 1-10. Connecting PLCs Using GBC or CMM Modules	1-9
Figure 2-1. Features of Series 90-30 Module	2-2
Figure 2-2. Installing a Module	2-3
Figure 2-3. Removing a Module	2-4
Figure 2-4. Installing an I/O Module's Terminal Board	2-5
Figure 2-5. Removing a Module's Terminal Board	2-6
Figure 2-6. Terminal Board with Holding Screws	2-7
Figure 2-7. IC693ACC308 Front Mount Adapter Bracket Installation	2-9
Figure 2-8. Dimensions for 19-inch Rack Mounting Using IC693ACC308 Adapter Bracket	2-9
Figure 2-9. IC693ACC313 Recessed Mount Adapter Bracket	2-10
Figure 2-10. Recommended System Grounding	2-11
Figure 2-11. Baseplate Grounding	2-12
Figure 2-12. CPU 351 or 352 - Attaching Shield Ground Wire	2-14
Figure 2-13. CPU 351 or 352 - Mounting the Shield Grounding Bracket and Wire	2-15
Figure 2-14. CPU 363, CPU364, or CPU374 - Attaching Ground Wire	2-16
Figure 2-15. Power Supply Terminal Boards	2-24
Figure 2-16. Overvoltage Protection Devices and Jumper Strap	2-24
Figure 3-1. Common Baseplate Features	3-2
Figure 3-2. Models IC693CPU311 and IC693CPU313 (5-Slot) Embedded CPU Baseplates	3-5
Figure 3-3. Model IC693CPU323 (10-slot) Embedded CPU Baseplate	3-5
Figure 3-4. IC693CHS397 5-Slot Modular CPU Baseplate	3-6
Figure 3-5. IC693CHS391 10-Slot Modular CPU Baseplate	3-6
Figure 3-6. IC693CHS398 5-Slot Expansion Baseplate	3-7
Figure 3-7. IC693CHS392 10-Slot Expansion Baseplate	3-8
Figure 3-8. IC693CHS399 5-Slot Remote Baseplate	3-9
Figure 3-9. IC693CHS393 10-Slot Remote Baseplate	
Figure 3-10. I/O Bus Expansion Cables	3-10

xxii

Series 90^{TM} -30 PLC Installation and Hardware Manual – August 2002

Figure 3-11. Rack Number Selection Switch (Shown with Rack 2 Selected)	3-13
Figure 3-12. Example of Connecting Expansion Baseplates	3-14
Figure 3-13. Example of Connecting Expansion and Remote Baseplates	3-15
Figure 3-14. Model 311 and 313 5-Slot Baseplate Dimensions and Spacing Requirements	3-16
Figure 3-15. Model 323 10-Slot Baseplate Dimensions and Spacing Requirements	3-17
Figure 3-16. Modular CPU, Expansion, and Remote 5-Slot Baseplate Dimensions and Spacing Requirements	3-18
Figure 3-17. Modular CPU, Expansion, and Remote 10-Slot Baseplate Dimensions and Spacing Requirements	3-18
Figure 3-18. IC693ACC308 Front Mount Adapter Bracket Installation	3-20
Figure 3-19. Dimensions for 19" Rack Mounting Using IC693ACC308 Adapter Bracket	3-21
Figure 3-20. IC693ACC313 Recessed Mount Adapter Bracket	3-21
Figure 4-1. Standard AC/DC Input Power Supply - IC693PWR321	4-2
Figure 4-2. High Capacity AC/DC Input Power Supply - IC693PWR330	4-4
Figure 4-3. Overvoltage Protection Devices and Jumper Strap	4-6
Figure 4-4. Series 90-30 24/48 VDC Input Power Supply - IC693PWR322	4-7
Figure 4-5. Typical Efficiency Curve for 24/48 VDC Power Supply	4-8
Figure 4-6. Series 90-30 48 VDC Input Power Supply - IC693PWR328	4-10
Figure 4-7. Typical Efficiency Curve for IC693PWR328 Power Supply	4-11
Figure 4-8. Series 90-30 24 VDC Input High Capacity Power Supply - IC693PWR331	4-13
Figure 4-9. 5 VDC Current Output Derating for Temperatures above 50°C (122°F)	4-14
Figure 4-10. Overvoltage Protection Devices and Jumper Strap	4-17
Figure 4-11. Interconnection of Power Supplies	4-17
Figure 4-12. Timing Diagram for all Series 90-30 Power Supplies	4-18
Figure 4-13. Serial Port Connector	4-19
Figure 4-14. Backup Battery for RAM Memory	4-20
Figure 5-1. Models 311 and 313 (5-Slot) Embedded CPU Baseplates	5-2
Figure 5-2. IC693CHS397 5-Slot Modular CPU Baseplate	5-3
Figure 5-3. CPU Serial Port Connector on Power Supply	5-4
Figure 5-4. CPUs 351, 352, and 363	5-19
Figure 6-1. Backup Battery for RAM Memory	
Figure 6-2. Installing the Battery Accessory Kit	6-10
Figure 7-1. Example of Series 90-30 Standard Density Discrete Output Module	7-3
Figure 7-2. Example of 32-Point I/O Module (IC693MDL654) With Dual Connectors	7-5
Figure 7-3. Example of 32-Point I/O Module (IC693MDL653) With Single Connector	7-5
Figure 7-4. 50-PIN, 32 Point I/O Module Connection Method	7-6
Figure 7-5. Example of Series 90-30 Analog Current Output Module	7-9
Figure 7-6. IC693DVM300 Digital Valve Driver Module	7-12

Figure 8-1. The IC693CMM301 GCM Module	8-2
Figure 8-2. Genius Bus Wiring Schematic	8-3
Figure 8-3. Example of Genius Communications Network	8-3
Figure 8-4. Enhanced Genius Communications Module	8-4
Figure 8-5. Genius Bus Controller Module	8-6
Figure 8-6. Example of FIP I/O System Configuration	8-10
Figure 8-7. Series 90-30 FIP Bus Controller	8-11
Figure 8-8. Example of FIP Remote I/O Scanner System Configuration	8-12
Figure 8-9. FIP Bus Interface Module	8-13
Figure 8-10. Motion Mate APM Module	8-15
Figure 8-11. Example of Motion Mate APM Servo System	8-16
Figure 8-12. Motion Mate DSM302 Module	8-17
Figure 8-13. Motion Mate DSM314 Module	8-20
Figure 8-14. High Speed Counter (HSC)	8-23
Figure 8-15. Example of a Series 90-30 PLC in a Fanuc I/O LINK Configuration	
Figure 8-16. Example of I/O LINK Master System Configuration	8-25
Figure 8-17. I/O Processor Module	8-27
Figure 8-18. Ethernet Interface Module	8-29
Figure 8-19. Programmable Coprocessor Module (PCM)	8-31
Figure 8-20. Communications Control Module	8-34
Figure 8-21. Alphanumeric Display Coprocessor Module (ADC)	8-35
Figure 8-22. IC693TCM302/303 Temperature Control Module (TCM)	
Figure 8-23. IC693PTM100/101 Components	8-41
Figure 8-24. IC693PTM100/101 Component Mounting	8-42
Figure 9-1. AD693CMM301 State Logic Serial Communications Module	9-2
Figure 9-2. IC693CBL305 WYE Cable	9-3
Figure 9-3. IC693SLP300 State Logic Processor Module for Series 90-30	9-4
Figure 9-4. State Logic Processor Module User Details	9-6
Figure 9-5. Model CSE311 or CSE313 5-Slot Embedded CPU Baseplate	9-9
Figure 9-6. Model CSE323 10-Slot Embedded CPU Baseplate	
Figure 9-7. CPU Models CSE 331 or CSE 340	9-10
Figure 9-8. Serial Port Connector	9-11
Figure 10-1. Serial Port to Work Station Interface Board Cable Connection	10-8
Figure 10-2. Series 90 PLC to Workmaster II Serial Cable	10-9
Figure 10-3. Example of Multidrop Configuration with Converter	10-10
Figure 10-4. Series 90 PLC to Programmer 8-Wire Multidrop, Serial Data Configuration	10-1 i
Figure 10-5. PCM, ADC, or CMM to Workmaster or PC-XT Serial Cable	10-12

Figure 10-6.	PCM to Workmaster Computer or PC-XT Personal Computer	10-13
Figure 10-7.	PCM, ADC, or CMM to Workmaster or PC-AT Serial Cable	10-14
Figure 10-8. I	PCM to PC-AT Personal Computer	10-15
Figure 10-9. I	PCM, ADC, or CMM to Workmaster II or PS/2 Serial Cable	10-16
Figure 10-10.	PCM to Workmaster II Computer or PS/2 Computer	10-17
Figure 10-11.	Connecting Diagram for Multidrop Cable IC690CBL714A	10-19
Figure 10-12.	Multidrop Arrangement for Series 90-30 Redundant System	10-20
Figure 10-13.	Connecting CPU and APM to Programmer with IC690CBL714A Cable	10-20
Figure 10-14.	Multidrop Arrangement for Series 90-70 TMR Redundant System	10-21
Figure 10-15.	Detail of I/O Bus Expansion Cables	10-22
Figure 10-16.	How to use Split-Ring Ferrules for Foil and Braided Cable Shield	10-26
	Point-To-Point Cable Wiring for Continuous Shield Custom Length Cables	
Figure 10-18.	Point-To-Point Cable Wiring Diagram for Applications Requiring Less Noise Immunity	10-28
Figure 10-19.	Earlier Versions of Remote Baseplate Custom WYE Cable Wiring Diagram	10-29
Figure 10-20.	Current Remote baseplate (IC693CHS393/399) Custom Wye Cable Wiring Diagram	10-30
Figure 10-21.	Example of Connecting Expansion Baseplates	10-31
Figure 10-22.	Example of Connecting Expansion and Remote Baseplates	10-32
Figure 10-23.	Wiring Connections for IC693CBL303 and Custom-Built Cables	10-34
Figure 10-24.	Hand-Held Programmer Cable Connection to a Series 90-30 PLC	10-34
Figure 10-25.	Wye Cable	10-35
Figure 10-26.	Wye Cable Connections	10-36
	32 Point I/O Module to Weidmuller Terminal Block Assembly	
Figure 10-28.	IC693CBL310 Cable	10-42
Figure 10-29.	Dimensions for Depth of Connector in front of PLC	10-44
Figure 10-30.	I/O Connector Cable Specifications	10-45
	IC693CBL315 Cable	
Figure 10-32.	Dimensions for Depth of Connector in front of PLC	10-52
Figure 10-33.	IC693CBL316A Serial Cable Illustration and Connector Pinouts	10-53
Figure 10-34.	Connector Orientation on I/O Faceplate	10-55
Figure 10-35.	I/O Faceplate to Terminal Block Cable	10-55
Figure 10-36.	Dimensions for Depth of Connector in front of PLC	10-56
Figure 10-37.	C693CBL327/328 Cables	10-57
Figure 10-38.	Dimension for Depth of Connector for IC693CBL327/328	10-58
Figure 10-39.	Dimensions for Depth of Connector in front of PLC for Custom Built Cables	10-61
•	IC693CBL329/330/331/332/333/334 Cables	
Figure 10-41.	Dimension for Depth of Connector	10-63
Figure 10-42.	Figure IC693CBL340/341 PTM Interface Cables	10-65

GFK-0356Q

Contents

xxv

Figure 10-43. PTM Component Mounting and Cable Connection	10-65
Figure 11-1. WSI Board for the Workmaster II Computer	11-2
Figure 11-2. Location of WSI in a Series II 90-30 PLC System	11-2
Figure 11-3. Example of IC690ACC900 Converter Connection	11-3
Figure 11-4. IC690ACC901 Series 90 SNP Port to RS-232 Adapter	11-4
Figure 11-5. Hand-Held Programmer for the Series 90-30 PLC	11-5
Figure 11-6. Example of PCIF Interface to Series 90-30 I/O	11-7
Figure 12-1. Hard-Wired MCR Circuit Example	12-9
Figure 12-2. Allowable Location of Modules	12-19
Figure 12-3. Series 90-30 Example Layout	12-20
Figure 12-4. Recommended PLC Mounting Orientation	12-21
Figure 12-5. Derated PLC Mounting Orientation	12-21
Figure 13-1. Relationship of Indicator Lights to Terminal Board Connections	13-1
Figure A-1. Series 90 PLC, RS-422 Serial Port Connector Configuration	A-3
Figure A-2. Workmaster RS-232 Serial Port Connector Configuration	A-4
Figure A-3. IBM-AT/XT Serial Port	A- 5
Figure A-4. IBM-AT (compatibles) Personal Computer to Series 90 PLCs	A -9
Figure A-5. Workmaster or IBM-XT (compatibles) Personal Computer to Series 90 PLCs	A-9
Figure A-6. Typical RS-422, Host to PLC Connection, with Handshaking	
Figure A-7. Workmaster II/Series 90 PLC Multidrop Connection	A- 11
Figure A-8. Workmaster/Series 90 PLC Multidrop Connection	A-12
Figure A-9. IBM-AT/Series 90 PLC Multidrop Connection	A-12
Figure A-10. IBM-XT/Series 90 PLC Multidrop Connection	A-13
Figure B-1. Front and Rear View of Converter	B-2
Figure B-2. Typical Configuration with Series 90-70 PLC	B-3
Figure B-3. Typical Configuration with Series 90-30 PLC	B-4
Figure B-4. RS-422/RS-485 to RS-232 Converter Logic Diagram	B-6
Figure B-5. Location of Jumpers for User Options	B-7
Figure C-1. Isolated/Repeater Converter	C-2
Figure C-2. RS-422 Isolated Repeater/RS-232 Converter Logic Diagram	C-3
Figure C-3. Example RS-422 Isolated Repeater/RS-232 Converter Connection	C-5
Figure C-4. Simple System Configuration Using the Isolated Repeater/Converter	C-6
Figure C-5. Complex System Configuration Using the Isolated Repeater/Converter	C-6
Figure C-6. Cable A; RS-232 CMM To Converter	C-8
Figure C-7. Cable B; RS-422 CMM To Converter	C-8
Figure C-8. Cable C; RS422 Twisted Pair	C-9
Figure C-9. Cable D; RS-422 Twisted Pair	C-10

xxvi

Series 90TM 30 PLC Installation and Hardware Manual - August 2002

Figure C-10. Cable E; RS-232 Converter to CMM	C-10
Figure D-1. Series 90 SNP to RS-232 Miniconverter	D-1
Figure D-2. Miniconverter to PC-AT	D-3
Figure D-3. Miniconverter to Workmaster II, PC-XT, PS/2	D-3
Figure D-4. Miniconverter to 9-Pin Workmaster or PC-XT Computer	D-4
Figure E-2. IC690ACC903 Block Diagram	E-3
Figure E-3. RS-485 Port Isolator in PLC Network	E-4
Figure E-4. Mounting Port Isolator to Panel	E-4
Figure E-5. Multidrop Configuration Connecting Devices with 15-Pin Ports and 25-Pin Ports	E-5
Figure E-6. Cable for Supplying External Power Through the Port Isolator	E-6
Figure H-1. Typical TBQC Terminal Block	H-1
Figure H-2. TBQC Faceplate	H-5
Figure H-3. IC693ACC329 TBQC Terminal Block	H-6
Figure H-4. IC693ACC330 TBQC Terminal Block	H-7
Figure H-5. IC693ACC331 TBQC Terminal Block	H-8
Figure H-6. IC693ACC332 TBQC Terminal Block	H-9
Figure H-7. IC693ACC333 TBQC Terminal Block	H-10
Figure H-8. IC693MDL654 32-Point Module	H-11
Figure H-9. IC693ACC337 TBQC Terminal Block	H-13
Figure I-1. Series 90-30 Multidrop Example	I-1
Figure I-2. Multidrop Cable Wiring Diagram	I-3
Figure I-3. Connecting CPU and APM to Programmer with IC690CBL714A Cable	I-4
Figure I-4. Multidrop Arrangement for Series 90-70 TMR Redundant System	I-4
Figure I-5. Multidrop Arrangement for Series 90-30 Redundant System	I-5
Figure J-1. IC649AEA102 Ethernet 10BASE-T Transceiver	J-1
Figure J-2. IC649AEA103 Ethernet 10BASE2 Transceiver	J-2
Figure L-1. 44A720084-001 Line Filter Connections to Series 90-30 Power Supply	L-2
Figure L-2. Equivalent Circuit for 44A720084-001 Line Filter	L-2
Figure I 2 44A 720084 001 I in Filter Mounting Dimensions	т э

GFK-0356Q

Contents

xxvii

Table 3-1. Rack Number Selection Switch Settings	3-13
Table 3-2. Series 90-30 Baseplate Comparison	3-22
Table 4-1. Power Supply Comparison	
Table 4-2. IC693PWR321 Power Supply Capacities	4-2
Table 4-3. Specifications for IC693PWR321 Standard AC/DC Input Power Supply	
Table 4-4. IC693PWR330 Power Supply Capacities	4-4
Table 4-5. Specifications for IC693PWR330 High Capacity AC/DC Input Power Supply	4-5
Table 4-6. IC693PWR322 Power Supply Capacities	4-7
Table 4-7. Specifications for IC693PWR322 Power Supply	4-8
Table 4-8. IC693PWR328 Power Supply Capacities	4-10
Table 4-9. Specifications for IC693PWR328 Power Supply	4-11
Table 4-10. IC693PWR331 Power Supply Capacities	
Table 4-11. Specifications for IC693PWR331 Power Supply	4-14
Table 5-1. CPU Firmware and PROM Configurations	5-6
Table 5-2. EPROM and EEPROM Catalog Numbers	5- 9
Table 5-3. Series 90-30 CPU Capacities	5-10
Table 5-4. Range and Size of User References for CPU Models 311-341	5-11
Table 5-5. Range and Size of User References for CPU Models 350 through 374	5-12
Table 5-6. Port 1 (RS-232)	5-22
Table 5-7. Port 2 (RS-485)	5-22
Table 7-1. IC693DVM300 Specifications	7-13
Table 7-2. IC693DVM300 Connections	7-14
Table 7-3. Series 90-30 Discrete I/O Modules	7-15
Table 7-4. Series 90-30 Analog I/O Modules	7-16
Table 8-1. Comparison of TCM302 and TCM303	8-39
Table 9-1. System Specifications for Series 90-30 State Logic CPUs	9-12
Table 10-1. Series 90-30 Cable Cross-Reference	10-1
Table 10-2. Expansion Port Pin Assignments	10-25
Table 10-3. Wire List for 32 Point I/O Cables	10-40
Table 10-4. Wire List for 24-Pin Connectors	10-43
Table 10-5. Catalog Numbers for 24-Pin Connector Kits	10-46
Table 10-6. I/O Cable Wire Coding for IC693CBL311 and IC693CBL319	10-47
Table 10-7. I/O Cable Wire Coding for IC693CBL317 and IC693CBL320	10-48
Table 10-8. Catalog Numbers for 24-Pin Connector Kits	10-50
Table 10-9. Wire List for 24-Pin Connectors	10-51
Table 10-10. Catalog Numbers for 24-Pin Connector Kits	10-59

Table 10-11. Wire List for 24-Pin Connectors	10-60
Table 10-12. TBQC Cable Cross-Reference Table	10-63
Table 11-1. Personal Computer Interface Card Comparison Table	11-7
Table 12-1. Power Supply Feature Comparison Table	12-6
Table 12-2. Maximum Number of Modules Per System	12-11
Table 12-3. Load Requirements (in milliamps)	12-12
Table 13-1. Fuse List for Series 90-30 Modules	13-6
Table 13-2. Spare/Replacement Parts	13-7
Table A-1. Connector/Cable Specifications	A-2
Table A-2. Series 90 PLC, RS-422 Serial Port Pin-out	A-4
Table A-3. Workmaster RS-232 Serial Port Pins-out	A-5
Table A-4. IBM-AT/XT Serial Port Pins-out	A-6
Table B-1. RS-232 Interface for Converter	B-4
Table B-2. RS-422/RS-485 Interface for Converter	B-5
Table B-3. Jumper Configuration for RS-422/RS-485 to RS-232 Converter	B-8
Table B-4. Specifications for IC690ACC900 Converter	B-9
Table C-1. Isolated Repeater/Converter Pin Assignments	C-4
Table D-1. Miniconverter RS-232 Port	D-2
Table D-2. Miniconverter RS-422 Port	D-2
Table D-3. Miniconverter Specifications	D-4
RS-485 Connectors	E-2
Table H-1. TBQC Terminal Block Selection Table	H-2
Table I-1. Connector and Cable Specifications	I-2
Table K-1. Standard ASCII (American Standard Code for Information Interchange) Codes	K-1
Table K-2. AWG to Metric Wire Size Conversion	K-2
Table K-3. Celsius to Fahrenheit Conversion	K-3
Table K-4. General Conversions	K-4
Table K-5. Length Equivalents	K-5
Table K-6. Area Equivalents	K-5
Table K-7. Volume Equivalents I	K-6
Table K-8 Volume Equivalents II	K-6

Chapter 1

Overview of the Series 90-30 PLC

The Series 90[™]-30 Programmable Logic Controller (PLC) is a member of the GE Fanuc Series 90 PLC family.

The Basic Parts of a Series 90-30 PLC

The Series 90-30 PLC is very versatile because (1) it is programmable, and (2) it is assembled from a wide variety of modular, plug-together components. Therefore, by choosing the correct components and developing an appropriate program, the PLC can be used for an almost unlimited variety of applications. Although there are many choices of individual hardware components to use in a system, there are just a few basic categories. Each of these component categories is covered in detail in a separate chapter in this manual. They are introduced in this chapter so you can see how they fit together:

- Baseplates
- Power Supplies
- CPUs
- I/O Modules
- Option Modules
- Cables

Baseplates

The baseplates are the foundation of the PLC system because most other components mount on them. As a basic minimum, every system has at least one baseplate, which usually contains the CPU (in which case, it is referred to as "the CPU Baseplate"). Many systems require more modules than can be mounted on one baseplate, so there are also Expansion and Remote baseplates that connect together. The three categories of baseplates, CPU, Expansion, and Remote, are available in two sizes, 5-slot and 10-slot, named according to the number of modules they can hold.

Power Supply Modules

Every baseplate must have its own power supply. The power supply always mounts in a baseplate's left-most slot. There are several power supply models available to meet a variety of requirements.

GFK-0356Q

1-1

CPUs

The CPU is the manager of the PLC. Every PLC system must have one. A CPU uses the instructions in its firmware and application program to direct the PLC's operation and to monitor the system to make sure there are no basic faults. Some Series 90-30 CPUs are built into baseplates, but most are contained in plug-in modules. In some cases, the CPU resides in a Personal Computer using a Personal Computer Interface Card that interfaces to Series 90-30 Input, Output, and Option modules.

Input and Output (I/O) Modules

These modules enable the PLC to interface with input and output field devices such as switches, sensors, relays, and solenoids. They are available in both discrete and analog types.

Option Modules

These modules extend the capability of the PLC beyond the basic functions. These provide such things as communications and networking options, motion control, high speed counting, temperature control, interfacing to operator interface stations, etc.

Cables

These connect the PLC components together or to other systems. Many standard prefabricated cables are available from GE Fanuc. They are primarily used to:

- Interconnect baseplates
- Connect a programmer to the CPU or to an option module
- Connect option modules to field devices or other systems.

Assembling a Basic Series 90-30 PLC System

Let's assemble, on paper, a basic system using the following components:

- Baseplate
- Power Supply module
- CPU module
- Some I/O modules

We'll start with the **baseplate**. To keep it simple, we'll use a 5-slot size. Note that a 5-slot baseplate actually has six slots, but the power supply slot is not numbered. Note also, that this baseplate has a CPU slot, which is slot number 1, and it has an expansion connector on the right end, which is used for connecting to another baseplate if the system has more than one baseplate.

1-2

Series 90-30 PLC Installation and Hardware Manual - August 2002

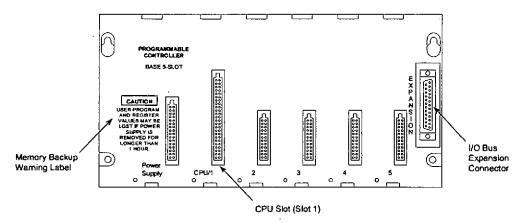


Figure 1-1. Five-Slot CPU Baseplate

Next, we'll add a power supply module. It mounts in the unnumbered slot on the left end of the baseplate. This slot has a unique connector that will only fit a power supply module.

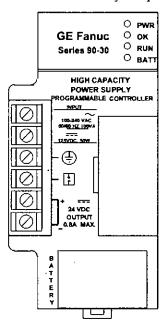


Figure 1-2. Power Supply Module

GFK-0356Q

Chapter 1 Overview of the Series 90-30 PLC

1-3

1

Then add a CPU module. A CPU module can only mount in baseplate slot 1, next to the power supply. Slot 1 has a unique connector that will only fit CPU or special Option modules.



Figure 1-3. CPU Module

To finish, we will add some I/O modules to baseplate slots 2 through 5.



Figure 1-4. VO Module

1-4

Series 90-30 PLC Installation and Hardware Manual - August 2002



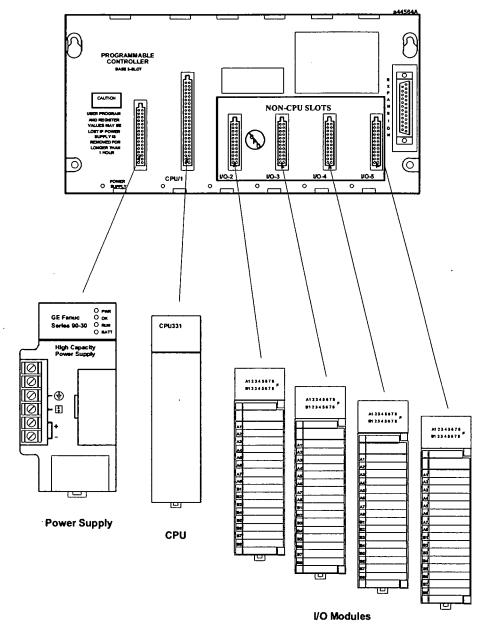


Figure 1-5. Assembling the System

When assembled, the system will look like this:

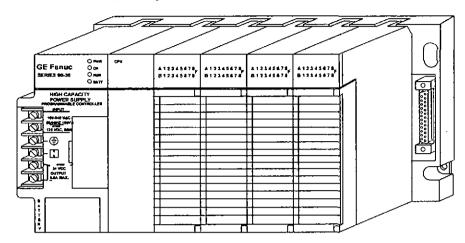


Figure 1-6. A Basic System

An assembly of baseplate and modules such as this one is called a "Rack."

What else would be needed to make this basic system functional?

To make this basic system functional, you would need:

- Mounting. Safe, secure mounting for the PLC in a protective enclosure.
- Wiring. This includes properly installed incoming power to the power supply, as well as wiring from the I/O modules to field devices such as switches, sensors, solenoids, relays, etc.
- **Program**. An application program for the PLC to run. This is developed with GE Fanuc PLC programming software.

What if the application requires more than five modules?

You could use a 10-slot baseplate, shown in the next picture:

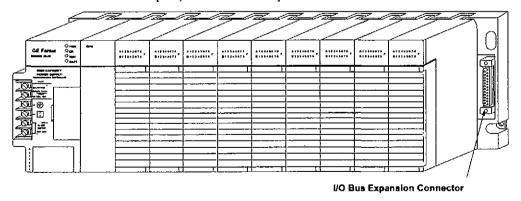


Figure 1-7. Ten-Slot Rack

Series 90-30 PLC Installation and Hardware Manual - August 2002

GFK-0356Q

Q-Pulse Id TMS1079

What if the application requires more than ten modules?

You can add one or more Expansion or Remote racks to this system. Some CPUs can support up to seven additional racks. If you added seven additional 10-slot racks, you could have 70 more modules.

Racks are interconnected in a "daisy-chain" cabling arrangement. This interconnection system is called the "I/O Expansion Bus." The connections are made from one baseplate's I/O Bus Expansion Connector (shown in the figure above) to the next one's. The I/O Bus Expansion Cables, shown below, have a double connector on one end to facilitate these connections.

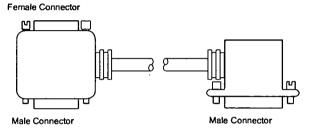


Figure 1-8. I/O Bus Expansion Cable

The next figure shows a system that has a CPU baseplate, one Expansion rack and three Remote racks. Notice that the last rack, the one at the end of the I/O Expansion Bus, must be terminated. A convenient way of terminating the bus is with an IC693ACC307 I/O Bus Terminator Plug, as shown.

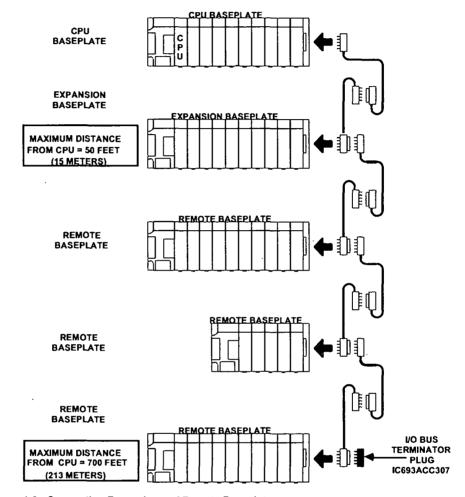


Figure 1-9. Connecting Expansion and Remote Baseplates

What is the Difference Between Expansion and Remote baseplates?

The main factor to consider is distance. How far will the baseplate be from the CPU baseplate? If the cabling distance from the CPU baseplate is 50 feet (15 meters) or less, use an Expansion baseplate. The Expansion baseplate is preferable because of its higher communication speed with the CPU baseplate. However, if a baseplate must be located where it requires a cabling distance from the CPU rack in excess of 50 feet, an Expansion baseplate will not work - a Remote baseplate must be used. The limit for a Remote baseplate is a cabling distance of 700 feet (213 meters) from the CPU baseplate to the farthest Remote baseplate.

1-8

Series 90-30 PLC Installation and Hardware Manual - August 2002

What if I need to cover more than 700 feet (213 meters)?

You can cover much greater distances by using Series 90-30 communications option modules. For example, Genius Bus Controller Modules (GBC) can communicate at distances up to 7,500 feet (2,286 meters) over a shielded twisted-pair cable, as shown in Example 1 below. Or, serial communications with Communications Coprocessor Modules (CMM) using the RS-485 standard can cover up to 4,000 feet (1,219 meters), as shown in Example 2 below. And virtually unlimited communication distances can be attained with modems and telephone lines or radio transmitters. Also, there are numerous networking options available such as Ethernet or WorldFIP.

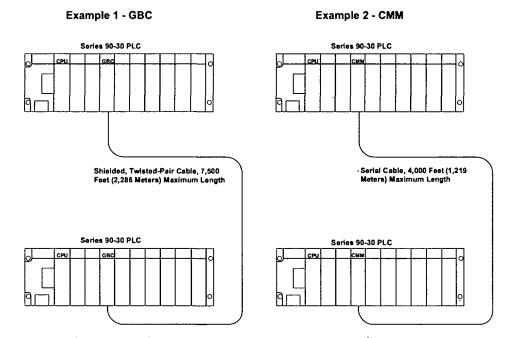


Figure 1-10. Connecting PLCs Using GBC or CMM Modules

Page 251 of 469

Chapter

2

Installation

This chapter discusses installation details only. Other information about the products such as hardware descriptions and specifications, is covered in the applicable chapters.

Important Note

Series 90-30 PLCs must be mounted in a protective enclosure.

The installation instructions described in this chapter apply to PLC installations that do not require special procedures for noisy or hazardous environments. For installations that must conform to more stringent requirements (such as CE Mark), see GFK-1179, Installation Requirements for Conformance to Standards. Also see GFK-0867, GE Fanuc Product Agency Approvals, Standards, General Specifications.

Receiving your Products - Visual Inspection

When you receive your Series 90-30 PLC system, carefully inspect all shipping containers for damage that may have occurred during shipping. If any part of the system is damaged, notify the carrier immediately. The damaged shipping container should be saved as evidence for inspection by the carrier.

As the consignee, it is your responsibility to register a claim with the carrier for damage incurred during shipment. However, GE Fanuc will fully cooperate with you if such action is necessary.

Pre-installation Check

After unpacking Series 90-30 PLC racks, cables, modules, etc., record all serial numbers. Serial numbers are printed on the module packaging. Serial numbers are required to make a claim during the warranty period of the equipment. All software product registration cards should be completed and returned to GE Fanuc. See "Module Features" in this chapter for location of module serial numbers. See "Common Baseplate Features" in chapter 3 for location of baseplate serial numbers.

You should verify that all components of the system have been received and that they agree with your order. If the parts received do not agree with your order, call Programmable Control Customer Service at 1-800-432-7521. A Customer Service representative will provide further instructions.

If you require assistance with your installation, GE Fanuc's Technical Support department offers expert help. Call the support number for your area from the list in Chapter 13, "Maintenance and Troubleshooting." The GE Fanuc web site support address is www.gefanuc.com/support/plc.

Warranty Claims

Record the serial number of the defective item and contact your distributor for instructions.

GFK-0356Q

2-1

Working with Series 90-30 Modules

Module Features

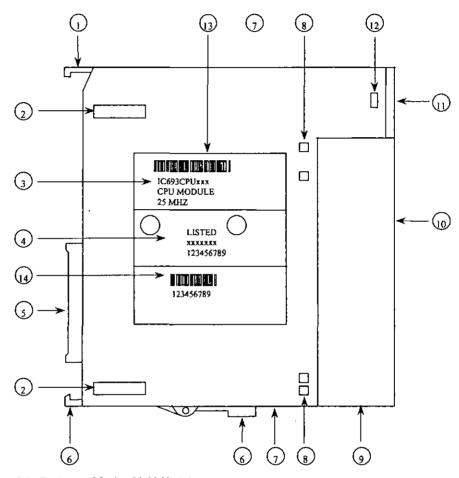


Figure 2-1. Features of Series 90-30 Module

- Pivot hook
- 2. Circuit board holding tabs (two on each side of module)
- 3. Catalog number and description section of label (Includes MAC address for CPU374.)
- 4. Certification (UL, CE, etc.) section of label
- 5. Module connector plugs into baseplate backplane connector
- 6. Release lever spring loaded
- 7. Ventilation openings in module case (top and bottom)
- 8. Front cover holding tabs (two on each side of module)
- Front cover (shown) or terminal board (for I/O modules).
- 10. Front cover faceplate or hinged cover for terminal board.
- 11. Lens cap (some modules do not have).
- 12. Lens cap holding tabs (one on each side of module)
- 13. Module label
- 14. Serial Number used to determine module warranty status. (On some modules, the Serial Number may be on a small tag on the back of the module.)

2-2

Series 90-30 PLC Installation and Hardware Manual - August 2002

Installing a Module

Warning

Do not insert or remove modules with power applied. This could cause the PLC to stop or malfunction. Injury to personnel and damage to the module or baseplate may result. Also, attempts to force a module into an improper slot type will result in damage to the module and/or the baseplate. Modules will mount in the correct slot type easily, with a minimum of force.

Use the following instructions as a guide when inserting a module into a baseplate slot.

- Check that module catalog number matches slot configuration. Each slot is, or will be, assigned a particular module type during configuration. A Power Supply module must be installed in the left end unnumbered slot only, and a CPU module and some special Option modules can only be installed in Slot 1 of a CPU baseplate. I/O Modules and most Option modules install in slots numbered 2 and higher.
- Grasp the module firmly with terminal board toward you and with rear pivot hook facing away from you.
- Align the module with the desired baseplate slot and connector. Tilt the module upwards so that top rear pivot hook of the module engages the baseplate's top module retainer.
- Swing the module downward until the module's connector engages the baseplate's backplane connector, and the release lever on the bottom of the module snaps into place in the baseplate's bottom module retainer.
- Visually inspect the module to be sure that it properly seated.

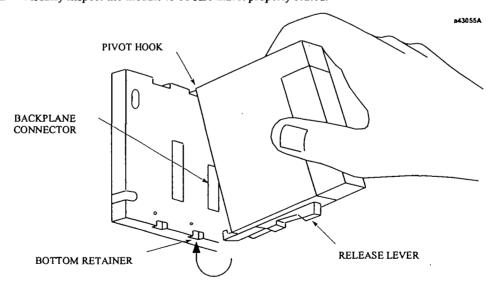


Figure 2-2. Installing a Module

GFK-0356Q

Chapter 2 Installation

Removing a Module

Warning

Do not insert or remove modules with power applied. This could cause the PLC to stop or malfunction. Injury to personnel and damage to the module or baseplate may result. Also potentially dangerous voltages from user devices may be present on a module's screw terminals even though power to the rack is turned off. Care must be taken any time that you are handling the module's removable terminal board or any wires connected to it.

- If the module has wiring, remove the module's terminal board (NOTE: You do not have to unwire the terminal board) or cables. The procedure for removing a terminal board is described later in this section.
- Locate the release lever at the bottom of the module and firmly press it up, towards the module.
- While holding the module firmly at its top and fully depressing release lever, swing (pivot) the module upward (release lever must be free of its retaining slot).
- Disengage pivot hook at the top rear of the module by moving the module up and away from the baseplate.

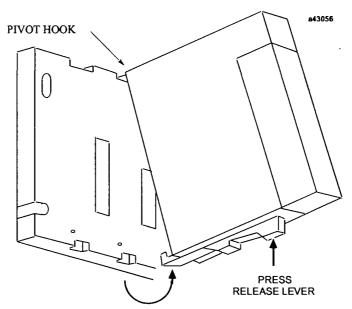


Figure 2-3. Removing a Module

Note

Modules in expansion or remote baseplates can be added, removed, or replaced while the PLC is in RUN mode if power is first removed from the expansion or remote baseplate. I/O data to/from this baseplate will not be updated while power is removed.

2-4

Series 90-30 PLC Installation and Hardware Manual - August 2002

Installing a Module's Terminal Board

Note: Modules IC693MDL730F (and later) and IC693MDL731F (and later) have special terminal boards that are equipped with holding screws. For Installation and Removal instructions, please see the section "Installing and Removing Terminal Boards with Holding Screws" later in this chapter.

To install a terminal board (circled numbers refer to drawing below):

- Hook the pivot hook ①, located on the bottom of the terminal board, to the lower slot on the module.
- Push the terminal board toward the module @ until it snaps into place.
- Open the terminal board cover ③ and ensure that the latch on the module is securely holding the terminal board in place.

Caution

Compare the module catalog number on the label on the back of the hinged door (see Figure 2-6) and the label on the side of the module (see below) to ensure that they match. If a wired terminal board is installed on the wrong module type, damage to the module may occur when the system is powered up.

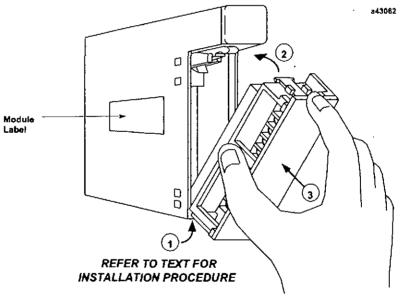


Figure 2-4. Installing an I/O Module's Terminal Board

GFK-0356Q

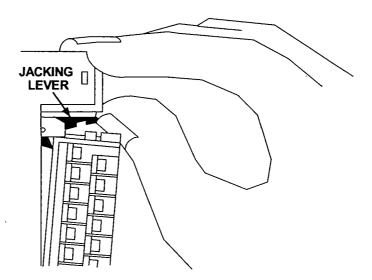
Q-Pulse Id TMS1079

Chapter 2 Installation

Removing a Module's Terminal Board

To remove a terminal board:

- Open the plastic terminal board cover.
- Push up on the jacking lever to release the terminal block.



Grasp pull-tab and pull it towards you until contacts have separated from module housing and bottom pivot hook has disengaged.

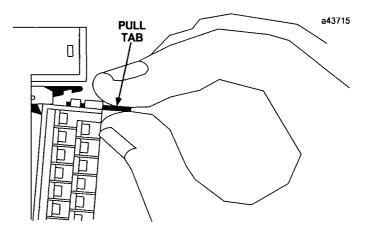


Figure 2-5. Removing a Module's Terminal Board

Series 90-30 PLC Installation and Hardware Manual – August 2002

GFK-0356Q

Q-Pulse Id TMS1079

I/O Module Terminal Board Posts

The terminal board has three posts on the left side. The top and bottom posts hold the terminal board cover in place. The middle post keeps the terminal board wiring in place. If you do not require it to hold the wiring in place, the middle post can be easily snapped off. (Be careful that you do not inadvertently snap it off if you need it to keep your wiring in place.)

Installing and Removing Terminal Boards with Holding Screws

Discrete output modules IC693MDL730F (and later) and IC693MDL731F (and later) have a special terminal board that is equipped with holding screws, shown in the figure below. These screws prevent the terminal board-to-module connections from deteriorating in applications where the PLC is subjected to severe vibration.

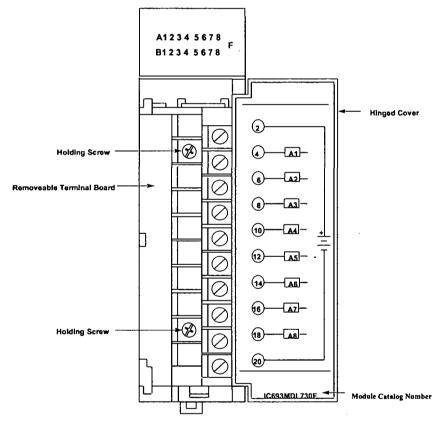


Figure 2-6. Terminal Board with Holding Screws

- Removing: To Remove these terminal boards, first loosen the two holding screws on the front of the terminal board, then follow the standard removal instructions in the section "Removing an I/O Module's Terminal Board." The holding screws are held captive in the terminal board and do not have to be completely removed.
- Installing: To install these terminal boards, follow the standard installation instructions in the section "Installing an I/O Module's Terminal Board," then tighten the two holding screws to 8 to 10 inch-pounds (1 Newton-meter) of torque.

GFK-0356Q

Chapter 2 Installation

Baseplate Mounting

Warning

Be sure to follow baseplate grounding instructions in this chapter. Failure to properly ground the PLC can result in improper operation, damage to equipment, and injury to personnel.

Mounting a Baseplate to a Panel

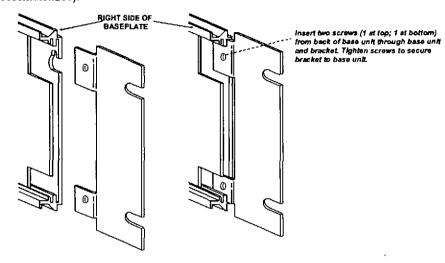
- Use four good-quality 8-32 x 1/2 (4 x 12mm) machine screws, lock washers and flat washers. Install the screws in four tapped holes. The "Baseplates" chapter has the applicable dimensions and mounting clearances. Alternately, 10-slot baseplates can be mounted in standard 19-inch racks by using the appropriate adapter. This is also discussed in the "Baseplates" chapter.
- A vertical mounting orientation is preferred for maximum heat dissipation. Other mounting orientations will require derating the Power Supply current capabilities. See Chapter 12, "System Design," for details.
- All baseplates must be grounded. The "Baseplate Safety Grounding" section of this chapter has details.
- The Rack Number Selection switch must be set on each Expansion or Remote baseplate. A CPU baseplate does not require this switch. Rack numbers should be assigned by the system designer. Failure to set the Rack Number Selection switches properly will result in system malfunction. See the "Baseplates" chapter for details on setting these switches.

Mounting a Baseplate to a 19" Rack

Two optional Baseplate Adapter Brackets allow a 10-slot baseplate to be mounted in a 19 inch rack. Each baseplate installation requires only one of the adapter brackets.

IC693ACC308 Front Mount Adapter Bracket. Used to mount a baseplate to the front face of a 19" rack. Install the adapter bracket by inserting the tabs at the top and bottom of the adapter bracket into the corresponding slots at the top and bottom of the plastic baseplate cover. NOTE: Although Figure 2-7 shows the plastic baseplate cover removed, this is for illustration purposes only. It is not necessary to remove the cover to install the bracket. With the bracket in place, insert and tighten the two screws (included with the bracket) through the back of the baseplate holes into the threaded holes in the bracket.

■ IC693ACC313 Recessed Mount Adapter Bracket. Used to recess mount a baseplate inside a 19" rack. A baseplate mounts on the rear panel of this adapter bracket using four 8-32 (4mm) screws, nuts, lock washers, and flat washers. The Adapter Bracket bolts through its four slotted holes to the face of the 19" rack using applicable hardware (lock washers recommended).



Note: Baseplate is shown with cover removed for illustration purposes. It is not necessary to remove the baseplate cover to install the bracket.

Figure 2-7. IC693ACC308 Front Mount Adapter Bracket Installation

Dimensions for rack mounting a 10-slot baseplate with the IC693ACC308 Front Mount Adapter Bracket are shown in the following figure.

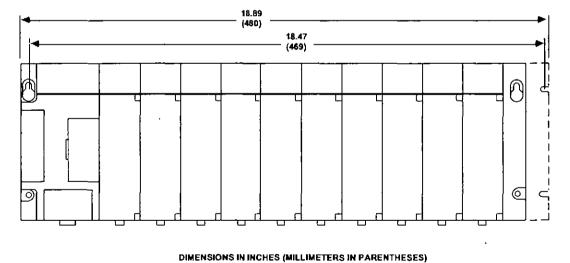


Figure 2-8. Dimensions for 19-inch Rack Mounting Using IC693ACC308 Adapter Bracket

GFK-0356Q

Chapter 2 Installation

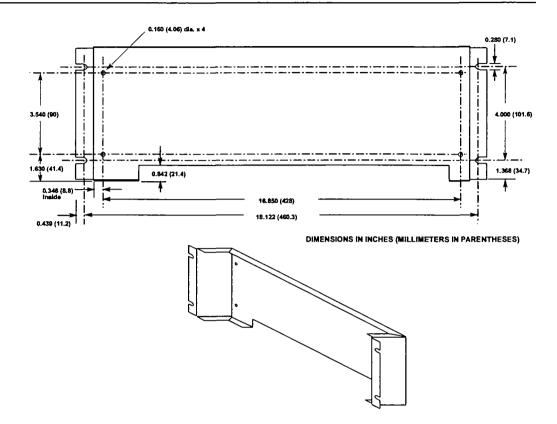


Figure 2-9. IC693ACC313 Recessed Mount Adapter Bracket

Grounding Procedures

System Grounding Procedures

Warning

In addition to the following grounding information, we strongly urge that you follow all applicable codes that apply to your area. For example, in the United States, most areas have adopted the National Electrical Code standard and specify that all wiring conform to its requirements. In other countries, different codes will apply. For maximum safety to personnel and property you must follow these codes. Failure to do so can mean injury or death to personnel, damage to property, or both.

All components of a programmable logic control system and the devices it is controlling must be properly grounded. This is particularly important for the following reasons.

- A low resistance path from all parts of a system to earth minimizes exposure to shock in the event of short circuits or equipment malfunction.
- The Series 90-30 PLC system requires proper grounding for correct operation.

Ground Conductors

- Ground conductors should be connected in a tree fashion with branches routed to a central earth ground point, shown in the figure below. This ensures that no ground conductor carries current from any other branch. This method is shown in the following figure.
- Ground conductors should be as short and as large in size as possible. Braided straps or ground cables (typically green insulation with a yellow tracer AWG #12 (3.3 mm²) or larger) can be used to minimize resistance. Conductors must always be large enough to carry the maximum short circuit current of the path being considered.

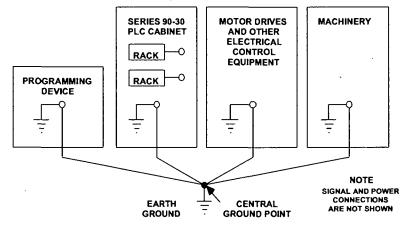


Figure 2-10. Recommended System Grounding

GFK-0356Q

Chapter 2 Installation

Series 90-30 PLC Equipment Grounding

Equipment grounding recommendations and procedures are listed below. These grounding procedures must be properly followed for safe, proper operation of your Series 90-30 PLC system.

Baseplate Safety Grounding

The following recommendations are offered, but applicable safety codes for your area or equipment type should also be consulted. The baseplate's metal back must be grounded using a separate conductor; the baseplate mounting screws are not considered to an acceptable ground connection by themselves. Use a minimum AWG #12 (3.3 mm²) wire with a ring terminal and star lock washer under the head of one of the baseplate's two lower mounting holes. These two holes have openings to the side to allow connecting a wire and ring terminal under the head of a mounting screw. Connect the other end of this ground wire to a tapped hole in the panel that the baseplate is mounted to, using a machine screw, star lock washer, and flat washer. Alternately, if your panel has a ground stud, it is recommended you use a nut and star lock washer for each wire on the ground stud to ensure adequate grounding. Where connections are made to a painted panel, the paint should be removed so clean, bare metal is exposed at the connection point. Terminals and hardware used should be rated to work with the aluminum baseplate material.

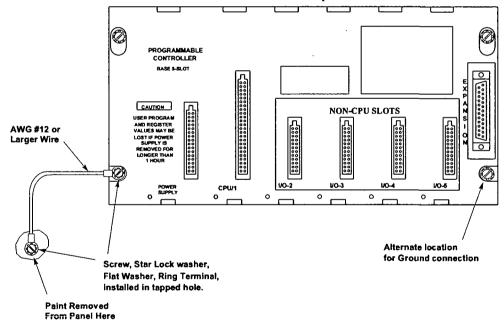


Figure 2-11. Baseplate Grounding

Warning

All baseplates must be grounded to minimize electrical shock hazard. Failure to do so can result in severe personal injury.

2-12

Series 90-30 PLC Installation and Hardware Manual - August 2002

All baseplates grouped together in a Series 90-30 PLC system must have a common ground connection. This is especially important for baseplates that are not mounted in the same control cabinet.

Grounding 19" Rack-Mounted Baseplates

There are two Adapter Brackets used for mounting a 10-slot Series 90-30 baseplate to a 19" Rack. Regardless of which of the two Adapter Brackets is used, the 19" Rack should be grounded as per the instructions in "System Grounding Procedures," including Figure 2-10. (For details on the Adapter Brackets, see the "Mounting a Baseplate to a 19" Rack" section earlier in this chapter.)

Nineteen-Inch Rack-mounted PLC baseplates should be grounded according to the guidelines in the "Baseplate Safety Grounding" section, using a separate ground wire from the PLC baseplate as shown in the previous figure (Fig. 2-11).

- If using the Recessed Mount Adapter Bracket (IC693ACC313), the ground wire can be installed as shown in Figure 2-11 with the ground attached to the Recessed Mount Adapter Bracket. An additional ground wire connecting the Adapter Bracket to a solid chassis ground on the 19" Rack should be installed. Use the same or equivalent hardware and paint removal scheme as shown in Figure 2-11.
- If using the Surface Mount Adapter Bracket (IC693ACC308), the ground wire should be run from the baseplate as shown in Figure 2-11, to a solid chassis ground on the 19" Rack. Use the same or equivalent hardware and paint removal scheme as shown in Figure 2-11.

Programmer Grounding

For proper operation, the computer (programmer) running the PLC software must have a ground connection in common with the CPU baseplate. Normally, this common ground connection is provided by ensuring that the programmer's power cord is connected to the same power source (with the same ground reference point) as the baseplate. If it is not possible to ensure this common ground scheme, use a port isolator (IC690ACC903) between the programmer and PLC serial connection. If the programmer ground is at a different potential than the PLC ground, a shock hazard could exist. Also, damage to the ports or converter (if used) could occur when the programmer serial cable is connected between the two.

Warning

Failure to follow programmer grounding recommendations could result in personal injury, equipment damage, or both.

GFK-0356Q

Chapter 2 Installation

Module Shield Grounding

In general, the aluminum PLC baseplate is used for module shield grounding. On some Series 90-30 modules, shield connections to the user terminal connector on the module are routed to the baseplate through the module's backplane connector. Other modules, such as CPUs 351, 352, 363, 364, and 374 require a separate shield ground. These are discussed in the next several sections.

Shield Grounding Information for CPUs with External Port Connections

CPUs with external port connections, the 351, 352, 363, 364, and 374 must have a separate shield ground connection to provide shielding for these ports. Because the design of the ground connection for the CPU351 and 352 is different from that of the CPU363, 364, and 374, each grounding method is discussed in a separate section.

CPU351 and 352 Shield Grounding

The CPU 351 or 352 module must be connected to frame ground at the slot where it is installed. Two methods are provided for making this ground connection. Each CPU comes with an EMC Grounding Kit (44A737591-G01) that contains a ground wire, grounding bracket, and screws.

1. The connection from the CPU to frame ground can be made using the ground wire (part number 44A735970-001R01) that comes with the module in the EMC Grounding Kit. This wire has a stab-on connector on one end for connection to a mating terminal on the bottom of the CPU, and a ring terminal on the other end for connection to a grounded enclosure. Where the ring terminal contacts a painted enclosure panel, either a star lock washer can be installed between the terminal and the panel to cut through the paint, or the paint can be scraped away down to clean, bare metal to ensure a good contact. Note: The star lock washer method is suitable for a shield ground, but not suitable for a safety ground.

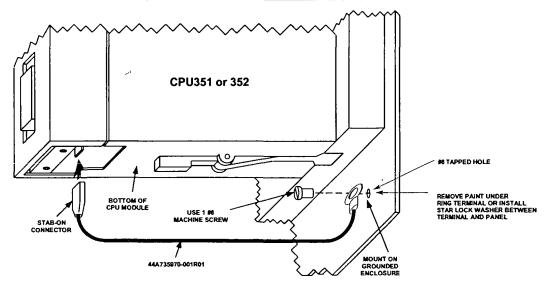


Figure 2-12. CPU 351 or 352 - Attaching Shield Ground Wire

2-14

Series 90-30 PLC Installation and Hardware Manual - August 2002

2

2. The second method, which can be used for systems in noisy environments consists of installing the green ground wire and the optional grounding bracket (part number 44C715646-001R01). This bracket attaches to the CPU using two #4 thread-rolling screws (part number N666P9004B6) and to the grounded enclosure using two #6 thread-rolling screws (part number N666P13006B6). Two holes must be drilled in the enclosure for mounting this bracket. Also, if the bracket will be attached to a painted surface, the paint should be removed down to bare metal under the bracket to ensure good contact between the bracket and the surface. See the next figure.

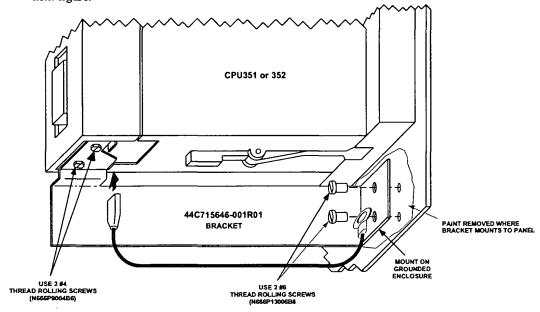


Figure 2-13. CPU 351 or 352 - Mounting the Shield Grounding Bracket and Wire

Note: When the grounding bracket is used, pin 1 of the cable connector that plugs into the Port 2 connector should not be connected. A metal connector shell must be used on the cable for this port, and the cable shield must be terminated at the metal shell instead of pin 1 of the connector.

CPU363, CPU364, and CPU374 Shield Grounding

The CPU363, CPU364, and CPU374 modules must be connected to frame ground at the slot where they are installed. Each module comes with a grounding wire for this purpose. These modules do not support or require the use of a grounding bracket. If the ring terminal on the grounding wire is to be mounted to a painted surface, remove the paint under the ring terminal to ensure good contact, or place a star lock washer between the ring terminal and the painted surface. See the next figure.

Note: The star lock washer method is suitable for a shield ground, but not suitable for a

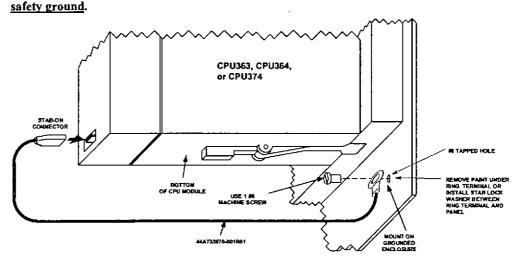


Figure 2-14. CPU 363, CPU364, or CPU374 - Attaching Ground Wire

Additional Modules with Shield Grounding Requirements

Some of the Series 90-30 Option modules, such as the FIP Remote I/O Scanner (IC693BEM330), and DSM modules (IC693DSM302 and IC693DSM314) also have shield grounding requirements. These modules come equipped with suitable grounding hardware. Please refer to each module's user's manual for grounding instructions. Appendix G contains a product to publication cross-reference to help you identify the correct manual.

2-16

Series 90-30 PLC Installation and Hardware Manual - August 2002

General Wiring Guidelines

Warning

In addition to the following wiring suggestions, we strongly urge that you follow all wiring and safety codes that apply to your area or your type of equipment. For example, in the United States, most areas have adopted the National Electrical Code standard and specify that all wiring conform to its requirements. In other countries, different codes will apply. For maximum safety to personnel and property you must follow these codes. Failure to do so can lead to personal injury or death, property damage or destruction, or both.

Color Coding Wires

These color codes are commonly used in industrial equipment manufactured in the United States. They are cited here as a reference. Where they are in conflict with codes that apply to your area or your type of equipment, you should follow your applicable codes instead. Besides satisfying code requirements, wire color coding makes testing and troubleshooting safer, faster, and easier.

- Green or green with stripe- Ground
- Black Primary AC
- Red Secondary AC
- Blue DC
- White Common or neutral
- Yellow Secondary power source not controlled by the main disconnect. Alerts maintenance personnel that there may be power present (from an external source) even if the equipment is disconnected from its main power source.

Wire Routing

To reduce noise coupling among PLC wires, it is recommended you keep electrically noisy wiring, such as AC power wiring and Discrete Output Module wiring, physically separated from low-level signal wiring such as DC and Analog Input module wiring or communications cables. This can be accomplished by grouping separately, where practical, the following categories of wiring:

- AC power wiring. This includes the AC input to the PLC power supply, as well as other AC devices in the control cabinet.
- Analog Input or Output Module wiring. This should be shielded to further reduce noise coupling. See the Series 90-30 I/O Module Specifications Manual, GFK-0898 for details.
- Discrete Output Module wiring. These often switch inductive loads that produce noise spikes when switched off.
- DC Input Module wiring. Although suppressed internally, these low-level inputs should be further protected against noise coupling by observing these wiring practices.
- Communications Cables. Wiring such as Genius Bus or serial cables should be kept away from noise-producing wiring.

GFK-0356Q

Chapter 2 Installation

Where AC or Output wiring bundles must pass near noise-sensitive signal wiring bundles, avoid running them beside each other. Route them so that, if they have to cross, they do so at a right angle. This will minimize coupling between them.

Grouping Modules to Keep Wires Segregated

If practical, grouping similar modules together in the PLC racks can help keep wiring segregated. For example, one rack could contain only AC modules, and a different rack only DC modules, with further grouping in each rack by input and output types. For smaller systems, as an example, the left end of a rack could contain Analog modules, the middle could contain DC modules, and the right end could contain AC modules.

Discrete I/O Module Connection Methods

- For modules with 16 points or less, the standard method is to use the removable terminal board which comes with these modules. The removable terminal board makes it easy to prewire field wiring to the user supplied input and output devices, and to replace modules in the field without disturbing existing field wiring.
- Some discrete 16-point I/O modules can be used with an optional Terminal Block Quick Connect (TBQC) assembly. This assembly contains a module faceplate, with built-in connector, that replaces the removable terminal board. The assembly also contains a DIN-rail mounted terminal block and a cable to connect the module to the terminal block. The advantage of this method is that it saves about two hours of wiring time per module compared with hand wiring from a module's removable terminal board to a user-supplied, panel-mounted terminal block or strip.
- Older 32-point I/O modules have one 50-pin connector on the front of the module that is either connected by a cable with a connector on each end to a Weidmuller panel-mounted terminal block (Weidmuller catalog no. 912263), or is connected by a cable with stripped, tinned leads to a user-supplied terminal block or strip.
- Newer 32-point I/O modules have two 24-pin connectors on the front of the module. These module may be wired in one of three ways. (1) Use a pair of cables (IC693CBL327/328 see data sheet in "Cables" chapter) to connect the module to a user-supplied, panel-mounted terminal block or strip. These cables have a 24-pin connector on one end, and stripped, tinned leads with wire markers on the other end. (2) Use a pair of dual-connector cables to connect the module to a Terminal Block Quick Connect (TBQC) terminal block (IC693ACC377). See Appendix H for details. (3) Make your own custom cables. Instructions are found in the IC693CBL327/328 data sheet in Chapter 10.

Connections to I/O Module Terminal Boards

Series 90-30 PLC I/O terminal boards have either 10 or 20 screw terminals that will accept from two AWG #22 (0.36 mm²) to two AWG #16 (1.3 mm²), or one AWG #14 (2.1 mm²) copper 90°C (194°F) wire(s). Each terminal can accept solid or stranded wires, but the wires into any given terminal should be the same type (both solid or both stranded) to ensure a good connection. Wires are routed to and from the terminals out of the bottom of the terminal board cavity. The suggested torque for the I/O terminal board connection screws is from 9.6 in-lbs to 11.5 in-lbs (1.1–1.3 Newton-meters).

2-18

Series 90-30 PLC Installation and Hardware Manual – August 2002

For 24 volt DC input modules, an internal 24 volt power connection is provided on the terminal board to supply a limited number of input devices. Also, a 24 volt DC output is available on the power supply module's terminal board to supply a limited number of output devices.

Terminal Block Quick Connect Installation for 16-Point Discrete Modules

The Terminal Block Quick Connect (TBQC) Assembly is an option for certain Series 90-30 discrete I/O modules. See Appendix H for more information.

- Remove standard terminal board from module.
- Install TBQC faceplate (it has a 24-pin connector).
- Mount the TBQC terminal block. It has a 24-pin connector and a terminal strip, and mounts on a standard 35 mm DIN-rail.
- Connect a TBQC cable between the TBQC faceplate connector on the module and the connector on the TBQC terminal block.
- Wire I/O devices to the terminal block.

Installation of 32-Point Discrete, 50-Pin Connector Modules

These 50-Pin modules are an older design and are not generally used on new systems, unless to fulfill standardization requirements. They are mainly used as replacements for existing installations. For new installations, we recommend the dual 24-pin connector style because they have additional features not found on the older modules (LED indicators, TBQC), and it is much easier to fabricate custom-length cables for them. Installation information is provided here for the convenience of those still using these modules.

Using Weidmuller #912263 Terminal Block

Note: The TBQC is not available for these modules, but you may purchase a Weidmuller #912263 from your electronics distributor for this application.

- Mount the Weidmuller#912263 terminal block. It has a 50-pin connector and a terminal strip, and mounts on a standard 35 mm DIN-rail.
- Connect an IC693CBL306/307 cable between the module's faceplate connector and the connector on the Weidmuller terminal block. See Chapter 10 for cable data.
- Wire I/O devices to the terminal block. See the Series 90-30 PLC I/O Module Specifications Manual, GFK-0898, for pin-out information.

GFK-0356Q

Chapter 2 Installation

Using a Generic Terminal Block or Strip

- Mount terminal block/strip to the enclosure panel.
- Connect an IC693CBL308 or 309 cable, or a custom made cable, to the module's faceplate connector and wire the stripped ends of the cable to the terminal block/strip. See Chapter 10 for cable data.
- Wire I/O devices to the terminal block/strip.

Direct Method

■ Connect an IC693CBL308 or 309 cable, or a custom made cable, to the module's faceplate connector and wire the stripped ends of the cable directly to the field devices. See Chapter 10 for cable data. See the Series 90-30 PLC I/O Module Specifications Manual, GFK-0898, for pin-out information.

Installation of Discrete 32-Point, Dual 24-Pin Connector Modules

Using a TBQC

- Mount two TBQC terminal blocks. Each has a 24-pin connector and a terminal strip, and mounts on a standard 35 mm DIN-rail.
- Connect a pair of TBQC cables (IC693CBL329 334) between the module's faceplate connector and the connectors on the two TBQC terminal blocks. Note that both a right side and left side cable is required. See Appendix H for a list of cables.
- Wire I/O devices to the terminal blocks. See the Series 90-30 PLC I/O Module Specifications Manual, GFK-0898, for pin-out information.

The Terminal Block Quick Connect (TBQC) Assembly is an option for certain Series 90-30 discrete I/O modules. See Appendix H for more information.

With a Generic Terminal Block/Strip

- Mount terminal block/strip to the enclosure panel.
- Connect an IC693CBL327/328 cables, or a custom made cables, to the module's faceplate connectors, and wire the stripped ends of the cables to the terminal block/strip. Note that both a right side and left side cable is required. See Appendix H for a list of cables. See Chapter 10 for cable data sheets.
- Wire I/O devices to the terminal block/strip. See the Series 90-30 PLC I/O Module Specifications Manual, GFK-0898, for pin-out information.

Direct Method

Connect an IC693CBL327/328 cable, or a custom made cable, to the module's faceplate connectors, and wire the stripped ends of the cable directly to the field devices. See Chapter 10 for cable data. See the Series 90-30 PLC I/O Module Specifications Manual, GFK-0898, for pin-out information.

General Wiring Methods for Analog Modules

Twisted, shielded instrumentation cable is strongly recommended for analog module input or output signal connections. Proper grounding of the shield is also important. For maximum electrical noise suppression, the cable shield should only be grounded at one end of the cable. For Input modules, ground the end that is in the noisiest environment (which often is at the field device end). For Output modules, ground at the module end. See GFK-0898, Series 90-30 PLC I/O Module Specifications, for more shield grounding information.

Analog Input Module Wiring Methods

Correcting electrical noise problems can sometimes be a trial-and-error routine. However, in general, it is generally best to ground the cable shield as close to the source of the noise as possible, which is usually at the device end. In troubleshooting noise problems, sometimes it is beneficial to experiment with the shield grounding point location. Remember, the cable shield should be grounded at one end only. Also, it is best to keep the length of stripped cable leads as short as possible to minimize the length of unshielded conductors that will be exposed to the noisy environment. See the Series 90-30 PLC I/O Module Specifications Manual, GFK-0898 for additional details.

Using a Generic Terminal Block or Strip

- Mount a terminal strip inside the control enclosure and run a shielded cable from the terminal strip to each input circuit on the module's terminal board terminals.
- Connect each cable's shield to the metal panel next to the terminal strip. Do not connect the shields at the module end (cut shield off at module end of cable and insulate with shrink tubing).
- Wire the field device to the terminal strip with a shielded cable, grounding the shield at the device end only (cut shield off at terminal strip end of cable and insulate with shrink tubing). Also, keep the length of exposed (outside of shield) leads at the terminal strip and device ends as short as possible.

Direct Method

- Run a shielded cable from the field device (transducer, potentiometer, etc.) directly to the module.
- Connect the conductors to the applicable screws on the module's terminal board.

GFK-0356Q Chapter 2 Installation

Ground the shield at the field device end, exposing a minimum amount of conductor to the noisy environment. Do not connect the shield at the module end (cut shield off at module end of cable and insulate with shrink tubing).

TBQC not Recommended for Analog Modules

The Terminal Block Quick Connect (TBQC) Assembly is not recommended for use with analog modules due to cable shielding requirements.

Analog Output Module Wiring

General

Each output should be connected using a good quality shielded wire with the cable shield grounded at the module end. See GFK-0898, Series 90-30 PLC I/O Module Specifications, for more information.

Using a Generic Terminal Block or Strip

- Mount a terminal strip inside the control enclosure and run a shielded cable from the terminal strip to each output circuit on the module's terminal board terminals.
- Ground each cable's shield at the module end only. Do not connect the shields at the terminal strip end (cut shields off at terminal strip end of cables and insulate with shrink tubing).
- Wire the field device to the terminal strip with shielded cables, grounding the shields at the terminal strip end only (cut shields off at field device end of cables and insulate with shrink tubing). Also, keep the length of exposed (outside of shield) leads at the terminal strip and device ends as short as possible.

Direct Method

- Run a shielded cable from each field device (transducer, potentiometer, etc.) directly to the module.
- Connect the conductors to the applicable screws on the module's terminal board.
- Ground the shield at the module end only, exposing a minimum amount of conductor to the noisy environment. Do not connect the shield at the device end (cut shield off at device end of cable and insulate with shrink tubing).

TBQC not Recommended for Analog Modules

The Terminal Block Quick Connect (TBQC) Assembly is not recommended for use with analog modules due to cable shielding requirements.

2-22

Series 90-30 PLC Installation and Hardware Manual – August 2002

AC Power Source Connections

AC Input Wiring to AC/DC Power Supplies

Warning

If the same AC power source is used to provide AC power to other baseplates in a Series 90-30 PLC System, ensure that all AC input connections are identical at each rack. Do not cross Line 1 (L1) and Line 2 (L2). A resulting difference in potential can injure personnel or cause damage to equipment. Each baseplate must be connected to a common ground.

Ensure that the protective cover is installed over all terminal boards. During normal operation with an AC power source either 120 VAC or 240 VAC is present on the AC Power Supply. The cover protects against accidental shock hazard which could cause severe or fatal injury to the operator or maintenance personnel.

Both the Standard (IC693PWR321) and High Capacity (IC693PWR330) AC/DC power supplies currently have six terminals for user connections. Early versions of some Series 90-30 power supplies had five terminals (see next figure). The wiring methods for both five-terminal and sixterminal types is similar, except that step 3 below does not apply to the five-terminal type.

The power supply terminal boards will accept one AWG #14 (2.1 mm²) or two AWG #16 (1.3 mm²) copper 75_C (167_F) wires. Each terminal can accept solid or stranded wires, but the wires in any given terminal should be the same type. The suggested torque for the power supply terminal board is 12 in-lbs (1.36 Newton-meters). Open the door protecting the terminal board and make the following connections from the AC power source, and ground connections (system grounding requirements are described in detail later in this chapter).

- These are wide range supplies that can operate from an AC power source within the nominal range of 100 VAC to 240 VAC at 50/60 Hz. This may vary -15% to +10% for a total maximum range of 85 VAC to 264 VAC. These are auto-ranging supplies that do not require jumper or switch settings for selection of power source voltage.
- 2. Connect the hot and neutral wires or lines L1 and L2 to the upper two terminals on the terminal board. Connect the safety ground wire to the ground terminal, which is the third terminal from the top, and is marked with a ground symbol.
- 3. For power supplies with six terminals, the factory jumper between the 3rd and 4th terminals (see figure below), should be left in place for normal installations. However, this jumper must be removed and external surge suppressors installed in installations with a "Floating Neutral" input. Please see the section "Special Instructions for Floating Neutral (IT) Systems" later in this chapter for details.
- 4. After all connections to Power Supply terminal board have been completed, the protective cover plate should be carefully reinstalled.

GFK-0356Q

Chapter 2 Installation

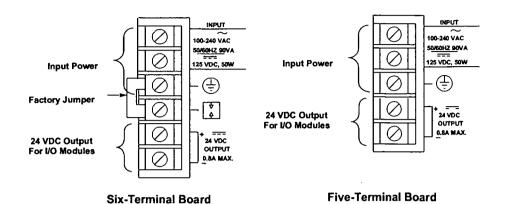


Figure 2-15. Power Supply Terminal Boards

Power Supply Overvoltage Protection Devices

The overvoltage protection devices for this power supply are connected internally to pin 4 on the user terminal board. This pin is normally connected to frame ground (pin 3) with the supplied jumper strap which is installed at the factory. If overvoltage protection is not required or is supplied upstream, this feature can be disabled by leaving pin 4 unconnected by removing the jumper strap. Also, this jumper must be removed and external surge suppressors installed in installations with a "Floating Neutral" input, please see the following section "Special Instructions for Floating Neutral (IT) Systems" later in this chapter.

If you want to Hi-pot test this supply, overvoltage protection *must be disabled* during the test by removing the terminal board strap. Re-enable overvoltage protection after testing by reinstalling the strap.

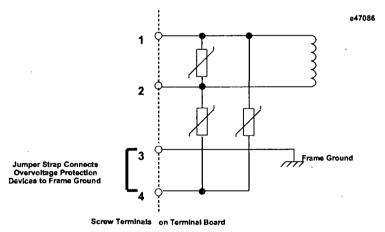


Figure 2-16. Overvoltage Protection Devices and Jumper Strap

2-24

Series 90-30 PLC Installation and Hardware Manual – August 2002

Special Installation Instructions for Floating Neutral (IT) Systems

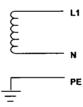
When the AC input power supplies listed below are installed in a system where the Neutral line is **not** referenced to Protective Earth Ground, these special installation instructions must be followed to prevent damage to the power supply.

IC693PWR321S (or later version) IC693PWR330A (or later version)

Definition of Floating Neutral Systems

A Floating Neutral System is a system of power distribution wiring where Neutral and Protective Earth Ground are **not** tied together by a negligible impedance. In Europe this is referred to as an IT system (see IEC950). In a Floating Neutral System, voltages measured from input terminals to protective earth ground may exceed the 264 Volts AC maximum input voltage specified in the power supply specifications in Chapter 24in this manual.

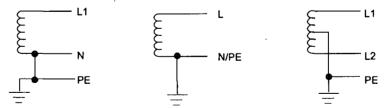
Example of Floating Neutral System



This system must be installed using the special installation instructions on the following page.

Systems in which one leg of the power distribution wiring is tied to Protective Earth or a tap between two legs of the power distribution wiring is tied to Protective Earth are **not** Floating Neutral Systems.

Examples of Non-Floating Neutral System



These non-floating neutral systems do not require these special installation instructions.

GFK-0356Q Chapter 2 Installation 2-25

Q-Pulse Id TMS1079 Active 10/12/2014 Page 276 of 469

Use These Special Installation Instructions for Floating Neutral Systems

- 1. The input power terminals should be wired according to the instructions in the "AC Power Source Connections" section of this chapter.
- 2. The factory installed jumper between terminals 3 and 4 of the Power Supply module **must** be removed if using one of the Power Supplies that have this feature. See the "Overvoltage Protection Devices" section of the "Power Supplies" chapter for details.
- Voltage surge protection devices, such as MOVs, <u>MUST</u> be installed between the following terminals:
 - From L1 to earth ground
 - From L2 (Neutral) to earth ground

The voltage surge devices must be rated such that the system is protected from power line transients that exceed $Line\ voltage + 100V + (N-PE)_{MAX}$

The expression *N-PE* refers to the voltage potential between neutral and Protective Earth (PE) ground.

For example, in a 240 Volt AC system with neutral floating 50V above earth ground, the transient protection should be rated at:

240V + 100V + 50V = 390V

DC Power Source Connections

DC Input Wiring to AC/DC and DC-Only Power Supplies

DC Input power can range from 12 to 30 VDC for the 24 VDC supply, 18 to 56 VDC for the 24/48 VDC supply or 100 to 150 VDC for the 125 VDC supply. All Series 90-30 power supplies have DC input capabilities. The following connection information applies to all of them:

Connect the + and - wires from the power source to the top terminals on the terminal board (+ to the top terminal, - to the second terminal). Connect the third terminal from the top to system ground.

+24 VDC Output (All Supplies)

The bottom two terminals are connected to the isolated 24 volt DC output that can be used to supply power to input circuits (within power limitations of the supply).

Warning

If the same DC input power source is used to provide power to two or more power supplies in a Series 90-30 PLC System, ensure that connection polarity is identical at each rack (top terminal + and second terminal -). Do not cross the Positive (+) and Negative (-) lines. A resulting difference in potential can injure personnel or cause damage to equipment. Also, each baseplate must be connected to a common system ground, described earlier in this chapter.

GFK-0356Q

Chapter 2 Installation

Basic Installation Procedure

Note: Series 90-30 PLCs must be mounted in a protective enclosure. The enclosure should be capable of properly dissipating the heat produced by all of the devices mounted inside it. For details on calculating heat dissipation, refer to Appendix F.

The system design, which includes producing the layout and wiring drawings, should be completed before beginning the installation procedure. This section offers a basic step-by-step approach to installing a Series 90-30 PLC system. Some steps refer to earlier sections of this chapter for additional details. An attempt was made to place the steps in an order that will make the process as efficient as possible. However, due to the wide variance in system designs, this order may not be the most efficient for your system, so you may wish modify this procedure to fit your needs.

1. Gather the schematics, layouts, prints, and other information for the job.

Warning

To avoid the possibility of electrical shock to personnel or damage to your PLC, we recommend that you shut off all power to the system before mounting and wiring the PLC. Also, keep all electronic components away from the area while drilling and tapping to keep metal chips and filings out of these sensitive components.

- 2. From the layout drawing, determine where the baseplate(s) will be mounted. Lay out the hole locations, either using the dimensions given on your layout drawing or from the "Baseplates" chapter of this manual.
- 3. Mark the hole locations for the baseplate safety ground wire (see "Baseplate Safety Ground" in this chapter).
- 4. Mark the hole locations for module shield ground connections (if any). See "Module Shield Ground" (and accompanying sections) in this chapter for instructions.
- 5. Finish laying (marking hole locations) out the rest of the system. This includes any terminal blocks you will be using. DIN-rail mounted terminal blocks for some of the 32-point I/O modules are manufactured by Weidmuller. DIN-rail mounted GE Fanuc Terminal Block Quick Connect (TBQC) assemblies are optional for some of the 16-point and 32-point discrete I/O modules. If using these TBQCs, refer to Appendix H for data. Also, APM and DSM modules use DIN-rail mounted terminal blocks.

Note

We recommend drilling and tapping all holes before mounting any components. This will avoid getting chips and filings in the components.

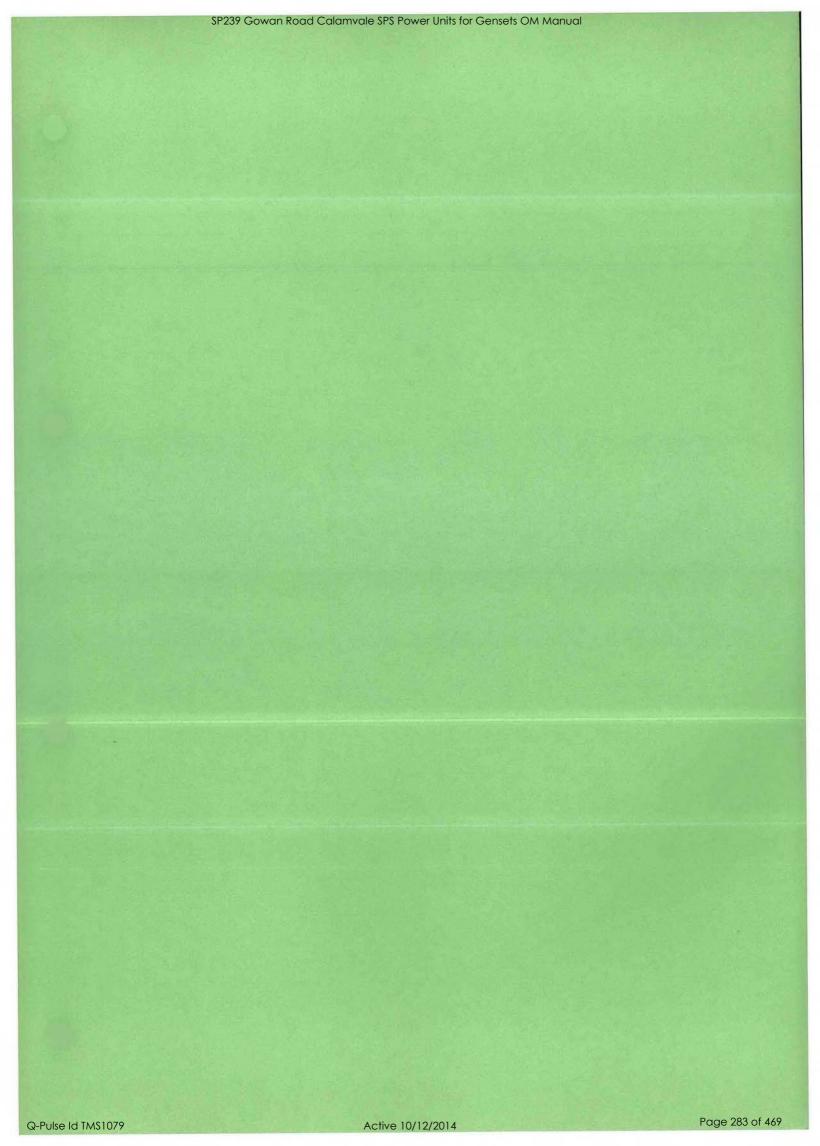
- 6. Drill and tap the marked holes. For baseplate mounting, use 8-32 or 4mm size.
- 7. Mount the baseplates. Use good quality 8-32 x 1/2 inch or 4 x 12mm size screws. We recommend using star lock washers and flat washers under the screw heads (star lock washer should be located between screw head and flat washer) to ensure a tight baseplate ground connection, and to keep the screws from loosening. Connect each baseplate ground wire as shown in the "Baseplate Safety Ground" section of this chapter.
- 8. If you have Expansion or Remote racks, determine the correct rack number for each one, then set the rack numbers using the Rack Number Selection dual in-line package (DIP) switch on

2-28

Series 90-30 PLC Installation and Hardware Manual - August 2002

- the baseplate. Please refer to the "Baseplates" chapter for details on setting these DIP switches. Rack numbers should be assigned by the system programmer because they correspond to system configuration settings and program memory addressing.
- 9. If you have more than one baseplate (rack), connect the I/O Bus Expansion Cables between the I/O Bus Expansion Connectors, which are located on the right end of the baseplates. The cables are connected in a "daisy-chain" arrangement from one baseplate to the other. This is made possible by the fact that the cables have a dual connector on one end. Therefore, when the cable is plugged into a baseplate connector, the second connector on that end of the cable provides a socket for connecting to the next cable. The data sheet for the I/O Bus Expansion cables (IC693CBL300 etc.) in the "Cables" chapter has sample wiring figures.
- 10. On the last I/O Bus Expansion Connector, plug in an I/O Bus Expansion Terminator, Catalog Number IC693ACC307 (unless using a cable with built-in terminator resistors, which would either be GE Fanuc cable IC693CBL302, or your own custom-built cable).
- 11. Install the modules in their correct slots using your system layout drawings. (The label on the side of each module identifies the module type and catalog number.) Refer to the section "Installing Modules" if you are not familiar with how to do this.
- 12. Connect cables to Option modules. Route cables away from noise-producing wires. See the "Wire Routing" section of this chapter.
- 13. Be sure to follow the information in the "Wiring Guidelines" section of this chapter to protect the system from electrical noise. Install the power wires to the Power Supply and I/O modules:
 - I/O modules with removable terminal boards. You can wire the terminal boards inplace on the modules or remove them from the modules before wiring. Although
 removing them may help make wiring easier (a previous section "Working with
 Removable Terminal Boards" shows how to remove a terminal board), care should be
 taken to avoid mixing them (each terminal board has the catalog number of the module
 printed on it, and the hinged cover has a wiring diagram for that module type). If you are
 using wire duct, routing each module's wires through the opening in the duct directly
 under the module will help to keep each terminal board in its correct position.
 - I/O Modules with terminal blocks. Some modules use terminal blocks that mount to the enclosure panel. This includes all 32-point modules and, can include other I/O modules if they are fitted with the optional Terminal Block Quick Connect Assembly. Connect the terminal blocks to the connectors on the modules with the provided cables.
- 14. Connect the signal (switches, sensors, solenoids, etc.) wires to the terminal boards, or terminal blocks/strips. If wiring to terminal boards, these can be removed for ease of wiring, if desired. See the section "Removing a Module's Terminal Board."
- 15. When finished wiring the I/O terminal boards (if used and if you removed them for ease of wiring), re-install them on the modules, being careful to match each one with the correct module.

Page 281 of 469





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.

GE Fanuc Automation makes no representation or warranty, expressed, implied, or statutory with respect to, and assumes no responsibility for the accuracy, completeness or usefulness of the information contained in this document. No warranties of merchantability of fitness for purpose shall apply.

The following are trademarks of GE Fanuc Automation North America, Inc.

Alarm Master	CIMSTAR	Helpmate
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	

© Copyright 1993 GE Fanuc Automation North America, Inc.

All Rights Reserved.

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 90TM 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 90TM–30 Programmable Controller Installation Manual (GFK–0356).

Series 90TM-30 and 90-20 PLC Hand-Held Programmer User's Manual (GFK-0402)

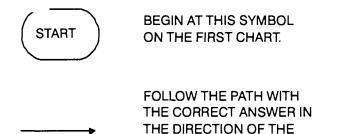
LogicmasterTM 90 Series 90–30 and 90–20 Programming Software User's Manual (GFK–0466)

Series 90TM–30/90–20 Programmable Controllers Reference Manual (GFK–0467)

We Welcome Your Comments and Suggestions

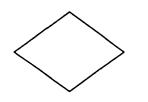
At GE Fanuc Automation, we strive to produce quality technical documentation. After you have used this troubleshooting guide, please take a few moments to write us with your comments and suggestions. Our address is: Manager Technical Publications, GE Fanuc Automation. PO Box 8106, Charlottesville, VA 22906

Drake C. Fink
Sr. Staff Systems Engineer

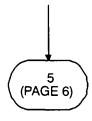


ARROW

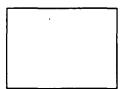
SYMBOLS USED THROUGHOUT THE GUIDE ARE GEOMETRICALLY CODED



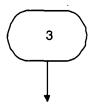
A DIAMOND ASKS A QUESTION



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 RECTANGLE TELLS
YOU TO DO SOMETHING



A NUMBERED BUBBLE WITH AN ARROW OUT OF THE BUBBLE INDICATES THE START OF A PROCEDURE ON THAT PAGE.I

Adding or Changing the EEPROM in the 90TM – 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)

- 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 EE-PROM 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 Logic-master 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)

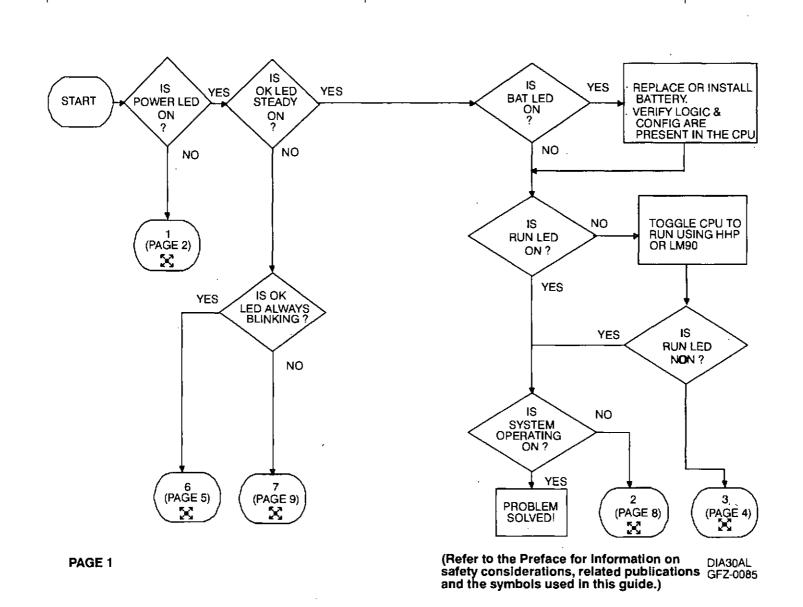
IC693PWR322:

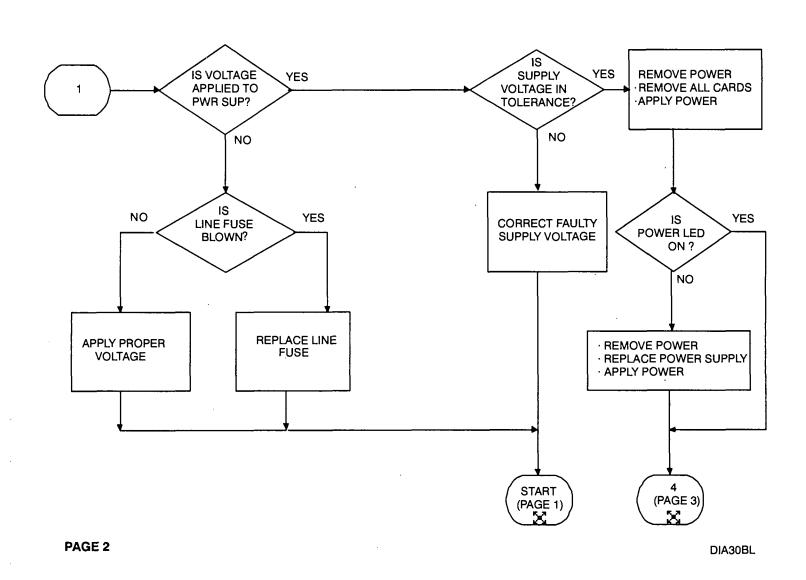
18 to 56 VDC, 21 VDC

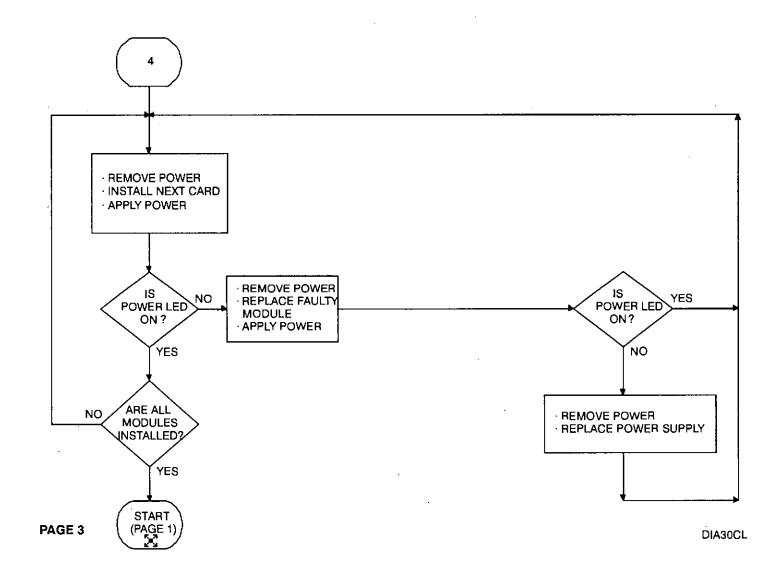
minimum to start

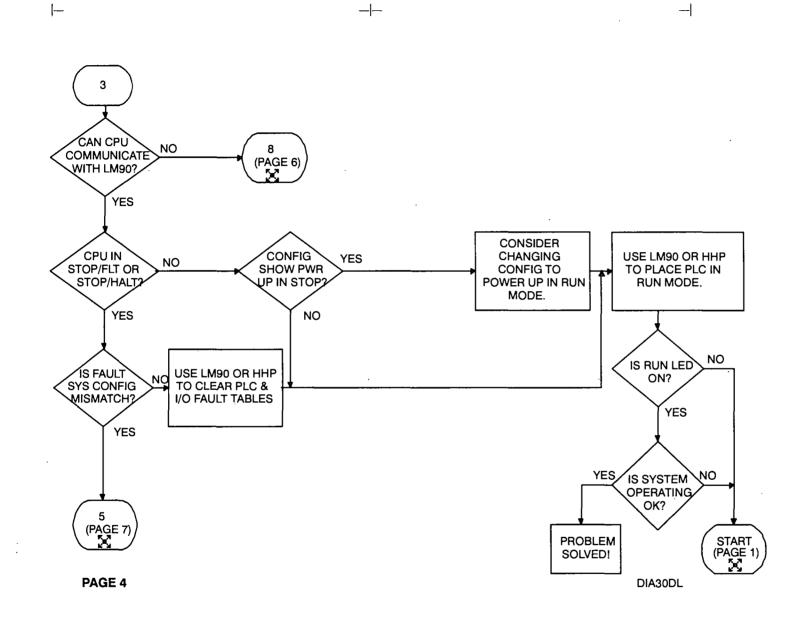
24 VDC OR 48 VDC nominal

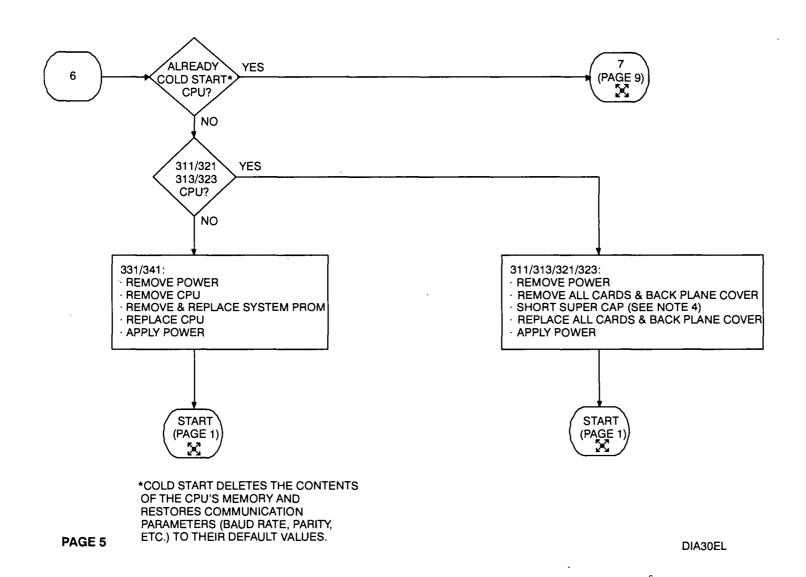
Total cable length must not exceed 50 feet between a CPU rack and an expansion rack.
 Length must not exceed 700 feet between a CPU rack and a remote rack. No termination plug is needed on a one-rack system.

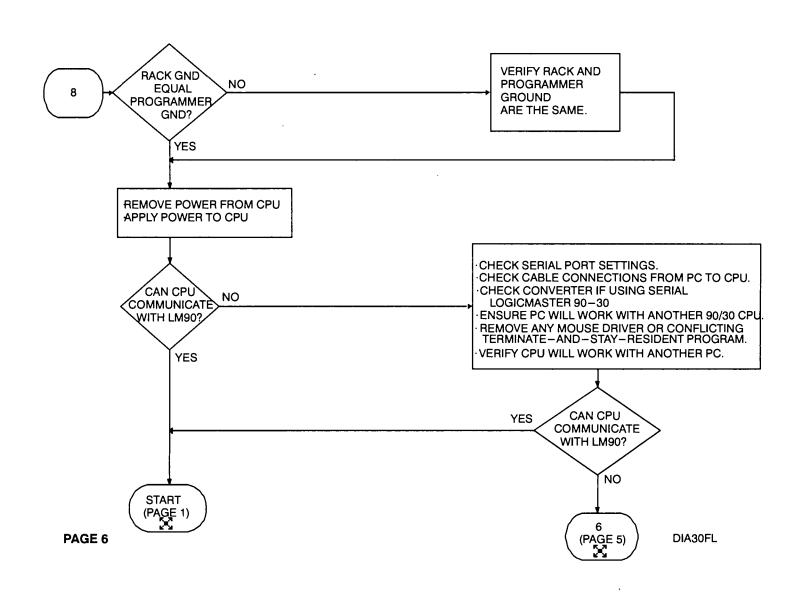


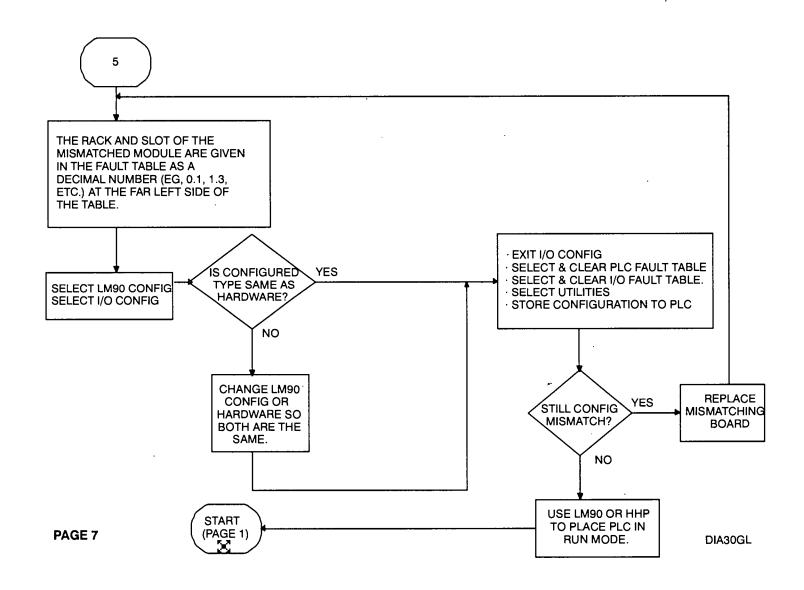


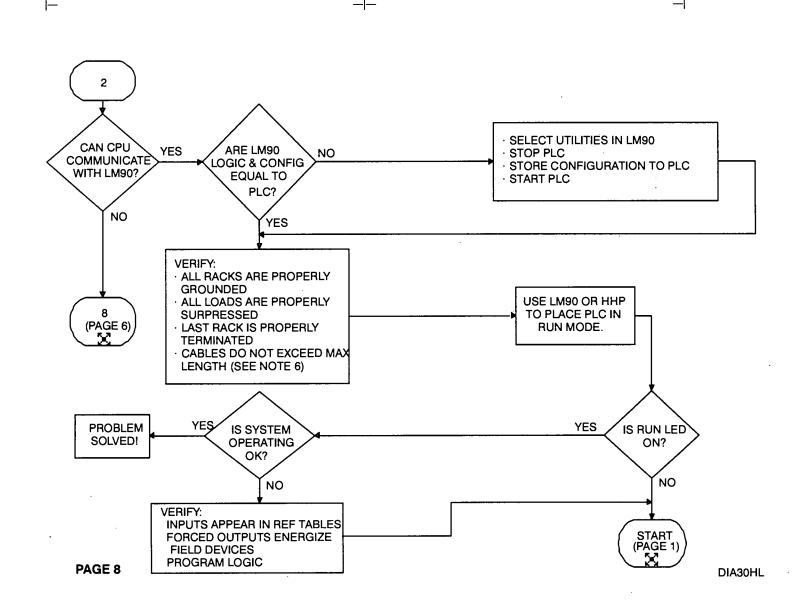




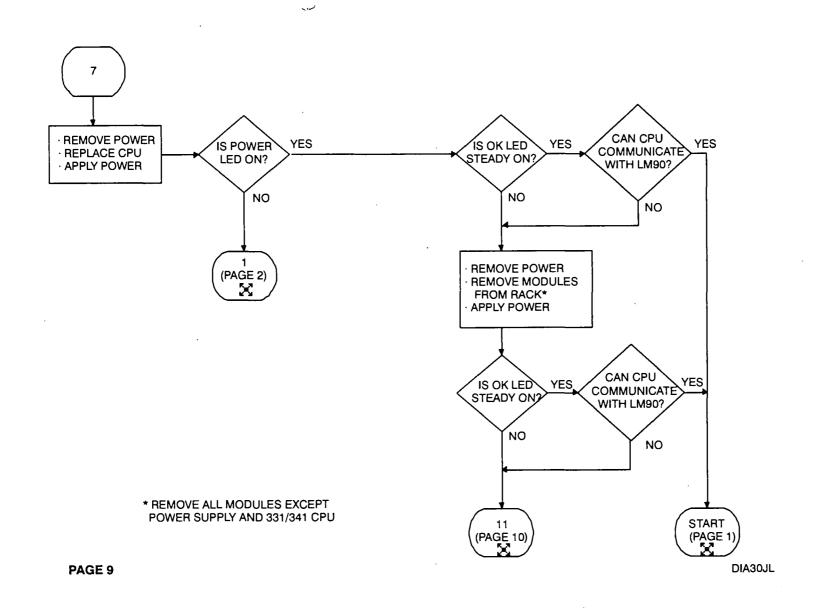




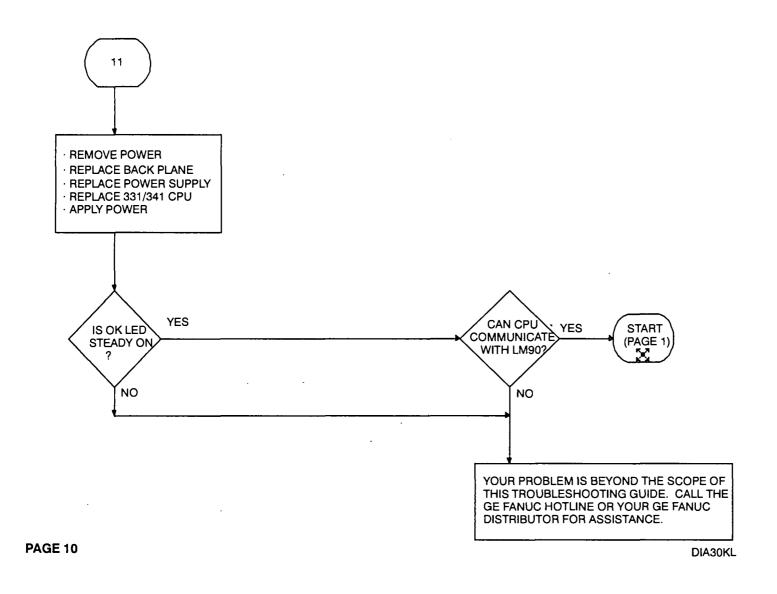




Page 299 of 469



Page 300 of 469





DIESEL STANDBY GENERATOR

LOCAL CONTROL PANEL

FUNCTIONAL DESCRIPTION

FOR

Brisbane City Council

19th May 2003

ABBREVIATIONS

G1 Generator 1 Diesel

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.

Page 306 of 469

- 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.

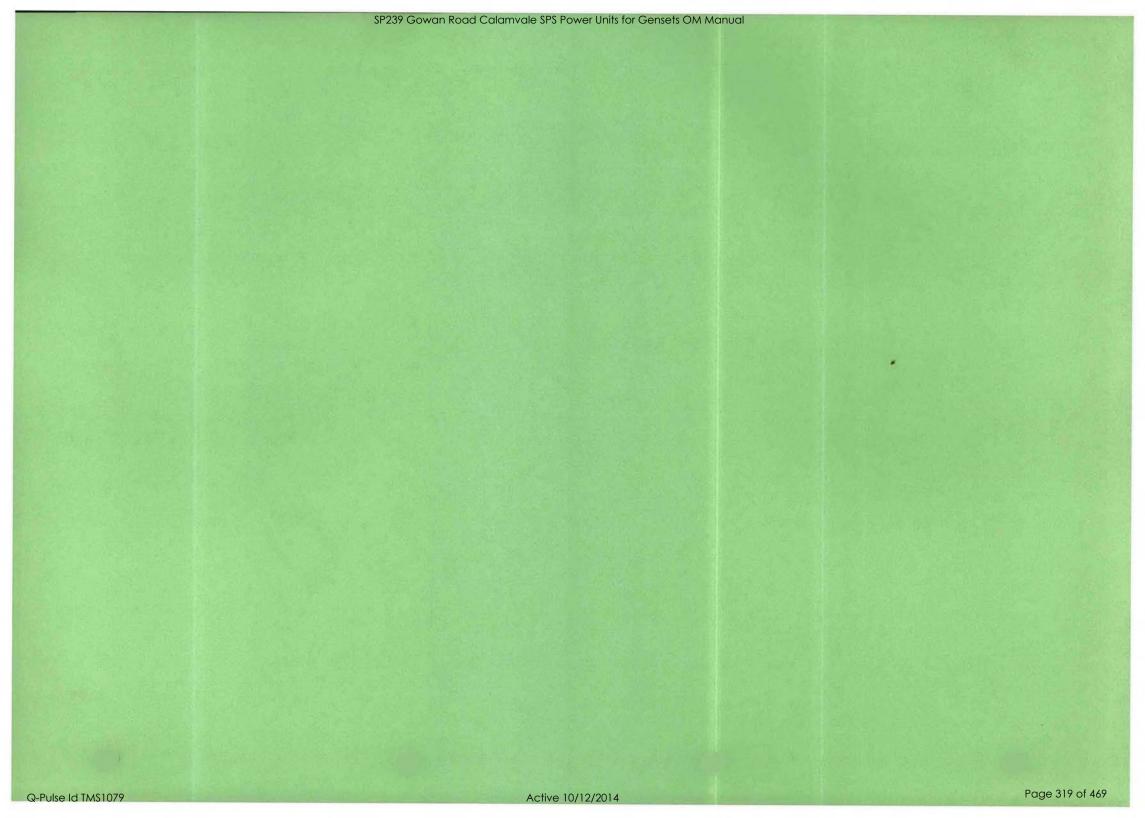
- 5.4.8.2. The system shall shut down and return back to MAINS ATS operation.
- 5.4.9. If the GEN ATS fails to Close.
 - 5.4.9.1. After a 5 second delay an Alarm shall be generated and the GENERATOR CONNECTED indicator shall flash to indicate the Alarm.
 - 5.4.9.2. The system shall shut down and return 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



BCC 4000 4

Page: A

Table of Contents

Overview	1
Main Rack: Base 10 Slot (IC693CHS391)	1
Detailed View	2
IC693PWR331 Power Supply 24 VDC 30W	2
Power Consumption	2
Settings	2
IC693CPU350 Series 90-30 CPU Model 350	2
Settings	2
Scan	2
Memory Power Consumption	2
Power Consumption	3
IC693CMM311 Communications Coprocessor	3
Settings	3
Port 1	3
Port 2	3
Power Consumption	3
IC693MDL645 16 Circuit Input 24 VDC Positive / Negative Logic	3
Settings	3
Wiring	3
Power Consumption	3
IC693MDL645 16 Circuit Input 24 VDC Positive / Negative Logic	. 4
Settings	4
Wiring	4
Power Consumption	4
IC693MDL645 16 Circuit Input 24 VDC Positive / Negative Logic	4
Settings	4
Wiring	4
Power Consumption	4
IC693MDL940 16 Circuit Output Relay 2A	4
Settings	4
Wiring_	. 4
Power Consumption	4
IC693MDL940 16 Circuit Output Relay 2A	5
Settings	5
Wiring	5
Power Consumption	5
IC693MDL940 16 Circuit Output Relay 2A	5
Settings	5
Wiring	5
Power Consumption	5
Reference Details	- 6
%I References	6
%Q References	6

Table of Contents

GE Fanuc Hardware Configuration

Series 90-30

BCC 4000 4

Page: 1

Main Rack: Base 10 Slot (IC693CHS391)

Overview

GE Fanuc Hardware Configuration

Series 90-30

Page 321 of 469

BCC 4000 4

Page: 2

Main Rack: Slot 0

IC693PWR331 Power Supply 24 VDC 30W

Power Consumption

Voltages / Supplied

+5VDC (Watts) 30

+24VDC Relay Power (Watts) 15

+24VDC Isolated (Watts) 20

Total System: 30

Settings

Parameters / Values

Hand Held Programmer: No

Converter: 0

Main Rack: Slot 1

IC693CPU350 Series 90-30 CPU Model 350

Settings

Parameters / Values

I/O Scan-Stop: No
Power Up Mode: Run

Logic / Configuration From: RAM

Registers: RAM

Passwords: Disabled

Checksum Words: 8

Data Rate (bps): 19200

Parity: Odd Stop Bits: 1

Modem Turnaround Time (.01 Sec / Count): 0

Idle Time (Sec): 10
Timer Faults: Disabled

SNP ID:

Key Switch Run/Stop: Enabled
Memory Protect: Disabled

Ignore Fatal Faults: Disabled

Scan

Parameters / Values

Sweep Mode: Normal

Sweep Timer (mSec): N/A

Memory

Parameters / Values

%I Discrete Input: 2048

%Q Discrete Output: 2048

%S System Use: 128

%M Internal Discrete: 4096

%T Temporary Status: 256

%G Genius® Global: 1280

%AI Analog Input: 2048

%AQ Analog Output: 512

Register Memory: 9999

Detailed View

GE Fanuc Hardware Configuration

Series 90-30

BCC 4000 4

Page: 3

Power Consumption

Parameters / Values

- +5VDC (Watts) 3.35
- +24VDC Relay Power (Watts) 0
- +24VDC Isolated (Watts) 0

Main Rack: Slot 2

IC693CMM311 Communications Coprocessor

Settings

Parameters / Values

Configuration Mode: RTU Only

Port 1

Parameters / Values

RTU Enable: Yes

Data Rate (bps): 9600 Flow Control: None

Parity: None

Station Address: 1

Port 2

Parameters / Values

RTU Enable: Yes Interface: RS485

Data Rate (bps): 9600 Flow Control: None

Parity: None

Station Address: 1

Power Consumption

Parameters / Values

+5VDC (Watts) 2.00

+24VDC Relay Power (Watts) 0

+24 VDC Isolated (Watts) 0

Main Rack: Slot 3

IC693MDL645 16 Circuit Input 24 VDC Positive / Negative Logic Settings

Parameters / Values

Reference Address: %100001

Length: 16

Wiring

Terminal / Wiring Information

From Terminal 1 to Terminal 20 : No wiring information.

Power Consumption

Parameters / Values

+5VDC (Watts) 0.40

+24VDC Relay Power (Watts) 0

Detailed View

GE Fanuc Hardware Configuration

Series 90-30

Page 323 of 469

BCC 4000 4

Page: 4

+24VDC Isolated (Watts) 0.6

Main Rack: Slot 4

IC693MDL645 16 Circuit Input 24 VDC Positive / Negative Logic Settings

Parameters / Values

Reference Address: %100017

Length: 16

Wiring

Terminal / Wiring Information

From Terminal 1 to Terminal 20: No wiring information.

Power Consumption

Parameters / Values

+5VDC (Watts) 0.40

+24VDC Relay Power (Watts) 0

+24VDC Isolated (Watts) 0.6

Main Rack: Slot 5

IC693MDL645 16 Circuit Input 24 VDC Positive / Negative Logic

Settings

Parameters / Values

Reference Address: %100033

Length: 16

Wiring

Terminal / Wiring Information

From Terminal 1 to Terminal 20: No wiring information.

Power Consumption

Parameters / Values

+5VDC (Watts) 0.40

+24VDC Relay Power (Watts) 0

+24VDC Isolated (Watts) 0.6

Main Rack: Slot 7

IC693MDL940 16 Circuit Output Relay 2A

Settings

Parameters / Values

Reference Address: %Q00001

Length: 16

Wiring

Terminal / Wiring Information

From Terminal 1 to Terminal 20: No wiring information.

Power Consumption

Detailed View

GE Fanuc Hardware Configuration

Series 90-30

Page 324 of 469

11/06/04 3:02

BCC 4000 4

Page: 5

Parameters / Values

- +5VDC (Watts) 0.04
- +24VDC Relay Power (Watts) 3.24
- +24VDC Isolated (Watts) 0

Main Rack: Slot 8

IC693MDL940 16 Circuit Output Relay 2A

Settings

Parameters / Values

Reference Address: %Q00017

Length: 16

Wiring

Terminal / Wiring Information

From Terminal 1 to Terminal 20: No wiring information.

Power Consumption

Parameters / Values

- +5VDC (Watts) 0.04
- +24VDC Relay Power (Watts) 3.24
- +24VDC Isolated (Watts) 0

Main Rack: Slot 9

IC693MDL940 16 Circuit Output Relay 2A

Settings

Parameters / Values

Reference Address: %Q00033

Length: 16

Wiring

Terminal / Wiring Information

From Terminal 1 to Terminal 20: No wiring information.

Power Consumption

Parameters / Values

- +5VDC (Watts) 0.04
- +24VDC Relay Power (Watts) 3.24
- +24VDC Isolated (Watts) 0

Detailed View

GE Fanuc Hardware Configuration

Series 90

Page 325 of 469

11/06/04 3:02

BCC 4000 4

Page: 6

Overla	p Start	End	Addr	Mem Type	Cat Num
	1 ′	16	(0.3)	Consumed	IC693MDL645
	. 17	32	(0.4)	Consumed	IC693MDL645
	33 /	48	(0.5)	Consumed	IC693MDL645
נ	Cotal %I: 4	8	Highest Reference:	48	

%Q References

, , , , , , , , , , , , , , ,			•		
Overlap	Start	End	Addr ·	Mcm Type	Cat Num
•	1	16	(0.7)	Produced	IC693MDL940
•	17	32	(0.8)	Produced	IC693MDL940
	33	48	(0.9)	Produced	IC693MDL940
Tota	al %Q: 4	8	Highest Reference:	48	

Reference Details

GE Fanuc Hardware Configuration

Series 90-30

	_ SP239			Power Units for Gensets OM Manu					J
Name	Type	Len	Address	Description	Stored Val	Scope		Ovr	Eı
SEL_AUTO	BIT	1	%100001	Selector Switch Auto		Global	R		
SEL_TEST	BIT	1	%100002	Selector Switch Test		Global	R		
SEL_MAN	.BIT	1	%100003	Selector Switch Manual		Global	R		
EM_STOP_PB	BIT	1	%100004	Emergency Stop PB		Global	R	_	
LAMP_TEST_PB	BIT	1	%100005	Lamp Test PB		Global	R		
ALM_RESET_PB	BIT	1	%100006	Alarm Reset PB		Giobal	R		
ALM_MUTE_PB	BIT	1	%100007	Alarm Mute PB		Global	R		
MAN_STR_PB	BIT	1	%100008	Manaul Start PB		Global	R		
MAN_STP_PB	₃BIT	1	.%100009	Manual Stop PB		Global	R		
MAN_TRF_MAINS_PB	BIT	1	%100010	Manual Transfer to Mains PB		Global	R		
MAN_TRF_GEN_PB	BIT	1	%100011	Manual Transfer to Generator PB		Global	R		
SPD STP CRK	BIT	1	%100017	Crank Cutout Relay		Global	R		
SPD UNDER	BIT	1	%100018	Under Speed Relay		Global	R		
SPD_OVER	BIT	1	%100019	Over Speed Relay		Global	Ŕ		
VOLTS_UNDER	BIT	1	%100020	Under Voltage Relay		Global	·R		
VOLTS OVER	BIT	i	%100021	Over Voltage Relay		Global	R		
ALT_TEMP	BIT	i	%100021	Alternator High Temperature		Global	R		
_				Relay					
GEN_CB_TRIP	BIT	1	%100023	Generator CB Tripped		Global	R		
MEN_FLT	BIT	1	%100024	MEN Fault Relay		Global	R		
BAT_CHG_AC	BIT	1	%100025	Battery Charger AC Relay		Global	R		
BAT_CONT_LOW_V	BIT	1	%100026	Control Battery Charger Low		Global	R		
BAT STR LOW V	BIT	1	%100027 ⁻	Voltage Start Battery Charger Low		Global	R		
	.	•	70100021	Voltage		Giobai	11		
MAINS_FAILED	BIT	1	%100033	BCC Mains Failed		Clobal	В		
MAINS_ATS_CLS	BIT	i	%I00033 %I00034			Global	R		
GEN_ATS_CLS	BIT	i		BCC Mains ATS Closed		Global	R		
			%100035 %100036	BCC Generator ATS Closed		Global	R		
REM_STR	BIT	1	%100036	BCC Remote Start		Global	R		
REM_STP	BIT	1	%100037	BCC Remote Stop		Global	R		
OIL_P_LOW_SD	BIT	1	%100041	Low Oil Pressure Shutdown		Global	R		
OIL_P_LOW_W	BIT	1	%100042	Low Oil Pressure Warning		Global	R		
ENG_T_HI_SD	BIT	1	%100043	High Engine Temperature Shutdown		Global	R		
ENG_T_HI_W	BIT	1	%100044	High Engine Temperature		Global	R		
				Waming					
RAD_WATER_LOW	BIT	1	%100045	Low Radiator Water Level	•	Global	R		
FUEĽ LEV LŌW	BIT	1	%100046	Low Fuel Level		Global	Ŕ		
FUEL_LEV_EMPTY	BIT	1	%100047	Fuel Empty		Global	R		
CAN_DOORS_OPEN	BIT	i	%100048		•				
	BIT			Canopy Doors Open		Global	R		
STEP_1		1	%M00001	Step Sequence No.1		Global			
STEP_2_E	BIT	1	%M00002	Step Sequence No.2		Global			
STEP_3	BIT	1	%M00003	Step Sequence No.3		Global			
STEP_4	BIT	1	%M00004	Step Sequence No.4		Global			
STEP_5	BIT	1	%M00005	Step Sequence No.5		Global	•		
STEP_6	BIT	1	%M00006	Step Sequence No.6		Global			
STEP_7	BIT	1	%M00007	Step Sequence No.7		Global			
STEP_8	BIT	1	%M00008	Step Sequence No.8		Global			
STEP 9	BIT	1	%M00009	Step Sequence No.9		Global			
STEP 2 GE	BIT	1	%M00022	Step Sequence No.2 GE					
GEN OFF	BIT	1	%M00101	Generator OFF	•	Global			
AUTO_TEST_STR	BIT					Global			
	BIT	1	%M00102	Auto _Test Start / Stop		Global			
REMOTE STR		1	%M00103	Remote Start		Global			
MAINS_FAIL_STP	BIT	1	%M00104	Mains Failed Stop		Global	,		
REMOTE_STP	BIT	1	%M00105	Remote Stop		Global			
TEST_STR	BIT	1	%M00106	Test Start	•	Global			
TEST_STP	BIT	1	%M00107	Test Stop		Global			
GEN_RUN_OFF	BIT.	1	%M00108	Generator Run Off		Global			
ENABLE_OFFLINE	BIT	1	%M00109	Enable Generator to go Offline		Global			
HH_ALM_OS1	BIT	1	%M00110			Clahat			
H_ALM_OS1	BIT	1		High Alarm One Shot		Global			
H_ALM_OS2	BIT		%M00111	High Alarm One Shot	•	Global			
		1	%M00112	High Alarm One Shot		Global			
M_ALM_OS1	BIT	1	%M00113	Medium Alarm One Shot		Global			
M_ALM_OS2	BIT	1	%M00114	Medium Alarm One Shot		Global			
M_ATS_ALM_OS1	BIT	1	%M00115	Mains ATS Alarm One Shot		Global			
M_ATS_ALM_OS2	BIT	1	%M00116	Mains ATS Alarm One Shot		Global			
MAINS_FAIL_STR	BIT	1	%M00117	Mains Fail Start		Global			
GEN_RUNNING	BIT	1	%M00201	Generator Running	•	Global			
FAIL_STR_TM	BIT	1	%M00202	Failed to Start Time		Global			
FAIL_STR_DLY	BIT	1	%M00203	Failed to Start Pulse Delay		Global	٠		
Program: BCC_4000_4				A:			GLOBAL	τ .	ABI
				***		,	GLUDAL	` '	LUL

				Power Units for Gensets OM Manu	al				
Name	Type	Len	Address	Description	Stored Val	Scope.	Ret	Ovr	Εi
FAIL_STR_CNT	BIT	1	%M00204	Failed to Start Counter		Global			- 1
CRK_CUTOUT	BIT	1	%M00205	Generator Crank Cutout		Global			
ENB_STR_DLY	BIT	1	%M00206	Enable Start Delay for		Global	••		- [
				Alarms		-10-0		•	i
~ P DLY	BIT	1	%M00207	Oil Pressure Alarm Delay		Global			Ì
ŪP DLY	BIT	i	%M00208	Startup Alarm Delay		Global	•		1
M_ATS_OPN_1	BIT								1
		1, 1, ,	%M00209	Mains ATS Open Command		Global			
G_ATS_CLS_1	BIT	1 "	%M00210	Generator ATS Close		Global			ļ
				Command		_	*		- 1
G_ATS_OPN_1	BIT	1	%M00211	Generator ATS Open		Global			-
				Command					}
M_ATS_CLS_1	BIT	1	%M00212	Mains ATS Close Command		Global		•	
M_ATS_CLS_ENB	BIT	1	%M00213	Mains ATS Close Enable		Global			1
G_ATS_CLS_ENB	BIT	1	%M00214	Generator ATS Close Enable		Global			ļ
HIGH_HIGH_ALM	BIT	1	%M00300	High High Alarm		Global			į
EM_STP_ALM	BIT				•				ļ
		1	%M00301	Emergency Stop Alarm		Global			į
MEN_ALM	BIT	1	%M00302	MEN Alarm		Global		•	- 1
OIL_P_SD_ALM	BIT	1	%M00303	Low Oil Pressure Shutdown		Global			
				Alarm					
ENG_T_SD_ALM	BIT	1	%M00304	High Engine Temperature		Global			,
		•		Shutdown Alarm			`		
RAD_WATER_LOW_ALM	BIT	1	%M00305	Low Radiator Water Level		Global			1
10.00_11V1FI/_r014_VFIAI	511	•	/014100303			Gional	•		1
000 0100 1111	D.T			Alarm		.			İ
SPD_OVER_ALM	BIT	1	%M00306	Over Speed Alarm		Global	, .		1
RAD_WATER_LOW_DLY	BIT	1	%M00315	Radiator Water Level Low		Global			
	•			Delay	•				
SPD_OVER_DLY	BIT	- 1	%M00316	Over Speed Delay Timer		Global	R		
I ALM	BIT	1	%M00320	High Alarm	•	Global	• • • • • • • • • • • • • • • • • • • •		
UNDER ALM	BIT	i	%M00321		•				
				Under Speed Alarm		Global			
VOLTS_UNDER_ALM	BIT	1	%M00322	Alternator Voltage Under	•	Global	٠.		
				Alarm			•		
VOLTS_OVER_ALM	BIT	1	%M00323	Alternator Voltage Over		Global	•		
				Alarm					
GEN CB_TRIP_ALM	BIT	1	%M00324	Generator CB Tripped Alarm		Global			
ALT_TEMP_ALM	BIT	1	%M00325	Alternator High Temperature		Global			
		•	7011100020	Alam		Ciobai			
SPD UNDER DLY	BIT	1	%M00331			Clobal			
				Under Speed Alarm Delay		Global			
VOLTS_UNDER_DLY	BIT	1	%M00332	Under Voltage Alarm Delay		Global			
VOLTS_OVER_DLY	BIT	1	%M00333	Over Voltage Alarm Delay		Global			-
MEDIUM_ALM	BIT	1	%M00340	Medium Alarm		Global			•
FUEL_LEV_EMPTY_ALM	BIT	1	%M00341	Fuel Empty Alarm		Global	•		
FAIL_TO_STR_ALM	BIT	1	%M00342	Fail to Start Alarm		Global			
FUEL_LEV_EMPTY_DLY	BIT	1	%M00351	Fuel Level Empty Alarm		Global			
		·	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Delay		Ciobai		•	
LOW ALM	BIT	1	%M00360			Clabal			•
	BIT	1		Low Alarm		Global			
OIL_P_W_ALM	ы	1	%M00361	Low Oil Pressure Warning		Global	i i i i		1
				Alarm					
ENG_T_W_ALM	BIT	·1	%M00362	High Engine Temperature		Global		-	•
	•			Warning Alarm					
FUEL_LEV_LOW_ALM	BIT	1	%M00363	Low Fuel Level Alarm		Global			
E CHG_AC_ALM	BIT	1	%M00364	Battery Charger AC Alarm	•	Global			
E _CONT_LOW_V_ALM		· i	%M00365	Control Battery Charger Low		Global			
		•	,0,100000	Voltage Alarm		Ciobai			4
BAT_STR_LOW_V_ALM	BIT	1	0/ NADO 200			Olak at	•		•
PVI_21V_FOAA^A_ATVEN	DIT	, 1	%M00366	Start Battery Charger Low		Global			
FUEL LEVILORY BLV	DIT.		0/14000==	Voltage Alarm		_	_ :		•
FUEL_LEV_LOW_DLY	BIT	1	%M00373	Fuel Level Low Alarm Delay		Global	R		
BAT_CHG_AC_DLY	BIT	1	%M00374	Battery Charger AC Failure		Global	R		
				Delay	•				
BAT_CONT_LOW_V_DLY	BIT	1	%M00375	Control Battery Low Voltage	•	Global	R		
<u> </u>				Delay	•		••		
BAT_STR_LOW_V_DLY	BIT	1 -	%M00376	Start Battery Low Voltage	. •	Global	R		-
= · · · _ • · · · _ • · · _ • · _ • · · · ·		-		Delay		Ciobai	11		
MAINS_ATS_OPN_ALM	BIT	1	%N#00304			Clabal			
MIMINO_ATO_OPIN_ALIVI	OH	•	%M00381	Mains ATS Failed to Open		Global			
AAANNO ATO OLO ALAZ	DIT			Alarm		_			
MAINS_ATS_CLS_ALM	BIT	1	%M00382 .	Mains ATS Failed to Close		Global			•
				Alarm					
GEN_ATS_OPN_ALM	BIT	1	%M00383	Generator ATS Failed to		Global			
- -				Open Alarm					
GEN_ATS_CLS_ALM	BIT	1	%M00384	Generator ATS Failed to		Global			
· — · · <u> </u>		-		Close Alarm	•	J.05041			
NEW_ALM	BIT	1	%M00400	New Alarm		Global	R	٠.	
%M00401	BIT	i	%M00400	**No Description**		Global	R		
	١١٠	•	VOINIOCHOT	No Description		Global	К		
P _i n: BCC_4000_4				A: .			GLOBAL	VARL	ABI
•		*							

 -	SP239	Gowan Ro	ad Calāmvāle SPS	Power Units for Gensets OM Manu	ual				
Name	Type	Len	Address	Description	Stored Val	Scope	Ret	Ovr	Ĕi i
% M00402	BÍT	1	%M00402	**No Description**		Global	R	_	
% M00403	BIT	1	%M00403	**No Description**		Global	R		-
% M00404	BIT	1	%M00404	**No Description**		Global	.R		
	∘BIT	4				Global	'R		
%M00405		1	%M00405	**No Description**				_ 	i
%M00406	BIT	1	%M00406	**No Description**		Global	R		,
%M00421	BIT	1	%M00421	**No Description**		Global	R		1
%M00422	BIT	1	%M00422	**No Description**		Global	R		
%M00423	≐BIT	1	%M00423	**No Description**		Global	R		
%M00424	BIT	1	%M00424	**No Description**		Global	R		- 1
%M00425	BIT	1	%M00425	**No Description**		Global	R		
%M00441	BIT	i .	%M00441	**No Description**		Global	R ·		
		4				Global	R		
%M00442	∙BIT	1	%M00442	**No Description**					i
%M00461	BIT	1	%M00461	**No Description**		Global	R		
%M00462	:BIT	1	%M00462	**No Description**		Global	R		
%M00463	BIT	1	%M00463	**No Description**	•	Global	R		i
%IM00464	BIT	1	%M00464	**No Description**		Global	R		!
%M00465	BIT	1	%M00465	**No Description**		Global	R		
%M00466	BIT	1	%M00466	**No Description**		Global	Ŕ		ļ
	BIT	i				Global	R		-
%M00481			%M00481	**No Description**					i
%M00482	BIT	1	%M00482	**No Description**		Global	R		
%M00483	BIT	1	%M00483	**No Description**		Global	· R		
%M00484	BIT	1.	%M00484	**No Description**		Global	R		1
AUTO IND	BIT	1 .	%Q00001	Controls in Auto Indicator		Global			
TEST_IND	BIT	1	%Q00002	Controls in Test Indicator		Global			
MAN_IND	BIT	1	%Q00003	Controls in Manual Indicator		Global			
	BIT	4							i i
REM_STR_IND			%Q00004	Remote Start Indicator		Global			. !
MAINS_AVAIL_IND	BIT	1	%Q00005	Mains Available Indicator		Global			1
MAINS_CON_IND	BIT	1	%Q00006	Mains Connected Indicator		Global			1
GEN_RUN_IND	BIT	1	%Q00007	Generator Running Indicator		Global			
GEN_CON_IND	BIT	1	%Q00008	Generator Connected		Global			j
02.1_0011_110		**		Indicated	•				1
MAINS_FAILED_IND	BIT	1	%Q00009	Mains Failed Indicator		Global			.
	BIT								
EM_STOP_IND		1	%Q00010	Emergency Stop Indicator		Global			į
MEN_FLT_IND	BIT	1	%Q00011	MEN Fault Indicator	•	Global			1
OIL_P_LOW_SD_IND	BIT	1	%Q00012	Low Oil Pressure Shutdown		Global			1
				Indicator					
OIL_P_LOW_W_IND	BIT	1	%Q00013	Low Oil Pressure Warning		Global			1
				Indicator					
ENG_T_HI_SD_IND	BIT	1	%Q00014	High Engine Temperature		Global			į
2/10_1_/000	2,,	•	70400011	Shutdown Indicator		0.050.			1
ENC T HI W IND	BIT	1	%Q00015			Global			.
ENG_T_HI_W_IND	ы	•	/6Q00013	High Engine Temperature		Giobai			İ
5.5 W.TED OW IND	DIT	4	0/ 000040	Warning Indicator		0111			
RAD_WATER_LOW_IND	BIT	1	%Q00016	Low Radiator Water Level		Global			1
				Indicator					-]
FUEL LEV EMPTY IND	BIT	1	%Q00017	Fuel Empty Indicator		Global			
FUEL LEV LOW IND	BIT	1	%Q00018	Low Fuel Level Indicator		Global			ļ
SPD OVER IND	BIT	1	%Q00019	Over Speed Indicator		Global			-
SPD_UNDER_IND	BIT	i	%Q00020	Under Speed Indicator		Global			
FAIL_TO_STR_IND	BIT	i			•				
FAIL TO STR IND			%Q00021	Fail to Start Indicator		Global			
VOLTS_UNDER_IND	BIT	1	%Q00022	Alternator Voltage Under		Global			
	.			Indicator					
VOLTS_OVER_IND	BIT	1	%Q00023	Alternator Voltage Over		Global			ł
				Indicator					
ALT_TEMP_IND	.BIT	1	%Q00024	Alternator High Temperature		Global			j
				Indicator					ļ
GEN_CB_TRIP_IND	BIT	1	%Q00025	Generator CB Tripped		Global			
OFIATOR IVIII TIME	D11	•	/0Q00025	Indicator		Ciobai			
DAT OUG AC IND	DIT	4	0/ 000000			Olahad			
BAT_CHG_AC_IND	BIT	1	%Q00026	Battery Charger AC Indicator		Global			-
BAT_CONT_LOW_V_IND	BIT	.1	%Q00027	Control Battery Charger Low		Global			-
				Voltage Indicator					i
BAT_STR_LOW_V_IND	BIT	1 ,	%Q00028	Start Battery Charger Low		Global			
				Voltage Indicator					
CAN_DOORS_OPEN_IND	BIT	1	%Q00029	Canopy Doors Open		Global			
		-	,	Indicator					
MAINS_ATS_OPN_CMD	BIT	1	%Q00033	BCC Mains ATS Open		Global			
MANUATO_OF N_OND	D11	•	\u000000	Command		Sionai			
CENTATE OLD CHE	DIT	4	0/ 00000 4			Clak-I			
GEN_ATS_CLS_CMD	BIT	1	%Q00034	BCC Generator ATS Close		Global			
OFN CD ALM	D.T		0/ 00000=	Command		o			
GEN_SD_ALM	BIT	1	%Q00035	BCC Generator Shutdown	4	Global			
				Alarm		_			
GEN_W_ALM	BIT	1	%Q00036	BCC Generator Warning		Global			
		•		Alarm					
Program: BCC_4000_4				A:			CIODAT	T :	A 1DT
1 1081aun 1000_1000_4				41.			GLOBAL	· · -	LUL

Page 329 of 469

	SP239-C	Sowan R	oad Calamvale S PS f	Power Units for Gensets OM Man	iual				, Ì
Name	Туре	Len	Address	Description	Stored Val	Scope	Ret	Ovr	E
FUEL LOW	BIT	1	%Q00037	BCC Low Fuel	\	Global			
GEN RUN	B∤T	1	%Q00038	BCC Generator Running		Global			
GEN_CON	BIT	• 1	%Q00039	BCC Generator Connected		Global			. į
SMR ⁻	BIT	1	%Q00040	Starter Motor Relay		Global		•	
GAG	BIT	1	%Q00041	Governor Control Relay		Global			
Į.	BIT	- 1	%Q00042	Audible Alarm Relay		Global		, .	
R	BIT	1 .	%Q00043	Generator Shunt Trip Relay		Global			
DOORS_OPEN	BIT	1	%Q00044	BCC Doors Open Alarm		Global			
GEN_AŪTO	BIT	1	%Q00045	Generator Auto Mode		Global			
SEQ_CNT	WORD	1	%R00001	Sequence Counter	•	Global	R	•	
MODBUS_INPUTS	WORD	1	%R00002	Modbus Digital Inputs		Global	R	•	
MODBUS_OUTPUTS	WORD	1	%R00005	Modbus Digital Outputs		Global	R		
MODBUS_STATUS_1	WORD	1	%R00008	Modbus Status 1		Global	R		
MODBUS_STATUS_2	WORD	1	%R00009	Modbus Status 2	-	Global	R		
MODBUS_ALARMS	WORD	1	%R00010	Modbus Alarms		Global	R		
%R00100	WORD	3	%R00100	**No Description**	•	Global	R		
%R00103	WORD	3	%R00103	**No Description**		Global	R		
%R00106	WORD.	3	%R00106	**No Description**		Global	R		
%R00109	WORD	3	%R00109	**No Description**		Global	R		
%R00112	WORD	3	%R00112	**No Description**		Global	R		
%R00115	WORD	3	%R00115	**No Description**		Global	R		
%R00118	WORD	3	%R00118	**No Description**		Global	R	•	
%R00121	WORD	3	%R00121	**No Description**	•	Global	R		
%R00124	WORD	3	%R00124	**No Description**		Global	Ŗ		
%R00127	WORD	3	%R00127	**No Description**		Global	Ŕ		
%R00130	WORD	3	%R00130	**No Description**		Global	R		
%R00133	WORD	3	%R00133	**No Description**		Global	R		
0136	WORD	3	%R00136	**No Description**		Global	R	•	
0139	WORD	3	%R00139	**No Description**		Global	R		
%R00200	WORD	3	%R00200	**No Description**		Global	R		
%R00203	WORD	3	%R00203	**No Description**		Global	R		
%R00206	WORD	3	%R00206	**No Description**	,	Global	R		
%R00209	WORD	3	%R00209	**No Description**		Global	R R		
%R00212	WORD	3	%R00212	**No Description**	(Global			
%R00215	WORD	3	%R00215	**No Description**		Global Global	R . R		
%R00218	WORD	3 3	%R00218	**No Description**		Global	R		
%R00221	WORD WORD	3	%R00221 %R00224	**No Description** **No Description**	~	Global	R		
%R00224 % B00227	WORD	3	%R00227	**No Description**	•	Global	R		
%R00227 %R00230	WORD	3	%R00230	**No Description**		Global	R	. '	
%R00300	WORD	· 3	%R00300	**No Description**		Global	R		•
%R00303	WORD	3	%R00303	**No Description**		Global	R		
%R00306	WORD	3	%R00306	**No Description**		Global	R	•	
%R00309	WORD	3	%R00309	**No Description**		Global	Ŕ		
%R00312	WORD	3	%R00312	**No Description**		Global	R		
%R00315	WORD	3	%R00315	**No Description**		Global	R		
%R00318	WORD	3	%R00318	**No Description**		Global	R		
%R00321	WORD	3	%R00321	**No Description**		Global	R		
%R00324	WORD	3	%R00324	**No Description**		Global	R		
%R00327	WORD	3	%R00327	**No Description**		Global	R		
% 330	WORD	3	%R00330	**No Description**		Global	R		
% 333	WORD	3	%R00333	**No Description**		Global	R		
%R00336	WORD	3	%R00336	**No Description**		Global	R		
%R00339	WORD	3	%R00339	**No Description**		Global	R		
FST_SCN	BIT	1	%S00001	Set to 1 when the current		Global	R		
•	- -			sweep is the first sweep			_		
LST_SCAN	BIŤ	1	%S00002	Reset from 1 to 0 when the		Globai	R		
				current sweep is the last			,		
				sweep			_		
T_10MS	BIT	1	%S00003	0.01 Second Timer Contact		Global	R		
T_100MS	BIT	1	%S00004	0.1 Second Timer Contact		Global	R		
<u>T_1S</u>	BIT	1	%S00005	1 Second Timer Contact		Global	R	`	
T_1M	BIT	1	%S00006	1 Minute Timer Contact		Global	R		
ALW_ON -/	BIT	1	%\$00007 %\$00008	Always ON		Global	R	•	
ALW_OFF	BIT	1	%S00008 %S00014	Always OFF		Global Global	R R		
PLC_BAT	BIT	1	%S00014	Set to indicate a bad battery in the CPU		Giodal	K		
% D00400	WORD	1	%R00400	in the CPU **No Description**		Global	R		
%R00400	HUND		/011UU-1UU	no bescription			11		

Pr :: BCC_4000_4

GLOBAL VARIABL

Name FST_SCN	T ype BIT	Len 1	Address %S00001	Description Set to 1 when the current	Stored Val	Scope System	Ret R	Ovr	Ē
LST_SCN	BIT	1	%S00002	sweep is the first sweep Reset from 1 to 0 when the		System	R		
-				current sweep is the last sweep		-		-	
T_10MS	BIT	1	%S00003	0.01 second timer contact		System	R		
T_100MS	BIT	i	%S00004	0.1 second timer contact		System	Ŕ		
		i					R		
T_SEC	BIT		%S00005	1.0 second timer contact		System			
T_MIN	BIT	1	%S00006	1.0 minute timer contact		System	R		
ALW_ON	BIT	1	%S00007	Always ON		System	R		
ALW OFF	BIT	1	%S00008	Always OFF		System	R		
SY_FULL	BIT	1	%S00009	Set when the PLC fault table fills up		System	R		
IO_FULL	BIT	1	%S00010	Set when the I/O fault table fills up		System	R		
OVR_PRE	віт	1 .	%S00011	Set when an override exists in %I, %Q, %M or %G		System	R .		
PRG_CHK	BIT	1	%S00013	memory Set when background		System	. R		
PLC_BAT	BIT	1	%S00014	program check is active Set to indicate a bad battery		System	R		
SNPXACT	BIT	1	%S00017	in a Release 4 or later CPU SNP-X host is actively		System	R		
	BIT	1	%S00017 %S00018	attached to the CPU			R		
SNPX_RD				SNP-X host has read data from the CPU		System			
SNPX_WT	BIT	1	%S00019	SNP-X host has written data to the CPU		System	R _ ·	-	
RLTN_OK	BIT	1	%S00020	Set ON when a relational function using REAL data is success		System	R		
CONTCON	BIT	1	%S00032	Reserved for use by the programming software for cont contact		System	R	•	
PB_SUM	BIT	1	%SA0001	Set when PLC checksum does not match app checksum		System	R		
OV_SWP	BIT	1	%SA0002	Set when PLC sweep time is longer than user specified sweep time		System	R		
APL_FLT	BIT	1	%SA0003	Set when an application fault occurs		System	R		
CFG_MM	BIT	1	%SA0009	Set when a config mismatch is detected during system powerup		System	R		
HRD_CPU	BIT	1	%SA0010	Set when the diagnostics detects a problem with the CPU hardware		System	R		
LOW_BAT	BIT	1	%SA0011	Set when a low battery fault occurs		System	R		
LOS_RCK	BIT	1	%SA0012	Set when an expansion rack stops communicating with the CPU		System	R		
LOS_IOM	BIT	1	%SA0014	Set when an I/O module stops communicating with the PLC CPU		System	R		
LOS_SIO	BIT	1	%SA0015	Set when an option module stops communicating with the PLC CPU		System	R		
ADD_RCK	BIT	1	%SA0017	Set when an expansion rack is added to the system		System	R		
ADD_IOM	BIT	1 .	%SA0019	Set when an I/O module is added to a rack		System	R		
ADD_SIO	BIT	1	%SA0020	Set when an option module is added to a rack	•	System	R		
HRD_SIO	ВІТ	1	%SA0027	Set when a hardware failure is detected in an option module		System	R		
SFT_SIO	BIT	1	%SA0031	Set when an unrecoverable fault is detected in an option module	9	System	R		
BAD_RAM	BIT	1	%SB0010	Set when the CPU detects		System	R		
Program: BCC_4000_4				A:		5	SYSTEM		Al

Name	Туре	Len	Address	Description Stored Va corrupted RAM memory at	Scope	Ret Ovr Ex
		J	•	powerup		٠.
BAD_PWD ,	BIT	1	%SB0011	Set when a password violation occurs	System	R
CPU	BIT	1	%SB0013	Set when the CPU detects an unrecoverable error in the software	System	R
STOR_ER	BIT	1	%SB0014	Set when an error occurs during a programmer store operation	System	R
ANY FLT	BIT	1	%SC0009	Set when any fault occurs	System	R-
SY_FLT	BIT	* · 1	%SC0010	Set when fault occurs where an entry is put in the PLC fault tbl	System	R `
IO_FLT	BIT	1	%SC0011	Set when fault occurs where an entry is put in the I/O fault tbl	System	R
SY_PRES	BIT	1	%SC0012	Set as long as there is at least one entry in the PLC fault tbl	System	R
IO_PRES	BIT	1	%SC0013 -	Set as long as there is at least one entry in the I/O fault tbl	System	R
HRD_FLT	BIT	1	%SC0014	Set when a hardware fault occurs	System	R
SFT_FLT	BIT	1	%SC0015	Set when a software fault occurs	System	R

P m: BCC_4000_4

A:

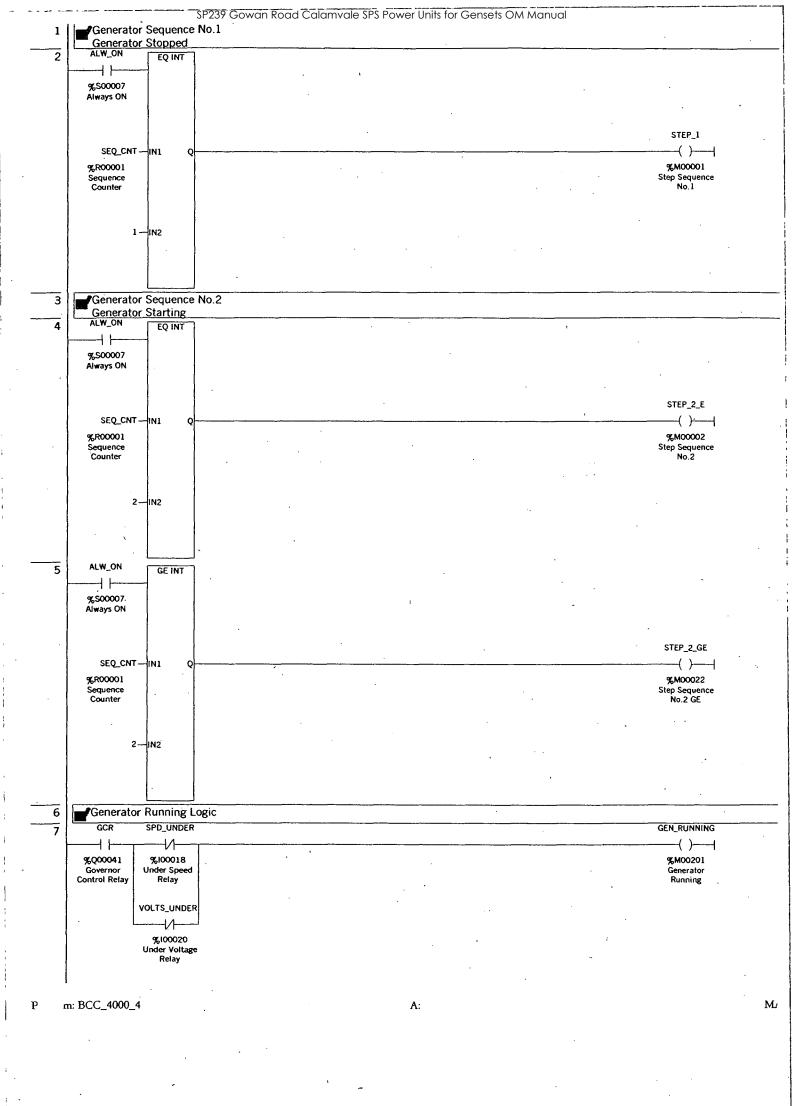
SYSTEM VARIAB

, , , - ,	vrillen för EFAC. Project: Brishane	City Council Star	ndhy Generator Pro	gram			
2	FST_SCN	PRESETS	ndby Generator Pro	,		~	
<u> </u>		CALL		•			
	%S00001						<u> </u>
Set	to 1 when the						
the	ent sweep is first sweep						
_							
3	SEQ		•				
-	CALL						•
	•						
	•						
	•				•		
4	MAIN					·	
	CALL)——						
						•	
_				٠			•
5	ALARM			•			
	CALL						
			•			•	
<u>-</u> /	AUD_ALM		•				
	-CALL			•			
	CALL				•		
	•						
	•						
`							
7 1	MODBUS			•			
ļ	CALL					*	
ļ					•.		
				. •			
			•				
						•	
	•						
			,		•		
				•			
•			•				
	•						
		÷					

A:

Page 333 of 469

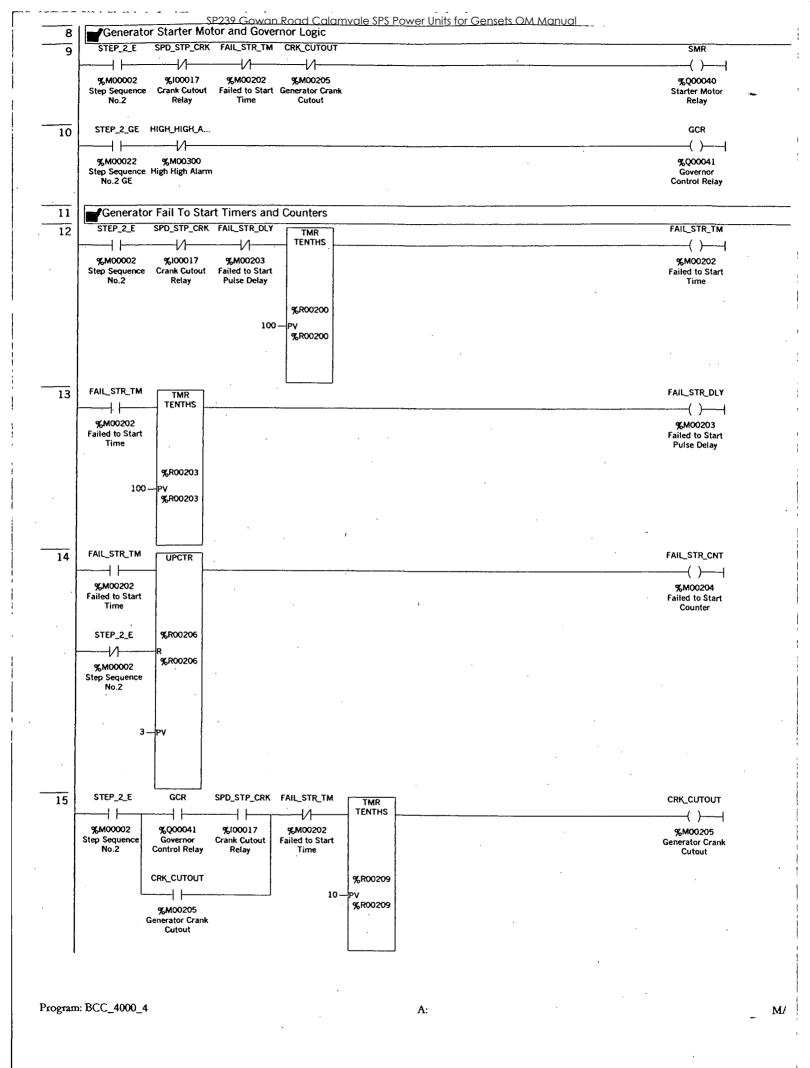
Program: BCC_4000_4



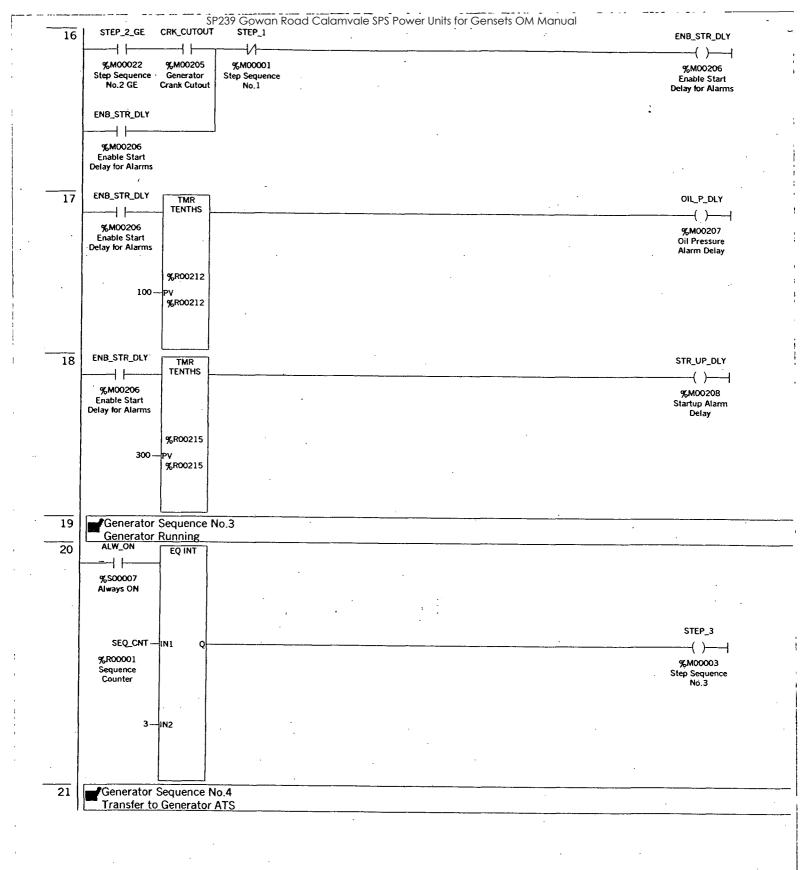
Active 10/12/2014

Q-Pulse Id TMS 1079

Page 334 of 469



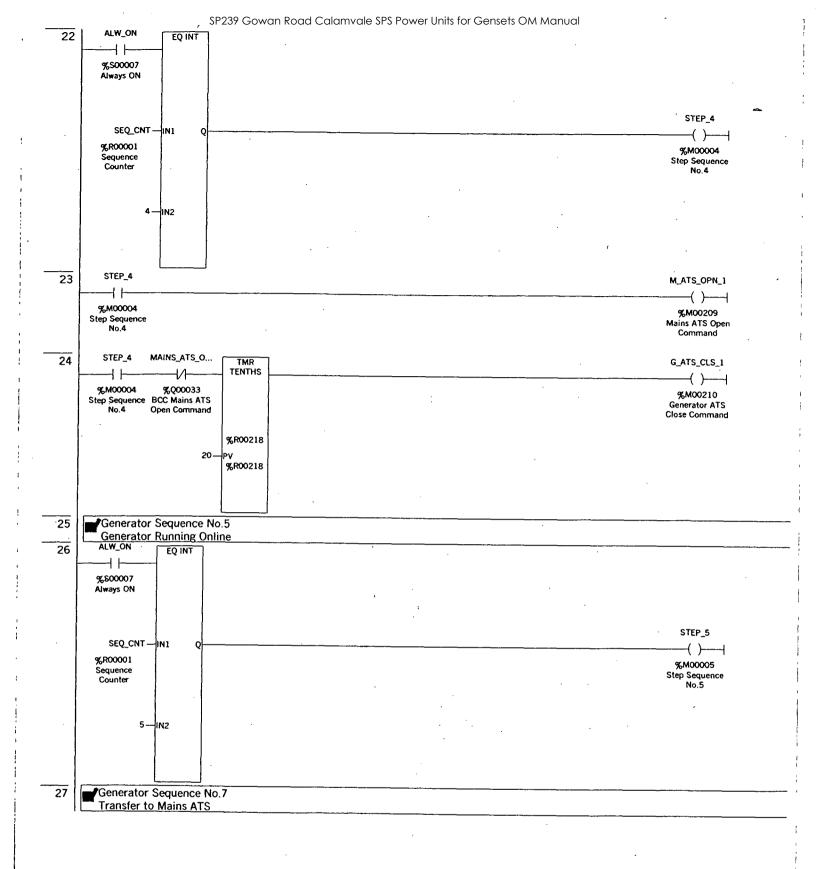
Page 335 of 469



P. m: BCC_4000_4

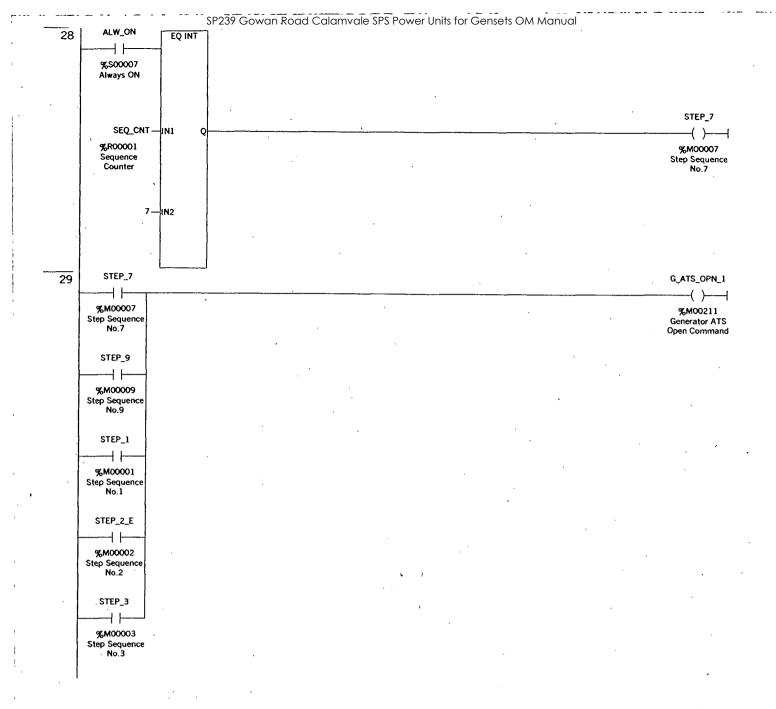
A:

M/



A:

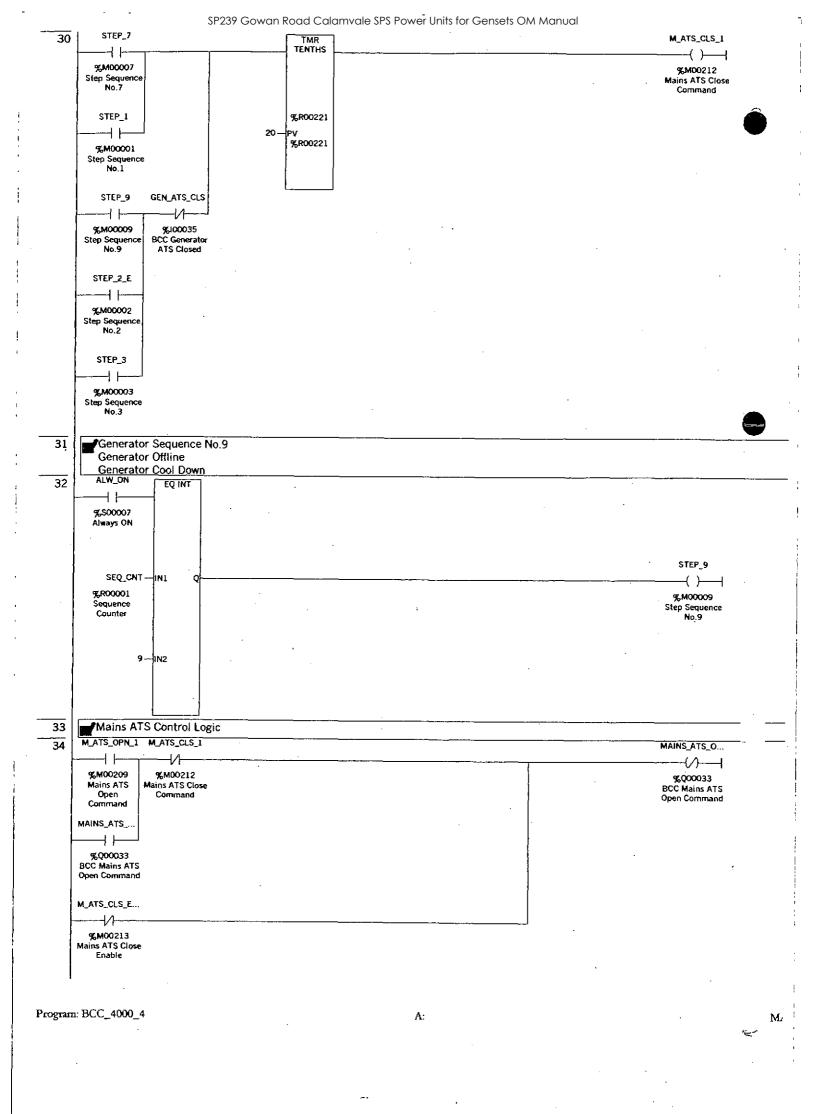
M/



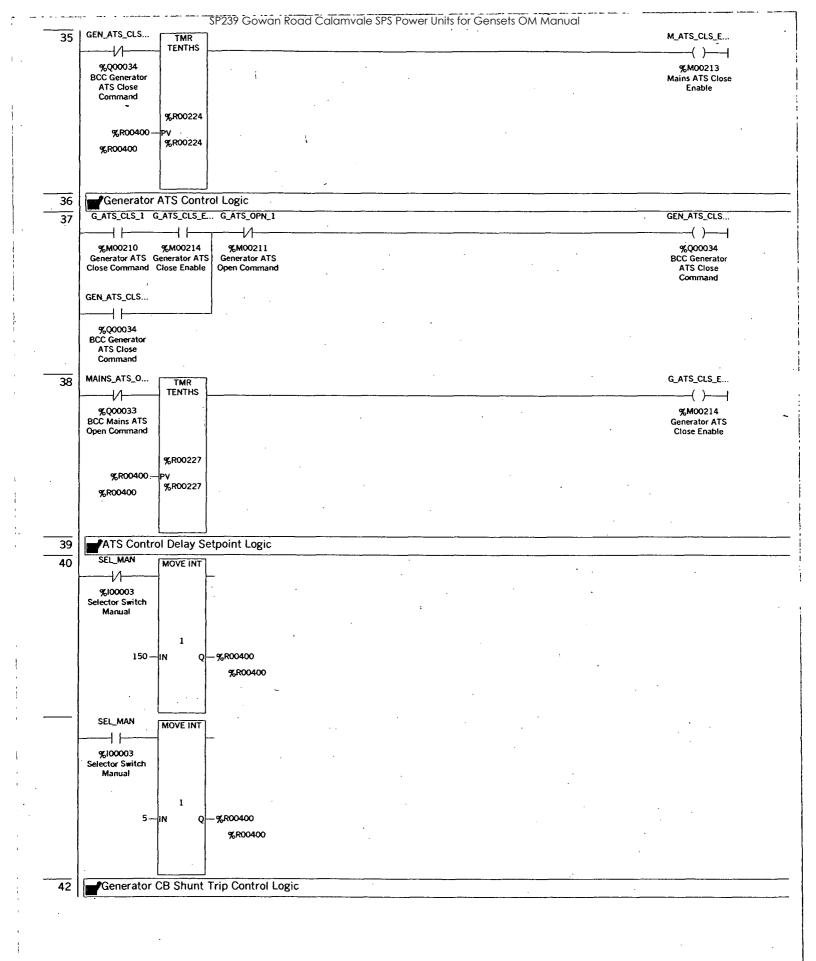
P m: BCC_4000_4

A:

Μı



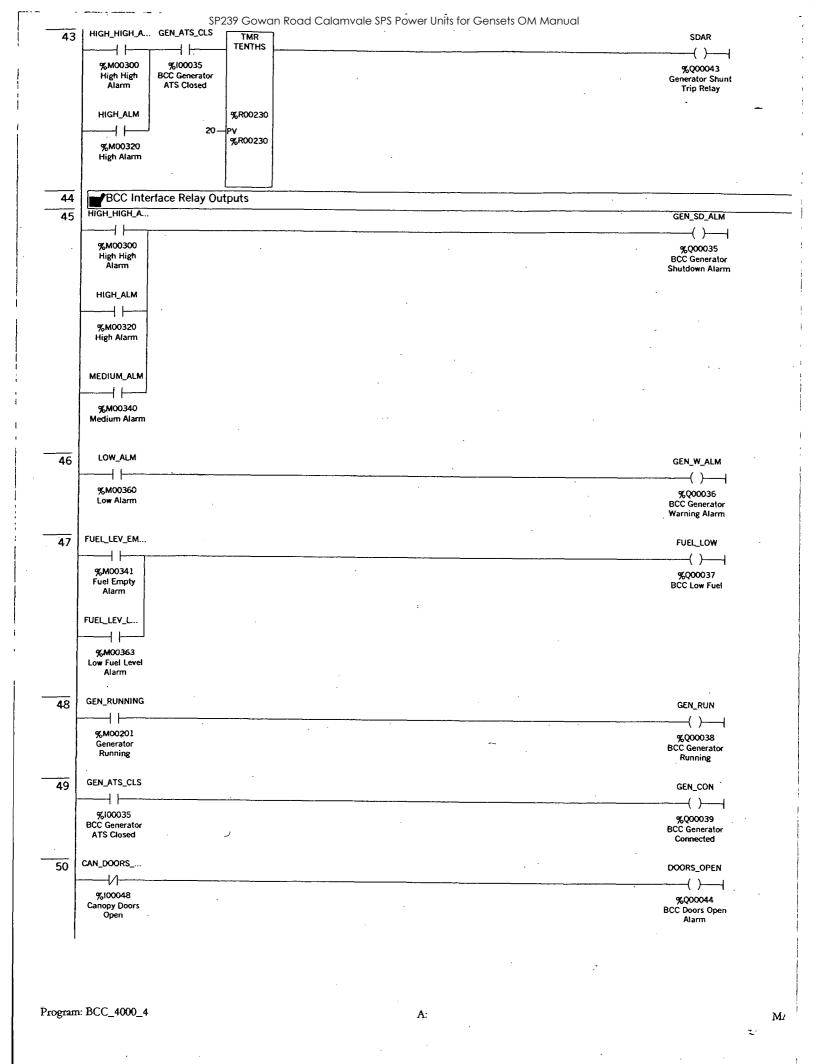
Page 339 of 469.



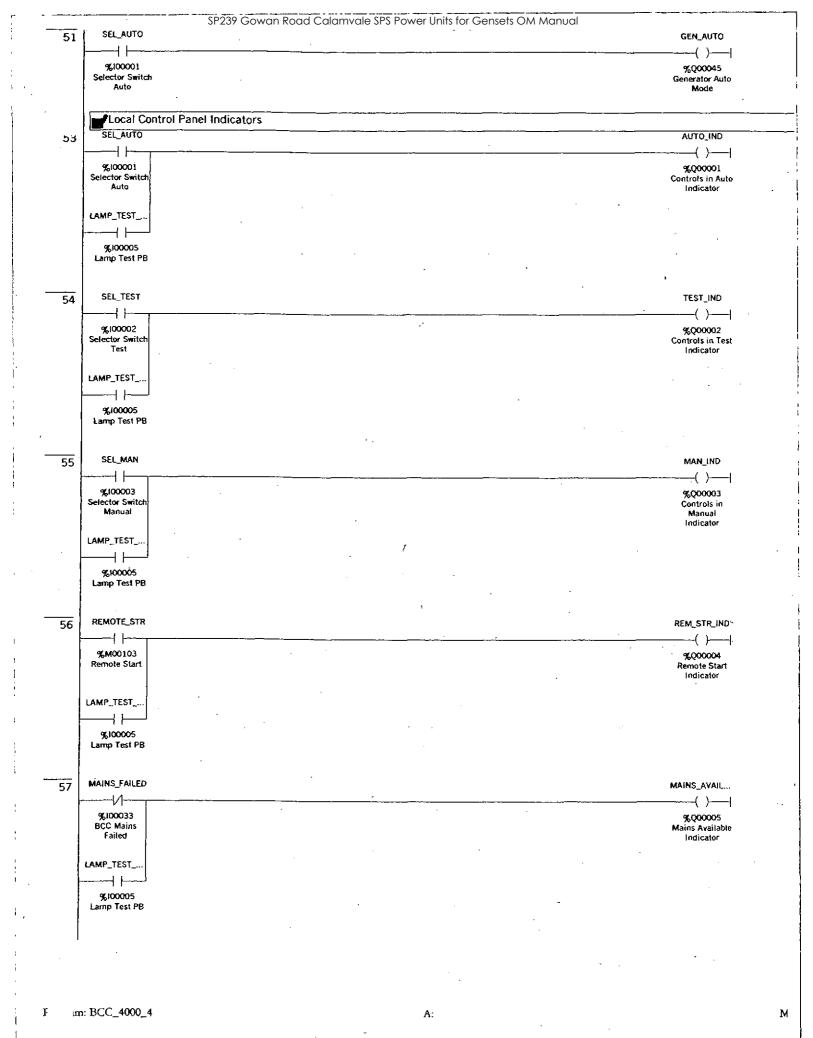
P. m: BCC_4000_4

A:

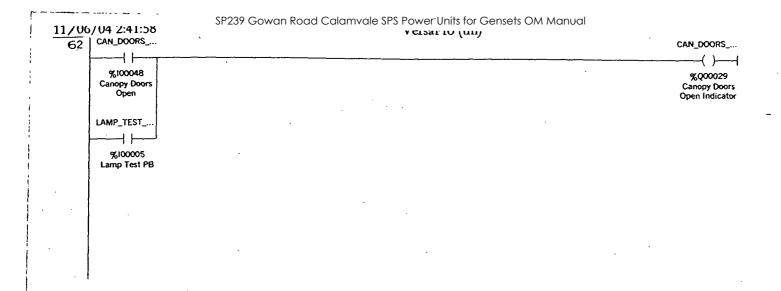
Μı



Page 341 of 469



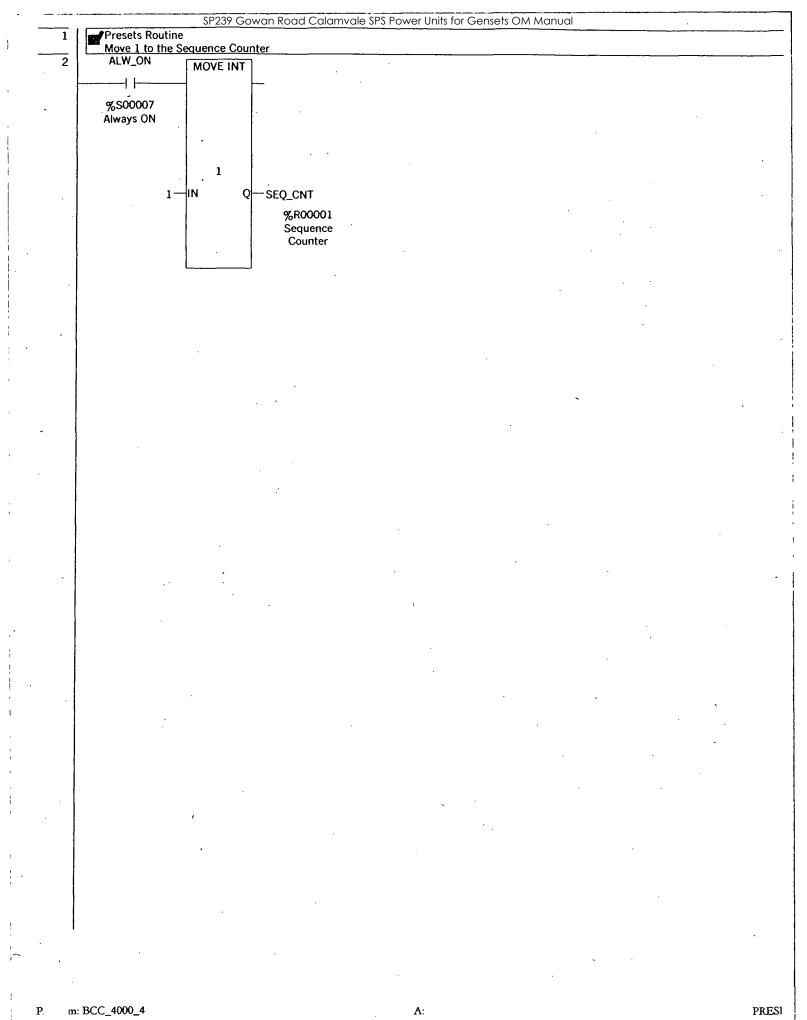
Page 342 of 469



A:

M

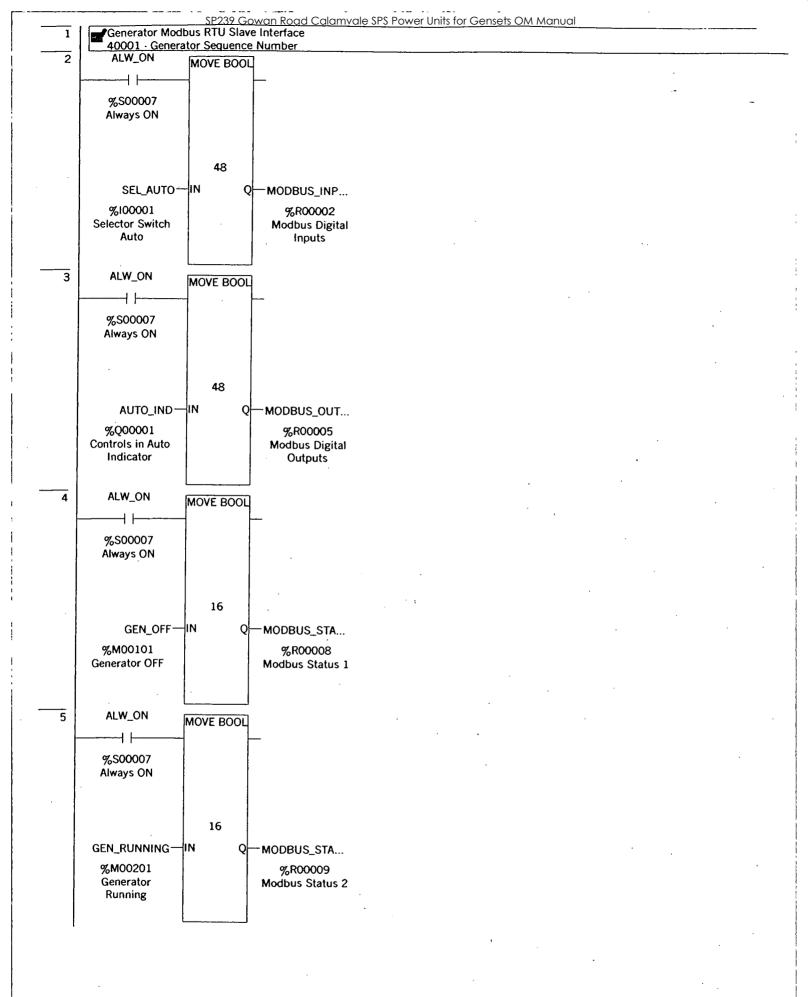
<u>--</u>



Q-Pulse Id TMS1079

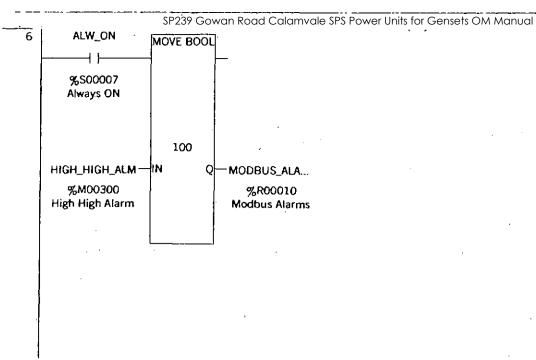
Active 10/12/2014

Page 344 of 469



A:

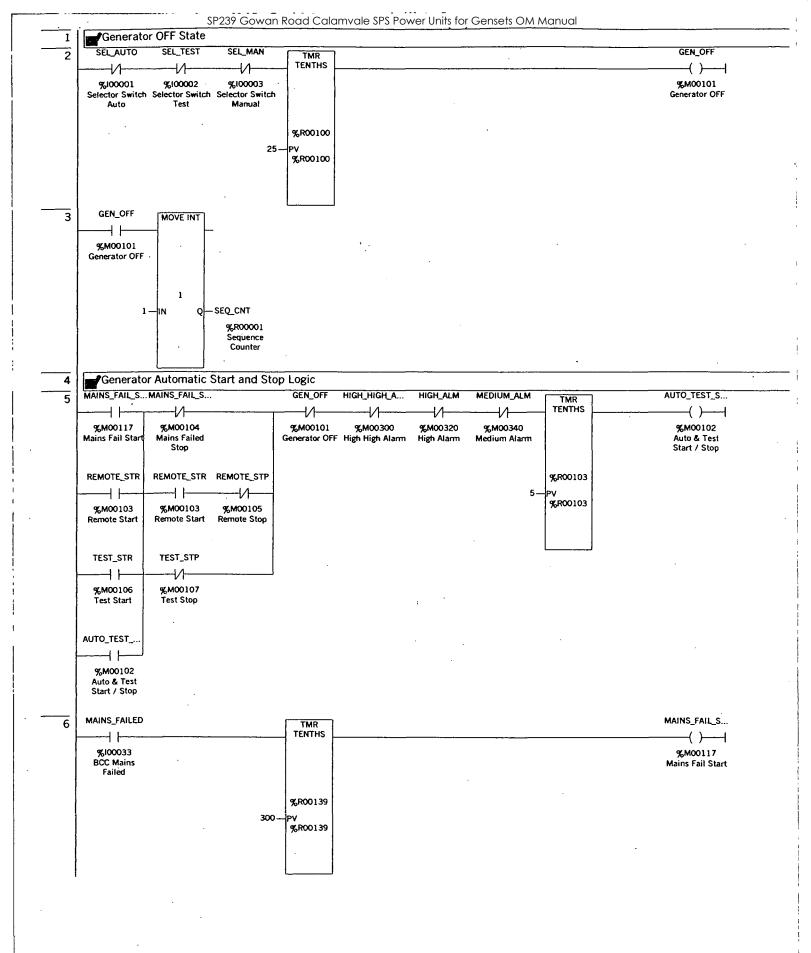
DDI



um: BCC_4000_4

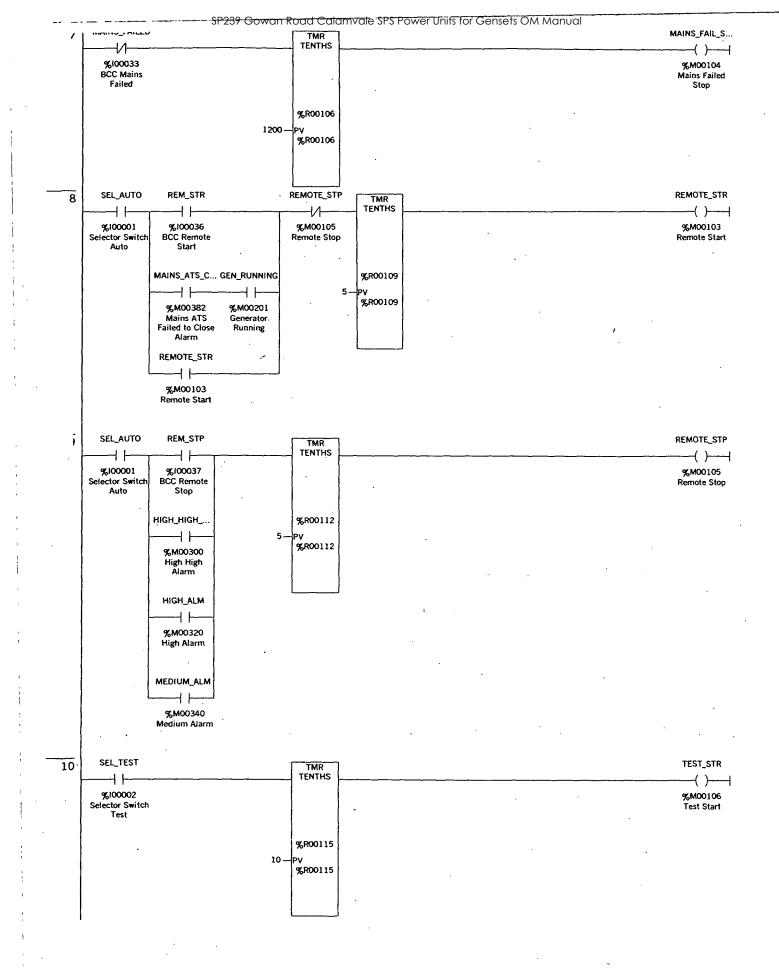
A:

MOD



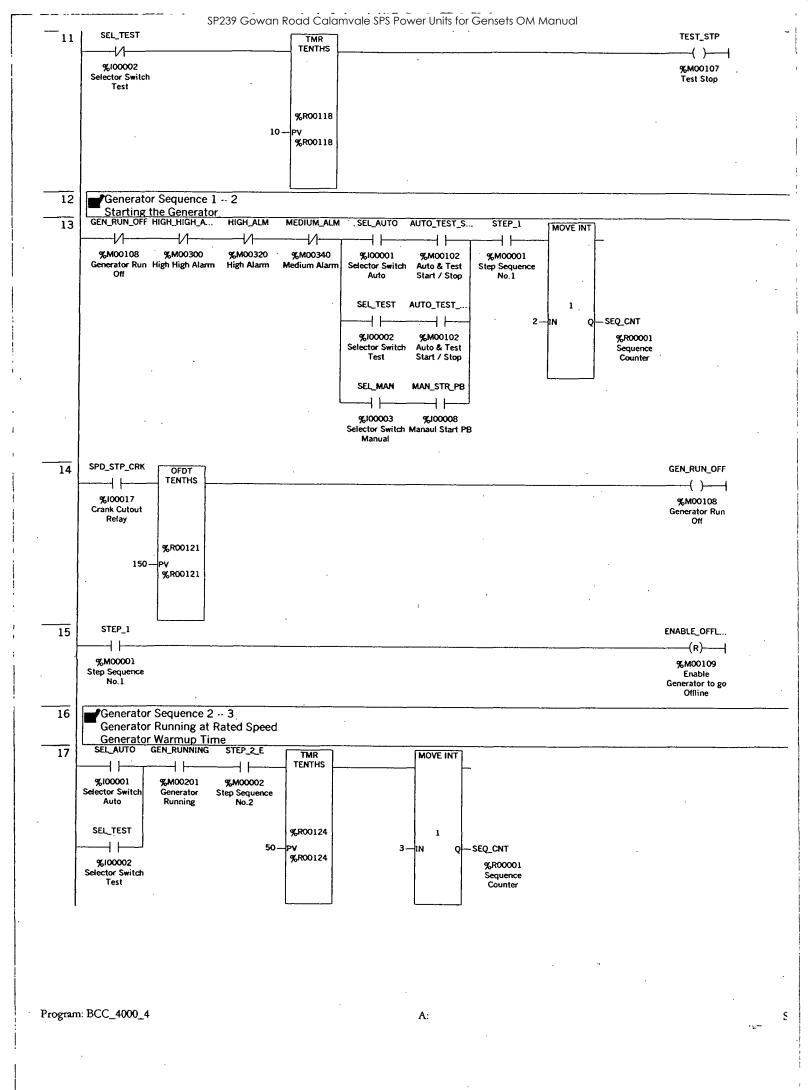
Α

Page 347 of 469

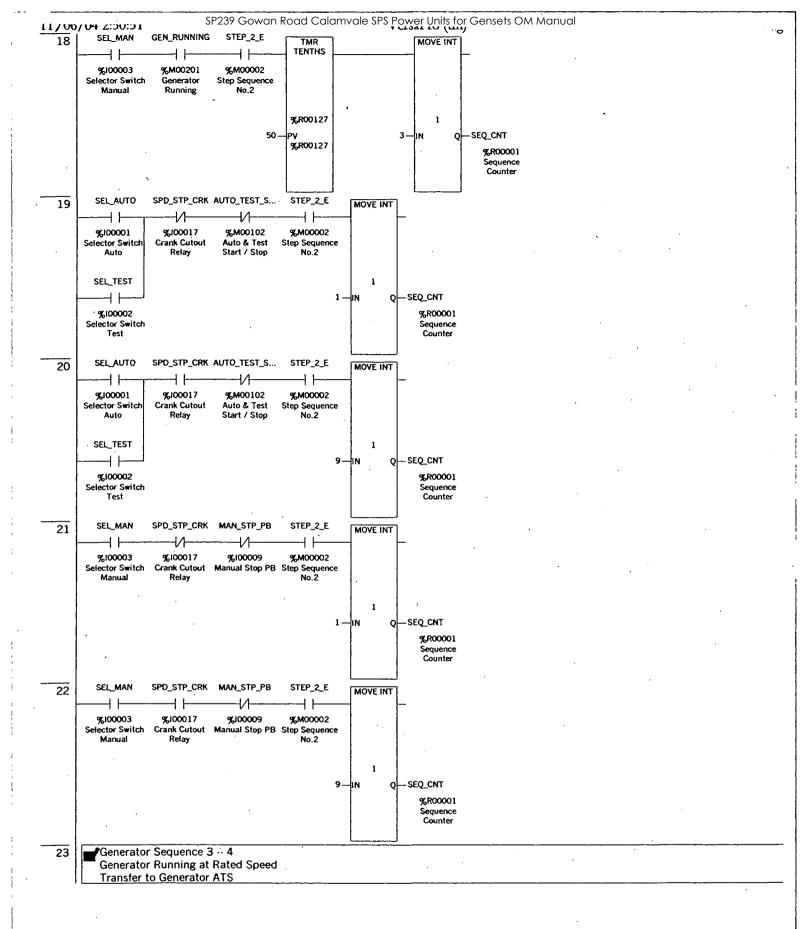


A:

SI

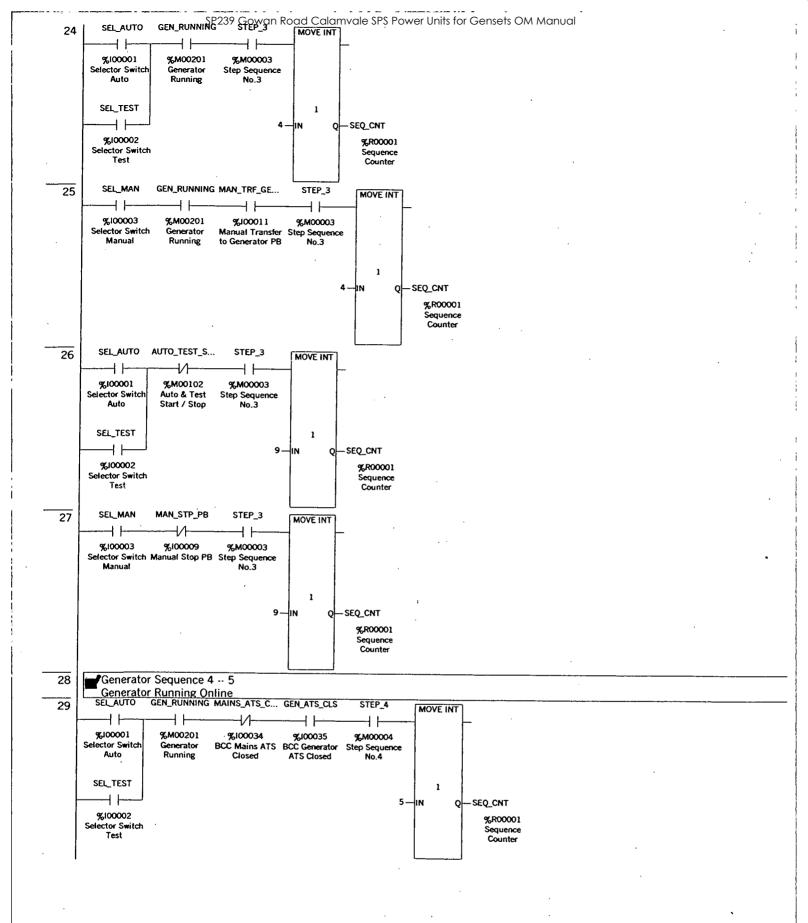


Page 349 of 469

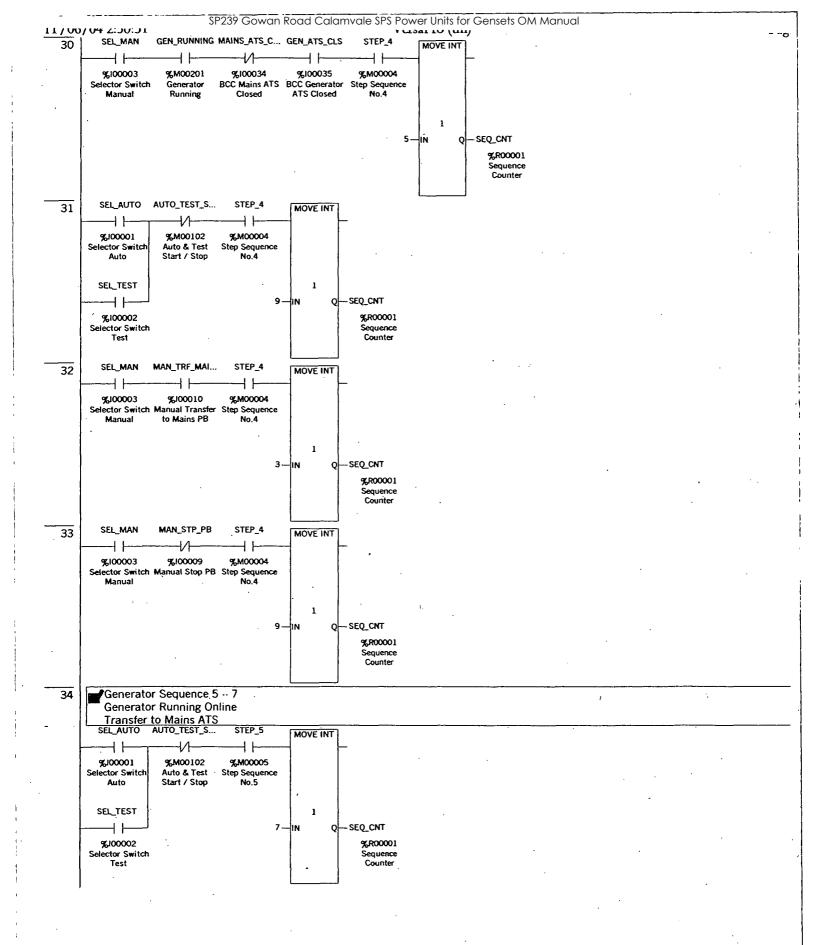


am: BCC_4000_4

A:



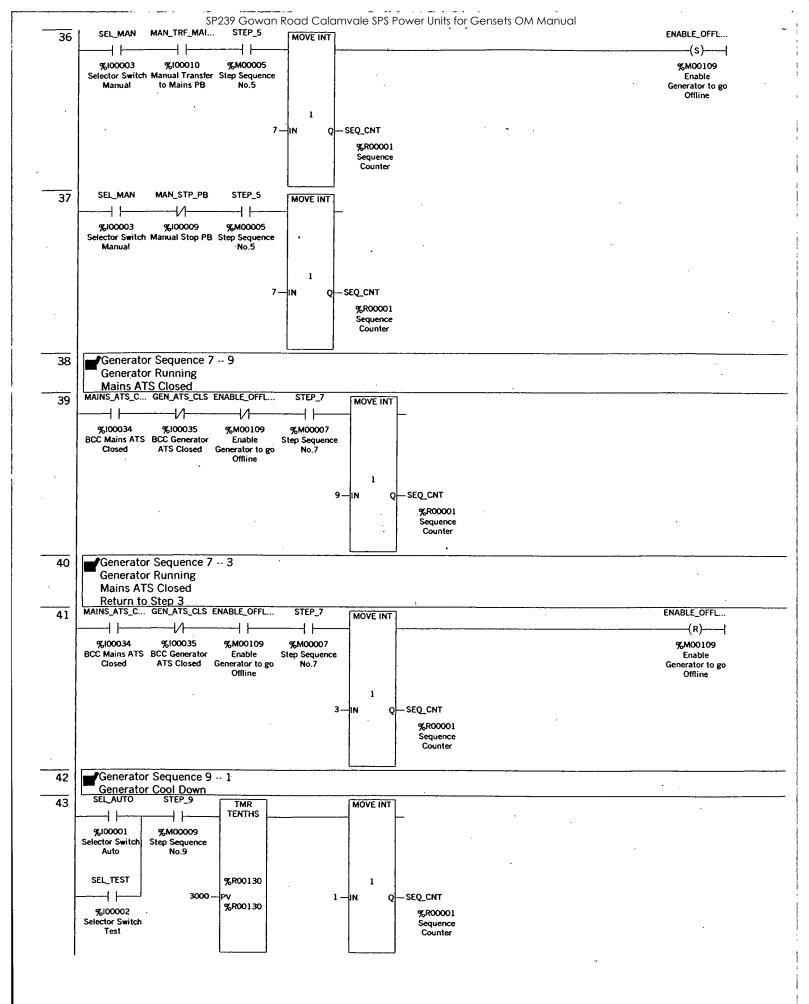
A:



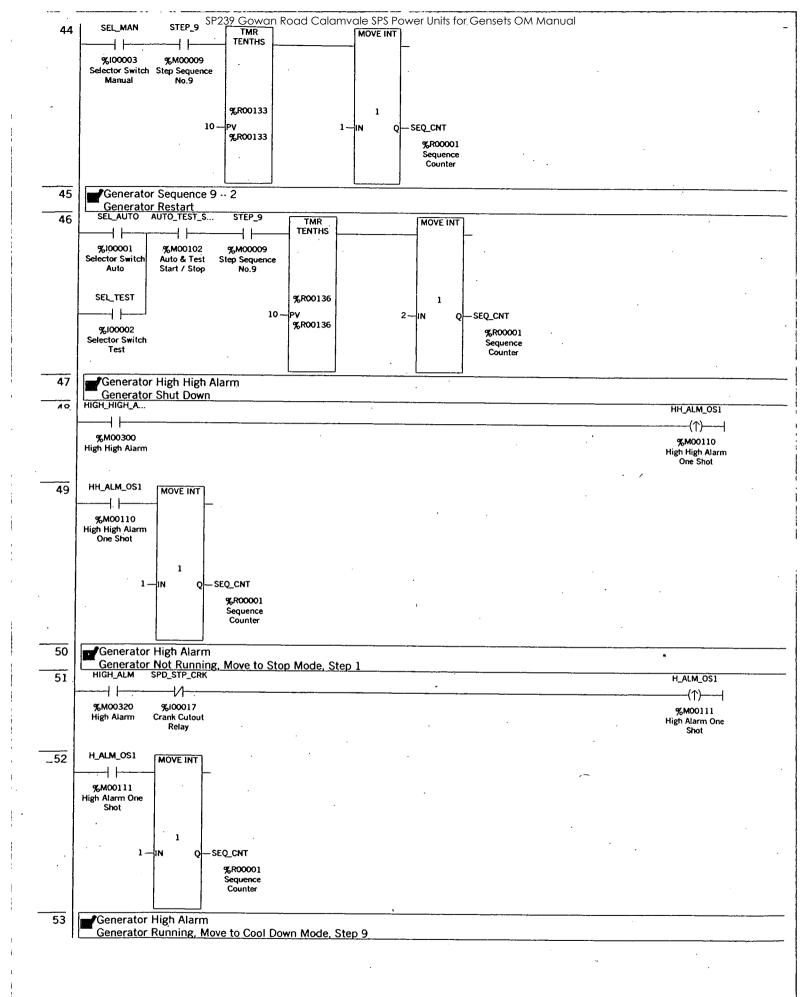
I um: BCC_4000_4

A:

Page 352 of 469



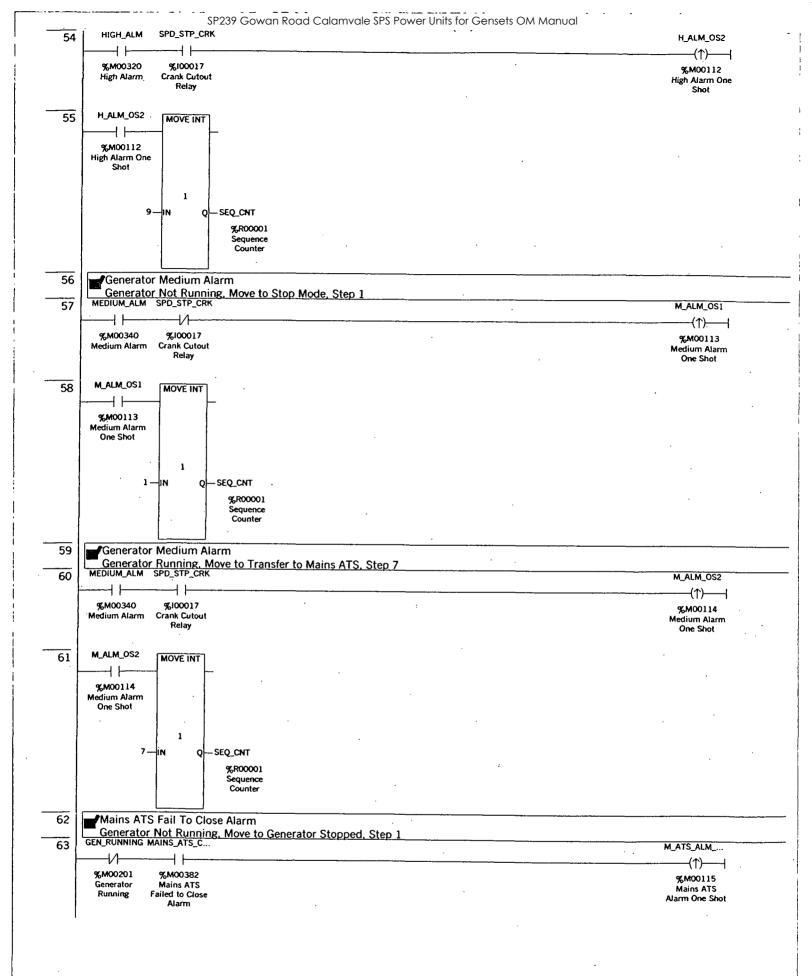
Α



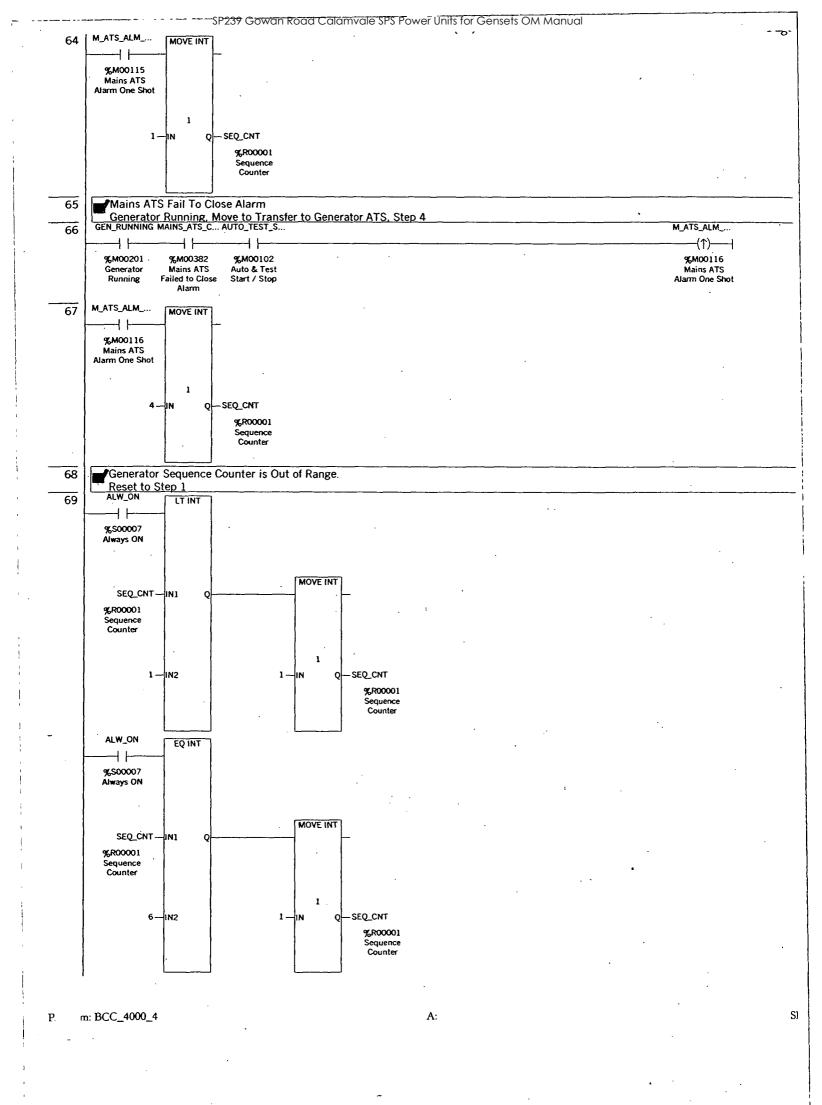
P. m: BCC_4000_4

A:

S



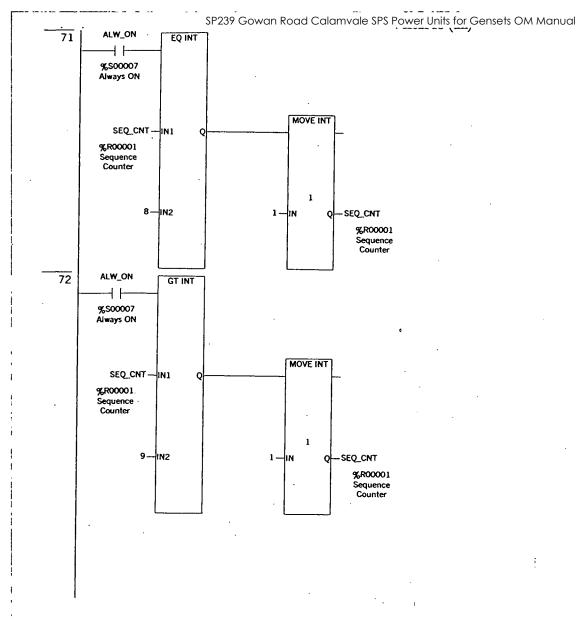
A:



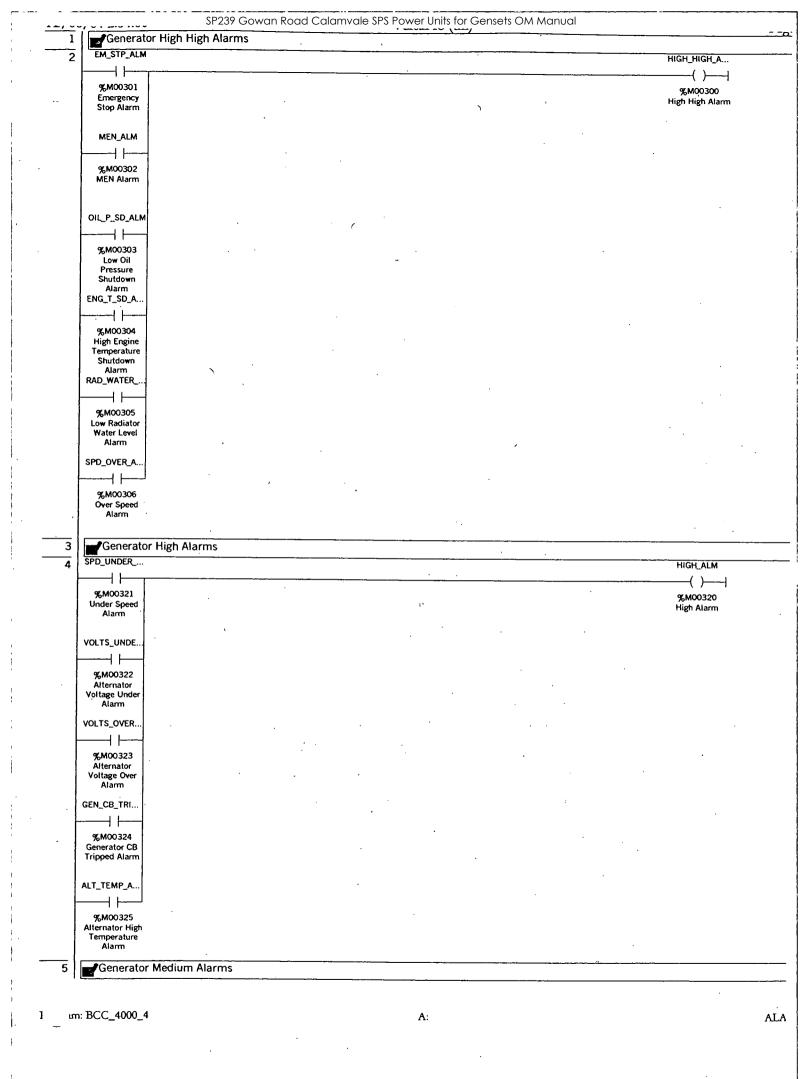
Active_10/12/2014...

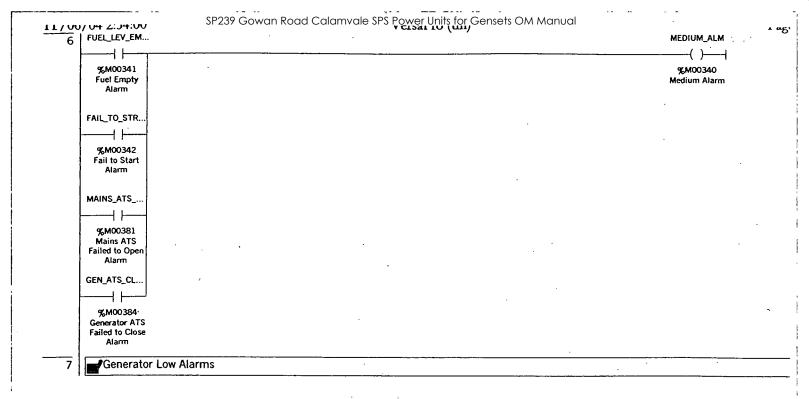
Q-Pulse Id TMS1079

<u>Page</u> 356 of 469



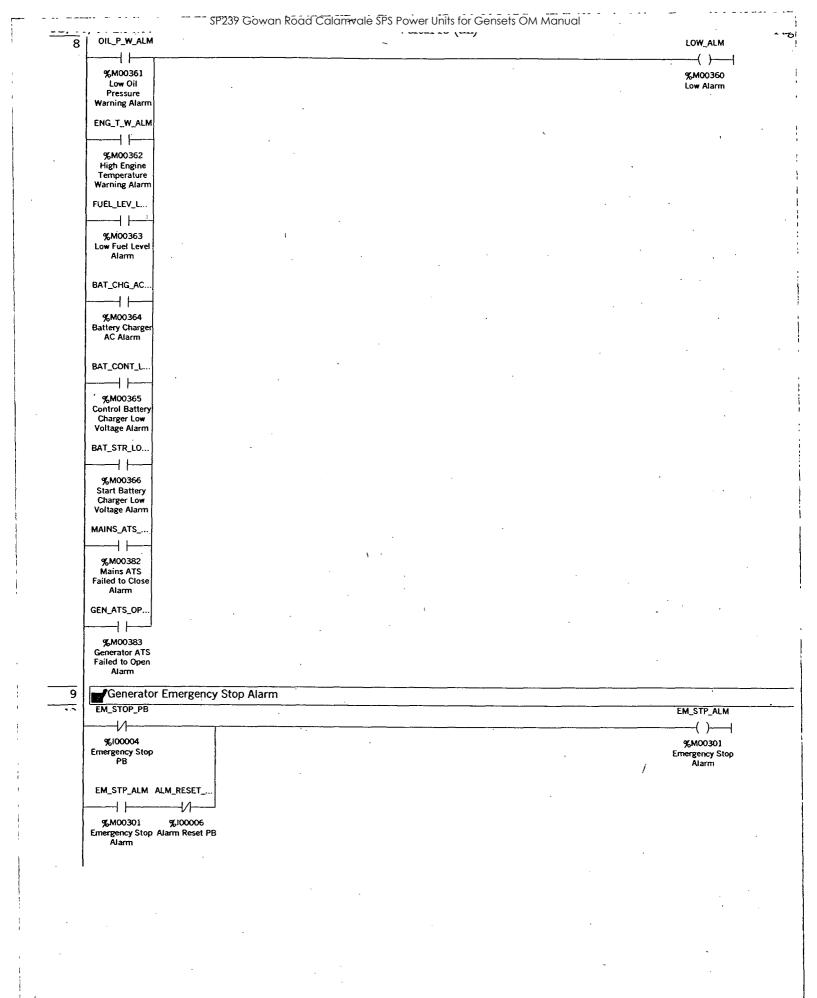
Α





A:

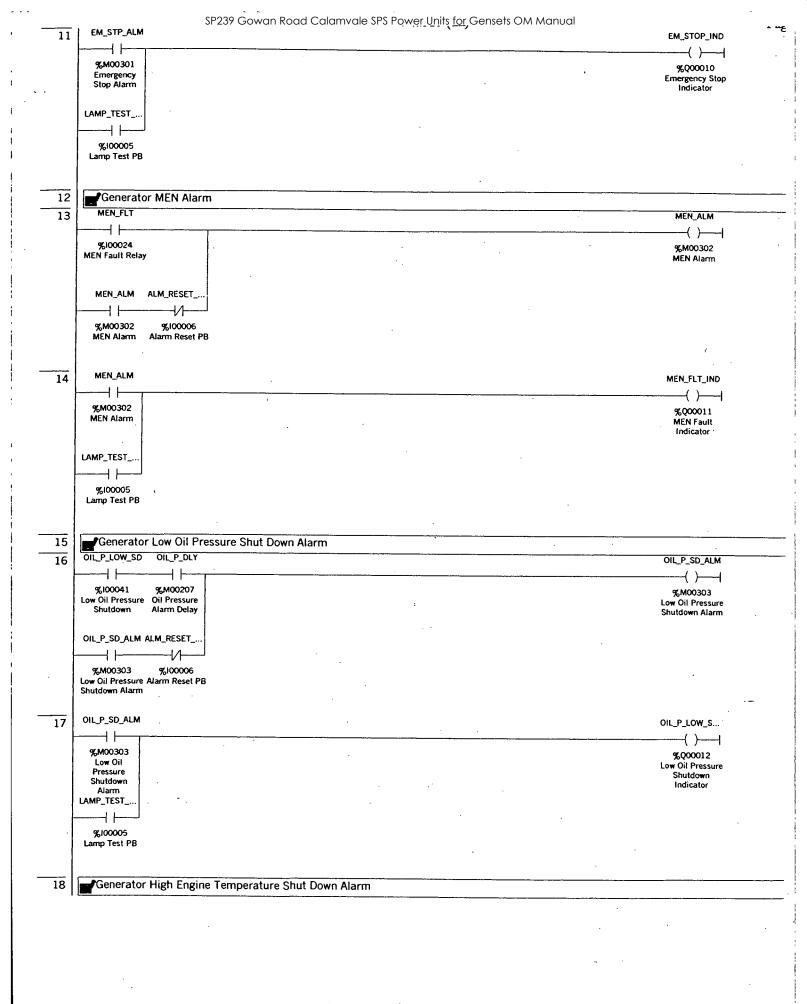
_ AL/



P m: BCC_4000_4

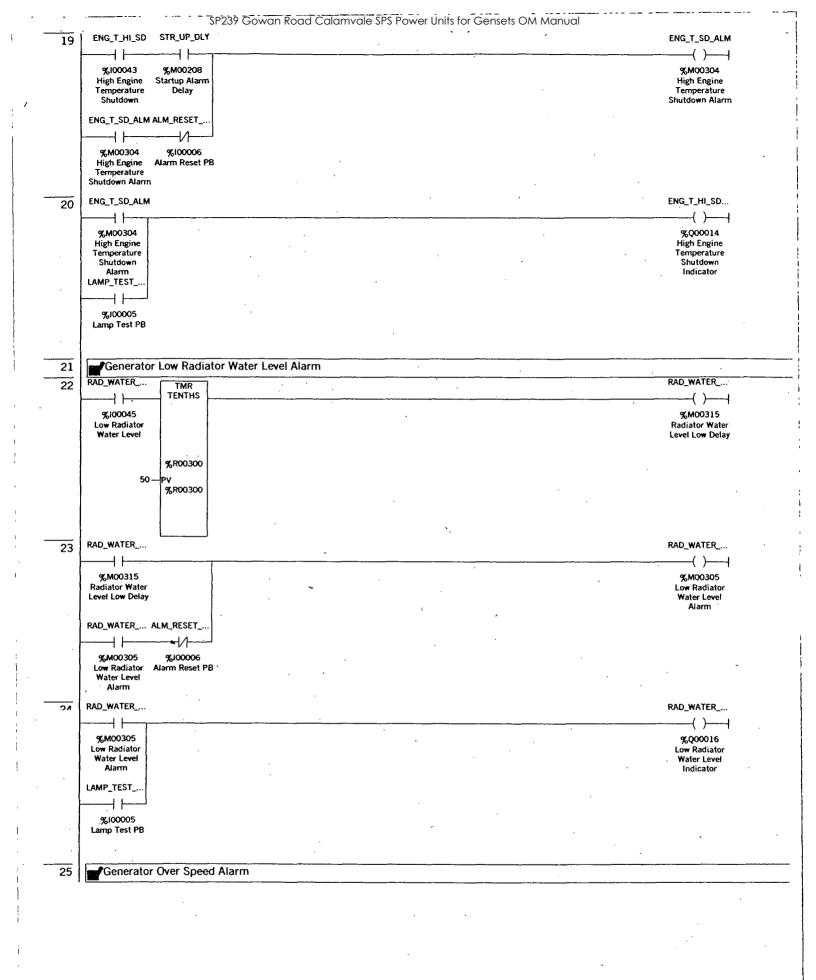
A:

ALA



F

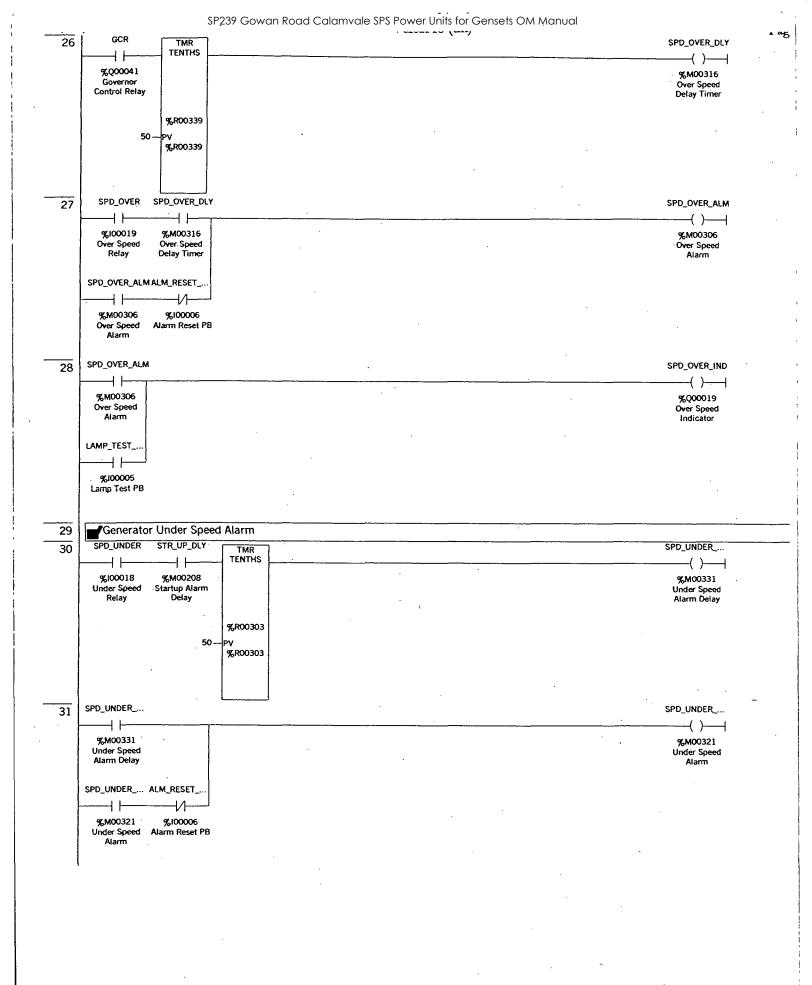
TA



P m: BCC_4000_4

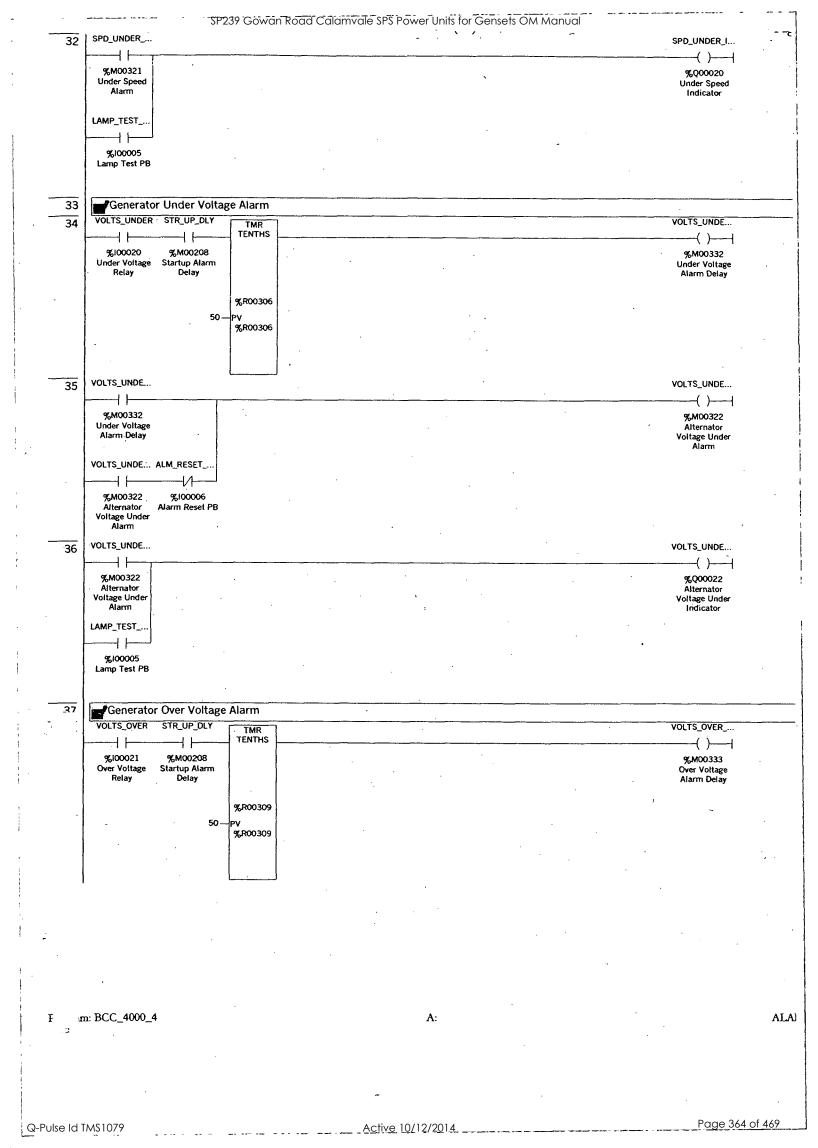
A:

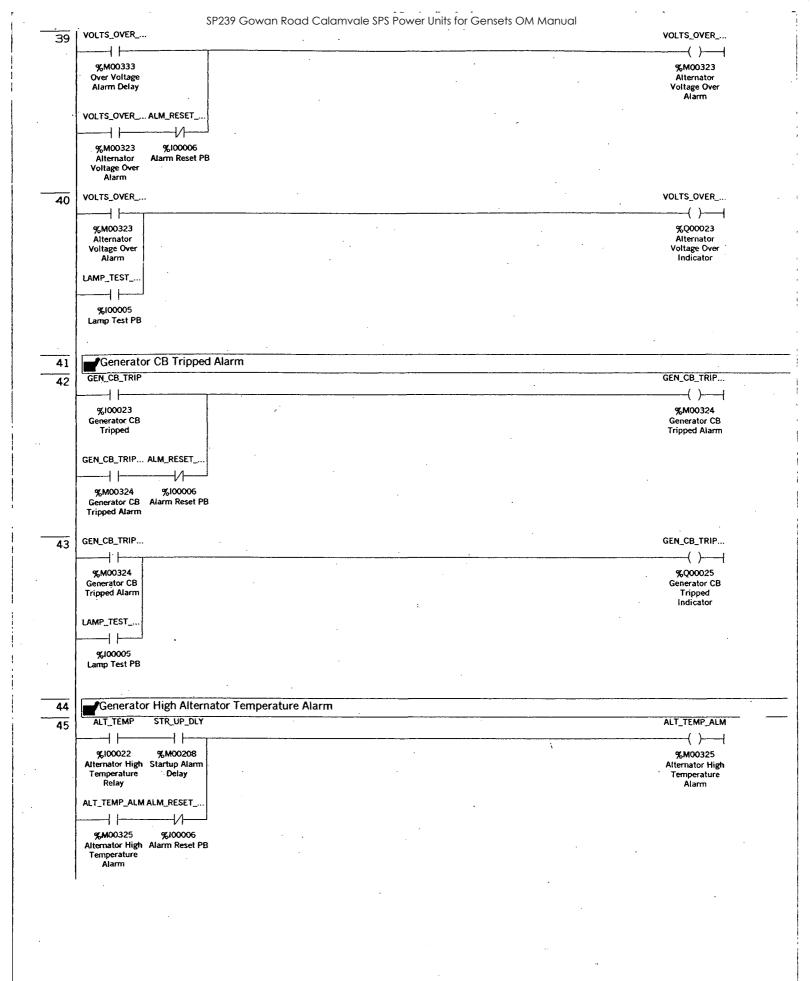
ALA



A:

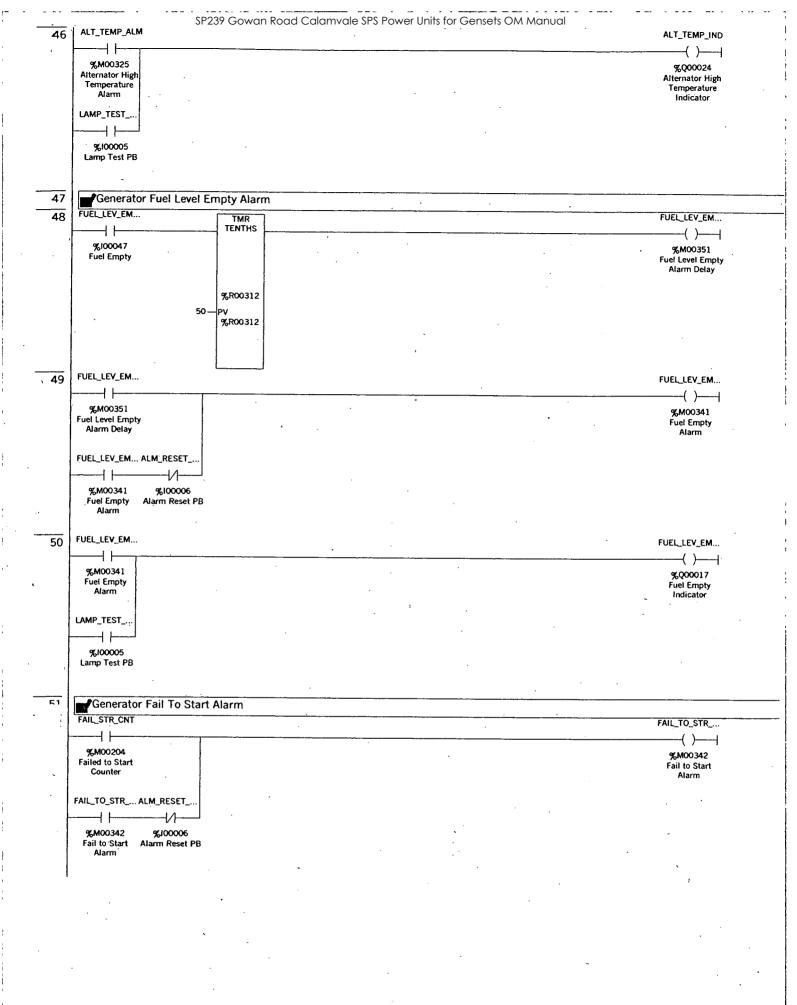
.LA





A:

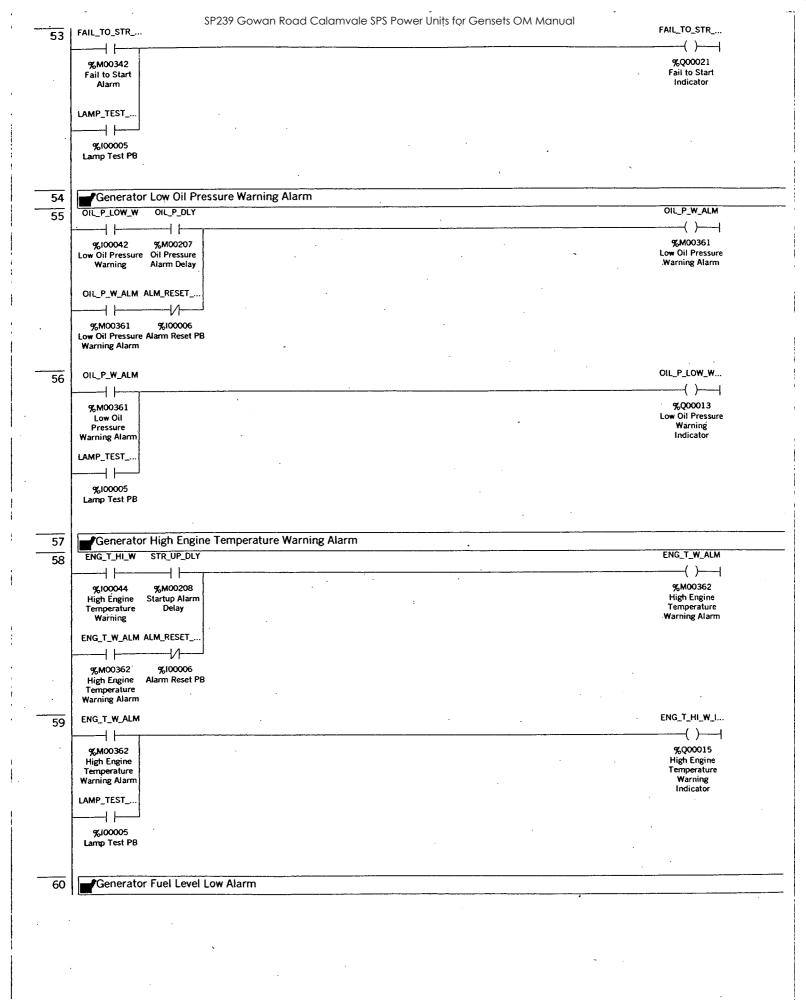
ALA



am: BCC_4000_4

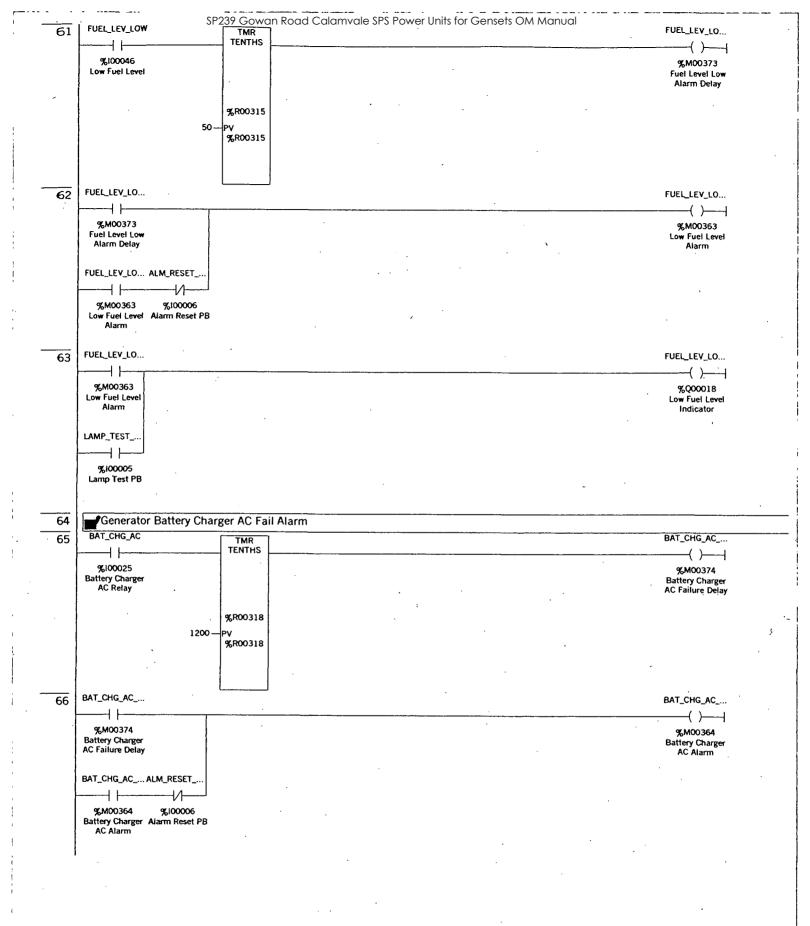
A:

AL/



Α

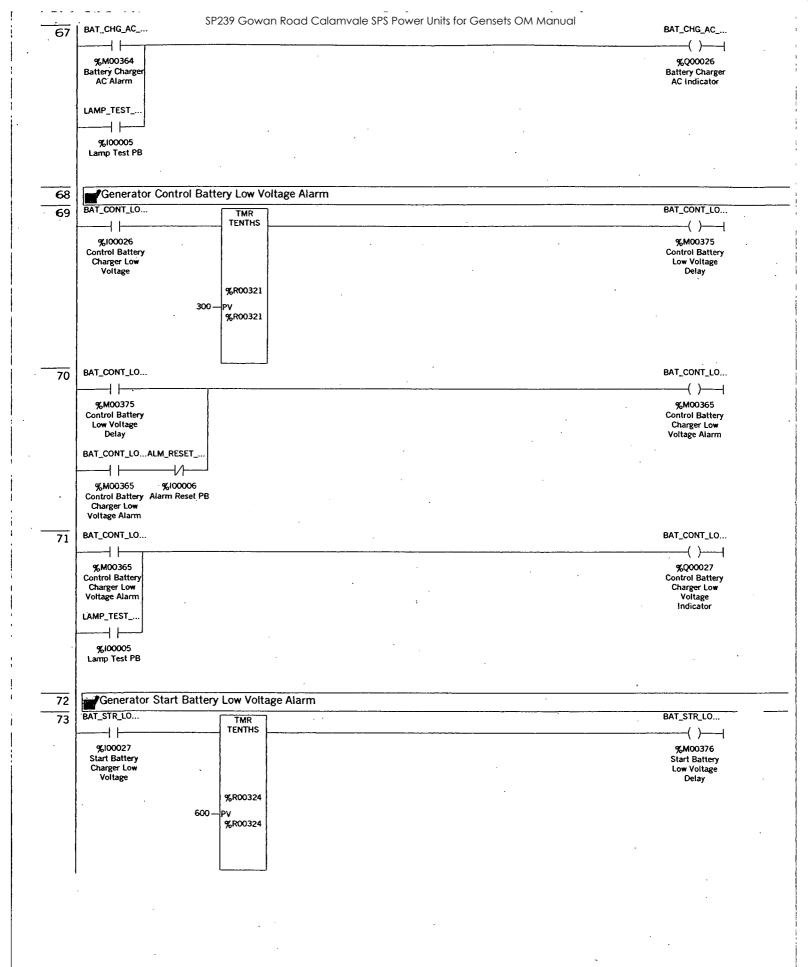
ALA.



m: BCC_4000_4

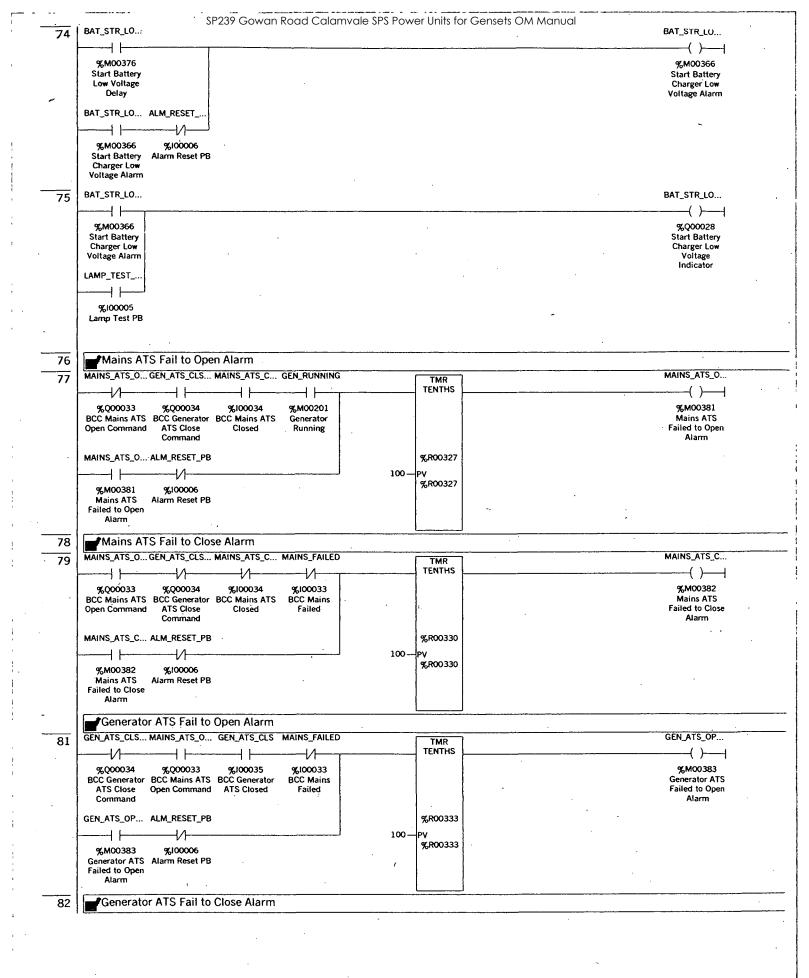
A:

AL/



A:

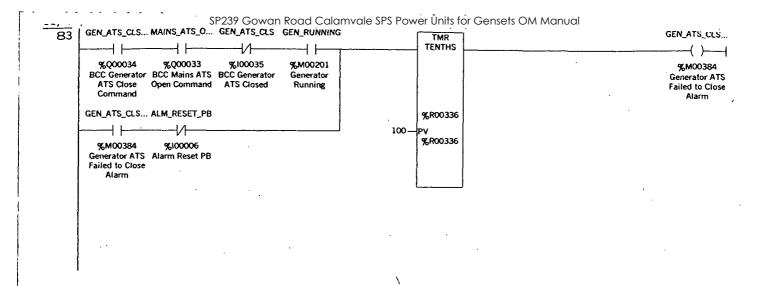
ALA



A:

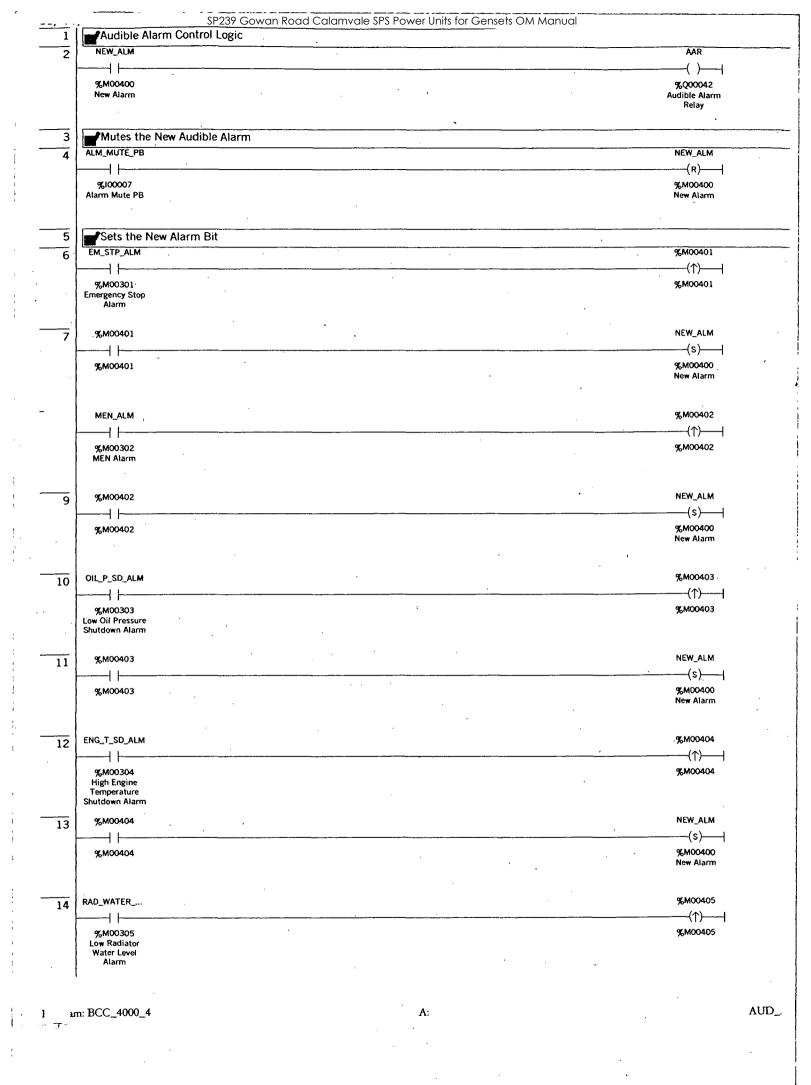
ΑL

am: BCC_4000_4

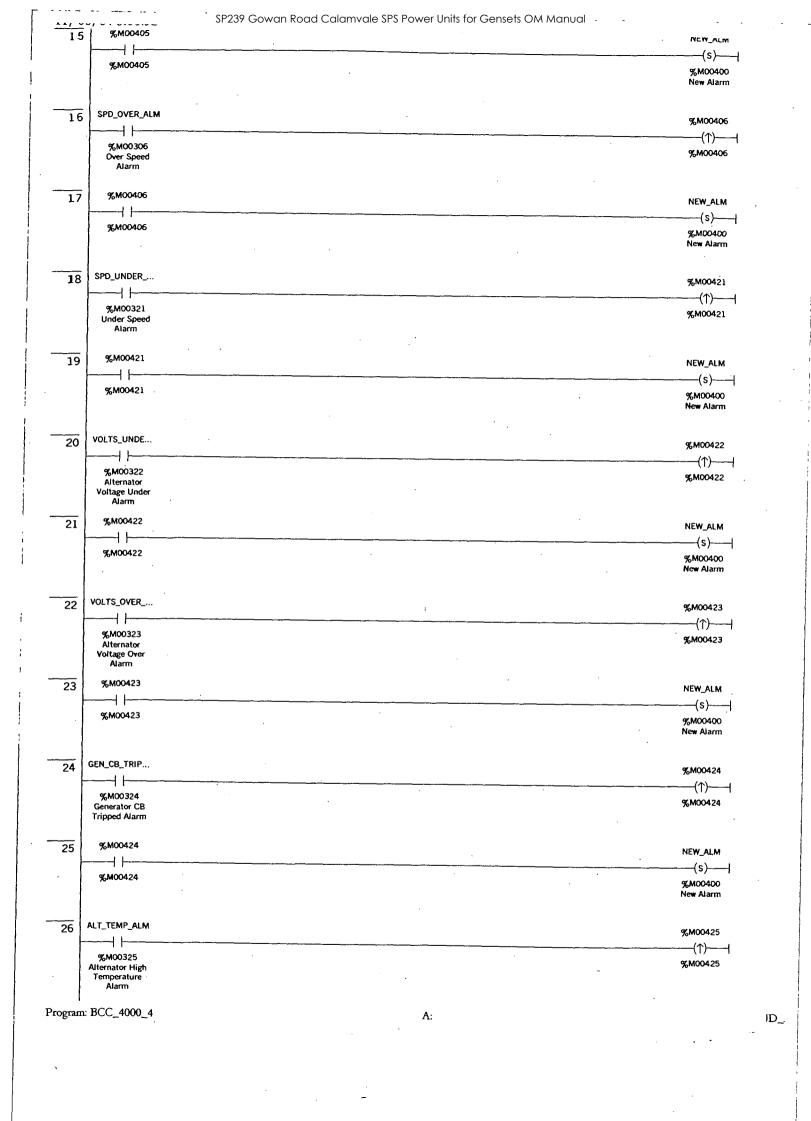


A:

ALI

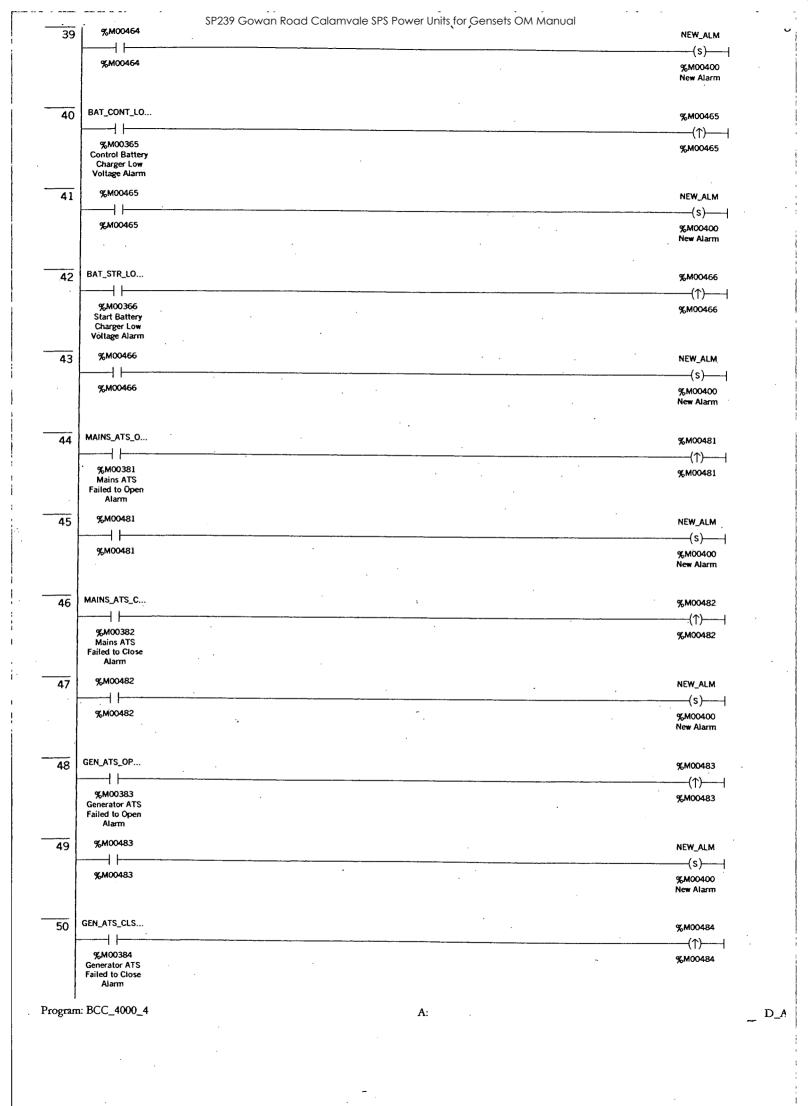


Pagė 372 of 469



Page 373 of 469

\$400045 \$400045 \$4000	27	%M00425		NEW_ALM	
FILE_LEV_M. \$400041 (f) (f) (g)		WAA0043E		——(s)——	
PUELLEY_DM \$400041 \$700041 \$700041 \$700041 \$700041 \$700041 \$700041 \$700041 \$700041 \$700041 \$700041 \$700041 \$700041 \$700041 \$700041 \$700041 \$700042 \$7000042 \$70000042 \$7000042 \$7000042 \$70000042 \$7000042 \$7000042 \$7000042 \$70000042 \$70000042 \$70000042 \$7000042 \$700004		76m00423			
\$\frac{1}{2} \text{SMOSA1} \text{First Bright \$\frac{1}{2} Fir		FUEL_LEY_EM		9CM00441	
\$4,00041 \$4,00041				-	
\$MO042		Fuel Empty			
\$\$\frac{\text{\$\t	<u>29</u>	%M00441		NEW_ALM	
FAIL_TO_STR		• •		——(s)——	
### ### #### #########################		%M00441			
### ### #### #########################					
\$\frac{\text{\$\text{MOOM42}}{\text{Pail to Start}} \	30				
SAMOO42	- 1			•	
SMOOMS S		Fail to Start		%M00442	
SMOOA2 S	<u>-</u>	%M00442	•	NEW_ALM	
OILP_WALM	_				
OILP_WALM		%M00442			
Tymoose Tymoose	_	OHPWAIM			
### ##################################	32				
SMO0461 SM00460 SM00460 SM00462 SM00463 SM00464 SM00463 SM00464 SM00		%M00361 Low Oil Pressure		, .	
SMO0461 SM00460 SM00460 SM00462 SM00463 SM00464 SM00463 SM00464 SM00	-	%M00461		NEW ALM	
\$\pmodesize{\pmo	33	——			
### SMO0462 #### SMO0462 ###################################		%M00461		%M00400	
### ### ##############################	34	ENG_T_W_ALM		%M00462	
High Engine Temperature Warning Alarm SS	` }	·			
\$\\\ \frac{\s}{\mathref{K}}\text{MOO462} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\		High Engine Temperature		%M00462	
\$\squaresqua	35	%M00462		NEW_ALM	
New Alarm SKM00463 SKM00460 SKM00460 SKM00460 SKM00460 SKM00460 SKM00460 SKM00464	- T	—			
### ##################################	i	%м 00462		%M00400 New Alarm	
### ##################################	-	FUEL_LEV_LO		9KM00463	
%M00363 %M00463 1 %M00463 9%M00463 NEW_ALM (S) 9%M00400 New Alarm New Alarm 88 BAT_CHG_AC %M00464 - - 9%M00464 - - 9%M00464 - - 9%M00464 - - 9%M00464 - 9%M00464	,				
%M00463		Low Fuel Level			
(\$) %M00463 8AT_CHG_AC %M00464 (↑) %M00364 Battery Charger AC Alarm A:					
\$\frac{\pi_{\text{MOO463}}}{\text{8MOO464}}\$ BAT_CHG_AC \$\frac{\pi_{\text{MOO464}}}{\text{gMOO364}}\$ Battery Charger AC Alarm A:	37				
(↑) %M00364 8attery Charger AC Alarm AC 4000 4 A:				%M00400	
(↑) %M00364 8attery Charger AC Alarm AC 4000 4 A:		,	•		
%M00364 Battery Charger AC Alarm ADD: BCC 4000 4	88	BAT_CHG_AC			
Battery Charger AC Alarm and BCC 4000 4	ŀ				
am: BCC_4000_4 A:		96M00364 Battery Charger AC Alarm		95M00464	
	2IT	a: BCC_4000_4	A:		•
				•	



SP239 Gowan Road Calamvale SPS Power Units for Gensets OM Manual 51 %M00484 NEW_ALM -(s)----(%M00400 New Alarm %M00484 um: BCC_4000_4 AUD_/ Q-Pulse Id TMS1079 Page 376 of 469

Page 377 of 46

NTB Design

Folder Name		BCC 4000 2
	•••••	
	C:\Program Files\GE Fanuc \Project\BCC 4000 2	
Created		27-Jun-03, 16:36:00
Modified		03-Jul-03, 18:02:02
Description	BCC	Standby Generator, 4000

Q-Pulse Id TMS1079 Active 10/12/2014 Page 378 of 469

Block Name:	AUD_ALM.blk
Description:	
	Ladder

Page 379 of 469

SPD_OVER_ALM

%M00306

Over Speed Alarm

16

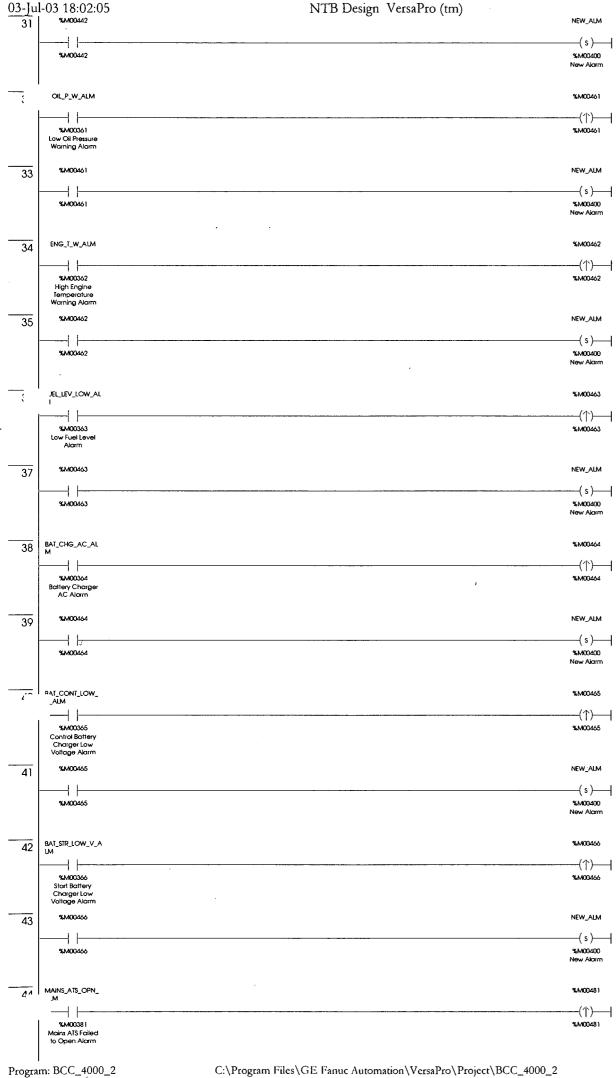
%M00406

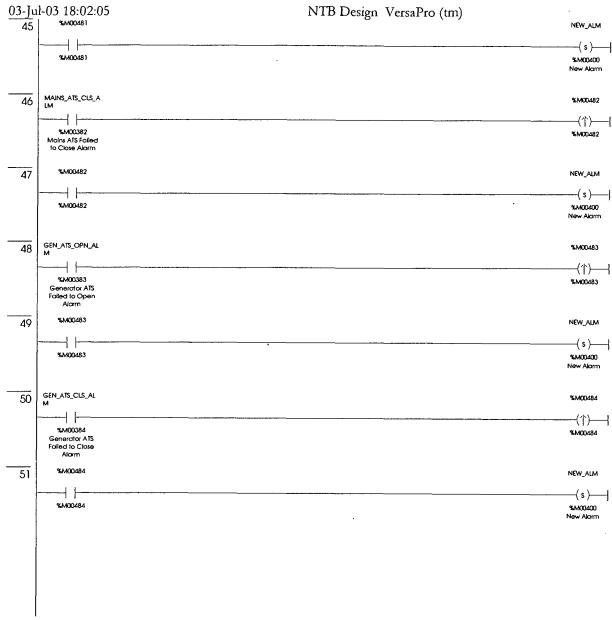
%M00406

-(↑)---|

AUD_ALM.blk Page 381 of 469

Page: 4





Block Name:	ALARM.blk
Description:	Control Logic for the Generator Alarms.
	Ladder

Program: BCC_4000_2 Q-Pulse Id TM\$1079

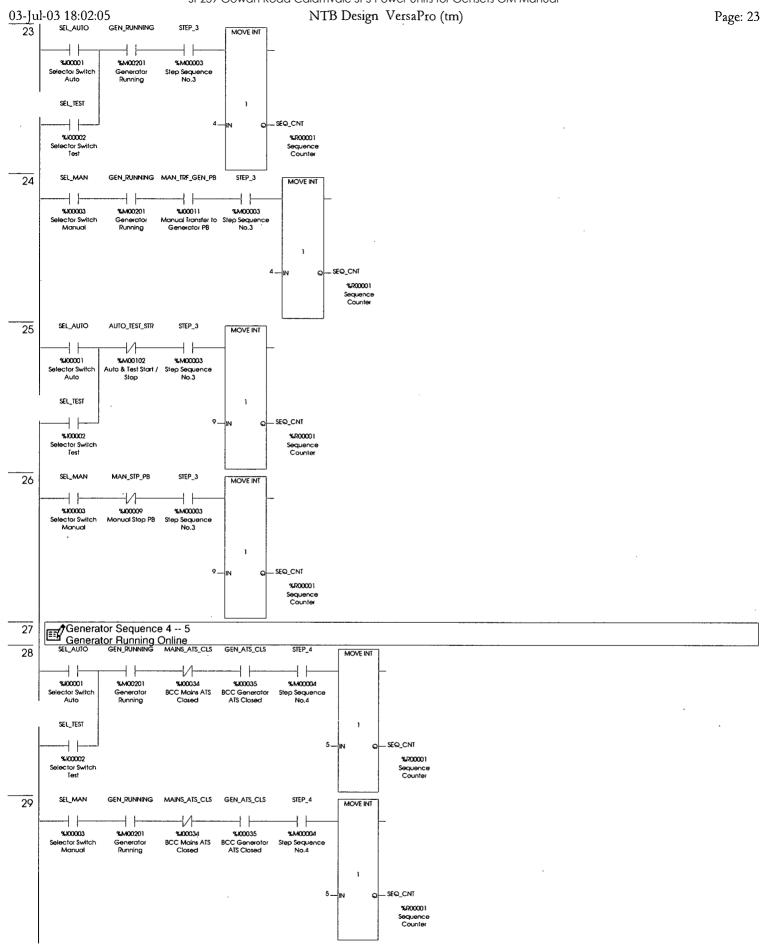
Block Name:	SEQ.blk
Description:	
	Ladder

Program: BCC_4000_2 Q-Pulse Id TM\$1079

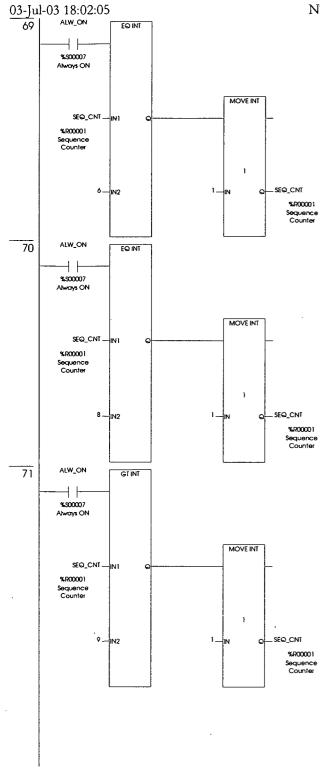
%R00121

%R00121

150



Sequence

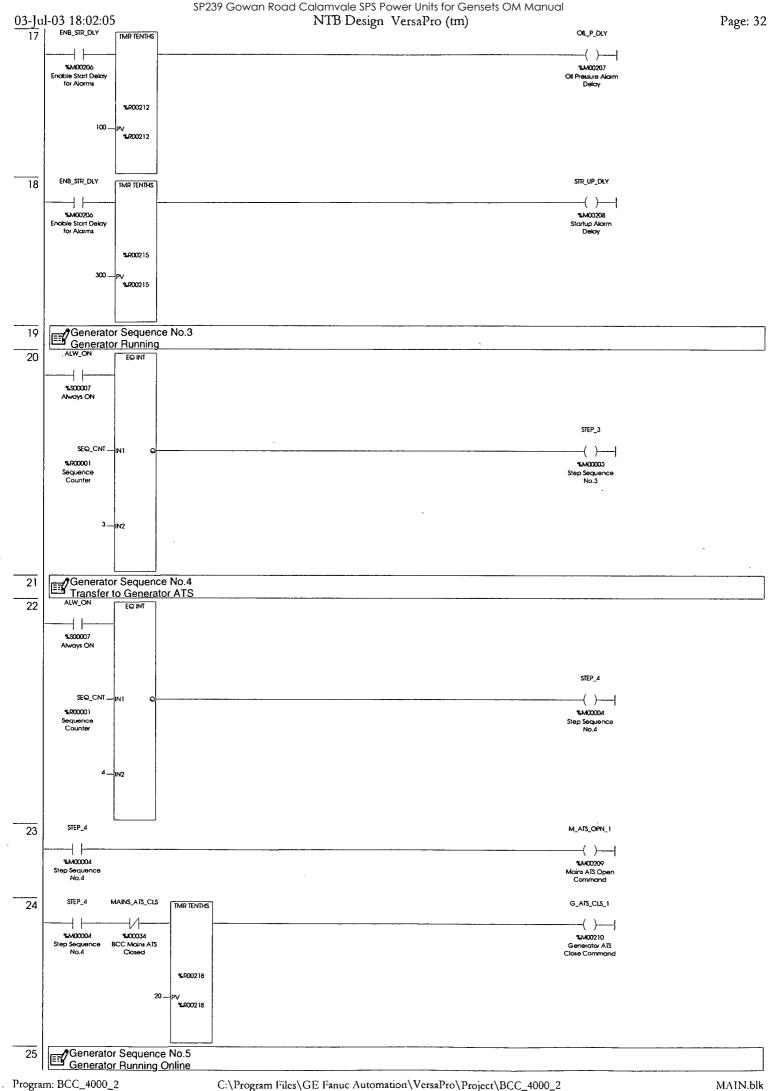


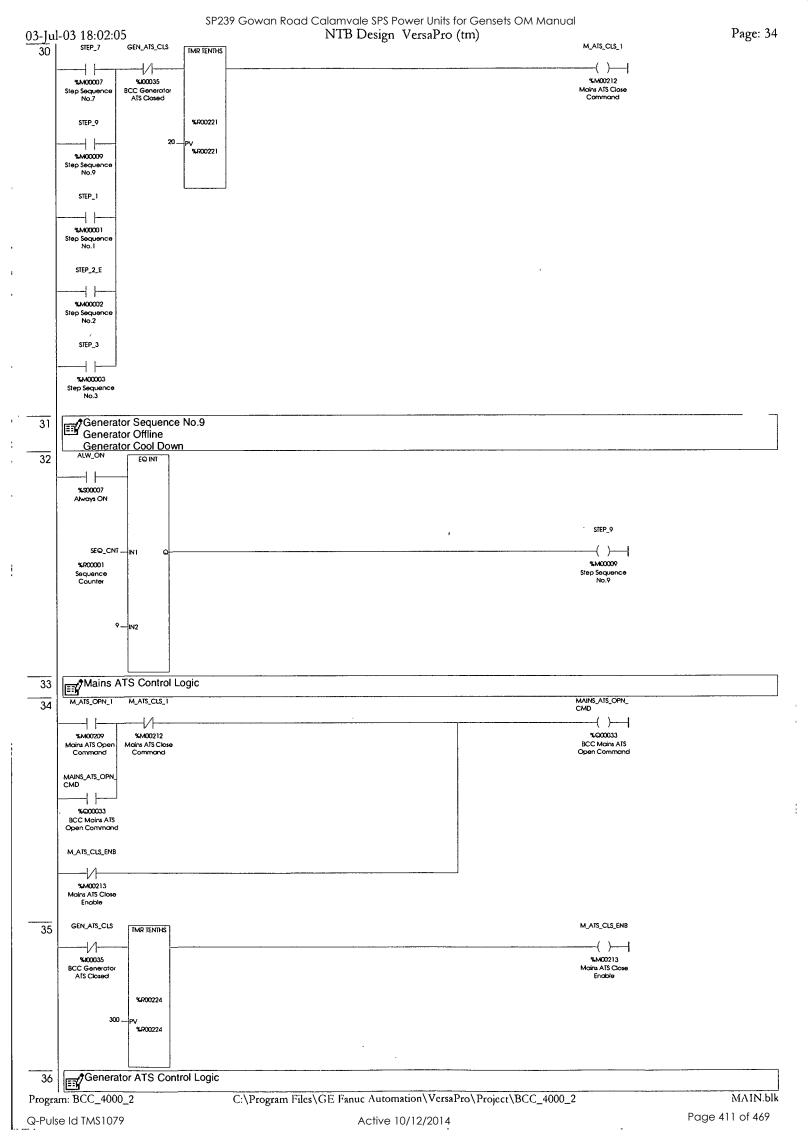
Block Name:	MAIN.blk
Description:	Control Logic for the Generator Sequence Steps.
	Ladder

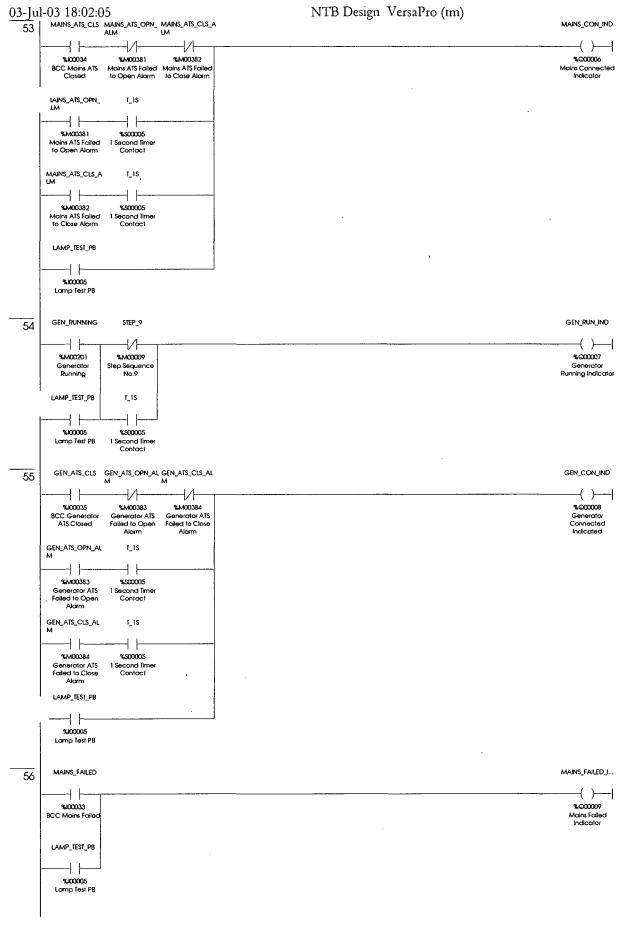
Program: BCC_4000_2 Q-Pulse Id TM\$1079

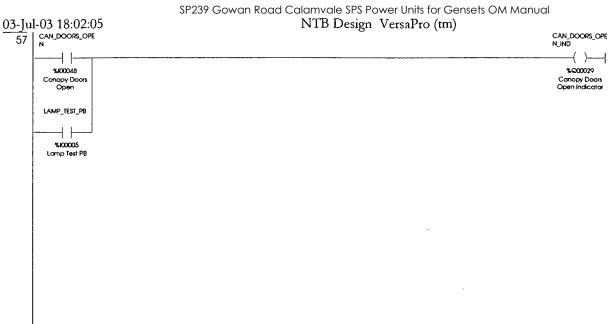
ENB_STR_DLY

%M00206 Enable Start Delay for Alarms









NTB Design VersaPro (tm)

Block Name:	MAIN.blk
	Ladder

Block Name:	PRESETS.blk
Description:	
Block Type:	Ladder

Program: BCC_4000_2

Q-Pulse Id TMS1079

Presets Routine
Move 1 to the Sequence Counter
ALW_ON
MOVE INT

%S00007
Always ON

1

IN

Q

SEQ_CNT

%R00001
Sequence Counter

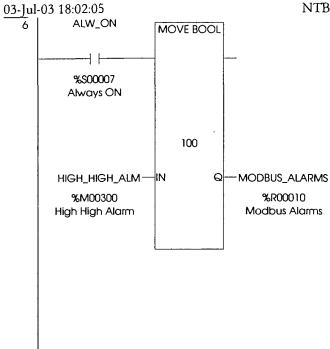
Program: BCC_4000_2

03-Jul-03 18:02:05

NTB Design VersaPro (tm)

Page: 43

Block Name:	MODBUS.blk
Description:	
	Ladder



			410 .					
Name	Type	Len	Address	Description	Stored Val	Scope	Ret Ovr	Ext
SEL_AUTO	BIT	1	%100001	Selector Switch Auto		Global	R	
SE EST	BIT	1	%100002	Selector Switch Test		Global	R	
SE _ AN	BIT	1	%100003	Selector Switch Manual		Global	R	
EM_STOP_PB	BIT	1	%100004	Emergency Stop PB		Global	R	
LAMP_TEST_PB	BIT	1	%100005	Lamp Test PB		Global	R	
ALM_RESET_PB	BIT	1	%100006	Alarm Reset PB		Global	R	
ALM_MUTE_PB	BIT	1	%100007	Alarm Mute PB		Global	R	
MAN_STR_PB	BIT	1	%100008	Manaul Start PB		Global	R	
MAN_STP_PB	BIT	1	%100009	Manual Stop PB		Global	R	
MAN_TRF_MAINS_PB	BIT	1	% 00010	Manual Transfer to Mains PB		Global	R	
MAN_TRF_GEN_PB	BIT	1	%100011	Manual Transfer to Generator		Global	R	
				PB			_	
SPD_STP_CRK	BIT	1	%100017	Crank Cutout Relay		Global	R	
SPD_UNDER	BIT	1	%100018	Under Speed Relay		Global	R	
SPD_OVER	BIT	1	%[00019	Over Speed Relay		Global	R	
VOLTS_UNDER	BIT	1	%100020	Under Voltage Relay		Global	R	
VOLTS_OVER	BIT	1	%100021	Over Voltage Relay		Global	R	
ALT_TEMP	BIT	1	%100022	Alternator High Temperature		Global	R	
				Relay				
GEN_CB_TRIP	BIT	1	%100023	Generator CB Tripped		Global	R	
MEN_FLT	BIT	1	%100024	MEN Fault Relay		Global	R	
BAT_CHG_AC	BIT	1	%100025	Battery Charger AC Relay		Global	R	
BAT_CONT_LOW_V	BIT	1	%100026	Control Battery Charger Low		Global	R	
				Voltage				
BAT ^TR_LOW_V	BIT	1	%100027	Start Battery Charger Low		Global	R	
		•		Voltage				
MAINS_FAILED	BIT	1	%100033	BCC Mains Failed		Global	R	
MAINS_ATS_CLS	BIT	1	%100034	BCC Mains ATS Closed		Global	R	
GEN_ATS_CLS	BIT	1	%100035	BCC Generator ATS Closed		Global	R	
REM_STR	BIT	1	%100036	BCC Remote Start		Global	R	
REM_STP	BIT	1	%100037	BCC Remote Stop		Global	R	
OIL_P_LOW_SD	BIT	1	%100041	Low Oil Pressure Shutdown		Global	R	
OIL_P_LOW_W	BIT	1	%100042	Low Oil Pressure Warning		Global	Ŗ	
ENG_T_HI_SD	BIT	1	%100043	High Engine Temperature		Global	Ř	
2.14_1_1	U	•	70100010	Shutdown		a.ooa.	• •	
ENG_T_HI_W	BIT	1	%100044	High Engine Temperature		Global	R	
2.10_1_11	O	•	70.000	Warning		a.obai	• •	
RAD_WATER_LOW	BIT	1	%100045	Low Radiator Water Level		Global	R	
FUEL_LEV_LOW	BIT	i	%100046	Low Fuel Level		Global	R	
FUEL_LEV_EMPTY	BIT	1	%100047	Fuel Empty		Global	Ř	
CAN_DOORS_OPEN	BIT	i	%100048	Canopy Doors Open		Global	R	
STEP_1	BIT	i	%M00001	Step Sequence No.1		Global		
STEP_2_E	BIT	1	%M00002	Step Sequence No.2		Global		
STEP_3	BIT	1	%M00002	Step Sequence No.3		Global		
STEP_4	BIT	1	%M00004	Step Sequence No.4		Global		
STEP_5	BIT	i	%M00004 %M00005	Step Sequence No.5		Global		
STEP_6	BIT	1	%M00005	Step Sequence No.6		Global		
STEP_7	BIT	1	%M00007	Step Sequence No.7		Global		
ST 3	BIT	i	%M00007	Step Sequence No.8		Global		
ST _9	BIT	i	%M00009	Step Sequence No.9		Global		
STEP_2_GE	BIT	1	%M00003 %M00022	Step Sequence No.2 GE		Global		
GEN_OFF	BIT	i	%M00101	Generator OFF		Global		
AUTO_TEST_STR	BIT	1	%M00101	Auto _Test Start / Stop		Global		
REMOTE_STR	BIT	1	%M00102 %M00103	Remote Start		Global		
MAINS_FAIL_STP	BIT	1	%M00103	Mains Failed Stop		Global		
REMOTE_STP	BIT	1	%M00104 %M00105	Remote Stop		Global		
TEST_STR	BIT	1	%M00105	Test Start		Global		
TEST_STP	BIT	1 .	%M00107	Test Stop		Global		
	BIT	1		Generator Run Off		Globai		
GEN_RUN_OFF	BIT	1	%M00108 %M00109			Global		
ENABLE_OFFLINE	ы	1	7010100109	Enable Generator to go Offline		Global		
LILL ALM OC1	DIT	4	9/ M00110			Global		
HH_ALM_OS1	BIT BIT	1	%M00110 %M00111	High High Alarm One Shot High Alarm One Shot		Global Global		
H_ALM_OS1	BIT	1	%M00111 %M00112	High Alarm One Shot		Global		
H_ALM_OS2 M_ALM_OS1	BIT	1	%M00112 %M00113	Medium Alarm One Shot		Global		
	BIT	1	%M00113 %M00114	Medium Alarm One Shot		Global		
M_ALM_OS2 M_ATS_ALM_OS1	BIT	1	%M00114 %M00115	Mains ATS Alarm One Shot		Global		
	BIT	1	%M00116	Mains ATS Alarm One Shot		Global		
M_ATS_ALM_OS2 GEN_RUNNING	BIT	1	%M00201	Generator Running		Global		
	BIT	1	%M00201 %M00202	Failed to Start Time		Global		
FAIL_STR_TM	BIT	1	%M00202 %M00203	Failed to Start Pulse Delay		Global		
FAIL_STR_DLY FA TR_CNT	BIT	1	%M00203 %M00204	Failed to Start Pulse Delay		Global		
CF UTOUT	BIT	1	%M00204	Generator Crank Cutout	•	Global		
ENB_STR_DLY	BIT	1	%M00205 %M00206	Enable Start Delay for Alarms		Global		
OIL_P_DLY	BIT	1	%M00200 %M00207	Oil Pressure Alarm Delay		Global		
STR_UP_DLY	BIT	1	%M00207 %M00208	Startup Alarm Delay		Global		
5.11_01_0E	٥,,		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Startop Filanti Dotay		J. 3041		

Program: BCC_4000_2

C:\Program Files\GE Fanuc Automation\VersaPro\Project\BCC_4000_2

Name Company				4202	AL VAIIIABLES					
G_ATS_CR_S_1	Name	Туре	Len	Address	Description	Stored Val	Scope	Ret	Ovr	Ext
GATS_OPN_1							Global			
G_ASS_CPPL_1 BIT 1	G_ATS_CLS_1	BIT	1	%M00210			Global			
N_ATS_CLS_1	C ATC ODN 4	DIT	4	0/1400011			Olekel			
M_ATS_CLS_THR M_ATS_CLS_ENB	G_ATS_OPN_T	BH	l	%MUU211			Global			
M_ATS_CLS_ENB BIT %M00213 Mains ATS Close Enable Global HGG-Holf-ALM BIT %M00214 Greater ATS Close Enable Global HGG-Holf-ALM BIT %M003030 Hgh-High-High-Alm Global Global HGG-Holf-ALM BIT %M003030 Hgh-High-High-Alm Global Glo	M ATS CLS 1	BIT	1	%M00212			Global			
G_ARS_CLS_ENB_ BIT	M ATS CLS ENB		i							
High-High-La.M			1							
EM_STP_ALM BIT 1 %M00301 Energency Stop Alarm Global OIL_P_SD_ALM BIT 1 %M00302 Low Oil Pressure Strutdown Global FRAD_WATER_LOW_ALM BIT 1 %M00303 Low Oil Pressure Strutdown Global SPD_OVER_ALM BIT 1 %M00303 Low Oil Pressure Strutdown Global SPD_OVER_ALM BIT 1 %M00303 Low Oil Pressure Strutdown Snutdown Alarm SPD_OVER_ALM BIT 1 %M00305 Gover Speed Alarm Global FRAD_WATER_LOW_ALM BIT 1 %M00305 Gover Speed Alarm Global FRAD_WATER_LOW_ALM BIT 1 %M00316 Gover Speed Alarm Global FRAD_WATER_LOW_ALM BIT 1 %M00316 Gover Speed Alarm Global FRAD_WATER_LOW_ALM BIT 1 %M00320 High Alarm Global FRAD_WATER_LOW_ALM BIT 1 %M00320 High Alarm Global FRAD_WATER_ALM BIT 1 %M00321 High Alarm Global FRAD_WATER_ALM BIT 1 %M00322 Alarm Global Global FRAD_WATER_ALM BIT 1 %M00322 Alarm Global Global Global FRAD_WATER_ALM BIT 1 %M00322 Alarm Global Global Alarm Global FRAD_WATER_ALM BIT 1 %M00323 Alarm Global Alarm Global Global Alarm Global FRAD_WATER_ALM BIT 1 %M00324 Alarm Global Alarm Global Global Alarm Global Global Alarm Global Global Alarm Global Global Global Alarm Global Global Alarm Global Global Alarm Global Globa			1	%M00300	High High Alarm		Global			
SD_ALM					Emergency Stop Alarm		Global			
BIT 1										
ENG_T_SQ_ALM	OIL_P_SD_ALM	RII	1	%M00303			Global			
RAD_WATER_LOW_ALM	ENG T SD ALM	DIT	1	9/ M00304			Global			
RAD_WATER_LOW_ALM	CNG_1_OD_ALW	ы	ı	761¥10030-4			Global			
SPP_OVER_ALM BIT	RAD WATER LOW ALM	BIT	1	%M00305			Global			
PAD_WATER_LOW_DLY							-11.5-2			
Delay	SPD_OVER_ALM	BIT	1	%M00306	Over Speed Alarm		Global			
SPD_UNCER_ALM	RAD_WATER_LOW_DLY	BIT	1	%M00315			Global			
HIGH_ALM	200 0450 044	D		0/1400045				_		
SPD_UNDER_ALM BIT 1					Over Speed Delay Timer			Я		
VOLTS_OVER_ALM										
Alarm Alar										
VOLTS_OVER_ALM	VOL13_ONDEN_ALW	ы	•	/61V100322			Global			
Alarm	VOLTS OVER ALM	BIT	1	%M00323			Global			
GEN_CB_TRIP_ALM BIT	, o = , o = o + =	Φ(,,	•	MINIOUSES			Global			
ALT_TEMP_ALM BIT 1	GEN_CB_TRIP_ALM	BIT	1	%M00324			Global			
SPD_UNDER_DLY	ALT_TEMP_ALM	BIT	1	%M00325			Global			
VOLTS_UNDER_DLY					Alarm					
VOLTS_OVER_DLY										
MEDIUM_ALM										
FUEL_LEV_EMPTY_ALM BIT										
FAIL_TO_STR_ALM										
FUEL_LEV_LOW_ALM			1							
Delay			1							
LOW_ALM	FUEL_LEV_EMPT1_DLT	ы	ı	7619100331			Giobai			
OIL_P_W_ALM	LOW ALM	BIT	1	%M00360			Global			
Alarm										
FUEL_LEV_LOW_ALM							-			
FUEL_LEV_LOW_ALM BIT 1	ENG_T_W_ALM	BIT	1	%M00362	High Engine Temperature		Global			
BAT_CHG_AC_ALM BIT 1							_			
BAT_CONT_LOW_V_ALM BIT 1 %M00365 Control Battery Charger Low Voltage Alarm Global FUEL_LEV_LOW_DLY BIT 1 %M00366 Start Battery Charger Low Voltage Alarm Global R FUEL_LEV_LOW_DLY BIT 1 %M00373 Fuel Level Low Alarm Delay Global R BAT_CHG_AC_DLY BIT 1 %M00374 Battery Charger AC Failure Global R BAT_CONT_LOW_V_DLY BIT 1 %M00375 Control Battery Low Voltage Global R BAT_STR_LOW_V_DLY BIT 1 %M00376 Start Battery Low Voltage Global R BAT_STR_LOW_V_DLY BIT 1 %M00381 Mains ATS Failed to Open Global R MAINS_ATS_OPN_ALM BIT 1 %M00382 Mains ATS Failed to Close Global Global GEN_ATS_OPN_ALM BIT 1 %M00383 Generator ATS Failed to Close Alarm Global R NEW_ALM BIT 1 %M004004 New Alarm Global R <			•							
Sat Sat]							
BAT_STR_LOW_V_ALM BIT 1	BAT_CONT_FOM_A_MEM	BH	I	%MUU365			Global			
Voltage Alarm	BAT STR LOW V ALM	RIT	1	%M00366			Global			
FUEL_LEV_LOW_DLY	BA1_3111_E044_4_AEM	Dil	· ·	781 4 100300			Global			
BAT_CHG_AC_DLY BIT 1 %M00374 Delay Delay Battery Charger AC Failure Global Paint R BAT_CONT_LOW_V_DLY BIT 1 %M00375 Control Battery Low Voltage Delay Global Paint R BAT_STR_LOW_V_DLY BIT 1 %M00376 Start Battery Low Voltage Delay Global Paint R MAINS_ATS_OPN_ALM BIT 1 %M00381 Mains ATS Failed to Open Alarm Global Alarm Global Alarm GEN_ATS_CLS_ALM BIT 1 %M00382 Mains ATS Failed to Close Alarm Global Open Alarm Global Global Paint GEN_ATS_CLS_ALM BIT 1 %M00384 Generator ATS Failed to Close Alarm Global Paint NEW_ALM BIT 1 %M00400 Close Alarm Global Paint NEW_ALM BIT 1 %M00400 Paint Global Paint %M00401 BIT 1 %M00400 Paint Global Paint %M00402 BIT 1 %M00400 Paint Global Paint %M00403 BIT 1 %M00400 Paint Global Paint %M00404 BIT 1	FUEL LEV LOW DLY	BIT	1	%M00373			Global	R		
BAT_CONT_LOW_V_DLY			1							
Delay Start Battery Low Voltage Global R	,									
BAT_STR_LOW_V_DLY BIT 1 %M00376 Start Battery Low Voltage Delay Global R MAINS_ATS_OPN_ALM BIT 1 %M00381 Mains ATS Failed to Open Alarm Global MAINS_ATS_CLS_ALM BIT 1 %M00382 Mains ATS Failed to Close Alarm Global GEN_ATS_OPN_ALM BIT 1 %M00383 Generator ATS Failed to Open Alarm Global GEN_ATS_CLS_ALM BIT 1 %M00384 Generator ATS Failed to Close Alarm Global NEW_ALM BIT 1 %M00400 New Alarm Global R %M00401 BIT 1 %M00400 New Alarm Global R %M00402 BIT 1 %M00401 "No Description** Global R %M00403 BIT 1 %M00402 "No Description** Global R %M00404 BIT 1 %M00404 "No Description** Global R %M00405 BIT 1 %M00406 "No Description** <t< td=""><td>BAT_CONT_LOW_V_DLY</td><td>BIT</td><td>1</td><td>%M00375</td><td></td><td></td><td>Global</td><td>R</td><td></td><td></td></t<>	BAT_CONT_LOW_V_DLY	BIT	1	%M00375			Global	R		
MAINS_ATS_OPN_ALM BIT 1 %M00381 Mains ATS Failed to Open Alarm Global Alarm MAINS_ATS_CLS_ALM BIT 1 %M00382 Mains ATS Failed to Close Alarm Global Glob	DIT OTO LOW V DIV	D.T.		0/14000			.	_		
MAINS_ATS_OPN_ALM BIT 1 %M00381 Mains ATS Failed to Open Alarm Global Alarm MAINS_ATS_CLS_ALM BIT 1 %M00382 Mains ATS Failed to Close Alarm Global Glob	BAT_STH_LOW_V_DLY	BH	1	%M00376			Global	Н		
MAINS_ATS_CLS_ALM BIT 1 %M00382 Mains ATS Failed to Close Alarm Global Generator ATS Failed to Open Alarm GEN_ATS_OPN_ALM BIT 1 %M00383 Generator ATS Failed to Open Alarm Global Generator ATS Failed to Open Alarm GEN_ATS_CLS_ALM BIT 1 %M00400 New Alarm Global R NEW_ALM BIT 1 %M00400 New Alarm Global R %M00401 BIT 1 %M004001 "No Description" Global R %M00402 BIT 1 %M004002 "No Description" Global R %M00403 BIT 1 %M00403 "No Description" Global R %M00404 BIT 1 %M00404 "No Description" Global R %M00405 BIT 1 %M00406 "No Description" Global R %M00421 BIT 1 %M00422 "No Description" Global R %M00422 BIT 1 %M00423 "No Description" Global R %M00423 BIT 1 <td>MAINS ATS ORN ALM</td> <td>RIT</td> <td>1</td> <td>9/ M00291</td> <td></td> <td></td> <td>Clobal</td> <td></td> <td></td> <td></td>	MAINS ATS ORN ALM	RIT	1	9/ M00291			Clobal			
MAINS_ATS_CLS_ALM BIT 1 %M00382 Alarm Mains ATS Failed to Close Alarm Global Open Alarm GEN_ATS_OPN_ALM BIT 1 %M00383 Generator ATS Failed to Open Alarm Global G	MAINS_ATS_OFN_ALM	ы	ı	/61VIUU361			Giobai			
Alarm	MAINS ATS CLS ALM	BIT	1	%M00382			Global			
Open Alarm Generator ATS Failed to Global Close Alarm			•				aloca.			
GEN_ATS_CLS_ALM BIT 1 %M00384 Generator ATS Failed to Close Alarm Global NEW_ALM BIT 1 %M00400 New Alarm Global R %M00401 BIT 1 %M00401 "No Description" Global R %M00402 BIT 1 %M00402 "No Description" Global R %M00403 BIT 1 %M00403 "No Description" Global R %M00404 BIT 1 %M00404 "No Description" Global R %M00405 BIT 1 %M00406 "No Description" Global R %M00421 BIT 1 %M00421 "No Description" Global R %M00422 BIT 1 %M00422 "No Description" Global R %M00423 BIT 1 %M00423 "No Description" Global R %M00424 BIT 1 %M00423 "No Description" Global R <td>GEN_ATS_OPN_ALM</td> <td>BIT</td> <td>1</td> <td>%M00383</td> <td></td> <td></td> <td>Global</td> <td></td> <td></td> <td></td>	GEN_ATS_OPN_ALM	BIT	1	%M00383			Global			
NEW_ALM		_								
NEW_ALM BIT 1 %M00400 New Alarm Global R %M00401 BIT 1 %M00401 "*No Description*" Global R %M00402 BIT 1 %M00402 "*No Description*" Global R %M00403 BIT 1 %M00403 "*No Description*" Global R %M00404 BIT 1 %M00404 "*No Description*" Global R %M00405 BIT 1 %M00406 "*No Description*" Global R %M00421 BIT 1 %M00421 "*No Description*" Global R %M00422 BIT 1 %M00422 "*No Description*" Global R %M00423 BIT 1 %M00423 "*No Description*" Global R %M00424 BIT 1 %M00423 "*No Description*" Global R	GEN_ATS_CLS_ALM	BIT	1	%M00384			Global			
%M00401 BIT 1 %M00401 "*No Description*" Global R %M00402 BIT 1 %M00402 "*No Description*" Global R %M00403 BIT 1 %M00403 "*No Description*" Global R %M00404 BIT 1 %M00404 "*No Description*" Global R %M00405 BIT 1 %M00406 "*No Description*" Global R %M00406 BIT 1 %M00421 "*No Description*" Global R %M00421 BIT 1 %M00422 "*No Description*" Global R %M00423 BIT 1 %M00423 "*No Description*" Global R %M00424 BIT 1 %M00424 "*No Description*" Global R	NICHAL ALAA	DIT	4	0/1400400				_		
%M00402 BIT 1 %M00402 **No Description** Global R %M00403 BIT 1 %M00403 **No Description** Global R %M00404 BIT 1 %M00404 **No Description** Global R %M00405 BIT 1 %M00405 **No Description** Global R %M00406 BIT 1 %M00421 **No Description** Global R %M00421 BIT 1 %M00422 **No Description** Global R %M00423 BIT 1 %M00423 **No Description** Global R %M00424 BIT 1 %M00424 **No Description** Global R										
%M00403 BIT 1 %M00403 **No Description** Global R %M00404 BIT 1 %M00404 **No Description** Global R %M00405 BIT 1 %M00405 **No Description** Global R %M00406 BIT 1 %M00406 **No Description** Global R %M00421 BIT 1 %M00421 **No Description** Global R %M00422 BIT 1 %M00423 **No Description** Global R %M00423 BIT 1 %M00424 **No Description** Global R %M00424 BIT 1 %M00424 **No Description** Global R			1							
%M00404 BIT 1 %M00404 **No Description** Global R %M00405 BIT 1 %M00405 **No Description** Global R %M00406 BIT 1 %M00406 **No Description** Global R %M00421 BIT 1 %M00421 **No Description** Global R %M00422 BIT 1 %M00423 **No Description** Global R %M00424 BIT 1 %M00424 **No Description** Global R			1							
%M00405 BIT 1 %M00405 **No Description** Global R %M00406 BIT 1 %M00406 **No Description** Global R %M00421 BIT 1 %M00421 **No Description** Global R %M00422 BIT 1 %M00422 **No Description** Global R %M00423 BIT 1 %M00424 **No Description** Global R %M00424 BIT 1 %M00424 **No Description** Global R			1				_			
%M00406 BIT 1 %M00406 **No Description** Global R %M00421 BIT 1 %M00421 **No Description** Global R %M00422 BIT 1 %M00422 **No Description** Global R %M00423 BIT 1 %M00423 **No Description** Global R %M00424 BIT 1 %M00424 **No Description** Global R			i							
%M00421 #No Description** Global R %M00422 BIT 1 %M00422 **No Description** Global R %M00423 BIT 1 %M00423 **No Description** Global R %M00424 BIT 1 %M00424 **No Description** Global R			1							
%M00422 BIT 1 %M00422 **No Description** Global R %M00423 BIT 1 %M00423 **No Description** Global R %M00424 BIT 1 %M00424 **No Description** Global R			1							
%M00423 BIT 1 %M00423 **No Description** Global R %M00424 BIT 1 %M00424 **No Description** Global R		BIT	1							
%M00424 BIT 1 %M00424 **No Description** Global R			1		**No Description**					
%M00425 BIT 1 %M00425 **No Description** Global R			1							
	%M00425	BIT	1	%M00425	**No Description**		Global	R		

Program: BCC_4000_2

C:\Program Files\GE Fanuc Automation\VersaPro\Project\BCC_4000_2

Page 425 of 469

			GLOD	AL VARIABLES						
Name	Туре	Len	Address	Description	Stored Val	Scope	Ret	Ovr	Ext	
%M00441	BIT	1	%M00441	**No Description**	5.5.52	Global	R	• • •		
%N 12	BIT	1	%M00442	**No Description**		Global	R			
%N 31	BIT	1	%M00461	**No Description**		Global	R			
%M00462	BIT	1	%M00462	**No Description**		Global	R			
%M00463	BIT	1	%M00463	**No Description**		Global	R			
%M00464	BIT	1	%M00464	**No Description**		Global ·	R			
%M00465	BIT	1	%M00465	**No Description**		Global	R			
%M00466	BIT	1	%M00466	**No Description**		Global	R			
%M00481	BIT	1	%M00481	**No Description**		Global	R			
%M00482	BIT	1	%M00482	**No Description**		Global	R			
%M00483	BIT	1	%M00483	**No Description**		Global	R			
%M00484	BIT	1	%M00484	**No Description**		Global	R			
AUTO_IND	BIT	1	%Q00001	Controls in Auto Indicator		Global				
TEST_IND	BIT	1	%Q00002	Controls in Test Indicator		Global				
MAN_IND	BIT BIT	1	%Q00003 %Q00004	Controls in Manual Indicator Remote Start Indicator		Global Global				
REM_STR_IND MAINS_AVAIL_IND	BIT	1	%Q00004 %Q00005	Mains Available Indicator		Global				
MAINS_AVAIL_IND	BIT	1	%Q00005 %Q00006	Mains Connected Indicator		Global				
GEN_RUN_IND	BIT	i	%Q00007	Generator Running Indicator	•	Global				•
GEN_CON_IND	BIT .	1	%Q00007 %Q00008	Generator Connected		Global				
GE14_GO14_114B	DII .	•	/8 Q 00000	Indicated		Global				
MAINS_FAILED_IND	BIT	1	%Q00009	Mains Failed Indicator		Global				•
EM_STOP_IND	BIT	1	%Q00010	Emergency Stop Indicator		Global				
MEN_FLT IND	BIT	1	%Q00011	MEN Fault Indicator		Global				
OIL OLOW_SD_IND	BIT	1	%Q00012	Low Oil Pressure Shutdown		Global				•
2011_00		•	75 4 5 5 5 5	Indicator						
OIL_P_LOW_W_IND	BIT	1	%Q00013	Low Oil Pressure Warning		Global				
5.5 <u>1</u> . 2 15		-		Indicator						
ENG_T_HI_SD_IND	BIT	1	%Q00014	High Engine Temperature		Global				
				Shutdown Indicator						
ENG_T_HI_W_IND	BIT	1	%Q00015	High Engine Temperature		Global				
				Warning Indicator						
RAD_WATER_LOW_IND	BIT	1	%Q00016	Low Radiator Water Level		Global				
				Indicator						
FUEL_LEV_EMPTY_IND	BIT	1	%Q00017	Fuel Empty Indicator		Global				
FUEL_LEV_LOW_IND	BIT	1	%Q00018	Low Fuel Level Indicator		Global				
SPD_OVER_IND	BIT	1	%Q00019	Over Speed Indicator		Global				
SPD_UNDER_IND	BIT	1	%Q00020	Under Speed Indicator		Global				
FAIL_TO_STR_IND	BIT	1	%Q00021	Fail to Start Indicator		Global				
VOLTS_UNDER_IND	BIT	1	%Q00022	Alternator Voltage Under		Global				
				Indicator						
VOLTS_OVER_IND	BIT	1	%Q00023	Alternator Voltage Over		Global				
				Indicator		o				
ALT_TEMP_IND	BIT	1	%Q00024	Alternator High Temperature		Global				
0511 05 5010 1115	D. T			Indicator		01.1.1				
GEN_CB_TRIP_IND	BIT	1	%Q00025	Generator CB Tripped		Global				
DAT OUG AG IND	DIT		0/ 000000	Indicator		0)-1-1				
BAT_CHG_AC_IND	BIT	1	%Q00026	Battery Charger AC Indicator		Global				
BA ONT_LOW_V_IND	BIT	1	%Q00027	Control Battery Charger Low		Global				
DAT STO LOW V IND	BIT	1	%Q00028	Voltage Indicator Start Battery Charger Low		Global				
BAT_STR_LOW_V_IND	ы	1	%Q00026	Voltage Indicator		Giobai	•			
CAN_DOORS_OPEN_IND	віт	1	%Q00029	Canopy Doors Open Indicato	•	Global				
MAINS_ATS_OPN_CMD	BIT	i	%Q00023 %Q00033	BCC Mains ATS Open	l	Global				
MANO_ATO_OF 14_OMB	511	•	70 Q 0 0 0 0 0 0	Command		Global				
GEN_ATS_CLS_CMD	BIT	1	%Q00034	BCC Generator ATS Close		Global				
GEN_/// O_OEO_OMB	2	•	,000000	Command		G.O.G.				
GEN_SD_ALM	BIT	1	%Q00035	BCC Generator Shutdown		Global				
<u> </u>			,	Alarm						
GEN_W_ALM	BIT	1	%Q00036	BCC Generator Warning		Global				
- - -	•			Alarm						
FUEL_LOW	BIT	1	%Q00037	BCC Low Fuel		Global				
GEN_RUN	BIT	1	%Q00038	BCC Generator Running		Global				
GEN_CON	BIT	1	%Q00039	BCC Generator Connected		Global				
SMR	BIT	1	%Q00040	Starter Motor Relay		Global				
GCR	BIT	1	%Q00041	Governor Control Relay		Global				
AAR	BIT	1	%Q00042	Audible Alarm Relay		Global				
SDAR	BIT	1	%Q00043	Generator Shunt Trip Relay		Global	Г.			
SEQ_CNT	WORD	1	%R00001	Sequence Counter		Global	R			
MODBUS_INPUTS	WORD	1	%R00002	Modbus Digital Inputs Modbus Digital Outputs		Global Global	R R			
MODBUS_OUTPUTS	WORD WORD	1	%R00005 %R00008	Modbus Digital Outputs Modbus Status 1		Global	R R			
MC S_STATUS_1 MC S_STATUS_2	WORD	1	%R00008 %R00009	Modbus Status 2		Global	R			
MODBUS_ALARMS	WORD	1	%R00010	Modbus Alarms		Global	R			
%R00100	WORD	3	%R00100	**No Description**		Global	R			
%R00103	WORD	3	%R00103	**No Description**		Global	R			
, 3, , 0 0 . 0 0		-		2 200p						

Program: BCC_4000_2

C:\Program Files\GE Fanuc Automation\VersaPro\Project\BCC_4000_2

Page 426 of 469

	_					_			
Name	Type	Len	Address	Description	Stored Val	Scope		Ovr	Ext
%R00106	WORD	3	%R00106	**No Description**		Global	R		
%R00109	WORD	3	%R00109	**No Description**		Global	R		
%R00112	WORD	3	%R00112	**No Description**		Global	R		
%R00115	WORD	3	%R00115	**No Description**		Global	R		
%R00118	WORD	3	%R00118	**No Description**		Global	R		
%R00121	WORD	3	%R00121	**No Description**		Global	R		
%R00124	WORD	3	%R00124	**No Description**		Global	R		
%R00127	WORD	3	%R00127	**No Description**		Global	R		
%R00130	WORD	3	%R00130	**No Description**		Global	R		
%R00200	WORD	3	%R00200	**No Description**		Global	R		
%R00203	WORD	3	%R00203	**No Description**		Global	R		
%R00206	WORD	3	%R00206	**No Description**		Global	R		
%R00209	WORD	3	%R00209	**No Description**		Global	R		
% <u>R</u> 00212	WORD	3	%R00212	**No Description**		Global	R		
%R00215	WORD	3	%R00215	**No Description**		Global	R		
%R00218	WORD	3	%R00218	**No Description**		Global	R		
%R00221	WORD	3	%R00221	**No Description**		Global	R		
%R00224	WORD	3	%R00224	**No Description**		Global	R		
%R00227	WORD	3	%R00227	**No Description**		Global	R		
%R00230	WORD	3	%R00230	**No Description**		Global	R		
%R00300	WORD	3	%R00300	**No Description**		Global	R		
%R00303	WORD	3	%R00303	**No Description**		Global	R		
%R00306	WORD	3	%R00306	**No Description**		Global	R		
%R00309	WORD	3	%R00309	**No Description**		Global	R		
%R00312	WORD	3	%R00312	**No Description**		Global	R		
%R00315	WORD	3	%R00315	**No Description**		Global	R		
%R00318	WORD	3	%R00318	**No Description**		Global	Ŕ		
%R00321	WORD	3	%R00321	**No Description**		Global	Ŕ		
%R00324	WORD	3	%R00324	**No Description**		Global	Ŕ		
%R00327	WORD	3	%R00327	**No Description**		Global	R		
%R00330	WORD	3	%R00330	**No Description**		Global	R		
%R00333	WORD	3	%R00333	**No Description**		Global	R		
%R00336	WORD	3	%R00336	**No Description**		Global	R		
%R00339	WORD	3	%R00339	**No Description**		Global	R		
FST_SCN	BIT	1	%S00001	Set to 1 when the current		Global	. R		
101_0011	511	•	7000001	sweep is the first sweep		Ciobai			
LST_SCAN	BIT	1	%S00002	Reset from 1 to 0 when the		Global	R		
E01_00/11	D/ 1	'	70000002	current sweep is the last		Ciobai	• • • • • • • • • • • • • • • • • • • •		
				sweep					
T_10MS	BIT	1	%S00003	0.01 Second Timer Contact		Global	R		
T_100MS	BIT	1	%S00003 %S00004	0.1 Second Timer Contact			R		
	BIT	1	%S00004 %S00005	1 Second Timer Contact		Global Global			
T_1S T_1M	BIT	1	%S00005 %S00006	1 Minute Timer Contact			R		
	BIT					Global	R		
ALW_ON	BIT	1	%S00007	Always ON		Global	R		
ALW_OFF		1	%S00008	Always OFF		Global	R		
PLC_BAT	BIT .	1	%S00014	Set to indicate a bad battery		Global	R		
N/ D00400	MODE	•	0/ 500100	in the CPU		01.1.1	-		
%R00133	WORD	3	%R00133	**No Description**		Global	R		
%R00136	WORD	3	%R00136	**No Description**		Global	R		

GLOBAL SUMMARY OF HIGHEST USED REFERENCE ADDRESSES

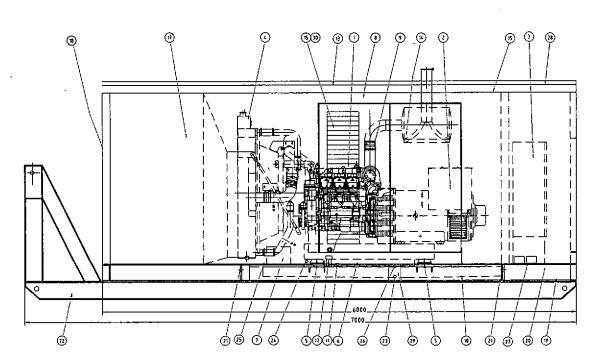
MEMORY AREA	ADDRESS
Analog Input (%AI)	None Used
Analog Output (%AQ)	None Used
Input (%I)	%100048
Output (%Q)	%Q00048
Internal Memory (%M)	%M00484
Register (%R)	%R00341
Genius Global (%G)	None Used
Genius Global (%GA)	None Used
Genius Global (%GB)	None Used
Genius Global (%GC)	None Used
Genius Global (%GD)	None Used
Genius Global (%GE)	None Used
Temporary (%T)	None Used
System (%S)	%S00007
System (%SA)	None Used
System (%SB)	None Used
System (%SC)	None Used
Program (%P)	None Used

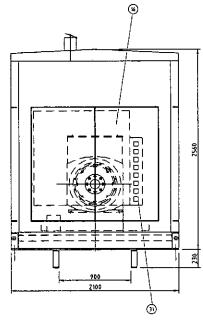
Program: BCC_4000_2

Table of Contents

Block: AUD_A	ALM.blk	
	Properties	2
	Logic	3
Block: ALARM	M.blk	
	Properties	7
	Logic	8
Block: SEQ.bll	lk .	
	Properties	19
	Logic	20
Block: MAIN.b	blk	
	Properties	29
	Logic	30
Block: _MAIN.		
	Properties	39
	Logic	40
Block: PRESE	ETS.blk	
	Properties	41
	Logic	42
Block: MODBL	· ·	
-	Properties	4
	Logic	
Variable Decla	arations Table	
	Highest Used Reference Addresses	

Page 430 of 46





ITEM DESCRIPTION 1 ENGINE DEUTZ BF6M1015C 20 ALTERNATOR STAMFORD HC534C 2b ALTERNATOR STAMFORD HC534F 3 CONTROL SWITCHBOARD 4 RADIATOR 5 A/V MOUNTS (4 OFF) 6 ENGINE DRIP TRAY 7 STARTING BATTERY 1382I 8 EXHAUST SILENCER 9 EXHAUST SILENCER 9 EXHAUST PIPE FLEXIBLE Ø75 10 FUEL TANK BASE FRAME 1000 L 11 FUEL GAUGE (MECHANICAL) 12 FUEL FILL POINT (INSIDE ENCLOSURE) 13 ACOUSTIC ENCLOSURE (70dbA ® 7m) 14 SIDE ACCESS DOORS (2 OFF) 15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN 31 OUTPUT & CONTROL SOCKETS T.B.A.		LEGEND							
20 ALTERNATOR STAMFORD HC534C 2b ALTERNATOR STAMFORD HC534F 3 CONTROL SWITCHBOARD 4 RADIATOR 5 A/V MOUNTS (4 OFF) 6 ENGINE DRIP TRAY 7 STARTING BATTERY 1382I 8 EXHAUST SILENCER 9 EXHAUST PIPE FLEXIBLE Ø75 10 FUEL TANK BASE FRAME 1000 L 11 FUEL GAUGE (MECHANICAL) 12 FUEL FILL POINT (INSIDE ENCLOSURE) 13 ACOUSTIC ENCLOSURE (70dbA @ 7m) 14 SIDE ACCESS DOORS (2 OFF) 15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	ITEM	DESCRIPTION							
2b ALTERNATOR STAMFORD MC534F 3 CONTROL SWITCHBOARD 4 RADIATOR 5 A/V MOUNTS (4 OFF) 6 ENGINE DRIP TRAY 7 STARTING BATTERY (382) 8 EXHAUST SILENCER 9 EXHAUST PIPE FLEXIBLE Ø 75 10 FUEL TANK BASE FRAME 1000 L 11 FÜEL GAUGE (MECHANICAL) 12 FUEL FILL POINT (INSIDE ENCLOSURE) 13 ACOUSTIC ENCLOSURE (70dbA @ 7m) 14 SIDE ACCESS DOORS (2 OFF) 15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FÜEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	1	ENGINE DEUTZ BF6M1015C							
3 CONTROL SWITCHBOARD 4 RADIATOR 5 A/V MOUNTS (4 OFF) 6 ENGINE DRIP TRAY 7 STARTING BATTERY (1382) 8 EXHAUST SILENCER 9 EXHAUST SILENCER 10 FUEL TANK BASE FRAME 1000 L 11 FÜEL GAUGE (MECHANICAL) 12 FUEL FILL POINT (INSIDE ENCLOSURE) 13 ACOUSTIC ENCLOSURE (700BA @ 7m) 14 SIDE ACCESS DOORS (2 OFF) 15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK ORAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	2a	ALTERNATOR STAMFORD HC534C							
4 RADIATOR 5 A/V MOUNTS (4 OFF) 6 ENGINE DRIP TRAY 7 STARTING BATTERY (382) 8 EXHAUST SILENCER 9 EXHAUST PIPE FLEXIBLE Ø75 10 FUEL TANK BASE FRAME 1000 L 11 FÜEL GAUGE (MECHANICAL) 12 FUEL FILL POINT (INSIDE ENCLOSURE) 13 ACOUSTIC ENCLOSURE (700BA @ 7m) 14 SIDE ACCESS DOORS (2 OFF) 15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK ORAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	26								
5 A/V MOUNTS (4 OFF) 6 ENGINE DRIP TRAY 7 STARTING BATTERY (382) 8 EXHAUST SILENCER 9 EXHAUST PIPE FLEXIBLE Ø75 10 FUEL TANK BASE FRAME 1000 L 11 FUEL GAUGE (MECHANICAL) 12 FUEL FILL POINT (INSIDE ENCLOSURE) 13 ACOUSTIC ENCLOSURE (70dbA @ 7m) 14 SIDE ACCESS DOORS (2 OFF) 15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	3	CONTROL SWITCHBOARD							
6 ENGINE DRIP TRAY 7 STARTING BATTERY (382) 8 EXHAUST SILENCER 9 EXHAUST PIPE FLEXIBLE Ø75 10 FUEL TANK BASE FRAME 1000 L 11 FUEL GAUGE (MECHANNCAL) 12 FUEL FILL POINT (INSIDE ENCLOSURE) 13 ACOUSTIC ENCLOSURE (70dbA @ 7m) 14 SIDE ACCESS DOORS (2 OFF) 15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	4	RADIATOR							
7 STARTING BATTERY 13821 8 EXHAUST SILENCER 9 EXHAUST SILENCER 9 EXHAUST PIPE FLEXIBLE Ø 75 10 FÜEL TANK BASE FRAME 1000 L 11 FÜEL GAUGE (MECHANICAL) 12 FUEL FILL POINT (INSIGE ENCLOSURE) 13 ACOUSTIC ENCLOSURE (70dbA @ 7m) 14 SIDE ACCESS DOORS (2 OFF) 15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FÜEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	5	A/V MOUNTS (4 OFF)							
8 EXHAUST SILENCER 9 EXHAUST SILENCER 9 EXHAUST PIPE FLEXIBLE Ø 75 10 FUEL TANK BASE FRAME 1000 L 11 FUEL GAUGE (MECHANICAL) 12 FUEL FILL POINT (INSIGE ENCLOSURE) 13 ACOUSTIC ENCLOSURE (70dbA @ 7m) 14 SIDE ACCESS DOORS (2 OFF) 15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	6	ENGINE DRIP TRAY							
9 EXHAUST PIPE FLEXIBLE Ø 75 10 FUEL TANK BASE FRAME 1000 L 11 FÜEL GAUGE (MECHANICAL) 12 FUEL FILL POINT (INSIDE ENCLOSURE) 13 ACOUSTIC ENCLOSURE (70dbA @ 7m) 14 SIDE ACCESS DOORS (2 OFF) 15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FÜEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	7								
10 FUEL TANK BASE FRAME 1000 L 11 FÜEL GAUGE (MECHANICAL) 12 FUEL FILL POINT (INSIDE ENCLOSURE) 13 ACOUSTIC ENCLOSURE (70dbA @ 7m) 14 SIDE ACCESS DOORS (2 OFF) 15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK ORAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	8	EXHAUST SILENCER							
11 FÜEL GAUGE (MECHANICAL) 12 FUEL FILL POINT (INSIGE ENCLOSURE) 13 ACOUSTIC ENCLOSURE (70dbA @ 7m) 14 SIDE ACCESS DOORS (2 OFF) 15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK ORAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	9	EXHAUST PIPE FLEXIBLE Ø 75							
12 FUEL FILL POINT (INSIDE ENCLOSURE) 13 ACOUSTIC ENCLOSURE (70dbA ® 7m) 14 SIDE ACCESS DOORS (2 OFF) 15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CDNTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	10	FUEL TANK BASE FRAME 1000 L							
13 ACOUSTIC ENCLOSURE (70dbA @ 7m) 14 SIDE ACCESS DOORS (2 OFF) 15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	11								
14 SIDE ACCESS DOORS (2 OFF) 15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	12	FUEL FILL POINT (INSIDE ENCLOSURE)							
15 AIR INLET GRILL 16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	13	ACOUSTIC ENCLOSURE (70dbA @ 7m)							
16 SWITCHBOARD ACCESS DOORS 17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	14	SIDE ACCESS DOORS (2 OFF)							
17 ACOUSTIC SPLITTER 18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK ORAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CDNTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	15	AIR INLET GRILL							
18 AIR OUTLET GRILL 19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CDNTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	16	SWITCHBOARD ACCESS DOORS							
19 CABLE ENTRY ZONE 20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2x12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	17	ACOUSTIC SPLITTER							
20 ANCHOR POINT 21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2x12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	. 18	AIR OUTLET GRILL							
21 LIFTING POINTS 22 TRANSPORT SKID 23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2x12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	19	CABLE ENTRY ZONE							
22 TRANSPORT SKID 23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2x12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	20	ANCHOR POINT							
23 FUEL TANK DRAIN (LOCKABLE) 24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CONTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	21								
24 OIL DRAIN ILOCKABLE) 25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CDNTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN	22	TRANSPORT SKID							
25 RADIATOR DRAIN HOSE 26 CATCHMENT TRAY DRAIN 27 CDNTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN									
26 CATCHMENT TRAY DRAIN 27 CDNTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN									
27 CDNTROL BATTERIES (2×12 VOLT) 28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN									
28 BATTERY CHARGING SOLAR PANEL 29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN									
29 DRAIN POINT LOCKABLE COVER 30 INSECT SCREEN									
30 INSECT SCREEN									
31 OUTPUT & CONTROL SOCKETS T.B.A.									
	31	OUTPUT & CONTROL SOCKETS T.B.A.							

NOTE

ENCLOSURE COLOUR : MIST GREEN
BASE TANK COLOUR : MIST GREEN
SKID BASE COLOUR : MIST GREEN

APPROVED FOR CONSTRUCTION

SP213 SANANANDA ROAD (USING ALTERNATOR 2a) SP239 GOWAN ROAD (USING ALTERNATOR 2b)

Dis decement in the property of S.L. Prove Equipment and in threshed stay for the purpose indictated. Provides that for themsel dues out comercy provides to be because the first formed the set of the point of the head of the provides of copy if in whate or in part or its most determ the schigle settler shows the risk. Such sermicists to be quarted such to be quarted such provide extraction in writing sixper by an allow of S.L. Prove equipment.

П						
П						
H		i			$\overline{}$	
H	0	2.6.03				ISSUE FOR CONSTRUCTION
П	A	2.5.03				APPROVAL ISSUE
,	Rev.	Date	DESIGN	REV D PJ 67	APP D P,MGR	Amendment

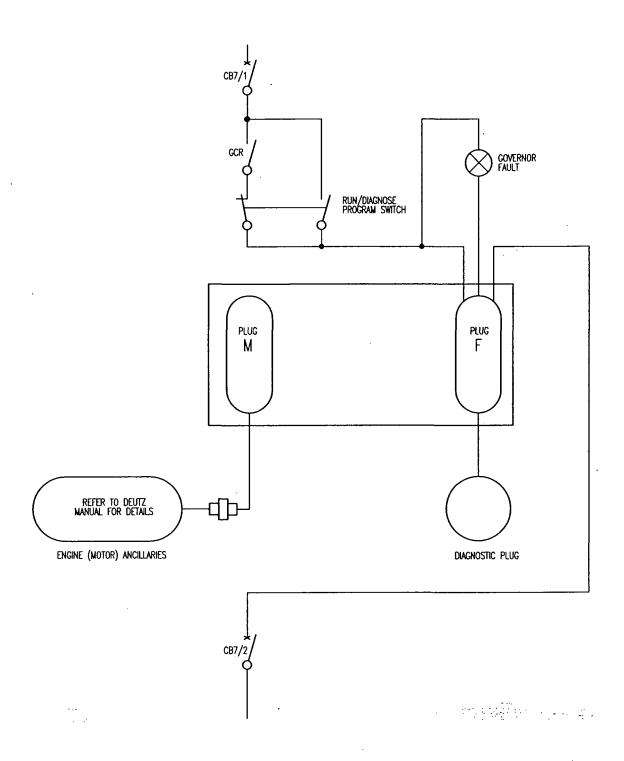


Division of Southside Engineering
47 PROPRIETARY ST.
TINGALPA
BRISBANE OLD 4173

BRISBANE, QLD, 4173 Phone: (07) 3890 1744 Facsimite: (07) 3398 4631

Client	(Sient BRISBANE WATER							
Project SEV	VAGE PUMP	STATION BACKUP GENSETS						
Orafter RSL	Draft Check	Reviewed Project Manager	Approved Project Director					
Designed RSL	Design Review	7	J					

	Title	SP213, SP239 ARRANGEMENT						
١	Scale 1:25	No in set	SE Ref Ho. 14291	SE Jab	Νa	S.E. Drawing No.	TOMA	
ľ	Engineer's Ref. No Client		Client Ref I 30140-02/0	Ref No. 0-02/03		14291-008	ر ۱	

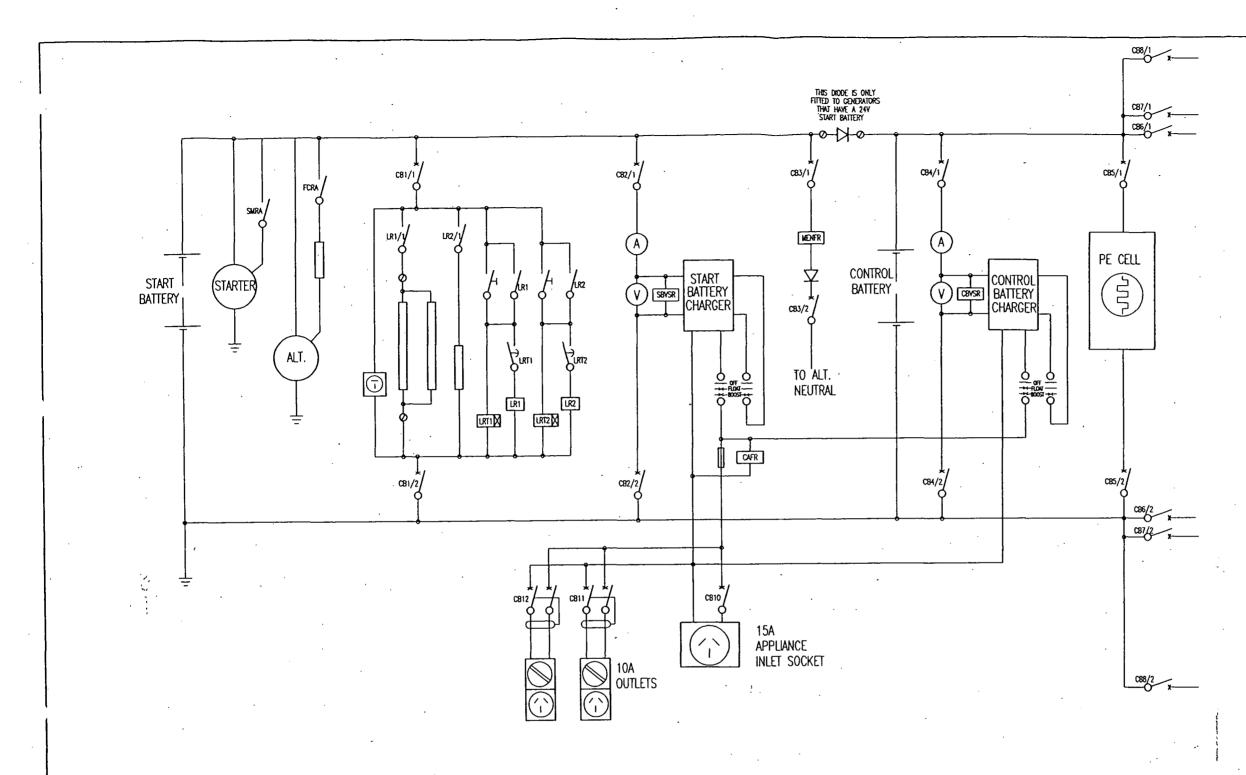


1.8.03 AS BUILT



EQUIPMENT DATA SHEET	REV No:	PROJECT No: 142	291-607	DATE: 1.08.03
TITLE: BCC BRISBANE WATER PUMP STATION BACKUP GENSE	т	REF:	PREPARED BY: HJR / RSL	CHECKED BY:
	ł	APPROVED FOR ISSUE		SCALE:
EMR GOVERNOR CONTROLS		JP		1:1
\				1 /

Page 435 of 469



This document is the property of S.I. Power Equipment and is furnished only for the purpose indicated. Possession of this document does not covery permission to had, reproduce or copy if in whate or in part or to canofacture the subject matter shown therein. Such permission to be granted only by specific authorisation in writing signed by an officer of S.I. Power equipment

١							
1					ļ		
١		 	·				\dashv
	0	1.8.03				AS BUILT	
J	Rev.	Date	DESIGN REVIEW	REV'D	APP'D P.MGR	Amendment	

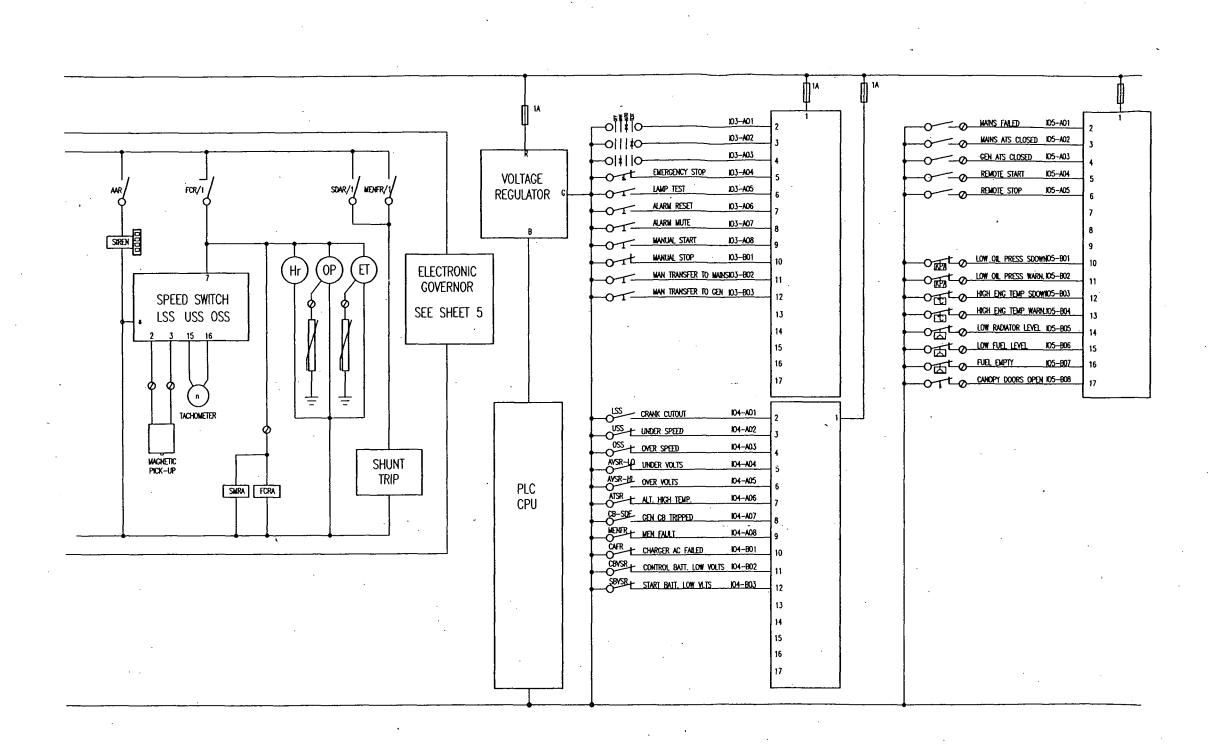


<u>Division of Southside Engineering</u> 47 PROPRIETARY ST. TINGALPA

BRISBANE, QLD. 4173 Phone: (07) 3890 1744 Facsimile: (07) 3390 4631

Client	BCC	BRISBANE WA	ATER .
Project	PUMP STA	TION BACKUP	GENSET
Drafter HJR / RSL	Draft Check	Reviewed Project Manager	Approved Project Director
Designed HJR	Design Review	JР	JР

Title .		ELECTRICAL SCHEMATIC	Ì
Scale 1:1	No in set	SE Ref No. SE Job No S.E. Drawing No.	AMDT
Engineer	's Ref. No	Client Ref No. 14291-601	



This document is the property of S.E. Power Equipment and is furnished only for the purpose indicated.
Posession of this document does not convey permission to load, reproduce or copy it in whole or in part or to nanufacture 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

			7.			
				ļ		
0	1.8.03		ł	1	AS BUILT	
Rev.	Date	DESIGN REVIEW	REY'D P.MGR	APP'D P.MGR	Amendment	



Division of Southside Engineering 47 PROPRIETARY ST. TINGALPA

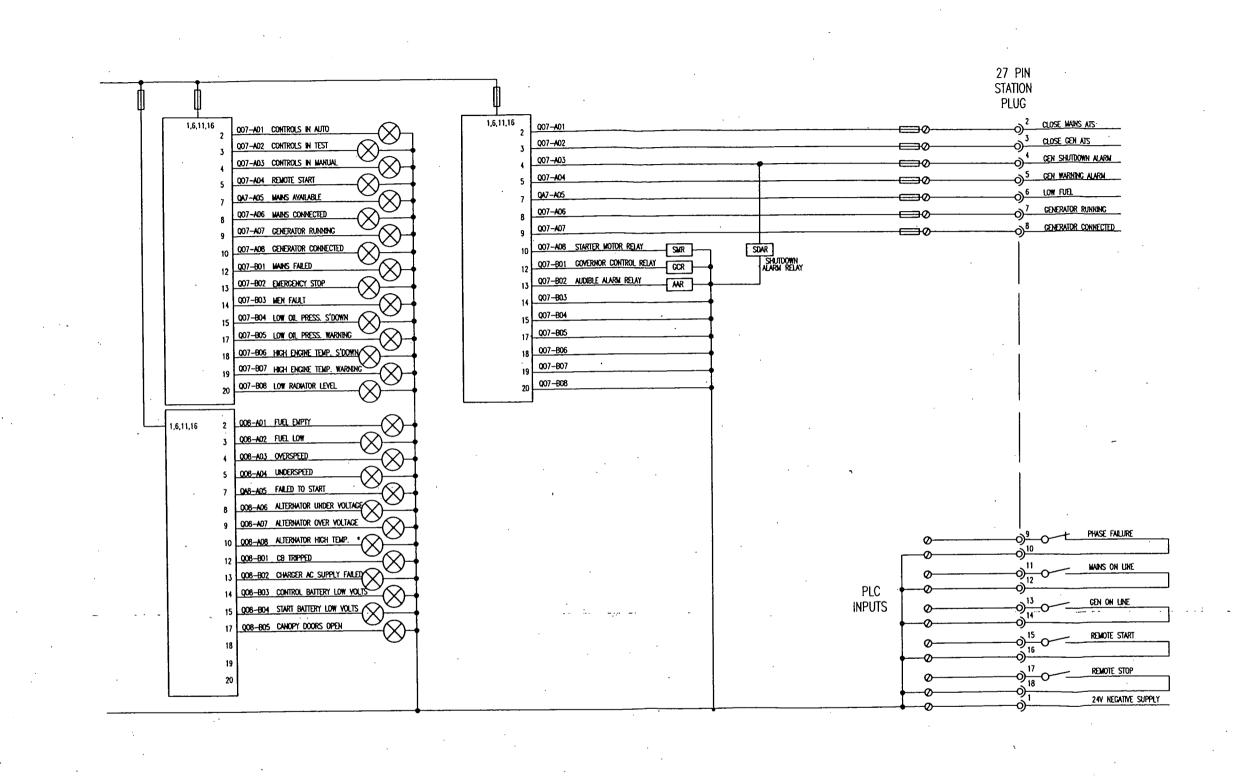
BRISBANE, QLD. 4173

OWER EQUIPMENT Phone: (07) 3890 1744

Forsimila (07) 3300

Client	B(C BRISB	ANE	WATER	
Project	PUMP	STATION	BACK	KUP GENSET	
Drafter HJR / R	Draft Ch	eck Reviewed Project Mo	ınager	Approved Project Director	
Designed HJR	Design R	eview	JP	JP	

Title		ELECTRICAL SCHEMATIC					
Scale 1:1	No in set	SE Ref No.	SE Job No	S.E. Drawing No.	AMDT		
	's Ref. No			14291-602	0		
()	-			1	l /		



This document is the property of S.E. Power Equipment and is turnished only for the purpose indicated. Presession of this document does not comery permission to load, reproduce or copy if 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

		_				
				·]		
						
0	1.8.03				AS BUILT	
Rev.	Date	DESIGN REVIEW	REV'D P.MGR	APP'O P.MGR	Amendment	
	<u> </u>					·

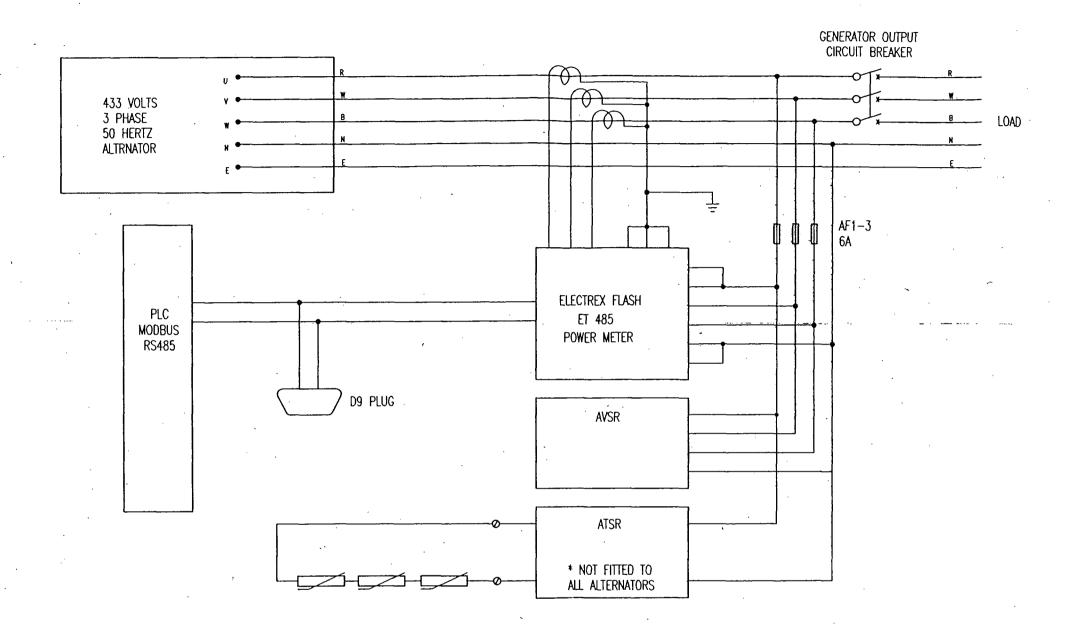
OWER FOUNDMEN

Division of Southside Engineering
47 PROPRIETARY ST.
TINGALPA
RDISBANE OLD (173

BRISBANE, QLD. 4173 Phone: (07) 3890 1744 Facsimile: (07) 3390 4631

Client ,	ВСС	BRISBANE WA	ATER
Project	PUMP STA	TION BACKUF	GENSET
Drafter HJR / RSL	Draft Check	Reviewed Project Manager	Approved Project Director
Designed HJR	Design Review	JР	JP

					$\overline{}$
$\Big $	Title		ELECTRICAL	SCHEMATIC	
$\frac{1}{2}$	Scale	No in set	SE Ref No. SE Job No 14291	S.E. Drawing No.	TOMA
J			Client Ref No.	14291-603	0



This document is the property of S.E. Power Equipment and is furnished only for the purpose indicated.

Possession of this document does not comery permission to load, reproduce or copy if in whole or in part or to monstrature the subject mother shown therein.

Such permission to be granted only by specific authorisation in writing signed by an officer of S.E. Power equipment

	<u> </u>				
				<u>L</u>	
0	1.8.03		L.		AS BUILT
Rev.	Date	DESIGN REVIEW	REV'D P.HGR	APP'D P.HGR	Amendment



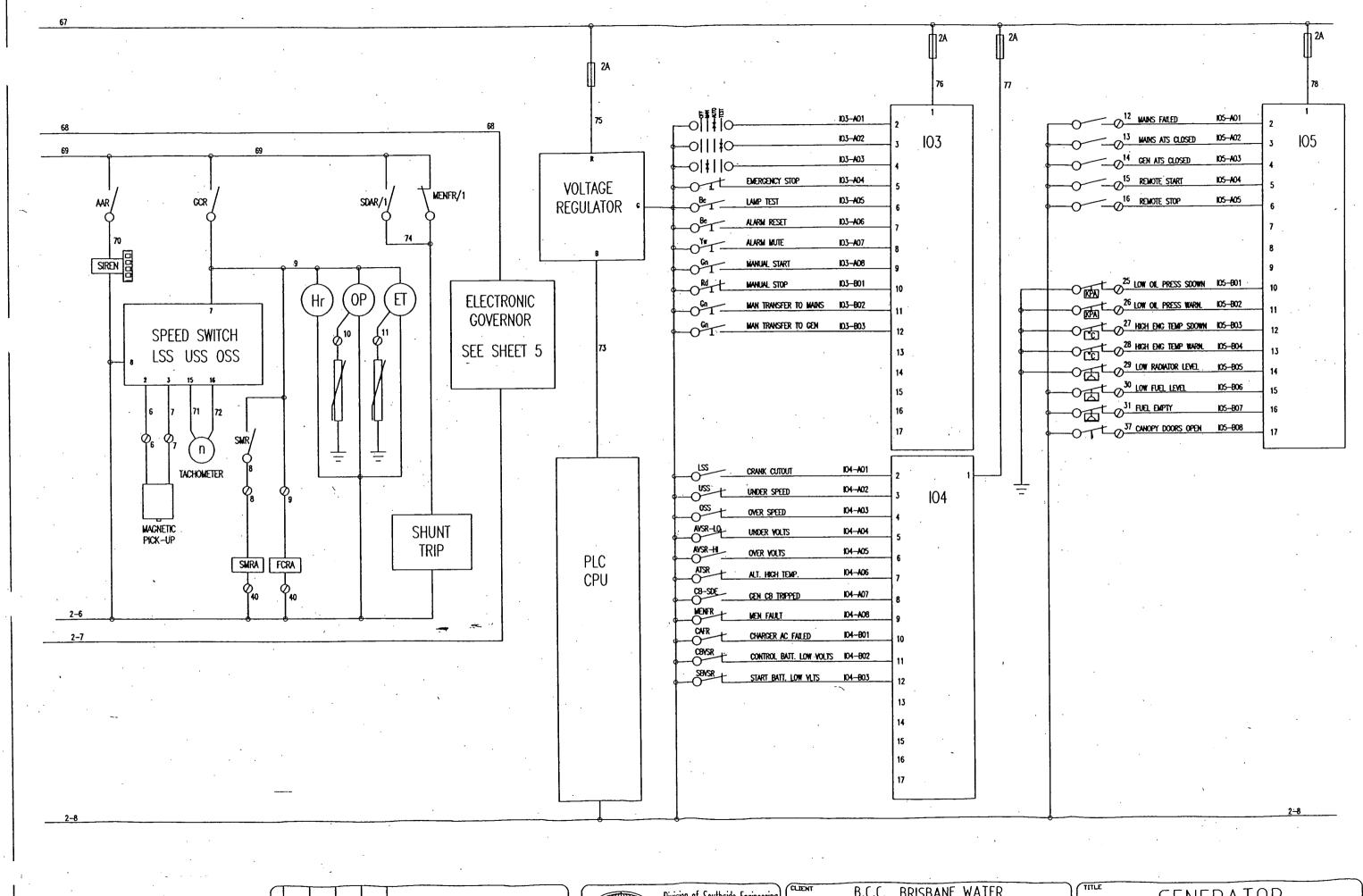
Division of Southside Engineering 47 PROPRIETARY ST. TINGALPA BRISBANE, QLD. 4173

Phone:	(07)	3890	17.44	
Facsimile:	(07)	3390	4631	_

Client	BCC	BRISBANE W	ATER	
Project	PUMP STA	TION BACKUP GENSET		
Drafter HJR / RSL	Draft Check	Reviewed Project Manager	Approved Project Director	
Designed HJR	Design Review	JP	JР	

	Title	<u> </u>	ELECTRICAL	SCHEMATIC	
1	Scale 1:1	No in set	SE Ref No. SE Job No	S.E. Drawing No.	AMDT
	Engineer		Client Ref No.	14291-604	0

Active 10/12/2014



C 1-9-03 . AS BULT

0 15-05-03 . DOWNING FRANCED

A 06-05 . DESCA REY'D APP'D . MEN DRAING

No DATE PRYSTY PAGE PAGE . AMENDMENT

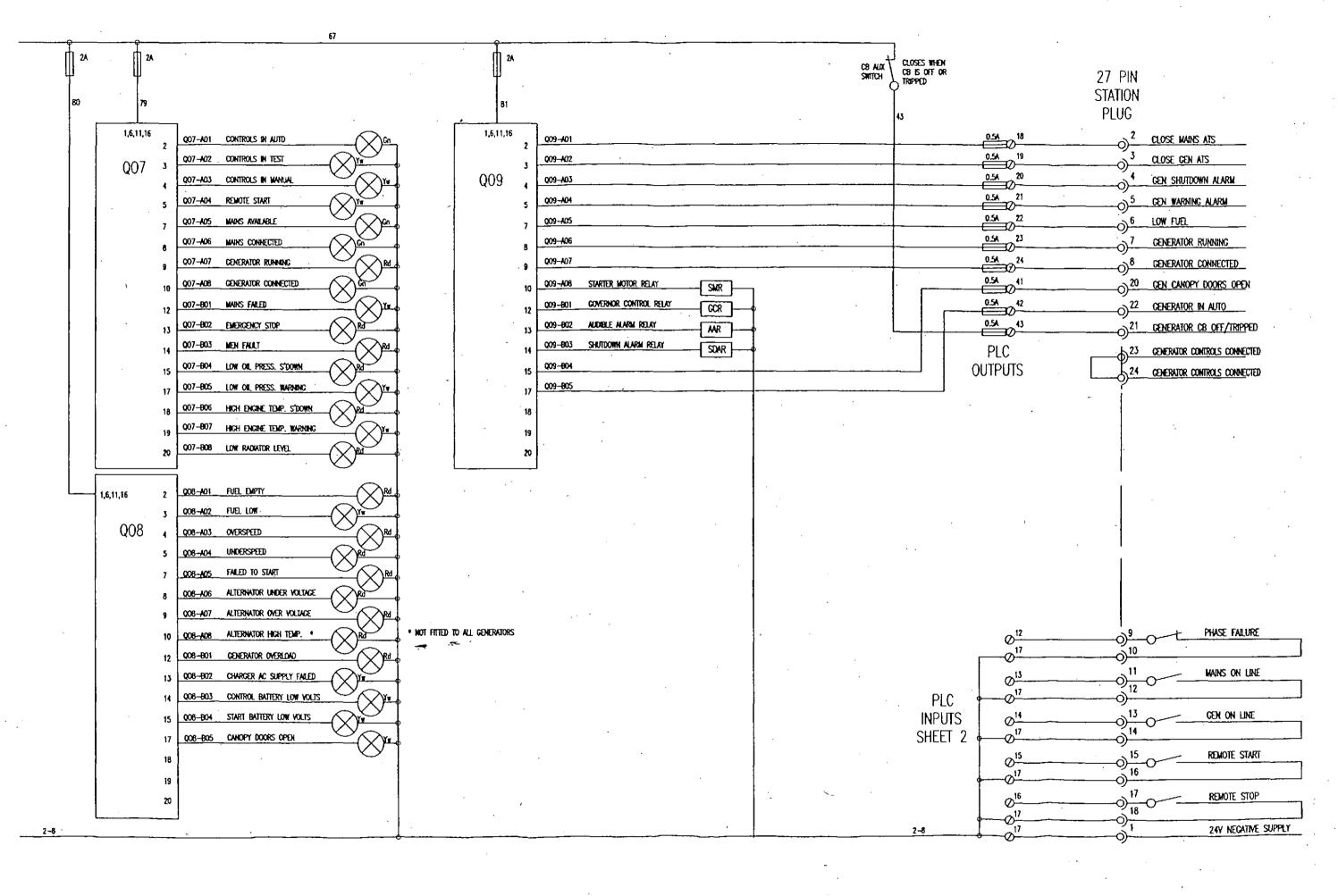


Division of Southside Engineering
47 PROPRIETARY ST.
TINGALPA
BRISBANE, QLD. 4173
Phone: (07) 3890 1744

L	<u> </u>	DKISDAIL WAT	LI
PROJECT		TATION GENERAT	
HJR	DRAFTING CHECK	JUB NUMBER	SE POVER JOB NUMBER
DESIGNED HJR	DESIGN REVIEW	4000	28396

GENERATOR
ELECTRICAL SCHEMATIC

Q-Pulse Id TM\$1079



E	10-05-04			┞──┼	27 PM PLUC RELIES COMPCIONS WERE CHANCED TO MAJOH SAC WANCE
0	01-09-01				AS BAU
c	21-07-03				COURT REMOTE MARKE NEED ADDICE
ī	15 CS 65				DRUNG FNULSED
Â	08-05-01				NEW DRAWAG
— ماف	DATE	DESIGN	REYTO	APP O	AMENDMENT



Division of Southside Engineering
47 PROPRIETARY ST.
TINGALPA
BRISBANE, QLD. 4173
Phone: (07) 3890 1744

7	PROJECT		TATION GENERA	TOR
	HJR	DRAFTING CHECK	•	SE POVER JULI HUMBER
J	HJR	DESIGN REVIEW	4000	28396

B.C.C.

BRISBANE WATER

GENERATOR
ELECTRICAL SCHEMATIC

TALE NTS | TRAVING NO 14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

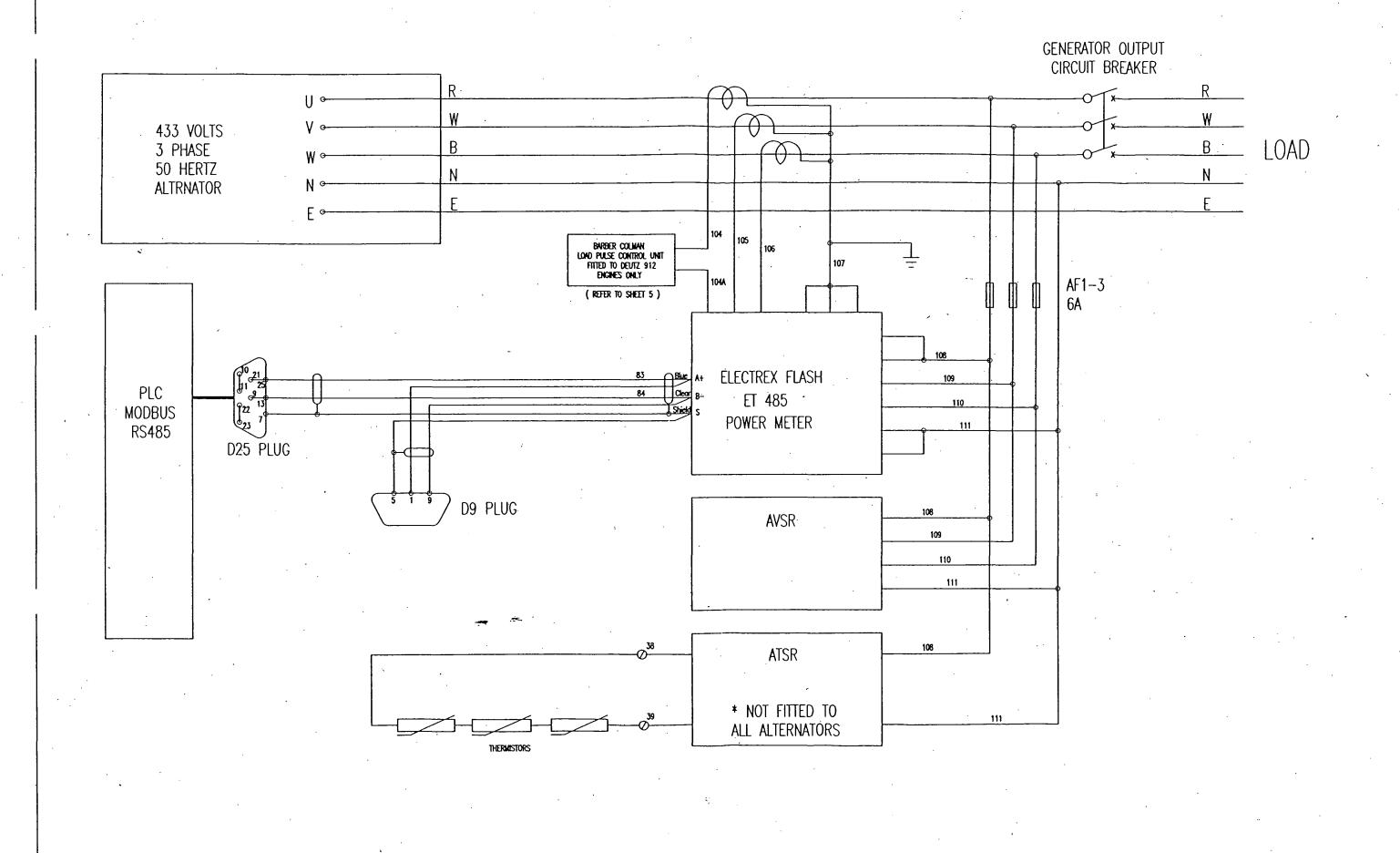
14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF 51 MODE

14291-02 | 18 OF



AS BULI
DOWNC PARLISED
BUT DOWNG
AMENDMENT

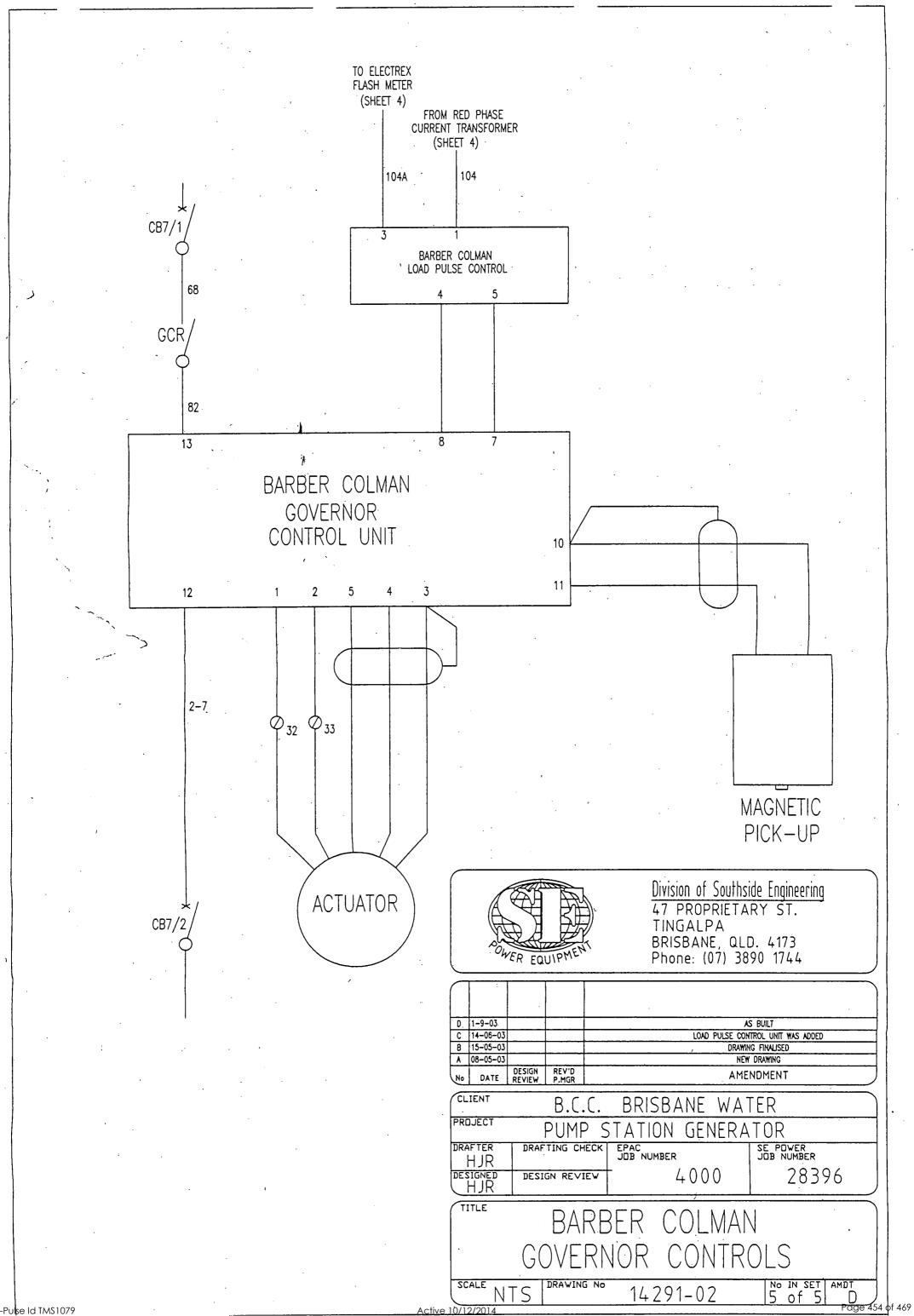
Division of Southside Engineering
47 PROPRIETARY ST.
TINGALPA
BRISBANE, QLD. 4173
Phone: (07) 3890 1744

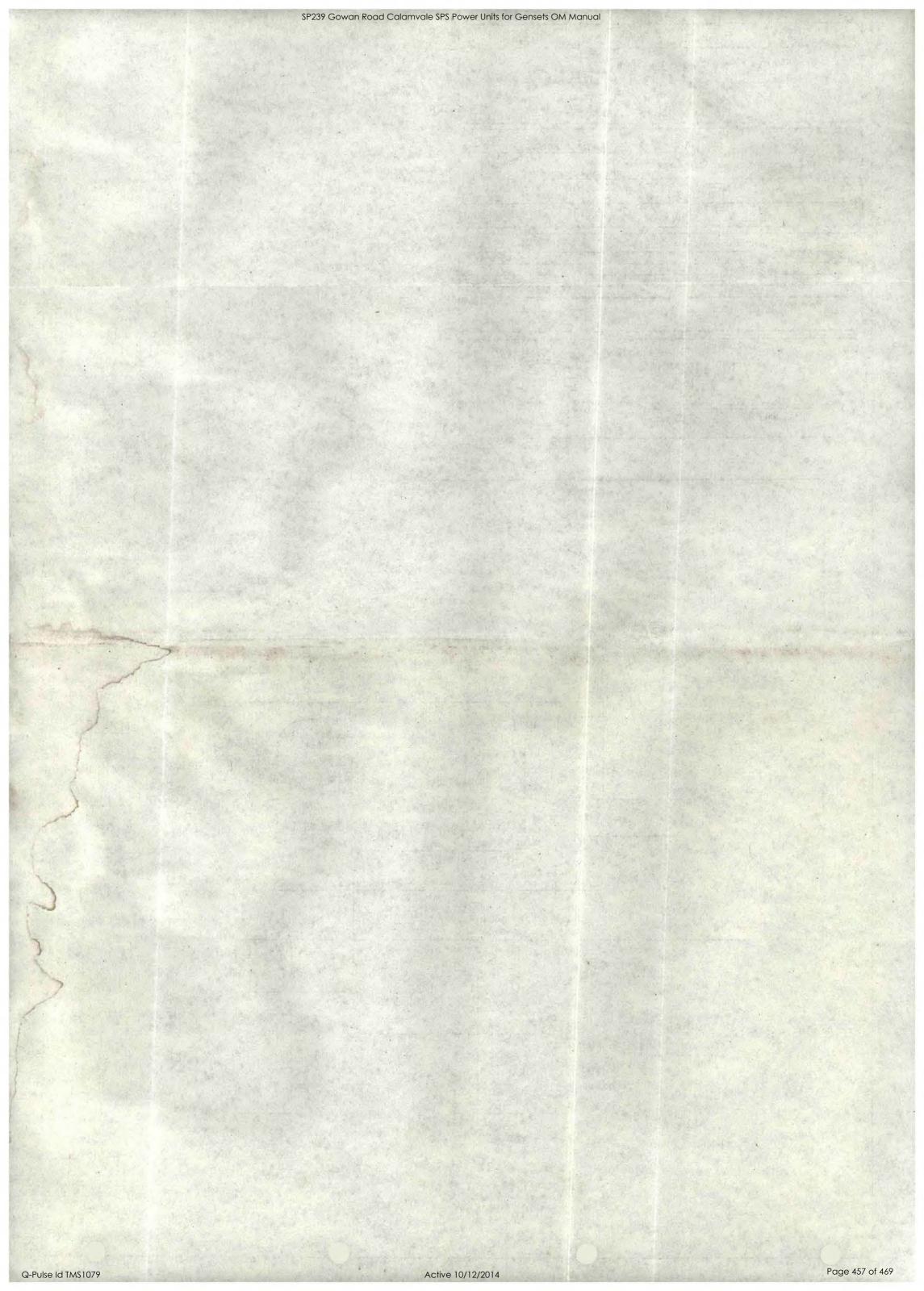
na)	CLIENT	B.C.C.	BRISBANE V	√ATER
ات	PROJECT		TATION GENE	
ı	HJR	DRAFTING CHECK	JUB NUMBER	SE POVER JOB NUMBER
J	DESIGNED HJR	DESIGN REVIEW	4000	- 28396

ELECTRICAL SCHEMATIC

NTS BRAVING NO 14291-02 4 of 5

Active 10/12/2014







CUSTOMER TESTING OFFICER:

SE Power Equipment

47 Proprietary Street, Tingalpa, Qld 4173 Telephone: (07) 3890 1744 PO Box 3306 Tingalpa B.C. Qld 4173

DIESEL GENERATOR SET CONTROL FUNCTION TEST REPORT

SEP 009/B

CLIENT: BRISBANE WATER SP)) 3a		25/00/00
	831	-	ATE: 25/08/03 DB NO: 14291
SERIAL NO: 0308006			
ENGINE TYPE: BP641015		<u>E1</u>	NG. SERIAL NO: 9147641
ALTERNATOR TYPE: HCI 534F		<u>Al</u>	T. SERIAL NO: 26020
GENSET CONTROL FUNCTIONS	FUNCTION .	LAMP	REMARKS
Engine High Temp. Alarm			
Engine High Temp. Shutdown			EMR
ow Water Level Alarm	/		<u> </u>
B Tripped/Alt., Overload			
Low Oil Pressure Alarm	/		EMB
Low Oil Pressure Shutdown			
Emergency Stop		-	
Start Fail Alarm			
Genset Running			
MEN Fault			
Starter Motor Relay			
Fuel Low			
Fuel Empty		V.	
Engine Gauges			
Status Lamps/Controls			
Underspeed Shutdown			
Overspeed Shutdown			
Remote Start/Stop			
Lamp Test			
Alarm Shudown		- /4	
Alt Undervolts			
Alt Overvolts			
harger AC Failed			a stant of the transition of
Control Batt. Low Volts			
Start Batt. Low volts			
Canopy doors Open		/	
Audible Alarm/Mute			
Remote ATS Controls			
Alternator High Temperature			
<u> </u>			
•		· 	
	<u> </u>		

Q-Pulse Id TM\$1079 Active 10/12/2014 Page 460 of 469

TESTING OFFICER:



DIESEL GENERATOR SET LOAD TEST REPORT

SEP 0064/D

47 Proprietary Street
Tingalpa Q 4173
BRISBANE AUSTRALIA

CLIENT: DELS. WATER ST 239					DATE:	25/0	<u>8/03 </u>	· <u> </u>		
SERIAL NO:						,	/	1420	71 .	
ENGINE TYPE:		3 <i>F6M10</i>	15					91476		,
ALTERNATOR TYPE: HC534F					ALT. SE	ERIAL NO):	26020	<u> </u>	·
GOVERNOR TYPE:		EM	<u>R</u> .	·	STARTI	ER MOTO	R:	DEUTZ	<u> </u>	
OVERSPEED TYPE:				·	UNDER	SPEED T	YPE:	EMR	·	
SHUTDOWN SOLEN						/ATER: _				
LOW OIL PRESSURE	E SHUTDO	OWN:								
: 255 + 10	%	κw: <u> </u>	84 + 10	»%					·	·
TECHNICAN: PAUL	- HLAVK	A·	1	_	INSPEC	TOR:	•	,		
		•	V							
TIME	1130	1145	1200	1230	1300	1330	1345	1400		
OIL PRESSURE	500	500	500	500	460	450	450	460		
OIL TEMPERATURE	NA	NA	NA	NA	NA	NA	NA	NA		
JACKET WATER TEMPERATURE	0	60	80	80	85	85	85	80		
y Dis	0	60.7	128.6	190.4	255	255	280	0		ž.
volts <u>415</u>	240 240 240	1	111	111	1	22	1	1		
AMBIENT TEMPERATURE	20	30	22	23	23	24	24	24		
HZ	50	50	50	50	50	50	50	50		
KW	0	42.7	918	135.9	184	184	200.4	0		
LOAD%	0	25%	50%	75%	100%	100%	110%	0		
REMARKS				,	· · · · · · · · · · · · · · · · · · ·		,			

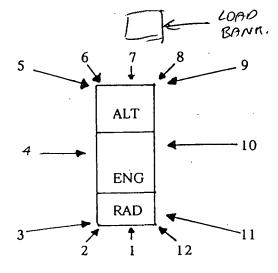


GENERATOR SET SOUND PRESSURE LEVEL TEST REPORT

SEP 0023/D

47 Proprietary Street Tingalpa Q 4173 BRISBANE AUST **AUSTRALIA**

CLIENT:	BUS. WATER	SP239	DATE:	25/08/0	<u> </u>	
SERIAL NO:	0308000	-	JOB NO	;	14291	
ENGINE TYPE	E: BF6M10	15	ENG. S	ERIAL NO:	9147641	
	TYPE: He.5	34F	ALT. SE	RIAL NO: _	26620	,
	L INSTRUMENT:	<i>j</i>			•	



Remarks:

Position Layout

POSITION	SOUND LEVEL	LOAD %						
	dB(A)	25	50	75	100	110		
1	66				1			
2	66							
3				1, 17 to 3.				
4	68				1			
5	68							
6					<u> </u>			
7	·			ļ				
8				ļ	<u> </u>			
9				ļ	 			
10					<u> </u>	<u> </u>		
11				ļ		ļ		
12	66.							
Average								

QUALITY ASSURANCE OFFICER:		
CUSTOMER TESTING OFFICER:		
TESTING OFFICER:	PAUL HLAVKA	
WITNESS TESTING OFFICER	PAVID COOPER.	



47 Proprietary Street Tingalpa Qld 4173 PH: (07) 3890 1744

SEP0084

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								
% Change HZ	.8	1.5	.6	3-5	1.4	1-5	.7	- 1
% Change Volts	0	1	1	3	0	0	0	1
Recovery secs	3	4	5	5	3	3	1)

CLIENT: BRISBANE WATER SP239

300800C

JOB No: 14291

47 Proprietary Street Tingalpa Q 4173 BRISBANE AUSTRALIA



SEP 0013

FINAL INSPECTION CHECKLIST

This form is to be completely filled out before any generating set leaves the factory.

It is to be signed by the person doing the inspection and by their immediate supervisor. In the case of a non-standard job it must also be signed by the Special Projects Manager or the Engineering Manager.

A copy of this form is to be sent out with the plant concerned.

Please neatly in the space p		es provided where	applicable an	nd note any c	aments :	
MODEL: BW	SP239	SERIAL NO:	0308006	ENGINE NO:	9147641	
JOB NO:	+ 291 DATE:	SERIAL NO:	STOMER: R.	W.		
			=======================================	.======================================	======	
BASE						,
(2) All bol (3) Bearers	ds continuous, n ts tightened. completely secu p corners.			·		212
RADIATOR						
<pre>(2) All pip (3) Drain p (4) Water r</pre>	r correctly moun ework included a lug in place. emoved from radi on hoses tight.	and secure.				7,1450
ENGINE	•					
(2) All gua (3) Wiring termina (4) Battery (5) Air cle (6) Magnetic (7) Exhaust (8) Dip stic (9) Oil rem (10) All fue (11) Allorde (12) All part (13) All eart (14) Cables a	ted in an appropred leads attached aner is properly complete pickup is fitted pipe and silence in place. The end oil unions bredoptions are for the secure, no daths less than 0. The end of the secure is secure and hoses secure is secure.	to drawing, secure to drawing, secure to drawing, secure and learned secure and learned and set to conser (where require to completely tight itted and functionage. I ohms. for transport.	ox. ong enough for crect depth. ed) are fitted tened.	termination		प्राथम् वर्गराय
CONTROL SYSTEM	(where applicab	le)				٠.
(2) Control (3) All lead complete	functions as or is mounted corr ds, terminals, f ely secure and m als are fitted a	ectly. uses, printed cir arked correctly.	rcuit boards a	nd switchgea	r are	
(±) Dusic Sec	are irred 9	Louna acors.				1

Q-Pulse Id TMS1079

(5)

(6)

(7)

Doors hinged correctly.

All earths less than 0.1 ohms.

Red Danger labels in cubicle. Active 10/12/2014

Page 466 of 469

Page 467 of 469

CONTRO	L SYSTEM (cont)	•		• .
(8) (9) (10)	Perspex shield secure, clean a Cables correct, no damage. Locks and keys satisfactory.	and no	sharp	corners.

ALTERNATOR

- (1) Alternator is correctly mounted.
- (2) Alternator leads are correctly mounted inside terminal box and marked correctly.
- (3) A.V.R. is mounted, connected properly and set to correct setting.
- (4) Coupling and adaptor are properly fastened between engine and alternator with correct size and tensile grade bolts.
- (5) All options ordered are fitted and function properly.
- (6) Alternator is correctly wired for the appropriate voltage as per either Order or Bills of Material.
- (7) Earth stud fitted.

FINISH

- (1) Plant is painted to correct colour.
- (2) All blemishes in finish, especially paint runs, are completely removed.

GENERAL INSPECTION

- (1) Genset is manufactured to correct engine/alternator/radiator/bases configuration as specified on Bill of Materials.
- (2) All documents are in a sealed plastic bag and secured inside alternator terminal box.
 - a) Engine Handbook
 - b) Alternator Handbook
 - c) Warranty Card
 - d) Packing List
 - e) Test Sheet
- (3) No Oil/No Water label is attached to positive battery lead.
- (4) All labels are straight and in correct location.

QUALITY ASSURANCE COMMENTS:	SIGNED:	YAUL HLAVKA	INSPECTOR			
COMMENTS:	· · · · · · · · · · · · · · · · · · ·		QUALITY ASSURANCE			
COMMENTS:						
	COMMENTS:					
	<u> </u>	<u> </u>				
			·			

Page 469 of 469