



T SERIES

# GENERATING SET OPERATORS' HANDBOOK



## **Abbreviations**

*The following are the abbreviations used in Lister Petter operators' handbooks.*

AC	<i>alternating current</i>	LED	<i>light-emitting diode</i>
ASU	<i>automatic control module</i>	MC	<i>mains contactor</i>
BC	<i>battery charger</i>	MCB	<i>AC circuit breaker</i>
CCS	<i>manual contactor switch</i>	MFR	<i>mains failure relay</i>
CT1	<i>current transformers</i>	MOL	<i>mains-on-load lamp</i>
DC	<i>direct current</i>	OPS	<i>oil pressure switch</i>
DCCB	<i>DC circuit breaker</i>	OPX	<i>oil pressure sender</i>
DCS	<i>DC control switch</i>	PC	<i>plant contactor</i>
EPB	<i>emergency stop pushbutton</i>	PCR	<i>plant contactor relay</i>
ETS	<i>engine temperature switch</i>	POL	<i>plant-on-load lamp</i>
ETX	<i>engine temperature sender</i>	SB	<i>starter battery</i>
F1	<i>fuses</i>	SM	<i>starter motor</i>
FCS	<i>fuel control solenoid</i>	SS	<i>starter solenoid</i>

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## MODEL DESIGNATION

Genset Model	Engine Type	Engine r/min
HSL8	TR1	1500/1800
HSL15	TR2	1500/1800
HSL24	TR3	1500/1800

# 1. INTRODUCTION AND PRECAUTIONS

This handbook covers the operation and routine maintenance of HSL generating sets powered by Lister Petter TR series engines in the following versions:

- Electric Start;
- Automatic Mains Failure (AMF).

There is a separate handbook for the engine.

Some features and facilities of the generating set are specific to certain models, as indicated in the text. To determine the version of generating set that you are using refer to the serial number stamped on the nameplate and read section 1.1 Nameplates.

## 1.1 NAMEPLATES

There are nameplates on the generating set, engine and alternator. They tell you what each item or equipment can do. The generating set nameplate defines the performance of the complete generating set and its limits.

An example of a generating set serial number is:

11 12345 G TR2 22 6

which is interpreted as follows:

11 .....	Year of manufacture code
12345.....	Consecutive number of genset
G .....	Lister Petter diesel genset
TR2.....	Engine model
2 .....	Starting mode 2 (electric start)
2 .....	Electrical output mode 2 (3-phase, 4-wire, 50Hz)
6 .....	Lister Petter alternator

For future reference write your genset serial number in the box below.

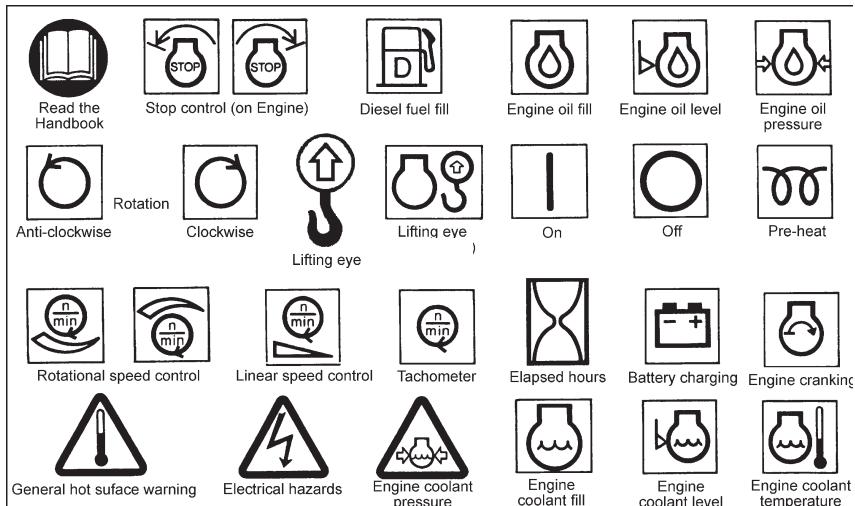
The engine nameplate defines the capabilities of the engine.

The alternator nameplate defines the maximum capabilities of the alternator at specific power ratings for the voltage, frequency, connection arrangement, ambient temperature and conditions shown.

Where there are differences between the nameplates, the generating-set nameplate data should be used.



1. T series HSL generating sets: closed set (left) and open set (right).



1.2. The ISO 8999 symbols used by Lister Petter

## 1.2 SAFETY SYMBOLS

Take note of, and be familiar with, the ISO 8999 symbols used by Lister Petter, shown in figure 1.2.

## 1.3 CAUTIONS AND WARNINGS

When a diesel engine is being serviced there are risks that must be avoided. If you do not take proper safety precautions you may be injured or killed, or the product may be damaged. Warning messages are used throughout this publication to alert you, as follows:

### **⚠ CAUTION**

*This caution draws attention to special instructions or procedures which, if not correctly followed, can result in damage to, or destruction of, equipment.*

### **⚠ WARNING**

*A warning with this type of text draws attention to special instructions or procedures which, if not correctly followed, can result in personal injury.*

### **⚠ WARNING**

*A WARNING SYMBOL WITH THIS TYPE OF TEXT DRAWS ATTENTION TO SPECIAL INSTRUCTIONS OR PROCEDURES WHICH, IF NOT CORRECTLY FOLLOWED, CAN RESULT IN SEVERE PERSONAL INJURY, OR LOSS OF LIFE.*

## 1.4 GENERAL PRECAUTIONS

### **⚠ WARNING**

*Before your generating set can be used it must be correctly installed by qualified engineers. See Appendix: Installation and Commissioning.*

## **WARNING**

*Untrained people must not start or operate any diesel generating set. It is dangerous. Operators must read and follow the instructions contained in this manual as well as the engine and alternator handbooks supplied.*

Before the first start, and at regular intervals, check the fuel and lubricating oil levels. For full details refer to the **Engine Operators' Handbook**.

### **When the Set is Running**

- Wear ear defenders.
- Do **not** touch any electrical connections.
- Do **not** run the set with any covers or guards removed or damaged.
- Do **not** smoke near the generating set.
- Do **not** touch any part of the exhaust system.
- Do **not** breathe exhaust fumes.

### **When the Set is at Rest**

- Do **not** touch the exhaust system immediately after the engine has stopped. It will still be very hot.
- Do **not** attempt any maintenance or adjustments unless you have the necessary knowledge and qualifications.

See 8. *Routine Maintenance* and read the precautions in this chapter.

- Do **not** work on the set before disconnecting the starter battery. Always disconnect the negative terminal first, reconnect the negative terminal last and use insulated tools.
- If work is to be carried out inside control or contactor cubicles they **must** be isolated from both AC and DC supplies.

## **1.5 PREPARING THE BATTERY**

If batteries are supplied they can be supplied 'wet' or dry-charged. Wet batteries need to be charged. Dry-charged batteries can normally be used for operation after filling with battery acid without initial charging.

## **WARNING**

*Battery electrolyte is corrosive. Batteries must be handled with care, and protective clothing should be worn.*

### **Preparing a Dry-Charged Battery**

The following procedure should be used to prepare a battery with factory-sealed charge.

1. Remove the vent plugs.
2. Fill the individual cells of the battery with sulphuric acid in accordance with VDE 0510 of density 1.280 kg/l (for tropical countries 1.230 kg/l)<sup>1</sup> up to the maximum acid level mark, or 15 mm above upper edge of plates. The temperature of the battery and acid should be at least 10°C before filling.
3. Allow the batteries to stand for 20 minutes, tilt slightly several times and top up with acid to correct level if required.
4. Clean and dry the outside of the battery. Thinly coat the terminals with petroleum jelly and fit the vent plugs.
5. Clean the plant connections, thinly coat with petroleum jelly and connect the battery, making sure that the positive cable is connected to the positive terminal and the negative terminal cable to the negative terminal.

If the battery does not provide an

adequate starting performance then it must be charged.

### Charging a Battery

1. Use a charge rate of approximately 6A. Discontinue the charging if the acid temperature exceeds 55°C. The battery is fully charged when the acid density and charging voltage have stopped rising for two hours.
2. After charging check the acid level and if required top up with distilled water to the maximum acid level mark, or 15 mm above the upper edge of the separators.
3. The battery should be checked within a week to ensure that the specific gravity is uniform throughout the battery and that no cell has a specific gravity below 1.280 kg/l<sup>1</sup>. If this is not the case then the battery must be recharged as in steps 1. and 2. above.

### Care of Batteries

- Never allow the battery to stand for long periods in the discharged state. Always recharge the battery promptly.
- Check the level of the battery acid at regular intervals and adjust by adding distilled or de-ionized water.

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### ⚠ CAUTION

*Do not use impure water or so-called 'improving agents'.*

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- Keep the top of the battery clean and dry. Inspect the terminals, and if necessary clean them and coat them with petroleum jelly.
- Do not allow metal objects to short-circuit the cells. Take special care when using spanners near a battery.

1. Tropical rates apply to those countries or areas where the average temperature of any month of the year exceeds 27°C (80°F).

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### ⚠ WARNING

*Never allow battery cells to become short-circuited by metal objects. Severe burns and electric shock can result.*

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### 1.6 USING THIS HANDBOOK

Refer to the table of contents (page 3) to find the section you need.

It is recommended that the individual steps contained in the various maintenance or repair operations are followed in the sequence in which they appear.

When a diesel engine is operating or being overhauled there are a number of associated practices which may lead to personal injury or product damage. Your attention is drawn to the caution and warning messages used throughout this publication (section 1.3).

Work should be carried out only if the necessary hand and service tools are available. When the user has insufficient tools, experience or ability to carry out adjustments, maintenance or repairs, this work should not be attempted.

Where accurate measurements or torque values are required they can only be made using calibrated instruments.

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### ⚠ WARNING

*Under no circumstances should makeshift tools or equipment be used as their use may adversely affect safe working procedures and operation.*

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## 2. THE CONTROL MODULE

### 2.1 THE CONTROL MODULE



Figure 2.1 Control Module

The control module is used to start and stop the engine, either manually or automatically and to indicate operational status and fault conditions.

Front panel mounted push buttons provide Automatic, Manual, Start, Stop/Reset, Lamp Test and Display Scroll facilities.

It monitors various engine and generator parameters. Under out of limit conditions it will either show a warning alarm or shut the engine down, indicated by a LCD symbol or LED display.

## 2.2 CONTROLS AND INDICATORS



*Figure 2.1 Control Module*

The LED display shows the selected parameter code and function as indicated by the icon.

Code	Function
1	Automatic mode selection
2	Manual mode selection
3	Start under manual control
4	Stop/Reset - this will clear any alarm condition or stop the engine if it is running
5	Alarm mute/Lamp test button
6	Display scroll buttons - used to step through measured parameters
7	Generator available LED
8	Connect to load LED
9	Main Status LCD display
10	Configurable alarms indicators
11	Transfer to generator button
12	Open generator button

## 2.3 VIEWING THE INSTRUMENTS

At power up, the display will show the software version and then show the default screen, which will display Generator Voltage.

It is possible to scroll to display the different pages of information by repeatedly operating the next / previous



page buttons

The complete order and contents of each information page is shown below.

Once selected the page will remain on the LCD display until the user selects a different page, or after an extended period of inactivity, the module will revert to the status display.

Metering:

- Generator Voltage, 3-phase, L-L and L-N
- Generator Frequency
- Generator Current
- Engine Speed (RPM)

- Engine Hours Run
- Battery Voltage
- Number of Engine Starts
- Events log: see below

## 2.4 EVENT LOG

Press the left or right scroll button to gain access. Pressing the down button on this display will move to the previous event, the event log entry at position 1 being the most recent. On moving from the instrumentation to the event log the unit will display the most recent entry. A number in the bottom left indicates the event log entry currently displayed.

There are five event log entries. When the event log is displayed the icon in the alarm icon area indicates the alarm type at that position of the event log. The hours run at the time of the alarm shows in the instrumentation area. The bottom right icon indicates the current mode as normal.

Example of Auxiliary Input Shutdown Alarm (see Figure 2.4).

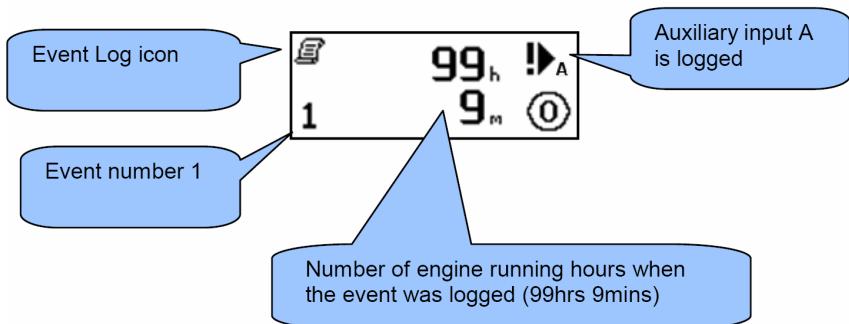


Figure 2.4 Example of Auxiliary Input Shutdown Alarm

## Controls

Stop/Reset Button - in addition to stopping the set it also resets any fault condition when the condition has been removed.

Manual Button - in this mode the engine will respond to the start button.

Automatic Button - in this mode the engine is controlled automatically.

Alarm Mute/Lamp Test Button - this silences the audible alarm and illuminates all the LEDs as a test feature.

Start Button - pressing this in manual mode will start the set which will run off load.

Transfer to Generator Button - allows transfer of generator to load in manual mode.

Open Generator Button - allows generator to be disconnected from the

load in manual load.

Menu Navigation Buttons - used to move between instrumentation and event log screens.

## 2.5 MODULE DISPLAY

The display is segmented into areas for instrumentation, units, alarm icons and various other icons.

Inst. Icon	Instrumentation	Units	Alarm Icon
Active config event index	Instrumentation	Units	Mode Icon
	Instrumentation	Units	

### 2.5.1 Display Example

This example shows Generator Volts as shown by the Generator symbol.



Figure 2.5.1 Display Example

### 2.5.2 Mode Icon

An icon is displayed in the mode icon area of the display to indicate what mode the unit is currently in.

Icon	Graphic	Details
Stopped	○	Appears when the engine is at rest and the unit is in stop mode.
Auto	↔	Appears when the engine is at rest and the unit is in auto mode.
Manual	✋	Appears when the engine is at rest and the unit is in manual mode.
Timer animation	⌚	Appears when a timer is active, for example cranking time, crank rest etc.
Running animation	⌚	Appears when the engine is running, and all timers have expired, either on or off load. The animation rate is reduced when running in idle mode.

### 2.5.3 Auto Run Icon

When the engine is running in AUTO mode, an icon is displayed to indicate the reason for the set being run.

Auto Run Reason	Icon
Remote Start Input	►

### 2.5.4 Instrumentation Icons

When displaying instrumentation a small icon is displayed in the instrumentation icon area to indicate what value is currently being displayed.

Icon	Graphic
Generator	⌚
Engine Speed	⚡
Hours Run	(L)
Battery Voltage	🔋
Engine Temperature	🌡
Oil Pressure	שמן
Event Log	📝

### 2.6 PROTECTIONS

When an alarm is present the LCD display will jump from the 'Information page' to display the Alarm Page. In the event of a warning alarm, the LCD will display the appropriate icon. If a shutdown then occurs, the module will again display the appropriate icon, flashing.

### 2.7 WARNING ALARMS

Warnings are non-critical alarm conditions and do not affect the operation of the generator system, they serve to draw the operators attention to an undesirable condition.

In the event of an alarm the LCD will jump to the alarms page, and scroll through all active warnings and shutdowns.

Warning alarms are self-resetting when the fault condition is removed.

Display	
Battery High Voltage	==↑
Battery Low Voltage	==↓
Digital Input Active	▶
Remote Input Active	▶ <sub>R</sub>
Battery Charger Failure	▶ <sub>B</sub>
Analogue Input A-C	⚡ <sub>A</sub>
Fail to Stop	⌚
Low Fuel Level (Option)	⛽

## 2.8 SHUTDOWN ALARMS

Shutdowns are latching alarms and stop the Generator. Clear the alarm and remove the fault then press Stop/Reset  to reset the module.

Display	Reason
	Digital Input A-D Auxiliary Digital inputs can be user configured as Digital inputs and will display the relevant icon.
	Analogue Input A-C Auxiliary Analogue inputs can be user configured as Digital inputs and will display the relevant icon.
	Emergency Stop Emergency stop button has been pressed. It will immediately stop the set.
	Fail to Start Engine has not fired after preset number of start attempts.
	Generator High Voltage Shutdown The generator output voltage has risen above the preset level
	Generator Low Voltage Shutdown The generator output voltage has fallen below the preset level
	High Engine Temperature Shutdown The module detects that the engine coolant temperature has exceeded the high engine temperature shutdown setting after the Safety On timer has expired.
	Low Oil Pressure Shutdown The engine oil pressure has fallen below the low oil pressure trip setting level after the Safety On timer has expired.
	Over Frequency Shutdown The generator output frequency has risen above the preset level
	Under Frequency Shutdown The generator output frequency has fallen below the preset level
	Temperaturuer Sensor Open Circuit Temperature sensor has been detected as being open circuit.
	Oil Pressure Sensor Open Circuit Oil pressure sensor has been detected as being open circuit.

**Note:**

When the fault condition has been rectified press the stop/reset button to reset the module.

### 3. THE CONTROL SYSTEM

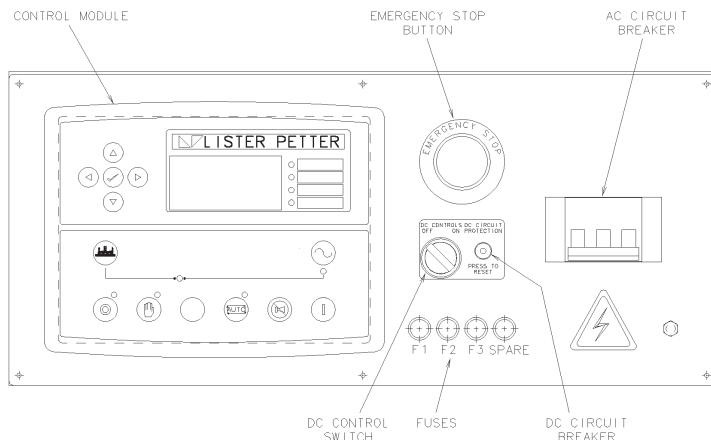


Figure 3.1 Control Cubicle

The generating set is governed by the control panel (Figure 3.1), the operation of which is described in 4. *Electric Start Sets* and 5. *Automatic Mains Failure Sets*. Automatic mains failure sets have an additional wall-mounted automatic transfer cubicle.

The principal element in the control system is the control module (Figure 2.1).

#### 3.1 CONTROL SYSTEM FEATURES

The set-mounted control system features:

- Automatic engine control module
- Emergency stop button
- DC control switch
- DC circuit breaker switch
- 2-, 3- or 4-pole AC circuit breaker
- AC instrumentation protection fuses
- Current transformers
- Automatic battery charger
- Terminal connection points for the

following remote input and output circuits:

- Emergency stop**
- Common alarm**
- Control contact input**
- Load transfer signal**

Automatic Mains Failure sets also have a battery charger and controls.

#### 3.2 THE CONTROL MODULE

The **control module** is used to start and stop the engine, either manually or automatically, and to indicate operational status and fault conditions. Instructions as to its specific use are given in the following two chapters.

##### 3.2.1 Controls and Indicators

The controls and indicators are illustrated and labelled in Figure 3.1. In both electric start and automatic mains failure sets there is a choice between **manual mode** and **automatic mode** (refer to sections 4 & 5).

## 4. STANDARD ELECTRIC START SETS

### 4.1 FEATURES

Standard electric start sets have the following features:

- Set-mounted control system (see 3. *The Control System*).
- Lister Petter air cooled engine, close-coupled to a brushless alternator
- Fabricated steel base frame with anti-vibration mountings
- Starter battery and leads
- 12-volt starter motor and solenoid
- Fuel solenoid, energised to run
- Oil, air and fuel filters
- Fuel-lift pump
- Integral fuel tank (66 litre)
- Integral silencer

### 4.2 EMERGENCY STOP

An **emergency stop button** is fitted to the control cubicle. On housed sets, an additional emergency stop button is fitted externally on the housing.

The operation of an emergency stop device will initiate a controlled shutdown.

Any attempt to restart the set will be prevented until the emergency stop device has been reset.

### 4.3 MANUAL CONTROL

This section describes the manual control and operation of the generating set.

#### 4.3.1 Starting

1. Ensure the **AC circuit breaker** is in the **off** position before starting.
2. Turn the **DC control switch** to the **on** position.
3. Press the **manual mode** button

on the control module. An LED indicator by the side of the button will illuminate.

4. Press the **start** button on the control module.
5. The generating set will start and run up to speed and voltage.
6. When the **generator available** LED illuminates the set can be connected to the load circuit by closing the AC circuit breaker (switching to **on** position).

#### 4.3.2 Monitoring

Electrical outputs and engine conditions can be monitored on the control module display by successive operation of the **scroll** button; see *Figure 2.1 Control Module*.

#### 4.3.3 Stopping

1. Open the **AC circuit breaker** (switch to **off**) to disconnect the load circuits.
2. Press the **stop** button on the control module. The engine will shut down and come to rest.
3. If the generating set is not going to be used again for more than eight hours it is recommended that the **DC control switch** is turned to the **off** position.

#### 4.3.4 Alarm and Fault Conditions

During the running period the engine control module monitors the set for the alarm and shutdown faults detailed in *2.6 Protections*.

A 12v DC signal for remote indication of an alarm can be taken across terminals B3(+) and B4(-).

#### 4.3.5 AC Circuit Breaker Trip

If the AC circuit breaker trips, investigate and rectify the cause, then wait two minutes before re-closing it. The set will continue to run.

### 4.4 AUTOMATIC CONTROL

This section describes the automatic control and operation of the standard generating set.

A remote switch or contact has to be connected across terminals B5 and B6. The contact is arranged to **close** to start and run the set, and to **open** to stop it.

A 12v DC signal for remote indication of plant available (load transfer) can be taken across terminals B7(+) and B8(-).

#### 4.4.1 Starting

- 1.Turn the **DC control switch** to the **on** position.
- 2.Press the **automatic mode** button on the control module. An LED indicator by the side of the button will illuminate.
- 3.On closure of the remote contact and after a short delay the set will start and run up to speed and voltage.
- 4.When the set is ready, the **generator available LED** illuminates and the 12V DC signal becomes available at B7 and B8. At this point the load can be connected to the generating set.

#### 4.4.2 Monitoring

Electrical outputs and engine conditions can be monitored on the control module display by successive operation of the **scroll** button; refer to *Figure 2.1 Control Module*.

#### 4.4.3 Stopping

- 1.Disconnect the load from the generating set.
- 2.Open the remote contact.
- 3.After a one-minute cooling-down period the engine will shut down and come to rest.
- 4.If the generating set is not going to be used again for more than eight hours it is recommended that the **DC control switch** is turned to the **off** position.

#### 4.4.4 Alarm and Fault Conditions

During the running period the engine control module monitors the set for the alarm and shutdown faults detailed in *2.6 Protections*.

A 12v DC signal for remote indication of an alarm can be taken across terminals B3(+) and B4(-).

#### 4.4.5 AC Circuit Breaker Trip

If the AC circuit breaker trips, investigate and rectify the cause, then wait two minutes before re-closing it. The set will continue to run.

### 4.5 EMERGENCY HAND START

If you have purchased the hand start option with your electric start set, the following procedure should be followed to start the set by hand.

#### WARNING

*Always use the correct Lister Petter starting handle which has been designed for the engine. Ensure that there are no burrs on it and lightly oil that part of the engine which fits into the engine. Do not attempt to start the engine if the starting handle is damaged or dirty.*

A non-limited kick-back handle, or limited kickback handle system may be fitted to the engine.

The two types of handle are not interchangeable and care must be taken to ensure the correct handle is retained with the engine.

1. Disconnect the battery.
2. Ensure the AC circuit breaker is in the 'OFF' position.
3. Operate the fuel solenoid linkage by hand and fix this in position with the locking latch (see *Figure 4.1*).
4. Turn the DC control switch to the 'OFF' position.
5. Refer to the engine Operators Handbook for the hand starting procedure.

## **⚠ WARNING**

*Always completely remove the handle when the engine has fired.*

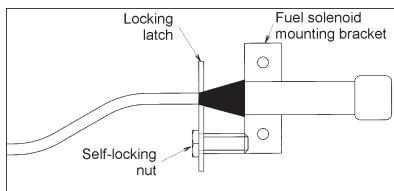
6. Close the AC circuit breaker when the engine is up to speed, stable and the output voltage is correct.

### **4.5.1 Stopping**

1. Switch the circuit breaker to the 'OFF' position.
2. Allow the set to run on no load for 1 minute to cool down.
3. Release the fuel solenoid locking latch. The arm should spring return to the 'STOP' position. The engine will now come to rest.

## **⚠ CAUTION**

*Under this mode the failure circuits are in-operative.*



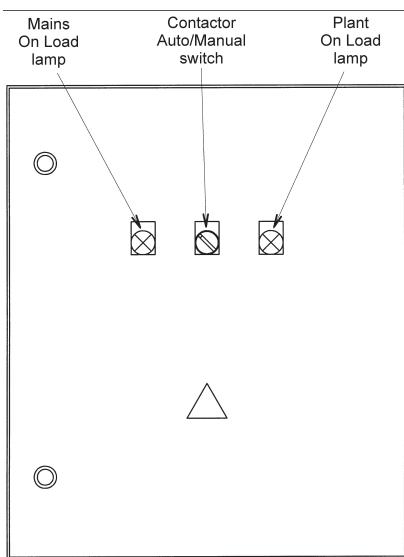
*Figure 4.1  
Fuel Control Solenoid Latch Lock  
Assembly*

## 5. AUTOMATIC MAINS FAILURE SETS

### 5.1 FEATURES

Automatic Mains Failure (AMF) sets have the following features:

- Set-mounted control system. The features of the control system and the operation of the control module are described in 3. *The Control System*.
- Lister Petter air cooled engine close-coupled to a brushless alternator
- Fabricated steel base frame with anti-vibration mountings
- Starter battery and leads
- 12-volt starter motor and solenoid
- Fuel solenoid, energised to run
- Oil, air and fuel filters
- Fuel-lift pump
- Integral fuel tank (66 litre)
- Integral silencer



5.1 The wall-mounted automatic transfer cubicle, showing the mains-on-load and plant-on-load indicator lamps.

- Battery charger (mains-operated, for battery maintenance)

In addition to these features, Automatic Mains Failure sets also have a wall-mounted automatic transfer cubicle (see Figure 5.1).

#### 5.1.1 Automatic Start and Transfer System

The wall-mounted automatic transfer cubicle contains:

- Mechanically and electrically interlocked plant and mains contactors
- Mains failure sensing relay
- Plant-on-load and mains-on-load indicator lamps
- Plant contactor Auto/Manual switch
- AC protection fuses
- DC control relay
- Terminal blocks for power and auxiliary circuits

#### 5.1.2 Emergency Stop

An **emergency stop button** is fitted to the control cubicle.

On housed sets, an additional emergency stop button is fitted externally on the housing.

Operation of the emergency stop button will initiate a controlled shutdown. Any attempt to restart the set will be prevented until the emergency stop device has been reset.

### 5.2 AUTOMATIC OPERATION

#### **WARNING**

*Automatic sets can start without warning. Keep clear of the set at all times.*

1. Turn the **DC control switch** to the **on** position.

2. Press the **automatic mode** button on the control module. An LED indicator by the side of the button will illuminate.

### 5.2.1 Mains (Utility) Failure

On receipt of a mains failure condition there is a ten-second start delay. The set will start and run up to speed and voltage.

When the set is ready the **change-over contactor** operates to isolate the mains (utilities) circuit and then transfers the load circuit on to the generator.

During this operation the **mains-on-load lamp** is extinguished and the **plant-on-load lamp** is illuminated.

### 5.2.2 Monitoring

Electrical outputs and engine conditions can be monitored on the control module display by successive operation of the **scroll** button; refer to 2.1 *Control Module*.

### 5.2.3 Mains (Utility) Returns

The mains (utility) supply must remain healthy for five minutes before the load circuit is transferred back to it from the set. At the end of this time the **plant-on-load lamp** is extinguished and the **mains-on-load lamp** is illuminated.

The set will continue to run for a further one minute on no load to allow for engine cooling.

### 5.2.4 Alarm and Fault Conditions

During the running period the engine control module monitors the set for the alarm and shutdown faults detailed in 2.6 *Protections*.

### 5.2.5 AC Circuit Breaker Trip

If the AC circuit breaker trips, investigate and rectify the cause, then wait two minutes before re-closing it. The set will continue to run.

## 5.3 MANUAL OPERATION

### 5.3.1 Starting

1. Turn the **DC control switch** to the **on** position.
2. Press the **manual mode** button on the control module. An LED indicator by the side of the button will illuminate.
3. Press the **start** button on the control module.

The generating set will then start and run up to speed and voltage. It will automatically connect to the load circuit if the mains (utility) supply has failed. Otherwise it will run off-load.

### 5.3.2 Stopping

1. Press the **stop** button on the control module. The engine will shut down and come to rest.

### 5.3.3 Mains (Utility) Failure

If the mains (utility) supply fails while the set is under manual control, the set will connect automatically to the load circuit.

On mains (utility) return, the set will continue to run on load until the **automatic mode** button is pressed. After a five-minute delay the load will then be transferred back to the mains supply. The set will continue running on no load for the one-minute cooling period.

If the **stop** button on the control module is pressed before the mains returns, the set is immediately disconnected from the load and will shut down.

## 5.4 EMERGENCY HAND START

If you have purchased the hand start option with your A.M.F. set, the following procedure should be followed to start the set by hand.

### **⚠ WARNING**

*Always use the correct Lister Petter starting handle which has been designed for the engine. Ensure that there are no burrs on it and lightly oil that part of the handle which fits into the engine. Do not attempt to start the engine if the starting handle is damaged or dirty.*

A non-limited kick-back handle, or limited kickback handle system may be fitted to the engine.

The two types of handle are not interchangeable and care must be taken to ensure the correct handle is retained with the engine.

1. Disconnect the starter battery.
2. Ensure the contactor control switch in the contactor cubicle is in the 'AUTO' position.
3. Operate the fuel solenoid linkage by hand and fix this in position with the locking latch (see *Figure 4.1*).

### **⚠ WARNING**

*Always completely remove the handle when the engine has fired.*

4. Turn the DC control switch to the 'OFF' position.
5. Refer to the engine Operators Handbook for the hand starting procedure.

### 5.4.1 Connecting to the Load

Once the generating set is up to speed, stable and the output voltage is correct, turn the plant contactor switch to the 'MANUAL' position, which will connect the generator to the load circuits.

### 5.4.2 Stopping

1. Return the contactor control switch to the 'AUTO' position.,
2. Allow the set to run on no load for 1 minute to cool down.
3. Release the fuel solenoid locking latch. The arm should spring return to the 'STOP' position.

The engine will now come to rest.

### **⚠ WARNING**

*Battery electrolyte is corrosive and batteries should be handled with care. Do not splash electrolyte on your skin and wear protective clothing.*

## 6. HAND START SETS

### 6.1 FEATURES

Hand start sets have the following features:

- Lister Petter air cooled engine close coupled to a brushless alternator.
- Fabricated steel base frame with anti-vibration mountings.
- Oil, air and fuel filters.
- Fuel lift pump.
- Integral fuel tank (8 hour run).
- Integral silencer.
- Starting handle.

### 6.2 HAND START CUBICLE

Set mounted cubicle containing:

- Combined digital voltmeter, ammeter, frequency meter and running hours recorder
- 2, 3 or 4 pole AC circuit breaker
- AC instrumentation protection fuses
- Current transformers.

### 6.3 HAND START SET OPERATION

A non-limited kick-back handle, or limited kickback handle system may be fitted to the engine.

The two types of handle are not interchangeable and care must be taken to ensure the correct handle is retained with the engine.

Before starting refer to the starting precautions in the in the engine operators' handbook.

1. Ensure the AC circuit breaker is in the 'OFF' position.
2. Refer to the engine Operators Handbook for the hand starting procedure.
3. Close the AC circuit breaker when the engine is up to speed, stable and the output voltage is correct.

### 6.3.1 Monitoring the Output of the Set

The multifunction meter provides indication of the voltage, current, frequency, power and time run. These are selected by four buttons marked I, V/Hz, P and E on the meter. LED annunciations in two columns and one row around the main display indicate which parameter is being displayed. Consecutive presses of the buttons show the following:  
I - line current - neutral current (3 phase) - current demand - maximum current demand  
V/Hz - phase voltage (3 phase) - line voltage - frequency  
P - power factor/time run (hours + minutes) - kW/kVA demand - kW/kVA maximum demand - kW/kVAR/kVA  
E - not used

### 6.3.2 Stopping

1. Switch the circuit breaker to the 'OFF' position.
2. Allow the set to run on no load for 1 minute to cool down.
3. Turn the engine control lever clockwise to the 'STOP' position and hold it there until the engine comes to rest.

### **CAUTION**

*Never stop the engine by operating the decompressor lever or valve damage may occur.*

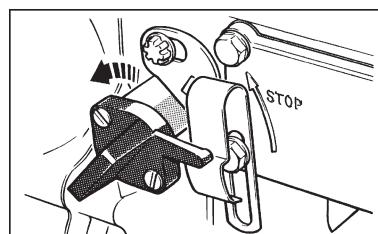
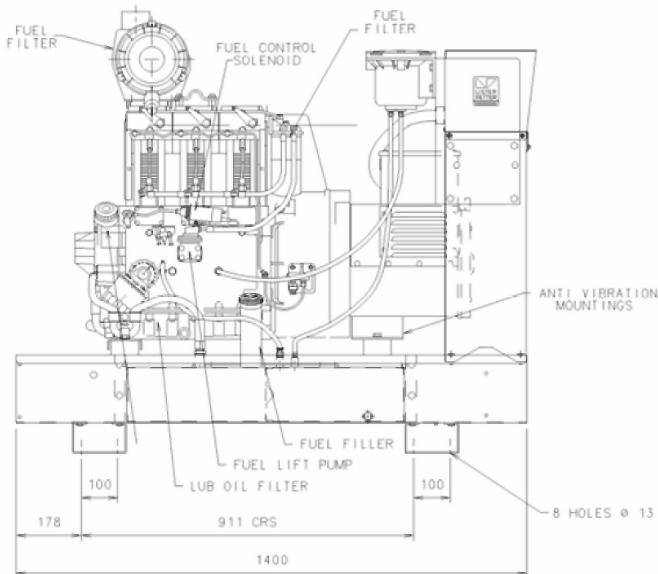


Figure 6.1 Engine Control

## 7. LONG RUN SETS



### 7.1 FEATURES

Long run sets have the following standard features:

- Available in either Electric start and AMF control systems.
- Fabricated steel base frame with anti vibration mountings
- Lister-Petter air cooled engine close coupled to a brushless alternator
- 55 litre steel fabricated lube oil tank (in place of standard fuel tank)
- Starter battery and leads
- 12 volt starter motor and solenoid
- Inspection cover for lube tank for ease of access and cleaning
- Heavy duty fuel agglomerator
- Heavy Duty oil filter
- 7" Air Cleaner
- High Performance Oil bypass filter
- Bulk Head fittings for "external" fuel

### 7.2 LONG RUN SETS COMMISSIONING

#### 7.2.1

Ensure the 55 litre lube tank contains 20 litres of running oil.

*Generator sets manufactured at Lister Petter will come as standard with 20 litres of running oil.*

If the set arrives without this oil then the following oil is recommended;

- Naturally aspirated engines: API CC or CD 15W40.

#### 7.2.2

Connect a suitable fuel supply and run the leak-off back to tank.

#### 7.2.3

Fill the cooling system with coolant

concentrate. A mix of 50% protects the system from damage and corrosion under all operating conditions. Ensure that the radiator level is full right up to and into the filler neck. Unless the cooling system is totally full the expansion bottle system will not operate correctly.

The radiator is fitted with a twin seal closed system filler cap.

Fill the expansion bottle to the level marked.

#### 7.2.4

Connect the unit to a suitable load bank to ensure that the unit can operate at 75% of its rated load.

#### 7.2.5

To ensure that the engine oil system is primed prior to starting the engine, motor the engine with the fuel control solenoid de-energised for 15 seconds.

The engine may then be started.

#### 7.2.6

Once the engine has obtained operating speed apply 75% load and run for 100hrs.

This exercise is essential to ensure that the engine is run in prior to commissioning. It also necessary as this will reduce the future risk of problems linked to light-load running

#### 7.2.7

On completion of the 100 hrs:

- Drain the oil tank and then refill with 55 litres of new lubricating oil as specified in 1. above.
- Renew the engine-mounted oil filter. (The bypass filter element does not need replacing at this time.)
- Check the coolant level and top up if necessary.
- Check all connections to ensure the integrity of the system.

---

#### NOTE:

*Running hours (2000) are based on the following parameters:*

- Engine is maintained in good operational condition.
- Engine installation is correct and well ventilated.
- Oil consumption does not exceed 0.5% of the fuel consumption.
- Fuel is clean and to the correct specification, BSS2869 Class A1.
- Engine has an adequate supply of clean combustion air (in dusty operating conditions additional air filtration may be necessary).
- Average running load of the unit does not drop below 40% of its rated load

## 8. ROUTINE MAINTENANCE

### **⚠ WARNING**

*Only qualified engineers should attempt any maintenance or adjustments. Refer to 1.2 Safety Symbols, 1.4 Safety Precautions and the equivalent sections of your engine Operators' Handbook.*

### **⚠ WARNING**

*Do not work on the set before disconnecting the starter battery. Always disconnect the negative terminal first, reconnect the negative terminal last and use insulated tools.*

#### 8.1 GENERAL

On a regular basis, check and replenish if necessary:

- The fuel level;
- The lubricating oil level;

Refer to the engine Operators' Handbook, P027-08265, supplied with the set, for capacities and specifications.

#### 8.2 DIESEL ENGINE

Refer to the Engine Operators' Hand-

book, P027-08265, supplied with the set, for details of routine maintenance to be carried out after prescribed periods.

#### 8.3 ALTERNATOR

No routine maintenance by the user is required, nor should it be attempted. The alternator manufacturer's manual is provided for use only by specialised personnel employed to undertake maintenance work on the alternator.

#### 8.4 BATTERY

To keep terminals and connections free from corrosion, coat with petroleum jelly or other suitable protective. Also refer to 1.5 Preparing the Battery.

### **⚠ WARNING**

*Battery electrolyte is corrosive and must not be splashed on your skin. Batteries must be handled with care, and protective clothing should be worn.*

## 9. TROUBLESHOOTING

### **⚠ WARNING**

*Fault finding and rectification should be undertaken only by competent professional engineers.*

#### 9.1 DIESEL ENGINE

The engine Operators' Handbook supplied with the set suggests possible causes for the most common faults, for the guidance of specialised diesel engine maintenance engineers.

#### 9.2 ALTERNATOR

The alternator manual supplied with the set suggests possible causes for the most common faults, for the guidance of specialised electrical engineers.

#### 9.3 ELECTRICAL SYSTEM

In the case of a suspected fault employ a qualified professional electrical engineer to resolve the fault.

The wiring diagrams supplied with this manual are for use only by specialised electrical engineers.

## 10. REPLACEMENT PARTS

### 10.1 SOURCE OF SUPPLY

When purchasing parts or giving instructions for repairs users should, in their own interests, always specify genuine parts and quote the part number, description of the part and the serial number.

Replacement parts are available from the worldwide network of Lister Petter diesel gensets distributors. For the name and address of the distributor nearest to you, contact the manufacturer (see 10.5).

Always use genuine parts supplied by Lister Petter through our distribution network.

Use of non-genuine parts can damage your set and invalidates the warranty.



### IMPORTANT

*Your distributor will need to know the generating set type and serial number stamped on the generating set nameplate to ensure that the correct parts are supplied.*

### 10.2 ENGINE PARTS

A Master Parts Manual, P027-08030, is available from Lister Petter or your local distributor.

### 10.3 ALTERNATOR PARTS

Consult Lister Petter (see 10.5).

### 10.4 Cubicle Parts

Consult Lister Petter (see 10.5).

### 10.5 CONTACTING LISTER PETTER

We are confident that you will obtain excellent safe service from your generating set. To achieve this however it is important that the installation, commissioning and maintenance of the set is undertaken by relevant competent engineers. If in doubt consult your local Lister Petter gensets distributor. To obtain advice on any aspect of the ownership of your Lister Petter diesel generating set please contact your local distributor or the manufacturer:

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## APPENDIX 1

### INSTALLATION AND COMMISSIONING

#### **SITE INSTALLATION**

##### **⚠ WARNING**

*All installation work should be undertaken by a competent professional engineer.*

- 1.The generating set must be installed in a suitable building or enclosure. This is essential to attenuate noise; protect the generating set from the environment; and prevent unauthorised access. The enclosure must have sufficient and suitable means to provide air for combustion and cooling and to remove hot air and exhaust gases.
- 2.Foundations must be of solid construction (usually concrete), with adequate load-bearing capabilities. If in doubt, consult a structural engineer.
- 3.The base frame must be securely fixed to a level and solid foundation to limit vibration to the base frame and cubicle assemblies. Distortion of the fabricated base frame must not occur when tightening down the foundation bolts. Packing shims should be used to ensure there are no irregularities occurring between the base frame and the foundations.
- 4.Separate floor trenches must be provided for fuel pipework and cabling.
- 5.When the installation is indoors, ensure that combustion and cooling-air inlets and hot-air outlets are provided with adequate ventilation. Heat from the engine must be expelled from

the building, otherwise the engine can become damaged due to overheating.

- 6.Exhaust fumes are dangerous. Ensure that the fumes are safely piped to the outside of the building.

##### **⚠ WARNING**

***DO NOT BREATHE EXHAUST GASES AS THEY CONTAIN CARBON MONOXIDE, A COLOURLESS, ODOURLESS AND POISONOUS GAS THAT CAN CAUSE UNCONSCIOUSNESS AND DEATH.***

- 7.The bulk storage of fuel oil should be sited in outbuildings if possible.
- 8.Check that the fire precautions are adequate and that the installer provides appropriate warning notices to ensure the safety of all personnel regarding all aspects of generating set operation.
- 9.Only lift the set by means of the identified lifting points, using certified lifting equipment. **Open and housed sets** have forklift pockets. **Housed sets** also have a centre-point lift option.

##### **⚠ WARNING**

***Never attempt to lift the set by the engine or alternator lifting eyes.***

#### **WIRING AND COMMISSIONING**

##### **⚠ WARNING**

***All wiring installation, connecting up and commissioning of the generating set should be carried out by a competent electrical engineer.***

1. It is the responsibility of the installer to ensure that the generating set is adequately earthed to a low-resistance earthing rod or earth plate.
2. Ensure that the battery is fully charged and serviceable, and that the engine has the correct quantity of the correct lubricating oil (see the **Engine Operators' Handbook**).
3. Ensure that the battery connections are secure. Make the final battery connection only when everything is ready for the first start, connecting the negative battery terminal last.
4. Before starting read the safety section in the **Engine Operators' Handbook**.

## APPENDIX 2: LIST OF DRAWINGS

### Standard Electric Start Sets

- AC/DC circuit diagram (basic)  
TR1/2/3 ..... 084-27329  
Remote control diagram .. 084-26982

### Automatic Mains Failure Sets

- AC/DC circuit diagram  
TR1/2/3 ..... 084-27330

### Circuit diagram

Contactor cubicle ..... 084-27290

### Interconnection diagram

Open set ..... 084-26977  
Housed set ..... 084-26978



### **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.

**T SERIES GENERATING SET OPERATORS' HANDBOOK,  
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