

Preventative Maintenance Plan

**Landfill Gas Treatment System
Solar Combustion Turbine
Waulkesha Internal Combustion Engines**

**C&C Energy LLC
C&C Landfill - Gas to Energy Facility
19401 15 Mile Road
Marshall, MI 49068**

**Revision Date:
September 2021**

INTRODUCTION

C&C Energy LLC (C&C) operates a landfill gas-to-energy facility at the C&C Landfill facility in Marshall, Michigan. C&C is subject to the United States Environmental Protection Agency (USEPA) New Source Performance Standards (NSPS). C&C receives all the gas collected from C&C Landfill and processes it through two compression and treatment systems, one for the combustion turbine and one for the internal combustion engines. After the treatment system processes the gas it is either sent to a combustion turbine, internal combustion engines, or a backup control device operated by the landfill owner (an enclosed flare).

C&C considers its landfill gas treatment systems as a means of controlling the landfill gas collected at the facility. The basis of C&C's determination are numerous rulings by the Air Protection Division of the USEPA. NSPS allows landfill gas to be controlled by routing the collected gas to a treatment system that processes the gas for subsequent sale or use. The USEPA considers dewatering, filtering through a 10 micron screen, and compression for combustion in energy recovery devices such as boilers, process heaters, turbines, or internal combustion engines to satisfy the definition of treatment in 40 CFR 60.762(b)(2)(iii)(C).

Below is a summary of the each system's treatment equipment through which gas travels at the facility:

- The landfill gas is filtered to remove particulate matter that may interfere with good combustion of the landfill gas in the Turbine or Internal Combustion Engines.
- The required volume of Landfill gas (LFG) enters the fuel gas compressor. The LFG is compressed to the pressure required by the engines or Turbine. The LFG temperature is raised a minimum of 20 degrees Fahrenheit above the dew point by compression.
- The heated and compressed LFG passes through an air-to-gas heat exchanger and a gas-to-gas heat exchanger to condense water vapor. A refrigeration based chiller can also operate intermittently to further reduce the water vapor if necessary.
- Particulates and water are removed by a minimum of a 10-micron coalescing filter.
- After removal of liquids and particulates, the LFG passes through a final gas-to-gas heat exchanger. The heat exchanger reheats the LFG to approximately 20°F above its dew point. This prevents any condensation of the remaining water vapor in the LFG in the piping or engine fuel system.
- All condensate produced by the process is disposed of by approved methods.

1.0 EQUIPMENT FUNCTION AND MONITORING

Each piece of equipment provides a specific function in the treatment process. C&C monitors various parameters at each piece of equipment on a regular basis to determine that the equipment is performing its intended function. The monitoring and recording of the data from the sensors and transmitters on the treatment system is variable with a normal frequency of approximately 10 seconds. Under certain conditions the monitoring frequency may reach 1 minute between updates, however this is an uncommon occurrence. Thus, the monitoring frequency is well within the typical definition of continuous monitoring – 15 minute intervals with a minimum of 3 readings per hour. All sensors on the treatment system update at this same frequency. C&C will maintain records of all monitoring data as required by 40 CFR 60.768(c.) The following summarizes the function of each piece of equipment and what C&C monitors to determine that it is operating properly.

Gas Treatment Skid

AC Compressor – The compressor(s) moves the landfill gas. It applies a vacuum to the well field and provides pressure for the landfill gas treatment system and subsequent end uses. The compressor is a sealed unit that requires little maintenance. On a daily basis C&C staff visually inspect the belts on the compressor for wear. On a monthly basis the unit is greased.

The temperature of the incoming and outgoing landfill gas is measured and recorded. The incoming landfill gas has an average temperature of 65-77 degrees Fahrenheit. The gas is then heated to approximately 210-230 degrees Fahrenheit before it passes through the Air-to-Air Heat Exchanger described below. The heat exchanger then cools the gas to the current ambient air temperature plus 25 degrees Fahrenheit. Based on annual ambient seasonal temperatures, the outlet will be a minimum of 20 degrees less than the inlet temperature. Compressor Exit Temperatures greater than 250 °F will cause an alarm to be recorded in the event log.

Air-to-Air Heat Exchanger – The purpose of the heat exchangers is to cool the gas. The gas flows through the exchanger's tubes, and while a fan blows air. On a daily basis C&C staff monitor the differential pressure on the unit. If the differential pressure is greater than 5 psig, the unit is shutdown and cleaned.

10 micron Coalescing Filter – The coalescing filter removes particulate from the gas. Gas enters the filter where particulates with a diameter of greater than 10 microns are removed. On a daily basis C&C staff monitor the differential pressure of the filter. If the differential pressure is greater than 5 psig, the unit is shutdown and the filter changed. Pressure drops of less than 5 inches of water column across the Coalescing Filter would indicate a potential rupture or breach of the internal element. Should this condition occur, C&C will shut down the system and perform a visual observation of the element to ensure that treatment is maintained. If the element is found to be damaged or defective, C&C will immediately replace the part.

Waukesha Model VPH7042GLD Internal Combustion Engines – There are three landfill gas fired internal combustion engines located at the facility. Each unit is rated at 1,408 B-Hp/hr and is connected to a 997 Kw generator. The engines are monitored using a DAHS which monitors numerous engine parameters and operating conditions. When an operating condition is outside of appropriate tolerances an alarm is activated, or in some cases the engine is tripped. Proper engine operation is integrally related to operation of the gas treatment system, which supplies the fuel to the engines.

Solar Centaur Model T-4500 – One landfill gas fired combustion turbine is located at the facility. The turbine is connected to a 3,500 kW generator. Similar to the engines, the turbine is monitored using a DAHS which monitors numerous turbine parameters and operating conditions. When an operating condition is outside of appropriate tolerances an alarm is activated, or in some cases the turbine is tripped. Proper turbine operation is integrally related to operation of the gas treatment system, which supplies the fuel to the unit.

2.0 MAINTENANCE ACTIVITIES

As discussed previously, C&C staff observes the operation of the treatment system on a regular basis. If an operator observes that equipment operating abnormally, or if it is operating outside normal parameters then a maintenance action will be taken. Below is a summary of anticipated maintenance activities that might occur. This list is not comprehensive, and at all times the facility reserves the right to conduct additional preventative maintenance activities in order to ensure that the treatment systems, engines, and turbine all function in accordance with their original designed intent.

Gas Treatment Skid

AC Compressor – If the compressors are not able to maintain enough pressure to supply the end user of if they are not applying a vacuum to the well field, C&C staff will begin troubleshooting and repair the compressor. Compressor bearings, motors and other parts are replaced on an as needed basis in order to maintain compressor performance. C&C will document when maintenance is conducted on this piece of equipment on its daily logs. Typical maintenance activities should take a maximum of 72 hours.

Air-to-Air Heat Exchanger – As stated before, the facility monitors the differential pressure on the unit. If the differential pressure is higher than normal operating parameters, C&C staff will expose the tubes used for cooling and clean using a pressure washer (or equivalent). C&C will document when maintenance is conducted on this piece of equipment on its daily logs. Typical maintenance activities should take a maximum of 24 hours.

10 micron Coalescing Filter – As stated before, the facility monitors the differential pressure on the unit. If the differential pressure is higher than normal operating parameters, C&C staff will change the filter. C&C will document when maintenance is conducted on this piece of equipment on its daily logs. Typical maintenance activities should take a maximum of 8 hours.

Waukesha Model VPH7042GLD Internal Combustion Engines – The engines are maintained in strict accordance with manufacturer's recommendations or in some cases to higher standards. C&C utilizes an advanced oil analysis program to ensure that engine lubrication is optimum, which will maximize the efficiency of the engine. Attached in Appendix A is a list of the Maintenance Procedures performed.

Solar Centaur Model T-4500 – The turbine also maintained in strict accordance with manufacturer's recommendations or in some cases to higher standards. There are daily, monthly, semi-annual, and annual maintenance activities which are performed. The maintenance plan followed is attached as Appendix B.

APPENDIX A

Internal Combustion Engine Maintenance Schedule

700 HOUR PREVENTITIVE MAINTENANCE CHECK LIST

For Waukesha L7042GL(D) Engines

Facility :	Date :	Entered by :	Performed By :		
Unit :	Engine Hours :	Genset Hours :			
<p>1. Replace lube oil filter elements.</p> <p>2. Replace spark plugs. Normal gap range is between .010" and .013".</p> <p>3. Gauge and record compression pressure on all cylinders. Record readings below:</p>					
1R: <input type="text"/>	2R: <input type="text"/>	3R: <input type="text"/>	4R: <input type="text"/>		
1L: <input type="text"/>	2L: <input type="text"/>	3L: <input type="text"/>	4L: <input type="text"/>		
		5R: <input type="text"/>	6R: <input type="text"/>		
		5L: <input type="text"/>	6L: <input type="text"/>		
<p>4. Visually inspect secondary ignition leads for deterioration.</p> <p>5. Inspect the security of the primary ignition leads and the ignition coils.</p> <p>6. Inspect the throttle linkage / control rod ends for wear and security.</p> <p>7. Inspect cooling system / lubrication system hoses for deterioration.</p> <p>8. Check pilot fuel admission valves for proper torque, 70 FT Lbs.</p> <p>9. Visually inspect rocker arm assemblies / adjusters for breakage / security.</p> <p>10. Clean crankcase breathers.</p> <p>11. Grease the auxiliary water pump bearing.</p> <p>12. Grease the jacket water pump bearing.</p> <p>13. Grease the cooling fan bearing.</p> <p>14. Check the jacket water pump drive belts for wear and tension.</p> <p>15. Check the auxiliary water pump drive belts for wear and tension.</p> <p>16. Check the cooling fan drive belts for wear and tension.</p> <p>17. Check ignition timing. Normal timing is 16 degrees BTDC.</p> <p>18. Visually inspect air filters and restriction indicator. Change as necessary.</p>					
Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost
	M77N/640	SPARK PLUGS	\$17.29	EA.	\$0.00
		OIL FILTERS		EA.	\$0.00
		LUBRICATING OIL		GL.	\$0.00
		BELT ,JACKET WATER DRIVE		EA.	\$0.00
		BELT ,AUX. WATER DRIVE		EA.	\$0.00
		BELT ,RADIATOR FAN DRIVE		EA.	\$0.00
		GLYCOL		GL.	\$0.00
		AIR FILTER		EA.	\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
When quantity Column is filled in, it indicates parts were actually used.					
Comments :					Total :
					\$0.00

1400 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Date :	Entered by :	
Unit :	Engine Hours after top end overhaul:	Genset Hours:	

	Performed By :

1. Replace lube oil filter elements.
2. Replace spark plugs. Normal gap range is between .010" and .013".
3. Gauge and record compression pressure on all cylinders. Record readings below:

1R:	2R:	3R:	4R:	5R:	6R:
1L:	2L:	3L:	4L:	5L:	6L:

4. Visually inspect secondary ignition leads for deterioration.
5. Inspect the security of the primary ignition leads and the ignition coils.
6. Inspect the throttle linkage / control rod ends for wear and security.
7. Inspect cooling system / lubrication system hoses for deterioration.
8. Check pilot fuel admission valves for proper torque, 70 FT Lbs.
9. Visually inspect rocker arm assemblies / adjusters for breakage / security.
10. Clean crankcase breathers.
11. Grease the auxiliary water pump bearing.
12. Grease the jacket water pump bearing.
13. Grease the cooling fan bearing.
14. Check the jacket water pump drive belts for wear and tension.
15. Check the auxiliary water pump drive belts for wear and tension.
16. Check the cooling fan drive belts for wear and tension.
17. Check ignition timing. Normal timing is 16 degrees BTDC.
18. Visually inspect air filters and restriction indicator. Change as necessary.

Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost
0	RM77N	SPARK PLUGS	\$0.00	EA.	\$0.00
0	168660B	OIL FILTERS	\$0.00	EA.	\$0.00
0	PEGASUS 605	LUBRICATING OIL	\$0.00	GL.	\$0.00
0	TR28657	BELT, JACKET WATER DRIVE		EA.	\$0.00
0	169180K	BELT ,AUX. WATER DRIVE		EA.	\$0.00
0	5V1500	BELT ,RADIATOR FAN DRIVE		EA.	\$0.00
0		GLYCOL	\$0.00	GL.	\$0.00
0	169180K	AIR FILTER	\$0.00	EA.	\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
When quantity Column is filled in, it indicates parts were actually used.					
Comments :					Total :
					\$0.00

2100 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Date :	Entered by :																																											
Unit :	Serial # :	Engine Hours after top end overhaul:	Genset Hours:																																										
			Performed By :																																										
<p>1. Remove and exchange the spark plug carriers and nozzles with clean reconditioned units. Clean pilot fuel gas port through the cylinder head.</p> <p>2. Remove /exchange the pilot fuel admission valves with rebuilt units, replace "O" ring seal and stainless steel washer and torque to 70ft lbs.</p> <p>3. Gauge and record compression pressure on all cylinders. Record readings below:</p> <table style="width: 100%; margin-top: 10px;"> <tr> <td style="width: 15%;">1R:</td> <td style="width: 15%;">2R:</td> <td style="width: 15%;">3R:</td> <td style="width: 15%;">4R:</td> <td style="width: 15%;">5R:</td> <td style="width: 15%;">6R:</td> </tr> <tr> <td>1L:</td> <td>2L:</td> <td>3L:</td> <td>4L:</td> <td>5L:</td> <td>6L:</td> </tr> </table> <p>4. Replace spark plugs. Normal gap range is between .010" and .013".</p> <p>5. Visually inspect secondary ignition leads for deterioration.</p> <p>6. Inspect the security of the primary ignition leads and the ignition coils.</p> <p>7. Inspect the throttle linkage / control rod ends for wear and security.</p> <p>8. Inspect cooling system / lubrication system hoses for deterioration.</p> <p>9. Visually inspect rocker arm assemblies / adjusters for breakage / security.</p> <p>10. Perform valve adjustments, per manufacturers specifications.</p> <p>11. Gauge / measure valve stem heights to determine valve recession.</p> <p>12. Grease the auxiliary water pump bearing.</p> <p>13. Grease the jacket water pump bearing.</p> <p>14. Grease the cooling fan bearing.</p> <p>15. Check the jacket water pump drive belts for wear and tension.</p> <p>16. Check the auxiliary water pump drive belts for wear and tension.</p> <p>17. Check the cooling fan drive belts for wear and tension.</p> <p>18. Check ignition timing. Normal timing is 16 degrees BTDC.</p> <p>19. Visually inspect air filters and restriction indicator. Change as necessary.</p> <p>20. Clean crankcase breathers.</p> <p>21. Inspect throttle body assemblies,replace shaft bearings / seals as necessary</p> <p>22.Drain Engine lube oil from sump and oil cooler.</p> <p>23. Replace lube oil filter elements.</p> <p>24.Remove and clean lube oil strainer element,replace seals.</p> <p>25.Remove all sump doors: vacuum and clean sump,remove clean and reinstall the oil pick up screen.</p> <p>26.Fill engine sump with fresh oil, run prelube pump to fill oil cooler and oil filter housing.</p> <p>27. Remove generator exciter cover, using dry compressed air blow dust,dirt and debris from the exciter and cover. Check exciter / PMG stator to field gap and record readings.</p> <p>28. Remove generator connection box cover: Inspect cable connectionsfor security and signs of heat damage</p> <p>29.Grease generator bearings,per manufacturers specifications.</p> <p>30.Inspect radiator / heat exchanger cores for damage to tubes or fins.</p> <p>31.Pressure wash radiator / heat exchanger cores.</p> <p>32.Check exhaust system backpressure,not to exceed 13.5" of water column.</p>				1R:	2R:	3R:	4R:	5R:	6R:	1L:	2L:	3L:	4L:	5L:	6L:																														
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<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Qty.</th> <th style="width: 15%;">Stock Number</th> <th style="width: 45%;">Parts Description</th> <th style="width: 15%;">Unit Cost</th> <th style="width: 15%;">Unit of Issue</th> <th style="width: 10%;">Extended Cost</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td>RM77N</td> <td>SPARK PLUGS</td> <td style="text-align: right;">\$20.00</td> <td style="text-align: center;">EA.</td> <td style="text-align: right;">\$0.00</td> </tr> <tr> <td style="text-align: center;">0</td> <td>168660B</td> <td>OIL FILTERS</td> <td style="text-align: right;">\$8.95</td> <td style="text-align: center;">EA.</td> <td style="text-align: right;">\$0.00</td> </tr> <tr> <td style="text-align: center;">0</td> <td>PEGASUS 605</td> <td>LUBRICATING OIL</td> <td style="text-align: right;">\$6.05</td> <td style="text-align: center;">GL.</td> <td style="text-align: right;">\$0.00</td> </tr> <tr> <td style="text-align: center;">0</td> <td>TR28657</td> <td>BELT, JACKET WATER DRIVE</td> <td></td> <td style="text-align: center;">EA.</td> <td style="text-align: right;">\$0.00</td> </tr> <tr> <td style="text-align: center;">0</td> <td>169180K</td> <td>BELT ,AUX. WATER DRIVE</td> <td></td> <td style="text-align: center;">EA.</td> <td style="text-align: right;">\$0.00</td> </tr> <tr> <td style="text-align: center;">0</td> <td>5V1500</td> <td>BELT ,RADIATOR FAN DRIVE</td> <td></td> <td style="text-align: center;">EA.</td> <td style="text-align: right;">\$0.00</td> </tr> </tbody> </table>				Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost	0	RM77N	SPARK PLUGS	\$20.00	EA.	\$0.00	0	168660B	OIL FILTERS	\$8.95	EA.	\$0.00	0	PEGASUS 605	LUBRICATING OIL	\$6.05	GL.	\$0.00	0	TR28657	BELT, JACKET WATER DRIVE		EA.	\$0.00	0	169180K	BELT ,AUX. WATER DRIVE		EA.	\$0.00	0	5V1500	BELT ,RADIATOR FAN DRIVE		EA.	\$0.00
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<p>When quantity Column is filled in, it indicates parts were actually used.</p>																																													
Page 1 of 2																																													

2100 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Serial # :	Date :	Entered by :
Unit :	Engine Hours after top end overhaul:	Engine Hours after top end overhaul:	Genset Hours:

Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost
0	168922N	Oil Filter Housing "O" Ring	\$25.00	EA.	\$0.00
0		Rebuilt Admission Valves	\$4.00	EA.	\$0.00
0	209992	Admission Valve "O" Rings	\$0.90	EA.	\$0.00
0	28357	Admission Valve S.S. Washers	\$0.85	EA.	\$0.00
0		Remanufactured Cylinder Head	\$1,237.50	EA.	\$0.00
2	G-997-49	Head Gasket Kit	\$110.00	EA.	\$220.00
0	211009C	Turbo		EA.	\$0.00
0	G-932-275	Cylinder Sleeve Kit		EA.	\$0.00
0		GLYCOL	\$6.36	GL.	\$0.00
0	169180K	AIR FILTER	\$36.25	EA.	\$0.00
0				EA.	\$0.00
0				EA.	\$0.00
0				EA.	\$0.00
0				EA.	\$0.00
When quantity Column is filled in, it indicates parts were actually used.				Total	\$220.00

Valve Recession Check :

1R:	2R:	3R:	4R:	5R:	6R:	Intake Valve Fwd. Side
1R:	2R:	3R:	4R:	5R:	6R:	Intake Valve Rear Side
1R:	2R:	3R:	4R:	5R:	6R:	Exhaust Valve Fwd. Side
1R:	2R:	3R:	4R:	5R:	6R:	Exhaust Valve Rear Side
1L:	2L:	3L:	4L:	5L:	6L:	Intake Valve Fwd. Side
1L:	2L:	3L:	4L:	5L:	6L:	Intake Valve Rear Side
1L:	2L:	3L:	4L:	5L:	6L:	Exhaust Valve Fwd. Side
1L:	2L:	3L:	4L:	5L:	6L:	Exhaust Valve Rear Side

Instructions: After adjusting valves , count the threads above the lock nut on the valve adjustment screw and record.

Comments:

2800 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Date :	Entered by :	
Unit :	Serial # :	Engine Hours after top end overhaul:	Genset Hours:
			Performed By :

1. Replace lube oil filter elements.
2. Replace spark plugs. Normal gap range is between .010" and .013".
3. Gauge and record compression pressure on all cylinders. Record readings below:

1R:	<input style="width: 90%;" type="text"/>	3R:	<input style="width: 90%;" type="text"/>	4R:	<input style="width: 90%;" type="text"/>	5R:	<input style="width: 90%;" type="text"/>	6R:	<input style="width: 90%;" type="text"/>
1L:	2L:	3L:	4L:	5L:	6L:				

4. Visually inspect secondary ignition leads for deterioration.
5. Inspect the security of the primary ignition leads and the ignition coils.
6. Inspect the throttle linkage / control rod ends for wear and security.
7. Inspect cooling system / lubrication system hoses for deterioration.
8. Check pilot fuel admission valves for proper torque, 70 FT Lbs.
9. Visually inspect rocker arm assemblies / adjusters for breakage / security.
10. Clean crankcase breathers.
11. Grease the auxiliary water pump bearing.
12. Grease the jacket water pump bearing.
13. Grease the cooling fan bearing.
14. Check the jacket water pump drive belts for wear and tension.
15. Check the auxiliary water pump drive belts for wear and tension.
16. Check the cooling fan drive belts for wear and tension.
17. Check ignition timing. Normal timing is 16 degrees BTDC.
18. Visually inspect air filters and restriction indicator. Change as necessary.

Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost
12	RM77N	SPARK PLUGS	\$20.00	EA.	\$240.00
7	168660B	OIL FILTERS	\$8.95	EA.	\$62.65
35	PEGASUS 605	LUBRICATING OIL	\$7.35	GL.	\$257.25
0	TR28657	BELT, JACKET WATER DRIVE		EA.	\$0.00
0	169180K	BELT ,AUX. WATER DRIVE		EA.	\$0.00
0	5V1500	BELT ,RADIATOR FAN DRIVE		EA.	\$0.00
0		GLYCOL	\$2.72	GL.	\$0.00
0	169180K	AIR FILTER	\$36.25	EA.	\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
When quantity Column is filled in, it indicates parts were actually used.					
Comments :					
				Total :	\$559.90

3500 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Date :	Entered by :	
Unit :	Engine Hours after top end overhaul:	Genset Hours:	

Performed By : _____

1. Replace lube oil filter elements.

2. Replace spark plugs. Normal gap range is between .010" and .013".

3. Gauge and record compression pressure on all cylinders. Record readings below:

1R:		2R:		3R:		4R:		5R:		6R:	
1L:		2L:		3L:		4L:		5L:		6L:	

4. Visually inspect secondary ignition leads for deterioration.
5. Inspect the security of the primary ignition leads and the ignition coils.
6. Inspect the throttle linkage / control rod ends for wear and security.
7. Inspect cooling system / lubrication system hoses for deterioration.
8. Check pilot fuel admission valves for proper torque, 70 FT Lbs.
9. Visually inspect rocker arm assemblies / adjusters for breakage / security.
10. Clean crankcase breathers.
11. Grease the auxiliary water pump bearing.
12. Grease the jacket water pump bearing.
13. Grease the cooling fan bearing.
14. Check the jacket water pump drive belts for wear and tension.
15. Check the auxiliary water pump drive belts for wear and tension.
16. Check the cooling fan drive belts for wear and tension.
17. Check ignition timing. Normal timing is 16 degrees BTDC.
18. Visually inspect air filters and restriction indicator. Change as necessary.

Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost
12	RM77N	SPARK PLUGS	\$20.00	EA.	\$240.00
7	168660B	OIL FILTERS	\$8.95	EA.	\$62.65
0	PEGASUS 605	LUBRICATING OIL	\$6.05	GL.	\$0.00
0	TR28657	BELT, JACKET WATER DRIVE		EA.	\$0.00
0	169180K	BELT ,AUX. WATER DRIVE		EA.	\$0.00
0	5V1500	BELT ,RADIATOR FAN DRIVE		EA.	\$0.00
0		GLYCOL	\$2.72	GL.	\$0.00
0	169180K	AIR FILTER	\$36.25	EA.	\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
When quantity Column is filled in, it indicates parts were actually used.					
Comments :					
				Total :	\$302.65

4200 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Date :	Entered by :	
Unit :	Engine Hours after top end overhaul:	Genset Hours:	
Serial # :		Performed By :	

1. Remove and exchange the spark plug carriers and nozzles with clean reconditioned units.
Clean pilot fuel gas port through the cylinder head.
2. Remove /exchange the pilot fuel admission valves with rebuilt units, replace "O" ring seal and stainless steel washer and torque to 70ft lbs.
3. Gauge and record compression pressure on all cylinders. Record readings below:

1R:		2R:		3R:		4R:		5R:		6R:	
1L:		2L:		3L:		4L:		5L:		6L:	
4. Replace spark plugs. Normal gap range is between .010" and .013".
5. Visually inspect secondary ignition leads for deterioration.
6. Inspect the security of the primary ignition leads and the ignition coils.
7. Inspect the throttle linkage / control rod ends for wear and security.
8. Inspect cooling system / lubrication system hoses for deterioration.
9. Visually inspect rocker arm assemblies / adjusters for breakage / security.
10. Perform valve adjustments, per manufacturers specifications.
11. Gauge / measure valve stem heights to determine valve recession.
12. Grease the auxiliary water pump bearing.
13. Grease the jacket water pump bearing.
14. Grease the cooling fan bearing.
15. Check the jacket water pump drive belts for wear and tension.
16. Check the auxiliary water pump drive belts for wear and tension.
17. Check the cooling fan drive belts for wear and tension.
18. Check ignition timing. Normal timing is 16 degrees BTDC.
19. Visually inspect air filters and restriction indicator. Change as necessary.
20. Clean crankcase breathers.
21. Inspect throttle body assemblies,replace shaft bearings / seals as necessary
- 22.Drain Engine lube oil from sump and oil cooler.
23. Replace lube oil filter elements.
- 24.Remove and clean lube oil strainer element,replace seals.
- 25.Remove all sump doors: vacuum and clean sump,remove clean and reinstall the oil pick up screen.
- 26.Fill engine sump with fresh oil, run prelube pump to fill oil cooler and oil filter housing.
27. Remove generator exciter cover, using dry compressed air blow dust,dirt and debris from the exciter and cover. Check exciter / PMG stator to field gap and record readings.
28. Remove generator connection box cover: Inspect cable connectionsfor security and signs of heat damage
- 29.Grease generator bearings,per manufacturers specifications.
- 30.Inspect radiator / heat exchanger cores for damage to tubes or fins.
- 31.Pressure wash radiator / heat exchanger cores.
- 32.Check exhaust system backpressure,not to exceed 13.5" of water column.

Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost
	RM77N	SPARK PLUGS	\$20.00	EA.	\$0.00
	168660B	OIL FILTERS	\$8.95	EA.	\$0.00
	PEGASUS 605	LUBRICATING OIL	\$6.05	GL.	\$0.00
	TR28657	BELT, JACKET WATER DRIVE		EA.	\$0.00
	169180K	BELT ,AUX. WATER DRIVE		EA.	\$0.00
	5V1500	BELT ,RADIATOR FAN DRIVE		EA.	\$0.00
When quantity Column is filled in, it indicates parts were actually used.					

4200 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Serial # : C-10812 / 9	Date :	Entered by :		
Unit :	Engine Hours after top end overhaul:	Engine Hours :	Genset Hours :		
Qty.	Stock Number	Parts Description	Unit Cost	Unit or Issue	Extended Cost
0		RECONDITIONED PILOT FUEL ADMISSION VALVES			\$0.00
0		GLYCOL	\$2.72	GL.	\$0.00
0	169180K	AIR FILTER	\$36.25	EA.	\$0.00
0					\$0.00
0					\$0.00
0					\$0.00
0					\$0.00
0					\$0.00
0					\$0.00
0					\$0.00
0					\$0.00
0					\$0.00
When quantity Column is filled in, it indicates parts were actually used.					
				Total :	\$0.00

Valve Recession Check :

1R:	2R:	3R:	4R:	5R:	6R:	Intake Valve Fwd. Side
1R:	2R:	3R:	4R:	5R:	6R:	Intake Valve Rear Side
1R:	2R:	3R:	4R:	5R:	6R:	Exhaust Valve Fwd. Side
1R:	2R:	3R:	4R:	5R:	6R:	Exhaust Valve Rear Side
1L:	2L:	3L:	4L:	5L:	6L:	Intake Valve Fwd. Side
1L:	2L:	3L:	4L:	5L:	6L:	Intake Valve Rear Side
1L:	2L:	3L:	4L:	5L:	6L:	Exhaust Valve Fwd. Side
1L:	2L:	3L:	4L:	5L:	6L:	Exhaust Valve Rear Side

Instructions: After adjusting valves , count the threads above the lock nut on the valve adjustment screw and record.

Comments :

4900 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Date :	Entered by :	
Unit :	Engine Hours after top end overhaul:	Genset Hours:	

	Performed By :

1. Replace lube oil filter elements.
2. Replace spark plugs. Normal gap range is between .010" and .013".
3. Gauge and record compression pressure on all cylinders. Record readings below:

1R:	2R:	3R:	4R:	5R:	6R:
1L:	2L:	3L:	4L:	5L:	6L:

4. Visually inspect secondary ignition leads for deterioration.
5. Inspect the security of the primary ignition leads and the ignition coils.
6. Inspect the throttle linkage / control rod ends for wear and security.
7. Inspect cooling system / lubrication system hoses for deterioration.
8. Check pilot fuel admission valves for proper torque, 70 FT Lbs.
9. Visually inspect rocker arm assemblies / adjusters for breakage / security.
10. Clean crankcase breathers.
11. Grease the auxiliary water pump bearing.
12. Grease the jacket water pump bearing.
13. Grease the cooling fan bearing.
14. Check the jacket water pump drive belts for wear and tension.
15. Check the auxiliary water pump drive belts for wear and tension.
16. Check the cooling fan drive belts for wear and tension.
17. Check ignition timing. Normal timing is 16 degrees BTDC.
18. Visually inspect air filters and restriction indicator. Change as necessary.

Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost
	RM77N	SPARK PLUGS	\$20.00	EA.	\$0.00
	168660B	OIL FILTERS	\$8.95	EA.	\$0.00
	PEGASUS 605	LUBRICATING OIL	\$6.05	GL.	\$0.00
	TR28657	BELT, JACKET WATER DRIVE		EA.	\$0.00
	169180K	BELT ,AUX. WATER DRIVE		EA.	\$0.00
	5V1500	BELT ,RADIATOR FAN DRIVE		EA.	\$0.00
		GLYCOL	\$2.72	GL.	\$0.00
	169180K	AIR FILTER	\$36.25	EA.	\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
When quantity Column is filled in, it indicates parts were actually used.					
Comments :					
				Total :	\$0.00

5600 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Date :	Entered by :	
Unit :	Engine Hours after top end overhaul:	Genset Hours:	

Performed By : _____

1. Replace lube oil filter elements.

2. Replace spark plugs. Normal gap range is between .010" and .013".

3. Gauge and record compression pressure on all cylinders. Record readings below:

1R:	<input style="width: 90%;" type="text"/>	3R:	<input style="width: 90%;" type="text"/>	4R:	<input style="width: 90%;" type="text"/>	5R:	<input style="width: 90%;" type="text"/>	6R:	<input style="width: 90%;" type="text"/>
1L:	<input style="width: 90%;" type="text"/>	3L:	<input style="width: 90%;" type="text"/>	4L:	<input style="width: 90%;" type="text"/>	5L:	<input style="width: 90%;" type="text"/>	6L:	<input style="width: 90%;" type="text"/>

4. Visually inspect secondary ignition leads for deterioration.
5. Inspect the security of the primary ignition leads and the ignition coils.
6. Inspect the throttle linkage / control rod ends for wear and security.
7. Inspect cooling system / lubrication system hoses for deterioration.
8. Check pilot fuel admission valves for proper torque, 70 FT Lbs.
9. Visually inspect rocker arm assemblies / adjusters for breakage / security.
10. Clean crankcase breathers.
11. Grease the auxiliary water pump bearing.
12. Grease the jacket water pump bearing.
13. Grease the cooling fan bearing.
14. Check the jacket water pump drive belts for wear and tension.
15. Check the auxiliary water pump drive belts for wear and tension.
16. Check the cooling fan drive belts for wear and tension.
17. Check ignition timing. Normal timing is 16 degrees BTDC.
18. Visually inspect air filters and restriction indicator. Change as necessary.

Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost
	RM77N	SPARK PLUGS	\$20.00	EA.	\$0.00
	168660B	OIL FILTERS	\$8.95	EA.	\$0.00
	PEGASUS 605	LUBRICATING OIL	\$6.05	GL.	\$0.00
	TR28657	BELT, JACKET WATER DRIVE		EA.	\$0.00
	169180K	BELT ,AUX. WATER DRIVE		EA.	\$0.00
	5V1500	BELT ,RADIATOR FAN DRIVE		EA.	\$0.00
		GLYCOL	\$2.72	GL.	\$0.00
	169180K	AIR FILTER	\$36.25	EA.	\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
When quantity Column is filled in, it indicates parts were actually used.					
Comments :					
				Total :	\$0.00

6300 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Date :	Entered by :	
Unit :	Engine Hours after top end overhaul:	Genset Hours:	
Serial # :		Performed By :	

1. Remove and exchange the spark plug carriers and nozzles with clean reconditioned units.
Clean pilot fuel gas port through the cylinder head.
2. Remove /exchange the pilot fuel admission valves with rebuilt units, replace "O" ring seal and stainless steel washer and torque to 70ft lbs.
3. Gauge and record compression pressure on all cylinders. Record readings below:

1R:		2R:		3R:		4R:		5R:		6R:	
1L:		2L:		3L:		4L:		5L:		6L:	
4. Replace spark plugs. Normal gap range is between .010" and .013".
5. Visually inspect secondary ignition leads for deterioration.
6. Inspect the security of the primary ignition leads and the ignition coils.
7. Inspect the throttle linkage / control rod ends for wear and security.
8. Inspect cooling system / lubrication system hoses for deterioration.
9. Visually inspect rocker arm assemblies / adjusters for breakage / security.
10. Perform valve adjustments, per manufacturers specifications.
11. Gauge / measure valve stem heights to determine valve recession.
12. Grease the auxiliary water pump bearing.
13. Grease the jacket water pump bearing.
14. Grease the cooling fan bearing.
15. Check the jacket water pump drive belts for wear and tension.
16. Check the auxiliary water pump drive belts for wear and tension.
17. Check the cooling fan drive belts for wear and tension.
18. Check ignition timing. Normal timing is 16 degrees BTDC.
19. Visually inspect air filters and restriction indicator. Change as necessary.
20. Clean crankcase breathers.
21. Inspect throttle body assemblies,replace shaft bearings / seals as necessary
22. Drain Engine lube oil from sump and oil cooler.
23. Replace lube oil filter elements.
24. Remove and clean lube oil strainer element,replace seals.
25. Remove all sump doors: vacuum and clean sump,remove clean and reinstall the oil pick up screen.
26. Fill engine sump with fresh oil, run prelube pump to fill oil cooler and oil filter housing.
27. Remove generator exciter cover, using dry compressed air blow dust,dirt and debris from the exciter and cover. Check exciter / PMG stator to field gap and record readings.
28. Remove generator connection box cover: Inspect cable connectionsfor security and signs of heat damage
29. Grease generator bearings,per manufacturers specifications.
30. Inspect radiator / heat exchanger cores for damage to tubes or fins.
31. Pressure wash radiator / heat exchanger cores.
32. Check exhaust system backpressure,not to exceed 13.5" of water column.

Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost
	RM77N	SPARK PLUGS	\$20.00	EA.	\$0.00
	168660B	OIL FILTERS	\$8.95	EA.	\$0.00
0	PEGASUS 605	LUBRICATING OIL	\$6.05	GL.	\$0.00
0	TR28657	BELT, JACKET WATER DRIVE		EA.	\$0.00
0	169180K	BELT ,AUX. WATER DRIVE		EA.	\$0.00
	5V1500	BELT ,RADIATOR FAN DRIVE		EA.	\$0.00
When quantity Column is filled in, it indicates parts were actually used.					

6300 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Date :	Entered by :	
Unit :	Serial # : C-10812 / 9	Engine Hours after top end overhaul:	Genset Hours:

Valve Recession Check :

1R:	2R:	3R:	4R:	5R:	6R:	Intake Valve Fwd. Side
1R:	2R:	3R:	4R:	5R:	6R:	Intake Valve Rear Side
1R:	2R:	3R:	4R:	5R:	6R:	Exhaust Valve Fwd. Side
1R:	2R:	3R:	4R:	5R:	6R:	Exhaust Valve Rear Side

1L:	2L:	3L:	4L:	5L:	6L:	Intake Valve Fwd. Side
1L:	2L:	3L:	4L:	5L:	6L:	Intake Valve Rear Side
1L:	2L:	3L:	4L:	5L:	6L:	Exhaust Valve Fwd. Side
1L:	2L:	3L:	4L:	5L:	6L:	Exhaust Valve Rear Side

Instructions: After adjusting valves , count the threads above the lock nut on the valve adjustment screw and record.

Comments :

7700 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Date :	Entered by :	
Unit :	Engine Hours after top end overhaul:	Genset Hours:	

Performed By : _____

1. Replace lube oil filter elements.

2. Replace spark plugs. Normal gap range is between .010" and .013".

3. Gauge and record compression pressure on all cylinders. Record readings below:

1R:	<input type="text"/>	2R:	<input type="text"/>	3R:	<input type="text"/>	4R:	<input type="text"/>	5R:	<input type="text"/>	6R:	<input type="text"/>
1L:	<input type="text"/>	2L:	<input type="text"/>	3L:	<input type="text"/>	4L:	<input type="text"/>	5L:	<input type="text"/>	6L:	<input type="text"/>

4. Visually inspect secondary ignition leads for deterioration.
5. Inspect the security of the primary ignition leads and the ignition coils.
6. Inspect the throttle linkage / control rod ends for wear and security.
7. Inspect cooling system / lubrication system hoses for deterioration.
8. Check pilot fuel admission valves for proper torque, 70 FT Lbs.
9. Visually inspect rocker arm assemblies / adjusters for breakage / security.
10. Clean crankcase breathers.
11. Grease the auxiliary water pump bearing.
12. Grease the jacket water pump bearing.
13. Grease the cooling fan bearing.
14. Check the jacket water pump drive belts for wear and tension.
15. Check the auxiliary water pump drive belts for wear and tension.
16. Check the cooling fan drive belts for wear and tension.
17. Check ignition timing. Normal timing is 16 degrees BTDC.
18. Visually inspect air filters and restriction indicator. Change as necessary.

Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost
	RM77N	SPARK PLUGS	\$20.00	EA.	\$0.00
	168660B	OIL FILTERS	\$8.95	EA.	\$0.00
	PEGASUS 605	LUBRICATING OIL	\$6.05	GL.	\$0.00
	TR28657	BELT, JACKET WATER DRIVE		EA.	\$0.00
	169180K	BELT ,AUX. WATER DRIVE		EA.	\$0.00
	5V1500	BELT ,RADIATOR FAN DRIVE		EA.	\$0.00
		GLYCOL	\$2.72	GL.	\$0.00
	169180K	AIR FILTER	\$36.25	EA.	\$0.00
		ReManufactured Cylinder Head	\$1,237.50	EA.	\$0.00
	G-997-49	Head Gasket Kit	\$110.00	EA.	\$0.00
					\$0.00
					\$0.00
When quantity Column is filled in, it indicates parts were actually used.					
Comments :					
Total :					\$0.00

8400 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility : Unit : One	Serial # :	Date: Engine Hours after top end overhaul:	Entered by : Genset Hours:	Performed By :
1. Remove and exchange the spark plug carriers and nozzles with clean reconditioned units. Clean pilot fuel gas port through the cylinder head.				
2. Remove /exchange the pilot fuel admission valves with rebuilt units, replace "O" ring seal and stainless steel washer and torque to 70ft lbs.				
3. Gauge and record compression pressure on all cylinders. Record readings below:				
1R: <input style="width: 50px; height: 20px;" type="text"/>	2R: <input style="width: 50px; height: 20px;" type="text"/>	3R: <input style="width: 50px; height: 20px;" type="text"/>	4R: <input style="width: 50px; height: 20px;" type="text"/>	5R: <input style="width: 50px; height: 20px;" type="text"/>
1L: <input style="width: 50px; height: 20px;" type="text"/>	2L: <input style="width: 50px; height: 20px;" type="text"/>	3L: <input style="width: 50px; height: 20px;" type="text"/>	4L: <input style="width: 50px; height: 20px;" type="text"/>	5L: <input style="width: 50px; height: 20px;" type="text"/>
6R: <input style="width: 50px; height: 20px;" type="text"/>				
6L: <input style="width: 50px; height: 20px;" type="text"/>				
4. Replace spark plugs. Normal gap range is between .010" and .013".				
5. Visually inspect secondary ignition leads for deterioration.				
6. Inspect the security of the primary ignition leads and the ignition coils.				
7. Inspect the throttle linkage / control rod ends for wear and security.				
8. Inspect cooling system / lubrication system hoses for deterioration.				
9. Visually inspect rocker arm assemblies / adjusters for breakage / security.				
10. Perform valve adjustments, per manufacturers specifications.				
11. Gauge / measure valve stem heights to determine valve recession.				
12. Grease the auxiliary water pump bearing.				
13. Grease the jacket water pump bearing.				
14. Grease the cooling fan bearing.				
15. Check the jacket water pump drive belts for wear and tension.				
16. Check the auxiliary water pump drive belts for wear and tension.				
17. Check the cooling fan drive belts for wear and tension.				
18. Visually inspect air filters and restriction indicator. Change as necessary.				
19. Clean crankcase breathers.				
20. Inspect throttle body assemblies,replace shaft bearings / seals as necessary				
21. Drain Engine lube oil from sump and oil cooler.				
22. Replace lube oil filter elements.				
23. Remove and clean lube oil strainer element,replace seals.				
24. Remove all sump doors: vacuum and clean sump,remove clean and reinstall the oil pick up screen.				
25. Perform Crankshaft Deflection Check. Record results.				
26. Fill engine sump with fresh oil, run prelube pump to fill oil cooler and oil filter housing.				
27. Remove generator exciter cover, using dry compressed air blow dust,dirt and debris from the exciter and cover. Check exciter / PMG stator to field gap and record readings.				
28. Remove generator connection box cover: Inspect cable connections for security and signs of heat damage				
29. Grease generator bearings,per manufacturers specifications.				
30. Inspect radiator / heat exchanger cores for damage to tubes or fins.				
31. Pressure wash radiator / heat exchanger cores.				
32. Check exhaust system backpressure,not to exceed 13.5" of water column.				
33. Change Oil in the Woodward Governor.				
34. Perform functional test of all genset pressure,temperature and vibration safety switches, transmitters ,transducers and overspeed trips .Record results.				
35. Check ignition timing. Normal timing is 16 degrees BTDC.				

8400 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility : <u>Davis Junction</u>		Date: _____		Entered by : <u>Tom McLaughlin</u>	
Unit : <u>One</u>		Serial # : <u>C-10812 / 9</u>		Genset Hours: _____	
		Engine Hours after top end overhaul: _____			

Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost
	RM77N	SPARK PLUGS	\$20.00	EA.	\$0.00
	168660B	OIL FILTERS	\$8.95	EA.	\$0.00
	PEGASUS 605	LUBRICATING OIL	\$6.05	GL.	\$0.00
	TR28657	BELT, JACKET WATER DRIVE		EA.	\$0.00
	169180K	BELT ,AUX. WATER DRIVE		EA.	\$0.00
	5V1500	BELT ,RADIATOR FAN DRIVE		EA.	\$0.00
		RECONDITIONED PILOT FUEL ADMISSION VALVES			\$0.00
		GLYCOL	\$2.72	GL.	\$0.00
	169180K	AIR FILTER	\$36.25	EA.	\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
Total :					\$0.00

When quantity Column is filled in, it indicates parts were actually used.

Valve Recession Check :

1R:	2R:	3R:	4R:	5R:	6R:	Intake Valve Fwd. Side
1R:	2R:	3R:	4R:	5R:	6R:	Intake Valve Rear Side
1R:	2R:	3R:	4R:	5R:	6R:	Exhaust Valve Fwd. Side
1R:	2R:	3R:	4R:	5R:	6R:	Exhaust Valve Rear Side

1L:	2L:	3L:	4L:	5L:	6L:	Intake Valve Fwd. Side
1L:	2L:	3L:	4L:	5L:	6L:	Intake Valve Rear Side
1L:	2L:	3L:	4L:	5L:	6L:	Exhaust Valve Fwd. Side
1L:	2L:	3L:	4L:	5L:	6L:	Exhaust Valve Rear Side

Instructions: After adjusting valves , count the threads above the lock nut on the valve adjustment screw and record.

Comments :

8400 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility : Davis Junction	Date:	Entered by :
Unit :	Serial # :	Engine Hours after top end overhaul:
		Genset Hours:

CRANKSHAFT DEFLECTION READINGS

Throw # 1	Throw # 2	Throw # 3
.000	.000"	.000"
.000"	.000"	.000"
.000"	.000"	.000"

Throw # 4	Throw # 5	Throw # 6
.000"	.000"	.000
.000"	.000"	.000
.000"	.000"	.000"

SAFETY DEVICE CHECKLIST

Device	Sat	Unsat	Tripped At	Parameters
Vibration / Knock Switch				N/A
Jacket water level switch				N/A
Aux water level switch				N/A
Crankcase B.P. Shutdown				2.5" to 3 " +W.C.
Overspeed Trip				1296 - 1320 RPM
Radiator Knock Switch				N/A
Oil Press.Alarm				40 PSI
Oil Press.Shutdown				30 PSI
Oil Exit Shutdown Temp				220 Degrees
J.W. Exit Temp Shutdown				250 Degrees
Air Man. Temp Shutdown				150 Degrees
Mn. Bearing Temp Alarm				245 Degrees
Mn. Bearing Temp Shutdown				250 Degrees
Post Turbo Temp Shutdown				850 Degrees
Cylinder Temp.Shutdown				1075 Degrees

9,100 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Date :	Entered by :	
Unit :	Engine Hours after top end overhaul:	Genset Hours:	
Serial # :		Performed By :	

1. Replace lube oil filter elements.
2. Replace spark plugs. Normal gap range is between .010" and .013".
3. Gauge and record compression pressure on all cylinders. Record readings below:

1R:	2R:	3R:	4R:	5R:	6R:
1L:	2L:	3L:	4L:	5L:	6L:

4. Visually inspect secondary ignition leads for deterioration.
5. Inspect the security of the primary ignition leads and the ignition coils.
6. Inspect the throttle linkage / control rod ends for wear and security.
7. Inspect cooling system / lubrication system hoses for deterioration.
8. Check pilot fuel admission valves for proper torque, 70 FT Lbs.
9. Visually inspect rocker arm assemblies / adjusters for breakage / security.
10. Clean crankcase breathers.
11. Grease the auxiliary water pump bearing.
12. Grease the jacket water pump bearing.
13. Grease the cooling fan bearing.
14. Check the jacket water pump drive belts for wear and tension.
15. Check the auxiliary water pump drive belts for wear and tension.
16. Check the cooling fan drive belts for wear and tension.
17. Check ignition timing. Normal timing is 16 degrees BTDC.
18. Visually inspect air filters and restriction indicator. Change as necessary.

Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost
	RM77N	SPARK PLUGS	\$20.00	EA.	\$0.00
	168660B	OIL FILTERS	\$8.95	EA.	\$0.00
	PEGASUS 605	LUBRICATING OIL	\$7.80	GL.	\$0.00
	TR28657	BELT, JACKET WATER DRIVE		EA.	\$0.00
	169180K	BELT ,AUX. WATER DRIVE		EA.	\$0.00
	5V1500	BELT ,RADIATOR FAN DRIVE		EA.	\$0.00
		GLYCOL	\$6.36	GL.	\$0.00
	169180K	AIR FILTER	\$36.25	EA.	\$0.00
	MB-3100 P(U)	Main Bearing #4 upper	\$60.00		\$0.00
	MB-3100 P(L)	Main Bearing #4 lower	\$60.00		\$0.00
					\$0.00
					\$0.00
When quantity Column is filled in, it indicates parts were actually used.					
Comments :					Total :
					\$0.00

9800 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Date :	Entered by :			
Unit :	Engine Hours after top end overhaul:	Genset Hours:			
Serial # :		Performed By :			
<p>1. Replace lube oil filter elements.</p> <p>2. Replace spark plugs. Normal gap range is between .010" and .013".</p> <p>3. Gauge and record compression pressure on all cylinders. Record readings below:</p>					
1R:	2R	3R	4R		
1L:	2L:	3L:	4L:		
			5R:		
			5L:		
			6R:		
			6L:		
<p>4. Visually inspect secondary ignition leads for deterioration.</p> <p>5. Inspect the security of the primary ignition leads and the ignition coils.</p> <p>6. Inspect the throttle linkage / control rod ends for wear and security.</p> <p>7. Inspect cooling system / lubrication system hoses for deterioration.</p> <p>8. Check pilot fuel admission valves for proper torque, 70 FT Lbs.</p> <p>9. Visually inspect rocker arm assemblies / adjusters for breakage / security.</p> <p>10. Clean crankcase breathers.</p> <p>11. Grease the auxiliary water pump bearing.</p> <p>12. Grease the jacket water pump bearing.</p> <p>13. Grease the cooling fan bearing.</p> <p>14. Check the jacket water pump drive belts for wear and tension.</p> <p>15. Check the auxiliary water pump drive belts for wear and tension.</p> <p>16. Check the cooling fan drive belts for wear and tension.</p> <p>17. Check ignition timing. Normal timing is 16 degrees BTDC.</p> <p>18. Visually inspect air filters and restriction indicator. Change as necessary.</p>					
Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost
	RM77N	SPARK PLUGS	\$20.00	EA.	\$0.00
	168660B	OIL FILTERS	\$8.95	EA.	\$0.00
	PEGASUS 605	LUBRICATING OIL	\$6.05	GL.	\$0.00
	TR28657	BELT, JACKET WATER DRIVE		EA.	\$0.00
	169180K	BELT ,AUX. WATER DRIVE		EA.	\$0.00
	5V1500	BELT ,RADIATOR FAN DRIVE		EA.	\$0.00
		GLYCOL	\$2.72	GL.	\$0.00
	169180K	AIR FILTER	\$36.25	EA.	\$0.00
		Control Rod End			\$0.00
					\$0.00
					\$0.00
					\$0.00
When quantity Column is filled in, it indicates parts were actually used.					
Comments :					Total :
					\$0.00

10,500 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Date :	Entered by :	
Unit :	Engine Hours after top end overhaul:	Genset Hours:	
Serial # :			Performed By :

1. Replace lube oil filter elements.
2. Replace spark plugs. Normal gap range is between .010" and .013".
3. Gauge and record compression pressure on all cylinders. Record readings below:

1R:	<input type="text"/>	2R:	<input type="text"/>	3R:	<input type="text"/>	4R:	<input type="text"/>	5R:	<input type="text"/>	6R:	<input type="text"/>
1L:	<input type="text"/>	2L:	<input type="text"/>	3L:	<input type="text"/>	4L:	<input type="text"/>	5L:	<input type="text"/>	6L:	<input type="text"/>

4. Visually inspect secondary ignition leads for deterioration.
5. Inspect the security of the primary ignition leads and the ignition coils.
6. Inspect the throttle linkage / control rod ends for wear and security.
7. Inspect cooling system / lubrication system hoses for deterioration.
8. Check pilot fuel admission valves for proper torque, 70 FT Lbs.
9. Visually inspect rocker arm assemblies / adjusters for breakage / security.
10. Clean crankcase breathers.
11. Grease the auxiliary water pump bearing.
12. Grease the jacket water pump bearing.
13. Grease the cooling fan bearing.
14. Check the jacket water pump drive belts for wear and tension.
15. Check the auxiliary water pump drive belts for wear and tension.
16. Check the cooling fan drive belts for wear and tension.
17. Check ignition timing. Normal timing is 16 degrees BTDC.
18. Visually inspect air filters and restriction indicator. Change as necessary.

Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost
	RM77N	SPARK PLUGS	\$20.00	EA.	\$0.00
	168660B	OIL FILTERS	\$8.95	EA.	\$0.00
0	PEGASUS 605	LUBRICATING OIL	\$6.05	GL.	\$0.00
0	TR28657	BELT, JACKET WATER DRIVE		EA.	\$0.00
0	169180K	BELT ,AUX. WATER DRIVE		EA.	\$0.00
0	5V1500	BELT ,RADIATOR FAN DRIVE		EA.	\$0.00
0		GLYCOL	\$2.72	GL.	\$0.00
0	169180K	AIR FILTER	\$36.25	EA.	\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
When quantity Column is filled in, it indicates parts were actually used.					
Comments :					
				Total :	\$0.00

11,200 Hour Preventive Maintenance Check List

For Waukesha L7042GL(D) Engines

Facility :	Date :	Entered by :	
Unit :	Engine Hours after top end overhaul:	Genset Hours:	

	Performed By :

1. Replace lube oil filter elements.
2. Replace spark plugs. Normal gap range is between .010" and .013".
3. Gauge and record compression pressure on all cylinders. Record readings below:

1R:	2R:	3R:	4R:	5R:	6R:
1L:	2L:	3L:	4L:	5L:	6L:

4. Visually inspect secondary ignition leads for deterioration.
5. Inspect the security of the primary ignition leads and the ignition coils.
6. Inspect the throttle linkage / control rod ends for wear and security.
7. Inspect cooling system / lubrication system hoses for deterioration.
8. Check pilot fuel admission valves for proper torque, 70 FT Lbs.
9. Visually inspect rocker arm assemblies / adjusters for breakage / security.
10. Clean crankcase breathers.
11. Grease the auxiliary water pump bearing.
12. Grease the jacket water pump bearing.
13. Grease the cooling fan bearing.
14. Check the jacket water pump drive belts for wear and tension.
15. Check the auxiliary water pump drive belts for wear and tension.
16. Check the cooling fan drive belts for wear and tension.
17. Check ignition timing. Normal timing is 16 degrees BTDC.
18. Visually inspect air filters and restriction indicator. Change as necessary.

Qty.	Stock Number	Parts Description	Unit Cost	Unit of Issue	Extended Cost
	RM77N	SPARK PLUGS	\$20.00	EA.	\$0.00
	168660B	OIL FILTERS	\$8.95	EA.	\$0.00
0	PEGASUS 605	LUBRICATING OIL	\$6.05	GL.	\$0.00
0	TR28657	BELT, JACKET WATER DRIVE		EA.	\$0.00
0	169180K	BELT ,AUX. WATER DRIVE		EA.	\$0.00
0	5V1500	BELT ,RADIATOR FAN DRIVE		EA.	\$0.00
0		GLYCOL	\$2.72	GL.	\$0.00
0	169180K	AIR FILTER	\$36.25	EA.	\$0.00
					\$0.00
					\$0.00
					\$0.00
					\$0.00
When quantity Column is filled in, it indicates parts were actually used.					
Comments :					Total :
					\$0.00

UNIT # ONE

Hours =

Actual Hours
@ last change

Water Pump

Actual Hours
@ last change

W.P.=

	Heads	Piston / Liners	Heads	Piston / Liners	Heads	Piston / Liners
Head =	0	0	0	0	RB-1	0
P/L = 0						0
Head = 0	0	0	0	0	RB-2	0
P/L = 0						0
Head = 0	0	0	0	0	RB-3	0
P/L = 0						0
Head =	0	0	0	0	RB-4	0
P/L = 0						0
Head =	0	0	0	0	RB-5	0
P/L = 0						0
Head = 0	0	0	0	0	RB-6	0
P/L = 0						0
Turbo =		Turbo [L]		Turbo [R]		0
		0		0		0

= Head

= P / L

= Head

= P / L

= Head

= P / L

= Head

= P / L

= Head

= P / L

= Head

= P / L

= Turbo

APPENDIX B

Combustion Turbine Maintenance Schedule

1.5.5 Scheduled Periodic Checks and Maintenance Tasks

Following tables (1.5.1 through 1.5.10) recommend general minimum maintenance intervals. Where Supplementary Data specify more frequent, or more extensive maintenance, or where operating conditions dictate, adhere to the more rigorous requirement.

- D (day)
- M (month)
- S (semiannual - 4000 operating hours)
- A (annual - 8000 operating hours)

Table 1.5.1 Maintenance - Electrical and Control Systems

System/Description	D	M	S	A
Periodic Checks				
Visually inspect gages and indicators for proper operation.	X			
Inspect control console electrical connections for cleanliness and security. Check wiring for absence of chafing and insulation damage. ¹		X		
If applicable, check fire detectors for sensitivity. ¹			X	
If applicable, clean fire detectors. ¹		X		
If applicable, check fire bottles for proper charge.			X	
Check battery charger for proper operation. For NiCad batteries, place charger to high rate for a few hours. ²		X		
Check and record speed magnetic pickup output voltage. This must be done with engine running.			X	
Check condition of thermocouple harnesses. Check integrity of support grommets. ¹			X	
Periodic Maintenance Tasks				
Remove and inspect igniter cable. Inspect igniter plug for erosion and proper gap. Replace plug if necessary.			X	
Test speed and temperature topping system.			X	
Test and calibrate backup overspeed monitor (OSM). ²			X	
Verify calibration of temperature monitors.			X	
Check and calibrate all temperature and pressure gages/switches.			X	
Test and calibrate as necessary all safety, warning, and shutdown devices.			X	

Table 1.5.1 Maintenance - Electrical and Control Systems, Contd

System/Description	D	M	S	A
Test package vibration monitor and calibrate transducers.				X
Change lithium battery in PLC, or controller. ²				X

NOTES:

- (1) Checks can only be performed with the unit shut down.
 (2) See MAINTENANCE in Electrical Control System Chapter of this volume.

Table 1.5.2 Maintenance - Air Systems

System/Description	D	M	S	A
Periodic Checks				
Check air inlet system for obstructions and contamination. ¹ Record differential pressure. ²		X		
If air dryer installed, check its operation. ¹		X		
Inspect engine compressor variable vane mechanism for wear. Check for bent arms, loose linkages, and loose bushings. ¹			X	
Inspect intake and exhaust systems for damage, leaks, and debris. ¹			X	
Periodic Maintenance Tasks				
Check and calibrate IGV (Inlet Guide Vane) activation system.			X	
Inspect and replace air inlet filters as needed. ²			X	
If self-cleaning air filter installed, check supply pressure, manually cycle through cleaning operation.		X		
Disassemble, clean, inspect, and reassemble bleed valve.				X

NOTES:

- (1) Checks can only be performed with the unit shut down.
 (2) Air inlet filters should be replaced per manufacturer's recommendation. As a guide, barrier filters require service if differential pressure reaches the alarm setpoint, normally 5 in. water (12.7 cm water). Prefilters require service if the differential pressure increases 1.0 to 1.5 in. water (2.5 to 3.8 cm water) above baseline.

Table 1.5.3 Maintenance - Lube Oil and Servo Oil Systems

System/Description	D	M	S	A
Periodic Checks				
Check oil tank level every 24 hours. Record oil consumption.		X		
Verify proper operation of oil makeup system, if installed.		X		
If applicable, check oil cooler belt tension. ¹				X

Table 1.5.3 Maintenance - Lube Oil and Servo Oil Systems, Contd

System/Description	D	M	S	A
Check oil cooler louver operation as applicable.		X		
If applicable, check lube oil tank vent fan and mist precipitator for proper operation.		X		
Check and record lube oil filter differential pressure. Change filters if differential pressure limit exceeded.		X		
Check servo oil filter "pop-up" indicator, if so equipped; change filter if popped.	X			
Check oil cooler core; clean as necessary.			X	
Periodic Maintenance Tasks				
Take lube oil sample for laboratory analysis. ^{2, 3}		X		
Check lube oil system for leaks.		X		
Inspect and replace lube oil and servo oil filters as needed. ⁴			X	
Lubricate oil cooler fan shaft bearings.			X	

NOTES:

- (1) Checks can only be performed with the unit shut down.
- (2) All maintenance tasks except for these require the unit to be shut down.
- (3) See Solar Engineering Specification 9-224 for oil replacement criteria.
- (4) Lube oil and servo oil filter elements should be replaced when visible contamination is present, when differential pressure "pop-up" indicators are popped, or when differential pressure limits are exceeded. Filters should be replaced no less than annually.

Table 1.5.4 Maintenance - Gas Fuel System (if applicable)

System/Description	D	M	S	A
Periodic Checks				
Inspect fuel control system for security and leaks, and visually inspect linkages and connections. ¹			X	
Check gas fuel system for leaks.		X		
Inspect fuel valve(s); clean as necessary. ¹				X
Periodic Maintenance Tasks				
Record fuel pressure, adjust at off-skid regulator if necessary.	X			
Disassemble, clean, and rebuild gas valves as applicable.			X	

Table 1.5.4 Maintenance - Gas Fuel System (if applicable), Contd

System/Description	D	M	S	A
Remove and inspect igniter torch housing for cracks, excessive erosion; inspect discharge tube for chafing wear.			X	
Rebuild or replace solenoid valves and regulators including those for air assist.				X

NOTES:

(1) Checks can only be performed with the unit shut down.

Table 1.5.5 Maintenance - Liquid Fuel System (if applicable)

System/Description	D	M	S	A
Periodic Checks				
Check low-pressure fuel pump operation, if installed.		X		
Check high-pressure fuel pump for leaks and noise.		X		
Check liquid fuel system for leaks.		X		
Check high-pressure fuel filter. Clean or replace as necessary. ¹		X		
Observe fuel control performance (stability, start time, lightoff time during start).		X		
Check operation of fuel control valve. Verify T5 temperatures during start; compare with original data if available.			X	
Periodic Maintenance Tasks				
Inspect and replace filters as needed. ²				X
Disassemble and lubricate fuel shutoff valves; reassemble with new O-rings.			X	
Inspect air purge manifolds for discoloration, cracks, and signs of overheating.			X	
Remove and inspect fuel injectors. Clean as needed.			X	
Rebuild or replace solenoid valves and regulators including those for air assist.				X

NOTES:

(1) Checks can only be performed with the unit shut down.

(2) Fuel filter elements should be replaced when visible contamination is present, when differential pressure "pop-up" indicators are popped, or when differential pressure limits are exceeded. Filters should be replaced no less than annually.

Table 1.5.6 Maintenance - Dual Fuel System (if applicable)

System/Description	D	M	S	A
Periodic Checks and Maintenance Tasks				
Conduct fuel transfer during operation. Observe speed, temperature, and load readings for stability.			X	
Check fuel system for leaks.		X		

Table 1.5.7 Maintenance - Water Injection System (if applicable)

System/Description	D	M	S	A
Periodic Checks				
Check water pump belts for proper tension. ¹			X	
Periodic Maintenance Tasks				
Grease and tighten water pump seals.			X	
Change oil in water pump.			X	

NOTES:

(1) Checks can only be performed with the unit shut down.

Table 1.5.8 Maintenance - Start System and Auxiliary Motors

System/Description	D	M	S	A
Periodic Checks				
Inspect and test pre/post lube oil pump, seal oil pump, backup lube oil pump, and backup seal oil pump, as applicable. ¹			X	
Inspect starter clutch, if applicable, to ensure lock-up in one direction and free rotation in the other. ¹			X	
Visually inspect starter gas seals. ¹			X	
If electrohydraulic start system, check oil reservoir level.	X			
Periodic Maintenance Tasks				
For electrohydraulic start systems, obtain oil sample from starter system for laboratory analysis. ²				X
For electrohydraulic start systems, change start system filters.				X
For pneumatic start systems, change lube oil. ³				X

NOTES:

- (1) Checks can only be performed with the unit shut down.
- (2) See Solar Engineering Specification 9-347 for oil replacement criteria. Sample more frequently if greater than normal number of starts is performed.
- (3) Lube oil should be replaced after each 500 starts.

Table 1.5.9 Maintenance - Generator

System/Description	D	M	S	A
Periodic Checks				
Verify governor load gain voltage.				X
Periodic Maintenance Tasks				
Disassemble, clean, and inspect coupling teeth and shear bolts for wear or damage. Repack with fresh Solar coupling grease. Reassemble using new gaskets.				X
Check gearbox to generator alignment; realign as necessary.				X
Inspect and, as necessary, clean the generator with a high-dielectric cleaner recommended by the generator manufacturer.				X

Table 1.5.10 Maintenance - General

System/Description	D	M	S	A
Periodic Checks				
Be alert for any unusual operating condition (vibration, noise, etc.).	X			
Inspect all lines and hoses for leaks, wear, chafing; correct as necessary.	X			
Inspect all mechanical linkages for wear, looseness; correct as necessary.	X			
Visually inspect entire package for fuel, oil, and air leaks.	X			
Visually inspect integrity of fasteners, auxiliary motor couplings, bleed valve, and fuel control linkages.		X		
Check condition and operation of solenoids and shutoff valves. ¹			X	
Inspect package for unusual noise, discoloration, cracks, and chafing lines.		X		
Visually inspect exhaust bellows for cracks or distortion.				X
Periodic Maintenance Tasks				
Record all panel readings, check that all oil-filled gages are filled. ²		X		
Conduct engine performance analysis. Perform ingestive cleaning if necessary and at least semiannually. ²		X		
Conduct borescope inspection of turbine.			X	
Lubricate all electric motors equipped with grease fittings.			X	
Check all safety relief valves as required by local regulations.			X	
Clean entire package.			X	
Remove seal oil pump from accessory drive (if installed). Inspect shaft splines for wear or evidence of seal leakage. Inspect accessory drive internally. Reinstall seal oil pump using new gasket.				X
If applicable, disassemble interconnect shafts and inspect splines for wear. Reassemble using new O-rings.				X

Table 1.5.10 Maintenance - General, Contd

System/Description	D	M	S	A
Check and adjust alignment of engine, gear unit, and compressor(s) as applicable.				X
Restart turbine and record acceleration time. Monitor control system for proper sequencing.			X	
Conduct vibration survey for trending. ²			X	
Sample NOx water quality and record results. ³	X			
Sample fuel(s) for specific gravity, lower heating value (LHV), dew point and composition, and record results. ³				X
For marine applications, lubricate the gimbal bearings and the slider in the primary package support tie-downs with National Lubricating Grease Institute (NLGI) Grade 2, lithium-based grease with extreme pressure (EP) and molybdenum disulfide additives. Pump grease into the Zerk fittings until fresh grease is extruded from the bearing grooves. Wipe away excess surface grease.			X	

NOTES:

- (1) Checks can only be performed with the unit shut down.
- (2) Maintenance tasks, except for these, require machine shutdown.
- (3) See Solar Engineering Specification 9-98 for NOx water quality and for fuel data.