

ELECTRICAL LOAD ANALYSIS

G500H

BELL 206L SERIES

Dwg. Number:
005-00577-21 Rev. 1

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1 INTRODUCTION

1.1 Purpose of Document

The purpose of this electrical load analysis (ELA) is to document electrical loads for the G500H system as installed for this STC. This ELA will show the following:

- 1) The total change in power consumption after the alteration is negligible and does not exceed the capacity of the electrical power generation and distribution system of the aircraft under foreseeable operating conditions.
- 2) The aircraft systems can be supported by the generator during normal operation.

2 APPLICABLE DOCUMENTS

Bell Helicopter, BHT-206L-MM-2, Bell model 206L Maintenance Manual Vol 2, Rev 6, dated 20 Mar 1979

Bell Helicopter, BHT-206L1-MM-2, Bell model 206L1 Maintenance Manual Vol 2, Rev 1, dated 31 Oct 2008

Bell Helicopter, BHT-206L3-MM-10, Bell model 206L3 Maintenance Manual Vol 10, Rev 10, dated 20 July 2009

Bell Helicopter, BHT-206L4-MM-10, Bell model 206L4 Maintenance Manual Vol 10, dated 2 Dec 1994

Bell Helicopter, BHT-206L3-FM-1, Bell Model 206L3 Rotorcraft Flight Manual, Rev 1, dated 8 Aug 2008

Bell Helicopter, BHT-206L4-FM-1, Bell Model 206L4 Rotorcraft Flight Manual, Rev 2, dated 22 Aug 2008

Garmin International, Document No. 190-01150-06, G500H Installation Manual

Garmin International, Document No. 005-C0577-00, G500H Flight Display System STC Installation Master Drawing List (MDL)

2.1 Applicable Regulations

This analysis will show compliance to the following regulations:

- 1) 14 CFR 27.1351(a) Amdt. 27-13

3 SYSTEM DESCRIPTION

The Bell 206L Series rotorcraft are equipped with a 28 VDC electrical system. The generator furnishes regulated power for all DC electrical circuits of the helicopter. Generator output is transferred to the main bus when a minimum of 24 VDC is achieved.

The Starter-generator is located on the underside of the engine to the right of helicopter centerline. This unit is used to start the engine, charge the battery, and supply power for operation of DC equipment. Power is stored in the 24 Volt battery.

The DC generator power capacity at 30 VDC for each of the Bell 206L series is as follows:

Model	Generator Rating	Continuous Rating	2 min rating	5 sec rating
Bell 206L	150A	125A	N/A	N/A
Bell 206L1	200A	137A	300A	400A
Bell 206L3	200A	180A	N/A	N/A
Bell 206L4	200A	180A	N/A	N/A

Refer to Figure 3-1 for a simplified diagram of the Bell 206L Electrical power system.

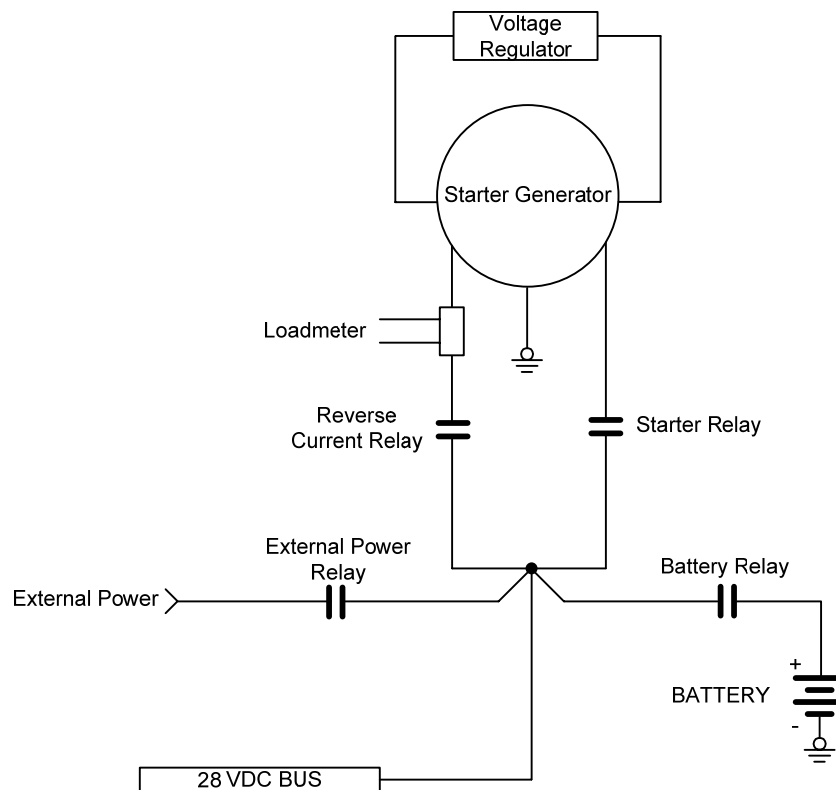


Figure 3-1. Bell 206L Series Electrical Power System

3.1 Electrical Load Analysis

An electrical load analysis (ELA) must be completed on the Bell 206L Series rotorcraft prior to installation to verify that the rotorcraft electrical system is capable of supporting the additional electrical load of the G500H system. The purpose of the ELA is to show compliance with FAR 27.1351(a). As part of the G500H installation it must be shown that the maximum electrical system demand does not exceed the DC power generating system capacity. The results of the ELA must be recorded on FAA Form 337. For the G500H system equipment, use the following values for computation:

LRU	28 Volt Current Draw	
	Typical	Maximum
GDU 620	1.9 A	2.7 A
GRS 77H/GMU 44	300 mA	1.0 A [1]
GDC 74H/GTP 59	200 mA	235 mA

[1] Maximum current draw occurs momentarily at startup or when the supply voltage drops to 9 VDC.

Table 3-1. G500H LRU Current Requirements

3.2 Bell 206L Series with Existing Electrical Load Analysis

If there is an existing ELA for the rotorcraft, this must be updated to reflect the modification. It must show that the generator has adequate capacity to supply power to the modified systems in all anticipated conditions. Add the G500H system equipment loads listed in Table 3-1 to the existing analysis and ensure that the generator capacity is not exceeded under all anticipated operating conditions.

The ELA is used to ensure that the DC power generating system will not exceed its designed capacity during all in-flight conditions. If additional electrical or avionics equipment is installed in the helicopter beyond what is covered in the existing ELA, be sure to obtain appropriate electrical load data for the installed equipment and add it to the ELA. Ensure the electrical load limits will not be exceeded with the installation of the G500H system.

3.2.1 Bell 206L Electrical Load Analysis

Table 3-2 includes an ELA showing the basic helicopter loads and optional equipment along with the G500H equipment. If there is other equipment installed in the rotorcraft beyond what is documented below, this equipment must be added to the ELA. Add the equipment in the 'Additional Equipment' rows. Be sure to include the number of units as well as the amps used per unit for each additional piece of equipment that is added to the list.

Also, if the rotorcraft does not have all of the listed equipment installed, be sure to remove these items from the ELA to ensure an accurate listing of all the loads applicable to a particular installation. For each piece of equipment that is removed from the list, subtract the Amps used per unit from the Total Amperage to ensure that the total value reflects the equipment removed.

After the ELA in Table 3-2 has been modified to reflect the individual rotorcraft installation, add the total number of Amps used, including the values for the G500H equipment. Ensure this value is below the rated continuous capacity for the installed generator. For the standard Bell 206L, this value is 125 Amps. If the total value is above 125 Amps, alternate FAA approval is required for installation of the G500H equipment.

EQUIPMENT--BASIC	NO. of Units	Amps per Unit	Amps Used	Duty Cycle
Flight Controls				
Hydraulic Bypass Solenoid	1	1.5	1.5	Intermittent
Instruments				
XMSN Oil Pressure System	1	0.1	0.1	Continuous
XMSN Oil Pressure Indicator	1			

XMSN Oil Pressure Transmitter	1			
Engine Instruments				
Fuel Quantity System	1	0.1	0.1	Continuous
Fuel Quantity Indicator	1			
Fuel Quantity Transmitter	3			
Fuel Pressure System	1	0.1	0.1	Continuous
Fuel Pressure Indicator	1			
Fuel Pressure Tranmitter	1			
Engine Oil Pressure System	1	0.1	0.1	Continuous
Engine Oil Pressure Indicator	1			
Engine Oil Pressure transmitter	1			
turbine outlet temperature	1	0.25	0.25	Continuous
engine hour meter	1	0.04	0.04	Continuous
Heating				
defog blower motor	2	1.4	2.8	Intermittent
engine de-ice control	1	0.14	0.14	Continuous
Engine Ignition				
ignitor relay	1	0.2	0.2	Intermittent
ignitor relay	1	1.6	1.6	Intermittent
Engine Controls				
start relay	1	0.6	0.6	Intermittent
Lighting				
tail position lights	1	1.02	1.02	Continuous
instrument and edge lights	95	0.04	3.8	Continuous
side position lights	4	0.93	3.72	Continuous
landing light	2	9.1	18.2	Continuous
landing light relay	2	0.25	0.5	Continuous
cockpit light	1	0.17	0.17	Continuous
anticollision light system	1	1.5	1.5	Continuous
anticollision light	1			
strobe power supply	1			
Power				
battery bus relay	1	0.6	0.6	Continuous
battery charging	1	38	38	Intermittent
generator line relay	1	0.6	0.6	Continuous
Fuel Control				
RPM governor actuator	1	0.9	0.9	Intermittent
fuel boost pump	1	4.3	4.3	Continuous
fuel boost pump	1	4.3	4.3	Continuous
fuel shutoff valve	1	2	2	Intermittent
fuel dump valve	1	1	1	Intermittent
Warning and Emergency				
low rotor RPM horn	1	0.1	0.1	Intermittent

engine out warning horn	1	0.1	0.1	Intermittent
engine out warning light	1	0.04	0.04	Intermittent
caution lights	9	0.04	0.36	Intermittent
battery hot warning light	1	0.04	0.04	Intermittent
Total 28VDC Continuous bus-Basic Aircraft			39.54	
Optional Equipment				
Flight Controls				
SCAS	1	2.2	2.2	Continuous
Flight Instruments				
Flight Instrument Group	1			
pitot heater	1	4	4	Continuous
altitude indicator	1	0.8	0.8	Continuous
heading indicator	1	0.8	0.8	Continuous
turn and slip indicator	1	0.2	0.2	Continuous
Heating				
bleed air heater kit	1	0.2	0.2	Continuous
ECU	1	38.5	38.5	Continuous
heater kit	1	16.7	16.7	Intermittent
Engine Ignition				
Automatic relight kit	1	0.5	0.5	Continuous
Lighting				
passenger compartment lights	1	1.2	1.2	Continuous
Miscellaneous				
Cargo hook kit	1	14	14	Intermittent
Radio NAV/COMM				
avionics kits	1			
VHF radio receiver	1	1.02	1.02	Continuous
VHF radio transmitter	1	3.1	3.1	Continuous
voltage converter	1	0.1	0.1	Continuous
ADF	1	1	1	Continuous
Omni/ILS Indicator	1	0.2	0.2	Continuous
Audio Panel	1	1.33	1.33	Continuous
Radar				
Avionics Kit	1			
Transponder	1	1.3	1.3	Continuous
Warning and Emergency				
Rotor brake kit	1	0.4	0.4	Intermittent
pop-out floats	1	4	4	Intermittent

Additional Equipment:				
Total 28VDC Optional kits			56.45	
G500H Equipment				
GDU 620 PFD/MFD	1	2.7	2.7	Continuous
GRS 77H AHRS/GMU 44	1	1	1	Continuous
GDC 74H ADC/GTP 59	1	0.235	0.235	Continuous
Total G500H Max Values			3.935	
Total Basic+optional+G500H			99.925	

Table 3-2. 206L Electrical Load Analysis with G500H Equipment

Notes and Assumptions:

1. Intermittent loads are not included in the total value as these loads are short duration loads and will be absorbed by the battery. Continuous circuits are assumed to be energized for all flight phases.
2. Helicopter is considered to be in worse case electrical loading conditions in landing configuration with an air conditioner installed and turned on.
3. The air conditioner and heater are mutually exclusive. It is assumed that both the air conditioner and heater will not be energized at the same time.
4. Load values were taken from the Bell 206L Maintenance Manual.
5. Battery charge current is not considered in the analysis.
6. Additional equipment or differences between this ELA and the actual rotorcraft configuration must be accounted for in the final calculation. It is the responsibility of the installer to ensure correct electrical loading calculations in the final ELA.

Conclusion:

The Bell 206L generator is rated at 125 Amps for continuous operation. The 206L generator has sufficient capacity to provide all systems with the necessary power in the stated configuration with the addition of the G500H system equipment in accordance with § 27.1351 (a). The addition of the G500H does not cause excessive loading on the electrical system of the Bell 206L in this configuration.

3.2.2 Bell 206L1 Electrical Load Analysis

Table 3-3 includes an ELA showing the basic helicopter loads and optional equipment along with the G500H equipment. If there is other equipment installed in the rotorcraft beyond what is documented below, this equipment must be added to the ELA. Add the equipment in the ‘additional equipment’ rows. Be sure to include the number of units as well as the amps used per unit for each additional piece of equipment that is added to the list.

Also, if the rotorcraft does not have all of the listed equipment installed, be sure to remove these items from the ELA to ensure an accurate listing of all the loads applicable to a particular installation. For each piece of equipment that is removed from the list, subtract the Amps used per unit from the Total Amperage to ensure that the total value reflects the equipment removed.

After the ELA in Table 3-3 has been modified to reflect your individual rotorcraft installation, add the total number of Amps used, including the values for the G500H equipment. Ensure this value is below the rated continuous capacity for the installed generator. For the standard Bell 206L1, the generator is rated at 200 Amps and is

derated to 137 Amps. Ensure that the continuous operating load with the addition of the G500H equipment does not exceed 137 Amps.

Basic Helicopter Operating Loads			
Flight Phase	5 seconds	2 minutes	15 minutes
Start/Warmup	32.63	31.27	31.15
Takeoff	32.15	31.26	31.11
Cruise	32.15	31.25	31.11
Landing	50.85	49.95	37.35
Optional Auxiliary Kits--Operating Loads			Duty Cycle
Heater Kit		16.7	Intermittent
ECU		39.5	Continuous
Flight Instruments		5.9	Continuous
Auto Relight		0.5	Intermittent
Cargo Hook		14	Intermittent
VHF Receiver		1.02	Continuous
VHF Transmitter		3.1	Continuous
ADF		1	Continuous
Voltage Converter		0.1	Continuous
OMNI/ILS Indicator		0.2	Continuous
Audio Panel		1.33	Continuous
Transponder		1.3	Continuous
Rotor Brake		0.4	Intermittent
Avionics Kits--For Bell 206L1 S/N 45154-45600			
VHF Receiver		1.02	Continuous
VHF Transmitter		3.1	Continuous
ADF Receiver		1	Continuous
Voltage Converter		0.1	Continuous
OMNI/ILS Indicator		0.2	Continuous
Audio Panel		1.33	Continuous
Transponder		1.3	Continuous
Avionics Kits--For Bell 206L1 S/N 45601 and after			
VHF NAV/COM RX		0.56	Continuous
VHF NAV/COM TX		2.75	Continuous
OMNI/ILS Indicator		0.2	Continuous
Audio Panel		1.84	Continuous
Isolation Amp		1.1	Continuous
ADF Receiver		0.59	Continuous
Transponder		1.17	Continuous
G500H Equipment			
GDU 620 PFD/MFD		2.7	Continuous
GRS 77H AHRS/GMU 44		1	Continuous
GDC 74H ADC/GTP 59		0.235	Continuous
Additional Equipment			

Total Basic+Optional+Avionics+ G500H (S/N 45154-45600)		102.785		
Total Basic+Optional+Avionics+ G500H (S/N 45601 & after)		102.945		

Table 3-3. Bell 206L1 Electrical Load Analysis with G500H Equipment

Notes and Assumptions:

1. Intermittent loads are not included in the total value as these loads are short duration loads and will be absorbed by the battery. Continuous circuits are assumed to be energized for all flight phases.
2. Helicopter is considered to be in worse case electrical loading conditions in landing configuration with an air conditioner installed and turned on.
3. The air conditioner and heater are mutually exclusive. It is assumed that both the air conditioner and heater will not be energized at the same time.
4. Load values were taken from the Bell 206L1 Maintenance Manual.
5. Battery charge current is not considered in the analysis.
6. The 15 minute landing configuration from the Bell 206 L1 maintenance manual was used for the basic helicopter operating loads.
7. Additional equipment or differences between this ELA and the actual rotorcraft configuration must be accounted for in the final calculation. It is the responsibility of the installer to ensure correct electrical loading calculations in the final ELA.

Conclusion:

The Bell 206L1 generator is rated at 137 Amps for continuous operation. The 206L1 generator has sufficient capacity to provide all systems with the necessary power in the stated configuration with the addition of the G500H system equipment in accordance with § 27.1351 (a). The addition of the G500H does not cause excessive loading on the electrical system of the Bell 206L1 in this configuration.

3.2.3 Bell 206L3 Electrical Load Analysis

The Bell 206L3 Maintenance Manual outlines the following values with basic and optional equipment installed:

Bell 206L3 Continuous Operating Loads--Amps

Basic Helicopter Equipment	41.73
Auxiliary Kits	51.37
Optional Avionics	8.7
Battery charge current	57.8
Additional G500H Equipment	
GDU 620 PFD/MFD	2.7
GRS 77H AHRS/GMU 44	1
GDC 74H ADC/GTP 59	0.235
Total	105.735

Table 3-4. Bell 206L3 Electrical Load Analysis with G500H Equipment

Table 3-4 shows that the total current draw from the generator is 105.735 Amps. This is assuming a worse-case situation with all optional avionics, all auxiliary kits, and the G500H installed. In most cases, not all of the optional avionics and kits will be installed, which would decrease the total load on the generator. The Bell 206L3 generator capacity is rated at 180 Amps for continuous operation. This shows that the Bell 206L3 has the capacity to supply the necessary power to the G500H system.

Notes and Assumptions:

1. Load values were taken from the Bell 206L3 Maintenance Manual.
2. The total includes the basic helicopter loads, all auxiliary kit loads, and all optional avionics.
3. Battery charge current is not considered in the analysis.
4. Additional equipment or differences between this ELA and the actual rotorcraft configuration must be accounted for in the final calculation. It is the responsibility of the installer to ensure correct electrical loading calculations in the final ELA.

Conclusion:

The Bell 206L3 generator is rated at 180 Amps for continuous operation. The 206L3 generator has sufficient capacity to provide all systems with the necessary power in the stated configuration with the addition of the G500H system equipment in accordance with § 27.1351(a). The addition of the G500H does not cause excessive loading on the electrical system of the Bell 206L3 in this configuration.

3.2.4 Bell 206L4 Electrical Load Analysis

The Bell 206L4 Maintenance Manual outlines the following values with basic and optional equipment installed:

Bell 206L4 Continuous Operating Loads--Amps

Basic Helicopter Equipment	35.14
Auxiliary Kits	51.37
Optional Avionics	8.7
Battery Charge Current	57.8
Additional G500H Equipment	
GDU 620 PFD/MFD	2.7
GRS 77H AHRS/GMU 44	1
GDC 74H ADC/GTP 59	0.235
Total	99.145

Table 3-5. Bell 206L4 Electrical Load Analysis with G500H Equipment

Table 3-5 shows that the total current draw from the generator is 99.145 Amps. This is assuming a worse-case situation with all optional avionics, all auxiliary kits, and the G500H installed. In most cases, not all of the optional avionics and kits will be installed, which would decrease the total load on the generator. The Bell 206L4 generator capacity is rated at 180 Amps for continuous operation. This shows that the Bell 206L4 has the capacity to supply the necessary power to the G500H system.

Notes and Assumptions:

1. Load values were taken from the Bell 206L4 Maintenance Manual.
2. The total includes the basic helicopter loads, all auxiliary kit loads, and all optional avionics.
3. Battery charge current is not considered in the analysis.
4. Additional equipment or differences between this ELA and the actual rotorcraft configuration must be accounted for in the final calculation. It is the responsibility of the installer to ensure correct electrical loading calculations in the final ELA.

Conclusion:

The Bell 206L4 generator is rated at 180 Amps for continuous operation. The 206L4 generator has sufficient capacity to provide all systems with the necessary power in the stated configuration with the addition of the G500H system equipment in accordance with § 27.1351(a). The addition of the G500H does not cause excessive loading on the electrical system of the Bell 206L4 in this configuration.

3.3 Pass/Fail Criteria

For a Bell 206L Series G500H installation, the following must be shown:

1. The electrical bus load must not exceed the generator capacity under continuous operating conditions.
2. The G500H system installation does not overload the generator capacity in any foreseeable operating conditions.

If the limits outlined above are exceeded, alternate FAA approval is required for installation of the G500H equipment.

4 SUMMARY

The analysis above demonstrates the following statements to be true:

1. The 206L Series generator capacity is sufficient with the addition of the G500H system equipment in the stated configuration in accordance with § 27.1351(a) Amdt. 27-13.
2. This STC contributes no significant change to the existing electrical distribution or loading of the Bell 206L Series with the addition of the G500H equipment.