Chapter: 24-00-00
ELECTRIC SYSTEM

Intro

The engine is supplied with the wiring completed and ready to operate. Only the following connections to the aircraft have to be established:

- integrated generator
- external rectifier-regulator
- electronic modules
- electric starter
- start relay
- items conditional for operation like circuit breakers, ON-OFF switches, control lamps, relays, instrumentation and capacitors.

Optional extras

- external alternator (as option if the output of the integrated generator is inadequate.
- electric rev counter (accessory).
- consumer (battery).

Table of contents

This section contains information about electronic modules, electric starter and wiring diagram of the engine.

1) Requirements for the circuit wiring

General note

NOTICE

The connections have to be made by the aircraft manufacturer in accordance with applicable regulations and the enclosed wiring diagram.
See chap. 24-00-00 section: Switch requirements.

NOTICE

The power supply to the various consumers (e.g. battery) must be adequately protected by fuses. Using incorrectly rated fuses may result in destruction of the equipment.

Under no circumstances must consumer cables (e.g. battery) be routed alongside the ignition cable. There is a risk of electromagnetic interference or damage.

NOTICE

Do not bend, kink, pinch or otherwise improperly stress the wiring harness. Use proper routing, clamping and strain relief on wiring harnesses.

1.1) Electromagnetic compatibility (EMC/EMI)

Electromagnetic interference

Electromagnetic interference (EMI) and lightning

The engine complies with EMI and lightning requirements as per DO-160C, sections 18, 20-22 as detailed in the following paragraphs.

Emission

Emission

Conductive radio interference:

Narrowband and broadband emissions meet RTCA DO160C Section 21-2 Cat. B (AZ) requirements except in the frequency range of 150 kHz-2 MHz where emissions are up to 20 dB higher than allowable limits.

Radiated radio interference:

Narrowband and broadband emissions meet RTCA DO160C Section 22, item 21-6 and 21-7, Cat. B requirements except in the frequency range of 190 kHz-2 MHz where emissions are up to 35 dB higher than allowable limits.

NOTE: Consult the aircraft manufacturer if further interpretation is needed. The exceeded limits do not affect the operation of the engine.

Electromagnetic compatibility

Electromagnetic compatibility (EMC)

The engine complies with the electromagnetic interference and lightning strike requirements of DO-160C, section 18, 20-22 and IEC 801-2.

The following EMC tests have been carried out:

- Radio frequency (RF) sensitivity (conducted)
- Radio frequency (RF) sensitivity (radiated)
- Audio frequency sensitivity
- Lightning strike sensitivity
- Conducted radio frequency (RF) interference
- Radiated radio frequency (RF) interference

2) Technical data and connection of the electric components

2.1) Internal generator

General note

NOTE: Approx. 250 W AC output at 5800 rpm. For DC output in connection with rectifier-regulator. See chap. 24-00-00 section: 3).

Connection

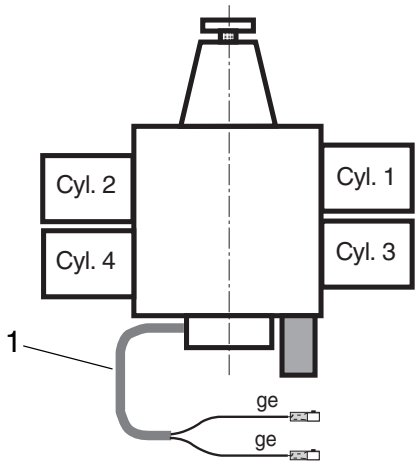
See Fig. 1.

Feeding wires (1) from the generator to rectifier-regulator on left side of ignition housing.

- 2 flexible cables, 1.5 mm^2 yellow (in shielding metal braid)
- length approx. 660 mm (26 in.) starting from ignition housing
- with on each plug socket 6.3 x 0.8 to DIN 46247

Graphic

Connection



Part	Function
1	Feeding wires (yellow)

Fig. 1 02498

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2.2) Rectifier regulator

Type

Electronic full-wave rectifier regulator.

Output voltage

14.2 V± 0.3 (from 1000 ± 250 rpm).

Current limit

Current limit:

Max. 22 A.

Component temperature

Max. permissible component temperature:

+80 °C (176 °F) (measured in area (1)).

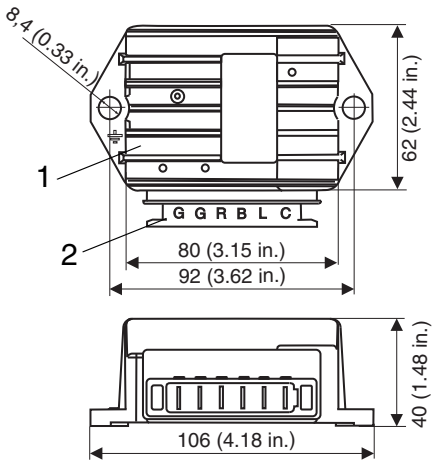
NOTE: The performance specifications are given for optimal cooled components. If necessary, use a separate heat sink for the rectifier regulator.

Weight

See chap. 72-00-00 section: weight.

Graphic

Connection



Part	Function
1	Area component temperature
2	Description of connections: G = yellow - from generator R = red - to battery, positive terminal B = battery positive terminal L = warning lamp circuit C = control or field circuit

Fig. 2 08631

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2.2.1) Requirements for flawless operation of the rectifier-regulator

General note

NOTICE

The voltage difference between battery and terminal **C** of regulator should be less than 0.2 V.

Use cables in this area as short as possible and with adequate cross section.

NOTICE

Never sever connection between terminal **C** and **B** of regulator (e.g. by removal of a fuse) while the engine is running. Overvoltage and regulator damage can occur.

During engine stop break circuit between battery and terminal C to avoid discharge of battery! (see Fig. 11).

NOTE: A charge-indicating lamp 3 W/12 V (see Fig. 11 pos. 18) may be fitted on the instrument panel.

Body of regulator

Body of regulator must be grounded with no restance allowed.

Fuse

The rectifier-regulator has to be protected by a slow blowing 25 A fuse.

Wire size

Wire size of the main circuit of at least 2.5 mm^2 (14 AWG).

Capacitor

A capacitor (see Fig. 11 pos. 14) of at least 22000 µF/25 V is necessary to protect the correct function of regulator and to flatten voltage. The regulator is not designed to store any electrical charge. If for any reason the battery or bus system is disconnected from the regulator while the engine is running (i.e. the master switch is shut off) the capacitor will safely absorb and dissipate the electrical charge produced by the generator. Otherwise the regulator would be damaged.

Amperage

NOTICE

The graph current over engine speed has been determined and is valid only at the following conditions:

- Ambient temperature: 20 °C (68 °F)
- Voltage: permanent 13.5 V
- Tolerance: max ± 5 %

Graphic Current

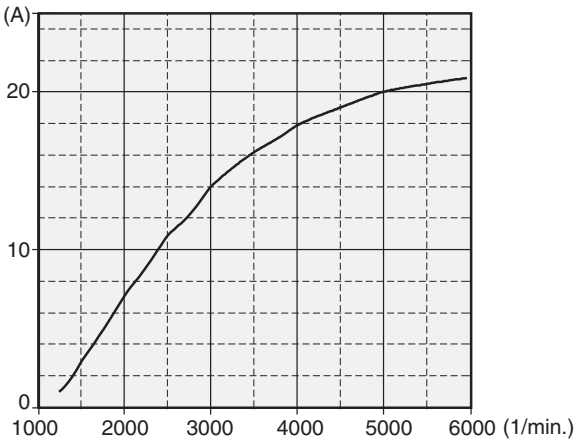


Fig. 3 *02500*

2.3) Electronic modules

See Fig. 4.

Component temperature Component temp. for the electronic modules (1): max. 80 °C (176 °F).

2.4) Ignition switches (MAG switch)

Type Two separate, suitable on-off switches (Fig. 11 pos. 15).

Switching voltage Min. 250 V.

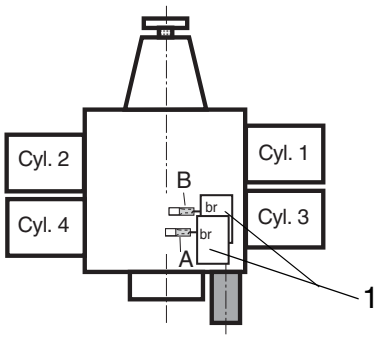
Switching current Min. 0.5 A.

2.4.1) Connection

Wires See Fig. 4.

Wires from the ignition switches connect to the electronic module (1).

Graphic Electronic modules



Part	Function
1	Electronic modules

Fig. 4 *02501*

Wire See Fig. 5.

NOTICE

The electromagnetic compatibility (EMC) and electromagnetic interference (EMI) depends essentially on the wire used.

Min. section area: 2x 0.75 mm^2 (18 AMG) (shielded flexible cable, shielding braid on both ends grounded to prevent EMI (e.g. specification MIL-27500/18).

NOTICE

No or insufficient shielded cables can cause engine shut-off due to electromagnetic and radio interference.

The metal base of each ignition switch must be grounded to aircraft frame to prevent EMI.

Wire A

Wire of top electronic module (marked “A“) for ignition circuit A.

Wire B

Wire of bottom electronic module (marked “B“) for ignition circuit B.

Ignition circuit A

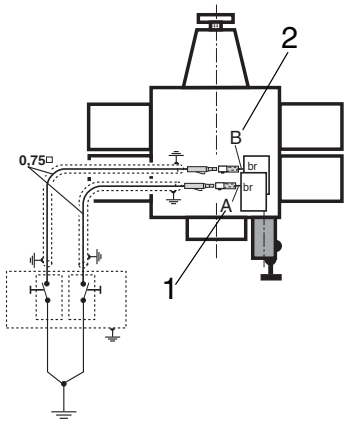
NOTE: Ignition circuit A controls: top spark plugs of cylinder 1 and 2; lower spark plugs of cylinder 3 and 4.

Ignition circuit B

NOTE: Ignition circuit B controls: top spark plugs of cylinder 3 and 4; lower spark plugs of cylinder 1 and 2.

Graphic

Wire



Part	Function
1	Wire for ignition circuit A
2	Wire for ignition circuit B

Fig. 5 07602

Flexible wire

One each flexible wire 0.75 mm^2 (18 AMG), brown.

Length approx. 35 mm (1 3/8“) beginning at electronic module with one each plug socket and insulating sleeve 3.96 mm. At the new version the cable grommet and fasten connector are integrated in the 6-pole connector housing. See also SI-912-013, latest issue.

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2.4.2) Assembly of the flat pin terminal

General note

See Fig. 6.

NOTE: One each cable grommet (1) and flat pin terminal (2) are supplied loosely packed.

Special tools

The following special tools and equipment are necessary for fitting the Faston connector.

Part number	Description
n.a.	MOLEX Crimping pliers 64016-0035
n.a.	MOLEX Disassembly total 63813-1500

Procedure

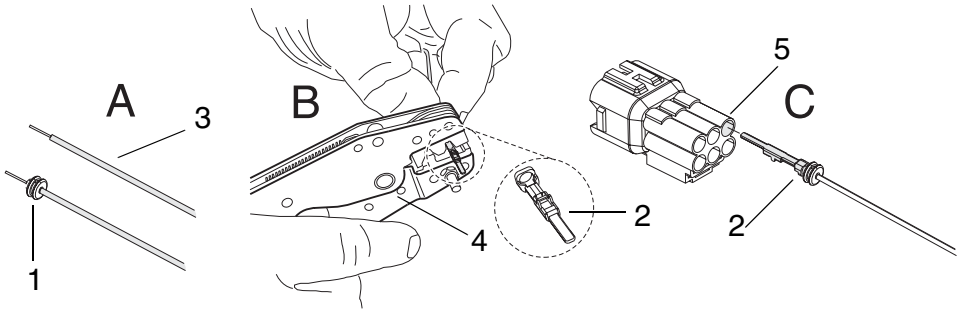
Assembly of the flat pin terminal

Step	Procedure
1	Strip cable (3) as required.
2	Install the cable grommet (1) in correct position and direction (**A**).
3	Use suitable crimping pliers (4) to fit the fasten connector (**B**).
4	The rubber grommet is held by the secondary crimp.
5	Push the faston connector in the corresponding slot (4) of the connector receptacle until it is locked in place (**C**).
6	Check for tight fit.
7	Press the pin holder (white) downwards using the long nose pliers.

NOTE: Faston connector and insulation sheath of the old version are available as spare part. See also SI-912-013, latest issue.

NOTE: The pin holder must not be pressed with excessive force.

Graphic Assembly of the flat pin terminal



Part	Function
1	Cable grommet
2	Flat pin terminal
3	Wiring (airframe)
4	Crimping pliers
5	Position in the connector housing

Fig. 6 *08323*

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2.5) External alternator (optional extra)

General note See Fig. 7.

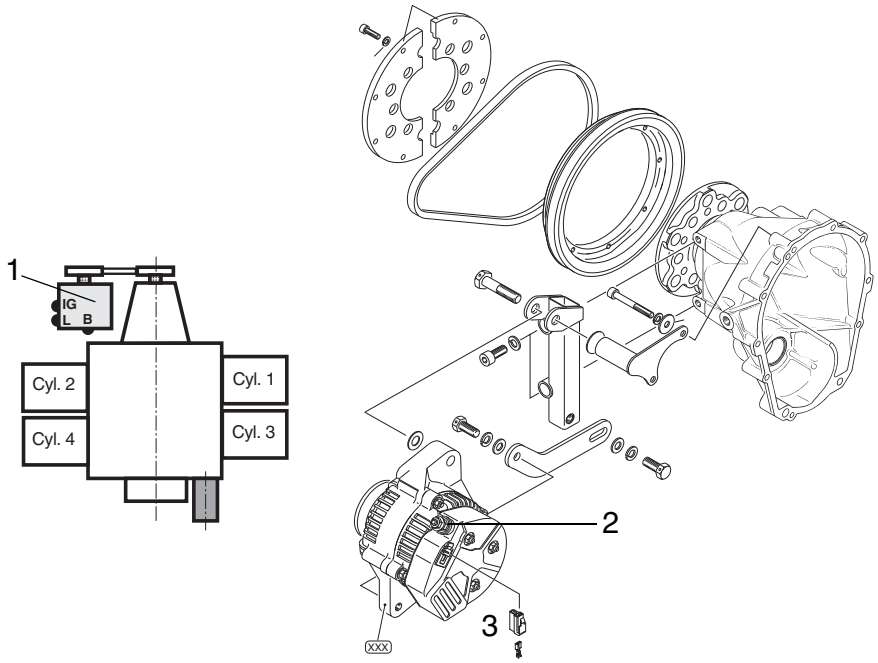
2.5.1) Technical data

General note	NOTE:	The voltage regulator is integrated in the alternator.
Output	Output: Max. 600 W/DC at 6000 r.p.m.	
Output Voltage	Output Voltage: 14.2 V - 14.8 V.	
Ambient temperature range	Ambient temperature:	Min. -30 °C (-22 °F) Max. +90 °C (194 °F)
Weight	See chap. 72-00-00 section: Technical data.	

2.5.2) Connection

Power supply wires	Power supply wires to external alternator (1) located on the outside of propeller gear.
Positive terminal	Positive terminal (2): - M6 screw connection suitable for cable terminal acording to DIN 46225 (tightening torque 4 Nm (35 in.lb).
Grounding	Via engine block.
Control wiring	Control wiring (field circuit) (3): - Via supplied standard plug (Sumitomo 6111-2568) and 6.3 x 0.8 Fasten connectors.

Graphic External alternator



Teil	Funktion
1	External alternator
2	Positive terminal
3	Control wiring

Fig. 7 *03199,02764,00547*

2.6) Requirements for correct operation of the integrated rectifier regulator

Fuse The rectifier regulator must be protected by a slow blowing fuse or circuit breaker. Fuse or circuit breaker rating must be determined by load, wire size and length.

Cross section Wire size of the main circuit at least 4 mm^2 (0.006 in^2).

Capacitor A capacitor of at least 22000 µF/25 V is necessary to flatten voltage.

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Amperage

NOTICE The current over speed graph was determined and is only effective under the following conditions:

- Ambient temperature: 20 °C (68 °F)
- Voltage: constant 13.5 V
- Tolerance: max. ± 5%

NOTE: The speed of the external generator is 1.24 times the crankshaft speed or 3 times the propeller speed.

Graphic

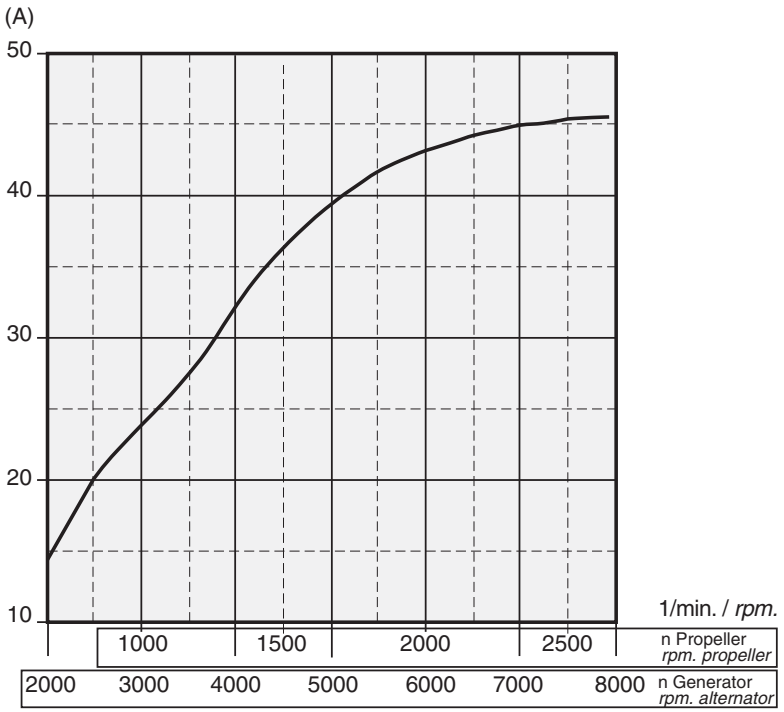

Fig. 8 00547

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2.7) Connection of the electric rev counter (tachometer)

2.7.1) Technical data

Output signal

NOTICE The graphs depicting output signals have been determined and are effective only at the following conditions:

- Ambient temperature: 20 °C (68 °F)
- Tolerance: Max. ± 5%

NOTE: The pick-up for the rev counter generates one pulse per revolution.

2.7.2) Connection

General note

NOTICE BRP-Powertrain developed especially for this application a non-certified electric rev counter. Certification to the latest requirements such as FAR or EASA has to be conducted by the aircraft manufacturer. See also SI-13-1996, latest issue.

Feeding wiring

Feeding wiring to electric rev counter on left side of ignition housing.

- Length approx. 600 mm (24 in.) starting from ignition housing.

Connections

2 flexible cables 0.5 mm^2, white/yellow and blue/yellow (in insulation wrap).

2.8) Battery

General note

See Fig. 11.

NOTICE To warrant reliable engine start use a battery of at least 16 Ah capacity.

2.9) Capacitor (Option electrical fuel pump)

General note

See Fig. 11.

NOTICE To warrant reliable operation of the electrical fuel pump the use of capacitor of at least 1 µF/25 V is necessary.

2.10) Easy start function on the electronic module (optional)

General note

See Fig. 10.

In order to use the easy start function the relevant connections to the starter relays and ignition switch need to be made.

The start function can be used for aircraft, which have an engine start problem in cold conditions.

NOTE: In addition also a modified fly wheel hub is offered, which aids improved starting.

Graphic

Easy start function

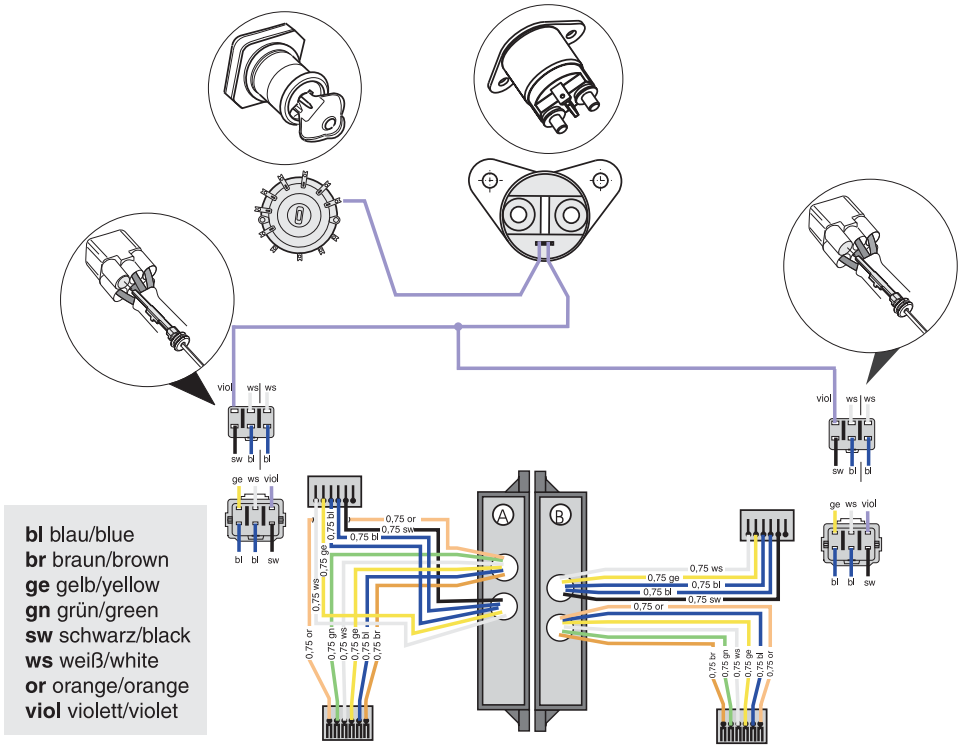


Fig. 10 08556

2.11) Wiring diagram

General note

See Fig. 11.

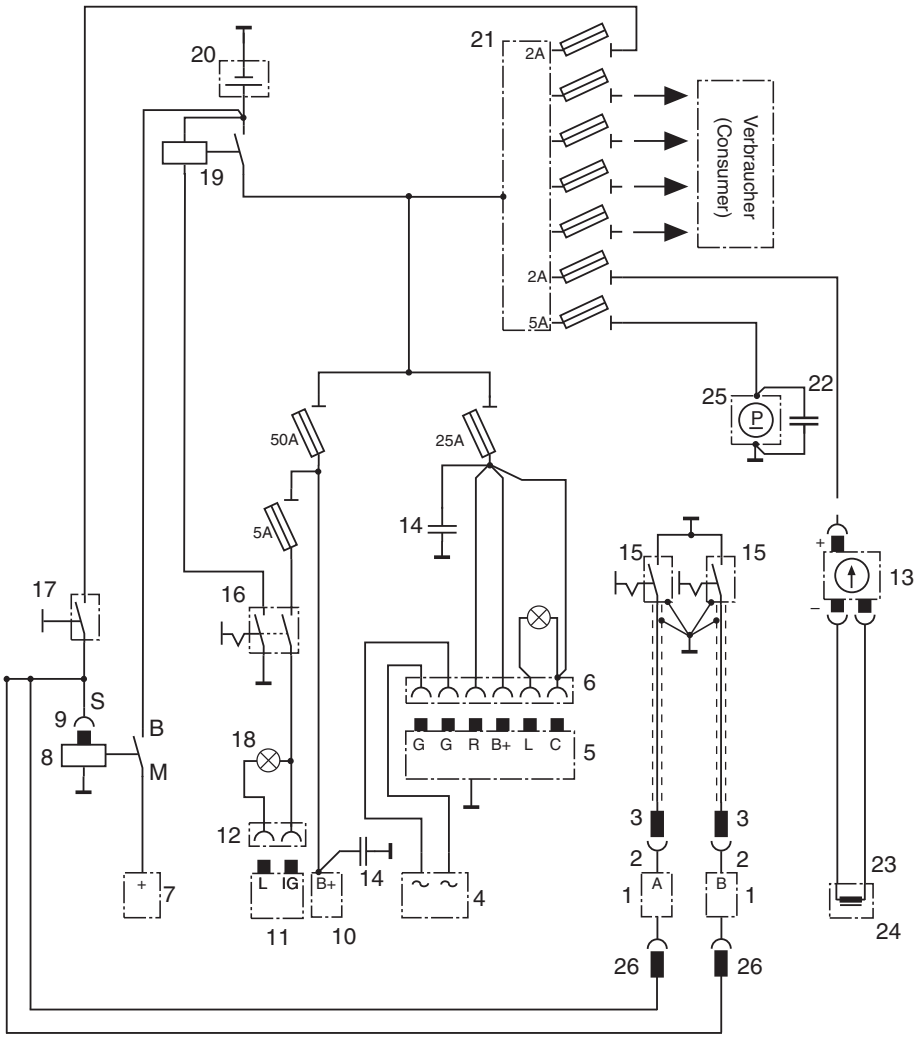
Scope of delivery

NOTICE

Items/components which are not included in the standard engine scope of delivery must be certified the aircraft or fuselage manufacturer in accordance with the latest regulation, such as FAR or EASA.

Position	Supply
1-9	Are included in the standard volume of supply of the engine.
22-24	Are included in the standard volume of supply of the engine.
10-14	Are available as accessory.
15-22	Can‘t be supplied by BRP-Powertrain.
25	Can‘t be supplied by BRP-Powertrain.

Graphic Wiring diagram



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Legend to wiring diagram

Part	Function	Part	Function
1	2 Electronic modules (A and B)	17	Starter switch
2, 3	Plug connection for ignition switch	18	Control lamp
4	Integrated generator	19	Battery relay
5, 6	External regulator - rectifier with plug connections	20	Battery
7	Electric starter	21	Bus Bar
8, 9	Starter relay with plug connection	22	Capacitor 1 µF
10, 11, 12	External alternator with connection	23	Plug connection for trigger coil assy.
13	Electric rev counter	24	Trigger coil assy. (tachometer)
14	2 capacitor 1 µF	25	Electrical fuel pump
15	2 ignition switches	26	Starting equipment at the electronic modules
16	Masterswitch		

Fig. 11 *08639*