

SERVICE INSTRUCTION - PAC

24 Volt electric starter assy. for ROTAX® Aircraft Engines

ATA System: 80-00-00 Electric starter

1) Planning information

“PAC” Service Instruction Documents provide detailed information on ROTAX® Aircraft Engine Parts and Accessories. Depending on the engine type used with, referenced parts and accessories may be provided with or without EASA certification or ASTM compliance. Certification / Compliance of referenced Parts and Accessories must in such cases be completed by the aircraft OEM.

To obtain satisfactory results, procedures specified in this publication must be accomplished with accepted methods in accordance with prevailing legal regulations.

BRP-Rotax GmbH & Co KG cannot accept any responsibility for the quality of work performed in accomplishing the requirements of this publication.

1.1) Applicability

Refer to the latest issue of the relevant Illustrated Parts Catalog of your specific engine type.

NOTICE

The 24 Volt electric starter assy. and its connectors may be declared as part of the starting system on aircraft-side and so might not be a part of the Engine Type Design. Such a PAC part has been then tested and released by BRP-Rotax, but it might not be certified for the relevant engine type. In such a case the correct function in conjunction with the entire system is the responsibility of the aircraft manufacturer and must be carried out jointly with the aircraft.

1.2) Concurrent ASB/SB/SI and SL

In addition to this Service Instruction- PAC the following Service Instruction- PAC should be considered:

SI-PAC-017, title “Starter relay assy. for ROTAX® Aircraft Engines“, current issue.

1.3) Reason

In the course of product maintenance and expansion of our spare parts program, a 24 Volt electric starter assy. is available.

1.4) Subject

24 Volt electric starter assy. for ROTAX® Aircraft Engines.

1.5) Compliance

None - For Information Only.

1.6) Approval

None.

1.7) Labor time

Estimated labor hours:

Engine installed in the aircraft - - - labor time will depend on airframe installation and therefore no estimate is available from the engine manufacturer.

1.8) Mass data

Change of weight - - - none.

Moment of inertia - - - unaffected.

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1.9) Electrical load data

No change.

1.10) Software modifications

No change.

1.11) References

In addition to this technical information refer to current issue of

- Operators Manual (OM)
- Illustrated Parts Catalog (IPC)
- Installation Manual (IM)
- Maintenance Manual Line (MML)
- Maintenance Manual Heavy (MMH)

NOTE: The status of the Manuals can be determined by checking the table of amendments. The 1st column of this table shows the revision status. Compare this number to the one listed on the ROTAX WebSite:
www.flyrotax.com. Updates and current revisions can be downloaded for free.

1.12) Other Publications affected

None.

1.13) Interchangeability of parts

- All parts are interchangeable

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2) Material Information

2.1) Material- cost and availability

Price and availability will be provided on request by ROTAX® Authorized Distributors or their independent Service Centers.

2.2) Company support information

- Any possible support by BRP-Rotax will be provided on request by ROTAX® Authorized Distributors or their independent Service Centers.

2.3) Material requirement per engine

Parts requirement for installation*:

Fig. no.	Part no.	Qty/ engine	Description	Application
1, 2	685672	1	Electric starter assy. 24 V	
consist of:				
	240457	1	Terminal screw M5x8	Electric starter
	241132	2	Set bolt M5x143	Electric starter
not included in Electric starter assy. 24 V				
2	942311	2	Hex. nut M5	Set bolt
3	250140	1	O-ring DIN 3771-24.4X3.1-N NBR70	Electric starter

* for further material and procedures to install starter assy. on the engine and in the aircraft check with aircraft manufacturer's instructions for continued airworthiness.

2.4) Material requirement per spare part

None.

2.5) Rework of parts

None.

2.6) Special tooling/lubricants- /adhesives- /sealing compounds

None.

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3) Accomplishment/Instructions

- ROTAX reserves the right to make any amendments to existing documents which might become necessary due to this standardization, at the time of next revision or issue.

NOTE: Before maintenance, review the entire documentation to make sure you have a complete understanding of the procedure and requirements.

Accomplishment

All measures must be implemented and confirmed by at least one of the following persons or organizations:

- ROTAX® - Airworthiness representatives
- ROTAX® - Authorized Distributors or their independent Service Centers
- Persons approved by the respective Aviation Authority
- Persons with approved qualifications for the corresponding engine types. Only authorized persons (iRMT, Level Heavy Maintenance) are entitled to carry out this work.



See current Installation Manual (IM) for the respective engine type.

3.1) Spare Parts - related information



See current Illustrated Parts Catalog (IPC) for the respective engine type.

3.2) Operation - related information



See current Operators Manual (OM) for the respective engine type.



See aircraft manufacturer's instructions for continued airworthiness for the respective aircraft and engine type.

3.3) Installation - related information

General



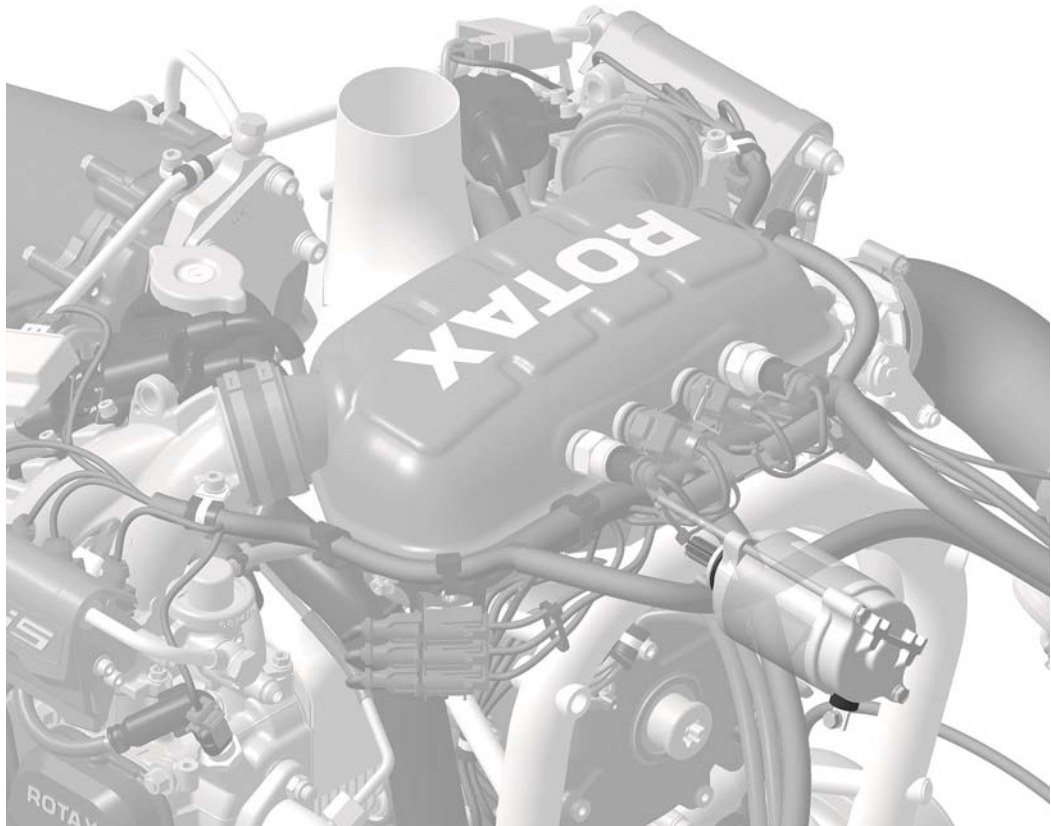
See current Installation Manual (IM) for the respective engine type.



See aircraft manufacturer's instructions for continued airworthiness for the respective aircraft and engine type.

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Fig. 1

**System
description**

For detailed system description refer to the latest issue of the Operators Manual (OM).

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3.3.1) System limitations

Operating limits

Refer to the latest issue of the Operators Manual (OM).

Ambient temperatures

System limit	Min.	Max.
Electric starter	- 40 °C (- 40 °F)	80 °C (176 °F)

Thermal durability

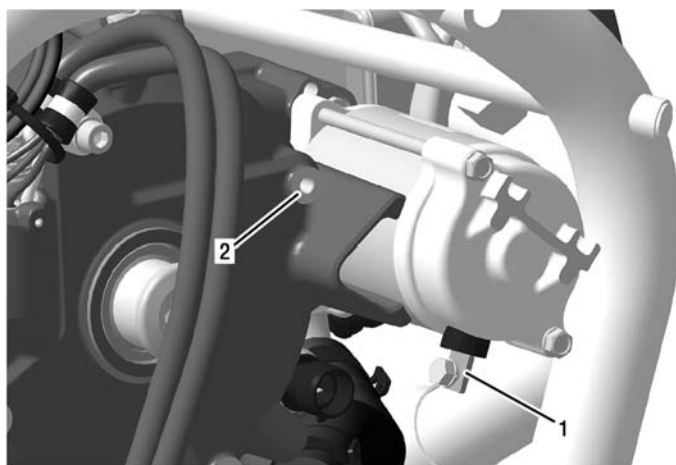
Suitable for short starting periods only. Activate starter for max. 10 seconds (without interruption), followed by a cooling period of 2 minutes.

Aircraft ground

The engine block must be connected to the aircraft using a properly sized ground strap (minimum the same cable cross section as starter supply), to provide the required starter current and to avoid static electricity between the engine and the aircraft.

3.3.2) Interface description

Interface overview



1 Positive terminal
2 Negative terminal

Fig. 2

Electrical interfaces

Positive terminal:

Interface parameter	Min.	Max.	Nominal
Input voltage			24 V
Input load:* *for resistance of starter circuit R _{smax} = <20 mOhm	20 A	350 A (when electric starter is activated)	

The terminal must be conducted as M5 screw connection suitable for cable lug according to DIN 46225.

Tightening torque: Min. 3 Nm (27 in.lb) Max. 5 Nm (44 in.lb).

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Negative terminal:

The engine block must be connected to the airframe using a properly sized ground strap (minimum the same cable cross section as the starter supply), for carrying the starter current and to avoid static electricity between the engine and the airframe.

3.3.3) Installation notes

General

The representation of components in this chapter which are not within scope of the delivery is only symbolic. The design shown in this chapter does not represent a specified execution but should support the understanding of the system.

The final design, the selection and specification of parts according to the respective applicable regulations, the consideration of the system limitations and interface description as well as the comprehension of the operating limits in every operational state is in the responsibility of the aircraft manufacturer.

The aircraft manufacturer has to make sure that the operating limits given in the Operators Manual (OM) can be supervised by the pilot. The execution of the installation must allow the operation of the engine according to the Operators Manual (OM).

Installation overview

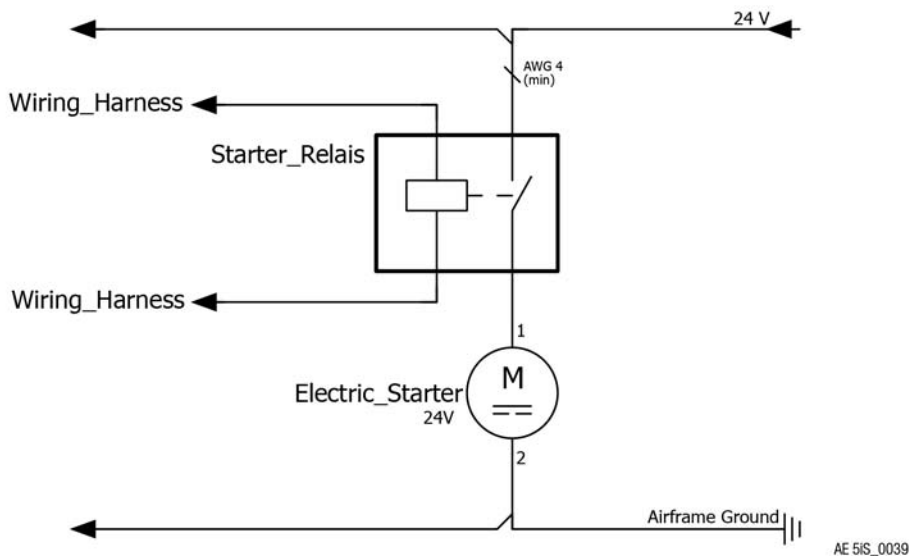


Fig. 3

Wiring

The engine block must be connected to the airframe using a properly sized ground strap for carrying the starter current and to avoid static electricity between the engine and the airframe.

The minimum cable cross-section for the line from the battery to the starter relay and from there to the electric starter and for the ground line (start system) depends on the cable length "l" (= Sum of the supply line and ground line of the electric starter) and has to be calculated according to the following table.

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I [m]	I [ft]	A (min.) [mm ²]	A (min.) [in ²]	A (max.) [mm ²]	A (max.) [in ²]	AWG (min.)
<4	<13	20.408	0.031	25	0.039	4
4<I<4.5	13<I<14.8	22.959	0.036	35	0.054	3
4.5<I<5	14.8<I<16.4	25.51	0.04	35	0.054	3
5<I<5.5	16.4<I<18	28.061	0.043	35	0.054	2
5.5<I<6	18<I<19.7	30.612	0.047	35	0.054	2
6<I<6.5	19.7<I<21.3	33.163	0.051	35	0.054	2
6.5<I<7	21.3<I<23	35.714	0.055	50	0.078	1
7<I<7.5	23<I<24.6	38.265	0.059	50	0.078	1
7.5<I<8	24.6<I<26.2	40.816	0.063	50	0.078	1
8<I<8.5	26.2<I<27.9	43.367	0.067	70	0.109	0
8.5<I<9	27.9<I<29.5	45.918	0.071	70	0.109	0
9<I<9.5	29.5<I<31.2	48.469	0.075	70	0.109	0
9.5<I<10	31.2<I<32.8	51.02	0.079	70	0.109	0

The internal resistance of the battery and the resistance of the electrical system (wires, contact points, relay contacts) largely determine the performance of the starting system. Therefore, the total loop resistance (RSmax) may not exceed 0.015 Ω.

$$RS_{max} = \sum R = R_{iBatt} + RC_{Starter\ relay} + RL + R_{Other}$$

Symbol	Description
R_iBatt	Inner resistance of battery
RC_Starter relay	Contact resistance starter relay
RL	Line resistance
R_Other	Any other resistor (e.g. Master relay, contact resistance...)

3.3.4) Validation of installation

General

The validation procedures described in this chapter do not claim to be complete. The correct execution and compliance with all given system limitations and interface descriptions as well as with standards and norms given by authorities must be proven by the aircraft manufacturer.

Check starting

Check of starting at cold weather condition. Starter interface must be executed.

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3.4) Maintenance (Line) - related information

Points of inspection	Interval Operating hours	Chapter Reference
	100 h	
Visual inspection of the electric starter assy. and wiring connection for secure fit, damage and signs of wear.	X	See current Maintenance Manual (Line) for the respective engine type and its periodical maintenance information.

3.5) Maintenance (Heavy) - related information



See current Maintenance Manual Heavy(MMH) for the respective engine type.

NOTE: Disassembly of the electric starter assy. is not allowed!
The electric starter assy. is a 100% replacement part and must not be repaired or disassembled.

3.5.1) Electric starter - removal

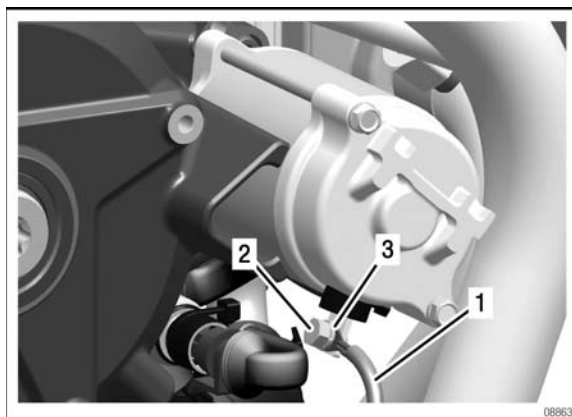
To remove the electric starter assy. the following steps are necessary:
See Fig. 4 - Fig. 6.

Preparation

- Switch the ignition/Master, ignition/Lane switches OFF
- Disconnect the battery (negative terminal)

Step	Procedure
1	Loosen the terminal screw M5x8 with washer and disconnect the positive cable of the electric starter.

TYPICAL



- 1 Positive (+) cable
- 2 Terminal screw M5x8
- 3 Washer

Fig. 4

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NOTICE

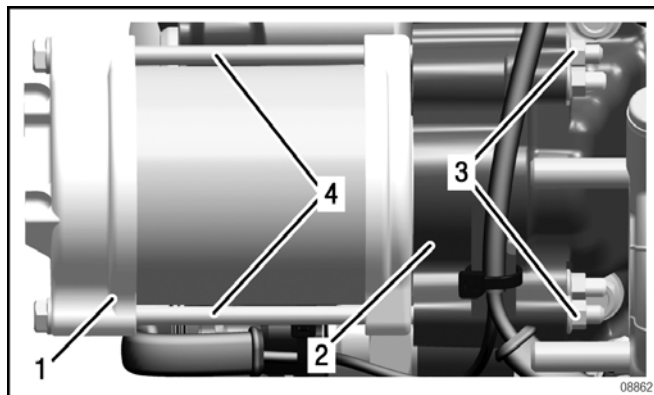
Do not tap the electric starter with a hammer, the magnets can be damaged.

NOTICE

Do not unscrew or remove the long set bolts M5!
Hold the set bolts M5x143 in position during unscrewing. If the bolts are turned, then the electric starter itself is unscrewed!

Step	Procedure
2	Loosen the hex. nuts M5 on the rear of the crankshaft housing.

TYPICAL



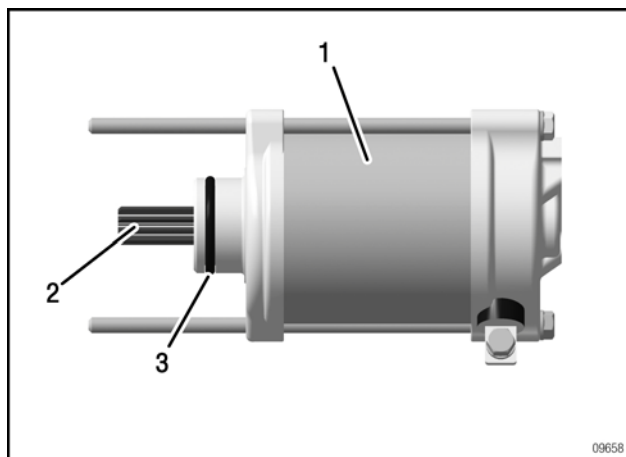
- 1 Electric starter
- 2 Crankshaft housing
- 3 Hex. nut M5
- 4 Set bolts M5

Fig. 5

Step	Procedure
3	Pull the electric starter off by hand.

NOTE: If the o-ring (Fig. 7) sticks, first pry starter gently away from engine with a slot screwdriver or plastic lever. Be careful not to damage surfaces.

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- 1 Electric starter
- 2 Rotor
- 3 O-ring

Fig. 6

3.5.2) Electric starter - installation

To install the electric starter assy. the following steps are necessary:
See Fig. 7 and Fig. 8.

Preparation

- Disconnect the battery (negative pole)
- Lightly grease the O-ring on the bearing flange and the centering bore in the ignition housing with LOCTITE ANTI SEIZE.

NOTICE

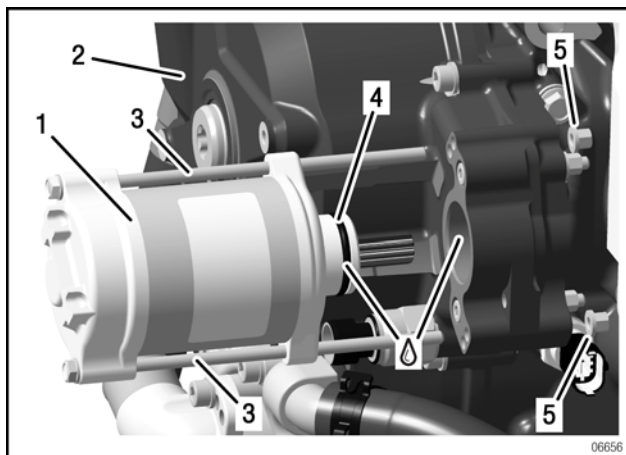
Ensure that the electric starter is in the correct installation position.
See Fig. 4.

Step	Procedure
1	Push the whole electric starter into the ignition housing. NOTE: Propeller needs to be rotated slowly to align gears.
2	Tighten the hex. nuts M5 equally. Tightening torque 6 Nm (53 in. lb.).

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TYPICAL

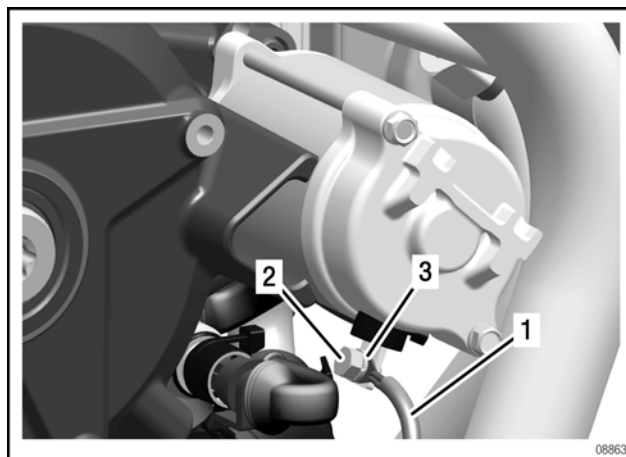


- 1 Electric starter
- 2 Ignition housing
- 3 Set bolts M5
- 4 O-ring
- 5 Hex. nuts M5

Fig. 7

Step	Procedure
3	Connect the positive cable of the electric starter. Tighten the terminal screw M5x8 with washer. Tightening torque 4 Nm (35 in. lb)

TYPICAL



- 1 Positive (+) cable
- 2 Terminal screw M5x8
- 3 Washer

Fig. 8

Step	Procedure
4	Connect the negative terminal of the on-board battery.

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3.6) Test run

In case of uninstalled engines test run can be skipped as this is covered by the mandatory test run after installation.



Conduct test run and perform leakage check. See current Maintenance Manual Line (MML) for the respective engine type, Chapter 12-20-00.

3.7) Summary

The execution of the Service Instruction - PAC must be confirmed in the logbook.

| A revision bar outside of the page margin indicates a change to text or graphic.

Translation into other languages might be performed in the course of language localization but does not lie within ROTAX' scope of responsibility.

In any case the original text in English language and the metric units are authoritative.

3.8) Inquiries

Inquiries regarding this Service Instruction - PAC should be sent to the ROTAX® Authorized Distributor of your area.

A list of all ROTAX® Authorized Distributors or their independent Service Centers is provided on www.FLYROTAX.com.

NOTE: The illustrations in this document show the typical construction. They may not represent full detail or the exact shape of the parts which have the same or similar function.

Exploded views are **not technical drawings** and are for reference only. For specific detail, refer to the current documents of the respective engine type.