



**USER'S MANUAL ENGINE  
BLACK DEVIL PRO**

**HAND START, ELECTRIC  
AND CLUTCH VERSION**

01/07/2018

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# INTRODUCTION

Thank you for choosing our engine the BLACK DEVIL PRO. We invite you to spend some time reading this manual, which will let you discover all the features of your engine. Advices on maintenance and operation will help you to have a reliable engine and to preserve your investment. Furthermore, we invite you to deliver this manual together with the engine if you sell it, so it can be useful for the next owner as well. The manufacturer and the resellers are ready to answer your questions and, if necessary, to solve every problem, because YOUR AND THE OTHER PEOPLE'S SAFETY IS THE MOST IMPORTANT THING FOR US.

## IDENTIFICATION OF THE OWNER

Owner

Address

Serial number

Reseller

Address

Owner's signature

Reseller's signature and stamp

Date of sale



# BLACK DEVIL

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CYCLE	TWO STROKE
TOTAL DISPLACEMENT	172,5 c.c.
BORE	65 mm.
STROKE	52 mm.
COMPRESSION RATIO	11:1
COOLING	BY AIR
PEAK RPM max.	8.000 / 8200 RPM
PISTON	WITH TWO PISTON RINGS
HEAD	IN ALLOY WITH HIGH PERCENTAGE OF SILICONAN HEMISPHERIC COMBUSTION CHAMBER, WITH SQUISH
CRANKCASE	MOLTEN IN G-AL SI 9 UNI 3051 ALLOY SUBSEQUENTLY TREATED AND ANODIZED AGAINST SEA SALT
CONNECTING ROD	IN COPPER PLATED STEEL 18 NI CR MO5 JOINED TO THE DRIVE SHAFT THROUGH VERY PRECISE HIGH SPEED SILVER-PLATED ROLLER BEARINGS
CARBURATOR	DIAPHRAGM
FEEDING	FOUR BLADE REED-VALVE SYSTEM CONNECTED TO THE CRANKCASE
SPARK PLUG	NGK BR9ES OR SIMILAR
SYSTEM	SIX PORT DISTRIBUTION
CYLINDER	IN ALLOY WITH NIKASIL COATING
REDUCTION	WITH POLY V BELT AVAILBLE IN 1:2.2— 1:2.3—1:2.5—1:2.6— 1:2,88
CYLINDER HEAD TEMPERATURE	MAX TEMPERATURE 200°C MEASURED UNDER SPARK PLUG EXHAUST GAS TEMPERATURE NOT EXCEEDING 590 C°

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# BLACK DEVIL PRO

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ENGINE MOUNTING	By 4 SHOCK ABSORBING RUBBER MOUNTS
ROTATION	COUNTERCLOCKWISE
DRIVE SHAFT	IN 18 Ni Cr Mo5 WITH 5 THERMIC TREATMENTS ON EVERY COMPONENT
ROLLER BEARINGS	FIT FOR HIGH SPEED CLASS C3
SEAL RING	IN VITON WITH VERY HIGH RESI STANCE AND LONG DURATION
RECHARGING SYSTEM	SECOND COIL WITH CHARGE REGULATOR available for LIFE PO battery or LEAD battery
FUEL	MIXTURE 2,2% - 2.5% WITH SYNTHETIC OIL, SUGGESTED BRANDS: MALOSSİ 7.1—WLADOİL K2T—ELF 2T MOTO
OIL	2,2% - 2.5% TOP QUALITY OIL 100/100 SYNTHETIC
ENGINE WEIGHT	<b>HAND START KG 13,95</b> <ul style="list-style-type: none"><li>• COMPLETE WITH AIRBOX, NEW EXHAUST, AND FOUR RUBBER MOUNTS</li></ul> <b>ELECTRIC START KG 14,45</b> <ul style="list-style-type: none"><li>• COMPLETE WITH AIRBOX, NEW EXHAUST, AND FOUR RUBBER MOUNTS</li></ul> <b>HAND START WITH CLUTCH KG 14,90</b> <ul style="list-style-type: none"><li>• COMPLETE WITH AIRBOX, NEW EXHAUST, AND FOUR RUBBER MOUNTS</li></ul>

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# MAIN TORQUES

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MAIN TORQUES	Kg. m	(Nm)
NUTS TO FIX THE HEAD	2,5	25
NUTS TO FIX HALF-CRANKCASE	2,5	25
BOLTS TO FIX THE BACK FLANGE TO THE CRANKCASE	2,0	20
NUTS TO FIX THE PINION TO THE FRONT PART OF THE DRIVE SHAFT	4,5	45
NUTS TO FIX BACK PART OF DRIVE SHAFT TO IGNITION HANDWHEEL	3,5	35
GAP BETWEEN COIL AND HANDWHEEL	0,4 mm	

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**IMPORTANT:** remember that the battery of the electric start should be recharged before starting the engine.

In case LiPo batteries are used, detach the recharge wire (yellow) and follow all safety precautions for LiPo batteries use.



## ASSEMBLY:

You can install the engine on the frame by using 4 rubber mounts of 30 mm between the back flange and the engine mount.

To attach the propeller use only bolts of class 10/8 (100 Kg) and make sure that their length is enough to exit from the reductor-pulley. Tighten the 6 bolts M8 in a cross, at 1.5 Kg.m.(15Nm). Re-check the torque of the bolts after the first hour of engine's working.

We suggest not to use a variable pitch carbon prop, because the big hub pushes the prop too forward, with possible damages to pulley and bearings.

For the connection between the carburetor and the fuel tank use a proper hose of the right diameter (1,2 times the max. expenditure per hour, that means sending 11 liters/hour). The length of the fuel line must not be more than 80 cm.

It is advisable to install a manual primer bulb to get the fuel to the carburetor before for starting. This device will allow the fuel to arrive to the carburettor, protecting in this way the battery.



### IMPORTANT NOTES

DO NOT try to start the engine without the propeller.

DO NOT start the engine with loose bolts or parts, since this can cause the detaching of the propeller, the ovalization of the propeller holes, the damage of the electric start and the breakage of the rubber mounts.

### IMPORTANT!

**BEFORE FLYING CHECK ALWAYS EVERY PART OF YOUR CRAFT, FROM ENGINE TO FRAME.**

Verify that there are no damaged electric wires, that there are no leaks from hoses, tank, carburettor or engine's crankcase, that the propeller is not damaged or loose, that the exhaust-pipe has no cracks, that the frame is not bent or broken because of falls, that rubber mounts are not cracked, that the reduction belt is not loose and every bolt is tight. Finally you can start the engine, leaving it to warm up at a speed of 2.200 to 3.000 rpm with head temperature at least 120 °C.

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## FUEL

Use for the mixture only premium gas for cars 98 octane, together with good-quality, synthetic oil for mixtures at a quantity of 2,2% - 2,5% .(DO NOT USE MIXTURE ALREADY DONE AT PETROL PUMPS).

When you prepare the mixture, make sure that the can has not dirt or water in it, put always the oil first and mix thoroughly.


Never run the engine without the air-filter, because dirt and dust raised by the propeller can damage it.

## ADJUSTMENT OF THE CARBURETTOR

The carburettor has two mixture adjustment screws, 1 marked L adjusting low speed and 1 marked H for high speed.

In order to make the adjustment, gently tighten clockwise then unscrew:

CARBURETTOR SETTINGS	BLACK DEVIL LIGHT engine ( all configurations)
L screw	30 / 35 minutes
H screw	1 hour + 30/40 minutes

 These adjustments can be different on the basis of weather conditions and flight altitudes.

Ideal mixture is reached when the insulator of the spark plug is coffee brown; if the colour is black, the mixture is too rich, therefore turn screw H clockwise 1/8 round per time. If the spark plug is grey/white, the mixture is lean, therefore turn screw H and L counterclockwise always 1/8 round per time. If you can't calculate 1/8 round, you can use as an example a watch and turn 5 minutes per time. Remember that if the mixture is too lean, THE PISTON CAN SEIZE. You can see better the colour of the spark plug by keeping the engine for 20 seconds at maximum speed and switching it off suddenly without letting it slow down. Once you have found the perfect mixture do not change it unless you change flight place or climate conditions, since register screws can be damaged by continuous adjustments.

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# RUNNING-IN

All CORS-AIR engines, before being delivered, are subject to a severe quality-check, in order to verify if all the components respect the fixed parameters, but a further running-in is anyway necessary.



A GOOD RUNNING-IN WILL PROLONG THE LIFE OF YOUR ENGINE.

- Go to a quiet place, put a thick rubber carpet under your craft to avoid that stones or other things damage the propeller by putting it on earth and let the engine work at a speed of 2500 rpm for 5 minutes, then regulate speed at 3000/3500 rpm for 15 minutes, then at 4000 rpm for other 15 minutes.
- Switch off the engine and check that there are no loose nuts or bolts and that every component is ok.
- **BE CAREFUL NOT TO TOUCH HOT PARTS (POWER UNIT AND EXHAUST PIPE).**
- Start the engine again and take it step by step to 4000 rpm for 5 minutes, then accelerate to 4500 rpm for 15 minutes.
- During the first 10 hours, do not subject the engine to extreme efforts and speed.
- Also during normal use excessive loads (ex. tandems with passenger) can force the engine with possible damages to the engine itself.
- **ALWAYS CHECK** at sight your craft before and after every flight, for loose parts or damage.
- During the run-in period vary the power often for a proper piston ring setting.



# MAINTENANCE

**AFTER THE FIRST HOUR OF RUNNING, CHECK THE BELT TENSIONING AND IN CASE RE-TENSIONING IT.**



- AFTER THE FIRST 2 HOURS, TIGHTEN HEAD NUTS (IN CROSS ORDER) WITH A TORQUE WRENCH AT 2.5 Kg.m (25Nm).
- AFTER THE FIRST 3 HOURS OF ENGINE RUNNING MAKE A NEW BELT CHECK UP, **AND IN CASE RETENSIONING IT AT 380/400 Hz.**

## - Every 20 hours:

- Check the condition and gap (0.7 mm) of the spark plug
- Clean the air-filter, the carburettor filter placed at the end of the fuel pipe and the filter of the fuel tank
- Check the torque of every bolt
- Check the tension and condition of the reduction belt
- Check fuel lines and wiring
- Check that the cord of the starter has no abrasions

## - Every 50 hours

- Same controls of the 20 hours and furthermore:
- Check the torque of the engine's crankcase nuts
- Change spark plugs
- Change the petals of the reed valve
- Check the reduction belt and the play of the pulley and change them in case of need
- Check the conditions of the starter gears (version with electric start)
- Once a year (independently from flight hours) change the diaphragm of the carburettor.
- N.B. It is advisable to keep records of all maintenance in a log book for the engine.
- It is also advisable to install an instrument (CHT) to control the head temperature at sight.



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## TENSION OF THE REDUCTION BELT DRIVE - USE CAUTION



Attention: a belt which is “over tensioned” can do permanent damage to the bearings inside of the pulley hubs and drive shaft.  
Therefore we strongly suggest for you to follow carefully these instructions.  
Correct belt tension is from 380 to 400 Hz.

Before adjusting the belt take a felt pen or marker and make a small sign on the cam shaft and on the front of the reduction plate.

This is your Zero or start point and from here you will be able to clearly see how much you move the eccentric tensioning cam in relation to the reduction plate.

Remember “these are Fine adjustments” and we suggest not to rotate the cam any more than 1 mm per adjustment. After each adjustment you can try to start the engine and check the result.

If the engine does not start well then it usually means the belt is still too loose and is slipping - in this case repeat the operation by tensioning the belt another 1 mm.

Consider that if the belt slips a little, but the engine still starts fine, then the tension is correct. Belt tension always increases automatically when the engine is running because of thermal expansion in the pulleys.

Once you have found the correct tension , do not adjust it any more. In case of doubts please contact your paramotor dealer – or CORS-AIR.

### To adjust the belt do the following:

- Loosen the safety bolt located high up behind the reduction mounting plate and the side bolt. Once these are loosened the you can turn the cam with a n.27 mm size wrench - careful to observe the 1 mm increments.
- Once you have finished turning the cam remember to re-tighten the safety bolts, first the back bolt, by keeping firm the cam with the wrench, and then the side bolt.

### **IGNITION (ONLY FOR ENGINE WITH HAND START)**

In case the coil and/or the handwheel must be changed, it is compulsory to turn to your dealer or to trained personnel, even if this operation can appear simple at the first sight, since the timing of the engine, if wrong, can change the performance and cause damage to the engine. To check the timing: the distance between the coil and the flywheel magnet is 0,3/0,5 mm.



# WARRANTY

**CORS-AIR engines are manufactured with top-quality material, therefore warranty is valid also for their accessories.**

**Warranty includes spare parts and labour, transport excluded.**

**For any defective part, please contact your reference authorized dealer or Cors-Air directly, so that you can get proper indications about how to handle it.**

## **DURATION OF WARRANTY**

**1 YEAR beginning from the date of sell or exit from CORS-AIR**

## **WARRANTY IS VOID IN THE FOLLOWING SITUATIONS:**

- Alterations to the engine not approved by Cors-Air.
- Wear & tear of components of the engine due to the instructions within the product manual not being adhered to.
- Accidental falls or dropping of the engine or its components.
- Overheating and seizure of the engine due to prolonged high speed running of the engine, running with excessive loads, running with inadequate loads, running with insufficient oil in the petrol (for a wrong tuning of the carburettor) or running with petrol only (oil mixture omitted).
- The presence of dirt, sand or foreign bodies in the carburettor of the engine.
- Corrosion through bad storage of the engine or inadequate preparation for storage of the engine.
- Running the engine without an air-filter fitted to the carburettor.
- Miss-assembly of engine parts or components not assembled by Cors-Air but by the manufacturer of the paramotor or by the end user, supplied disassembled for packing and transport purposes, included all electrical or electronic components.
- Corrosion of the engine or components emanating from stone chips or any other impact or abnormal stress damage.
- Work other than the maintenance set out in the product manual having been carried out on the engine by anyone other than Cors-Air or official dealers.
- Incidental or consequential loss or damage.
- Service bulletins from Cors-Air not having been adhered to.
- Engine used for racing use.

**CORS-AIR AND ITS RESELLERS REMAIN AT YOUR DISPOSAL FOR EVERY INFORMATION AND ADVICE ABOUT THE USE OF THE ENGINE.**



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# TROUBLE SHOOTING

## THE ENGINE DOES NOT START

Please check:

- switch on-off
- cable of the spark plug
- correct spark plug gap
- all the connections of the electric plant
- that fuel arrives correctly from the tank to the carburettor

## FLOODED ENGINE

- Dismantle the spark plug
- dry it well
- before re-assembling it, let the propeller turn slowly 2/3 times.

## THE ENGINE DOES NOT HOLD IDLE SPEED OR HAS AN IRREGULAR SPEED

- Clean and adjust the carburettor.
- Check the reed valve petals are closing completely.
- Hold the reed up to a light and you should not see any light past the petal seating area.

## THE ENGINE CANNOT REACH MAXIMUM SPEED

- Check cable pulling throttle fully open.
- Check that there is no dirt in the carburettor or tank-filter nor restrictions in the fuel pipe, due to too tight curves, or air bubbles.
- Check the spark plug; is it's worn, change it with one of the same brand and same heat range.
- In case the head is dismantled to be decarboned, change both the head gasket and the cylinder gasket.



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## **SOME FINAL IMPORTANT ADVICE**

NEVER switch on the engine with people near propeller, or to sides.

The BREAKAGE of a propeller can cause very severe hurts even several meters away.

DO NOT keep engine at peak rpm after the take off, except for the absolutely necessary time and for emergencies (obstacles or sudden wind).

If you use big propellers, REMEMBER that cooling is not perfect flying at high speed, so keep under control the temperature of the engine with proper instruments (CHT).

In addition, dismantle the propeller at regular intervals and check that it is perfectly balanced, since an unbalanced propeller, even slightly, creates micro-vibrations which are not felt by the pilot, but can damage seriously parts of the engine with consequent breakages.

Please do NOT forget that the propeller has mass and a considerable inertial moment, so it's advisable not to vary suddenly the RPM of the engine, both in flight and on the ground.

These sharp and violent stresses could cause damages to the reduction, to the engine, to the belt and also possible deformations to the fixing holes of the propeller.

Once you have found the perfect carburation, DO NOT modify it unless you change flying place going to much higher or lower altitudes or unless climate and temperature are very different from the ones where you fly usually.

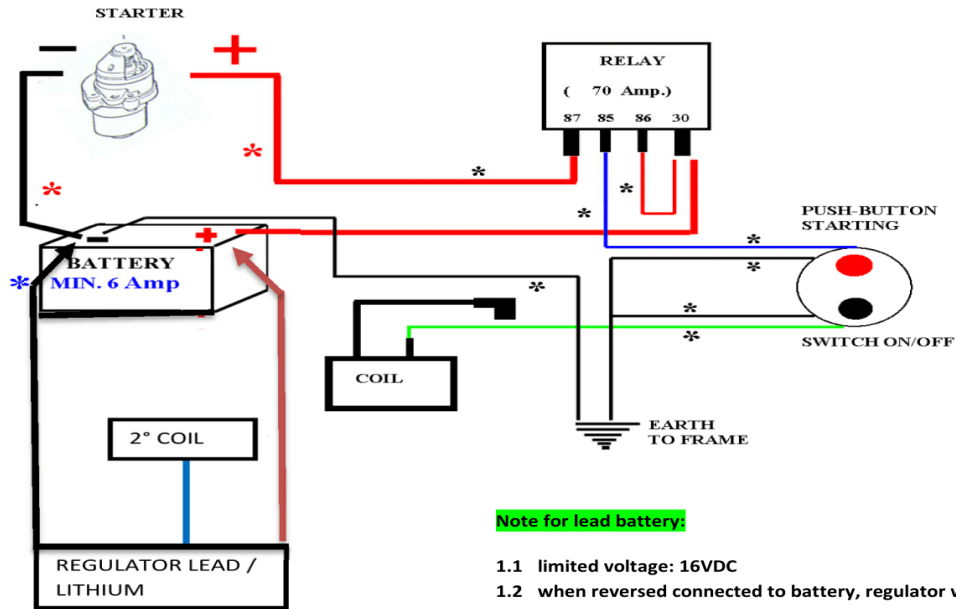
**DO NOT FLY in bad weather conditions, you'll fly the day after.**

**REMEMBER: FLIGHT IS FOR FUN, NOT FOR RISKING YOUR LIFE! HAVE A GOOD FLIGHT AND ENJOY YOURSELF.**



# ELECTRIC SYSTEM WITH RECHARGING KIT

**N.B.** \* CABLE SECTION MIN. Ø 4 mm. \* CABLE SECTION MIN. Ø 2 mm.

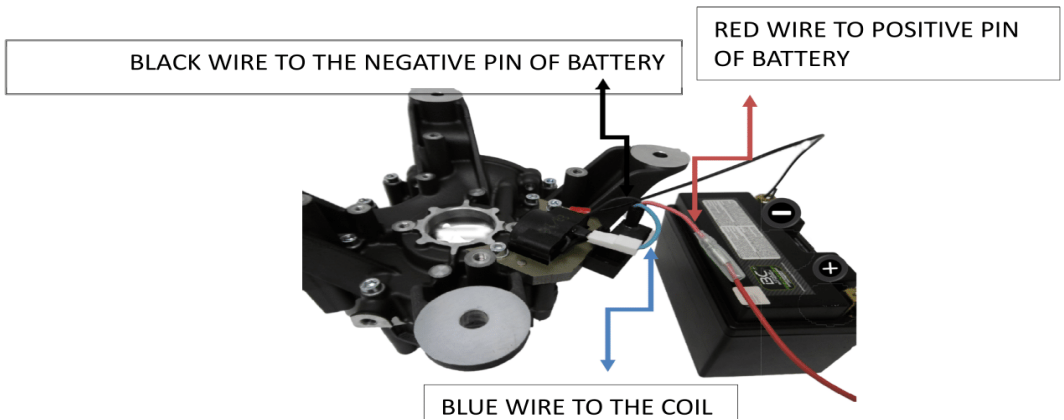


### Note for lead battery:

- 1.1 limited voltage: 16VDC
- 1.2 when reversed connected to battery, regulator will fail
- 1.3 when regulator used without battery it will fail
- 1.4 unit temperature working range: -10°C to 50°C (on unit surface)

### NOTE FOR LITHIUM BATTERY:

- 1.1 LIMITED VOLTAGE: 13.5÷14.5VDC
- 1.2 REGULATOR MUST BE DISCONNECTED BY BATTERY WHEN ENGINE STOPPED
- 1.3 WHEN REVERSED CONNECTED TO BATTERY, REGULATOR WILL FAIL
- 1.4 WHEN REGULATOR USED WITHOUT BATTERY IT WILL FAIL
- 1.5 UNIT TEMPERATURE WORKING RANGE: -10° C TO 50° C (on unit surface)

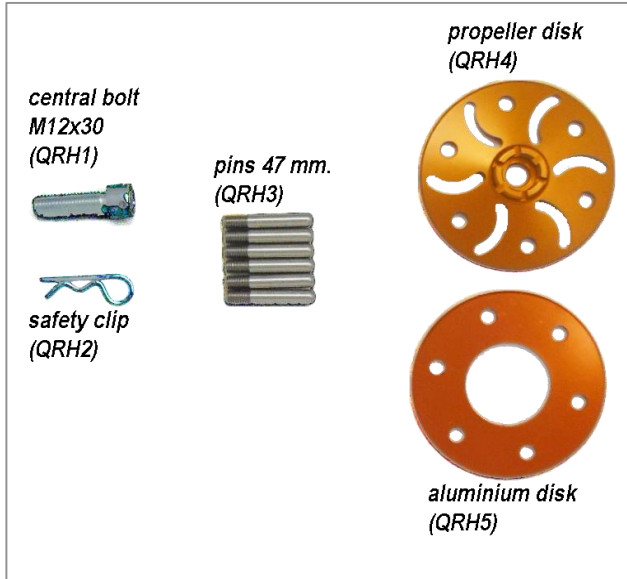


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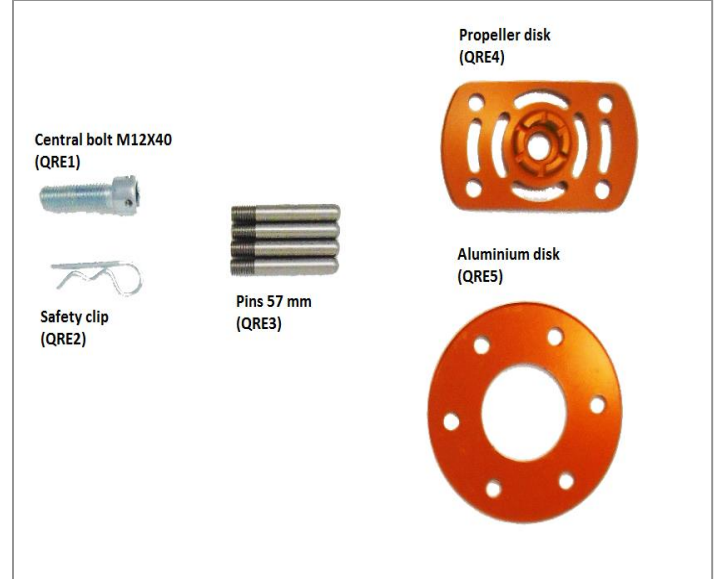


# Propeller quick release system

## HELIX model



## EPROP model



### Instructions for assembly:

- Put some light or medium Loctite on the 4/6 pins and tighten them completely
- Always use the aluminum disk
- Insert the propeller
- Insert the propeller disk
- Insert the central bolt and tighten it at about 1,5 Kg (15Nm), checking that the clip can be inserted
- Insert the safety clip



