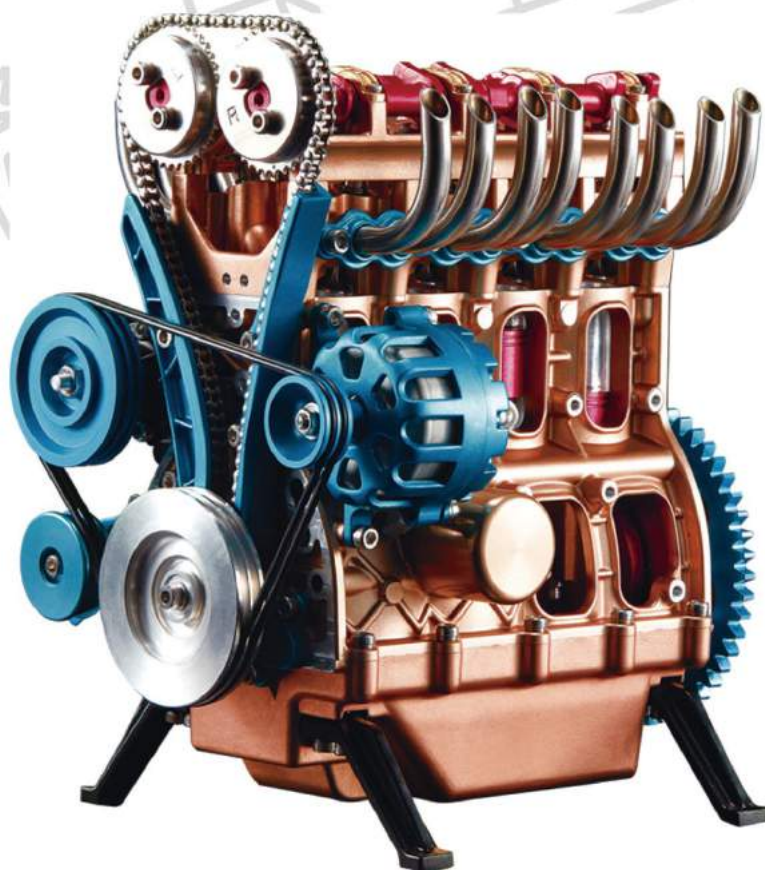


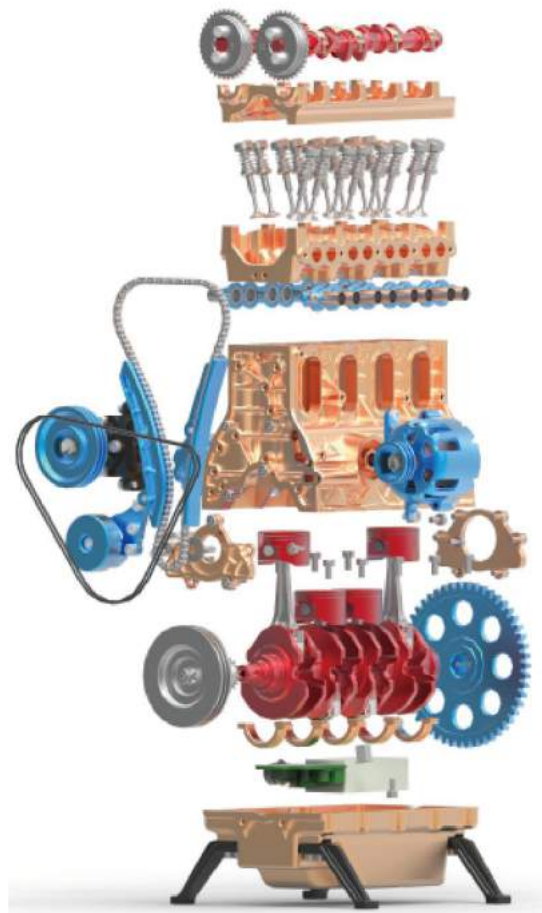
土星工匠师[®]



组装手册

PRODUCT DESCRIPTION





Product name: in-line 4-cylinder overhead camshaft engine

Product model: DM13-L4-T

Main materials: anodic aluminum oxide + stainless steel

Charging voltage: 10-20V DC

Battery capacity: 700mAh*2

Assembly difficulty: ★★★

Product standards: GB/T9254-2008

GB/T17626.2-2006

Quality grade: A

Safety Tips

1. Some safety awareness is required to use this product, and improving safety awareness is also one of the functions of this product;
2. This product is not intended for children below 8 years, and adult guidance on assembly is recommended for children below 10 years;
3. Use assembly tools rationally, assemble the parts in strict conformity with the instruction manual, and avoid forcible handling to avoid scratches; keep sharp points of tools or parts away from the eyes to avoid contusions;
4. This product is made up of metallic parts mainly, and has a certain level of hardness and a certain weight; please place it properly to avoid bodily injuries;
5. During mechanical movement, do not put a finger or any other part of the body within the movement range to avoid contusions;
6. When any mechanical part is turning, do not put a finger or any other part of the body beside it to avoid entanglement and contusions;
7. Wire connectors must be connected according to the marks specified in the instruction manual to avoid short-circuit or failure arising from wrong connection;
8. Charge, discharge and place the battery as required; it is advised to replace the battery when it has not been used for 3 months or more;
9. Do not prevent any part from running forcibly in any form; to do this, turn off the power directly;
10. To refit this product, please pay attention to the relevant part parameters, and avoid using any high-power electric part that may result in an accident.

Statement

1. This product is subject to change. If there is any difference between any part and this instruction manual, please refer to the actual package, or consult our after-sales department;
2. This product is a patented product developed independently by us, and should not be used for any other commercial purpose or any illegal purpose by any individual or organization without our written consent.

Assembly Instructions for Teching Craftsman

- “Teching Craftsman” is a metallic assembly model other than a toy for playing only. It serves to improve hands-on skills of children and youngsters, and let them learn common industrial knowledge mainly. By keeping using our products, the user can reach the goal of assembly — refitting — creation in stages.
- The requirements for product assembly are as follows:
 - ♦Perform assembly rigorously and orderly, keep the tabletop tidy, look at drawings carefully, and pay attention to safety;
 - ♦If you have any doubt when adjusting any assembly clearance or tightness after the completion of assembly, please refer to our website or WeChat public account;
 - ♦The user is encouraged to modify part defects or fitting clearances, and apply lubricant under adult supervision to further improve assembly;
 - ♦The user is encouraged to use simple material removal tools (file, sandpaper, etc.) under adult supervision;
 - ♦The user is encouraged to modify or generally refit parts of this product to enter the refitting stage as early as possible;
 - ♦The user may disassemble this product and put it in the package again according to the parts list attached hereto;
 - ♦If any part is lost, please inquire of or purchase it from us (Teching store on www.taobao.com);
- If you are willing to share with us, after completing product assembly tasks of different difficulty levels at different stages, you will receive corresponding gifts, and have a chance to win our special medals and take part in relevant events.

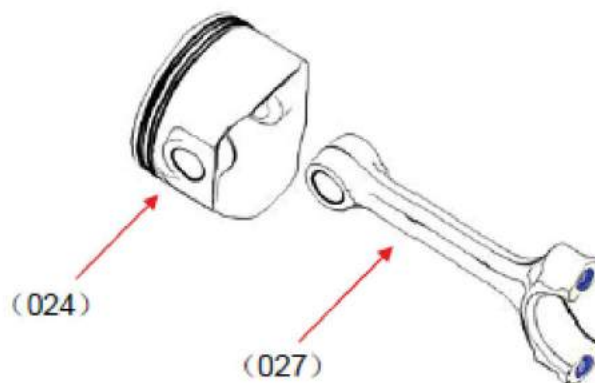
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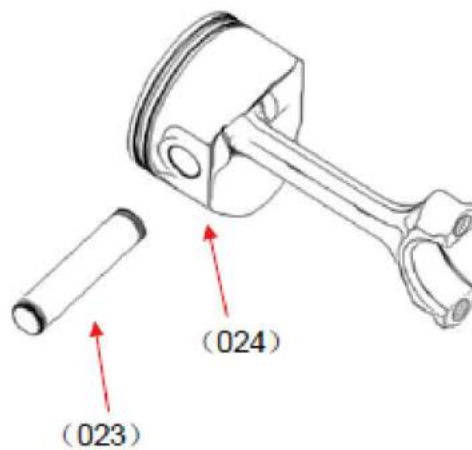
I. Assembly of in-line 4-cylinder engine

1. Crankshaft connecting rod assembly

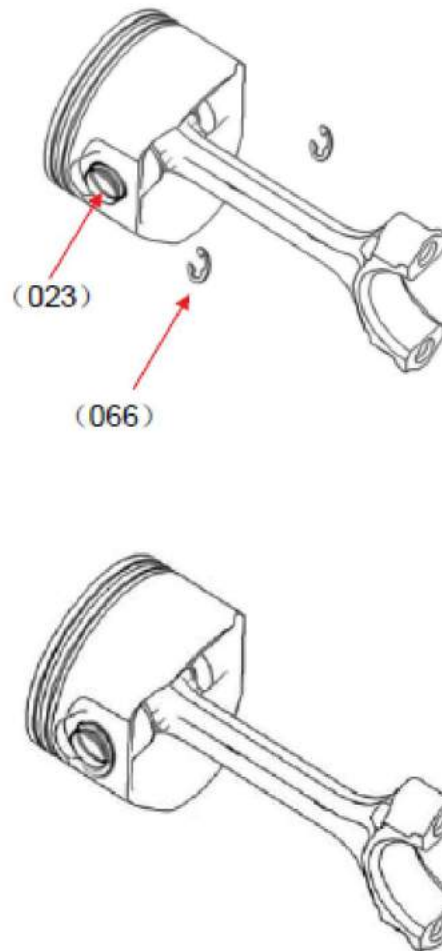
1.1 Assembly of piston mechanism



1.2 Mounting of piston pin

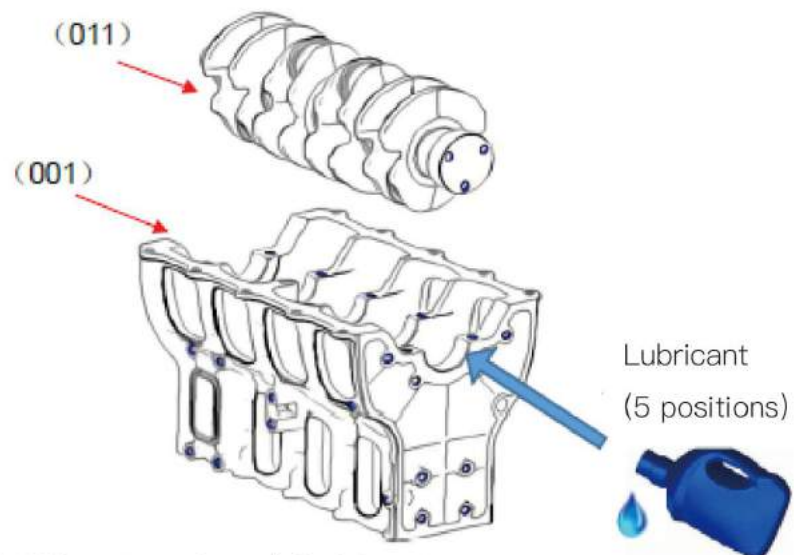


1.3 Mounting of snap ring

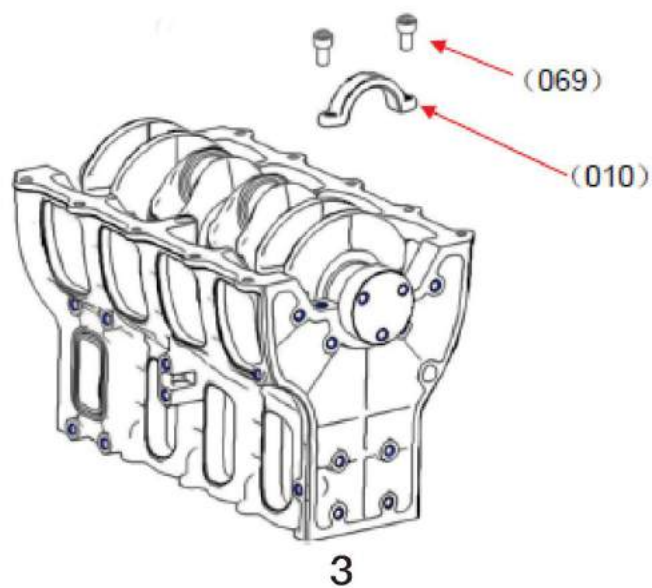


(Assembly and connection between piston and piston rod completed)

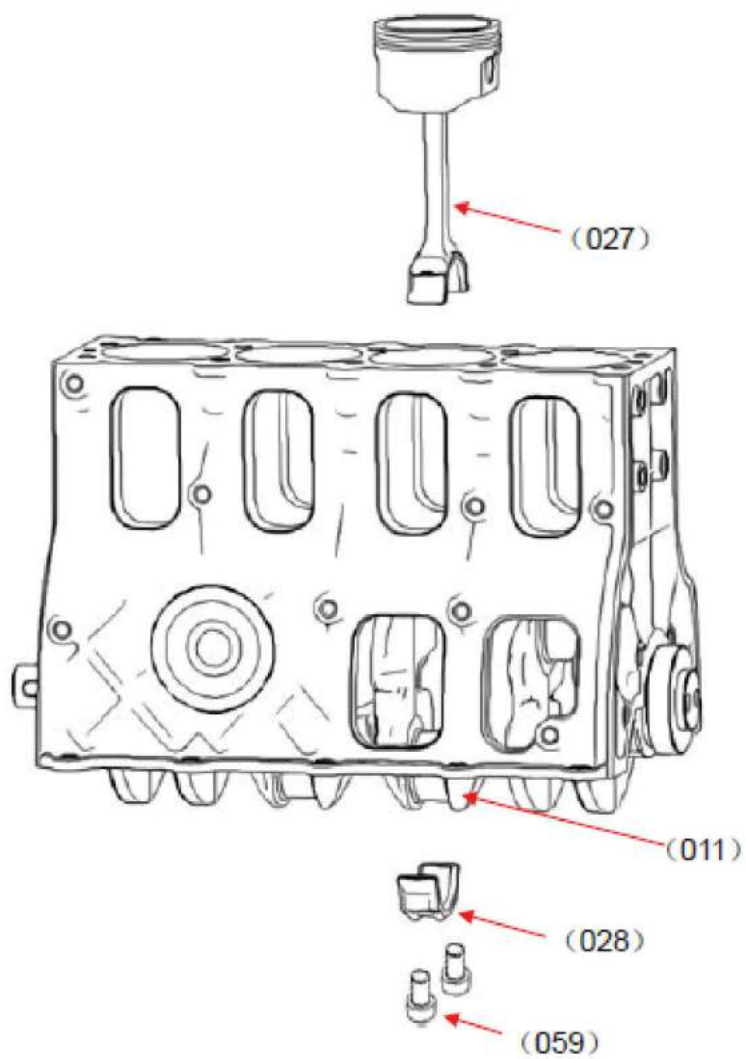
1.4 Assembly and connection between crankshaft and cylinder block

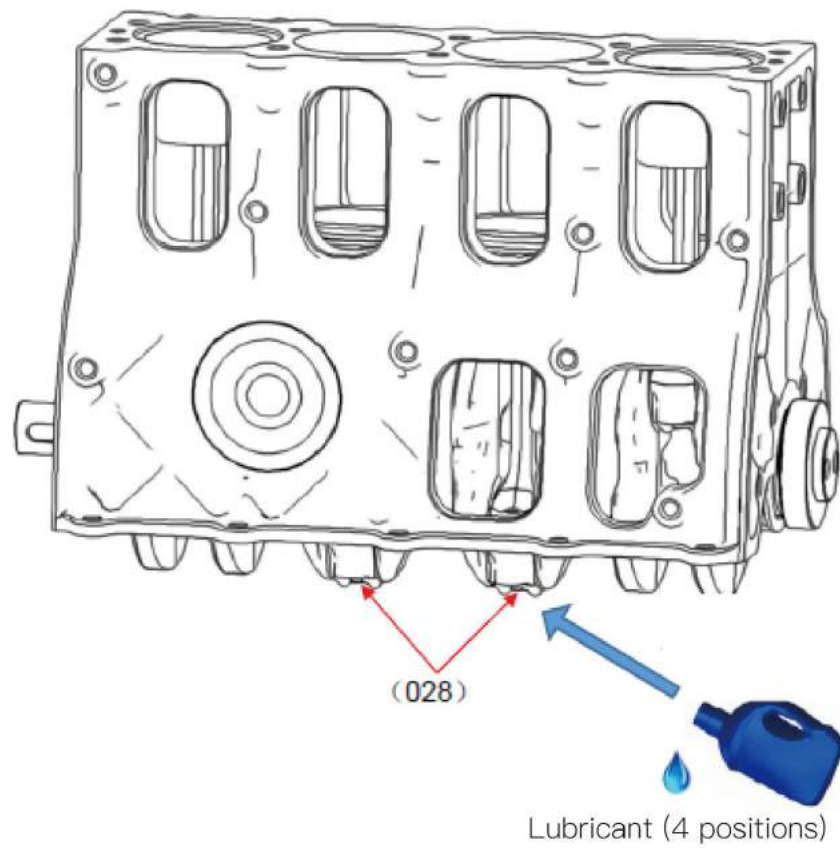


1.5 Mounting of crankshaft bearing



1.6 Assembly and connection between piston rod and crankshaft (4 groups of pistons in total)

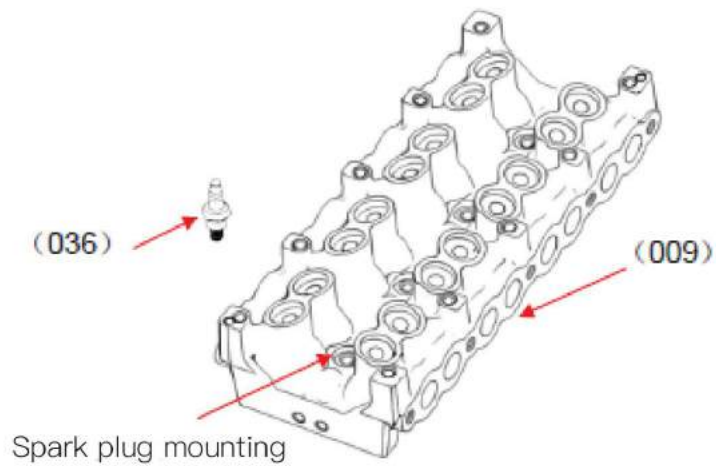




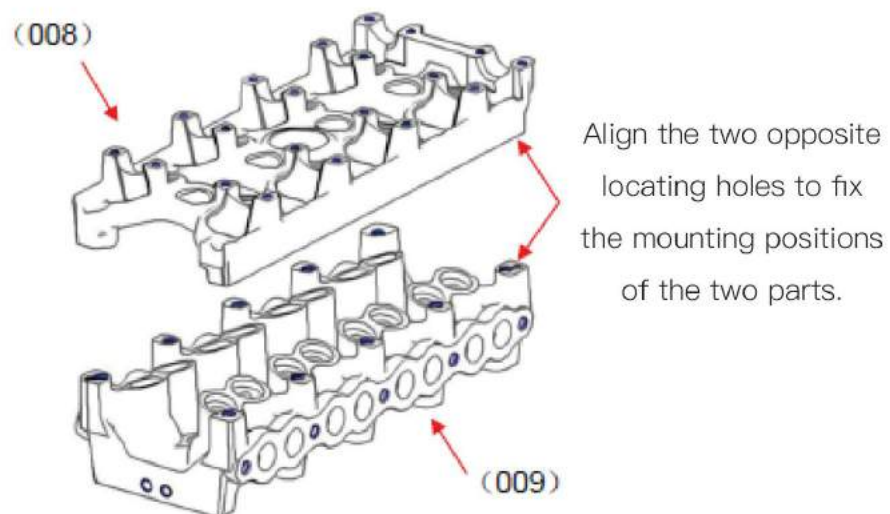
(Assembly and connection between piston rod and
crankshaft completed)

2.Cylinder assembly

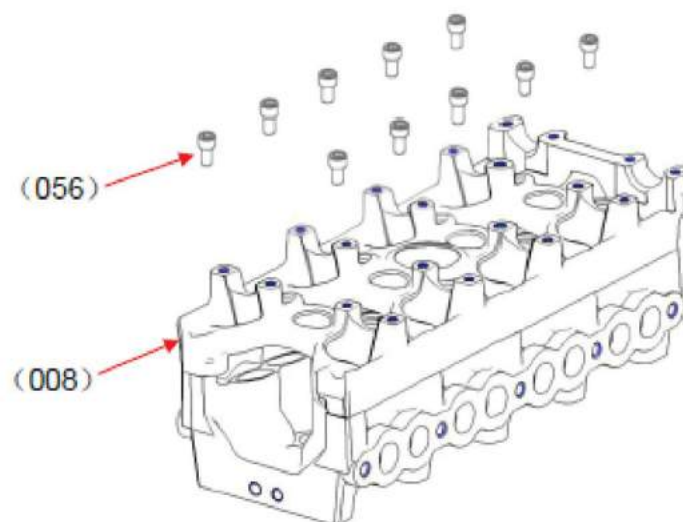
2.1 Mounting of spark plugs (4 in total)



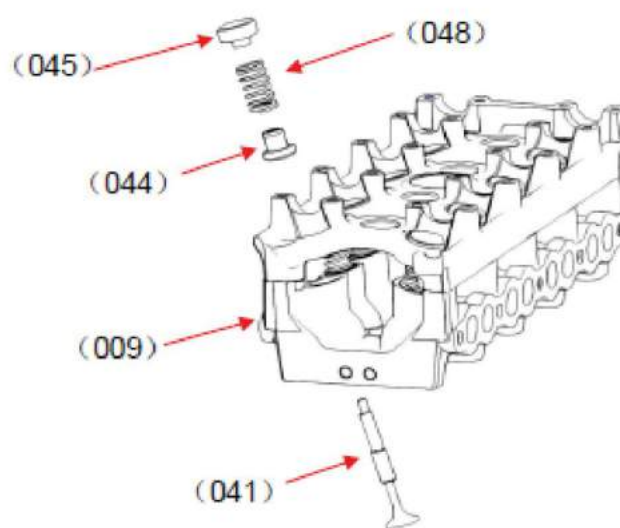
2.2 Mounting of cam seat



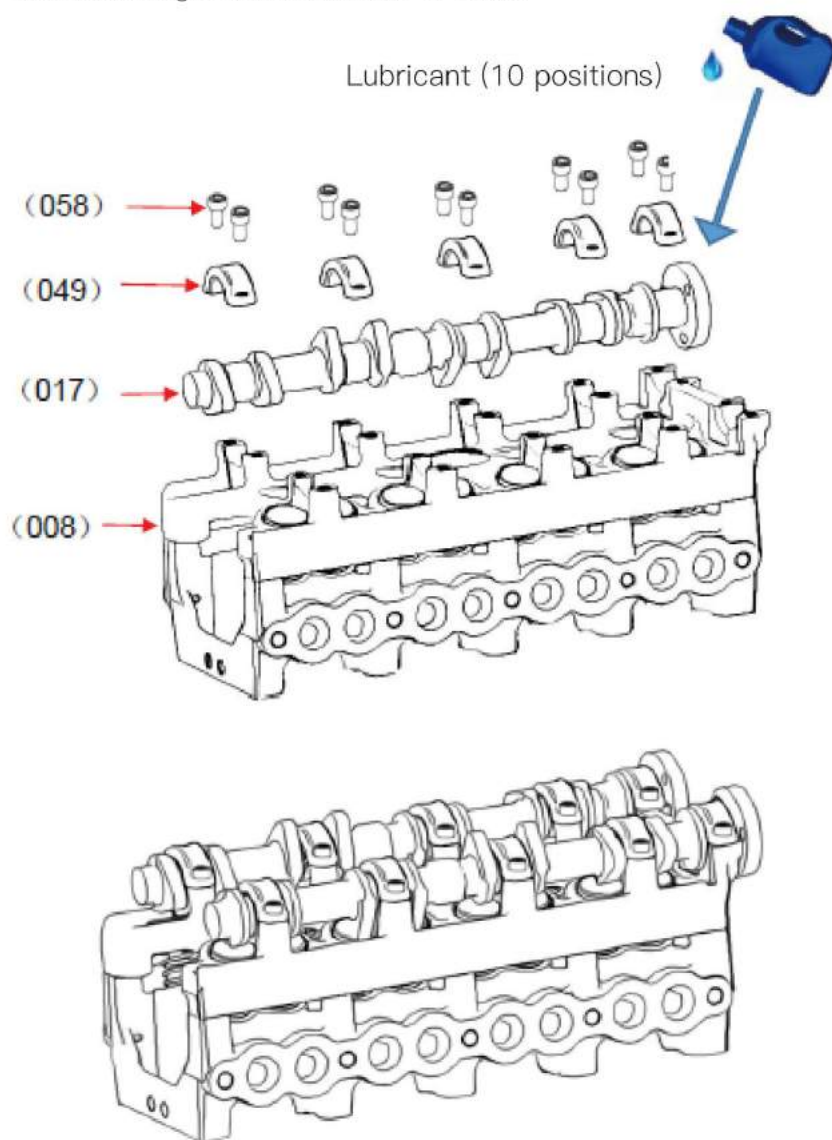
2.3 Mounting of screws



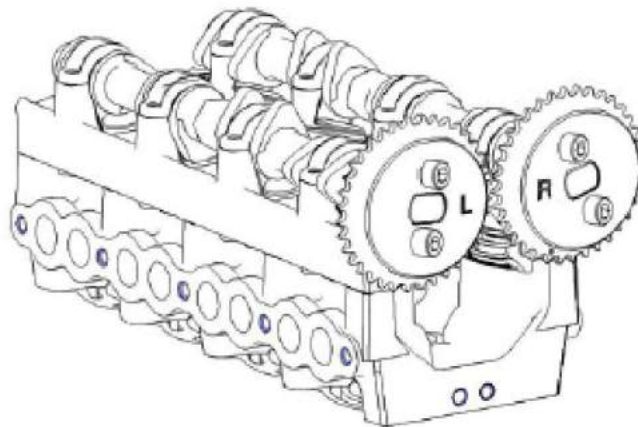
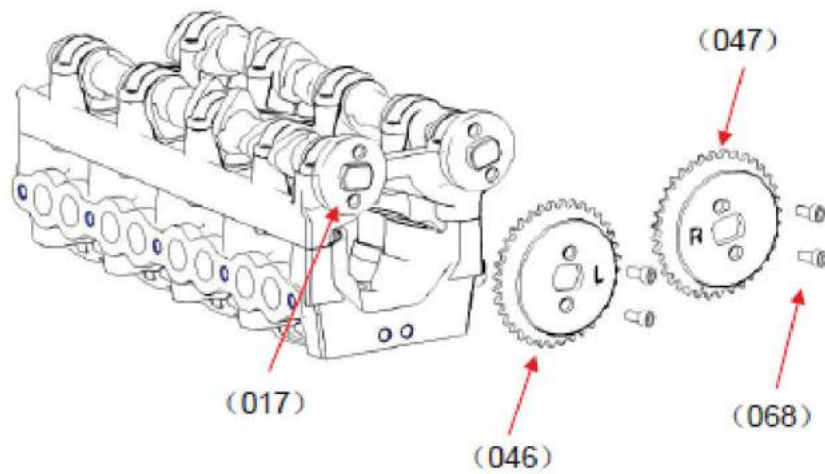
2.4 Mounting of valve assembly (16 groups of valves in total)



2.5 Mounting of camshafts (2 in total)



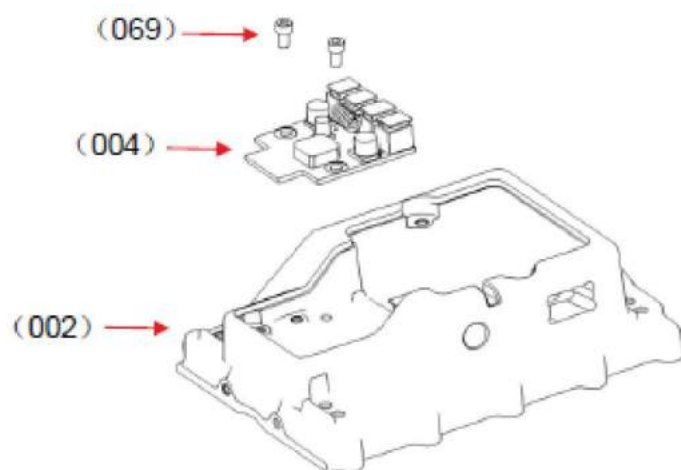
2.6 Mounting of cam timing sprocket



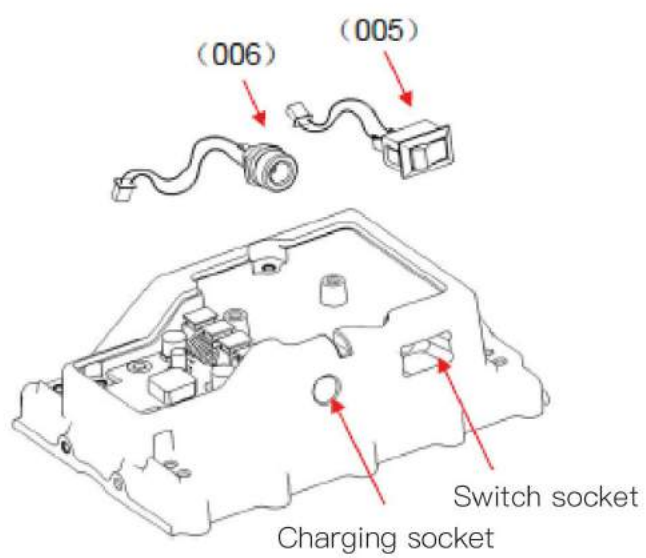
(Mounting of cam timing sprocket completed)

3.Circuit system

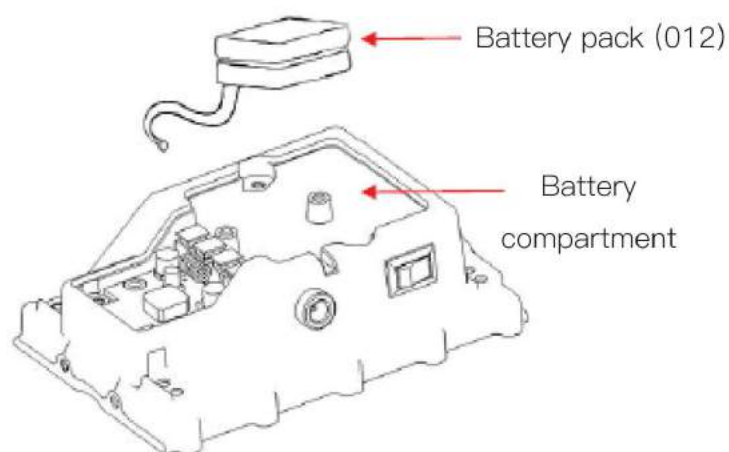
3.1 Mounting of circuit board



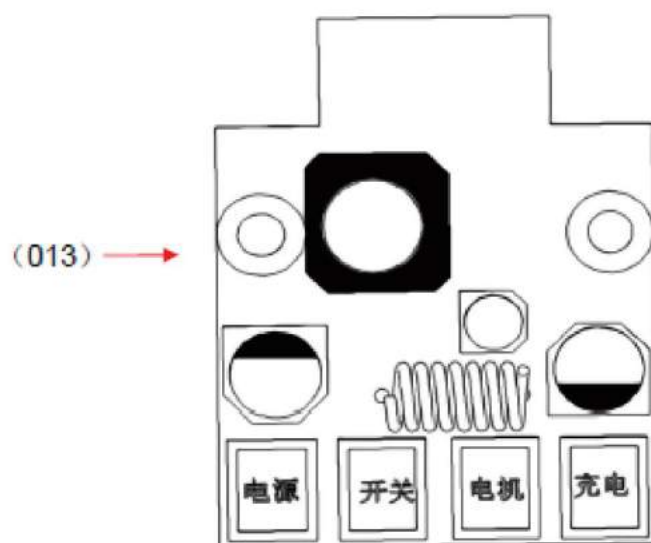
3.2 Mounting of switch and charging plug



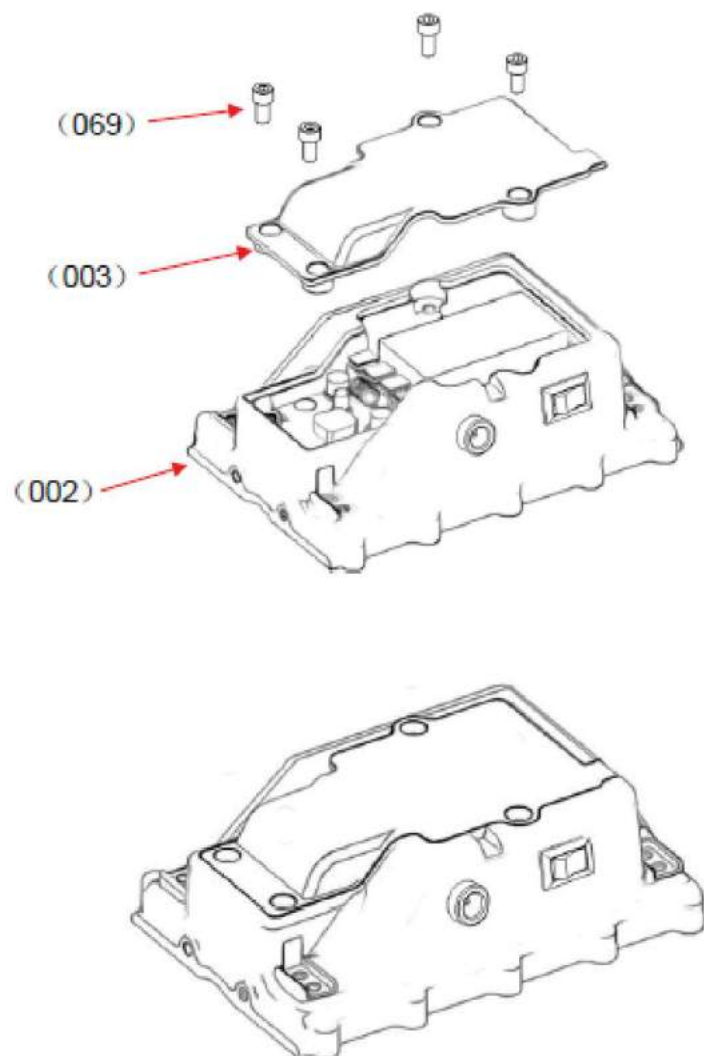
3.3 Mounting of battery pack



3.4 Connection of wiring plugs (Insert the charging, switch and battery plugs into the corresponding sockets on the circuit board in turn carefully.)

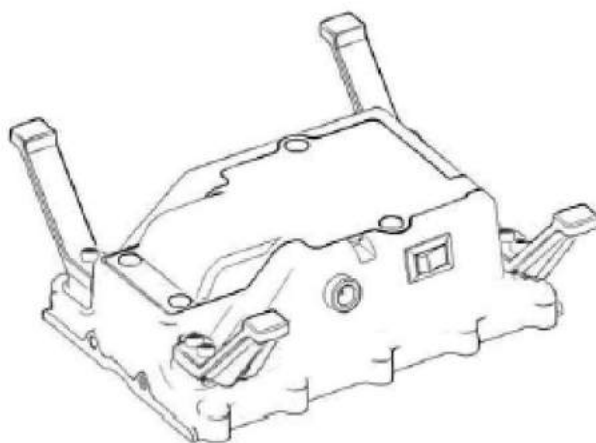
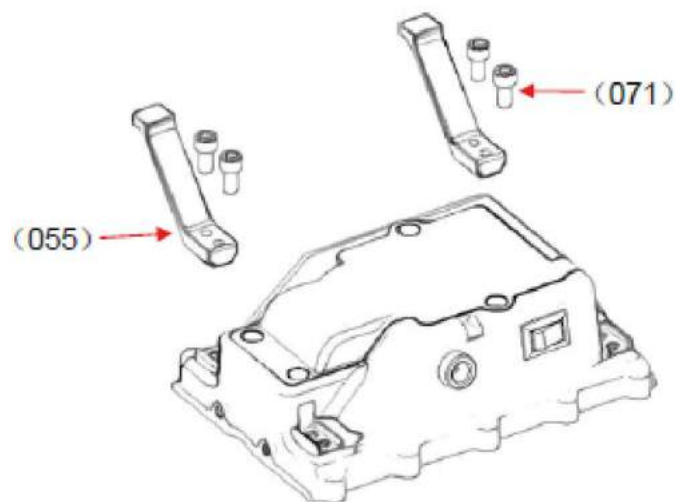


3.5 Mounting of battery cover



(Mounting of battery cover completed)

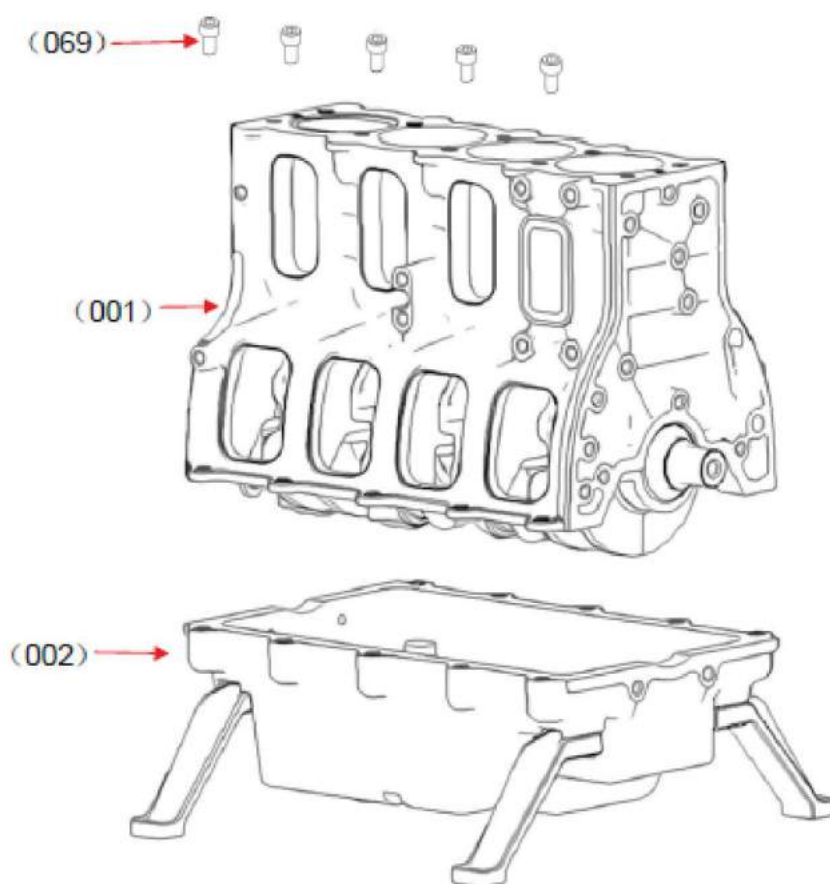
3.6 Mounting of engine mounts (4 in total)



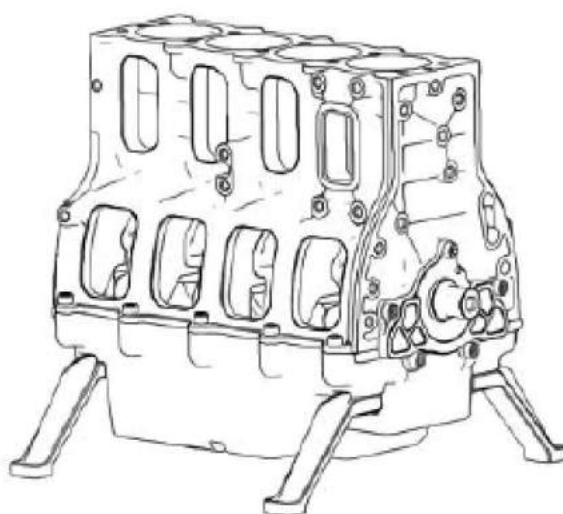
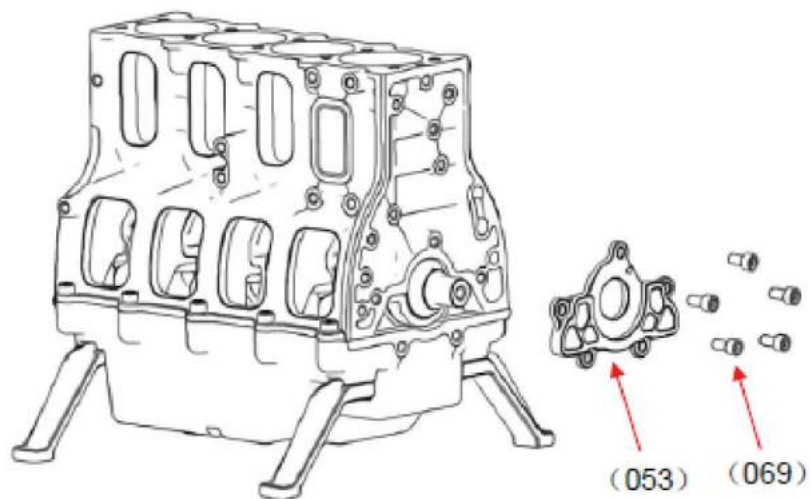
(Mounting of engine mount completed)

4. Engine body assembly

4.1 Cylinder block and base assembly (10 screws on both sides in total)

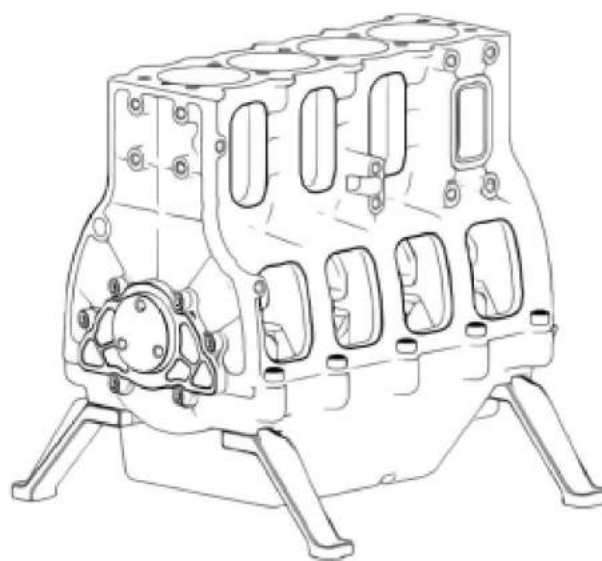
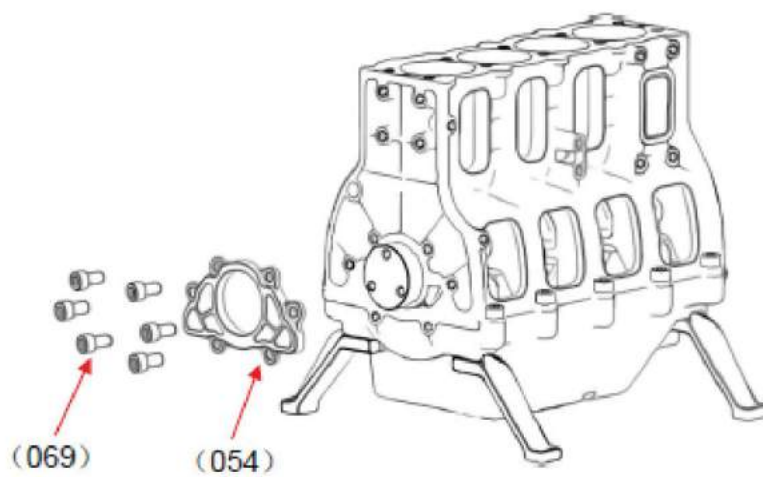


4.2 Mounting of rear end cap



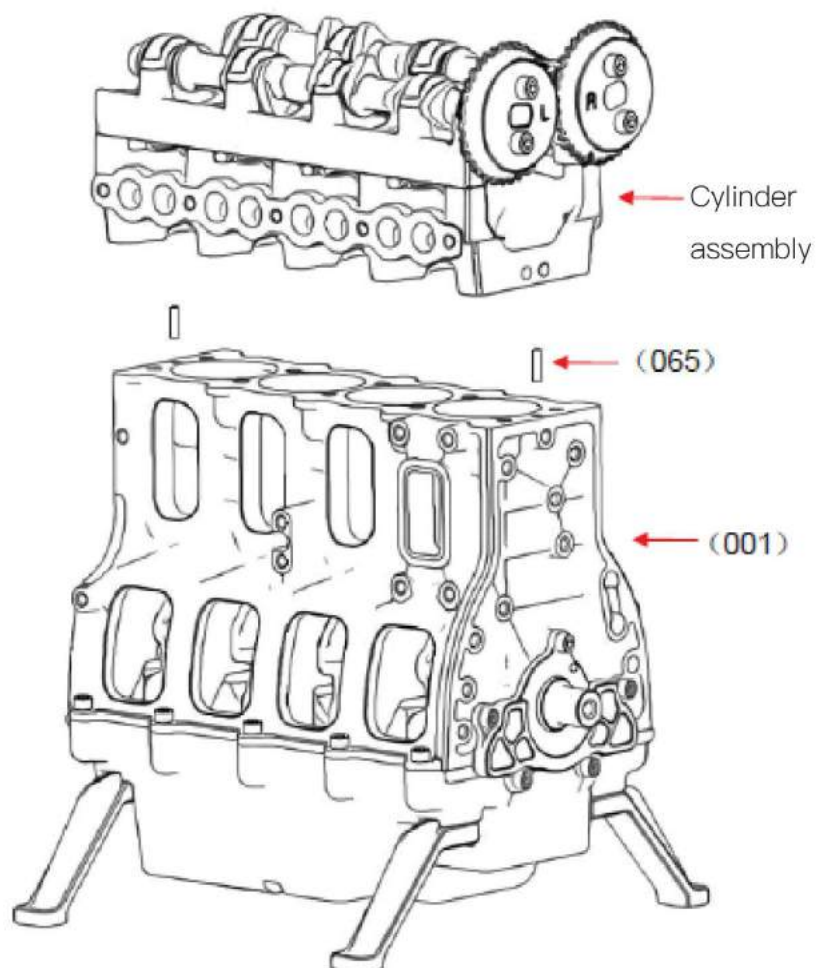
(Mounting of rear end cap completed)

4.3 Mounting of front end cap

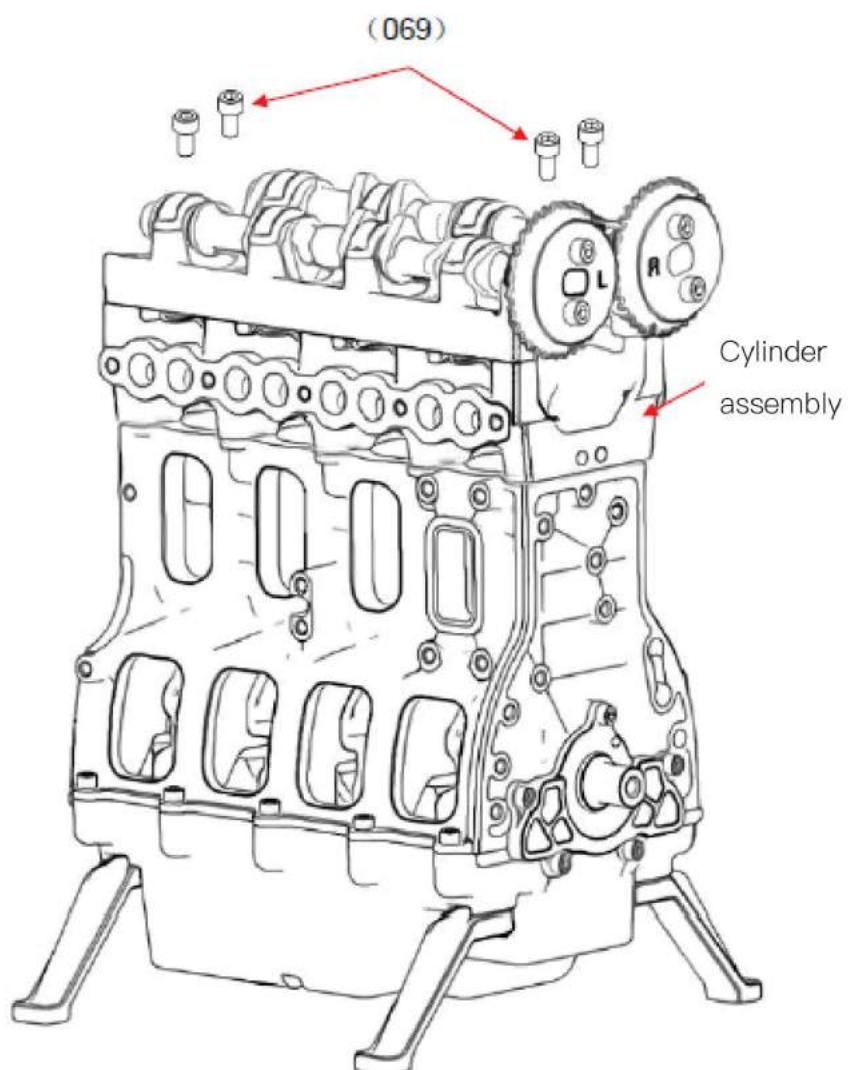


(Mounting of front end cap completed)

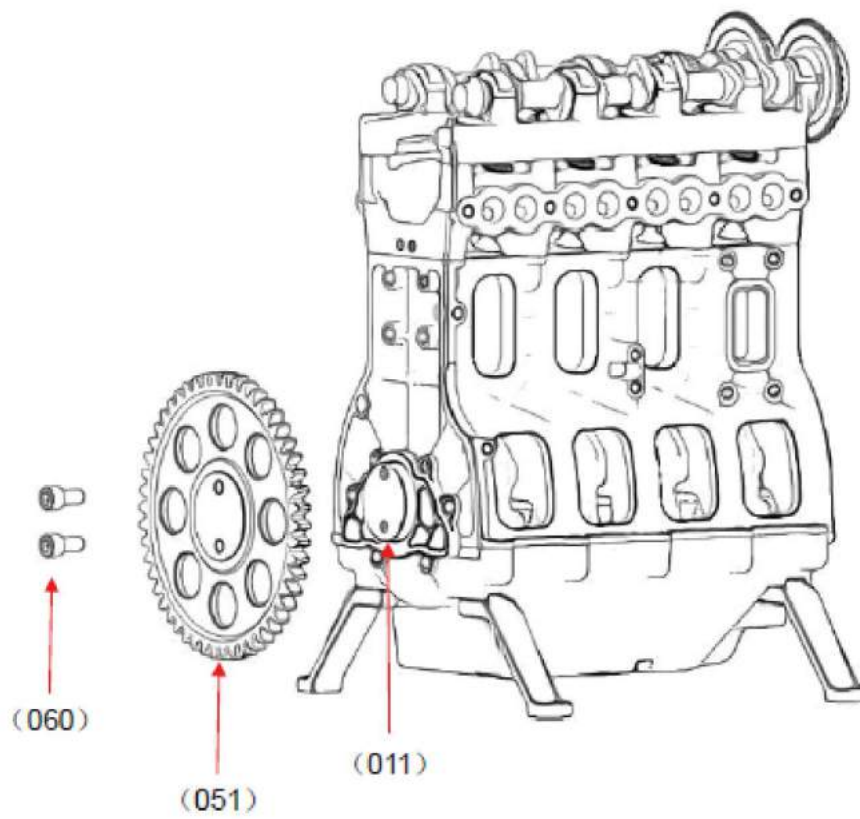
4.4 Assembly and connection of cylinder assembly

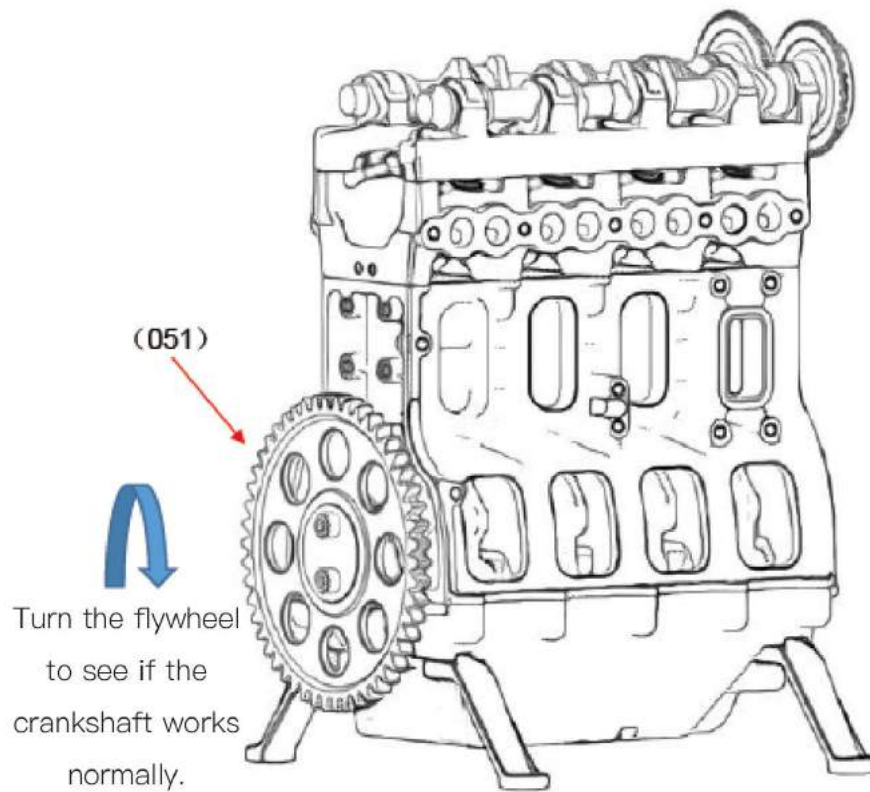


4.5 Mounting of fixing screws



4.6 Mounting of flywheel

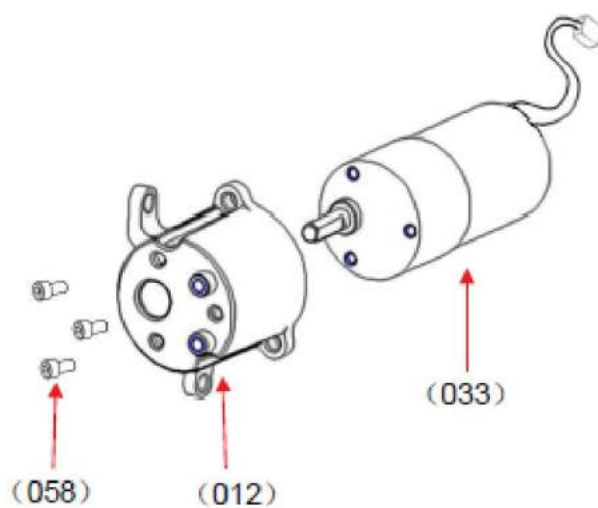




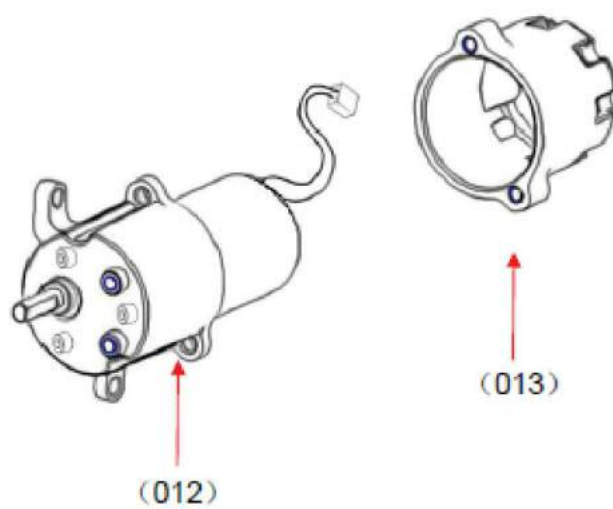
(Assembly and connection of engine body completed)

5. Starting motor assembly

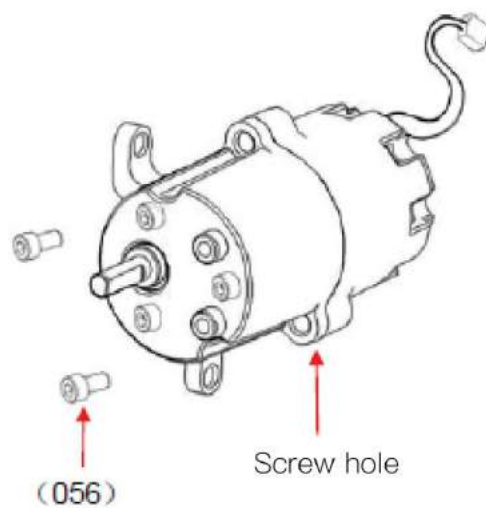
5.1 Mounting of front cover of starting motor



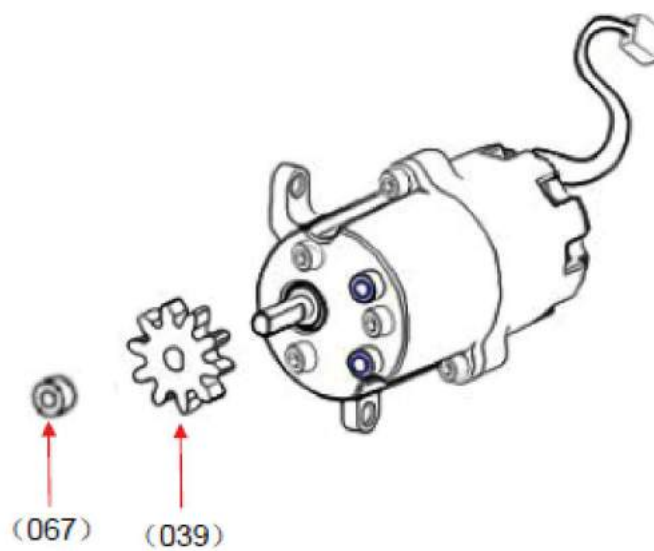
5.2 Mounting of rear cover of starting motor



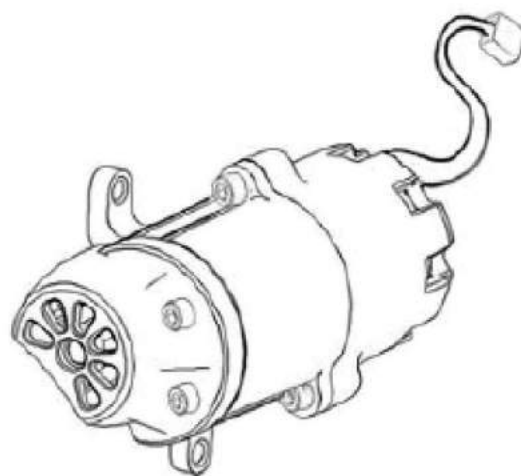
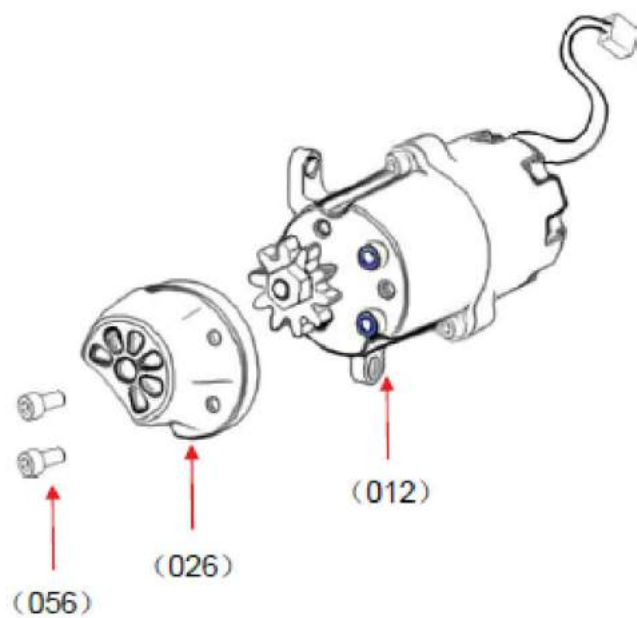
5.3 Connection of front and rear covers of starting motor



5.4 Mounting of gear of starting motor

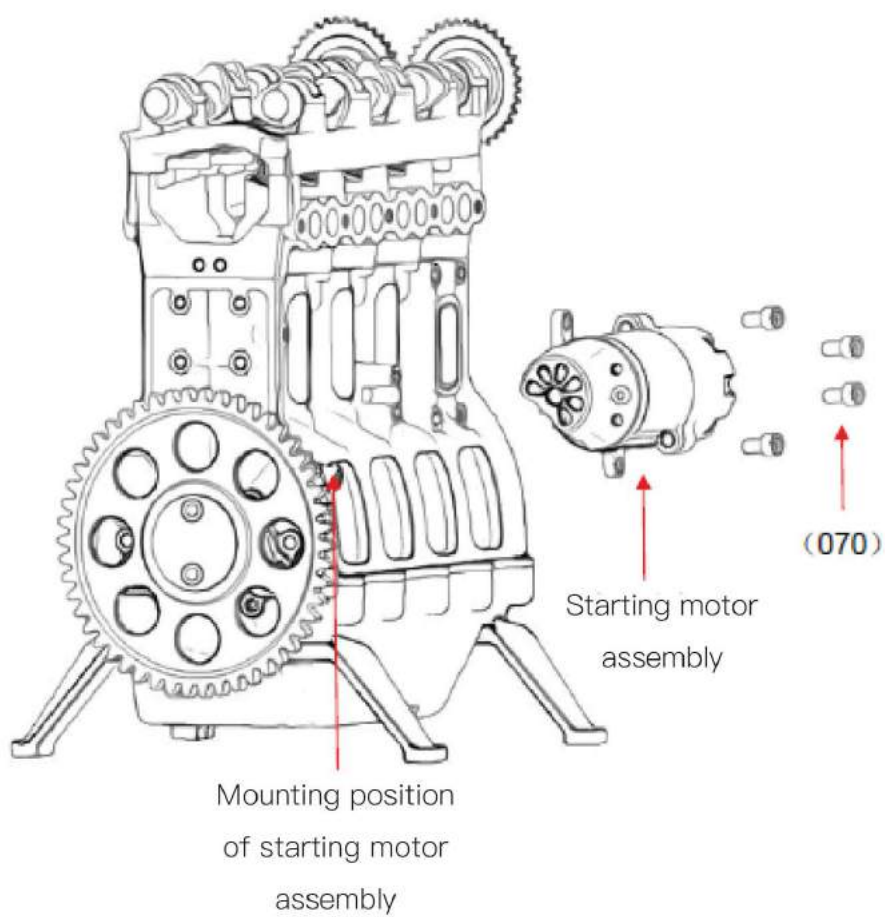


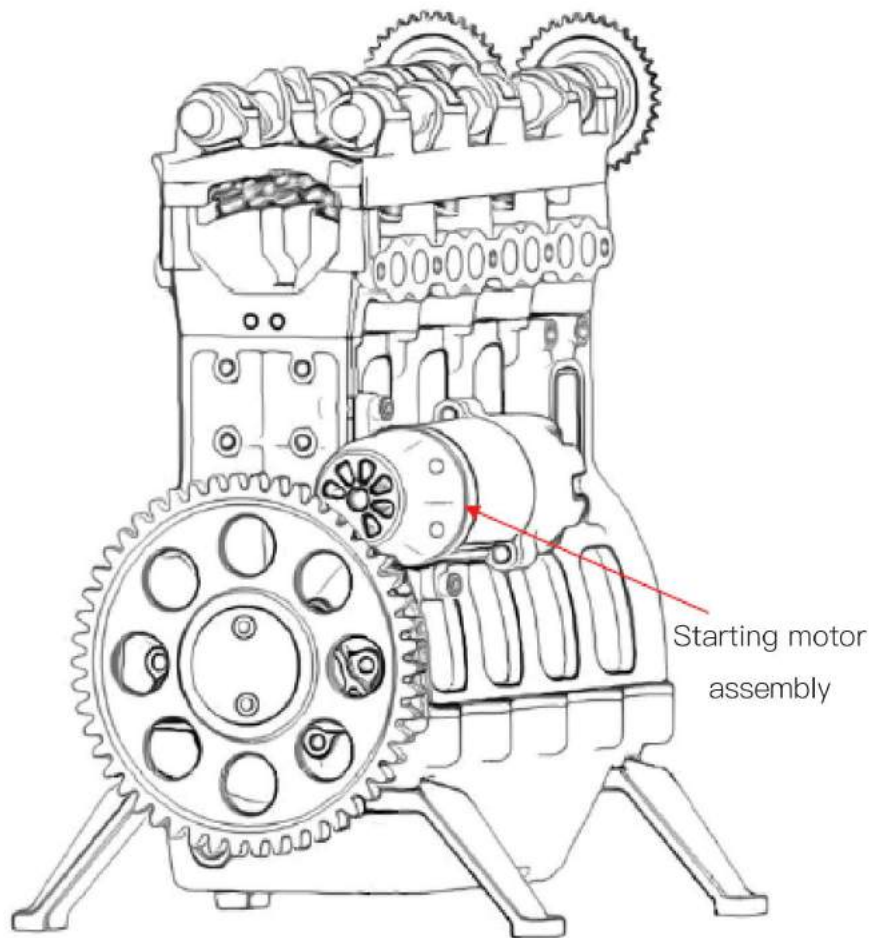
5.5 Mounting of gear cover



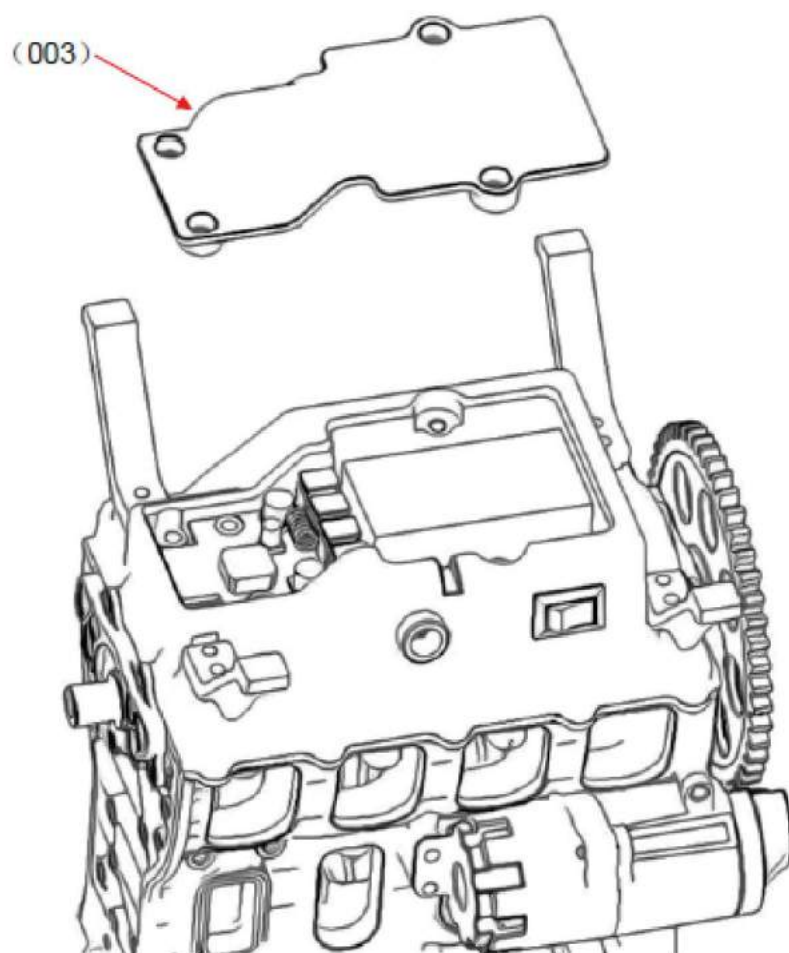
(Assembly of starting motor completed)

5.6 Combination of starting motor assembly and engine

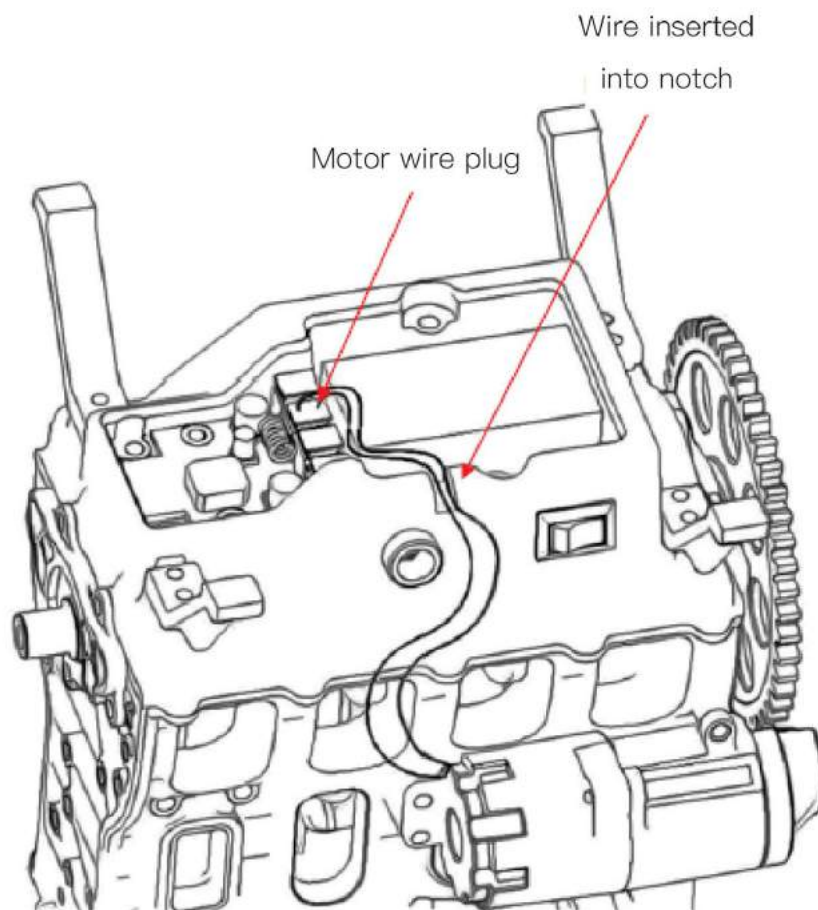




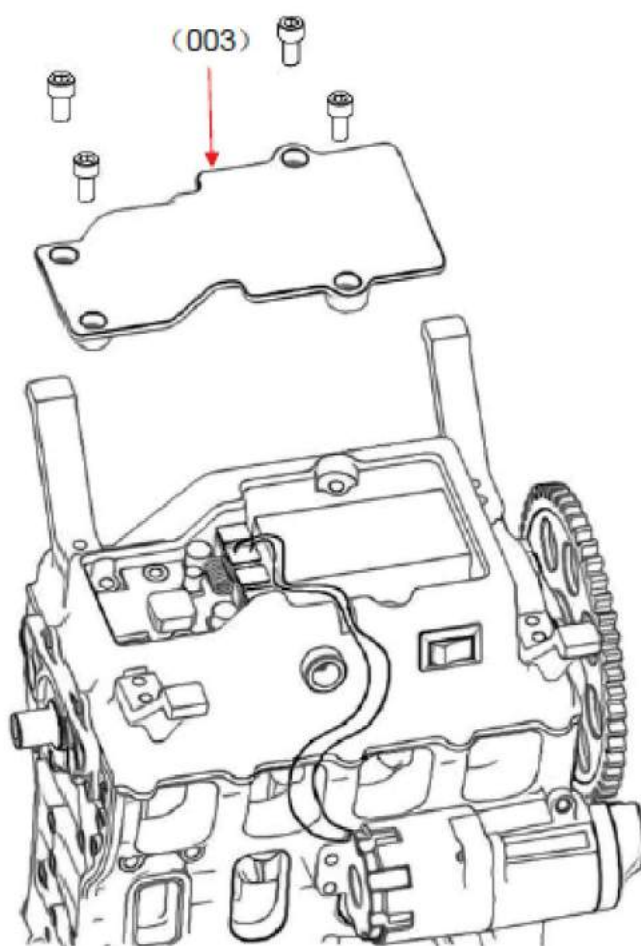
5.7 Removal of battery cover and connection of motor plug

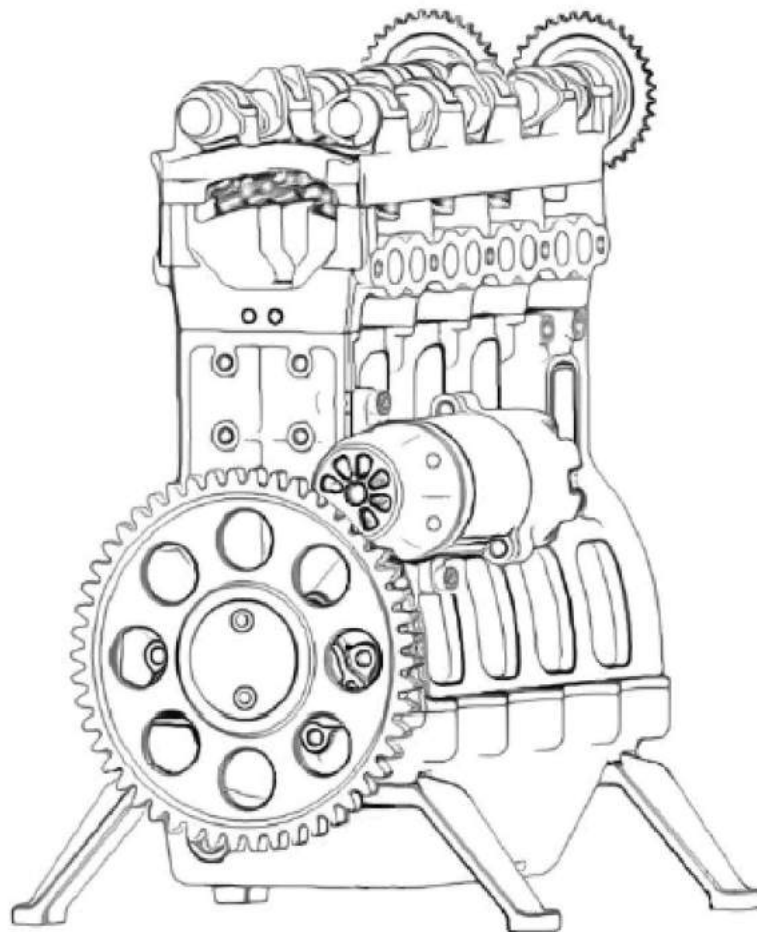


5.8 Connection of starting motor plug



5.9 Mounting of battery cover

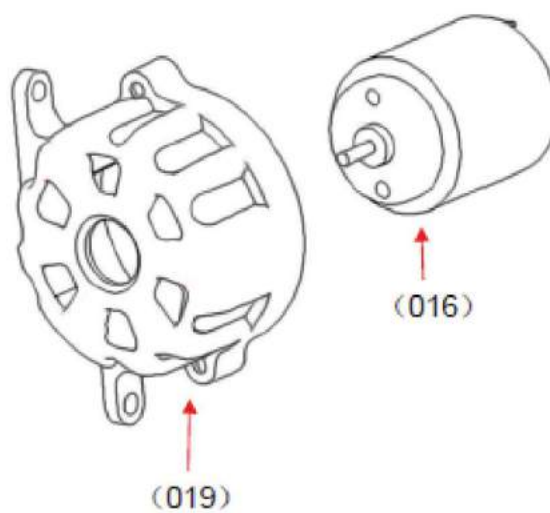




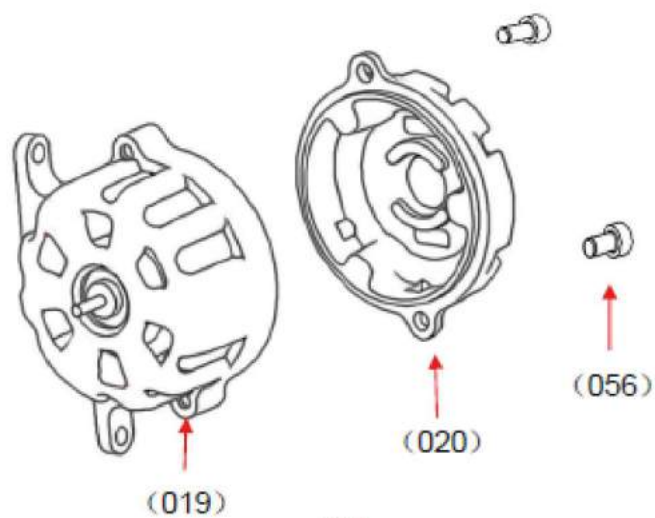
(Assembly and connection between starting motor and
cylinder block completed)

6. Generator assembly

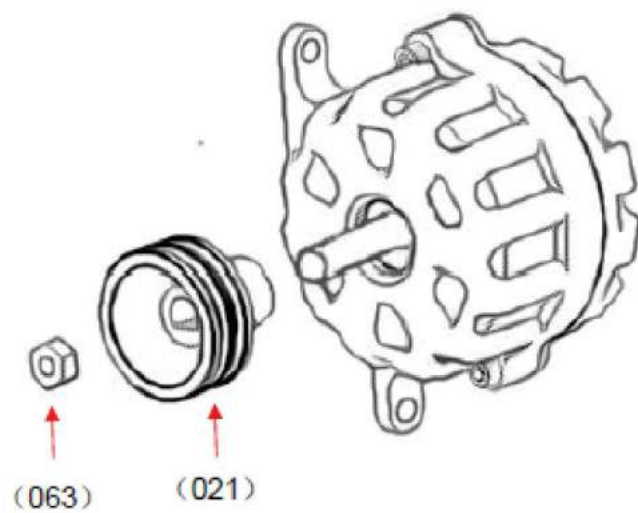
6.1 Combination of generator and front cover of generator



6.2 Mounting of rear cover of generator

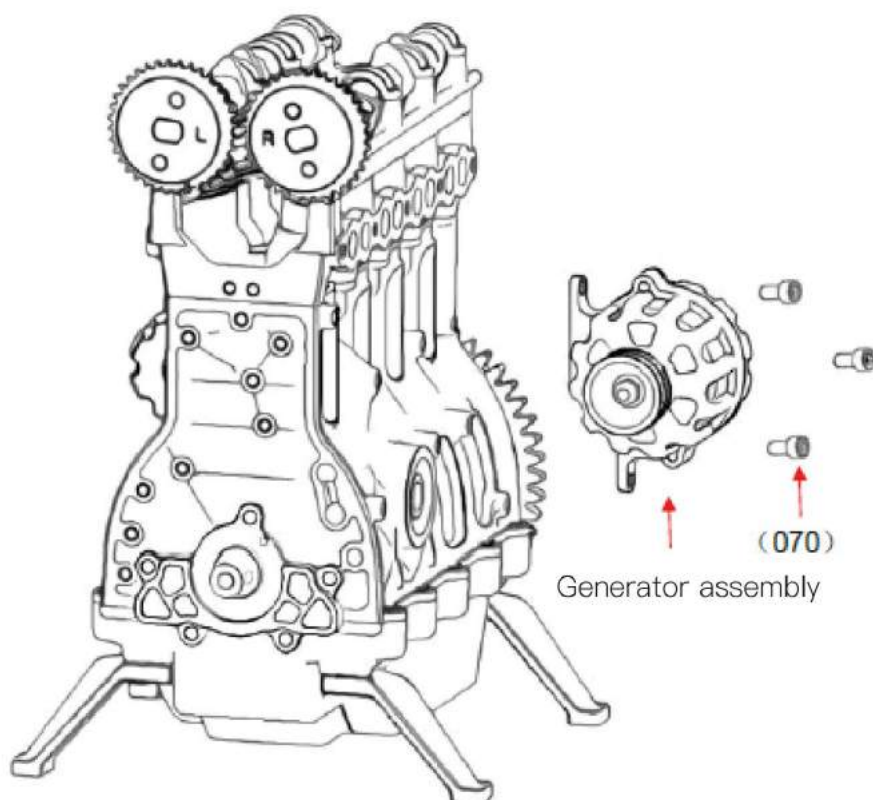


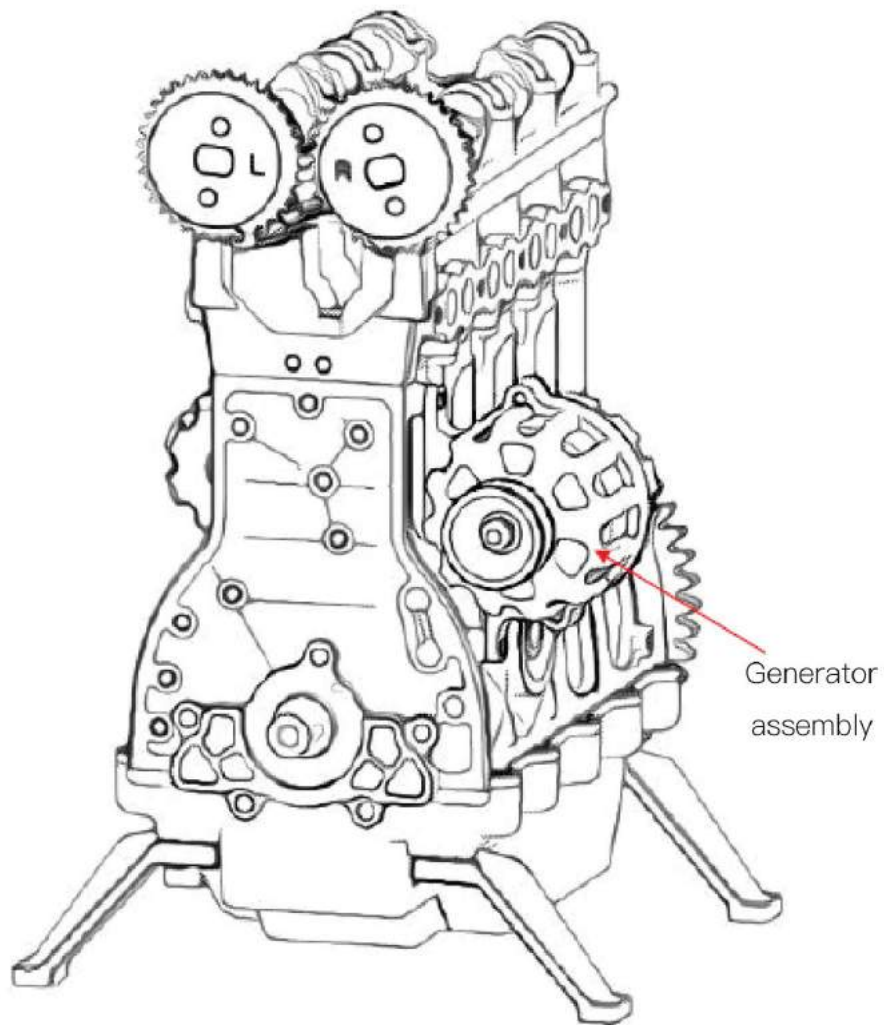
6.3 Mounting of generator pulley



(Mounting of generator pulley completed)

6.4 Assembly and connection between generator assembly and cylinder block

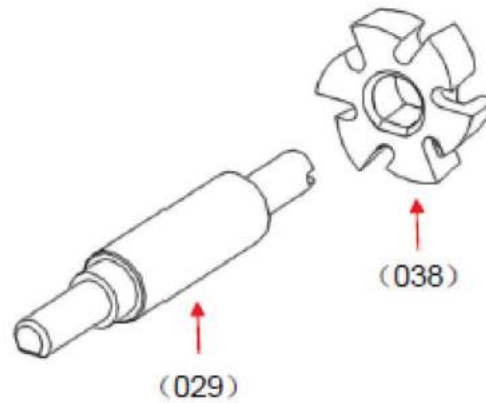




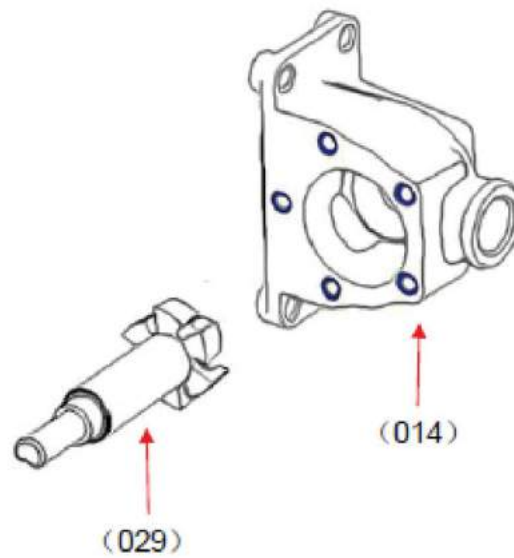
(Assembly and connection between generator assembly and
cylinder block completed)

7. Water pump assembly

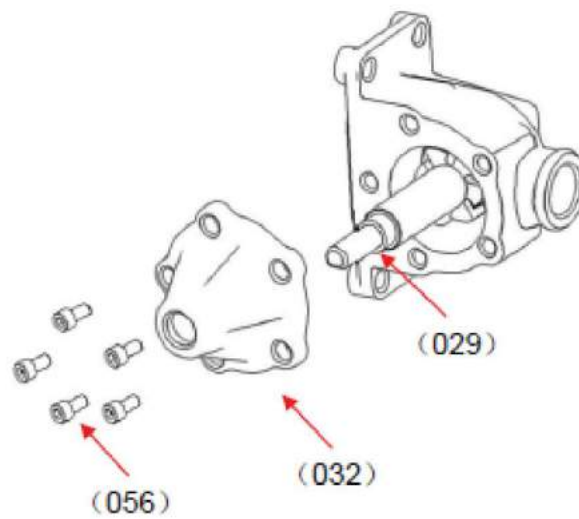
7.1 Connection between water pump impeller and water pump shaft



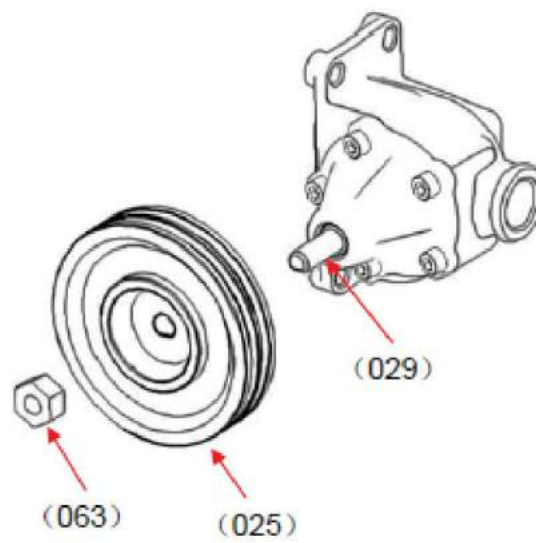
7.2 Connection between water pump shaft and water pump tank



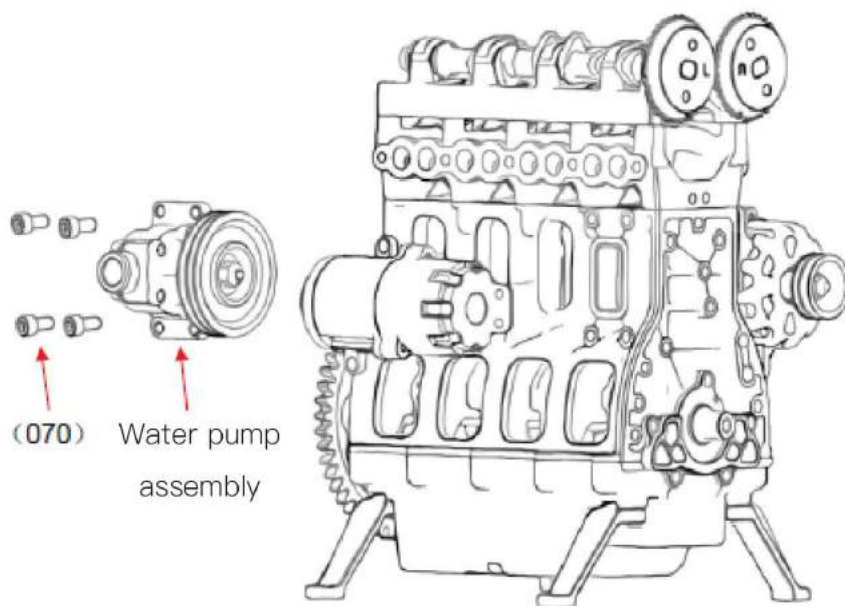
7.3 Mounting of end cover of water pump

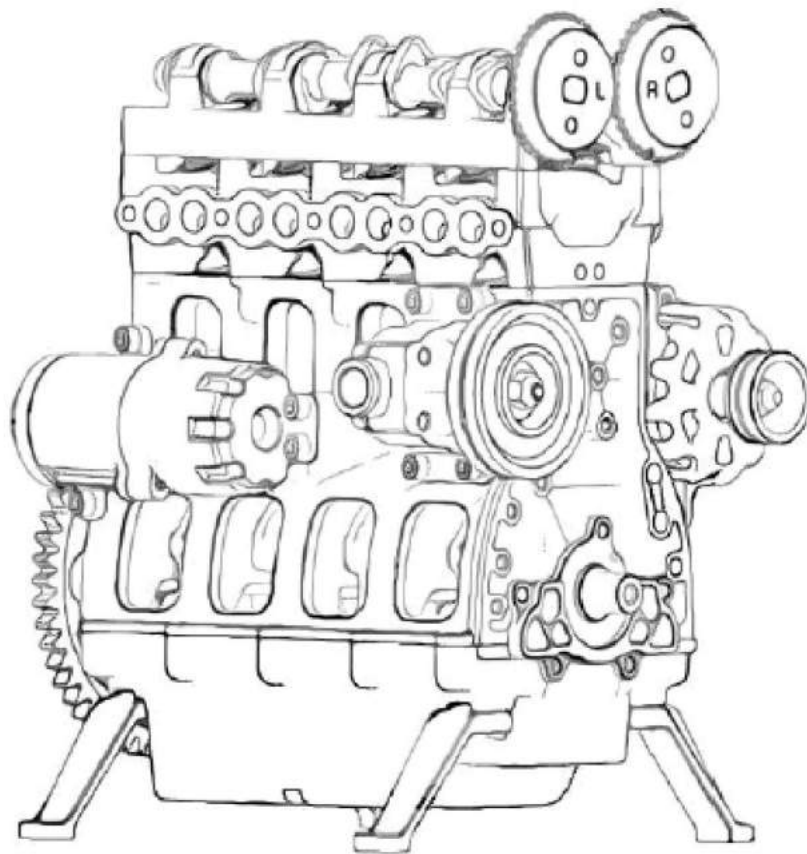


7.4 Mounting of water pump pulley



7.5 Combination of water pump assembly and cylinder block

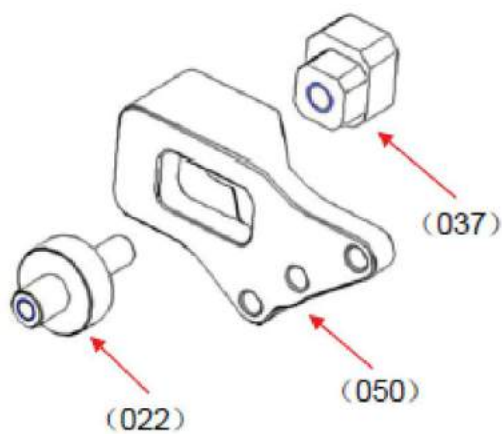




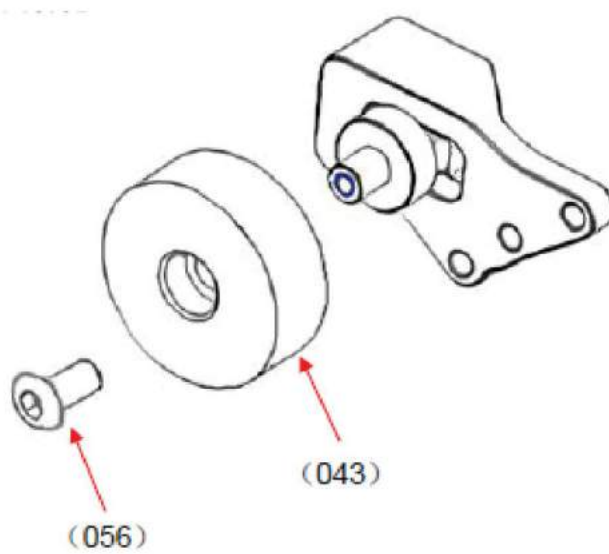
(Assembly and connection between water pump assembly
and cylinder block completed)

8. Tension base assembly

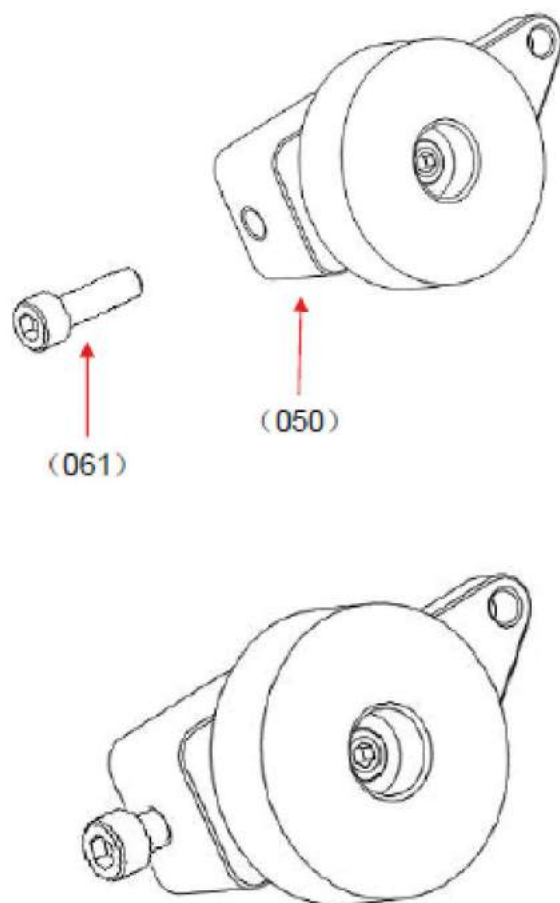
8.1 Assembly and connection of tension shaft lever and tension block



8.2 Mounting of tension pulley

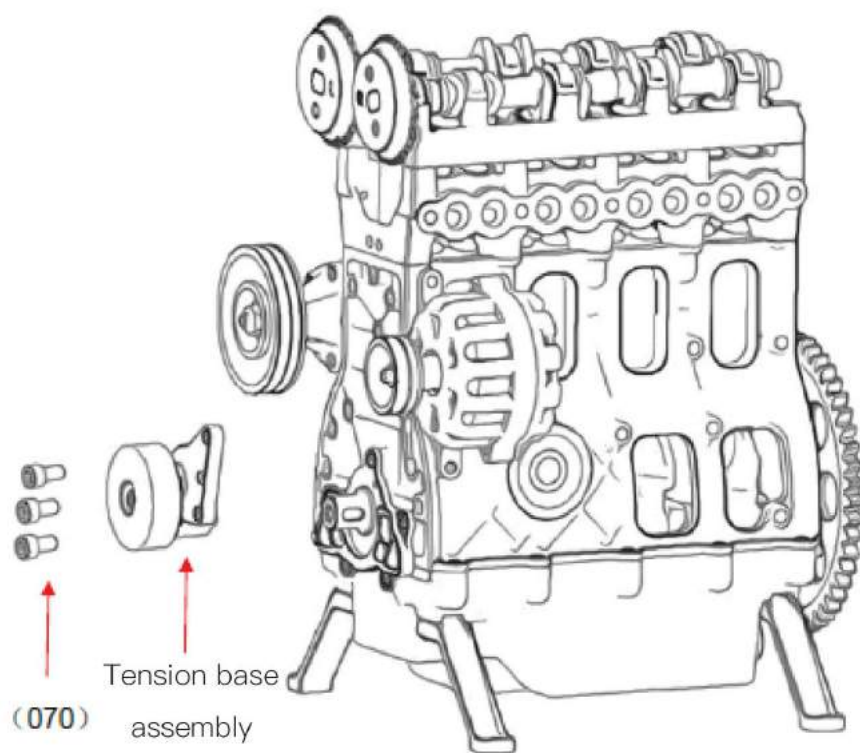


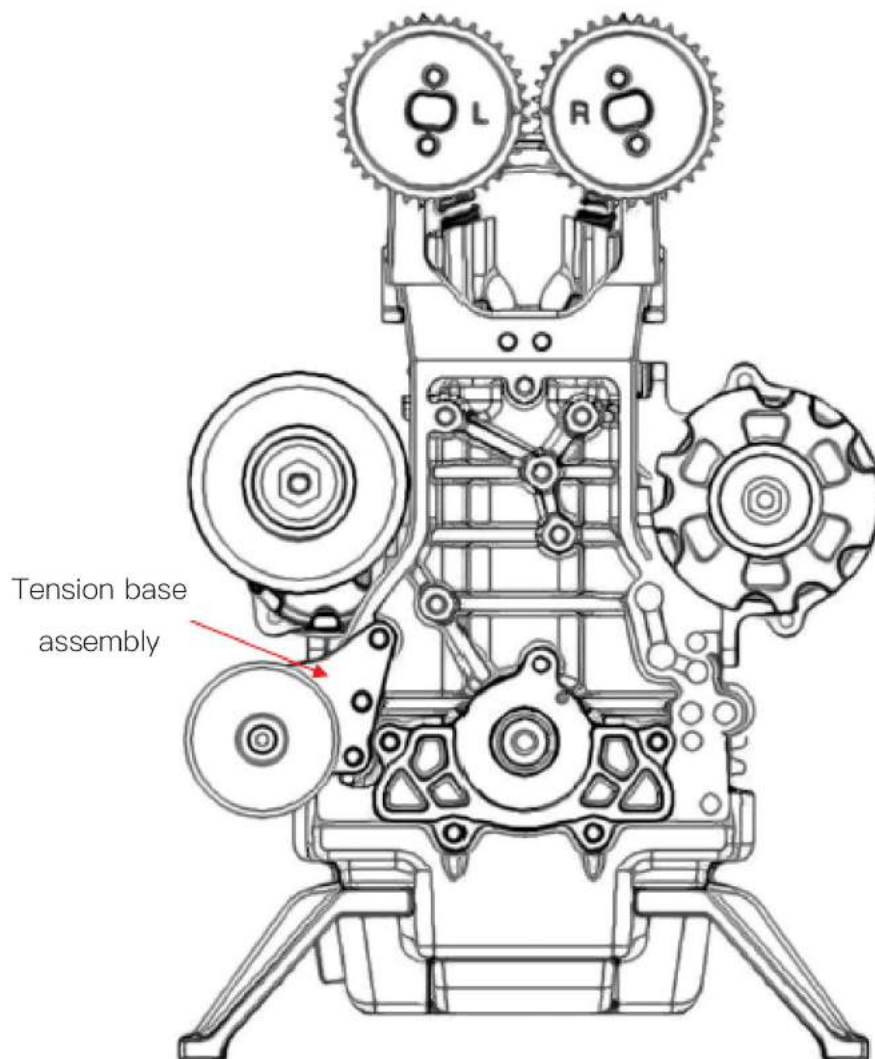
8.3 Mounting of adjusting screw



(Mounting of adjusting screw completed)

8.4 Assembly and connection between tension base assembly and cylinder block

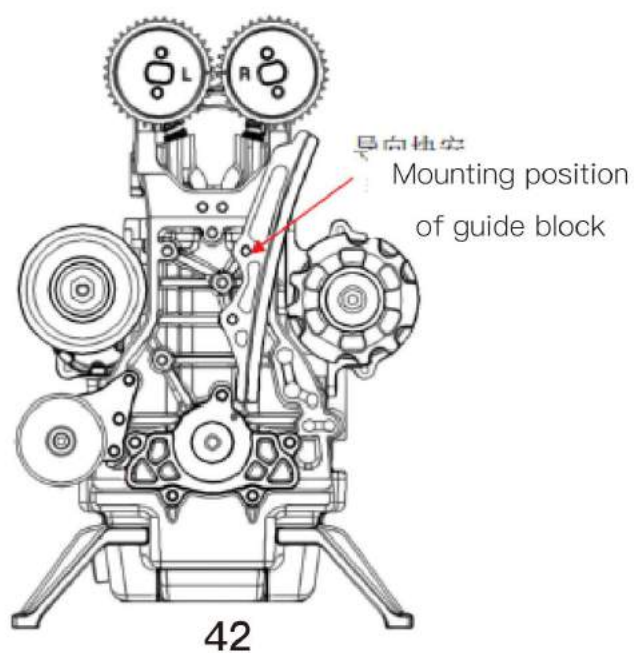
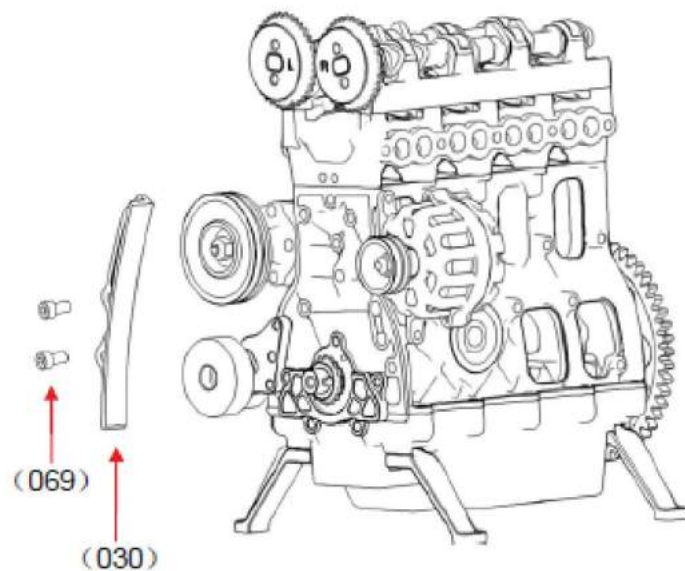




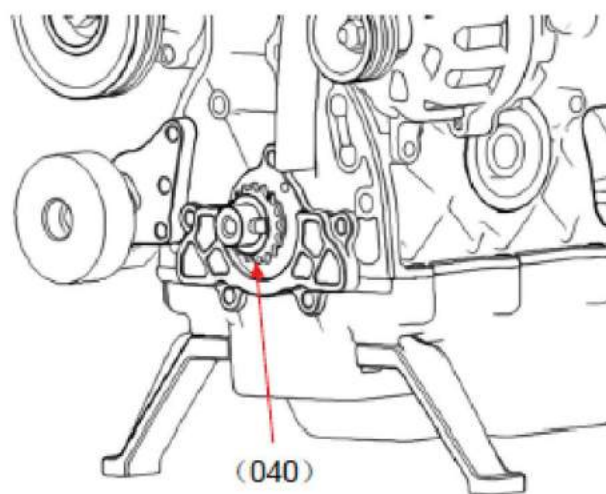
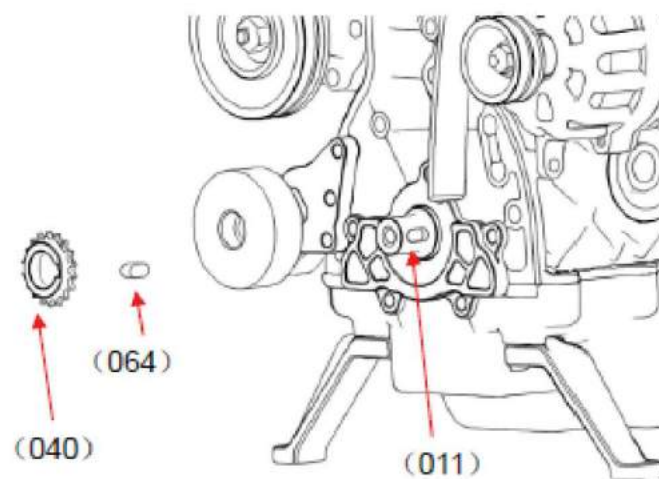
(Assembly and connection between tension base assembly
and cylinder block completed)

9. Timing gear

9.1 Mounting of chain guide block

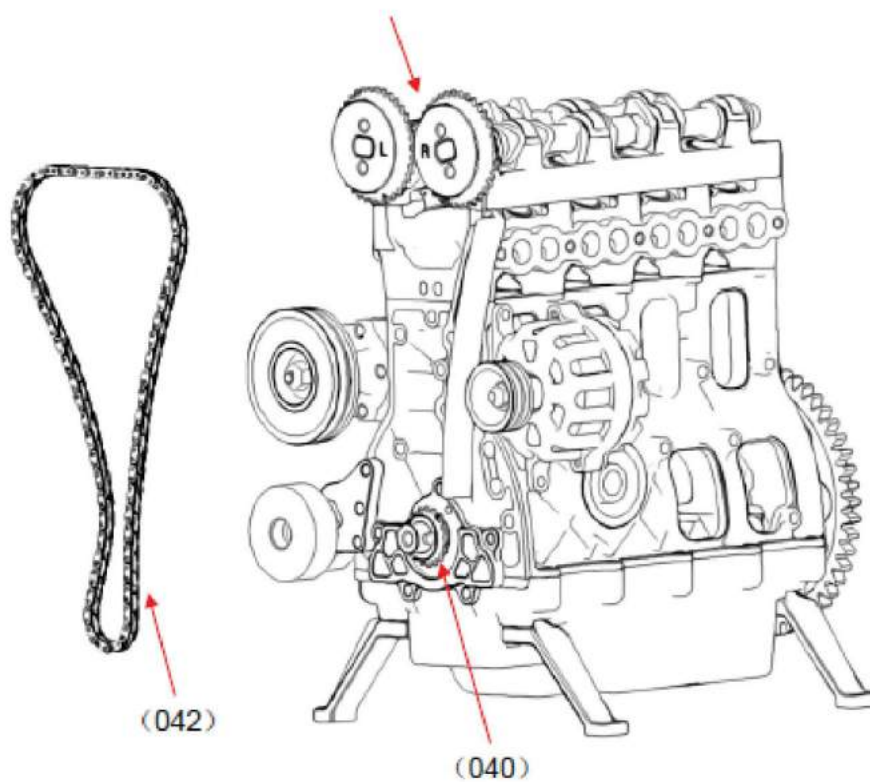


9.2 Mounting of crankshaft timing sprocket



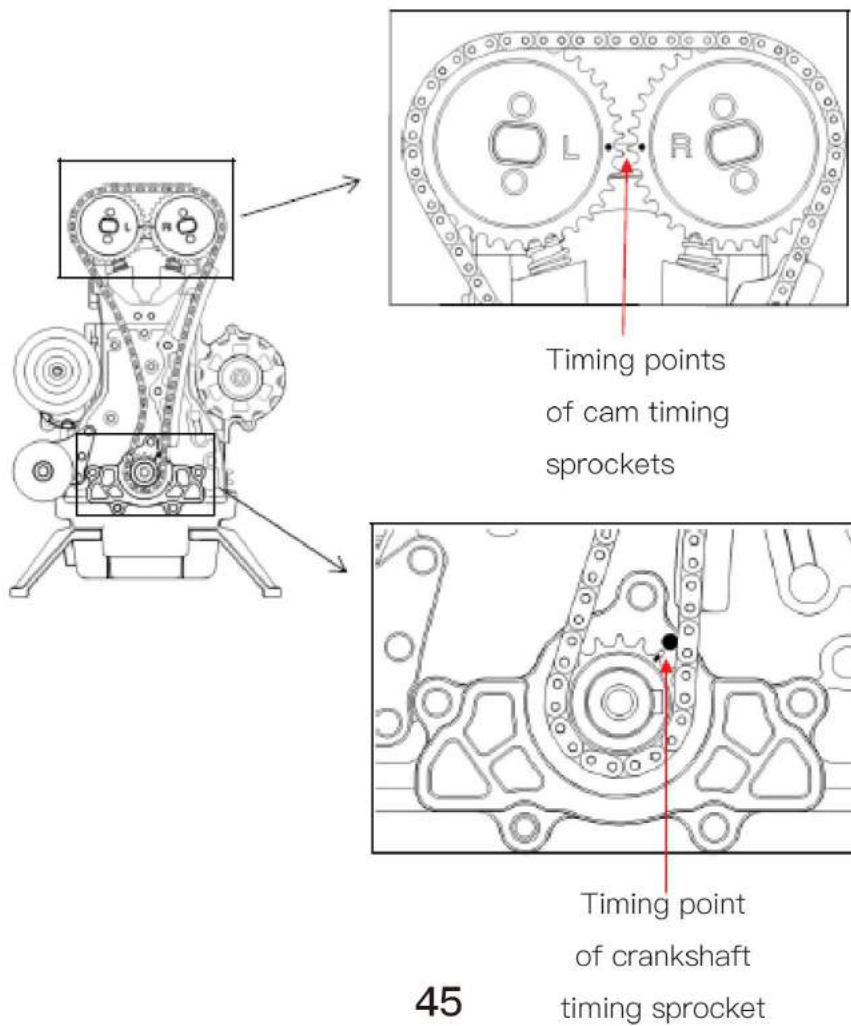
9.3 Mounting of timing chain

Cam timing
sprocket

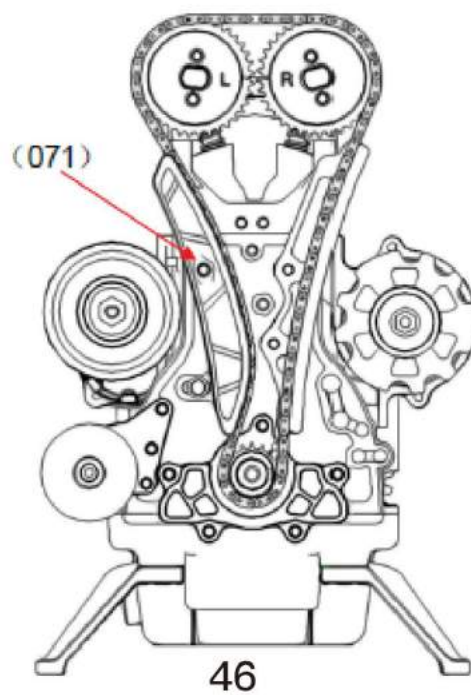
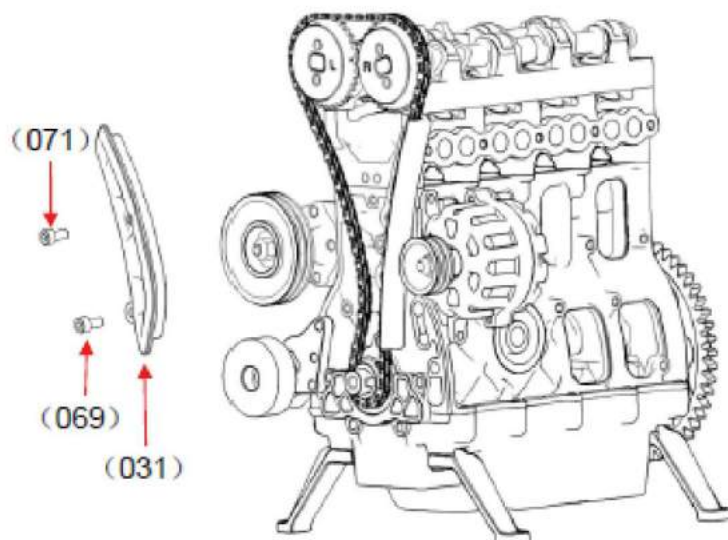


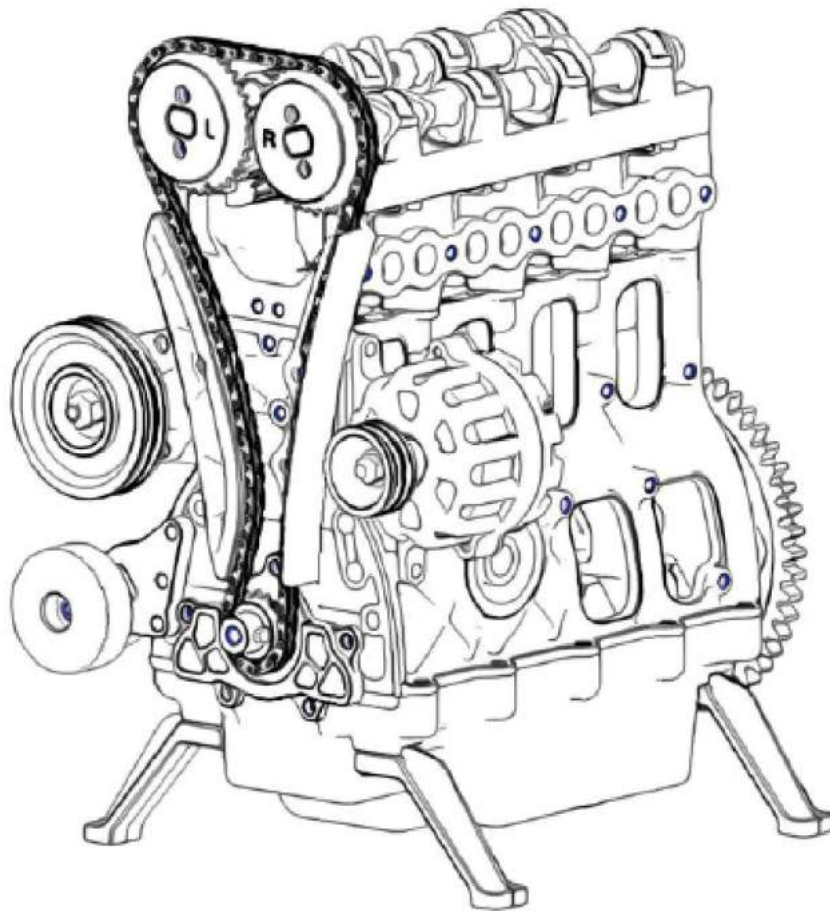
9.4 Timing calibration

As shown in the figure, align the timing points on the left and right cam timing sprockets; only if the timing point of the crankshaft timing sprocket is aligned with that on the rear end cap, and the 3 timing points are aligned simultaneously can the chain be put on.



9.5 Mounting of chain tension block

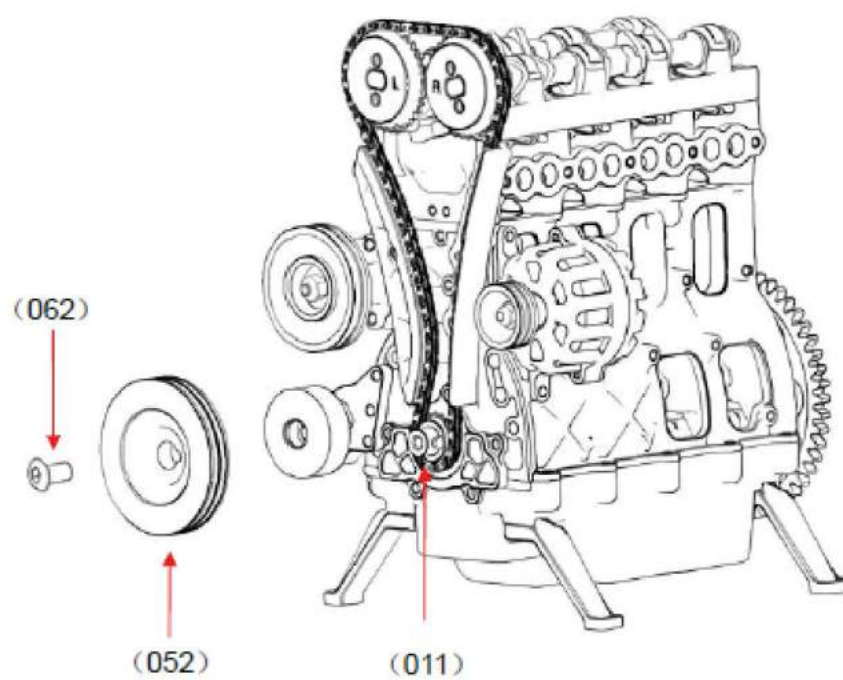




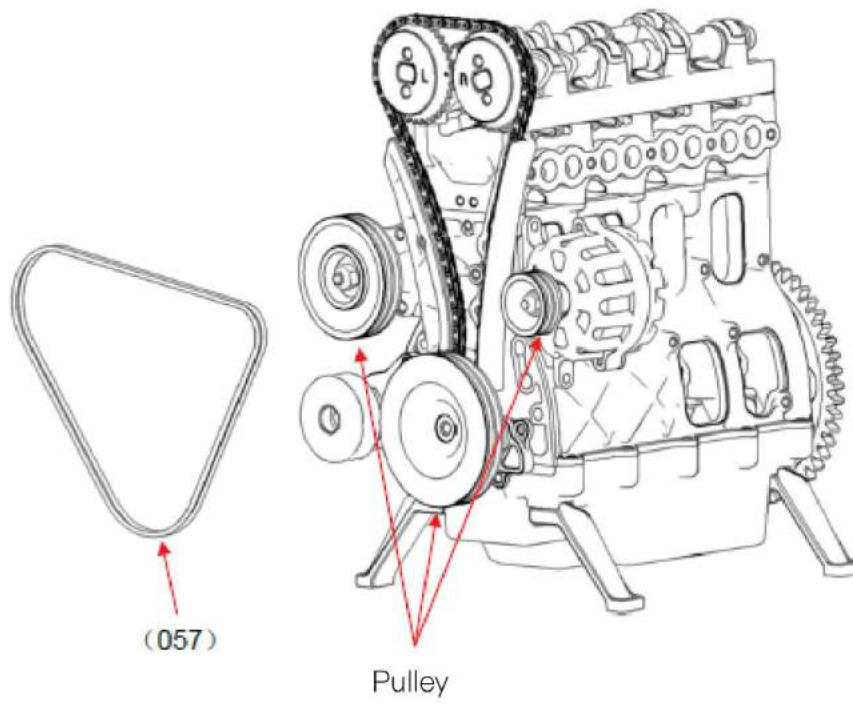
(Mounting of timing gear completed)

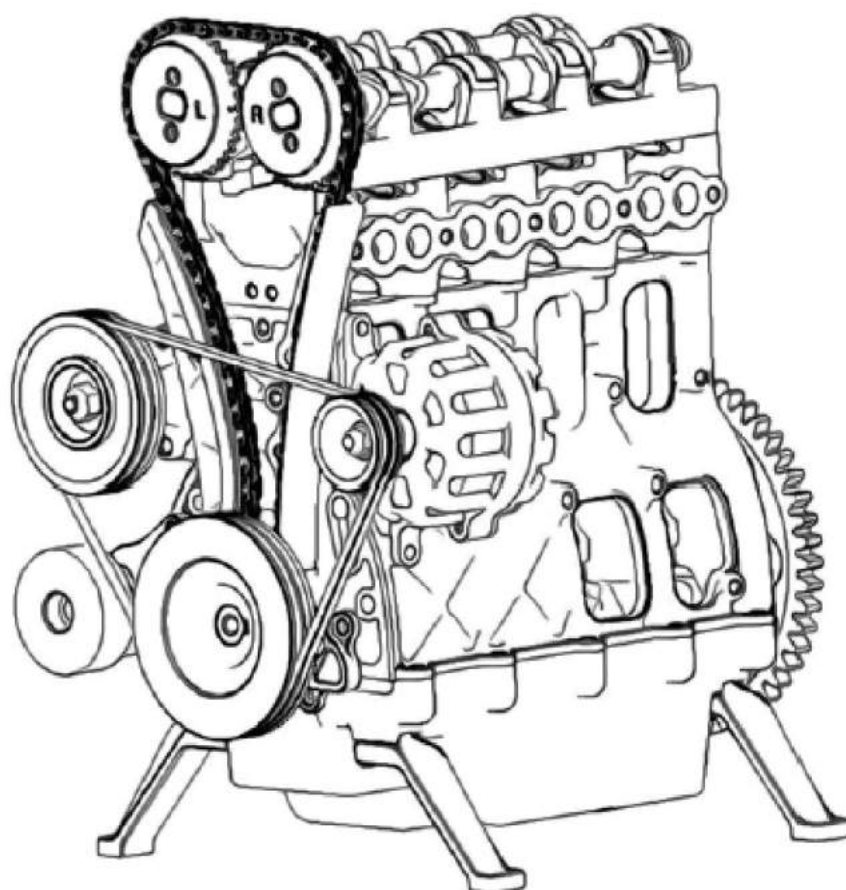
10. Other accessories

10.1 Mounting of crankshaft pulley



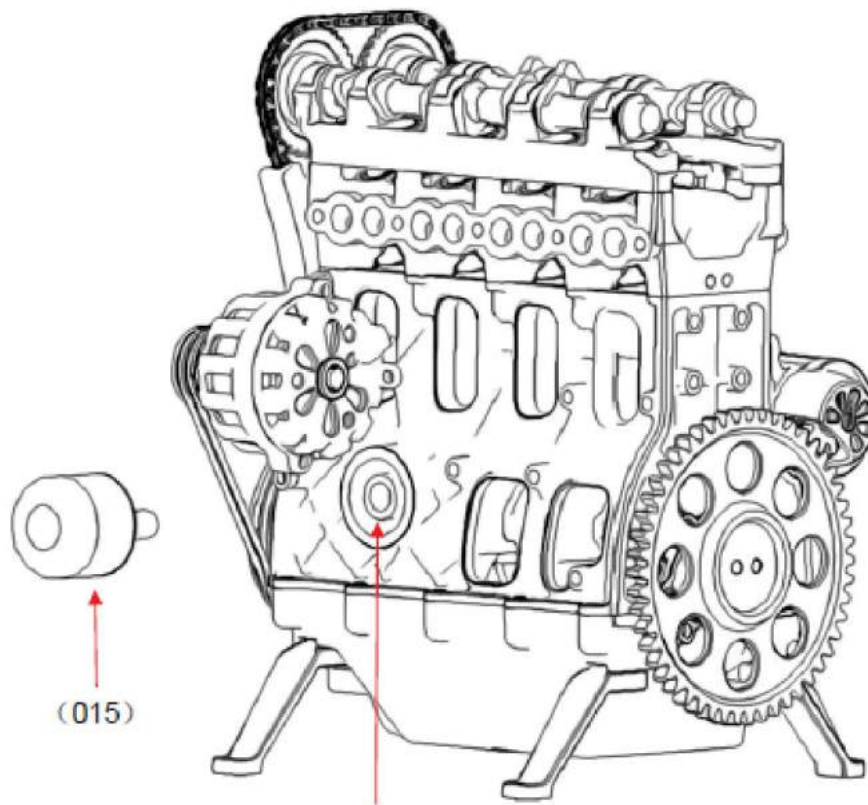
10.2 Mounting of belt



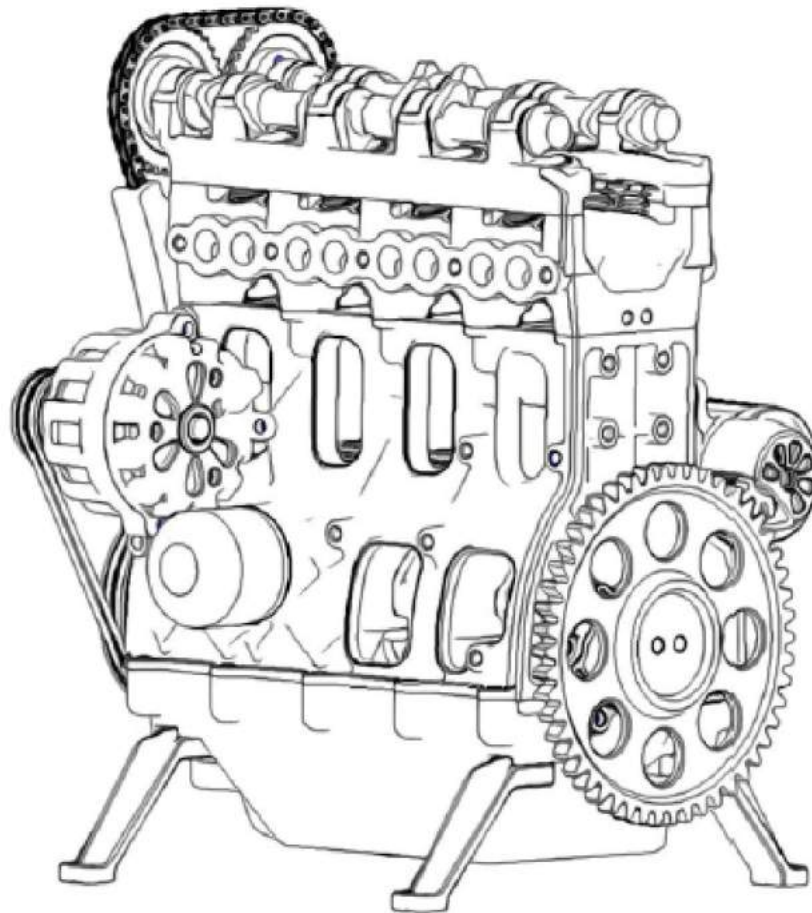


(Mounting of belt completed)

10.3 Mounting of oil filter

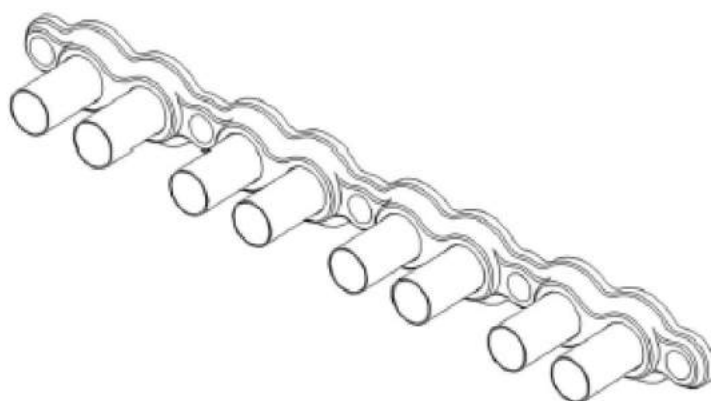
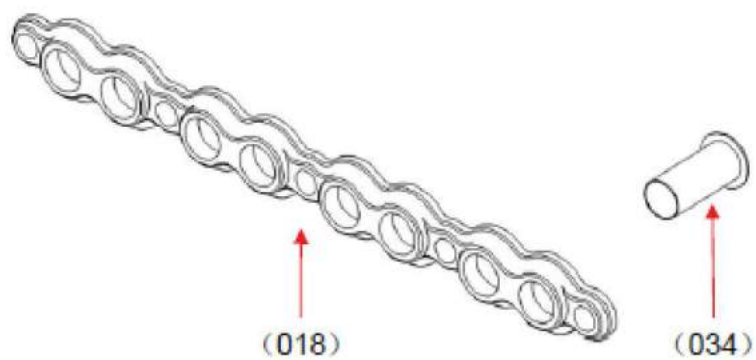


Mounting hole of oil filter

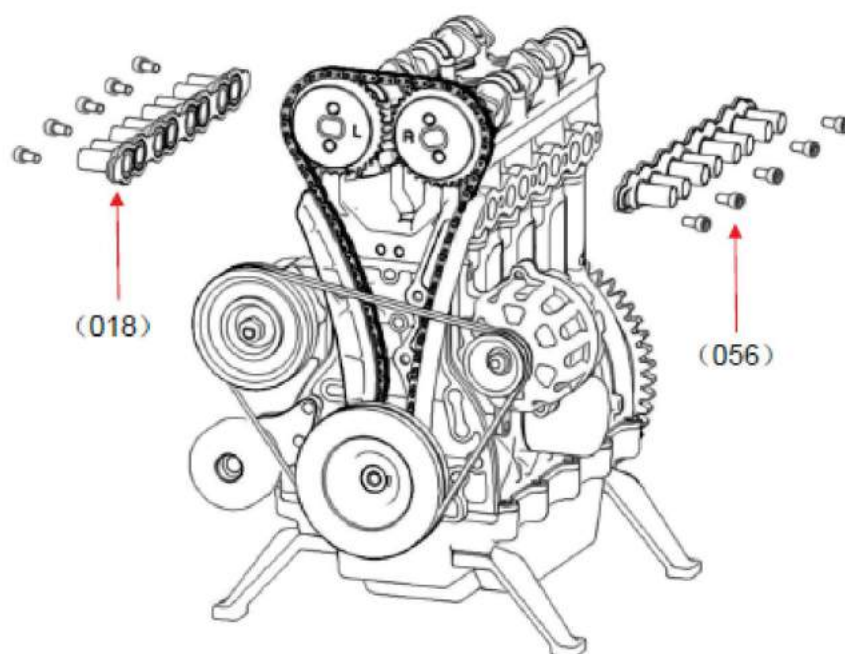


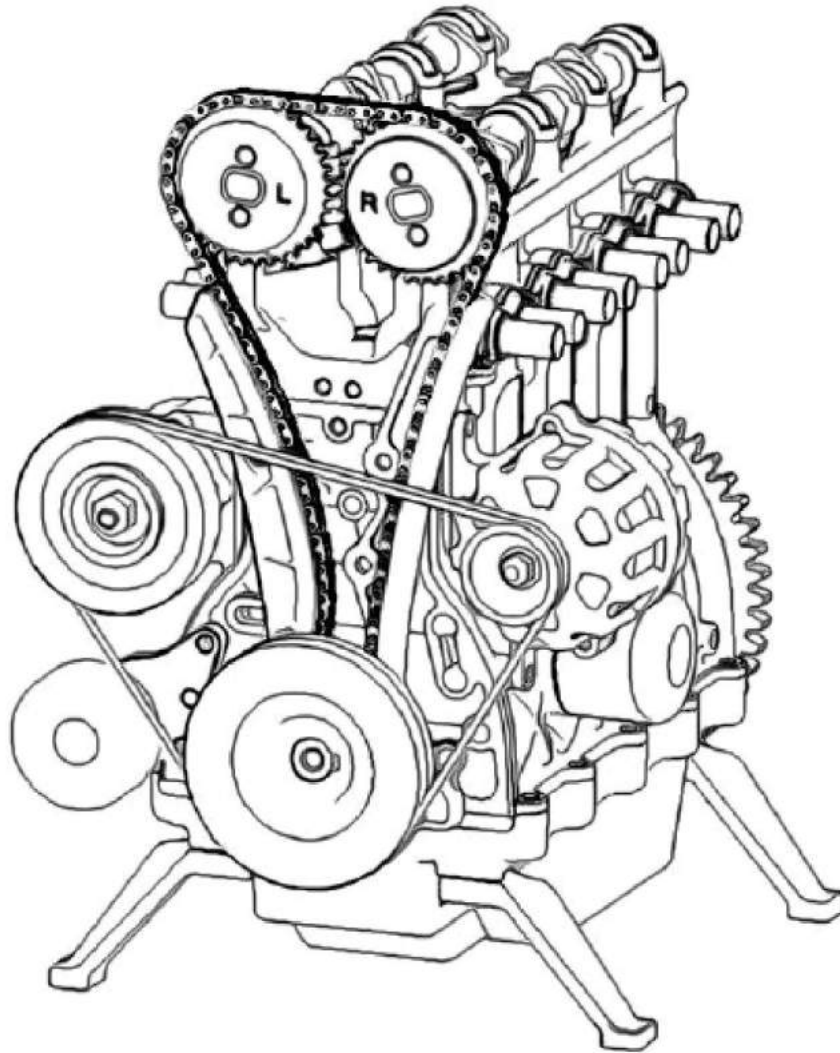
(Mounting of oil filter completed)

10.4 Assembly and connection of intake and exhaust pipes
(2 groups in total — left and right)

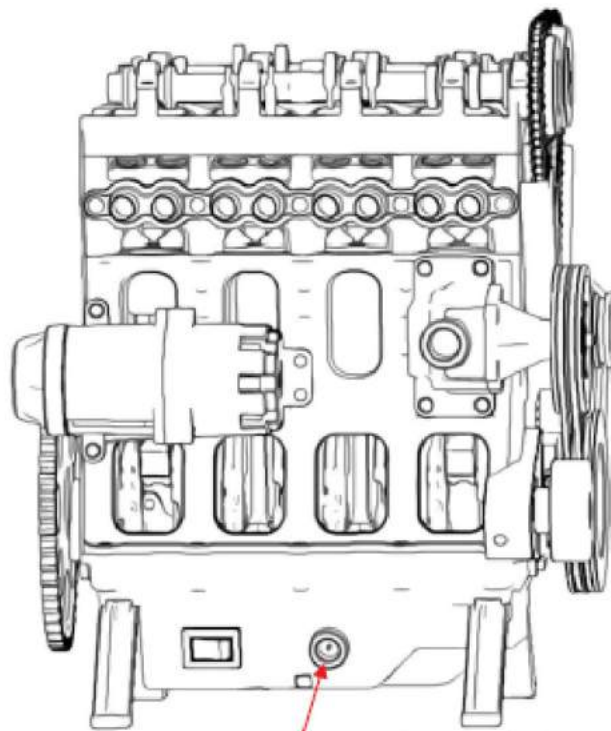


10.5 Assembly and connection between exhaust pipe and
cylinder head





(Mounting of complete engine completed)



Charging socket Standard plug of
notebook



12V charger self-provided by the user

II. Adjustment of in-line 4-cylinder engine

1. Fitting clearances

Pay attention to fitting clearances among moving parts. The user is encouraged to adjust clearances slightly using, for example, sandpaper and calipers, based on his/her own observations and judgments.

The main parts are as follows:

- 1.1 Crankshaft and related moving parts
- 1.2 Camshaft and related moving parts
- 1.3 Starting motor and related moving parts
- 1.4 Piston rod and related moving parts

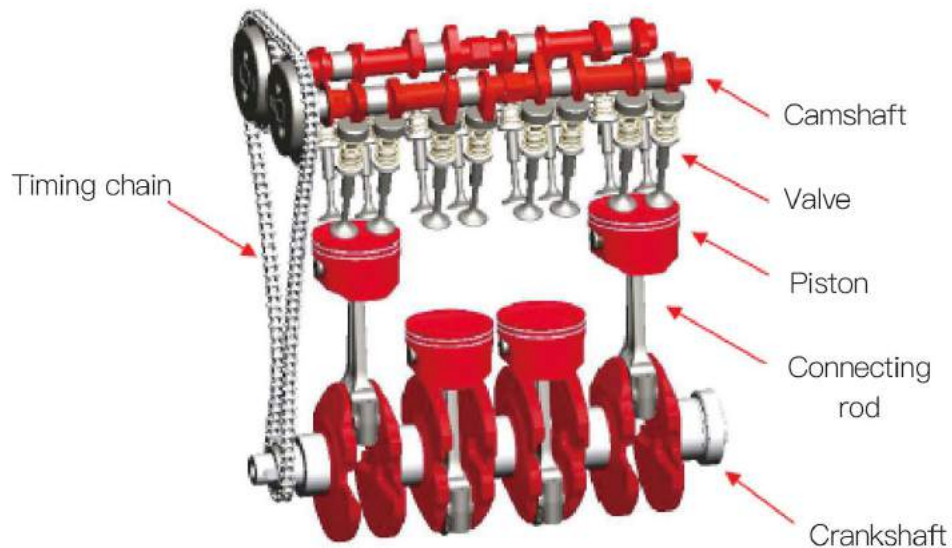
2. Lubrication

Since this product is a metallic mechanical model, the absence of lubricant for shaft movement may result in higher frictions or even seizure of parts during movement. The user is encouraged to apply appropriately more lubricant at shaft assembly positions, and observe the effect after lubricant application.

3. Noise reduction

Shaft moving parts are made of aluminum alloy and have anodized surfaces, and there are loose clearances among some parts, so this product may produce high noise when newly assembly. The user is encouraged to observe and analyze noise producing positions, and may also repair with such tools as sandpaper and file, and apply lubricant to observe the noise reduction effect.

III. Basic structure and features of in-line 4-cylinder engine



In-line 4-cylinder is a cylinder arrangement of internal combustion engines. Since the 4 cylinders are arranged in a straight line, it is also called coaxial 4-cylinder. In this 4-cylinder engine assembly model, each cylinder has two intake valves and two exhaust valves, which are driven by the timing chain.

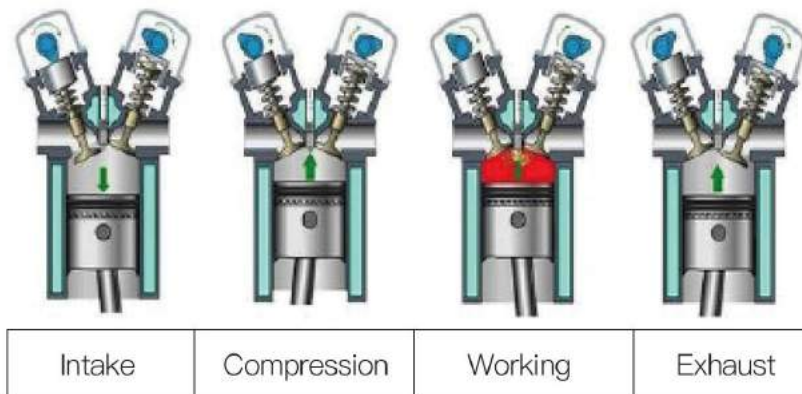
Most car engines with a displacement of less than 2.5L are in-line 4-cylinder engines. Generally, with the same cylinder diameter, the more cylinders are, the greater the displacement and the higher the power will be; with the same displacement, the more cylinders are, the smaller the cylinder diameter will be, and the speed can be raised to obtain a greater power boost.

IV. Basic principle of piston engine

IV. Basic principle of piston engine

1. Piston moving down → taking in air and gasoline;
2. Piston moving up → compressing the mixture;
3. Piston moving down → igniting the compressed gas; which burns and expands to drive the piston;
4. Piston moving up → discharging exhaust gas

As shown below:










When the in-line 4-cylinder engine is working, for every two turns of the crankshaft, the piston makes 4 straight-line reciprocating motions in the cylinder to complete a working procedure (4 strokes), the mixture in the cylinder is ignited, and the bursting gas pushes the piston to make the crankshaft rotate via the crankshaft connecting rod, realizing the straight-line reciprocating motion of the piston in the cylinder. The continuous vertical motion of the piston turns into the continuous rotary motion of the crankshaft to output power continuously and make the engine run normally.

No.	Product picture	Product name	Product No.	Qty.
01		Cylinder block	DM13-001	1
02		Oil sump	DM13-002	1
03		Battery cover	DM13-003	1
04		Circuit board	DM13-004	1
05		Switch	DM13-005	1
06		Charging plug	DM13-006	1
07		Battery pack	DM13-007	1
08		Cam seat	DM13-008	1
09		Cylinder head	DM13-009	1
10		Crankshaft bearing	DM13-010	5
11		Crankshaft	DM13-011	1
12		Front cover of starting motor	DM13-012	1

13		Rear cover of starting motor	DM13-013	1
14		Water pump tank	DM13-014	1
15		Oil filter	DM13-015	1
16		Generator	DM13-016	1
17		Camshaft	DM13-017	2
18		Mounting bracket of air pipe	DM13-018	2
19		Generator front cover	DM13-019	1
20		Generator rear cover	DM13-020	1
21		Generator pulley	DM13-021	1
22		Tension shaft lever	DM13-022	1
23		Piston pin	DM13-023	4
24		Piston	DM13-024	4
25		Water pump pulley	DM13-025	1

26		Front cover of starting motor	DM13-026	1
27		Piston rod	DM13-027	4
28		Connecting rod bearing	DM13-028	4
29		Water pump shaft	DM13-029	1
30		Chain guide block	DM13-030	1
31		Chain tension block	DM13-031	1
32		End cover of water pump	DM13-032	1
33		Starting motor	DM13-033	1
34		Exhaust pipe	DM13-034	8
35		Intake pipe	DM13-035	8
36		Spark plug	DM13-036	4
37		Tension block	DM13-037	1
38		Water pump impeller	DM13-038	1
39		Starting motor gear	DM13-039	1
40		Crankshaft timing sprocket	DM13-040	1

41		Valve	DM13-041	16
42		Timing chain	DM13-042	1
43		Tension pulley	DM13-043	1
44		Valve cover	DM13-044	16
45		Valve cap	DM13-045	16
46		Left camshaft sprocket	DM13-046	1
47		Right camshaft sprocket	DM13-047	1
48		Valve spring	DM13-048	16
49		Camshaft bearing	DM13-049	10
50		Tension base	DM13-050	1
51		Flywheel	DM13-051	1
52		Crankshaft pulley	DM13-052	1
53		Rear end cap	DM13-053	1
54		Front end cap	DM13-054	1

67		Motor bushing	DM13-067	1
68		M3X5 screw	DM13-068	4
69		M3.5X6 screw	DM13-069	45
70		M3.5X8 screw	DM13-070	14
71		M3.5X10 screw	DM13-071	9