



ASSEMBLY MANUAL

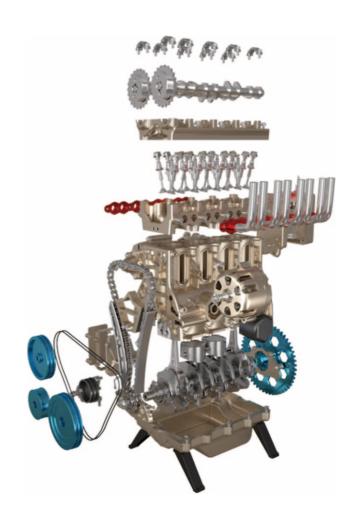
4-CYLINDER ENGINE

MODEL: DM13



Structural features:

- 1. Four cylinder in line engine structure
- 2. Overhead camshaft valve control structure
- 3.Cam chain transmission gear
- 4. Traditional crankshaft connecting rod system
- 5. The number of parts exceeds 300



I-Make · Real Model · Real World

General information about product

I. Product Data

Product name: Dual overhead cams four cylinder engine

Product model: DM 13

Main materials: Anodic aluminum oxide + stainless steel

Charging voltage: DC5V

Battery capacity:450 mAh

Assembly difficulty: ★★★

Product standards: GB/T9254–2008

GB/T17626.2-2006

Quality grade: A

II. Product description

- ◆ Teching Craftsman series of products are metal structure assembly models. Its primary material is aluminum alloy with anodized surface, and the product structure is a real industrial structure;
- ◆ Assemble parts using various tools with the installation procedures and methods substantially compliant with practical industrial requirements:
- ◆ This series of products are principally designed to improve users' hands—on ability and concentration, and to develop habits of "preciseness and stress on discipline":
- ◆ Learn about various industrial machines, and study various industrial structures to improve user's capability of research and innovation.

III. Assembly Requirements

- ♦ Be sure to read the Basics of Standard Parts Assembly carefully to master basic standard parts assembly procedure and the usage of tools before assembly;
- ◆ The table shall be kept tidy and clean during assembly to prevent parts being lost or incorrectly assembled. Assemble parts in a rigorous and orderly fashion, view the diagrams carefully, and avoid incorrect assembly;
- ◆ Pay attention to the prompt text in instruction manual, carefully view the part installation orientation, and avoid incorrect comprehension. Pay attention to the requirements on testing:
- ◆ Lubricating oil shall be applied to friction areas to the greatest extent to prevent jamming during operation. Fastening screws must be thoroughly mounted to prevent looseness of parts;
- ◆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;
- ◆ Users are encouraged to optimize the parts using material removing tools like files and sand paper with adult care where the personal safety is guaranteed:

- ◆ Users are encouraged to perform part modification or overall modification of model without potential safety hazard so as to develop modification capability as soon as possible;
- ◆ The user may disassemble this model 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 official online store);
- ◆The model structure is subject to continual improvement. If the real object differs from the instruction manual, please refer to our latest assembly information.
- ♦ Once the product fails to function due to battery failure, lubricating oil shortage or dust accumulation in product gaps because it is left unused for long, it's advisable to change the battery or disassemble and clean its parts.

Precautions

- I. Safety Instruction
- ◆ Please read this manual carefully so that you are in a position to use this product correctly and safely:
- ◆ This series of products are industrial—level metal models, so its assembly and use requires certain safety awareness; improvement of safety awareness is also a function of the model;
- ◆ This model is suitable for users aged 14 and over. Please read this manual carefully for relevant safety information;
- Strictly prohibit children or pets swallowing or biting this product or its spare parts, since this may cause injury/damage:
- ◆ 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:

- ◆ This model 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; Protect the products and accessories against intense shock and vibration so as to avoid personal injury and product damage;
- ◆ During mechanical movement, do not put a finger or any other part of the body within the movement range to avoid contusions:
- Wire connectors must be connected according to the marks specified in the instruction manual to avoid short-circuit or failure arising from wrong connection;
- ◆ 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;
- ◆ Do not prevent any part from running forcibly in any form; to do this, turn off the power directly;
- ◆ To refit this model, please pay attention to the relevant part parameters, and avoid using any high-power electric part or device that may result in an accident.
- ◆ Please use parts of this product properly as per instruction manual. Don't use them for other purposes.

II. Battery and charging precautions

- ◆ This product is delivered with dedicated charging cable. Users shall use their own power adapters; output DC voltage: 5V; output DC current ≥ 1000mA:
- ◆ Please make sure the contact is dry and free of dirt before charging. Please don't charge the battery if the product is not in use or is in repair;
- ◆ Don't put the battery in fire or have it exposed to sunlight, fire or similar excessively hot environment, since this may lead to leakage, excessively high temperature. bursting or ignition of battery:
- ◆ If improper change of battery may cause explosion, the battery must be replaced with one of identical or equivalent type;

- ◆ Never disassemble, squeeze, heat and set fire to the lithium battery delivered with this product, and never touch and pry the battery using any sharp object or screwdriver, etc., since this may cause the battery to ignite or burn;
- ♦ In the case of excessively high temperature, discoloration, bulging, leakage and other anomalies during the use, charging or keeping of battery, please take it out of service and change it with a new one to avoid safety problem;
- ♦ Since the battery temperature rises when it's being charged, please don't have the battery to come into contact with inflammables (e.g. bedside, clothing and books, etc.) since this may result in a fire:
- ◆Please don't charge the battery in a moist space with high temperature; the temperature is recommended to be 0 35° C, and the humidity shall not exceed 65%; the design max. ambient temperature for using the product is 45° C;
- ◆ To alleviate the risk of electric shock, children are not allowed to use the product without the help of their parents or other custodians.

III. Product Declaration

- ◆ Please carefully read and observe various instructions and warnings in this manual before using this product. Our company shall not be held responsible for any consequence of failure to properly use this product or observe related operating instructions;
- ◆ This product is suitable for users aged 14 and over. Our company shall not be held responsible for any safety problem arising from the use of this product by too young users or users who are not familiar with relevant safety requirements:
- ◆ As a model in industrial structure, this product is designed exclusively for learning and experience. Do not use this product for other purposes; otherwise, we will assume no responsibility for any consequence thereof;

- ◆ We have been improving the design and operation features of our product, so separate notice will not be given for slight difference between instruction manual and actual product. Hence, any claim for compensation filed based on the data, pictures or text of this instruction manual will be rejected;
- ◆ For constant improvement and sustainable development, our company reserves the right to modify and improve any product detail given in this manual without prior notice;
- ◆ The pictures in instruction manual guide users for operation, and are thus for indication only; the real product shall prevail;
- Our company and its suppliers shall not be held responsible for any special, incidental, collateral or indirect loss in any case to the greatest extent the law permits, regardless of its cause;
- ◆ Please keep this manual properly since it contains important information.



Four cylinder engine commissioning

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Basic structure and features of in-line four-cylinder engine

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Basic principle of piston engine

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Contents



Assembly instructions

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- P3. Crankshaft connecting rod assembly
- **P6.** Cylinder assembly
- P11. Engine body assembly
- P15. Starting motor assembly
- P17. Generator assembly
- P19. Water pump assembly
- P21. Tension base assembly
- P23. Timing gear
- P26. Other accessories
- P35. Troubleshooting

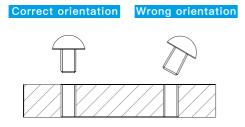


Four-cylinder engine parts list

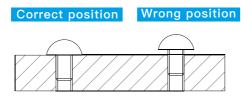
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Basic knowledge on standard parts assembly

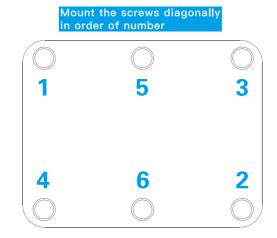
- 1.Installation of screws
- (1) Installation of screws



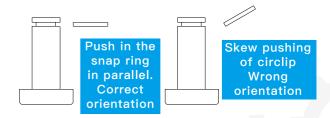
(2)Degree of screw tightening



(3)Screw installation order

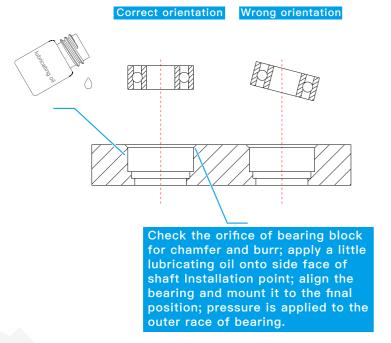


2.Installation of snap ring

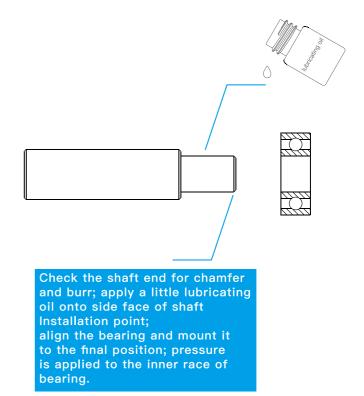


3.Installation of Bearing

(1)Install the bearing into the bearing seat hole



(2) Install the bearing onto the shaft





Important note:

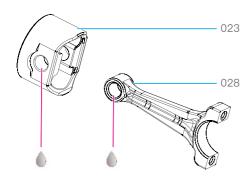
before assembly, find the bottled lubricating oil, be sure to put enough oil in all the places that need to be lubricated, otherwise the machine is easy to get stuck



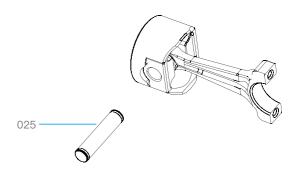


Four-cylinder engine assembly

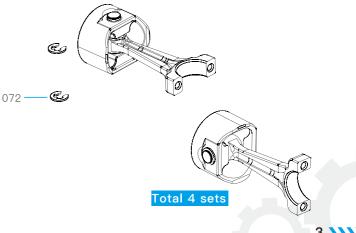
- 1 Crankshaft connecting rod assembly
- 1.1 Assembly piston mechanism



1.2 Mounting piston pin

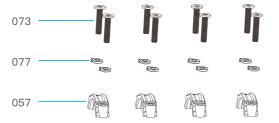


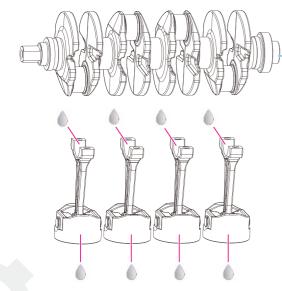
1.3 Mounting circlip



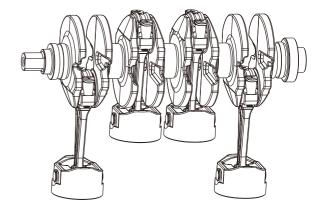


1.4 Assembly and connection between the Piston and crankshaft



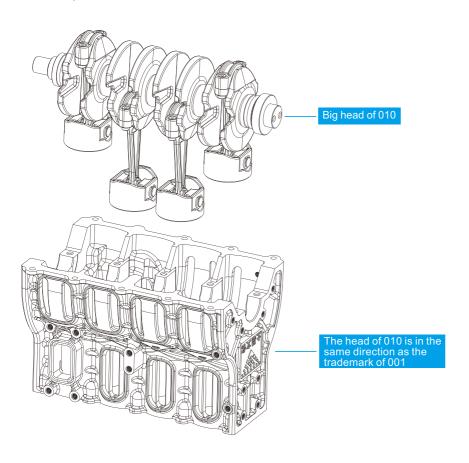


If the installation is inconvenient, you can turn 010 to make the installation position face up, which is convenient for installation

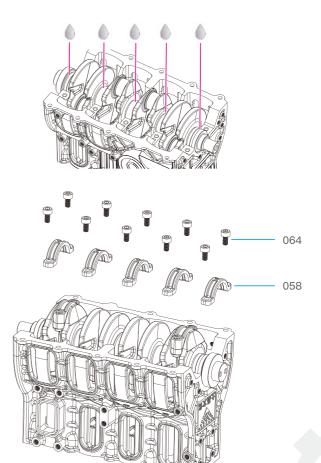




1.5 Assembly and connection between crankshaft and cylinder block

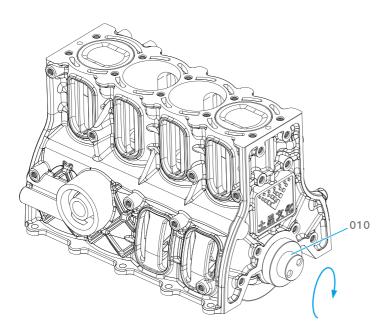


1.6 Mounting crankshaft bearing



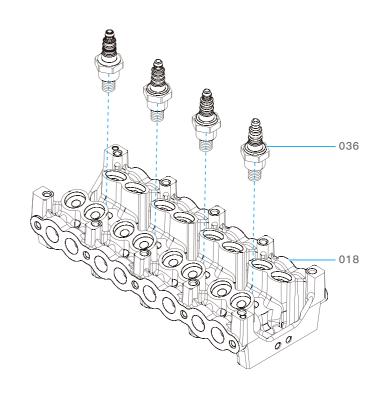


1.7 Check the transmission of the piston and crankshaft



After installing the piston mechanism, turn 010 to check if the piston and crankshaft rotate smoothly.

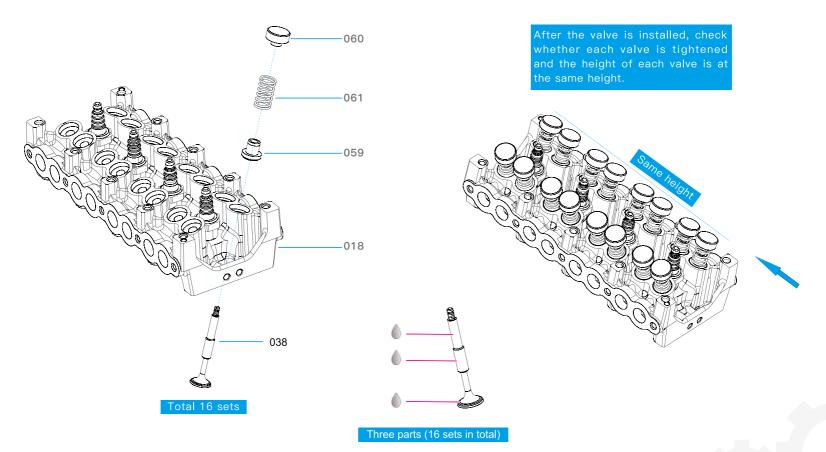
- 2 Cylinder assembly
- 2.1 Installing the spark plug



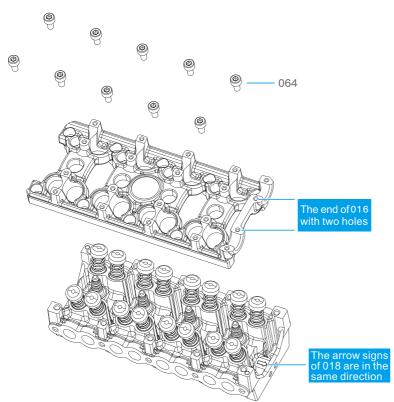


2.2 Installing the valve

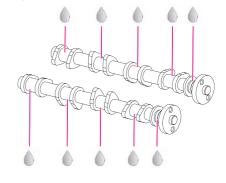
2.3 Check if the valve installation is in place

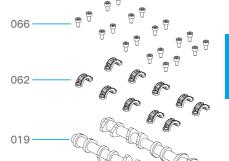


2.4 mounting cam seat



2.5 mounting camshaft



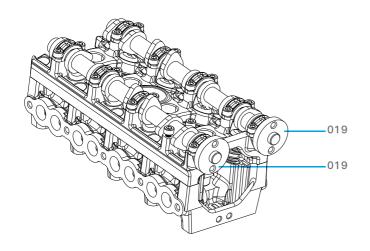


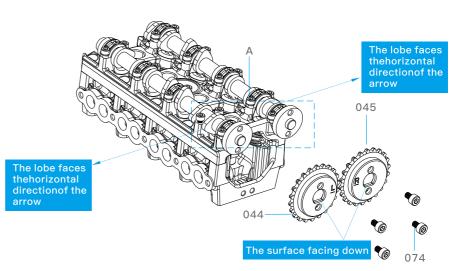
After tightening the screw 066, loosen the half turn in the reverse direction



2.6 Check the transmission of the camshaft

2.7 Install the CAM synchronous sprocket



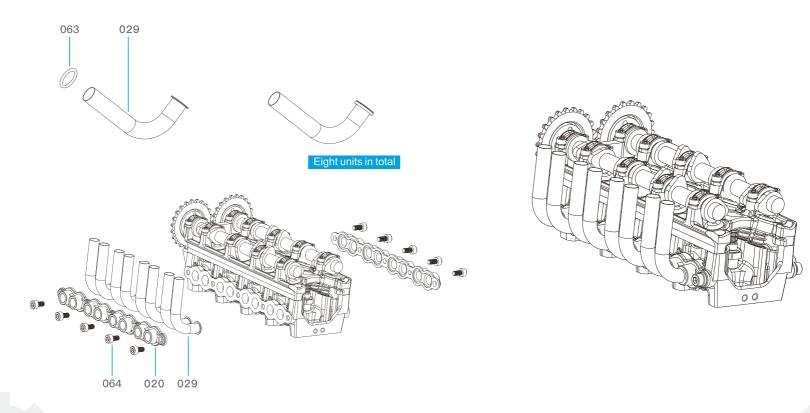


Turn the 019 camshaft by hand to check if the cam position and valve contact smoothly $\,$

The timing line on the 044 and 045 two cam synchronization sprocket are aligned



2.8 Install the exhaust pipe

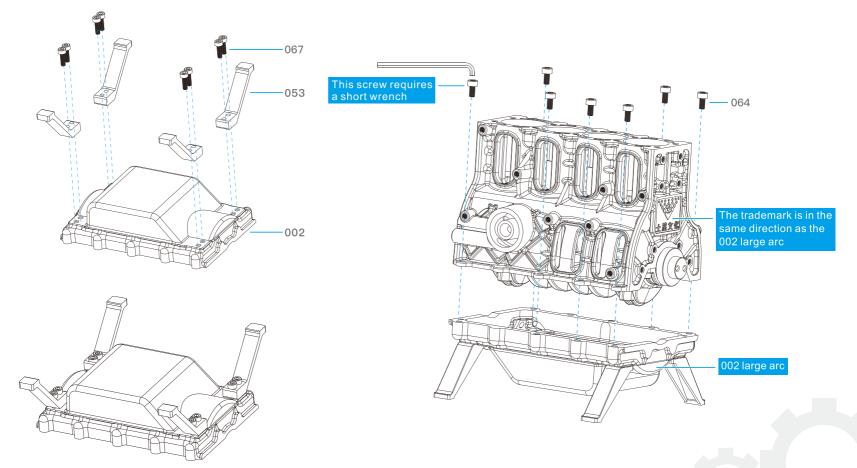




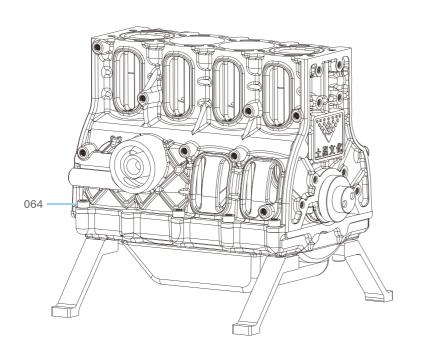
3. Assembly engine body

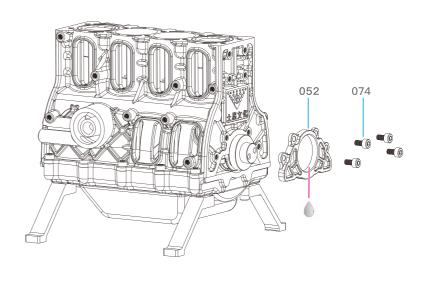
3.1 Assembly engine bracket

3.2 Cylinder block and base combination

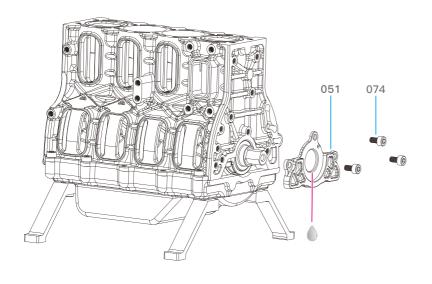


3.3 Installing the front end cover

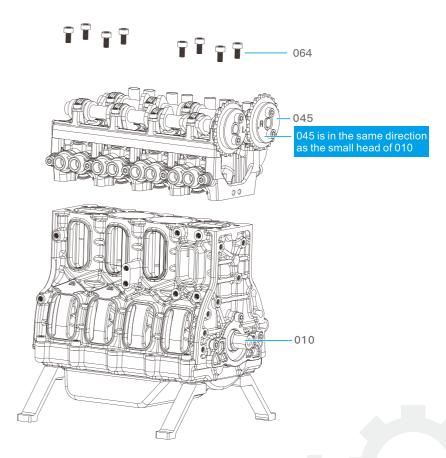




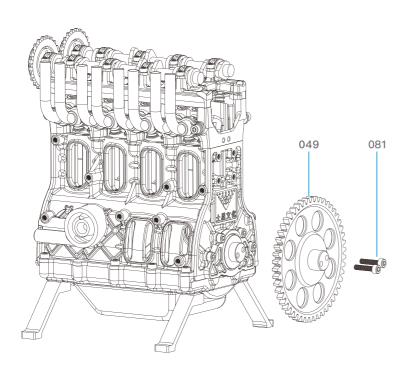
3.4. Installing the rear end cover

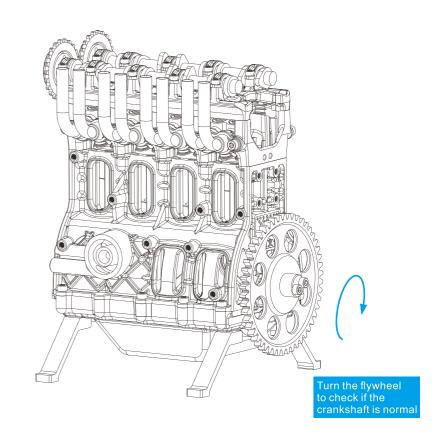


3.5. Cylinder assembly



3.6 Installation flywheel

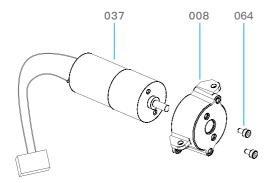




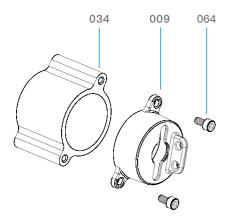


4 Starter motor

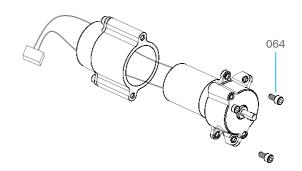
4.1 Install the starter motor front cover



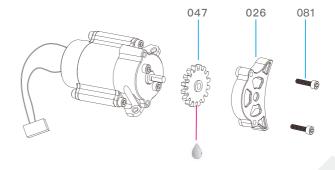
4.2 Install the rear cover of the starter motor



4.3 Front and rear cover docking

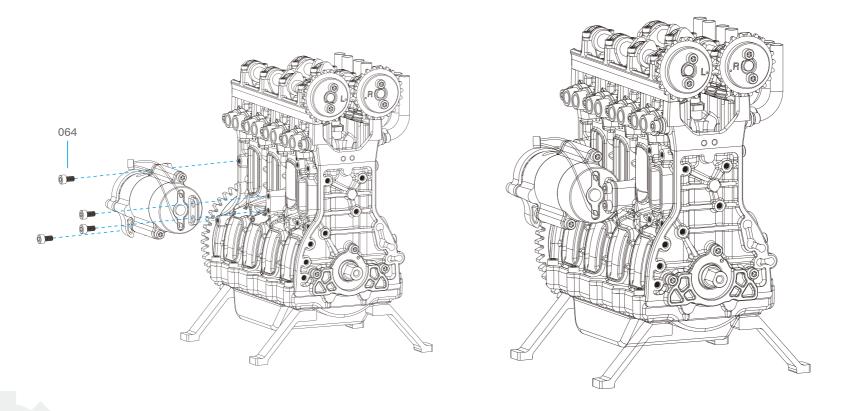


4.4 Install the starter motor gear





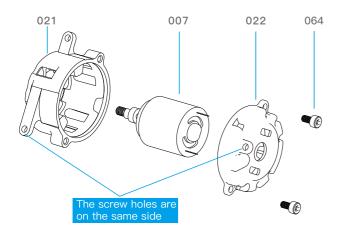
4.5 Start motor and engine combination





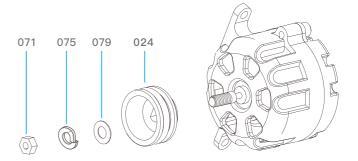
5 Generator assembly

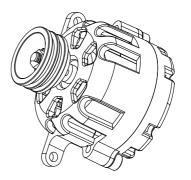
5.1 Combination of generator and generator front cover





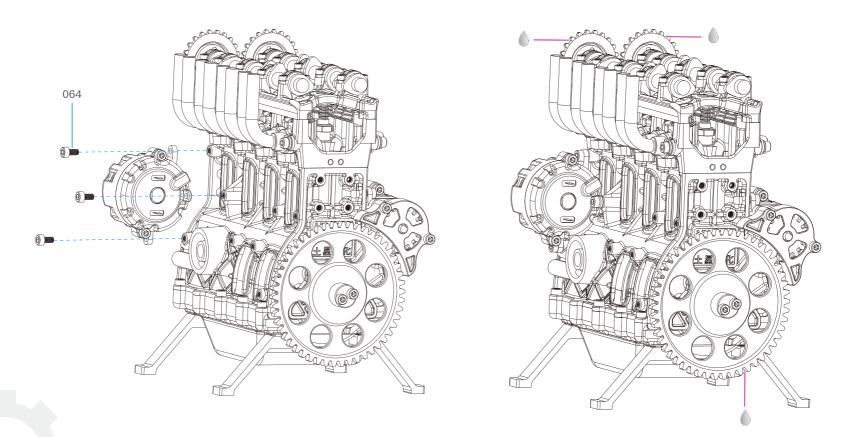
5.2 Installing the engine back cover





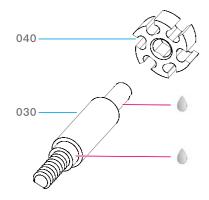


5.3 Generator and cylinder assembly

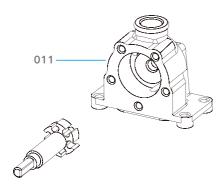


6 water pump assembly

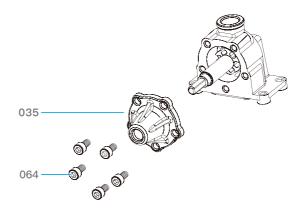
6.1 Impeller, water pump docking



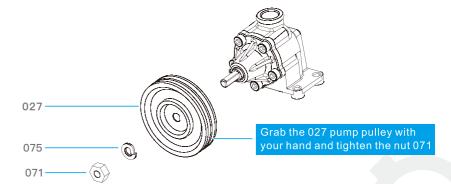
6.2 Water pump shaft, pump box docking



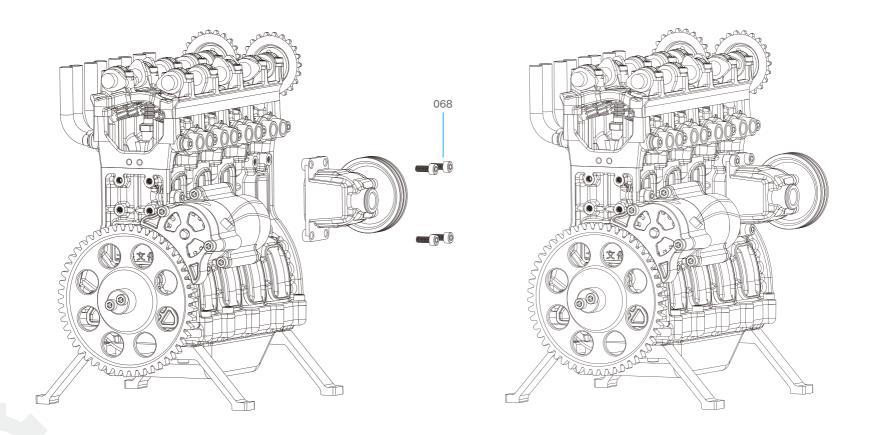
6.3 Installation of the water pump end cover



6.4 Install the water pump pulley

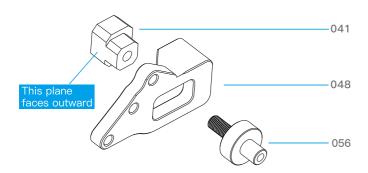


6.5 Water pump and cylinder combination

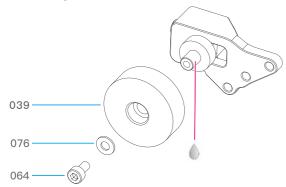


7 Tension set assembly

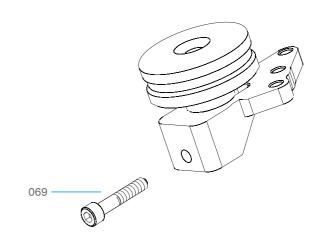
7.1 Tensioning shaft and tensioning block assembly

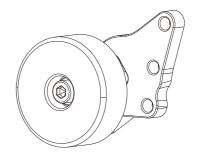


7.2 Installing the tensioner



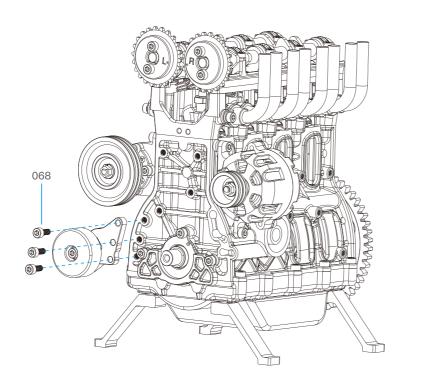
7.3 Installing the adjusting screw

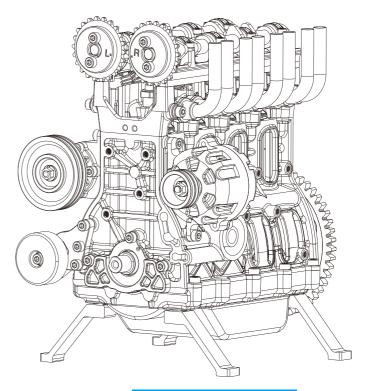






7.4 Tensioning block and cylinder block





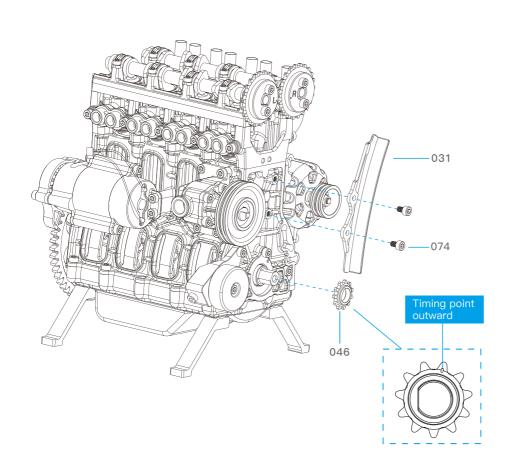
The tension seat is assembled with the cylinder block

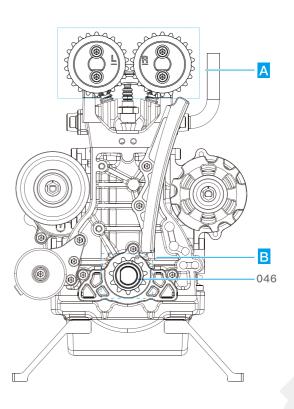


8 Timing gear

8.1 Installing the chain guide block





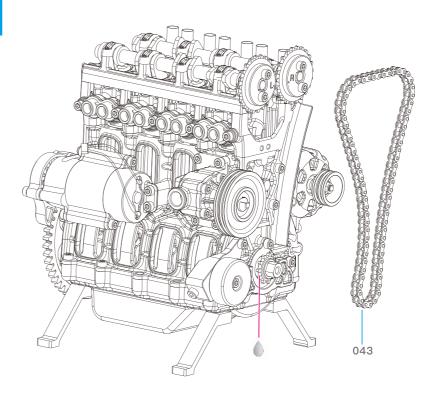




as the picture shows: Alignment the timing lines on the left and right cam synchronization sprocket, the timing point on the crankshaft synchronization sprocket should be aligned with the timing line on the rear cover, and the three timing positions should be aligned, and then put on the chain.

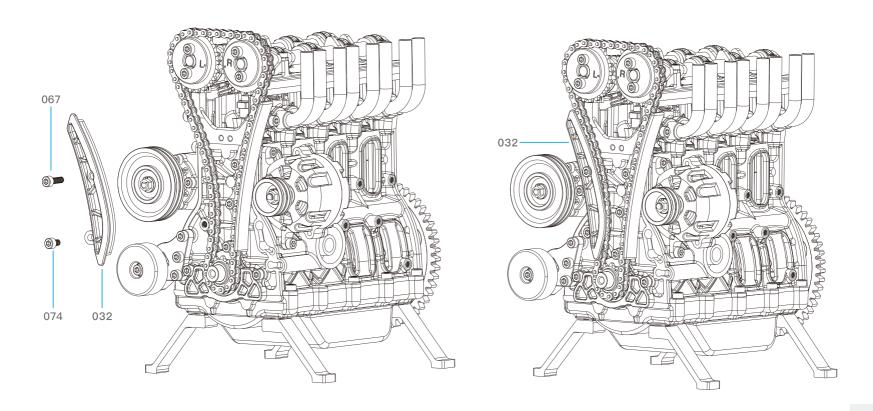
Timing line of cam synchronous sprocket Timing point of crankshaft synchronous sprocket

8.3 Installing the timing chain



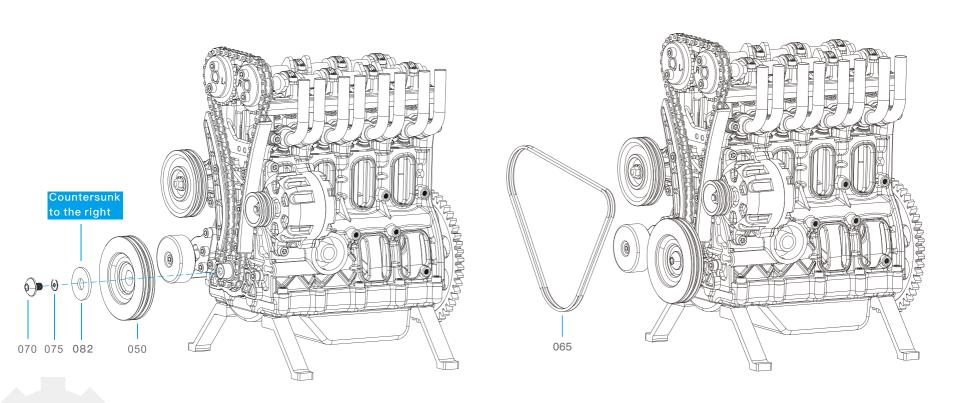


8.4 Mounting chain tensioning set



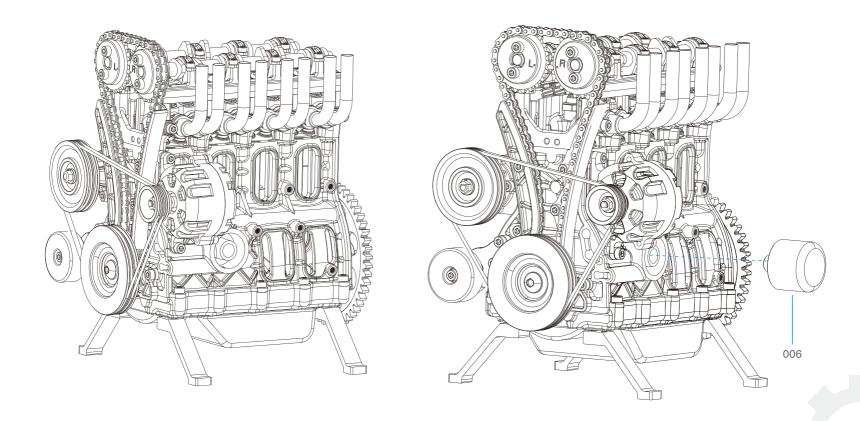
- 9. Other accessories
- 9.1 Installing the crankshaft pulley



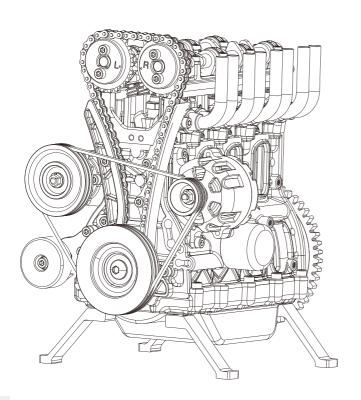


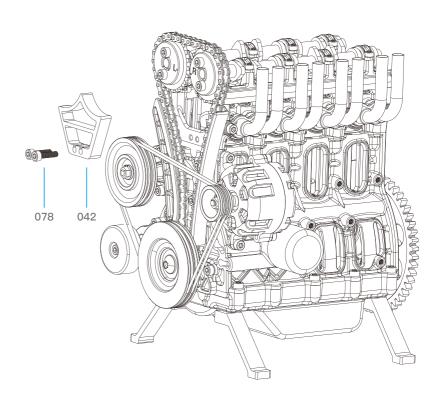


9.3 Installing oil filter



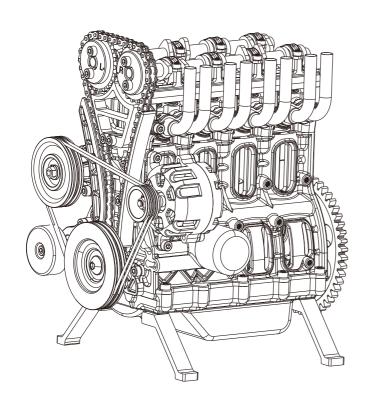
9.4 Assembly synchronous chain block

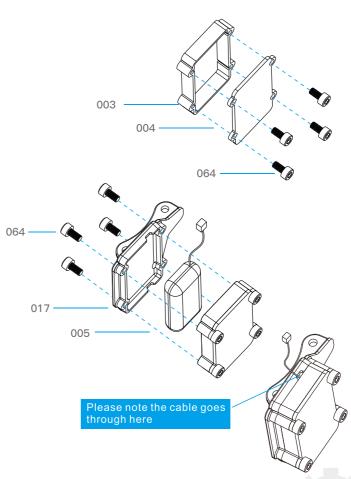




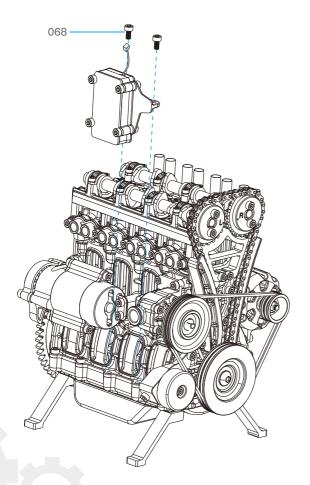


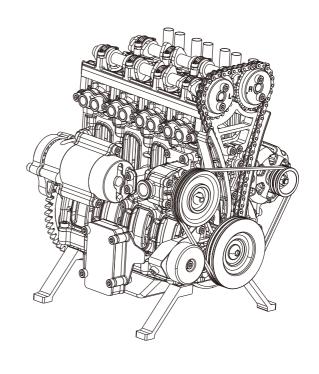
9.5 Assembly battery mounting frame



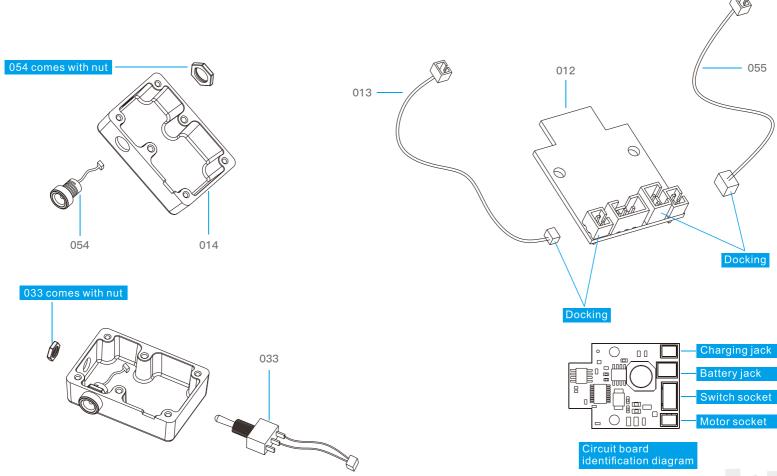


9.6 Installing battery mounting frame

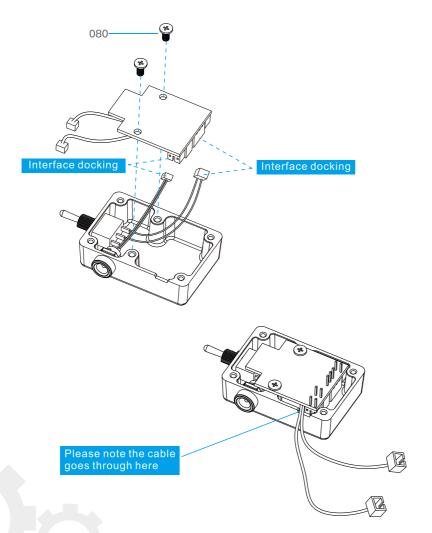


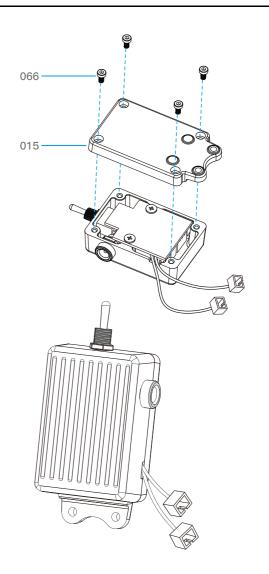


9.7 Assembly the circuit board box

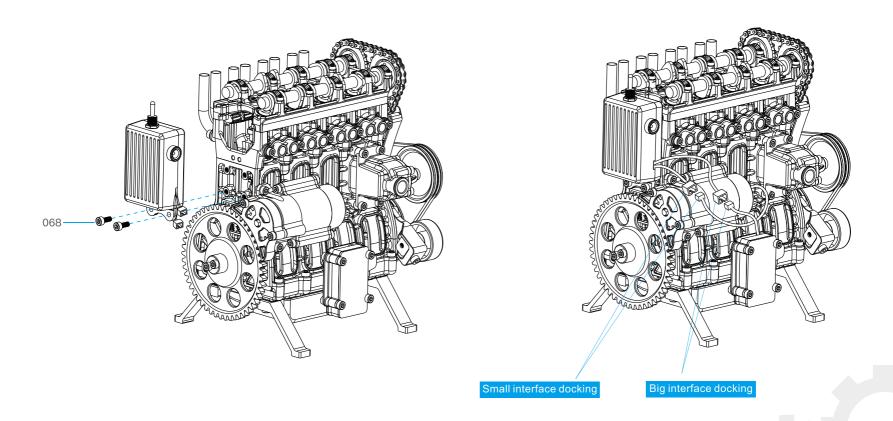


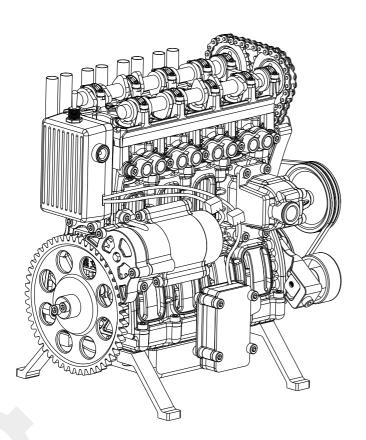




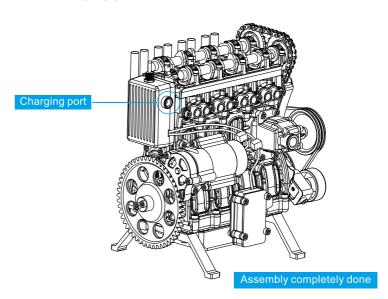


9.8 Install the circuit board box





Charging guidance



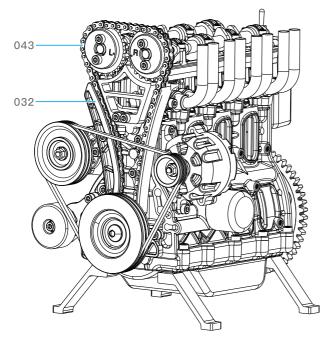
- 1. This product is equipped with a dedicated charging cable. The output DC voltage for the power adapter that user supplied is DC5V, and output DC current is not less than 1000mA. Do not use an adapter higher than 6V to charge the product.
- 2. Please refer to the precautions II battery and charging precautions in this manual.
- 3. Normal charging state:
- 1: The read lamp is on during charging
- 2: The blue lamp is on when fully charged
- 3: The maximum charging time is 2 hours



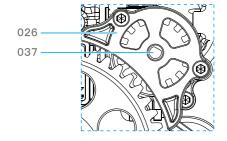
Troubleshooting

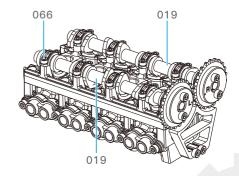
1: Mechanical troubleshooting

After the assembly is completed, please check the corresponding parts and checkit again according to the instructions. If there is any abnormality in the movement. Please follow the steps below to find and solve the problem.



- Whether the installation direction of the parts is correct
- 2. Whether the screws are tightened and loose
- 3. Check whether similar parts are reversed
- If there is any abnormality, you can loosen the screws of the chain tension block (032) to adjust the tension to make the movement normal
- 5. Check if the (037) starting motor shaft rubbing the center hole of the (026) front cover of the starting motor. If it rubs, loosen the screw of the front cover of the starting motor to fine-tune the position.
- If the (019) camshaft does not rotate smoothly, please remove the (043)timing chain and manually rotate the (019) camshaft to see if it rotates smoothly.
 If it does not, loosen the (066) screw half a turn in reverse







2: Electronic troubleshooting

1. Charging failure

Charger does not match

Solution:

Charge the product with a standard USB charger. The charger requires an output of 5V 1A (inclusive) or more. Use the USB head of TECHING's dedicated charging cable to plug into the USB port of the phone charger. Plug the round plug into the charging port of the product and charge it. As shown in Figure 1–1.

Charger
Input 100-240VAC.50/60Hz.0.35A
Output 5V 1A S/N 140500081556

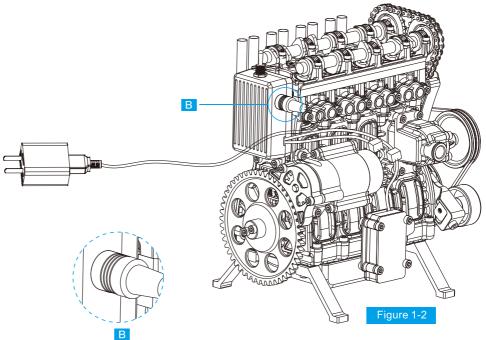
Figure 1-1

Output: 5V 1A

Charging cable round plug is inserted into the end

Solution:

Check whether the round plug of TECHING's special charging cable and the charging plug of the product are inserted into the end; As shown in Figure 1–2.

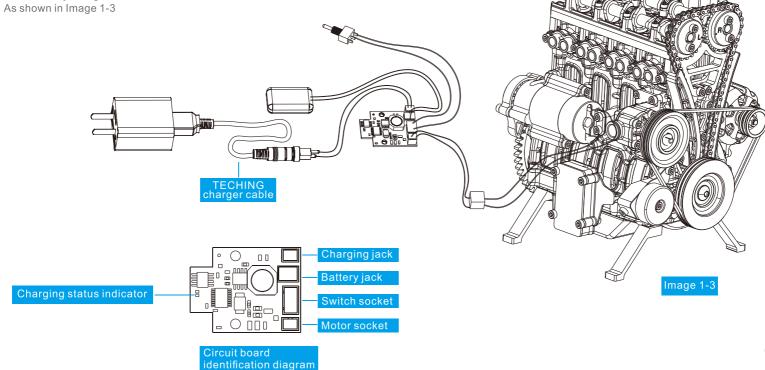


3. Wrong position of charging plug

Solution:

Remove the circuit board:

Make sure the charging plug is correctly inserted in the charging interface position DC5V of the circuit board. And then charge the product. Check the charging lamp indication on the circuit board. The read lamp is on during charging; blue light stays on when fully charged.

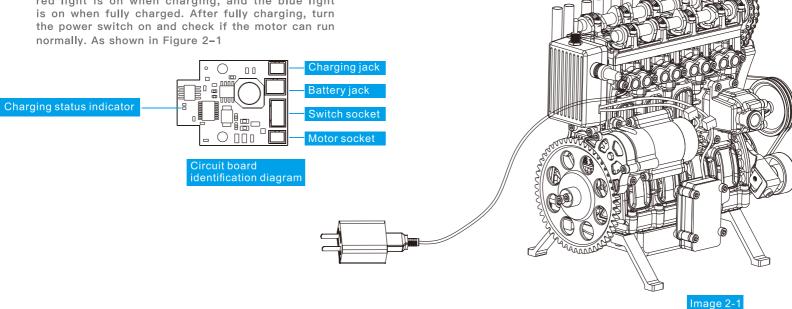


2 The motor does not work

The battery is dead

Solution:

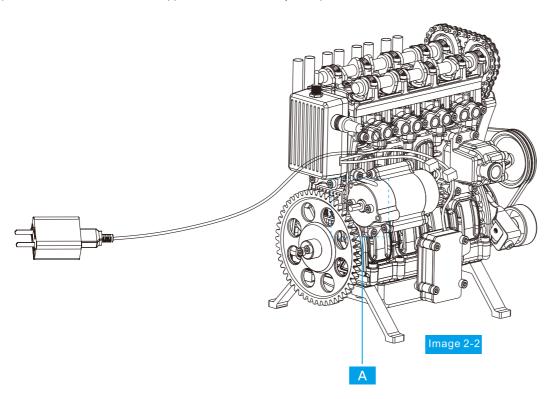
Use TECHING's dedicated charging cable to plug into the computer's USB port or the USB port of the mobile phone charger to charge the product. The red light is on when charging, and the blue light is on when fully charged. After fully charging, turn the power switch on and check if the motor can run normally. As shown in Figure 2–1

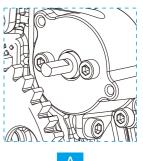


2 Mechanical causes the motor does not rotate

Solution:

Remove the start gear of the motor then test whether the motor (A) can run smoothly. As shown in Image 2-2. Note: If it can run smoothly, check the mechanical part reason according to the mechanical troubleshooting method. If the motor still does not work, please consult our after-sales support or return to factory for repair.





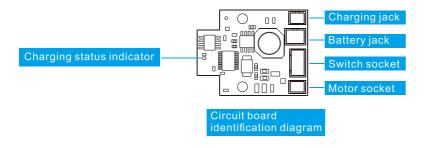


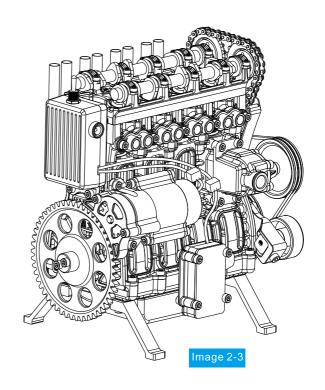


3 Motor plug is inserted in the wrong position

Solution:

Check if the motor is in the right position, as shown in Image 2-3





Other

If the above solution can not solve the problem, please consult our after-sales support or return to factory for repair.



Debugging the four-cylinder engine

1. Matching clearance

Pay attention to the matching clearance between the moving parts, and encourage the user to make small adjustments to the movement gap of the parts according to their own observation and judgment, including the use of sandpaper and calipers.

The main parts are as follows::

- 1.1 Crankshaft and related moving parts
- 1.2 Camshaft and related moving parts
- 1.3 Start the motor related motion parts
- 1.4 Piston connecting rod and related moving

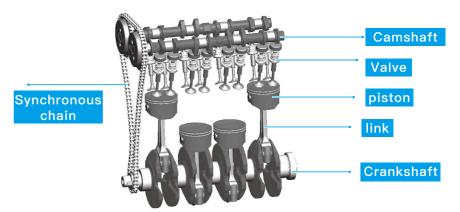
2. Lubrication

Since this product is a metal mechanical model, there is no lubricating oil in the shaft movement, which may cause the friction of the various parts to be too large or even cause the card to die. Encourage users to properly add lubricating oil to the shaft assembly area and observe the effect of

3. Denoise

The shaft moving parts are made of aluminum alloy and are anodized surfaces, and some parts have loose gaps, so the noise of the newly assembled products will be too large. Encourage users to observe and analyze the noise generating parts. It can also be improved by sandpaper, trowel and other tools, and add lubricating oil to observe the noise reduction effect.

Basic structure and characteristics of the four-cylinder engine



The in-line four-cylinder is one of the cylinder arrangement types of the internal combustion engine. Because its four cylinders are arranged in a straight line, it is also called a coaxial four cylinder. In the four-cylinder engine assembly model, each cylinder has two intake valves and two exhaust valves. The valve is driven by a synchronous chain. Most of the car engines with a displacement of less than 2.5 liters use this in-line four-cylinder engine. Generally speaking, under the same cylinder diameter, the more the cylinder number, the larger the displacement and the higher the power; under the same displacement, the more the cylinder number, the smaller the cylinder diameter, the higher the rotation speed, and the larger the lifting power.

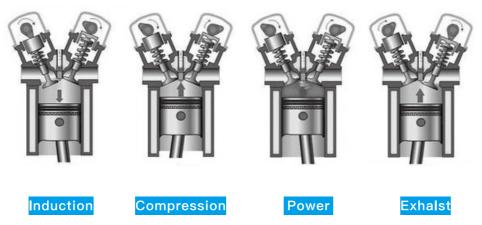




Basic principle of piston engine

- 1. Piston moving down → taking in air and gasoline;
- 2. Piston moving up \rightarrow 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.

Figure



When the single-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.	Parts picture	Part name	Qty.
001	MIT	Cylinder block	1
002		Oil sump	1
003		Battery mounting frame	1
004		Battery cover	1
005		Battery	1
006	9	Oil filter	1
007	1	Generator	1
008		Front cover of starting motor	1

No.	Parts picture	Part name	Qty.
009		Rear cover of starting motor	1
010	दाससा	crankshaft	1
011		Water pump tank	1
012		Circuit board	1
013		Motor cable	1
014		Battery box top cover	1
015		battery box bottom cover	1
016		Cam seat	1

No.	Parts picture	Part name	Qty.
017		Battery box bracket	1
018	Wildlight	Cylinder head	1
019	Militar Maria	Camshaft	2
020	ALEXANDE.	Mounting bracket of air pipe	2
021		Generator front cover	1
022		Generator rear cover	1
023	.0	Piston	4
024	0	Generator pulley	1

No.	Parts picture	Part name	Qty.
033		Switch	1
034	Q	Middle cover of start motor	1
035		End cover of water pump	1
036	YES	Spark plug	4
037		Starting motor	1
038	1	Valve	16
039	9	Tension pulley	1
040	ES!	water pump impeller	1

No.	Parts picture	Part name	Qty.
041	0	Tension block	1
042	白	Synchronous chain block	1
043		Timing chain	1
044	O.	Left camshaft sprocket	1
045	(<u>3</u>)	Right camshaft sprocket	1
046	20,5	Crankshaft synchronous sprocket	1
047	16	Starting motor gear	1
048	.3	Tension base	1

No.	Parts picture	Part name	Qty.
049	(3)	Flywheel	1
050		Crankshaft pulley	1
051	ZÔS	Rear end cap	1
052		Front end cap	1
053		Engine mount	4
054		charging plug	1
055		Battery cable	1
056	-	Tension shaft lever	1

No.	Parts picture	Part name	Qty.
065		Belt	2
066	Ŷ	M2.5x5 screw	24
067		M3x10 screw	9
068		M3x8 screw	13
069		M4x14 screw	1
070		M4x6 screw with pad	1
071		M4 nut	2
072	9	M3 snap ring	8

No.	Parts picture	Part name	Qty.
081	7	M3x14 Screw	4
082	6	Crankshaft gasket	1



Warranty instruction

I. Warranty Instruction

Please carefully read the following warranty terms when purchasing this product so as to assure effective warranty for the product:

- 1. Since this product is for assembly experience, "7-day no-hassle return/change policy" is not available if no quality defect is found after unpacking. "7-day no-hassle return policy" is available if the package is not removed;
- 2. When this product is purchased, your dealer will assist you to write down your complete real information on the warranty card, when you should ask the dealer for effective invoice or purchase voucher; then, the invoice and voucher shall be properly kept;
- 3. Users who apply for warranty have to show their purchase invoices or effective "three guarantees" certificate. For users who lost their effective voices or "three guarantees" certificate and fail to provide their copies, the warranty period is one year from the 60th day after the manufacturing of machine:
- 4. The warranty object is the parts that are found with defects after purchase and before use. We provide paid services for parts damaged by improper use by users;
- 5. We reserve the right to interpret and modify the terms & conditions of after-sales service.

II. Items of After-sales Service and Warranty

- 1. The warranty period for motor, battery and circuit board is three months from the day on which they are received and accepted; the warranty period for other parts is one year from the day on which they are received and accepted:
- 2. The user who finds some part missed when purchasing a new machine could request the manufacturer to supply the missed part within 30 days after the purchase date on warranty card; the user has to purchase that

part at Teching's official website after the said 30 days;

- 3. If the assembled product fails to run or run properly, the user could either consult the manufacturer for possible causes, or send the product back to the manufacturer for free testing or debugging;
- 4. We and our authorized agencies provide free technical advice or instruction for users who encounter any product problem;
- 5. All parts and accessories replaced within the scope of the warranty belong to our company. Users have to provide defective parts so that we can exchange them with new ones.

III. Items outside Scope of Warranty

- 1. Beyond the "three guarantees" period;
- 2. Damage is caused by failure to use, maintain and keep the product as per instruction manual;
- 3. Products that are not sold by us or our authorized sales outlets;
- 4. Those who hold no valid invoice or "three guarantees" certificate, or those who modify the after–sales service card without permission (except the case where the product is confirmed to be within the "three guarantees" period);
- 5. The product model or serial number on after–sales service card fail to match the commodity:
- 6. Damage caused by force majeure (e.g. flood, fire, earthquake, lightning strike, etc.);
- 7. Natural wear during the use of product, e.g. the problems arising from product gaps expansion, lubricating oil shortage, and battery aging, etc.;
- 8. For the faults (e.g. moisture invasion, dampness, breakage, external force extrusion, deformation and improper use, etc.) caused by other factors than product quality;
- 9. Dealers shall make agreement on warranty coverage; the situations outside this warranty agreement are not covered by the warranty.

Sales Service

- 1. Scan the Teching Assistant QR code for technical consultation;
- 2. Relevant technical information is available at Teching's official account;
- 3. You can call our hotline directly and consult our technician;
- 4. Technical consultation can be sent to us by mail;
- 5. Technical advice can be obtained from nearby authorized agencies;
- 6. You are encouraged to bring forward your comments and suggestions on our products and your expectations for new products in various manners.

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Sales service card

Account name: Tel:
Product name: Product No.:
Serial number of product:
Problem description:
Service content: Part replenishment Testing service Part replacement Return and change of goods needed
Sales unit:
Place of sale:
Operator:After-sales completion time:
ompany: Guangzhou Teching Cultural Development Co., Ltd. ddress: Baosheng Building, Hongming Road, Huangpu District. Guangzhou City. China



After-sales email: sales@techingedu.com.cn Hotline: 0086-13924277386 4001-020-019





Family game



Educational



Original design



Patented



Company: Guangzhou Teching Cultural Development Co.Ltd

Address: Bao sheng Building, Hong ming Road, Huangpu District, Guangzhou City, China.

Service Tel: 0086-13924277386 4001-020-019

After-sales email: sales@techingedu.com.cn

http://www.techingedu.com



Official Website