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

   ![Diagram of piston mechanism](image1)

   (024) (027)

1.2 Mounting of piston pin

   ![Diagram of piston pin](image2)

   (024) (023)
1.3 Mounting of snap ring

(Assembly and connection between piston and piston rod completed)

2
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)
Lubricant (4 positions)

(Assembly and connection between piston rod and crankshaft completed)
2. Cylinder assembly

2.1 Mounting of spark plugs (4 in total)

Spark plug mounting

2.2 Mounting of cam seat

Align the two opposite locating holes to fix the mounting positions of the two parts.
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)

Lubricant (10 positions)

(Mounting of camshaft bearing completed)
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

Battery pack (012)

Battery compartment

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

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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

Cylinder assembly

(069)
4.6 Mounting of flywheel
Turn the flywheel to see if the crankshaft works normally.

(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

Starting motor assembly

Mounting position of starting motor assembly
5.7 Removal of battery cover and connection of motor plug
5.8 Connection of starting motor plug

Motor wire plug

Wire inserted into notch
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

Water pump assembly
(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

[Diagram showing mounting position of 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.

Timing points of cam timing sprockets

Timing point of crankshaft timing sprocket
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)

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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:

<table>
<thead>
<tr>
<th>Intake</th>
<th>Compression</th>
<th>Working</th>
<th>Exhaust</th>
</tr>
</thead>
</table>

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.
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<tr>
<th>No.</th>
<th>Product picture</th>
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<th>Qty.</th>
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