It is vitally important, before attempting to operate your engine, to read the general ‘SAFETY INSTRUCTIONS AND WARNINGS’ in the following section and to strictly adhere to the advice contained therein.

Also, please study the entire contents of this instruction manual, so as to familiarize yourself with the controls and other features of the engine.

SAFETY INSTRUCTIONS AND WARNINGS ABOUT YOUR O.S. ENGINE

Remember that your engine is not a “toy”, but a highly efficient internal-combustion machine whose power is capable of harming you, or others. If it is misused or abused. As owner, you, alone, are responsible for the safe operation of your engine, so act with discretion and care at all times. If at some future date, your O.S. engine is acquired by another person, we would respectfully request that these instructions are also passed on to its new owner.

The advice which follows is grouped under two headings according to the degree of damage or danger which might arise through misuse or neglect.

WARNINGS

These cover events which might involve serious (in extreme circumstances, even fatal) injury.

NOTES

These cover the many other possibilities, generally less obvious sources of danger, but which, under certain circumstances, may also cause damage or injury.

WARNINGS

Never touch, or allow any object to come into contact with the rotating propeller and do not crouch over the engine when it is running.

Gasoline is poisonous. Do not allow it to come into contact with the eyes or mouth. Always store it in a clearly marked container in a cool and dark place and out of the reach of children. There is a possibility that it may damage your health.

Gasoline is highly flammable. Keep it away from an open flame, excessive heat, sources of sparks, or anything else which might cause it to ignite. Do not smoke or allow anyone else to smoke near it.

ABOUT THE ENGINE

- This engine is designed for experienced flyers. Beginners and newcomers should not use this engine.
- The engine unit, silencer and carburetor are specially designed.
- It offers broad power characteristics suitable for sport flight as well as acrobatic flight.
- The large and dense cooling fins ensure sufficient cooling against overheating.
- The specially designed ignition module “IG-02” is equipped with a micro computer and designed not to operate below 120 rpm.
- The new E-5040 silencer is supplied with the engine. It develops very efficient silencing effect.
- The engine is designed to operate choking easily and also designed to equip choke valve rod.

ENGINE PARTS NAME

- Spark Plug
- Cylinder Head
- E-5040 Silencer
- Carburetor Complete WT1054
- Drive Hub
- Sensor Leads Cover Plate
- Be Prepared Nut
- Lock Nut
- Crankshaft
- High Tension Cord
- Sensor Leads

STANDARD ACCESSORIES

- Spark Plug CM-6
- E-5040 Silencer Exhaust Gasket
- Ignition module Assembly (IG-02)

INSTALLATION

- It is suggested to use as heavy and rigid as possible engine mounting for highest performance and safe running. Install the engine on a mount using at least 4mm steel screws, such as Allen type, with locknuts, for bolting the engine to the bearers.
- Also, use the Nord Lock Washers (optional extra) and other anti-bossing washers or apply locking agent.

FUEL TANK & LINES

- Use a tank designed for gasoline. (Tanks designed for glow fuel use a rubber cap which is deteriorated by gasoline.)
- A 260cc tank will provide 11–12 minutes flight. (With full throttle, it will provide 7–8 minutes flight.)
- Install a commercially available gasoline fuel filter between fuel tank and carburetor. (Clean the filter from time to time.)
- For plumbing use TYGONRF-4040 (Yellow color) or strong-nitrile rubber of more than 2A-3.2mm ID and 4.8-6.4mm OD. Replace tubing periodically as it becomes hardened. (Replace tubing inside the fuel tank every six months.)

More than 40mm dia.

Be sure that there is sufficient air intake and outlet area on the model for engine cooling to avoid overheating. (Pay careful attention to the cooling since a gasoline engine generates more heat than a glow engine.)

Be sure to secure air intake around the carburetor intake. (When the firewall prevents air intake, enlarge the hole on the firewall side or that may be taken in from the reverse side of the firewall.)

Be sure that there is sufficient air intake and outlet area on the model for engine cooling to avoid overheating. (Pay careful attention to the cooling since a gasoline engine generates more heat than a glow engine.)

Be sure to secure air intake around the carburetor intake. (When the firewall prevents air intake, enlarge the hole on the firewall side or that may be taken in from the reverse side of the firewall.)
IGNITION MODULE

- **Major specifications**
  - **Consumption current** is 600mA/6.000rpm. User a power source of more than 1000mAh capacity.
  - The ignition module is set to operate below 120rpm for safety.
  - The voltage of power source is 4.8-7.6V (rated).
  - Ni-Cd, Ni-H 4-6 cells, Li-Po, Li-Fe 2 cells

**Installation**

- Install the ignition module taking sufficient anti-vibration measures.
- Install the ignition module at least 100mm away from the engine and in a place where there is airflow so that engine exhaust heat and radiation heat do not affect its operation.
- Do not share the power source with receiver and use a separate power source.
- Equip an ON/OFF switch between the ignition module and its power source and install it in a place where can be operated from outside the model.
- Install the ignition module and its power source as far as possible away from the servos and receiver power source.
- Connect the sensor leads of the igniter module (white, red, black parallel wires) to the sensor leads from the engine.
- Connect the battery leads of the igniter module (red, black two parallel wires) to the power source.
- Make sure the jacks of high tension cord does not touch the engine and cause to avoid accidental short circuit.
- Install the plug cap on the plug securely.

**Precautions**

- Do not disassemble the ignition module and plug cap. (The ignition module is irreparable. Replace it when necessary.)
- Be careful not to mount the ignition module so that it can be hit by water, gasoline or exhaust.
- Avoid using the engine when the external temperature is over 45°C.
- Do not move the rpm sensor as it is placed at its optimum position, otherwise the engine will not run properly.
- Do not pull on the high tension cord to remove the plug cap, or the wire will break. Be sure to hold the plug cap to remove it, Be careful not to damage your fingers while removing it.
- Do not connect nor disconnect the rpm sensor with the ignition module or there is a possibility it will fire and the engine start.
- Check the ignition module for spark when installing the plug cap on the plug and be careful about getting a shock. Make sure there is no flammable material or gasoline vapors near by that could ignite.
- Do not turn the propeller with the ignition module on, or there is a possibility the engine will start.

PROPELLER & SPINNER ATTACHMENT

There is a risk, particularly with powerful four-stroke engines, of the propeller flying off if the prop nut loosens due to detonation (‘knocking’) in the combustion chamber when the engine is operated too lean, or under an excessively heavy load. Obviously, this can be very hazardous. To eliminate such dangers, the O.S. Safety Locknut Assembly was devised.

Install this as follows:

1. Ream the propeller shaft hole to 8.1mm bore with an appropriate reamer, checking that the hole is exactly centered.

2. Instil the prop to the engine shaft, followed by the retaining washer and prop nut and tighten firmly with a 14mm wrench. (not supplied).

3. Add the special tapped and slotted locknut and secure with a 12mm wrench while holding the prop nut with the 14mm wrench. (not supplied).

**Note:**

Some spinners which are retained at the top of the cone cannot be used with the prop locknut supplied with the engine. In this case, optional locknut sets are available from O.S. — Propeller Locknut Set for Spinner (Code No.49910200 4mm) and (Code No.49910200 5mm).

**NOTE:**

Make a habit of always checking the tightness of the propeller before starting the engine. Remember that, especially with wooden propellers, there is a tendency for the material to shrink, or for it to be reduced by the serrated face of the drive hub. Relighten the propeller if necessary after loosening the Safety Propeller Locknut. The locknut should be tightened firmly after relighting the propeller nut.

Since the GT22 is intended to be started with an electric starter, the addition of a spinner assembly for centering the starter sleeve is desirable. Special propeller locknut sets are available for use with spinners. Use a good quality well balanced spinner, securing the propeller boss. Make sure that it is of precision-made and sturdy construction so that the spinner shell cannot loosen when the starter is used. Make sure the spinner notches do not interfere the propeller. If they do, cut the notches to clear.

MIXING OF OIL

- Use regular gasoline. (No need to use high octane gasoline.)
- Alcohol based glow fuel cannot be used in this engine. Not only will the engine not work properly but the internal carburetor plastic parts will be damaged.
- Use high quality commercially available 2 stroke engine oil.
- Follow the oil manufacturer’s recommendations concerning the mixture ratio of gasoline and oil. If there is no recommendation, mix with a 30:1 ratio. We have checked and approved the following of mixture ratio.
- KLOTZ NadelölB (50:1). (This does not mean we guarantee the quality of this oil.) Follow the instructions in the running-in section concerning the mixture ratio.
- With a gasoline engine, passages in the carburetor are narrower than that of a glow engine, and therefore very sensitive against foreign matter such as dust. It is suggested to use optional accessory Super Filter L (Code No. 72403050) when filling a tank in the model from a container used for transportation or storing.

**Warning:**

Make sure that the propeller is well balanced. An unbalanced propeller and/or spinner can cause serious vibration which may weaken parts of the airframe or affect the safety of the radio-control system. Do not use any propeller which has become split, cracked or nicked even very slightly, or received strong impact even if no apparent damage is visible.
**RUNNING-IN / STARTING**
- Use a fuel with increased oil content and set the needle a little on the rich side. Too rich a needle setting may cause misfiring or erratic running due to fouling of the plug.
- Use a 2 1/2:1 fuel/oil mixture if the particular brand of oil states 3:1 mix. Use a 2:1 fuel/oil mixture if the particular brand of oil states 3:1 mix. Set the high speed needle 200 below maximum rpm. The low speed needle need not be richened.
- No need to carry out running-in on a bench nor with the model fixed. Just fly the model with the above mentioned fuel and needle setting.
- A total of 10 flights (3 4-1tters fuel) are required. Avoid prolonged full throttle running at initial stage, and gradually extend the full throttle running time.

**WARNING:**
When ground running the engine, avoid dusty or sandy locations. If dust or grit is drawn into the engine, this can have a ruinous effect, drastically shortening engine life in a matter of minutes.

**Initial needle position**
When starting the engine for the first time, set both the high speed needle 2 turns open and the slow speed needle 1.5 turns open from the fully closed position. With this position both high and slow speed mixtures will be rich. If the settings are upset, come back to this setting and adjust them according to procedure in the needle setting section.

**Starting by an electric starter**
1. Turn on the transmitter switch.
2. Turn on the receiver switch.
3. Turn on the ignition switch.
4. Open the choke valve fully (OFF).
5. Pull down the throttle stick on the transmitter fully or to the 1/8 open position (2 to 3 clicks). With the throttle stick half to fully advanced, the fuel will not be delivered to the carburetor suitably when an electric starter is applied. Also, the model will move forward with engine high power right after it is started, which is very dangerous.)
6. Tell the helper and onlookers that you will start the engine now and have the helper hold the model securely.
7. Apply the electric starter.

**Starting with a Chicken stick or gloved hand**
(It is suggested to use an electric starter for safety.)
1. Turn on the transmitter switch.
2. Turn on the receiver switch.
3. Turn on the ignition switch.
4. Close the choke fully (ON).
5. Pull down the throttle stick on the transmitter fully or to the 1/8 open position (2 to 3 clicks).
6. Flip the propeller until the fuel reach the carburetor and you hear explosion several times.
7. Open the choke fully (OFF).
8. Make sure the throttle stick is set slowest position or 1/8 open (2-3 clicks) position.
9. Tell the helper and onlookers that you will start the engine now and have the helper hold the model securely.
10. Flip the propeller with a Chicken stick to start the engine. (Usually the engine starts with 5 to 6 fps.)

**Note**
If you have only short runs or the engine does not start with more than 5 fps, most probably priming is not sufficient. Remove the plug to check if it is wet.
If it is wet, replace it or wait until it becomes dry. Then, flip the propeller quickly 10 times without installing the plug to eject the fuel in the engine. Then, install the plug and repeat the procedure.

**NEEDLE ADJUSTMENTS**
The slow speed needle is effective through the high speed range, while the high speed needle is not effective in the low speed range. Both needles are effective in the mid speed range, while the slow speed needle is the most effective. (Refer to the diagram below.)

**Carry out the needle settings as follows.**

- **Adjustment on the ground**

  1. Set the high speed needle 2 turns open and the slow needle at 1.5 turns open from fully closed position.
  2. Start the engine. Open the throttle valve slowly until fully open and run the engine for 10 seconds to warm the engine.
  3. Set the throttle stick 1 clicks advanced from the bottom and measure rpm with a tachometer and write it down.
  4. Close the slow speed needle approx. 30 degrees and measure rpm with a tachometer and write it down. Be sure to adjust the slow needle only after stopping the engine.
  5. Repeat step 4, to locate the slow speed needle position where maximum rpm is achieved. Open it approx. 180 degrees from this position. This is the basic slow needle position.
  6. Open the throttle valve fully and measure rpm with a tachometer and write it down.
  7. Close the high needle approx. 30 degrees and measure rpm and write it down. (Be sure to adjust the high needle only after stopping the engine."
  8. Repeat step 7, to locate the high needle position where maximum rpm is achieved. Open it approx. 45 degrees from this position. This is the basic high needle position.
  9. Set the throttle trim on the transmitter so that the idle rpm is approx. 1,900 (approx. 1,700rpm when idle down function is used).
  10. Warm the engine for 10 seconds with the throttle fully open, then idle the engine for 5 seconds, then quickly open the throttle fully. Make sure the engine does not respond sluggishly to increase rpm nor hesitates before picking up speed or even ceases firing.
  11. If the engine responds sluggishly to increase rpm, the mixture is too rich due to the slow speed needle being open too far. Close the slow speed needle approx. 15 degrees. Repeat this procedure until the engine accelerates smoothly. (Be sure to adjust the slow needle only after stopping the engine.)
  12. If the engine hesitates before picking up speed or ceases firing, the mixture is too lean due to the slow speed needle being open too far. Open the needle approx. 15 degrees. Repeat this procedure until the engine accelerates smoothly. (Be sure to adjust the slow needle only after stopping the engine.)

**Adjustment with flight**
13. If the rpm drops or the exhaust sound weakens when vertically climbing from level flight with full throttle, the mixture is too lean. Land the model and open the high speed needle approx. 15 degrees. Repeat this procedure until the engine sound is smooth.
14. If, on the other hand, exhaust sound is irregular when vertically climbing from level flight, the mixture is too rich. Land the model and close the high speed needle approx. 15 degrees. Repeat this procedure until the sound in level flight is steady.
15. If the power drops gradually or exhaust sound weakens (overheating symptom), when performing torque roll and hovering, the mixture is too lean. Land the model and open the slow speed needle approx. 15 degrees. Repeat this procedure until power remains steady.

16. If the above symptom is not detected with prolonged torque roll and hovering but sluggishly to increased rpm when the throttle is fully opened abruptly, the mixture is too rich. Land the model and close the slow speed needle approx. 15 degrees until sluggish rpm increase disappears.

**Note**
Generally, a gasoline engine is sensitive to a lean mixture compared with a glow engine, and will stop without warning hesitation and stops with overheating. It is recommended that the engine be run with a slightly richer mixture.

**FLIGHT & MAINTENANCE**

**Checking prior to flight**
- When the engine is started, make sure the radio control system works normally (dummy test).
- Engine does not run erratic with full throttle.
- Idling is stable.
- Responds positively to the throttle operation.
- Warm-up is finished.

Warm-up is required as with full size aircraft and car engines. Take off the model after warming the engine for approx. 10 seconds with full throttle.

**Precautions in flight**
- A slight engine rpm increase and decrease delay is normal. Abrupt throttle operation will cause the engine to quit. Move throttle smoothly.
- Due to the construction of the carburetor, 80-90% of maximum power develops with half throttle. If you feel uneasy with this, adjust with transmitter function (exponential and throttle curve, etc.) or differential of throttle linkage.

Cooling is more vitally important to a gasoline engine than to a glow engine. If overheating symptoms (loss of power at full throttle) occur, you must note mid speed changes from cloudy to clear one are observed during flight. Immediately stop flying and carry out the following countermasures.
1. Enlarge the air intake cutout on the cowling.
2. Enlarge the air outlet cutout on the cowling. (It is vitally important.)
3. Partly cover the air intake cutout on the cowling where air does not hit direct the engine.
4. Install an air guiding plate on the fuselage and cowling so that cooling air may be guided to the cylinder portion of the engine and muffler.
- When the interval between the flights is short and the engine is still hot, it may be possible overheating symptoms are observed by circulating the head from the former flight through the engine even if the overheating symptoms were not observed during the former flight. In this case, leave it until the engine is fully cooled down (in hot weather, it may take more than one hour) or run the engine for 4 to 5 minutes at idling.

**Maintenance after the day's flights**
Please pay attention to the matter described below to ensure that your engine serves you well in regard to performance, reliability and long life.
- Check the tightening of each screw, especially engine installing screws and silencer installing screws each time. Also, for the first several flights, tighten the screws after each check.
- As previously mentioned, it is vitally important to avoid operating the engine in conditions where dust, distributed by the propeller, may be deposited on the engine and enter its working parts.
- Remember to keep your fuel container closed to prevent foreign matter from contaminating the fuel.
- Install a fuel filter to prevent foreign matter in the fuel container from entering the fuel tank. O.S. Super Filter (L) is available as an optional extra.
- Install an inline fuel filter between the tank and carburetor to prevent foreign matter in the tank from entering the carburetor.
- Clean these filters periodically.

- If these precautions are neglected, restrictions of fuel flow may cause the engine to cut out, or the fuelair mixture becomes too lean causing the engine to overheat.

- With a gasoline engine rust hardly occurs. Check the exterior to make sure there is nothing wrong and wipe off any oil res.
- Fill the carburetor with fuel at the conclusion of a day's flying. (Pay careful attention to the fuel and ignition source when carrying and storing the model.)
  If the engine is stored without filling the carburetor, with fuel the inside parts will dry out and not work properly at the next running. If the engine quits out of fuel, refill the carburetor with fuel.
- When the engine is not to be used for a long period (more than a year), remove the engine from the model, clean the outside then remove the carburetor, and plug all tubing. Clean inside the engine by rotating the crankshaft with the engine immersed in container filled with gasoline.
- Also use gasoline to clean the outside of the carburetor. Clean the outside only because the inside parts are sensitive to foreign substances.
- After cleaning the engine, dry it well then inject a small quantity of oil used to mix fuel and rotate the crankshaft several times to distribute the oil well inside the engine. Finally reassemble the engine and store it in a dry place after inserting it in a heavy vinyl bag.

### O.S. GENUINE PARTS & ACCESSORIES
- **PROPELLER LOCKNUT SET FOR SPINNER**
  - 5/16"-M4 (45910200)
  - 5/16"-M5 (45910300)
- **SUPER FILTER (S)**
  - (72403051)
- **SUPER FILTER (L)**
  - (72403050)
- **NON-BUBBLE WEIGHT**
  - (S) (71531010)
- **BLIND NUT (10pcs.)**
  - M4 (79870040)
- **LOCK WASHER (10sets)**
  - M4 (55900003)

Note: The specifications are subject to alteration for improvement without notice.

### THREE VIEW DRAWING
Dimensions (mm)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>22.12 cc / 1.350 cu.in.</td>
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<tr>
<td>Bore</td>
<td>32.0 mm / 1.260 in.</td>
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<tr>
<td>Stroke</td>
<td>27.5 mm / 1.083 in.</td>
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<tr>
<td>Practical R.P.M.</td>
<td>1,800-9,000 r.p.m.</td>
</tr>
<tr>
<td>Output</td>
<td>6.57 ps / 4.75 hp / 4,900 r.p.m.</td>
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<tr>
<td>Weight</td>
<td>761.6 g / 26.86 oz. (Engine)</td>
</tr>
<tr>
<td></td>
<td>132.6 g / 4.68 oz. (Silencer)</td>
</tr>
<tr>
<td></td>
<td>105.0 g / 3.70 oz. (Ignition module)</td>
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</table>

### ENGINE EXPLODED VIEW

### CAP SCREW SETS (10pcs./sets)

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Size</th>
<th>Part Name</th>
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<tbody>
<tr>
<td>79871700</td>
<td>M3x20</td>
<td>Cylinder Head Retaining Screw (4pcs.)</td>
</tr>
<tr>
<td>79871120</td>
<td>M3x10</td>
<td>Cover Plate Retaining Screw (4pcs.)</td>
</tr>
<tr>
<td>79871555</td>
<td>M5x55</td>
<td>Carburetor &amp; Reed valve Retaining Screw (2pcs.)</td>
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### ENGINE PARTS LIST

<table>
<thead>
<tr>
<th>No.</th>
<th>Code No.</th>
<th>Description</th>
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<tr>
<td>1</td>
<td>28204000</td>
<td>Cylinder Head</td>
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<tr>
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<td>28204100</td>
<td>Head Gasket</td>
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<td>28203100</td>
<td>Cylinder Liner</td>
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<td>3</td>
<td>28203400</td>
<td>Piston Ring</td>
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<td>4</td>
<td>28203200</td>
<td>Piston</td>
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<td>5</td>
<td>28206000</td>
<td>Piston Pin</td>
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<tr>
<td>6</td>
<td>28317000</td>
<td>Piston Pin Retainer</td>
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<tr>
<td>7</td>
<td>28205000</td>
<td>Connecting Rod</td>
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<td>8</td>
<td>46810000</td>
<td>Lock Nut Set</td>
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<td>9</td>
<td>28208000</td>
<td>Drive Hub</td>
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<td>27720000</td>
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<td>44731000</td>
<td>Ball Bearing (F)</td>
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<td>Woodruff Key</td>
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<td>18</td>
<td>28152100</td>
<td>Crank Pin Stop Screw</td>
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<td>Cover Plate</td>
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<td>28215100</td>
<td>Carburetor &amp; Reed Valve Gasket Set (1piece each)</td>
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<td>22</td>
<td>28216000</td>
<td>Reed Valve Assembly</td>
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<td>29781000</td>
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<td>29781360</td>
<td>Choke Arm Assembly (1pcs.)</td>
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<td>N4-40x5 Screw (1pc.)</td>
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<td>74002310</td>
<td>Ignition Module (IG-02)</td>
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<td>71689000</td>
<td>Spark Plug CM-6</td>
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<td>26</td>
<td>28225000</td>
<td>E-5040 Silencer</td>
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<td>28214400</td>
<td>Exhaust Gasket</td>
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<tr>
<td>28</td>
<td>79871440</td>
<td>Cap Screw M5x40 (10pcs./set)</td>
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Note: The specifications are subject to alteration for improvement without notice.