TOWMOTOR®

# Service Manual

## K15, K21, K25 Gasoline Engine

For use with GP15N-GP35N, GPE15N-GPE35N, GP20S-GP30S
Chassis Service Manual.

99729-93100

MidWestTech | Towmotor K15, K21, K25 Gasoline Engine Service Manual | Publication 99... Order the manual at mid-west-tech.com >

# GENERAL INFORMATION

# SECTION GI



## CONTENTS


**HOW TO USE THIS MANUAL ..... GI-2**
- Description ..... GI-2
- Definition of Terms ..... GI-2
- Definition of Units ..... GI-2
- Description ..... GI-2

**PRECAUTIONS FOR SAFETY AND QUALITY .. GI-3**
- Safe Operation ..... GI-3
- Correct Operation ..... GI-4
- Precautions for Radio Equipment Installation . GI-4

**PRECAUTIONS ..... GI-5**
- Precautions in Draining Engine Coolant ..... GI-5
- Precautions for Disconnecting Fuel Piping ..... GI-5
- Precautions for Removing and Disassembling GI-5
- Precautions for Inspection, Correction, and Replacement ..... GI-5
- Precautions for Assembly and Installation ..... GI-5
- Parts Requiring Angle Tightening ..... GI-6
- Caution for Use of Power Tools ..... GI-6
- Precautions for Liquid Gasket Application ..... GI-6

**TIGHTENING TORQUE ..... GI-7**
- Standard Bolt Tightening Torque ..... GI-7
- Engine Part Tightening Torque ..... GI-8

**SPECIAL SERVICE TOOLS ..... GI-10**

**ENGINE OUTSIDE DRAWINGS ..... GI-11**

**MAIN SPECIFICATIONS ..... GI-12**

**STANDARD AND REPAIR LIMIT ..... GI-16**

**STAMPED LOCATION OF ENGINE NO. ..... GI-20**

**TROUBLE DIAGNOSIS ..... GI-21**
- Engine Adjustment ..... GI-22
- Engine LPG Fuel System ..... GI-27


MidWestTech | Towmotor K15, K21, K25 Gasoline Engine Service Manual | Publicatio... Order the manual at mid-west-tech.com >

# MAINTENANCE

# SECTION MA

MA

## CONTENTS


**ENGINE MAINTENANCE ..... MA-2**
Specifications ..... MA-2
Tightening Torque ..... MA-6
Maintenance Schedule ..... MA-8
Oil and Grease, and Capacity ..... MA-9
On Board Inspection and Service ..... MA-10


MidWestTech | Towmotor K15, K21, K25 Gasoline Engine Service Manual | Publicatio... Order the manual at mid-west-tech.com >

# ENGINE TUNE-UP

# SECTION ET

ET

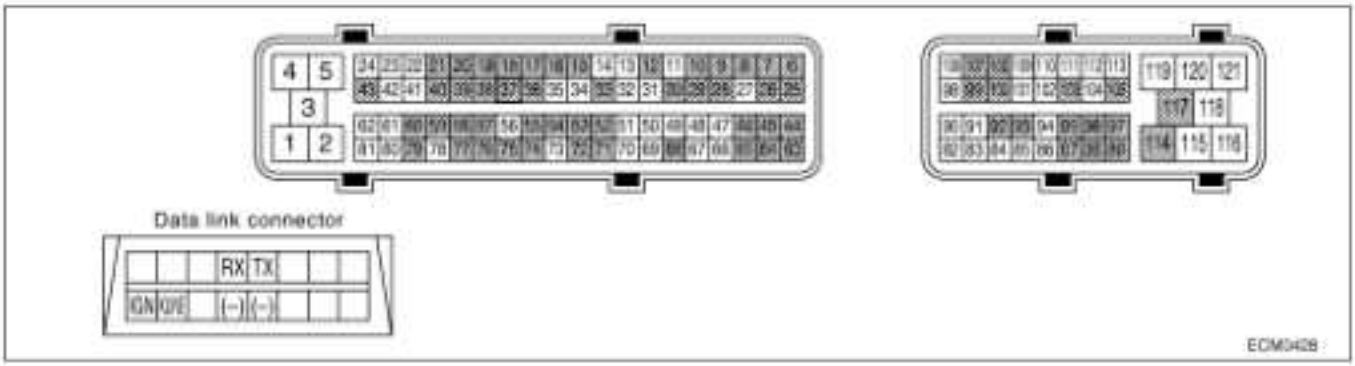
## CONTENTS


SPECIFICATIONS ..... ET-2
TIGHTENING TORQUE ..... ET-3
TROUBLE DIAGNOSIS ..... ET-4
ENGINE INSPECTION AND ADJUSTMENT ..... ET-9
Engine Body Related ..... ET-9
Ignition and Fuel Systems ..... ET-13
SPECIAL SERVICE TOOLS FOR CARBURETOR MODEL ..... ET-20



MidWestTech | Towmotor K15, K21, K25 Gasoline Engine Service Manual | Publicatio... Order the manual at mid-west-tech.com >

## ECM Terminal




## REFERENCE VALUE LIST

Voltage is measured with a circuit tester, and the sample waveforms obtained with an oscilloscope are shown below for each ECM terminal. Measurement data varies depending on variation in parts as well as many other factors. Such factors include vehicle history, driving conditions, environmental conditions, maintenance status, measuring instrument/method, etc. Data shown below are reference values.

| Terminal signal | Description | Measurement condition | Measured value |
|---|---|---|---|
| 1<br>2<br>115<br>116 | ECM ground | Always | Approx. 0V |
| 66 | Sensor ground (Throttle position sensor) | At idle after warming up | Approx. 0V |
| | | At approx. 2,000 rpm | |
| 67 | Mass air flow sensor ground | Always | Approx. 0V |
| 78 | Heated oxygen sensor ground | Always | Approx. 0V |
| 82 | Accelerator pedal position sensor 1 ground | Always | Approx. 0V |
| 83 | Accelerator pedal position sensor 2 ground | Always | Approx. 0V |
| 32 | Fuel changing switch 2 (Gasoline) | Changing switch ON (At gasoline side) | Approx. 5V |
| | | Changing switch ON (At LPG side) | Approx. 0V |
| 70 | Fuel changing switch 1 (LPG) | Changing switch ON (At LPG side) | Approx. 5V |
| | | Changing switch ON (At GAS side) | Approx. 0V |
| 84 | Headlamp switch | Lighting switch OFF | Approx. 0V |
| | | Lighting switch ON | Battery voltage |
| 101 | Brake switch | Brake pedal released | Approx. 0V |
| | | Brake pedal depressed | Battery voltage |
| 102 | Neutral switch | N position | Approx. 0V |
| | | Other than above | Battery voltage |
| 109 (IGN) | Ignition switch | Ignition switch OFF | Approx. 0V |
| | | Ignition switch ON | Battery voltage |



MidWestTech | Towmotor K15, K21, K25 Gasoline Engine Service Manual | Publicatio... Order the manual at mid-west-tech.com >

## Diagnosis Chart by Symptom (Cont'd)

### RELATIONSHIPS BETWEEN MALFUNCTIONING SYMPTOMS AND ACTUATOR CIRCUITS

The table below shows the possible symptoms caused by the malfunction of each actuator circuit.

Actuator malfunction
⊕: Highly possible
•: Possible

| Symptoms | | | Impossible to start | | Poor starting | | Poor idle | | | | | | Poor driving | | | | | | | | Engine stall | | | | Other | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | No initial combustion | Initial combustion | When engine is cold | When engine is warming up | Fast idle is not effective | High idle rpm | Low idle rpm | Inconsistent idle when engine is cold. | Inconsistent idle when warming up | Poor power output | Poor acceleration | Engine rpm does not increase smoothly. | During surge and acceleration | During surge and constant speed driving | Knocking | Backfire | After-burn | At Idle | Driving | During deceleration | During a heavy load | Engine over temperature (Overheat) | Poor fuel consumption efficiency | Check that symptoms are detected with self-diagnosis. | Check that symptoms are in fail-safe condition. | Description/notable characteristics of the symptom |
| Gasoline injector | Power supply circuit | OPEN | • | • | • | • | | | | ⊕ | ⊕ | • | • | • | • | | | | | • | • | • | • | | | | | • No fuel injection to cylinder with open circuit, resulting in LEAN output of heated oxygen sensors.<br>• Starting engine is impossible when the circuits for all the cylinders are open. |
| | | Momentarily open | | | | | | | | | | | | | | • | | | | • | | • | • | | | | | |
| | Coil | OPEN | • | • | • | • | | | | ⊕ | ⊕ | • | • | • | • | | | | | • | • | • | • | | | | | |
| | | Momentarily open | | | | | | | | | | | | | | • | | | | • | | • | • | | | | | |
| | Drive circuit (ECM side) | OPEN | • | • | • | • | | | • | ⊕ | ⊕ | • | • | • | • | | • | • | | • | • | • | • | | | | | |
| | | Momentarily open | | | | | | | | | | | | | | • | | | | | | | | | | | | |
| | | SHORT | • | • | • | • | | | | ⊕ | ⊕ | • | • | • | • | | | | • | • | • | • | • | | | | | • Continuous fuel injection to cylinder with short circuit, resulting in OVER-RICH and misfiring.<br>• Starting engine is impossible when the circuits for all the cylinders are open. |
| | Nozzle hole | Foreign material intrusion | • | • | • | • | | | | | ⊕ | • | • | • | | • | | | • | • | • | • | • | | | | | • The cylinder with foreign material will keep injecting. |
| | | Clogging | • | • | • | • | | • | | ⊕ | ⊕ | • | • | • | | • | • | • | | • | • | • | • | | | | | • The symptom depends on clogging status. The correction factor of air-fuel ratio becomes larger. |
| | Ground circuit (ECM) | OPEN | • | | | | | | | | | | | | | | | | | • | • | • | • | | | | | • Shocks may be sensed and engine stall may be occur depending on the duration of the operation conditions. |
| | | Momentarily open | | | | | | | | • | • | • | • | | • | • | | | | • | | • | • | | | | | |
| Ignition signal circuit | | OPEN | • | • | • | • | | | • | • | • | • | • | • | • | | | | • | • | • | • | • | | • | | | • Slight shocks and surges may be sensed depending on the duration of momentarily open circuit and the operating conditions. |
| | | Momentarily open | | | | | | | | | | | | | | • | | | • | • | | | | | | | | |
| Ignition coil | Power supply circuit | OPEN | • | • | | • | | | | • | • | • | • | • | • | | | | • | • | • | • | • | | | | | • |
| | | Momentarily open | | | | | | | | | | | | | | • | | | • | • | | | | | | | | • Engine stall may occur if duration of momentarily open circuit is too long. |
| | Coil | OPEN | • | • | | • | | | | • | • | • | • | • | • | | | | • | • | • | • | • | | | | | • Shocks may be sensed and engine stall may be occur depending on the duration of the operation conditions. |
| | Ground circuit | OPEN | • | • | | • | | | | • | • | • | • | • | • | | | | • | • | • | • | • | | | | | • Injects fuel toward spark plug on the cylinder with open circuit. |
| | | Momentarily open | | | | | | | | | | | | | | • | | | • | • | | | | | | | | |



MidWestTech | Towmotor K15, K21, K25 Gasoline Engine Service Manual | Publicatio... Order the manual at mid-west-tech.com >

## Electric Control System Specifications

Gasoline electronic injection (injection from each cylinder port)
LPG electronic injection (injection from single point on this side of electric throttle control actuator)
Vaporizer (water heater) ..... Fuel discharge pressure: Approx. 31.9 kPa (0.31 bar, 0.33 kg/cm$^2$, 4.6 psi)
Throttle body and injector holder bolts tightening torque (Air horn also secures.)
M6 bolt [thread length: 90 mm (3.54 in)]: 11.8 - 13.7 N·m (1.2 - 1.4 kg-m, 9 -10 ft-lb)

## Carburetor Specifications

Fuel pump ..... 1,400 ml or more (at 1,000 rpm)
Fuel pump discharge pressure ..... 16.7 - 23.5 kPa (0.17 - 0.24 kgf/cm$^2$)
Fuel discharge pressure ..... Atmospheric pressure
Vaporizer (with secondary room, integrated with water heater)

### Carburetor

| Engine type | K15 | K21 | K25 |
|---|---|---|---|
| Carburetor type | | | |
| Starting choke type | Automatic return hot-water wax | ← | ← |
| Inlet diameter (mm) | | 57 | |
| Outlet diameter (mm) | | 30 | |
| Venturi diameter | | 24 | |
| Large | | | |
| Small (Inner diameter - Outer diameter) | | 12 - 16.5 | |
| Main jet | | 116 | |
| Main air bleed | | 60 | |
| Slow jet | | 48 | |
| Slow air bleed | | 80/140 | |
| Float level adjustment (mm) | | 22 | |
| High position (H1) | | | |
| Low position (H2) | | | |

### Governor (carburetor specifications)

| Type | Pneumatic |
|---|---|
| Speed control type | Controlled by amount of mixture |
| Control mechanism | Vacuum type |
| Hunting allowable frequency | 3 (Max) |



MidWestTech | Towmotor K15, K21, K25 Gasoline Engine Service Manual | Publicatio... Order the manual at mid-west-tech.com >