FOREWORD

This Manual contains maintenance, specifications and repair procedures for the chassis, body and material handling system of the TOYOTA ELECTRIC POWERED TOWING TRACTOR TEA15.

Please use this manual for providing quick, correct servicing of the corresponding towing tractor.

This manual deals with the above model as of October 2001. Please understand that disagreement can take place between the descriptions in the manual and actual vehicles due to change in design and specifications. Any change or modifications thereafter will be informed by Toyota Industrial Equipment Parts & Service News.

TOYOTA Material Handling Company
A Division of TOYOTA INDUSTRIES CORPORATION

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GENERAL

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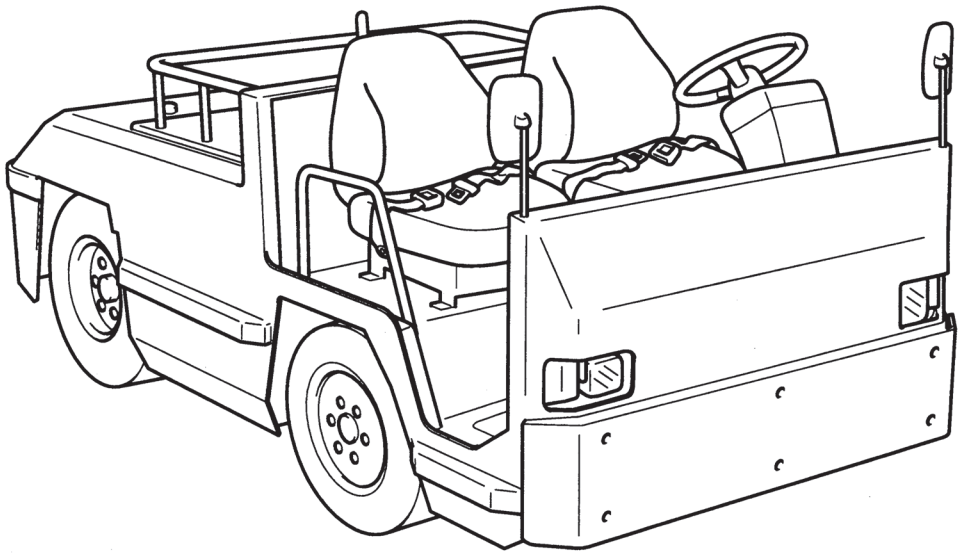
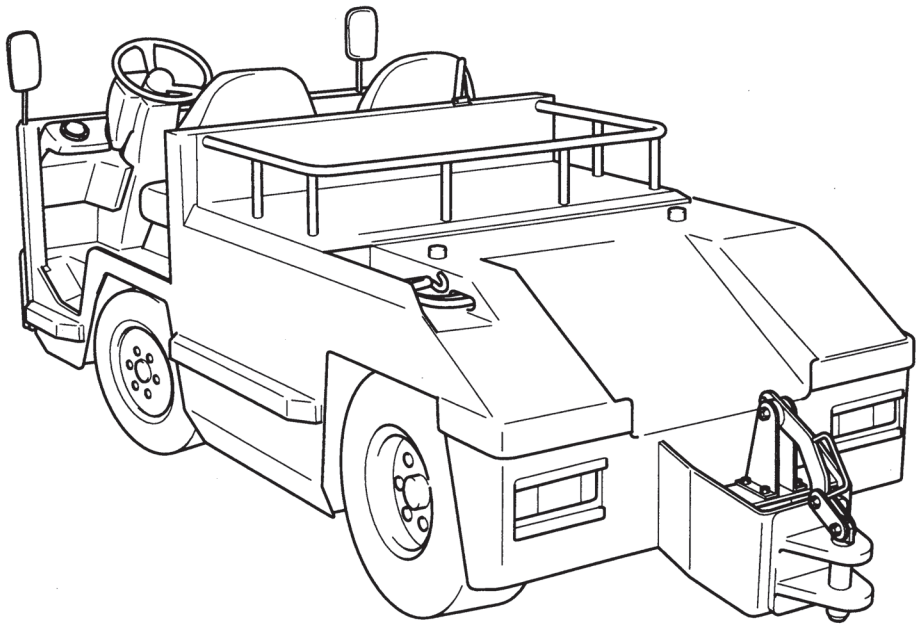
EXTERIOR VIEW

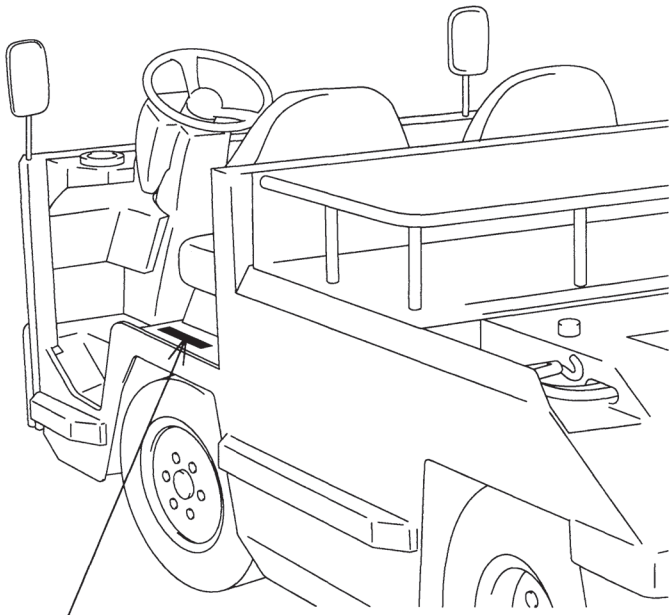




VEHICLE MODELS

Model		TEA15
Control method		Microcomputer
Battery	Voltage (V)	80
	Quantity (AH/5HR)	390

FRAME NUMBER

Vehicle model	TEA15
Punching format	TE15-10011
Punching position	 Frame No. punching position

HOW TO USE THIS MANUAL

EXPLANATION METHOD

1. Operating procedure

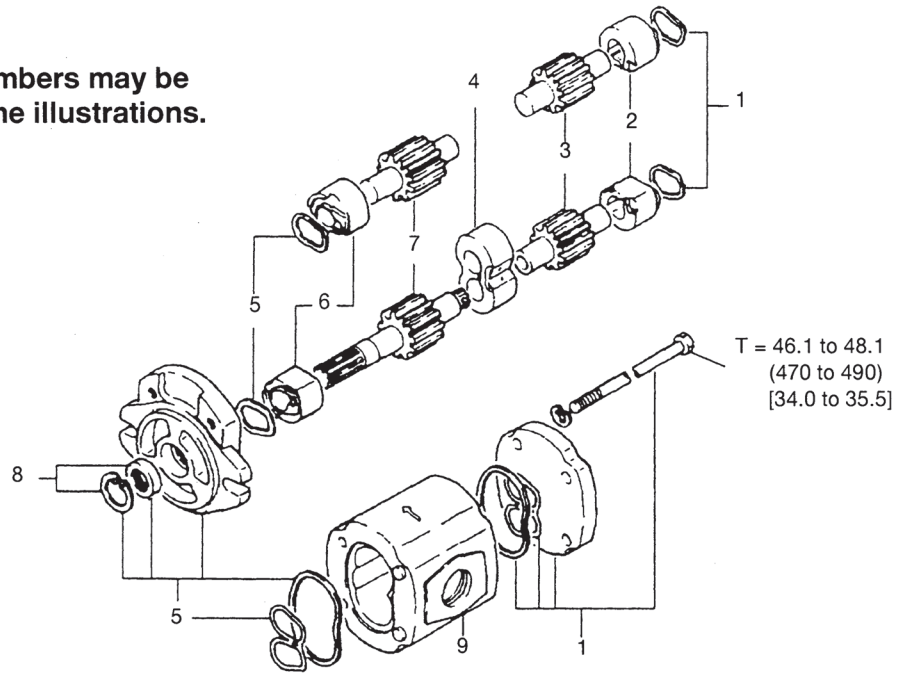
(1) Operating procedures are described using either pattern A or pattern B.
Pattern A: Each step of the operation is explained with its own illustration.
Pattern B: Each step of the operation is explained with reference to step numbers in a single illustration. Explanations in the form of point operations, cautions, and notes follow.

Example of pattern B

DISASSEMBLY • INSPECTION • REASSEMBLY

Tightening torque unit→T=N • m (kgf-cm) [ft-lbf]

• **Some step numbers may be omitted in some illustrations.**



Disassembly Procedure

1 Remove the cover. **[Point 1]**
2 Remove the bushing. **[Point 2]**
3 Remove the gear.

← Operation to be explained in following pages.

Point Operations

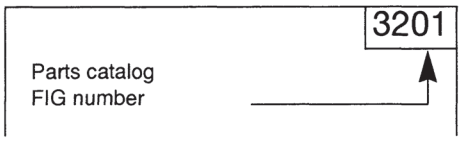
Explanation of operation point with illustration. ↙

[Point 1]
Disassembly:
Make match marks before removing the pump cover.

[Point 2]
Inspection:
Measure the bushing inside diameter.
Limit 19.12 mm

1. How to read component figures
   (1) The component figures use the illustration in the parts catalog for the vehicle model. Please refer to the catalog to check the part name.

(Example)



2. Matters omitted from this manual
   (1) This manual omits descriptions of the following jobs, but perform them in actual operation:
      (a) Cleaning and washing of removed parts as required
      (b) Visual inspection (partially described)

TERMINOLOGY

Caution:
Important matters, negligence of which may cause accidents.Be sure to observe them.

Note:
Important items, negligence of which may cause accidents, or matters in operating procedure which require special attention.

Standard: Value showing the allowable range in inspection or adjustment.

Limit: The maximum or minimum value allowed in inspection or adjustment.

ABBREVIATIONS

Abbreviation	Meaning	Abbreviation	Meaning
ASSY	Assembly	SAE	Society of Automotive Engineers (USA)
LH	Left Hand	SST	Special Service Tool
LLC	Long Life Coolant	STD	Standard
L/	Less	TBC	Traction and brake control
M/T	Manual Transmission	T/C	Torque Converter & Transmission
OPT	Option	T=	Tightening Torque
O/S	Oversize	OOT	Number of teeth (OOT)
PS system	Power Steering	U/S	Undersize
RH	Right Hand	W/	With (what follows is included)

SI UNITS

Meaning of SI

This manual uses SI units.SI represents the International System of Units, which was established to unify the various systems of units used in the past for smoother international technical communication.

New Units Adopted in SI

Item	New unit	Conventional unit	Conversion rate*1 (1 [conventional unit] = X [SI unit])
Force*2	N (newton)	kgf	1 kgf = 9.80665 N
Torque*2 (Moment)	N·m	kgf·cm	1 kgf·cm = 9.80665 N·m
Pressure	Pa (pascal)	kgf/cm^2	1 kgf/cm^2 = 98.0665 kPa = 0.0980665 MPa
↑	↑	mmHg	1 mmHg = 0.133322 kPa
Revolving speed	r/min	rpm	1 rpm = 1 r/min
Spring constant*2	N/mm	kgf/mm	1 kgf/mm = 9.80665 N/mm
Volume	L	cc	1 cc = 1 mL
Power	W	PS	1 PS = 0.735499 kW
Heat quantity	W·h	cal	1 kcal = 1.16279 W·h
Specific fuel consumption	g/W·h	g/PS·h	1 g/PS·h = 1.3596 g/kW·h

<Reference>

* 1: X is the value obtained by converting 1 [in conventional unit] into the SI unit. It is also used as the conversion rate between conventional and SI units.
* 2: In the past, kilogram (kg), representing mass, was often used in place of weight kilogram (kgf), which should be used as the unit of force.

Conversion between Conventional and SI Units

Equation for conversion

Value in SI unit = Conversion rate × Value in conventional unit	Conversion rate: Figure corresponding to X in the conversion rate column in the table above
Value in conventional unit = Value in SI unit ÷ Conversion rate	

When converting, change the unit of the value in conventional or SI units to the one in the conversion rate column in the table above before calculation. For example, when converting 100 W to the value in conventional unit PS, first change it to 0.1 kW and divide by the conversion rate 0.735499.

OPERATING TIPS

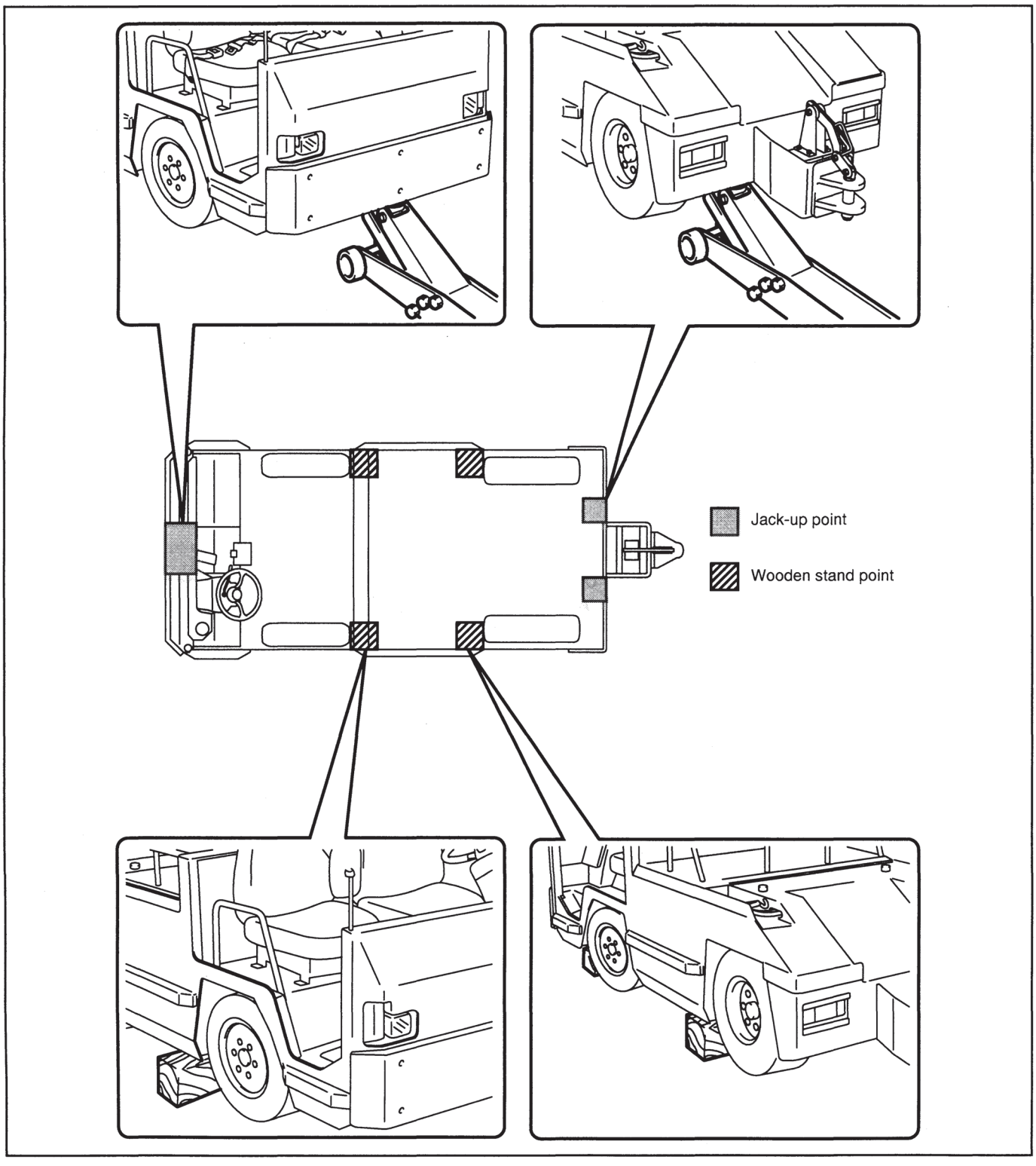
GENERAL INSTRUCTIONS

1. Skillful operation
   (1) Prepare the tools, necessary measuring instruments (circuit tester, megohmmeter, oil pressure gauge, etc.) and SSTs before starting operation.
   (2) Check the cable color and wiring state before disconnecting any wiring.
   (3) When overhauling functional parts, complicated sections or related mechanisms, arrange the parts neatly to prevent confusion.
   (4) When disassembling and inspecting a precision part such as the control valve, use clean tools and operate in a clean location.
   (5) Follow the specified procedures for disassembly, inspection and reassembly.
   (6) Always replace gaskets, packing, O-rings, self-locking nuts and cotterpins with new ones each time they are disassembled.
   (7) Use genuine Toyota parts for replacement.
   (8) Use specified bolts and nuts and observe the specified tightening torque when reassembling. (Tighten to the medium value of the specified tightening torque range.) If no tightening torque is specified, use the value given in the "standard tightening torque table".
2. Protection of functional parts (battery-operated vehicles)
   (1) Before connecting the battery plug after vehicle inspection or maintenance, thoroughly check each connector for any connection failure or imperfect connection.
   Failure or imperfect connection of connectors related to controllers, especially, may damage elements inside the controllers.
3. Defect status check
   Do not start disassembly and/or replacement immediately, but first check that disassembly and/or replacement is necessary for the defect.
4. Waste fluid disposal
   Always use a proper container when draining waste fluid from the vehicle.
   Careless discharge of oil, fuel, coolant, oil filter, battery or other harmful substance may adversely affect human health and the environment. Always collect and sort well, and ask specialized companies for appropriate disposal.

JACKING UP

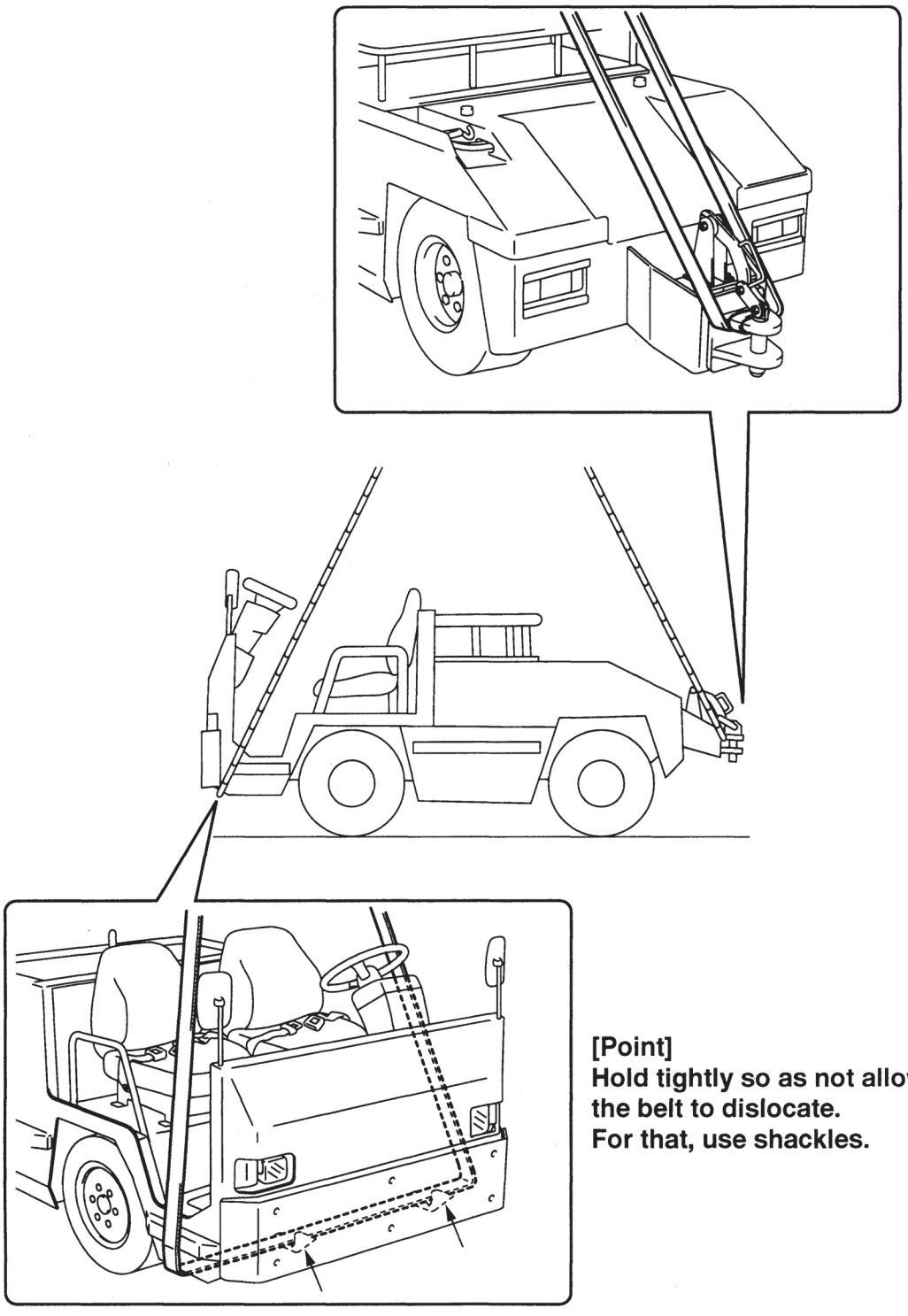
Always observe the following instructions when jacking up the vehicle:

- **Park the vehicle on a flat surface. Be sure to avoid an inclined or rough surface.**
- **Use a jack with ample capacity and jack up the vehicle at the specified jack-up point. Jacking up at any other point is dangerous.**
- **Always support the load of jacked-up vehicle with wooden blocks at specified points. Supporting the vehicle with the jack only is very dangerous.**
- **Never, under any circumstances, put any part of the body (including hands and feet) under the jacked-up vehicle.**



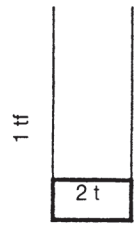
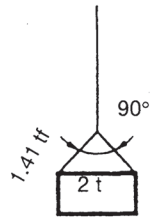
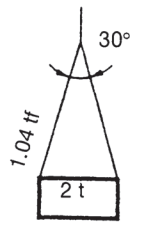
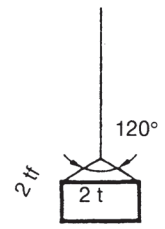
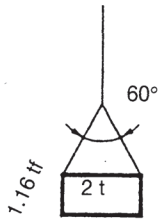
HOISTING THE VEHICLE

When hoisting the vehicle, always observe the specified hoist attachment section and method. Never hoist by any other attachment section as it is very dangerous.



[Point]
Hold tightly so as not allow the belt to dislocate.
For that, use shackles.

WIRE ROPE SUSPENSION ANGLE LIST

Suspension angle	Tension	Compression	Suspension method	Suspension angle	Tension	Compression	Suspension method
0°	1.00 time	0 time		90°	1.41 time	1.00 time	
30°	1.04 time	0.27 time		120°	2.00 time	1.73 time	
60°	1.16 time	0.58 time					

SAFE LOAD FOR EACH WIRE ROPE SUSPENSION ANGLE

Unit: N (ton:tf)

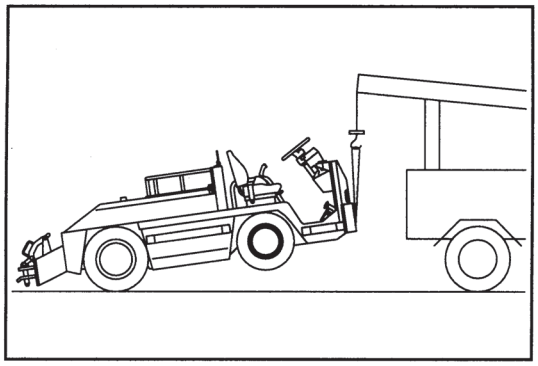
Rope diameter mm	Cutting load	Single-rope suspension	Two-rope suspension				Four-rope suspension			
		0°	0°	30°	60°	90°	0°	30°	60°	90°
6	21380 (2.18)	3040 (0.31)	6080 (0.62)	5880 (0.60)	5200 (0.53)	4310 (0.44)	12160 (1.24)	11770 (1.20)	10400 (1.06)	8630 (0.88)
8	31480 (3.21)	4410 (0.45)	8830 (0.90)	8530 (0.87)	7650 (0.78)	6280 (0.64)	17650 (1.80)	17060 (1.74)	15300 (1.56)	12550 (1.28)
10	49230 (5.02)	6960 (0.71)	14020 (1.43)	13440 (1.38)	11770 (1.20)	9810 (1.00)	27460 (2.80)	26480 (2.70)	23540 (2.40)	19610 (2.00)
12.5	76880 (7.84)	10980 (1.12)	21570 (2.20)	21280 (2.10)	18630 (1.90)	14710 (1.50)	43150 (4.40)	41190 (4.20)	37270 (3.80)	29420 (3.00)
14	96400 (9.83)	13730 (1.40)	27460 (2.80)	26480 (2.70)	23540 (2.40)	18630 (1.90)	54920 (5.60)	52960 (5.40)	47070 (4.80)	37270 (3.80)

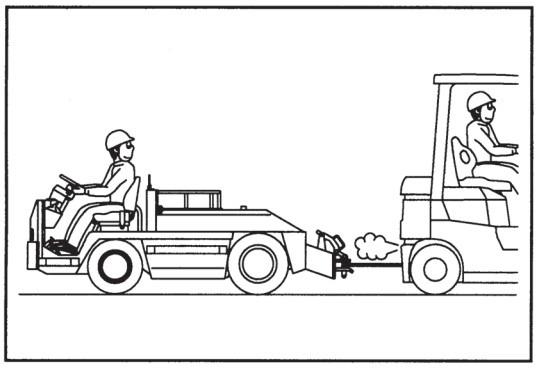
Components weights

Unit: kg (lb)

Member	Weight
Battery ASSY	1045 (2304)
Drive motor ASSY	102 (225)
Rear axle and drive unit W/ drive motor	400 (882)
Font axle ASSY(W/ spring)	150 (331)
Vehicle weight	1975 (4355)

CAUTION FOR TOWING





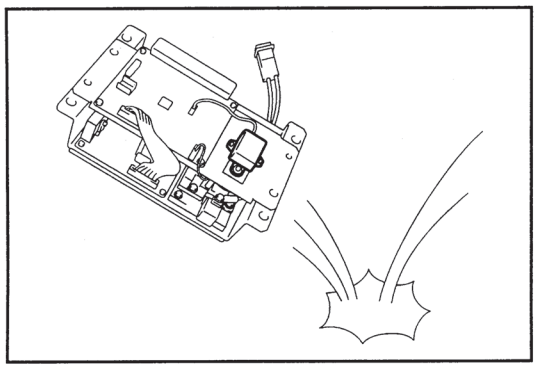
1. When towing the vehicle always lift the front wheels away from the ground.

2. The traveling speed in towing must not exceed the maximum traveling speed of the vehicle.

3. Always set the key switch to OFF and the direction switch to the neutral position before starting towing. In case of towing by connection with a wire rope with the operator on the vehicle, however, set the key switch to ON and always set the direction switch to the towing direction for PS operation.

ELECTRICAL PARTS INSPECTION

1. Always disconnect the battery plug before inspecting or servicing electrical parts.
2. Pay sufficient attention when handling electronic parts.



(1) Never subject to electronic parts, such as computers and relays, to impact.
(2) Never expose electronic parts to high temperature or moisture.
(3) Do not touch connector terminals, as they may be deformed or damaged due to static electricity.

3. Use a circuit tester that matches the object and purpose of measurement.

Analog type: This type is convenient for observing movement during operation and the operating condition. The measured value should be used only for reference or rough judgement.

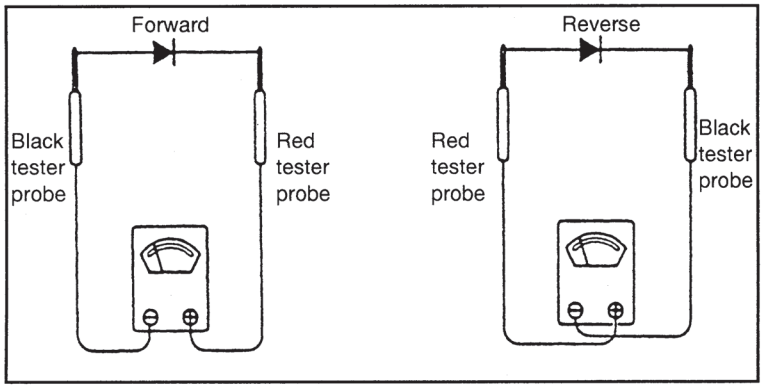
Digital type: A fairly accurate reading is possible. However, it is difficult to observe operation or movement.

(1) Difference between results of measurement with analog and digital types

* The results of measurements using the analog type and the digital type may be different. Use the circuit tester according to its instruction manual.

Differences between the polarities of the analog type and the digital type are described below.

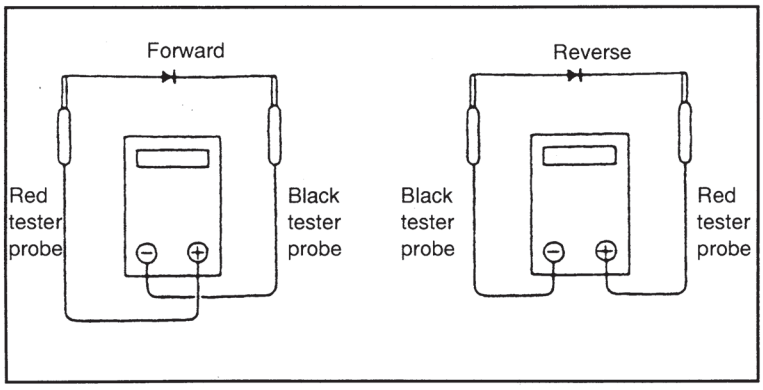
1) Analog circuit tester



Example of measurement result
Tester range: kΩ range

Forward direction:Continuity 11 kΩ
Reverse direction:No continuity ∞

2) Digital circuit tester



Example of measurement result
Tester range:2 MΩ range

Forward direction:Continuity 2 MΩ
Reverse direction:No continuity 1

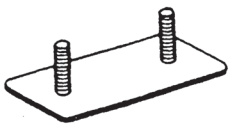
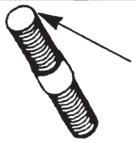
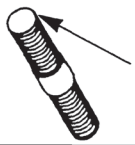
STANDARD BOLT & NUT TIGHTENING TORQUE

Tightening torques of standard bolts and nuts are not indicated throughout the manual.
Use the charts and table below to judge the standard tightening torque.

1. Find the class of the bolt strength on the table below and then find the bolt tightening torque on the tightening torque table.
2. The nut tightening torque can be judged from its corresponding bolt type.

BOLT STRENGTH CLASS IDENTIFICATION METHOD

Identification by bolt shape

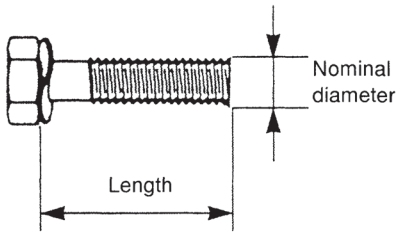
	Shape and class	Class
Hexagon head bolt Hexagon bolt	 Bolt with raised or etched numeral on head	4 = 4T 5 = 5T 6 = 6T 7 = 7T 8 = 8T
(standard)	 No mark	4T
Hexagon flange bolt	 No mark	4T
Hexagon head bolt (standard)	 Bolt with two raised lines on head	5T
Hexagon flange bolt	 Bolt with two raised lines on head	6T
Hexagon head bolt (standard)	 Bolt with three raised lines on head	7T
Hexagon head bolt (standard)	 Bolt with four raised lines on head	8T
Welded bolt		4T
Stud bolt	 No mark	4T
	 2 mm groove(s) on one/both edge(s)	6T

Identification by part No.

Hexagon head bolt

Part No.
91611-40625

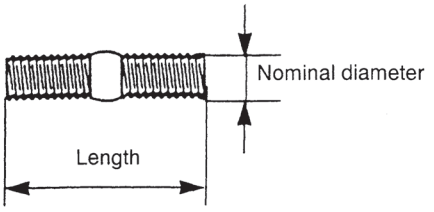
- Length (mm)
- Nominal diameter (mm)
- Class



Stud bolt

Part No.
92132-40614

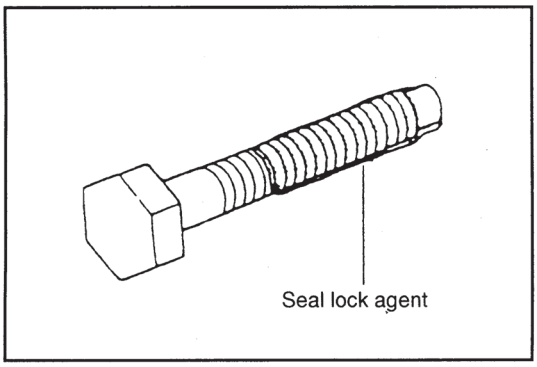
- Length (mm)
- Nominal diameter (mm)
- Class



TIGHTENING TORQUE TABLE

Class	Nominal diameter mm	Pitch mm	Standard tightening torque N·m (kgf-cm) [ft-lbf]	
			Hexagon head bolt 	Hexagon flanged bolt 
4T	6	1.0	5.4 (55) [48 in-lbf]	5.9 (60) [52 in-lbf]
	8	1.25	13 (130) [9]	14 (145) [10]
	10	1.25	25 (260) [19]	28 (290) [21]
	12	1.25	47 (480) [35]	53 (540) [39]
	14	1.5	75 (760) [55]	83 (850) [61]
	16	1.5	113 (1150) [83]	— (—) [—]
5T	6	1.0	6.4 (65) [56 in-lbf]	7.5 (75) [65 in-lbf]
	8	1.25	16 (160) [12]	18 (175) [13]
	10	1.25	32 (330) [24]	36 (360) [26]
	12	1.25	59 (600) [43]	65 (670) [48]
	14	1.5	91 (930) [67]	100 (1050) [76]
	16	1.5	137 (1400) [101]	157 (1600) [116]
6T	6	1.0	7.8 (80) [69 in-lbf]	8.8 (90) [78 in-lbf]
	8	1.25	19 (195) [14]	21 (215) [16]
	10	1.25	38 (400) [29]	43 (440) [32]
	12	1.25	72 (730) [53]	79 (810) [59]
	14	1.5	110 (1100) [80]	123 (1250) [90]
	16	1.5	170 (1750) [127]	191 (1950) [141]
7T	6	1.0	11 (110) [8]	12 (120) [9]
	8	1.25	25 (260) [19]	28 (290) [21]
	10	1.25	52 (530) [38]	58 (590) [43]
	12	1.25	95 (970) [70]	103 (1050) [76]
	14	1.5	147 (1500) [108]	167 (1700) [123]
	16	1.5	226 (2300) [166]	— (—) [—]
8T	6	1.0	12 (125) [9]	14 (145) [9]
	8	1.25	29 (300) [22]	32 (330) [24]
	10	1.25	61 (620) [45]	68 (690) [50]
	12	1.25	108 (1100) [80]	123 (1250) [90]
	14	1.5	172 (1750) [127]	196 (2000) [145]
	16	1.5	265 (2700) [195]	299 (3050) [221]

PRECOATED BOLTS



1. Do not replace or restore a precoated bolt as it is in the following cases:
   (1) After it has been removed.
   (2) When it has been moved by tightness check, etc. (loosened or tightened)

Note:
For torque check, tighten the bolt at the lower limit of the allowable tightening torque range; if the bolt moves, retighten it according to the steps below.

2. How to reuse precoated bolts
   (1) Wash the bolt and threaded hole.
   (The threaded hole must be washed even when replacing the bolt with a new one)
   (2) Completely dry the washed parts by blowing with air.
   (3) Apply a specified seal lock agent to the threaded portion of the bolt.

HIGH PRESSURE HOSE FITTING TIGHTENING TORQUE

1. When connecting a high pressure hose, wipe the hose fitting and corresponding nipple contact surfaces with a clean cloth to remove foreign matter and dirt.Also check that there are no dents or other damage on the contact surfaces before installation.
2. When connecting the high pressure hose, hold the hose to align the fitting with the nipple and tighten the fitting.
3. The maximum tightening torque must not exceed twice the standard tightening torque.

Nominal diameter of screw	Standard tightening torque N·m (kgf-cm)		Hose inside diameter mm
	Standard	Tightening range	
7/16-20UNF	25 (250)	24 to 26 (240 to 270)	6
9/16-18UNF	49 (500)	47 to 52 (480 to 530)	9
3/4-16UNF	59 (600)	56 to 62 (570 to 630)	12
7/8-14UNF	59 (600)	56 to 62 (570 to 630)	12
7/8-14UNF	78 (800)	74 to 82 (740 to 840)	15
1·1/16-12UNF	118 (1200)	112 to 123 (1140 to 1250)	19
1·5/16-12UNF	137 (1400)	130 to 144 (1330 to 1470)	25
PF1/4	25 (250)	24 to 26 (240 to 270)	6
PF3/8	49 (500)	47 to 52 (480 to 530)	9
PF1/2	59 (600)	56 to 62 (570 to 630)	12
PF3/4	118 (1200)	112 to 123 (1140 to 1250)	19
PF1	137 (1400)	130 to 144 (1330 to 1470)	25

RECOMMENDED LUBRICANT QUANTITY AND TYPES

Applicable portion	Type	Quantity
Drive unit	Hypoid gear oil API GL-4,5	6.5L (until overflow from oil filler port) The above value is for reference
Power steering	GM Dexron® II	approx. 1.8L
Brake line	SAE J-1703,DOT-3	Appropriate amount
Chassis parts	MP Grease	Appropriate amount
Battery	Distilled water	Appropriate amount