TOYOTA

REPAIR MANUAL

2TE15, 18

Pub. No. CE660

FOREWORD

This Manual contains maintenance, specifications and repair procedures for the chassis and body of the TOYOTA ELECTRIC POWERED TOWING TRACTOR 2TE15 and 2TE18.

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

This manual deals with the above model as of October 2005. 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.

The service standard values described in this manual are measured by using a standard vehicle for examination in the condition specified by TOYOTA Industries Corporation. In an actual operation, therefore, they may be changeable according to the meteorological, road, servicing, or operating condition.

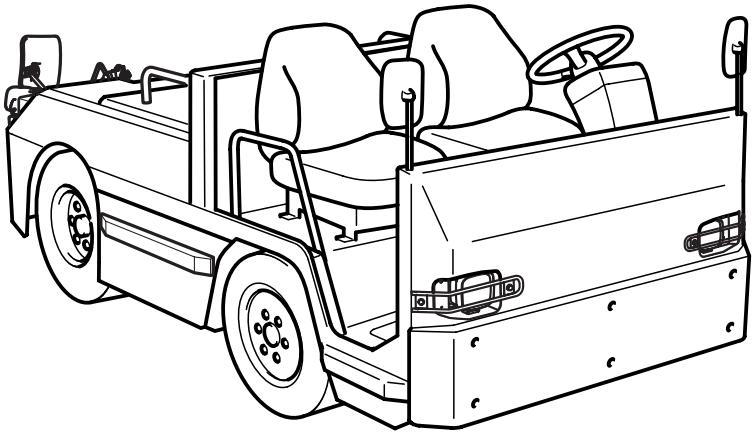
TOYOTA Material Handling Company
A Division of TOYOTA INDUSTRIES CORPORATION

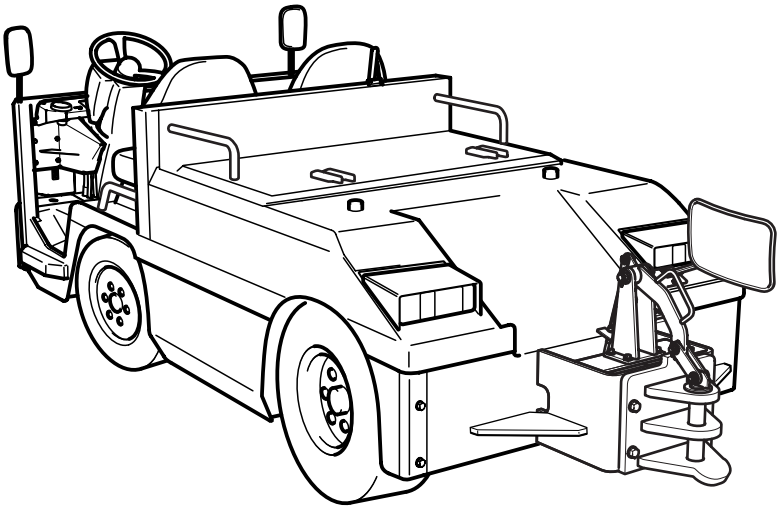
SECTION INDEX

GENERAL

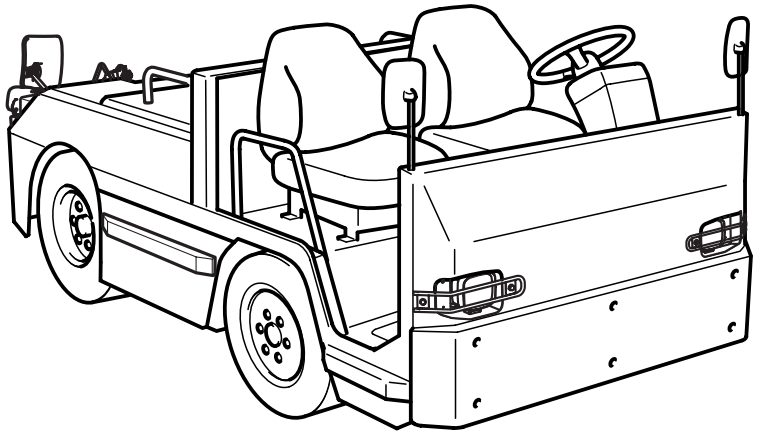
EXTERIOR VIEW

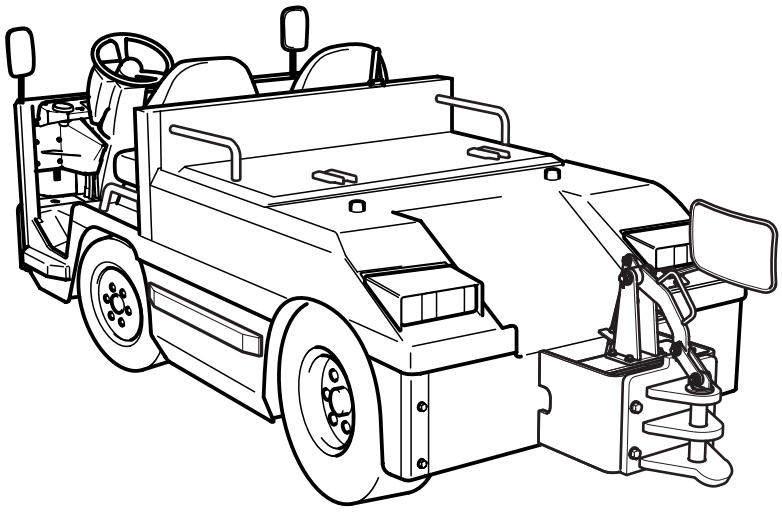
2TE15



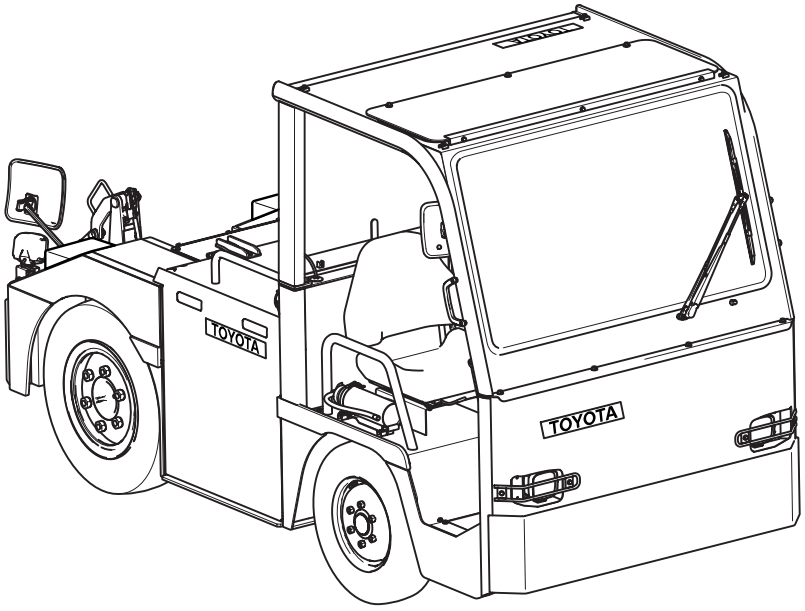


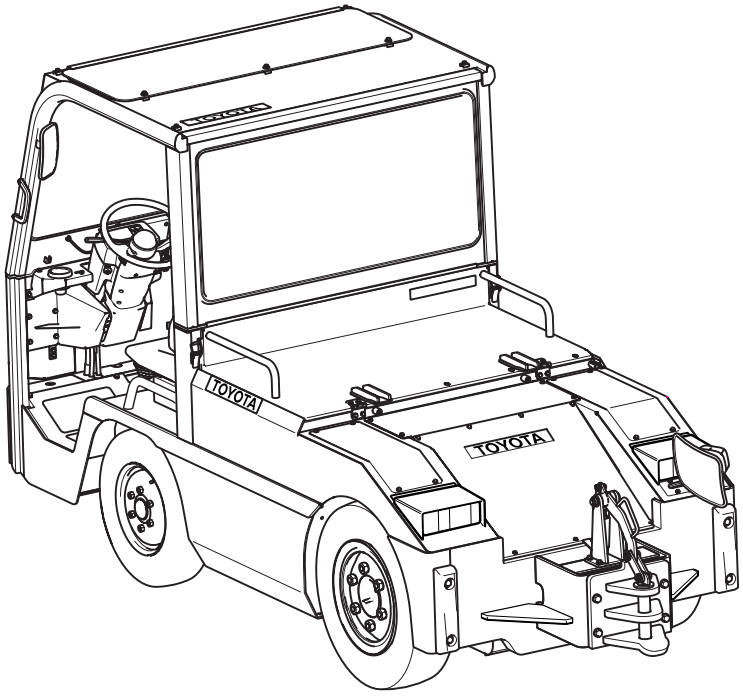
2TE18





2TE15 (W/ wind top)





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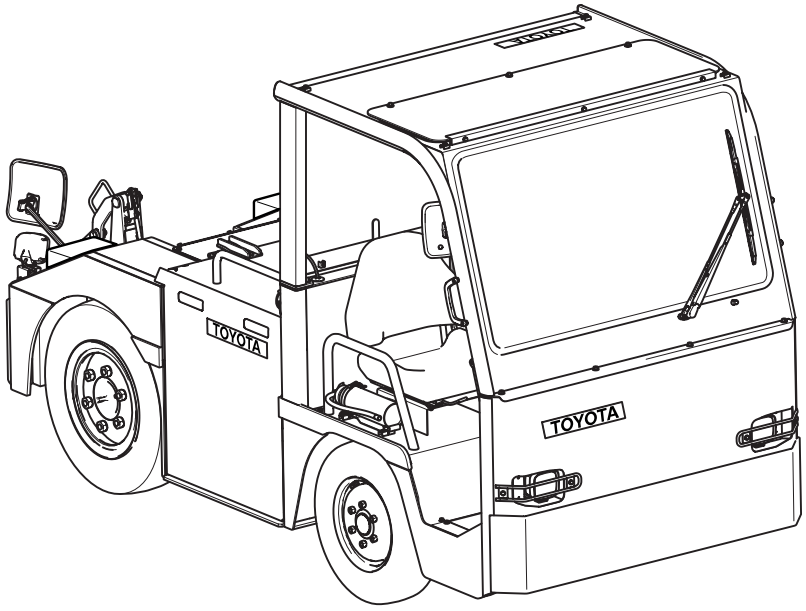
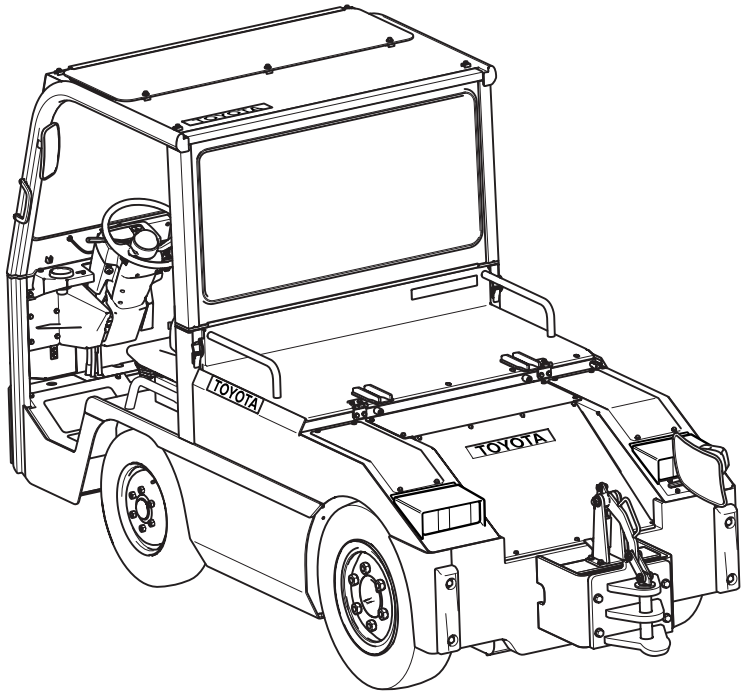
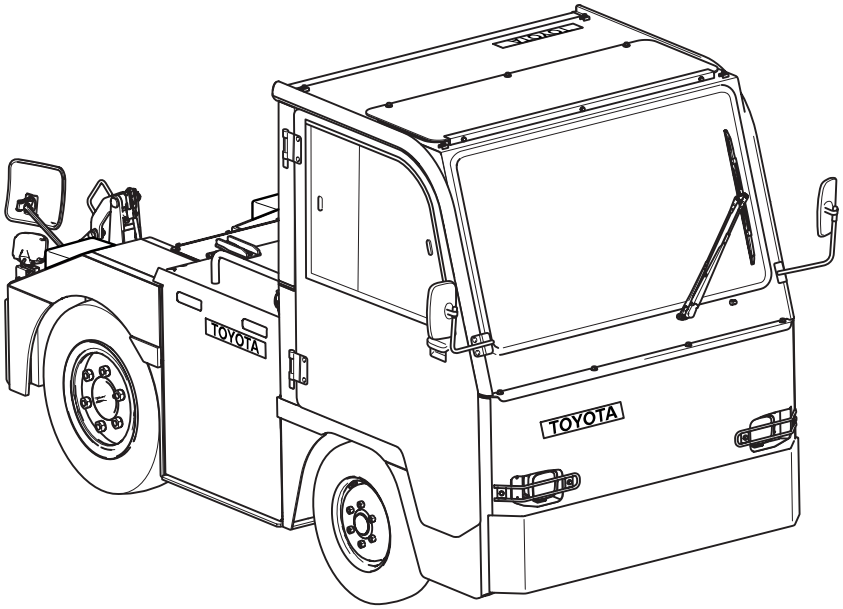
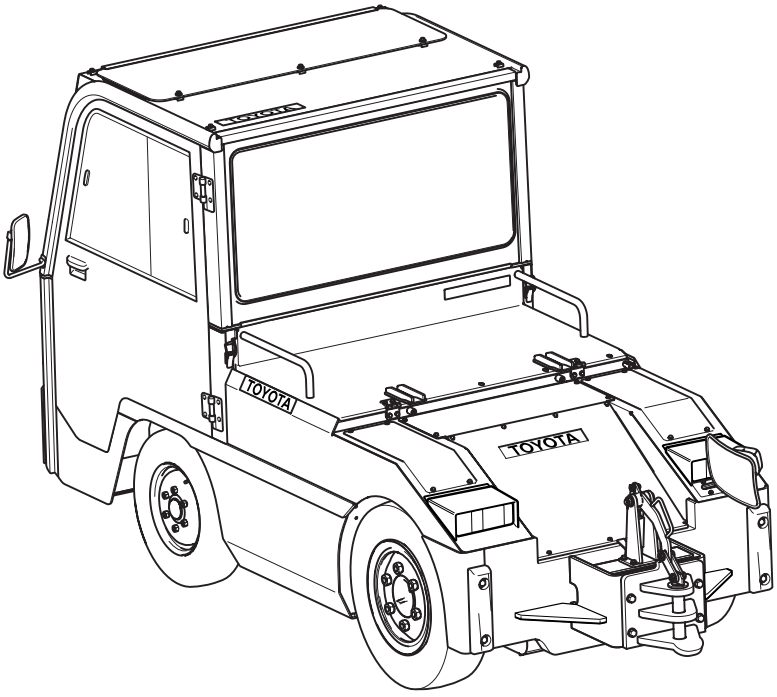


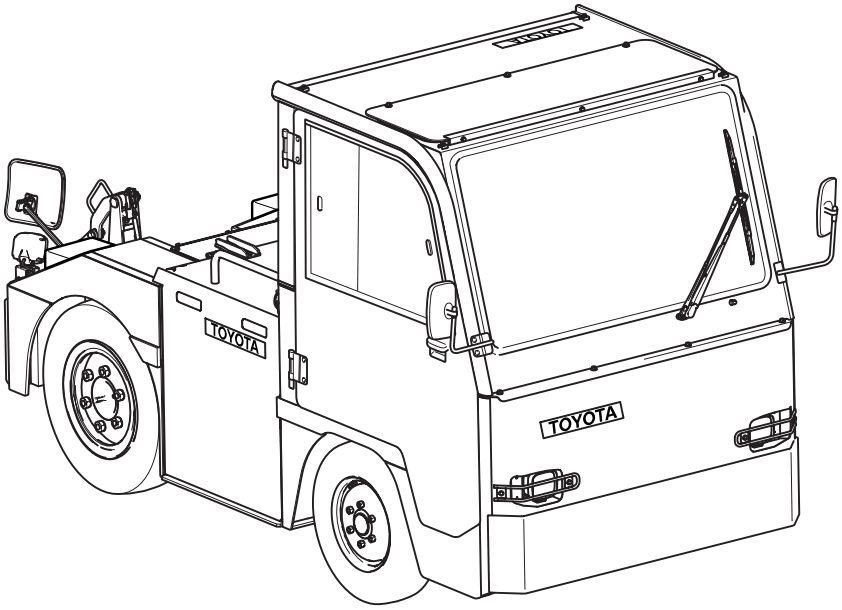


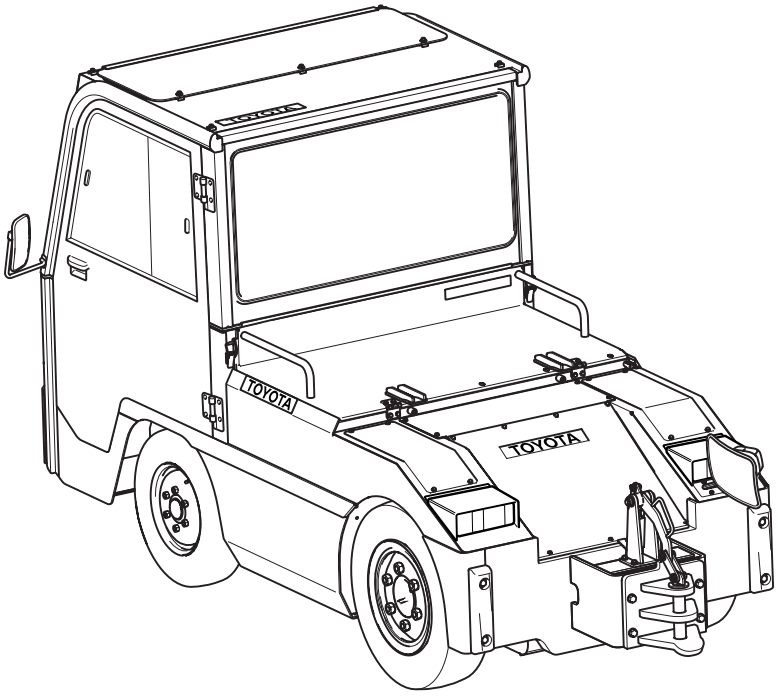
2TE15 (W/ steel cabin)





2TE18 (W/ steel cabin)

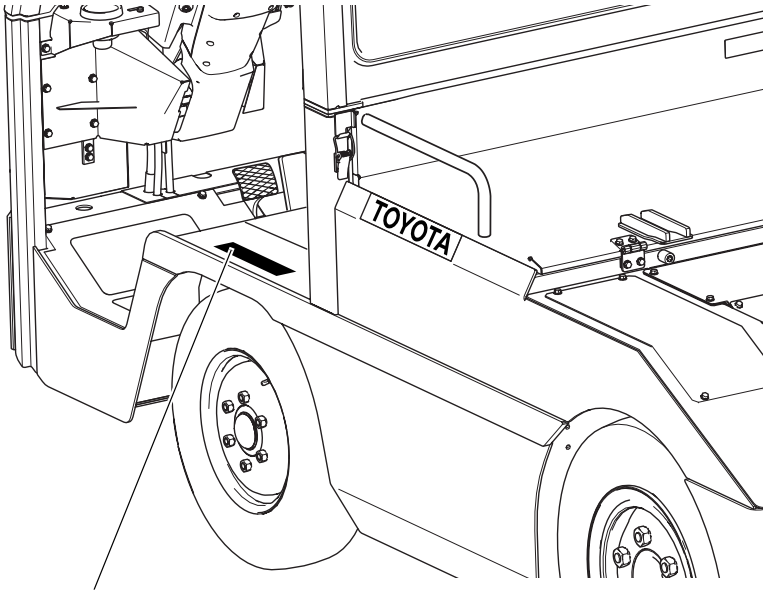




VEHICLE MODELS

Model		2TE15, 2TE18
Control method		Microcomputer
Battery	Voltage (V)	80
	Quantity (AH/5HR)	445 (STD) / 470 (OPT)

FRAME NUMBER

Vehicle model	2TE15	2TE18
Punching format	2TE15-10011	2TE18-10011
Punching position	 Frame No. punching position	

HOW TO USE THIS MANUAL

EXPLANATION METHOD

1. Operating procedure

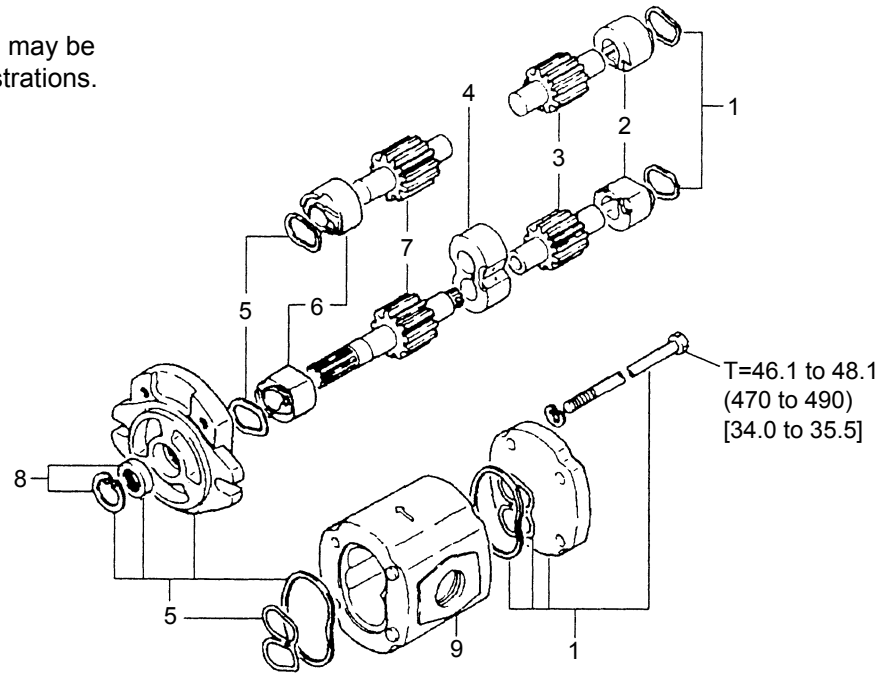
   (1) Operating procedures are described using either pattern A or pattern B.
   Pattern A : Each step of the operation is explained with its own illustration.
   Pattern B : Each step of the operation is explained with reference to step numbers in a single illustration. Explanations in the form of point 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]** ← Operation to be explained in following pages.
3. Remove the gear.

Point Operations

Explanation of operation point with illustration.

[Point 1] ↙

Disassembly:
Make match marks before removing the pump cover.

[Point 2]

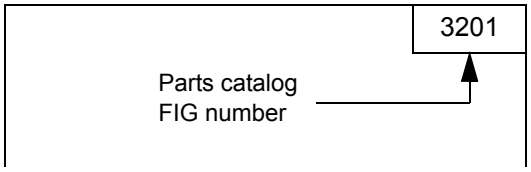
Inspection:
Measure the bushing inside diameter.

Limit: 19.12 mm

2. 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)



3. 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 Automotive Engineers (USA)
ATT	Attachment	SST	Special Service Tool
LH	Left Hand	STD	Standard
L/	Less	T=	Tightening Torque
OPT	Option	○○T	Number of teeth (○○T)
O/S	Oversize	U/S	Undersize
PS	Power Steering	W/	With (what follows is included)
RH	Right Hand		

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

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	

OPERATING TIPS

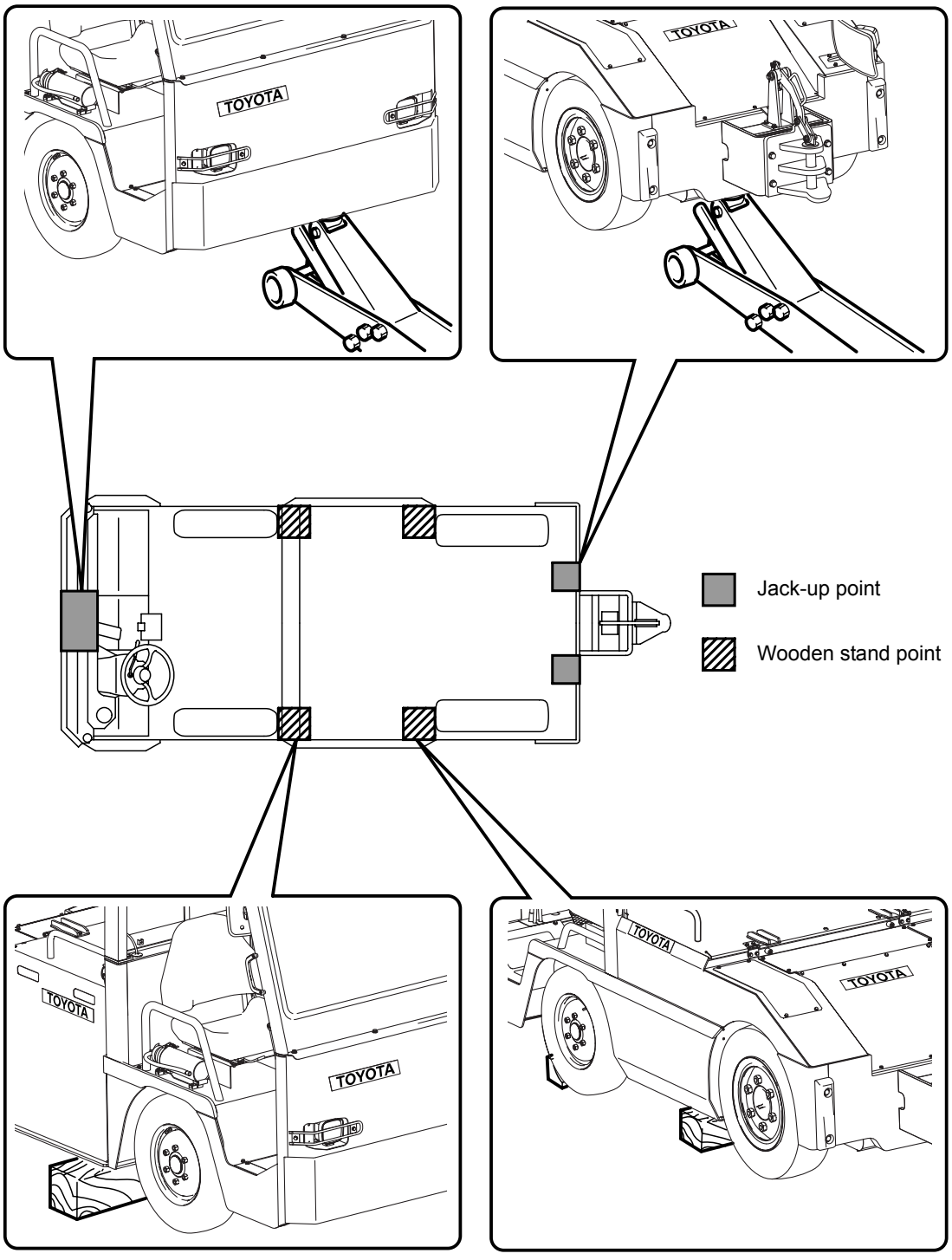
GENERAL INSTRUCTIONS

1. Safe operation
   (1) After jacking up, always support with wooden blocks or rigid stands.
   (2) When hoisting the vehicle or its heavy component, use wire rope(s) with a sufficient reserve in load capacity.
   (3) Be sure to disconnect the battery plug before servicing of electrical parts.
2. 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 removed.
   (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 BOLT TIGHTENING TORQUE table.
3. Protection of functional parts
   (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.
4. Defect status check
   Do not start disassembly and/or replacement of components immediately, but first check that disassembly and/or replacement of them is necessary for the defect.
5. 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:

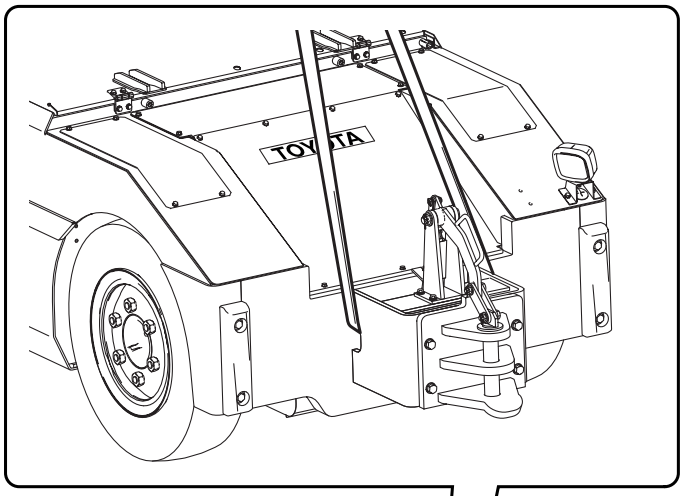
- **Park the vehicle on a flat surface. Be sure to avoid an inclined or rough surface.**
- **Use a jack with ample capacity and jack up the vehicle at the specified jack-up point. Jacking up at any other point is dangerous.**
- **Always support the load of jacked-up vehicle with wooden blocks at specified 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.**



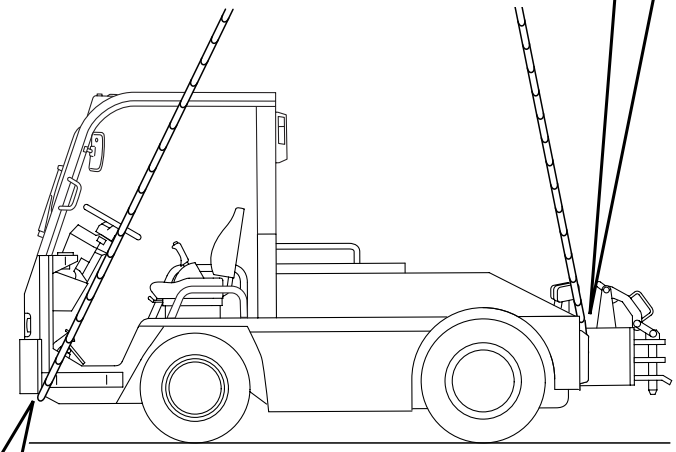
HOISTING THE VEHICLE

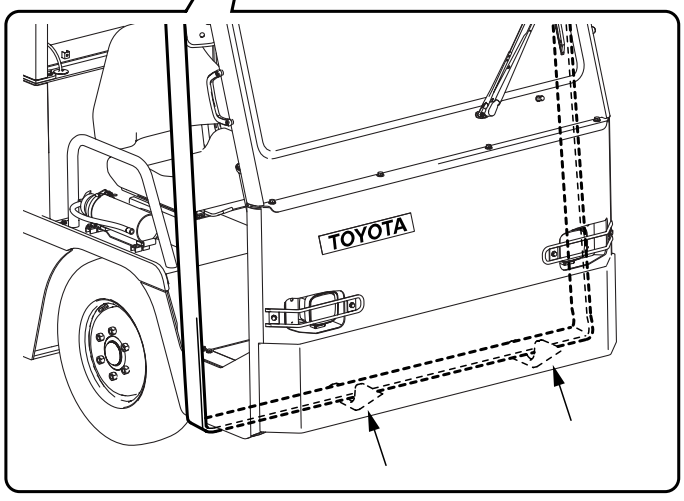
When hoisting the vehicle, always observe the specified hoist attachment section and method. Never hoist by any other attachment section as it is very dangerous.

Caution:
Be sure to attach the belt with a thick cloth under the belt.



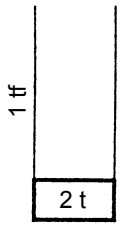
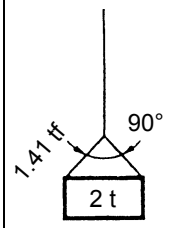
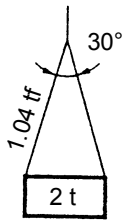
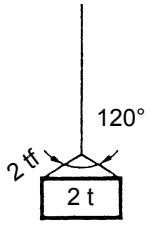
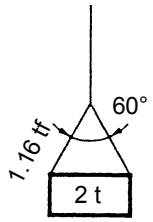
Note:
For vehicles with rear under mirror, remove it before attaching belt.





Caution:
Hold tightly so as not to 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)

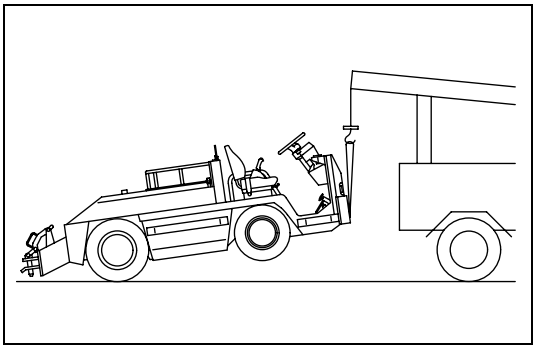
Rope diameter mm	Cutting load	Single-rope suspension	Two-rope suspension				Four-rope suspension			
		0°	0°	30°	60°	90°	0°	30°	60°	90°
6	21380 (2.18)	3040 (0.31)	6080 (0.62)	5880 (0.60)	5200 (0.53)	4310 (0.44)	12160 (1.24)	11770 (1.20)	10400 (1.06)	8630 (0.88)
8	31480 (3.21)	4410 (0.45)	8830 (0.90)	8530 (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

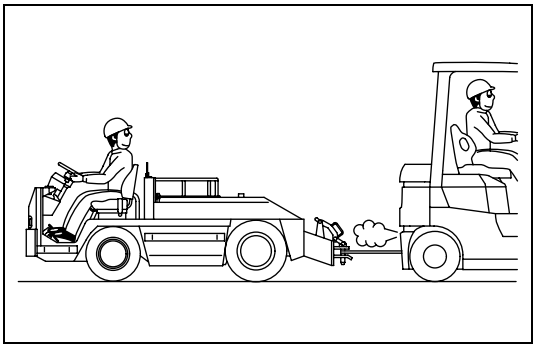
Unit: kg (lb)

Item	Weight	
Battery ASSY	1150 (2535)	
Drive motor ASSY	2TE15	102 (225)
	2TE18	96 (212)
Rear axle and drive unit W/ drive motor	2TE15	400 (882)
	2TE18	430 (948)
Front axle ASSY (W/ spring)	150 (331)	
Vehicle weight (W/ battery)	2TE15	3150 (6945)
	2TE18	3510 (7738)

CAUTION FOR TOWING



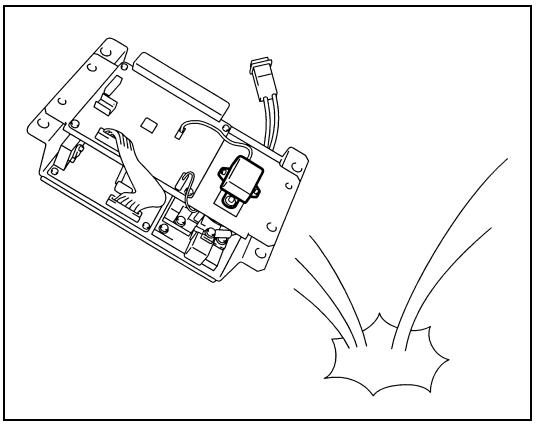
1. When towing the vehicle always lift the front wheels away from the ground.
2. The traveling speed in towing must not exceed the maximum traveling speed of the vehicle.
3. Always set the key switch to OFF and the direction switch to the neutral position before starting towing.



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.

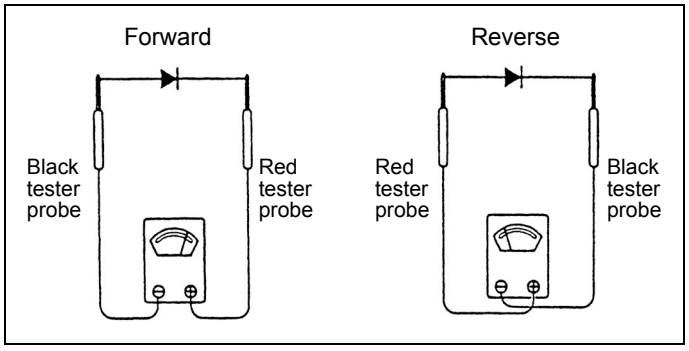
Digital type : A fairly accurate reading is possible. However, it is difficult to observe operation or movement.

(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.

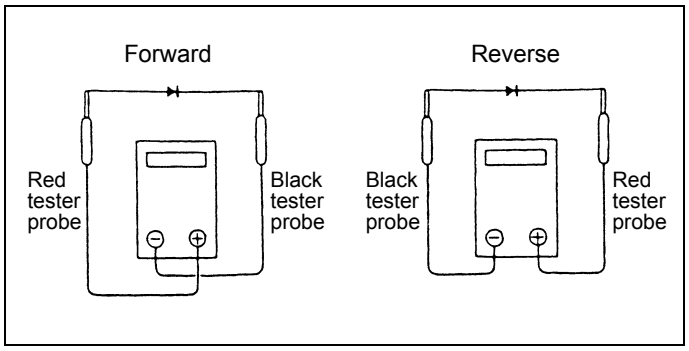
(a) Analog circuit tester



Example of measurement result
Tester range: kΩ range

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

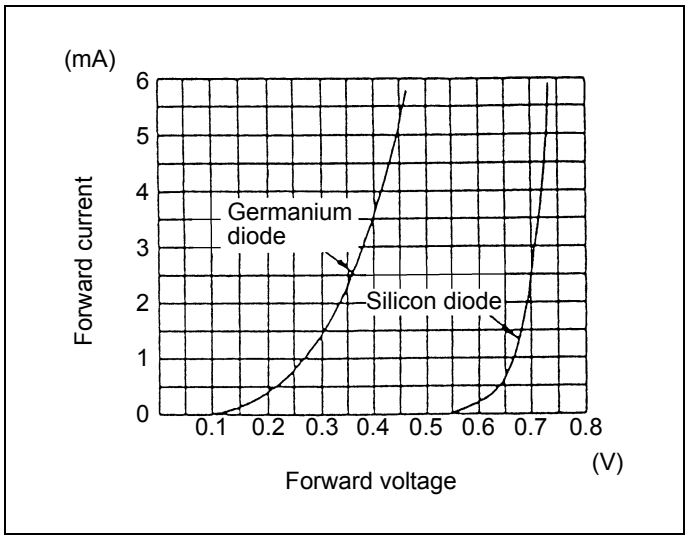
(b) Digital circuit tester



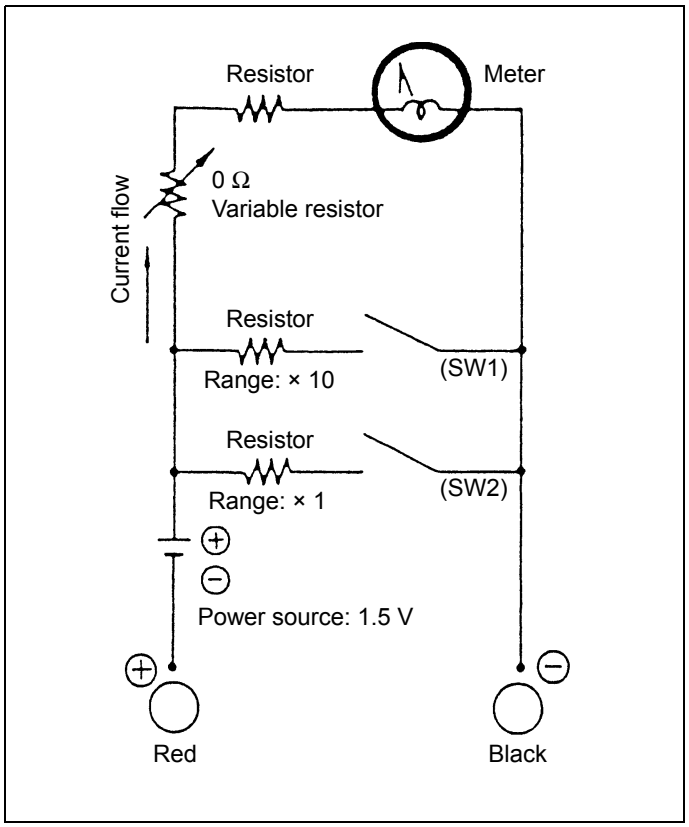
Example of measurement result
Tester range: MΩ range

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

4. Difference in result of measurement with circuit tester:
   The circuit tester power supply voltage depends on the tester type. 1.5 V, 3.0 V or 6.0 V is used.
   The resistance of a semiconductor such as a diode varies with the circuit tester power supply voltage.
   The diode characteristics are shown in the figure below.
   The resistance values of the same semiconductor measured with two types of circuit testers having different power supply voltages are different.
   This manual describes the results of measurement with a circuit tester whose power supply voltage is 3.0 V.



5. Difference in measurement result by measurement range (analog type):
   In the analog type circuit tester, changing the measurement range switches over the internal circuit to vary the circuit resistance. Even when the same diode is measured, the measurement result varies with the measurement range.
   Always use the range described in the repair manual for measurement.



BOLT & NUT TIGHTENING TORQUE

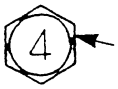
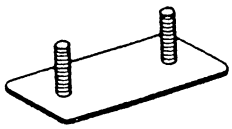
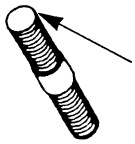
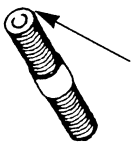
STANDARD BOLT & NUT TIGHTENING TORQUE

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. Judge the tightening torque for the hexagon head bolt, welded bolt or stud bolt having the standard bearing surface according to the tightening torque table by identifying the bolt strength class from the table below.
2. Judge the tightening torque for the hexagon flange bolt based on the threading diameter.
3. The nut tightening torque can be judged from its corresponding bolt type.

BOLT STRENGTH CLASS IDENTIFICATION METHOD AND TIGHTENING TORQUE

Identification by Actual Part

Type	Shape and class	Class
Hexagon head bolt (standard)	 Number in relief or hallmark on the head	4 = 4T 5 = 5T 6 = 6T 7 = 7T 8 = 8T
	 No mark	4T
	 Bolt with two raised lines on head	5T
	 Bolt with three raised lines on head	7T
	 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