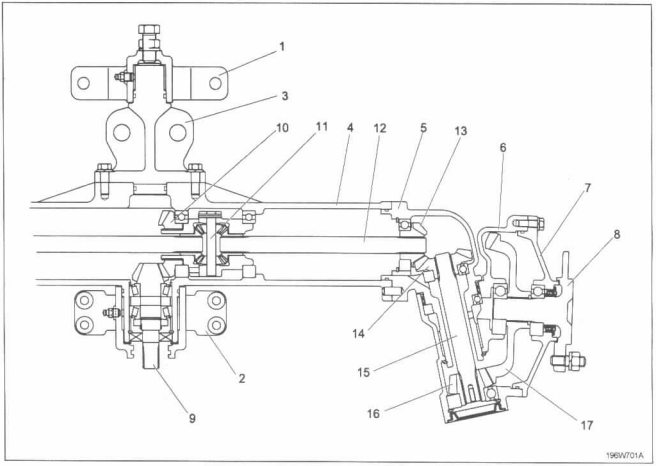
CHAPTER 7

FRONT AXLE

1. STRUCTURE

1.1 FRONT AXLE STRUCTURE



(1) Front Bracket
(2) Rear Bracket
(3) Center Pin
(4) Front Axle Support
(5) Bevel Gear Case
(6) Front Differential Case
(7) Front Differential Cover
(8) Front Axle
(9) Spiral Bevel Pinion Shaft
(10) Spiral Bevel Gear
(11) Pinion Shaft
(12) Differential Gear Shaft
(13) Bevel Gear
(14) Bevel Gear
(15) Bevel Gear Shaft
(16) Bevel Gear
(17) Bevel Gear

The front axle is constructed as shown above. Power is transmitted from the transmission through the propeller shaft and to the spiral bevel pinion shaft (9), then to the spiral bevel gear (10) after that to the differential gear. The power through the differential is transmitted to the differential gear shaft (12), and to the bevel gear shaft (15) in the bevel gear case (5).

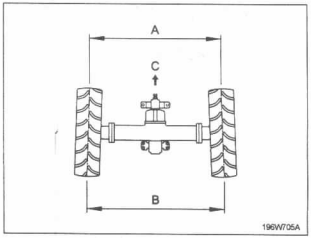
The revolution is greatly reduced by the bevel gear (16), (17), and then the power is transmitted to the front axle (8).

The differential system allows each wheel to rotate at a different speed to make turning easier.

4. The front wheels tend to roll outward due to the camber, but toe-in offsets it and ensures parallel rolling of the front wheels. Another purpose of toe-in is to prevent excessive and uneven wear of tires.

   Tow-in

   Tow-in (B-A) = 2 ~ 8 mm



(C) Front

2.2 SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Front wheel alignment	Toe-in	2 ~ 8 mm 0.08 ~ 0.31 in.	-
Front wheel	Axial sway	Less than 5 mm 0.20 in.	-
Front axle	Rocking force	49.0 ~ 117.7 N 5.0 ~ 12.0 kgf 11.0 ~ 26.5 lbs	-
Front axle case boss (front) to bracket bushing	Clearance	0.000 ~ 0.110 mm 0.0000 ~ 0.0040 in.	0.35 mm 0.0138 in.
Front axle case boss (front)	O.D.	34.075 ~ 35.000 mm 1.34154 ~ 1.37795 in.	-
Busing	I.D.	35.000 ~ 35.085 mm 1.37795 ~ 1.38130 in.	-
Front axle case boss (rear) to bracket bushing	Clearance	0.060 ~ 0.220 mm 0.00236 ~ 0.00866 in.	0.35 mm 0.0138 in.
Front axle case boss (rear)	O.D.	64.070 ~ 65.000 mm 2.52244 ~ 2.55906 in.	-
Busing	I.D.	65.060 ~ 65.190 mm 2.56142 ~ 2.56654 in.	-
Differential case, 19 bevel gear to differential side gear	Clearance	0.040 ~ 0.074 mm 0.00157 ~ 0.00291 in.	0.35 mm 0.0138 in.
Differential case	I.D.	26.020 ~ 26.041 mm 1.02441 ~ 1.02524 in.	-
Differential case cover bore	I.D.	26.020 ~ 26.041 mm 1.02441 ~ 1.02524 in.	-
Differential side gear	O.D.	25.067 ~ 25.080 mm 0.98689 ~ 0.98740 in.	-
Pinion shaft to differential pinion	Clearance	0.016 ~ 0.052 mm 0.00063 ~ 0.00204 in.	0.25 mm 0.0096 in.
Pinion shaft	O.D.	10.966 ~ 10.984 mm 0.43173 ~ 0.43244 in.	-
Differential pinion	I.D.	11.000 ~ 11.018 mm 0.43307 ~ 0.43378 in.	-
Differential pinion to differential side gear	Backlash	0.1 ~ 0.3 mm 0.004 ~ 0.012 in.	-
Shim	Thickness	0.1 mm 0.0039 in. 0.2 mm 0.0078 in. 0.4 mm 0.0157 in. 1.6 mm 0.0630 in.	- - - -

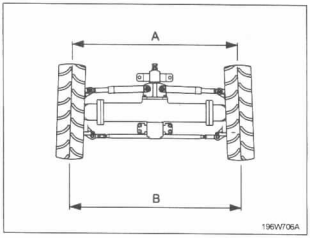
2.3 CHECKING, DISASSEMBLING AND SERVICING

A. CHECKING AND ADJUSTING

a. Toe-in

1. Apply air pressure as specified to tires.
2. Measure the front width (A) and the rear width (b) between the front wheels while straightened to obtain the difference (toe-in).
3. For other than specified, loosen the tightening nut on the ball joint for adjustment while turning the screw on the ball joint. Be sure to make the exposure of left and right rods in the steering cylinder equal this time.

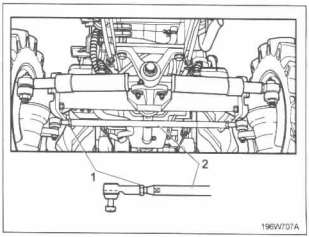
Item	Factory spec.
Toe-in (B-A)	2 ~ 8 mm 0.08 ~ 0.31 in.



(A) Front Width (B) Rear Width

b. Toe-in Adjusting

1. Loosen the lock nuts (1).
2. Turn the tie-rod (2) until to be factory specification.
3. Tighten the lock nuts (1).

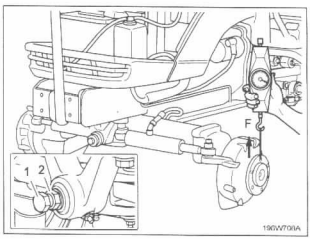


(1) Lock Nut (2) Tie-Rod

c. Rocking Force of Front Axle

1. Jack up the front side of tractor and remove the front wheel.
2. Set a spring balance to the front gear case cover.
3. Measure the front axle rocking force.
4. If the measurement is not within the factory specifications, adjust with the adjusting screw (1).
5. Tighten the lock nut (2) firmly.

Item	Factory spec.
Front axle rocking force	49.0 ~ 117.7 N 5.0 ~ 12.0 kgf 11.0 ~ 26.5 lbs



(1) Adjusting Screw (2) Lock Nut

B. DISASSEMBLING AND ASSEMBLING

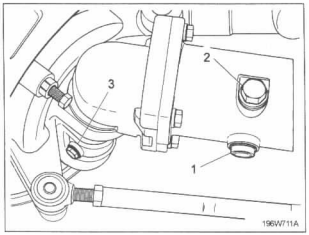
a. Draining Front Axle Case Oil

1. Place oil pans underneath the front axle case.
2. Remove the drain plug (3) both sides and filling port plug (2) to drain the oil.
3. After draining, reinstall the drain plugs (3) and filling port plug (2).

(When refilling)

- Remove the filling port plug (2) and check gauge (1).
- Fill with the new oil up to the check plug port.
- After filling, reinstall the check gauge (1) and filling port plug (2).

Item	Factory spec.
Front axle case oil	3.1 ℓ 0.82 U.S.gal.



(1) Check Plug (2) Filling Port Plug
(3) Drain Plug

IMPORTANT

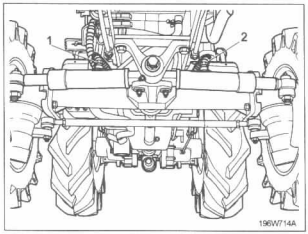
- ***Use SAE 80, 90 gear oil. Refer to "LUBRICANTS, FUEL AND COOLING WATER".***

b. Disconnecting Hydraulic Hoses

1. Remove the steering hoses.

(When reassembling)

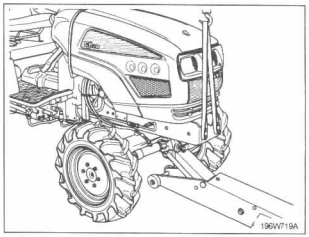
Item	Tightening torque
Steering hoses	24.5 ~ 29.4 N·m 2.5 ~ 3.0 Kgf·m 18.1 ~ 21.7 lbs·ft



(1) Steering Hose (L) (2) Steering Hose (R)

e. Disassembling Front Axle

1. Place the jacks under the front axle, and hang up the bumper by the hoist to support it.
2. Remove the shaft bracket 1 mounting screws and shaft bracket 2 mounting screws.
3. Separate the front axle from the front support.
4. Remove the front wheels.



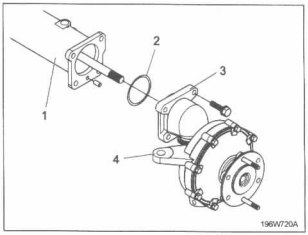
Item	Tightening torque
Front bracket bolts	123.6 ~ 147.1 N·m 12.6 ~ 15.0 Kgf·m 91.1 ~ 108.5 lbs·ft
Rear bracket bolts	123.6 ~ 147.1 N·m 12.6 ~ 15.0 Kgf·m 91.1 ~ 108.5 lbs·ft
Front wheel mounting nuts	62.8 ~ 72.5 N·m 6.4 ~ 7.4 Kgf·m 46.3 ~ 53.5 lbs·ft
Front wheel mounting bolts	77.5 ~ 90.2 N·m 7.9 ~ 9.2 Kgf·m 57.2 ~ 66.5 lbs·ft
Front wheel mounting stud	29.5 ~ 49.0 N·m 3.0 ~ 5.0 Kgf·m 21.7 ~ 36.1 lbs·ft

f. Dissembling Bevel Gear Case and Front Gear Case

1. Remove the bevel gear case mounting bolts.
2. Remove the bevel gear case (3) and front gear case (4) as a unit from the front axle case (1).

(When reassembling)

- Apply grease to the O-ring (2) and take care not to damage it.
- Do not interchange right and left bevel gear case assemblies and front gear case assemblies.



(1) Front Axle Case (2) O-Ring
(3) Bevel Gear Case (4) Front Gear Case

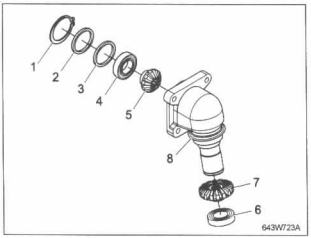
Item	Tightening torque
Bevel gear case mounting screw	123.5 ~ 147.0 N·m 12.6 ~ 15.0 Kgf·m 91.2 ~ 108.4 lbs·ft

h. Disassembling Bevel Gear Case Gears

1. Remove the internal snap ring (1).
2. Take out the bevel gears (5), (7) with ball bearings (4), (6), collar (2) and shims (3).

(When reassembling)

- Install the same shims (3) before they are removed.



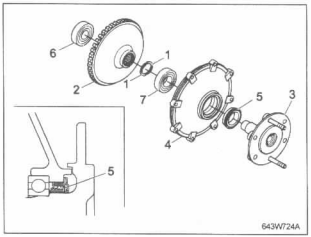
(1) Snap Ring
(2) Shim
(3) Shim
(4) Ball Bearing
(5) 11 Bevel Gear
(6) Ball Bearing
(7) 16 Bevel Gear
(8) Bevel Gear Case

i. Disassembling Axle

1. Remove the bearing wit a special use puller set.
2. Take out the 40T bevel gear (2).
3. Take out the collar (1).
4. Tap out the front axle (3).

(When reassembling)

- Install the oil seal (5) of the front differential cover (4), noting its direction as shown in the left figure.



(1) Snap Pin
(2) 40T Bevel Gear
(3) Front Axle
(4) Front Differential Cover
(5) Oil Seal
(6) Bearing
(7) Bearing

k. Disassembling Differential Gear

1. Remove the differential case cover mounting bolts (9) and then take out the differential case cover (5), ball bearing (6) and spiral bevel gear (7) as a unit.
2. Remove the external snap ring (8), and then remove the ball bearing (6) and spiral bevel gear (7) as a unit with a puller.
3. Remove the straight pin (13).
4. Pull out the pinion shaft (10) and take out the differential pinions (4) and differential side gears (12).

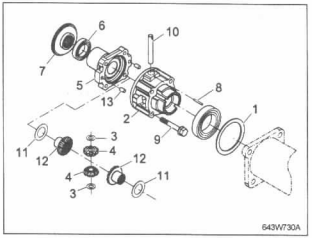
NOTE:

- *Arrange the parts to know their original position.*

(when reassembling)

- Apply molybdenum disulfide (Three bond 1901 or equivalent) to the inner circumferential surface of the differential side gears (12) and differential pinions (4).
- Install the pinion shaft (10) so that the hole on it may align with the hole on differential case (2), and install the straight pin (13).

Item	Tightening torque
Differential case cover mounting bolts	48.1 ~ 55.9 N·m 4.9 ~ 5.7 Kgf·m 35.4 ~ 41.2 lbs·ft

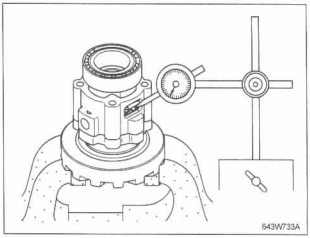


(1) Shim
(2) Differential Case
(3) Thrust Collar
(4) Differential Pinion
(5) Differential Case Cover
(6) Ball Bearing
(7) Spiral Bevel Gear
(8) Snap Ring
(9) Screws
(10) Pinion Shaft
(11) Shim
(12) Differential Side Gear
(13) Straight Pin

C. BACKLASH BETWEEN DIFFERENTIAL PINION AND DIFFERENTIAL SIDE GEAR

1. Set a dial gauge (lever type) on a tooth of the differential pinion.
2. Fix the differential side gear and move the differential pinion to measure the backlash.
3. If the measurement exceeds the factory specifications, adjust with the differential side gears shims.

Item	Factory spec.	Allowable limit
Backlash between differential pinion and differential side gear	0.1 ~ 0.3 mm 0.004 ~ 0.012 in.	-



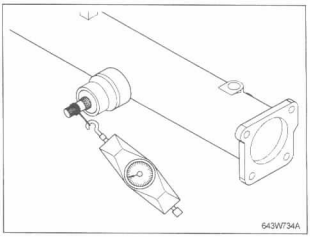
(Reference)

- Thickness of adjusting shims:
  0.4 mm (0.016 in.) 0.6 mm (0.024 in.)
  0.8 mm (0.031 in.) 1.0 mm (0.039 in.)
  1.2 mm (0.047 in.)
- Tooth contact : More than 35 %
- Center of tooth contact:
  1/3 to 1/2 of the entire width from the small end.

D. TURNING FORCE OF SPIRAL BEVEL PINION SHAFT (PINION SHAFT ONLY)

1. Install the spiral bevel pinion shaft assembly to the front axle case.
2. Wind a string around the spiral bevel pinion shaft and attach spring balance to the tip of the string.
3. Slowly pull the spring balance in a direction at right angle to the spiral bevel pinion shaft to measure the turning force.
4. If the turning force is not within the factory specifications, adjust with the lock nut.

Item	Factory spec.
Turning force	98.1 ~ 117.7 N 10 ~ 12 kgf 22.0 ~ 26.5 lbs



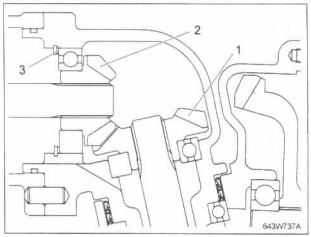
NOTE:

- *The turning torque is figured by multiplying the radius (distance form the center of the spiral bevel pinion shaft to a point on the circumference from which the string is pulled) by the reading on the spring balance.*
- *After turning torque adjustment, be sure to stake the lock nut.*

F. BACKLASH BETWEEN 11T BEVEL GEAR AND 16T BEVEL GEAR

1. Stick a strip of fuse to three spots on the 16T bevel gear (1) with grease.
2. Fix the front axle case, bevel gear case and front gear case.
3. Turn the axle.
4. Remove the bevel gear case from front axle case and measure the thickness of the fuses with an outside micrometer.
5. If the backlash is not within the factory specifications, adjust with shim (3).

Item	Factory spec.
Backlash between 11T bevel gear and 16T bevel gear	0.15 ~ 0.35 mm 0.0059 ~ 0.0138 in.



(1) 16T Bevel Gear (3) Shim
(2) 11T Bevel Gear

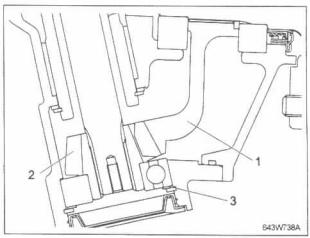
(Reference)

- Thickness of adjusting shims (3):
  0.8 mm (0.031 in.) 1.2 mm (0.047 in.)
  1.0 mm (0.039 in.)
- Tooth contact: More than 35%

G. BACKLASH BETWEEN 9T BEVEL GEAR AND 40T BEVEL GEAR

1. Stick a strip of fuse to three spots on the 40T bevel gear (1) with grease.
2. Fix the axle flange and front gear case.
3. Turn the axle.
4. Remove the axle flange from front gear case and measure the thickness of the fuse with an outside micrometer.
5. If the backlash is not within the factory specifications, adjust with shim (3).

Item	Factory spec.
Backlash between 9T bevel gear and 40T bevel gear	0.15 ~ 0.35 mm 0.0059 ~ 0.0138 in.



(1) 40T Bevel Gear (3) Shim
(2) 9T Bevel Gear

(Reference)

- Thickness of adjusting shims (3):
  1.0 mm (0.039 in.) 1.8 mm (0.071 in.)
  1.2 mm (0.047 in.) 2.0 mm (0.079 in.)
  1.4 mm (0.055 in.) 2.2 mm (0.087 in.)
  1.6 mm (0.063 in.)
- Tooth contact : More than 35 %