FOREWORD

This workshop manual has been prepared to provide information regarding repair procedures on Hino Vehicles.

Applicable for FR1E, FS1E, FY1E, SH1E, SS1E and ZS1E series, equipped with E13C engine

When making any repairs on your vehicle, be careful not to be injured through improper procedures.
As for maintenance items, refer to the Owner's Manual.
All information and specifications in this manual are based upon the latest product information available at the time of printing.
Hino Motors reserves the right to make changes at any time without prior notice.
This manual is divided into 9 sections with a thumb index for each section at the edge of the pages.

Please note that the publications below have also been prepared as relevant service manuals for the components and systems in this vehicles.

Manual Name	Pub. No.
Chassis Workshop Manual	S1-YFSE16A 1/3
Chassis Workshop Manual	S1-YFSE16A 3/3
E13C Engine Workshop Manual	S5-YE13E01A

Hino Motors, Ltd.

CHAPTER REFERENCES REGARDING THIS WORKSHOP MANUAL

Use this chart to the appropriate chapter numbers for servicing your particular vehicle.

CHAPTER	MANUAL NO.	S1-YFSE16A 2/3				
	MODELS	FR1E, FS1E, FY1E, SH1E, SS1E, ZS1E				
GENERAL INTRODUCTION		GN02-001				
CLUTCH MAIN UNIT		CL02-001	CL02-002	CL02-003	CL02-004	
CLUTCH CONTROL		CL03-001	CL03-002	CL03-003	CL03-004	
TRANSMISSION MAIN UNIT		TR02-001	TR02-002	TR02-003	TR02-004	
P.T.O. (POWER TAKE-OFF)		TR05-001	TR05-002	TR05-003		
TRANSMISSION/TRANSFER CONTROL		TR06-001				
PROPELLER SHAFT		PP02-001	PP02-002	PP02-003		
DIFFERENTIAL EQUIPMENT		DF01-001				
DIFFERENTIAL CARRIER		DF02-001	DF02-002	DF02-003	DF02-004	DF02-005
BRAKE EQUIPMENT		BR01-001				
SERVICE BRAKE		BR02-001				
ABS (ANTI-LOCK BRAKE SYSTEM)		BR03-001				
ES START (EASY & SMOOTH START) SYSTEM		BR04-001				
STEERING EQUIPMENT		SR01-001				
STEERING UNIT		SR02-001				
POWER STEERING		SR03-001				
FRONT AXLE		AX02-001	AX02-002			
REAR AXLE		AX03-001	AX03-002			
WHEEL & TIRE		AX04-001				
SUSPENSION		SU02-001	SU02-002	SU02-003	SU02-004	
CHASSIS FRAME		FC02-001				
COUPLER (5TH WHEEL)		FC03-001				
PINTLE HOOK		FC04-001				
CAB		CA02-001				
ELECTRICAL EQUIPMENT		EL01-001				
ELECTRIC WIRE		EL02-001				
BRAKE CONTROL		DN03-001	DN03-002			
SUSPENSION CONTROL		DN04-001				
OTHERS		DN06-001				

This manual does not contain items on half-tone dot meshing.

HINO

WORKSHOP MANUAL

INDEX: CHASSIS GROUP 1/4

Hino Motors, Ltd.

This manual does not contain items on half-tone dot meshing.

INDEX: CHASSIS GROUP 2/4

This manual does not contain items on half-tone dot meshing.

ELECTRICAL EQUIPMENT

ELECTRIC WIRE

This manual does not contain items on half-tone dot meshing.

INDEX: CHASSIS GROUP 4/4

This manual does not contain items on half-tone dot meshing.

BRAKE EQUIPMENT

BR01-001

SERVICE BRAKE ASSEMBLY

DESCRIPTION

EN0680201C100001

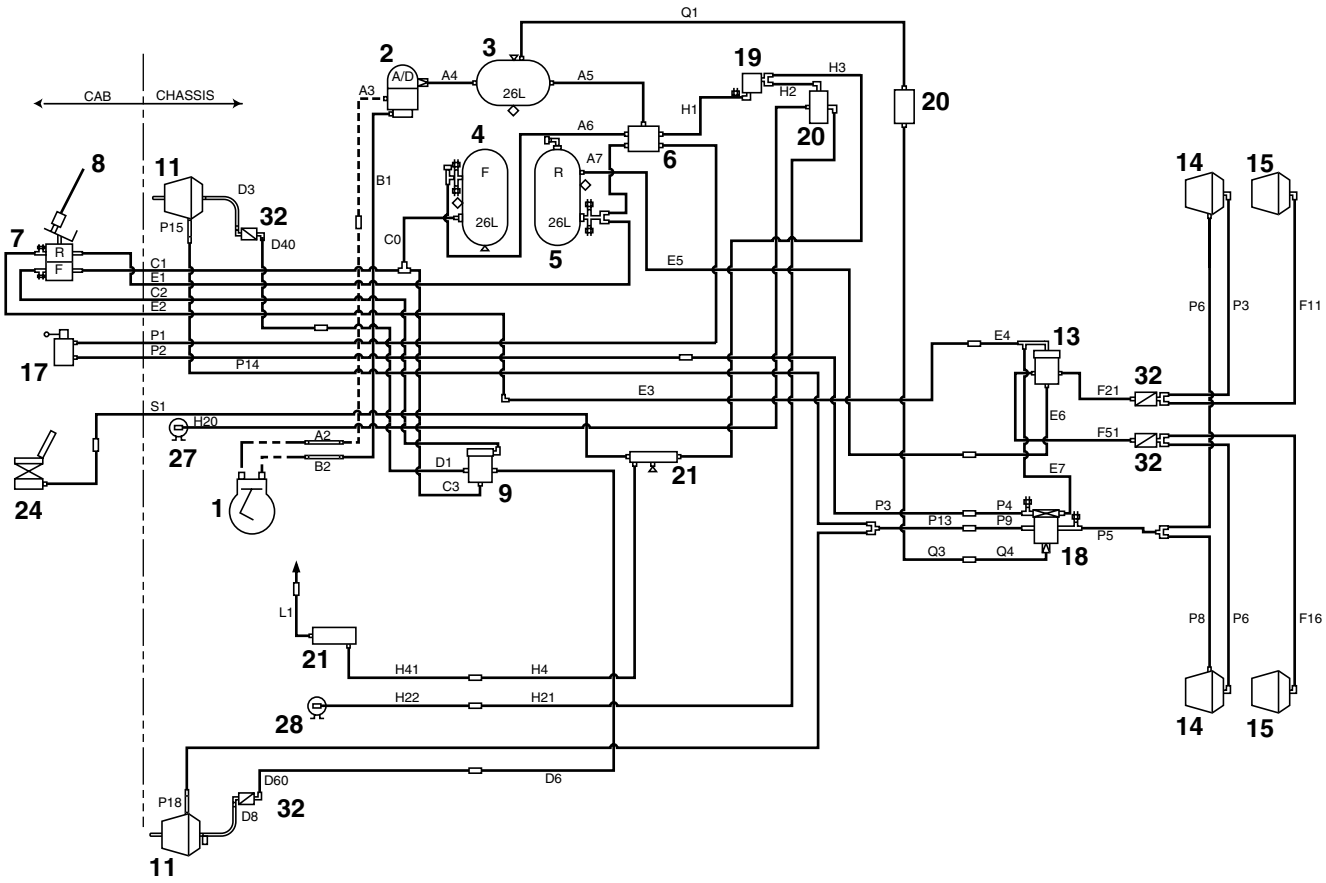
Type of service brake	Drum-shoe type wheel brake activated by compressed air.
Air charging system	Air charging is from piston type air compressor and air flow is directed and controlled by a pressure regulator, the necessary valves, and lines as required. Pressure sensor and air pressure warning switch are used for indicating the pressure level in the system.
Service brake control system	Two independent lines for front and rear wheels with air flow controlled by a brake valve, and each line comprises a group of valve and brake chambers (one/ wheel). Stop lamp switch is used to operate the stop lamps.
Spring brake control system	Single line for all spring brake chambers. The line comprises a control valve which controls air flow, the other necessary valve and spring brake chambers. A stop lamp switch is used to turn on the stop lamps. A parking brake switch is used to turn off the warning buzzer and to turn on the parking brake warning lamp.
Wheel brake	Drum brake with internally expanding, leading-trailing shoes are operated by slack adjuster and cam shaft or expander in all wheels.

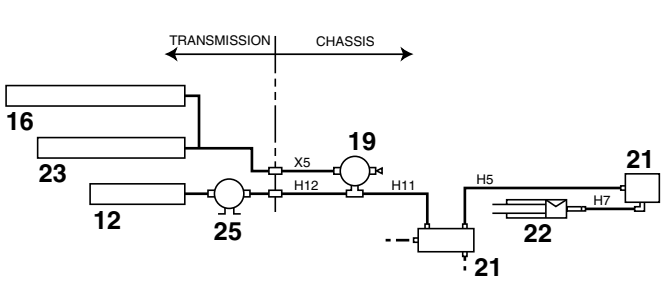
NOTICE
See "DIAGRAM" of the following page the component parts (Valves, Switches, etc.) used in easy system.

DIAGRAM

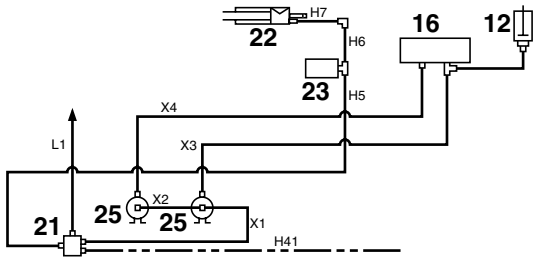
EN0680201J100001

MODELS: FS (DUMP, MIXER AND CARGO TRUCK), ZS (DUMP AND CARGO TRUCK) (For GENERAL COUNTRIES, CHILE, CHINA, G.C.C. COUNTRIES, HONG KONG, IRELAND, SOUTH AFRICA, TAIWAN)

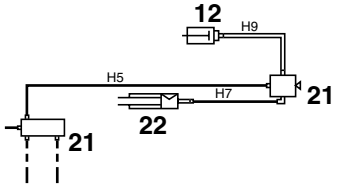




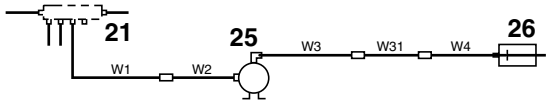
WITH MZ12 TRANSMISSION (IF SO EQUIPPED)



WITH ZF TRANSMISSION (IF SO EQUIPPED)

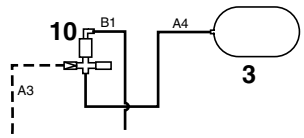


WITH HX07 TRANSMISSION (IF SO EQUIPPED)



WITH INER-AXLE DIFFERENTIAL LOCK (IF SO EQUIPPED)

SHTS068020100001



WITHOUT AIR DRYER
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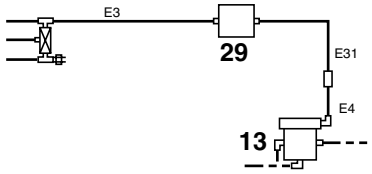
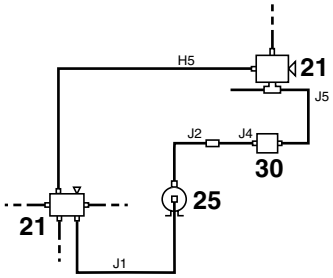
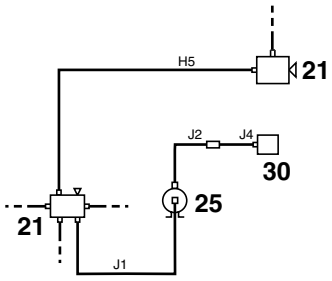


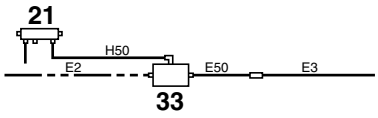
WITH LOAD SENSING VALVE
(IF SO EQUIPPED)



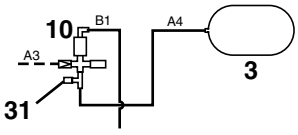
WITH TRANSMISSION P.T.O.
(WITH HX07 AND MZ12 TRANSMISSION)
(IF SO EQUIPPED)



WITH TRANSMISSION P.T.O.
(WITH ZF TRANSMISSION)
(IF SO EQUIPPED)



WITH ES START
(IF SO EQUIPPED)



WITH TIRE INFLATOR
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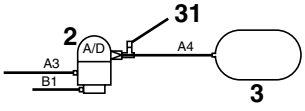
(IF SO EQUIPPED)

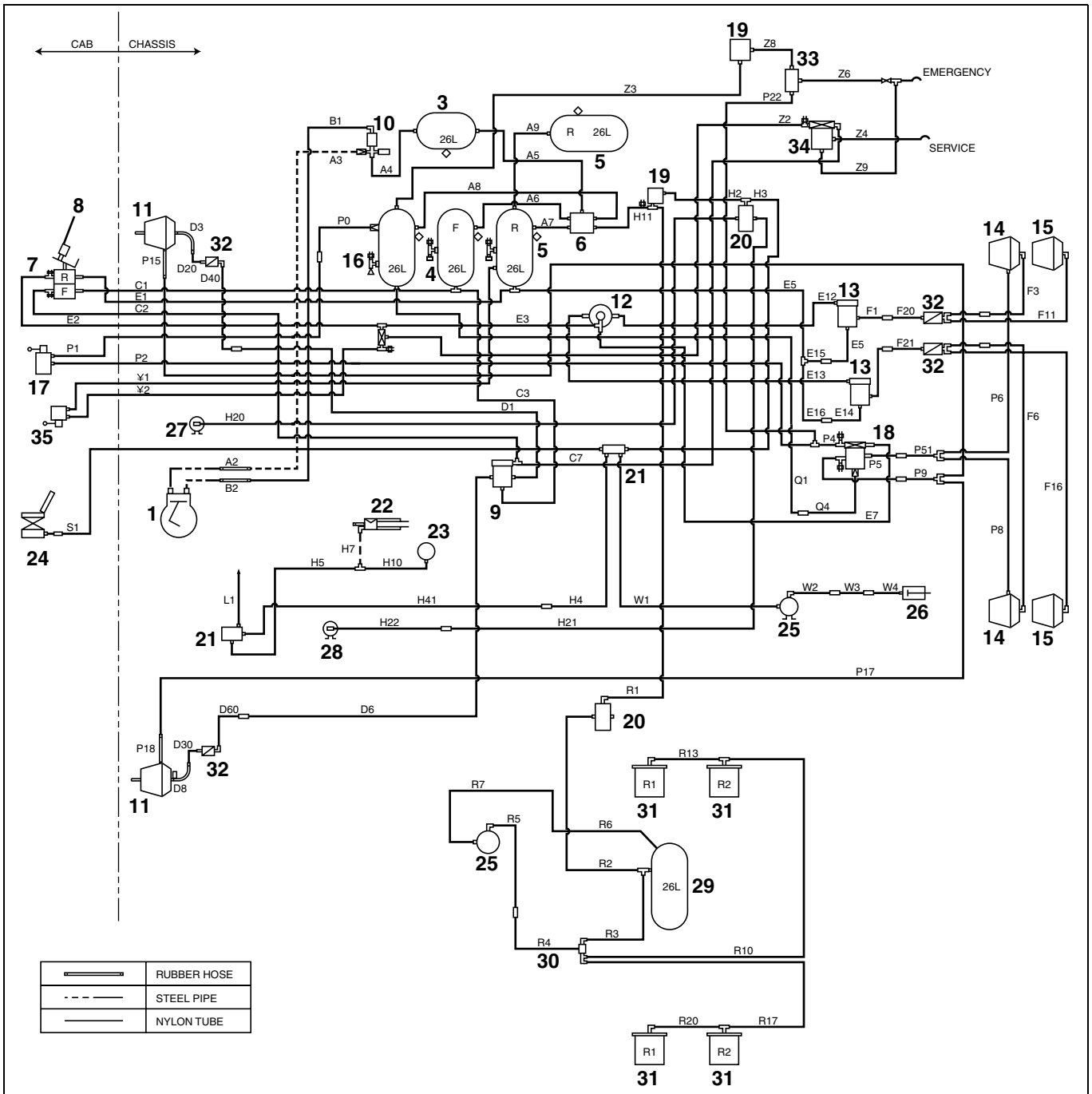


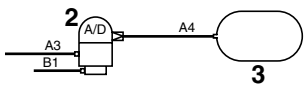
WITH TIRE INFLATOR
(WITH AIR DRYER)
(IF SO EQUIPPED)

SHTS068020100002

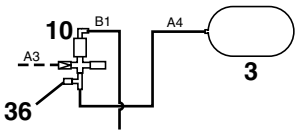
1	Air compressor	18	Relay valve-Spring brake
2	Air dryer (If so equipped)	19	Reducing valve
3	Air tank-Water separator	20	Protection valve
4	Air tank-Front brake	21	Multi joint
5	Air tank-Rear brake	22	Clutch booster
6	Protection valve	23	Range valve
7	Brake valve	24	Air suspension seat
8	Stop lamp switch	25	Magnetic valve
9	Relay valve-Front brake	26	Inter-axle differential lock control cylinder
10	Pressure regulator	27	Cab suspension-Front
11	Spring brake chamber-Front	28	Cab suspension-Rear
12	Power shift	29	Load sensing valve (If so equipped)
13	Release valve-Rear brake	30	Transmission P.T.O. (If so equipped)
14	Spring brake chamber-Rear	31	Tire inflator (If so equipped)
15	Brake chamber	32	ABS control valve (If so equipped)
16	Splitter valve	33	ES start control valve (If so equipped)
17	Spring brake control valve		

MODEL: FS (For AUSTRALIA)

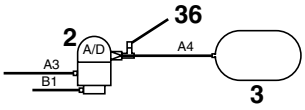




WITH AIR DRYER



WITH TIRE INFLATOR (WITHOUT AIR DRYER) (IF SO EQUIPPED)

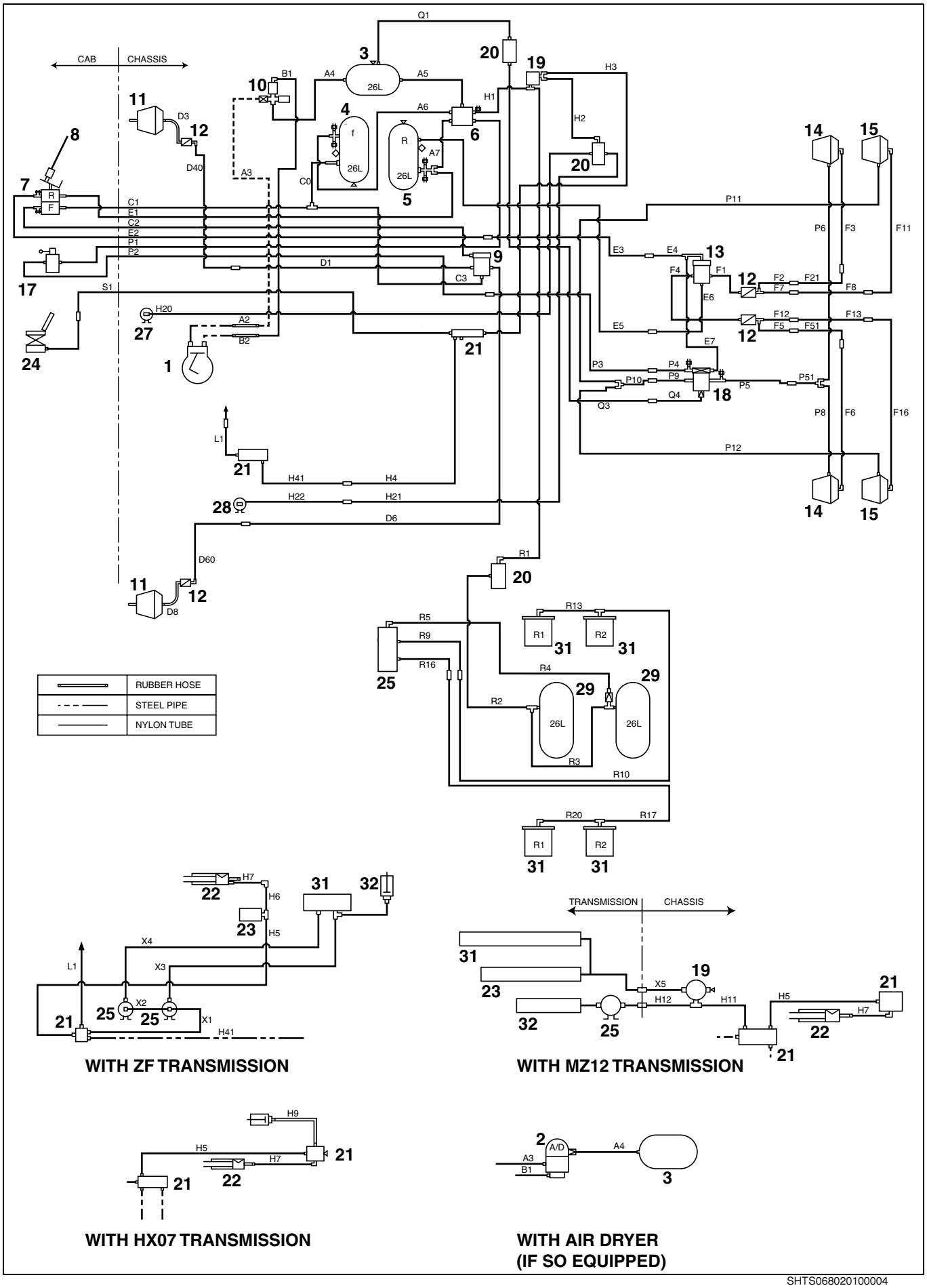


WITH TIRE INFLATOR (WITH AIR DRYER) (IF SO EQUIPPED)

SHTS068020100003

1	Air compressor	19	Reducing valve
2	Air dryer (If so equipped)	20	Protection valve
3	Air tank-Water separator	21	Multi joint
4	Air tank-Front brake	22	Clutch booster
5	Air tank-Rear brake	23	Range valve
6	Protection valve	24	Air suspension seat
7	Brake valve	25	Magnetic valve
8	Stop lamp switch	26	Inter-axle differential lock control cylinder
9	Relay valve-Front brake	27	Cab suspension-Front
10	Pressure regulator	28	Cab suspension-Rear
11	Spring brake chamber-Front	29	Air tank-Air suspension
12	Quick release valve	30	Leveling valve
13	Release valve-Rear brake	31	Air spring
14	Spring brake chamber-Rear	32	ABS control valve
15	Brake chamber	33	Cut valve
16	Air tank-Spring brake and trailer brake	34	Trailer control valve
17	Spring brake control valve	35	Trailer hand brake valve
18	Relay valve-Spring brake	36	Tire inflator (If so equipped)

MODEL: FS (CARGO TRUCK) (For HONG KONG, IRELAND, TAIWAN)



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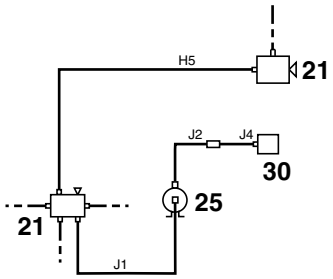
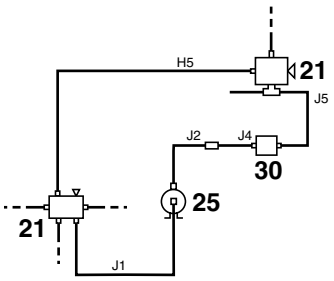


**WITH TRANSMISSION P.T.O.
(WITH ZF TRANSMISSION)
(IF SO EQUIPPED)**



**WITH TRANSMISSION P.T.O.
(WITH HX07, MZ12 TRANSMISSION)
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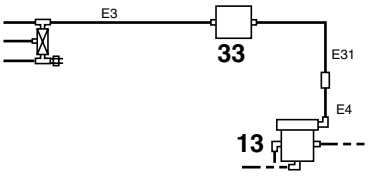
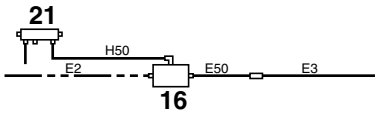
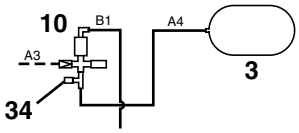


**WITH LOADSENSING VALVE
(IF SO EQUIPPED)**



**WITH ES START
(IF SO EQUIPPED)**



**WITH TIRE INFLATOR
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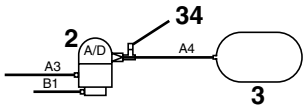
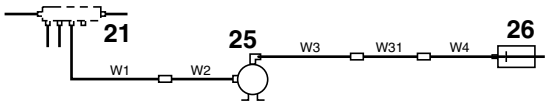
(IF SO EQUIPPED)**



**WITH TIRE INFLATOR
(WITHOUT AIR DRYER)
(IF SO EQUIPPED)**

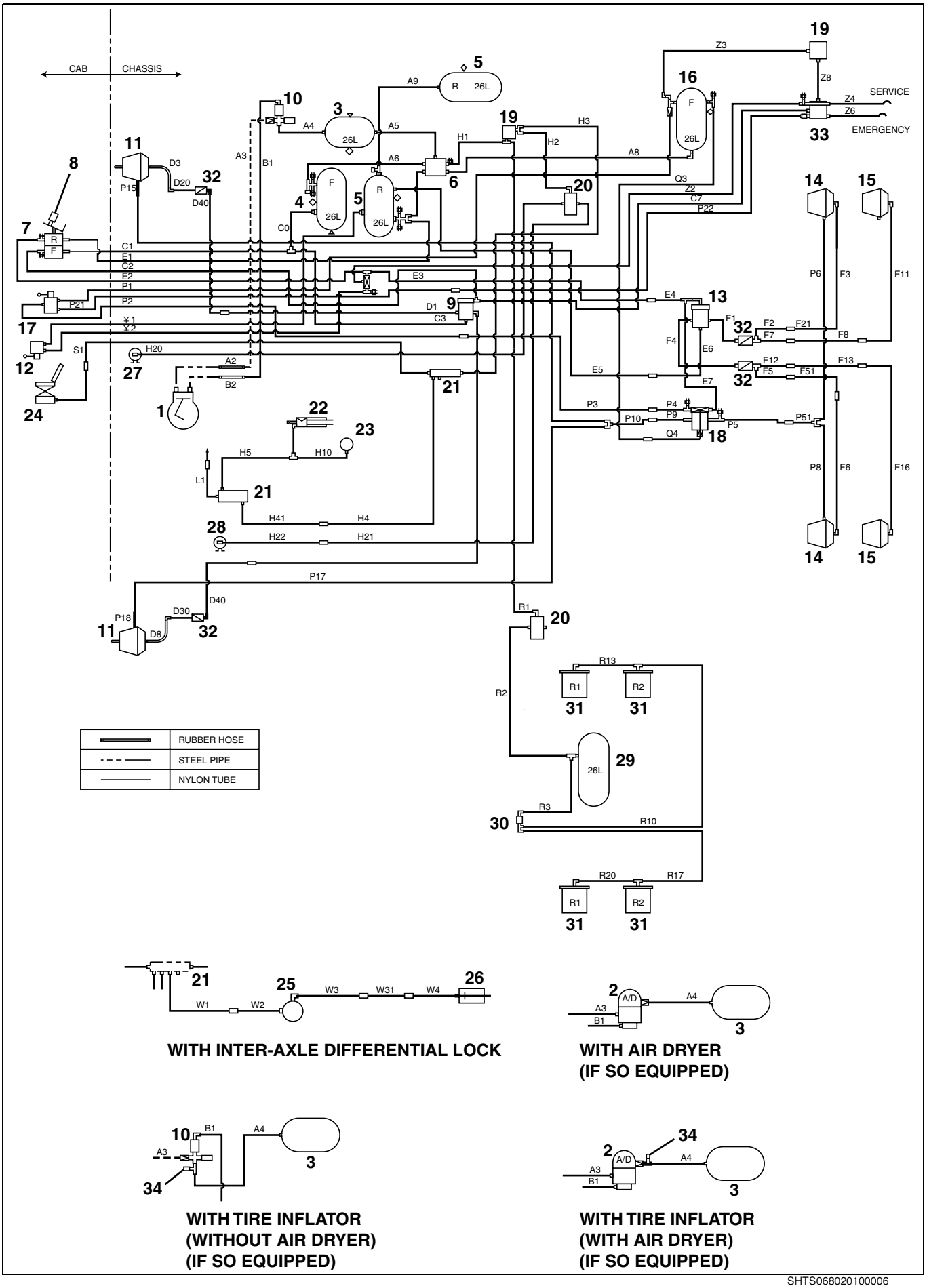


**WITH INTER-AXLE DIFFERENTIAL LOCK
(MODEL: FS)**

SHTS068020100005

1	Air compressor	18	Relay valve-Spring brake
2	Air dryer (If so equipped)	19	Reducing valve
3	Air tank-Water separator	20	Protection valve
4	Air tank-Front brake	21	Multi joint
5	Air tank-Rear brake	22	Clutch booster
6	Protection valve	23	Range valve
7	Brake valve	24	Air suspension seat
8	Stop lamp switch	25	Magnetic valve
9	Relay valve-Front brake	26	Inter-axle differential lock control cylinder
10	Pressure regulator	27	Cab suspension-Front
11	Brake chamber	28	Cab suspension-Rear
12	ABS control valve (If so equipped)	29	Air tank-Air suspension
13	Relay valve-Rear	30	Transmission P.T.O.
14	Spring brake chamber-Rear, Frontward	31	Splitter valve
15	Spring brake chamber-Rear, Rearward	32	Power shift
16	ES start control valve (If so equipped)	33	Load sensing valve
17	Spring brake control valve	34	Tire inflator (If so equipped)

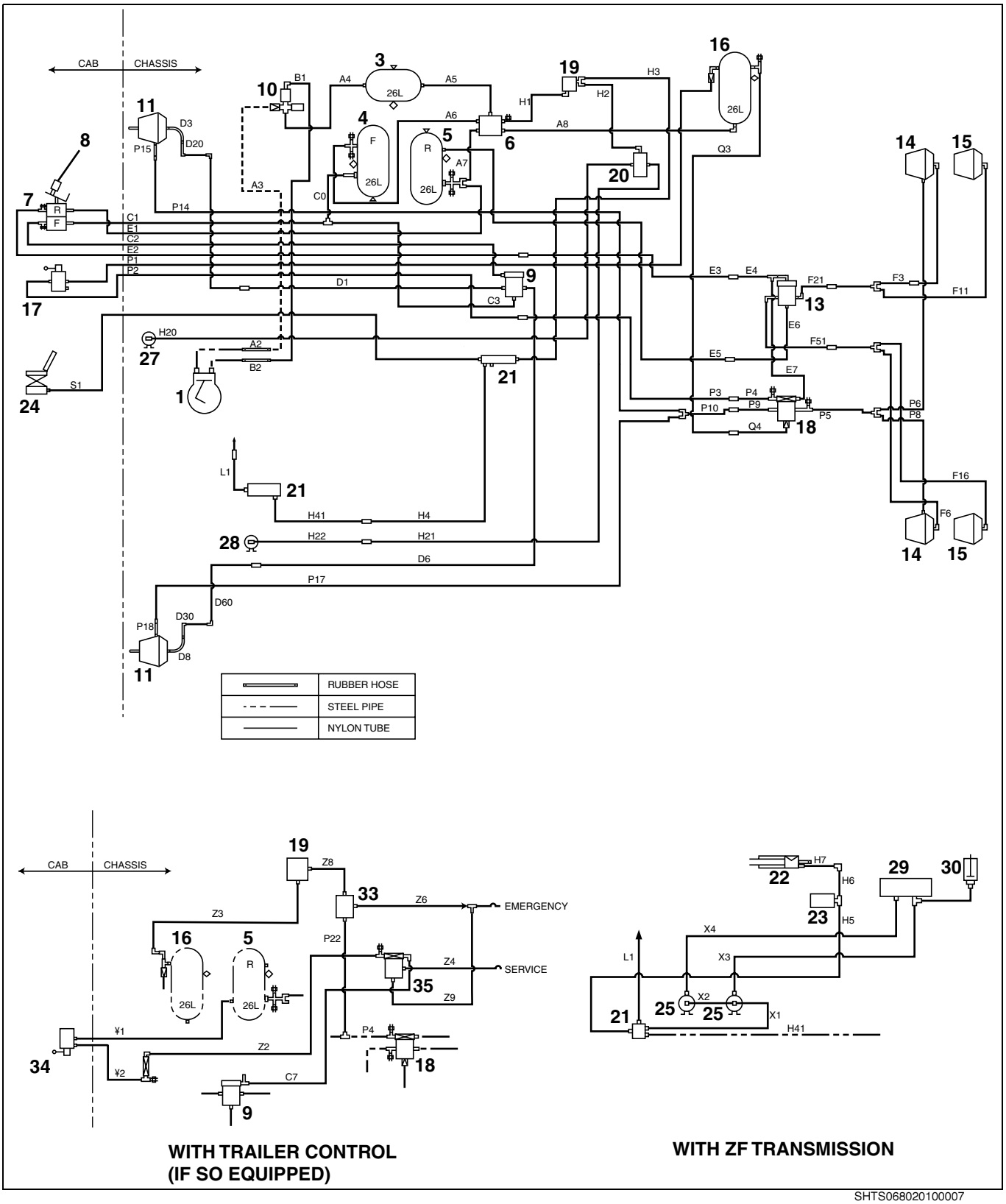
MODEL: FS (For NEW ZEALAND)



SHTS068020100006

1	Air compressor	18	Relay valve-Spring brake
2	Air dryer (If so equipped)	19	Reducing valve
3	Air tank-Water separator	20	Protection valve
4	Air tank-Front brake	21	Multi joint
5	Air tank-Rear brake	22	Clutch booster
6	Protection valve	23	Range valve
7	Brake valve	24	Air suspension seat
8	Stop lamp switch	25	Magnetic valve
9	Relay valve-Front brake	26	Inter-axle differential lock control cylinder
10	Pressure regulator	27	Cab suspension-Front
11	Spring brake chamber-Front	28	Cab suspension-Rear
12	Trailer hand brake valve	29	Air tank-Air suspension
13	Release valve-Rear brake	30	Leveling valve
14	Spring brake chamber-Rear	31	Air spring
15	Brake chamber	32	ABS control valve
16	Air tank-Spring brake and trailer brake	33	Trailer control valve
17	Spring brake control valve	34	Tire inflator (If so equipped)

MODEL: FS (FULL TRACTOR) (For GENERAL COUNTRIES, CHILE, G.C.C. COUNTRIES)



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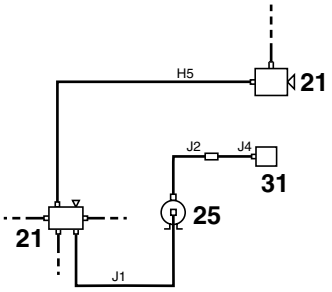
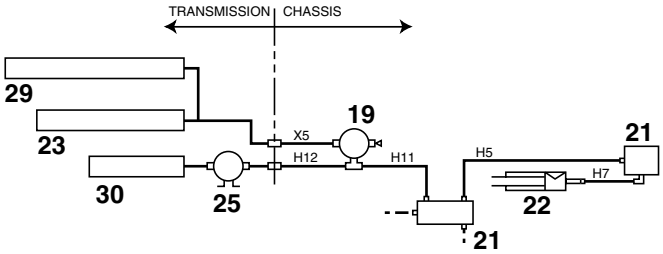
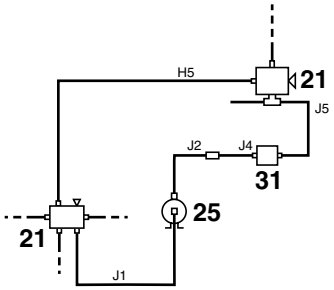


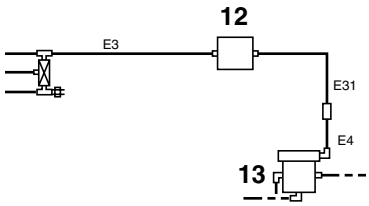
WITH TRANSMISSION P.T.O.
(WITH ZF TRANSMISSION)
(IF SO EQUIPPED)



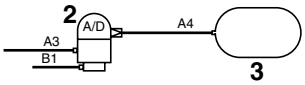
WITH MZ12 TRANSMISSION



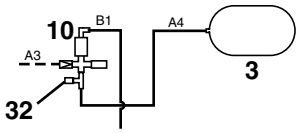
WITH TRANSMISSION P.T.O.
(WITH MZ12 TRANSMISSION)
(IF SO EQUIPPED)



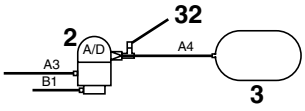
WITH LOAD SENSING VALVE
(IF SO EQUIPPED)



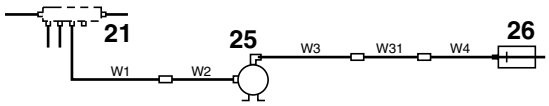
WITH AIR DRYER



WITH TIRE INFLATOR
(WITHOUT AIR DRYER)
(IF SO EQUIPPED)



WITH TIRE INFLATOR
(WITH AIR DRYER)
(IF SO EQUIPPED)

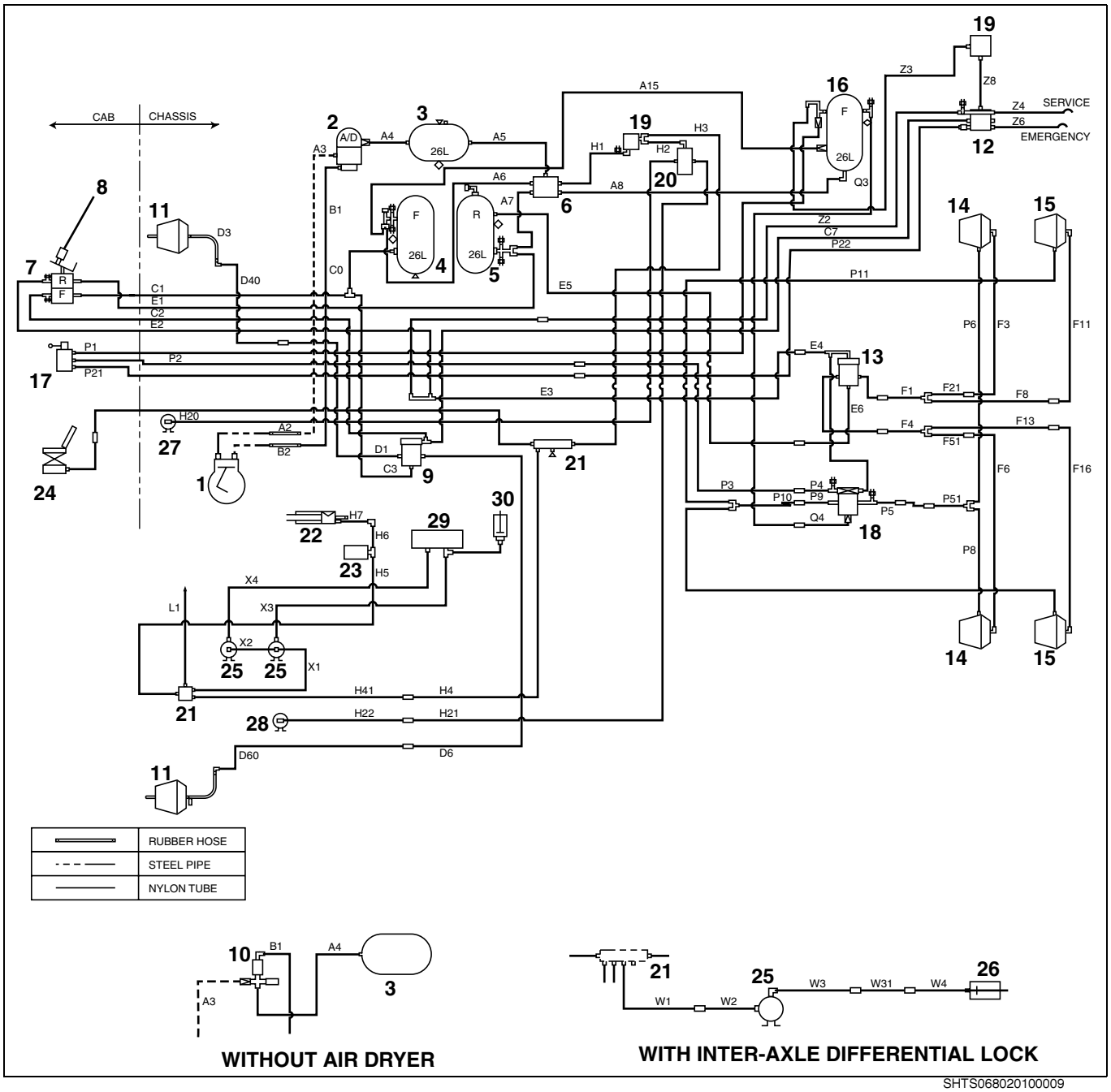


WITH INTER-AXLE DIFFERENTIAL LOCK

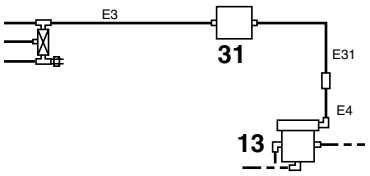
SHTS068020100008

1	Air compressor	19	Reducing valve
2	Air dryer (If so equipped)	20	Protection valve
3	Air tank-Water separator	21	Multi joint
4	Air tank-Front brake	22	Clutch booster
5	Air tank-Rear brake	23	Range valve
6	Protection valve	24	Air suspension seat
7	Brake valve	25	Magnetic valve
8	Stop lamp switch	26	Inter-axle differential lock control cylinder
9	Relay valve-Front brake	27	Cab suspension-Front
10	Pressure regulator	28	Cab suspension-Rear
11	Spring brake chamber-Front	29	Splitter valve
12	Load sensing valve (If so equipped)	30	Power shift
13	Release valve-Rear brake	31	Transmission P.T.O. (If so equipped)
14	Spring brake chamber-Rear	32	Tire inflator (If so equipped)
15	Brake chamber	33	Cut valve (If so equipped)
16	Air tank-Spring brake and trailer brake	34	Trailer hand brake valve (If so equipped)
17	Spring brake control valve	35	Trailer control valve (If so equipped)
18	Relay valve-Spring brake		

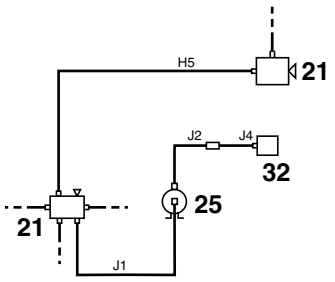
MODEL: FS (FULL TRACTOR) (For SOUTH AFRICA)



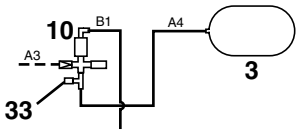
SHTS068020100009



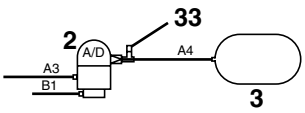
WITH LOAD SENSING VALVE
(IF SO EQUIPPED)



WITH TRANSMISSION P.T.O.
(IF SO EQUIPPED)



WITH TIRE INFLATOR
(WITHOUT AIR DRYER)
(IF SO EQUIPPED)

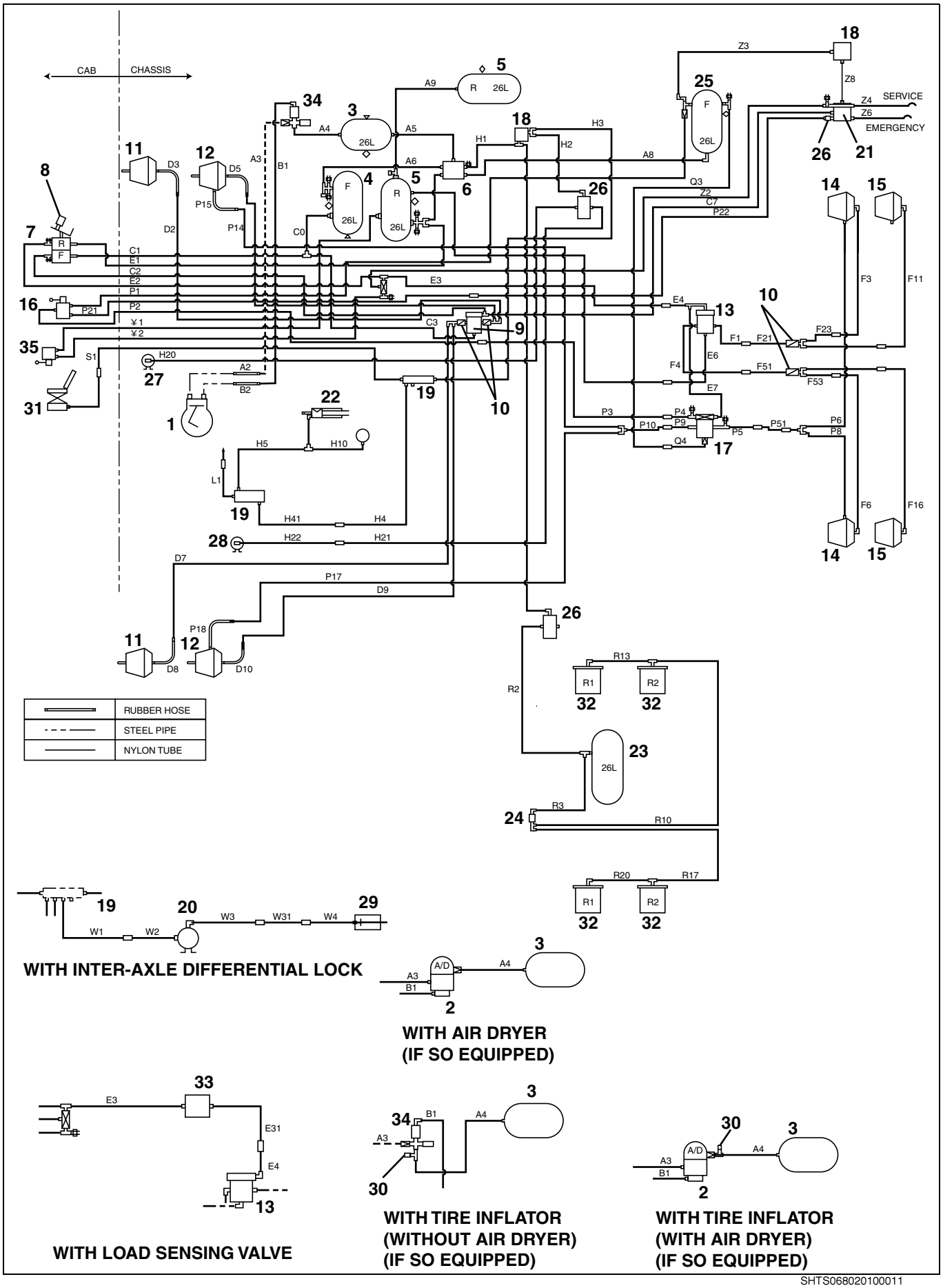


WITH TIRE INFLATOR
(WITH AIR DRYER)
(IF SO EQUIPPED)

SHTS068020100010

1	Air compressor	18	Relay valve-Spring brake
2	Air dryer (If so equipped)	19	Reducing valve
3	Air tank-Water separator	20	Protection valve
4	Air tank-Front brake	21	Multi joint
5	Air tank-Rear brake	22	Clutch booster
6	Protection valve	23	Range valve
7	Brake valve	24	Air suspension seat
8	Stop lamp switch	25	Magnetic valve
9	Relay valve-Front brake	26	Inter-axle differential lock control cylinder
10	Pressure regulator	27	Cab suspension-Front
11	Brake chamber-Front	28	Cab suspension-Rear
12	Trailer control valve	29	Splitter valve
13	Release valve-Rear brake	30	Power shift
14	Spring brake chamber-Rear	31	Load sensing valve
15	Spring brake chamber-Rearward	32	Transmission P.T.O.
16	Air tank-Spring brake and trailer brake	33	Tire inflator
17	Spring brake control valve		

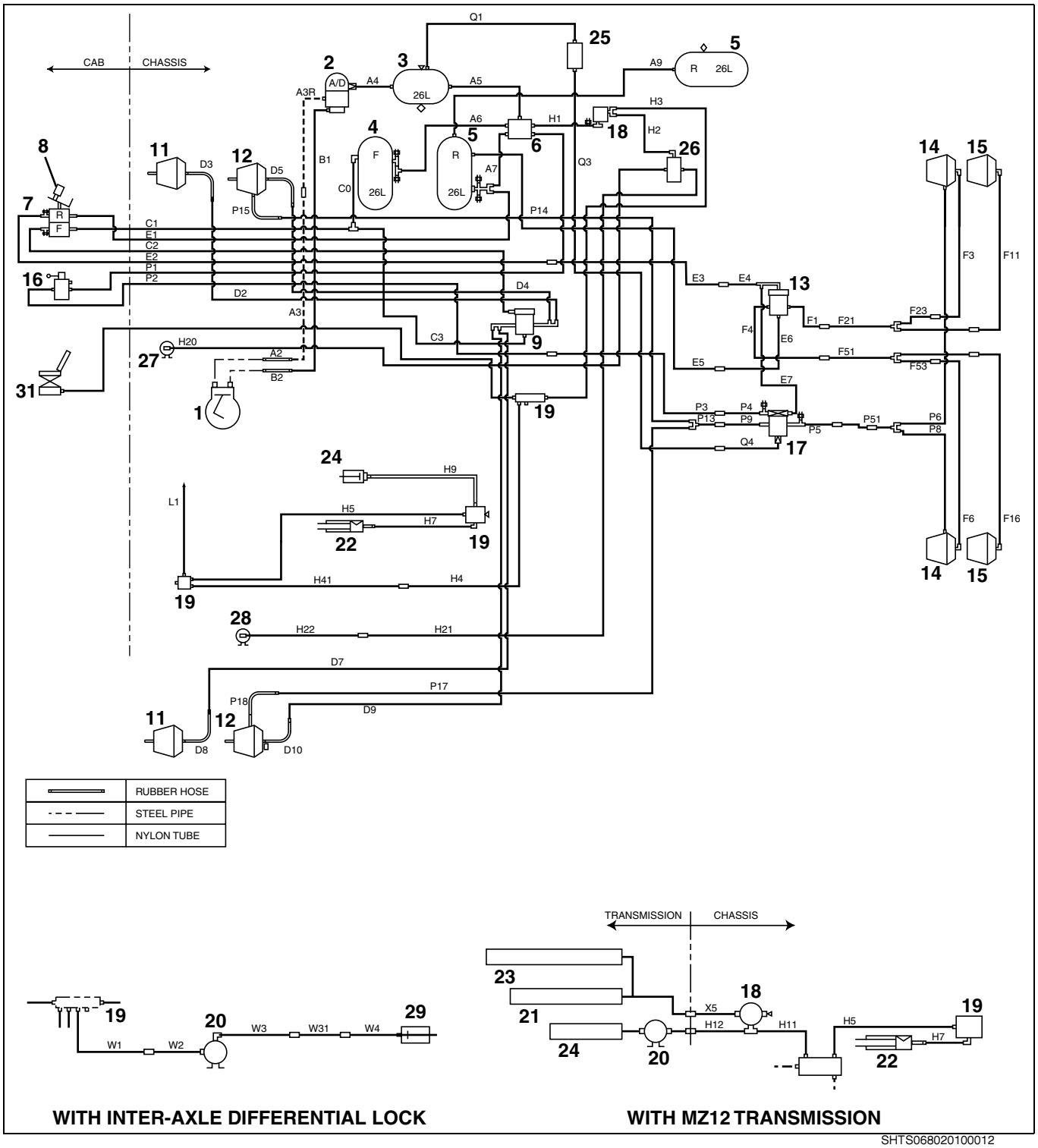
MODEL: FY (For GENERAL COUNTRIES, NEW ZEALAND)



SHTS068020100011

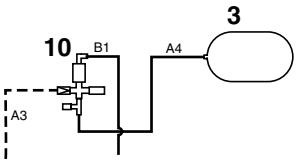
1	Air compressor	19	Multi joint
2	Air dryer (If so equipped)	20	Magnetic valve
3	Air tank-Water separator	21	Trailer control valve (If so equipped)
4	Air tank-Front brake	22	Clutch booster
5	Air tank-Rear brake	23	Air tank-Air suspension (If so equipped)
6	Protection valve	24	Leveling valve (If so equipped)
7	Brake valve	25	Air tank-Spring brake and trailer brake (If so equipped)
8	Stop lamp switch	26	Protection valve
9	Relay valve-Front brake	27	Cab suspension-Front
10	ABS control valve	28	Cab suspension-Rear
11	Brake chamber-Front	29	Inter-axle differential lock control cylinder
12	Spring brake chamber-Front	30	Tire inflator (If so equipped)
13	Relay valve-Rear brake	31	Air suspension seat (If so equipped)
14	Spring brake chamber-Rear	32	Air spring (If so equipped)
15	Brake chamber-Rear	33	Load sensing valve (If so equipped)
16	Spring brake control valve	34	Pressure regulator
17	Relay valve-Spring brake	35	Trailer hand brake valve (If so equipped)
18	Reducing valve		

MODEL: FY (For CHINA, HONG KONG)

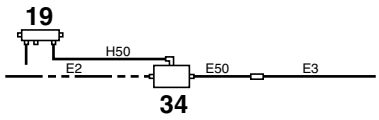


WITH INTER-AXLE DIFFERENTIAL LOCK **WITH MZ12 TRANSMISSION**

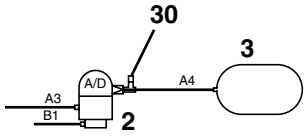
SHTS068020100012



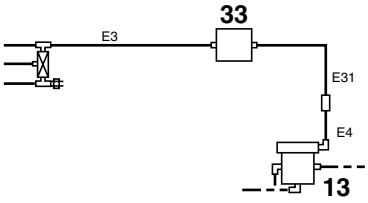
WITHOUT AIR DRYER



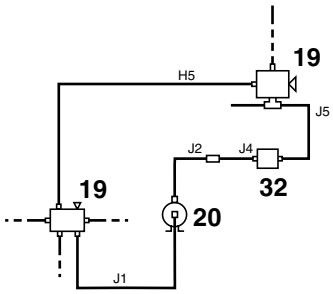
WITH ES START



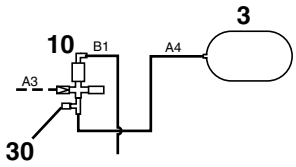
WITH TIRE INFLATOR
(WITH AIR DRYER)
(IF SO EQUIPPED)



WITH LOAD SENSING VALVE
(IF SO EQUIPPED)



WITH TRANSMISSION P.T.O.
(IF SO EQUIPPED)

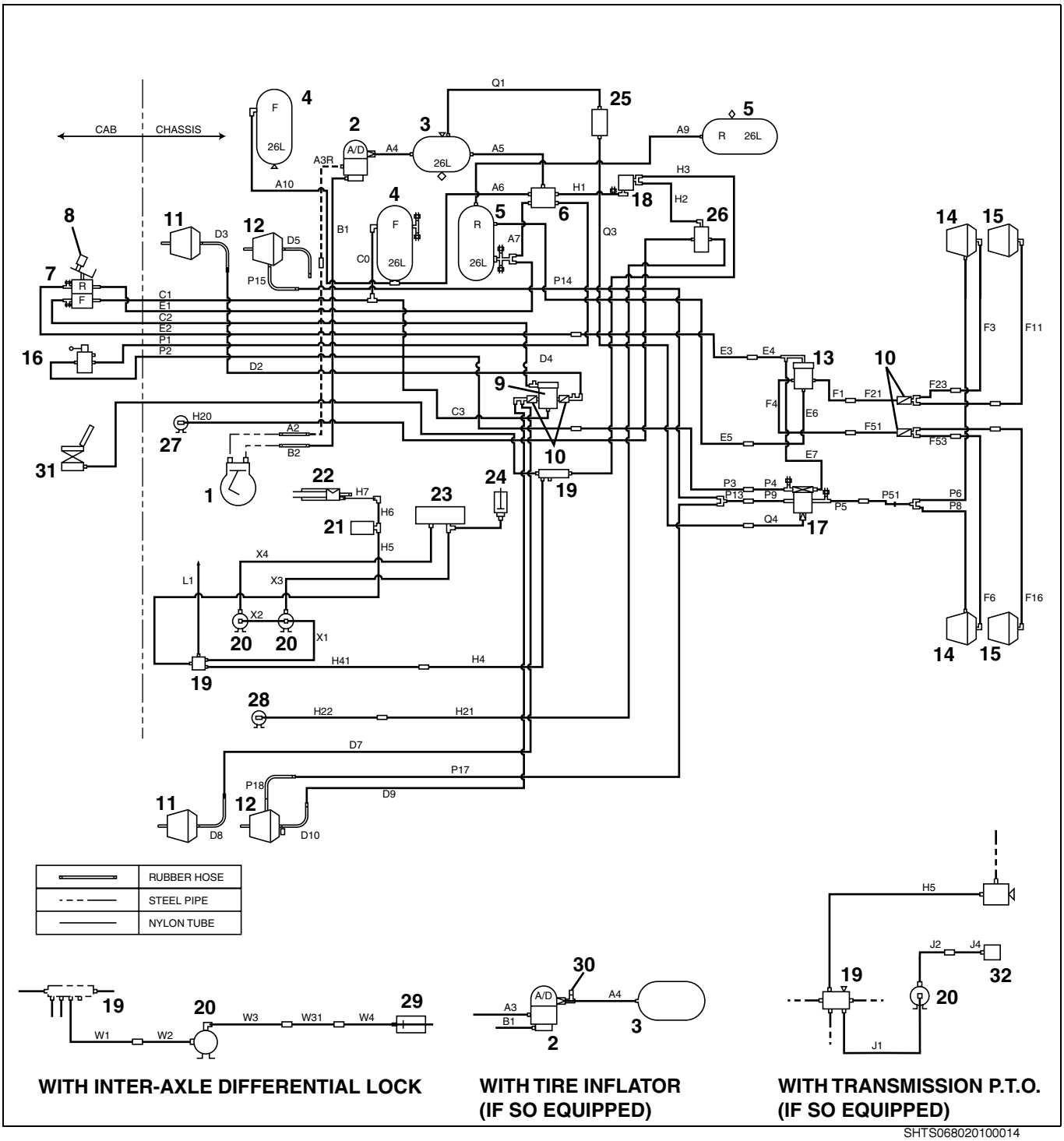


WITH TIRE INFLATOR
(WITHOUT AIR DRYER)
(IF SO EQUIPPED)

SHTS068020100013

1	Air compressor	18	Reducing valve
2	Air dryer (If so equipped)	19	Multi joint
3	Air tank-Water separator	20	Magnetic valve
4	Air tank-Front brake	21	Range valve (If so equipped)
5	Air tank-Rear brake	22	Clutch booster
6	Protection valve	23	Splitter valve (If so equipped)
7	Brake valve	24	Power shift
8	Stop lamp switch	25	Protection valve
9	Relay valve-Front brake	26	Protection valve
10	Pressure regulator (If so equipped)	27	Cab suspension-Front
11	Brake chamber-Front	28	Cab suspension-Rear
12	Spring brake chamber-Front	29	Inter-axle differential lock control cylinder
13	Relay valve-Rear brake	30	Tire inflator (If so equipped)
14	Spring brake chamber-Rear	31	Air suspension seat (If so equipped)
15	Brake chamber-Rear	32	Transmission P.T.O. (If so equipped)
16	Spring brake control valve	33	Load sensing valve (If so equipped)
17	Relay valve-Spring brake	34	ES start control valve (If so equipped)

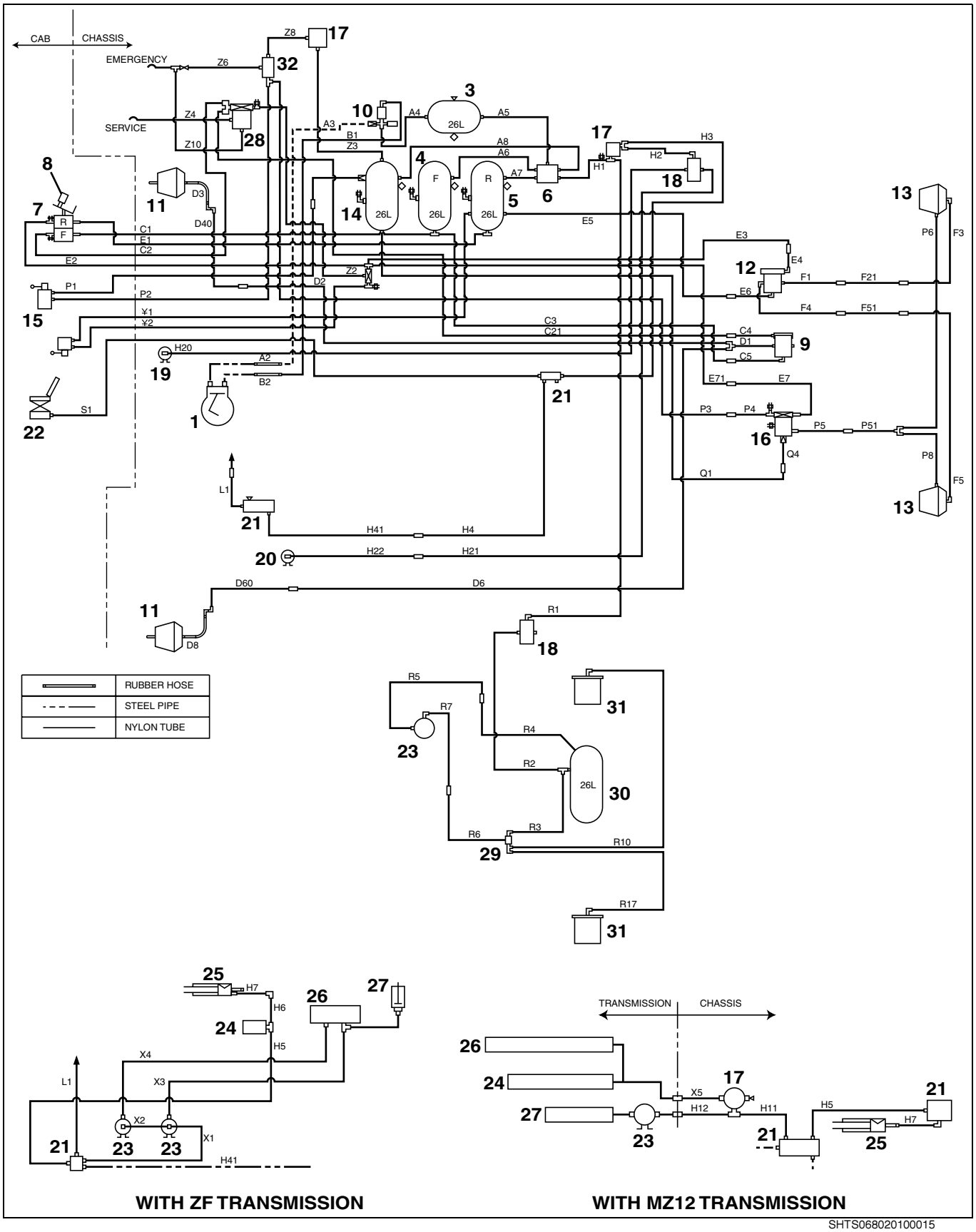
MODEL: FY (For IRELAND)



SHTS068020100014

1	Air compressor	17	Relay valve-Spring brake
2	Air dryer	18	Reducing valve
3	Air tank-Water separator	19	Multi joint
4	Air tank-Front brake	20	Magnetic valve
5	Air tank-Rear brake	21	Range valve
6	Protection valve	22	Clutch booster
7	Brake valve	23	Splitter valve
8	Stop lamp switch	24	Power shift
9	Relay valve-Front brake	25	Protection valve
10	ABS control valve	26	Protection valve
11	Brake chamber-Front	27	Cab suspension-Front
12	Spring brake chamber-Front	28	Cab suspension-Rear
13	Relay valve-Rear brake	29	Inter-axle differential lock control cylinder
14	Spring brake chamber-Rear	30	Tire inflator (If so equipped)
15	Brake chamber-Rear	31	Air suspension seat (If so equipped)
16	Spring bake control valve	32	Transmission P.T.O. (If so equipped)

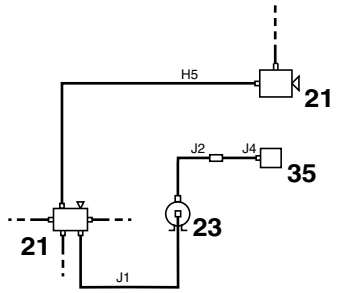
MODEL: SH (For CHILE, G.C.C. COUNTRIES)



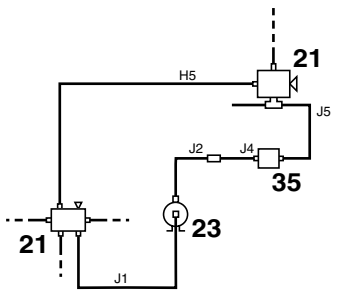
WITH ZF TRANSMISSION

WITH MZ12 TRANSMISSION

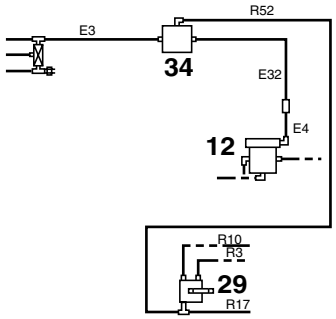
SHTS068020100015



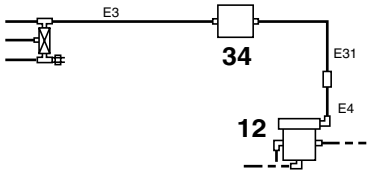
**WITH TRANSMISSION P.T.O.
(WITH ZF TRANSMISSION)
(IF SO EQUIPPED)**



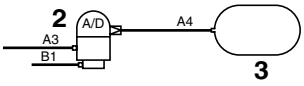
**WITH TRANSMISSION P.T.O.
(WITH MZ12 TRANSMISSION)
(IF SO EQUIPPED)**



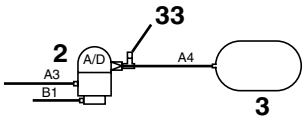
**WITH LOAD SENSING VALVE
(WITH AIR SUSPENSION)
(IF SO EQUIPPED)**



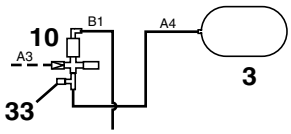
**WITH LOAD SENSING VALVE
(WITH LEAF SUSPENSION)
(IF SO EQUIPPED)**



**WITH AIR DRYER
(IF SO EQUIPPED)**



**WITH TIRE INFLATOR
(WITH AIR DRYER)
(IF SO EQUIPPED)**

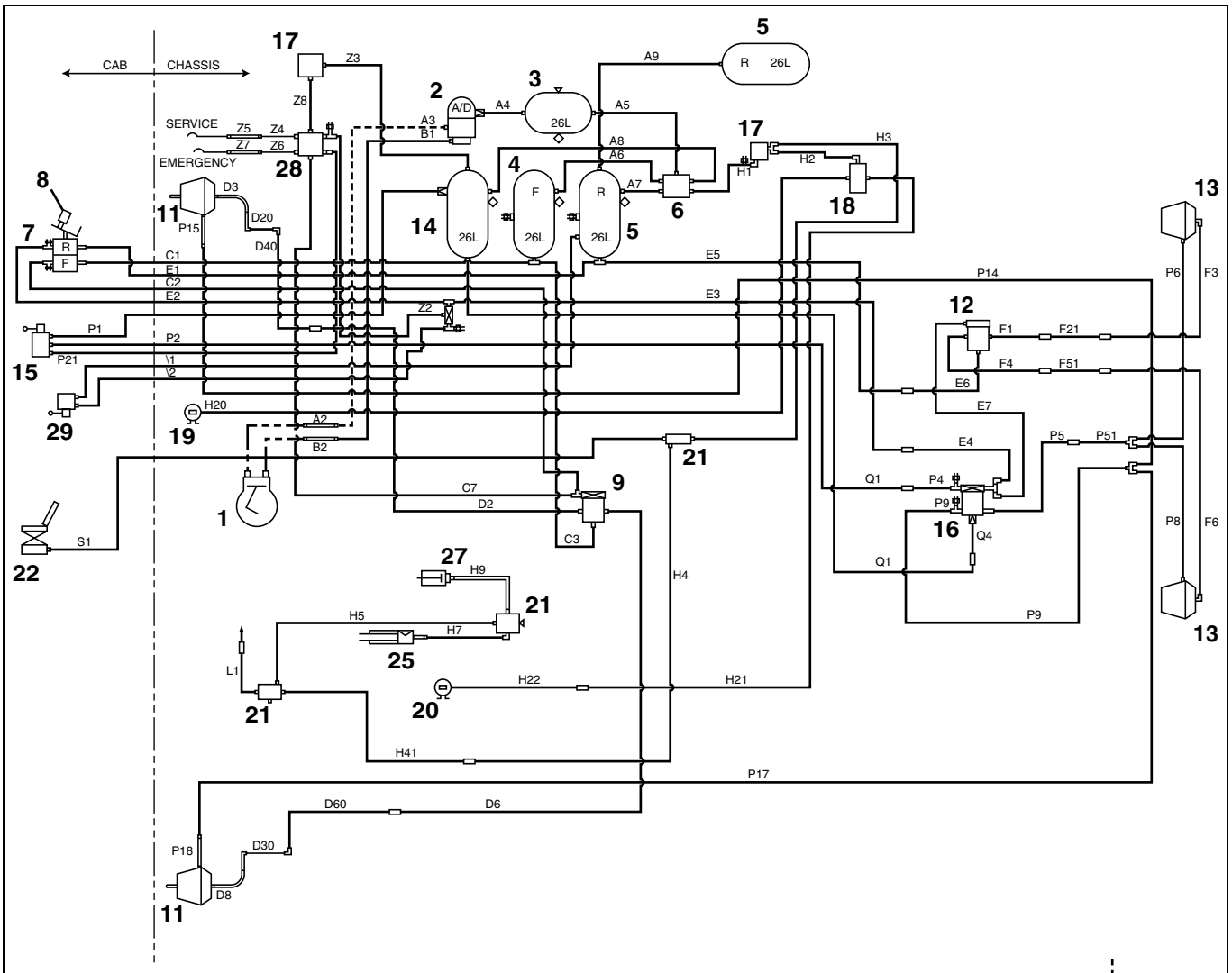


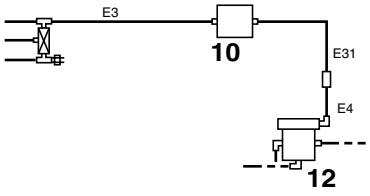
**WITH TIRE INFLATOR
(WITHOUT AIR DRYER)
(IF SO EQUIPPED)**

SHTS068020100016

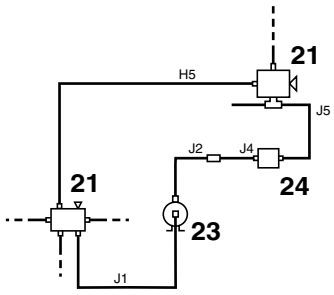
1	Air compressor	19	Cab suspension-Front
2	Air dryer	20	Cab suspension-Rear (If so equipped)
3	Air tank-Water separator	21	Multi joint
4	Air tank-Front brake	22	Air suspension seat (If so equipped)
5	Air tank-Rear brake	23	Magnetic valve
6	Protection valve	24	Range valve
7	Brake valve	25	Clutch booster
8	Stop lamp switch	26	Splitter valve
9	Relay valve-Front brake	27	Power shift
10	Pressure regulator	28	Trailer control valve
11	Brake chamber-Front	29	Leveling valve
12	Relay valve-Rear brake	30	Air tank-Air suspension
13	Spring brake chamber-Rear	31	Air spring
14	Air tank-Spring brake and trailer brake	32	Cut valve
15	Spring brake control valve	33	Tire inflator (If so equipped)
16	Relay valve-Spring brake	34	Load sensing valve (If so equipped)
17	Reducing valve	35	Transmission P.T.O. (If so equipped)
18	Protection valve		

MODEL: SH (For CHINA)

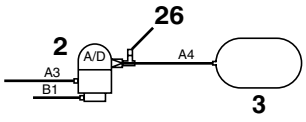




WITH LOAD SENSING VALVE



WITH TRANSMISSION P.T.O. (IF SO EQUIPPED)

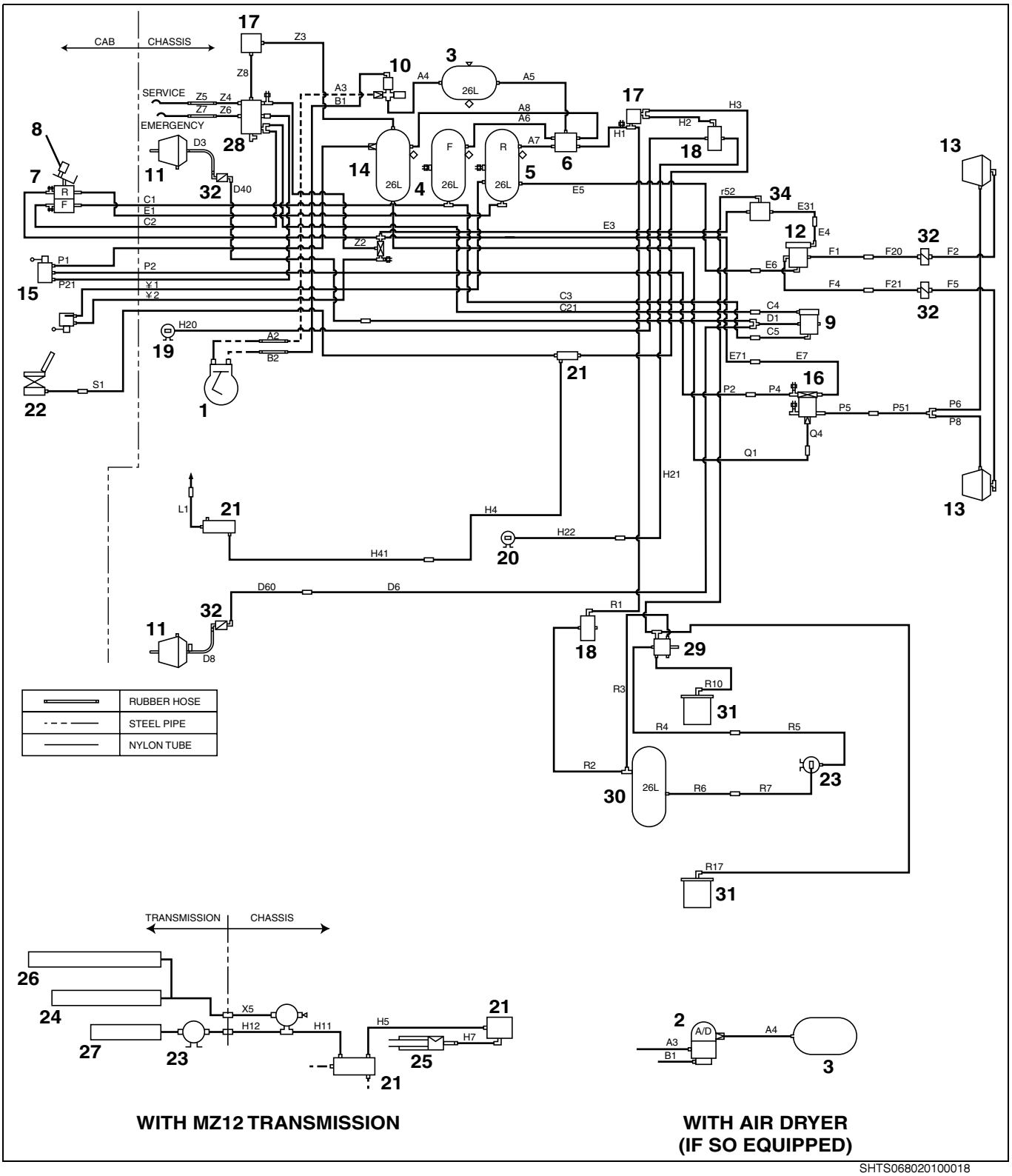


WITH TIRE INFLATOR (IF SO EQUIPPED)

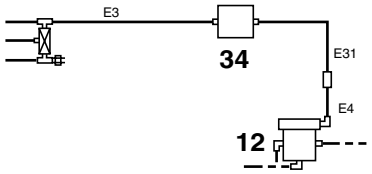
SHTS068020100017

1	Air compressor	16	Relay valve-Spring brake
2	Air dryer	17	Reducing valve
3	Air tank-Water separator	18	Protection valve
4	Air tank-Front brake	19	Cab suspension-Front
5	Air tank-Rear brake	20	Cab suspension-Rear (If so equipped)
6	Protection valve	21	Multi joint
7	Brake valve	22	Air suspension seat (If so equipped)
8	Stop lamp switch	23	Magnetic valve
9	Relay valve-Front brake	24	Transmission P.T.O. (If so equipped)
10	Load sensing valve	25	Clutch booster
11	Brake chamber-Front	26	Tire inflator (If so equipped)
12	Relay valve-Rear brake	27	Power shift
13	Spring brake chamber-Rear	28	Trailer control valve
14	Air tank-Spring brake and trailer brake	29	Trailer hand brake valve
15	Spring brake control valve		

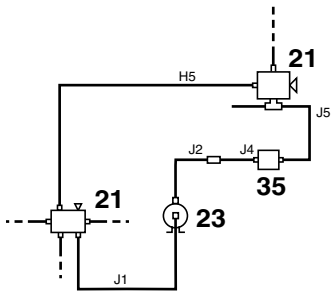
MODEL: SH (For HONG KONG, TAIWAN)



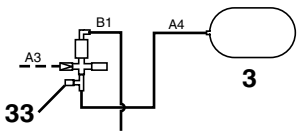
SHTS068020100018



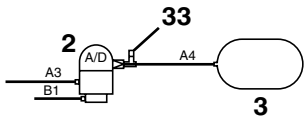
WITH LOAD SENSING VALVE (IF SO EQUIPPED)



WITH TRANSMISSION P.T.O. (IF SO EQUIPPED)



WITH TIRE INFLATOR (WITH AIR SUSPENSION) (IF SO EQUIPPED)

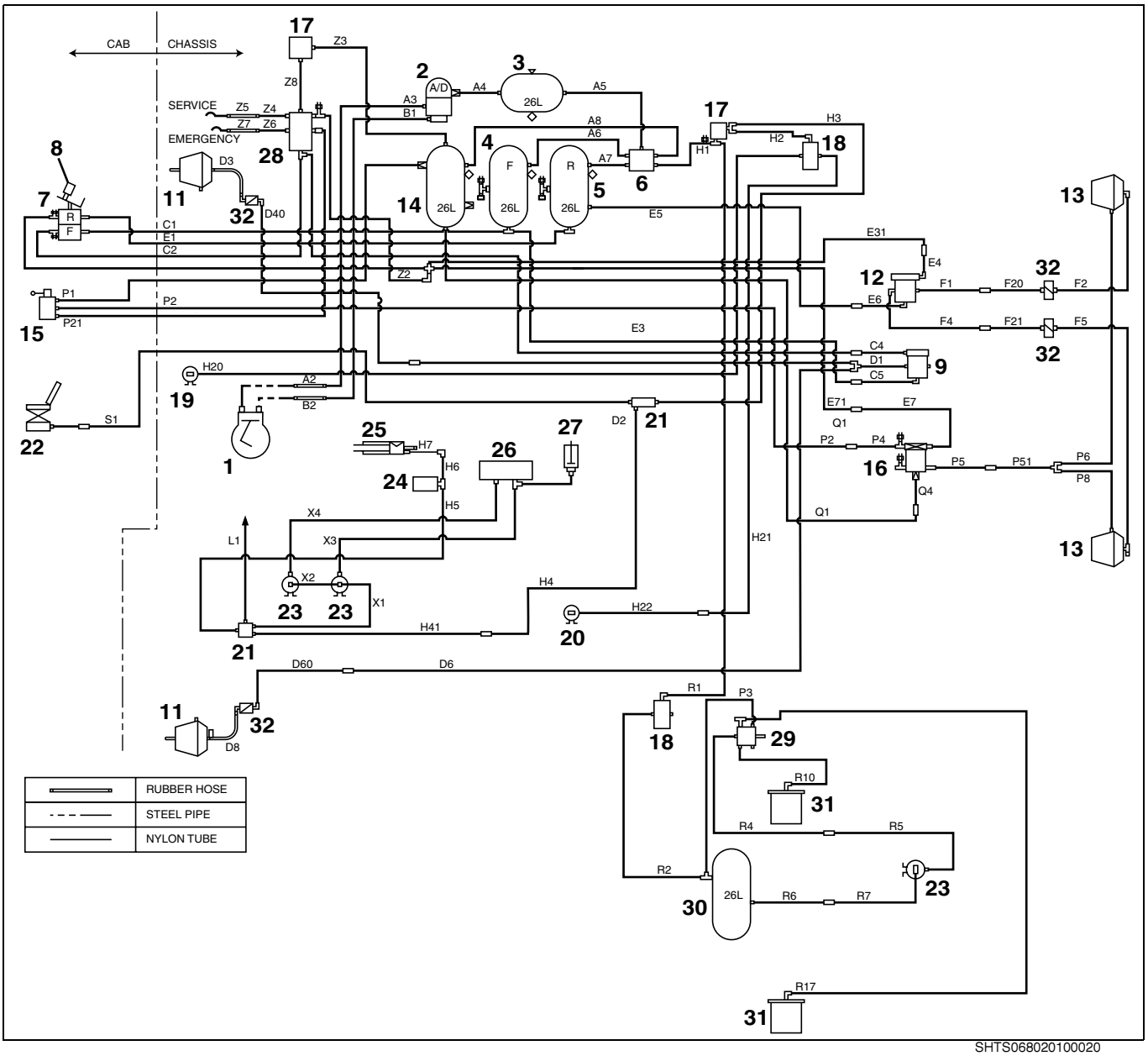


WITH TIRE INFLATOR (WITH LEAF SUSPENSION) (IF SO EQUIPPED)

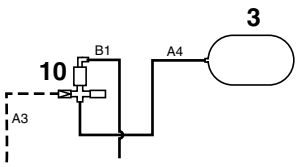
SHTS068020100019

1	Air compressor	19	Cab suspension-Front
2	Air dryer	20	Cab suspension-Rear (If so equipped)
3	Air tank-Water separator	21	Multi joint
4	Air tank-Front brake	22	Air suspension seat (If so equipped)
5	Air tank-Rear brake	23	Magnetic valve
6	Protection valve	24	Range valve
7	Brake valve	25	Clutch booster
8	Stop lamp switch	26	Splitter valve
9	Relay valve-Front brake	27	Power shift
10	Pressure regulator	28	Trailer control valve
11	Brake chamber-Front	29	Leveling valve
12	Relay valve-Rear brake	30	Air tank-Air suspension
13	Spring brake chamber-Rear	31	Air spring
14	Air tank-Spring brake and trailer brake	32	ABS control valve (If so equipped)
15	Spring brake control valve	33	Tire inflator (If so equipped)
16	Relay valve-Spring brake	34	Load sensing valve (If so equipped)
17	Reducing valve	35	Transmission P.T.O. (If so equipped)
18	Protection valve		

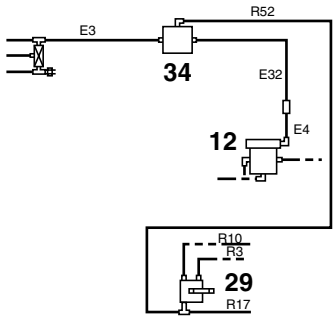
MODEL: SH (For IRELAND, SOUTH AFRICA)



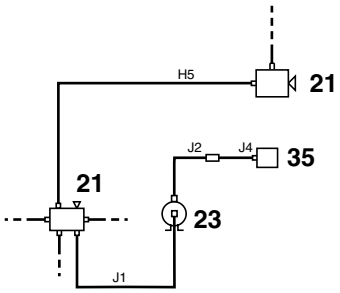
SHTS068020100020



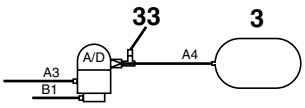
WITHOUT AIR DRYER
(IF SO EQUIPPED)



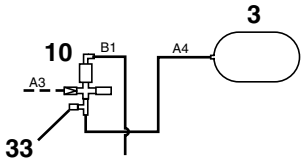
WITH LOAD SENSING VALVE
(IF SO EQUIPPED)



WITH TRANSMISSION P.T.O.
(IF SO EQUIPPED)



WITH TIRE INFLATOR
(WITH AIR DRYER)
(IF SO EQUIPPED)

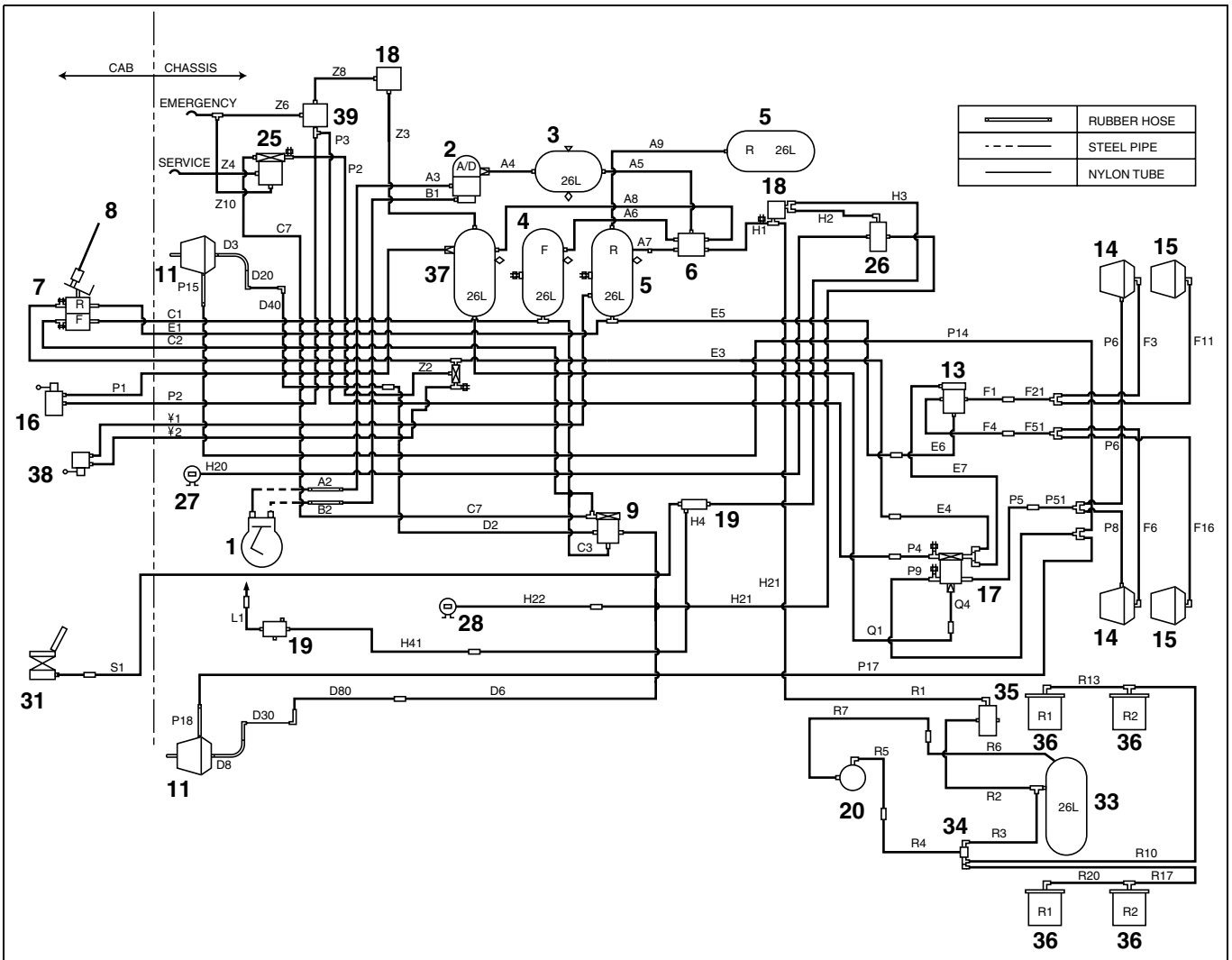


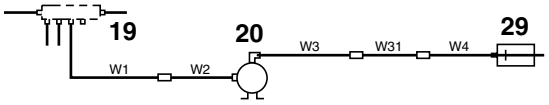
WITH TIRE INFLATOR
(WITHOUT AIR DRYER)
(IF SO EQUIPPED)

SHTS068020100021

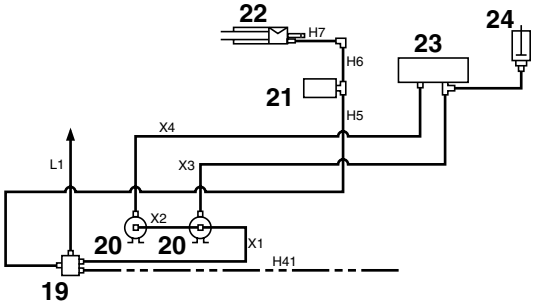
1	Air compressor	19	Cab suspension-Front
2	Air dryer	20	Cab suspension-Rear (If so equipped)
3	Air tank-Water separator	21	Multi joint
4	Air tank-Front brake	22	Air suspension seat (If so equipped)
5	Air tank-Rear brake	23	Magnetic valve
6	Protection valve	24	Range valve
7	Brake valve	25	Clutch booster
8	Stop lamp switch	26	Splitter valve
9	Relay valve-Front brake	27	Power shift
10	Pressure regulator	28	Trailer control valve
11	Brake chamber-Front	29	Leveling valve
12	Relay valve-Rear brake	30	Air tank-Air suspension
13	Spring brake chamber-Rear	31	Air spring
14	Air tank-Spring brake and trailer brake	32	ABS control valve (If so equipped)
15	Spring brake control valve	33	Tire inflator (If so equipped)
16	Relay valve-Spring brake	34	Load sensing valve (If so equipped)
17	Reducing valve	35	Transmission P.T.O. (If so equipped)
18	Protection valve		

MODEL: SS (For GENERAL COUNTRIES, CHILE, G.C.C. COUNTRIES)

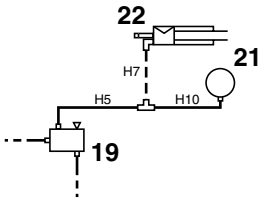




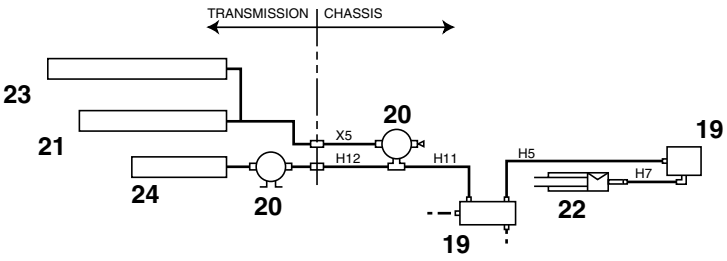
WITH INTER-AXLE DIFFERENTIAL LOCK



WITH ZF TRANSMISSION

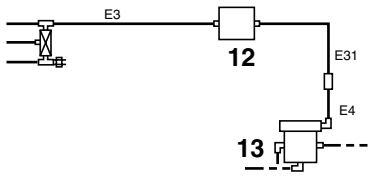


WITH FULLER TRANSMISSION

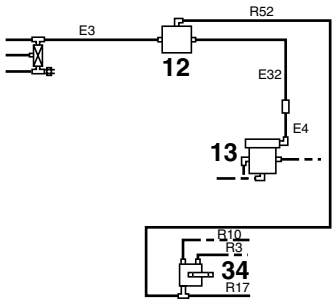


WITH MZ12 TRANSMISSION

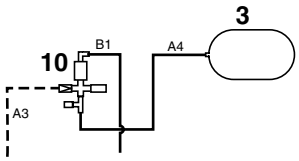
SHTS068020100022



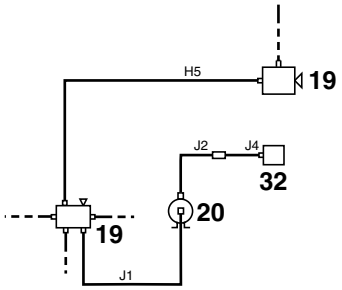
WITH LOAD SENSING VALVE (WITH LEAF SUSPENSION) (IF SO EQUIPPED)



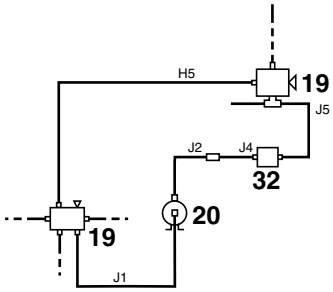
WITH LOAD SENSING VALVE (WITH AIR SUSPENSION) (IF SO EQUIPPED)



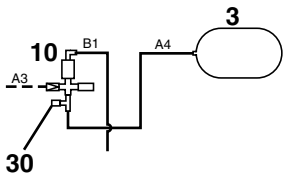
WITHOUT AIR DRYER



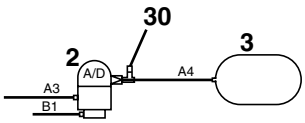
WITH TRANSMISSION P.T.O. (ZF TRANSMISSION) (IF SO EQUIPPED)



WITH TRANSMISSION P.T.O. (MZ12 TRANSMISSION) (IF SO EQUIPPED)



WITH TIRE INFLATOR (WITHOUT AIR DRYER) (IF SO EQUIPPED)

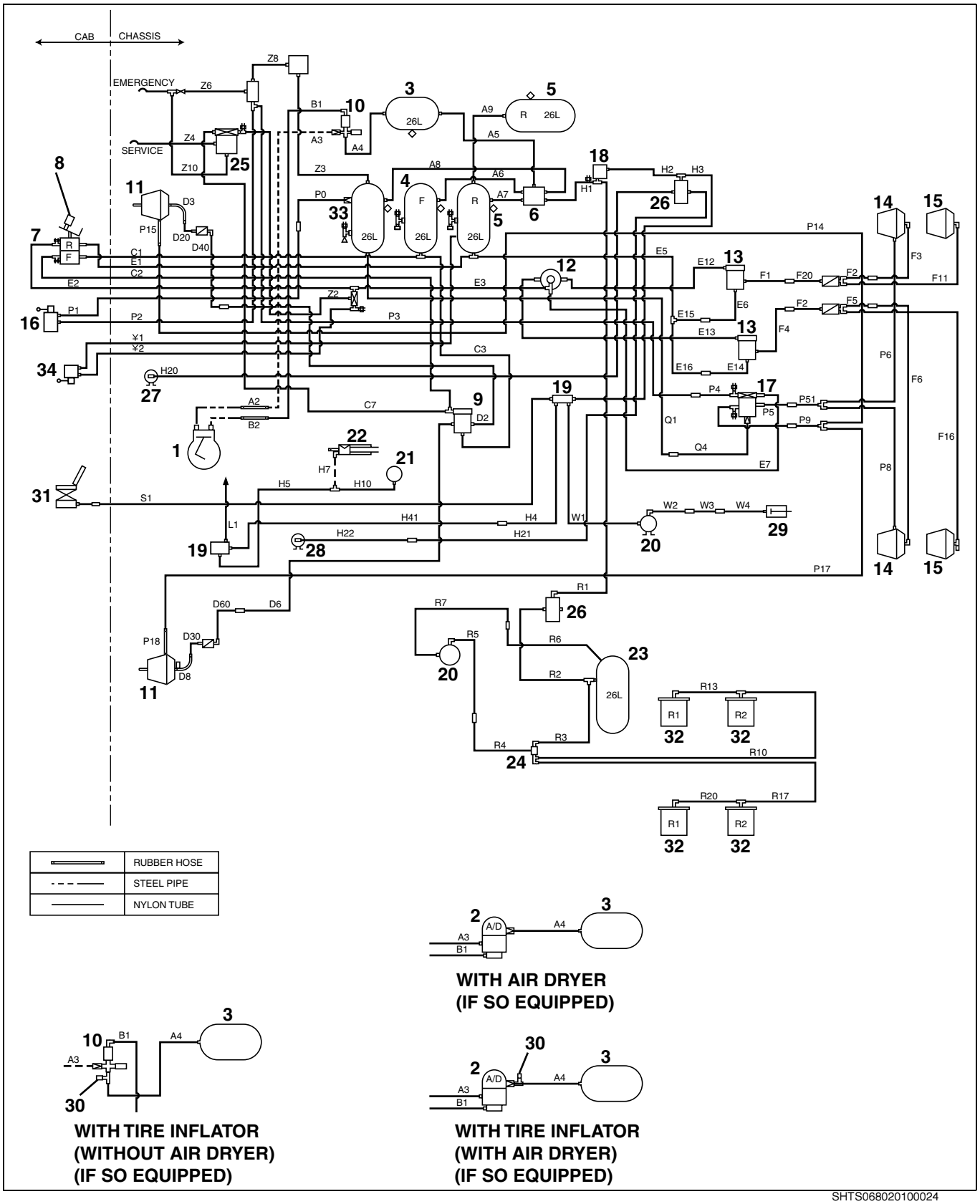


WITH TIRE INFLATOR (WITH AIR DRYER) (IF SO EQUIPPED)

SHTS068020100023

1	Air compressor	21	Range valve
2	Air dryer	22	Clutch booster
3	Air tank-Water separator	23	Splitter valve
4	Air tank-Front brake	24	Power shift
5	Air tank-Rear brake	25	Trailer control valve
6	Protection valve	26	Protection valve
7	Brake valve	27	Cab suspension-Front
8	Stop lamp switch	28	Cab suspension-Rear
9	Relay valve-Front brake	29	Inter-axle differential lock control cylinder
10	Pressure regulator	30	Tire inflator (If so equipped)
11	Brake chamber-Front	31	Air suspension seat (If so equipped)
12	Load sensing valve	32	Transmission P.T.O. (If so equipped)
13	Relay valve-Rear brake	33	Air tank-Air suspension (If so equipped)
14	Spring brake chamber-Rear	34	Leveling valve (If so equipped)
15	Brake chamber-Rear	35	Protection valve (If so equipped)
16	Spring brake control valve	36	Air spring (If so equipped)
17	Relay valve-Spring brake	37	Air tank-Trailer brake
18	Reducing valve	38	Trailer hand brake valve
19	Multi joint	39	Cut valve
20	Magnetic valve		

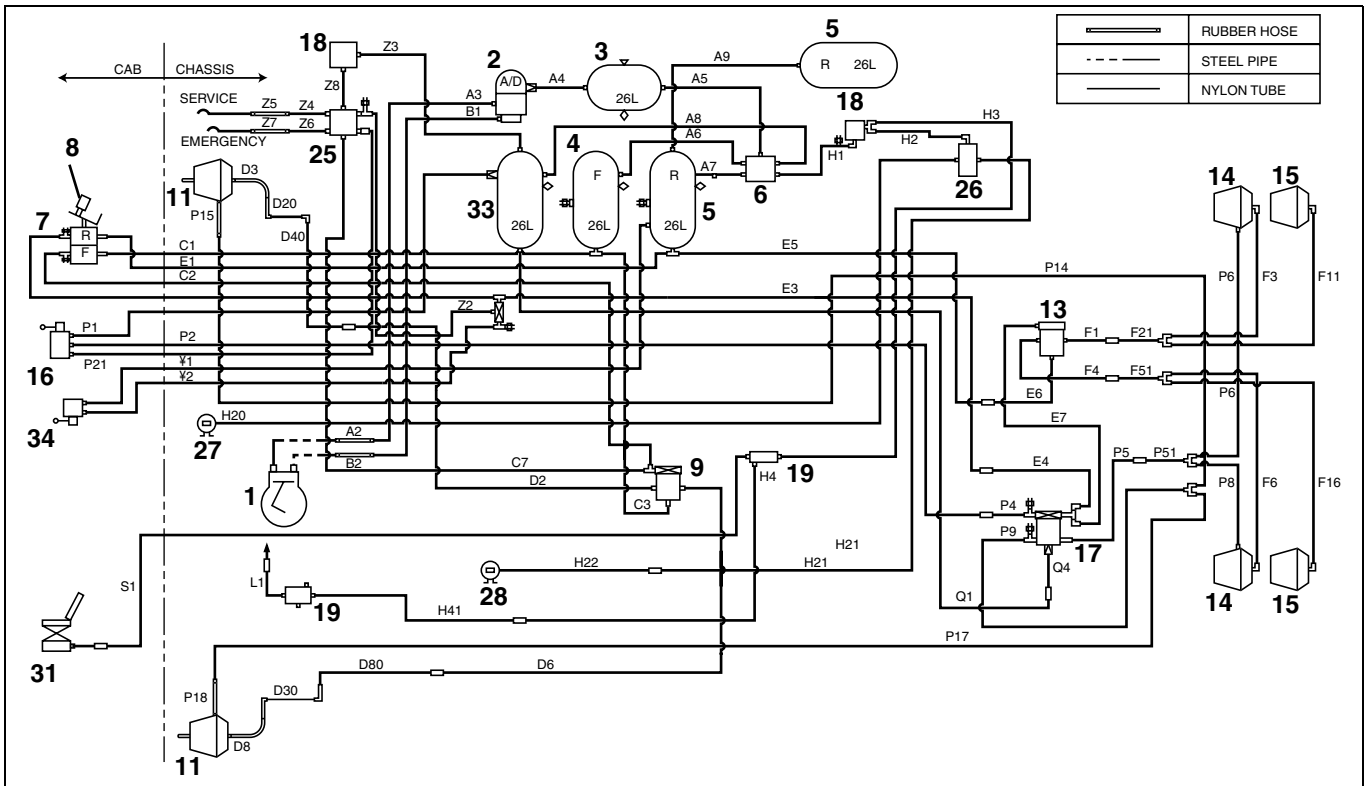
MODEL: SS (For AUSTRALIA)



SHTS068020100024

1	Air compressor	18	Reducing valve
2	Air dryer	19	Multi joint
3	Air tank-Water separator	20	Magnetic valve
4	Air tank-Front brake	21	Range valve
5	Air tank-Rear brake	22	Clutch booster
6	Protection valve	23	Air tank-Air suspension
7	Brake valve	24	Leveling valve
8	Stop lamp switch	25	Trailer control valve
9	Relay valve-Front brake	26	Protection valve
10	Pressure regulator	27	Cab suspension-Front
11	Brake chamber-Front	28	Cab suspension-Rear
12	Quick release valve	29	Inter-axle differential lock control cylinder
13	Relay valve-Rear brake	30	Tire inflator (If so equipped)
14	Spring brake chamber-Rear	31	Air suspension seat (If so equipped)
15	Brake chamber-Rear	32	Air spring
16	Spring brake control valve	33	Air tank-Trailer brake
17	Relay valve-Spring brake	34	Trailer hand brake valve

MODEL: SS (For CHINA)



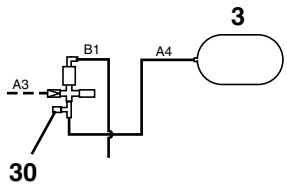
WITH ZF TRANSMISSION

WITH LOAD SENSING VALVE

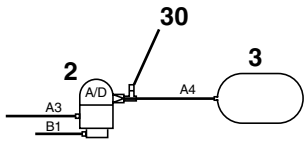
WITH INTER-AXLE DIFFERENTIAL LOCK

WITH TRANSMISSION P.T.O. (IF SO EQUIPPED)

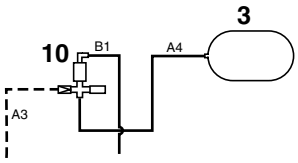
SHTS068020100025



WITH TIRE INFLATOR
(WITHOUT AIR DRYER)
(IF SO EQUIPPED)



WITH TIRE INFLATOR
(WITH AIR DRYER)
(IF SO EQUIPPED)

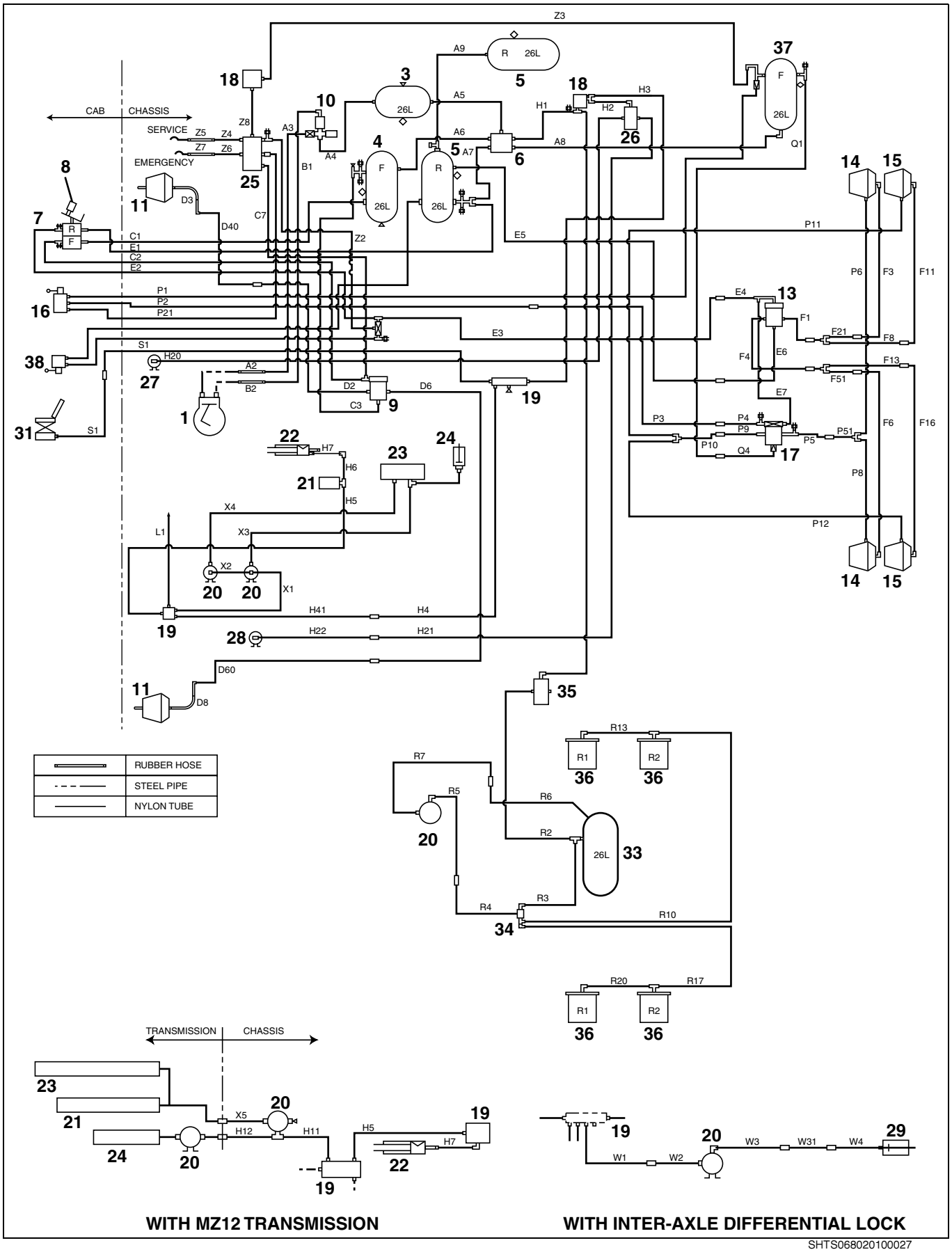


WITHOUT AIR DRYER

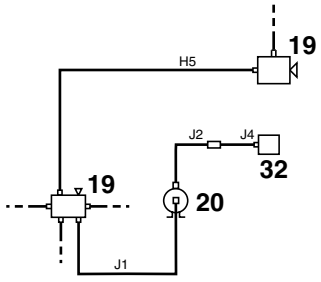
SHTS068020100026

1	Air compressor	18	Reducing valve
2	Air dryer	19	Multi joint
3	Air tank-Water separator	20	Magnetic valve
4	Air tank-Front brake	21	Range valve
5	Air tank-Rear brake	22	Clutch booster
6	Protection valve	23	Splitter valve
7	Brake valve	24	Power shift
8	Stop lamp switch	25	Trailer control valve
9	Relay valve-Front brake	26	Protection valve
10	Pressure regulator	27	Cab suspension-Front
11	Brake chamber-Front	28	Cab suspension-Rear
12	Load sensing valve	29	Inter-axle differential lock control cylinder
13	Relay valve-Rear brake	30	Tire inflator (If so equipped)
14	Spring brake chamber-Rear	31	Air suspension seat (If so equipped)
15	Brake chamber-Rear	32	Transmission P.T.O. (If so equipped)
16	Spring brake control valve	33	Air tank-Trailer brake
17	Relay valve-Spring brake	34	Trailer hand brake valve

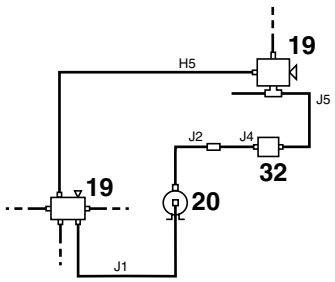
MODEL: SS (For HONG KONG, SOUTH AFRICA)



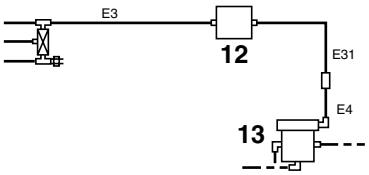
SHTS068020100027



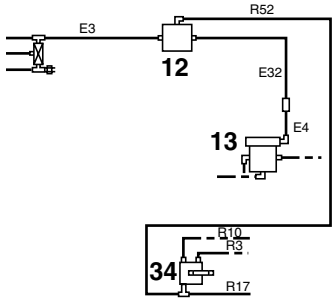
**WITH TRANSMISSION P.T.O.
(WITH ZF TRANSMISSION)
(IF SO EQUIPPED)**



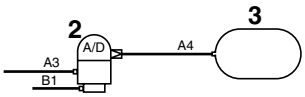
**WITH TRANSMISSION P.T.O.
(WITH MZ12 TRANSMISSION)
(IF SO EQUIPPED)**



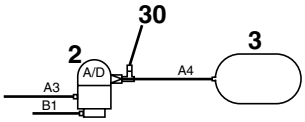
**WITH LOAD SENSING VALVE
(WITH LEAF SUSPENSION)
(IF SO EQUIPPED)**



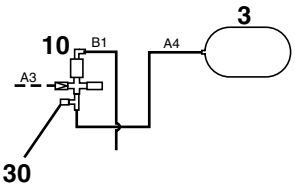
**WITH LOAD SENSING VALVE
(WITH AIR SUSPENSION)
(IF SO EQUIPPED)**



**WITH AIR DRYER
(IF SO EQUIPPED)**



**WITH TIRE INFLATOR
(WITH AIR DRYER)
(IF SO EQUIPPED)**



**WITH TIRE INFLATOR
(WITHOUT AIR DRYER)
(IF SO EQUIPPED)**

SHTS068020100028

1	Air compressor	20	Magnetic valve
2	Air dryer	21	Range valve
3	Air tank-Water separator	22	Clutch booster
4	Air tank-Front brake	23	Splitter valve
5	Air tank-Rear brake	24	Power shift
6	Protection valve	25	Trailer control valve
7	Brake valve	26	Protection valve
8	Stop lamp switch	27	Cab suspension-Front
9	Relay valve-Front brake	28	Cab suspension-Rear
10	Pressure regulator	29	Inter-axle differential lock control cylinder
11	Brake chamber-Front	30	Tire inflator (If so equipped)
12	Load sensing valve	31	Air suspension seat (If so equipped)
13	Relay valve-Rear brake	32	Transmission P.T.O. (If so equipped)
14	Spring brake chamber-Rear	33	Air tank-Air suspension (If so equipped)
15	Brake chamber-Rear	34	Leveling valve (If so equipped)
16	Spring brake control valve	35	Protection valve (If so equipped)
17	Relay valve-Spring brake	36	Air spring (If so equipped)
18	Reducing valve	37	Air tank-Trailer brake
19	Multi joint	38	Trailer hand brake valve

TROUBLESHOOTING

EN0680201F300001

Symptom	Possible cause	Remedy/Prevention
Not enough braking (Wheel brake and drum)	Lining is wet with grease or fluid	Replace the lining.
	Improper contact of drum and lining	Correct.
	Improper lining material or glazed lining	Correct.
	Deformation or hardening of drum	Correct or replace.
	Excessively worn lining	Replace.
Not enough braking (Control system)	Leakage of compressed air from brake system	Tighten further or replace gasket.
	Lack of compressed air pressure due to excessive use.	Use properly.
	Improper operation of air compressor	Repair or replace.
	Improper operation of brake valve	Repair or replace.
	Improper operation of relay valve and quick release valve	Repair or replace.
	Clogging of brake system	Replace pipe, hose, etc.
Unequal or unstable braking	Lining is wet with grease or fluid	Replace lining.
	Defective lining material (Improper combination)	Replace lining.
	Non-uniform lining contact	Correct.
	Improper adjustment of brake shoe	Adjust.
	Non-uniform shoe clearance	Adjust the clearance.
	Distorted drums	Correct or replace.
	Excessive abrasion of drums	Correct or replace.
	Loose hub bearing	Adjust or replace bearing.
	Improper or unequal pneumatic pressure of tire	Adjust to proper pneumatic pressure.
	Clogging of brake system	Replace pipe, hose, etc.
Brake drags or does not release (Wheel brake and drum)	Improper adjustment of shoe clearance	Adjust the clearance.
	Defective shoe return spring	Replace.
Brake drags or does not release (Control system)	Lack of pedal play	Adjust.
	Improper return of brake pedal	Repair or replace.
	Improper operation of brake valve	Repair or replace.
	Improper operation of relay valve and quick release valve	Repair or replace.
	Clogging of brake system	Replace pipe, hose, etc.
Brake squeal	Improper lining material or glazed lining	Replace lining.
	Loose lining rivets	Replace or tighten the rivet further.
	Lining rivet in contact with drum	Replace lining and rivet.
	Deformation or wear of drum	Repair or replace.
	Intrusion of foreign matter between drum and lining	Clean the surface of lining or replace
	Loose hub bearing	Adjust or replace bearing.

SERVICE BRAKE

BR02-001

AIR DRYER

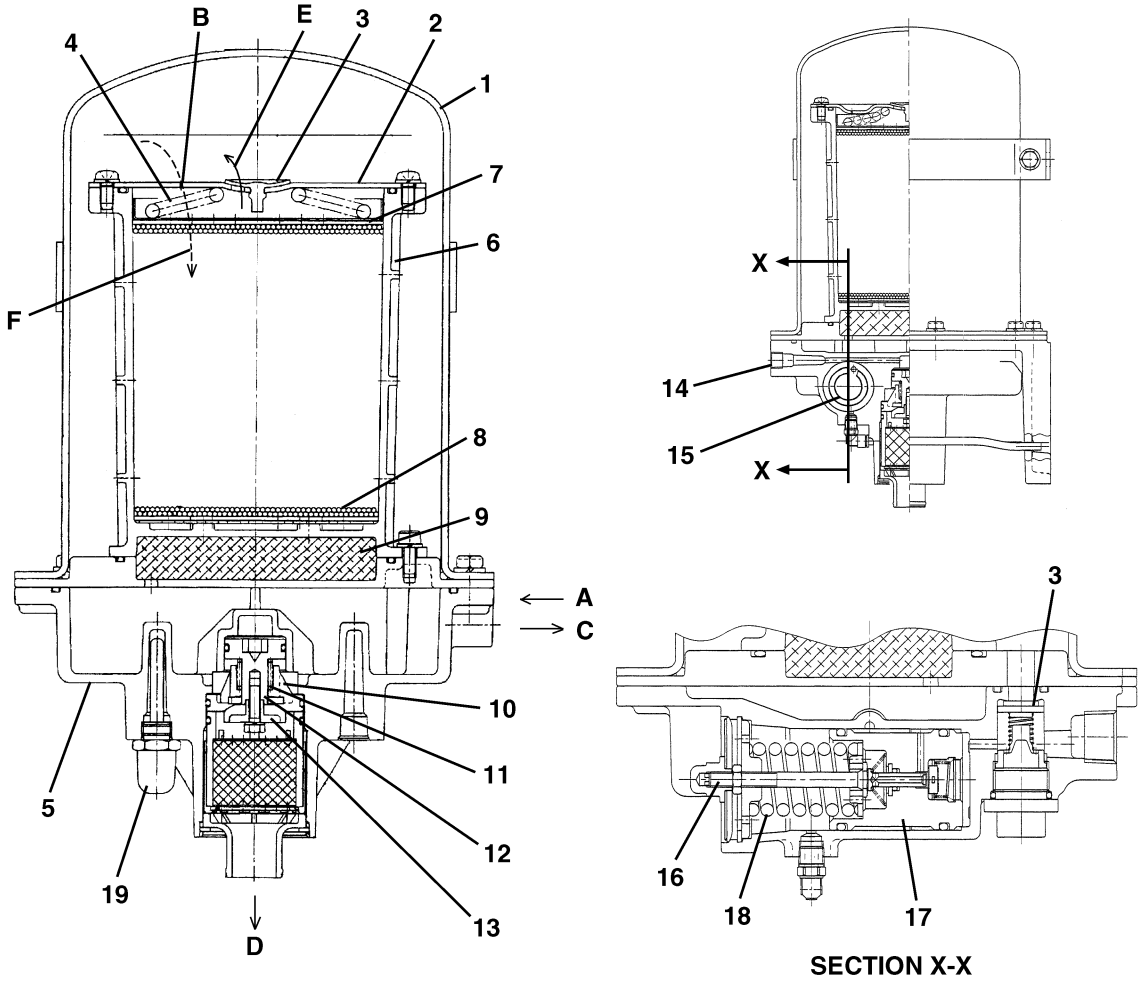
DATA AND SPECIFICATIONS

EN0680202I200001

Type	Purge tank, desiccant, auto-purge valve.
Air and Water discharging time (Reclamation cycle)	Approx. 50 sec.

DESCRIPTION

EN0680202C100001

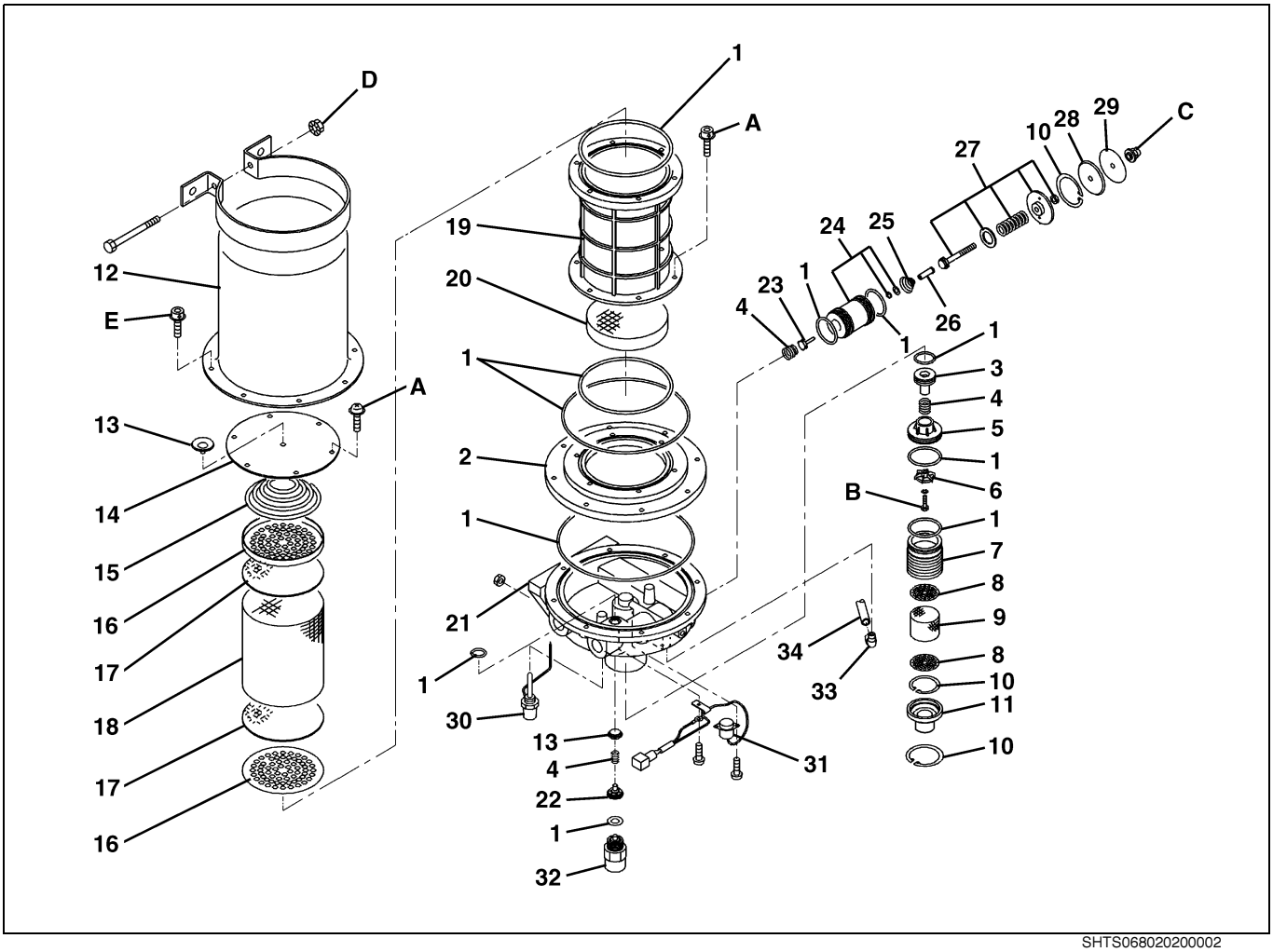


SHTS068020200001

1	Chamber (Purge tank)	14	Plug
2	Case cover	15	Pressure regulator
3	Check valve	16	Adjusting screw
4	Spring	17	Piston
5	Body	18	Piston spring
6	Desiccant case	19	Heater (If so equipped)
7	Filter	A	Inlet (From air compressor)
8	Desiccant	B	Orifice
9	Oil separator filter	C	Outlet (Dried air to air tank)
10	Valve body	D	Purged air
11	Valve spring	E	Dehumidification
12	Piston	F	Reclamation
13	Purge valve		

COMPONENT LOCATOR

EN0680202D100001



SHTS068020200002

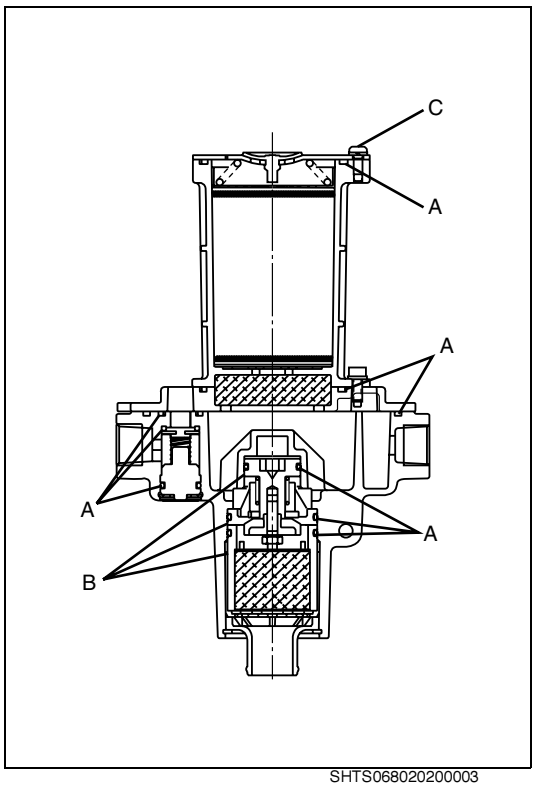
1	O-ring	18	Desiccant
2	Cover	19	Desiccant case
3	Piston	20	Oil separator filter
4	Valve spring	21	Body
5	Valve body	22	Valve stopper
6	Purge valve	23	Governor valve
7	Silencer case	24	Piston assembly
8	Silencer plate	25	Exhaust stem spring
9	Silencer	26	Exhaust stem
10	Retainer ring	27	Pressure regulator assembly
11	Exhaust cover	28	Valve seat
12	Chamber	29	Plate
13	Check valve	30	Heater
14	Case cover	31	Thermostat
15	Set spring	32	Plug
16	Filter plate	33	Elbow connector
17	Filter	34	Tube

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	3.9-6.9 {40-70, 2.9-5.0}	D	6.9-7.8 {71-79, 5.1-5.7}
B	3.9-6.9 {40-70, 2.9-5.0}	E	17.7-27.5 {181-280, 14-20}
C	4.9-5.9 {50-60, 3.7-4.3}		

OVERHAUL

EN0680202H200001



SHTS068020200003

IMPORTANT POINTS - ASSEMBLY

1. LUBRICATION

(1) When assembling the air dryer, use new O-ring, gasket and seal.
(2) Apply grease (lithium base) to each sliding surface of the component parts and O-ring groove.

- **A: O-ring**
- **B: Sliding surface**

2. ASSEMBLY

NOTICE

Before tighten the bolt with specified tightening torque, tap all over the outer surface of the desiccant case with a plastic hammer.

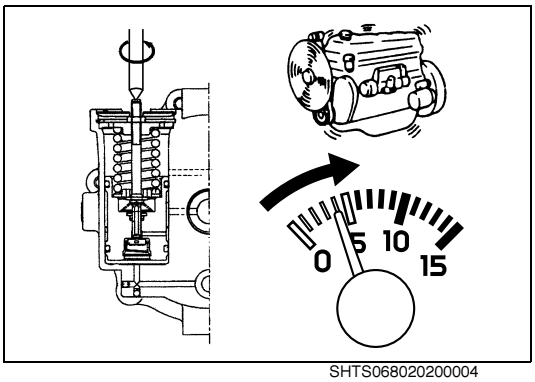
- **C: Bolt**

IMPORTANT POINTS - MOUNTING

1. INSPECTION

(1) Operate the engine and raise the air pressure until the air discharge from the purge valve, then stop the engine.
(The pressure reaches the valve opening pressure of the air pressure regulator).

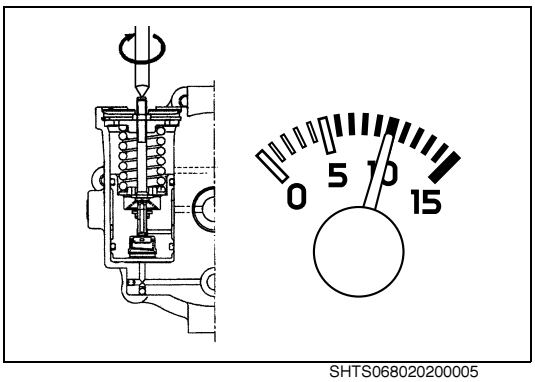
a. Check to see that there is no air leakage from the purge valve.



SHTS068020200004

2. ADJUSTMENT

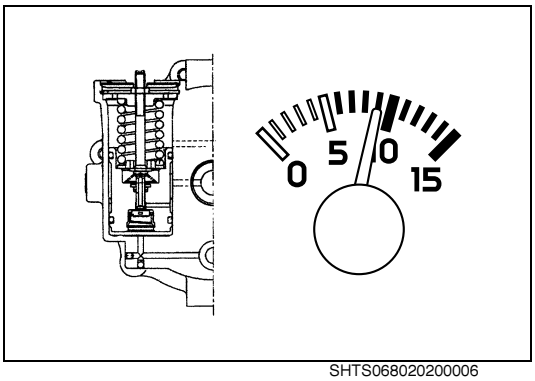
(1) Loosen the adjusting screw until the rod spring tension is released, and start and idle the engine to charge the air for the air tank.



SHTS068020200005

(2) Tighten the adjusting screw gradually till the air pressure gauge indicate valve opening pressure shown below and the air starts to discharge from purge valve.
Governor valve opening pressure:
960-1,000 kPa {9.8-10.2 kgf/cm^2, 139.2-145.0 lbf/in.^{2}}

(3) Tighten the adjusting screw lock nut.

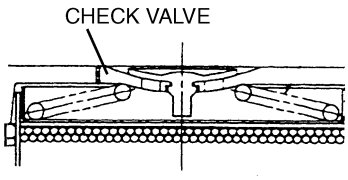
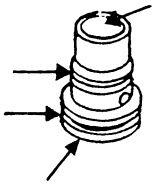
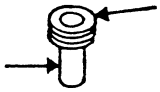
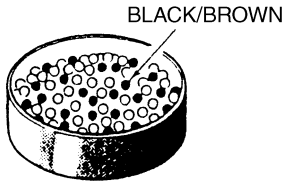


SHTS068020200006

(4) Watch the air pressure gauge needle and see that it stops at the valve closing pressure shown below.
Governor valve closing pressure:
860-900 kPa {8.8-9.2 kgf/cm^2, 124.7-130.5 lbf/in.^{2}}

INSPECTION AND REPAIR

EN0680202H300001

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Check valve and valve seat surface: Wear and damage	—	—	Replace, if necessary.	Visual check 
Valve body sliding surface and purge valve seat surface: Wear and damage	—	—	Replace, if necessary.	Visual check 
Piston sliding surface: Wear and damage	—	—	Replace, if necessary.	Visual check 
Purge valve seat surface: Wear and damage	—	—	Replace, if necessary.	Visual check 
Desiccant: Contamination and deterioration	—	Discolored, more than 1/5 of the quantity.	Replace.	Visual check 

CHECK VALVE

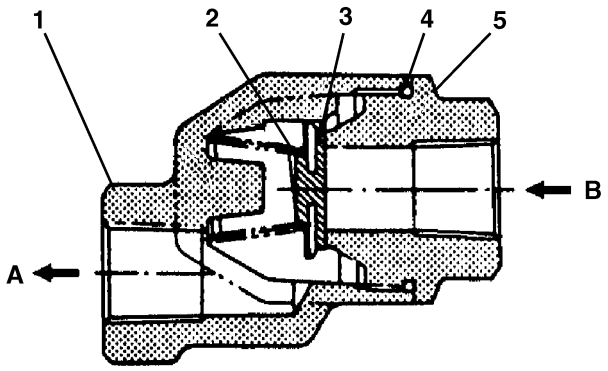
DATA AND SPECIFICATIONS

EN0680202I200002

Type	Spring type
Valve opening pressure	Outlet side pressure 14.7 kPa {0.15 kgf/cm^2, 2.13 lbf/in.^{2}}

DESCRIPTION

EN0680202C100002

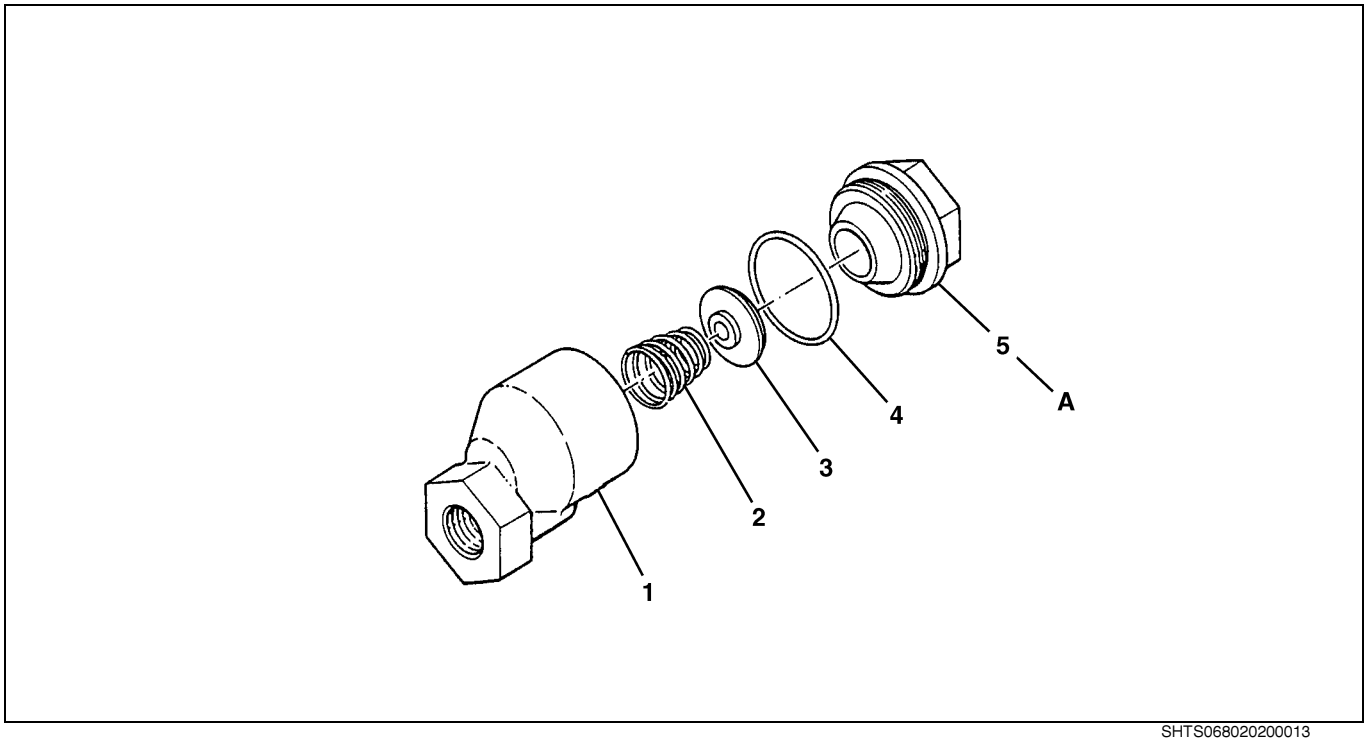


SHTS068020200012

1	Valve body	5	Body cap
2	Conical spring	A	OUT
3	Valve seat	B	IN
4	O-ring		

COMPONENT LOCATOR

EN0680202D100002



SHTS068020200013

1	Valve body	4	O-ring
2	Conical spring	5	Body cap
3	Valve seat		

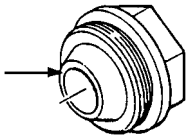
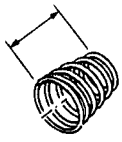
Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	44.1-53.9 {450-550, 33-39}		

INSPECTION AND REPAIR

EN0680202H300002

Unit: mm {in.}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Body cap: Wear and any other damage	—	—	Replace, if necessary.	Visual check 
Conical spring: Rust, damage and free length	17.5 {0.69}	16.5 {0.65}	Replace.	Measure and Visual check 

DOUBLE CHECK VALVE

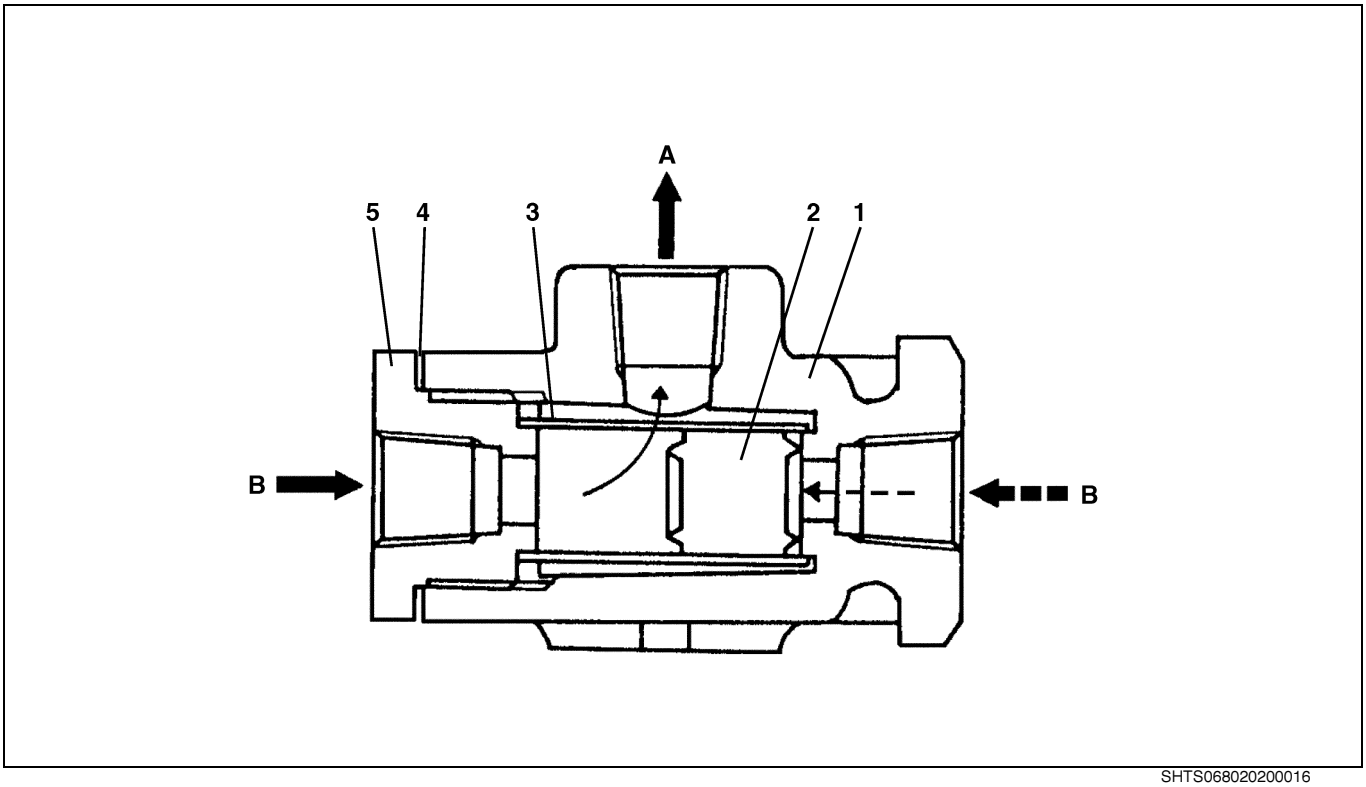
DATA AND SPECIFICATION

EN0680202I200003

Type	Piston type

DESCRIPTION

EN0680202C100003

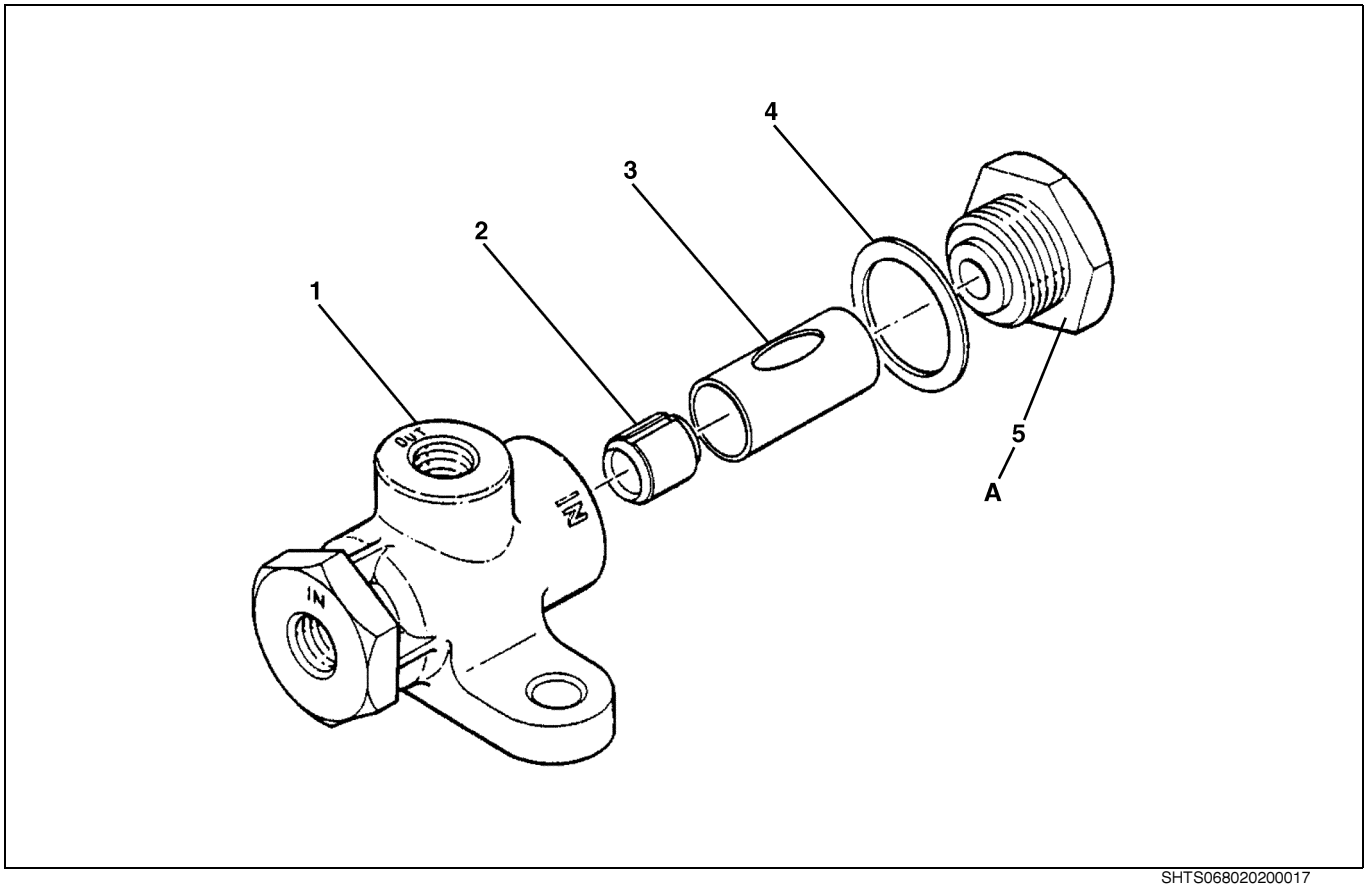


SHTS068020200016

1	Valve body	5	Plug
2	Valve	A	Outlet
3	Guide	B	Inlet
4	Gasket		

COMPONENT LOCATOR

EN0680202D100003



SHTS068020200017

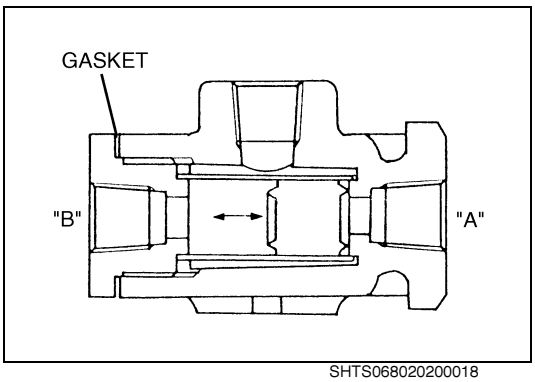
1	Valve body	4	Gasket
2	Valve	5	Plug
3	Guide		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	34.3-44.1 {350-450, 25.3-32.5}		

OVERHAUL

EN0680202H200002



SHTS068020200018

IMPORTANT POINT - ASSEMBLY

1. LUBRICATION

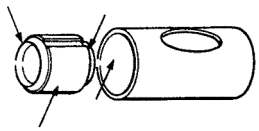
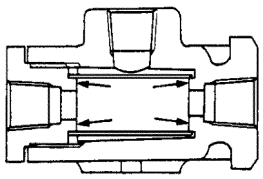
(1) When assembling the double check valve, apply the ThreeBond: TB-1101 or equivalent to the gasket.

NOTICE

Check to see that there is no air leakage from "A", when air is charged from "B", and no air leakage from "B", when air is charged from "A".

INSPECTION AND REPAIR

EN0680202H300003

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Valve and guide: Rust, wear and damage	**—**	**—**	**Clean or replace, if necessary.**	**Visual check** 
Valve body and plug: Rust, wear and damage	**—**	**—**	**Clean or replace, if necessary.**	**Visual check** 

SAFETY VALVE

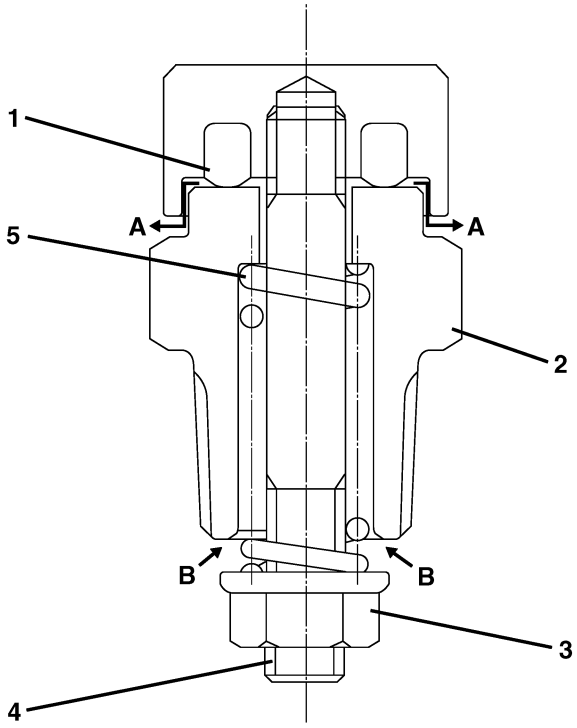
DATA AND SPECIFICATIONS

EN06802022600001

Type	Spring type
Valve opening pressure	1,029-1,068 kPa {10.5-10.9 kgf/cm^2, 149.2-154.9 lbf/in.^{2}}

DESCRIPTION

EN0680202C100004



SHTS068020200021

1	Valve	5	Compression spring
2	Body	A	Exhaust
3	Nut	B	From air tank (Pressure air)
4	Bolt		

INSPECTION AND REPAIR

EN0680202H300004

Unit: kPa {kgf/cm^2, lbf/in.^{2}}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Valve opening pressure	1,029-1,068 {10.5-10.9, 149.2-154.9}	—	Replace.	Measure

BRAKE VALVE

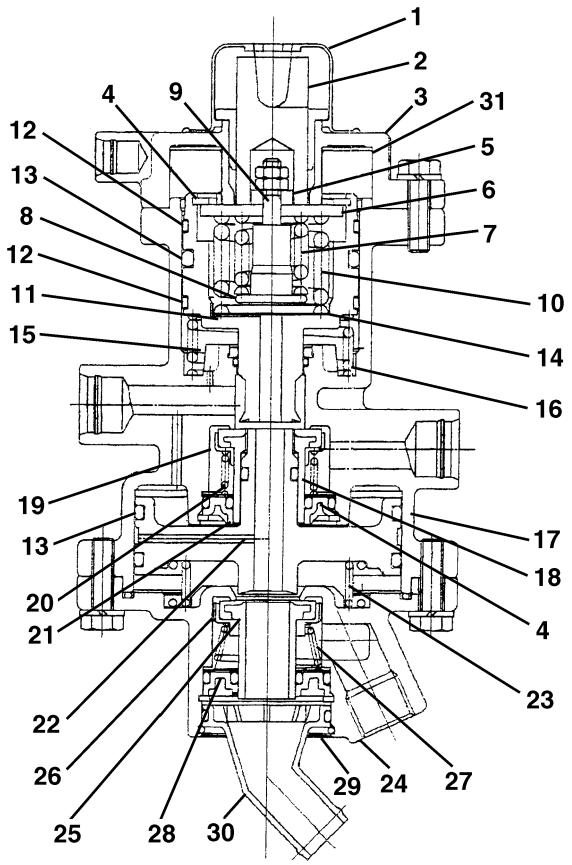
DATA AND SPECIFICATION

EN0680202I200004

Type	Dual pistons and valves with a plunger type pedal

DESCRIPTION

EN0680202C100005

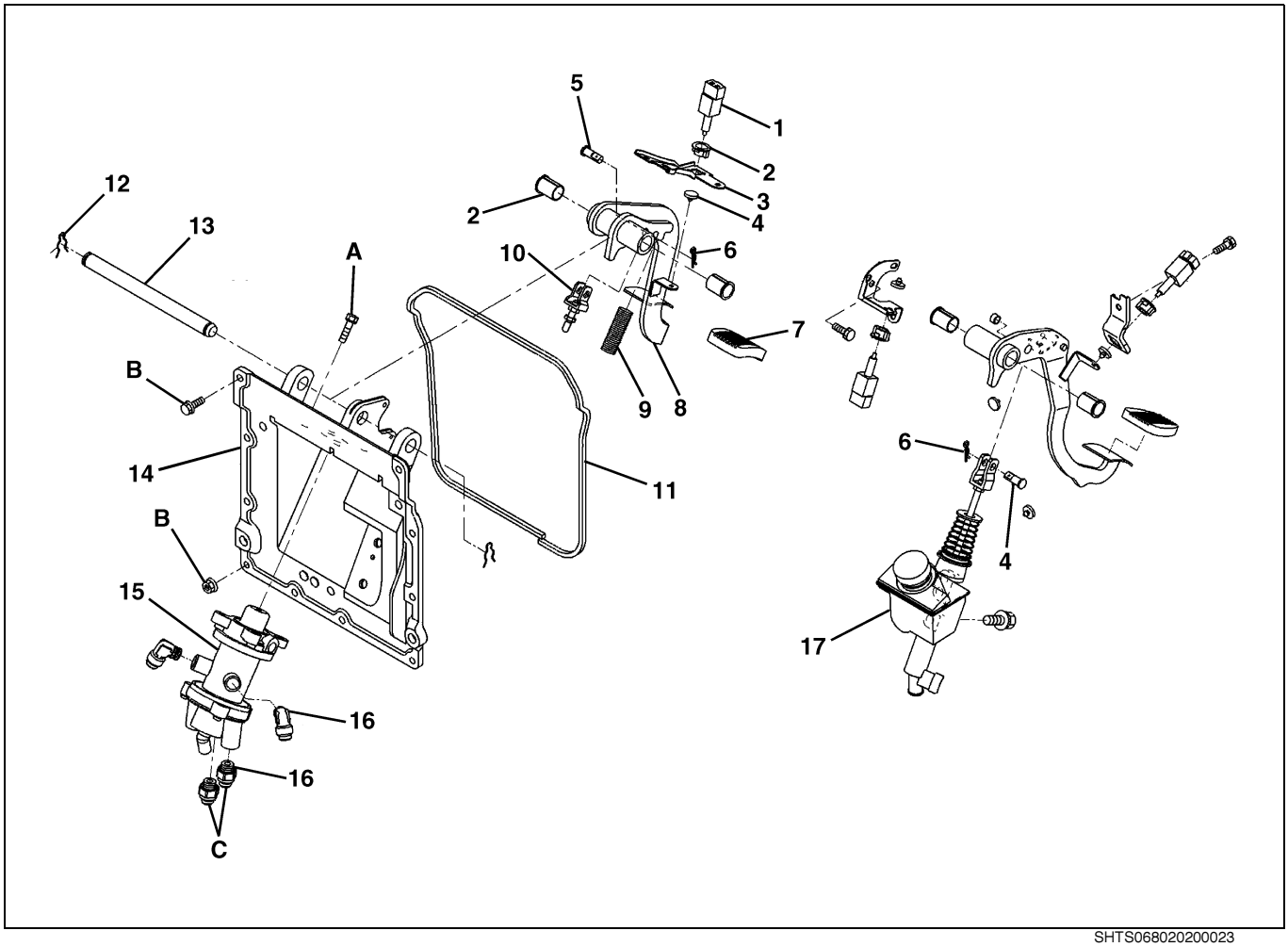


SHTS068020200022

1	Boot	16	Primary piston return spring
2	Plunger	17	Primary valve body
3	Brake valve cover	18	Primary feed valve
4	Retainer ring	19	Retainer
5	Guide ring	20	Primary feed valve return spring
6	Spring seat	21	Primary feed valve retainer
7	Sub spring	22	Secondary piston
8	Shim	23	Secondary piston return spring
9	Stem	24	Secondary valve body
10	Main spring	25	Secondary feed valve
11	Shim	26	Retainer
12	Guide ring	27	Secondary feed valve return spring
13	O-ring	28	Secondary feed valve retainer
14	Primary piston	29	C-ring
15	Guide	30	Exhaust port

COMPONENT LOCATOR

EN0680202D100004

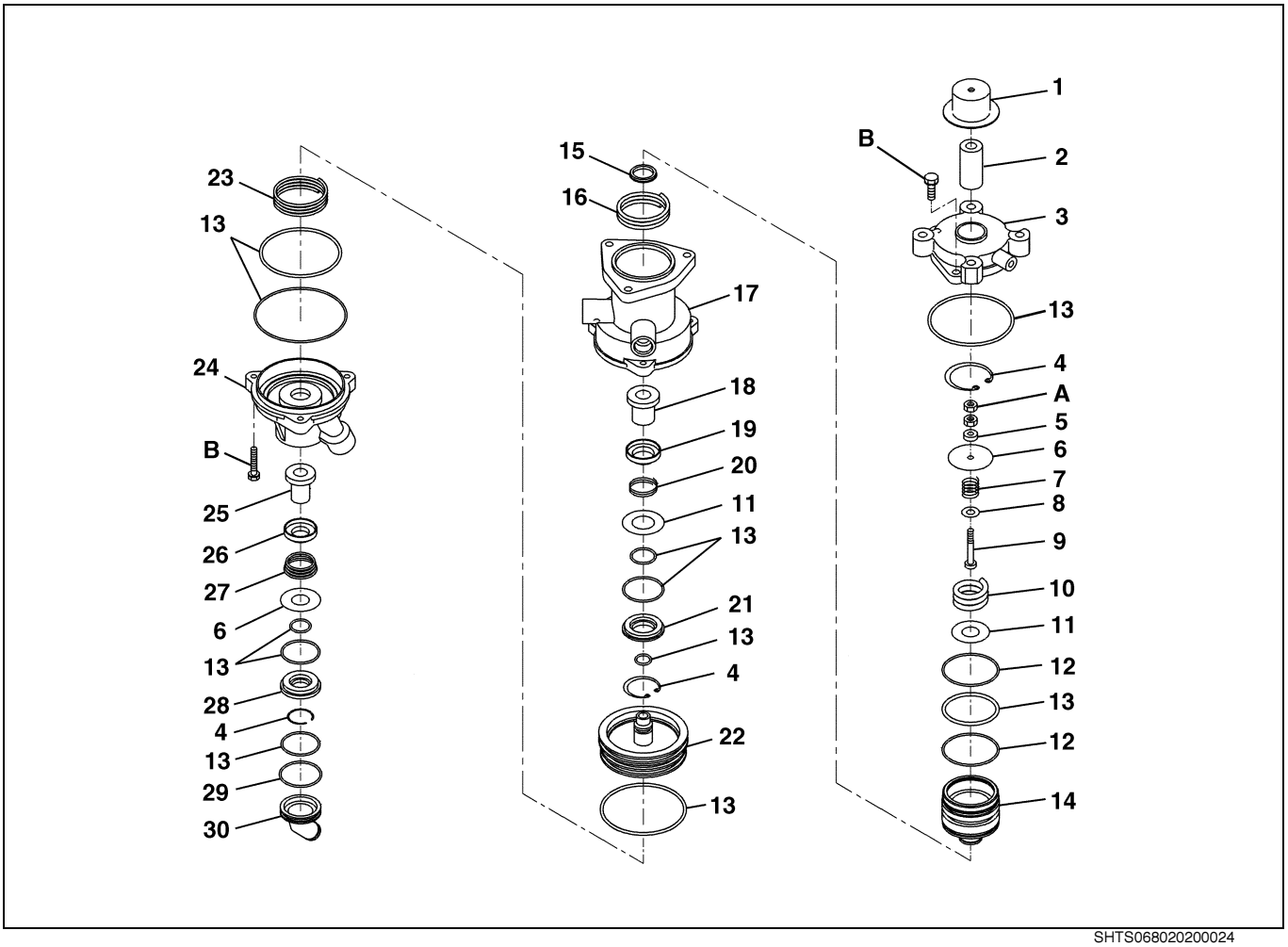


SHTS068020200023

1	Stop lamp switch	10	Push rod
2	Bushing	11	Seal
3	Bracket	12	Clip
4	Buffer	13	Shaft
5	Pin	14	Pedal bracket
6	R-pin	15	Brake valve
7	Pedal pad	16	Connector
8	Brake pedal	17	Clutch master cylinder
9	Return spring		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	9.5-18.5 {97-188, 7.1-13.6}	C	24.4-34.5 {249-351, 18-25}
B	18-31 {184-316, 14-22}		



SHTS068020200024

1	Boot	16	Primary piston return spring
2	Plunger	17	Primary valve body
3	Brake valve cover	18	Primary feed valve
4	Retainer ring	19	Retainer
5	Guide ring	20	Primary feed valve return spring
6	Spring seat	21	Primary feed valve retainer
7	Sub spring	22	Secondary piston
8	Shim	23	Secondary piston return spring
9	Stem	24	Secondary valve body
10	Main spring	25	Secondary feed valve
11	Shim	26	Retainer
12	Guide ring	27	Secondary feed valve return spring
13	O-ring	28	Secondary feed valve retainer
14	Primary piston	29	C-ring
15	Guide	30	Exhaust port

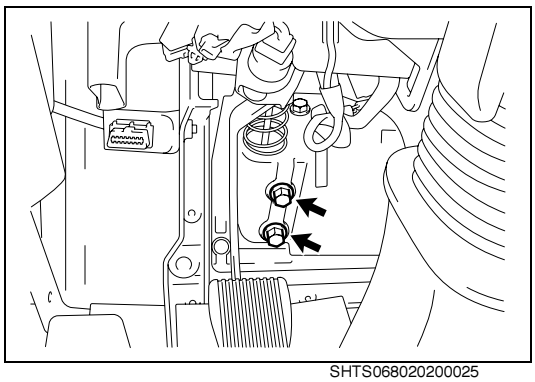
Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	2.9-4.9 {30-50, 2.2-3.6}	B	5.9-7.4 {60-75, 4.3-5.4}

NOTICE
The parts in 4 and 13 are not the ones to be reusable.

OVERHAUL

EN0680202H200003


SHTS068020200025

IMPORTANT POINTS - DISMOUNTING

1. REMOVE THE CLUTCH MASTER CYLINDER.

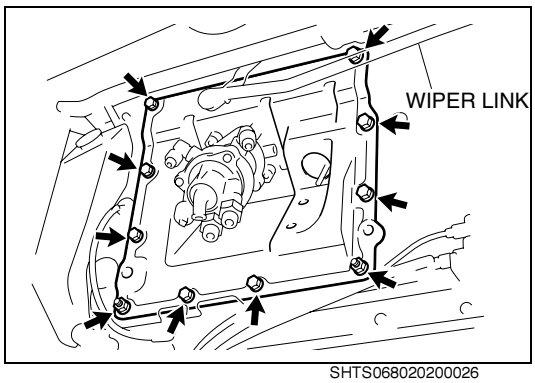
HINT

Even if without removing the clutch master cylinder, pedal bracket can be removed only to the length of the clutch hose.

2. DISCONNECT THE NYLON TUBE.

NOTICE

Before disconnecting, apply aligning marks on the brake valve assembly and nylon tube.



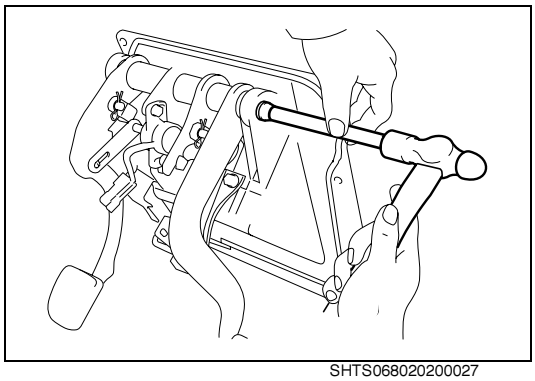
SHTS068020200026

3. REMOVE THE PEDAL BRACKET ASSEMBLY.

(1) Loosen the bolt and nut to remove the pedal bracket assembly.

NOTICE

Before removing the pedal bracket, put the wiper link upward.

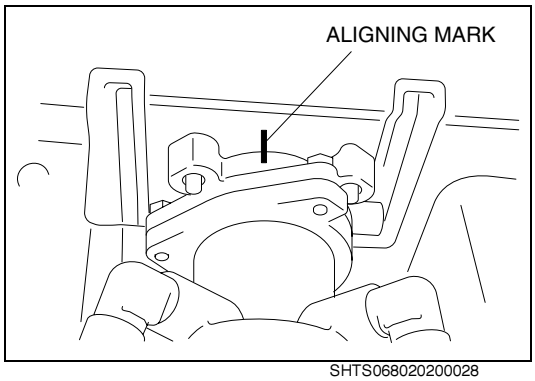

SHTS068020200027

4. REMOVE THE BRAKE PEDAL.

(1) Tap the shaft lightly using a brass rod and a hammer, remove the brake pedal from the pedal bracket assembly.

NOTICE

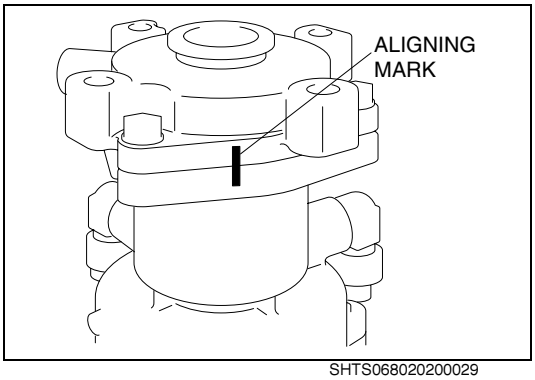
Do not pull out the shaft because the brake pedal and the clutch pedal are installed by one shaft.



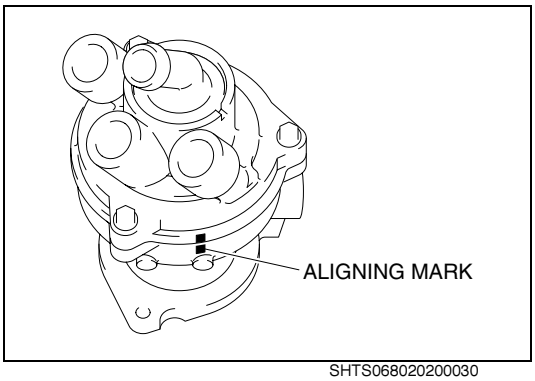
SHTS068020200028

5. REMOVE THE BRAKE VALVE ASSEMBLY.

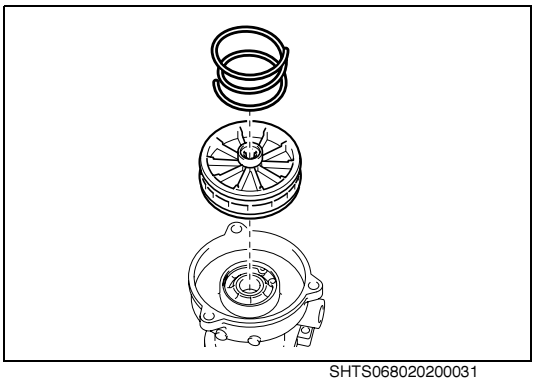
(1) Apply aligning marks on the brake valve assembly and pedal bracket assembly.



SHTS068020200029



SHTS068020200030


SHTS068020200031

IMPORTANT POINTS - DISASSEMBLY

NOTICE

Before disassembling the brake valve, apply aligning marks on the brake valve cover, primary valve body and secondary valve body.

1. REMOVE THE PRIMARY PISTON ASSEMBLY.

2. REMOVE THE SECONDARY VALVE BODY.

3. REMOVE THE SECONDARY PISTON.

NOTICE

Pull out with hands to prevent the seat part of the secondary piston from being damaged by using a pryer etc. If not with hands, secondary piston should not be reused.

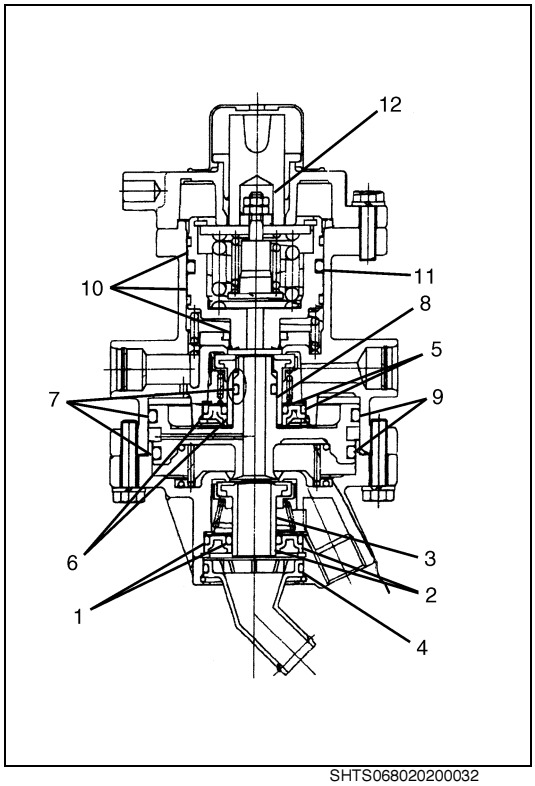
4. REMOVE THE PRIMARY FEED VALVE.

5. REMOVE THE EXHAUST PORT.

6. REMOVE THE SECONDARY FEED VALVE.

NOTICE

In order to prevent from incorrect assembling, keep in stock respectively primary feed valve assembly and secondary feed valve assembly.



SHTS068020200032

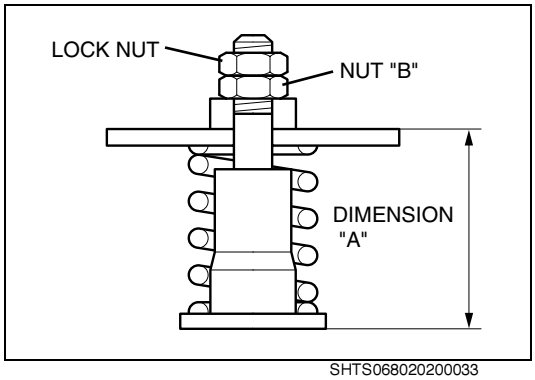
IMPORTANT POINTS - ASSEMBLY

1. LUBRICATION

(1) When reassembling the brake valve, replace the O-rings and retainer rings with new ones.

(2) Apply adequate amount of silicone grease on the grooves for the O-ring and to the sliding surfaces of the component parts.

1. Secondary feed valve retainer O-ring
2. Secondary feed valve retainer
3. Secondary feed valve
4. Exhaust port O-ring
5. Primary feed valve retainer O-ring
6. Primary feed valve retainer
7. Secondary piston O-ring
8. Secondary piston
9. Primary valve body
10. Primary piston
11. Primary piston O-ring
12. Plunger



SHTS068020200033

2. ASSEMBLE THE STEM, SPRING, SPRING SEAT AND SHIM.

(1) Assemble the sub spring. At this time, adjust dimension "A" and the spring compression "P" by means of the nut "B" and the shim.

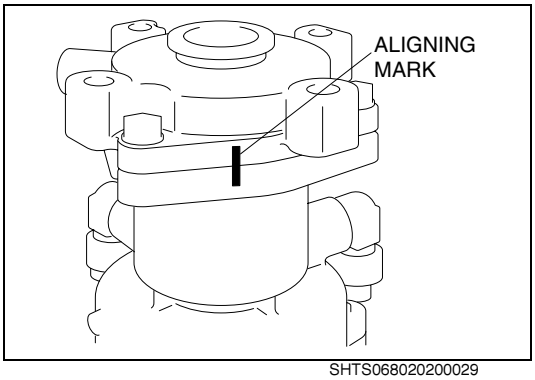
Tightening Torque (Lock nut):
2.9-4.9 N·m {30-50 kgf·cm, 2.2-3.6 lbf·ft}

Dimension "A": 27.55-27.95 mm {1.0847-1.1003 in.}

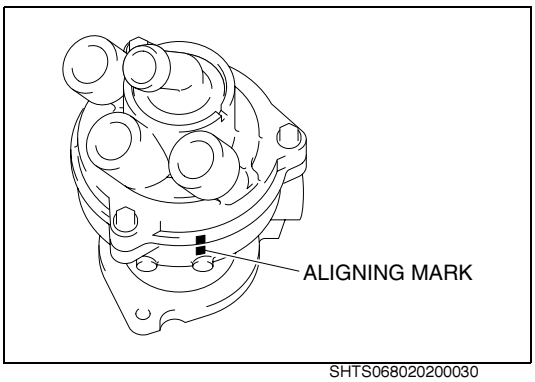
Setting load "P": 0-9.8 N {0-1 kgf, 0-2.2 lbf}

NOTICE

In adjusting the spring compression, the axial play of the spring must be removed.



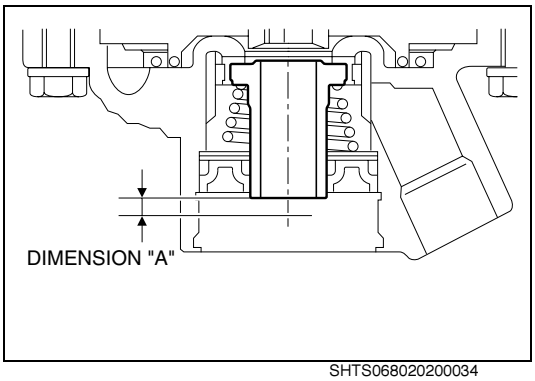
SHTS068020200029



SHTS068020200030

3. ALIGN THE VALVE COVER AND VALVE BODIES.

(1) When assemble the brake valve cover, primary body and secondary body, align the marks which were applied at disassembly.



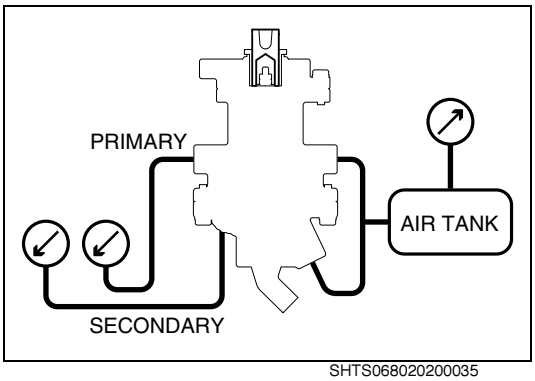
SHTS068020200034

4. INSPECTION AND ADJUSTMENT

(1) Brake valve

a. Measure the secondary feed valve stroke (Dimension "A" from starting to release the plunger to completing to fully release the plunger).

A dimension: 0.6 mm {0.0236 in.} or above

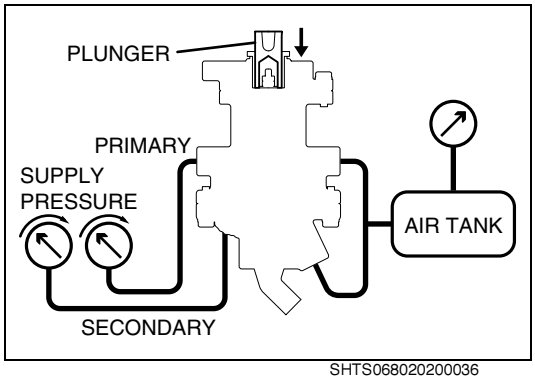


SHTS068020200035

b. Connect the brake valve, nylon tube, air pressure gauge, and air tank as shown in the figure.

c. Set the air tank pressure at 830 kPa {8.5 kgf/cm^2, 120.87 lbf/in.^{2}}.

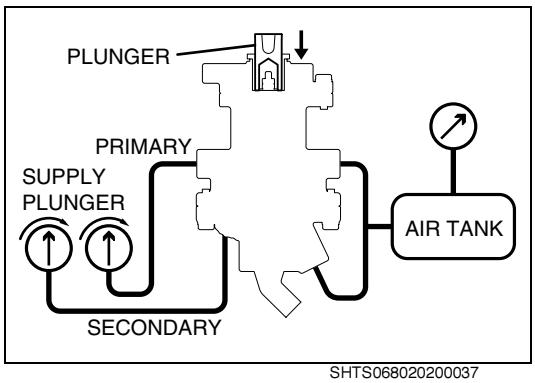
d. Apply soap water to the exhaust port and check to see there is no air leakage.



SHTS068020200036

e. Drive in slowly the plunger. Measure the plunger stroke and supply pressure at the point where the primary and secondary air pressure gauges start to rise. If the measurements do not match with the standard values, adjust by the shim of the main spring.

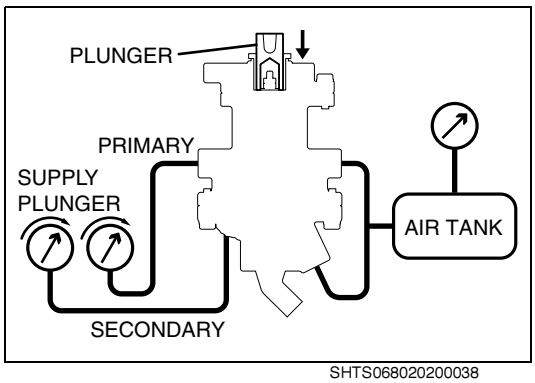
Measurement item	Standard value
Plunger stroke	0.8-1.6 mm {0.0315-0.0630 in.}
Supply pressure	19-41 kPa {0.20-0.41 kgf/cm^2, 2.76-5.94 lbf/in.^{2}}



SHTS068020200037

f. Drive in further the plunger. Measure the plunger stroke and supply pressure at the point immediately before that the primary and secondary pressure increases rapidly (bending point). If the measurements do not match with the standard values, replace each spring.

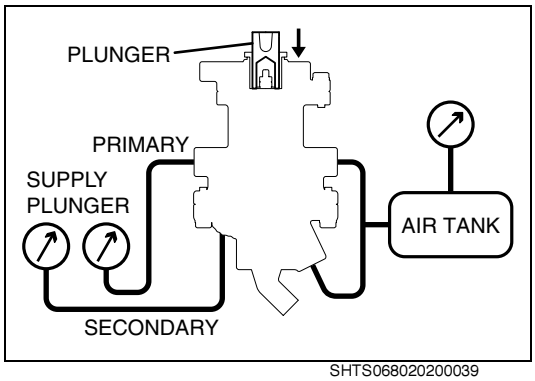
Measurement item	Standard value
Plunger stroke	3.6-4.7 mm {0.1418-0.1850 in.}
Supply pressure	196 kPa {2.00 kgf/cm^2, 28.42 lbf/in.^{2}}



SHTS068020200038

g. Drive in further the plunger. Measure the plunger stroke and supply pressure at the point where the primary and secondary pressures increase rapidly. If the measurements do not match with the standard values, replace each spring.

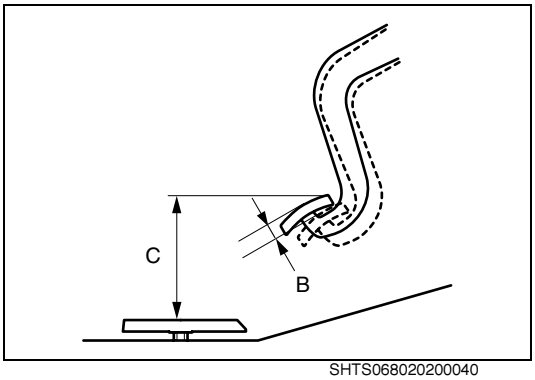
Measurement item	Standard value
Plunger stroke	5.94-7.26 mm {0.2339-0.2858 in.}
Supply pressure	624 kPa {6.36 kgf/cm^2, 90.50 lbf/in.^{2}}



SHTS068020200039

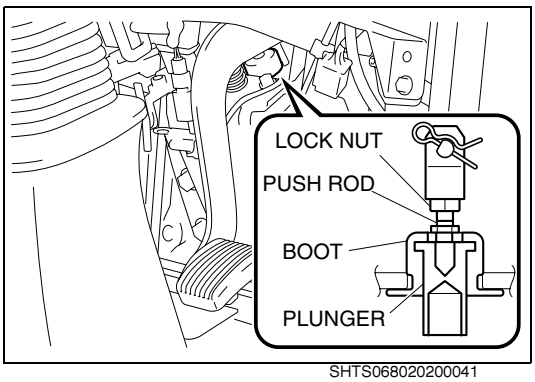
h. Drive in further the plunger. Measure the pedal stepping down angle and supply pressure at the point where the primary and secondary pressure are maximum. If the measurements do not match with the standard values, replace each spring.

Measurement item	Standard value
Plunger stroke	8.34-9.76 mm {0.3284-0.3842 in.}
Supply pressure	980 kPa {9.99 kgf/cm^2, 142.14 lbf/in.^{2}}



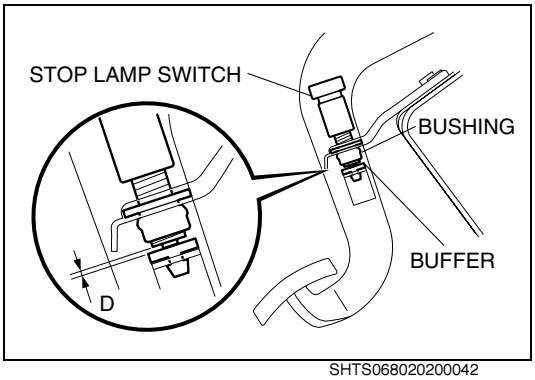
SHTS068020200040

(2) Brake pedal
a. Make sure that the installing height of the brake pedal "C" and the pedal play "B".
"B": 2-5 mm {0.0788-0.1968 in.}
"C": 147.7-157.7 mm {5.815-6.208 in.}



SHTS068020200041

b. If the pedal play is out of the standard value, loosen the lock nut and turn the push rod to adjust the pedal play to the standard value.
Tightening Torque (Lock nut):
14-26 N·m {143-265 kgf·cm, 11-19 lbf·ft}

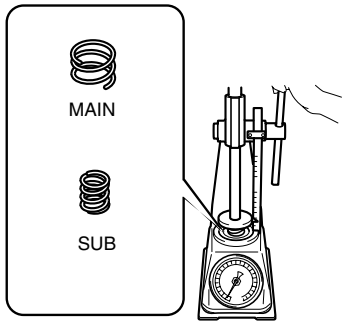
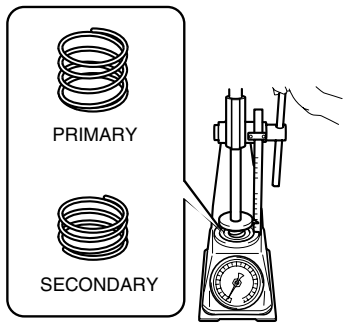
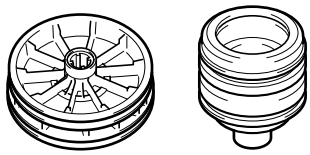
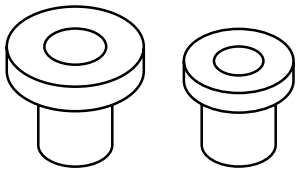
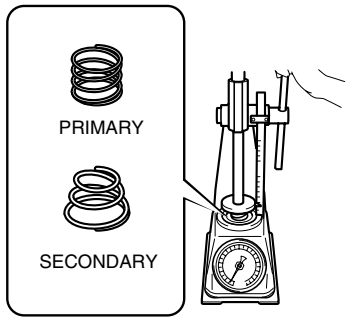


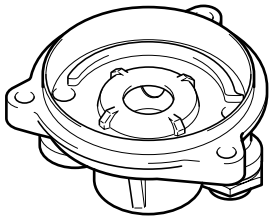
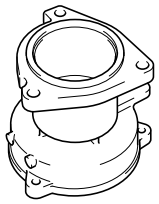
SHTS068020200042

(3) Check the clearance between stop lamp switch and buffer.
"D": 0.5-1.5 mm {0.0197-0.0590 in.}

INSPECTION AND REPAIR

EN0680202H300005

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Main and sub spring: Free length/ setting length/ setting load Crack, rust and damage	Main: 29.3 mm {1.15 in.}/ 27.5 mm {1.08 in.}/ 176.5 N {18 kgf, 39.68 lbf}	28.5 mm {1.12 in.} (Free length)	Replace, if necessary.	Measure and visual check 
	Sub: 21.6 mm {0.85 in.}/ 21.6 mm {0.85 in.}/ 9.8 N {1.0 kgf, 2.20 lbf} or more	20.5 mm {0.81 in.} (Free length)		
Primary and secondary piston return spring: Free length/ setting length/ setting load Crack, rust and damage	Primary: 43.2 mm {1.70 in.}/ 16.5 mm {0.65 in.}/ 95.1 N {9.7 kgf, 21.38 lbf}	40.5 mm {1.59 in.} (Free length)	Replace, if necessary.	measure and visual check 
	Secondary: 45.8 mm {1.80 in.}/ 16.0 mm {0.63 in.}/ 49.0 N {5.0 kgf, 11.02 lbf}	43.2 mm {1.70 in.} (Free length)		
Primary and secondary piston: Wear and damage	—	—	Replace, if necessary.	Visual check 
Primary and secondary feed valve: Wear and damage	—	—	Replace, if necessary.	Visual check 
Primary and secondary feed valve return spring: Free length/ setting length/ setting load Crack, rust and damage	Primary: 21.4 mm {0.84 in.}/ 12.5 mm {0.49 in.}/ 52.0 N {5.3 kgf, 11.68 lbf}	20.4 mm {0.80 in.} (Free length)	Replace, if necessary.	Measure and visual check 
	Secondary: 22.8 mm {0.90 in.}/ 13.0 mm {0.51 in.}/ 49.0 N {5.0 kgf, 11.02 lbf}	21.8 mm {1.13 in.} (Free length)		

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Secondary valve body: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Primary valve body: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

PROTECTION VALVE (TYPE-A)

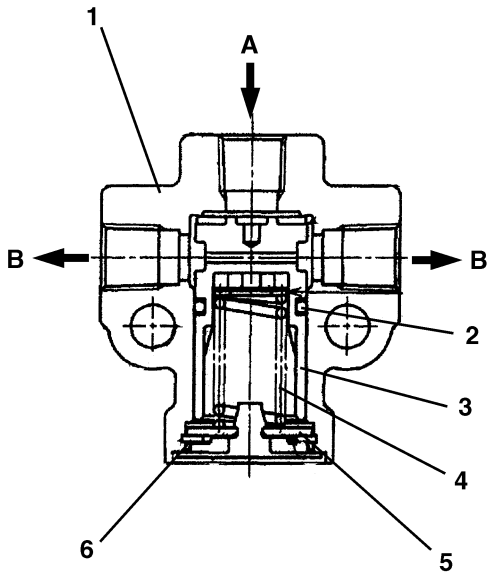
DATA AND SPECIFICATIONS

EN0680202I200005

Type		Spring type
Operating pressure	Open	637 kPa {6.5 kgf/cm^2, 92.4 lbf/in.^{2}}
	Close	510 kPa {5.2 kgf/cm^2, 74.0 lbf/in.^{2}}

DESCRIPTION

EN0680202C100006

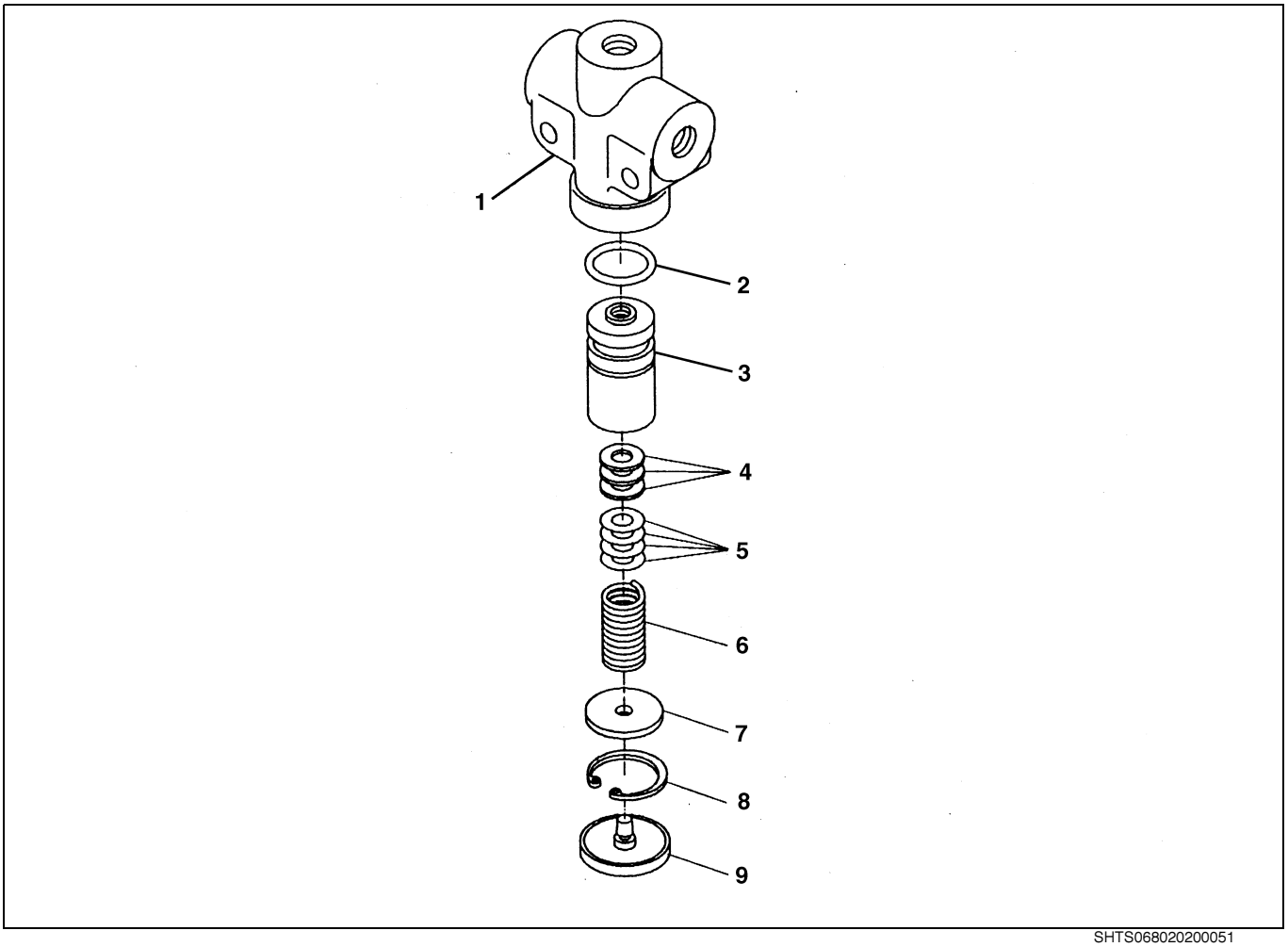


SHTS068020200050

1	Valve body	5	Dust seal plate
2	O-ring	6	Retainer ring
3	Valve	A	Inlet
4	Compression spring	B	Outlet

COMPONENT LOCATOR

EN0680202D100005

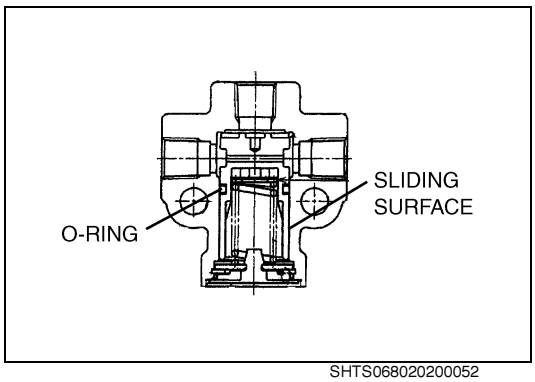


SHTS068020200051

1	Body	4	Spacer	7	Dust seal plate
2	O-ring	5	Shim	8	Retainer ring
3	Piston	6	Spring	9	Dust seal

OVERHAUL

EN0680202H200004



SHTS068020200052

IMPORTANT POINT - ASSEMBLY

1. LUBRICATION

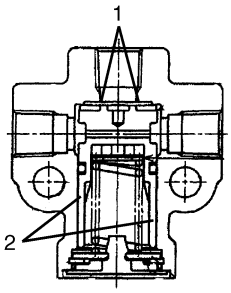
(1) When reassembling the protection valve, replace the O-rings and valve with new ones.

(2) Apply adequate amount of silicone grease to the sliding surface of the component parts.

INSPECTION AND REPAIR

EN0680202H300006

Unit: mm {in.}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Valve contact surface of body cap 1: Rust, wear and damage	**—**	**—**	**Clean or replace, if necessary.**	**Visual check** 
Sliding surface of valve body 2: Rust, wear and damage	**—**	**—**	**Clean or replace, if necessary.**	
Valve spring: Free length	**60.0 {2.36}**	**—**	**Replace, if necessary.**	**Measure** 

PROTECTION VALVE (TYPE-B)

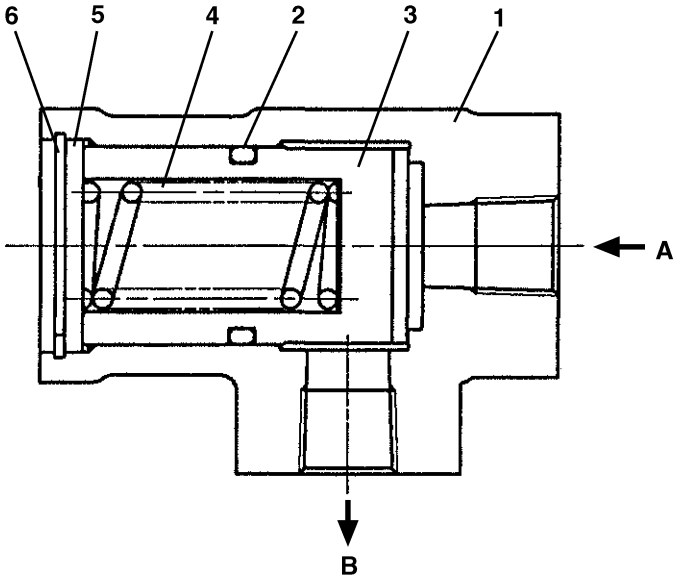
DATA AND SPECIFICATIONS

EN0680202I200006

Type		Spring type
Operating pressure	Open	540 kPa {5.5 kgf/cm^2, 78.3 lbf/in.^{2}}
	Close	390 kPa {4.0 kgf/cm^2, 56.6 lbf/in.^{2}}

DESCRIPTION

EN0680202C100007

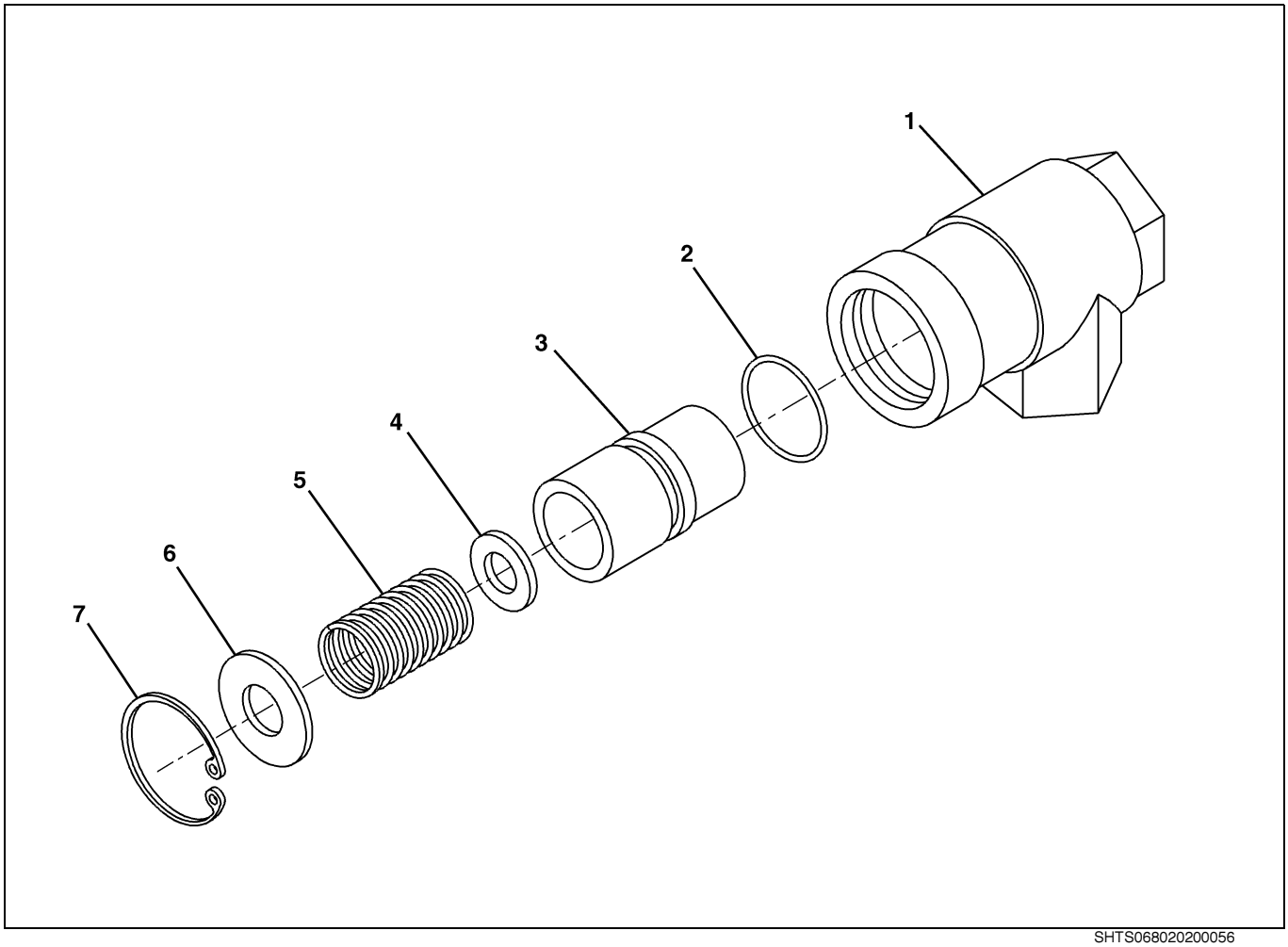


SHTS068020200055

1	Valve body	5	Dust seal plate
2	O-ring	6	Retainer ring
3	Valve	A	Inlet
4	Compression spring	B	Outlet

COMPONENT LOCATOR

EN0680202D100006

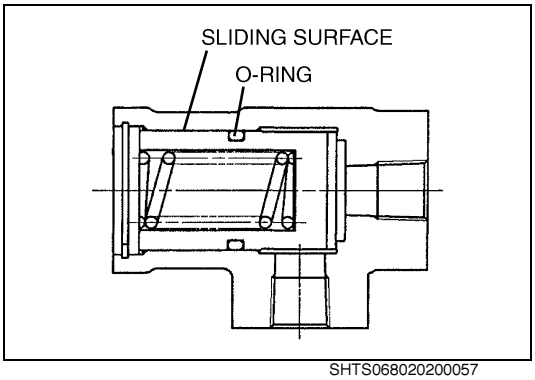


SHTS068020200056

1	Body	5	Spring
2	O-ring	6	Dust seal plate
3	Piston	7	Retainer ring
4	Shim		

OVERHAUL

EN0680202H200005



SHTS068020200057

IMPORTANT POINT - ASSEMBLY

1. LUBRICATION

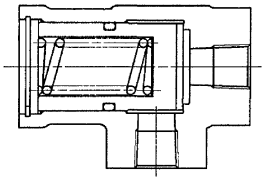
(1) When reassembling the protection valve, replace the O-rings and valve with new ones.

(2) Apply adequate amount of silicone grease to the sliding surface of the component parts.

INSPECTION AND REPAIR

EN0680202H300007

Unit: mm {in.}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Sliding surface of valve: Rust, wear and damage	**—**	**—**	**Clean or replace, if necessary.**	**Visual check** 
Valve spring: Free length	**47.5 {1.87}**	**—**	**Replace, if necessary.**	**Measure** 

PROTECTION VALVE (WITH 4-WAY PROTECTION VALVE)

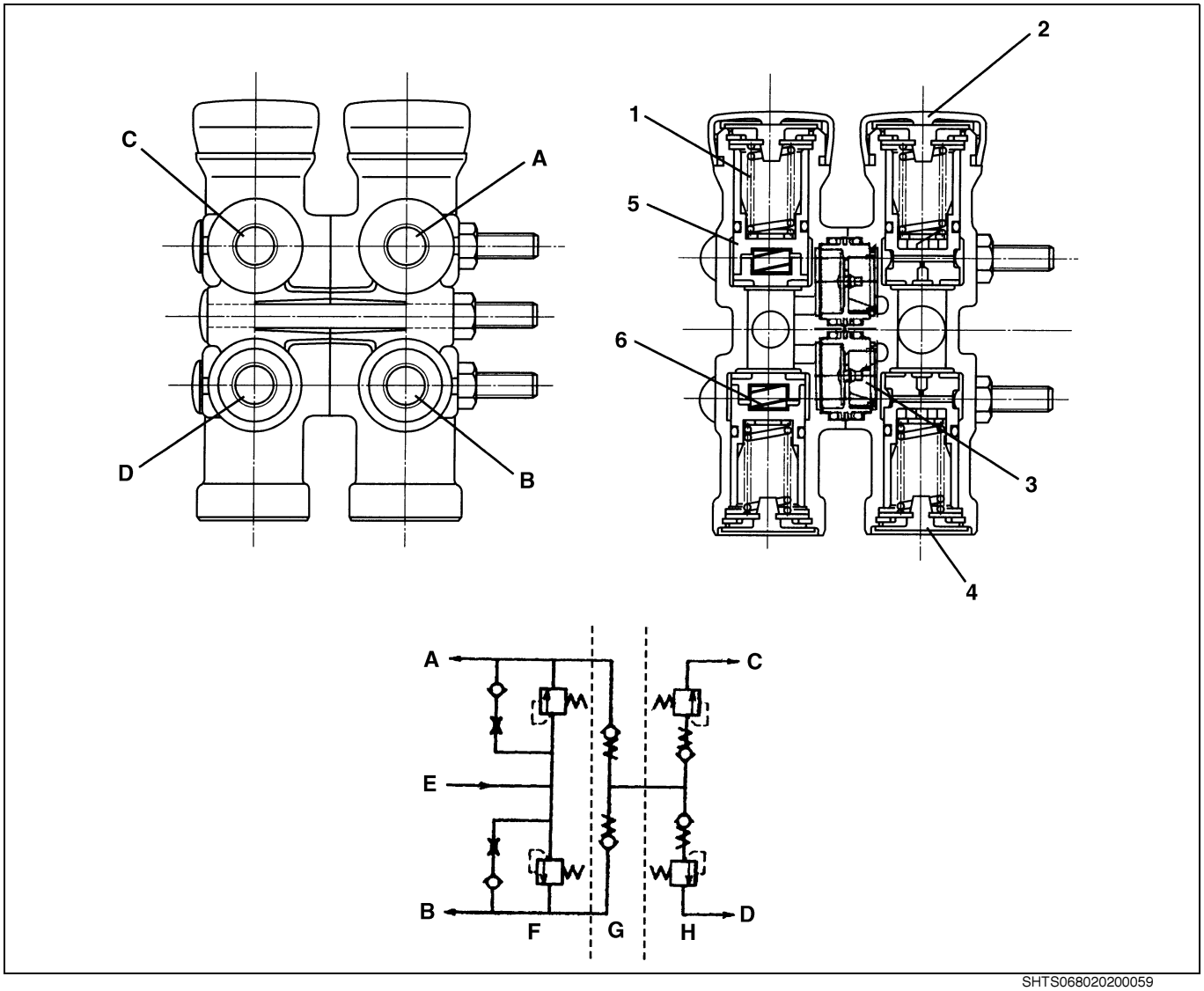
DATA AND SPECIFICATIONS

EN0680202I200007

Type			Spring type (4-way protection)
Opening pressure	Open:	Port 21, 22, 23	620-660 kPa {6.4-6.7 kgf/cm^2, 89.93-95.72 lbf/in.^{2}}
		Port 24	570-610 kPa {5.9-6.2 kgf/cm^2, 82.67-88.47 lbf/in.^{2}}
	Close:	Port 21, 22, 24	440-480 kPa {4.5-4.8 kgf/cm^2, 63.82-69.61 lbf/in.^{2}}
		Port 23	490-530 kPa {5.0-5.4 kgf/cm^2, 71.07-76.87 lbf/in.^{2}}

DESCRIPTION

EN0680202C100008

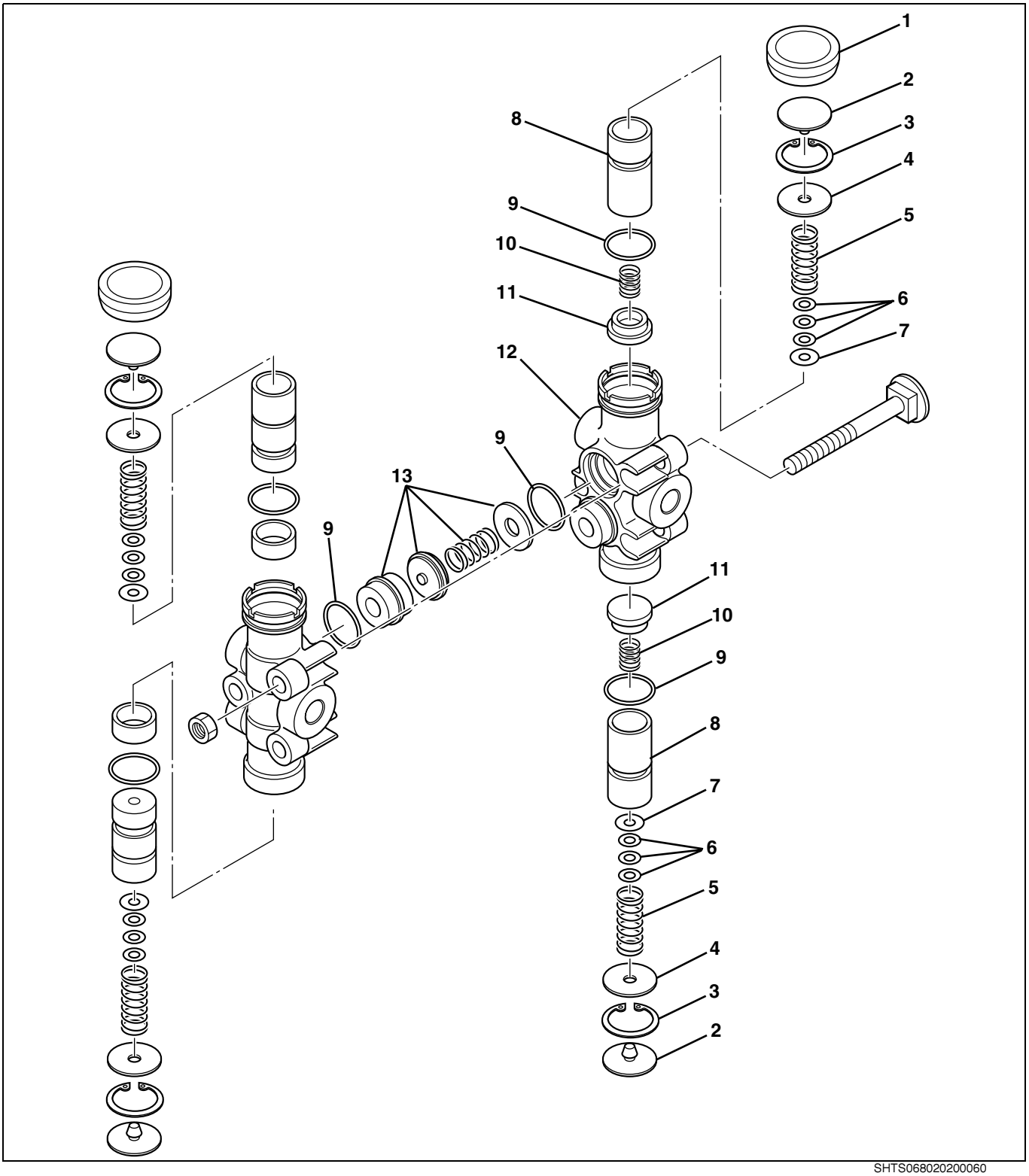


SHTS068020200059

1	Main spring	A	Port 21 (Outlet)
2	Dust cover	B	Port 22 (Outlet)
3	Check valve	C	Port 23 (Outlet)
4	Dust seal rubber	D	Port 24 (Outlet)
5	Piston	E	Inlet port
6	Valve spring	F	No.1 side
		G	Center check valve
		H	No.2 side

COMPONENT LOCATOR

EN0680202D100007



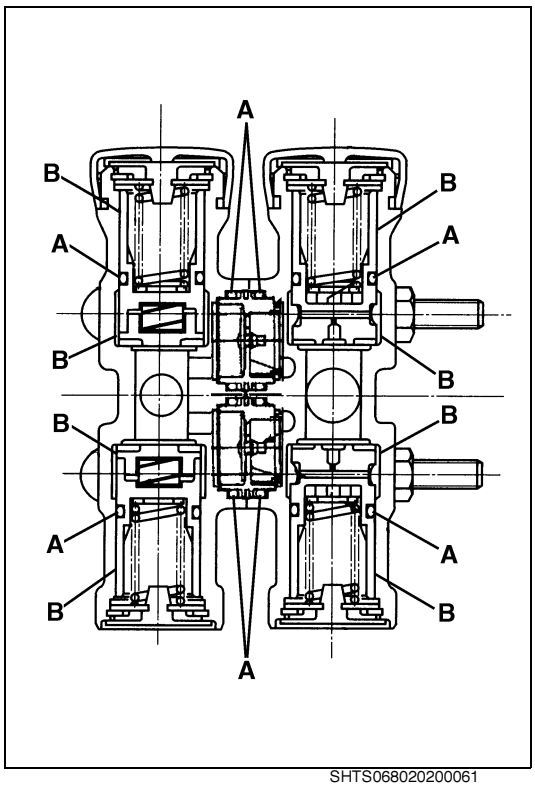
SHTS068020200060

1	Dust cover	6	Shim	11	Valve
2	Dust seal rubber	7	Spacer	12	Body
3	Retainer ring	8	Piston	13	Check valve
4	Dust seal plate	9	O-ring		
5	Main spring	10	Valve spring		

NOTICE
The parts in 3, 9 and 11 are not the ones to be reusable.

OVERHAUL

EN0680202H200006



SHTS068020200061

IMPORTANT POINT - ASSEMBLY

1. LUBRICATION

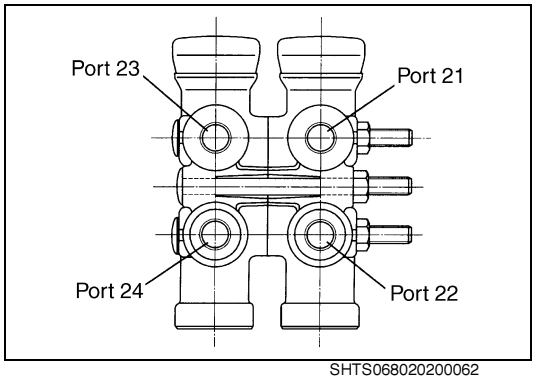
(1) When assembling the protection valve use the new O-rings and valves.

(2) Apply the silicone grease on the each sliding surface of the component parts and O-ring groove.

- **A: O-ring**
- **B: Sliding surface**

ADJUSTMENT

EN0680202H300008



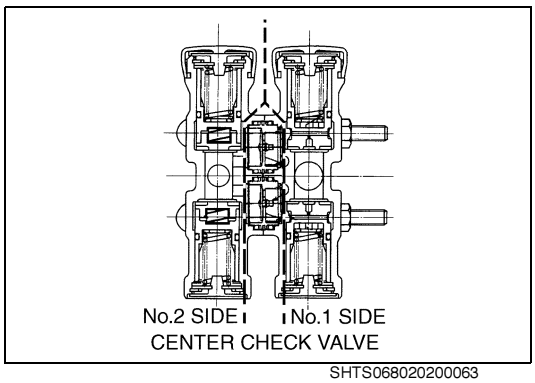
SHTS068020200062

AIR LEAKAGE

1. CHECK VALVE

(1) By-pass check valve at No.1 side.

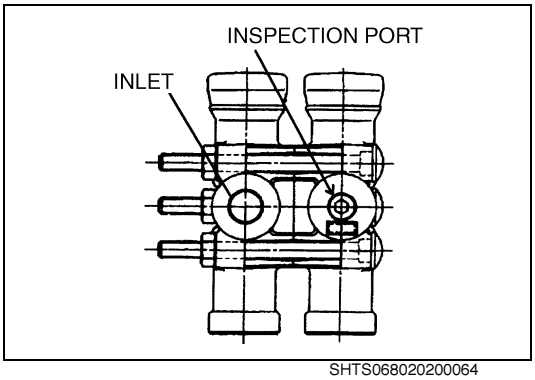
a. Confirm no leakage of air at inlet port, when applying air pressure 49 kPa {0.5 kgf/cm^2, 7.11 lbf/in.^{2}} and 392 kPa {4 kgf/cm^2, 56.89 lbf/in.^{2}} from outlet port No.21 and No.22.



SHTS068020200063

(2) Center check valve

a. Confirm no leakage of air at the outlet port No.21 and No.22, when applying air pressure 49 kPa {0.5 kgf/cm^2, 7.11 lbf/in.^{2}} and 980 kPa {10 kgf/cm^2, 142 lbf/in.^{2}} from the inspection port.



SHTS068020200064

(3) Check valve at No.2 side
a. Confirm no leakage of air at the inspection port, when applying air pressure 49 kPa {0.5 kgf/cm^2, 7.11 lbf/in.^{2}} and 980 kPa {10 kgf/cm^2, 142 lbf/in.^{2}} from the outlet port No.23 and No.24.

2. OTHER AIR TIGHTNESS

(1) When applying air pressure 0-980 kPa {0-10 kgf/cm^2, 0-142 lbf/in.^{2}}, confirm that any leakage of air should be 0 cm^{3}min.

PERFORMANCE CHRACTERISTIC

1. OPENING VALVE PRESSURE

(1) No.1 side
a. Releasing the compressed air at the outlet port No.21 and No.22 to air, when applying the compressed air at the speed specified below, confirm that air pressure of the compressed air, saturated at the inlet should be of opening valve pressure, which should be 620-660 kPa {6.3-6.7 kgf/cm^2, 89.61-95.29 lbf/in.^{2}}.
Charging speed: From 295 kPa {3.0 kgf/cm^2, 42.66 lbf/in.^{2}} to 490 kPa {5.0 kgf/cm^2, 71.10 lbf/in.^{2}} within 3-7 seconds.

(2) No.2 side
a. When applying air at charging speed specified below from the inlet side under air pressure "0" at the outlet port No.23 and No.24, confirm that a pressure at the inspection port when it starting to go up at the outlet should be of opening valve pressure, which should be 570-610 kPa {5.8-6.2 kgf/cm^2, 82.49-88.18 lbf/in^2}.

	Opening valve pressure
Port No.23	**620-660 kPa {6.3-6.7 kgf/cm^2, 89.61-95.29 lbf/in.^{2}}**
Port No.24	**570-610 kPa {5.8-6.2 kgf/cm^2, 82.67-88.47 lbf/in.^{2}}**

Charging speed: From 295 kPa {3.0 kgf/cm^2, 42.66 lbf/in.^{2}} to 490 kPa {5.0 kgf/cm^2, 71.10 lbf/in.^{2}} within 8-22 seconds.

2. CLOSING VALVE PRESSURE

(1) When discharging air through respective No.1 side and No.2 side inlet under a pressure of 980kPa {10 kgf/cm^2, 142 lbf/in.^{2}} at the inlet and the outlet, at discharging speed specified below, confirm that a pressure when the pressures saturated should be of closing valve pressure, which should be 440-480 kPa {4.5-4.8 kgf/cm^2, 64.01-68.27 lbf/in.^{2}} (Port No.21, 22 and 24), and 490-530 kPa {5.0-5.4 kgf/cm^2, 71.07-76.87 lbf/in.^{2}} (Port No.23).
Discharging speed: From 590 kPa {6.0 kgf/cm^2, 85.32 lbf/in.^{2}} to 295 kPa {3.0 kgf/cm^2, 42.66 lbf/in.^{2}} within less than 3 seconds.

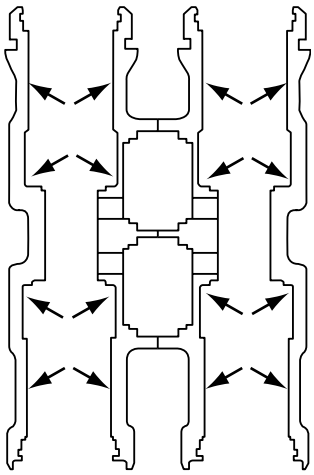
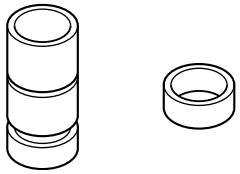
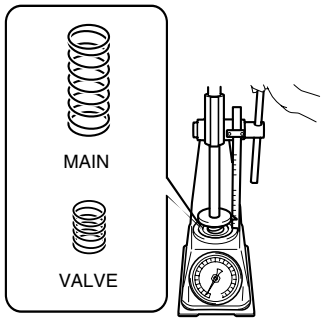
NOTICE

- **Perform test again by increasing sims, when the respective pressures is low and by decreasing it when high in the above inspection.**
- **After inspecting, make sure to tighten the inspection port securely.**

INSPECTION AND REPAIR

EN0680202H300009

Unit: mm {in.}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Sliding surface and contact surface of body: Wear and damage	—	—	Replace, if necessary.	Visual check 
Sliding surface and contact surface of valve seat and piston: Wear and damage	—	—	Replace, if necessary.	Visual check 
Main spring and valve spring: Free length/ Setting length/ Setting load Crack, rust and damage	Main spring (Port 21, 22, 24): 42.4 {1.67}/ 27.5 {1.08}/ 158.9 N {16.2 kgf, 35.72 lbf}	137.3 N {14.0 kgf, 30.87 lbf} (Setting load)	Replace, if necessary.	Measure and Visual check 
	Main spring (Port 23): 35.3 {1.39}/ 27.5 {1.08}/ 169.7 N {17.3 kgf, 38.15 lbf}			
	Valve spring: 20.0 {0.79}/ 9.0 {0.35}/ 0.78 N {0.08 kgf, 0.175 lbf}	0.69 N {0.07 kgf, 0.155 lbf} (Setting load)		

QUICK RELEASE VALVE

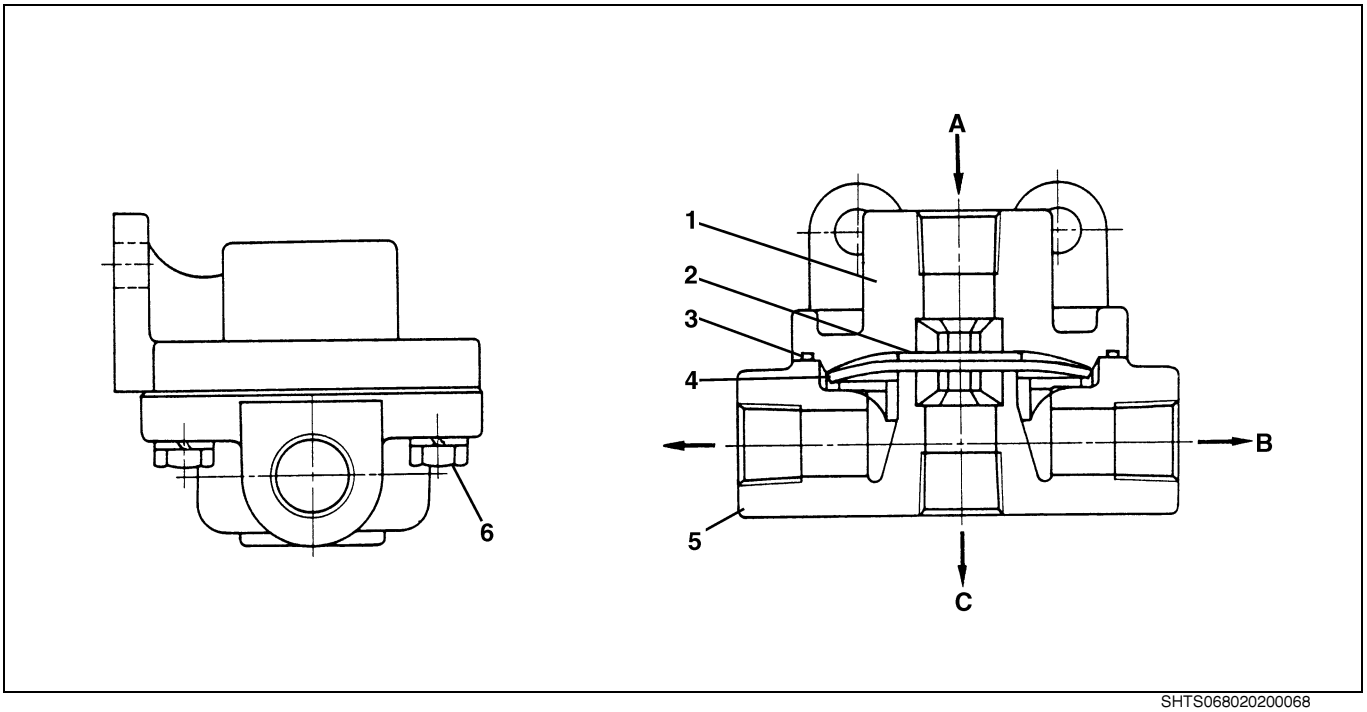
DATA AND SPECIFICATION

EN0680202I200008

Type	Diaphragm type

DESCRIPTION

EN0680202C100009

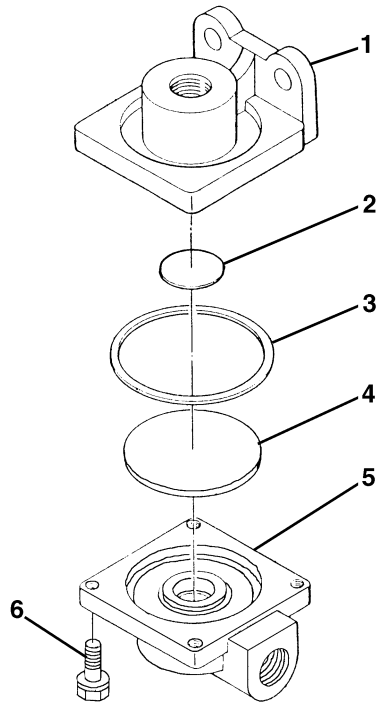


SHTS068020200068

1	Cover	6	Bolt
2	Filter	A	Inlet
3	Gasket	B	Outlet
4	Diaphragm	C	Exhaust
5	Valve body		

COMPONENT LOCATOR

EN0680202D100008

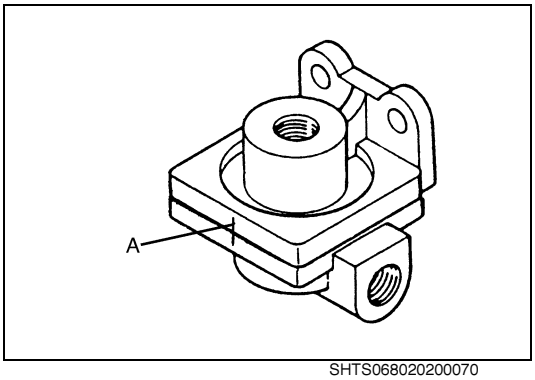


SHTS068020200069

1	Cover	4	Diaphragm
2	Filter	5	Valve body
3	Gasket	6	Bolt

OVERHAUL

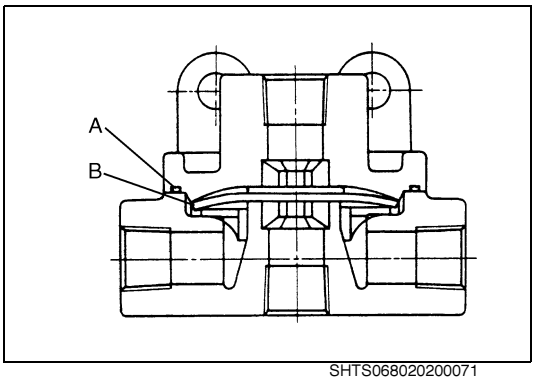
EN0680202H200007



SHTS068020200070

IMPORTANT POINT - DISASSEMBLY

NOTICE
Before disassemble the relay valve apply the aligning mark "A" for the cover and valve body.



SHTS068020200071

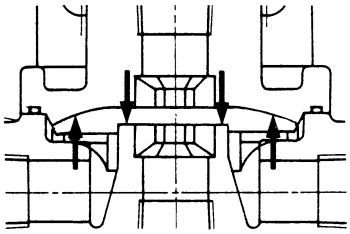
IMPORTANT POINT - ASSEMBLY

1. ASSEMBLE THE RELAY VALVE.
(1) When assembly the relay valve, use the new diaphragm and gasket.
- **A: Gasket**
- **B: Diaphragm**

(2) Coincide the aligning mark "A" which were applied at disassembly.

INSPECTION AND REPAIR

EN0680202H300010

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Valve body and cover surface: Rust and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

LOAD SENSING VALVE

DATA AND SPECIFICATION

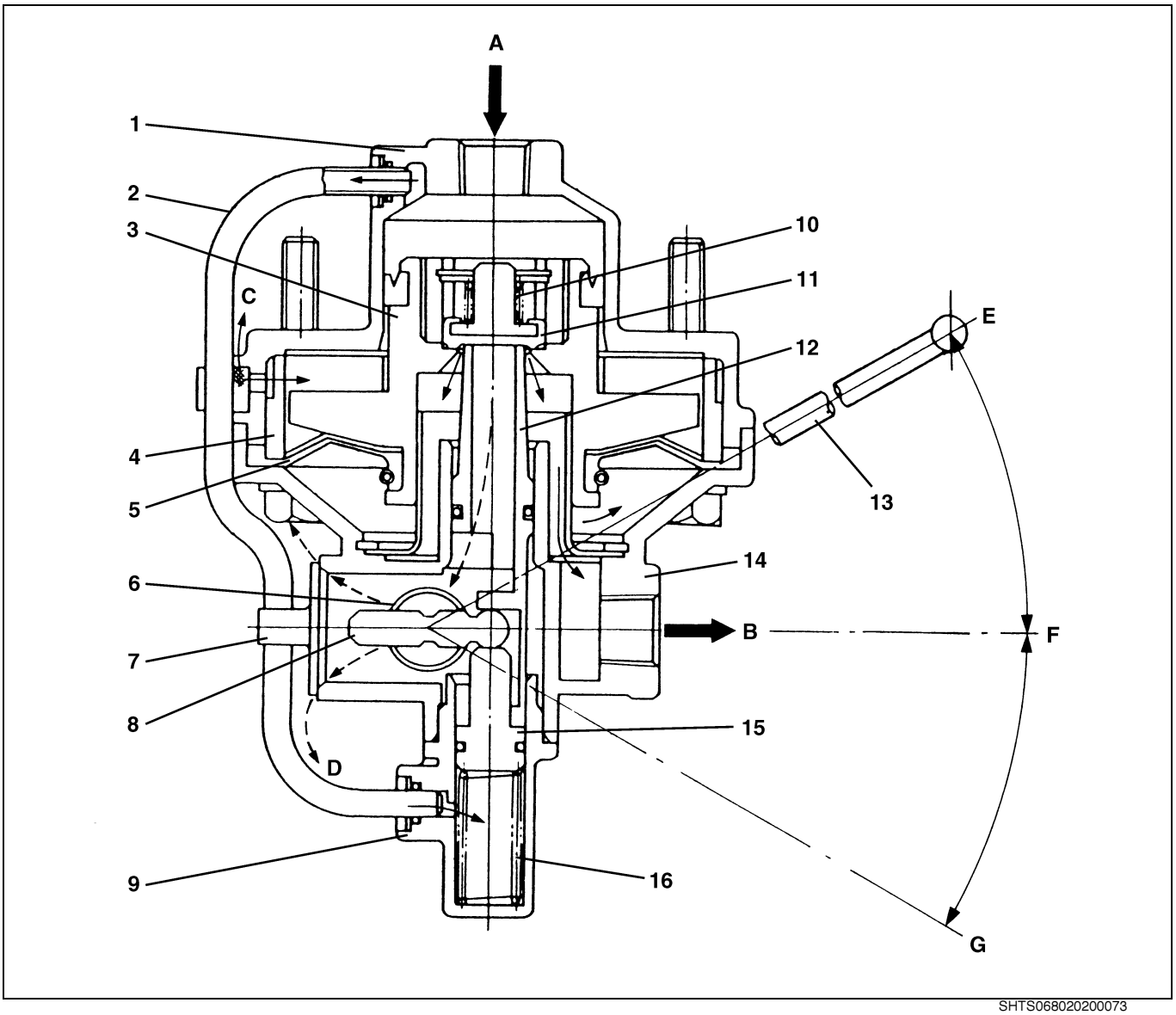
EN0680202I200009

Type	**Piston with diaphragm type**

DESCRIPTION

EN0680202C100010

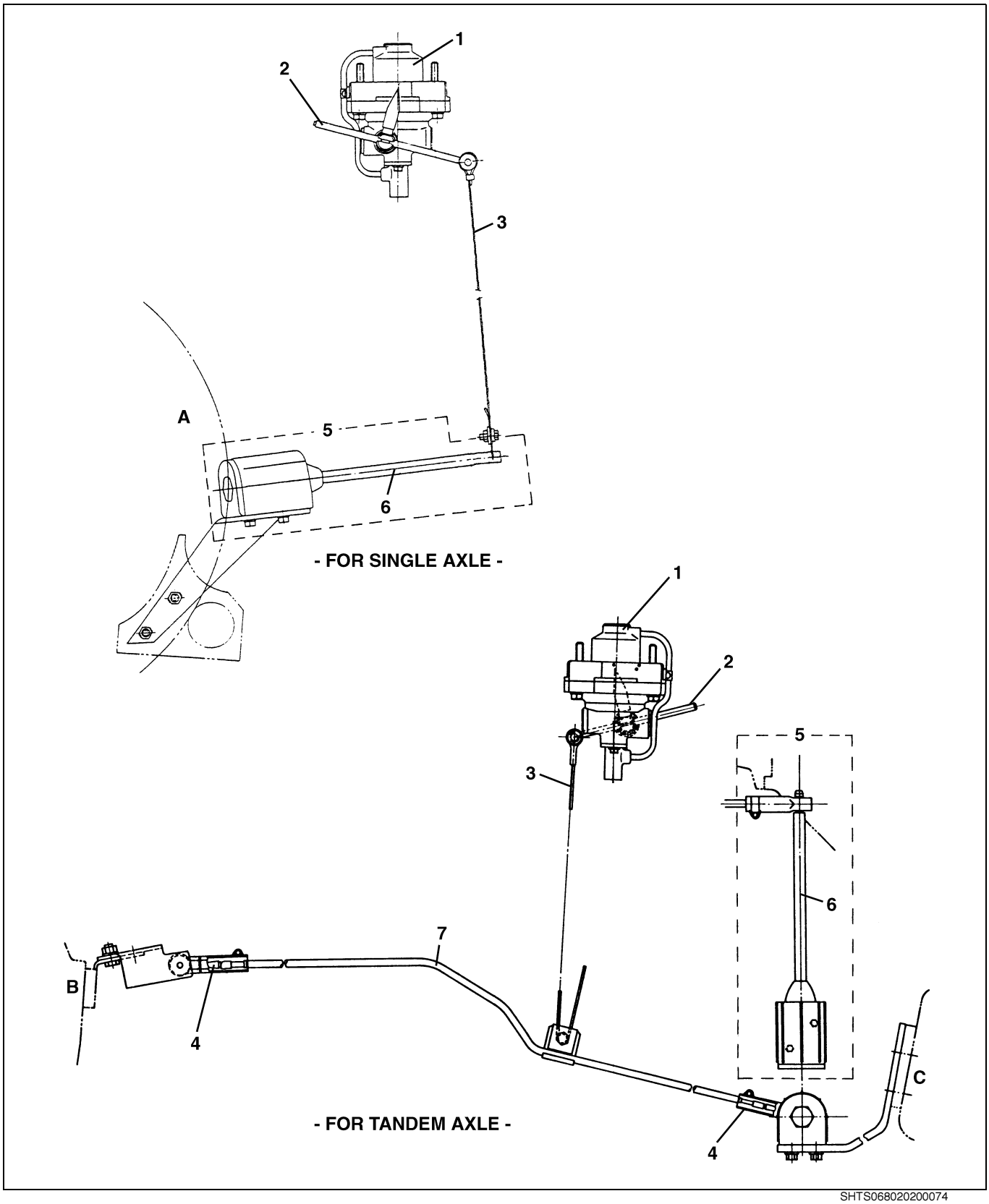
LOAD SENSING VALVE



SHTS068020200073

1	Cover	13	Operating arm
2	Air pipe	14	Body
3	Piston	15	Plunger return piston
4	Diaphragm guide	16	Plunger spring
5	Diaphragm	A	Inlet (From Brake valve)
6	Connecting rod	B	Outlet (To Relay valve)
7	Check valve (Exhaust)	C	Breathing
8	Cam	D	Exhaust
9	Cap	E	MAX.
10	Valve spring	F	Half
11	Valve	G	MIN.
12	Plunger		

LINKAGE



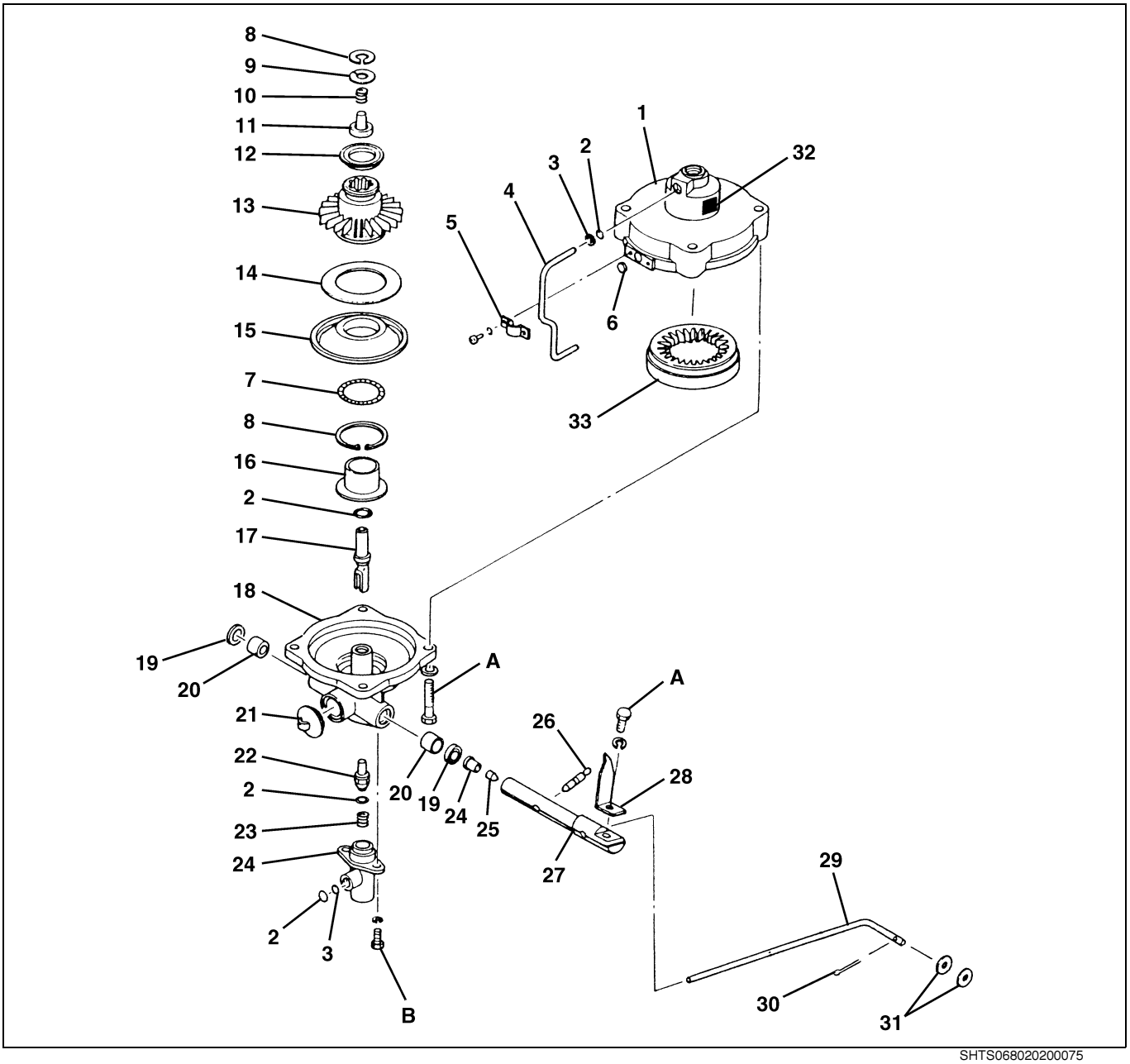
SHTS068020200074

1	Load sensing valve	6	Connecting rod
2	Operating arm	7	Push rod
3	Adjuster	A	Rear axle
4	Holder	B	Rear-front axle
5	Damper assembly	C	Rear-rear axle

COMPONENT LOCATOR

EN0680202D100009

LOAD SENSING VALVE



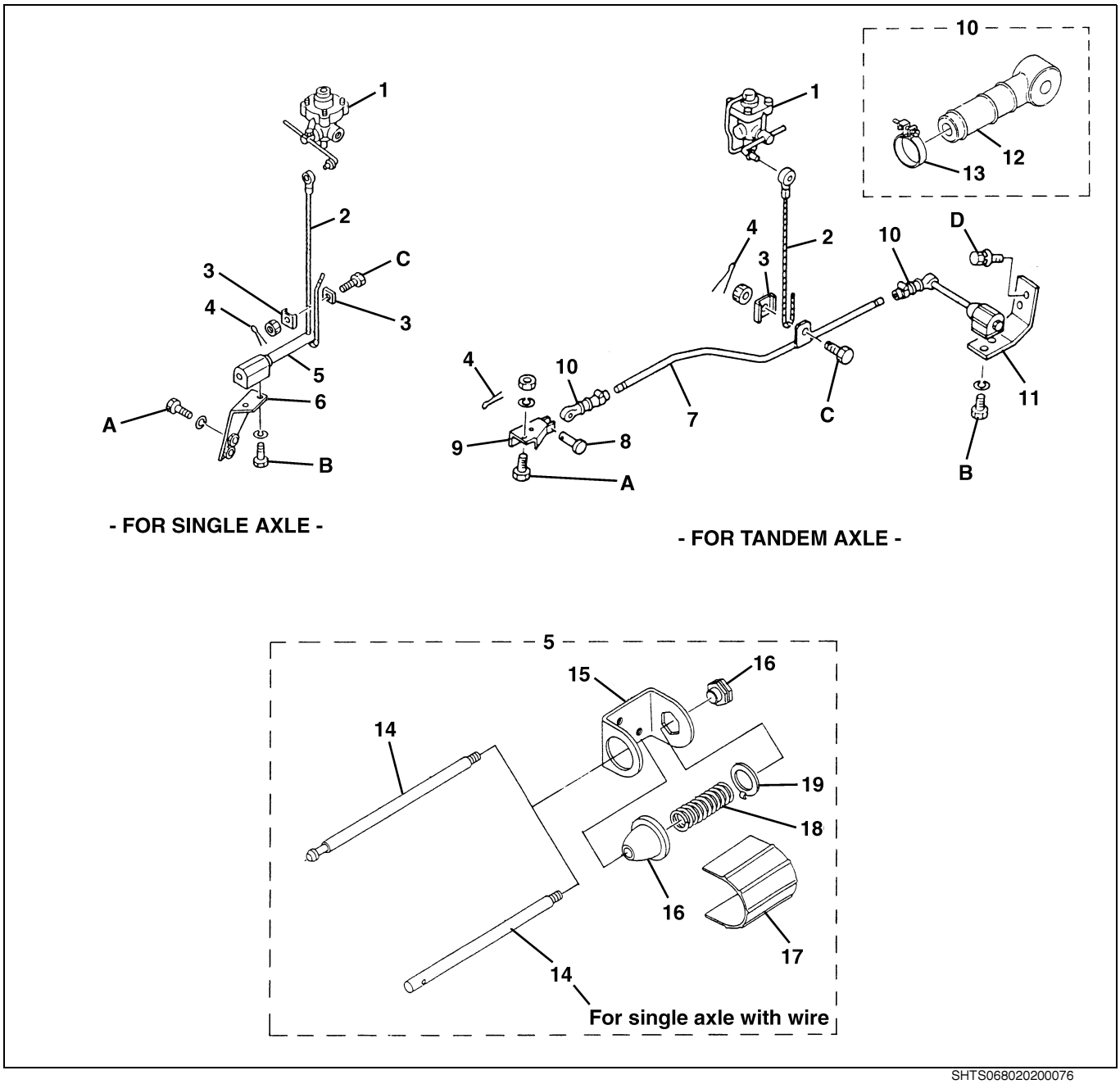
SHTS068020200075

1	Cover	12	Piston seal	23	Plunger spring
2	O-ring	13	Piston	24	Cap
3	O-ring retainer	14	Diaphragm protector	25	Hexagonal socket screw
4	Air pipe	15	Diaphragm	26	Cam
5	Pipe retainer	16	Piston guide	27	Connecting rod
6	Filter	17	Plunger	28	Indicator
7	Diaphragm retainer	18	Body	29	Operating arm
8	Retainer ring	19	Oil seal	30	Cotter pin
9	Spring seat	20	Bushing	31	Washer
10	Valve spring	21	Check valve (Exhaust)	32	Valve No. plate
11	Valve	22	Plunger return piston	33	Diaphragm guide

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	7.8-9.8 {80-100, 5.76-7.22}	B	3.4-4.9 {35-50, 2.51-3.61}

LINKAGE



SHTS068020200076

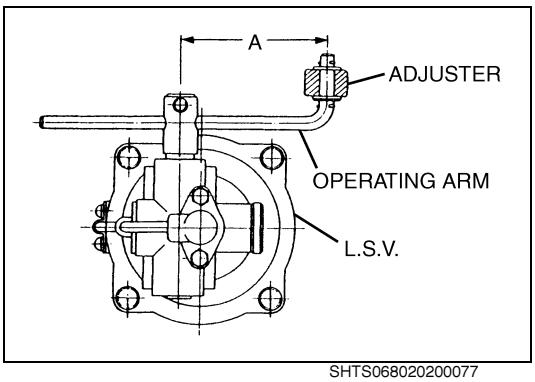
1	Load sensing valve	8	Pin	15	Supporter
2	Adjuster (Wire type)	9	Bracket (To Rear-front axle)	16	Spring seat
3	Lock plate	10	Holder assembly	17	Cover
4	Cotter pin	11	Bracket (To Rear-rear axle)	18	Spring
5	Damper assembly	12	Connector	19	Retainer
6	Bracket (To Rear axle)	13	Clamp band		
7	Push rod	14	Connecting rod		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	35.3-52.0 {360-530, 27-38}	C	19.6-39.2 {200-400, 15-28}
B	17.7-26.5 {180-270, 14-19}	D	62.8-91.2 {640-930, 47-67}

OVERHAUL

EN0680202H200008

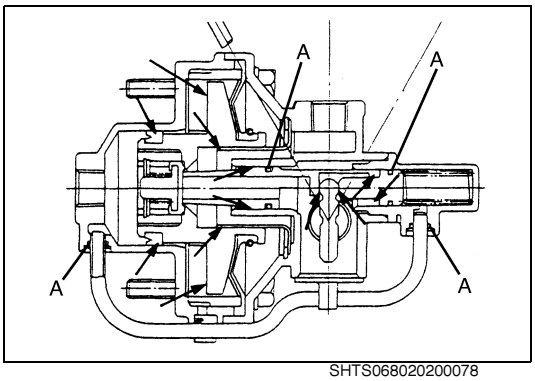


SHTS068020200077

IMPORTANT POINT - DISASSEMBLY

1. REMOVE THE OPERATING ARM.

(1) Measure and record the fixing length A of the operating arm before removing.



SHTS068020200078

IMPORTANT POINTS - ASSEMBLY

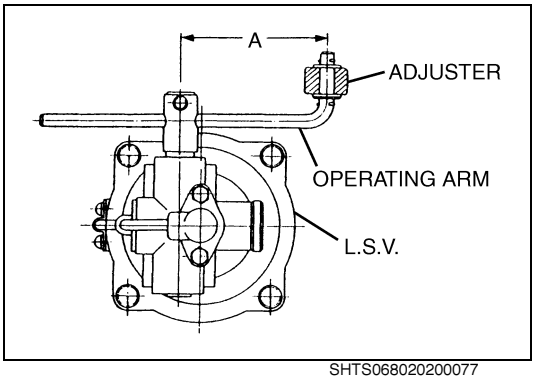
1. LUBRICATION

(1) When reassembling the L.S.V. replace all rubber parts (Piston seal, Valves, Diaphragm, Dust seals and O-rings) with new ones.

(2) Apply lithium grease to each sliding surface of the components parts and the O-ring groove.

A: O-ring

***L.S.V.: Load sensing valve**



SHTS068020200077

2. ASSEMBLE THE OPERATING ARM.

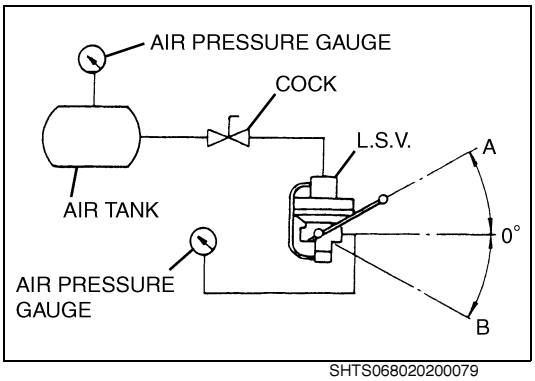
(1) Set the dimension "A" of operating arm to the original length or according to table below.

Unit: mm {in.}

Valve No.	47640-1280	47640-1080
A	84-86 {3.307-3.385}	59-61 {2.323-2.401}

NOTICE

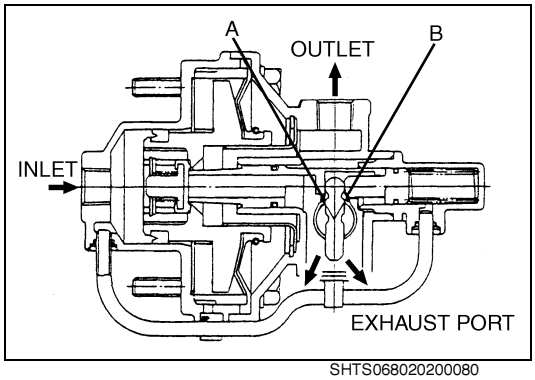
Valve No. is indicated on the cover.



SHTS068020200079

3. INSPECTION OF THE LOAD SENSING VALVE

(1) Connect the L.S.V., nylon tube, air pressure gauge and air tank as shown in the figure.

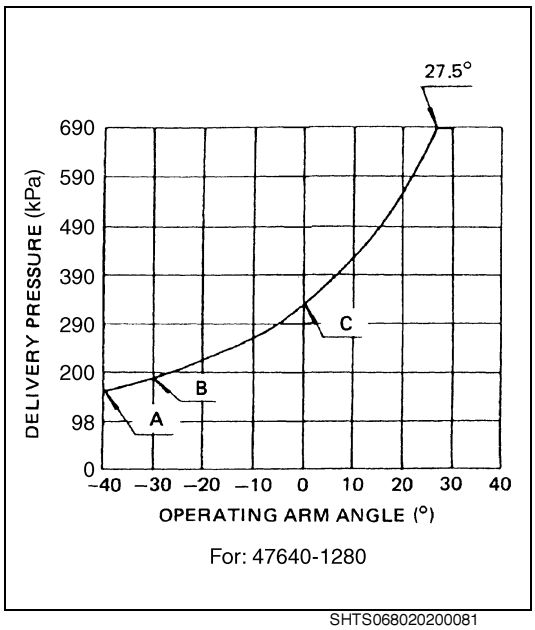


SHTS068020200080

(2) Set operating arm to the "A" position and close the outlet port; then hold a charge with air at a pressure of 686 kPa {7.0 kgf/ cm^2, 99.541 $lbf/in.^2$} into the inlet port.
Let the operating arm swing over the entire range.
At this time, check for air leak by applying soapy water around the body and pipe joint.

Valve No.	47640-1280	47640-1080
A	+30°	+15°
B	-30°	-15°

NOTICE
Valve No. is indicated on the cover.



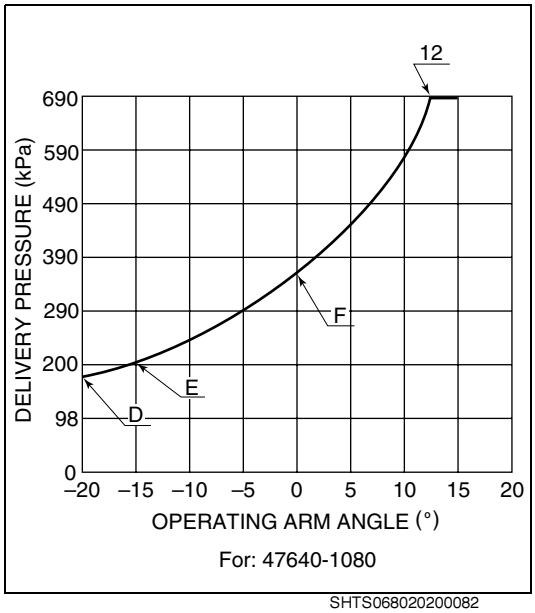
SHTS068020200081

(3) Set the air tank pressure at 686 kPa {7.0 kgf/cm^2, 99.54 $lbf/in.^2$.}, fix the angle of the operating arm as specified below, and measure the pressure on the outlet port when compressed air is supplied to the inlet port by using of the cock.
(4) For your information, the relation between angle of the operating arm and pressure on the outlet port is shown in the adjacent diagrams.

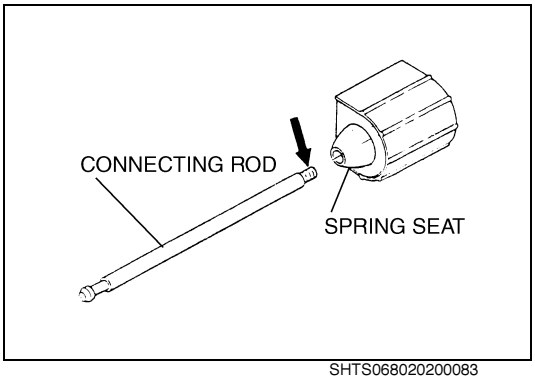
Unit: kPa {kgf/cm^2, $lbf/in.^2$}

Valve No.	Operating arm angle	Rated pressure on outlet port
47640-1020 47640-1280	+30°	686 {7.0, 99.50}
	0°	C: 301-359 {3.1-3.6, 43.66-52.06}
	-30°	B: 170-210 {1.8-2.1, 24.66-30.45}
	-40°	A: 150-190 {1.6-1.9, 21.76-27.55}
47640-1080	+15°	686 {7.0, 99.50}
	0°	F: 321-379 {3.3-3.8, 46.56-54.96}
	-15°	E: 190-230 {2.0-2.3, 27.56-33.35}
	-20°	D: 160-200 {1.7-2.0, 23.21-29.00}

NOTICE
Valve No. is indicated on the cover.



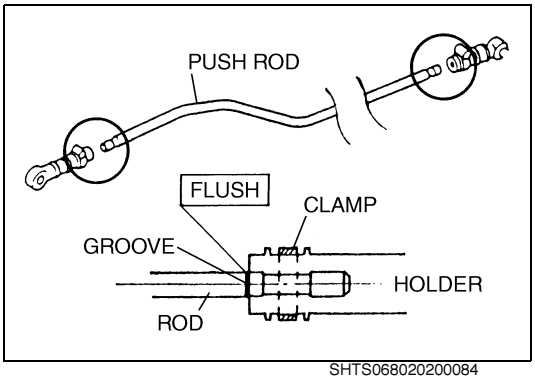
SHTS068020200082



SHTS068020200083

4. DAMPER ASSEMBLY

(1) Before installing the connecting rod to the spring seat, apply the lock agent to the threads of the rod.



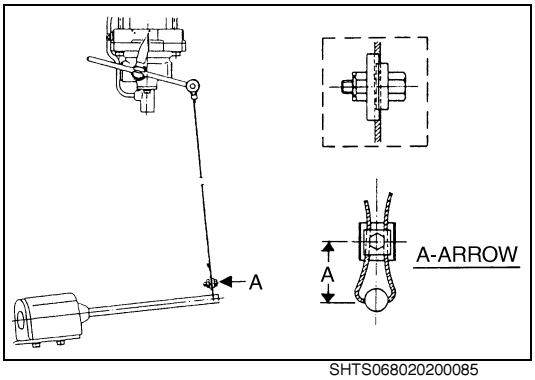
SHTS068020200084

5. PUSH ROD AND HOLDER ASSEMBLY (For tandem axle)

(1) When assembling the push rod and holder assembly, insert the push rod ends to the connectors so that the groove on the push rod and connector end will be flush as shown in the figure.

(2) Clamp band should be placed as shown in the figure.

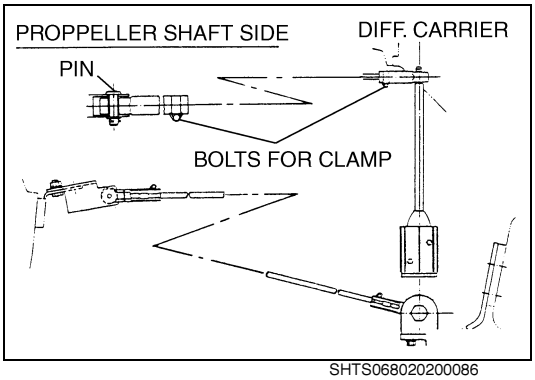
IMPORTANT POINTS - MOUNTING



SHTS068020200085

1. ADJUSTER (For single axle)

(1) Position of the lock plate:
After connection the operating arm of the L.S.V., adjust the adjuster (wire) on the connecting rod then lock the wire as shown in the figure.
A = 60 mm {2.36 in.}



SHTS068020200086

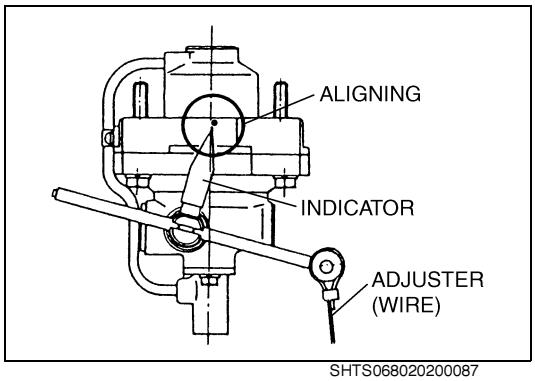
2. PUSH ROD WITH HOLDER ASSEMBLY (For tandem axle)

(1) Position of bolt for clamp band:
Set the clamp bands so that the bolts for clamp bands will be on opposite sides of the propeller shaft and differential carrier.

(2) Inserting direction of the pin:
Connect the pin to the push rod as shown in the figure.

ADJUSTMENT

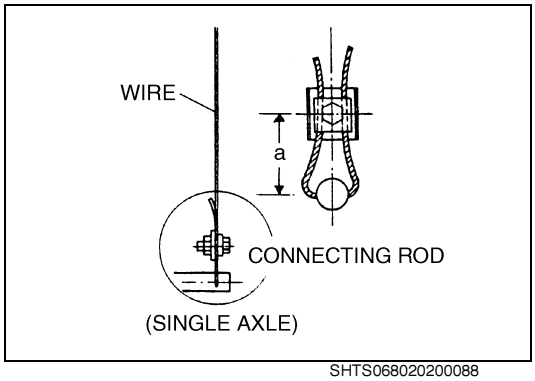
EN0680202H300011



SHTS068020200087

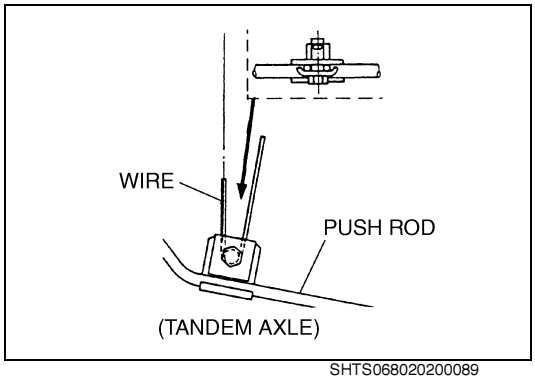
1. ADJUSTER

(1) With the vehicle unloaded, adjust the length of the wire to align the indicator of the L.S.V. with the mark "•".



SHTS068020200088

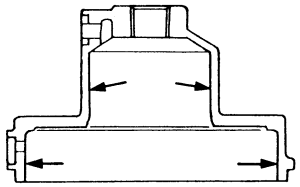
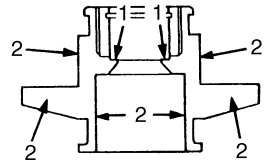
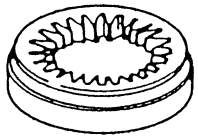
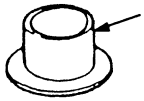
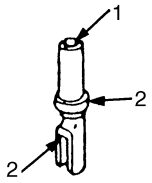
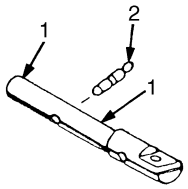
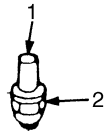
(2) Lock the wire as shown in the figure.
a = 60 mm {2.36 in.}

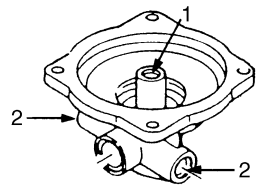
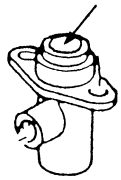
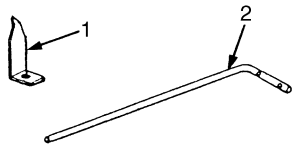
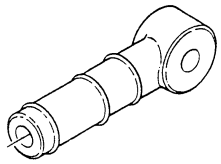
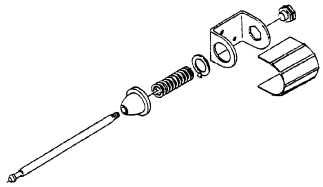
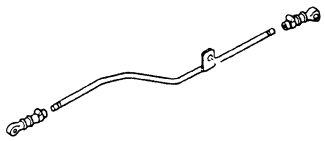


SHTS068020200089

INSPECTION AND REPAIR

EN0680202H300012

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Inner surface of cover: Wear, damage and rust	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Valve contact surface 1 and friction surface 2 of piston: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Friction surface of diaphragm guide: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Friction surface of piston guide: Wear, damage and rust	**—**	**—**	**Clean or replace.**	**Visual check** 
Valve contact surface 1 and friction surface 2 of plunger: Wear, damage and rust	**—**	**—**	**Clean or replace, if necessary.**	**Visual check** 
Friction surface of rod 1 and cam 2: Wear, damage and rust	**—**	**—**	**Clean or replace, if necessary.**	**Visual check** 
Valve contact surface 1 and friction surface 2 of plunger return piston: Wear, damage and rust	**—**	**—**	**Clean or replace, if necessary.**	**Visual check** 
Valve spring and plunger spring: Elastic distortion and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Friction surface of body 1 and bushing: Wear, damage and rust	—	—	**Clean or replace, if necessary.**	**Visual check** 
Friction surface of cap: Wear, damage and rust	—	—	**Clean or replace, if necessary.**	**Visual check** 
Indicator 1, Operating arm 2: Deformation	—	—	**Repair or replace.**	**Visual check** 
Connector: Deterioration and damage	—	—	**Replace, if necessary.**	**Visual check** 
Components of damper: Deformation and damage	—	—	**Replace, if necessary.**	**Visual check** 
Push rod assembly (Tandem axle): Deformation	—	—	**Replace, if necessary.**	**Visual check** 

SPRING BRAKE CONTROL VALVE (TYPE-A)

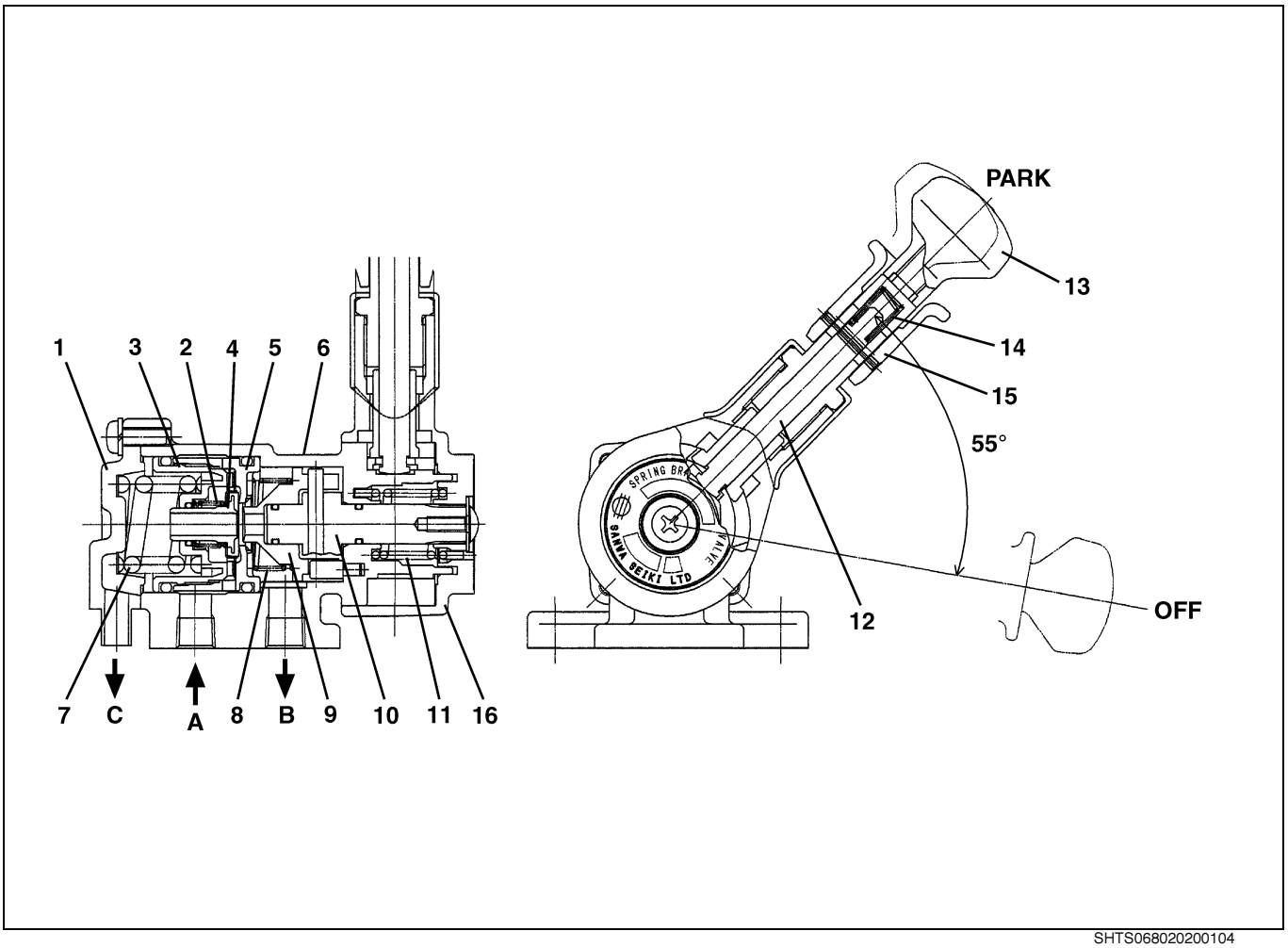
DATA AND SPECIFICATIONS

EN0680202I200010

Type	**Variable pressure control type**
Outlet pressure difference between parking and releasing stroke at a specified lever angle	**Within 147 kPa {1.5 kgf/cm^2, 21.32 lbf/in.^{2}}**

DESCRIPTION

EN0680202C100011

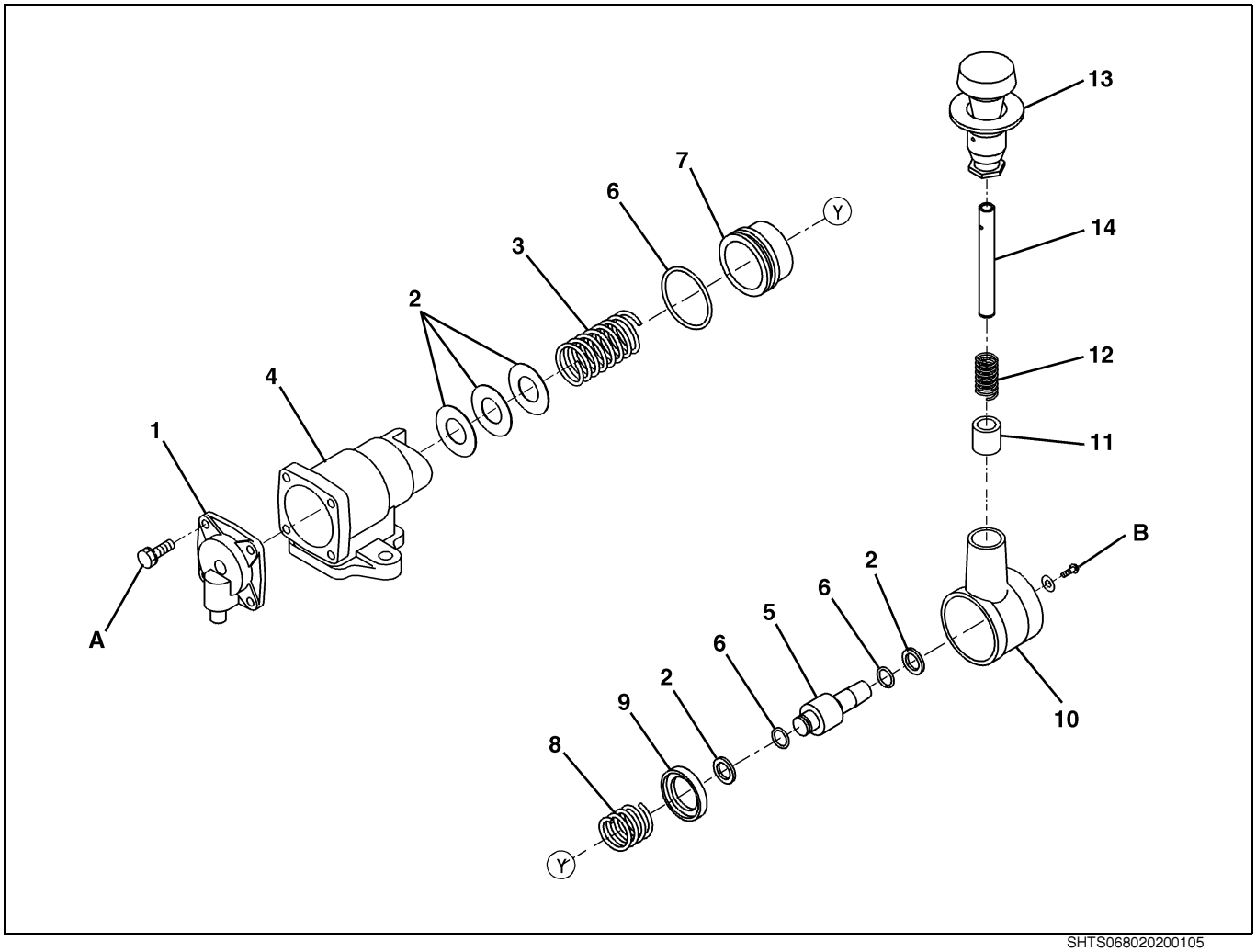


SHTS068020200104

1	Body cover	11	Handle return spring
2	Feed valve spring	12	Pull rod
3	Piston	13	Knob
4	Feed valve	14	Compression spring
5	Valve seat	15	Release knob
6	Valve body	16	Handle body
7	Piston spring	A	Inlet
8	Valve spring	B	Outlet
9	Cam	C	Exhaust (PARK)
10	Cam holder		

COMPONENT LOCATOR

EN0680202D100010



SHTS068020200105

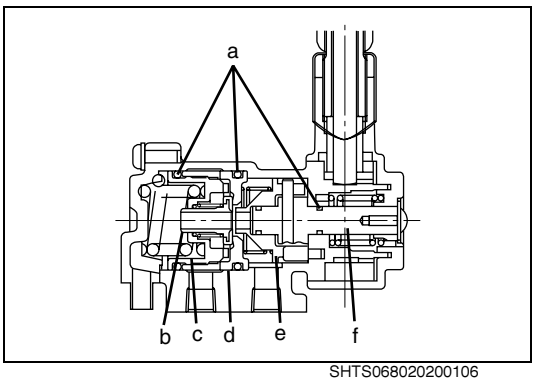
1	Body cover	8	Valve spring
2	Shim	9	Valve seat
3	Piston spring	10	Handle body
4	Valve body	11	Stopper
5	Cam holder	12	Compression spring
6	O-ring	13	Knob sub assembly
7	Piston sub assembly	14	Pull rod

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	5.4-7.4 {55-75, 4.0-5.4}	B	3.4-4.9 {35-50, 2.6-3.6}

OVERHAUL

EN0680202H200009



SHTS068020200106

IMPORTANT POINTS - ASSEMBLY

1. LUBRICATION

(1) When assembling the spring brake control valve, replace the feed valve, valve seats and O-rings.

(2) Apply silicone grease to each sliding surface of the assembly parts, O-rings and O-ring grooves.

a. O-ring

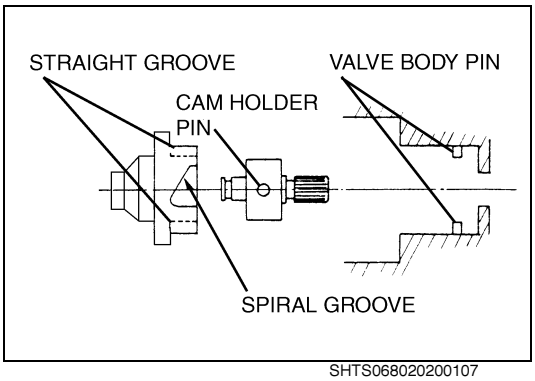
b. Feed valve

c. Piston

d. Valve seat

e. Cam

f. Cam holder

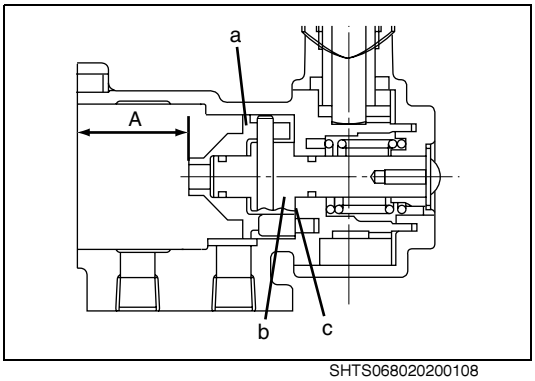


SHTS068020200107

2. ASSEMBLE THE CAM ASSEMBLY.

(1) When assembling the cam and cam holder, make sure that the cam holder pin and spiral groove of the cam are aligned.

(2) When installing the cam assembly to the valve body, the valve body pin and straight groove of the cam must be aligned.



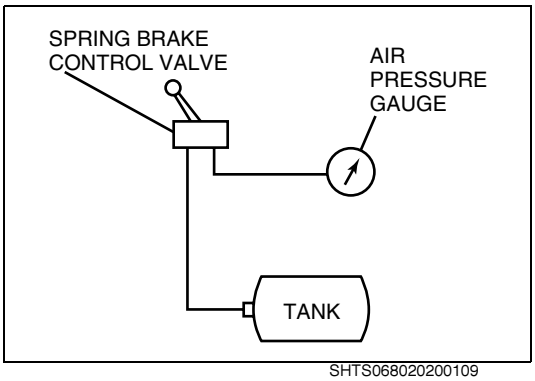
SHTS068020200108

(3) Adjust dimension "A" with the shim.
Assembly standard: 33.8-34.2 mm {1.331-1.346 in.}

a. Cam

b. Cam holder

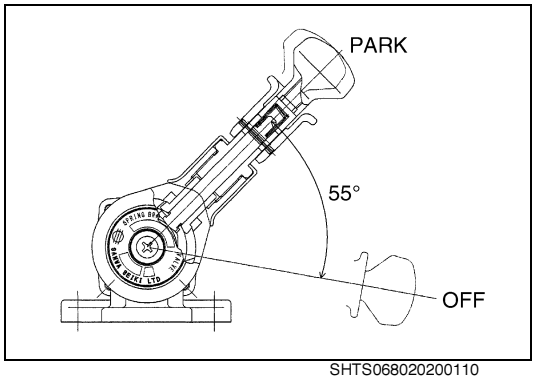
c. Shim



SHTS068020200109

3. SPRING BRAKE CONTROL VALVE PERFORMANCE TEST

(1) First, connect the pressure gauge to the outlet line and apply an air pressure of 980 kPa {10.0 kgf/cm^2, 142 lbf/in.^{2}} to the inlet line.



SHTS068020200110

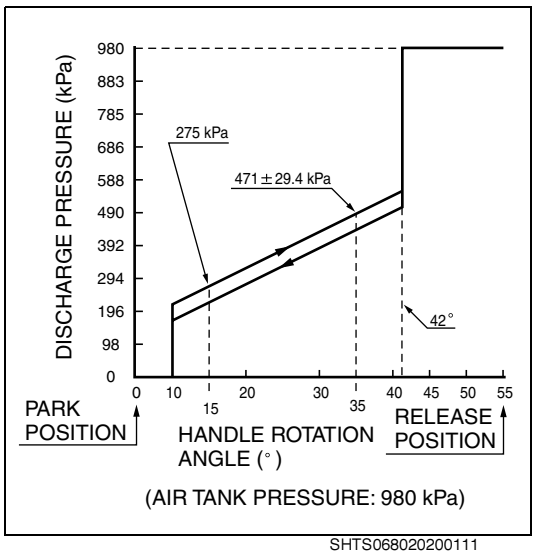
(2) Move the spring brake control lever towards the OFF position, gradually and confirm that the air pressure in the outlet line meets the characteristic shown in figure.

Standard:

Handle angle:	**Outlet pressure: kPa {kgf/cm^2, lbf/in.^{2}}**
15°	**275 {2.8, 39.9}**
35°	**441.6-500.4 {4.5-5.1, 64.0-72.6}**
Over 42°	**980 {10.0, 142}**

NOTICE

The characteristic shown is under the inlet pressure of 480 kPa {10.0 kgf/cm^2, 142 lbf/in^2.}



SHTS068020200111

(3) Confirm the following functions.

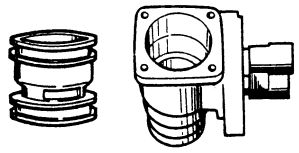
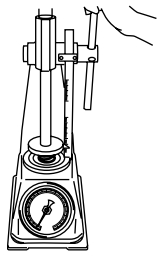
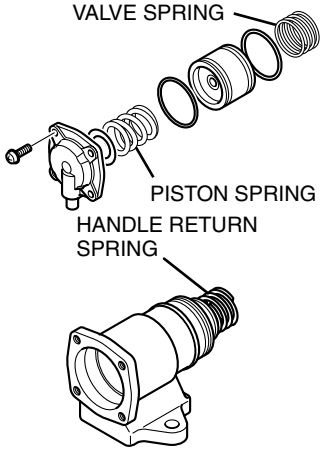
a. The control handle is locked at PARK position.

b. The control handle automatically turn to OFF position when the lever is released at PARK position.

INSPECTION AND REPAIR

EN0680202H300013

Unit: mm {in.}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Piston and valve body: Wear and damage	—	—	Replace, if necessary.	Visual check 
Cam, pin and cam holder: Wear and damage	—	—	Replace, if necessary.	Visual check 
Piston spring, valve spring and handle return spring: Free length/ Setting length/ Setting load Crack, rust and damage	Piston spring 27.9 {1.10}/ 25.0 {0.98}/ 553.1 N {56.4 kgf, 124.34 lbf}	500.1 N {51.0 kgf, 112.43 lbf} (Setting load)	Replace, if necessary.	Measure and visual check  
	Valve spring 19.6 {0.77}/ 10.5 {0.41}/ 19.6 N {2.0 kgf, 4.41 lbf}	17.6 N {1.8 kgf, 3.96 lbf} (Setting load)		
	Handle return spring 19.3 {0.76}/ 13.5 {0.53}/ 7.8 N {0.8 kgf, 1.76 lbf}	6.9 N {0.7 kgf, 1.55 lbf} (Setting load)		
Feed valve spring: Rust and damage	—	—	Replace, if necessary.	Visual check 

SPRING BRAKE CONTROL VALVE (TYPE-B)

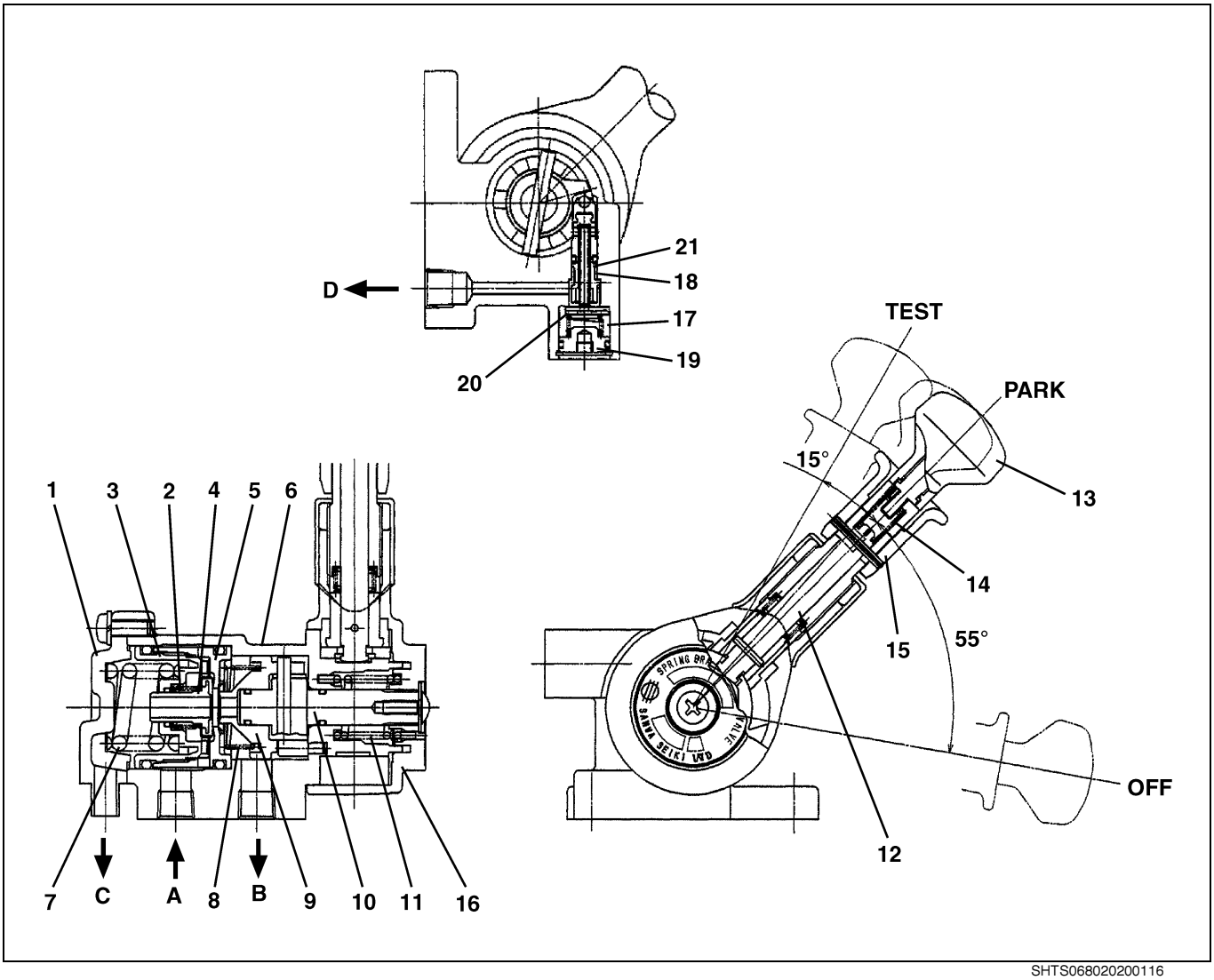
DATA AND SPECIFICATIONS

EN0680202I200011

Type	Variable pressure control type
Outlet pressure difference between parking and releasing stroke at a specified lever angle	Within 196 kPa {2.0 kgf/cm^2, 28.43 lbf/in.^{2}}

DESCRIPTION

EN0680202C100012

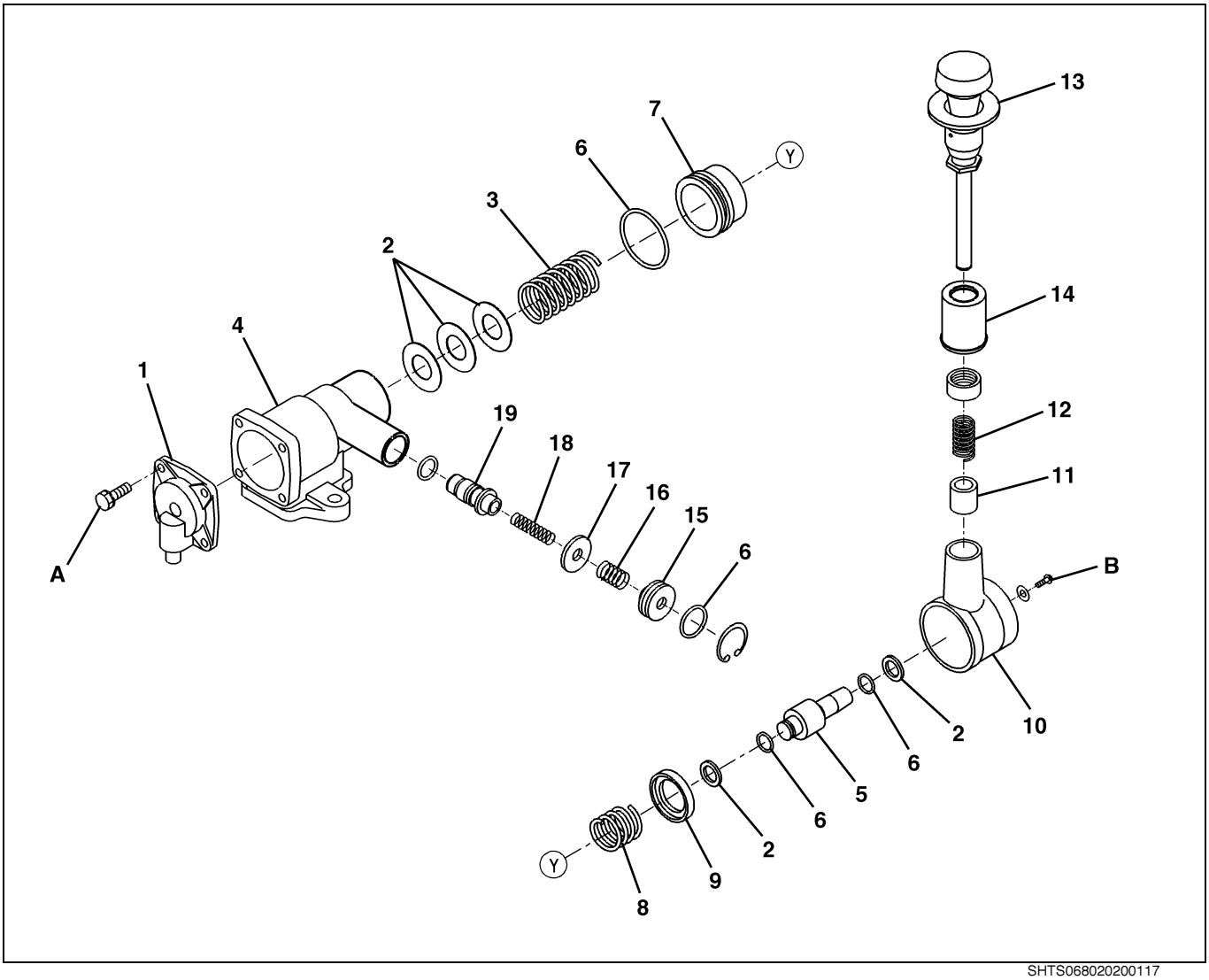


SHTS068020200116

1	Body cover	10	Cam holder	19	Retainer
2	Feed valve spring	11	Handle return spring	20	Feed valve
3	Piston	12	Pull rod	21	Plunger
4	Feed valve	13	Knob	A	Inlet
5	Valve seat	14	Compression spring	B	Outlet (To spring brake line)
6	Valve body	15	Release knob	C	Exhaust (PARK)
7	Piston spring	16	Handle body	D	Outlet (To multiple relay valve)
8	Valve spring A	17	Valve spring B		
9	Cam	18	Return spring		

COMPONENT LOCATOR

EN0680202D100011



SHTS068020200117

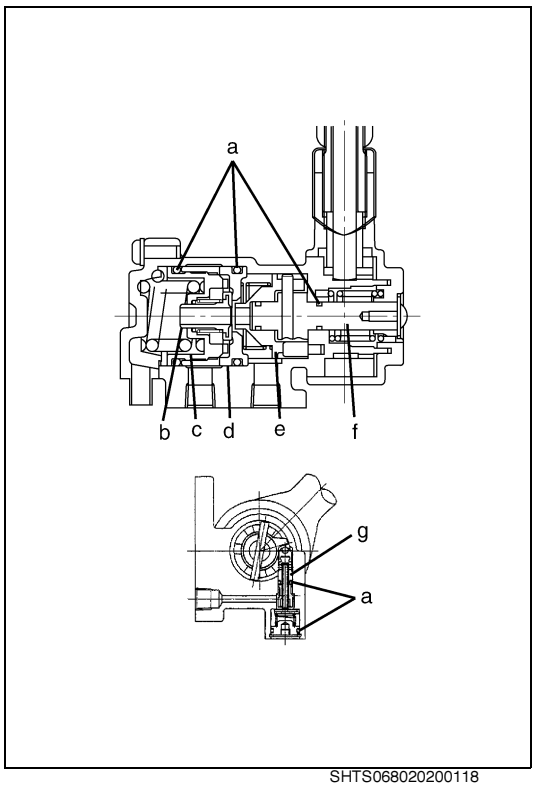
1	Body cover	11	Stopper
2	Shim	12	Compression spring
3	Piston spring	13	Knob sub-assembly
4	Valve body	14	Pull rod
5	Cam holder	15	Retainer
6	O-ring	16	Valve spring B
7	Piston sub-assembly	17	Feed valve
8	Valve spring A	18	Return spring
9	Valve seat	19	Plunger
10	Handle body		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	5.4-7.4 {55-75, 4.0-5.4}	B	3.4-4.9 {35-50, 2.6-3.6}

OVERHAUL

EN0680202H200010



SHTS068020200118

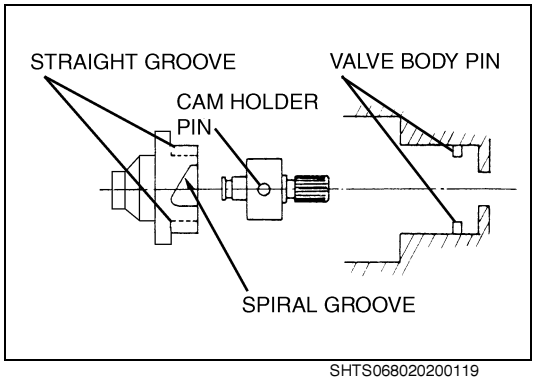
IMPORTANT POINTS - ASSEMBLY

1. LUBRICATION

(1) When assembling the spring brake control valve, replace the feed valve, valve seats and O-rings.

(2) Apply silicone grease to each sliding surface of the assembly parts, O-rings and O-ring grooves.

a. O-ring
b. Feed valve
c. Piston
d. Valve seat
e. Cam
f. Cam holder
g. Plunger

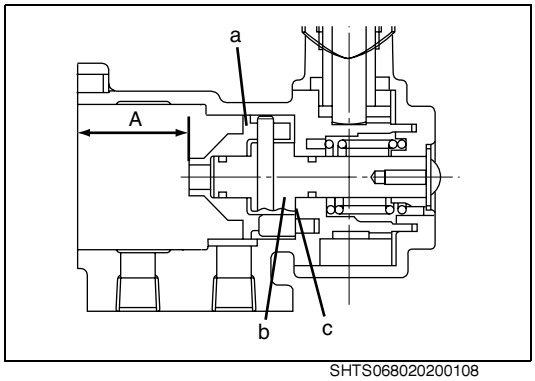


SHTS068020200119

2. ASSEMBLE THE CAM ASSEMBLY.

(1) When assembling the cam and cam holder, make sure that the cam holder pin and spiral groove of the cam are aligned.

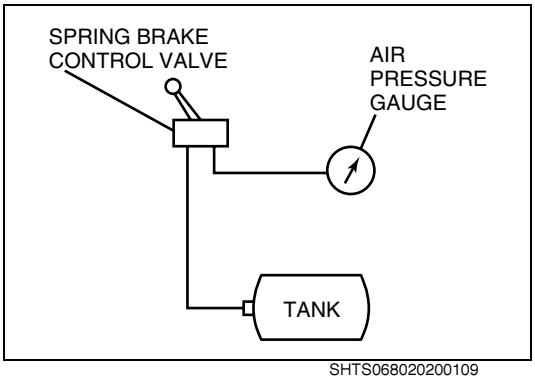
(2) When installing the cam assembly to the valve body, the valve body pin and straight groove of the cam must be aligned.



SHTS068020200108

(3) Adjust dimension "A" with the shim.
Assembly standard: 33.8-34.2 mm {1.331-1.346 in.}

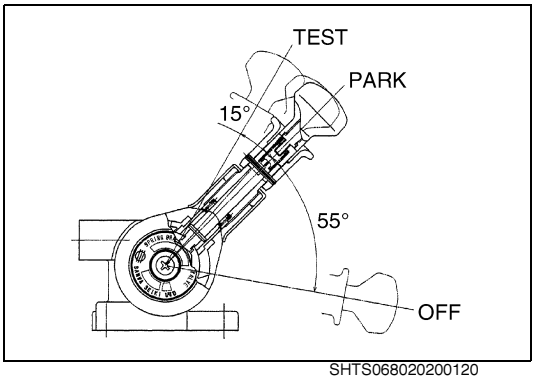
a. Cam
b. Cam holder
c. Shim



SHTS068020200109

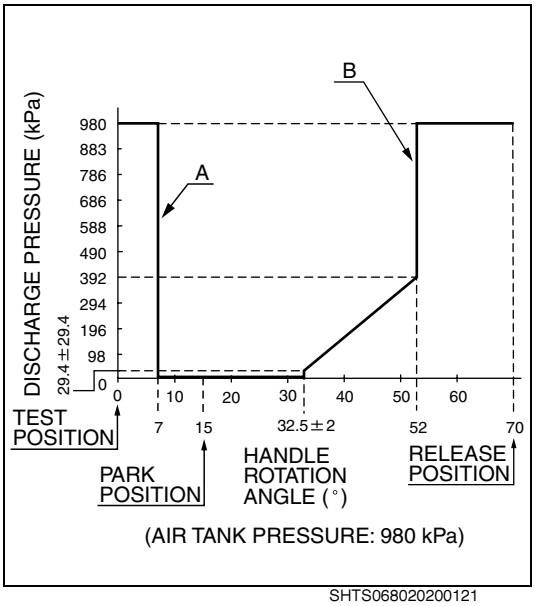
3. SPRING BRAKE CONTROL VALVE PERFORMANCE TEST

(1) First, connect the pressure gauge to the outlet line and apply an air pressure of 980 kPa {10.0 kgf/cm^2, 142 lbf/in.^{2}} to the inlet line.



SHTS068020200120

(2) Move the spring brake control handle towards the OFF position, gradually and confirm that the air pressure in the outlet line meets the characteristic shown in figure below.



SHTS068020200121

NOTICE

The characteristic shown is under the inlet pressure of 980 kPa {10.0 kgf/cm^2, 142 lbf/in.^{2}}

A- Outlet pressure (To multiple relay valve)
B- Outlet pressure (To spring brake line and multiple relay valve)

(3) Confirm the following functions.

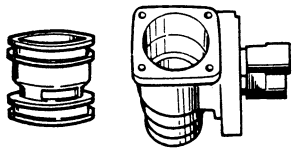
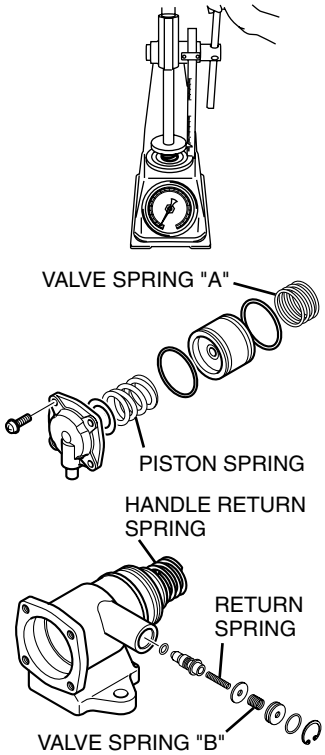
a. The control handle is locked at PARK position.

b. The control handle automatically turn to OFF position when the handle is released PARK position.

INSPECTION AND REPAIR

EN0680202H300014

Unit: mm {in.}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Piston and valve body: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Cam, pin and cam holder: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Piston spring, valve spring, handle return spring: Free length/ Setting length/ Setting load Crack, rust and damage	**Piston spring 26.8 {1.06}/ 24.8 {0.98}/ 651.7 N {66.5 kgf, 146.50 lbf}**	**588.0 N {60.0 kgf, 132.19 lbf} (Setting load)**	**Replace, if necessary.**	**Measure and visual check** 
	Valve spring A 19.6 {0.77}/ 10.5 {0.41}/ 19.6 N {2.0 kgf, 4.41 lbf}	**17.6 N {1.8 kgf, 3.96 lbf} (Setting load)**		
	Handle return spring 19.3 {0.76}/ 13.5 {0.53}/ 7.8 N {0.8 kgf, 1.76 lbf}	**6.9 N {0.7 kgf, 1.54 lbf} (Setting load)**		
	Valve spring B 11.2 {0.44}/ 7.8 {0.31}/ 19.6 N {2.0 kgf, 4.41 lbf}	**18.0 N {1.8 kgf, 4.05 lbf} (Setting load)**		
	Return spring 32.0 {1.26}/ 29.0 {1.14}/ 9.8 N {1.0 kgf, 2.20 lbf}	**8.8 N {0.9 kgf, 1.98 lbf} (Setting load)**		
Feed valve spring and valve seat spring: Rust and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

RELAY VALVE (TYPE-A)

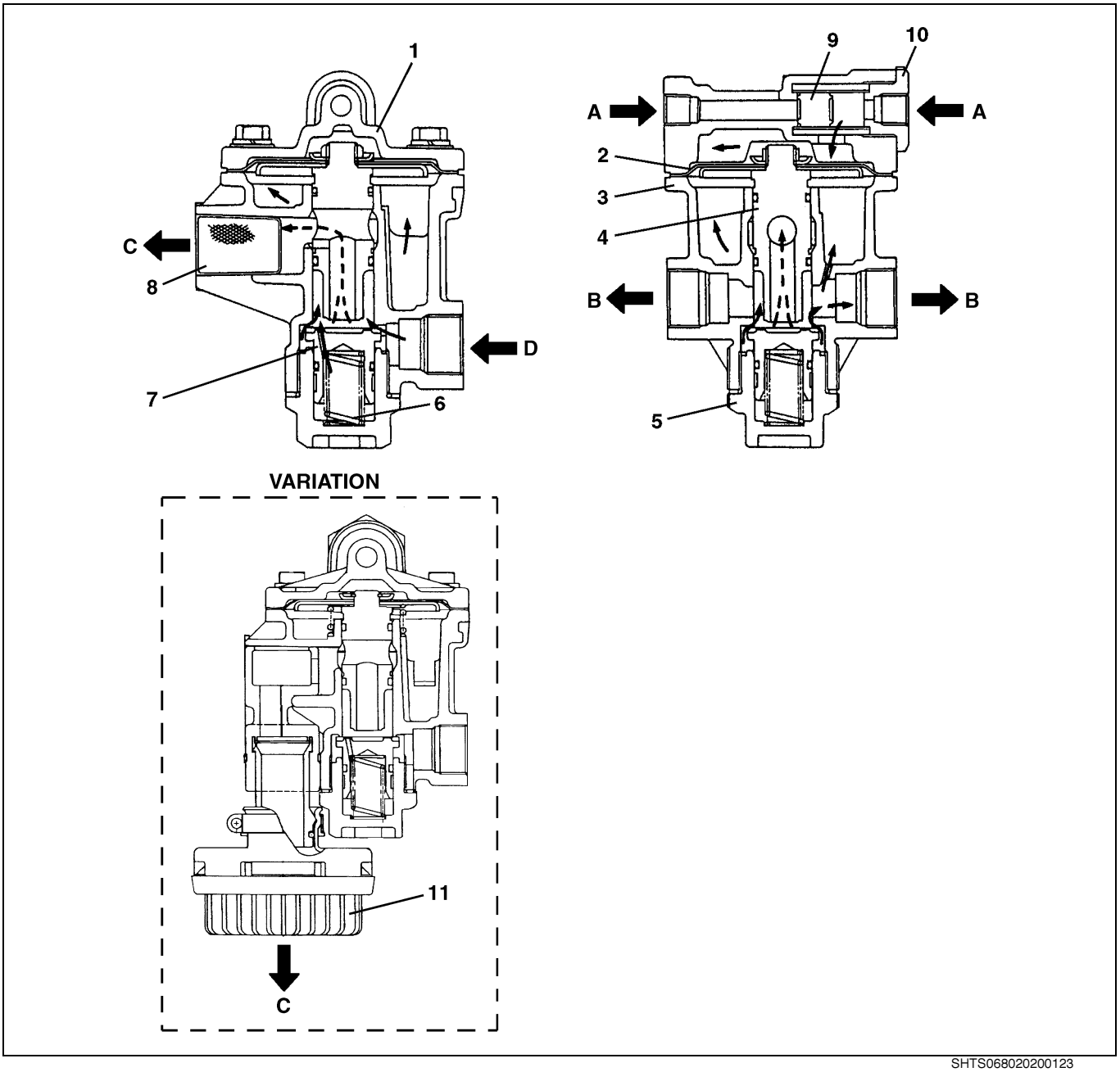
DATA AND SPECIFICATIONS

EN0680202I200012

Type	Diaphragm type with double check valve combined
Pressure difference between signal and outlet pressure	29.4 kPa {0.29 kgf/cm^2, 4.26 lbf/in.^{2}} or less

DESCRIPTION

EN0680202C100013

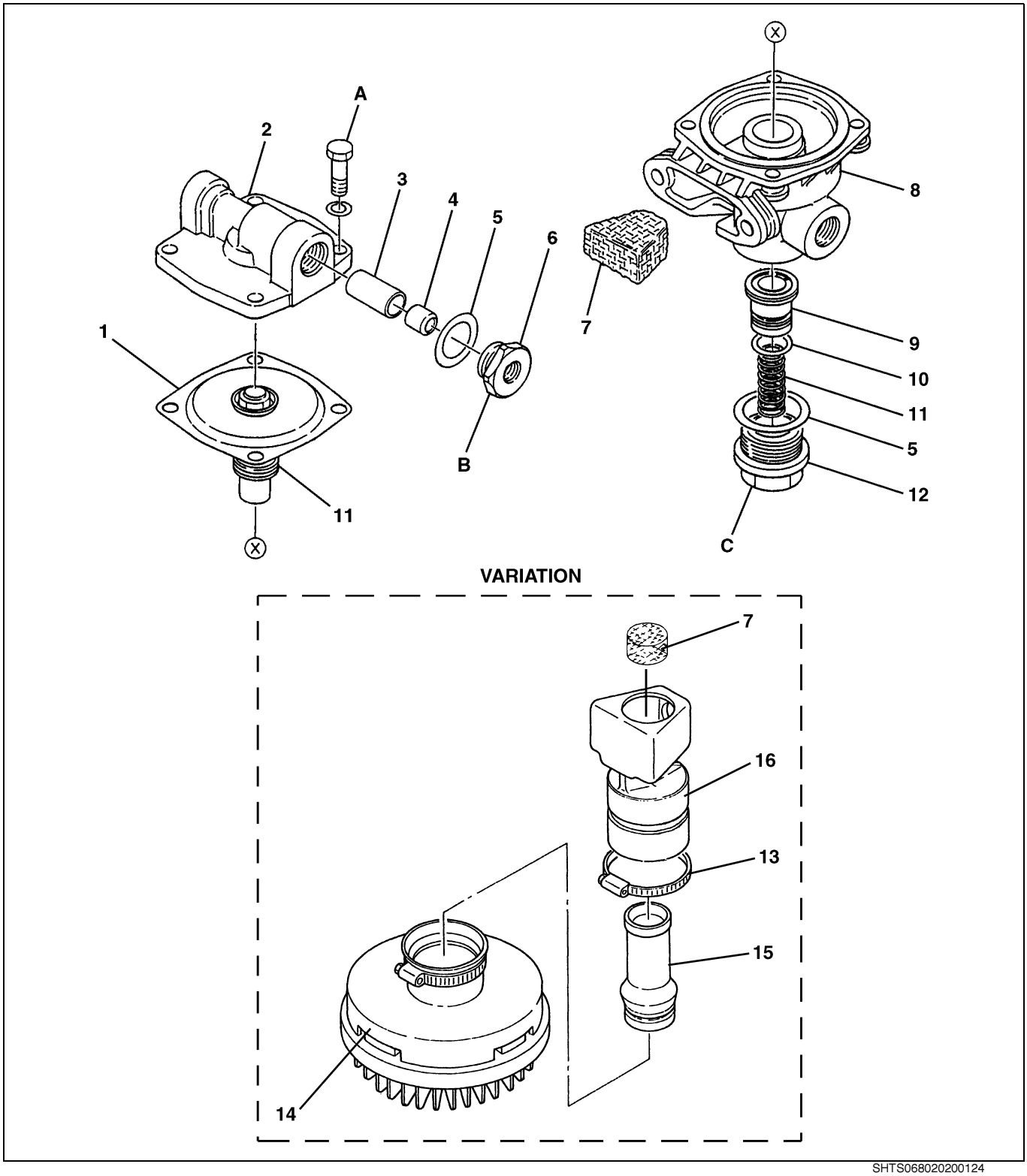


SHTS068020200123

1	Cover	9	Valve
2	Diaphragm	10	Plug
3	Valve body	11	Silencer
4	Valve sub assembly	A	Signal
5	Valve cap	B	Outlet
6	Spring	C	Exhaust
7	Valve	D	Inlet
8	Filter		

COMPONENT LOCATOR

EN0680202D100012



SHTS068020200124

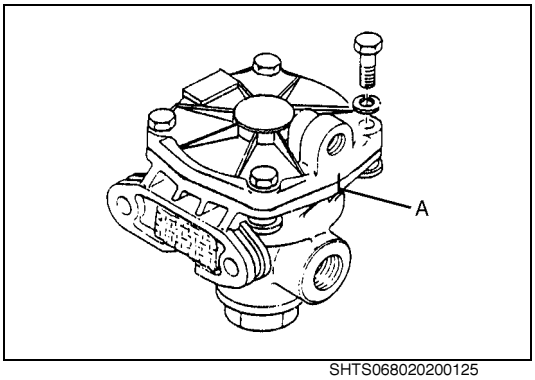
1	Valve sub assembly	9	Valve
2	Cover	10	O-ring
3	Guide	11	Spring
4	Valve	12	Valve cap
5	Gasket	13	Clip
6	Plug	14	Silencer
7	Filter	15	Pipe
8	Valve body	16	Dust cover

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	11.8-14.7 {120-150, 9-10}	C	58.8-78.4 {600-800, 44-57}
B	34.3-44.1 {350-450, 26-32}		

OVERHAUL

EN0680202H200011

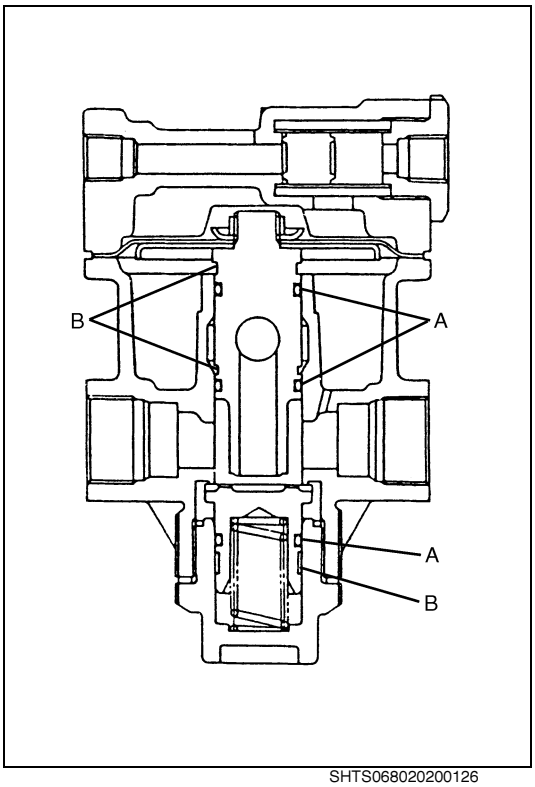


SHTS068020200125

IMPORTANT POINT - DISASSEMBLY

NOTICE

Before disassembling the relay valve, mark the aligning marks "A" on the cover and valve body.



SHTS068020200126

IMPORTANT POINT - ASSEMBLY

1. LUBRICATION

(1) When assembling the relay valve, use new O-rings and valves.

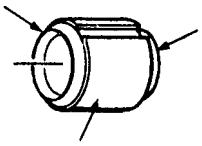
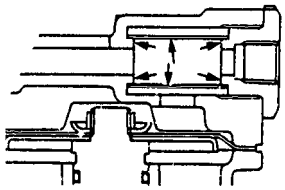
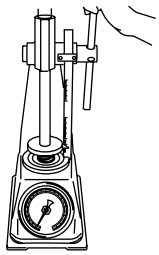
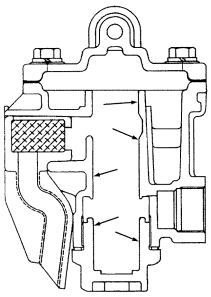
(2) Apply the silicone grease to each sliding surface of the component parts and O-ring groove.
A: O-ring
B: Apply the silicone grease

(3) When installing the cover to the body, align the aligning marks which were applied at disassembly.

INSPECTION AND REPAIR

EN0680202H300015

Unit: mm {in.}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Check valve: Wear and damage	—	—	Replace, if necessary.	Visual check 
Cover, guide and plug: Damage, wear and rust	—	—	Clean or replace, if necessary.	Visual check 
Spring: Free length/ Setting length/ Setting load Crack, rust and damage	46 {1.81}/ 30 {1.18}/ 59.3 N {6.05 kgf, 13.33 lbf}	52.0 N {5.30 kgf, 11.69 lbf} (Setting load)	Replace, if necessary.	Measure and Visual check 
Relay valve body and cap sliding surface: Damage, wear and rust	—	—	Clean or replace, if necessary.	Visual check 

RELAY VALVE (TYPE-B)

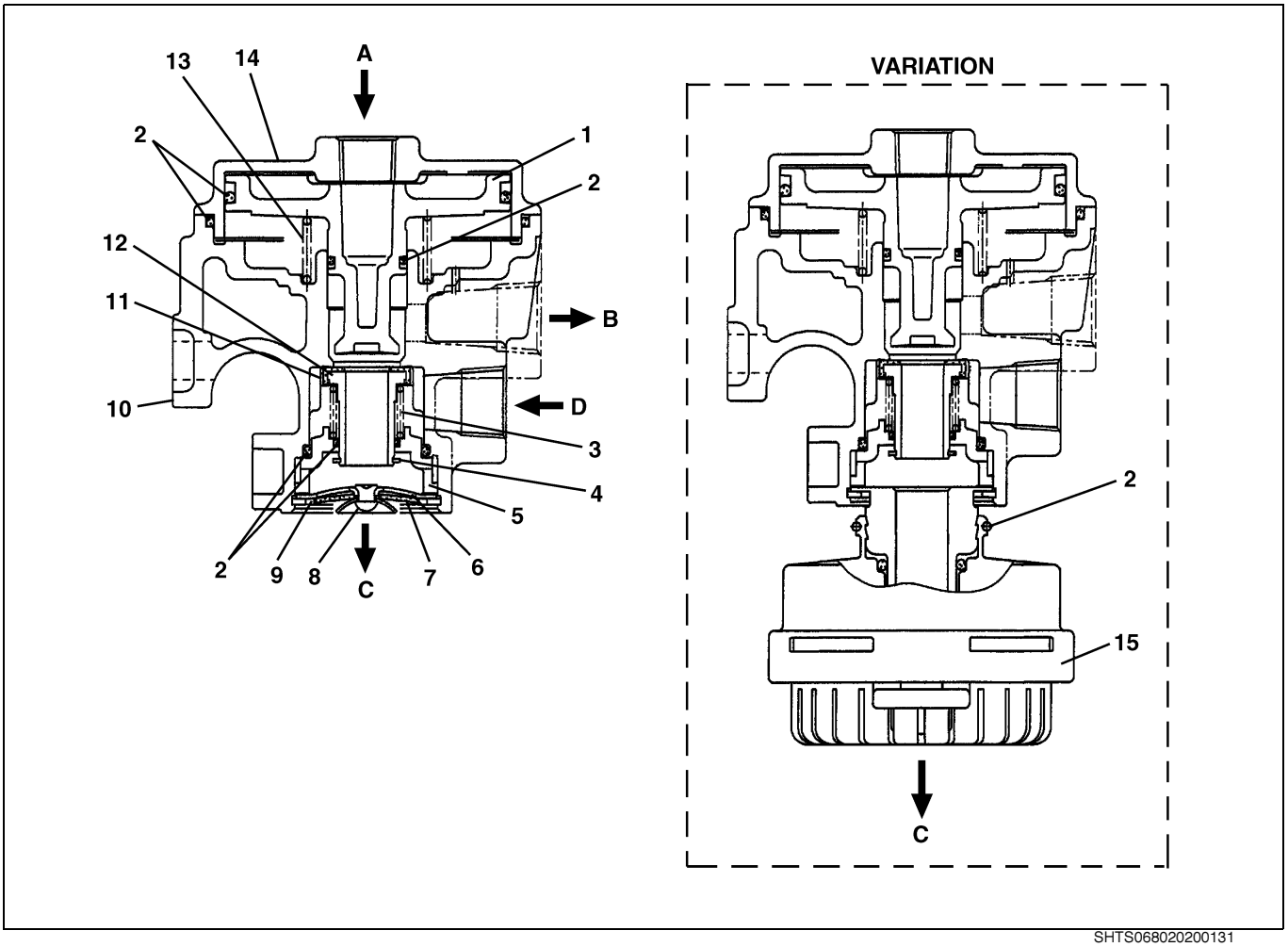
DATA AND SPECIFICATIONS

EN0680202I200013

Type	**Diaphragm type with double check valve combined**
Pressure difference between signal and outlet pressure	**34 kPa {0.34 kgf/cm^2, 4.93 lbf/in.^{2}} or less (At output pressure is 50 kPa {0.51 kgf/cm^2, 7.25 lbf/in.^{2}} or more)**

DESCRIPTION

EN0680202C100014

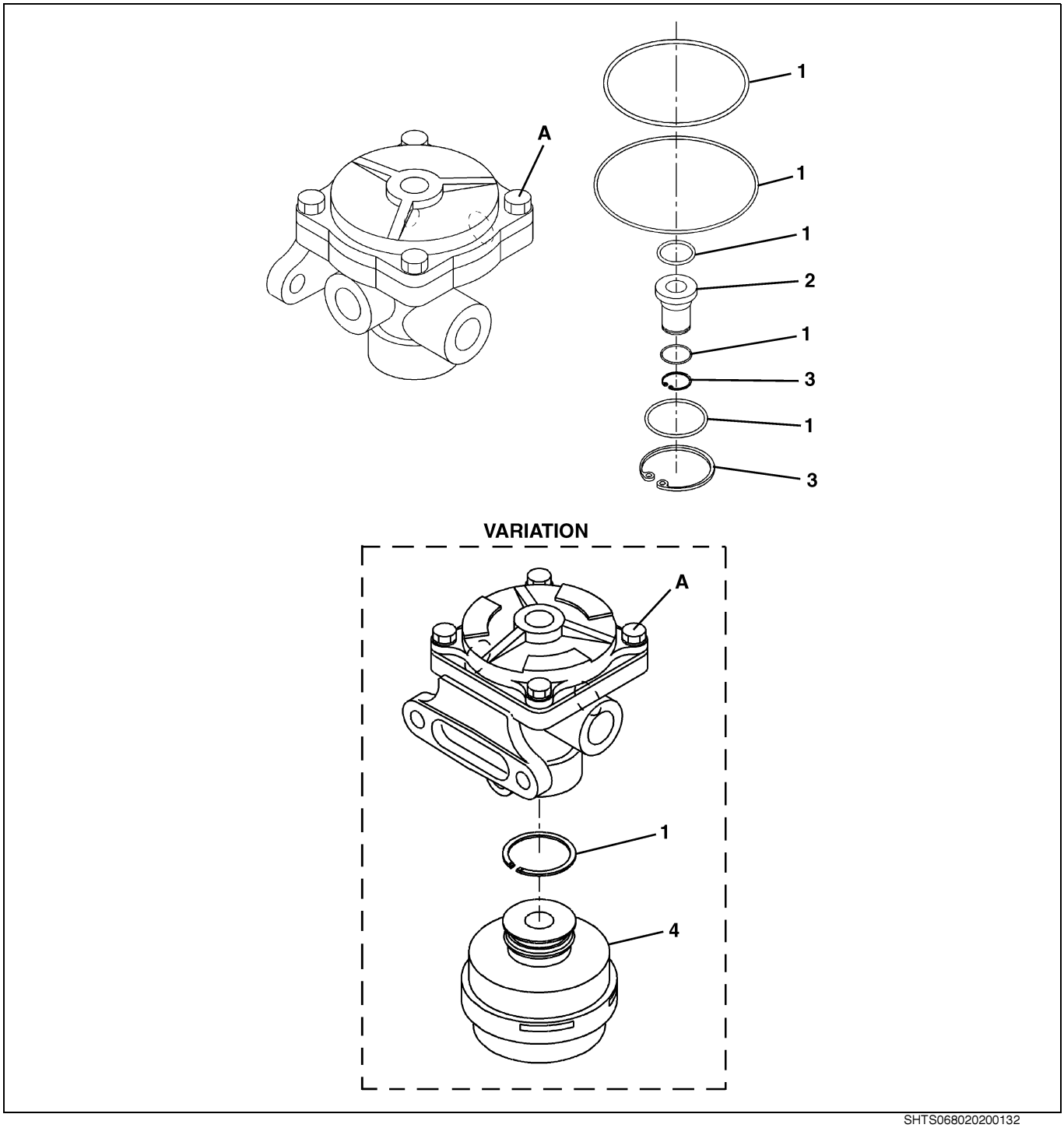


SHTS068020200131

1	Piston	10	Body
2	O-ring	11	Retainer
3	Valve spring	12	Inlet valve
4	Valve retainer	13	Piston spring
5	Valve guide	14	Cover
6	Valve seat	A	Signal
7	Exhaust valve	B	Outlet
8	Rivet	C	Exhaust
9	Retainer ring	D	Inlet

COMPONENT LOCATOR

EN0680202D100013



SHTS068020200132

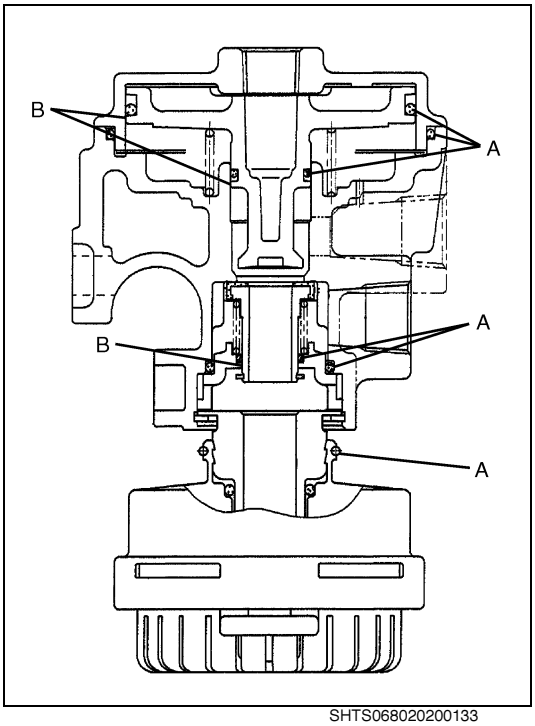
1	O-ring	3	Retainer ring
2	Inlet valve	4	Silencer

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	12-19 {123-193, 8.9-14}	

OVERHAUL

EN0680202H200012



SHTS068020200133

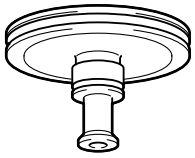
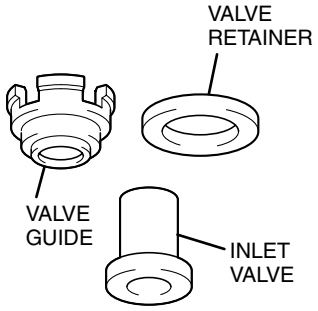
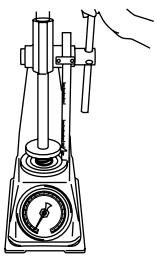
IMPORTANT POINT - ASSEMBLY

1. LUBRICATION
(1) When assembling the relay valve, use new O-rings and valves.
(2) Apply the silicone grease to each sliding surface of the component parts and O-ring groove.
A: O-ring
B: Apply the silicone grease

INSPECTION AND REPAIR

EN0680202H300016

Unit: mm {in.}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Piston and sliding surface of cover and valve body: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Inlet valve, valve guide, valve retainer and valve body sliding surface: Wear and damage	**—**	**—**	**Clean or replace, if necessary.**	**Visual check** 
Valve spring and piston spring: Free length/ Setting length/ Setting load Crack, rust and damage	**Valve spring 23.5 {0.93}/ 15.7 {0.62}/ 29.0 N {2.96 kgf, 6.52 lbf}**	**21.8 N {2.22 kgf, 4.90 lbf} (Setting load)**	**Replace, if necessary.**	**Measure and visual check** 
	Piston spring 34.5 {1.36}/ 18.8 {0.74}/ 54.6 N {5.57 kgf, 12.27 lbf}	**41.0 N {4.18 kgf, 9.22 lbf} (Setting load)**		

CUT VALVE

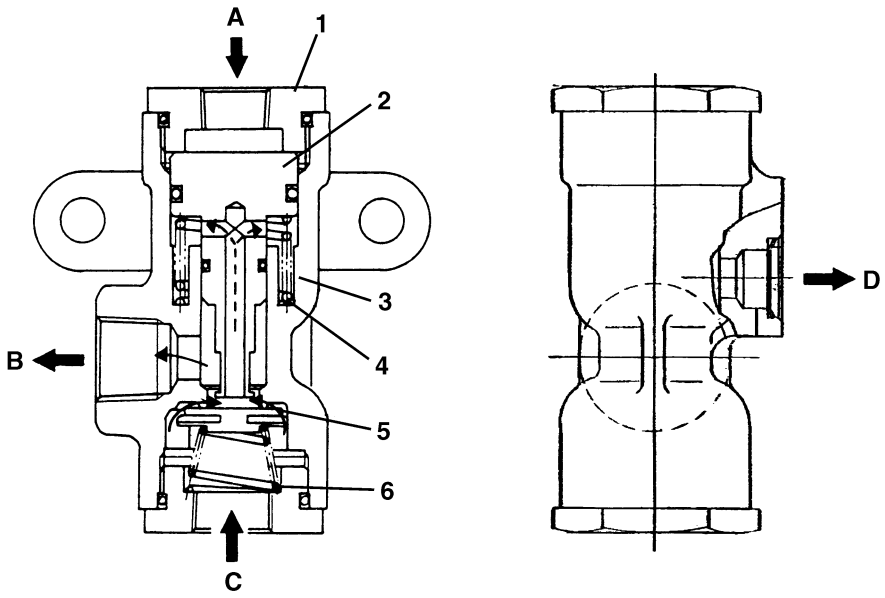
DATA AND SPECIFICATION

EN0680202I200014

Type	Spring type

DESCRIPTION

EN0680202C100015

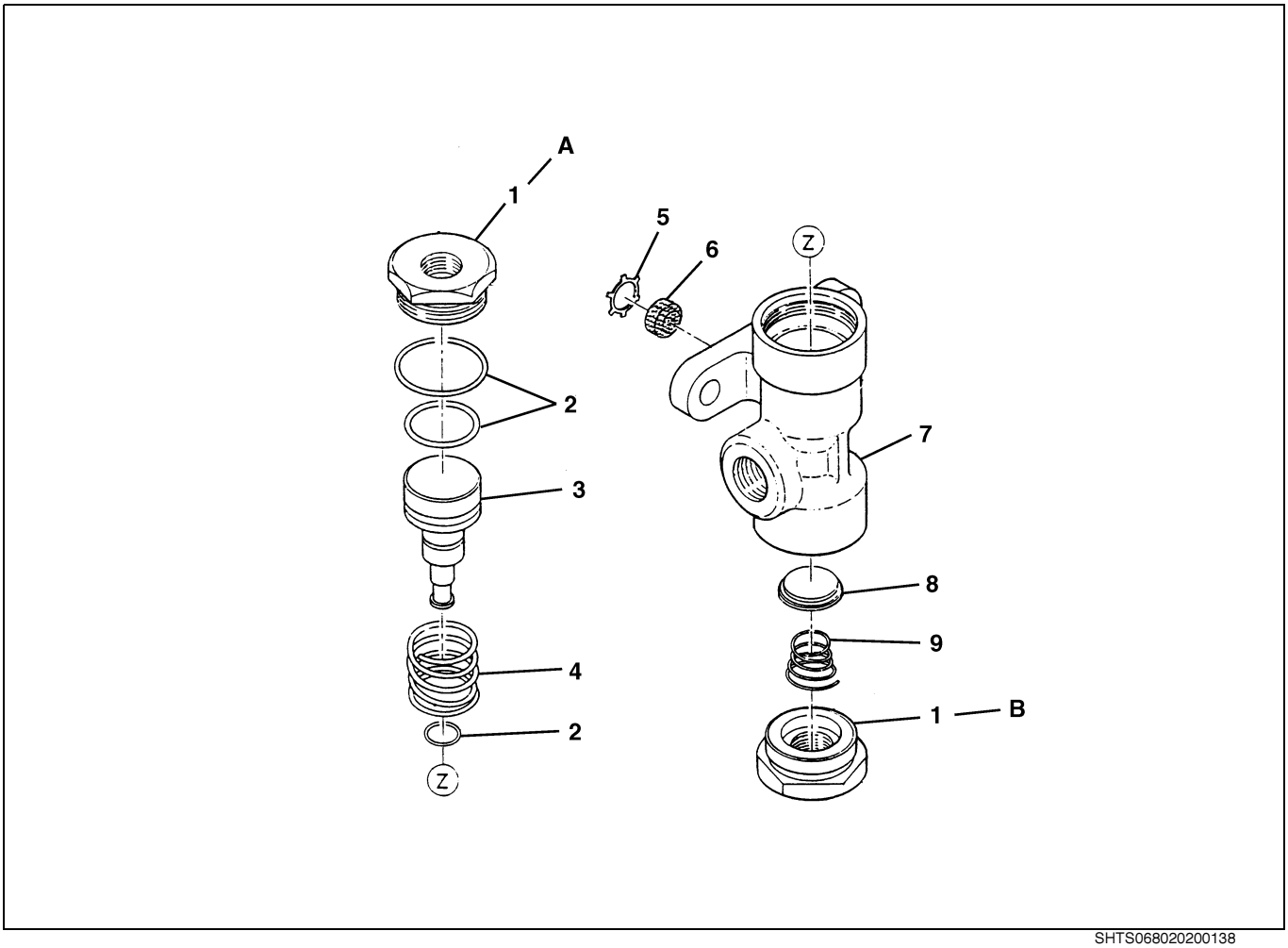


SHTS068020200137

1	Valve cap	6	Conical spring
2	Piston	A	Signal
3	Valve body	B	Outlet
4	Compression spring	C	Inlet
5	Valve sub assembly	D	Exhaust

COMPONENT LOCATOR

EN0680202D100014



SHTS068020200138

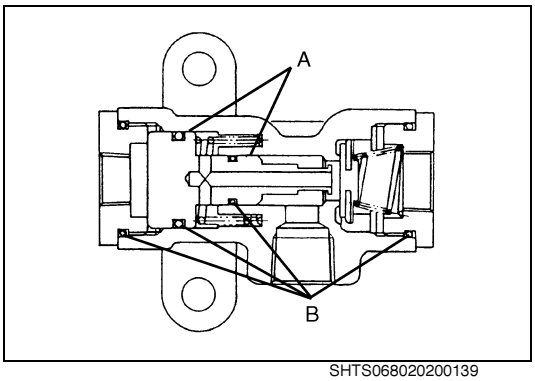
1	Valve cap	4	Compression spring	7	Valve body
2	O-ring	5	Ring retainer	8	Valve sub assembly
3	Piston	6	Filter	9	Conical spring

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	49.04-58.83 {500-600, 36.2-43.3}	B	49.04-58.83 {500-600, 36.2-43.3}

OVERHAUL

EN0680202H200013



SHTS068020200139

IMPORTANT POINT - ASSEMBLY

1. LUBRICATION

(1) When assembling the cut valve, use the new O-ring and retainer ring.

(2) Apply the silicone grease to the each sliding surface of the component parts and O-ring groove.

NOTICE

Check the air leakage from exhaust port, with the piston at the released position.

A: Sliding surface

B: O-ring

PERFORMANCE CHARACTERISTIC

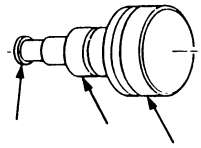
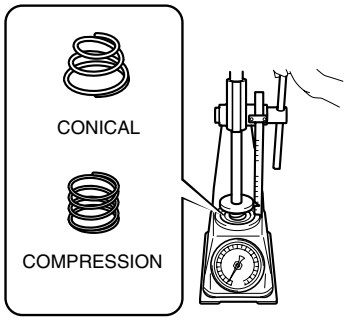
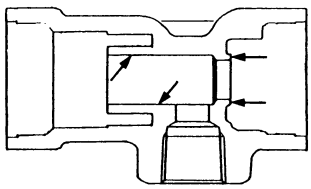
1. When the inlet pressure is 686 kPa {7.0 kgf/cm^2, 99.54 lbf/in.^{2}}, the valve should be opened with the signal pressure of below 343 kPa {3.5 kgf/cm^2, 49.77 lbf/in.^{2}} and the valve should be closed with the signal pressure of 147-245 kPa {1.5-2.4 kgf/cm^2, 21.32-35.53 lbf/in.^{2}}.

2. When the inlet and signal pressure are decreasing at same time, the valve should be closed at pressure of 99-196 kPa {1.0-2.0 kgf/cm^2, 14.22-28.44 lbf/in.^{2}}.

3. When the inlet and signal pressure are increasing at same time, the valve should be opened with the pressure of 148-245 kPa {1.5-2.5 kgf/cm^2, 21.33-35.55 lbf/in.^{2}}.

INSPECTION AND REPAIR

EN0680202H300017

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Sliding surface and valve contact surface of piston: Wear and damage	—	—	Replace, if necessary.	Visual check 
Conical spring and compression spring: Free length/ setting length/ setting load Crack, rust and damage	Conical spring: 17.6 mm {0.69 in.}/ 15.4 mm {0.61 in.}/ 0.08 N {0.008 kgf, 0.0180 lbf}	16.6 mm {0.66 in.} (Free length)	Replace, if necessary.	Visual check 
	Compression spring: 22.5 mm{0.90 in.}/ 15.5 mm {0.51 in.}/ 7.0 N {0.714 kgf, 1.5737 lbf}	20.5 mm {0.81 in.} (Free length) 6.7 N {0.684 kgf, 1.5063 lbf} (Setting load)		
Valve body: Sliding surface and contact surface: Wear and damage	—	—	Replace, if necessary.	Visual check 

REDUCING VALVE (TYPE-A)

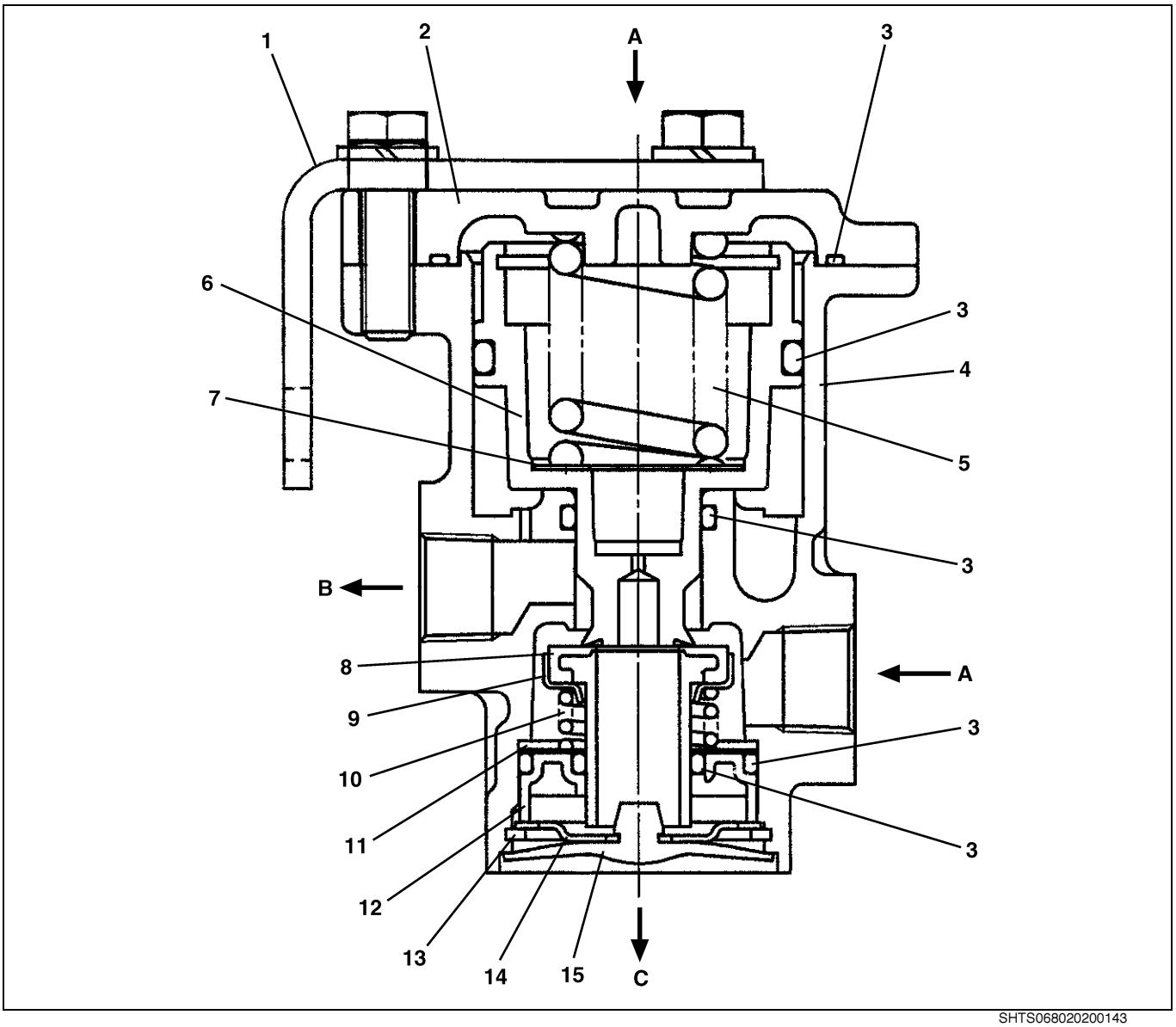
DATA AND SPECIFICATIONS

EN0680202I200015

Type	**Piston**
Outlet pressure	**520.4-559.6 kPa {5.4-5.7 kgf/cm^2, 75.5-81.1 lbf/in.^{2}} at inlet pressure 690 kPa {7.0 kgf/cm^2, 100.0 lbf/in.^{2}}**

DESCRIPTION

EN0680202C100016

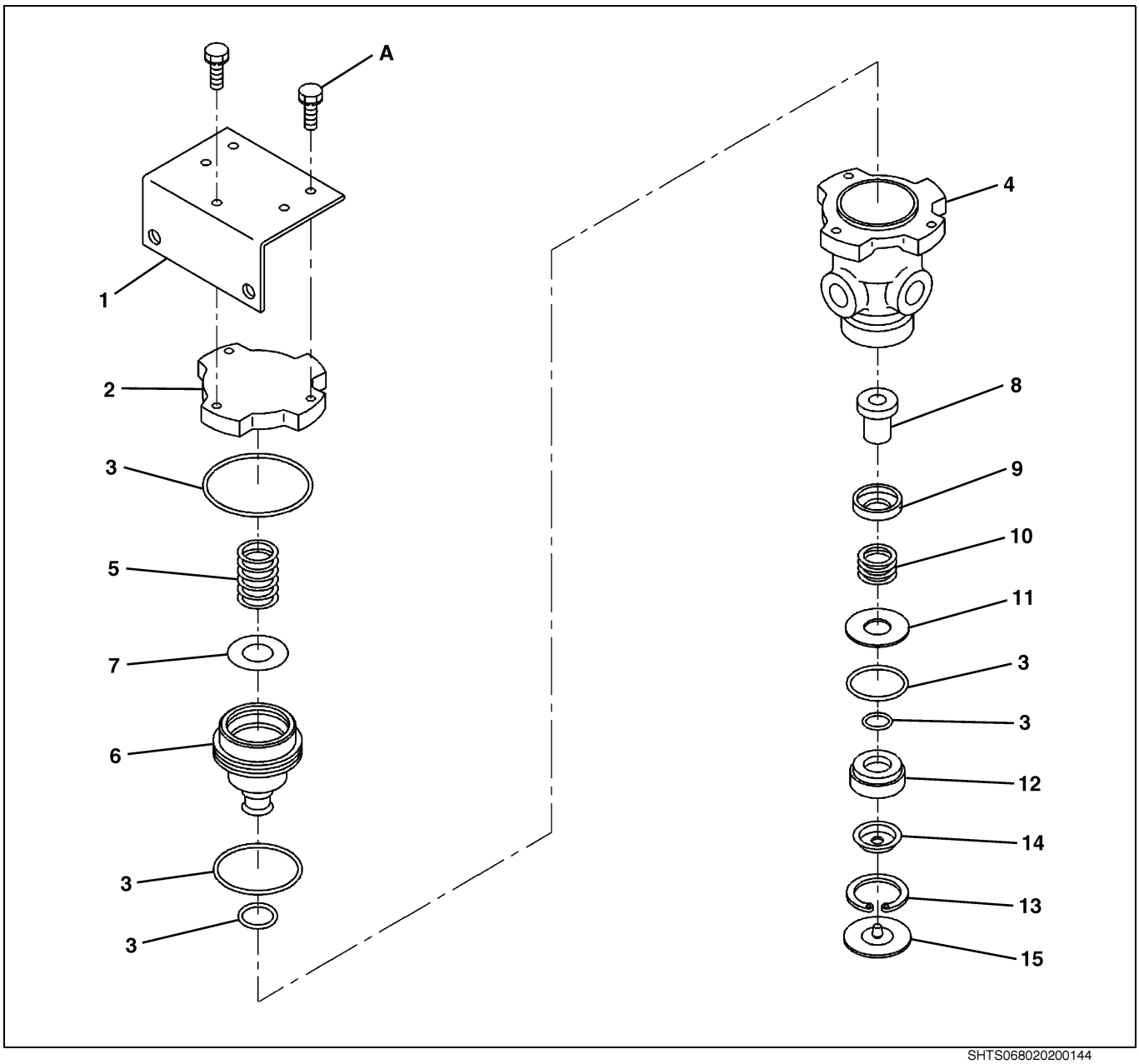


SHTS068020200143

1	Bracket	10	Spring
2	Cover	11	Spring seat
3	O-ring	12	Retainer
4	Valve body	13	Ring retainer
5	Spring	14	Valve seat
6	Piston	15	Check valve
7	Shim	A	Inlet
8	Valve	B	Outlet
9	Retainer	C	Exhaust

COMPONENT LOCATOR

EN0680202D100015



SHTS068020200144

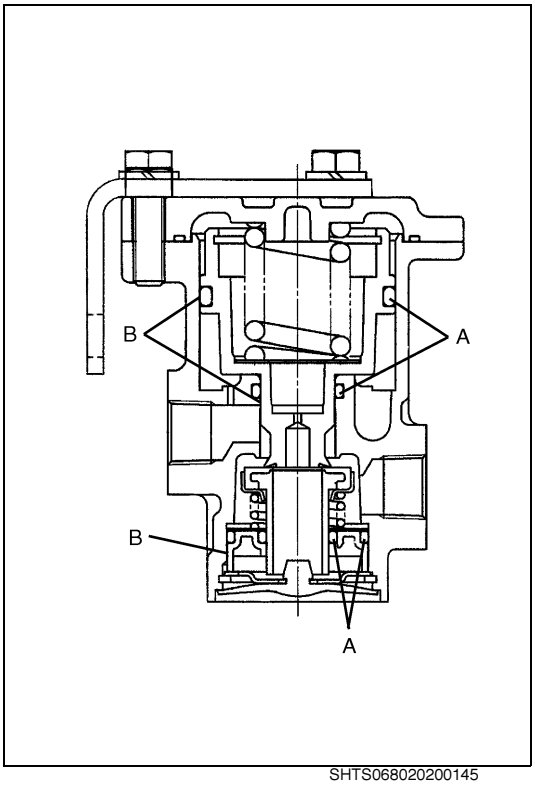
1	Bracket	9	Retainer
2	Cover	10	Spring
3	O-ring	11	Spring seat
4	Valve body	12	Retainer
5	Spring	13	Ring retainer
6	Piston	14	Valve seat
7	Shim	15	Check valve
8	Valve		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	9.8-19.6 {100-200, 7.3-14.4}		

OVERHAUL

EN0680202H200014



SHTS068020200145

IMPORTANT POINT - ASSEMBLY

1. LUBRICATION

(1) When assembling the relay valve, use new O-rings and valves.

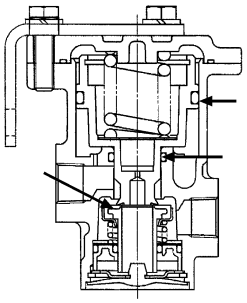
(2) Apply the silicone grease to each sliding surface of the component parts and O-ring groove.

A: O-ring

B: Apply the silicone grease

INSPECTION AND REPAIR

EN0680202H300018

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Spring: Rust and damage	—	—	**Replace, if necessary.**	**Visual check** 
Valve body and piston sliding surface: Damage, wear and rust	—	—	**Clean or replace, if necessary.**	**Visual check** 
Valve contact surface: Damage, wear and rust	—	—		

REDUCING VALVE (TYPE-B)

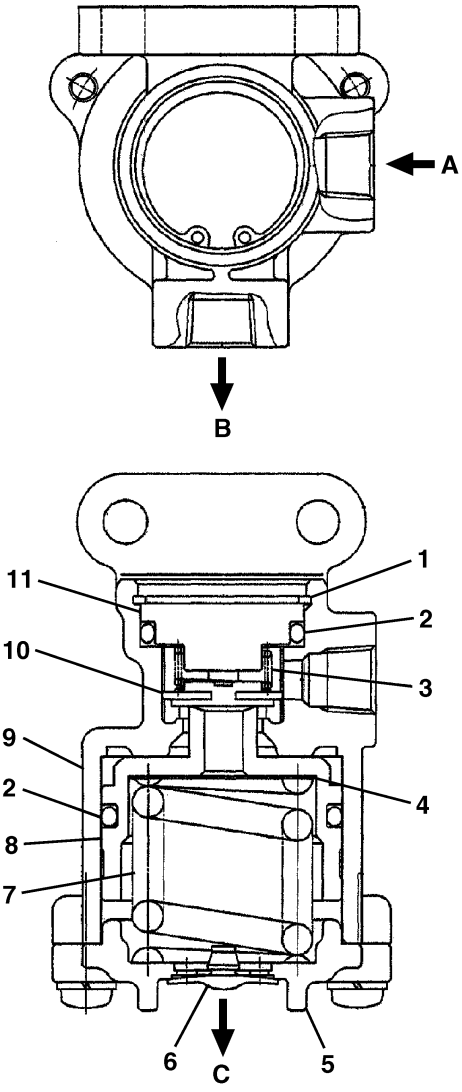
DATA AND SPECIFICATIONS

EN0680202I200016

Type	**Piston**
Outlet pressure	**784-824 kPa {8.0-8.4 kgf/cm^2, 113.8-119.5 lbf/in.^{2}} at inlet pressure 980 kPa {10.0 kgf/cm^2, 142.1 lbf/in.^{2}}**

DESCRIPTION

EN0680202C100017

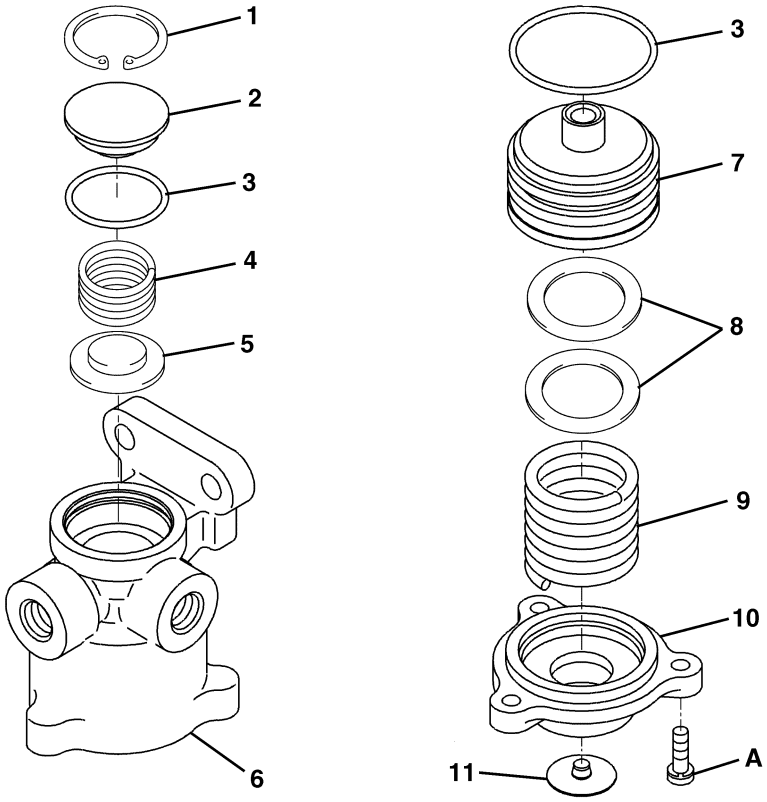


SHTS068020200148

1	Retainer ring	8	Piston
2	O-ring	9	Body
3	Valve spring	10	Valve
4	Shim	11	Valve cover
5	Lower cover	A	Inlet
6	Check valve	B	Outlet
7	Main spring	C	Exhaust

COMPONENT LOCATOR

EN0680202D100016



SHTS068020200149

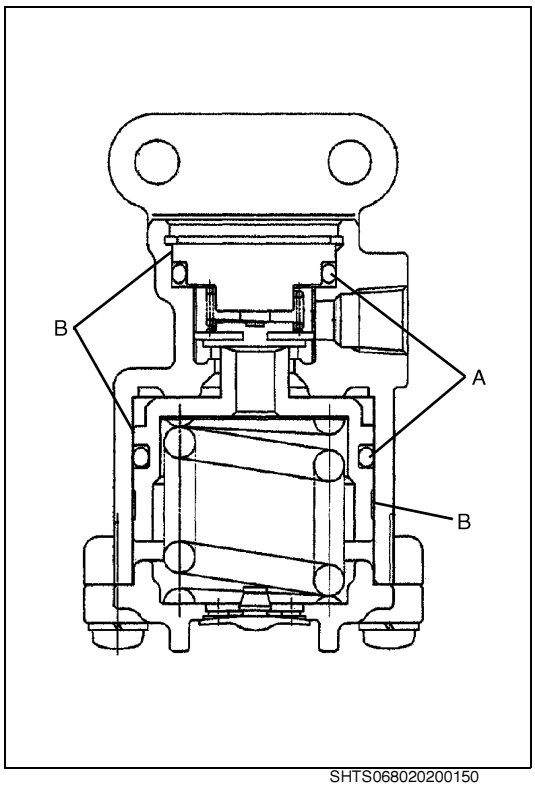
1	Retainer ring	7	Piston
2	Cover	8	Shim
3	O-ring	9	Main spring
4	Valve spring	10	Lower cover
5	Valve	11	Check valve
6	Body		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	6.2-7.8 {64-79, 4.6-5.7}	

OVERHAUL

EN0680202H200015



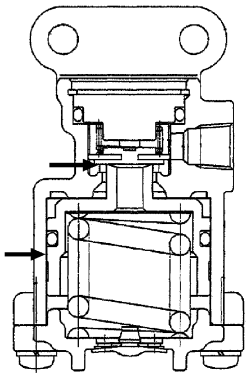
SHTS068020200150

IMPORTANT POINT - ASSEMBLY

1. LUBRICATION
(1) When assembling the relay valve, use new O-rings and valves.
(2) Apply the silicone grease to each sliding surface of the component parts and O-ring groove.
A: O-ring
B: Apply the silicone grease

INSPECTION AND REPAIR

EN0680202H300019

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Spring: Rust and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Valve body and piston sliding surface: Damage, wear and rust	**—**	**—**	**Clean or replace, if necessary.**	**Visual check** 
Valve contact surface: Damage, wear and rust	**—**	**—**		

BRAKE CHAMBER

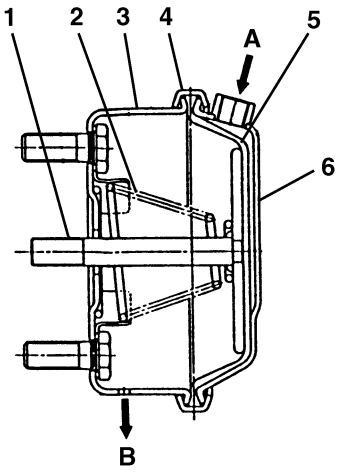
DATA AND SPECIFICATION

EN0680202I200017

Type	**Diaphragm type**

DESCRIPTION

EN0680202C100018

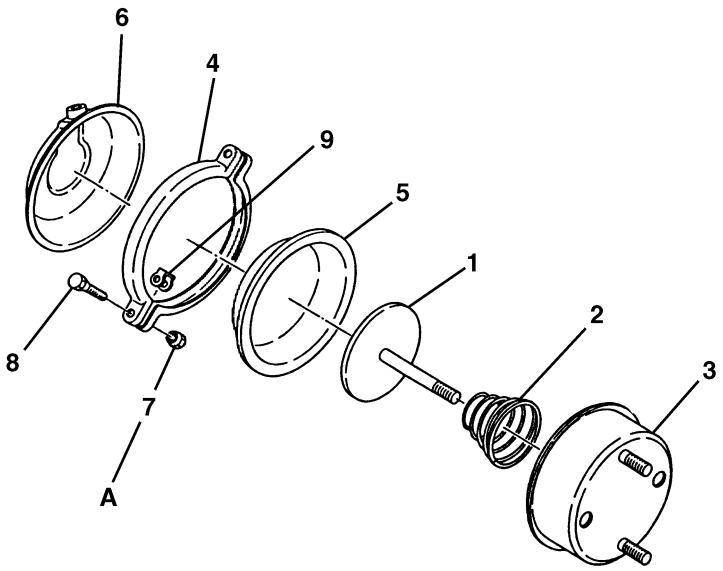


SHTS068020200152

1	Push rod	5	Diaphragm
2	Return spring	6	Chamber cover
3	Chamber	A	Inlet
4	Clamp	B	Drain hole

COMPONENT LOCATOR

EN0680202D100017



SHTS068020200153

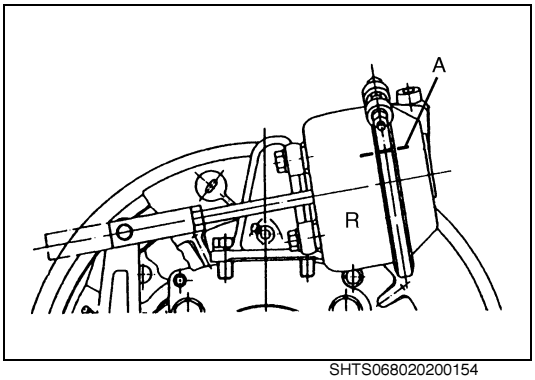
1	Push rod	6	Chamber cover
2	Return spring	7	Clamp nut
3	Chamber	8	Clamp bolt
4	Clamp	9	Spacer
5	Diaphragm		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	26.5-32.3 {270-330, 19.9-24.1}	

OVERHAUL

EN0680202H200016



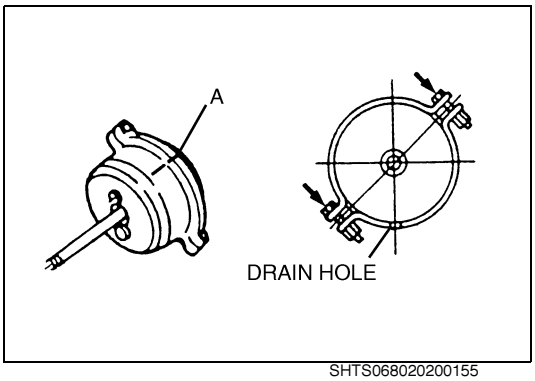
SHTS068020200154

IMPORTANT POINT - DISMOUNTING

1. DISMOUNTING OF THE BRAKE CHAMBER

(1) Before dismounting, apply aligning mark A to the chamber, clamp and chamber cover.

(2) Apply a position mark R or L to identify the side where the chamber was installed.



SHTS068020200155

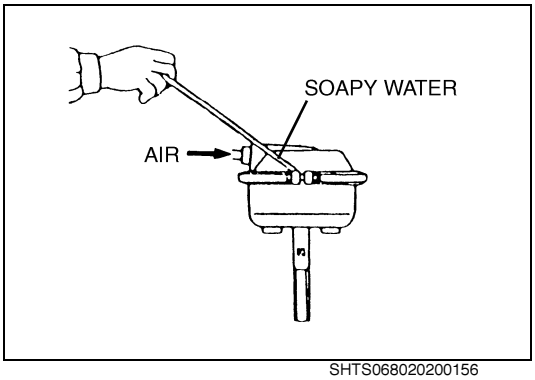
IMPORTANT POINTS - ASSEMBLY

1. ASSEMBLING THE BRAKE CHAMBER

(1) Replace the diaphragm with new one.

(2) Align the aligning mark A of the chamber, clamp and chamber cover.

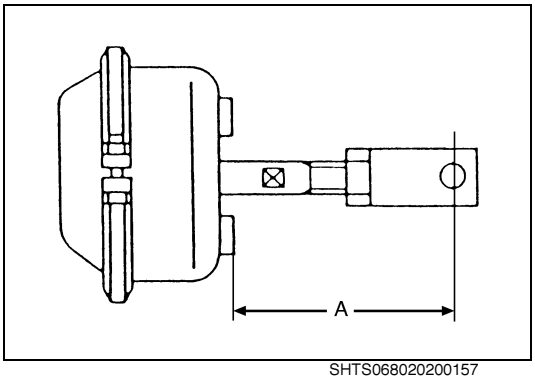
(3) Insert the bolt from opposite side of drain hole and tighten the bolts evenly with nut within the specified torque.



SHTS068020200156

2. CHECKING FOR AIR LEAKAGE

(1) Apply soapy water to the chamber as shown and charge with compressed air of 830 kPa {8.5 kgf/cm^2, 121 lbf/in.^{2}} from the inlet port A then check for leakage.



SHTS068020200157

3. INSTALLING CLEVIS

(1) Install the clevis to the push rod and adjust dimension A to the specified value.
Assembly Standard: 84-86 mm {3.31-3.38 in.}

IMPORTANT POINT - MOUNTING

1. INSTALLING THE BRAKE CHAMBER

(1) The chamber must be mounted on the side as marked when dismounting.

NOTICE

- **See the position mark (R or L) which was applied when dismounting.**
- **When connecting the clevis with the slack adjuster, lubricate the clevis pin hole and clevis pin with sufficient chassis grease.**

INSPECTION AND REPAIR

EN0680202H300020

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Cover, clamp, push rod, return spring and chamber: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

BRAKE CHAMBER (MAKER: WABCO)

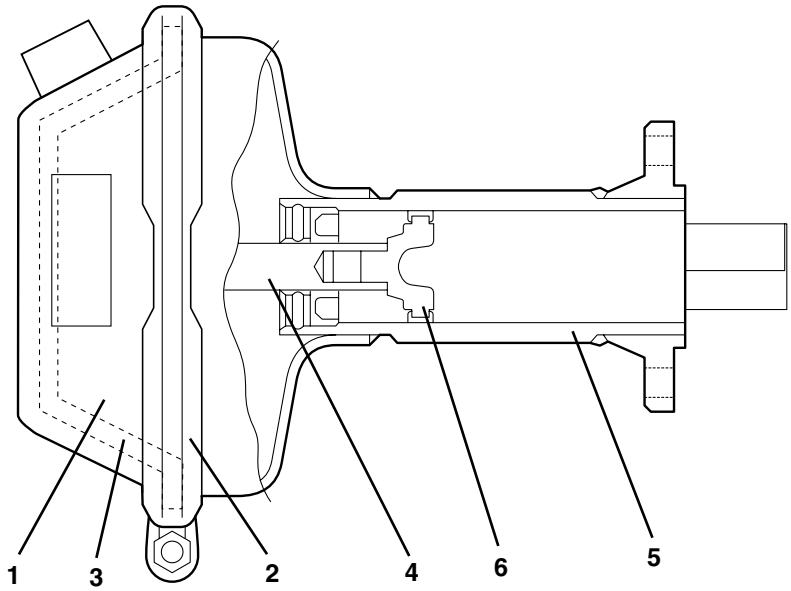
DATA AND SPECIFICATION

EN0680202I200018

Type	**Diaphragm type**

DESCRIPTION

EN0680202C100019

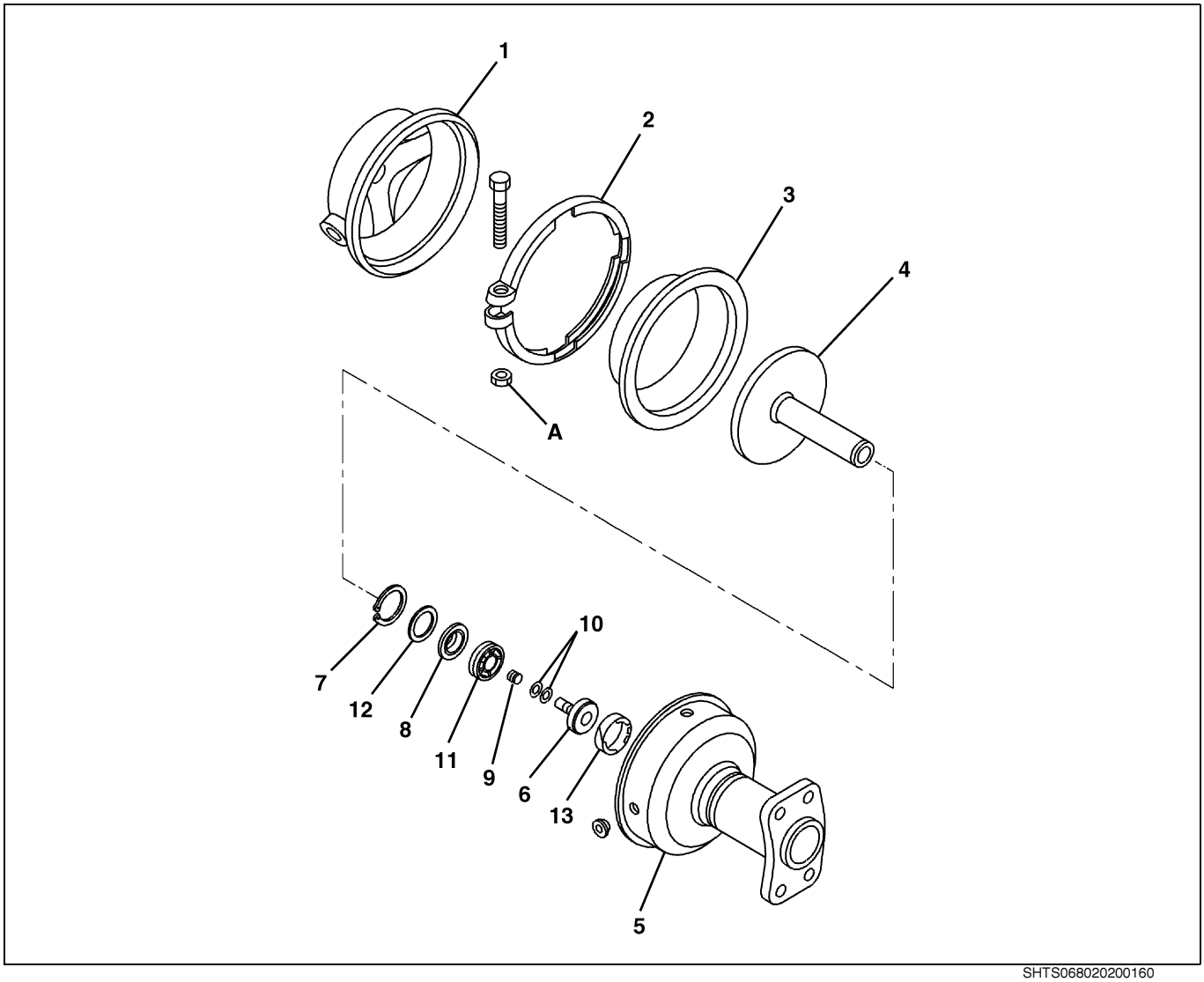


SHTS068020200159

1	**Pressure plate**	**4**	**Push rod**
2	**Clamp ring**	**5**	**Base**
3	**Diaphragm**	**6**	**Push rod guide**

COMPONENT LOCATOR

EN0680202D100018



SHTS068020200160

1	Pressure plate	8	Oil seal
2	Clamp ring	9	Tolerance ring
3	Diaphragm	10	Washer
4	Push rod	11	Guide
5	Base	12	Plate
6	Push rod guide	13	Bushing
7	Snap ring		

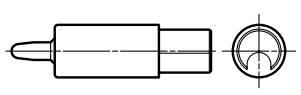
Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	25-30 {260-310, 18.8-22.4}		

SPECIAL TOOL

EN0680202K100001

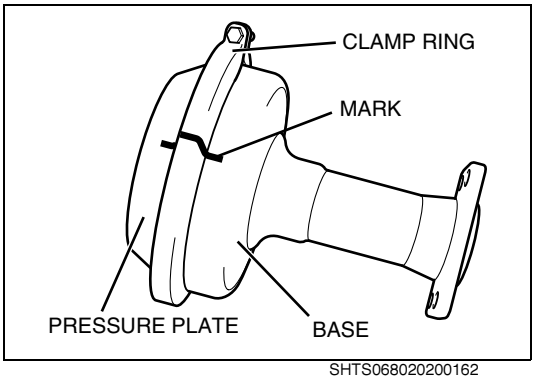
Prior to starting a brake chamber overhaul, it is necessary to have this special tool.

Illustration	Part number	Tool name	Remarks
	09714-1030	WEDGE CHAMBER STROKE TOOL	

OVERHAUL

EN0680202H200017

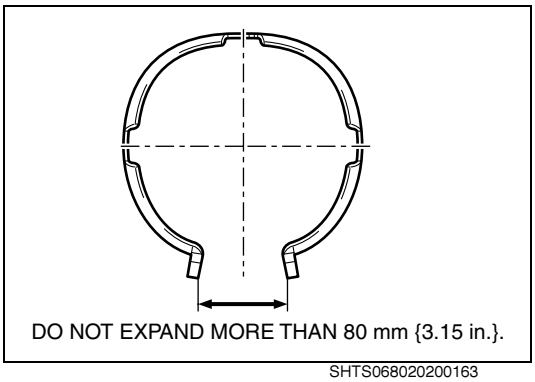
IMPORTANT POINTS - DISASSEMBLY



SHTS068020200162

1. REMOVAL OF PRESSURE PLATE

(1) Make a matching mark to base, clamp ring and pressure plate.

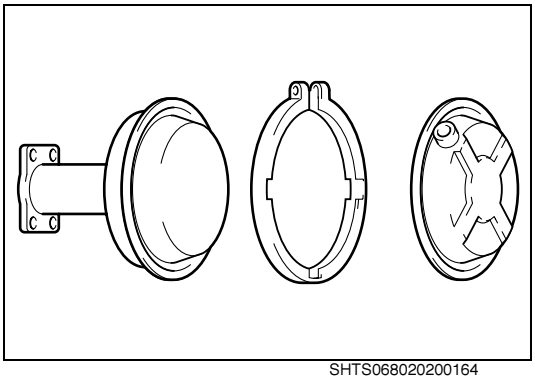


SHTS068020200163

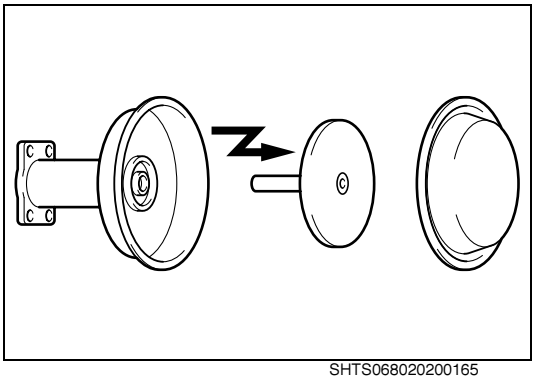
(2) Mark clamp ring not to forget the inserting direction of clamp ring bolt and remove clamp ring.

NOTICE

When removing clamp ring, do not expand the inserting portion of clamp ring bolt by more than 80 mm {3.15 in.}.


SHTS068020200164

(3) Remove pressure plate from base.

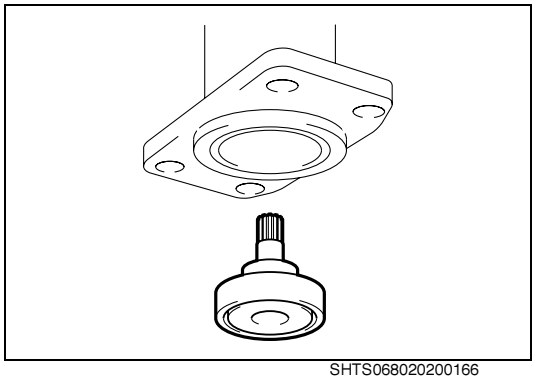

SHTS068020200165

2. REMOVAL OF DIAPHRAGM AND PUSH ROD

(1) Remove diaphragm and push rod from base.

NOTICE

- **Push rod should be removed out, holding plate and repeating to push and pull it straightly for a few times.**
- **When removing, push rod should not be pulled out up or downward, toward right or left, not hammering from the square flange side.**

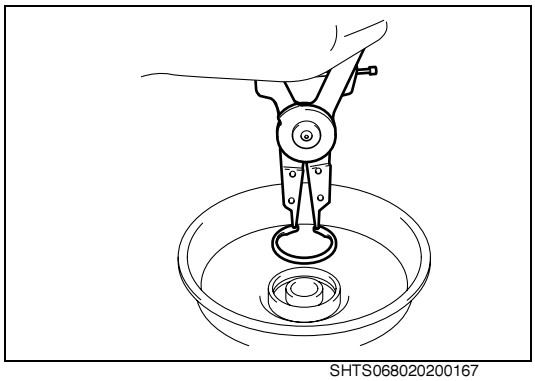

SHTS068020200166

3. REMOVAL OF PUSH ROD GUIDE

(1) Take out push rod guide out of the square flange.

NOTICE

When removing push rod guide, do not drop off a washer in it.


SHTS068020200167

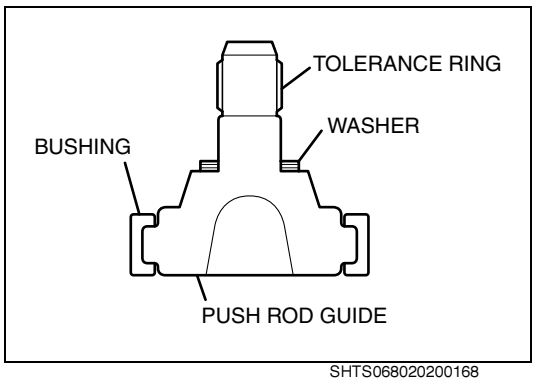
4. REMOVAL OF GUIDE

(1) Remove snap ring, plate and oil seal with snap ring pliers.

NOTICE

Make sure not to jump out a snap ring.

(2) Remove guide, using a pipe having outer diameter of about ϕ37 mm {1.46 in.} and tapping with plastic hammer by making the square flange of base upside.



SHTS068020200168

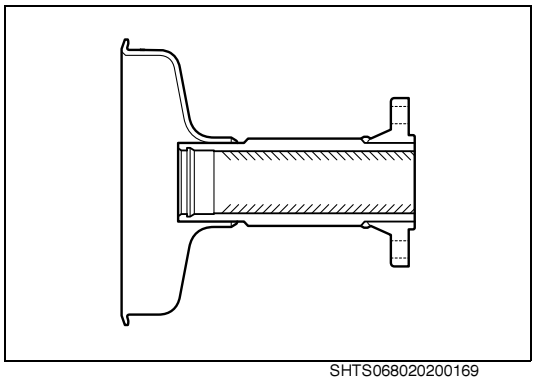
5. DISASSEMBLY OF PUSH ROD GUIDE ASSEMBLY

(1) Remove bushing and tolerance ring from push rod guide.

NOTICE

- **Keep it surely as washer in the push rod guide may be reused when assembling it.**
- **There is a case that tolerance ring may be in the fitting hole at the tip of push rod, in case of which, pick it up with screw-driver, etc.**

IMPORTANT POINTS - ASSEMBLY

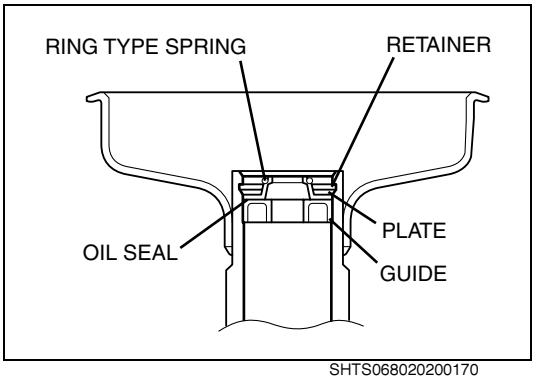

SHTS068020200169

1. INSTALLATION OF GUIDE, OIL SEAL AND PLATE

(1) Apply lightly grease (stored in the repair kit) at moving portion of push rod guide on base.

NOTICE

Never fail to use the grease, stored in the "REPAIR KIT".

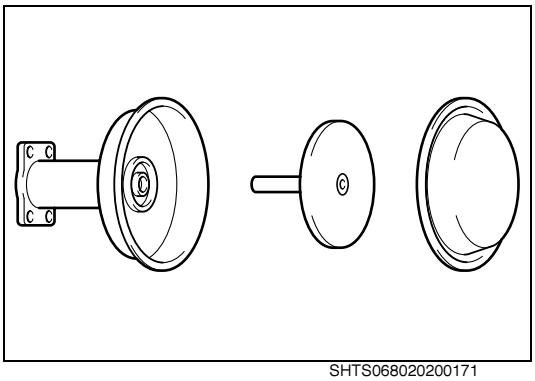


SHTS068020200170

(2) Facing the flat side of new guide to diaphragm side, insert it until it touches down to base by tapping lightly with stick having an outer diameter of about ϕ37 mm {1.46 in.} or box-socket.

NOTICE

- **Confirm that ring type spring is installed on oil seal.**
- **Confirm that retainer is in its groove.**

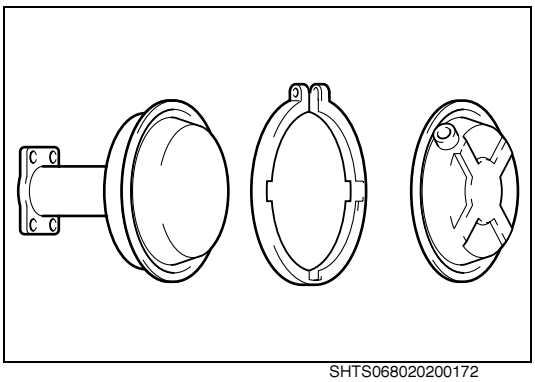

SHTS068020200171

2. INSTALLATION OF PUSH ROD AND DIAPHRAGM

(1) Insert it to base by applying grease (stored in the "REPAIR KIT") at the rod portion of push rod.

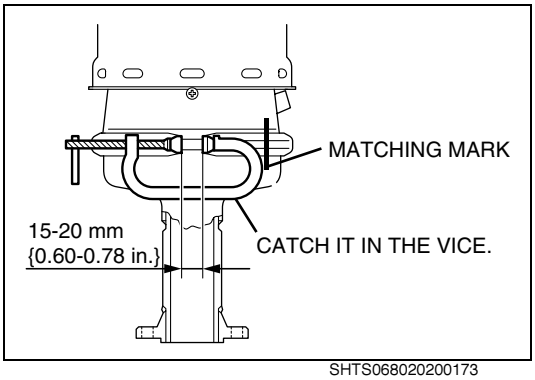
NOTICE

- **Never fail to use grease, stored in the "REPAIR KIT".**
- **When installing push rod, make sure not to damage oil seal.**


SHTS068020200172

3. INSTALLATION OF PRESSURE PLATE

(1) Putting pressure plate on base, align those matching marks.

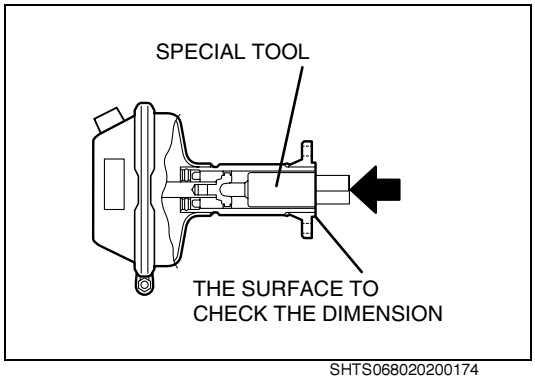


SHTS068020200173

4. INSTALLATION OF CLAMP RING

(1) Matching clamp ring with the fitting mark, catch the both end at bolt inserting portion of clamp ring with the vice gradually and make its both end of ring come closer to approx. 15-20 mm {0.60-0.78 in.} in the distance. After that, removing the vice, tighten temporally them toward inserting direction with the bolt and nut.

(2) Tap all periphery of clamp ring with plastic hammer and tighten securely the nut. Repeat this 2-3 times for gradual tightening.

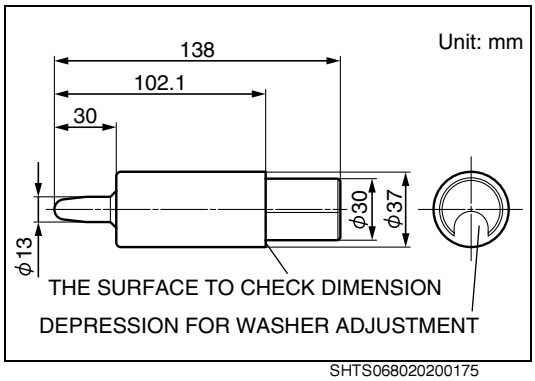


SHTS068020200174

5. INSTALLATION OF PUSH ROD GUIDE

(1) Putting new bush into pushing rod guide, insert it deeply to base until push rod guide contacts with the internal hole of push rod guide by special tool.
SST: Wedge Chamber Stroke Tool (09714-1030)

NOTICE
In this case, do not install tolerance ring and washer.



SHTS068020200175

(2) Under the status that the special tool remains pushed against push rod guide, piling washers on the depression for adjustment at the end-face of special tool and picking out one top washer piled up, determine Max. quantity of washers, installable in the internal diameter of base.

NOTICE
The washer quantity at this time is adjusted one for setting dimension of push rod guide. Accordingly, keep them securely.

HINT

- **Do not mind to use the washers picked out in dismounting.**
- **Target for washer quantity: 0-4 pcs.**
- **Washer thickness (1 pierce): 0.5 mm {0.02 in.}**

(3) Picking out special tool and push rod guide for a while and installing the washer of quantities determined in the above (3) and new tolerance ring on push rod guide, insert it deeply with special tool again until push rod guide contacts with the bottom.

NOTICE

- **Be careful not to drop off the washers.**
- **After installing, confirm that, under the status that the special tool remains pushed against push rod guide, the end-face of base side is almost identical with the surface to check setting dimension of special tool.**

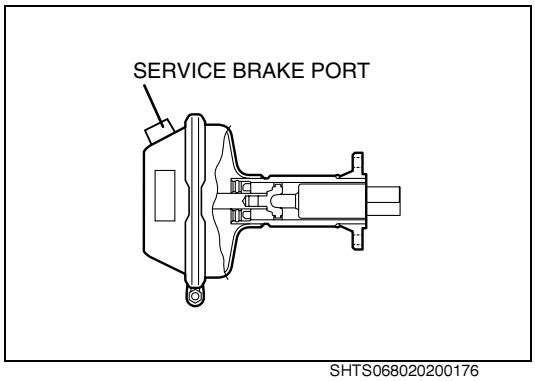
(4) Apply grease at the depression portion of push rod guide.

Using grease:
COSMO Heat-resistant grease B No. 2 or equivalent.

6. INSPECTION AFTER INSTALLATION

(1) When adding air of 700-800 kPa {7.2-8.2 kgf/cm^2, 102-116 lbf/in^2.} to service brake port, check that push rod moves smoothly.

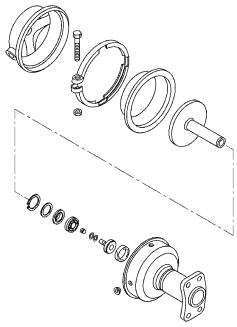
(2) Make sure not to leak air from diaphragm.



SHTS068020200176

INSPECTION AND REPAIR

EN0680202H300021

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Pressure plate, clamp, push rod, diaphragm and base: Wear and damage	**—**	**—**	**Replace, if necessary**	**Visual check** 

SPRING BRAKE CHAMBER

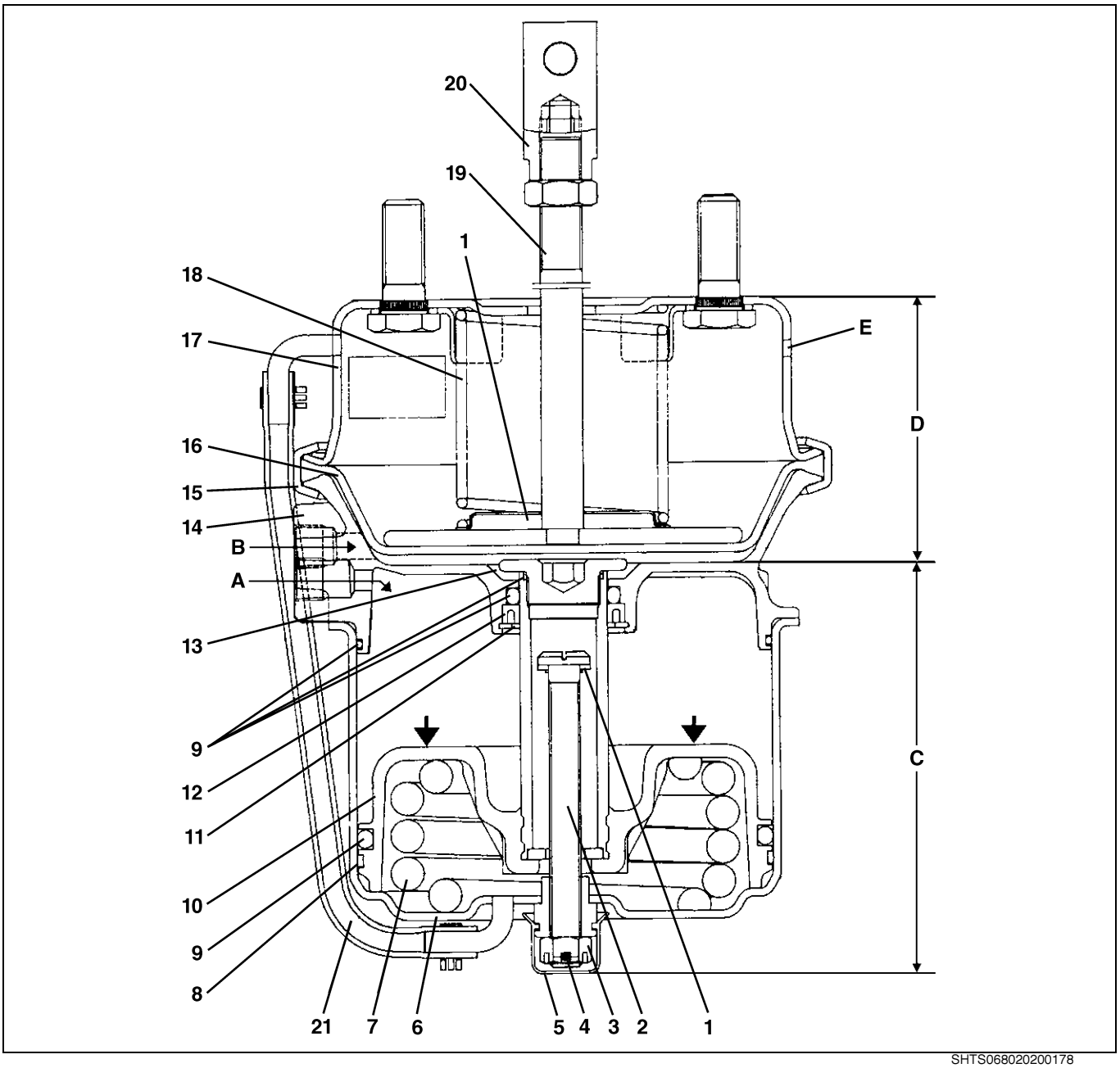
DATA AND SPECIFICATION

EN0680202I200019

Type	**Spring and piston type brake chamber combined with diaphragm type chamber with breather tube**

DESCRIPTION

EN0680202C100020



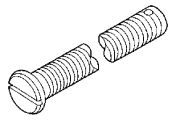
SHTS068020200178

1	Retainer	15	Clamp band
2	Release bolt	16	Diaphragm
3	Slotted nut	17	Service brake chamber
4	Spring pin	18	Compression spring
5	Dust cover	19	Push rod
6	Spring brake chamber	20	Clevis
7	Spring	21	Breather tube
8	Piston ring	A	Spring brake air port (Emergency and parking) - for releasing air
9	O-ring	B	Service brake air port (Service) - for braking air
10	Piston	C	Spring brake portion
11	Retainer ring	D	Service brake portion
12	Bushing	E	Drain hole
13	Piston follower		
14	Bulkhead		

SPECIAL TOOL

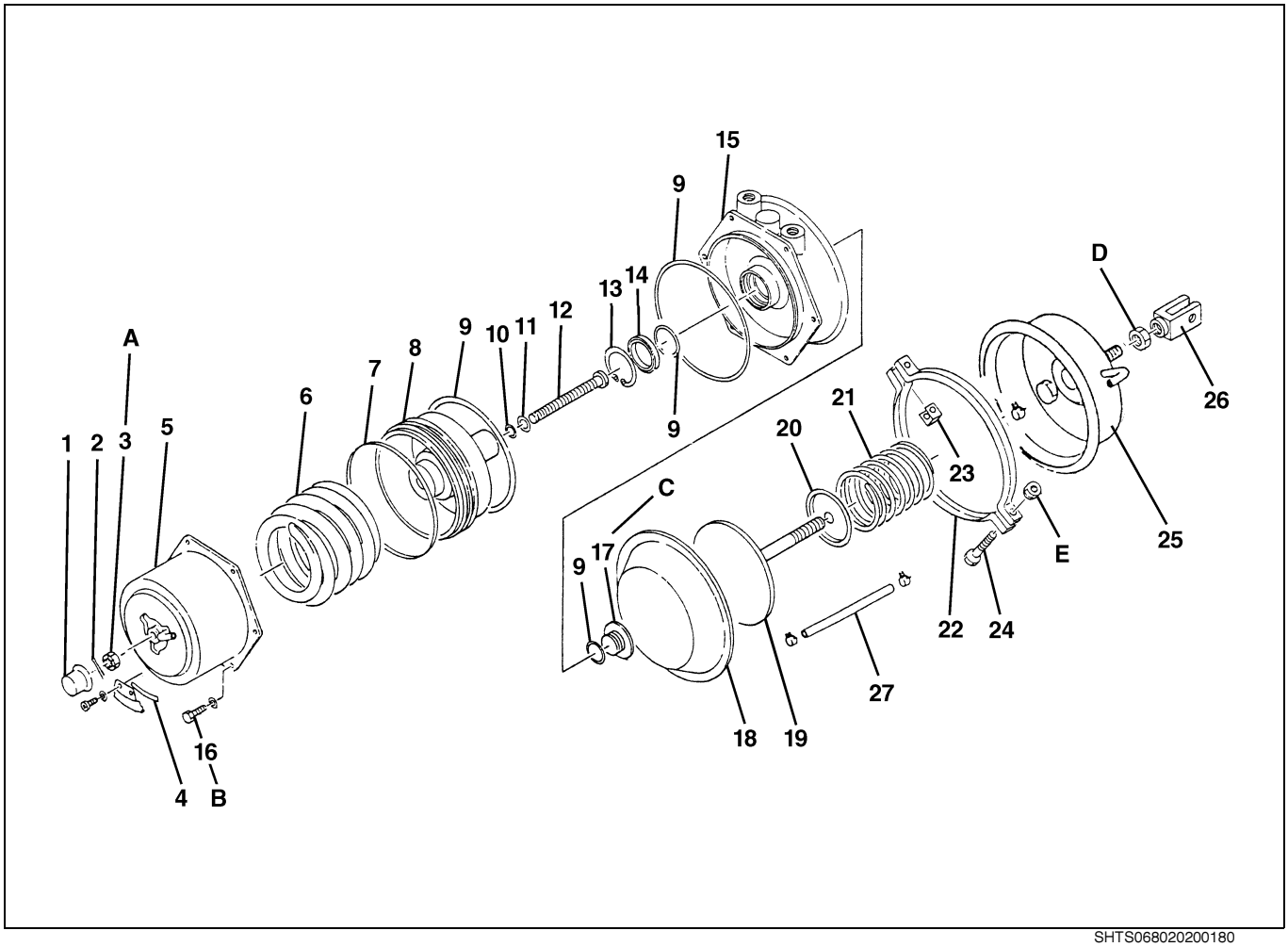
EN0680202K100002

Prior to starting a spring brake chamber overhaul, it is necessary to have this special tool.

Illustration	Part number	Tool name	Remarks
	09683-1051	SPRING BRAKE PISTON RELEASE BOLT	

COMPONENT LOCATOR

EN0680202D100019



SHTS068020200180

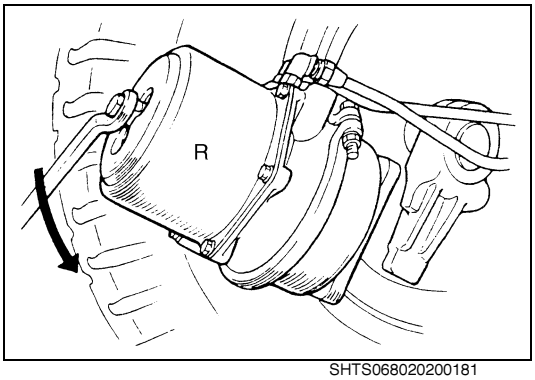
1	Dust cover	10	Retainer	19	Push rod
2	Spring pin	11	Plain washer	20	Spring retainer
3	Slotted nut	12	Release bolt	21	Compression spring
4	Caution plate	13	Retainer ring	22	Clamp band
5	Spring brake chamber	14	Bushing	23	Spacer
6	Spring	15	Bulkhead	24	Clamp band bolt
7	Piston ring	16	Chamber cover bolt	25	Service brake chamber
8	Piston	17	Piston follower	26	Clevis
9	O-ring	18	Diaphragm	27	Breather tube

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	39.0-44.0 {400-450, 29-32}	D	39.0-49.0 {400-500, 29-36}
B	9.8-17.6 {100-180, 7.3-13.0}	E	26.5-32.3 {270-330, 20-23}
C	39.0-49.0 {400-500, 29-36}		

OVERHAUL

EN0680202H200018



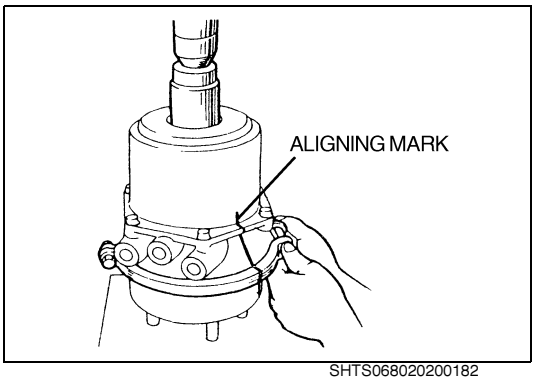
SHTS068020200181

IMPORTANT POINT - DISMOUNTING

1. DISMOUNTING THE CHAMBER ASSEMBLY

(1) Before dismounting the chamber, turn the release bolt counterclockwise to release the spring brake.

(2) Apply a position mark R or L to make clear the side where the chamber was installed.

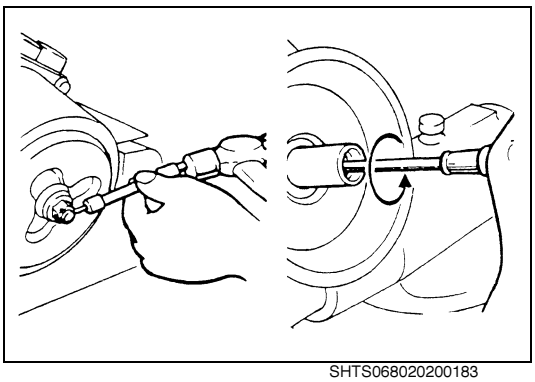


SHTS068020200182

IMPORTANT POINT - DISASSEMBLY

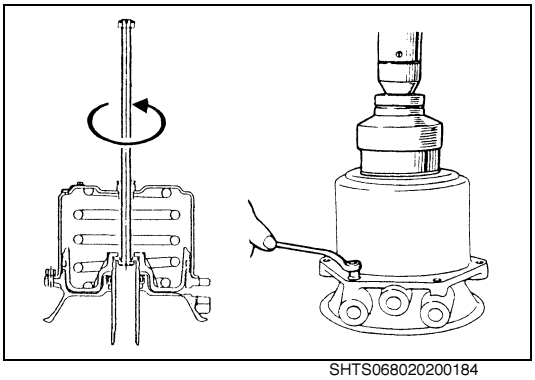
NOTICE

Before disassembling, put aligning marks to the clamp band, service brake chamber, bulkhead and spring brake chamber.

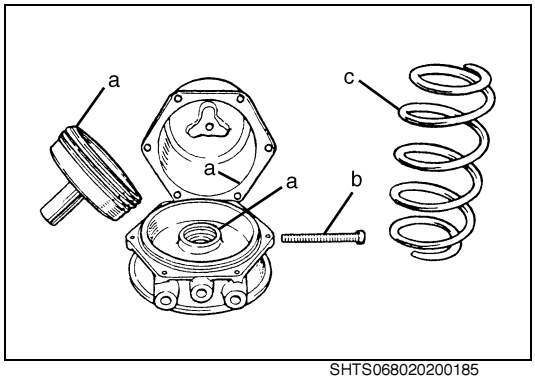

SHTS068020200183

1. DISASSEMBLING THE SPRING BRAKE CHAMBER

(1) Remove the piston follower and then remove the dust cover, spring pin and release bolt.


SHTS068020200184

(2) Use a press or special tool to hold the spring in compression then remove the chamber cover bolt.
SST: Spring Brake Piston Release Bolt (09683-1051)



SHTS068020200185

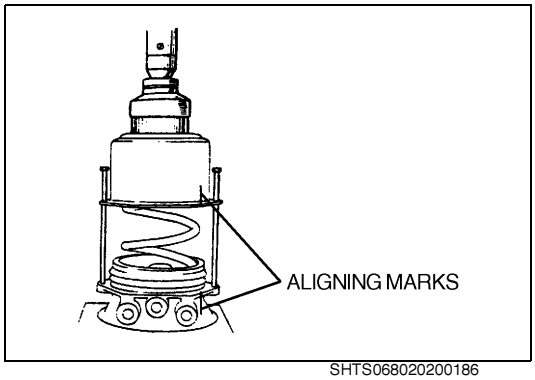
IMPORTANT POINTS - ASSEMBLY

1. LUBRICATION

(1) When assembling the spring brake chamber, replace the piston ring, bushing and O-ring with new ones.

(2) Apply grease or oil to each point.

- a Silicone grease: O-ring, Bushing, Piston ring and Spring brake chamber inner side.
- b Bearing grease: Release bolt
- c Rust preventive oil: Spring



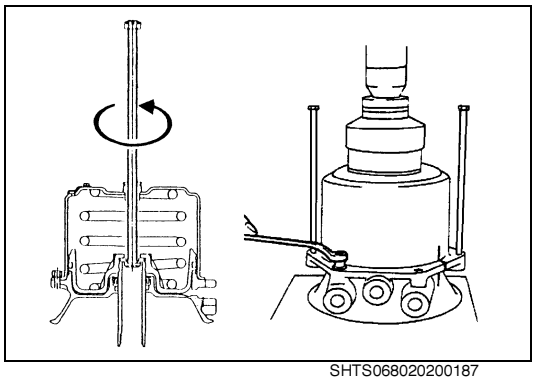
SHTS068020200186

2. ASSEMBLING THE SPRING BRAKE CHAMBER

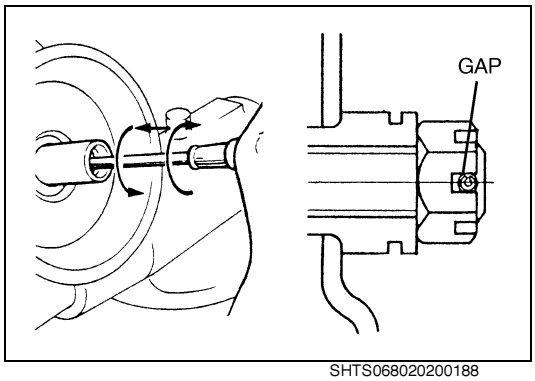
(1) Attach guide bolts to align the holes.

NOTICE

Align the aligning marks of the spring brake chamber and bulkhead.


SHTS068020200187

(2) Use a press or special tool to compress the spring then tighten the chamber cover with the bolts.
SST: Spring Brake Piston Release Bolt (09683-1051)

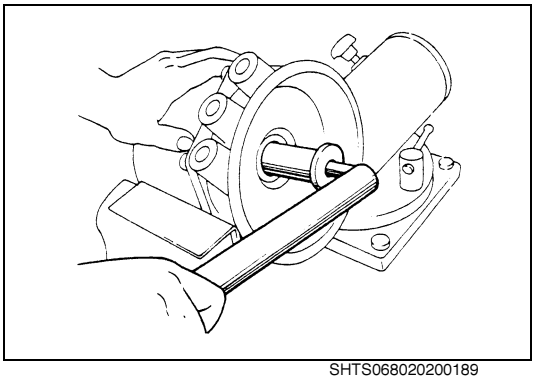


SHTS068020200188

(3) Screw in the release bolt until its head contacts the piston flange, then return the release bolt one or two turns, then install the slotted nut and spring pin.

NOTICE

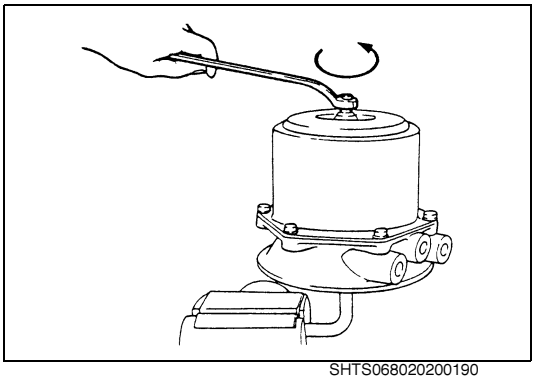
The spring pin should be installed as shown in the figure.


SHTS068020200189

(4) Install the piston follower on the piston.

NOTICE

Apply locking adhesive (LOCTITE 242 or equivalent) to the thread of the piston follower.

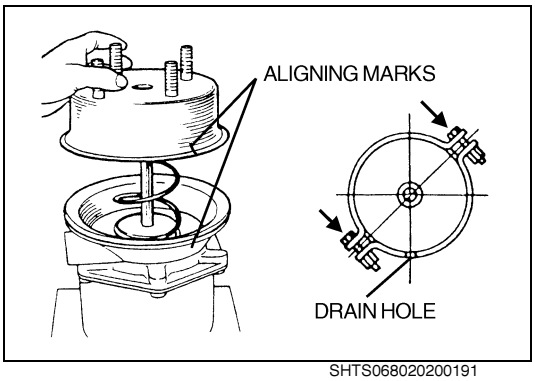

SHTS068020200190

3. ASSEMBLING THE SERVICE BRAKE CHAMBER

(1) Turn the release bolt counterclockwise to compress the spring of the spring brake chamber.

NOTICE

To make turning easy, apply compressed air to the spring brake chamber.



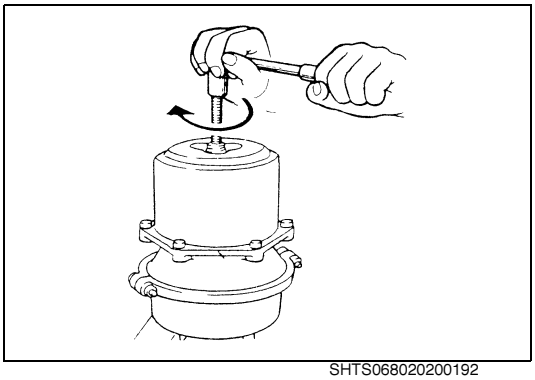
SHTS068020200191

(2) When reassembling the chamber, replace the diaphragm with new one.

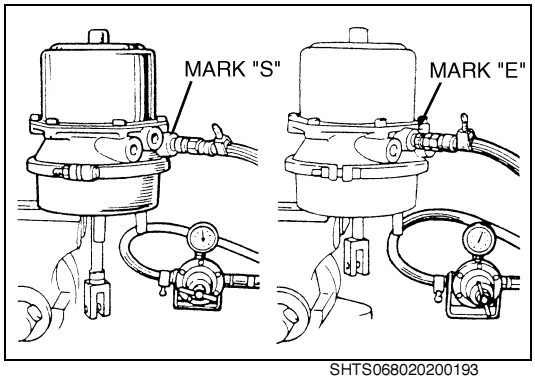
NOTICE

Align the aligning marks of the chamber, clamp band and bulkhead.

(3) Insert the clamp band bolts from opposite side of drain hole and tighten the bolts evenly with nuts within specified torque.


SHTS068020200192

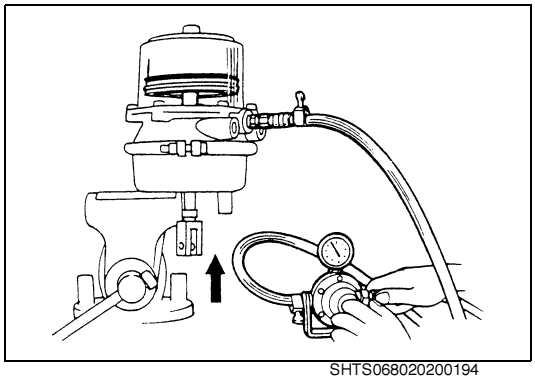
(4) Turn the release bolt clockwise to release the spring of the spring brake chamber.



SHTS068020200193

4. INSPECTION FOR AIR LEAKAGE

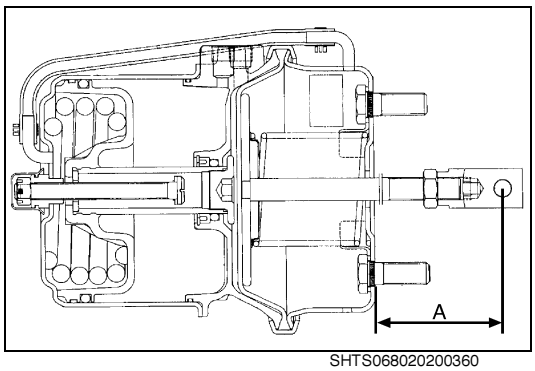
(1) Apply compressed air of 834 kPa {8.5 kgf/cm^2, 121 lbf/in.^{2}} to both inlet ports marked "E" and "S", and make sure that there is no air leakage from the joints of the assembly.


SHTS068020200194

5. INSPECTION FOR PISTON MOVEMENT

(1) Apply compressed air of 640-830 kPa {6.5-8.5 kgf/cm^2, 93-120 lbf/in.^{2}} to the inlet port with mark E gradually and make sure that the push rod is completely returned.

Piston stroke: 64 mm {2.52 in.}
for spring brake chamber parts No.
47850 -4290/ -4300/ -4310/ -4320/ -4330/ -4340/ -4350/ -4360
: 56 mm {2.20 in.}
for spring brake chamber parts No.
47850 -4370/ -4380/ -4390/ 4400



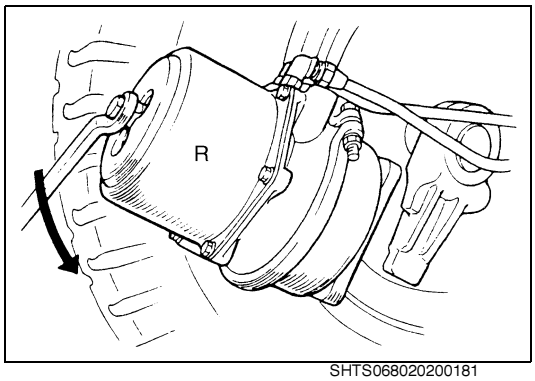
SHTS068020200360

6. INSTALLING THE CLEVIS

(1) Install the clevis to the push rod and adjust dimension "A" to the specified value.

A: 261-263 mm {10.28-10.35 in.}
for spring brake chamber parts No.
47850-4290/ -4300/ -4330/ -4340

A: 84-86 mm {3.31-3.38 in.}
for spring brake chamber parts No.
47850-4310/ -4320/ -4350/ -4360/ -4370/ -4380/ -4390/ -4400



SHTS068020200181

IMPORTANT POINT - MOUNTING

1. INSTALLING THE CHAMBER ASSEMBLY

(1) Before mounting, turn the release bolt counterclockwise to release the spring brake.

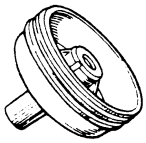
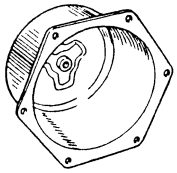
NOTICE

- **Note the position mark R or L on the chamber which mark was applied when dismounting and install it to its former side.**
- **When connecting the clevis with slack adjuster, lubricate clevis pin-hole and clevis pin with sufficient chassis grease.**

(2) After mounting, the release bolt must be set at the specified torque.

INSPECTION AND REPAIR

EN0680202H300022

Inspection item	Standard	Limit	Remedy	Inspection procedure
Piston: **Wear and damage**	**—**	**—**	**Replace,** **if necessary.**	**Visual check** 
Chamber: **Wear and damage**	**—**	**—**	**Replace,** **if necessary.**	**Visual check** 
Spring and compression spring: **Rust and damage**	**—**	**—**	**Replace,** **if necessary.**	**Visual check** 

SPRING BRAKE CHAMBER (MAKER: NABCO)

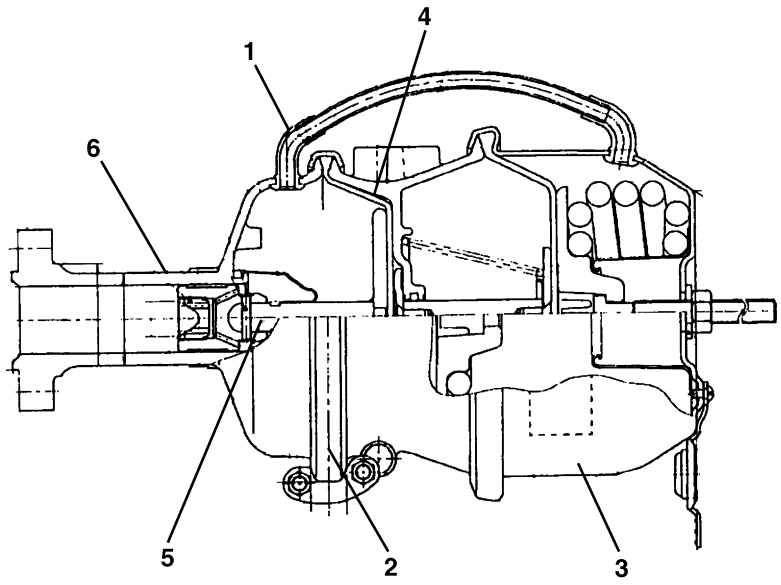
DATA AND SPECIFICATION

EN0680202I200020

Type	Spring and piston type brake chamber combined with diaphragm type chamber

DESCRIPTION

EN0680202C100021

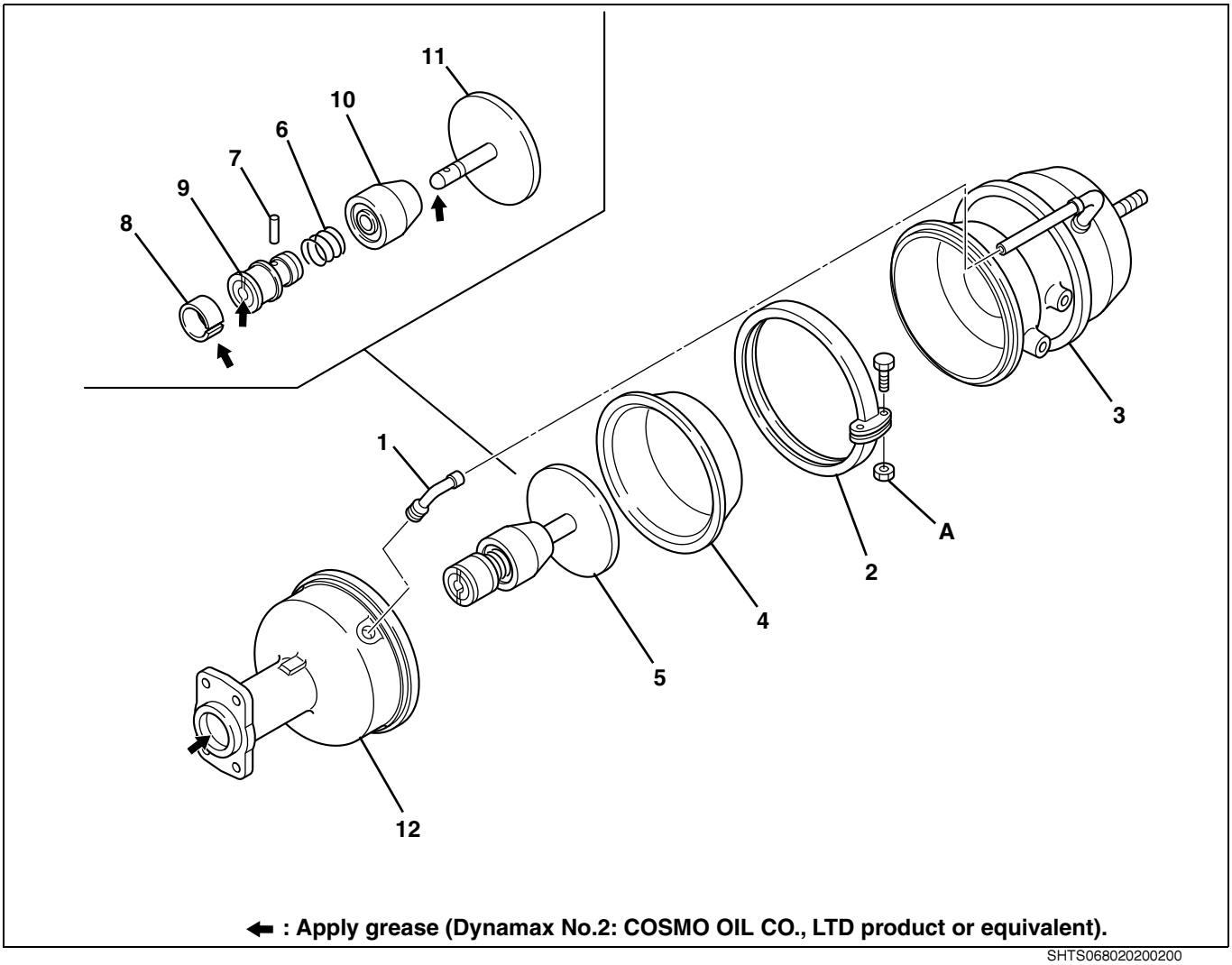


SHTS068020200199

1	Elbow	4	Diaphragm
2	Clamp	5	Push rod assembly
3	Piggyback	6	Base

COMPONENT LOCATOR

EN0680202D100020



: Apply grease (Dynamax No.2: COSMO OIL CO., LTD product or equivalent).

SHTS068020200200

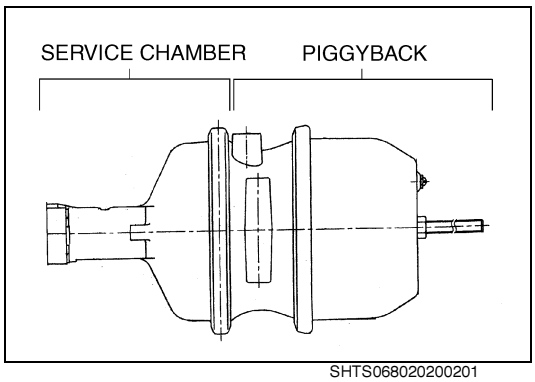
1	Elbow	7	Pin
2	Clamp	8	Bushing
3	Piggyback	9	Push rod guide
4	Diaphragm	10	Push rod boot
5	Push rod assembly	11	Push rod
6	Spring	12	Base

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	14.7-20.0 {150-204, 11.0-14.8}	

OVERHAUL

EN0680202H200019

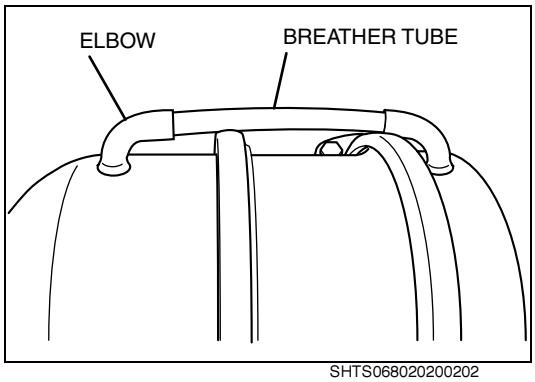


SHTS068020200201

IMPORTANT POINT - DISASSEMBLY

1. DISASSEMBLY OF THE SPRING BRAKE CHAMBER

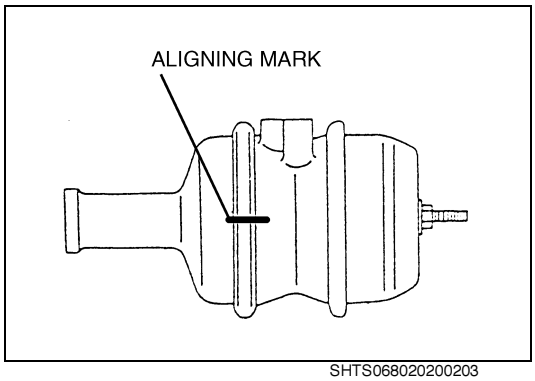
⚠ WARNING
Piggyback is very dangerous because there is very strong spring inside it. Never disassemble the piggyback.



SHTS068020200202

(1) Disconnect the breather tube from the service chamber side elbow.

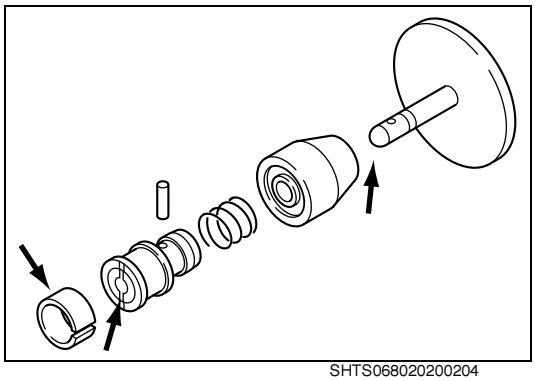
NOTICE
- **Do not disconnect the breather tube from the piggyback side.**
- **Pulling the center of the elbow obliquely can easily disconnect the breather tube from the elbow.**



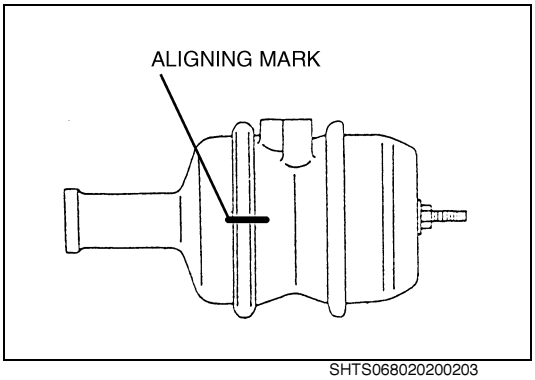
SHTS068020200203

(2) Apply the aligning mark on the clamp, piggyback and base.
(3) Remove the clamp, the piggyback and diaphragm from the bracket.
(4) Remove the ring and pin, then disassemble the push rod assembly.

IMPORTANT POINTS - ASSEMBLY


SHTS068020200204

1. ASSEMBLY OF THE PUSH ROD ASSEMBLY
(1) Before assembling, apply grease (Dynamax No.2: COSMO OIL., LTD. product or equivalent) to each component parts.



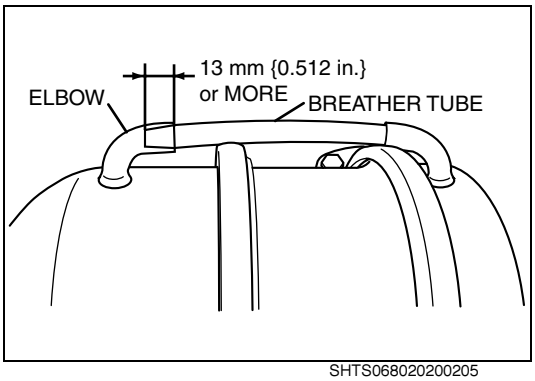
SHTS068020200203

2. ASSEMBLY OF THE SPRING BRAKE CHAMBER

(1) Apply grease to inside of the bracket, and install the push rod assembly, new diaphragm, piggyback and clamp.

NOTICE

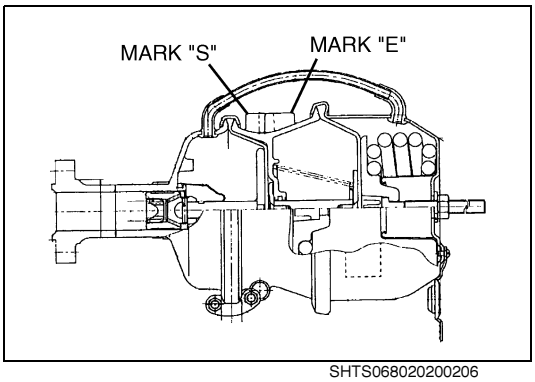
- **Do not adhere grease to the diaphragm.**
- **Before assembling, align the aligning marks on the clamp, piggyback and bracket.**
- **Spring cylinder (piggyback) portion should be changed every 3 years, even though it does not fail.**
- **Diaphragm, dust cover and bushing, etc. are the parts to be changed periodically.**



SHTS068020200205

(2) After wiping the breather tube, apply lock agent (LOCTITE 414 or equivalent) on the tube open end.

(3) Insert the breather tube in the elbow as shown in the figure.



SHTS068020200206

3. INSPECTION FOR AIR LEAKAGE

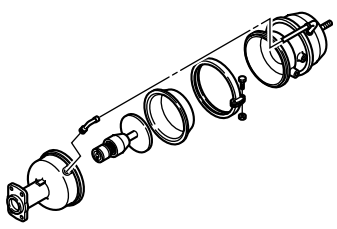
(1) Apply compressed air of 690-880 kPa {7.0-9.9 kgf/cm^2, 100-128 lbf/in.^{2}} to both inlet ports marked "E" and "S", and make sure that there is no air leakage from the joints of the assembly.

4. INSPECTION FOR PISTON MOVEMENT

(1) Apply compressed air of 690-880 kPa {7.0-9.9 kgf/cm^2, 100-128 lbf/in.^{2}} to the inlet port marked "E" gradually and measure the service chamber stroke.
Piston stroke: 58-61 mm {2.28-2.40 in.}

INSPECTION AND REPAIR

EN0680202H300023

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Bracket, push rod, diaphragm and piggyback: Wear and damage	—	—	**Replace, if necessary**	**Visual check** 

SPRING BRAKE CHAMBER (MAKER: WABCO)

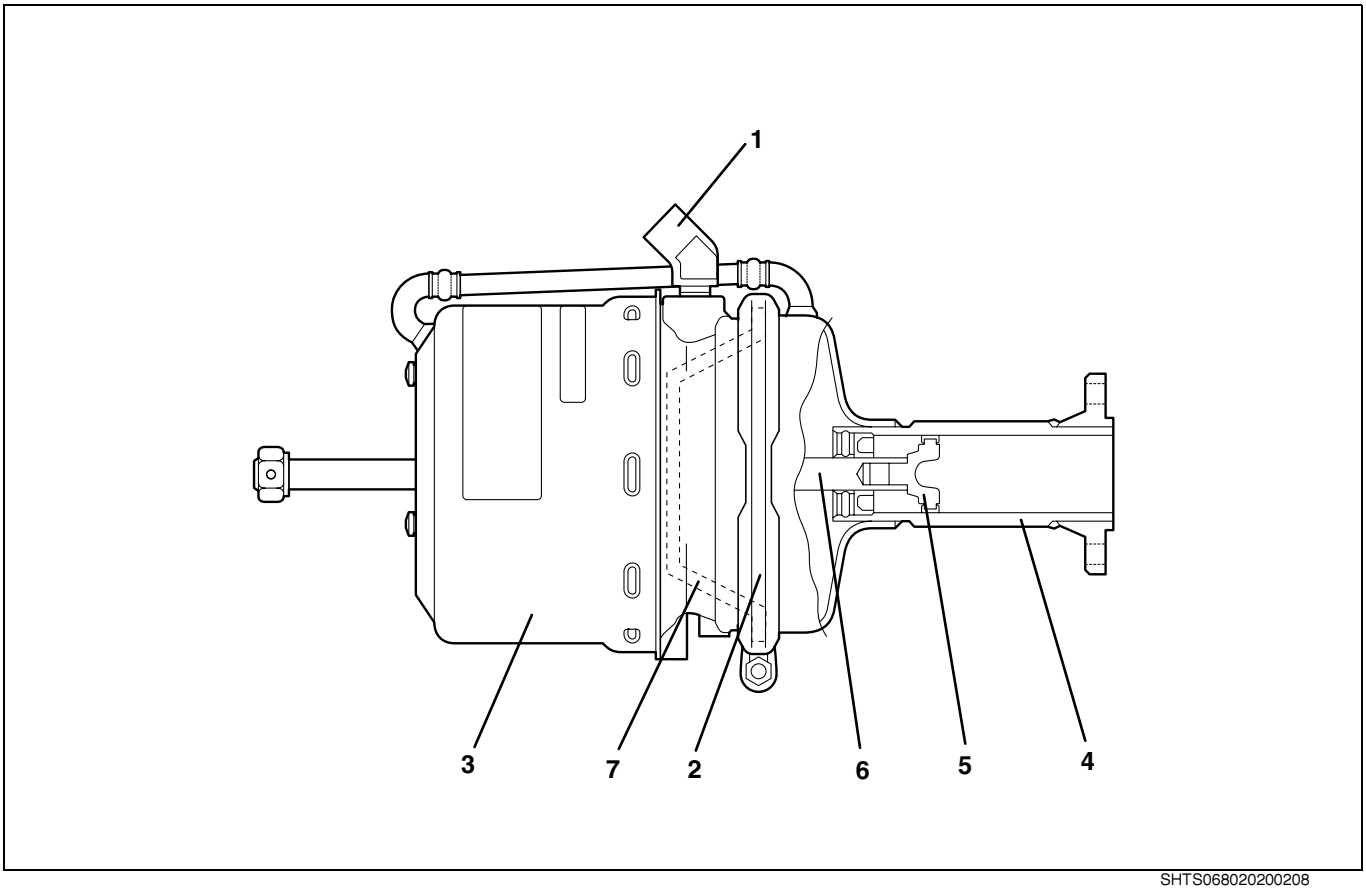
DATA AND SPECIFICATION

EN0680202I200021

Type	**Spring and piston type brake chamber combined with diaphragm type chamber**

DESCRIPTION

EN0680202C100022

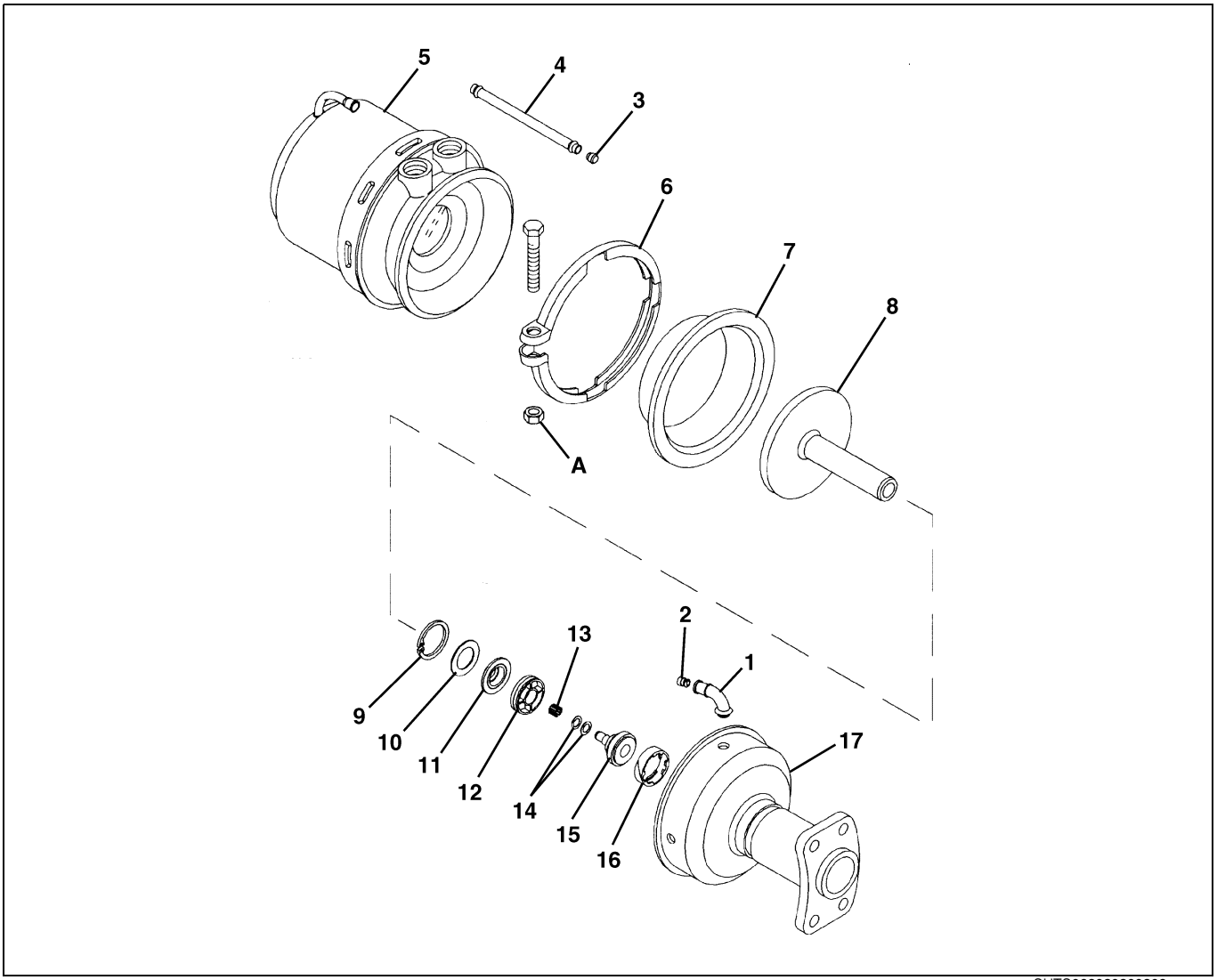


SHTS068020200208

1	**Elbow**	**5**	**Push rod guide**
2	**Clamp**	**6**	**Push rod**
3	**Spring brake cylinder**	**7**	**Diaphragm**
4	**Base**		

COMPONENT LOCATOR

EN0680202D100021



SHTS068020200209

1	Elbow	10	Plate
2	Plug	11	Oil seal
3	Filter	12	Guide
4	Tube	13	Tolerance ring
5	Spring brake cylinder	14	Washer
6	Clamp ring	15	Push rod guide
7	Diaphragm	16	Bushing
8	Push rod	17	Base
9	Snap ring		

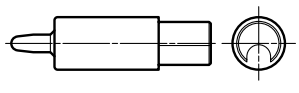
Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	25-30 {260-310, 18.8-22.4}	

SPECIAL TOOL

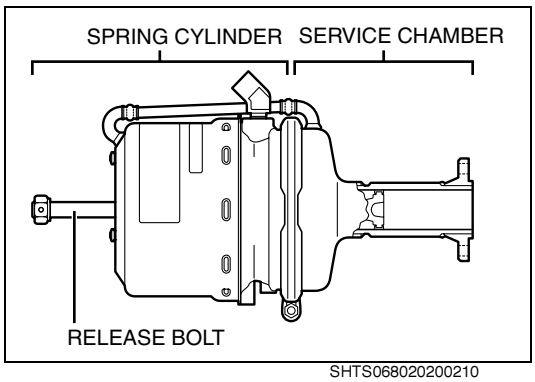
EN0680202K100003

Prior to starting a spring brake chamber overhaul, it is necessary to have this special tool.

Illustration	Part number	Tool name	Remarks
	09714-1030	WEDGE CHAMBER STROKE TOOL	

OVERHAUL

EN0680202H200020

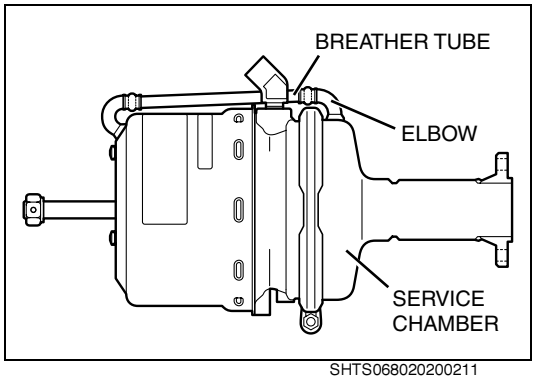


SHTS068020200210

IMPORTANT POINTS - DISASSEMBLY

⚠ WARNING

- **Before disassembling it, check and verify that the release bolt is extruded.**
- **Spring cylinder is very dangerous because there is very strong spring inside it. Never disassembly the spring cylinder.**



SHTS068020200211

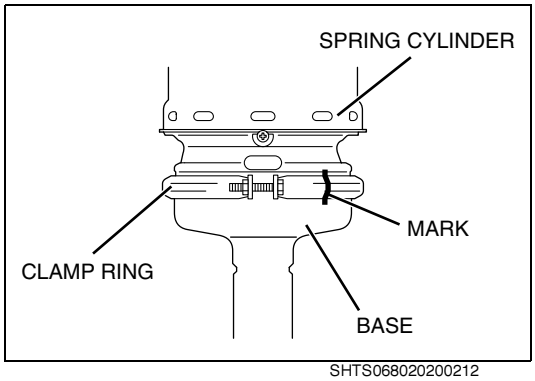
1. REMOVAL OF BREATHER TUBE

(1) Remove off breather tube from service chamber side.

NOTICE

When carrying or moving to other place it, don't hold breather tube.

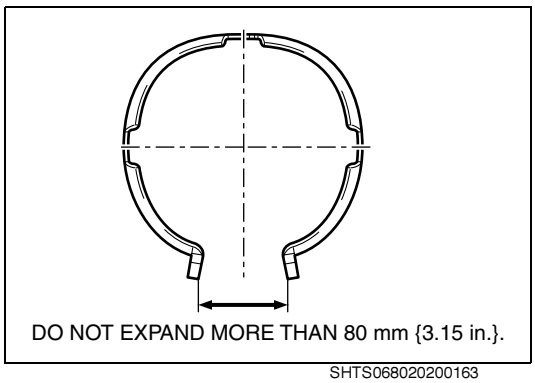
(2) Remove the filter in the elbow.



SHTS068020200212

2. REMOVAL OF SPRING CYLINDER

(1) Make a matching mark to base, clamp ring and spring cylinder.

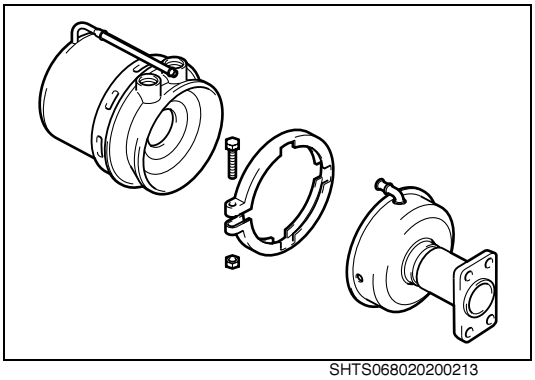


SHTS068020200163

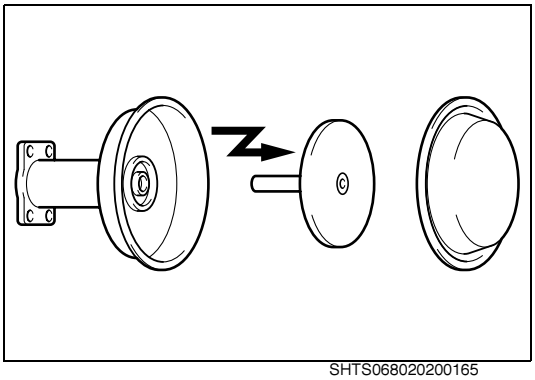
(2) Mark clamp ring not to forget the inserting direction of clamp ring bolt and remove clamp ring.

NOTICE

When removing clamp ring, do not expand the inserting portion of clamp ring bolt by more than 80 mm {3.15 in.}.


SHTS068020200213

(3) Remove spring cylinder from base.

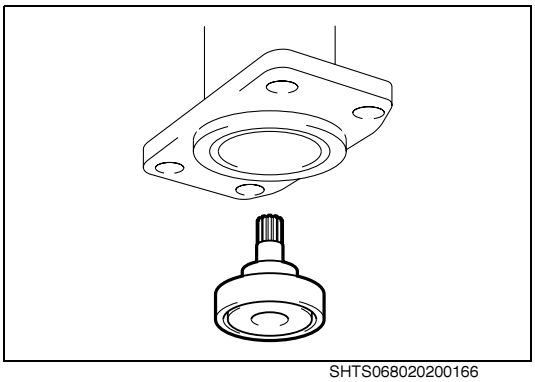

SHTS068020200165

3. REMOVAL OF DIAPHRAGM AND PUSH ROD

(1) Remove diaphragm and push rod from base.

NOTICE

- **Push rod should be removed out, holding plate and repeating to push and pull it straightly for a few times.**
- **When removing, push rod should not be pulled out up or downward, toward right or left, not hammering from the square flange side.**

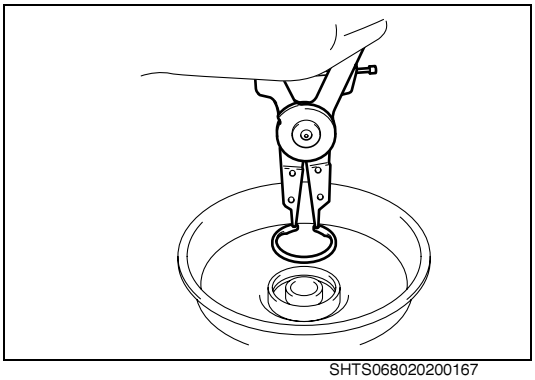

SHTS068020200166

4. REMOVAL OF PUSH ROD GUIDE

(1) Take out push rod guide out of the square flange.

NOTICE

When removing push rod guide, do not drop off a washer in it.


SHTS068020200167

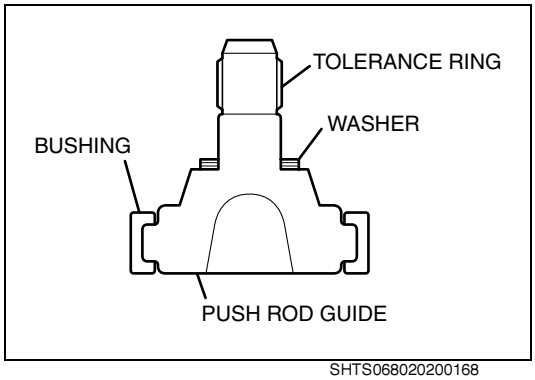
5. REMOVAL OF GUIDE

(1) Remove snap ring, plate and oil seal with snap ring pliers.

⚠ WARNING

Make sure not to jump out a snap ring.

(2) Remove guide, using a pipe having outer diameter of about ϕ37 mm {1.46 in.} and tapping with plastic hammer by making the square flange of base upside.



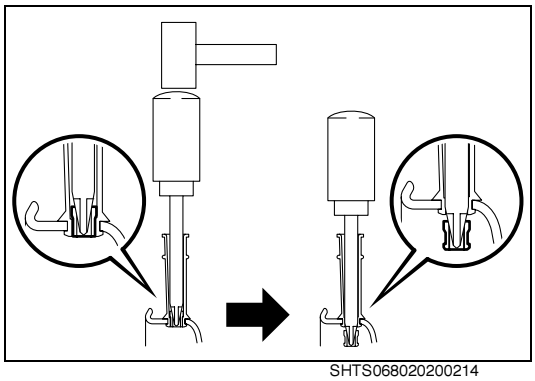
SHTS068020200168

6. DISASSEMBLY OF PUSH ROD GUIDE ASSEMBLY

(1) Remove bushing and tolerance ring from push rod guide.

NOTICE

- **Keep it surely as washer in the push rod guide may be reused when assembling it.**
- **There is a case that tolerance ring may be in the fitting hole at the tip of push rod, in case of which, pick it up with screw-driver, etc.**


SHTS068020200214

7. REMOVAL OF ELBOW

(1) By inserting a stick of ϕ6 - ϕ8 mm {0.24-0.31 in.} or screw-driver from inserting side of elbow hose, remove the plug from base, tapping with plastic hammer.

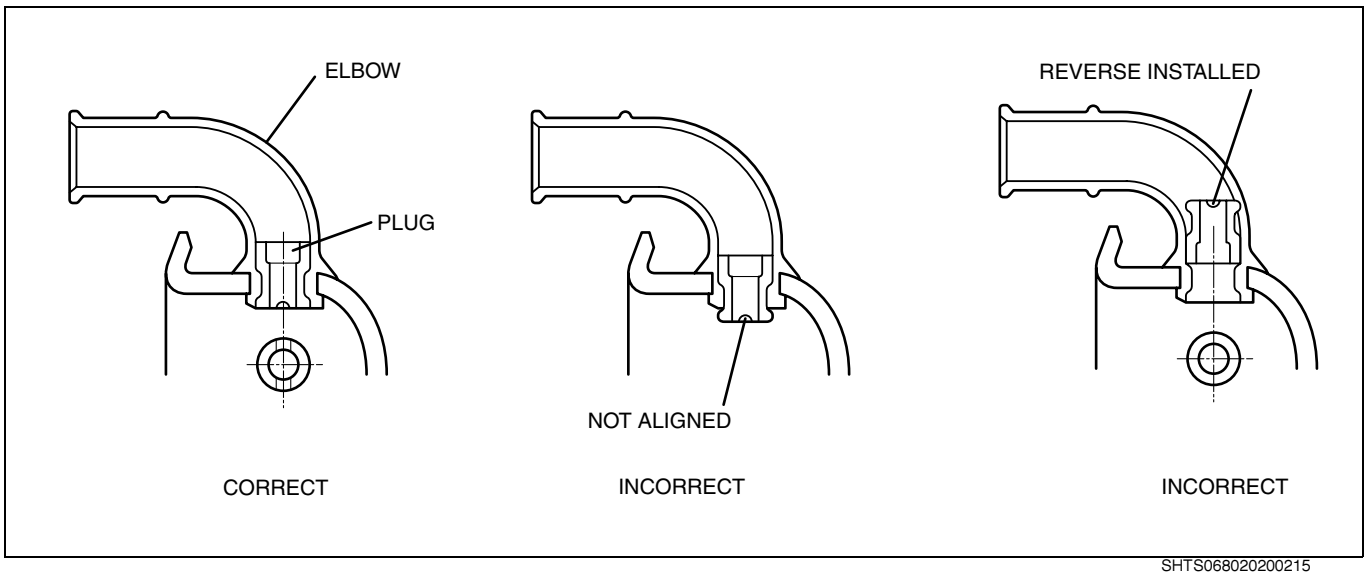
IMPORTANT POINTS - ASSEMBLY

1. MOUNTING OF ELBOW

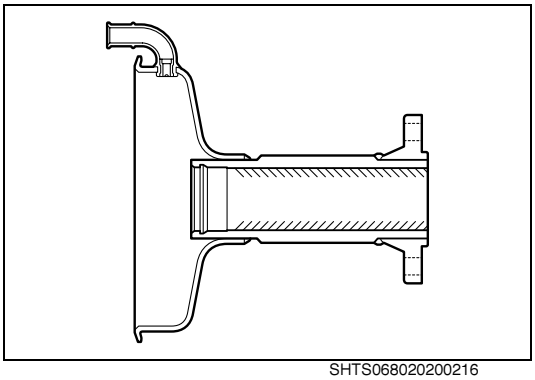
(1) Install new elbow on base. In that case, set the direction of elbow tip to be faced toward diaphragm side and put plug in from the tip of elbow. Inserting the stick used in dismounting it or screw-driver, insert it so that both tips of plug and elbow may be aligned by tapping lightly with plastic hammer.

NOTICE

- **Check and verify if the direction of plug and its installing condition are shown in the figure.**
- **When inserting the stick or the screw-driver, make sure not to damage elbow with their tips.**
- **After installing plug, make sure that elbow is not taken out by a force of 60 N {6.1 kgf, 27 lbf}.**



SHTS068020200215

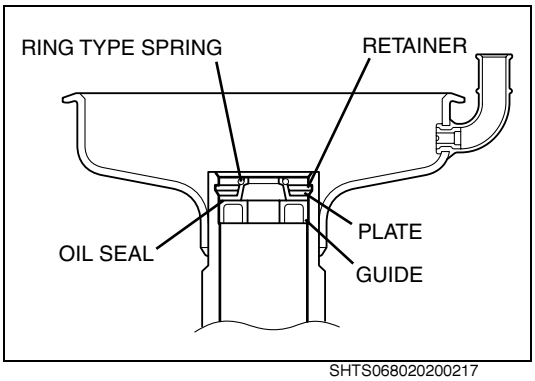

SHTS068020200216

2. INSTALLATION OF GUIDE, OIL SEAL AND PLATE

(1) Apply lightly grease (stored in the repair kit) at moving portion of push rod guide on base.

NOTICE

Never fail to use the grease, stored in the "REPAIR KIT".

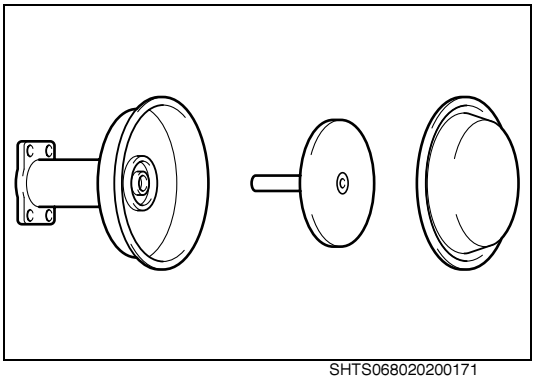


SHTS068020200217

(2) Facing the flat side of new guide to diaphragm side, insert it until it touches down to base by tapping lightly with stick having an outer diameter of about ϕ37 mm {1.46 in.} or box-socket.

NOTICE

- **Confirm that ring type spring is installed on oil seal.**
- **Confirm that retainer is in its groove.**

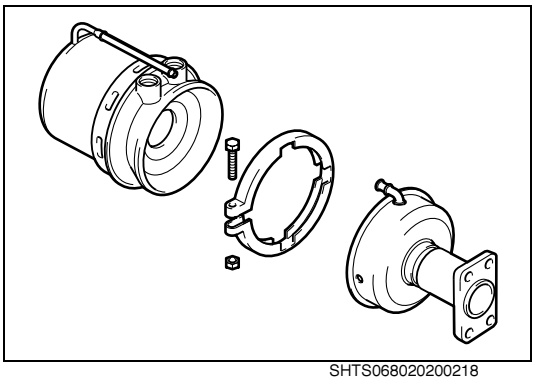

SHTS068020200171

3. INSTALLATION OF PUSH ROD AND DIAPHRAGM

(1) Insert it to base by applying grease (stored in the "REPAIR KIT") at the rod portion of push rod.

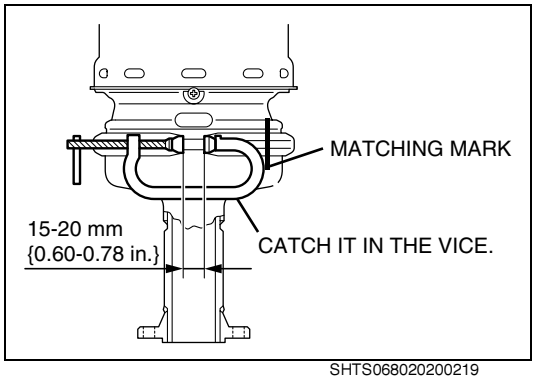
NOTICE

- **Never fail to use grease, stored in the "REPAIR KIT".**
- **When installing push rod, make sure not to damage oil seal.**


SHTS068020200218

4. INSTALLATION OF SPRING CYLINDER

(1) Putting spring cylinder on base, align those matching marks.

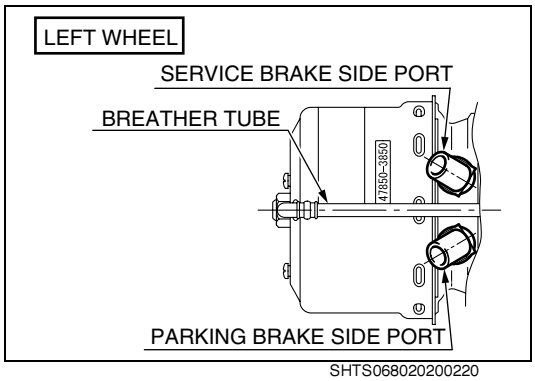


SHTS068020200219

5. INSTALLATION OF CLAMP RING

(1) Matching clamp ring with the fitting mark, catch the both end at bolt inserting portion of clamp ring with the vice gradually and make its both end of ring come closer to approx. 15-20 mm {0.60-0.78 in.} in the distance. After that, removing the vice, tighten temporally them toward inserting direction with the bolt and nut.

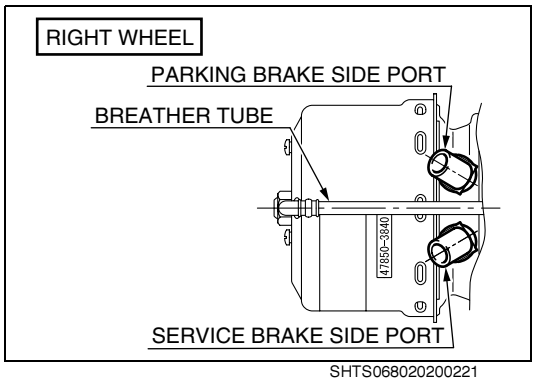
(2) Tap all periphery of clamp ring with plastic hammer and tighten securely the nut. Repeat this 2-3 times for gradual tightening.



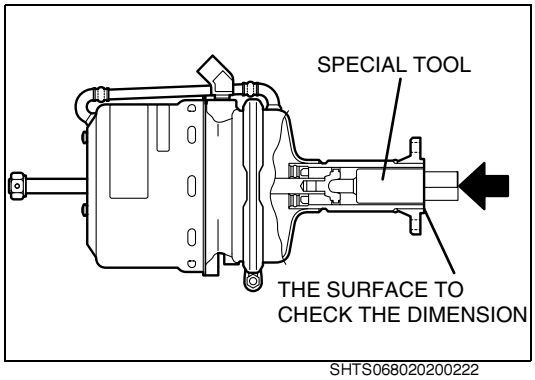
SHTS068020200220

6. INSTALLATION OF PUSH ROD GUIDE

(1) Add into the parking brake side port a compressed air of 700-800 kPa {7.2-8.2 kgf/cm^2, 102-116 lbf/in.^{2}}



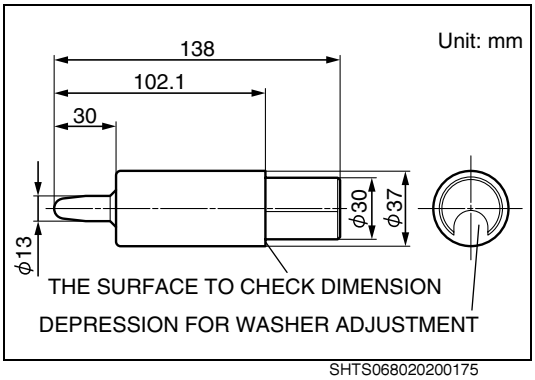
SHTS068020200221



SHTS068020200222

(2) Putting new bushing into push rod guide, insert it deeply to base until push rod guide contacts with the internal hole of push rod guide by special tool.
SST: Wedge Chamber Stroke Tool (09714-1030)

NOTICE
In this case, do not install tolerance ring and washer.



SHTS068020200175

(3) Under the status that the special tool remains pushed against push rod guide, piling washers on the depression for adjustment at the end-face of special tool and picking out one top washer piled up, determine Max. quantity of washers, installable in the internal diameter of base.

NOTICE

The washer quantity at this time is adjusted one for setting dimension of push rod guide. Accordingly, keep them securely.

HINT

- **Do not mind to use the washers picked out in dismounting.**
- **Target for washer quantity: 0-4 pcs.**
- **Washer thickness (1 pierce): 0.5 mm {0.02 in.}**

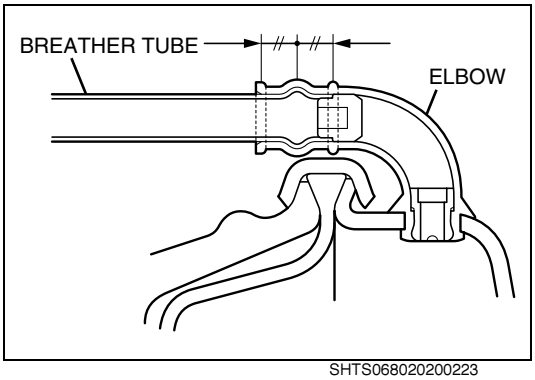
(4) Picking out special tool and push rod guide for a while and installing the washer of quantities determined in the above (3) and new tolerance ring on push rod guide, insert it deeply with special tool again until push rod guide contacts with the bottom.

NOTICE

- **Be careful not to drop off the washers.**
- **After installing, confirm that, under the status that the special tool remains pushed against push rod guide, the end-face of base side is almost identical with the surface to check setting dimension of special tool.**

(5) Exhaust the air of parking brake side port.
(6) Apply grease at the depression portion of push rod guide.

Using grease:
COSMO Heat-resistant grease B No. 2 or equivalent.



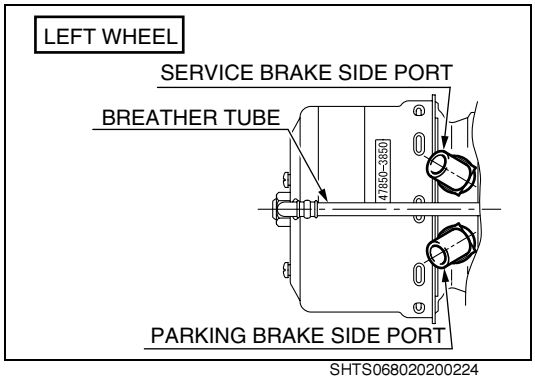
SHTS068020200223

7. INSTALLATION OF BREATHER TUBE

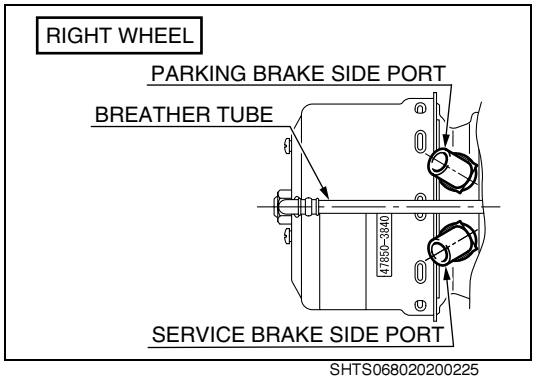
(1) Insert new filter into the tip of breather tube, after which it should be inserted into elbow. In this case, make sure that the hose bulge should come to the center between two protuberant portions, located at the end of elbow.

NOTICE

- **Pay attention to the direction of filter. (Its small path side should be tube side)**
- **When inserting breather tube into elbow, do not apply any grease or the like.**



SHTS068020200224



SHTS068020200225

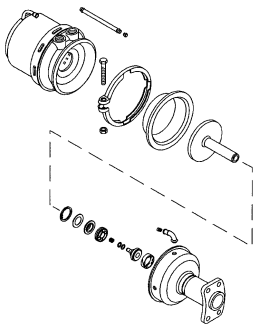
8. INSPECTION AFTER INSTALLATION

(1) When adding air of 700-800 kPa {7.2-8.2 kgf/cm^2, 102-116 lbf/in.^{2}} to service brake side port or parking brake side port, check that push rod moves smoothly.

(2) Make sure not to leak air from diaphragm.

INSPECTION AND REPAIR

EN0680202H300024

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Base, push rod, diaphragm and spring brake cylinder: Wear and damage	—	—	**Replace, if necessary**	**Visual check** 

TRAILER HAND BRAKE CONTROL VALVE

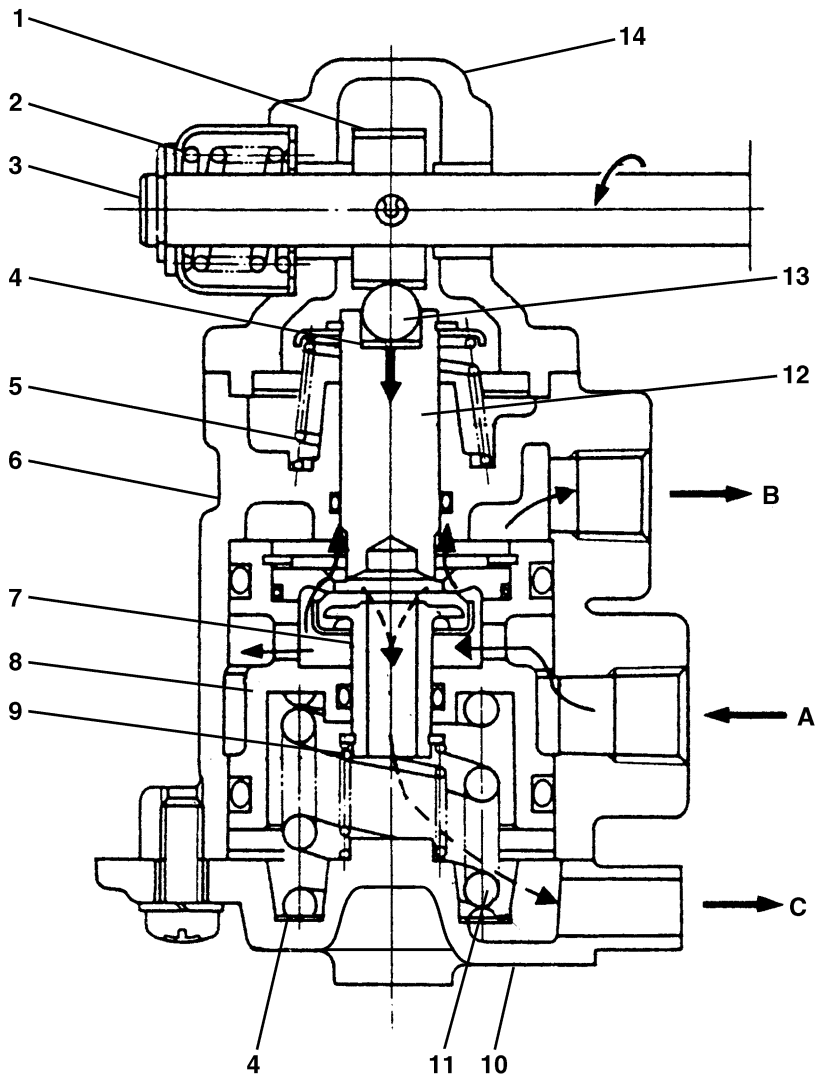
DATA AND SPECIFICATION

EN0680202I200022

Type	**Variable pressure control type**

DESCRIPTION

EN0680202C100023

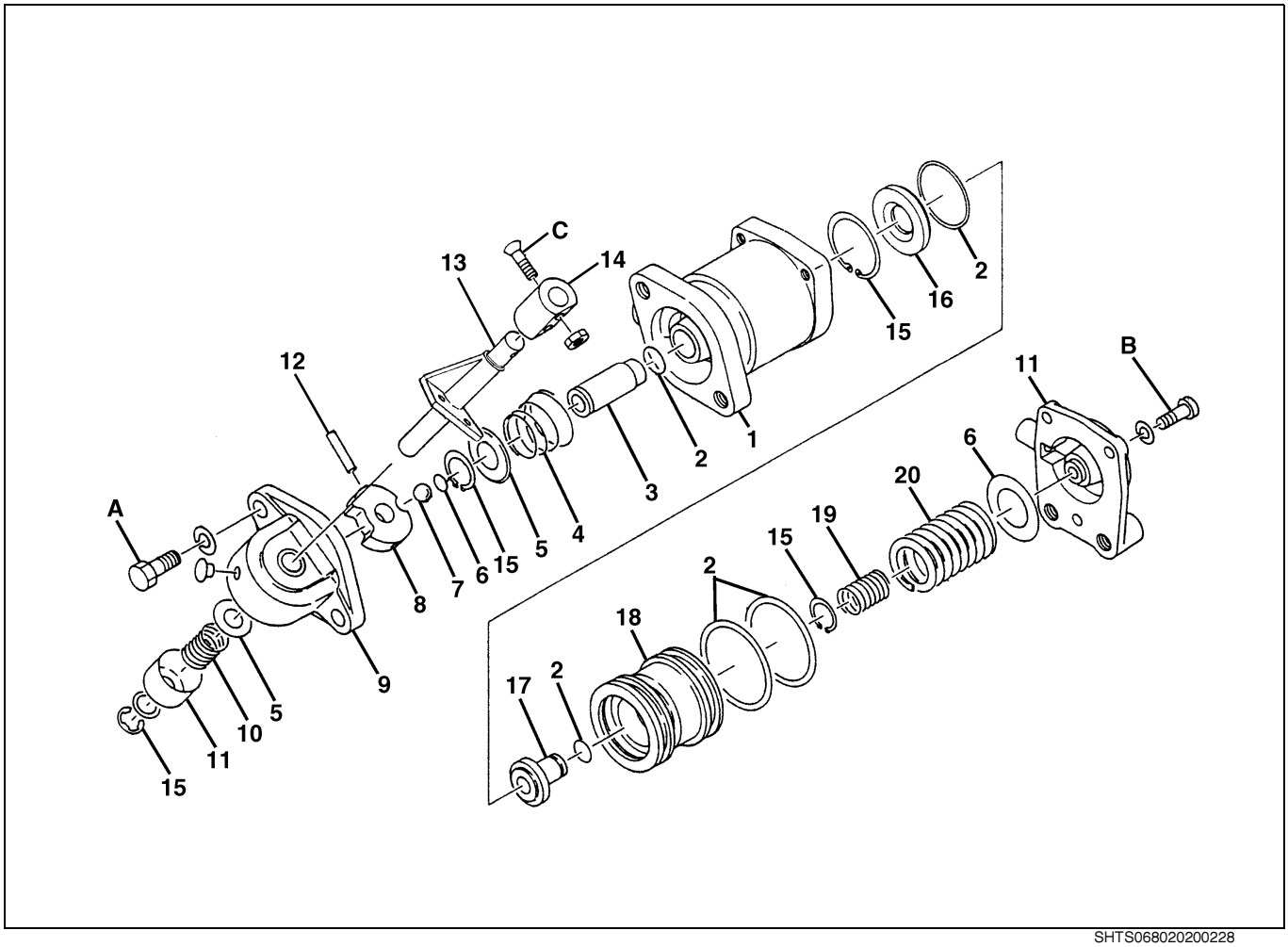


SHTS068020200227

1	Cam	7	Feed valve	13	Steel ball
2	Spring	8	Piston	14	Holder
3	Handle	9	Inner spring	A	Inlet
4	Shim	10	Cover	B	Outlet
5	Conical spring	11	Outer spring	C	Exhaust
6	Valve body	12	Exhaust valve		

COMPONENT LOCATOR

EN0680202D100022



SHTS068020200228

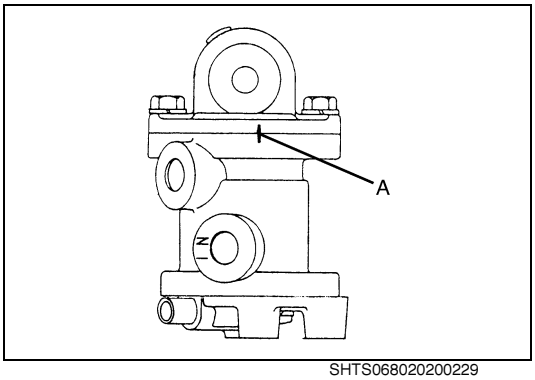
1	Valve body	8	Cam	15	Retainer ring
2	O-ring	9	Holder	16	Valve seat
3	Exhaust valve	10	Spring	17	Feed valve
4	Conical spring	11	Cover	18	Piston
5	Spring seat	12	Pin	19	Inner spring
6	Shim	13	Handle	20	Outer spring
7	Steel ball	14	Connector		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	9.8-19.6 {100-200, 8-14}	C	2.5-3.9 {25-40, 1.9-2.8}
B	5.4-7.4 {55-75, 4.0-5.4}		

OVERHAUL

EN0680202H200021

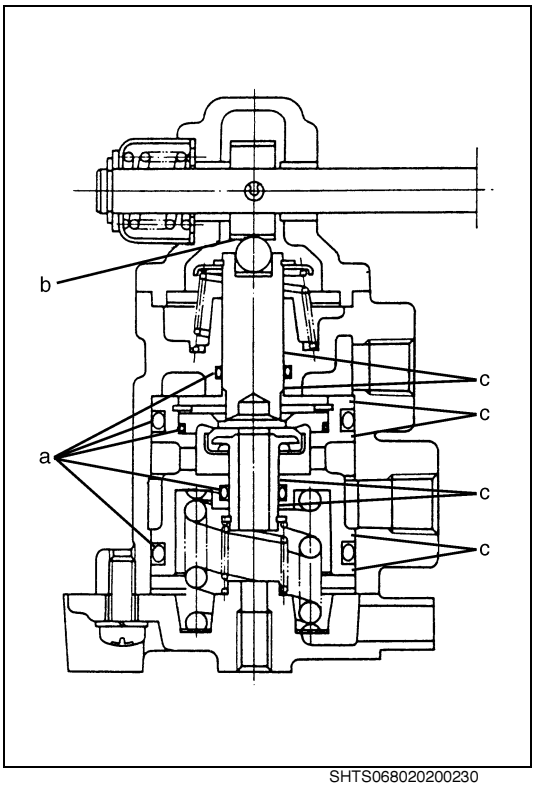


SHTS068020200229

IMPORTANT POINT - DISASSEMBLY

NOTICE

Before disassembling the hand brake valve, mark the aligning mark "A" on the holder and valve body.



SHTS068020200230

IMPORTANT POINT - ASSEMBLY

1. LUBRICATION

(1) When assembling the hand brake valve, use new O-ring and feed valve.

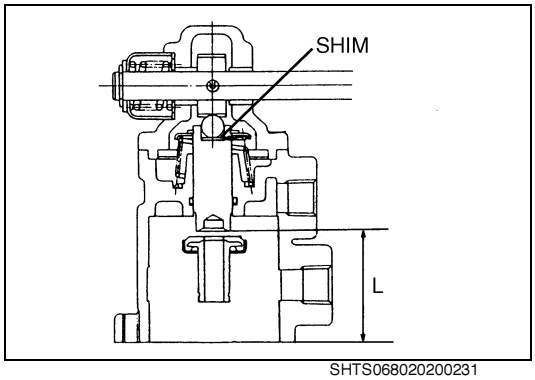
(2) Apply silicone grease to each sliding surface of the component parts and O-ring groove.

a. **O-ring**

b. **Contact of steel ball**

c. **Sliding surface**

(3) Align the aligning mark of the holder and valve body.



SHTS068020200231

IMPORTANT POINTS - ADJUSTMENT

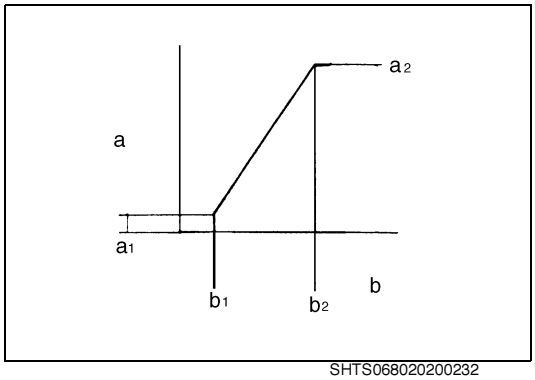
1. EXHAUST VALVE FITTING HEIGHT

(1) Measure the exhaust valve fitting height "L" and adjust it.

NOTICE

Adjust this dimension with shims.

L: 38.3-38.7 mm {1.508-1.523 in.}



SHTS068020200232

2. HAND BRAKE VALVE PERFORMANCE CHARACTERISTIC

a. **Air pressure at outlet port (kPa {kgf/cm^2, lbf/in.^{2}})**

b. **Handle turning angle (°)**

Part No. -1341

a	**(a_1) 19.6-68.6 {0.2-0.7, 2.8-9.9}**	**(a_2) 313.6-411.8 {3.2-4.2, 45.5-59.7}**
b	**(b_1) 7-13**	**(b_2) 37-43**

Part No. -1350/ -1360

a	**(a_1) 19.6-68.6 {0.2-0.7, 2.8-9.9}**	**(a_2) 421-559 {4.3-5.7, 61.1-81.0}**
b	**(b_1) 7-13**	**(b_2) 42-48**

NOTICE

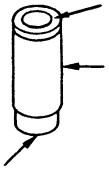
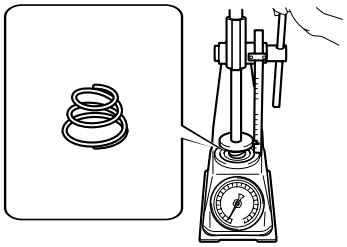
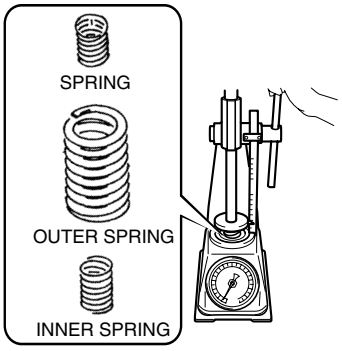
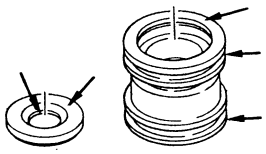
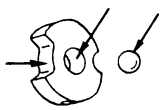
The characteristic shown in both diagrams are for inlet air pressure of 690 kPa {7.0 kgf/cm^2, 99.54 lbf/in.^{2}}.

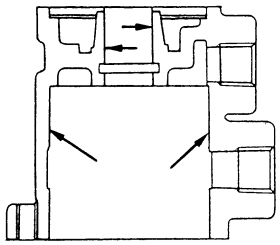
The characteristic can be adjusted by changing the shim thickness of the steel ball and of the outer spring.

INSPECTION AND REPAIR

EN0680202H300025

Unit: mm {in.}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Sliding surface of exhaust valve: Wear and damage	—	—	Replace, if necessary.	Visual check 
Conical spring: Free length/ Setting length/ Crack, rust and damage	28.5 {1.12}/ 18 {0.71}/ 31.4 N {3.2 kgf, 7.06 lbf}	29.4 N {3.0 kgf, 6.61 lbf} (Setting load)	Replace, if necessary.	Measure and visual check 
Spring, outer spring and inner spring: Free length/ Setting length/ Setting load Crack, rust and damage	Spring 25 {0.98}/ 15 {0.59}/ 50.0 N {5.1 kgf, 11.24 lbf}	44.1 N {4.5 kgf, 9.92 lbf} (Setting load)	Replace, if necessary.	Measure and Visual check 
	Outer spring 31.3 {1.23}/ 30.5 {1.20}/ 152.0 N {15.5 kgf, 34.17 lbf}	29.5 {1.16} (Free length) 122.6 N {12.5 kgf, 27.56 lbf} (Setting load)		
	Inner spring 28.5 {1.12}/ 18 {0.71}/ 31.4 N {3.2 kgf, 7.06 lbf}	27.5 {1.08} (Free length) 28.4 N {2.9 kgf, 6.39 lbf} (Setting length)		
Piston and valve seat: Wear and damage	—	—	Replace, if necessary.	Visual check 
Cam and steel ball: Wear and damage	—	—	Replace, if necessary.	Visual check 

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Valve body: **Rust, wear and damage**	**—**	**—**	**Replace,** **if necessary.**	**Visual check** 

WHEEL BRAKE (TYPE: S-CAM BRAKE)

DATA AND SPECIFICATIONS

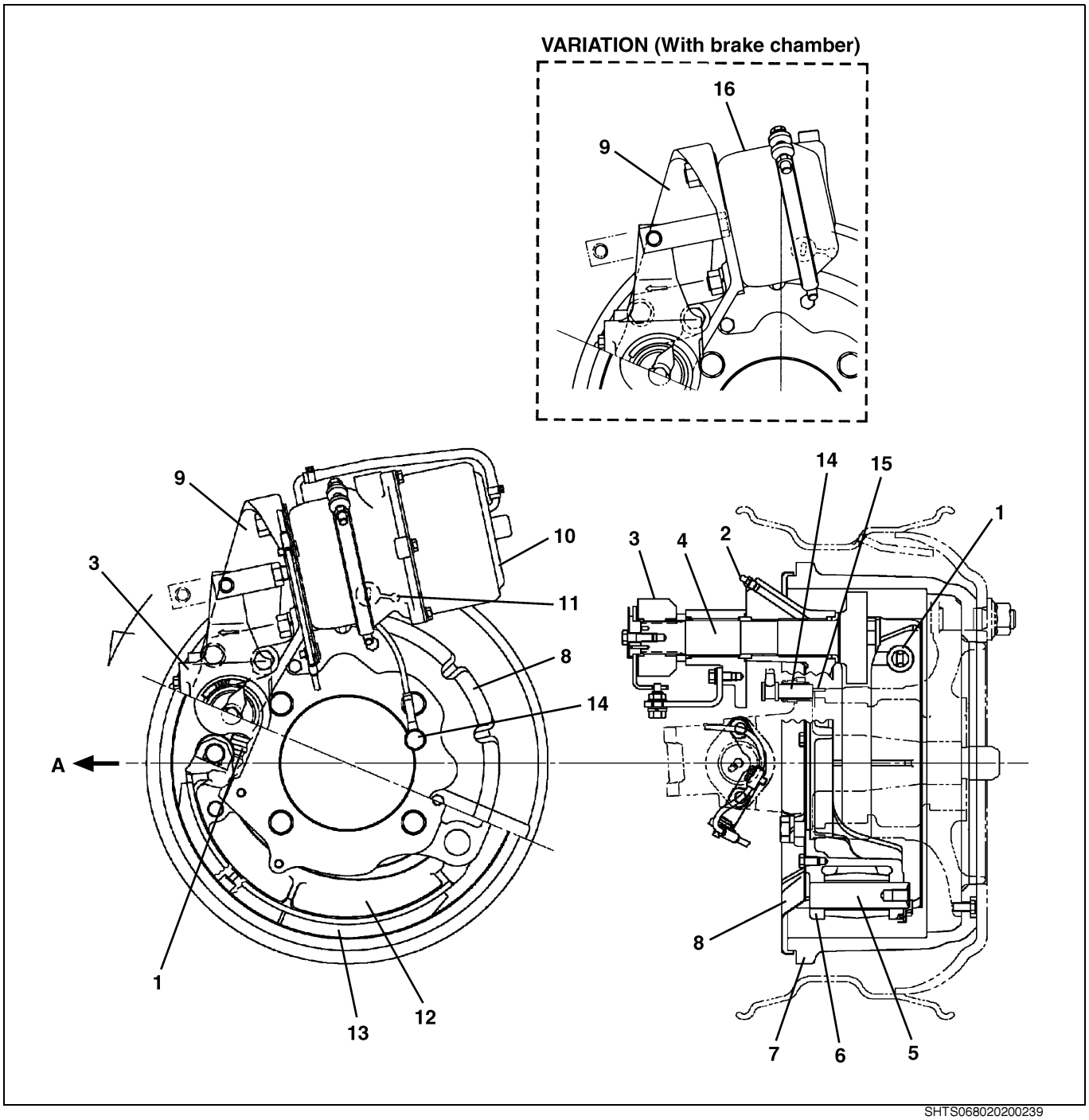
EN0680202I200023

Type		**Drum brake with internally expanding, leading-trailing shoes operating by cam shaft and slack adjuster in all wheels.**	
Brake drum inside diameter	**With ISO type wheel**	**406.4 mm {16.0 in.} for both front and rear**	
	With spoke type wheel	**440.0 mm {17.3 in.} for both front and rear**	
Brake lining Width x Thickness	**With ISO type wheel**	**Front**	**152 x 15.5 mm {6.0 x 0.61 in.}**
		Rear	**216 x 15.5 mm {8.5 x 0.61 in.}**
	With spoke type wheel	**Front**	**127 x 15.5 mm {5.0 x 0.61 in.}**
		Rear	**203 x 15.5 mm {8.0 x 0.61 in.}**

DESCRIPTION

EN0680202C100024

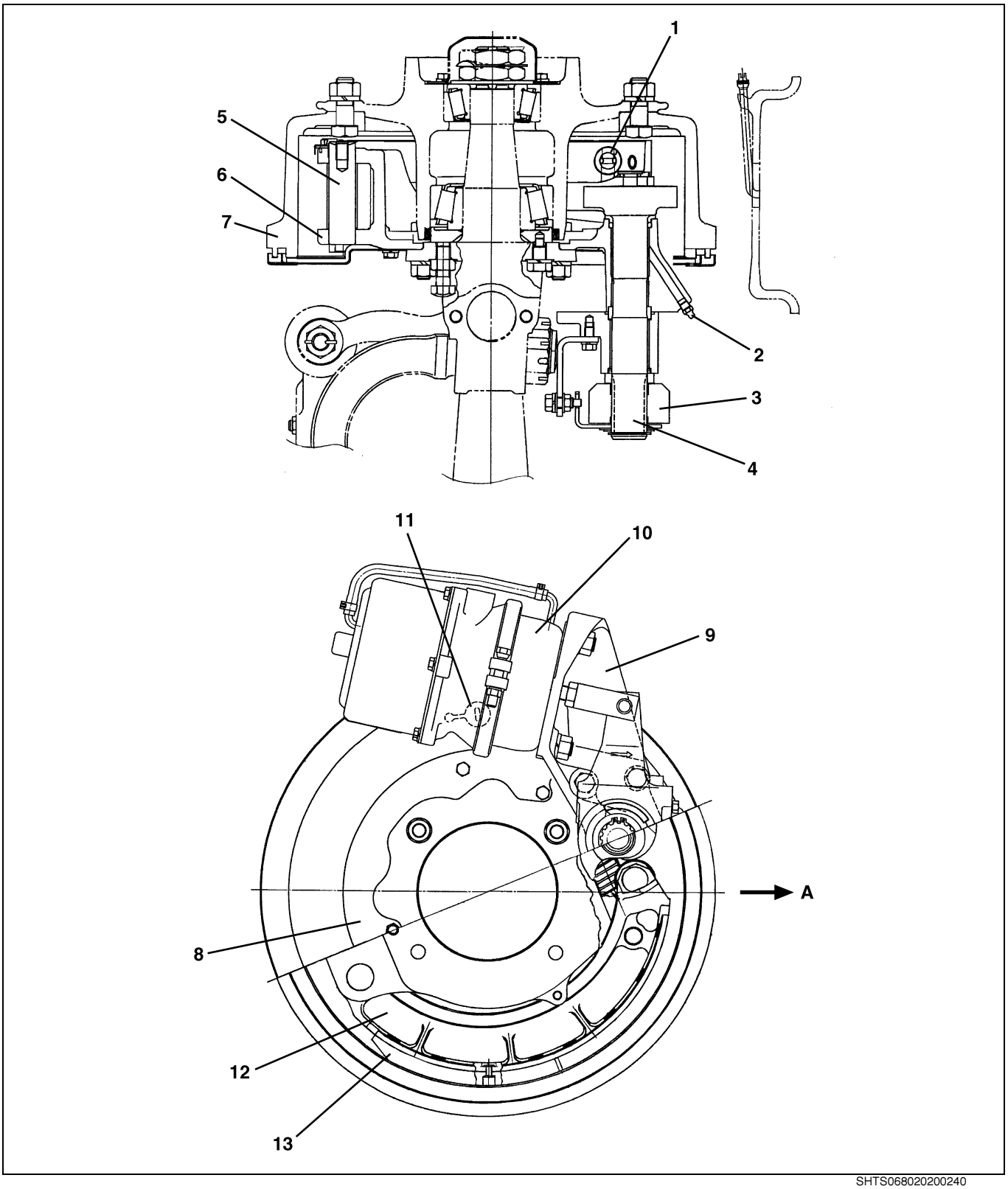
FRONT (With ISO type wheel)



SHTS068020200239

1	Brake shoe return spring	10	Spring brake chamber
2	Lubrication fitting	11	Hole plug
3	Slack adjuster	12	Brake shoe
4	Cam shaft	13	Brake lining
5	Anchor pin	14	Wheel sensor (If so equipped)
6	Brake spider	15	Sensor ring (If so equipped)
7	Brake drum	16	Brake chamber
8	Brake drum cover	A	Front
9	Brake chamber bracket		

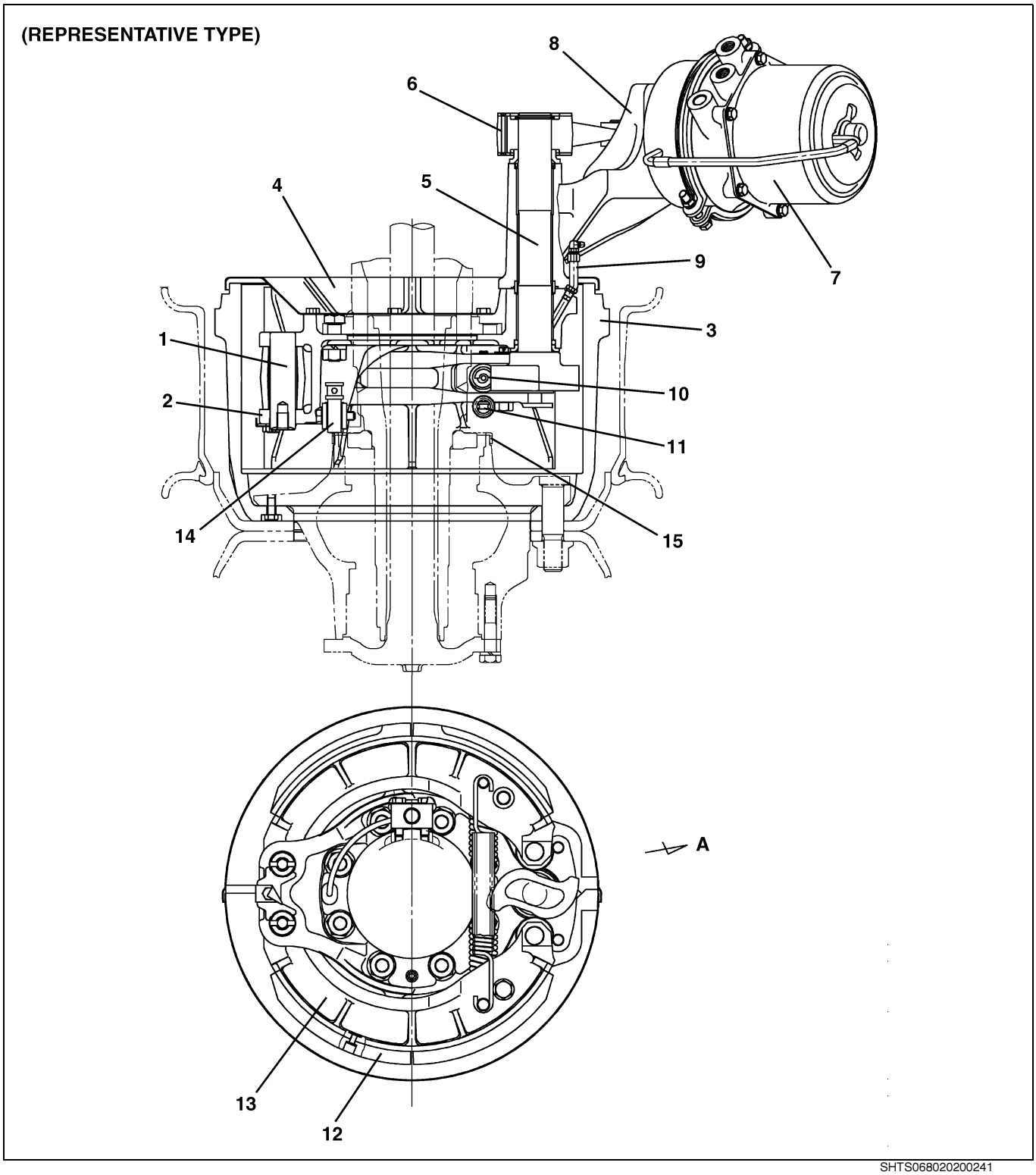
FRONT (With spoke type wheel)



SHTS068020200240

1	Brake shoe return spring	8	Brake drum cover
2	Lubrication fitting	9	Brake chamber bracket
3	Slack adjuster	10	Spring brake chamber
4	Cam shaft	11	Hole plug
5	Anchor pin	12	Brake shoe
6	Brake spider	13	Brake lining
7	Brake drum	A	Front

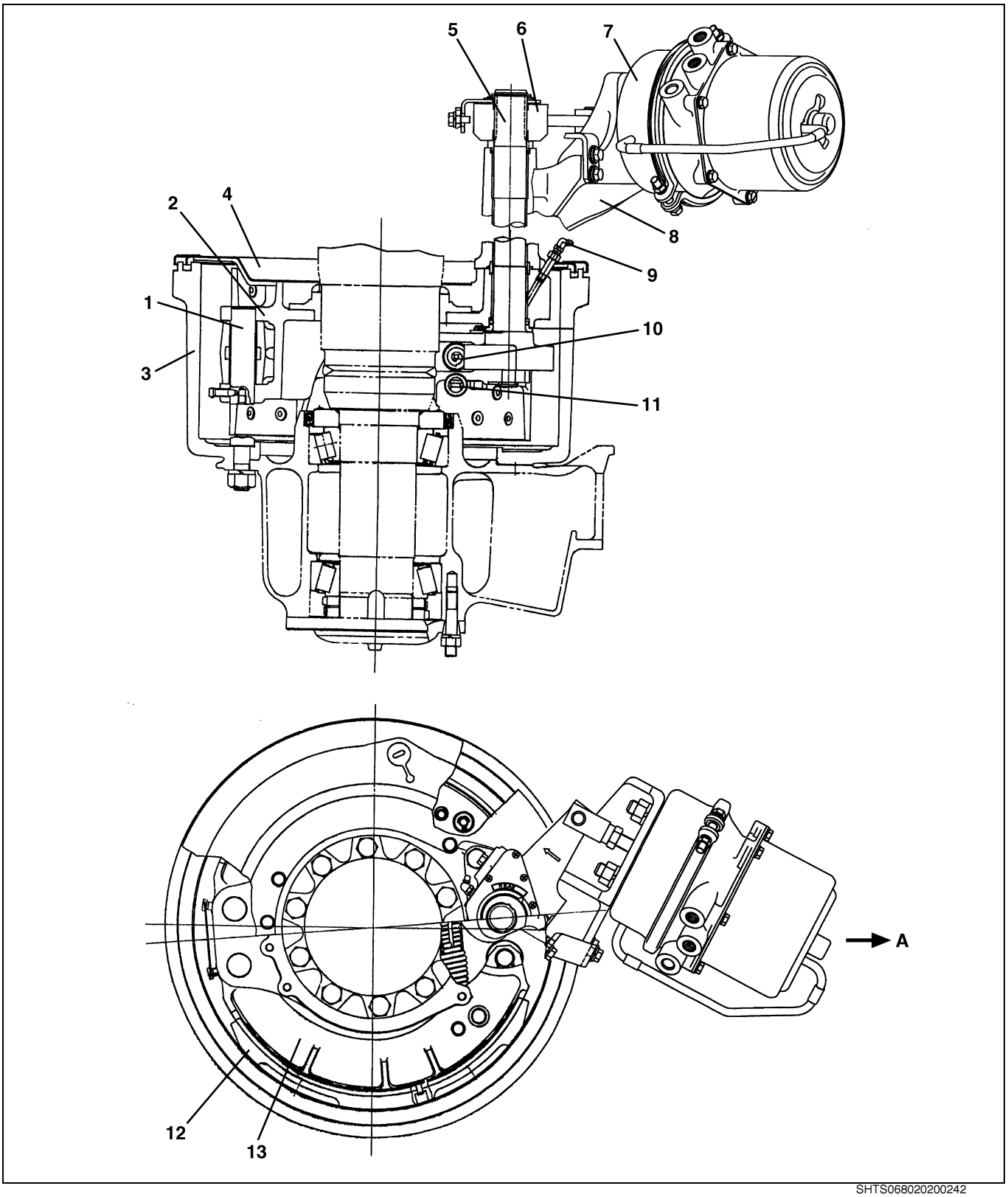
REAR-FRONT (With ISO type wheel)



SHTS068020200241

1	Anchor pin	9	Lubrication fitting
2	Brake spider	10	Brake shoe return spring (Inner)
3	Brake drum	11	Brake shoe return spring (Outer)
4	Brake drum cover	12	Brake lining
5	Cam shaft	13	Brake shoe
6	Slack adjuster	14	Wheel sensor (If so equipped)
7	Spring brake chamber	15	Sensor ring (If so equipped)
8	Brake chamber bracket	A	Front

REAR-FRONT (With spoke type wheel)

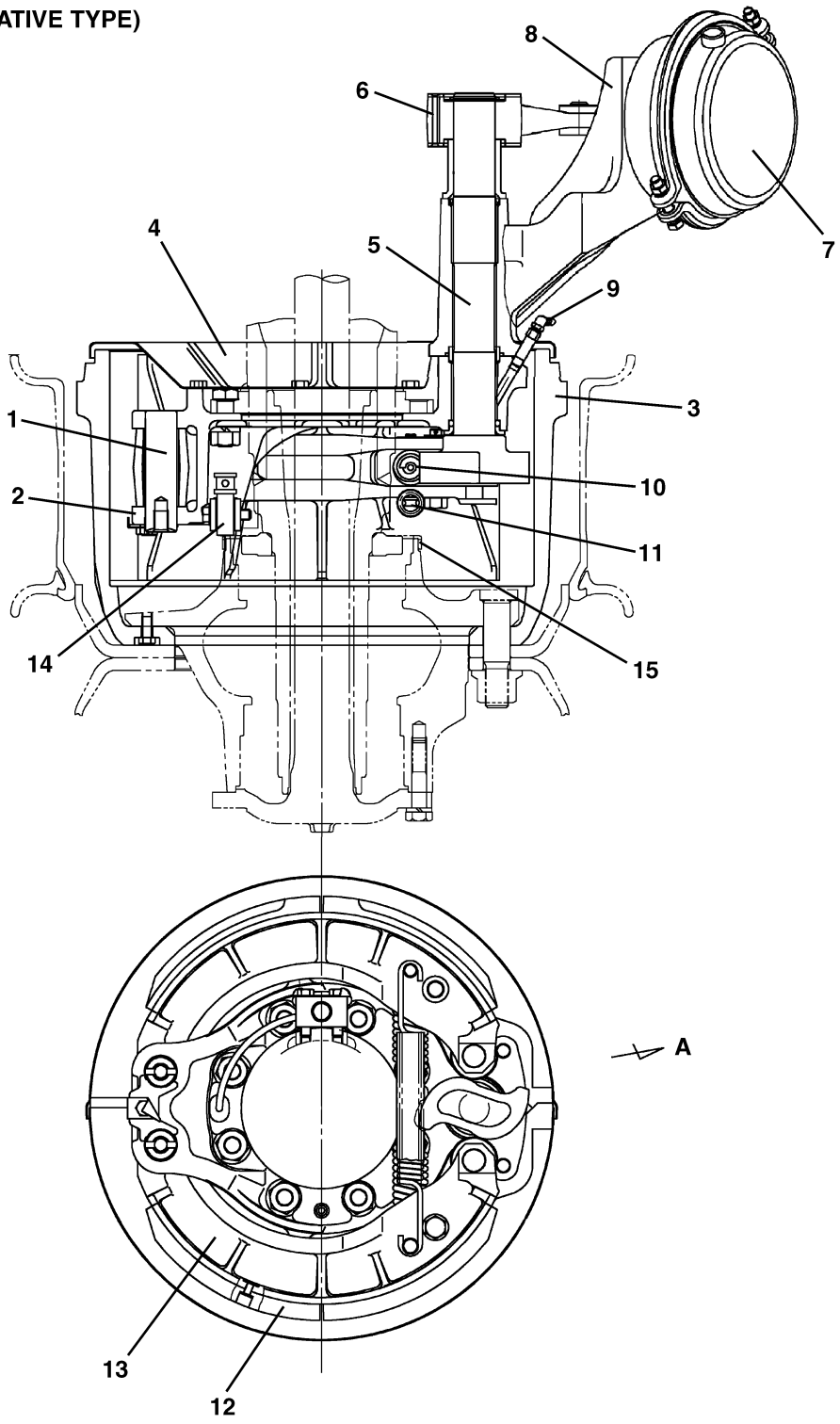


SHTS068020200242

1	Anchor pin	8	Brake chamber bracket
2	Brake spider	9	Lubrication fitting
3	Brake drum	10	Brake shoe return spring (Inner)
4	Brake drum cover	11	Brake shoe return spring (Outer)
5	Cam shaft	12	Brake lining
6	Slack adjuster	13	Brake shoe
7	Spring brake chamber	A	Front

REAR-REAR (With ISO type wheel)

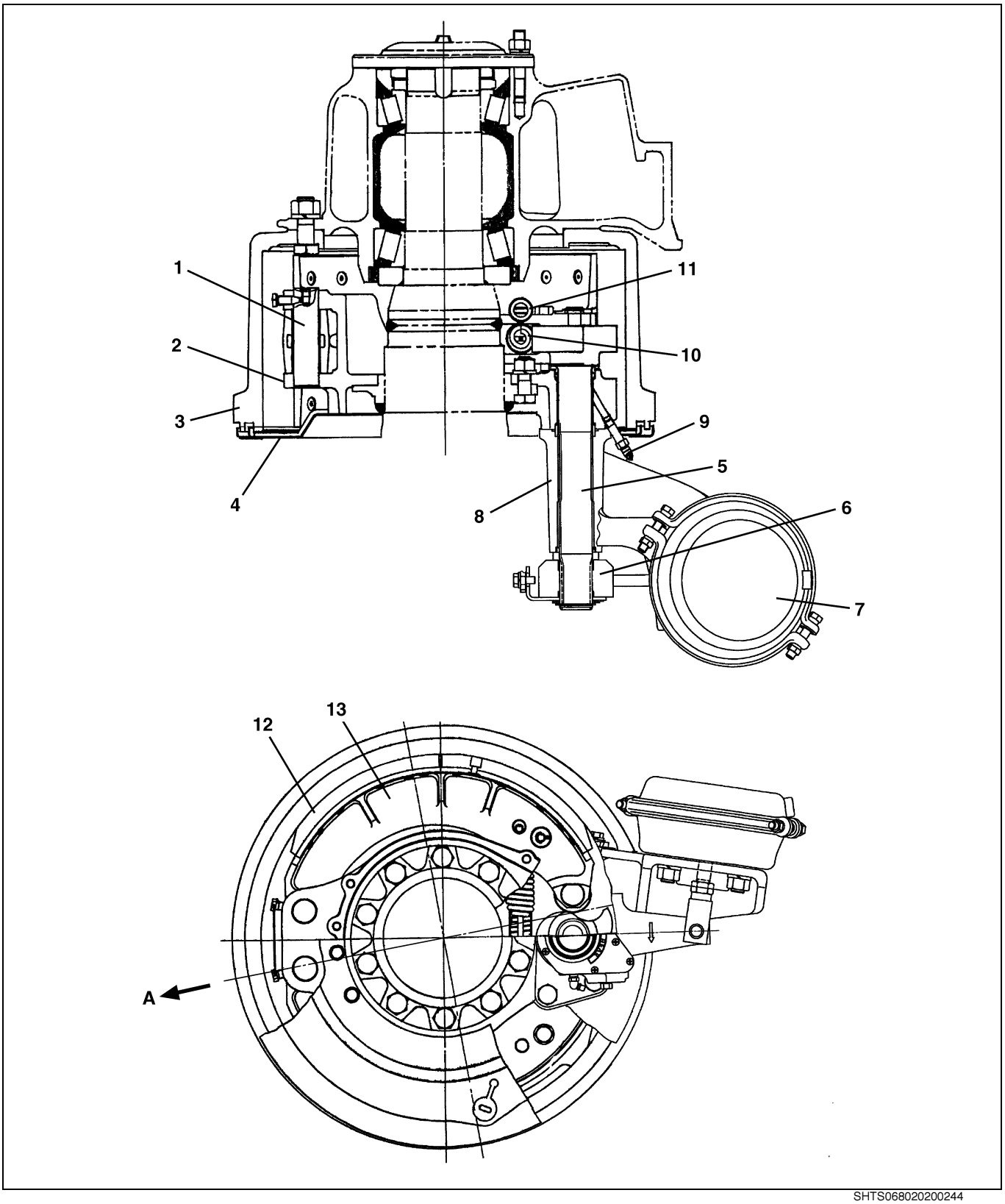
(REPRESENTATIVE TYPE)



SHTS068020200243

1	Anchor pin	9	Lubrication fitting
2	Brake spider	10	Brake shoe return spring (Inner)
3	Brake drum	11	Brake shoe return spring (Outer)
4	Brake drum cover	12	Brake lining
5	Cam shaft	13	Brake shoe
6	Slack adjuster	14	Wheel sensor (If so equipped)
7	Brake chamber	15	Sensor ring (If so equipped)
8	Brake chamber bracket	A	Front

REAR-REAR (With spoke type wheel)



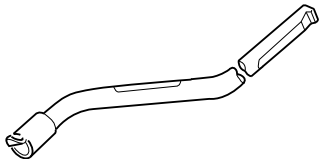
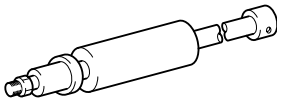
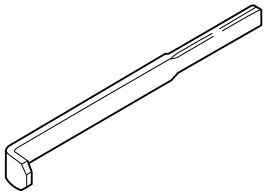
SHTS068020200244

1	Anchor pin	8	Brake chamber bracket
2	Brake spider	9	Lubrication fitting
3	Brake drum	10	Brake shoe return spring (Inner)
4	Brake drum cover	11	Brake shoe return spring (Outer)
5	Cam shaft	12	Brake lining
6	Slack adjuster	13	Brake shoe
7	Brake chamber	A	Front

SPECIAL TOOL

EN0680202K100004

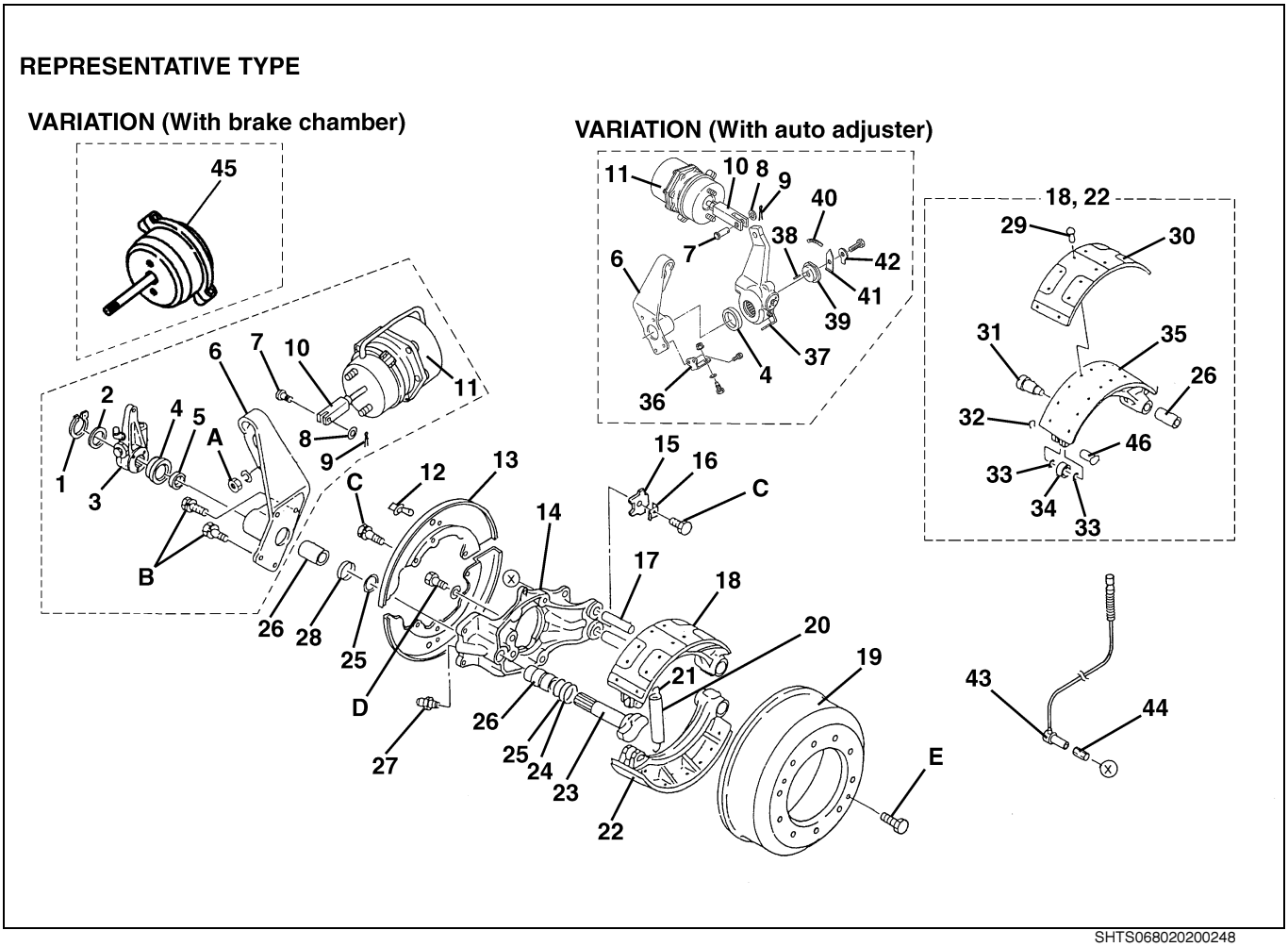
Prior to starting a wheel brake overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	09683-1070	SPRING PULL BACK TOOL	
	09420-1510	ANCHOR PIN PULLER	
	09684-1010	ANCHOR PIN TOOL	

COMPONENT LOCATOR

EN0680202D100023

FRONT (With ISO type wheel)



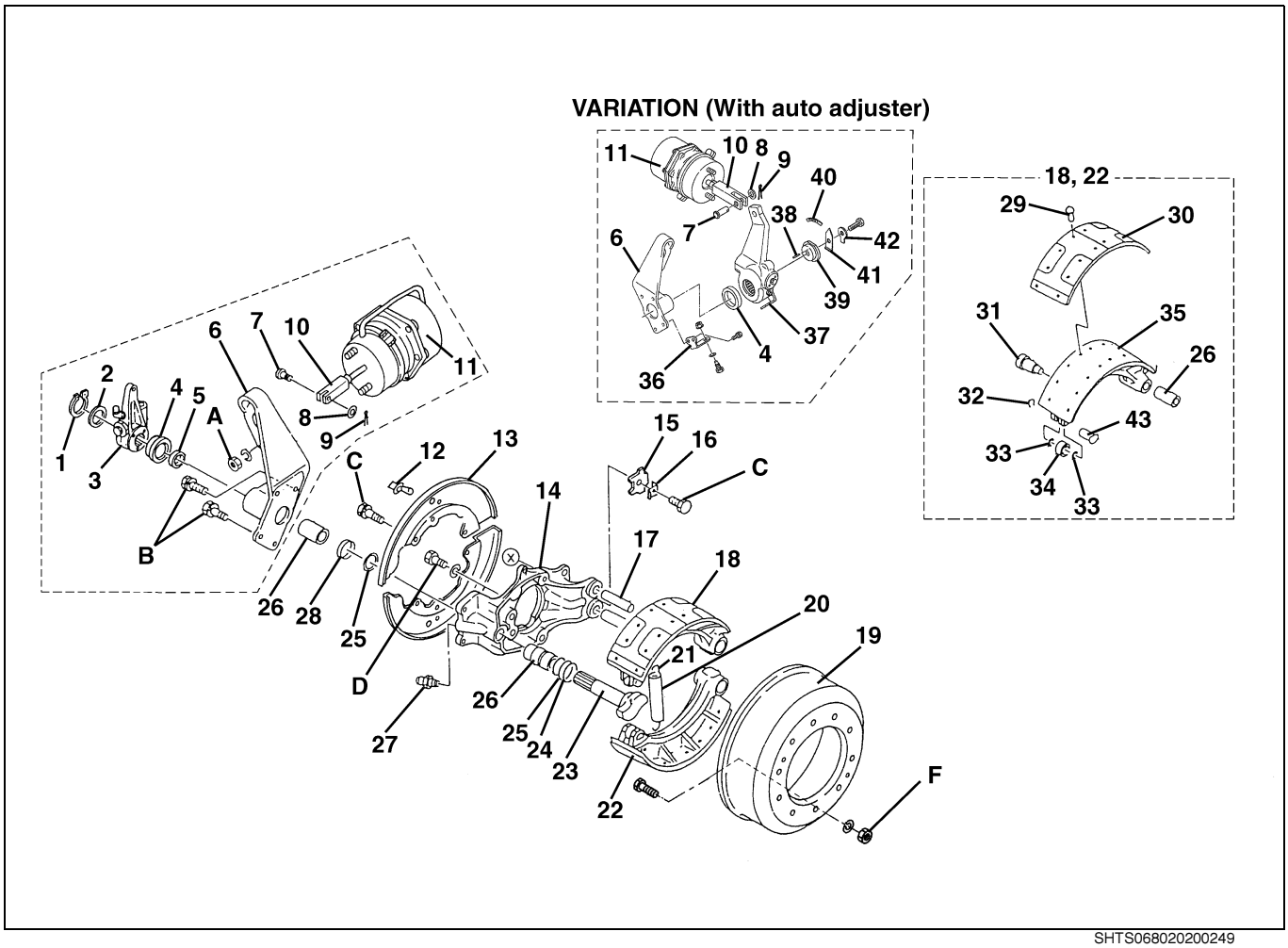
SHTS068020200248

1	Retainer ring	17	Anchor pin	33	Seal
2	Thrust washer	18	Brake shoe assembly (Trailing)	34	Roller
3	Slack adjuster	19	Brake drum	35	Brake shoe
4	Collar	20	Spring cover	36	Bracket (If so equipped)
5	Oil seal	21	Brake shoe return spring	37	Auto slack adjuster (If so equipped)
6	Brake chamber bracket	22	Brake shoe assembly (Leading)	38	Pin (If so equipped)
7	Pin	23	Cam shaft	39	Spacer (If so equipped)
8	Washer	24	Collar	40	Plate (If so equipped)
9	Cotter pin	25	O-ring	41	Indicator (If so equipped)
10	Clevis	26	Bushing	42	Lock washer (If so equipped)
11	Spring brake chamber	27	Lubrication fitting	43	Wheel sensor (If so equipped)
12	Hole plug	28	Spacer	44	Sleeve (If so equipped)
13	Brake drum cover	29	Rivet	45	Brake chamber
14	Brake spider	30	Brake lining	46	Roller pin
15	Retainer	31	Spring pin		
16	Lock plate	32	Retainer ring		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	119-225 {1,214-2,294, 88-165}	D	246-324 {2,509-3,303, 182-238}
B	109-147 {1,112-1,498, 81-108}	E	20.5-39.5 {210-402, 16-29}
C	34.5-51.5 {352-525, 26-37}		

FRONT (With spoke type wheel)



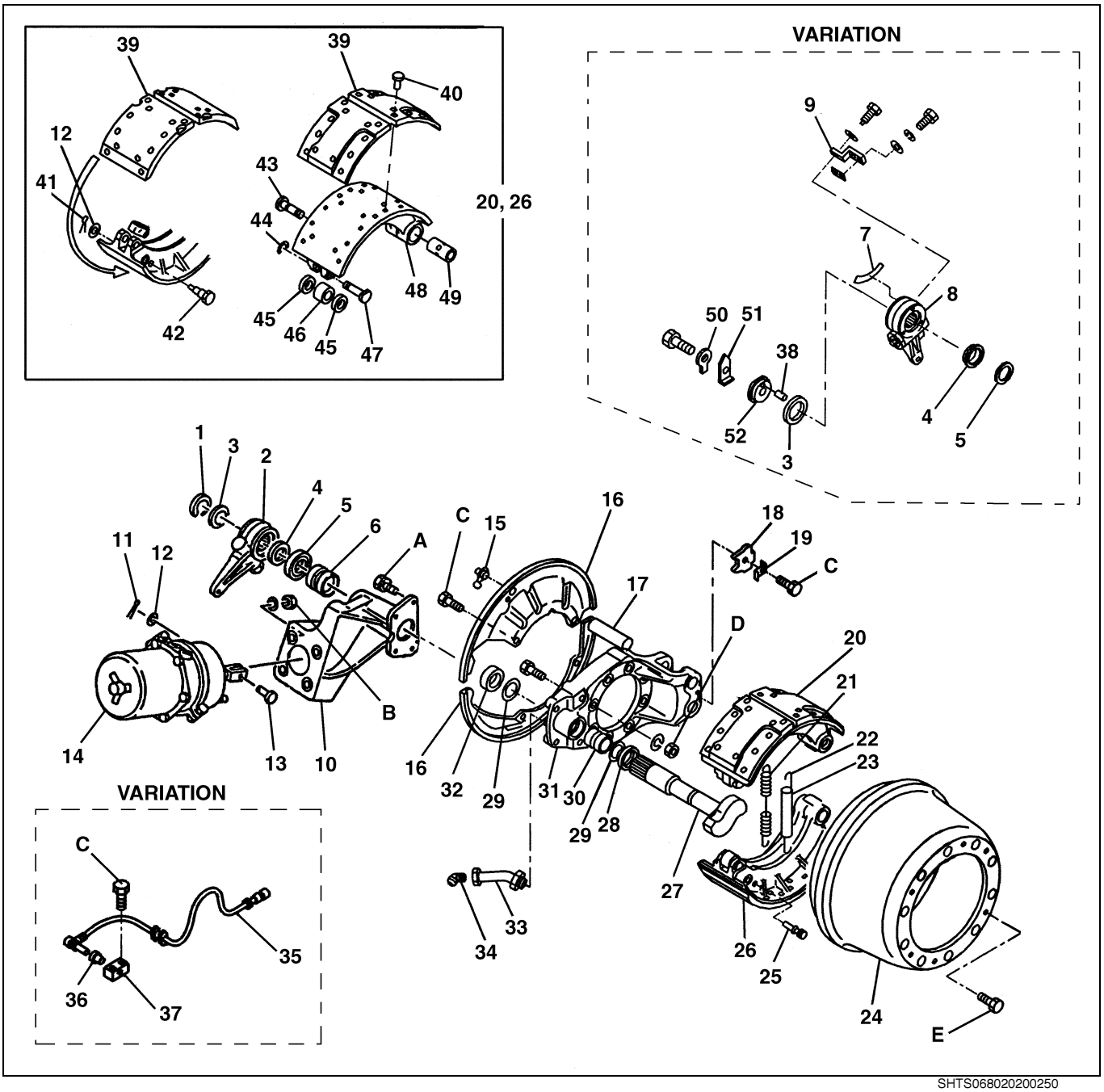
SHTS068020200249

1	Retainer ring	16	Lock plate	31	Spring pin
2	Thrust washer	17	Anchor pin	32	Retainer ring
3	Slack adjuster	18	Brake shoe assembly (Trailing)	33	Seal
4	Collar	19	Brake drum	34	Roller
5	Oil seal	20	Spring cover	35	Brake shoe
6	Brake chamber bracket	21	Brake shoe return spring	36	Bracket (If so equipped)
7	Pin	22	Brake shoe assembly (Leading)	37	Auto slack adjuster (If so equipped)
8	Washer	23	Cam shaft	38	Pin (If so equipped)
9	Cotter pin	24	Collar	39	Spacer (If so equipped)
10	Clevis	25	O-ring	40	Plate (If so equipped)
11	Spring brake chamber	26	Bushing	41	Indicator (If so equipped)
12	Hole plug	27	Lubrication fitting	42	Lock washer (If so equipped)
13	Brake drum cover	28	Spacer	43	Roller pin
14	Brake spider	29	Rivet		
15	Retainer	30	Brake lining		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	119-225 {1,214-2,294, 88-165}	D	246-324 {2,509-3,303, 182-238}
B	109-147 {1,112-1,498, 81-108}	E	393-471 {4,008-4,802, 290-347}
C	34.5-51.5 {352-525, 26-37}		

REAR-FRONT (With ISO type wheel)



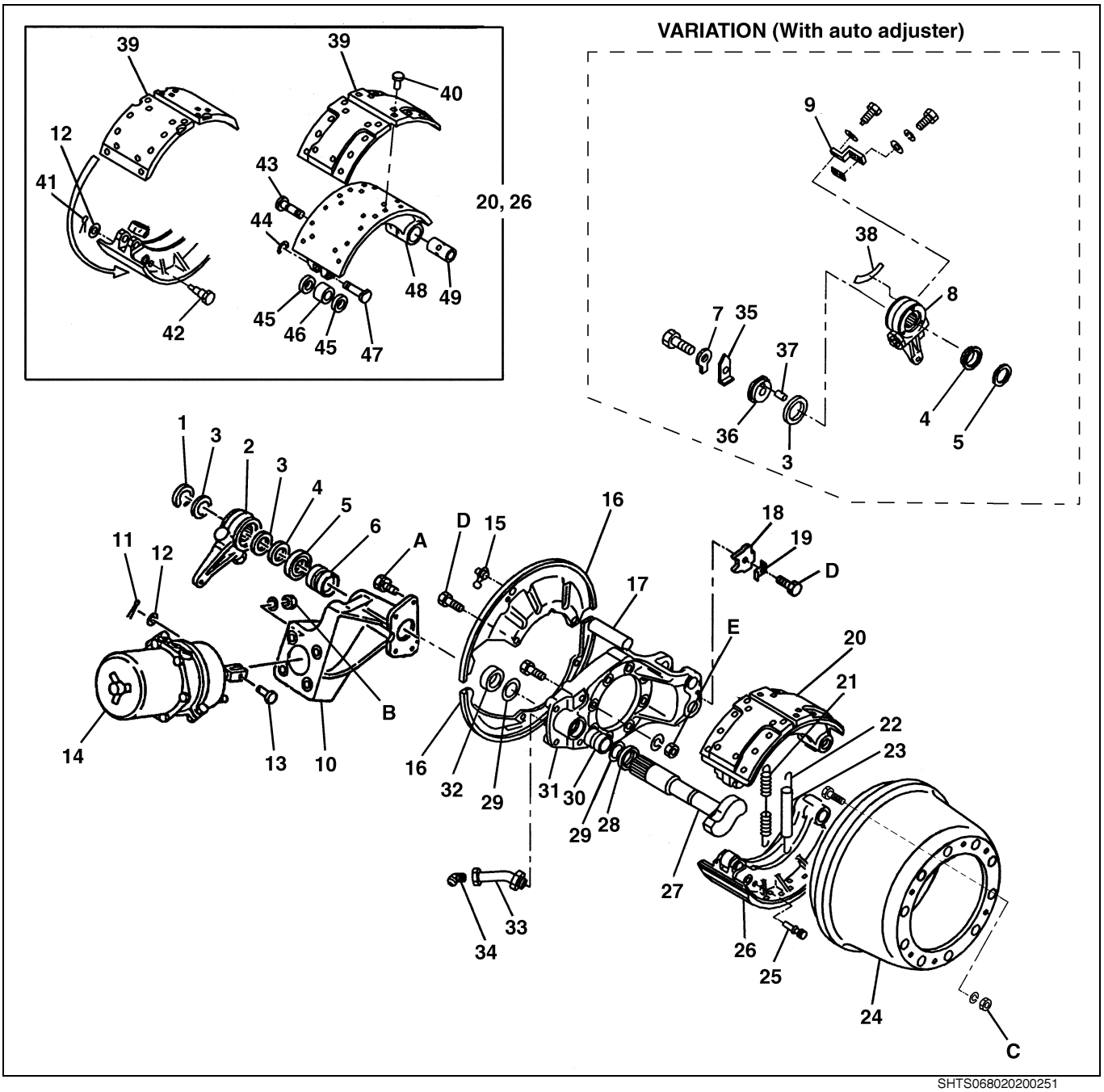
SHTS068020200250

1	Retainer ring	19	Lock plate	37	Holder (If so equipped)
2	Slack adjuster	20	Brake shoe assembly (Trailing)	38	Pin (If so equipped)
3	Thrust washer	21	Brake shoe return spring (Inner)	39	Brake lining
4	Collar	22	Brake shoe return spring (Outer)	40	Rivet
5	Oil seal	23	Spring cover	41	Cotter pin
6	Bushing	24	Brake drum	42	Pivot pin
7	Plate (If so equipped)	25	Spring pin	43	Spring pin
8	Auto slack adjuster (If so equipped)	26	Brake shoe assembly (Leading)	44	Retainer ring
9	Bracket (If so equipped)	27	Cam shaft	45	Seal
10	Brake chamber bracket	28	Collar	46	Roller
11	Cotter pin	29	O-ring	47	Roller pin
12	Washer	30	Bushing	48	Brake shoe
13	Pin	31	Brake spider	49	Bushing
14	Spring brake chamber	32	Spacer	50	Lock washer (If so equipped)
15	Hole plug	33	Connector	51	Indicator (If so equipped)
16	Brake drum cover	34	Lubrication fitting	52	Spacer (If so equipped)
17	Anchor pin	35	Wheel sensor (If so equipped)		
18	Retainer	36	Sleeve (If so equipped)		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	109-147 {1,112-1,498, 81-108}	D	168-226 {1,714-2,304, 124-166}
B	119-225 {1,214-2,294, 88-165}	E	20.5-39.5 {210-402, 16-29}
C	34.5-51.5 {352-525, 26-37}		

REAR-FRONT (With spoke type wheel)



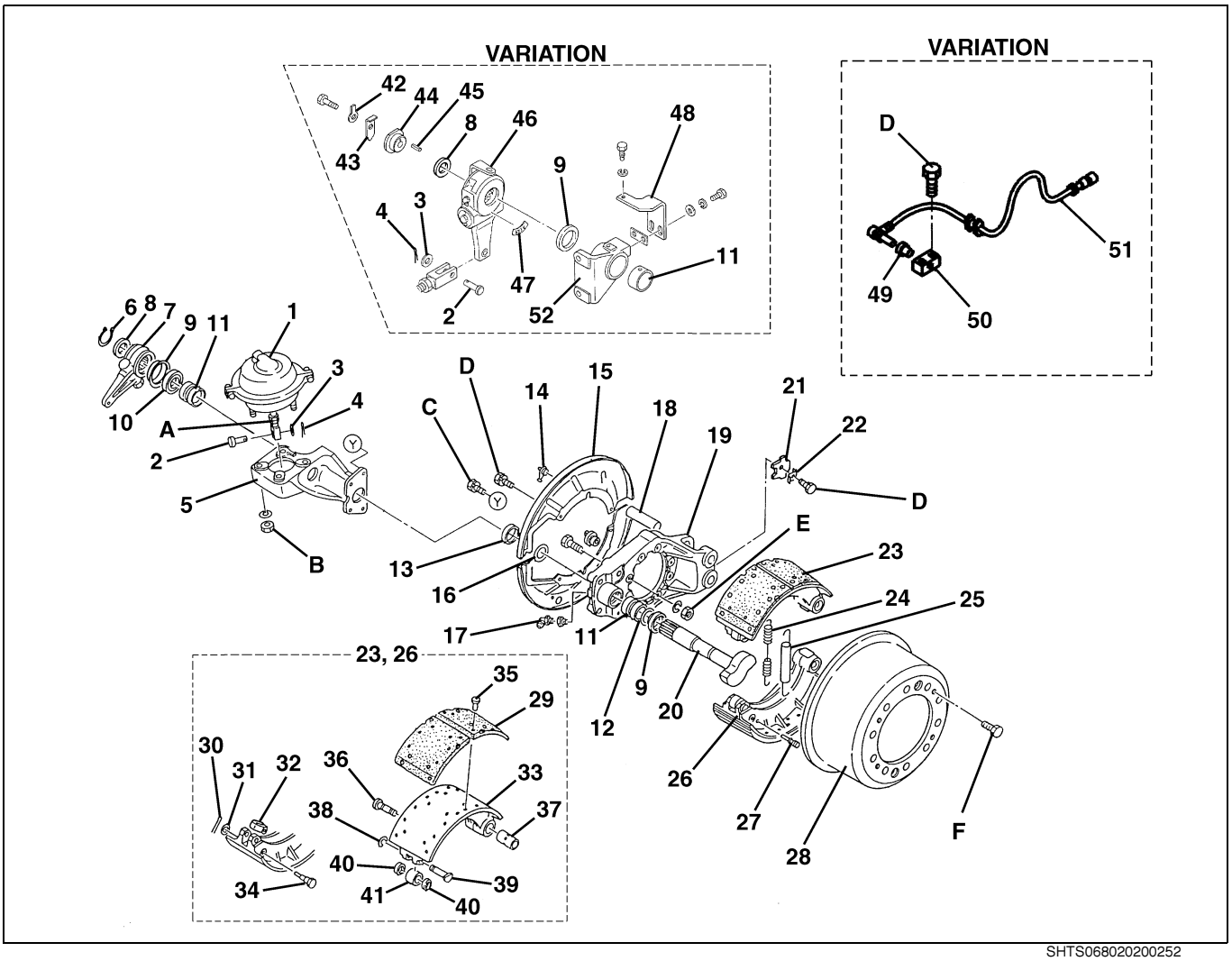
SHTS068020200251

1	Retainer ring	18	Retainer	35	Indicator (If so equipped)
2	Slack adjuster	19	Lock plate	36	Spacer (If so equipped)
3	Thrust washer	20	Brake shoe assembly (Trailing)	37	Pin (If so equipped)
4	Collar	21	Brake shoe return spring (Inner)	38	Plate (If so equipped)
5	Oil seal	22	Brake shoe return spring (Outer)	39	Brake lining
6	Bushing	23	Spring cover	40	Rivet
7	Lock washer (If so equipped)	24	Brake drum	41	Cotter pin
8	Auto slack adjuster (If so equipped)	25	Spring pin	42	Pivot pin
9	Bracket (If so equipped)	26	Brake shoe assembly (Leading)	43	Spring pin
10	Brake chamber bracket	27	Cam shaft	44	Retainer ring
11	Cotter pin	28	Collar	45	Seal
12	Washer	29	O-ring	46	Roller
13	Pin	30	Bushing	47	Roller pin
14	Spring brake chamber	31	Brake spider	48	Brake shoe
15	Hole plug	32	Spacer	49	Bushing
16	Brake drum cover	33	Connector		
17	Anchor pin	34	Lubrication fitting		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	109-147 {1,112-1,498, 81-108}	D	34.5-51.5 {352-525, 26-37}
B	119-225 {1,241-2,294, 88-165}	E	168-226 {1,714-2,304, 124-166}
C	393-471 {4,008-4,802, 290-347}		

REAR-REAR (With ISO type wheel)



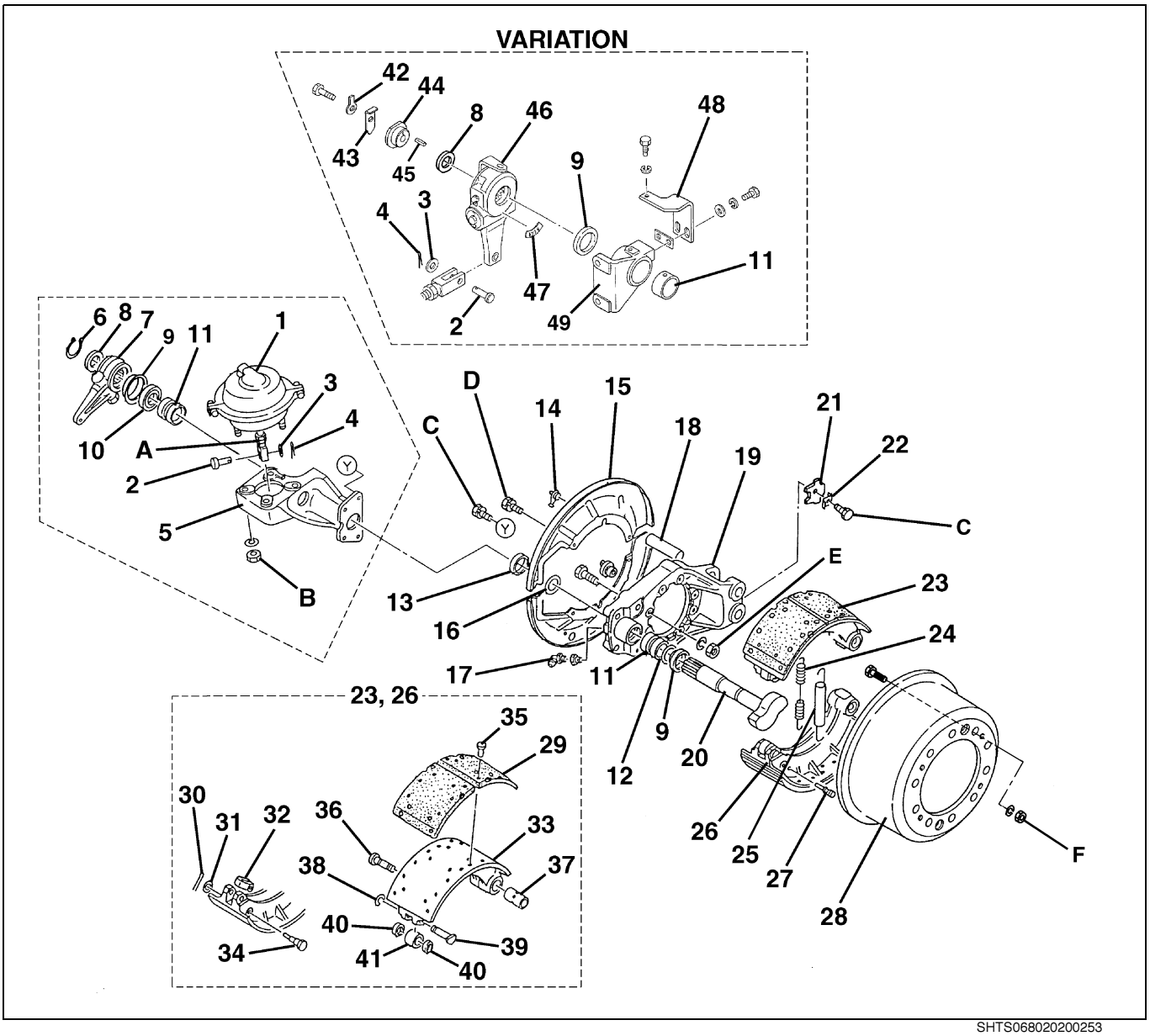
SHTS068020200252

1	Brake chamber	19	Brake spider	37	Bushing
2	Pin	20	Cam shaft	38	Retainer ring
3	Washer	21	Retainer	39	Roller pin
4	Cotter pin	22	Lock plate	40	Seal
5	Brake chamber bracket	23	Brake shoe assembly (Leading)	41	Roller
6	Retainer ring	24	Brake shoe return spring (Inner)	42	Lock washer (If so equipped)
7	Slack adjuster	25	Brake shoe return spring (Outer)	43	Indicator (If so equipped)
8	Thrust washer	26	Brake shoe assembly (Trailing)	44	Spacer (If so equipped)
9	Collar	27	Spring pin	45	Pin (If so equipped)
10	Oil seal	28	Brake drum	46	Auto slack adjuster (If so equipped)
11	Bushing	29	Brake lining	47	Plate (If so equipped)
12	O-ring	30	Cotter pin	48	Bracket (If so equipped)
13	Spacer	31	Washer	49	Sleeve (If so equipped)
14	Hole plug	32	Clamp	50	Holder (If so equipped)
15	Brake drum cover	33	Brake shoe	51	Wheel sensor (If so equipped)
16	O-ring	34	Pivot pin	52	Cam shaft bracket
17	Lubrication fitting	35	Rivet		
18	Anchor pin	36	Spring pin		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	50-68 {510-693, 37-50}	D	34.5-51.5 {352-525, 26-37}
B	119-225 {1,214-2,294, 88-165}	E	168-226 {1,714-2,304, 124-166}
C	109-147 {1,112-1,498, 81-108}	F	20.5-39.5 {210-402, 16-29}

REAR-REAR (With spoke type wheel)



SHTS068020200253

1	Brake chamber	18	Anchor pin	35	Rivet
2	Pin	19	Brake spider	36	Spring pin
3	Washer	20	Cam shaft	37	Bushing
4	Cotter pin	21	Retainer	38	Retainer ring
5	Brake chamber bracket	22	Lock plate	39	Roller pin
6	Retainer ring	23	Brake shoe assembly (Leading)	40	Seal
7	Slack adjuster	24	Brake shoe return spring (Inner)	41	Roller
8	Thrust washer	25	Brake shoe return spring (Outer)	42	Lock washer (If so equipped)
9	Collar	26	Brake shoe assembly (Trailing)	43	Indicator (If so equipped)
10	Oil seal	27	Spring pin	44	Spacer (If so equipped)
11	Bushing	28	Brake drum	45	Pin (If so equipped)
12	O-ring	29	Brake lining	46	Auto slack adjuster (If so equipped)
13	Spacer	30	Cotter pin	47	Plate (If so equipped)
14	Hole plug	31	Washer	48	Bracket (If so equipped)
15	Brake drum cover	32	Clamp	49	Cam shaft bracket
16	O-ring	33	Brake shoe		
17	Lubrication fitting	34	Pivot pin		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	50-68 {510-693, 37-50}	D	34.5-51.5 {352-525, 26-37}
B	119-225 {1,214-2,294, 88-165}	E	168-226 {1,714-2,304, 124-166}
C	109-147 {1,112-1,498, 81-108}	F	393-471 {4,008-4,802, 290-347}

OVERHAUL

EN0680202H200022

IMPORTANT POINTS - DISASSEMBLY

1. REMOVAL OF TIRE

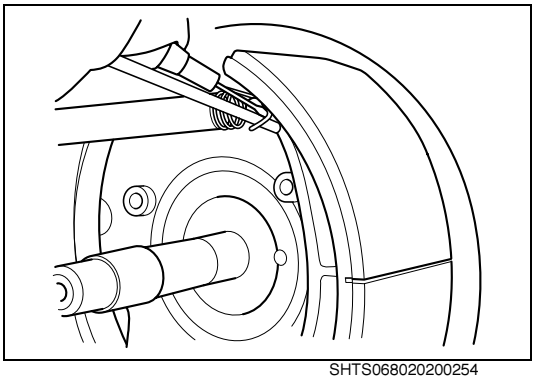
(1) Refer to chapter for WHEEL & TIRE.

2. REMOVAL OF BRAKE DRUM WITH WHEEL HUB AND WHEEL HUB BEARINGS.

(1) Refer to chapter FRONT AXLE and REAR AXLE.

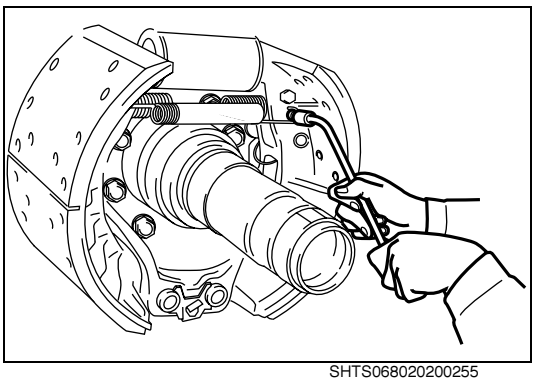
3. REMOVAL OF BRAKE SHOE RETURN SPRING

(1) Using the special tool, remove the return spring. (FRONT WHEEL)
SST: Spring Pull Back Tool (09683-1070)



SHTS068020200254

(2) Using the special tool, remove the outer return spring. (REAR WHEEL)
SST: Spring Pull Back Tool (09683-1070)



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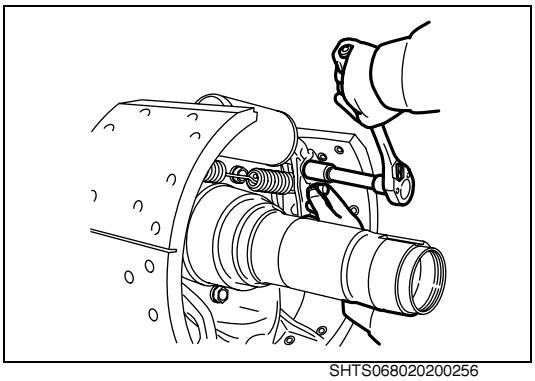
(3) Turn the pivot pin and pull out the spring pin then remove the return spring, inner. (REAR WHEEL)

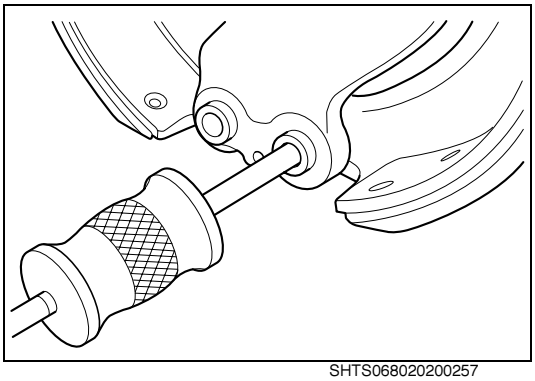


SHTS068020200256

4. REMOVAL OF ANCHOR PIN

(1) Remove the lock plate and anchor pin retainer.

(2) Using the special tool, remove the pin and the brake shoe assembly.
SST: Anchor pin puller (09420-1510)



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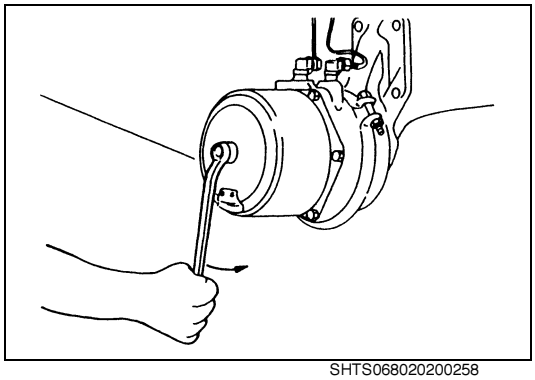

SHTS068020200258

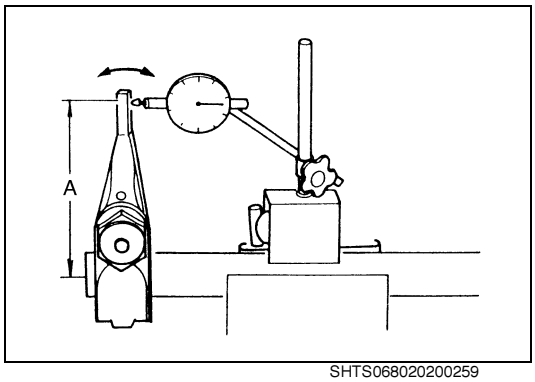
5. REMOVAL OF CAM SHAFT AND SLACK ADJUSTER

(1) If the vehicle is equipped with spring brake chamber, before removing the cam shaft and slack adjuster, release the spring brake.

NOTICE

Before removing the slack adjuster and cam shaft, apply a mark to them to make clear the side (Left or Right) where they were installed.

IMPORTANT POINTS - ASSEMBLY

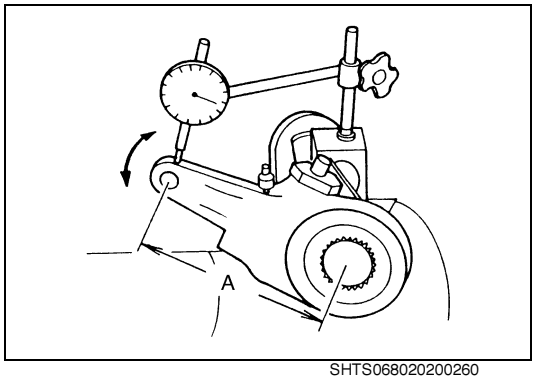


SHTS068020200259

1. INSPECTION OF SLACK ADJUSTER

(1) Measure the axial play and if the play exceed the limit, inspect the spline of cam shaft and disassemble the adjuster.

Dimension "A": 150 mm {5.9 in.}
Assembly Standard: 1.5 mm {0.06 in.}
Service Limit: 3.0 mm {0.12 in.}



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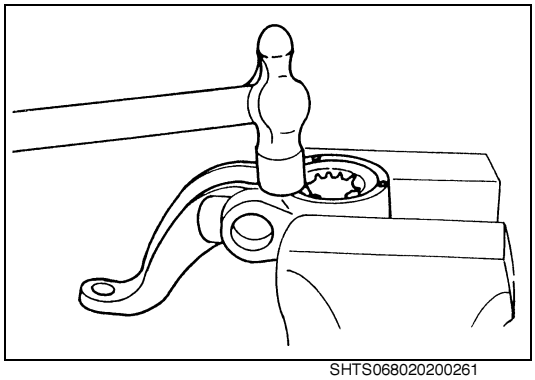
(2) Measure the circumference play and if the play exceed the limit, inspect the spline of cam shaft and disassemble the adjuster.

Dimension "A": 150 mm {5.9 in.}
Assembly Standard: 3.0 mm {0.12 in.}
Service Limit: 10.0 mm {0.39 in.}

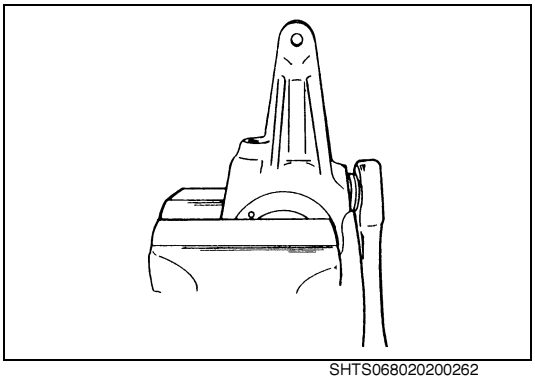

SHTS068020200261

2. ASSEMBLY OF SLACK ADJUSTER

(1) Install the body cover.
(2) Use new rivets and caulk the rivet ends.

NOTICE

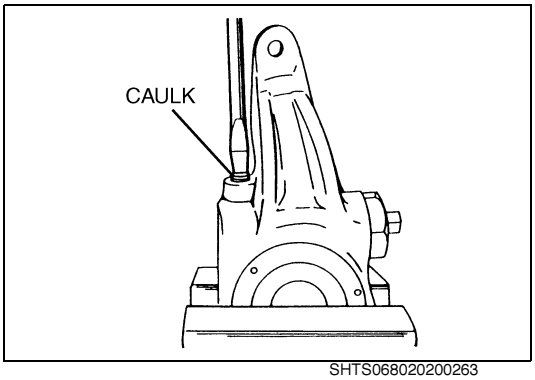
Apply enough chassis grease on the worm gear shaft before installing the cover.


SHTS068020200262

(3) Tighten the worm gear shaft stopper fully then loose it by 1/12-1/6 turn.

NOTICE

- **Replace the O-ring with new one.**
- **Apply enough chassis grease on the worm gear shaft before installing the worm gear shaft.**

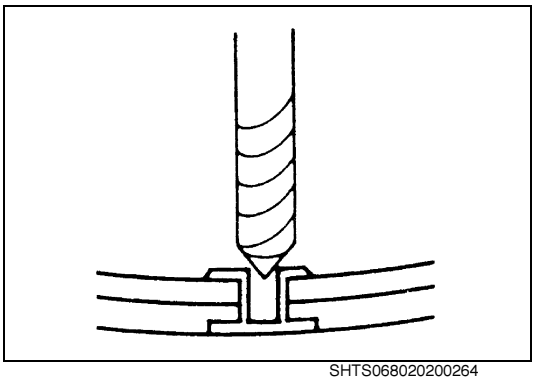


SHTS068020200263

(4) Install the lock ball, spring and plug.
(5) After tighten the plug, caulk it to the body by a punch.

NOTICE

Apply enough chassis grease on the lock ball and spring.

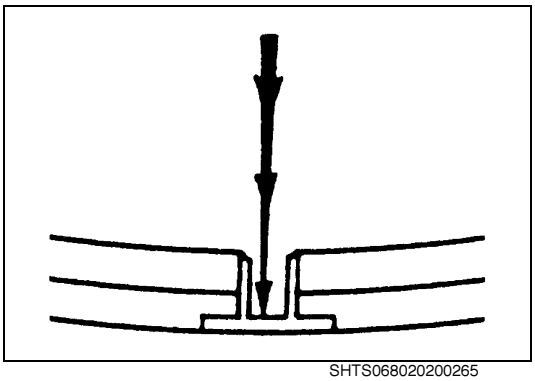

SHTS068020200264

3. REPLACEMENT OF BRAKE LINING

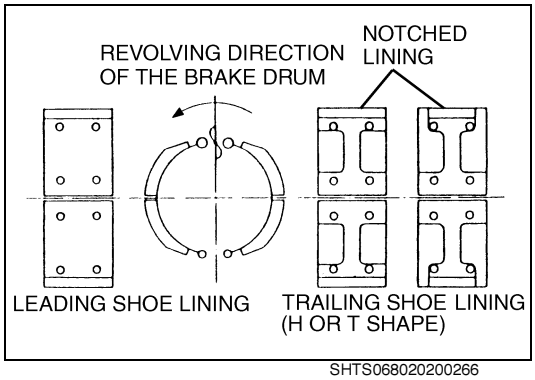
(1) Remove the brake lining from the brake shoe.
   a. Drill the rivet caulking section with a drill smaller than the rivet diameter.

NOTICE

At this time, be careful not to scratch the brake shoe.


SHTS068020200265

   b. After drilling, remove the remaining portion of the rivet with a fine chisel or a riveting machine.

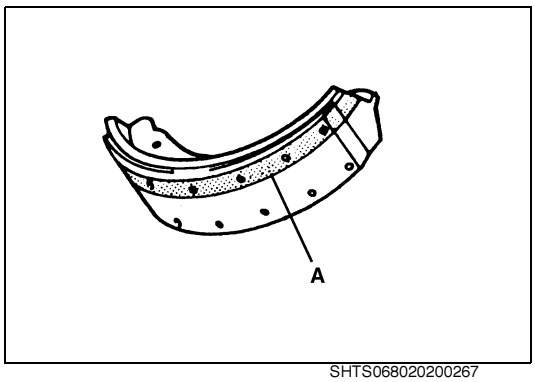


SHTS068020200266

(2) Install the brake lining to the brake shoe.

NOTICE

If a notched lining is used, the brake shoe and brake lining should be installed as shown in figure.



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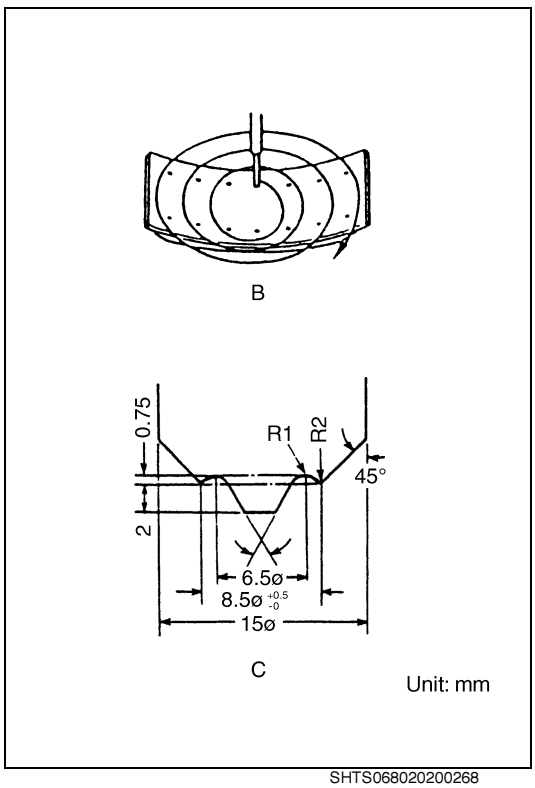
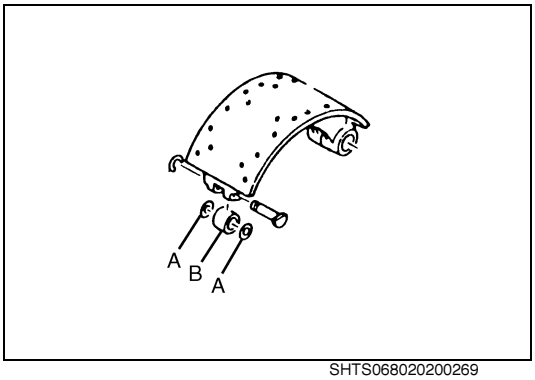
a. Set the lining on the shoe and insert the rivets into all holes, then hold them in place with adhesive tape "A".



SHTS068020200268

b. Caulk the rivets lightly in a circular pattern as shown in figure "B", repeat several times assure proper seating of the lining.
Recommended configuration of punch: shown in "C".
Recommended force of staking the rivet: 2.4 tons.

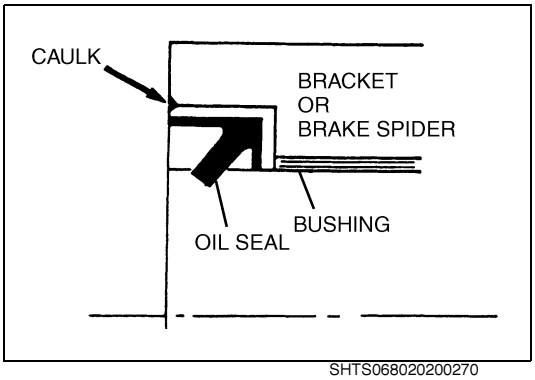
c. Remove adhesive tape.



SHTS068020200269

4. ASSEMBLY OF BRAKE SHOE

(1) Seals "A" for roller "B" should be replaced with new ones.
(2) Apply adequate amount of heat resistance grease on the roller and seals.



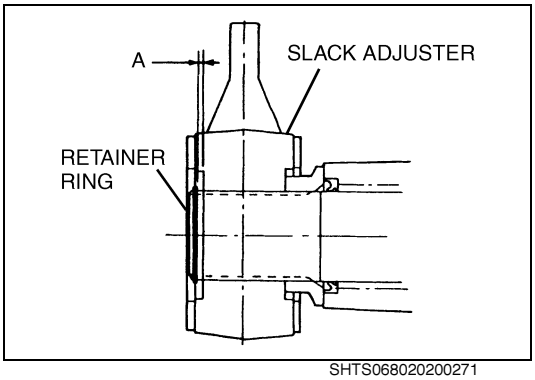
SHTS068020200270

5. INSTALLATION OF O-RING AND OIL SEAL

(1) When assembling the wheel brake, replace the O-rings and oil seals with new ones.

NOTICE

- **The lip parts of the seal should always be facing outside.**
- **The seal should be caulked to the bracket (or bracket spider) with a punch.**



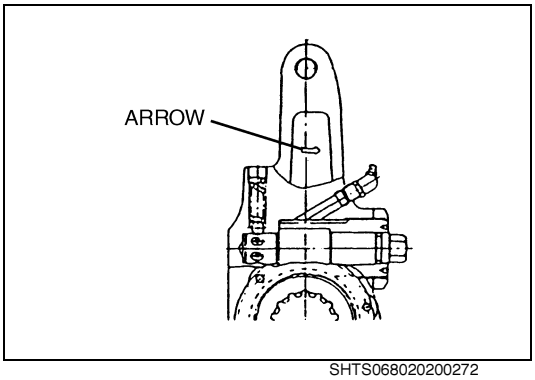
SHTS068020200271

6. INSTALLATION OF CAM SHAFT AND SLACK ADJUSTER

(1) Apply adequate amount of chassis grease on the O-ring, oil seal and bushing before installing the cam shaft.
(2) If the clearance "A" between the retainer ring and slack adjuster exceed 2.0 mm {0.078 in.}, install the washer between them.

NOTICE

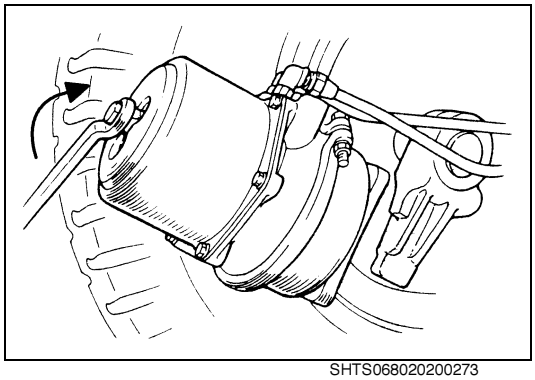
Install the cam shaft and slack adjuster on the correct side (Left or Right) according to the mark on them which were applied when disassembling.



SHTS068020200272

NOTICE

- **Make sure that the slack adjuster is installed, so that the arrow on the adjuster points to the direction of the brake chamber rod stroke as shown in figure.**
- **When connecting the slack adjuster with the brake chamber and/or spring brake chamber, lubricate the clevis pin-hole and the pin with sufficient chassis grease.**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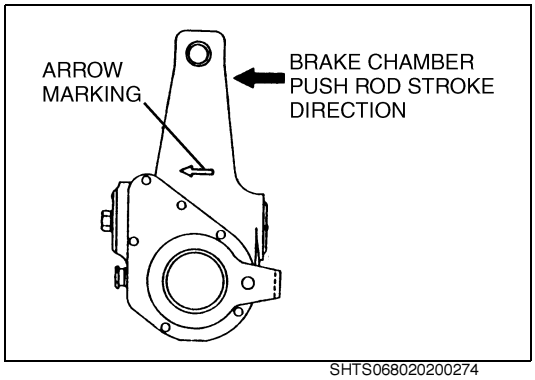
(3) If the vehicle is equipped with a spring brake chamber, after connecting the slack adjuster with the brake chamber push rod, turn the spring brake release bolt clockwise and securely tighten (with mechanical released device).



SHTS068020200274

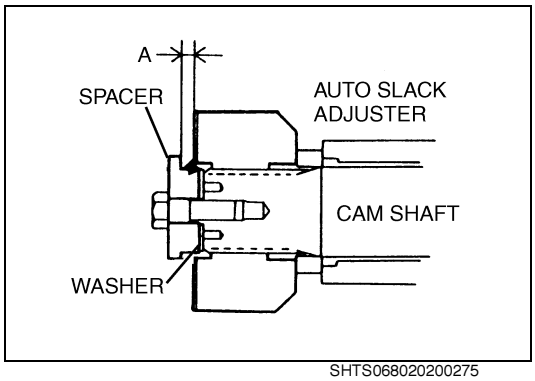
7. INSTALLATION OF CAM SHAFT AND AUTO SLACK ADJUSTER (IF SO EQUIPPED)

(1) Apply adequate amount of chassis grease on the O-ring, oil seal and bushing before installing the cam shaft.

(2) Make sure that the auto slack adjuster is installed so that the arrow on the adjuster points in the direction of the brake chamber rod stroke, as shown in figure.

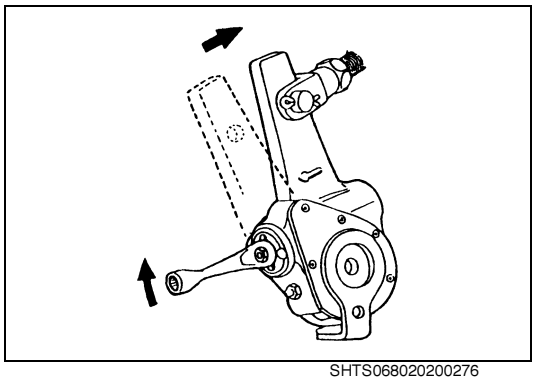
NOTICE

Install the cam shaft and auto slack adjuster on the correct side (Left or Right) according to the mark which was applied when disassembly.



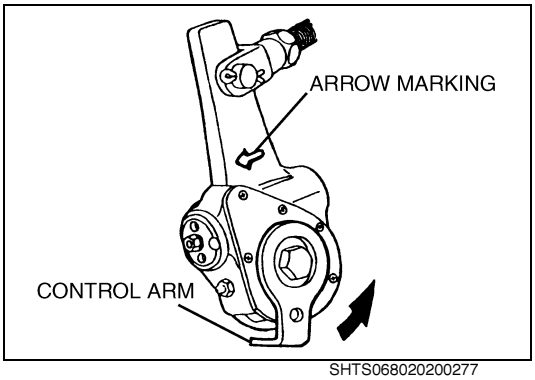
SHTS068020200275

(3) Make sure that clearance "A" between the spacer and auto slack adjuster is 0.5-2.0 mm {0.020-0.078 in.}. Install or remove the washer to maintain the required clearance.


SHTS068020200276

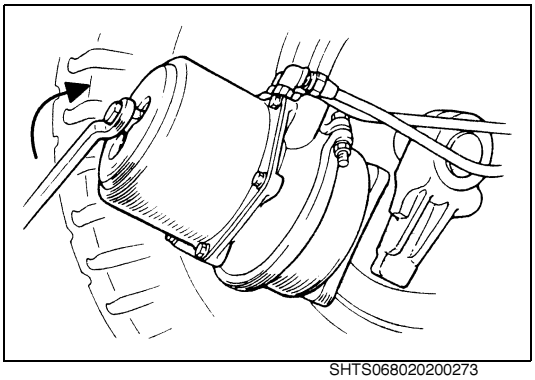
(4) When connection the auto slack adjuster with the brake chamber and/or spring brake chamber, lubricate the clevis pin-hole and pin with sufficient chassis grease.

(5) If the clevis pin-hole and auto slack adjuster pin-hole are misaligned, turn the set screw of auto slack adjuster for clockwise.



SHTS068020200277

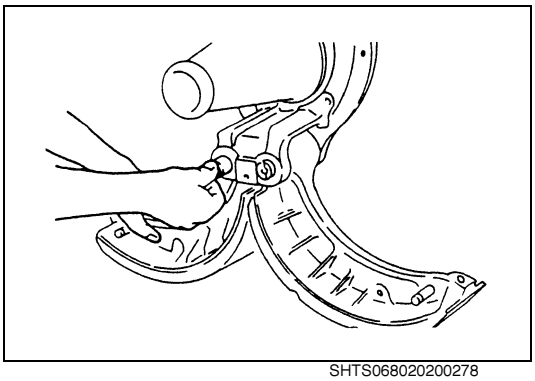
(6) Rotate by hand, the control arm as for as possible in the direction of the arrow on the adjuster point.
(7) Make sure that clearance between set bolt and control arm is correct, and tighten the nut.


SHTS068020200273

(8) If the spring brake chamber is the equipped, after connecting the auto slack adjuster with the brake chamber push rod, turn the spring brake release bolt for clockwise fully (with mechanical released device).

8. INSTALLATION OF BRAKE SHOE ASSEMBLY

(1) Apply adequate amount of heat resistance grease on the bushing of the brake shoe.
(2) Set the brake shoe assembly in place, then insert the anchor pins.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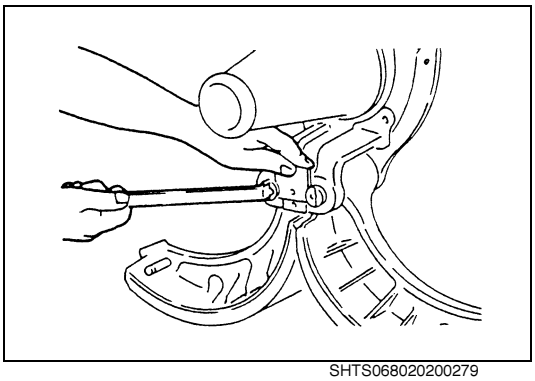
(3) Using the special tool, set the grooves of the two anchor pin parallel and then insert the retainer in the grooves so that the retainer hole and brake spider hole are aligned.
SST: Anchor Pin Tool (09684-1010)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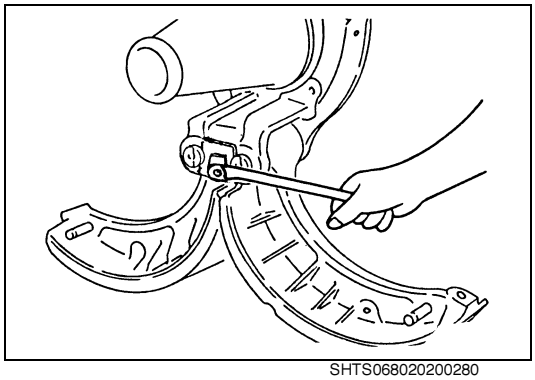
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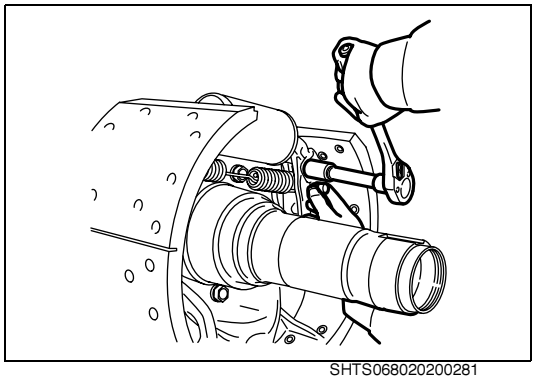
(4) Place the lock plate on the retainer so that its hole is aligned with the lock plate hole, then insert the bolt and tighten it.

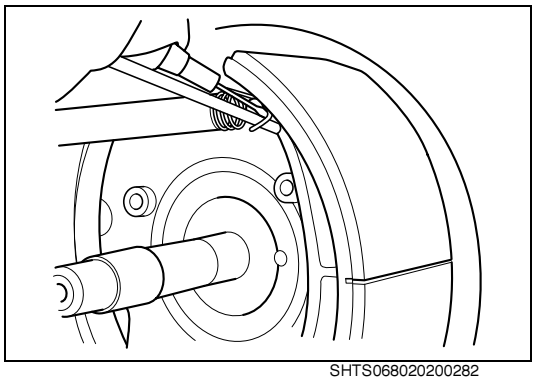

SHTS068020200281

9. INSTALLATION OF BRAKE SHOE RETURN SPRING

(1) Hook the inner spring to the clamp and turn the pivot pin to align the holes, then insert the spring pin. (REAR WHEEL)

NOTICE

Painted part of the spring must be placed in the upper side.

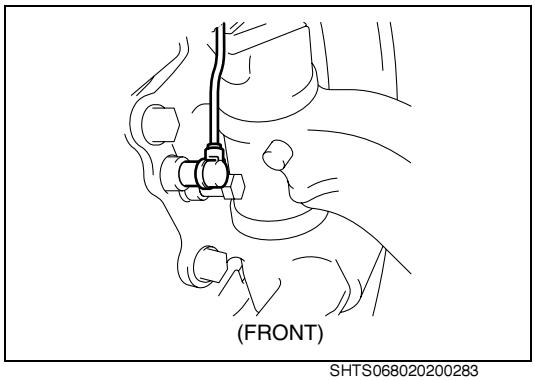

SHTS068020200282

(2) Use the special tool to install the return spring. (FRONT WHEEL, REAR WHEEL - OUTER SPRING).

NOTICE

The folded part of the spring cover must be placed in the upper side.

SST: Spring Pull Back Tool (09683-1070)



SHTS068020200283

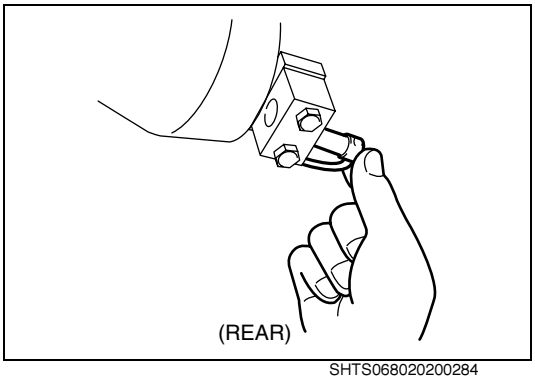
10. INSTALL THE WHEEL SENSOR. (IF SO EQUIPPED)

(1) Push in the clamping bushing until the stopper makes contact with the wheel sensor holder.

(2) Push the wheel sensor forcefully into the clamping bushing until you feel that the wheel sensor has contact with the sensor ring.

NOTICE

When inserting the wheel sensor, do not tap on it with a hammer or attempt to pry it into place using a screwdriver, or the like. Doing so could damage the wheel sensor.



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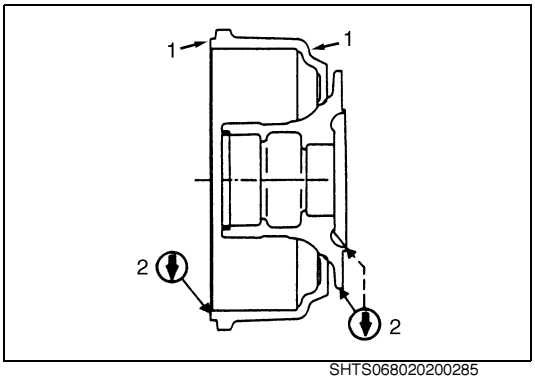
(3) Arrange the wire harness.



SHTS068020200285

11. ASSEMBLE THE BRAKE DRUM AND WHEEL HUB. (FRONT WHEEL)

(1) See the mark located at 1 or 1' on the brake drum as shown in figure. Install the drum according to NOTICE.

NOTICE

- **The drums, number with R or L.**
  With R: Install in right side.
  With L: Install in left side.
- **The drums, with no R or L.**
  New drums: Install in any side.
  Reused drums: Install in the side originally installed.

(2) When assembling the brake drum and wheel hub, make sure that their aligning marks are aligned as close to each other as possible.

NOTICE

Position of marks are located at 2 as shown in the figure. (Broken line shows alternative position).

12. MOUNTING OF WHEEL HUB WITH BRAKE DRUM

(1) Refer to chapter FRONT AXLE and REAR AXLE.

NOTICE

1. **Be careful not to push back the wheel sensor too far when mounting the wheel hub and brake drum. Also, make sure they are straight so that you do not bump the tip of the wheel sensor.**
2. **When inserting the outer hub bearing, avoid tapping on it with a hammer as this will expose the wheel sensor to bumps. Insert the outer hub bearing carefully using a lock nut.**

(2) Slowly turn the wheel hub and brake drum and confirm that they move smoothly.

13. MOUNTING OF TIRE

(1) Refer to chapter WHEEL & TIRE.

14. GREASING

(1) After completion of assembly, lubricate the bushings of the brake spider, cam shaft bracket (REAR WHEEL) and slack adjuster wire with chassis grease from the lubrication fittings.

15. ADJUSTMENT

(1) Finally, adjust the brake chamber rod stroke as explained in Section "ADJUSTMENT".

ADJUSTMENT

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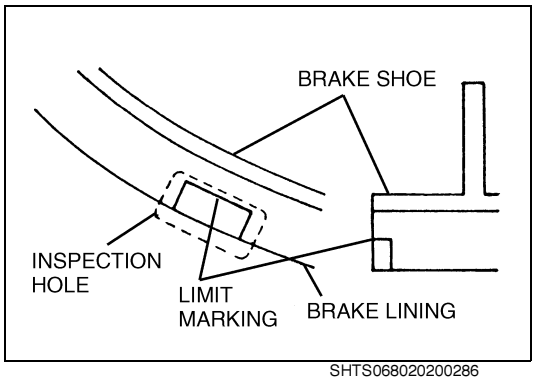
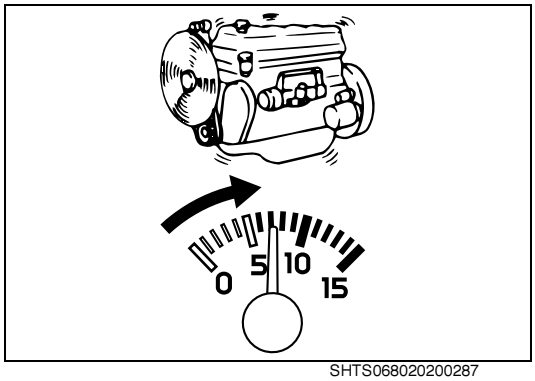


SHTS068020200286

1. REMAINING THICKNESS OF THE BRAKE LINING

(1) Check remaining thickness of lining through the inspection hole of the brake drum cover. If the lining has been worn to the limit marking or if it is foreseen that the lining will be worn to the limit by the time the next inspection is made, replace the lining.



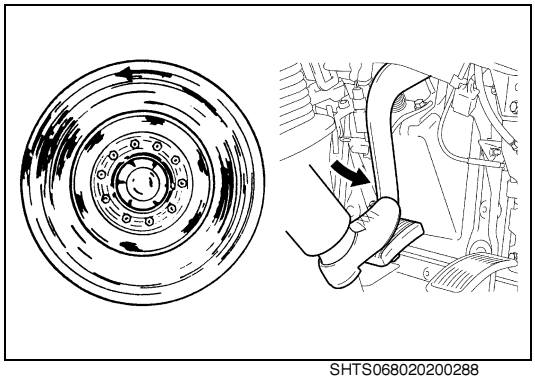
SHTS068020200287

2. AIR PRESSURE IN THE AIR TANK

(1) Operate the engine and obtain an air pressure of the 690 kPa {7.0 kgf/cm^2, 99.54 lbf/in.^{2}}

NOTICE

The specified air pressure in the air tank should be maintained when making the adjustment.


SHTS068020200288

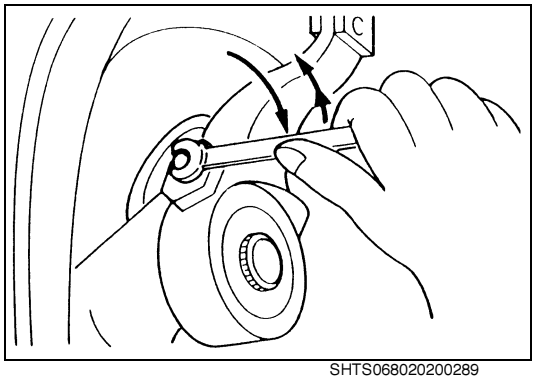
3. ADJUST THE BRAKE CHAMBER STROKE

(1) Lift the wheel to be adjusted off the ground.

(2) Step on the brake pedal several times while turning the wheel in the forward direction to make sure that the brake shoes are correctly positioned.

NOTICE

In the case of spring brake chamber, set the spring brake control valve to the "OFF" position.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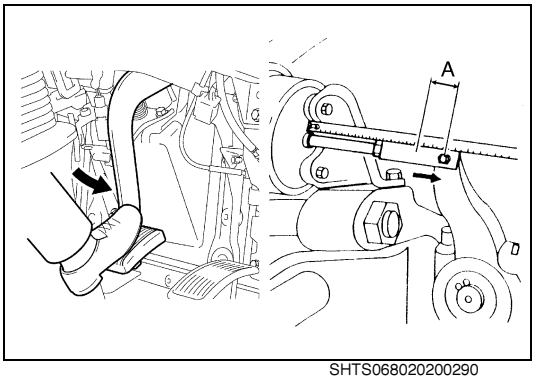
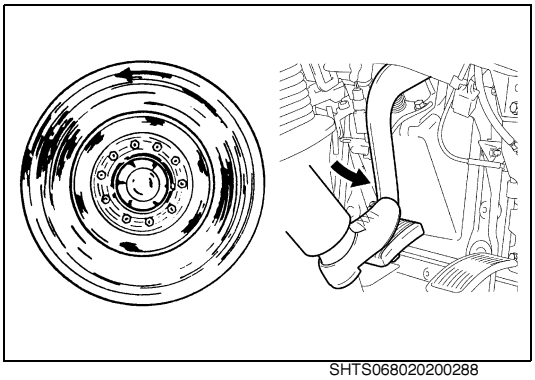
(3) Turn the worm gear shaft of the slack adjuster clockwise fully and then turn it back at least two notches.



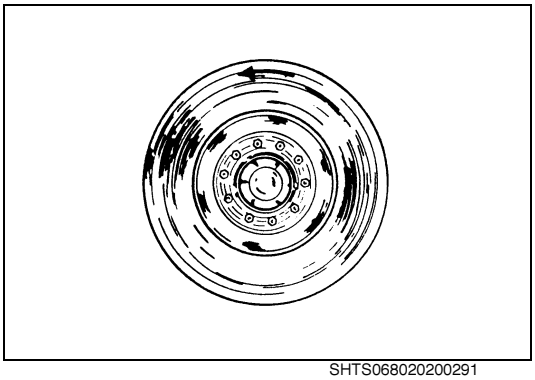
SHTS068020200290

(4) Depress the brake pedal fully and measure the brake chamber push rod stroke "A".

Assembly standard: 22-30 mm {0.87-1.18 in.}
Repair limit: Brake chamber: 40 mm {1.57 in.}
Spring brake chamber: 45 mm {1.77 in.}


SHTS068020200288

(5) While turning the wheel by hand in the forward direction, step on the brake pedal several times to make sure that the brake shoes are correctly positioned.


SHTS068020200291

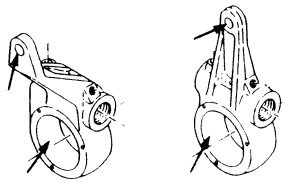
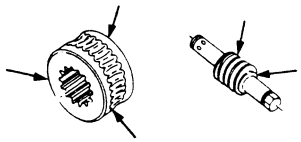
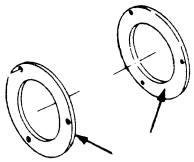
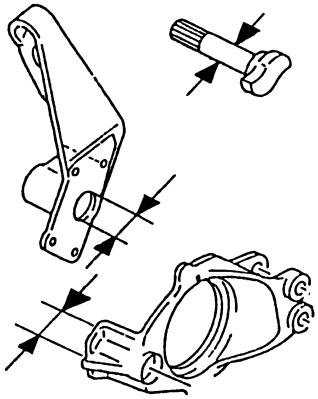
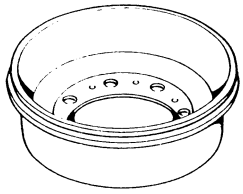
(6) Make sure that there is no dragging, when turning the wheel by hand. If there is any dragging, repeat the operation over again from (2).

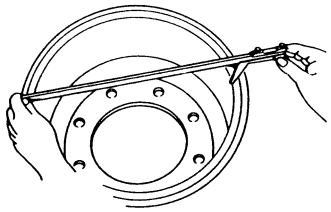
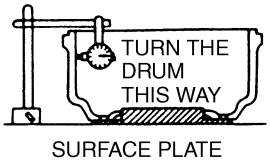
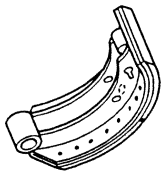
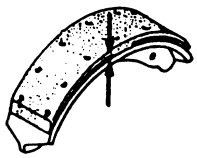
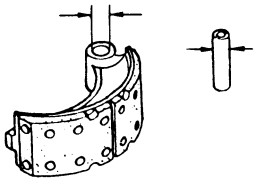
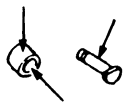
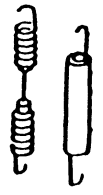
NOTICE
In accordance with the same procedure as above, adjust the stroke for all wheels.

INSPECTION AND REPAIR

EN0680202H300027

Unit: mm {in.}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Slack adjuster body: Wear and damage.	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Slack adjuster, worm gears: Wear and damage.	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Slack adjuster, body cover: Wear and damage.	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Cam shaft: Diameter.	**39.8 {1.57}**	**39.5 {1.56)**	**Replace.**	**Measure** 
Clearance between cam shaft and bushing of brake spider, chamber bracket, cam shaft bracket.	**0.23-0.30 {0.0091-0.0110}**	**0.6 {0.024}**	**Replace bushing and/ or cam shaft.**	
Cam shaft collar and spacer: Wear and damage.	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Brake drum: Cracks and damage.	**—**	**—**	**Regrind or replace, if necessary.**	**Visual check** 

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Brake drum: Inside diameter.	**406.4 {16.0}**	**Regrind 409.4 {16.12} Service 410.4 {16.16}**	**Regrind or replace.**	**Visual check** 
	440.0 {17.3}	**Regrind 443.0 {17.44} Service 444.0 {17.48}**		
Brake drum: Run out.	**0-0.1 {0-0.0039}**	**0.2 {0.0079}**	**Regrind or replace.**	**Measure** 
Brake shoe assembly: Cracks and damage.	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Brake lining: Thickness.	**15.5 {0.61}**	**5.5 {0.217}**	**Replace.**	**Visual check** 
Clearance between brake shoe bushing and anchor pin.	**0.02-0.07 {0.0008-0.0027}**	**0.25 {0.0098}**	**Replace the brake shoe bushing and/ or anchor pin.**	**Visual check** 
Brake shoe roller and pin: Wear and damage.	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Brake shoe return spring and spring cover: Damage, Lacking elastic strength distortion.	**—**	**—**	**Replace, if necessary.**	**Visual check** 

WHEEL BRAKE (TYPE: WEDGE BRAKE)

DATA AND SPECIFICATIONS

EN0680202I200024

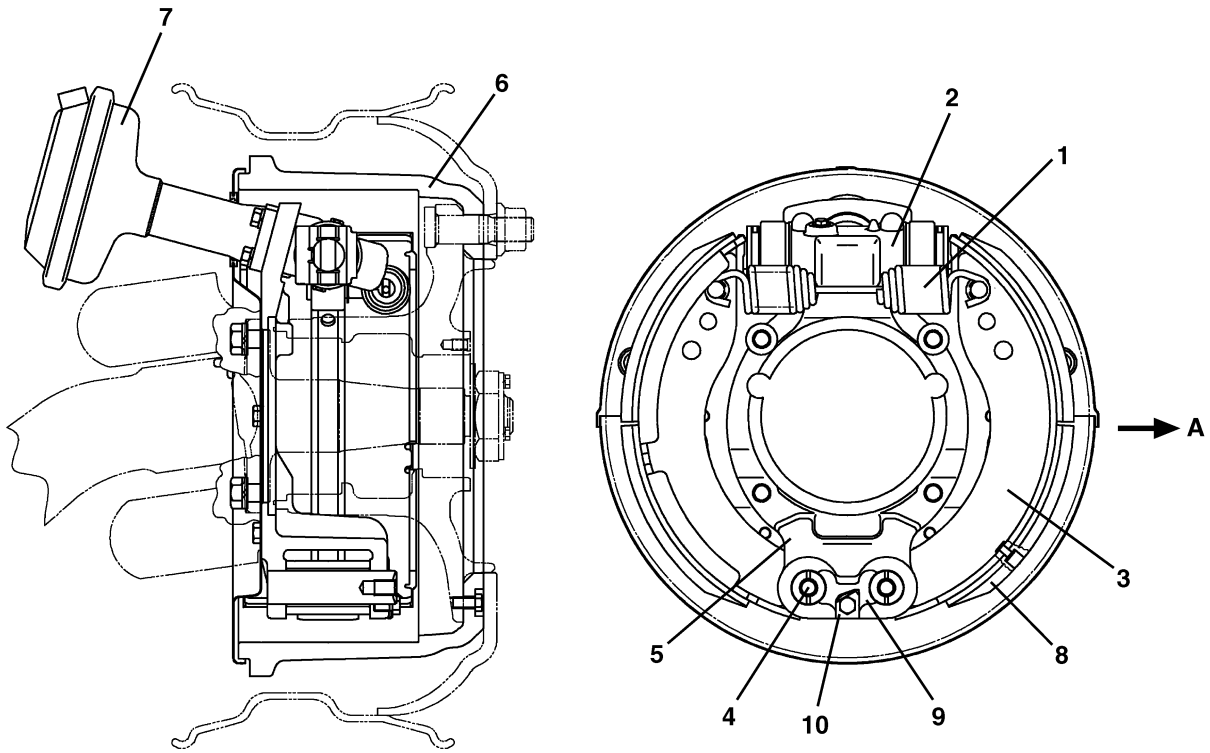
Type	Drum brake with internally expanding, leading-trailing shoes operating by expander in all wheels.		
Brake drum inside diameter			406.4 mm {16.0 in.} for both front and rear.
Brake lining Width x Thickness	Front		152 x 15.5 mm {6.0 x 0.61 in.}
	Rear	Frontward	216 x 15.5 mm {8.5 x 0.61 in.} (Models: FR, FS, FY, ZS)
			203 x 15.5 mm {8.0 x 0.61 in.} (Models: SH, SS)
		Rearward	152 x 15.5 mm {6.0 x 0.61 in.} (Model: FR)
			216 x 15.5 mm {8.5 x 0.61 in.} (Models: FS, FY)
			203 x 15.5 mm {8.0 x 0.61 in.} (Model: SS)

DESCRIPTION

EN0680202C100025

FRONT

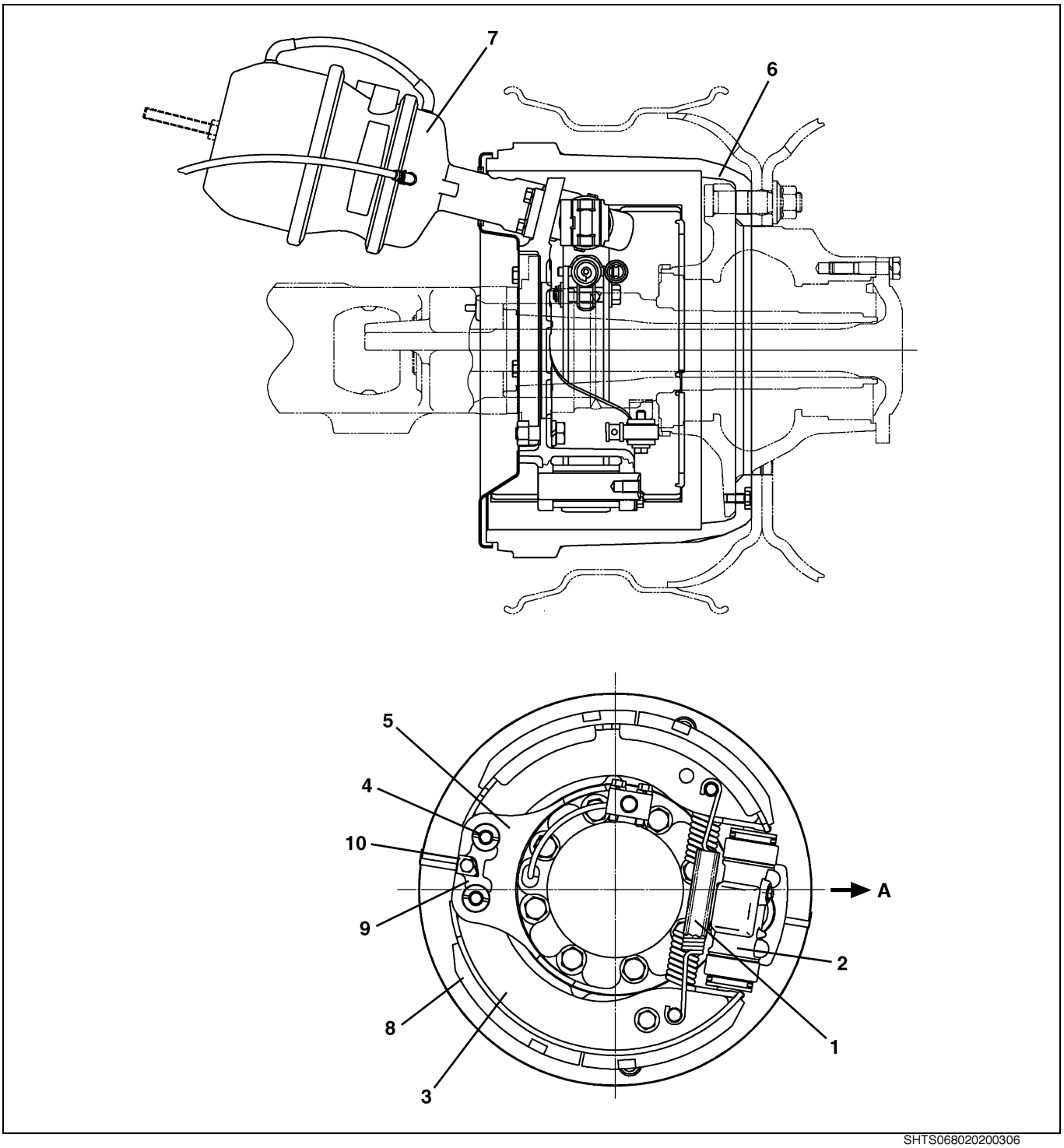
REPRESENTATIVE TYPE



SHTS068020200305

1	Brake shoe return spring	7	Brake chamber
2	Expander	8	Brake lining
3	Brake shoe	9	Anchor pin retainer
4	Anchor pin	10	Lock plate
5	Brake spider	A	Front
6	Brake drum		

REAR



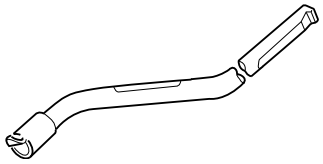
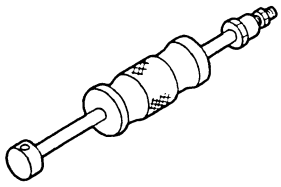
SHTS068020200306

1	Brake shoe return spring	7	Spring brake chamber
2	Expander	8	Brake lining
3	Brake shoe	9	Anchor pin retainer
4	Anchor pin	10	Lock plate
5	Brake spider	A	Front
6	Brake drum		

SPECIAL TOOL

EN0680202K100005

Prior to starting a wheel brake overhaul, it is necessary to have these special tools.

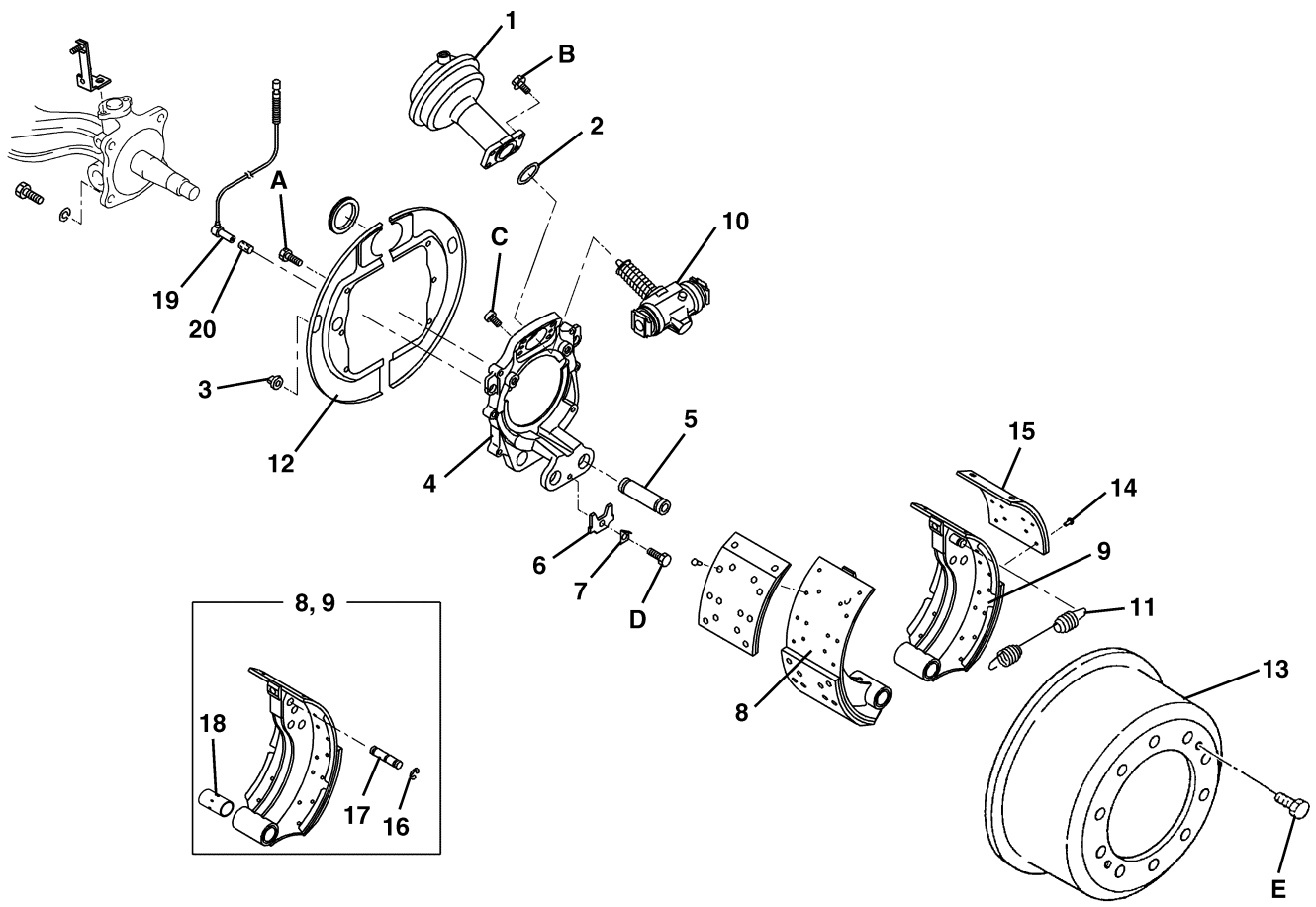
Illustration	Part number	Tool name	Remarks
	09683-1070	SPRING PULL BACK TOOL	
	09420-1510	ANCHOR PIN PULLER	

COMPONENT LOCATOR

EN0680202D100024

FRONT

(REPRESENTATIVE TYPE)



SHTS068020200308

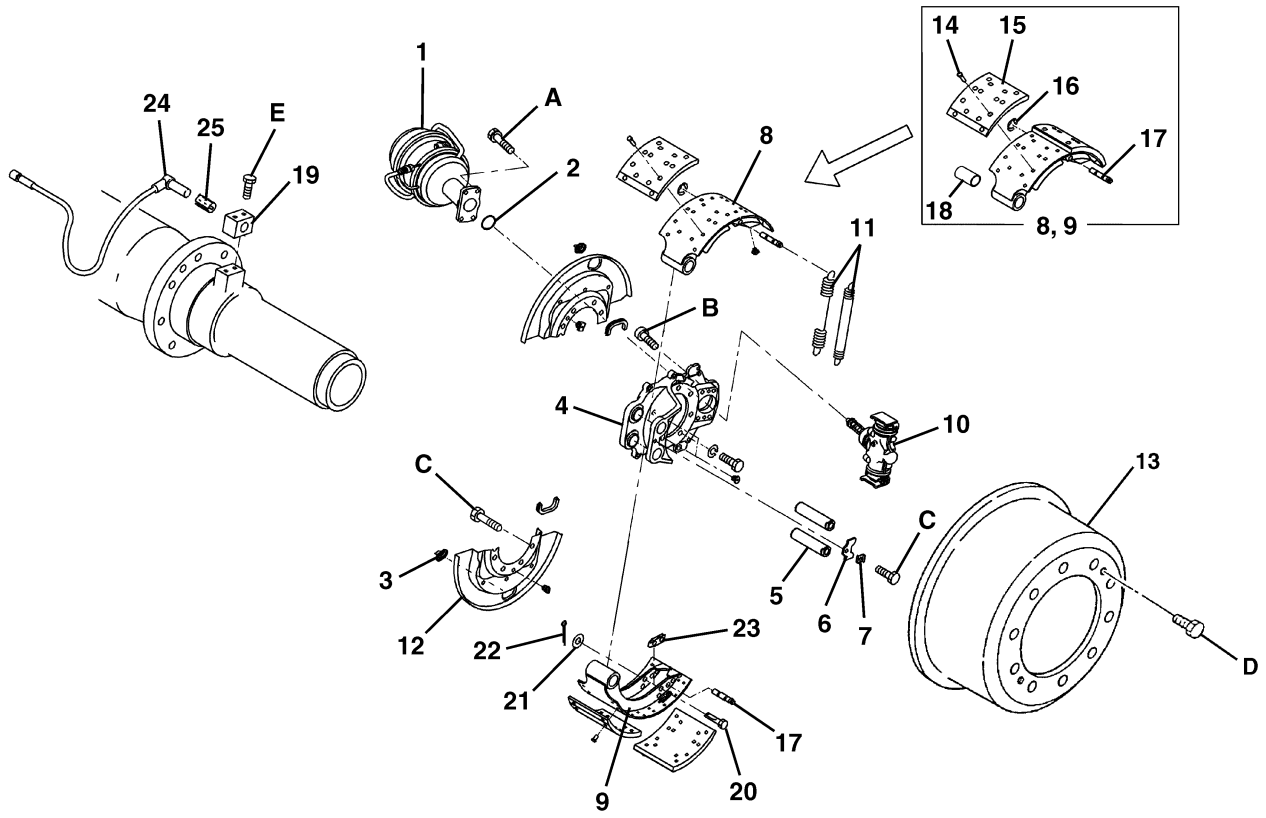
1	Brake chamber	11	Brake shoe return spring
2	O-ring	12	Brake drum cover
3	Hole plug	13	Brake drum
4	Brake spider	14	Rivet
5	Anchor pin	15	Brake lining
6	Anchor pin retainer	16	Retainer spring
7	Lock plate	17	Return spring pin
8	Brake shoe assembly (Leading)	18	Bushing
9	Brake shoe assembly (Trailing)	19	Wheel sensor (If so equipped)
10	Expander	20	Sleeve (If so equipped)

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	35.8-51.4 {366-524, 26.4-37.9}	D	20.1-33.9 {205-345, 14.9-24.9}
B	36.2-51.8 {370-528, 26.7-38.1}	E	20.5-39.5 {210-402, 15.2-29.1}
C	14.1-23.9 {144-243, 10.4-17.6}		

REAR

(REPRESENTATIVE TYPE)



SHTS068020200309

1	Brake chamber	10	Expander	19	Sensor holder (If so equipped)
2	O-ring	11	Brake shoe return spring	20	Pivot pin
3	Hole plug	12	Brake drum cover	21	Washer
4	Brake spider	13	Brake drum	22	Cotter pin
5	Anchor pin	14	Rivet	23	Return spring hanger
6	Anchor pin retainer	15	Brake lining	24	Wheel sensor (If so equipped)
7	Lock plate	16	Retainer spring	25	Sleeve (If so equipped)
8	Brake shoe assembly (Trailing)	17	Return spring pin		
9	Brake shoe assembly (Leading)	18	Bushing		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	35.8-51.4 {366-524, 26.4-37.9}	D	20.5-39.5 {210-402, 15.2-29.1}
B	14.1-23.9 {144-243, 10.4-17.6}	E	34.5-51.5 {352-525, 25.5-37.9}
C	20.1-33.9 {205-345, 14.9-24.9}		

OVERHAUL

EN0680202H200023

IMPORTANT POINTS - DISASSEMBLY

1. REMOVAL OF TIRE

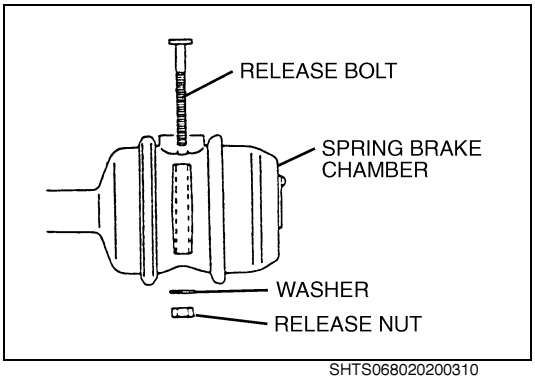
(1) Refer to chapter for WHEEL AND TIRE.

2. REMOVAL OF BRAKE DRUM, WHEEL HUB AND WHEEL HUB BEARINGS

(1) Refer to chapter for FRONT AXLE and for REAR AXLE.

3. COMPRESSION OF SPRING IN SPRING BRAKE CHAMBER BY RELEASE BOLT

(1) Remove the release bolt, washer and release nut from the chamber.

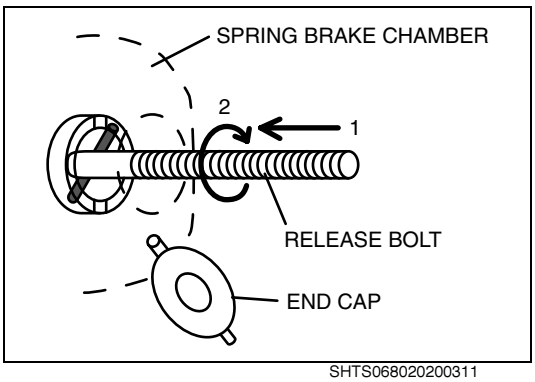


SHTS068020200310

(2) Remove the end cap. Insert the release bolt to the brake chamber, then turn the release bolt by 1/4.

NOTICE

- **Make sure that the release bolt can not be pulled out.**
- **When the release bolt is pulled out, insert the release bolt again and turn it by 1/4 similarly.**



SHTS068020200311

(3) Apply compressed air of 640 kPa {6.5 kgf/cm^2, 92.5 lbf·in.^{2}} to the spring brake port.

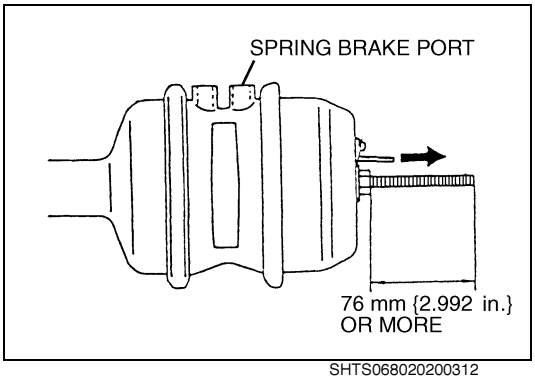
NOTICE

When compressed air cannot be applying, coat grease to the release bolt.

(4) Install the washer and release nut to the release bolt and pull out the release bolt by 85 mm {3.34 in.}.

NOTICE

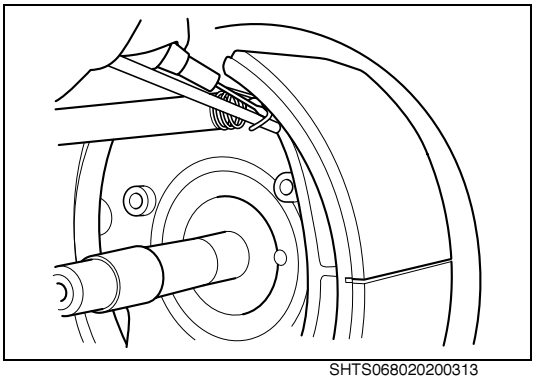
Do not turn the release nut at the strong torque (68.6 N·m {700 kgf·cm, 50.6 lbf·ft} or more).

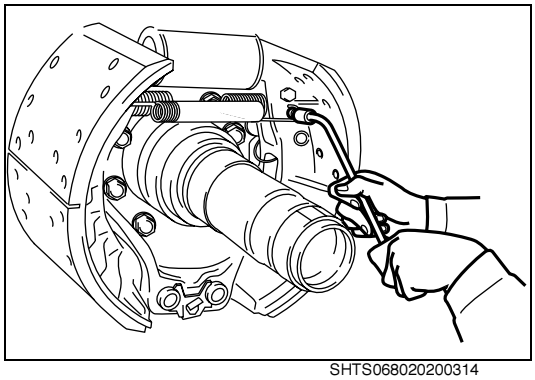


SHTS068020200312

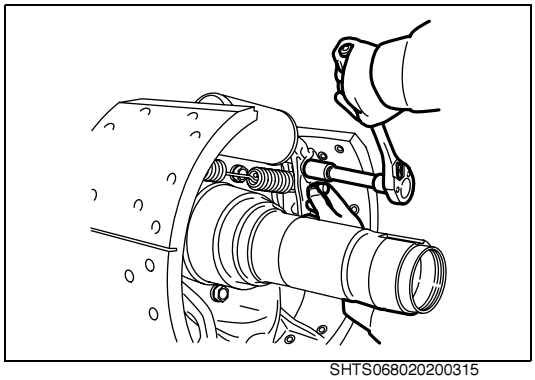
4. REMOVAL OF BRAKE SHOE RETURN SPRING

(1) Using the special tool, remove the return spring.
(FRONT WHEEL)
SST: Spring Pull Back Tool (09683-1070)

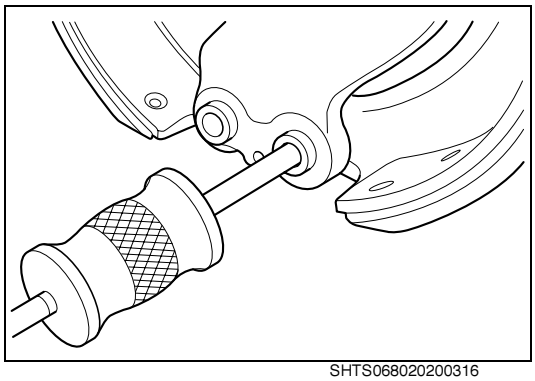

SHTS068020200313


SHTS068020200314

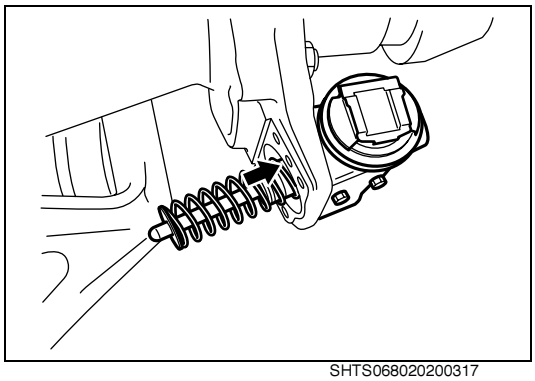
(2) Using the special tool, remove the outer return spring. (REAR WHEEL)
SST: Spring Pull Back Tool (09683-1070)


SHTS068020200315

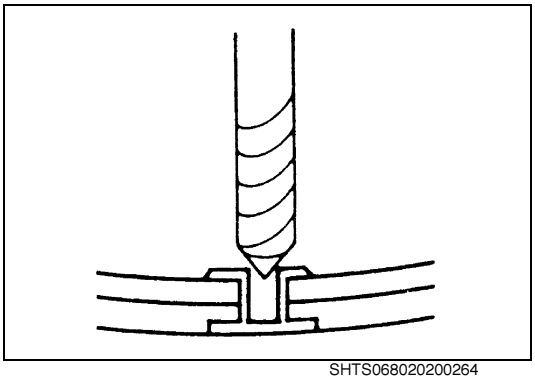
(3) Turn the pivot pin and pull out the return spring pin then remove the inner return spring (REAR WHEEL).

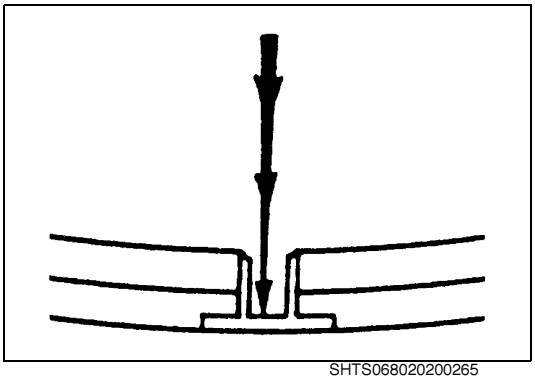

SHTS068020200316

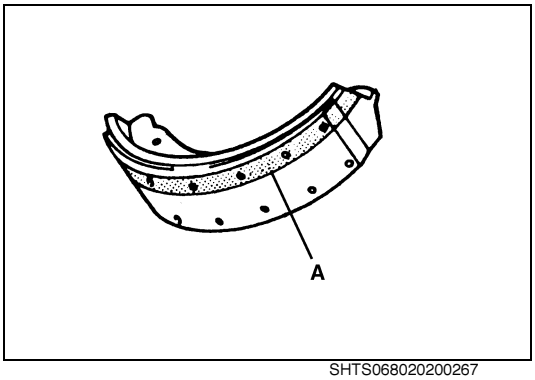
5. REMOVAL OF ANCHOR PIN
(1) Remove the lock plate and anchor pin retainer.
(2) Using the special tool, remove the pin and brake shoe assembly.
SST: Anchor Pin Puller (09420-1510)


SHTS068020200317

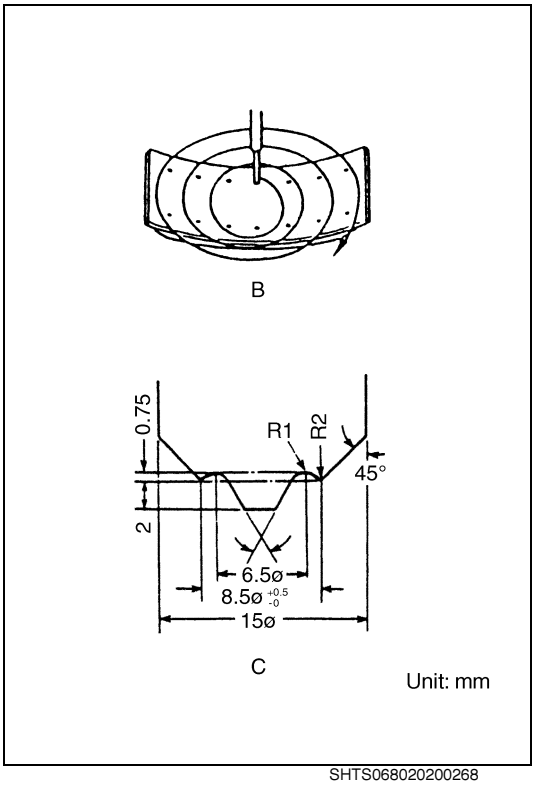
6. REMOVAL OF BRAKE CHAMBER AND EXPANDER
(1) Remove the air hose.
(2) Remove the brake chamber and O-ring from the brake spider.
(3) Using a hexagon wrench, remove the expander from the brake spider.


SHTS068020200264


SHTS068020200265



SHTS068020200267



SHTS068020200268

IMPORTANT POINTS - ASSEMBLY

1. REPLACEMENT OF BRAKE LINING

(1) Remove the brake lining from the brake shoe.

a. Drill the rivet caulking section with a drill smaller than the rivet diameter.

NOTICE

At this time, be careful not to scratch the brake shoe.

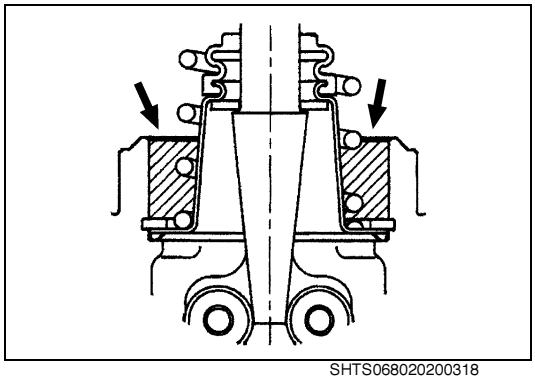
b. After drilling, remove the remaining portion of the rivet with a fine chisel or a riveting machine.

(2) Install the brake lining to the brake shoe.

a. Set the lining on the shoe and insert the rivets into all holes, then hold them in place with adhesive tape "A".

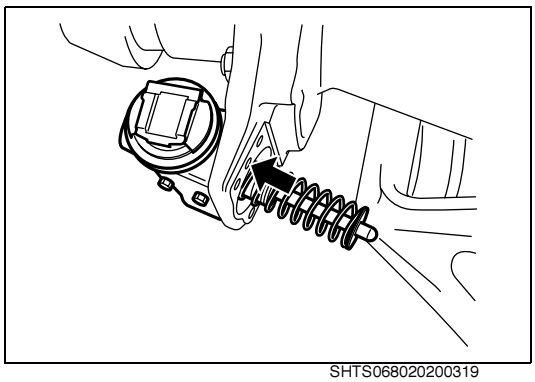
b. Caulk the rivets lightly in a circular pattern as shown in figure "B", repeat several times assure proper seating of the lining.
Recommended configuration of punch: shown in "C".
Recommended force of staking the rivet: 2.4 tons.

c. Remove adhesive tape.


SHTS068020200318

2. INSTALLATION OF EXPANDER AND BRAKE CHAMBER

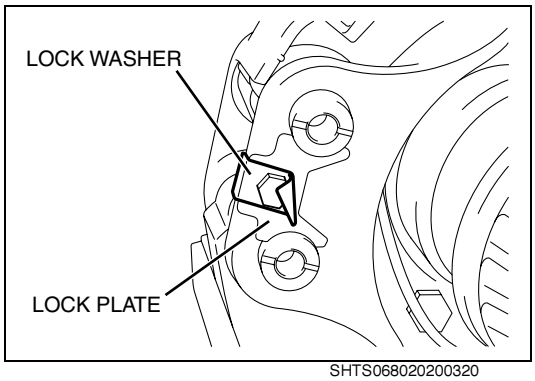
(1) Apply grease (Darina Grease: Showa Shell Sekiyu K.K. product or equivalent) to the expander as shown in the figure.


SHTS068020200319

(2) Using a hexagon wrench, install the expander to the brake spider.
Tightening Torque:
14.1-23.9 N·m {144-243 kgf·cm, 10.4-17.6 lbf·ft}

NOTICE
Pay attention to assembling way.

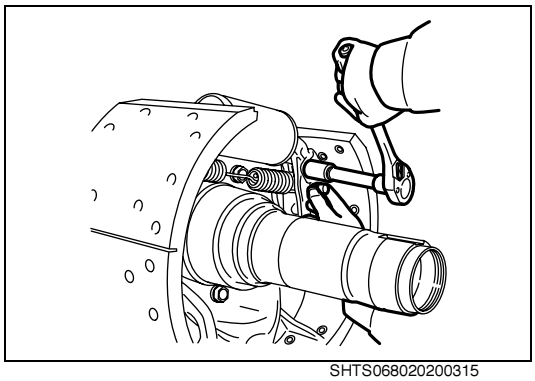
(3) Install the new O-ring and brake chamber to the brake spider.



SHTS068020200320

3. INSTALLATION OF BRAKE SHOE ASSEMBLY

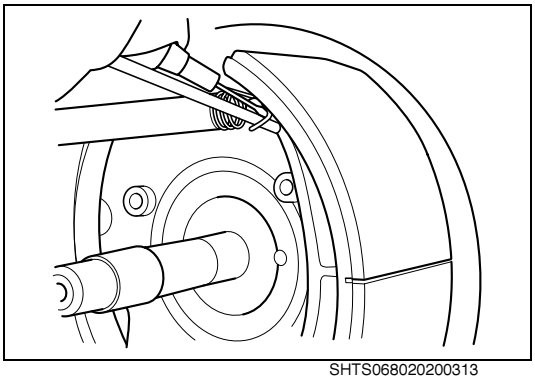
(1) Apply adequate amount of heat resistance grease on the brake shoe bushing and anchor pin.
(2) Set the brake shoe assembly in place, then insert the anchor pins.
(3) Insert the anchor pin retainer in the grooves of the two anchor pins.
(4) Place the lock plate on the anchor pin retainer so that its hole is aligned with the lock plate hole, then insert the bolt and tighten it.


SHTS068020200315

4. INSTALLATION OF BRAKE SHOE RETURN SPRING

(1) Hook the inner spring to the clamp and turn the pivot pin to align the holes, then insert the spring hanger.
(REAR WHEEL)

NOTICE
Painted part of the spring must be placed in the upper side.

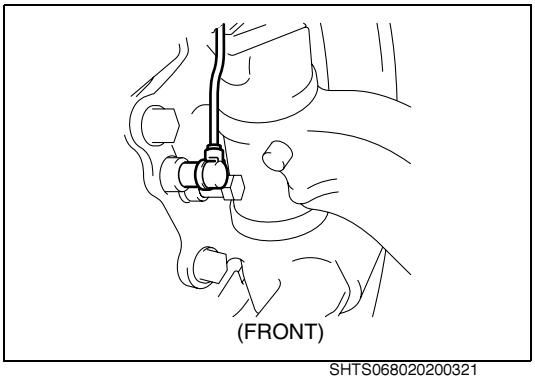

SHTS068020200313

(2) Use the special tool to install the return spring.
(FRONT WHEEL, REAR WHEEL OUTER SPRING)

NOTICE

The folded part of the spring cover must be placed in the upper side.

SST: Spring Pull Back Tool (09683-1070)



SHTS068020200321

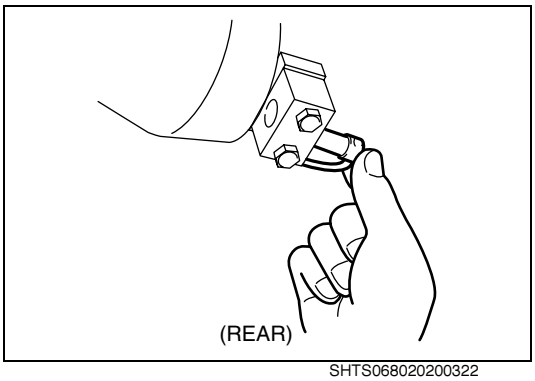
5. INSTALL THE WHEEL SENSOR. (IF SO EQUIPPED)

(1) Push in the clamping bushing until the stopper makes contact with the wheel sensor holder.

(2) Push the wheel sensor forcefully into the clamping bushing until you feel that the wheel sensor has contact with the sensor ring.

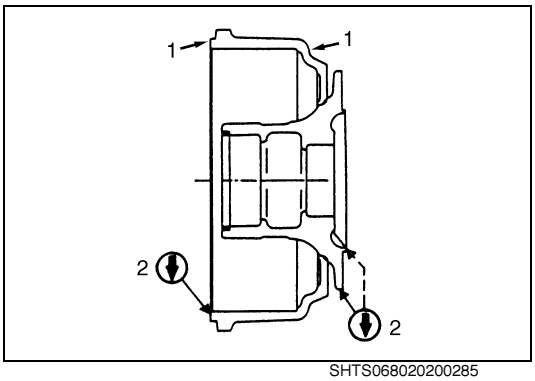
NOTICE

When inserting the wheel sensor, do not tap on it with a hammer or attempt to pry it into place using a screwdriver, or the like. Doing so could damage the wheel sensor.



SHTS068020200322

(3) Arrange the wire harness.



SHTS068020200285

6. ASSEMBLE THE BRAKE DRUM AND WHEEL HUB. (FRONT WHEEL)

(1) See the mark located at 1 or 1' on the brake drum as shown in figure. Install the drum according to NOTICE.

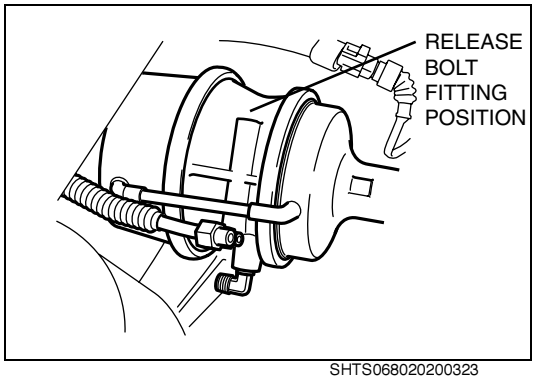
NOTICE

- **The drums, number with R or L.**
  With R: Install in right side.
  With L: Install in left side.
- **The drums, with no R or L.**
  New drums: Install in any side.
  Reused drums: Install in the side originally installed.

(2) When assembling the brake drum and wheel hub, make sure that their aligning marks are aligned as close to each other as possible.

NOTICE

Position of marks are located at 2 as shown in the figure. (Broken line shows alternative position).



SHTS068020200323

IMPORTANT POINTS - MOUNTING

1. REMOVAL OF THE RELEASE BOLT

(1) After mounting, turn the release bolt counterclockwise to release the spring brake.

NOTICE

Note the position mark R or L on the chamber which mark was applied when dismounting and install it to its former side.

(2) After mounting, the release bolt must be set at the specified torque.
Tightening Torque:
13.7-15.7 N·m {140-160 kgf·cm, 10.2-11.5 lbf·in.}

2. MOUNTING OF WHEEL HUB AND BRAKE DRUM

(1) Refer to chapter for FRONT AXLE and for REAR AXLE.

NOTICE

1. **Be careful not to push back the wheel sensor too far when mounting the wheel hub and brake drum. Also, make sure they are straight so that you do not bump the tip of the wheel sensor.**
2. **When inserting the outer hub bearing, avoid tapping on it with a hammer as this will expose the wheel sensor to bumps. Insert the outer hub bearing carefully using a lock nut.**

(2) Slowly turn the wheel hub and brake drum and confirm that they move smoothly.

3. MOUNTING OF TIRE

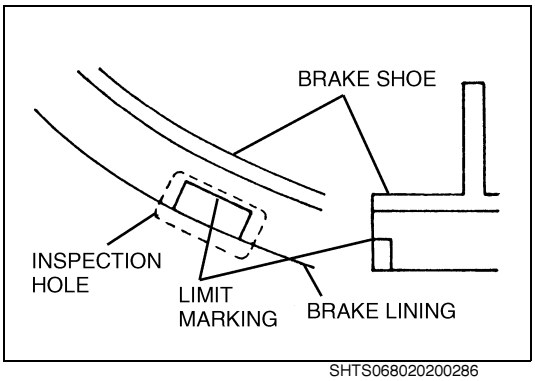
(1) Refer to chapter for WHEEL AND TIRE.

4. ADJUSTMENT

(1) Finally, adjust the brake shoe clearance as explained in Section WHEEL BRAKE.

ADJUSTMENT

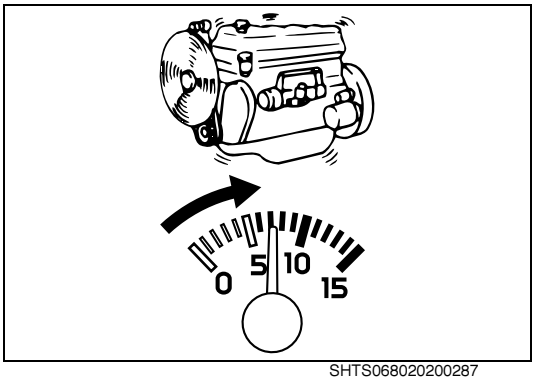
EN0680202H300028



SHTS068020200286

1. REMAINING THICKNESS OF THE BRAKE LINING

(1) Check remaining thickness of lining through the inspection hole of the brake drum cover. If the lining has been worn to the limit marking or if it is foreseen that the lining will be worn to the limit by the time the next inspection is made replace the lining.



SHTS068020200287

2. AIR PRESSURE IN THE AIR TANK

(1) Operate the engine and obtain an air pressure of the 740-840 kPa {7.5-8.5 kgf/cm^2, 107-121 lbf/in.^{2}}

NOTICE

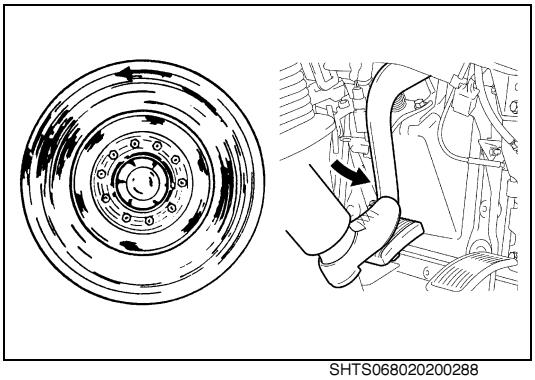
The specified air pressure in the air tank should be maintained while making the adjustment.

3. INSPECTION OF THE CLEARANCE BETWEEN BRAKE LINING AND BRAKE DRUM

(1) Step on the brake pedal several times to make sure that the brake shoes are correctly positioned.

(2) Insert a thickness gauge from the inspection hole to inspect the clearance between brake lining and brake drum. If the clearance exceeds standard value, disassemble auto adjuster and perform maintenance service because auto adjuster possibly may be out of order.

	STANDARD (mm {in.})
FRONT	0.2-1.0 {0.0079-0.0393}
REAR	0.2-1.0 {0.0079-0.0393}


SHTS068020200288

4. ADJUSTMENT OF THE CLEARANCE BETWEEN BRAKE LINING AND BRAKE DRUM

NOTICE

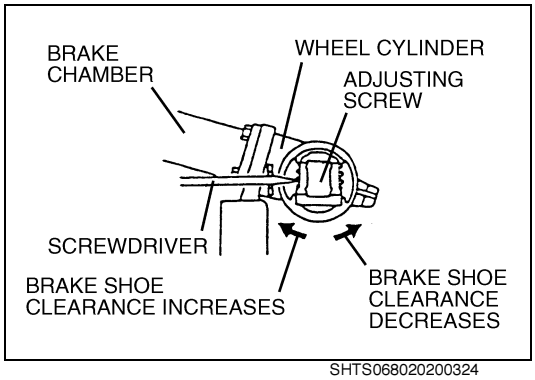
As this brake has auto adjuster function, it is not necessary to adjust the clearance between brake lining and brake drum. Adjust the clearance in accordance with the following method, if the brake lining is replaced and maintenance service is performed.

(1) Lift the wheel to be adjusted off the ground.

(2) While turning the wheel in the forward direction and step on the brake pedal several times to make sure that the brake shoes are correctly positioned.

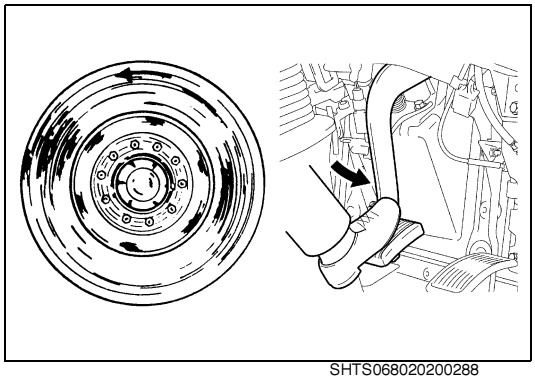
NOTICE

When adjusting the clearance between brake lining and brake drum, set spring brake control valve to the OFF position.



SHTS068020200324

(3) Remove the brake drum cover.
(4) Insert the thickness gauge and turn the adjusting screw with screwdriver so that brake shoe clearance come to the standard value.


SHTS068020200288

(5) While turning the wheel by hand in the forward direction, step on the brake pedal several times to make sure that the brake shoes are correctly positioned.

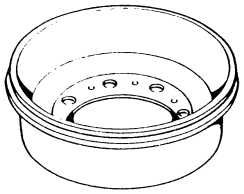
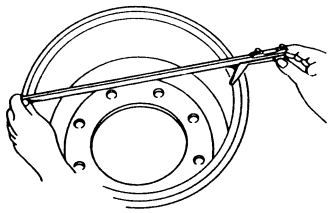
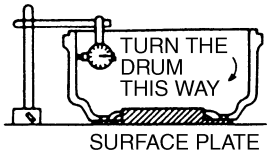
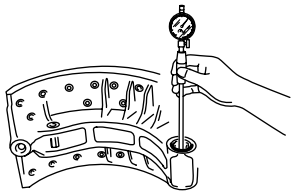
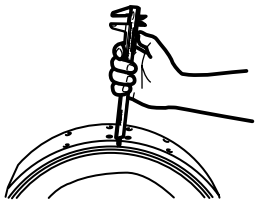
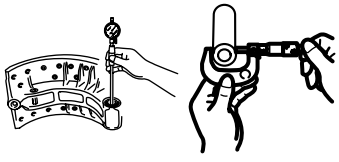
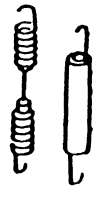
(6) See to it that there is no dragging, when turning the wheel by hand. If there is any dragging, repeat the operation over again from 2.

NOTICE
Using the same procedure as above, adjust the clearance for all wheels.

INSPECTION AND REPAIR

EN0680202H300029

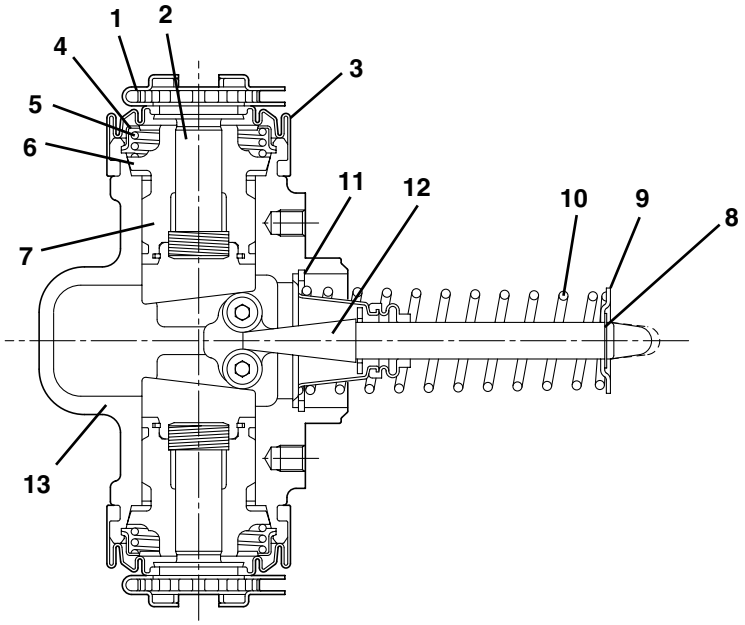
Unit: mm {in.}

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Brake drum: Cracks and damage	—	—	Regrind or replace, if necessary.	Visual check 
Brake drum: Inside diameter	406.4 {16.0}	Regrind 409.4 {16.12} Service 410.4 {16.16}	Regrind or replace.	Measure 
Brake drum: Runout	0-0.1 {0-0.0039}	0.2 {0.0079}	Regrind or replace.	Measure 
Brake shoe assembly: Cracks and damage	—	—	Replace, if necessary.	Visual check 
Brake lining: Thickness	15.5 {0.610}	5.5 {0.217}	Replace.	Measure 
Clearance between brake shoe bushing and anchor pin	0.02-0.07 {0.0008-0.0027}	0.25 {0.0098}	Replace the brake shoe bushing and/ or anchor pin.	Measure 
Brake shoe return spring and spring cover: Damage, lacking elastic strength distortion	—	—	Replace, if necessary.	Visual check 

EXPANDER

DESCRIPTION

EN0680202C100026



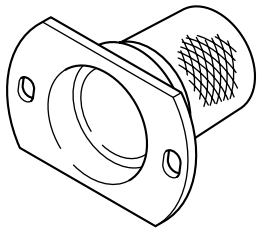
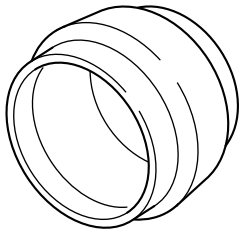
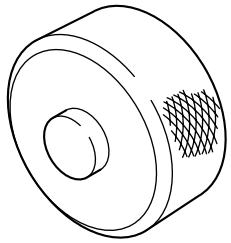
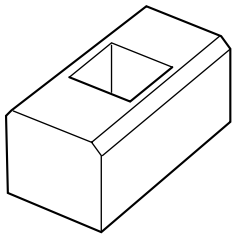
SHTS068020200331

1	Clip	8	E-retainer
2	Adjusting screw	9	Spring retainer
3	Boot	10	Wedge spring
4	Case	11	Retainer ring
5	Adjusting spring	12	Wedge
6	Drive ring	13	Body
7	Sleeve assembly		

SPECIAL TOOL

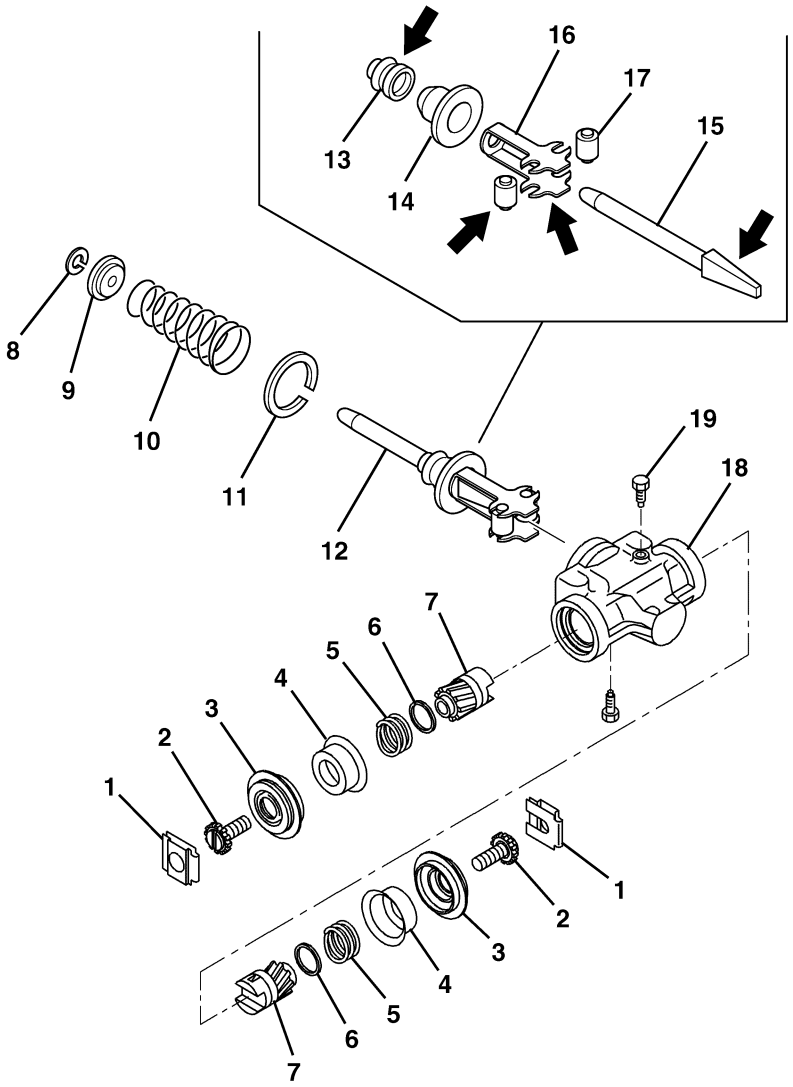
EN0680202K100006

Prior to starting an expander overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	09683-1080	SPRING PULL BACK TOOL	
	09657-2330	GUIDE	
	09685-1020	BOOT SETTING TOOL	
	09659-1610	ADAPTER	

COMPONENT LOCATOR

EN0680202D100025



: Apply grease (Darina Grease 2: Showa Shell Sekiyu K.K product or equivalent).

SHTS068020200336

1	Clip	11	Retainer ring
2	Adjusting screw	12	Wedge assembly
3	Boot	13	Wedge boot
4	Case	14	Wedge cap
5	Adjusting spring	15	Wedge
6	Drive ring	16	Cage
7	Sleeve assembly	17	Roller
8	E-retainer	18	Expander body
9	Spring retainer	19	Locating screw
10	Wedge spring		

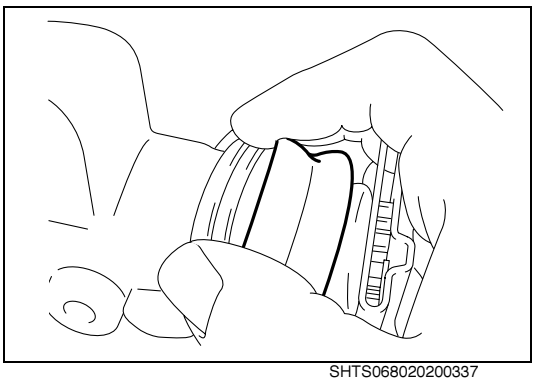
Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	12-18 {120-180, 9-13}		

OVERHAUL

EN0680202H200024

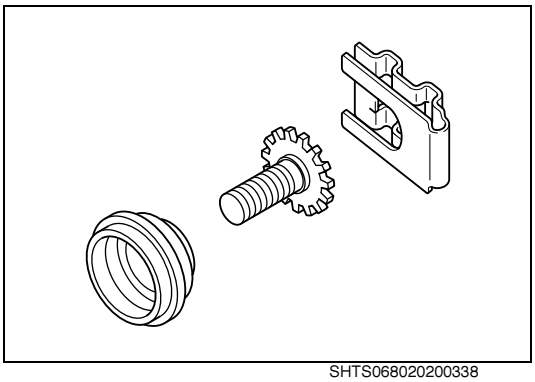
IMPORTANT POINTS - DISASSEMBLY


SHTS068020200337

1. DISASSEMBLY OF THE EXPANDER

(1) Remove the boot from the body.

(2) Turn the adjusting bolt counterclockwise and remove the boot with adjusting bolt.

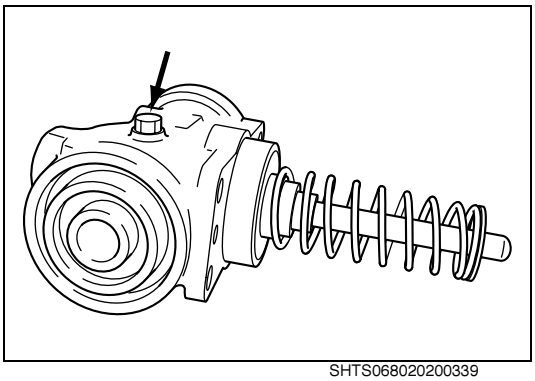

SHTS068020200338

(3) Remove the boot and retainer from the adjusting bolt.

NOTICE
When removing the retainer, take care not to damage it.

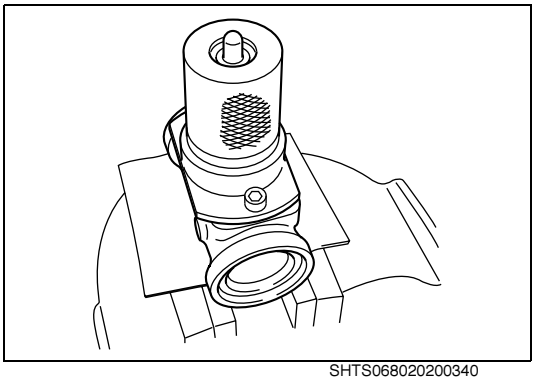
(4) Using the screwdriver, remove the cover and then remove the adjust lock spring and adjust ring.

⚠ WARNING
Pay attention to adjusting lock spring jump-out.


SHTS068020200339

(5) Remove the screw and then remove the sleeve assembly.

NOTICE
Sleeve assembly can not be disassembly.

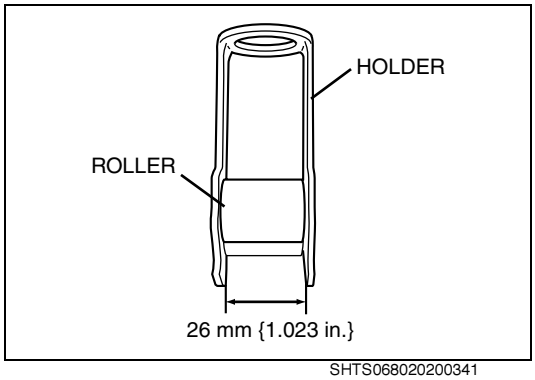

SHTS068020200340

(6) Install the special tool to the body and tighten the bolt.
SST: Spring Pull Back Tool (09683-1080)

(7) Remove the E-ring.

(8) Remove the special tool and then remove the retainer, return spring and wedge assembly.

⚠ WARNING
Pay attention to return spring jump-out when removing the special tool.



SHTS068020200341

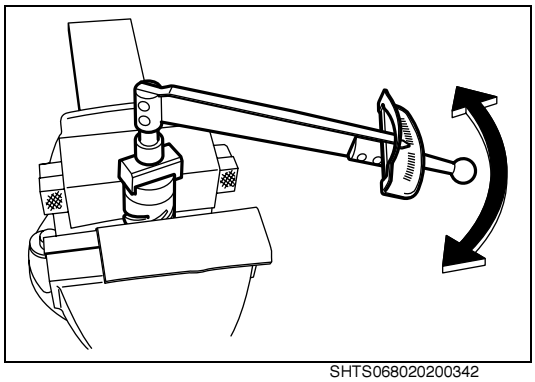
2. DISASSEMBLY OF THE WEDGE ASSEMBLY

(1) Remove the retainer ring and then remove the boot, retainer and wedge assembly.

(2) Remove the holder and the roller from the wedge.

NOTICE

Do not expand open end of holder 26 mm {1.023 in.} or more.


SHTS068020200342

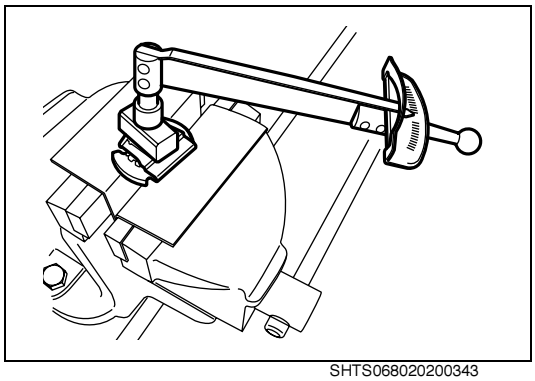
IMPORTANT POINTS - INSPECTION

1. INSPECTION FOR SLEEVE ASSEMBLY

(1) Fix the sleeve assembly in a vise and install the special tool to the tappet part.
SST: Adapter (09659-1610)

(2) Install the torque wrench to the special tool to measure the starting torque of the tappet part. Replace the sleeve assembly if the torque exceeds the standard value.

	Standard (N·m {kgf·cm, lbf·ft})
Clockwise (Right turn)	0.6 {6.0, 0.433} or less
Counterclockwise (Left turn)	2.0 {20.0, 1.447} or more


SHTS068020200343

2. INSPECTION FOR RETAINER KEEP TORQUE OF ADJUSTING BOLT ASSEMBLY

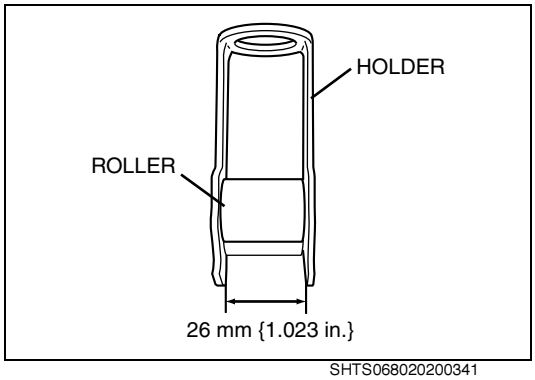
(1) Fix the adjusting bolt fitted retainer in a vise and install the special tool to clip.

NOTICE

Take care not to damage thread of the adjusting bolt when fixing adjusting bolt in a vise.

SST: Adapter (09659-1610)

(2) Install the torque wrench to the special tool to measure the starting torque of the retainer. Replace the adjusting bolt if the torque exceeds the standard value.
Standard: 2.0-5.5 N·m {20-55 kgf·cm, 1.45-3.97 lbf·ft}



SHTS068020200341

IMPORTANT POINTS - ASSEMBLY

1. ASSEMBLY OF THE WEDGE ASSEMBLY

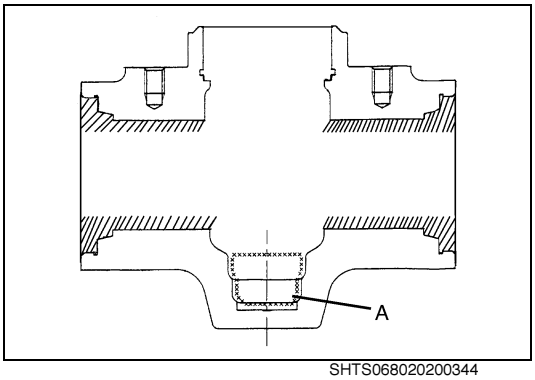
(1) Assemble the roller to the holder and assemble them to the wedge.

NOTICE

Do not expand open end of holder 26 mm {1.023 in.} or more.

(2) Apply grease (Darina Grease 2: Showa Shell Sekiyu K.K. product or equivalent) to engaged part and contact part of the roller, holder and wedge.

(3) Assemble the boot and retainer to the wedge, applying grease to wedge axle part and boot contact surface.



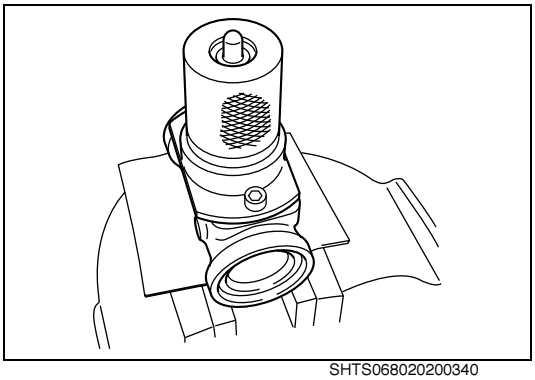
SHTS068020200344

2. ASSEMBLY OF THE EXPANDER

(1) Fill up grease (Darina Grease 2: Showa Shell Sekiyu K.K. product or equivalent) to the "A" part of body.

(2) Apply grease (Darina Grease 2: Showa Shell Sekiyu K.K. product or equivalent) to the following part.

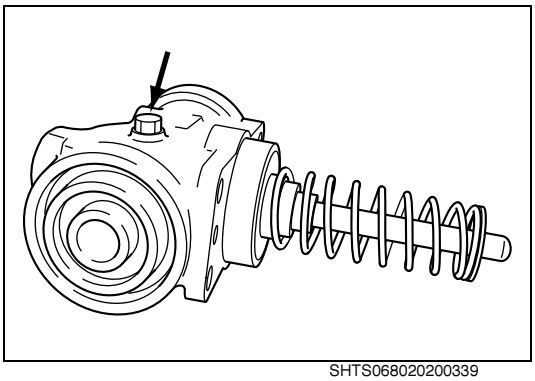
1. Adjust ring seat surface of body
2. Sleeve sliding part of body and tappet part stabbing part
3. Roller contact surface of tappet part and outer periphery
4. Sleeve assembly outer periphery and gear part
5. Sleeve assembly thread part.


SHTS068020200340

(3) Assemble wedge assembly to body, and install the new retainer ring using the snap ring pliers.

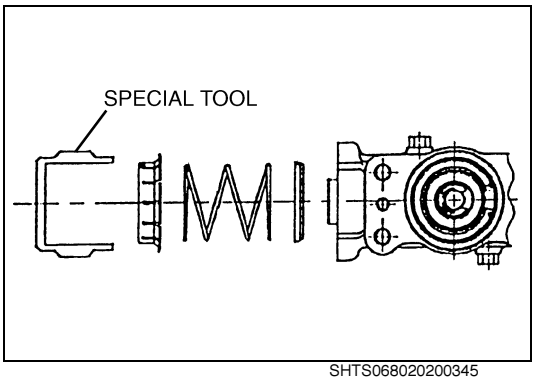
(4) Install the return spring and then install the special tool.
SST: Spring Pull Back Tool (09683-1080)

(5) Install the new E-ring and remove the special tool.


SHTS068020200339

(6) After assembling the sleeve assembly to the body, tighten the screw applied the LOCTITE 202 or ThreeBond 2415 or equivalent.

NOTICE
Align the screw setting hole of body with the groove of tappet part.



SHTS068020200345

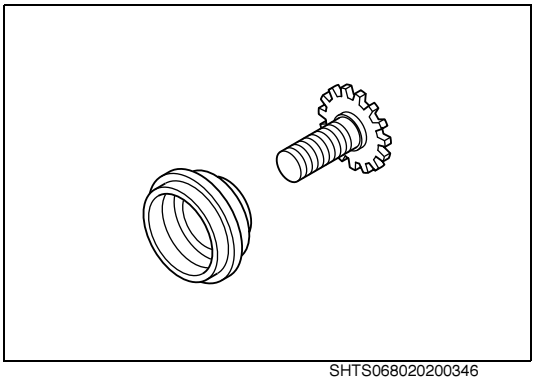
(7) Install the adjust ring and adjust lock spring.

(8) Using the special tool, Install the cover.

NOTICE

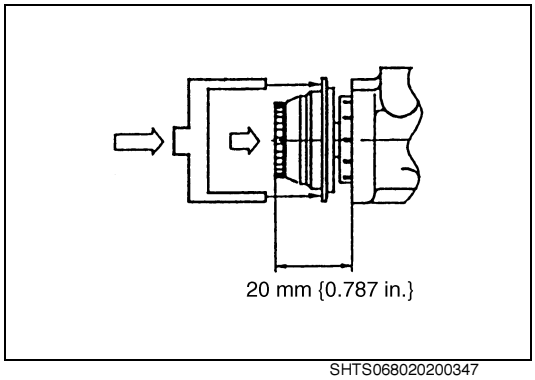
- **Be sure to install by hand using such as hammer.**
- **Before driving cover into sleeve assembly, assemble the cover to the body groove.**
- **After assembling the cover, turn the cover while pushing it and make sure that the cover turns smoothly in order to confirm the cover fits securely to the groove of the body.**

SST: Guide (09657-2330)


SHTS068020200346

(9) Assemble the new boot to the adjusting bolt. Apply grease (Darina Grease 2: Showa Shell Sekiyu K.K. product or equivalent) to contact part of boot and adjusting bolt, and thread part of adjusting bolt.

NOTICE
Be sure to assemble the boot to the groove of the adjusting bolt securely.



SHTS068020200347

(10) Screw adjusting bolt into the sleeve assembly until the dimension of end surfaces from adjusting bolt to body is about 20 mm {0.787 in.}.

(11) Pull the adjusting bolt lightly to confirm the sleeve slides.

(12) Using the plastic hammer and special tool, press a new boot in.
SST: Boot setting tool (09685-1020)

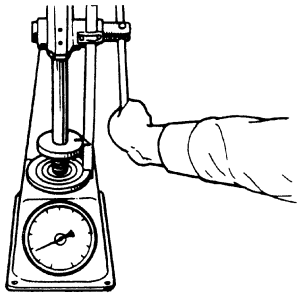
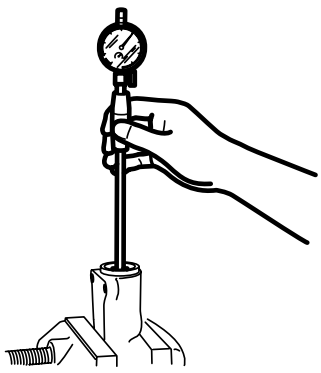
(13) Install the retainer to the adjusting bolt.

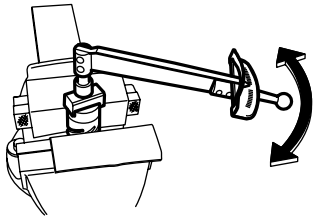
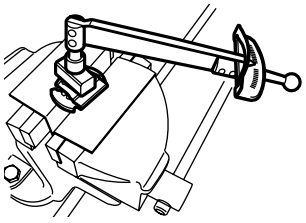
NOTICE

- **Do not cut the boot.**
- **Pay attention to installing direction of the retainer.**

INSPECTION AND REPAIR

EN0680202H300030

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Adjust lock spring: Setting load at the specified setting length	**78.3 N {8.0 kgf, 17.6 lbf} at 11.3 {0.45}**	**73.6 N {7.5 kgf, 16.5 lbf}**	**Replace.**	**Measure** 
Return spring: Setting load at the specified setting length	**147 N {15 kgf, 33.1 lbf} at 105.8 {4.17}**	**132 N {13.5 kgf, 29.8 lbf}**		
Sliding parts of sleeve assembly and roller: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check**
Axle dent of sleeve assembly and roller: Wear and damage	**—**	**0.010 mm {0.0004 in.} or less**	**Replace, sleeve assembly or roller.**	**Visual check**
Sliding parts of wedge and roller: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check**
Body inside diameter	**38.05 mm {1.498 in.}**	**38.10 mm {1.5 in.} or less**	**Replace.**	**Measure** 

Inspection Item		Standard	Limit	Remedy	Inspection Procedure
Sleeve assembly turning torque	Clockwise	0.6 N·m {6.0 kgf·cm, 0.433 lbf·ft} or less	—	Replace.	Measure 
	Counter-clockwise	2.0 N·m {20.0 kgf·cm, 1.447 lbf·ft} or more			
Retainer keep torque of adjusting bolt assembly		2.0-5.5 N·m {20-55 kgf·cm, 1.45-3.97 lbf·ft}	—	Replace.	Measure 

PRESSURE REGULATOR

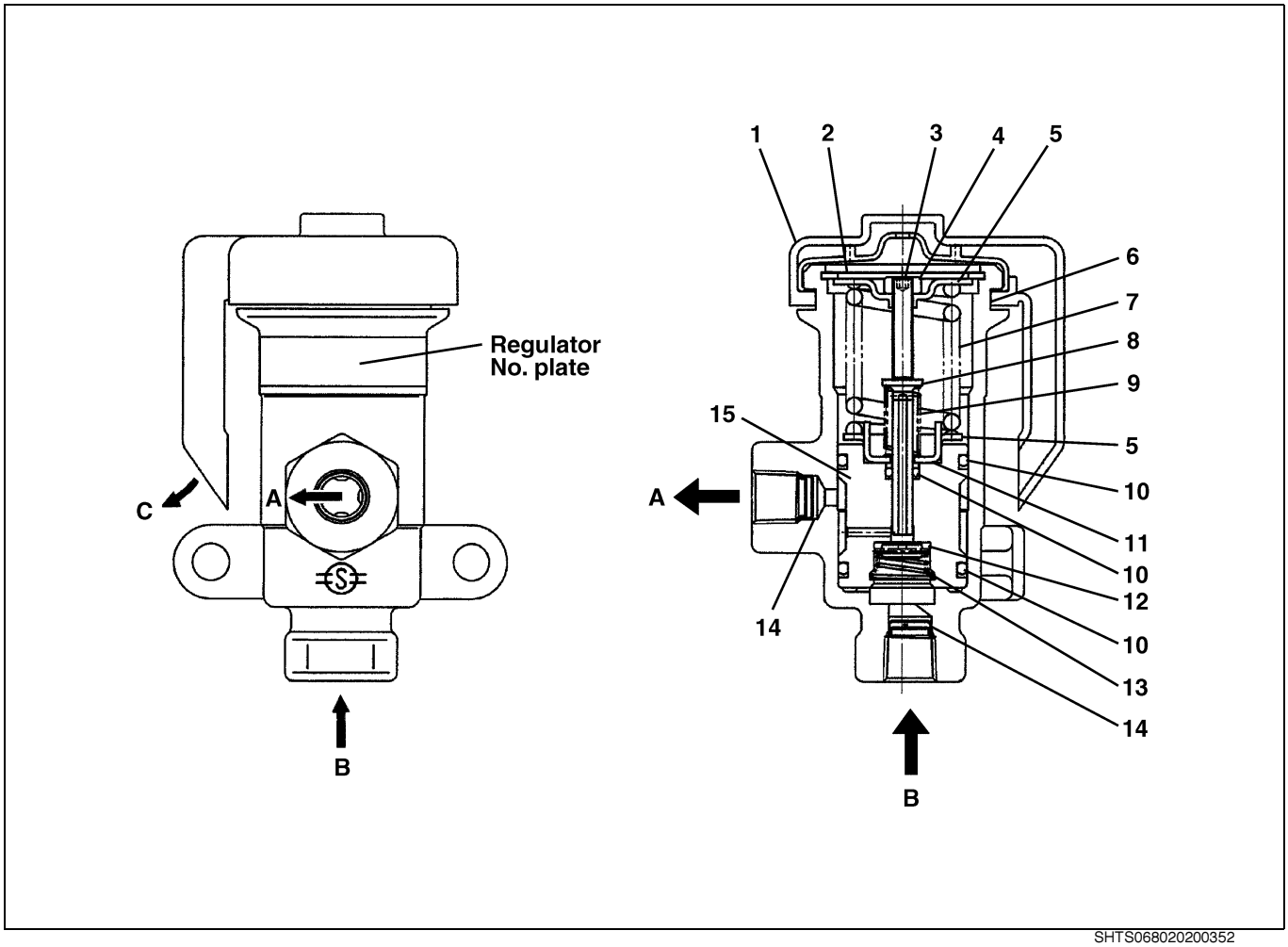
DATA AND SPECIFICATIONS

EN0680202I200025

Type	**Spring type, regulates air pressure together with unloader valve on compressor**
Regulating pressure: Regulator No. 44530-1420	**860-980 kPa {8.8-10.0 kgf/cm^2, 125-142 lbf/in.^{2}}**

DESCRIPTION

EN0680202C100027

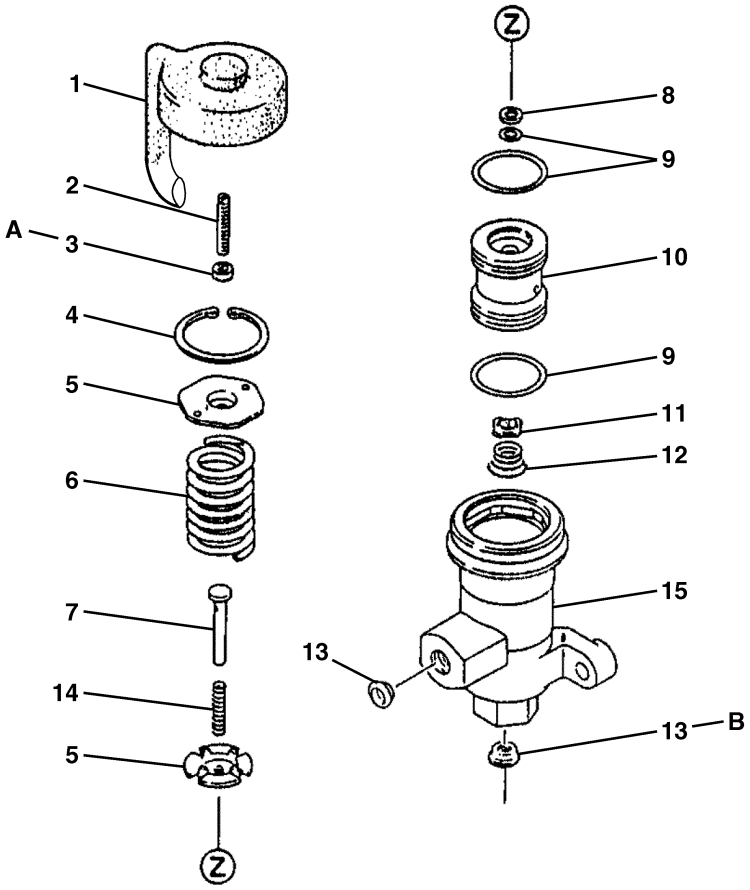


SHTS068020200352

1	Dust cover	7	Main spring	13	Valve spring
2	Retainer ring	8	Valve rod	14	Filter
3	Adjusting screw	9	Rod spring	15	Piston
4	Lock nut	10	O-ring	A	To Unloader valve
5	Spring seat	11	Washer	B	From Air tank
6	Valve body	12	Valve seat	C	Exhaust

COMPONENT LOCATOR

EN0680202D100026



SHTS068020200353

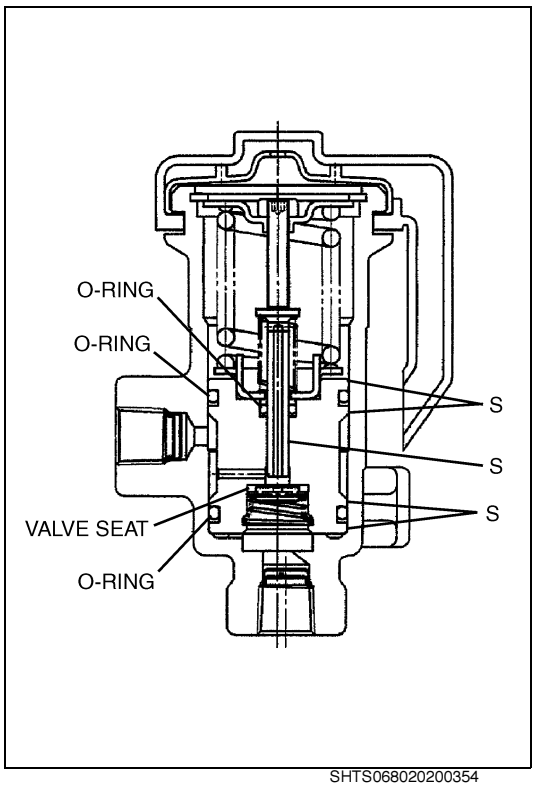
1	Dust cover	6	Main spring	11	Valve seat
2	Adjusting screw	7	Valve rod	12	Valve spring
3	Lock nut	8	Washer	13	Filter
4	Retainer ring	9	O-ring	14	Rod spring
5	Spring seat	10	Piston	15	Valve body

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	2.4-3.5 {24-36, 1.8-2.6}	B	0.29-0.49 {3-5, 0.22-0.36}

OVERHAUL

EN0680202H200025



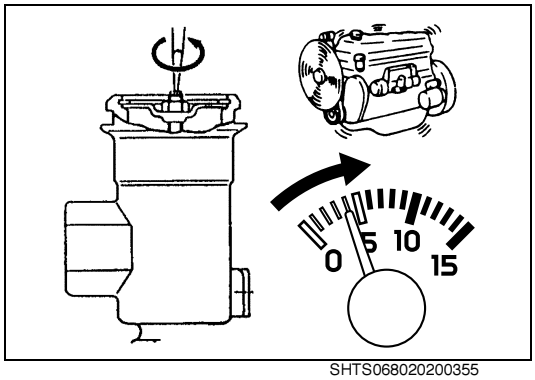
SHTS068020200354

IMPORTANT POINT - ASSEMBLY

1. LUBRICATION

(1) When reassembling the pressure regulator, replace all rubber parts with new ones.

(2) Apply adequate amount of silicone grease to the O-rings, and sliding surface S of the piston and valve rod.

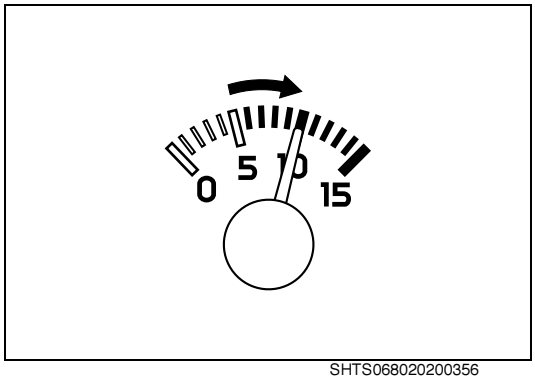


SHTS068020200355

IMPORTANT POINT - MOUNTING

1. ADJUSTMENT

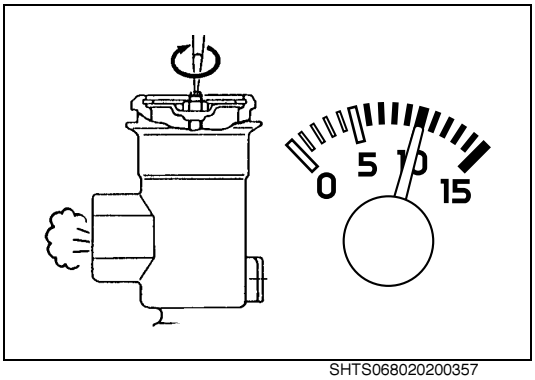
(1) Loosen the adjusting screw until the rod spring tension is released, and start and idle the engine to charge the air for the air tank.



SHTS068020200356

(2) Stop the engine when the gauge indicates valve opening pressure shown below.

Valve opening pressure	Pressure kPa {kgf/cm^2, lbf/in.^{2}}
44530-1420	940-980 {9.6-10.0, 136.3-142.1}



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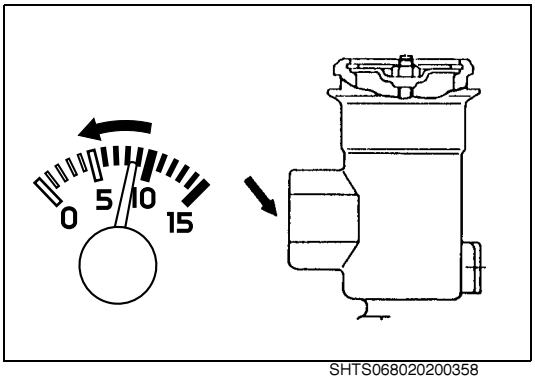
(3) Tighten the adjusting screw gradually till the air starts to leak from the port to the unloader valve side.
(4) Tighten the adjusting screw lock nut.



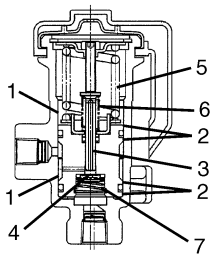
SHTS068020200358

(5) Watch the pressure gauge needle and see that it stops at the valve closing pressure shown below.
(6) Connect the pipe and pressure regulator.

Valve closing pressure	Pressure kPa {kgf/cm^2, lbf/in.^{2}}
44530-1420	820-860 {8.4-8.8, 118.9-124.7}

INSPECTION AND REPAIR

EN0680202H300031

Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Valve body 1, piston 2 and valve rod 3. Sliding surface: Valve rod 4. Valve contact surface: Wear and any other damages	—	—	Replace, if necessary.	Visual check 
Main spring 5. rod spring 6. and valve spring 7: Rust and damage	—	—	Replace, if necessary.	

ABS (ANTI-LOCK BRAKE SYSTEM) (WABCO MAKE)

BR03-001

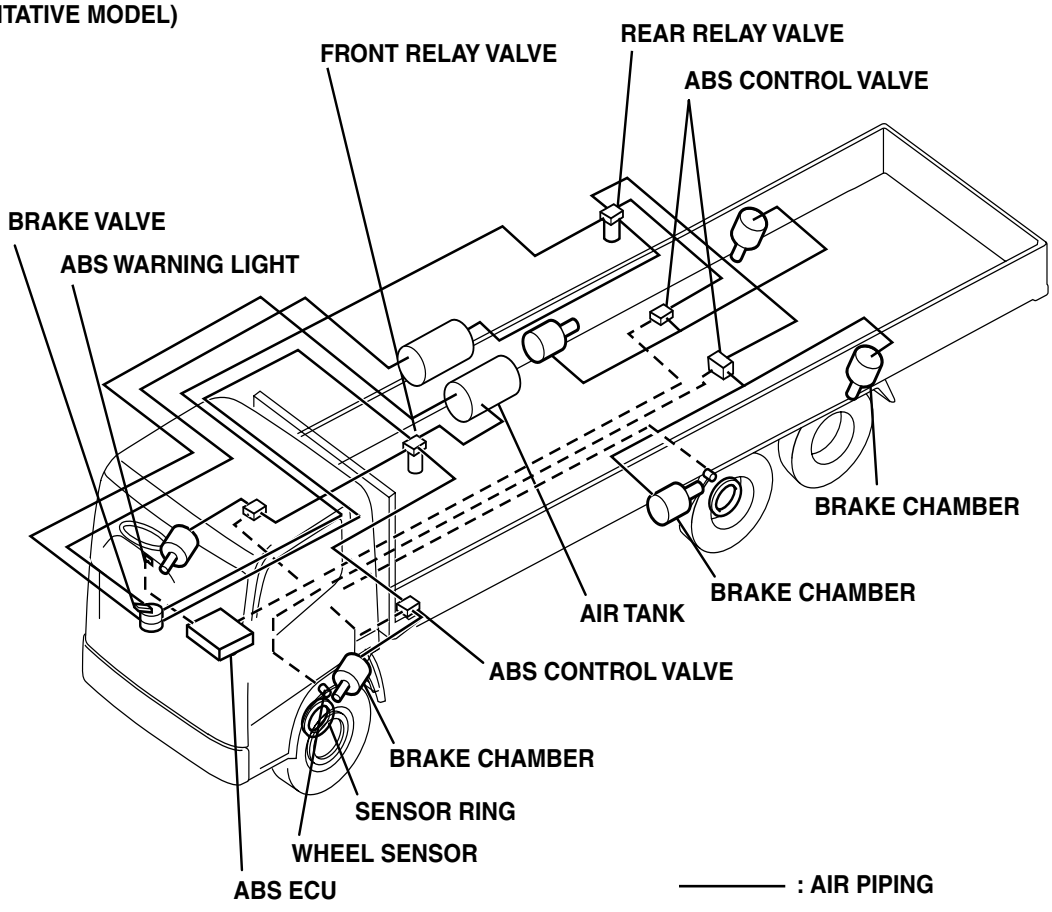
ABS

OVERVIEW

EN06Z0803C100001

ABS is a system that makes effective use of the friction between the tires and the road surface to maintain vehicle stability while the brakes are being applied and for stopping the vehicle.
Applying the brakes forcefully on a slippery road surface can cause the wheels to be locked, due to excessive braking force. This causes the vehicle to lose a stability because the locked wheels lose resistance in the lateral direction. More specifically, if the front wheels are locked, it becomes impossible to steer the vehicle, and if the rear wheels are locked, the rear of the vehicle may fishtail from side to side.
Also, when wheel-locking occurs, it is not possible to make effective use of friction between the tires and the road surface. This may cause the braking distance to be increased.
ABS uses wheel sensors mounted on the axles to constantly monitor the rotation of the wheels. If any of the wheels is starting to lock up, the ABS ECU sends signals to the ABS control valve and immediately adjusts the brake pressure to prevent wheel-locking.
In this way, ABS maintains the stability of the vehicle while stopping by making effective use of the friction between the tires and the road surface.

(REPRESENTATIVE MODEL)



SHTS06Z080300001

COMPOSITION AND OPERATION

EN06Z0803C100002

The ABS system is comprised of the sensor rings mounted on the wheels, the ABS ECU, which receives signals from the wheel sensors that monitor the rotational speed of the wheels and outputs control signals to maintain the appropriate braking force; ABS control valves, which increase or decrease the braking force, based on the control signals; the warning light, which gives an alarm if the system malfunctions; the piping, wire harnesses, etc., that link together the various units that compose the system.

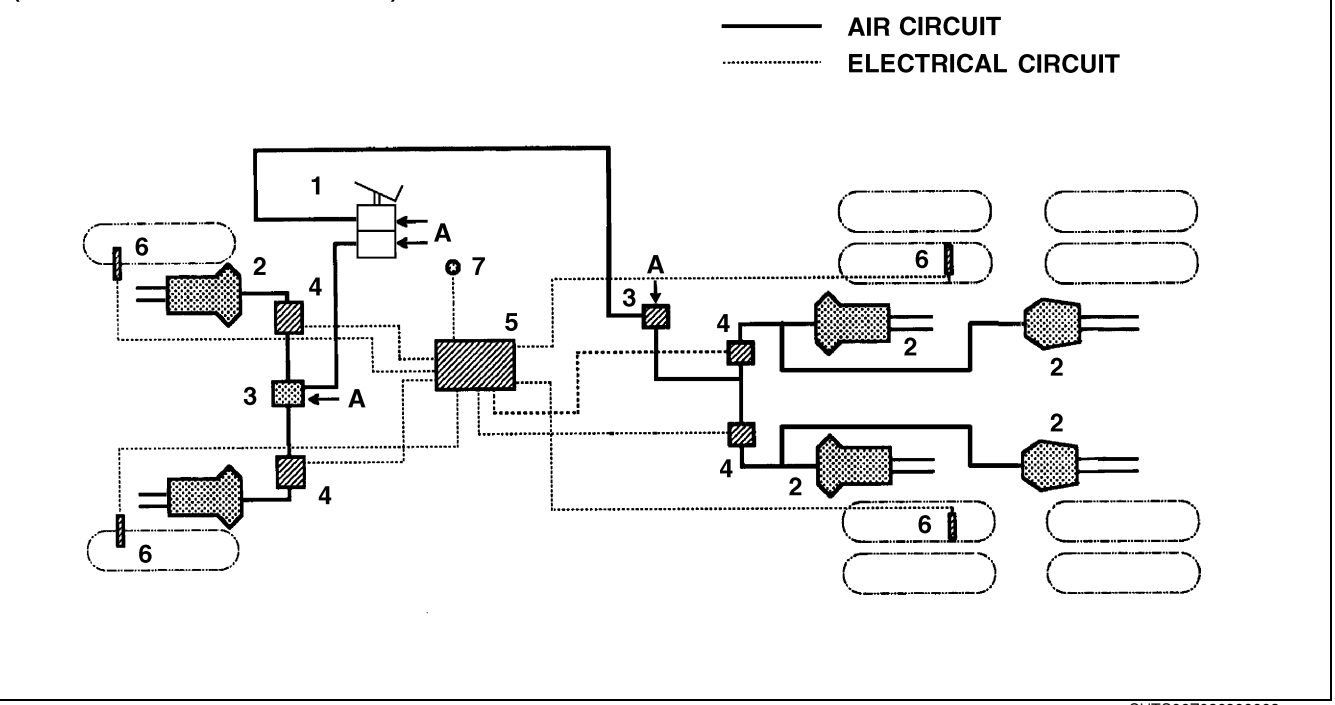
Pulse signals transmitted by the sensor rings mounted on the wheel hubs, rotated together with the wheels, and the wheel sensors mounted near sensor ring on the axles are sent to the ABS ECU. The ABS ECU then calculates the wheels' rotational speed, acceleration, deceleration, and amount of slippage, based on these signals.

If the limit values for the wheel's deceleration, or slippage ratio are exceeded, the ABS ECU immediately transmits signals to the ABS control valves to adjust any excess braking force.

This ABS system controls the four wheels, front, rear, right, and left, independently.

SYSTEM COMPOSITION DIAGRAM

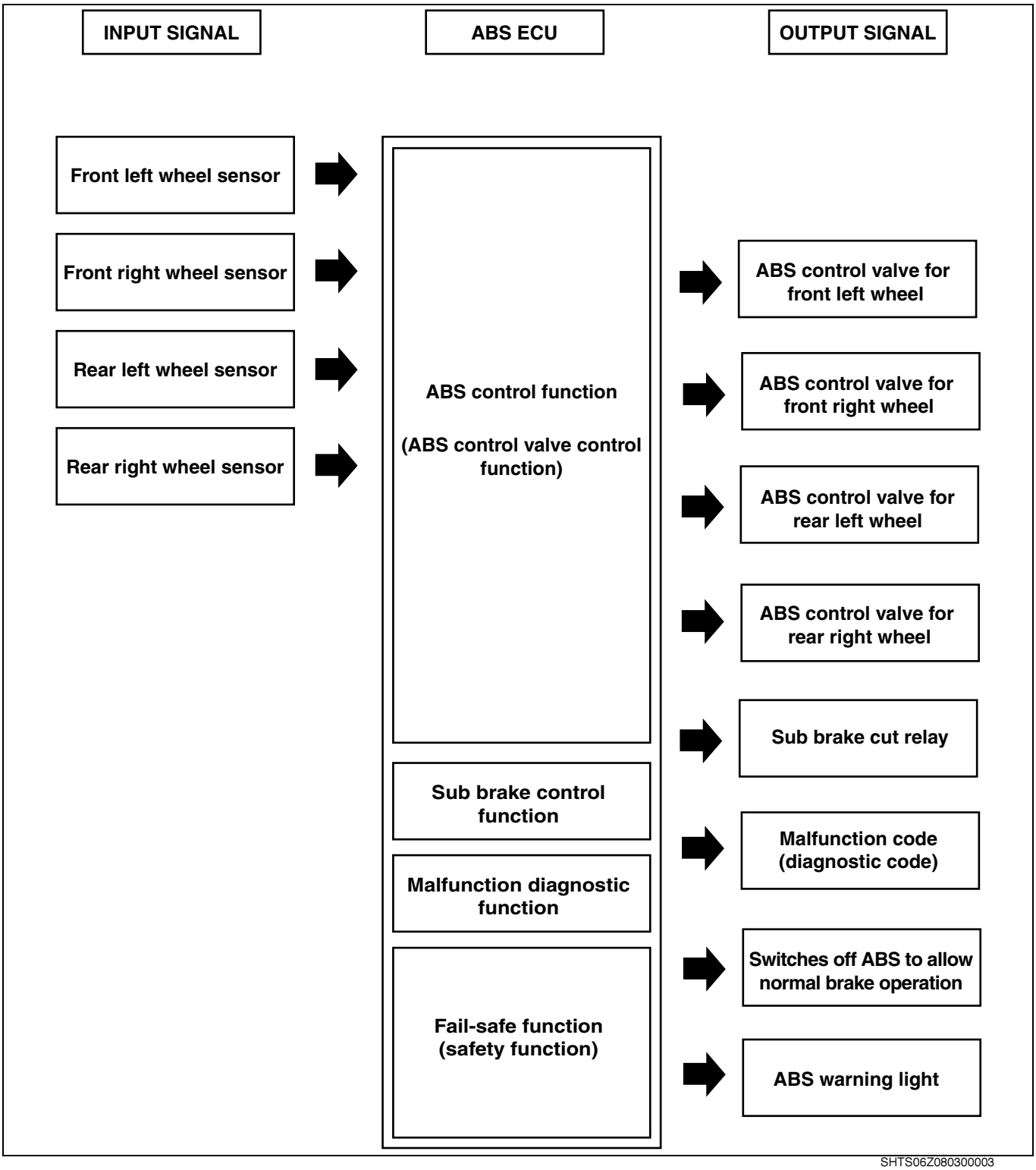
(REPRESENTATIVE MODEL: FS)



SHTS06Z080300002

1	Brake valve	5	ABS ECU
2	Brake chamber	6	Wheel sensor
3	Relay valve	7	ABS warning light
4	ABS control valve	A	From air tank

ABS CONTROL FLOWCHART



SHTS06Z080300003

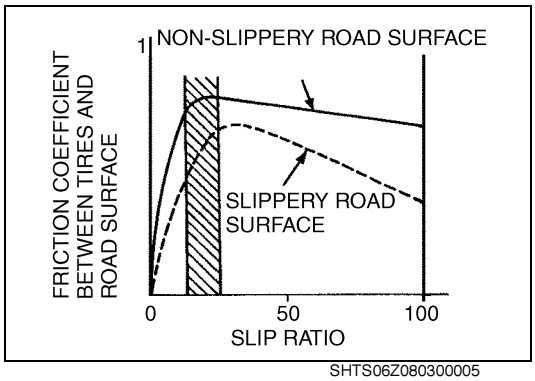
BASIC PRINCIPLE

Based on its relationship with the slip ratio, which is determined from the wheels' rotational speed and the vehicle's speed, ABS controls the brake force so that it will be most effective.

When the driver applies the brakes, the rotation of the wheels is controlled and the vehicle speed drops. However, the momentum of the vehicle attempts to push it forward further even though the rotation of the wheels is being braked. At this point, slipping will occur if there is a gap between the wheels' rotational speed and the vehicle's speed. The slip ratio is a value that indicates the rate of slippage.

$$\text{Slip ratio} = \frac{\text{Vehicle's speed} - \text{Wheel's rotational speed}}{\text{Vehicle's speed}} \times 100\ \%$$

Slip ratio 0 %: No slipping between the wheels and the road surface
100 %: Wheels locked

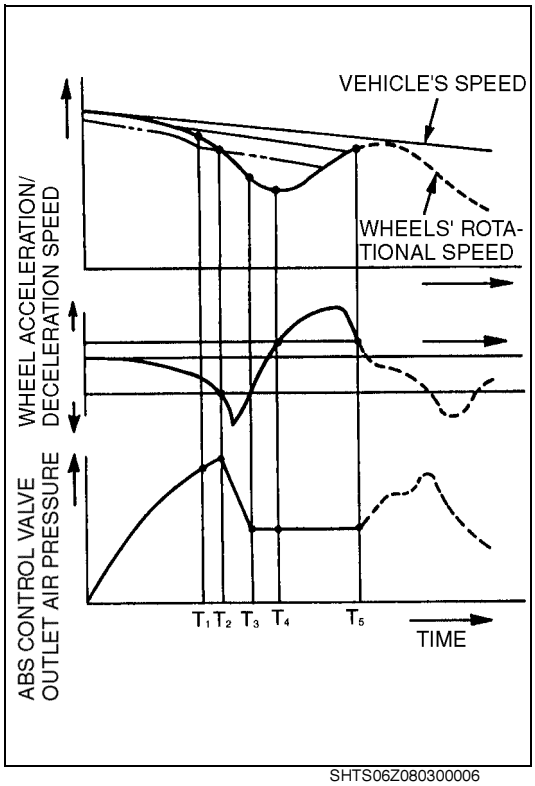


SHTS06Z080300005

The graph shown at left shows the relationship between the friction coefficient of the tires and of the road surface and the slip ratio.

In an ABS-equipped vehicle, the brake force is controlled to ensure that it is within the range where the friction coefficient is high (shaded portion of the graph) without locking the wheels. This ensures efficient braking performance.

OPERATION



SHTS06Z080300006

The ABS control characteristics line graph at left illustrates how the vehicle's speed, the wheels' rotational speed, the wheel acceleration/ deceleration, and the air pressure at the ABS control valve outlet change over time after the brakes are applied.

When the brakes are applied, the vehicle's speed and the wheels' rotational speed drop and at the same time, the wheel acceleration/deceleration speed also drops. At point T1, a gap begins to open between the wheels' rotational speed and the vehicle's speed. Passing on point T2, the ABS ECU detects that the wheels are beginning to lock and is lowering the outlet air pressure of the ABS control valve to prevent wheel locking from occurring.

At point T3, the wheel acceleration/deceleration speed is starting to return to normal one, and the ABS ECU stops lowering the air pressure at the ABS control valve outlet and maintains it at a constant level.

At point T5, the wheels' rotational speed and the vehicle's speed are about the same. The ABS ECU detects that the wheels are no longer likely to be locked and increases the air pressure at the ABS control valve outlet.

The above processes is repeated over and over until the vehicle comes to a complete stop.

FUNCTION

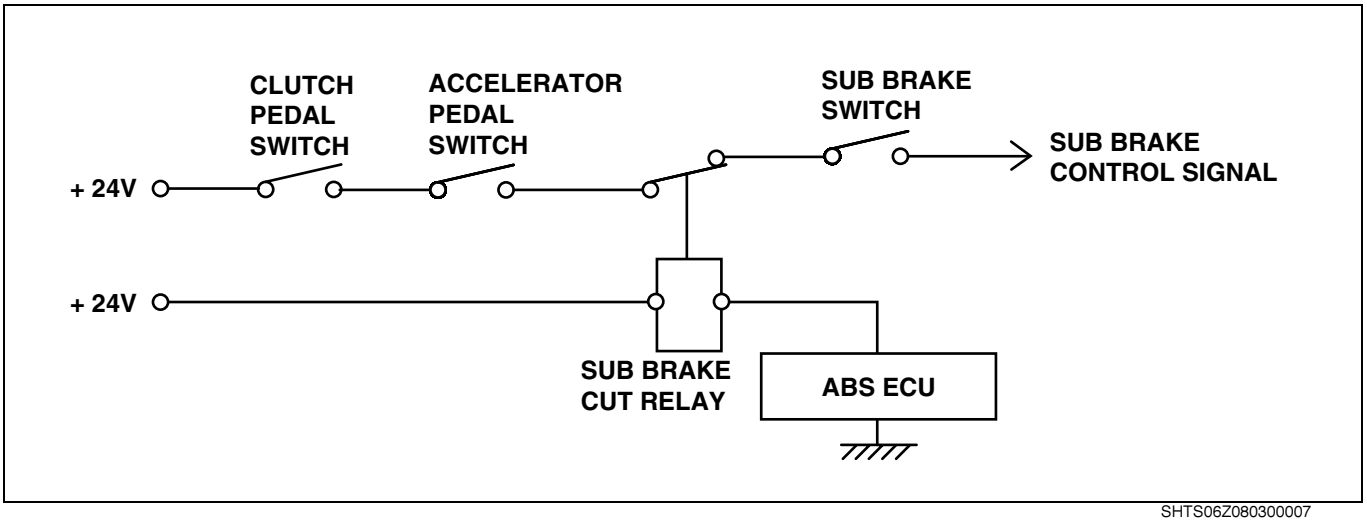
EN06Z0803C100003

FAIL-SAFE FUNCTION

This ABS system is equipped with a fail-safe function that causes the ABS warning light on the instrument panel to light and to restore the normal (non-ABS) brake system, should an ABS malfunction occur.
Note that the ABS system consists of two independent circuits. Should a malfunction occur for whatever reason in the electrical circuits, that system's ABS is switched off and the normal brake system is restored while ABS control continued for the other system. This configuration is designed to minimize the effects of any malfunction on ABS function.

SUB BRAKE CONTROL FUNCTION

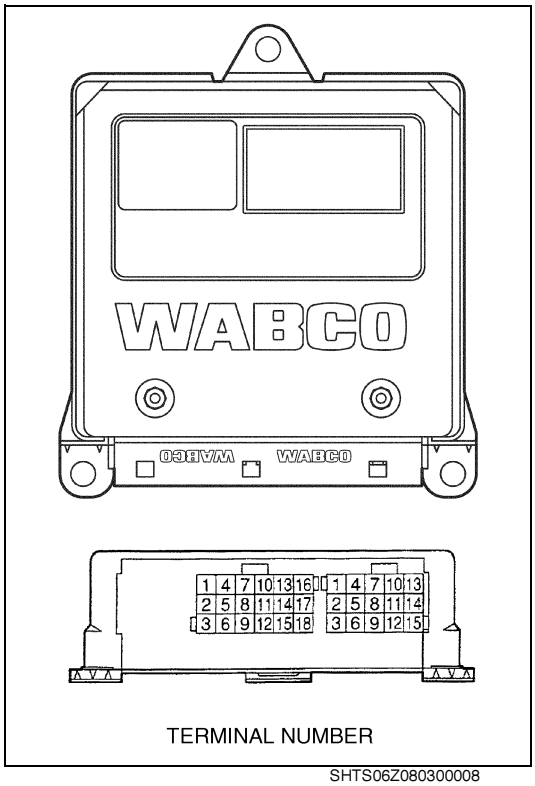
The ABS system of this vehicle is equipped with a function that controls the sub brake while ABS is operating.
If the sub brake is applied independently or together with the service brake on a road surface with very low friction coefficient, the driving wheels may lock. This ABS system prevents the driven wheels from locking in such cases by automatically releasing the sub brake, if necessary, during ABS operation.



SHTS06Z080300007

OVERVIEW AND FUNCTION

EN06Z0803C100004



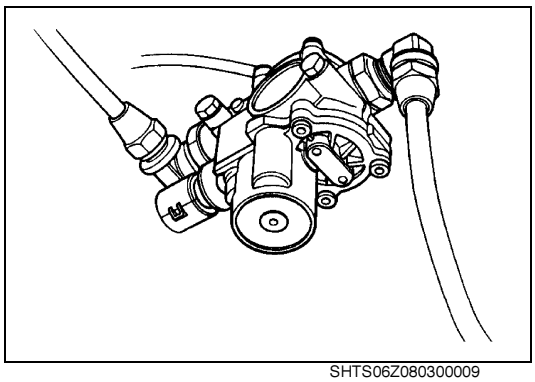
SHTS06Z080300008

1. ABS ECU

Based on pulse signals from the wheel sensors, the ABS ECU mounted in the vehicle calculates and evaluates the slip ratio and the acceleration/deceleration speed of the wheels. Based on the results, it sends signals to the various control valves as necessary, causing them to operate and apply the brakes to maintain the slippage of the wheels within the optimal range.

During braking, the air pressure applied to the brake chambers is regulated to prevent the wheels from locking. The brakes are applied so as to maintain the slippage of the wheels within the optimal range.

Regardless of whether the vehicle is stopped or being driven, and whether or not the brakes are being applied, the circuit consisting of the wheel sensors, control valves, ABS ECU, and wire harnesses are constantly being checked by the ABS ECU's fail-safe circuit. If some sort of malfunction occurs, the fail-safe circuit warns the driver by lighting the ABS warning light. At the same time, the ABS system that is experiencing the malfunction is shut off and braking is restored to normal (non-ABS) operation.

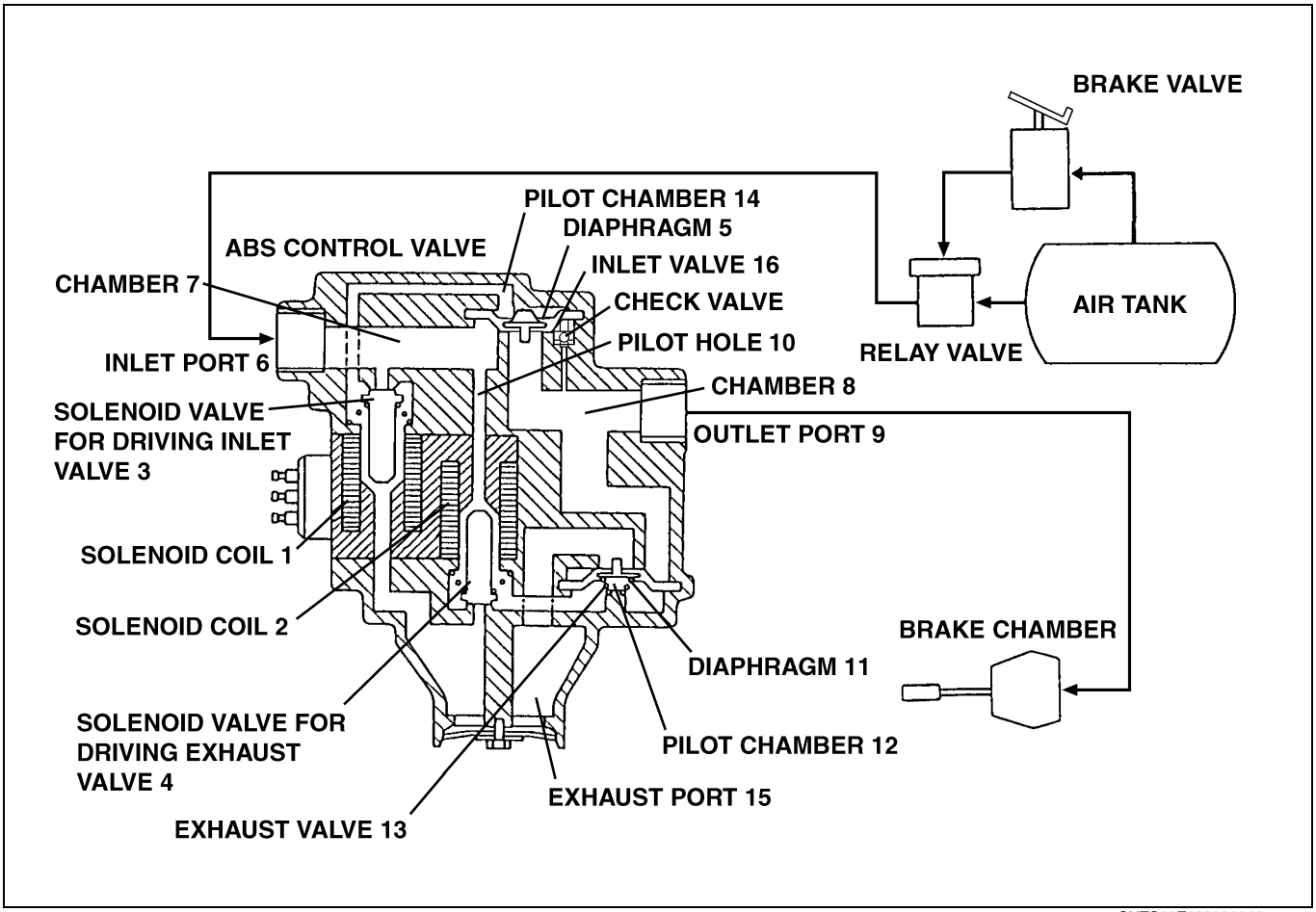


SHTS06Z080300009

2. ABS CONTROL VALVES

(1) Overview

- The ABS control valves are positioned in the brake air circuit between the relay valves and brake chambers. Based on signals from the ABS ECU, they adjust the air pressure sent to the brake chambers in one of three modes: pressure increase, pressure reduction, or pressure maintenance.



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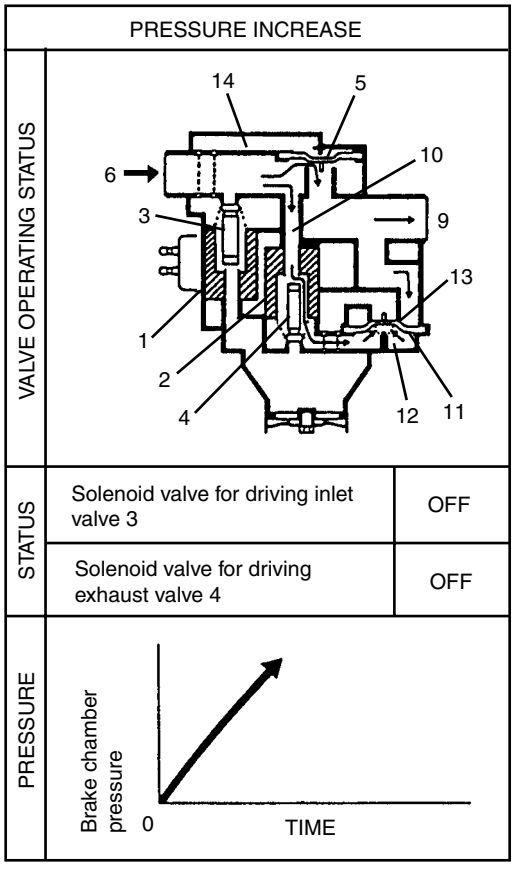

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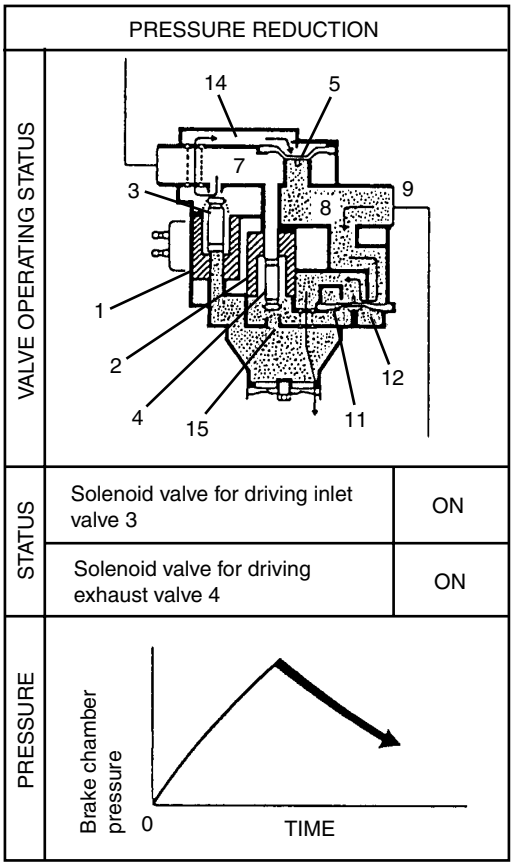
(2) Operation

a. PRESSURE INCREASE MODE

- When the driver steps on the brake pedal, air from the relay valve enters through inlet port (6), pushes open diaphragm (5), passes through outlet port (9), and flows into the brake chamber. At this point, solenoid coil (1) is not energized, so solenoid valve (3) is closed and pilot chamber (14) is open to the atmosphere. Also, solenoid coil (2) is also not energized, so solenoid valve (4) is closed. As a result, air passes through pilot hole (10) and enters pilot chamber (12). It then pushes up diaphragm (11) and closes exhaust valve (13).

b. PRESSURE REDUCTION MODE

- When solenoid coil (1) is energized, solenoid valve (3) opens and air also flows into pilot chamber (14). It pushes down on diaphragm (5), shutting off chambers (7) and (8). At the same time, solenoid coil (2) is also energized. This causes solenoid valve (4) to open and the operating air from pilot chamber (12) passes through exhaust port (15) and is released into the atmosphere. Consequently, the air from the outlet port (9) side (brake chamber) pushes down on diaphragm (11) and air is released into the atmosphere. This causes the air pressure of the brake chamber to decrease.



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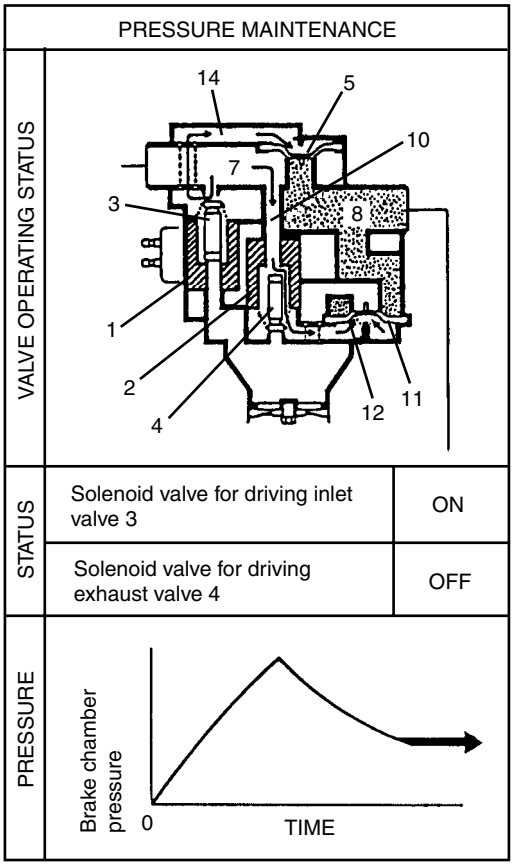
c. PRESSURE MAINTENANCE MODE

- When solenoid coil (1) is energized, solenoid valve (3) opens and air flows through chamber (7) and acts on pilot chamber (14). On the other hand, since solenoid coil (2) is not energized, solenoid valve (4) is closed and air flows through pilot hole (10) and acts on pilot chamber (12). This causes diaphragms (5) and (11) to shut off their air passages, and the chamber (8) pressure, that is to say the air acting on the brake chamber, is maintained at the pressure that was current when the switch from the pressure reduction mode to the pressure maintenance mode took place.



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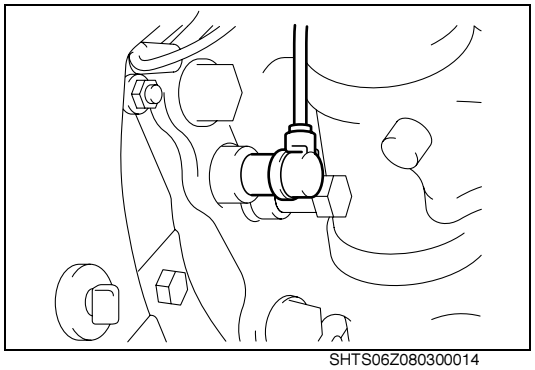
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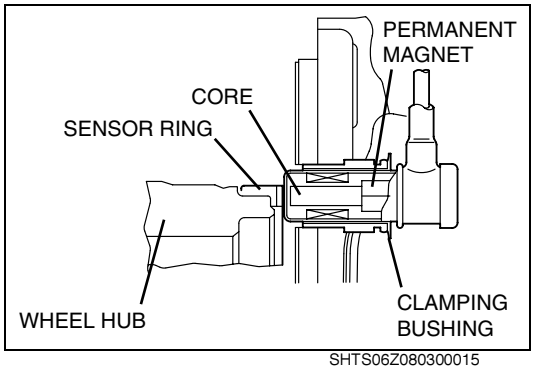
3. WHEEL SENSORS

These sensors are mounted, facing the sensor rings on each wheel on the front and rear axles.

The wheel sensors are electromagnet sensors consisting of a permanent magnet core with a coil of wire wrapped around it.

The frequency of the pulse signals generated by magnetic inductance between the sensors and the sensor rings they face is proportional to the rotational speed of the wheels. These pulse signals are sent to the ABS ECU and are used to determine the wheels, rotational status.



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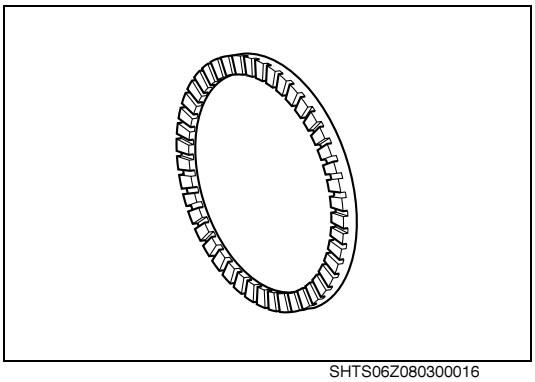
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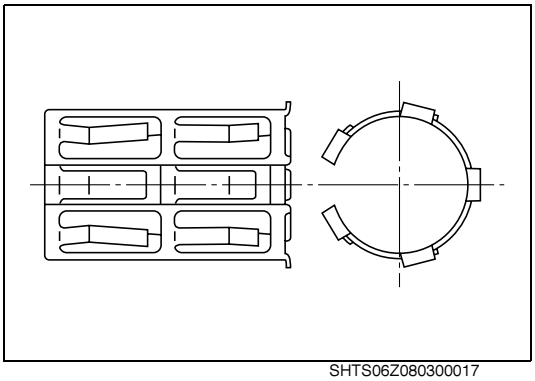
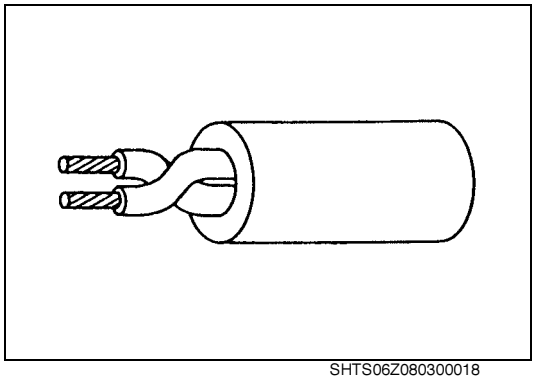
4. SENSOR RINGS

The sensor rings are press-fitted into the insides of the wheel hubs of each wheel on the front and rear axles, and they face the wheel sensors described in the preceding section. The sensor rings are made of a magnetic material, and teeth are cut into the surface which faces the wheel sensor at regular intervals. Also, when the sensor ring performs one complete rotation, the sensor generates pulse signals corresponding to the number of teeth.


SHTS06Z080300017

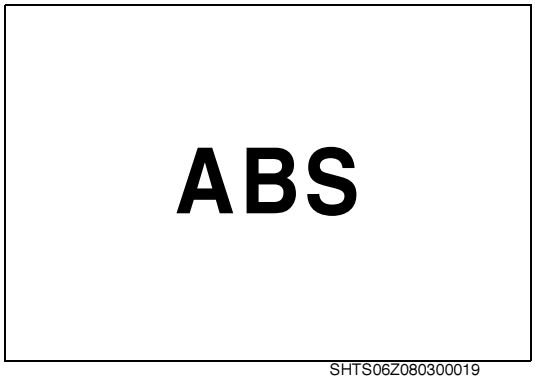
5. CLAMPING BUSHINGS

The wheel sensors are held in place through friction by clamping bushings that are inserted into the mounting brackets. If they are assembled properly, the clamping bushings serve to eliminate the need to adjust the clearance between the wheel sensors and sensor rings.


SHTS06Z080300018

6. WHEEL SENSOR HARNESSES

Each wheel sensor wire harness employs a two-conductor twisted wire cable. Its function is to protect the wheel sensor signals, which are vital to the proper operation of the ABS system, from electromagnetic interference. Under no circumstances should any part of the wheel sensor wire harnesses be cut or connected to any other wire.



SHTS06Z080300019

7. ABS WARNING LIGHT

The status of the ABS system is indicated.
It lights when the starter switch is turned "ON" and automatically goes off when the system functions correctly.
If malfunction occurs in the ABS system while the vehicle is being driven, the light goes on to alert the driver.
However, when a defects code is eliminated after repairing it and the starter switch is turned "ON", the light will remain lit until the vehicle speed reaches 7-10 km/h {11.2 - 16 mile/h}.
Then, note that even when the warning light is lit, the ABS system, unaffected by the malfunction, continues to operate. Also, the brake whose ABS system experiences the malfunction is reverted to normal braking operation without ABS.
When a diagnosis switch is turned "ON", this light will goes on and off, which indicates defect code.

8. SUB BRAKE CUT RELAY

When this relay is energized during ABS operation, the relay contact opens, the current to the solenoid valve for the sub brake is shut down, and the sub brake is released.

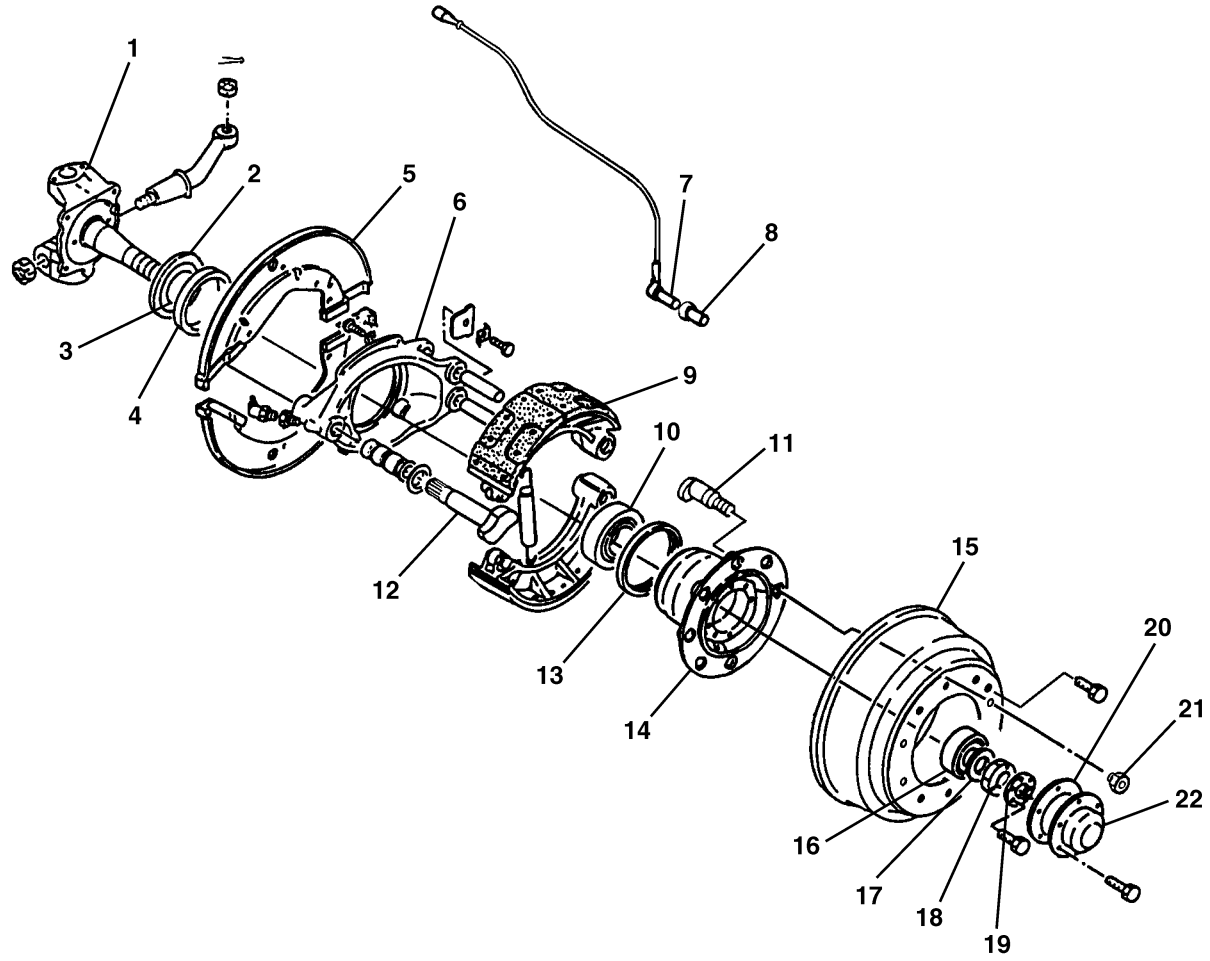
FRONT WHEEL BRAKE

COMPONENT LOCATOR

EN06Z0803D100001

FRONT AXLE

(REPRESENTATIVE MODEL)



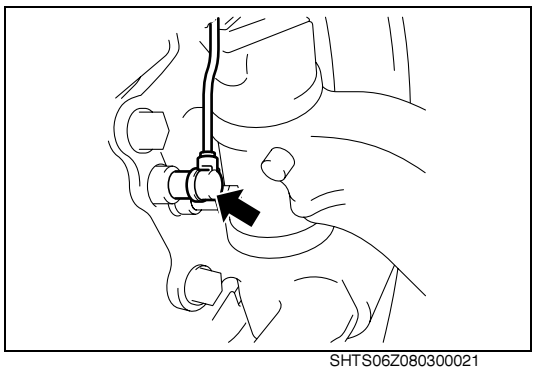
SHTS06Z080300020

1	Knuckle	12	Cam shaft
2	Oil seal guide	13	Sensor ring
3	O-ring	14	Wheel hub
4	Oil seal	15	Brake drum
5	Brake drum cover	16	Outer wheel hub bearing
6	Brake spider	17	Washer
7	Wheel sensor	18	Wheel hub bearing lock nut
8	Clamping bushing	19	Lock plate
9	Brake shoe	20	Gasket
10	Inner wheel hub bearing	21	Wheel nut
11	Hub bolt	22	Wheel hub cap

OVERHAUL

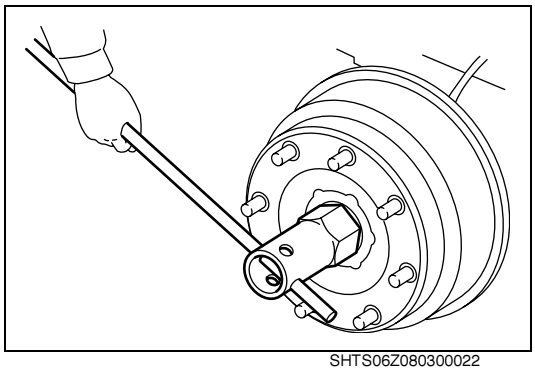
EN06Z0803H200001

IMPORTANT POINTS - DISASSEMBLY

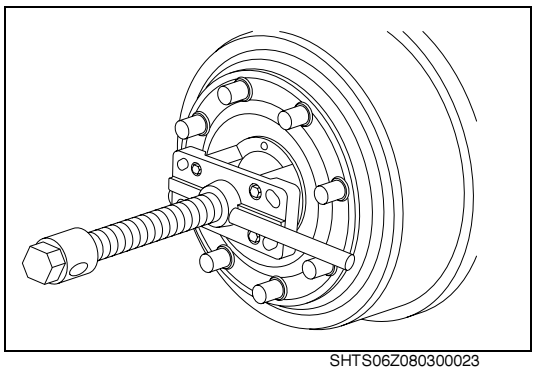

SHTS06Z080300021

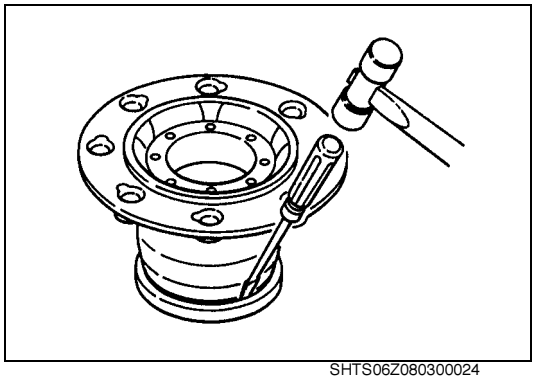
1. REMOVE THE WHEEL SENSOR.
(1) Remove the brake drum cover.
(2) Pull off the wheel sensor.

NOTICE
Exposing the wheel sensor to strong bumps could cause interior damage. Never hit the wheel sensor with a hammer or bang it into other parts.


SHTS06Z080300022

2. REMOVE THE WHEEL HUB, WHEEL HUB BEARINGS AND BRAKE DRUM.
(1) Refer to chapter FRONT AXLE.


SHTS06Z080300023

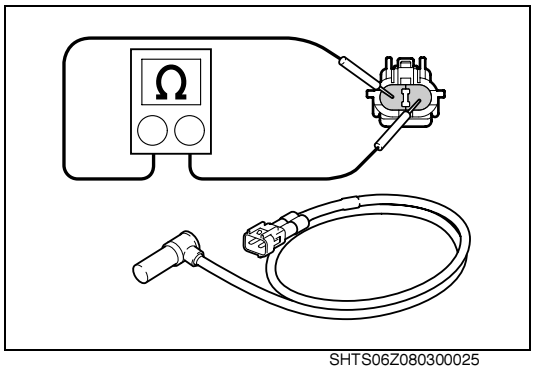

SHTS06Z080300024

3. REMOVE THE SENSOR RING.
(1) Use a screwdriver or the like to gradually remove the sensor ring by tapping evenly on its outer ring.

NOTICE
- **When tapping on the sensor ring to remove it, be careful not to scratch the wheel hub.**
- **Do not remove the sensor ring unless it is required.**
- **Do not reuse the removed sensor ring, be sure to replace it with new one.**

INSPECTION

EN06Z0803H300001

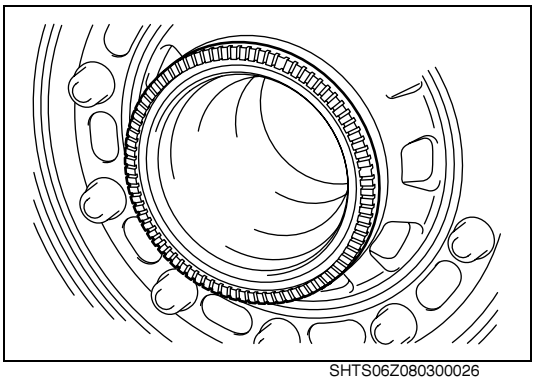


SHTS06Z080300025

1. INSPECTION OF ONLY WHEEL SENSOR

(1) With a tester, measure the resistance of wheel sensor.
Standard: 1.0-1.3 kΩ

(2) When the measured value is out of the basic standard, change the wheel sensor as it might be considered presumably to be abnormal.

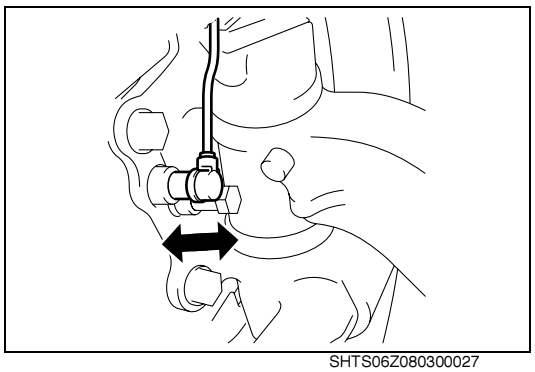

SHTS06Z080300026

2. INSPECTION OF THE SENSOR RING.

(1) Make a visual inspection to check for damage or deformation of the sensor ring, and also to make sure it is not coming loose from the wheel hub.

(2) If any damage or malformation is discovered, replace the sensor ring.

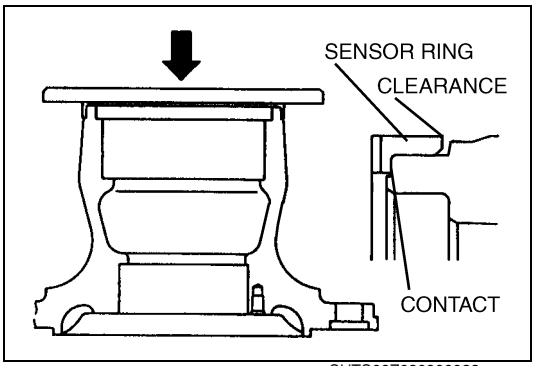
(3) If the sensor ring is coming loose from the wheel hub, use a dolly block and press in it with a press again.


SHTS06Z080300027

3. INSPECTION OF THE CLAMPING BUSHING.

(1) Make sure that wheel sensor is securely fixed.

(2) Change the clamping bushing when it can be pulled off or pushed in with a lightly force.



SHTS06Z080300028

4. MOUNTING THE SENSOR RING

(1) Place the sensor ring on the wheel hub and use the dolly block and a press to evenly pressure mount it.

NOTICE

Warming up the sensor ring with hot water will make it easier to pressure mount it. Do not use a gas burner or the like to warm the sensor ring. Doing so could cause malformation of the sensor ring.

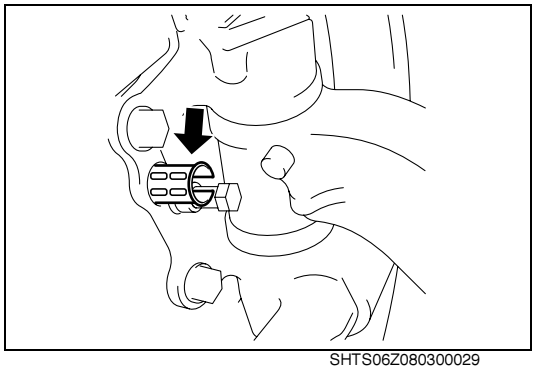
(2) After pressure mounting it, check for flutter of the sensor ring in the axle direction.
Assembly standard: 0.2 mm {0.0078 in.} or less

5. MOUNTING THE WHEEL HUB AND BRAKE DRUM

(1) Refer to chapter FRONT AXLE.

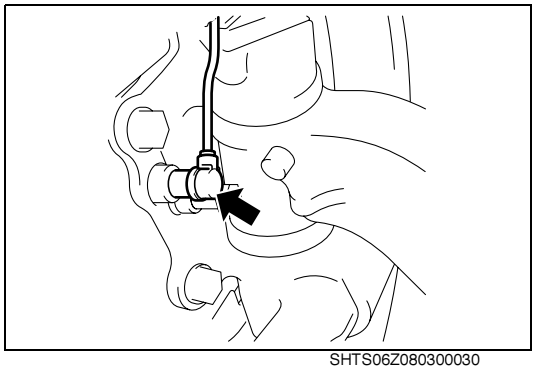
NOTICE

If the wheel sensors are mounted, hammering on the wheel hubs and the like on that axle could cause internal damage to the wheel sensors. Either mount the tire and then tap on the tire or tap on the wheel hub after removing the right and left wheel sensors.


SHTS06Z080300029

6. MOUNTING THE WHEEL SENSOR

(1) Apply a light coating of chassis grease to the inner surface of the knuckle wheel sensor boss. Then push in the clamping bushing until the stopper makes contact with the knuckle's wheel sensor holder.


SHTS06Z080300030

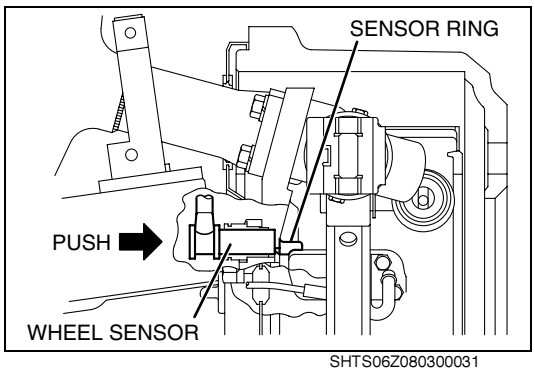
(2) Apply a light coating of chassis grease to the hub of the wheel sensor. Then push it forcefully into the clamping bushing until you feel that the wheel sensor has made contact with the sensor ring.

NOTICE

When inserting the wheel sensor, do not tap on it with a hammer or attempt to pry it into place with a screwdriver, or the like. Doing so could damage the wheel sensor.

(3) Slowly turn the wheel hub and brake drum and confirm that they move smoothly.

(4) Mount the drum dust cover.



SHTS06Z080300031

7. INSPECT THE WHEEL SENSOR

(1) Arrange the wire harness.

(2) With a circuit tester, confirm the output voltage of the wheel sensor (By rotating the tire by one time for 5 seconds)

Standard: 150-1,999 mV

(Range of Alternating Current Voltage)

(3) In case of out of the standard range at (2), push the wheel sensor softly by fingers until the sensor contacts with the sensor ring, then inspect again from (1).

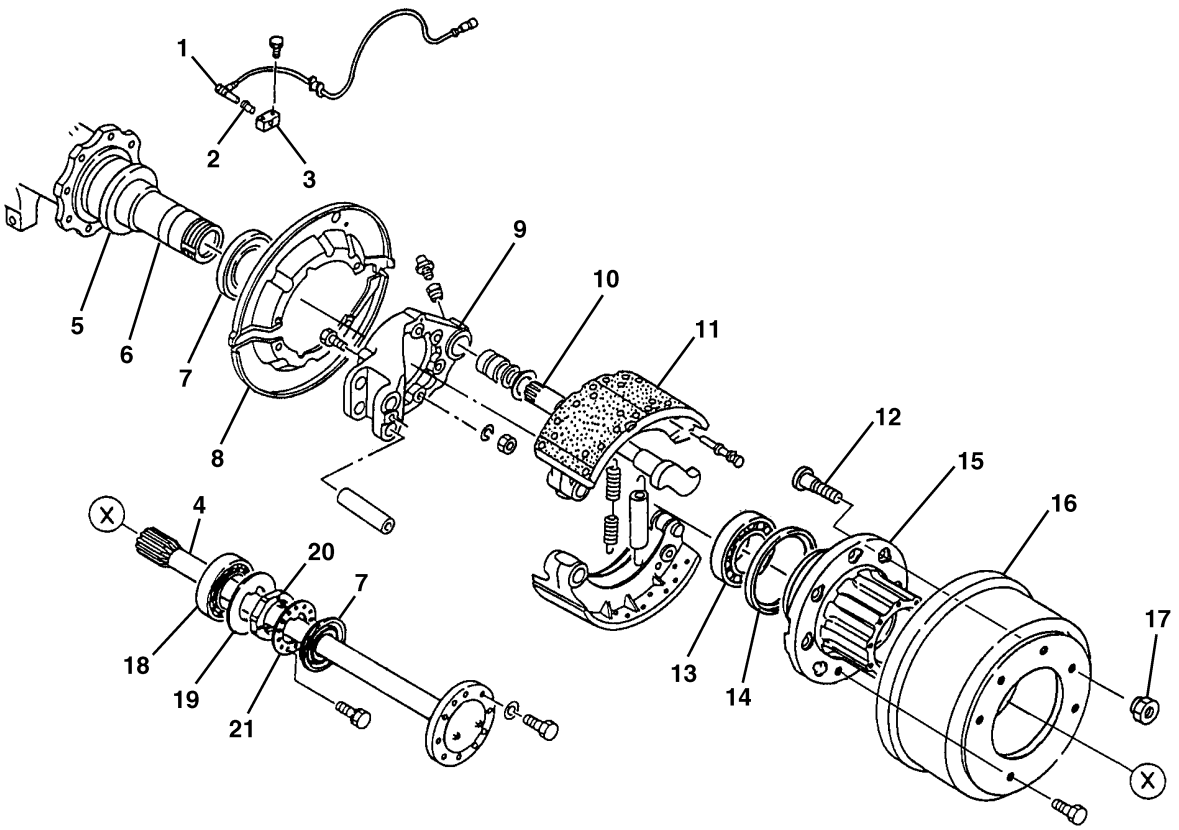
REAR WHEEL BRAKE

COMPONENT LOCATOR

EN06Z0803D100002

REAR AXLE

(REPRESENTATIVE MODEL)

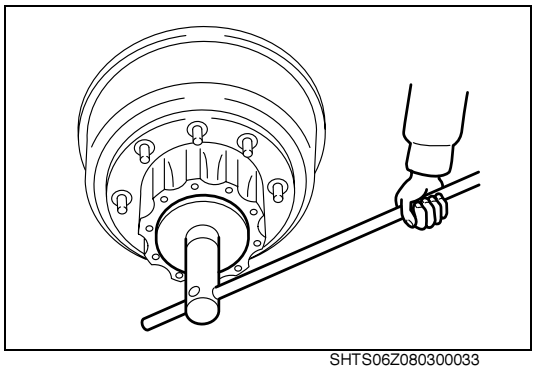


SHTS06Z080300032

1	Wheel sensor	12	Hub bolt
2	Clamping bushing	13	Inner wheel hub bearing
3	Wheel sensor holder	14	Sensor ring
4	Axle shaft	15	Wheel hub
5	Oil seal collar	16	Brake drum
6	Axle housing assembly	17	Wheel nut
7	Oil seal	18	Outer wheel hub bearing
8	Brake drum cover	19	Washer
9	Brake spider	20	Lock nut
10	Cam shaft	21	Lock plate
11	Brake shoe		

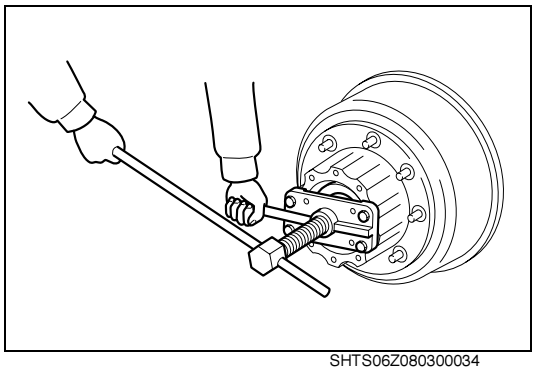
OVERHAUL

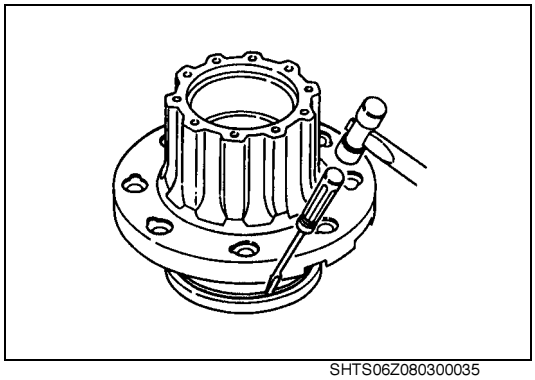
EN06Z0803H200002


SHTS06Z080300033

1. REMOVE THE WHEEL HUB, WHEEL HUB BEARINGS AND BRAKE DRUM.

(1) Refer to chapter REAR AXLE.


SHTS06Z080300034

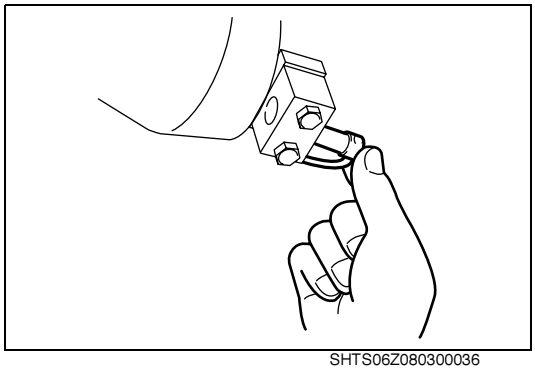

SHTS06Z080300035

2. REMOVING THE SENSOR RING

(1) Use a screwdriver or the like to gradually remove the sensor ring by tapping evenly on its outer ring.

NOTICE

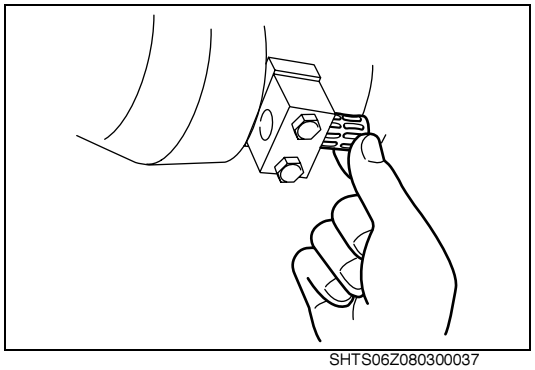
- **When tapping on the sensor ring to remove it, be careful not to scratch the wheel hub.**
- **Do not remove the sensor ring unless it is required.**
- **Do not reuse the removed sensor ring, be sure to replace it with new one.**


SHTS06Z080300036

3. REMOVING THE WHEEL SENSOR

NOTICE

- **Exposing the wheel sensor to strong bumps could cause interior damage. Never hit the wheel sensor with a hammer or bang it into other parts.**
- **Pull out the wheel sensor from the sensor holder by hand.**

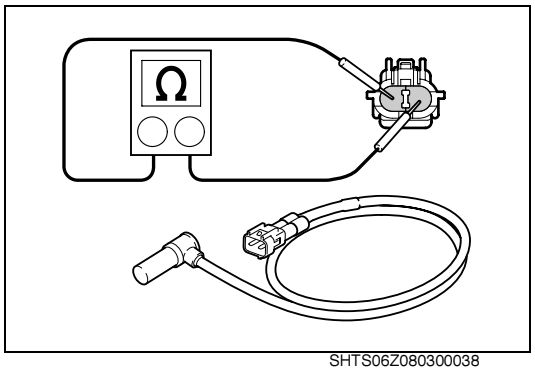

SHTS06Z080300037

4. REMOVING THE CLAMPING BUSHING.

(1) Remove the clamping bushing out of the wheel sensor holder.

INSPECTION

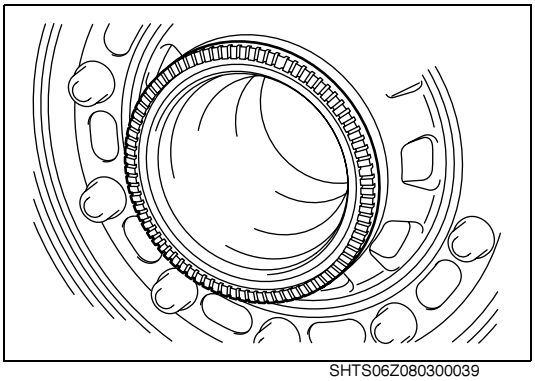
EN06Z0803H300002


SHTS06Z080300038

1. INSPECTION OF ONLY WHEEL SENSOR

(1) With a tester, measure the resistance of wheel sensor.
Standard: 1.0-1.3 kΩ

(2) When the measured value is out of the basic standard, change the wheel sensor as it might be considered presumably to be abnormal.

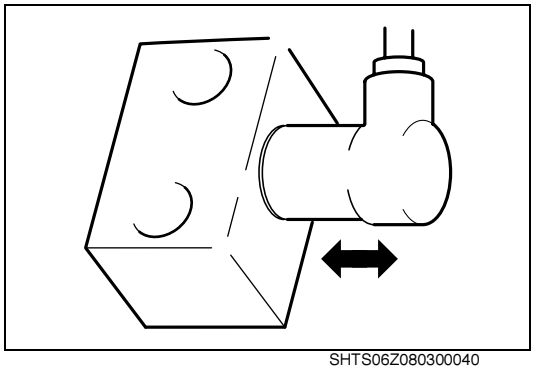

SHTS06Z080300039

2. INSPECTION OF THE SENSOR RING.

(1) Make a visual inspection to check for damage or deformation of the sensor ring, and also to make sure it is not coming loose from the wheel hub.

(2) If any damage or malformation is discovered, replace the sensor ring.

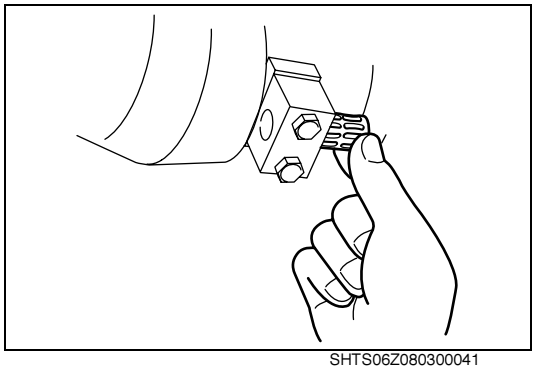
(3) If the sensor ring is coming loose from the wheel hub, use a dolly block and a press to pressure mount it again.


SHTS06Z080300040

3. INSPECTION OF THE CLAMPING BUSHING.

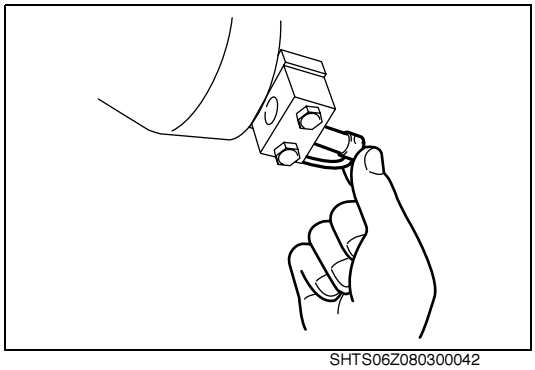
(1) Make sure that the wheel sensor is securely fixed.

(2) Change the clamping bushing when it can be pulled off or pushed in with a lightly force.


SHTS06Z080300041

4. MOUNTING THE WHEEL SENSOR

(1) Apply a lightly coating of chassis grease to the inner surface of the wheel sensor holder. Then push in the clamping bushing until the stopper makes contact with the wheel sensor holder.

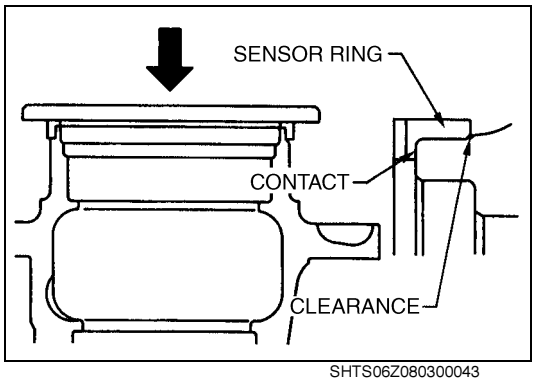

SHTS06Z080300042

(2) Push the wheel sensor fully in the wheel sensor holder with hands until the wheel sensor makes contact with the clamping bushing.

NOTICE

When inserting the wheel sensor, do not tap on it with a hammer or attempt to pry it into place using a screwdriver, or the like. Doing so could damage the wheel sensor.

(3) Arrange the wire harness.



SHTS06Z080300043

5. MOUNTING THE SENSOR RING

(1) Place the sensor ring on the wheel hub and use the dolly block and a press to evenly pressure mount it.

NOTICE

Warming up the sensor ring with hot water will make it easier to pressure mount it. Do not use a gas burner or the like to warm the sensor ring. Doing so could cause malformation of the sensor ring.

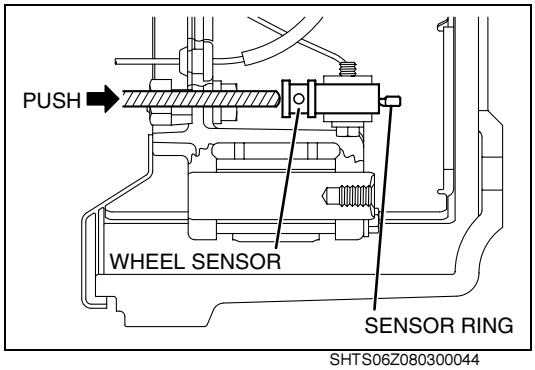
(2) After pressure mounting it, check for flutter of the sensor ring in the axle direction.
Assembly standard: 0.2 mm {0.0078 in.} or less

6. MOUNTING THE WHEEL HUB AND BRAKE DRUM

(1) Refer to chapter REAR AXLE.

NOTICE

- **Be careful not to push back the wheel sensor too far when mounting the wheel hub and brake drum. Also, make sure they are straight so that you do not bump the tip of the wheel sensor.**
- **When inserting the outer hub bearing, avoid tapping on it with a hammer as this will expose the wheel sensor to bumps. Insert the outer hub bearing carefully with a lock nut.**



SHTS06Z080300044

7. INSPECT THE WHEEL SENSOR.

(1) Arrange the wire harness.

(2) With a circuit tester, confirm the output voltage of the wheel sensor (By rotating the tire by one time for 5 seconds)
Standard: 150-1,999 mV
(Range of Alternating Current Voltage)

(3) In case of out of the standard range at (2), remove the dust cover located on the back plate unit, and the wheel sensor softly by using round end bar until the sensor contacts with the sensor ring. Then inspect again from (1).

NOTICE

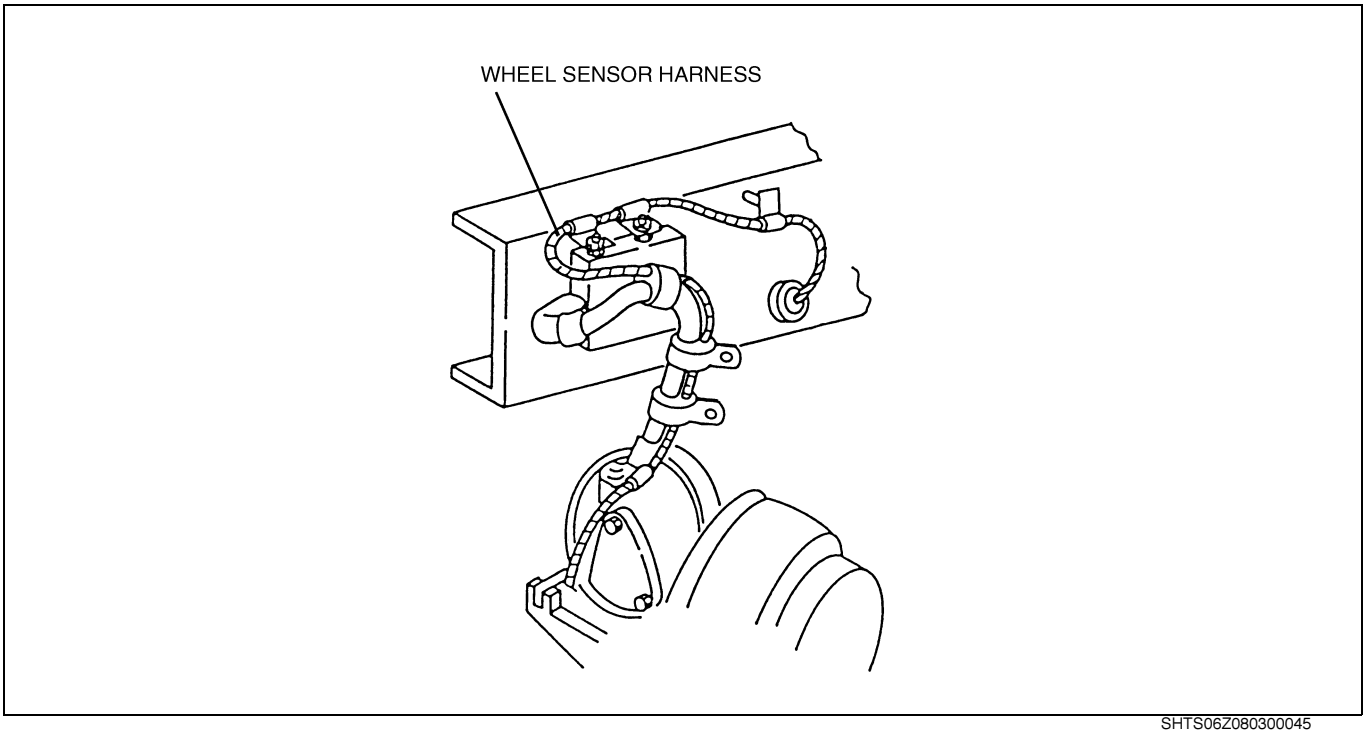
Do not tap by hammer or turn when pushing the wheel sensor. This may damage the wheel sensor.

(4) Mount the axle shaft to the wheel hub and tighten the bolt on the axle shaft.
Refer to chapter REAR AXLE.

8. ABS WIRE HARNESSES

(1) Front axle ABS wire harnesses

- The front axle chassis harnesses, particularly the ones that pass over the front axle and extend as far as the wheel sensors, must absorb the movement when the wheels are turned and when the springs move. It is therefore necessary to always maintain an optimal spacing between the clips.
In addition, if there is a large amount of variation in the spacing between the clips, the wheel sensor harnesses can come into contact with tire chains and sustain damage.
The wire harness for the front axle wheel sensor extends directly from the clip on top of the king pin cover to the frame. In particular, make sure that the distance between the clip on top of the king pin cover and the clip on the frame side is as indicated in the diagram below. There are markings on the wheel sensors in cases where the wheel sensor harness clips are in locations where the relative movement is particularly great. These places should be inspected regularly to ensure that the clip positions are still meeting with the same marking.



SHTS06Z080300045

(2) Rear axle chassis harness

- The rear axle chassis harnesses is arranged so that the left and right wheel sensor harnesses are near each other. Therefore, special care should be taken not to make incorrect connections if the harnesses have been removed for inspection or repairs.
If incorrect connections are made, it will interfere with the functioning of the ABS system. For this reason, caution plates indicating "LEFT" and "RIGHT" are affixed to the harnesses. Be sure to check when connecting the harnesses. (The left harness is on the left side of the vehicle when viewed from the behind and facing toward the front, and the right harness is on the right side of the vehicle.)
The wheel sensor harnesses are arranged along the top of the rear axle housing. Therefore, make sure to allow sufficient harness length between the chassis and the rear axle so that the harnesses can absorb the up-and-down motion of the rear axle.

ES START (EASY & SMOOTH START SYSTEM)

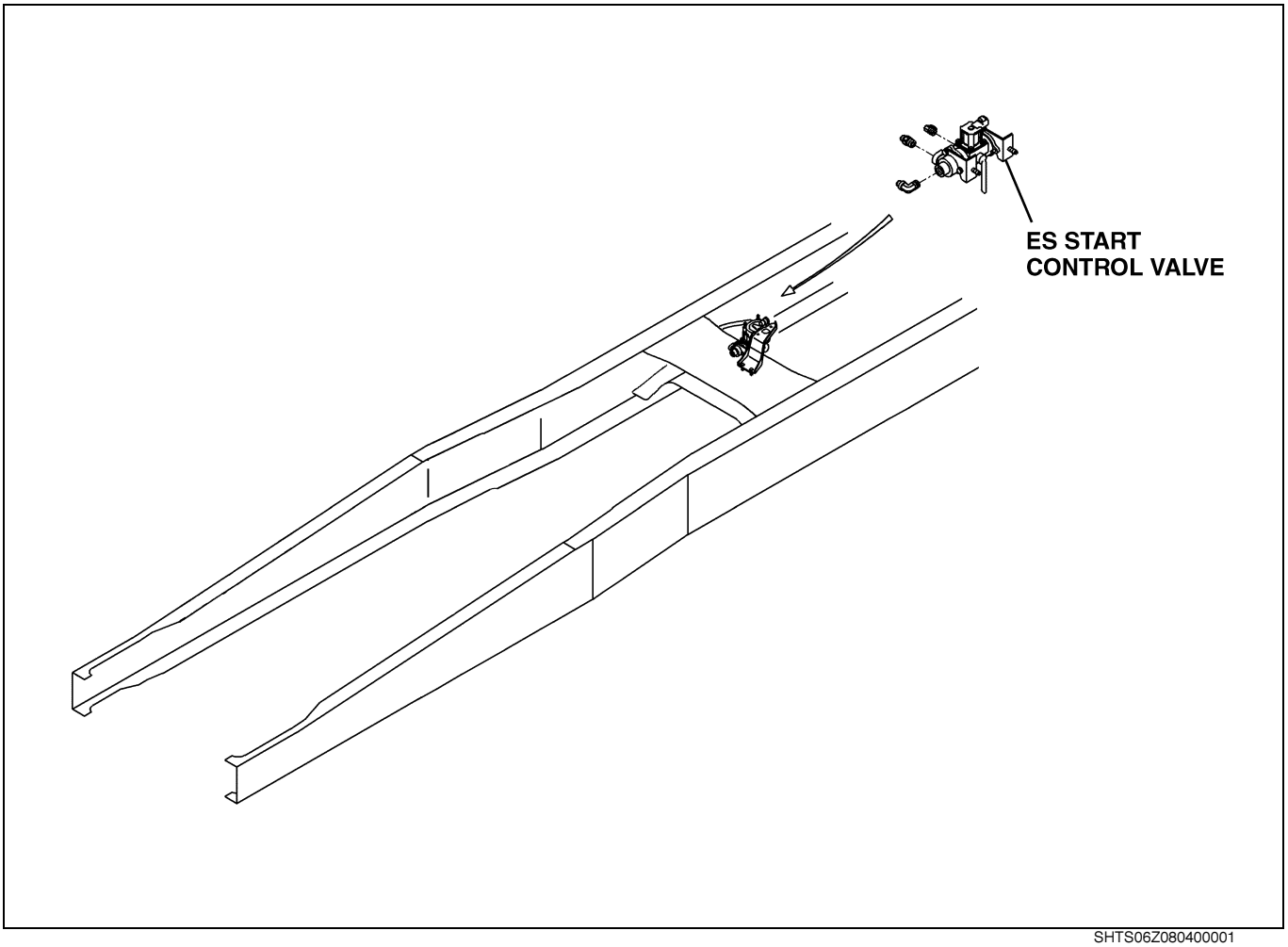
BR04-001

ES START

DESCRIPTION

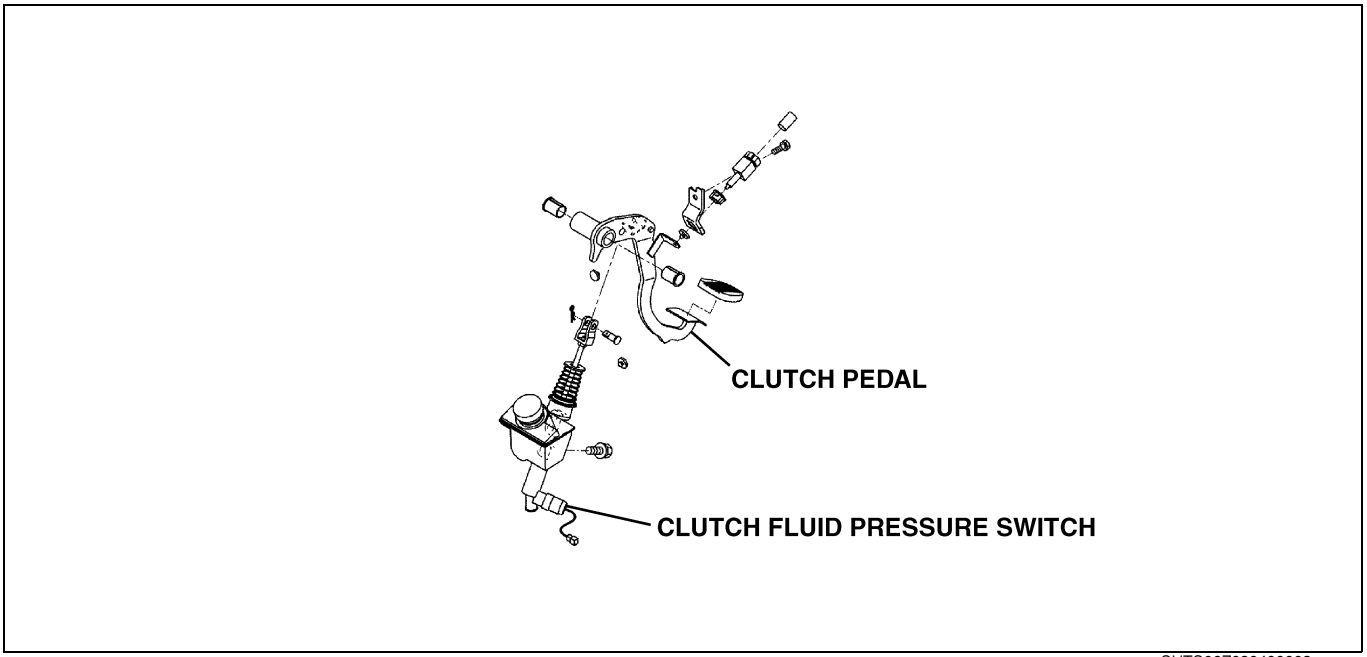
EN06Z0804C100001

ES START CONTROL VALVE



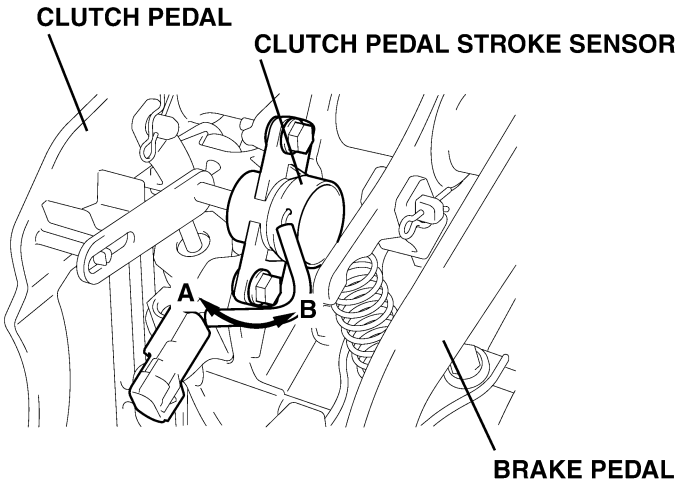
SHTS06Z080400001

CLUTCH FLUID PRESSURE SWITCH



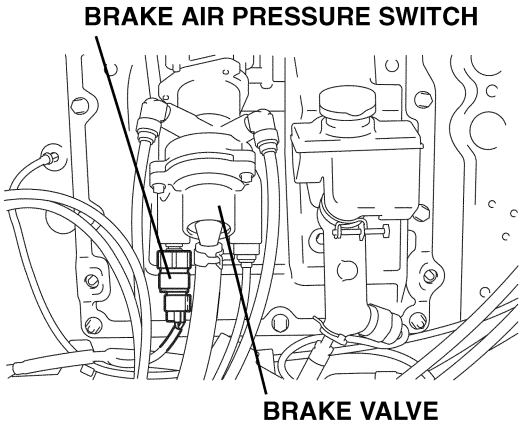
SHTS06Z080400002

CLUTCH PEDAL STROKE SENSOR



SHTS06Z080400003

STOP LIGHT SWITCH

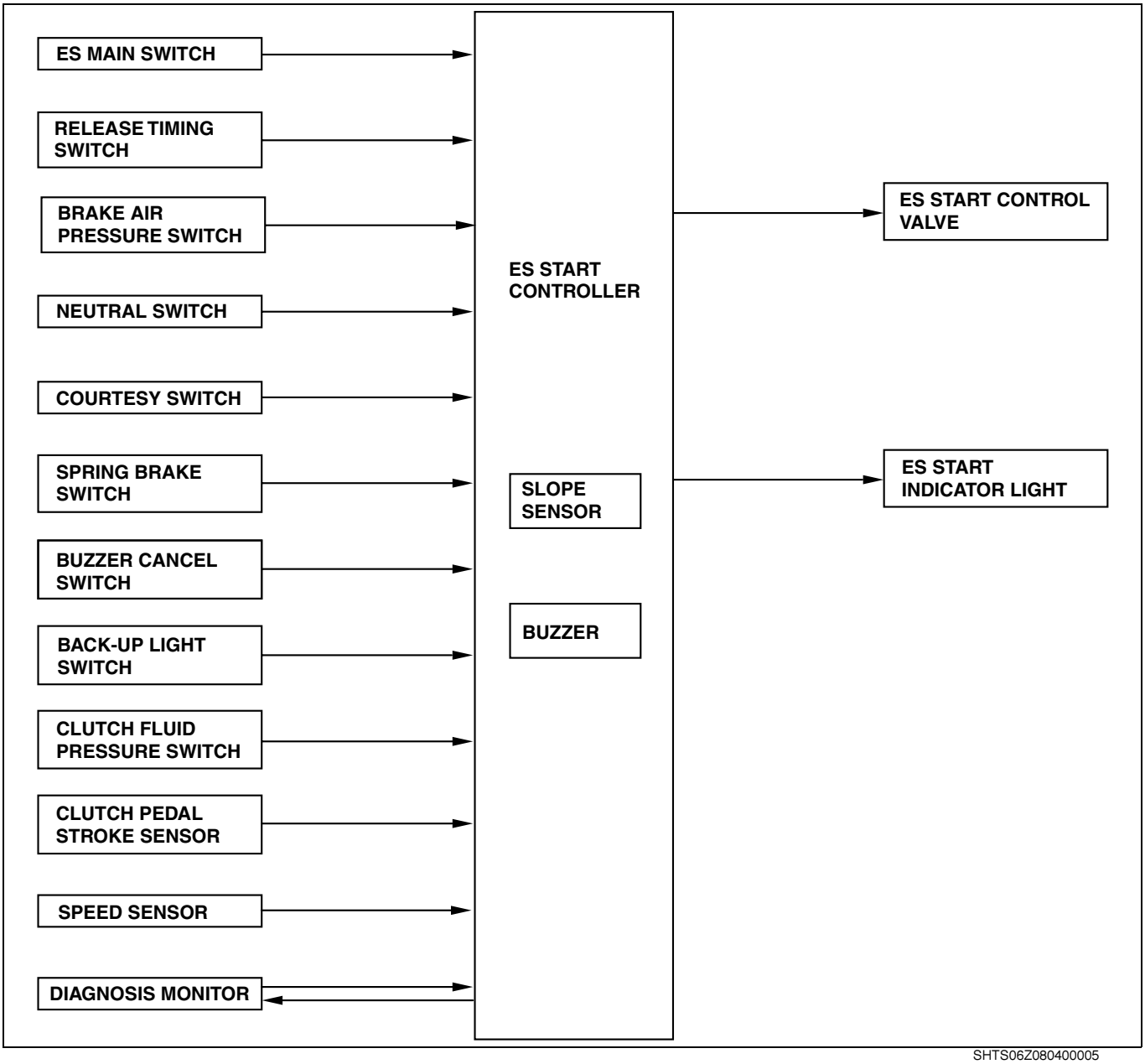


SHTS06Z080400004

DIAGRAM

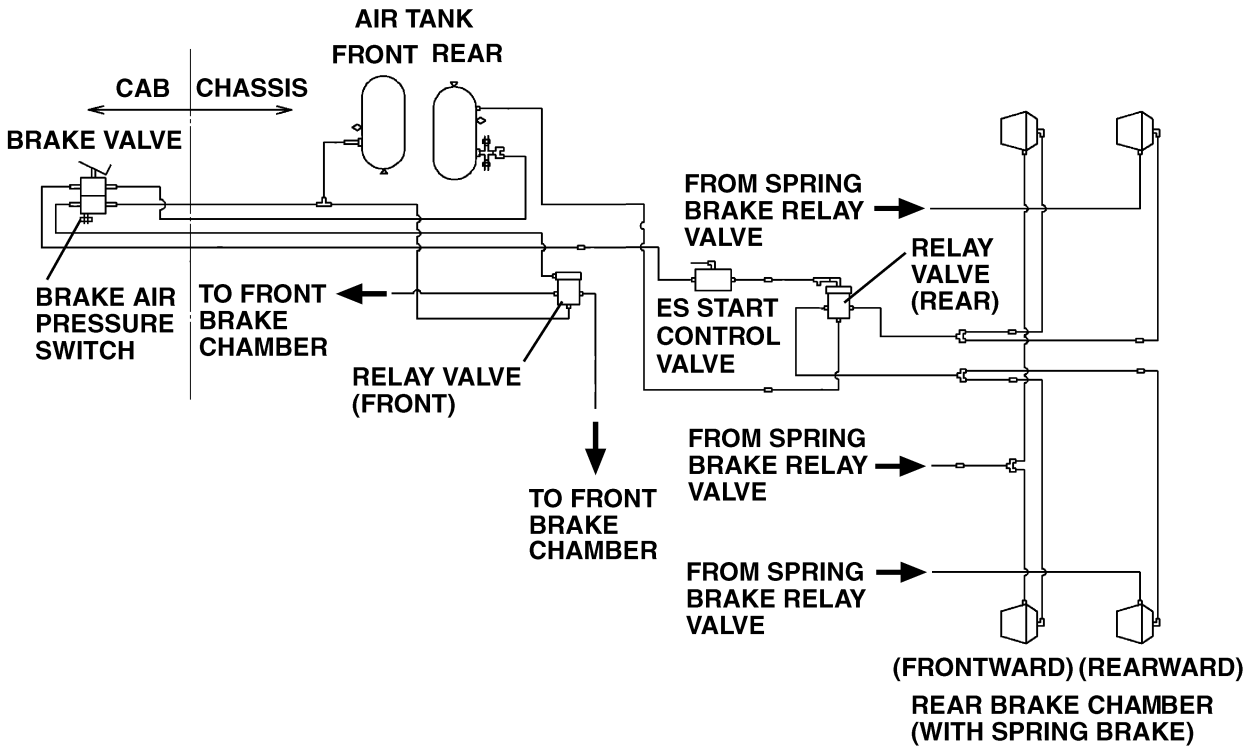
EN06Z0804J100001

SYSTEM DIAGRAM



SHTS06Z080400005

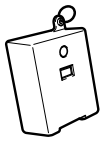
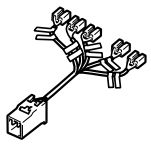
PIPING DIAGRAM



SHTS06Z080400006

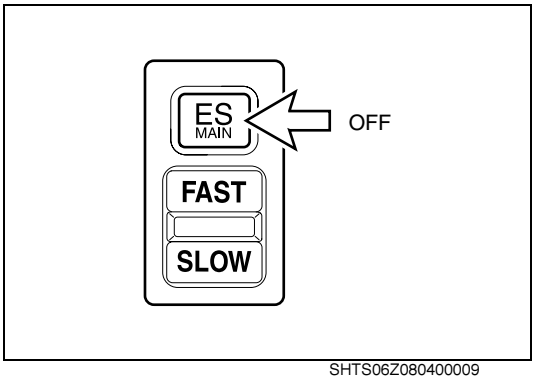
SPECIAL TOOL

EN06Z0804K100001

Illustration	Part number	Tool name	Remarks
	09630-1370	DIAGNOSIS MONITOR	FOR DIAGNOSING AND SETUP OF ES START
	09630-2300	SPECIAL WIRING HARNESS FOR INTENSIVE DIAGNOSIS CONNECTOR	FOR CONNECTING DIAGNOSIS MONITOR

INITIAL SETTING OF ES START

EN06Z0804H300001



SHTS06Z080400009

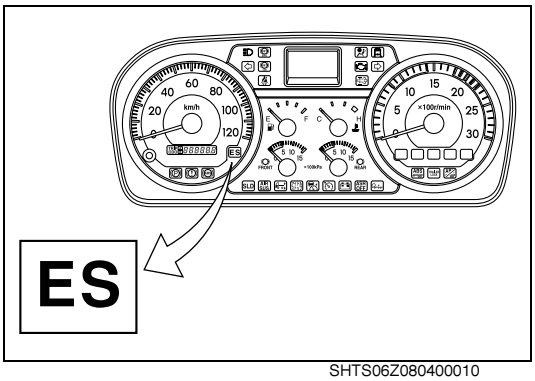
INITIAL SETTING

NOTICE

When replacing a controller of "ES Start", be sure to execute this initial setting.

1. CHECK "ON" OF POWER SUPPLY WHEN SWITCHING THE STARTER KEY "ON".

(1) Turn "OFF" ES main switch while turning "ON" the starter key.

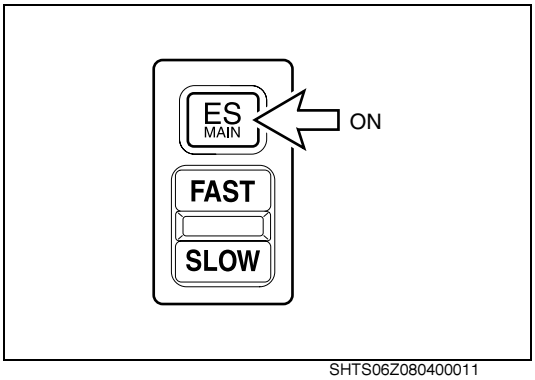


SHTS06Z080400010

(2) Check the operation of "ES start" indicator in the meter and also the buzzer.
Standard:
After the indicator light is lit for a second, the buzzer to switch off the light beeps one time.

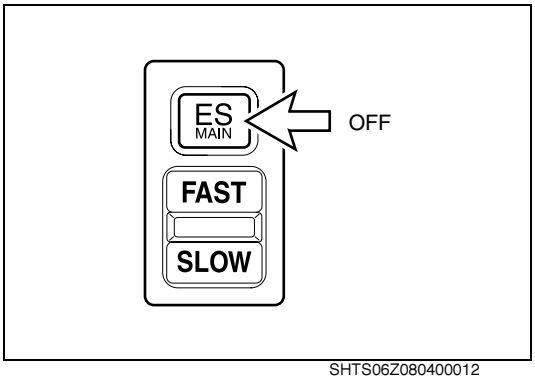
NOTICE

Unless the buzzer beeps, the indicator is not lit. When it does not turn off even after one second, inspect the electrical circuit.



SHTS06Z080400011

(3) Turn "ON" the ES main switch.



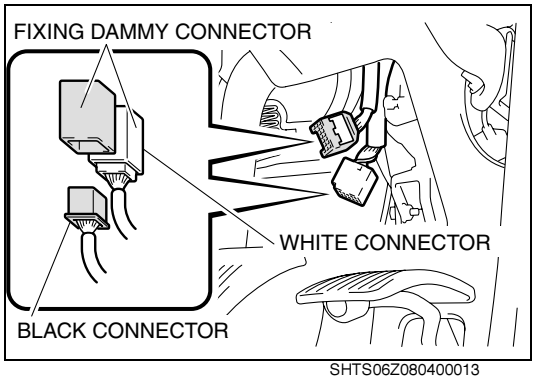
SHTS06Z080400012

2. CHECK OF INSTALLING CONDITION OF CLUTCH STROKE SENSOR.

NOTICE

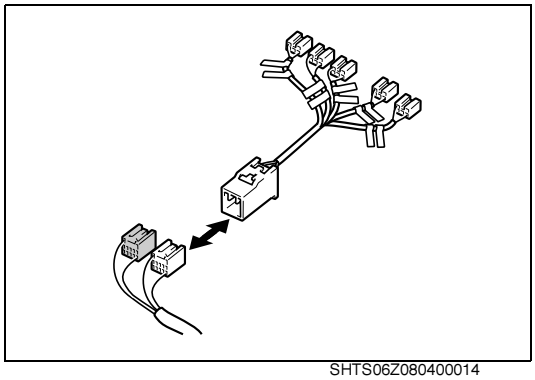
- **When replacing clutch stroke sensor, execute this inspection without fail.**
- **Execute this under the condition that clutch adjustment (for normal clearance of clutch pedal) completed.**

(1) Turn "ON" starter key and turn "OFF" the ES main switch.

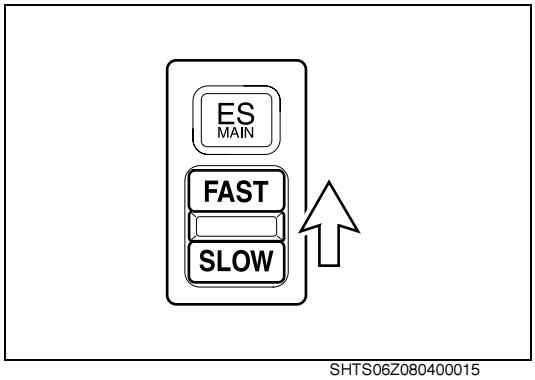


SHTS06Z080400013

(2) White color connector, one of two intensive diagnosis connectors, located at lower part of right side of the instrument panel, should be connected to the specific harness and the diagnosis monitor be connected to the connector with a tag of "ES start".
SST:
Dedicated Harness (09630-2300)
Diagnosis Monitor (09630-1370)

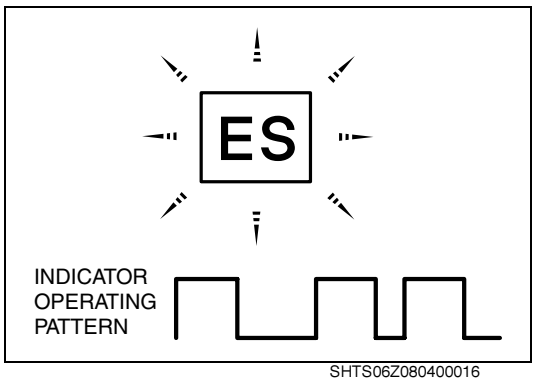

SHTS06Z080400014

NOTICE
As intensive diagnosis connector is normally connected to the fixed dummy connector, pull it out from the dummy connector to use. Also, couple it with the fixed dummy connector while not using it.



SHTS06Z080400015

(3) Turn on "FAST" release timing switch three times within 5 seconds.



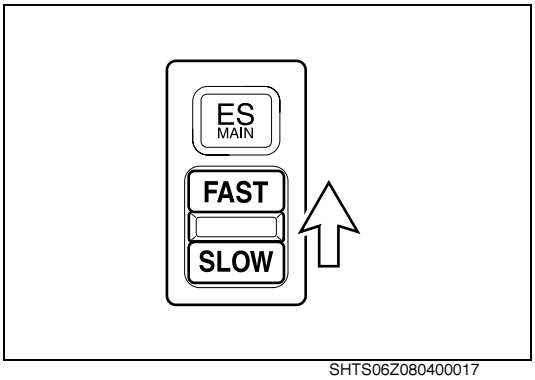
SHTS06Z080400016

(4) Checking function of sensor installation condition starts and check that indicator is flashing as shown in the figure.

NOTICE
When indicator not flashing, inspect the electrical circuit.

(5) Check sensor installation condition with the buzzer beeping when clutch pedal is free.
Standard: The buzzer beeps continuously.

NOTICE
When not beeping the buzzer, inspect clutch stroke sensor and its relating circuit.



SHTS06Z080400017

(6) After turning again release timing switch on "FAST", remove diagnosis monitor.

3. INITIAL SETTING FOR RELEASING POSITION

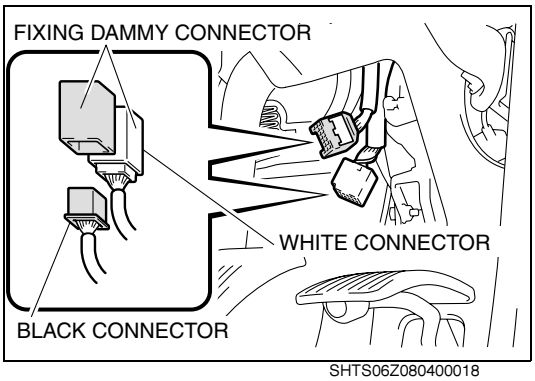
NOTICE

Execute initial setting of releasing position without fail when replacing clutch.

(1) Confirm the following condition of the vehicle.
- Starter key: ON
- ES main switch: OFF
- Clutch pedal: Free position
- Parking brake: Operating

(2) Starting engine, check that idling revolution is normal.

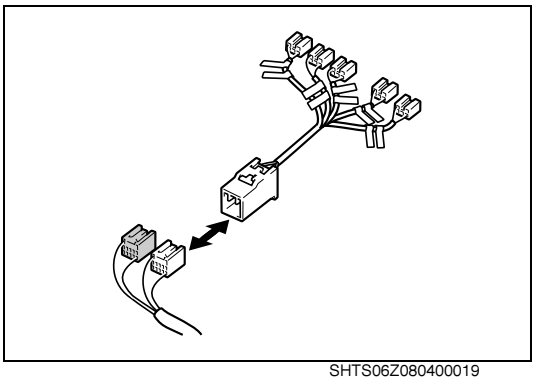
(3) White color connector, one of two centralized diagnosis connectors located at lower part of right side of the instrument panel, should be connected to the dedicated harness and diagnosis monitor be connected to the connector with a tag of "ES start".
SST:
Dedicated Harness (09630-2300)
Diagnosis Monitor (09630-1370)

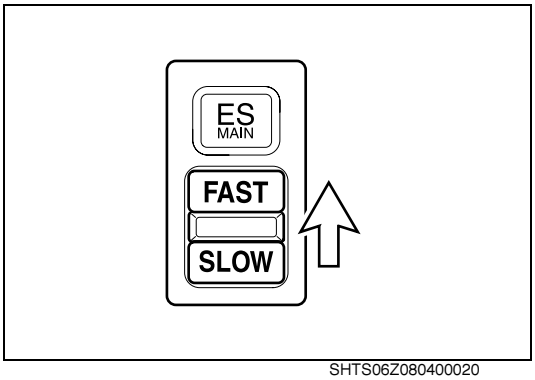


SHTS06Z080400018

NOTICE

As centralized diagnosis connector is normally connected to the fixed dummy connector, pull it out from the dummy connector to use. Also, couple it with the fixed dummy connector while not using it.


SHTS06Z080400019



SHTS06Z080400020

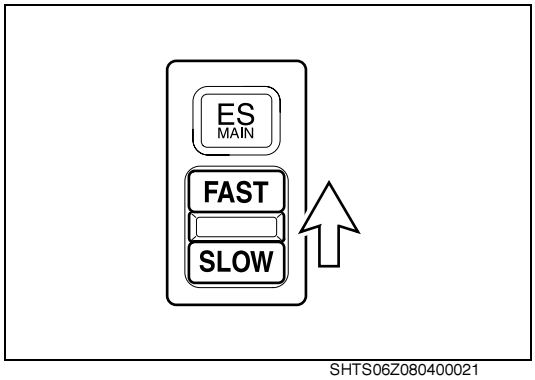
(4) Put release timing switch on "FAST" for more than 3 seconds.

(5) Initial setting function of release position starts. Check that buzzer and indicator are working as it follows.
- Buzzer: 1 long beeping continuously.
- Indicator: Flashes in synchronization with the buzzer beeping.

(6) When buzzer does not beep, check the following points:
- Relating circuit with parking brake (buzzer cancel switch)
- Relating circuit with "ES start" switch.
- Controller

(7) Depress the clutch pedal and shift the gear to 3rd speed.

(8) Release slowly the pedal for clutch engagement.



SHTS06Z080400021

(9) When tachometer needle descends and then comes back again, put again release timing switch on "FAST". At this moment, controller memorizes signal of clutch stroke sensor.

(10) Once controller memory completed, buzzer stops after it beeps one time. Indicator light goes off.

(11) Remove diagnosis monitor from the coupler.

4. INITIAL SETTING OF SLOPE SENSOR AT "0" POINT.

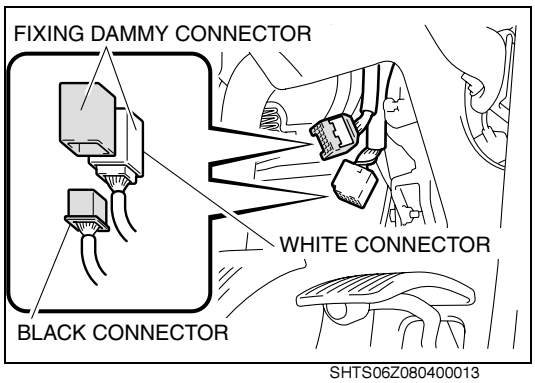
NOTICE

When any style of body mounted on the chassis of vehicle and the vehicle level changed, implement this initial setting without fail.

(1) Confirm that the following condition of the vehicle.

- ES main switch: OFF
- Road surface condition: Flat (±1 deg)
- Parking brake: Operating

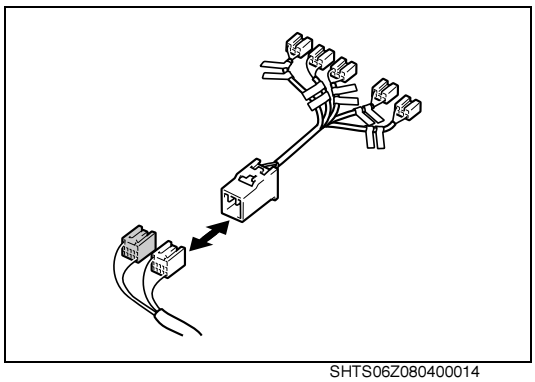
(2) White color connector, one of two intensive diagnosis connectors, located at lower part of right side of the instrument panel, should be connected to the dedicated harness and the diagnosis monitor be connected to the connector with a tag of "ES Start".
SST:
Dedicated Harness (09630-2300)
Diagnosis Monitor (09630-1370)



SHTS06Z080400013

NOTICE

As intensive diagnosis connector is normally connected to the fixed dummy connector, pull it out from the dummy connector to use. Also, couple it with the fixed dummy connector while not using it.


SHTS06Z080400014

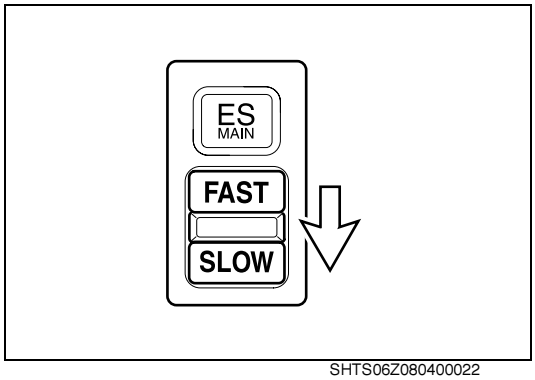
(3) Put release timing switch on "SLOW" for more than 3 seconds.

(4) Initial setting function of slope sensor starts. Check that buzzer and indicator are working as it follows:

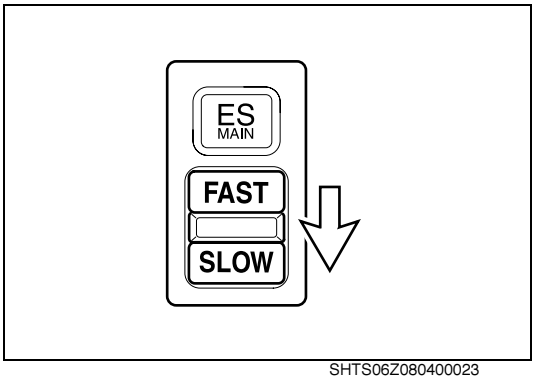
- Buzzer: 2 short beeping continuously.
- Indicator: Flashes in synchronization with the buzzer beeping.

(5) When not beeping nor flashing as mentioned above, check the following points:

- Relating circuit with parking brake (buzzer cancel switch)
- Relating circuit with "ES start" switch
- Controller



SHTS06Z080400022



SHTS06Z080400023

(6) Put again release timing switch on "SLOW". At this moment, controller memorizes signal of slope sensor.

(7) Once controller memory completed, buzzer stops after it beeps one time.

(8) Indicator light goes off.

CHECKING PROCEDURE OF OPERATION

1. PREPARATION

(1) Confirm that the vehicle is under the following condition:

- The road surface is not at down hill.
- Starter key: ON
- Parking brake released
- The both doors of the cab at driver's and the other side are closed.

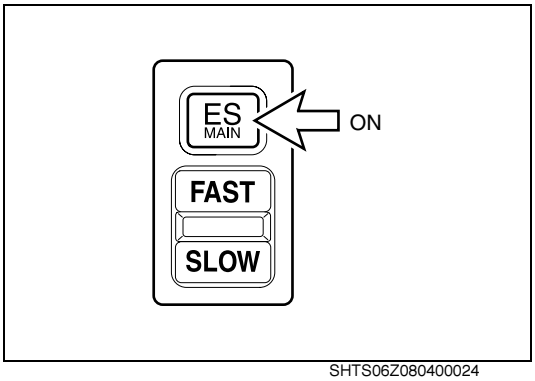
NOTICE

- **Operation check can be done, even though the engine is not in motion.**
- **In case of operation checking while the engine is in motion, you will need to perform a starting operation by paying much attention not to start out the vehicle suddenly.**

2. OPERATION OF "ES START"

(1) Free clutch pedal by shifting the gear to the neutral position.

(2) Turn "ON" ES main switch.



SHTS06Z080400024

(3) Once continuing to depress the brake pedal, "ES start" will start to work within about one second.

(4) Confirm the operation of "ES start" with the following points.

- Buzzer beeps one time.
- Indicator light is lit.
- The braking force will be retained, even though setting your leg free from the brake pedal.

Braking axle when operating "ES Start"

Model	Axle position			
	Front-front	Front-rear	Rear-front	Rear-rear
FS	X	—	O	O
FY	X	X	O	O

O: Operating, X: Not operating, —: Not available

(5) When "ES start" does not work, check the following points:

a. Indicator light is not lit.

- Inclination of road (when at down hill, shift the gear to "R", it does not work unless the clutch pedal is depressed.)
- Neutral switch and its relating circuit
- Stop light switch and its relating circuit

b. Indicator flashes and the buzzer beeps.

- Check it through diagnosis function.

c. Indicator light is lit. But the buzzer beeps.

- Courtesy switch and its relating circuit.

d. Braking force is not retained.

- ES start valve and brake air circuit
- Controller

3. RELEASE OF "ES START"

(1) Depressing deep and surely the clutch pedal, shift the gear for moving forward.

(2) Release the pedal for clutch engagement.

(3) "ES start" will be released at the partial clutch engagement. Check the following conditions:

- Indicator light is not lit.
- Release of braking force.

(4) When "ES start" not released, check the following points:

a. Indicator light does not turn out.

- It will not be released by mis-handling (when the clutch pedal is not deeply depressed at shifting the gear)
- Neutral switch and its relating circuit
- Clutch pedal stroke sensor and its relating circuit.

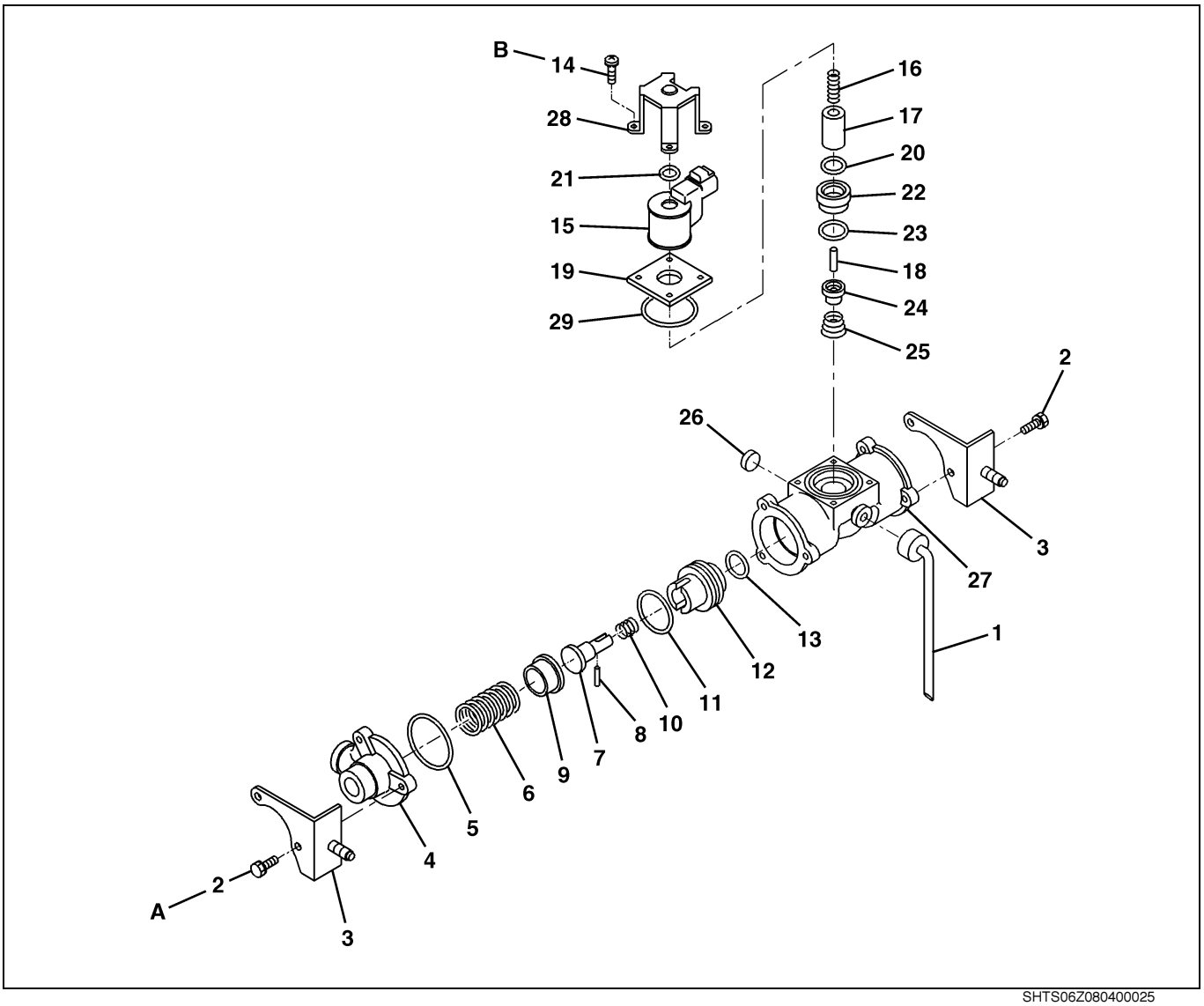
b. Braking force is not retained.

- "ES start" valve and the brake air circuit.
- Controller

ES START CONTROL VALVE

COMPONENT LOCATOR

EN06Z0804D100001



SHTS06Z080400025

1	Hose	11	O-ring	21	O-ring
2	Bolt	12	Piston	22	Valve seat
3	Bracket	13	O-ring	23	O-ring
4	Cover	14	Screw	24	Valve
5	O-ring	15	Solenoid assembly	25	Spring
6	Spring	16	Spring	26	Filter
7	Inlet valve	17	Plunger	27	Body
8	Straight pin	18	Rod	28	Cover
9	Spring seat	19	Coil cover	29	O-ring
10	Spring	20	O-ring		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	4.0-6.0 {40-60, 2.9-4.3}	B	1.3-1.7 {13-17, 0.49-1.22}

OVERHAUL

EN06Z0804H200001

IMPORTANT POINT - DISMOUNTING

NOTICE

- **When dismounting and storing parts, place a cap on all ports so not dirt or dust enters.**
- **Be careful so water, dirt, or dust does not enter inside the harness connector to prevent solenoid short circuits or faulty connections.**

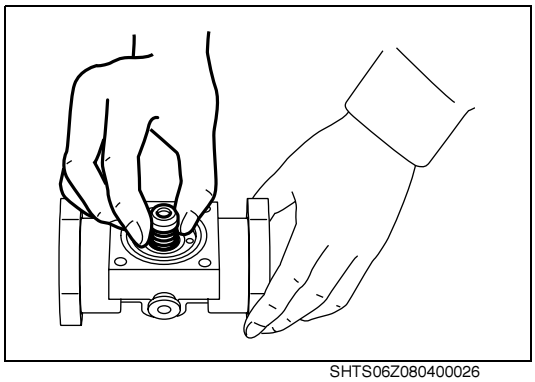
IMPORTANT POINT - ASSEMBLY

NOTICE

Apply an adequate amount of grease to each O-ring before assembly.

1. ASSEMBLING ES START CONTROL VALVE

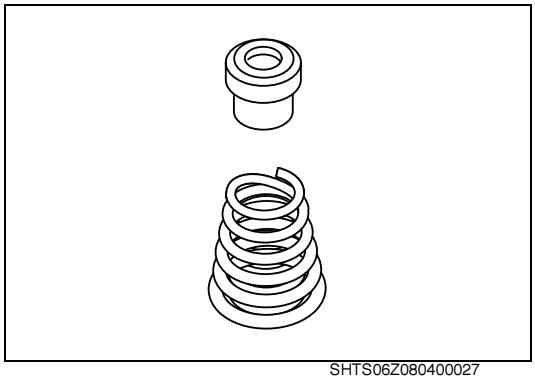
(1) Insert the spring in the valve and assemble it in the body.



SHTS06Z080400026

NOTICE

Assemble the valve and the spring as shown in the figure.

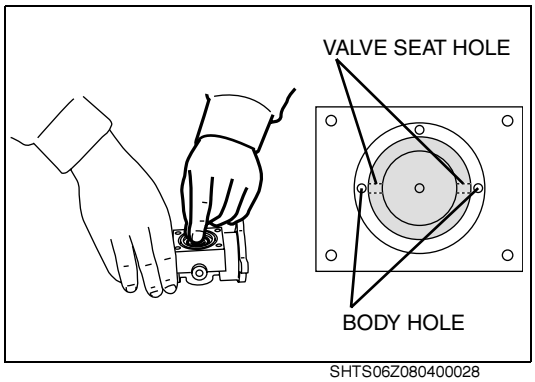


SHTS06Z080400027

(2) Align and attach the O-ring to the groove of the inside valve seat correctly and install it in the body.

NOTICE

Align the valve seat holes and body holes to perform the assembly.



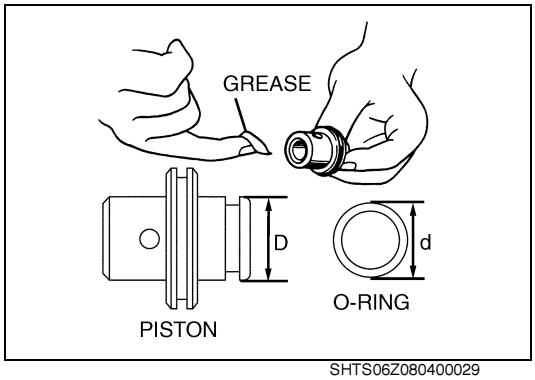
SHTS06Z080400028

(3) Assemble the O-rings (2 units) in the piston and lubricate the inside diameter of the piston with grease.

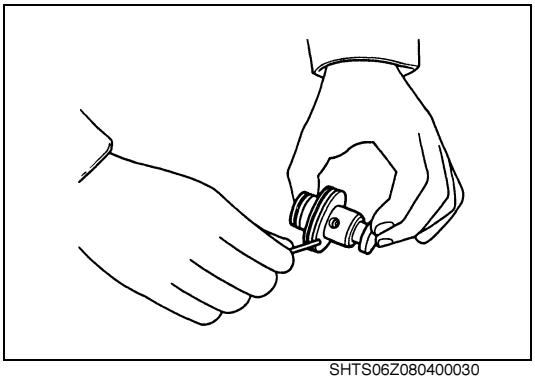
NOTICE

Verify the diameter of the O-ring (small one) because there are multiple settings and then assemble the unit.

Dimension "D" and "d"= 22 mm {0.87 in.}



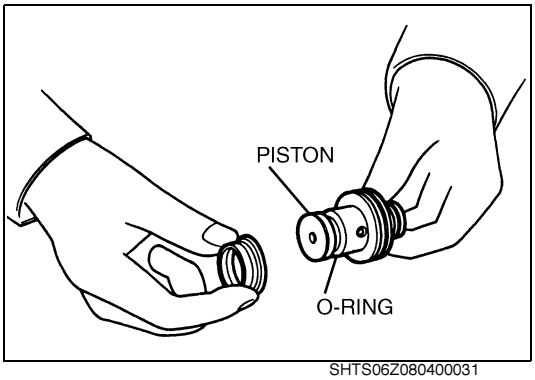
SHTS06Z080400029


SHTS06Z080400030

(4) Assemble the spring, piston and inlet valve. Press in the inlet valve and install the straight pin.

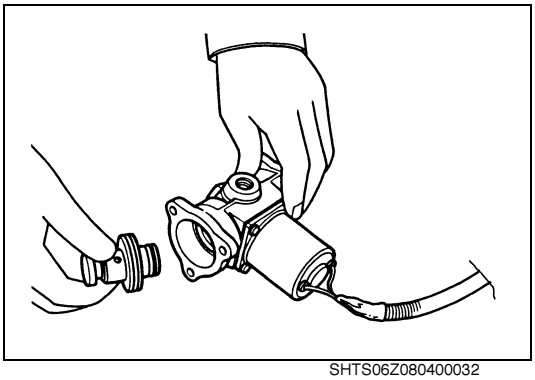
NOTICE

Align the inlet valve pin hole and piston pin hole and assemble the parts. After the assembly is completed, do not rotate the inlet valve to align the pin holes.



SHTS06Z080400031

(5) Position the spring seat collar so it faces the rear side and install the unit.
(6) Apply grease to the outer surface of the O-ring installed in the piston.


SHTS06Z080400032

(7) Apply grease to the inner surface of the body.
(8) Insert the piston inlet valve assembly in the body.

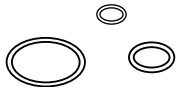
NOTICE

Do not turn the piston when inserting it.

INSPECTION AND REPAIR

EN06Z0804H300002

NOTICE
Isopropyl alcohol should only be used to wash the ES start control valve components.

Inspection item	Standard	Limit	Remedy	Inspection procedure
Valve body inside, piston, valve, valve seat, spring and inlet valve: Wear and damage	—	—	Replace, if necessary.	Visual check 
O-ring: Crack and damage	—	—	Replace, if necessary.	Visual check 

STEERING EQUIPMENT

SR01-001

STEERING SYSTEM

TROUBLESHOOTING

EN07Z0701F300001

Symptom	Possible cause	Remedy/Prevention
Hard steering or poor return of steering wheel to center	Bent steering shaft, sliding shaft or column	Replace parts.
	Universal joint oscillates or catches.	Replace universal joint in the assembly.
	Column bearing does not revolve or catch.	Replace parts.
	Lack of lubrication in steering linkage.	Lubricate.
	Wheel alignment is incorrect.	Refer to chapter FRONT AXLE.
	Power steering system is faulty.	Refer to chapter POWER STEERING.
	Tire air pressure is too low.	Adjust properly.
Steering wheel shimmy	Steering system linkage is loose.	Tighten properly.
	Too much wear or play in steering linkage (spline and ball joints).	Replace parts.
	Other front axle problems.	Refer to chapter FRONT AXLE.
	Power steering gear badly adjusted.	Refer to chapter POWER STEERING.
	The wheels are out of balance.	Balance the wheels.
	Wheel wobbles.	Replace wheel.
	Tire air pressure is not uniform or sufficient.	Adjust tire pressure.
	Distorted disc wheel.	Replace parts.
Abnormal noises	Lack of lubrication in steering linkage.	Lubricate.
	Power steering system is faulty.	Refer to chapter POWER STEERING.

STEERING UNIT

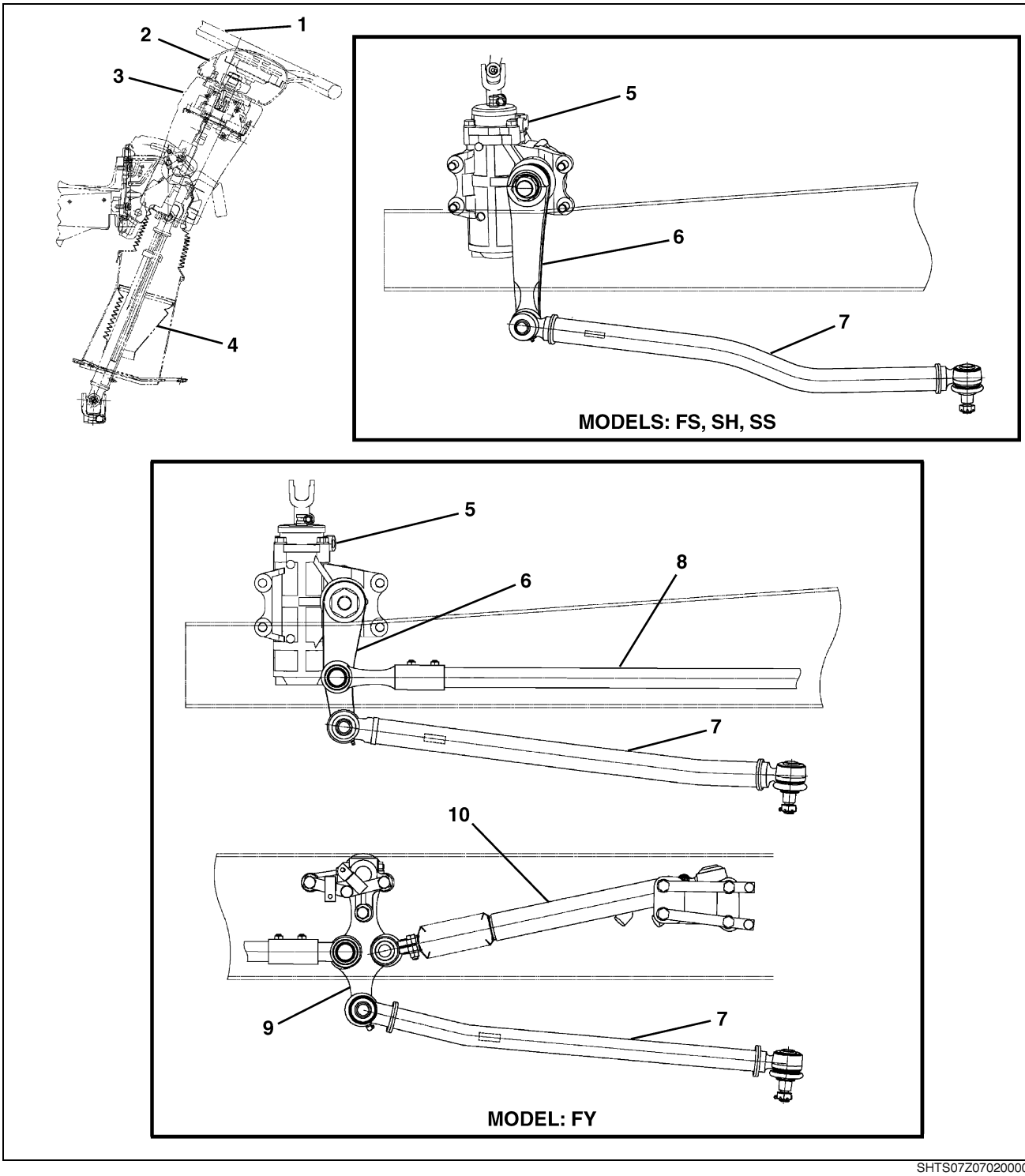
SR02-001

STEERING LINKAGE

DESCRIPTION

EN07Z0702C100001

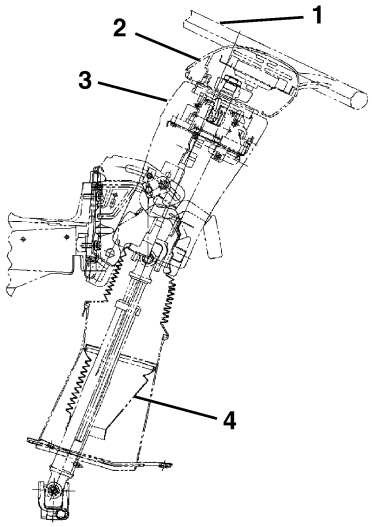
FOR RIGHT-HAND DRIVE MODEL

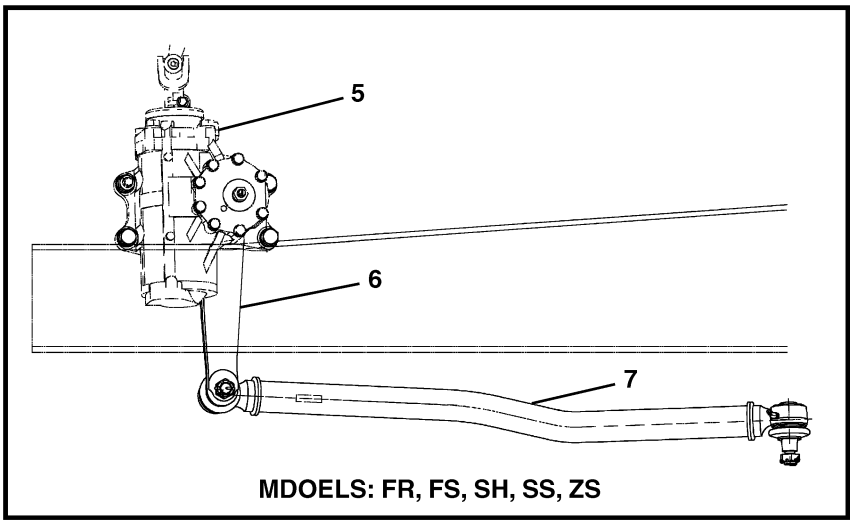


SHTS07Z070200001

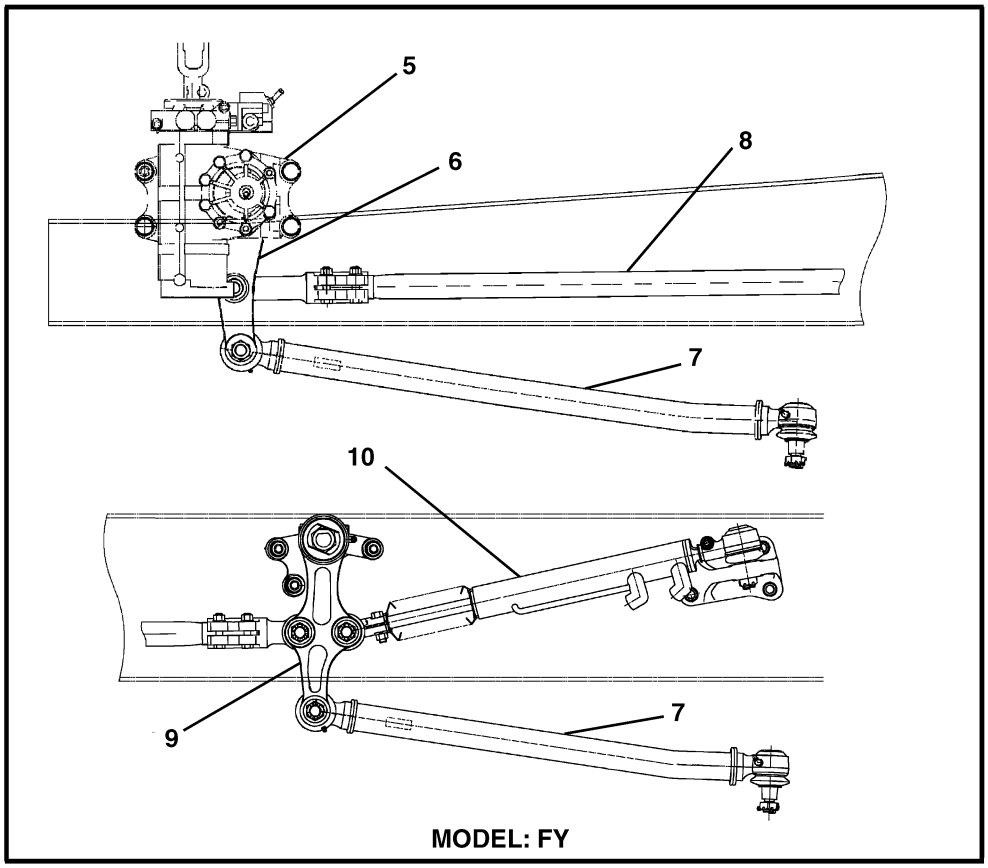
1	Steering wheel	6	Pitman arm
2	Horn button	7	Drag link
3	Steering column assembly	8	Relay rod
4	Dust cover	9	Idler arm
5	Steering gear unit	10	Power steering booster

FOR LEFT-HAND DRIVE MODEL





MDOELS: FR, FS, SH, SS, ZS



MODEL: FY

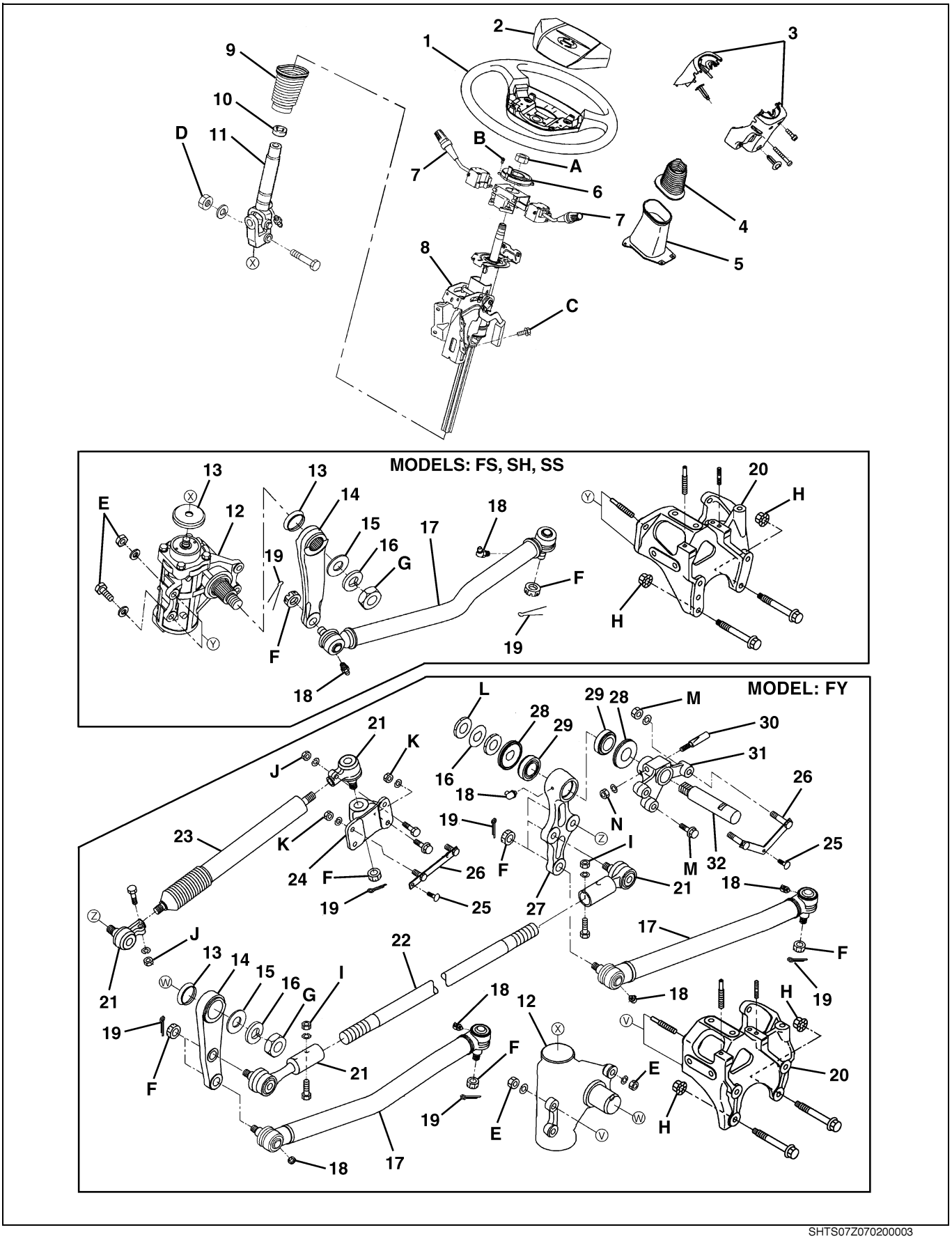
SHTS07Z070200002

1	Steering wheel	6	Pitman arm
2	Horn button	7	Drag link
3	Steering column assembly	8	Relay rod
4	Dust cover	9	Idler arm
5	Steering gear unit	10	Power steering booster

COMPONENT LOCATOR

EN07Z0702D100001

FOR RIGHT-HAND DRIVE MODEL



SHTS07Z070200003

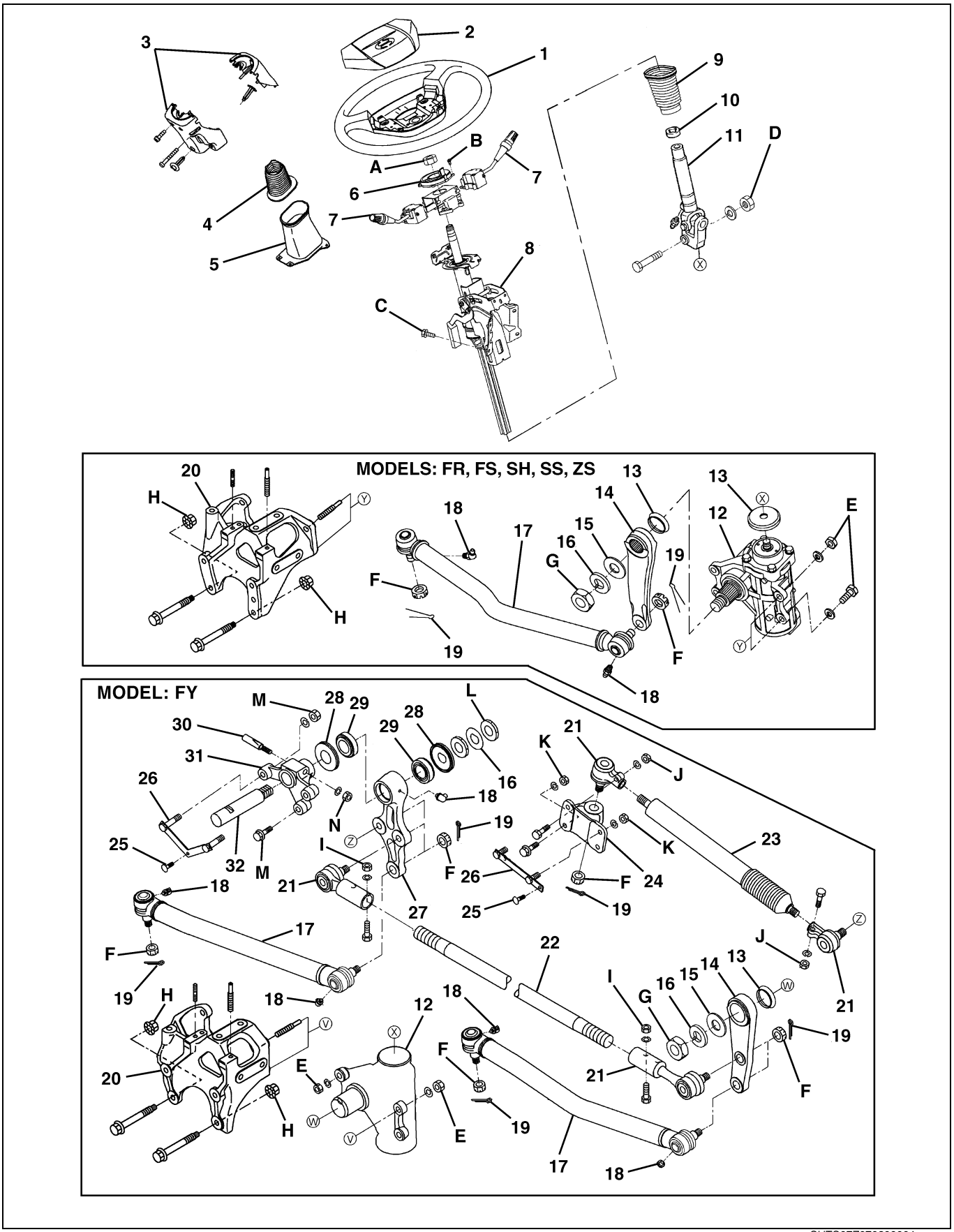
1	Steering wheel	17	Drag link
2	Horn button	18	Lubrication fitting
3	Column cover	19	Cotter pin
4	Column boot	20	Steering gear bracket
5	Column tube	21	Ball joint socket
6	Spiral cable	22	Relay rod
7	Combination switch	23	Power steering booster assembly
8	Steering column assembly	24	Anchor bracket
9	Dust cover	25	Retainer
10	Dust seal	26	Fixture plate
11	Sliding yoke	27	Idler arm
12	Steering gear unit	28	Idler arm dust seal
13	Steering gear unit dust cover	29	Taper roller bearing
14	Pitman arm	30	Lock pin
15	Plain washer	31	Idler arm bracket
16	Lock washer	32	Idler arm pin

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	48.5-77.5 {495-790, 36-57}	H	205-227 {2,091-2,314, 152-167}
B	6.5-13.5 {67-137, 4.8-9.9}	I	85.5-114.5 {872-1,167, 64-84}
C	9.5-16.5 {97-168, 7.1-12.1}	J	64-78 {653-795, 48-57}
D	48.5-57.5 {495-586, 36-42}	K	135.5-184.5 {1,382-1,881, 100-136}
E	326-424 {3,325-4,323, 241-312}	L	291-389 {2,968-3,966, 215-286}
F	146-244 {1,489-2,488, 108-179}	M	166-224 {1,693-2,284, 123-165}
G	391-489 {3,988-4,986, 289-360}	N	39.5-48.5 {403-494, 30-35}

NOTICE
When retightening the nut "H", be sure to replace the nut with new one, because the nut "H" is coated with frictional coefficient stabilizer.

FOR LEFT-HAND DRIVE MODEL



SHTS07Z070200004

1	Steering wheel	17	Drag link
2	Horn button	18	Lubrication fitting
3	Column cover	19	Cotter pin
4	Column boot	20	Steering gear bracket
5	Column tube	21	Ball joint socket
6	Spiral cable	22	Relay rod
7	Combination switch	23	Power steering booster assembly
8	Steering column assembly	24	Anchor bracket
9	Dust cover	25	Retainer
10	Dust seal	26	Fixture plate
11	Sliding yoke	27	Idler arm
12	Steering gear unit	28	Idler arm dust seal
13	Steering gear unit dust cover	29	Taper roller bearing
14	Pitman arm	30	Lock pin
15	Plain washer	31	Idler arm bracket
16	Lock washer	32	Idler arm pin

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

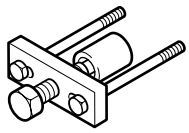
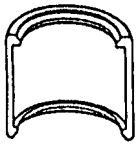
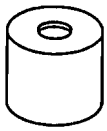
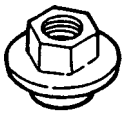
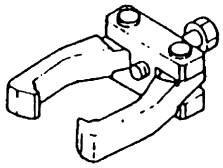
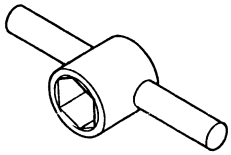
A	48.5-77.5 {495-790, 36-57}	H	205-227 {2,091-2,314, 152-167}
B	6.5-13.5 {67-137, 4.8-9.9}	I	85.5-114.5 {872-1,167, 64-84}
C	9.5-16.5 {97-168, 7.1-12.1}	J	64-78 {653-795, 48-57}
D	48.5-57.5 {495-586, 36-42}	K	135.5-184.5 {1,382-1,881, 100-136}
E	326-424 {3,325-4,323, 241-312}	L	291-389 {2,968-3,966, 215-286}
F	146-244 {1,489-2,488, 108-179}	M	166-224 {1,693-2,284, 123-165}
G	391-489 {3,988-4,986, 289-360}	N	39.5-48.5 {403-494, 30-35}

NOTICE
When retightening the nut "H", be sure to replace the nut with new one, because the nut "H" is coated with frictional coefficient stabilizer.

SPECIAL TOOL

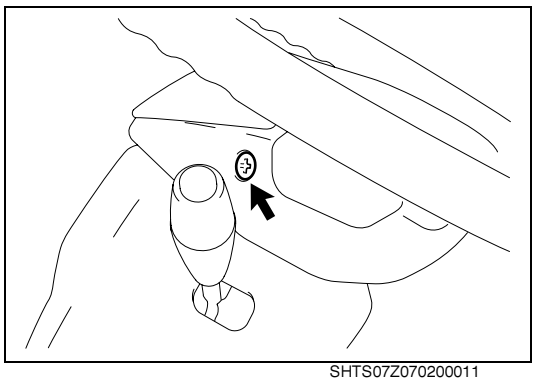
EN07Z0702K100001

Prior to starting a steering linkage overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	09650-1341	STEERING WHEEL PULLER	
	09657-1790	GUIDE	2 PIECES
	09657-1800	GUIDE	
	9209-20120	NUT	
	09650-1260	PITMAN ARM PULLER	
	09603-1280	SOCKET WRENCH	

OVERHAUL

EN07Z0702H200001

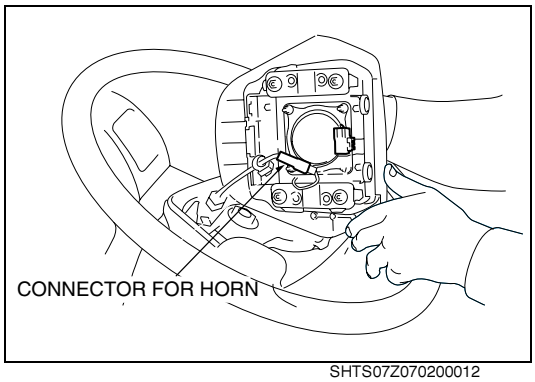

SHTS07Z070200011

IMPORTANT POINTS - DISASSEMBLY

1. REMOVE THE STEERING WHEEL.

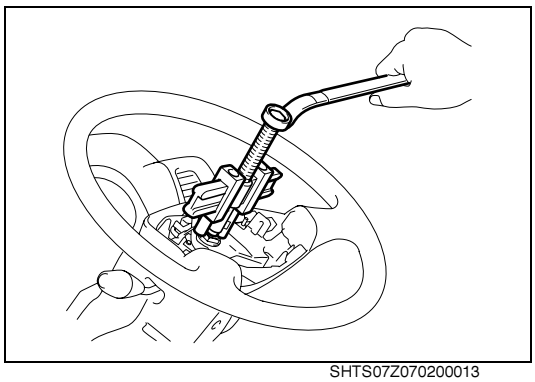
(1) Loosen the torx bolt for fixing the horn button using torx wrench.

(2) Remove the horn button from the steering wheel.



SHTS07Z070200012

(3) Remove the connector for the horn.


SHTS07Z070200013

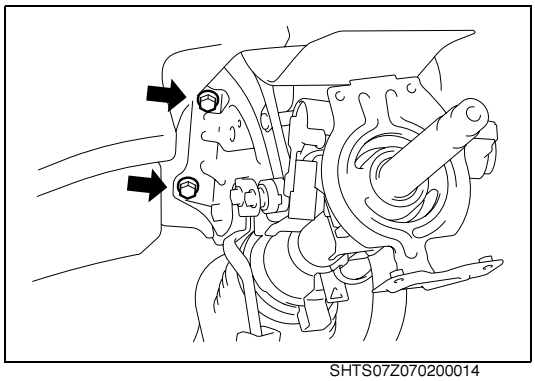
(4) Remove the steering wheel lock nut.

(5) Use the special tool or commercial tool to remove the steering wheel as shown in the figure.
SST: Steering Wheel Puller (09650-1341)

NOTICE

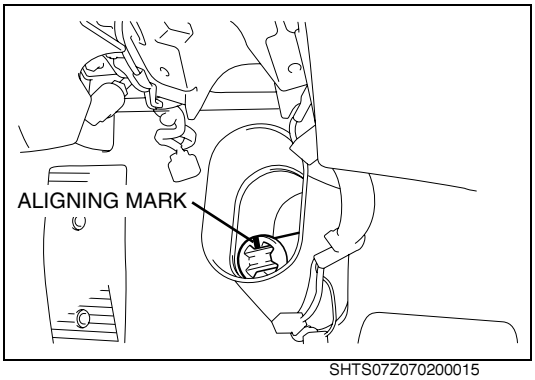
- **Before removing the steering wheel from the steering shaft, make aligning marks on both so that they can be assembled in the same position.**
- **Because the puller hole is made of aluminum and it is easily damaged, screw the puller bolt deeply.**

(6) Fix the rotating part of spiral cable with tape etc. to prevent the spiral cable from rotating.


SHTS07Z070200014

2. REMOVE THE STEERING COLUMN.

(1) Remove the steering column bracket mounting bolts.

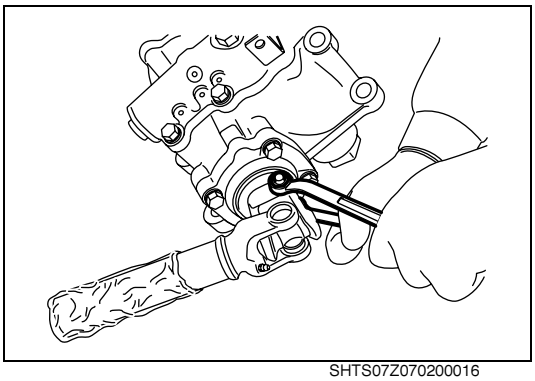


SHTS07Z070200015

(2) Remove the steering column and the shaft integrally with the column bracket from the steering support bracket.

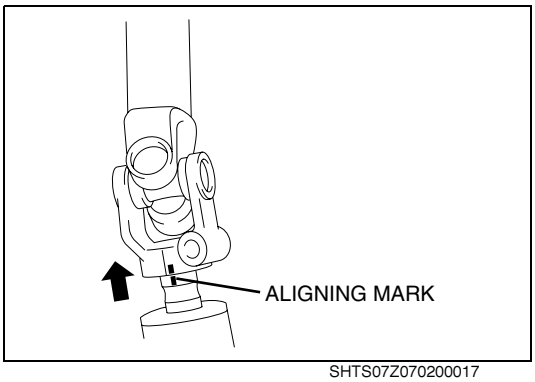
NOTICE

- **Before removing the steering column from the steering support bracket, make the aligning marks on both sliding shaft and sliding yoke.**
- **When removing the sliding shaft, be careful not to scratch the nylon coating of fitting part.**


SHTS07Z070200016

3. REMOVE THE UNIVERSAL JOINT.

(1) Remove the universal joint clamp nut.

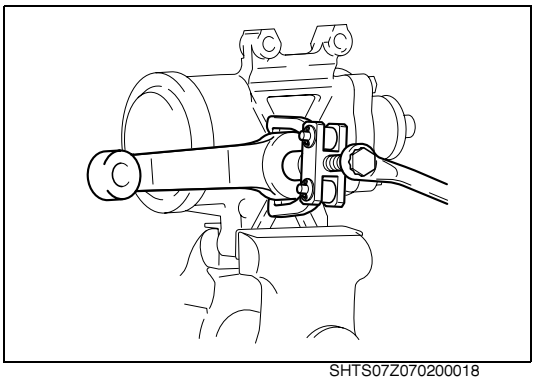


SHTS07Z070200017

(2) Disconnect the universal joint from the steering gear unit.

NOTICE

Before disconnecting, make the aligning marks on both universal joint and steering gear unit.


SHTS07Z070200018

4. REMOVE THE PITMAN ARM.

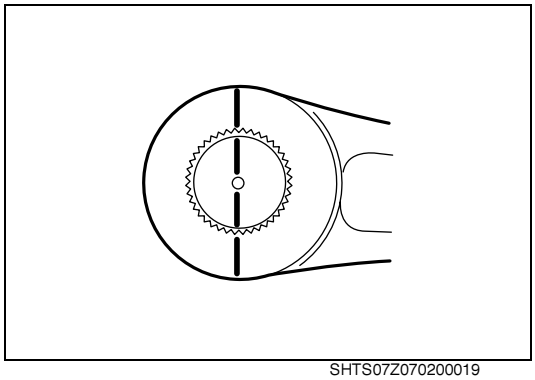
(1) Remove the nut, lock washer and plain washer from the sector shaft.

NOTICE

Do not use wedges or hit with a hammer.

SST: Socket Wrench (09603-1280)

(2) Using the special tool, remove the pitman arm.
SST: Pitman Arm Puller (09650-1260)


SHTS07Z070200019

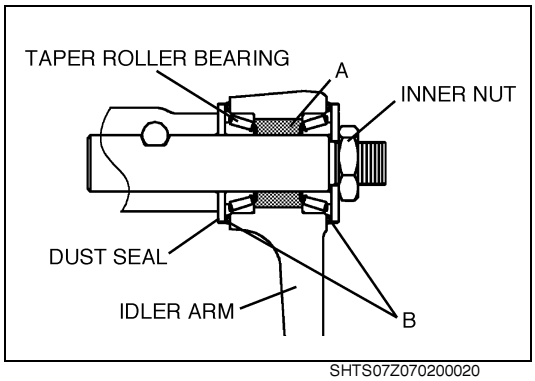
IMPORTANT POINTS - ASSEMBLY

1. INSTALL THE PITMAN ARM.

(1) Through the pitman arm, install the plain washer and lock washer to the sector shaft.

NOTICE
Align the aligning marks.

(2) Tighten the nut to the specified torque.
SST: Socket Wrench (09603-1280)



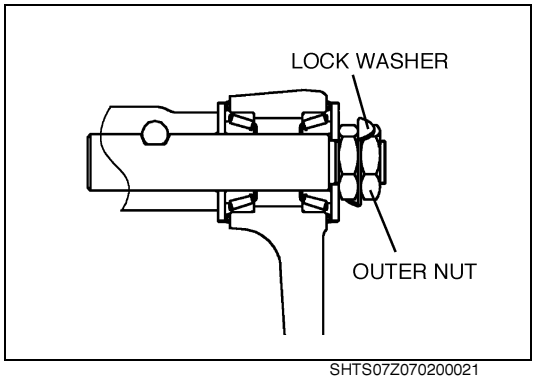
SHTS07Z070200020

2. INSTALL THE IDLER ARM. (MODEL: FY)

(1) Fill chassis grease with the taper roller bearings and the space between the bearings "A".

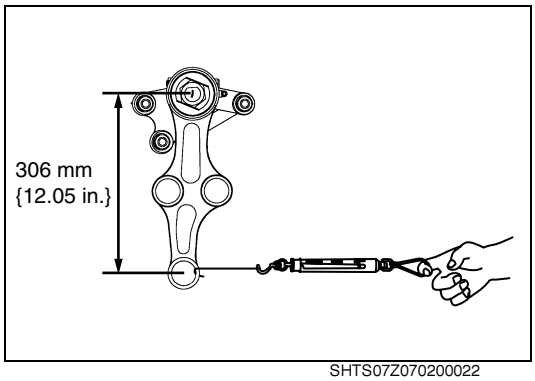
(2) Install the idler arm to the idler arm pin, and tighten the inner nut.
Tightening Torque:
147.5-156.5 N·m {1,504-1,595 kgf·cm, 109-115 lbf·ft}

NOTICE
Before installation, apply chassis grease to the lip part of the dust seal "B".



SHTS07Z070200021

(3) Loosen the inner nut by 1/4 turn, and then tighten the outer nut.
Tightening Torque:
291-389 N·m {2,968-3,966 kgf·cm, 215-286 lbf·ft}

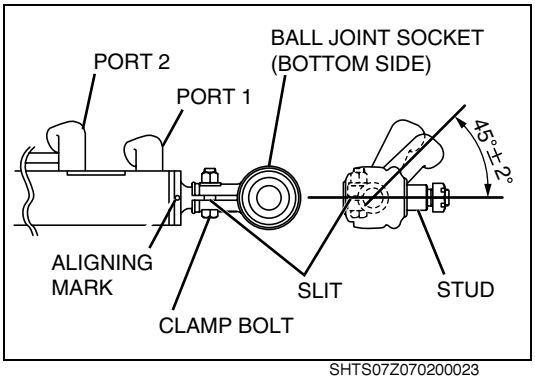


SHTS07Z070200022

(4) Swing the idler arm and gently strike the bracket with a copper hammer then measure the turning torque, using spring balancer.

Turning torque (N·m {kgf·cm, lbf·ft})	**1.97-3.92 {20-39, 1.5-2.8}**
Spring balancer reading (N {kgf, lbf})	**6.5-12.4 {0.7-1.2, 1.4-2.8}**

(5) If the turning torque is out of above range, readjust from item 1.
(6) After adjusting the turning torque, bend the lock washer.

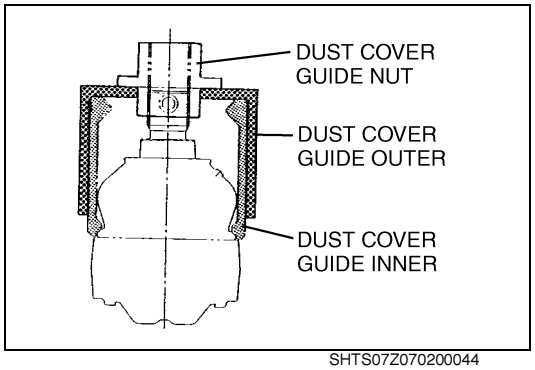


SHTS07Z070200023

3. INSTALL THE POWER STEERING BOOSTER. (MODEL: FY)

NOTICE

- **When installation of ball joint socket, it should be made an angle of 43°-47° with slit of the ball joint socket and the port 1, and then tighten clamp bolt.**
- **After tighten the clamp bolt, check that the slit of ball joint socket is aligned with the mark on power steering booster body.**

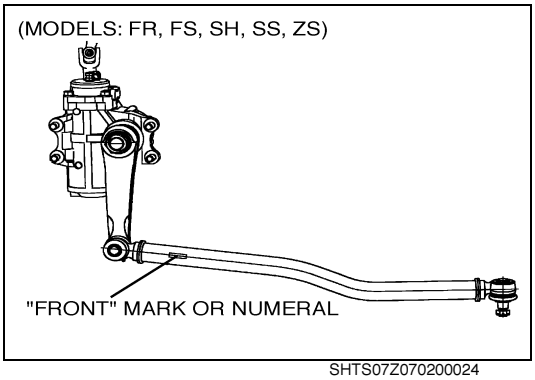


SHTS07Z070200044

4. IF NECESSARY, REPLACE THE DUST SEAL OF DRAG LINK AND RELAY ROD.

(1) Observe the following procedure when changing the dust seal.
   a. Pry off the dust seal with a screw driver.
   b. Put 6.5 g {0.23 oz} of lithium molybdenum grease in the seal.
   c. Use the special tools to install the dust seal onto the socket without damaging it.

   SST:
   Dust Cover Guide Inner (09657-1790)
   Dust Cover Guide Outer (09657-1800)
   Dust Cover Guide Nut (9209-20120)



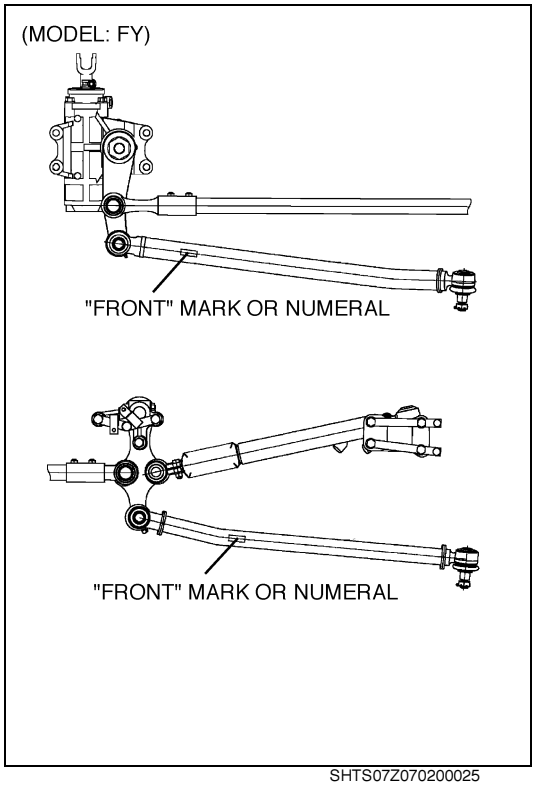
SHTS07Z070200024

5. INSTALL THE DRAG LINKS AND RELAY ROD.

(1) Connect the drag links and relay rod with the pitman arm, the knuckle arm and the idler arm.

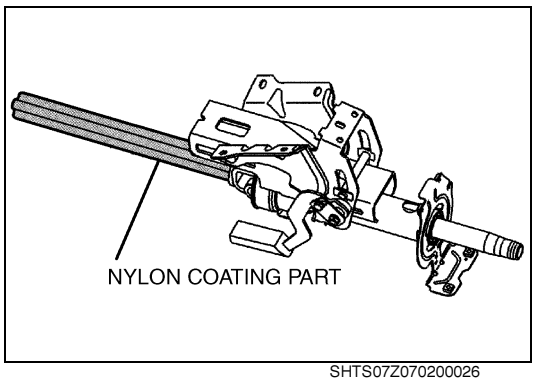
NOTICE

- **At this time, make sure that the arrow "FRONT" or numeral on the drag links is positioned toward the front of vehicle.**
- **When handling the drag links and relay rod, take care not to damage the dust seal.**



SHTS07Z070200025

(2) Tighten the slotted nuts of the ball studs at both ends of the link to the specified torque, and then secure the nuts with the cotter pins.

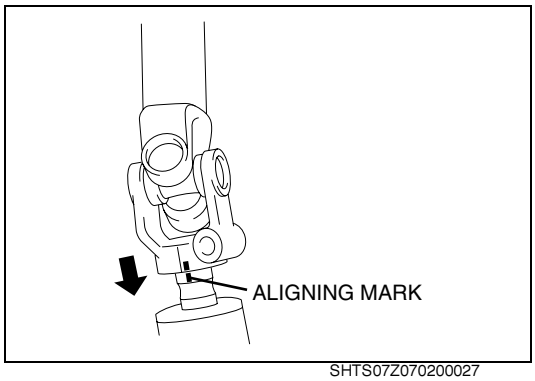


SHTS07Z070200026

6. INSTALL THE STEERING COLUMN.

(1) Apply chassis grease to the nylon coating part of sliding shaft, and install the steering column to the steering support bracket.

NOTICE
When assembling, take care not to damage the steering shaft spline.



SHTS07Z070200027

7. INSTALL THE UNIVERSAL JOINT.

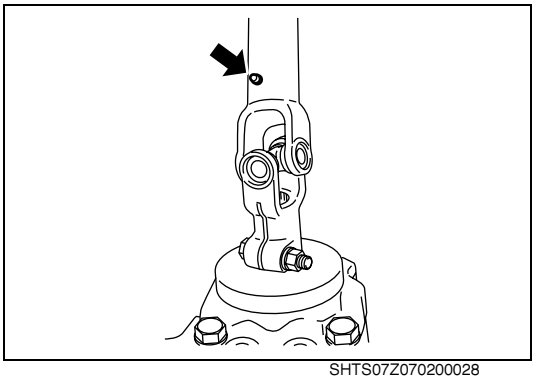
(1) Set front axles toward rectilinear direction.

(2) Apply chassis grease to sliding shaft of steering shaft and install the steering yoke to the sliding shaft.

NOTICE
Align the aligning mark.

(3) Install the universal joint to steering gear unit with clamp bolt and clamp nut.

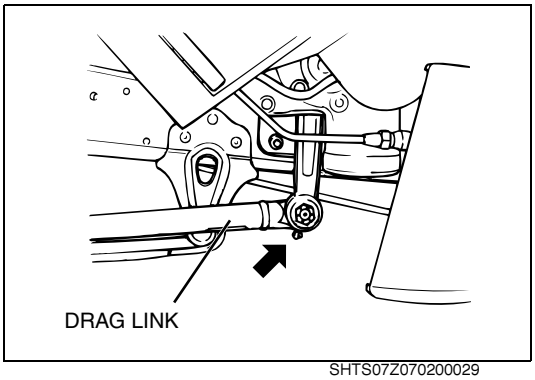
NOTICE
Align the aligning mark.



SHTS07Z070200028

8. LUBRICATE THE STEERING SHAFT.

(1) Lubricate the steering shaft with chassis grease, using the lubrication fitting located on the steering yoke.



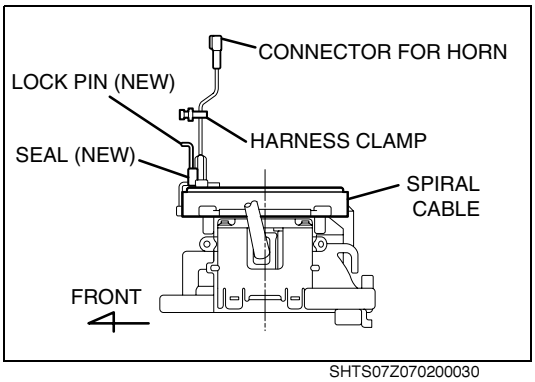
SHTS07Z070200029

9. LUBRICATE THE DRAG LINK.

(1) Lubricate the ball joint of drag link with chassis grease, using the lubrication fittings.

NOTICE

Lubricate the grease till it overflows from the dust cover hole.

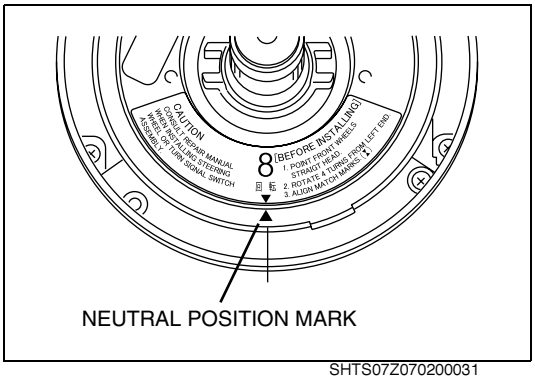


SHTS07Z070200030

10. INSTALL THE STEERING WHEEL.

(1) Set front axles toward rectilinear direction.

(2) When spiral cable is new, make sure that the lock pin is seated in the spiral cable assembly and the seal is not cut. When spiral cable is reused, make sure that the neutral position of the spiral cable does not get out of position.

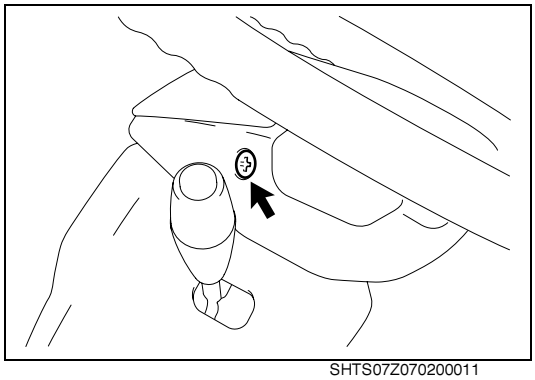


SHTS07Z070200031

NOTICE

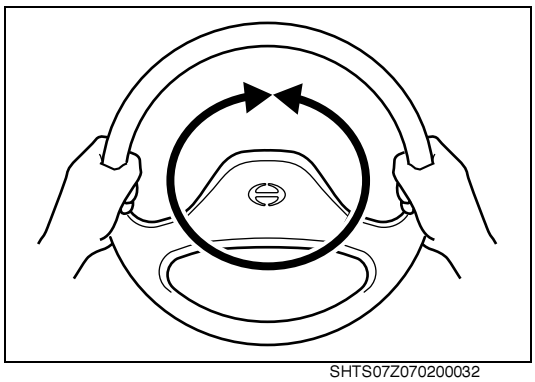
When there is no lock pin though the spiral cable is new, or when the seal is cut though there is a lock pin, or when the neutral position of the spiral cable gets out of position in reuse, turn the spiral cable counterclockwise lightly. And turn it back clockwise by 4 rotations at the point of beginning of the hard steering. Then match the neutral position marks on the upper side of the spiral cable assembly.

(3) Pass the spiral cable through the steering wheel opening area and set the steering wheel straight to install it with nut. When the spiral cable is new, remove the lock pin. When it is reused, remove the tape etc. for fixing the rotation of the spiral cable.

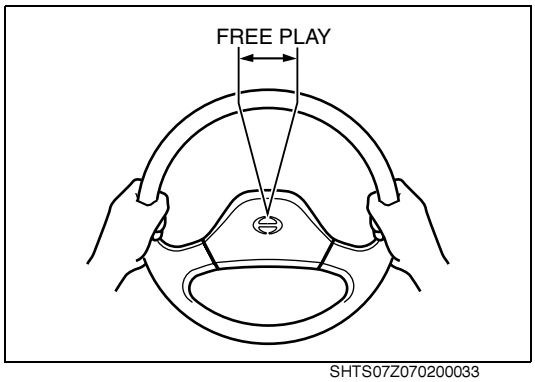

SHTS07Z070200011

(4) Tighten the set screw for fixing the horn button after pushing it in by using a torx wrench.
Tightening Torque:
6.5-13.5 N·m {66-138, 4.8-9.9 kgf·cm}

11. ADJUST THE ALIGNMENT BETWEEN FRONT FORWARD AXLE AND FRONT REARWARD AXLE. (MODEL: FY)
(1) Refer to the section "INSPECTION AND ADJUSTMENT" in the chapter "FRONT AXLE (MF78I)".


SHTS07Z070200032

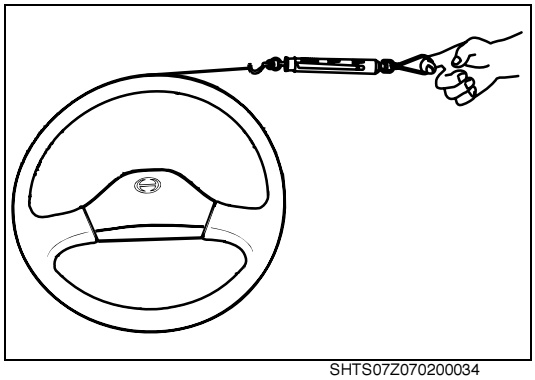
12. INSPECT THE STEERING SYSTEM FOR OPERATING ABILITY.
(1) Place the front wheels on turn tables.
(2) Make sure that the steering wheel turns smoothly without any jolts or abnormal resistance when the steering wheel is turned full range.



SHTS07Z070200033

(3) Check the steering wheel free play while engine is idling.
Wheel free play: 15-35 mm {0.591-1.377 in.}
(4) Check the steering wheel axial play.
Wheel axial play: Less than 0.1 mm {0.004 in.}
(5) If wheel free play exceeds 15-35 mm {0.591-1.377 in.}, turn the set screw clockwise to decrease wheel free play and counterclockwise to increase it.

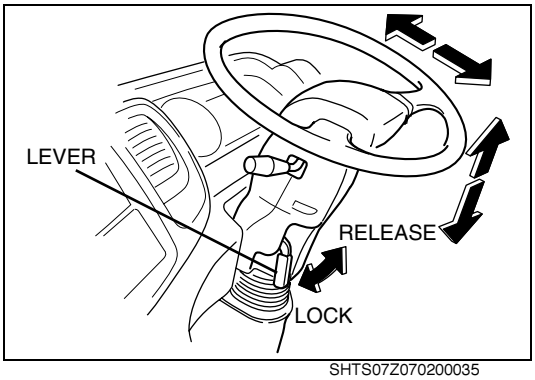
⚠ WARNING
Excessive steering wheel free play may adversely affect vehicle handling. This can result in personal injury and/or property damage.


SHTS07Z070200034

(6) Measure the steering wheel turning force. Use a spring balancer to measure the steering wheel turning force.

NOTICE
Measure the steering wheel turning force while the engine is idling.

Turning force: 40 N {4.1 kgf, 8.9 lbf}



SHTS07Z070200035

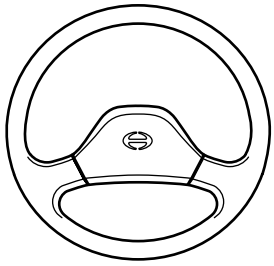
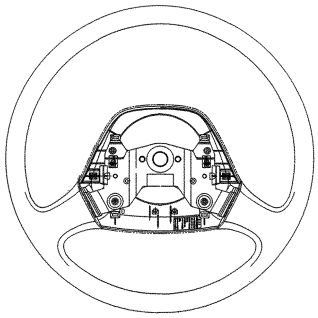
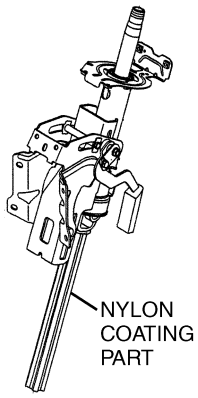
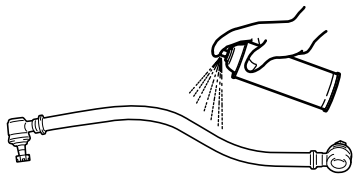
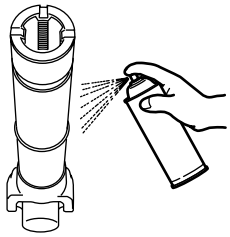
(7) The steering wheel must be locked securely in any position up, down, forward and backward.

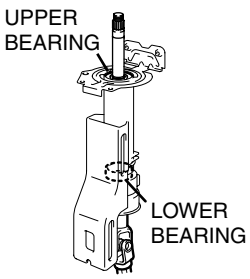
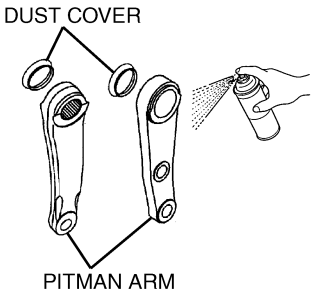
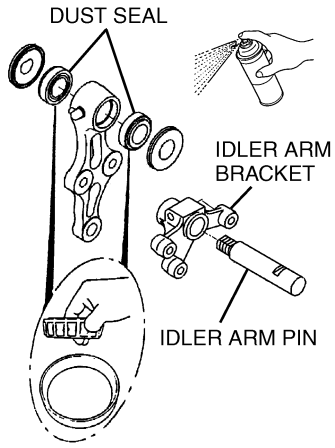
⚠ WARNING
Before moving the vehicle, tighten the lever securely and try to move the steering wheel up and down, and forward and backward to make sure that it is locked securely. Never try to adjust the steering wheel position while the vehicle is moving. Any adjustment of the steering wheel while driving can cause the driver to lose control, and result in personal injury and/or property damage.

(8) Check to see that the combination switch is operating properly.

INSPECTION AND REPAIR

EN07Z0702H300001

Inspection item	Standard	Limit	Remedy	Inspection procedure
Steering wheel: Cracks, distortion and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Steering wheel serration: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Steering column assembly: Bent, oscillation and cracks Nylon coating part: Damage	**—**	**—**	**Replace, if necessary**	**Visual check** 
Drag link: Cracks and damage Ball joint: Play Dust seal: Damage	**—**	**—**	**Replace the whole drag link assembly or replace only dust cover.**	**Use the magnetic flaw detector or color checking instrument.** 
Universal joint assembly: Oscillation, Play, Damage Oil seal: Damage	**—**	**—**	**Replace, if necessary.**	**Use the magnetic flaw detector or color checking instrument.** 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Column tube: Cracks, Bent **Ball bearing:** **Play, Poor rotation**	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Pitman arm: Cracks, Bent **Dust cover, Wear, Damage**	**—**	**—**	**Replace, if necessary.**	**Use the magnetic flaw detector or color checking instrument.** 
Idler arm: Cracks, Bend **Dust seal: Wear, Damage** **Taper roller bearing:** **Play, Poor rotation, Burns, Pitting** **Idler arm pin:** **Cracks, Bend** **Idler arm bracket:** **Cracks, Bend**	**—**	**—**	**Replace, if necessary.**	**Use the magnetic flaw detector or color checking instrument.** 

POWER STEERING

SR03-001

POWER STEERING SYSTEM

TROUBLESHOOTING

EN07Z0703F300001

Symptom	Possible cause	Remedy/Prevention
Fluid leakage	Pump	Replace pump.
Fluid leakage (Gear box, steering booster)	Oil seal, O-rings other than those for the seal lock nut and drain plug	Repair oil seal or O-ring.
	Seal lock nut, drain plug	Replace lock nut or plug.
Fluid leakage	Line joints	Replace leaky parts.
Hard steering (Excessive steering effort) (One side is hard)	Steering gear is faulty	Hydraulic test. Replace piston sub-assembly.
Hard steering (Excessive steering effort) (Both sides are hard)	Steering gear pump faulty	Hydraulic test.
		Measure pump discharge pressure. Replace pump.
	Incorrect preload of the sector shaft bearing	Measure system hydraulic pressure. Replace piston sub-assembly.
		Adjust sector shaft preload.
Hard steering (Excessive steering effort) (Hard, when starting to steer) **NOTICE** **Basic inspection items** • **Fluid level, Fluid cleanliness** • **Air in fluid** • **Tire pressure** • **Front alignment** • **Steering linkage** • **Universal joint**	Incorrect preload of the sector shaft bearing	Adjust sector shaft preload.
Abnormal noise (Pump) **NOTICE** **Basic inspection items** • **Fluid level, fluid cleanliness** • **Air mixed in fluid** • **Pump piping** • **Steering linkage**	Air sucked in at input pipe	Repair and bleed air or replace pump.
Abnormal noise	Gear box	Replace piston sub-assembly.

NOTE: ○ : Indicates a possible cause

▽: Indicates trouble that occurs upon engine starting in cold weather. Wait until the engine is heated.

Appearance \ Cause	Insufficient lubrication of the mal-sliding	Reduced inflation pressure of tire	Over loading or one-side loading of cargo	Looseness the relative bolt or nut and contact of parts	Improper front wheel alignment	Abnormal condition of steering linkages	Wrong connection the lines	Insufficient air bleeding	Inhale the air to lines	Crush or foreign matter is in lines	Inside of the gear case is damaged by any for - eign matter	Loose the adjuster or lock nut of adjust bolt	Maladjustment of backlash	Malfunction of the spool valve due to mal-sliding condition	Malfunction of the spool valve due to spring tension is weaken	Oil leak form the spool valve due to wear	Oil leak in gear case due to seal damage	Malfunction of relief valve due to dust	The flow control valve is closed with dust	The flow control valve is not close with dust	Large clearance between rotor and side plate	Malfunction of the pump part due to bearing damage	Malfunction of the pump part due to vanes stick	Malfunction of the pump part due to seize	Lowering of function due to wear	The oil filter clogged	Suck a air due to diminish in quantity the oil
(Cause group)	Others						Lines				Steering gear assembly							Oil pump								Rese-rvoir	
Operation of the steering wheel is not smoothly.	○			○		○		○	○		○			○	○							○		○			
Turning force of the steering wheel is heavy both direction right and left.	○	○	○	○	○	○		○	○	○	○		○	○		○	○	○		○	○	○	○	○	○	○	○
Turning force of the steering wheel is unbalance right and left.		○	○	○	○					○																	
Detective return of the steering wheel in both direction left and right.	○	○		○	○	○				○			○	○	○												
Detective return of the steering wheel in only one direction.		○	○	○	○	○				○			○	○	○												
The steering wheel tends to turn by itself in one direction, when released.		○	○		○										○												
Considerable variations for operating force of steering wheel.					○			○	○	○														○	○		○
Excessive play of steering wheel and the vehicle is unstable.				○	○			○	○					○		○	○			○		○		○	○		○
Vibration does not stop.				○	○		○	○	○													○		○			○
Operating force is heavy while the engine in idling.								○	○	○						○	○	○		○	○	○	○	○	○	○	○
Oil temperature rise in a moment.										○									○							○	
The oil pump noise.								○	○	○								○				○		○	○		○
The oil pressures high , when not operating the steering wheel.										○									○								
The oil pressure does not rise.											○					○	○	○		○	○	○	○	○	○		○
The oil pressure is higher than setting pressure of relief valve.																			○								
The oil pressure rise slowly.								○	○	○						○	○										○
Abnormal function of the pump (seizing, etc).										○									○			○		○			○
The oil spill from reservoir.								○	○	○																	○
Countermeasure	Lubrication	Adjust	Proper loading	Tighten, repair	Adjust	Check, repair	Repair	Air bleeding	Check, tighten	Replace or clean	Replace	Adjust and tighten	Adjust	Repair or replace	Replace	Replace	Repair or replace	Repair	Repair	Repair	Replace	Replace	—	Replace	Repair or replace	Clean the filter, change the oil	Check the oil level, replenishment the oil

SHTS07Z070300001

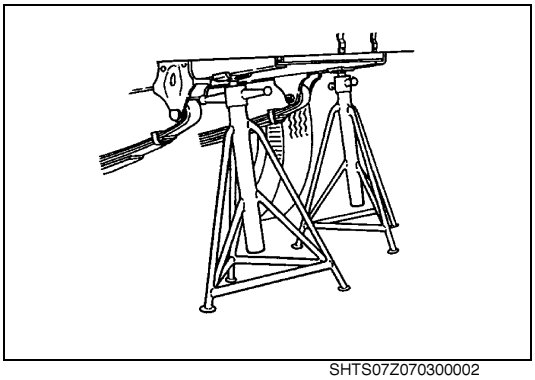
AIR BLEEDING

EN07Z0703H200001

1. FILL THE OIL RESERVOIR WITH POWER STEERING FLUID.

NOTICE

- **Use only specified fluid.**
- **Do not overfill the oil reservoir.**
- **Replace old fluid with new fluid after overhauling power steering gear unit or power steering pump.**
- **Specified fluid....Refer to recommended lubricant list.**

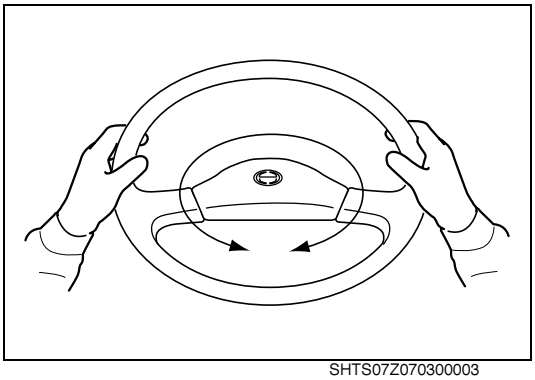


SHTS07Z070300002

2. JACK UP THE FRONT AXLE AND SUPPORT THE FRAME WITH STANDS.

NOTICE

Block the rear wheels.

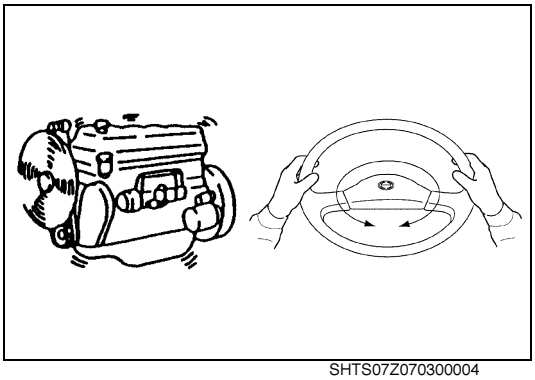


SHTS07Z070300003

3. TURN THE STEERING WHEEL FULLY IN BOTH DIRECTIONS SEVERAL TIMES.

4. CHECK THE FLUID LEVEL IN THE OIL RESERVOIR.

(1) Add the fluid, if necessary.



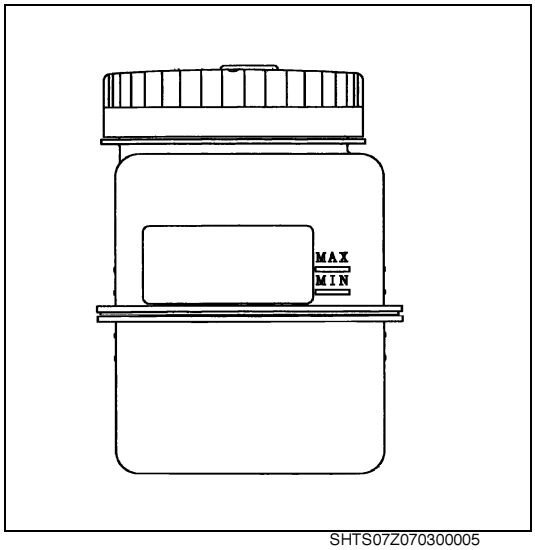
SHTS07Z070300004

5. START THE ENGINE AND TURN THE STEERING WHEEL FULLY IN BOTH DIRECTIONS SEVERAL TIMES WITH ENGINE IDLING.

NOTICE

The fluid in the oil reservoir should be continuously replenished while air bleeding so that the oil reservoir never become empty.

6. RETURN THE STEERING WHEEL TO STRAIGHT AHEAD.



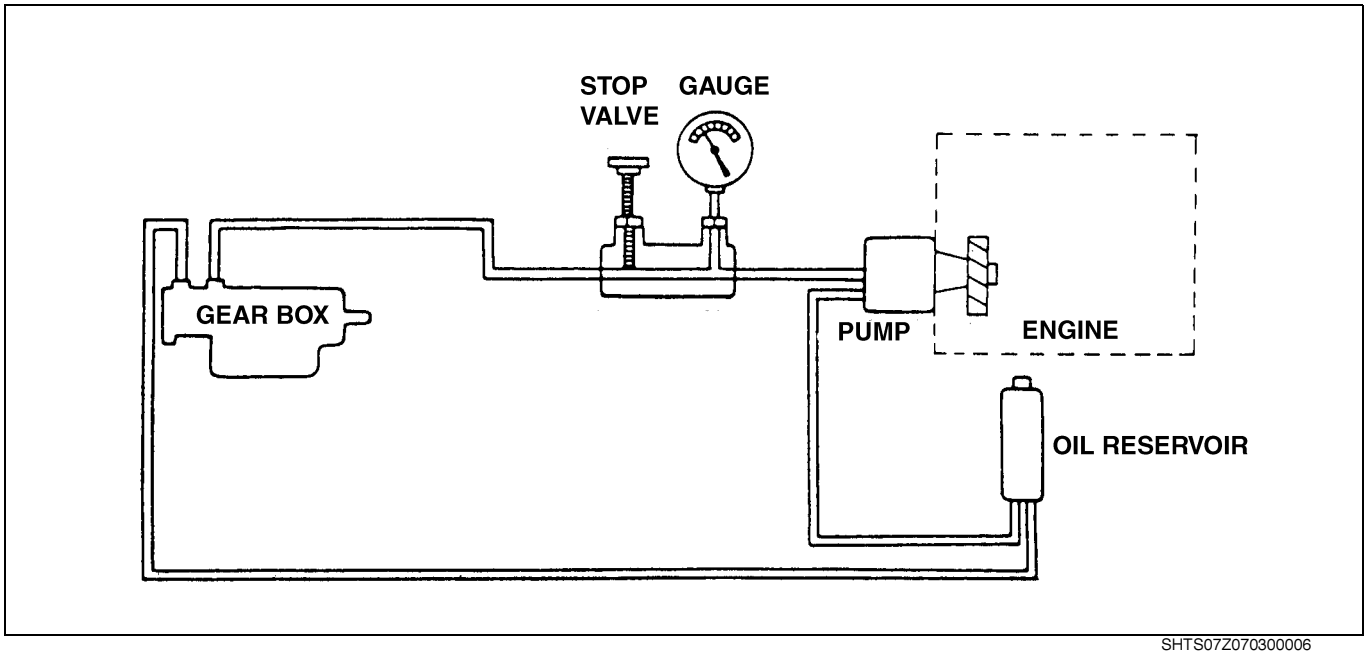
SHTS07Z070300005

7. RECHECK THE FLUID LEVEL WHEN THE ENGINE IS STOPPED.

(1) If necessary, add or decrease the power steering fluid to match the between "MAX" and "MIN".

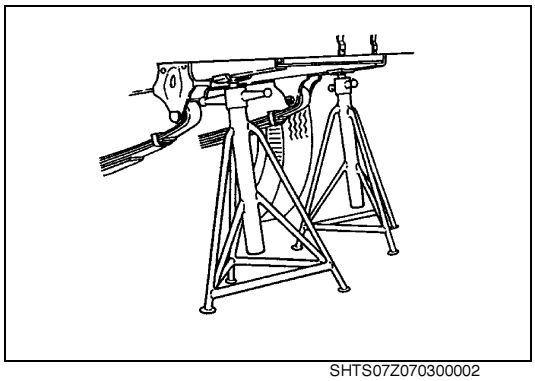
HYDRAULIC TEST

EN07Z0703H300001



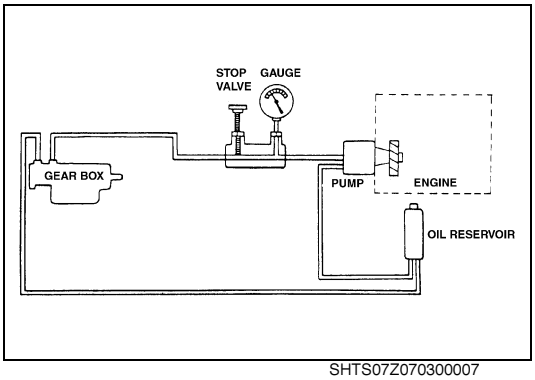
SHTS07Z070300006

HYDRAULIC TEST


SHTS07Z070300002

1. JACK UP THE FRONT AXLE AND SUPPORT THE FRAME WITH STANDS.

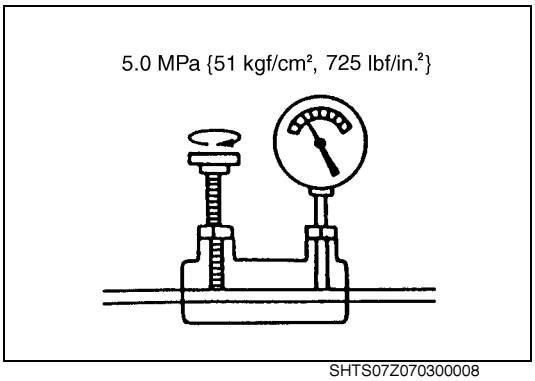
NOTICE
Block the rear wheels.



SHTS07Z070300007

2. SET THE STOP VALVE AND OIL PRESSURE GAUGE AS SHOWN IN THE FIGURE.

NOTICE
After setting the stop valve and oil pressure gauge, perform the air bleeding in the system according to "AIR BLEEDING".



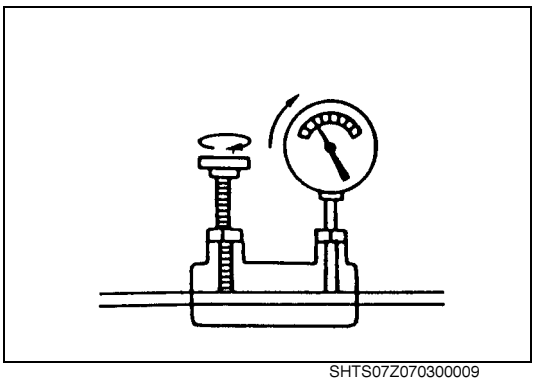
SHTS07Z070300008

3. CHECK THE FLOW CONTROL VALVE OPERATION.
(1) Start the engine and idle then close the stop valve until the fluid pressure is at 5.0 MPa {51 kgf/cm^2, 725 lbf/in.^{2}}.

(2) Run the engine up to 1,500 r/min, then reduce the engine speed suddenly.

NOTICE
This operation should be repeated more than 5 times.

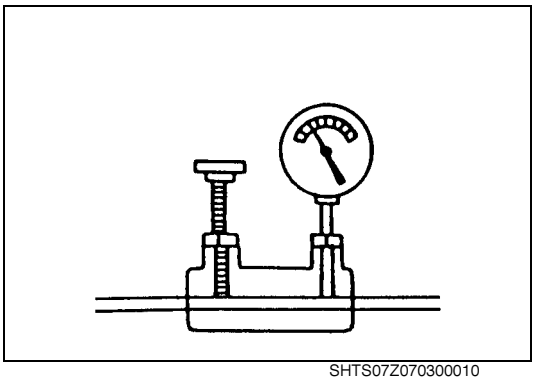
(3) Good, if the set pressure of 5.0 MPa {51 kgf/cm^2, 725 lbf/in.^{2}} is recovered immediately.
If the set pressure is not recovered immediately, stop the engine and replace the flow control valve assembly.
(4) Open the stop valve fully.


SHTS07Z070300009

4. CHECK THE RELIEF VALVE OPERATION.
(1) Run the engine up to 2,000 r/min.
(2) Close the stop valve until the fluid pressure is at 14.7 MPa {150 kgf/cm^2, 2,132 lbf/in.^{2}}.

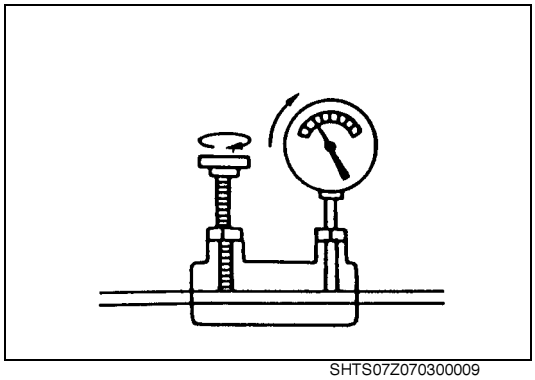
NOTICE
Be careful not to exceed 14.7 MPa {150 kgf/cm^2, 2,132 lbf/in.^{2}}

(3) Good, if the fluid pressure is maintained at 14.0-14.7 MPa {143-150 kgf/cm^2, 2,030-2,132 lbf/in.^{2}}.
(4) If pressure is higher, stop the engine and replace the flow control valve assembly.


SHTS07Z070300010

5. MEASURE THE SYSTEM HYDRAULIC PRESSURE.
(1) Make sure that the stop valve is fully open.
(2) Start the engine and idle and then turn the steering wheel to a full stop.
(3) Apply a force of approx. 147.1 N {15 kgf, 33 lbf} to the steering wheel and measure the hydraulic pressure.
(4) Repeat the measurement by fully turning the steering wheel in the opposite direction.
Hydraulic pressure:
14.0-14.7 MPa {143-150 kgf/cm^2, 2,030-2,132 lbf/in.^{2}}

(5) If the above pressure is not attained, measure the discharge pressure or stop the engine and repair the power steering gear unit.


SHTS07Z070300009

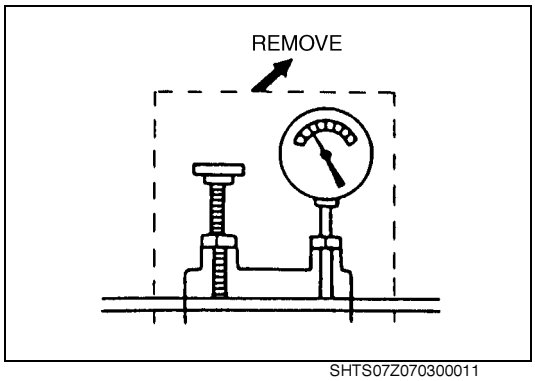
6. MEASURE THE DISCHARGE PRESSURE.

(1) Make sure that the stop valve is fully open.

(2) Start the engine and idle and measure the discharge pressure with the stop valve fully close.
Discharge Pressure:
14.0-14.7 MPa {143-150 kgf/cm^2, 2,030-2,132 lbf/in.^{2}}

NOTICE
Do not allow the stop valve to remain closed for more than 15 seconds.

(3) Open the stop valve fully.



SHTS07Z070300011

7. REMOVE THE STOP VALVE AND OIL PRESSURE GAUGE.

(1) Stop the engine and remove the stop valve and oil pressure gauge.

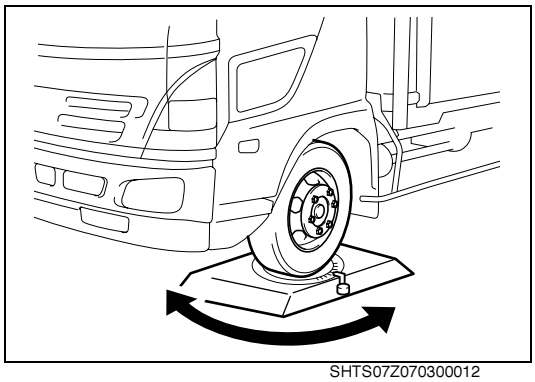
NOTICE
After removing stop valve and oil pressure gauge, perform the air bleeding in according to "AIR BLEEDING".

8. INSPECT THE STEERING SYSTEM FOR OPERATION ABILITY.

(1) Place the front wheels on turn tables then start the engine and idle.

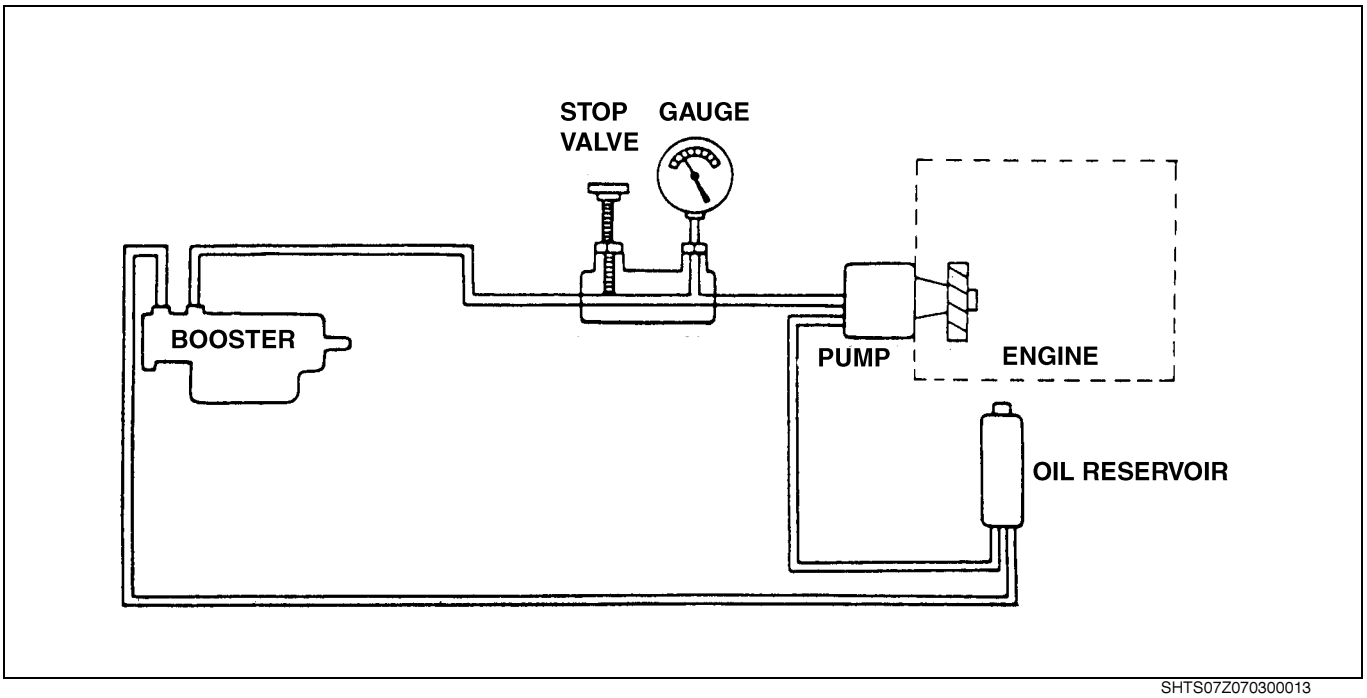
(2) Check to see that the steering wheel turned smoothly without any jolts or abnormal resistance, when it is turned fully in both directions.

(3) Measure the steering wheel turning force.
Turning force: Less than 40 N {4.1 kgf, 8.9 lbf}


SHTS07Z070300012

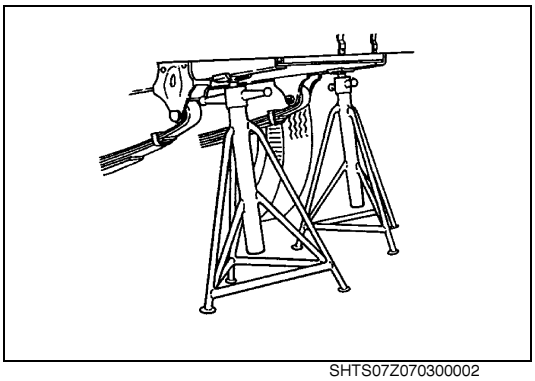
HYDRAULIC TEST (STEERING BOOSTER)

EN07Z0703H300002



SHTS07Z070300013

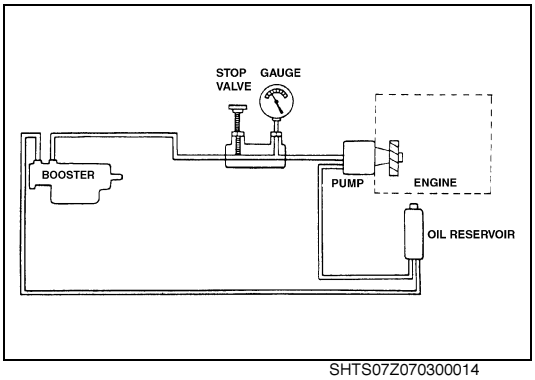
HYDRAULIC TEST



SHTS07Z070300002

1. **JACK UP THE FRONT AXLE AND SUPPORT THE FRAME WITH STANDS.**

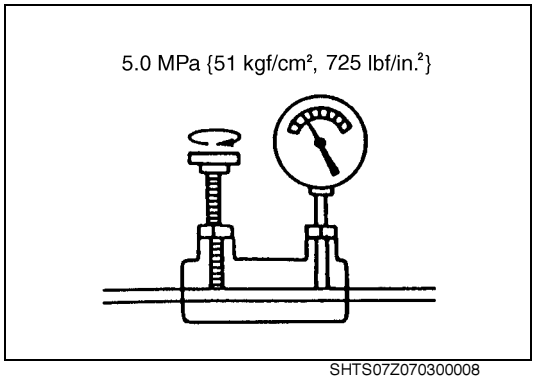
NOTICE
Block the rear wheels.



SHTS07Z070300014

2. **SET THE STOP VALVE AND OIL PRESSURE GAUGE AS SHOWN IN THE FIGURE.**

NOTICE
After setting the stop valve and oil pressure gauge, perform the air bleeding in the system according to "AIR BLEEDING".



SHTS07Z070300008

3. CHECK THE FLOW CONTROL VALVE OPERATION.

(1) Start the engine and idle then close the stop valve until the fluid pressure is at 5.0 MPa {51 kgf/cm^2, 725 lbf/in.^{2}}

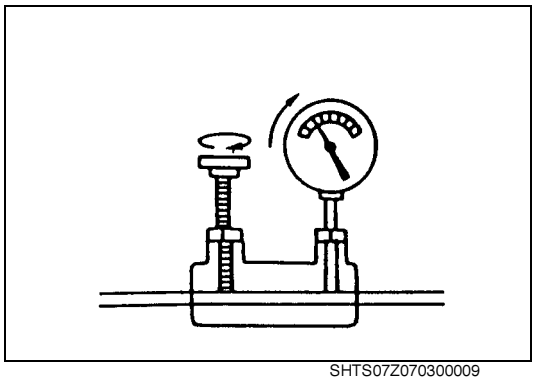
(2) Run the engine up to 1,500 r/min, then reduce the engine speed suddenly.

NOTICE

This operation should be repeated more than 5 times.

(3) Good, if the set pressure of 5.0 MPa {51 kgf/cm^2, 725 lbf/in.^{2}} is recovered immediately.
If the set pressure is not recovered immediately, stop the engine and replace the flow control valve assembly.

(4) Open the stop valve fully.


SHTS07Z070300009

4. CHECK THE RELIEF VALVE OPERATION.

(1) Run the engine up to 2,000 r/min.

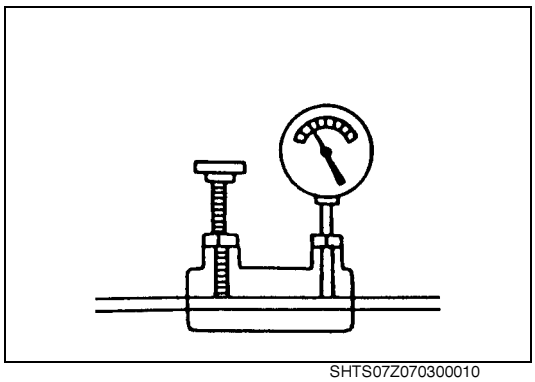
(2) Close the stop valve fully.

(3) Good, if the fluid pressure is maintained at 14.0-14.7 MPa {143-150 kgf/cm^2, 2,030-2,132 lbf/in.^{2}}.

(4) If pressure is higher, stop the engine and replace the flow control valve assembly.

NOTICE

Be careful not to exceed 14.7 MPa {150 kgf/cm^2, 2,132 lbf/in.^{2}}


SHTS07Z070300010

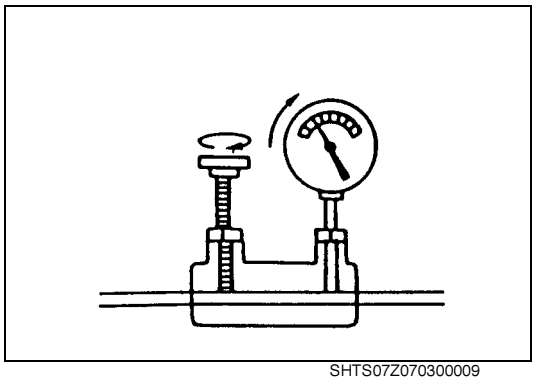
5. MEASURE THE SYSTEM HYDRAULIC PRESSURE.

(1) Make sure that the stop valve is fully open.

(2) Run the engine up to 2,000 r/min.

(3) Repeat the measurement by fully turning the steering wheel in the opposite direction.
Hydraulic pressure:
14.0-14.7 MPa {143-150 kgf/cm^2, 2,030-2,132 lbf/in.^{2}}

(4) If the above pressure is not attained, measure the discharge pressure or stop the engine and repair the steering booster unit.


SHTS07Z070300009

6. MEASURE THE DISCHARGE PRESSURE.

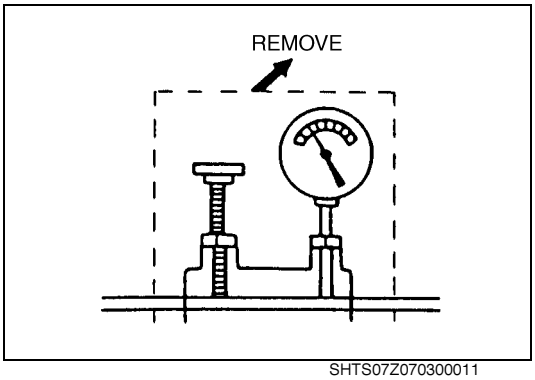
(1) Make sure that the stop valve is fully open.

(2) Start the engine and idle and measure the discharge pressure with the stop valve fully close.
Discharge Pressure:
14.0-14.7 MPa {143-150 kgf/cm^2, 2,030-2,132 lbf/in.^{2}}

NOTICE

Do not allow the stop valve to remain closed for more than 15 seconds.

(3) Open the stop valve fully.



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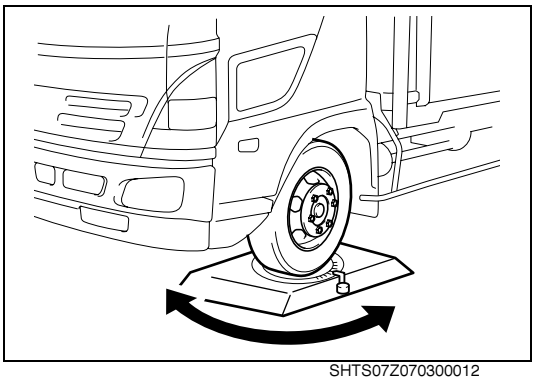

SHTS07Z070300012

7. REMOVE THE STOP VALVE AND OIL PRESSURE GAUGE.

(1) Stop the engine and remove the stop valve and oil pressure gauge.

NOTICE

After removing stop valve and oil pressure gauge, perform the air bleeding in according to "AIR BLEEDING".

8. INSPECT THE STEERING SYSTEM FOR OPERATION ABILITY.

(1) Place the front wheels on turn tables then start the engine and idle.

(2) Check to see that the steering wheel turned smoothly without any jolts or abnormal resistance, when it is turned fully in both directions.

(3) Measure the steering wheel turning force.
Turning force: Less than 24.5 N {2.5 kgf, 5.5 lbf}

POWER STEERING GEAR UNIT

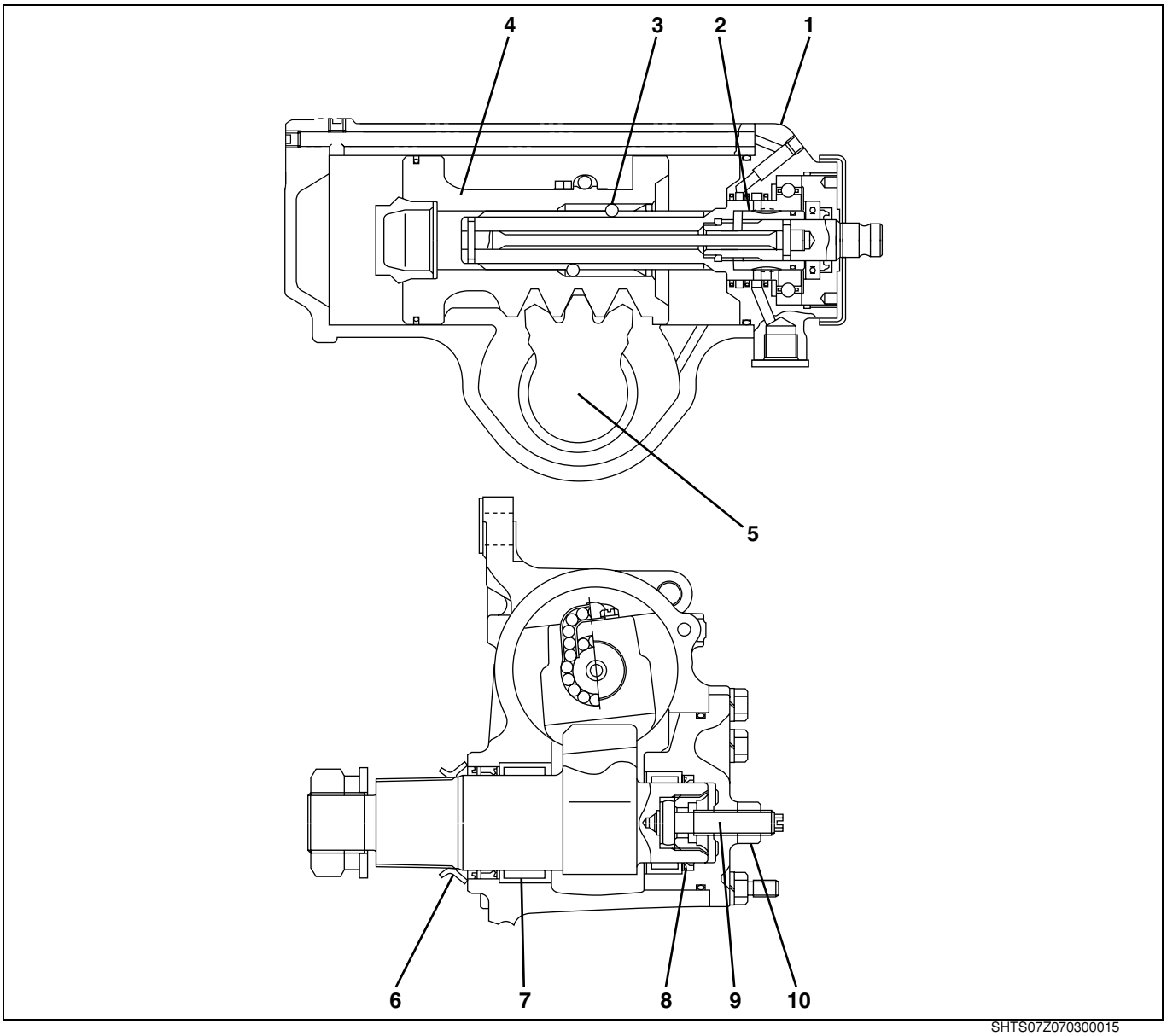
DATA AND SPECIFICATIONS

EN07Z0703I200001

Type	MODEL	FR, FS, SH, SS, ZS	Integral type power steering
		FY	Integral type power steering with steering booster
Gear ratio	MODEL	FR, FS, SH, SS, ZS	21.4-23.8
		FY	22.4
Cylinder inside diameter	MODEL	FR, FS, SH, SS, ZS	110 mm {4.331 in.}
		FY	100 mm {3.937 in.}

DESCRIPTION

EN07Z0703C100001

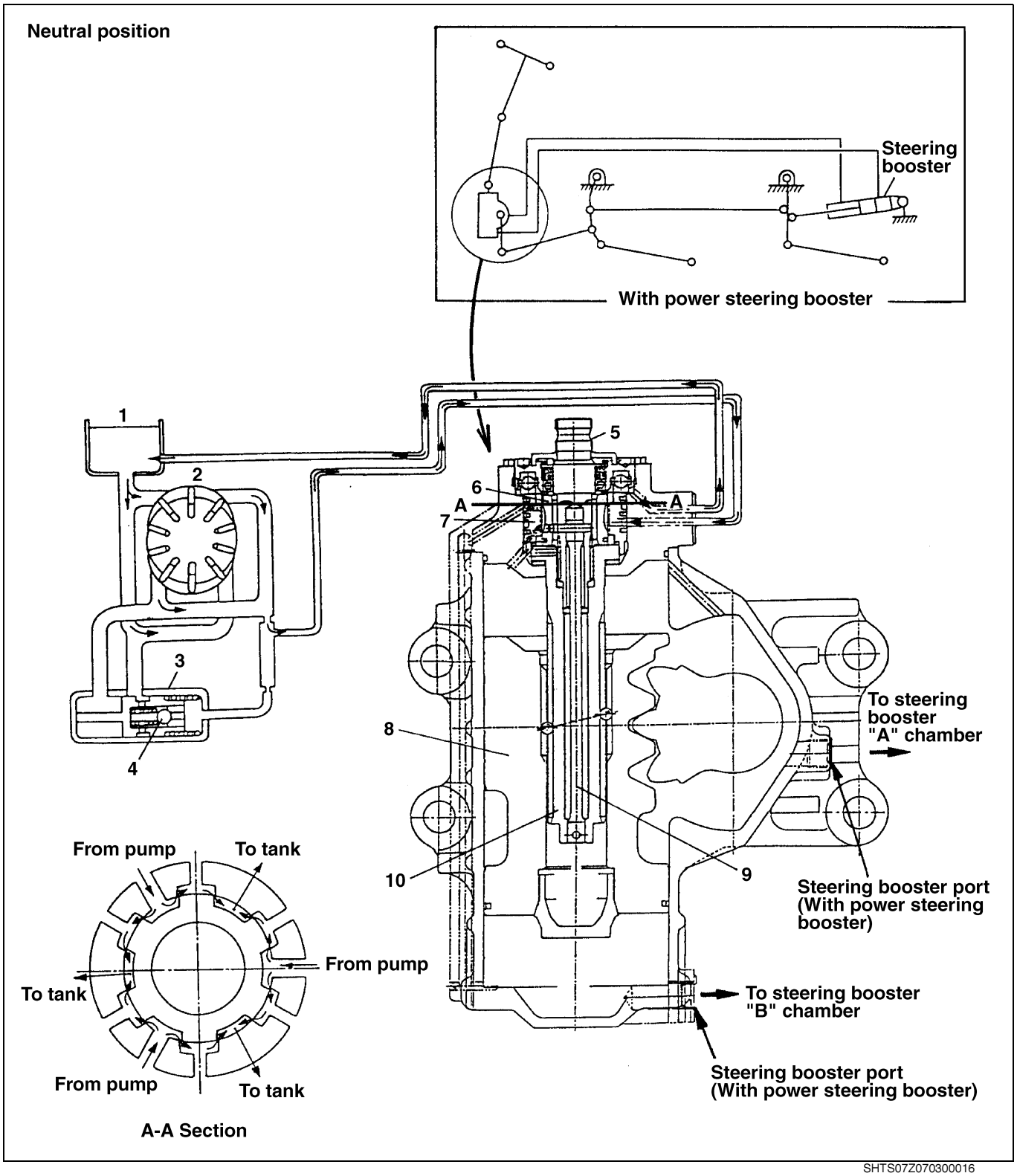


SHTS07Z070300015

1	Valve housing assembly	6	Dust cover
2	Worm valve assembly	7	Needle roller bearing
3	Steel ball	8	Oil seal
4	Ball nut assembly	9	Adjusting screw
5	Sector shaft	10	Adjusting screw lock nut

OPERATION

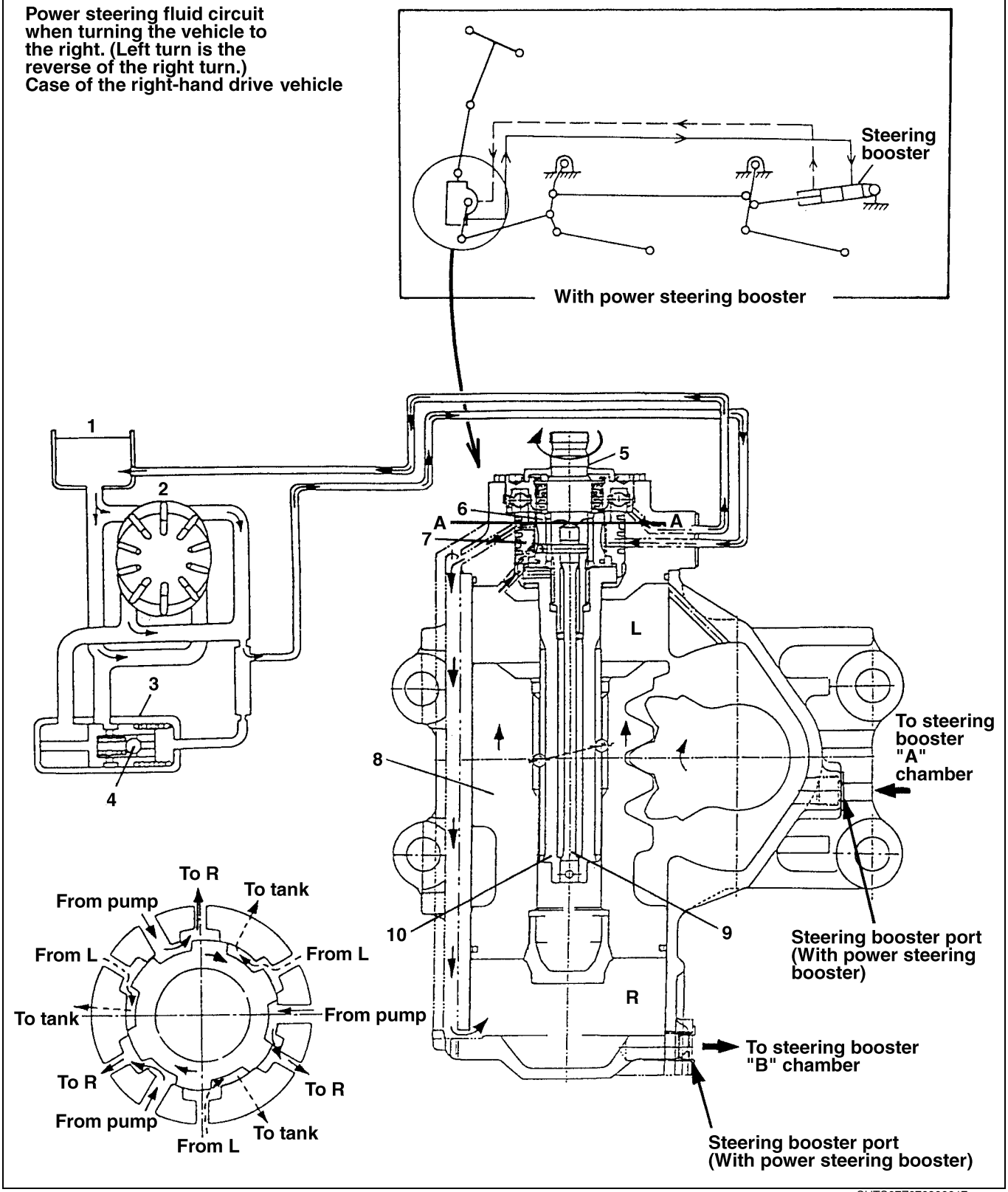
EN07Z0703C100002



SHTS07Z070300016

1	Oil reservoir	6	Spool valve
2	Oil pump	7	Sleeve
3	Flow control valve assembly	8	Ball nut
4	Relief valve	9	Torsion bar
5	Stud shaft	10	Worm shaft

Power steering fluid circuit when turning the vehicle to the right. (Left turn is the reverse of the right turn.)
Case of the right-hand drive vehicle



SHTS07Z070300017

1	Oil reservoir	6	Spool valve
2	Oil pump	7	Sleeve
3	Flow control valve assembly	8	Ball nut
4	Relief valve	9	Torsion bar
5	Stud shaft	10	Worm shaft

SPECIAL TOOL

EN07Z0703K100001

Prior to starting a power steering gear unit overhaul, it is necessary to have the following special tools.

Tool and accessory set: 09030-4180

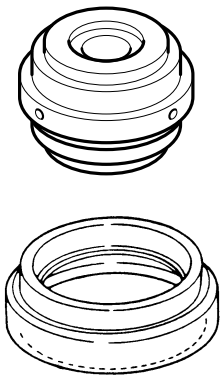
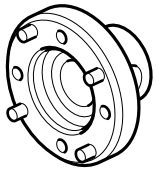
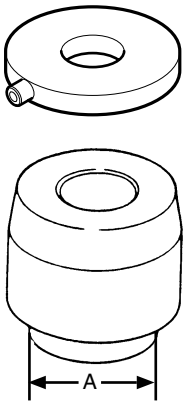
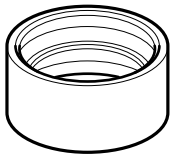
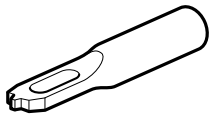
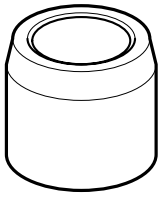
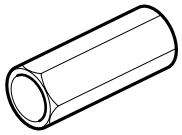
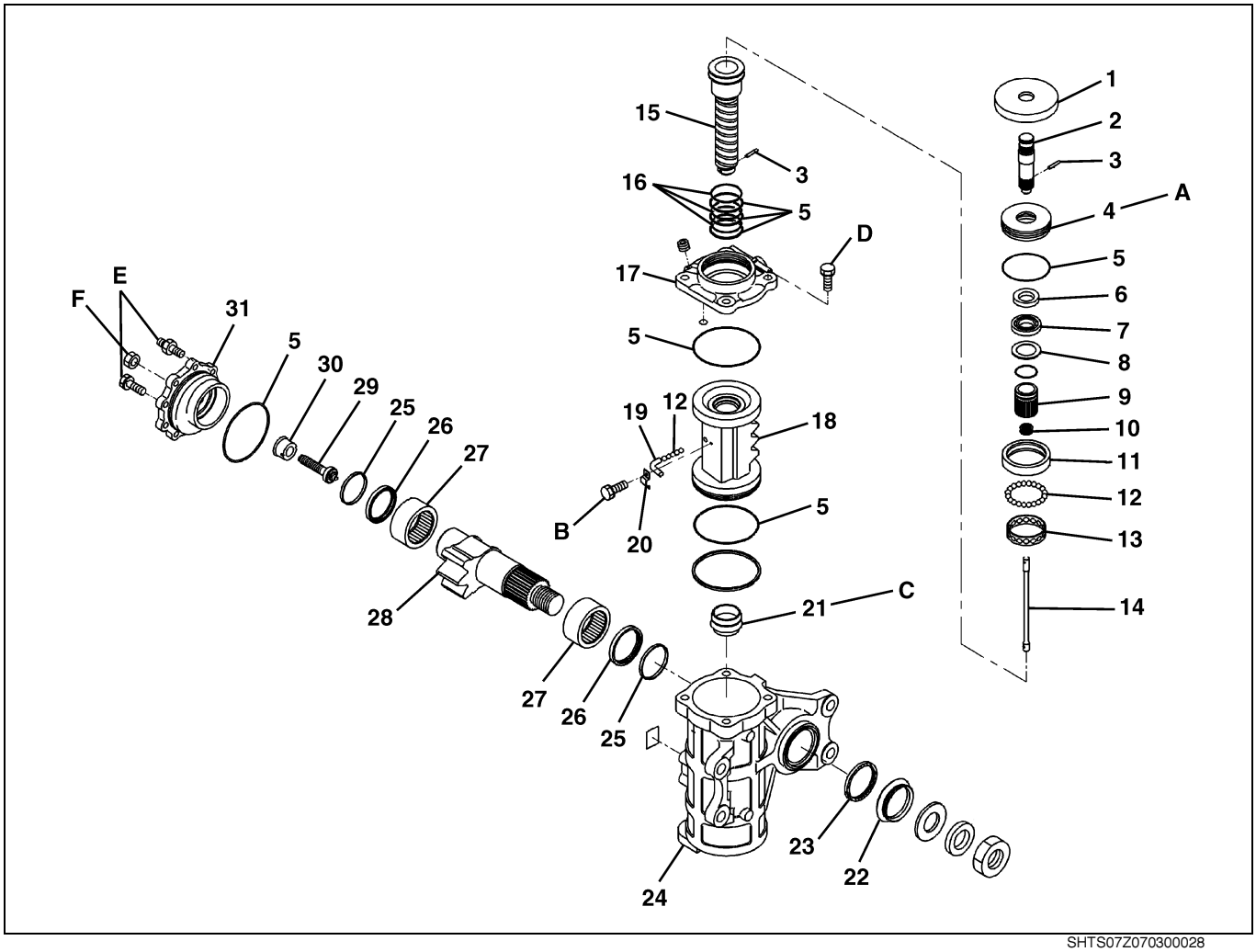
Illustration	Part number	Tool name	Remarks
	09657-1870	TOOL ASSEMBLY • For 85 mm {3.346 in.} • For 90-110 mm {3.544-4.330 in.} (Used together with tool assembly)	
	09659-1400	ATTACHMENT ASSEMBLY	
	09603-1560	WRENCH ASSEMBLY	
	09657-1860	INSERTER ASSEMBLY A: For 40 mm {1.575 in.} For 45 mm {1.772 in.} For 48 mm {1.890 in.} For 53 mm {2.087 in.} For 58 mm {2.283 in.} (Used together with inserter assembly)	
	09659-1410	PRESS FITTER	
	09699-1360	NEEDLE	
	09657-1840	INSERTER	

Illustration	Part number	Tool name	Remarks
	09694-1020	CAULKING TOOL	
	09657-1850	INSERTER	
	09712-1130	BAR	

COMPONENT LOCATOR

EN07Z0703D100001

RIGHT-HAND DRIVE VEHICLE



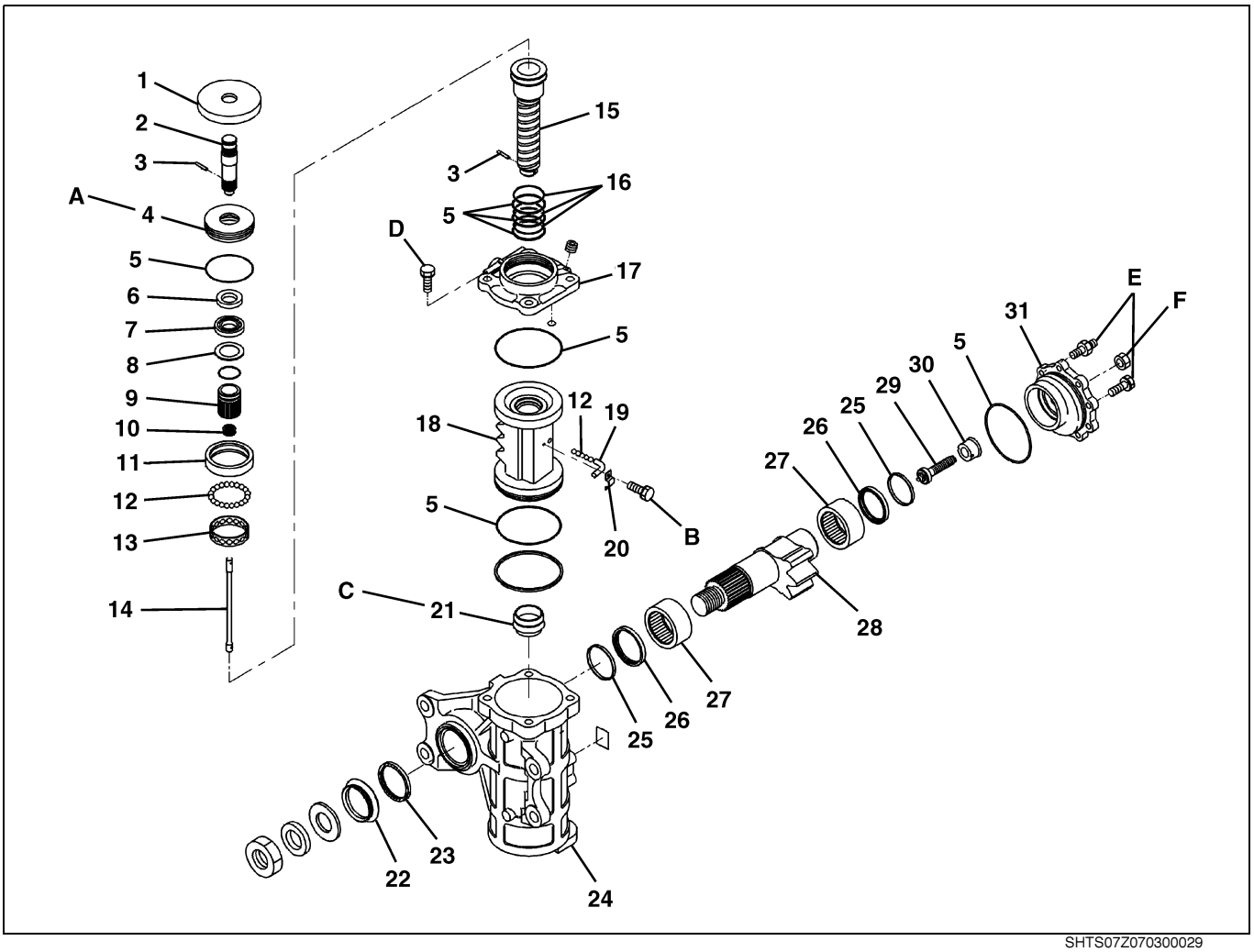
SHTS07Z070300028

1	Dust cover	17	Valve housing
2	Stab shaft	18	Power piston (Ball nut)
3	Pin	19	Ball tube
4	Plug	20	Tube clip
5	O-ring	21	Plug
6	Oil seal	22	Dust cover
7	Ball bearing	23	Oil seal
8	Washer	24	Steering body
9	Rotor	25	Back up ring
10	Needle roller bearing	26	Y-packing
11	Side race	27	Needle roller bearing
12	Ball bearing	28	Sector shaft
13	Ball bearing cage	29	Adjusting screw
14	Torsion bar	30	Retainer
15	Worm shaft	31	Side cover
16	Seal ring		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	226-245 {2,305-2,498, 167-180}	D	118-127 {1,203-1,295, 87-93}
B	4.4-5.4 {45-55, 3.3-4.0}	E	74-83 {755-846, 55-61}
C	294-392 {2,998-3,997, 217-289}	F	112-127 {1,142-1,295, 83-93}

LEFT-HAND DRIVE VEHICLE



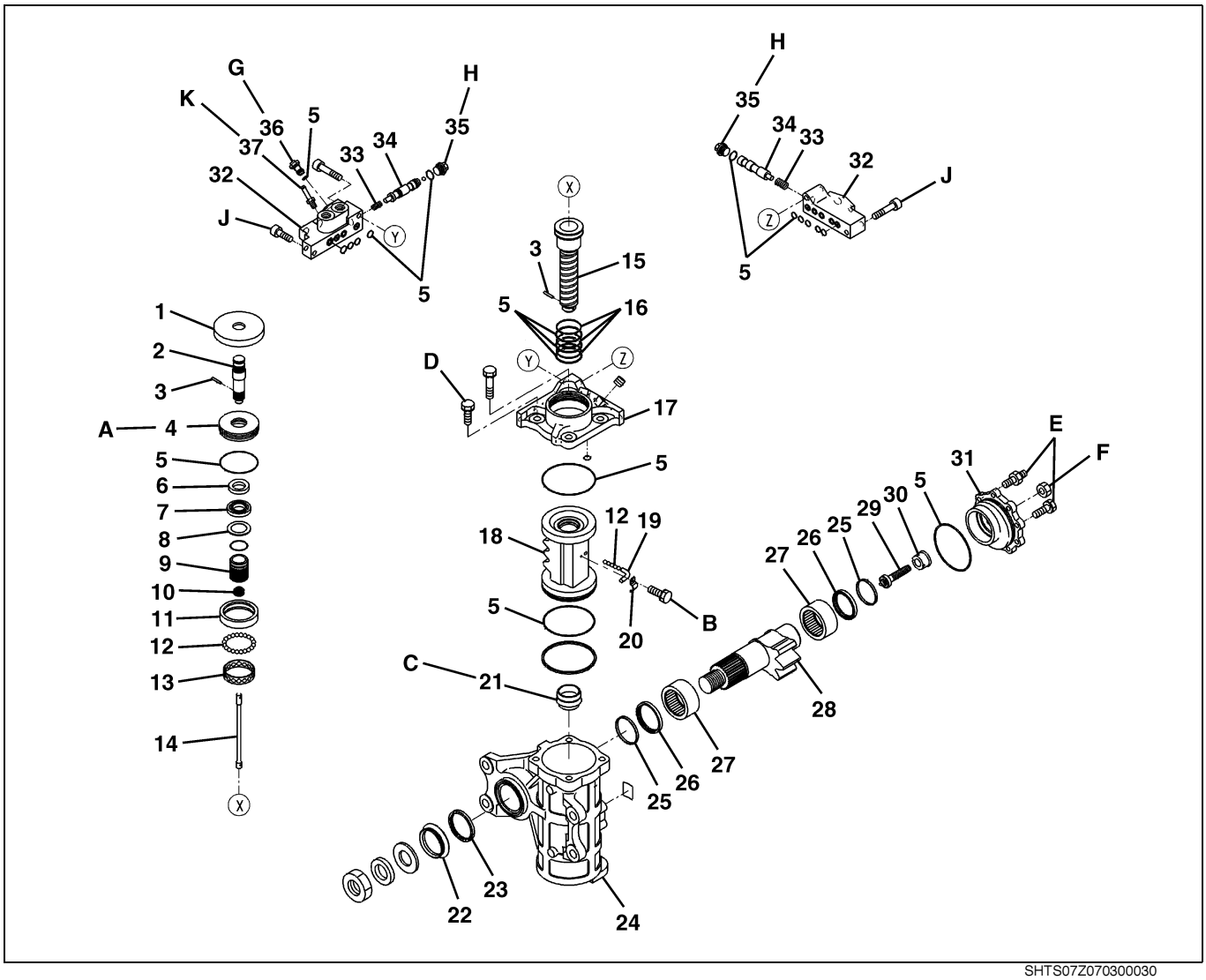
SHTS07Z070300029

1	Dust cover	17	Valve housing
2	Stab shaft	18	Power piston (Ball nut)
3	Pin	19	Ball tube
4	Plug	20	Tube clip
5	O-ring	21	Plug
6	Oil seal	22	Dust cover
7	Ball bearing	23	Oil seal
8	Washer	24	Steering body
9	Rotor	25	Back up ring
10	Needle roller bearing	26	Y-packing
11	Side race	27	Needle roller bearing
12	Ball bearing	28	Sector shaft
13	Ball bearing cage	29	Adjusting screw
14	Torsion bar	30	Retainer
15	Worm shaft	31	Side cover
16	Seal ring		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	226-245 {2,305-2,498, 167-180}	D	118-127 {1,203-1,295, 87-93}
B	4.4-5.4 {45-55, 3.3-4.0}	E	74-83 {755-846, 55-61}
C	294-392 {2,998-3,997, 217-289}	F	112-127 {1,142-1,295, 83-93}

MODEL: FY (LEFT-HAND DRIVE VEHICLE)



SHTS07Z070300030

1	Dust cover	20	Tube clip
2	Stab shaft	21	Plug
3	Pin	22	Dust cover
4	Plug	23	Oil seal
5	O-ring	24	Steering body
6	Oil seal	25	Back up ring
7	Ball bearing	26	Y-packing
8	Washer	27	Needle roller bearing
9	Rotor	28	Sector shaft
10	Needle roller bearing	29	Adjusting screw
11	Side race	30	Retainer
12	Ball bearing	31	Side cover
13	Ball bearing cage	32	Power steering control valve body
14	Torsion bar	33	Spring
15	Worm shaft	34	Spool valve
16	Seal ring	35	Plug
17	Valve housing	36	Valve assembly
18	Power piston (Ball nut)	37	Connector
19	Ball tube		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	226-245 {2,305-2,498, 167-180}	F	112-127 {1,142-1,295, 83-93}
B	4.4-5.4 {45-55, 3.3-4.0}	G	24.5-34.3 {250-350, 18-25}
C	294-392 {2,998-3,997, 217-289}	H	29.4-39.2 {300-400, 22-29}
D	118-127 {1,203-1,295, 87-93}	J	49.0-53.9 {500-550, 36-40}
E	74-83 {755-846, 55-61}	K	8.8-12.7 {90-130, 6.5-9.4}

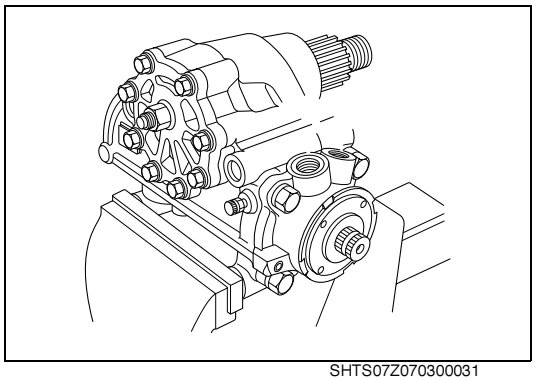
OVERHAUL

EN07Z0703H200002

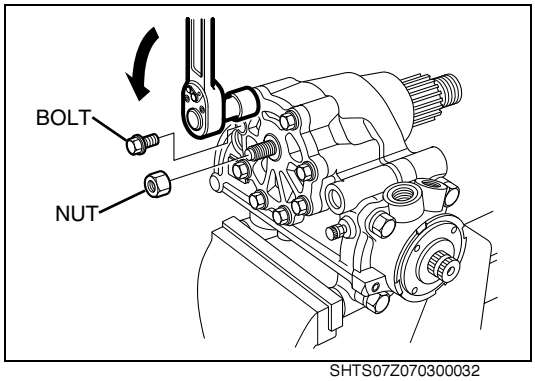
NOTICE
OBSERVE THE FOLLOWING INSTRUCTIONS BEFORE DISASSEMBLY AND ASSEMBLY.

1. **All functional parts should be clean. Blow dirty parts off with dry compressed air, then clean them with volatile metal cleanser. Never use brushes or cloth.**
2. **Handle rubber parts, seals, etc., in clean condition. Any worn part should be replaced immediately.**
   Volatile metal cleanser may attack rubber parts, so they should never be used. Always use fluid.
3. **For disassembling and assembling, only use the specified fluid.**
4. **Standard tools can generally be used for assembling and disassembling, although special tools may be required. When using special tools, read the instruction carefully, and never use standard tools in place of special tools.**

IMPORTANT POINTS - DISASSEMBLY


SHTS07Z070300031

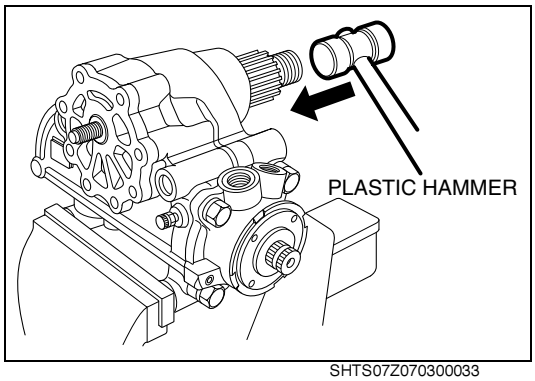
1. **BEFORE DISASSEMBLY, SECURE THE POWER STEERING IN THE VISE, AND THEN CENTER THE POWER PISTON.**



SHTS07Z070300032

2. **REMOVE THE SIDE COVER ASSEMBLY AND SECTOR SHAFT.**

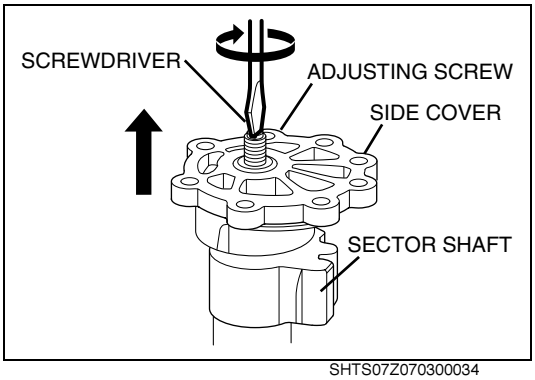
(1) Loosen and remove the nut fixing the adjusting screw to the side cover.
(2) Remove the eight bolts and washers fitting the side cover to the steering body.



SHTS07Z070300033

(3) Confirm that the power piston is located in the center, and then gently tap the output end of the sector shaft with a plastic (or wooden) hammer to remove the sector shaft assembly and the side cover together from the steering body.

NOTICE
Never use a steel hammer when removing the sector shaft (as the threads will be damaged).

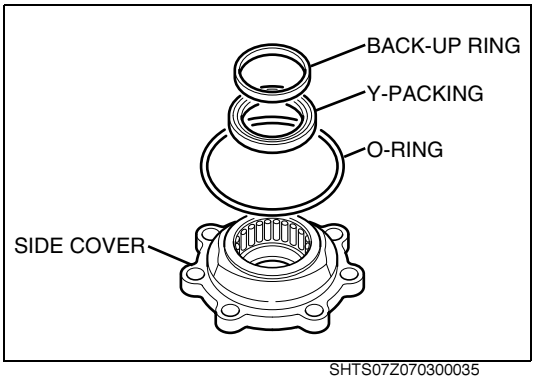


SHTS07Z070300034

(4) Turn the adjusting screw clockwise using a screwdriver to raise and separate the side cover assembly from the sector shaft assembly.

NOTICE

- **Do not secure the sector shaft directly in the vise.**
- **Always use a cloth etc. to protect the sector shaft.**



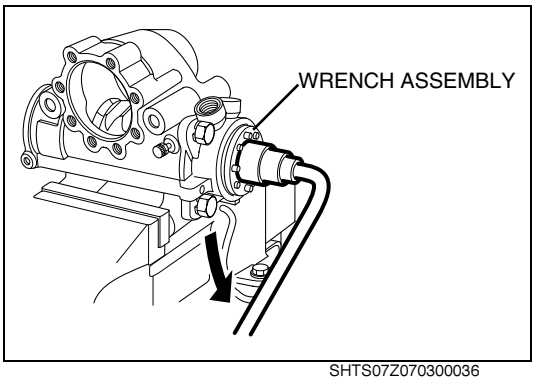
SHTS07Z070300035

(5) Remove the O-ring from the groove around the outside of the side cover using the special tool. Then remove the Y-packing from behind the needle roller bearing and the back-up ring using the special tool.

NOTICE

It is not necessary to remove the needle bearing unless it is damaged.

SST: Needle (09699-1360)



SHTS07Z070300036

3. REMOVE THE VALVE HOUSING AND BALL NUT ASSEMBLY.

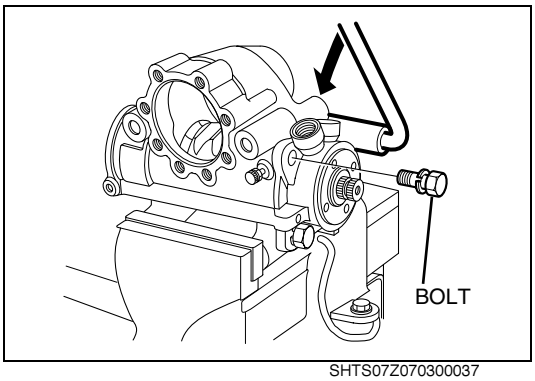
(1) Remove the dust cover from the valve housing.

(2) Loosen the plug and seal assembly in the valve housing section using the special tool. At this time, only back off the plug and seal assembly 180°. Do not remove it.

NOTICE

If the plug and seal assembly is removed, the steel balls (bearing) in the valve housing may spring out.

SST: Wrench Assembly (09603-1560)

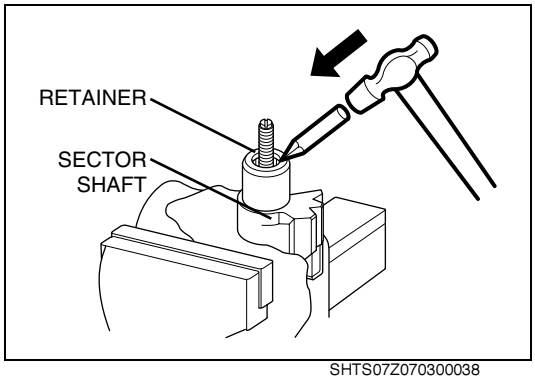


SHTS07Z070300037

(3) Remove the bolts to remove the worm shaft assembly and valve housing assembly from the steering body.

NOTICE

- **Do not damage the internal surface of the steering body when removing the worm shaft assembly and valve housing assembly.**
- **Do not let the steel balls spring out.**
- **Never damage the power piton.**



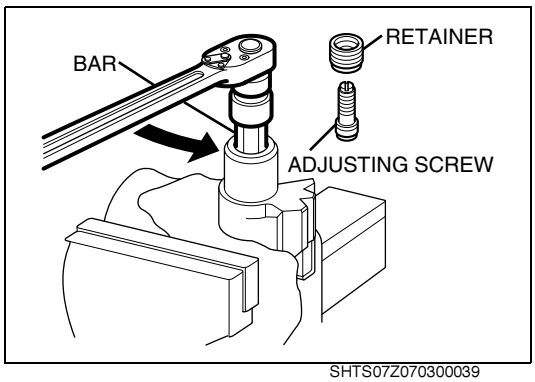
SHTS07Z070300038

4. REMOVE THE ADJUSTING SCREW AND SECTOR SHAFT.

(1) Uncaulk the retainer at two caulked positions.

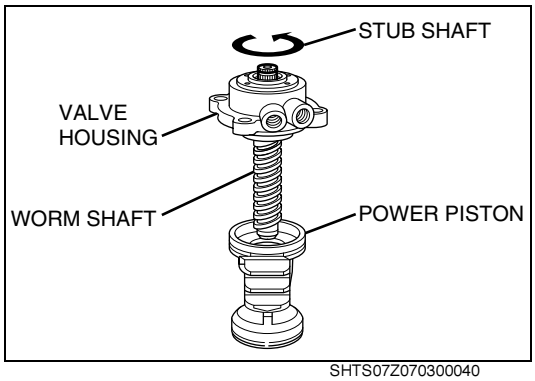
NOTICE

- **Do not disassemble the sector shaft assembly unless it is damaged.**
- **Do not secure the sector shaft directly in the vise. Always use a cloth etc. to protect the sector shaft.**



SHTS07Z070300039

(2) Remove the retainer using the special tool. Remove the adjusting screw at the same time.
SST: Bar (09712-1130)



SHTS07Z070300040

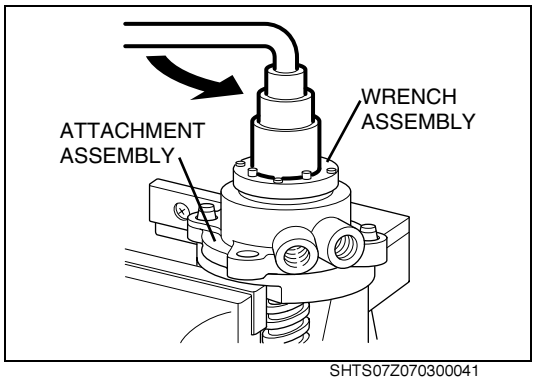
5. REMOVE THE WORM SHAFT ASSEMBLY, VALVE HOUSING AND POWER PISTON ASSEMBLY.

(1) Place the assembly on the work bench with the power piston side down. Turn the stub shaft while holding the valve housing, and remove the worm shaft from the power piston.

(2) Let the steel balls assembled in the power piston and ball race of the worm shaft drop into the power piston.

NOTICE

Do not tilt the piston as it contains the steel balls. Do not lose the steel balls.

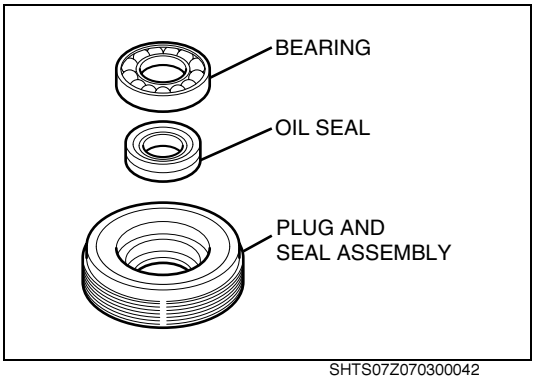


SHTS07Z070300041

(3) Secure the special tool in the vise.
SST: Attachment Assembly (09659-1400)

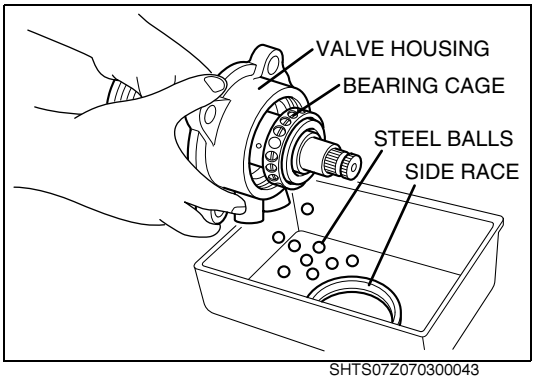
(4) Remove the O-rings fitted on the contact surfaces of the steering body of the valve housing.

(5) Attach the valve housing to the attachment assembly, and remove the previously loosened plug and seal assembly.
SST: Wrench Assembly (09603-1560)



SHTS07Z070300042

(6) Remove the ball bearing and oil seal from the plug and seal assembly.



SHTS07Z070300043

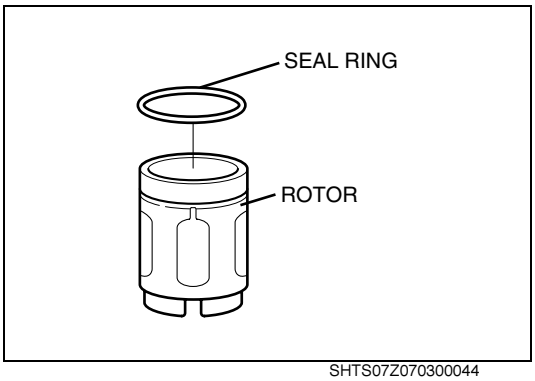
6. REMOVE THE WORM SHAFT ASSEMBLY AND VALVE HOUSING.

(1) Prepare a plastic box, etc. Hold the valve housing over the box and remove the worm shaft assembly by pushing it from the power piston side as shown in figure. The side race, steel balls, and bearing cage will come apart and fall into the box.

NOTICE

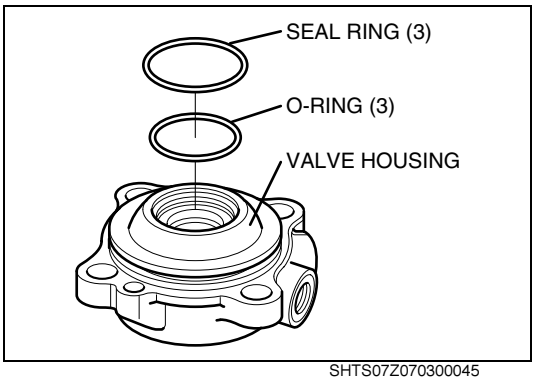
- **Do not lose any steel balls.**
- **If only one side race and/or steel ball is lost, the worm shaft and valve housing assembly must be replaced.**

  Number of the steel balls: 18 pieces.



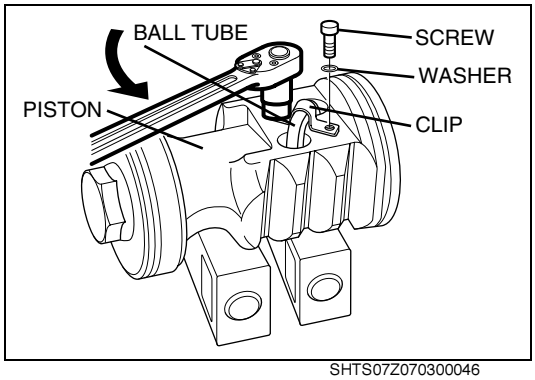
SHTS07Z070300044

(2) Remove the rotor from the worm shaft assembly, and then remove the seal ring from the rotor using the special tool.
SST: Needle (09699-1360)



SHTS07Z070300045

(3) Remove the three seal rings and three O-rings from the valve housing using the special tool.
SST: Needle (09699-1360)



SHTS07Z070300046

7. REMOVE THE POWER PISTON.

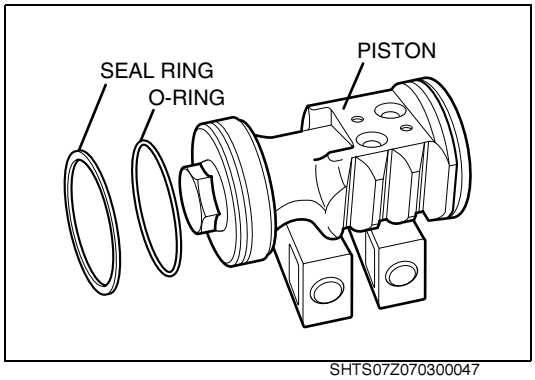
(1) Place the piston's steel balls in a separate container.

(2) Loosen the screw of the tube clip securing the ball tube using a wrench. Remove the ball tube from the power piston by pinching it with your fingers and shaking it.

NOTICE

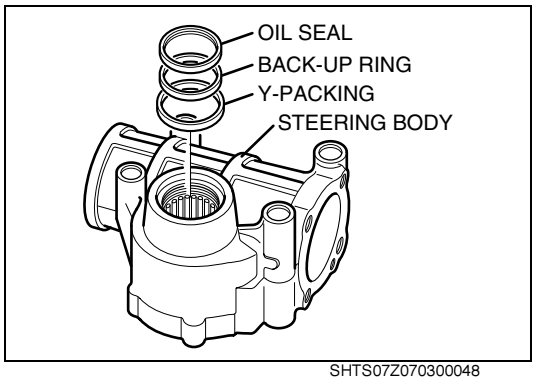
- **Never insert a screwdriver etc., between the ball tube and the piston to pry them apart.**
- **Check for any steel balls remaining in the ball tube.**

  Number of the steel balls: 32 pieces.



SHTS07Z070300047

(3) Remove the seal ring and O-ring from the power piston using the special tool.
SST: Needle (09699-1360)



SHTS07Z070300048

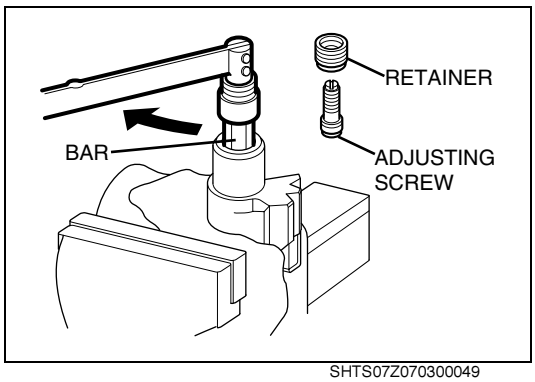
8. REMOVE THE STEERING BODY.

(1) Remove the oil seal, back-up ring, and Y-packing from the section of the steering body contacting the sector shaft.

NOTICE

Do not remove the needle roller bearing and taper plug unless they are damaged.

IMPORTANT POINTS - ASSEMBLY

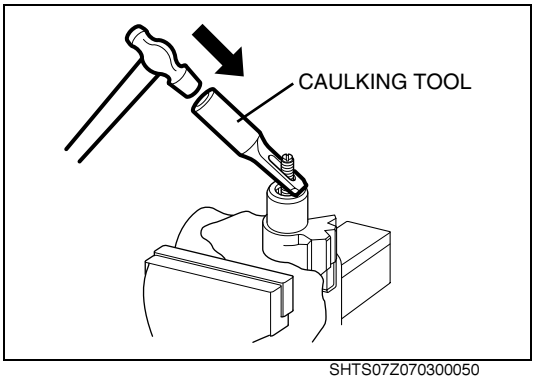


SHTS07Z070300049

1. INSTALL THE SECTOR SHAFT.

(1) Secure the sector shaft in the vise while protecting the geared base of the shaft with a rag.

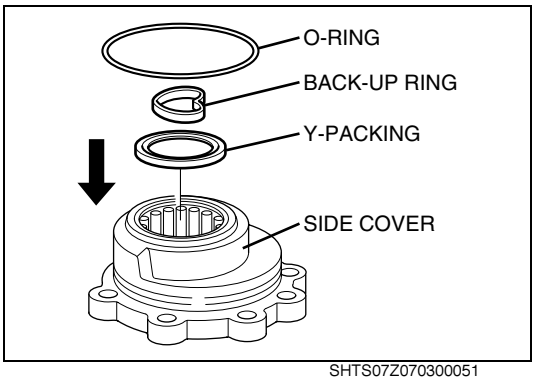
(2) Fill the assembly with grease through the adjusting screw hole. Then, insert the adjusting screw, and fix the retainer using the special tool.
SST: Bar (09712-1130)



SHTS07Z070300050

NOTICE
How to tighten the retainer; After fully tightening, back off the retainer 180° and then, after retightening it to 39 N·m {400 kgf·cm, 29 lbf·ft}, back it off 20°. Ensure the adjusting screw rotates smoothly.

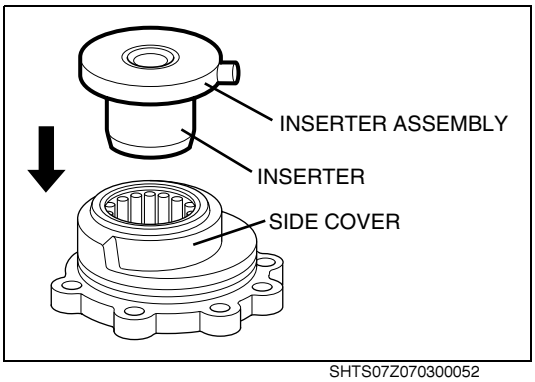
(3) After tightening the retainer, securely caulk it at two positions using the special tool.
SST: Caulking Tool (09694-1020)



SHTS07Z070300051

2. INSTALL THE SIDE COVER.
(1) Insert the Y-packing and back-up ring in the bottom of the needle roller bearing press fitted inside the side cover.

NOTICE
- **The back-up ring can be assembled easily if inserted by pinching it with the fingers as shown in figure.**
- **After filling the groove with grease, assemble the Y-packing so that the lip faces to the needle roller bearing side.**



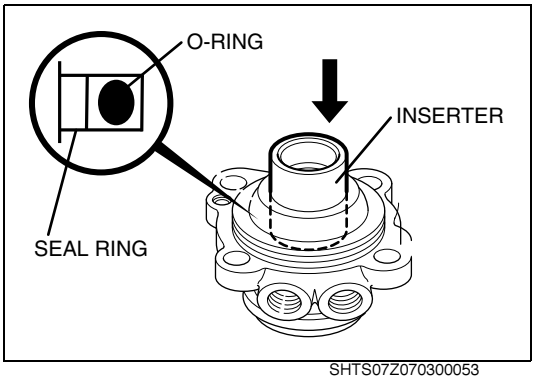
SHTS07Z070300052

(2) Form the back-up ring using the special tool.
SST: Inserter Assembly (09657-1860)

NOTICE
There are five kinds of inserters as below, and install the back-up ring using the inserter for the diameter 48 mm {1.890 in.}.

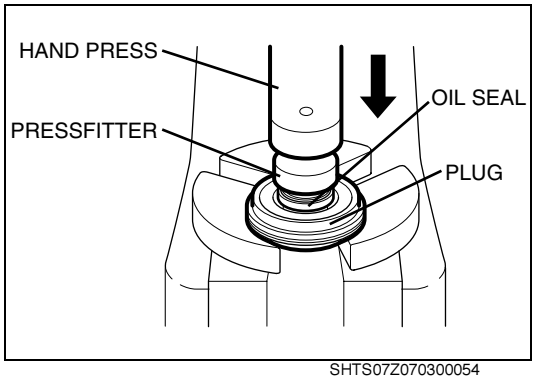
Unit: mm {in.}

INSERTER DIAMETER
40 {1.575}
45 {1.772}
48 {1.890}
53 {2.087}
58 {2.283}



SHTS07Z070300053

3. INSTALL THE VALVE HOUSING.
(1) Insert an O-ring and a seal ring into each of the three narrower grooves of the five grooves in the valve housing.
(2) Then, form the seal ring using the special tool.
SST: Inserter (09657-1850)



SHTS07Z070300054

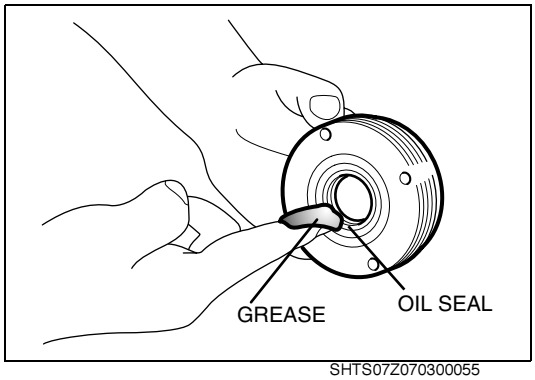
4. INSTALL THE PLUG AND SEAL ASSEMBLY.

(1) Press fit the oil seal into the inside of the plug and seal assembly using the special tool.

NOTICE

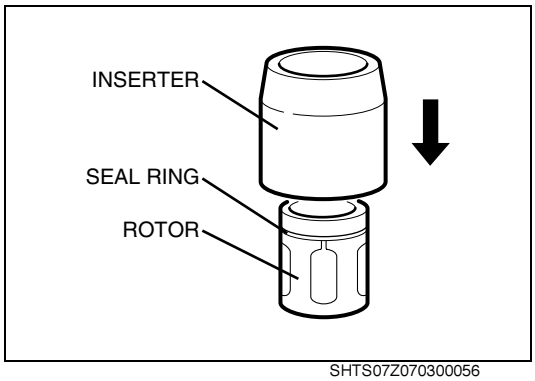
Always use a hand press when press fitting the oil seal.

SST: Press Fitter (09659-1410)



SHTS07Z070300055

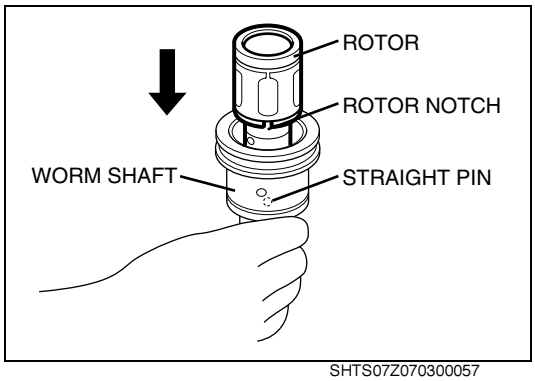
(2) Apply grease to the oil seal and then install the ball bearing.



SHTS07Z070300056

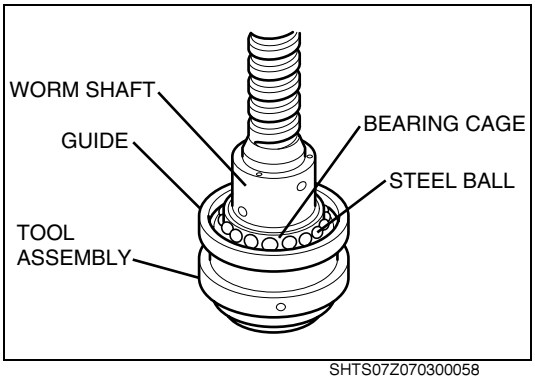
5. INSTALL THE WORM SHAFT AND THE VALVE HOUSING.

(1) Form the seal ring using the special tool after assembling the seal ring in the outer groove of the rotor.
SST: Inserter (09657-1850)



SHTS07Z070300057

(2) Insert the rotor between the stub shaft and the worm shaft. At this time, assemble it so that the straight pin in the bottom fits in the rotor notch.



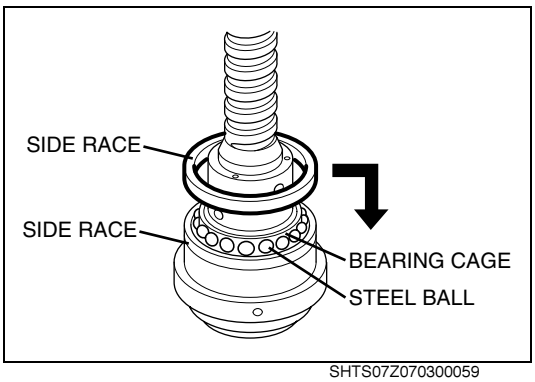
SHTS07Z070300058

(3) Fit the guide into the special tool and insert the previously assembled worm shaft assembly into the guide with the input side down.
SST: Tool Assembly (09657-1870)

NOTICE
There are two kinds of guide as below, and install worm shaft assembly using the guide for power piston diameter 90-110 mm {3.544-4.330 in.}.

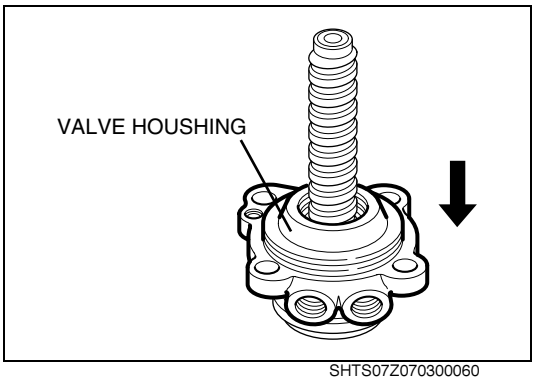
Unit: mm {in.}

POWER PISTON DIAMETER
85 {3.346}
90-110 {3.544-4.330}



SHTS07Z070300059

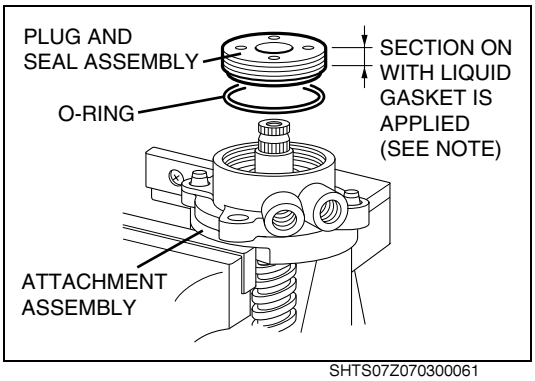
(4) Install the race of bearing side (one side), the bearing cage and the steel balls, and allow the tool assembly to slide down and set the balls in position.
(5) Remove the guide and fit the other side race.



SHTS07Z070300060

(6) Assemble the valve housing to the worm shaft assembly and previously assembled bearing sub-assembly by inserting it from the worm shaft side.

NOTICE
- **When fitting the valve housing, do not damage the seal ring in the valve housing.**
- **Inserter (09657-1850) can be used to form the seal rings of the valve housing part.**

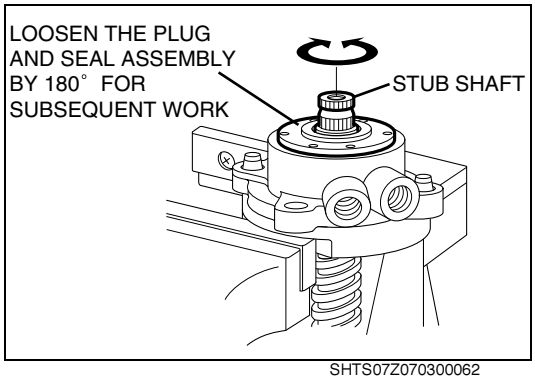


SHTS07Z070300061

(7) Secure the special tool in the vise.
SST: Attachment Assembly (09659-1400)

(8) Fit the previously assembled worm shaft assembly and valve housing onto the attachment assembly, place the O-ring in the inner groove of the valve housing, and screw the plug and seal assembly into the valve housing.

NOTICE
- **Apply liquid gasket (equivalent to ThreeBond 1102) to the screw section of the plug and seal assembly.**
- **The O-ring must not be fitted in the thread escape groove of the valve housing.**
- **When assembling the plug and seal assembly, do not let the stub shaft serration damage the oil seal.**

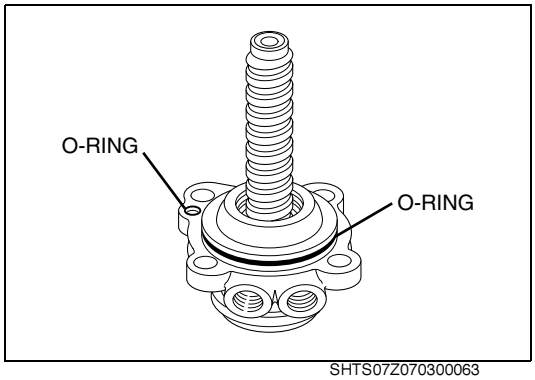


SHTS07Z070300062

(9) Tighten the plug and seal assembly using the special tool.
SST: Wrench Assembly (09603-1560)

NOTICE
Check that the stub shaft rotates smoothly and uniformly while holding the valve housing.

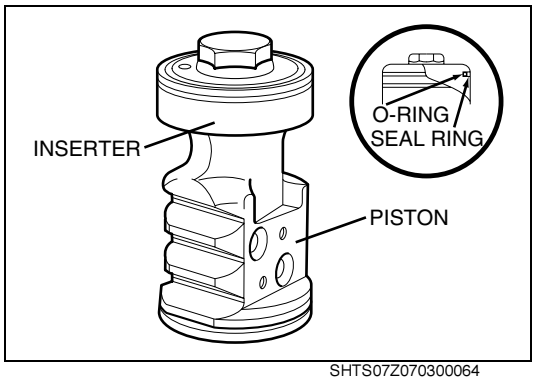
(10) Loosen the plug and seal assembly by approx 180°.



SHTS07Z070300063

(11) Install O-rings in the groove around the outside of the valve housing, and in the oil port recess.

NOTICE
Do not twist the O-rings.



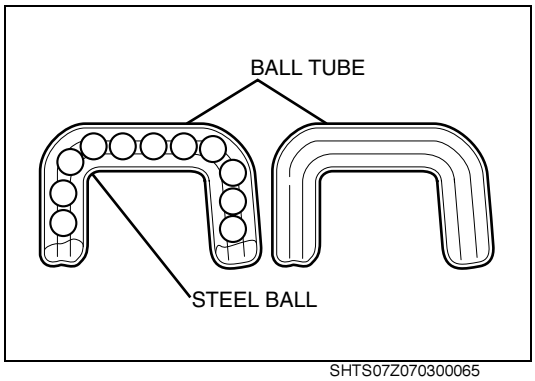
SHTS07Z070300064

6. INSTALL THE POWER PISTON.

(1) Fit the O-ring and seal ring in the groove around the outside of the power piston and form the seal ring using the special tool.

NOTICE
Do not twist the O-ring or stretch the seal ring.

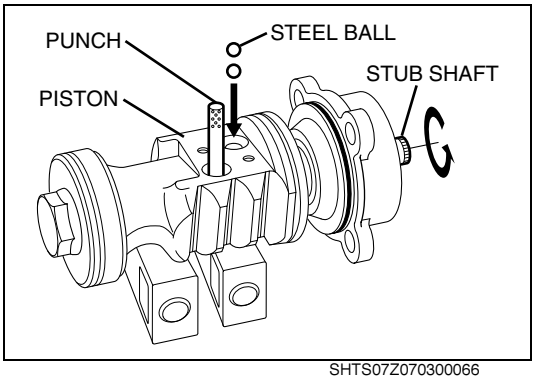
SST: Inserter (09657-1840)



SHTS07Z070300065

(2) Place the power piston on the bench.
(3) Fill the ball tube with grease, lay 10-11 steel balls in the tube, and place the other side of the ball tube on top.

NOTICE
Never fix the piston in a vise.

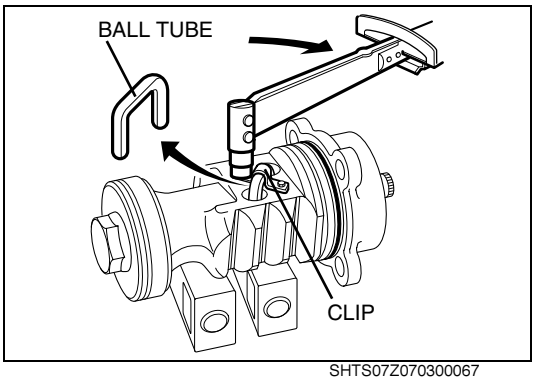


SHTS07Z070300066

(4) Insert the worm shaft and valve housing assembly in the center hole of the power piston, align the power piston and worm shaft ball races, and drop the remaining steel balls one by one through the piston's ball tube hole.

NOTICE

- **Drop the steel balls while turning the stub shaft to facilitate assembly.**
- **Steel balls sometimes come out of the hole on the other side of the ball tube after a certain number are inserted. Plug the hole with a punch to prevent the steel balls from coming out.**
- **When installing the steel balls, the worm shaft and valve housing assembly must not be drawn out to its extreme position, as the steel balls may drop outside the ball race.**



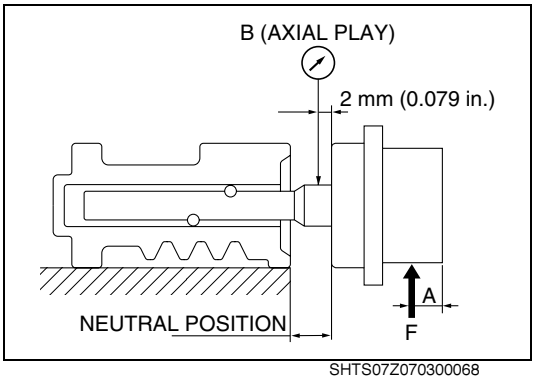
SHTS07Z070300067

(5) After inserting the steel balls in the power piston, insert the ball tube into the power piston and fix it using the clip, washer, and screw.

NOTICE

Always push in the ball tube by hand. Never force or strike it. If forced or struck, the ball tube may be deformed, the edge may be nipped, or otherwise damaged, causing malfunctions.

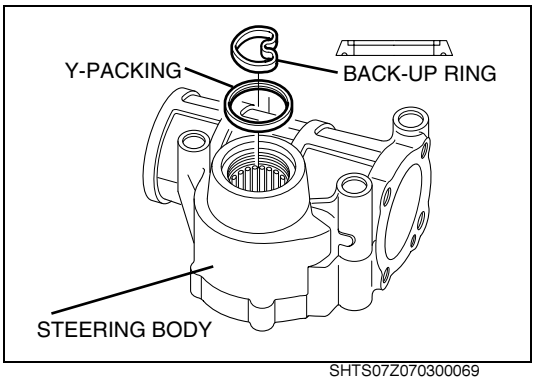
(6) Tighten the screw to the specified torque.



SHTS07Z070300068

(7) Measure the axial play between the power piston and the worm shaft assembly.

A (point of application)	**20 mm {0.787 in.}**
F (force)	**5 kg**
B (axial play)	**0.5 mm {0.0197 in.} or less**



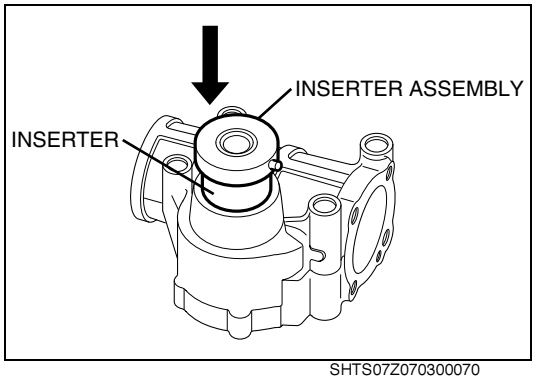
SHTS07Z070300069

7. INSTALL THE STEERING BODY.

(1) Fit the Y-packing and back-up ring in the groove in front of the needle roller bearing (in the hole for the steering body output shaft).

NOTICE

- **Back-up ring installation is facilitated by pinching the ring with the fingers as shown in figure.**
- **After filling the groove with grease, assemble the Y-packing so that the lip faces to the needle roller bearing.**



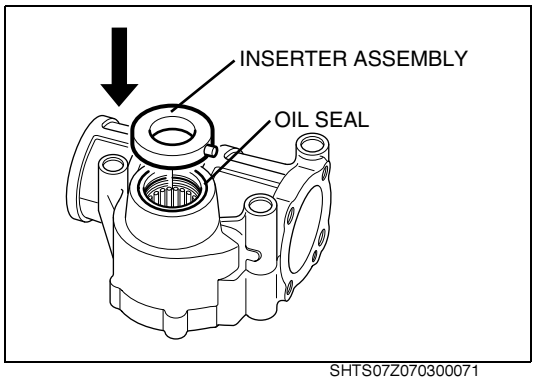
SHTS07Z070300070

(2) Form the back-up ring using the special tool.
SST: Inserter Assembly (09657-1860)

NOTICE
There are five kinds of inserters as below, and install the back-up ring using the inserter for the diameter 58 mm {2.283 in.}.

Unit: mm {in.}

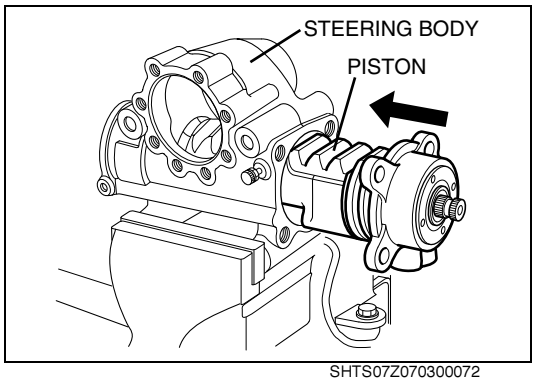
INSERTER DIAMETER
40 {1.575}
45 {1.772}
48 {1.890}
53 {2.087}
58 {2.283}



SHTS07Z070300071

(3) Press fit the oil seal into the steering body using the special tool.
SST: Inserter Assembly (09657-1860)

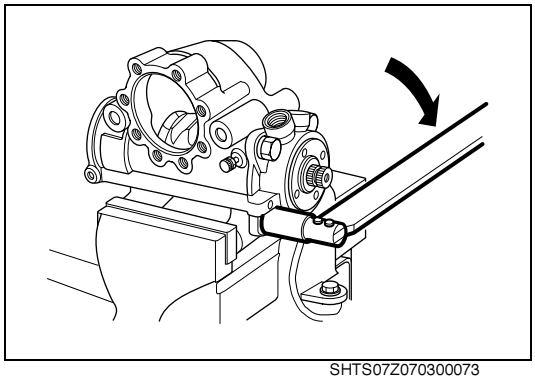
(4) Fill the oil seal with grease.



SHTS07Z070300072

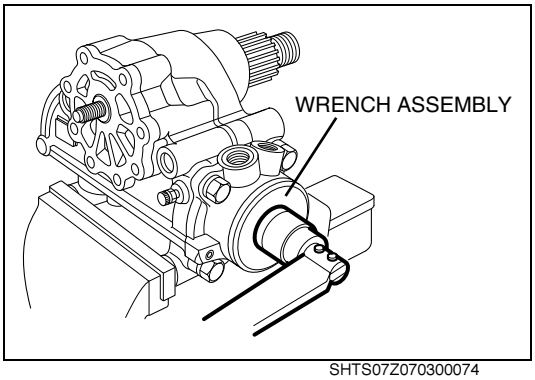
8. INSTALL THE VALVE HOUSING AND BALL NUT ASSEMBLY.
(1) Secure the steering body in the vise.
(2) Fit the worm shaft and valve housing assembly by inserting it into the steering body with the power piston gear placed on the side of the sector shaft. Hold the power piton lightly by hand so that it dose not rotate.

NOTICE
- **When inserting the worm shaft and valve housing assembly, do not damage the piston seal ring.**
- **Be careful that the O-ring dose not fall out.**


SHTS07Z070300073

(3) Align the steering body and valve housing oil passage holes and tighten the bolt to the specified torque.

NOTICE
Insert a bar into the bolt hole to align the body and housing oil passage holes. Prevent housing rotation to prevent the O-ring from being cut or dislodged.

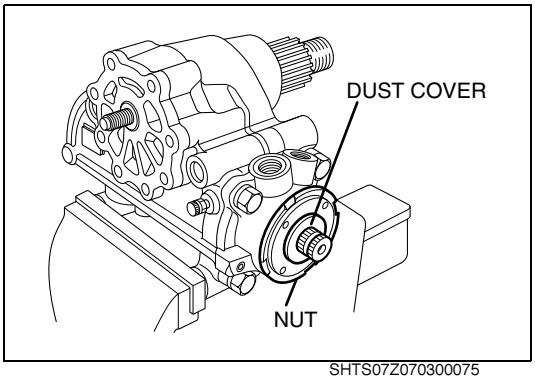


SHTS07Z070300074

(4) Tighten the plug and seal assembly (which was previously loosened through 180°) to the specified torque using the wrench assembly.
SST: Wrench Assembly (09603-1560)

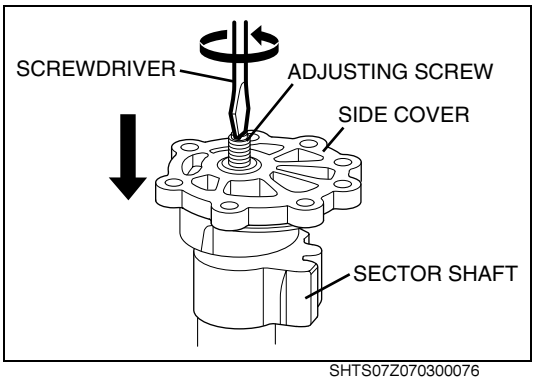
NOTICE
After applying a thin and uniform coat of liquid gasket to 3-5 whole threads of the screw part of the plug and seal assembly and tightening it with the indicated torque, apply turning stopper punches every 180°.

Liquid gasket: Equivalent to ThreeBond 1102



SHTS07Z070300075

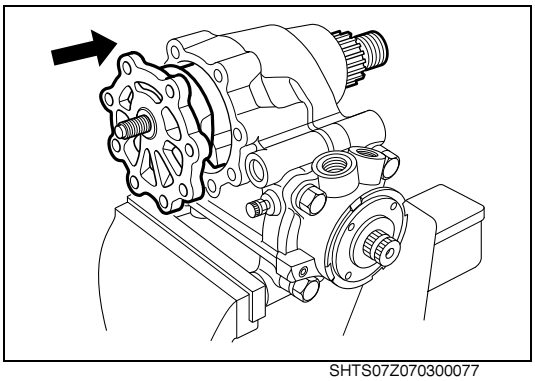
(5) Attach the dust cover to the valve housing.



SHTS07Z070300076

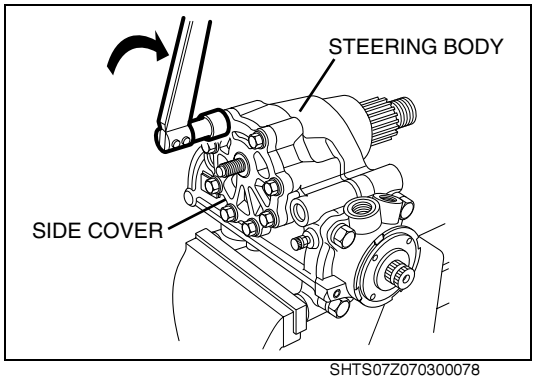
9. INSTALL THE SIDE COVER ASSEMBLY AND SECTOR SHAFT.

(1) Assemble the side cover assembly to the sector shaft assembly by aligning the screw hole in the center of the side cover with the adjusting screw and turning the adjusting screw.
Install the O-ring around the outside of the side cover.


SHTS07Z070300077

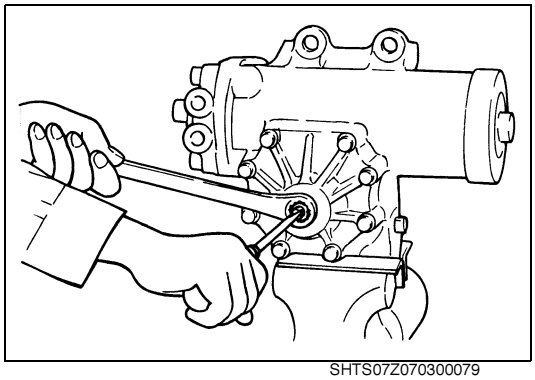
(2) Insert the sector shaft into the steering body so that its gear and the power piston gear engage in the center.

NOTICE
When inserting the sector shaft, do not let the sector shaft serration damage the lip of the Y-packing. Damage may affect oil tightness.



SHTS07Z070300078

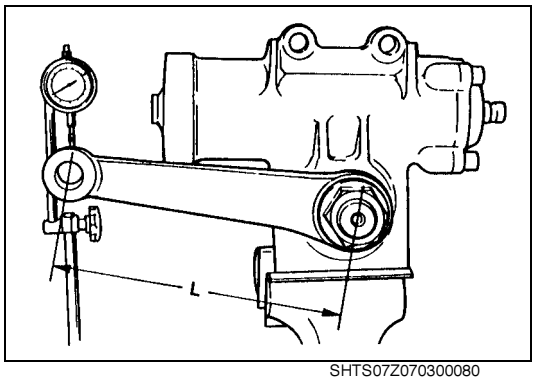
(3) Assemble the side cover to the steering body using the bolts. Tighten them to the specified torque.


SHTS07Z070300079

10. MEASURE THE SECTOR SHAFT BACKLASH.

(1) Align the marks on the sector shaft with pitman arm.

(2) Install the pitman arm and tighten the nut finger tight.

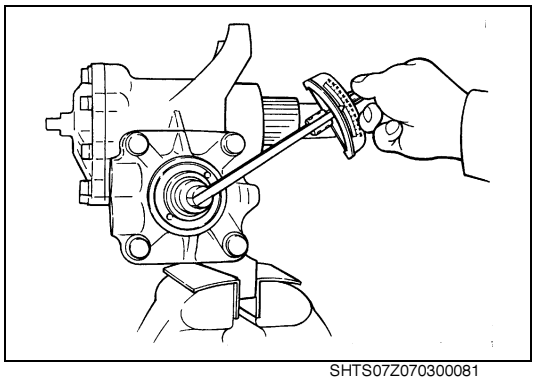


SHTS07Z070300080

(3) Use a dial gauge to check to see that the sector shaft backlash in neutral position.

L	Backlash
270 mm {10.63 in.}	0.05-0.25 mm {0.002-0.009 in.}

(4) If measurement is not within specification, readjust the backlash with adjusting screw.


SHTS07Z070300081

11. INSPECT THE WORM VALVE ASSEMBLY ROTATION CONDITION.

(1) Check to see that the worm valve assembly rotate smoothly without any shocks, abnormal resistance, noise and drag, when the worm valve assembly rotates full lock in both direction.

12. TIGHTEN THE PITMAN ARM LOCK NUT.

INSPECTION AND REPAIR

EN07Z0703H300003

METALLIC PARTS

Inspection item	Location	Remedy
Steering body	• The internal surface of the cylinder	Repair or replace the steering body if there is evidence of abrasion or stepped wear. Check visually and by touch for any flaws that may affect smooth piston stroke.
	• Side cover assembly surface	Repair or replace the steering body if there is evidence of any flaws, rust or gouging that may affect oil tightness (check visually and by touch).
	• Y-packing groove in the sector shaft hole	Repair or replace the steering body if there is evidence of any flaws, rust or gouging that may affect oil tightness (check visually and by touch).
Sector shaft	• Gear	Replace the gear if it is severely flawed or worn. Chipped gears must also be replaced. (Check visually and by touch)
	• Gear shaft and serrations	Check for cracks using magnetic-particle test equipment and a color penetration test. Replace any cracked parts.
	• Needle roller bearing contact surface	Check for wear, flaws or gouging (visually and by touch). Repair or replace if necessary.
	• Y-packing contact surface	Repair or replace if any flaws, rust or gouging affecting oil tightness are found (check visually and by touch).
	• Adjusting screw	Measure the axial clearance of the adjusting screw with a dial gauge. 0.01-0.1 mm is acceptable, but if excessive, the screw must be disassembled for inspection. Also check whether the adjusting screw rotates smoothly. If not, the screw must be disassembled and inspected.
Power piston	• Cylinder contact surface	Any wear or abrasion that affects smooth piston stroke must be corrected, or the power piston must be replaced.
	• Rack gear	Replace the rack gear if severely flawed, worn or chipped.
	• Steel ball race surface	Any wear or flaw that disturbs smooth rotation and movement of steel balls must be corrected, or the race must be replaced. (Visual inspection)
	• Seal ring and O-ring	Replace the seal ring or O-ring if any flaws or tears affecting oil tightness are found.
Ball tube	• Steel ball rotation surface	Replace the ball tube if any wear, flaws or gouging that affect smooth ball rotation are found on the inside at the tube.
	• Tang (end)	Replace the ball tube if any warping, bending, flaws or pits that affect smooth ball rotation are found on the tang.

Inspection item	Location	Remedy
Worm shaft (stub shaft)	• Steel ball race surface	Repair or replace the race if any wear, flaws or pits that affect smooth ball rotation are found.
	• Seal ring	Any wear, flaw, or gouge affecting oil tightness must be corrected or the seal ring must be replaced.
	• Y-packing contact surface	Any wear, flaw, rust, or gouge which may affect oil tightness must be corrected or the packing must be replaced.
	• Thrust bearing (steel ball) contact surface	Check the bearing for wear, flaws or pits if shaft rotation is stiff or uneven. Repair or replace if found.
Thrust bearing (steel ball) and bearing cage	• Bearing race and steel ball	Check the bearing for wear, flaws or pits if shaft rotation is stiff or uneven. Repair or replace if found.
	• Bearing cage	Replace the cage if any flaws or damage affecting smooth rotation are found.
Rotor	• External surface	Repair or replace the rotor if any wear, flaws or gouging affecting smooth rotation are found.
	• Chamber	Replace the chamber if any flaws, breaks, or chips affecting steering characteristics are found.
	• Seal ring groove	Replace the seal ring if any flaws or tears affecting oil tightness are found.
Side cover	• Steering body contact surface	Repair or replace the side cover if any flaws, gouging or rust affecting oil tightness are found.
	• Y-packing groove	Repair or replace the side cover if any flaws, gouging or rust affecting oil tightness are found.
	• O-ring groove	Repair or replace the side cover if any flaws, gouging or rust affecting oil tightness are found.
Plug and seal assembly	• Thrust bearing side race contact surface	Repair or replace the plug and seal assembly if any flaws, rust or gouging affecting uniform tightening are found.
	• Y-packing press fitted section	Replace the plug and seal assembly if any flaws, rust or gouging affecting oil tightness are found.
	• O-ring contact surface	Replace the plug and assembly if any flaws, rust or gouging affecting oil tightness are found.
Bearings		Check that the bearing rotates smoothly. Replace the bearing if rotation is stiff or uneven.

POWER STEERING BOOSTER UNIT

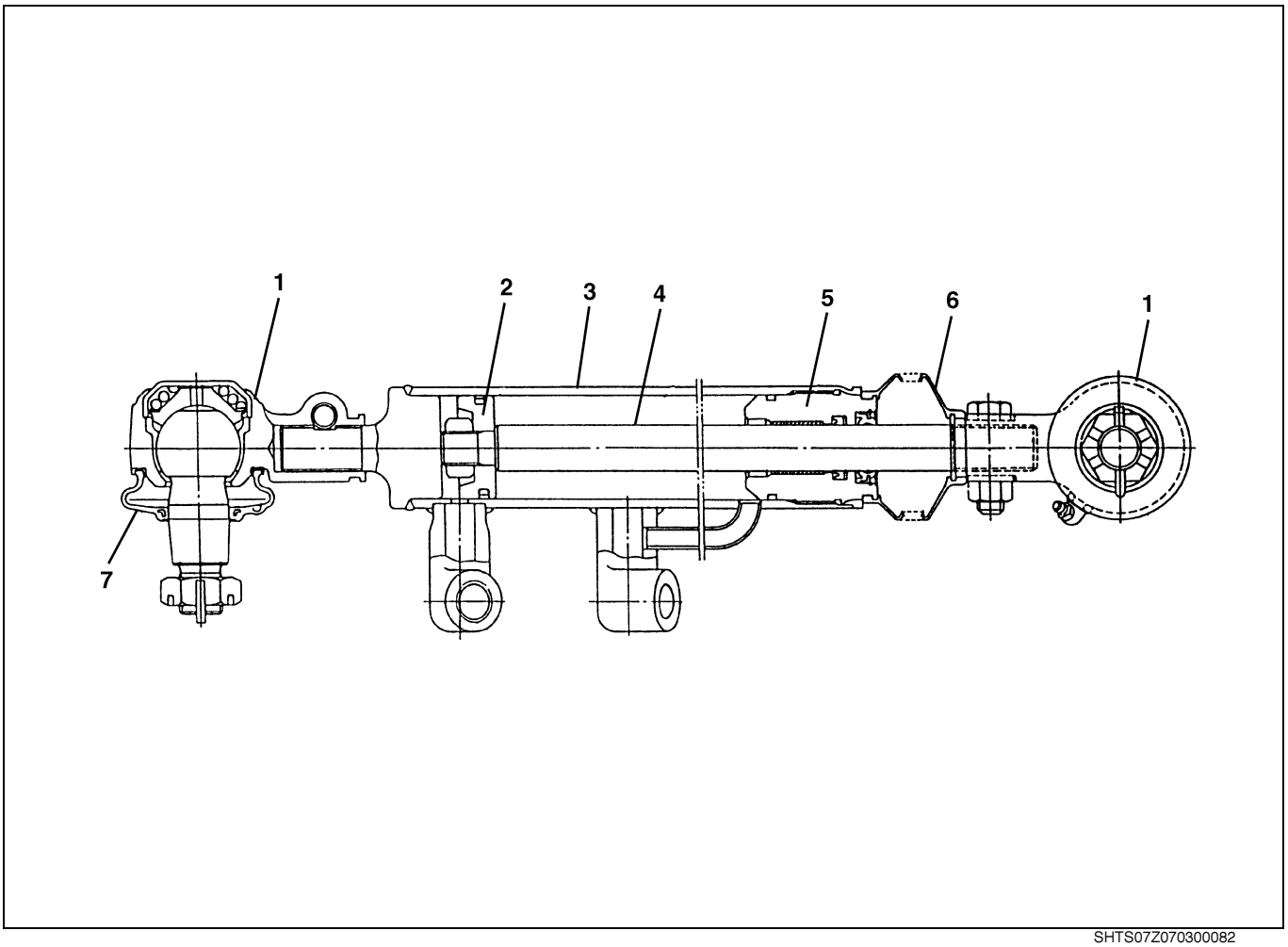
DATA AND SPECIFICATIONS

EN07Z0703I200002

Bore	**50 mm {1.968 in.}**
Stroke	**280 mm {11.024 in.}**
Piston rod diameter	**22 mm {0.866 in.}**

DESCRIPTION

EN07Z0703C100003



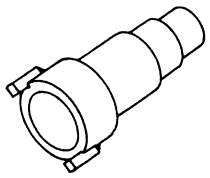
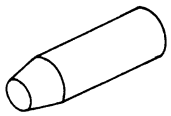
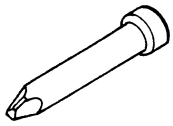
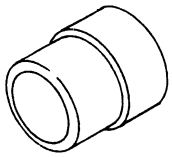
SHTS07Z070300082

1	**Ball joint socket**	**5**	**Guide assembly**
2	**Piston**	**6**	**Boot**
3	**Cylinder**	**7**	**Dust seal**
4	**Rod**		

SPECIAL TOOL

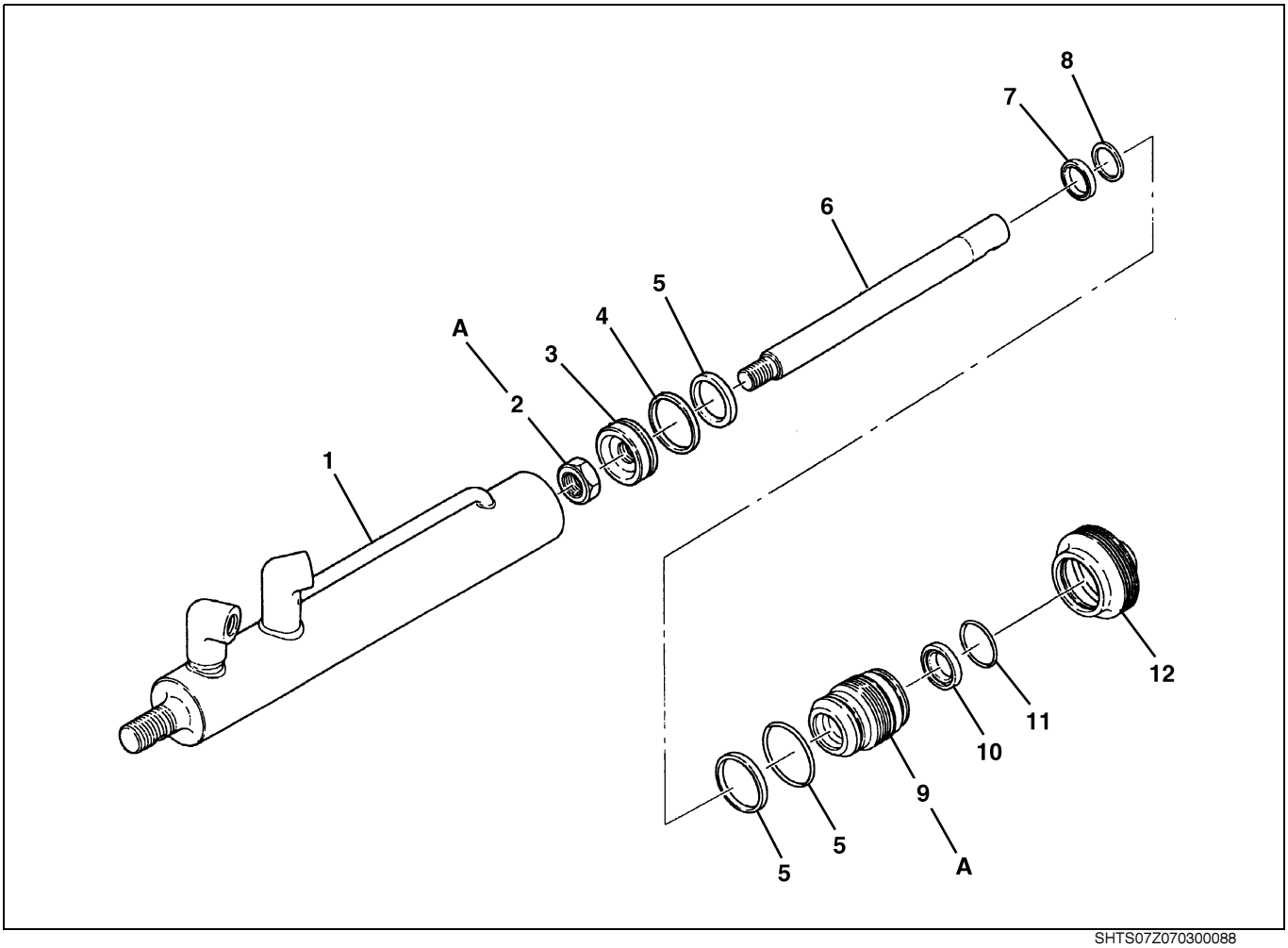
EN07Z0703K100002

Prior to starting a power steering booster unit overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	09603-1540	GUIDE REMOVER	
	09657-1780	DUST SEAL INSTALLING JIG	
	09657-1770	ROD CAP	
	09434-1120	ROD END STAKING JIG	
	09657-1760	PISTON INSTALLING JIG	

COMPONENT LOCATOR

EN07Z0703D100002



SHTS07Z070300088

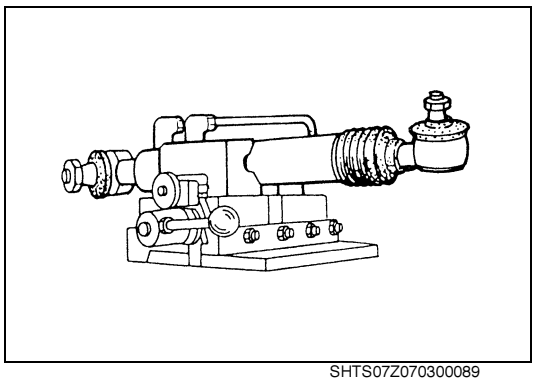
1	Cylinder	7	Dust seal
2	Nut	8	Back up ring
3	Piston	9	Guide assembly
4	Slipper seal	10	Dust seal
5	O-ring	11	Ring retainer
6	Rod		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	98 {1,000, 72}	

OVERHAUL

EN07Z0703H200003

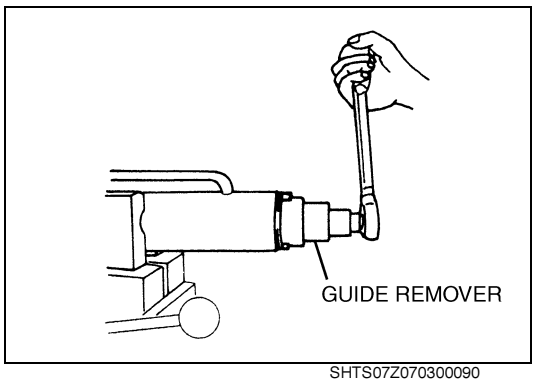

SHTS07Z070300089

IMPORTANT POINTS - DISASSEMBLY

1. INSTALL THE POWER CYLINDER IN VICE.

(1) When disassembling the power cylinder, hold in a vice using wood block to prevent damage.

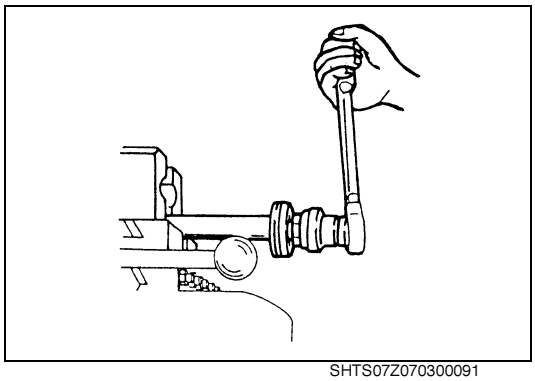
2. REMOVE THE BALL JOINT SOCKET.



SHTS07Z070300090

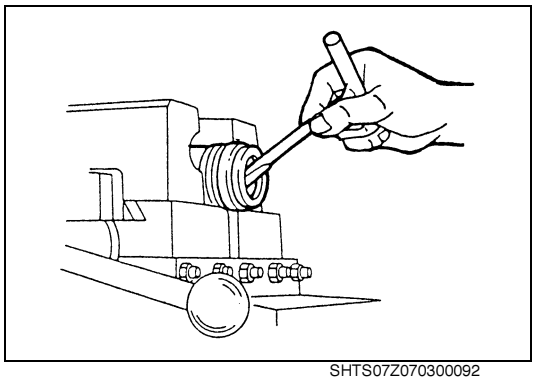
3. LOOSEN THE GUIDE ASSEMBLY.

(1) Raise staked portion of the guide and using the special tool, loosen the guide assembly.
Do not remove the guide assembly from the rod side but remove integral with the rod from the cylinder.
SST: Guide Remover (09603-1540A)


SHTS07Z070300091

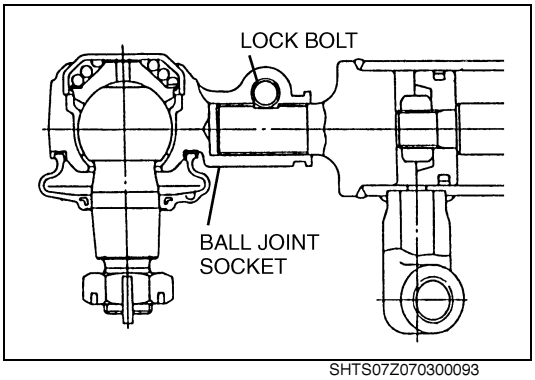
4. REMOVE THE PISTON.

(1) Loosen the nut and remove the piston and guide assembly. Do not reuse the nut. Be sure to replace it with a new one. Correct the piston side threaded portion of the rod by dies.


SHTS07Z070300092

5. REMOVE THE RETAINER RING AND DUST SEAL.

(1) Remove the retainer ring, dust seal, etc. from the guide assembly, using care not to damage grooves and rod sliding surface.

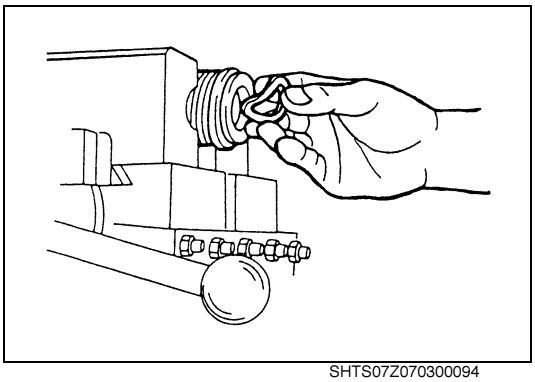


SHTS07Z070300093

6. REMOVE THE BALL JOINT SOCKET.

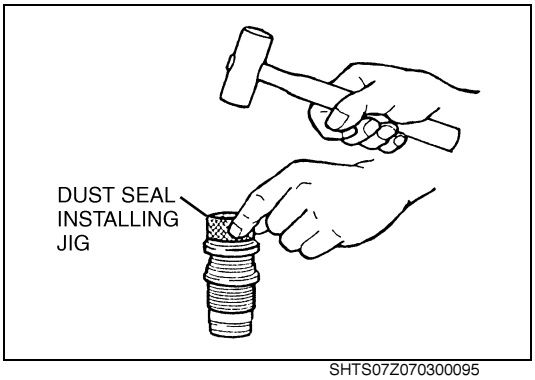
(1) Loosen the lock bolt of ball joint socket, then turn the ball joint socket to counterclockwise and remove it.

IMPORTANT POINTS - ASSEMBLY


SHTS07Z070300094

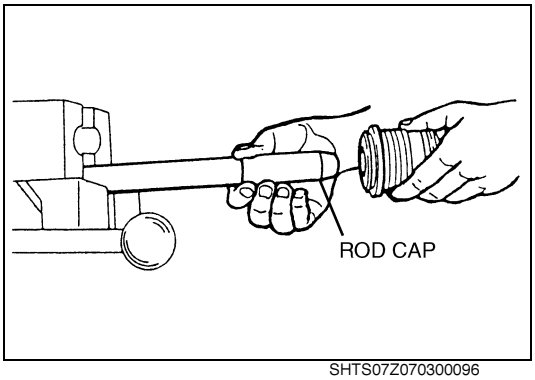
1. ASSEMBLE THE GUIDE ASSEMBLY.

(1) Install the dust seal.
When inserting the dust seal, bend it to heart shape.



SHTS07Z070300095

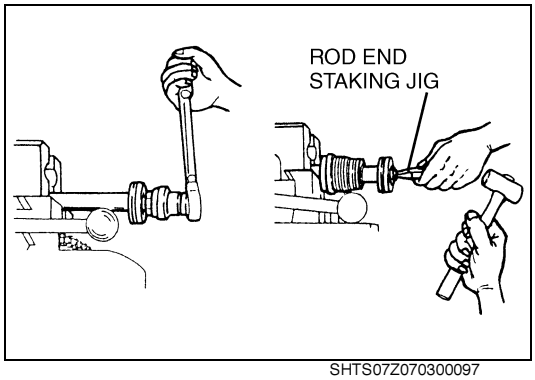
(2) Install the dust seal.
Install the dust seal using the special tool.
SST: Dust Seal Installing Jig (09657-1780A)



SHTS07Z070300096

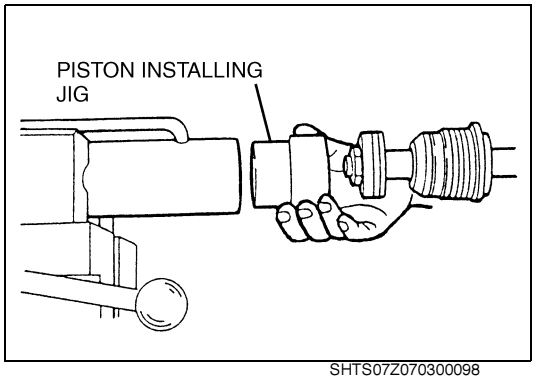
2. INSTALL THE GUIDE ASSEMBLY.

(1) Using the special tool, at the piston rod end, insert the guide assembly.
SST: Rod Cap (09657-1770A)



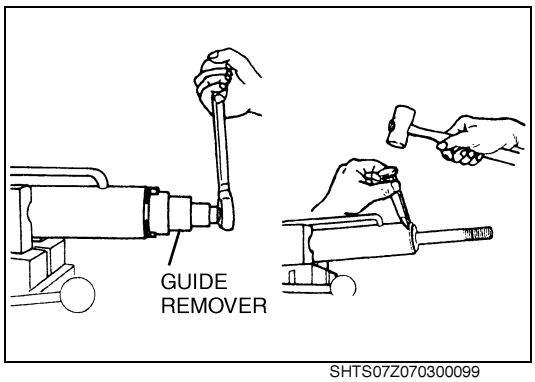
SHTS07Z070300097

3. INSTALL THE PISTON.
(1) Install the piston, and then tighten the nut.
(2) Staking the rod end (three places) using the special tool.
SST: Rod End Staking Jig (09434-1120A)



SHTS07Z070300098

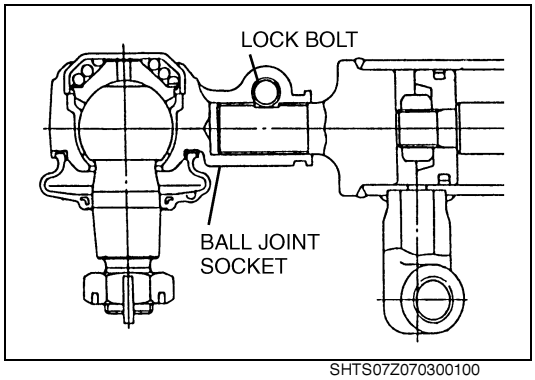
4. INSTALL THE PISTON AND ROD.
(1) Apply hydraulic oil to inside of cylinder.
(2) Install the piston and rod using the special tool.
SST: Piston Installing Jig (09657-1760A)



SHTS07Z070300099

5. STAKING THE GUIDE ASSEMBLY.
(1) Tighten the guide assembly using the special tool.
SST: Guide Remover (09603-1540A)

(2) Secure the guide assembly on the cylinder by staking the tube end on the outer circumference groove of the guide assembly.



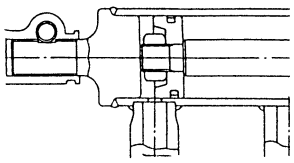
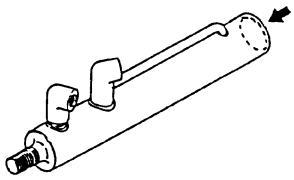
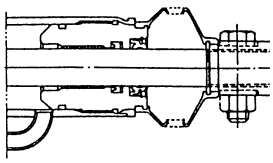
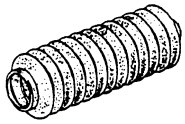
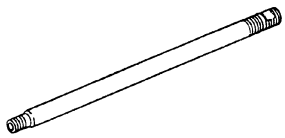
SHTS07Z070300100

6. INSTALL THE BALL JOINT SOCKET.

INSPECTION AND REPAIR

EN07Z0703H300004

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Clearance between piston and cylinder	0.064 - 0.137 {0.0025-0.0054}	0.18 {0.0071}	Replace the piston and/or cylinder.	Measure 
Cylinder: Scratches on inner surface.	—	—	Replace, if necessary.	Visual check 
Clearance between rod and guide assembly	0.024-0.112 {0.0009-0.0044}	0.12 {0.0047}	Replace the rod and/or guide.	Measure 
Rod: Bent and/or damaged.	—	—	Replace, if necessary.	Visual check 
Boots: Damaged.	—	—	Replace, if necessary.	Visual check 

POWER STEERING PUMP

DATA AND SPECIFICATIONS

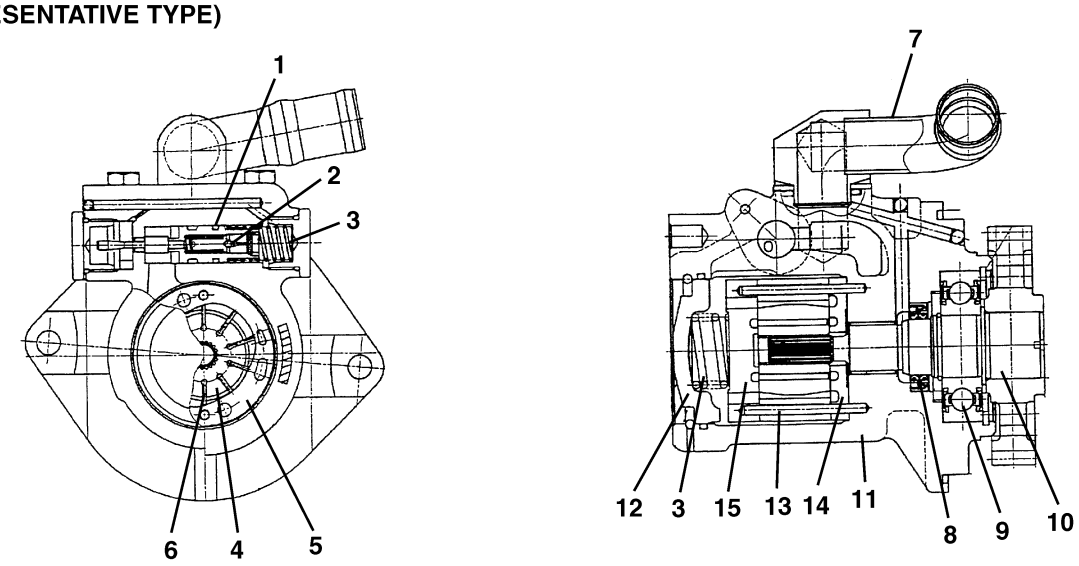
EN07Z0703I200003

Type		Vane type
Speed range		707-5,200 r/min
Relief pressure		14.0-14.7 MPa {143-150 kgf/cm^2, 2,030-2,132 lbf/in.^{2}}
Flow rate	Front single axle model	18.5-21.5 L/min. {4.89-5.67 U.S.gal, 4.07-4.72 Imp.gal} at 2,000 r/min.
	Front tandem axle model	26-29 L/min. {6.87-7.66 U.S.gal, 5.72-6.38 Imp.gal} at 2,000 r/min.

DESCRIPTION

EN07Z0703C100004

(REPRESENTATIVE TYPE)



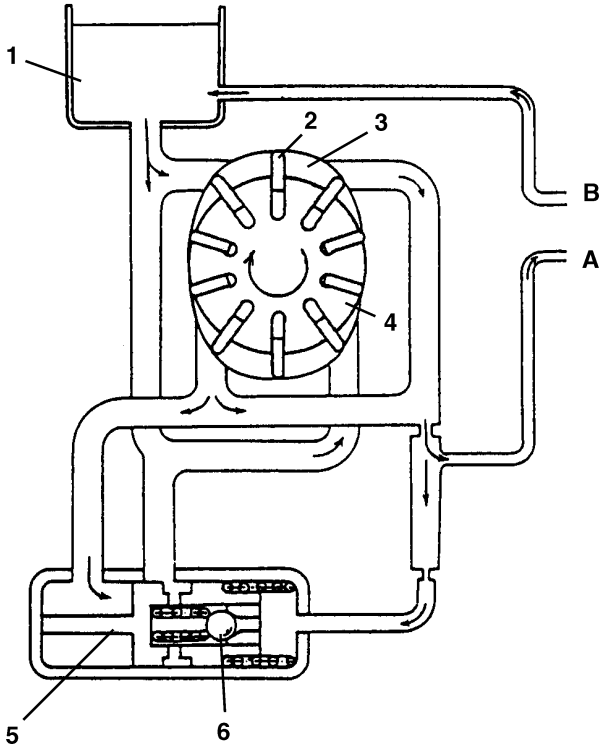
SHTS07Z070300106

1	Flow control valve assembly	9	Ball bearing
2	Relief valve	10	Pump shaft
3	Spring	11	Pump body
4	Rotor	12	Pump cover
5	Cam ring	13	Dowel
6	Vane	14	Front plate
7	Suction connector	15	Rear plate
8	Oil seal		

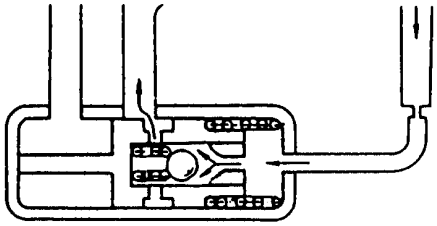
OPERATION

EN07Z0703C100005

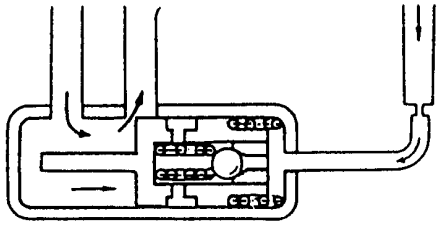
Neutral (Flow control valve assembly and relief valve are not operating)



Relief valve operation



Flow control valve operation

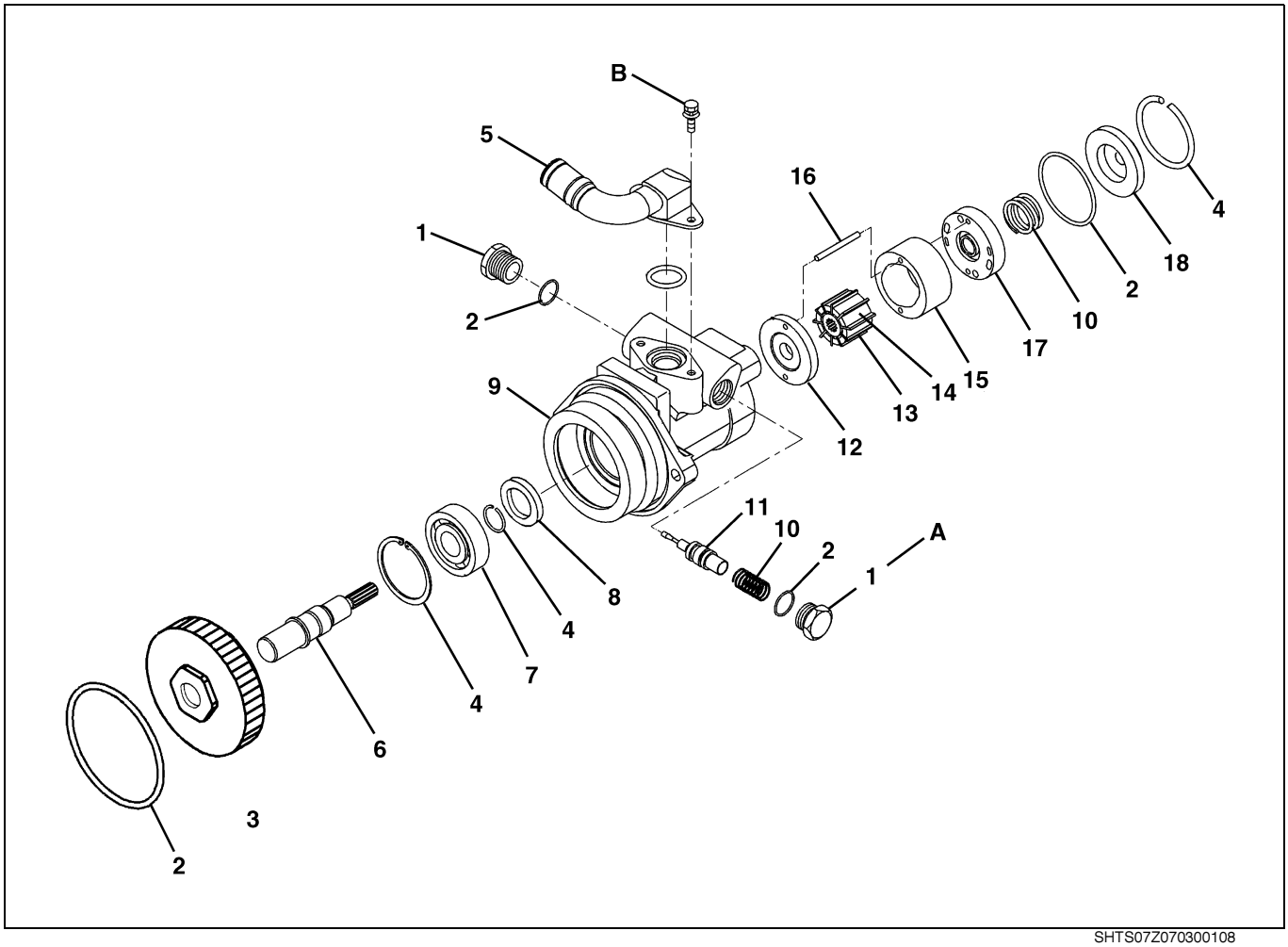


SHTS07Z070300107

1	Reservoir	5	Flow control valve assembly
2	Vane	6	Relief valve
3	Cam ring	A	To power steering gear unit
4	Rotor	B	From power steering gear unit

COMPONENT LOCATOR

EN07Z0703D100003



SHTS07Z070300108

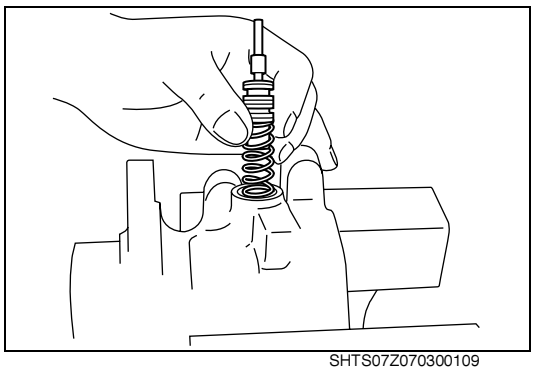
1	Plug	7	Bearing	13	Vane
2	O-ring	8	Oil seal	14	Rotor
3	Drive gear	9	Pump body	15	Cam ring
4	Retainer ring	10	Spring	16	Dowel
5	Suction connector	11	Flow control valve	17	Rear plate
6	Pump shaft	12	Front plate	18	Pump cover

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	108-127 {1,100-1,295, 80-93}	B	29-39 {295-397, 22-28}

OVERHAUL

EN07Z0703H200004


SHTS07Z070300109

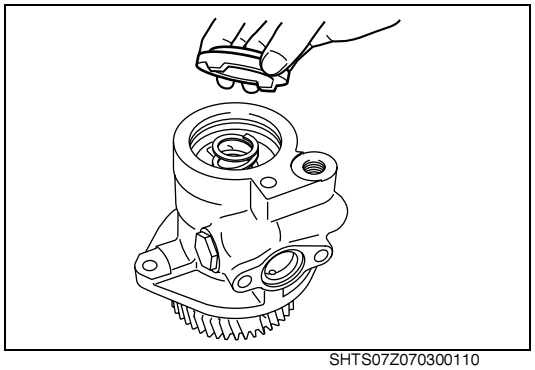
IMPORTANT POINTS - DISASSEMBLY

1. REMOVE THE FLOW CONTROL VALVE ASSEMBLY.

(1) Remove the plug, spring and flow control valve assembly.

NOTICE

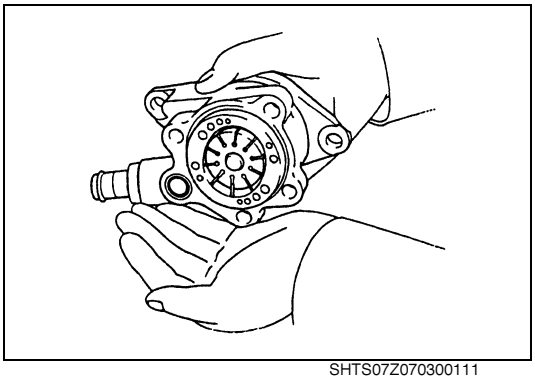
Be careful not to drop, scratch or nick the flow control valve assembly.


SHTS07Z070300110

2. REMOVE THE BODY COVER.

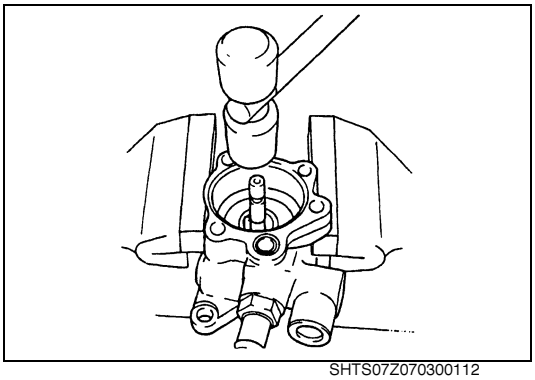
(1) Remove the retainer ring.

(2) Remove the body cover and spring.


SHTS07Z070300111

3. REMOVE THE VANE PUMP CORE.

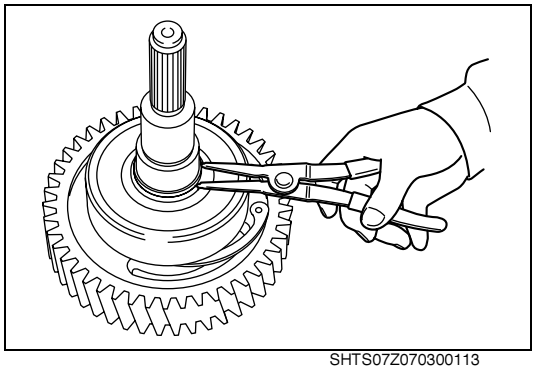
(1) As shown in the figure, face the vane pump core side downward and remove the rear plate and vane pump core. The vane pump core consists of the cam ring, rotor and vane. Since dimensional checks of these parts have been completed, handle the vane pump core carefully. Remove the front plate.


SHTS07Z070300112

4. REMOVE THE PUMP SHAFT ASSEMBLY.

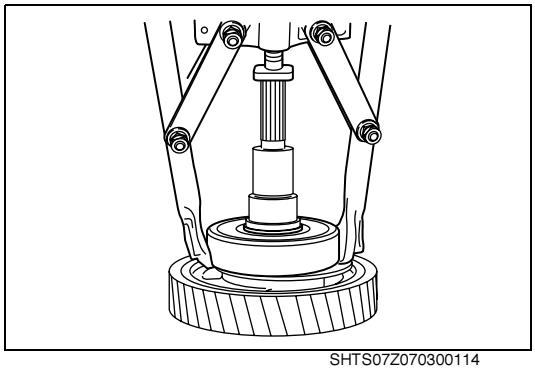
(1) Remove the retainer ring from the pump body, and push and remove the spline edge surface of the pump shaft by hand or by using a plastic hammer. Be careful not to damage the oil seal lip. This process completes disassembly. Carry out inspection.

REPLACEMENT

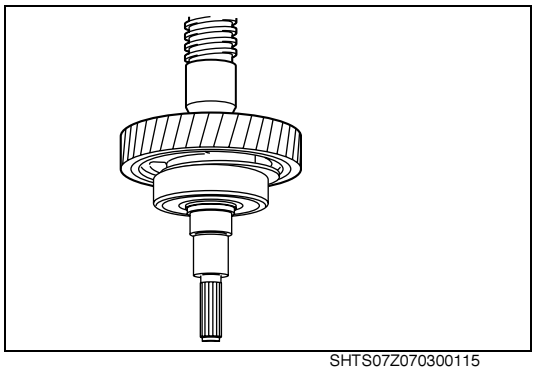

SHTS07Z070300113

1. REPLACE THE BALL BEARING, IF NECESSARY.

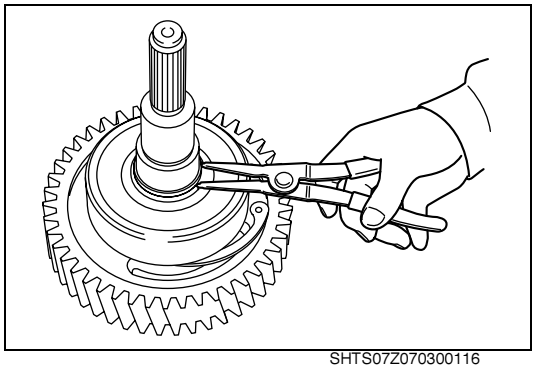
(1) Use a pair of snap ring pliers to remove the retainer ring.


SHTS07Z070300114

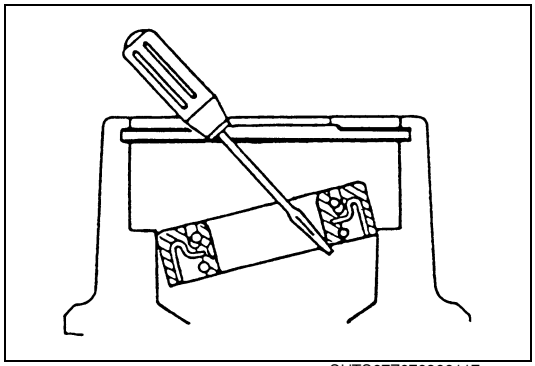
(2) Use a press, press out the ball bearing.


SHTS07Z070300115

(3) Use a press to press in the ball bearing.


SHTS07Z070300116

(4) Use snap ring pliers to install the retainer ring.

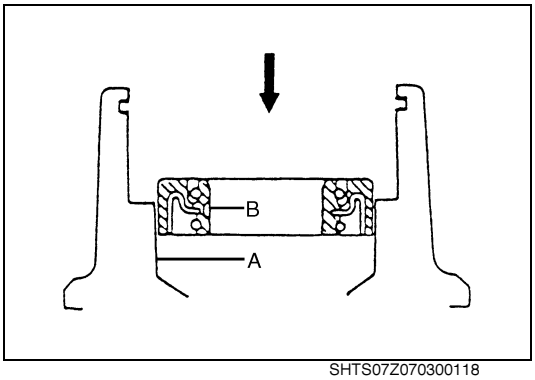

SHTS07Z070300117

2. REPLACE THE OIL SEAL, IF NECESSARY.

(1) Use a screw driver to remove the oil seal.

NOTICE

Do not scrape or damage the inside of pump body.



SHTS07Z070300118

(2) Insert the oil seal as shown in the figure.

NOTICE

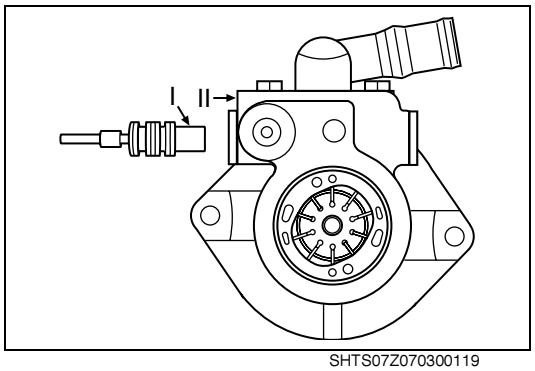
To prevent oil leakage from oil seal due to lip wear, apply lithium base grease to A and B.

(3) Using a press, press in the oil seal into the pump body.

IMPORTANT POINTS - ASSEMBLY

NOTICE

- **Before assembling, clean all the parts and lubricate them with fluid.**
- **When assembling the power steering pump, be sure to use new O-rings.**



SHTS07Z070300119

1. INSTALL THE FLOW CONTROL VALVE ASSEMBLY.

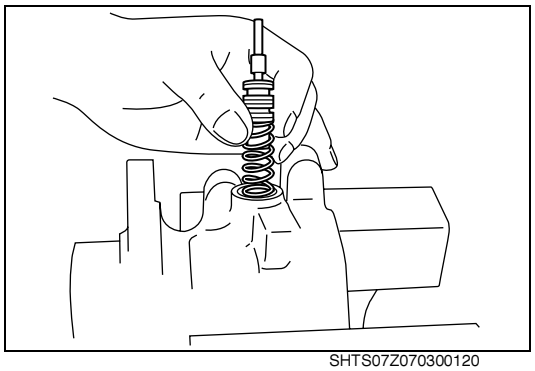
(1) Apply fluid to the valve and check to see that it falls smoothly into the valve hole by its own weight.
If a problem is detected, replace the flow control valve assembly.

NOTICE

- **There are three different valve diameters, therefore be careful that the mark on both valve and the pump body are always matched.**
- **Rank indication of flow control valve is not found on the valve built-in the power steering pump assembly. On flow control valve of spare parts, the rank is indicated.**
- **On the body of "A"rank, the rank is not indicated.**

I: Letter on the valve, II : Letter of the body

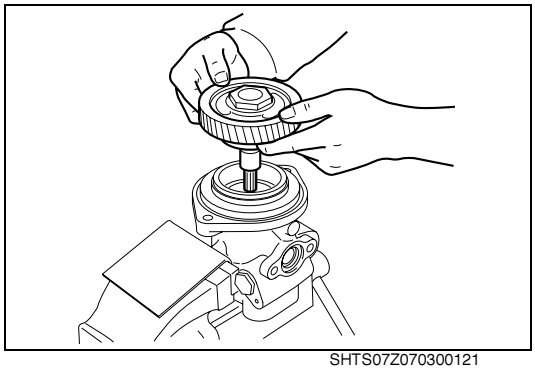
March mark	I	A	B	C
	II	—	B	C


SHTS07Z070300120

(2) Install the spring and the flow control valve assembly, and tighten the plug.

NOTICE

Apply lithium base grease to an O-ring.


SHTS07Z070300121

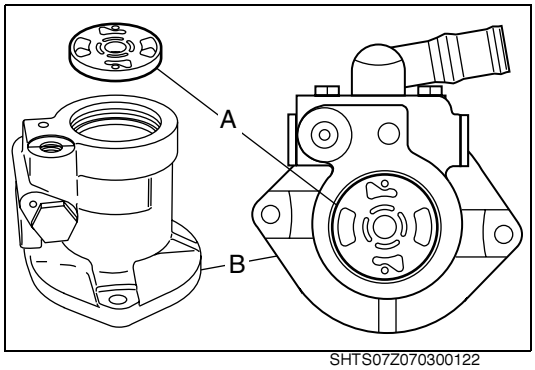
2. INSTALL THE PUMP SHAFT.

(1) Using a press, press in the pump shaft with bearing into the pump body.

(2) Install the retainer ring.

NOTICE

When installing the retainer ring, face the chamfer side toward ball bearing.



SHTS07Z070300122

3. INSTALL THE FRONT PLATE.

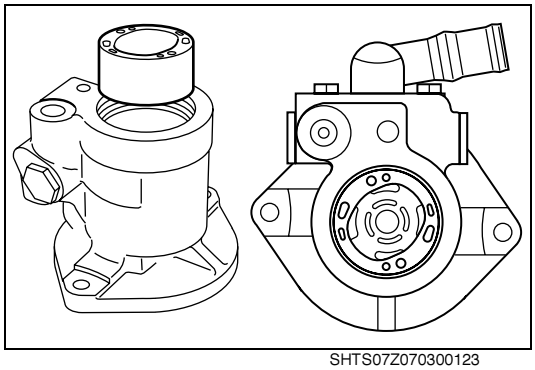
(1) As shown in the figure, insert the front plate into the pump body and the dowel into the standard hole and the long one of front plate

A: Front plate

B: Pump body

NOTICE

When inserting the front plate, the face with a stamped "RR" indication should be turned to the rear side and also the long hole be faced against the suction pipe side for the installation.

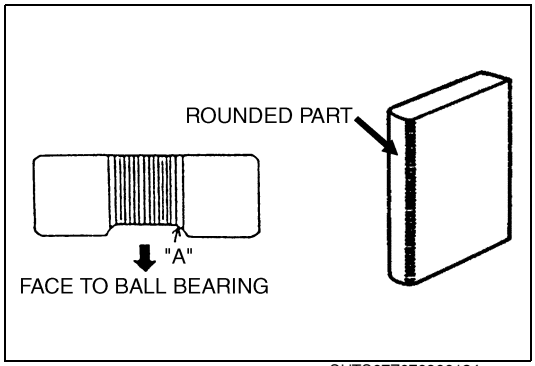

SHTS07Z070300123

4. INSTALL THE CAM RING.

(1) Insert the cam ring into the pump body through the standard hole and elliptic one with the dowel, as shown in the figure.

NOTICE

At this moment, the stamped side should be faced against ball bearing side and also the long hole turned against suction pipe side.

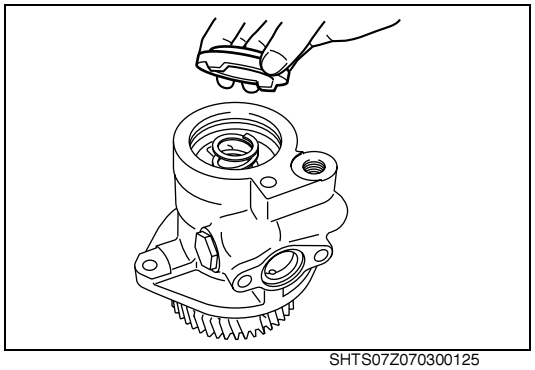


SHTS07Z070300124

5. INSTALL THE ROTOR AND VANE.

(1) Insert the rotor with the cut spline "A" side facing toward the ball bearing.

(2) Insert the vanes with the rounded part facing outward.


SHTS07Z070300125

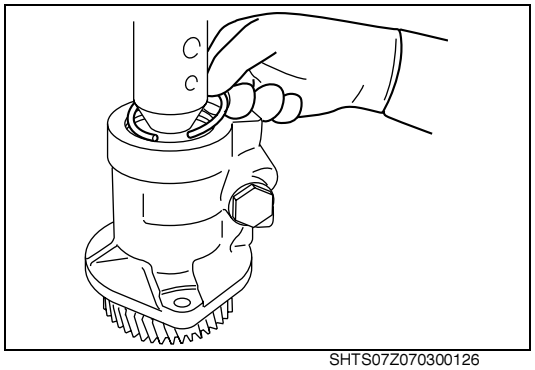
6. INSTALL THE REAR PLATE, SPRING, O-RING AND PUMP COVER.

(1) Put the rear plate on the cam ring through the standard hole and elliptic one with the dowel.

NOTICE

At this moment, the stamped side should be faced against ball bearing side and also the long hole turned against suction pipe side.

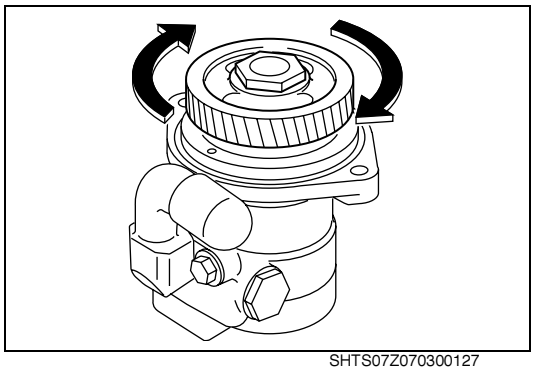
(2) Put the spring on the rear plate and insert the O-ring into the groove of the pump body.


SHTS07Z070300126

(3) Using a press, press in the pump cover and then install the retainer ring securely.

NOTICE

- **Be careful to see that the O-ring is not pinched by the rear cover.**
- **With the pump cover pressed in completely fit the retainer ring to pump body.**

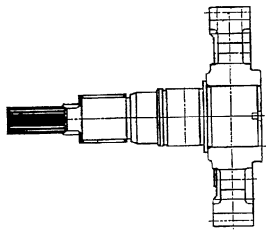
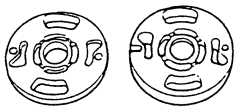
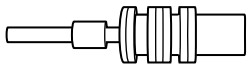
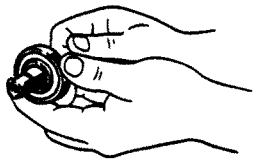
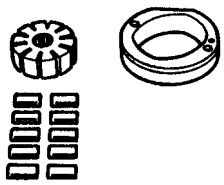
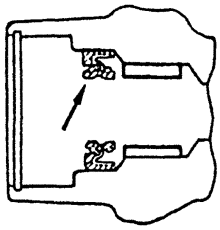
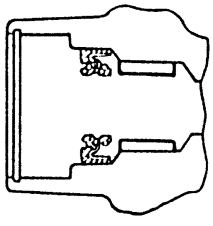

SHTS07Z070300127

7. INSPECT PUMP SHAFT ROTATING CONDITION.

(1) Check to see that the pump shaft rotates smoothly without abnormal noise.

INSPECTION AND REPAIR

EN07Z0703H300005

Inspection item	Standard	Limit	Remedy	Inspection procedure
Shaft: **Damage**	—	—	**Replace,** **if necessary.**	**Visual check** 
Side plate: **Abrasion and flaw**	—	—	**Replace,** **if necessary.**	**Visual check** 
Flow control valve assembly: **Wear and damage**	—	—	**Replace,** **if necessary.**	**Visual check** 
Ball bearing: **Scratched and damage**	—	—	**Replace,** **if necessary.**	**Visual check** 
Cam ring inner surface: **Rotor surface:** **Vane surface:** **Wear, scratches and scoring**	—	—	**Replace,** **if necessary.**	**Visual check** 
Oil seal: **Wear and damage**	—	—	**Replace,** **if necessary.**	**Visual check** 
Bushing: **Scratched and damage**	—	—	**Replace the** **pump body,** **if necessary.**	**Visual check** 

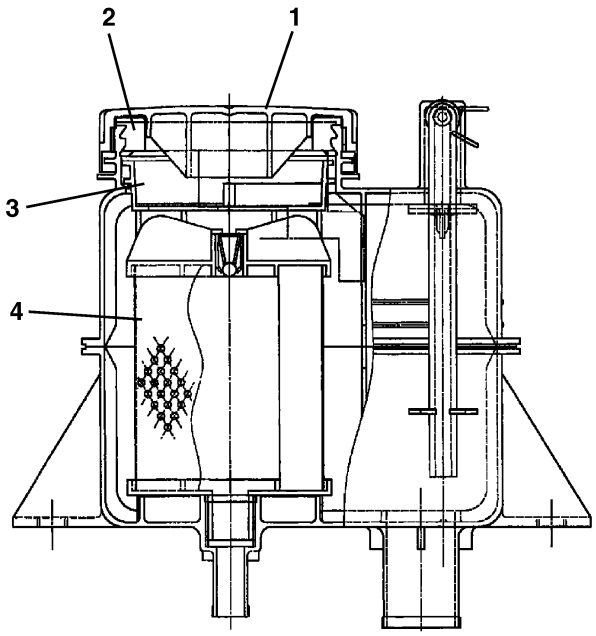
OIL RESERVOIR

DESCRIPTION

EN07Z0703C100006

EXCEPT FY LEFT-HAND DRIVE MODEL

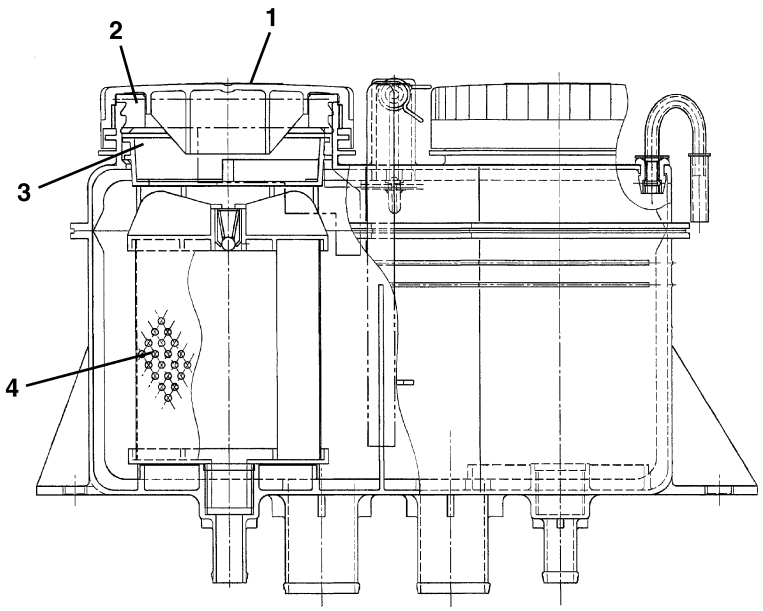
(REPRESENTATIVE TYPE)



SHTS07Z070300135

1	Oil reservoir cap	3	Oil strainer
2	Oil seal	4	Oil filter

EXCEPT FY LEFT-HAND DRIVE MODEL



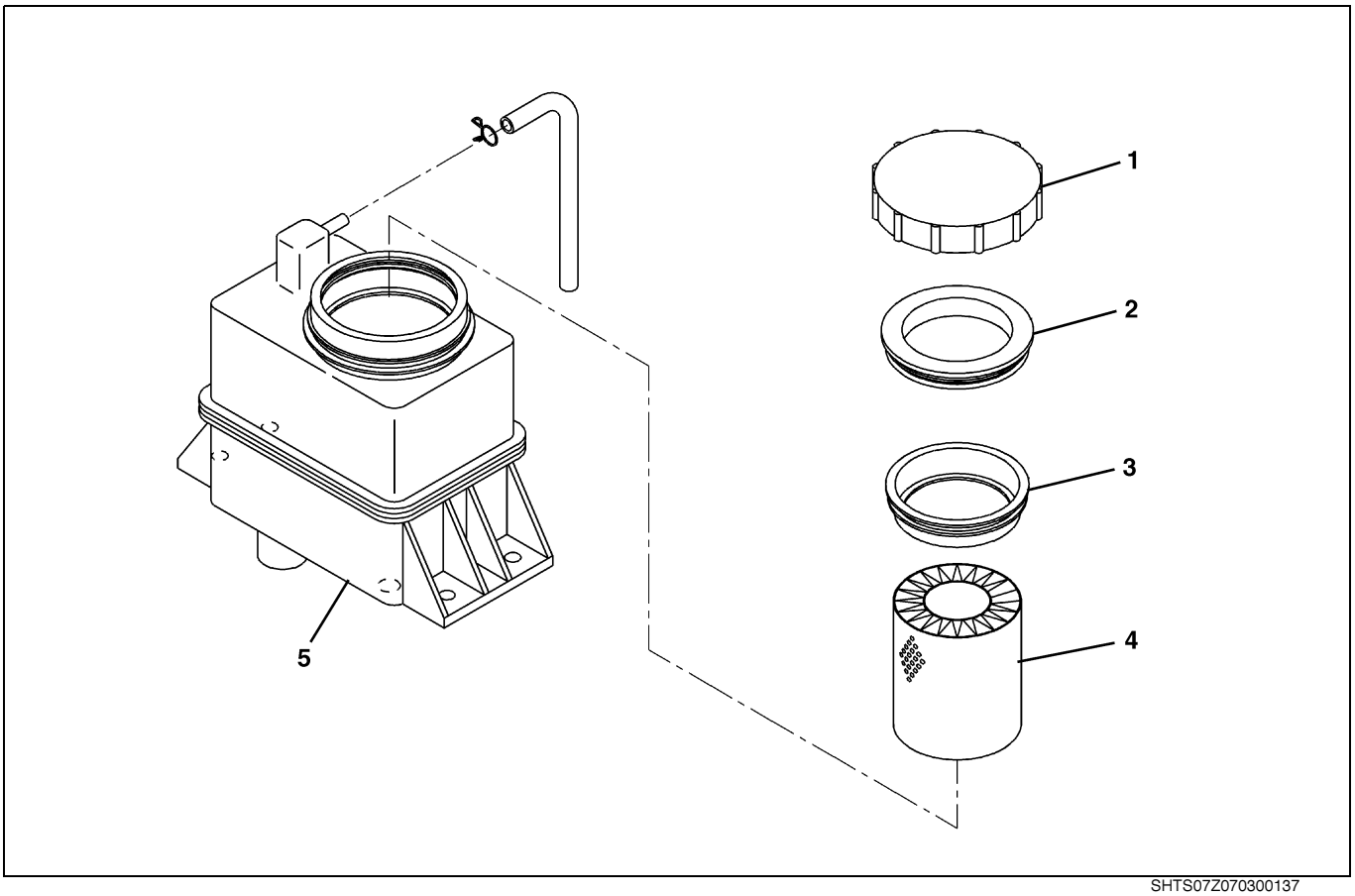
SHTS07Z070300136

1	Oil reservoir cap	3	Oil strainer
2	Oil seal	4	Oil filter

COMPONENT LOCATOR

EN07Z0703D100004

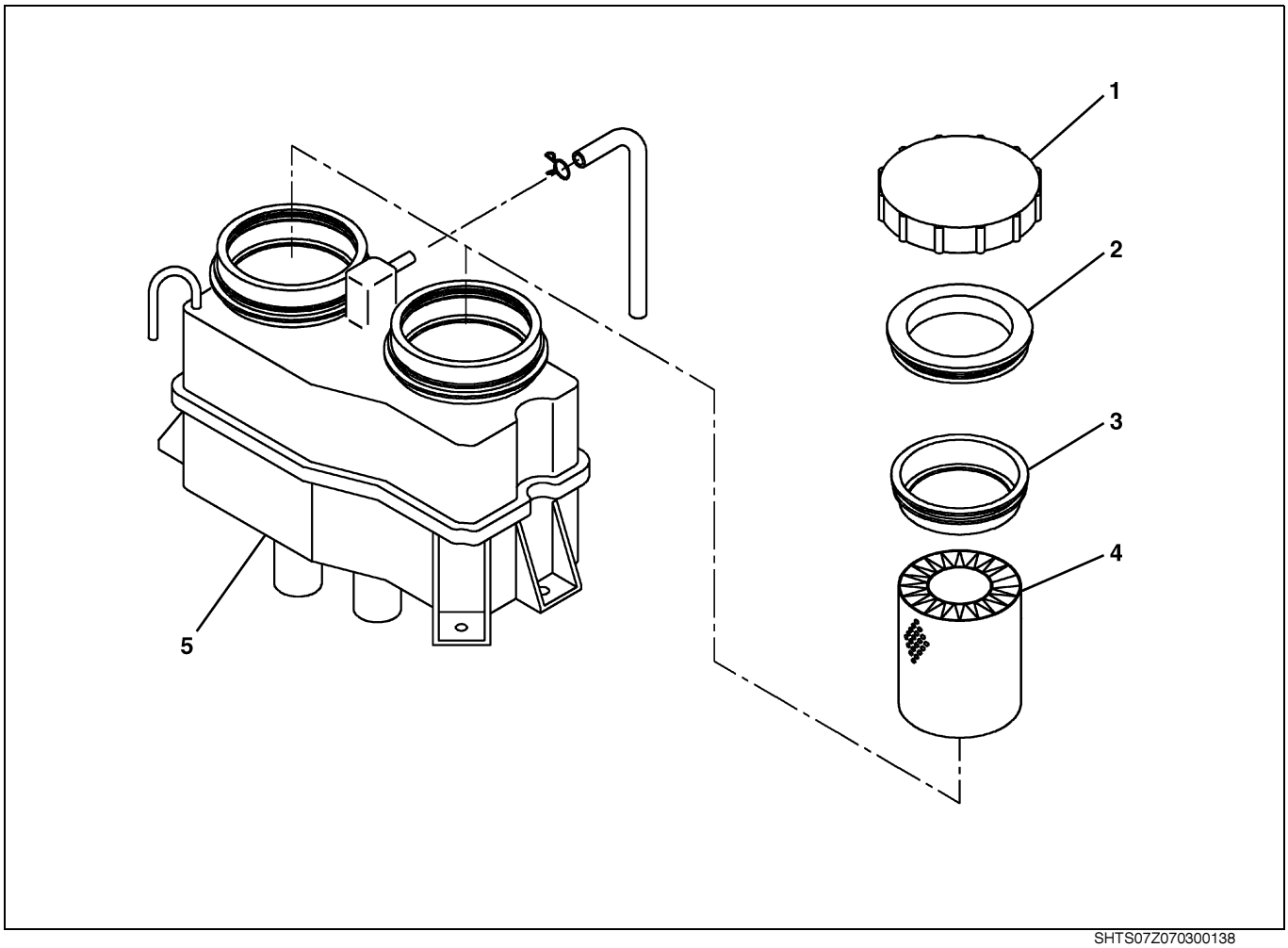
EXCEPT FY LEFT-HAND DRIVE MODEL



SHTS07Z070300137

1	Oil reservoir cap	4	Oil filter
2	Oil seal	5	Oil reservoir
3	Oil strainer		

FOR FY LEFT-HAND DRIVE MODEL



SHTS07Z070300138

1	Oil reservoir cap	4	Oil filter
2	Oil seal	5	Oil reservoir
3	Oil strainer		

OVERHAUL

EN07Z0703H200005

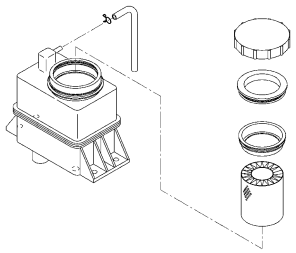
IMPORTANT POINT - ASSEMBLY

NOTICE

- **Use only compressed air to clean the oil filter.**
- **The oil filter is made of synthetic resin, so never wash it with hot water, solvent or detergent.**
- **Before assembling, clean all the parts.**

INSPECTION AND REPAIR

EN07Z0703H300006

Inspection item	Standard	Limit	Remedy	Inspection procedure
Oil strainer: Clogged and damage	**—**	**—**	**Clean or replace, if necessary.**	**Visual check** 
Oil reservoir: Damage	**—**	**—**	**Replace, if necessary.**	

FRONT AXLE (ISO 10-STUDS TYPE)

AX02-001

FRONT AXLE (ISO 10-STUDS TYPE)

DATA AND SPECIFICATIONS

EN0861902I200001

Specifications

Model	FR, FS, FY, SH, SS	ZS
Front axle series No.	MF78I	MFM08I
Axle beam type	Reversed Elliot "I" beam	
Axle beam material	Heat-treated carbon	
Brake drum location	Outboard mounted	
Wheel bearing	Two tapered roller bearings	
King pin thrust bearing	Ball bearing	
Amount of grease in a hub	600 g {21.2 oz} at one wheel	

Wheel alignment

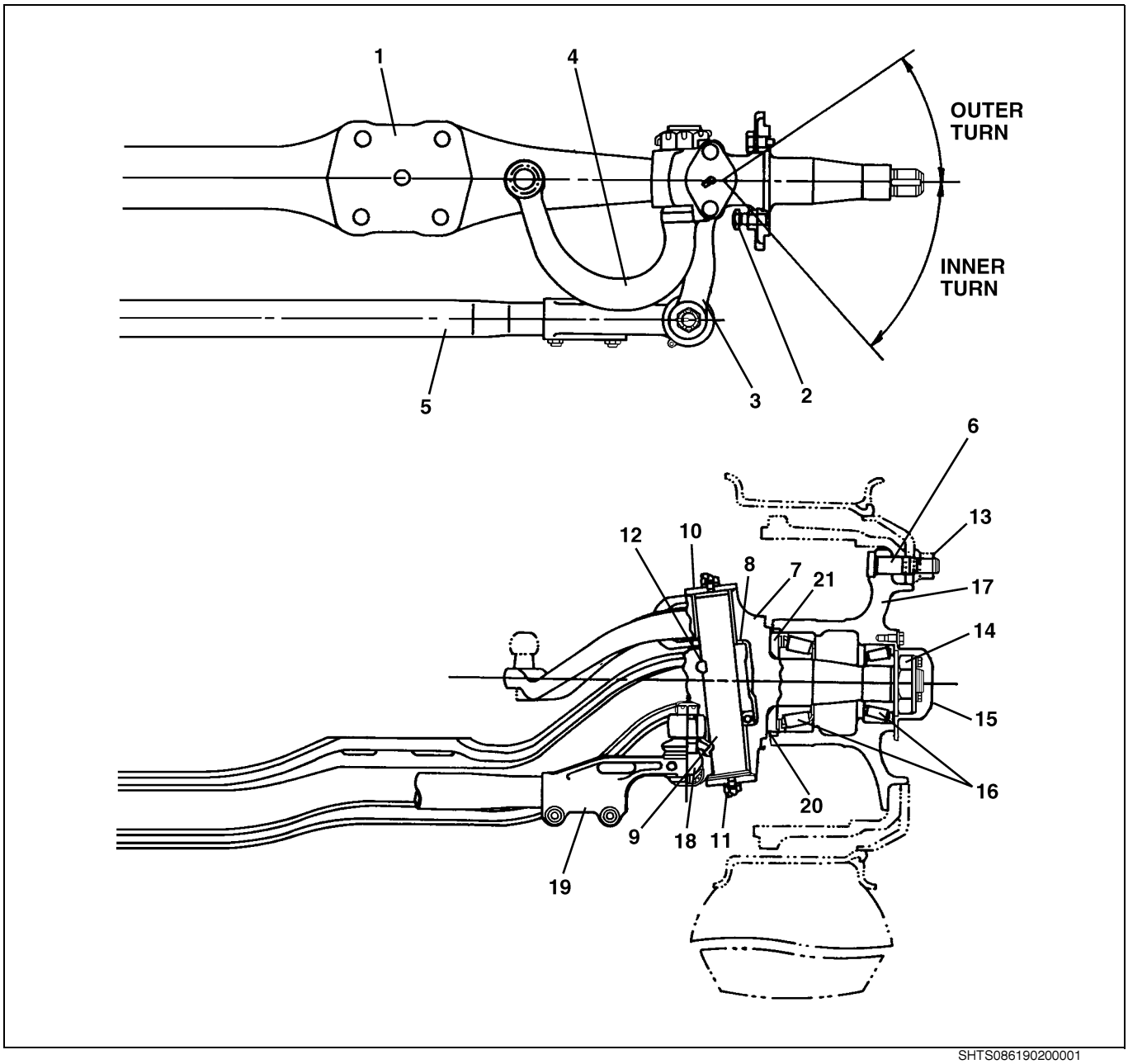
Camber		0°-2°
King pin angle		6°-8°
Caster		1°30'
Toe-in	Diagonal tires	1-3 mm {0.0394-0.1181 in.}
	Radial tires	0-2 mm {0-0.0787 in.}

Knuckle turning angle

Models		Tire size	Inner turn	Outer turn
FR, FS, SH, SS		295/80R 22.5	48°-50°	39°
		315/80R 22.5	45°-47°	39°
ZS		385/80R 22.5	41°	34°
FY	Front forward axle	295/80R 22.5	44°-46°	34.5°
		315/80R 22.5	39°-41°	34°
	Front rearward axle	295/80R 22.5	34°-36°	30°
		315/80R 22.5	29.5°-31.5°	27.5°

DESCRIPTION

EN0861902C100001



SHTS086190200001

1	Axle beam	12	Lock pin
2	Stopper bolt	13	Wheel nut
3	Tie-rod arm	14	Lock nut
4	Knuckle arm	15	Hub cap
5	Tie rod	16	Wheel hub bearing
6	Hub bolt	17	Wheel hub
7	Knuckle	18	Ball stud
8	Thrust washer	19	Tie-rod end
9	King pin	20	Oil seal
10	King pin cover	21	Oil seal guide
11	Lubrication fitting		

TROUBLESHOOTING

EN0861902F300001

Symptom	Possible cause	Remedy/Prevention
Hard steering or poor return of steering wheel to center	Lack of lubrication in steering linkage	Lubricate king pins and ball joints.
	Incorrect front wheel alignment (Toe-in angle is incorrect.)	Correct the toe-in.
	Incorrect front wheel alignment (Camber, caster of king pin angles are not within specifications.)	Inspect king pin bushings for wear or deflection of knuckles axle beam and tie rod, and replace if necessary.
	Worn out or damaged thrust bearing	Replace thrust bearings.
	Tire pressure is too low	Inflate to proper pressure.
Vibration or shimmy	Incorrect front wheel alignment	Adjust or replace parts if necessary.
	Worn out king pin bushing	Replace king pin bushings.
	The preload of the wheel bearing is off	Adjust wheel bearing preload.
	Badly worn hub bearings	Replace hub bearings.
	Loose tie-rod ends ball joints	Replace all the tie-rod ends.
	Loose U-bolt nuts holding the springs to the beams	Tighten the nuts properly.
	Loose hub nuts	Tighten the hub nuts properly.
	Distorted disc wheels	Replace the disc wheels.
	The tires are out of balance	Balance the tires.
	Run-out of the tire and wheel rim	Correct the run-out of the tire and wheel rim.
	Tire and wheel are out of balance	Balance the wheel using a balancing machine.
	Tire pressure is not uniform or sufficient	Adjust the pressure of all tires.
	Other faults in the steering system	Refer to the chapter STEERING EQUIPMENT.
Abnormal tire wear	Incorrect front wheel alignment	Adjust properly or replace parts, if necessary.
	Improper tire pressure	Adjust to proper pressure.
Grease leakage from wheel hub	Worn out oil seal	Replace oil seal.
	Hub cap bolts are not tightened properly	Tighten the bolts properly.
	Too much grease	Apply only the specified amount of grease.

SPECIAL TOOL

EN0861902K100001

Prior to starting a front axle overhaul, it is necessary to have these special tools.

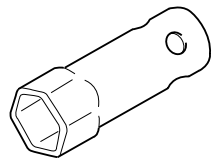
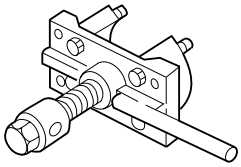
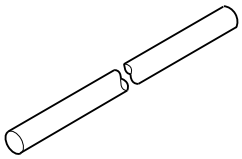
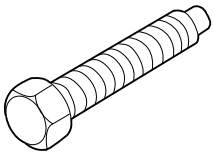
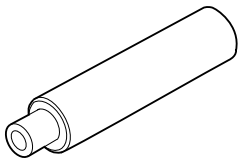
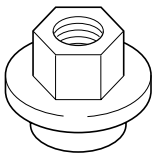
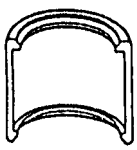
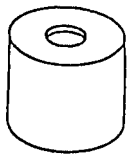
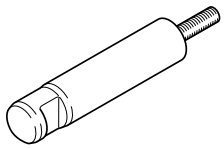
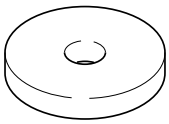
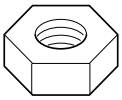
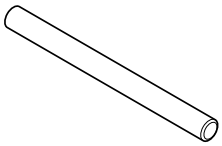
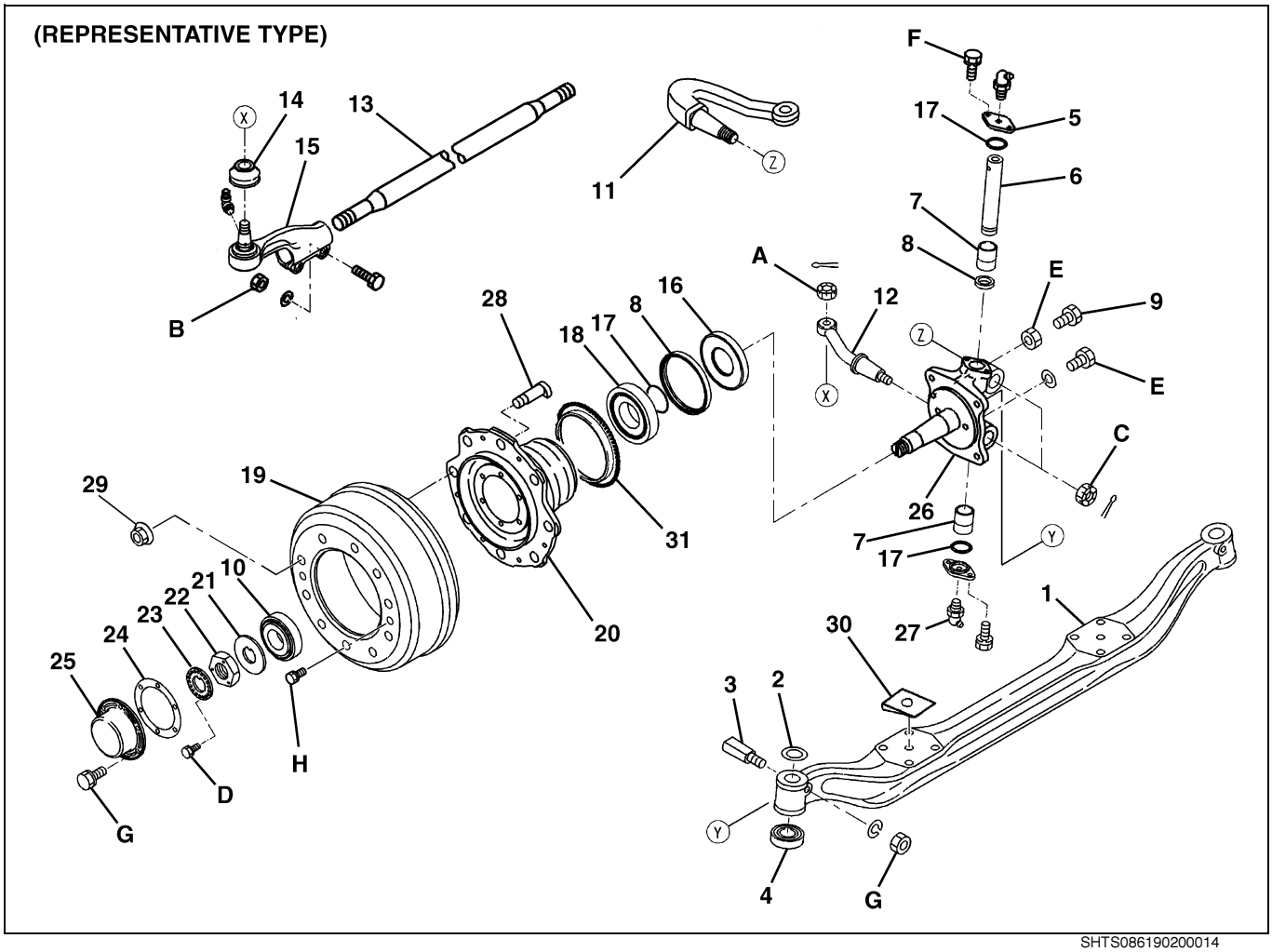
Illustration	Part number	Tool name	Remarks
	09839-7001	SOCKET WRENCH	
	09650-1790	WHEEL HUB PULLER	
	09849-2001	HANDLE	
	09652-1210	SCREW PULLER	2 PIECES
	09659-1010	ADAPTER	
	9209-20120	DUST COVER GUIDE NUT	
	09657-1790	DUST COVER GUIDE (INNER)	2 PIECES

Illustration	Part number	Tool name	Remarks
	09657-1800	DUST COVER GUIDE (OUTER)	
	09657-1350	KING PIN GUIDE	
	09654-1300	PLATE	
	9201-16130	NUT	
	09712-1100	BAR	

COMPONENT LOCATOR

EN0861902D100001

FOR RIGHT-HAND DRIVE MODELS



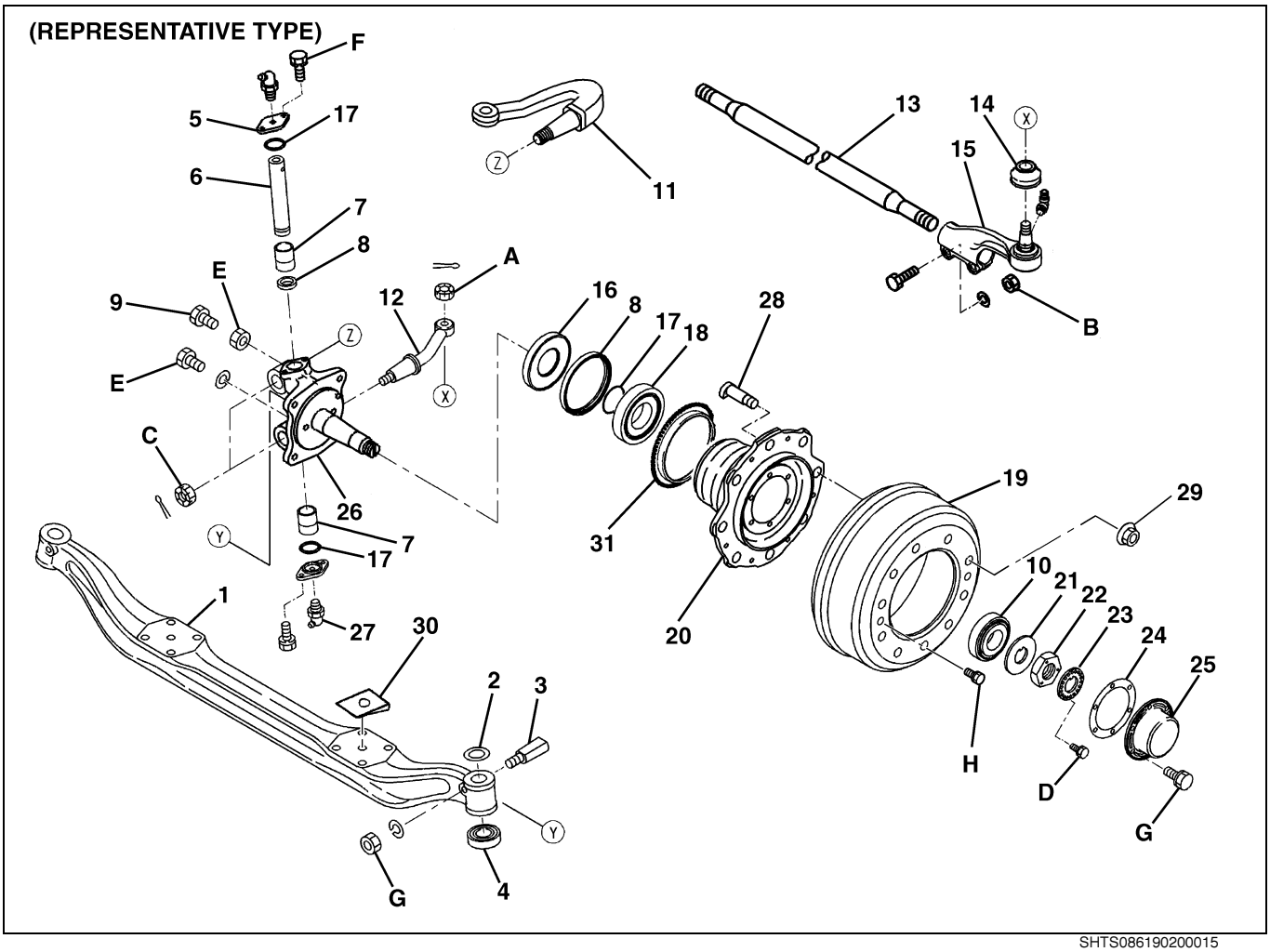
SHTS086190200014

1	Axle beam	12	Tie-rod arm	23	Lock plate
2	Thrust washer	13	Tie rod	24	Gasket
3	Lock pin	14	Dust cover	25	Wheel hub cap
4	Thrust bearing	15	Tie-rod end assembly	26	Knuckle
5	King pin cover	16	Oil seal guide	27	Lubrication fitting
6	King pin	17	O-ring	28	Hub bolt
7	Bushing	18	Inner wheel hub bearing	29	Wheel nut
8	Oil seal	19	Brake drum	30	Caster shim
9	Stopper bolt	20	Wheel hub	31	ABS sensor ring (If so equipped)
10	Outer wheel hub bearing	21	Washer		
11	Knuckle arm	22	Wheel hub bearing lock nut		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	147-343 {1,499-3,497, 109-252}	E	96-144 {979-1,468, 71-106}
B	85.5-114.5 {872-1,167, 64-84}	F	105.5-144.5 {1,076-1,473, 78-106}
C	685-1,175 {6,986-11,981, 506-866}	G	37.5-48.5 {383-494, 28-35}
D	8.5-10.5 {87-107, 6.3-7.7}	H	20.5-39.5 {210-402, 16-29}

FOR LEFT-HAND DRIVE MODELS



SHTS086190200015

1	Axle beam	12	Tie-rod arm	23	Lock plate
2	Thrust washer	13	Tie rod	24	Gasket
3	Lock pin	14	Dust cover	25	Wheel hub cap
4	Thrust bearing	15	Tie-rod end assembly	26	Knuckle
5	King pin cover	16	Oil seal guide	27	Lubrication fitting
6	King pin	17	O-ring	28	Hub bolt
7	Bushing	18	Inner wheel hub bearing	29	Wheel nut
8	Oil seal	19	Brake drum	30	Caster shim
9	Stopper bolt	20	Wheel hub	31	ABS sensor ring (If so equipped)
10	Outer wheel hub bearing	21	Washer		
11	Knuckle arm	22	Wheel hub bearing lock nut		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	147-343 {1,499-3,497, 109-252}	E	96-144 {979-1,468, 71-106}
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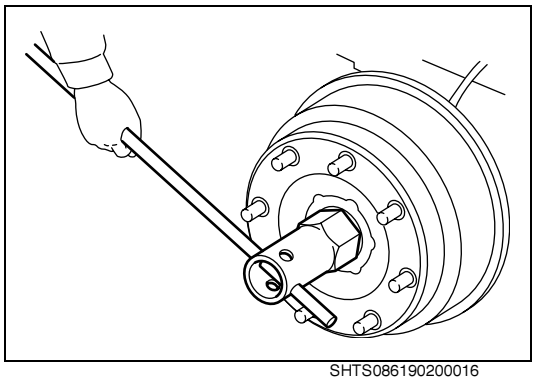
C	685-1,175 {6,986-11,981, 506-866}	G	37.5-48.5 {383-494, 28-35}
D	8.5-10.5 {87-107, 6.3-7.7}	H	20.5-39.5 {210-402, 16-29}

OVERHAUL

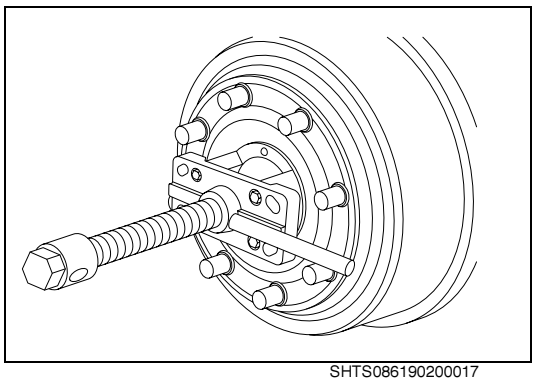
EN08619022300001

IMPORTANT POINTS - DISASSEMBLY

1. REMOVAL OF THE WHEELS
(1) Refer to chapter WHEEL & TIRE.

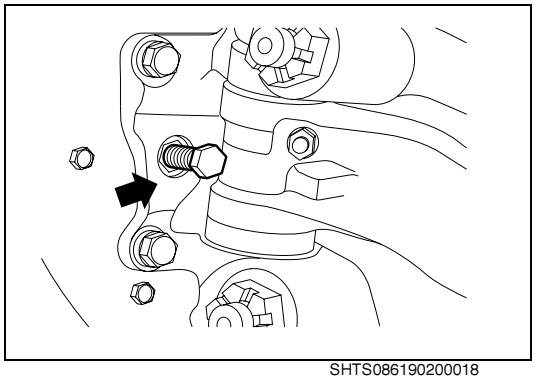

SHTS086190200016

2. REMOVAL OF THE WHEEL HUB BEARING LOCK NUT
SST:
Socket Wrench (09839-7001)
Handle (09849-2001)


SHTS086190200017

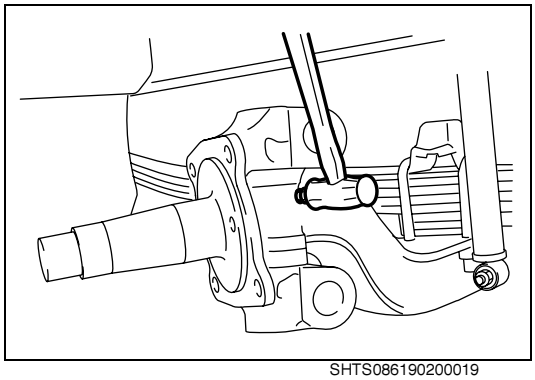
3. REMOVAL OF THE WHEEL HUB ASSEMBLY AND THE INNER RACE OF OUTER WHEEL HUB BEARING
SST:
Wheel Hub Puller (09650-1790)
Handle (09849-2001)

NOTICE
Wheel hub assembly is heavy, therefore be careful when handling it.


SHTS086190200018

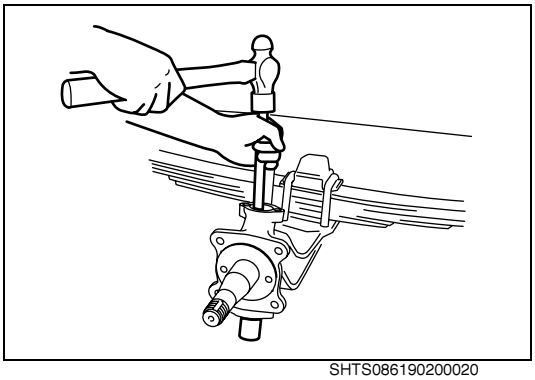
4. REMOVAL OF THE INNER RACE OF INNER WHEEL HUB BEARING TOGETHER WITH OIL SEAL GUIDE
SST: Screw Puller (09652-1210)

5. REMOVAL OF THE WHEEL BRAKE
(1) Refer to chapter SERVICE BRAKE.


SHTS086190200019

6. REMOVAL OF THE LOCK PIN
(1) Remove the lock nut.
(2) Drive out the lock pin, using a special tool and a hammer.
SST: Adapter (09659-1010)

NOTICE
Be careful not to bend the thread part.

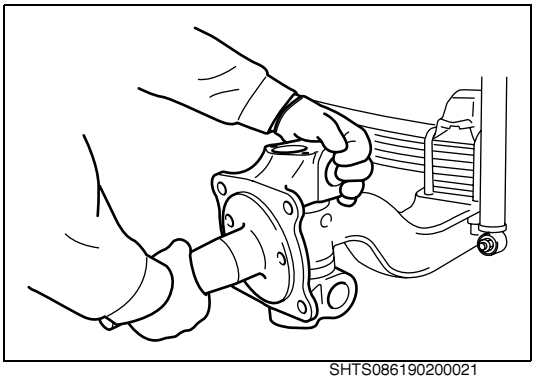

SHTS086190200020

7. REMOVAL OF THE KING PIN

(1) Drive out the king pin, using a brass bar and a hammer.

NOTICE

- **Be careful not to damage the inner surface of bush of knuckle and insert part of king pin of axle beam.**
- **Be careful not to drop the king pin.**

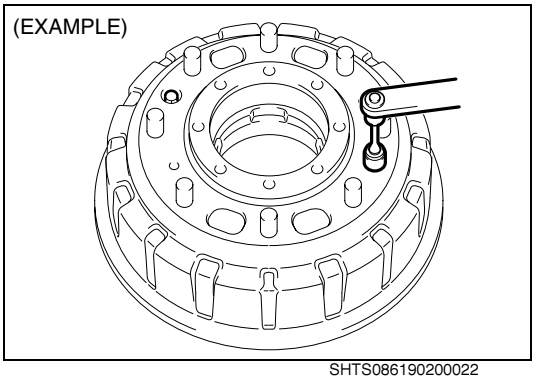

SHTS086190200021

8. REMOVAL OF THE KNUCKLE

(1) Remove the knuckle, thrust washer and thrust bearings.

NOTICE

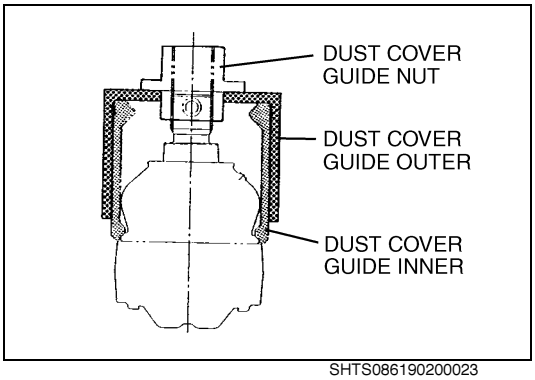
Be careful not to drop the thrust washer and thrust bearings.



SHTS086190200022

9. SEPARATION OF THE BRAKE DRUM AND WHEEL HUB

(1) Remove the bolts, and separate the brake drum and wheel hub.



SHTS086190200023

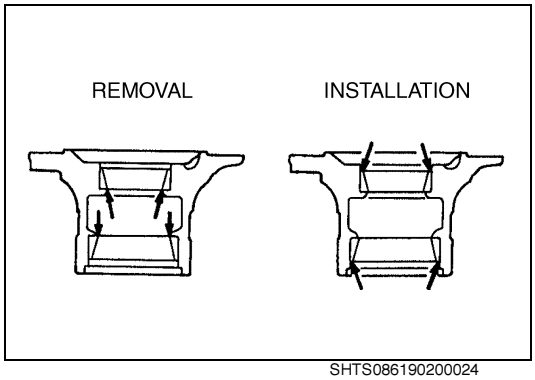
IMPORTANT POINTS - ASSEMBLY

1. REPLACEMENT OF THE DUST COVER

NOTICE

Apply lithium molybdenum sulfide grease to the inside and lip part of the dust cover.

SST:
Dust Cover Guide Nut (9209-20120)
Dust Cover Guide Inner (09657-1790)
Dust Cover Guide Outer (09657-1800)

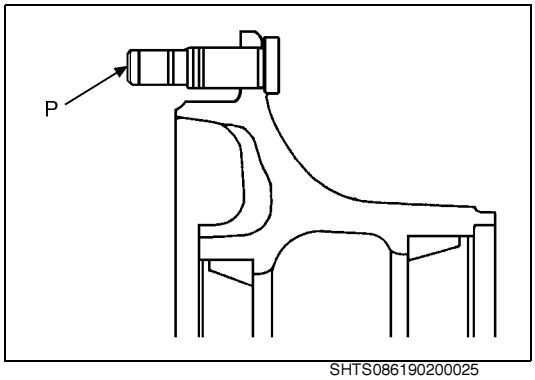


SHTS086190200024

2. REPLACEMENT OF THE WHEEL HUB BEARING RACE

(1) Remove the outer race of bearing by striking the race lightly and evenly through the 4 access holes in the wheel hub, using a tapping rod.

(2) To install the outer race, use a tapping rod and a hammer, or a press.



SHTS086190200025

3. REPLACEMENT OF THE HUB BOLTS

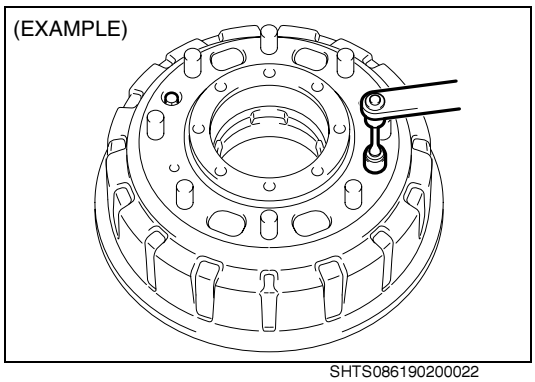
(1) Remove the hub bolts from the wheel hub.

(2) Install the new hub bolts.

NOTICE

The right and left hub bolts differ, so install them according to the chart below.

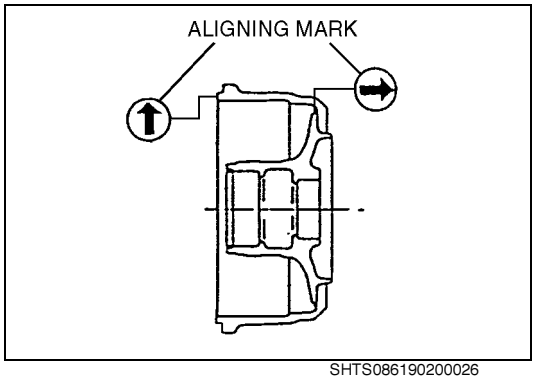
	Marks at "P"	Color
RIGHT	**R**	**Gold**
LEFT	**L**	**Silver**



SHTS086190200022

4. ASSEMBLY OF THE BRAKE DRUM AND WHEEL HUB

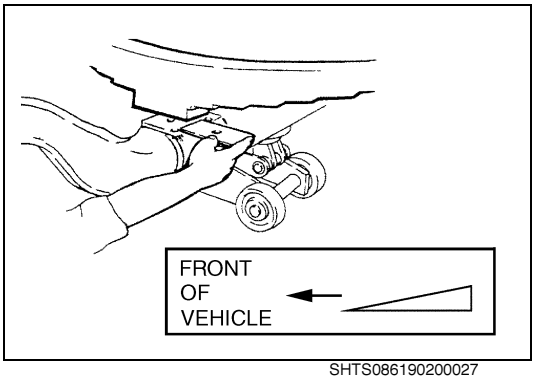
(1) Assemble the brake drum and wheel hub, and tighten the bolts.



SHTS086190200026

NOTICE

When assembling the brake drum and wheel hub, make sure that their aligning marks are oriented as closely to each other as possible.



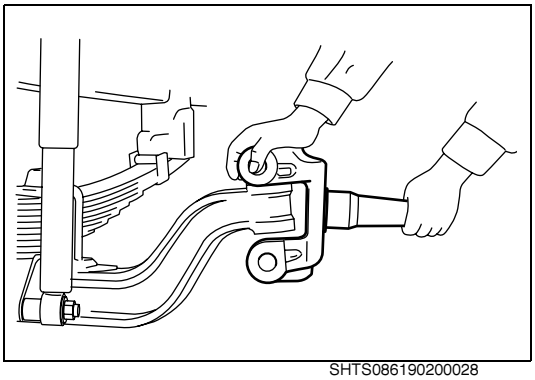
SHTS086190200027

5. INSTALLATION OF THE AXLE BEAM

(1) Secure the axle to the leaf springs with U-bolts.

NOTICE

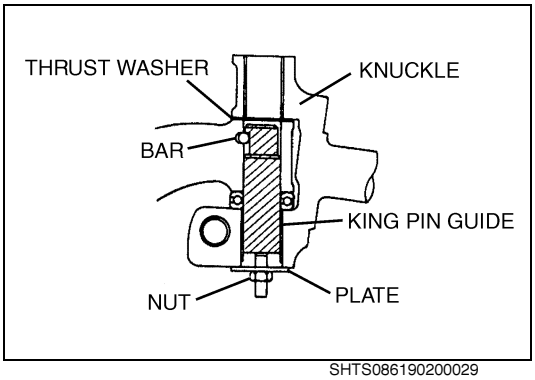
Confirm the direction of caster shim.


SHTS086190200028

6. INSTALLATION OF THE KNUCKLE

NOTICE

Before installation, apply chassis grease to the king pin bush, the rip part of the oil seal and the sliding surfaces of axle beam and knuckle.



SHTS086190200029

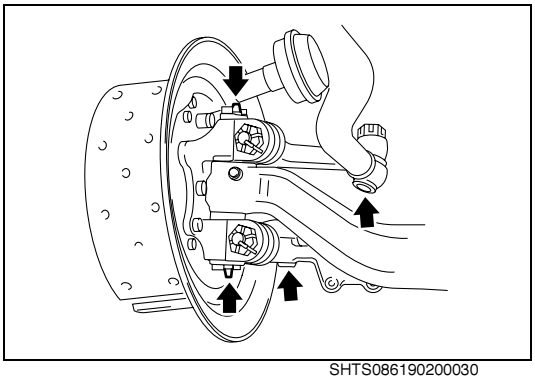
7. ADJUSTMENT OF THE CLEARANCE BETWEEN THE THRUST WASHER AND KNUCKLE

(1) Adjust the clearance with the correct thickness thrust washer.
Assembly Standard: Less than 0.1 mm {0.004 in.}
Thickness of Thrust Washer: mm {in.}
3.2 {0.126} 3.3 {0.130} 3.4 {0.134} 3.5 {0.138}
3.6 {0.142} 3.7 {0.146} 3.8 {0.150}

SST:
King Pin Guide (09657-1350)
Plate (09654-1300)
Nut (9201-16130)
Bar (09712-1100)

8. ASSEMBLY OF THE WHEEL BRAKE

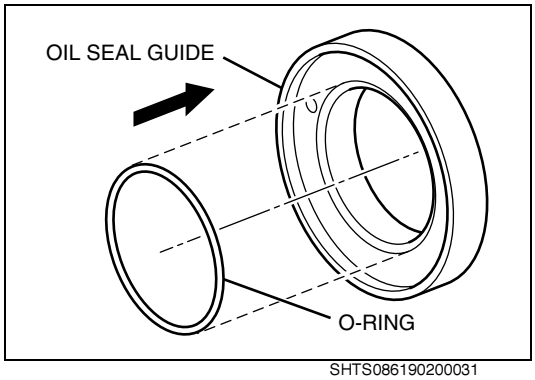
(1) Refer to chapter SERVICE BRAKE.


SHTS086190200030

9. LUBRICATION

(1) Lubricate the king pin with chassis grease, using the lubrication fittings located on the two king pin covers.

(2) Lubricate the ball joint of the drag link and the tie rod with the chassis grease, using the lubrication fittings.

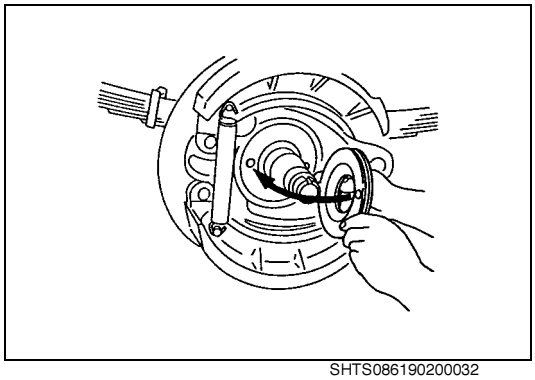


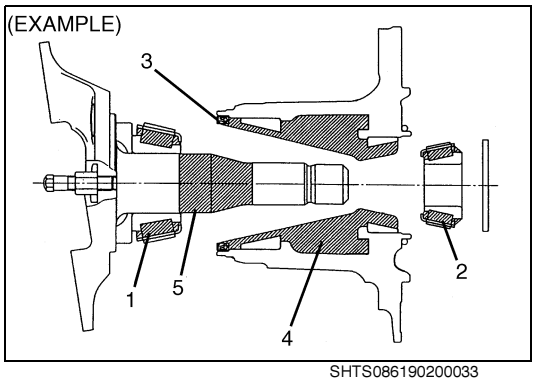
SHTS086190200031

10. INSTALLATION OF THE OIL SEAL GUIDE

NOTICE

- **Install the O-ring to bore side of oil seal guide as shown in the figure.**
- **Align the stopper bolt hole of the knuckle and oil seal guide hole.**
- **If oil seal guide is warmed up with hot water, it can easily be installed.**


SHTS086190200032



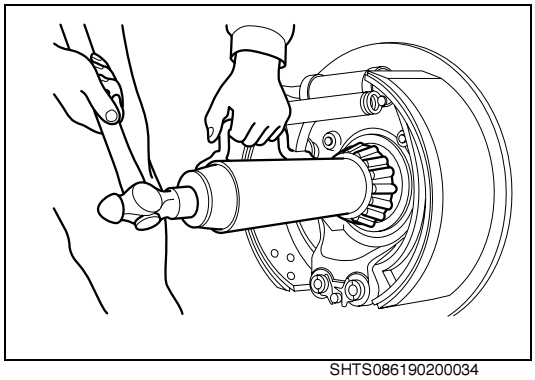
SHTS086190200033

11. GREASING

(1) Before assembling, apply wheel hub bearing grease to the following parts as shown in the figure.

1. Inner wheel hub bearing inner race
2. Outer wheel hub bearing inner race
3. Sealing lip of the oil seal
4. Wheel hub
5. Knuckle spindle

(2) Lubricate the king pin with chassis grease, using the lubrication fittings located on the two king pin covers.

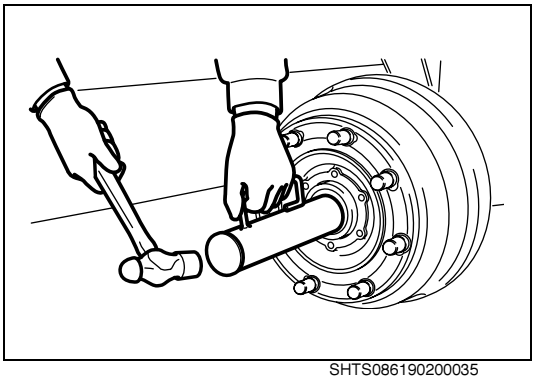

SHTS086190200034

12. INSTALLATION OF THE WHEEL HUB BEARINGS AND WHEEL HUB ASSEMBLY

(1) Install the inner race of inner wheel hub bearing.

NOTICE

Using a tool as shown, simplifies installation.


SHTS086190200035

(2) Install the oil seal in the wheel hub.
(3) Install the wheel hub assembly and the inner race of outer wheel hub bearing.

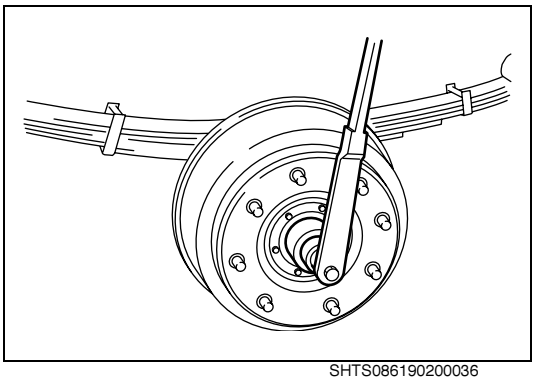
NOTICE

- **Using a tool as shown, simplifies installation.**
- **The wheel hub assembly is heavy, therefore be careful when handling it.**

(4) Install the lock washer.

NOTICE

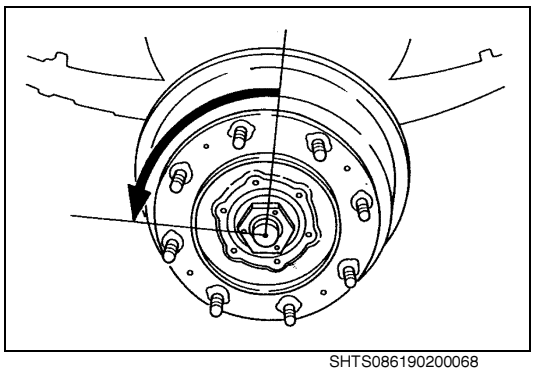
Apply bearing grease to the space between outer wheel hub bearing and lock washer.


SHTS086190200036

13. ADJUSTMENT OF THE WHEEL HUB BEARING PRELOAD

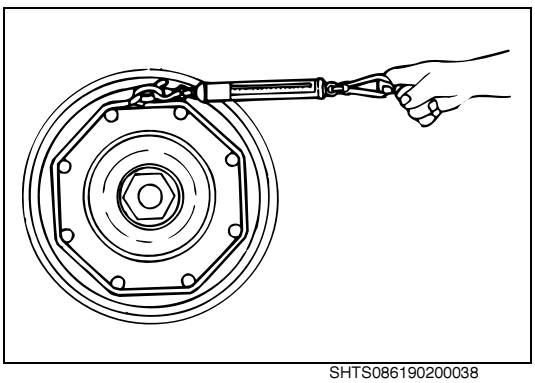
(1) Tighten the wheel hub bearing lock nut with the specified torque then loosen the nut by 1/6 - 1/4 turn.
Tightening Torque:
Approx. 343 N·m {3,500 kgf·cm, 253 lbf·ft}

SST: Socket Wrench (09839-7001)

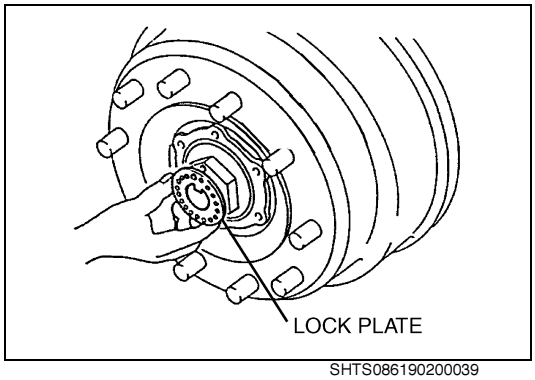

SHTS086190200068

(2) Strike the wheel hub with a copper hammer to properly seat the wheel hub, and check the return of the bearing. (Check that the hub can be turned by hands, and the nut cannot be turned by hands.)
(3) Measure the wheel bearing preload. If it exceeds or it is less than the standard value shown below, and adjust the preload with the lock nut.

Assembly Standard:


SHTS086190200038

	New bearing	Re-used bearing
Turning Torque N·m {kgf·cm, lbf·ft}	**3.14-5.10 {33-35, 2.4-3.7}**	**2.94-5.10 {30-35, 2.2-3.7}**
Spring balancer reading N {kgf, lbf}	**18.7-30.4 {2.0-3.0, 4.3-6.8}**	**17.6-30.4 {1.8-3.0, 4.0-6.8}**

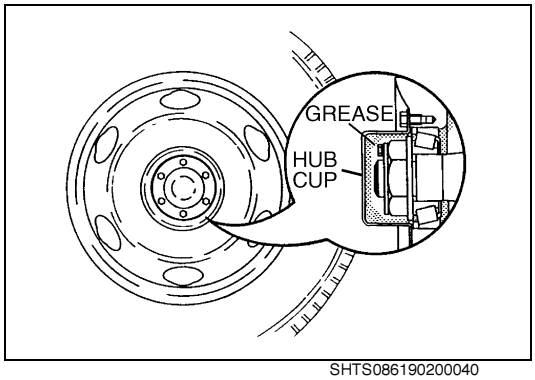


SHTS086190200039

14. INSTALLATION OF THE LOCK PLATE

NOTICE

- **If the holes of the plate are not aligned with the screw holes of the nut, turn over the plate.**
- **If alignment is still unattainable, turn the lock nut further within the limits of wheel hub bearing preload.**



SHTS086190200040

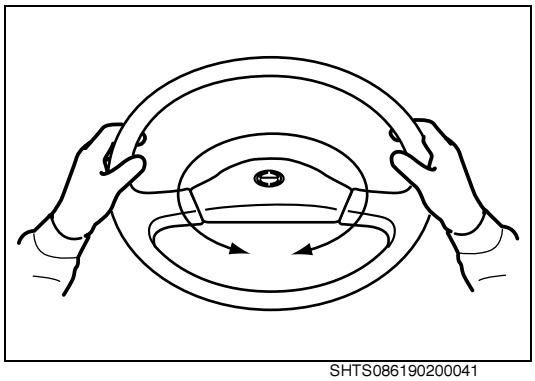
15. INSTALLATION OF THE HUB CAP

NOTICE

Before installing the cap, apply wheel hub bearing grease to the inner surface of the cap.

16. INSTALLATION OF THE WHEELS

(1) Refer to chapter WHEEL & TIRE.


SHTS086190200041

17. TURN THE STEERING WHEEL TO THE FULL RANGE TO THE RIGHT AND THE LEFT, AND CONFIRM THAT ALL STEERING LINKAGES MOVE FREELY (ESPECIALLY THE BALL JOINTS).

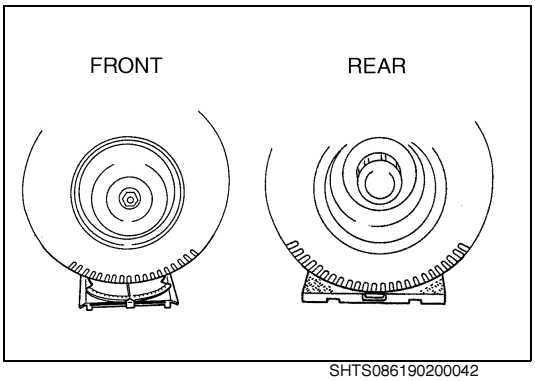
18. THE BRAKE SHOE CLEARANCE AND THE BRAKE CHAMBER ROD STROKE ADJUSTMENT

(1) On completion of the wheel hub and related parts reassembly, conduct the followings:

- Adjust the brake shoe clearance according to the section WHEEL BRAKE in the chapter SERVICE BRAKE.

INSPECTION AND ADJUSTMENT

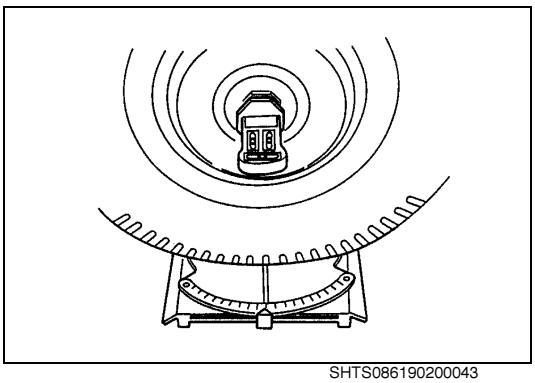
EN0861902H300001



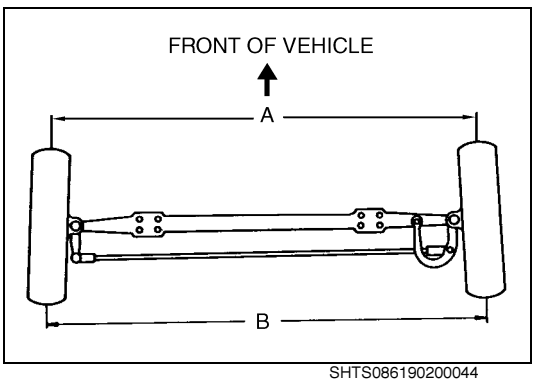
SHTS086190200042

1. INSPECTION OF THE WHEEL ALIGNMENT

(1) Park the vehicle on a level surface and check the tire pressure.


SHTS086190200043

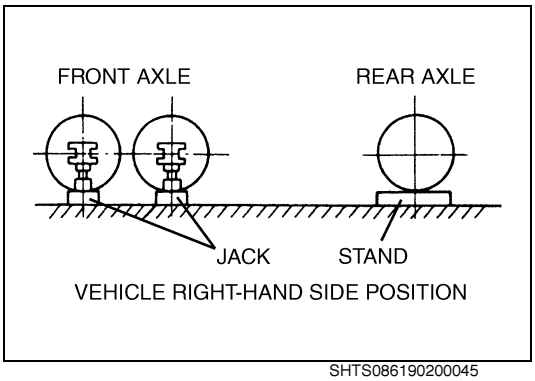
(2) Adjust the king pin inclination, caster, and camber.
Refer to section DATA AND SPECIFICATIONS.



SHTS086190200044

(3) Check the toe-in.

- **B - A =Toe-in**



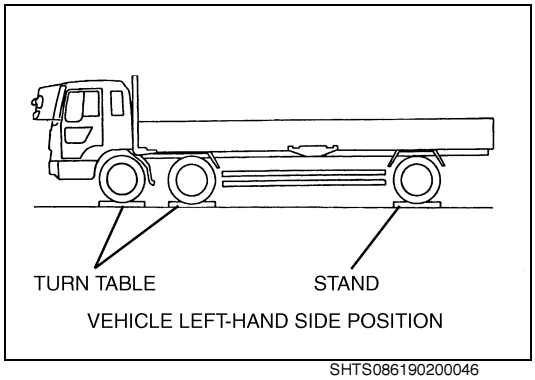
SHTS086190200045

2. ADJUSTMENT OF ALIGNMENT BETWEEN FRONT FOWERD AXLE AND FRONT REARWARD AXLE (MODEL: FY)

NOTICE

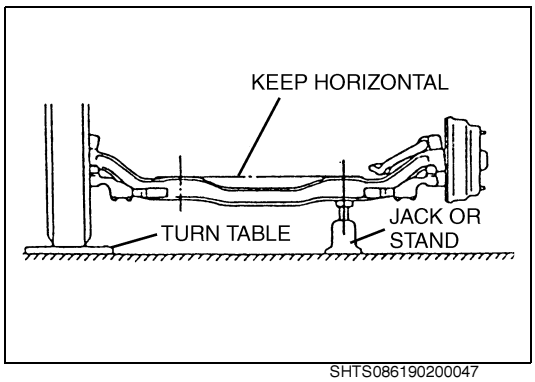
Following procedures to Right-hand drive models.

(1) Toe-in must be adjusted within the specified value for both forward and rearward front axles.
(2) Park the unloaded vehicle on a level surface.
(3) Remove the right side tires from front axles with placing a stand or a jack under the front axle beams at the right-hand side.



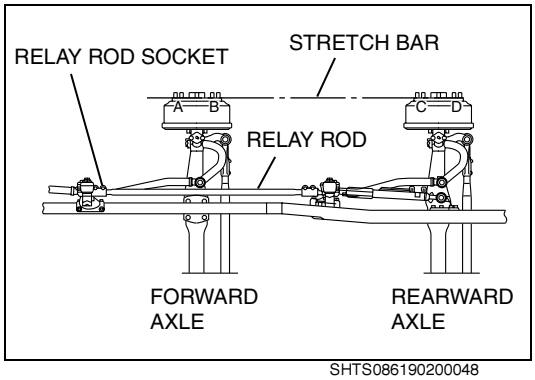
SHTS086190200046

(4) Place the turn table under the left side tires of the both front axles.



SHTS086190200047

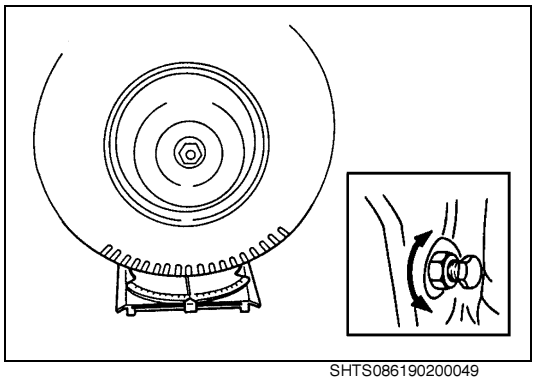
(5) Adjust the height of the stand or jack so that the front axle beams are level.



SHTS086190200048

(6) Set the brake drum surface of first axle and frame for parallel.
(7) Set the stretch bar on the sides of the hub at the right-hand side of the forward and rearward front axles.
(8) Make proper adjustment by mean of the relay rod so that the four points, "A", "B", "C" and "D" may be on the same line.
Clearance between front rearward axle hub side face and the stretch bar:
0.4 mm {0.016 in.} or less
(9) Check the toe-in after the tire has been installed.

NOTICE
At this time, if adjusted the tie rod, confirm above item 7 and 8.


SHTS086190200049

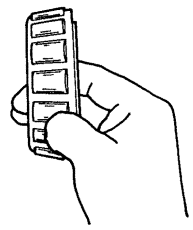
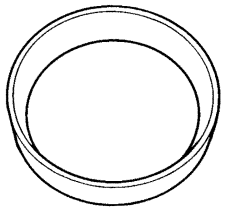
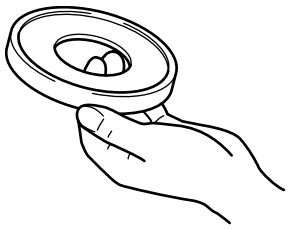
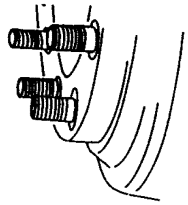
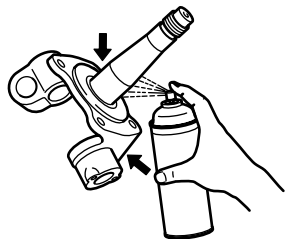
3. ADJUSTMENT OF THE WHEEL TURNING ANGLE WITH STOPPER BOLT

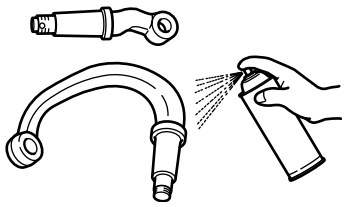
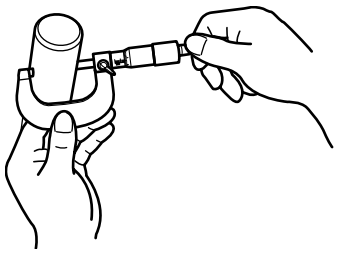
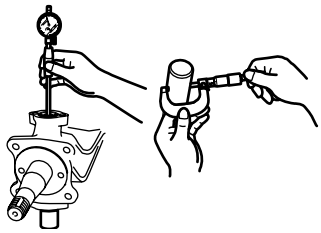
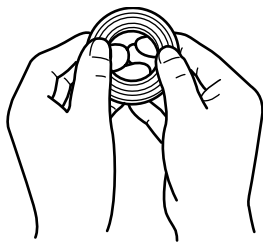
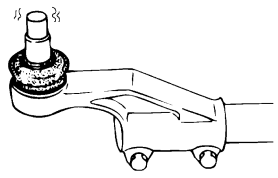
(1) Refer to section DATA AND SPECIFICATIONS.

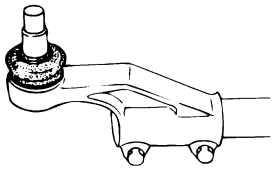
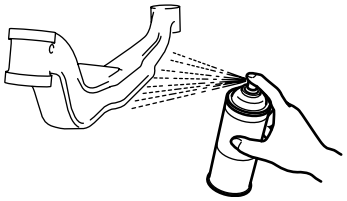
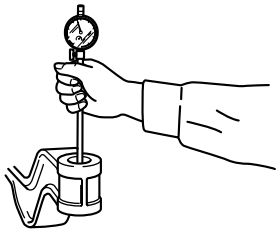
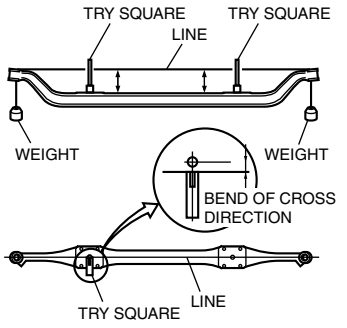
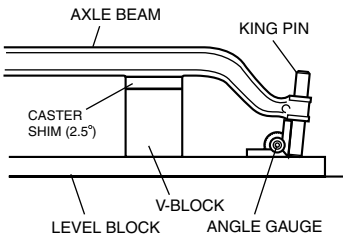
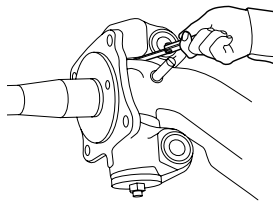
INSPECTION AND REPAIR

EN0861902H300002

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Bearing and race: Burns and pitting	—	—	Replace, if necessary.	Visual check 
			Replace, if necessary.	Visual check 
Oil seal guide: Wear	—	—	Replace, if necessary.	Visual check 
Hub bolts: Threads wear and damage	—	—	Replace, if necessary.	Visual check 
Knuckle: Wear and damage	—	—	Replace, if necessary.	Use the magnetic flaw detector or color checking instrument. 
King pin: Wear and damage	—	—	Replace, if necessary.	Use the magnetic flaw detector or color checking instrument. 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Knuckle arm and tie-rod arm: Crack and damage	—	—	Replace, if necessary.	Use the magnetic flaw detector or color checking instrument. 
King pin diameter	50 {1.969}	49.85 {1.9626}	Replace.	Measure 
King pin clearance	0.025-0.080 {0.0010-0.0031}	0.35 {0.0138}	Replace.	Measure 
Thrust bearing: Burns and pitting	—	—	Replace, if necessary.	Visual check 
Tie rod: Distortion	—	—	Replace, if necessary.	Visual check 
Tie-rod end ball stud: Threads wear and damage	—	—	Replace the tie-rod end assembly.	Visual check 
Tie-rod end ball joint: Gutter	—	—		

Inspection item	Standard	Limit	Remedy	Inspection procedure
Tie-rod end and dust cover: Crack	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Muddy water in the cover (Sealed type ball stud)	**—**	**—**	**Replace the tie-rod end assembly.**	
Axle beam: Crack and damage	**—**	**—**	**Replace, if necessary.**	**Use the magnetic flaw detector or color checking instrument.** 
Clearance between king pin and axle beam	**0-0.036 {0-0.0014}**	**0.1 {0.0039}**	**Replace.**	**Measure** 
Axle beam: Bend of cross direction	**—**	**1.0 {0.039}**	**Repair or replace. NOTICE Never heat repair.**	**Measure**  BEND =MEASURED VALUE -10 mm {0.39 in.}
King pin mounting angle	**7°30'**	**6°30'-8°30'**	**Replace.**	**Measure** 
Thrust washer: wear (Clearance between knuckle and axle beam)	**—**	**0.5 {0.0197}**	**Replace the thrust washer.**	**Measure** 

FRONT AXLE (TRILEX TYPE)

AX02-002

FRONT AXLE (TRILEX TYPE)

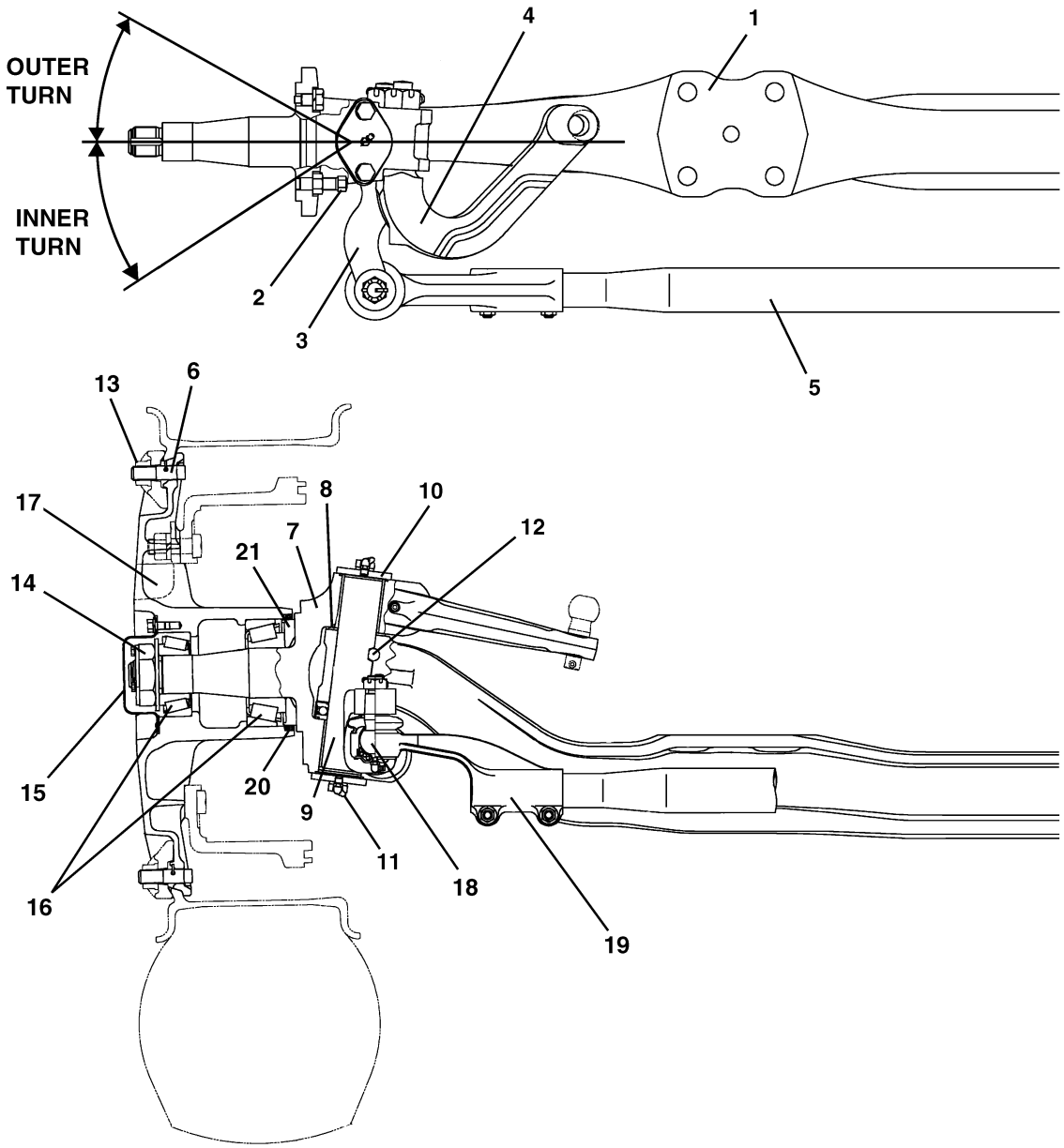
DATA AND SPECIFICATIONS

EN0862002I200001

Front axle series No.		MF88S
Axle beam type		Reversed Elliot "I" beam
Axle beam material		Chrome molybdenum steel
Brake drum location		Inboard mounted
Wheel bearing		Two tapered roller bearings
King pin thrust bearing		Ball bearing
Camber		0°-2°
King pin angle		6°-8°
Caster		1°30'
Toe-in	Diagonal tires	1-3 mm {0.0394-0.1181 in.}
	Radial tires	0-2 mm {0-0.0787 in.}
Knuckle turning angle	Inner turn	32°-34°
	Outer turn	29°
Amount of grease in a hub		600 g {21.2 oz} at one wheel

DESCRIPTION

EN0862002C100001



SHTS086200200001

1	Axle beam	12	Lock pin
2	Stopper bolt	13	Hub nut
3	Tie-rod arm	14	Lock nut
4	Knuckle arm	15	Hub cap
5	Tie rod	16	Wheel hub bearing
6	Hub bolt	17	Wheel hub
7	Knuckle	18	Ball stud
8	Thrust washer	19	Tie-rod end
9	King pin	20	Oil seal
10	King pin cover	21	Oil seal guide
11	Lubrication fitting		

TROUBLESHOOTING

EN0862002F300001

Symptom	Possible cause	Remedy/Prevention
Hard steering or poor return of steering wheel to center	Lack of lubrication in steering linkage	Lubricate king pins and ball joints.
	Incorrect front wheel alignment (Toe-in angle is incorrect.)	Correct the toe-in.
	Incorrect front wheel alignment (Camber, caster of king pin angles are not within specifications.)	Inspect king pin bushings for wear or deflection of knuckles axle beam and tie rod, and replace if necessary.
	Worn out or damaged thrust bearing	Replace thrust bearings.
	Tire pressure is too low	Inflate to proper pressure.
Vibration or shimmy	Incorrect front wheel alignment	Adjust or replace parts if necessary.
	Worn out king pin bushing	Replace king pin bushings.
	The preload of the wheel bearing is off	Adjust wheel bearing preload.
	Badly worn hub bearings	Replace hub bearings.
	Loose tie-rod ends ball joints	Replace all the tie-rod ends.
	Loose U-bolt nuts holding the springs to the beams	Tighten the nuts properly.
	Loose hub nuts	Tighten the hub nuts properly.
	Distorted disc wheels	Replace the disc wheels.
	The tires are out of balance	Balance the tires.
	Run-out of the tire and wheel rim	Correct the run-out of the tire and wheel rim.
	Tire and wheel are out of balance	Balance the wheel using a balancing machine.
	Tire pressure is not uniform or sufficient	Adjust the pressure of all tires.
	Other faults in the steering system	Refer to the CHAPTER, STEERING EQUIPMENT.
Abnormal tire wear	Incorrect front wheel alignment	Adjust properly or replace parts, if necessary.
	Improper tire pressure	Adjust to proper pressure.
Grease leakage from wheel hub	Worn out oil seal	Replace oil seal.
	Hub cap bolts are not tightened properly	Tighten the bolts properly.
	Too much grease	Apply only the specified amount of grease.

SPECIAL TOOL

EN0862002K100001

Prior to starting a front axle overhaul, it is necessary to have these special tools.

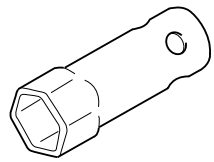
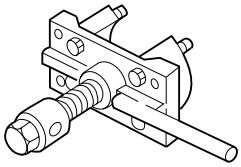
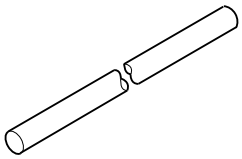
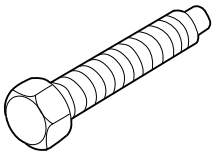
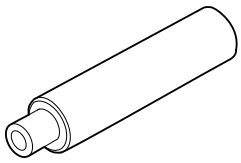
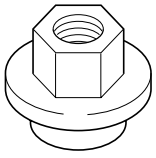
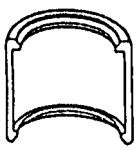
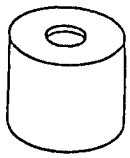
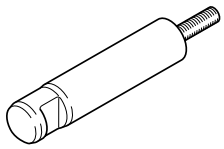
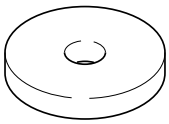
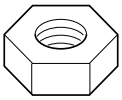
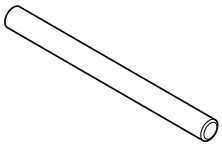
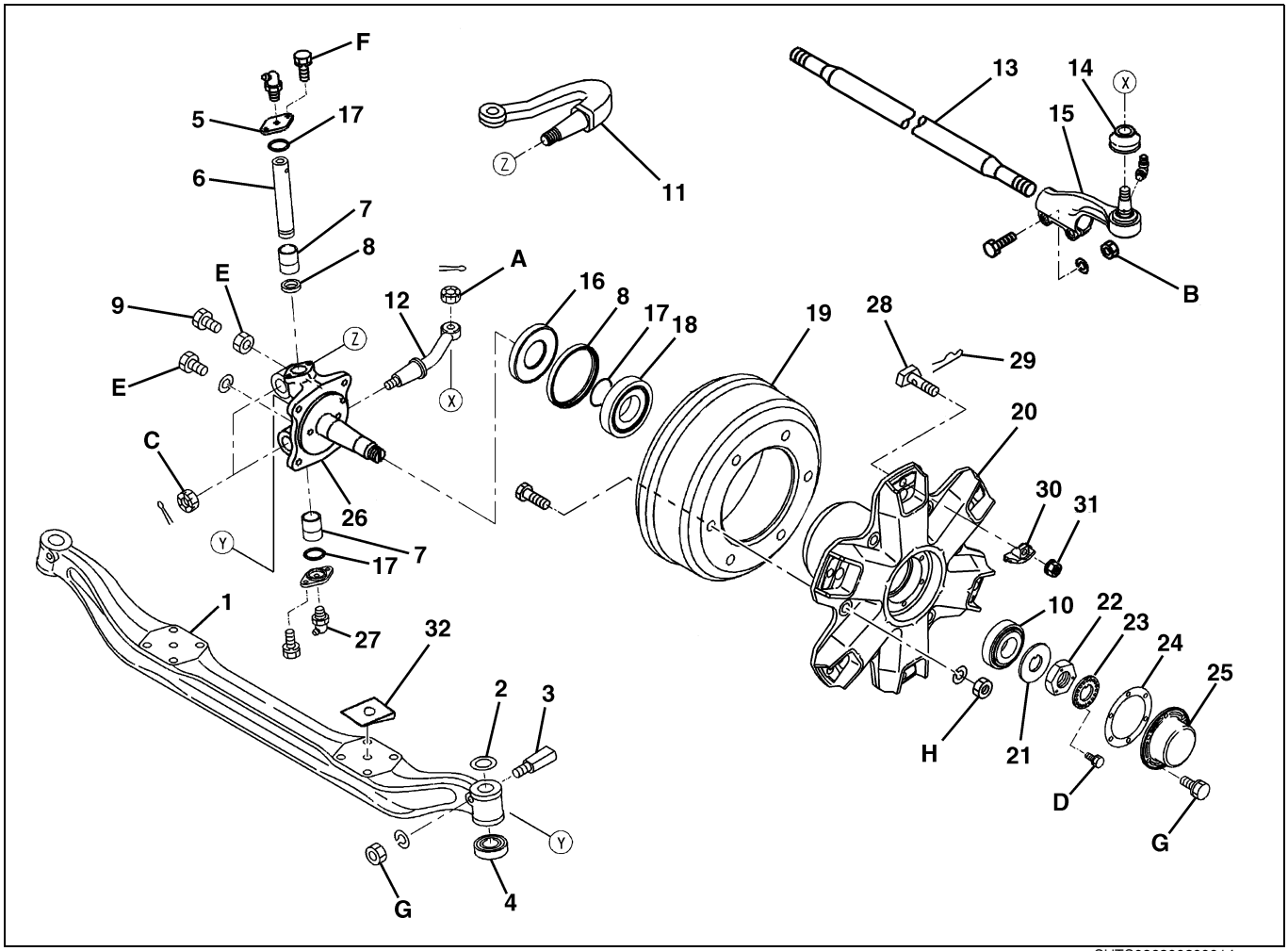
Illustration	Part number	Tool name	Remarks
	09839-7001	SOCKET WRENCH	
	09650-1790	WHEEL HUB PULLER	
	09849-2001	HANDLE	
	09652-1210	SCREW PULLER	2 PIECES
	09659-1010	ADAPTER	
	9209-20120	DUST COVER GUIDE NUT	
	09657-1790	DUST COVER GUIDE (INNER)	2 PIECES

Illustration	Part number	Tool name	Remarks
	09657-1800	DUST COVER GUIDE (OUTER)	
	09657-1350	KING PIN GUIDE	
	09654-1300	PLATE	
	9201-16130	NUT	
	09712-1100	BAR	

COMPONENT LOCATOR

EN0862002D100001



SHTS086200200014

1	Axle beam	12	Tie-rod arm	23	Lock plate
2	Thrust washer	13	Tie rod	24	Gasket
3	Lock pin	14	Dust cover	25	Wheel hub cap
4	Thrust bearing	15	Tie-rod end assembly	26	Knuckle
5	King pin cover	16	Oil seal guide	27	Lubrication fitting
6	King pin	17	O-ring	28	Hub bolt
7	Bushing	18	Inner wheel hub bearing	29	Pin
8	Oil seal	19	Brake drum	30	Clamp
9	Stopper bolt	20	Wheel hub	31	Hub nut
10	Outer wheel hub bearing	21	Lock washer	32	Caster shim
11	Knuckle arm	22	Wheel hub bearing lock nut		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

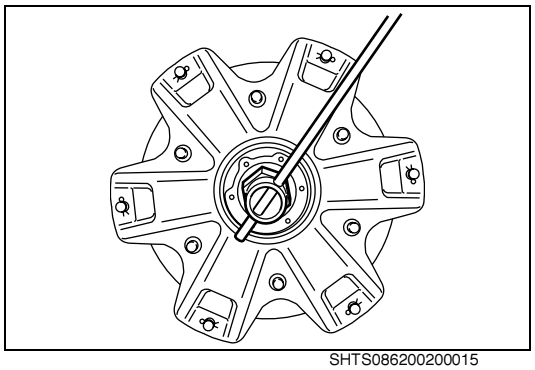
A	147-343 {1,499-3,497, 109-252}	E	96-144 {979-1,468, 71-106}
B	85.5-114.5 {872-1,167, 64-84}	F	105.5-144.5 {1,076-1,473, 78-106}
C	685-1,175 {6,986-11,981, 506-866}	G	37.5-48.5 {383-494, 28-35}
D	8.5-10.5 {87-107, 6.3-7.7}	H	393-471 {4,008-4,802, 290-347}

OVERHAUL

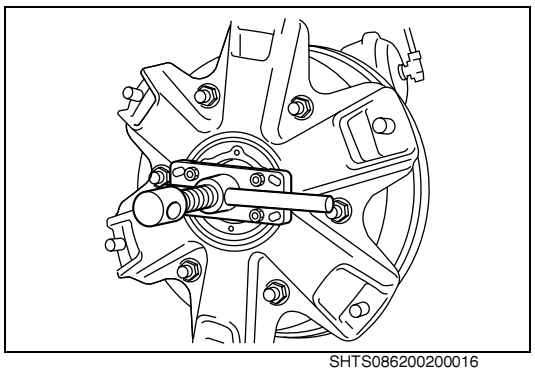
EN08620022300001

IMPORTANT POINTS - DISASSEMBLY

1. REMOVAL OF THE WHEELS
(1) Refer to chapter WHEEL & TIRE.

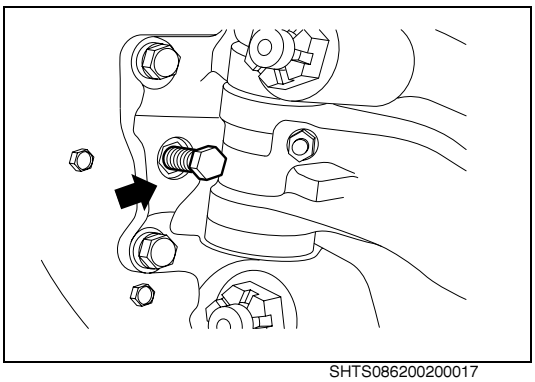

SHTS086200200015

2. REMOVAL OF THE WHEEL HUB BEARING LOCK NUT
SST:
Socket Wrench (09839-7001)
Handle (09849-2001)


SHTS086200200016

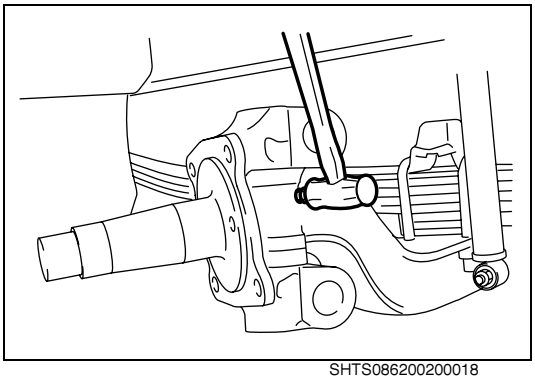
3. REMOVAL OF THE WHEEL HUB ASSEMBLY AND THE INNER RACE OF OUTER WHEEL HUB BEARING
SST:
Wheel Hub Puller (09650-1790)
Handle (09849-2001)

NOTICE
Wheel hub assembly is heavy, therefore be careful when handling it.


SHTS086200200017

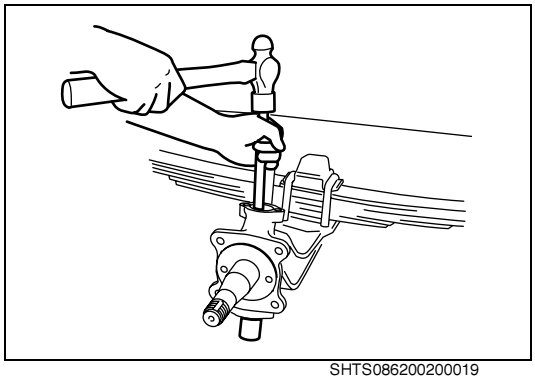
4. REMOVAL OF THE INNER RACE OF INNER WHEEL HUB BEARING TOGETHER WITH OIL SEAL GUIDE
SST: Screw Puller (09652-1210)

5. REMOVAL OF THE WHEEL BRAKE
(1) Refer to chapter SERVICE BRAKE.


SHTS086200200018

6. REMOVAL OF THE LOCK PIN
(1) Remove the lock nut.
(2) Drive out the lock pin, using a special tool and a hammer.
SST: Adapter (09659-1010)

NOTICE
Be careful not to bend the thread part.

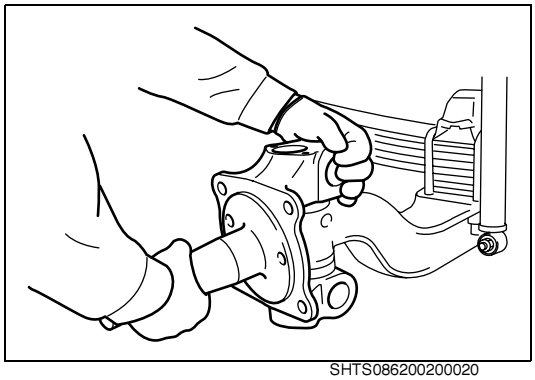

SHTS086200200019

7. REMOVAL OF THE KING PIN

(1) Drive out the king pin, using a brass bar and a hammer.

NOTICE

- **Be careful not to damage the inner surface of bush of knuckle and insert part of king pin of axle beam.**
- **Be careful not to drop the king pin.**


SHTS086200200020

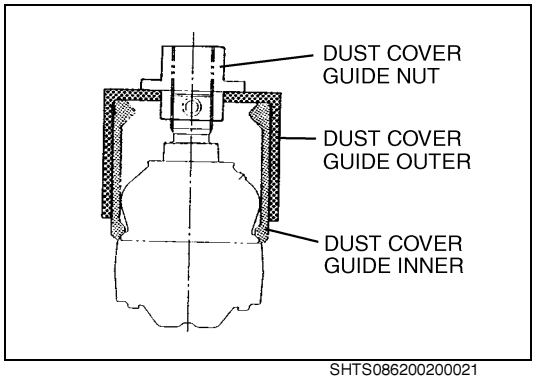
8. REMOVAL OF THE KNUCKLE

(1) Remove the knuckle, thrust washer and thrust bearings.

NOTICE

Be careful not to drop the thrust washer and thrust bearings.

IMPORTANT POINTS - ASSEMBLY



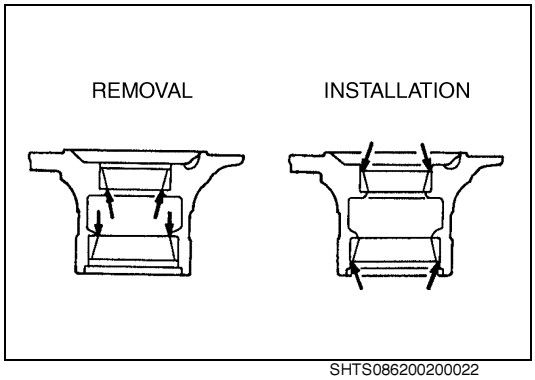
SHTS086200200021

1. REPLACEMENT OF THE DUST COVER

NOTICE

Apply lithium molybdenum sulfide grease to the inside and lip part of the dust cover.

SST:
Dust Cover Guide Nut (9209-20120)
Dust Cover Guide Inner (09657-1790)
Dust Cover Guide Outer (09657-1800)

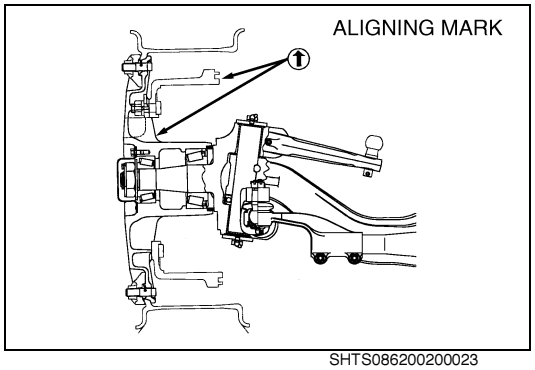


SHTS086200200022

2. REPLACEMENT OF THE WHEEL HUB BEARING RACE

(1) Remove the outer race of bearing by striking the race lightly and evenly, using a tapping rod.

(2) To install the outer race, use a tapping rod and a hammer, or a press.



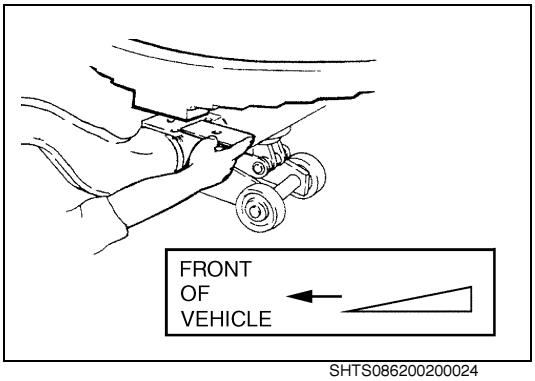
SHTS086200200023

3. ASSEMBLY OF THE BRAKE DRUM AND WHEEL HUB

(1) Assemble the brake drum and wheel hub, and tighten the bolts and nuts.

NOTICE

When assembling the brake drum and wheel hub, make sure that their aligning marks are oriented as closely to each other as possible.



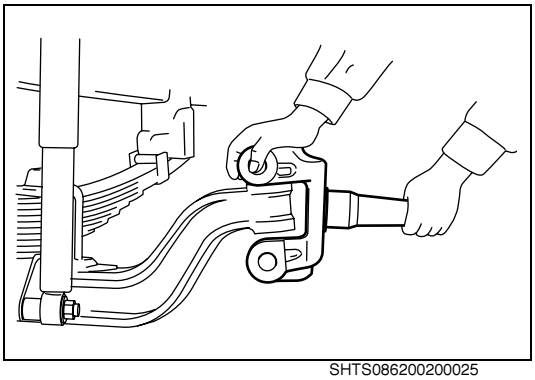
SHTS086200200024

4. INSTALLATION OF THE AXLE BEAM

(1) Secure the axle to the leaf springs with U-bolts.

NOTICE

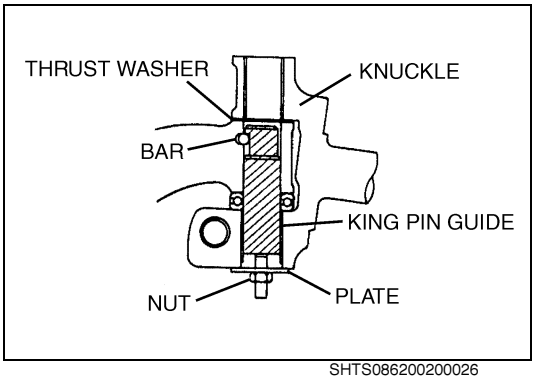
Confirm the direction of caster shim.


SHTS086200200025

5. INSTALLATION OF THE KNUCKLE

NOTICE

Before installation, apply chassis grease to the king pin bush, the rip part of the oil seal and the sliding surfaces of axle beam and knuckle.



SHTS086200200026

6. ADJUSTMENT OF THE CLEARANCE BETWEEN THE THRUST WASHER AND KNUCKLE

(1) Adjust the clearance with the correct thickness thrust washer.

Assembly Standard: Less than 0.1 mm {0.004 in.}

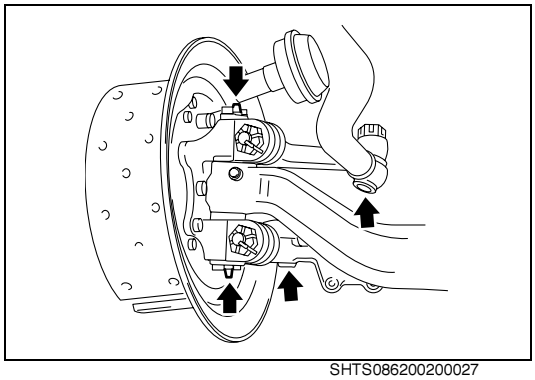
Thickness of Thrust Washer: mm {in.}

3.2 {0.126} 3.3 {0.130} 3.4 {0.134} 3.5 {0.138}
3.6 {0.142} 3.7 {0.146} 3.8 {0.150}

SST:
King Pin Guide (09657-1350)
Plate (09654-1300)
Nut (9201-16130)
Bar (09712-1100)

7. ASSEMBLY OF THE WHEEL BRAKE

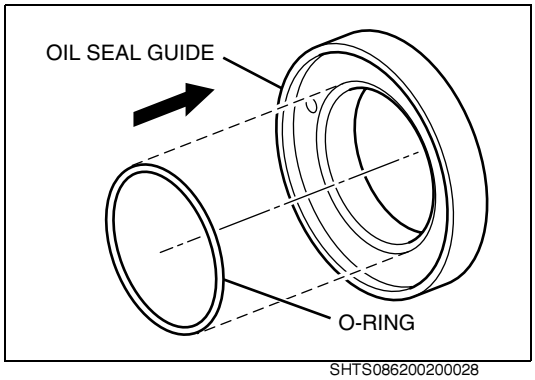
(1) Refer to chapter SERVICE BRAKE.


SHTS086200200027

8. LUBRICATION

(1) Lubricate the king pin with chassis grease, using the lubrication fittings located on the two king pin covers.

(2) Lubricate the ball joint of the drag link and the tie rod with the chassis grease, using the lubrication fittings.

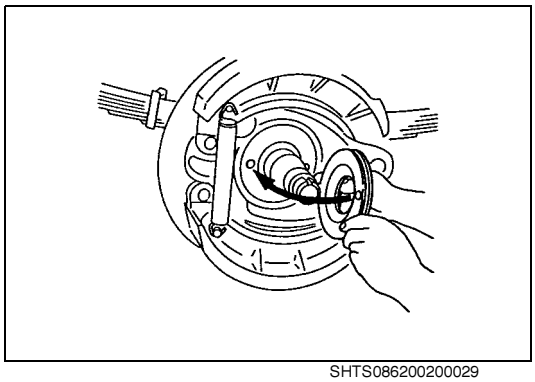


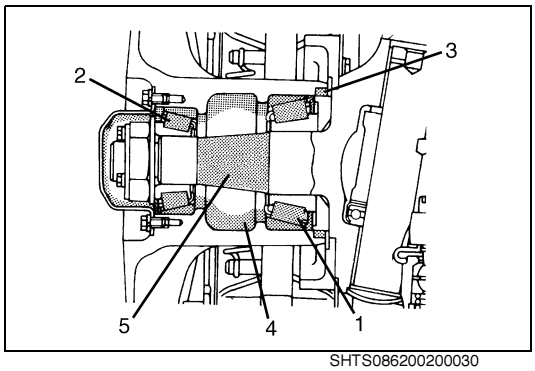
SHTS086200200028

9. INSTALLATION OF THE OIL SEAL GUIDE

NOTICE

- **Install the O-ring to bore side of oil seal guide as shown in the figure.**
- **Align the stopper bolt hole of the knuckle and oil seal guide hole.**
- **If oil seal guide is warmed up with hot water, it can easily be installed.**


SHTS086200200029



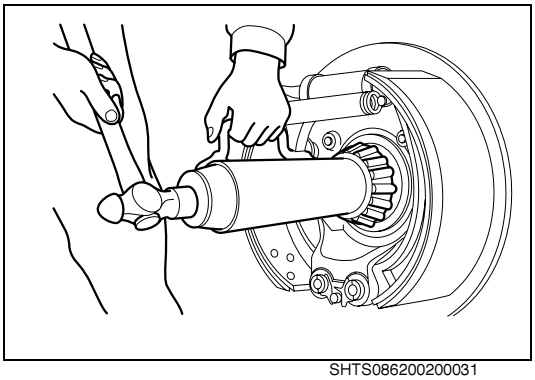
SHTS086200200030

10. GREASING

(1) Before assembling, apply wheel hub bearing grease to the following parts as shown in the figure.

1. Inner wheel hub bearing inner race
2. Outer wheel hub bearing inner race
3. Sealing lip of the oil seal
4. Wheel hub
5. Knuckle spindle

(2) Lubricate the king pin with chassis grease, using the lubrication fittings located on the two king pin covers.

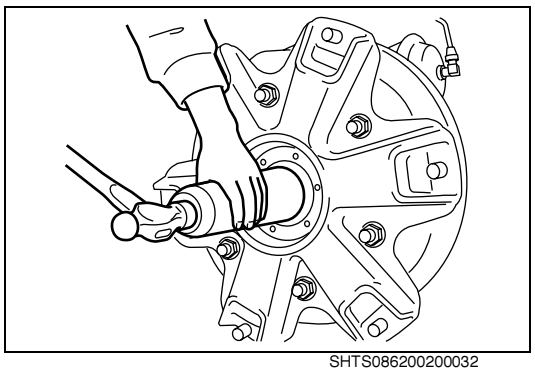

SHTS086200200031

11. INSTALLATION OF THE WHEEL HUB BEARINGS AND WHEEL HUB ASSEMBLY

(1) Install the inner race of inner wheel hub bearing.

NOTICE

Using a tool as shown, simplifies installation.


SHTS086200200032

(2) Install the oil seal in the wheel hub.

(3) Install the wheel hub assembly and the inner race of outer wheel hub bearing.

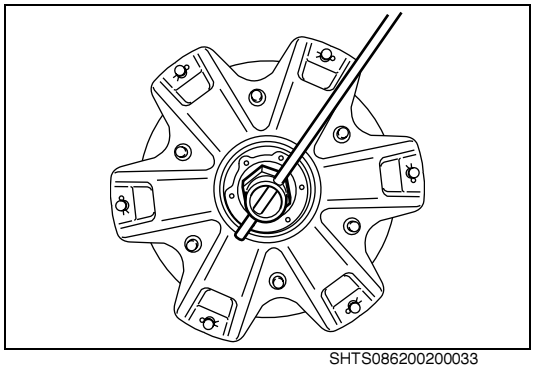
NOTICE

- **Using a tool as shown, simplifies installation.**
- **The wheel hub assembly is heavy, therefore be careful when handling it.**

(4) Install the lock washer.

NOTICE

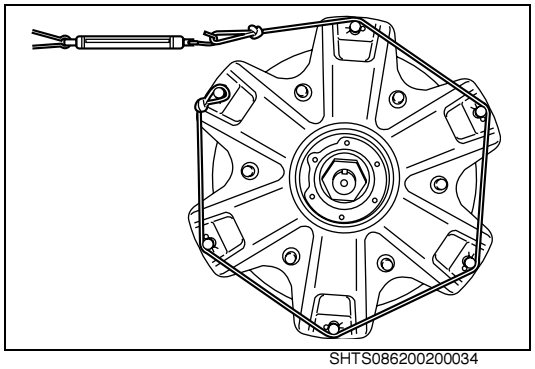
Apply bearing grease to the space between outer wheel hub bearing and lock washer.


SHTS086200200033

12. ADJUSTMENT OF THE WHEEL HUB BEARING PRELOAD

(1) Tighten the wheel hub bearing lock nut with the specified torque then loosen the nut by 1/6 - 1/4 turn.
Tightening Torque:
Approx. 343 N·m {3,500 kgf·cm, 253 lbf·ft}

SST: Socket Wrench (09839-7001)


SHTS086200200034

(2) Strike the wheel hub with a copper hammer to properly seat the wheel hub, and check the return of the bearing. (Check that the hub can be turned by hands, and the nut cannot be turned by hands.)

(3) Measure the wheel bearing preload. If it exceeds or it is less than the standard value shown below, and adjust the preload with the lock nut.

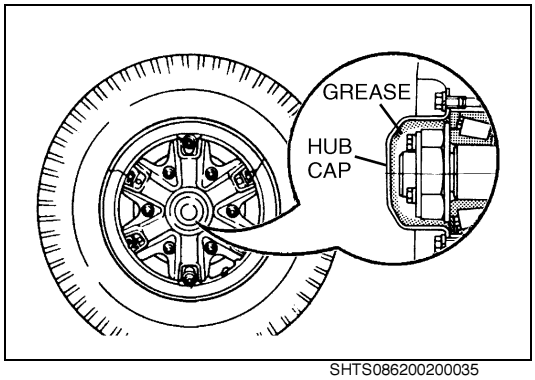
Assembly Standard:

	New bearing	Re-used bearing
Turning Torque N·m {kgf·cm, lbf·ft}	**3.14-5.10 {33-35, 2.4-3.7}**	**2.94-5.10 {30-35, 2.2-3.7}**
Spring balancer reading N {kgf, lbf}	**18.7-30.4 {2.0-3.0, 4.3-6.8}**	**17.6-30.4 {1.8-3.0, 4.0-6.8}**

13. INSTALLATION OF THE LOCK PLATE

NOTICE

- **If the holes of the plate are not aligned with the screw holes of the nut, turn over the plate.**
- **If alignment is still unattainable, turn the lock nut further within the limits of wheel hub bearing preload.**



SHTS086200200035

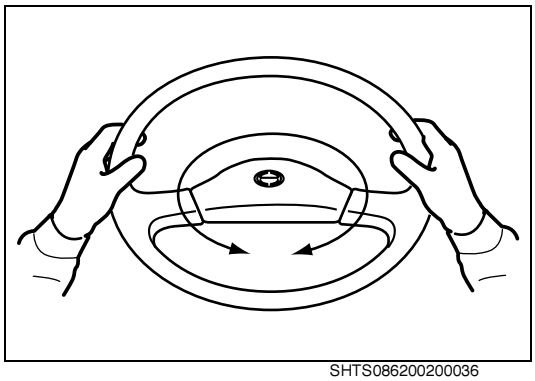
14. INSTALLATION OF THE HUB CAP

NOTICE

Before installing the cap, apply wheel hub bearing grease to the inner surface of the cap.

15. INSTALLATION OF THE WHEELS

(1) Refer to chapter WHEEL & TIRE.


SHTS086200200036

16. TURN THE STEERING WHEEL TO THE FULL RANGE TO THE RIGHT AND THE LEFT, AND CONFIRM THAT ALL STEERING LINKAGES MOVE FREELY (ESPECIALLY THE BALL JOINTS).

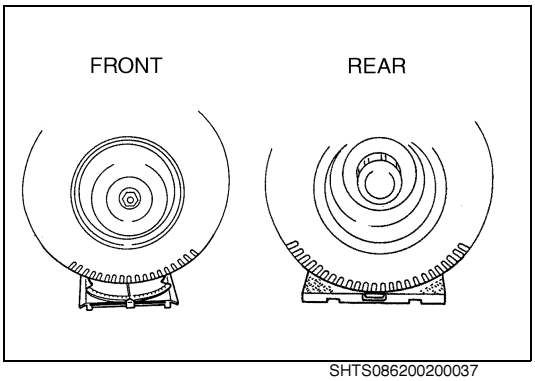
17. THE BRAKE SHOE CLEARANCE AND THE BRAKE CHAMBER ROD STROKE ADJUSTMENT

(1) On completion of the wheel hub and related parts reassembly, conduct the followings:

- Adjust the brake shoe clearance according to the section WHEEL BRAKE in the chapter SERVICE BRAKE.

INSPECTION AND ADJUSTMENT

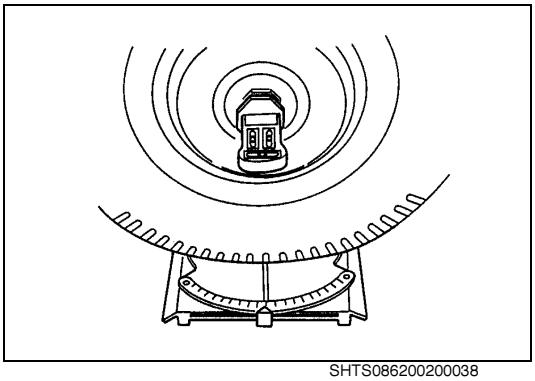
EN0862002H300001



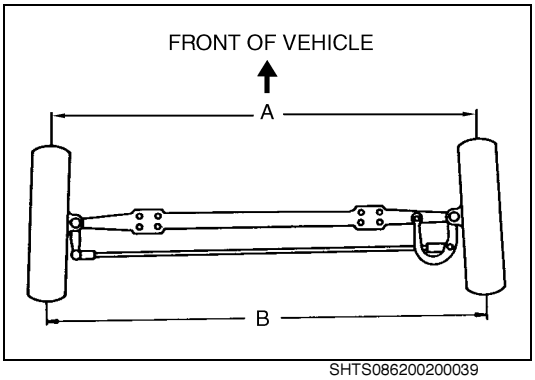
SHTS086200200037

1. INSPECTION OF THE WHEEL ALIGNMENT

(1) Park the vehicle on a level surface and check the tire pressure.


SHTS086200200038

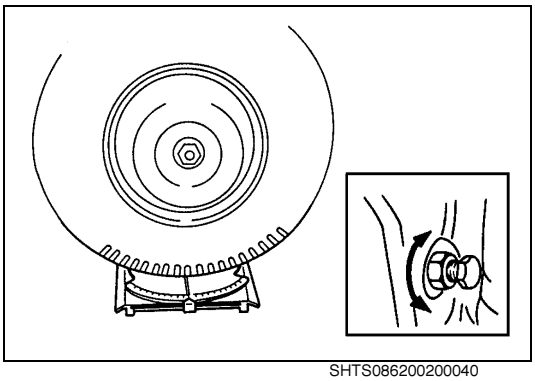
(2) Adjust the king pin inclination, caster, and camber.
Refer to section DATA AND SPECIFICATIONS.



SHTS086200200039

(3) Check the toe-in.

- **B - A =Toe-in**


SHTS086200200040

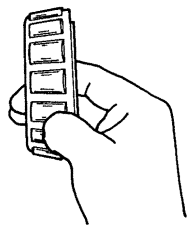
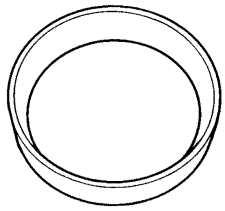
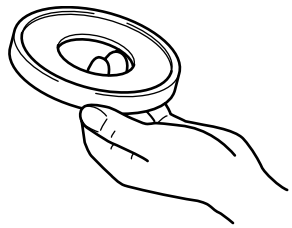
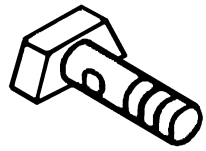
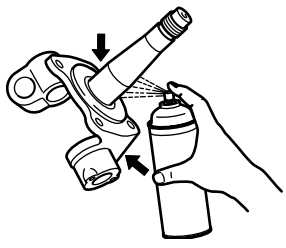
2. ADJUSTMENT OF THE WHEEL TURNING ANGLE WITH STOPPER BOLT

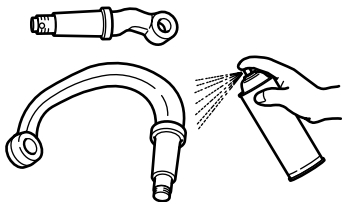
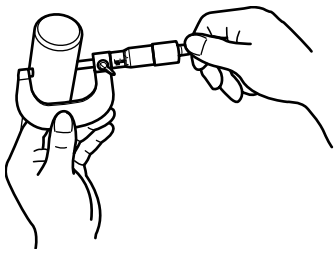
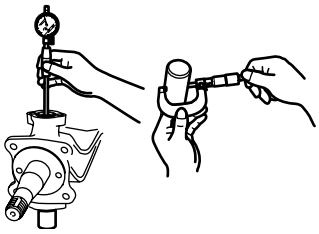
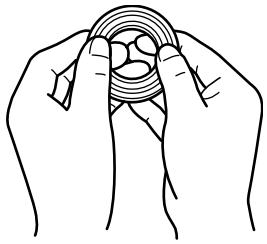
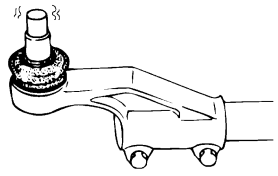
(1) Refer to section DATA AND SPECIFICATIONS.

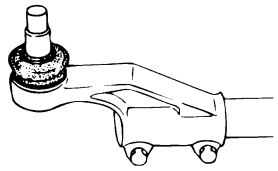
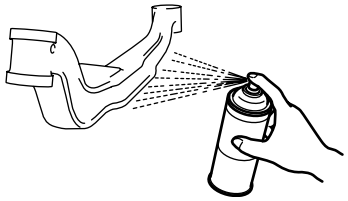
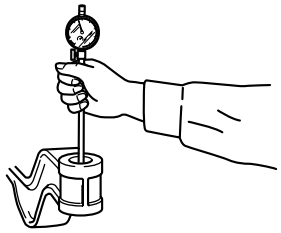
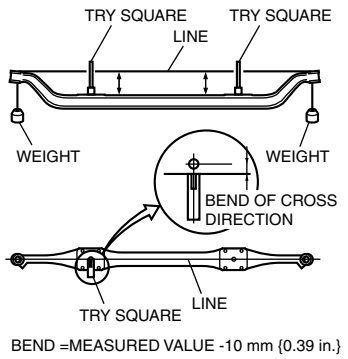
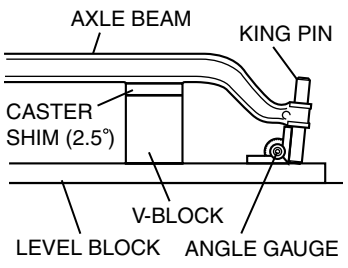
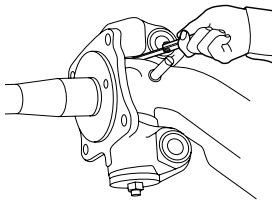
INSPECTION AND REPAIR

EN0862002H300002

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Bearing and race: Burns and pitting	—	—	Replace, if necessary.	Visual check 
			Replace, if necessary.	Visual check 
Oil seal guide: Wear	—	—	Replace, if necessary.	Visual check 
Hub bolts: Threads wear and damage	—	—	Replace, if necessary.	Visual check 
Knuckle: Wear and damage	—	—	Replace, if necessary.	Use the magnetic flaw detector or color checking instrument. 
King pin: Wear and damage	—	—	Replace, if necessary.	Use the magnetic flaw detector or color checking instrument. 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Knuckle arm and tie-rod arm: Crack and damage	**—**	**—**	**Replace, if necessary.**	**Use the magnetic flaw detector or color checking instrument.** 
King pin diameter	**50 {1.969}**	**49.85 {1.9626}**	**Replace.**	**Measure** 
King pin clearance	**0.025-0.080 {0.0010-0.0031}**	**0.35 {0.0138}**	**Replace.**	**Measure** 
Thrust bearing: Burns and pitting	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Tie rod: Distortion	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Tie-rod end ball stud: Threads wear and damage	**—**	**—**	**Replace the tie-rod end assembly.**	**Visual check** 
Tie-rod end ball joint: Gutter	**—**	**—**		

Inspection item	Standard	Limit	Remedy	Inspection procedure
Tie-rod end and dust cover: Crack	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Muddy water in the cover (Sealed type ball stud)	**—**	**—**	**Replace the tie-rod end assembly.**	
Axle beam: Crack and damage	**—**	**—**	**Replace, if necessary.**	**Use the magnetic flaw detector or color checking instrument.** 
Clearance between king pin and axle beam	**0-0.036 {0-0.0014}**	**0.1 {0.0039}**	**Replace.**	**Measure** 
Axle beam: Bend of cross direction	**—**	**1.0 {0.039}**	**Repair or replace. NOTICE Never heat repair.**	**Measure**  BEND =MEASURED VALUE -10 mm {0.39 in.}
King pin mounting angle	**7°30'**	**6°30'-8°30'**	**Replace.**	**Measure** 
Thrust washer: wear (Clearance between knuckle and axle beam)	**—**	**0.5 {0.0197}**	**Replace the thrust washer.**	**Measure** 

REAR AXLE (WITH ISO TYPE WHEEL) AX03-001

REAR AXLE

DATA AND SPECIFICATIONS

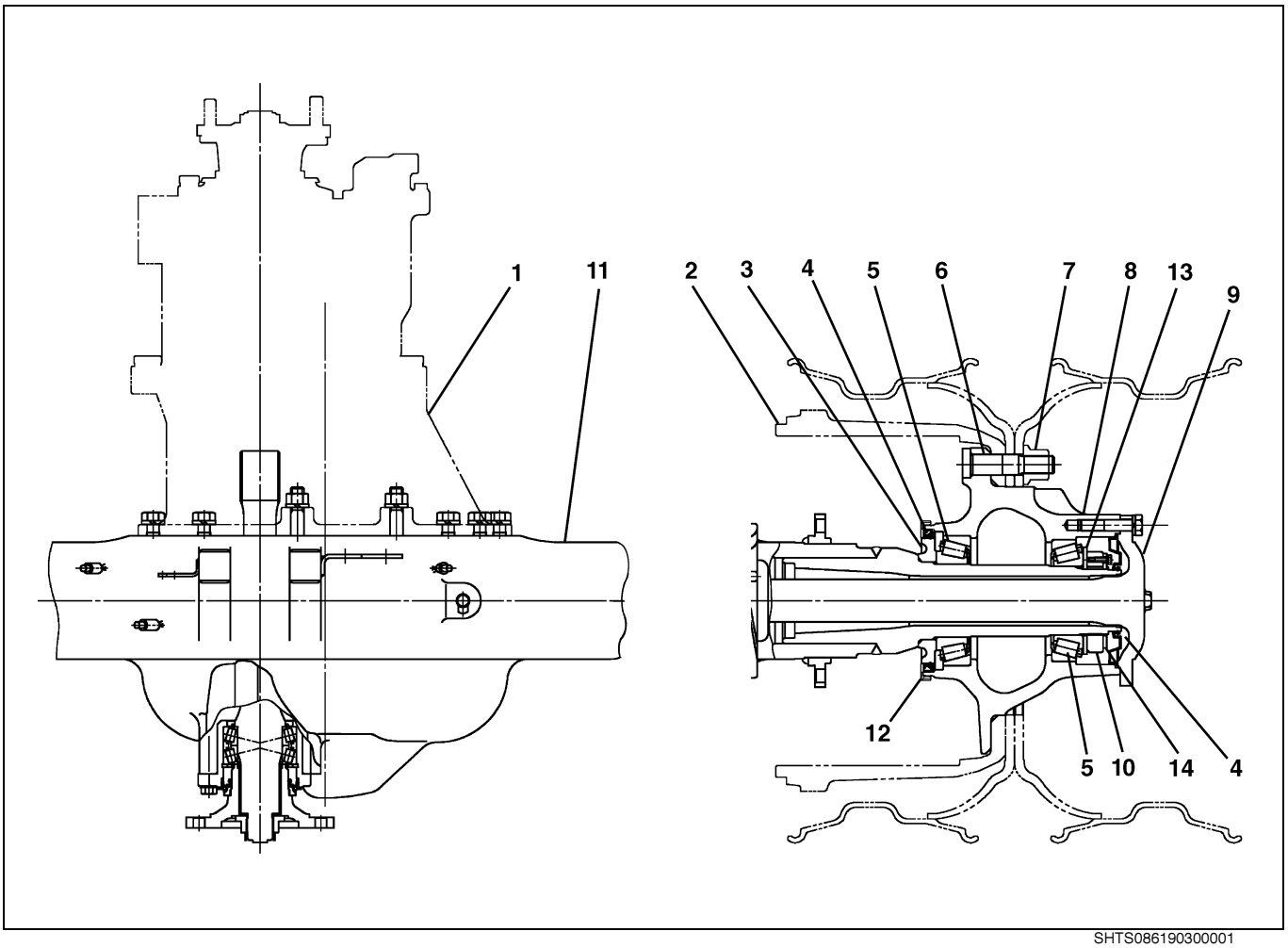
EN0861903I200001

Type	Full-floating axle shaft
Housing	Banjo type, with extension tubes welded on both ends
Type of drive	Torque rod drive or hotchkiss drive

DESCRIPTION

EN0861903C100001

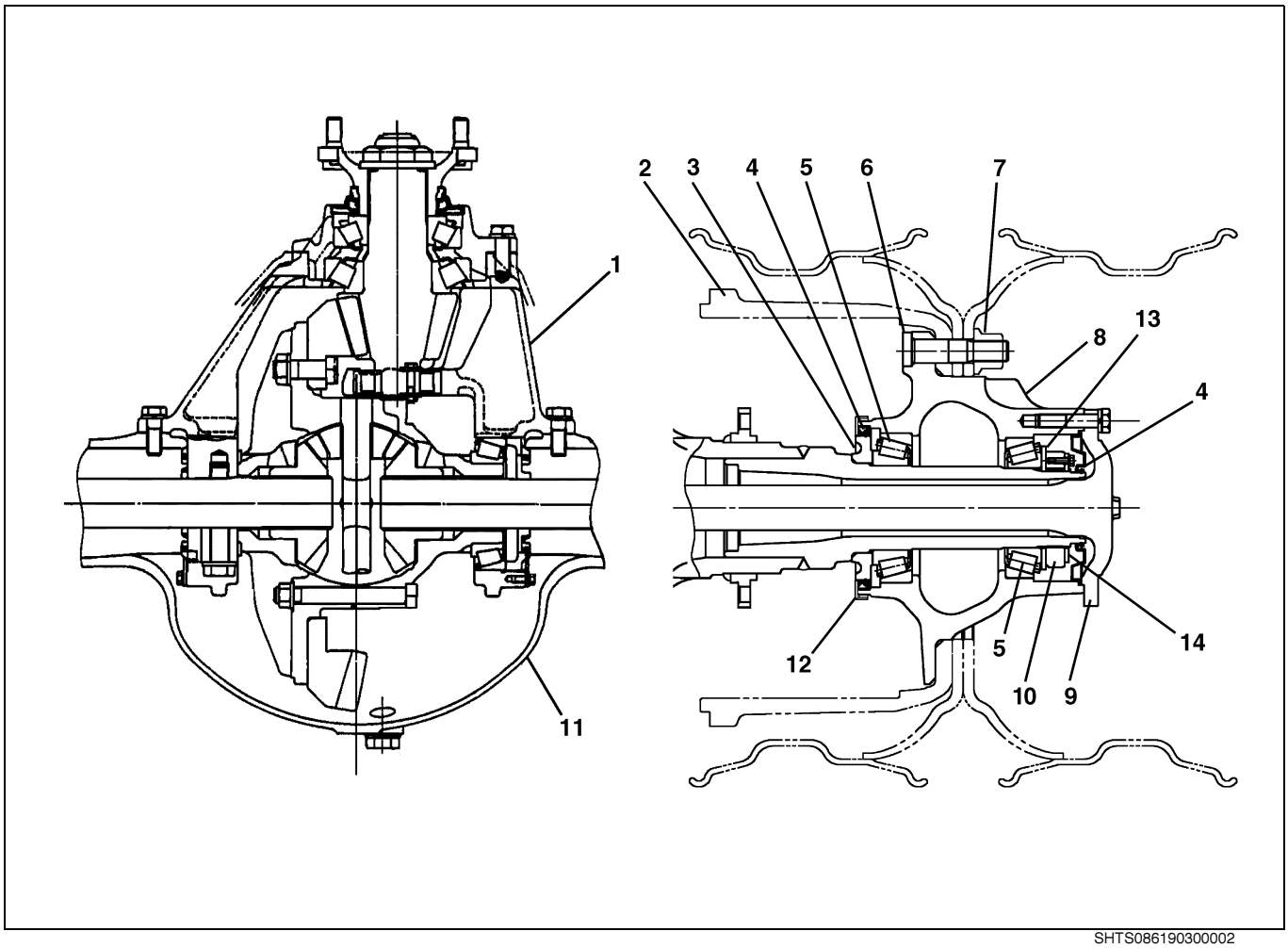
DIFFERENTIAL GEAR SERIES: THD17/THD18



SHTS086190300001

1	Differential carrier assembly	8	Wheel hub
2	Brake drum	9	Axle shaft
3	Oil seal collar	10	Lock nut
4	Oil seal	11	Axle housing
5	Wheel hub bearing	12	ABS sensor ring (If so equipped)
6	Hub bolt	13	Lock washer
7	Wheel nut	14	Lock plate

DIFFERENTIAL GEAR SERIES: SH17/SH18/SH19



SHTS086190300002

1	Differential carrier assembly	8	Wheel hub
2	Brake drum	9	Axle shaft
3	Oil seal collar	10	Lock nut
4	Oil seal	11	Axle housing
5	Wheel hub bearing	12	ABS sensor ring (If so equipped)
6	Hub bolt	13	Lock washer
7	Wheel nut	14	Lock plate

TROUBLESHOOTING

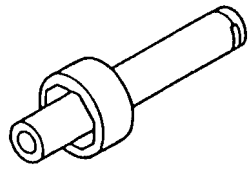
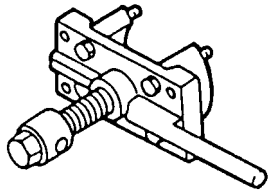
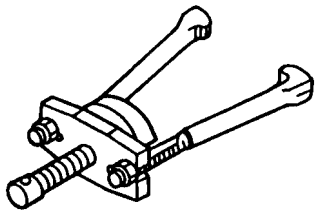
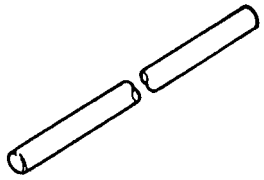
EN0861903F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal noise (Bearing system)	Worn or damaged pinion bearings	Replace bearings.
	Worn or damaged differential side bearings	Replace bearings.
	Loose pinion bearings	Adjust bearing preload.
	Loose differential side bearings	Adjust bearing preload.
Abnormal noise (Gear system)	Inadequate backlash on ring gear and pinion gear	Adjust backlash.
	Worn thrust washers	Replace.
	Worn differential spider	Replace.
	Worn or damaged ring gear and pinion	Replace.
	Worn or damaged differential side gears and pinions	Replace.
	Loose ring gear tightening bolts	Tighten bolts.
	Inadequate tooth contact of ring gear and pinion gear	Replace or adjust tooth contact.
	Worn pinion spline	Replace.
Abnormal noise (Rear axle system)	Worn rear axle shaft spline	Replace.
	Worn hub bearings	Replace.
	Loose hub bearings	Adjust bearing preload.
	Loose differential case tightening bolts	Tighten bolts.
Abnormal noise (Oil system, etc.)	Insufficient oil	Add oil; check for leakage.
	Poor oil quality	Change oil.
	Abnormal noise of propeller shaft	Refer to chapter PROPELLER SHAFT.

SPECIAL TOOL

EN0861903K100001

Prior to starting a rear axle overhaul, it is necessary to have these special tools.

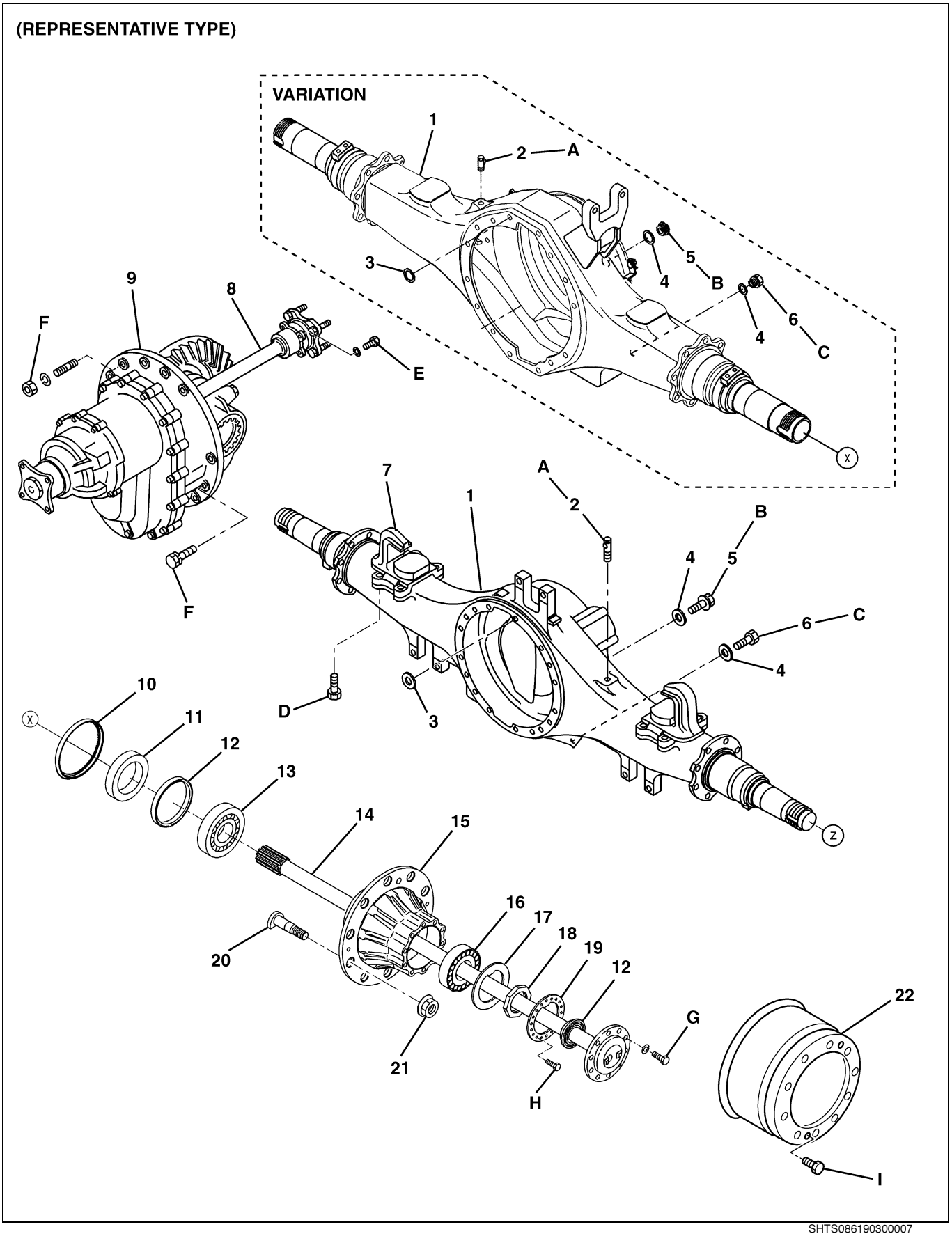
Illustration	Part number	Tool name	Remarks
	09603-1360	SOCKET WRENCH	
	09650-1790	WHEEL HUB PULLER	
	09650-1310	HUB BEARING PULLER	
	09849-1601 09849-2001	HANDLE	

COMPONENT LOCATOR

EN0861903D100001

DIFFERENTIAL GEAR SERIES: THD17/THD18

(REPRESENTATIVE TYPE)



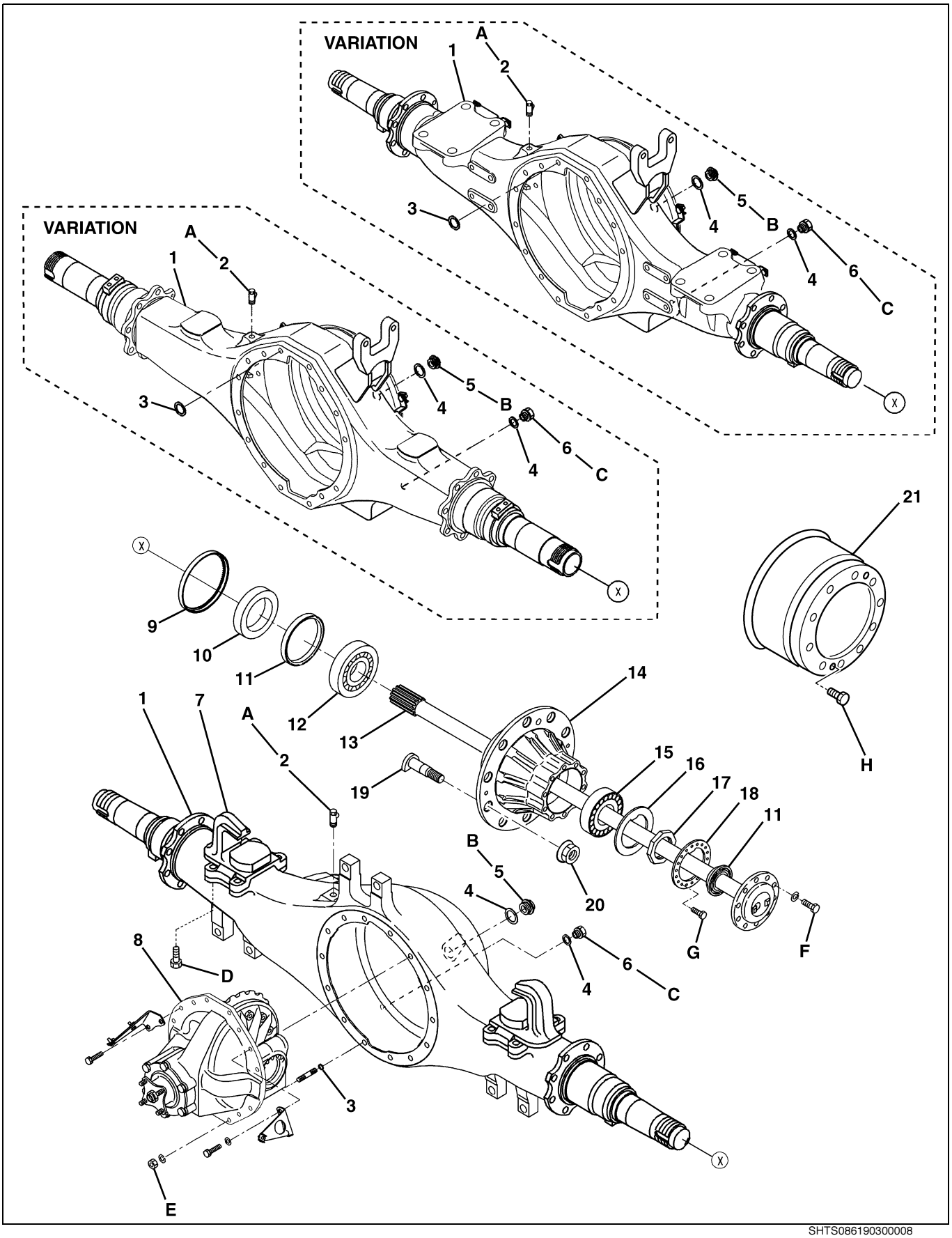
SHTS086190300007

1	Axle housing assembly	12	Oil seal
2	Air breather	13	Inner wheel hub bearing
3	O-ring	14	Axle shaft
4	Gasket	15	Wheel hub
5	Oil filler plug	16	Outer wheel hub bearing
6	Oil drain plug	17	Lock washer
7	Spring bracket	18	Lock nut
8	Through shaft assembly	19	Lock plate
9	Differential carrier assembly	20	Hub bolt
10	ABS sensor ring (If so equipped)	21	Wheel nut
11	Oil seal guide	22	Brake drum

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	9.8-19.6 {100-200, 7.3-14.4}	F	167-213 {1,700-2,200, 123-159}
B	78.4-117.6 {800-1,200, 58-86}	G	148-192 {1,500-2,000, 109-144}
C	39.2-68.6 {400-700, 29-50}	H	8.33-10.79 {85-110, 6.2-8.0}
D	236-324 {2,400-3,300, 175-238}	I	20.5-39.5 {210-400, 16-29}
E	64-84 {650-850, 47-63}		

DIFFERENTIAL GEAR SERIES: SH17/SH18/SH19



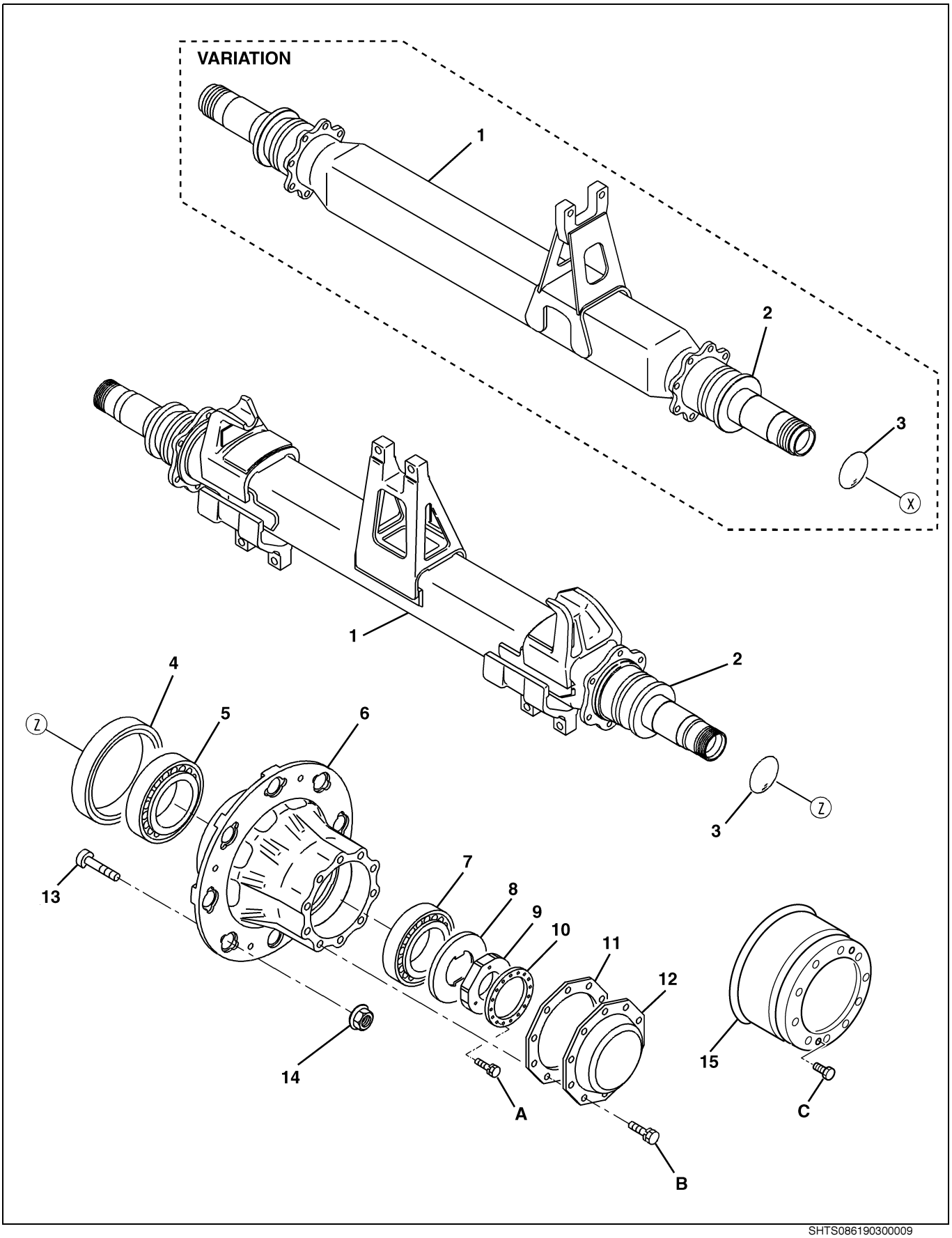
SHTS086190300008

1	Axle housing assembly	12	Inner wheel hub bearing
2	Air breather	13	Axle shaft
3	O-ring	14	Wheel hub
4	Gasket	15	Outer wheel hub bearing
5	Oil filler plug	16	Lock washer
6	Oil drain plug	17	Lock nut
7	Spring bracket	18	Lock plate
8	Differential carrier assembly	19	Hub bolt
9	ABS sensor ring (If so equipped)	20	Wheel nut
10	Oil seal guide	21	Brake drum
11	Oil seal		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	9.8-19.6 {100-200, 7.3-14.4}	E	167-213 {1,700-2,200, 123-159}
B	78.4-117.6 {800-1,200, 58-86}	F	148-192 {1,500-2,000, 109-144}
C	39.2-68.6 {400-700, 29-50}	G	8.33-10.79 {85-110, 6.2-8.0}
D	236-324 {2,400-3,300, 175-238}	H	20.5-39.5 {210-400, 16-29}

DEAD AXLE



SHTS086190300009

1	Dead axel tube	9	Lock nut
2	Oil seal guide	10	Lock plate
3	Expansion plug	11	Gasket
4	Oil seal	12	Wheel hub cover
5	Inner wheel hub bearing	13	Hub bolt
6	Wheel hub	14	Wheel nut
7	Outer wheel hub bearing	15	Brake drum
8	Lock washer		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

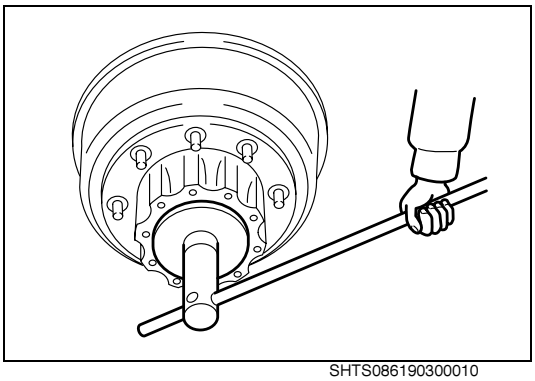
A	8.33-10.79 {85-110, 6.2-8.0}	C	20.5-39.5 {210-400, 16-29}
B	10.7-146.6 {1,100-1,500, 81-110}		

OVERHAUL

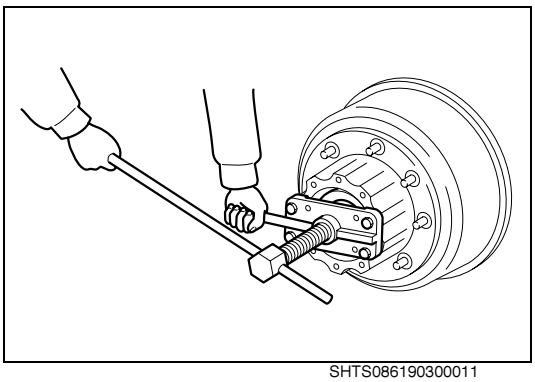
EN0861903H200001

IMPORTANT POINTS - DISASSEMBLY

1. REMOVAL OF THE WHEELS
(1) Refer to chapter WHEEL & TIRE.

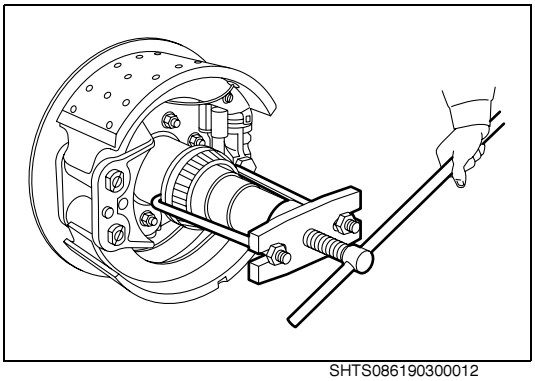

SHTS086190300010

2. REMOVAL OF THE WHEEL HUB BEARING LOCK NUT
SST:
Socket Wrench (09603-1360)
Handle (09849-1601)
Handle (09849-2001)


SHTS086190300011

3. REMOVAL OF THE WHEEL HUB ASSEMBLY AND THE OUTER WHEEL HUB BEARING
SST:
Wheel Hub Puller (09650-1790)
Handle (09849-1601)
Handle (09849-2001)

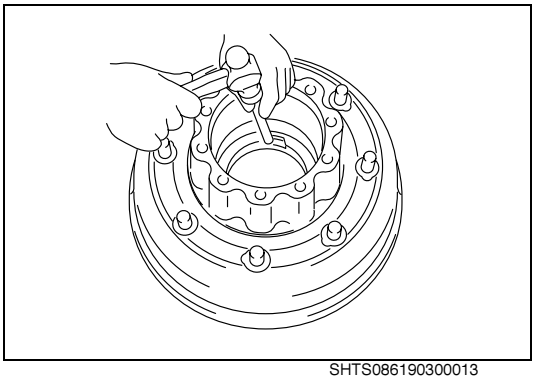
NOTICE
The wheel hub assembly is heavy, therefore be careful when handling it.


SHTS086190300012

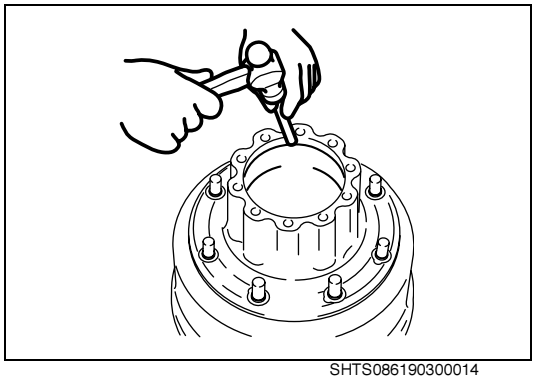
4. REMOVAL OF THE INNER WHEEL HUB BEARING TOGETHER WITH OIL SEAL COLLAR
SST:
Hub Bearing Puller (09650-1310)
Handle (09849-1601)
Handle (09849-2001)

5. REMOVAL OF THE WHEEL BRAKE
(1) Refer to chapter SERVICE BRAKE.

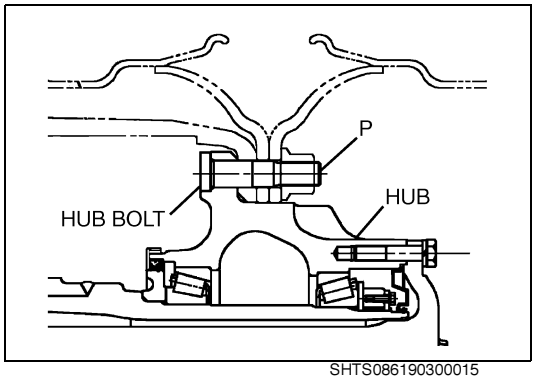
IMPORTANT POINTS - ASSEMBLY


SHTS086190300013

1. REPLACEMENT OF THE WHEEL HUB BEARING RACE
(1) Remove the outer race of bearing by striking the race lightly and evenly through the 4 access holes in the wheel hub, using a tapping rod.


SHTS086190300014

(2) Using a tapping rod and a hammer or a press, install the outer race.



SHTS086190300015

2. SEPARATION OF THE BRAKE DRUM

(1) Loosen the drum set screws, separate the brake drum and wheel hub.

NOTICE

- **If the drum does not easily come out, screw the set screws into the drum removing hole.**
- **Brake drum is heavy, therefore be careful when handling it.**

3. REPLACEMENT OF THE HUB BOLTS

(1) Remove the hub bolts from the wheel hub.
(2) Install the new hub bolts.

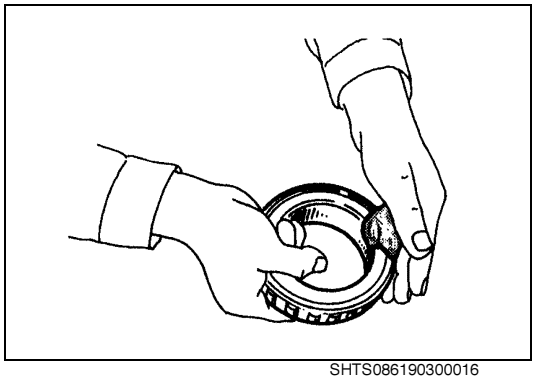
NOTICE

The left and right hub bolts differ, so install them according to the chart below.

	Marks at "P"	Color
RIGHT	R	Gold
LEFT	L	Silver

4. ASSEMBLING OF THE BRAKE DRUM

(1) Assemble the brake drum and the wheel hub, and tighten the drum set screw.

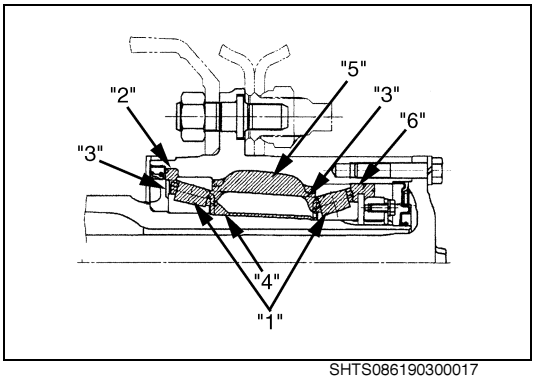

SHTS086190300016

5. GREASING

(1) Pack sufficient amount of wheel hub bearing grease between the bearing rollers.

NOTICE

"1": Fill the grease to spaces among the inner race, rollers and retainer to the extent that there is not any vacancy remained.

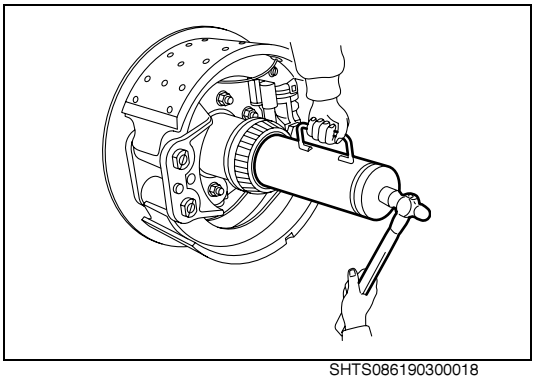


SHTS086190300017

(2) Apply bearing grease to wheel hub.

NOTICE

- **"2": Fill the grease between the oil seal and inner bearing, and at this time some grease may flow out to the oil seal.**
- **"3": The grease has to ooze out to the extent that the retainer is buried.**
- **"4": After pressing in the inner race of the inner bearing, apply the grease to the end of race circumferentially with the width of 15 mm {0.591 in}.**
- **"5": When filling the grease to this space, do it up to the line which connects between the small diameter sides edges of 2 bearings.**
- **"6": Fill the grease up the half depth of the lock nut.**

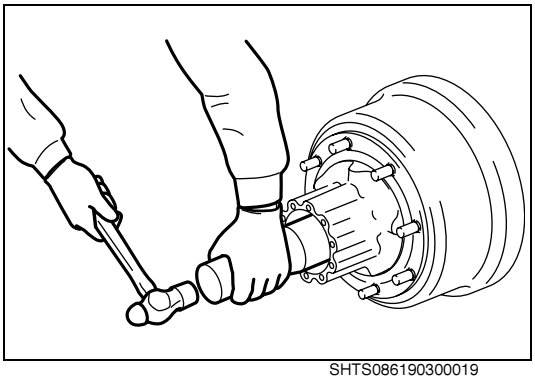

SHTS086190300018

6. INSTALLATION OF THE OIL SEAL, THE WHEEL HUB BEARINGS AND WHEEL HUB ASSEMBLY

(1) Install the oil seal and the inner wheel hub bearing.

NOTICE

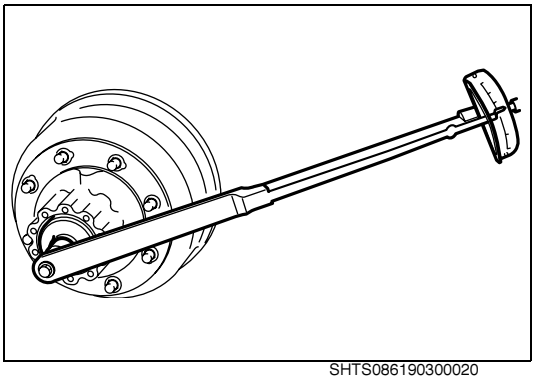
- **If the guide is warmed up with hot water, it can easily be installed.**


SHTS086190300019

(2) Install the wheel hub assembly and the outer wheel hub bearing.

NOTICE

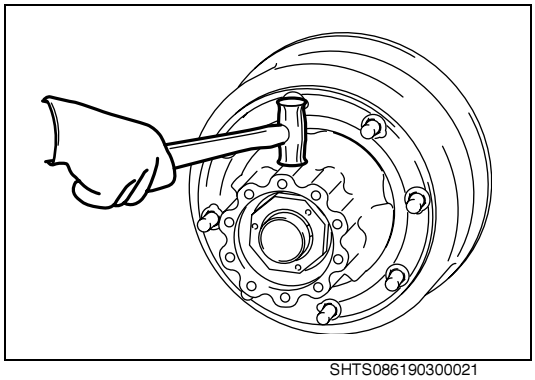
- **Using a tool as shown simplifies installation.**
- **The wheel hub assembly is heavy, therefore be careful when handling it.**


SHTS086190300020

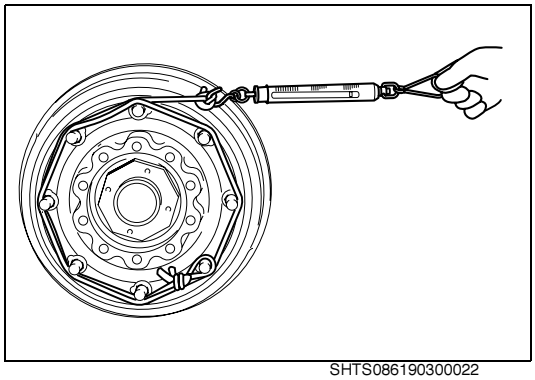
7. ADJUSTMENT OF THE WHEEL HUB BEARING PRELOAD

(1) Tighten the wheel hub bearing lock nut with the specified torque then loosen the nut by 1/3 - 1/4 turn.
SST: Socket Wrench (09603-1360)

Tightening Torque:
588-1,176 N·m {6,000-12,000 kgf·cm, 434-867 lbf·ft}


SHTS086190300021

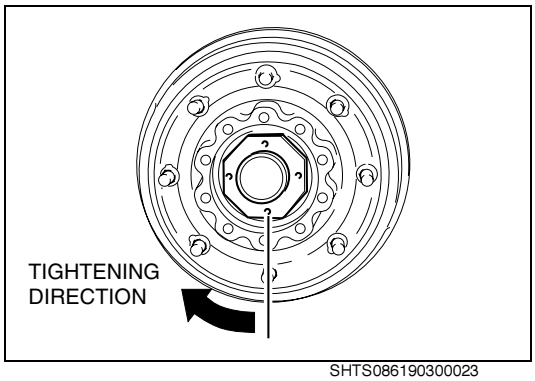
(2) Strike the wheel hub with a copper hammer to properly seat the wheel hub.


SHTS086190300022

(3) Measure the wheel bearing preload. If it exceeds or it is less than the standard value shown below, adjust the preload with the lock nut.

Assembly standard:

Turning Torque N·m {kgf·cm, lbf·ft}	**3.9-7.9 {40-80, 2.9-5.8}**
Spring balancer reading N {kgf, lbf}	**23.3-47.1 {2.4-4.8, 5.3-10.5}**



SHTS086190300023

8. INSTALLATION OF THE LOCK PLATE

(1) Install the lock plate to the lock nut.

NOTICE

- **If the holes of the plate are not aligned with screw holes of the nut, turn over the plate.**
- **If alignment is still unattainable, turn the lock nut further within the limits of wheel hub bearing preload.**

9. INSTALLATION OF THE WHEELS

(1) Refer to chapter WHEEL & TIRE.

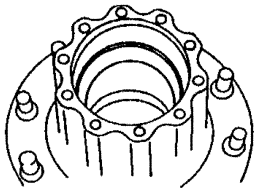
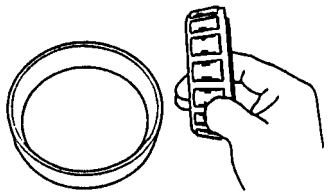
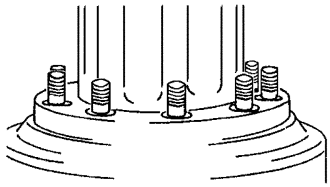
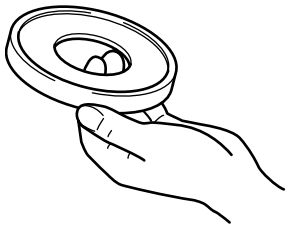
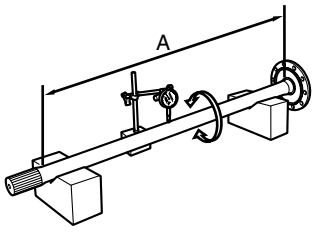
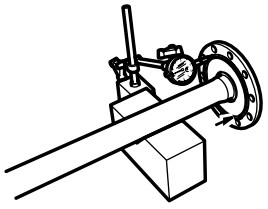
10. THE BRAKE SHOE CLEARANCE AND THE BRAKE CHAMBER ROD STROKE ADJUSTMENT

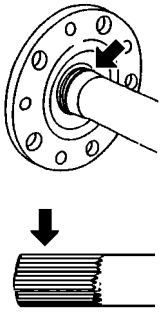
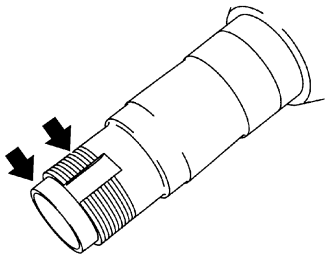
(1) On completion of the wheel hub and related parts reassembly, conduct the followings.
   a. Adjust the brake shoe clearance according to the section WHEEL BRAKE in the chapter SERVICE BRAKE.

INSPECTION AND REPAIR

EN0861903H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Wheel hub bearing race: Burns, pitting and cracks	—	—	Replace, if necessary.	Visual check 
Wheel hub bearings: Burns and pitting	—	—	Replace, if necessary.	Visual check 
Hub bolt: Wear and damage	—	—	Replace, if necessary.	Visual check 
Oil seal guide: Wear and damage	—	—	Replace, if necessary.	Visual check 
Axel shaft: Bend (Measure the bend at 2 or 3 points of the range "A".)	0.8 {0.0314} or less	—	Replace.	Measure 
Axel shaft flange: Bend	0.3 {0.0118} or less	—	Replace.	Measure 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Axle shaft flange and spline: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Use the magnetic flaw detector or color checking instrument.** 
Axle tube: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

REAR AXLE (WITH SPOKE TYPE WHEEL)

AX03-002

REAR AXLE

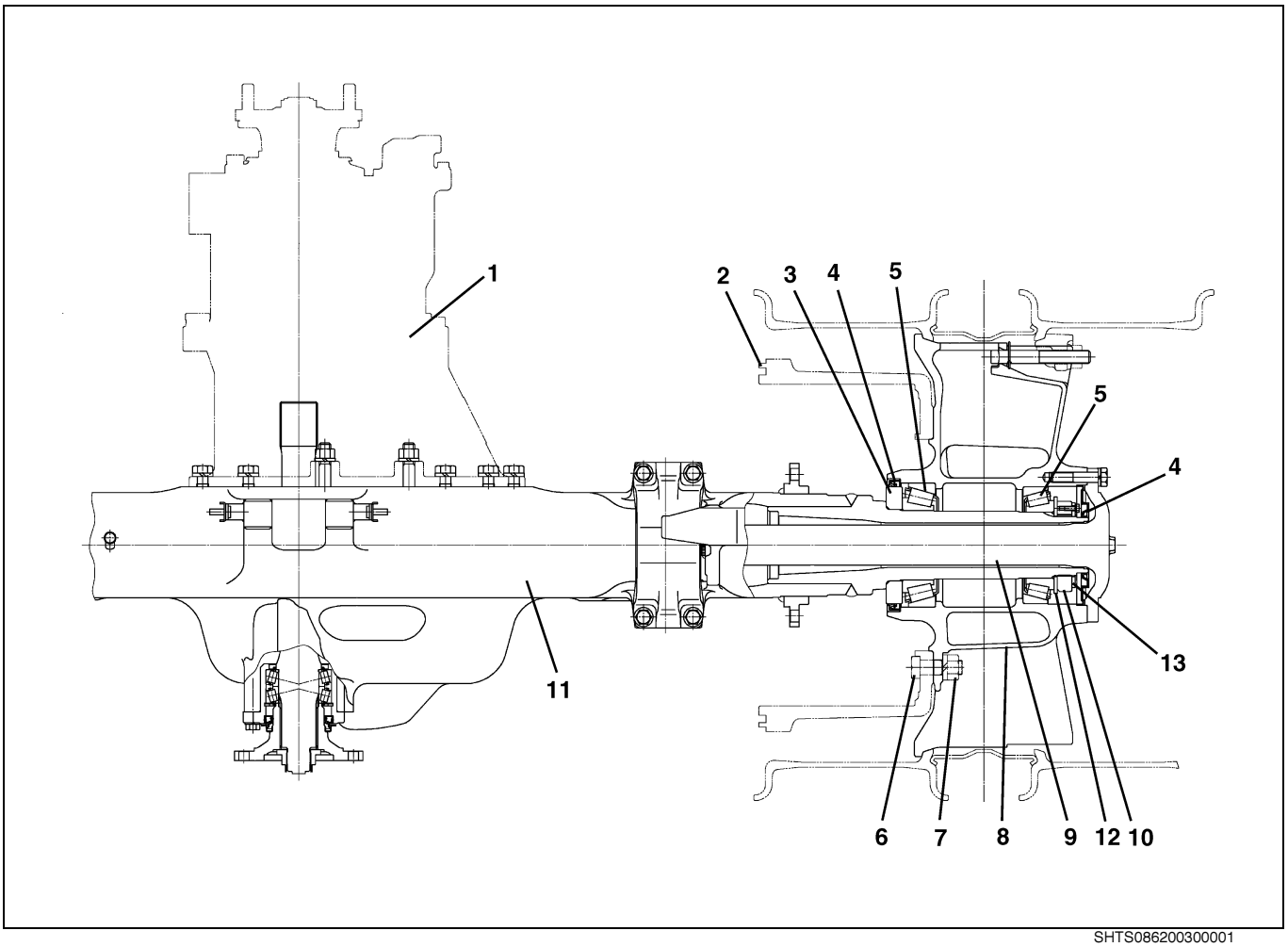
DATA AND SPECIFICATIONS

EN0862003I200001

Type	Full-floating axle shaft
Housing	Banjo type, with extension tubes welded on both ends
Type of drive	Torque rod drive

DESCRIPTION

EN0862003C100001



SHTS086200300001

1	Differential carrier assembly	8	Wheel hub
2	Brake drum	9	Axle shaft
3	Oil seal collar	10	Lock nut
4	Oil seal	11	Axle housing
5	Wheel hub bearing	12	Lock washer
6	Hub bolt	13	Lock plate
7	Wheel nut		

TROUBLESHOOTING

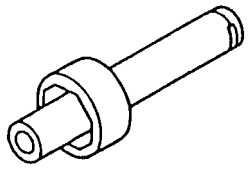
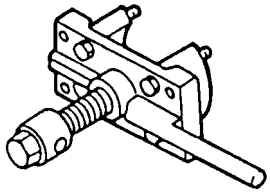
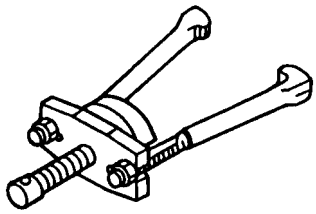
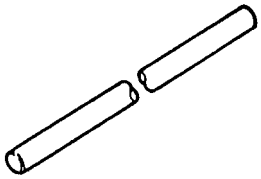
EN0862003F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal noise (Bearing system)	Worn or damaged pinion bearings	Replace bearings.
	Worn or damaged differential side bearings	Replace bearings.
	Loose pinion bearings	Adjust bearing preload.
	Loose differential side bearings	Adjust bearing preload.
Abnormal noise (Gear system)	Inadequate backlash on ring gear and pinion gear	Adjust backlash.
	Worn thrust washers	Replace.
	Worn differential spider	Replace.
	Worn or damaged ring gear and pinion	Replace.
	Worn or damaged differential side gears and pinions	Replace.
	Loose ring gear tightening bolts	Tighten bolts.
	Inadequate tooth contact of ring gear and pinion gear	Replace or adjust tooth contact.
	Worn pinion spline	Replace.
Abnormal noise (Rear axle system)	Worn rear axle shaft spline	Replace.
	Worn hub bearings	Replace.
	Loose hub bearings	Adjust bearing preload.
	Loose differential case tightening bolts	Tighten bolts.
Abnormal noise (Oil system, etc.)	Insufficient oil	Add oil; check for leakage.
	Poor oil quality	Change oil.
	Abnormal noise of propeller shaft	Refer to chapter PROPELLER SHAFT.

SPECIAL TOOL

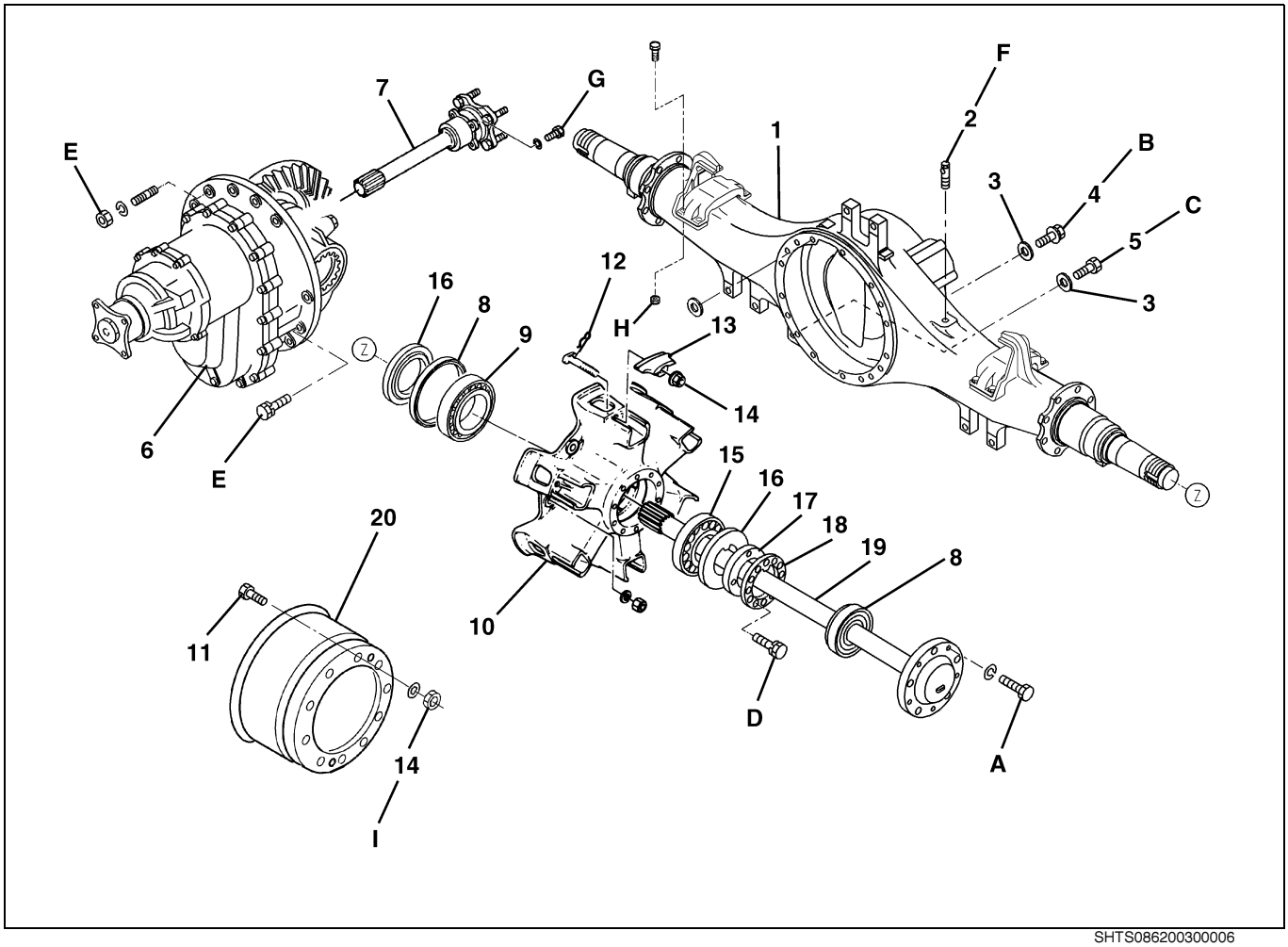
EN0862003K100001

Prior to starting a rear axle overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	09603-1360	SOCKET WRENCH	
	09650-1790	WHEEL HUB PULLER	
	09650-1310	HUB BEARING PULLER	
	09849-1601 09849-2001	HANDLE	

COMPONENT LOCATOR

EN0862003D100001



SHTS086200300006

1	Axle housing assembly	8	Oil seal	15	Outer wheel hub bearing
2	Air breather	9	Inner wheel hub bearing	16	Lock washer
3	Gasket	10	Spoke wheel hub	17	Lock nut
4	Oil filler plug	11	Hub bolt	18	Lock plate
5	Oil drain plug	12	Pin	19	Axle shaft
6	Differential carrier assembly	13	Clamp	20	Brake drum
7	Through shaft assembly	14	Wheel nut		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	148-192 {1,510-1,957, 110-141}	F	9.8-19.6 {100-199, 7.3-14.4}
B	78.4-117.6 {800-1,199, 58-86}	G	64-84 {653-856, 48-62}
C	39.2-68.6 {400-699, 29-50}	H	107.4-146.6 {1,096-1,495, 80-108}
D	8.33-10.79 {85-110, 6.2-7.9}	I	393-471 {4,008-4,802, 290-347}
E	167-213 {1,703-2,171, 124-157}		

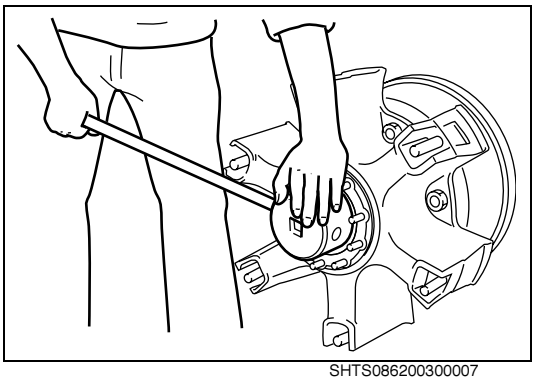
OVERHAUL

EN0862003H200001

IMPORTANT POINTS - DISASSEMBLY

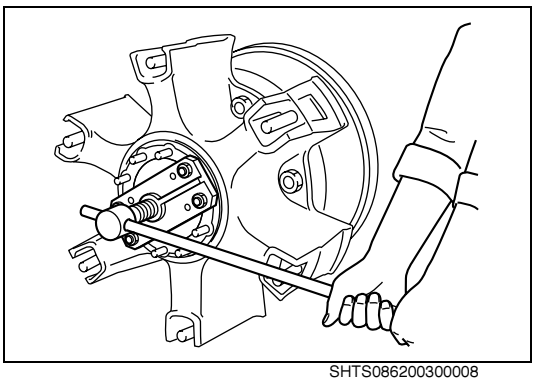
1. REMOVAL OF THE RIM AND TIRE

(1) Refer to chapter WHEEL & TIRE.



SHTS086200300007

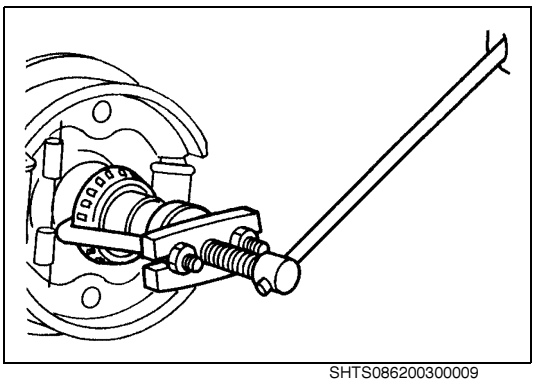
2. REMOVAL OF THE WHEEL HUB BEARING LOCK NUT
SST:
Socket Wrench (09603-1360)
Handle (09849-1601)
Handle (09849-2001)



SHTS086200300008

3. REMOVAL OF THE WHEEL HUB ASSEMBLY AND THE OUTER WHEEL HUB BEARING
SST:
Wheel Hub Puller (09650-1790)
Handle (09849-1601)
Handle (09849-2001)

NOTICE
The wheel hub assembly is heavy, therefore be careful when handling it.

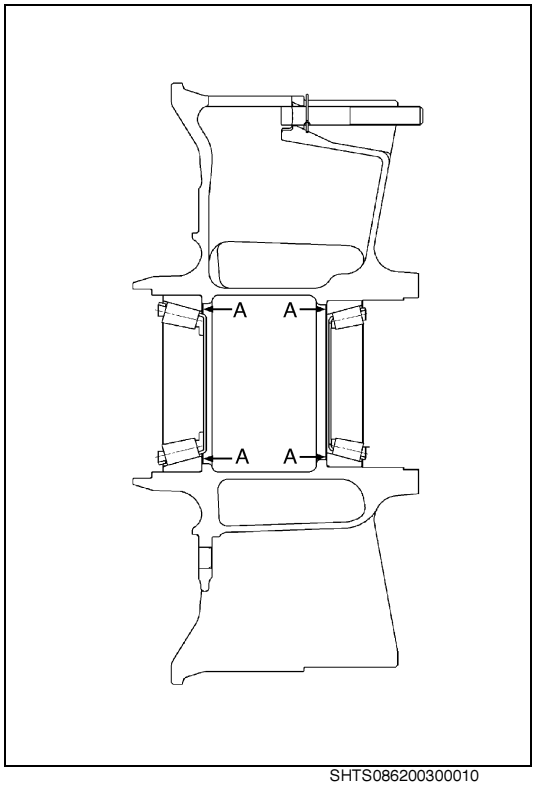


SHTS086200300009

4. REMOVAL OF THE INNER WHEEL HUB BEARING TOGETHER WITH OIL SEAL COLLAR
SST:
Hub Bearing Puller (09650-1310)
Handle (09849-1601)
Handle (09849-2001)

5. REMOVAL OF THE WHEEL BRAKE

(1) Refer to chapter SERVICE BRAKE.

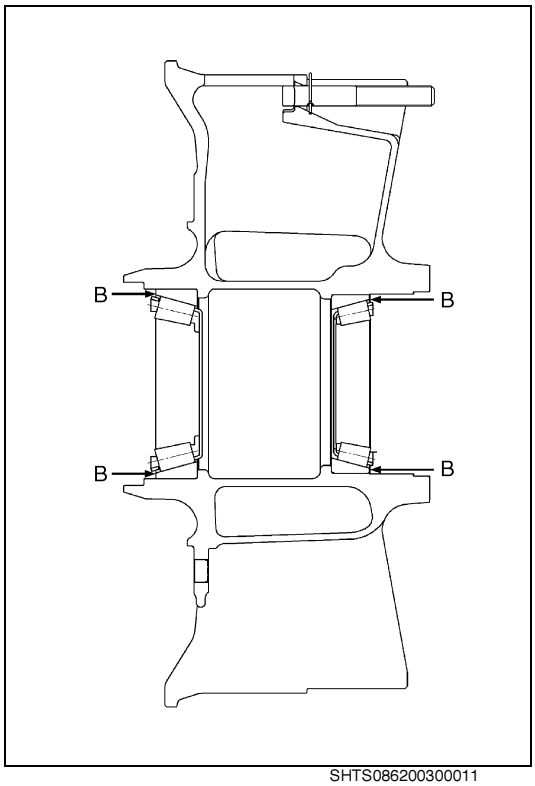


SHTS086200300010

IMPORTANT POINTS - ASSEMBLY

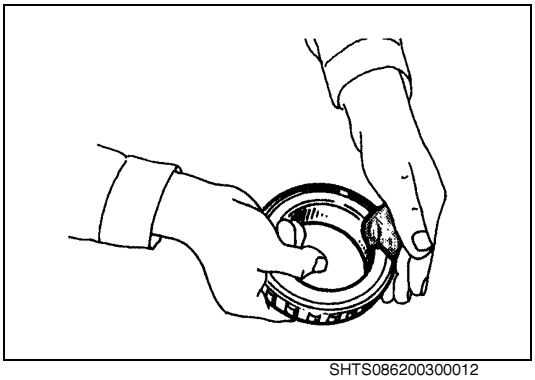
1. REPLACEMENT OF THE WHEEL HUB BEARING RACE

(1) Remove the outer race of bearing by striking the race (part "A") lightly and evenly through the 4 access holes in the wheel hub, using a tapping rod.



SHTS086200300011

(2) Using a tapping rod and a hammer or a press, install the outer race (part "B").

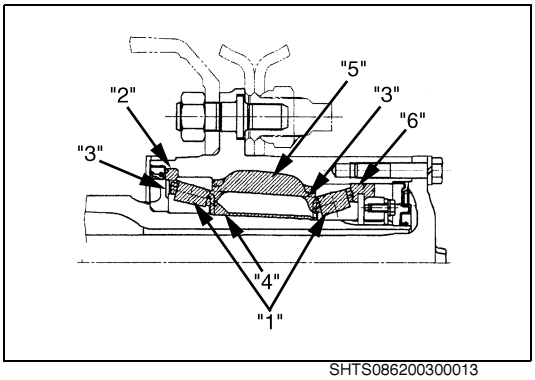

SHTS086200300012

2. GREASING

(1) Pack sufficient amount of wheel hub bearing grease between the bearing rollers, apply bearing grease to the lip part of oil seal.

NOTICE

"1": Fill the grease to spaces among the inner race, rollers and retainer to the extent that there is not any vacancy remained.

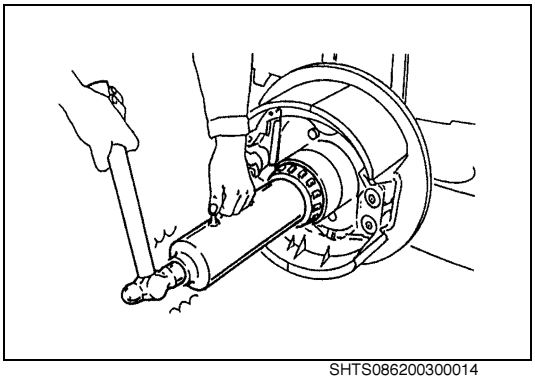


SHTS086200300013

(2) Apply wheel hub bearing grease to wheel hub.

NOTICE

- **"2": Fill the grease between the oil seal and inner bearing, and at this time some grease may flow out to the oil seal.**
- **"3": The grease has to ooze out to the extent that the retainer is buried.**
- **"4": After pressing in the inner race of the inner bearing, apply the grease to the end of race circumferentially with the width of 15 mm {0.591 in}.**
- **"5": When filling the grease to this space, do it up to the line which connects between the small diameter sides edges of 2 bearings.**
- **"6": Fill the grease up the half depth of the lock nut.**

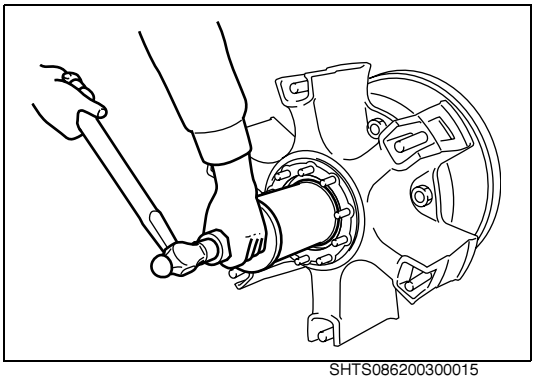

SHTS086200300014

3. INSTALLATION OF THE OIL SEAL, THE WHEEL HUB BEARINGS AND WHEEL HUB ASSEMBLY

(1) Install the oil seal and the inner wheel hub bearing.

NOTICE

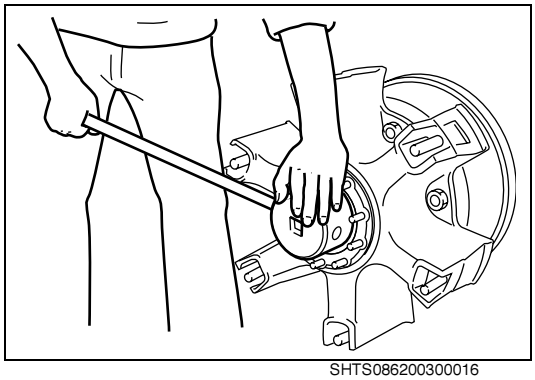
- **If the collar is warmed up with hot water, it can easily be installed.**


SHTS086200300015

(2) Install the wheel hub assembly and the outer wheel hub bearing.

NOTICE

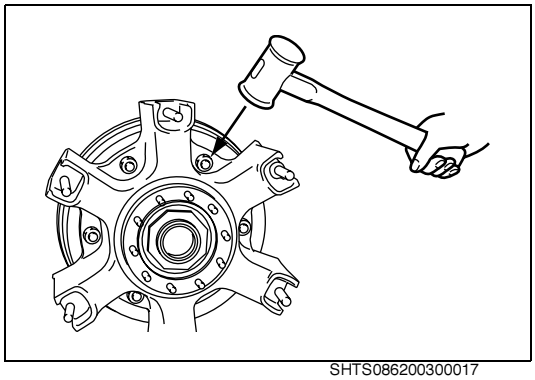
- **Using a tool as shown simplifies installation.**
- **The wheel hub assembly is heavy, therefore be careful when handling it.**


SHTS086200300016

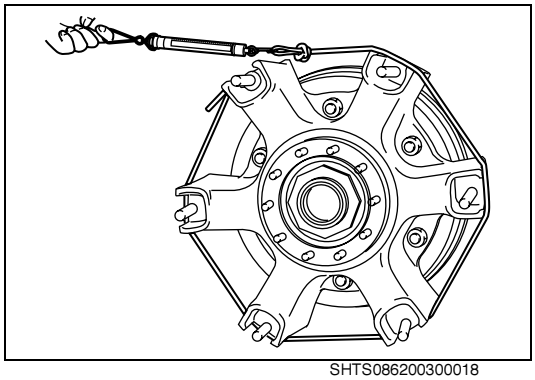
4. ADJUSTMENT-OF THE WHEEL HUB BEARING PRELOAD

(1) Tighten the wheel hub bearing lock nut with the specified torque then loosen the nut by 1/3 - 1/4 turn.
SST: Socket Wrench (09603-1360)

Tightening Torque:
588-1,176 N·m {6,000-12,000 kgf·cm, 434-867 lbf·ft}


SHTS086200300017

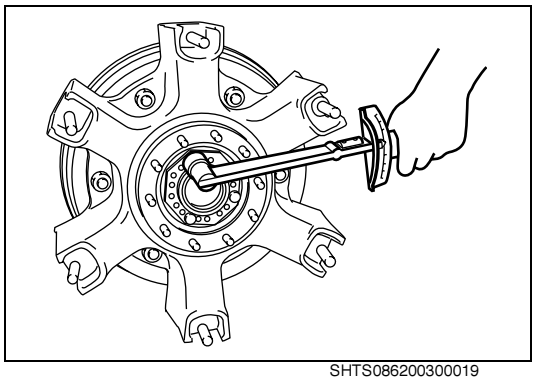
(2) Strike the wheel hub with a copper hammer to properly seat the wheel hub.


SHTS086200300018

(3) Measure the wheel bearing preload. If it exceeds or it is less than the standard value shown below, adjust the preload with the lock nut.

Assembly standard:

Turning Torque N·m {kgf·cm, lbf·ft}	**4.9-8.9 {50-90, 3.7-6.5}**
Spring balancer reading N {kgf, lbf}	**17.8-32.3 {1.8-3.3, 4.0-7.3}**


SHTS086200300019

5. INSTALLATION OF THE LOCK PLATE

(1) Install the lock plate to the lock nut.

NOTICE

- **If the holes of the plate are not aligned with screw holes of the nut, turn over the plate.**
- **If alignment is still unattainable, turn the lock nut further within the limits of wheel hub bearing preload.**

6. INSTALLATION OF THE WHEELS

(1) Refer to chapter WHEEL & TIRE.

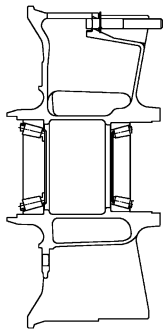
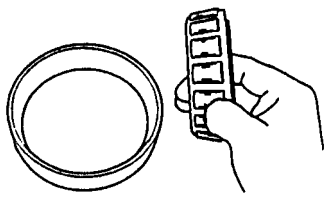
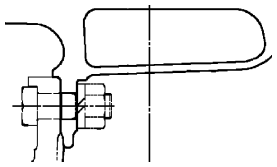
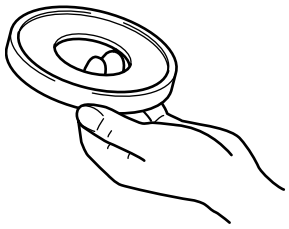
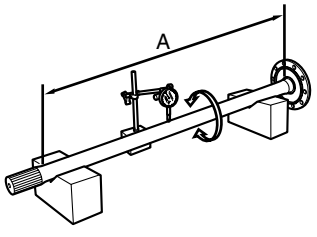
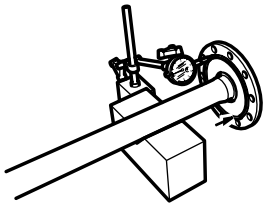
7. BRAKE SYSTEM AIR BLEEDING AND BRAKE SHOE CLEARANCE ADJUSTMENT.

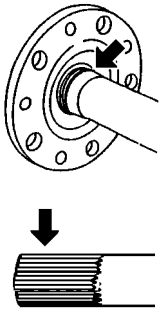
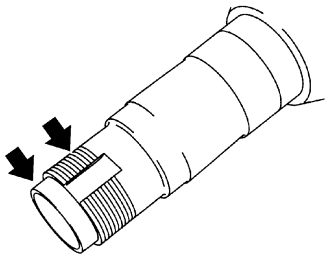
(1) On completion of the wheel hub and related parts reassembly, conduct the followings.
   a. Adjust the brake chamber rod stroke according to the section WHEEL BRAKE in the chapter SERVICE BRAKE.

INSPECTION AND REPAIR

EN0862003H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Wheel hub bearing race: Burns, pitting and cracks	—	—	Replace, if necessary.	Visual check 
Wheel hub bearings: Burns and pitting	—	—	Replace, if necessary.	Visual check 
Hub bolt: Wear and damage	—	—	Replace, if necessary.	Visual check 
Oil seal guide: Wear and damage	—	—	Replace, if necessary.	Visual check 
Axel shaft: Bend (Measure the bend at 2 or 3 points of the range "A".)	0.8 {0.0314} or less	—	Replace.	Measure 
Axel shaft flange: Bend	0.3 {0.0118} or less	—	Replace.	Measure 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Axle shaft flange and spline: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Use the magnetic flaw detector or color checking instrument.** 
Axle tube: Wear and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

WHEEL & TIRE

AX04-001

WHEEL AND TIRE

DATA AND SPECIFICATIONS

EN08Z0904I200001

The figures given in the table are based on the recommendation by European Tire and Rim Technical Organization. (E.T.R.T.O.), Japan Automobile Tire Manufacturers' Association (J.A.T.M.A.) and Australian Design Rule (ADR).

***(1). Tire radius given is dynamic effective radius for single tire, for dual tires, add 1.0 mm {0.039 in.} to the figure given.**

***(2). The max. air pressure and max. load for New Zealand.**

***(3). Industrial tire, Max. speed 40km/h {25 mile/h}, tire radius is static loaded radius.**

1. Diagonal tires

Tire size	Max. air pressure kPa {kgf/cm^2, lbf/in.^{2}}		Allowable max. load kg {lb}		*(1) Tire radius mm {in.}	Rim size
			Single	Dual		
10.00-20-16PR	ETRTO	750 {7.65, 109}	3,000 {6,614}	2,725 {6,008}	505 {19.88}	20 x 7.00T
11.00-20-14PR	JATMA	675 {6.75, 98}	2,840 {6,261}	2,670 {5,886}	519 {20.43}	20 x 7.50V
11.00-20-16PR	JATMA	725 {7.25, 105}	3,100 {6,834}	2,785 {6,140}		
11.00-20-16PR	JATMA	700 {7.00, 102}	3,115 {6,867}	2,965 {6,537}	538 {21.18}	20 x 8.50V
*(3) 12.00-20-16PR	JATMA	700 {7.00, 102}	4,605 {10,152}		*(3) 512 {20.16}	24 x 8.50V
12.00-24-18PR	JATMA	700 {7.00, 102}	3,660 {8,069}	3,485 {7,683}	592 {23.31}	24 x 8.50V

2. Radial tires (with tube)

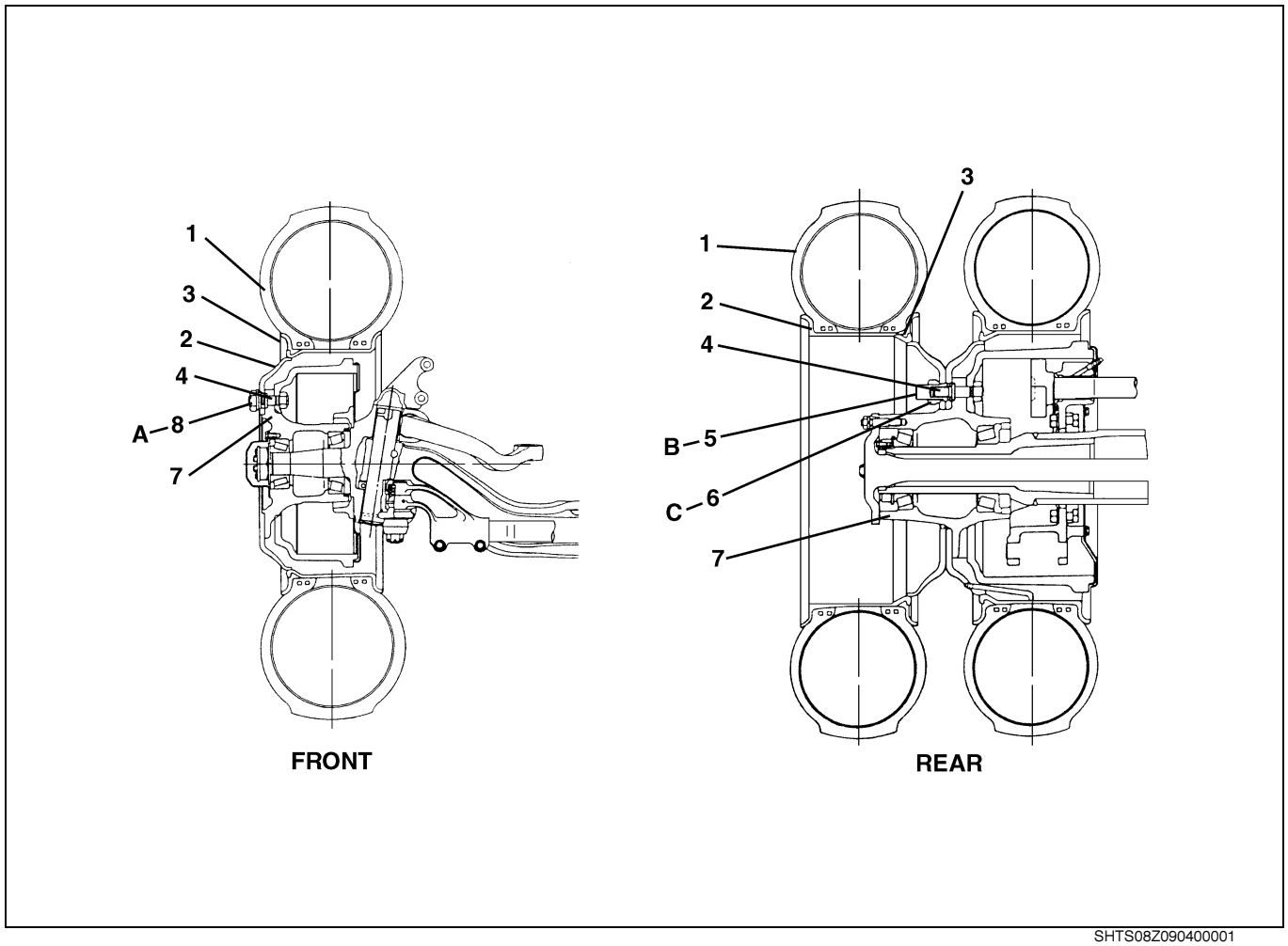
Tire size	Max. air pressure kPa {kgf/cm^2, lbf/in.^{2}}		Allowable max. load kg {lb}		*(1) Tire radius mm {in.}	Rim size
			Single	Dual		
11.00R-20-14PR	JATMA	725 {7.25, 105}	2,840 {6,261}	2,670 {5,886}	522 {20.55}	20 x 7.50V
11.00R-20-16PR	JATMA	775 {7.75, 112}	3,100 {6,834}	2,785 {6,140}		
12.00R-24-18PR	JATMA	750 {7.50, 109}	3,660 {8,069}	3,485 {7,683}	593 {23.35}	24 x 8.50V
12.00R-24-18PR	ETRTO	775 {7.90, 112}	4,000 {8,818}	3,650 {8,047}		
12.00R-24-160/156	ETRTO	850 {8.67, 123}	4,500 {9,921}	4,000 {8,818}		

3. Radial tires (with tubeless)

Tire size	Max. air pressure kPa {kgf/cm^2, lbf/in.^{2}}		Allowable max. load kg {lb}		*(1) Tire radius mm {in.}	Rim size
			Single	Dual		
11R22.5-16PR	JATMA	800 {8.00, 116}	3,000 {6,614}	2,725 {6,008}	507 {19.96}	22.5 x 7.50 22.5 x 8.25
11R22.5 148/145	ETRTO	850 {8.67, 123}	3,150 {6,944}	2,900 {6,393}		22.5 x 8.25
11R22.5 148/145	ADR	825 {8.41, 120}	3,000 {6,614}	2,725 {6,008}		
12R22.5-16PR	JATMA	800 {8.00, 116}	3,250 {7,165}	2,900 {6,393}	522 {20.55}	22.5 x 8.25
12R22.5 152/148	ETRTO	850 {8.67, 123}	3,350 {7,826}	3,150 {6,944}		
275/70R22.5 148/145J	JATMA	900 {9.00, 131}	3,150 {6,944}	2,900 {6,393}	464 {18.27}	22.5 x 8.25
*(2) 275/70R22.5 148/145J	JATMA	825 {8.25, 120}	2,995 {6,603}	2,755 {6,074}		
275/70R22.5 148/145	ETRTO	900 {9.18, 131}	3,150 {6,944}	2,900 {6,393}		
*(2) 275/70R22.5 148/145	ETRTO	825 {8.25, 120}	2,995 {6,603}	2,755 {6,074}		
295/80R22.5 153/150J	JATMA	900 {9.00, 131}	3,650 {8,047}	3,350 {7,385}	504 {19.84}	22.5 x 8.25
295/80R22.5 152/148	ETRTO	850 {8.67, 123}	3,550 {7,826}	3,150 {6,944}		
295/80R22.5 152/148	ADR	825 {8.41, 120}	3,250 {7,165}	3,000 {6,614}		
315/80R22.5 156/153J	JATMA	900 {9.00, 131}	4,000 {8,818}	3,650 {8,047}	519 {20.43}	22.5 x 9.00
315/80R22.5 154/150	ETRTO	825 {8.41, 120}	3,750 {8,267}	3,350 {7,385}		
315/80R22.5 156/150	ETRTO	850 {8.67, 123}	4,000 {8,818}	3,350 {7,385}		
385/65R22.5	ETRTO	900 {9.18, 131}	4,500 {9,921}	—	517 {20.35}	22.5 x 11.75

DESCRIPTION

EN08Z0904C100001

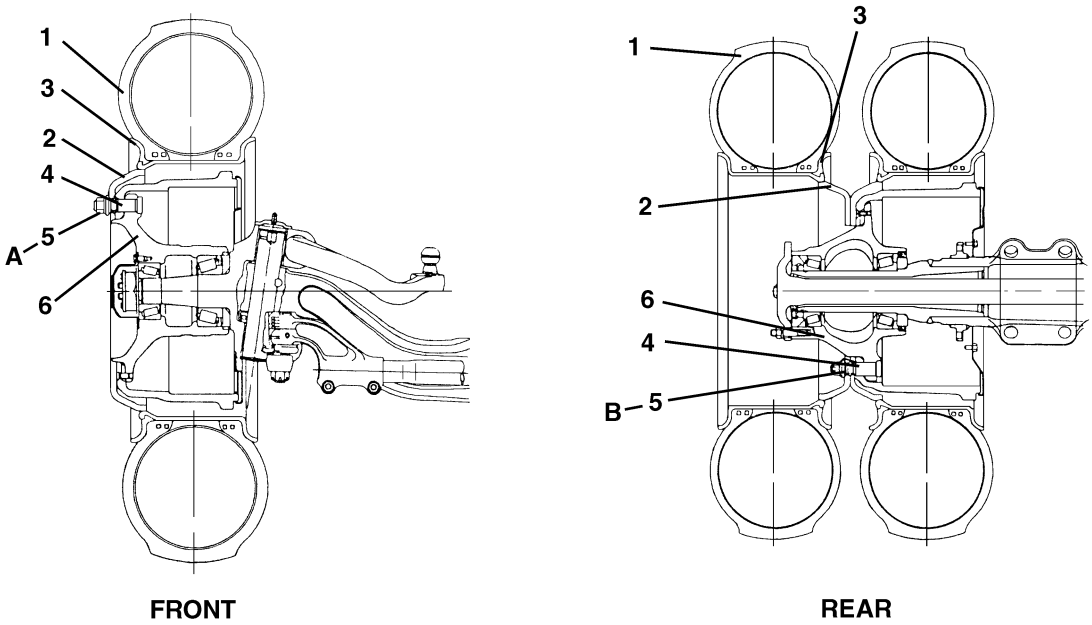


SHTS08Z090400001

SAE AND JIS TYPE

1	Tire	5	Inner wheel nut
2	Disc wheel	6	Outer wheel nut
3	Side ring	7	Hub
4	Hub bolt	8	Wheel nut

	Hub bolt diameter mm {in.}	Tightening torque N·m {kgf·cm, lbf·ft}
A	20 {0.787}	392.27-470.71 {4,000-4,800, 290-347}
	18 {0.709}	235.36-294.19 {2,400-3,000, 174-216}
B, C	20 {0.787}	392.27-470.71 {4,000-4,800, 290-347}
	18 {0.709}	235.36-294.19 {2,400-3,000, 174-216}

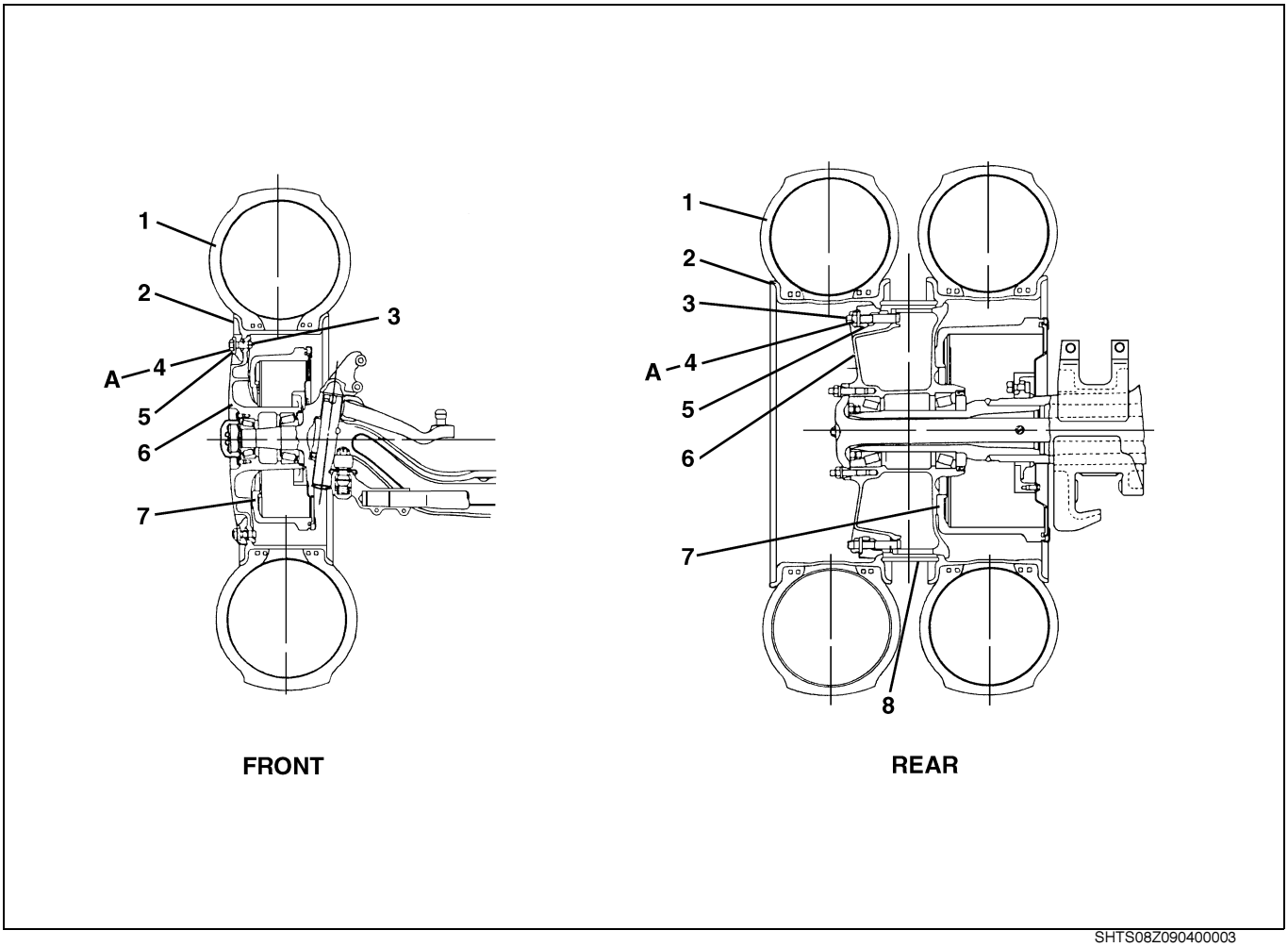


SHTS08Z090400002

DIN AND ISO TYPE

1	Tire	4	Hub bolt
2	Disc wheel	5	Wheel nut
3	Side ring	6	Hub

	Type	Tightening torque N·m {kgf·cm, lbf·ft}
A	DIN	490.34-588.39 {5,000-6,000, 362-433}
	ISO	490-539 {5,000-5,500, 362-397}
B	DIN	490.34-588.39 {5,000-6,000, 362-433}
	ISO	490-539 {5,000-5,500, 362-397}

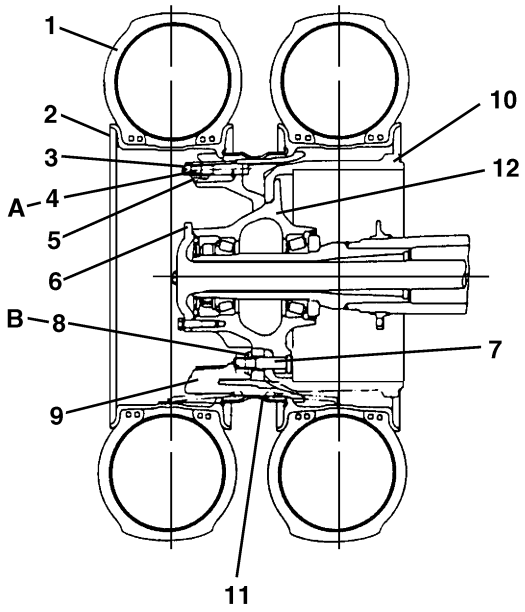


SHTS08Z090400003

SPOKE WHEEL TYPE

1	Tire	5	Clamp
2	Rim	6	Spoke wheel
3	Clamp bolt	7	Brake drum
4	Clamp nut	8	Band spacer

	Tightening torque N·m {kgf·cm, lbf·ft}
A	265-295 {2,700-3,000, 196-216}

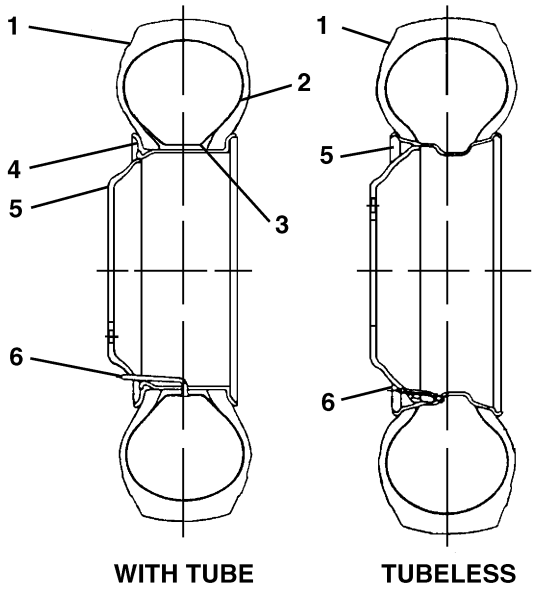


SHTS08Z090400004

ADAPTER TYPE SPOKE WHEEL (Only for rear)

1	Tire	7	Hub bolt
2	Rim	8	Hub nut
3	Clamp bolt	9	Adapter
4	Clamp nut	10	Brake drum
5	Clamp	11	Band spacer
6	Axle shaft	12	Hub

	Tightening torque N·m {kgf·cm, lbf·ft}
A	294.20-323.61 {3,000-3,300, 217-238}
B	490.34-588.39 {5,000-6,000, 362-433}



SHTS08Z090400005

WHEEL AND TIRE

1	Tire	4	Side ring
2	Tube	5	Disc wheel
3	Flap	6	Valve

TROUBLESHOOTING

EN08Z0904F300001

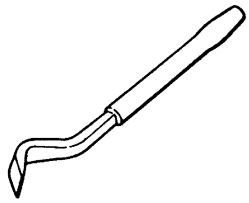
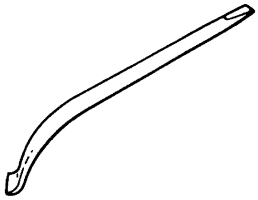
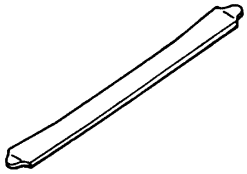
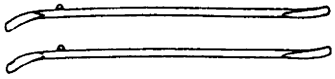
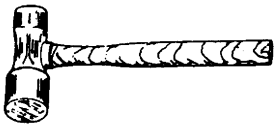
Symptom	Possible cause	Remedy/Prevention
Excessive wear on edges of tread	Under inflated tires	Properly inflate with the recommended pressure.
	Vehicle overloading	Correct as required by Factory spec.
	High speed cornering	Correct as required by Factory spec.
	Incorrect wheel alignment	Set to the correct specifications.
Tires show excessive wear in center of tread	Tires overinflated	Properly inflate with the recommended pressure.
Excessive tire wear	Improper tire pressure	Properly inflate with the recommended pressure.
	Incorrect tire wheel usage	Install the correct tire wheel combination.
	Bent wheel	Repair or replace.
	Defective shock absorbers	Repair or replace.
	Front end out of alignment	Align front end.
	Loose, worn or damaged steering linkage, joints, suspension components, bushing or ball joints	Inspect, repair or replace as required
Wheel hopping (vehicle vibration and rough steering) (Disc wheels)	Rocks or debris wedged between dual disc wheels	Remove the rocks and the debris.
	Out-of-balance tire and/or hub and drum	Determine the out-of-balance component and balance or replace.
	Improper positioning of the side ring split	Reassemble with ring split, opposite (180 degrees) to the valve opening to improve the balance.
Wheel hopping (vehicle vibration and rough steering) (Vehicle)	Loose or worn drive line or suspension	Identify the location of vibration carefully. Then repair or replace the loosened or worn parts. (Refer to PROPELLER SHAFT for vehicle vibration.)
Wobbling (vehicle vibration and rough steering) (Disc wheels)	Bent or distorted due to the overloading or improper handling	Replace the wheel.
	Loose mountings, damaged studs, wheel nuts, enlarged stud holes, worn or broken hub face, or foreign material on mounting surfaces	Replace worn or damaged parts. Clean mounting surfaces.
Wobbling (vehicle vibration and rough steering) (Vehicle)	Improper alignment	Have vehicle aligned.
	Loose, worn or broken suspension parts	Repair or replace.
Cracked or broken wheel discs (cracks develop in the wheel disc from hand hole to hand hole, from hand hole to rim, or from hand hole to stud hole.)	Metal fatigue resulting from overloading	Replace wheel.

Symptom	Possible cause	Remedy/Prevention
Damaged hub bolt holes (hub bolt holes become worn, elongated or deformed, metal builds up around hub bolt hole edges, cracks develop from hub bolt hole to hub bolt hole.)	Loose wheel mounting	• Replace wheel and check the installation of correct hub bolts and nuts. • Check the cracked or broken hub bolt-replace. • Check the worn hub face-replace. • Check the broken or cracked hub-replace. • Clean mounting surfaces (Retighten the wheel nuts periodically.) • Rust streaks fanning out from hub bolt holes: indicates that the wheel nuts are or have been loosen.
Tire slippage on rim (Disc wheels)	Improper storage or operating conditions	Correct as required.
	Poor maintenance	Follow the proper maintenance procedures.
	Rust, corrosion or bead seating	Correct as required.
	Loss of pressure	Follow the proper maintenance procedures.
Tire mounting difficulties (Wheel rims)	Mismatched tire and rim sizes	Correct as required.
	Defective or mismatched rings for the rim	Correct as required.
	Tires overinflated	Properly inflate with the recommended pressure.
	Corrosion and dirt	Correct as required.
Loose inner wheel	Excessive hub bolt stand out from the mounting face of hub allowing the wheel nut to bottom out	Replace with the proper length hub bolt.
	Improper torque	Follow the recommended torque procedure.
	Wrong inner nut	Use correct inner nuts.
Broken hub bolts	Loose wheel nuts	Replace the hub bolt and follow the proper torque procedures.
	Overloading	Replace the hub bolt.
Stripped threads	Excessive clamp load	Replace hub bolt and follow the proper torque procedures.
Rust streaks from hub bolt holes	Loose wheel nuts	Check complete assembly, replace damaged parts and follow the proper torque procedures.
Damaged inner or outer wheel nuts	Loose wheel assembly	Replace wheel nuts. Check the proper torque procedures.
Frozen inner or outer wheel nuts	Corrosion or damage	Replace wheel nuts and hub bolts.

SPECIAL TOOL

EN08Z0904K100001

Prior to starting a wheel and tire overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	09672-1010	LEVER	
	09672-1020	LEVER	
	09672-1040	LEVER	
	09609-1210	LEVER	
	09609-1220	RUBBER HUMMER	

PRECAUTIONS

EN08Z0904C100002

⚠ CAUTION
Failure to comply with the following procedures may result in faulty positioning of the tire and/or rim parts, and can cause the assembly to burst with a explosive force sufficient to cause serious physical injury or death.

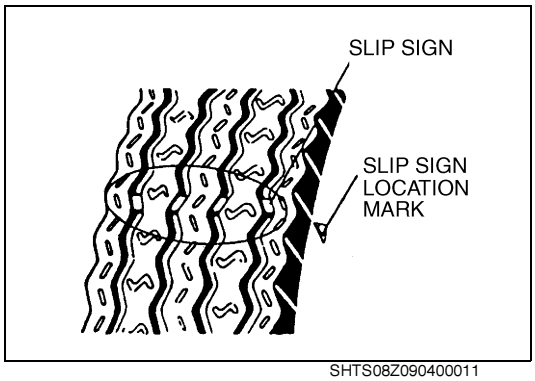
1. DEFLATION AND DISASSEMBLY
(1) Always check the tire/rim assembly for the proper components seating prior to the removal from the vehicle.
(2) Always deflate the tire by removing the valve core prior to removing the wheel from vehicle or disassembling of the components.
(3) Never position your body in front of the rim during deflation.
(4) Always follow the assembly and disassembly procedures outlined in this instruction manual and obtain safety literature from the Authorities.
(5) Never use a steel hammer to assemble or disassemble the rim components. Use a lead, brass, or plastic type mallet.

2. RIM INSPECTION
(1) Always select the proper tire size and construction to match the rim or wheel rating and size.
(2) Never use damaged, worn, or corroded rims, wheels, or mounting hardware.
(3) Always clean and repaint lightly rusted rims.
(4) Never use a rim or wheel component you cannot identify.

3. ASSEMBLY AND INFLATION
(1) Always perform the double check to see that the removable rings are properly seated before inflating.
(2) Always inflate the tire in a safety cage or use a portable lock ring guard. Use a clip-on type air chuck with a remote valve so that you can stand clear during the tire inflation.
(3) Never attempt to seat the rings while the tire is totally or partially inflated.
(4) Never re-inflate or add inflation pressure to a tire that has been run flat or seriously under inflated without removing and checking for ring seating and rim damage.
(5) Tire pressure should be checked while cold. Do not bleed air from tires while hot. This will result in an under inflated condition. Under inflated tires build up excessive heat due to overdeflection that may result in sudden tire deterioration, causing severe handling problems.
(6) Never use an assembly with excessive side ring play, wide gaps between ring ends, or butting ring ends.
(7) Never hammer on the components of an inflated or partially inflated assembly.

INSPECTION

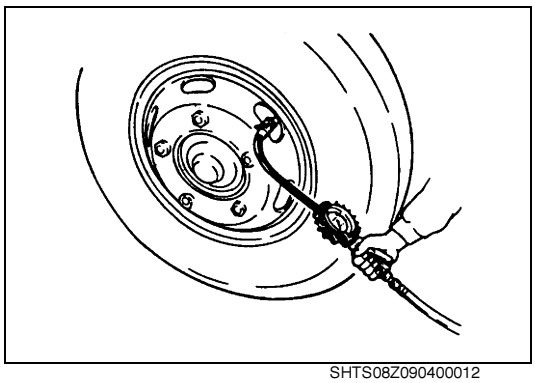
EN08Z0904H300001



SHTS08Z090400011

1. GENERAL INSPECTION

(1) Check the tire tread wear (groove depth) and tire damage. If the slip sign on the tire tread comes out, replace the tire.
Groove depth (Remaining groove)
General running: 1.6 mm {0.063 in.}
High-speed running: 3.2 mm {0.126 in.}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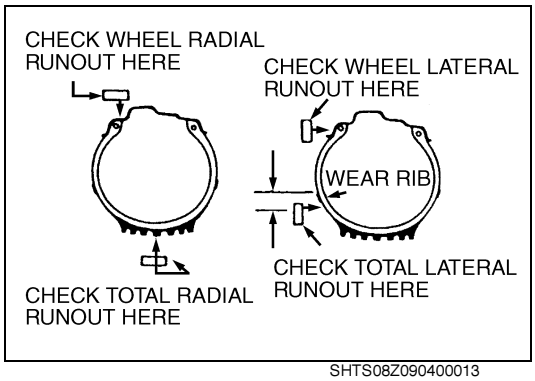
(2) Check the air pressure.
If improper, inflate the tire to the proper pressure as previously described in this chapter.



SHTS08Z090400013

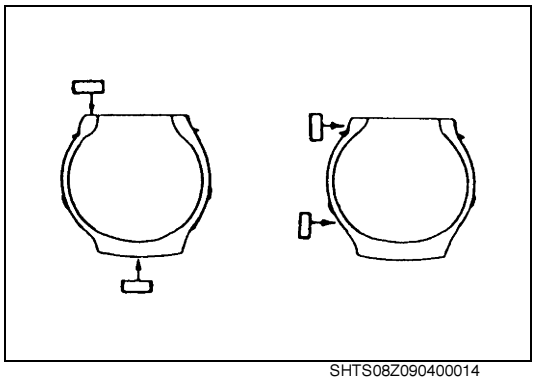
2. CHECK RUNOUT IN THE TIRE AND WHEEL RIM.

NOTICE
Eliminate any flat spots in the tire by driving the vehicle a little.

(1) Jack up the vehicle and the check the runout in the tire and wheel rim.

Unit: mm {in.}

	Tire	Wheel rim
Lateral runout	**Less than 3.5 {0.138}**	**Less than 1.8 {0.071}**
Radial runout	**Less than 2.5 {0.098}**	**Less than 1.8 {0.071}**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(2) If the wheel rim does not conform to the runout limits, try re-mounting the wheel in a different position.
(3) If the wheel rim is still not within 1.8 mm {0.072 in.} of runout, then replace it with a new rim.
(4) If the tire does not conform to runout standards, reinstall it in different position on the rim.

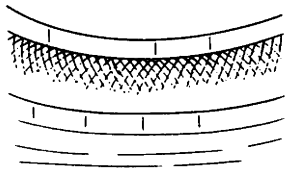
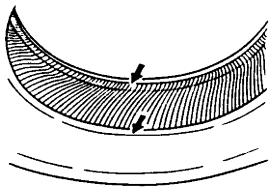
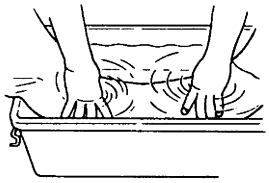
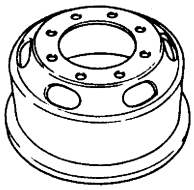
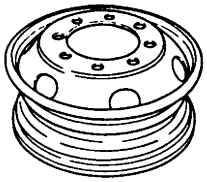
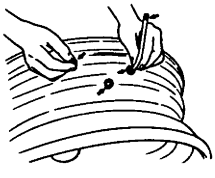
3. WHEEL AND TIRE BALANCING.

(1) Driving with a rim or tire that is unbalanced may cause the vehicle and steering wheel to shimmy, and will produce an abnormal tire wear.
In this situation, we recommend that you should balance the wheels.

- Static balancing
  This is relatively effective when operating at low speeds; however, if operating at high speeds, dynamic balancing is recommended.
- Dynamic balancing
  Please balance the wheels, using a balancing machine.

INSPECTION AND REPAIR

EN08Z0904H300002

Inspection item	Standard	Limit	Remedy	Inspection procedure
Tire: Damage, foreign matter, etc.	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Tubeless tire: Damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Tube: Air leakage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Wheel (With tube): Cracks and deformation	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Wheel (Tubeless tire): Cracks and deformation	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Rim (Tubeless tire): Damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Pipe, nut and O-ring of the valve (tubeless tire): Damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 

SAE, JIS, DIN AND ISO TYPE WHEEL

OVERHAUL

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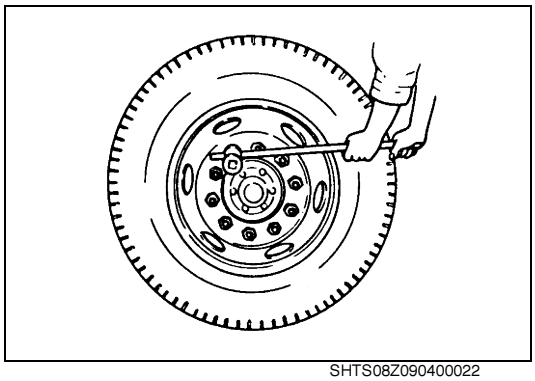
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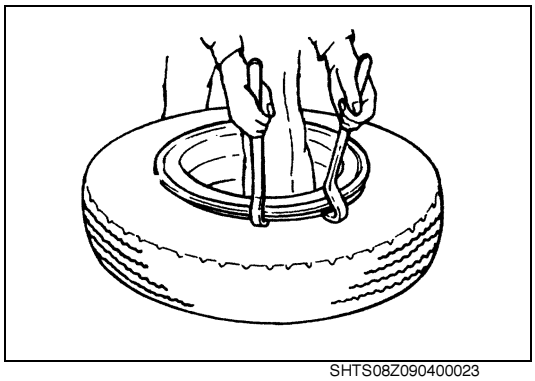
IMPORTANT POINT - REMOVAL

1. REMOVE THE WHEEL AND TIRE.
(1) Loosen the wheel nuts, but do not remove them.
(2) Raise the vehicle until the tire clear the floor.
(3) Remove the wheel nuts and tire from the hub and drum.
On dual tires, the inner wheel nuts will also have to be removed for the inner tire to be removed.

NOTICE

- **Be sure to apply the wheel stoppers in the front or rear tires.**
- **The wheel nuts on the right side of the vehicle have right hand threads, and those on the left side have left hand threads.**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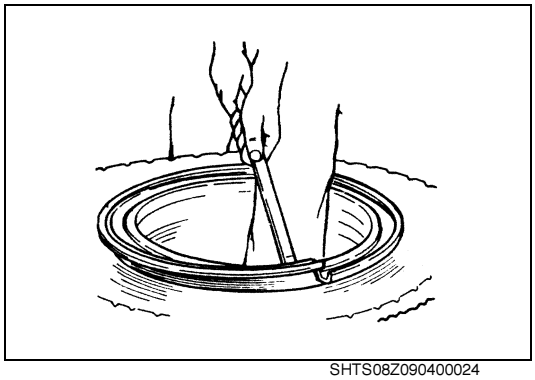
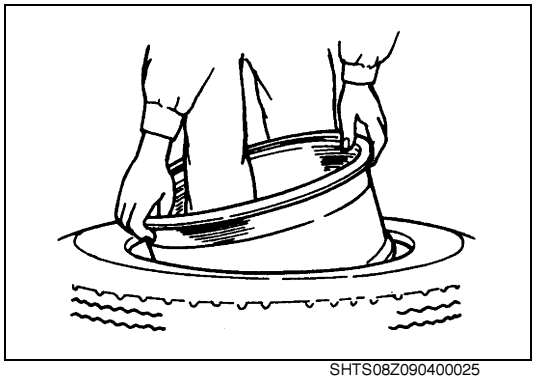
IMPORTANT POINTS - DISASSEMBLY

1. DISASSEMBLE THE WHEEL AND TIRE (WITH TUBE).
(1) Place the wheel and tire on the floor with side ring up.
(2) Make certain that the tire is completely deflated with the valve core removed.
(3) With a suitable tools, insert the hook end between the side ring and side wall of the tire and pry the bead loose from the side ring with a downward pressure on the tools.
(4) Continue prying progressively around the tire until the bead is completely freed from side ring.


SHTS08Z090400024

(5) With the special tool, pry the side ring from its groove in the rim by prying progressively around the tire until the ring is freed.
SST: Lever (09672-1040)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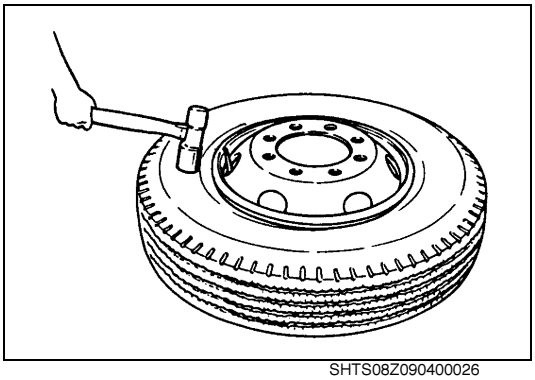
(6) Turn the assembly over and unseat the second tire bead from the rim. Lift the rim from the tire.
Remove the tube and flap, if any, from the tire.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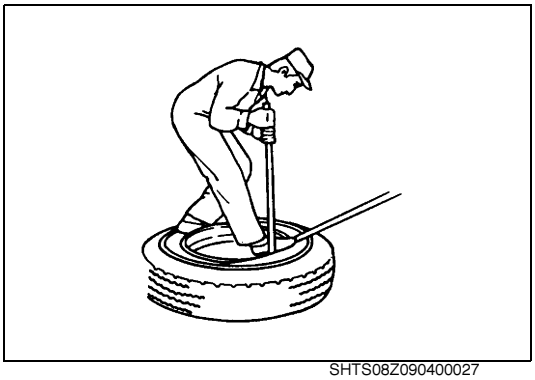
2. DISASSEMBLE THE WHEEL AND TIRE (TUBELESS).

(1) Make certain the tire completely deflated with the valve core removed.

(2) With the tire lying flat, loosen both beads with the special tool or by standing on the tire with your heels close to the rim.
SST: Rubber hammer (09609-1220)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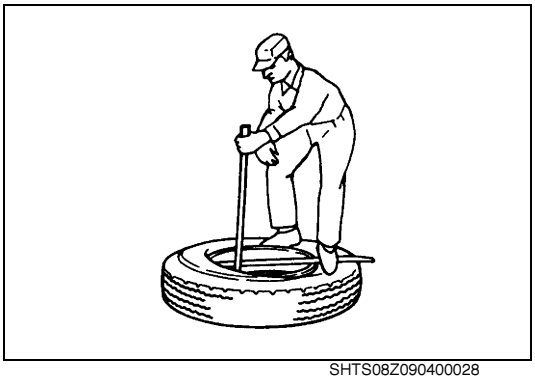
(3) With the wide side of the rim down, lubricate the top bead.

(4) With the stops toward the rim, insert the spoon ends of the special tools about 250 mm {10 in.} apart. Holding the bead in the well with one foot, pull one tool towards the center of the rim.
SST: Lever (09609-1210)

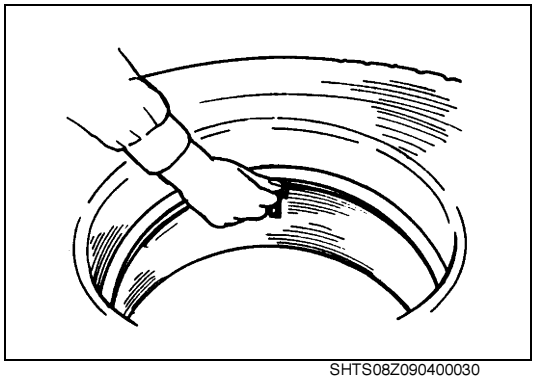

SHTS08Z090400028

(5) Hold the tool in position with one foot and pull the second tool toward the center of the rim. Progressively work the bead off the rim, taking additional bites with the tools as necessary.


SHTS08Z090400029

(6) Stand the assembly in a vertical position.
Lubricate the second bead.

(7) At the top of the assembly, insert the straight end of the tool between the bead and back the flange of the rim at about 45 degrees angle.
Turn the tool so that it is perpendicular to the rim. Pry the second bead off.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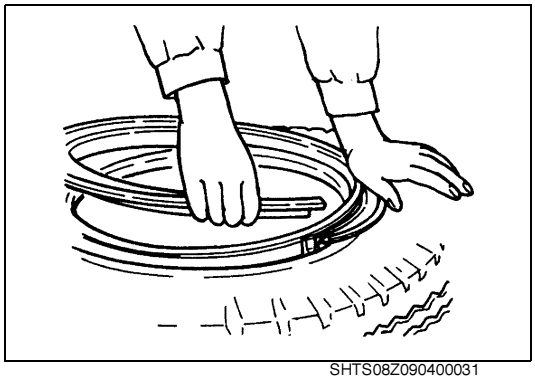
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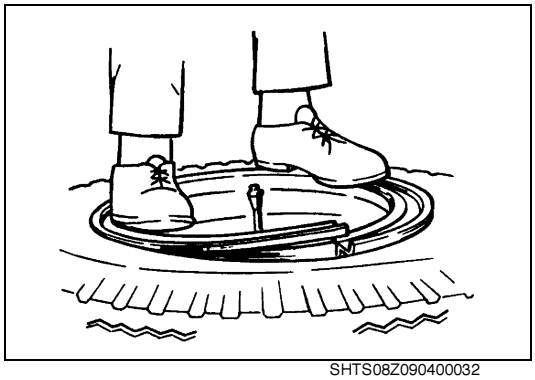
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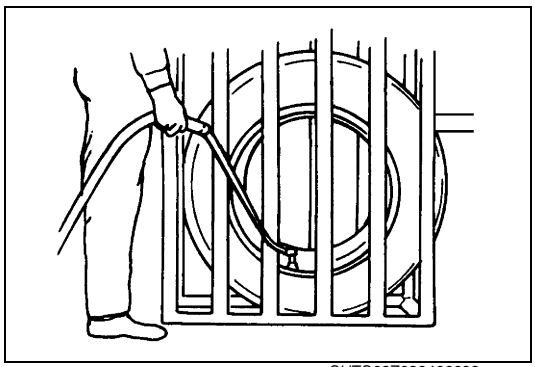

SHTS08Z090400033

IMPORTANT POINTS - ASSEMBLY

1. ASSEMBLY THE WHEEL AND TIRE (WITH TUBE).

(1) Insert the tube and the flap into the tire and partially inflate to round out the tube. Apply the rubber lubricant to the inside and outside surfaces of both beads and to that portion of the tube and flap that appears between the beads. Lay the rim flat on the floor with the valve slot up. Align the valve with the rim valve slot, and place the tire onto the rim, and insert the valve through the valve slot.

(2) Place the side-ring on the rim base so that the ring split is opposite to the valve stem. Place the leading end of the ring into the groove in the rim as shown.

(3) Starting at the valve side progressively walk the side-ring into place. Check to ensure that the ring is fully seated in the groove.

(4) Place the tire assembly in a safety cage and inflate the tire as previously described in this chapter. Again check the side-ring, tapping lightly with a mallet to ensure the proper engagement. Check to see that the beads are properly seated. Completely deflate the tire to prevent the tube from the buckling. Reinflate according to the recommended pressure, and check the tire assembly.

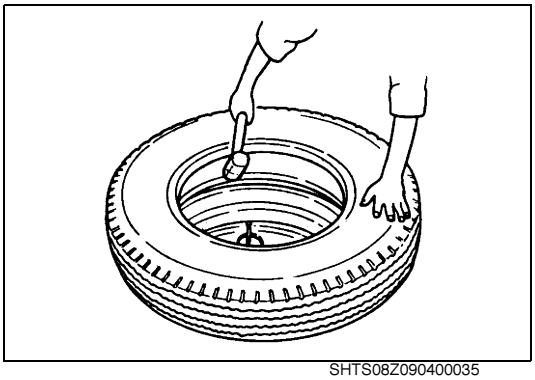

SHTS08Z090400034

2. ASSEMBLY THE WHEEL AND TIRE (TUBELESS).

(1) Be sure that the proper valve is used and is properly installed in the rim.
Valve nut tightening torque: 12.7 N·m {130 kgf·cm, 9.4 lbf·ft}

(2) Inspect the rim to ensure that the bead seats are clean and smooth.

(3) Place the rim on the floor with the wide side down and lubricate the first bead of the tire and upper bead seat of the rim.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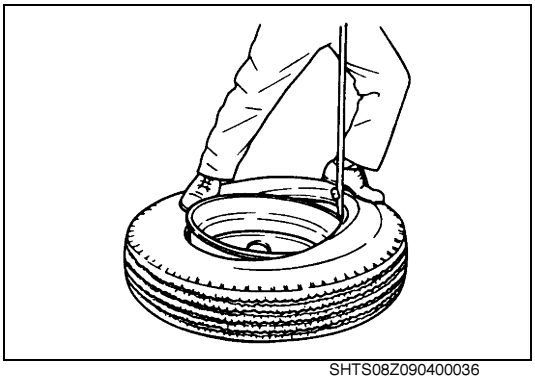
(4) Push the first bead into the well of the rim and onto the rim as far as possible.
With the special tool, hammer the first bead so that the bead gets over the rim flange.
SST: Rubber hammer (09609-1220)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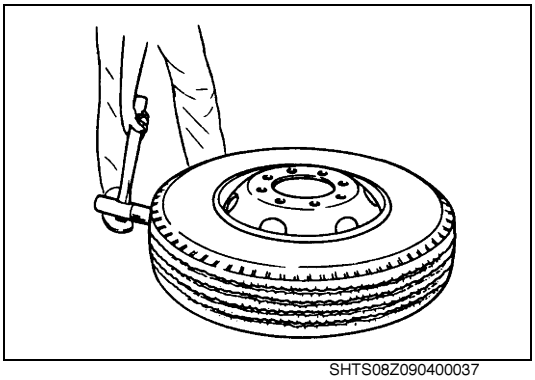
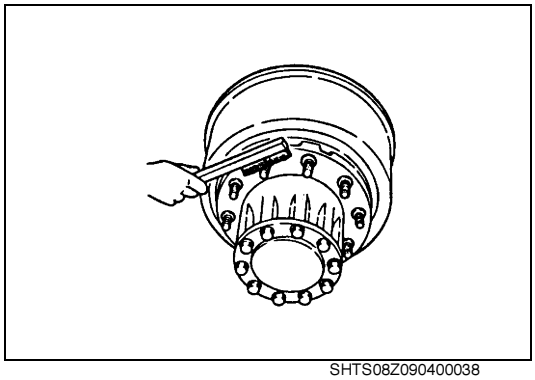
(5) Insert the lever between the rim flange and the tire bead and then raise the lever so that the bead gets over the rim flange.
SST: Lever (09609-1210)


SHTS08Z090400037

(6) With the special tool, hammer the tire tread so that the bead and the rim will be seated.
SST: Rubber hammer (09609-1220)

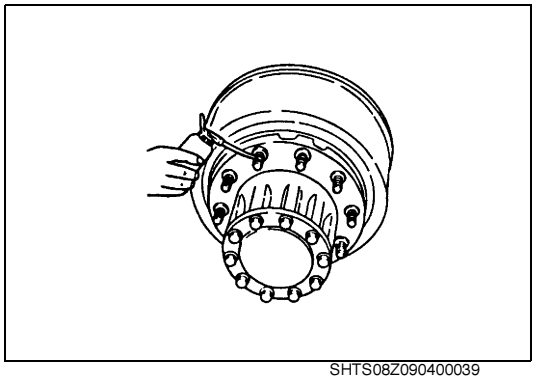
(7) Inflate the tire as described in this chapter, making certain that all the safety precautions are followed. Check for the leakage.


SHTS08Z090400038

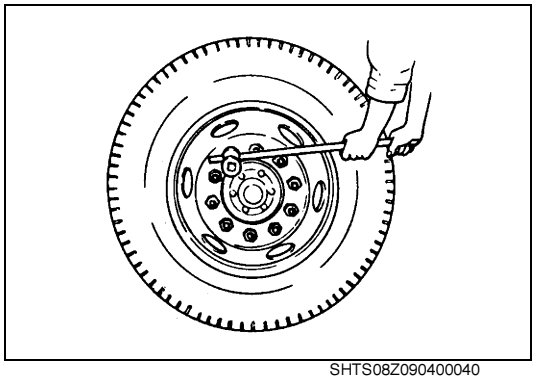
IMPORTANT POINTS - INSTALLATION

1. INSTALL THE WHEEL AND TIRE.

(1) Be sure to check all parts and replace any parts that are overly worn or damaged. Clean and remove any foreign matter from hub bolts, wheel nuts and wheel side is contacting with the brake drum.


SHTS08Z090400039

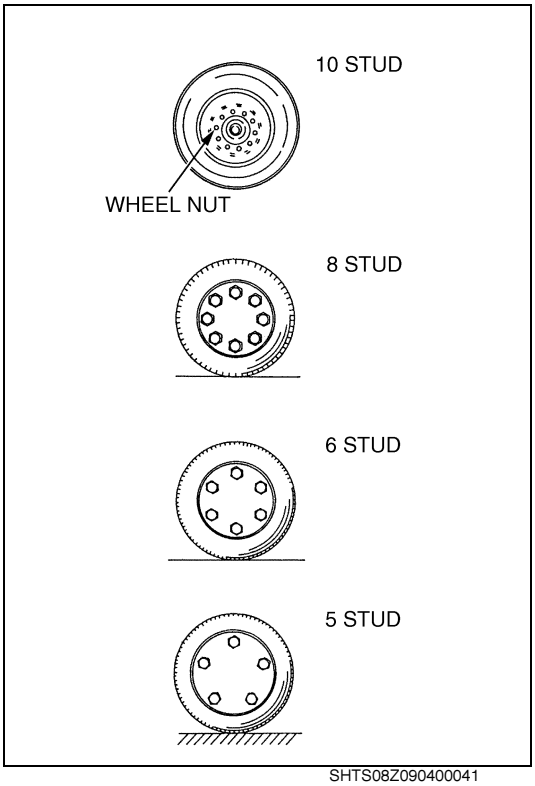
(2) Apply lubricant (engine oil or grease) to the thread part of the hub bolts and wheel nuts.


SHTS08Z090400040

(3) Rotate the wheel if necessary and check to see that the hub bolts are in the center of the wheel's hub bolt holes, then tighten the wheel nuts lightly.

NOTICE

The wheel nuts on the right side of the vehicle have right hand threads, and those on the left side have left hand threads.



SHTS08Z090400041

(4) Using a wheel nut wrench, tighten the wheel nuts in accordance with specified torque using diagonal method.

		Tightening torque N·m {kgf·cm, lbf·ft}
DIN type		**490.34-588.39 {5,000-6,000, 362-434}**
SAE and JIS type	**10 stud**	**392.27-470.71 {4,000-4,800, 290-347}**
	8 stud	
	6 stud	
	5 stud	**235.36-294.19 {2,400-3,000, 174-217}**
ISO type		**490-539 {5,000-5,500, 362-397}**

NOTICE
Tighten the wheel nuts with several repetitions in the tightening order so as to reach the proper torque evenly and gradually.

⚠ WARNING
The specified torque should be referred to the torque tightening wheel nuts. Tightening it with incorrect can cause the wheel to come off while driving. This can result in physical injury and/or property damage due to the loss of vehicle control.
When the vehicle, wheels, or wheel nuts are new, the wheel nuts should be checked and tightened with specified torque at 50-100 km {30-60 miles} since they may not be well tightened. The tightening torque should be checked with the proper torque wrench.

2. THE FOLLOWING ORDER AND INSTRUCTIONS ARE NECESSARY FOR INSTALLING THE DUAL TIRES.

(1) Installation procedures for the inner wheel nuts are the same as in 1. through 4. above.
(2) Installation procedures for the outer wheel nuts are the same as above.
(3) When only the outer wheel is replaced, first tighten all the inner wheel nuts to the specified torque. Then mount the outer wheel and tighten all the outer wheel nuts to the specified torque.

NOTICE

- **Install the dual rear wheels with their valve stems positioned at 180 degrees apart to facilitate inflation.**
- **Tighten all the inner nuts and outer nuts according to the above-mentioned procedures.**

3. WHEEL AND TIRE BALANCING

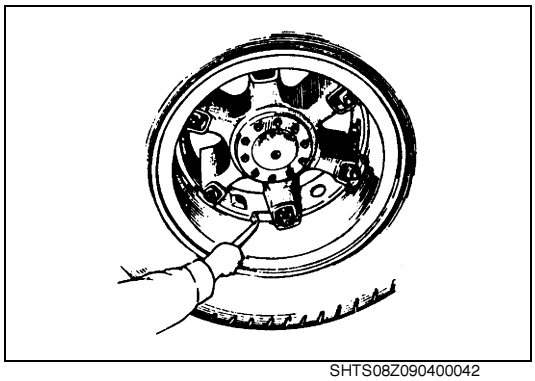
(1) Driving with a rim or tire that is unbalanced may cause the vehicle and steering wheel to shimmy, and will produce an abnormal tire wear.
In this situation, we recommend that you should balance the wheels.

- Static balancing
This is relatively effective when operating at low speeds; however, if operating at high speeds, dynamic balancing is recommended.
- Dynamic balancing
Please balance the wheels, using a balancing machine.

SPOKE WHEEL AND ADAPTER TYPE WHEEL

OVERHAUL

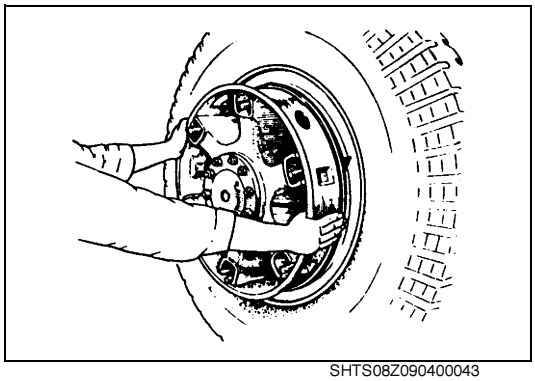
EN08Z0904H200002


SHTS08Z090400042

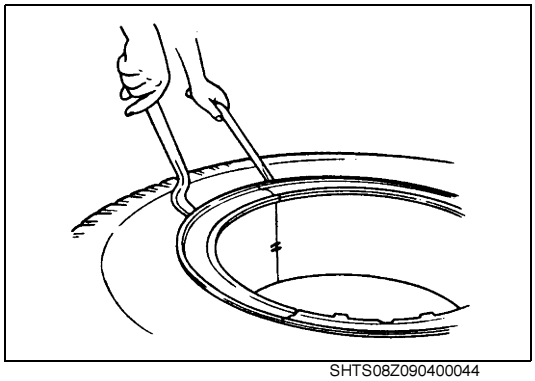
IMPORTANT POINT – REMOVAL

1. REMOVAL OF THE RIM AND TIRE.
(1) Loosen the clamp nuts, but do not remove them completely.
(2) Raise the vehicle until the tire clear from floor.
(3) Remove the clamp nuts and then use the special tool to pry off the clamps.
SST: Lever (09672–1010)

NOTICE
Block the wheels.

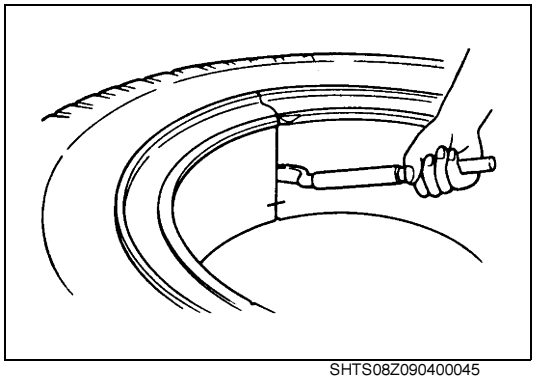

SHTS08Z090400043

(4) On the dual tires, the band spacer will also have to be removed and then remove the inner wheel.


SHTS08Z090400044

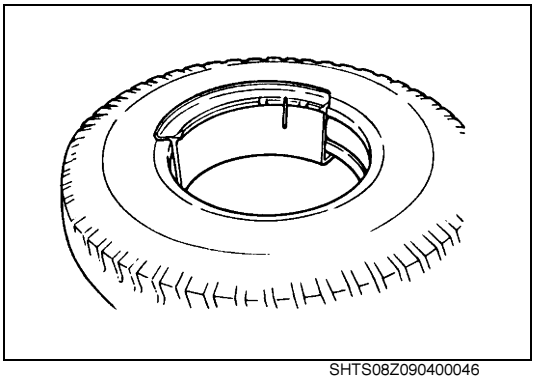
IMPORTANT POINT – DISASSEMBLY

1. DISASSEMBLE THE RIM AND TIRE.
(1) Place the wheel on the floor with valve side up.
(2) Make sure the tire is completely deflated with the valve core removed.
(3) With the special tools, insert the hook end between the rim and side wall of tire and pry the bead loose from the rim with a downward pressure on the tools.
SST: Lever (09672–1010, 09672–1020)


SHTS08Z090400045

(4) Continue prying progressively around the tire until the bead is completely freed from the rim.
(5) Make a matching marks on the segments.
(6) Place the special tool in the rim joint groove and pry the rim segments apart.
SST: Lever (09672–1010)

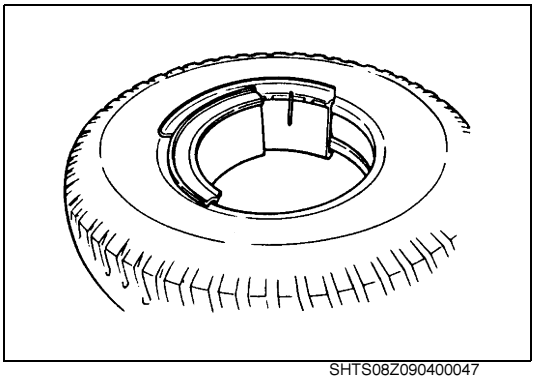
(7) Remove the rim segments.


SHTS08Z090400046

IMPORTANT POINT – ASSEMBLY

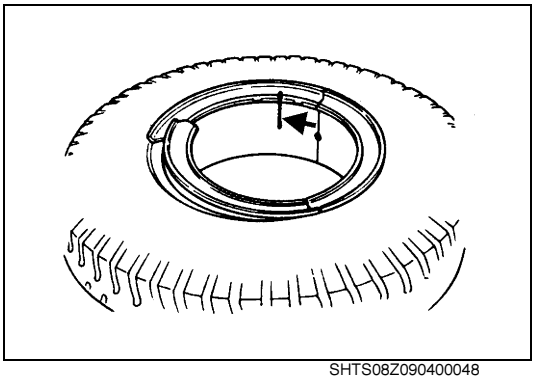
1. ASSEMBLE THE RIM AND TIRE.

(1) Clean the rim segments and check for damages, if there is any damage, repair or replace.
(2) Fit the tube and flap in the tire.
(3) Place the segment with valve hole in the tire.
The valve must point upwards.

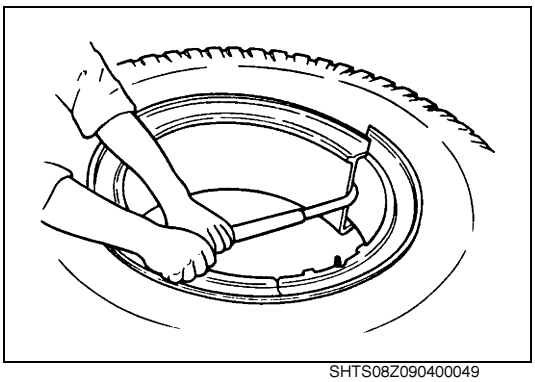

SHTS08Z090400047

(4) Place the other segment on the first one as shown in the figure.

NOTICE
Align the matching marks on the segments.


SHTS08Z090400048

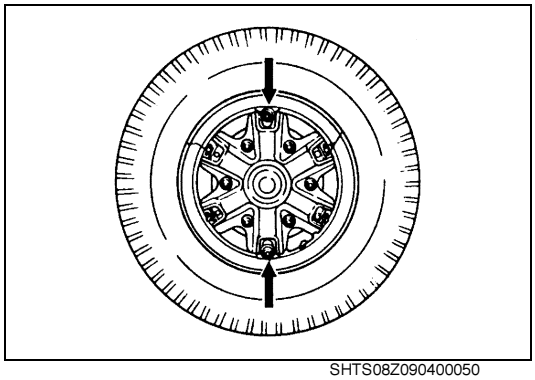
(5) Place the other segment together with the first one.
Fit the segment so that the valve lies against the side of the hole marked with an arrow.


SHTS08Z090400049

(6) With the special tool, pry the segments to fit the last segment in position.
SST: Lever (09672–1020)

NOTICE
Do not pull upwards.

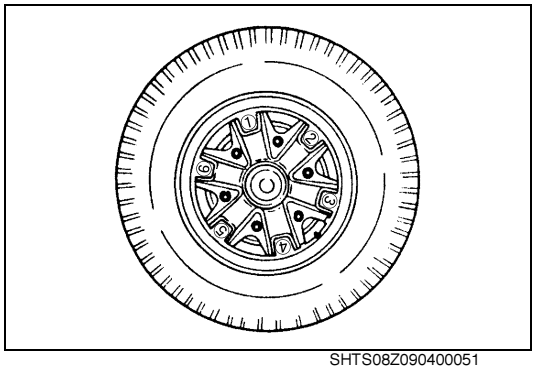
(7) Install the valve core and then inflate the tire as previously described in this chapter, making sure that all the safety precautions are followed. Check for the leakage.


SHTS08Z090400050

IMPORTANT POINTS – INSTALLATION

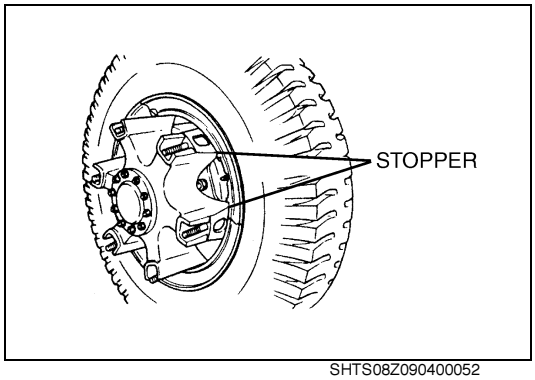
1. INSTALL THE SINGLE WHEEL.

(1) Clean the spoke ends, rim edges, clamps and nuts.
(2) Lubricate the clamp bolts.
(3) Install the wheel over the spoke ends so that the valve and rim stopper are between two spokes.
(4) Install two clamps and nuts on opposite sides of the rim as indicated by arrows on the drawing.
Tighten the nuts lightly.


SHTS08Z090400051

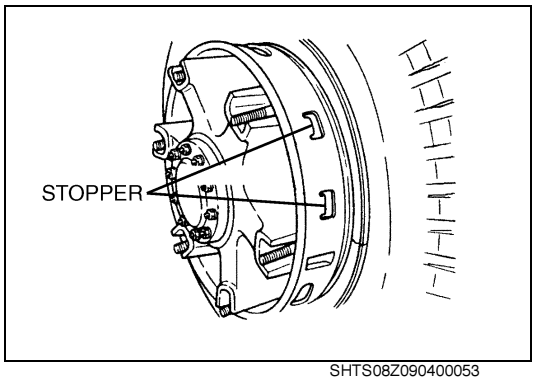
(5) Install the remaining clamps and nuts.
Tighten the nuts in sequence round the rim edge to sufficient torque as described in this chapter.
(6) Check and retighten the nuts after driving the vehicle in a distance.

2. INSTALL THE DUAL WHEEL.



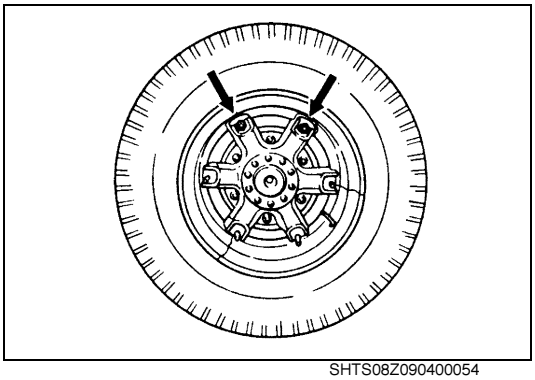
SHTS08Z090400052

(1) Clean the spoke ends, rim edge, band spacer, clamps and nuts.
(2) Lubricate the clamp bolts.
(3) Install the inner wheel so that the valve and rim stopper are between two spokes.



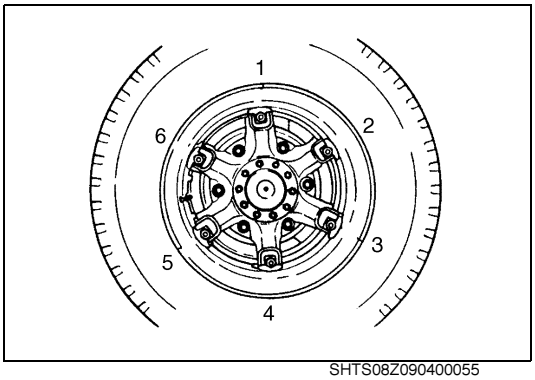
SHTS08Z090400053

(4) Install the band spacer over the spokes so that it may tightened up against the inner wheel rim.
The band spacer stopper must be between two spokes. Make sure that the band spacer stopper does not cover the inner wheel valve.



SHTS08Z090400054

(5) Install the outer wheel and press it, and then tighten up against the band spacer. Make sure that the rim stopper and valve are between two spokes and diagonally to the inner wheel valve.
Install two top clamps and nuts as indicated by the arrows on the drawing and tighten the nuts lightly.



SHTS08Z090400055

(6) Install the remaining clamps and nuts.
(7) Tighten the nuts in sequence round the rim edge to sufficient torque as previously described in this chapter.
(8) Check and retighten the nuts after driving the vehicle in a distance.

SUSPENSION (FRONT)

SU02-001

LEAF SUSPENSION ASSEMBLY

DATA AND SPECIFICATIONS

EN09A0302I200001

Unit: mm {in.}

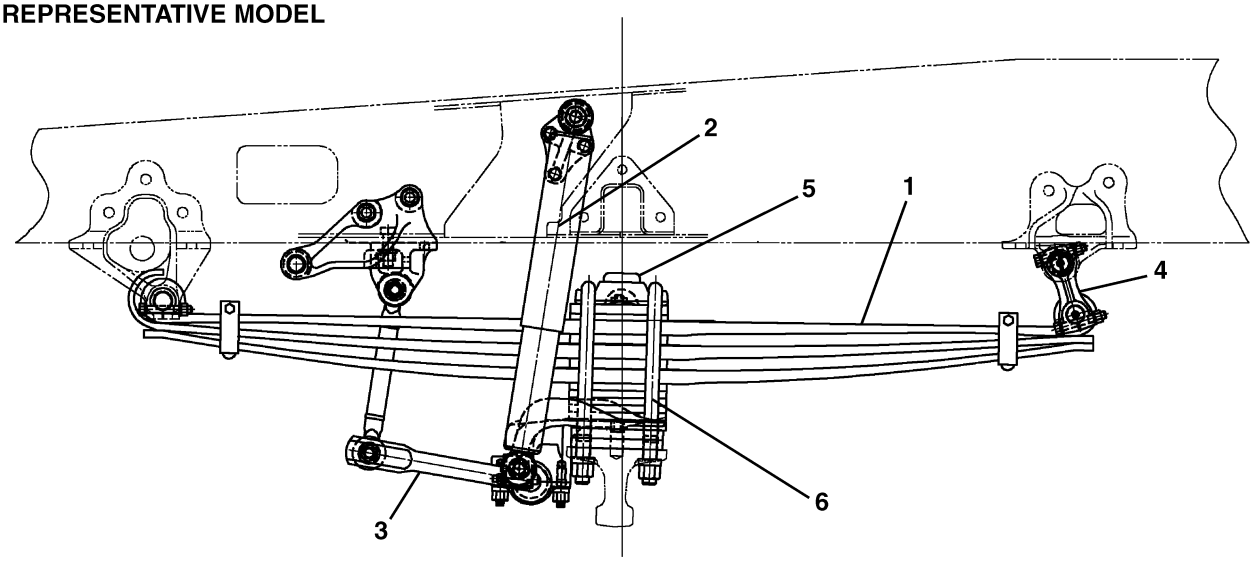
Models		FR, FS, FY, SH, SS						ZS
Type		Semi-elliptic leaf springs with shock absorber						
Dimensions of leaf springs	Span	1,500 {59.06}						1,700 {66.93}
	Width	90 {3.54}						
	Thickness of leaves	Multi leaf spring		Taper leaf spring				Taper leaf spring
		12 {0.47}		21 {0.83}				24 {0.94}
		13 {0.51}		22 {0.87}				25 {0.98}
		—		23 {0.91}				—
Shock absorbers	Type	Single acting		Single acting		Double acting		Double acting
	Stroke	270 {10.63}	290 {11.42}	270 {10.63}	300 {11.81}	270 {10.63}	280 {11.02}	340 {13.39}
	Min. length	420 {16.54}	440 {17.32}	420 {16.54}	450 {17.72}	423 {16.65}	433 {17.05}	489 {19.25}
	Max. length	690 {27.17}	730 {28.74}	690 {27.17}	750 {29.53}	693 {27.28}	713 {28.07}	829 {32.64}
Stabilizer (If so equipped)		Torsion bar						—

DESCRIPTION

EN09A0302C100001

MODELS: FS, FR, SH, SS, ZS

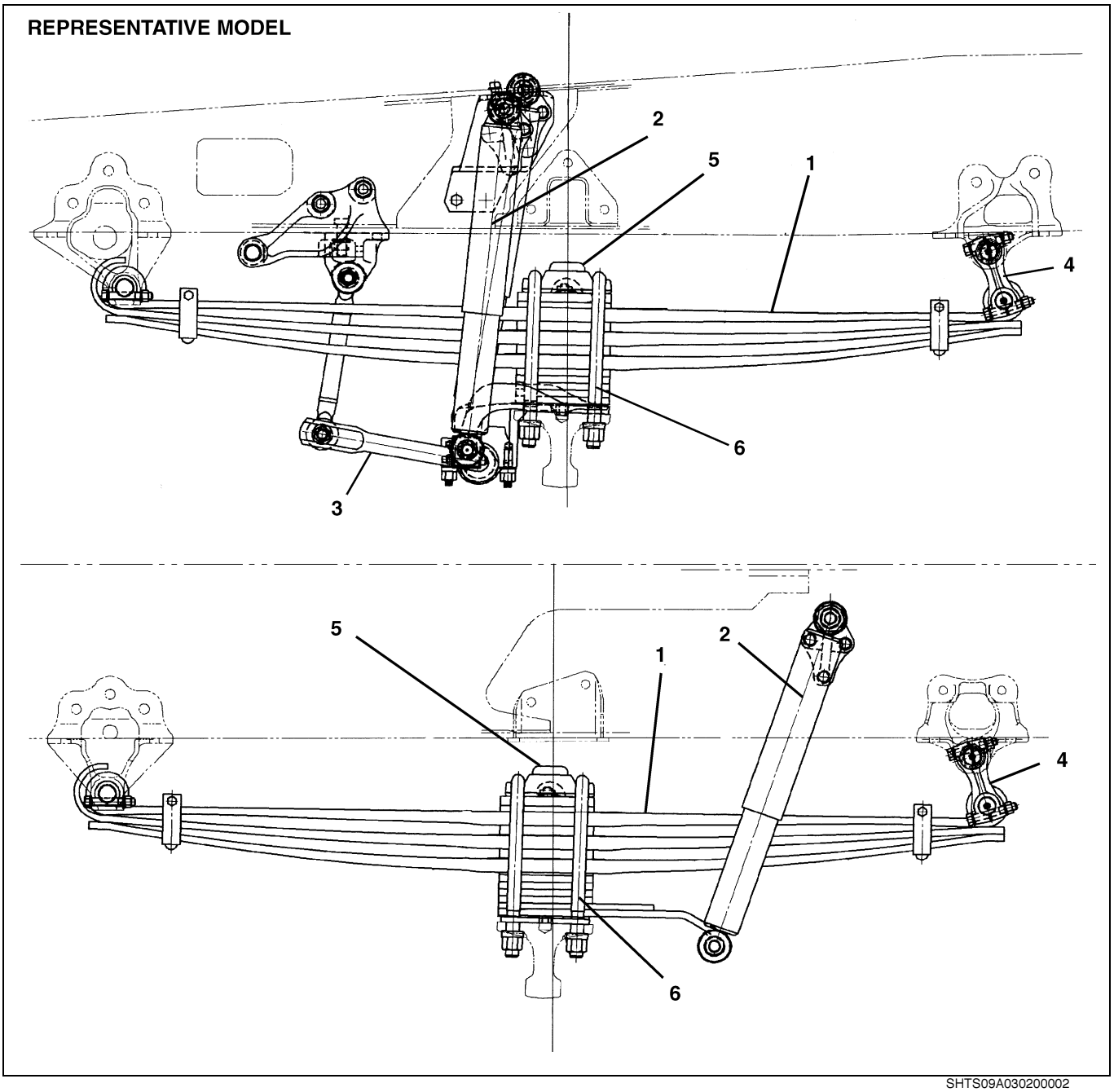
REPRESENTATIVE MODEL



SHTS09A030200001

1	Spring assembly	4	Shackle
2	Shock absorber	5	Spring bumper
3	Stabilizer (If so equipped)	6	U-bolt

MODEL: FY



SHTS09A030200002

1	Spring assembly	4	Shackle
2	Shock absorber	5	Spring bumper
3	Stabilizer (If so equipped)	6	U-bolt

TROUBLESHOOTING

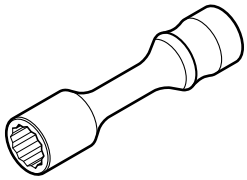
EN09A0302F300001

Symptom	Possible cause	Remedy/Prevention
Rough ride	Broken leaves	Replace the leaves. Check the load capacity rating.
	Cracked or damaged	Replace the leaves. Check the load capacity rating.
	Overloading	Decrease the load.
Heavy sway	Inoperative shock absorber	Replace the shock absorber.
Leaves broken at the center bolt hole	Loosen U-bolts	Tighten to specified torque.
Squeaking of the leaves	Friction between the leaves	Replace the silencers and/or apply chassis grease between leaves.

SPECIAL TOOL

EN09A0302K100001

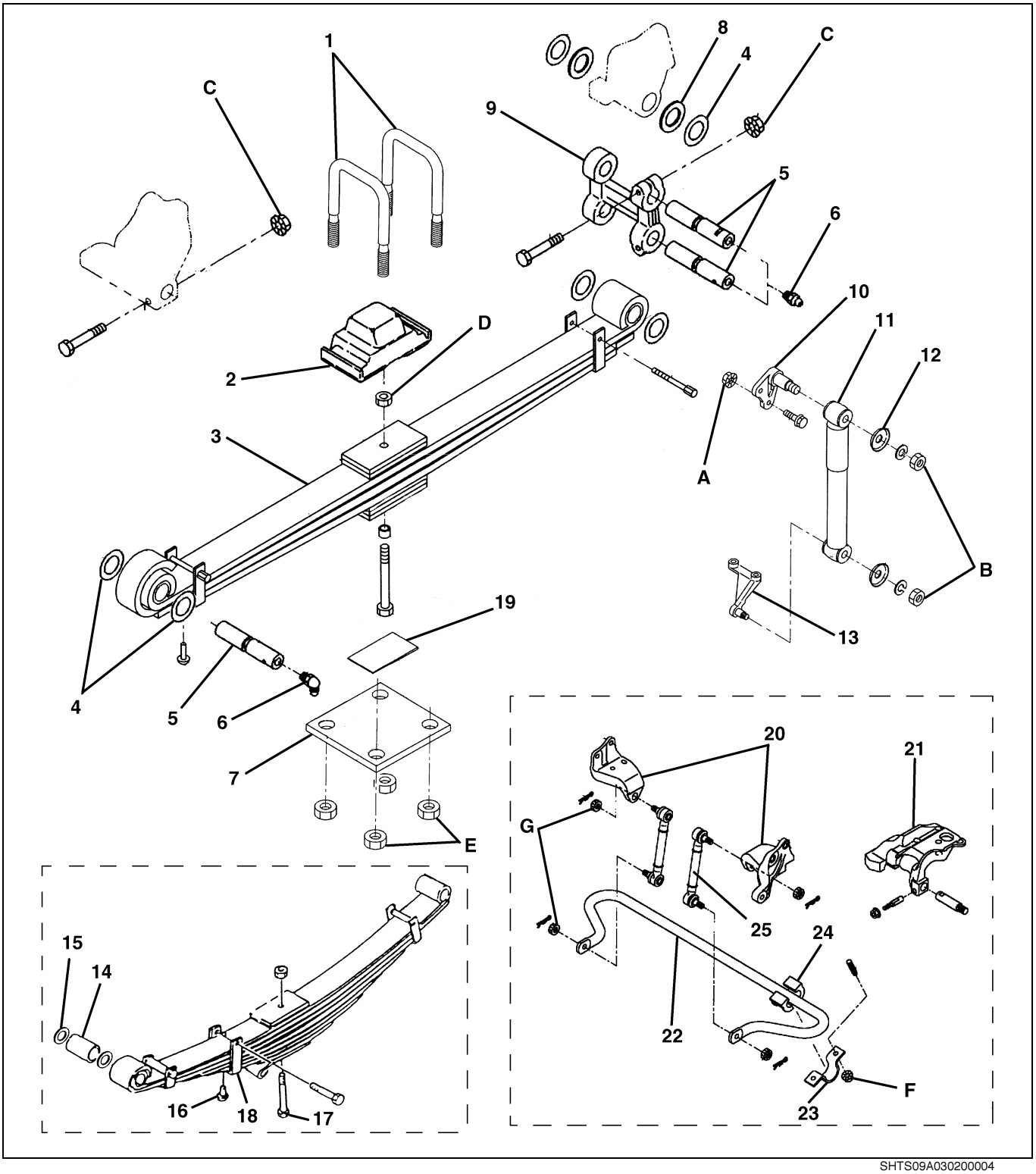
Prior to starting a suspension overhaul, it is necessary to have this special tool.

Illustration	Part number	Tool name	Remarks
	09603-1550	SOCKET WRENCH	FOR FRONT U-BOLT

COMPONENT LOCATOR

EN09A0302D100001

FRONT SUSPENSION



SHTS09A030200004

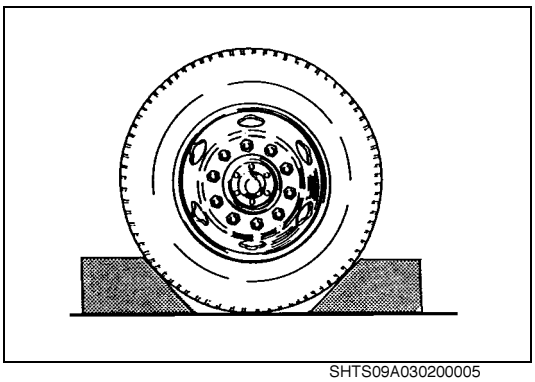
1	U-bolt	14	Bushing
2	Spring bumper	15	Dust seal
3	Leaf spring assembly	16	Rivet
4	Thrust washer	17	Center bolt
5	Spring pin	18	Clip
6	Lubrication fitting	19	Caster shim
7	Seat	20	Bracket (If so equipped)
8	Dust seal	21	Lower seat (If so equipped)
9	Shackle	22	Stabilizer (If so equipped)
10	Shock absorber bracket	23	Holder (If so equipped)
11	Shock absorber	24	Rubber bushing (If so equipped)
12	Cushion washer	25	Stabilizer link rod (If so equipped)
13	Shock absorber bracket		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	73-109 {745-1,111, 54-80}	E	490-590 {4,997-6,016, 362-435}
B	236-324 {2,407-3,304, 175-239}	F	107.5-146.5 {1,097-1,493, 80-108}
C	73-109 {745-1,111, 54-80}	G	128-172 {1,306-1,753, 95-126}
D	148-176 {1,510-1,794, 110-129}		

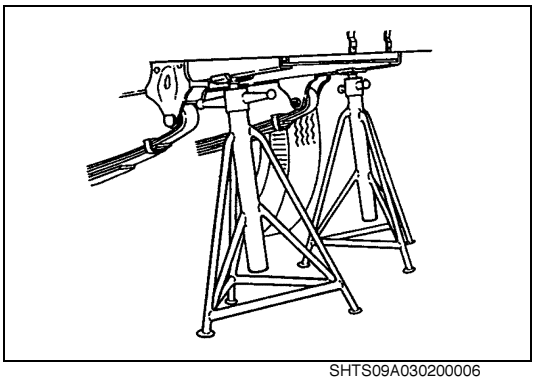
OVERHAUL

EN09A0302H200001

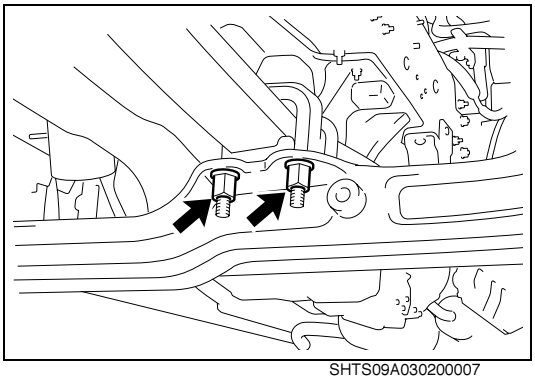

SHTS09A030200005

IMPORTANT POINTS - DISMOUNTING

1. SUPPORT OF THE FRAME WITH STANDS
(1) Park the vehicle on level ground.
(2) Be sure to block the wheels before dismounting.


SHTS09A030200006

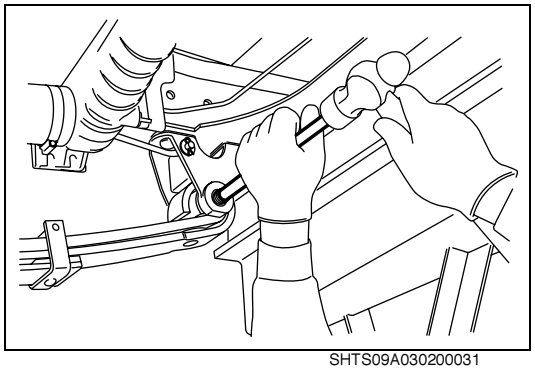
(3) Jack up the axle, and support the frame with stands.
(4) Remove the tires.


SHTS09A030200007

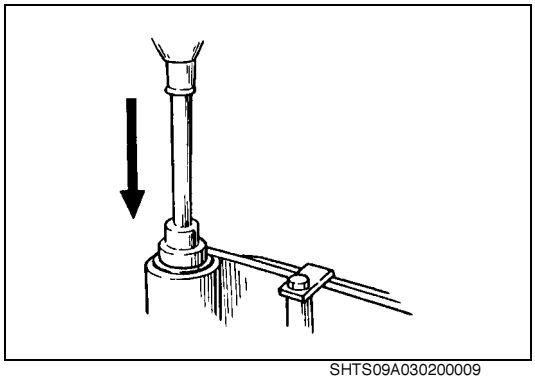
2. REMOVAL OF THE U-BOLT
(1) Remove the shock absorber.
(2) Support the axle with a floor jack.
(3) Remove the U-bolt mounting nuts.

NOTICE
When cutting off the U-bolts (Due to rusted threads) with a torch, never direct the flame toward the leaves or allow sparks to come in contact with the leaves.

SST: Socket Wrench for Front U-bolt (09603-1550)


SHTS09A030200031

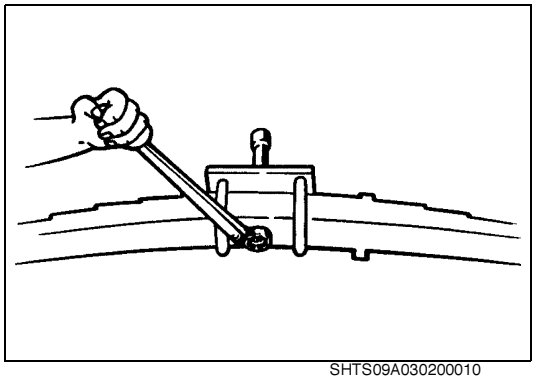
3. REMOVAL OF THE SPRING PIN
(1) Remove the lubrication fitting and spring pin lock bolt.
(2) Use a brass rod to remove the spring pins.


SHTS09A030200009

IMPORTANT POINTS - DISASSEMBLY

1. REPLACEMENT OF THE EYE BUSHING

(1) Use a suitable tool to press out the old eye bushing.
(2) Use a suitable tool to press in the new eye bushing.


SHTS09A030200010

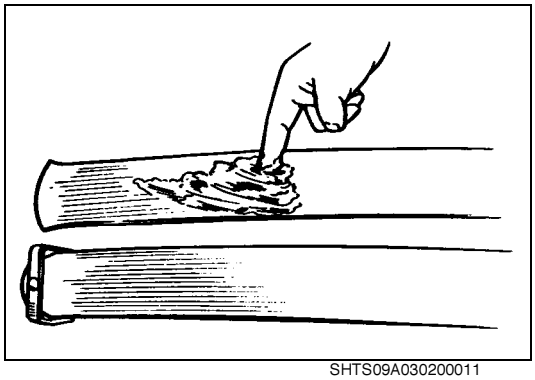
2. DISASSEMBLY OF THE LEAF SPRING

⚠ WARNING
When removing the center bolt lock nut, the spring leaves may jump. Care should be taken to avoid possible personal injury.

(1) Remove the clip bolts.
(2) Use a vise or an arbor press to hold the leaf spring near the center bolt.
(3) Remove the center bolt.
(4) Loosen a vise or an arbor press slowly, and separate the leaves.

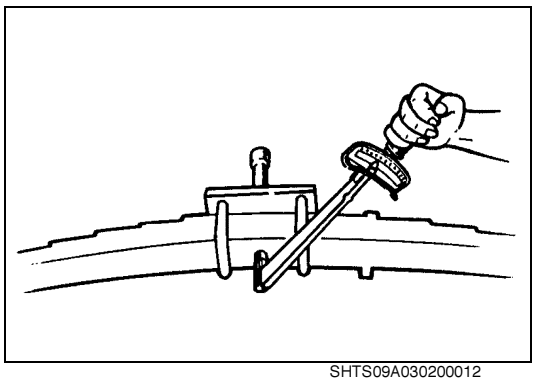
IMPORTANT POINT - ASSEMBLY

1. ASSEMBLY OF THE LEAF SPRING


SHTS09A030200011

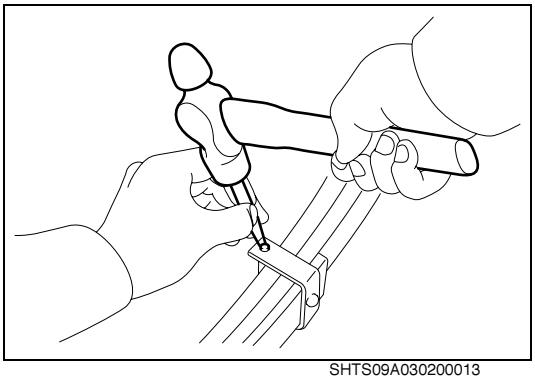
⚠ WARNING
When clamping the spring leaves, they may jump. Care should be taken to avoid possible personal injury.

(1) Apply coating on the leaf after removing rust, and apply chassis grease on both surface at leaves.


SHTS09A030200012

(2) Align the leaf holes and secure the leaves with a vise or an arbor press.
(3) Insert the center bolt and tighten the lock nut.

NOTICE
When reassembling the leaf spring, replace the center bolt with a new one.

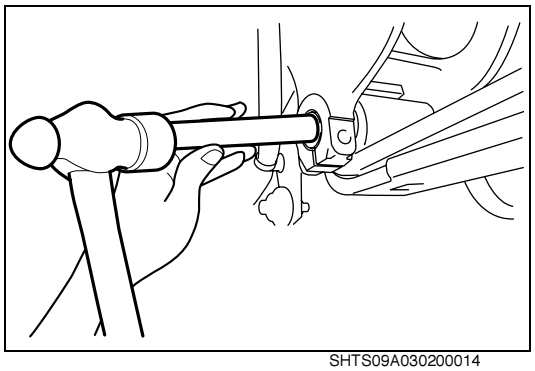

SHTS09A030200013

(4) Tighten the clip bolts.

NOTICE

When tightening the clip bolts, use a new clip bolts.

(5) Use a punch to peen the thread of the clip bolts.


SHTS09A030200014

IMPORTANT POINTS - MOUNTING

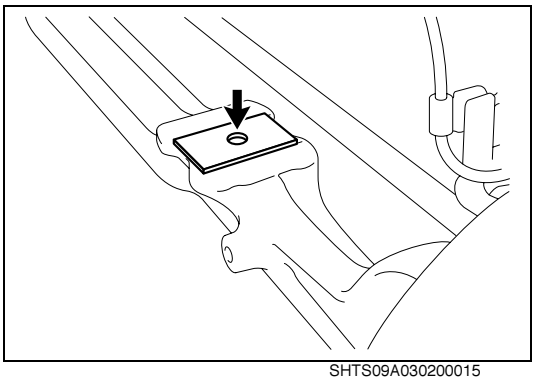
1. INSTALLATION OF THE SPRING PIN

(1) Use a brass rod to install the spring pin with thrust washers.

NOTICE

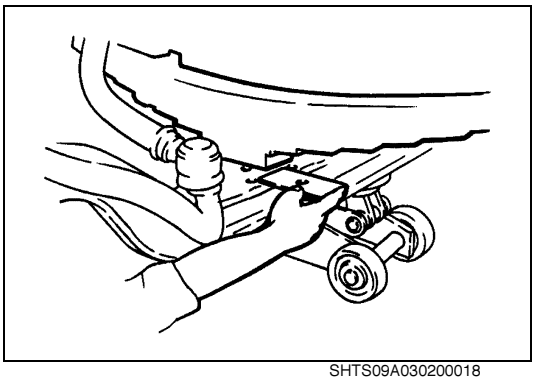
Apply chassis grease on the surface of the eye bushing and spring pin before installing.

(2) Install the spring pin lock bolt.


SHTS09A030200015

2. INSTALLATION OF THE U-BOLT

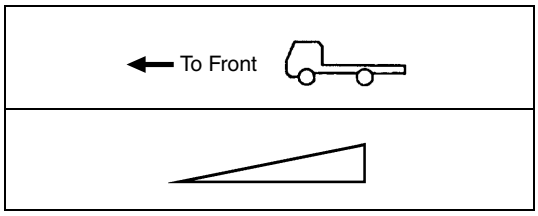
(1) Put the spacer on the front axle I-beam part of the driver's seat side.

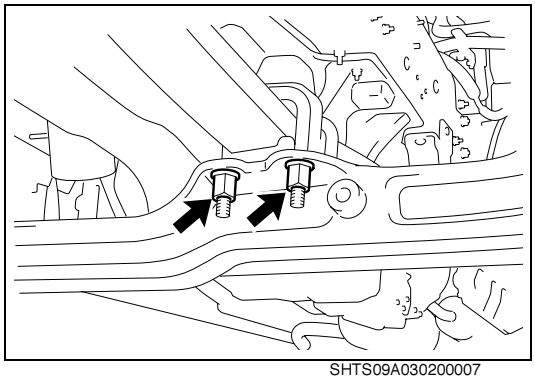

SHTS09A030200018

(2) Place the caster shim between the spring seat and leaf spring.

NOTICE

When installing the caster shim, the thick end should face the rear of the vehicle.



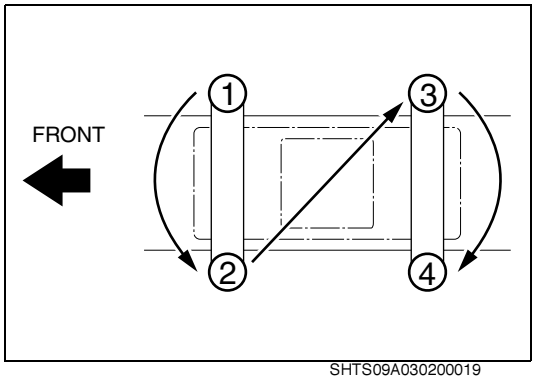

SHTS09A030200007

(3) Lift the axle using a jack and align the hole of the leaf spring center bolt and the hole of the axle I-beam.

NOTICE

Axle and suspension assembly are heavy, therefore be careful when handling them.

(4) Put the spring pads on the leaf springs.
(5) Set the U-bolts so that they catch the spring pads and tighten the U-bolt nuts temporarily.



SHTS09A030200019

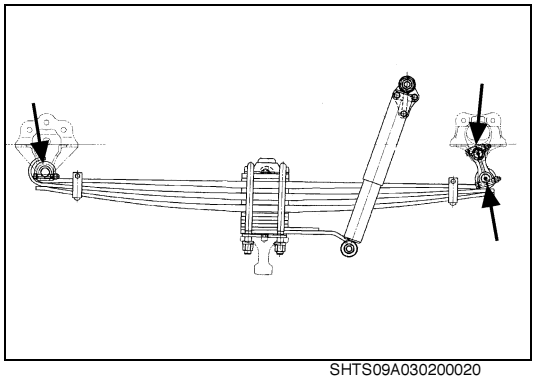
(6) Using the special tool, tighten the U-bolt nuts (4 pieces) alternately right and left and equally.
After repeating this operation 3 to 5 times, tighten the nuts to the specified torque.
SST: Socket Wrench for Front U-bolt (09603-1550)

3. ADJUSTMENT OF THE SUSPENSION AFTER ASSEMBLING

(1) If the vehicle inclination is observed after assembling suspension, correct it by inserting the following spacer between the spring and the axle.

Spacer:

Part No.	Thickness (mm)
9004-85492	4.5
9004-85493	9.0


SHTS09A030200020

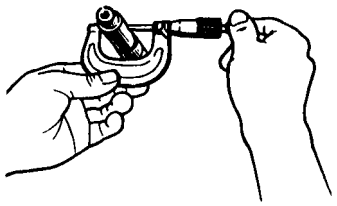
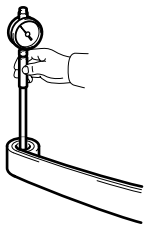
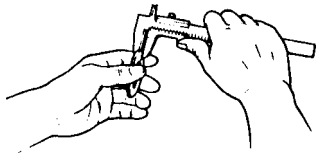
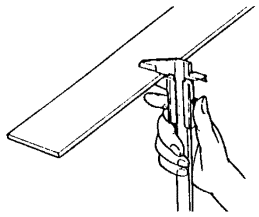
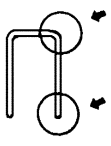
4. LUBRICATION

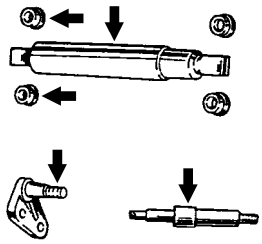
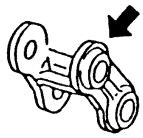
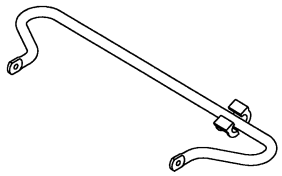
(1) Lubricate the following parts with chassis grease.
a. Spring pins

INSPECTION AND REPAIR

EN09A0302H300001

Unit: mm {in.}

Inspection item		Standard	Limit	Remedy	Inspection procedure
Spring pin: Outside diameter		30 {1.181}	29.7 {1.170}	Replace.	Measure 
Clearance between spring pin and eye bushing		0.020-0.13 {0.0008-0.0051}	0.5 {0.0196}	Replace the pin and/or bushing.	Measure 
Thrust washer: Wear	Pivot side	1.8 {0.071}	1.5 {0.059}	Replace.	Measure 
	Shackle side	4.0 {0.157}	3.5 {0.138}		
Leaf: Damage and wear		—	More than 15%	Replace.	Measure 
Silencer: Wear		5.0 {0.1968}	1.0 {0.0394}	Replace.	Measure 
Spring bumper: Damage and wear		—	—	Replace, if necessary.	Visual check 
U-bolt: Damage		—	—	Replace, if necessary.	Visual check 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Shock absorber: Operation, oil leak and damage	—	—	**Replace, if necessary.**	**Visual check** 
Cushion: Damage and wear	—	—		
Shock absorber pin and bracket: Damage and wear	—	—		
Shackle: Damage	—	—	**Replace, if necessary.**	**Visual check** 
Stabilizer bar: Damage (If so equipped)	—	—	**Replace, if necessary.**	**Visual check** 
Stabilizer sleeve: Wear (If so equipped)				
Stabilizer bushing: Wear (If so equipped)				

SUSPENSION (REAR, MODELS: FR, FS, FY, SS, ZS)

SU02-002

LEAF SUSPENSION ASSEMBLY

DATA AND SPECIFICATIONS

EN09A0602I200001

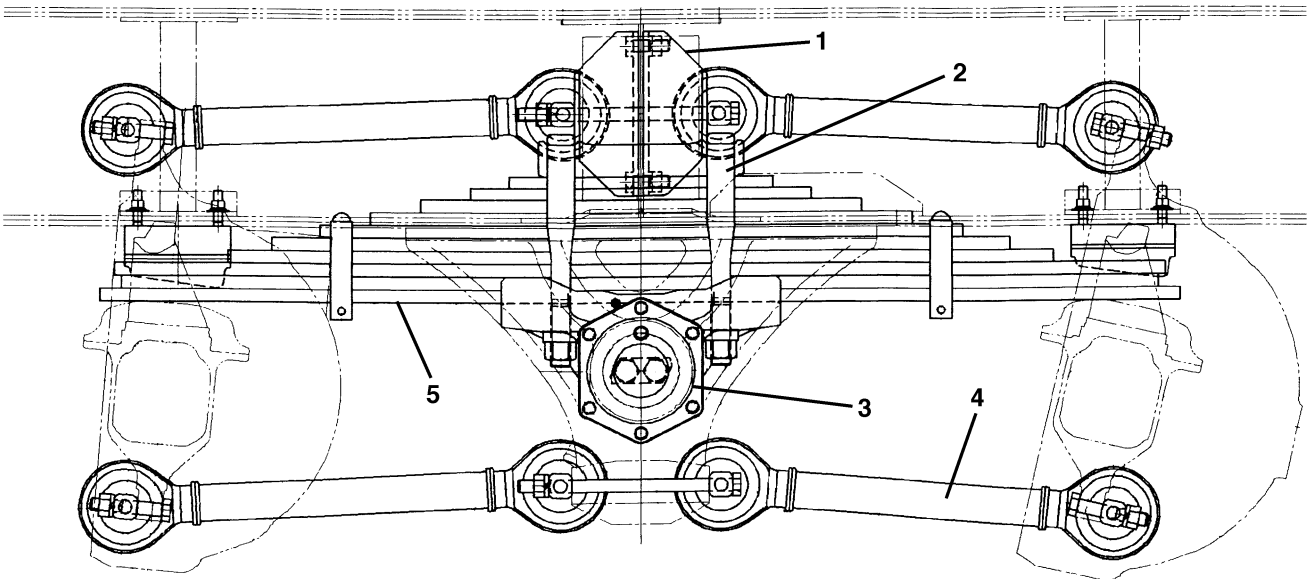
Unit: mm {in.}

Models		FR	FS		FY		SS	ZS
Type		Semi-elliptic springs with torque rod						
Dimensions of leaf springs	Span	1,310 {51.57}						1,500 {59.06}
	Width	90 {3.54}						
	Thickness of leaves	Multi leaf spring					Taper leaf spring	Multi leaf spring
		14 {0.55}	16 {0.63}	22 {0.87}	16 {0.63}	21 {0.83}	33 {1.30}	20 {0.79}
		16 {0.63}	18 {0.71}	25 {0.98}	18 {0.71}	22 {0.87}	—	22 {0.87}

DESCRIPTION

EN09A0602C100001

(REPRESENTATIVE MODEL)



SHTS09A060200001

1	Torque rod bracket	4	Torque rod
2	U-bolt	5	Leaf spring assembly
3	Trunnion assembly		

TROUBLESHOOTING

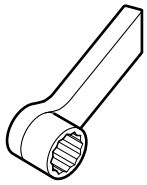
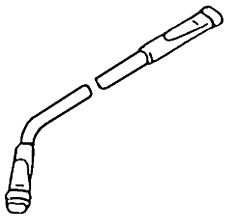
EN09A0602F300001

Symptom	Possible cause	Remedy/Prevention
Rough ride	Broken leaves	Replace the leaves. Check the load capacity rating.
	Cracked or damaged	Replace the leaves. Check the load capacity rating.
	Overloading	Decrease the load.
Heavy sway	Inoperative shock absorber	Replace the shock absorber.
Leaves broken at the center bolt hole	Loosen U-bolts	Tighten to specified torque.
Squeaking of the leaves	Friction between the leaves	Replace the silencers and/or apply chassis grease between leaves.

SPECIAL TOOL

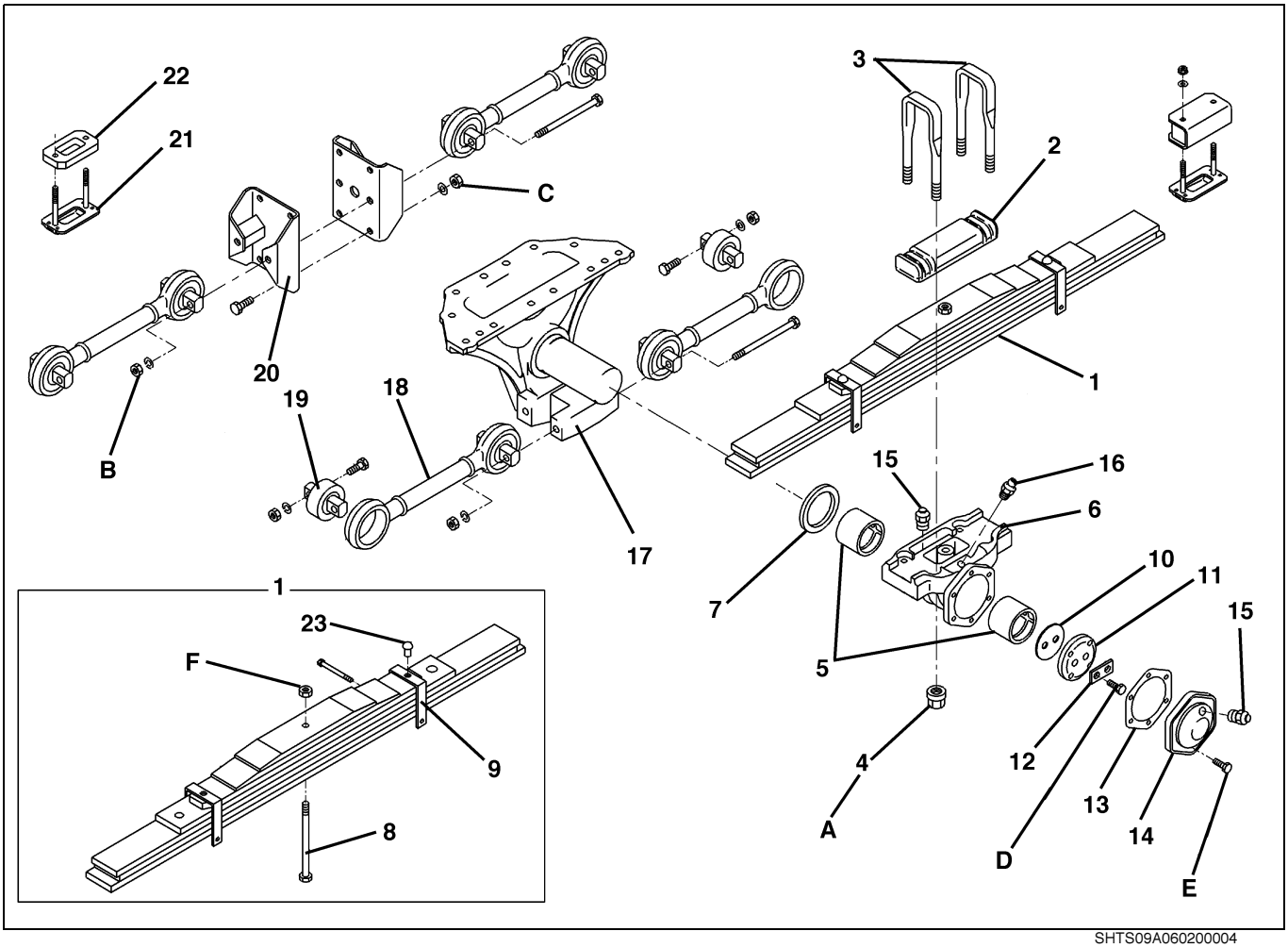
EN09A0602K100001

Prior to starting a suspension overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	09603-1010	SOCKET WRENCH	FOR REAR U-BOLT
	09404-1060	HANDLE	

COMPONENT LOCATOR

EN09A0602D100001



SHTS09A060200004

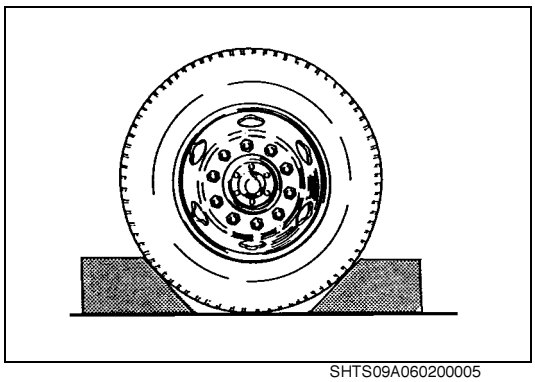
1	Leaf spring assembly	9	Clip	17	Trunnion bracket
2	Spring pad	10	Shim	18	Torque rod
3	U-bolt	11	Clamp plate	19	Rubber bushing
4	Nut	12	Lock plate	20	Torque rod bracket
5	Bushing	13	Trunnion gasket	21	Spring bumper
6	Trunnion seat	14	Trunnion cover	22	Spacer
7	Oil seal	15	Breather valve	23	Rivet
8	Center bolt	16	Lubrication fitting		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	782-978 {7,975-9,972, 577-721}	D	341-459 {3,478-4,680, 252-338}
B	236-324 {2,407-3,303, 175-238}	E	37-49 {378-499, 28-36}
C	170-230 {1,734-2,345, 126-169}	F	226-284 {2,305-2,895, 167-209}

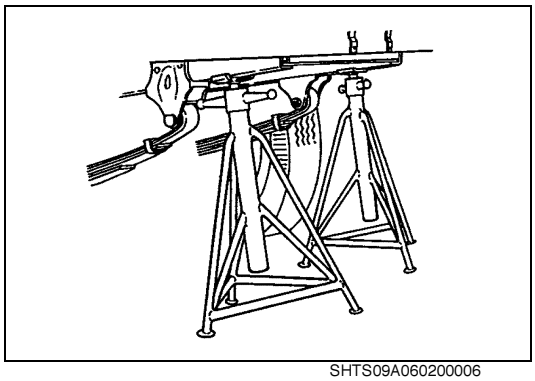
OVERHAUL

EN09A0602H200001

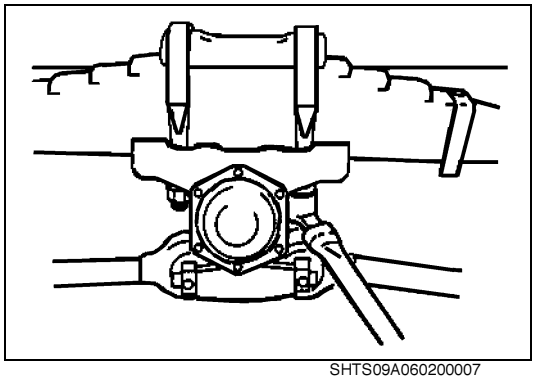

SHTS09A060200005

IMPORTANT POINTS - DISMOUNTING

1. SUPPORT OF THE FRAME WITH STANDS
(1) Park the vehicle on level ground.
(2) Be sure to block the wheels before dismounting.


SHTS09A060200006

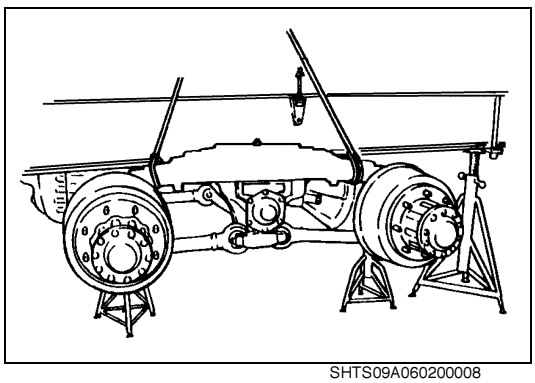
(3) Jack up the axle, and support the frame with stands.
(4) Remove the tires.


SHTS09A060200007

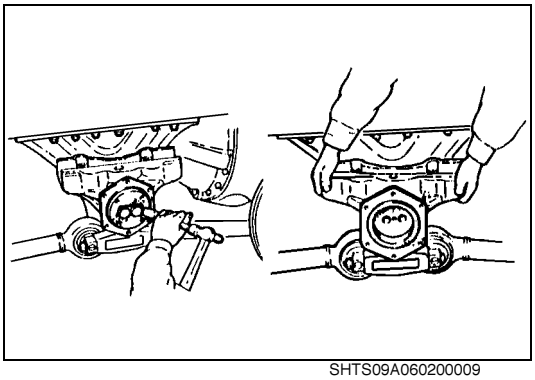
2. REMOVAL OF THE U-BOLT
(1) Support the axle with a floor jack.
(2) Remove the U-bolt mounting nuts.

NOTICE
When cutting off the U-bolts (Due to rusted threads) with a torch, never direct the flame toward the leaves or allow sparks to come in contact with the leaves.

SST:
Socket Wrench for Rear U-bolt (09603-1010)
Handle (09404-1060)


SHTS09A060200008

3. REMOVAL OF THE LEAF SPRING FROM THE TRUNNION SEAT
(1) Remove the leaf spring from the trunnion seat.

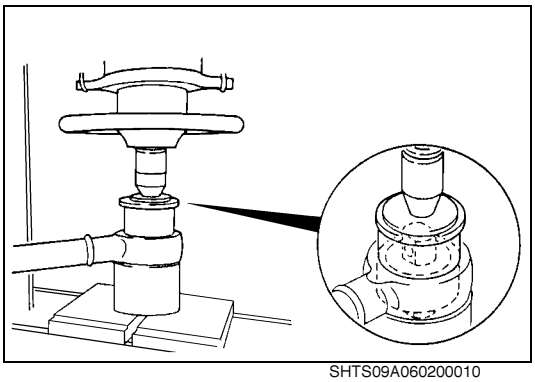

SHTS09A060200009

4. REMOVAL OF THE TRUNNION SEAT

(1) Remove the trunnion shaft cover.
(2) Uncaulk the lock plate of the clamp plate bolts with a chisel, then remove the bolts, lock plate, clamp plate and shims.
(3) Remove the trunnion seat from trunnion shaft.

⚠ WARNING

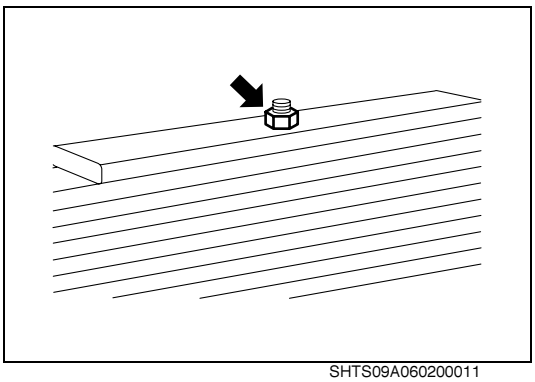
Since the trunnion seat is too heavy, be careful not to drop it on your feet.


SHTS09A060200010

IMPORTANT POINTS - DISASSEMBLY

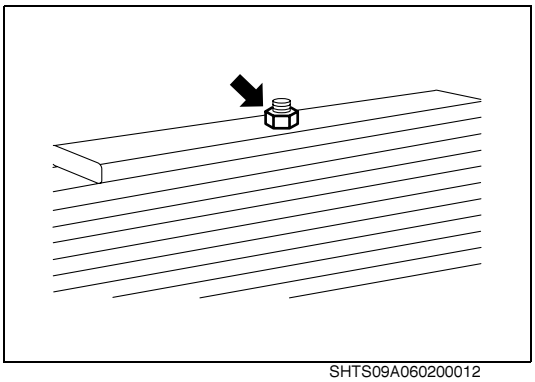
1. REPLACEMENT OF THE RUBBER BUSHING

(1) Use a commercial tool to press out the old tubber bushing.
(2) Use a commercial tool to press in the new rubber bushing.


SHTS09A060200011

2. DISASSEMBLY OF THE LEAF SPRING

(1) Remove the clip bolts.
(2) Remove the center bolt.


SHTS09A060200012

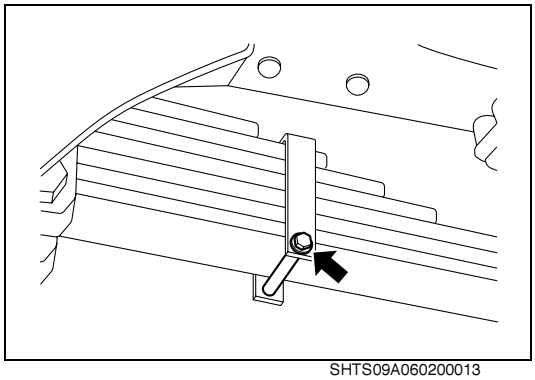
IMPORTANT POINT - ASSEMBLY

1. ASSEMBLY OF THE LEAF SPRING

(1) Insert the center bolt and tighten the lock nut.

NOTICE

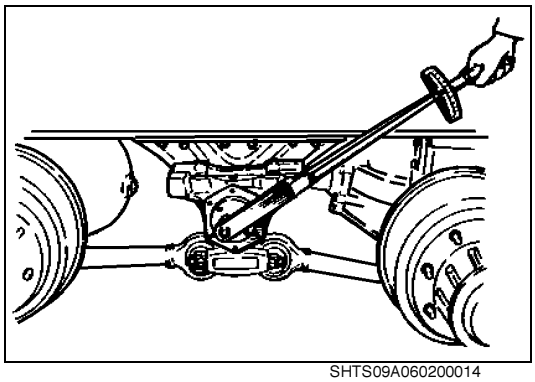
When reassembling the leaf spring, replace the center bolt with a new one.


SHTS09A060200013

(2) Tighten the clip bolts.

NOTICE

When tightening the clip bolts, use a new clip bolts.


SHTS09A060200014

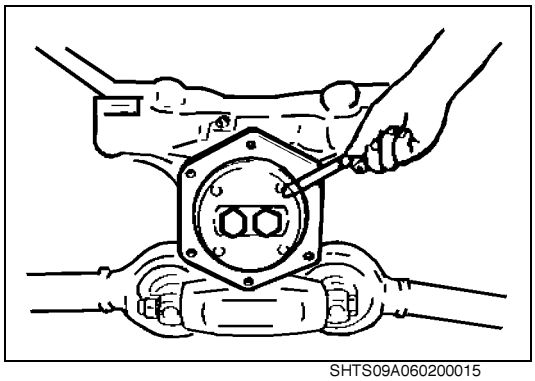
IMPORTANT POINTS - MOUNTING

1. INSPECT THE CLEARANCE BETWEEN THE CLAMP PLATE AND THE TRUNNION SEAT.

NOTICE

- **Replace the oil seal and trunnion gasket with new ones.**
- **Apply chassis grease to lip of the oil seal and the inside of the bushing.**
- **Insert two trunnion seat bolts before installing the trunnion seat on the trunnion shaft.**

(1) Install the trunnion seat to the trunnion shaft.
(2) Set the shim and clamp plate and tighten the bolts with the lock plate.


SHTS09A060200015

(3) Inspect the clearance between the clamp plate and trunnion seat.

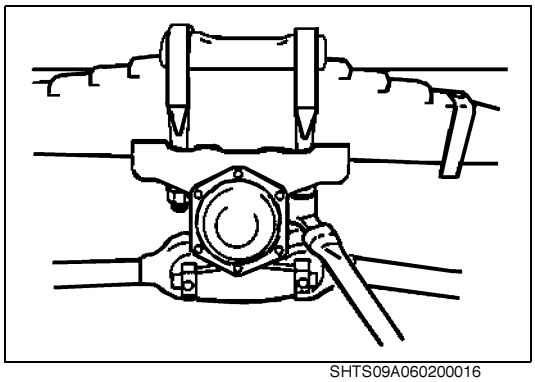
Standard clearance: 0.05-0.1 mm {0.0020-0.0039 in.}
Service limit: 0.4 mm {0.0157 in.}

NOTICE

If the standard clearance is not correct, adjust the clearance by decreasing or increasing the shim.

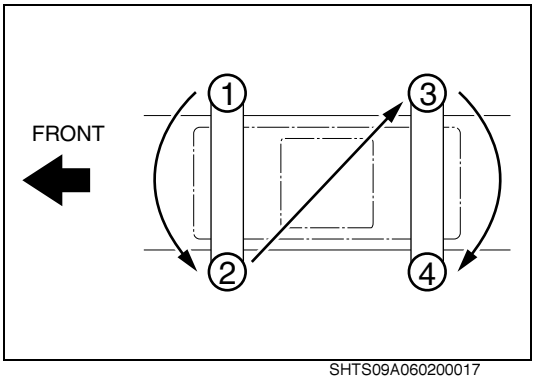
The following shims are available.
0.30 mm {0.0118 in.}, 0.40 mm {0.0157 in.},
0.45 mm {0.0177 in.}, 0.50 mm {0.0197 in.}.

(4) Lock the clamp plate bolts with the lock plate.


SHTS09A060200016

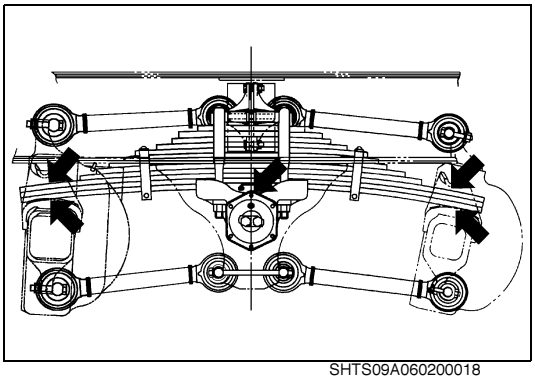
2. INSTALLATION OF THE U-BOLT

(1) Put the spring pads on the leaf springs.
(2) Set the U-bolt so that they catch the spring pads and tighten the U-bolt nuts temporarily.



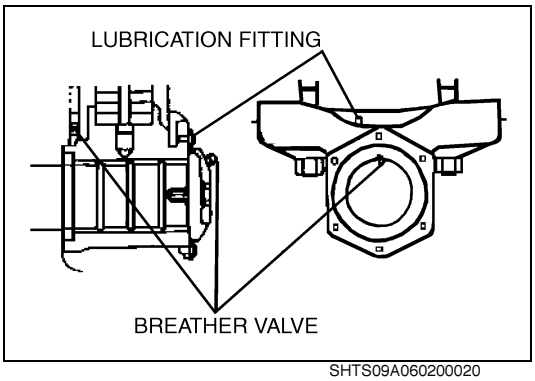
SHTS09A060200017

(3) Using the special tool, tighten the U-bolt nuts (4 pieces) alternately right and left and equally.
After repeating this operation 3 to 5 times, tighten the nuts to the specified torque.
SST:
Socket Wrench for Rear U-bolt (09603-1010)
Handle (09404-1060)


SHTS09A060200018

3. LUBRICATION

(1) Lubricate the following parts with chassis grease.
a. Spring surface of the spring and axle housing
b. Trunnion shaft



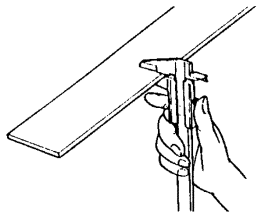
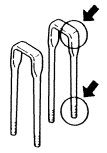
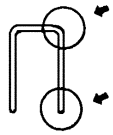
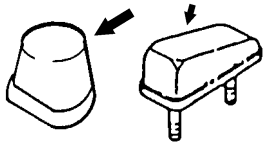
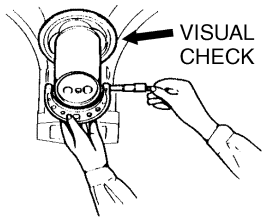
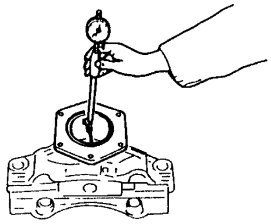
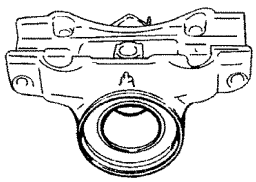
SHTS09A060200020

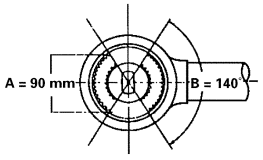
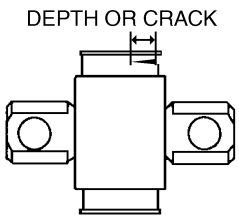
NOTICE
Use the lubrication fitting to chassis grease the trunnion shaft, until the grease flows out from the breather valve of trunnion seat and trunnion cover.

INSPECTION AND REPAIR

EN09A0602H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Leaf: **Damage and wear.**	**—**	**More than 15%**	**Replace.**	**Measure** 
U-Bolt: **Damage.**	**—**	**—**	**Replace, if necessary.**	**Visual check**  
Spring bumper: **Damage and wear.**	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Trunnion shaft outside diameter.	**100 {3.937}**	**—**	**Replace, if necessary.**	**Measure**  
Clearance between trunnion shaft and bushing.	**0.26-0.43 {0.0103-0.0169}**	**0.7 {0.0275}**	**Replace, if necessary.**	
Dust shield: **Damage.**	**—**	**—**	**Replace, if necessary.**	
Trunnion oil seal: **Damage.**	**—**	**—**	**Replace, if necessary.**	**Visual check** 

Inspection item	Standard	Limit	Remedy	Inspection procedure
Rubber bushing: Damage and crack.	**—**	**15 {0.59}**	**In case cracks have developed on the rubber circumference in the range (A or B) shown in figure, replace the torque rod bushing.**	**Measure and Visual check**  

SUSPENSION (REAR, MODEL: SH)

SU02-003

LEAF SUSPENSION ASSEMBLY

DATA AND SPECIFICATIONS

EN09A0502I200001

Unit: mm {in.}

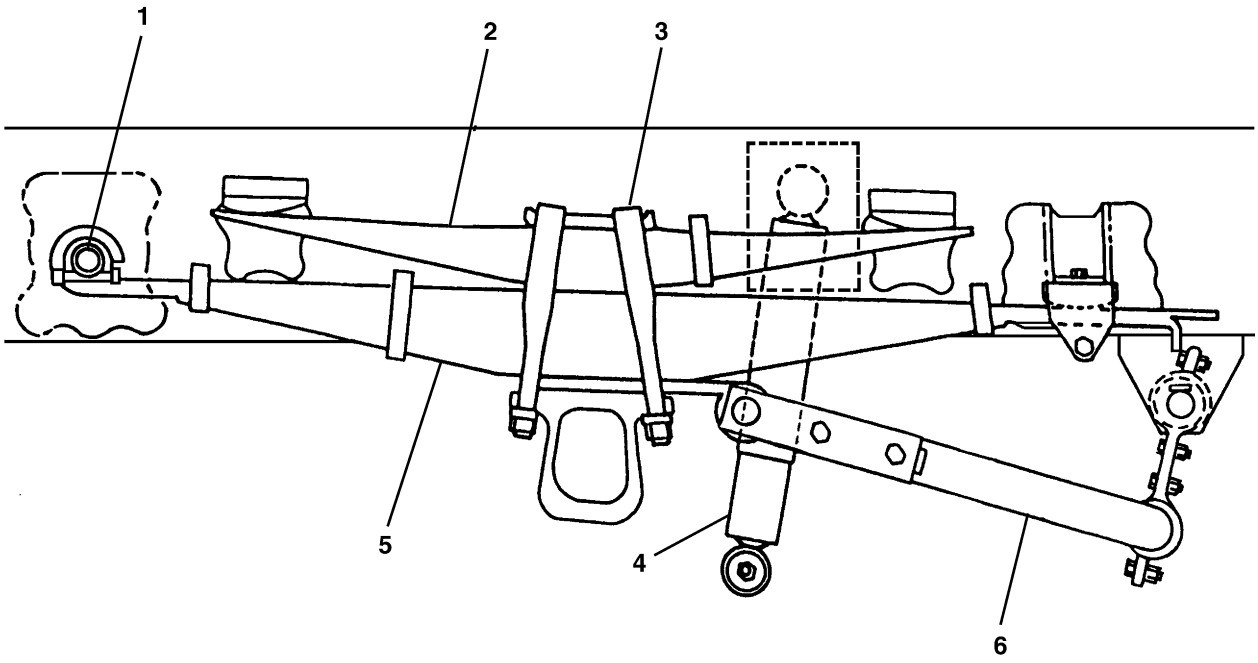
Type		**Semi-elliptic main and auxiliary leaf springs with shock absorber (if so equipped) and stabilizer (if so equipped)**	
Dimensions of leaf spring	**Span**	**1,430 {56.30}**	
	Width	**90 {3.54}**	
	Thickness of leaves	**Multi leaf spring**	**Taper leaf spring**
		10.0 {0.39}	**18.0 {0.71}**
		12.0 {0.47}	**19.0 {0.75}**
Dimensions of auxiliary leaf springs	**Spain**	**980 {38.58}**	
	Width	**90 {3.54}**	
	Thickness of leaves	**10.0 {0.39}**	**15.0 {0.59}**
Shock absorbers	**Type**	***Single acting**	***Double acting**
	Stroke	**280 {11.02}**	**270 {10.63}**
	Min. length	**458 {18.03}**	**460 {18.11}**
	Max. length	**738 {29.06}**	**730 {28.74}**
Stabilizer		**Option**	

***: If so equipped**

DESCRIPTION

EN09A0502C100001

(REPRESENTATIVE MODEL)



SHTS09A050200001

1	Spring pin	4	Shock absorber (If so equipped)
2	Auxiliary leaf spring assembly	5	Main leaf spring assembly
3	U-bolt	6	Stabilizer (If so equipped)

TROUBLESHOOTING

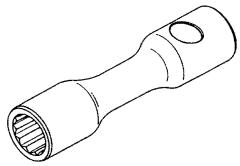
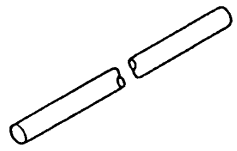
EN09A0502F300001

Symptom	Possible cause	Remedy/Prevention
Rough ride	Broken leaves	Replace the leaves. Check the load capacity rating.
	Cracked or damaged	Replace the leaves. Check the load capacity rating.
	Overloading	Decrease the load.
Heavy sway	Inoperative shock absorber	Replace the shock absorber.
Leaves broken at the center bolt hole	Loosen U-bolts	Tighten to specified torque.
Squeaking of the leaves	Friction between the leaves	Replace the silencers and/or apply chassis grease between leaves.

SPECIAL TOOL

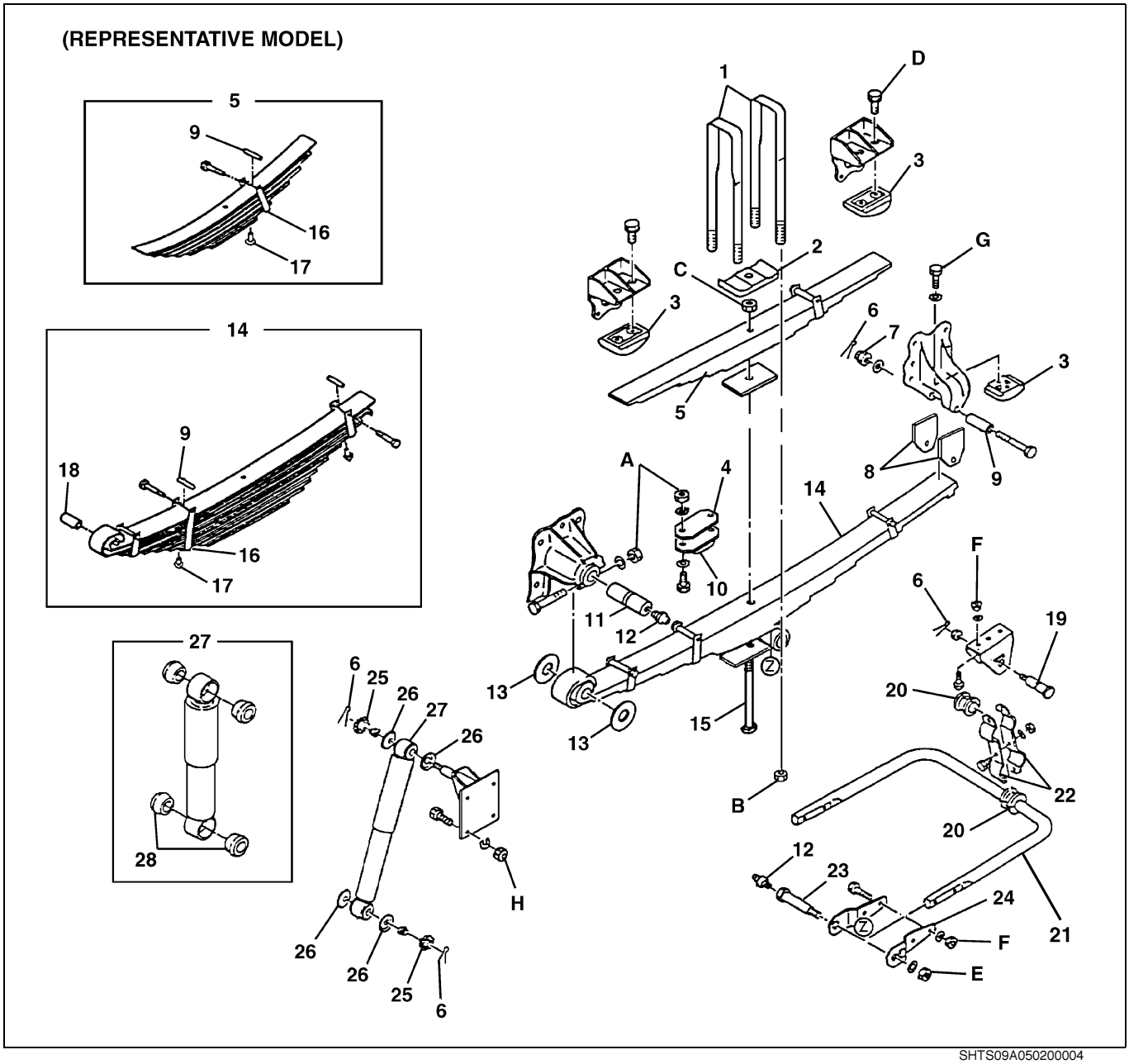
EN09A0502K100001

Prior to starting a suspension overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	09839-3202 09839-3203	SOCKET WRENCH	FOR REAR U-BOLT
	09841-2560	BAR	FOR REAR U-BOLT

COMPONENT LOCATOR

EN09A0502D100001



SHTS09A050200004

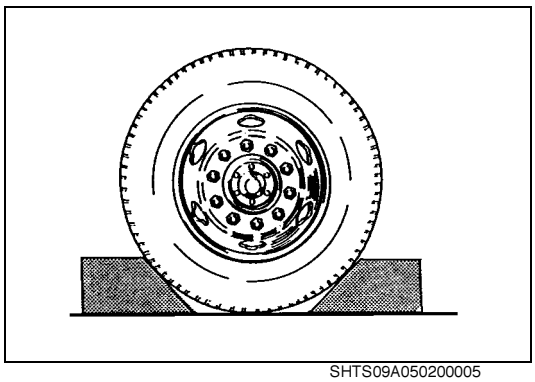
1	U-bolt	11	Spring pin	21	Stabilizer (If so equipped)
2	Spring pad	12	Lubrication fitting	22	Holder (If so equipped)
3	Slide seat	13	Thrust washer	23	Stabilizer link pin (If so equipped)
4	Spacer	14	Main leaf spring assembly	24	Stabilizer lever (If so equipped)
5	Auxiliary leaf spring assembly	15	Center bolt	25	Slotted cap (If so equipped)
6	Cotter pin	16	Clip	26	Cushion washer (If so equipped)
7	Slotted nut	17	Rivet	27	Shock absorber (If so equipped)
8	Wear plate	18	Bushing	28	Cushion (If so equipped)
9	Collar	19	Holder pin (If so equipped)		
10	Spring bumper	20	Rubber bushing (If so equipped)		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	73-109 {745-1,111, 54-80}	E	341-459 {3,478-4,680, 252-338}
B	641-739 {6,537-7,535, 473-544}	F	166-224 {1,693-2,284, 123-165}
C	226-284 {2,305-2,895, 167-209}	G	106-144 {1,081-1,468, 79-106}
D	64-86 {653-876, 48-63}	H	106-144 {1,081-1,468, 79-106}

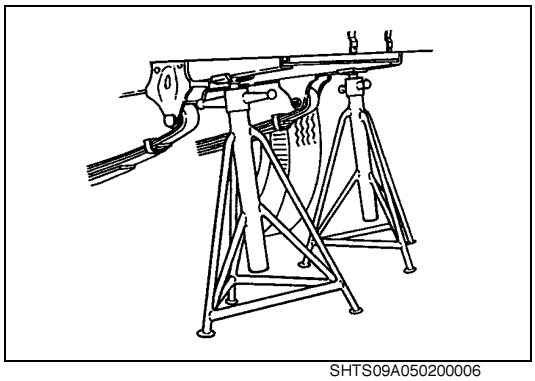
OVERHAUL

EN09A0502H200001

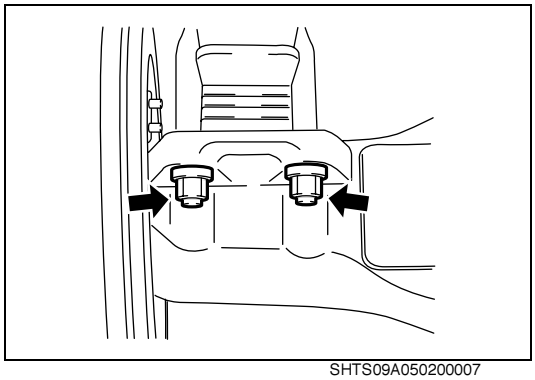

SHTS09A050200005

IMPORTANT POINTS - DISMOUNTING

1. SUPPORT OF THE FRAME WITH STANDS
(1) Park the vehicle on level ground.
(2) Be sure to block the wheels before dismounting.


SHTS09A050200006

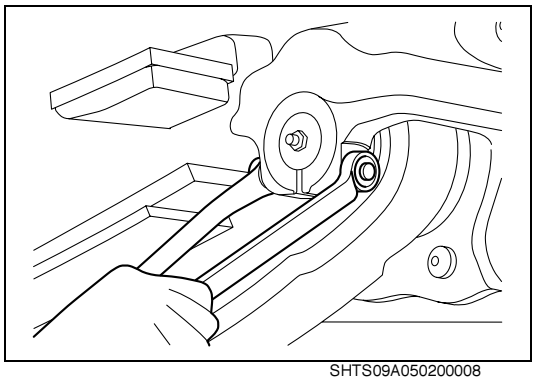
(3) Jack up the axle, and support the frame with stands.
(4) Remove the tires.


SHTS09A050200007

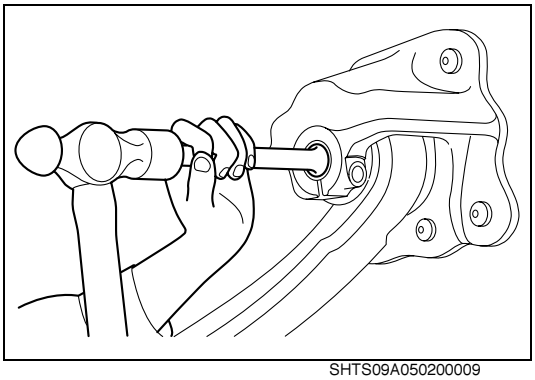
2. REMOVAL OF THE U-BOLT
(1) Remove the stabilizer.
(2) Support the axle with a floor jack.
(3) Remove the U-bolt mounting nuts.

NOTICE
When cutting off the U-bolts (Due to rusted threads) with a torch, never direct the flame toward the leaves or allow sparks to come in contact with the leaves.

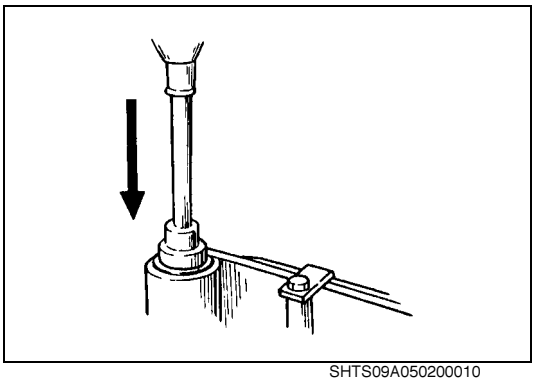
SST:
Socket Wrench for Rear U-bolt (09839-3202)
Socket Wrench for Rear U-bolt (09839-3203)
Bar (09841-2560)


SHTS09A050200008

3. REMOVAL OF THE SPRING PIN
(1) Remove the lubrication fitting and spring pin lock bolt.


SHTS09A050200009

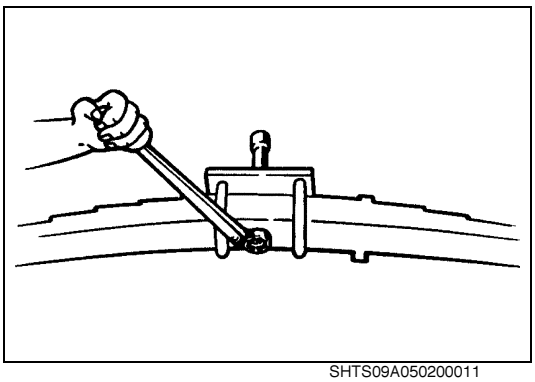
(2) Use a brass rod to remove the spring pins from the shackle and spring bracket.


SHTS09A050200010

IMPORTANT POINTS - DISASSEMBLY

1. REPLACEMENT OF THE EYE BUSHING

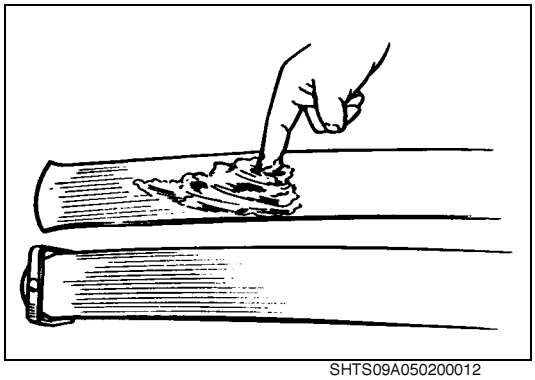
(1) Use a suitable tool to press out the old eye bushing.
(2) Use a suitable tool to press in the new eye bushing.


SHTS09A050200011

2. DISASSEMBLY OF THE LEAF SPRING

⚠ WARNING
When removing the center bolt lock nut, the spring leaves may jump. Care should be taken to avoid possible personal injury.

(1) Remove the clip bolts.
(2) Use a vise or an arbor press to hold the leaf spring near the center bolt.
(3) Remove the center bolt.
(4) Loosen a vise or an arbor press slowly, and separate the leaves.

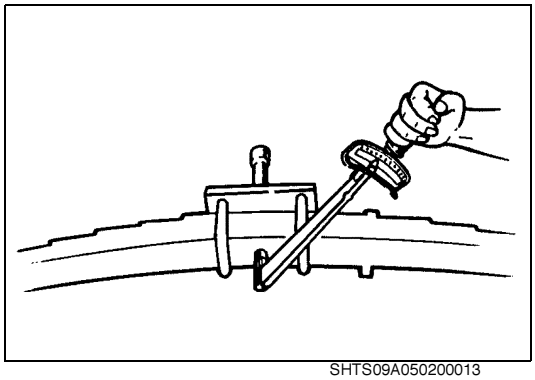

SHTS09A050200012

IMPORTANT POINT - ASSEMBLY

1. ASSEMBLY OF THE LEAF SPRING

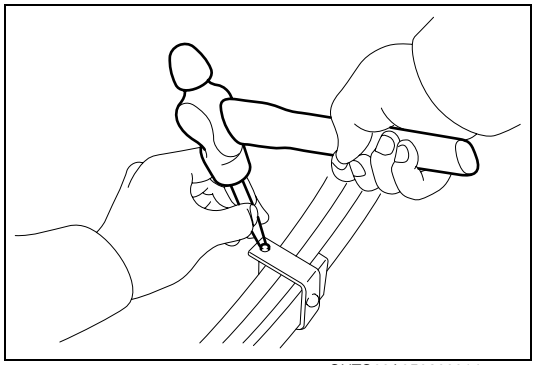
⚠ WARNING
When clamping the spring leaves, they may jump. Care should be taken to avoid possible personal injury.

(1) Apply coating on the leaf after removing rust, and apply chassis grease on both surface at leaves.


SHTS09A050200013

(2) Align the leaf holes and secure the leaves with a vise or an arbor press.
(3) Insert the center bolt and tighten the lock nut.

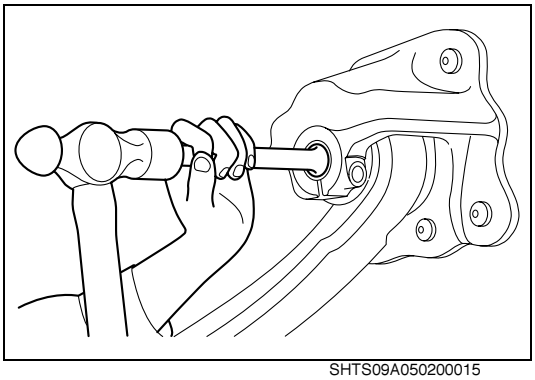
NOTICE
When reassembling the leaf spring, replace the center bolt with a new one.


SHTS09A050200014

(4) Tighten the clip bolts.

NOTICE
When tightening the clip bolts, use a new clip bolts.

(5) Use a punch to peen the thread of the clip bolts.


SHTS09A050200015

IMPORTANT POINTS - MOUNTING

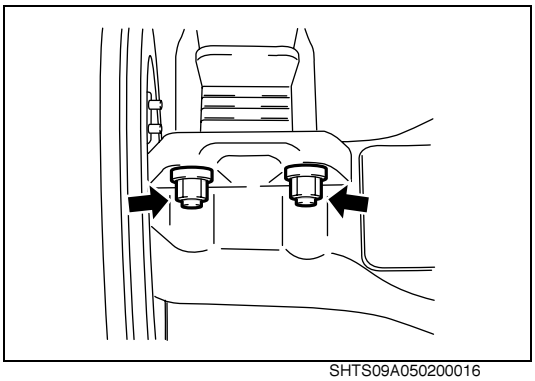
1. INSTALLATION OF THE SPRING PIN

(1) Use a brass rod to install the spring pin with thrust washers.

NOTICE

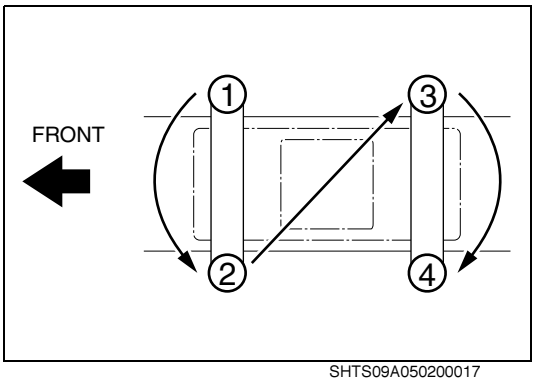
Apply chassis grease on the surface of the eye bushing and spring pin before installing.

(2) Install the spring pin lock bolt and nut.
(3) Install and secure the lock nut.


SHTS09A050200016

2. INSTALLATION OF THE U-BOLT

(1) Set the U-bolts and tighten the U-bolt nuts temporarily.



SHTS09A050200017

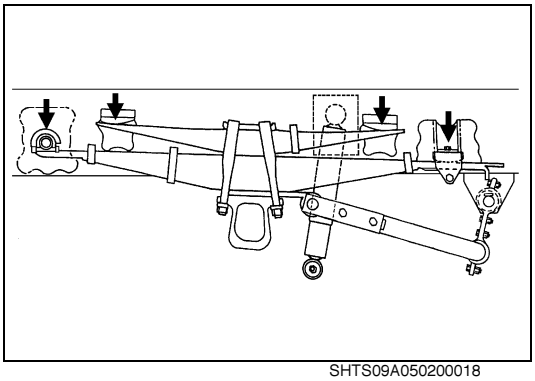
(2) Using the special tool, tighten the U-bolt nuts (4 pieces) alternately right and left and equally.
After repeating this operation 3 to 5 times, tighten the nuts to the specified torque.
SST:
Socket Wrench for Rear U-bolt (09839-3202)
Socket Wrench for Rear U-bolt (09839-3203)
Bar (09841-2560)

3. ADJUSTMENT OF THE SUSPENSION AFTER ASSEMBLING

(1) If the vehicle inclination is observed after assembling suspension, correct it by inserting the following spacer between the spring and the axle.

Spacer:

Part No.	Thickness (mm)
9004-85244	4.5


SHTS09A050200018

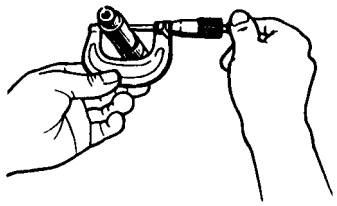
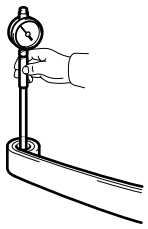
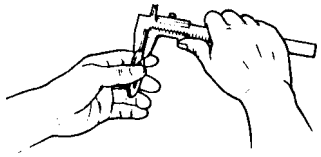
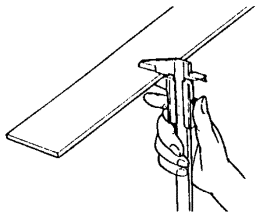
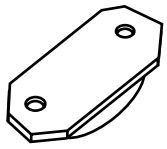
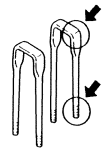
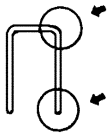
4. LUBRICATION

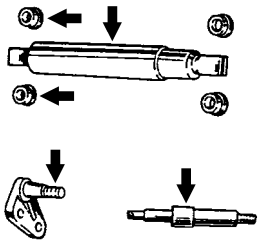
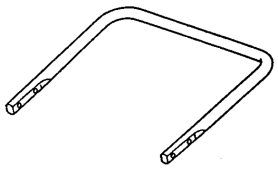
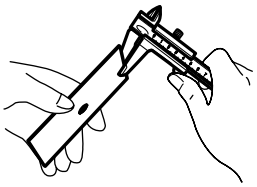
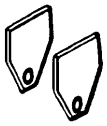
(1) Lubricate the following parts with chassis grease.
a. Spring pins
b. Auxiliary spring slide seats

INSPECTION AND REPAIR

EN09A0502H300001

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Spring pin: Outside diameter	38 {1.496}	37.7 {1.484}	Replace.	Measure 
Clearance between spring pin and eye bushing	0.020-0.125 {0.0008-0.0049}	0.5 {0.0196}	Replace the pin and/or bushing.	Measure 
Thrust washer: Wear	2.0 {0.079}	1.5 {0.059}	Replace.	Measure 
Leaf: Damage and wear	—	More than 15%	Replace.	Measure 
Spring bumper: Damage and wear	—	—	Replace, if necessary.	Visual check 
U-bolt: Damage	—	—	Replace, if necessary.	Visual check  

Inspection item	Standard	Limit	Remedy	Inspection procedure
Shock absorber: Operation, oil leak and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Cushion: Damage and wear	**—**	**—**		
Shock absorber pin and bracket: Damage and wear	**—**	**—**		
Stabilizer bar: Damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Stabilizer sleeve: Wear				
Stabilizer bushing: Wear				
Inter leaf: Wear	**1.0 {0.0397}**	**0.5 {0.0197}**	**Replace.**	**Measure** 
Wear plate: Wear	**4.5 {0.177}**	**4.0 {0.0158}**	**Replace.**	**Measure** 

SUSPENSION (HENDRICKSON HAS 250, HAS 460)

SU02-004

SUSPENSION ASSEMBLY

DATA AND SPECIFICATIONS

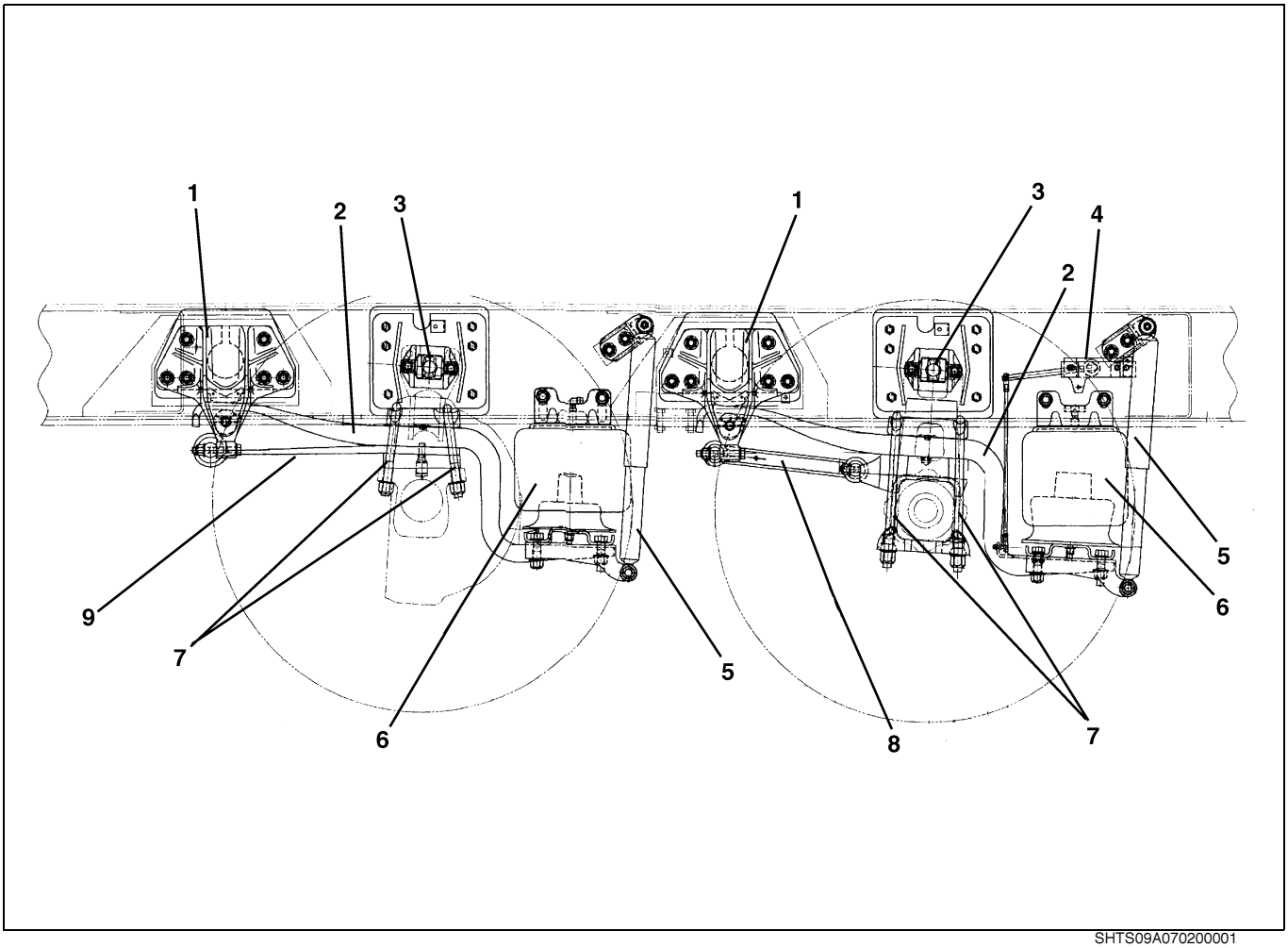
EN09A0702I200001

MODEL	FR, FS, FY, SS	SH
TYPE	HENDRICKSON HAS 460	HENDRICKSON HAS 250

DESCRIPTION

EN09A0702C100001

MODEL: FR

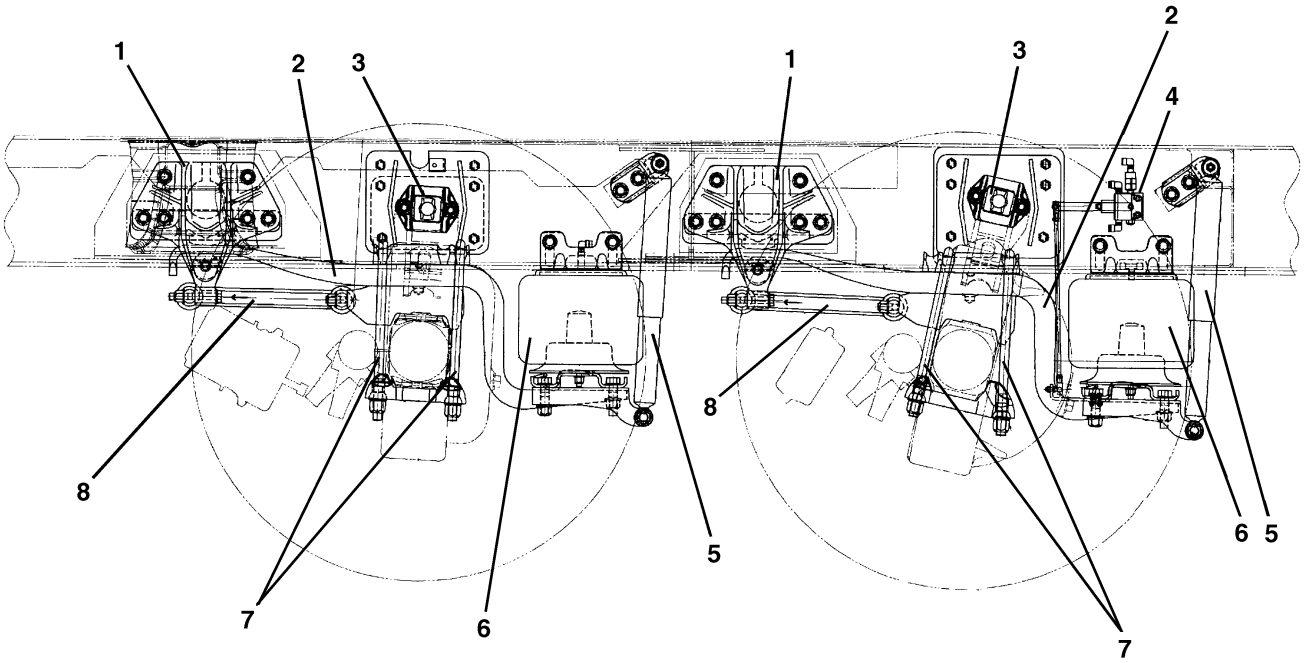


SHTS09A070200001

1	Frame hanger	6	Air spring
2	Leaf spring	7	U-bolt
3	Transverse rod	8	Torque rod
4	Height sensor	9	Tension leaf
5	Shock absorber		

MODELS: FS, FY, SS
(FOR AUSTRALIA AND CHILE)

(REPRESENTATIVE TYPE)

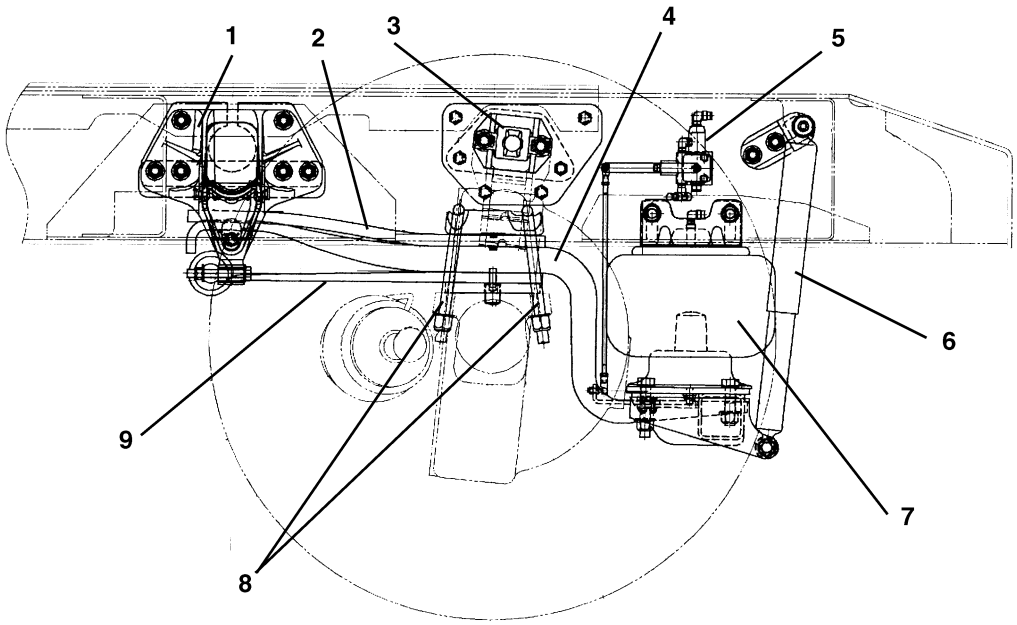


SHTS09A070200002

1	Frame hanger	5	Shock absorber
2	Leaf spring	6	Air spring
3	Transverse rod	7	U-bolt
4	Leveling valve	8	Torque rod

MODEL: SH

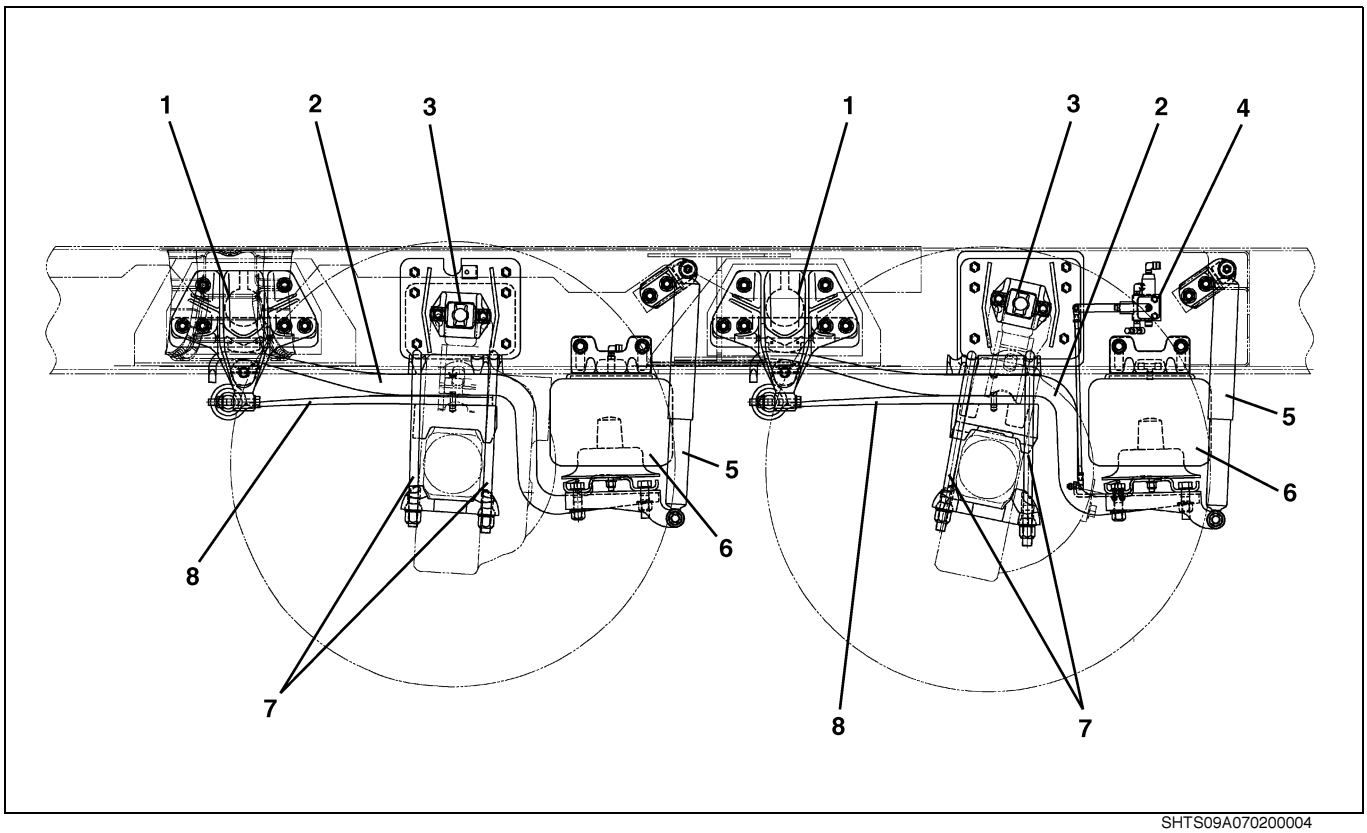
(REPRESENTATIVE TYPE)



SHTS09A070200003

1	Frame hanger	6	Shock absorber
2	Leaf spring No. 2	7	Air spring
3	Transverse rod	8	U-bolt
4	Leaf spring No.1	9	Tension leaf
5	Leveling valve		

MODEL: SS
(FOR SOUTH AFRICA)



SHTS09A070200004

1	Frame hanger	5	Shock absorber
2	Leaf spring	6	Air spring
3	Transverse rod	7	U-bolt
4	Leveling valve	8	Tension leaf

TROUBLESHOOTING

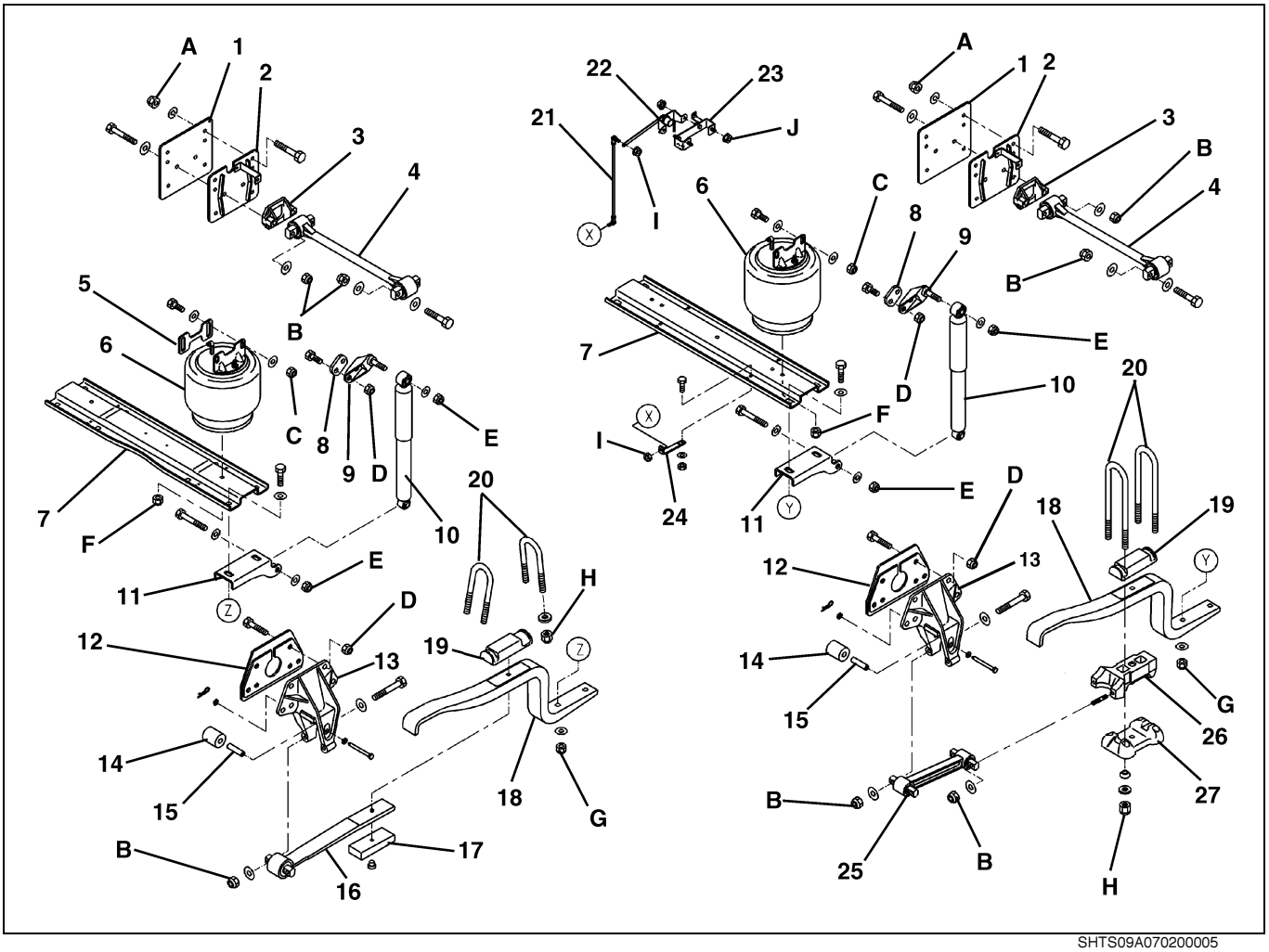
EN09A0702F300001

Symptom	Possible cause	Remedy/Prevention
Abnormal sound occurs from the spring while driving.	Eccentric wear of the shock absorber fitting pin	Replace the pin and/or rubber bushing.
	Wear and deflection of the rebound roller	Remove the rebound roller and/or rebound bolt spacer.
Uncomfortably (Rolling and pitching)	Deflection and damage of the bushings of the torque rod and the transverse rod	Replace the bushings.
	Faulty of the shock absorber	Replace the shock absorber.
	Faulty of the leveling valve	Repair the leveling valve.
Vibration of the steering wheel, and the car shake	Deflection of the bushing in the torque rod and the transverse rod	Replace the bushings.
	Looseness of the torque rod and the transverse rod bracket bolt	Replace the lock nut and tighten with the specified torque.
Vehicle height is not adjusted correctly.	Faulty of the leveling valve	Repair the parts.

COMPONENT LOCATOR

EN09A0702D100001

MODEL: FR



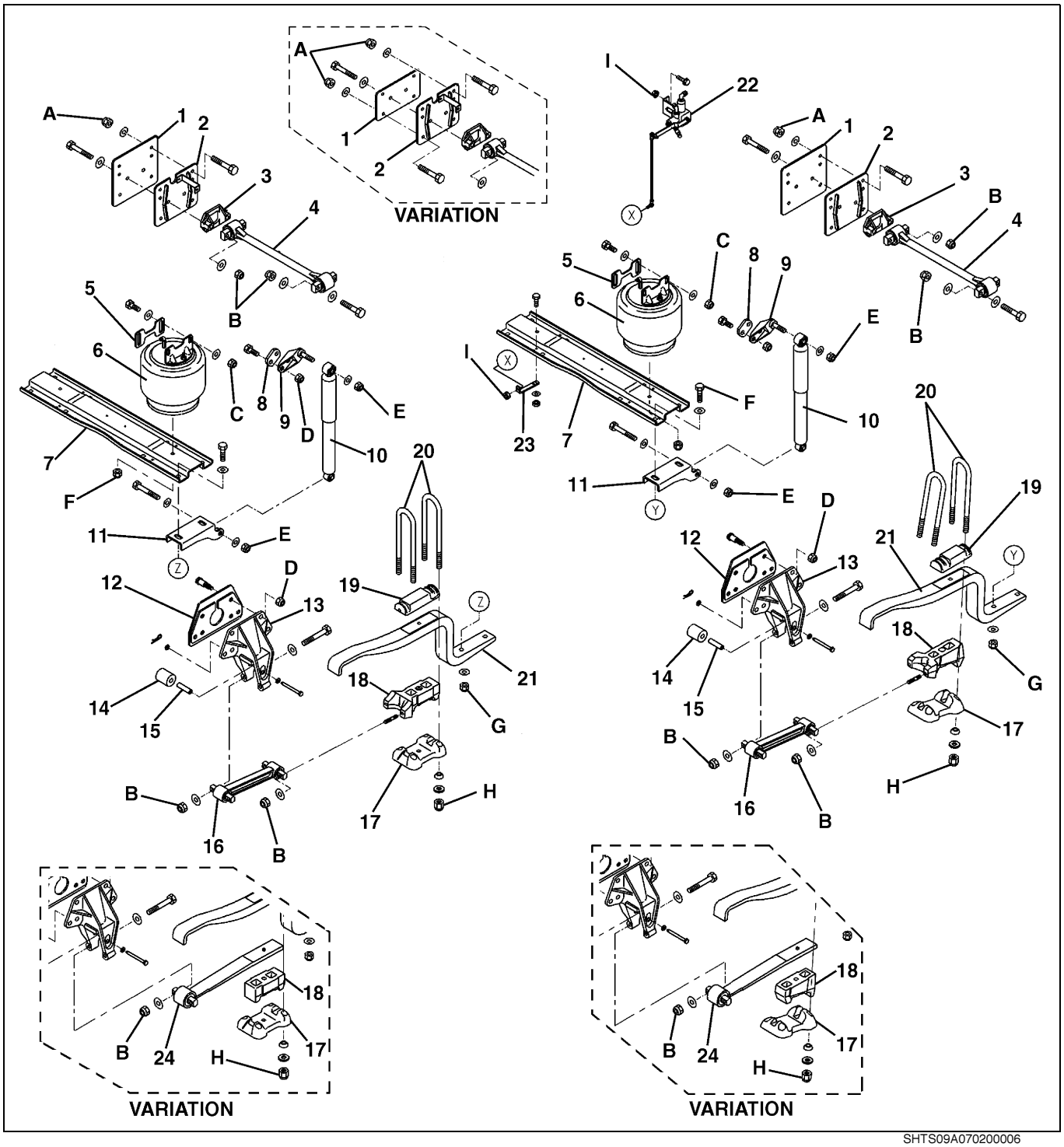
SHTS09A070200005

1	Spacer	15	Spacer tube
2	Plate	16	Tension leaf
3	Transverse rod bracket	17	Caster wedge
4	Transverse rod	18	Leaf spring
5	Spacer	19	Spring pad
6	Air spring	20	U-bolt
7	Cross channel	21	Adjusting rod
8	Spacer	22	Height sensor
9	Shock absorber upper bracket	23	Sensor bracket
10	Shock absorber	24	Lever
11	Shock absorber lower bracket	25	Torque rod
12	Back plate	26	Torque rod bracket
13	Frame hanger	27	Spring seat
14	Rebound roller		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	104-156 {1,061-1,590, 77-115}	F	27-41 {276-418, 20-30}
B	203-277 {2,070-2,824, 150-204}	G	352-434 {3,590-4,425, 260-319}
C	237-305 {2,417-3,110, 175-224}	H	460-520 {4,691-5,302, 340-383}
D	212-318 {2,162-3,242, 157-234}	I	11-17 {113-173, 9-12}
E	70-98 {714-999, 52-72}	J	41-61 {418-622, 31-44}

MODELS: FS, FY, SS (FOR AUSTRALIA AND CHILE)



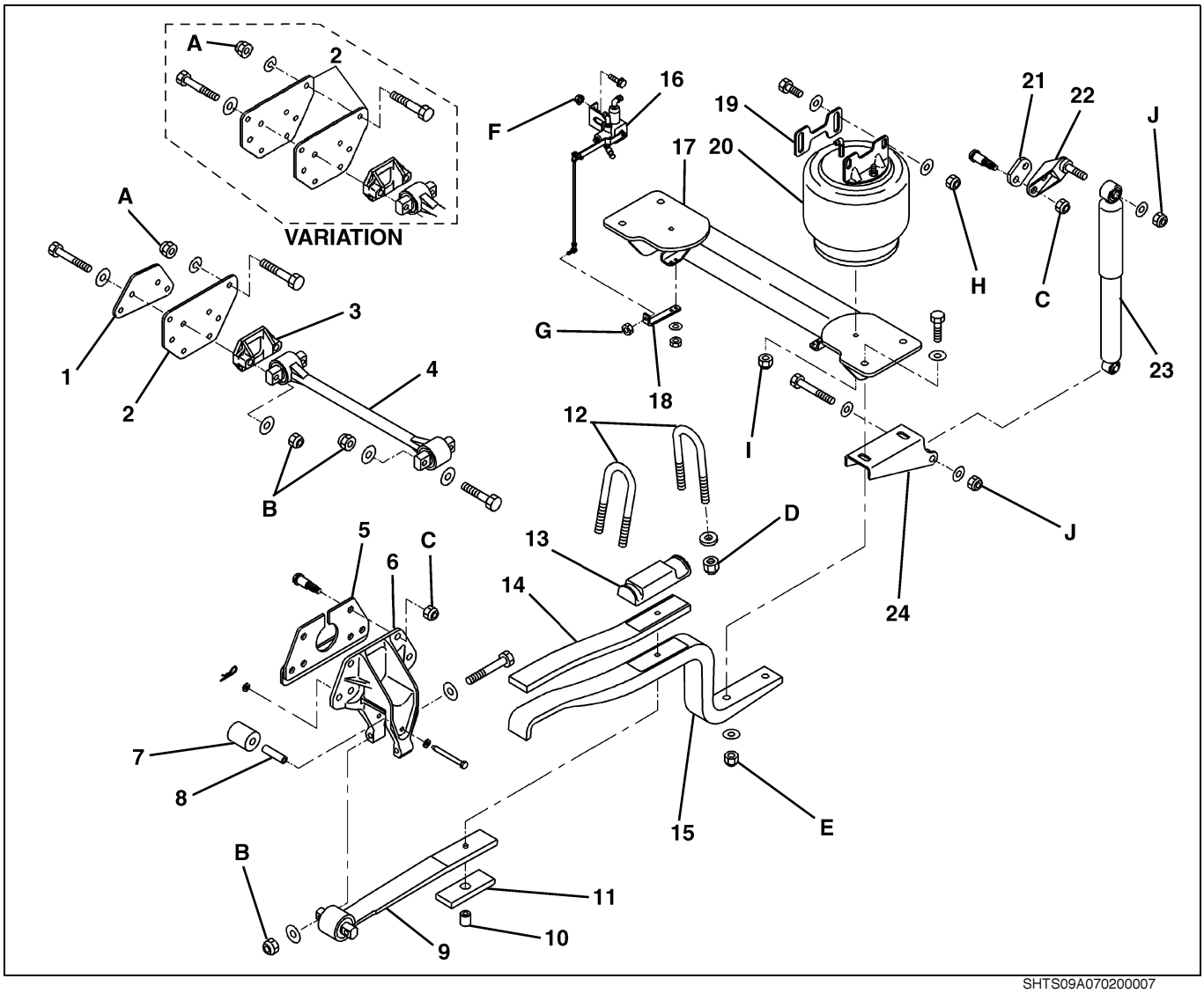
SHTS09A070200006

1	Spacer	13	Frame hanger
2	Plate	14	Rebound roller
3	Transverse rod bracket	15	Spacer tube
4	Transverse rod	16	Torque rod
5	Spacer	17	Spring seat
6	Air spring	18	Torque rod bracket
7	Cross channel	19	Spring pad
8	Spacer	20	U-bolt
9	Shock absorber upper bracket	21	Leaf spring
10	Shock absorber	22	Leveling valve
11	Shock absorber lower bracket	23	Lever
12	Back plate	24	Tension leaf

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	104-156 {1,061-1,590, 77-115}	F	27-41 {276-418, 20-30}
B	203-277 {2,070-2,824, 150-204}	G	352-434 {3,590-4,425, 260-319}
C	237-305 {2,417-3,110, 175-224}	H	460-520 {4,691-5,302, 340-383}
D	212-318 {2,162-3,242, 157-234}	I	11-17 {113-173, 9-12}
E	70-98 {714-999, 52-72}	J	41-61 {418-622, 31-44}

MODEL: SH



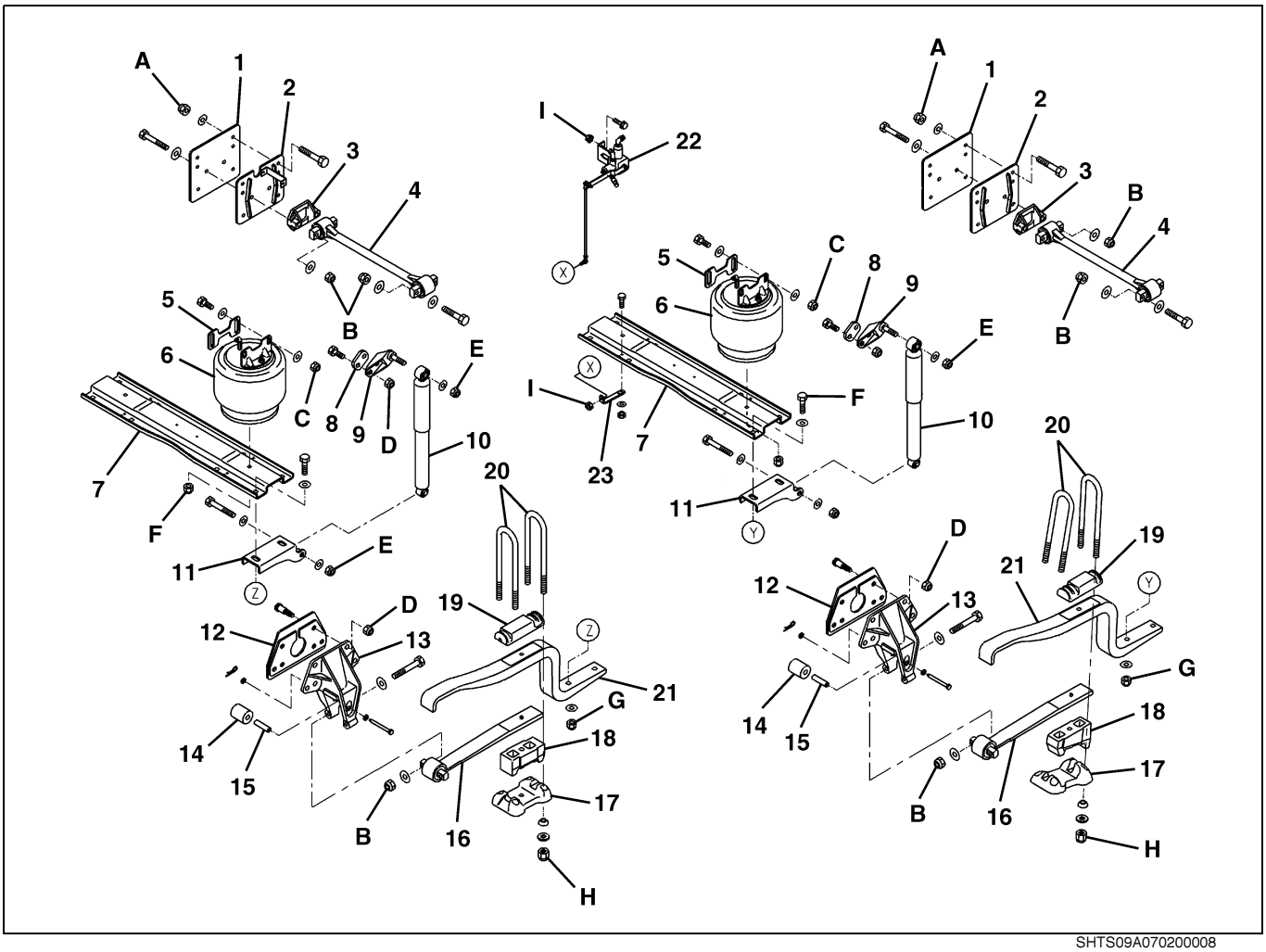
SHTS09A070200007

1	Spacer (If so equipped)	13	Spring pad
2	Plate	14	Leaf spring No. 2
3	Transverse rod bracket	15	Leaf spring No. 1
4	Transverse rod	16	Leveling valve
5	Back plate	17	Cross channel
6	Frame hanger	18	Lever
7	Rebound roller	19	Spacer
8	Spacer tube	20	Air spring
9	Tension leaf	21	Spacer
10	Dowel	22	Shock absorber upper bracket
11	Caster wedge	23	Shock absorber
12	U-bolt	24	Shock absorber lower bracket

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	160-240 {1,632-2,447, 117-176}	F	41-61 {418-622, 31-44}
B	203-277 {2,070-2,824, 150-204}	G	11-17 {113-173, 9-12}
C	212-318 {2,162-3,242, 157-234}	H	237-305 {2,417-3,110, 175-224}
D	460-520 {4,691-5,302, 340-383}	I	27-41 {276-418, 20-30}
E	352-434 {3,590-4,425, 260-319}	J	70-98 {714-999, 52-72}

MODEL: SS (FOR SOUTH AFRICA)



SHTS09A070200008

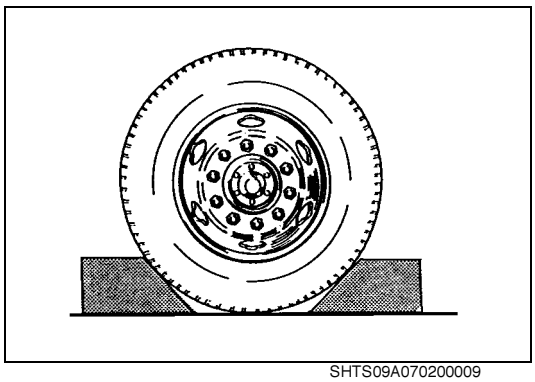
1	Spacer	13	Frame hanger
2	Plate	14	Rebound roller
3	Transverse rod bracket	15	Spacer tube
4	Transverse rod	16	Tension leaf
5	Spacer	17	Spring seat
6	Air spring	18	Caster wedge
7	Cross channel	19	Spring pad
8	Spacer	20	U-bolt
9	Shock absorber upper bracket	21	Leaf spring
10	Shock absorber	22	Leveling valve
11	Shock absorber lower bracket	23	Lever
12	Back plate		

Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	104-156 {1,061-1,590, 77-115}	F	27-41 {276-418, 20-30}
B	203-277 {2,070-2,824, 150-204}	G	352-434 {3,590-4,425, 260-319}
C	237-305 {2,417-3,110, 175-224}	H	460-520 {4,691-5,302, 340-383}
D	212-318 {2,162-3,242, 157-234}	I	11-17 {113-173, 9-12}
E	70-98 {714-999, 52-72}	J	41-61 {418-622, 31-44}

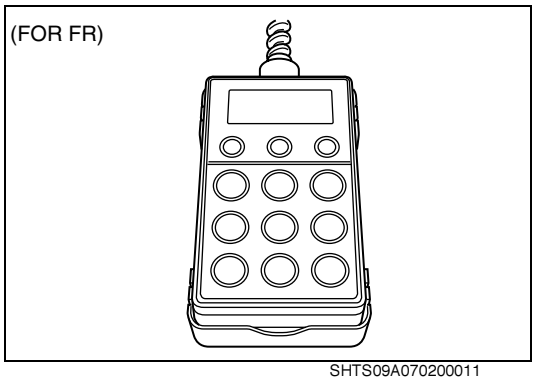
OVERHAUL

EN09A0702H200001


SHTS09A070200009

IMPORTANT POINTS - DISASSEMBLY

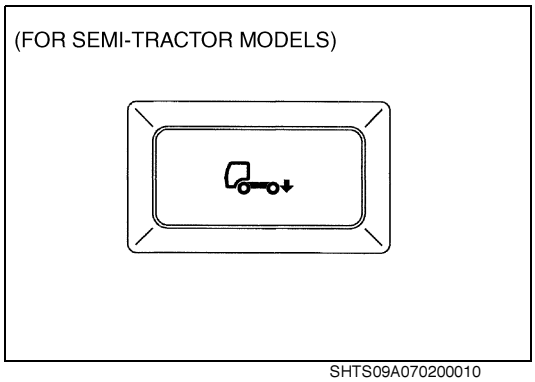
1. SUPPORT THE FRAME WITH THE STAND.
(1) Park the vehicle on level ground.
(2) Be sure to block the wheels before dismounting.



SHTS09A070200011

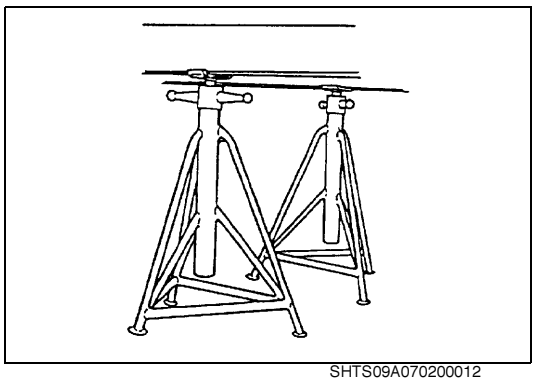
(3) Release air pressure from the air springs.

NOTICE
Before release air pressure, turn down vehicle height by the remote controller or the dump control switch. (Models: FR and semi-tractors)



SHTS09A070200010

(4) Turn the starter switch to "LOCK" position. (Model: FR)
(5) Jack up the axle, and support the frame with the stand.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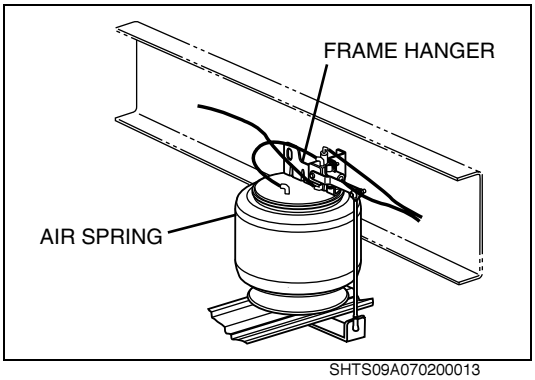
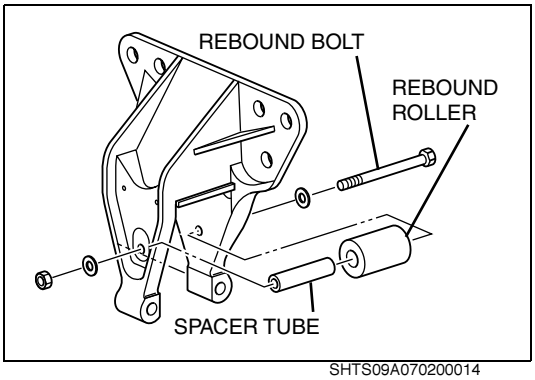


SHTS09A070200013

2. REMOVAL OF LEAF SPRINGS

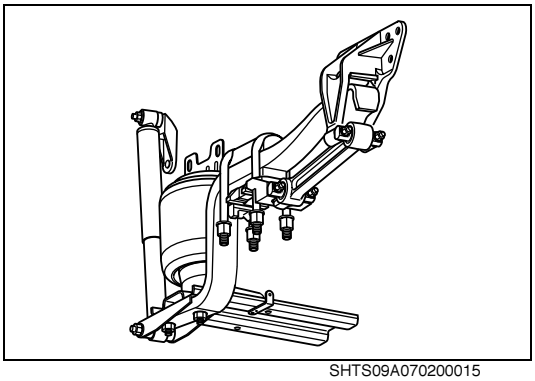
(1) Remove the leveling valve or height sensor link from the valve by removing the nut and the lock washer.



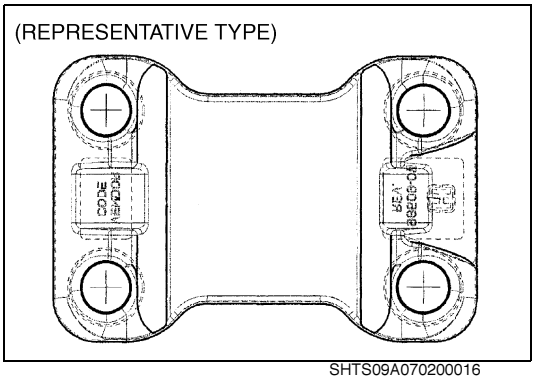
SHTS09A070200014

(2) Remove the rebound bolts, lock nuts, washers, spacer tube, and rebound roller from the frame hanger.

(3) Jack up the axle then support it to remove the load from leaf spring.


SHTS09A070200015

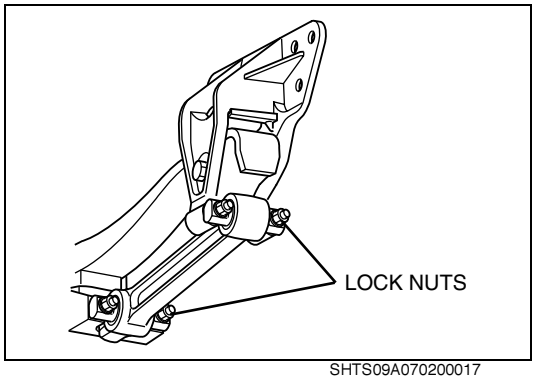
(4) Remove the U-bolt lock nuts and washers.
(5) Remove the U-bolts, bottom cap, and top pad.
(6) Remove both the lock nuts and washers which connect the cross channel to both the leaf springs.
(7) Lift cross channel off the leaf spring with jacks.
(8) Remove the leaf spring assembly.



SHTS09A070200016

3. REPLACEMENT OF THE SPRING SEAT

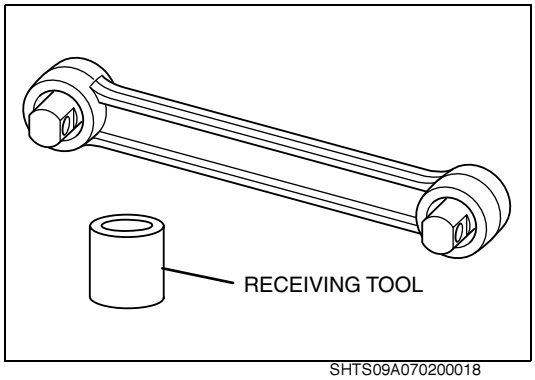
(1) Remove the spring seat.



SHTS09A070200017

4. REPLACEMENT OF THE TORQUE ROD (TENSION LEAF) BUSHINGS

(1) Remove the straddle mount bar pin lock nuts and washers at the axle end of the torque rod.
(2) Loosen the rebound bolt lock nut in the frame hanger.
(3) Remove the straddle mount bar pin lock nuts, bolts, and washers at the frame hanger ends of the torque rod.



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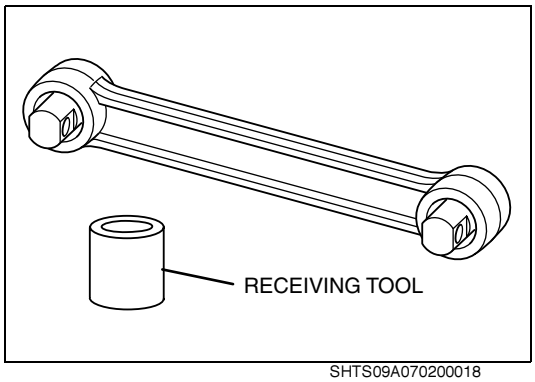
(4) Push out oil bushings. Use a vertical shock press with a capacity of at least 10 tons. Steel tube receiving tool is required. These bushings are not cartridge type bushings. They do not have outer metals. Support the torque rod end on receiving tool with the end tube of torque rod centered on tool. Push directly on the bushing straddle mount bar pin until the bushing clears the torque rod end tube.

⚠ WARNING
Be sure the torque rod is securely supported on the press bed for safety.
Do not use heat or cutting torch to remove the bushings from the torque rod. The use of heat will adversely affect a strength of the torque rod.

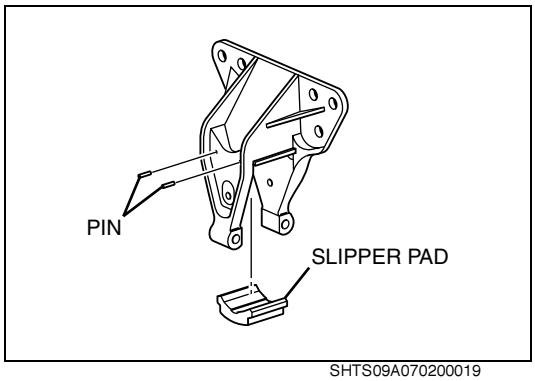


SHTS09A070200018

(5) Clean and inspect the torque rod ends, removing any nick with emery cloth.
(6) Lubricate the torque rod ends and the new rubber bushings with a vegetable base oil (cooking oil or lard). Do not use a petroleum or soap base lubricant.
(7) Press in new bushings. Support the torque rod end on receiving tool with end tube of torque rod centered on receiving tool. Straddle mount bar pin bushing must have mounting flats positioned zero degrees to shank of torque rod as shown in the figure. Press directly straddle mount bar pin of bushing. Bushing must be centered within torque rod end tubes. When pressing in new bushings, overshoot desired final position by approximately 3/16 and press bushing again from opposite side to center bushing within torque rod end.

5. REPLACEMENT OF THE FRAME HANGER SLIPPER PADS

(1) In most cases removal of the rebound roller and spacer may be required to disassemble the slipper pad. Remove the rebound bolt lock nut, washer bolt rebound roller and spacer.
(2) Procure the slipper pad locally from Hendrickson's Agent.



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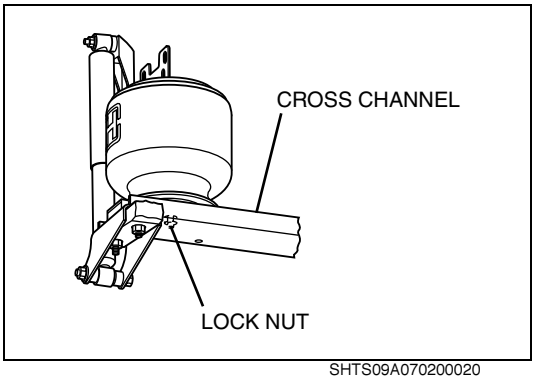
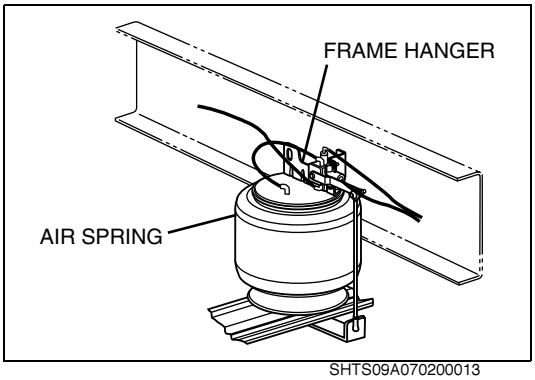


SHTS09A070200020

6. REMOVAL OF CROSS CHANNEL

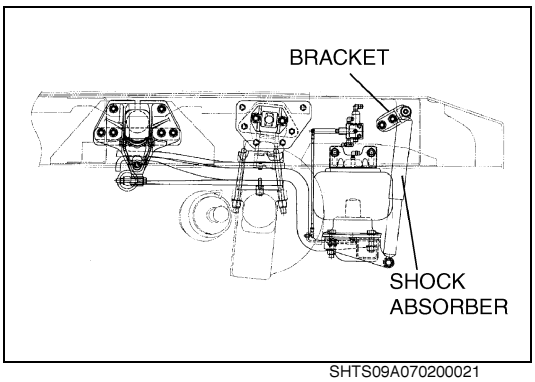
(1) Remove the lock nuts and washers which connect the air spring to cross channel.
(2) Raise the cross channel by using jack if required.



SHTS09A070200013

7. REMOVAL OF AIR SPRING

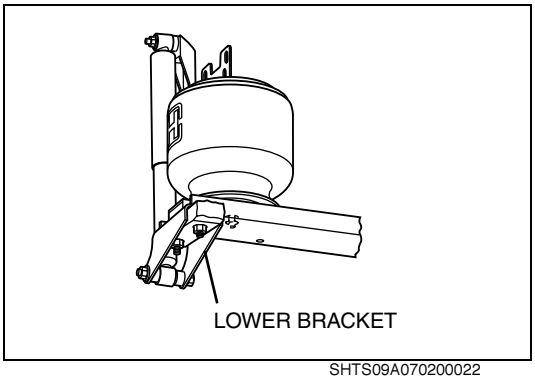
(1) Remove the air line to the air spring seat.
(2) Remove the brass air fittings from the air spring.
(3) Remove the lock nuts and washers which connect the air spring to the upper air spring frame hanger.
(4) Remove the air spring.
(5) Remove the air spring frame hanger.



SHTS09A070200021

8. REMOVAL OF SHOCK ABSORBER UPPER BRACKET

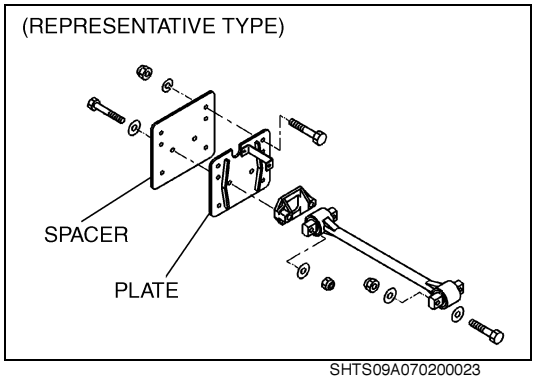
(1) Remove the lock nuts and washers at both ends of the shock absorber.
(2) Remove the shock absorber completely from the chassis.
(3) Remove the lock nuts and washers which connect the shock absorber upper bracket to the frame.
(4) Remove the shock absorber upper bracket.



SHTS09A070200022

9. REMOVAL OF SHOCK ABSORBER LOWER BRACKET

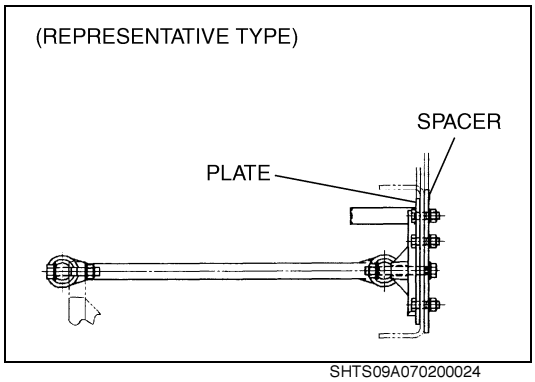
(1) Remove the shock absorber completely from the chassis.
(2) Remove the lock nuts and washers which connect the cross channel to the leaf spring.
(3) Remove the shock absorber lower bracket by sliding the bracket to rear.



SHTS09A070200023

10. REMOVAL OF TRANSVERSE ROD

(1) Remove the lock nuts and washers which connect the transverse rod to the frame.
(2) Remove the lock nuts and washers which connect to the axle bracket.
(3) Use Owatonna Tool Company's tool set to remove and install the transverse rod bushings. Follow their instructions.

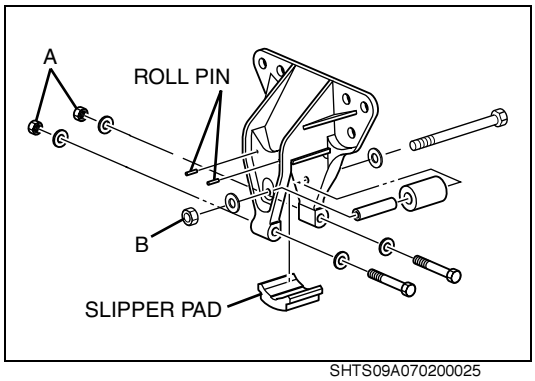


SHTS09A070200024

IMPORTANT POINTS - ASSEMBLY

1. INSTALLATION OF TRANSVERSE ROD

(1) Assemble the washer and lock nut to the bolt. Tighten the lock nut to specified torque.
(2) Install the spacer and plate.
Thickness: 8 mm {0.315 in.}
(3) Position the straddle mount end of torque rod at the transverse rod to the frame, tighten the lock nuts to specified torque.



SHTS09A070200025

2. INSTALLATION OF FRAME HANGER

(1) Install new slipper pad.
(2) Raise the main support member to secure slipper pad in place.
(3) Drive new roll pin in place with punch until flush with the front of frame hanger.
(4) Tighten fasteners to specified torque.

3. CHECK THE AIR LEAKAGE.

(1) Apply soapy water for each joint of air line and charge the compressed air of 780 kPa {8.0 kgf/cm^2, 113 lbf/in.^{2}} then check the leakage.

4. ADJUSTMENT OF THE VEHICLE HEIGHT

NOTICE

- **Adjustment should be done only after assembling.**
- **Adjustment should be done with the air pressure of 687-833 kPa {7.0-8.5 kgf/cm^2, 100-120 lbf/in.^{2}}, keeping on supplying the air while rotating the engine at the idle speed.**

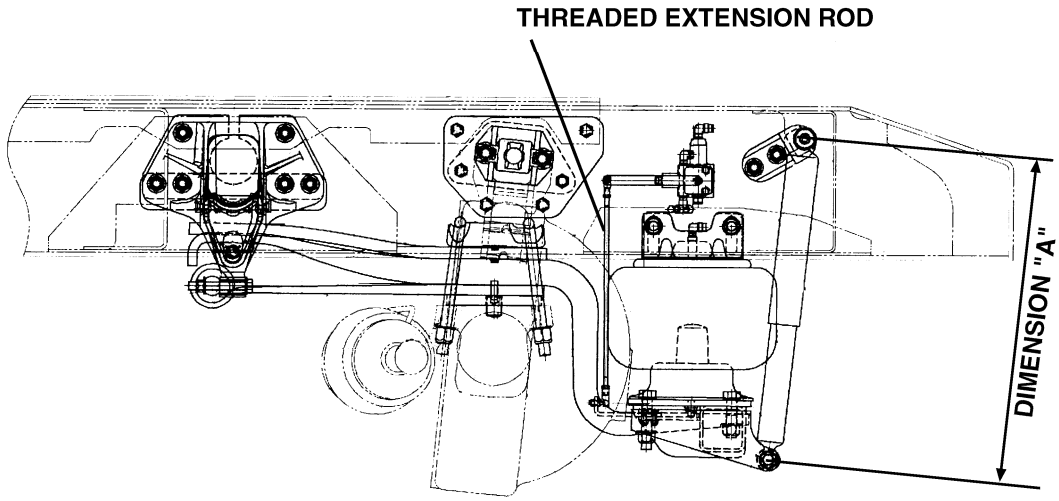
(1) Measure the shock absorber length between upper and lower pins.

Assembly standard: Unit: mm {in.}

Model	Dimension "A"
FR	**642-688 {25.28-27.08}**
FS, FY	**582-628 {22.92-24.72}**
SH	**611-657 {24.06-25.86}**
SS (For Australia, Chile)	**584-630 {23.00-24.80}**
SS (For South Africa)	**592-638 {23.31-25.11}**

(2) If the shock absorber length is not the assembly standard, adjust the extension rod length, so that the shock absorber length is the assembly standard.

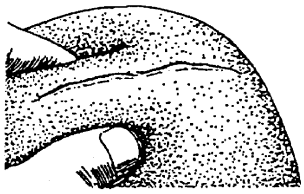
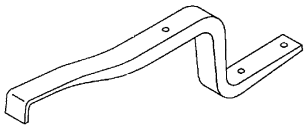
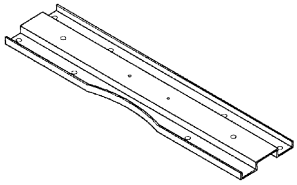
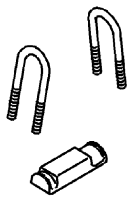
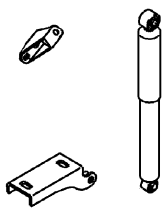
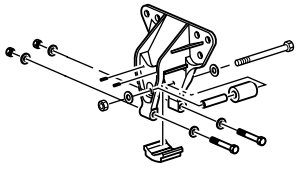
(REPRESENTATIVE TYPE)

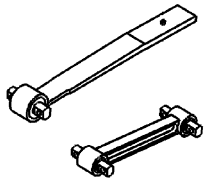
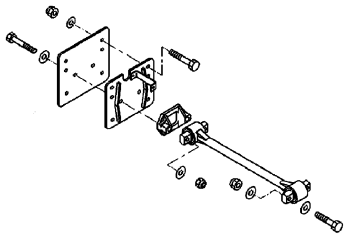


SHTS09A070200026

INSPECTION AND REPAIR

EN09A0702H300001

Inspection item	Standard	Limit	Remedy	Inspection procedure
Air spring: Wear, damage and crack	—	—	**Replace, if necessary.**	**Visual check** 
Leaf spring: Crack and damage	—	—	**Replace, if necessary.**	**Visual check** 
Cross channel: Crack and damage	—	—	**Replace, if necessary.**	**Visual check** 
Spring seat: Wear, damage and crack	—	—	**Replace, if necessary.**	**Visual check** 
U-Bolt: Damage	—	—	**Replace, if necessary.**	**Visual check** 
Pad: Wear, damage and crack	—	—		
Shock absorber: Operation, oil leak and damage	—	—	**Replace, if necessary.**	**Visual check** 
Upper and lower brackets: Crack and damage	—	—		
Rebound roller: Wear, damage and crack	—	—	**Replace, if necessary.**	**Visual check** 
Slipper pad: Wear, damage and crack	—	—		

Inspection item	Standard	Limit	Remedy	Inspection procedure
Torque rod (Tension leaf): Crack and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Torque rod (Tension leaf) bushings: Wear, damage and crack	**—**	**—**		
Transverse rod: Crack and damage	**—**	**—**	**Replace, if necessary.**	**Visual check** 
Transverse rod bushings: Wear, damage and crack	**—**	**—**		
Spacer: Crack and damage	**—**	**—**		
Plate: Crack and damage	**—**	**—**		

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