FOREWORD2.fm 1 ページ ２０１１年１１月１日 火曜日 午前１１時１６分

FOREWORD

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

Applicable for HINO 238, 258LP, 268, 338 series, equipped with J08E-VB and J08E-VC engine

When making any repairs on your vehicle, be careful not to be injured through improper procedures.
As for maintenance items, refer to the Driver's / 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 Sales U.S.A., Inc. reserves the right to make changes at any time without prior notice.

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

Manual Name	Pub. No.
Chassis Workshop Manual	S1-UNAE09A 1/2
J08E-VB, VC Engine Workshop Manual	S5-UJ08E09A
Trouble Shooting Workshop Manual	S7-UNAE09A 1/3 S7-UNAE09A 2/3 S7-UNAE09A 3/3

Hino Motors Sales U.S.A. , Inc.

S1-UNAE09A-2.book 2 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

CHAPTER REFERENCES REGARDING THIS WORKSHOP MANUAL

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

CHAPTER				
	MANUAL NO.	S1-UNAE09A 2/2 (U.S.A.), S1-CNAE09A 2/2 (CANADA)		
	MODELS	HINO 238, 258LP, 268, 338, 358		
	Production Model Code	NE8J, NF8J, NJ8J, NV8J		
GENERAL INTRODUCTION		GN02-001		
CLUTCH MAIN UNIT		CL02-001	CL02-002	CL02-003
CLUTCH CONTROL		CL03-001		
TRANSMISSION MAIN UNIT		TR02-001	TR02-002	
AUTOMATIC TRANSMISSION		TR04-001	TR04-002	
TRANSMISSION/TRANSFER CONTROL		TR06-001	TR06-002	TR06-003
PROPELLER SHAFT		PP02-001		
DIFFERENTIAL CARRIER		DF02-001		
BRAKE EQUIPMENT		BR01-001	BR01-002	
SERVICE BRAKE		BR02-001	BR02-002	
ABS (ANTI-LOCK BRAKE SYSTEM)		BR03-001	BR03-002	
EXHAUST BRAKE		BR05-001		
PARKING BRAKE		BR07-001		
STEERING EQUIPMENT		SR01-001		
STEERING UNIT		SR02-001		
POWER STEERING		SR03-001		
FRONT AXLE		AX02-001		
REAR AXLE		AX03-001		
WHEEL & TIRE		AX04-001		
SUSPENSION		SU02-001		
CHASSIS FRAME		FC02-001		
CAB		CA02-001		
ELECTRICAL EQUIPMENT		EL01-001		
ELECTRIC WIRE		EL02-001		
BRAKE CONTROL		DN03-001	DN03-002	

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

INDEX2-1.fm 1 ページ ２０１１年１１月２２日 火曜日 午前１０時１３分

HINO

WORKSHOP MANUAL

INDEX: CHASSIS GROUP 1/4

GENERAL INTRODUCTION	
CLUTCH EQUIPMENT	
CLUTCH MAIN UNIT	
CLUTCH CONTROL	
TRANSMISSION EQUIPMENT	
TRANSMISSION MAIN UNIT	
TRANSFER MAIN UNIT	
AUTOMATIC TRANSMISSION	
P.T.O. (POWER TAKE-OFF)	
TRANSMISSION / TRANSFER CONTROL	
PROPELLER SHAFT EQUIPMENT	
PROPELLER SHAFT	
DIFFERENTIAL EQUIPMENT	
DIFFERENTIAL CARRIER	
BRAKE EQUIPMENT	
SERVICE BRAKE	
ABS	

S1-UNAE09A-2.book 3 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

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ES START (EASY & SMOOTH START) SYSTEM	
EXHAUST BRAKE	
RETARDER BRAKE	
PARKING BRAKE	
STEERING EQUIPMENT	
STEERING UNIT	
POWER STEERING	
AXLE EQUIPMENT	
FRONT AXLE	
REAR AXLE	
WHEEL & TIRE	
SUSPENSION EQUIPMENT	
SUSPENSION	
CHASSIS EQUIPMENT	
CHASSIS FRAME	
COUPLER (5TH WHEEL)	
PINTLE HOOK	

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CAB EQUIPMENT	
CAB	
ELECTRICAL EQUIPMENT	
ELECTRIC WIRE	
HYBRID SYSTEM	

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INDEX: CHASSIS GROUP 4/4

ENGINE CONTROL	
FUEL CONTROL	
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SUSPENSION CONTROL	
CAB EQUIPMENT CONTROL	
OTHERS	

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STEERING EQUIPMENT

SR01-001

STEERING SYSTEM.....SR01-2
TROUBLESHOOTING..... SR01-2

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STEERING SYSTEM

TROUBLESHOOTING

EN07Z0701F300001

Symptom	Possible cause	Remedy/Prevention
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.

Symptom	Trouble shooting and repair
Hard steering or poor return of steering wheel to center	**Reference: STEERING EQUIPMENT, STEERING SYSTEM, TROUBLESHOOTING, STEERING IS HEAVY (Page SR01-3)**
	Reference: STEERING EQUIPMENT, STEERING SYSTEM, TROUBLESHOOTING, STEERING RETURN IS RELUCTANT (Page SR01-4)
	Reference: STEERING EQUIPMENT, STEERING SYSTEM, TROUBLESHOOTING, OIL LEAKAGE (Page SR01-5)
Abnormal noise	**Reference: STEERING EQUIPMENT, STEERING SYSTEM, TROUBLESHOOTING, ABNORMAL NOISE (Page SR01-6)**

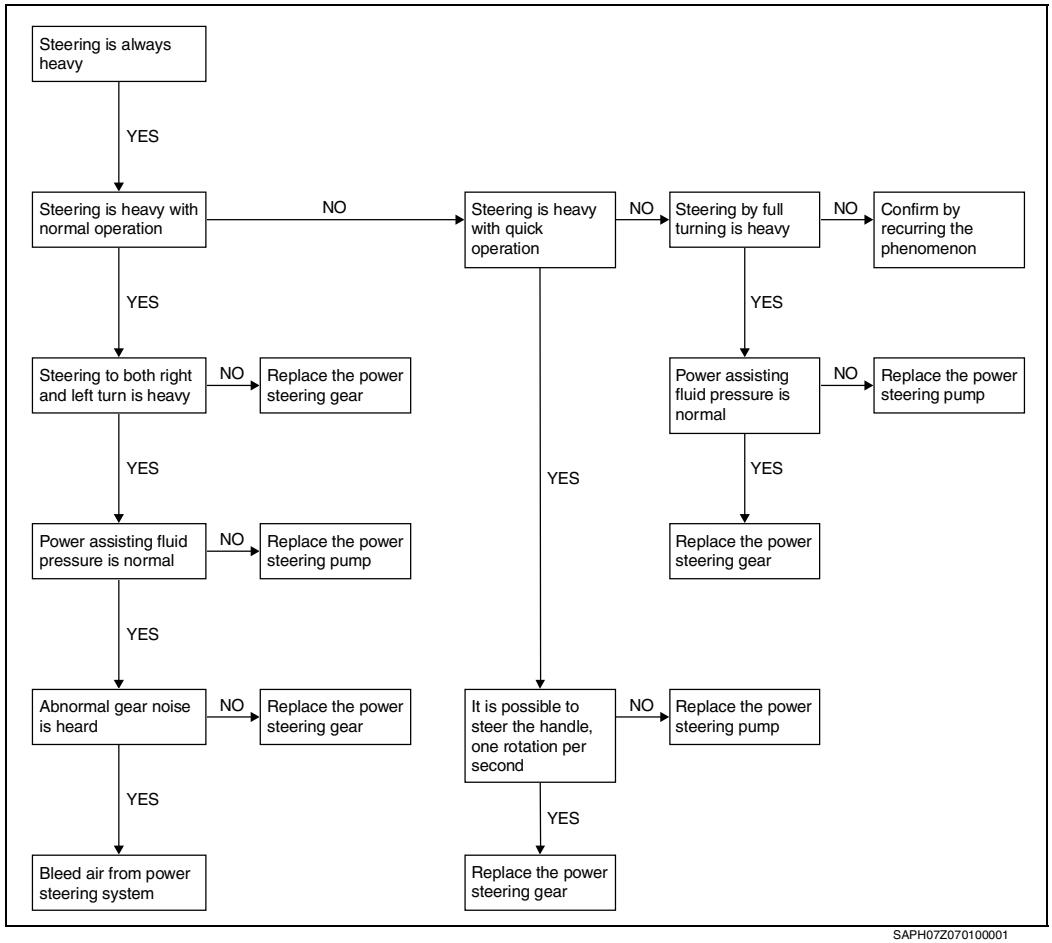
SR01_001.fm 3 ページ ２０１１年１０月３１日 月曜日 午前１０時５７分

STEERING IS HEAVY

1. CHECK AND CONFIRM THE FOLLOWING POINTS AND TAKE COUNTERMEASURE.

(1) Check the front tire pressure, and supply compressed air with the specified pressure if insufficient.
(2) Check the tire for abnormal wear and improper groove depth, if any problem found, replace the tire.
(3) Measure the front axle loading, if it exceeds the specified value, correct or empty the cargo.
(4) If frontward cargo causes the excessive front axle loading, correct it by reviewing the weight balance.
(5) If superstructure causes the excessive front axle loading, refurbish the superstructure to reduce loading.
(6) Check the power steering fluid level and replenish if insufficient.

In spite of the above check and countermeasure taken, if the troubles still remain, pursue the true cause with the following procedures, and repair the troubles.



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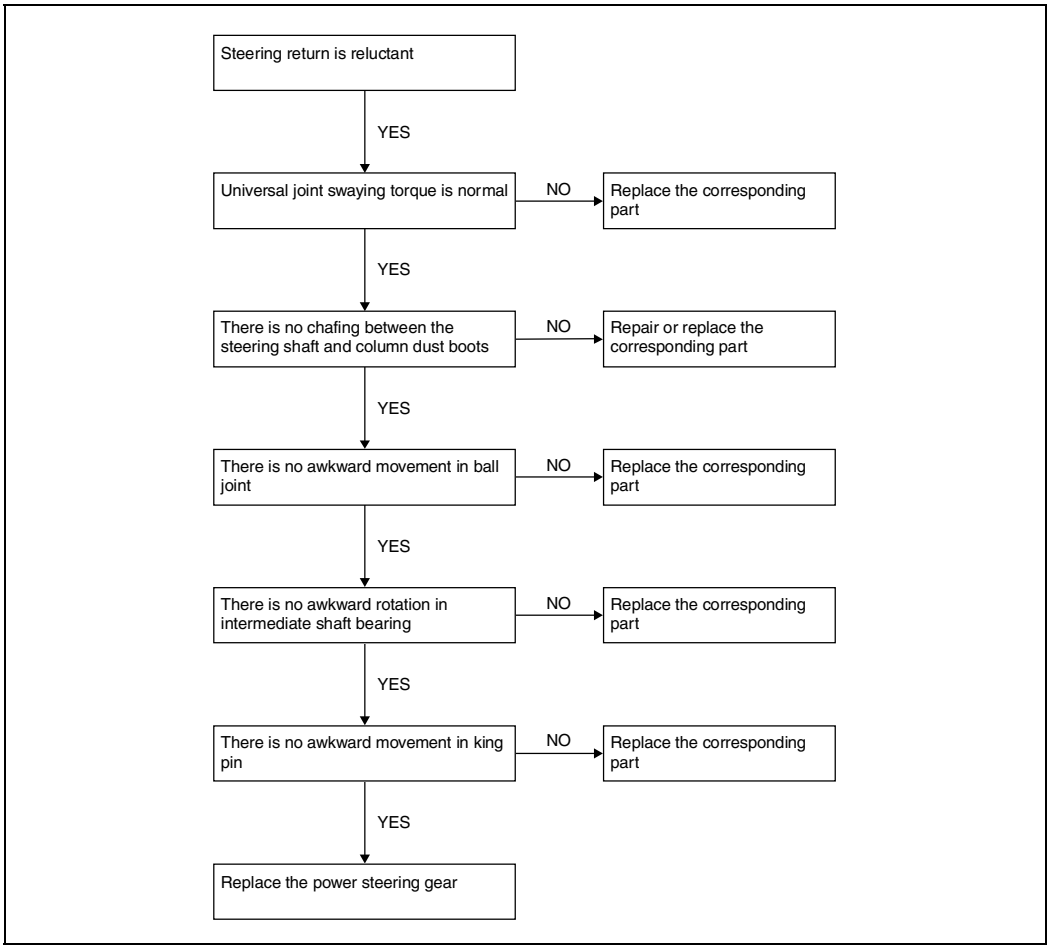
SR01_001.fm 4 ページ ２０１１年１０月３１日 月曜日 午前１０時５７分

STEERING RETURN IS RELUCTANT

1. CHECK AND CONFIRM THE FOLLOWING POINTS AND TAKE COUNTERMEASURE.

(1) Check the front tire pressure, and supply compressed air with the specified pressure if insufficient.
(2) Check the tire for abnormal wear and improper groove depth, if any problem found, replace the tire.
(3) Measure the front axle loading, if it exceeds the specified value, correct or empty the cargo.
(4) If frontward cargo causes the excessive front axle loading, correct it by reviewing the weight balance.
(5) If superstructure causes the excessive front axle loading, refurbish the superstructure to reduce loading.
(6) Check the power steering fluid level and replenish if insufficient.

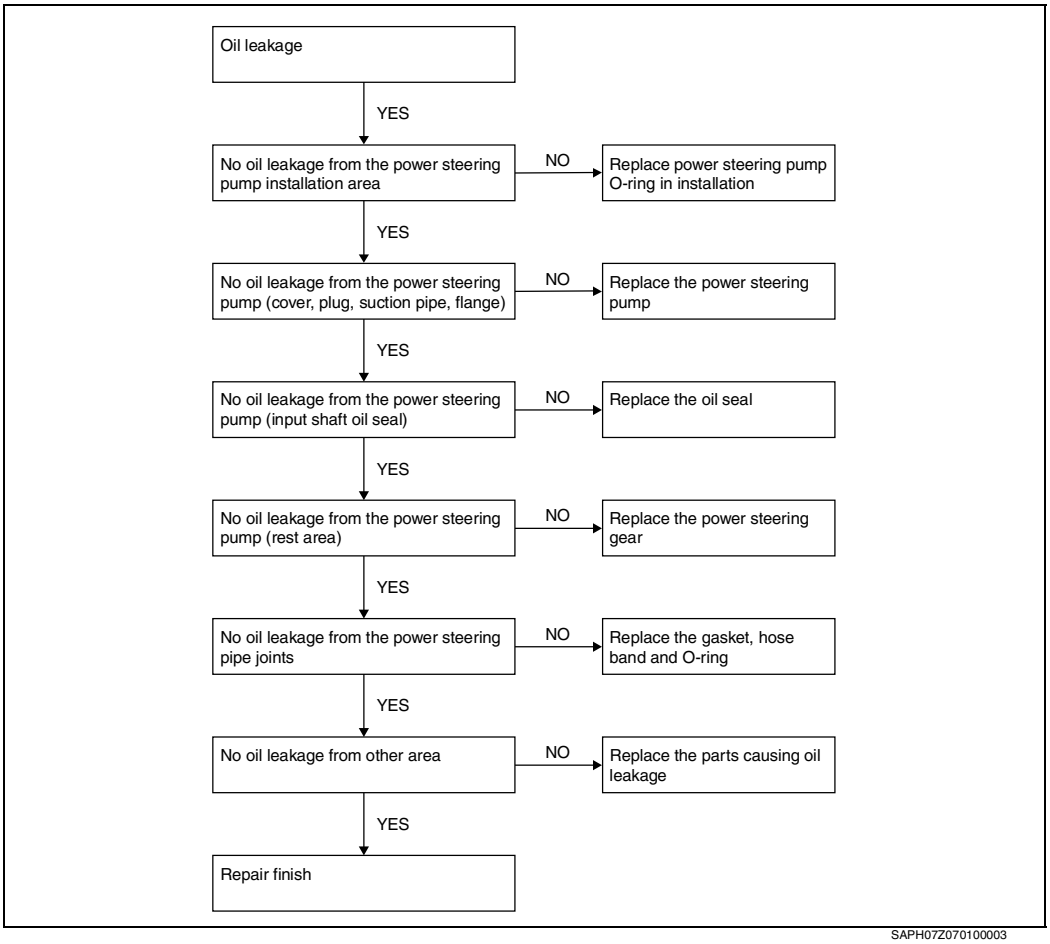
In spite of the above check and countermeasure taken, if the troubles still remain, pursue the true cause with the following procedures, and repair the troubles.



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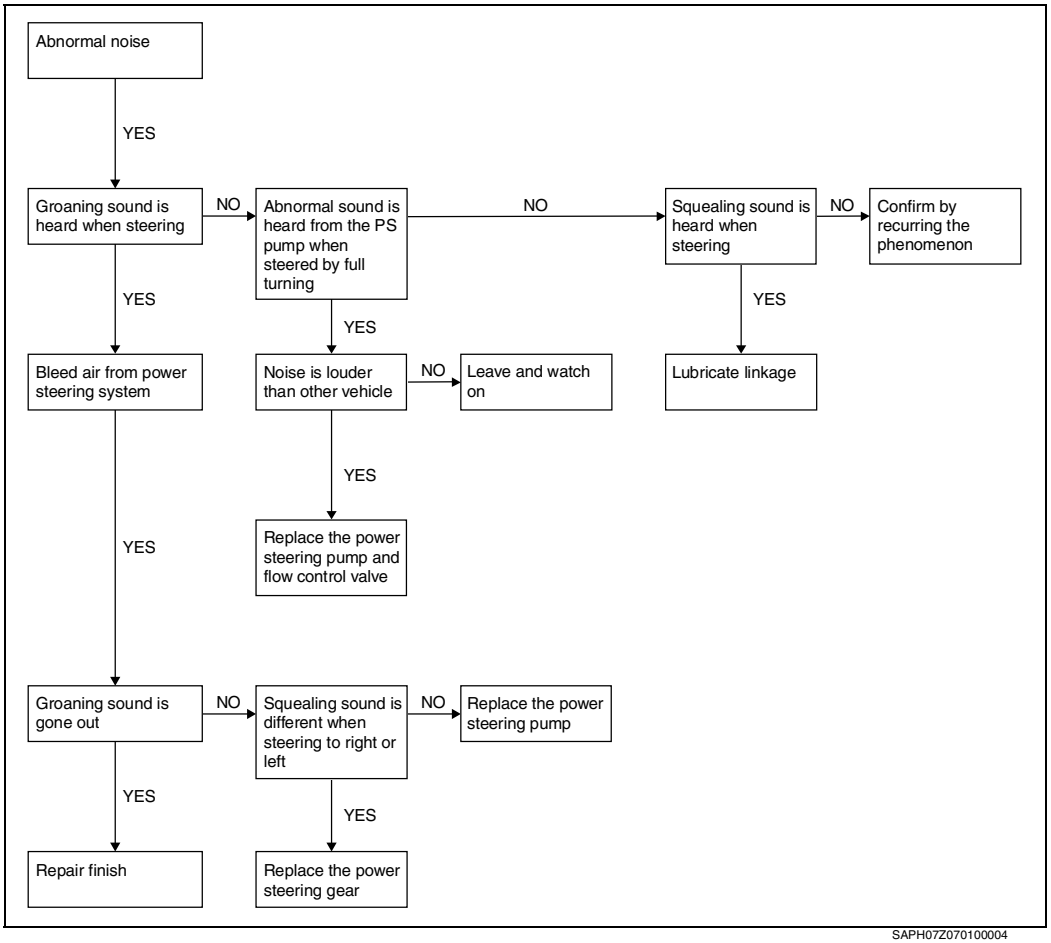
OIL LEAKAGE



SAPH07Z070100003

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ABNORMAL NOISE



SAPH07Z070100004

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STEERING UNIT

SR02-001

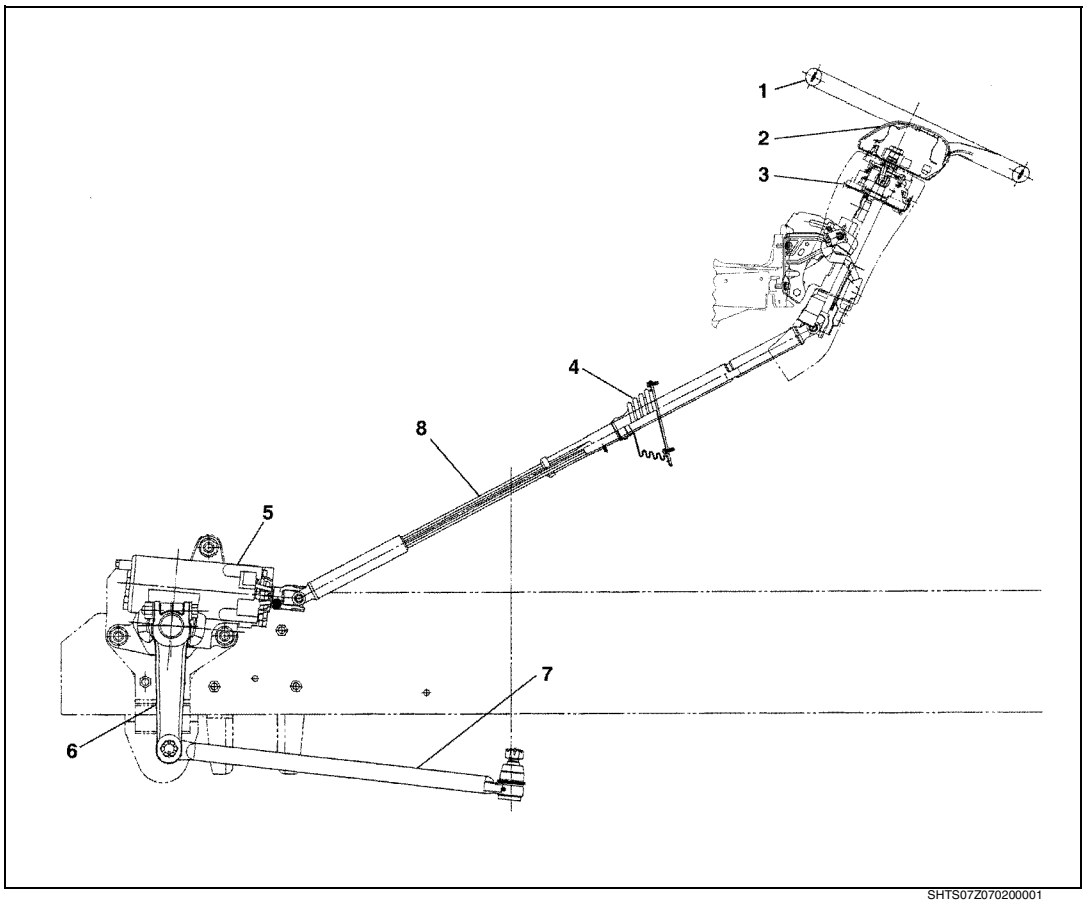
STEERING LINKAGE SR02-2
DESCRIPTION SR02-2
COMPONENT LOCATOR SR02-3
SPECIAL TOOL SR02-4
OVERHAUL SR02-4
INSPECTION AND REPAIR SR02-9

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STEERING LINKAGE

DESCRIPTION

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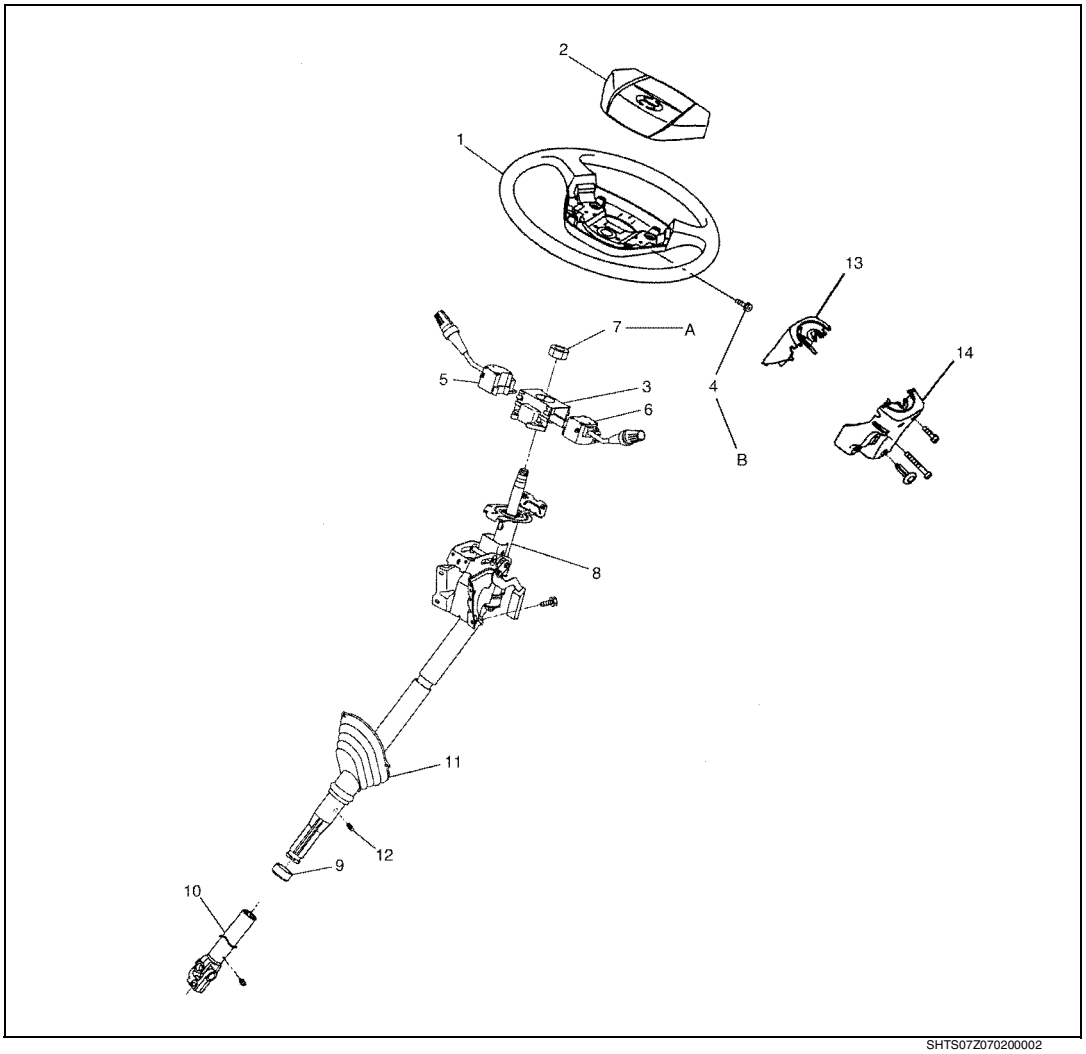
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1	Steering wheel	5	Steering gear unit
2	Horn button	6	Pitman arm
3	Steering column assembly	7	Drag link
4	Dust cover	8	Steering shaft joint assembly

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COMPONENT LOCATOR

EN07Z0702D100001



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1	Steering wheel	8	Steering column assembly
2	Horn button	9	Dust seal
3	Combination switch body	10	Steering shaft joint assembly
4	Torx bolt	11	Dust cover
5	Windshield wiper switch	12	Lubrication fitting
6	Light control switch	13	Column upper cover
7	Nut	14	Column lower cover

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

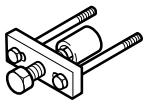
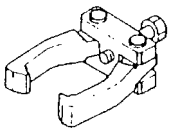
A	48.5-77.5 {500-800, 37-57}	B	6.5-13.5 {67-137, 4.8-9.9}

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SPECIAL TOOL

EN07Z0702K100001

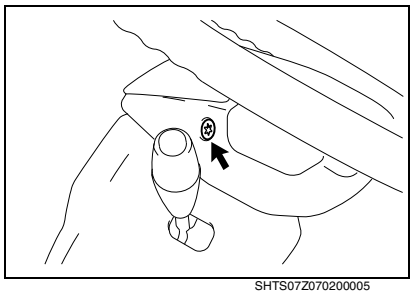
Prior to starting a steering linkage overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	S0965-01341	STEERING WHEEL PULLER	
	S0965-01260	PITMAN ARM PULLER	

OVERHAUL

EN07Z0702H200001

IMPORTANT POINTS - DISASSEMBLY

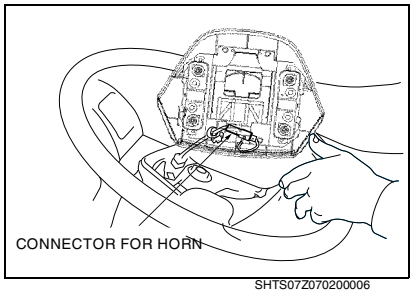


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1. REMOVE THE STEERING WHEEL.

(1) Loosen the torx bolt for fixing the horn button using torx wrench.

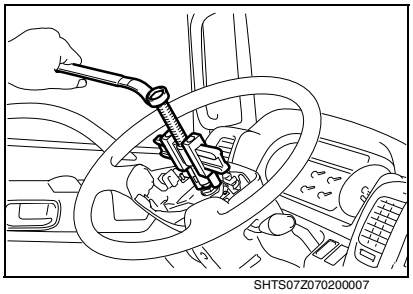
(2) Remove the horn button from the steering wheel.



SHTS07Z070200006

(3) Remove the connector for the horn.

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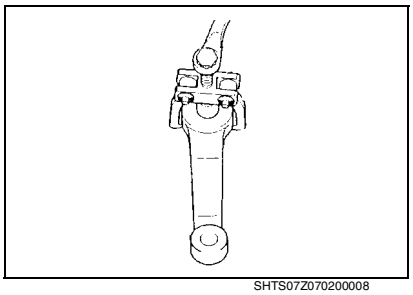

SHTS07Z070200007

(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 (S0965-01341)

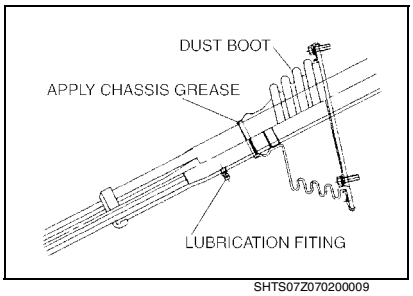
NOTICE

- **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.


SHTS07Z070200008

2. REMOVE THE PITMAN ARM.
(1) Remove the nut and pinch bolt from the pitman arm.
(2) Using the special tool, remove the pitman arm from the sector shaft.
SST: Pitman Arm Puller (S0965-01260)



SHTS07Z070200009

IMPORTANT POINTS - ASSEMBLY

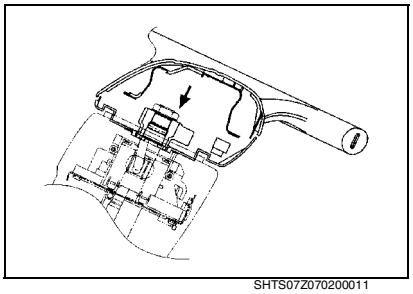
1. ASSEMBLE THE STEERING SHAFT.

2. INSTALL THE DUST BOOT.

3. ASSEMBLE THE STEERING SHAFT.
(1) Before assembling, apply chassis grease to the spline of the sliding yoke, and after assembling also fill grease through lubrication fitting.

When replacing parts: 115g (4.0 oz)
When replenishing parts: 14 g (0.5 oz)

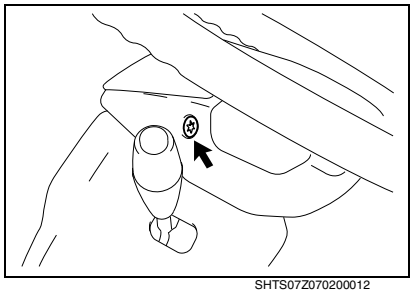
NOTICE
When assembling, take care not to damage the steering shaft spline. Apply chassis grease to the boundary of the dust boot and steering shaft.


SHTS07Z070200011

4. INSTALL THE STEERING WHEEL.
(1) Set front axles toward rectilinear direction.
(2) Set the steering wheel straight to install it with nut.

Tightening Torque:
48.5-77.5 N·m {500-800 kgf·cm, 37-57 lbf·ft}

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SHTS07Z070200012

(3) 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 {67-137 kgf·cm, 4.8-9.9 lbf·ft}

5. IF NECESSARY, REPLACE THE DRAG LINK DUST SEAL.


SHTS07Z070200013

(1) Press or tap on the flanged foot portion of the seal to remove it from the socket assembly. If you use a screwdriver to loosen the seal, be careful not to damage the sealing face of the socket forging.


SHTS07Z070200014

(2) Wipe off all grease and foreign material from around the ball stud and socket throat. Do not use any type of cleanser to remove the grease.


SHTS07Z070200015

(3) Using **#2 NLGI extreme pressure, lithium-based, moly-filled, heavy duty grease**, grease the socket throat and stud ball. Then fill the new boot seal 3/4 full with the same grease.

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SHTS07Z070200016

(4) Position the socket assembly in a large vise, or on a press so that the ball stud is perpendicular to the socket stem.

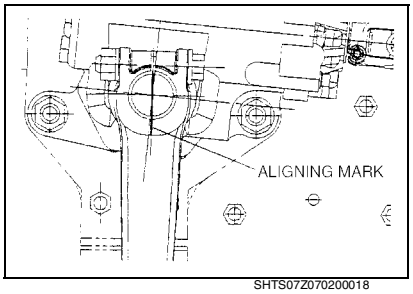

SHTS07Z070200017

(5) Press on the new boot seal using the tool described on below. The seal is in place when the flanged portion is seated on the machined section (sealing face) of the socket forging.

TOOL REQUIRED: A section of tubing with the inside diameter as close to the outside diameter of the boot seal (middle section) as possible.

The inside corner of the tube should be radiused (rounded) or chamfered (angled) so it will not cut the rubber during the press-on operation.

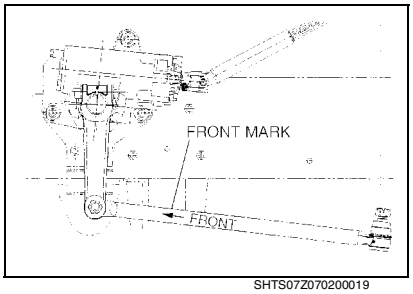
⚠ CAUTION
DO NOT over-press the seal; over-pressing could cause it to deform and seal improperly. DO NOT use a screwdriver, chisel, punch, etc. on the flanged foot of the seal for installation.



SHTS07Z070200018

6. INSTALL THE PITMAN ARM.
(1) Align the marks on the pitman arm and sector shaft.
(2) Spread open the split end of the arm. Push the arm.
(3) Install the pinch bolt and nut. Tighten the nut specified torque.
Tightening Torque:
367-423 N·m {3,743-4,313 kgf·cm, 271-311 lbf·ft}

NOTICE
In case of reusing bolt or nut, apply oil to the nut contact surface and thread.



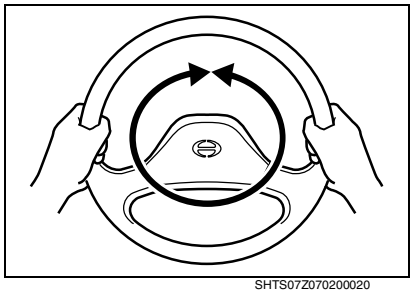
SHTS07Z070200019

7. INSTALL THE DRAG LINK.
(1) Connect the drag link with the pitman arm and with the knuckle arm.
NOTICE
- **At this time, make sure that the arrow "FRONT" or numeral on the drag link is positioned toward the front of vehicle.**
- **When handling the drag link, take care not to damage the dust seal.**

(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.
Tightening Torque:
136-170 N·m {1,388-1,735 kgf·cm, 100-125 lbf·ft}

NOTICE
When aligning the castle nut cut parts with the cotter pin fitting hole, make it by turning the nut to torque in the increasing direction. Don't turn in the decreasing direction.

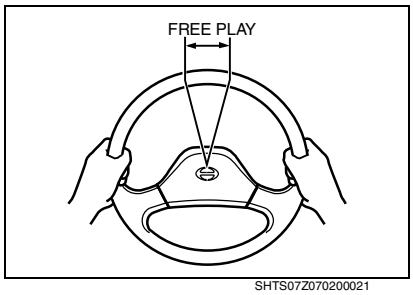
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SHTS07Z070200020

8. 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.

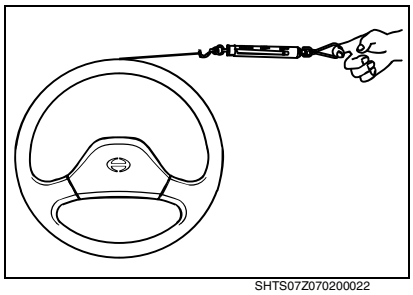


SHTS07Z070200021

(3) Check the steering wheel free play while engine is idling.
Wheel Free Play: 0-35 mm {0-1.377 in.}

(4) If wheel free play exceeds 0-35 mm {0-1.377 in.}, turn the set screw clockwise to decrease wheel free play and counterclockwise to increase it.

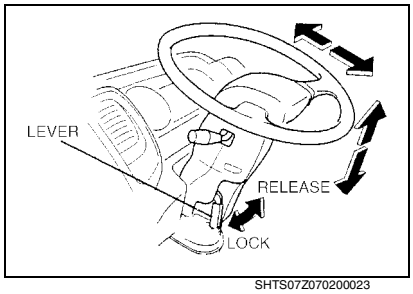
⚠ WARNING
Excessive steering wheel free play may adversely affect vehicle handling. This can result in personal injury and/or property damage.


SHTS07Z070200022

(5) 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:20 N {2.0 kgf, 4.4 lbf}



SHTS07Z070200023

(6) 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.

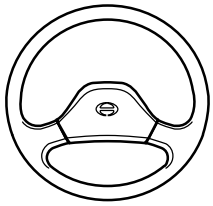
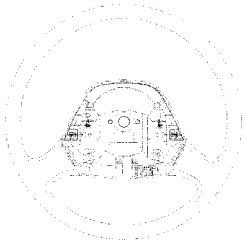
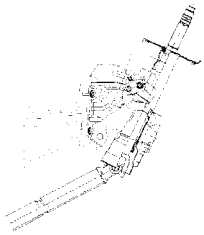
(7) Check to see that the combination switch is operating properly.

S1-UNAE09A-2.book 9 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

INSPECTION AND REPAIR

EN07Z0702H300001

Unit: mm {in.}

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	—	—	**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.**	**Visual check** 
Pitman arm internal splines for: • **severe wear, corrosion and fretting** • **twisted splines** • **missing splines**	—	—	**Replace, if necessary**	**Visual check** 

S1-UNAE09A-2.book 10 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

⚠ WARNING
If twisted or missing splines are found, be sure to inspect all internal steering gear components carefully for signs of impact damage. Follow the procedure in the chapter power steering gear unit.

S1-UNAE09A-2.book 1 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

POWER STEERING

SR03-001

POWER STEERING GEAR UNIT SR03-2
DATA AND SPECIFICATIONS SR03-2
DESCRIPTION SR03-3
OPERATION SR03-4
COMPONENT LOCATOR SR03-6
TORQUE CHART SR03-8
HAZARD WARNING DEFINITIONS SR03-8
DISCLAIMER SR03-9
PATENTS SR03-9
MAINTENANCE TIPS SR03-9
ON-VEHICLE SERVICE SR03-11
RESEAL & REPAIR SR03-21

POWER STEERING PUMP SR03-55
DATA AND SPECIFICATIONS SR03-55
DESCRIPTION SR03-55
OPERATION SR03-56
COMPONENT LOCATOR SR03-57
OVERHAUL SR03-59
INSPECTION AND REPAIR SR03-65

S1-UNAE09A-2.book 2 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

POWER STEERING GEAR UNIT

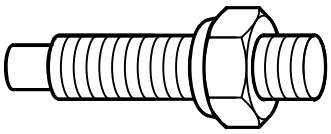
DATA AND SPECIFICATIONS

EN07Z0703I200001

Vehicle model	**HINO 238, 258, 268, 338, 358 (NE8J, NJ8J, NF8J, NV8J)**
Manufacture	**TRW Automotive**
Power steering gear unit model	**TAS65**
Type	**Integral hydraulic power steering gears**
Gear ratio	**20.4**

NOTICE

- **Poppet valve adjustment is needed when the following occurs.**
  (1) Reducing the turning angle.
  (2) Reducing the toe in.
- **Readjustment**
  Refer to [Poppet Readjustment-Single Gears] part on page SR03-17 and the following parts are needed.
  Poppet adjusting screw and lock nut assembly.
  TRW CSS part number 021407X1

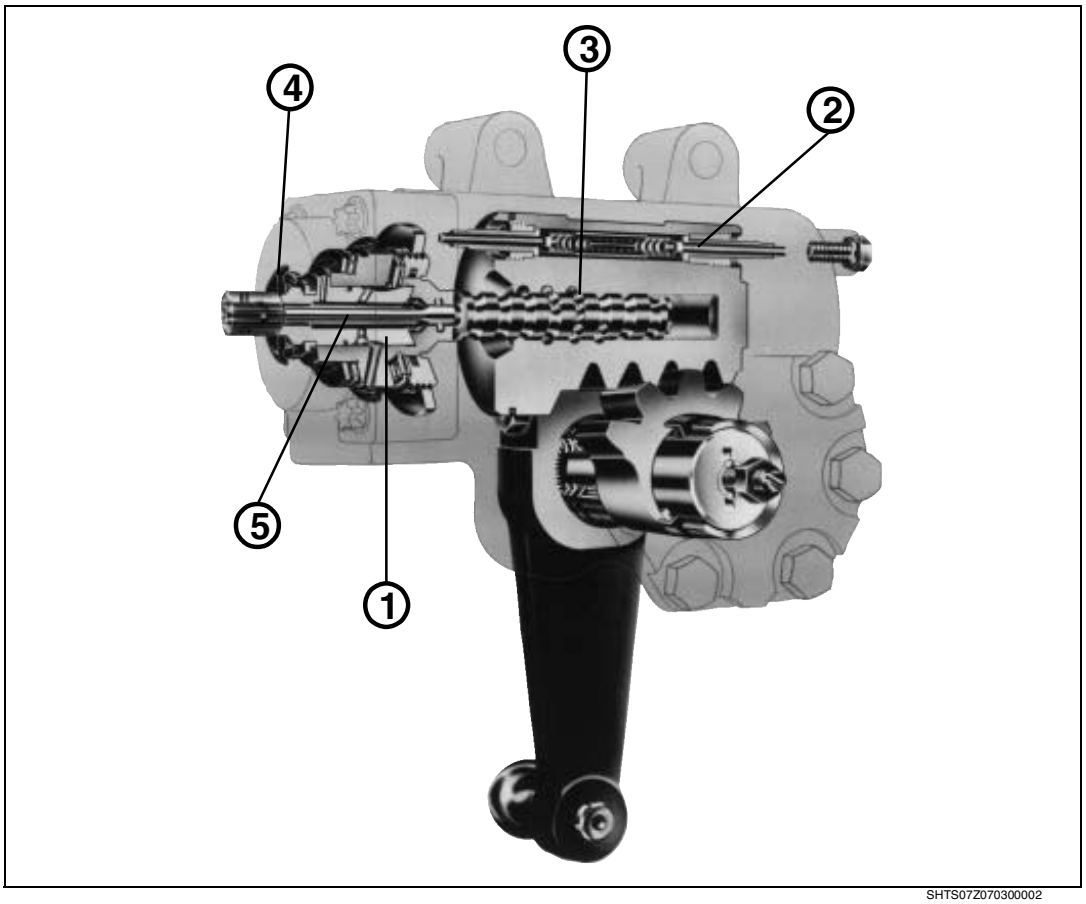


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S1-UNAE09A-2.book 3 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

DESCRIPTION

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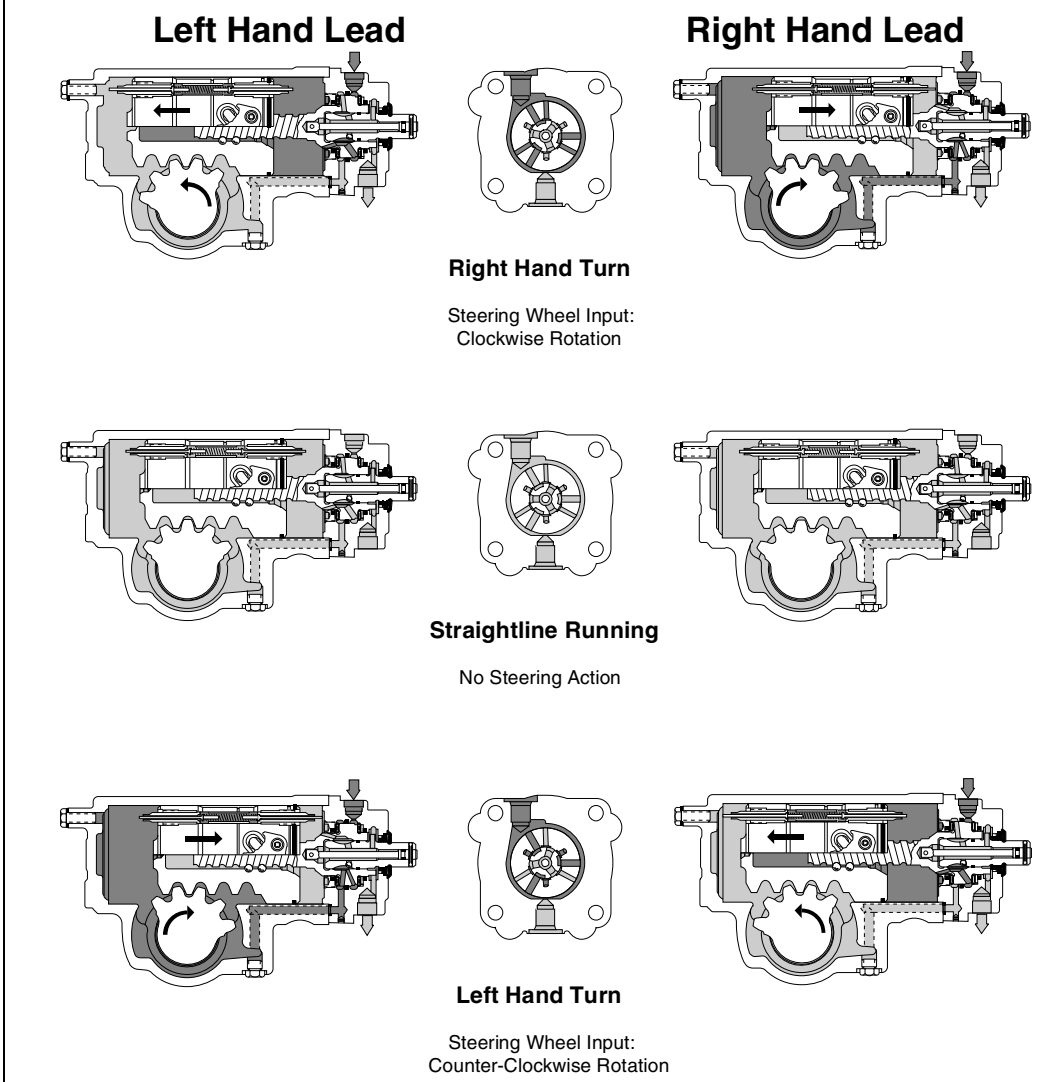
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1	Rotary Valve	This device provides responsive steering control.
2	Poppets (optional)	These unloading valves are automatically set to furnish power steering pump protection and reduce pressure to unload steering linkage at vehicle axle stop settings.
3	Recirculating Balls	Combine high mechanical efficiency with smooth operation.
4	Dirt & Water Seals	Lip-type seals on both input and output shafts.
5	Torsion Bar	Provides positive valve centering with definitive "feel of the road".

S1-UNAE09A-2.book 4 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

OPERATION

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S1-UNAE09A-2.book 5 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

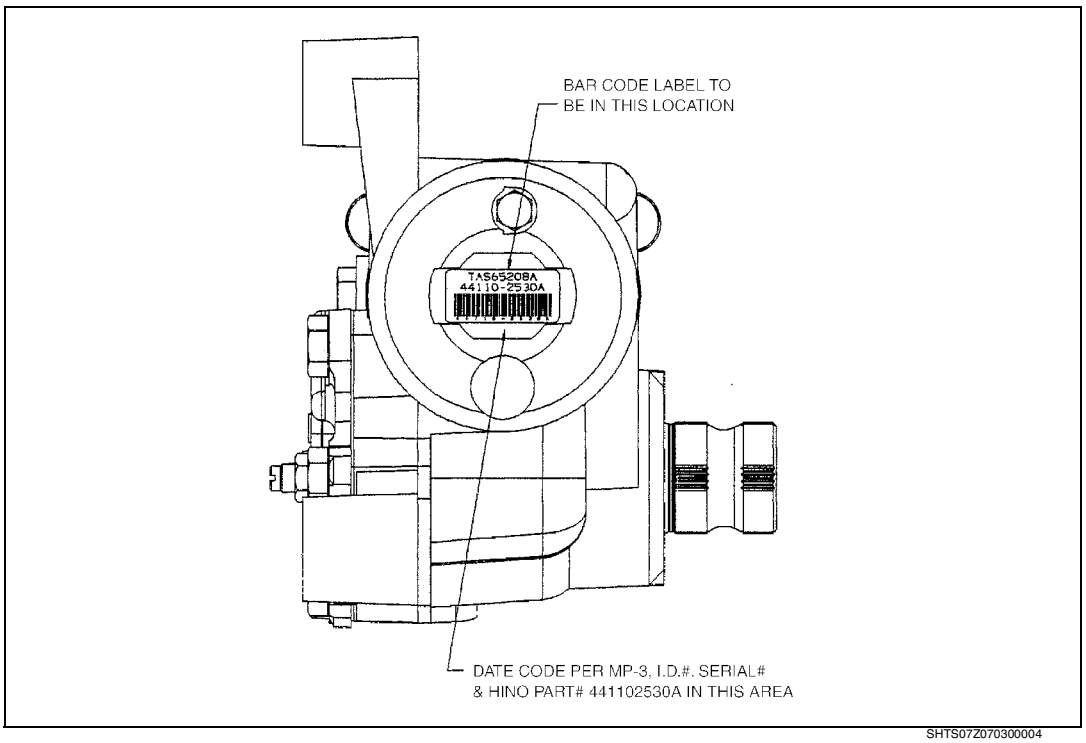
APPROVED HYDRAULIC FLUIDS

Automatic Transmission Fluid Dexron II	Mobil ATF 210
Automatic Transmission Fluid Type "E" or "F"	Mobil Super 10W-40 Motor Oil
Chevron 10W-40	Premium Blue 2000-SAE 15W-40
Chevron Custom 10W-40 Motor Oil	*Shell Rotella T30W
Chevron Torque 5 Fluid	*Shell Rotella T SAE 30
Exxon Nuto H32 Hydraulic Fluid	Texaco 10W-40
Fleetrite PSF (Can #990625C2)	Texaco TL-1833 Power Steering Fluid
Ford Spec. M2C138CJ	Union 10W-40
Mack EO-K2 Engine Oil	Union 15W-40
	Unocal Guardol 15W-40 Motor Oil

The steering system should be kept filled with one of the above fluids. Fluids marked with an asterisk (*) have not been approved for use with TRW's pump.

⚠ **WARNING**
Completely flush the steering system with one of the recommended fluids above only. Do not mix oil types. Any mixture or any unapproved oil could lead to seal deterioration and leaks. A leak could ultimately cause the loss of fluid, which could result in a loss of power steering assist.

SPECIFICATION NUMBERS



SHTS07Z070300004

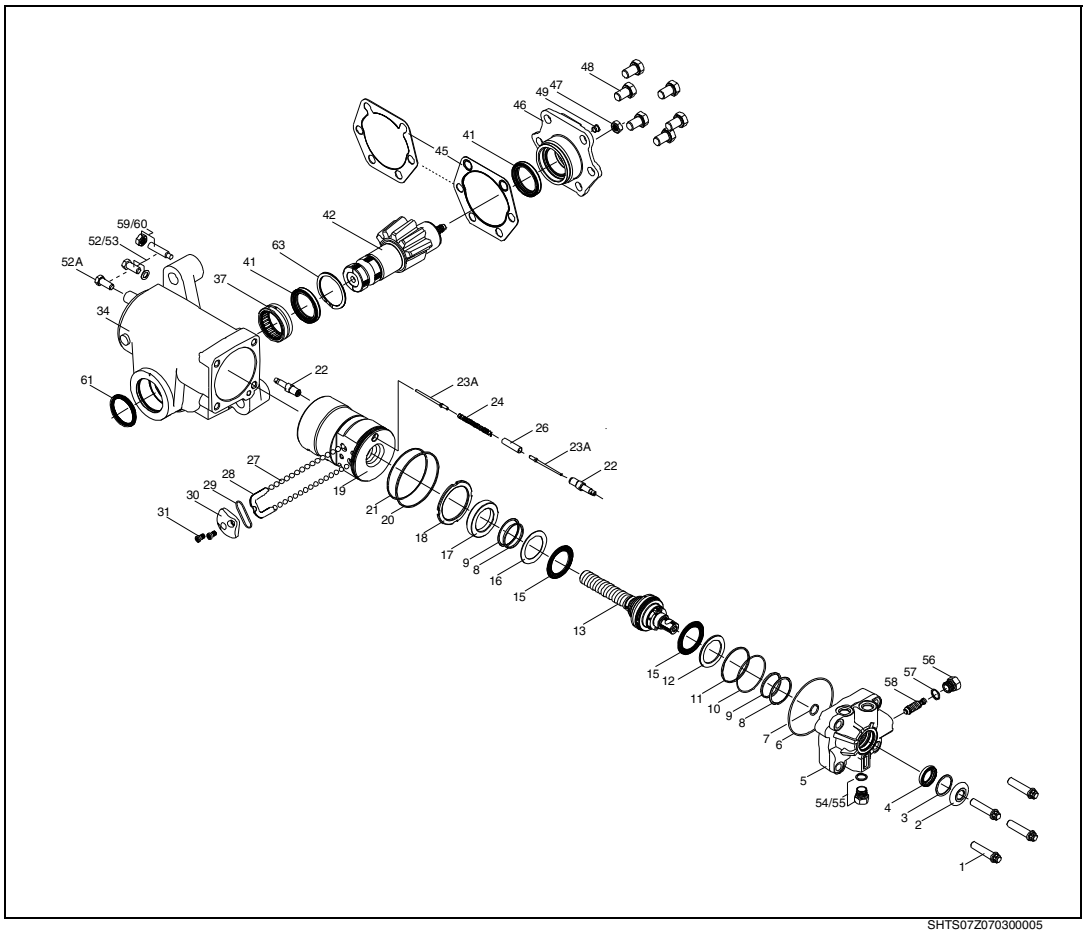
S1-UNAE09A-2.book 6 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

COMPONENT LOCATOR

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TAS SERIES EXPLODED VIEW

1. STEP BORE



SHTS07Z070300005

S1-UNAE09A-2.book 7 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

1	Bolts (4-Valve Housing)	*31	Torx Screws (2-Cap/Strap)
*2	Dirt and Water Seal	34	Housing
*3	Retaining Ring	35	Grease Fitting
*4	Seal (Input Shaft)	37	Roller Bearing
5	Valve Housing	*41	Seal (2-Output)
*6	Seal Ring (Valve Housing)	42	Sector Shaft
*7	Seal Ring (Valve Housing)	43	Adjusting Screw (Sector Shaft)
*8	Seal Ring (2)	44	Retainer (Adjusting Screw)
*9	O-ring (2)	*45	Gasket (Side Cover)
*10	Seal Ring	46	Side Cover Assembly
*11	O-ring (Valve Housing)	47	Jam Nut
12	Thrust Washer (Thick)	48	Special Bolts (6 or 8-Side Cover)
13	Input Shaft, Valve, Worm Assy.	*49	Vent Plug (Side Cover)
15	Thrust Bearing (1 or 2)	50	Bleed Screw (Manual)
16	Thrust Washer (Thin)	51	Plug (Auto Bleed)
17	Bearing Adjuster	52	Fixed Stop Screw (Poppet)
*18	Adjuster Locknut	52A	Fixed Stop Screw (Poppet-Alt)
19	Rack Piston	53	Washer (Stop Screw)
*20	Teflon Seal Ring	54	Auxiliary Port Plug (2)
*21	O-ring (Back up; Rack Piston)	*55	O-ring (2-Aux. Port Plug)
22	Poppet Seat and Sleeve Assy. (2)	56	Relief Valve Cap
23	Poppet (2)	*57	O-ring (Relief Valve)
24	Poppet Spring	58	Relief Valve (2 piece)
26	Push Tube	59	Service Poppet Adjusting Screw
27	Balls	60	Service Sealing Jam Nut
28	Ball Return Guide Halves (2)	*61	Dirt & Water Seal (Trunnion)
*29	Seal (Cap)	63	Retaining Ring
30	Ball Return Guide Cap		

S1-UNAE09A-2.book 8 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

TORQUE CHART

EN07Z0703A200001

Part Name	Item #	Torque Range Dry	Torque Range Lubricated
Auxiliary cylinder plug	54	25-35 lbf·ft (34-48 N·m)	
Ball return guide cap/strap bolts	31	31 14-22 lbf·ft (19-29 N·m)	
Bearing adjuster	17		11-15 lbf·ft (15-20 N·m)*
Locknut	18		101-122 lbf·ft (137-165 N·m)**
Manual bleed screw	50	40-50 lbf·in. (3.1-3.7 N·m)	
Plug, auto bleed	51	38-58 lbf·ft (52-79 N·m)	
Poppet sleeve assembly	22	16-20 lbf·ft (22-27 N·m)	
Poppet sealing nut, service	60	33-37 lbf·ft (45-50 N·m)	
Poppet fixed stop screw	52	38-42 lbf·ft (52-57 N·m)	
Poppet fixed stop screw	52A	38-58 lbf·ft (52-79 N·m)	
Relief valve cap	56	25-35 lbf·ft (34-48 N·m)	
Sector shaft adjusting screw jam nut	47	40-45 lbf·ft (54-61 N·m)	
Side cover bolts (TAS40)	48		108-128 lbf·ft (147-174 N·m)
Side cover bolts (TAS55, 65, 85)	48		160-180 lbf·ft (217-244 N·m)
Valve housing bolts (TAS40, 55, 65)	1		75-85 lbf·ft (102-115 N·m)
Valve housing bolts (TAS85)	1		108-128 lbf·ft (147-174 N·m)

* After tightening to this torque value, the adjuster must be backed off $^1/_4$ to $^1/_2$ of a turn as described in step (24) on page SR03-49.

**Torque value indicated is using recommended tools.

Special tools can be purchased through:
SPX Corporation
Kent-Moore Tool Group
28635 Mound Road
Warren, MI 48092
1-800-328-6657

HAZARD WARNING DEFINITIONS

EN07Z0703A100001

⚠ WARNING
A warning describes hazards or unsafe practices which could result in severe personal injury or death.

⚠ CAUTION
A caution describes hazards or unsafe practices which could result in personal injury or product or property damage.

NOTICE
A note gives key information to make following a procedure easier or quicker.

S1-UNAE09A-2.book 9 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

DISCLAIMER

EN07Z0703A200002

This Service Manual has been prepared by TRW Commercial Steering Division for reference and use by mechanics who have been trained to repair and service steering components and systems on heavy commercial vehicles. TRW Commercial Steering Division has exercised reasonable care and diligence to present accurate, clear and complete information and instructions regarding the TRW Commercial Steering TAS Series Integral Power Steering Gears. Since this is a general Service Manual, the photographs and illustrations may not look exactly like the steering gear being serviced. The procedures, therefore, must be carefully read and understood before servicing.

If inspection or testing reveals evidence of abnormal wear or damage to the TAS steering gear or if you encounter circumstances not covered in the Manual, **Stop-Consult the vehicle manufacturer's Service Manual and warranty. Do not try to repair or service a TAS steering gear which has been damaged or includes any part that shows excessive wear unless the damaged and worn parts are replaced with original TRW replacement and service parts and the unit is restored to TRW's specifications for the TAS steering gear.**

It is the responsibility of the mechanic performing the maintenance, repairs or service on a particular TAS steering gear to (a) inspect the steering gear for abnormal wear and damage, (b) choose a repair procedure which will not endanger his/her safety, the safety of others, the vehicle, or the safe operation of the vehicle, and (c) fully inspect and test the TAS steering gear and the vehicle steering system to ensure that the repair or service of the steering gear has been properly performed and that the steering gear and system will function properly.

PATENTS

EN07Z0703A200003

TRW Commercial Steering Division TAS power steering gears are covered by several United States and foreign patents, either issued or pending.

TRW Inc., 1998

MAINTENANCE TIPS

EN07Z0703A200004

Never high-pressure wash or steam clean a power steering gear while on or off the vehicle. Doing so could force contaminants inside the gear and cause it to malfunction.

Make sure vehicle wheel cut or clearances meet manufacturer's specifications, and make sure pitman arm timing marks are aligned properly to **prevent internal bottoming** of the steering gear.

Regularly check the fluid and the fluid level in the power steering reservoir.

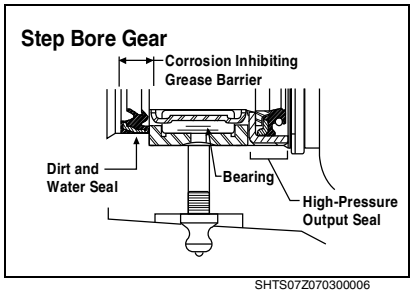
Keep tires inflated to correct pressure.

Never use a torch to remove pitman arm.

Investigate and immediately **correct the cause of any play, rattle, or shimmy** in any part of the steering system.

Make sure the steering column is aligned properly.

S1-UNAE09A-2.book 10 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



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Encourage drivers to report any malfunctions or accidents that could have damaged steering components.

Do not attempt to weld any broken steering component.
Replace the component with original equipment only.

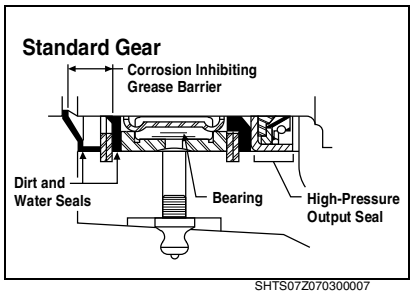
Do not cold straighten, hot straighten, or bend any steering system component.

Always **clean off around the reservoir filler cap** before you remove it. Prevent dirt or other foreign matter from entering the hydraulic system.

Investigate and correct any external leaks, no matter how minor.

Replace reservoir filters according to requirements.

If you feel the vehicle is developing excessively **high hydraulic fluid temperatures,** consult with your vehicle manufacturer for recommendations.



SHTS07Z070300007

Maintain grease pack behind the output shaft dirt and water seal as a general maintenance procedure at least twice a year, in the Spring and Fall. Grease fitting is provided in housing trunnion. Use only NLGI grade 2 multipurpose chassis lube, and use only a hand operated grease gun on fitting. Add grease until it begins to extrude past the sector shaft dirt and water seal.

S1-UNAE09A-2.book 11 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

ON-VEHICLE SERVICE

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1. FILLING AND AIR BLEEDING THE SYSTEM

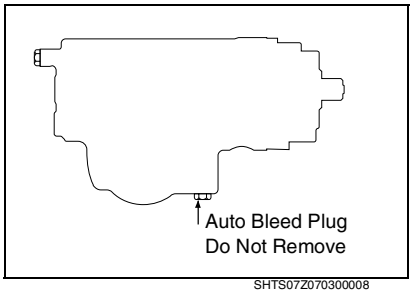
⚠ CAUTION
Make sure poppets are set correctly before beginning this procedure.

(1) Fill the reservoir nearly full. Do not steer. Start and run the engine for 10 seconds, then shut it off. Check and refill the reservoir. Repeat at least three times, checking the reservoir each time.

⚠ CAUTION
Do not allow the fluid level to drop significantly or run out of the reservoir. This may induce air into the system.

(2) Start the engine and let it idle for 2 minutes. Do not steer. Shut off the engine and check the fluid level in the reservoir. Refill as required.
(3) Start the engine again. Steer the vehicle from full left to full right several times. Add fluid, as necessary, to the full line on the dip stick.

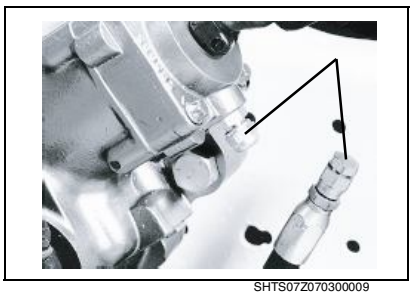
Automatic bleed systems should now be free from trapped air.



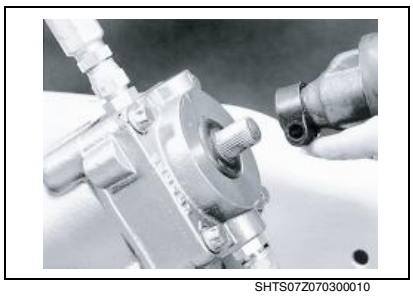
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2. INPUT SHAFT SEAL REPLACEMENT

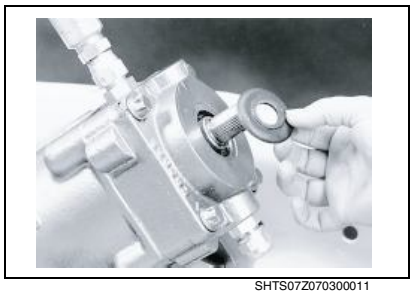
This procedure uses the vehicle's power steering pump to force out the input shaft seal. To use this procedure, the power steering pump should have a minimum of 1,500 psi available.
(1) Disconnect return line from the steering gear and plug the line. Also cap the return port of the gear with a high pressure fitting.


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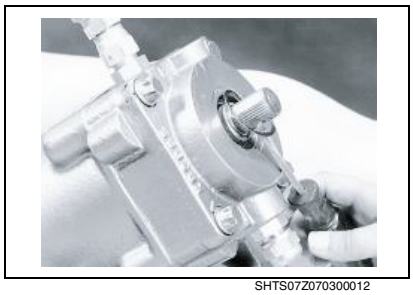
S1-UNAE09A-2.book 12 ページ ２０１１年１０月２７日 木曜日 午後５時２１分


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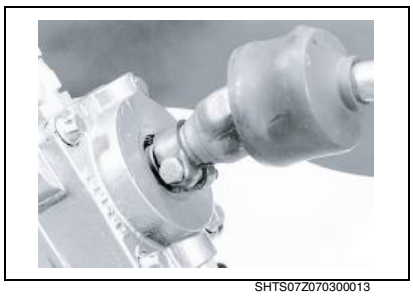
(2) Remove the steering column from the gear input shaft.


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(3) Remove the dirt and water seal from the steering gear. Save this seal to match the new seal to the correct size.

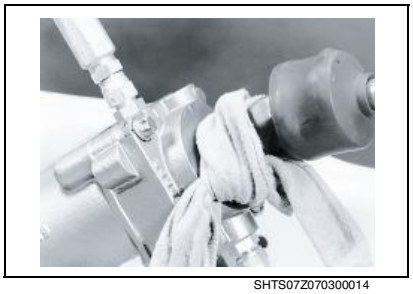

SHTS07Z070300012

(4) Wipe out the grease and then remove the spiral retaining ring. Use a screwdriver inserted into the notch formed in the end of the ring. Be careful not to scratch the bore with the screwdriver.


SHTS07Z070300013

(5) Slip the steering column back onto the input shaft with the pinch bolt installed, but not tightened.

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(6) Tie or wrap a shop towel around the input shaft area and place a drip pan under the vehicle to catch the oil.



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(7) Add fluid as necessary, to the full line on the dip-stick. Do not mix fluid types.

⚠ WARNING

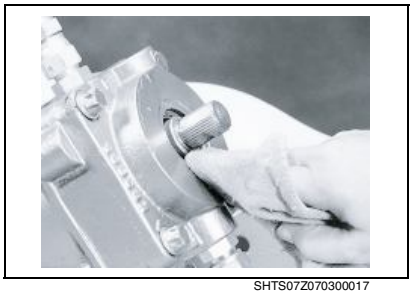
Any mixture of fluid types, or use of any unapproved fluid could lead to seal deterioration and leaks. A leak could ultimately cause the loss of fluid, which could result in a loss of power steering assist.

(8) With the vehicle in neutral, momentarily turn the starter (quickly turn off the engine if it starts).

(9) Remove the shop towel. Disconnect the steering column, and remove the input shaft seal.



SHTS07Z070300016



SHTS07Z070300017

(10) Check the seal area of the valve housing for any seal fragments. Remove any that are found.

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SHTS07Z070300018

(11) Check the seal for heat damage. If the seal is stiff and brittle, and not pliable like the new seal, it is probably heat damaged. Determine and fix the cause of excessive heat in the vehicle.


SHTS07Z070300019

(12) Put clean grease 406038 on the inside dia. of the new input shaft seal, and place it over the input shaft. With the small dia. of tool J37073 against the seal, tap the tool until the tool shoulder is square against the valve housing. Remove any seal material that may have sheared off in the seal bore or retaining ring groove.

⚠ CAUTION
Do not use a socket to install this seal because you will not be able to control seal installation depth, possibly causing a leak.


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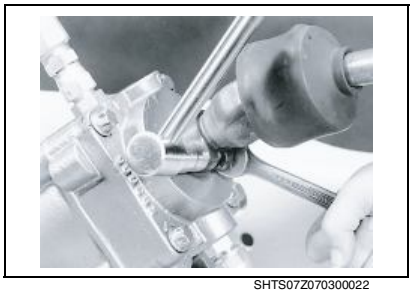
(13) Insert new retaining ring into the groove.


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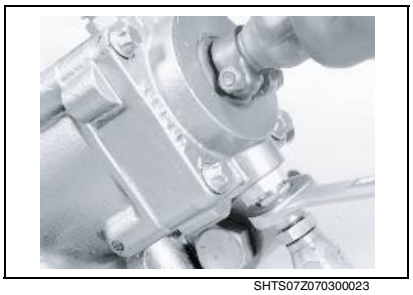
(14) Pack the end of the valve housing bore around the input shaft with grease 406038. Choose the correct size dirt & water seal by comparing the choices to the old seal, or by measuring the major diameter of the input shaft serrations (see chart below). Apply more grease 406038 to the new dirt & water seal and install it over the input shaft. Seat it in the groove behind the serrations and against the valve housing.

Seal Part No.	Serration Size	Major Serration Dia.
478044	13/16" x 36	0.807 / 0.799
478060	7/8 x 36	0.866 / 0.857
478050	1" x 36	0.987 / 0.977
478050	1" x 79	1.008 / 1.000

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(15) Reconnect the steering column to the input shaft and tighten the pinch bolt to torque level specified.


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(16) Reconnect the return line to the steering gear return port.

(17) Air bleed the system using the procedure on page SR03-11.

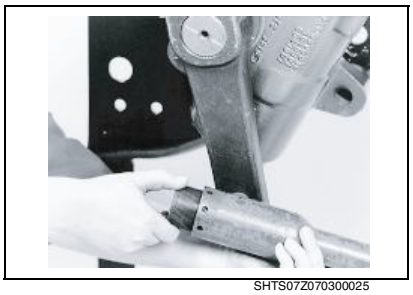
3. SECTOR SHAFT ADJUSTMENT

This adjustment can only be completed on the vehicle if the adjusting screw jam nut is accessible. This nut is located on the side cover.

Photos in this section were taken on a mock frame rail for clarity.


SHTS07Z070300024

(1) With the engine on, rotate the steering wheel (input shaft) until the timing mark on the sector shaft lines up with the mark on the housing. The line on the sector shaft should be at a 90° angle from the input shaft. The sector shaft is now on its "center of travel". Turn the vehicle off.

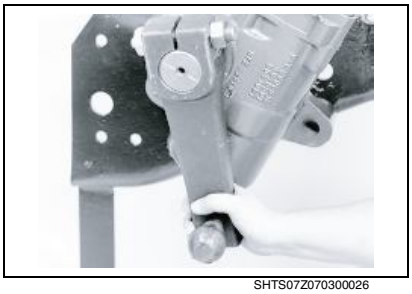

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(2) Remove the drag link from the pitman arm.

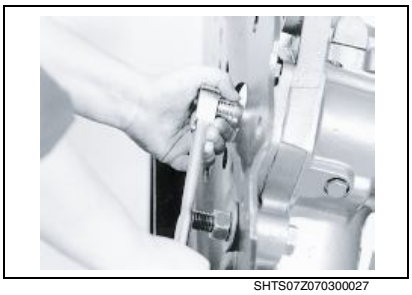
⚠ CAUTION

To avoid resetting the poppets, do not rotate the input shaft more than $1^1/_2$ turns from the "center of travel" position while the drag link is disconnected.

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(3) From the "center of travel" position, grasp the pitman arm and gently try to rotate it back and forth. If looseness or lash is felt at this point, the sector shaft is out of adjustment.


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(4) Loosen the jam nut.

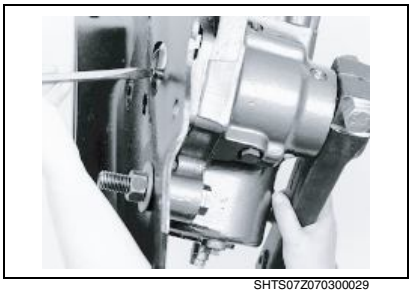
NOTICE

If the gear is removed from the vehicle to adjust the lash:

- **Leave the pitman arm connected to the gear.**
- **Best option is to follow the Final Adjustment procedure on page SR03-53.**
- **Alternate option is to continue with step (5) of this procedure.**

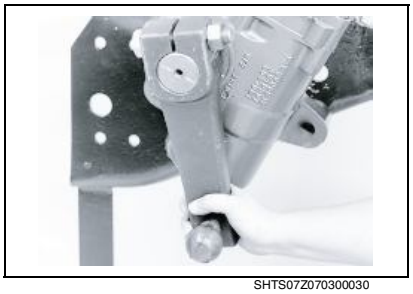

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(5) If no lash was detected in step (3), turn the shaft adjusting screw counterclockwise until you feel lash at the output shaft.


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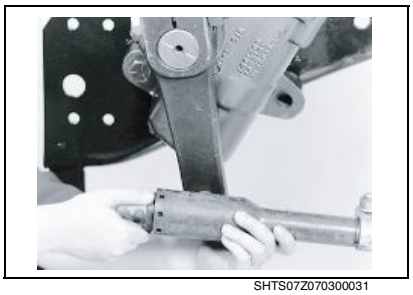
(6) Slowly turn the shaft adjusting screw clockwise until you feel no lash at the output shaft without using more than 10 lbf·ft (14 N·m) of torque. From this position, turn the screw clockwise $^{1}/_{8}$ to $^{3}/_{16}$ of a turn more. Hold the adjusting screw in place, and tighten the jam nut. **Final jam nut torque 43 lbf·ft** (58 N·m).

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(7) Turn the steering wheel $^1/_4$ turn each side of center, then back to center and recheck the pitman arm for lash. You should feel no lash; if there is lash, repeat steps (4), (6) and (7).



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(8) Reconnect the drag link to the pitman arm according to manufacturer's specifications.

⚠ **CAUTION**

Maintain grease in the sector shaft bearing through the grease fitting in the housing using only a hand operated grease gun. Add grease until it begins to extrude past the dirt and water seal. Do not use a power grease gun because it will supply grease too fast; this could adversely affect the high pressure seal and contaminate the hydraulic fluid.

4. POPPET READJUSTMENT-SINGLE GEARS

This resetting procedure will work in most cases with at least $1^3/_4$ hand-wheel-turns from each side of center. If you're making a large reduction in wheelnut and this procedure does not work, you may have to replace or internally reset the poppets using the procedure described in the Poppet Component section of this Service Manual.

(1) Set the axle stops to vehicle manufacturer's wheelnut or clearance specifications.

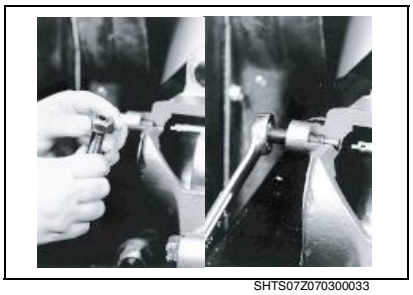
Start the engine and allow the vehicle to idle for 5-10 minutes to warm the hydraulic fluid. Shut off the engine.



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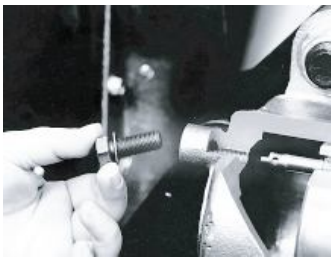
(2) If a new poppet adjusting screw and nut are being used, turn the screw into the non-sealing end of the jam nut until the drive end of screw is flush with the nut.

Your steering gear will have either a fixed stop bolt or an adjusting screw. If the adjusting screw is already part of the steering gear, back the nut off of the adjusting screw until it is flush with the end of the adjusting screw.



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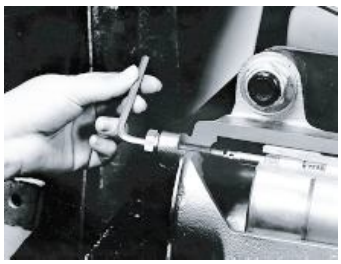
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(3) Make sure the engine is off and the road wheels are in straight ahead position. Remove and discard the poppet fixed stop bolt (if equipped) and washer (if equipped) from the lower end of the housing.

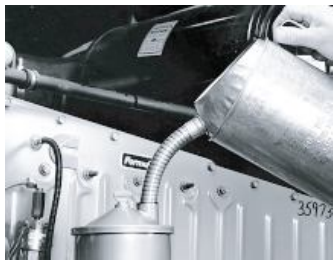
If the unit has a poppet adjusting screw and sealing nut that need to be replaced, remove and discard them.



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(4) Turn the adjusting screw and sealing nut assembly, without rotating the nut on the screw, into the housing until the nut is firmly against the housing using a $^{7}/_{32}$" Allen wrench. Tighten the sealing nut against the housing.

⚠ CAUTION
If the drive end of the screw is below the face of the nut, the poppet seat flange will break during step (7)d.



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(5) Refill the system reservoir with approved hydraulic fluid.

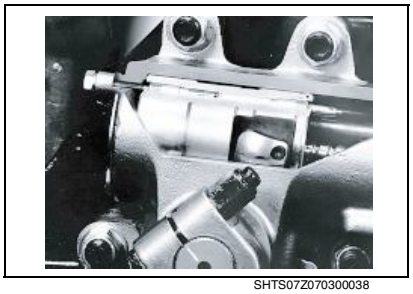
⚠ CAUTION
Do not mix fluid types. Mixing of transmission fluid, motor oil, or other hydraulic fluids will cause seals to deteriorate faster.



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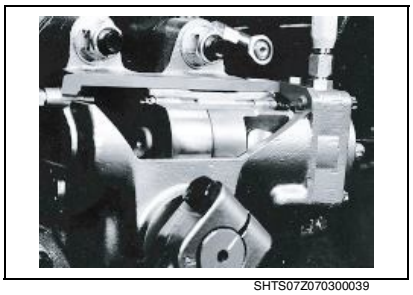
(6) Place a jack under the center of the front axle and jack up the front end of the vehicle so the steer axle tires are off the ground.

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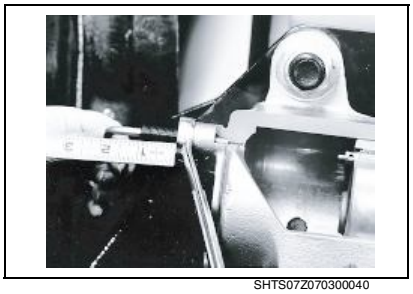
(7) Push upper poppet out to prepare it for setting

a. Start the engine and let it run at idle speed.
b. Note which output shaft timing mark is nearest the housing piston bore.
c. Turn the steering wheel in the direction that makes this timing mark move toward the adjusting screw just installed. Turn in this direction until axle stop contact is made.
d. Pull hard on the steering wheel (put up to 40 lb rim pull on a 20" dia. steering wheel) after the axle stop is contacted.


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(8) Set upper poppet

a. Turn the steering wheel in the opposite direction (end of timing mark away from adjusting screw) until the other axle stop is contacted.
b. Pull hard on the steering wheel (put up to 40 lb rim pull on a 20" dia. steering wheel).
c. Release the steering wheel and shut off the engine.


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(9) Loosen the sealing nut and back out the adjusting screw until 1" is past the nut. Tighten the sealing nut against the housing.

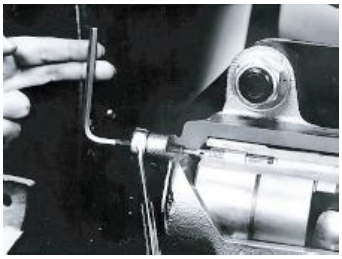
⚠ CAUTION
Do not hold the steering wheel at full turn for more than 10 seconds at a time; the heat build-up at pump relief pressure may damage components.


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(10) Set lower poppet

a. Start the engine and let it idle.
b. Turn the steering wheel in the original direction (end of timing mark toward adjusting screw), until axle stop contact is made.
c. Hold the steering wheel in this position (with up to 40 lb rim pull) for 10 seconds, then release.
Repeat this hold and release process as many times as necessary while completing step (11).

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(11) Position adjusting screw

a. With steering wheel held tightly at full turn loosen the jam nut and hold it in place with a wrench.
b. Turn the adjusting screw in (clockwise) using **finger-pressure only (don't use a ratchet),** until the Allen wrench stops. Do not attempt to turn it in further. Pause the turning-in process each time the driver releases the steering wheel; continue turning only while the wheel is held at full turn.
c. Back off the adjusting screw $3^1/_4$ turns and tighten the sealing nut. Torque sealing nut to **35 lbf·ft** (47.5 N·m).

(12) The poppets have now been completely reset.
Lower the vehicle. Check the reservoir and fill if required.

⚠ WARNING
The length of the adjusting screw beyond the nut must be no more than $1^1/_{16}$" for proper thread engagement.

NOTICE
The length of adjusting screw beyond the sealing nut may be different for each vehicle.

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RESEAL & REPAIR

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1. DISASSEMBLY PREPARATION

Stop the vehicle with wheels pointed straight ahead.

Clean off all outside dirt from around fittings and hose connections before you remove the gear.

Remove input and output shaft connections per vehicle manufacturer's instructions.

⚠ WARNING

When using a chisel to spread a pinch bolt-type pitman arm boss for assembly or removal from the shaft, maintain a firm grip on the chisel at all times. Failure to do this may result in the chisel flying loose which could cause an injury. Never leave the chisel wedged in the pitman arm boss. If you cannot remove the pitman arm from the shaft with a chisel and your hands, remove the chisel from the arm boss and use a puller only to remove pitman arm.

⚠ CAUTION

- **Do not use a hammer on the pitman arm to remove it from sector shaft as internal damage to steering gear could result. Be sure there is no spreading wedge left in the pitman arm boss before tightening pitman arm clamp bolt after assembly on sector shaft. Do not pound the universal joint or input shaft coupling on or off the input shaft as internal damage to the steering gear can result.**
- **Unless the poppet adjuster seat and sleeve assemblies (22) are to be removed and replaced or reset for automatic poppet adjustment, or a manual adjustment with a service poppet adjuster screw (59) and nut (60) is anticipated, do not allow the input shaft on a steering gear with the automatic poppet adjustment feature to rotate more than 1.5 input shaft revolutions from "straight ahead position" when the output shaft is disconnected from the vehicle steering linkage; this could disrupt the poppet setting achieved at initial installation. The steering gear is in the "straight ahead position" when the timing marks on the end of the housing trunnion and sector shaft are aligned.**

Remove the supply and return lines from the gear, and immediately plug all port holes and fluid lines.

⚠ WARNING

TAS steering gears can weigh up to 110 pounds dry. Exercise caution when you remove, lift, carry, or fix in a bench vise.

Remove the steering gear from the vehicle and take it to a clean work surface.

Clean and dry the gear before you start to disassemble it.

As you disassemble the gear, clean all parts in clean, OSHA approved solvent, and air blow-dry them only.

⚠ WARNING

- **Because they are flammable, be extremely careful when using any solvents. Even a small explosion or fire could cause injury or death.**
- **Wear eye protection and be sure to comply with OSHA or other maximum air pressure requirements.**

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⚠ CAUTION
Never steam clean or high-pressure wash hydraulic steering components. Do not force or abuse closely fitted parts. Use care that bearing and sealing surfaces are not damaged by the assembly and disassembly procedures.

Keep each part separate to avoid nicks and burrs.

Discard all seals, o-rings, and gaskets removed from the gear. Replace them with new parts only.

The steering gear should be identified to the vehicle from which it was removed. The poppet adjuster seat and sleeve assemblies are set for that particular vehicle only.

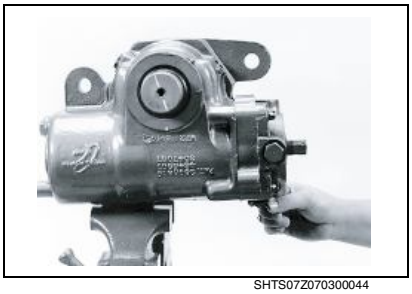
2. DISASSEMBLY

(1) Put the steering gear in a vise, clamping firmly against the housing mounting flange or boss. Input shaft should be horizontal; side cover and valve housing are accessible for disassembly.

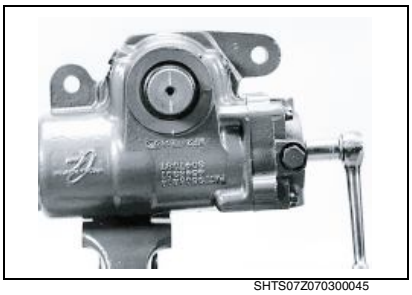
⚠ CAUTION
Do not clamp against body of housing. If mounting boss or flange is not accessible, fabricate and attach a mounting plate to the housing mounting bosses.


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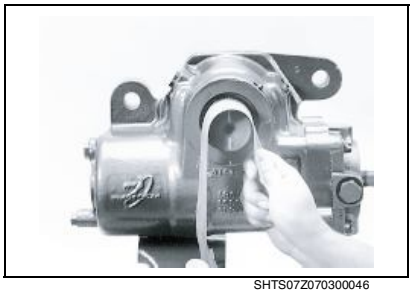
(2) Prepare for fluid drainage and unplug hydraulic ports.


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(3) Rotate the input shaft until the timing mark on the end of the sector shaft is in line with the timing mark on the end of the housing. This will position the sector shaft for removal.

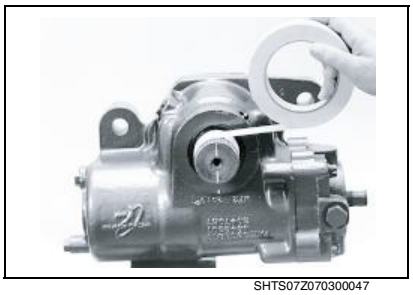

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(4) Remove any paint or corrosion from the exposed area of the sector shaft (42).



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(5) Tape the serrations and bolt groove of the sector shaft with one layer of masking tape. The tape should not extend onto the sector shaft bearing diameter.



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(6) Remove the sector shaft adjusting screw jam nut (47).



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(7) Be prepared for more fluid drainage and remove the six or eight special bolts (48) from the side cover (46).

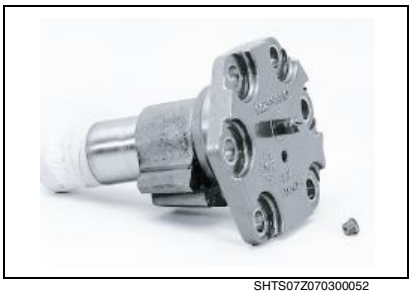
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(8) Be prepared for more fluid drainage and remove the side cover and sector shaft assembly from the gear.
You may start the shaft and cover assembly removal by tapping the end of the shaft lightly with a soft mallet or wooden hammer handle.


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(9) Remove and discard the side cover gasket (45).


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(10) Remove and discard the vent plug (49).


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(11) Screw sector shaft adjusting screw (43) clockwise through the side cover and pull the sector shaft out of the side cover.

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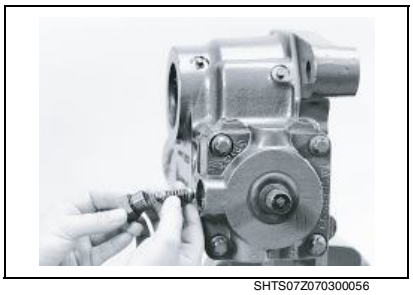
(12) Clamp the side cover in a vise. Place a standard $^{5}/_{8}$" or $^{11}/_{16}$"-$^{3}/_{8}$ drive socket in the center of the side cover. pry the seal (41) out with a rolling head pry bar, using the socket for support. Discard the seal and remove the socket.

⚠ CAUTION
Don't damage the bore or DU bushing when removing the seal.



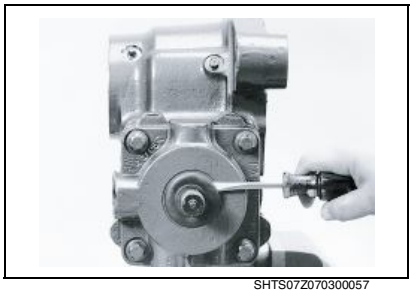
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(13) Inspect the sector shaft assembly for damaged adjusting screw threads. The retainer (44) must be securely staked in place. The adjusting screw must rotate by hand with no perceptible end play (lash).



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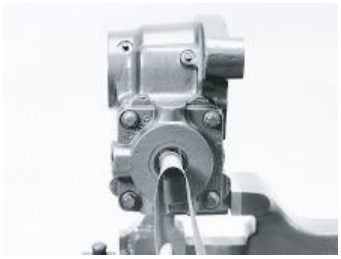
(14) If equipped, remove relief valve cap (56), o-ring (57) and two-piece relief valve (58) from the valve housing. Discard the o-ring.



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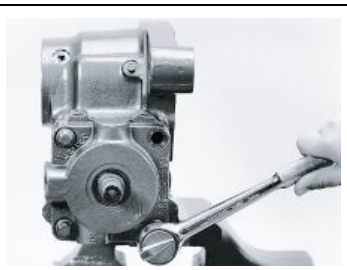
(15) Remove and discard the dirt & water seal (2, 2B or 2C) from the input shaft (13 or 13A). Save this seal for comparison with the new seal.

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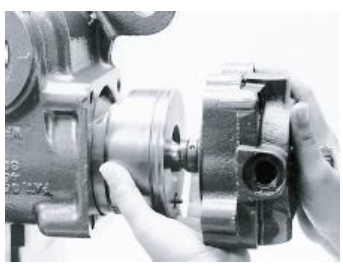
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(16) Clean any paint or corrosion from the exposed area of the input shaft.



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(17) Remove the four torx head valve housing bolts (1).

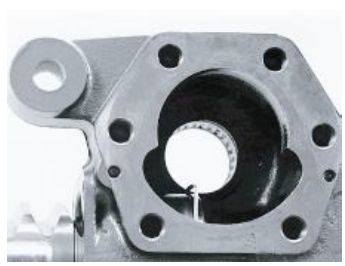


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(18) Be prepared for more fluid drainage and remove the rack piston subassembly. Place the assembly on a clean cloth. For the TAS85 it may help to rotate the input shaft to move the rack piston toward the lower end of the housing. This will force the valve housing to exit the main housing.

⚠ CAUTION

The set position of poppet seat and sleeve assemblies (22) must not be disturbed if the poppets are not going to be replaced or reset during disassembly.



SHTS07Z070300061

NOTICE

If your gear is short "V" construction, the rack piston seal is on the end of the rack piston farthest from the input shaft. Remove the seal before removing the valve housing assembly to prevent the Teflon rack piston seal ring (20) from "hanging up" when it exits the housing. Expose the seal through the sector shaft cavity, then cut and remove the seal ring from the rack piston.

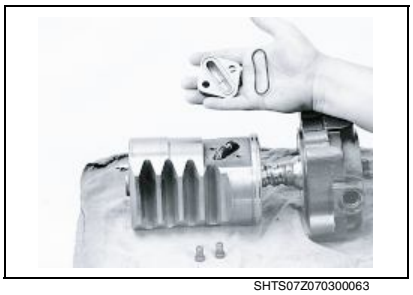
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SHTS07Z070300062

(19) Remove and discard the valve housing seal rings (6 & 7).

⚠ CAUTION
Do not remove the input shaft, valve worm assembly or balls from the rack piston until the ball return guides are removed as damage to the ball guides will occur.



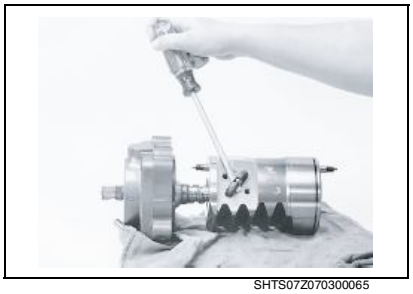
SHTS07Z070300063

(20) Remove and discard the two special sealing screws (31). Remove the ball return cap (30) and seal (29), or strap (32), discard the seal. (cap type)



SHTS07Z070300064

(21) Bend down the two tabs (tangs) that are against the hex head bolts. Remove two bolts and the clip. Discard the clip. (clip type)



SHTS07Z070300065

(22) Make sure the rack piston is on a cloth so the steel balls that fall out won't roll very far. Remove ball return guide halves (28) by carefully inserting a screwdriver between the rack piston and guides.

NOTICE
Left hand ball return guide halves are copper plated for identification and right hand guides are not plated.
Retain the guides for reassembly.

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SHTS07Z070300066

(23) Remove the steel balls (27) from the rack piston (19) by rotating the input shaft, valve worm assembly until the balls fall out. Place the balls and return guides in a cup or other container. Count the balls, and make sure all have been removed.

⚠ CAUTION
The steel balls are a matched set. If any are lost, the set must be replaced by service balls. Number of factory balls installed: TAS40-29, TAS55-31 (30 if date code is 337-89 or earlier), TAS65-32, TAS85-34.



SHTS07Z070300067

(24) Remove the input shaft, valve/worm, valve housing subassembly from the rack piston.



SHTS07Z070300068

(25) Cut and remove the Teflon seal ring (20) and o-ring (21) from the rack piston if not removed during disassembly step (18) NOTICE.



SHTS07Z070300069

(26) Push poppet stems, they should spring back. Push poppet seat, it should not move by hand. If components are bent or broken, poppet stems don't spring back, or poppet seat moves by hand, go to **Poppet Component Replacement** section on page SR03-40. Otherwise, proceed to step (27).

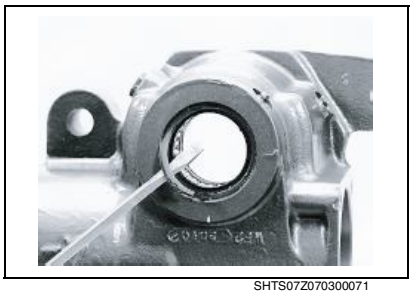
NOTICE
TRW recommends the poppet adjuster seat and sleeve assemblies (22) not be removed unless replacement of poppet components is required.

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SHTS07Z070300070

(27) Inspect valve housing/worm screw subassembly for heat damage or bearing roughness. If these conditions are present, or if there was excessive internal leakage, or if preload adjustment is required, go to **Valve Housing/Worm Screw Disassembly** procedures on page SR03-43. If not, proceed to step (28).

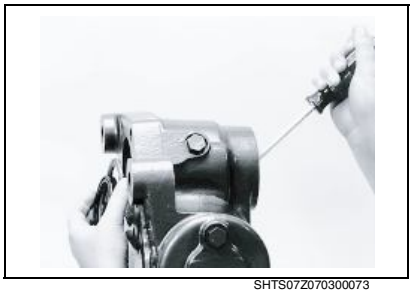


SHTS07Z070300071



SHTS07Z070300072

(28) Remove and discard the dirt and water seal (61).



SHTS07Z070300073

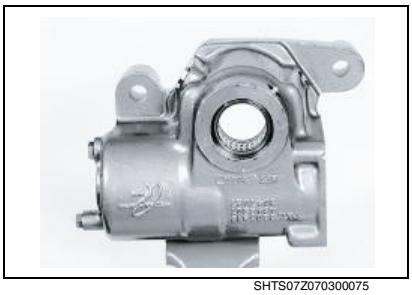
(29) Remove the retaining ring (63) through the side cover opening. Then insert a screwdriver through the trunnion opening, and carefully push the seal (41) out **without damaging the sealing area of the bore.** Discard the seal.

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SHTS07Z070300074

(30) Inspect the roller bearing (37) for brinelling or spalling. If replacement is required, go to **Roller Bearing Replacement-Step Bore** on page SR03-51. If not, proceed to step (31).



SHTS07Z070300075

(31) Inspect the following for damage:

- Poppet fixed stop screw (52 or 52A) and washer (53) if equipped.
- Poppet adjusting screw (59) and sealing nut (60)
- Auto-bleed plug (51)
- Manual bleed screw (50)
- Auxiliary port plugs (54) and o-rings (55)

If any are damaged, go to **Replace Housing Ports, Plugs and Screws** on page SR03-52. If not, proceed to the Inspection Section.

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3. INSPECTION

Make sure all sealing surfaces and seal cavities are free from nicks and corrosion. Any nicked or corroded surface requires part replacement to ensure proper sealing.

Wash all parts in clean, OSHA approved solvent. Air blow them dry only.

⚠ WARNING

- **Because they are flammable, be extremely careful when using any solvents. Even a small explosion or fire could cause injury or death.**
- **Wear eye protection and be sure to comply with OSHA or other maximum air pressure requirements.**
- **Any of the following conditions present in the steering gear indicates impact damage.**

Condition	Area
Brinelling	• Ball track grooves of rack piston • Ball track grooves of worm screw • Bearing area of sector shaft • Thrust washers and bearings in valve housing
Cracks or Breaks	• Bearing area of sector shaft • Sector shaft teeth • Rack piston teeth • Housing • Thrust washers and bearings in valve housing • Worm screw
Twisted serrations	• Output shaft serrations

If one of these conditions is found in one component, be sure to inspect all components carefully for signs of impact damage. Replace components noted in individual inspection steps below if you suspect impact damage. Failure to replace all damaged components could result in a serious vehicle accident.



SHTS07Z070300076

(1) Inspect the rack piston (19) teeth for cracks or obvious damage. If teeth are damaged, replace the rack piston, sector shaft (42) and set of balls (27).

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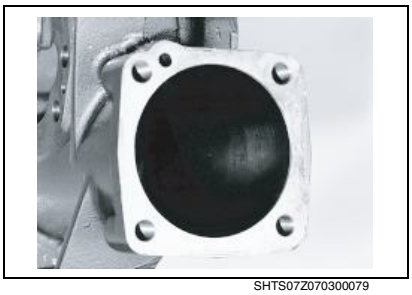
SHTS07Z070300077

(2) Inspect the rack piston (19) ball track grooves for brinelling or spalling. If either condition exists, replace the input shaft, valve/worm assembly, valve housing, rack piston subassembly and balls.



SHTS07Z070300078

(3) Inspect the sealing area of input shaft and valve (13 or 13A) for nicks, and damage. Inspect for discoloration from excess heat. Inspect input shaft ball-track grooves for brinelling or spalling. If any of these conditions exist, replace the input shaft, valve worm assembly, valve housing and balls. Also replace rack piston if brinelling or spalling is found.



SHTS07Z070300079

(4) Inspect the housing (34) cylinder bore. Some scoring marks are normal. If there was internal leakage greater than 1 gal/mm (3.8 L/min), make sure there are no damaged seals before replacing the housing.



SHTS07Z070300080

(5) Inspect the housing faces for nicks that would prevent proper sealing. Replace the gear housing if these nicks are present and cannot be easily removed with a fine-tooth flat file without changing the dimensional characteristics.

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SHTS07Z070300081

(6) Inspect side cover (46) DU bushing for damage. Also check side cover bushing to sector shaft clearance. If damage exists, or if clearance exceeds .008" (0.20 mm) replace side cover/bushing assembly.



SHTS07Z070300082

(7) Inspect the sector shaft (42) bearing and sealing areas and sector teeth contact surfaces for brinelling, spalling or cracks. Run your fingernail edge across these areas to detect steps. Remove masking tape from the shaft and inspect for twisted or otherwise damaged serrations. If any of these conditions exist, replace the sector shaft.

NOTICE

A service sector shaft will come assembled with the adjusting screw (43) and retainer (44).

4. ASSEMBLY PREPARATION

Wash all parts in clean, OSHA approved solvent. Air blow-dry them only.

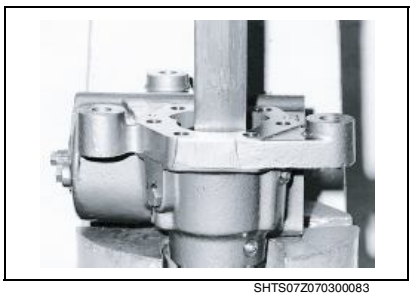
⚠ WARNING

- **Because they are flammable, be extremely careful when using any solvents. Even a small explosion or fire could cause injury or death.**
- **Wear eye protection and be sure to comply with OSHA or other maximum air pressure requirements.**

Replace all seals, seal rings, and gaskets with new ones each time you disassemble the gear.

TRW Commercial Steering Division makes complete seal kits available. These parts can be purchased through most OEM parts distributors. Contact your local dealer for availability.

5. ASSEMBLY



SHTS07Z070300083

(1) Assemble new seal (41) onto bearing and seal tool (short end) so the lip with the garter spring is toward the shoulder of the tool. Working from the side cover side of the housing, pilot the seal tool into the washer and bearing and press with a force of 100-800 lb (445-3,560 N) until the seal is seated firmly.

Install the inside retaining ring (63) from the side cover opening. Seat the ring firmly in the retaining ring groove.

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SHTS07Z070300084

(2) Install the dirt & water seal (61) with the bearing and seal tool (long end), making sure it is not cocked. **Press the seal only until it seats against the bearing, don't push it in farther.**

Liberally pack the roller bearing and new seals with clean, high temperature industrial grease, Exxon Unirex* RS460.

*Trademark of Exxon Oil Corp.



SHTS07Z070300085

(3) Lightly oil new seal ring (7) and assemble in valve housing mounting face groove.

Oil new seal ring (6) and assemble in valve housing mounting face groove.



SHTS07Z070300086

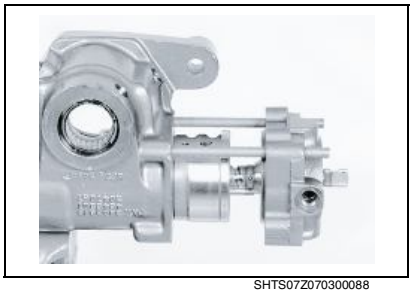
(4) Install a new backup o-ring (21) and then a new Teflon seal ring (20) on rack piston (19). Do not over-stretch these rings as you install them. Do not allow the Teflon seal ring to be twisted.



SHTS07Z070300087

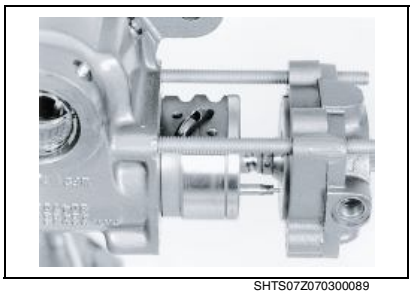
(5) Apply clean oil to housing cylinder bore. Place the rack piston (19) in the housing piston bore with ball return guide holes up.

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SHTS07Z070300088

(6) Insert the worm screw into the rack piston close to maximum depth, without the valve housing making contact with the poppet stem. Insert two $^{7}/_{16}$"-14 All threads through valve housing bolt holes and tighten into housing to support the worm screw. Line up rack piston ball guide holes with the worm ball track grooves by rotating the input shaft.



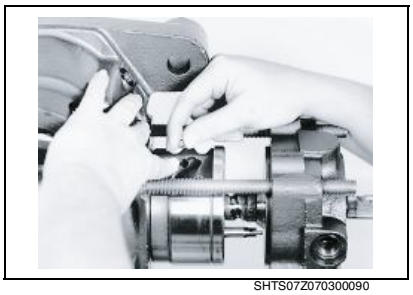
SHTS07Z070300089

(7) Assemble the ball return guide halves (28) into the rack piston until seated, rotate the input shaft slightly if necessary.

⚠ WARNING
Do not seat guides with a hammer.
Damage to guides can result in subsequent lockup or loss of steering.

⚠ CAUTION

- **If a new rack piston (19) or a new input shaft, valve, worm subassembly (13 or 13A) is being assembled, the balls (27) removed from the unit must be discarded and a service ball kit utilized. The balls in a service ball kit are sized to function in the ball track guide path as altered by component replacement.**
- **When using the service ball kit, use the correct quantity of service balls: TAS65-32.**



SHTS07Z070300090

(8) **Hold the ball return guides (28) firmly in place during this entire procedure.** Insert as many of the steel balls as you can through the hole in the top of the ball return guides. Rotate the input shaft to pull the balls down and around the ball track guide path. Continue until the correct number of balls are in the ball track guide path.

⚠ WARNING

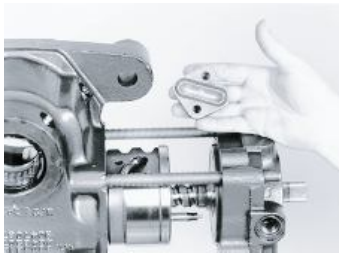
- **Hold down the ball return guides until cap or clip is reinstalled. Failure to hold the guides will result in a trapped ball or balls, which could cause a vehicle accident. If the ball guides become unseated (raise up) at any time, repeat the procedure starting at step (5).**
- **The correct number of balls are required for proper gear operation.**
  Count the balls and insert each carefully as in step (7).

	TAS65
Original	**32**
Service	**32**

⚠ CAUTION

- **Do not allow valve housing to contact the poppet stem or move more than $2^{1}/_{2}$ inches (69.1 mm) from upper end of rack piston during these procedures. This could incorrectly reset the poppet, or back out worm beyond closed ball loop, trapping balls.**
- **Remove any fluid present in the two screw holes. Fluid in these holes could cause improper clamp load when torquing the cap or strap screws.**

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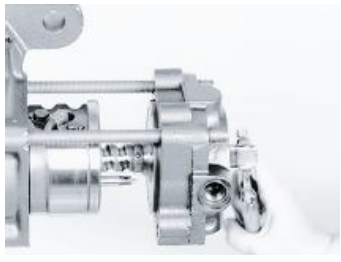
(9) Place a new ball return guide cap seal (29) in the seal groove of the cap (30). Make sure the seal makes full contact with the rack piston surface. Install two new Allen or Torx head screws (31) and torque each screw alternately until a final torque of **18 lbf·ft** (24.5 N·m) is achieved.

⚠ CAUTION
Ball cap seal is greased to hold seal in groove while assembling. Be sure not to trap the seal outside of the groove during reassembly.



SHTS07Z070300092

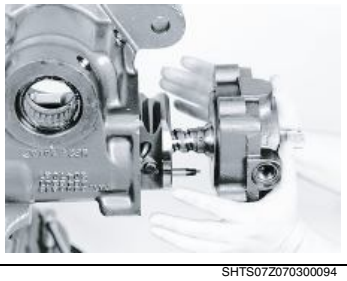
(10) If your gear was equipped with the ball return guide strap (32), or if it was equipped with the clip, install the new ball return guide strap. Position it on the rack piston, install two new Allen or Torx head screws (31) and torque each screw alternately until a final torque of **18 lbf·ft** (24.5 N·m) is achieved.



SHTS07Z070300093

(11) Rotate the input shaft from one end of travel to the other without contacting the poppet stem to the valve housing, and without moving the valve housing face more than $2^{1}/_{2}$" (69.1 mm) from input end (upper end) of rack piston. If you cannot rotate the input shaft, remove the balls and reassemble them.

⚠ WARNING
If you install a gear on a vehicle with the worm shaft unable to rotate, the gear will not function correctly. Steering and gear failure may result.



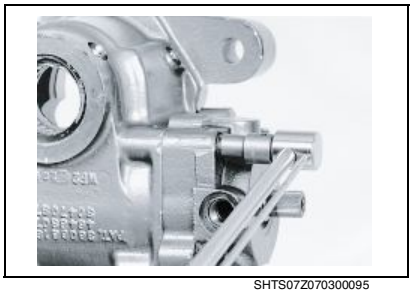
SHTS07Z070300094

(12) Apply clean oil to Teflon seal ring (20) on rack piston. Make sure there is a space of $^{3}/_{8}$-$^{1}/_{2}$" (10.0-13.0 mm) between valve housing (5) and poppet stem to prevent poppet contact at either end. Remove the All Threads, and push the rack piston assembly into the housing with the rack piston teeth toward the sector shaft cavity. Line up the valve housing cylinder feed hole with the gear housing feed hole. Make sure both o-rings in the valve housing remain in position.

⚠ CAUTION

- **Do not damage the seal ring (19) while installing the rack piston into housing. If the seal ring end of rack piston enters the housing first, the seal ring will be destroyed when the rack is removed.**
- **The poppet seat and sleeve assemblies (22) must not bottom against the internal poppet stops in the steering gear until the gear is installed on the vehicle and the poppet adjustment procedures are performed.**

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SHTS07Z070300095

(13) Lubricate and install the four valve housing bolts (1) into the housing. Torque the **bolts alternately to 80 lbf·ft** (108.5 N·m).



SHTS07Z070300096

(14) If the gear is equipped with a relief valve, assemble a new o-ring (57) on relief valve cap (56). Assemble the small end of tapered spring onto the pin on the relief valve cartridge and insert the assembly (58), (large end of tapered spring end first) into the relief valve cap cavity. Turn the relief valve cap as assembled into the valve housing and torque to **30 lbf·ft** (41 N·m).



SHTS07Z070300097

(15) Lightly oil DU bushing. **Do not grease.**

⚠ CAUTION
This bearing is sealed and will receive no lubrication from the hydraulic fluid in the gear. Failure to use the proper grease could result in premature bearing wear.



SHTS07Z070300098

(16) Grease and assemble new seal (41) onto installation tool so the side with the garter spring is against the shoulder of the tool. Pilot the tool into the side cover (46) with a force of 100-800 lb (445-3560 N) until it is seated against the bearing or bushing.

⚠ CAUTION
Make sure the OD of the seal, and the ID of the bore are free from grease and dust, for proper engagement of the seal.

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SHTS07Z070300099

(17) Lightly oil short bearing area of sector shaft. **Do not grease.**


SHTS07Z070300100

(18) Insert the sector shaft (42) into the side cover subassembly (46), and screw the sector shaft adjusting screw (43) counterclockwise into the side cover until the screw reaches solid height.

Rotate the adjusting screw clockwise one half turn so the side cover will rotate freely on the sector shaft.


SHTS07Z070300101

(19) Install the sector shaft adjusting screw jam nut (47) onto the sector shaft adjusting screw (43) a few threads. Final adjustment will be made later.


SHTS07Z070300102

(20) Press the new vent plug (49) into the hole provided in the side cover until the plug is bottomed.

⚠ **WARNING**

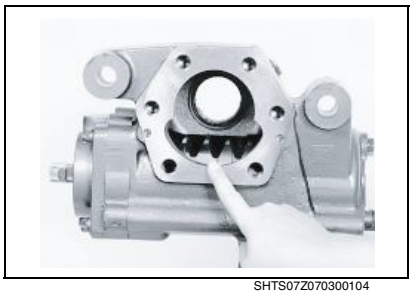
Do not weld or otherwise plug this hole in any permanent manner. This is a safety vent which functions only if the side cover seal fails. If the seal fails and the plug cannot vent, the steering gear may lock-up or otherwise malfunction.

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SHTS07Z070300103

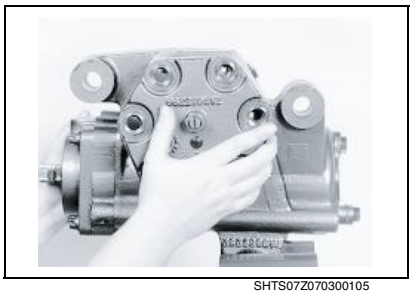
(21) Apply clean grease to the new side cover gasket (45) to hold it in place and assemble it onto the side cover (46).



SHTS07Z070300104

(22) There are four teeth on the rack piston. Rotate input shaft to position the rack piston so the space between the second and third tooth is in the center of the sector shaft opening. This will center the rack piston for assembly of sector shaft.

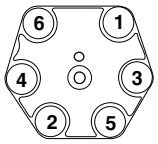
⚠ WARNING
If the rack piston is not centered when sector shaft is installed, gear travel will be severely limited in one direction. This could result in an accident.



SHTS07Z070300105

(23) Clean off any old tape on the serrations. Reapply one layer of masking tape. Install the sector shaft assembly into the housing. The center tooth of the sector shaft must engage the center space (between the second and third tooth) of the rack piston, with side cover gasket in place.

⚠ CAUTION
If the serrations are not properly taped, they will damage the output seal (38) in housing, causing the seal to leak.



TAS40, 65

SHTS07Z070300106

(24) Install bolts in positions 3 and 4 first, by hand. Install the remaining special side cover bolts (48) into the side cover and torque them in the sequence shown. If bolts must be replaced, use bolts of the same design, type and length as those you removed. Do not use a substitute.

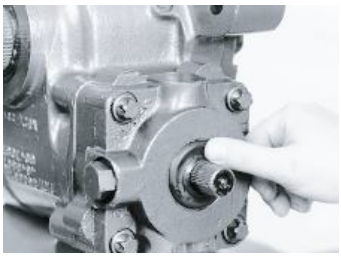
Lubricate side cover bolts and torque, TAS65 bolts to **170 lbf·ft** (230 N·m).

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SHTS07Z070300107

(25) Remove tape from the sector shaft.



SHTS07Z070300108

(26) Pack the end of the valve housing bore around the input shaft with clean, high temperature industrial grease, Exxon Unirex* RS460. Apply more of the grease to the inside of a new dirt and water seal (2, 2B or 2C) and install it over the input shaft. Seat the seal in the groove behind the serrations and against the valve housing.

This step may have already been completed if you disassembled the valve housing and worm screw for repair.

Proceed to Final Adjustments on page SR03-53.

*Trademark of Exxon Oil Corp.



SHTS07Z070300109

6. POPPET COMPONENT REPLACEMENT

(1) If the poppet assemblies are to be removed for replacement, place rack piston in a soft-jawed vise.



SHTS07Z070300110

(2) Slide special tool #J36452-A over the seat of poppet adjuster seat and sleeve assembly (22) and engage tool in the slots in the threaded sleeve. Hit the end of the tool firmly four or five times with a 2 lb sledge hammer to loosen Loctite.

⚠ CAUTION

Poppet adjuster seat and sleeve assemblies (22) are retained by Loctite applied to the threads which makes the assemblies difficult to remove.

S1-UNAE09A-2.book 41 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



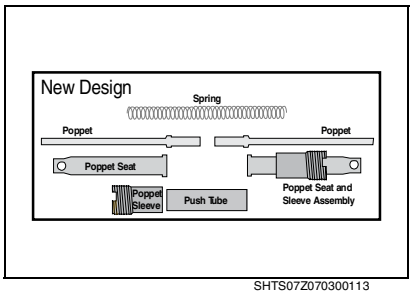
SHTS07Z070300111

(3) With a ratchet applied to the tool, turn one adjuster seat and sleeve assembly out of the rack piston. If the ratchet does not turn easily, strike the adjuster removal tool again with a hammer. If the engaging tangs won't stay in place while torquing, it might be necessary to hold in place with an arbor press while applying loosening torque. Discard poppet seat and sleeve assembly.



SHTS07Z070300112

(4) Remove the two poppets (23 or 23A), spring (24), and push tube (26). Some gears will also have a spacer rod (25) to be removed.



SHTS07Z070300113

(5) Remove and discard remaining poppet seat and sleeve assembly only if required.

NOTICE

It is possible to reset one poppet adjuster seat and sleeve assembly for automatic poppet adjustment while it is in the rack piston if one adjuster seat and sleeve assembly and the poppets, spring, spacer rod and push tube are removed.



SHTS07Z070300114

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SHTS07Z070300115

(6) If one poppet seat and sleeve assy. (22) was left in rack piston, it can be reset for automatic poppet adjustment by inserting a $^{3}/_{8}$" (9.52 mm) diameter X 6" (152.4 mm) drill rod down through the poppet seat hole at the opposite end of the rack piston and against the adjuster seat to press the seat in until it bottoms against the adjuster sleeve.



SHTS07Z070300116

(7) Carefully apply Locquic "T" primer to the threads in poppet holes, and threads on the new seat and sleeve assemblies (22). Allow to dry for ten minutes; then carefully apply Loctite® RC680 to same threads.

⚠ CAUTION

Do not allow Loctite or Locquic to get on the adjuster seat component of the adjuster seat and sleeve assembly. The poppets will not function properly.



SHTS07Z070300117

(8) Place rack piston (19) in a soft-jawed vise and turn one new poppet adjuster seat and sleeve assembly (22), (slotted end out) into the poppet hole in one end of rack piston.

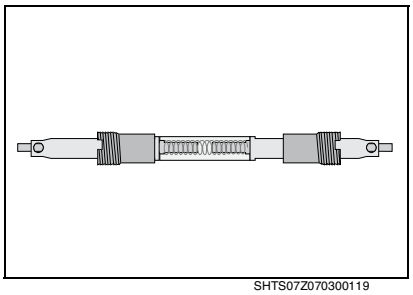
⚠ WARNING

- **Wear eye protection while assembling poppets, as spring loaded poppets could eject and cause eye injury.**
- **Do not use the spacer with the new poppet design. You must install the spacer with the old poppet design.**

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SHTS07Z070300118

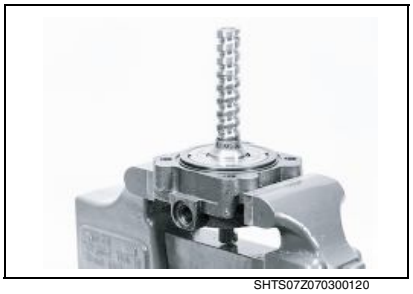


SHTS07Z070300119

(9) From the other end of the poppet hole in the rack piston, install: one poppet (23A), poppet spring (24), push tube (26), other poppet (23A), and the other new poppet adjuster seat and sleeve assembly (22). The new components will stack up as shown below.

Torque both poppet seat and sleeve assemblies to **18 lbf·ft** (25 N·m).

Return to step (27), page SR03-29.



SHTS07Z070300120

7. VALVE HOUSING/WORM SCREW DISASSEMBLY

(1) With worm vertical, place the valve housing, input shaft, valve/worm assembly in a vise.



SHTS07Z070300121

(2) Unstake the valve housing (5) where it was upset into the adjuster locknut (18) slot. Also unstake adjuster nut from adjuster (17).

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SHTS07Z070300122

(3) Turn bearing adjuster locknut (18) out of the valve housing.


SHTS07Z070300123

(4) Turn bearing adjuster (17) out of the valve housing.


SHTS07Z070300124

(5) Remove and discard seal ring (8) and o-ring (9) from bearing adjuster.


SHTS07Z070300125

(6) Remove the input shaft, valve/worm assembly (13 or 13A) from the valve housing.

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SHTS07Z070300126

(7) Remove thin thrust washer (16) and thrust bearing (15) from input shaft.



SHTS07Z070300127

(8) Remove thick thrust washer (12) and thrust bearing (15) from valve housing.

⚠ CAUTION
Input shaft, valve worm assembly must not be disassembled further. The components were a select fit at assembly and are available only as part of this subassembly. If disassembled further, the subassembly must be replaced.



SHTS07Z070300128

(9) For alternate construction TAS65 gears, remove spacer sleeve (14), thin washer (16), thrust bearing (15) and thick washer (12).

⚠ WARNING
If the TAS65 gear has a ball bearing and ball race in the valve housing, remove them and call TRW for disposition. Do not rebuild the gear.



SHTS07Z070300129

(10) Remove and discard seal rings (10) and (8) and o-rings (11) and (9) from valve housing (5).

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SHTS07Z070300130

(11) Turn over valve housing and remove retaining ring (3).



SHTS07Z070300131

(12) Tap input shaft seal (4) out of valve housing. Discard seal.

⚠ **CAUTION**
Exercise special care when removing seal (4) to prevent damaging the valve housing seal bore.

NOTICE
The valve housing also utilizes a ball plug for manufacturing purposes that must not be removed.



SHTS07Z070300132

(13) Inspect the sealing areas of input shaft and valve (13 or 13A) for nicks and run your fingernail edge across the sealing surfaces to detect steps. Inspect for discoloration from excess heat. Inspect input shaft ball-track grooves for brinelling or spalling. If any of these conditions exist, you must replace the input shaft, valve/worm assembly, valve housing and balls. Also replace rack piston if brinelling or spalling is found.



SHTS07Z070300133

(14) Inspect the thrust bearing (15) rollers for any deterioration. Inspect thrust washers (12 & 16) for brinelling, spalling, or cracks. Replace any part with these conditions.

Alternate Construction TAS65: If spacer sleeve (14) is damaged, **replace the input shaft/valve/worm subassembly** and use thick washer and roller bearing only during reassembly.

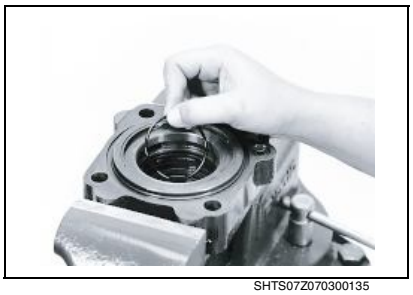
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SHTS07Z070300134

(15) Place valve housing (5) firmly in a vise so the input shaft, valve/worm assembly (13 or 13A) can be assembled vertically with the worm end up.

⚠ CAUTION
Do not clamp against threaded port hole or relief valve hole sealing faces when placing valve housing in vise.



SHTS07Z070300135

(16) Oil and assemble a new o-ring (9) into its counterbore in valve housing.



SHTS07Z070300136

(17) Lightly oil and assemble new o-ring (11) and new seal ring (10) into the large diameter seal ring groove in valve housing, bending and working them in and smoothing them out as necessary.



SHTS07Z070300137

(18) Install roller thrust bearing (15) and then the thick washer (12) (square side out) onto input shaft end of input shaft, valve, worm subassembly, seating them against the input shaft thrust face.

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SHTS07Z070300138

(19) **Alternate construction TAS65:** Assemble spacer sleeve (14) onto input shaft with radiused side toward valve. Make sure sleeve is square. Assemble thin washer (16), thrust bearing (15) and thick washer (12) onto input shaft behind spacer sleeve.

⚠ **CAUTION**
If you are replacing the input shaft/valve/worm assembly, discard spacer sleeve and thin washer.


SHTS07Z070300139

(20) Lightly oil and assemble new seal ring (8) onto input shaft and against the thick thrust washer (12) to hold the bearing components in place.


SHTS07Z070300140

(21) Dip the input end of the input shaft, valve, worm assembly (13 or 13A) into oil up to the worm lead. Assemble the input shaft end of the assembly into the valve housing (5) until it is firmly seated.


SHTS07Z070300141

(22) Apply oil and assemble the other thrust bearing (15) then the thin thrust washer (16) over the ball groove end of worm, and seat them against the shoulder of input shaft, valve, worm assembly.

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SHTS07Z070300142

(23) Lightly oil a new o-ring (9) and assemble into the seal groove in bearing adjuster (17). Oil and work a new seal ring (8) into the same groove and smooth it out.

NOTICE

Be sure the valve housing, adjuster locknut and bearing adjuster threads are clean and free of any staking burrs that would impede the locknut from turning freely on adjuster or the adjuster turning freely in valve housing.



SHTS07Z070300143

(24) Lightly oil and assemble bearing adjuster (17) over worm and into valve housing. Torque adjuster to **13 lbf·ft** (18N·m) indicated torque using a torque wrench inserted in adjuster tool #J37070. This will seat the components. Back off adjuster $^{1}/_{4}$ to $^{1}/_{2}$ of a turn.



SHTS07Z070300144

(25) Lightly oil and assemble new locknut (18) onto bearing adjuster (17) with radius (slightly rounded) side down. Tighten slightly to keep the bearing adjuster in place.



SHTS07Z070300145

(26) Reverse assembly in vise so the worm end is down. With an inch pound torque wrench on the input shaft, note torque required to rotate the input shaft 360° in each direction. Tighten the bearing adjuster to increase the maximum torque at the input shaft **5-10 lbf·in**. (.5-1.0 N·m) over that which was previously noted.

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SHTS07Z070300146

(27) Again reverse the assembly in vise. Torque locknut while holding bearing adjuster in position established in step (26) with appropriate adjuster tool. When using a torque wrench in locknut tool J37464, the torque wrench reading should be **112 lbf·ft** (152 N·m).

NOTICE

The bearing adjuster, locknut and valve housing flange should be flush. If not, the seal ring (8) or o-ring (9) may be out of position; which will result in axial lash.


SHTS07Z070300147

(28) Recheck input shaft torque. It should match torque measured in step (26). Repeat steps (26) and (27) if necessary.


SHTS07Z070300148

(29) Stake valve housing into the clockwise most corner of two opposing slots in locknut (18). Stake the locknut into the adjuster (17) in two places (180° apart) at threaded area. Choose areas that have not been previously staked.

After staking, torque required to rotate input shaft must be between **5-10 lbf·in.** (.5-1.0 N·m) **greater** than the torque noted in step (26). Torque value must **not exceed 22 lbf·in.** (2.5 N·m). Unstake and readjust if necessary.


SHTS07Z070300149

(30) Reposition worm screw/valve housing subassembly in soft-jawed vise, clamping tightly against valve housing, so the worm screw is pointing down.

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SHTS07Z070300150

(31) Apply clean grease (Exxon Unirex* RS460) to the outside and inside diameters (fill cavity between the lips) of the new input shaft seal (4) and assemble it, garter spring side first over the input shaft. Align seal in the valve housing seal bore.

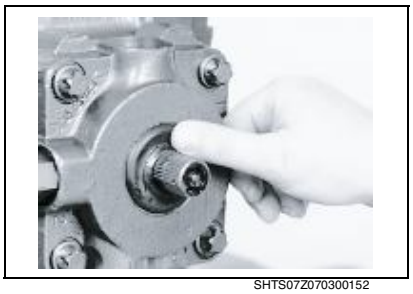
Assemble seal installer tool #J37073, small diameter end first, over the input shaft and against the seal. Tap the seal installer tool until the tool shoulder is squarely against the valve housing. This will correctly position the seal in the housing bore just beyond the retaining ring groove.

Remove any seal material that may have sheared off and is in seal bore and retaining ring groove.

⚠ CAUTION
The input shaft seal must be square in the seal bore and installed to the correct depth.


SHTS07Z070300151

(32) Insert new retaining ring (3) into its groove in valve housing.


SHTS07Z070300152

(33) Pack the end of the valve housing bore around the input shaft with clean, high temperature industrial grease, Exxon Unirex* RS460. Apply more of the grease to the inside of a new dirt and water seal (2, 2B or 2C) and install it over the input shaft. Seat the seal in the groove behind the serrations and against the valve housing.

*Trademark of Exxon Oil Corp.


SHTS07Z070300153

8. ROLLER BEARING REPLACEMENT-STEP BORE

(1) If roller bearing (37) in housing needs to be replaced, place the bearing removal end (long end) of the bearing and seal tool against the trunnion end of the bearing and press it out of the side cover end of the bearing bore. Discard bearing.

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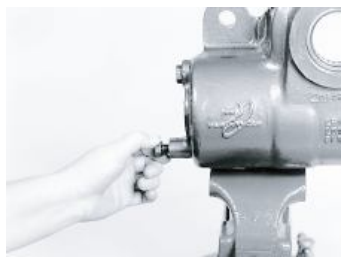
SHTS07Z070300154

(2) Press the roller bearing (37) into the housing from the side cover end of the bearing bore until it is seated against the step bore. Be sure the housing is square with the press base and the bearing is not cocked.

⚠ CAUTION
Use the bearing installation end of the tool (short end). If the bearing removal end of the bearing & seal tool is used to press in bearing, the cage on the new bearing may be damaged.

NOTICE
If the unmachined trunnion face is not square, use shims to square it before pressing in the bearing.

Return to step (30), page SR03-30.



SHTS07Z070300155

9. REPLACE HOUSING PORTS, PLUGS, SCREWS, FITTINGS

(1) If damaged, remove and replace the poppet fixed stop screw (52 or 52A) and washer (53) if equipped. Replace with poppet fixed stop screw (52A), discard the washer. Torque to **48 lbf·ft** (65 N·m).



SHTS07Z070300156

(2) If damaged, remove poppet adjusting screw (59) and sealing nut (60) without allowing the nut to change its position on the screw.

Assemble the new nut onto the new adjusting screw, matching its position to the nut and screw removed. Torque sealing nut to **35 lbf·ft** (47 N·m).

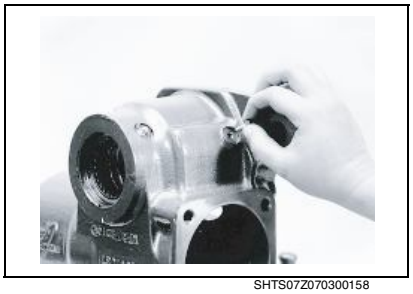


SHTS07Z070300157

(3) If damaged, remove and replace automatic bleed plug (51). Torque to **48 lbf·ft** (65 N·m).

If damaged, remove and replace permanent auxiliary port plugs (54) and o-rings (55). Assemble new o-rings (55) on port plugs and torque to their respective ports in the housing or valve housing to **30 lbf·ft** (41 N·m).

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SHTS07Z070300158

(4) If damaged, remove and replace manual bleed screw (50). Torque to **45 lbf·in.** (3.4 N·m).

Return to inspection section, page SR03-31.


SHTS07Z070300159

10. FINAL ADJUSTMENTS

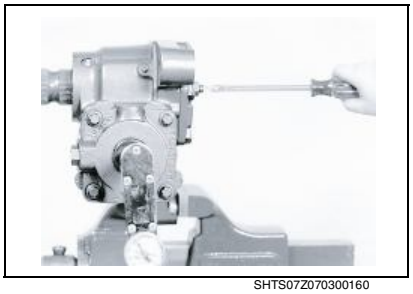
(1) To center the steering gear, rotate input shaft, valve worm assembly (13 or 13A) until the timing mark on the end of the sector shaft (42) is in line with the timing mark on the end of housing trunnion.

⚠ CAUTION

Do not rotate the input shaft more than 1.5 revolutions from center position until the steering gear is installed, during poppet setting procedure. Doing so could make the automatic poppets inoperative, which would require disassembly of steering gear to reposition poppet seat and sleeve assemblies.

NOTICE

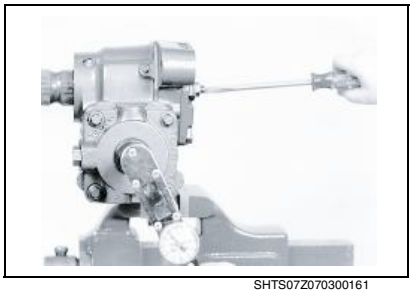
- **Initial poppet contact will occur at less than one input shaft rotation in one direction from steering gear center position, if new or reset poppet adjuster seat and sleeve assemblies are assembled in the unit.**
- **Worm preload adjustment was set when input shaft, valve and worm were assembled into valve housing.**


SHTS07Z070300160

(2) With adjusting screw jam nut (47) loose, turn sector shaft adjusting screw (43) clockwise to provide 45-50 lbf·in. (5-5.5 N·m) of torque required to rotate the input shaft, valve/worm assembly (13 or 13A) through one half turn (180°) each side of center.

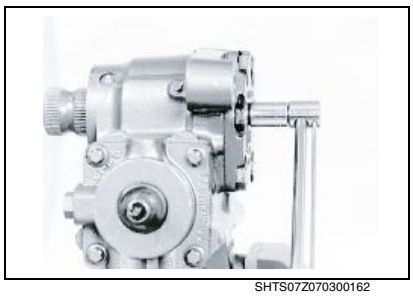
NOTICE

This procedure will properly mesh and seat the rack piston and sector shaft teeth for final adjustments.


SHTS07Z070300161

(3) Turn sector shaft adjusting screw (43) counterclock-wise one half turn and **note maximum torque** required to rotate the input shaft, valve/worm assembly through one half turn (180°) each side of center.

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SHTS07Z070300162

(4) Adjust sector shaft adjusting screw (43) clockwise **to increase** maximum torque noted in step (3) by **7 lbf·in.** (.8 N·m). Tighten jam nut (47) firmly against side cover while holding the adjusting screw in position. **Final torque jam nut to 43 lbf·ft** (58 N·m) and check input shaft, valve/worm assembly torque again. Readjust if input shaft torque exceeds 40 lbf·in. (4.5 N·m).

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POWER STEERING PUMP

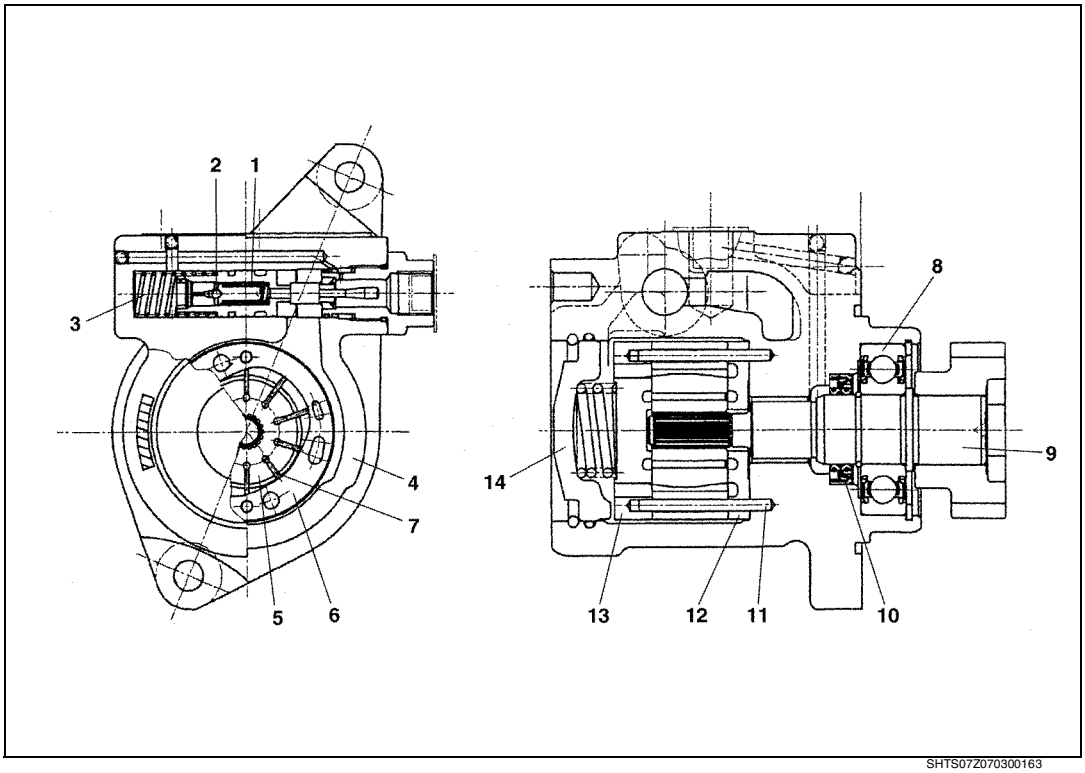
DATA AND SPECIFICATIONS

EN07Z0703I200002

Type	Vane type
Relief pressure	14.0-14.7 MPa {142.76-149.89 kgf/cm^2, 2030.54-2132.05 lbf/in^2}
Flow rate	14.9-18.9 L/min {3.94-4.99 U.S. gal}

DESCRIPTION

EN07Z0703C100004



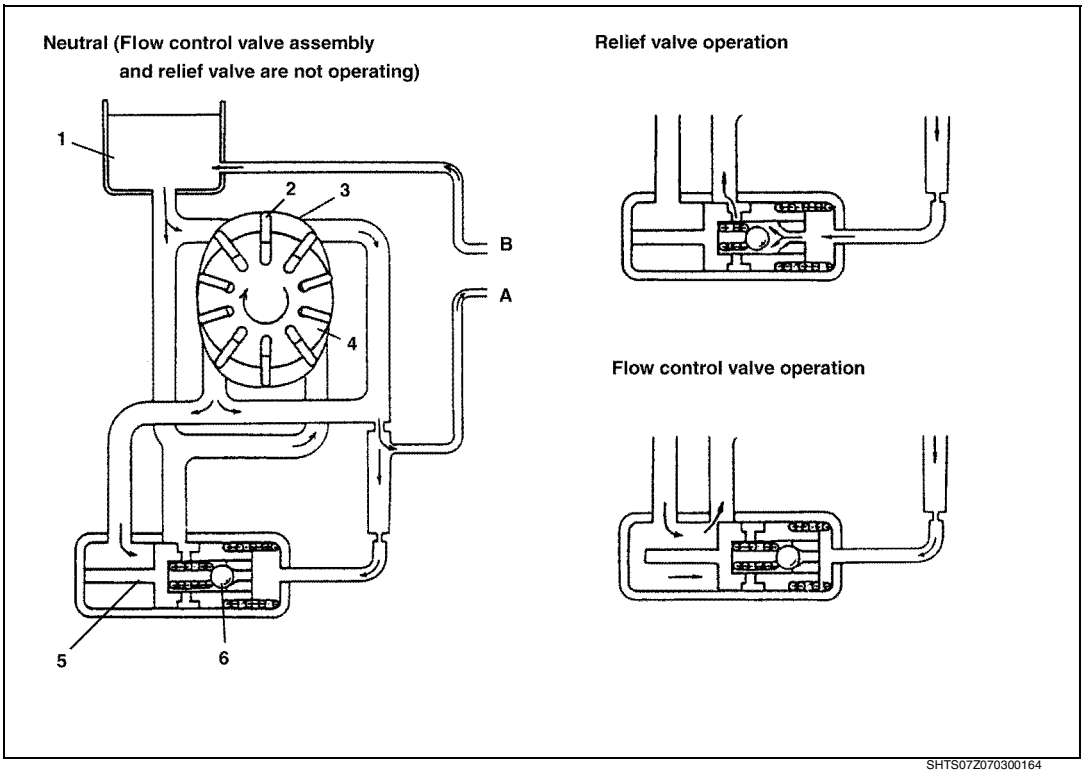
SHTS07Z070300163

1	Flow control valve assembly	8	Ball bearing
2	Relief valve	9	Pump shaft
3	Spring	10	Oil seal
4	Pump body	11	Dowel
5	Rotor	12	Front plate
6	Cam ring	13	Rear plate
7	Vane	14	Pump cover

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OPERATION

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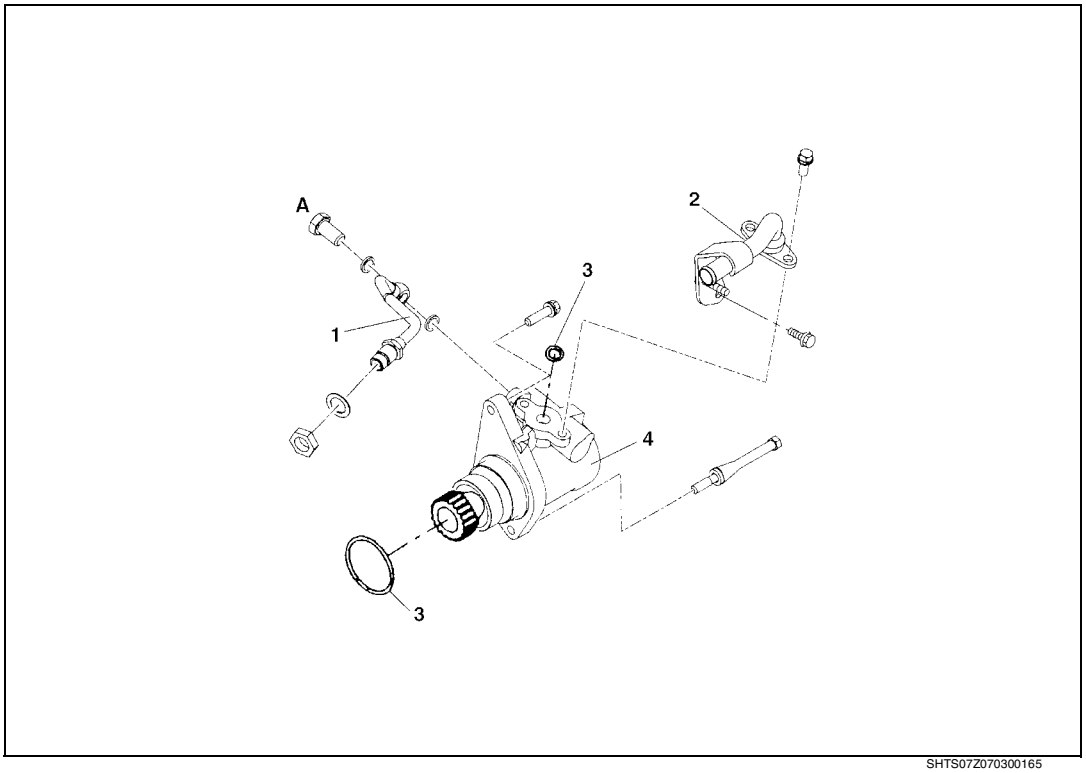
SHTS07Z070300164

1	Oil 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

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COMPONENT LOCATOR

EN07Z0703D100002



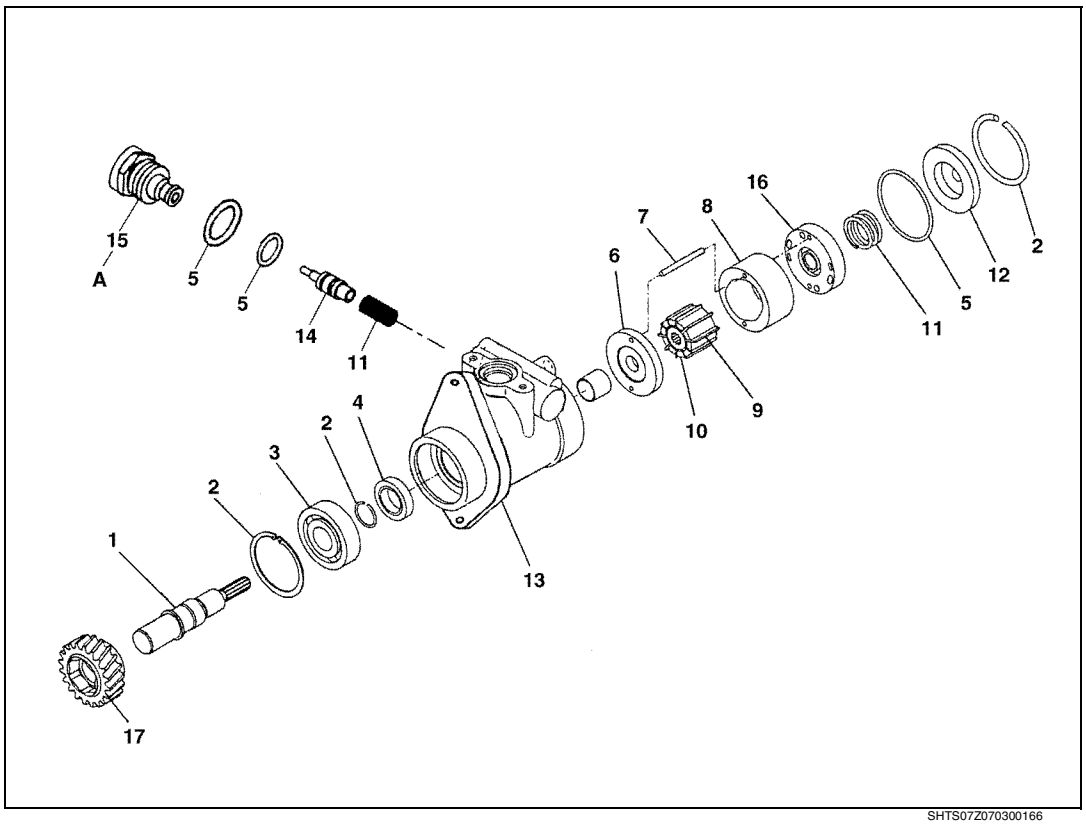
SHTS07Z070300165

1	Feed pipe	3	O-ring
2	Power steering pipe	4	Power steering pump

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

A	71-92 {724-938, 53-67}	

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SHTS07Z070300166

1	Pump shaft	10	Rotor
2	Retainer ring	11	Spring
3	Ball bearing	12	Pump cover
4	Oil seal	13	Pump body
5	O-ring	14	Flow control valve assembly
6	Front plate	15	Connector
7	Dowel	16	Rear plate
8	Cam ring	17	Drive gear
9	Vane		

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

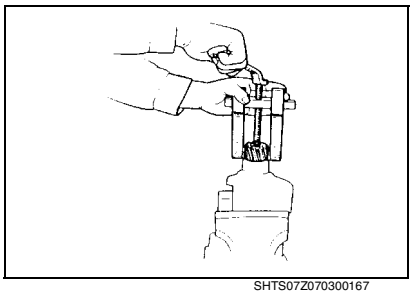
A	108-127 {1,100-1,300, 80-93}		

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OVERHAUL

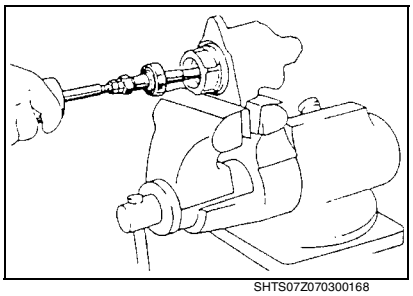
EN07Z0703H200001

IMPORTANT POINTS - DISASSEMBLY


SHTS07Z070300167

1. REMOVE THE DRIVE GEAR.
(1) Use a commercial puller to remove the drive gear.

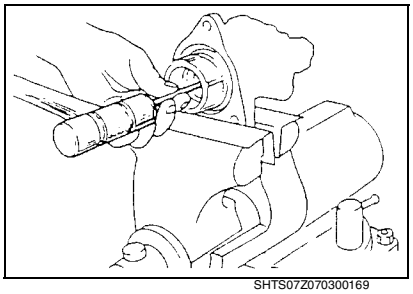
NOTICE
Do not tighten vice too tight when clamping the pump in vice.


SHTS07Z070300168

2. REMOVE THE PUMP SHAFT.
(1) Use a pair of snap ring pliers to remove the retainer ring.

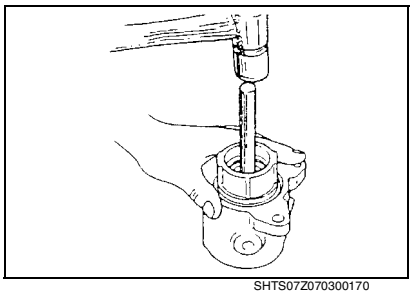
⚠ WARNING
Retainer ring in spring steel and may pop out from the groove when removing. Wear safety glasses during removal.

(2) Use a sliding hammer and adapter to remove the pump shaft with bearing.


SHTS07Z070300169

3. REMOVE THE PUMP COVER AND REAR PLATE.
(1) Remove the retainer ring.
(2) Remove the pump cover, spring, and rear plate using a plastic hammer and rod.

NOTICE
Avoid gripping the rear plate with pliers as this could mar it.

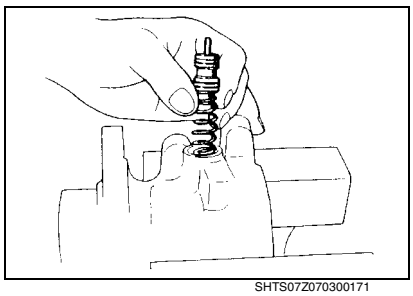

SHTS07Z070300170

4. REMOVE THE ROTOR, VANES, CAM RING, AND FRONT PLATE.
(1) Using a plastic hammer and rod, tap the rod to remove the front plate, cam ring, rotor and vanes.

NOTICE
- **Be careful to see that the cam ring, rotor, and vanes do not fall out.**
- **Avoid gripping the front plate with pliers as this could mar it.**

(2) Remove the O-ring from the pump body.

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SHTS07Z070300171

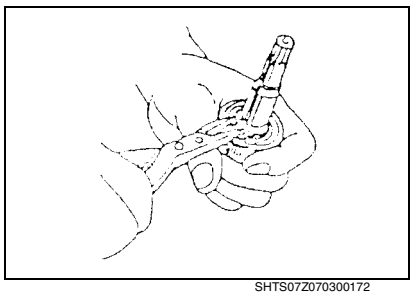
5. REMOVE THE FLOW CONTROL VALVE ASSEMBLY.

(1) Remove the connector, flow control valve assembly and spring.

NOTICE

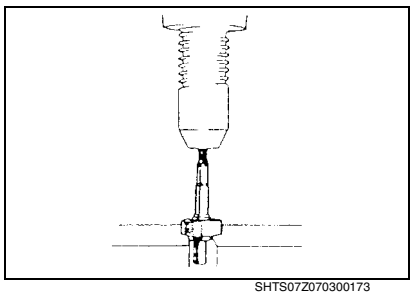
Be careful not to drop, scratch or nick the flow control valve assembly.

REPLACEMENT

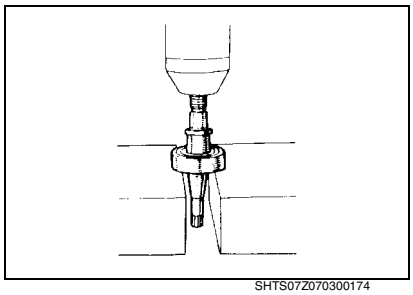

SHTS07Z070300172

1. REPLACE THE BALL BEARING, IF NECESSARY.

(1) Use a pair of snap ring pliers to remove the retainer ring.

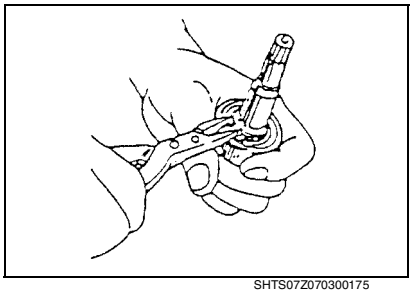

SHTS07Z070300173

(2) Using a press, press out the ball bearing.


SHTS07Z070300174

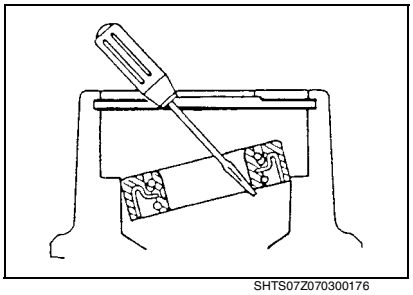
(3) Use a press to press in the ball bearing.

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SHTS07Z070300175

(4) Use a pair of snap ring pliers to install the retainer ring.



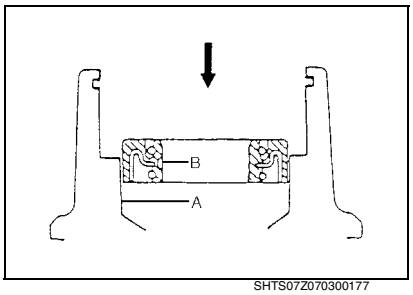
SHTS07Z070300176

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.



SHTS07Z070300177

(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.

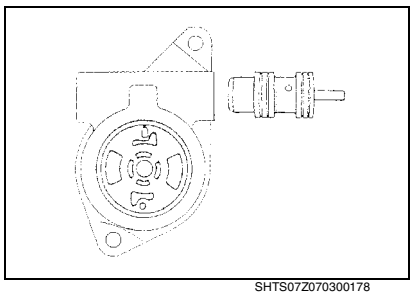
(3) Using a press, press in the oil seal into the pump body.

IMPORTANT POINTS - ASSEMBLY

NOTICE

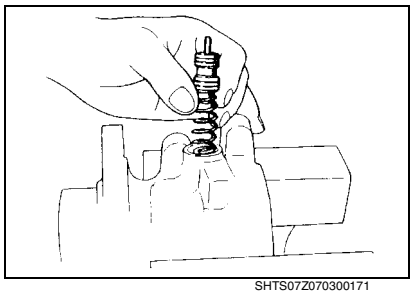
- **Before assembling, clean all the parts and lubricate them with fluid.**
- **When assembling the power steering pump, be sure to use new O-rings.**

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SHTS07Z070300178

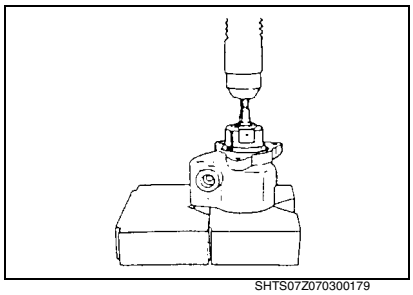
1. INSTALL THE FLOW CONTROL VALVE ASSEMBLY.

(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.


SHTS07Z070300171

(2) Install the spring, flow control valve assembly and tighten the connector.

NOTICE
Apply lithium base grease to O-ring.

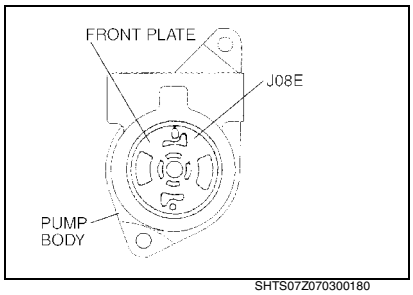

SHTS07Z070300179

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, chamfer side face toward ball bearing.

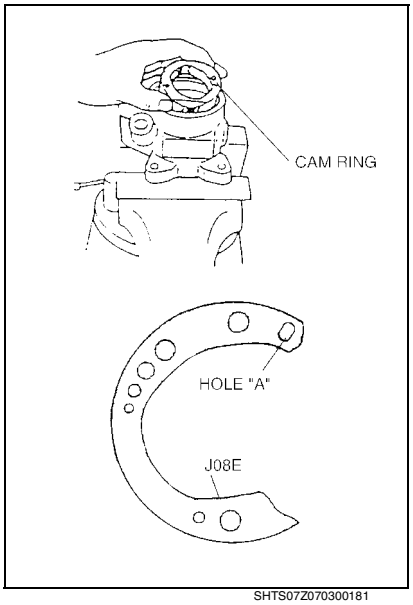


SHTS07Z070300180

3. INSTALL THE FRONT PLATE.

(1) Insert the front plate into the pump body as shown in figure.

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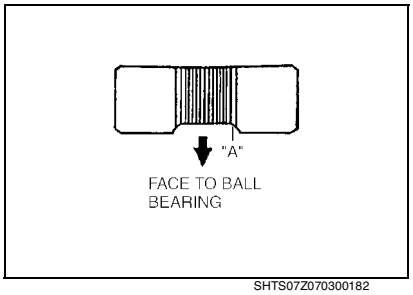
SHTS07Z070300181

4. INSTALL THE CAM RING.

(1) Insert the cam ring with hole "A" aligned with dowel.

NOTICE

At this time, make sure that the hole "A" in the side surface is positioned toward the ball bearing.

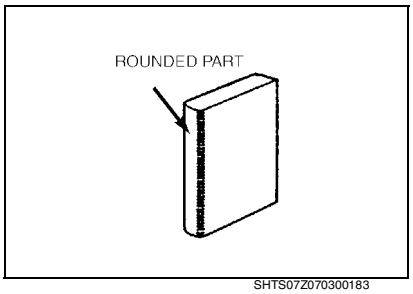


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5. INSTALL THE ROTOR AND VANE.

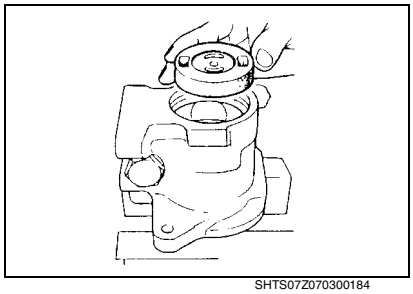
(1) Insert the rotor with the cut spline "A" side facing toward the ball bearing.

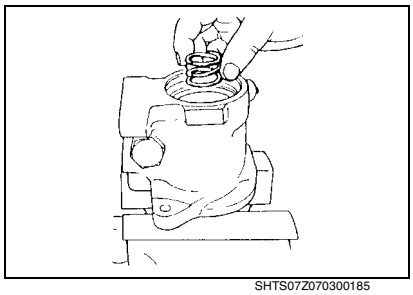
(2) Insert the vanes with the rounded part facing outward.

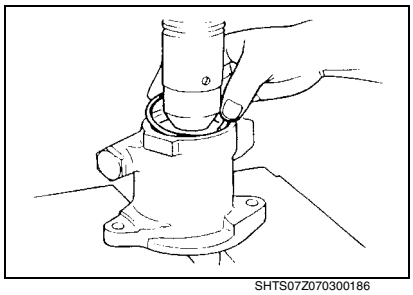


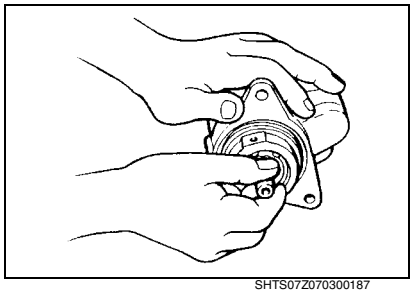
SHTS07Z070300183

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SHTS07Z070300184


SHTS07Z070300185


SHTS07Z070300186


SHTS07Z070300187

6. INSTALL THE REAR PLATE, SPRING, O-RING AND PUMP COVER.

(1) Insert the rear plate on the cam ring and put the spring on the rear plate.

(2) Insert the O-ring into the groove of the pump body.

(3) Using a press, press in the pump cover and then install the retainer ring securely.

NOTICE

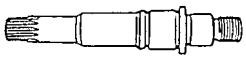
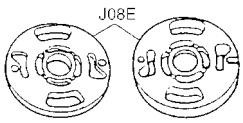
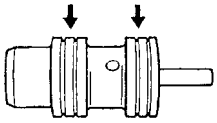
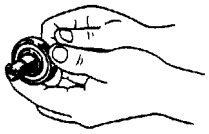
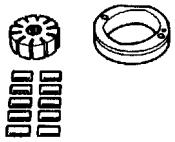
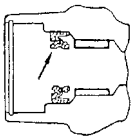
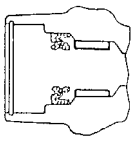
- **Be careful to see that the O-ring is not pinched by the rear cover.**
- **With the pump cover pressed in completely, fit the retainer ring to pump body.**
- **Check to see that the pump shaft rotates smoothly.**

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INSPECTION AND REPAIR

EN07Z0703H300002

Unit: mm {in.}

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** 

S1-UNAE09A-2.book 1 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

FRONT AXLE (MFS)

AX02-001

FRONT AXLE (MFS).....AX02-2
DATA AND SPECIFICATIONS AX02-2
TROUBLESHOOTING AX02-4
COMPONENT LOCATOR..... AX02-6
SERVICE NOTES AX02-10
SPECIAL TOOLS..... AX02-11
INTRODUCTION AX02-16
INSPECTION..... AX02-17
DISASSEMBLY AX02-23
PREPARE PARTS FOR ASSEMBLY AX02-30
ASSEMBLY AX02-38
ADJUSTMENT..... AX02-50
LUBRICATION AND MAINTENANCE AX02-59
MAINTENANCE..... AX02-63

S1-UNAE09A-2.book 2 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

FRONT AXLE (MFS)

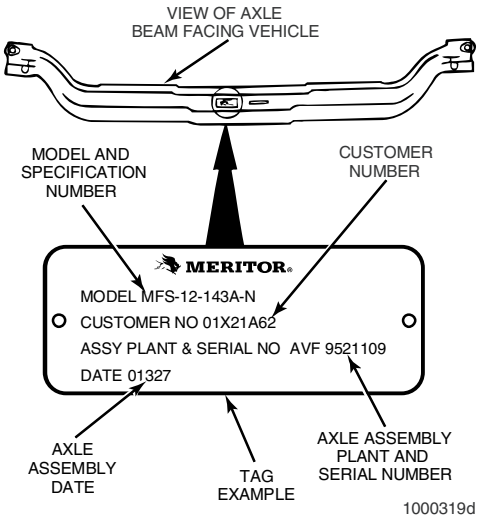
DATA AND SPECIFICATIONS

EN08Z0602I200001

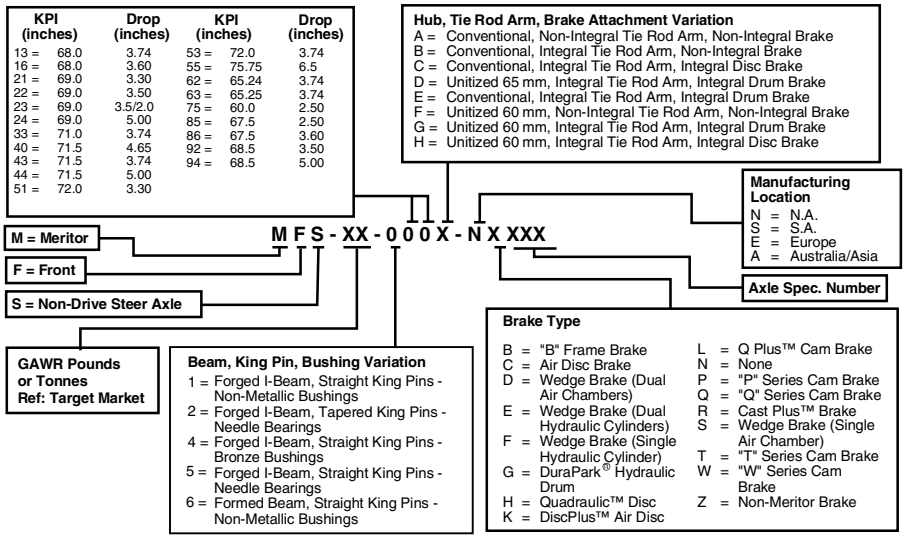
Vehicle Model			HINO 238, 258, 268 (NE8J)	HINO 268 (NE8J, NF8J)	HINO 268, 338 (NJ8J, NV8J)	HINO 338 (NF8J)	HINO 258, 338, 358 (NF8J, NJ8J, NV8J)	HINO 338, 358 (NV8J)
Front axle series No.			MFS-8	MFS-10	MFS-10	MFS-12	MFS-12	MFS-14
Axle beam type			Reversed Elliot "I" beam	Reversed Elliot "I" beam	Reversed Elliot "I" beam	Reversed Elliot "I" beam	Reversed Elliot "I" beam	Reversed Elliot "I" beam
Axle beam material			As rolled normalized steels	As rolled normalized steels	As rolled normalized steels	As rolled normalized steels	As rolled normalized steels	As rolled normalized steels
Brake disc or drum location			Inboard	Inboard	Outboard	Inboard	Outboard	Outboard
Wheel bearing			Two tapered roller bearings	Two tapered roller bearings	Two tapered roller bearings	Two tapered roller bearings	Two tapered roller bearings	Two tapered roller bearings
Lubrication of wheel bearing (Amount of grease or oil in a hub as shown, below)			Oil	Oil	Oil	Oil	Oil	Oil
King pin thrust bearing			tapered roller bearing	tapered roller bearing	tapered roller bearing	tapered roller bearing	tapered roller bearing	tapered roller bearing
Wheel alignment	Camber	(deg)	0.25	0.25	0.25	0.25	0.25	0.25
	King pin angle	(deg)	9.25	6.25	6.25	6.25	6.25	6.25
	Caster	(deg)	3.5	3.5	3.5	3.5	3.5	3.5
	Toe-in	(mm)	1.0-3.0	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5	1.5-3.5
Knuckle turning	Inner turn	(deg)	51	51	51	51	51	50
	Outer turn	(deg)	36.8	37.6	37.6	37.6	37.6	37.2

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IDENTIFICATION



SHTS08Z060200001



SHTS08Z060200002

S1-UNAE09A-2.book 4 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

TROUBLESHOOTING

EN08Z0602F300001

FRONT NON-DRIVE STEER AXLE DIAGNOSTIC TABLE

Condition	Cause	Correction
Tire wear out quickly or have uneven tire tread wear.	Tire have incorrect air pressure.	Place specified air pressure in tires.
	Tire out-of-balance.	Balance or replace tires.
	Incorrect tandem axle alignment.	Align tandem axles.
	Incorrect toe-in setting.	Adjust toe-in specified setting.
	Incorrect steering arm geometry.	Service steering system as necessary.
	Excessive wheel end play exists.	Readjust wheel bearing.
Vehicle is hard to steer.	Power steering system pressure low.	Repair power steering system.
	Steering gear linkage not assembled correctly.	Assemble steering gear correctly.
	Steering linkage needs lubrication.	Lubricate steering linkage.
	King pins binding.	Replace king pins.
	Incorrect steering arm geometry.	Service steering system as necessary.
	Caster out-of-adjustment.	Adjust caster as necessary.
	Tie rod ends hard to move.	Replace tie rod ends.
	Worn thrust bearing.	Replace thrust bearing.
Tie rod ends are worn and require replacement.	Tie rod ends require lubrication.	Lubricate ends of cross tube. Make sure lubrication schedule is followed.
	Severe operating conditions.	Increase frequency of inspection and lubrication intervals.
	Damaged boot on tie rod end.	Replace boot.

SHTS08Z060200003

S1-UNAE09A-2.book 5 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

Condition	Cause	Correction
Bent or broken cross tube, tie rod end ball stud, steering arm or tie rod end. Component requires replacement.	Too much pressure in the power steering system, pressure exceeds vehicle manufacturer's specification.	Adjust power steering system to specified pressure.
	Power steering system cut-off pressure, out of adjustment.	Adjust power steering system to specified pressure.
	Vehicle operated under severe conditions.	Verify that vehicle is operated correctly.
	Add-on type of power steering system not installed correctly.	Correctly install add-on power steering system.
	Steering gear overtravel poppets incorrectly set or malfunctioning.	Check for correct operation or adjust overtravel of poppets to vehicle manufacturer's specifications.
	Axle stops incorrectly set.	Set axle stops to vehicle manufacturer's specification.
Worn or broken steering ball stud.	Drag link fasteners tightened higher than vehicle manufacturer specified.	Tighten drag link fasteners to vehicle manufacturer's specified torque.
	Lack of lubrication or incorrect lubricant.	Lubricate linkage with specified lubricant.
	Power steering stops out-of-adjustment.	Adjust stops to specified dimension.
Worn king pins and king pin bushings.	Worn or missing seals and gaskets.	Replace seals and gaskets.
	Incorrect lubricant.	Lubricate axle with specified lubricant.
	Axle not lubricated at scheduled frequency.	Lubricate axle at scheduled frequency.
	Incorrect lubrication procedures.	Use correct lubrication procedures.
	Lubrication schedule does not match operating conditions.	Change lubrication schedule to match operating conditions.
Vibration or shimmy of front axle during operation.	Caster out-of-adjustment.	Adjust caster.
	Wheels and/or tires out-of-balance.	Balance or replace wheels and/or tires.
	Worn shock absorbers.	Replace shock absorbers.

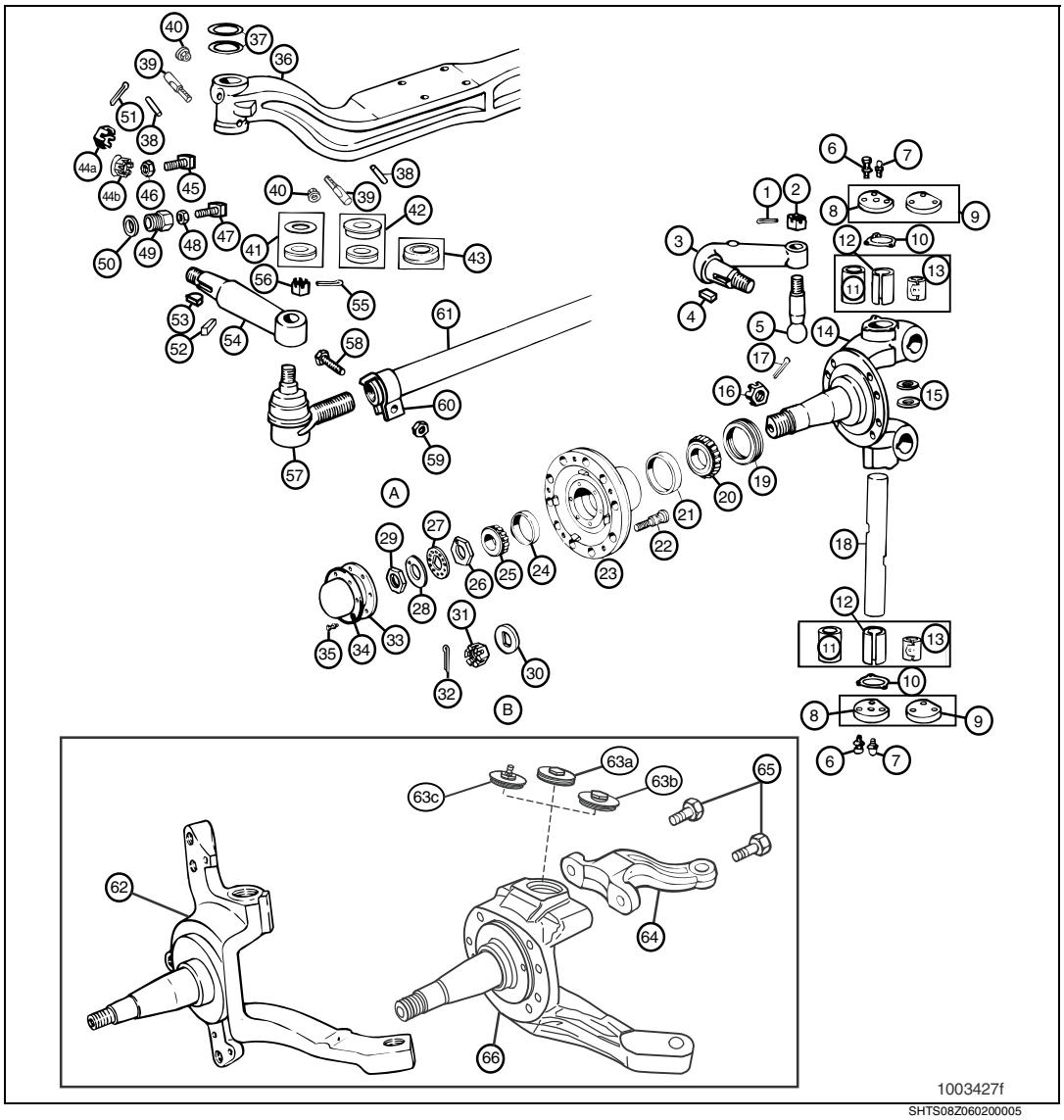
SHTS08Z060200004

S1-UNAE09A-2.book 6 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

COMPONENT LOCATOR

EN08Z0602D100001

1. AXLE WITH A CONVENTIONAL WHEEL END



SHTS08Z060200005

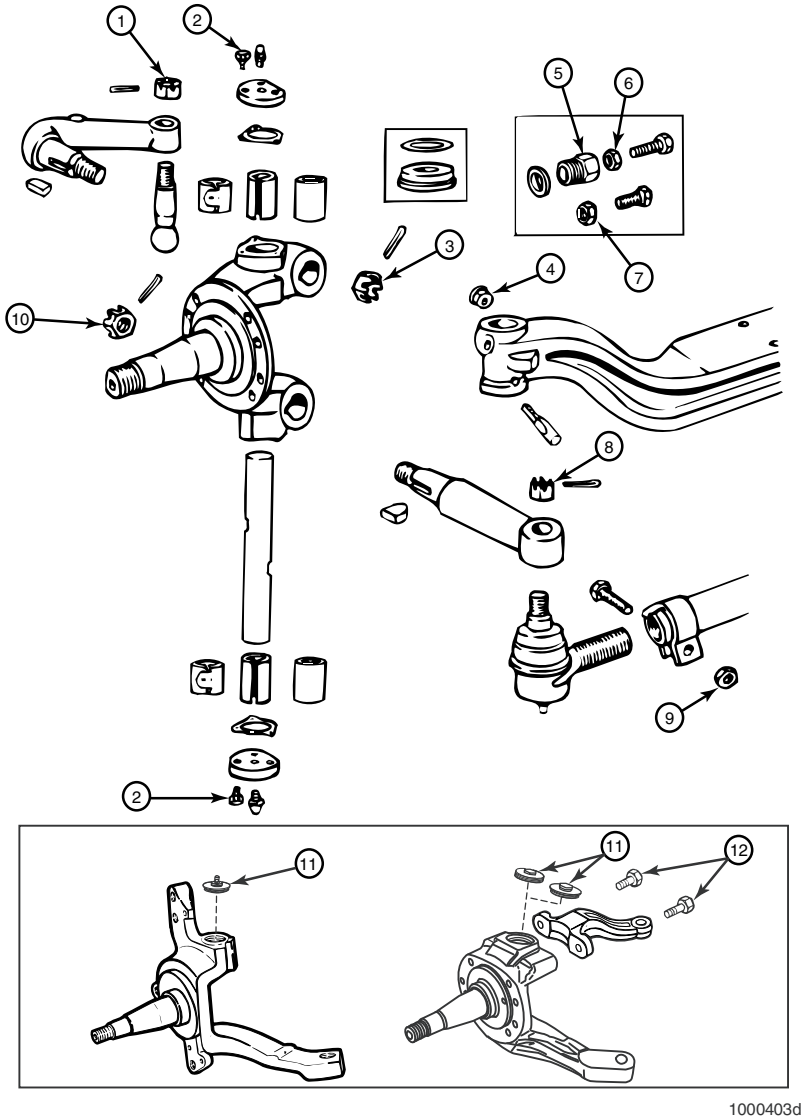
S1-UNAE09A-2.book 7 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

A	Double Nut	36	Axle Beam
B	Single Nut	37	Shims
1	Cotter Pin	38	Tapered Draw Key
2	Drag Link-to-Steering Arm Castle Nut	39	Threaded Draw Key
3	Steering Arm	40	Threaded Draw Key Nut
4	Key	41	Thrust Bearing and Flat-Type Bearing Seal
5	Ball Stud	42	Thrust Bearing and Cover-Type Bearing Seal
6	Capscrew and Washer	43	Integral Thrust Bearing and Oil Seal
7	Grease Fitting	44a	Steering Arm-to-Knuckle Castle Nut
8	Greaseable Knuckle Cap	44b	Steering Arm-to-Knuckle Castle Nut, Flared Base
9	Sealed Knuckle Cap	45	3/4-Inch Stop Bolt
10	Gasket	46	3/4-Inch Jam Nut
11	Easy Steer™ King Pin Bushing	47	1/2-Inch Stop Bolt
12	Bronze King Pin Bushing	48	1/2-Inch Jam Nut
13	Nylon King Pin Bushing	49	3/4-Inch Adapter
14	Knuckle	50	Washer
15	King Pin Bushing Seal	51	Cotter Pin
16	Tie Rod Arm-to-Knuckle Castle Nut	52	Square Key
17	Cotter Pin	53	Woodruff Key
18	King Pin	54	Knuckle Tie Rod Arm
19	Hub Grease Seal	55	Cotter Pin
20	Inner Wheel Bearing Cone	56	Tie Rod Arm-to-Tie Rod End Castle Nut
21	Inner Wheel Bearing Cup	57	Tie Rod End
22	Wheel Bolt	58	Clamp Bolt
23	Hub	59	Clamp Lock Nut
24	Outer Wheel Bearing Cup	60	Cross Tube Clamp
25	Outer Wheel Bearing Cone	61	Cross Tube
26	Adjusting Nut	62	Knuckle with Integral Tie Rod Arm and Torque Plate
27	Pierced Lock Ring	63a	Old Style Threaded Knuckle Cap
28	Lock Washer	63b	New Style Threaded Knuckle Cap
29	Wheel Bearing Nut	63c	Round Threaded Knuckle Cap
30	"D" Washer	64	Bolt-On Steering Arm
31	Adjusting Nut	65	Steering Arm Capscrew
32	Cotter Pin	66	Knuckle with Integral Tie Rod Arm
33	Gasket		
34	Hubcap		
35	Capscrew and Washer		

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2. TORQUE SPECIFICATIONS

Front Non-Drive Axles with Conventional Wheel Ends



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Front Axle with Conventional Wheel-End Torque Specifications

Item	Description	Size	Torque Range lb-ft	Torque Range N·m
1	Steering Arm-to-Drag Link Nut	Refer to the vehicle manufacturer's specification		
2	Knuckle Cap Capscrew	5/16"-18	20-30	28-40
3	Steering Arm-to-Knuckle Nut	7/8"-14	250-450	339-610
		1"-14	390-725	529-982
		1-1/8"-12	550-1025	746-1389
		1-1/4"-12	775-1450	1051-1965
		1-1/2"-12	1350-2525	1831-3423
4	Draw Key Nut	7/16"-20	30-45	41-61
5	3/4" Stop Screw Adapter		65-115	88-155
6	1/2" Stop Screw Lock/Jam Nut		50-75	68-101
7	3/4" Stop Screw Lock/Jam Nut		65-85	88-115
8	Tie Rod Arm-to-Tie Rod End Nut	7/8"-14	160-300	217-406
		1"-14	250-450	339-610
		1-1/8"-12	350-650	475-881
		1-1/4"-12	500-675	678-915
9	Cross Tube Clamp Nut	5/8"-11	40-60	55-81
		3/4"-10	155-175	211-237
10	Tie Rod Arm-to-Knuckle Nut	7/8"-14	250-450	339-610
		1"-14	390-725	529-982
		1-1/8"-12	550-1025	746-1389
		1-1/4"-12	775-1450	1051-1965
		1-1/2"-12	1350-2525	1831-3423
11	Threaded Knuckle Cap	2.00"-20	70-90	95-122
		1-5/8"-20		
12	Steering Arm Knuckle Bolt	3/4"-16	360-470	490-638
		M16 x2.0	215-265	290-360

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SERVICE NOTES

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BEFORE YOU BEGIN

1. Read and understand all instructions and procedures before you begin to service components.
2. Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.
3. Follow your company's maintenance and service, installation, and diagnostics guidelines.
4. Use special tools when required to help avoid serious personal injury and damage to components.

1. HAZARD ALERT MESSAGES AND TORQUE SYMBOLS

⚠ WARNING
A Warning alerts you to an instruction or procedure that you must follow exactly to avoid serious personal injury and damage to components.

⚠ CAUTION
A Caution alerts you to an instruction or procedure that you must follow exactly to avoid damage to components.

2. OBTAIN ADDITIONAL MAINTENANCE AND SERVICE INFORMATION

(1) On the Web
Visit Literature on Demand at arvinmeritor.com to access product, service, aftermarket, and warranty literature for ArvinMeritor's truck, trailer and specialty vehicle components.

3. OBTAIN TOOLS AND SUPPLIES SPECIFIED IN THIS MANUAL

Call ArvinMeritor's Commercial Vehicle Aftermarket at 888-725-9355 to obtain Meritor tools and supplies.

SPX Kent-Moore, 28635 Mound Road, Warren, Michigan, 48092. Call the company's customer service center at 800-345-2233, or visit their website at spxkentmoore.com.

Tiger Tools. Call the company's customer service center at 800-661-4661, or visit their website at tigertool.com.

For Owatonna Tools, contact OTC Tool and Equipment Division, 655 Eisenhower Drive, Owatonna, Minnesota, 55060.

Great Lakes Tool Specialties, 8530 M-89, Richland, Michigan, 49083. Call the company's customer service center at 800-877-9618 or 616-629-9628.

For Snap-On® tools, contact your local Snap-On® dealer.

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SPECIAL TOOLS

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To obtain these tools, refer to the Service Notes on page AX02-10.

Table U: Special Tools

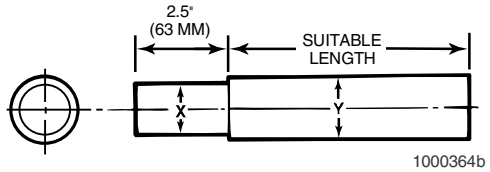
Description	SPX Kent-Moore Tool Number	Owatonna Tool Number	Snap-On® Tool Number	Great Lakes Tool	References
King Pin Remover	4240	4240	20 Ton: CG430HYB 35 Ton: CG730HY	-	Draw Keys, King Pin Caps, King Pins and Steering Knuckle on page AX02-25
King Pin Bushing Service Kit	[1]				King Pin Bushings on page AX02-29 King Pin Bushings on page AX02-38
Basic Service Kit	PT 4375-A	-	-	-	
FC and MFS-7 and -8	PT-4370-120	-	-	-	
Seal Installer	-	-	-	Meritor Front Axle Seal Installer Kit	Inner Knuckle Bore King Pin Seals on page AX02-41

[1] Use the Basic Service Kit along with the correct axle series kit.

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1. DIMENSIONS FOR BUSHING REMOVAL AND INSTALLATION TOOL

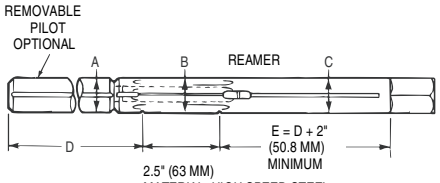


1000364b

Axle Model Number	Dimension X (± 0.001-inch)	(± 0.025 mm)	Dimension Y (± 0.001-inch)	(± 0.025 mm)
MFS8	1.493	37.922	1.618	41.097
MFS 10				
MFS 12	1.786	45.364	1.911	48.539
MFS 14				

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2. BUSHING REAMER DIMENSIONS



MATERIAL: HIGH SPEED STEEL
NUMBER OF BLADES: USE 10-14 BLADES
CUT OF BLADES: RIGHT-HAND CUT,
LEFT-HAND FLUTE
LENGTH OF BLADES: 2.50" (63.5 MM)

1000049d

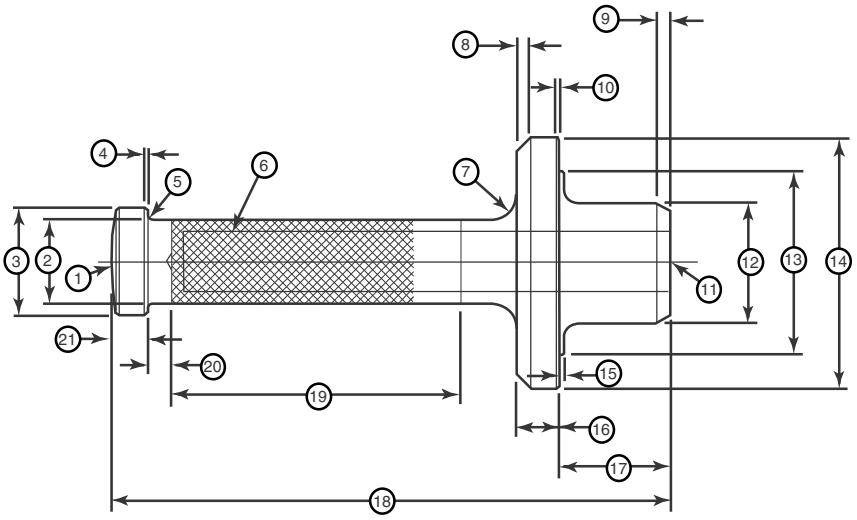
	Lower Pilot Diameter Dimension A (± 0.001-inch or ± 0.0245 mm)		Blade Diameter Dimension B (± 0.0005-inch or ± 0.0127 mm)		Upper Pilot Diameter C (± 0.001-inch or ± 0.0245 mm)		Lower Pilot Length Dimension D		Upper Pilot Length Minimum Dimension E	
Axle Model	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
MFS 8	1.4875	37.7825	1.5015	38.1381	1.4960	37.9984	8.90	226.06	10.90	276.86
MFS 10	1.7800	45.2120	1.7955	45.6057	1.7900	45.4660	10.25	260.35	12.25	311.15
MFS 12										
MFS 14	1.7800	45.2120	1.7955	45.6057	1.7900	45.4660	10.25	260.35	12.25	311.15

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3. WHEEL-END SEAL DRIVER APPLICATION CHART

(1) MFS-8 AXLE



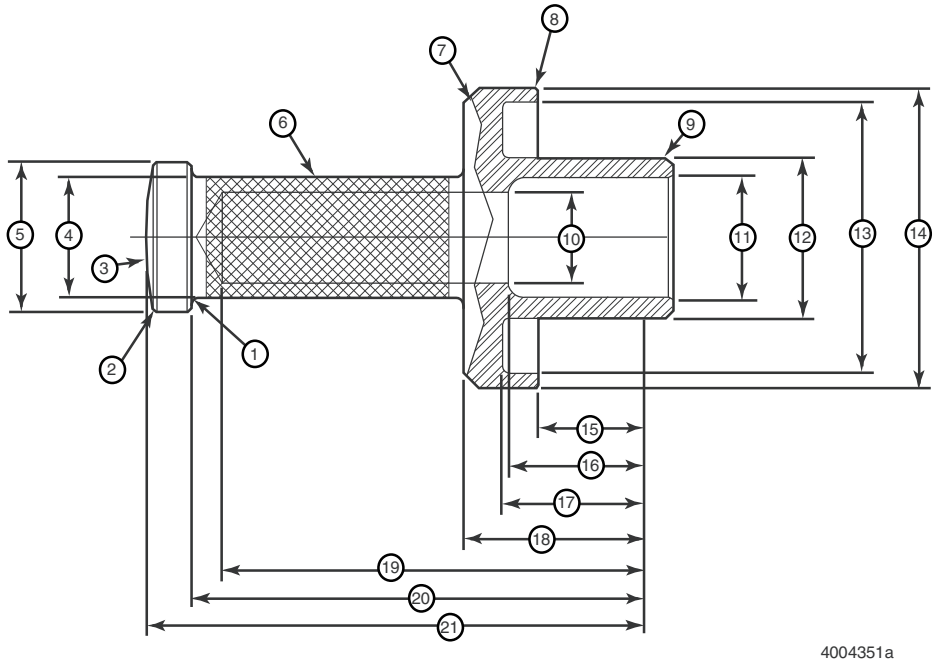
4004353a

1	0.75” (19.1 MM)	7	R 0.5” (12.7 MM)	13	3.29” (83.57 MM)	18	2” (50.8 MM)
2	1.5” (38.1 MM) DIAMETER	8	0.25” (6.35 MM) X 45˚ TYP	14	4.5” (114 MM)	19	10” (254 MM)
3	2” (50.8 MM) DIAMETER	9	0.25” (6.35 MM) X 60˚	15	R 0.25” (6.35 MM)	20	5” (127 MM)
4	0.06”(1.52 MM) X 45˚ TYP	10	0.03” (0.76 MM) X 45˚	16	0.1” (2.54 MM)	21	0.5” (12.7 MM)
5	R 0.13” (3.3 MM)	11	1” (25 MM) DIAMETER-8.5” (216 MM) DEEP	17	0.75” (19.1 MM)	22	6” (152.4 MM) SPHERE RADIUS
6	COARSE KNURL	12	2.16” (54.8 MM) DIAMETER				

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(2) MFS-10 AXLE



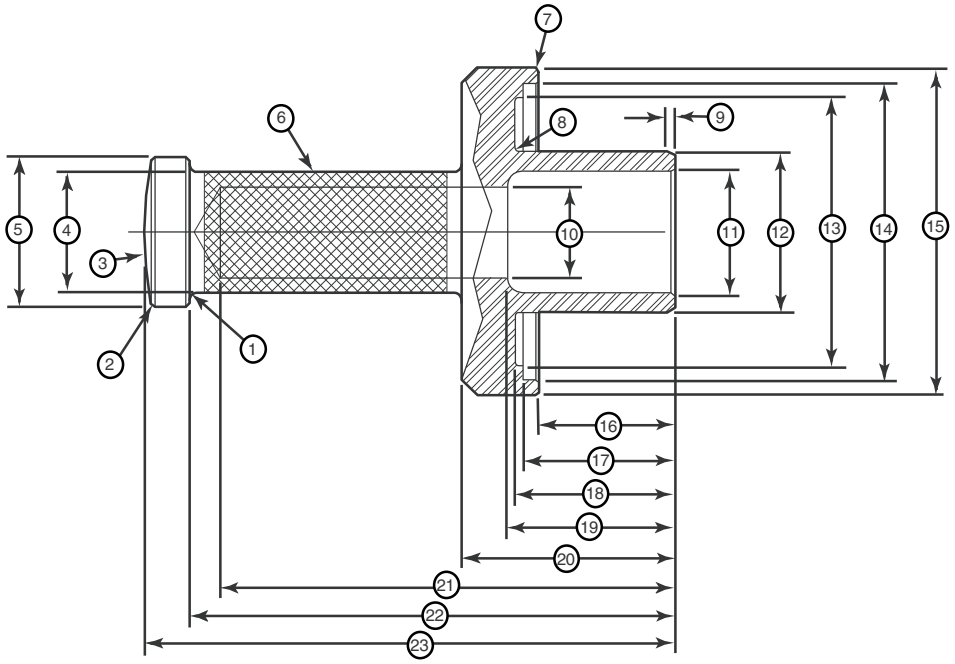
4004351a

1	0.13” (3.3 MM) RADIUS (2)	7	0.25” (6.35 MM) X 45° CHAMFER	12	2.62/2.622” (66.55/66.6 MM) DIAMETER	17	2.85” (72.4 MM)
2	0.6” (1.52 MM) X 45 CHAMFER (2)	8	0.03” (0.76 MM) X 45° CHAMFER (2)			18	3.5” (88.9 MM)
3	6” (152.4 MM) SPHERE RADIUS ± 0.25. (6.35 MM)	9	0.12” (3.05 MM) X 0.13” (3.3 MM) CHAMFER	13	4.5” (114 MM) DIAMETER	19	7.5” (190.5 MM)
4	2” (50.8 MM) DIAMETER	10	1.5” (38.1 MM) DIAMETER	14	5” (127 MM) DIAMETER	20	8” (203.2 MM)
5	2.5” (63.5 MM) DIAMETER	11	2” (50.8 MM)	15	2.25” (57.2 MM)	21	8.75” (222.25 MM)
6	COARSE KNURL			16	2.75” (69.9 MM)		

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(3) MFS-12 AXLE



1	0.13” (3.3 MM) RADIUS (2)	8	0.06” (1.52 MM) R-2PLS	14	4.4” (111.76 MM) DIAMETER	20	2.62” (69.85 MM)
2	0.06” (1.52 MM) X 45˚ CHAMFER (2)	9	0.12” (3.05 MM) X 30˚	15	4.865” (123.57 MM) DIAMETER	21	2.75” (69.85 MM)
3	6” (152.4 MM) SPHERE RADIUS ^2.5	10	0.25” (6.35 MM) R	16	5.38” (136.65 MM) DIAMETER	22	3.5” (88.9 MM)
4	2” (50.8 MM)	11	1.5” (38.1 MM) DIAMETER	17	0.03” (0.76 MM) R. MAX.	23	7.5” (190.5 MM)
5	2.5” (63.5 MM) DIAMETER	12	2” (50.8 MM) DIAMETER	18	2.25” (57.15 MM)	24	8” (203.2 MM)
6	COARSE KNURL	13	2.60/2.622” (66.55/66.6 MM) DIAMETER	19	2.5” (63.5 MM)	25	8.75” (222.25 MM)
7	0.03” (0.76 MM) X 45˚ CHAMFER (2)						

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INTRODUCTION

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1. HAZARD ALERT MESSAGES

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

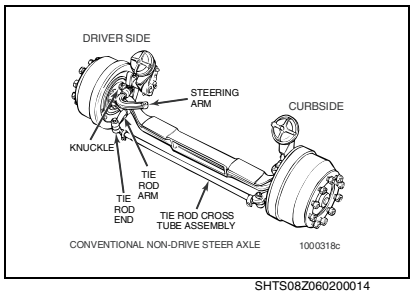
⚠ WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

2. DESCRIPTION

The descriptions and procedures contained in this maintenance manual are applicable to all Meritor front non-drive steer axles.

Meritor front non-drive steer axles in this manual feature the following components.



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3. TIE ROD ARM, KNUCKLE AND KING PIN

The right tie rod arm is a mirror image of the left, and they are linked by the cross tube assembly. An integral tie rod design is used on Easy Steer Plus™ and MFS axles.

The right knuckle and king pin assembly is similar to the left, except that it does not have a steering arm attached to it as in a manual steering system.

A power steering system requires a steering arm in various applications for attachment of the auxiliary assist cylinder to the right knuckle.

4. STEERING KNUCKLE

Steering knuckles are rated according to the capacity of the front axle. All models use straight king pins. Three types of king pin bushings are used: nylon, bronze and Easy Steer™.

The brake spider has been combined into the knuckle of the Easy Steer Plus™ axle.

5. STEERING ARMS

The steering arm, usually a forged component, converts the drag link force into a turning movement through the left king pin and the knuckle. Bolt-on steering arms are used on Easy Steer Plus™ and MFS modular axles.

6. PITMAN ARM

The Pitman arm converts the output torque from the steering gear into the control force applied to the drag link. This linkage component connects the steering gear to the linkage at the center link end.

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INSPECTION

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HAZARD ALERT MESSAGES

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

⚠ WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

Replace damaged or out-of-specification axle components. Do not bend, repair or recondition axle components by welding or heat-treating. A bent axle beam reduces axle strength, affects vehicle operation and voids Meritor's warranty. Serious personal injury and damage to components can result.

Before inspecting axle components, verify that the correct tools are available. Using the correct tools will ensure safety and provide the most accurate results.

- Dial indicator
- Tire blocks
- Jack
- Safety stands
- Pry bar
- Torque wrench

1. RECOMMENDATION

Meritor believes that the wheel attachment clamp joint must be carefully maintained with:

- Correct hardware.
- Clean, flat, uncontaminated mounting surfaces.
- Correct nut torquing and retorquing practices.

Meritor believes that installing a wheel separator plate may make it more difficult to ensure correct wheel clamp with use over time. Refer to the wheel separator plate manufacturer's recommended wheel stud nut torque maintenance practices.

Meritor further believes that the use of more than one wheel separator plate in a wheel end is inappropriate and that a wheel separator plate should never be installed between the hub and the drum. This practice is expressly prohibited with Meritor axle models MFS-12, FF-981, FF-982, FF-983, FF-984, FF-986 and FF-987.

Therefore, Meritor recommends that vehicle owners who install and use wheel separator plates should also increase the frequency of their wheel-end maintenance, consistent with wheel separator plate manufacturer's recommended practices, so they are confident that the intended wheel attachment clamp integrity is maintained.

In addition, Meritor recommends that the users of wheel separator plates should contact the wheel separator plate manufacturers to obtain recommendations and approval for any special application or

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more demanding environments (i.e., use at elevated temperature ranges or frequent stop-start cycling) which may also potentially affect the integrity of the wheel attachment system.

2. INSPECT PARTS

(1) Fasteners
   a. Verify that all fasteners are tightened to the specified torque.
   b. Use a torque wrench to check the torque. As soon as the fastener starts to move, record the torque. Correct if necessary.
   c. Replace any worn or damaged fasteners.

(2) Wear and Damage
Inspect the parts of the axle for wear and damage. Look for bent or cracked parts. Replace all worn or damaged parts.

(3) Pivot Points
Verify that pivot points are not loose. Verify that the pivot points are lubricated.

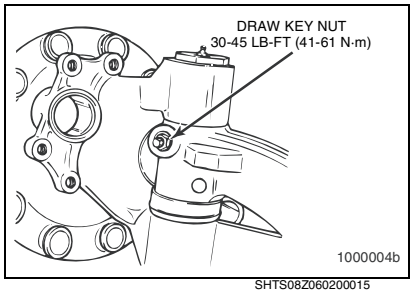
(4) Operation
Verify that all the parts move smoothly through the complete turning radius.

(5) Tire Wear
Inspect the tires for wear patterns that indicate suspension damage or misalignment. Correct if necessary.

(6) Steering Arm Bolts
Check the torque on all bolt-on steering arm bolts every 200,000 miles (320,000 km).

(7) Draw Key Nuts
On axles with either conventional or unitized wheel ends, tighten the draw key nuts to 30-45 lb-ft (41-61 N·m) at the following intervals.

- After the first 6,000 miles (10,000 km) of new vehicle operation
- Every 36,000 miles (58,000 km) of operation



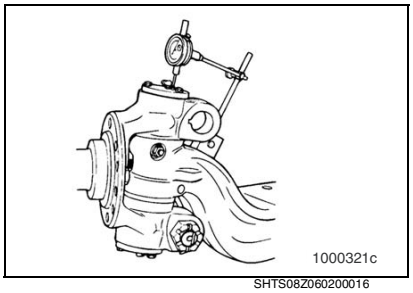
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3. STEERING KNUCKLE VERTICAL END PLAY

End Play Specifications

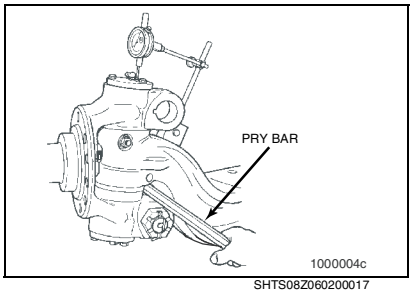
New or Rebuilt Axles	**0.001-0.010 inch (0.025-0.254 mm)**
In-Service Axles	**0.001-0.030 inch (0.025-0.762 mm)**



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(1) Axles with Conventional Wheel Ends

a. Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Set the parking brake.
b. Use a jack to raise the vehicle until the front wheels are off the ground. Support the front axle with safety stands.
c. Install a dial indicator with the base on the I-beam and the tip on the top knuckle cap.



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d. Place a pry bar between the boss for the tie rod arm and the I-beam. Push the knuckle to the BOTTOM of vertical travel.
e. Set the dial indicator on ZERO.
f. Use the pry bar to push the knuckle UPWARD. Record the reading on the dial indicator.

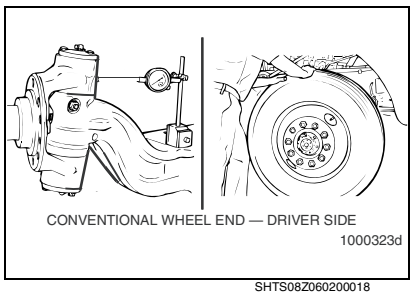
- **If the reading is ZERO:** Remove the knuckle. Refer to "Draw Keys, King Pin Caps, King Pins and Steering Knuckle" on page AX02-25. Remove the shims from the shim pack. Refer to "Knuckle to the Axle Beam" on page AX02-42.
- **If the reading is more than the correct end play:** Remove the knuckle. Refer to "Draw Keys, King Pin Caps, King Pins and Steering Knuckle" on page AX02-25. Add shims to the shim pack. Refer to "Knuckle to the Axle Beam" on page AX02-42.

4. UPPER AND LOWER KING PIN BUSHINGS

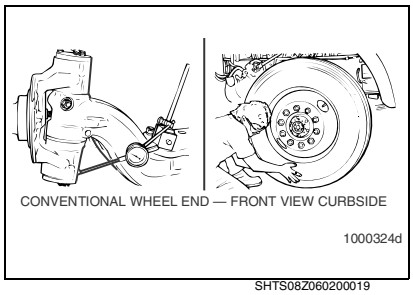
(1) Wheel-to-Hub Mounting
To help determine the cause of movement and looseness, first check the wheel-to-hub mounting.
a. Verify that the wheel is mounted correctly and all wheel-end fasteners and hardware are tightened to the correct specification.
b. Apply the service brake to lock the hub and spindle together.

- **If movement is detected:** The king pin or king pin bushings should be inspected. Refer to the procedure below.
- **If applying the service brake eliminates the movement:** Proceed to "Unitized Wheel Ends", "Detailed Inspection" to determine the unitized wheel-end hub end play.

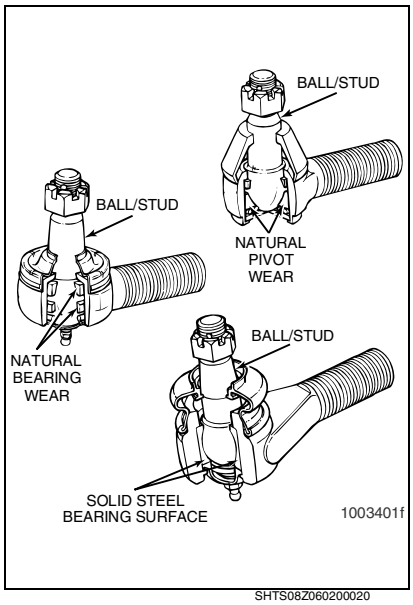
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(2) Axles with Conventional and Unitized Wheel Ends

a. Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Set the parking brake.
b. Use a jack to raise the vehicle until the wheels are off the ground. Support the vehicle with safety stands.
c. Check the upper king pin bushing for wear. Install a dial indicator with the base on the I-beam and the tip against the side of the top of the knuckle.
d. Set the dial indicator to ZERO.
e. Move the top of the tire side-to-side TOWARD and AWAY from the vehicle.

- **If the dial indicator moves a total of 0.010-inch (0.254 mm):** The upper bushing is worn or damaged. Replace both bushings in the knuckle. Refer to "King Pin Bushings" on page AX02-29, "Inspection" on page AX02-34 and "King Pin Bushings" on page AX02-38.

f. Check the lower king pin bushing. Install a dial indicator so that the base is on the I-beam and that the tip is against the side of the bottom of the knuckle.
g. Set the dial indicator to ZERO.
h. Move the bottom of the tire side-to-side TOWARD and AWAY from the vehicle.

- **If the dial indicator moves a total of 0.010-inch (0.254 mm):** The lower bushing is worn or damaged. Replace both bushings in the knuckle. Refer to "King Pin Bushings" on page AX02-29, "Inspection" on page AX02-34 and "King Pin Bushings" on page AX02-38.

5. TIE ROD AND CROSS TUBE ASSEMBLY

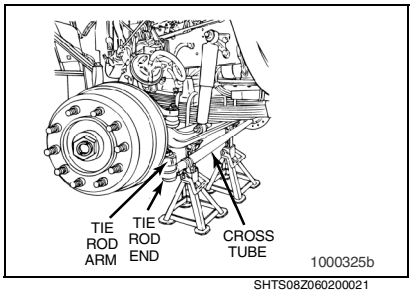
NOTICE

Do not grease the tie rod assembly before you perform the inspection.

You may not be able to detect loose or worn tie rod ends during operation. Under normal operating conditions, wear occurs over time. The preload bearings inside each tie rod end provide less resistance, which can affect steering control, front tire wear and other axle components.

Regularly-scheduled inspection and maintenance helps to minimize the effects of tie rod end wear on the vehicle.

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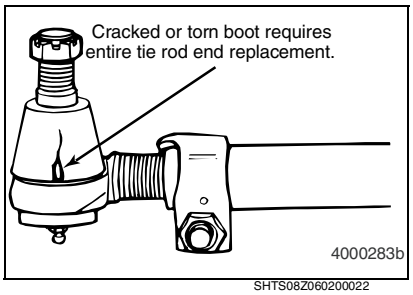


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(1) Park the vehicle on a level surface with the wheels STRAIGHT. Block the wheels to prevent the vehicle from moving. Set the parking brake.

(2) Raise the vehicle so that the front wheels are off the ground. Support the vehicle with safety stands. Do not use a jack to support the vehicle.

(3) With the engine off, turn the wheels from full left to full right. Return to the straight-ahead position. This step will require more force for vehicles with the power steering off.

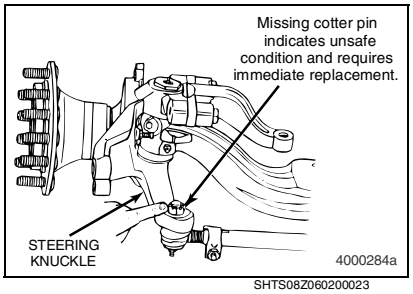


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(4) Check the tie rod boot for cracks, tears or other damage. Also check the boot seals for damage. Replace the entire tie rod end if the boot is damaged or missing.

⚠ WARNING

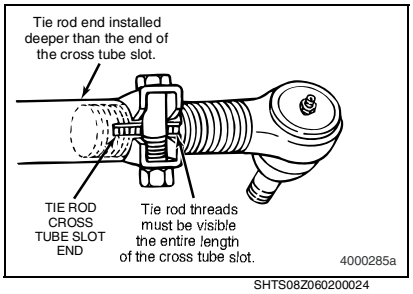
Verify that a cotter pin is installed through the tie rod end, and the tie rod end nut is tightened to the correct torque specification. Replace a missing cotter pin and tighten a loose tie rod end nut. A missing cotter pin or loose tie rod end nut can cause loss of steering control. Serious personal injury and damage to components can result.



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(5) Check that the tie rod nut is installed and secured with a cotter pin.

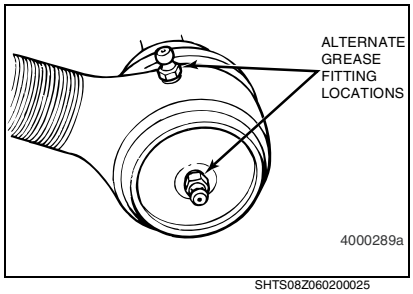
- **If the cotter pin is missing:** Tighten the tie rod end nut to the correct specification. Install a new cotter pin. Always tighten the tie rod nut to the specified torque when setting the cotter pin. Refer to page AX02-8. Do not back-off the nut to insert the cotter pin.



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(6) Check that the tie rod end is threaded correctly into the cross tube and installed deeper than the end of the cross tube slot. The tie rod end must be visible the entire length of the cross tube slot.

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(7) Check that the grease fittings are installed. Replace a damaged grease fitting.

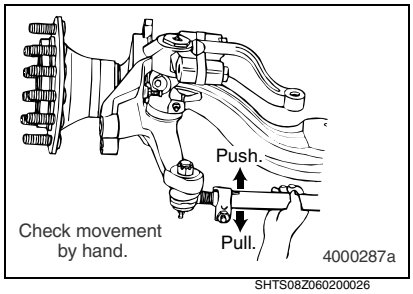
- **If the tie rod ends are non-greaseable:** Do not install a grease fitting.

(8) By hand or using a pipe wrench with jaw protectors to avoid gouging the cross tube, rotate the cross tube toward the FRONT of the vehicle and then toward the REAR. After rotating, center the cross tube between the stop positions.

- **If the cross tube will not rotate in either direction:** Replace both tie rod ends.

(9) Position yourself directly below the ball stud socket. Using both hands, grasp the assembly end as close to the socket as possible, no more than 6-inches (152.4 mm) from the end.

⚠ CAUTION
Only use your hands to check for movement or looseness of the tie rod assembly. Do not use a crow bar, pickle fork or two-by-four. Do not apply pressure or force to tie rod assembly ends or joints. Do not rock the tires with the vehicle on the ground or with the wheels raised. Damage to components can result.

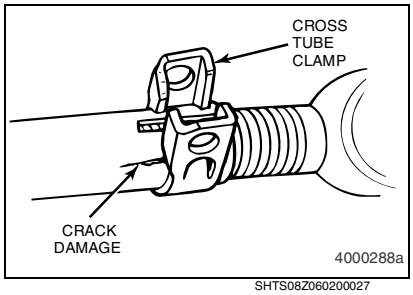


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(10) Apply hand pressure of approximately 100 pounds in a vertical PUSH and PULL motion several times. Check for any movement or looseness at both tie rod ends.

- **If there is any movement in the tie rod assembly:** Replace both tie rod ends.

⚠ CAUTION
Replace bent or damaged cross tubes with original equipment parts of the same length, diameter and threads. Do not attempt to straighten a bent cross tube. Damage to components can result.



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(11) Inspect the cross tube and clamps for damage.

- **If the cross tube is bent or cracked:** Replace it. Use original equipment parts of the same length, diameter and threads.
- **If the clamps are damaged:** Replace them.
- **If either clamp has become welded to the cross tube:** Replace the entire cross tube assembly. Use original equipment parts of the same length, diameter and threads.

6. DEPARTMENT OF TRANSPORTATION ROADSIDE TIE ROD ASSEMBLY REPLACEMENT CRITERIA

When the roadside check indicates tie rod movement of 1/8-inch (3 mm) or more, immediately remove the vehicle from service to replace the tie rod.

- **If the roadside check is less than 1/8-inch (3 mm) tie rod end movement:** The vehicle does not need to be immediately removed from a service run. Schedule a major out-of-service inspection and maintenance as soon as possible.

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DISASSEMBLY

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HAZARD ALERT MESSAGES

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

⚠ WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

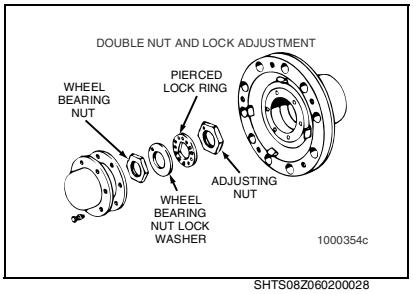
Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

REMOVAL

1. WHEEL ENDS

(1) Axles with conventional wheel ends.
   a. Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Set the parking brake.
   b. Raise the front of the vehicle until the front wheels are off the floor. Support the vehicle with safety stands.
   c. Use the correct size socket to remove the capscrews that fasten the cap to the hub. Remove the cap and the gasket.
   d. Remove the fasteners for the wheel bearings.



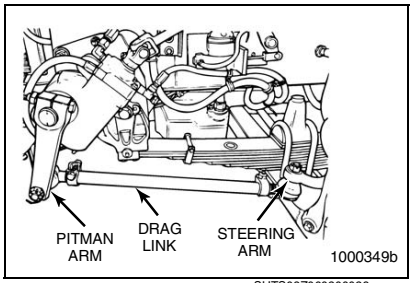
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1. For double nut and lock fasteners, bend the tabs of the flattened lock washer away from the wheel bearing nut and the adjusting nut.
2. Remove the wheel bearing nut, the lock washer, the pierced lock ring and the adjusting nut from the knuckle.
   e. Remove the outer wheel bearing cone from the hub. Remove the wheel, tire, hub and drum as an assembly.
   f. Remove the brake components.
   g. Remove the oil seal from the hub. Remove the inner wheel bearing cone.
   h. Inspect the wheel bearings. Refer to "Wheel Bearings" on page AX02-35.

2. DRAG LINK

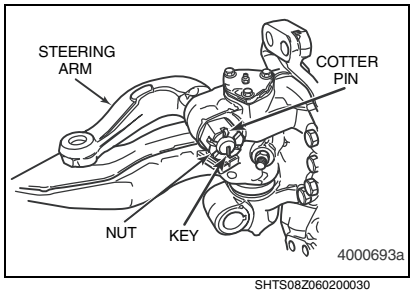
(1) Remove the cotter pins from the ball studs. Remove the nuts from the ball studs.

(2) Disconnect the drag link from the Pitman arm and the steering arm. Inspect the drag link. Refer to "INSPECTION" on page AX02-34.



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3. STEERING ARM

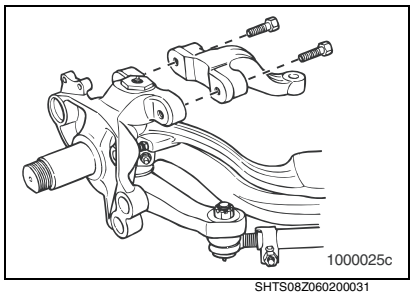
(1) Axles with a keyed steering arm.

a. Remove the cotter pin and nut that fasten the steering arm to the drag link. Disconnect the steering arm from the drag link.

b. Remove the cotter pin and nut that fasten the steering arm to the knuckle.

c. Remove the steering arm from the knuckle. If necessary, use a leather or plastic mallet to tap on the end of the arm and separate the arm from the knuckle.

d. Remove the key from the steering arm. Inspect the steering arm. Refer to "INSPECTION" on page AX02-34.



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(2) Axles with a bolt-on steering arm.

a. Remove the two steering-arm-to-knuckle capscrews from the knuckle assembly.

b. Remove the steering arm from the knuckle. If necessary, use a leather or plastic mallet to tap the outside of the arm and separate the arm from the knuckle.

c. Remove the steering arm. Inspect the steering arm. Refer to "INSPECTION" on page AX02-34.

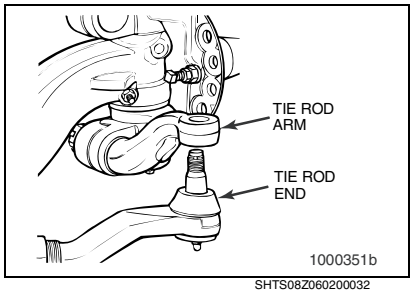
4. TIE ROD ARMS, TIE ROD ENDS AND CROSS TUBE

⚠ WARNING

Support the tie rod assembly during maintenance and service to prevent serious personal injury and damage to components. If the cross tube clamps are tack-welded, do not remove the tack weld during tie rod assembly removal. If you remove the tack weld, clamp force is reduced. Replace the cross tube if the weld is broken. Loss of steering control, serious personal injury and damage to components can result.

⚠ CAUTION

Do not heat the arm to remove the tie rod assembly. Heating the tie rod arm will soften parts. Damage to components will result.



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(1) Axles with Removable Tie Rod Arms

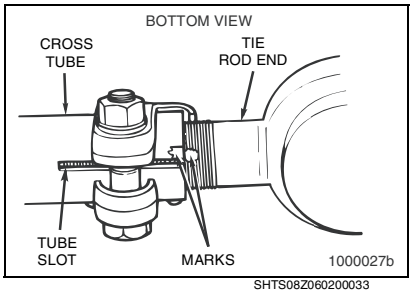
a. Remove the cotter pins and nuts that fasten each tie rod end to the tie rod arms.

b. Disconnect the cross tube assembly from the tie rod arms. If available, use a tie rod end puller to separate the tie rod end from the tie rod arm.

c. Remove the cotter pin and nut that fastens the tie rod arms in the knuckle.

d. Remove the tie rod arms from the knuckle. If necessary, use a leather or plastic mallet to tap on the end of the rod. Remove the key.

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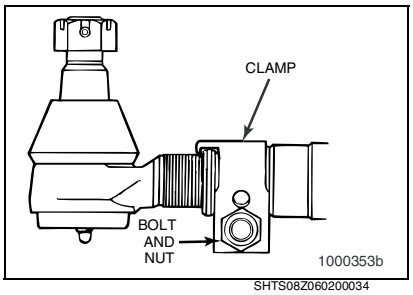
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e. If necessary, use this procedure to remove the tie rod ends.

a. Mark the position of each tie rod end in the cross tube. Count and record the number of threads that appear outside of the cross tube.

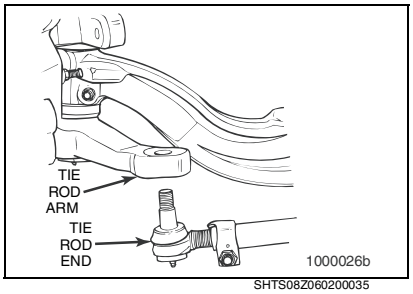
b. Remove the bolts and nuts from the clamp on the cross tube. Rotate the cross tube clamp to remove the nuts and bolts from the clamp.

c. Remove the tie rod ends from the cross tube.



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f. Inspect the parts. Refer to "INSPECTION" on page AX02-34.



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(2) Axles with integral tie rod arms.

a. Remove the cotter pins and nuts that fasten each tie rod end to the tie rod arms.
b. Disconnect the cross tube assembly from the tie rod arms. If available, use a tie rod end puller to separate the tie rod end from the tie rod arm. If necessary, use a leather or plastic mallet to tap on the tie rod end to loosen and remove it.
c. If necessary, use this procedure to remove the tie rod ends.

1. Mark the position of each tie rod end in the cross tube. Count and record the number of threads that appear outside of the cross tube.
2. Remove the bolts and nuts from the clamp on the cross tube. Rotate the cross tube clamp to remove the nuts and bolts from the clamp.
3. Remove the tie rod ends from the cross tube.

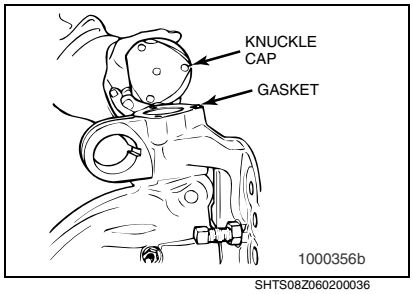
d. Inspect the parts. Refer to "INSPECTION" on page AX02-34.

5. DRAW KEYS, KING PIN CAPS, KING PINS AND STEERING KNUCKLE

(1) Axles with bolt-on king pin caps.

a. Remove the wheel ends as described in this section.
b. Vent the air from the brake system. Disconnect the air lines from the brakes.
c. Remove the brake components.
d. Remove the tie rod arms and the steering arm from the knuckle. Refer to the procedure in this section.

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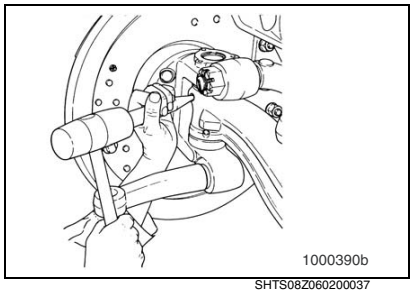
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e. Remove the capscrews that fasten the king pin caps to the top and the bottom of the knuckle. Remove the caps and the gasket.

f. Remove the plain or the threaded draw keys. Refer to below Table.

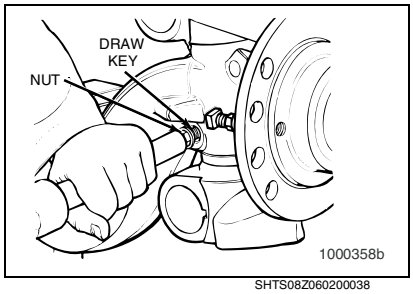
Threaded or Plain Draw Keys

Threaded Draw Keys	Plain Draw Keys
All other axle models	FC-901, FC-921, FE-970, FF-971 and FL-901



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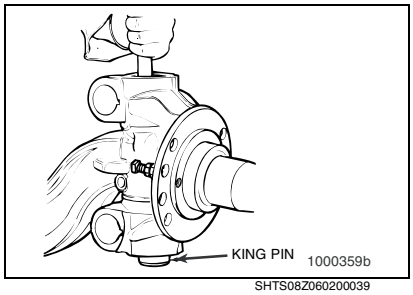
- **For plain draw keys:** Use a brass hammer and a steel drift to remove the draw key. Place the drift onto the small, "D"-shaped end of the key.



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- **For threaded draw keys:** Perform the following procedure.

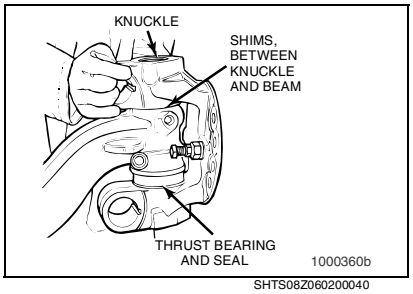
g. Loosen the threaded draw key lock nut until the top of the lock nut is even with the end of the draw key.
h. Use a brass drift and a hammer to hit the end of the draw key.
i. Remove the nut from the draw key. Remove the draw key from the knuckle.
j. If you're not replacing the bushings, use the following procedure to prevent damaging the bushings during king pin removal.
k. Use a brass drift and a hammer to remove the king pins from the knuckle.
l. Remove any flaring on the drift that touches the bushings.
m. Wrap tape to a thickness of 1/16-inch (1.5 mm) onto the end of the drift.
n. If the king pin is hard to remove, use a hydraulic king pin remover. Refer to "Special Tools" in Section 11. To obtain this tool, refer to the Service Notes page on the front inside cover of this manual.
o. Remove the knuckle from the axle beam.



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⚠ WARNING
Wear gloves when you remove or install shims. Shims have sharp edges that can cause serious personal injury.

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p. While wearing gloves, remove the shims, the thrust bearing and the seal from the beam and knuckle.

q. Inspect the parts. Refer to "INSPECTION" on page AX02-34.

(2) Axles with threaded king pin caps.

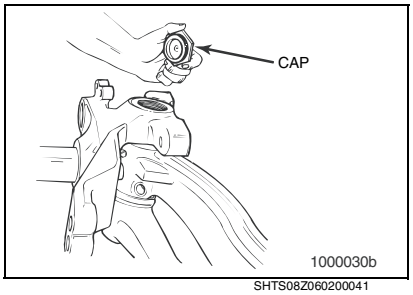
a. Remove the wheel end as described in this section.

b. Vent the air from the brake system. Disconnect the air lines from the brakes.

c. Remove the brake components. Refer to the brake manufacturer's procedures.

d. Remove the steering arm from the knuckle, if applicable.

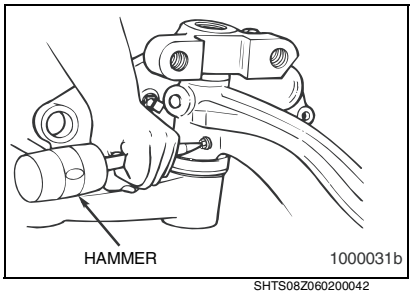
e. Remove the top and bottom king pin caps.



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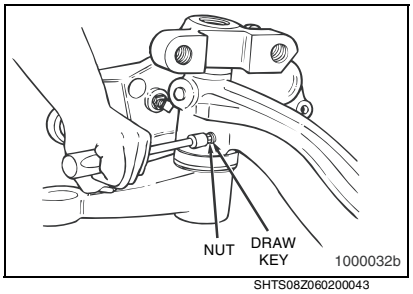
f. Use the following procedure to remove the upper and lower draw keys from the knuckle.

g. Loosen the draw key nut. Use a brass drift and a hammer to hit the end of the draw key.



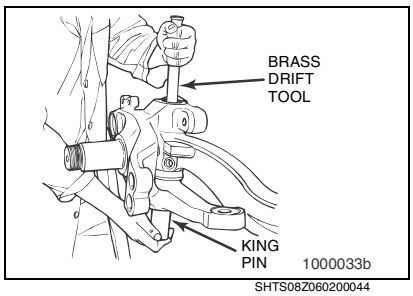
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h. Remove the nut from the draw key. Remove the draw key from the knuckle.



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i. If you're not replacing the bushings, use the following procedure to prevent damage to the bushings during king pin removal.

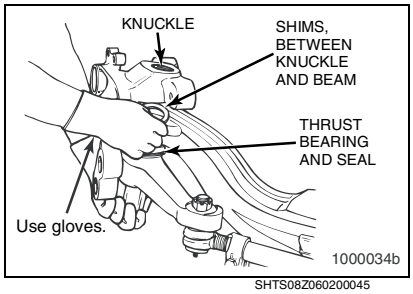
j. Use a hammer and brass drift to remove the king pins from the knuckle.

k. Remove any flaring on the drift that touches the bushings.

l. Wrap tape to a thickness of 1/16-inch (1.5 mm) onto the end of the drift.

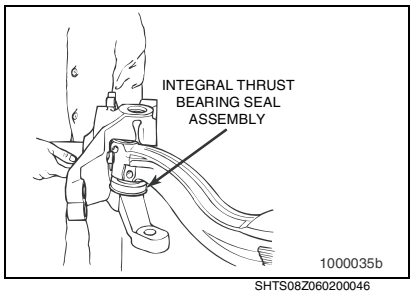
m. If the king pin is hard to remove, use a hydraulic king pin remover. Refer to "Special Tools" on page AX02-11. To obtain this tool, refer to the Service Notes on page AX02-10.

⚠ WARNING
Wear gloves when you remove or install shims. Shims have sharp edges that can cause serious personal injury.



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n. While wearing gloves, remove the integral thrust bearing and seal, and the shims from the beam and knuckle.



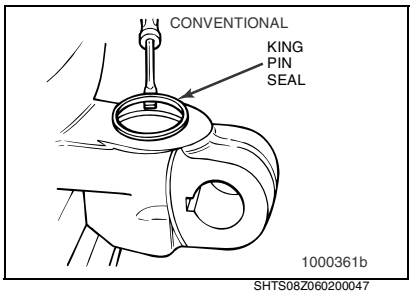
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o. Remove the knuckle from the axle beam. Inspect the parts. Refer to "INSPECTION" on page AX02-34.

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6. KING PIN BUSHINGS

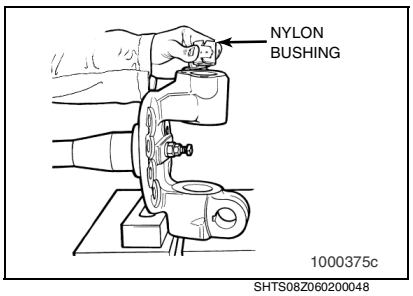
⚠ WARNING
Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.



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(1) Axles with Conventional Wheel Ends — Nylon Bushings

a. Remove and discard the lower king pin seal.
b. Turn the knuckle upside down and remove the upper king pin seal. Remove the old bushings.



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c. Remove the top and the bottom bushings from the knuckle bore.

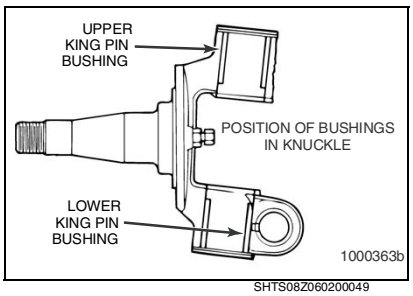
(2) Axles with Conventional Wheel Ends — Easy Steer™ and Bronze Bushings

a. Remove and discard the lower king pin seal.
b. Turn the knuckle upside down and remove the upper king pin seal. Remove the old bushings.

NOTICE
For some axles, you can remove the bushings with a bushing service kit. Refer to "Special Tools" on page AX02-11.

c. Make a tool to remove the bushings. Refer to "Special Tools" on page AX02-11.

d. Place the knuckle in a vise. Use a press with a five-ton capacity. The knuckle must not move when the bushings are removed.
e. Install the tool into the upper king pin bushing. Press the upper king pin bushing from the knuckle bore.
f. Turn the knuckle upside down and install the tool into the lower king pin bushing. Press the lower bushing from the knuckle bore.



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PREPARE PARTS FOR ASSEMBLY

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REPLACE

1. WORN OR DAMAGED PARTS

Do not repair or recondition front axle components. Replace damaged or out-of-specification components. All major components are heat-treated and tempered.

Do not perform the following operations on front axle components.

- Weld steering arms, tie rod arms, knuckles, king pins, axle beams, tie rod assemblies, hubs, drums or brakes.
- Hot- or cold-bend the knuckles, steering arms, tie rod arms, ball studs, axle beams or tie rod assemblies.
- Drill holes in the axle beam for the king pins.
- Drill draw key holes in the knuckle.
- Spray-weld bearing diameters onto the knuckles or into the machined bores.
- Disassemble the unitized wheel end.
- Mill or machine any components.

⚠ WARNING

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, and emulsion-type and petroleum-base cleaners. Read the manufacturer's instructions before using a solvent cleaner, then carefully follow the instructions. Also follow the procedures below.

- **Wear safe eye protection.**
- **Wear clothing that protects your skin.**
- **Work in a well-ventilated area.**
- **Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.**
- **You must use hot solution tanks or alkaline solutions correctly. Read the manufacturer's instructions before using hot solution tanks and alkaline solutions. Then carefully follow the instructions.**

⚠ CAUTION

Do not use hot solution tanks or water and alkaline solutions to clean ground or polished parts. Damage to parts can result.

2. CLEAN, DRY AND INSPECT PARTS

(1) Ground or Polished Parts

Use a cleaning solvent to clean the ground or polished parts and surfaces. Kerosene or diesel fuel can be used for this purpose. DO NOT USE GASOLINE.

Do NOT clean ground or polished parts in a hot solution tank or with water, steam or alkaline solutions. These solutions will cause corrosion of the parts.

(2) Rough Parts

Rough parts can be cleaned with the ground or polished parts. Rough parts also can be cleaned in hot solution tanks with a weak alkaline solution. Parts must remain in the hot solution tanks until they are completely cleaned and heated.

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(3) Dry Cleaned Parts
Parts must be dried immediately after cleaning. Dry parts with clean paper or rags, or compressed air. Do not dry bearings by spinning with compressed air.

(4) Prevent Corrosion on Cleaned Parts
Apply a light oil to cleaned and dried parts that are not damaged and are to be immediately assembled. Do NOT apply oil to the brake linings or the brake drums.

If the parts are to be stored, apply a good corrosion preventative to all surfaces. Do NOT apply the material to the brake linings or the brake drums. Store the parts inside special paper or other material that prevents corrosion.

NOTICE
All tapered joints must be clean and dry with no lubrication or corrosion preventative applied to the mating surfaces.

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INSTALLATION

1. NEW FASTENERS WITH PRE-APPLIED ADHESIVE PATCHES

(1) Clean the oil and dirt from the threaded holes. Use a wire brush to remove the old patch material. There is no special cleaning required.

⚠ CAUTION
Do not apply adhesives or sealants onto new fasteners with pre-applied adhesive patches or into the threaded holes. If other adhesives or sealants are used, the new adhesive will not function correctly. Damage to components can result.

(2) Assemble the parts using the new pre-applied adhesive fasteners.

NOTICE
There is no drying time required for fasteners with pre-applied adhesive.

(3) Tighten the fasteners to the required torque value for that size fastener. Refer to "Front Non-Drive Axles with Conventional Wheel Ends", "Torque Specifications" on page AX02-8.

2. ORIGINAL OR USED FASTENERS USING MERITOR SPECIFICATION 2297-C-7049 LIQUID ADHESIVE, LOCTITE® 680 ADHESIVE OR EQUIVALENT

⚠ WARNING
Take care when you use Loctite® adhesive to avoid serious personal injury. Read the manufacturer's instructions before using this product. Follow the instructions to prevent irritation to the eyes and skin. If Loctite® adhesive material gets into your eyes, follow the manufacturer's emergency procedures. Have your eyes checked by a physician as soon as possible.

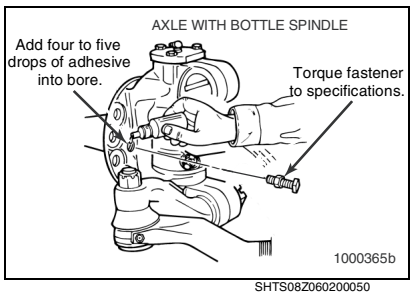
(1) Clean the oil, dirt and old adhesive from all threads and threaded holes. Use a wire brush.

⚠ CAUTION
Do not apply adhesive to the fastener threads. Air pressure in the hole will push the adhesive out as the fastener is installed. Damage to components can result.

NOTICE
There is no drying time required for Meritor specification 2297-C-7049 liquid adhesive, Loctite® 680 adhesive or equivalent.

(2) Apply four or five drops of Meritor liquid adhesive, Loctite® 680 adhesive or equivalent into each threaded hole or bore only.

(3) Tighten the fasteners to the required torque value for that size fastener. Refer to "Front Non-Drive Axles with Conventional Wheel Ends", "Torque Specifications" on page AX02-8.



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3. CHECK THE TORQUE VALUES OF DRI-LOC®, FASTENERS NOT REQUIRING REMOVAL

If Dri-Loc® fasteners do not require removal from components, use the following procedure to check the fasteners for the correct torque value.

Apply the minimum amount of torque required for that size fastener. Refer to page AX02-8. The fastener must not rotate.

- **If the fastener rotates:** Remove the fastener from the component. Inspect the fastener and the hole for wear and damage. Repair as necessary.
- **If the fastener and the hole are in good condition:** Apply adhesive into the threaded hole. Follow the procedure to install old Dri-Loc® fasteners.

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INSPECTION

1. AXLES WITH CONVENTIONAL AND UNITIZED WHEEL ENDS

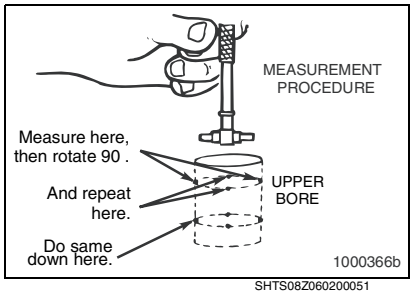
⚠ WARNING
Use only dye penetrant inspection techniques on unitized wheel-end hub units. Be careful not to get penetrant fluids into the bore of the hub unit. Do not use fluid immersion-based crack inspection techniques. The fluids can enter the joint between the inner bearing cones through the bore of the hub unit and damage the lubricant. Serious personal injury and damage to components can result.

Refer to the following guidelines to carefully inspect all disassembled parts before assembly.

(1) Inspect and replace any parts that are worn, cracked or damaged. Check for cracks using dye penetrant, magnetic flux or fluorescent particle testing methods. Follow the inspection product manufacturer's procedures.

(2) Remove the old bushing from the knuckle. Measure the upper knuckle bore inside diameter at two locations. Always use a micrometer and a telescoping gauge when taking knuckle bore measurements. Some rounding of the top and bottom bore edges is acceptable.

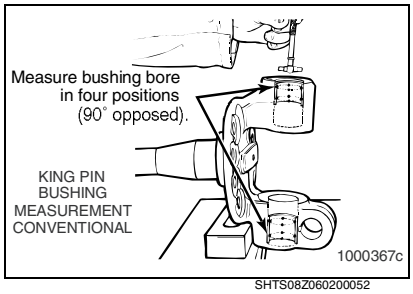
(3) Measure the bore in four positions and at two locations. The two locations must be 90 degrees opposite each other.



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- **If the average measurement is more than the knuckle bore maximum diameter specification on page AX02-35:** Replace the knuckle.

(4) Repeat this procedure for measuring the lower knuckle bore. Refer to the knuckle bore maximum diameter on page AX02-35.



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- **If measurements at either the upper or lower knuckle bores exceed the knuckle bore maximum diameter on page AX02-35:** Replace the knuckle.

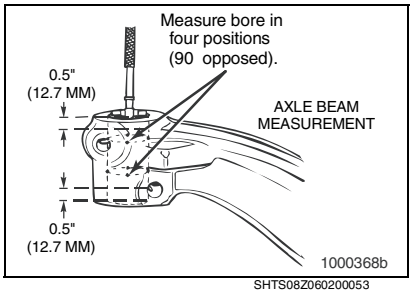
(5) Measure the king pin bushing inside diameter using a micrometer and a telescoping gauge.

- **If the average inside diameter measurement is greater than the king pin bushing maximum inner diameter on page AX02-35:** Install a new bushing.

(6) Measure the inner diameter of the new bushing after installation and reaming in four positions and at two locations. The two locations must be 90 degrees opposite each other.

- **If the average measurement is more than the king pin bushing maximum inner diameter specification on page AX02-35:** Replace the bushing.

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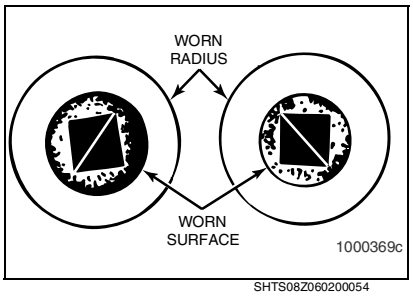
(7) Measure the inner bore diameter of the axle beam. Rounding at the top and bottom of the beam is acceptable. Measure the axle beam bore at four positions and at two locations. Refer to the guidelines below.

a. 0.5-inch (12.7 mm) below the top of the bore.
b. 0.5-inch (12.7 mm) above the bottom of the bore.

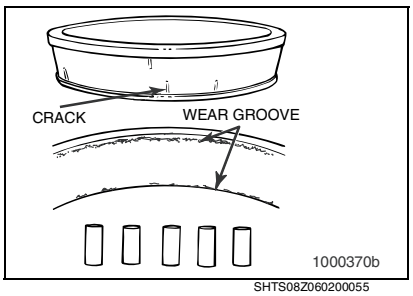
- **If the average measurement is greater than the axle beam bore maximum diameter in Table D:** Replace the entire axle beam.

Axle Wear Limits Specifications

Model Number	Knuckle Bore Maximum Diameter	Axle Beam Bore Maximum Diameter	King Pin Bushing Maximum Inner Diameter
MFS 8	1.6295 in. (41.389 mm)	1.5040 in. (31.4450 mm)	1.5020 in. (38.1510 mm)
MFS 10	1.9220 in. (41.389 mm)	1.7960 in. (45.6180 mm)	1.7980 in. (45.6692 mm)
MFS 12			
MFS 14			



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2. WHEEL BEARINGS

(1) Axles with Conventional Wheel Ends

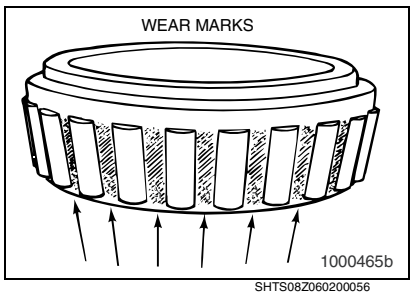
Inspect the wheel bearings when the hub is removed from the knuckle spindle.

Remove all lubricant from the bearings, knuckle, hub and hubcap.

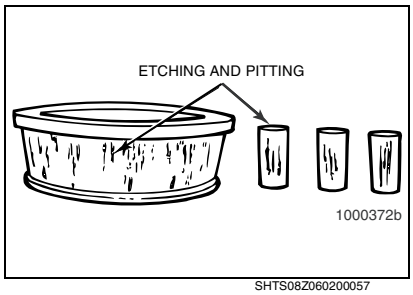
Inspect the cup, the cone and the rollers and cage of all bearings. If any of the following conditions exist, you must replace the bearing.

- The center of the large diameter end of the rollers is worn level or below the outer surface.
- The radius at the large diameter end of the rollers is worn to a sharp edge.
- There is a visible roller groove in the cup or the cone inner race surfaces. The groove can be seen at the small or large diameter end of both parts.
- There are deep cracks or breaks in the cup, the cone inner race or the roller surfaces.
- There are bright wear marks on the outer surface of the roller cage.
- There is damage on the rollers and on the surfaces of the cup and the cone inner race that touch the rollers.
- There is damage on the cup and the cone inner surfaces that touch the rollers.

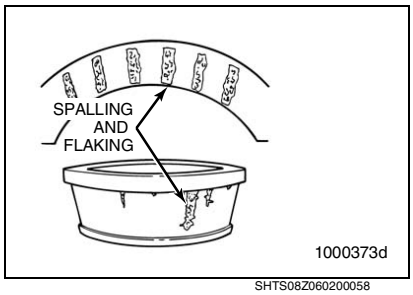
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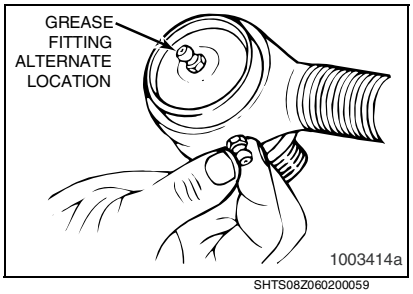


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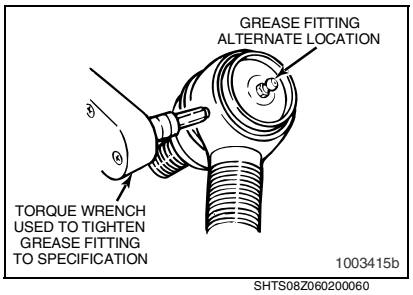
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3. TIE ROD GREASE FITTINGS

(1) If a grease fitting is missing, install a new one. Do not install a fitting if the tie rod end is a non-greaseable design.



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(2) Tighten all grease fittings to 10 lb-ft (13.558 N·m).

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ASSEMBLY

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KING PIN BUSHINGS

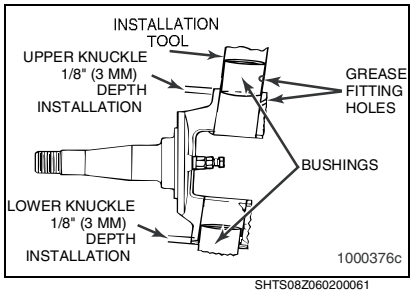
1. BRONZE AND EASY STEER™ — KING PIN BUSHING INSTALLATION WITHOUT A PRESS AXLES WITH CONVENTIONAL

NOTICE

For some axles you can install the bushings without a press. Use a bushing service kit to install and ream the bushings. Refer to "Special Tools" on page AX02-11.

Bronze and Easy Steer™ bushings have an interference fit in the knuckle bores and require a bushing installation tool. Refer to "Special Tools" on page AX02-11. To obtain this tool, refer to the Service Notes on page AX02-10.

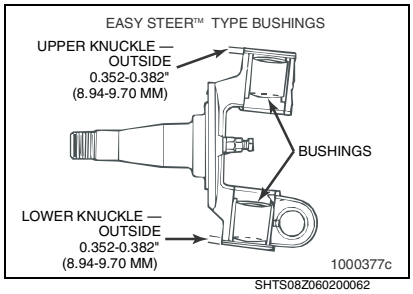
(1) Place the new bushing into the upper knuckle bore. On MFS-7 and -8 front axles, the bushing hole must be aligned with the grease fitting hole in the knuckle bore.



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(2) Use the installation tool to start the bushing 1/8-inch (3 mm) STRAIGHT into the upper bore.

a. On Easy Steer™ bushings and for MFS axles, press the bushing to a depth of 0.352-0.382-inch (8.94-9.70 mm) below the top of the upper knuckle bore or until the grease fitting holes are aligned.

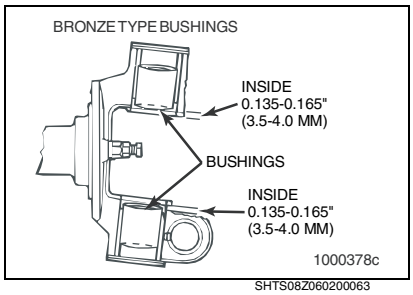


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b. On bronze bushings, press the bushing to a depth of 0.135-0.165-inch (3.5-4.0 mm) above the bottom of the upper bore.

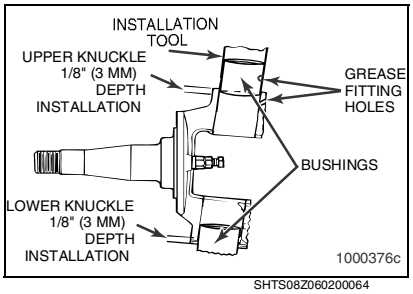
(3) Turn the knuckle over so that the bottom of the knuckle is UP. The bore must be parallel to the top of the press.

(4) Place the new bushing into the lower knuckle bore. On MFS-7 and -8 front axles, the bushing hole must be aligned with the grease fitting hole in the knuckle bore.



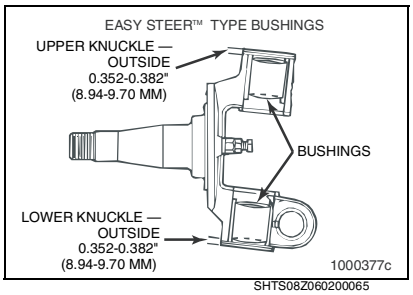
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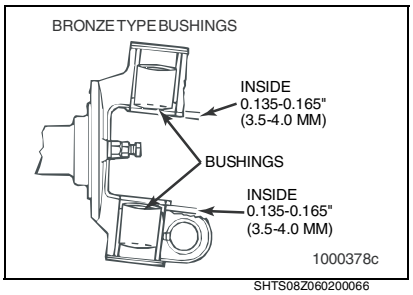
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(5) Use the installation tool to start the bushing 1/8-inch (3.0 mm) STRAIGHT into the lower bore.
   a. On Easy Steer™ bushings and for MFS axles, press the bushing to a depth of 0.352-0.382-inch (8.94-9.70 mm) below the top of the lower knuckle bore, as viewed with the knuckle upside down or until the grease fitting holes are aligned.
   b. On bronze bushings, press the bushing to a depth of 0.135-0.165-inch (3.5-4.0 mm) above the bottom of the lower bore, as viewed with the knuckle upside down.



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(6) Ream the bushings. Refer to "Ream the King Pin Bushings" on page AX02-40.



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2. BRONZE AND EASY STEER™ KING PIN BUSHING INSTALLATION WITH A PRESS — AXLES WITH CONVENTIONAL AND UNITIZED WHEEL ENDS

(1) Install the top king pin bushing first.

⚠ WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

(2) Place the knuckle in a press with the top of the knuckle toward the top of the press. The top of the bores must be parallel to the top of the press.
(3) Place the new bushing into the upper knuckle bore. On MFS-7 and -8 front axles, the bushing hole must be aligned with the grease fitting hole in the knuckle bore.
(4) Use the installation tool to press the bushing 1/8-inch (3.0 mm) STRAIGHT into the upper bore. Release the pressure.
   a. On Easy Steer™ bushings and for MFS axles, press the bushing to a depth of 0.352-0.382-inch (8.94-9.70 mm) below the top of the upper knuckle bore or until the grease fitting holes are aligned.
   b. On bronze bushings, press the bushing to a depth of 0.135-0.165-inch (3.5-4.0 mm) above the bottom of the upper bore.
(5) Turn the knuckle over so that the bottom of the knuckle is UP. The bore must be parallel to the top of the press.
(6) Place the new bushing into the lower knuckle bore. On MFS-7 and -8 front axles, the bushing hole must be aligned with the grease fitting hole in the knuckle bore.
(7) Use the installation tool to start the bushing 1/8-inch (3.0 mm) STRAIGHT into the lower bore. Release the pressure.
   a. On Easy Steer™ bushings and for MFS axles, press the bushing to a depth of 0.352-0.382-inch (8.94-9.70 mm) below the top of the lower knuckle bore, as viewed with the knuckle upside down or until the grease fitting holes are aligned.

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b. On bronze bushings, press the bushing to a depth of 0.135-0.165-inch (3.5-4.0 mm) above the bottom of the lower bore, as viewed with the knuckle upside down.

(8) Ream the bushings. Refer to "Ream the King Pin Bushings", "Installation" below.

3. REAM THE KING PIN BUSHINGS

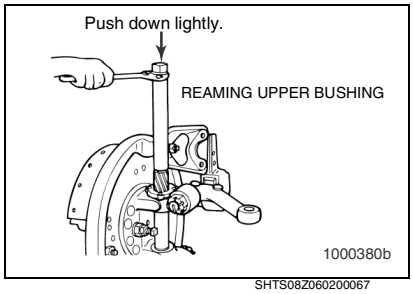
(1) Axles with Conventional and Unitized Wheel Ends — Bronze and Easy Steer™ Bushings

⚠ CAUTION
Use a fixed reamer to ream the king pin bushings. Do not hone or burnish the bushings. Damage to the bushings will result.

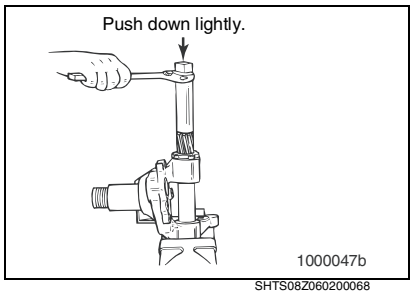
NOTICE
Reamer tools are available from SPX Kent-Moore. Refer to "Special Tools" on page AX02-11. To obtain these tools, refer to the Service Notes on page AX02-10.

a. Place the knuckle in a vise with brass jaws.

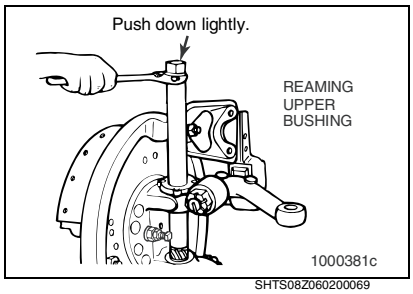
b. Slide the pilot of the reamer through the top bushing until the reamer blades touch the bushing.



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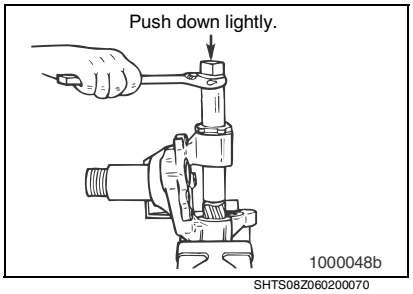
(2) Rotate the reamer with a light DOWNWARD pressure. Do not apply too much force. Rotate the reamer smoothly.

(3) After cutting the top bushing, guide the reamer into the bottom bushing. Do not allow the tool to drop to the bottom bushing. Repeat Step (2) and Step (3).

(4) Slide the reamer out of the bottom bushing.

- **If the reamer must be removed through the top bushing:** Rotate the tool in the opposite cutting direction.

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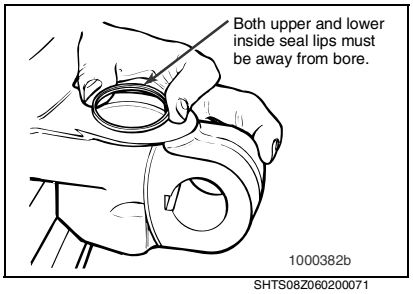
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(5) Clean all material from the bushings.

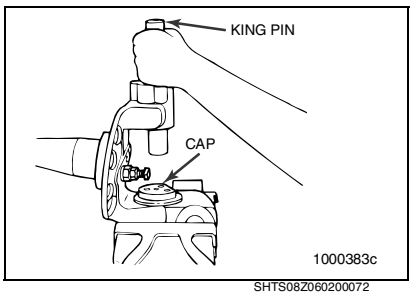
4. INNER KNUCKLE BORE KING PIN SEALS

(1) Axles with Conventional Wheel Ends

a. Place the top of the knuckle into a vise with brass jaws. The bottom of the knuckle must be TOWARD you.
b. Place the seal into the bottom of the top knuckle bore. The lip of the seal must be AWAY from the bore.



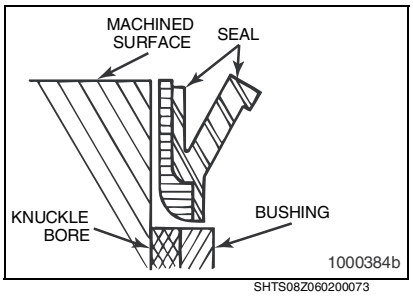
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c. Place the end cap for the knuckle on top of the seal. Slide the king pin through the opposite knuckle bore. Use the king pin to install the seal.

- **For bronze bushings:** The bottom of the seal must touch the bushing.



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- **For Easy Steer™ and nylon bushings:** The top of the seal must be even with the top of the knuckle.

d. Turn the knuckle over in the vise. The jaws of the vise must hold the bottom of the knuckle, and the top of the knuckle must be toward you.
e. Place the seal into the top of the bottom knuckle bore. The lip of the seal must be AWAY from the bore.
f. Repeat Step "C" of this procedure.
g. After installing the Easy Steer™ bushings, the top of the seal must be even with the inner machined surface of each knuckle bore.
h. Turn the knuckle over to the UP position. Place the seal lightly into the inner bore. The seal lip must be AWAY from the bore.
i. Use a seal installer tool to press the seal firmly into the knuckle bore. The top of the seal must be even with the inner machined surface of each knuckle bore.

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5. KNUCKLE TO THE AXLE BEAM

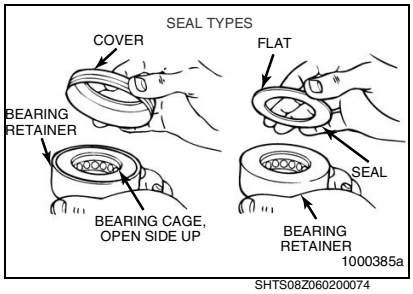
⚠ WARNING
Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off Serious personal injury and damage to components can result.

(1) Axles with Conventional Wheel Ends
   a. Clean the bores of the knuckle and the axle beam.

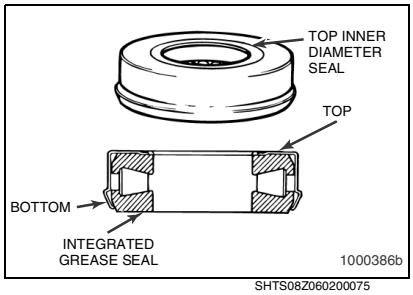
NOTICE
The one-piece thrust bearing with an integrated grease seal is completely interchangeable with the two-piece design. It has a specified top and bottom orientation.

   b. Install the seal onto the thrust bearing. The surface with the inner diameter seal must be on the top. The surface with the outer diameter seal must be on the bottom.

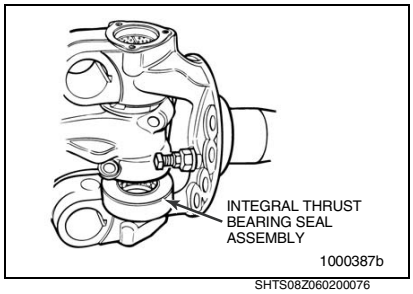
a. On cover-type seals: Install the seal over the open end of the bearing.
b. On flat-type seals: Install the seal over the closed part of the bearing.



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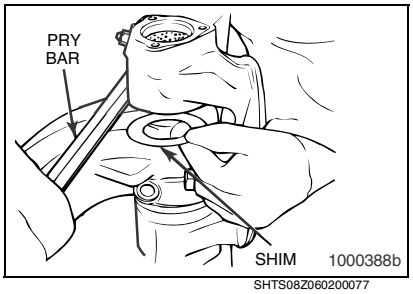
   c. Install the seal and thrust bearing assembly on the inner knuckle. The seal must face UPWARD toward the beam. The top inner diameter will contact the bottom of the axle beam.

⚠ WARNING
Wear gloves when you install the shims. Shims have sharp edges that can cause serious personal injury.

   d. Inspect the shims for damage before installation.

a. Replace damaged shims with the same size shims, or in combination, that allow the least amount of knuckle end play.
b. If a new shim pack is required, select the amount of shims that will give the least amount of end play.
   e. After inspection, place the shims on top of the axle beam bore machined surface. Align the shims for king pin installation.
   f. Place the knuckle onto the axle beam.

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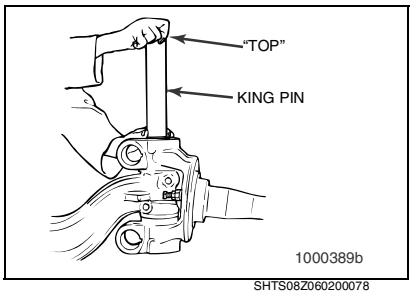
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g. Place a pry bar between the steering arm boss and the axle beam. Lift the knuckle and slide the shim pack between the top of the beam and the knuckle.

h. Align all the bores. If the bores are not aligned, the parts will be damaged when the king pin is installed.

i. Remove the pry bar.

j. Before installing the king pin into the top of the knuckle, apply the multi-purpose grease onto the bottom half of the king pin.

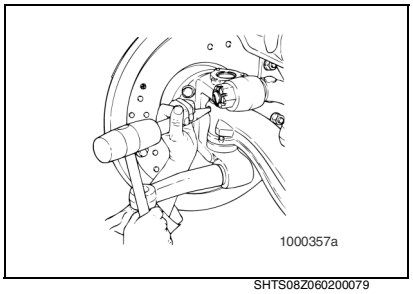


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k. Verify that you can see the word "TOP," which is stamped on the king pin.

l. Rotate the king pin so that the two draw key slots of the pin correctly align with the draw key slots in the knuckle.

m. Install the king pin into the TOP of the knuckle and through the area where the shims are located. Do not force the pin through the top bushing.



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n. If required, use a hammer and a brass drift to apply direct force to the king pin for seating it into the lower knuckle bore.

o. Seat the top draw key into the front of the beam. Refer to Table below. Seat the bottom draw key into the back of the beam by striking it with a hammer and drift. The keys must align with the slots of the king pin. Do not install or tighten the lock nuts before checking the knuckle end play.

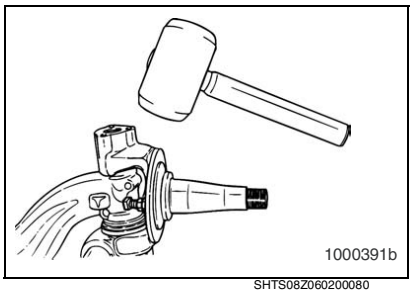
Threaded or Plain Draw Keys

Threaded Draw Keys	Plain Draw Keys
All other axle models	FC-901, FC-921, FE-970, FF-971 and FL-901

6. CHECK STEER KNUCKLE VERTICAL END PLAY

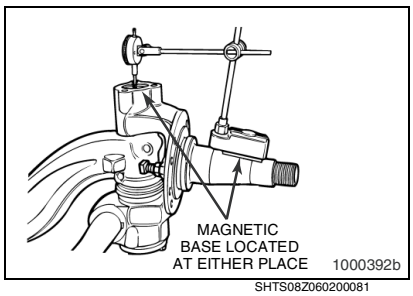
(1) Axles with Conventional Wheel Ends

a. Strike the boss of the knuckle with a rubber mallet to move the parts into position.



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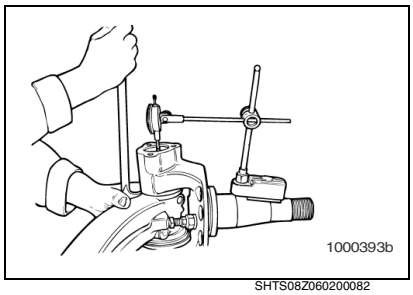
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b. Turn the knuckle to the straight-ahead position.

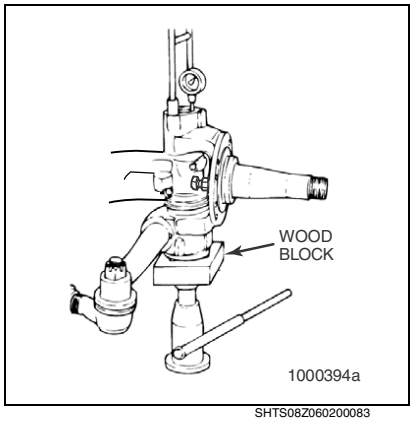
c. Attach a dial indicator. Place the base onto the knuckle. Place the tip onto the center of the king pin. Set the dial indicator to ZERO.



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d. Use one of the following methods to measure the end play.

- Place a pry bar between the knuckle and the top of the axle center. Push the knuckle up and measure the end play.



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- Place a block of wood and a hydraulic jack under the bottom of the knuckle. Raise the knuckle until the pointer on the dial indicator stops.

e. Repeat Step c and Step d with the axle in the full RIGHT and full LEFT positions.

f. Record the reading on the dial indicator.

- **If the knuckle binds or ZERO end play is measured:** Remove the shims from the shim pack.
- **If the reading is more than the correct specification shown in Table below:** Add shims to the shim pack.

End Play Specifications

New or Rebuilt Axles	**0.001-0.010 inch (0.025-0.254 mm)**
In-Service Axles	**0.001-0.030 inch (0.025-0.762 mm)**

7. DRAW KEY LOCK NUTS

⚠ WARNING

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off Serious personal injury and damage to components can result.

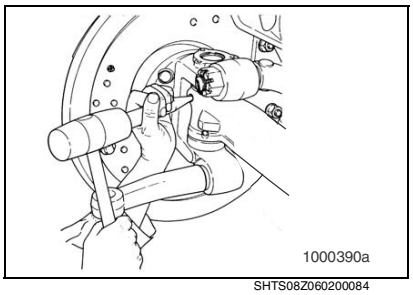
⚠ CAUTION

Verify that the draw key is installed completely or the lock nut is tightened to 30-45 lb-ft (41-61 N·m). If not installed correctly, the king pin and the axle beam will be damaged.

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Threaded or Plain Draw Keys

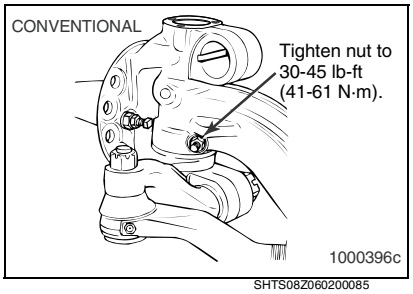
Threaded Draw Keys	Plain Draw Keys
All other axle models	FC-901, FC-921, FE-970, FF-971 and FL-901



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(1) Plain Draw Keys — Axles with Conventional and Unitized Wheel Ends

Use a hammer and a brass drift to install the draw key into the axle beam and knuckle. The key must be installed 1/32-1/8-inch (1-3 mm) below the outer surface of the beam.



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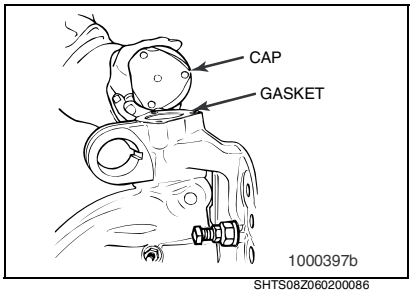
(2) Threaded Draw Keys — Axles with Conventional and Unitized Wheel Ends

Install the lock nut and tighten it to 30-45 lb-ft (41-61 N·m).

8. KING PIN CAPS

(1) Bolt-On King Pin Caps

a. Install new gaskets and the caps onto the top and the bottom of the knuckle. Install the capscrews and the washers and tighten to 20-30 lb-ft (28-40 N·m).
b. Connect the tie rod arm to the knuckle. Refer to "Tie Rod Arms, Tie Rod Ends and Cross Tube Assembly" on page AX02-47.



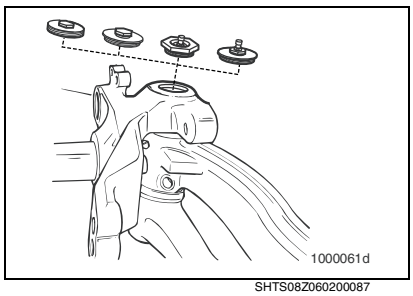
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(2) Threaded King Pin Caps

⚠ WARNING

When you apply some silicone gasket materials, a small amount of acid vapor is present. To prevent serious personal injury, ensure that the work area is well-ventilated. Read the manufacturer's instructions before using a silicone gasket material, then carefully follow the instructions. If a silicone gasket material gets into your eyes, follow the manufacturer's emergency procedures. Have your eyes checked by a physician as soon as possible.

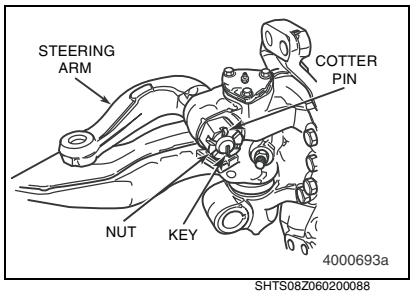
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a. Apply the sealant, part number 2297-D-7076, onto the threads. To obtain these supplies, refer to the Service Notes on page AX02-10.

b. Install the threaded king pin caps onto the top and the bottom of the knuckle.
c. Tighten the king pin caps to 70-90 lb-ft (95-120 N·m).
d. Connect the tie rod end assembly to the integral knuckle arm. Refer to "Tie Rod Arms, Tie Rod Ends and Cross Tube Assembly" on page AX02-47.



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9. AXLES WITH KEYED STEERING ARM

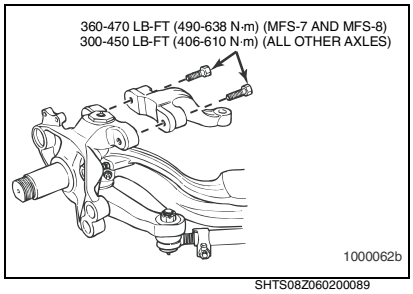
(1) Press the key into the slot in the arm. Install the steering arm into the knuckle.
(2) Install the nuts. Tighten to the specified torque. Refer to "Front Non-Drive Axles with Conventional Wheel Ends", "Torque Specifications" on page AX02-9.
(3) Install the cotter pins. If necessary, tighten the nut until the holes are aligned. Do not loosen the nut to install the cotter pin.
(4) Lubricate the drag link end that connects to the steering arm. Refer to "Ball Studs on the Steering Arm, the Tie Rod Arm Ends and the Drag Link" on page AX02-61.
(5) Check for correct operation.

10. AXLES WITH BOLT-ON STEERING ARM

⚠ WARNING
Take care when you use Loctite® adhesive to avoid serious personal injury. Read the manufacturer's instructions before using this product. Follow the instructions carefully to prevent irritation to the eyes and skin. If Loctite® adhesive material gets into your eyes, follow the manufacturer's emergency procedures. Have your eyes checked by a physician as soon as possible.

(1) Use a wire brush to remove old Loctite® adhesive from capscrew bolts and internal threads of the knuckle. Reapply Meritor specification 2297-C-7049 liquid adhesive or Loctite® 680 adhesive. At least half of the thread area must be covered.
(2) Insert the bolts through the steering arm. Hand-start the bolts into the knuckle assembly.
(3) Tighten the arm bolts to the following specification.

- **MFS-7 or MFS-8 axles:** 360-470 lb-ft (490-638 N·m)
- **All other axles:** 300-450 lb-ft (406-610 N·m)



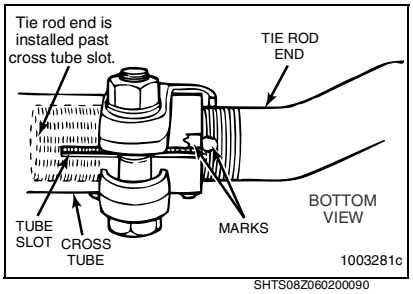
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11. INSTALL THE TIE ROD ENDS INTO THE CROSS TUBE

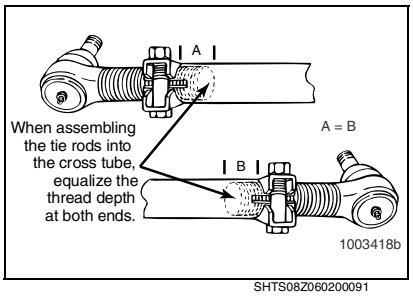
NOTICE

The cross tube has right-hand threads on the right side of the vehicle and left-hand threads on the left side of the vehicle.



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The replacement cross tube must be the same length and diameter as the original tube. Use the thread count as a guide. Install the tie rod ends into the threaded cross tube ends to the approximate depth marked during the tie rod assembly removal.



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If you are installing new tie rod ends, thread the tie rod ends to the approximate original depth inside the cross tube.

Both tie rod ends must be installed into the cross tube deeper than the end of the cross tube slot.

(1) Verify that the tab on the clamp is firmly seated against the end of the cross tube.

(2) Install the nuts and the bolts into the clamps. Tighten to the specified torque. Refer to "Front Non-Drive Axles with Conventional Wheel Ends", "Torque Specifications" on page AX02-9.

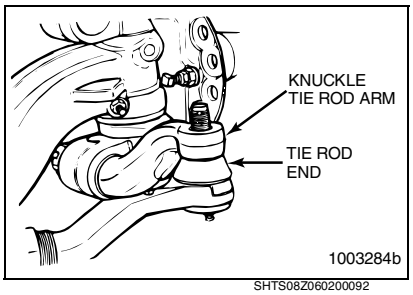
- **If the tab on the clamp is tack-welded:** Do not remove the tack weld. If you remove the tack weld, you will reduce the clamping force.

12. TIE ROD ARMS, TIE ROD ENDS AND CROSS TUBE ASSEMBLY

(1) Axles with Removable Tie Rod Arms

NOTICE

If a different size tie rod arm is installed, the steering geometry is changed and may cause tire wear. Contact the ArvinMeritor Customer Service Center at 800-535-5560.



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a. Press the key into the slot in the arm. Install the tie rod arm into the knuckle.

b. Install the nut onto the tie rod arm. Tighten to the specified torque. Refer to "Front Non-Drive Axles with Conventional Wheel Ends", "Torque Specifications" on page AX02-9.

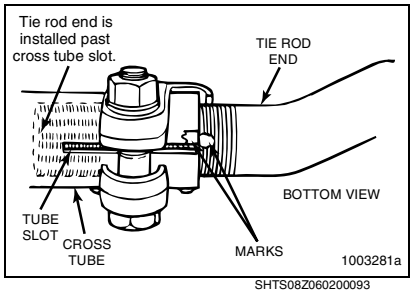
c. Install the cotter pins. If necessary, tighten the nut slightly, increasing the final torque value until the holes are aligned. Do not loosen the nut to install the cotter pin.

NOTICE

The cross tube has right-hand threads on one end and left hand threads on the other end.

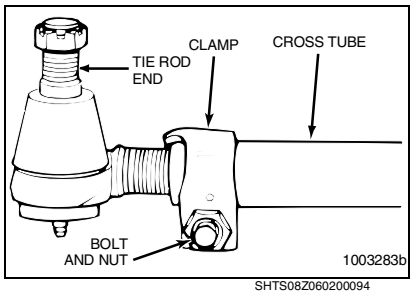
d. If removed, install the tie rod ends into the cross tube to the position marked during removal. Thread the ends equally into the cross tube to the required length.

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e. Install the nuts and the bolts into the clamps. Tighten to the specified torque. Refer to "Front Non-Drive Axles with Conventional Wheel Ends", "Torque Specifications" on page AX02-9.



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f. Rotate the cross tube clamp to remove the nuts and bolts from the clamp. Tighten the nut to engage the locking element of the nut with the bolt. The clamp and tie rod end must be free to rotate. The clamp tab must be firmly seated against the cross tube.

g. Check the tie rod boot for cracks, tears or other damage. Also check the boot seals for damage. Replace the entire tie rod end if the boot is damaged or missing.

h. Clean and dry the tie rod taper and the tie rod arm taper hole.

i. Install the tie rod ends into the tie rod arms. The threaded portion of the tie rod end must be installed into the cross tube beyond the end of the slot. The clamp tab must be firmly seated against the cross tube.

j. Install the nuts onto the tie rod ends. Tighten to the specified torque. Refer to "Front Non-Drive Axles with Conventional Wheel Ends", "Torque Specifications" on page AX02-9.

k. Install the cotter pins. If necessary, tighten the nut until the holes are aligned. Do not loosen the nut to install the cotter pin.

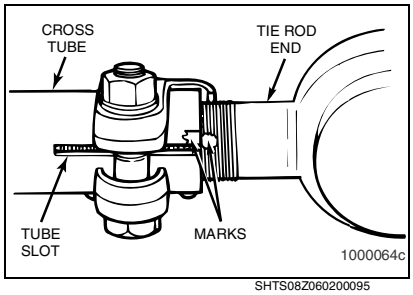
l. Check and, if necessary, adjust the toe. Refer to "Measure and Adjust the Toe" on page AX02-57.

13. CROSS TUBE AND TIE ROD ENDS

(1) Axles with Integral Tie Rod Arms

NOTICE

The cross tube has right-hand threads on one end and left hand threads on the other end.

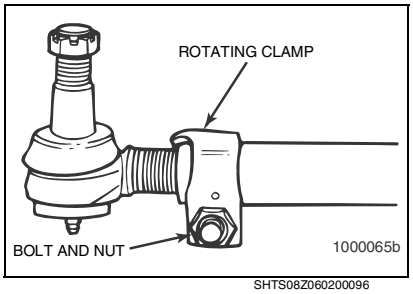


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a. If the tie rods have been removed, reinstall the tie rod ends into the cross tube to the position marked during removal. Thread the ends equally into the cross tube to the required length.

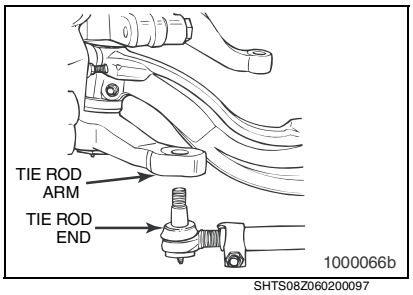
b. Install the nuts and the bolts into the clamps. Tighten to the specified torque. Refer to "Front Non-Drive Axles with Unitized Wheel Ends", "Torque Specifications" on page AX02-9.

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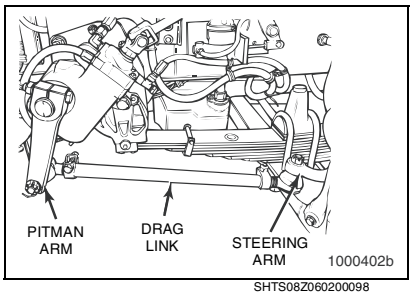
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c. Rotate the cross tube clamp to remove the nuts and bolts from the clamp. Tighten the nut to engage the locking element of the nut with the bolt. The clamp and tie rod end must be free to rotate. The clamp tab must be firmly positioned against the cross tube.



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d. Clean and dry the tie rod end taper and the tie rod arm taper hole.
e. Install the tie rod ends into the tie rod arm. The threaded portion of the tie rod end must be installed into the cross tube beyond the end of the cross tube slot.
f. Install the nuts onto the tie rod ends. Tighten to the specified torque. Refer to "Front Non-Drive Axles with Unitized Wheel Ends", "Torque Specifications" on page AX02-9.
g. Install the cotter pins. If necessary, tighten the nut until the holes are aligned. Do not loosen the nut to install the cotter pin.
h. Check and, if necessary, adjust the toe. Refer to "Measure and Adjust the Toe" on page AX02-57.



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14. DRAG LINK

(1) Connect the drag link to the steering arm. Connect the drag link to the Pitman arm.
(2) Install the nuts. Tighten to the specified torque. Refer to "Front Non-Drive Axles with Conventional Wheel Ends", "Torque Specifications" on page AX02-9.
(3) Install the cotter pins. If necessary, tighten the nut until the holes are aligned. Do not loosen the nut to install the cotter pin.
(4) Lubricate the drag link. Refer to "Ball Studs on the Steering Arm, the Tie Rod Arm Ends and the Drag Link" on page AX02-61.
(5) Check for correct operation.

15. BRAKE COMPONENTS AND WHEEL ENDS

(1) Axles with Conventional Wheel Ends
   a. Install the brake assembly onto the knuckle. Lubricate the wheel bearings. Refer to "Grease-Lubricated Wheel Bearings" on page AX02-62 or "Oil-Lubricated Wheel Bearings" on page AX02-62.
   b. Install the outer wheel bearing cone into the hub. Install the adjusting nut.
   c. Adjust the wheel bearings. Refer to "Check and Adjust Wheel Bearings" on page AX02-51.
   d. Install the cap and the gasket onto the hub. Install the capscrews and tighten to 20-30 lb-ft (27-41 N·m).
   e. Install the wheel and tire assembly. Lower the vehicle to the ground. Check for correct operation.
   f. Check and adjust the toe. Refer to "Measure and Adjust the Toe" on page AX02-57.

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ADJUSTMENT

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HAZARD ALERT MESSAGES

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

⚠ WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

1. INSPECTION BEFORE ALIGNMENT

(1) Parts

Refer to "Inspect Parts" on page AX02-18.

(2) Wheels and Tires

a. Verify that the tires are inflated to the specified pressure.
b. Verify that the front tires are the same size and type.
c. Verify that the lug nuts are tightened to the specified torque.
d. Verify that the wheels are balanced.
e. Check for bent or damaged wheels.

(3) Front Suspension

a. Verify that all fasteners are tightened to the specified torque.
b. Inspect the leaf springs for wear and damage.
c. Inspect the shock absorbers for wear and damage.

(4) Rear Axle and Rear Suspension

Front tire wear can be caused by the rear axle. If the outer edge of one front tire is worn and the inner edge of the other front tire is worn, check the following.

a. All fasteners are tightened to the specified torque.
b. The leaf springs are not worn or damaged.
c. The bushings in the leaf springs are not worn or damaged.
d. The torque rods, if used, are correctly adjusted.
e. The frame is not bent.

2. FRONT WHEEL ALIGNMENT

(1) Check the front wheel alignment:

a. Every 200,000 miles (320,000 km) or 24 months (normal maintenance).
b. When the vehicle does not steer correctly.
c. To correct a tire wear condition.

(2) Minor Front Wheel Alignment

Perform a minor front wheel alignment for all normal maintenance conditions using the following procedure.

a. Inspect all systems that affect the wheel alignment. Refer to "Inspection Before Alignment" in above 1.
b. Check and adjust the wheel bearings or wheel bearing end play for the unitized wheel end.
c. Check and adjust the toe.

(3) Major Front Wheel Alignment

Perform a major front wheel alignment to correct steering and tire wear conditions using the following procedure.

a. Inspect all systems that affect the wheel alignment. Refer to "Inspection Before Alignment" in above 1.
b. Check and adjust the wheel bearings.
c. Check and adjust the maximum turn angle.

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- **If the vehicle has power steering:** Check and adjust the pressure relief in the power steering system. Refer to "Adjust the Pressure Relief in the Power Steering System, Set the Maximum Turn Angle" on page AX02-54.
  d. Check and adjust the turning radius angle. Refer to "Turning Radius Angle" on page AX02-55.
  e. Check the king pin, or steering axis, inclination. Refer to "King Pin Inclination" on page AX02-56.
  f. Check the camber angle. Refer to "Camber Angle" on page AX02-56.

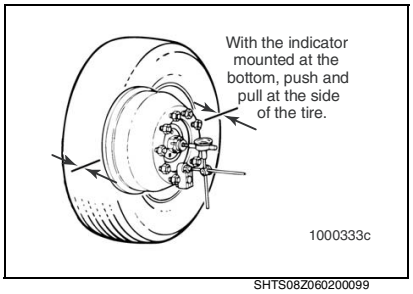
⚠ CAUTION
Replace damaged or out-of-specification axle components. Do not bend, repair or recondition axle components by welding or heat-treating. A bent axle beam reduces axle strength, affects vehicle operation and voids Meritor's warranty. Serious personal injury and damage to components can result.

  g. Check and adjust the caster angle. Refer to "Caster Angle" on page AX02-57.
  h. Check and adjust the toe. Refer to "Measure and Adjust the Toe" on page AX02-57.

3. CHECK AND ADJUST WHEEL BEARINGS

⚠ WARNING
Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

(1) Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Set the parking brake.
(2) Raise the vehicle so that the wheels are off the floor. Support the vehicle with safety stands.
(3) Remove the capscrews and remove the gasket and the cap from the hub.
(4) Verify that the brake drum and the hub fasteners are tightened to the manufacturer's specifications.
(5) Attach a dial indicator with the magnetic base at the bottom of the hub or the brake drum. Adjust the dial indicator so that the pointer is against the center of the knuckle. Set the dial indicator on ZERO.



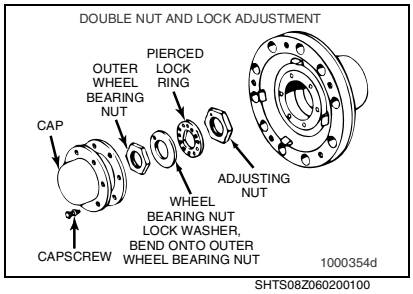
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NOTICE
Do not push or pull at the top and bottom of the hub or drum, which can affect the end play measurement.

(6) Measure the end play by pushing and pulling on each side of the hub or drum while looking at the dial indicator. The end play is the total travel observed.

- **If the end play is 0.001-0.005-inch (0.025-0.127 mm):** The bearings do not need adjustment.
- **If the end play is not 0.001-0.005-inch (0.025-0.127 mm):** Adjust the wheel bearings.

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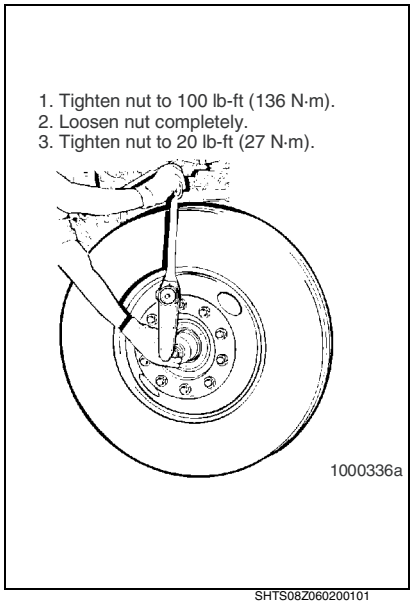


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(7) **On double nut and lock fasteners:** Bend the lock washer off the wheel bearing nut. Remove the wheel bearing nut, the lock washer and the pierced lock ring.

⚠ WARNING

Use a torque wrench to tighten or loosen adjusting nuts. Do not use a hammer to directly hit adjusting nuts, or to hit a chisel or drift placed against them. Damaged adjusting nuts can prevent you from obtaining correct wheel bearing end play, which can affect vehicle operation and cause the wheels to separate from the vehicle. Serious personal injury and damage to components will result.

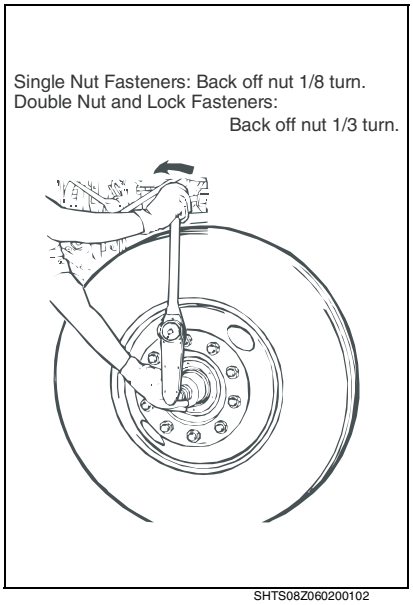


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(8) Use a torque wrench to tighten the adjusting nut to 100 lb-ft (136 N·m) while rotating the tire in both directions.

(9) Loosen the nut completely. Tighten the nut to 20 lb-ft (27 N·m) while rotating the tire.

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(10) For axles with single nut fasteners, perform the following procedure.
   a. Back off the adjusting nut 1/8 turn.
   b. Rotate the nut in either direction to line up a slot with the closest cotter pin hole in the spindle.
   c. Install a new cotter pin into the nut.
   d. Measure the end play. The end play must be 0.001-0.005-inch (0.025-0.127 mm). Refer to Step (4) and Step (5). Readjust if necessary.

(11) For axles with double nut and lock fasteners, perform the following procedure.
   a. Back off the adjusting nut 1/3 turn.
   b. Install the pierced lock ring, the lock washer and the wheel bearing nut.
   c. For 1-1/8-inch (28.6 mm) wheel bearing nuts used on MFS-07 and MFS-08 Series axles, tighten to 150-225 lb-ft (203-305 N·m).
   d. For wheel bearing nuts in sizes from 1-1/8-inches up to 2-5/8-inches (28.6-66.7 mm), tighten to 200-300 lb-ft (271-407 N·m).
   e. For wheel bearing nuts 2-5/8-inches (66.7 mm) and more, tighten to 250-400 lb-ft (339-542 N·m).
   f. Measure the end play. The end play must be 0.001-0.005-inch (0.025-0.127 mm). Refer to Step (4) and Step (5). Readjust if necessary.
   g. If the end play is to specification, bend the washer to at least one flat edge of the outer wheel bearing nut.

(12) Install the gasket and the cap onto the hub. Install the capscrews and tighten to 20-30 lb-ft (27-41 N·m).

(13) Lower the vehicle to the ground. Check for correct vehicle operation.

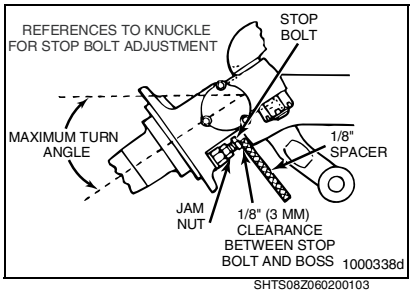
4. MAXIMUM TURN ANGLE ADJUSTMENT

⚠ CAUTION

Do not exceed the maximum turn angle specified by the vehicle manufacturer. If the angle is exceeded, the steering arms, the cross tube and the tie rod ends will be damaged.

The stop bolt on the back of the knuckle controls the maximum turn angle. If the stop bolt is missing, bent or broken, the system requires adjustment. Use the mechanical stop in the steering system to adjust the pressure relief.

Check the angle if the front tires rub against the frame or if the steering gear has been serviced. Use an alignment machine to check the angle.



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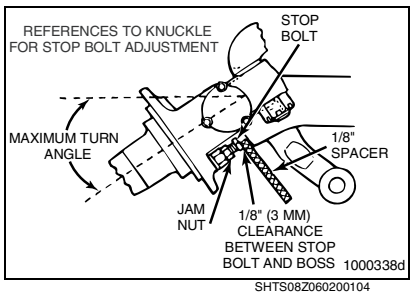
- **For power steering systems:** The stop bolt should NOT touch the beam. The stop bolt should always have a minimum clearance of 1/8-inch (3.0 mm) when the knuckle is in the full-turn position as shown in figure.

NOTICE

If the steering system is out-of-adjustment, inspect the steering arm for damage. Use a magnetic particle or liquid dye penetrant inspection procedure to inspect the steering arm. Pay particular attention to the bend, the taper and the area near the ball stud.

(1) Two-Piece Steering 3/4-Inch Stop Bolt, Includes Unitized
   a. Place a 1/8-inch (3.0 mm) spacer between the stop bolt and the boss on the axle beam.

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b. Turn the steering wheel until the boss on the axle beam touches the spacer in front of the stop bolt. Measure the turn angle.

c. If the maximum turn angle does not meet vehicle manufacturer's specifications, correct the maximum angle.

- **In a power steering system:** Adjust the pressure relief.
- **In a manual steering system:** Follow the guidelines and specifications from the vehicle manufacturer.

d. When the maximum turn angle is correct:

a. Loosen the stop bolt jam nut.

b. Insert a 1/8-inch (3.0 mm) spacer and adjust the stop bolt.

c. Tighten the jam nut on conventional knuckles to 65-85 lb-ft (68-101 N·m).

(2) Four-Piece Steering 1/2-Inch Stop Bolt, Conventional Only

a. Place the washer onto the adapter.

b. Apply adhesive patch material into the 3/4-inch (19.0 mm) knuckle bore stop screw adapter hole.

c. Install the adapter with the washer into the threaded knuckle cavity.

d. Tighten the adapter to 85-115 lb-ft (115-155 N·m).

e. Start the jam nut onto the 1/2-inch (12.7 mm) bolt, and install the bolt and jam nut assembly into the adapter.

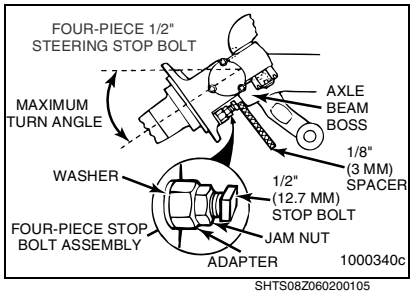
f. Place a 1/8-inch (3.0 mm) spacer between the stop bolt and the boss on the axle beam.

g. Turn the steering wheel until the boss on the axle beam touches the spacer in front of the stop bolt. Measure the turn angle.

h. If the maximum turn angle does not meet vehicle manufacturer's specifications, adjust the maximum turn angle.

- **In a power steering system:** Adjust the pressure relief.
- **In a manual steering system:** Follow guidelines and specifications from the vehicle manufacturer.

i. Proceed to the following instructions when the maximum turn angle is correct.



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a. Loosen the stop bolt jam nut.

b. Insert a 1/8-inch (3.0 mm) spacer between the stop bolt and the axle beam boss with the steering arm in the full-turn position.

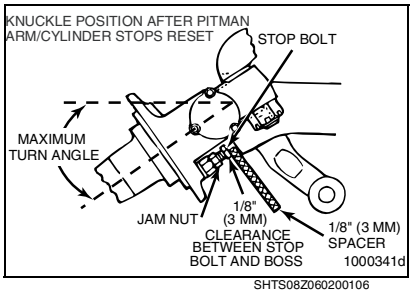
c. Tighten the jam nut 50-75 lb-ft (68-101 N·m).

5. ADJUST THE PRESSURE RELIEF IN THE POWER STEERING SYSTEM, SET THE MAXIMUM TURN ANGLE

⚠ CAUTION

In power steering systems, the hydraulic pressure should relieve or "drop off" at the end of the steering stroke, with 1/8-inch or 3 mm minimum clearance at the stop bolt. If the pressure does not relieve, the components of the front axle will be damaged.

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The pressure relief in the power steering system stops or reduces forces applied to the axle when the wheel is moved in the full-turn position.

Check the pressure relief if the steering arm is damaged or the power steering gear is serviced.

Two types of systems are used to adjust the pressure relief.

- Mechanical stop on the Pitman arm or in the assist cylinder
- Hydraulic pressure relief in the power steering gear

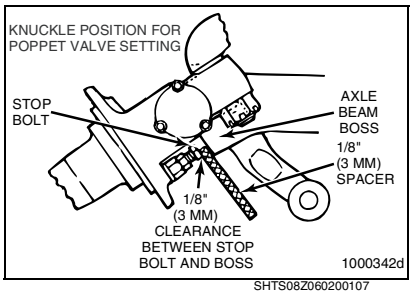
⚠ CAUTION
Meritor does not recommend a power steering system that does not have mechanical stops or pressure relief before the maximum turn angle is obtained. Damage to the axle can result.

(1) Mechanical Stop
Use the mechanical stop in the steering system to adjust the pressure relief. Do not use the stop bolt on the knuckle alone to adjust the poppet valve pressure relief.

⚠ CAUTION
Use a pressure gauge to verify that the pressure drops from the maximum system delivery pressure to gear box manufacturing recommendation BEFORE the full turning angle is achieved. If the pressure does not drop, damage to the front axle components will result.

Steering systems with mechanical stops are adjusted when the wheels are turned to the full-right and full-left turn positions. The stop travel is set at 1/8-inch (3.0 mm) before the stop bolt contacts the axle beam boss.

(2) Hydraulic Pressure Relief in the Steering Gear

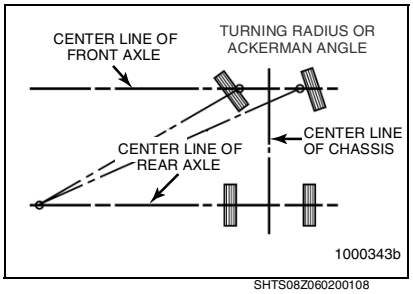


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NOTICE
The stop bolt should always have a minimum clearance of 1/8-inch (3.0 mm) between the stop bolt and the axle beam boss.

Hydraulic steering gears with poppet valves are adjusted with a spacer between the stop bolt in the knuckle and the boss on the axle beam. The poppet valves are adjusted to stop or reduce steering forces from the 1/8-inch (3.0 mm) specified distance between the beam boss and the spacer.

6. TURNING RADIUS ANGLE



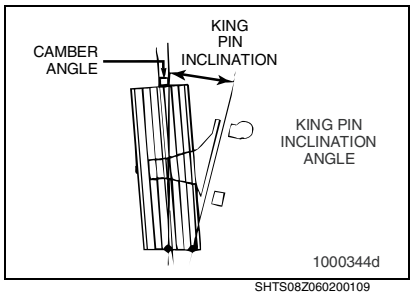
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When turning, the inner wheel must turn at a greater angle than the outer wheel. This angle is the turning radius angle, often called the Ackerman angle.

Check the turning radius angle with the radius plates on the alignment equipment. To determine correct turning radius angle specification, refer to "Data and Specifications" on page AX02-2.

- **If the angle is not within specifications:** Premature tire wear will occur. Inspect the knuckle, tie rod arms, tie rod ends and cross tube for wear or damage. Service as necessary.

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7. KING PIN INCLINATION

NOTICE

King pin, or steering axis inclination, is the angle measured between the center line of the king pin and the vertical position, as viewed from the front of the vehicle.

The king pin inclination and the camber angle are designed into the axle to place the tire tread center line in contact with the road. This reduces steering effort and improves directional stability.

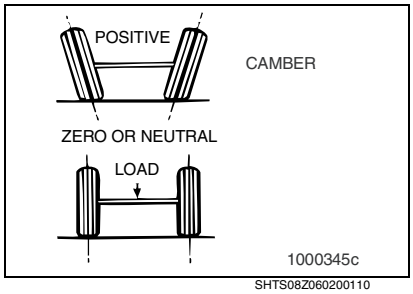
Use an alignment machine to check the king pin inclination angle. Refer to "Data and Specifications" on page AX02-2.

The king pin inclination is not adjustable. If the inclination is not at the specified angle, check the axle beam and knuckle for damage. Service as necessary.

8. CAMBER ANGLE

⚠ WARNING

Replace damaged or out-of-specification axle components. Do not bend, repair or recondition axle components by welding or heat-treating. A bent axle beam reduces axle strength, affects vehicle operation and voids Meritor's warranty. Serious personal injury and damage to components can result.



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Camber is the angle of the tire with respect to the ground. Camber is positive when the distance between the top of the wheels is greater than the distance at the ground.

A small amount of positive camber is built into the knuckle, because camber changes with load. This results in a zero camber angle when the vehicle is operated at normal load.

If camber is out of specification by more than 1-1/2 degrees, rapid or uneven tire wear will occur. Bias ply tires will show excess camber easily, while with vehicles equipped with radial tires, excess camber will not be as evident.

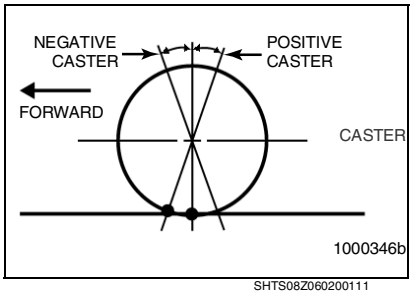
The camber angle is not adjustable. The camber angle is machined into both the axle beam and the knuckle. If the camber angle is not at the specified angle, check the axle beam and the steering knuckle for damage. Service as necessary.

Use an alignment machine to check the camber angle. Refer to "Data and Specifications" on page AX02-2. Following Table I gives the specification Meritor builds into the axle, but always use the specification from the vehicle manufacturer.

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Table I: Camber Angle Recommendations

Vehicle Condition	Axles with Biased Chamber	Axles with Unbiased Chamber
Truck or Tractor or Alignment Rack	Left Side: +11/16° to -3/16° Right Side: +3/16° to -11/16°	+3/16° to -11/16°
Axle Not Installed in Vehicle	Left Side: +3/4° Nominal Right Side: +1/4° Nominal	+1/4° Nominal



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9. CASTER ANGLE

Caster is the FORWARD or REARWARD tilt of the king pin center line when viewed from the side of the vehicle. The caster angle is the angle from the vertical position to the center line of the king pin. If the top of the king pin axis is toward the rear of the vehicle, the caster is positive. A slight positive caster creates a self-aligning action that helps to stabilize the vehicle after turning and stabilizes it for driving straight ahead.

Always use an alignment machine to check the caster angle.

If the caster is greater than specification, steering effort can increase a shimmy condition.

The caster angle is controlled by tapered shims installed under the leaf springs. Adjust the caster according to the specifications.

Caster specifications, refer to "Data and Specifications" on page AX02-2.

10. MEASURE AND ADJUST THE TOE

Toe is the relationship of the distance between the front of the front tires and the rear of the front tires.

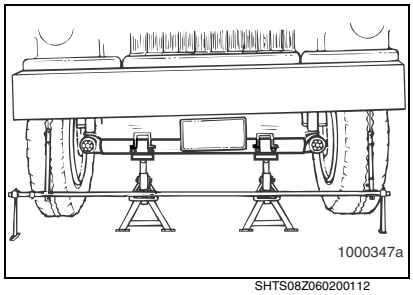
When the front distance is less than the rear distance, the wheels are "toed in." Toe-in is designed into the vehicle to counteract the tendency of the tires to toe-out when the vehicle is driven.

Incorrect toe will result in rapid tire wear.

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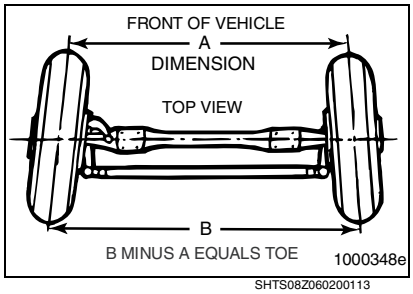
⚠ WARNING
Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

(1) Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Set the parking brake.
(2) Use jacks to raise vehicle so that front tires are off the ground. Support the front axle with safety stands.
(3) Use paint or chalk to mark the center area of both front tires around the complete outer surface of the tire.
(4) Place the pointers of a trammel bar on the marks of each tire. Rotate the tires. Verify that a straight line is marked on the outer surface of the tire.
(5) Lower the vehicle to the floor. Do not measure toe with the front axle in the raised position. The weight of the vehicle must be on the front axle when toe is measured. Move the vehicle FORWARD and BACKWARD 10 feet (3 meters).



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(6) Place the trammel bar at the back of the tires. Raise the pointers so that the pointers are level with the spindles. Align the pointers with the marks on the tires. Measure and record the distance between the pointers.
(7) Repeat Step (6) for the front of the tires.
(8) To obtain the toe measurement, subtract the distance reading between the front of the tires from the distance reading between the back of the tires.



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(9) Use the following procedure if the toe measurement is not within the correct specifications shown in below Table.

Toe Specifications

Unloaded Vehicles	**0.03-0.09 in. (0.8-2.4 mm)**
Loaded Vehicles	**0-0.06 in. (0-1.6 mm)**

a. Loosen the tube clamp nut and bolt on each end of the cross tube.
b. Turn the cross tube until the specified toe distance is obtained.
c. The threaded portion of the tie rod end must be installed into the cross tube beyond the point where the tube slot stops.
d. Tighten the nut and bolt on each end of the cross tube to the specified torque. Refer to "Front Non-Drive Axles with Conventional Wheel Ends", "Torque Specifications" in page AX02-9.

(10) Repeat Step (1) through Step (8) to check the toe dimension.

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LUBRICATION AND MAINTENANCE

EN08Z0602A200001

LUBRICATION

Read and observe all Caution and Warning safety alerts below and those that precede instructions or procedures you will perform.

⚠ WARNING

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

Front Non-Drive Axle Greasing Intervals and Specifications

Component	Greasing Interval	Grease	Meritor Specification	NL GI Grade	Grease Type	Outside Temperature
King Pins and Bushings, Thrust Bearings, Ball Studs on Steering Arm, Tie Rod Ends, and Drag Link[1]	100,000 miles (160,000 kilometers) or once a year, whichever comes first	Multi-Purpose Grease	O-617-A or O-617-B	1 or 2	Lithium 12 Hydroxystearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.
Unitized Wheel End	No Lube to Hub	Unit sealed for life of component	NONE	DO NOT LUBRICATE		

[1] Applies to ball studs on Easy SteerPlus axles. Sealedaxles require in spection of the boot on the ballstud every 100,000 miles (160,000 km) for wear and damage. Service as necessary.

Wheel-End Oil Change Intervals and Specifications

On-Highway Operation Intervals		Off-Highway Operation Intervals					Outside Temperature			
							°F		°C	
Check Oil Level	Petroleum Oil Change	Check Oil Level	Petroleum Oil Change	Meritor Specification	Military Specification	Oil Description	Min.	Max.	Min.	Max.
1,000 miles (1600 kilometers)	Whichever comes first: Seals replaced. Brakes relined 100,000 miles (160,000 kilometers) Once a year	1,000 miles (1600 kilometers	Whichever comes first: Seals replaced. Brakes relined. Once a year	O-76-A, Gear Oil	MIL-L-2105-D	GL-5, SAE 85W/140	10	None	12	None
				O-76-D, Gear Oil	MIL-L-2105-D	GL-5, SAE 80W/90	-15	None	- 26	None
				O-76-E, Gear Oil	MIL-L-2105-D	GL-5, SAE 75W/90	- 40	None	- 40	None
				O-76-J, Gear Oil	MIL-L-2105-D	GL-5, SAE 75W	- 40	36	- 40	2
				Heavy-Duty Engine Oil	MIL-L-210-B, -C, -D or -E	API -CD, -CE, -SF or -SG SAE 40 or 50[1]	10	None	12	None
				Heavy-Duty Engine Oil	MIL-L -210-B, -C, -D or -E	API -CD, -CE, -SF or -SG SAE 30[2]	- 15	None	- 26	None

[1] Current designations are acceptable. Multi-weight engine oils are acceotable if the SAE rating ends in a 40 or 50.

[2] Current designations are acceptable. Multi-weight engine oils are acceotable if the SAE rating ends in a 30.

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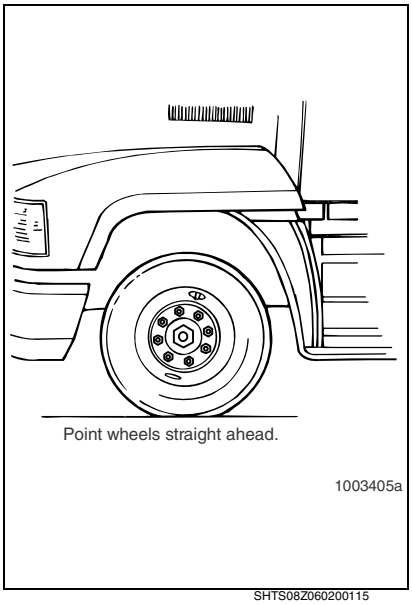
S1-UNAE09A-2.book 60 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

1. TIE ROD END

This procedure refers to all tie rod ends on Meritor non-drive steer axles.

(1) Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Set the parking brake.

(2) Turn the vehicle wheels to the STRAIGHT position.



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(3) Wipe the grease fitting, seal and boot clean with shop towels.

(4) Attach either a hand or air pressure grease gun to the grease fitting. If using air pressure, do not exceed 150 psi (1035 kPa).

(5) Apply grease into the grease fitting. Discolored old grease should come out of the purge holes near the boot crimp or bellows area, typically three or more places.

(6) If the tie rod end is designed for lube service and it does not accept grease:



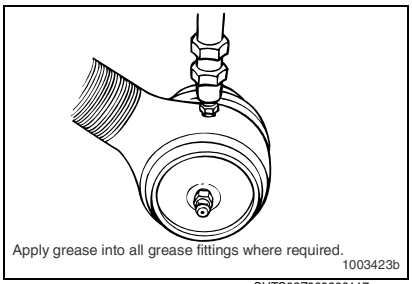
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a. Remove the grease fitting.

b. Inspect the threaded grease fitting hole in the tie rod end and remove any obstructions.

c. Install a new grease fitting.

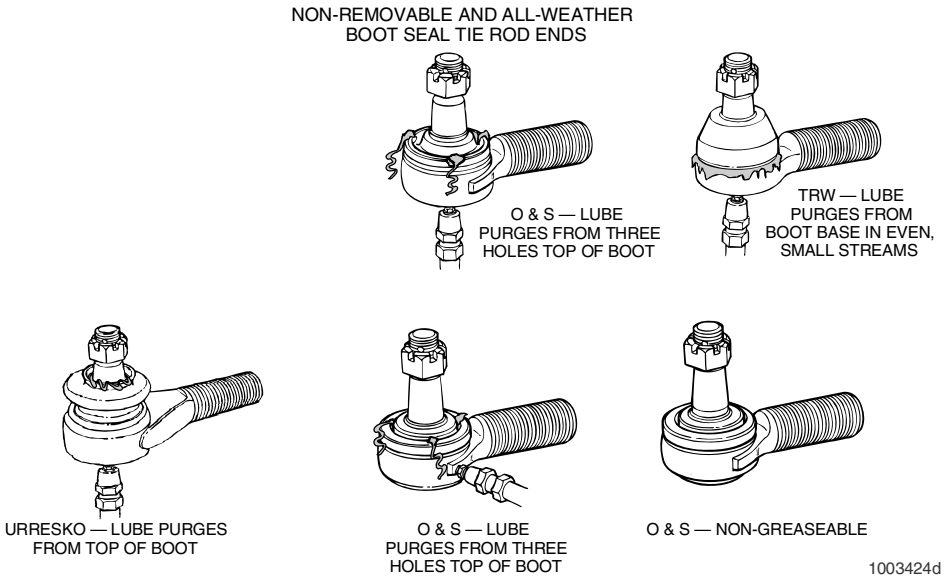
d. Continue the lubrication procedure.



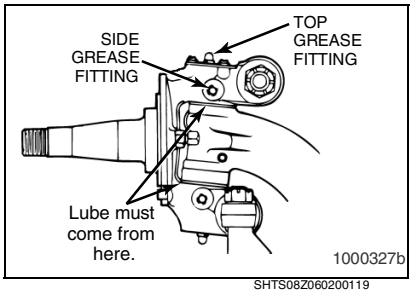
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(7) Apply grease until all old grease is purged from the boot.



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2. KING PINS

(1) Axles with Conventional Wheel Ends

a. Park the vehicle on a level surface. Block the wheels to keep the vehicle from moving. Set the parking brake.

b. Verify that the tires touch the ground. DO NOT RAISE THE VEHICLE.

c. Clean off all grease fittings prior to lubrication.

d. Lubricate the king pins through the top and the bottom grease fittings.

e. Apply lubricant until new lubricant comes from between the upper shim pack and thrust bearing seal.

f. Apply lubricant into the bottom fitting until new lubricant purges and fills the thrust bearing.

3. BALL STUDS ON THE STEERING ARM, THE TIE ROD ARM ENDS

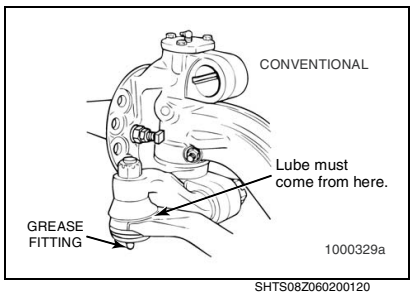
(1) Axles with Conventional and Unitized Wheel Ends

a. Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Set the parking brake.

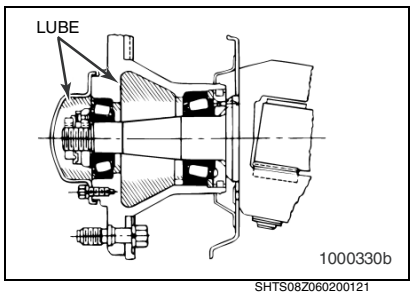
b. Verify that the tires touch the ground. DO NOT RAISE THE VEHICLE.

c. Clean off all grease fittings prior to lubrication.

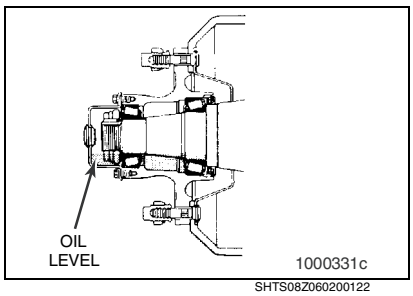
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d. Apply lubricant until new lubricant comes from the boot.

4. GREASE-LUBRICATED WHEEL BEARINGS

(1) Axles with Conventional Wheel Ends

NOTICE

This procedure applies to hubs with grease-lubricated wheel bearings.

a. Park the vehicle on a level surface. Block the wheels to keep the vehicle from moving. Set the parking brake.
b. Remove the tire and wheel assembly. Remove and disassemble the hub. Refer to "Wheel Ends" on page AX02-23.
c. Remove the old lubricant from all parts. Discard the seals. Inspect the wheel bearings for wear or damage. Replace worn or damaged bearings. Refer to "Wheel Bearings" on page AX02-35.
d. Force the specified lubricant from the large end of the cones into the cavities between the rollers and cage. Pack the hub between the bearing cups with lubricant to the level of the smallest diameter of the cups.
e. Install the inner and outer bearing cones into the cups in the hubs. The bearing cups must be pressed tight against the shoulder in the hubs.
f. Install new wheel seals into the hubs.
g. Install the hub and the wheel and tire assembly. Install the outer wheel bearing cone into the hub. Install the adjusting nut.
h. Adjust the wheel bearings. Refer to "Check and Adjust Wheel Bearings" on page AX02-51.

5. OIL-LUBRICATED WHEEL BEARINGS

(1) Axles with Conventional Wheel Ends

NOTICE

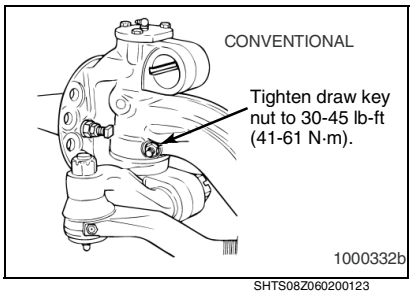
This procedure applies to hubs with oil-lubricated wheel bearings.

a. Check the level on the cap. If the oil level is not at the specified level on the cap, remove the fill plug.
b. Add the specified oil until the oil is at the specified level.

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MAINTENANCE

EN08Z0602G100001



SHTS08Z060200123

1. TIGHTEN DRAW KEY NUTS

(1) Axles with Conventional and Unitized Wheel Ends

NOTICE

This procedure applies to all except 901, 903 and 970 Series axles. These axles do not use a draw key. Refer to the identification tag on the front of the axle beam.

Tighten the nuts on the side of the knuckle that hold the draw keys to 30-45 lb-ft (41-61 N·m) at the following times.

- After the first 6,000 miles (10,000 km) of new vehicle operation
- Every 36,000 miles (58,000 km) of operation

2. CHECK THE STEERING ARM BOLTS

⚠ WARNING

Take care when you use Loctite® adhesive to avoid serious personal injury. Read the manufacturer's instructions before using this product. Follow the instructions carefully to prevent irritation to the eyes and skin. If Loctite® adhesive material gets into your eyes, follow the manufacturer's emergency procedures. Have your eyes checked by a physician as soon as possible.

(1) Check the steering arm bolts for minimum torque. Refer to below Table.

Steering Arm Bolts Torque Specifications

Axle	Torque lb-ft (N·m)
MFS-7 or MFS-8	360-470 (490-638)
All other axles	300-450 (406-610)

- If steering arm bolt torque has fallen below minimum torque:
  a. Remove the bolts. Clean all the threads. Install new Loctite® 680 adhesive, Meritor part number 2297-K-5523.
  b. Tighten the bolts to specification.

(2) Check the steering arm bolt torque every 200,000 miles (320,000 km) or 24 months.

(3) Refer to "Check the Torque Values of Dri-Loc® Fasteners Not Requiring Removal" on page AX02-33 for Dri-Loc® fastener installation procedures.

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REAR AXLE

AX03-001

REAR AXLE AX03-2
DATA AND SPECIFICATIONS AX03-2
TROUBLESHOOTING AX03-9
COMPONENT LOCATOR AX03-10
SPECIAL TOOL AX03-13
DISASSEMBLY AX03-15
PREPARE PARTS FOR ASSEMBLY AX03-17
ASSEMBLY AX03-21
ADJUSTMENT AX03-31
LUBRICATION AND MAINTENANCE AX03-33

S1-UNAE09A-2.book 2 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

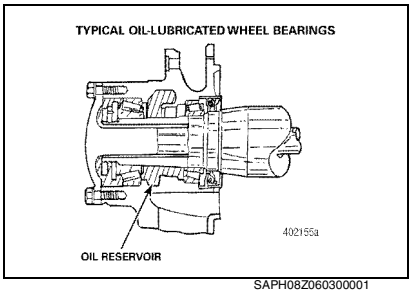
REAR AXLE

DATA AND SPECIFICATIONS

EN08Z0603I200001

Type	**Full-floating axle shaft**

MODEL		AXLE MODEL
HINO 238	(NE8J)	RS17-145
HINO 258LP	(NE8J, NJ8J)	RS17-145
HINO 268	(NE8J, NJ8J)	RS19-145
	(NF8J)	RS21-145
HINO 338	(NF8J)	RS21-145
	(NV8J)	RS21-145
		RS23-160
HINO 358	(NV8J)	RS23-160



SAPH08Z060300001

NOTICE
All models use oil-lubricated wheel bearings.

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SPEED LIMIT DATA LIST

- Speed limit must not exceed the following table.
- Be sure to carry out the adjustment of engine's speed limit data by Hino-DX when you change the tire size or rear axle gear ratio.

⚠ WARNING
The maximum speed limit of the speed limiter depends upon the tire size and rear axle gear ratio.
NEVER set the "speed limit" in excess of the speed set forth on the table below for the corresponding tire size and rear axle gear ratio.
ALWAYS adjust the engine's speed limit data by using the Hino-DX whenever the tire size or the rear axle gear ratio is changed.

Apply to allison auto transmission series

MODEL	AUTO TRANSMISSION MODEL	REAR AXLE SERIESE	REAR AXLE GEAR RATIO	TIRE SIZE	TIRE RADIUS	SPEEDLIMIT (km/h)	REFERENCE; SPEED LIMIT (mile/h)
NE; Lopro	2200HS 2200RDS	RS17	4.11	245/70R19.5	0.407	135	84
NJ; Lopro	2200HS 2200RDS	RS17	4.11	245/70R19.5	0.407	135	84
NE	2200HS 2200RDS	RS17	5.13	255/80R22.5	0.475	126	78
			5.13	10R22.5	0.492	131	81
			5.13	11R22.5	0.508	135	84
			5.29	255/80R22.5	0.475	123	76
			5.29	10R22.5	0.492	127	79
			5.29	11R22.5	0.508	131	81
	2200HS 2200RDS	RS19	5.13	255/70R22.5	0.453	120	74
			5.13	255/80R22.5	0.475	126	78
			5.13	295/75R22.5	0.493	131	81
			5.13	11R22.5	0.508	135	84
			5.29	255/70R22.5	0.453	117	73
			5.29	255/80R22.5	0.475	123	76
			5.29	295/75R22.5	0.493	127	79
			5.29	11R22.5	0.508	131	81
			5.57	255/70R22.5	0.453	111	69
			5.57	255/80R22.5	0.475	116	72
			5.57	295/75R22.5	0.493	121	75
			5.57	11R22.5	0.508	124	77
	2500RDS	RS19	5.13	255/70R22.5	0.453	120	74
			5.13	255/80R22.5	0.475	126	78
			5.13	295/75R22.5	0.493	131	81
			5.13	11R22.5	0.508	135	84
			5.29	255/70R22.5	0.453	117	73
			5.29	255/80R22.5	0.475	123	76
			5.29	295/75R22.5	0.493	127	79
			5.29	11R22.5	0.508	131	81
			5.57	255/70R22.5	0.453	111	69
			5.57	255/80R22.5	0.475	116	72
			5.57	295/75R22.5	0.493	121	75
			5.57	11R22.5	0.508	124	77

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MODEL	AUTO TRANSMISSION MODEL	REAR AXLE SERIESE	REAR AXLE GEAR RATIO	TIRE SIZE	TIRE RADIUS	SPEED LIMIT (km/h)	REFERENCE; SPEED LIMIT (mile/h)
NF	2500RDS	RS21	5.29	295/75R22.5	0.493	127	79
			5.29	11R22.5	0.508	131	81
			5.57	295/75R22.5	0.493	121	75
			5.57	11R22.5	0.508	124	77
NJ	2200HS 2200RDS	RS19	5.13	255/70R22.5	0.453	120	74
			5.13	255/80R22.5	0.475	126	78
			5.13	295/75R22.5	0.493	131	81
			5.13	11R22.5	0.508	135	84
			5.29	255/70R22.5	0.453	117	73
			5.29	255/80R22.5	0.475	123	76
			5.29	295/75R22.5	0.493	127	79
			5.29	11R22.5	0.508	131	81
			5.57	255/70R22.5	0.453	111	69
			5.57	255/80R22.5	0.475	116	72
			5.57	295/75R22.5	0.493	121	75
			5.57	11R22.5	0.508	124	77
	2500RDS	RS17	4.11	245/70R19.5	0.407	135	84
		RS19	5.13	255/70R22.5	0.453	120	74
			5.13	255/80R22.5	0.475	126	78
			5.13	295/75R22.5	0.493	131	81
			5.13	11R22.5	0.508	135	84
			5.29	255/70R22.5	0.453	117	73
			5.29	255/80R22.5	0.475	123	76
			5.29	295/75R22.5	0.493	127	79
			5.29	11R22.5	0.508	131	81
			5.57	255/70R22.5	0.453	111	69
			5.57	255/80R22.5	0.475	116	72
			5.57	295/75R22.5	0.493	121	75
			5.57	11R22.5	0.508	124	77

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MODEL	AUTO TRANSMISSION MODEL	REAR AXLE SERIESE	REAR AXLE GEAR RATIO	TIRE SIZE	TIRE RADIUS	SPEEDLIMIT (km/h)	REFERENCE; SPEED LIMIT (mile/h)
NV	2500RDS	RS21	4.88	295/75R22.5	0.493	138	86
			4.88	11R22.5	0.508	142	88
			5.29	295/75R22.5	0.493	127	79
			5.29	11R22.5	0.508	131	81
			5.57	295/75R22.5	0.493	121	75
			5.57	11R22.5	0.508	124	77
			5.86	295/75R22.5	0.493	115	71
			5.86	11R22.5	0.508	118	73
			6.14	295/75R22.5	0.493	110	68
			6.14	11R22.5	0.508	113	70
		RS23	5.38	11R22.5	0.508	129	80
			5.63	11R22.5	0.508	123	76
			6.14	11R22.5	0.508	113	70
	3000RDS	RS21	4.88	295/75R22.5	0.493	132	82
			4.88	11R22.5	0.508	136	84
			5.29	295/75R22.5	0.493	122	76
			5.29	11R22.5	0.508	126	78
			5.57	295/75R22.5	0.493	116	72
			5.57	11R22.5	0.508	119	74
			5.86	295/75R22.5	0.493	110	68
			5.86	11R22.5	0.508	114	71
			6.14	295/75R22.5	0.493	105	65
			6.14	11R22.5	0.508	108	67
		RS23	5.38	11R22.5	0.508	124	77
			5.63	11R22.5	0.508	118	73
			6.14	11R22.5	0.508	108	67

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IDENTIFICATION

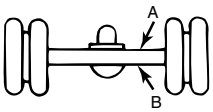
AXLE IDENTIFICATION TAG INFORMATION

Model No. . . . . .
Customer No. . . . . .

Serial No. . . . . Plant . . . . . .
Ratio . . . . . .

IDENTIFICATION TAG

LOCATION OF THE IDENTIFICATION TAG, OR STAMP NUMBER, FOR THE AXLES. LOCATION IS DETERMINED FROM THE LEFT DRIVER SIDE LOOKING TOWARD THE FRONT OF THE VEHICLE.

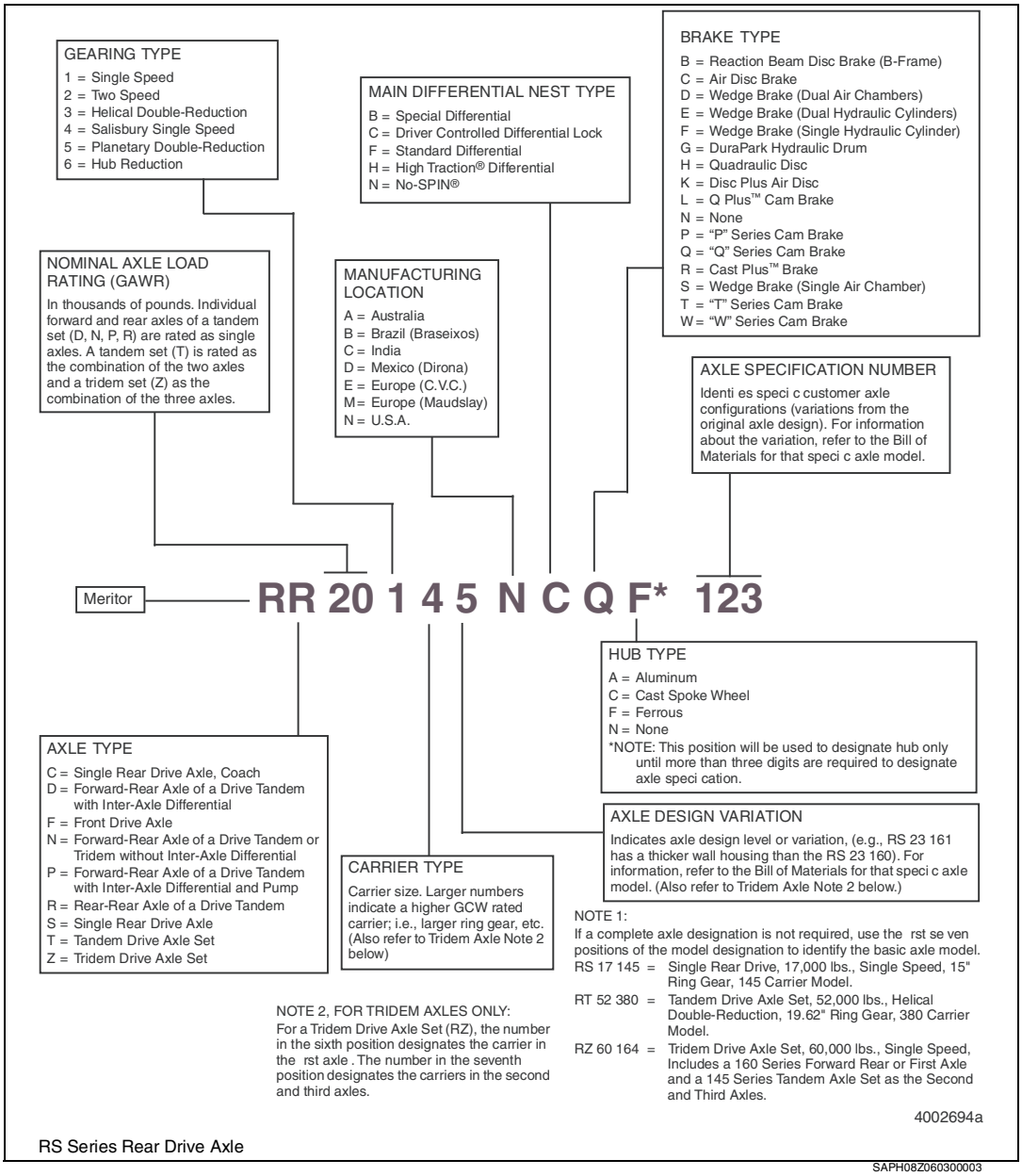


A — FRONT ENGINE DRIVE — RIGHT REAR, NEXT TO COVER
B — REAR ENGINE DRIVE — LEFT OR RIGHT REAR, NEXT TO DRIVE UNIT

1002704c

SAPH08Z060300002

S1-UNAE09A-2.book 7 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



RS Series Rear Drive Axle

SAPH08Z060300003

S1-UNAE09A-2.book 8 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

Hazard Summary

Because some brake linings contain asbestos, workers who service brakes must understand the potential hazards of asbestos and precautions for reducing risks. Exposure to airborne asbestos dust can cause serious and possibly fatal diseases, including asbestosis (a chronic lung disease) and cancer, principally lung cancer and mesothelioma (a cancer of the lining of the chest or abdominal cavities). Some studies show that the risk of lung cancer among persons who smoke and who are exposed to asbestos is much greater than the risk for non-smokers. Symptoms of these diseases may not become apparent for 15, 20 or more years after the first exposure to asbestos.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons. OSHA has set a maximum allowable level of exposure for asbestos of 0.1 f/cc as an 8-hour time-weighted average and 1.0 f/cc averaged over a 30-minute period. Scientists disagree, however, to what extent adherence to the maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling asbestos dust. OSHA requires that the following sign be posted at the entrance to areas where exposures exceed either of the maximum allowable levels:

DANGER: ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA.

2. Respiratory Protection. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA for use with asbestos at all times when servicing brakes, beginning with the removal of the wheels.

3. Procedures for Servicing Brakes.

a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.

b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

c. If an enclosed vacuum system or brake washing equipment is not available, employers may adopt their own written procedures for servicing brakes, provided that the exposure levels associated with the employer's procedures do not exceed the levels associated with the enclosed vacuum system or brake washing equipment. Consult OSHA regulations for more details.

d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.

e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.

4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.

5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.

6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

NON-ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to non-asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

Hazard Summary

Most recently manufactured brake linings do not contain asbestos fibers. These brake linings may contain one or more of a variety of ingredients, including glass fibers, mineral wool, aramid fibers, ceramic fibers and silica that can present health risks if inhaled. Scientists disagree on the extent of the risks from exposure to these substances. Nonetheless, exposure to silica dust can cause silicosis, a non-cancerous lung disease. Silicosis gradually reduces lung capacity and efficiency and can result in serious breathing difficulty. Some scientists believe other types of non-asbestos fibers, when inhaled, can cause similar diseases of the lung. In addition, silica dust and ceramic fiber dust are known to the State of California to cause lung cancer. U.S. and international agencies have also determined that dust from mineral wool, ceramic fibers and silica are potential causes of cancer.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to non-asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons.

2. Respiratory Protection. OSHA has set a maximum allowable level of exposure for silica of 0.1 mg/m³ as an 8-hour time-weighted average. Some manufacturers of non-asbestos brake linings recommend that exposures to other ingredients found in non-asbestos brake linings be kept below 1.0 f/cc as an 8-hour time-weighted average. Scientists disagree, however, to what extent adherence to these maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling non-asbestos dust.

Therefore, wear respiratory protection at all times during brake servicing, beginning with the removal of the wheels. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA, if the exposure levels may exceed OSHA or manufacturer's recommended maximum levels. Even when exposures are expected to be within the maximum allowable levels, wearing such a respirator at all times during brake servicing will help minimize exposure.

3. Procedures for Servicing Brakes.

a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.

b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

c. If an enclosed vacuum system or brake washing equipment is not available, carefully clean the brake parts in the open air. Wet the parts with a solution applied with a pump-spray bottle that creates a fine mist. Use a solution containing water, and, if available, a biodegradable, non-phosphate, water-based detergent. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.

e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.

4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA, to minimize exposure. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.

5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.

6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

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TROUBLESHOOTING

EN08Z0603F300001

HAZARD ALERT MESSAGES

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

⚠ **WARNING**

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

1. TROUBLESHOOTING DIAGNOSTIC CHART

Significant wheel end component wear may enable the ABS warning light and cause a fault code to be set. Slow return of the steering wheel to its neutral position following completion of a turn may be another indication of wheel end component wear.

Wheel-End Component Troubleshooting

Condition	Cause	Correction
Tires wear out quickly or have uneven tire tread wear.	Tires have incorrect air pressure.	Place the specified air pressure in the tires.
	Tires are out-of-balance.	Balance or replace the tires.
	Tandem axle alignment is incorrect.	Align the tandem axles.
	Toe-in setting is incorrect.	Adjust the toe-in to the specified setting.
	Steering arm geometry is incorrect.	Service the steering system as necessary.
	Wheel end play is excessive.	Readjust the wheel bearings.

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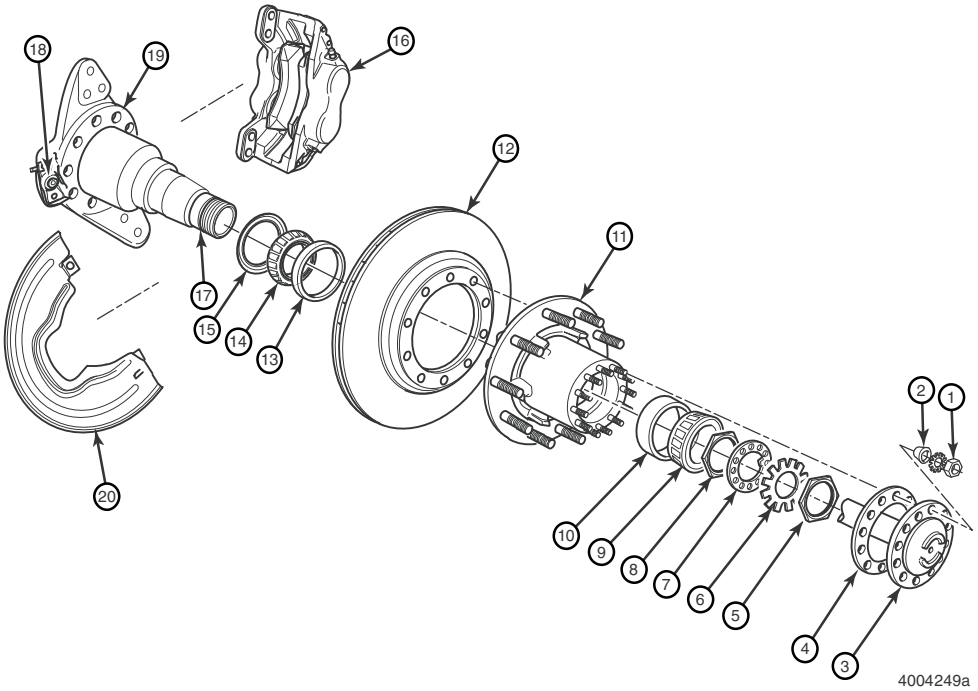
S1-UNAE09A-2.book 10 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

COMPONENT LOCATOR

EN08Z0603D100001

1. RS19-145 (QUADRAULIC™ DISC BRAKE)

REPRESENTATIVE MODEL

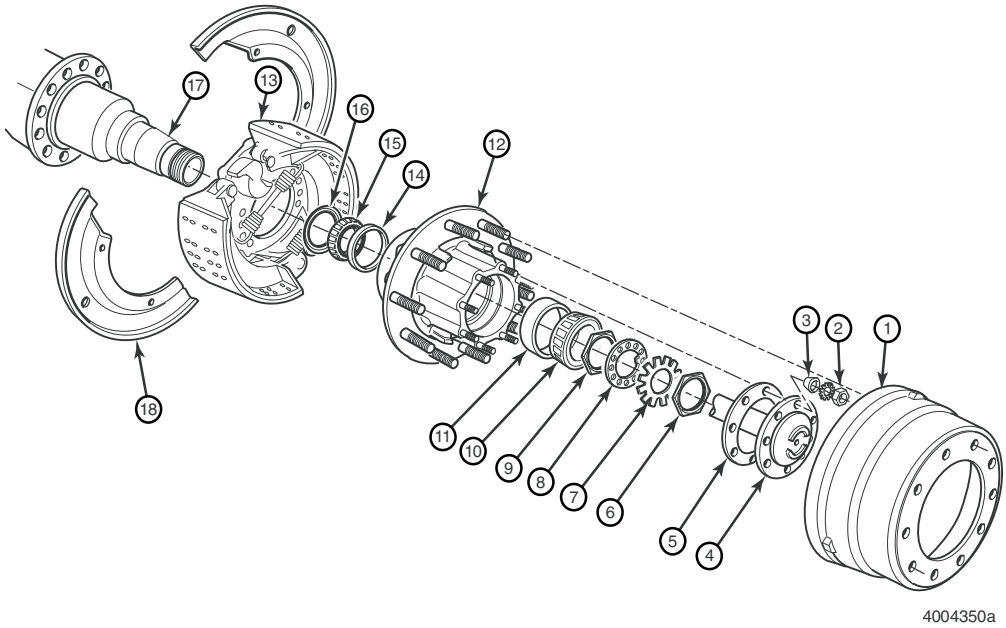


SAPH08Z060300006

1	Nut and Star Lock Washer	11	Hub
2	Tapered Dowel	12	Disc Brake Rotor
3	Axle Shaft	13	Inner Race
4	Gasket	14	Inner Wheel Bearing
5	Outer Wheel Bearing Jam Nut	15	Oil Seal
6	Tabbed Lock Washer	16	Reaction Beam Caliper Assembly
7	Pierced Lock Ring with Keyway Tab	17	Spindle
8	Outer Wheel Bearing Adjusting Nut	18	ABS Sensor
9	Outer Wheel Bearing	19	Knuckle
10	Outer Race	20	Backing Plate

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2. RS21-145 (Q PLUS™ CAM BRAKE)



SAPH08Z060300007

1	Brake Drum	10	Outer Wheel Bearing
2	Nut and Star Lock Washer	11	Outer Race
3	Tapered Dowel	12	Hub
4	Axle Shaft	13	Q Plus™ Cam Brake Assembly
5	Gasket	14	Inner Race
6	Outer Wheel Bearing Jam Nut	15	Inner Wheel Bearing
7	Tabbed Lock Washer	16	Oil Seal
8	Pierced Lock Ring with Keyway Tab	17	Spindle
9	Outer Wheel Bearing Adjusting Nut	18	Backing Plate

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3. TORQUE SPECIFICATIONS

(1) RS Series Wheel-End Components

Conventional Wheel-End Torque Specifications

Axle Model	Hub and Drum or Rotor Assembly	Hub	Drum or Rotor	Initial Adjusting Nut Torque Lb-Ft (N•m)	Jam Nut Torque Lb-Ft (N•m)	Rotor Attach Bolt Size	Rotor Attach Bolt Torque Lb-Ft (N•m)	Axle Shaft Fastener Size	Axle Shaft Fastener Torque Lb-Ft (N•m)[1]
RS17	16157191000	15719	123557		100-200 (136-339)				65-100 (88-136)
RS19									
RS21	1415675107MTB	15675	123207			–	–	5/8-18	150-230 (203-312)
RS23	16159431000	15943	123574			–	–		

[1] Refer to Axle Division recommendations.

SAPH08Z060300008

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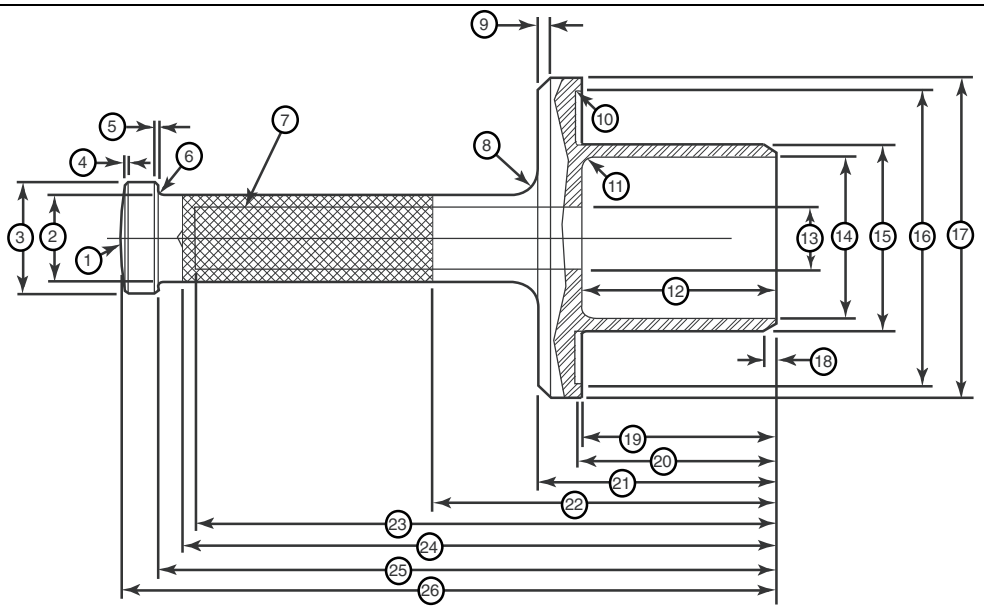
SPECIAL TOOL

EN08Z0603K100001

1. WHEEL-END SEAL DRIVER APPLICATION

To obtain these tools, call Arvin Meritor's Commercial Vehicle Aftermarket at 888-725-9355 to obtain Meritor tools and supplies.

(1) RS17-145 AND RS19-145 AXLE



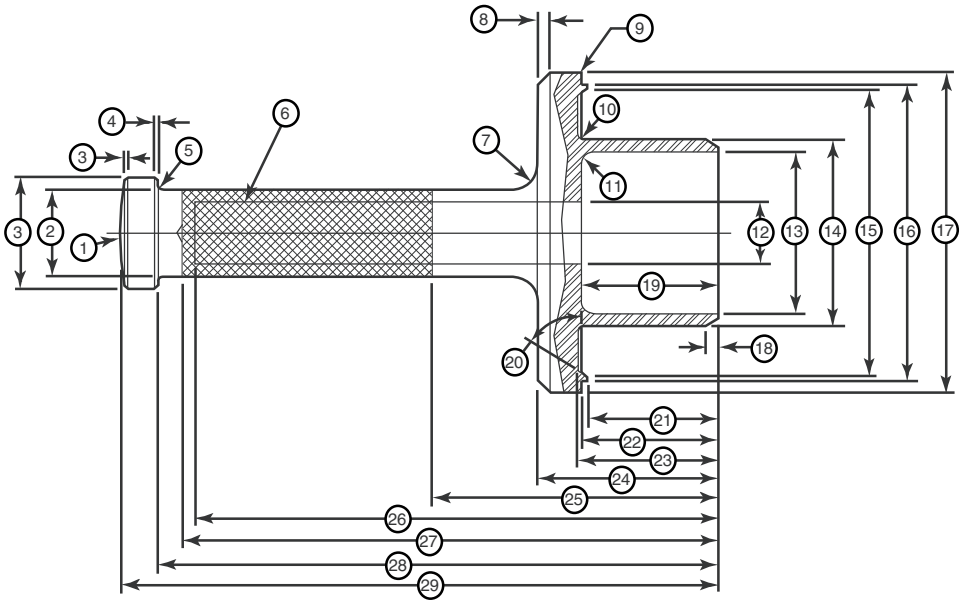
4004345a

1 6” (152.4 MM) SPHERE RADIUS	9 0.25” (6.35 MM) X 45˚	16 5.25” (133.1 MM) DIAMETER	22 4.25” (107.95 MM)
2 1.75” (44.45 MM) DIAMETER	10 0.03” (0.76 MM) X 45˚	17 5.63” (143 MM) DIAMETER	23 6.25” (158.75 MM)
3 2.25” (57.15 MM) DIAMETER	11 0.06” (1.52 MM) R-TYP	18 3.5” (88.9 MM)	24 11” (279.4 MM)
4 0.06” (1.52 MM) X 45˚ TYP	12 0.25” (6.35 MM) RADIUS	19 0.25” (6.35 MM) X 30˚	25 11.25” (285.75 MM)
5 0.06” (1.52 MM) X 45˚	13 1.25” (31.75 MM)	20 3.25” (82.55 MM)	26 11.75” (298.45 MM)
6 0.13” (3.3 MM) RADIUS	14 2.75” (69.85 MM)	21 3.37” (85.6 MM)	27 12.5” (317.5 MM)
7 COARSE KNURL	15 3.24” (82.296 MM) DIAMETER		
8 0.5” (12.7 MM) RADIUS			

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(2) RS21-145 AXLE (CAM BRAKE AND DISC BRAKE)



4004344a

1	6” (152.4 MM) SPHERE RADIUS	10	0.02” (0.5 MM) X 45° CHAMFER (2)	17	5.875” (149.225 MM) DIAMETER	24	2.81” (71.374 MM)
2	1.75” (44.45 MM)	11	0.12” (3.05 MM) RADIUS			25	3.62” (91.95 MM)
3	2.25” (57.15 MM) DIAMETER	12	0.25” (6.35 MM) RADIUS	18	6.25” (158.75 MM) DIAMETER	26	5.75” (146.05 MM)
4	0.06” (1.524 MM) X 45° TYP	13	1.25” (31.75 MM) DIAMETER			27	10.5” (266.7 MM)
5	0.06” (1.524 MM) X 45° TYP	14	3.25” (82.55 MM) DIAMETER	19	0.25” (6.35 MM) X 30°	28	10.75” (273.1 MM)
6	0.13” (3.302 MM) RADIUS	15	3.745” (95.123 MM) DIAMETER	20	2.75” (69.85 MM)	29	11.25” (285.75 MM)
7	COARSE KNURL	16	5.775” (146.685 MM) DIAMETER	21	60°	30	12” (304.8 MM)
8	0.5” (12.7 MM) RADIUS			22	0.11” (2.79 MM)		
9	0.25” (6.35 MM) X 45°			23	2.75” (69.85 MM)		

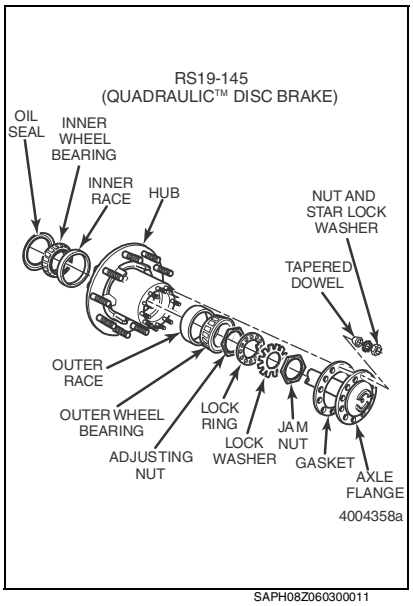
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DISASSEMBLY

EN08Z0603H200001

RS SERIES WHEEL END — REAR DRIVE AXLE



SAPH08Z060300011

1. RS19-145 — QUADRAULICT™ DISC BRAKE

(1) Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Set the parking brake.

(2) Raise the vehicle until the wheels are off the ground. Support the vehicle with safety stands.
(3) Remove the tire and wheel assembly.
(4) Remove the four fasteners securing the Quadraulic™ disc brake caliper assembly to the torque plate.
(5) Remove the caliper assembly from the torque plate.
(6) Remove the 12 nut fasteners and star lock washers securing the axle shaft to the hub.

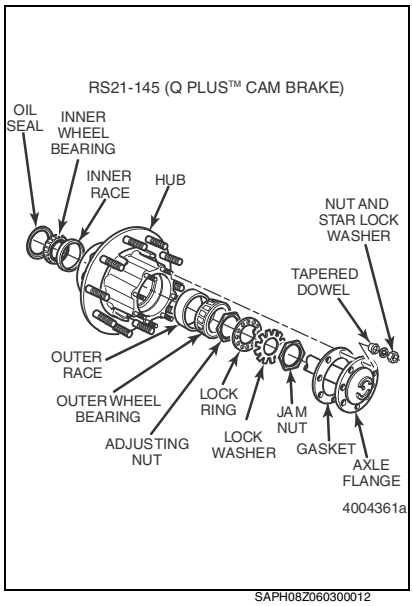
NOTICE
These nuts cannot be reused and must be replaced during assembly.

(7) Tap the axle shaft flange on the strike bars to loosen the tapered dowels.
(8) Remove the tapered dowels, axle shaft and gasket.
(9) Remove the fastening hardware securing the wheel bearings.
   a. Bend back the tabs of the tabbed lock washer holding the outer wheel bearing jam nut.
   b. Remove the outer wheel bearing jam nut, the tabbed lock washer, the pierced lock ring with keyway tab and the outer wheel bearing adjusting nut from the spindle.
(10) Carefully rock the hub from side-to-side to free the outer wheel bearing. Remove the outer wheel bearing. Remove the hub and rotor assembly.
(11) Using a seal puller, remove the inner wheel bearing oil seal from the hub. Discard the seal.
(12) Remove the inner wheel bearing.
(13) Inspect the bearings, races and spindle for signs of damage. Refer to PREPARE PARTS FOR ASSEMBLY on page AX03-17 to 20.

NOTICE
Worn or damaged wheel-end components must be replaced as a set.

(14) If damage to either race is observed, tap out the inner and outer races with a brass drift and discard.
(15) Use the correct cleaning solution to remove the old lubricant from all parts. Refer to PREPARE PARTS FOR ASSEMBLY on page AX03-17 to 20.

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SAPH08Z060300012

2. RS21-145 — Q PLUS™ CAM BRAKE

(1) Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Set the parking brake.

(2) Raise the vehicle until the wheels are off the ground. Support the vehicle with safety stands.

(3) Remove the tire and wheel assembly.

(4) Cage the brake chamber.

(5) Remove the brake drum.

(6) Remove the eight nuts and star lock washers securing the axle shaft to the hub.

(7) Tap the axle shaft flange on the strike bars to loosen the tapered dowels.

(8) Remove the tapered dowels, axle shaft and gasket.

(9) Remove the fastening hardware securing the outer wheel bearing.
   a. Bend back the tabs of the tabbed lock washer holding the outer wheel bearing jam nut.
   b. Remove the outer wheel bearing jam nut.
   c. Remove the tabbed lock washer, the pierced lock ring with keyway tab and the outer wheel bearing adjusting nut from the spindle.

(10) Carefully rock the hub from side-to-side to free the outer wheel bearing. Remove the outer wheel bearing and hub.

(11) Using a seal puller, remove the inner wheel bearing oil seal from the hub. Discard the seal.

(12) Remove the inner wheel bearing.

(13) Inspect the bearings, races and spindle for signs of damage.

NOTICE

Worn or damaged wheel-end components must be replaced as a set.

(14) If damage to either race is observed, tap out the inner and outer races with a brass drift and discard.

(15) Use the correct cleaning solution to remove the old lubricant from all parts. Refer to PREPARE PARTS FOR ASSEMBLY on page AX03-17 to 20.

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PREPARE PARTS FOR ASSEMBLY

EN08Z0603H200002

HAZARD ALERT MESSAGES

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

⚠ WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Replace damaged or out-of-specification axle components. Do not bend, repair or recondition axle components by welding or heat-treating. A bent axle beam reduces axle strength, affects vehicle operation and voids Meritor's warranty. Serious personal injury and damage to components can result.

1. **REPLACE WORN OR DAMAGED PARTS**
   Do not repair or recondition wheel-end components. Replace damaged, worn or out-of-specification components. Do not mill or machine any components.

⚠ WARNING

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, and emulsion-type and petroleum-base cleaners. Read the manufacturer's instructions before using a solvent cleaner, then carefully follow the instructions. Also follow the procedures below.

- **Wear safe eye protection.**
- **Wear clothing that protects your skin.**
- **Work in a well-ventilated area.**
- **Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.**
- **You must use hot solution tanks or alkaline solutions correctly. Read the manufacturer's instructions before using hot solution tanks and alkaline solutions. Then carefully follow the instructions.**

⚠ CAUTION

Do not use hot solution tanks or water and alkaline solutions to clean ground or polished parts. Damage to parts can result.

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2. CLEAN, DRY AND INSPECT PARTS

(1) Ground or Polished Parts

a. Use a cleaning solvent to clean the ground or polished parts and surfaces. Kerosene or diesel fuel can be used for this purpose. DO NOT USE GASOLINE.

b. Do NOT clean ground or polished parts in a hot solution tank or with water, steam or alkaline solutions. These solutions will cause corrosion of the parts.

c. Thoroughly clean the hub cavity with spray degreaser. The cavity must be free of any metal chips or dirt.

d. To remove grease from a wheel end, use a stiff fiber brush, not steel, and kerosene or diesel fuel, not gasoline. Allow the parts to dry. Note that any solvent residue must be completely wiped dry since it may either dilute the grease or oil or prevent the lubricant from correctly adhering to the wheel-end components.

e. Clean and inspect the wheel bearings, race, spindle bearing journals and hub. Bearings should be cleaned in a suitable non-flammable solvent and dried with either compressed air or a lint-free rag.

NOTICE

If compressed air is used, do not spin dry the bearings as the rollers may score due to lack of lubricant. Ensure that the air line is moisture free.

3. ROUGH PARTS

Rough parts can be cleaned with the ground or polished parts. Rough parts also can be cleaned in hot solution tanks with a weak alkaline solution. Parts must remain in the hot solution tanks until they are completely cleaned and heated.

4. DRY CLEANED PARTS

Parts must be dried immediately after cleaning. Dry parts with clean paper or rags, or compressed air. Do not dry bearings by spinning with compressed air.

5. PREVENT CORROSION ON CLEANED PARTS

Apply a light oil to cleaned and dried parts that are not damaged and are to be immediately assembled. Do NOT apply oil to the brake linings or the brake drums.

If the parts are to be stored, apply a good corrosion preventative to all surfaces. Do NOT apply the material to the brake linings or the brake drums. Store the parts inside special paper or other material that prevents corrosion.

NOTICE

All tapered joints must be clean and dry with no lubrication or corrosion preventative applied to the mating surfaces.

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INSPECTION WHEEL-END COMPONENTS

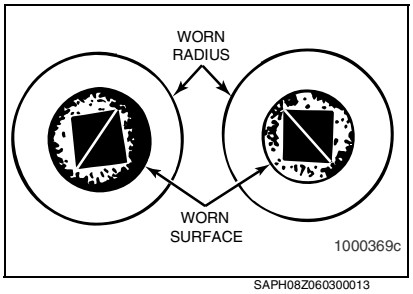
1. FOLLOWING DISASSEMBLY AND CLEANING OF THE WHEEL-END COMPONENTS, INSPECT THE SPINDLE JOURNALS, HUB AND WHEEL BEARINGS FOR SIGNS OF WEAR AND DAMAGE.

NOTICE

Damage to either the wheel bearing or race will require replacement of both bearings and races as a set.

2. INSPECT THE CUP, THE CONE AND THE ROLLERS AND CAGE OF THE WHEEL BEARINGS FOR THE FOLLOWING DEFECTS.

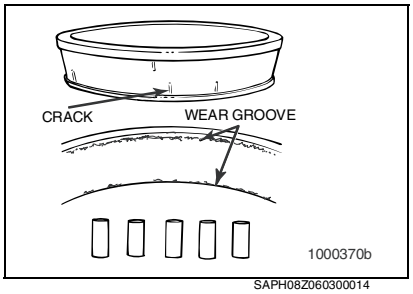
- Cracked or broken separators
- Broken or cracked rollers
- Flaked areas on rollers or races
- Spalled rollers or races
- Overheated bearings
- Brinelled races
- Scored or etched rollers or races
- Pitting of rollers or races
- Wear bands on critical surfaces
- Rust or corrosion on critical surfaces



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If any of the following conditions exist, you must replace the bearing.

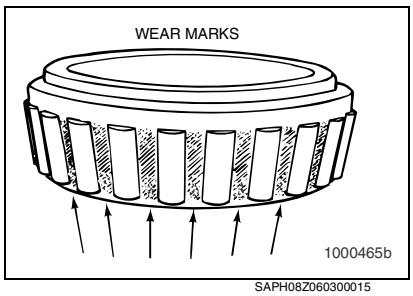
- The center of the large diameter end of the rollers is worn level or below the outer surface.
- The radius at the large diameter end of the rollers is worn to a sharp edge.



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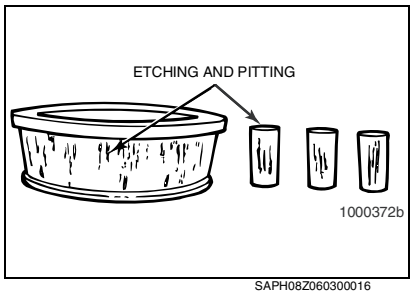
- There is a visible roller groove in the cup or the cone inner race surfaces. The groove can be seen at the small or large diameter end of both parts.
- There are deep cracks or breaks in the cup, the cone inner race or the roller surfaces.

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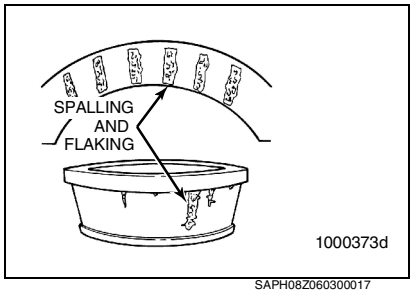
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- There are bright wear marks on the outer surface of the roller cage.



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- There is damage on the rollers and on the surfaces of the cup and the cone inner race that touch the rollers.



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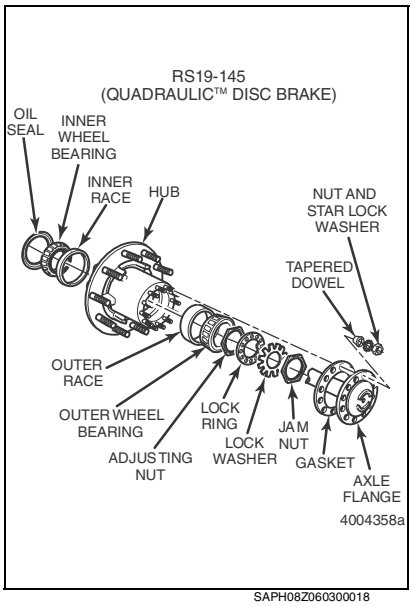
- There is damage on the cup and the cone inner surfaces that touch the rollers.

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ASSEMBLY

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RS SERIES WHEEL END — REAR DRIVE AXLE



SAPH08Z060300018

1. RS19-145 — QUADRAULIC™ DISC BRAKE

(1) If removed during the previous wheel-end disassembly procedure, install the torque plate and backing plate onto the knuckle.

(2) Lubricate both the inner and outer wheel bearings. Dip the wheel bearings into the same lubricant as used in the differential carrier housing. Refer to LUBRICATION AND MAINTENANCE on pages AX03-33 to 34.

- **If race or wheel bearing replacement is required as a result of damage observed during the disassembly procedure:** Replace these components as a set. If necessary, drive new inner and outer bearing races into the hub.

(3) Insert the inner wheel bearing into the hub bore.

(4) Install a new oil seal using the correct seal driver. Refer to SPECIAL TOOL on pages AX03-13 to 14.

(5) Carefully install the hub and rotor assembly onto the spindle. Ensure that the assembly is correctly seated.

⚠ CAUTION
Do not assemble dry. Damage to wheel end components may result.

(6) Before the outer wheel bearing is installed, fill the wheel cavity with the same lubricant as used in the differential carrier housing. Typically, one-half pint of lubricant is required.

(7) Insert the outer wheel bearing into the hub bore.

(8) Secure the hub and rotor assembly on the spindle using the outer wheel bearing adjusting nut. The adjusting nut must be installed so that the nipple faces outward toward the axle shaft flange. Tighten finger-tight.

(9) Tighten the outer wheel bearing adjusting nut to 100 lb-ft (136 N·m) while rotating the hub in both directions. This will ensure correct bearing-to-hub bore contact. Refer to TORQUE SPECIFICATIONS on page AX03-12.

(10) Back off the outer wheel bearing adjusting nut one full turn.

(11) Retighten the outer wheel bearing adjusting nut to 50 lb-ft (68 N·m) while rotating the hub.

(12) Back off the outer wheel bearing adjusting nut 1/3 turn.

(13) Install the pierced lock ring so that the inner tab locks into the spindle keyway and the outer wheel bearing adjusting nut nipple engages one of the through holes on the lock ring.

(14) Install a new tabbed lock washer onto the spindle.

(15) Install the outer wheel bearing jam nut. Tighten to 100-250 lb-ft (136-339 N·m). Refer to TORQUE SPECIFICATIONS on page AX03-12.

(16) Measure bearing end play with a dial indicator. Bearing end play should be 0.001-0.005-inch (0.025-0.127 mm). Refer to ADJUSTMENT on pages AX03-31 to 32.

(17) If necessary, adjust bearing end play to obtain the correct dial indicator reading. Refer to ADJUSTMENT on pages AX03-31 to 32.

(18) Bend two opposed lock washer tabs over the outer wheel bearing jam nut to lock it in position.

(19) Install the axle shaft and gasket.

(20) Install the tapered dowels.

(21) Secure the axle shaft with 12 star lock washers and 12 new nuts. Tighten to 75-115 lb-ft (102-156 N·m).

(22) Install the Quadraulic™ disc brake caliper assembly onto the torque plate with four fasteners and washers. Tighten to 320-360 lb-ft (435-490 N·m). Refer to TORQUE SPECIFICATIONS on page AX03-12.

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(23) Check the rear end differential fluid level by removing the oil fill plug from the carrier or housing bowl. If necessary, add the specified fluid through the carrier or housing bowl oil fill hole. Fill so that the fluid level is even with the bottom of the fill plug hole.

2. RS21-145 — Q PLUS™ CAM BRAKE

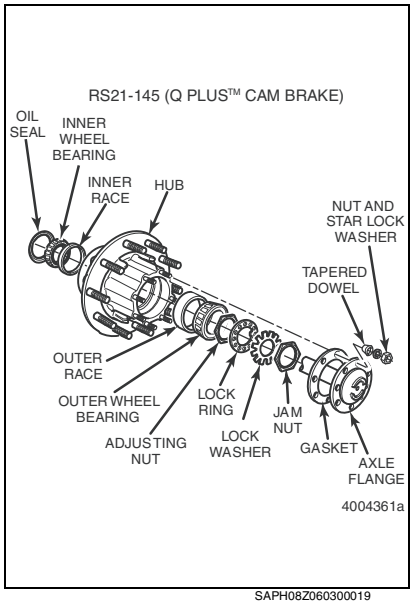
(1) Lubricate both the inner and outer wheel bearings. Dip the wheel bearings into the same lubricant as used in the differential carrier housing. Refer to LUBRICATION AND MAINTENANCE on pages AX03-33 to 34.

- **If race or wheel bearing replacement is required as a result of damage observed during the disassembly procedure:** Replace these components as a set. If necessary, drive new inner and outer bearing races into the hub.

(2) Insert the inner wheel bearing into the hub bore.
(3) Install a new oil seal using the correct seal driver. Refer to SPECIAL TOOL on pages AX03-13 to 14.
(4) Carefully install the hub assembly onto the spindle. Ensure that the assembly is correctly seated.

⚠ CAUTION
Do not assemble dry. Damage to wheel end components may result.

(5) Before the outer wheel bearing is installed, fill the wheel cavity with the same lubricant as used in the differential carrier housing. Typically, one-half pint of lubricant is required.
(6) Insert the outer wheel bearing into the hub bore.
(7) Secure the hub assembly on the spindle using the outer wheel bearing adjusting nut. The adjusting nut must be installed so that the nipple faces outward toward the axle shaft flange. Tighten finger-tight.
(8) Tighten the outer wheel bearing adjusting nut to 100 lb-ft (136 N·m) while rotating the hub in both directions. This will ensure correct bearing-to-hub bore contact. Refer to TORQUE SPECIFICATIONS on page AX03-12.
(9) Back off the outer wheel bearing adjusting nut one full turn.
(10) Retighten the outer wheel bearing adjusting nut to 50 lb-ft (68 N·m) while rotating the hub.
(11) Back off the outer wheel bearing adjusting nut 1/3 turn.
(12) Install the pierced lock ring so that the inner tab locks into the spindle keyway and the outer wheel bearing adjusting nut nipple engages one of the through holes on the lock ring.
(13) Install a new tabbed lock washer onto the spindle.
(14) Install the outer wheel bearing jam nut. Tighten to 100-250 lb-ft (136-339 N·m). Refer to TORQUE SPECIFICATIONS on page AX03-12.
(15) Measure bearing end play with a dial indicator. Bearing end play should be 0.001-0.005-inch (0.025-0.127 mm). Refer to ADJUSTMENT on pages AX03-31 to 32.
(16) If necessary, adjust bearing end play to obtain the correct dial indicator reading. Refer to ADJUSTMENT on pages AX03-31 to 32.
(17) Bend two opposed lock washer tabs over the outer wheel bearing jam nut to lock it in position.
(18) Install the axle shaft and gasket.
(19) Install the tapered dowels.
(20) Secure the axle shaft with eight star lock washers and nuts. Tighten to 150-230 lb-ft (203-312 N·m).
(21) Install the brake drum onto the hub.
(22) Check the rear end differential fluid level by removing the oil fill plug from the carrier or housing bowl. If necessary, add the specified fluid through the carrier or housing bowl oil fill hole. Fill so that the fluid level is even with the bottom of the fill plug hole.



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3. STUDS AND NUTS

The following warnings are to alert you to stud and nut conditions and maintenance procedures that can affect your safety and the integrity of the vehicle and its components.

Carefully read the warnings before you install disc wheels.

⚠ WARNING

Replace bent, loose, broken or stripped studs. When you replace a stripped stud, always replace the stud on each side of the stripped stud as well. Even if the adjoining studs are not cracked, they have sustained fatigue damage, which can cause the wheels to loosen and separate from the vehicle. Serious personal injury and damage to components can result.

Always replace a serrated stud, bolt, with a new one. Do not reuse a serrated stud, which will not tighten correctly and can cause the wheels to loosen and separate from the vehicle. Serious personal injury and damage to components can result.

Do not apply paint to mounting surfaces, studs or nuts. Paint decreases a fastener assembly's capability to maintain clamp load, which can cause wheels to loosen and separate from the vehicle. Serious personal injury and damage to components can result.

Ensure that you do not damage the stud threads. Damaged threads will not allow the stud to provide the required clamp load to support the wheel retention system. The wheels can loosen and separate from the vehicle. Serious personal injury and damage to components can result.

Check that stud standout is correct for stud-piloted wheels. If standout exceeds specifications even though the correct torque is used, the cap nut can bottom against the hub stud and loosen both wheels and the brake drum, which will cause the wheels to separate from the vehicle. If standout is too short, the cap nut will overload and crack, causing the inner and dual wheels to separate from the vehicle. Serious personal injury and damage to components can result.

Install right-hand studs onto the right side of the vehicle and left-hand studs onto the left side of the vehicle. Studs that are not installed correctly can loosen, which can cause the wheels to loosen and separate from the vehicle. Serious personal injury and damage to components can result.

Do not lubricate the studs or nut threads. Lubricants will not enable you to tighten the fasteners correctly, which causes excessive clamp load. The studs can break and cause the wheels to loosen and separate from the vehicle. Serious personal injury can result.

Install aluminum wheel nuts onto an aluminum disc wheel. Do not install steel wheel nuts. Steel wheel nuts can damage an aluminum wheel or cause the dual wheels to loosen and separate from the vehicle. Serious personal injury and damage to components can result.

Install steel wheel nuts onto steel wheels. Do not install aluminum wheel nuts. The extension on an aluminum wheel nut can bottom against the hub flange or brake drum before the disc wheel is clamped correctly, which can cause the wheels to separate from the vehicle. Serious personal injury and damage to components can result.

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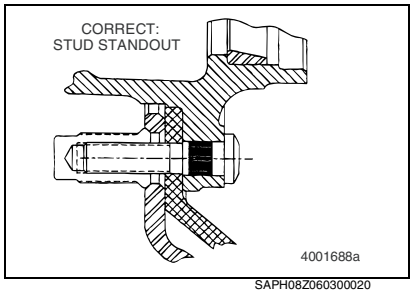
Install the nuts with the correct thread size onto the studs. A nut with an incorrect thread size will not turn freely on the stud or will fit loosely on the stud. The thread can strip, which can cause loss of clamp load. The wheels can loosen and separate from the vehicle. Serious personal injury and damage to components can result.

Install the correct wheel system components for the application. Do not mix wheel system components. The wheels can loosen and separate from the vehicle. Serious personal injury and damage to components can result.

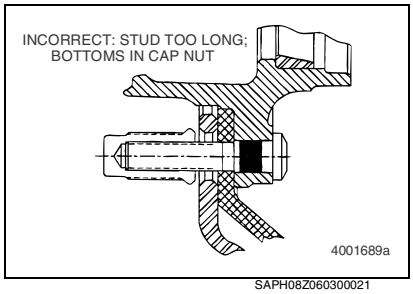
Add two drops of oil between the nut flange and the hex portion of the swivel area at each installation if you reinstall the two-piece flange nuts that have been in service. Without lubrication, the fasteners may not produce adequate clamp load, and the wheel(s) can loosen and separate from the vehicle. Serious personal injury and damage to components can result.

(1) Check the studs. Repair or replace loose, bent, stripped or broken studs.

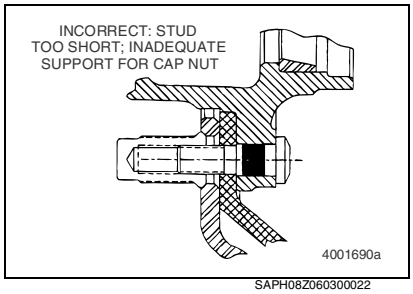
(2) Check for correct serrated stud standout.
   a. Figure shows correct standout.
   b. Figure shows incorrect standout.



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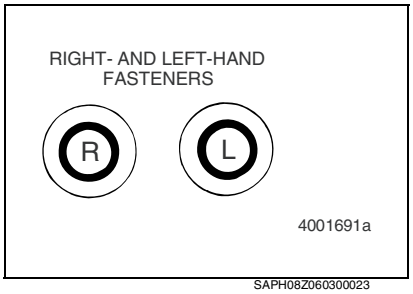


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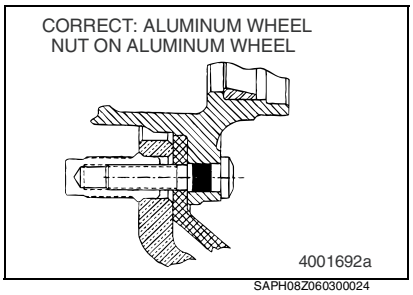
(3) Serrated studs do not usually interchange with those in various hub part numbers. Check the application. Call ArvinMeritor's Customer Service Center at 800-535-5560 for more information.

(4) Check for **R** and **L** stamped in the end of the stud. Install right-hand studs onto the right side of the vehicle, and left-hand studs onto the left side of the vehicle.

(5) Some manufacturers color code studs. Check the manufacturer's instructions to verify the color code used.

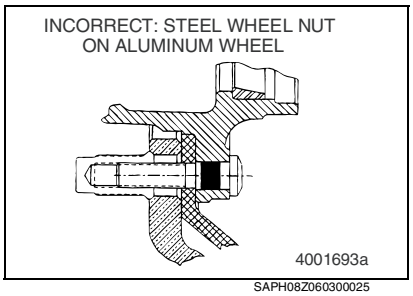
(6) Install the correct nut into all applications. Do not install rusty, galled or worn nuts. Ensure that you use the correct nuts in the following installations.

- Install 33 mm hex two-piece flange nuts into ISO 285.75 mm bolt circle diameter (BC) and ISO 335 mm BC systems.
- Install 1-1/2-inch hex two-piece flange nuts into a 275 mm system with M22 x 1.5 serrated studs. Do not install 1-1/2-inch hex two-piece flange nuts onto M22 x 1.5 serrated studs when 33 mm two-piece hex nuts are used on the CentroMount-8^{TM} system.

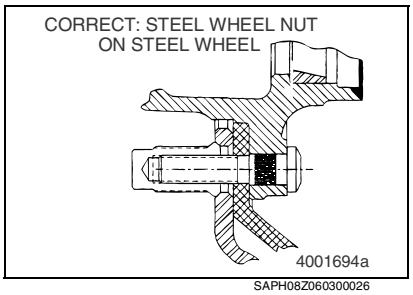


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(7) Install aluminum wheel nuts onto aluminum wheels. Do not install steel wheel nuts. An aluminum wheel nut has an extension to accommodate the thickness of the aluminum.



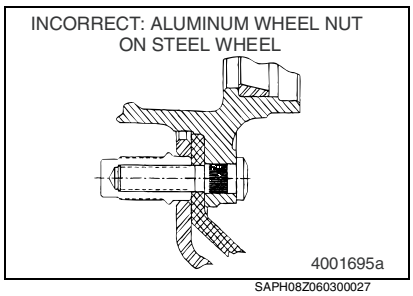
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(8) Install steel wheel nuts onto steel wheels. Do not install aluminum wheel nuts. The extension of the aluminum wheel nut can bottom against the hub flange or brake drum before the disc is clamped correctly.

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(9) Install nuts with the correct thread size onto the studs. A correct thread size enables the nut to turn freely on the stud. An incorrect nut will fit very loosely on the stud thread, which can cause the thread to strip.

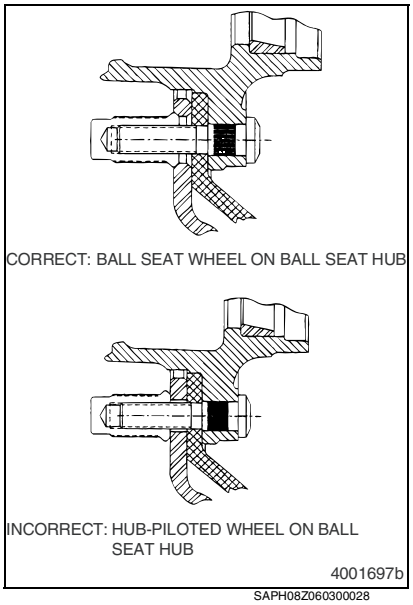
(10) Check the extension of the stud through the nut after you tighten the nut to the specified torque.

- **If less than two threads extend through the nut, or more than 3/8-inch (9.5 mm) of the stud extends through the nut:** Check all parts to verify that they are correct for the wheel system you will install onto the vehicle.

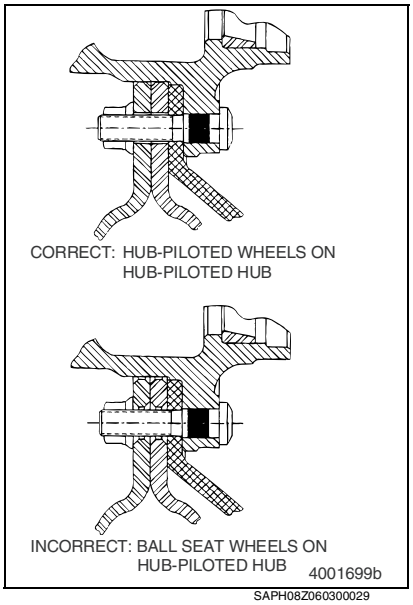
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(11) Ensure that the nut and wheel mate correctly. Ensure that you install the correct components onto the wheel systems.

- **If the wheel has a ball seat bolt hole pattern:** The nut must have a spherical surface that seats in the ball seat.
- **If the wheel has a cylindrical bolt hole pattern:** The nut must have a flat surface that seats against the wheel.

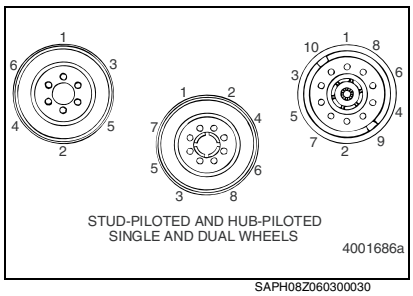


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STUD-PILOTED AND HUB-PILOTED
SINGLE AND DUAL WHEELS

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(12) Follow the disc wheel manufacturer's fastener tightening sequence when you install fasteners to help ensure a higher and more uniform clamp load. Always check fasteners at the wheel manufacturer's recommended service intervals.

(13) Add two drops of oil between the nut flange and the hex portion of the swivel area at each installation if you reinstall the two-piece flange nuts that have been in service. Do not oil the stud or nut threads.

(14) Retighten all wheel nuts on all systems at 50-100 miles (80-160 km) to the correct torque specifications.

(15) Use the correct installation tools.

(16) Ensure that the gross weight does not exceed gross vehicle weight (GVW). Ensure that the axle loads do not exceed gross axle weight ratings (GAWR).

STUD REPLACEMENT PROCEDURES

⚠ WARNING

Do not use a hammer to remove or install studs. A hammer can cause impact damage to the bearing raceway, which will reduce bearing life. Serious personal injury and damage to components can result.

Ensure that you do not damage stud threads during installation procedures. Damaged threads will not allow the stud to provide the required clamp to support the wheel retention system. The wheels can loosen and separate from the vehicle. Serious personal injury and damage to components can result.

If a stud is stripped and needs replacement, use one of the following procedures.

1. PREFERRED METHOD — REPLACING STUDS WITH THE HUB INSTALLED ONTO THE VEHICLE

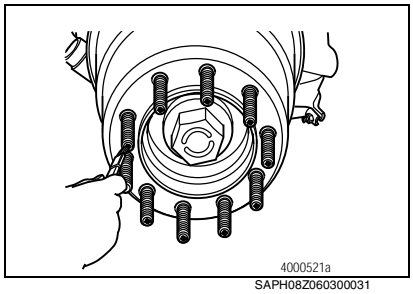
⚠ WARNING

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

(1) Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving.

(2) Raise the vehicle so that the front wheels are off the ground. Support the vehicle with safety stands.

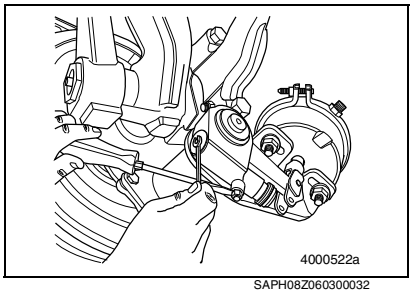
(3) Mark the wheel and hub relationship. Remove the wheel and tire assembly. Use a paint stick to mark the wheel studs you are removing. Do not reuse the studs.



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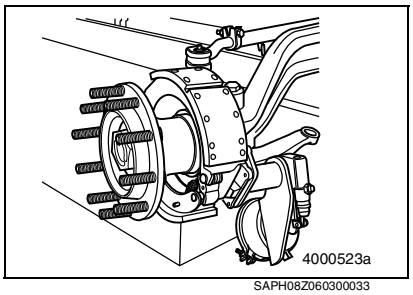
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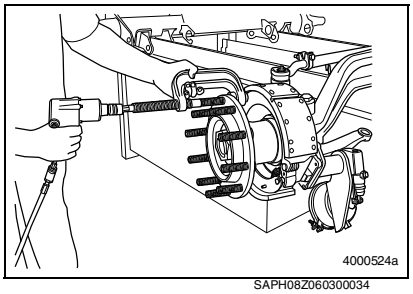
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(4) If necessary, back off the brake at the slack adjuster until the brake shoes retract and the drum clears the linings.



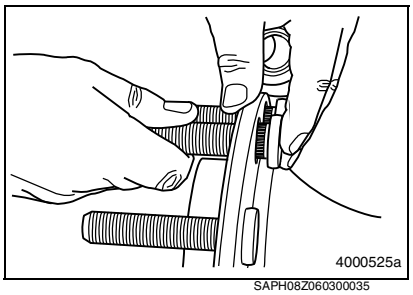
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(5) Remove the brake drum.



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(6) Use a 1/2-inch (12.7 mm) drive impact wrench and a ball joint removal kit to remove the studs.



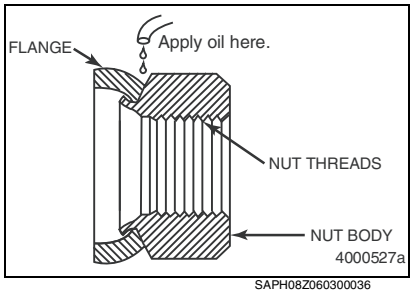
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(7) Use a crocus cloth to clean all the flat surfaces on the wheel band hub.

(8) Position the new studs into the hub. Align the stud knurls with the impressions in the hub stud hole.

⚠ WARNING
Do not lubricate studs or nut threads. Lubricants will not enable you to tighten fasteners correctly, which causes excessive clamp load. Studs can break and cause wheels to loosen and separate from the vehicle. Serious personal injury can result.

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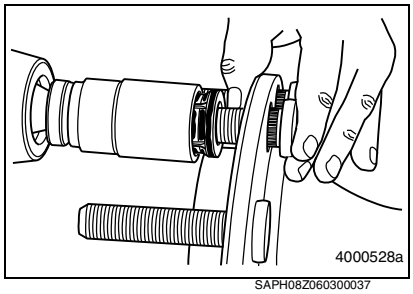


SAPH08Z060300036

(9) Add two drops of oil between the body and flange on the stud nuts. Do not use more than two drops of oil.

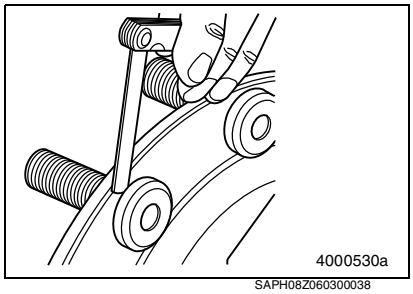
⚠ WARNING

Install nuts with the correct thread size onto the studs. A nut with an incorrect thread size will not turn freely on the stud or will fit loosely on the stud. The thread can strip, which can cause loss of clamp load. The wheels can loosen and separate from the vehicle. Serious personal injury and damage to components can result.



SAPH08Z060300037

(10) Position the nuts onto the studs. Use a 1/2-inch (12.7 mm) drive impact wrench to draw the stud into the hub. Do not exceed 300 lb-ft (408 N·m).



SAPH08Z060300038

(11) Use a 0.0015-inch (0.0381 mm) feeler gauge to check that the stud is correctly seated.

- If the stud is not correctly seated: Remove the stud, clean all surfaces and install a new stud as described previously.
- If the stud is still not correctly seated: Replace the hub.

(12) Remove all the nuts. Install the wheel and tire assembly.

(13) Discard all removed studs.

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ADJUSTMENT

EN08Z0603H600001

HAZARD ALERT MESSAGES

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

⚠ WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

1. CHECK AND ADJUST WHEEL BEARINGS

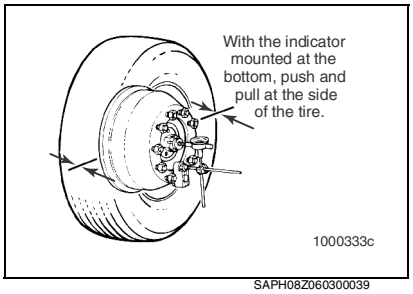
The most accurate bearing end play measurement is obtained with the brake drum and tires removed.

- **If the brake drum and tires are installed and the bearing end play is greater than 0.003-inch (0.0762 mm):** Remove the brake drum and the tire-wheel assembly. Recheck bearing end play.

⚠ WARNING

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

(1) Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Set the parking brake.
(2) Raise the vehicle so that the wheels are off the floor. Support the vehicle with safety stands.
(3) Remove the capscrews and remove the gasket and the cap from the hub.
(4) Verify that the brake drum and the hub fasteners are tightened to the manufacturer's specifications.
(5) Attach a dial indicator with the magnetic base at the bottom of the hub or the brake drum. Adjust the dial indicator so that the pointer is against the center of the knuckle. Set the dial indicator on ZERO.



SAPH08Z060300039

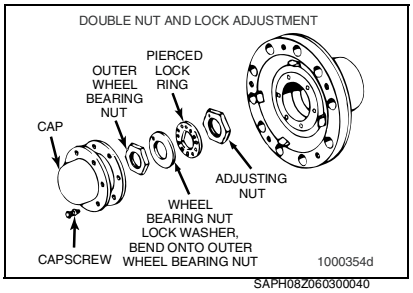
NOTICE

Do not push or pull at the top and bottom of the hub or drum, which can affect the end play measurement.

(6) Measure the end play by pushing and pulling on each side of the hub or drum while looking at the dial indicator. The end play is the total travel observed.

- **If the end play is 0.001-0.005-inch (0.025-0.127 mm):** The bearings do not need adjustment.
- **If the end play is not 0.001-0.005-inch (0.025-0.127 mm):** Adjust the wheel bearings.

(7) **On double nut and lock fasteners:** Bend the lock washer off the wheel bearing nut. Remove the wheel bearing nut, the lock washer and the pierced lock ring.



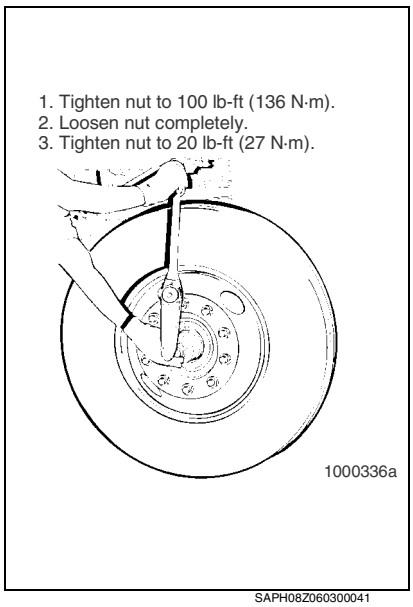
SAPH08Z060300040

⚠ WARNING

Use a torque wrench to tighten or loosen adjusting nuts. Do not use a hammer to directly hit adjusting nuts, or to hit a chisel or drift placed against them. Damaged adjusting nuts can prevent you from obtaining correct wheel bearing end play, which can affect vehicle operation and cause the wheels to separate from the vehicle. Serious personal injury and damage to components will result.

(8) Use a torque wrench to tighten the adjusting nut to 100 lb-ft (136 N·m) while rotating the tire in both directions.

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SAPH08Z060300041

(9) Loosen the nut completely. Tighten the nut to 20 lb-ft (27 N·m) while rotating the tire.

(10) Perform the following adjustment procedure.
   a. Back off the adjusting nut 1/3 turn.
   b. Install the pierced lock ring, the lock washer and the wheel bearing nut.
   c. For wheel bearing nuts in sizes from 1-1/8-inches up to 2-5/8-inches (2.86-6.67 cm), tighten to 200-300 lb-ft (271-407 N·m). For wheel bearing nuts 2-5/8-inches (6.67 cm) and more, tighten to 250-400 lb-ft (339-542 N·m)
   d. Measure the end play. The end play must be 0.001-0.005-inch (0.025-0.127 mm). Refer to Step (5) and Step (6). Readjust if necessary.
   e. If the end play is to specification, bend the washer to at least one flat edge of the outer wheel bearing nut.

(11) Install the gasket and the cap onto the hub. Install the capscrews and tighten to 20-30 lb-ft (27-41 N·m).

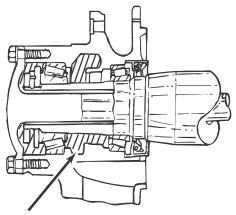
(12) Lower the vehicle to the ground. Check for correct vehicle operation.

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LUBRICATION AND MAINTENANCE

EN08Z0603H600002

TYPICAL OIL-LUBRICATED WHEEL BEARINGS



SAPH08Z060300042

1. OIL-LUBRICATED WHEEL BEARINGS, DRIVE AXLE HUBS WITHOUT FILL HOLES

(1) Park the vehicle on a level surface. Place blocks under the wheels to prevent the vehicle from moving.

(2) Add the specified amount of lubricant through the carrier or housing bowl oil fill hole.

(3) Tilt the axle to the right and to the left to let the oil flow into the hub cavities. Keep the axle tilted for one minute in each position.

(4) With the axle in the level position, add the specified oil so that the level is even with the bottom of the fill plug hole.

(5) Install and tighten the fill plug.

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2. LUBRICATION INTERVALS AND SPECIFICATIONS

Wheel-End Axle Greasing Intervals and Specifications

Greasing Interval	Grease	Meritor Specification	NLGI Grade	Grease Description	Typical Application	Outside Temperature
Whichever comes first: Replacing Seals Relining Brakes On-Highway: 30,000 miles (48,000 km) On/Off Highway and Off-Highway: Twice a year	Multi-Purpose Grease[1]	O-617-A, preferred, or O-617-B, acceptable	1 or 2	Lithium 12-Hydroxy Stearate or Lithium Complex	Wheel Bearings Hubs Spindle	Refer to the grease manufacturer's specifications for the temperature service limits.

[1] Meritor recognizes that industry trends are moving toward increased selection and usage of synthetic grease in vehicle maintenance. However, some seals are known to expand when in contact with synthetic grease. Consult your local Meritor representative for synthetic grease application references before using any synthetic grease when performing wheel-end service and maintenance.

Wheel-End Oil Change Intervals and Specifications

Operation	On-Highway	Off-Highway
Check Oil Level	1,000 miles (1,600 km)	1,000 miles (1,600 km)
Petroleum Oil Change	Whichever comes first. Seals replaced. Brakes relined. 100,000 miles (160,000 km). Once a year.	Whichever comes first. Seals replaced. Brakes relined. Once a year.
Synthetic Oil Change	Whichever comes first. Seals replaced. Brakes relined. 100,000 miles (160,000 km). Once a year.	Whichever comes first. Seals replaced. Brakes relined. Once a year.

Approved Lubricants

Meritor Specifications	Military/SAE Specifications	Oil Description	Outside Temperature °F Min.	°F Max.	°C Min.	°C Max.
O-76-A Gear Oil	MIL-PRF-2105-E and SAEJ2360	GL-5, SAE 85W/140	–10	None	–12	None
O-76-D Gear Oil		GL-5, SAE 80W/90	–15	None	–26	None
O-76-E Gear Oil		GL-5, SAE 75W/90	–40	None	–40	None
O-76-J Gear Oil		GL-5, SAE 75	–40	35	–40	2
O-76-M Full-Synthetic Oil		GL-5, SAE 75W/140	–40	None	–40	None
O-76-N Full-Synthetic Oil		GL-5, SAE 75W/90	–40	None	–40	None
Heavy-Duty Engine Oil	MIL-L-2104 E or F	A.P.I. -CD, -CE, -SG, -SH or -SJ SAE 40 or 50 [11]	–10	None	–12	None
Heavy-Duty Engine Oil	MIL-L-210 E or F	A.P.I. -CD, -CE, -SG, -SH or -SJ SAE 30[22]	–15	None	–26	None

[1] Current designations are acceptable. Multi-grade engine oils are acceptable if the SAE rating ends in 40 or 50.

[2] Current designations are acceptable. Multi-grade engine oils are acceptable if the SAE rating ends in 30.

SAPH08Z060300043

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WHEEL & TIRE

AX04-001

WHEEL AND TIRE.....AX04-2
DATA AND SPECIFICATIONS AX04-2
DESCRIPTION AX04-6
TROUBLESHOOTING AX04-7
SPECIAL TOOL AX04-9
PRECAUTIONS AX04-10
INSPECTION AX04-11
INSPECTION AND REPAIR AX04-12

WHEEL.....AX04-13
OVERHAUL AX04-13

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WHEEL AND TIRE

DATA AND SPECIFICATIONS

EN08Z0904I200001

TIRE SIZE DESIGNATION D: DUAL S: SINGLE		TIRE LOAD LIMITS (LBS.) AT VARIOUS COLD INFLATION PRESSURES (PSI) (The pressure is minimum for the load)										
		70	75	80	85	90	95	100	105	110	115	120
245/70R19.5	D			3,415	3,515	3,655	*3,860(F)	3,940	4,075	*4,300(G)	4,345	*4,540(H)
	S			3,640	3,740	3,890	*4,080(F)	4,190	4,335	*4,540(G)	4,620	*4,805(H)
255/70R22.5	D			3,970	4,110	4,275	4,410	4,455	4,610	*4,675(G)	4,915	*5,070(H)
	S			4,190	4,370	4,550	4,675	4,895	5,065	*5,205(G)	5,400	*5,510(H)
255/80R22.5	D	3,525	3,705	3,860	4,040	4,205	4,410	4,525	4,685	*4,805(G)		
	S	3,875	4,070	4,300	4,440	4,620	4,805	4,975	5,150	*5,205(G)		
295/75R22.5	D	4,095	4,300	4,540	4,690	4,885	*5,070(F)	5,260	5,440	*5,675(G)	5,795	*6,005(H)
	S	4,500	4,725	4,940	5,155	5,370	*5,510(F)	5,780	5,980	*6,175(G)	6,370	*6,610(H)
10R22.5	D	3,860	4,045	4,230	*4,410(E)	4,585	4,760	*4,940(F)	5,075	5,210	*5,355(G)	
	S	4,080	4,280	4,480	*4,675(E)	4,850	5,025	*5,205(F)	5,360	5,515	*5,675(G)	
11R22.5	D	4,380	4,580	4,760	4,950	*5,205(F)	5,415	5,625	*5,840(G)	5,895	5,950	*6,005(H)
	S	4,530	4,770	4,990	5,220	*5,510(F)	5,730	5,950	*6,175(G)	6,320	6,465	*6,610(H)

NOTICE
Attached *mark show maximum recommended load (LBS.)
Load range letters and corresponding PLY ratings
(E= 10 PLY, F= 12 PLY, G= 14 PLY, H= 16 PLY)
Tires for vehicles in highway service
Tire load limits at various cold inflation pressures

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SPEED LIMIT DATA LIST

- Speed limit must not exceed the following table.
- Be sure to carry out the adjustment of engine's speed limit data by Hino-DX when you change the tire size or rear axle gear ratio.

⚠ WARNING
The maximum speed limit of the speed limiter depends upon the tire size and rear axle gear ratio.
NEVER set the "speed limit" in excess of the speed set forth on the table below for the corresponding tire size and rear axle gear ratio.
ALWAYS adjust the engine's speed limit data by using the Hino-DX whenever the tire size or the rear axle gear ratio is changed.

Apply to allison auto transmission series

MODEL	AUTO TRANSMISSION MODEL	REAR AXLE SERIESE	REAR AXLE GEAR RATIO	TIRE SIZE	TIRE RADIUS	SPEEDLIMIT (km/h)	REFERENCE; SPEED LIMIT (mile/h)
NE; Lopro	2200HS 2200RDS	RS17	4.11	245/70R19.5	0.407	135	84
NJ; Lopro	2200HS 2200RDS	RS17	4.11	245/70R19.5	0.407	135	84
NE	2200HS 2200RDS	RS17	5.13	255/80R22.5	0.475	126	78
			5.13	10R22.5	0.492	131	81
			5.13	11R22.5	0.508	135	84
			5.29	255/80R22.5	0.475	123	76
			5.29	10R22.5	0.492	127	79
			5.29	11R22.5	0.508	131	81
	2200HS 2200RDS	RS19	5.13	255/70R22.5	0.453	120	74
			5.13	255/80R22.5	0.475	126	78
			5.13	295/75R22.5	0.493	131	81
			5.13	11R22.5	0.508	135	84
			5.29	255/70R22.5	0.453	117	73
			5.29	255/80R22.5	0.475	123	76
			5.29	295/75R22.5	0.493	127	79
			5.29	11R22.5	0.508	131	81
			5.57	255/70R22.5	0.453	111	69
			5.57	255/80R22.5	0.475	116	72
			5.57	295/75R22.5	0.493	121	75
			5.57	11R22.5	0.508	124	77
	2500RDS	RS19	5.13	255/70R22.5	0.453	120	74
			5.13	255/80R22.5	0.475	126	78
			5.13	295/75R22.5	0.493	131	81
			5.13	11R22.5	0.508	135	84
			5.29	255/70R22.5	0.453	117	73
			5.29	255/80R22.5	0.475	123	76
			5.29	295/75R22.5	0.493	127	79
			5.29	11R22.5	0.508	131	81
			5.57	255/70R22.5	0.453	111	69
			5.57	255/80R22.5	0.475	116	72
			5.57	295/75R22.5	0.493	121	75
			5.57	11R22.5	0.508	124	77

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MODEL	AUTO TRANSMISSION MODEL	REAR AXLE SERIESE	REAR AXLE GEAR RATIO	TIRE SIZE	TIRE RADIUS	SPEED LIMIT (km/h)	REFERENCE; SPEED LIMIT (mile/h)
NF	2500RDS	RS21	5.29	295/75R22.5	0.493	127	79
			5.29	11R22.5	0.508	131	81
			5.57	295/75R22.5	0.493	121	75
			5.57	11R22.5	0.508	124	77
NJ	2200HS 2200RDS	RS19	5.13	255/70R22.5	0.453	120	74
			5.13	255/80R22.5	0.475	126	78
			5.13	295/75R22.5	0.493	131	81
			5.13	11R22.5	0.508	135	84
			5.29	255/70R22.5	0.453	117	73
			5.29	255/80R22.5	0.475	123	76
			5.29	295/75R22.5	0.493	127	79
			5.29	11R22.5	0.508	131	81
			5.57	255/70R22.5	0.453	111	69
			5.57	255/80R22.5	0.475	116	72
			5.57	295/75R22.5	0.493	121	75
			5.57	11R22.5	0.508	124	77
	2500RDS	RS17	4.11	245/70R19.5	0.407	135	84
		RS19	5.13	255/70R22.5	0.453	120	74
			5.13	255/80R22.5	0.475	126	78
			5.13	295/75R22.5	0.493	131	81
			5.13	11R22.5	0.508	135	84
			5.29	255/70R22.5	0.453	117	73
			5.29	255/80R22.5	0.475	123	76
			5.29	295/75R22.5	0.493	127	79
			5.29	11R22.5	0.508	131	81
			5.57	255/70R22.5	0.453	111	69
			5.57	255/80R22.5	0.475	116	72
			5.57	295/75R22.5	0.493	121	75
			5.57	11R22.5	0.508	124	77

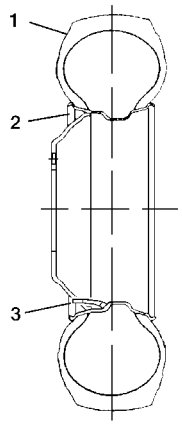
S1-UNAE09A-2.book 5 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

MODEL	AUTO TRANSMISSION MODEL	REAR AXLE SERIESE	REAR AXLE GEAR RATIO	TIRE SIZE	TIRE RADIUS	SPEEDLIMIT (km/h)	REFERENCE; SPEED LIMIT (mile/h)
NV	2500RDS	RS21	4.88	295/75R22.5	0.493	138	86
			4.88	11R22.5	0.508	142	88
			5.29	295/75R22.5	0.493	127	79
			5.29	11R22.5	0.508	131	81
			5.57	295/75R22.5	0.493	121	75
			5.57	11R22.5	0.508	124	77
			5.86	295/75R22.5	0.493	115	71
			5.86	11R22.5	0.508	118	73
			6.14	295/75R22.5	0.493	110	68
			6.14	11R22.5	0.508	113	70
		RS23	5.38	11R22.5	0.508	129	80
			5.63	11R22.5	0.508	123	76
			6.14	11R22.5	0.508	113	70
	3000RDS	RS21	4.88	295/75R22.5	0.493	132	82
			4.88	11R22.5	0.508	136	84
			5.29	295/75R22.5	0.493	122	76
			5.29	11R22.5	0.508	126	78
			5.57	295/75R22.5	0.493	116	72
			5.57	11R22.5	0.508	119	74
			5.86	295/75R22.5	0.493	110	68
			5.86	11R22.5	0.508	114	71
			6.14	295/75R22.5	0.493	105	65
			6.14	11R22.5	0.508	108	67
		RS23	5.38	11R22.5	0.508	124	77
			5.63	11R22.5	0.508	118	73
			6.14	11R22.5	0.508	108	67

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DESCRIPTION

EN08Z0904C100001



TUBELESS

SHTS08Z090400001

WHEEL AND TIRE

1	Tire	3	Valve
2	Disc wheel		

S1-UNAE09A-2.book 7 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

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.
	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.
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 loose 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.

S1-UNAE09A-2.book 8 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

Symptom	Possible cause	Remedy/Prevention
Damaged wheel bolt holes (wheel bolt holes become worn, elongated or deformed, metal builds up around wheel bolt hole edges, cracks develop from wheel bolt hole to wheel bolt hole.)	Loose wheel mounting	• Replace wheel and check the installation of correct wheel bolt and nuts. • Check the cracked or broken wheel bolt-replace. • Check the worn hub face-replace. • Check the broken or cracked hub-replace. • Clean mounting surfaces (Re-torque the wheel nuts periodically.) • Rust streaks fanning out from wheel bolts holes: indicates that the wheel nuts are or have been loose.
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 wheel bolt standout from the mounting face of hub allowing the wheel nut to bottom out	Replace with the proper length wheel bolt.
	Improper torque	Follow the recommended torque procedure.
	Wrong inner nut	Use correct inner nuts.
Broken wheel bolts	Loose wheel nuts	Replace the wheel bolt and follow the proper torque procedures.
	Overloading	Replace the wheel bolt.
Stripped threads	Excessive clamp load	Replace wheel bolt and follow the proper torque procedures.
Rust streaks from wheel 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 wheel bolts.

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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
	S0960-91210	LEVER	
	S0960-91220	RUBBER HAMMER	

S1-UNAE09A-2.book 10 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

PRECAUTIONS

EN08Z0904C100002

⚠ WARNING
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 an explosive force sufficient to cause death or serious personal injury.

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.

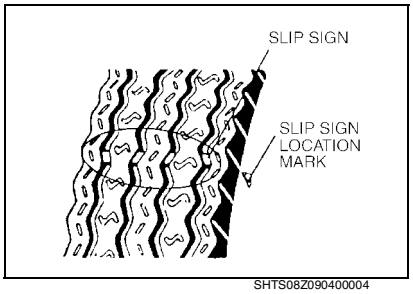
2. RIM INSPECTION
(1) Always select the proper tire size and construction to match the rim or wheel rating and size.
(2) Never use damaged, worn, or corroded rims, wheels, or mounting hardware.
(3) Always clean and repaint lightly rusted rims.
(4) Never use a rim or wheel component you cannot identify.

3. ASSEMBLY AND INFLATION
(1) Always 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.
(2) Never re-inflate or add inflation pressure to a tire that has been run flat or seriously under inflated without removing and checking for rim damage.
(3) 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.
(4) Never hammer on the components of an inflated or partially inflated assembly.

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INSPECTION

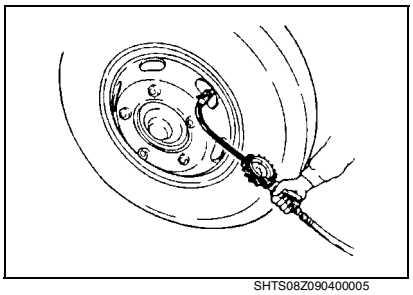
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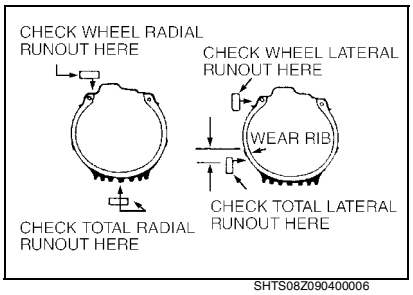
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1. GENERAL INSPECTION

(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.}


SHTS08Z090400005

(2) Check the air pressure.
If improper, inflate the tire to the proper pressure as previously described in this chapter.



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2. CHECK RUNOUT IN THE TIRE AND WHEEL RIM.

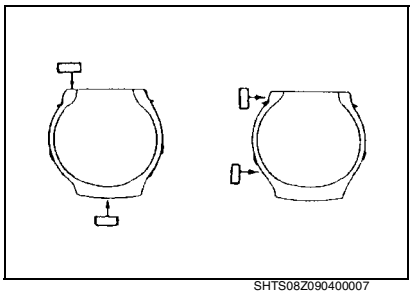
NOTICE

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 2.5 {0.098}	Less than 1.8 {0.071}
Radial runout	Less than 2.5 {0.098}	Less than 1.8 {0.071}


SHTS08Z090400007

(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 a 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.

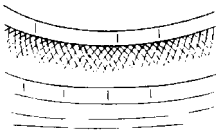
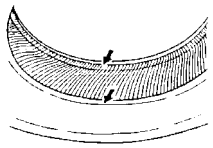
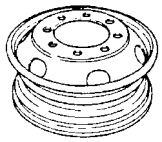
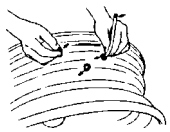
- Static balancing
  This is relatively effective when operating at low speeds; however, if operating at high speeds, dynamic balancing is recommended.
- Dynamic balancing
  Please balance the wheels, using a balancing machine.

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INSPECTION AND REPAIR

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Unit: mm {in.}

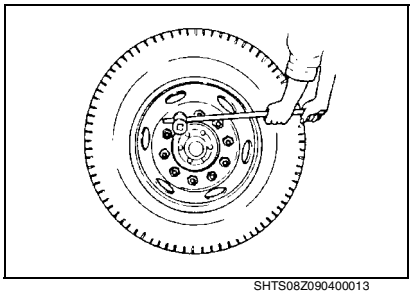
Inspection item	Standard	Limit	Remedy	Inspection procedure
Tire: Damage, foreign matter, etc.	—	—	Replace, if necessary.	Visual check 
Tubeless tire: Damage	—	—	Replace, if necessary.	Visual check 
Wheel (Tubeless tire): Cracks and deformation	—	—	Replace, if necessary.	Visual check 
Rim (Tubeless tire): Damage	—	—	Replace, if necessary.	Visual check 
Pipe, nut and O-ring of the valve (tubeless tire): Damage	—	—	Replace, if necessary.	Visual check 

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WHEEL

OVERHAUL

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IMPORTANT POINT– REMOVAL

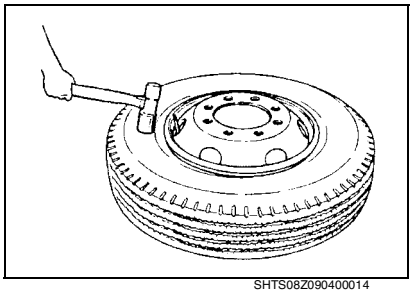
1. REMOVE THE WHEEL AND TIRE.

(1) Loosen the wheel nuts, but do not remove them.
(2) Raise the vehicle until the tire clears 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.

Wheel position	Direction of wheel nut threads
Both side vehicle	Right-hand threads

NOTICE

- **Be sure to apply the wheel stoppers in the front or rear tires.**

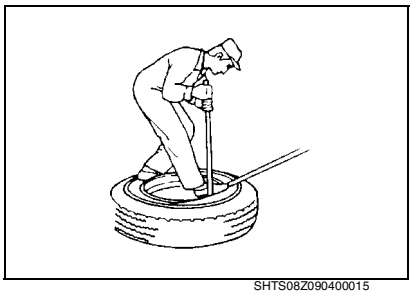


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IMPORTANT POINT - DISASSEMBLY

1. DISASSEMBLE THE WHEEL AND TIRE (TUBELESS).

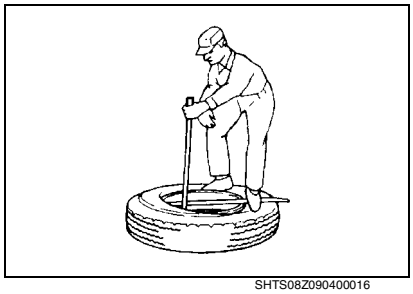
(1) Make certain the tire is completely deflated with the valve core removed.
(2) With the tire lying flat, loosen both beads with the special tool or by standing on the tire with your heels close to the rim.
SST: Rubber hammer (S0960-91220)



SHTS08Z090400015

(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 (S0960-91210)

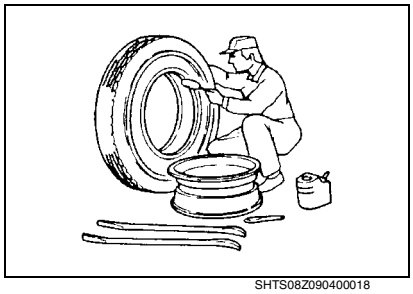
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SHTS08Z090400016

(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.


SHTS08Z090400017

(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.

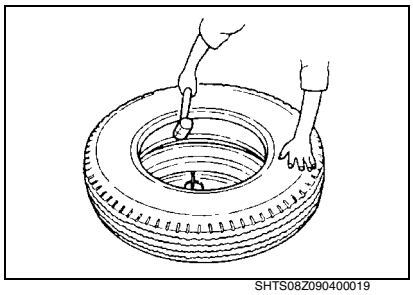

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IMPORTANT POINTS – ASSEMBLY

1. ASSEMBLY OF WHEEL AND TIRE (TUBELESS).
(1) Be sure that the right valve is used and is properly installed in the rim.

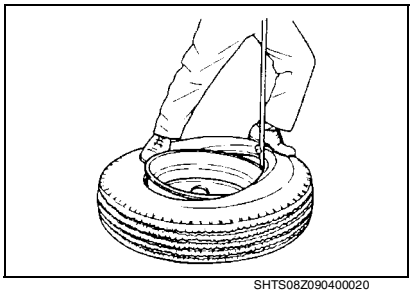
Tire size designation	Valve nut tightening torque N·m {kgf·cm, lbf·in}
245/70R19.5	**4.5-6.2 {46-63, 40-55}: 19.5 x 6.75 wheel 9.0-14.1 {92-143, 80-125}: 19.5 x 7.50 wheel**
255/70R22.5 255/80R22.5 295/75R22.5 10R22.5 11R22.5	**4.5-6.2 {46-63, 40-55}**

(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.

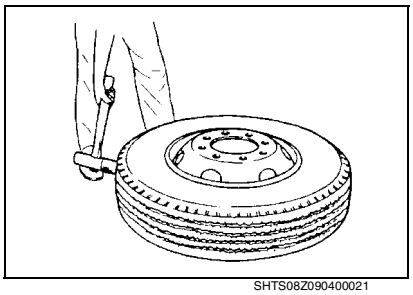

SHTS08Z090400019

(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 (S0960-91220)

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SHTS08Z090400020

(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 (S0960-91210)


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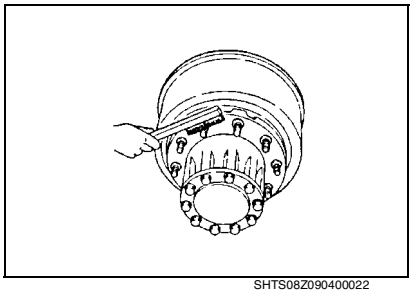
(6) With the special tool, hammer the tire tread so that the bead and the rim will be seated.
SST: Rubber hammer (S0960-91220)

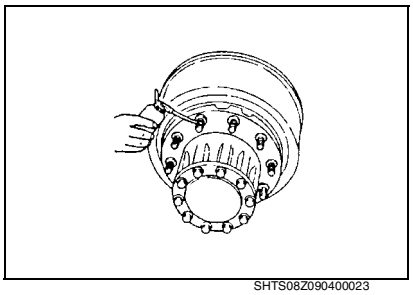
(7) Inflate the tire as described in this chapter, making certain that all the safety precautions are followed. Check for leakage.

IMPORTANT POINT – INSTALLATION

1. INSTALL THE WHEEL AND TIRE.

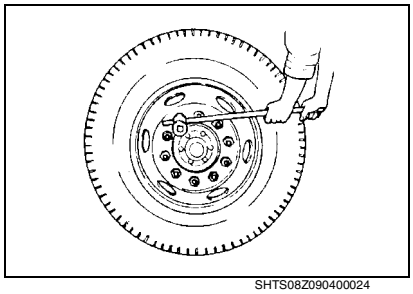
(1) Be sure to check all parts and replace any parts that are overly worn or damaged. Clean and remove any foreign matter from wheel bolts, wheel nuts and wheel side is contacting with the brake drum.


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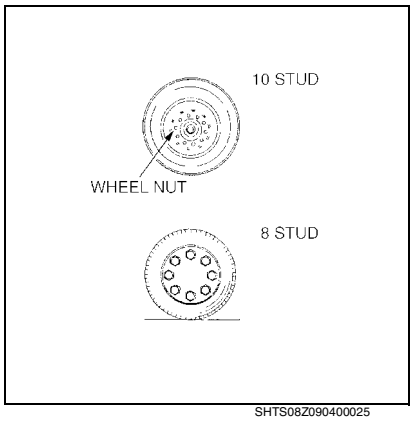

SHTS08Z090400023

(2) Apply lubricant (engine oil or grease) to the thread part of the wheel bolts and wheel nuts.

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SHTS08Z090400024



SHTS08Z090400025

(3) Rotate the wheel if necessary and check to see that the wheel bolts are in the center of the wheel's wheel bolt holes, then tighten the wheel nuts lightly.

(4) Using a wheel nut wrench, tighten the wheel nuts in accordance with specified torque using diagonal method.

MODEL	WHEEL BOLT (Diameter x Thread Pitch)	Tightening torque N·m {kgf·cm, lbf·ft}
NE8J, NJ8J	ISO 8 STUDS (M22 x 1.5)	610-680 {6,200-6,900, 450-500}
NE8J, NF8J, NJ8J, NV8J	ISO 10 STUDS (M22 x 1.5)	610-680 {6,200-6,900, 450-500}

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 refers to torque tightening of wheel nuts. Incorrect tightening can cause the wheel to come off while driving. This can result in death, personal 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 100, 500 and 1,000 miles to confirm they are not loosen and correctly tightened. The tightening torque should be checked with the proper torque wrench.

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2. THE FOLLOWING ORDER AND INSTRUCTIONS ARE NECESSARY FOR INSTALLING 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.

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SUSPENSION

SU02-001

LEAF SUSPENSION ASSEMBLY SU02-2
DATA AND SPECIFICATIONS SU02-2
DESCRIPTION SU02-4
TROUBLESHOOTING SU02-6
COMPONENT LOCATOR SU02-7
OVERHAUL SU02-11
INSPECTION AND REPAIR SU02-16

AIR SUSPENSION ASSEMBLY SU02-19
DATA AND SPECIFICATIONS SU02-19
SYSTEM DIAGRAM
FOR HEIGHT CONTROL SU02-19
DESCRIPTION SU02-20
TROUBLESHOOTING SU02-21
COMPONENT LOCATOR SU02-22
OVERHAUL SU02-23
INSPECTION AND REPAIR SU02-27

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LEAF SUSPENSION ASSEMBLY

DATA AND SPECIFICATIONS

EN09Z1002I200001

FRONT SUSPENSION Unit: mm {in.}

Model		HINO 238 (NE8J) HINO 258 (NE8J, NJ8J) HINO 268 (NE8J, NJ8J)	HINO 268 (NE8J, NF8J, NJ8J) HINO 338 (NF8J, NV8J) HINO 358 (NV8J)	HINO 338 (NV8J) HINO 358 (NV8J)
Type		Taper-leaf spring with double acting shock absorber		
Dimensions of main leaf springs:	Span	1,470 {57.88}	1,470 {57.88}	1,470 {57.88}
	Width	76.20 {3.00}	76.20 {3.00}	76.20 {3.00}
	Thickness of leaves	20.01 {0.79} x2	20.01 {0.79} x3	20.62 {0.812} x4
Shock absorbers	Type	Double acting	Double acting	Double acting
	Stroke	255 {10.04}	255 {10.04}	255 {10.04}
	Min. length	390 {15.35}	390 {15.35}	390 {15.35}
	Max. length	645 {25.40}	645 {25.40}	645 {25.40}

REAR SUSPENSION Unit: mm {in.}

Model		HINO 238 (NE8J) HINO 258 (NE8J, NJ8J) HINO 268 (NE8J, NJ8J) HINO 338 (NV8J)	HINO 268 (NF8J) HINO 338 (NF8J, NV8J)	HINO 338 (NV8J) HINO 358 (NV8J)	HINO 358 (NV8J)
Type		Semi-elliptic leaf spring or semi-elliptic main and auxiliary helper-leaf spring (If so equipped)			
Dimensions of main leaf springs	Span	1,300 {51.18}	1,300 {51.18}	1,300 {51.18}	1,300 {51.18}
	Width	76.20 {3.00}	76.20 {3.00}	76.20 {3.00}	76.20 {3.00}
	Thickness of leaves	14.17 {0.56}	14.99 {0.59}	15.88 {0.63}	15.88 {0.63}
		13.40 {0.53}	—	—	—
		10.20 {0.40}	10.20 {0.40}	10.20 {0.40}	10.20 {0.40}
Dimensions of auxiliary leaf springs (If so equipped)	Span	900 {35.44}	900 {35.44}	900 {35.44}	—
	Width	76.20 {3.00}	76.20 {3.00}	76.20 {3.00}	—
	Thickness	17.83 {0.70}	17.83 {0.70}	17.83 {0.70}	—
Shock absorbers (If so equipped)	Type	Double acting	Double acting	Double acting	Double acting
	Stroke	242 {9.53}	242 {9.53}	242 {9.53}	242 {9.53}
	Min. length	432 {17.01}	432 {17.01}	432 {17.01}	432 {17.01}
	Max. length	674 {26.53}	674 {26.53}	674 {26.53}	674 {26.53}

SU02_001_Mokuji kai.fm 3 ページ ２０１１年１０月３１日 月曜日 午前１１時７分

Model		HINO 238 (NE8J) HINO 258 (NE8J, NJ8J) HINO 268 (NE8J, NJ8J) HINO 338 (NV8J)	HINO 268 (NF8J) HINO 338 (NF8J, NV8J)	HINO 338 (NV8J) HINO 358 (NV8J)	HINO 358 (NV8J)
Stabilizer (If so equipped)	Type	Torsion ber	Torsion ber	Torsion ber	Torsion ber
	Diameter	48 {1.89}	48 {1.89}	48 {1.89}	48 {1.89}
	Length	550 {21.65}	550 {21.65}	550 {21.65}	550 {21.65}
Helper rubber		Less	Less	Less	With

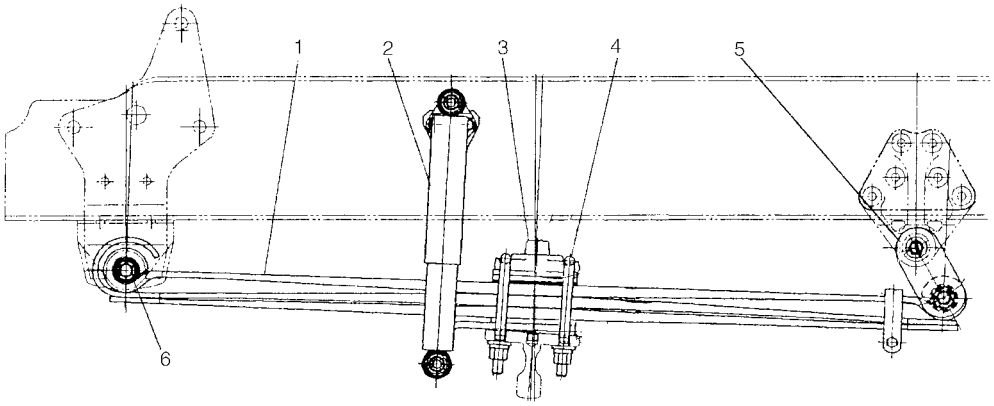
SU02_001_Mokuji kai.fm 4 ページ ２０１１年１０月３１日 月曜日 午前１１時７分

DESCRIPTION

EN09Z1002C100001

FRONT SUSPENSION

(REPRESENTATIVE TYPE)

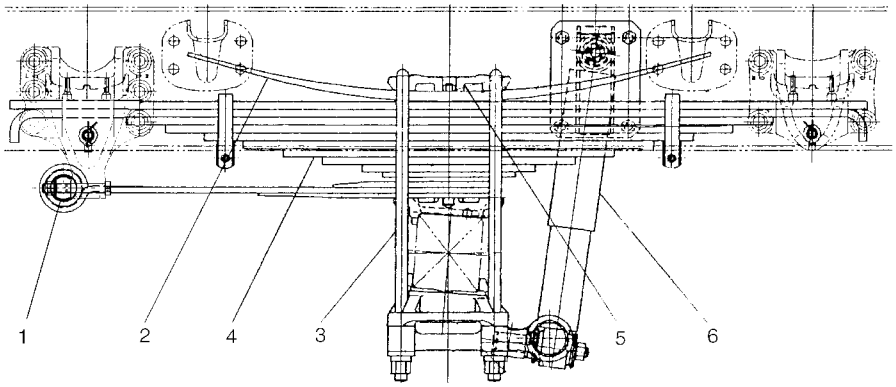


SHTS09Z100200001

1	Leaf spring assembly	4	U-bolt
2	Shock absorber	5	Shackle
3	Spring bumper	6	Spring pin

REAR SUSPENSION

(REPRESENTATIVE TYPE)

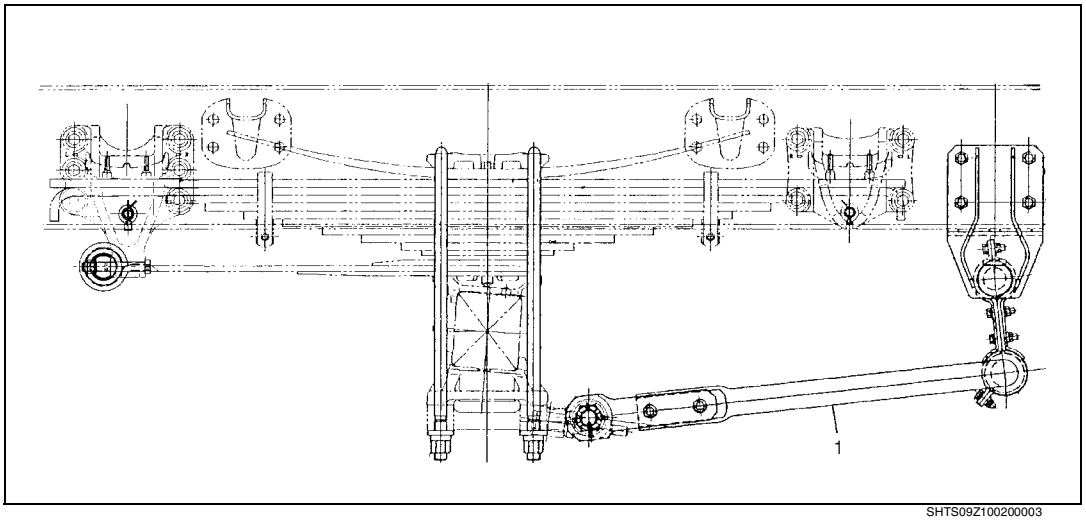


SHTS09Z100200002

1	Spring pin	4	Main leaf spring assembly
2	Auxiliary leaf spring (If so equipped)	5	Spring pad
3	U-bolt	6	Shock absorber (If so equipped)

SU02_001_Mokuji kai.fm 5 ページ ２０１１年１０月３１日 月曜日 午前１１時７分

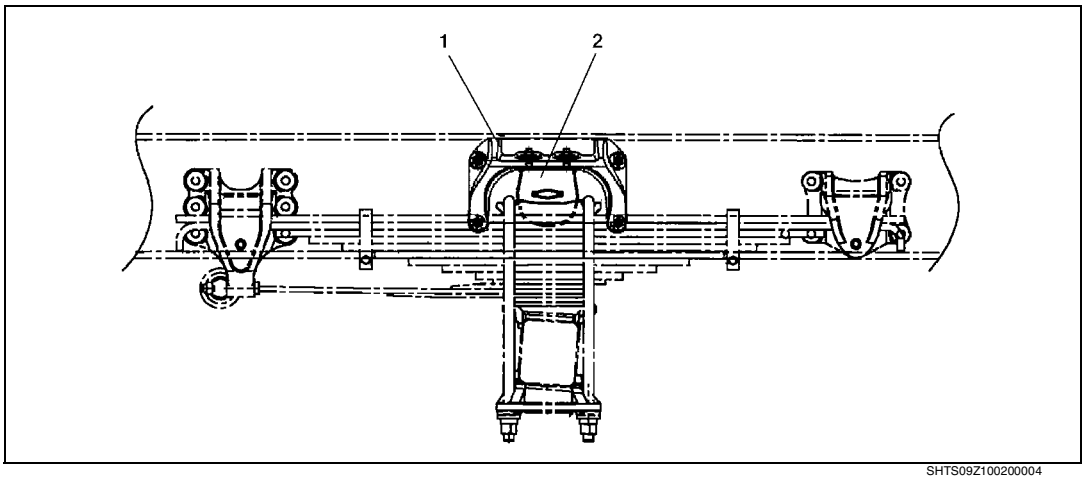
REAR SUSPENSION (STABILIZER)



SHTS09Z100200003

1 Stabilizer (If so equipped)	

REAR SUSPENSION (HELPER RUBBER)



SHTS09Z100200004

1 Bracket	2 Helper rubber

S1-UNAE09A-2.book 6 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

TROUBLESHOOTING

EN09Z1002F300001

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	Replace the leaves and tighten the U-bolts to specified torque.
Squeaking of the leaves	Friction between the leaves	Apply chassis grease between leaves.

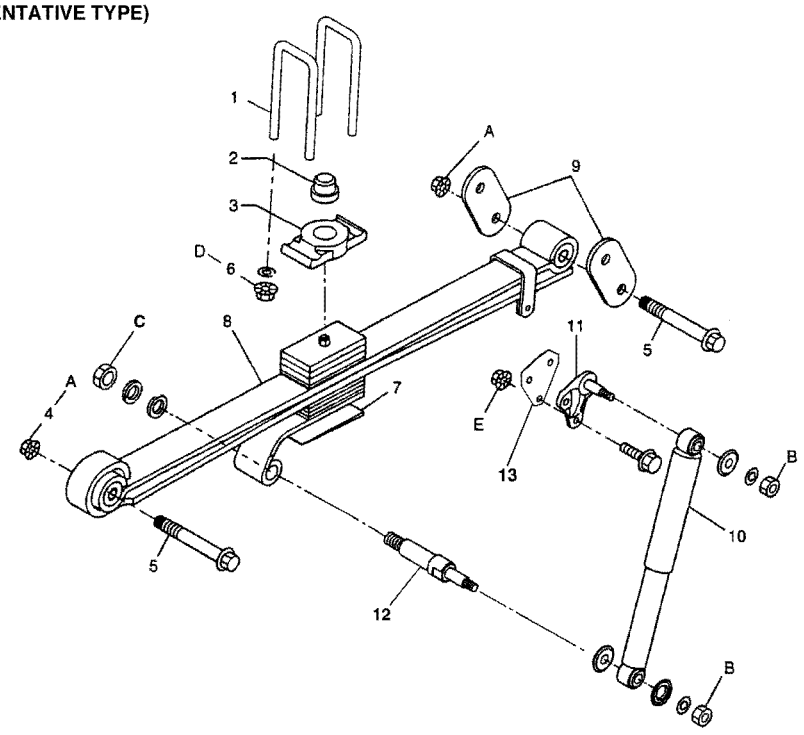
S1-UNAE09A-2.book 7 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

COMPONENT LOCATOR

EN09Z1002D100001

FRONT SUSPENSION

(REPRESENTATIVE TYPE)



SHTS09Z100200005

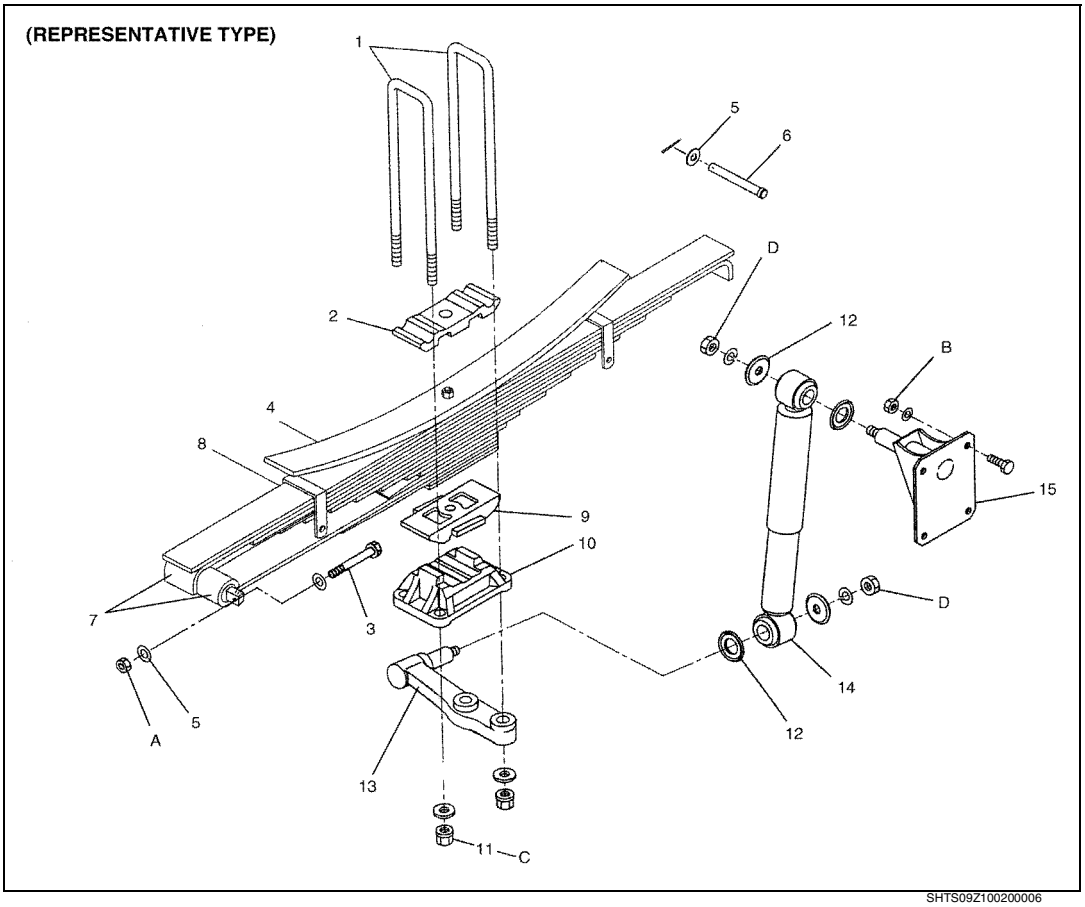
1	U-bolt	8	Leaf spring assembly
2	Spring bumper	9	Shackle
3	Spring pad	10	Shock absorber
4	Nut	11	Shock absorber bracket
5	Spring pin	12	Shock absorber pin
6	U-bolt nut	13	Spacer
7	Caster shim		

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

A	472-502 {4,813-5,118, 348-370}	D	370-472 {3,773-4,813, 273-348}
B	169-227 {1,724-2,314, 125-167}	E	91-149 {928-1,519, 67-109}
C	210-294 {2,142-2,998, 155-216}		

SU02_001_Mokuji kai.fm 8 ページ ２０１１年１０月３１日 月曜日 午前１１時７分

REAR SUSPENSION



SHTS09Z100200006

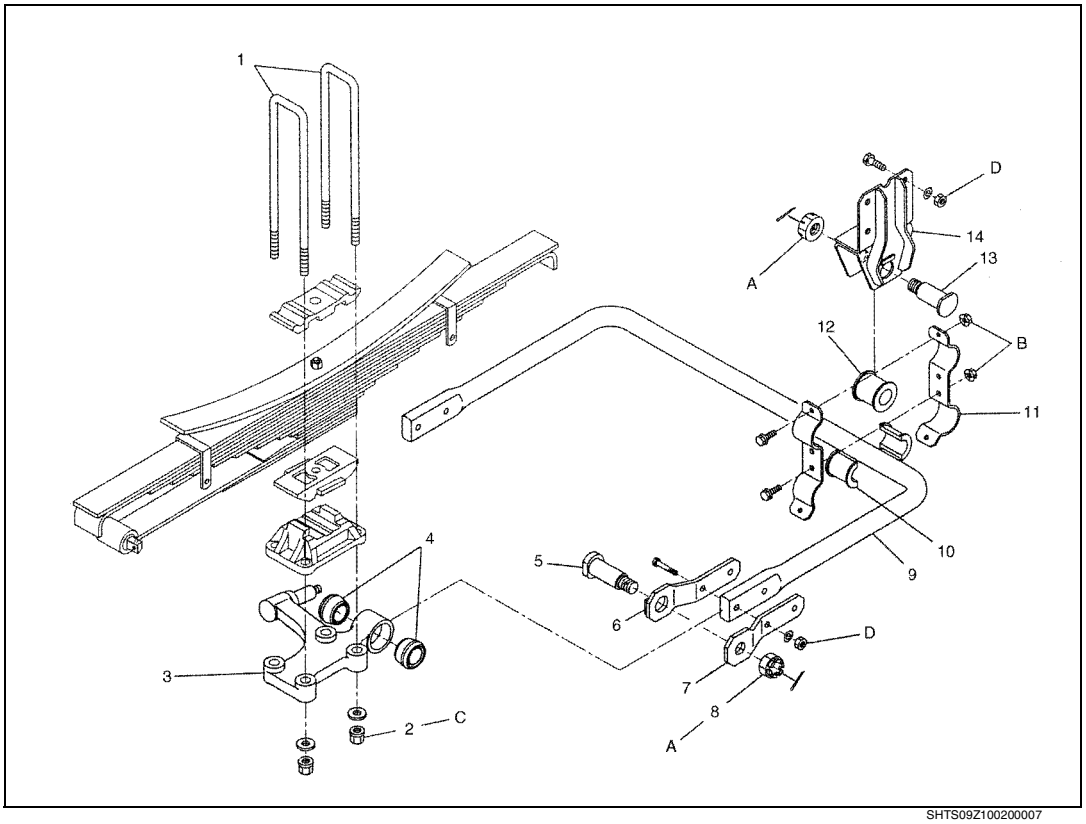
1	U-bolt	9	Rear spring upper seat
2	Spring pad	10	Rear spring lower seat
3	Flange bolt	11	U-bolt nut
4	Auxiliary leaf spring (If so equipped)	12	Cushion washer (If so equipped)
5	Washer	13	Rear bracket sub assembly (If so equipped)
6	Pin	14	Shock absorber (If so equipped)
7	Tension leaf spring	15	Shock absorber bracket (If so equipped)
8	Leaf spring assembly		

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

A	203-277 {2,070-2,824, 150-204}	C	490-734 {4,997-7,484, 362-541}
B	122-182 {1,244-2,855, 90-134}	D	180-240 {1,836-2,447, 133-176}

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REAR SUSPENSION (STABILIZER)



SHTS09Z100200007

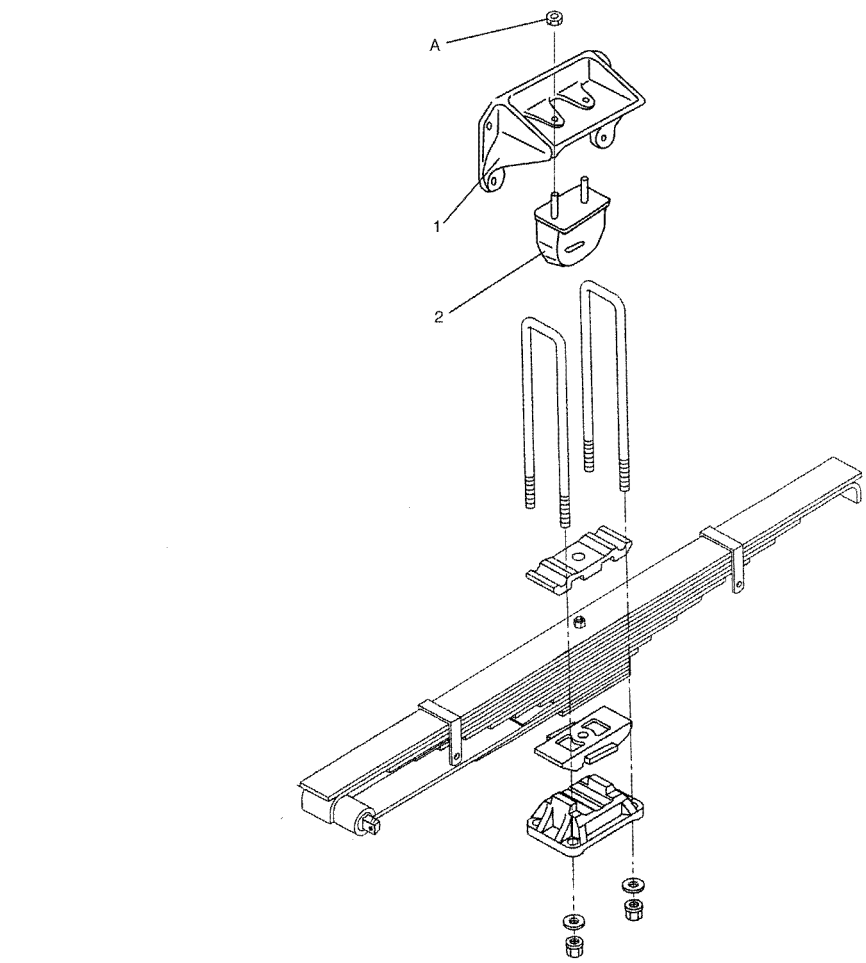
1	U-bolt	8	Slotted nut
2	U-bolt nut	9	Stabilizer bar
3	Rear bracket sub assembly	10	Stabilizer bar sleeve
4	Rubber bushing	11	Stabilizer lever
5	Stabilizer link pin	12	Stabilizer bar sleeve
6	Stabilizer lever sub assembly	13	Stabilizer link pin
7	Stabilizer lever	14	Stabilizer bracket sub assembly

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

A	180-240 {1,836-2,447, 133-176}	C	490-734 {4,997-7,484, 362-541}
B	53-89 {541-907, 39-65}	D	107-147 {1,091-1,498, 79-108}

S1-UNAE09A-2.book 10 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

REAR SUSPENSION (HELPER RUBBER)



SHTS09Z100200008

1 Bracket	2 Helper rubber

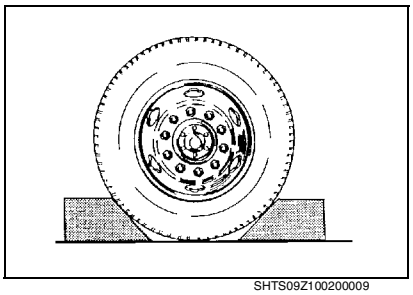
Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A 73-109 {745-1,111, 54-80}	

S1-UNAE09A-2.book 11 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

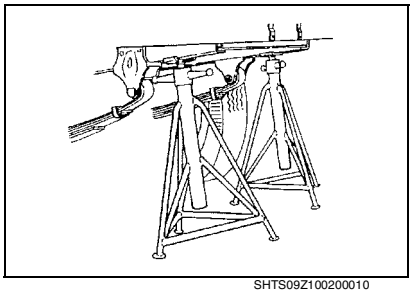
OVERHAUL

EN09Z1002H200001

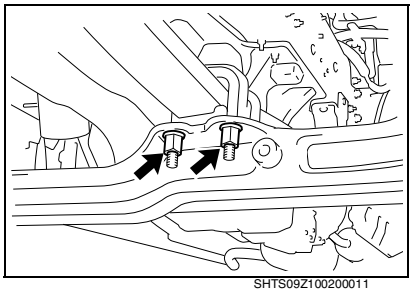

SHTS09Z100200009

IMPORTANT POINTS - DISMOUNTING

1. SUPPORT THE FRAME WITH STANDS
(1) Park the vehicle on level ground.
(2) Be sure to block the wheels before dismounting.

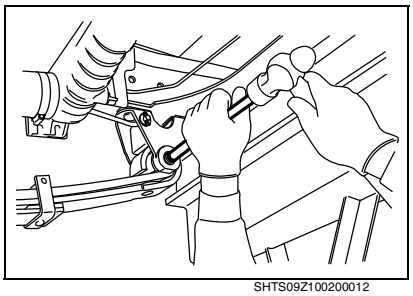

SHTS09Z100200010

(3) Jack up the axle, and support the frame with stands.
(4) Remove the tires.


SHTS09Z100200011

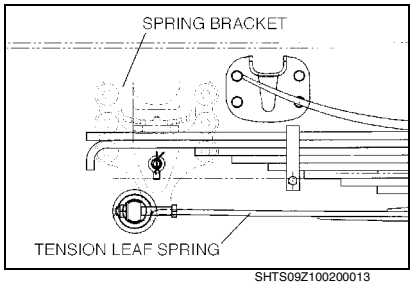
2. REMOVAL OF THE U-BOLT
(1) Remove the shock absorber.
(2) Support the axle with a jack.
(3) Remove the U-bolt mounting nuts.

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.


SHTS09Z100200012

3. REMOVAL OF THE SPRING PIN (FRONT SUSPENSION)
(1) Use a brass rod to remove the spring pins from the shackle and spring bracket.

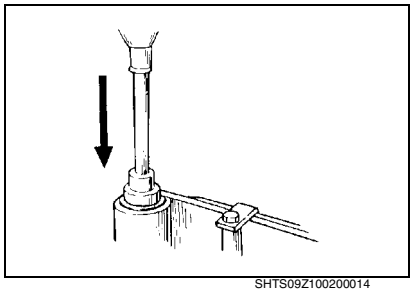
S1-UNAE09A-2.book 12 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



SHTS09Z100200013

4. REMOVAL OF THE TENSION LEAF SPRING (REAR SUSPENSION)

(1) Remove the lock nuts and washers which connect to the spring bracket.


SHTS09Z100200014

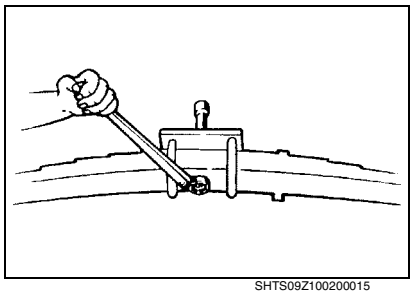
IMPORTANT POINTS - DISASSEMBLY

1. REPLACEMENT OF THE BUSHING (FRONT SUSPENSION)

(1) Use a suitable tool to press out the old bushing.
(2) Use a suitable tool to press in the new bushing.

2. REPLACEMENT OF THE BUSHING (REAR SUSPENSION)

(1) The bushing of the tension leaf cannot be replaced independently. Replace it along with the whole tension leaf.

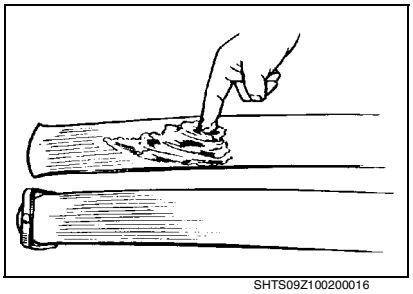

SHTS09Z100200015

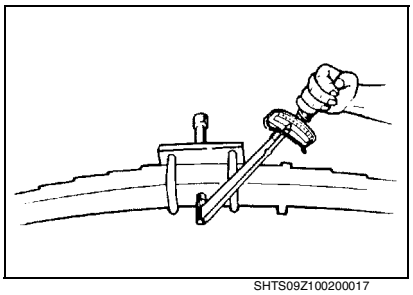
3. DISASSEMBLY OF THE LEAF SPRING

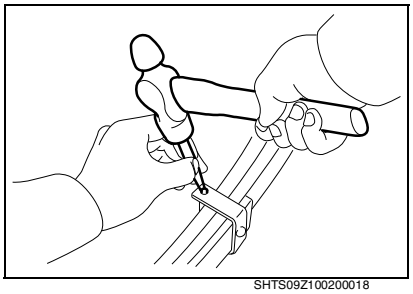
⚠ WARNING
When removing the center bolt lock nut, the spring leaves may jump. Care should be taken to avoid possible personal injury.

(1) Remove the clip bolts.
(2) Use a vice or an arbor press to hold the leaf spring near the center bolt.
(3) Remove the center bolt.
(4) Loosen the vice or arbor press slowly, and separate the leaves.

S1-UNAE09A-2.book 13 ページ ２０１１年１０月２７日 木曜日 午後５時２１分


SHTS09Z100200016


SHTS09Z100200017


SHTS09Z100200018

IMPORTANT POINTS - 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 surfaces of leaves.

(2) Align the leaf holes then secure the leaves with a vice or an arbor press.
(3) Insert the center bolt and tighten the lock nut.

Tightening Torque:
90-100 N·m {918-1,020 kgf·cm, 66-74 lbf·ft}

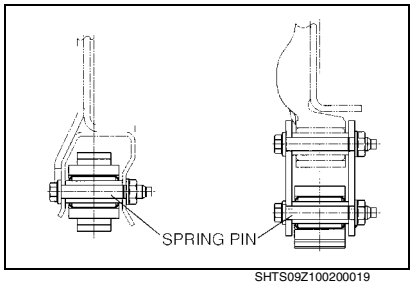
NOTICE
When reassembling the leaf spring, replace the center bolt with a new one.

(4) Tighten the clip bolts.
Tightening Torque:
20 N·m {205 kgf·cm, 15 lbf·ft}

NOTICE
When tightening the clip bolts, use a new clip bolts.

(5) Use a punch to peen the thread of the clip bolts.

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SHTS09Z100200019

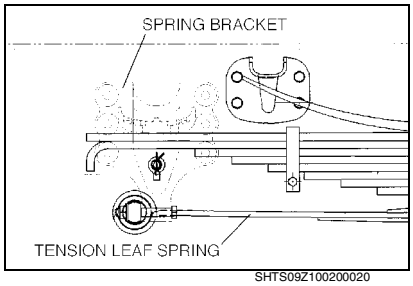
IMPORTANT POINTS - MOUNTING

1. INSTALLATION OF THE SPRING PIN (FRONT SUSPENSION)

(1) Use a copper hammer to install the spring pin.

NOTICE

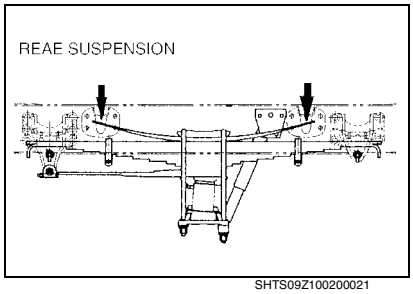
Apply chassis grease on the surface of the bushing and spring pin before installing.



SHTS09Z100200020

2. INSTALLATION OF THE REAR SPRING ASSEMBLY

(1) Install the tension leaf spring of the rear spring assembly to the spring bracket.



SHTS09Z100200021

3. LUBRICATION (REAR SUSPENSION)

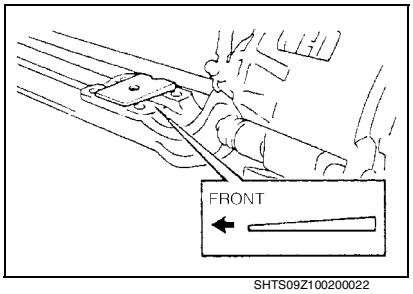
(1) Lubricate the following parts with chassis grease.

- Auxiliary spring slide seats

HINT

Do not apply chassis grease to other parts and Front suspension.

S1-UNAE09A-2.book 15 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



SHTS09Z100200022

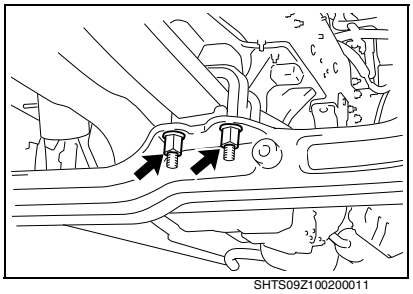
4. INSTALLATION OF THE U-BOLT

(1) Put the caster shim on the front axle I-beam part of the each side. (For front suspension)

(2) Lift the axle using a jack and align the hole of the leaf spring center bolt and the hole of the axle I-beam.

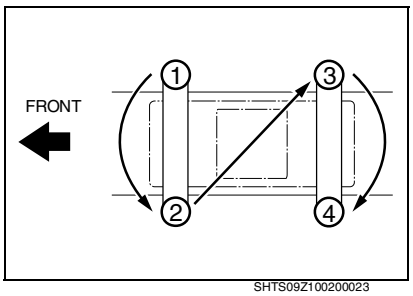
NOTICE

Axle and suspension assembly are heavy, therefore be careful when handling them.


SHTS09Z100200011

(3) Put the spring pads and bumper rubbers on the leaf springs.

(4) Set the U-bolts so that they catch the spring pads and tighten the U-bolt nuts temporarily.



SHTS09Z100200023

(5) 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.

Tightening Torque: N·m {kgf·cm, lbf·ft}

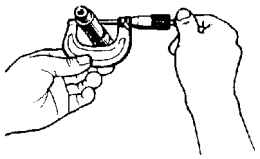
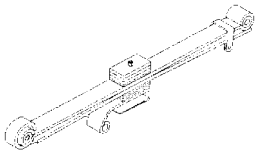
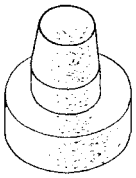
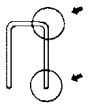
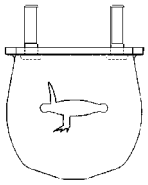
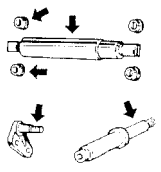
Model	HINO 238, 258, 268, 338, 358 (NE, NF, NJ, NV)
Front	370-472 {3,773-4,813, 273-348}
Rear	490-734 {4,997-7,484, 362-541}

S1-UNAE09A-2.book 16 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

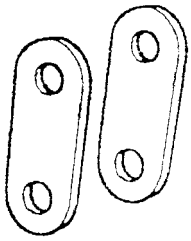
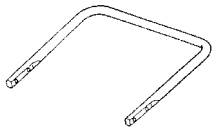
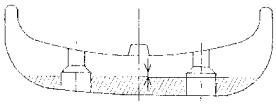
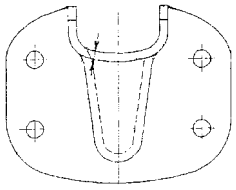
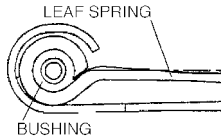
INSPECTION AND REPAIR

EN09Z1002H300001

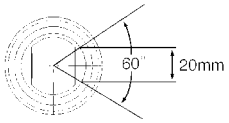
Unit: mm {in.}

Inspection item		Standard	Limit	Remedy	Inspection procedure
Spring pin: Outside diameter	Rear	31.66 {1.246}	31.30 {1.232}	Replace.	Measure 
Leaf: Damage and wear		—	—	Replace.	Visual check 
Spring bumper: Damage and wear		—	—	Replace, if necessary.	Visual check 
U-Bolt: Damage		—	—	Replace, if necessary.	Visual check 
Rear stopper rubber: Damage or crack		—	—	Replace, if necessary.	Visual check 
Shock absorber: Operation, oil leak and damage		—	—	Replace, if necessary.	Visual check 
Cushion: Damage and wear		—	—		
Shock absorber pin and bracket: Damage and wear		—	—		

S1-UNAE09A-2.book 17 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

Inspection item	Standard	Limit	Remedy	Inspection procedure
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)**				
Slide Seat: **Wear**	—	**2 {0.08}**	**Replace.**	**Measure: thickness from bolt head as shown below.** 
Helper Bracket: **Wear**	**6 {0.236}**	**2 {0.08}**	**Replace.**	**Measure: thickness** 
Front spring bushing: **Damage and crack**	—	—	**Replace,** **if necessary.**	**Visual check** 

S1-UNAE09A-2.book 18 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

Inspection item	Standard	Limit	Remedy	Inspection procedure
Rear spring bushing: Damage and crack	**—**	**—**	**Replace, if necessary.**	**Visual check** 

S1-UNAE09A-2.book 19 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

AIR SUSPENSION ASSEMBLY

DATA AND SPECIFICATIONS

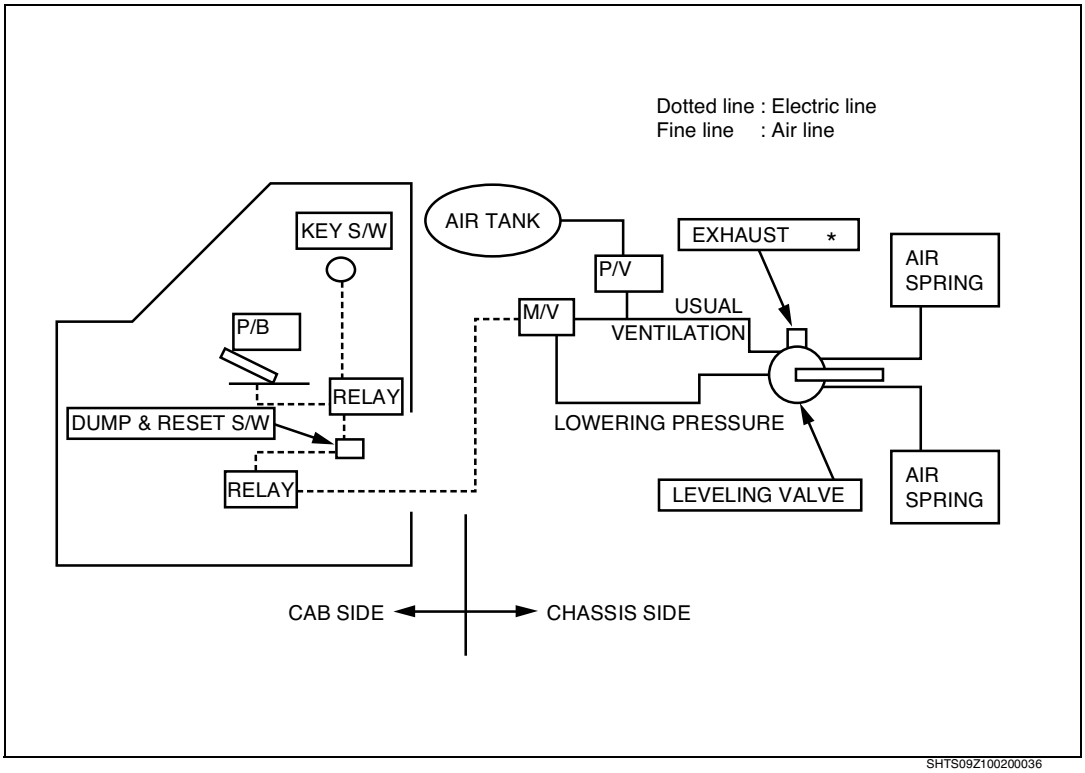
EN09Z1002I200002

REAR SUSPENSION

Model	**HINO 238, 258, 268, 338, 358 (NE8J, NF8J, NJ8J, NV8J)**
Type	**HENDRICKSON AL-V**
Option	**WITH HEIGHT CONTROL DEVICE**

SYSTEM DIAGRAM FOR HEIGHT CONTROL

EN09Z1002I200003



SHTS09Z100200036

S/W: Switch	**P/V: Protection valve**
P/B: Parking brake	**M/V: Magnetic valve**
	*** Exhaust air in the air spring.**

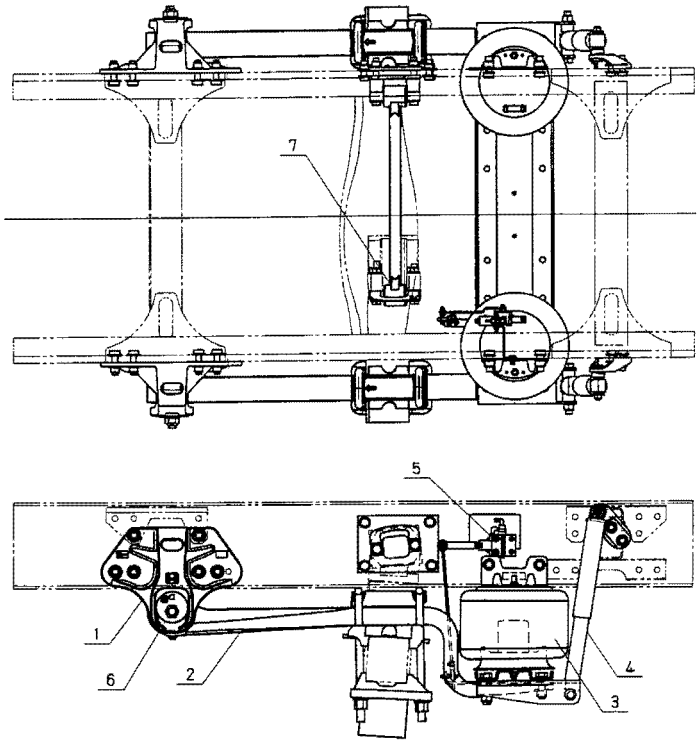
NOTICE
Refer to chapter “ELECTRIC WIRE” about air suspension dump electric circuit.

S1-UNAE09A-2.book 20 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

DESCRIPTION

EN09Z1002C100002

REAR SUSPENSION



SHTS09Z100200037

1	Spring hanger	5	Height control valve
2	Main support member	6	Quick align base
3	Air spring	7	Transverse torque rod
4	Shock absorber		

S1-UNAE09A-2.book 21 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

TROUBLESHOOTING

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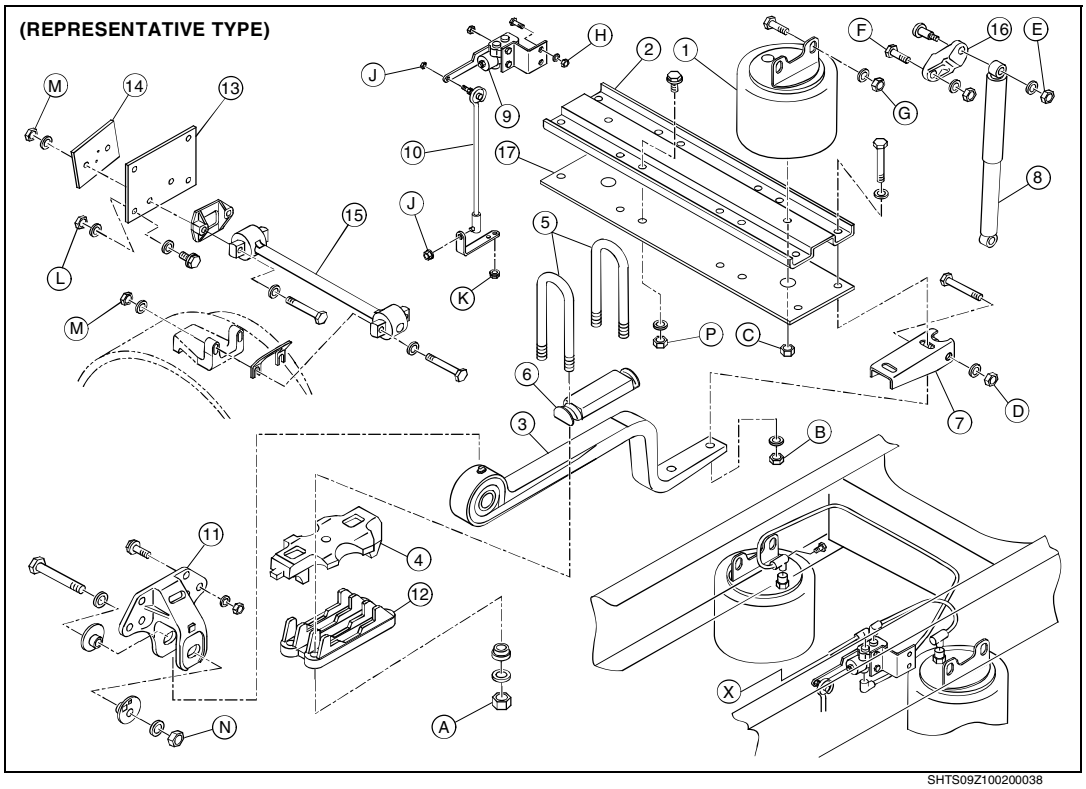
Symptom	Possible cause	Remedy/Prevention
Abnormal sound occurs from the spring while driving.	Eccentric wear of the shock absorber fitting pin	Replace the pin and/or rubber bushing.
Uncomfortably (Rolling and pitching)	Deflection and damage of the bushings of the main support member or the transverse rod	Replace the main support member or the bushing of the transverse rod.
	Faulty of the shock absorber	Replace the shock absorber.
	Faulty of the height control valve	Repair the height control valve.
Vibration of the steering wheel, and the car shake	Deflection of the bushing in the main support member or the transverse rod	Replace the main support member or the bushing of the transverse rod.
	Looseness of the transverse rod bracket bolt	Replace the lock nut and tighten with the specified torque.
Vehicle height is not adjusted correctly	Faulty of the height control	Repair the parts.

S1-UNAE09A-2.book 22 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

COMPONENT LOCATOR

EN09Z1002D100002

REAR SUSPENSION



1	Air spring	10	Link
2	Cross channel	11	Spring hanger
3	Main support member	12	Bottom cap
4	Spring seat	13	Inner reinforcement plate
5	U-bolt	14	Outer reinforcement plate
6	Top pad	15	Transverse rod
7	Lower shock absorber bracket	16	Upper shock absorber bracket
8	Shock absorber	17	Plate
9	Height control valve	X	From air tank

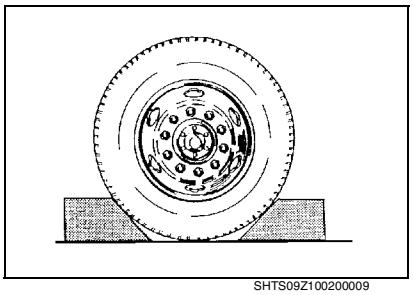
Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	545-611 {5,558-6,230, 402-450}	H	26-40 {266-407, 20-29}
B	285-365 {2,907-3,721, 211-269}	J	13-17 {133-173, 10-12}
C	27-41 {276-418, 20-30}	K	13-17 {133-173, 10-12}
D	215-245 {2,193-2,498, 159-180}	L	170-230 {1,735-2,346, 125-169}
E	69-95 {704-968, 51-70}	M	170-230 {1,735-2,346, 125-169}
F	170-230 {1,735-2,346, 125-169}	N	500-600 {5,099-6,118, 369-442}
G	215-245 {2,193-2,498, 159-180}	P	170-230 {1,735-2,346, 125-169}

S1-UNAE09A-2.book 23 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

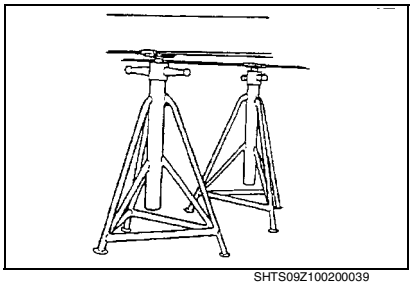
OVERHAUL

EN09Z1002H200002

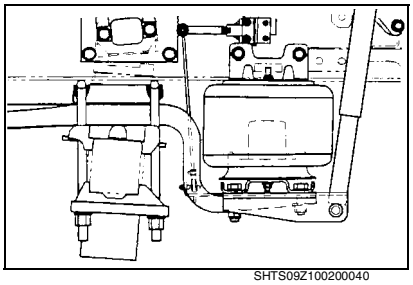

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IMPORTANT POINTS - DISASSEMBLY

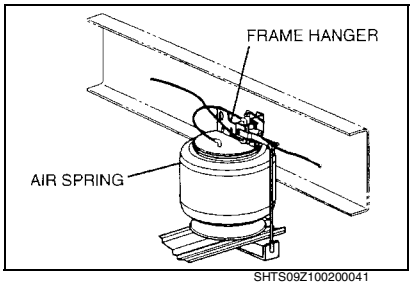
1. SUPPORT THE FRAME WITH STAND.
(1) Park the vehicle on level ground.
(2) Be sure to block the wheels before dismounting.


SHTS09Z100200039

(3) Jack up the axle, and support the frame with the stand.


SHTS09Z100200040

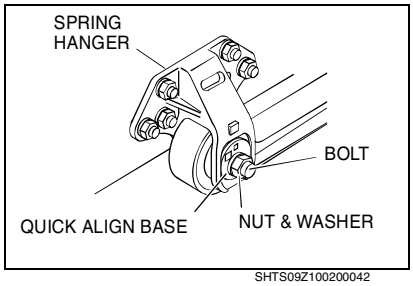
2. DISCONNECT THE SUSPENSION FROM REAR AXLE
(1) Remove the U-bolt lock nuts and washers.
(2) Remove the U-bolts, bottom cap, and top pad.
(3) Remove the lock nuts and washers which connect the cross channel to both the main support members.
(4) Lift cross channel off the main support member with jacks.



SHTS09Z100200041

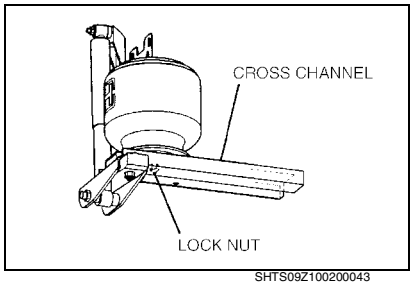
3. REMOVE OF MAIN SUPPORT MEMBERS
(1) Release air pressure from the air springs.
(2) Remove the height control valve link from the valve by removing the nut and the lock washer.

S1-UNAE09A-2.book 24 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



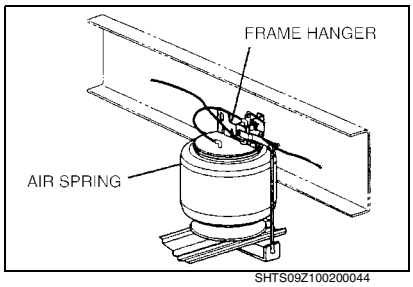
SHTS09Z100200042

(3) Remove the quick align bolts, lock nuts washers, and quick align bases from the spring hanger.
(4) Remove the main support member assembly.



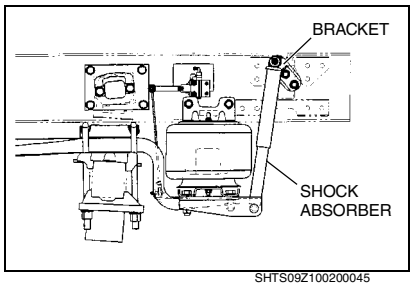
SHTS09Z100200043

4. REMOVE 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 requires.



SHTS09Z100200044

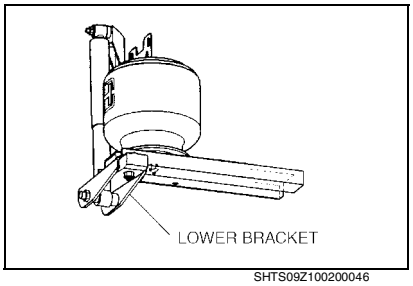
5. REMOVAL OF AIR SPRING
(1) Remove the air line from the air spring seat.
(2) Remove the brass air fittings from the air spring, if necessary.
(3) Remove the lock nuts and washers which connect the air spring to the upper air spring frame hanger.
(4) Remove the air spring.
(5) Remove the air spring frame hanger, if necessary.



SHTS09Z100200045

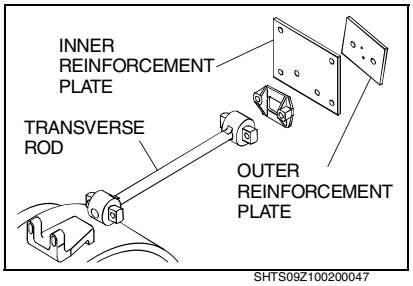
6. REMOVE OF SHOCK ABSORBER FRAME HANGER BRACKET
(1) Remove the lock nuts and washers at both ends of the shock absorber.
(2) Remove the shock absorber completely from the chassis.
(3) Remove the lock nuts and washers which connect the shock absorber bracket to the frame.
(4) Remove the shock absorber bracket.

S1-UNAE09A-2.book 25 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



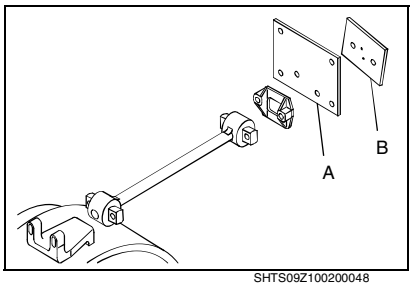
SHTS09Z100200046

7. REMOVE OF SHOCK ABSORBER LOWER BACKET
(1) Remove the shock absorber completely from the chassis.
(2) Remove the shock absorber lower bracket.



SHTS09Z100200047

8. 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.



SHTS09Z100200048

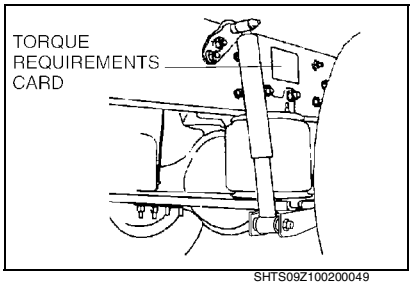
IMPORTANT POINTS - DISASSEMBLY

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 back up plates.
(3) Position the straddle mount end of torque rod at the transverse rod to the frame, tighten the lock nuts to specified torque.

NOTICE
All the nuts and bolts are lock type. Therefore these are not reuseable. You should install a new one.

2. INSTALL OF MAIN SUPPORT MEMBERS AND AIR SPRING
(1) Installation is in the reverse order of removal.

NOTICE
Tighten fasteners to specified torque. Refer to on page SU02-22, or Torque Requirements card on the right frame.



SHTS09Z100200049

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, 110 lbf/in.^{2}} then check the leakage.

4. ADJUSTMENT OF THE VEHICLE HEIGHT

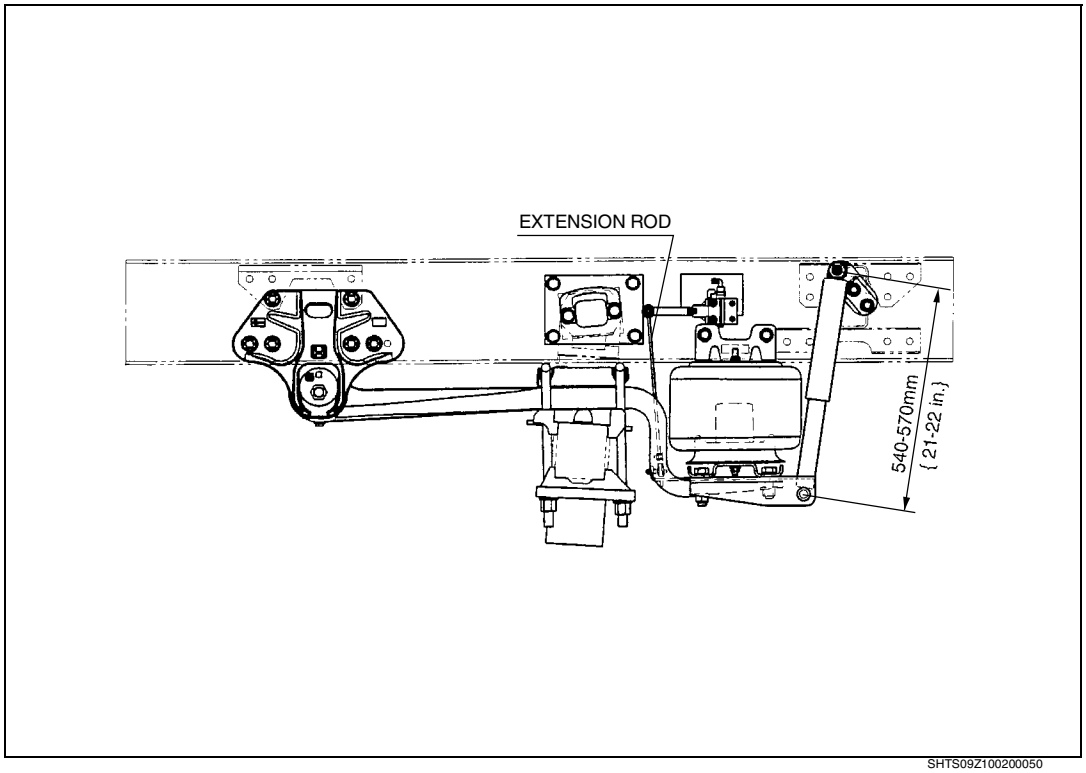
NOTICE
- **Adjustment should be done only after assembling.**
- **Adjustment should be done with the air pressure of 71-86 kPa {7.0-8.5 kgf/cm^2, 99-120 lbf/in.^{2}}, keeping on supplying the air while rotating the engine at the idle speed.**

(1) Measure the shock absorber length between upper and lower pins.

S1-UNAE09A-2.book 26 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

Assembly standard: 540-570 mm {21-22 in.}

(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.



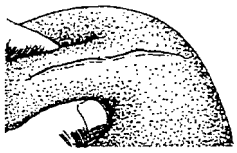
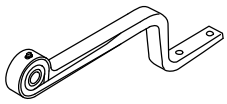
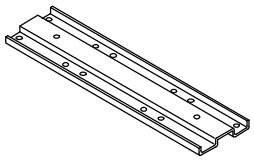
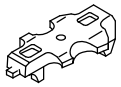
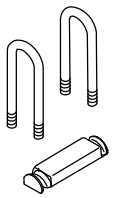
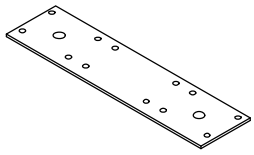
SHTS09Z100200050

S1-UNAE09A-2.book 27 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

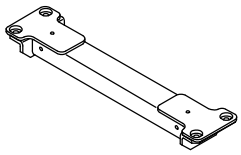
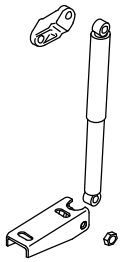
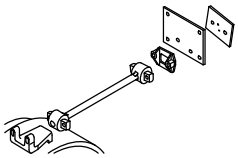
INSPECTION AND REPAIR

EN09Z1002H300002

Unit: mm {in.}

Inspection item	Standard	Limit	Remedy	Inspection procedure
Air spring: Wear, damage and crack	—	—	Replace, if necessary.	Visual check 
Main support member: Crack and damage	—	—	Replace, if necessary.	Visual check 
Bushing: Wear, damage and crack	—	—		
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	—	—		
Plate: Crack and damage	—	—	Replace, if necessary.	Visual check 

S1-UNAE09A-2.book 28 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

Inspection item	Standard	Limit	Remedy	Inspection procedure
Cross channel: Crack and damage	—	—	**Replace, if necessary.**	**Visual check** 
Shock absorber: Operation, oil leak and damage	—	—	**Replace, if necessary.**	**Visual check** 
Upper and lower brackets: Crack and damage	—	—		
Transverse rod: Crack and damage	—	—	**Replace, if necessary.**	**Visual check** 
Transverse rod bushings: Wear, damage and crack	—	—		
Chassis Reinforcement: Crack and damage	—	—		
Spacer plate: Crack and damage	—	—		

S1-UNAE09A-2.book 1 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

CHASSIS FRAME

FC02-001

CHASSIS FRAME FC02-2
TROUBLESHOOTING FC02-2
INSPECTION FC02-2
REPAIRS FC02-3

S1-UNAE09A-2.book 2 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

CHASSIS FRAME

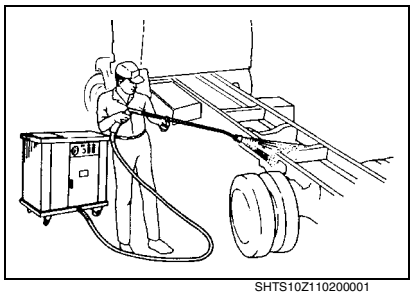
TROUBLESHOOTING

EN10Z1102F300001

Symptom	Possible cause	Remedy/Prevention
Frame distortion (Vehicle inclination)	Flattening or breakage of springs on one side	Replace spring
	Incorrect mounting (Attachment of heavy weight on one side of the vehicle)	Correct mounting
Bent frame	Overloading or concentrated weight on rear end of frame	• Correct load • Correct with frame correction device
Frame cracking or rivets breaking	Wrong body mounting	Correct mounting
	Overloading	• Improvement of the usage • Reinforce with stiffener

INSPECTION

EN10Z1102H200001

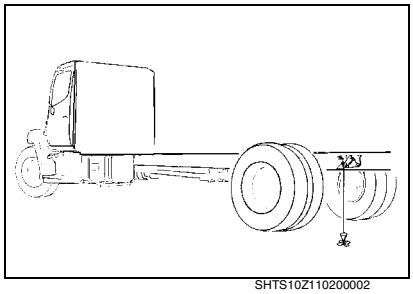


SHTS10Z110200001

1. CLEAN THE FRAME

NOTICE

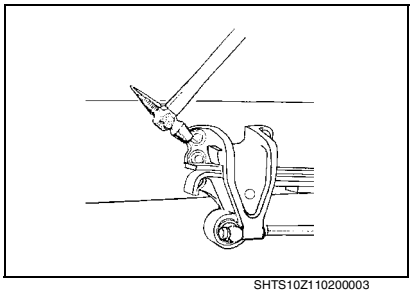
While inspecting or repairing, stop the engine and block the wheels. When cleaning with a steam cleaner, use safety goggles.



SHTS10Z110200002

2. PLACE THE VEHICLE ON A FLAT SURFACE, HANG A WEIGHT FROM EACH MEASURING POINT ON THE FRAME, AND MARK THE FLOOR BELOW THE WEIGHT.

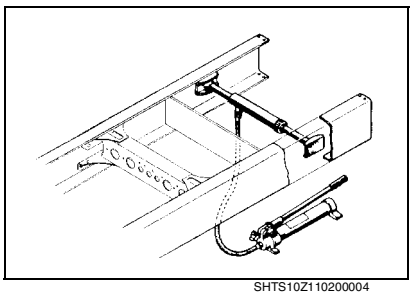
S1-UNAE09A-2.book 3 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



SHTS10Z110200003

3. INSPECT THE FRAME FOR BENDING, TWISTING OR OTHER DEFORMATION.

4. CHECK THE TIGHTENESS OF THE RIVETS, AND BOLTS.



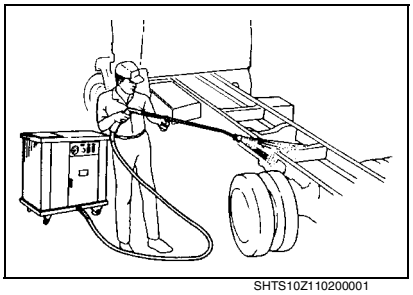
SHTS10Z110200004

REPAIRS

EN10Z1102H200002

1. FRAME ALIGNMENT

(1) Correct the frame alignment.



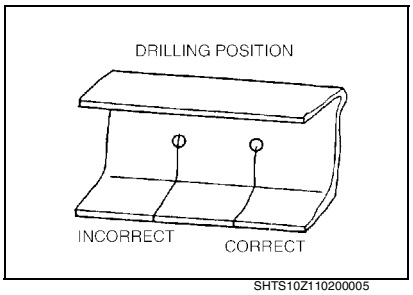
SHTS10Z110200001

2. CRACKING OF THE FRAME

(1) Clean the area around the cracks with a steam cleaner, soap and water, or a solvent.

NOTICE

When cleaning with a steam cleaner, use safety goggles.



SHTS10Z110200005

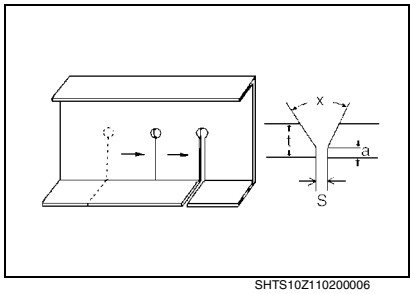
3. REPAIRING OF FRAME CRACKS

(1) Perform the procedure for preventing the enlargement of cracks.

NOTICE

Do not make drill holes on the frame flanges except when repairing the cracks.

S1-UNAE09A-2.book 4 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

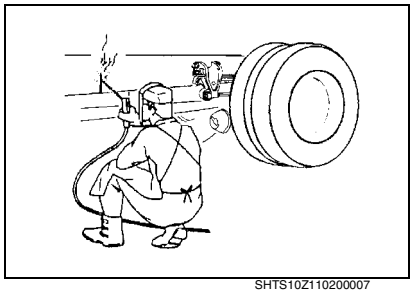


SHTS10Z110200006

(2) Make the V-shape groove with a grinder along the frame crack according the following table.

Unit: mm {in.}

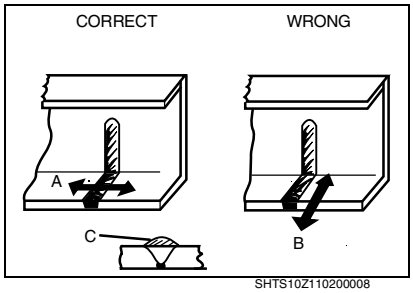
t	x°	s	a
4.5 {0.18}	90	1.0 {0.039}	0
6 {0.24}	70	1.0 {0.039}	0
7 {0.28}	70	1.5 {0.059}	1 {0.039}
8 {0.31}	70	1.5 {0.059}	1 {0.039}
9 {0.35}	70	1.5 {0.059}	1 {0.039}
10 {0.39}	60	1.5 {0.059}	1 {0.039}
12 {0.47}	60	1.5 {0.059}	1 {0.039}
16 {0.63}	60	2.0 {0.079}	1 {0.039}


SHTS10Z110200007

(3) Use an electric welder.
Refer to page FC02-7 for WELDING CONDITION (WHEN WELDING ROD IS USED).

⚠ WARNING

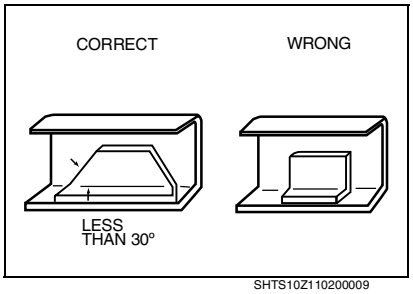
- **Disconnect the negative battery ground cable before using arc welding equipment.**
- **While welding, make sure that there are no flammable materials such as oil, rags, etc. around. As welded parts becomes extremely hot and sparks are present, make sure that there are no items such as harnesses, tubes, pipes, suspension component, etc. which may be damaged.**
- **If material is allowed to sputter onto the spring leaf during welding its strength will be significantly diminished. It should therefore be covered with a protective sheet. Also, for the same reason, the spring leaf should never be used as a ground for arc welding.**
- **When arc welding, ventilate or wear antitoxic mask for noxious gas.**
- **To prevent burns, electric shock and gas poisoning during arc welding, wear a helmet, apron, antitoxin mask, safety goggles, arm coverings, leg covering, safety boots and gloves.**



SHTS10Z110200008

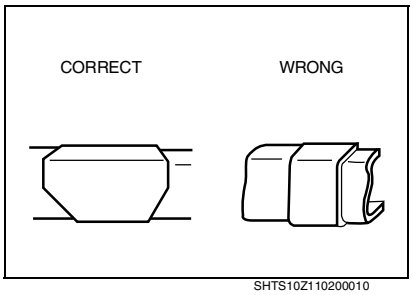
(4) After welding, shake the grinder crosswise the bead line A, along direction B, to polish the welded area as illustrated in C.
Grind and polish the bead line A so that the frame surface becomes even.

S1-UNAE09A-2.book 5 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

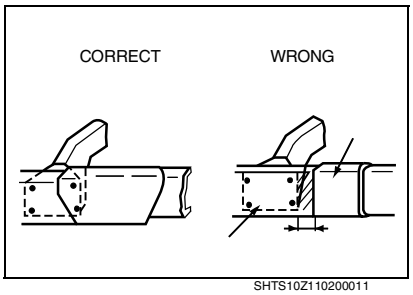


SHTS10Z110200009

(5) Reinforcement patching method.
Patch-plate with ends squared off rather than tapered can cause damage.
The patching plate thickness should be the same as the frame.

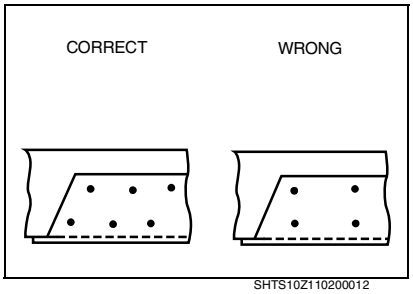


SHTS10Z110200010



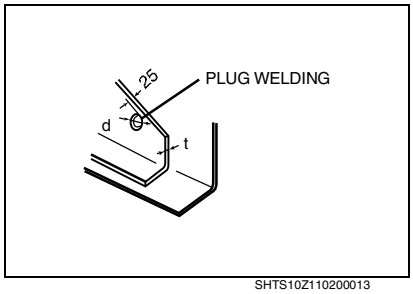
SHTS10Z110200011

(6) Be sure to fasten the bolts at the hole locations of ups and downs (use rivets or perform the plug welding).



SHTS10Z110200012

S1-UNAE09A-2.book 6 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

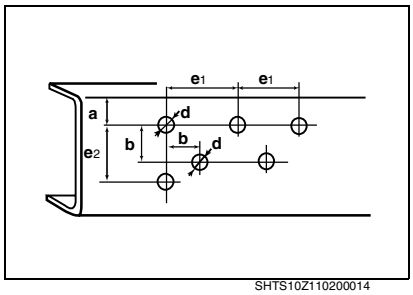


SHTS10Z110200013

(7) Diameter of plug welding hole.

NOTICE
Prohibit plug welding on the flange.

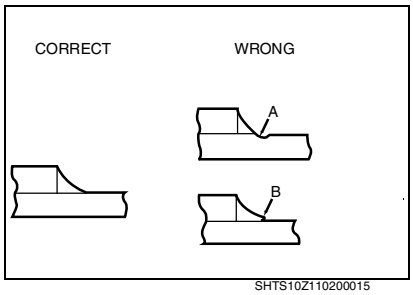
t	dϕ
3.2	15
4.5	15
6	18
8	18
10	18



SHTS10Z110200014

(8) Interval of the holes

a ≥50+d/2
b≥ 3d
e1e2≥701+a
dϕ: 18or less



SHTS10Z110200015

(9) In welding, be sure that there is no undercut A or overlap B of the bead and pin hole.

NOTICE
An experienced professional welder should always perform the welding since a poor welding job on the frame can cause damage.

S1-UNAE09A-2.book 7 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

WELDING CONDITION (WHEN WELDING ROD IS USED)

		Electric current (Unit: A)					
	Rod dia ϕ	3.2 mm {0.126 in.}		4mm {0.157 in.}		5 mm {0.197 in.}	
	Welding position	Flat	Vertical overhead	Flat	Vertical overhead	Flat	Vertical overhead
Mechanical property of weld metal & rod	Weld Metal (Hot roll plate) Tensile strength; 621 MPa {63 kgf/mm^2, 89.6 lbf/in.^{2}} Welding Rod Tensile strength; 539 MPa {55 kgf/mm^2, 78.2 lbf/in.^{2}} Illuminate type (JIS D8016 AWS E8018) Coated electrode	100-150	90-140	140-200	130-180	190-270	—
	Weld Metal (Hot roll plate) Tensile strength; 539 MPa {55 kgf/mm^2, 78.228 lbf/in.^{2}} Welding Rod Tensile strength; 490 MPa {50 kgf/mm^2, 71.116 lbf/in.^{2}} Illuminate type (JIS D4301 AWS E6019) Coated electrode	90-140	80-130	141-190	110-160	180-250	—

NOTICE

- **Diameter of welding rod ϕ3.2 mm {0.126 in.} or ϕ4 mm {0.157 in.} - plate thinner than 5 mm {0.197 in.}**
- **Diameter of welding rod ϕ4 mm {0.157 in.} or ϕ5 mm {0.197 in.} - plate thicker than 6 mm {0.236 in.}**

S1-UNAE09A-2.book 1 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

CAB

CA02-001

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TROUBLESHOOTING CA02-3
DISMOUNTING AND MOUNTING CA02-4
INSPECTION AND REPAIR CA02-7

HOOD CA02-8
COMPONENT LOCATOR CA02-8
OVERHAUL CA02-9
FRP REPAIR PROCEDURE CA02-12

RADIATOR GRILLE CA02-17
COMPONENT LOCATOR CA02-17
OVERHAUL CA02-18

DOOR CA02-19
COMPONENT LOCATOR CA02-19
OVERHAUL CA02-20

SEAT CA02-23
COMPONENT LOCATOR CA02-23

INSTRUMENT PANEL CA02-26
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DISMOUNTING AND MOUNTING CA02-27

HEATER AND AIR CONDITIONER CA02-28
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AIR CONDITIONING SYSTEM CA02-29
SPECIFICATION DATA CA02-29
PRECAUTIONS REGARDING REFRIGERANT (HFC134a) CA02-29
PRECAUTIONS FOR REPLENISHING THE REFRIGERANT GAS CA02-30
TROUBLESHOOTING (FAULT DIAGNOSIS BY SYMPTOMS) CA02-31
GAS LEAKAGE INSPECTION CA02-40
PRECAUTIONS FOR REMOVING/INSTALLING THE AIR CONDITIONER CA02-43
RECOVERY AND REPLENISHMENT OF REFRIGERANT CA02-45
MAINTENANCE CA02-49
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WINDSHIELD CA02-54
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REPLACEMENT CA02-55
AFFIXING WEATHERSTRIP PROCEDURE CA02-56

FRONT BUMPER CA02-60
COMPONENT LOCATOR CA02-60

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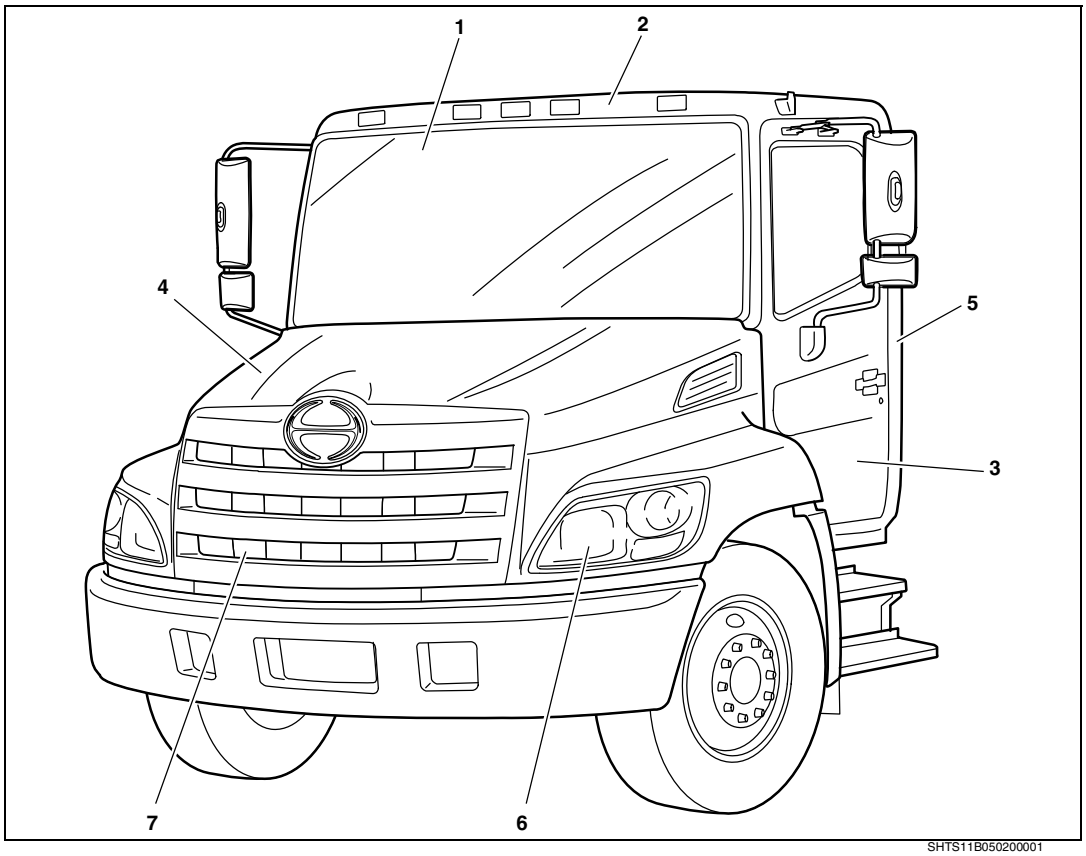
CAB ASSEMBLY

DATA AND SPECIFICATIONS

EN11B0502I200001

CAB

	Cabin	Engine hood
Type	All steel welded construction, safety glass fitted to all windows	Tilt hood, made of FRP. (SMC)
Tilt system	Less	Torsion bar
Tilt angle	—	75°



SHTS11B050200001

1	Windshield glass	5	Cab body
2	Roof	6	Head light
3	Door	7	Radiator grille
4	Hood		

S1-UNAE09A-2.book 3 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

TROUBLESHOOTING

EN11B0502F300001

HOOD TILT

Symptom	Possible cause	Remedy/Prevention
Hood does not tilt up.	Hood mounting hook does not release.	Inspection of hood mounting hook.
	Oil damper does not release.	Inspection of oil damper mechanism.
	Damaged torsion bar	Replace torsion bar.
Hood tilting is difficult.	Tilt up force is weak.	Replace torsion bar.
Hood does not lock to hood mounting member.	Mounting hook does not operate.	Replace mounting hook.
	Hood mounting cushion is not correctly installed.	Correct installation of hood mounting.

DOOR

Symptom	Possible cause	Remedy/Prevention
Door does not close properly.	Door is not adjusted	Adjust door installation.
	Striker is not adjusted	Adjustment of shim for door lock striker
	Damaged door lock	Replace door lock.
Door does not lock by inside lock knob.	Deformation of rod	Replace rod.
	Rod is disconnected	Connect rod.
	Damaged door lock	Replace door lock.
Door does not lock by key.	Rod is disconnected	Connect rod.
	Damaged door lock	Replace door lock.
	Damaged lock cylinder	Replace lock cylinder.
Door does not open by outside handle.	Outside handle push rod is not adjusted.	Adjust push rod.
	Damaged door lock	Replace door lock.
Door does not open by inside handle.	Inside handle is not installed properly.	Install inside handle properly.
	Deformation of rod	Replace rod.
	Rod is disconnected.	Connect rod.
	Damaged door lock	Replace door lock.
Inside handle does not return to its normal position.	Interference between rods.	Replace rod.
	Inside handle is not installed properly.	Adjust inside handle.
	Return spring is damaged.	Replace inside handle.
Door window goes down while driving.	Window is not in the glass holder.	Repair.
	Regulator is damaged.	Replace regulator.
Regulator makes abnormal noise while driving.	Window sill weather strip is installed improperly.	Install properly or replace clips.

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BLOWER

Symptom	Possible cause	Remedy/Prevention
Malfunction of blower when power is ON.	Blown fuse	Change fuse or check for short circuit.
	Malfunction in heater relay	Inspect relay.
	Malfunction of heater blower switch	Inspect power switch.
	Malfunction of register	Check register.
	Blower motor malfunction	Replace motor.
	Damaged electrical wiring or poor grounding	Repair as necessary.

DISMOUNTING AND MOUNTING

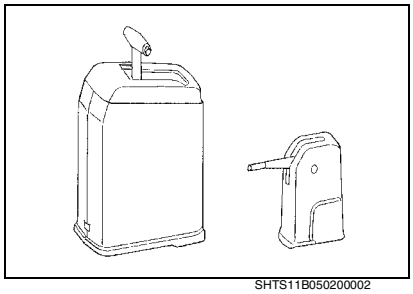
EN11B0502H100001

1. BEFORE DISMOUNTING THE CAB

(1) Be sure to block the front wheels.
(2) Disconnect the battery cable from the battery ground terminal.
(3) Tilt the engine hood.
(4) Drain engine coolant, clutch fluid, brake fluid and refrigerant of the air conditioner.

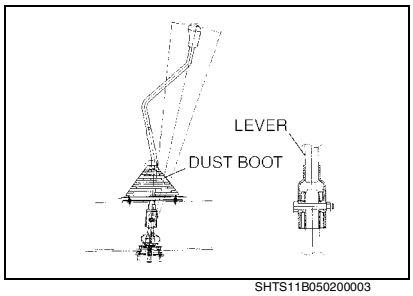
2. CAB INSIDE

(1) Hydro brake model: Remove the box of parking brake control lever and remove the cable retainer spring and pin.



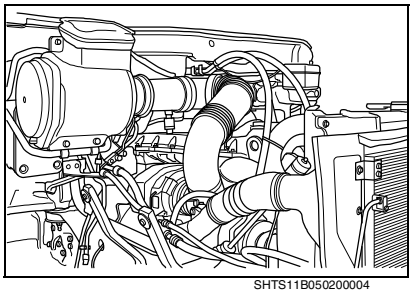
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(2) Manual transmission: Remove the transmission control lever assembly with dust boot.
ALLISON auto-transmission: Remove the cover and cable of the auto-transmission control assembly.



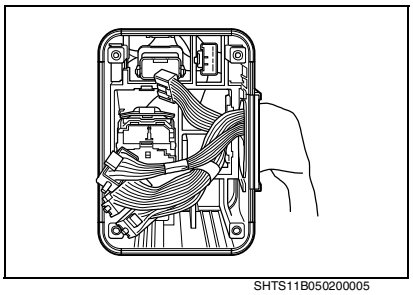
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S1-UNAE09A-2.book 5 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

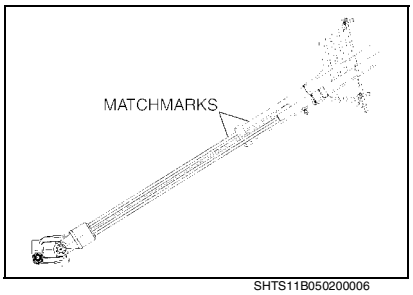

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3. CAB FRONT SIDE

(1) Remove the heater hose, pipe for air conditioner, air cleaner and bracket.

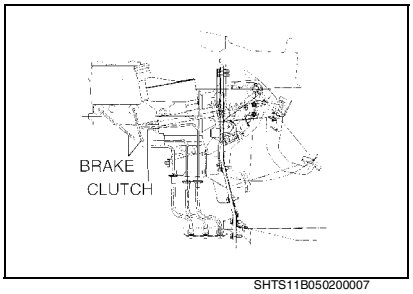

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(2) Remove the cab-chassis harness box lid and disconnect all the connectors of the harness connected to the cab and chassis.



SHTS11B050200006

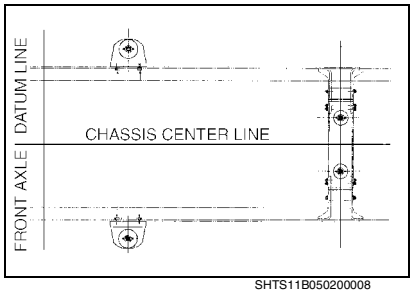
(3) Disconnect the steering shaft
Make alignment marks on both the steering shaft and shaft spline. Then remove the tightening nut and disconnect the shaft yoke from the steering gear assembly.



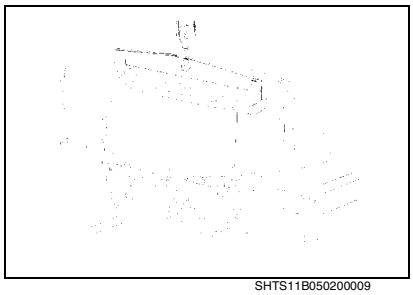
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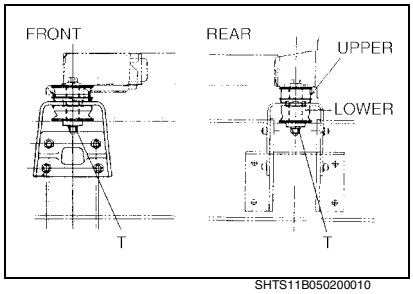
(4) Hydro brake, manual transmission:
Disconnect the brake pipe from the Hydro Max and the clutch pipe from the master cylinder. Disconnect its hose.
Hydro brake, automatic transmission:
Disconnect the brake pipe from the Hydro Max and disconnect its hose.
Full air brake, manual transmission:
Disconnect the brake tube from the brake valve and the spring brake control valve. Disconnect the clutch pipe from the master cylinder.
Full air brake, automatic transmission and UltraShift transmission:
Disconnect the brake tube from the brake valve and the spring brake control valve.

S1-UNAE09A-2.book 6 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



SHTS11B050200008


SHTS11B050200009



SHTS11B050200010

4. DISMOUNT CAB

(1) Remove the mounting rubber nuts. (4 places)

(2) Using a crane or hoist, bring the cab lifting device to slight tension.

(3) Lift the cab and set the cab on a cab stand.

⚠ WARNING

Never go under the cab while lifting or suspending the cab.

5. MOUNT CAB

HINT

Mounting takes place in the reverse order of dismounting, so please pay attention to the following points.

(1) Discrimination of the mounting rubber.

Model	Front Mounting		Rear Mounting	
	Upper	Lower	Upper	Lower
HINO 23, 25, 26, 33, 35 (NE, NJ, NF, NV)	Pink ϕ10-1	← ϕ10-2	Green ϕ10-1	← ϕ10-2

Nut Tightening Torque:
T=213-227N·m {2,173-2,316kgf·cm, 157-167lbf·ft}

(2) Connect the pipes to the brake valve and the clutch master cylinder.

- Tighten flare nuts and tapered joints to the specified tightening torque shown below.

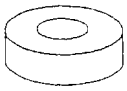
Pipe or joint diameter		Flare Nut	Tapered joint		
		ϕ6.35mm	1/4 in.	3/8 in.	1/2 in.
Tightening Torque	N·m	20-30	20-30	29-39	39-49
	kgf·cm	204-306	204-306	296-398	398-500
	lbf·ft	15-22	15-22	21-29	29-36
Material		Steel pipe	Aluminum Copper		

(3) Connect the steering shaft.
The steering shaft should be aligned to the marks.

S1-UNAE09A-2.book 7 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

INSPECTION AND REPAIR

EN11B0502H100002

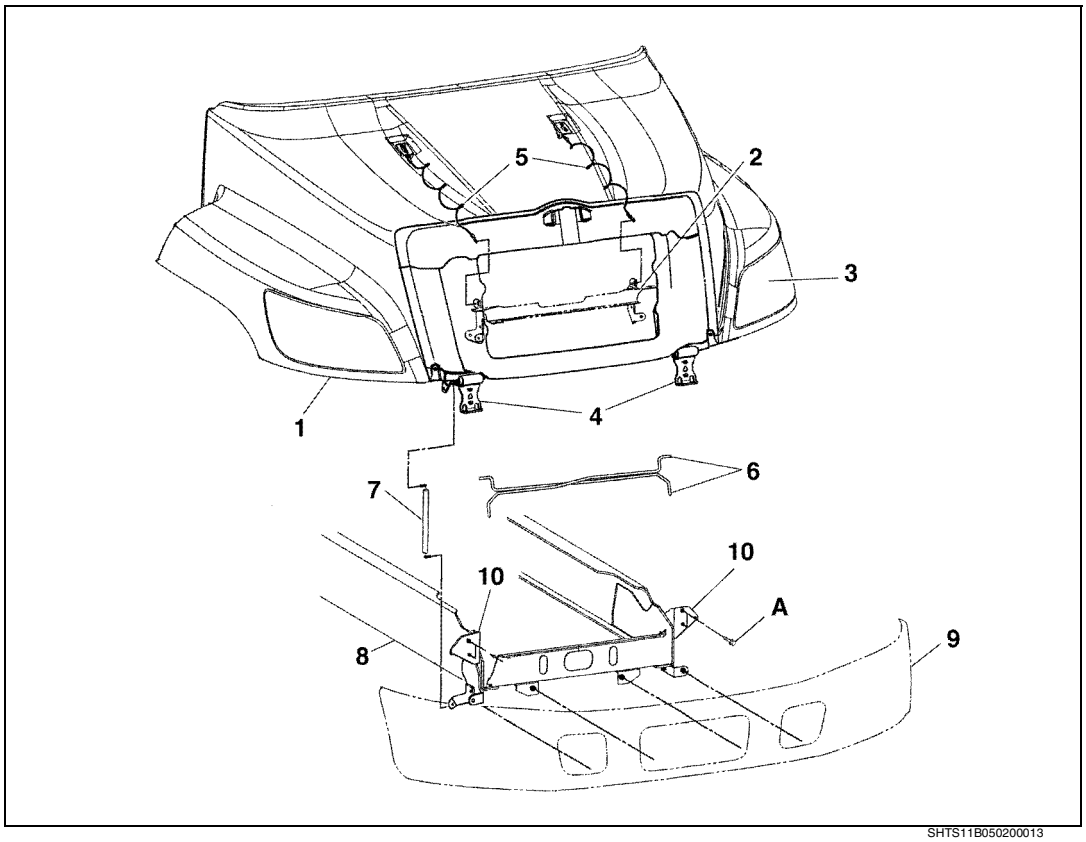
Inspection item	Standard	Limit	Remedy	Inspection procedure
Check the mounting rubber for deformation.	—	—	Replace, if necessary.	Visual check 
Check the cab for damage and crack.	—	—	Repair or Replace, if necessary.	Visual check 

S1-UNAE09A-2.book 8 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

HOOD

COMPONENT LOCATOR

EN11B0502D100001



SHTS11B050200013

1	Hood	6	Torsion bar
2	Radiator	7	Oil damper
3	Head light, Front & Side turn light	8	Chassis frame
4	Hinge	9	Front bumper
5	Stopper wire	10	Hinge sub assembly

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

A	34.5-51.5 {352-526, 25-38}	

S1-UNAE09A-2.book 9 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

OVERHAUL

EN11B0502H200001

1. BEFORE DISMOUNTING THE HOOD

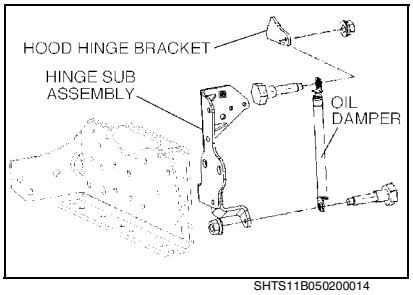
(1) Be sure to block the front wheels.

2. REMOVE BUMPER FROM CHASSIS FRAME

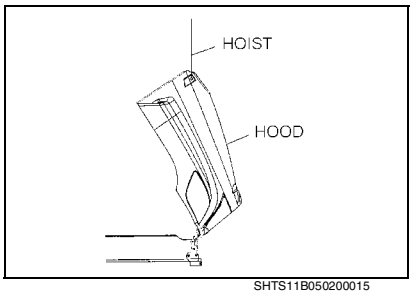
3. TILT HOOD

4. REMOVE OIL DAMPER

(1) While complete opening the hood, remove the upper and lower nuts from the ball joints of the oil damper.



SHTS11B050200014



SHTS11B050200015

5. SUPPORT THE HOOD

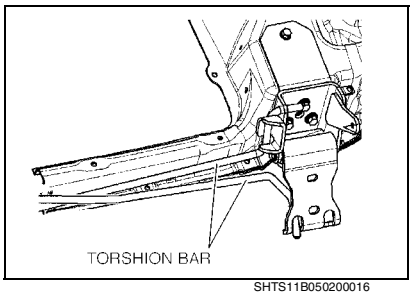
- By supporting the hood using a crane or hoist, adjust the hood tilt angle so that the torsion bar is free.
  Refer to page CA02-11 for illustration.

⚠ WARNING

Never go under the hood without supporting the hood with a crane or hoist otherwise the hood could come down and cause severe personal injury.

⚠ CAUTION

When hoisting the hood, be careful of deformation of the hood.

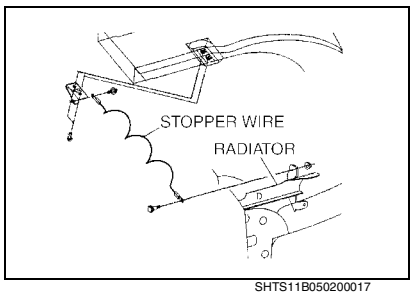


SHTS11B050200016

6. REMOVE TORSION BAR

(1) Remove the two torsion bars.

S1-UNAE09A-2.book 10 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

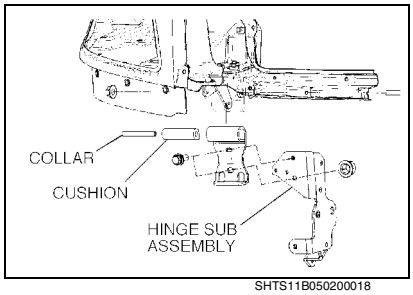


SHTS11B050200017

7. REMOVE STOPPER WIRE

(1) Using a crane or hoist, hold the hood before removing the stopper wire.

(2) Remove the bolts and nuts from the stopper wire.



SHTS11B050200018

8. REMOVE HINGE

(1) Remove the flange bolts and nuts from the hinge sub assembly on the chassis frame.

S1-UNAE09A-2.book 11 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

9. INSTALL HOOD

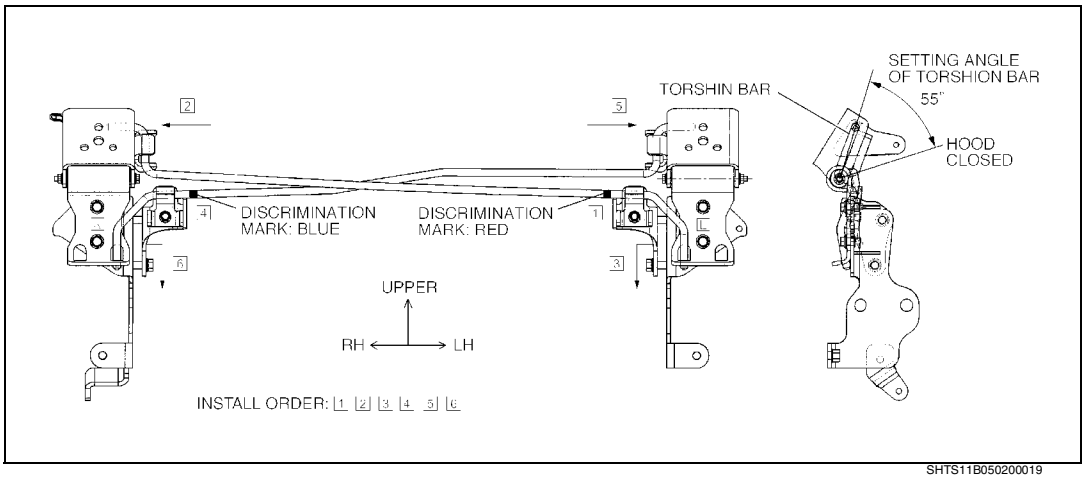
HINT

Installation takes place in the reverse order of the removal. Please pay attention to the following points.

(1) Using a crane or hoist, support the hood.
(2) Match the hole of hinge and hinge sub assembly.
Tighten the flange bolts and nuts.
(3) Install the stopper wire between the hood bracket and the radiator frame.
(4) Install the torsion bar.

NOTICE

Torsion bar should be inserted perfectly to the holes and the clamping brackets.



SHTS11B050200019

(5) Install the oil damper.

S1-UNAE09A-2.book 12 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

FRP REPAIR PROCEDURE

EN11B0502H200002

1. REPAIR MATERIAL

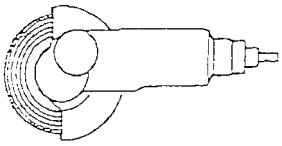
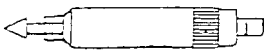
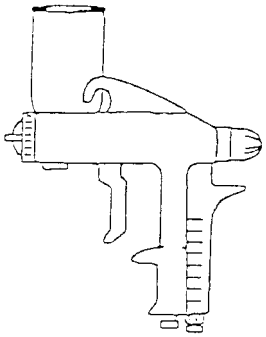
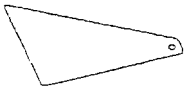
Material	Main composition	Note
a. Polyester resin	Unsaturated polyester	
b. Hardener for polyester	Methyl ethyl ketone	
c. Glass mat	Peroxyacid	
d. Acetone	Acetone	
e. Putty	Unsaturated polyester	
f. Putty hardener	Methyl ethyl ketone Peroxyacid	
g. Compound (rubbed finely)		
h. Waxes (twinkle)		
i. Masking tape		Adhesive tape (18 mm wide)
j. Waste paper		
k. Rag		White knit goods
l. Sandpaper		#240, 360, 800

2. PRECAUTION (except i., j., k., l.)

(1) Keep flames and sparks away from work area as repair materials are highly flammable.
(2) Keep repair materials in a tightly covered container and well ventilated place out of direct sunlight.
(3) Label the container containing the hazardous material.
(4) After the procedure, clean at once your hands, fingers, tools etc. using acetone.
(5) Mix the hardener properly;
Polyester resin: Hardener: 1%—3%
Putty: Hardener: 1%—3%
(6) While preparing repair materials, prevent contamination of mixture by foreign substances, in particular water or metal compounds.
(7) Dispose of solvent and resin wisely in accordance with Environmental and Safety Regulations.

S1-UNAE09A-2.book 13 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

3. MAIN TOOLS

Tool	Form	Use
Hand grinder (or disc sander)		for wide grinding or cutting
Hand router		for V–groove cutting or small grinding
Spray gun		to spray repair paint
Polyethylene vessel		to mix resin and hardener or compound paints (2 pcs)
Scissors (or cutter)	—	for cutting glass mat
Infrared light	—	for heating repair part
Putty knife		for applying putty
Brush	—	for impregnating resin
Rubber gloves	—	anti-solvent type
Patch rubber	—	flatten

S1-UNAE09A-2.book 14 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

4. REPAIR METHOD

(1) Possible Repair Area

a. Resin crack or paint damage can be repaired if area is less than 60mm (2.4 in.) in length.

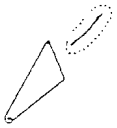
b. A broken edge or cracked corner more than 10mm^2 (0.016in.^{2}) cannot be repaired.

c. In the case where there are many areas to repair, it must be decided whether repair work is required or not.

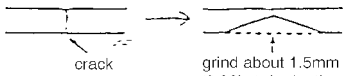
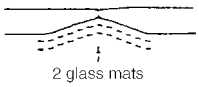
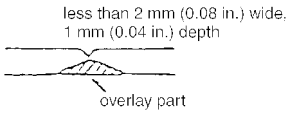
NOTICE

A cracked or broken area on the hood which is located at a major stress point, which requires frequent repairing due to strength (in particular the circumference of hole) and area size, needs to be replaced.

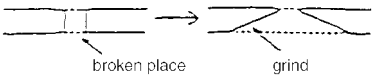
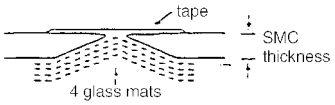
(2) Repair method.

Symptom	Repair method	Note
(1) Scratch or crack on the surface	a) Grind around damage.  • Sandpaper #120-#400 • Grind lightly (Create a small area as possible around the damage)	This purpose is to flatten around the damage and to increase fitting of the putty.
	b) Apply putty Compound the resin and hardener sufficiently.  • Press putty strongly into the crack with putty knife. • Apply putty in grinding area.	Apply putty with small convex.
	c) Dry the putty Using an infrared light, dry the putty to harden perfectly under 80°C (177°F).	In case of incomplete drying, putty peels off while grinding.
	d) Grinding Using sandpaper (#400-#1000), grind lightly on the putty. e) Painting/coating Apply touch-up coat onto a repaired area.	Apply sandpaper to uneven areas.
	f) Finishing Using compound etc. finish up buffing.	

S1-UNAE09A-2.book 15 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

Symptom	Repair method	Note
(1) Scratch or crack on the surface	a) Back side grinding Using a hand grinder or router, grind the back side of the crack.  	Grind area as small as possible
(Overlay on the back side.)	b) Overlay Cut two glass mats larger than grinding area, impregnate perfectly with polyester resin and place it on the repair area without a wrinkle and air bubble.  	Mix hardener perfectly. Clean the repair place using acetone before overlaying.
	c) Dry resin Refer to (1)-c).	In case of improper drying, putty peels off while sanding.
	d) Grinding Grind using hand grinder or router and then sandpaper #120 to #400.	Use patch rubber to flatten repair area.
	e) If there is a pinhole or air bubble, apply methods(1)-b) to -d).	Grind using #400 sandpaper.
	f) V-groove cutting on the front side Using a hand router, cut a V-groove on the front side.  	
	g) Finish on the front side Apply methods (1)-a) to f).	

S1-UNAE09A-2.book 16 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

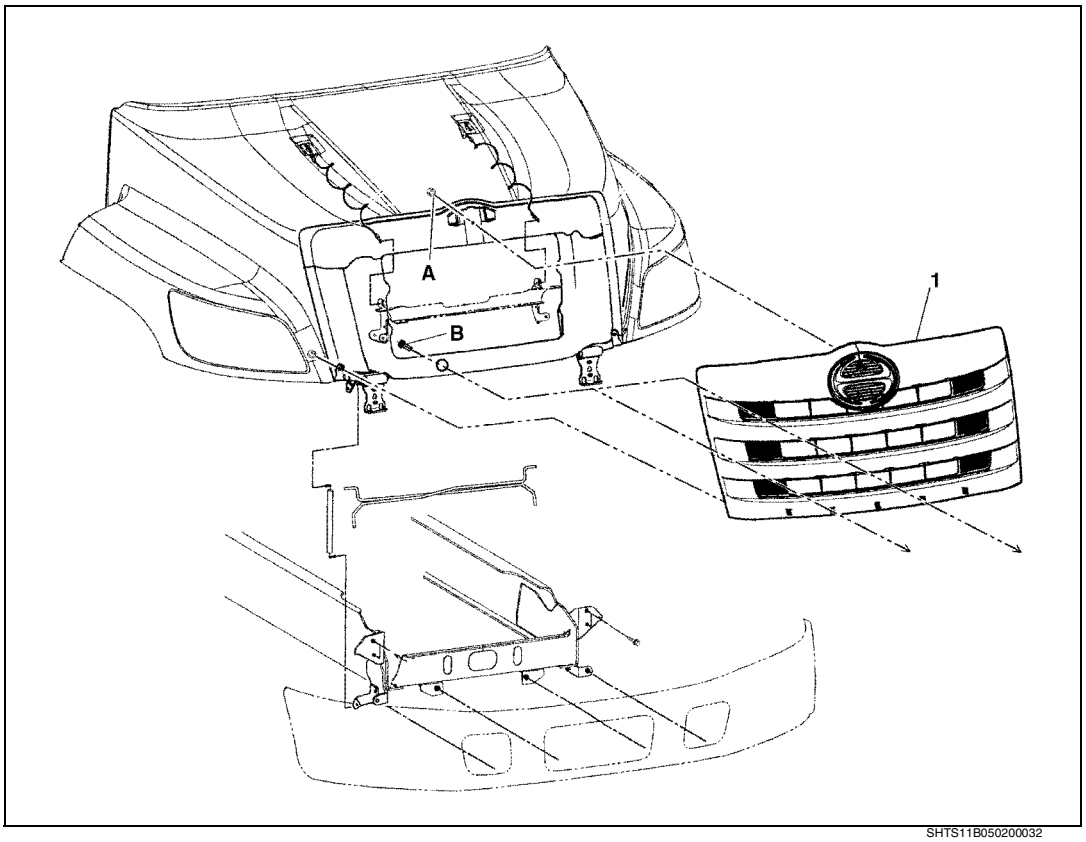
Symptom	Repair method	Note
(3) Broken resin (Overlay from back side.)	a) Grind back side Grind back side using hand grinder or router.  	
	b) Overlay Refer to (2)-b) but use 4 sheets of glass mats. Apply masking tape in order that resin does not flow to front surface while overlaying.  	
	c) Apply methods (2)-c) to -d).	
	d) Apply methods (1)-a) to -f).	

CA02_001_Mokuji kai.fm 17 ページ ２０１１年１０月３１日 月曜日 午前１１時５５分

RADIATOR GRILLE

COMPONENT LOCATOR

EN11B0502D100002



SHTS11B050200032

1 Radiator grille	

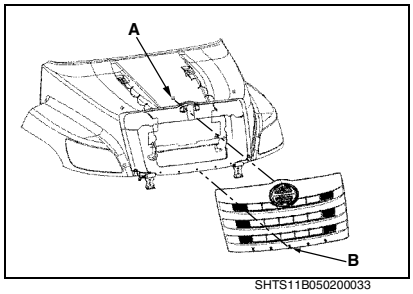
Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A 5.5-7.0 {56-71, 4.1-5.2}	B 5.5-7.0 {56-71, 4.1-5.2}

CA02_001_Mokuji kai.fm 18 ページ ２０１１年１０月３１日 月曜日 午前１１時５５分

OVERHAUL

EN11B0502H200003



SHTS11B050200033

1. REMOVE RADIATOR GRILLE

(1) After loosening the nuts (11 locations) and the bolts (2 locations) from behind the radiator grille paying attention not to impact on them, remove the resin clips (3 locations) and remove it from the radiator grille hood.

2. INSTALL RADIATOR GRILLE

(1) Replace the dry lock fixing bolts and resin clips with new ones.

(2) Fasten the clip at (B) the center lower and nut at (A) the center upper , and then fasten other bolts, nuts and clips.

HINT

Thread lock cures about 24 hours after fastening.

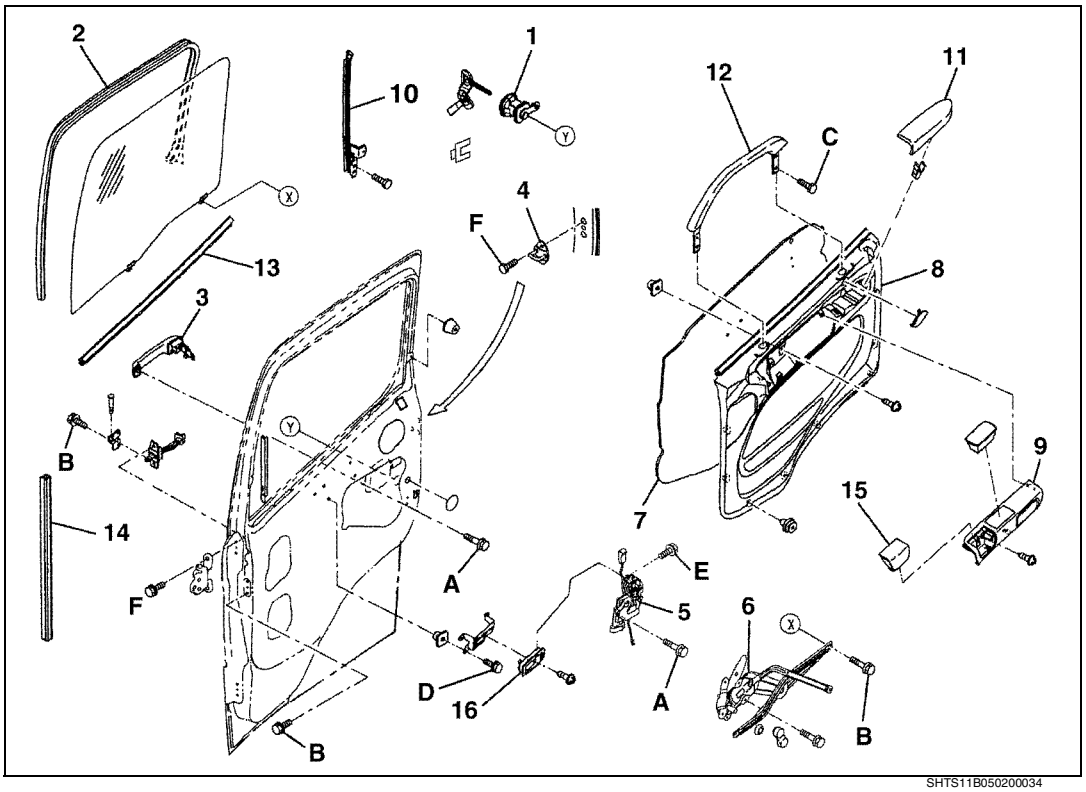
Tightening Torque:
5.5-7.0N·m {56-71kgf·cm, 4.1-5.2lbf·ft}

S1-UNAE09A-2.book 19 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

DOOR

COMPONENT LOCATOR

EN11B0502D100003



SHTS11B050200034

1	Lock cylinder	9	Inside upper trim
2	Weather strip	10	Door frame
3	Outside handle	11	Armrest
4	Striker	12	Door assist grip
5	Door lock	13	Outer oscillate-proof
6	Regulator	14	Glass run weather strip
7	Inside hole cover	15	Ashtray (driver side only)
8	Inside trim	16	Inside handle

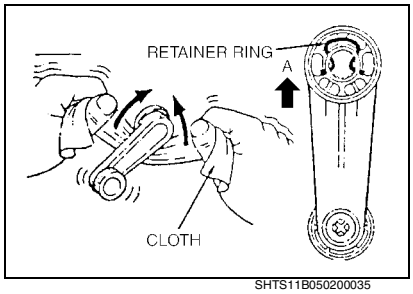
Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	4.4-6.6 {45-67, 3.3-4.8}	D	2.0-3.0 {20-30, 1.5-2.1}
B	7.2-10.8 {74-110, 5.4-7.9}	E	7.2-10.8 {74-110, 5.4-7.9}
C	10.8-20.2 {110-206, 8.0-14.8}	F	18-26 {184-264, 13.3-19.0}

S1-UNAE09A-2.book 20 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

OVERHAUL

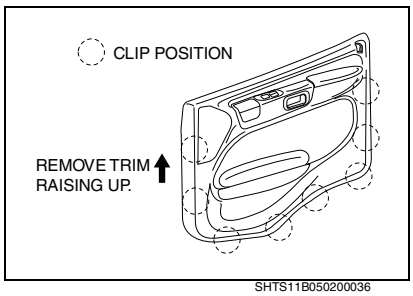
EN11B0502H200004



SHTS11B050200035

1. REMOVE REGULATOR HANDLE. (Without power window)

(1) Use a piece of cloth to catch the two ends of the retainer ring and pull the cloth back and forth as shown, to remove the ring.

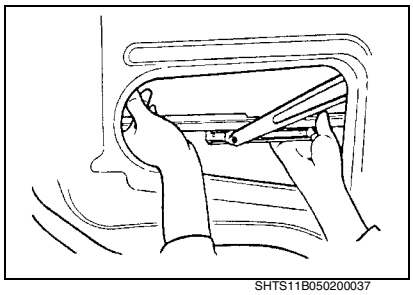


SHTS11B050200036

2. REMOVE INSIDE TRIM.

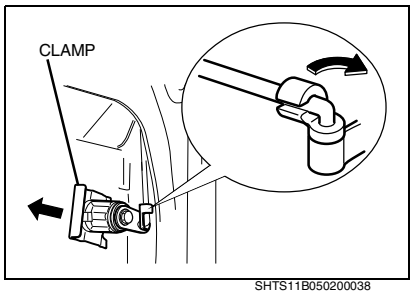
(1) Remove the parts listed below.
(Refer to the DOOR COMPONENT LOCATOR)
   a. Ashtray
   b. Armrest
   c. Inside upper trim
   d. Inside handle
   e. Door assist grip

(2) Pull off the inside trim.


SHTS11B050200037

3. REMOVE WINDOW.

(1) Disconnect regulator from window channel.

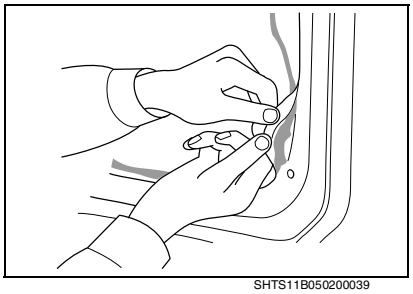


SHTS11B050200038

4. REMOVE DOOR LOCK.

(1) Disconnect the lock cylinder from the door lock.
(2) Remove the lock cylinder.
(3) Remove the door lock with rods.

S1-UNAE09A-2.book 21 ページ ２０１１年１０月２７日 木曜日 午後５時２１分


SHTS11B050200039

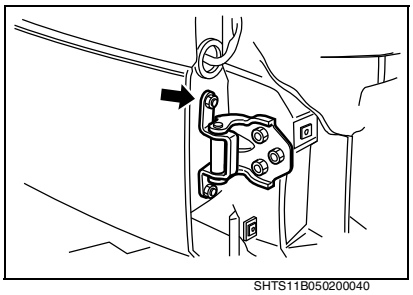
5. SERVICE HOLE COVER AND REGULATOR INSTALLING

(1) Stick butyl rubber tape along lower tangent line of the drain hole of the door.

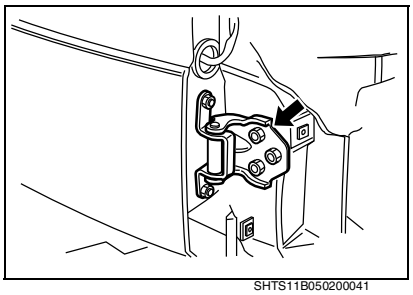
(2) Insert the regulator handle with retainer ring into the regulator.

6. DOOR HINGE ADJUSTMENT

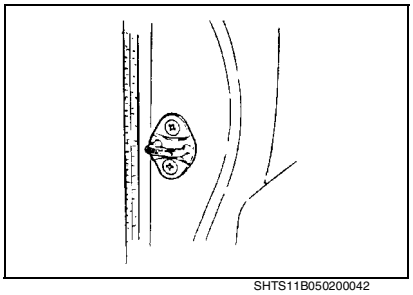
(1) Tilt the hood.


SHTS11B050200040

(2) Make vertical and horizontal adjustments by loosening the hinge bolts on the door.


SHTS11B050200041

(3) Make depth adjustments by loosening the hinge bolts on the body.


SHTS11B050200042

7. STRIKER ADJUSTMENT

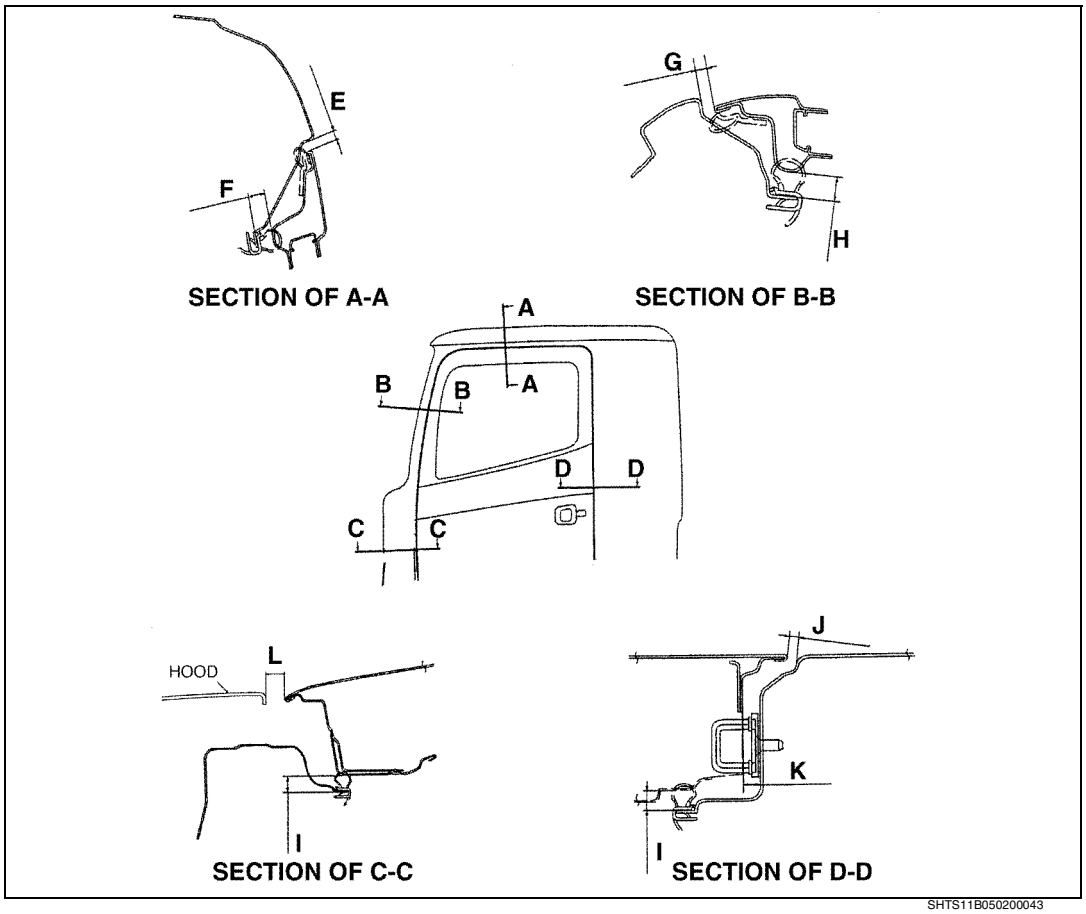
(1) Check the engagement between the door lock and the striker. Make the top and bottom contact even.

(2) Perform adjustment so that the outside of the door and the outside of the rear quarter panel are flush with each other. After adjustment, properly tighten the bolts.

NOTICE

When adjusting the door in the vertical direction, do not force into alignment by using the door lock striker.

S1-UNAE09A-2.book 22 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



SHTS11B050200043

CLEARANCES BETWEEN BODY AND DOOR **Unit: mm {in.}**

E	**5.8-8.8 {0.23-0.35}**	**I**	**14.6-18.6 {0.57-0.73}**
F	**12.5-16.5 {0.50-0.64}**	**J**	**5.8-8.8 {0.23-0.35}**
G	**5.0-9.0 {0.20-0.35}**	**K**	**11.8-15.8 {0.46-0.62}**
H	**12.5-16.5 {0.50-0.64}**	**L**	**17.3-23.3 {0.68-0.92}**

S1-UNAE09A-2.book 23 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

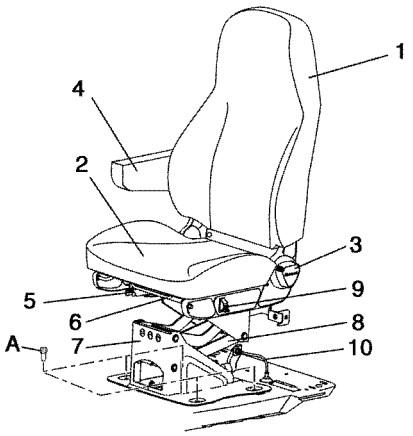
SEAT

COMPONENT LOCATOR

EN11B0502D100004

DRIVER'S SEAT

SUSPENSION TYPE (AIR SUSPENSION)



SHTS11B050200044

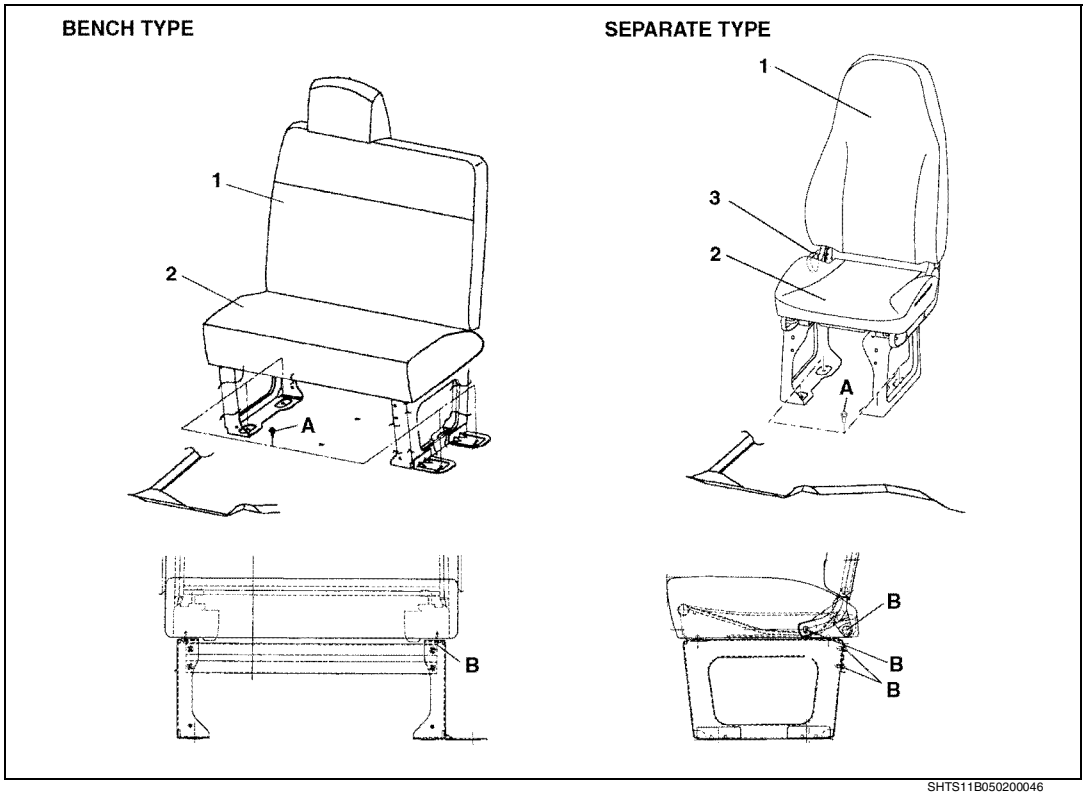
1	Seat back	6	Cushion adjuster
2	Seat cushion	7	Seat leg
3	Reclining knob	8	Seat suspension
4	Arm rest	9	Height adjuster switch
5	Seat adjuster	10	Air tube

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

A 17.5-32.5 {179-331, 13-23}	

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ASSISTANT'S SEAT



SHTS11B050200046

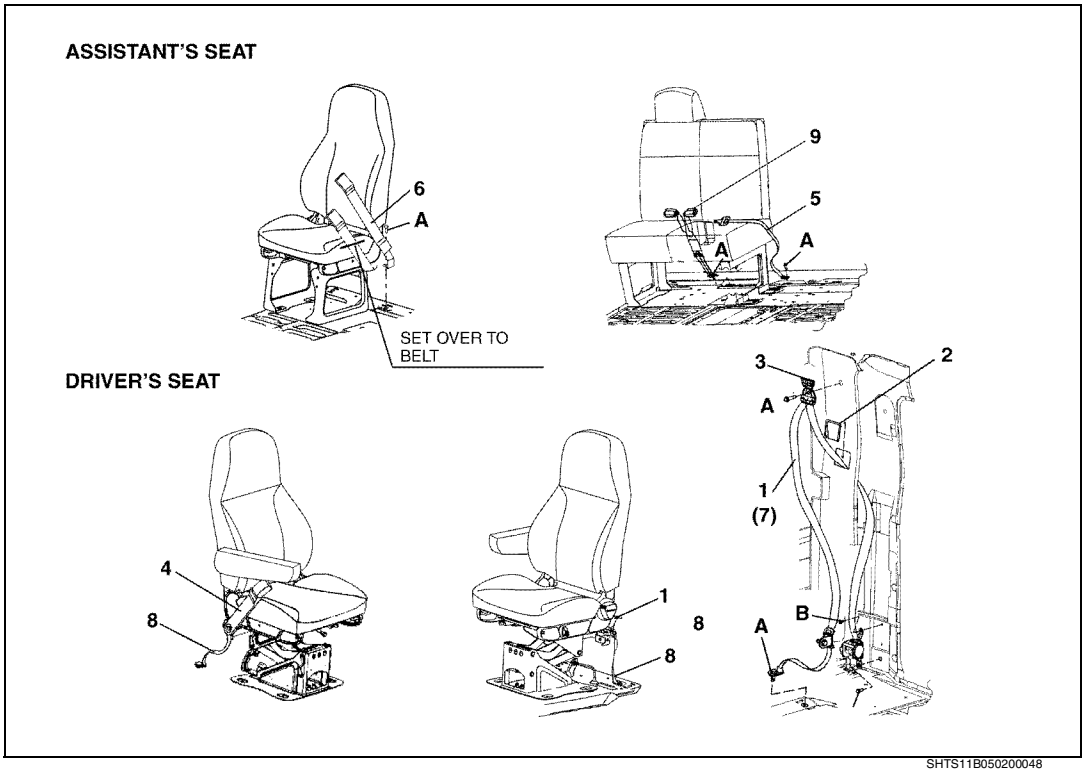
1	Seat back	3	Reclining knob
2	Seat cushion		

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

A	17.5-32.5 {179-331, 13-23}	B	29.4-44.1 {300-450, 22-32.5}

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SEAT BELT



SHTS11B050200048

1	Outer seat belt (Driver's seat)	6	Inner seat belt (Assistant's seat)
2	Seat belt guide	7	Outer seat belt (Assistant's seat)
3	Seat belt cover	8	Tether belt (Driver's seat)
4	Inner seat belt (Driver's seat)	9	Inner seat belt (Assistant's seat and center seat)
5	Lap type seat belt (Center seat)		

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

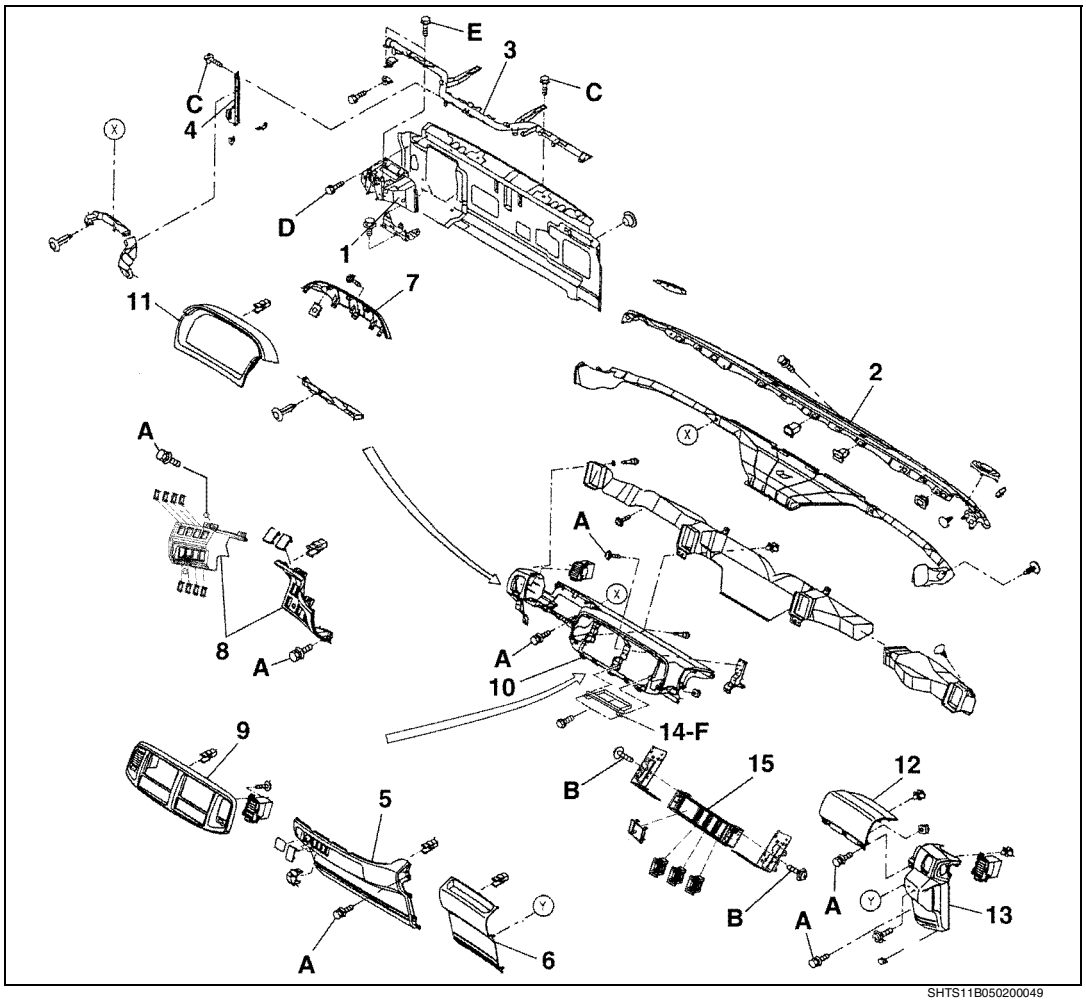
A	29-55 {296-560, 22-40}	B	4.5-10.5 {46-107, 3-8}

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INSTRUMENT PANEL

COMPONENT LOCATOR

EN11B0502D100005



SHTS11B050200049

1	Pedal bracket support	9	Cluster finish panel
2	Upper panel	10	Cluster housing
3	Instrument panel cross member	11	Cluster bezel
4	Gusset	12	Upper right cover
5	Lower center cover	13	Side cover
6	Lower right cover	14	Cup holder (If so equipped)
7	Panel upper cover	15	Switch base
8	Switch board panel		

S1-UNAE09A-2.book 27 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

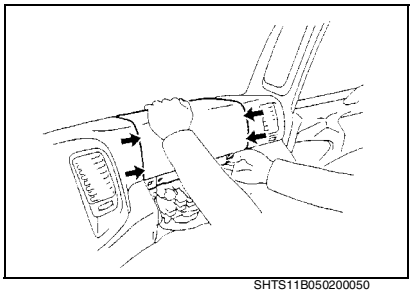
Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	**2.8-3.2 {29-32, 2.1-2.3}**	**D**	**11.5-20.5 {117-209, 8.5-15.1}**
B	**1.5-2.5 {16-25, 1.2-1.8}**	**E**	**12-22 {122-224, 8.8-16.2}**
C	**7.5-16.5 {77-168, 5.6-12.1}**	**F**	**2.8-3.2 {29-32, 2.1-2.3}**

DISMOUNTING AND MOUNTING

EN11B0502H100003

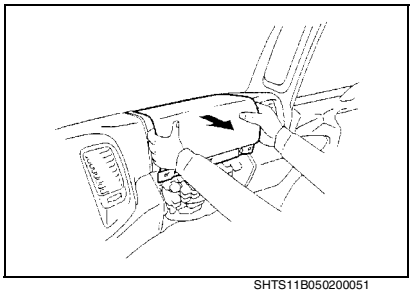
1. BEFORE REMOVING THE INSTRUMENT PANEL.
(1) Disconnect the battery cable from the battery ground terminal.



SHTS11B050200050

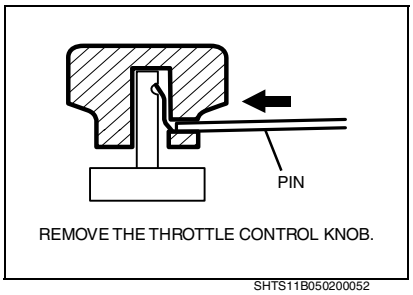
2. REMOVE THE UPPER RIGHT COVER.
(1) Remove the lower bolt on the upper right cover.
(2) Pull the upper right cover toward you, remove the 4 clips of this side.

⚠ CAUTION
- **When pulling the upper right cover, be careful not to damage the clips.**
- **Be sure to remove the 4 clips of this side beforehand because pulling out the upper right cover at one time may damage it.**



SHTS11B050200051

(3) Pull the upper right cover straight with both hands to remove the inner clip and remove the upper right cover.



REMOVE THE THROTTLE CONTROL KNOB.

SHTS11B050200052

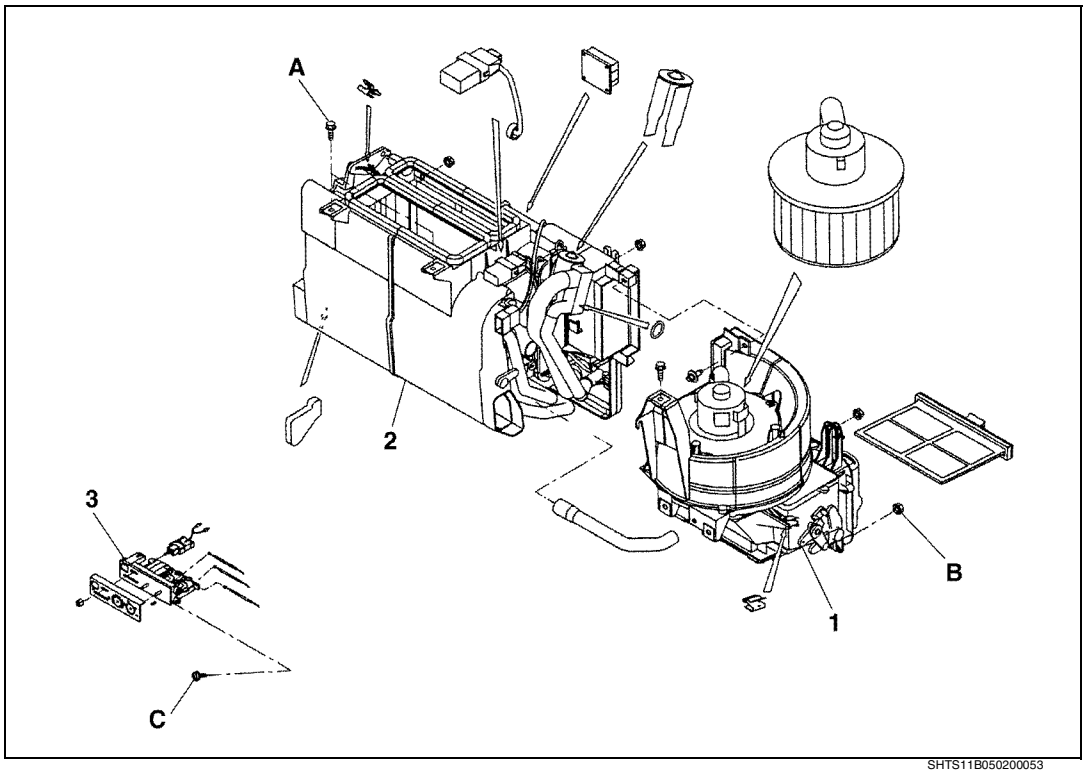
3. REMOVE THE SWITCH BOARD PANEL.
(1) Remove the throttle control knob.
(2) Remove the bolt and pull out the switch board panel.

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HEATER AND AIR CONDITIONER

COMPONENT LOCATOR

EN11B0502D100006



SHTS11B050200053

1	Blower assembly	3	Control panel assembly
2	Air conditioner assembly		

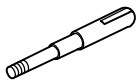
Tightening torque **Unit: N·m {kgf·cm, lbf·ft}**

A	3.9-4.9 {40-50, 2.9-3.6}	C	1.4-2.4 {14-24, 1.0-1.7}
B	3.9-4.9 {40-50, 2.9-3.6}		

SPECIAL TOOL

EN11B0502K100001

Prior to starting a steering linkage overhaul, it is necessary to have these special tools.

Illustration	Part number	Tool name	Remarks
	S0944-41210	COMPRESSION GAUGE	

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AIR CONDITIONING SYSTEM

SPECIFICATION DATA

EN11B0502H100004

Refrigerant	**HFC 134a**
Oil for air conditioning compressor.	**ND-OIL 8**

PRECAUTIONS REGARDING REFRIGERANT (HFC134a)

EN11B0502H300001

1. COMPATIBILITY

The HFC134a system and R12 system do not have compatible cooling cycle components, compressor oil, and other parts.

2. ABOUT THE NEW REFRIGERANT (HFC134a)

(1) Always use HFC134a. If the wrong refrigerant gas is used, the air conditioner compressor may lock up due to poor lubrication.

3. ABOUT THE COMPRESSOR OIL

(1) Always use compressor oil for HFC134a (ND-OIL8). If compressor oil for R12 is used in a compressor for HFC134a, the service life of the compressor will be severely shortened due to poor lubrication.

Reference
Compressor oil for HFC134a: ND-OIL8
Compressor oil for R12: ND-OIL6

(2) Compressor oil for HFC134a (ND-OIL8) has high moisture-absorbing characteristics. When disassembling the air conditioner, therefore, immediately plug openings with a plug or vinyl tape to keep outside air away from the oil.

(3) Compressor oil for HFC134a (ND-OIL8) has an adverse effect on acrylic and ABS resins. When replenishing the compressor oil, therefore, do not allow the oil to splatter.

(4) Do not allow compressor oil for HFC134a (ND-OIL8) to stick to painted surfaces, for it may cause the paint to peel.

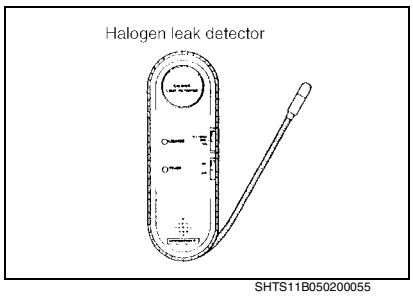
4. ABOUT THE O-RINGS

(1) O-rings for HFC134a and O-rings for R12 have different materials, gauges, and other characteristics, so using the wrong O-ring may result in a gas leak. Always use an O-ring for HFC134a.

5. PRECAUTIONS FOR EVACUATING AIR

(1) When a vacuum pump for R12 is used to evacuate air and it is left on after the vacuum has been formed, the pump oil (for R12) may flow back into the HFC134a system. Always use an adapter equipped with a solenoid valve.

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6. CHECKING FOR REFRIGERANT GAS LEAKS

(1) The conventional halide torch type leak tester uses a reaction with chlorine to detect a refrigerant leak. It cannot be used to detect an HFC134a gas leak, therefore, not only because HFC134a contains no chlorine but also because the tester breaks down the sucked-in HFC134a and produces a toxic substance. Also, a conventional electric gas leak tester may not be sensitive enough to detect an HFC134a gas leak because HFC134a gas has smaller molecules than R12 gas. A halogen leak detector must therefore be used to detect an HFC134a gas leak.

(2) Detecting a refrigerant gas leak with the engine running is difficult because a gas leak would be diluted by air from the fan, blower, and other sources. Be sure to set the starter switch to the LOCK position when checking for a refrigerant gas leak.

PRECAUTIONS FOR REPLENISHING THE REFRIGERANT GAS

EN11B0502H500001

1. WHAT TO DO IF REFRIGERANT GAS GETS IN YOUR EYES

(1) Do not rub your eyes with your hands or a handkerchief.

(2) Immediately wash your eyes with clean water for at least 15 minutes and then see an eye specialist as soon as possible.

2. PRECAUTIONS FOR HANDLING REFRIGERANT GAS (SERVICE CAN)

(1) Do not apply heat directly to the can or immerse it in hot water, for this will cause the pressure inside the can to rise and burst the can. If the can must be warmed up, use running water that is no hotter than 40°C.

(2) Do not drop or impart shock to the service can.

(3) Do not open the valve on the high-pressure side of the gauge manifold while the engine is running, because it may cause high-pressure gas to flow back into the service can and burst the can.

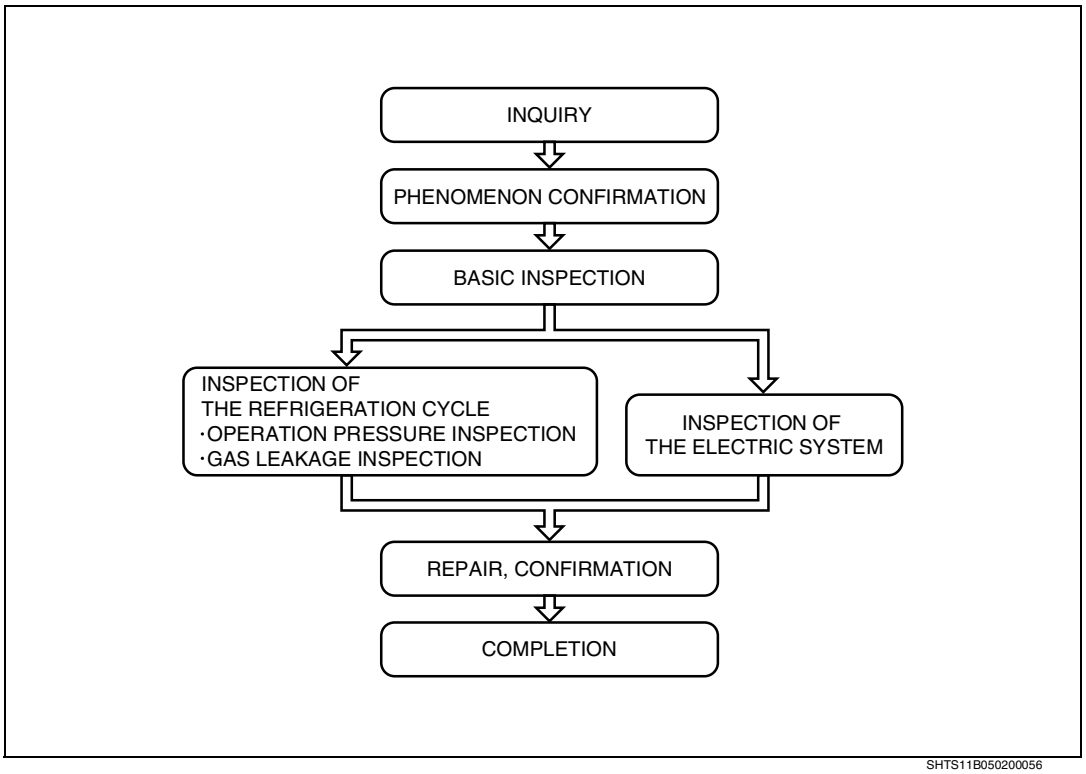
(4) Do not hold the service can close to your face while handling it. Always wear safety goggles when working with the refrigerant gas.

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TROUBLESHOOTING (FAULT DIAGNOSIS BY SYMPTOMS)

EN11B0502F300002

FAULT DIAGNOSIS PROCEDURE



SHTS11B050200056

The diagram shows the basic procedure for fault diagnosis.

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BASIC INSPECTION

Symptom	Possible cause	Remedy/Prevention
Abnormal noise from around the compressor	Loosened mounting bolts of compressor or bracket	Retighten
	Broken discharge or suction valve Loosening of the connecting rod	Contact DENSO Service station for compressor repair or replacement.
	Insufficient compressor oil	Contact DENSO Service station and request oil quantity inspection and refilling.
Oil leakage at connection parts or tightening parts of the refrigeration cycle.	Gas leakage	Retighten. Replace the related parts.
Abnormal noise from around the blower	Foreign objects caught in the blower Insufficient blower tightening	Repair or replace the blower motor.
Many air bubbles in the sight glass	Insufficient refrigerant filling quantity	Contact DENSO Service station for refrigerant filling to a suitable quantity.
No air bubbles visible in the sight glass and suction and discharge pressure both high	Excessive refrigerant filling	Contact DENSO Service station for refrigerant bleeding to a suitable quantity (discharge into the atmosphere is prohibited).
Insufficient V-belt tension	—	V-belt retightening. If the V-belt has been worn thin, replace it by a new one.
Condenser fins covered by mud or dust	—	Wash off any mud or dust covering the condenser fins.
Clogged air filter	—	Clean the air filter.
The control mechanism does not operate smoothly and accurately.	—	Operate the levers and switches of the control panel and replace in case of abnormalities. Also inspect fuses and relays as required and replace them in case of abnormalities.

COMPRESSOR-RELATED

ABNORMALLY HIGH DISCHARGE PRESSURE

Symptom	Possible cause	Remedy/Prevention
Even when the condenser is cooled with water, no air bubbles can be seen in the sight glass.	Excessive refrigerant filling	Contact DENSO Service station for refrigerant bleeding to a suitable quantity (discharge into the atmosphere is prohibited).
The pressure on the high-pressure side is abnormally high and immediately after the compressor is stopped, the pressure rapidly drops to approximately 2 kg/cm^2.	Air has entered into the refrigeration cycle.	Contact DENSO Service station for refrigerant bleeding to a suitable quantity (discharge into the atmosphere is prohibited), and refill refrigerant after sufficient vacuum drawing in the refrigeration cycle.

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ABNORMALLY HIGH SUCTION PRESSURE

Symptom	Possible cause	Remedy/Prevention
Abnormally cold around low-pressure hose and service valve on the low-pressure side	Excessive opening of the expansion valve	Contact DENSO Service station and request repair or replacement of the expansion valve.
The pressure on the high-pressure side is high, but when the condenser is cooled, the suction pressure drops.	Excessive refrigerant filling	Contact DENSO Service station for refrigerant bleeding (discharge into the atmosphere is prohibited).
When the compressor is stopped, the pressure immediately becomes the same on high-pressure side and low-pressure side.	Gasket breakage, high-pressure valve breakage, or entry of foreign matter	Contact DENSO Service station for gasket replacement, high-pressure valve replacement, or removal of foreign matter.

ABNORMALLY LOW DISCHARGE PRESSURE

Symptom	Possible cause	Remedy/Prevention
No dew becomes attached to the outlet of the expansion valve and the pressure on the low-pressure side is a negative pressure.	Expansion valve freezing or defective expansion valve	Contact DENSO Service station and request replacement of the expansion valve.
Many air bubbles pass through the sight glass and the condenser is not hot.	Too little refrigerant.	Contact DENSO Service station for refrigerant filling to a suitable quantity.
When the compressor is stopped, the pressure immediately becomes the same on high-pressure side and low-pressure side.	Breakage of compressor discharge valve and/or suction valve, catching of foreign matter	Contact DENSO Service station for compressor repair or replacement.

ABNORMALLY LOW SUCTION PRESSURE

Symptom	Possible cause	Remedy/Prevention
Many air bubbles can be seen in the sight glass and the condenser is not hot.	Insufficient refrigerant filling	Contact DENSO Service station for refrigerant filling to a suitable quantity.
No dew becomes attached to the outlet of the expansion valve and the low-pressure piping is not cold.	Expansion valve freezing or defective expansion valve	Contact DENSO Service station and request replacement of the expansion valve.
Low temperature of the discharge port, no air is blown out.	There is frost on the evaporator.	Contact DENSO Service station for thermistor replacement and position confirmation.
There is frost on the expansion valve.	The expansion valve tends to become clogged.	Contact DENSO Service station for cleaning (moisture removal) or replacement.
There is a temperature difference around receiver and drier, and in extreme cases, there is frost on the piping after the receiver strainer.	Clogging of receiver and drier	Contact DENSO Service station for desiccant in the modulator and for replacement of receiver and drier.

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DISCHARGE PRESSURE AND SUCTION PRESSURE BOTH HIGH

Symptom	Possible cause	Remedy/Prevention
Much dust on the condenser fins	Insufficient condenser cooling	Wash off the dust to improve air passage.
No air bubbles pass through the sight glass	Excessive refrigerant filling	Contact DENSO Service station for refrigerant bleeding to a suitable quantity (discharge into the atmosphere is prohibited).
The surroundings of the service valve are cold compared to the evaporator.	Clogging in the equipment and/or piping on the low-pressure side.	Contact DENSO Service station for repair or replacement.
The temperature at the expansion valve inlet is low in comparison with the temperature around receiver and drier.	Clogging in the piping on the high-pressure side.	Contact DENSO Service station for compressor repair or replacement.

GAS LEAKAGE

Symptom	Possible cause	Remedy/Prevention
Notable dirt on the shaft seal part and decreasing gas	Gas leakage from the shaft seal	Contact DENSO Service station for shaft seal replacement.
Oil contamination on the bolt part	Gas leakage from the respective tightening bolt part	Retighten
Oil contamination on the gasket part	Gas leakage from each gasket part	Contact DENSO Service station for gasket replacement.
Leakage from broken parts	Gas leakage from broken parts	Contact DENSO Service station for replacement of the broken parts.

NO ADSORPTION

Symptom	Possible cause	Remedy/Prevention
The wiring relation is correct.	Coil wire break	Contact DENSO Service station for replacement of the coil with a wire break.
No adsorption even with cooler switch ON	Wire break, wrong wiring, defective contact of wiring-related parts (ground, fuse)	Inspect the harness connectors and repair or replace in case of abnormalities.
	Defective contact or operation of switches (thermostat, relay, cooler switch)	Inspect the switch-related parts and repair or replace in case of abnormalities.
Simultaneously with switch ON, the rotor moves and there is adsorption when it is pushed.	Too large gap between rotor and stator	Contact DENSO Service station for repair or compressor replacement.

SLIPPING OCCURS

Symptom	Possible cause	Remedy/Prevention
The clutch slips at the time of rotation.	Drop of the battery voltage	Charge the battery.
	Clutch surface contaminated with oil	Contact DENSO Service station for oil removal.
	Coil layer short-circuit	Contact DENSO Service station for replacement of the coil with a wire break.

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RELATED TO THE EXPANSION VALVE

THE VALVE OUTLET IS NOT COLD

Symptom	Possible cause	Remedy/Prevention
No temperature difference can be felt between inlet and outlet.	Extremely little refrigerant in the refrigeration cycle.	Check for gas leakage and repair if there is leakage. After repair fill in the correct quantity of refrigerant.
No temperature difference can be felt between inlet and outlet.	Excessive opening of the expansion valve	Contact DENSO Service station and request replacement of the expansion valve.

THE VALVE INLET IS COLD AND THERE IS DEW ON IT

Symptom	Possible cause	Remedy/Prevention
Frost is formed.	Excessively closed expansion valve	Contact DENSO Service station and request adjustment or replacement of the expansion valve.
	A tendency for clogging in the expansion valve	Contact DENSO Service station for replacement of the desiccant in expansion valve and modulator and for replacement of receiver and drier.

ABNORMAL NOISE DURING OPERATION

Abnormal noise can occur with various operation conditions. Accordingly, careful inspection must be performed under sufficient consideration of the contents of the inquiry.

- Does the abnormal noise occur with the air conditioner OFF?
- Does the abnormal noise occur with the air conditioner ON?
- Does the noise occur sometimes, continuously, or directly after air conditioner ON?

WHEN THE AIR CONDITIONER IS ON

Symptom	Possible cause	Remedy/Prevention
Abnormal noise occurring when the refrigerant is discharged from the compressor	Caused by refrigerant compression fluctuations	Contact DENSO Service station to have the refrigerant filling quantity reduced to the specified minimum value (discharge into the atmosphere is prohibited).
Abnormal noise from the compressor	Defective compressor	Contact DENSO Service station for compressor repair or replacement.

DIRECTLY AFTER THE AIR CONDITIONER IS SWITCHED ON

Symptom	Possible cause	Remedy/Prevention
Abnormal noise occurring when the compressor is started with liquid refrigerant remaining on the inside	Accumulation of liquid refrigerant caused by liquid compression	Contact DENSO Service station to have the refrigerant filling quantity reduced to the specified minimum value (discharge into the atmosphere is prohibited).
Abnormal metallic noise when the magnet clutch disengages and engages	Caused by disengaging and engaging of the magnet clutch	Contact DENSO Service station for setting the attraction gap of the magnet clutch to the lower limit value.

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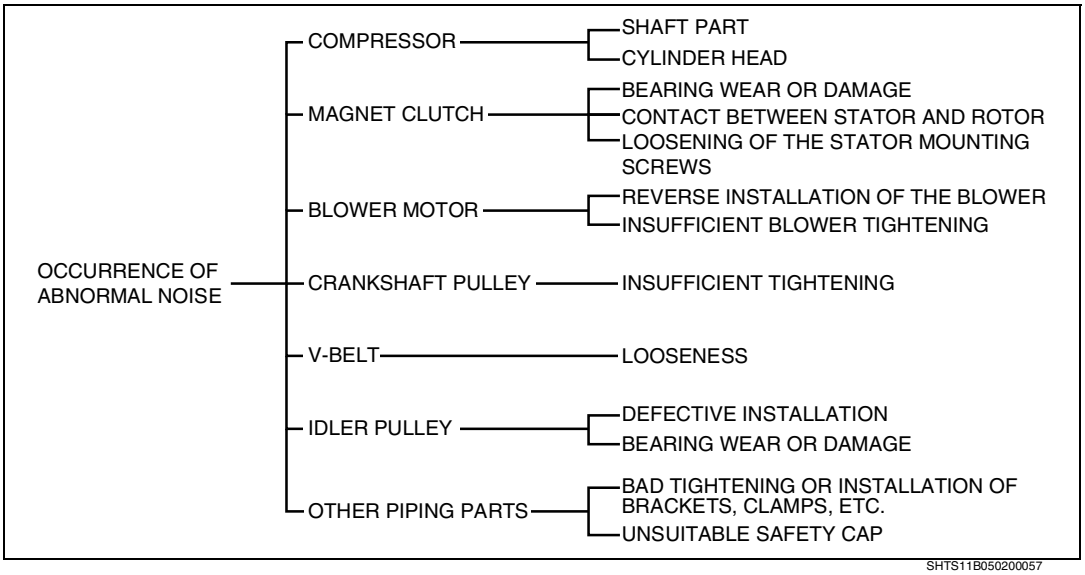
FROM TIME TO TIME AFTER THE AIR CONDITIONER IS SWITCHED ON

Symptom	Possible cause	Remedy/Prevention
An abnormal knocking noise when the clutch pulley deflection is transmitted via the shaft to the inside of the compressor	Weak belt tension	Adjust the belt tension to the standard upper limit value. Contact DENSO Service station for setting the attraction gap of the magnet clutch to the lower limit value.
Abnormal noise caused by refrigerant passing through expansion valve and magnet valve	Noise caused by passage of refrigerant through the expansion valve	Confirm that the refrigerant quantity is the specified filling quantity, and if this is not the case, recover or refill as required.

ONLY WHEN THE AIR CONDITIONER SWITCH IS ON

Symptom	Possible cause	Remedy/Prevention
Abnormal noise from the compressor	Defective compressor	Contact DENSO Service station for compressor repair or replacement.

ABNORMAL NOISE BY PARTS



SHTS11B050200057

ABNORMAL NOISE FROM THE COMPRESSOR

Symptom	Possible cause	Remedy/Prevention
A knocking noise from inside the compressor	Foreign matter caught in discharge valve or suction valve	Contact DENSO Service station for disassembly of the compressor and removal of the foreign matter.
	Broken discharge valve or suction valve	Contact DENSO Service station for replacement of the discharge valve or the suction valve.

ABNORMAL NOISE FROM THE MAGNET CLUTCH

Symptom	Possible cause	Remedy/Prevention
A rattling noise from the magnetic clutch while it is not operating	Bearing wear or breakage	Contact DENSO Service station for bearing replacement.

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ABNORMAL NOISE FROM THE PIPING

Symptom	Possible cause	Remedy/Prevention
The piping is vibrating.	The piping is not fixed.	Fix the piping.

ABNORMAL NOISE FROM THE BRACKET

Symptom	Possible cause	Remedy/Prevention
The bracket has play when touched and causes noise during operation.	The bracket is cracked or broken.	Replace the bracket.
	Loose fixing bolts	Retighten

ABNORMAL NOISE FROM THE IDLER PULLEY

Symptom	Possible cause	Remedy/Prevention
Abnormal rattling noise	Broken bearing	Replace the bearing.
Shows play when touched	Cracked or loose bracket	Replace or retighten the bracket.

ABNORMAL NOISE FROM THE CRANKSHAFT PULLEY

Symptom	Possible cause	Remedy/Prevention
Rattling	Defective installation of the crankshaft pulley	Install the crankshaft pulley correctly.
	Broken bearing	Replace the bearing.
	Defective key groove	Replace the crankshaft pulley.

ABNORMAL NOISE FROM THE V-BELT

Symptom	Possible cause	Remedy/Prevention
Large deflection of the V-belt	Loose V-belt	Retighten the V-belt.
Cut side of the V-belt	The pulley is off-center.	Center the pulley.

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INSPECTION OF THE REFRIGERATION CYCLE

INSPECTION WITH A GAUGE MANIFOLD

NORMAL VALUE
- HIGH-PRESSURE SIDE: 1.37 - 1.57 MPa {14 - 16 kgf/cm^2, 200 - 227 lbf/in^2}
- LOW-PRESSURE SIDE: 0.15 - 0.25 MPa {1.5 - 2.5 kgf/cm^2, 22 - 351 lbf/in^2}

CONDITIONS

• DOORS	: FULLY OPEN
• INSIDE/OUTSIDE AIR SWITCHING	: INSIDE AIR
• ENGINE SPEED	: 1500 rpm
• SUCTION PORT TEMPERATURE	: 30 - 35℃ {86.0 - 95.0℉}
• BLOWER SPEED	: HI
• TEMPERATURE CONTROL	: COLDEST

SHTS11B050200058

BAD COOLING

Symptom	Possible cause	Remedy/Prevention
No air bubbles occur in the sight glass.	Excessive refrigerant filling, insufficient condenser cooling	Adjust to a suitable refrigerant filling quantity (discharge into the atmosphere is prohibited). Check the condenser fins for clogging, inspect the vehicle cooling system, and clean or repair in case of abnormalities.
Air bubbles occur in the sight glass.	Insufficient refrigerant filling	Contact DENSO Service station for repair in case of gas leakages and for refrigerant filling to a suitable quantity.
Insufficient air flow	Frosted evaporator	Contact DENSO Service station for inspection of evaporator and thermistor. Repair or replace in case of abnormalities.
Bad cooling	Insufficient evaporator heat exchange, defective operation of the electric fan	Remove any clogging of the evaporator fins. Inspect the electric fan and replace it in case of abnormalities.

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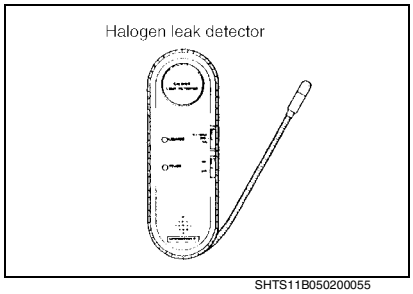
OTHER PHENOMENA

Symptom	Possible cause	Remedy/Prevention
The low-pressure piping does not cool, there are always bubbles in the sight glass.	Entry of air into the refrigeration cycle	Contact DENSO Service station for refrigerant bleeding to a suitable quantity (discharge into the atmosphere is prohibited), and refill refrigerant after sufficient vacuum drawing in the refrigeration cycle.
The low-pressure side shows a negative pressure (when the refrigeration cycle is completely clogged. In case of a clogging tendency, negative pressure is shown gradually).	Clogging of the refrigeration cycle (piping, expansion valve, receiver, drier, etc.)	Contact DENSO Service station for replacement of abnormal parts in the refrigeration cycle.
After expiration of a fixed time, the low-pressure side gradually shows a negative pressure.	Entry of water into the refrigeration cycle, water absorption capacity of receiver and drier exceeded	Contact DENSO Service station for desiccant in the modulator and for replacement of receiver and drier. Perform sufficient vacuum drawing and moisture removal before refrigerant filling.
Condensation forms on the low-pressure-piping.	Excessive opening of the expansion valve	Contact DENSO Service station and request replacement of the expansion valve.
When the compressor is switched off, high pressure and low pressure show the same value (the compressor does not become very hot).	Defective compressor compression	Contact DENSO Service station for compressor repair.

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GAS LEAKAGE INSPECTION

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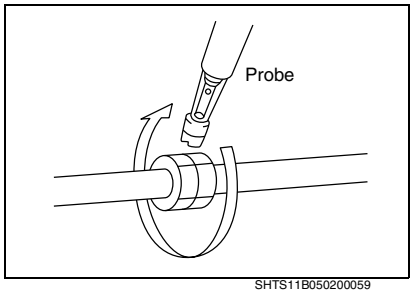


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When the basic inspection indicates that there may be leakage of refrigerant, use a halogen leak detector and inspect as described below.

1. ADVANCE CHECKING
CONNECT THE GAUGE MANIFOLD AND CONFIRM THE STATUS OF THE REFRIGERANT REMAINING IN THE REFRIGERATION CYCLE.
THEN REFILL REFRIGERANT AS REQUIRED AND INCREASE THE PRESSURE IN THE REFRIGERATION CYCLE TO INCREASE THE GAS LEAKAGE DETECTION ACCURACY AS THE ADVANCE CHECK.

(1) Read the gauge pressure with stopped compressor.
(2) If the gauge pressure is approximately 0.4 MPa {4 kgf/cm^2, 57 lbf/in^2}, start inspection in this condition. However, the ambient temperature shall be 15°C or more.
(3) If the gauge pressure is lower than approximately 0.4 MPa {4 kgf/cm^2, 57 lbf/in^2}, refill refrigerant and start inspection only from a condition with 0.4 MPa or more.



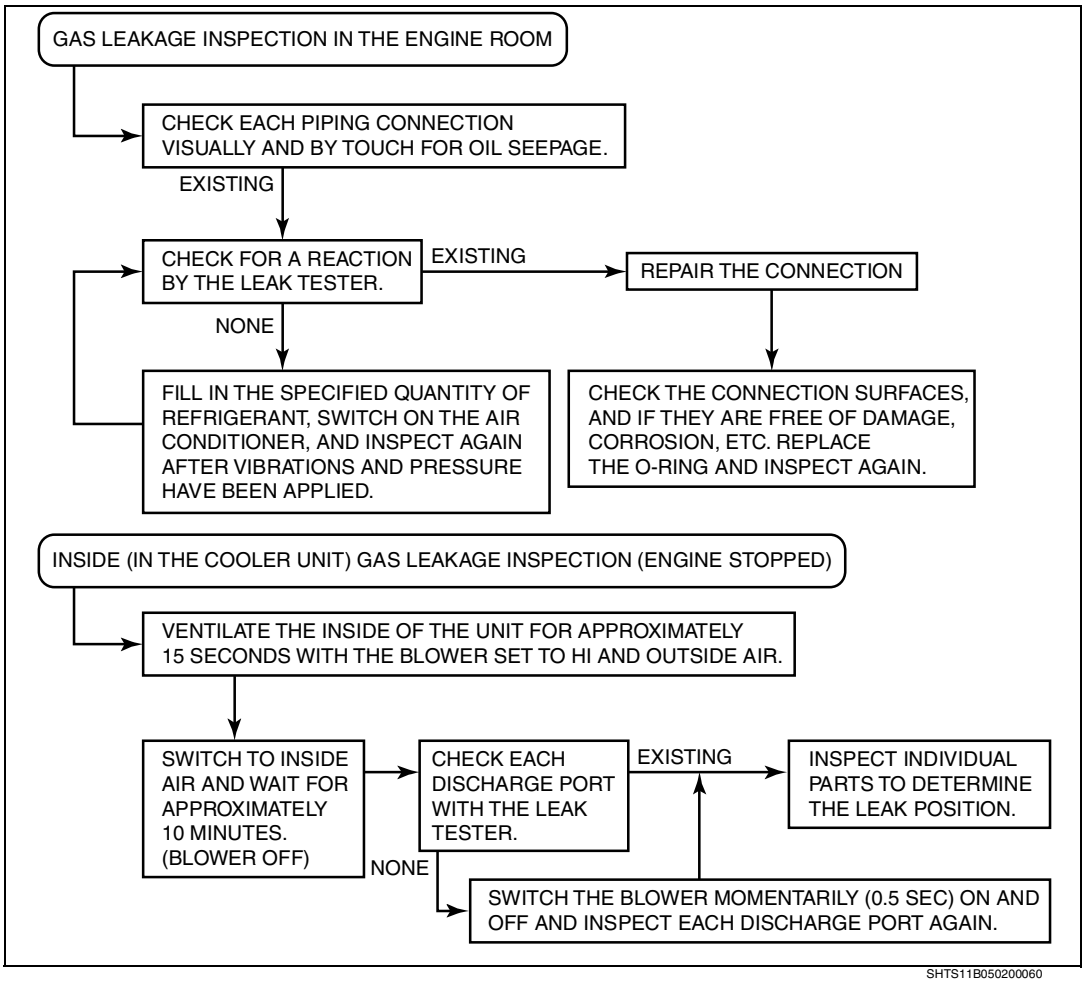
SHTS11B050200059

NOTICE
Gas leaking from piping connections flows with minute air currents. When bringing the probe into contact with the location to be checked, approach not only from one direction, but from all directions.

⚠ CAUTION
Do not perform gas leakage inspection with a halide torch leak detector. This type of tester uses the reaction with chlorine to detect gas leakage, so that it not only cannot detect HFC134a refrigerant not containing chlorine, but also decomposes any HFC134a which has been sucked in and generates harmful substances.

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2. INSPECTION PROCEDURE



SHTS11B050200060

⚠ CAUTION

Cautions for use of the leak tester

- **Handling of Hi sense: As Hi sense easily can cause erroneous reactions in the engine room, use a different mode for the inspection. (It is effective for leakage inspection in the unit.)**
- **Leak tester reaction time: The reaction time of a normal tester is within several seconds, but it differs according to the wind direction.**
  In case of irregular reaction, inspect repeatedly.
- **Erroneous reaction of the leak tester: Please note that erroneous reactions can be caused by volatile gases (gasoline, thinner, etc.), steam, low battery voltage, defective contact of the sensor part, etc.**

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3. INSPECTION OF THE ELECTRIC CIRCUITS
FOR THE INSPECTION, REFER TO THE RESPECTIVE WIRING DIAGRAMS AND UNDERSTAND THE CIRCUITS. THEN USE A CIRCUIT TESTER OR SIMILAR TO SYSTEMATICALLY CHECK THE CONNECTION OF THE PARTS.

(1) Blown fuse
   a. Refer to the wiring diagram and check the circuit where the fuse has blown.
   b. To inspect equipment parts for internal short-circuits, try disconnecting their connectors.

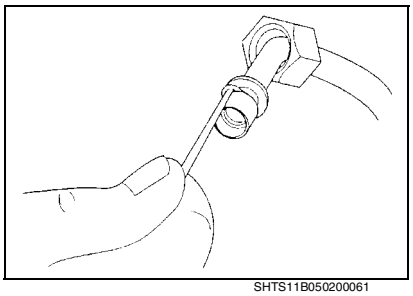
(2) Defective connector contact
   a. Please note that function parts may not function because of defective connector contact.
   b. Unstable operation and erroneous operation when the vehicle vibrates often are caused by defective connector contact.

(3) Defective body grounding
   a. Even when the external appearance is quite normal, insulation may be caused by a coat of paint or rust.

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PRECAUTIONS FOR REMOVING/INSTALLING THE AIR CONDITIONER

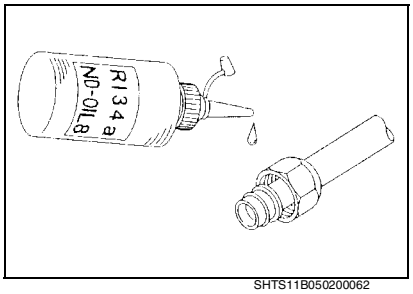
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SHTS11B050200061

1. PRECAUTIONS FOR CHANGING O-RINGS

(1) Always replace an old O-ring with a new O-ring for HFC134a when you remove a pipe or hose.
(2) Use a toothpick or other soft implement to remove the O-ring so that you do not damage the pipe or hose.



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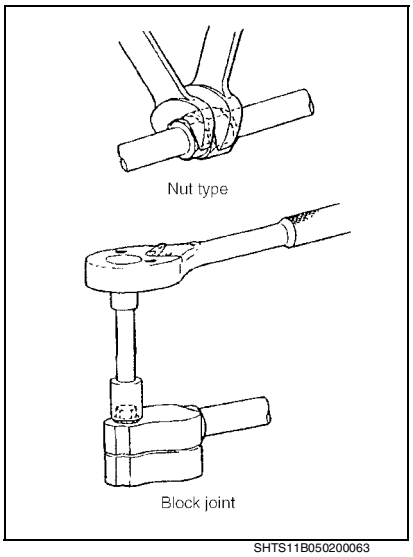
2. PRECAUTIONS FOR CONNECTING PIPES AND HOSES

(1) Coat the O-ring with compressor oil (ND-OIL8) when making a pipe or hose connection.
(2) Pipe joints in the HFC134a system have a cylindrical surface seal, so you can feel them snap together when they are assembled.

NOTICE
Use compressor oil for HFC134a (ND-OIL8) to coat O-rings for HFC134a. Do not use a penetrating type lubricating oil (mineral oil) or other oil.

(3) When connecting pipes, use the tightening torques shown in the following table.

NOTICE
Insufficient or excessive torque can cause a refrigerant gas leak due to an improperly installed or broken O-ring. Always use the specified tightening torque.



SHTS11B050200063

Connection	Tube size or Bolt size	Tightening torque N·m (kgf·cm)
Nut type	ϕ8 tube	12—15 (120—150)
	D1/2 tube	20—25 (200—250)
	D5/8 tube	30—35 (300—350)
Block joint	M6 bolt in receiver (4T)	4.0—7.0 (40—70)
	Above other M6 bolt (6T)	8.0—12 (80—120)

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3. REPLENISHING THE COMPRESSOR OIL

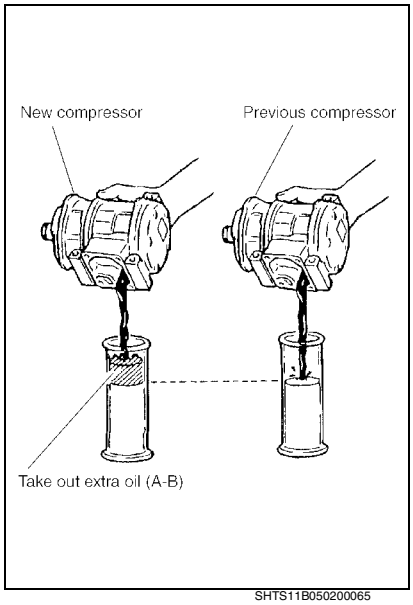
(1) When replacing a functional part
When replacing a functional part (condenser, evaporator, etc.), supply the amount of new compressor oil shown in the following table.

NOTICE

- **Use compressor oil for HFC134a (R134a)**
- **Compressor oil for HFC134a (R134a) has an adverse effect on acrylic and ABS resins. When replenishing the compressor oil, therefore, do not allow the oil to splatter.**

Compressor oil replacement

	Replace parts				
	Compressor	**Condenser**	**Evaporator**	**Receiver**	**Tubes**
Oil replacement amount	**(as follows)**	**40cc**	**40cc**	**10cc**	**10cc (per one tube)**



SHTS11B050200065

(2) When changing the compressor oil
A new compressor is filled with the amount of oil required by its operating cycle. When changing the compressor, therefore, take out the extra oil contained in the new compressor.

NOTICE

- **Compressor oil for HFC134a (R134a) readily absorbs moisture, so it should be sealed immediately after it has been used.**
- **When transferring compressor oil to an oil can, be sure to use an oil can that has been labeled for HFC134a (R134a) use.**

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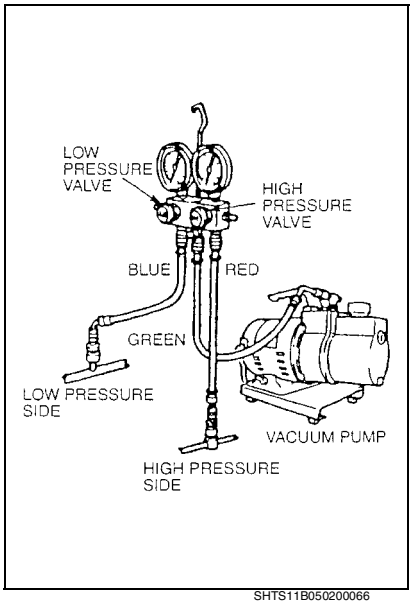
RECOVERY AND REPLENISHMENT OF REFRIGERANT

EN11B0502H500002

1. RECOVERING THE REFRIGERANT (HFC134a)

(1) Connect a gauge manifold to the air conditioner piping service valve and the refrigerant gas recovery unit, and then open the valves on the low-pressure and high-pressure sides and recover the refrigerant gas.

(2) Once the gas has been recovered, close the gauge manifold valves (low-pressure side and high-pressure side).



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2. REPLENISHING THE REFRIGERANT (HFC134a)

(1) Evacuate air to form a vacuum.

a. Connecting the gauge manifold

(a) Connect charging hoses to the low-pressure and high-pressure service valves.

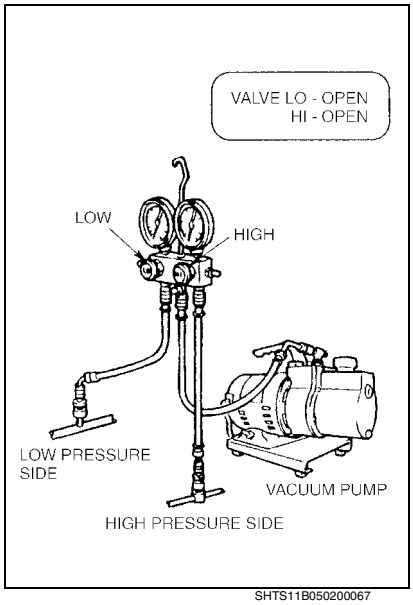
- Red hose on high-pressure side (H mark)
- Blue hose on the low-pressure side (L mark)

(b) Connect the middle charging hose on the gauge manifold (green hose) to a vacuum pump.

NOTICE

- **Do not get the low-pressure and high-pressure sides mixed up.**
- **In some models, the service valve is installed on the compressor.**

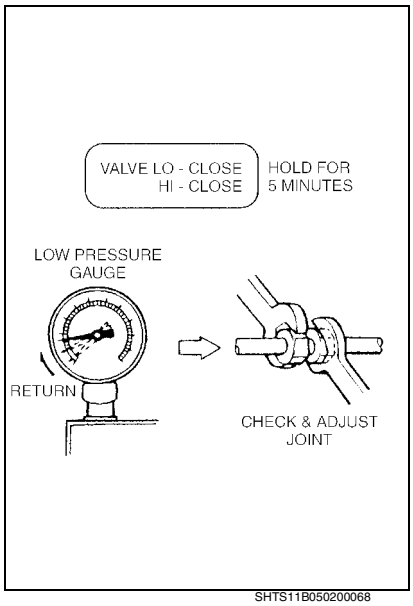
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SHTS11B050200067

b. Forming a vacuum
(a) Open the gauge manifold high-pressure valve (HI) and low-pressure valve (LO).
(b) Turn on the vacuum pump and evacuate air until a vacuum is formed (10 minutes).
(c) When the low-pressure gauge scale reading equals or exceeds -0.1MPa (-750mmHg), close the high-pressure and the low-pressure valves and turn off the vacuum pump.

NOTICE
If the pump is switched off before the gauge manifold valves are closed, air will get into the system.

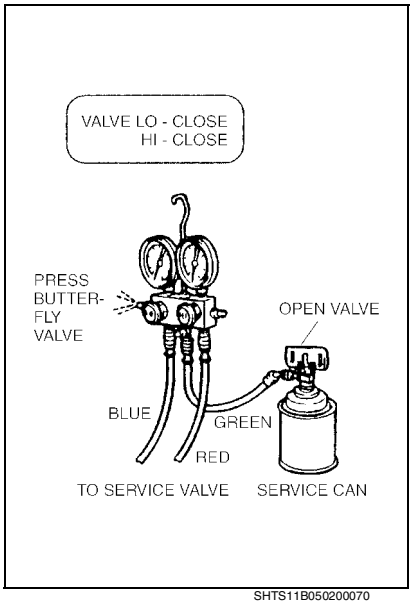


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c. Airtightness check (1) (using the gauge needle)
(a) Leave the gauge manifold high-pressure and low-pressure valves closed (for 5 minutes) and make sure that the gauge needle does not return to the zero point.

NOTICE
If the gauge needle returns to the zero point, it means that air is leaking out somewhere. Check and adjust the pipe joints and then re-form the vacuum and check for airtightness.

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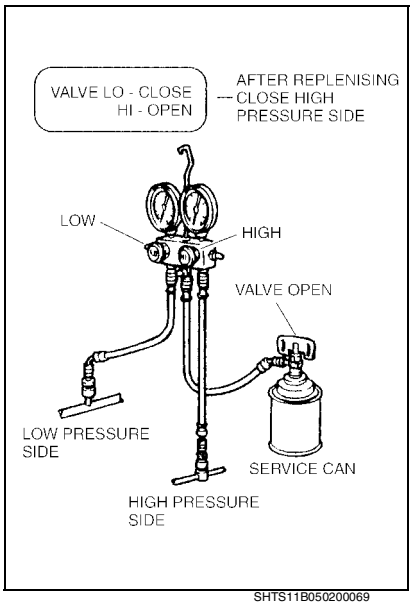
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d. Airtightness check (2) (using refrigerant)
Add a small quantity of refrigerant and then check for airtightness using a gas leak detector.
(a) Remove the charging hose connected to the vacuum pump (green hose) and connect it to a service can.
(b) Remove the air inside the charging hose (green).

- Tighten the service can valve handle and open the hole in the service can; then open the valve.
- Press the butterfly valve on the gauge manifold so that the air inside the hose is expelled by the refrigerant pressure. Continue until you hear the whooshing sound of refrigerant escaping.

NOTICE

- **At this time, the gauge manifold high-pressure and low-pressure valves should both be closed.**
- **Be careful not to get refrigerant on your hands (or they may get frostbitten).**



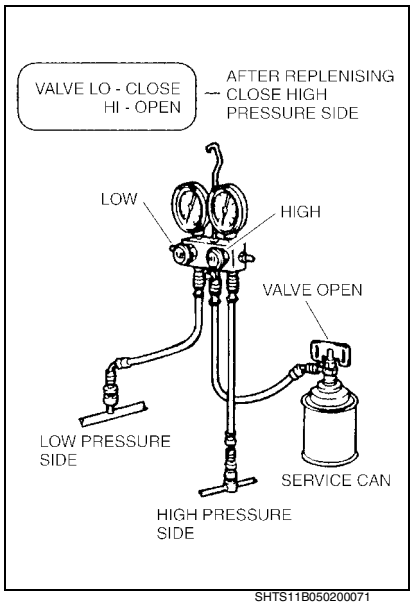
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(c) Open the gauge manifold high-pressure valve and supply refrigerant until the low-pressure gauge reading reaches 0.1MPa (1kgf/cm^2).

(d) Close the high-pressure valve once the refrigerant has been replenished.
(e) Carefully check for air leakage using a gas leak detector. Repair any leaks that you find.

NOTICE
Be sure to use a gas leak detector for HFC134a (R134a) when checking for gas leaks.

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SHTS11B050200071

(2) Replenish the refrigerant.

a. Supplying refrigerant from the high-pressure side

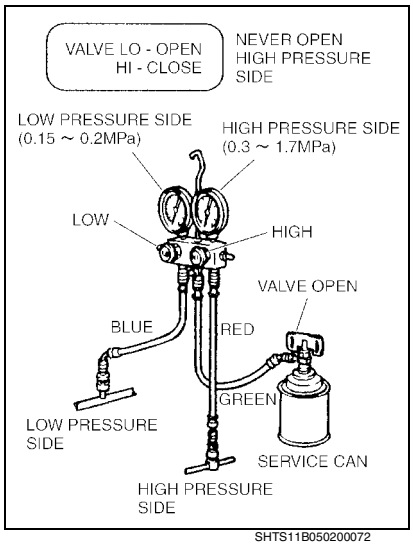
(a) With the engine stopped, open the gauge manifold high-pressure valve and the service can valve, and fill about one service can with refrigerant.

NOTICE

- **Never run the compressor at this time. Running the compressor is extremely dangerous because refrigerant will flow back into the hose or the service can, causing the hose to rupture or the can to burst.**
- **Do not run the compressor without any refrigerant in the system; otherwise, the compressor may seize.**
- **Do not open the gauge manifold low-pressure valve, for this will cause the liquid refrigerant to get sucked into the compressor, where it will be compressed and possibly damage the compressor valve.**

(b) Close the gauge manifold high-pressure valve and the service can valve.

b. Supplying refrigerant from the low-pressure side



SHTS11B050200072

(a) Make sure the gauge manifold high-pressure valve is closed.

(b) Set the following vehicle conditions.

- Turn on the engine and open all the vehicle doors.
- Turn the air conditioner on.
- Set the temperature control lever to the maximum cooling setting.
- Set the blower switch to the HI position.
- Run the engine at 1500rpm approximately.

(c) Open the gauge manifold low-pressure valve and the service can valve, supply the stipulated amount of refrigerant.

- Refrigerant quantity: 450±50g

(d) Once the refrigerant has been replenished, close the gauge manifold low-pressure valve and the service can valve and stop the engine.

NOTICE

- **Never open the gauge manifold high-pressure valve (HI) at this time. Opening the valve is extremely dangerous because it will cause high-pressure gas to flow back into the charging hose or the service can, causing the hose to rupture or the can to burst.**
- **Never turn the service can upside down. If the can is turned upside down, liquid refrigerant will get sucked into the compressor, where it will be compressed and possibly damage the compressor valve.**
  Keep the can upright and supply refrigerant in a gaseous state.

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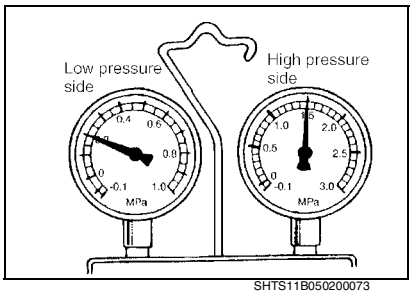
(3) Checking the amount of refrigerant supplied
a. Using the gauge manifold
(a) Set the following conditions.

- Open all the vehicle doors.
- Set the temperature control to the maximum cooling setting.
- Set the blower speed to the HI position.
- Set the outside air/room air selector lever to the room air position.
- Run the engine at 1500rpm.

NOTICE

- **Determination is made with the pressure on the high-pressure side no greater than 1.86MPa (19kgf/cm^2).**
- **If the outside air temperature is high (above 40°C) and the pressure on the high-pressure side drops below 1.86MPa (19kgf/cm^2) when you are setting the judgment criteria:**

((a)) Open all the doors and set the blower speed to the LO position.
((b)) Use an indoor workplace or work outdoors in the shade. Carry out the procedure in steps 1 and 2 above and then determine the refrigerant quantity with the pressure no greater than 1.86MPa (19kgf/cm^2).
(b) Check the gauge manifold reading.



SHTS11B050200073

- If it is normal
((a)) Pressure on low-pressure side 0.15—0.25MPa (1.5—2.5 kgf/cm^2)
((b)) Pressure on high-pressure side 1.37—1.57MPa (14—16 kgf/cm^2)

NOTICE

- **The gauge manifold reading may vary somewhat depending on conditions.**
- **Too much refrigerant can lead to problems such as faulty cooling or overheating.**

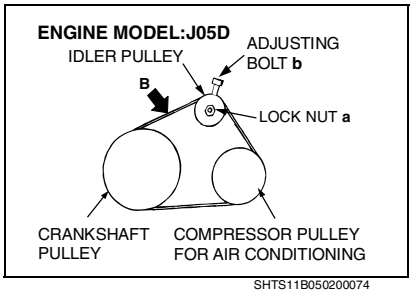
MAINTENANCE

EN11B0502H600001

1. ADJUSTING THE V-BELT TENSION

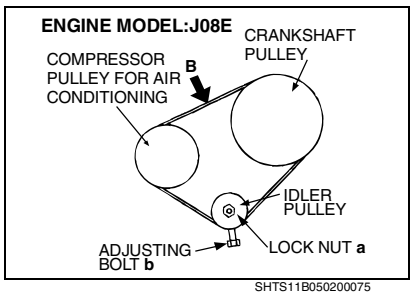
⚠ CAUTION
After a new belt has been installed it may loosen during its initial break-in period. Run the engine for 3—5 minutes, therefore, and re-adjust the belt tension.

(1) Loosen the idler pulley lock nut and adjust the V-belt tension (measuring point: B) until it is within the prescribed range, by turning the adjusting bolt with the special tool.



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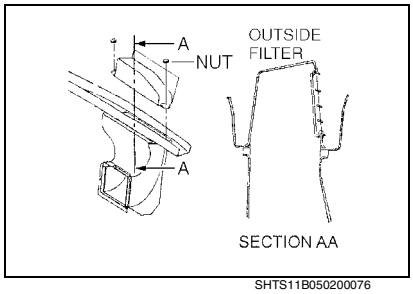
SST:
Compression gauge (S0944-41210)
or belt tension gauge (Denso product No. 95506-00090)

Amount of deflection:
Use S0944-41210

Standard value 11mm (0.434 in.) [Reference force applied to belt: 98N (10kgf, 22lb)]
Tension: Use Denso product No. 95506-00090
Standard value: [330N (34kgf, 75lbf)]

(2) Tighten the idler pulley lock nut.
Tightening Torque:
41N·m (420kgf·cm)

(3) Make sure the adjusting bolt is tight and locked in place.
Tightening Torque:
5.9N·m (60kgf·cm)

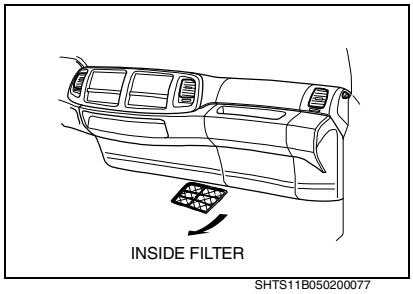


SHTS11B050200076

2. CLEANING THE AIR FILTER

(1) Removing the outside air filter

(2) Removing the inside air filter
The air filter is located at the bottom of the blower assembly. Remove it by bending it and pushing it downward at the same time.



SHTS11B050200077

(3) Cleaning the air filter

- Clean the filter every 5000km.
- Set the starter key to the LOCK position. If the key is in the ON or ACC position, the wiper motor will operate and your fingers may get caught in the wiper linkage.
- Clean the air filter by washing it with water or blowing it with compressed air.
- If you wash the filter, make sure it is completely dry before you reinstall it.

3. WASHING THE CONDENSER

(1) The condenser fins have to be washed periodically because problems such as reduced cooling efficiency and corrosion may occur if the fins are clogged with dirt or dust.

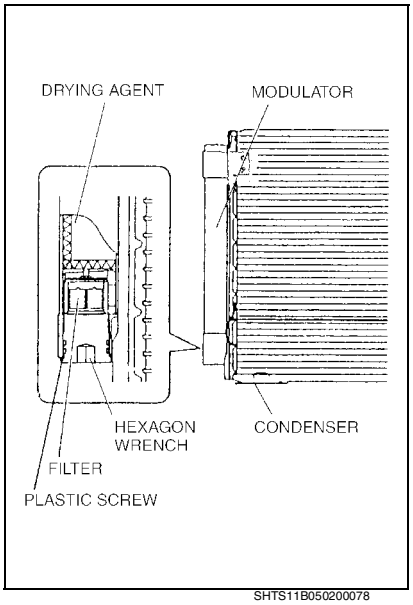
⚠ CAUTION

- **Make sure the air conditioner is off when you wash the condenser.**
- **Do not use a brush, for strong brushing may crush the fins.**
- **Wash the condenser carefully so that you do not damage the fins.**
- **Do not use a detergent.**
- **Give the condenser a thorough cleaning if the vehicle has been driven in coastal areas or on roads that have been salted to prevent freezing.**

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REPLACEMENT

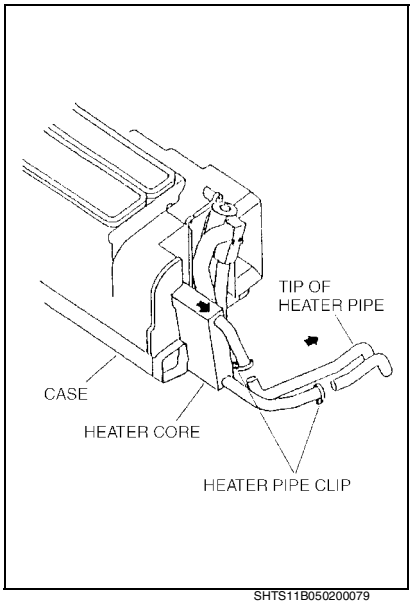
EN11B0502H100005



SHTS11B050200078

1. REPLACING THE DRYING AGENT IN THE MODULATOR

(1) Remove the filter with hexagon wrench and then take out and replace the drying agent.
The plastic screw cannot be re-used. Be sure to replace it with a new one.

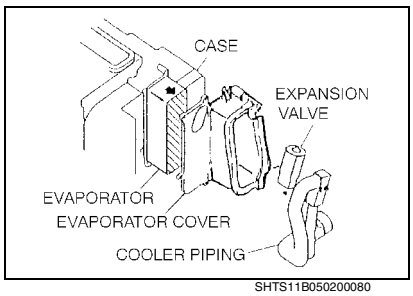


SHTS11B050200079

2. HVAC (HEATER AND A/C UNIT)

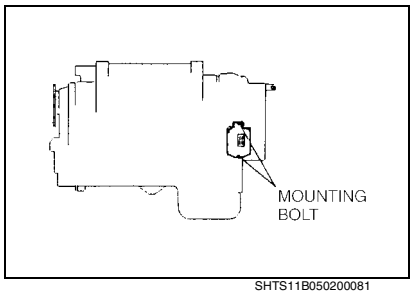
(1) Replacing the heater core
a. Remove the instrument panel center lower cover and AS lower cover.
b. Remove the blower assembly.
c. Remove the heater pipe clips and pull out the end of the heater pipe.
d. Remove the heater core.

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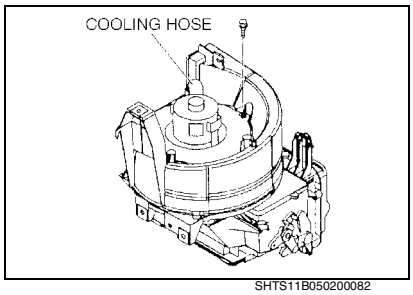
SHTS11B050200080

(2) Replacing the evaporator
a. Remove the instrument panel center lower cover and AS lower cover.
b. Remove the blower assembly.
c. Remove the HVAC.
d. Remove the cooler piping (interior).
e. Remove the bracket below the piping through-hole.
f. Remove the expansion valve and cover.
g. Remove the evaporator.



SHTS11B050200081

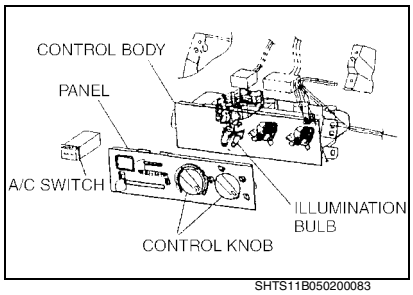
(3) Replacing the blower resistor and power transistor
a. Remove the two mounting bolts.



SHTS11B050200082

3. BLOWER ASSEMBLY

(1) Replacing the motor
a. Remove the cooling hose.
b. Remove the three bolts holding the motor in place.



SHTS11B050200083

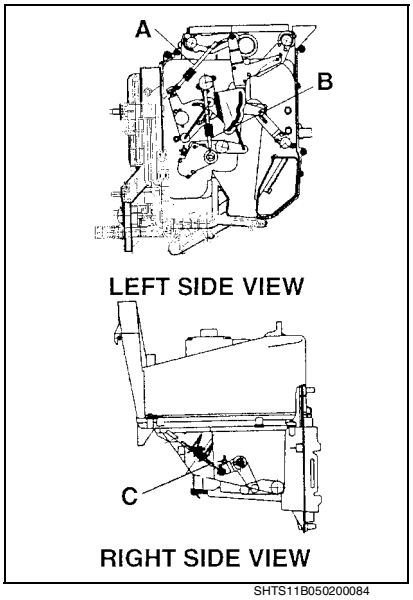
4. HEATER CONTROL

(1) Replacing the illumination bulb
a. Remove the center cluster.
b. Remove the control knob and A/C switch.
c. Remove the heater control panel (claw connection).
d. Remove the illumination bulb.

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DISMOUNTING AND MOUNTING

EN11B0502H100006



SHTS11B050200084

IMPORTANT POINTS - MOUNTING

NOTICE

- **Should not bend the Inner cable when cable route.**
- **Set the cable at pulled state and make sure the link to boss. Set position is as follows.**

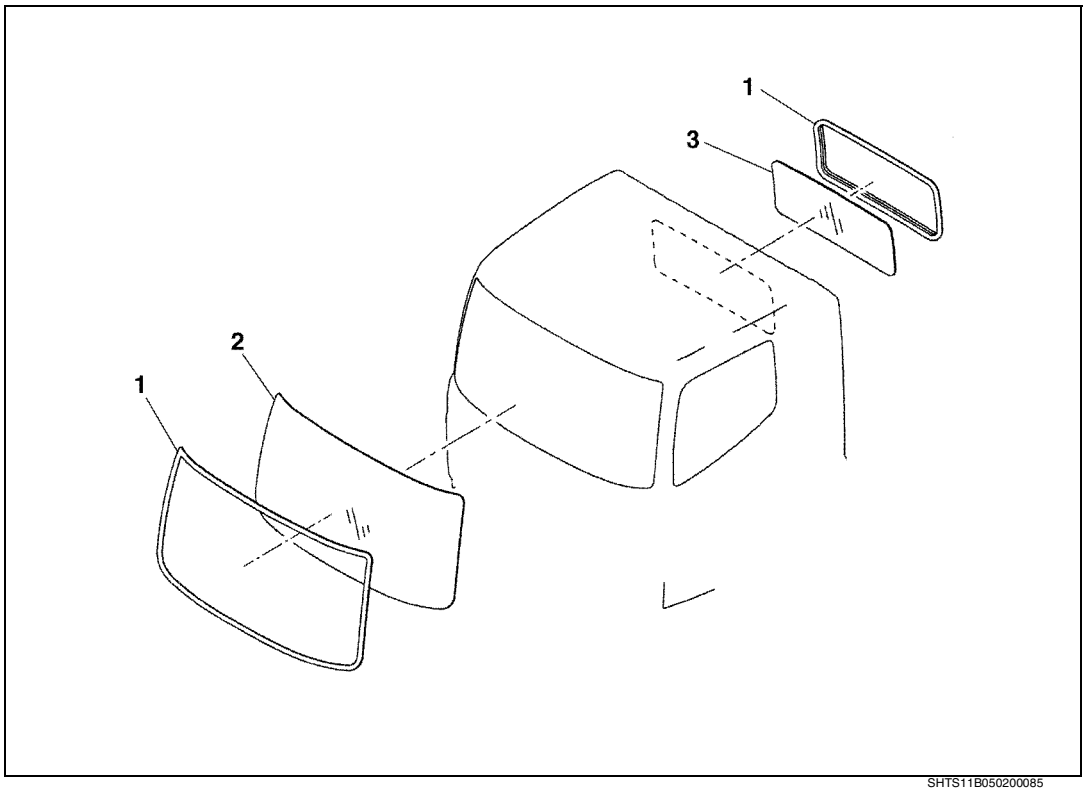
Cable	Color	Position
A: Mode control	BLUE	FACE
B: Temperature control	NATURAL	MAX COOL
C: Inside and outside air control	BLACK	OUTSIDE

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WINDSHIELD

COMPONENT LOCATOR

EN11B0502D100007



SHTS11B050200085

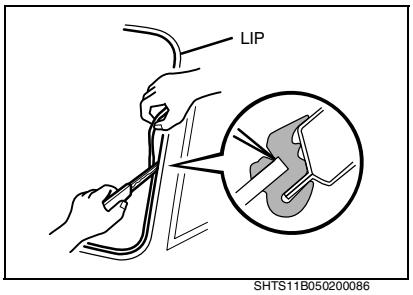
1	Weatherstrip	3	Back window
2	Windshield glass		

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REPLACEMENT

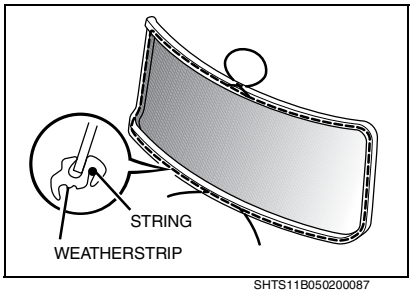
EN11B0502H100007

1. BEFORE REPLACING THE WINDSHIELD.
(1) Remove the windshield wiper.



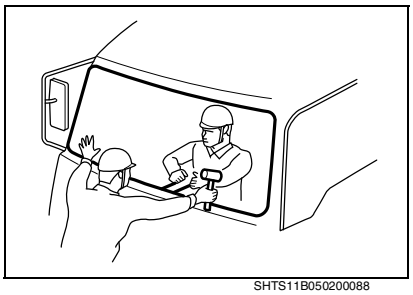
SHTS11B050200086

2. REMOVE THE WINDSHIELD.
(1) Cut the lip of the weatherstrip with a knife.
(2) The windshield is heavy so remove it using at least two persons.



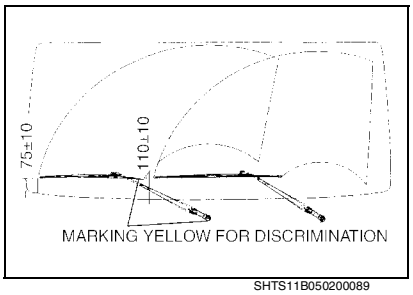
SHTS11B050200087

3. MOUNTING THE WINDSHIELD.
(1) Clean the weatherstrip, mounting flange of cab and contact surface of the window.
(2) Repair any wavy area at the mounting flange as necessary.
(3) Insert the working string as shown in the figure.


SHTS11B050200088

(4) Pull the working string from the interior of the cab, and gradually install the lip of the weatherstrip on the mounting flange.
(5) During this operation, knock the glass from outside. Use soapy water as necessary.
(6) After installing the glass properly, knock the glass from inside and outside.

4. INSTALL THE WINDSHIELD WIPER.
(1) Install the wiper arm.



SHTS11B050200089

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AFFIXING WEATHERSTRIP PROCEDURE

EN11B0502H300003

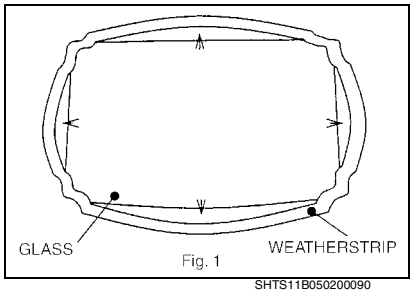


Fig. 1

SHTS11B050200090

1. REMOVE THE CORNER WINDSHIELD WEATHERSTRIPS (79413-1470A) FROM THE WINDSHIELD GLASS ASSY. (79410-2511A). (REFER TO FIGURE 1.)

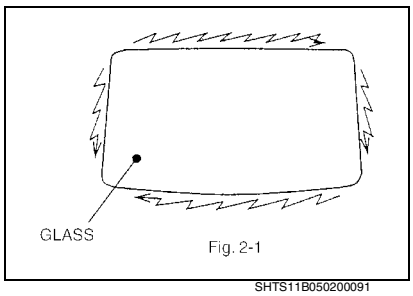


Fig. 2-1

SHTS11B050200091

2. CLEANING THE GLASS
Using a nap-free cloth or felt and a cleaning solvent, clean the glass flange areas where the weatherstrip has been removed, and remove grease, oil, water, dirt, and foreign substances from the joining surfaces. (Refer to Figures 2-1 and 2-2.)

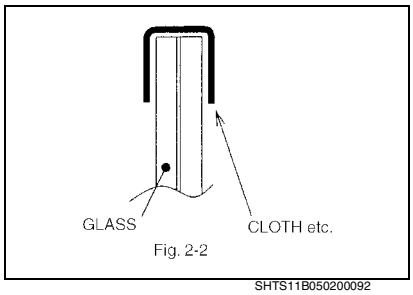


Fig. 2-2

SHTS11B050200092

NOTICE

- **Cleaning solvent: (Isopropyl) alcohol**
- **Always keep the cleaning solvent in a clean container. Avoid the use of a cleaning solvent that is obviously dirty.**
- **For the cleaning cloth, use a clean cloth, gauze, felt, or other equivalent material that is free of stains.**
- **Always use a clean surface of the cleaning cloth and use a fresh cloth for every glass you clean.**
- **Add cleaning solvent to the cleaning cloth so that when the cloth is forcefully squeezed the solvent does not drip out.**

3. CLEANING THE WEATHERSTRIP: GLASS SIDE AND BODY SIDE
Using a cloth and a cleaning solvent, clean the glass areas where the weatherstrip has been removed, removing grease, oil, water, dirt, and foreign substances.

NOTICE

- **Cleaning solvent: (Isopropyl) alcohol**
- **Always keep the cleaning solvent in a clean container. Avoid the use of a cleaning solvent that is obviously dirty.**
- **For the cleaning cloth, use a clean cloth, gauze, felt, or other equivalent material that is free of stains.**
- **Always use a clean surface of the cleaning cloth and use a fresh cloth for every weatherstrip you clean.**
- **Add cleaning solvent to the cleaning cloth so that when the cloth is forcefully squeezed the solvent does not drip out.**

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4. DRY THE SOLVENT
After completing steps 2 and 3, allow the glass to dry for at least 3 minutes so that the cleaning solvent has fully dried.

NOTICE
After the cleaning solvent has been applied (and while it is drying), be careful not to allow oil, water, dirt, or foreign substances to stick to the solvent.

5. APPLYING PRIMER: GLASS AND WEATHERSTRIP (GLASS SIDE AND BODY SIDE)
Apply a uniform coat of primer to the indicated area.

NOTICE

- **After applying the primer, make sure oil, water, or foreign substances do not stick to the primer.**
- **Primer: Sika Activator, made by Japan Sika Co., Ltd.**
- **Application temperature range: +5°C—+25°C**
- **Storage method: Keep primer in a sealed container in a cool, dark place.**
- **Storage period: 12 months (unopened)**
  Use primer within one month after it has been opened.

6. WIPE THE PRIMED AREA WITH A DRY CLOTH WITHIN 30 SECONDS AFTER APPLYING THE PRIMER.

7. AFTER WIPING THE PRIMER WITH A DRY CLOTH, ALLOW IT TO DRY FOR AT LEAST 10 MINUTES (IF THE TEMPERATURE IS 15°C OR HIGHER) OR 30 MINUTES (IF THE TEMPERATURE IS BELOW 15°C).

NOTICE
Be careful not to allow water, dirt, or foreign substances to stick to the primed surface.

8. FIT THE REMOVED WEATHERSTRIP ONTO THE GLASS (as it was prior to the start of work.)

9. APPLYING ADHESIVE: GLASS AND WEATHERSTRIP
Apply adhesive between the glass and the weatherstrip. (For details, refer to the assembly diagram.)

NOTICE

- **Do not use an adhesive whose expiration date has passed.**
- **Storage conditions: 0 - 40°C, indoor storage**
- **Adhesive: Silkaflex 250-2**
- **Apply a suitable amount of adhesive to the range indicated in the diagram (so that adhesive sticks out from the edge of the weatherstrip).**
- **With the weatherstrip securely fitted on the glass, proceed to the next task (check and repair, including corners).**

10. WASHING OFF THE ADHESIVE: GLASS SIDE
Remove the adhesive and primer sticking out from the edge of the weatherstrip.

(1) Scrape off adhesive with a pallet knife.
(2) Wipe the scraped area with a cloth dipped in a cleaning agent.

NOTICE

- **Work as quickly as possible.**
- **Use a clean cloth or equivalent material and use a clean surface of the cloth at all times.**

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11. CLEANING THE BODY
Using a cloth dipped in a cleaning solvent, clean the area where the weatherstrip and glass have been removed, and remove grease, oil, water, dirt, and foreign substances.

NOTICE

- **Cleaning solvent: (Isopropyl) alcohol**
- **Always keep the cleaning solvent in a clean container. Avoid the use of a cleaning solvent that is obviously dirty.**
- **For the cleaning cloth, use a clean cloth, gauze, felt, or other equivalent material that is free of stains.**
- **Always use a clean surface of the cleaning cloth and use a fresh cloth for every weatherstrip you clean.**
- **Add cleaning solvent to the cleaning cloth so that when the cloth is forcefully squeezed the solvent does not drip out.**
- **Before cleaning, remove adhesive or weatherstrip stuck to the body.**

12. APPLYING PRIMER: BODY SIDE
Apply a uniform coat of primer to the indicated area.

NOTICE

- **After applying the primer, make sure oil, water, or foreign substances do not stick to the primer.**
- **Primer: Sika Activator, made by Japan Sika Co., Ltd.**
- **Application temperature range: +5°C—+25°C**
- **Storage method: Keep primer in a sealed container in a cool, dark place.**
- **Storage period: 12 months (unopened) Use primer within one month after it has been opened.**

13. WIPE THE PRIMED AREA WITH A DRY CLOTH WITHIN 30 SECONDS AFTER APPLYING THE PRIMER.

14. AFTER WIPING THE PRIMER WITH A DRY CLOTH, ALLOW IT TO DRY FOR AT LEAST 10 MINUTES (IF THE TEMPERATURE IS 15°C OR HIGHER) OR 30 MINUTES (IF THE TEMPERATURE IS BELOW 15°C).

NOTICE
Be careful not to allow water, dirt, or foreign substances to stick to the primed surface.

15. APPLYING LUBRICANT
Apply a lubricant for installation to the body flange.

NOTICE

- **Use a detergent as the lubricant.**
- **Do not allow detergent to get on the surfaces where adhesive has been applied.**

16. FIT THE GLASS IN PLACE ON THE BODY.

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17. APPLYING ADHESIVE: WEATHERSTRIP AND BODY
Apply adhesive between the body and the weatherstrip. (For details, refer to the assembly diagram.)

NOTICE

- **Do not use an adhesive whose expiration date has passed.**
- **Storage conditions: 0—40°C, indoor storage**
- **Adhesive: Silkaflex 250-2**
- **Apply a suitable amount of adhesive to the area indicated in the diagram (so that adhesive sticks out from the edge of the weatherstrip).**

18. WASHING OFF THE ADHESIVE: BODY SIDE
Remove the adhesive and primer sticking out from the edge of the weatherstrip.

(1) Scrape off adhesive with a pallet knife.
(2) Wipe the scraped area with a cloth dipped in a cleaning agent.

NOTICE

- **Work as quickly as possible.**
- **Use a clean cloth or equivalent material and use a clean surface of the cloth at all times.**

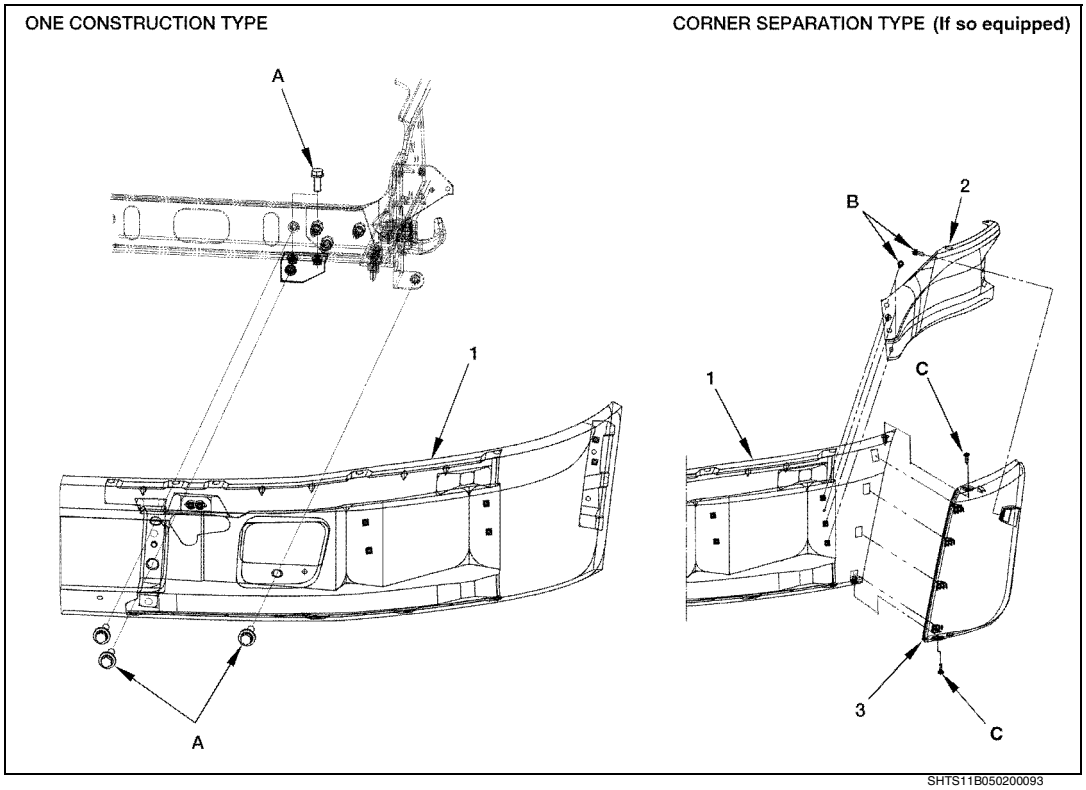
CA02_001_Mokuji kai.fm 60 ページ ２０１１年１０月３１日 月曜日 午後１時１９分

FRONT BUMPER

COMPONENT LOCATOR

EN11B0502D100008

1. STANDARD SETTING



SHTS11B050200093

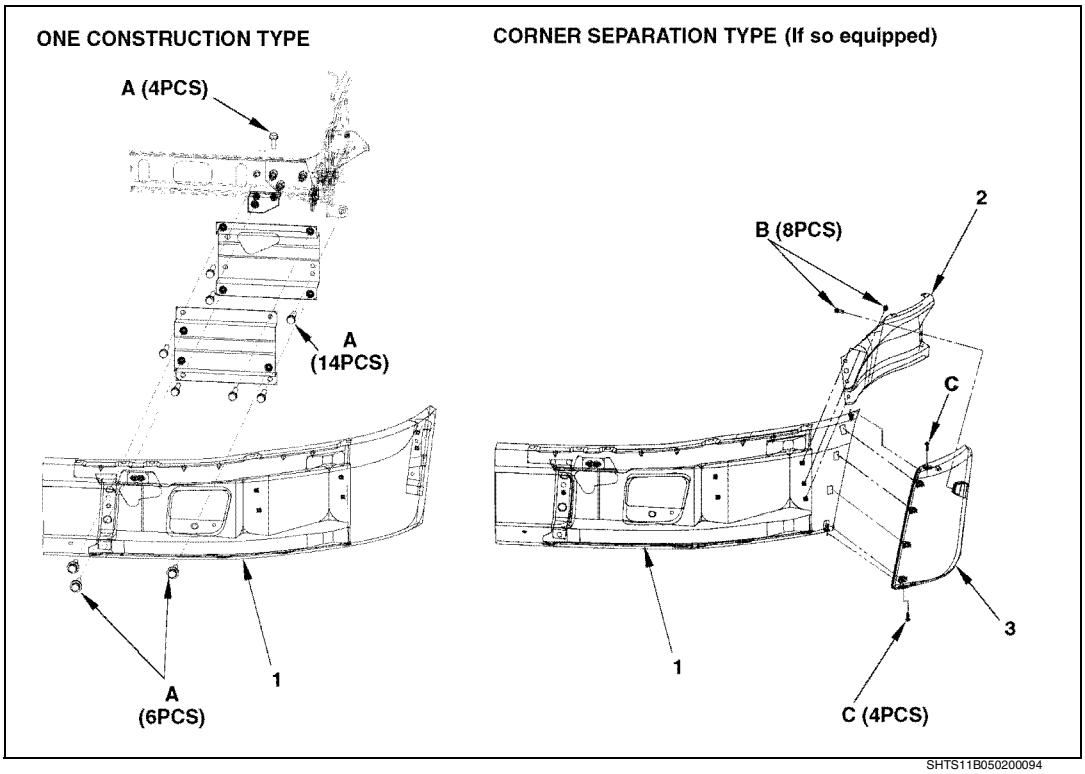
1	Bumper sub assembly	3	Corner bumper
2	Bumper stay		

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

A	104-156 {1061-1592, 77-115}	C	3-7 {31-71, 2-5}
B	13-29 {133-296, 10-21}		

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2. IN FRONT SETTING



SHTS11B050200094

1	Bumper sub assembly	3	Corner bumper
2	Bumper stay		

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

A	104-156 {1061-1592, 77-115}	C	3-7 {31-71, 2-5}
B	13-29 {133-296, 10-21}		

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ELECTRICAL EQUIPMENT

EL01-001

ELECTRICAL PARTS EL01-2
DATA AND SPECIFICATIONS EL01-2
COMPONENT LOCATOR EL01-3
TROUBLESHOOTING EL01-12
GENERAL INSTRUCTION EL01-13
HANDLING PRECAUTION EL01-18
INSPECTION EL01-20
INSPECTION AND ADJUSTMENT EL01-41
SPEEDOMETER CONVERSION
RATE LIST EL01-42

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ELECTRICAL PARTS

DATA AND SPECIFICATIONS

EN12Z1601I200001

ELECTRICAL SYSTEM

Voltage	Direct current 12 volts
Ground	Negative (-) ground

BULB WATTAGE RATING

Head light		60/55W
Clearance light and Identification light	LED TYPE	1.54W (Replace with unit)
Front turn signal light		27W
Front side turn signal light		5W
Front side maker light		8W
Dome light		8W
Rear turn signal light		27W
Stop/tail light		27/8W
Back-up light		27W
License plate light		8W

GAUGE TYPE

Fuel	Coil type
Coolant temperature	Coil type
Tachometer	Coil type
Speedometer	Coil type
Air pressure	Coil type

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COMPONENT LOCATOR

EN12Z1601D100001

PARTS INSTALLED POSITION

PARTS	INSTALLED	PARTS	INSTALLED
Air conditioner relay	Fuse and relay block, behind the instrument panel lower RH cover	Power accessory relay No.2 (Fuel heater relay)	Relay block, inside right frame at the rear side of the No.3 cross-member
ATM starter relay		ABS motor relay	
Daytime running light relay		Starter relay	
Head light dimmer relay		ATM back light relay	
Head light main relay		Glow control unit	
Heater relay (Air conditioner)		ABS ECU (Full air brake)	ECU lack, behind the instrument panel lower RH cover
Horn relay		Daytime running light ECU	
Air horn relay		Stop and turn controller	
Mirror heater relay (If so equipped)		Stop light relay	
Power accessory relay		Vehicle control ECU	
Power relay No.1		Wiper relay	
Power relay No.2		Pulse converter (MTM, ALLISON 2200HS, 2200/ 2500RDS & 3000RDS ATM)	
Power relay No.3			
Power relay No.4		Combination meter	Meter cluster
Tail light relay No.1		Light and turn switch	Steering column
Tail light relay No.2		Starter switch	
Air suspension dump relay 1		Wiper and retarder switch	
Air suspension dump relay 2		Horn switch	Steering wheel
Parking brake indicator off relay		Air suspension dump switch	Switch board panel, under the combination meter
Parking brake buzzer off relay		Cruise control main switch	
ABS exhaust brake cut relay		Rheostat	
ABS warning light relay		Set/resume switch	
Fuel cut dummy relay		Air horn switch	
Fuel cut relay		Economy running switch	
Engine ECU main relay		Multi indicator switch	
Engine ECU actuator power relay		Idle set knob	
Starter cut relay		Spare power source (Live)	Behind the instrument panel lower center cover
Vehicle control actuator power relay		Blower motor	

EL01_001_Mokuji ka.fm 4 ページ ２０１１年１０月３１日 月曜日 午後１２時０分

PARTS	INSTALLED	PARTS	INSTALLED
Door lock controller	Behind the instrument panel lower center cover	Power window motor (Passenger seat (If so equipped)	Door
Heater and cooler unit			
Monitor module (HYDRO MAX brake)		Door lock motor	
Water level warning relay		Dome light LH	Roof inside
Courtesy switch front LH	Cab rear pillar	Dome light RH	
Courtesy switch front RH		Back mirror light (If so equipped)	Back mirror
Air conditioner switch	Instrument panel	Heater back mirror LH (If so equipped)	
Blower switch			
Cigarette lighter		Heater back mirror RH (If so equipped)	
Daytime running light diode			
Differential lock switch		Water temperature sender	Engine front side
Van light switch		Boost sensor	Engine left side
DPR manual regeneration switch		EGR valve	
Remote control mirror switch			
Pressure switch		Glow plug	
Radio/Audio unit		Injector 1	
Diagnosis connector	Pedal bracket	Injector 2	
DST-1 Connector		Injector 3	
Clutch interlock switch		Injector 4	
Exhaust clutch switch		Injector 5	
Stop light switch		Injector 6	
ABS Diagnosis switch	Steering support	PC sensor	
Accelerator sensor		Diesel throttle sensor	
Wiper motor	Front panel	Engine ECU	
Button selector or Lever selector (ALLISON 3000RDS)	ATM selector console	Intake manifold temperature sensor	
ATM mode switch (ALLISON 2200HS, 2200/2500RDS ATM)		Intercooler exit temperature sensor	
		EGR exit temperature sensor	
Button selector (EATON FO-6406B)		Starter	
		Suction control valve	
Parking brake switch	Parking brake lever	VNT controller	
Washer motor	Washer tank	Block heater (If so equipped)	
Power window motor (Driver seat) (If so equipped)	Door	Oil pressure switch	Engine right side
		VNT actuator	

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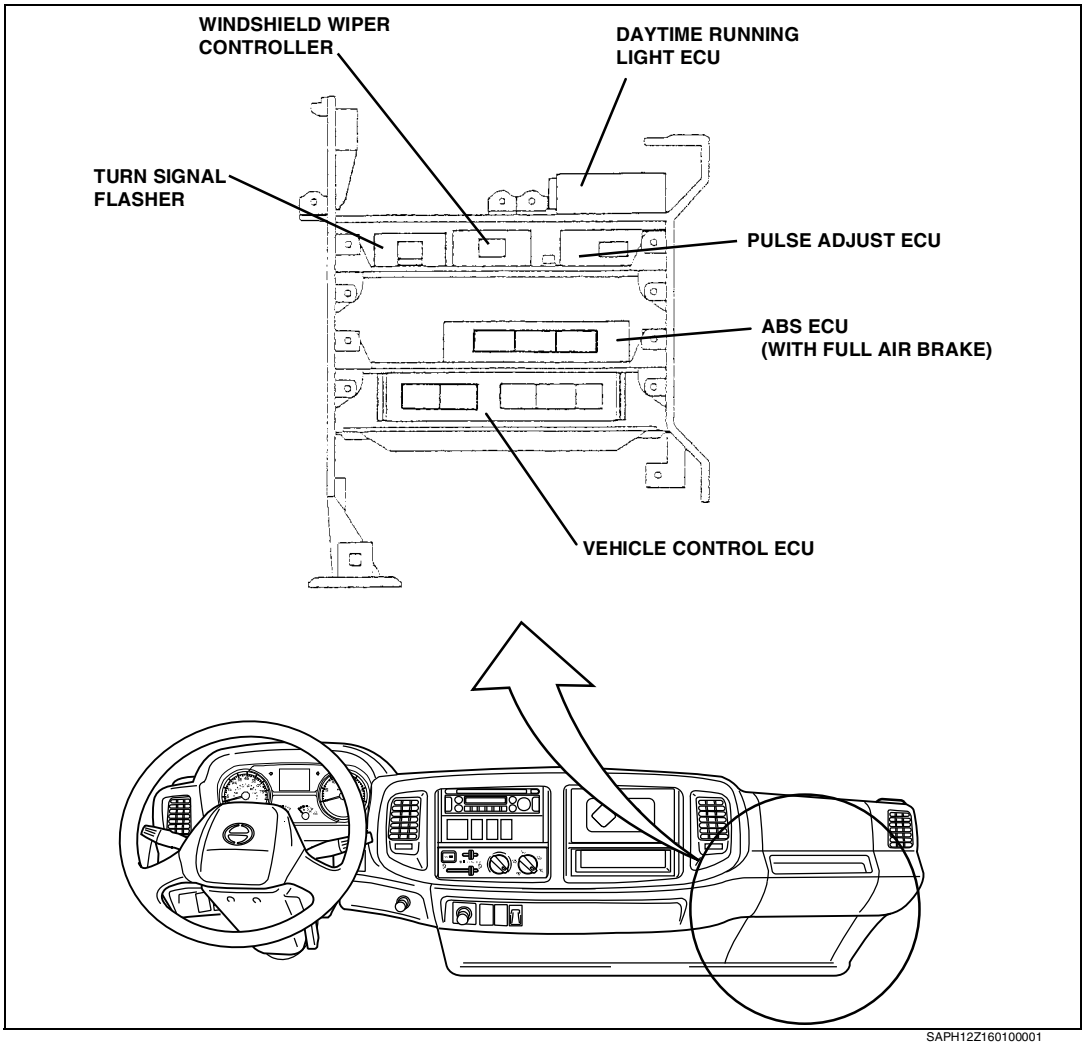
PARTS	INSTALLED	PARTS	INSTALLED
Cylinder angle sensor	Engine rear side	Air gauge sensor front (Full air brake)	Air tank
NE sensor		Air gauge sensor rear (Full air brake)	
Fuel temperature sensor	Engine left side		
Alternator	Engine right side	Low pressure switch No.1 (Full air brake)	
Air flow sensor	Air cleaner		
Intake air temperature sensor		Low pressure switch No.2 (Full air brake)	
Horn	Air cleaner bracket		
Coolant level switch	Radiator upper tank	Van light connector	Frame, inside of the side rail RH
Antenna	Roof outside		
Identification light center		ABS modulator (HYDRO-MAX brake)	Frame, inside of the side rail LH, at cab back
Identification light LH			
Identification light RH		Air dryer (Full air brake)	Frame, outside of the side rail LH, at cab back
Roof clearance light LH		Spare power source (Tail) 2	Frame, inside of the side rail RH, at the 3rd crossmember
Roof clearance light RH			
Front turn light LH	Hood	Modulator front LH (Full air brake)	Frame, outside of the side rail LH, at front axle
Front turn light RH		ABS sensor front LH (Full air brake)	
Head light LH		ABS sensor front LH (HYDRO-MAX brake)	
Head light RH			
Side turn light LH		Back-up buzzer	Frame, inside of the side rail RH
Side turn light RH			
Back-up light switch (EATON MTM)	Manual transmission	Engine speed sensor (ALLISON 2200HS, 2200/2500RDS ATM)	2200HS, 2200/ 2500RDS ATM
Neutral switch (EATON MTM)			
Speed sensor (EATON MTM)		Main transmission (ALLISON 2200HS, 2200/2500RDS ATM)	
ALLISON 2200HS, 2200/2500RDS ATM ECU	Frame, No.3 crossmember		
Fuel filter lever sensor (If so equipped)	Fuel filter, outside of the frame side rail LH at cab back	Neutral start backup (ALLISON 2200HS, 2200/2500RDS ATM)	
Fuel filter heater sensor		Output speed sensor (ALLISON 2200HS, 2200/2500RDS ATM)	
Fuel sender	Fuel tank	Turbine speed sensor (ALLISON 2200HS, 2200/2500RDS ATM)	
		ALLISON ATM ECU	Frame, No.3 crossmember

S1-UNAE09A-2.book 6 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

PARTS	INSTALLED	PARTS	INSTALLED
Engine speed sensor (ALLISON 3000RDS ATM)	3000RDS ATM	Connector, block heater power source	Upper side of the battery box
		Spring brake switch (Full air brake)	SR7 valve at rear of chassis
Output speed sensor (ALLISON 3000RDS ATM)		Buzzer off switch (Full air brake)	
Transmission main (ALLISON 3000RDS ATM)		Differential lock magnetic valve	Chassis
		Air suspension dump magnetic valve	
Speed sensor (EATON AMT)	ULTRASHIFT FO-5506B-DM3, FO-6406B-DM3 AMT		
Back-up light switch (EATON AMT)		Dosing control unit	Muffler unit
Transmission ECU (EATON AMT)		DEF injector	
Differential switch	HYDRO-MAX unit, pedal bracket outside	DEF pump	
Flow switch		Burner control unit	
Motor pump (HYDRO-MAX brake)		Atomization module	
Motor relay (HYDRO-MAX brake)		Igniter	
Rear combination light LH	Frame, outside of the side rail LH rear end	Fuel pump	
Modulator rear LH (Full air brake)	Frame, outside of the side rail LH, at rear axle	DEF level sensor	
ABS sensor rear LH (Full air brake)		Coolant cut off valve	
ABS sensor rear LH (HYDRO-MAX brake)		Air pressure sensor	
		Temperature sensor	
Modulator front RH (Full air brake)	Frame, outside of the side rail RH, at rear axle	NOx sensor	
ABS sensor front RH (Full air brake)		Combination air valve	
ABS sensor front RH (HYDRO-MAX brake)			
Rear combination light RH	Frame, outside of the side rail RH rear end		
Modulator rear RH (Full air brake)	Frame, outside of the side rail RH, at rear axle		
ABS sensor rear RH (Full air brake)			
ABS sensor rear RH (HYDRO-MAX brake)			

S1-UNAE09A-2.book 7 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

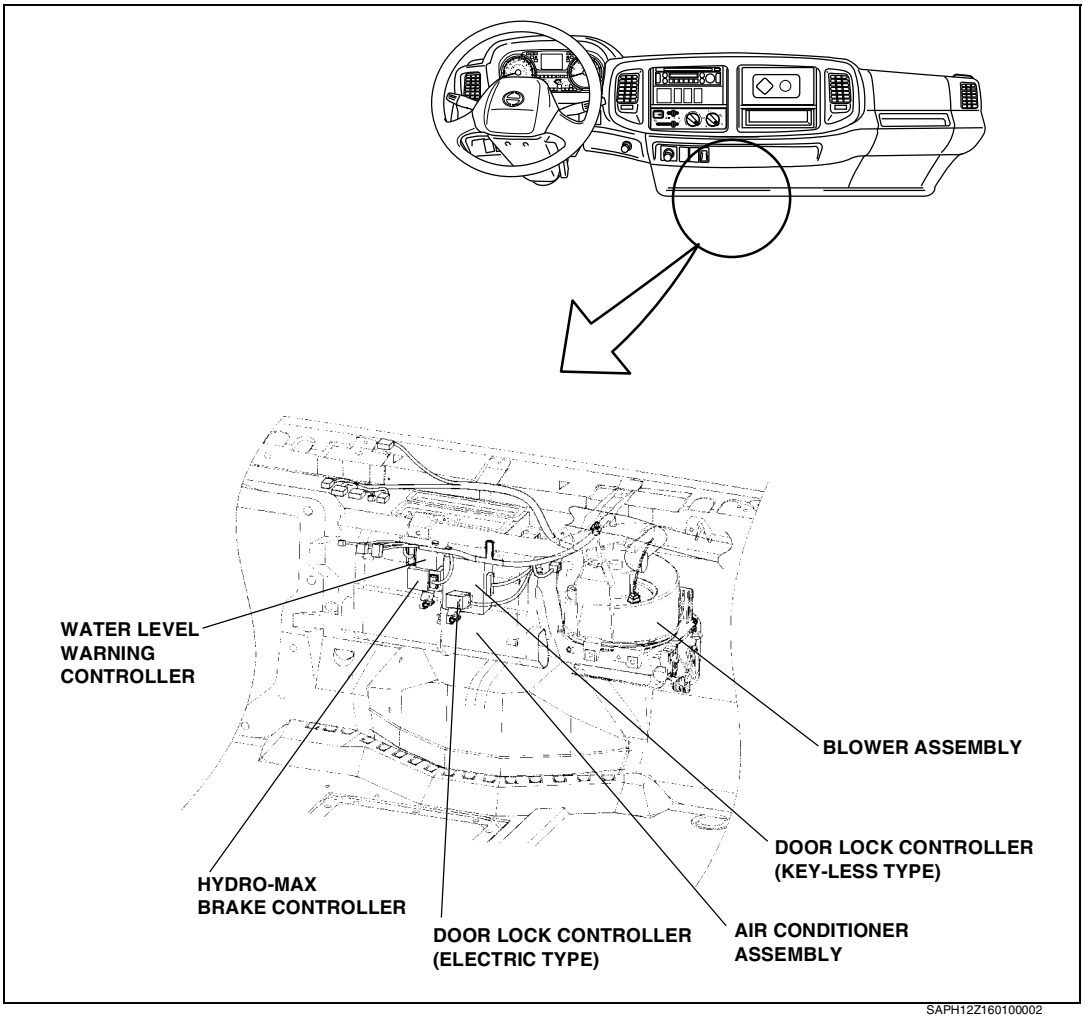
ECU RACK



SAPH12Z160100001

S1-UNAE09A-2.book 8 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

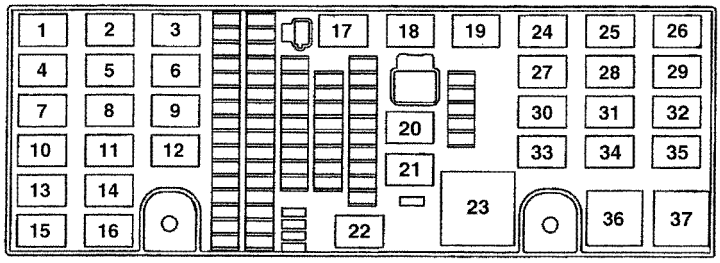
INSTRUMENT PANEL LOWER CENTER



SAPH12Z160100002

S1-UNAE09A-2.book 9 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

RELAY PANEL

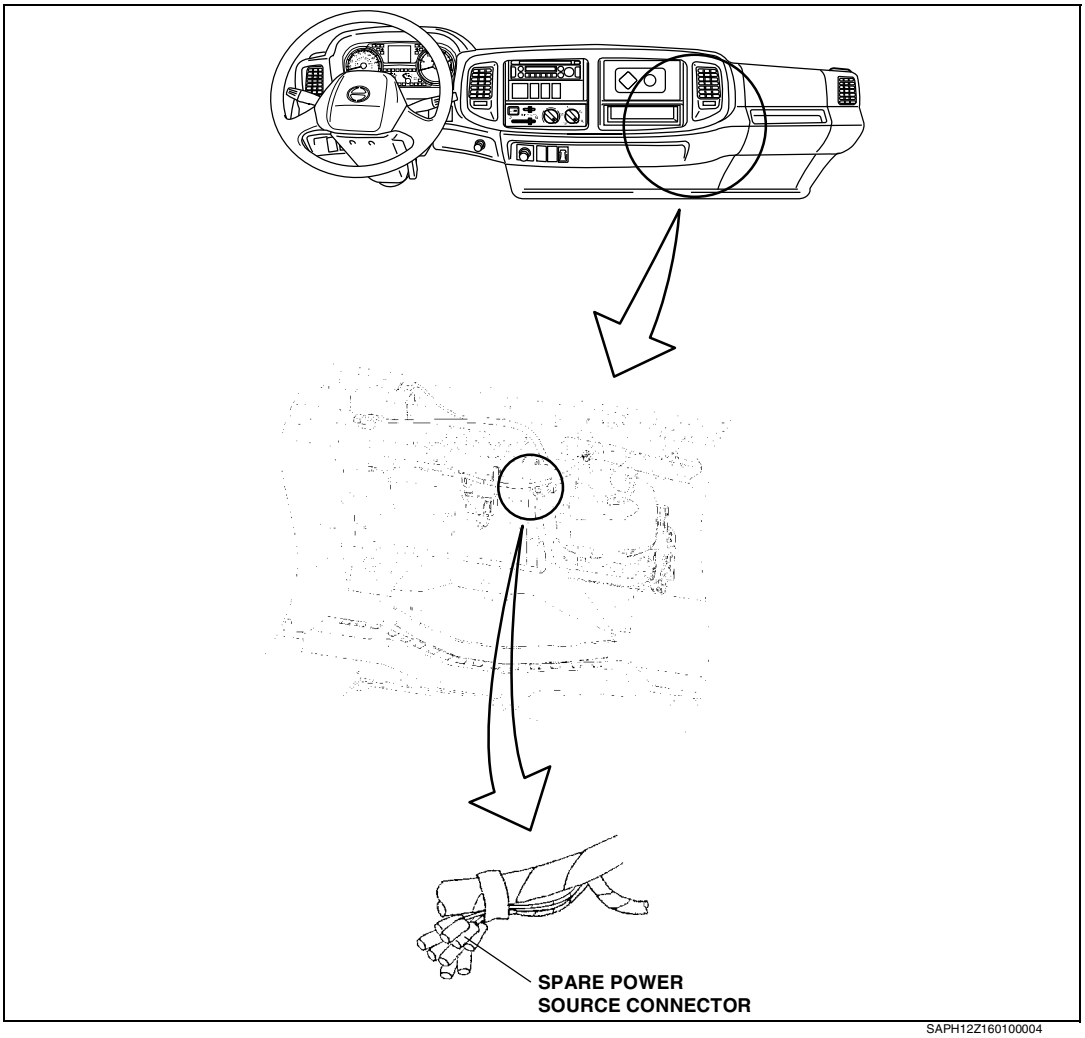


SAPH12Z160100003

1	Daytime running light relay	16	ATM (Allison) starter relay
2	Head light dimmer relay	17	Power relay No.1
3	Head light main relay	19	Power relay No.2
4	Air suspension dump relay1	20	Tail light relay No.1
5	Air horn relay	21	Tail light relay No.2
6	Horn relay	24	Power relay No.3
7	Air suspension dump relay2	25	Power accessory relay
8	Air conditioner relay	26	Power relay No.4
9	Heater relay (Air conditioner)	28	Fuel cut dummy relay
10	ABS exhaust brake cut relay	29	Fuel cut relay
11	ABS warning light relay (with HYDRO-MAX brake E version)	31	Starter cut relay
13	Parking indicator off relay	32	Vehicle control actuator power relay
14	Mirror heater relay (If so equipped)	33	Engine ECU main relay
15	Parking buzzer off relay	34	Engine ECU actuator power relay

S1-UNAE09A-2.book 10 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

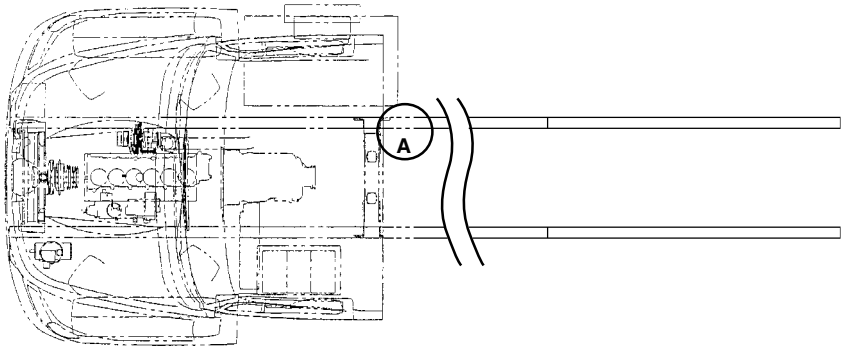
POSITION OF THE POWER SUPPLY TERMINAL FOR EXTRA EQUIPMENT (CAB SIDE)



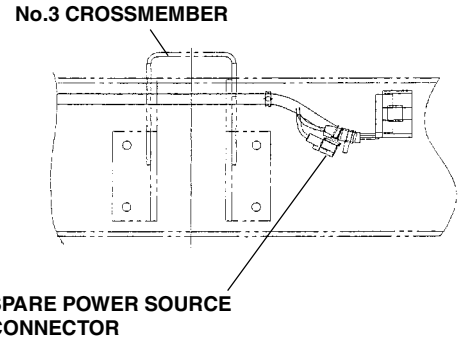
SAPH12Z160100004

S1-UNAE09A-2.book 11 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

POSITION OF THE POWER SUPPLY TERMINALS FOR EXTRA EQUIPMENT (CHASSIS SIDE)



DETAIL A



SAPH12Z160100005

S1-UNAE09A-2.book 12 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

TROUBLESHOOTING

EN12Z1601F300001

STARTING SYSTEM

Symptom	Possible cause	Remedy/Prevention
Engine does not operate (Starter switch)	Poor contact condition	Clean or replace contacts.
Engine does not operate (Battery)	Open circuit in harness	Check and correct.
	Short circuit between electrodes	Replace battery.
	Poor contact condition of battery terminal	Clean or retighten.
Engine does not operate (Engine oil)	Improper viscosity oil	Change oil.
Engine does not operate (Starter relay)	Defective or poor contact of starter relay	Repair or replace.
Engine does not operate (Starter)	Starter does not operate	Repair or replace. Refer to chapter "**STARTER**".

HEAD LIGHT CIRCUIT

Symptom	Possible cause	Remedy/Prevention
Head light does not turn on (Head light)	Bulb burned out	Replace bulb.
	Not grounded	Check the grounding.
	Broken wire	Repair wire.
Head light does not turn on (Fuse)	Fuse burned out	Replace fuse.
Head light does not turn on (Head light relay)	Defective relay	Replace relay.
Head light does not turn on (Lighting switch)	Broken wire between relay and switch	Repair wire.
	Defective switch	Replace switch.

TURN SIGNAL CIRCUIT

Symptom	Possible cause	Remedy/Prevention
Turn signal does not work (Turn signal light)	Bulb burned out	Replace bulb.
	Not grounded	Check the grounding.
	Broken wire	Repair wire.
Turn signal does not work (Fuse)	Fuse burned out	Replace fuse.
Turn signal does not work (Turn signal flasher)	Not grounded	Check the grounding.
	Defective flasher	Replace flasher.
Turn signal does not work (Turn signal switch)	Broken wire between fuse and switch	Repair wire.
	Defective switch	Replace switch.

S1-UNAE09A-2.book 13 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

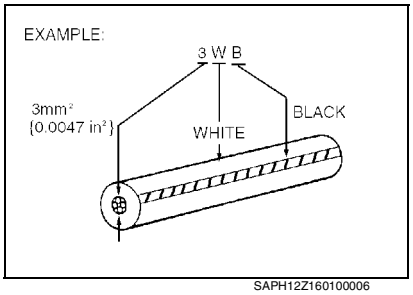
TAIL AND LICENSE PLATE LIGHT CIRCUIT

Symptom	Possible cause	Remedy/Prevention
Tail and license plate light does not turn on (Light)	Bulb burned out	Replace bulb.
	Not grounded	Check the grounding.
	Broken wire	Repair wire.
Tail and license plate light does not turn on (Fuse)	Fuse burned out	Replace fuse.
Tail and license plate light does not turn on (Tail light relay)	Defective relay	Replace relay
Tail and license plate light does not turn on (Lighting switch)	Broken wire between fuse and switch	Replace wire.
	Defective switch	Replace switch.

GENERAL INSTRUCTION

EN12Z1601C100001

⚠ CAUTION
Be sure to disconnect the ground cable before servicing the electrical circuits except for testing on-vehicle.



SAPH12Z160100006

1. WIRING CODE

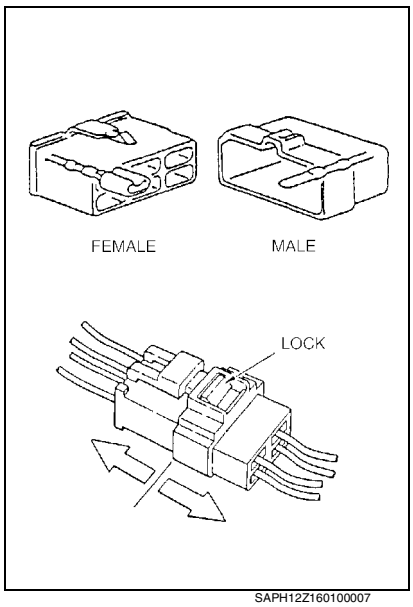
(1) Wiring colors are indicated by a code.

B	: Black	LG	: Light green
BR	: Brown	O	: Orange
DG	: Dark gray	R	: Red
G	: Green	V	: Violet
GR	: Gray	W	: White
L	: Blue	Y	: Yellow
P	: Pink		

(2) The first letter indicates the ground wire color and second letter indicated the strip color.

(3) Arabic numerals indicates the cross sectional area of wire.
Example: 3 indicates 3 mm^2 {0.0047 in^2}

S1-UNAE09A-2.book 14 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



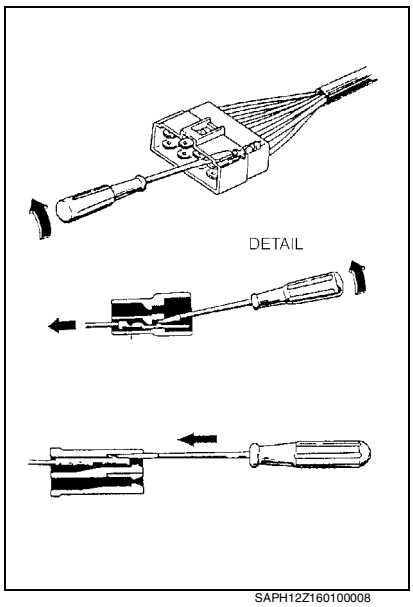
SAPH12Z160100007

2. CONNECTOR

(1) The connector consists of the male and female connectors.
Male and female connectors are classified according to the shape of the terminals in the connector.
Male and female connectors are provided with a lock, so that they can not be separated easily.
To separate the connectors, unlock the lock, then hold one connector with one hand and the other one with the other hand, and pull each other.

NOTICE

When the connector is disconnected by pulling the wires, the connection between the terminals and the wires will be damaged.

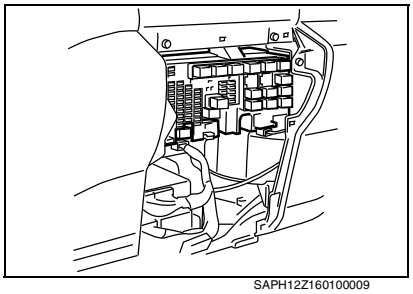


SAPH12Z160100008

(2) Removing the terminal from the connector.
a. Insert a miniature screwdriver or a terminal puller between terminal and connector, and unlock the lock between terminal and connector.
b. When the lock has been released, pull the wire to remove the terminal.

(3) Installing the terminal in the connector.
a. Insert the terminal into the connector until it clicks.
b. Pull the wire to confirm correct lock engagement

S1-UNAE09A-2.book 15 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



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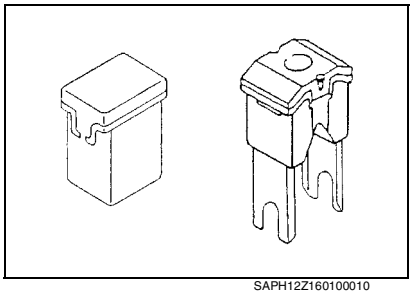
3. FUSE

(1) The power supply must be switched off for fuse replacement.
Use a proper amperage fuse.

NOTICE

Wire burning may be caused when a fuse with an excessively large current capacity is used.

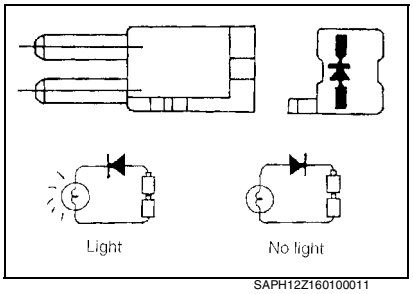
If the fuse should blow frequently, investigate the cause and correct it.



SAPH12Z160100010

4. FUSIBLE LINK

(1) The cause of an overload current should be determined and corrected before a melted fusible link is replaced.
A melted fusible link can be determined by swollen or melted insulation of the link.

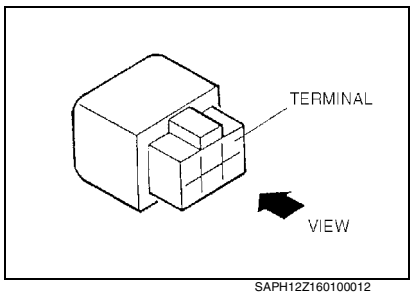


SAPH12Z160100011

5. DIODE

(1) Diode allows the flow of electric current in only one direction.

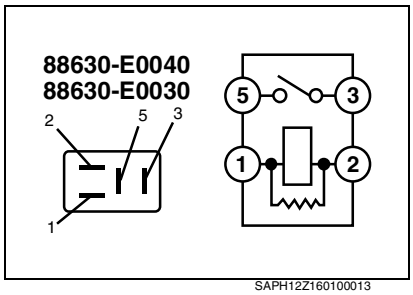
S1-UNAE09A-2.book 16 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



SAPH12Z160100012

RELAY (TYPE, NAME AND INSPECTION)

TYPE-1:	Tail light relay No.1
	Tail light relay No.2
	Power accessory relay
	Power relay No.1
	Power relay No.2
	Power relay No.3
	Power relay No.4
	AT and AMT starter relay
	Head light main relay
	Head light dimmer relay
	Daytime running light relay
	Mirror heater relay
	Air horn relay
	Horn relay
	Heater relay
	Engine ECU main relay
	Engine ECU actuator power relay
	ATM back light relay
	Air suspension dump relay
TYPE-2:	Air conditioner relay
	Vehicle control actuator power relay
TYPE-3:	Fuel heater relay (Power accessory relay No.2)
TYPE-4:	Starter relay
TYPE-5:	Stop light relay
TYPE-6:	ABS exhaust brake cut relay
	ABS warning light relay
	Parking indicator off relay
	Parking buzzer off relay
	Fuel cut dummy relay
	Fuel cut relay
	Starter cut relay



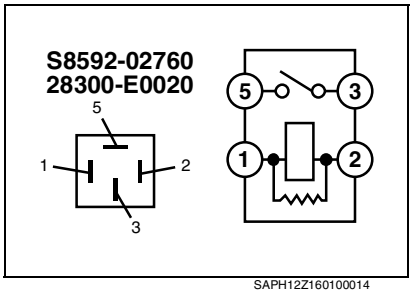
SAPH12Z160100013

1. TYPE-1 AND TYPE-2 INSPECTION

(1) Apply voltage to terminals;
12V to terminal 1,
Ground to terminal 2.

(2) Under normal condition, terminals 3 and 5 switch on.

S1-UNAE09A-2.book 17 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

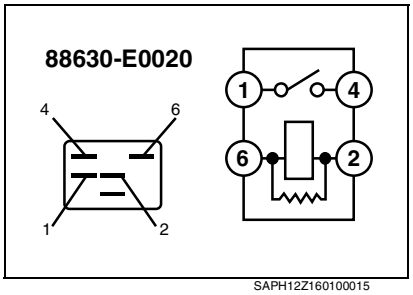


SAPH12Z160100014

2. TYPE-3 AND TYPE-4 INSPECTION

(1) Apply voltage to terminals;
12V to terminal 1,
Ground to terminal 2.

(2) Under normal condition, terminals 3 and 5 switch on.

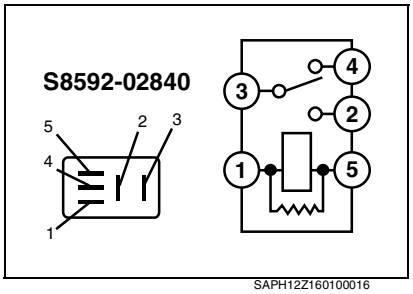


SAPH12Z160100015

3. TYPE-5 INSPECTION

(1) Apply voltage to terminals;
12V to terminal 6,
Ground to terminal 2.

(2) Under normal condition, terminals 1 and 4 switch on.



SAPH12Z160100016

4. TYPE-6 INSPECTION

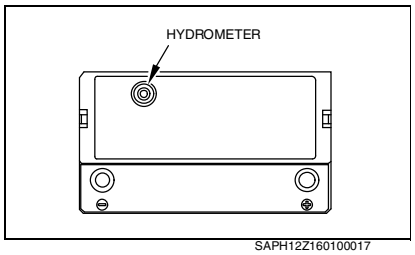
(1) Apply voltage to terminals;
12V to terminal 1,
Ground to terminal 5.

(2) Under normal condition, relay switches the continuity from terminals 3 and 4 to 3 and 2.

S1-UNAE09A-2.book 18 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

HANDLING PRECAUTION

EN12Z1601C100002



SAPH12Z160100017

BATTERY

⚠ WARNING

- **Since the batteries produce explosive hydrogen gas, do not allow any open or electric sparks near the batteries.**
- **The batteries produce explosive gas and contain corrosive sulfuric acid. A battery explosion, contact with electrolyte, or an electrical short can result in personal injury and/or property damage.**
- **Always shield your eyes or wear safety goggles when working on the batteries. Do not let electrolyte, which is sulfuric acid, come in contact with eyes, skin, or clothing. Since electrolyte is corrosive acid, it can damage skin and clothing. If acid should contact your skin, eyes or clothing, immediately flush the contact area thoroughly with water and get medical treatment immediately.**
- **When working on the batteries, be sure to remove any metal accessories from your arms. Do not lean over the batteries.**
- **This vehicle has a 12-volt, negative grounds system. Make sure that any other vehicle used for jump starting also has a 12-volt, negative ground system. Do not attempt to jump start when you are not sure of the voltage or ground of the other vehicle.**

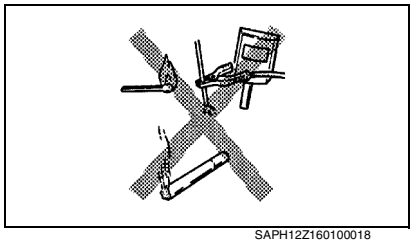
1. MAINTENANCE-FREE BATTERY

(1) The hydrometer on the top of the battery provides a guide regarding condition of the change and the electrolyte level.
(2) Check the battery condition by the hydrometer color.

a. Good condition
Green eye (EXIDE battery):

b. Charging necessary
Black eye.

NOTICE
Do not refill the battery with water.


SAPH12Z160100018

2. BATTERY CHARGING

NOTICE
If the electrolyte level is below the specified level, replace the battery. If it is within the specified level, the battery can be recharged.

- Be careful of the following points.

(1) While the battery is being charged, ensure that the temperature of the electrolyte does not rise above 45°C {113°F}.
(2) While the battery is being charged, be particularly careful to keep it away from sources of fire.
(3) The amount of electrolyte must be within the specified level.

3. CLEANING THE BATTERY

- If the terminals at the top of the battery are dirty, clean them with cold water or lukewarm water.
- Apply a light coating of grease to the terminals to prevent them from rusting so as to prevent faulty contact.

S1-UNAE09A-2.book 19 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

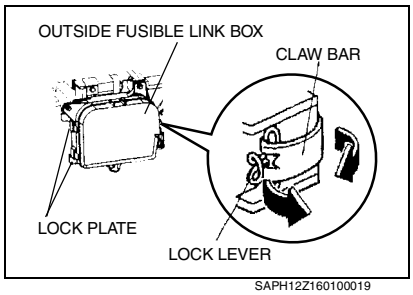
4. CONNECTING THE BATTERY CABLES

- Tighten the cables securely to prevent improper contact between the cables and the battery terminals.
- Be very careful not to connect the (+) and (-) leads in reverse. (Because this may cause damage to the equipment and batteries)

S1-UNAE09A-2.book 20 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

INSPECTION

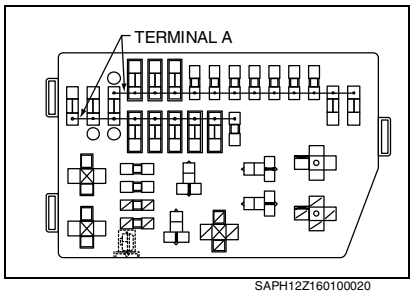
EN12Z1601H300001



SAPH12Z160100019

REMOVAL PROCEDURE FOR OUTSIDE FUSIBLE LINK BOX

1. **Push the lock lever and disconnect the claw bar. (2 portions)**
2. **Remove the box cover while lifting two lock plate.**



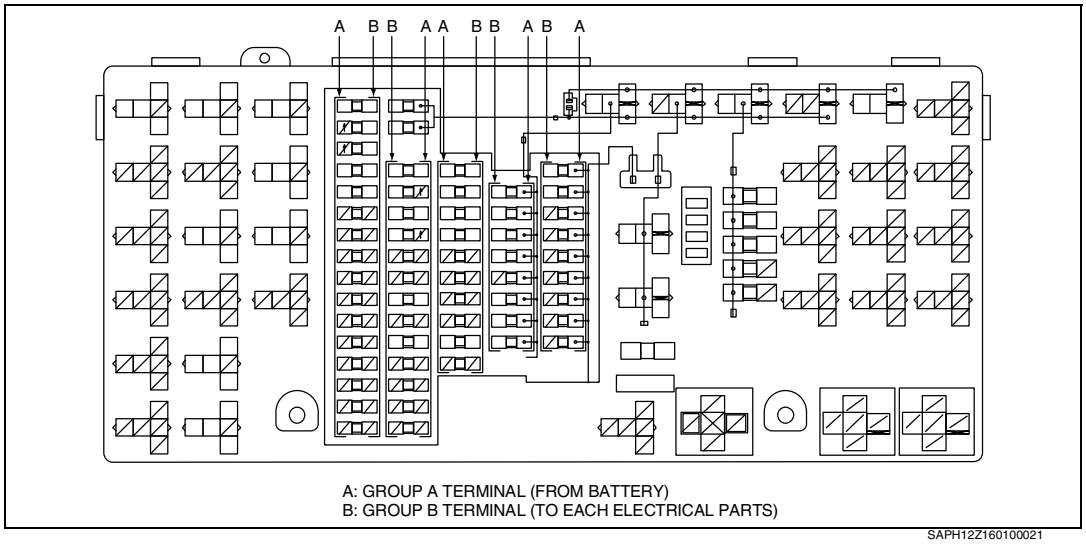
SAPH12Z160100020

POWER SUPPLY CIRCUIT

1. FUSIBLE LINK BLOCK INSPECTION

(1) Check the voltage between fusible link block terminal A and chassis body ground.
(2) Under normal condition, the voltage is about 12V.
(3) If it is not correct, check the battery cable, wiring harness, etc.

- Battery cable (Open circuit, loosen connection, etc.)
- Wiring harness (Open circuit, etc.)
- Battery (Discharged)



A: GROUP A TERMINAL (FROM BATTERY)
B: GROUP B TERMINAL (TO EACH ELECTRICAL PARTS)

SAPH12Z160100021

S1-UNAE09A-2.book 21 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

2. FUSE BLOCK INSPECTION

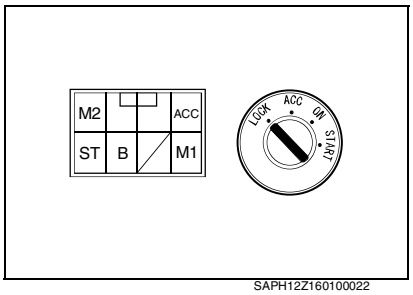
(1) Check the voltage between group A terminals of fuse block and cab body ground.
(2) Under normal condition, the voltage is about 12V.
(3) If it is not correct, check the circuit from battery to fuse.

- Coupler connection between cab harness and chassis harness
- Coupler connection of each electrical parts
- Cab harness and chassis harness
  (Open circuit, against short, etc.)
- Fusible link burn out

ENGINE STARTING CIRCUIT

1. STARTER SWITCH INSPECTION

(1) Check the continuity between terminals.



SAPH12Z160100022

Terminals / Switch position	B	ACC	M2	M1	ST
LOCK					
ACC	○—○				
ON	○—○	○—○	○—○		
ST	○—	—	○—	○—	○

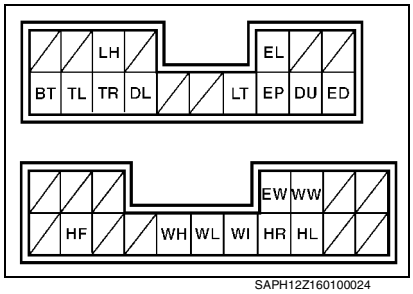
SAPH12Z160100023

2. STARTER RELAY INSPECTION

Refer to page EL01-16.

S1-UNAE09A-2.book 22 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

HEAD LIGHT CIRCUIT



SAPH12Z160100024

1. COMBINATION SWITCH INSPECTION

(1) Check the continuity between terminals.

Lighting (ON, OFF):

Switch position \ Terminals	EL	LT	LH
OFF			
TAIL	○	○	
TAIL AND HEAD	○	○	○

Lighting (HIGH, LOW):

Switch position \ Terminals	ED	DL	DU	EP
PASSING	○	○	○	○
LOW BEAM	○	○		
HIGH BEAM	○		○	

Turn signal:

Switch position \ Terminals	BT	TL	TR
LEFT	○	○	
OFF			
RIGHT	○		○

Hazard warning:

Switch position \ Terminals	HF	HL	HR	HT
OFF				
ON	○	○	○	○

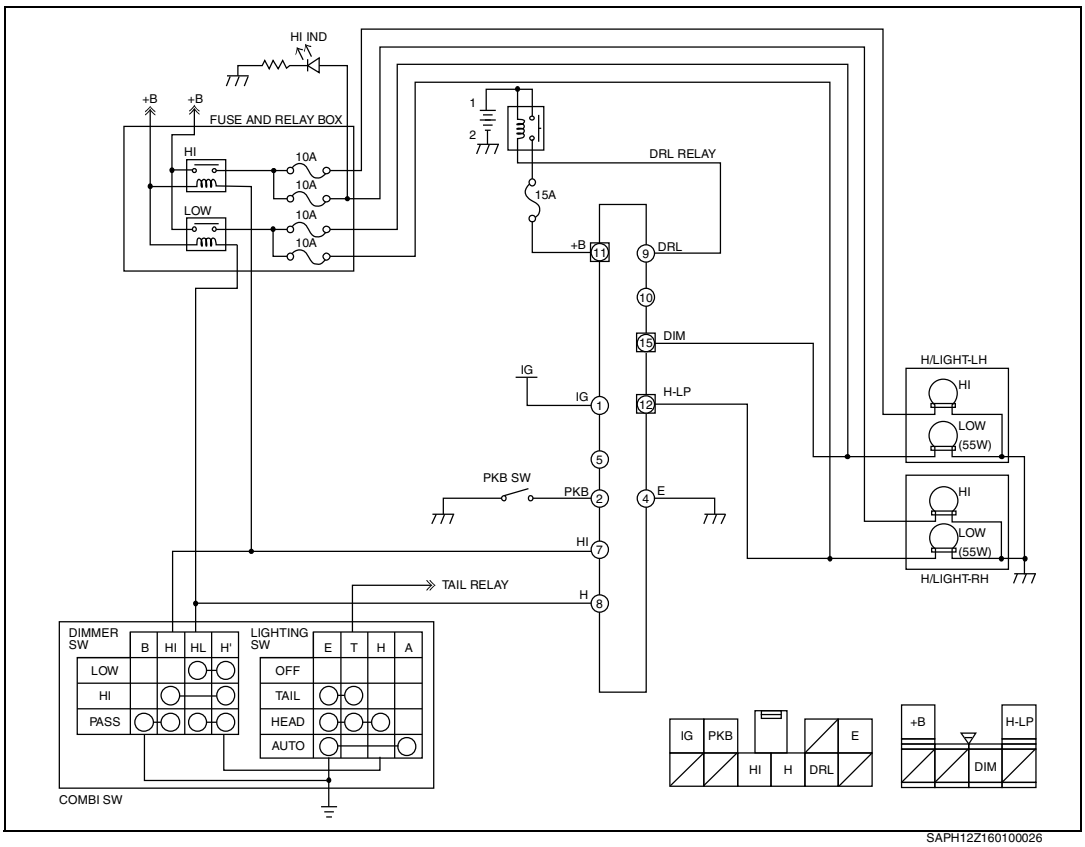
Windshield wiper and washer:

Switch position \ Terminals	WW	EW	WI	WL	WH
OFF					
WIPER: INT		○	○		
LOW		○		○	
HIGH		○		○	○
WASHER: ON	○	○			

SAPH12Z160100025

EL01_001_Mokuji ka.fm 23 ページ ２０１１年１０月３１日 月曜日 午後１２時１分

2. HEAD LIGHT RELAY INSPECTION
Refer to page EL01-16.



SAPH12Z160100026

S1-UNAE09A-2.book 24 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

3. DAYTIME RUNNING LIGHT ECU INSPECTION

(1) Wire the daytime running light ECU, bulbs, battery and others as shown in figure (See page EL01-22).

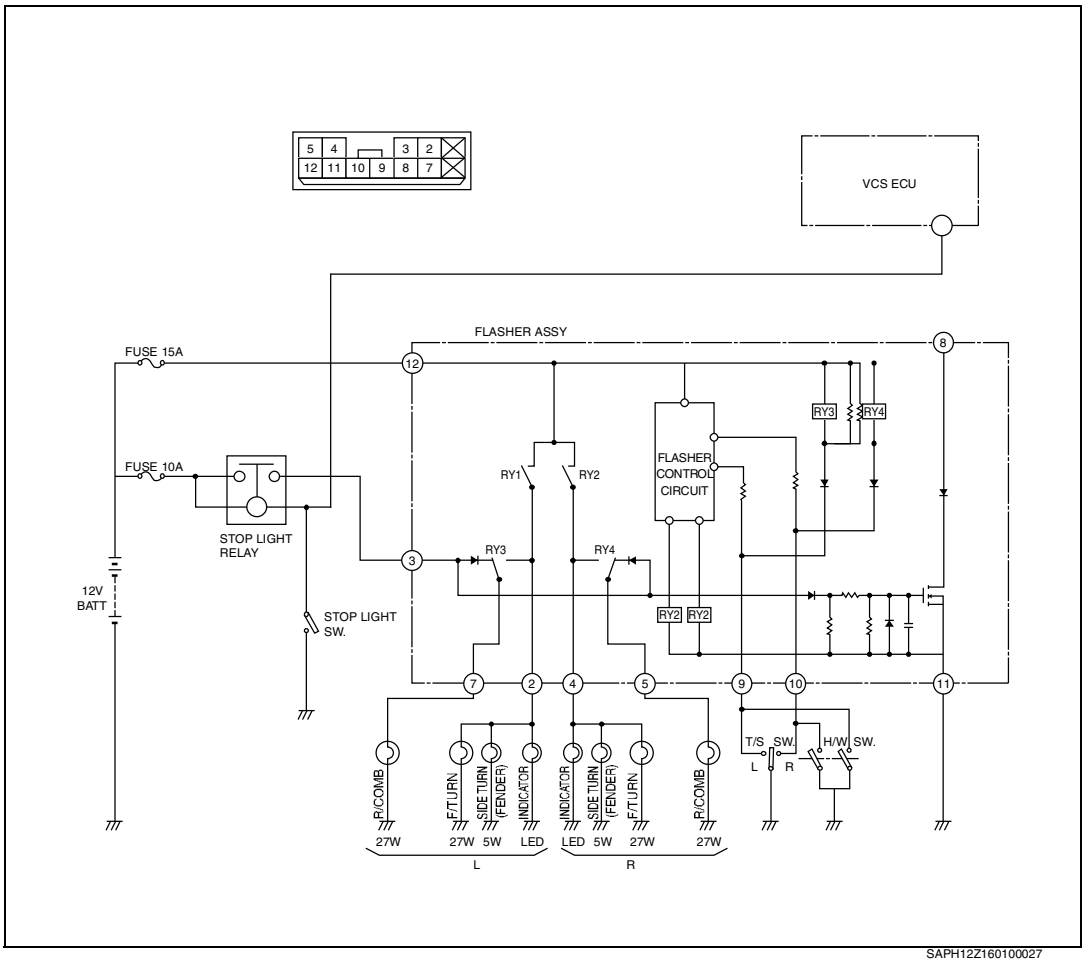
(2) Check operation of daytime running light ECU.

	Engine stopping					
Lighting switch position	**OFF or Tail**			**Head light**		
Dimmer switch position	**Low**	**High**	**Passing**	**Low**	**High**	**Passing**
Headlight low beam	**Off**	**Off**	**Off**	**On**	**Off**	**On**
Headlight high beam	**Off**	**Off**	**On**	**Off**	**On**	**On**

		Engine running					
Lighting switch position		**OFF or Tail**			**Head light**		
Dimmer switch position		**Low**	**High**	**Passing**	**Low**	**High**	**Passing**
Headlight low beam	**Parking brake off**	**Dim on**	**Dim on**	**Off**	**On**	**Off**	**On**
	Parking brake pull	**Off**	**Off**				
Headlight high beam		**Off**	**Off**	**On**	**Off**	**On**	**On**

S1-UNAE09A-2.book 25 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

TURN SIGNAL, HAZARD, STOP CLEARANCE, TAIL AND LICENSE PLATE LIGHT CIRCUIT



SAPH12Z160100027

1. TURN SIGNAL FLASHER INSPECTION

(1) Wire the turn signal flasher, bulbs, battery and fuse as shown in figure.

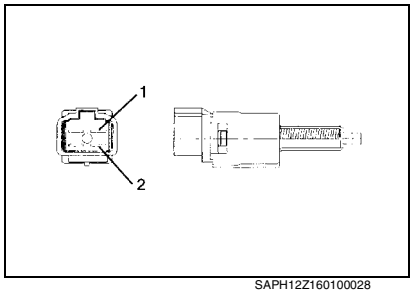
(2) Under normal condition, bulbs turn on and off.

NOTICE

Take care of quantity when installing bulbs.

TURN SIGNAL:	**27W x 2 pcs, 5W x 1 pcs, LED x 1pcs**
HAZARD WARNING:	**27W x 4 pcs, 5W x 2 pcs, LED x 2 pcs**

S1-UNAE09A-2.book 26 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



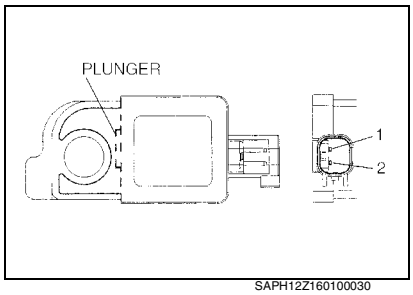
SAPH12Z160100028

2. STOP LIGHT SWITCH INSPECTION (MODEL: NJ8J, NV8J)

(1) Check the continuity between terminals.

Terminals / Switch position	1	2
PUSH		
FREE	O	O

SAPH12Z160100029

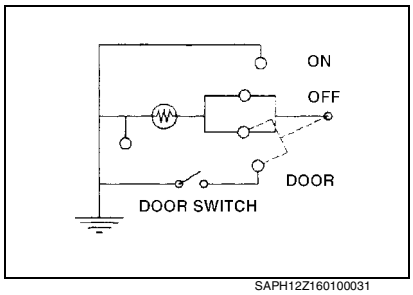


SAPH12Z160100030

3. STOP LIGHT SWITCH INSPECTION (EXCEPT FOR NJ8J, NV8J)

(1) Check the continuity between terminals
Push the plunger: continuity

DOME LIGHT

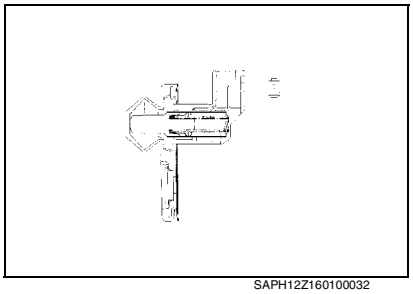


SAPH12Z160100031

1. DOME LIGHT INSPECTION

(1) Apply voltage to terminals and check the bulbs lighting.

S1-UNAE09A-2.book 27 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



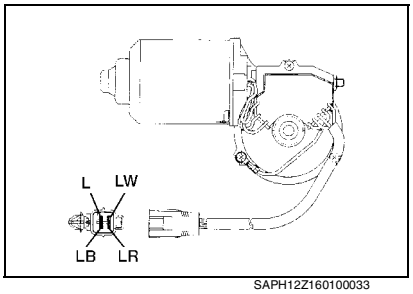
SAPH12Z160100032

2. COURTESY SWITCH INSPECTION

(1) Check the continuity between terminal and body ground.

	Between terminals
PUSH	No continuity
FREE	Continuity

WINDSHIELD WIPER CIRCUIT



SAPH12Z160100033

1. WIPER MOTOR INSPECTION

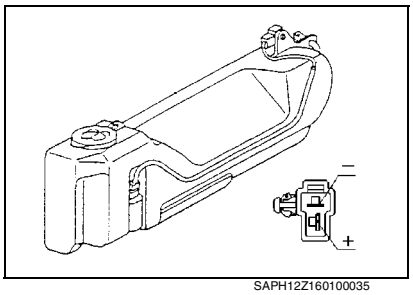
(1) Apply 12V to terminals, the motor should operate as below.

NOTICE

Connect terminal LW to a 10A fuse and 12V power source. Connect wiper motor body to negative terminal of power source. If the fuse burns out or the motor does not operate, replace the motor.

Terminals / Switch position	LW	LB	L	LR
OFF	○	○		
LOW	○		○	
HIGH			○	○

SAPH12Z160100034



SAPH12Z160100035

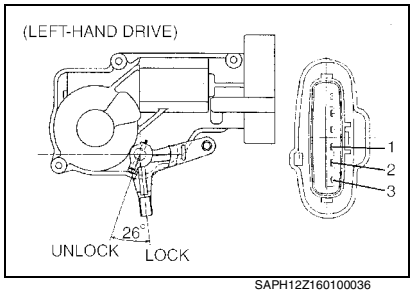
2. WASHER PUMP INSPECTION

(1) Check the continuity between terminals of the motor.
If no continuity, replace washer tank and pump assembly.

NOTICE

Do not apply voltage to the pump motor with an empty washer tank, or the motor will be damaged.

S1-UNAE09A-2.book 28 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



SAPH12Z160100036

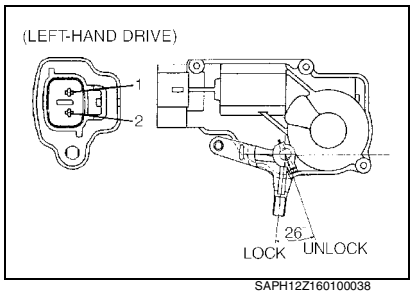
POWER DOOR LOCK CIRCUIT

1. DRIVER'S SIDE DOOR LOCK SWITCH INSPECTION

(1) Check the continuity between terminals. If there is no continuity, replace the switch.

Terminals / Lever position	1	2	3
LOCK	O		O
UNLOCK		O	O

SAPH12Z160100037



SAPH12Z160100038

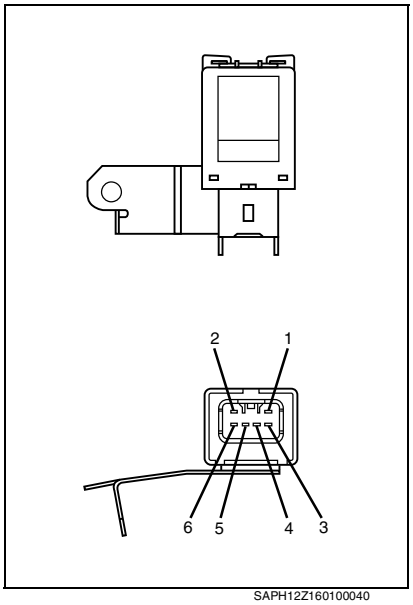
2. ASSISTANT'S SIDE AND REAR LEFT SIDE DOOR LOCK ACTUATOR INSPECTION

(1) Check the continuity between terminals. If there is no continuity, replace the actuator.

Terminals / Lever position	1	2
LOCK	+	−
UNLOCK	−	+

SAPH12Z160100039

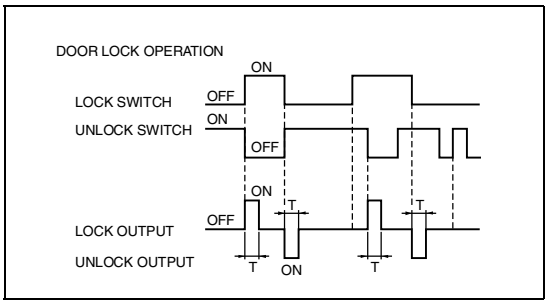
S1-UNAE09A-2.book 29 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

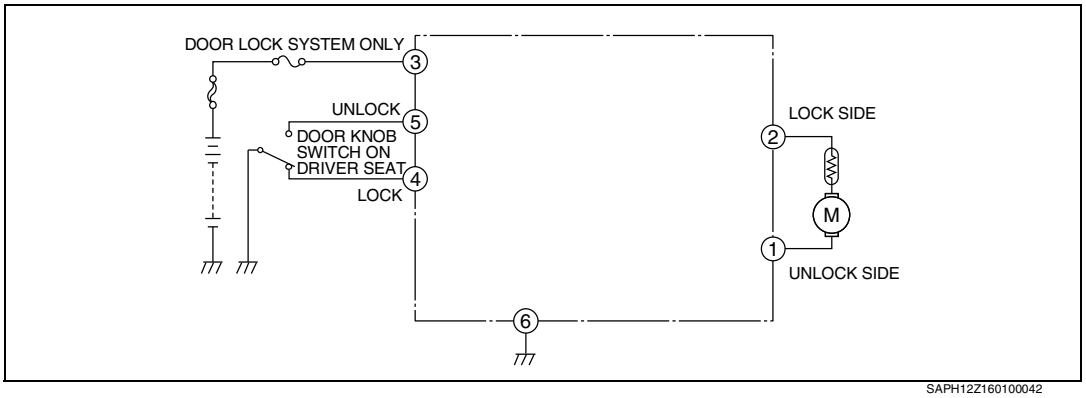


SAPH12Z160100040

3. DOOR LOCK CONTROLLER INSPECTION (ELECTRIC TYPE)

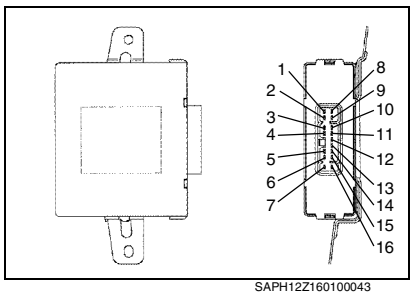
(1) Wire the door lock controller as shown in the figure.
(2) Check the function.





SAPH12Z160100042

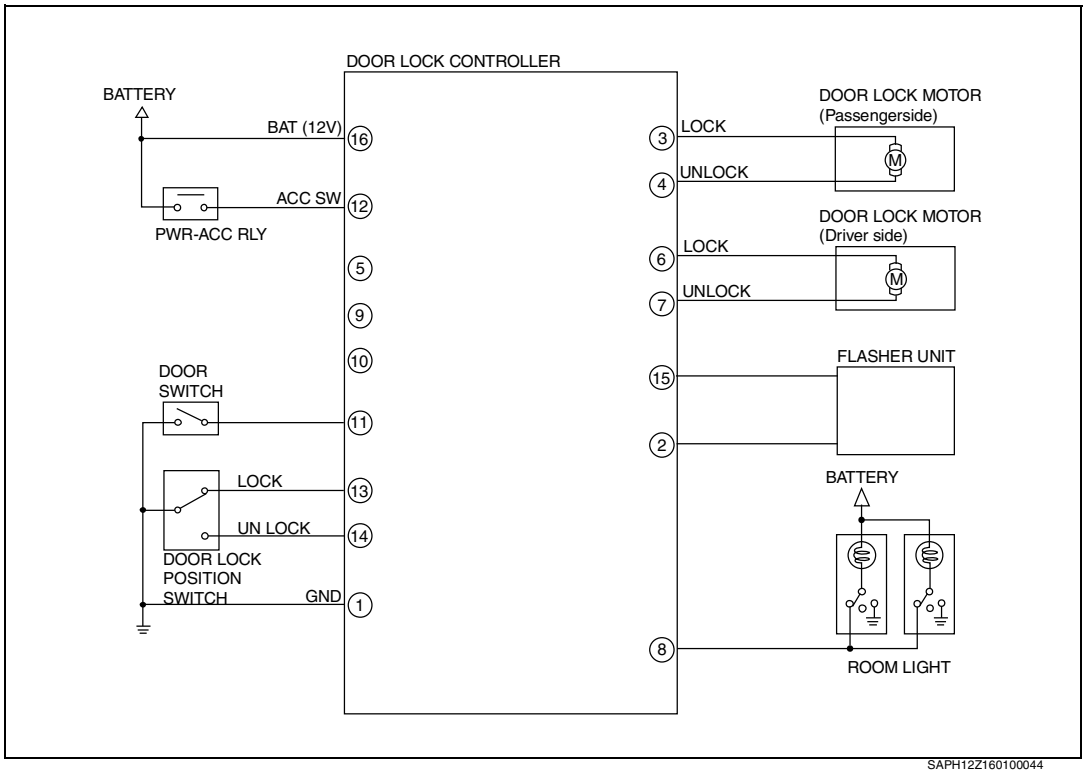
S1-UNAE09A-2.book 30 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



SAPH12Z160100043

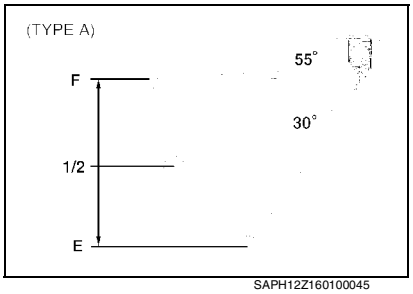
4. DOOR LOCK CONTROLLER INSPECTION (KEY-LESS TYPE)

(1) Wire the door lock controller as shown in the figure.



SAPH12Z160100044

S1-UNAE09A-2.book 31 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



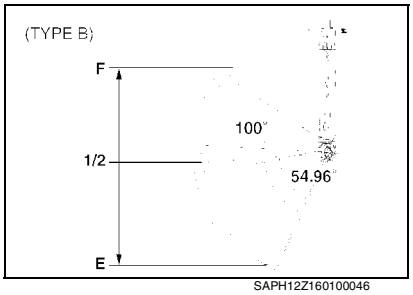
SAPH12Z160100045

GAUGE, METER AND WARNING CIRCUIT

1. FUEL GAUGE SENDER UNIT INSPECTION

(1) Measure resistance between terminals.

Float position	F	1/2	E
Resistance: Ω	0-1.2	29.5-32.5	146.5-153.5

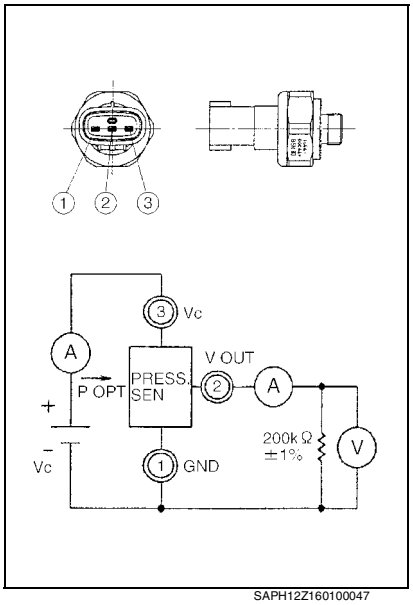


SAPH12Z160100046

2. COOLANT TEMPERATURE GAUGE SENDER UNIT INSPECTION

(1) Warm up the sender gauge and measure the resistance between the terminal and the body ground.

Temperature	20°C {68°F}	80°C {176°F}
Resistance:kΩ	2.32-2.59	0.310-0.326



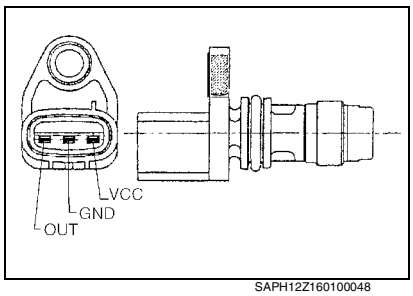
SAPH12Z160100047

3. AIR PRESSURE GAUGE SENSOR INSPECTION

(1) Wire the air pressure gauge sensor and voltmeter as shown in figure.
(2) Apply voltage terminal; 5 V to terminal 3
(3) Apply air pressure
(4) Check voltage between terminal 1 and 2

Air pressure	Voltage
0 MPa {0 kgf/cm^2, 0 lbf/in^2}	0.1 V
1.6 MPa {16.3 kgf/cm^2, 232 lbf/in^2}	0.9 V

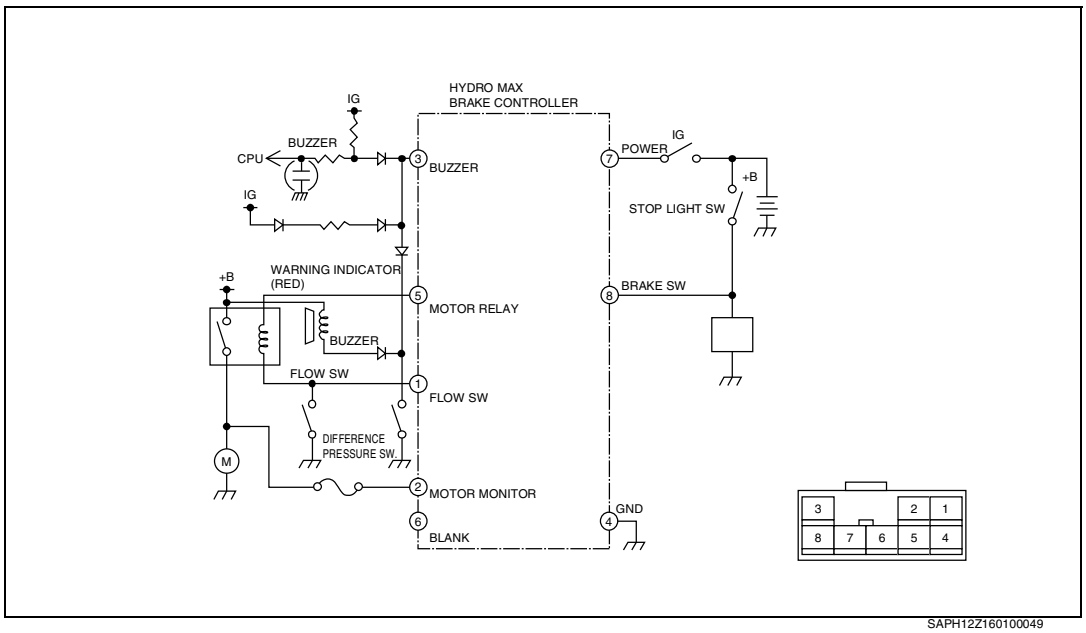
S1-UNAE09A-2.book 32 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



SAPH12Z160100048

4. REVOLUTION SENSOR INSPECTION

(1) Check the continuity between terminals.
If the revolution sensor is normal, there will be continuity between the terminals.



SAPH12Z160100049

5. HYDRO-MAX BRAKE CONTROLLER INSPECTION

(1) Wire the HYDRO-MAX brake controller, buzzer, motor relay and others as shown in figure.

(2) Check operation

a. When IG on, an alarm is carried out by motor monitor low voltage. If the motor monitor is low voltage after high voltage, warning stops.

b. An alarm is carried out by high voltage of motor monitor and IG on.

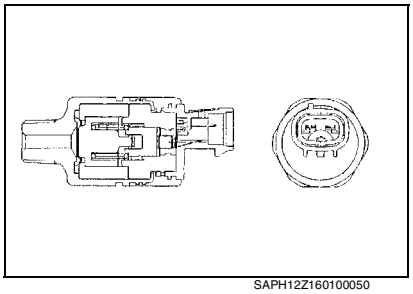
c. An alarm is carried out by opening of motor monitor circuit and IG on.

d. Electric power is supplied to the motor relay coil with IG on or brake switch on.

NOTICE

"IG on" means starter switch is turned on.

S1-UNAE09A-2.book 33 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



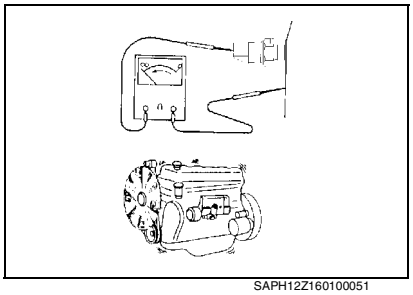
SAPH12Z160100050

6. AIR PRESSURE SWITCH INSPECTION (MODEL: NJ8J, NV8J)

(1) Apply air pressure.

(2) Check the continuity between terminals.

	Between terminals
Less than 490 kPa {5.0 kgf/cm^2 71 lbf/in^2}	Continuity
More than 490 kPa {5.0 kgf/cm^2 71 lbf/in^2}	No continuity



SAPH12Z160100051

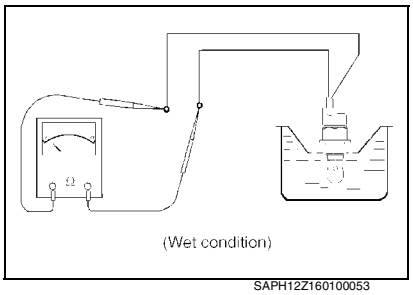
7. OIL PRESSURE SWITCH INSPECTION

(1) Start engine and disconnect the coupler.

(2) Check the continuity between terminal and engine ground.

	Terminal	Engine ground
Engine stop	O	O
Engine running		

SAPH12Z160100052



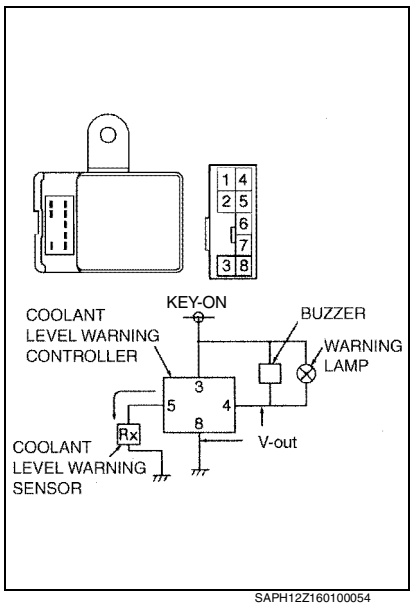
SAPH12Z160100053

8. CHECK THE OPERATION OF THE COOLANT LEVEL WARNING SENSOR.

(1) Using an ohmmeter, measure the resistance between the terminal and ground at the indicated coolant temperatures.
If resistance is not within specifications, replace the gauge unit.

	Resistance
Dry condition	Over 1MΩ
Wet condition	Under 10kΩ

S1-UNAE09A-2.book 34 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



SAPH12Z160100054

9. CHECK THE OPERATION OF THE COOLANT LEVEL WARNING CONTROLLER.

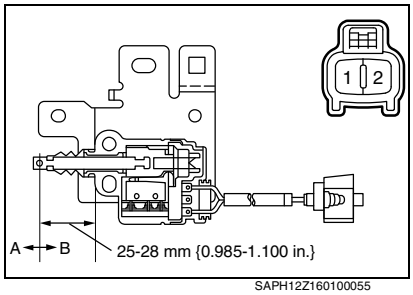
(1) When the resistance of the coolant level sensor indicates less than 10kΩ, the coolant level warning controller does not operate, and when it is more than 30kΩ, it is operational and the buzzer rings.

(2) When the voltage of the power is 12V and the temperature is 20°C — 5°C (68° — F41°F) the voltage and the resistance of sensor operates as follows, (Rx=The resistance of coolant level sensor)

- When Rx indicates infinity, Voltage (Vout) comes to less than 1.5V and the buzzer rings.
- When Rx indicates 0Ω, voltage (Vout) is nearly equal to the voltage of the power, the buzzer does not ring.

(3) When the connector of coolant level sensor is taken off, the warning light turn on.

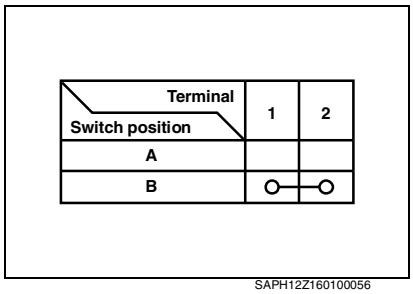
(4) When terminal No.5 is taken off and is connected to the ground, Rx indicates almost 0Ω.
Unless it is as noted above, replace the coolant level sensor.



SAPH12Z160100055

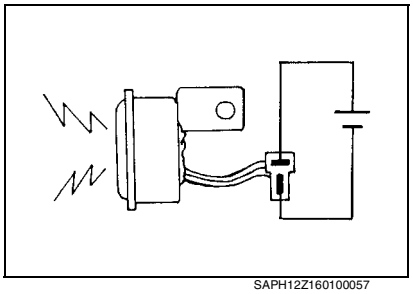
10. PARKING BRAKE SWITCH INSPECTION (EXCEPT FOR NJ8J, NV8J MODEL)

(1) Check the continuity between terminals.



SAPH12Z160100056

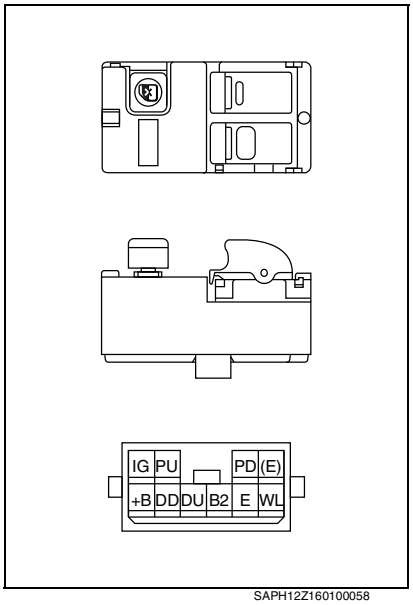
S1-UNAE09A-2.book 35 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



SAPH12Z160100057

11. CHECK THE OPERATION OF THE WARNING BUZZER.

(1) Apply 12V D.C. across the terminals and check that the buzzer sounds.
If it does not, replace the buzzer.



SAPH12Z160100058

POWER WINDOW CIRCUIT (IF SO EQUIPPED)

1. DRIVER'S SIDE SWITCH INSPECTION

(1) Check the continuity between terminals.

S1-UNAE09A-2.book 36 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

DRIVER'S SIDE:

Terminals / Switch position	+B	DU	DD	E
CLOSE	○	○	○	○
↕	×			×
OFF		○	○	○
↕	×			×
OPEN	○		○	
		○		○

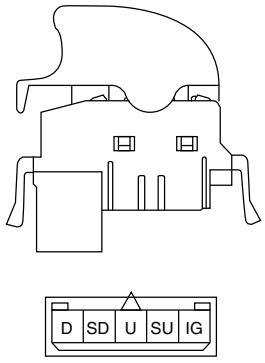
ASSISTANT'S SIDE: LOCK SWITCH ON POSITION

Terminals / Switch position	+B	PU	PD	E	WL
CLOSE	○	○			
↕	×			×	
OFF		○	○		
↕	×			×	
OPEN	○		○		

ASSISTANT'S SIDE: LOCK SWITCH OFF POSITION

Terminals / Switch position	+B	PU	PD	E	WL
CLOSE	○	○		○	○
			○	○	
↕	×			×	
				○	○
OFF		○		○	○
			○	○	
↕	×			×	
				○	○
OPEN	○		○	○	○
		○		○	

SAPH12Z160100059



SAPH12Z160100060

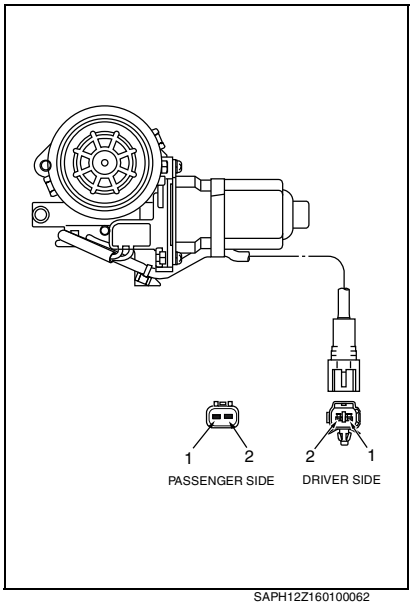
2. ASSISTANT'S SIDE SWITCH INSPECTION

(1) Check the continuity between terminals.

S1-UNAE09A-2.book 37 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

Terminals / Switch position	SU	U	IG	D	SD
CLOSE		O—O		O—O	
↕	X		X		
OFF	O—O			O—O	
↕			X		X
OPEN	O—O		O—O		

SAPH12Z160100061



SAPH12Z160100062

3. POWER WINDOW MOTOR INSPECTION

(1) Check the continuity between terminals. If there is no continuity, replace the motor.

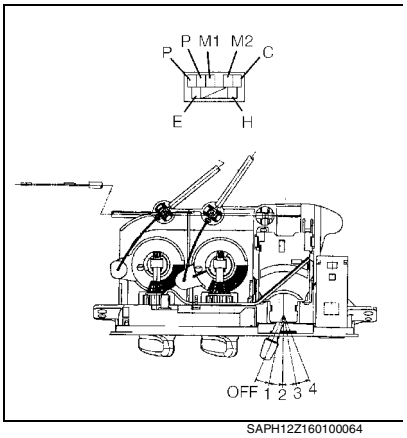
(2) Apply 12V to terminals, inspect the motor operation as below.

Terminals / Direction of rotation (View from out put shaft)	1	2
CLOCKWISE	+	−
COUNTERCLOCKWISE	−	+

SAPH12Z160100063

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HEATER AND COOLER CIRCUIT



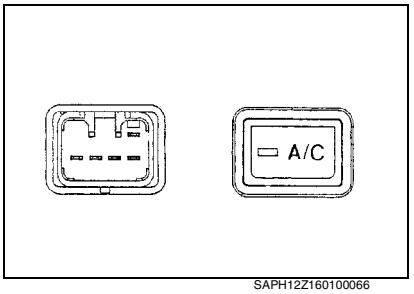
SAPH12Z160100064

1. BLOWER SWITCH INSPECTION

(1) Check the continuity between terminals.

Switch position \ Terminals	E	C	M1	M2	H	P	P
OFF						LIGHT	
1	○	○					
2	○	○	○				
3	○	○		○			
4	○	○			○		

SAPH12Z160100065

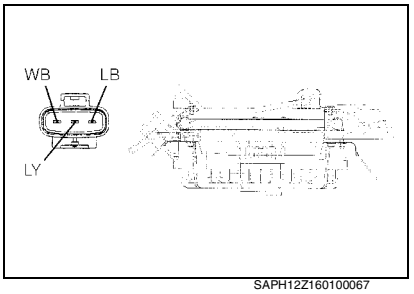


SAPH12Z160100066

2. COOLER CONTROL SWITCH

(1) Check the continuity between terminals.

	Between terminals
PUSH	Continuity
FREE	No continuity



SAPH12Z160100067

3. CONDENSER ASSEMBLY INSPECTION

(1) Check continuity between terminals.

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Terminal / Switch position	LB	WB	LY
OFF			
LO	○	○	
HIGH	○		○

SAPH12Z160100068

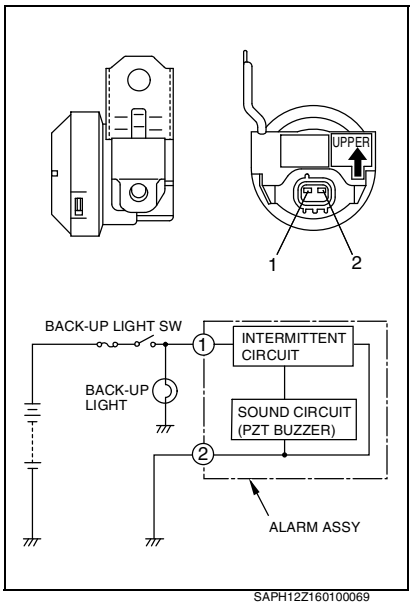
4. POWER RELAY No.2 INSPECTION
Refer to page EL01-16

BACK-UP LIGHT CIRCUIT

1. BACK-UP LIGHT SWITCH INSPECTION
(1) Check the continuity between terminals.

	Between terminals
PUSH	Continuity
FREE	No continuity

BACK-UP BUZZER CIRCUIT (IF SO EQUIPPED)

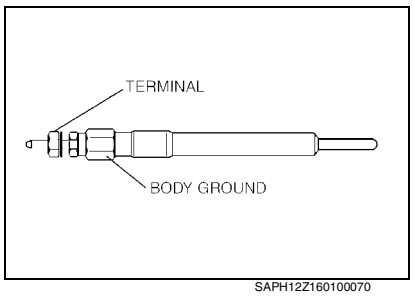


SAPH12Z160100069

1. BACK-UP BUZZER INSPECTION
(1) Check continuity between terminal 1 and 2.

2. CHECK THE OPERATION OF THE BACK-UP BUZZER
(1) Apply 12 V D.C across the terminal and check that the buzzer sounds. If it does not, replace the buzzer.

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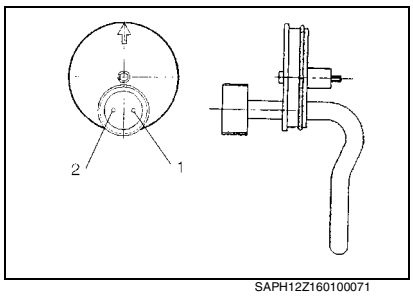
SAPH12Z160100070

PRE-HEATING CIRCUIT

1. GLOW PLUG INSPECTION

(1) Check continuity between terminal and body ground.

(2) Under normal condition, the terminal and body ground should show continuity.



SAPH12Z160100071

BLOCK HEATER CIRCUIT (IF SO EQUIPPED)

1. BLOCK HEATER INSPECTION

(1) Check continuity between terminal 1 and 2.

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INSPECTION AND ADJUSTMENT

EN12Z1601H300002

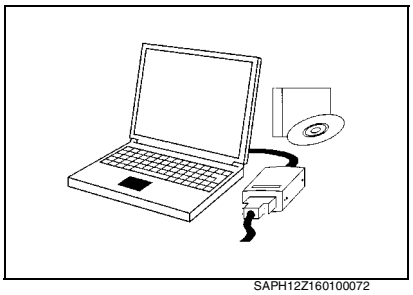
ADJUSTMENT OF PULSE CONVERSION RATE

NOTICE

Be sure to carry out the adjustment of pulse conversion rate when you replace the combination meter.

HINT

This is a device that enables a fine-tuning of compensating ratio of speedometer without modifying the speedometer driven gear of the transmission.



SAPH12Z160100072

1. CONNECTING INPUT TOOL

(1) Set the starter switch to the "LOCK" position.
(2) Connect the diagnosis cable between diagnosis connector and interface.
(3) Connect the interface to the PC.

NOTICE

Do not disconnect other connectors.

SST:
Interface Box (Hino-Bowie) (09993-E9070)
Cable between diagnosis connector & Hino-Bowie (09042-1220)
Hino Diagnostic eXplorer (Hino-DX)

2. THE ADJUSTMENT METHOD OF PULSE CONVERSION RATE.

(1) Set the starter switch to "ON", and then turn on the power of PC to start up the Hino-DX.
(2) With a Hino-DX, change the "Pulse conversion rate" in "Manufacture Parameters" of the vehicle control ECU.
(3) With a Hino-DX, reset the "Pulse conversion rate" in "Learned Value" of the meter.
(4) Confirm that a conversion rate was displayed by information display.

3. DISCONNECTING INPUT TOOL

(1) Turn off the power of PC unit, and then turn the starter switch to "LOCK" position.
(2) Disconnect the diagnosis cable between diagnosis connector and interface.
(3) Disconnect the interface to the PC.

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SPEEDOMETER CONVERSION RATE LIST

EN12Z1601H300003

EATON FS-5406A, FS6406A MANUAL TRANSMISSION SERIES AND FO-5506B, FO-6406B ULTRASHIFT TRANSMISSION SERIES

		REAR AXLE GEAR RATIO											
TIRE SIZE	RADIUS	2.93	3.07	3.15	3.21	3.31	3.42	3.58	3.73	3.90	3.91	4.10	4.11
245/70R19.5	0.407	0.868	0.829	0.808	0.792	0.768	0.744	0.710	0.682	0.652	0.650	0.620	0.619
255/70R22.5	0.453	0.966	0.922	0.899	0.882	0.855	0.828	0.791	0.759	0.726	0.724	0.690	0.689
255/80R22.5	0.475	1.013	0.967	0.943	0.925	0.897	0.868	0.829	0.796	0.761	0.759	0.724	0.722
275/80R22.5	0.491	1.047	1.000	0.974	0.956	0.927	0.897	0.857	0.823	0.787	0.785	0.748	0.747
10R22.5	0.492	1.050	1.002	0.976	0.958	0.929	0.899	0.859	0.824	0.788	0.786	0.750	0.748
295/75R22.5	0.493	1.052	1.004	0.978	0.960	0.931	0.901	0.861	0.826	0.790	0.788	0.751	0.750
11R22.5	0.508	1.084	1.034	1.008	0.989	0.959	0.928	0.887	0.851	0.814	0.812	0.774	0.772

		REAR AXLE GEAR RATIO											
TIRE SIZE	RADIUS	4.30	4.33	4.56	4.63	4.78	4.88	4.89	5.13	5.29	5.38	5.57	5.63
245/70R19.5	0.407	0.591	0.587	0.558	0.549	0.532	0.521	0.520	0.496	0.481	0.473	0.456	0.452
255/70R22.5	0.453	0.658	0.654	0.621	0.611	0.592	0.580	0.579	0.552	0.535	0.526	0.508	0.503
255/80R22.5	0.475	0.690	0.686	0.651	0.641	0.621	0.608	0.607	0.579	0.561	0.552	0.533	0.527
275/80R22.5	0.491	0.714	0.709	0.673	0.663	0.642	0.629	0.627	0.598	0.580	0.570	0.551	0.545
10R22.5	0.492	0.715	0.710	0.674	0.664	0.643	0.630	0.629	0.599	0.581	0.571	0.552	0.546
295/75R22.5	0.493	0.716	0.712	0.676	0.665	0.644	0.631	0.630	0.600	0.582	0.573	0.553	0.547
11R22.5	0.508	0.738	0.733	0.696	0.686	0.664	0.651	0.649	0.619	0.600	0.590	0.570	0.564

		REAR AXLE GEAR RATIO			
TIRE SIZE	RADIUS	5.86	6.14	6.43	6.83
245/70R19.5	0.407	0.434	0.414	0.395	0.372
255/70R22.5	0.453	0.483	0.461	0.440	0.414
255/80R22.5	0.475	0.506	0.483	0.461	0.434
275/80R22.5	0.491	0.523	0.500	0.477	0.449
10R22.5	0.492	0.525	0.501	0.478	0.450
295/75R22.5	0.493	0.526	0.502	0.479	0.451
11R22.5	0.508	0.542	0.517	0.494	0.465

ALLISON 2200HS, 2200RDS, 2500RDS, 3000RDS AUTOMATIC TRANSMISSION SERIES

		REAR AXLE GEAR RATIO								
TIRE SIZE	RADIUS	4.11	4.88	5.13	5.29	5.38	5.57	5.63	5.86	6.14
245/70R19.5	0.407	1.238	1.043	0.992	0.962	0.946	0.913	0.904	0.868	0.829
255/70R22.5	0.453	1.378	1.161	1.104	1.071	1.053	1.017	1.006	0.966	0.922
255/80R22.5	0.475	1.445	1.217	1.158	1.123	1.104	1.066	1.055	1.013	0.967
10R22.5	0.492	1.497	1.260	1.199	1.163	1.143	1.104	1.093	1.050	1.002
295/75R22.5	0.493	1.500	1.263	1.201	1.165	1.146	1.107	1.095	1.052	1.004
11R22.5	0.508	1.545	1.302	1.238	1.201	1.181	1.140	1.128	1.084	1.034

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ELECTRIC WIRE

EL02-001

DIAGRAM..... EL02-2
HOW TO USE THIS CHAPTER.....EL02-2
SPECIFICATION SYMBOL LIST EL02-7
TERMS CONTRADISTINCTION LIST.....EL02-15
DIAGRAM EL02-18
POSITION OF CONNECTOR.....EL02-162
CONNECTOR.....EL02-189
BULK HEAD CONNECTOR BOX EL02-214
CONNECTOR LIST EL02-217

EL02_001.fm 2 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

DIAGRAM

HOW TO USE THIS CHAPTER

EN12Z1602J100001

- In this chapter, "specification symbols" are used as prefix of each wiring diagram in order to specify the circuits that are different in accordance with the models and specifications. For further detail on how to use this chapter, refer to "1. Description of specification symbol list" and "2. Description of wiring diagram".

1. Description of specification symbol list

a	Circuit name	b Specification symbol	c Specifications	d Page
A	POWER SUPPLY CIRCUIT	○	Models equipped with 6 cylinder engine	EL02-16
B	ENGINE STARTING CIRCUIT-1: MODELS EQUIPPED WITH EATON FS SERIES MANUAL TRANSMISSION	⋈	Models equipped with 6 cylinder engine and manual transmission	EL02-24
C	ENGINE STARTING CIRCUIT-2: MODELS EQUIPPED WITH ALLISON 2200HS, 2200RDS/ 2500RDS AND 3000RDS AUTOMATIC TRANSMISSION AND EATON FO SERIES AUTOMATIC MECHANICAL TRANSMISSION	□	Models equipped with ALLISON 3000RDS automatic transmission	EL02-25
		○	Models equipped with ALLISON 2200HS and 2200RDS/2500RDS automatic transmission	
		◐	Models equipped with 6 cylinder engine and automatic mechanical transmission	
D	GLOW PLUG CIRCUIT	○	Models equipped with 6 cylinder engine and GCU and glow plugs	EL02-28
E	CHARGING CIRCUIT	□	Models equipped with 6 cylinder engine	EL02-29
F	SPARE POWER SOURCE CIRCUIT	○	Models equipped with 6 cylinder engine	EL02-30
G	FOG LIGHT POWER SOURCE CIRCUIT	—	Common to all models	EL02-31

SAPH12Z160200001

a. Circuit name
Designates the circuit names on the wiring diagram.

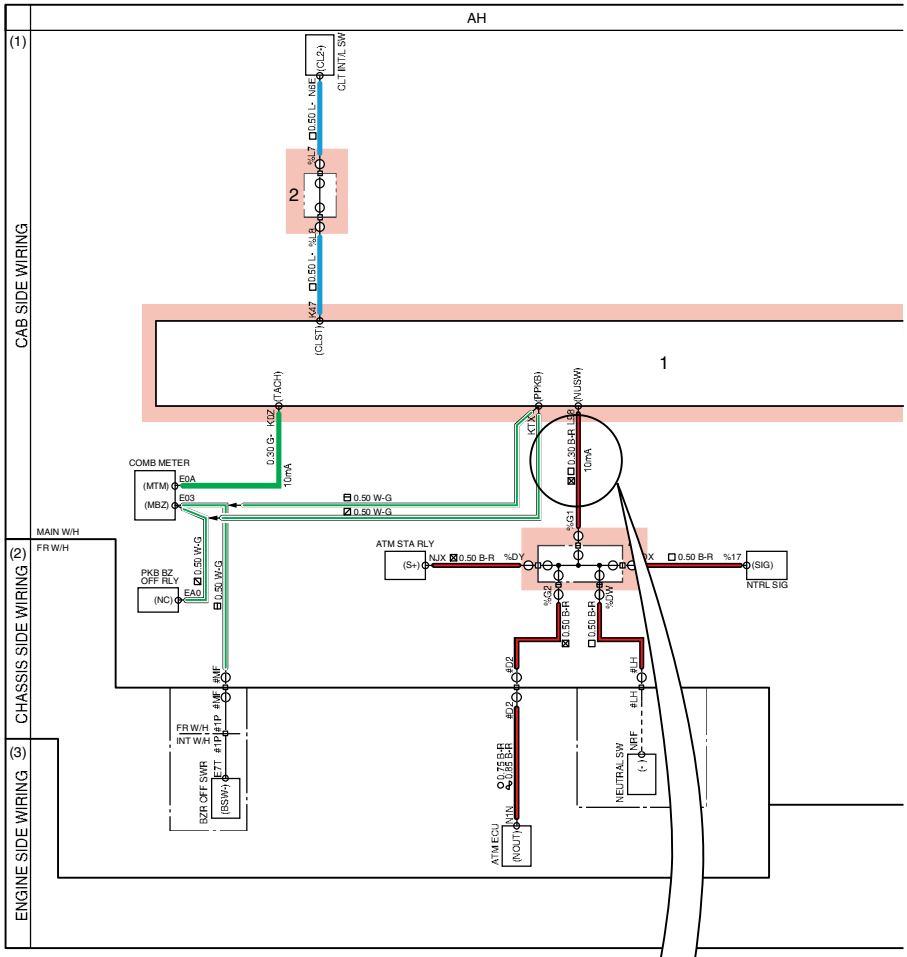
b. Specification symbol
This is the symbol of the specification listed on the "Specifications" column. On the wiring diagram, this symbol is prefixed to all the wiring type mark (example: 0.85 W-R).
Each wiring is installed only on the vehicles of the specifications that the relevant specification symbol designates.

c. Specifications
Describes the contents of specifications that each specification symbol designates. All the wirings are classified according to the specifications listed here.

d. Page
Indicates the page where the relevant wiring diagram is found.

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2. Description of wiring diagram



This is the circuit name.

AH VEHICLE CONTROL ECU CIRCUIT-2

1 Vehicle control ECU
2 U2 J/C No.2
3 Fuse vehicle control actuator 2
4 Economy running switch
5 U2 J/C No.1
6 J/C EARTH

This is name of the parts on the diagram and the number corresponds to that on the diagram.

Specification symbol (□,⊠,etc.)
Each wiring is installed to the vehicles relevant to the specification that the specification symbol designates.

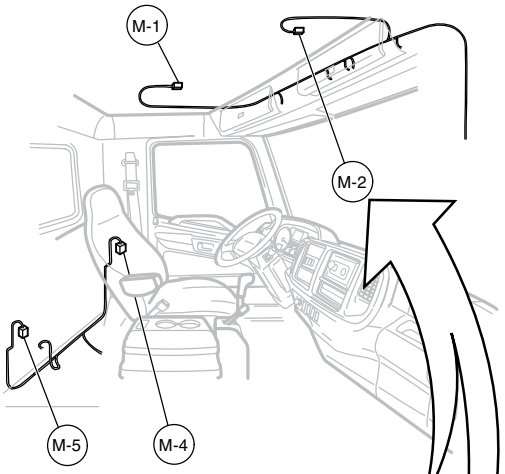
SAPH12Z160200002

EL02_001.fm 4 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

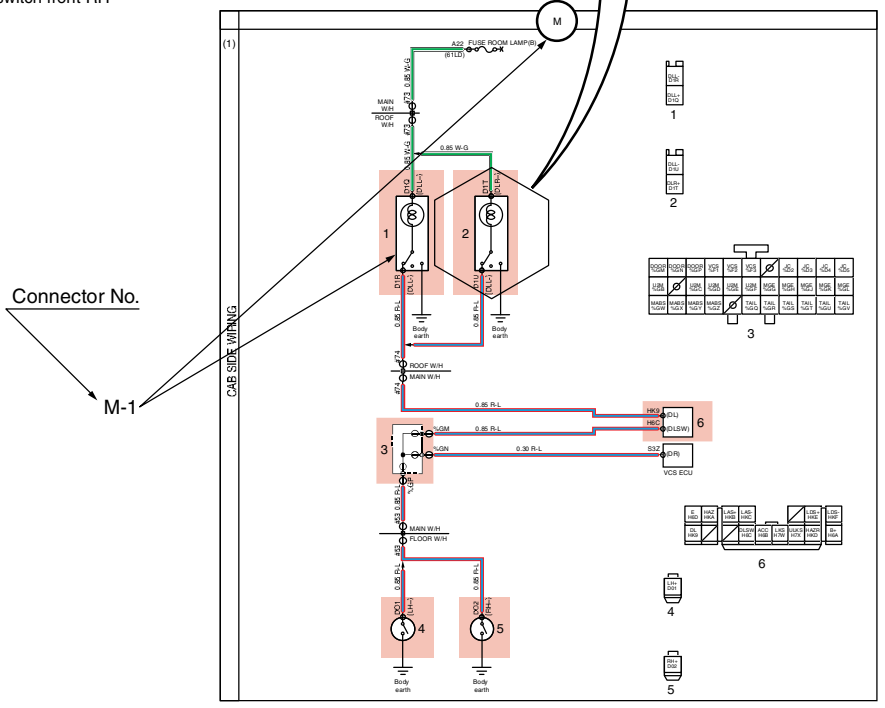
3. Position of connector

- The position of an electrical equipment connector of the wiring diagram (example: M-2) in the car can be seen.

Position of connectors M



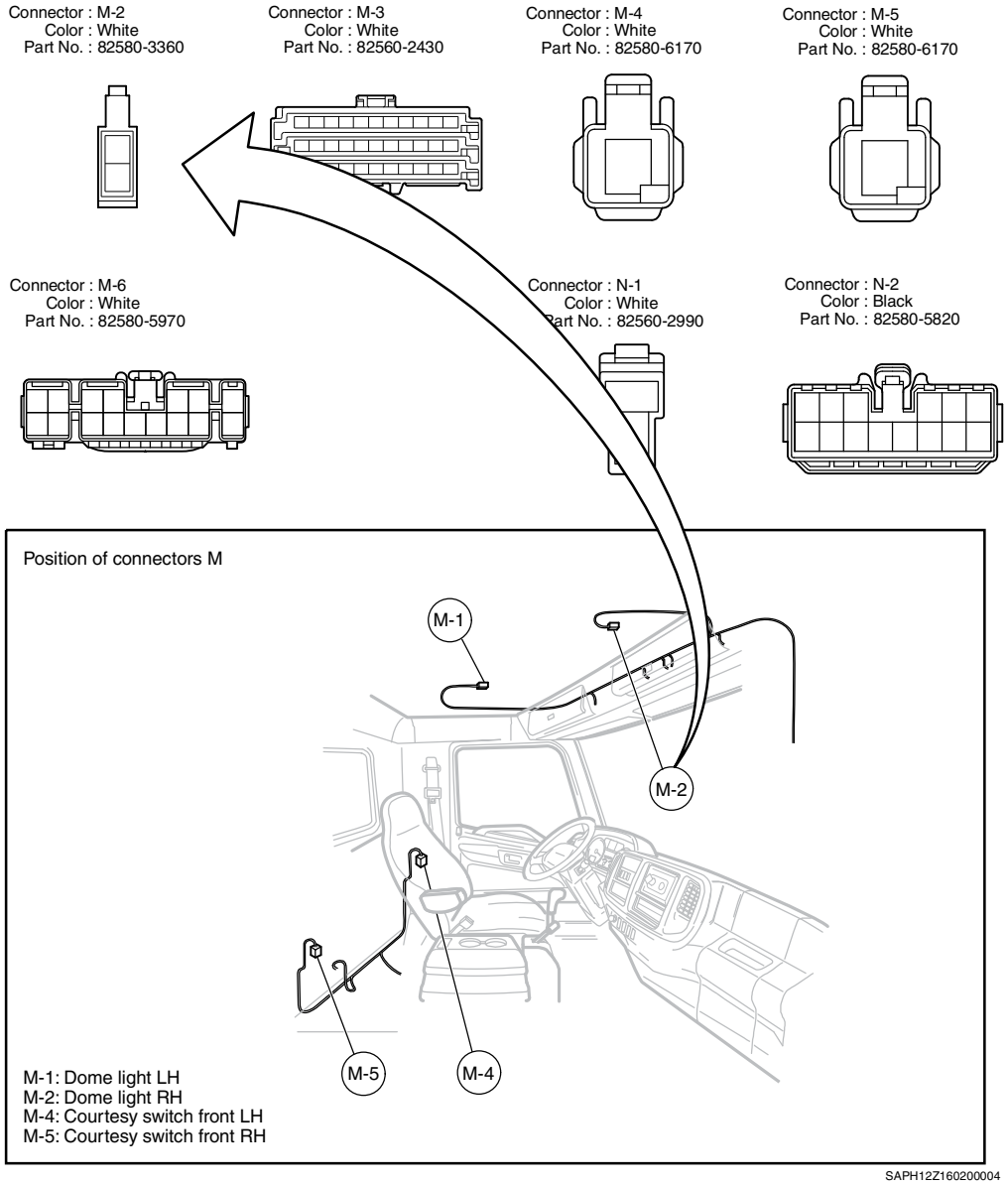
M-1: Dome light LH
M-2: Dome light RH
M-4: Courtesy switch front LH
M-5: Courtesy switch front RH



SAPH12Z160200003

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4. Connector
   - The shape, the color, and the part No. of electrical equipment connectors are listed in order of the connector No. The position of the connector can be seen (example: M-2).



SAPH12Z160200004

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5. Connector List

- The connector No. can be used as the keyword to search for the page on which a connector (example: O-1) is listed.

Diagram symbol	Connector No.	Electrical equipmentname	Wiring diagram listing page	Three-dimensional connector diagram (Position of connector) listing page
M	M-1	Dome light LH	EL02-52	EL02-173
	M-2	Dome light RH	EL02-52	EL02-173
	M-3	U2 J/C No.1	EL02-52	EL02-165
	M-4	Courtesy switch front LH	EL02-52	EL02-173
	M-5	Courtesy switch front RH	EL02-52	EL02-173
	M-6	Key-less entry controller	EL02-52	EL02-172
N	N-1	Washer pump motor	EL02-53	EL02-172
	N-2	Wiper relay	EL02-53	EL02-172
	N-3	Wiper motor	EL02-53	EL02-172
	N-4	Wiper and retarder switch	EL02-53	EL02-172
O	O-1	Mirror heater switch	EL02-54	EL02-168
	O-3	Heater and light mirror LH	EL02-54	EL02-170
	O-4	Heater and light mirror RH	EL02-54	EL02-170
P	P-1	Remote control mirror switch	EL02-55	EL02-167
	P-2	Remote control mirror LH	EL02-55	EL02-170
	P-3	Remote control mirror RH	EL02-55	EL02-170
Q	Q-2	Horn switch	EL02-56	EL02-173
	Q-3	Horn (Low)	EL02-56	EL02-175
	Q-4	Horn (High)	EL02-56	EL02-175
	Q-5	J/C G3	EL02-56	EL02-166
R	R-2	Air horn switch	EL02-57	EL02-168
	R-3	Air horn magnetic valve	EL02-57	EL02-175
	R-4	J/C EARTH	EL02-57	EL02-166
S	S-1	Cigarette lighter	EL02-58	EL02-168
T	T-1	Driver seat master switch	EL02-59	EL02-174
	T-2	Passenger seat sub switch	EL02-59	EL02-174
	T-3	Power window motor (Driver seat)	EL02-59	EL02-174
	T-4	Power window motor (Passenger seat)	EL02-59	EL02-174

SAPH12Z160200005

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SPECIFICATION SYMBOL LIST

EN12Z1602J100002

Circuit name		Specification symbol	Specifications	Page
A	POWER SUPPLY CIRCUIT	○	Models equipped with 6 cylinder engine	EL02-18
B	ENGINE STARTING CIRCUIT-1: MODELS EQUIPPED WITH EATON FS SERIES MANUAL TRANSMISSION	⋈	Models equipped with 6 cylinder engine and manual transmission	EL02-24
C	ENGINE STARTING CIRCUIT-2: MODELS EQUIPPED WITH ALLISON 2200HS, 2200RDS/ 2500RDS AND 3000RDS AUTOMATIC TRANSMISSION AND EATON FO SERIES AUTOMATIC MECHANICAL TRANSMISSION	□	Models equipped with ALLISON 3000RDS automatic transmission	EL02-25
		○	Models equipped with ALLISON 2200HS and 2200RDS/2500RDS automatic transmission	
		◐	Models equipped with 6 cylinder engine and automatic mechanical transmission	
D	GLOW PLUG CIRCUIT	○	Models equipped with 6 cylinder engine and GCU and glow plugs	EL02-28
E	CHARGING CIRCUIT	□	Models equipped with 6 cylinder engine	EL02-29
F	SPARE POWER SOURCE CIRCUIT	○	Models equipped with 6 cylinder engine	EL02-30
G	FOG LIGHT POWER SOURCE CIRCUIT	—	Common to all models	EL02-31
H	GROUND CIRCUIT	○	Models equipped with 6 cylinder engine	EL02-32
		⏃	Models equipped with HYDRO MAX brake	
		⊕	Models equipped with full air brake	
		⋈	Models equipped with air horn	
		⩚	Models equipped with air suspension dump	
		◐	Models equipped with power window	
		✡	Models equipped with manual transmission	
		⊗	Models equipped with automatic mechanical transmission	
		⊠	Models equipped with ALLISON 3000RDS automatic transmission	
		⏁	Models equipped without power window	
		△	Models equipped with key-less entry	

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Circuit name		Specification symbol	Specifications	Page
H	GROUND CIRCUIT	⊠	Models equipped with ALLISON 2200HS and 2200RDS/2500RDS automatic transmission	EL02-32
		⊞	Models equipped with power door lock	
		◪	Models equipped with standard frame and full air brake	
		▽	Models equipped with ABS (For HYDRO MAX brake E version)	
		⊟	Models equipped with economy running switch	
		□	Models equipped with ABS (For HYDRO MAX brake D version)	
I	METER CIRCUIT (CAB SIDE)	○	Models equipped with 6 cylinder engine	EL02-36
		◪	Models equipped with center parking brake	
		⊠	Models equipped with wheel parking brake and full air brake	
		◰	Models equipped with 6 cylinder engine and EATON FS series manual transmission and HYDRO MAX brake	
		⊞	Models equipped with ALLISON 2200HS and 2200RDS/2500RDS and 3000RDS automatic transmission	
		◮	Models equipped with 6 cylinder engine and EATON FS series manual transmission and full air brake	
		∽	Models equipped with EATON FO series automatic mechanical transmission	
		✡	Models equipped with air horn	
		⋈	Models equipped with air suspension and center parking brake	
		⊟	Models equipped with air suspension and wheel parking brake	
		◰	Models equipped with HYDRO MAX brake	
		▽	Models equipped with clean frame and full air brake	
		▥	Models equipped with standard frame and full air brake	
		◲	Models equipped with rear differential lock	
		⩓	Models equipped with automatic mechanical transmission (without parking range)	

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Circuit name		Specification symbol	Specifications	Page
J	METER CIRCUIT (CHASSIS SIDE)	○	Models equipped with 6 cylinder engine	EL02-40
		◪	Models equipped with center parking brake	
		⊠	Models equipped with wheel parking brake and full air brake	
		◬	Models equipped with 6 cylinder engine and EATON FS series MTM and HYDRO MAX brake	
		⊞	Models equipped with ALLISON 2200HS and 2200RDS/2500RDS and 3000RDS automatic transmission	
		◭	Models equipped with 6 cylinder engine and EATON FS series manual transmission and full air brake	
		⬭	Models equipped with EATON FO series automatic mechanical transmission	
		✡	Models equipped with air horn	
		⋈	Models equipped with air suspension and center parking brake	
		⊟	Models equipped with air suspension and wheel parking brake	
		⛛	Models equipped with HYDRO MAX brake	
		▽	Models equipped with clean frame and full air brake	
		▥	Models equipped with standard frame and full air brake	
		⊠	Models equipped with rear differential lock	
		⩕	Models equipped with automatic mechanical transmission (without parking range)	
K	DAYTIME RUNNING LIGHT (DRL) AND TAIL LIGHT CIRCUIT	○	Models equipped with 6 cylinder engine	EL02-44
		⊟	Models equipped with power window	
		△	Models equipped without power window	
L	STOP AND TURN LIGHT CIRCUIT	⊞	Models equipped with EATON FO series automatic mechanical transmission and EATON FS series manual transmission	EL02-48
		◭	Models equipped with stop light switch (For HYDRO MAX brake)	
		⊕	Models equipped with stop light switch (For full air brake)	

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Circuit name		Specification symbol	Specifications	Page
L	STOP AND TURN LIGHT CIRCUIT	⊠	Models equipped with ALLISON 2200HS and 2200RDS/2500RDS automatic transmission	EL02-48
		▥	Models equipped with ALLISON 3000RDS automatic transmission automatic transmission	
		⋈	Models equipped with HYDRO MAX brake	
M	ROOM LIGHT CIRCUIT	—	Common to all models	EL02-52
N	WIPER AND WASHER CIRCUIT	—	Common to all models	EL02-53
O	MIRROR HEATER CIRCUIT	—	Common to all models	EL02-54
P	REMOTE CONTROL MIRROR CIRCUIT	—	Common to all models	EL02-55
Q	ELECTRIC HORN CIRCUIT	—	Common to all models	EL02-56
R	AIR HORN CIRCUIT	—	Common to all models	EL02-57
S	CIGARETTE LIGHTER CIRCUIT	—	Common to all models	EL02-58
T	POWER WINDOW CIRCUIT	—	Common to all models	EL02-59
U	POWER DOOR LOCK AND KEY-LESS ENTRY CIRCUIT	⊠	Models equipped without power window	EL02-60
		□	Models equipped with power window	
		△	Models equipped with key-less entry	
V	AUDIO CIRCUIT	—	Common to all models	EL02-62
W	MANUAL AIR CONDITIONER CIRCUIT	—	Common to all models	EL02-64
X	COMMON RAIL CIRCUIT-1 (CAB SIDE)	○	Models equipped with 6 cylinder engine	EL02-66
		□	Models equipped with automatic transmission and automatic mechanical transmission	
		≈	Models equipped with manual transmission	
Y	COMMON RAIL CIRCUIT-1 (CHASSIS SIDE)	○	Models equipped with 6 cylinder engine	EL02-70
		□	Models equipped with automatic transmission and automatic mechanical transmission	
		≈	Models equipped with manual transmission	
Z	COMMON RAIL CIRCUIT-2: MANUAL TRANSMISSION AND EXHAUST BRAKE	M	Models equipped with 6 cylinder engine	EL02-74
AA	COMMON RAIL CIRCUIT-3: AUTOMATIC TRANSMISSION AND AUTOMATIC MECHANICAL TRANSMISSION AND EXHAUST BRAKE	M	Models equipped with 6 cylinder engine	EL02-76

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Circuit name		Specification symbol	Specifications	Page
AA	COMMON RAIL CIRCUIT-3: AUTOMATIC TRANSMISSION AND AUTOMATIC MECHANICAL TRANSMISSION AND EXHAUST BRAKE	△	Models equipped with ALLISON 2200HS and 2200RDS/2500RDS and 3000RDS automatic transmission	EL02-76
		◫	Models equipped with EATON FO series automatic mechanical transmission	
		○	Models equipped with ALLISON 2200HS and 2200RDS/2500RDS automatic transmission	
		≈	Models equipped with ALLISON 3000RDS automatic transmission	
AB	COMMON RAIL CIRCUIT-4: EATON AUTOMATIC MECHANICAL TRANSMISSION AND EXHAUST BRAKE	—	Common to all models	EL02-80
AC	COMMON RAIL CIRCUIT-5: MODELS EQUIPPED WITH P.T.O.	—	Common to all models	EL02-82
AD	COMMON RAIL CIRCUIT-6: DIESEL THROTTLE	⊠	Models equipped with 6 cylinder engine	EL02-84
AE	COMMON RAIL CIRCUIT-7: DPR	—	Common to all models	EL02-88
AF	COMMON RAIL CIRCUIT-8: FS CRUISE	○	Models equipped with full air brake	EL02-90
		△	Models equipped with HYDRO MAX brake	
		⩓	Models equipped with 6 cylinder engine	
AG	VEHICLE CONTROL ECU CIRCUIT-1	⊠	Models equipped with ABS (For full air brake)	EL02-92
		△	Models equipped with EATON FO series automatic mechanical transmission and EATON FS series manual transmission	
		⩓	Models equipped with 6 cylinder engine	
		○	Models equipped with ABS (For HYDRO MAX brake E version)	
		⩚	Models equipped with ABS (For HYDRO MAX brake D version)	
AH	VEHICLE CONTROL ECU CIRCUIT-2	□	Models equipped with manual transmission	EL02-96
		⊠	Models equipped with automatic transmission	
		○	Models equipped with ALLISON 2200HS and 2200RDS/2500RDS automatic transmission	
		≈	Models equipped with ALLISON 3000RDS automatic transmission	

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Circuit name		Specification symbol	Specifications	Page
AH	VEHICLE CONTROL ECU CIRCUIT-2	⊠	Models equipped with center parking brake	EL02-96
		⊟	Models equipped with wheel parking brake	
AI	VEHICLE CONTROL ECU CIRCUIT-3	○	Models equipped with full air brake	EL02-100
		△	Models equipped with HYDRO MAX brake	
		Ⓜ	Models equipped with 6 cylinder engine	
AJ	VEHICLE CONTROL ECU CIRCUIT-4	✡	Models equipped with manual transmission	EL02-102
		△	Models equipped with automatic transmission	
		∾	Models equipped with automatic mechanical transmission	
AK	BURNER CIRCUIT	—	Common to all models	EL02-104
AL	DEF SCR CIRCUIT	—	Common to all models	EL02-108
AM	ABS CIRCUIT-1 (FOR FULL AIR BRAKE)	⊠	Models equipped with 6 cylinder engine	EL02-112
		⊠	Models equipped with automatic transmission	
		□	Models equipped with manual transmission	
AN	ABS CIRCUIT-2 (FOR HYDRO MAX BRAKE E VERSION)	⊠	Models equipped with automatic transmission	EL02-116
		⊠	Models equipped with 6 cylinder engine	
		✡	Models equipped with manual transmission	
AO	HYDRO MAX SYSTEM CIRCUIT	○	Models equipped with 6 cylinder engine	EL02-118
AQ	AUTOMATIC TRANSMISSION CIRCUIT-1: EQUIPPED WITH ALLISON 2000 AUTOMATIC TRANSMISSION	△	Models equipped with HYDRO MAX brake	EL02-120
		○	Models equipped with full air brake	
		✡	Models equipped with ABS (For HYDRO MAX brake E version)	
AQ	AUTOMATIC TRANSMISSION CIRCUIT-1: EQUIPPED WITH ALLISON 2000 AUTOMATIC TRANSMISSION	□	Models equipped with ABS (For HYDRO MAX brake D version)	EL02-120

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Circuit name		Specification symbol	Specifications	Page
AR	AUTOMATIC TRANSMISSION CIRCUIT-2: EQUIPPED WITH ALLISON 3000RDS AUTOMATIC TRANSMISSION	△	Models equipped with HYDRO MAX brake	EL02-122
		○	Models equipped with full air brake	
		⊠	Models equipped with 6 cylinder engine	
		⩓	Models equipped with 6 cylinder engine and HYDRO MAX brake	
		□	Models equipped with ABS (For HYDRO MAX brake E version)	
AS	EATON AUTOMATIC MECHANICAL TRANSMISSION CIRCUIT	⋈	Models equipped with parking range	EL02-126
		✡	Models equipped without parking range	
		⊠	Models equipped with 6 cylinder engine	
		◪	Models equipped with full air brake	
		⩓	Models equipped with ABS (For HYDRO MAX brake E version)	
		△	Models equipped with ABS (For HYDRO MAX brake E version) and 6 cylinder engine	
		□	Models equipped with ABS (For HYDRO MAX brake D version)	
AT	DIAGNOSIS CONNECTOR CIRCUIT (16P)	□	Models equipped with 6 cylinder engine	EL02-130
AU	DIAGNOSIS CONNECTOR CIRCUIT (9P)	⊠	Models equipped with 6 cylinder engine	EL02-132
AV	MANUAL DIFFERENTIAL LOCK CIRCUIT	□	Models equipped with 6 cylinder engine	EL02-133
AW	AIR DRYER CIRCUIT	○	Models equipped with 6 cylinder engine	EL02-134
AX	AIR SUSPENSION DUMP CIRCUIT	⊠	Models equipped with wheel parking brake and full air brake	EL02-135
		◪	Models equipped with center parking brake	
AY	CAN (CONTROLLER AREA NETWORK) COMMUNICATION CIRCUIT	△	Models equipped without ALLISON 3000RDS automatic transmission	EL02-136
		⩓	Models equipped with manual transmission	

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Circuit name		Specification symbol	Specifications	Page
AY	CAN (CONTROLLER AREA NETWORK) COMMUNICATION CIRCUIT	≈	Models equipped with ALLISON 3000RDS automatic transmission	EL02-136
		☒	Models equipped with automatic mechanical transmission	
		□	Models equipped with ALLISON 2200HS and 2200RDS/2500RDS and 3000RDS automatic transmission	
AZ	CAN (CONTROLLER AREA NETWORK) COMMUNICATION CIRCUIT (ENGINE)	—	Common to all models	EL02-138
BA	CAN (CONTROLLER AREA NETWORK) COMMUNICATION CIRCUIT (DPR)	—	Common to all models	EL02-142
BB	TELEMATICS CIRCUIT	—	Telematics connector	EL02-146
BC	EXTEND CIRCUIT	○	Models equipped with full air brake	EL02-147
BD	BLOCK HEATER CIRCUIT	—	Common to all models	EL02-148
BE	WIRE TO WIRE CONNECTOR	—	Common to all models	EL02-150

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TERMS CONTRADISTINCTION LIST

EN12Z1602J100003

WIRING DIAGRAM	OTHER CHAPTER
ABS exhaust brake cut relay	ABS exhaust cut relay
ABS sensor	Wheel sensor
Air gauge sensor	Air pressure sensor
Ambient temperature sensor	Ambient air temperature sensor
Atomization module	Atomizer
Atomization module 2	Atomizer 2
Auto cruising switch	Cruise control main switch
BCU	Burner control unit
Boost sensor	Boost pressure sensor
Brake switch (NC) (Full air)	Brake switch (Full air)
Brake switch (NC) (HYDRO MAX)	Brake switch (HYD)
Clutch interlock switch	Clutch switch
Combustion air valve	Solenoid valve
Coolant cut off valve	Coolant shutoff valve, DEF tank heater valve
Cylinder angle sensor	Camshaft position sensor, Engine speed sub sensor
DCU	Dosing control unit
Diagnosis connector	DLC connector
Diesel throttle	Intake throttle valve position sensor
Dosing module	DEF dosing valve
DPR intake temperature sensor	Exhaust temperature sensor (Burner outlet)
DPR refresh switch	DPR manual regeneration switch
EGR controller	EGR valve
EGR exit temperature sensor	EGR gas temperature sensor
Exhaust brake magnetic valve	Exhaust brake solenoid valve
Exhaust gas pressure sensor	Differential pressure sensor
Exhaust gas temperature sensor 1	Temperature sensor, Exhaust gas temperature sensor (DOC inlet)
Exhaust gas temperature sensor 3	Temperature sensor, Exhaust gas temperature sensor (DOC outlet)
Exhaust temperature sensor	Temperature sensor, Exhaust temperature sensor (Burner inlet)
GCU	Glow control unit
Idling volume	Idle set knob
Intake manifold temperature sensor	Intake air temperature sensor (intake manifold)

EL02_001.fm 16 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

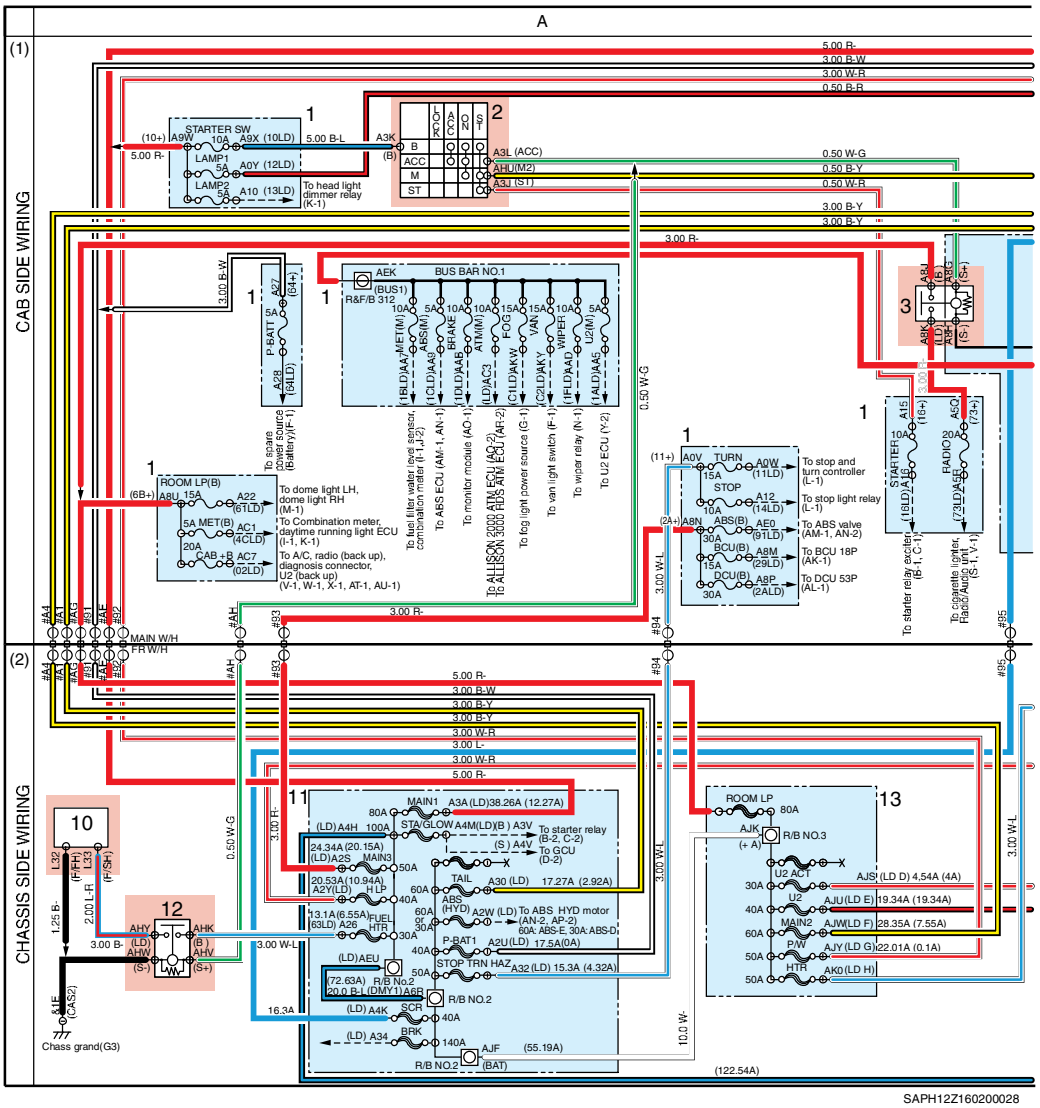
WIRING DIAGRAM	OTHER CHAPTER
Intercooler exit temperature sensor	Intake air temperature sensor (intercooler outlet)
Multi indicator switch	Information display control switch
NE sensor	Engine speed main sensor
Parking brake switch	Parking switch
PC sensor	Common rail pressure sensor 1, Common rail pressure sensor 2
SCR front temperature sensor	Exhaust gas temperature sensor, Exhaust gas temperature sensor (SCR inlet)
Supply module	DEF pump connector, DEF pressure sensor, DEF pump motor
U2 ECU	Engine ECU
Urea	DEF
Urea sensor	DEF level sensor, DEF tank level sensor, DEF tank temperature sensor
Water temperature sender	Engine coolant temperature sensor

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EL02_001.fm 18 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

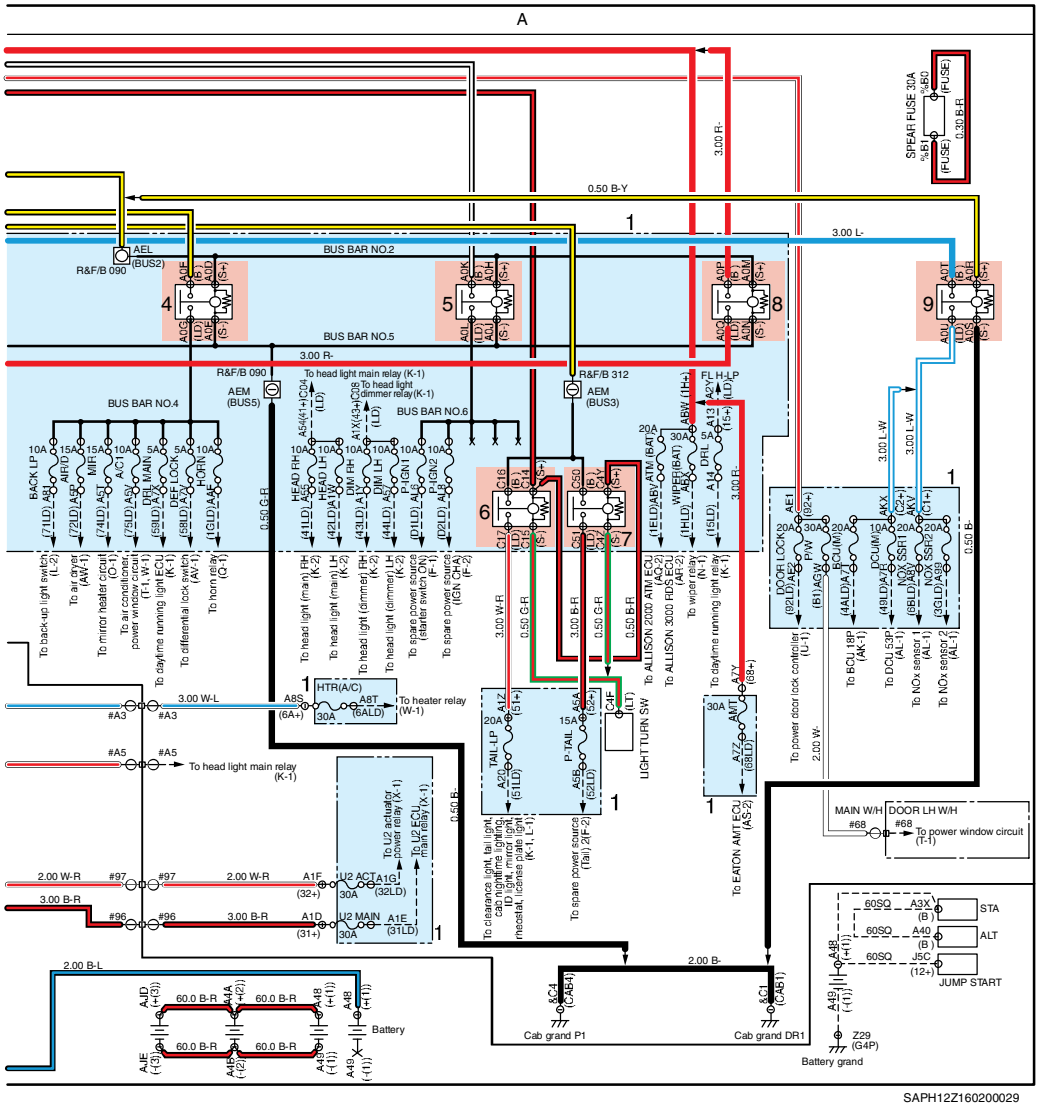
DIAGRAM

EN12Z1602J100004



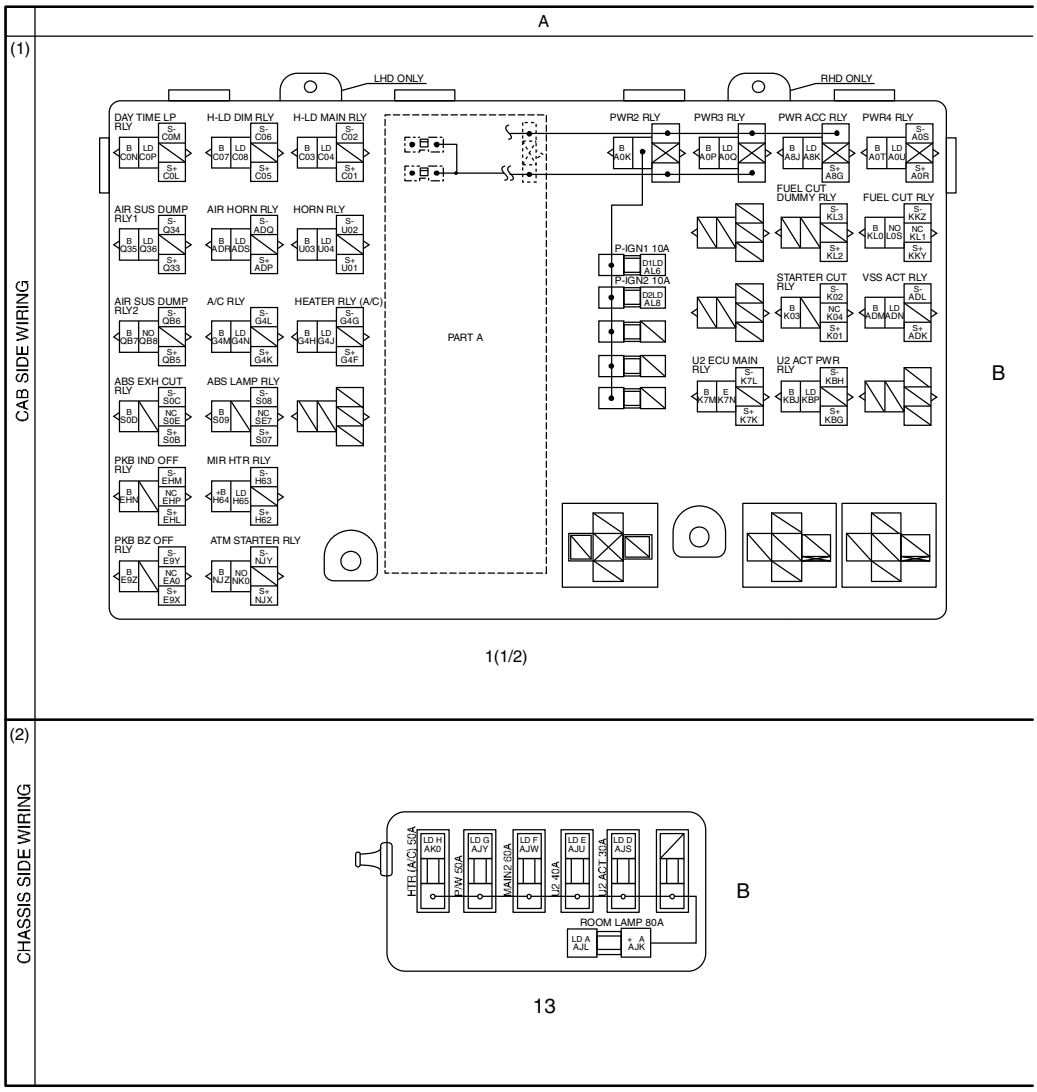
A	**POWER SUPPLY CIRCUIT**
1	**Fuse and relay block B**
2	**Starter switch**
3	**Power accessory relay No.1**
4	**Power relay No.1**
5	**Power relay No.2**
6	**Tail light relay No.1**
7	**Tail light relay No.2**
8	**Power relay No.3**
9	**Power relay No.4**
10	**Fuel filter heater sensor**
11	**Relay block No.2**
12	**Power accessory relay No.2**
13	**Fuse and relay block A**

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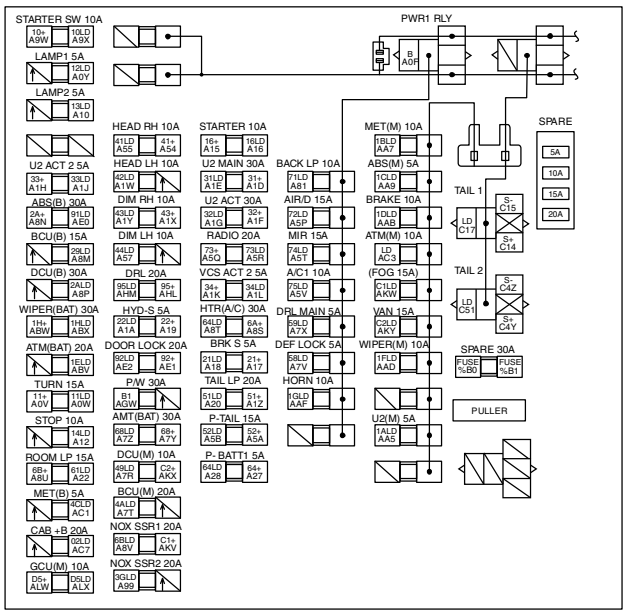


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EL02_001.fm 21 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

A

Part A

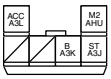
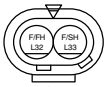


1(2/2)

B

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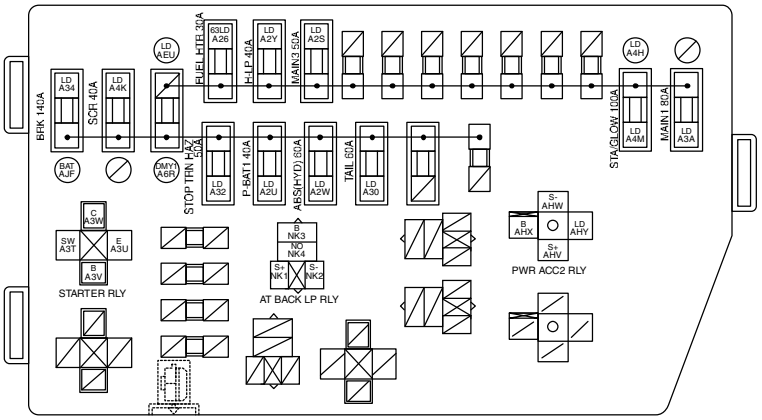
EL02_001.fm 22 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

	A
(1) CAB SIDE WIRING	 B 2
(2) CHASSIS SIDE WIRING	 DG 10

SAPH12Z160200032

EL02_001.fm 23 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

A

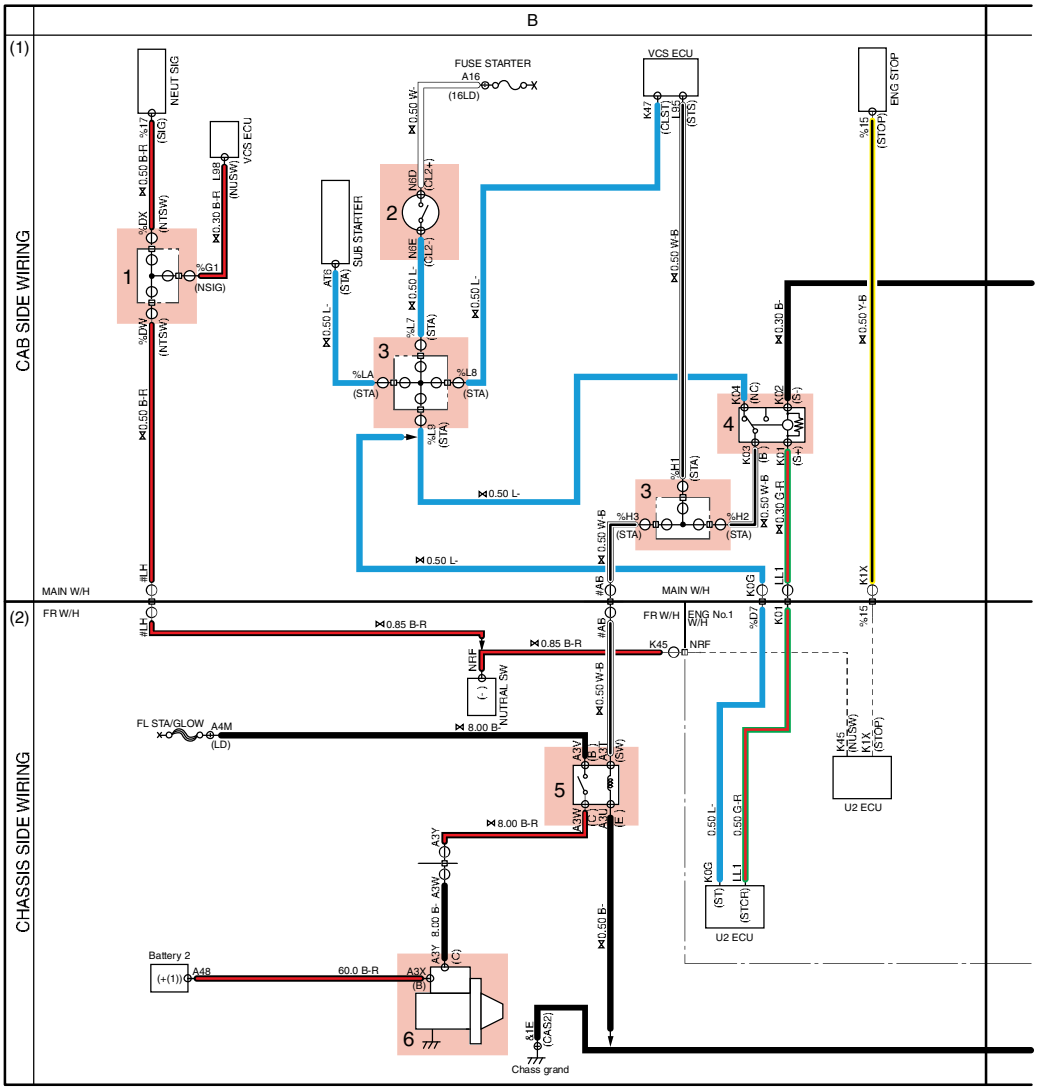


B

11

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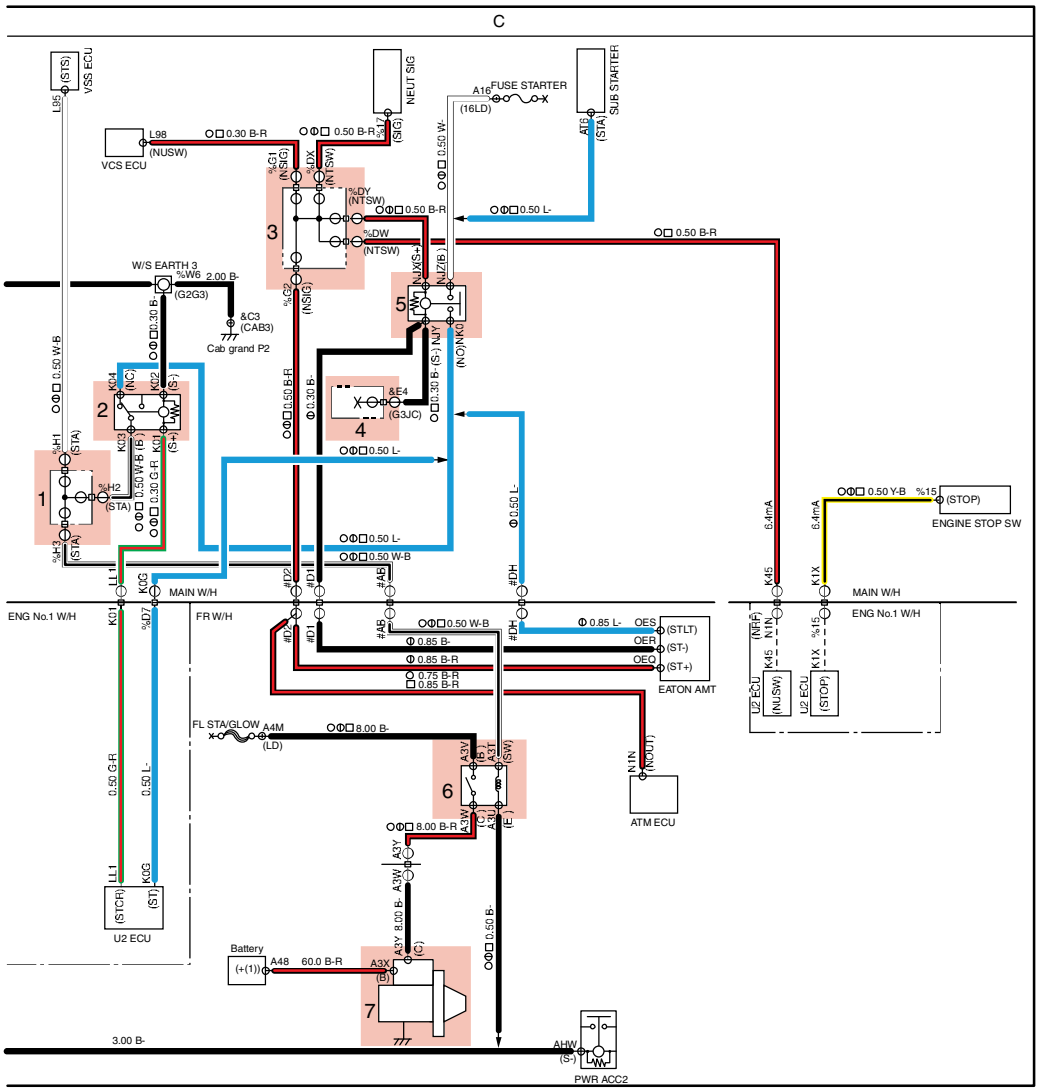


SAPH12Z160200034

B ENGINE STARTING CIRCUIT: MODELS EQUIPPED WITH EATON FS SERIES MANUAL TRANSMISSION

1 J/C SIGNAL
2 Clutch interlock switch
3 U2 J/C No.2
4 Starter cut relay
5 Starter relay
6 Starter

EL02_001.fm 25 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

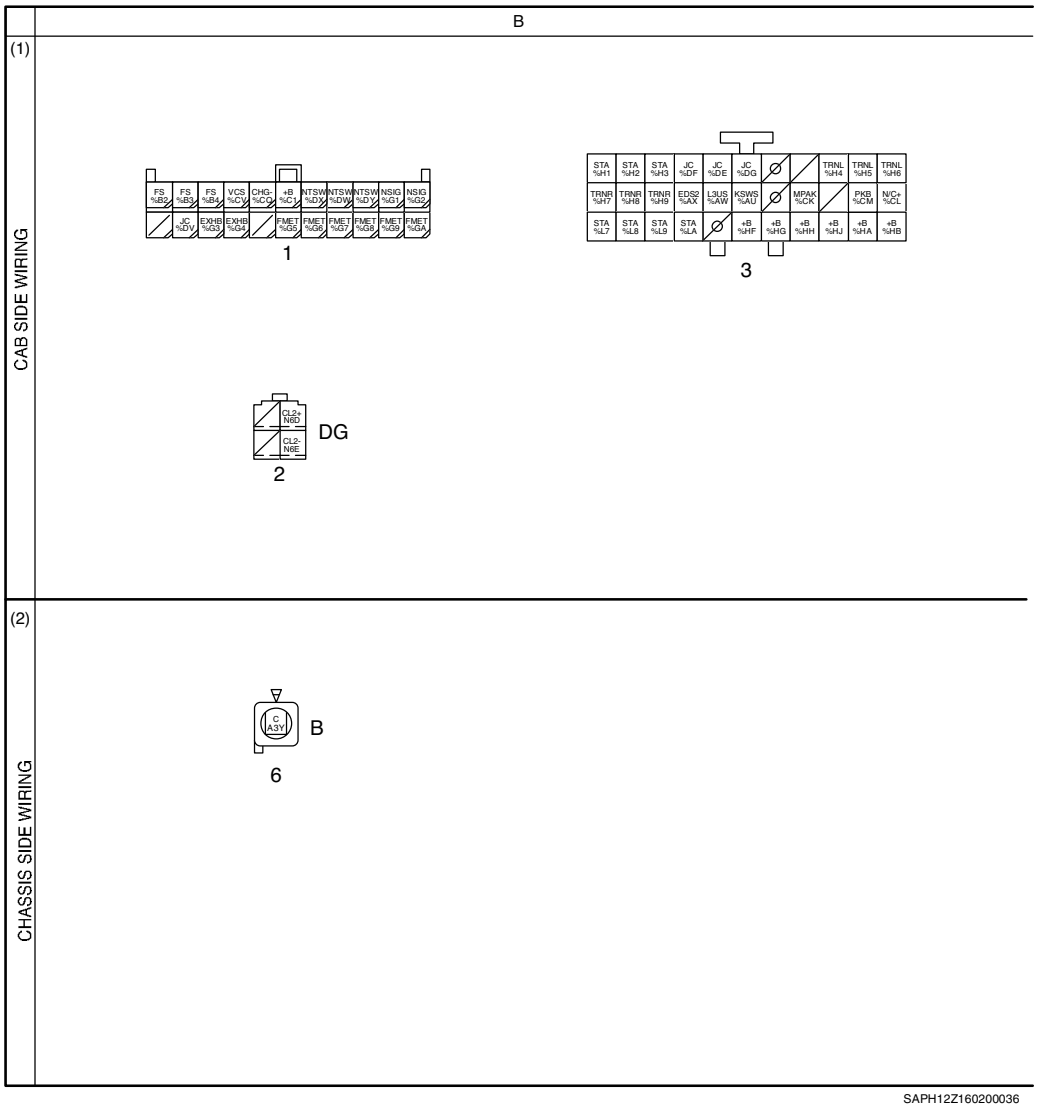


SAPH12Z160200035

C ENGINE STARTING CIRCUIT-2: MODELS EQUIPPED WITH ALLISON 2200HS, 2200RDS/2500RDS AND 3000RDS AUTOMATIC TRANSMISSION AND EATON FO SERIES AUTOMATIC MECHANICAL TRANSMISSION

1 U2 J/C No.2
2 Starter cut relay
3 J/C SIGNAL
4 J/C G3
5 ATM starter relay
6 Starter relay
7 Starter

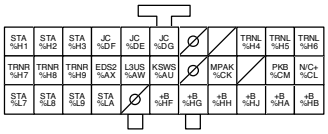
EL02_001.fm 26 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



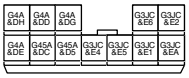
SAPH12Z160200036

EL02_001.fm 27 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

C



1



4



3

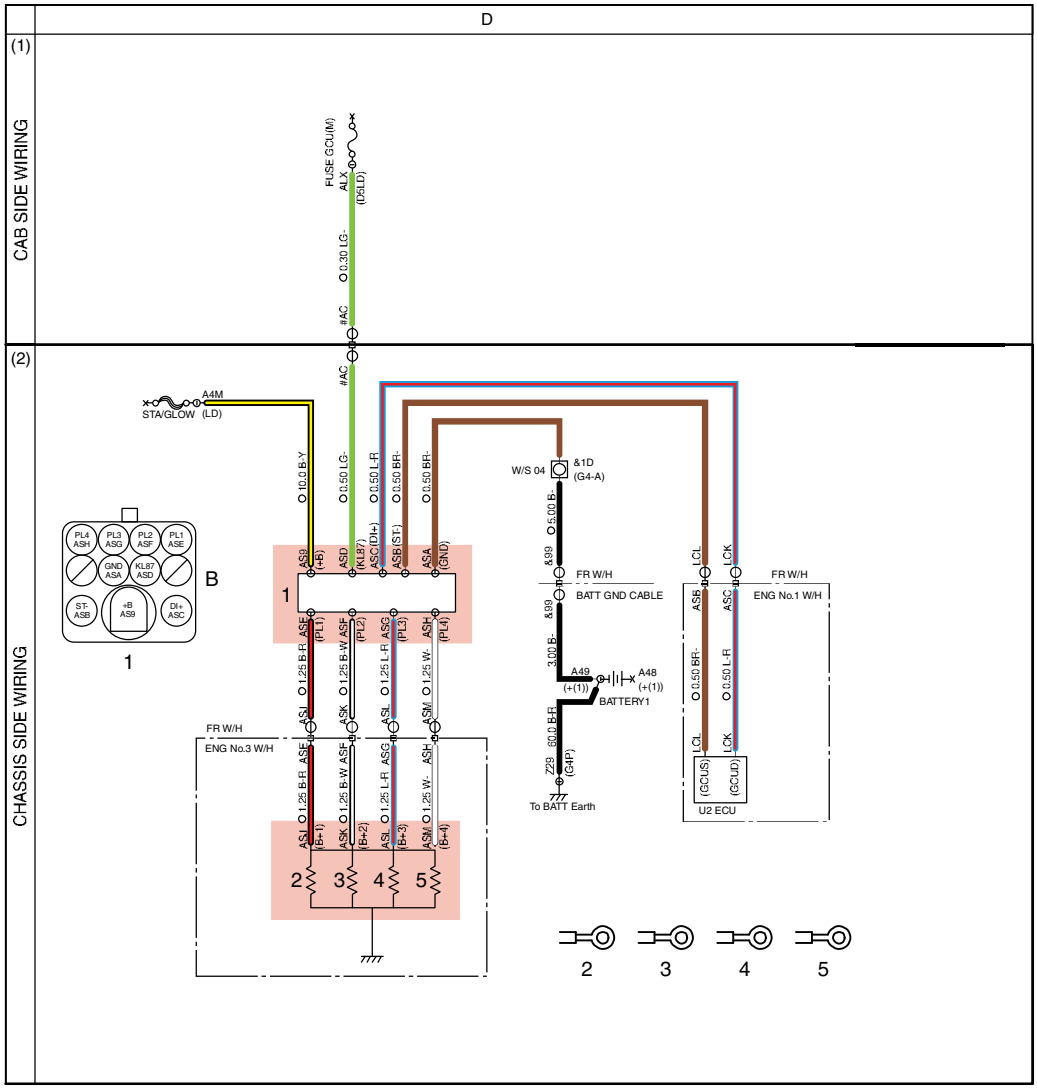


B

7

SAPH12Z160200037

EL02_001.fm 28 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200038

D GLOW PLUG CIRCUIT

1 GCU

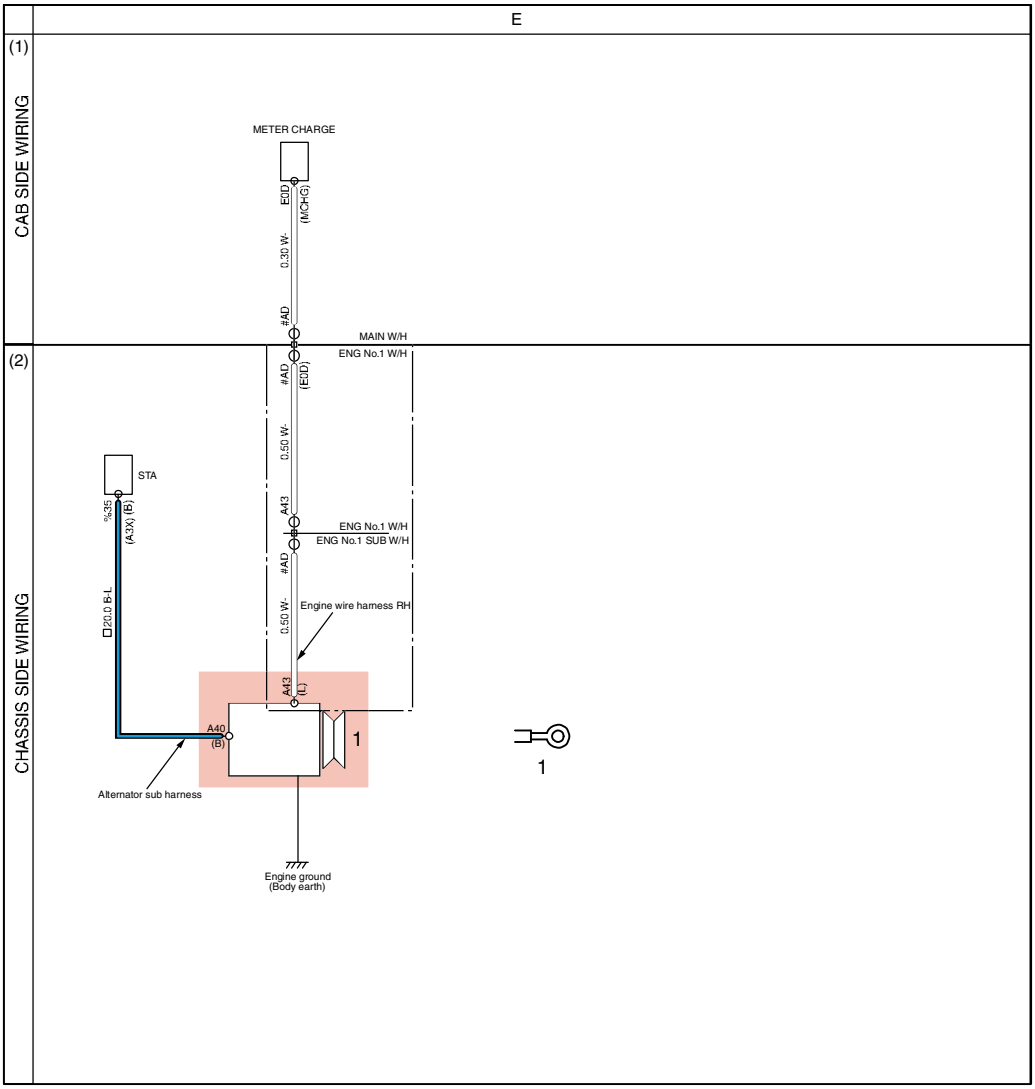
2 Glow plug No.1

3 Glow plug No.2

4 Glow plug No.3

5 Glow plug No.4

EL02_001.fm 29 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

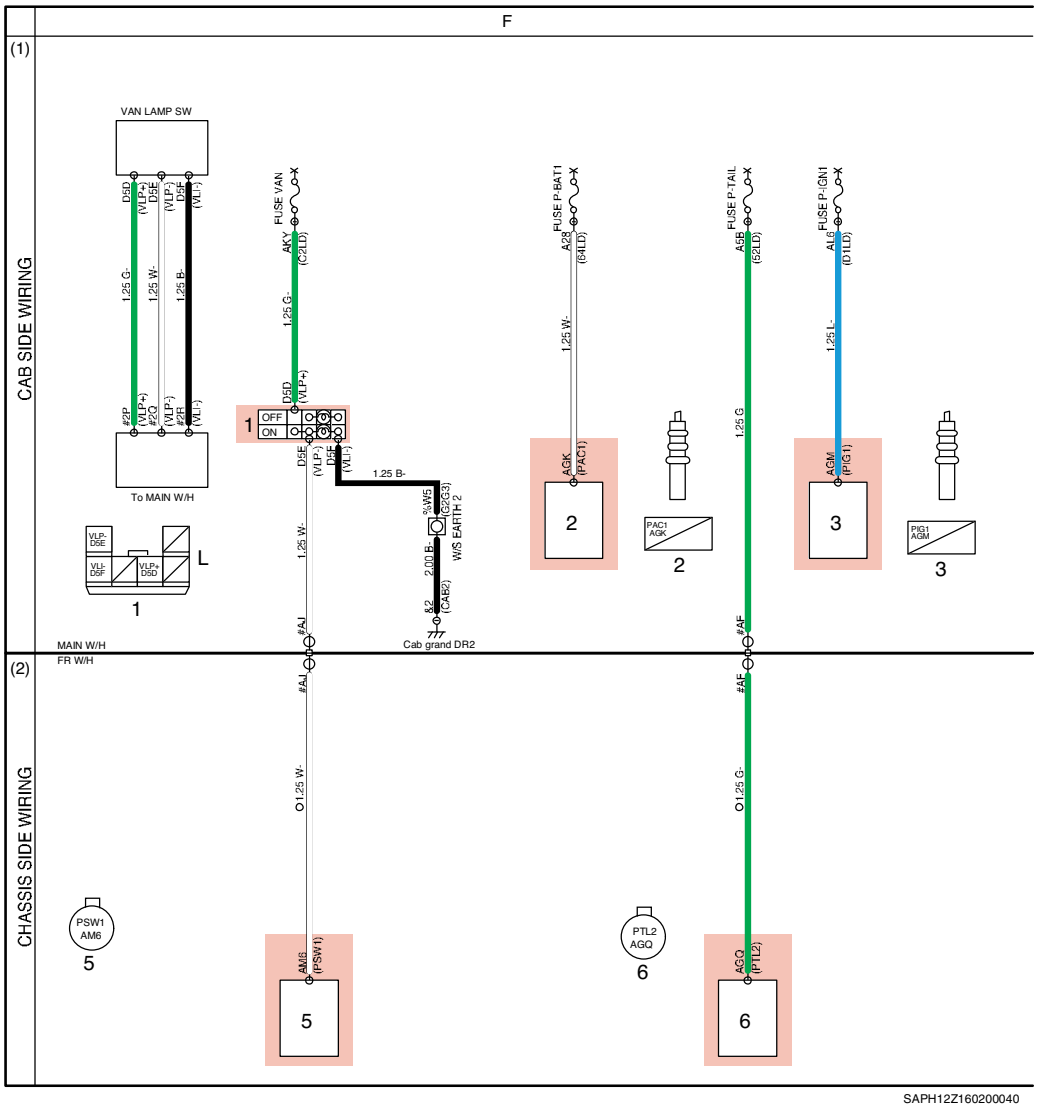


SAPH12Z160200039

E CHARGING CIRCUIT

1 Alternator

EL02_001.fm 30 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

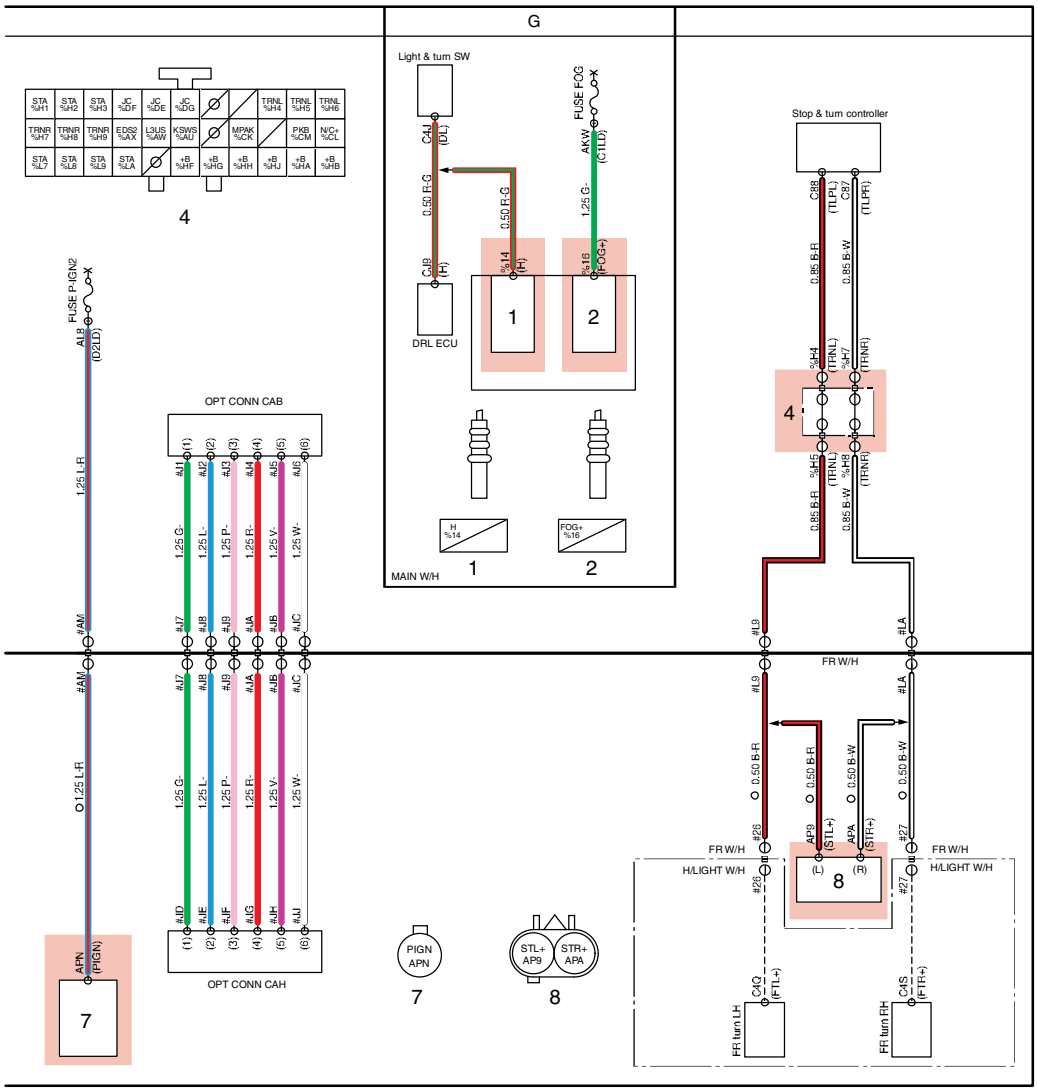


SAPH12Z160200040

F SPARE POWER SOURCE CIRCUIT

1 Van light switch
2 Spare power source (Battery)
3 Spare power source (Starter switch ON)
4 U2 J/C No.2
5 Van light connector
6 Spare power source (Tail) 2
7 Spare power source (Ignition chassis)
8 Spare power source (Signal side turn)

EL02_001.fm 31 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



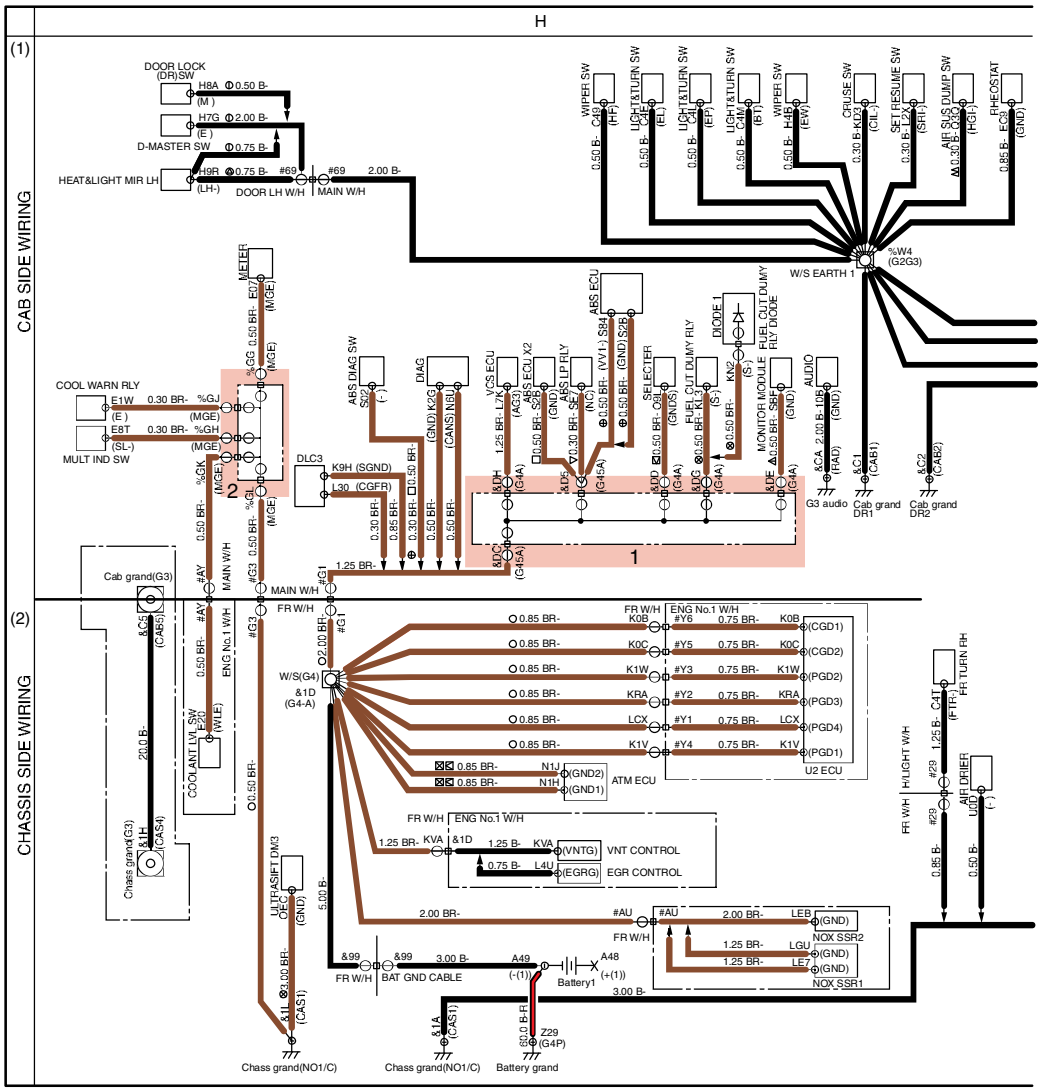
SAPH12Z160200041

G FOG LIGHT POWER SOURCE CIRCUIT

1 Fog light switch

2 Fog light power source

EL02_001.fm 32 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200042

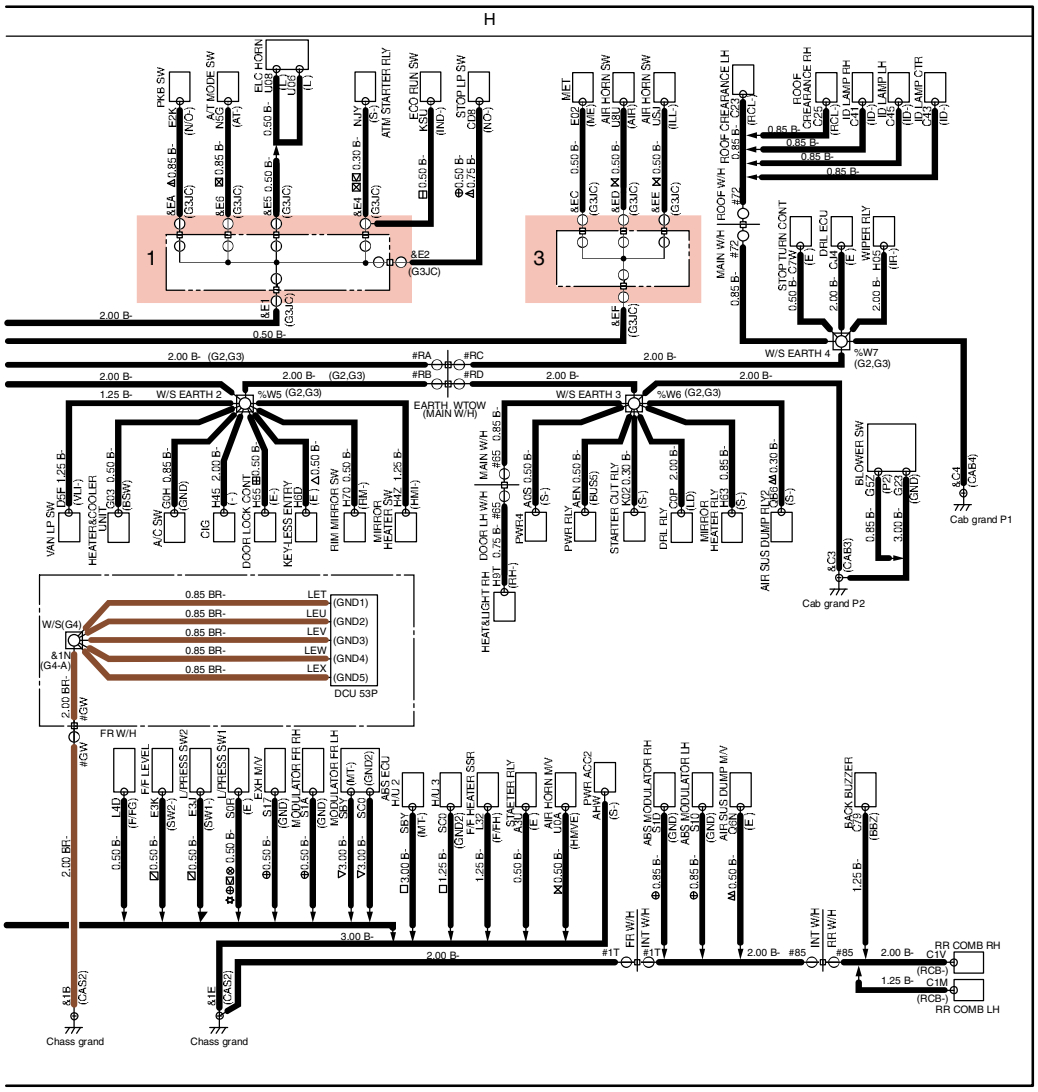
H GROUND CIRCUIT

1 J/C EARTH

2 U2 J/C No.1

3 J/C EARTH 4P

EL02_001.fm 33 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

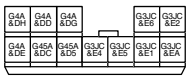


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EL02_001.fm 34 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

H

(1) CAB SIDE WIRING



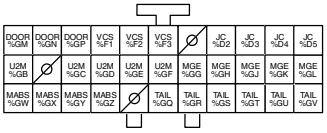
1

(2) CHASSIS SIDE WIRING

SAPH12Z160200044

EL02_001.fm 35 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

H



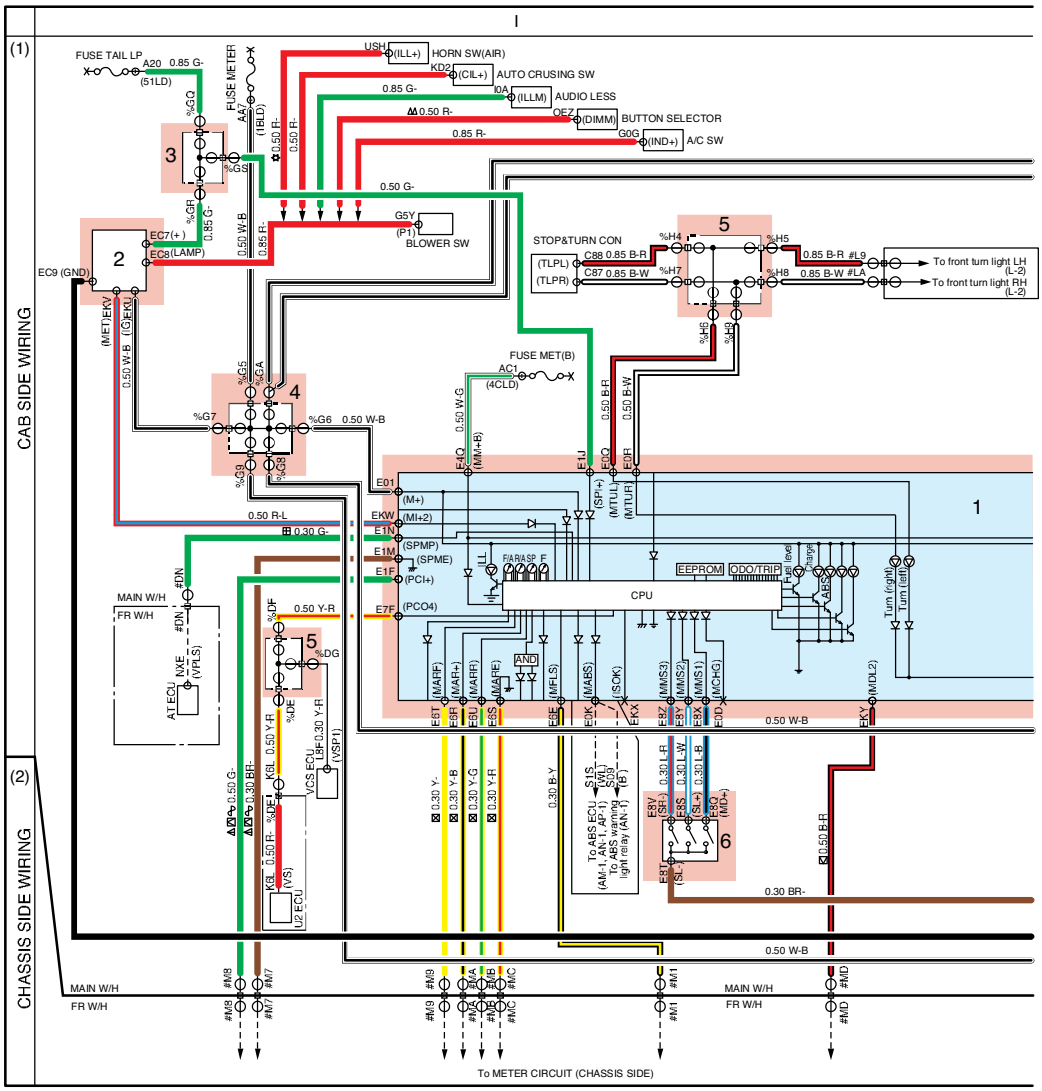
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3

SAPH12Z160200045

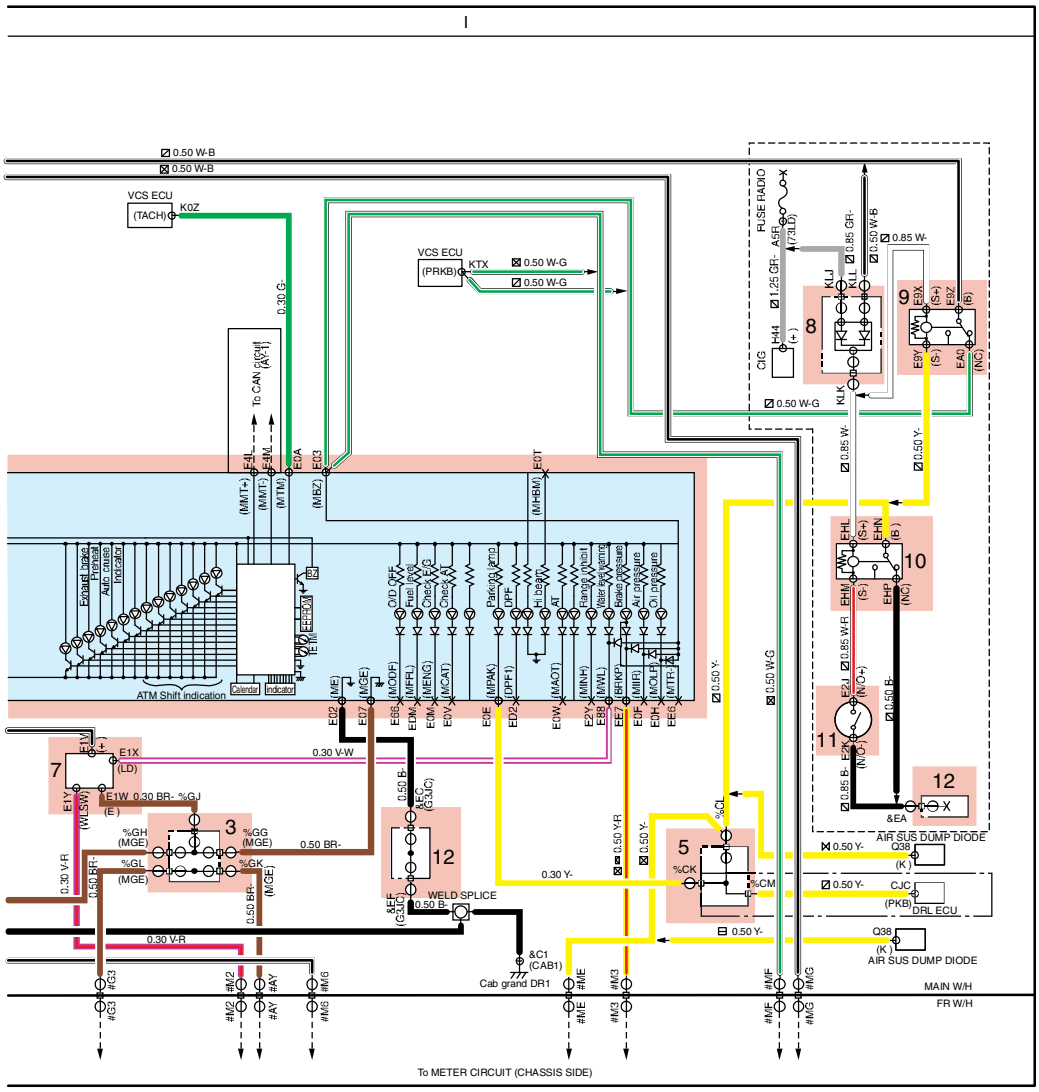
EL02_001.fm 36 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200046

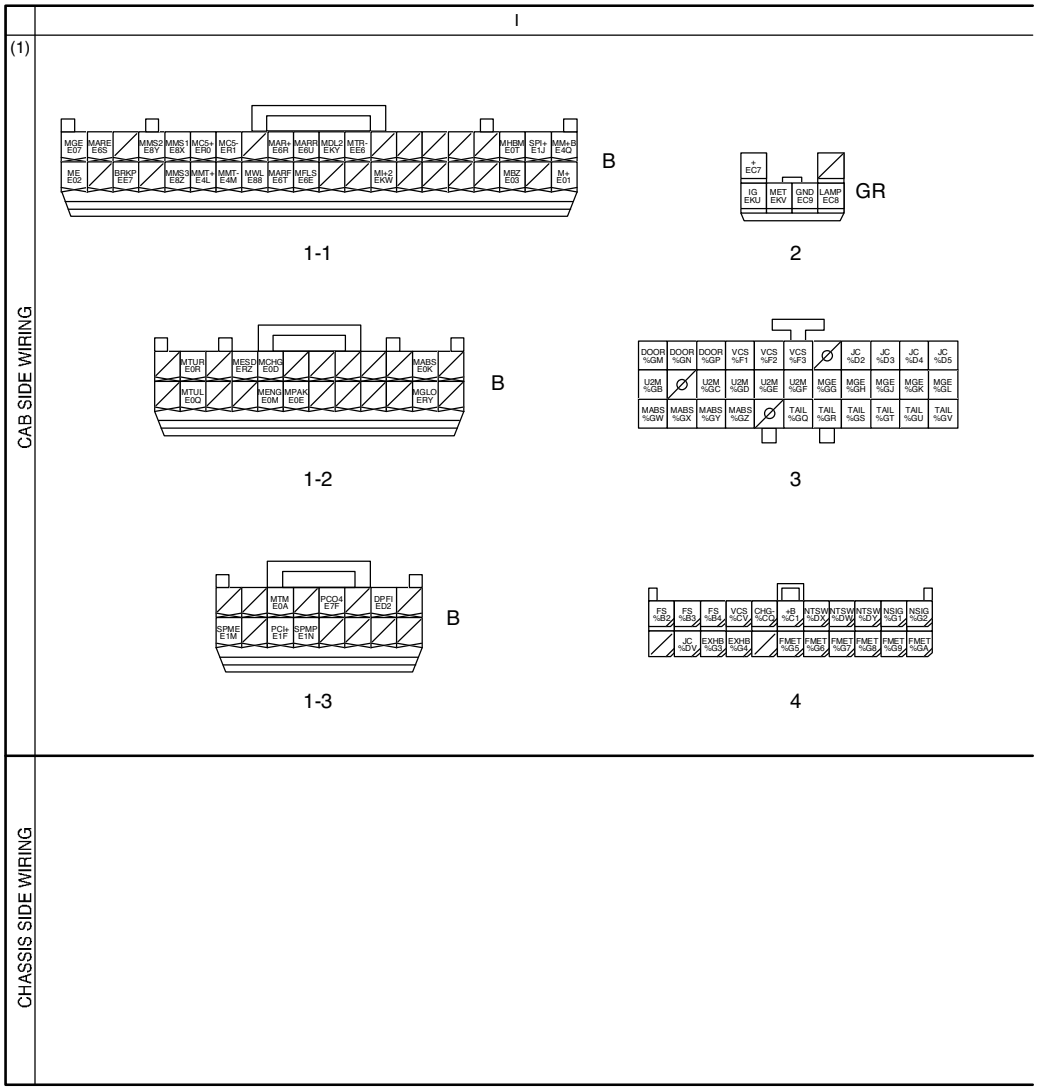
I	METER CIRCUIT (CAB SIDE)		
1	Combination meter	7	Coolant warning relay
2	Rheostat	8	Parking brake off diode (For center parking)
3	U2 J/C No.1	9	Parking brake buzzer off relay (For center parking)
4	J/C SIGNAL	10	Parking brake indicator off relay (For center parking)
5	U2 J/C No.2	11	Parking brake switch
6	Multi indicator switch	12	J/C EARTH 4P

EL02_001.fm 37 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200047

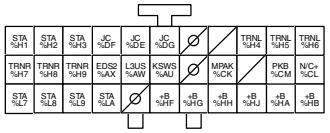
EL02_001.fm 38 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



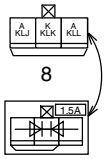
SAPH12Z160200048

EL02_001.fm 39 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

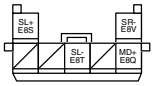
I



5



8



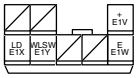
B

6



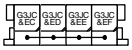
B

11



W

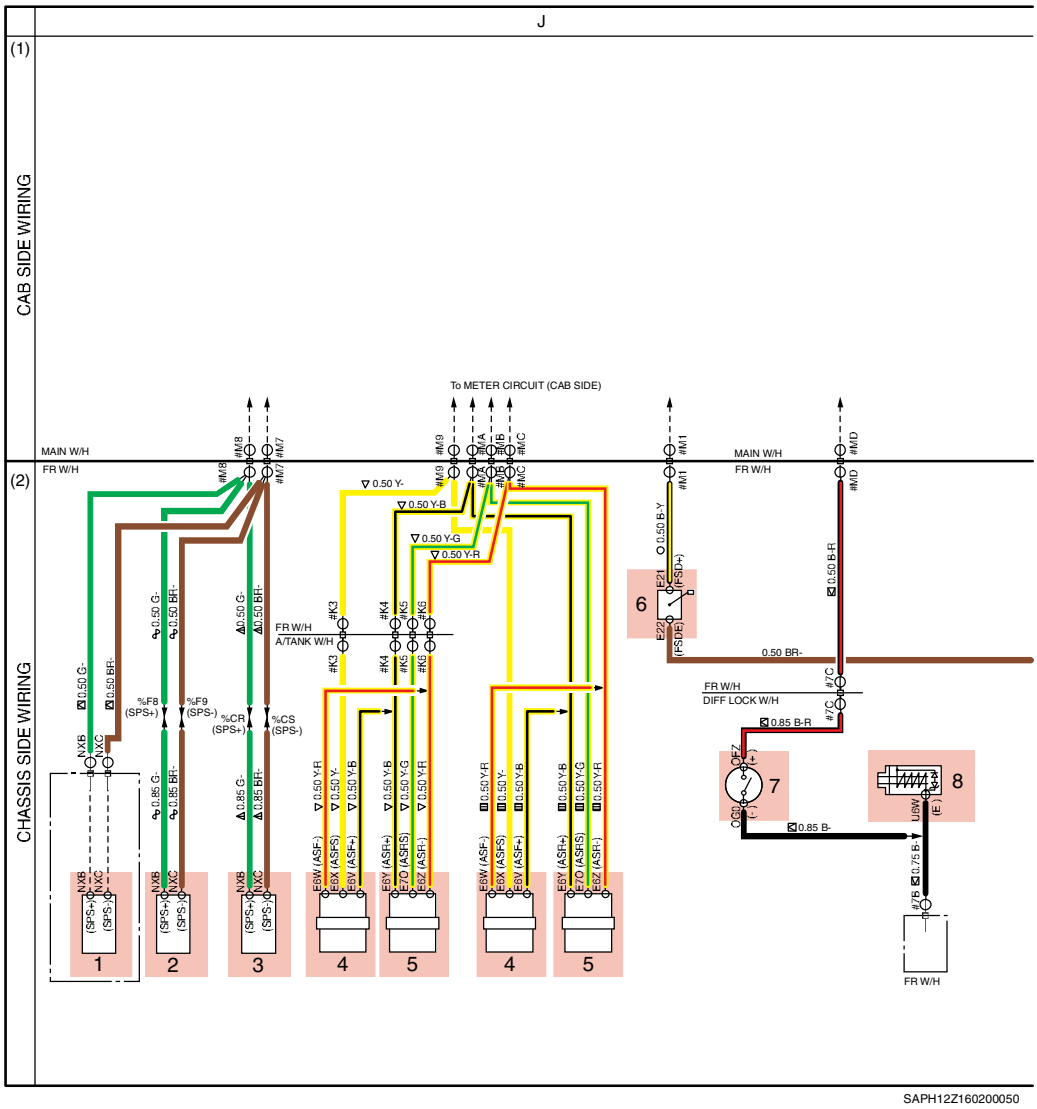
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12

SAPH12Z160200049

EL02_001.fm 40 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



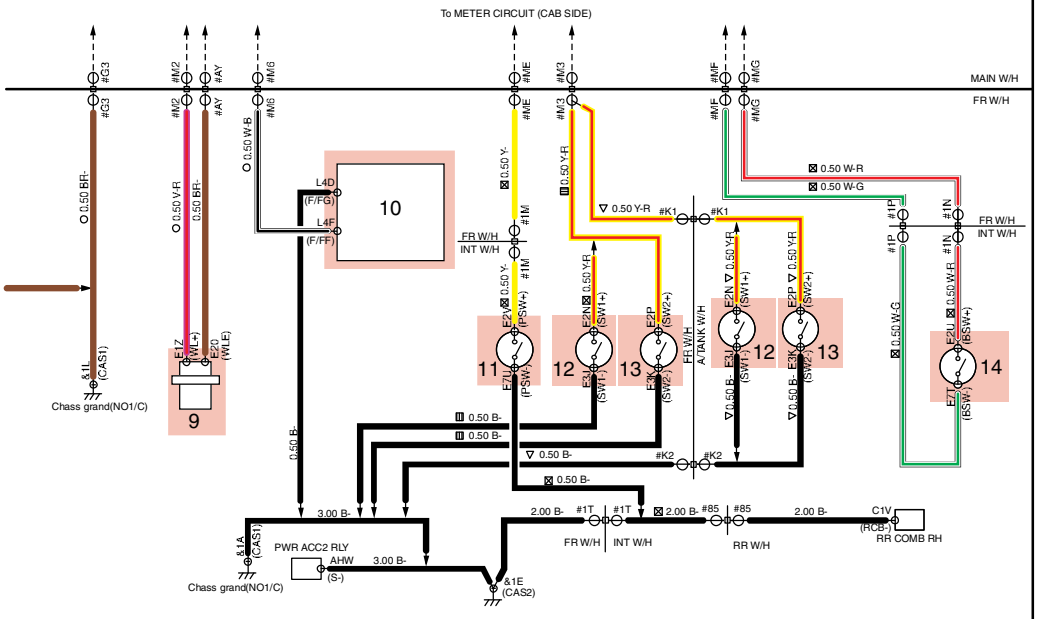
SAPH12Z160200050

J METER CIRCUIT (CHASSIS SIDE)

1 Speed sensor (For HYDRO MAX brake and MTM)
2 Speed sensor (For EATON AMT)
3 Speed sensor (For full air brake and MTM)
4 Air gauge sensor front (For full air brake)
5 Air gauge sensor rear (For full air brake)
6 Fuel sender
7 Manual differential lock switch
8 Manual differential lock magnetic valve
9 Coolant level switch
10 Fuel filter water level sensor
11 Spring brake switch (For wheel parking)
12 Low pressure switch No.1
13 Low pressure switch No.2
14 Buzzer off switch (For wheel parking)

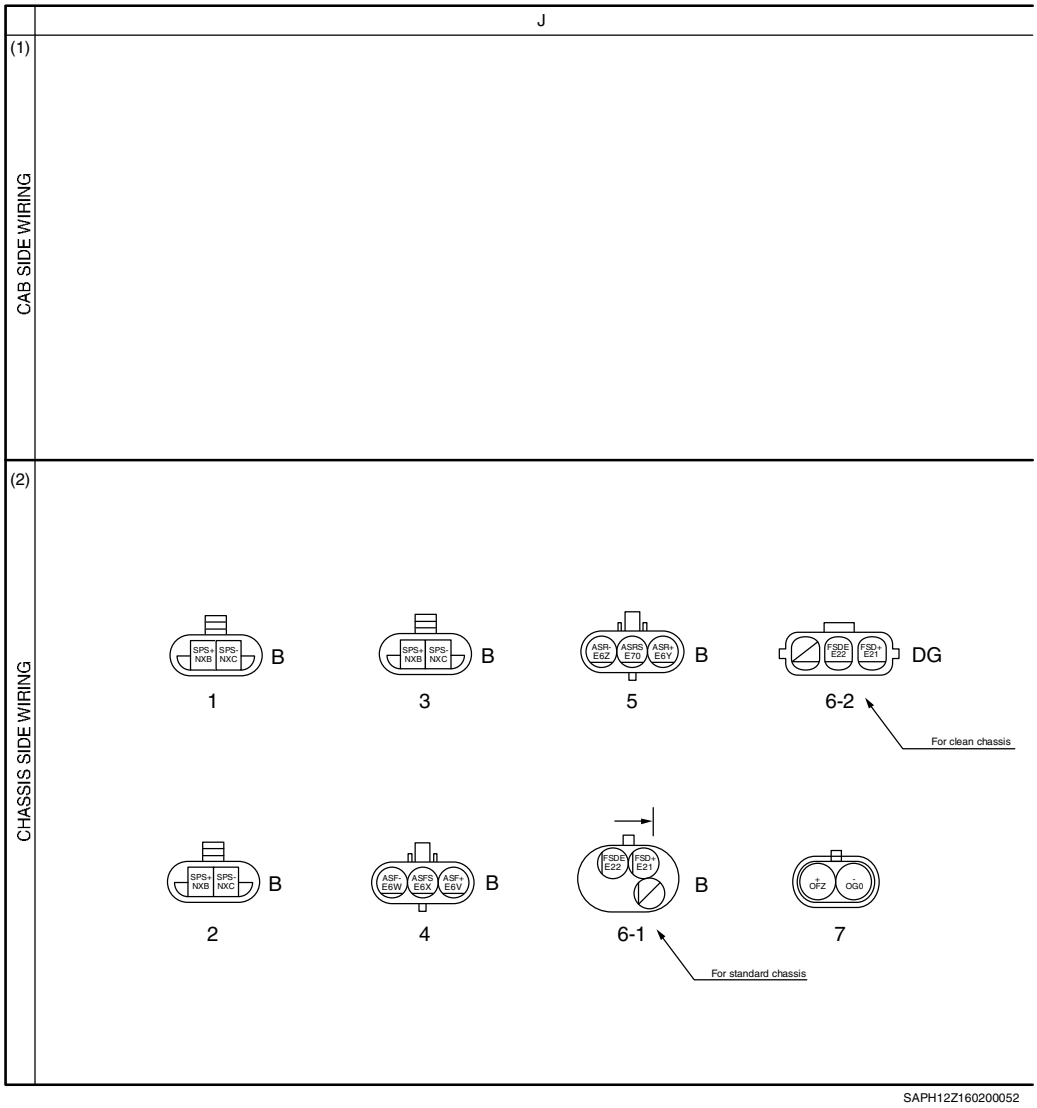
EL02_001.fm 41 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

J



SAPH12Z160200051

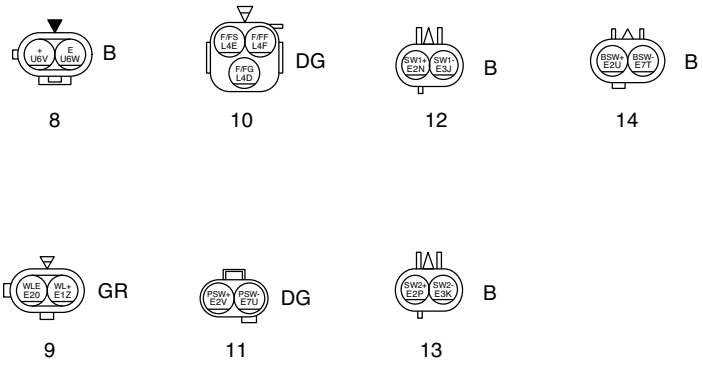
EL02_001.fm 42 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200052

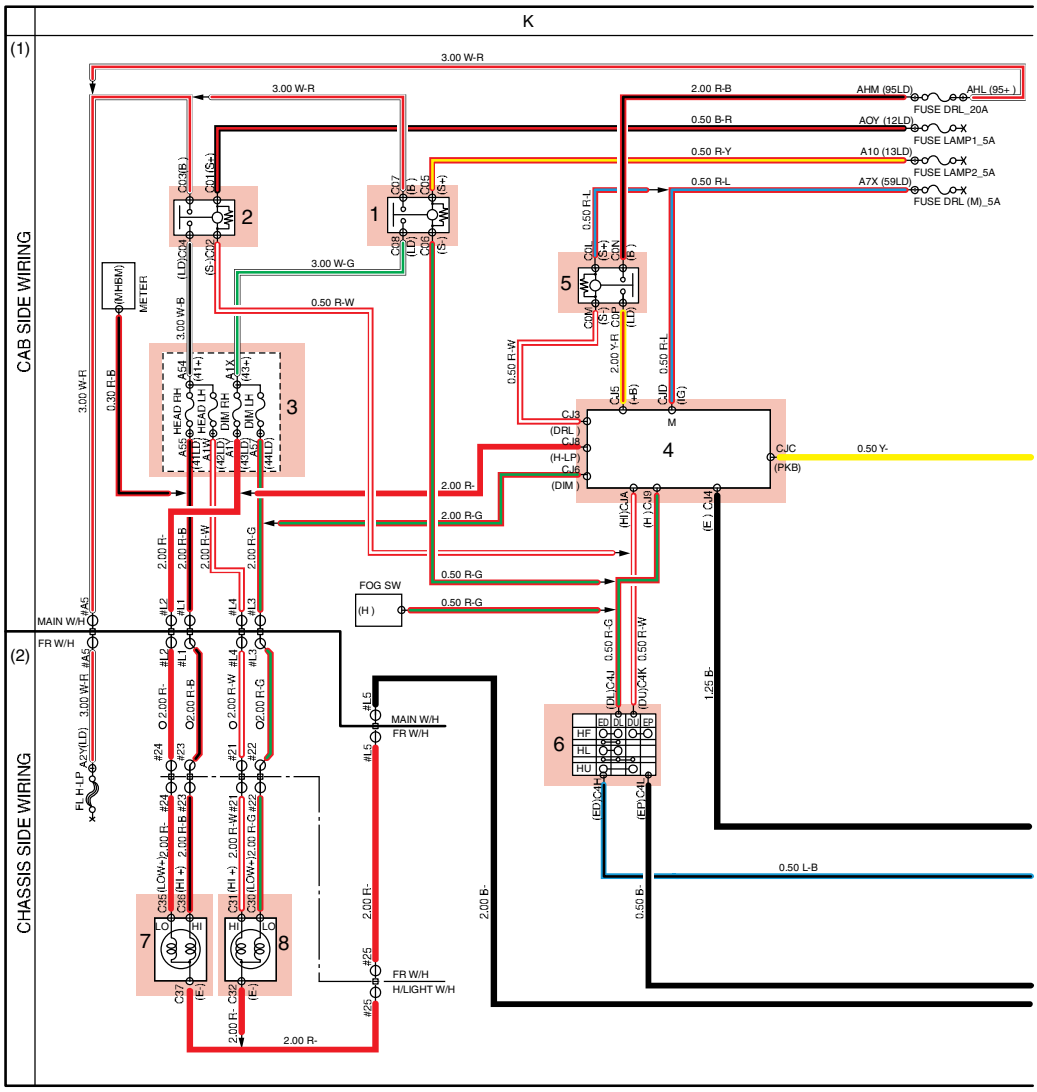
EL02_001.fm 43 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

J



SAPH12Z160200053

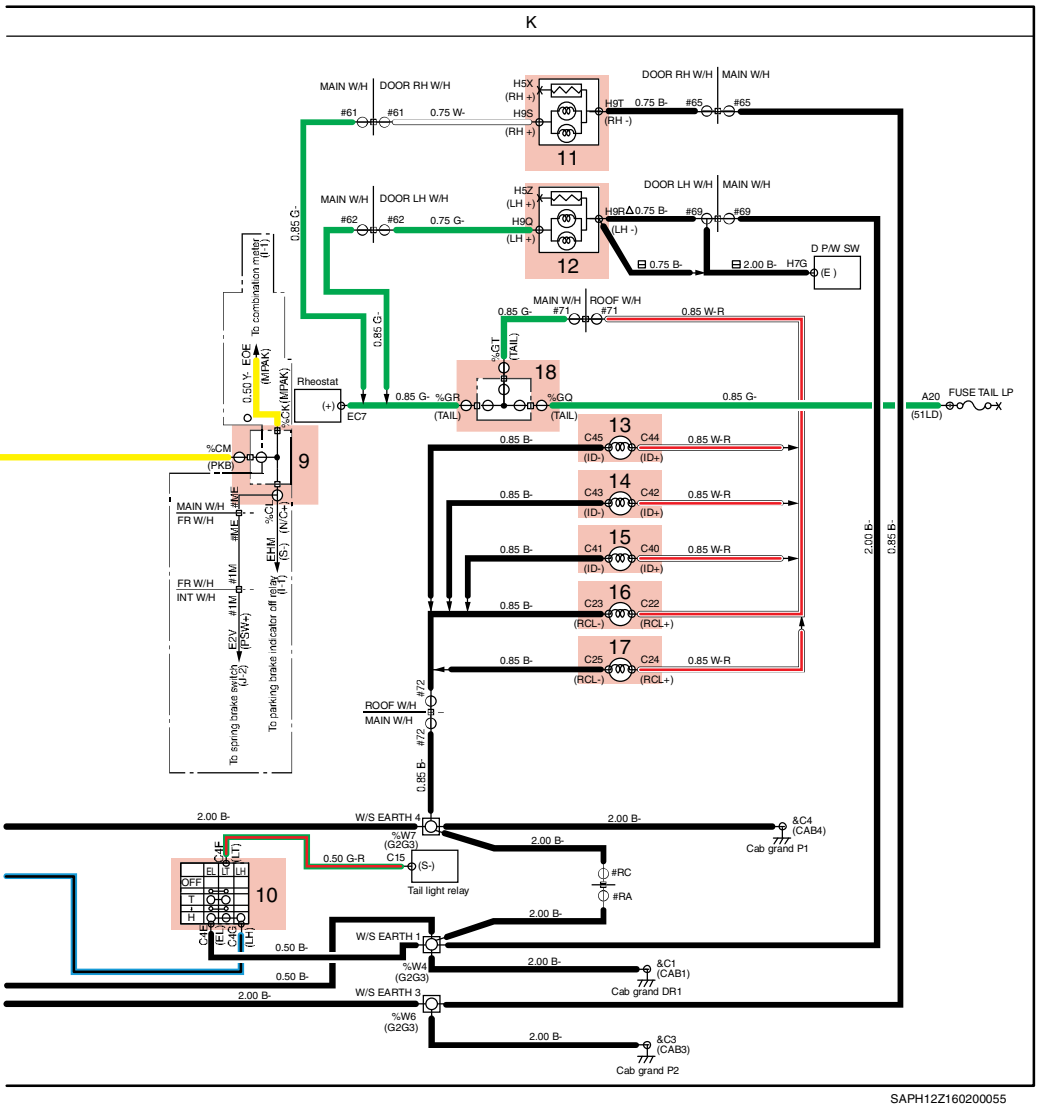
EL02_001.fm 44 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



K DAYTIME RUNNING LIGHT (DRL) AND TAIL LIGHT CIRCUIT

1 Head light dimmer relay
2 Head light main relay
3 Fuse and relay block B
4 Daytime running light ECU
5 Daytime running light relay
6 Light and turn switch
7 Head light RH
8 Head light LH
9 U2 J/C No. 2
10 Light and turn switch
11 Heater and light mirror RH
12 Heater and light mirror LH
13 Identification light LH

EL02_001.fm 45 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200055

14 Identification light center

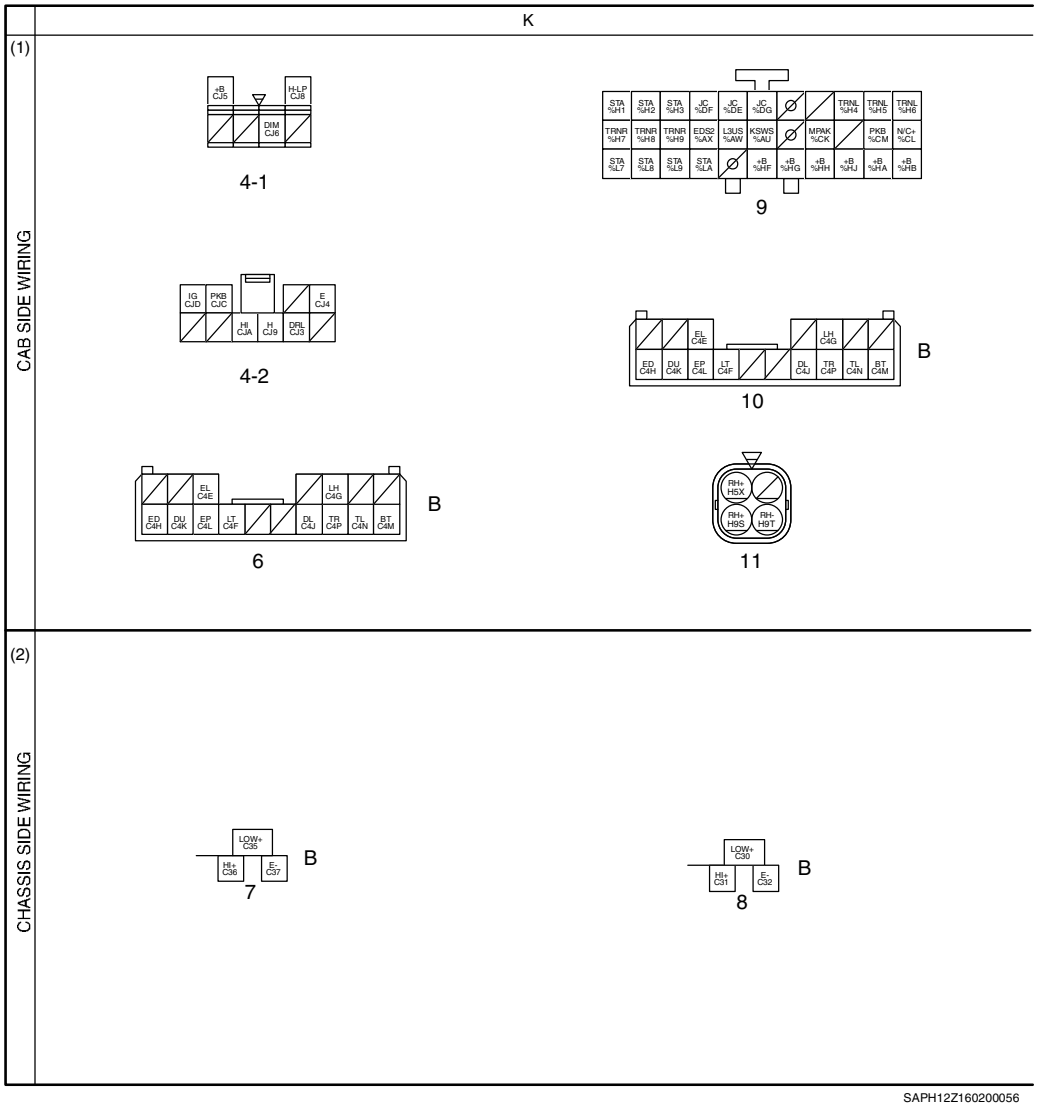
15 Identification light RH

16 Roof clearance light LH

17 Roof clearance light RH

18 U2 J/C No.1

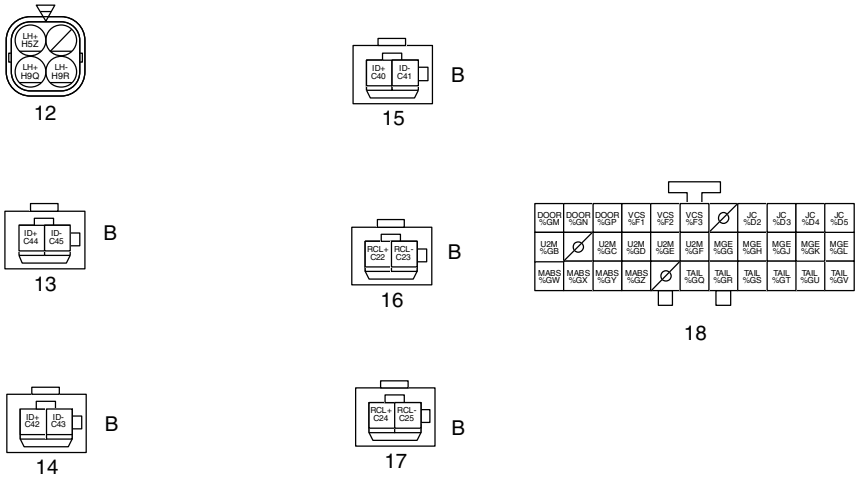
EL02_001.fm 46 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200056

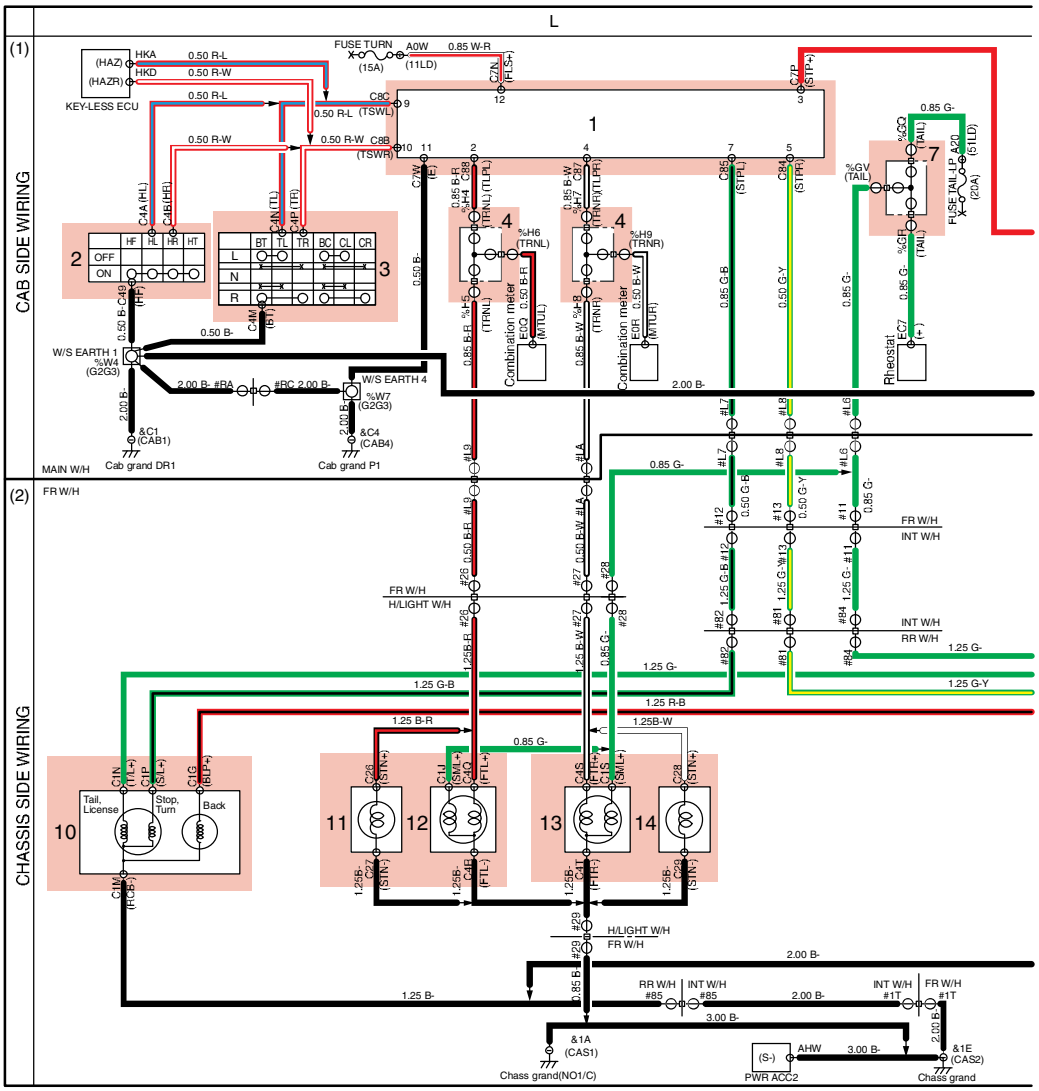
EL02_001.fm 47 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

K



SAPH12Z160200057

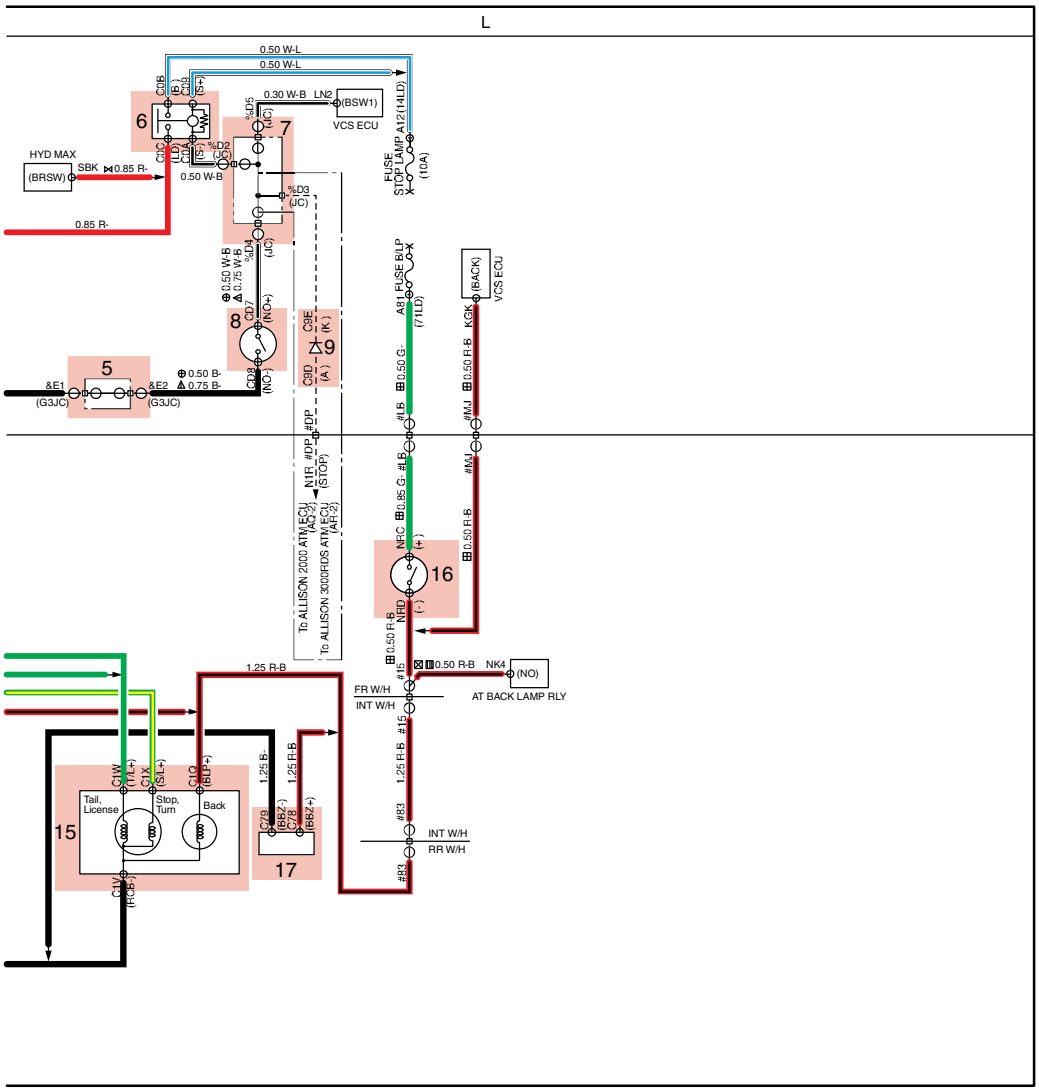
EL02_001.fm 48 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



L STOP AND TURN LIGHT CIRCUIT

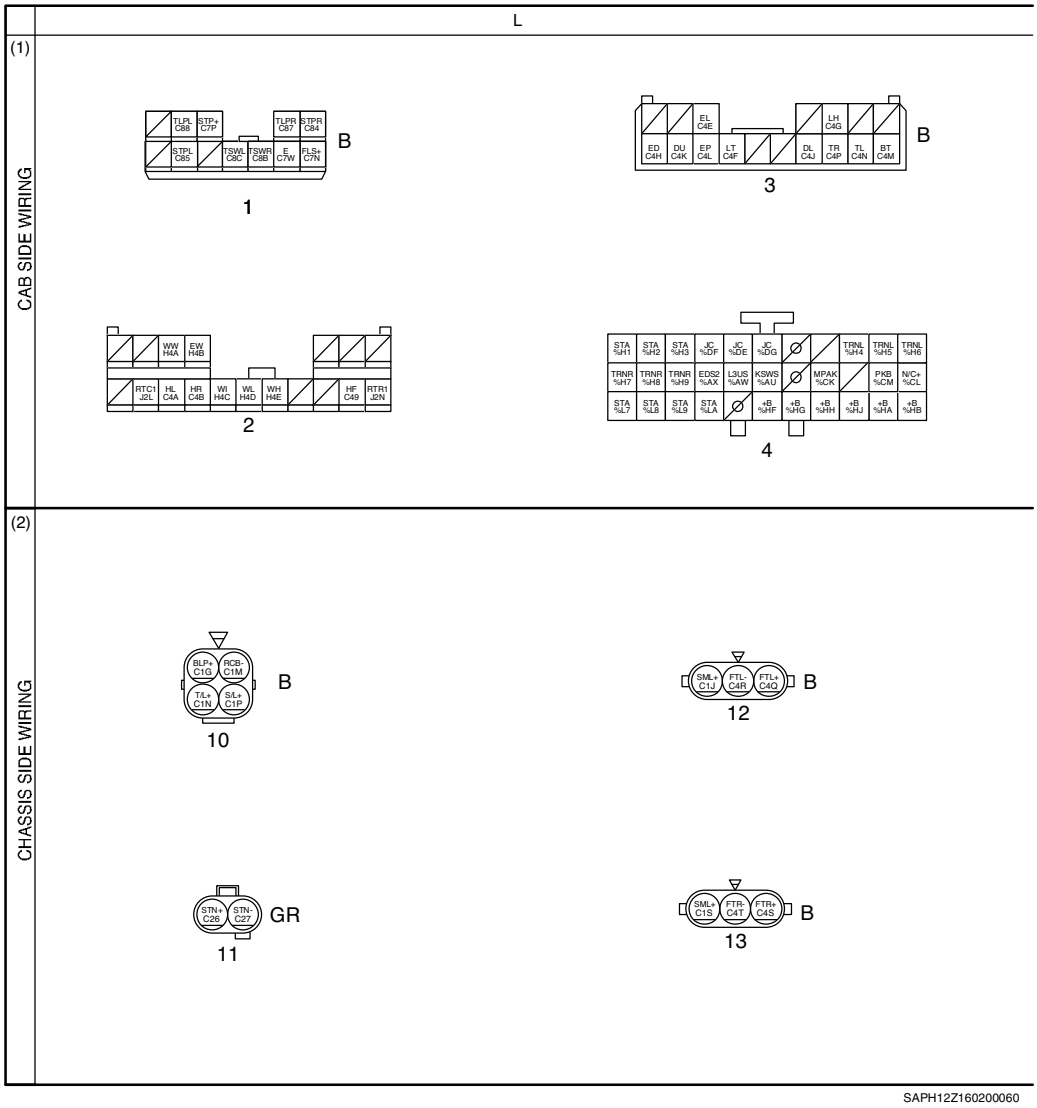
1 Stop and turn controller
2 Wiper and retarder switch
3 Light and turn switch
4 U2 J/C No. 2
5 J/C EARTH
6 Stop light relay
7 U2 J/C No. 1
8 Stop light switch
9 STP AT diode
10 Rear combination light LH
11 Side turn light LH (Fender)
12 Front turn light LH
13 Front turn light RH
14 Side turn light RH (Fender)
15 Rear combination light RH
16 Back-up light switch
17 Back-up buzzer

EL02_001.fm 49 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200059

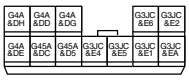
EL02_001.fm 50 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



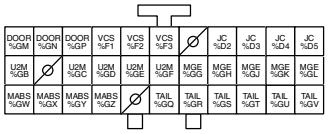
SAPH12Z160200060

EL02_001.fm 51 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

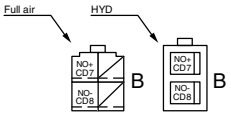
L



5



7



8-1 8-2



9





6



14



16



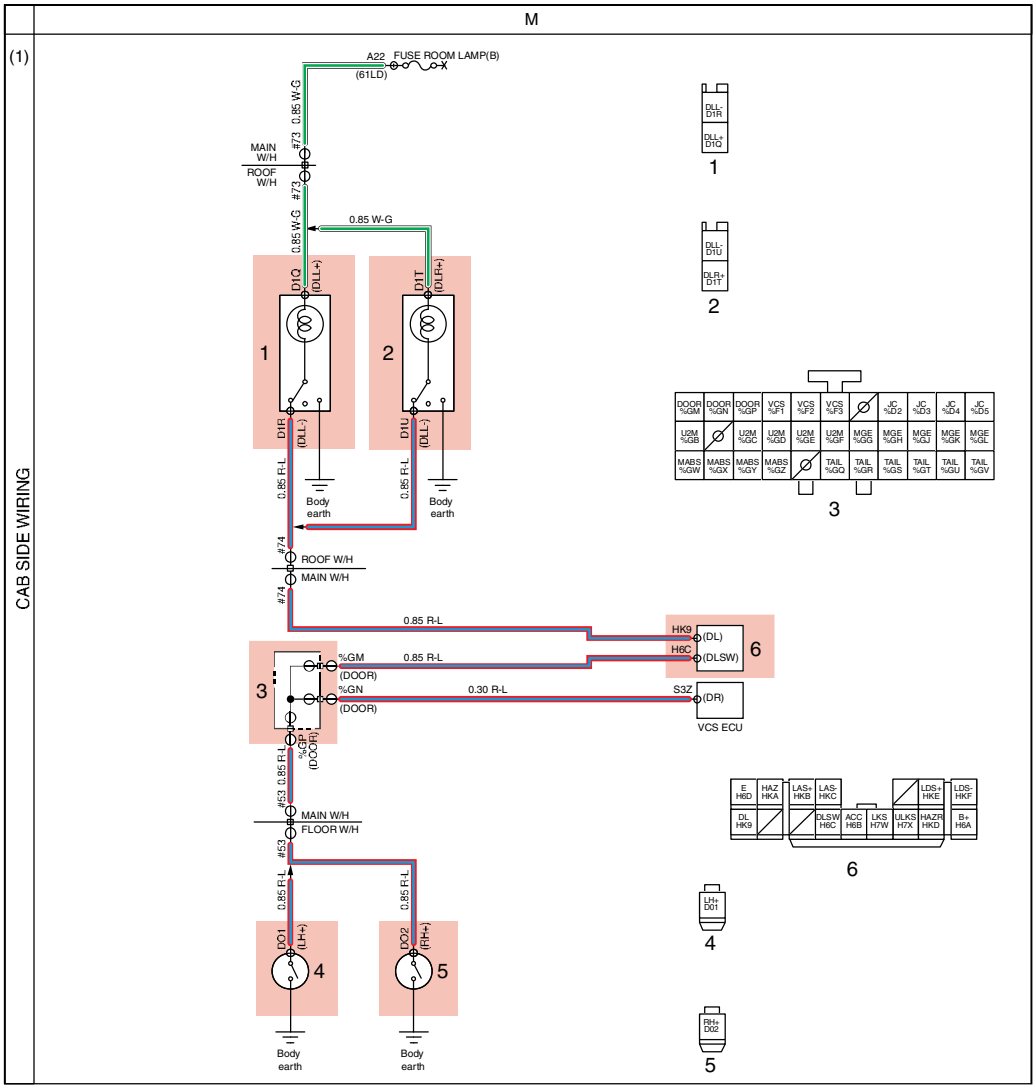
15



17

SAPH12Z160200061

EL02_001.fm 52 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200062

M ROOM LIGHT CIRCUIT

1 Dome light LH

2 Dome light RH

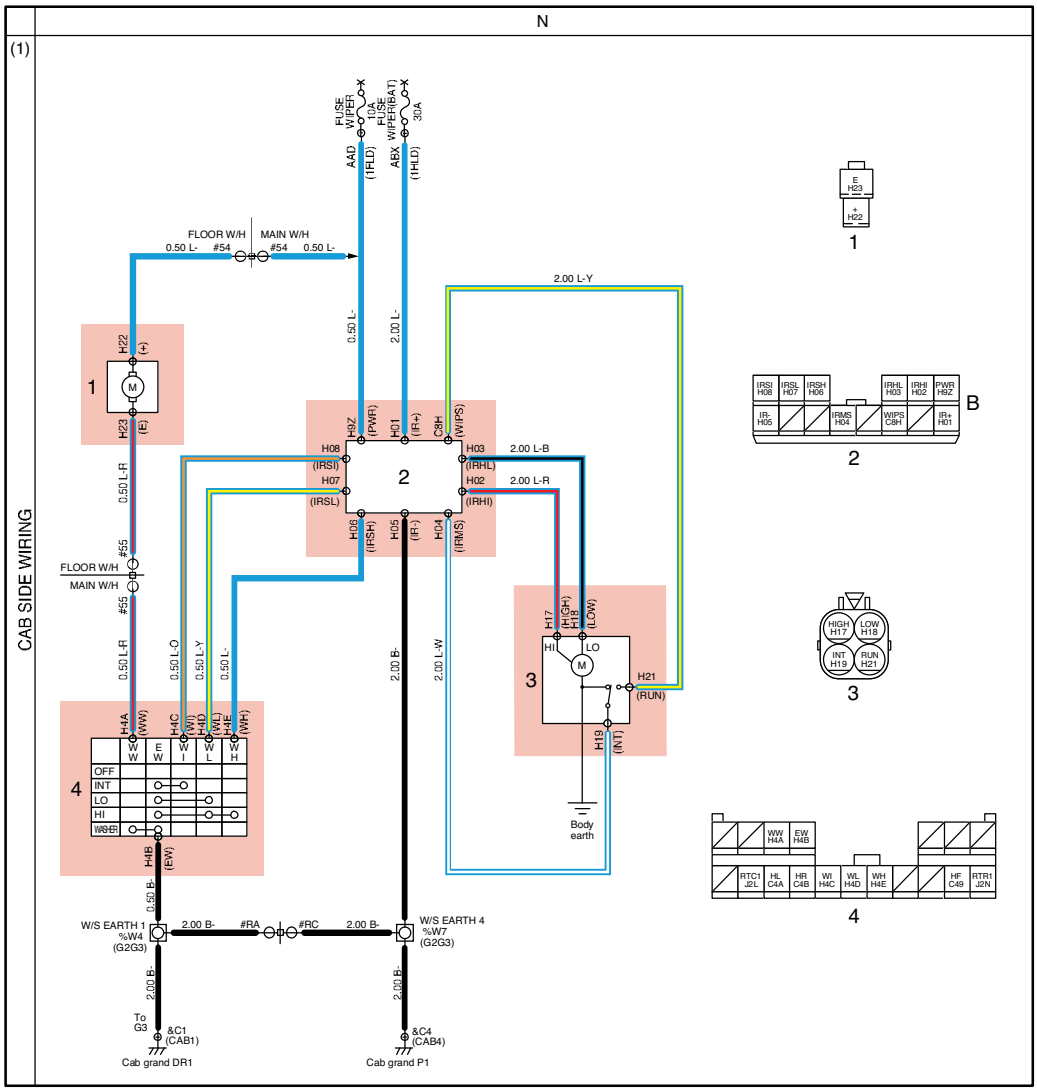
3 U2 J/C No.1

4 Courtesy switch front LH

5 Courtesy switch front RH

6 Key-less entry controller

EL02_001.fm 53 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200063

N WIPER AND WASHER CIRCUIT

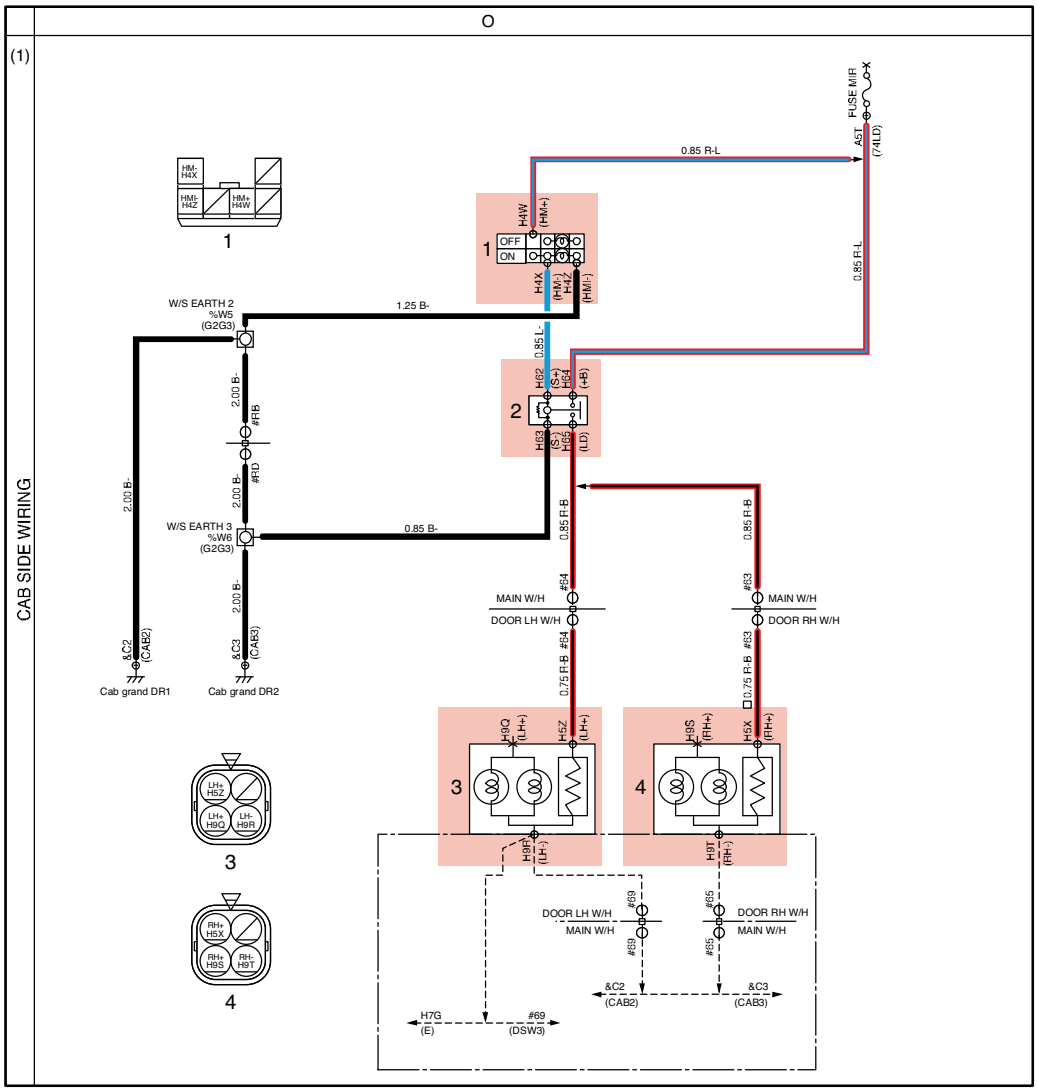
1 Washer pump motor

2 Wiper relay

3 Wiper motor

4 Wiper and retarder switch

EL02_001.fm 54 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200064

O MIRROR HEATER CIRCUIT

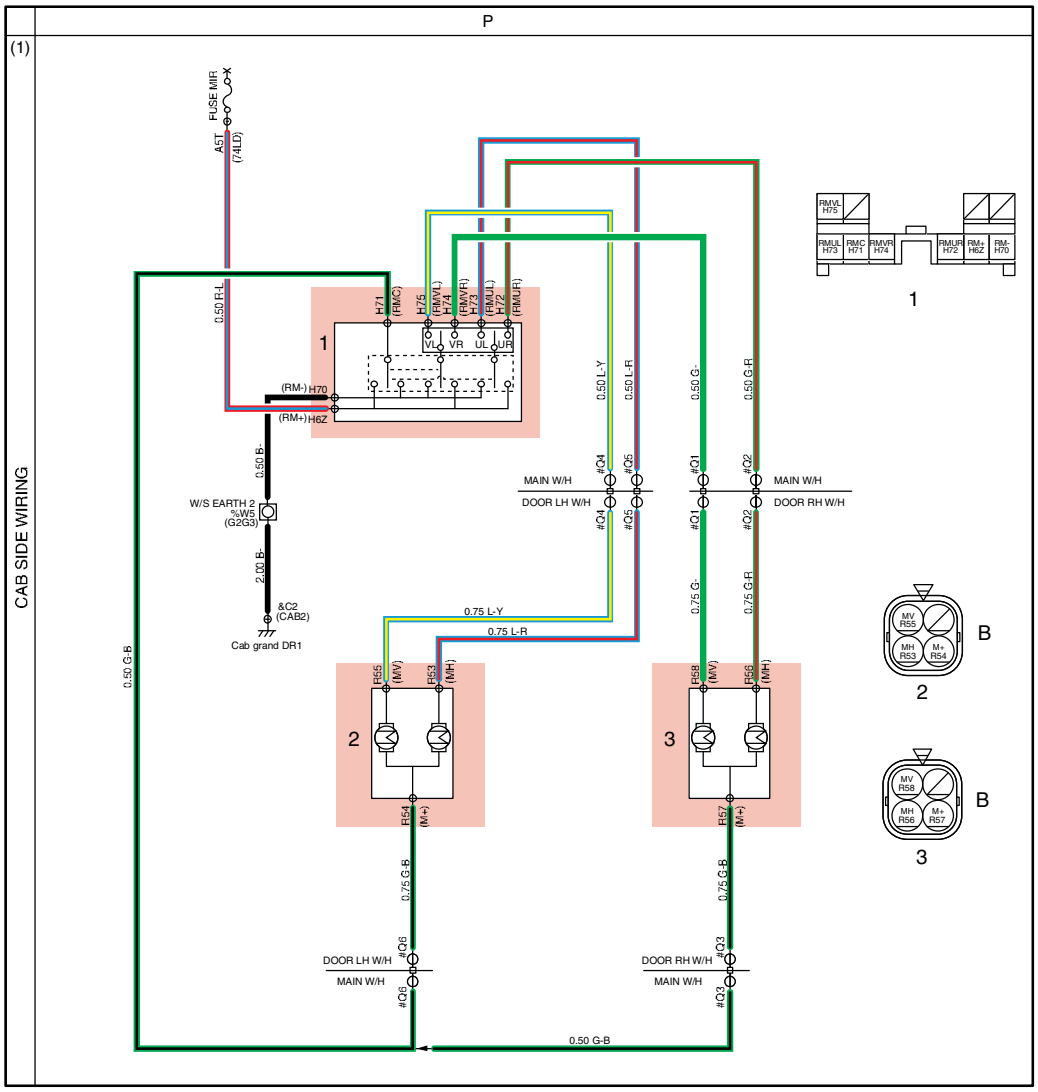
1 Mirror heater switch

2 Mirror heater relay

3 Heater and light mirror LH

4 Heater and light mirror RH

EL02_001.fm 55 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200065

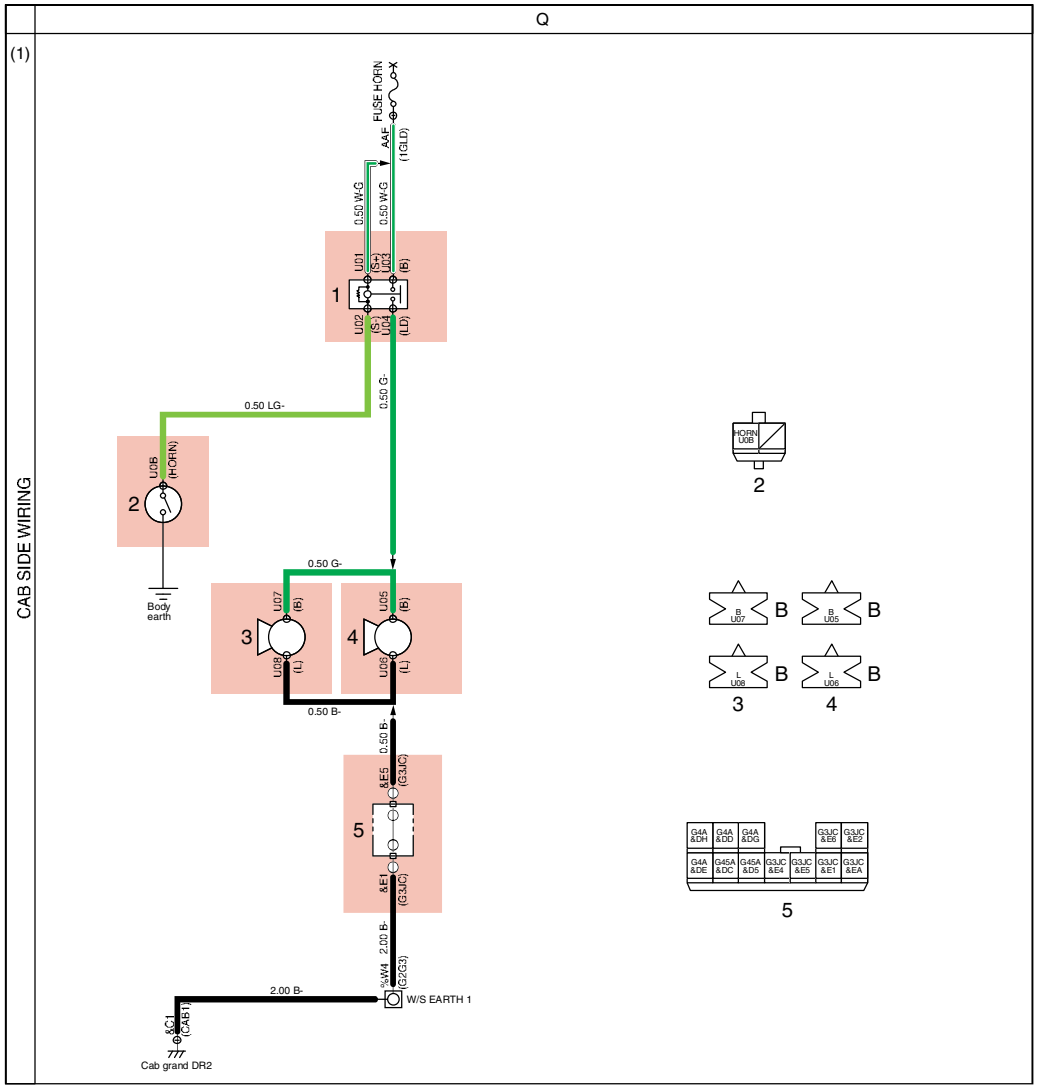
P REMOTE CONTROL MIRROR CIRCUIT

1 Remote control mirror switch

2 Remote control mirror LH

3 Remote control mirror RH

EL02_001.fm 56 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200066

Q ELECTRIC HORN CIRCUIT

1 Horn relay

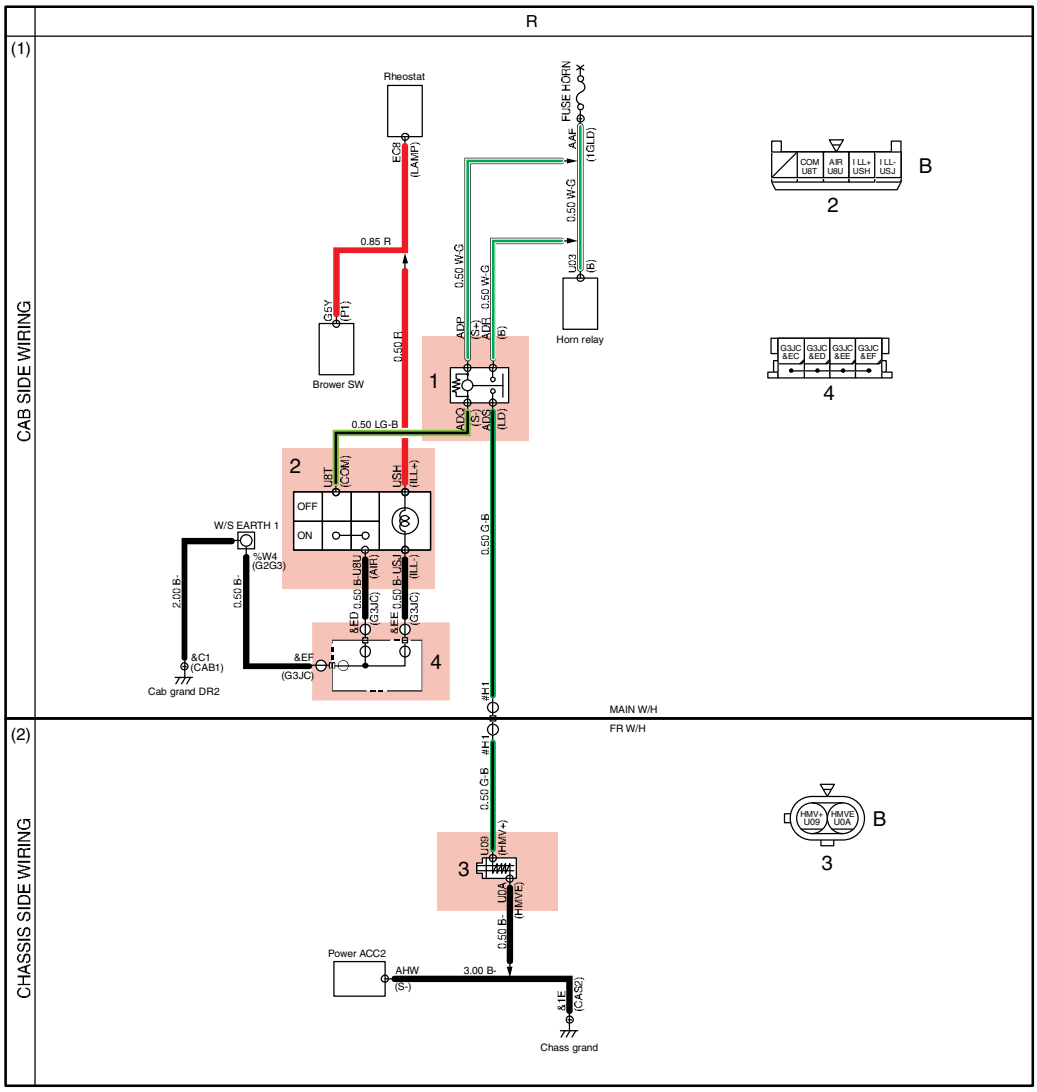
2 Horn switch

3 Horn (Low)

4 Horn (High)

5 J/C G3

EL02_001.fm 57 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200067

R AIR HORN CIRCUIT

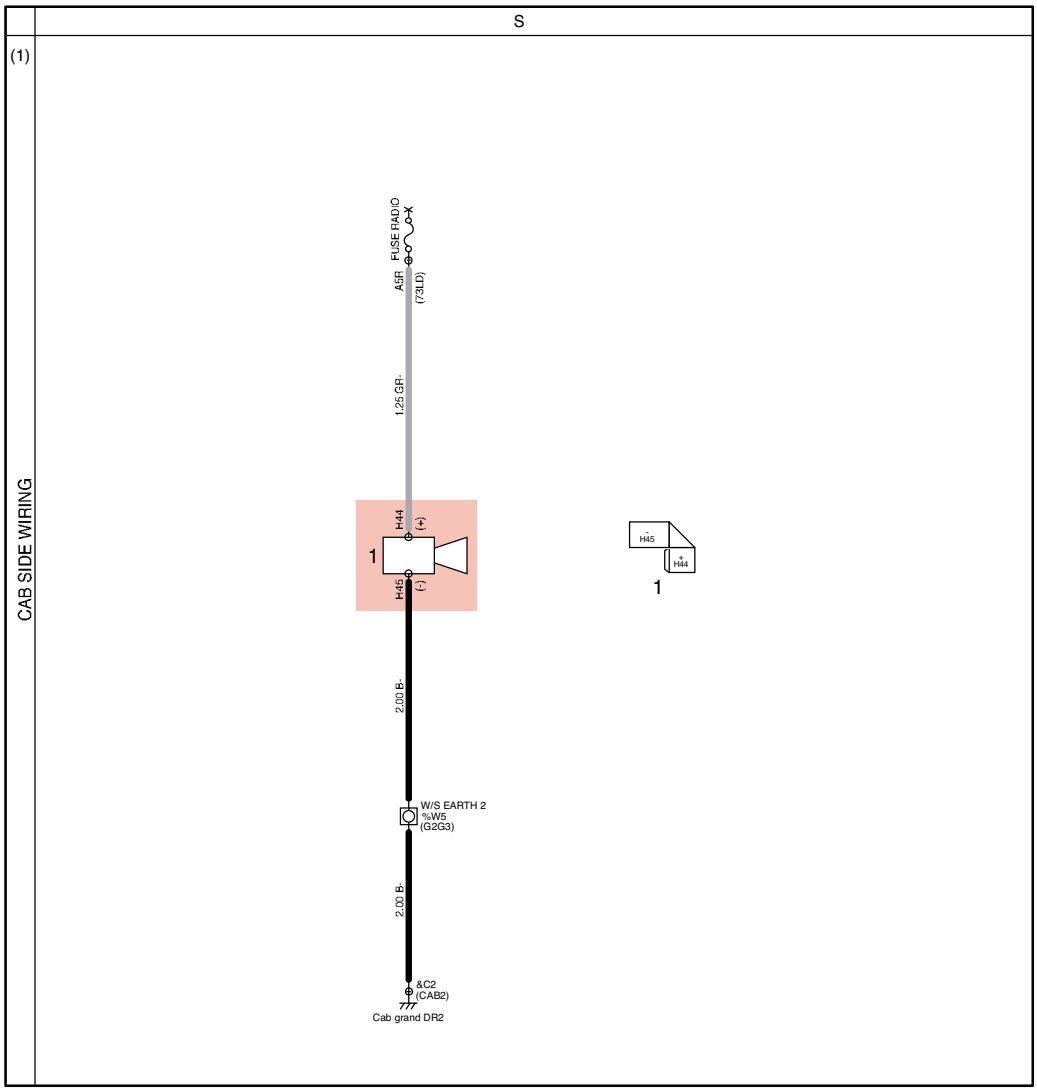
1 Air horn relay

2 Air horn switch

3 Air horn magnetic valve

4 J/C EARTH 4P

EL02_001.fm 58 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

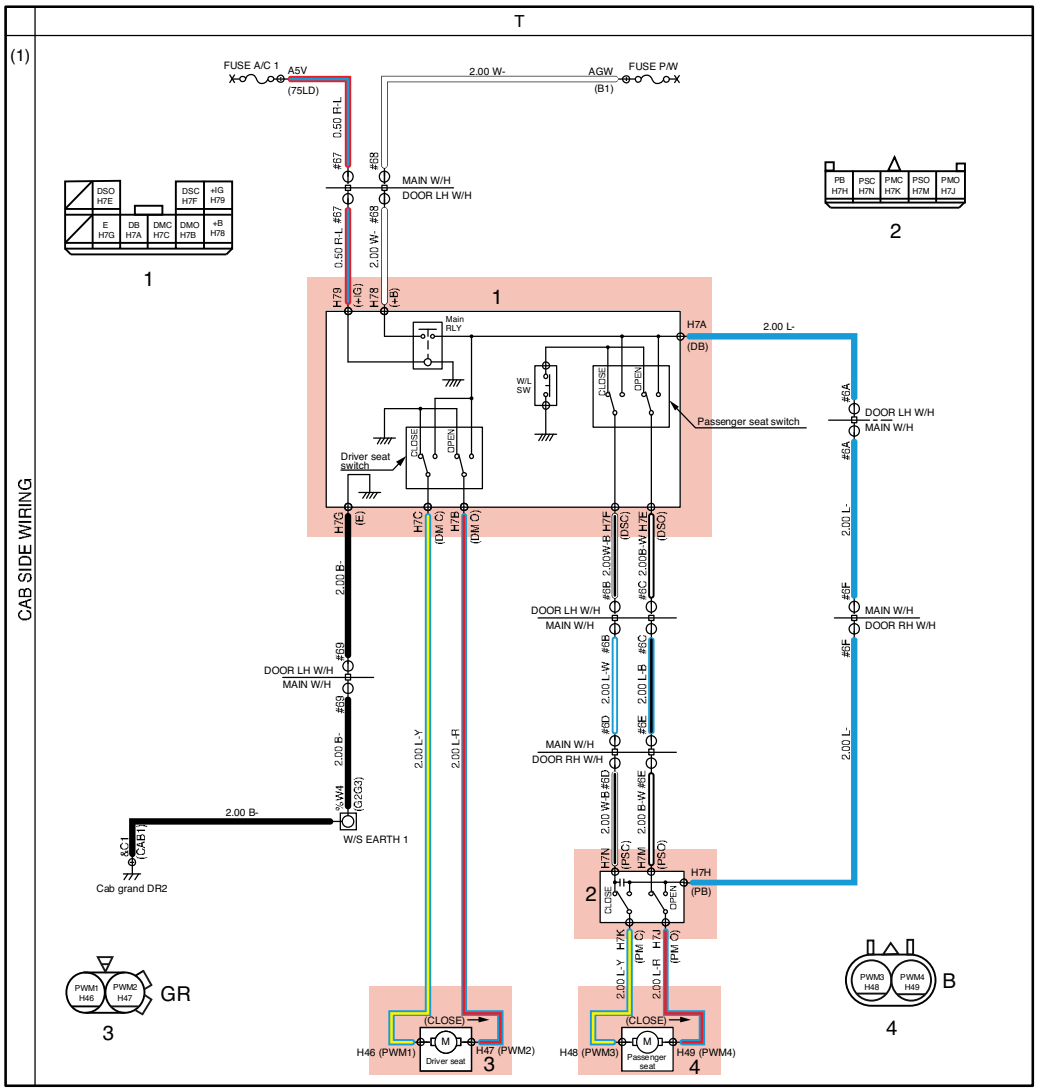


SAPH12Z160200068

S CIGARETTE LIGHTER CIRCUIT

1 Cigarette lighter

EL02_001.fm 59 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200069

T POWER WINDOW CIRCUIT

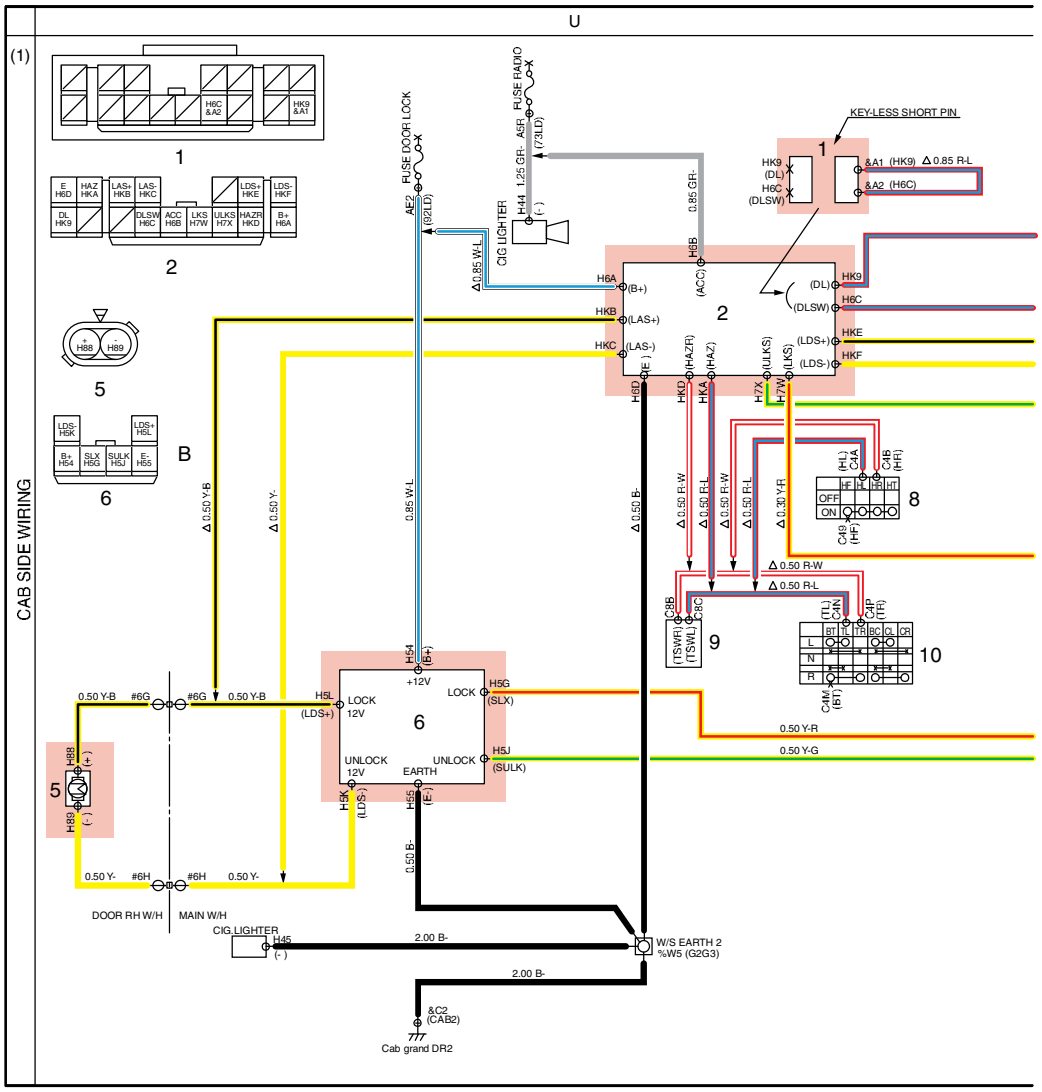
1 Driver seat master switch

2 Passenger seat sub switch

3 Power window motor (Driver seat)

4 Power window motor (Passenger seat)

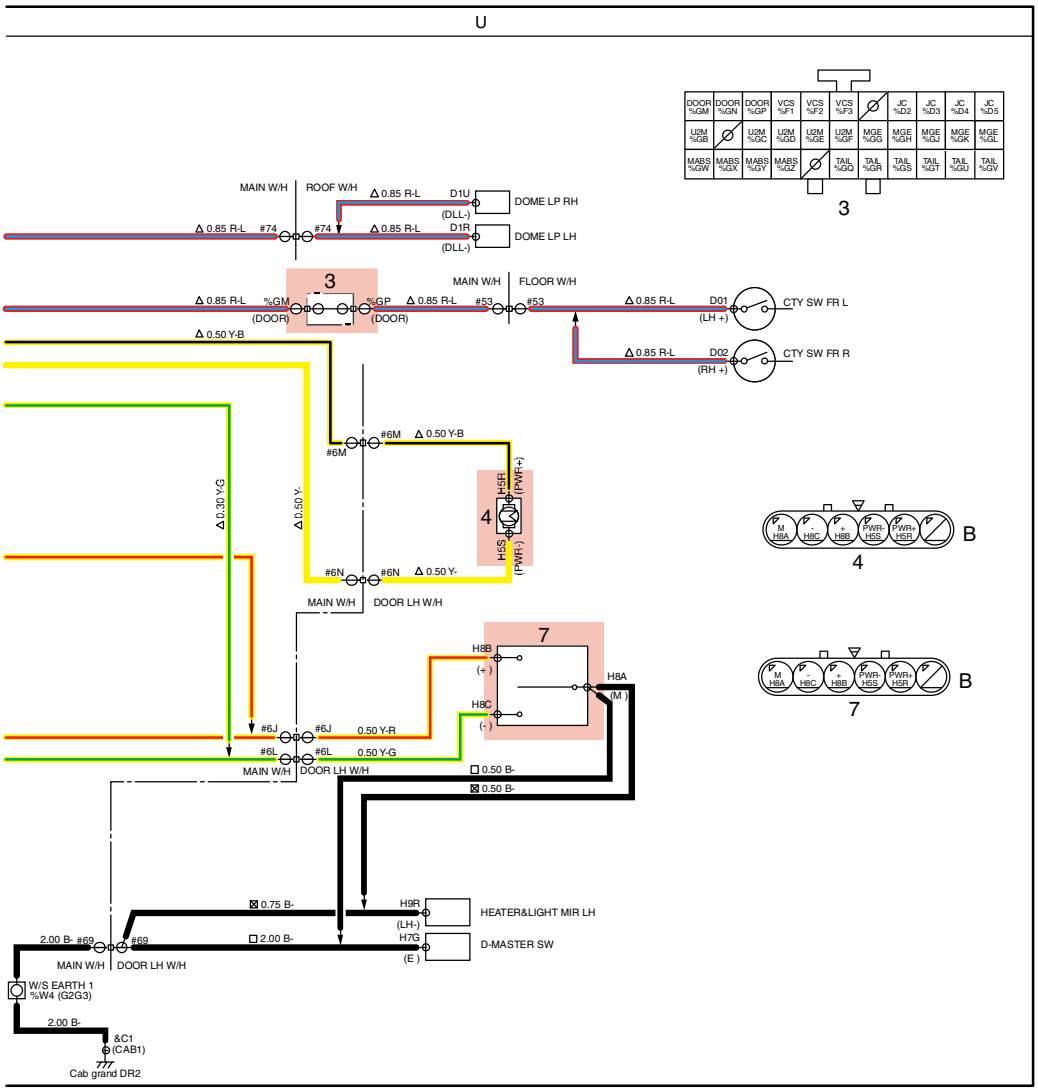
EL02_001.fm 60 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



U POWER DOOR LOCK AND KEY-LESS ENTRY CIRCUIT

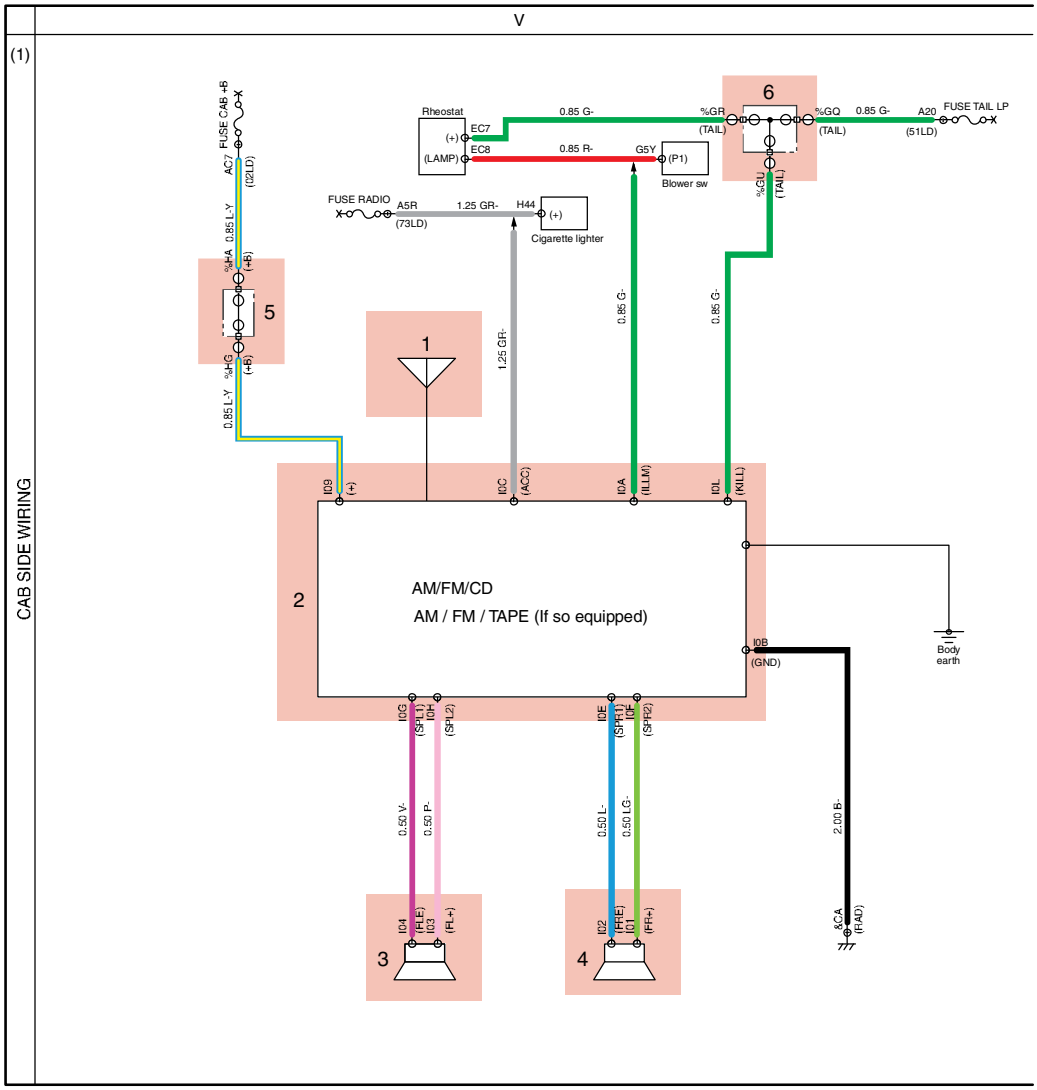
1 Key-less entry short circuit connector
2 Key-less entry controller
3 U2 J/C No.1
4 Power door lock motor (Driver side)
5 Power door lock motor (Passenger side)
6 Power door lock controller
7 Power door lock switch (Driver side)
8 Wiper and retarder switch
9 Light and turn switch
10 Stop and turn controller

EL02_001.fm 61 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200071

EL02_001.fm 62 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

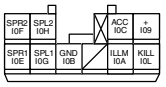


SAPH12Z160200072

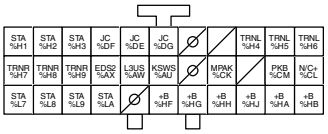
V AUDIO CIRCUIT
1 Antenna
2 Radio/Audio unit
3 Front speaker LH
4 Front speaker RH
5 U2 J/C No.2
6 U2 J/C No.1

EL02_001.fm 63 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

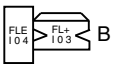
V



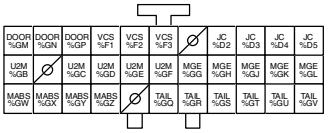
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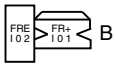
5



3



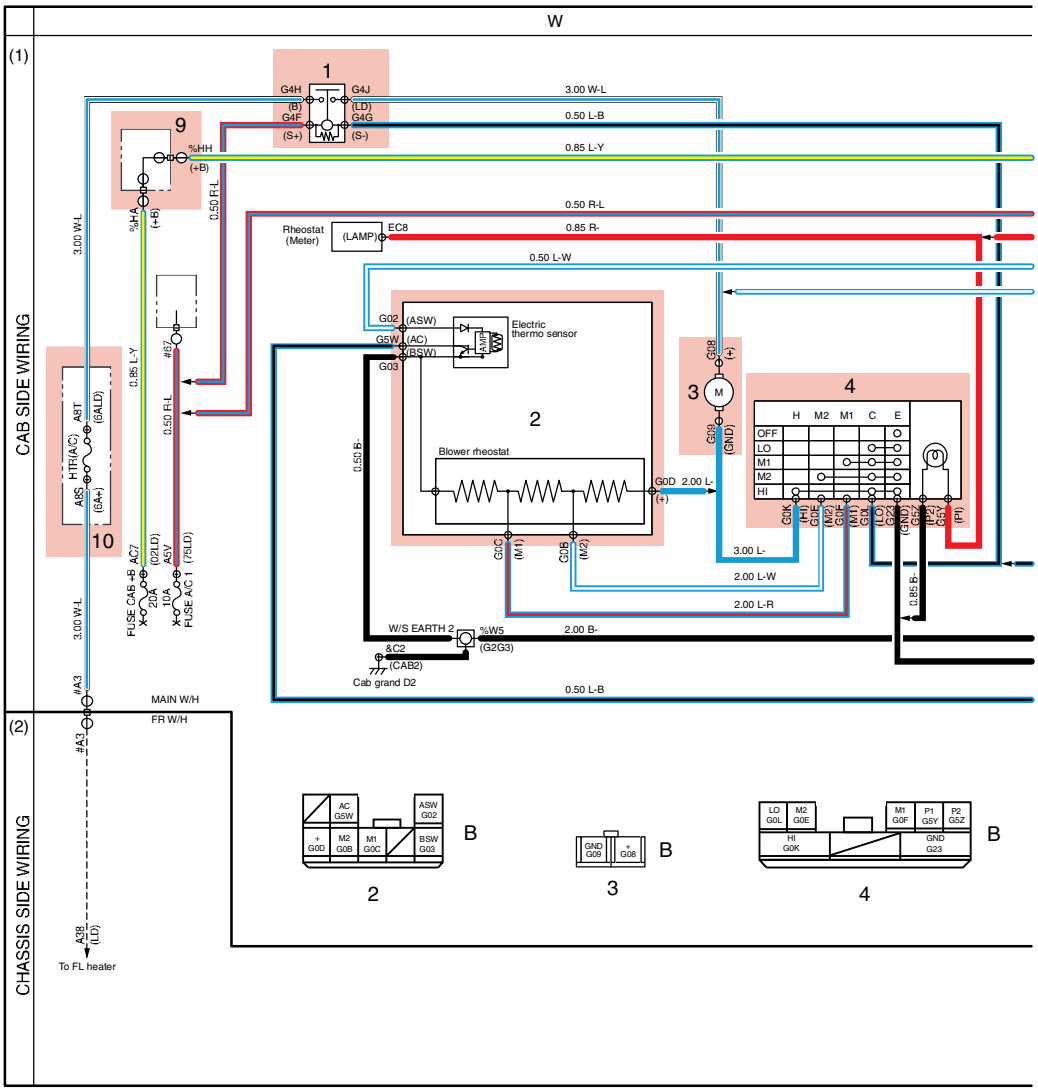
6



4

SAPH12Z160200073

EL02_001.fm 64 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

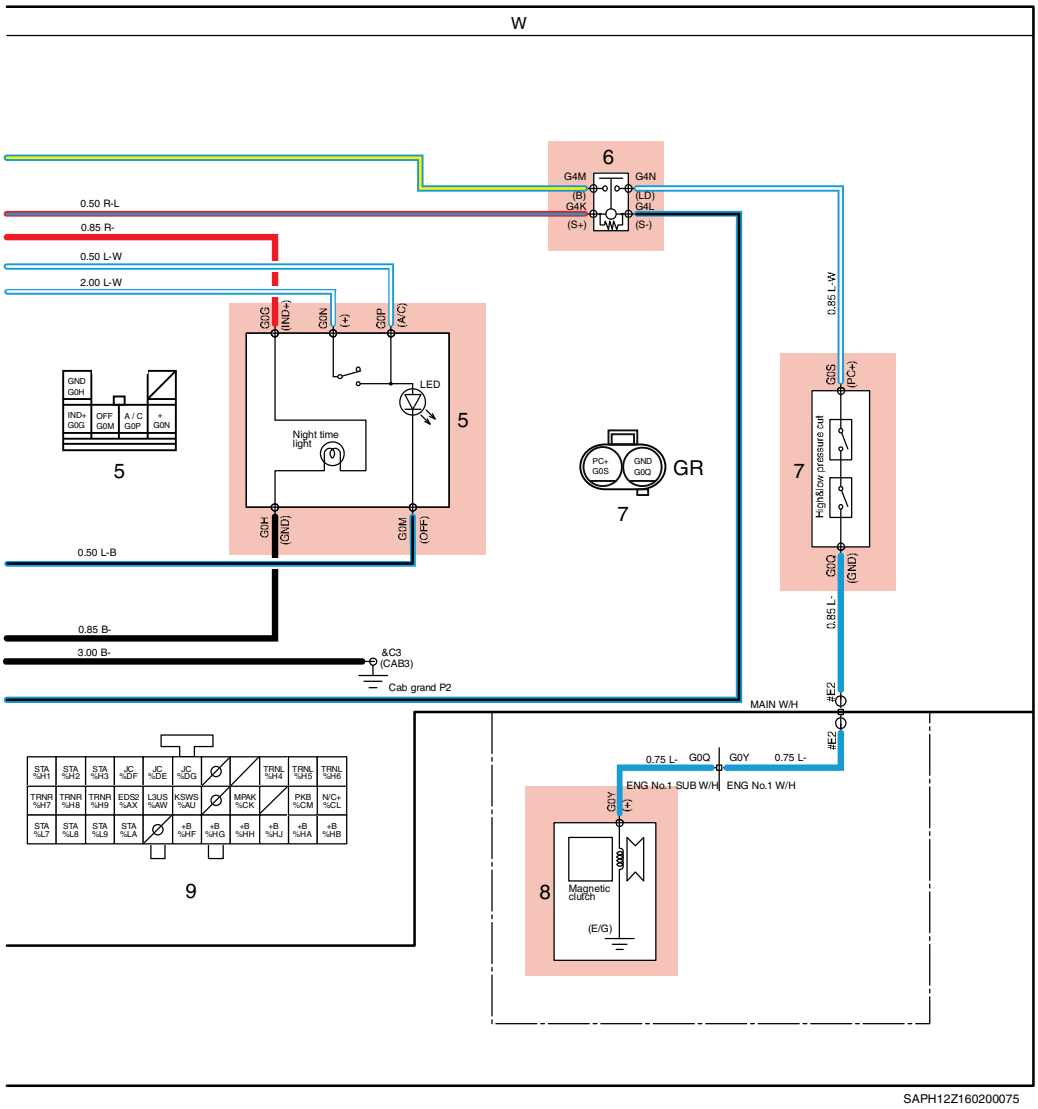


SAPH12Z160200074

W MANUAL AIR CONDITIONER CIRCUIT

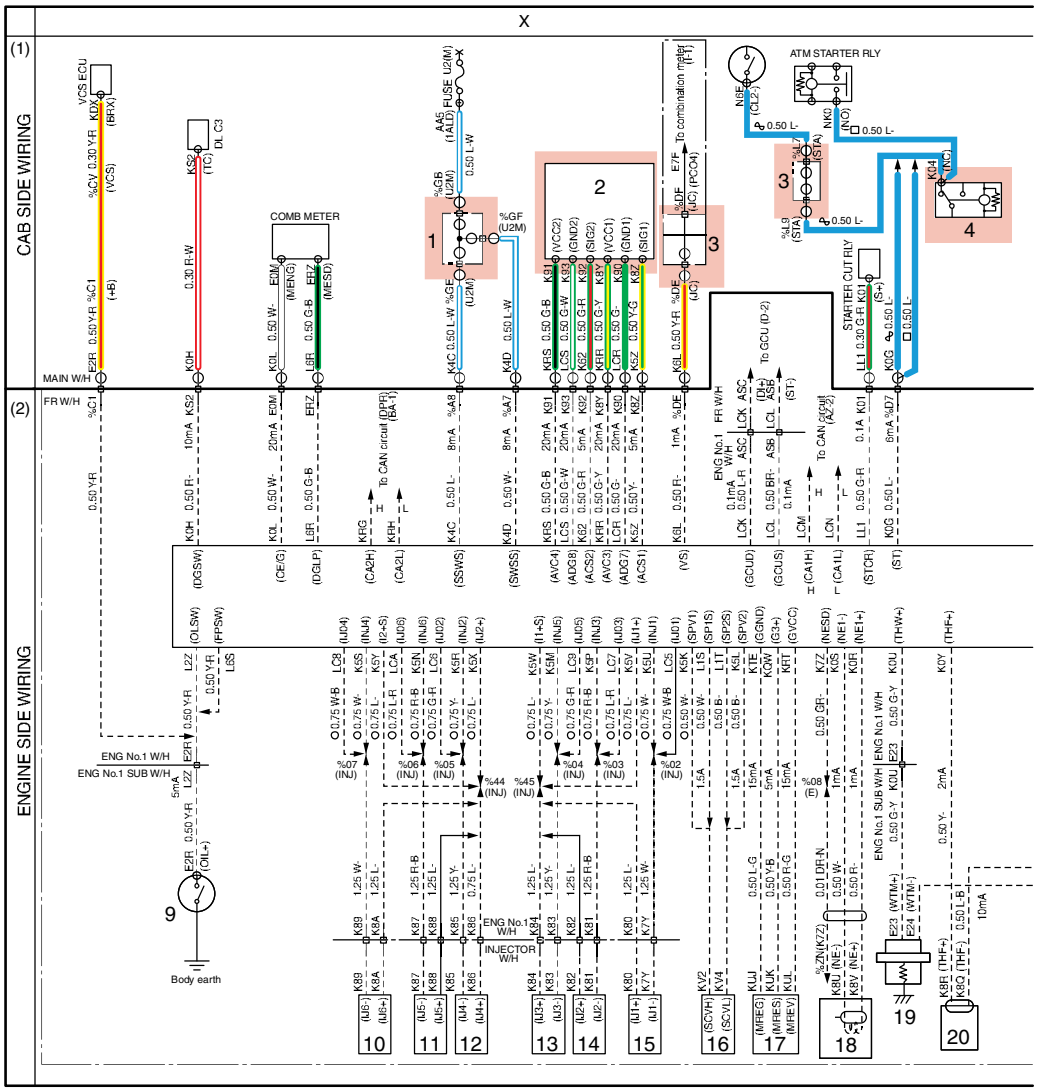
1	Heater relay	6	Air conditioner relay
2	Heater and cooler unit	7	Pressure switch
3	Blower motor	8	Compressor
4	Blower switch	9	U2 J/C No.2
5	Air conditioner switch	10	Fuse and relay block B

EL02_001.fm 65 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200075

EL02_001.fm 66 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

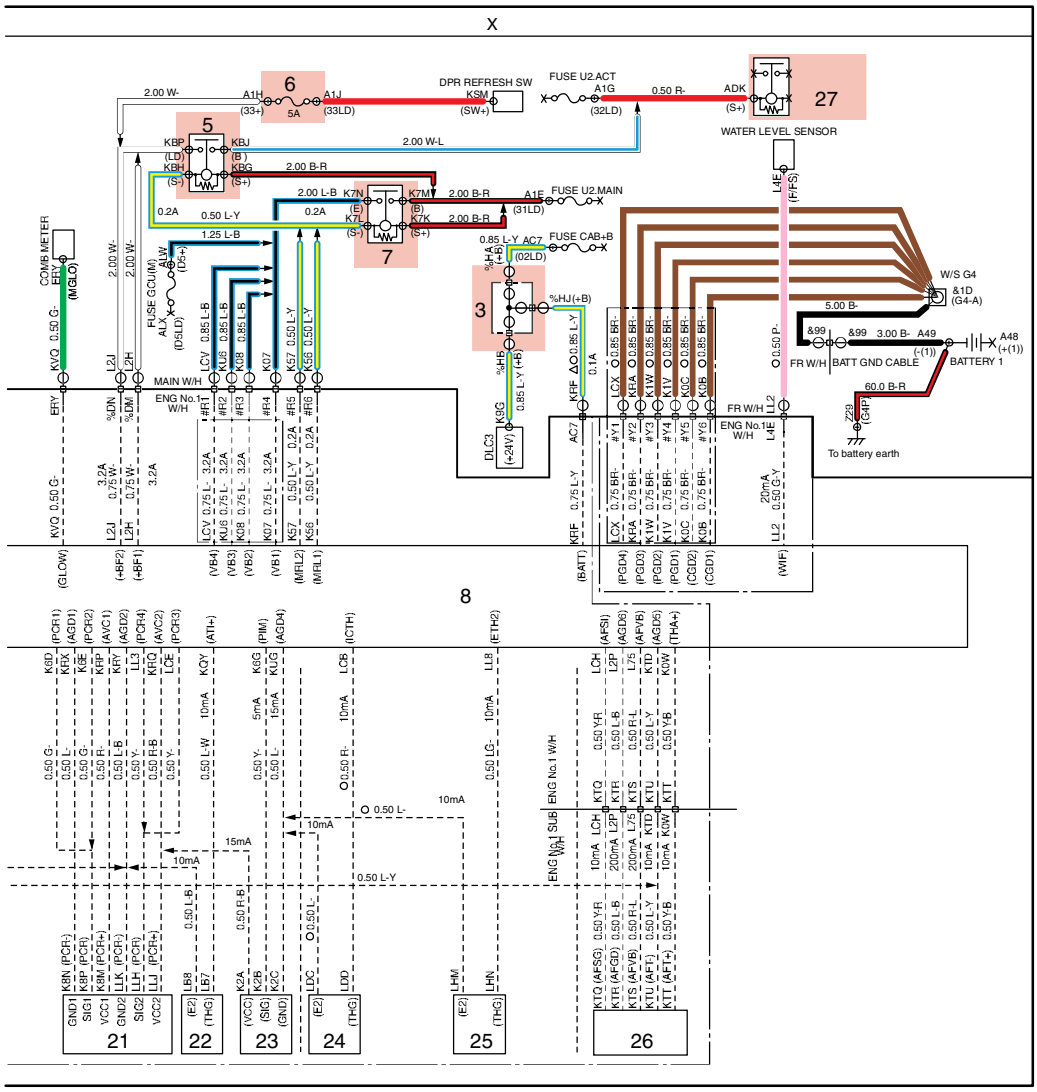


SAPH12Z160200076

X COMMON RAIL CIRCUIT-1 (CAB SIDE)

1 U2 J/C No.1
2 Accelerator sensor
3 U2 J/C No.2
4 Starter cut relay
5 U2 actuator power relay
6 Fuse U2 actuator 2
7 U2 ECU main relay
8 U2 ECU
9 Oil pressure switch
10 Injector 6
11 Injector 5
12 Injector 4
13 Injector 3
14 Injector 2
15 Injector 1
16 Suction control valve
17 Cylinder angle sensor
18 NE sensor

EL02_001.fm 67 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



19 Water temperature sender

20 Fuel temperature sensor

21 PC sensor

22 Intake manifold temperature sensor

23 Boost sensor

24 Intercooler exit temperature sensor

25 EGR exit temperature sensor

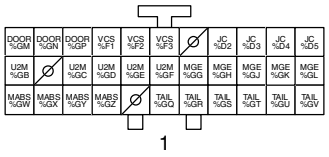
26 Air flow sensor

27 VSS actuator relay

EL02_001.fm 68 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

X

(1) CAB SIDE WIRING



(2) ENGINE SIDE WIRING

SAPH12Z160200078

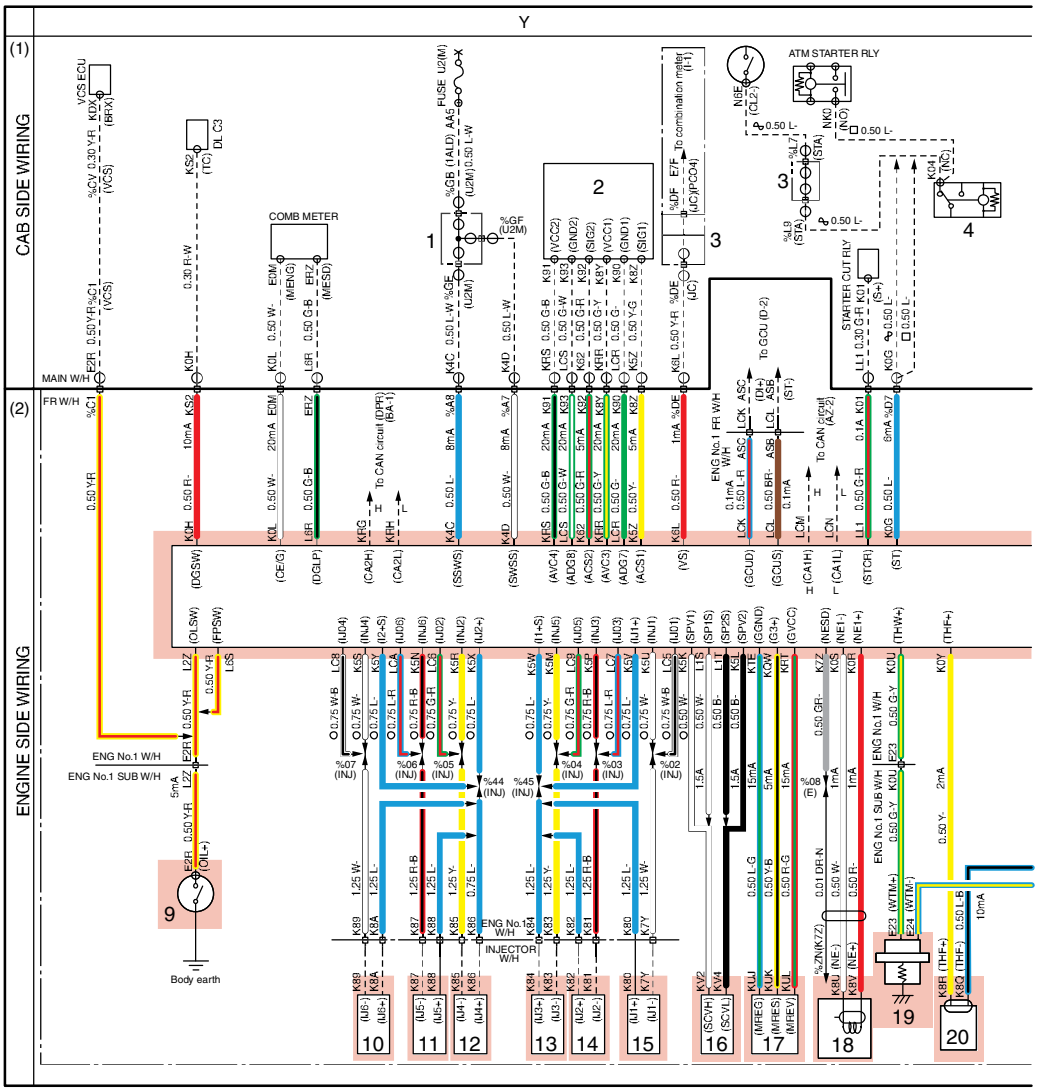
EL02_001.fm 69 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

X



SAPH12Z160200079

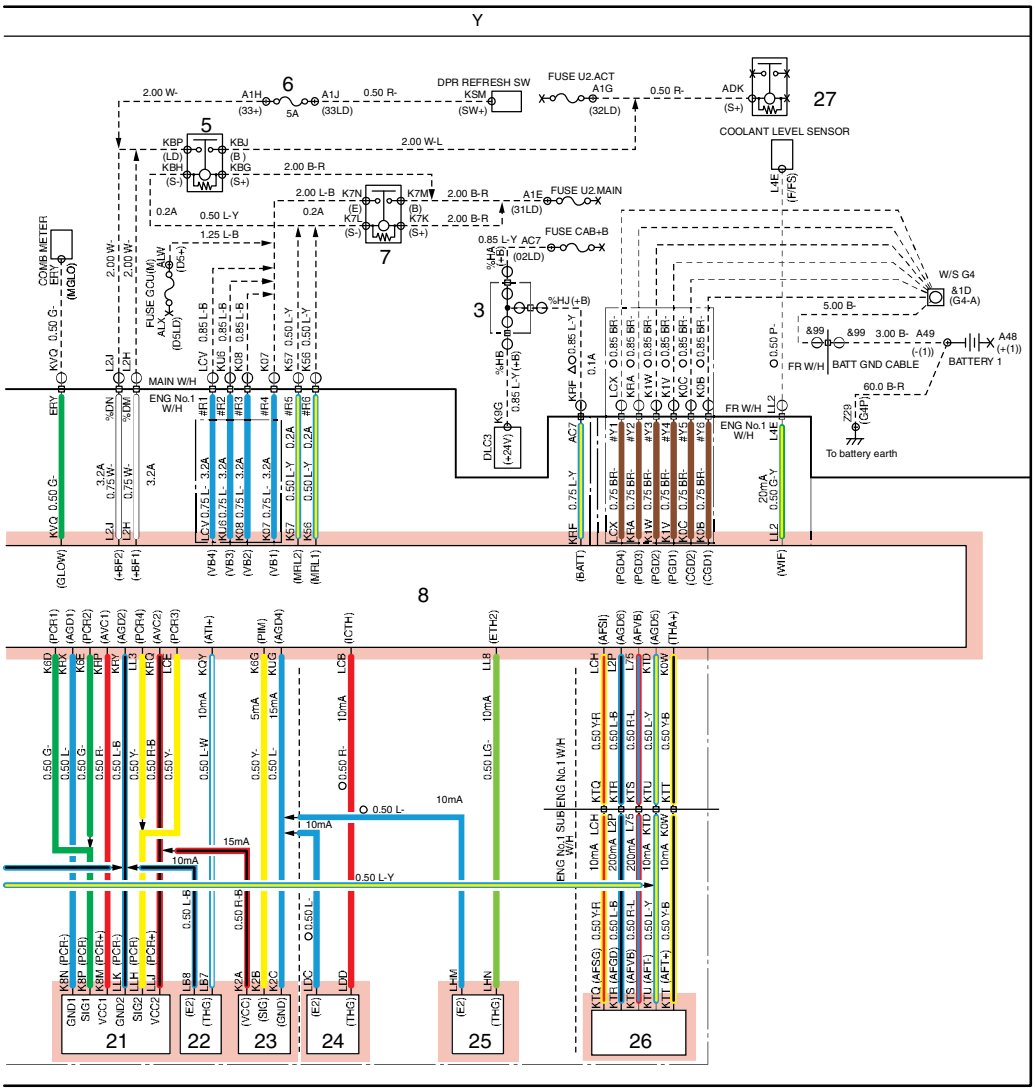
EL02_001.fm 70 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200080

Y	**COMMON RAIL CIRCUIT-1 (CHASSIS SIDE)**
1	**U2 J/C No.1**
2	**Accelerator sensor**
3	**U2 J/C No.2**
4	**Starter cut relay**
5	**U2 actuator power relay**
6	**Fuse U2 actuator 2**
7	**U2 ECU main relay**
8	**U2 ECU**
9	**Oil pressure switch**
10	**Injector 6**
11	**Injector 5**
12	**Injector 4**
13	**Injector 3**
14	**Injector 2**
15	**Injector 1**
16	**Suction control valve**
17	**Cylinder angle sensor**
18	**NE sensor**

EL02_001.fm 71 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200081

19 Water temperature sender

20 Fuel temperature sensor

21 PC sensor

22 Intake manifold temperature sensor

23 Boost sensor

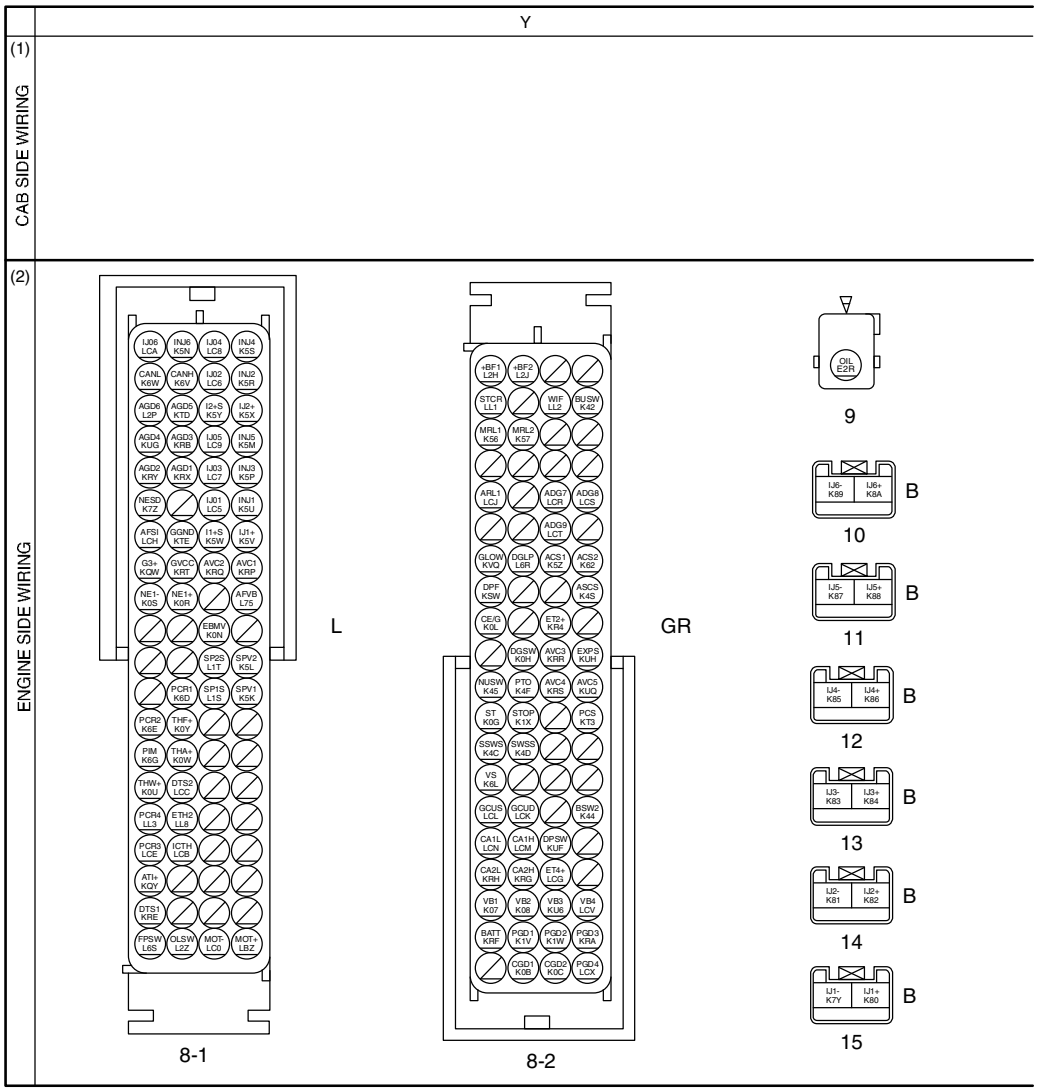
24 Intercooler exit temperature sensor

25 EGR exit temperature sensor

26 Air flow sensor

27 VSS actuator relay

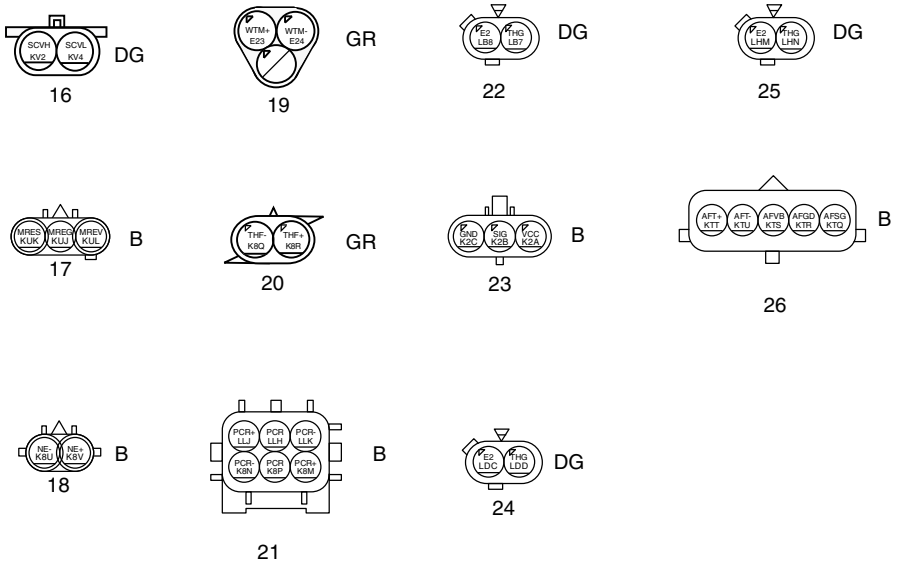
EL02_001.fm 72 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200082

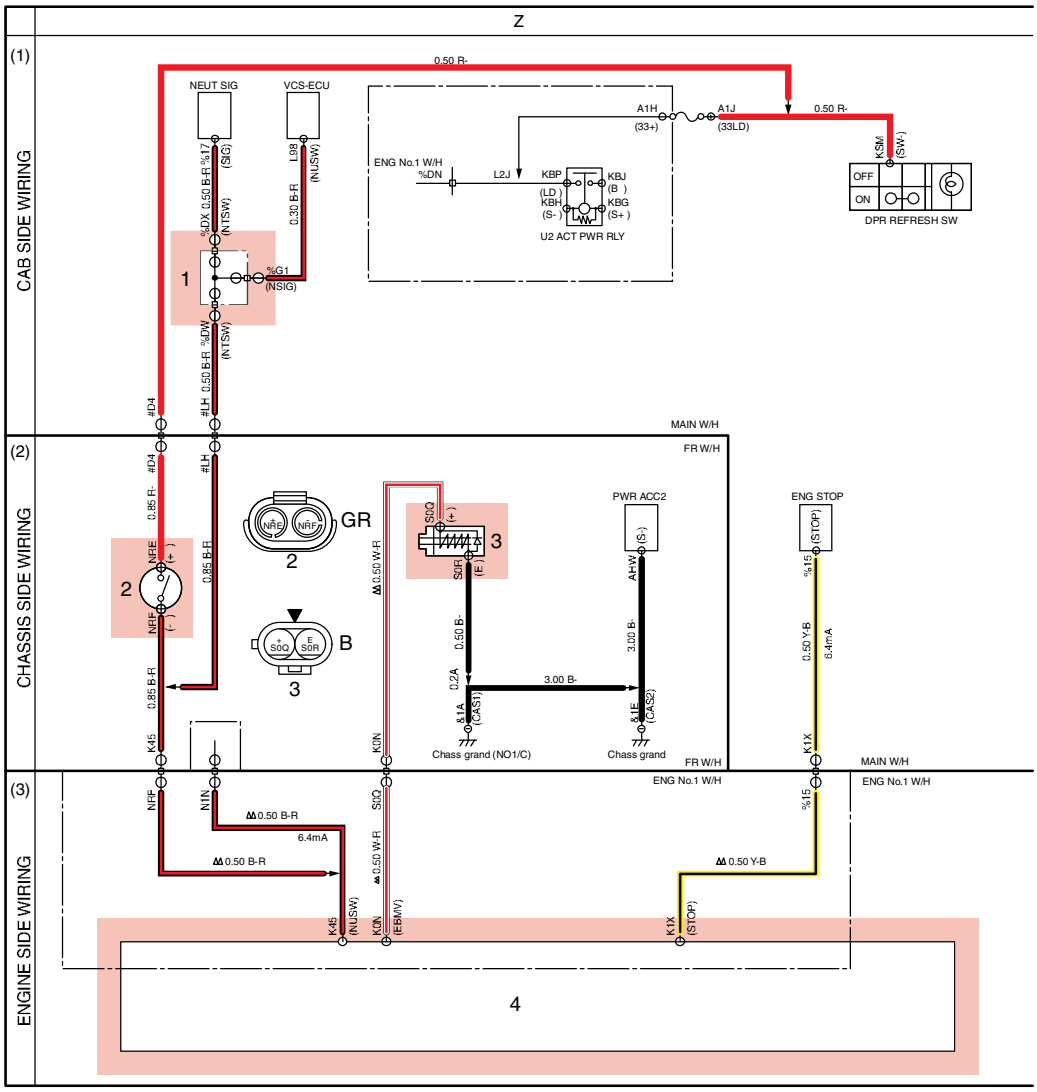
EL02_001.fm 73 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

Y



SAPH12Z160200083

EL02_001.fm 74 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200084

Z COMMON RAIL CIRCUIT-2: MANUAL TRANSMISSION AND EXHAUST BRAKE

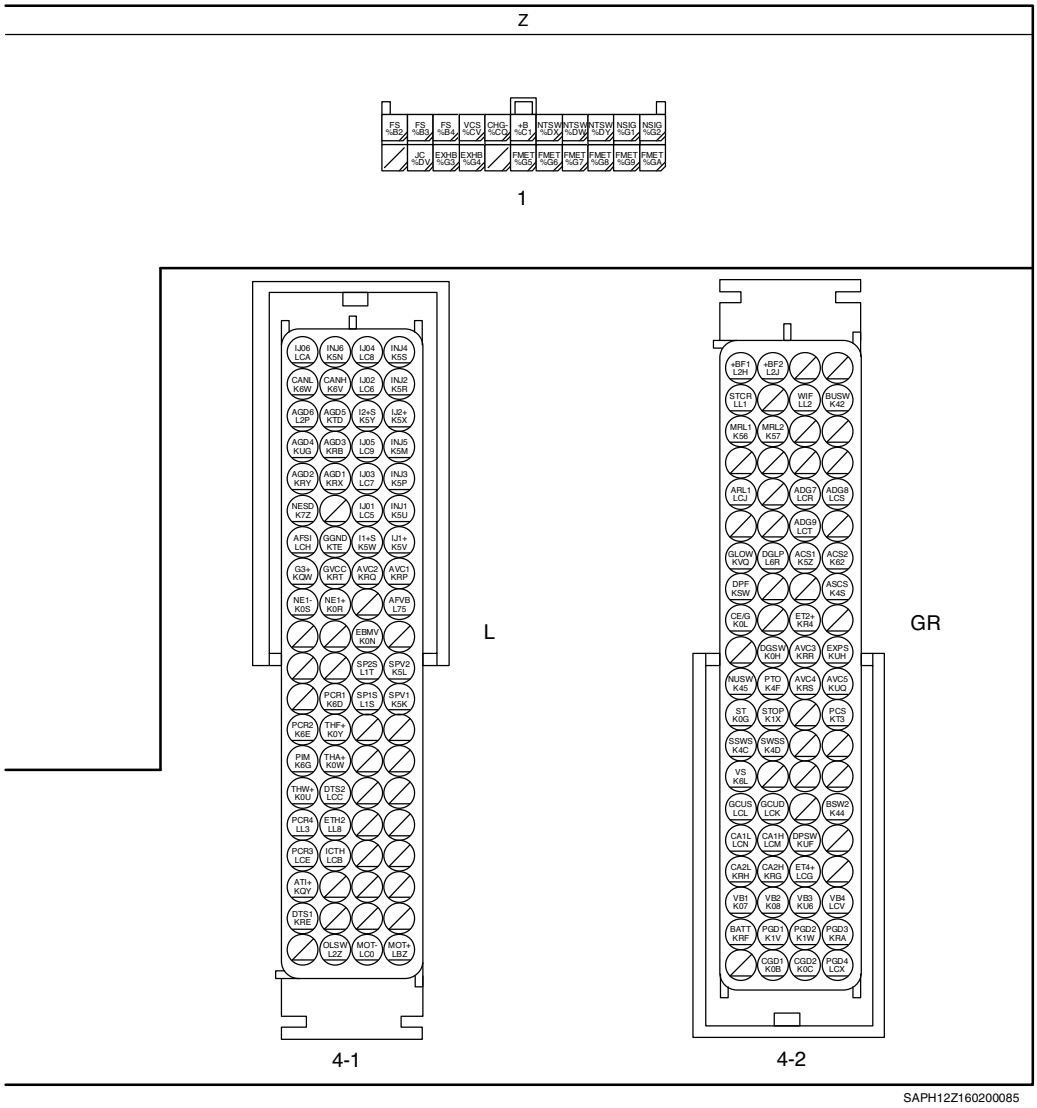
1 J/C SIGNAL

2 Neutral switch

3 Exhaust brake magnetic valve

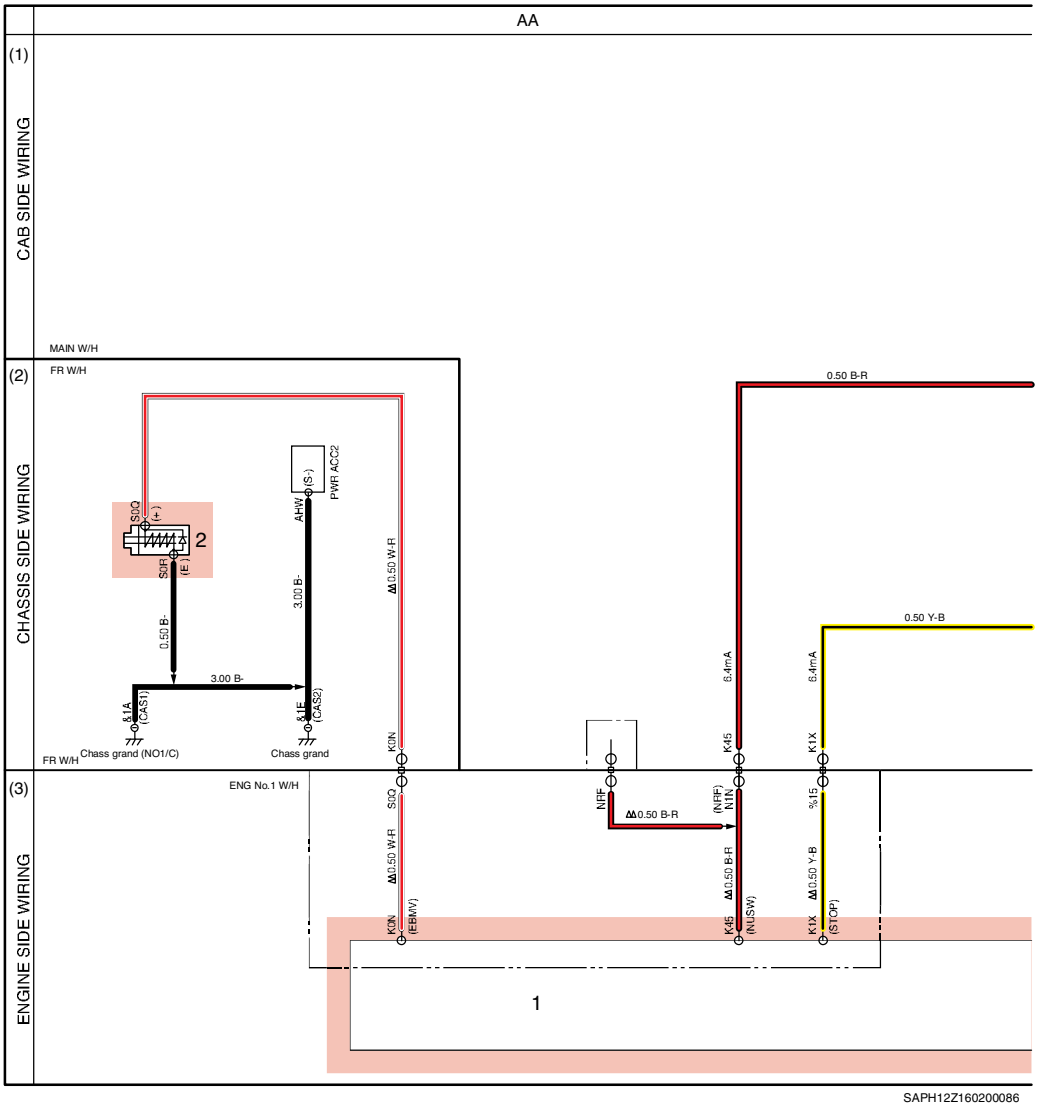
4 U2 ECU

EL02_001.fm 75 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200085

EL02_001.fm 76 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200086

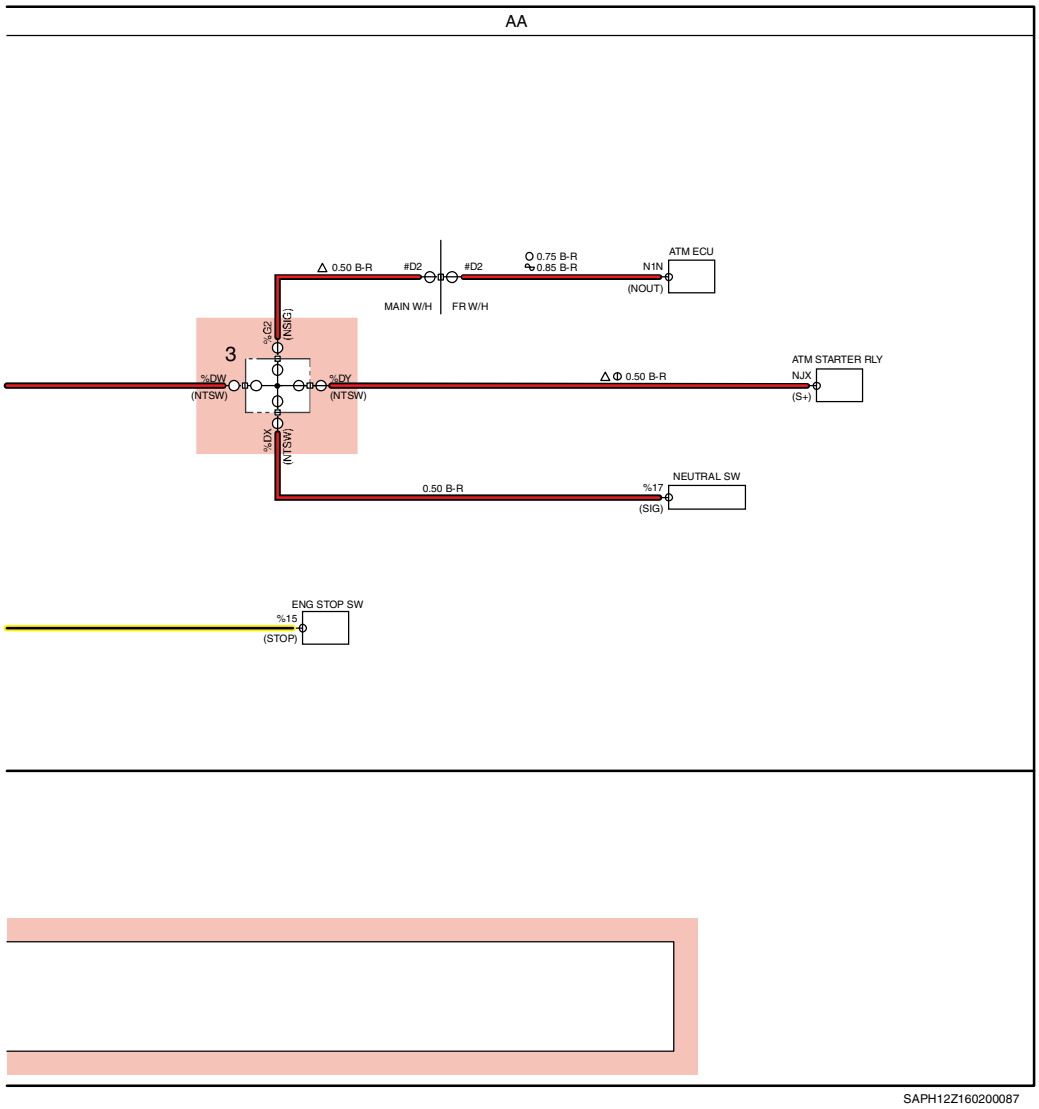
AA COMMON RAIL CIRCUIT-3: AUTOMATIC TRANSMISSION AND AUTOMATIC MECHANICAL TRANSMISSION AND EXHAUST BRAKE

1 U2 ECU

2 Exhaust brake magnetic valve

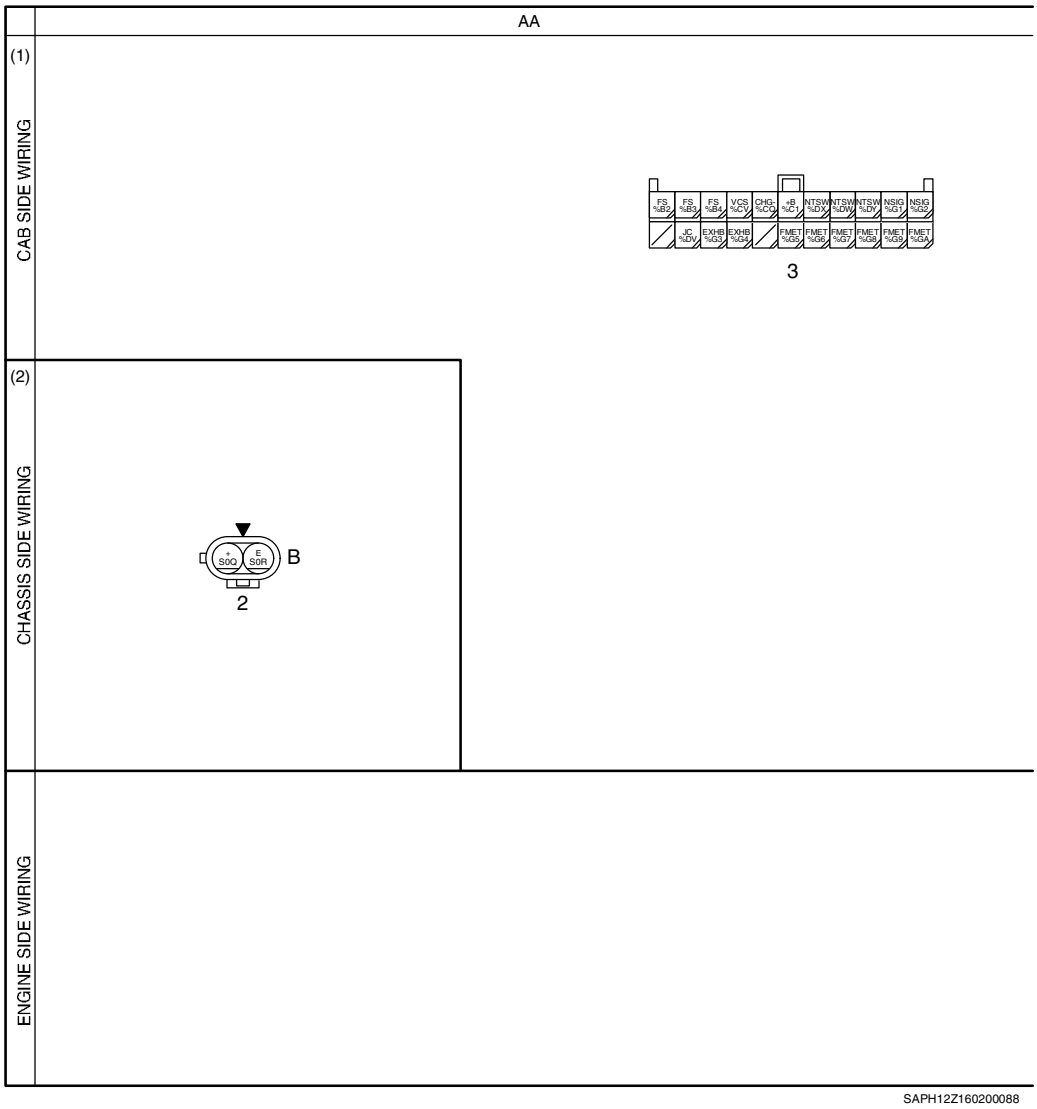
3 J/C SIGNAL

EL02_001.fm 77 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



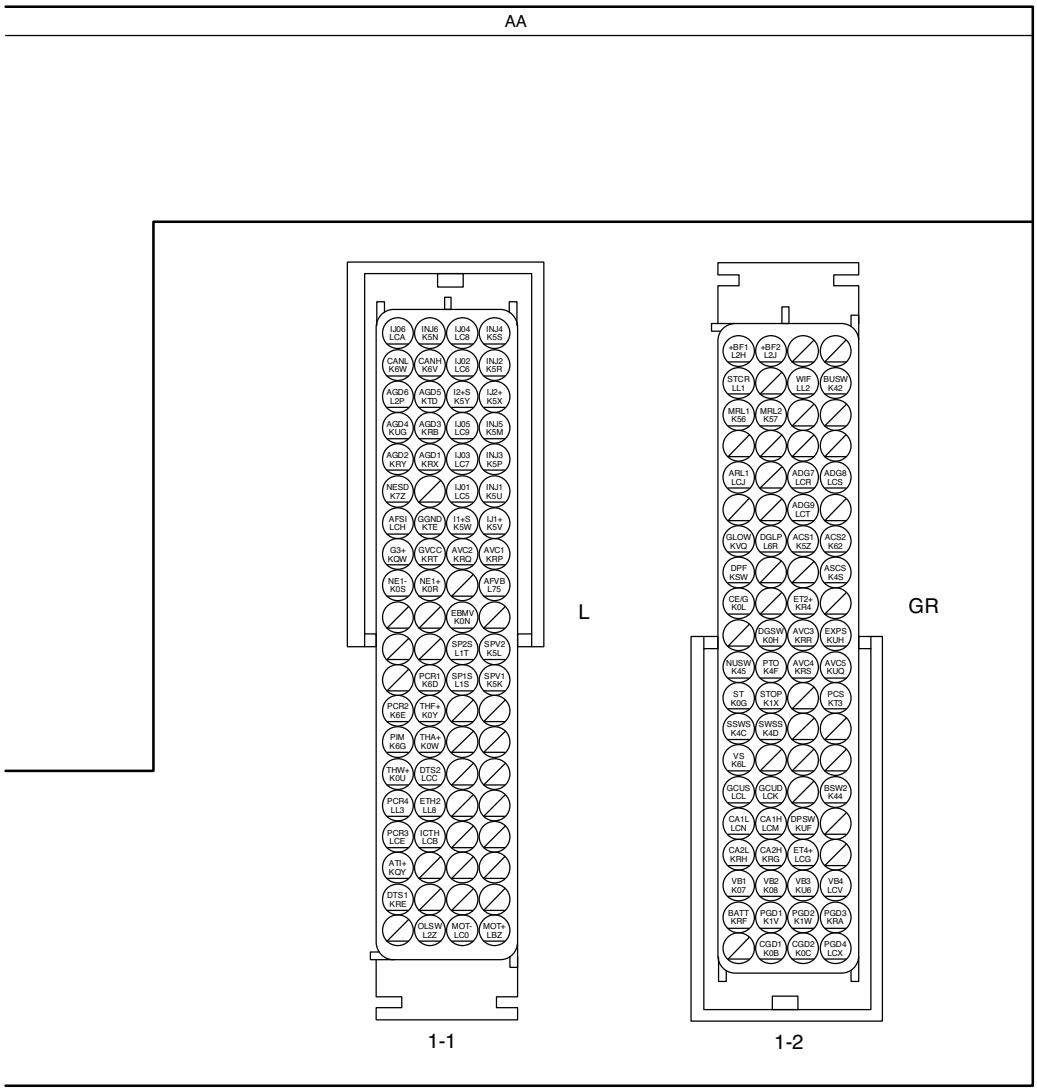
SAPH12Z160200087

EL02_001.fm 78 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

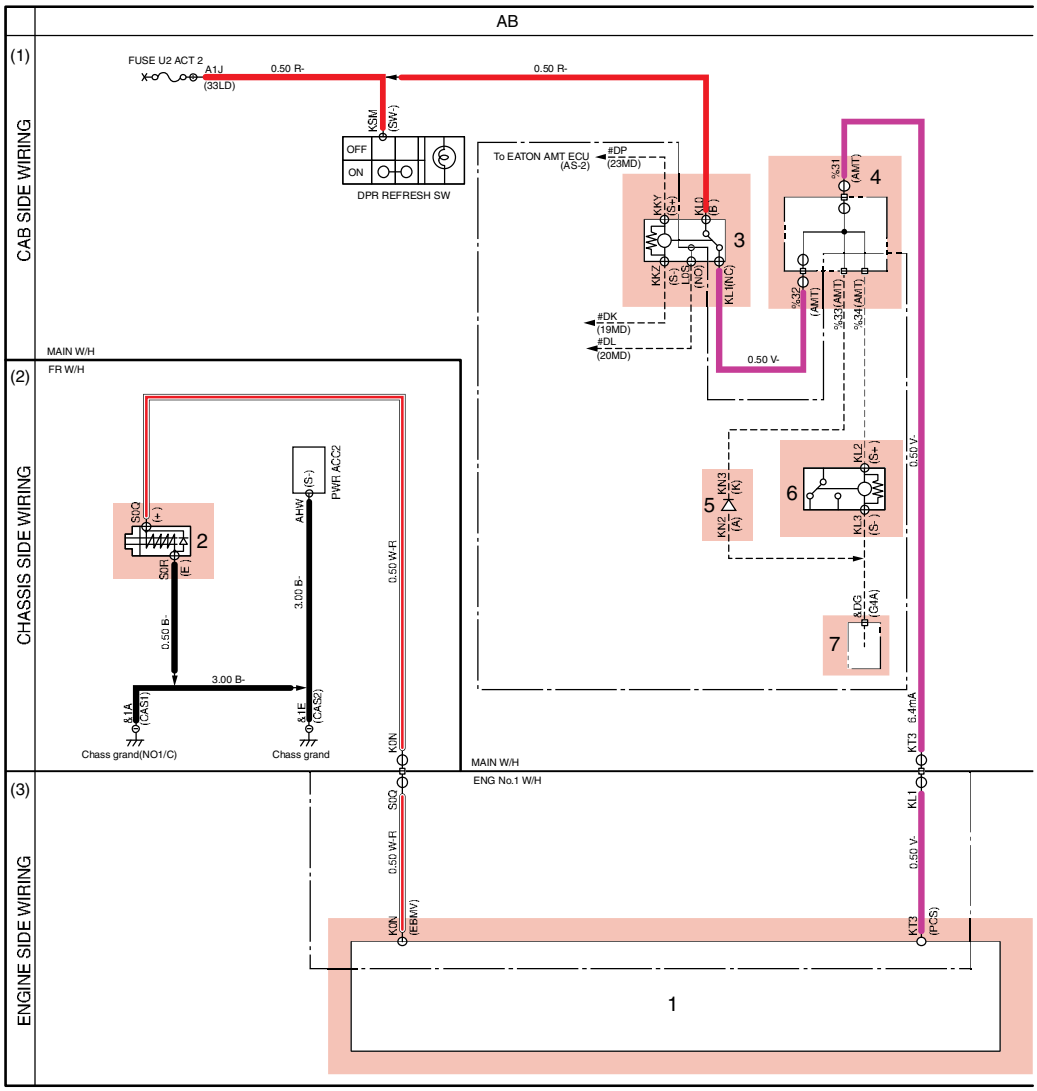


SAPH12Z160200088

EL02_001.fm 79 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



EL02_001.fm 80 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200090

AB COMMON RAIL CIRCUIT-4: EATON AUTOMATIC MECHCANICAL TRANSMISSION AND EXHAUST BRAKE

1 U2 ECU

2 Exhaust brake magnetic valve

3 Fuel cut relay

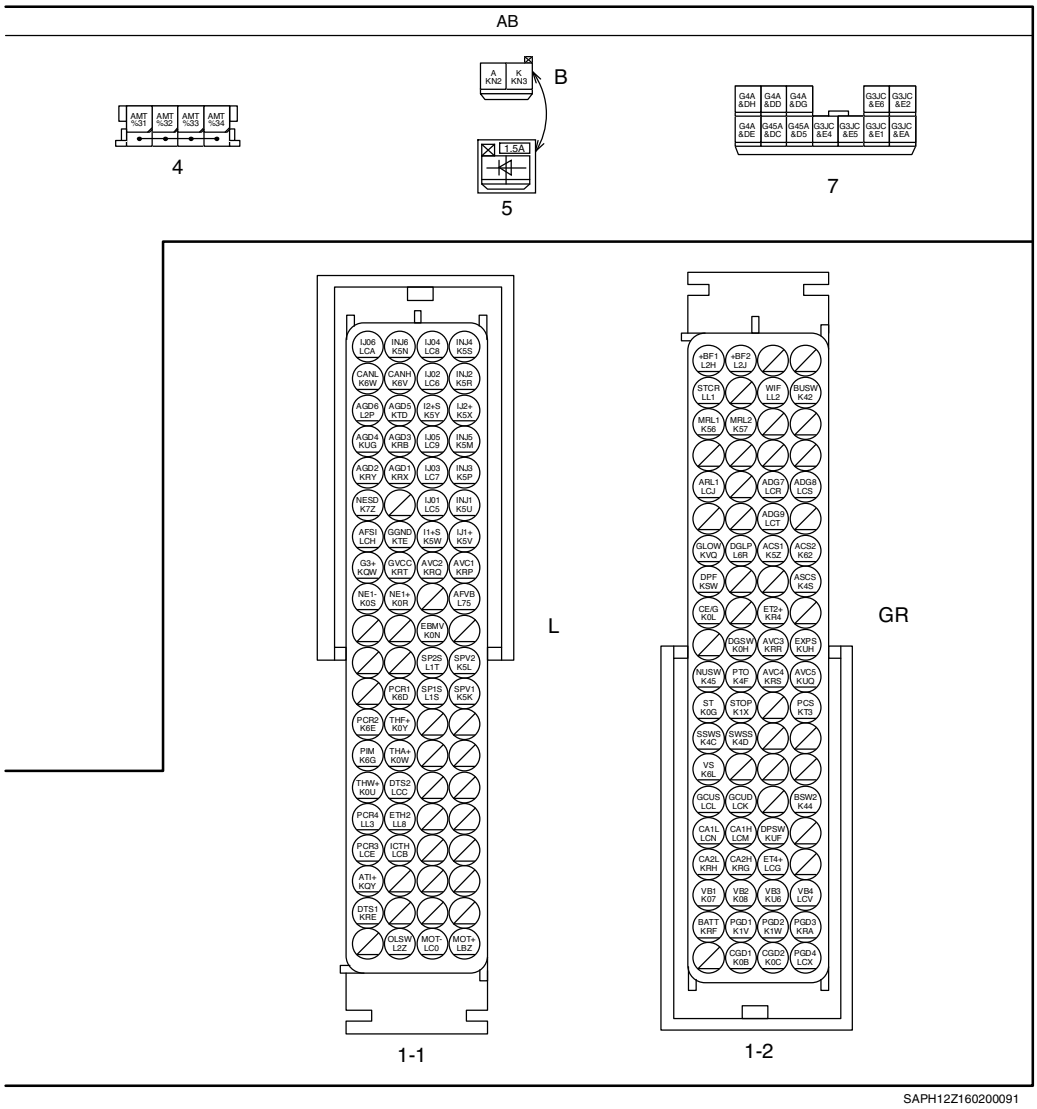
4 Fuel cut 4P JP

5 Fuel cut dummy diode

6 Fuel cut dummy relay

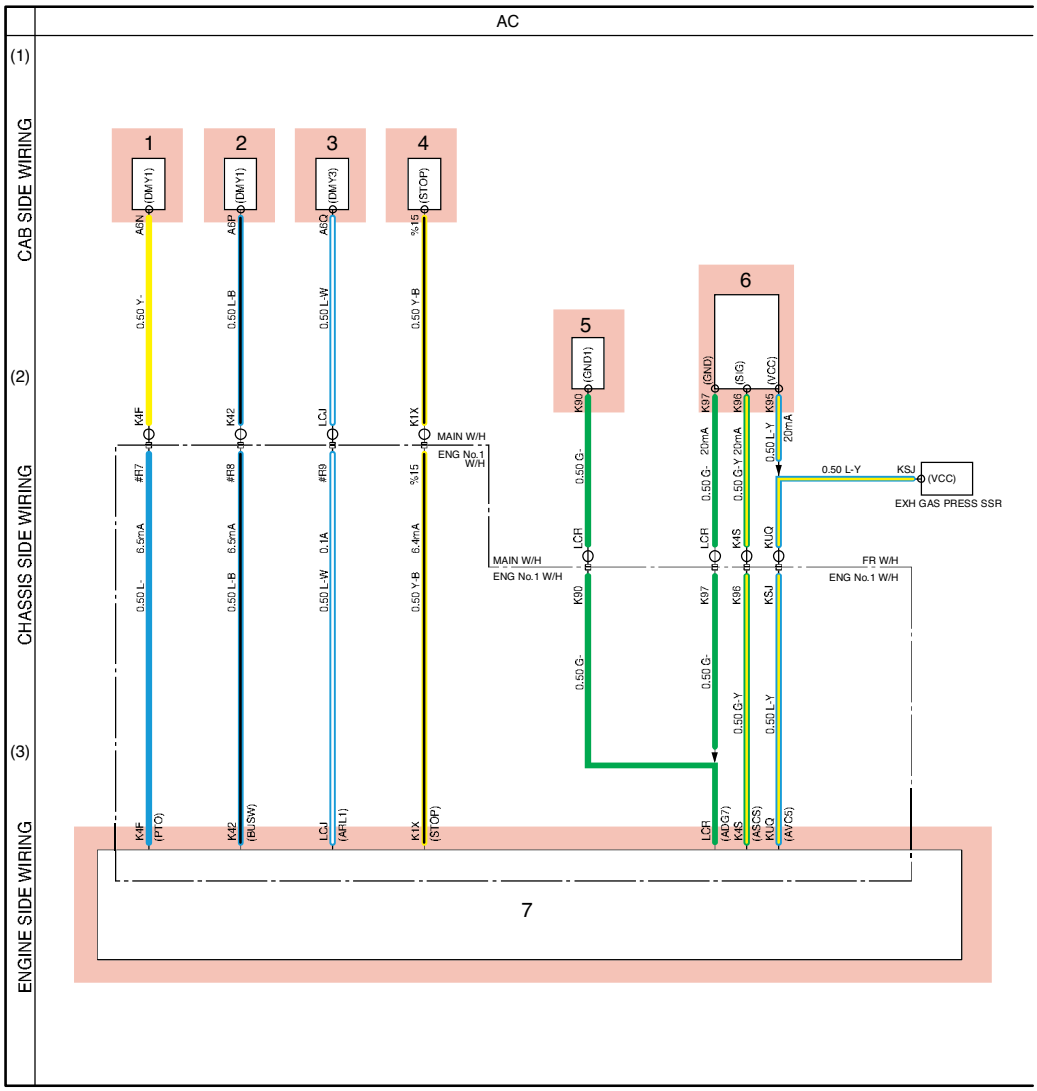
7 J/C G4

EL02_001.fm 81 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200091

EL02_001.fm 82 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



AC COMMON RAIL CIRCUIT-5: MODELS EQUIPPED WITH P.T.O.

1 P.T.O. switch 1

2 P.T.O. switch 2

3 P.T.O. cut relay

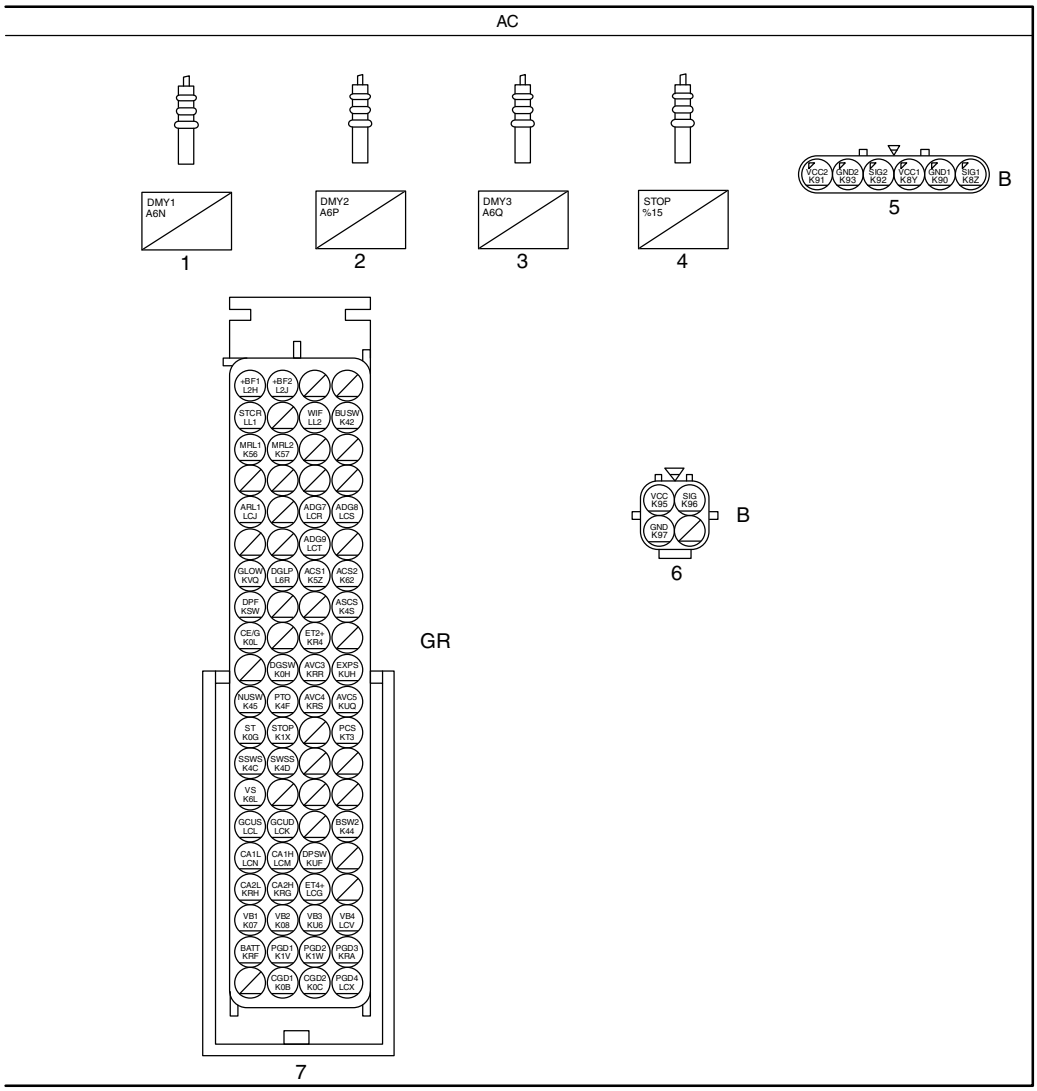
4 Engine stop switch

5 Accelerator sensor

6 P.T.O. accelerator sensor

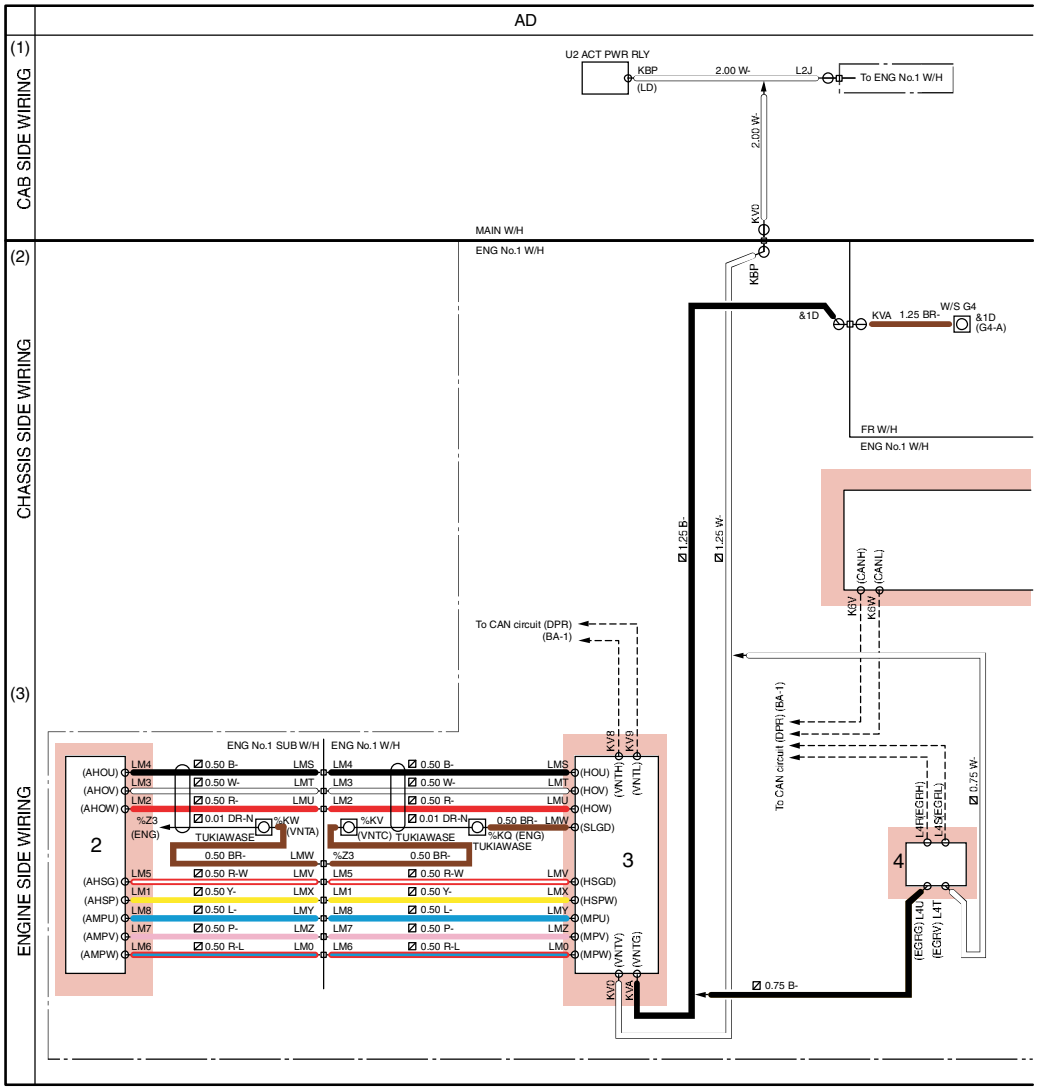
7 U2 ECU

EL02_001.fm 83 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200093

EL02_001.fm 84 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200094

AD COMMON RAIL CIRCUIT-6: DIESEL THROTTLE

1 U2 ECU

2 VNT actuator

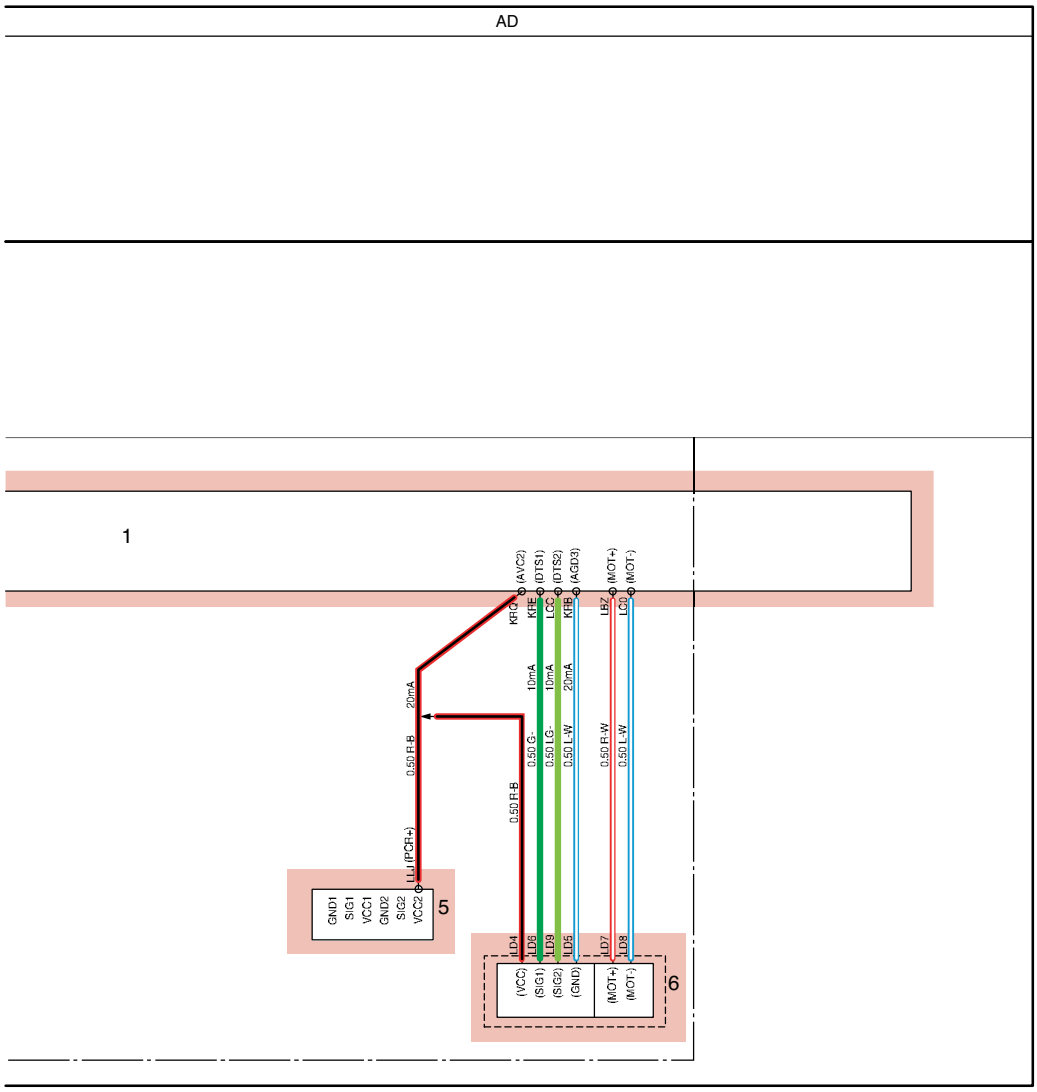
3 VNT controller

4 EGR controller

5 PC sensor

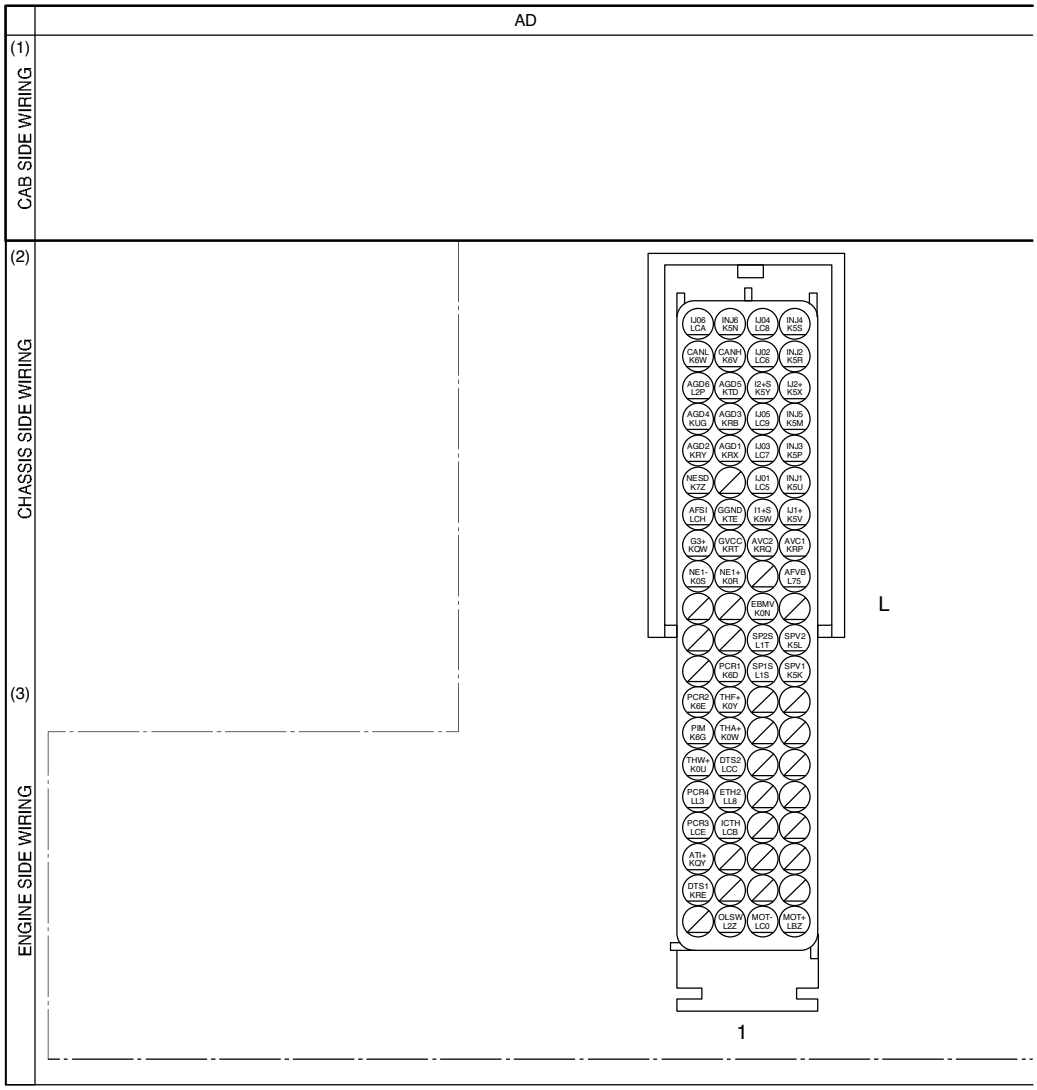
6 Diesel throttle

EL02_001.fm 85 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200095

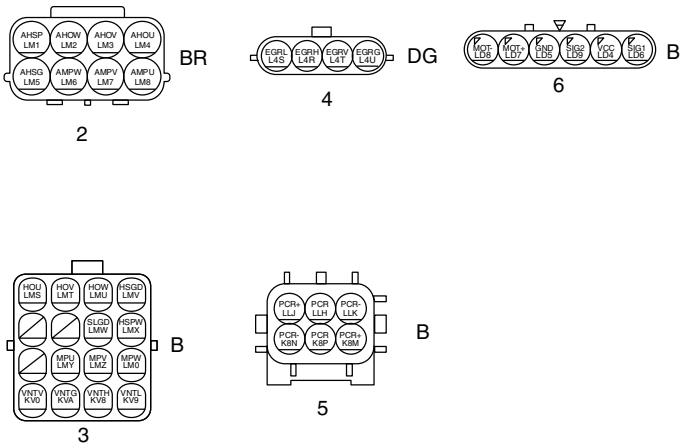
EL02_001.fm 86 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200096

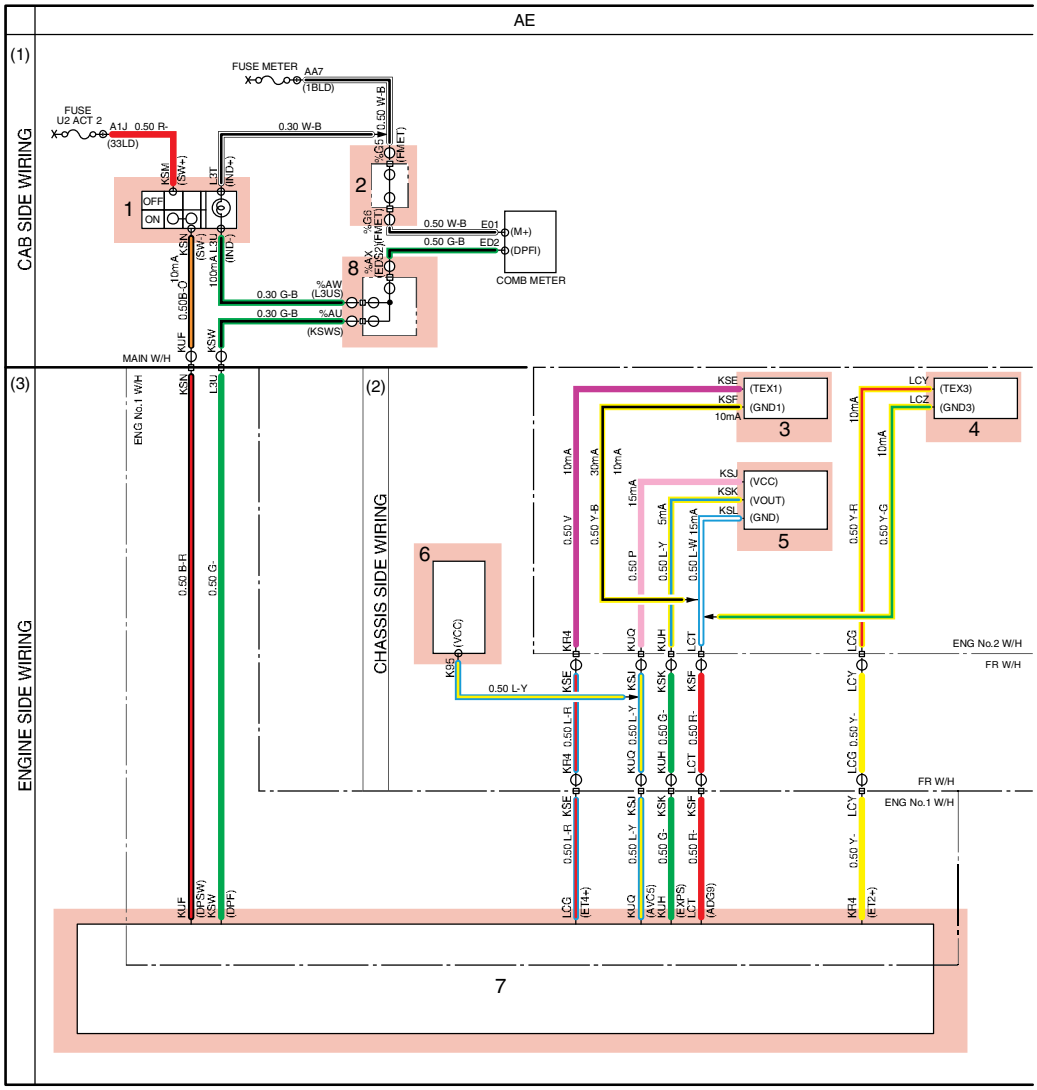
EL02_001.fm 87 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

AD



SAPH12Z160200097

EL02_001.fm 88 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

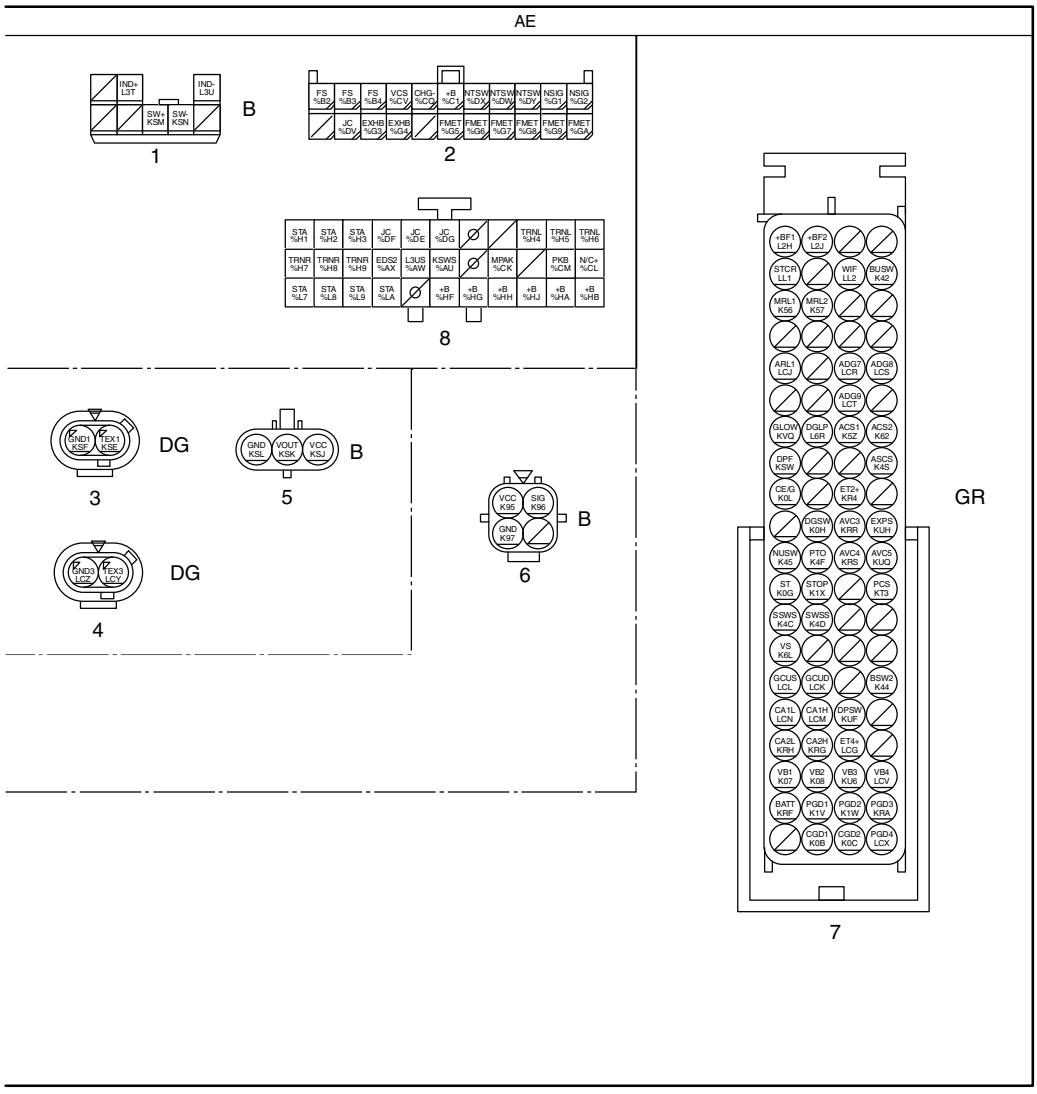


SAPH12Z160200098

AE COMMON RAIL CIRCUIT-7: DPR

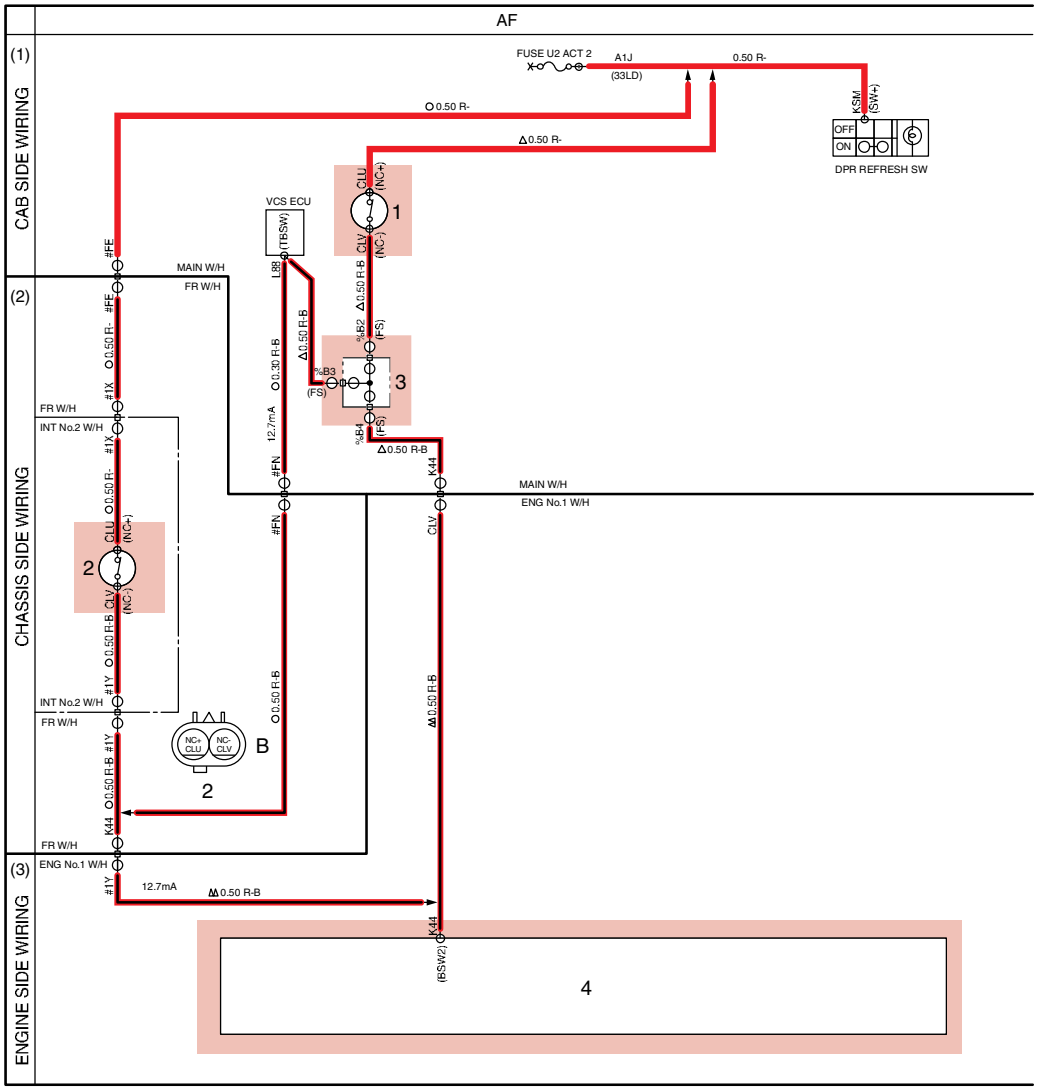
1 DPR refresh switch
2 J/C SIGNAL
3 Exhaust gas temperature sensor 1
4 Exhaust gas temperature sensor 3
5 Exhaust gas pressure sensor
6 P.T.O. accelerator sensor
7 U2 ECU
8 U2 J/C No.2

EL02_001.fm 89 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200099

EL02_001.fm 90 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200100

AF COMMON RAIL CIRCUIT-8: FS CRUISE

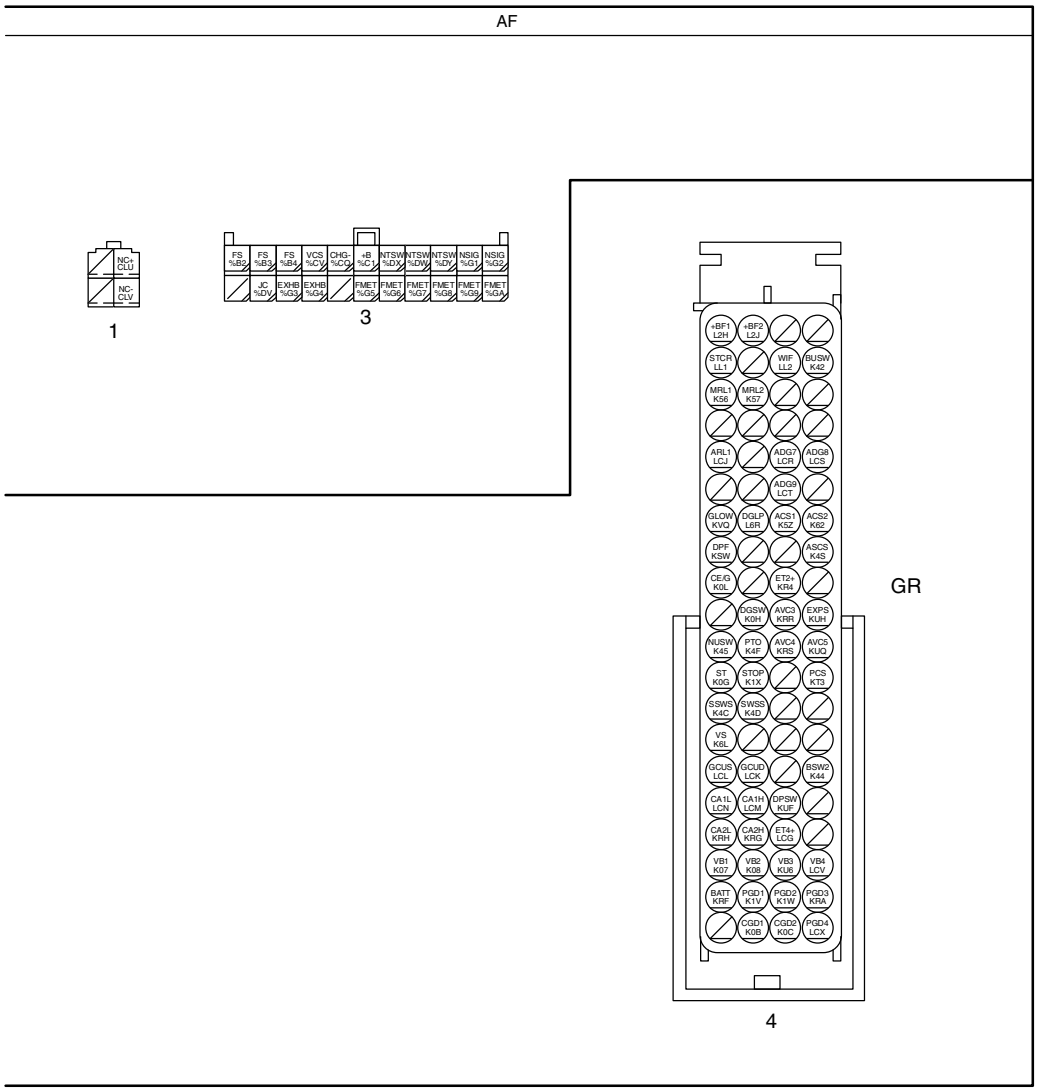
1 Brake switch (NC) (HYDRO MAX)

2 Brake switch (NC) (Full air)

3 J/C SIGNAL

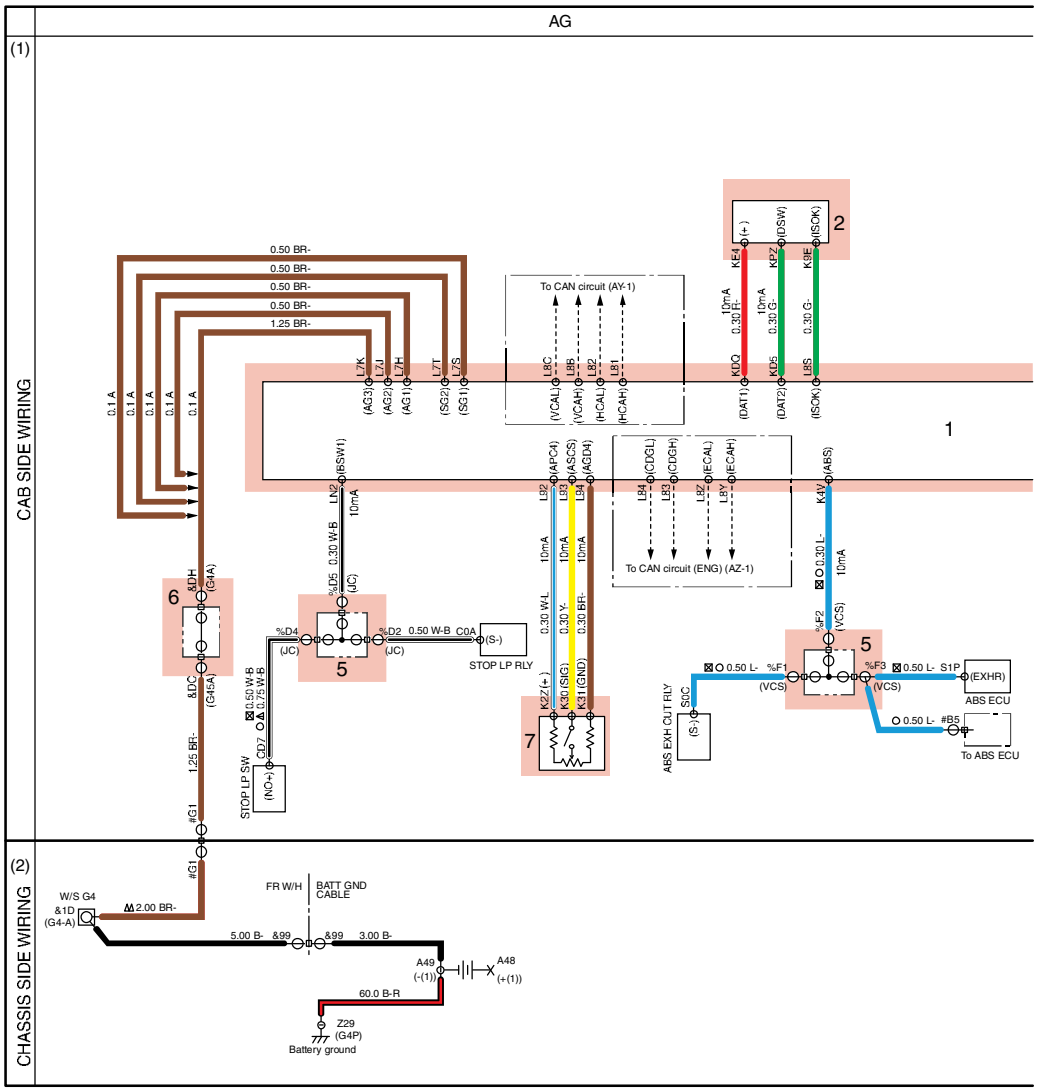
4 U2 ECU

EL02_001.fm 91 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200101

EL02_001.fm 92 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

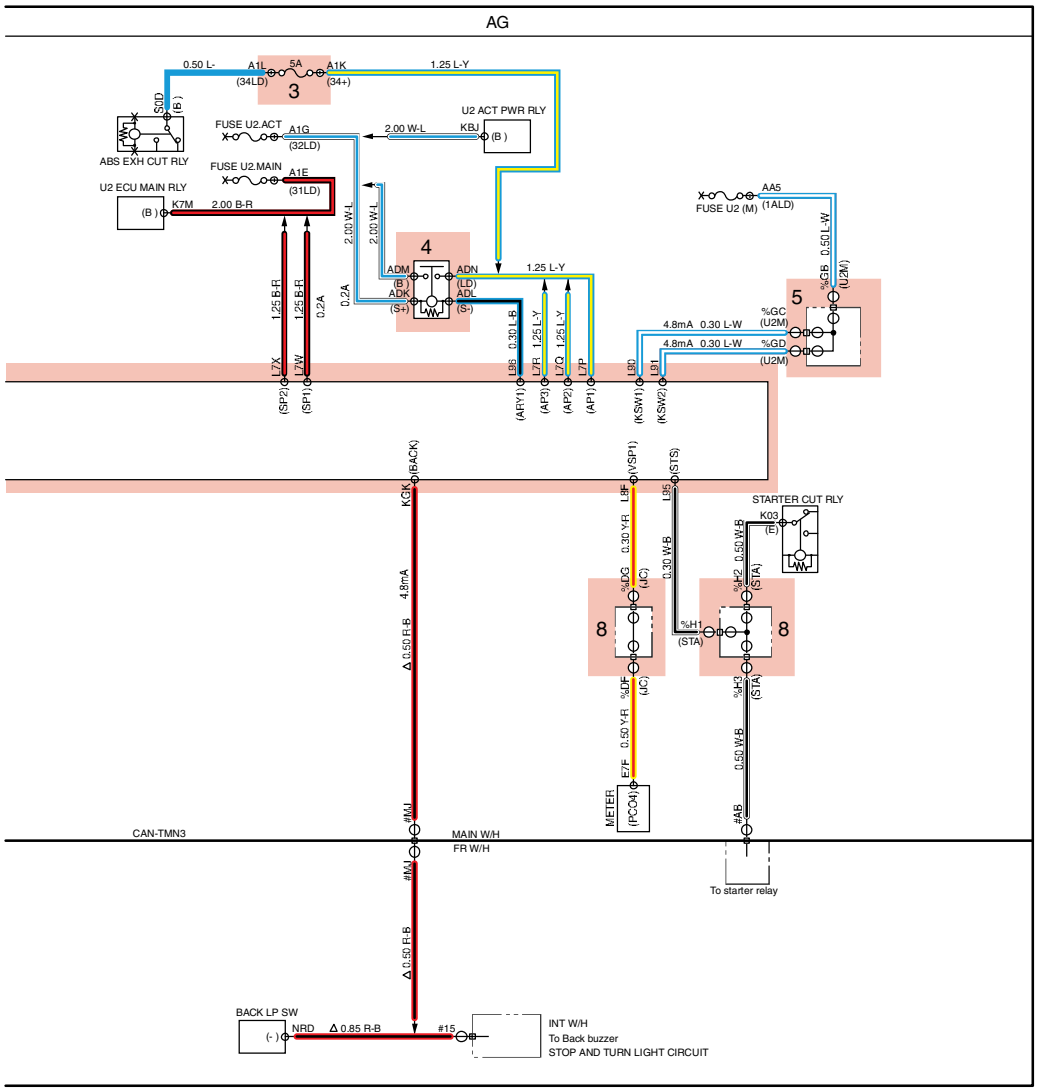


SAPH12Z160200102

AG VEHICLE CONTROL ECU CIRCUIT-1

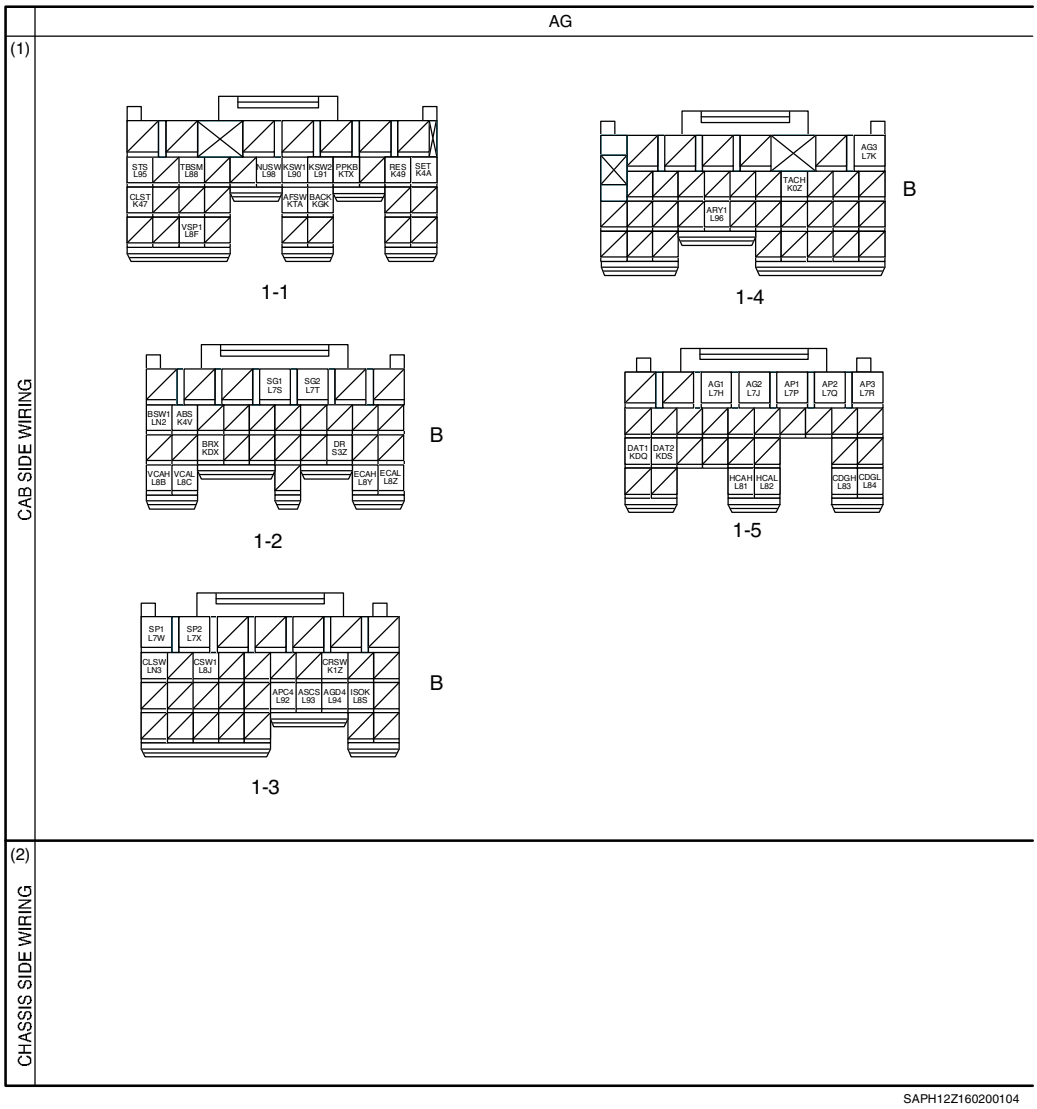
1	Vehicle control ECU	5	U2 J/C No.1
2	Diagnosis connector (16P)	6	J/C G4
3	Fuse vehicle control actuator 2	7	Idling volume
4	VSS actuator relay	8	U2 J/C No.2

EL02_001.fm 93 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200103

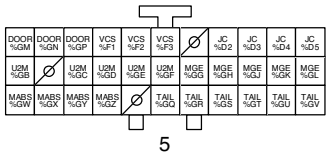
EL02_001.fm 94 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



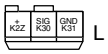
SAPH12Z160200104

EL02_001.fm 95 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

AG

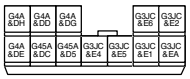


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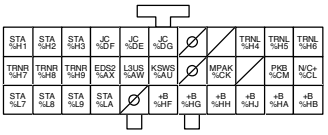


L

7



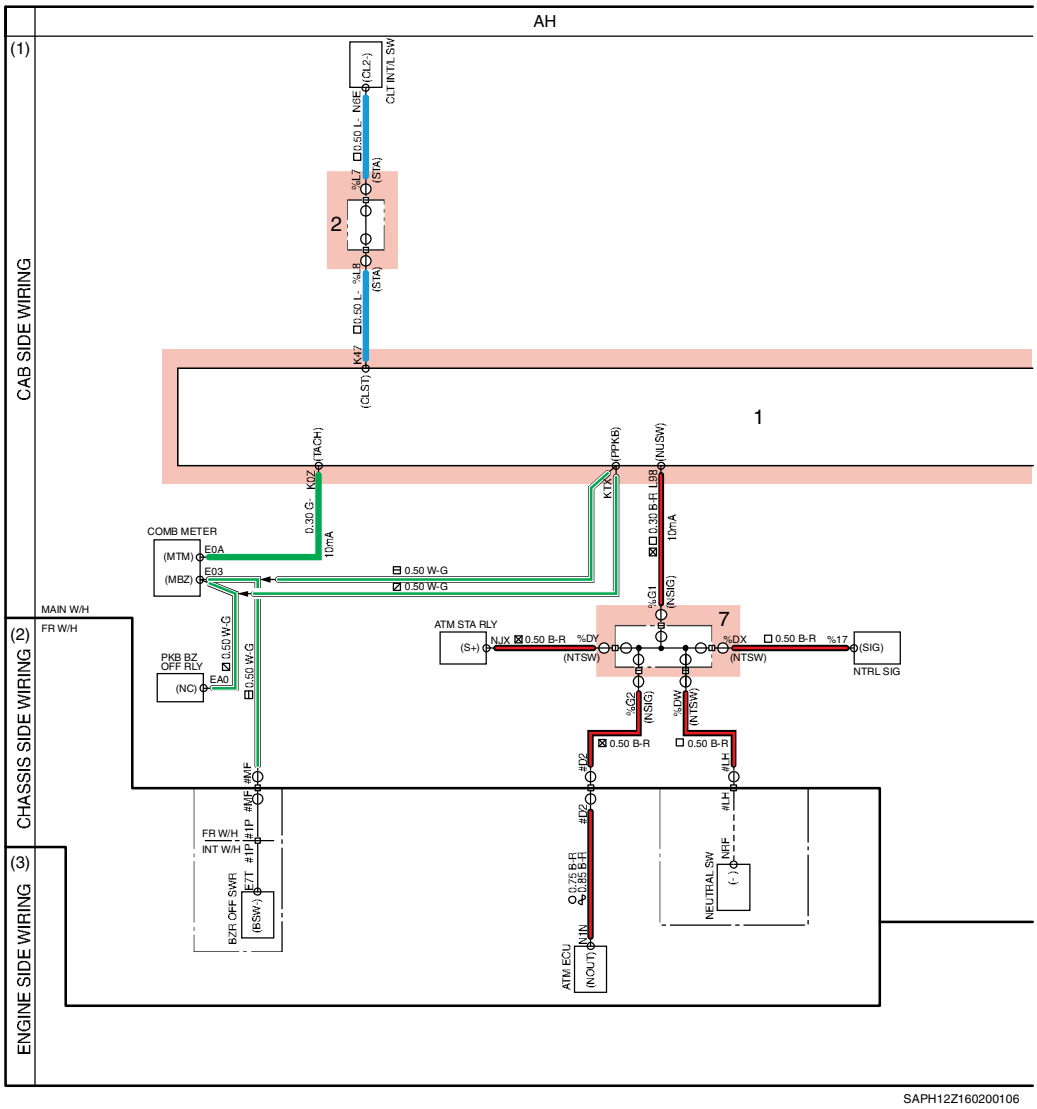
6



8

SAPH12Z160200105

EL02_001.fm 96 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200106

AH VEHICLE CONTROL ECU CIRCUIT-2

1 Vehicle control ECU

2 U2 J/C No.2

3 Fuse vehicle control actuator 2

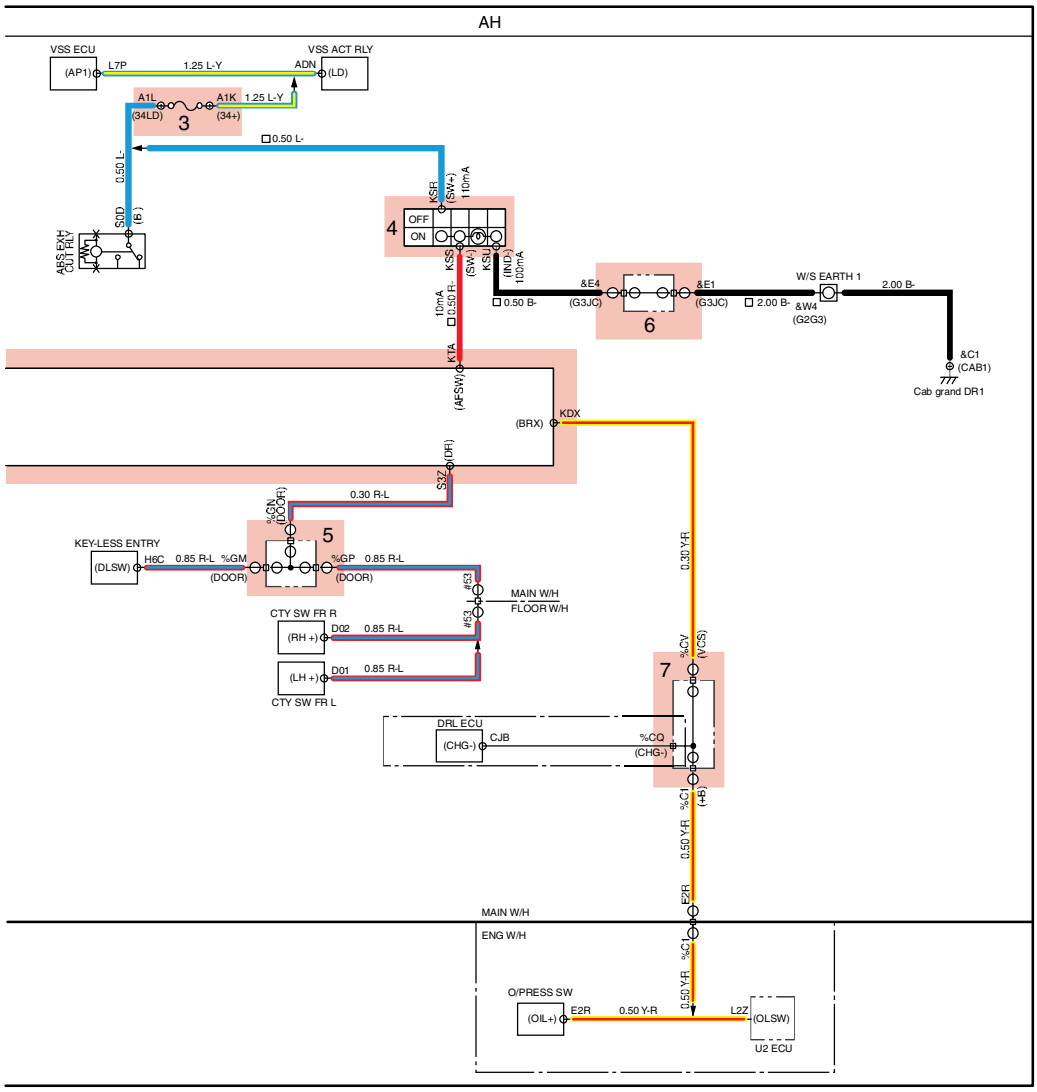
4 Economy running switch

5 U2 J/C No.1

6 J/C EARTH

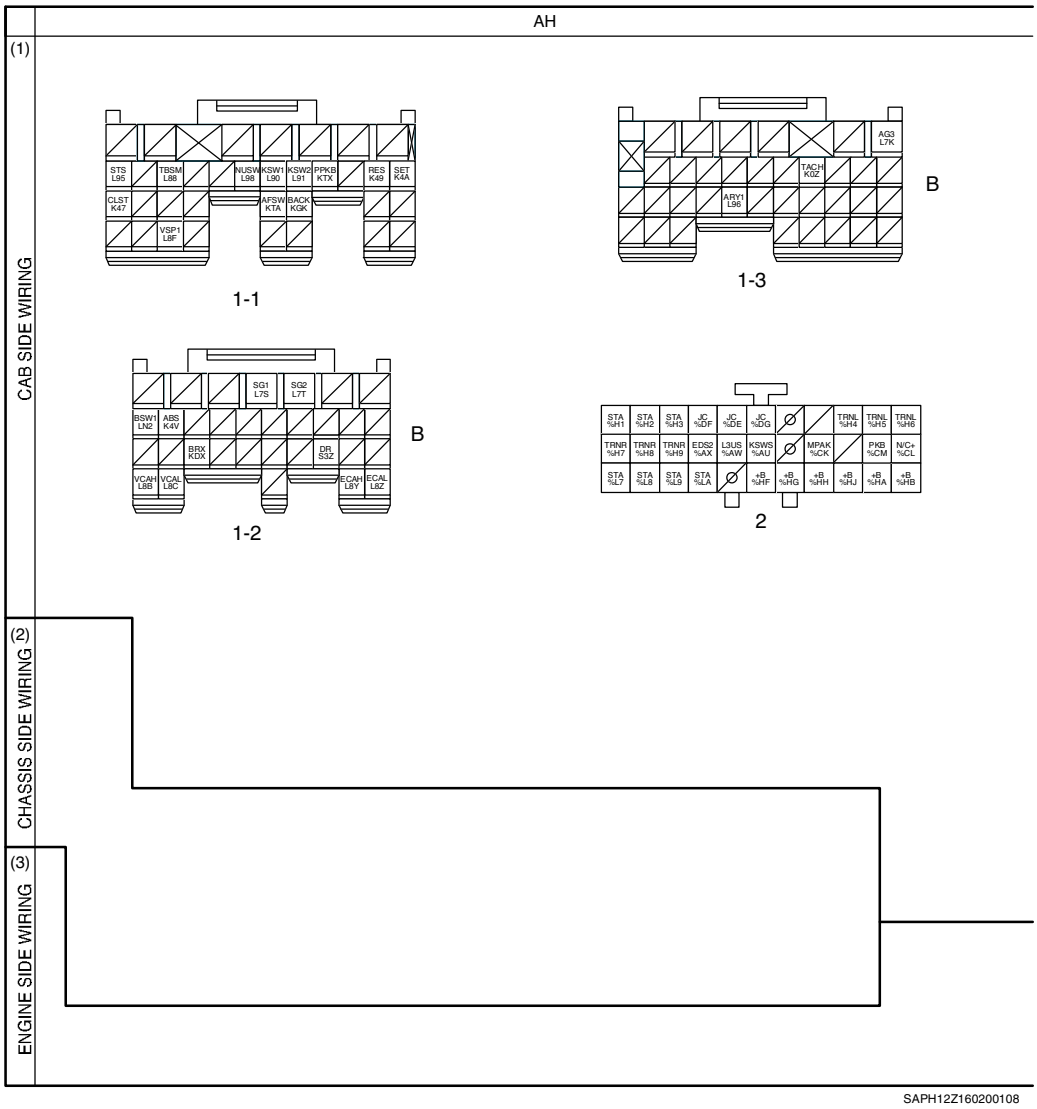
7 J/C SIGNAL

EL02_001.fm 97 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200107

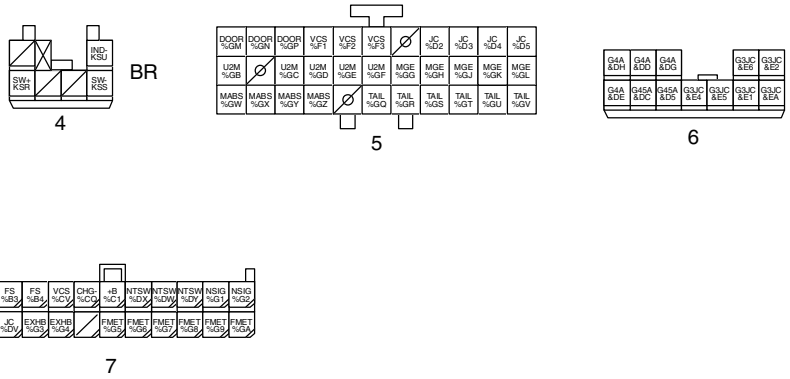
EL02_001.fm 98 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200108

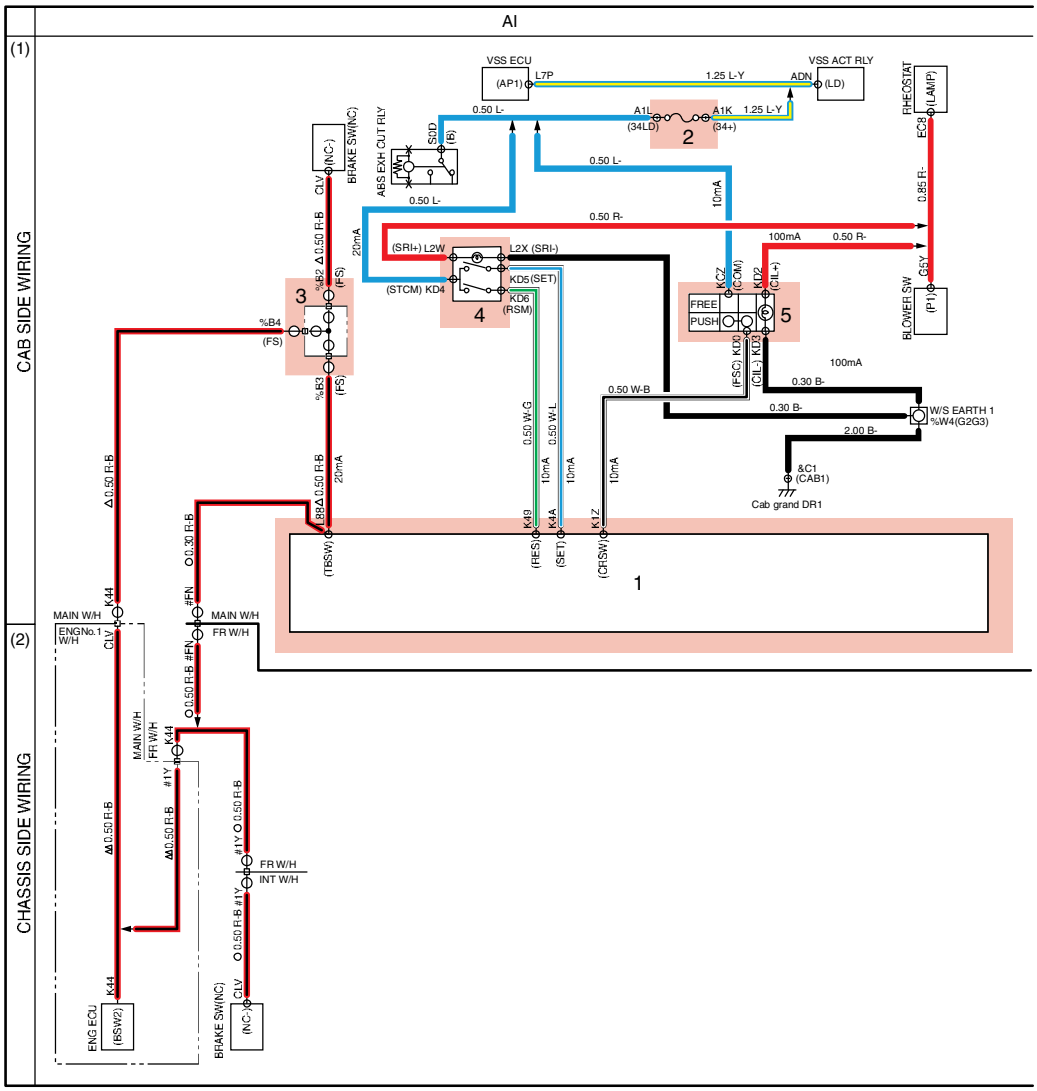
EL02_001.fm 99 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

AH



SAPH12Z160200109

EL02_001.fm 100 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200110

AI VEHICLE CONTROL ECU CIRCUIT-3

1 Vehicle control ECU

2 Fuse vehicle control actuator 2

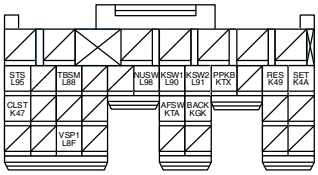
3 J/C SIGNAL

4 Set/resume switch

5 Auto cruising switch

EL02_001.fm 101 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

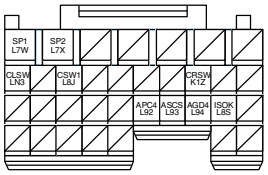
AI



1-1

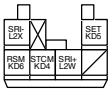


3



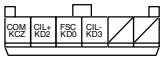
B

1-2



BR

4

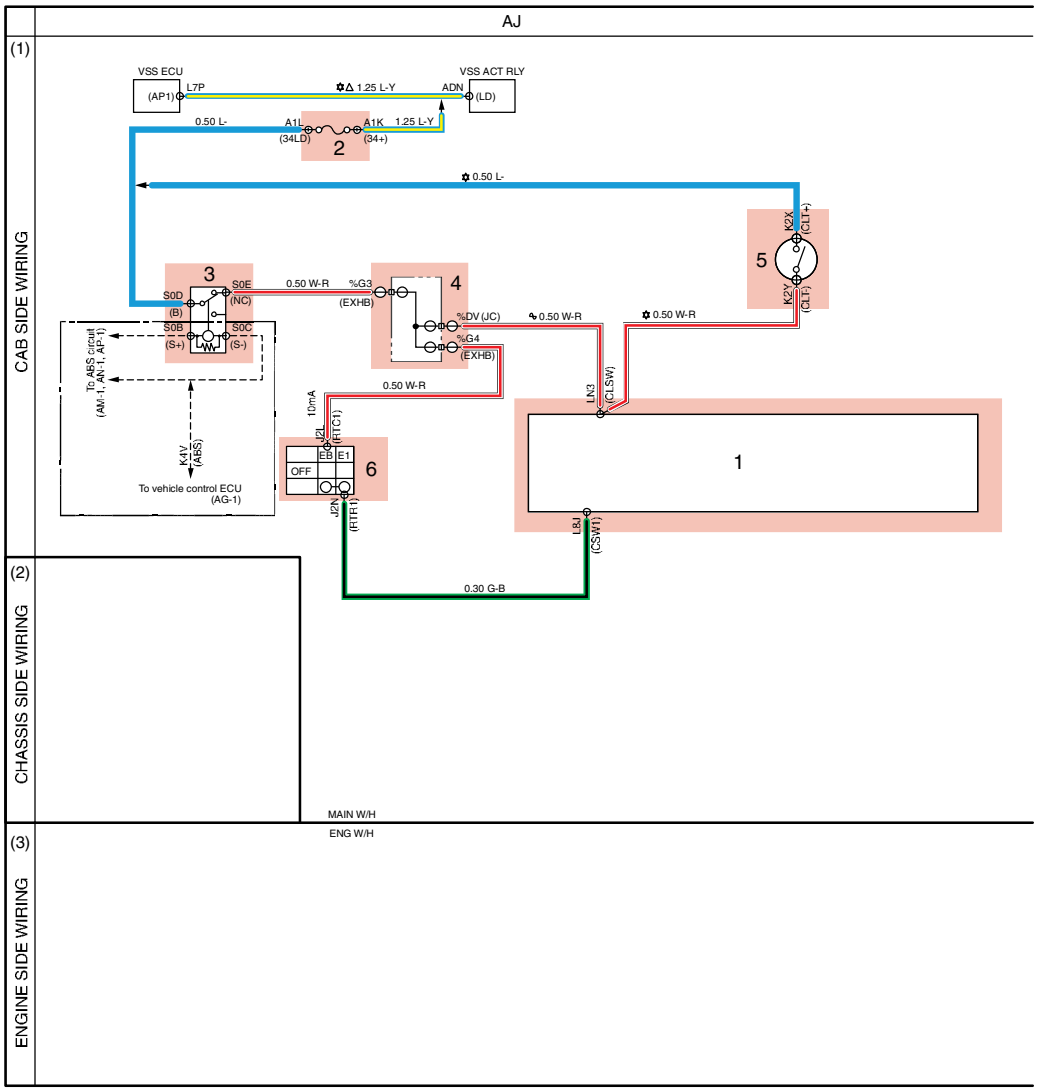


B

5

SAPH12Z160200111

EL02_001.fm 102 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200112

AJ VEHICLE CONTROL ECU CIRCUIT-4

1 Vehicle control ECU

2 Fuse vehicle control actuator 2

3 ABS exhaust brake cut relay

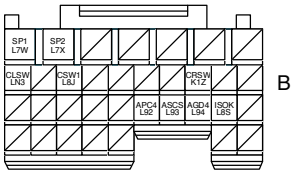
4 J/C SIGNAL

5 Exhaust clutch switch

6 Wiper and retarder switch

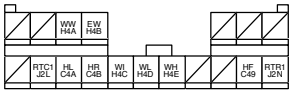
EL02_001.fm 103 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

AJ



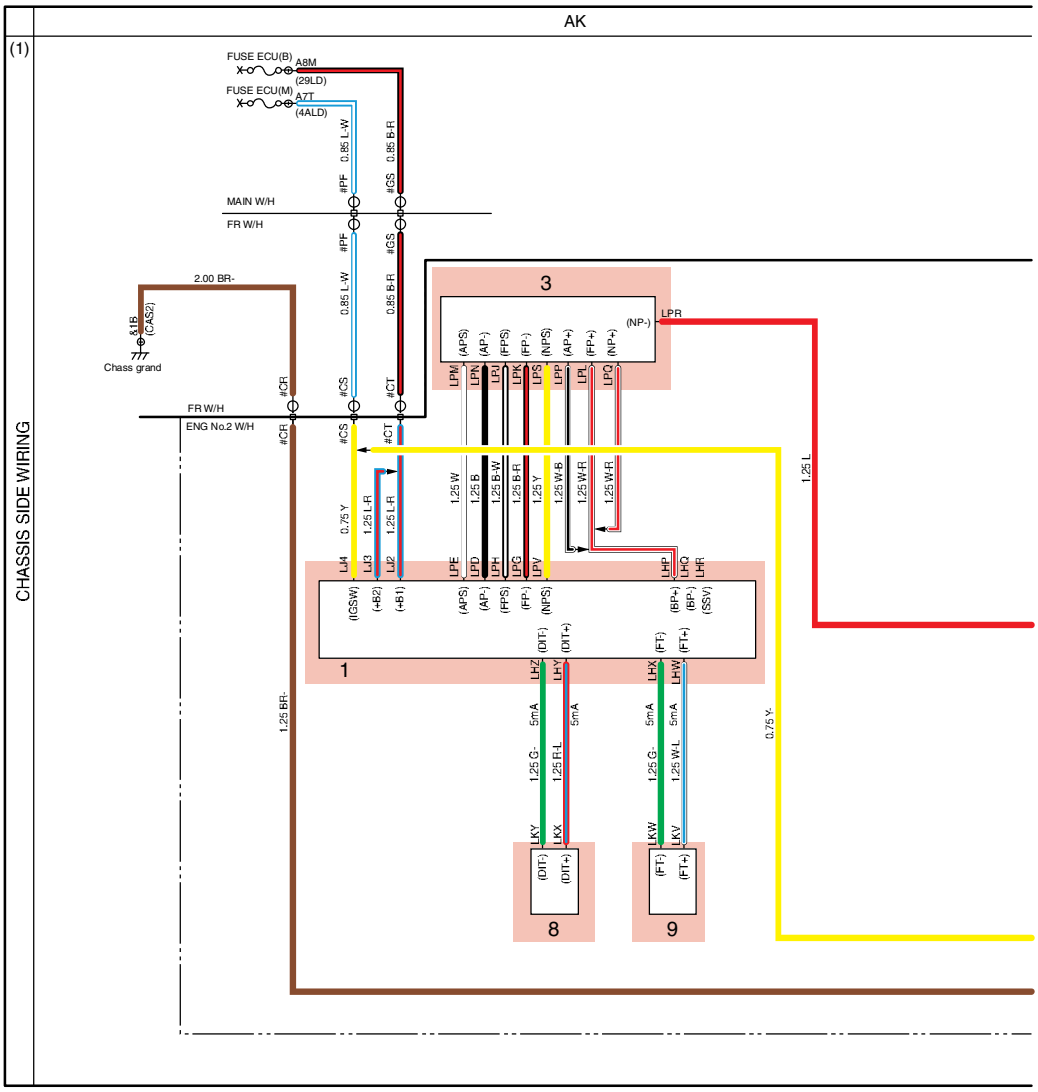






SAPH12Z160200113

EL02_001.fm 104 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



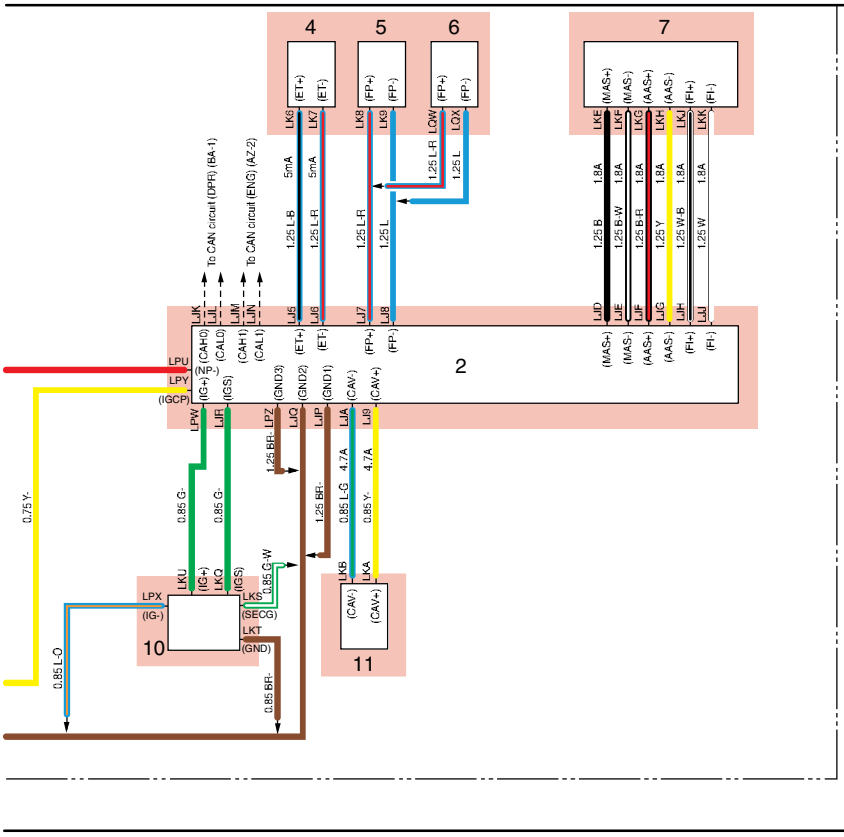
SAPH12Z160200114

AK BURNER CIRCUIT

1 BCU 18P
2 BCU 30P
3 Atomization module 2
4 Exhaust temperature sensor
5 Fuel pump
6 Fuel pump 2
7 Atomization module
8 DPR intake temperature sensor
9 Flame temperature sensor
10 Ignition coil
11 Combustion air valve

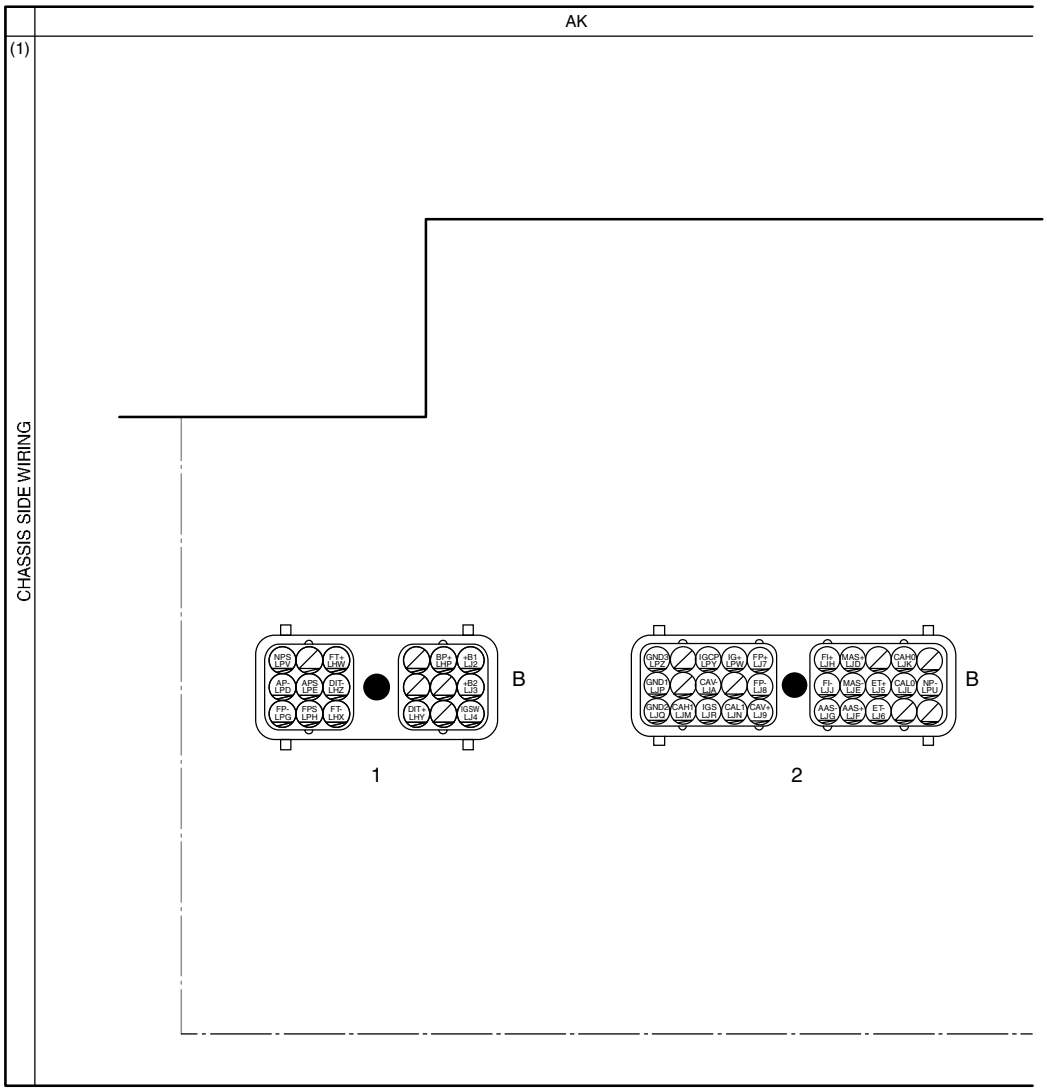
EL02_001.fm 105 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

AK



SAPH12Z160200115

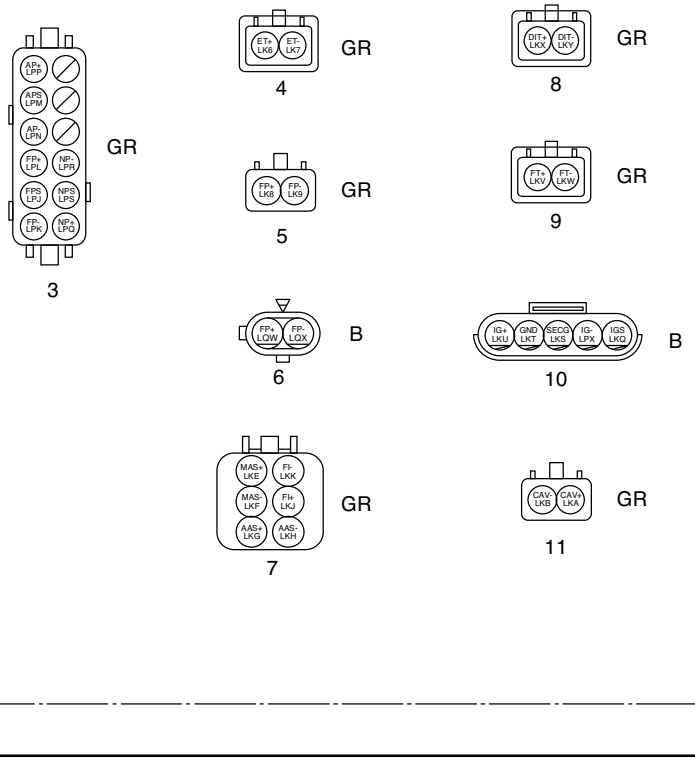
EL02_001.fm 106 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200116

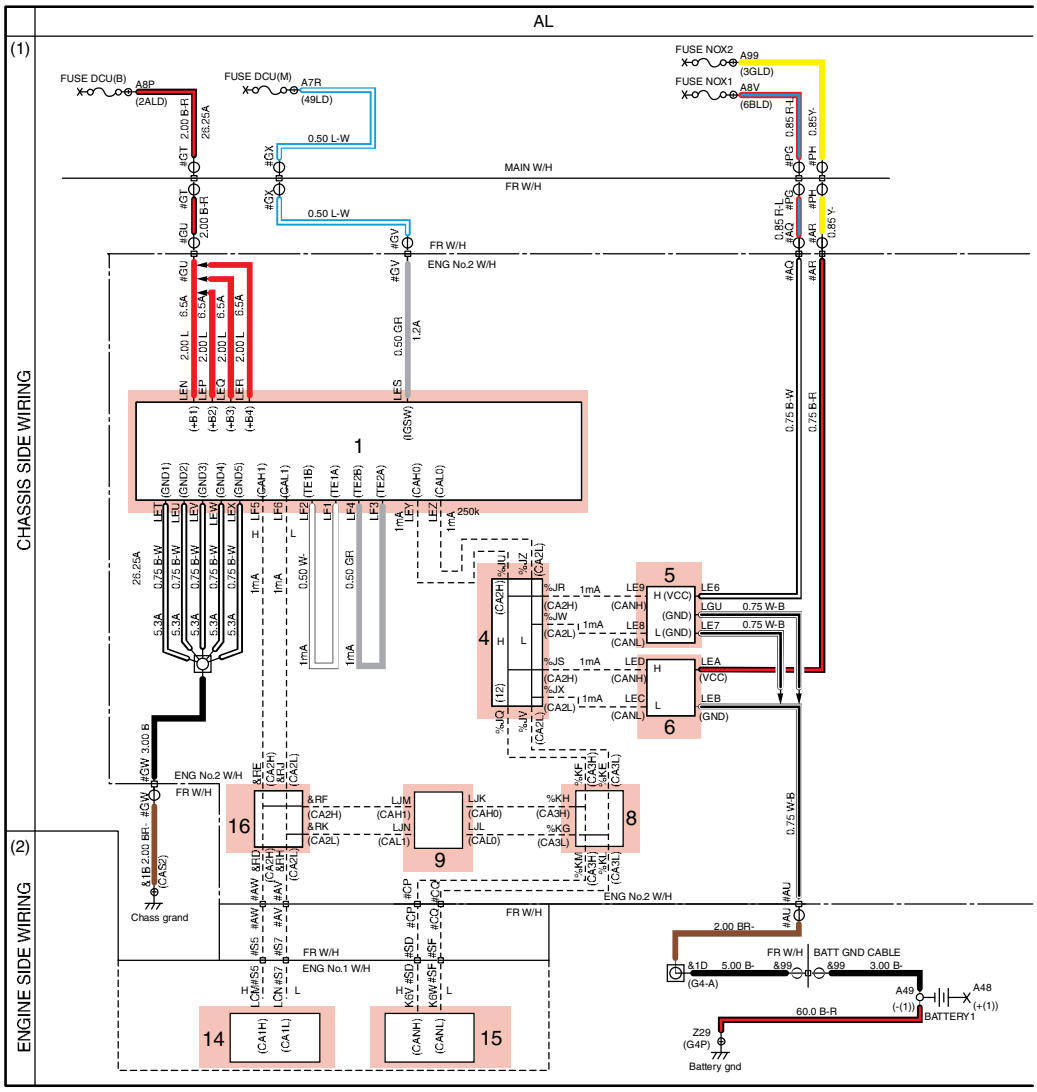
EL02_001.fm 107 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

AK



SAPH12Z160200117

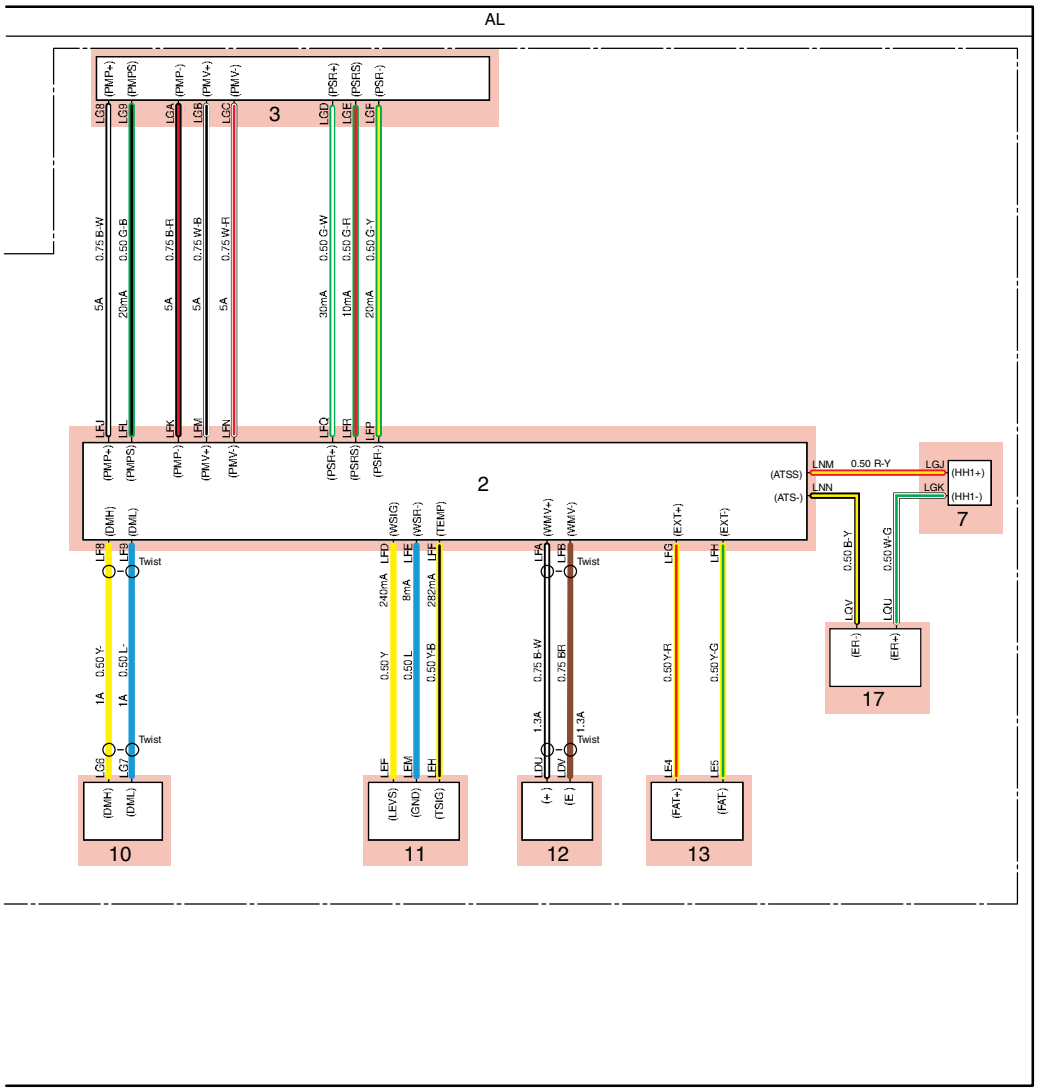
EL02_001.fm 108 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



AL DEF SCR CIRCUIT

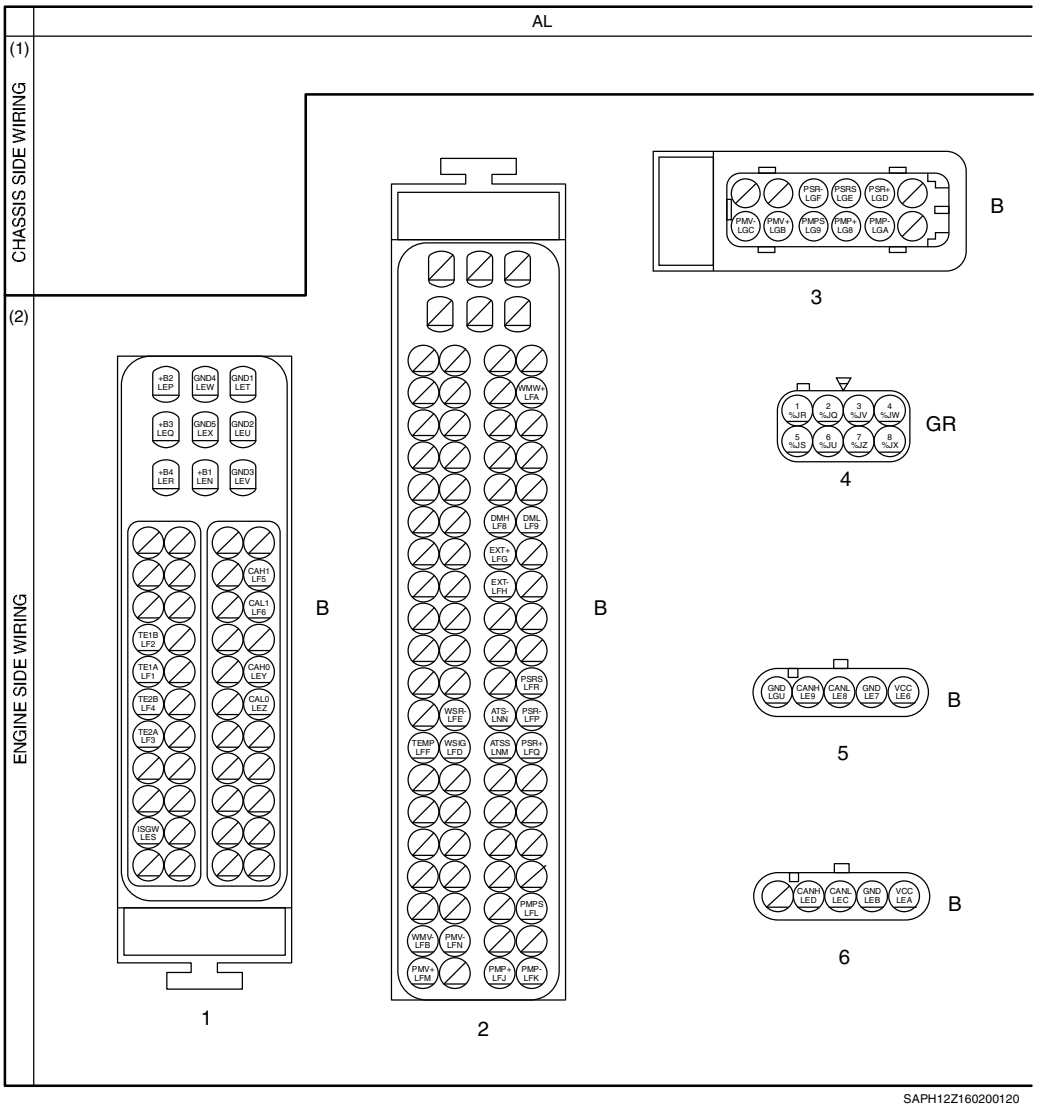
1	DCU 53P	10	Dosing module
2	DCU 86P	11	Urea sensor
3	Supply module	12	Coolant cut off valve
4	U2 CAN J/C No.3	13	SCR front temperature sensor
5	NOx sensor 1	14	U2 ECU
6	NOx sensor 2	15	U2 ECU
7	Ambient temperature sensor	16	U2 CAN J/C No.2
8	U2 CAN J/C No.1	17	External resistance
9	BCU 30P		

EL02_001.fm 109 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200119

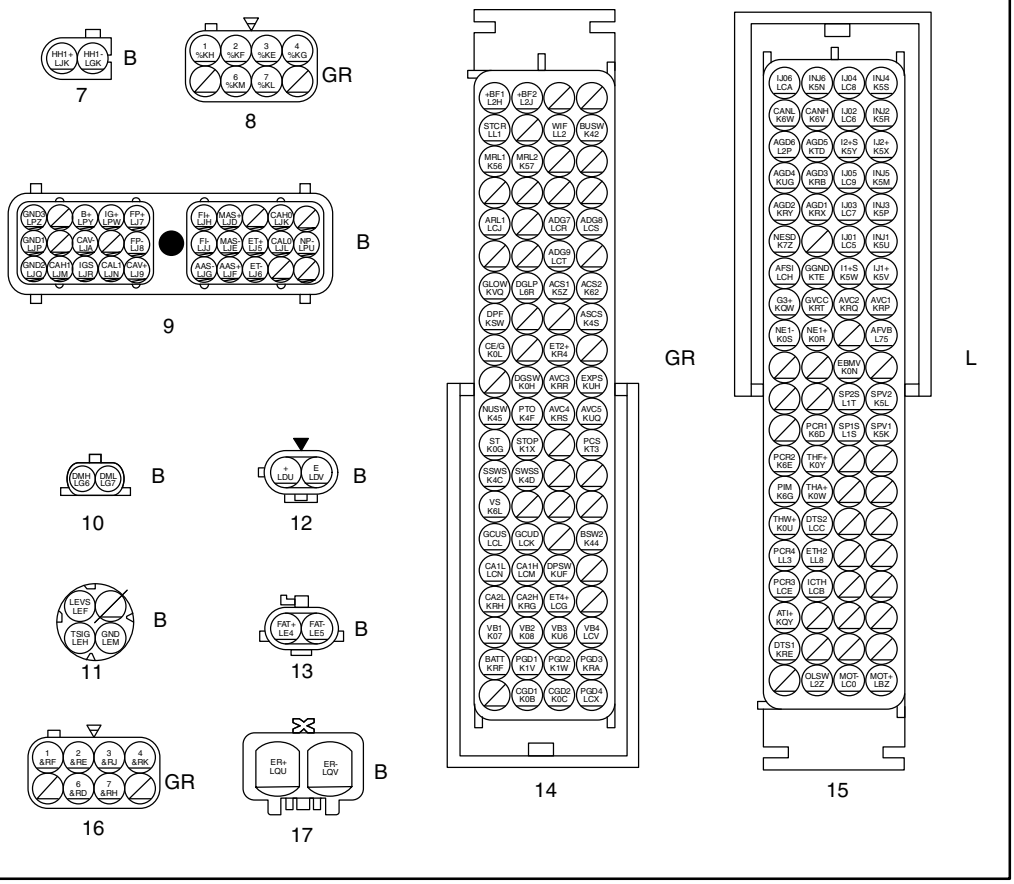
EL02_001.fm 110 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200120

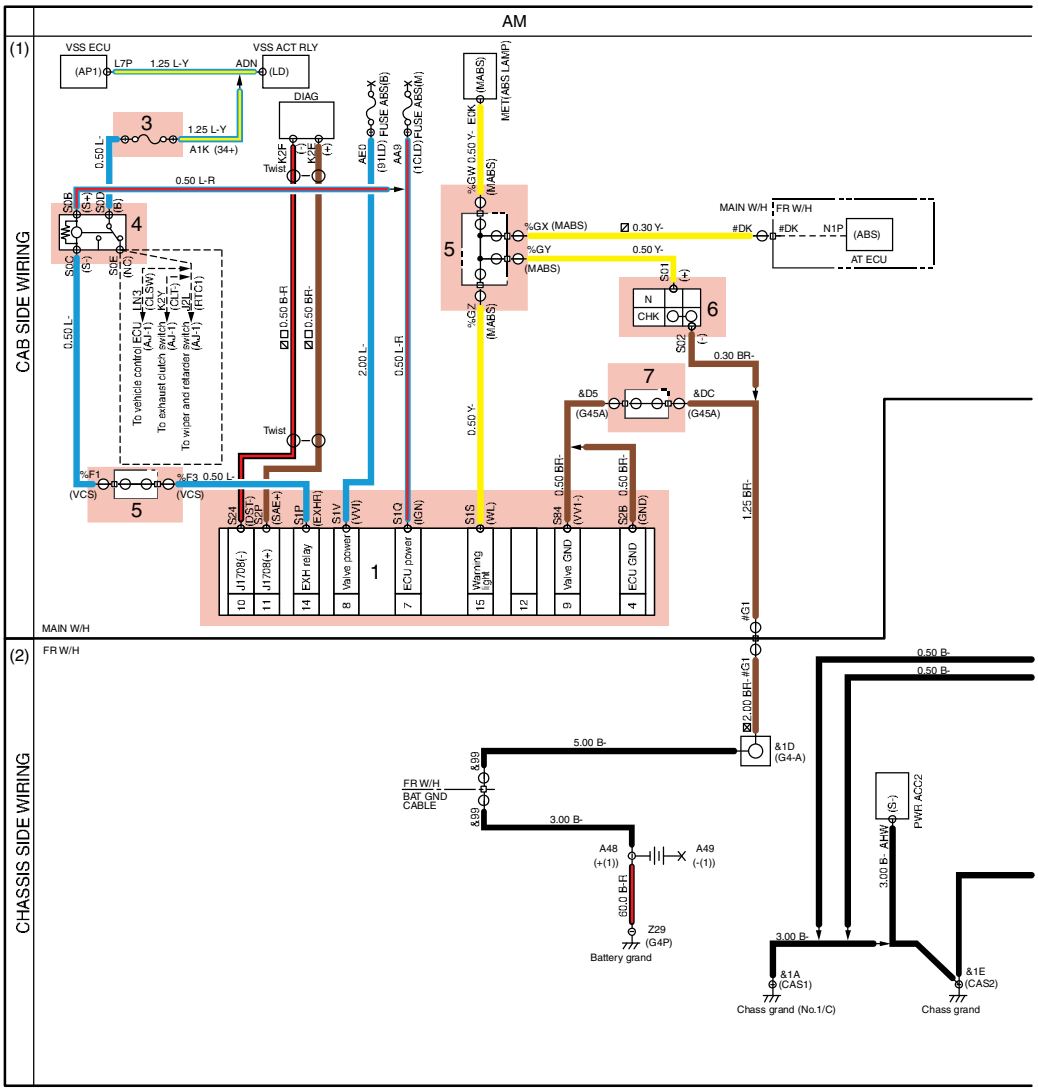
EL02_001.fm 111 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

AL



SAPH12Z160200121

EL02_001.fm 112 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



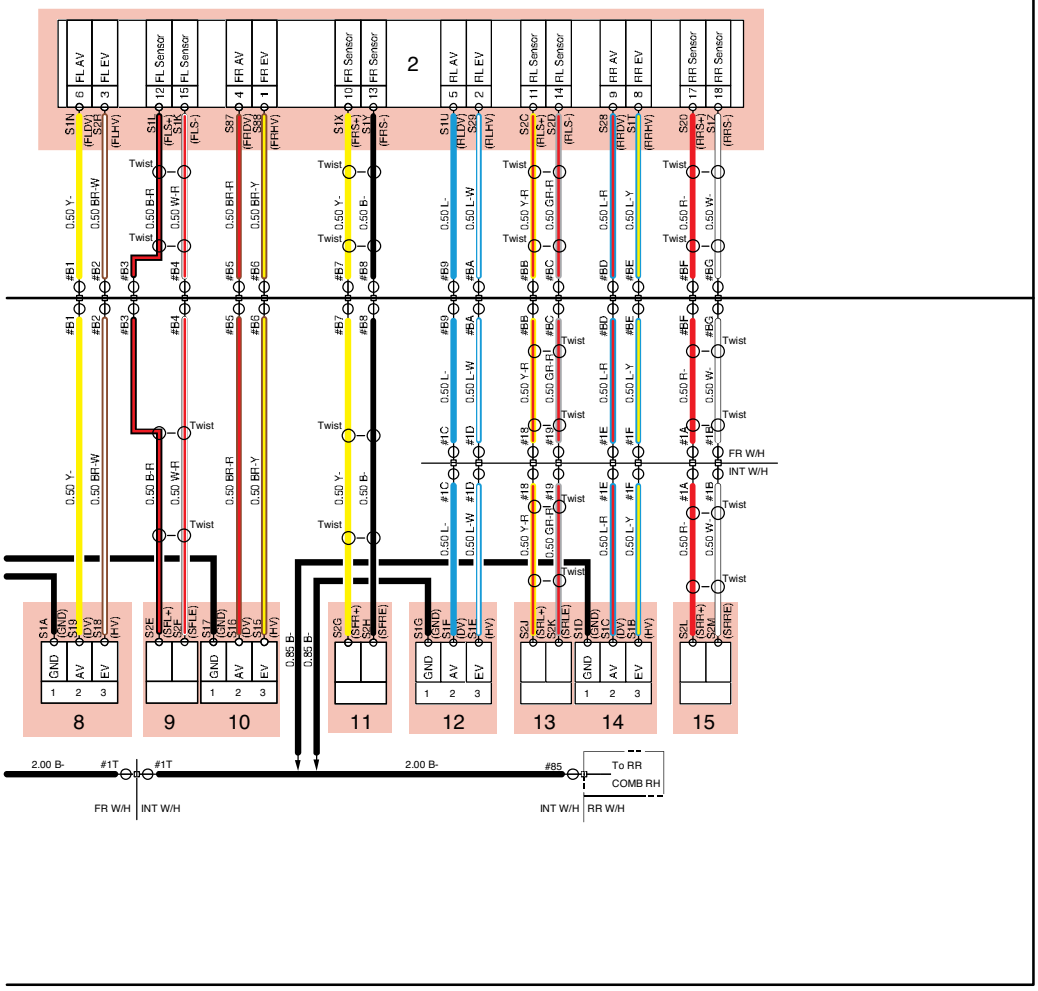
SAPH12Z160200122

AM ABS CIRCUIT-1 (FOR FULL AIR BRAKE)

1 ABS ECU E
2 ABS ECU F
3 Fuse vehicle control actuator 2
4 ABS exhaust brake cut relay
5 U2 J/C No.1
6 ABS diagnosis switch
7 J/C EARTH
8 Modulator front LH
9 ABS sensor front LH
10 Modulator front RH
11 ABS sensor front RH
12 Modulator rear LH
13 ABS sensor rear LH
14 Modulator rear RH
15 ABS sensor rear RH

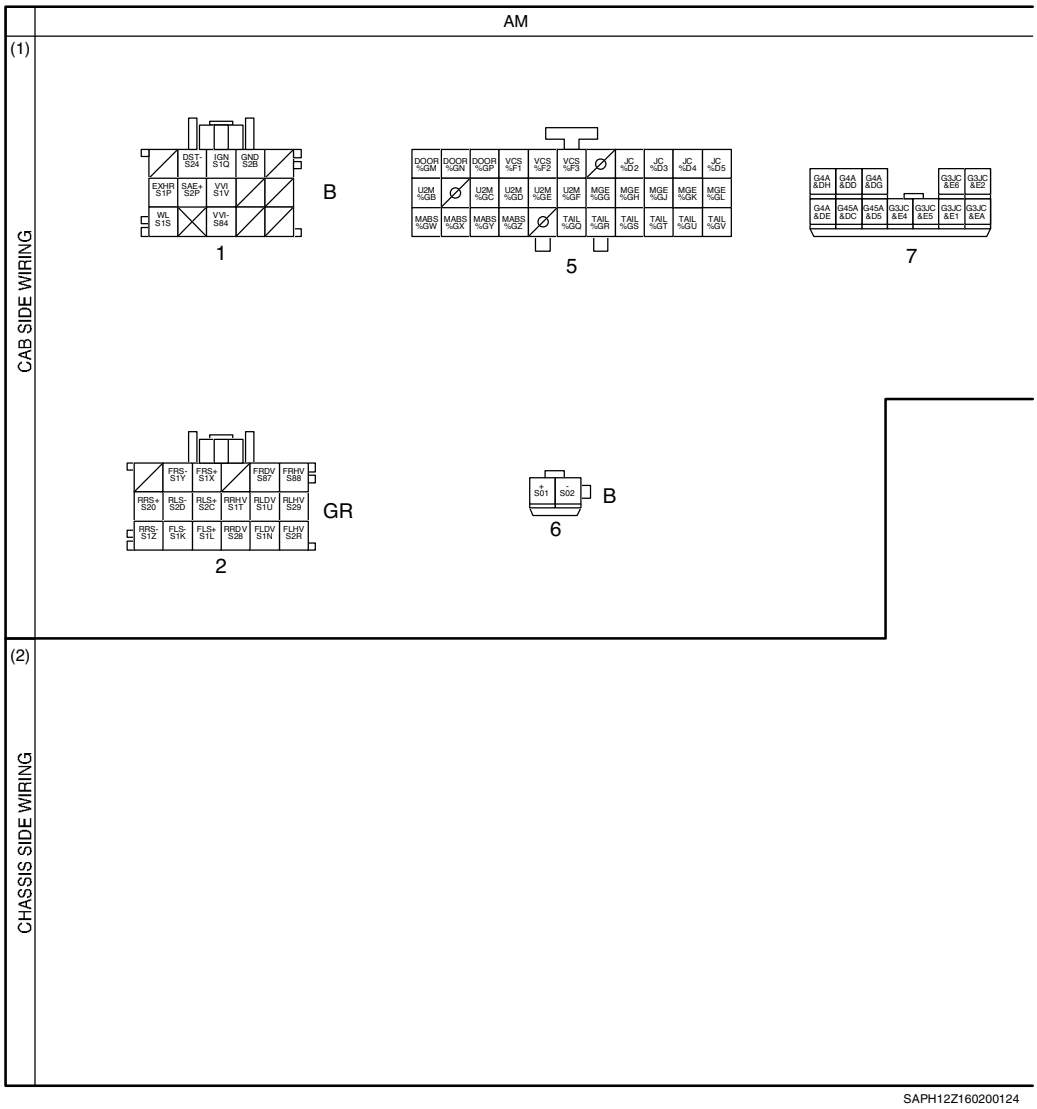
EL02_001.fm 113 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

AM



SAPH12Z160200123

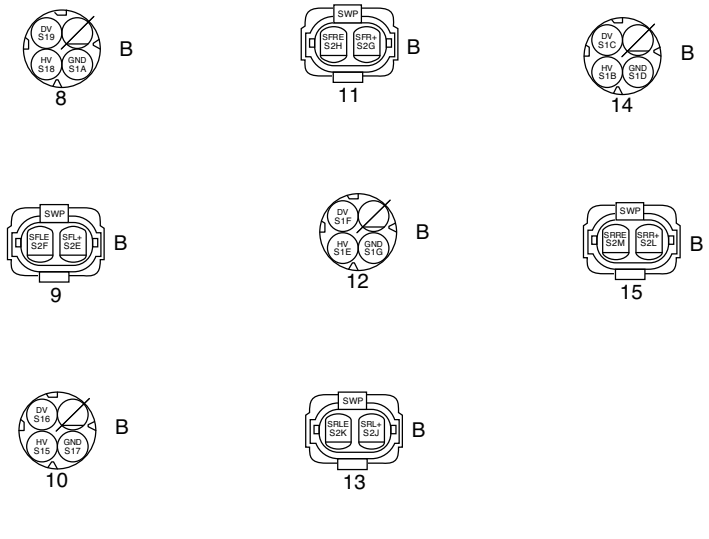
EL02_001.fm 114 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200124

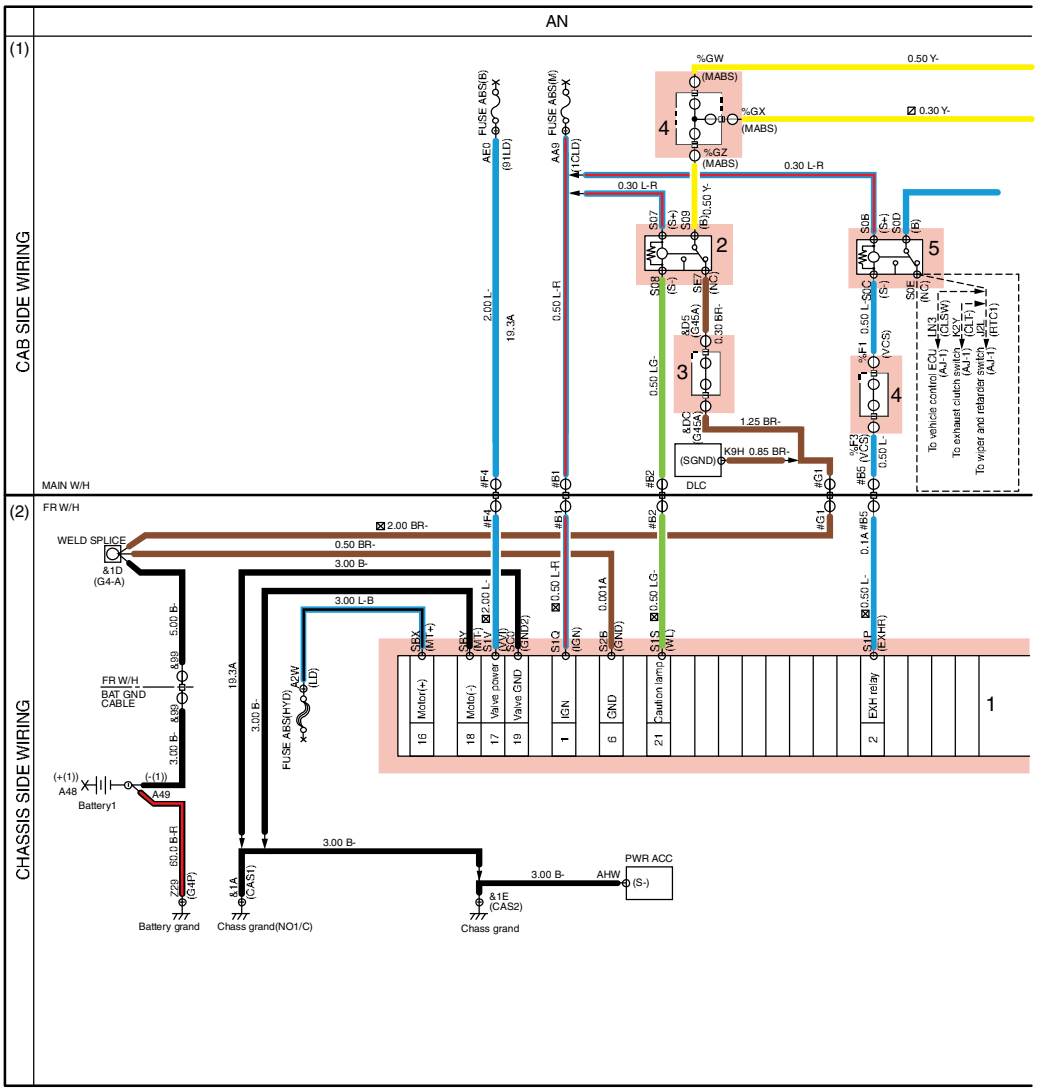
EL02_001.fm 115 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

AM



SAPH12Z160200125

EL02_001.fm 116 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

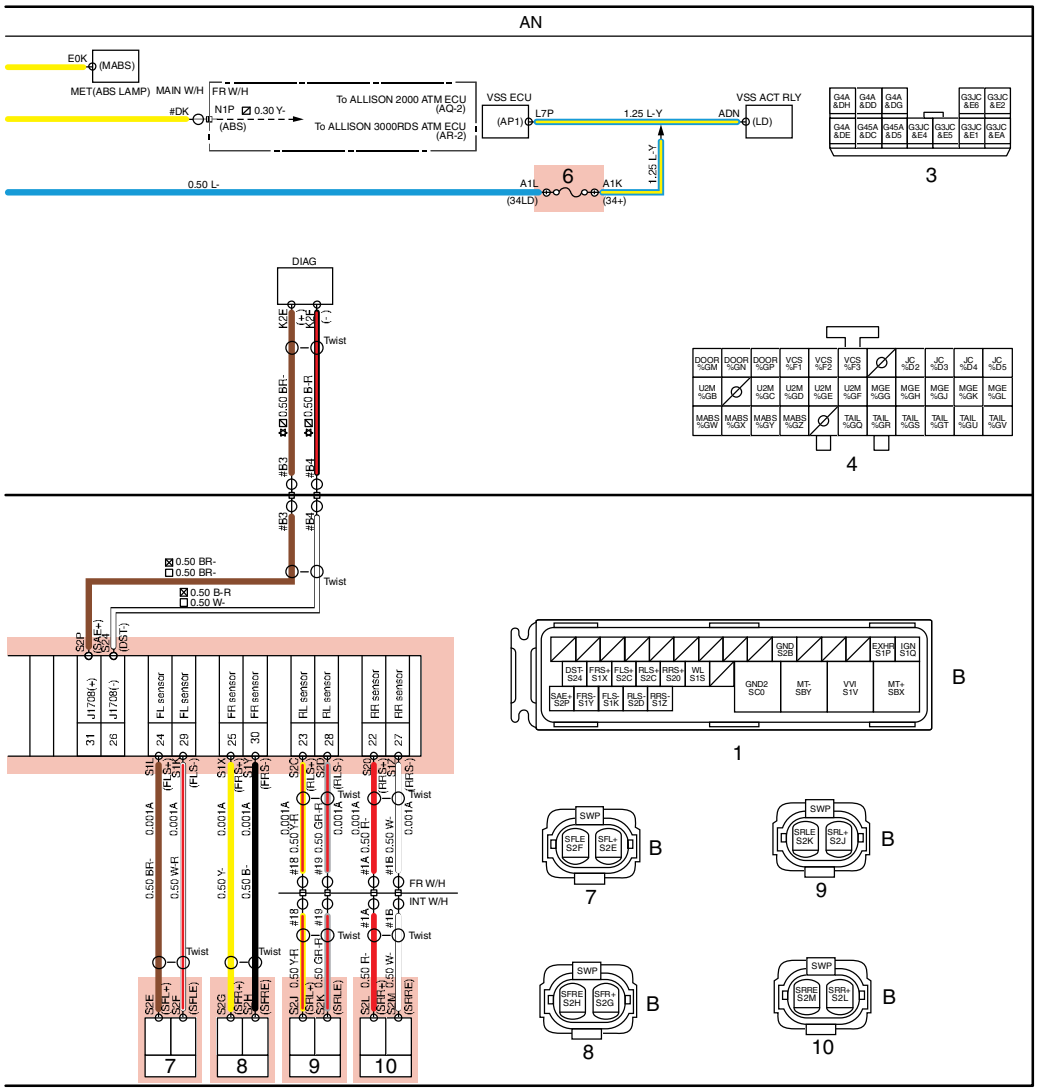


SAPH12Z160200126

AN ABS CIRCUIT-2 (FOR HYDRO MAX BRAKE E VERSION)

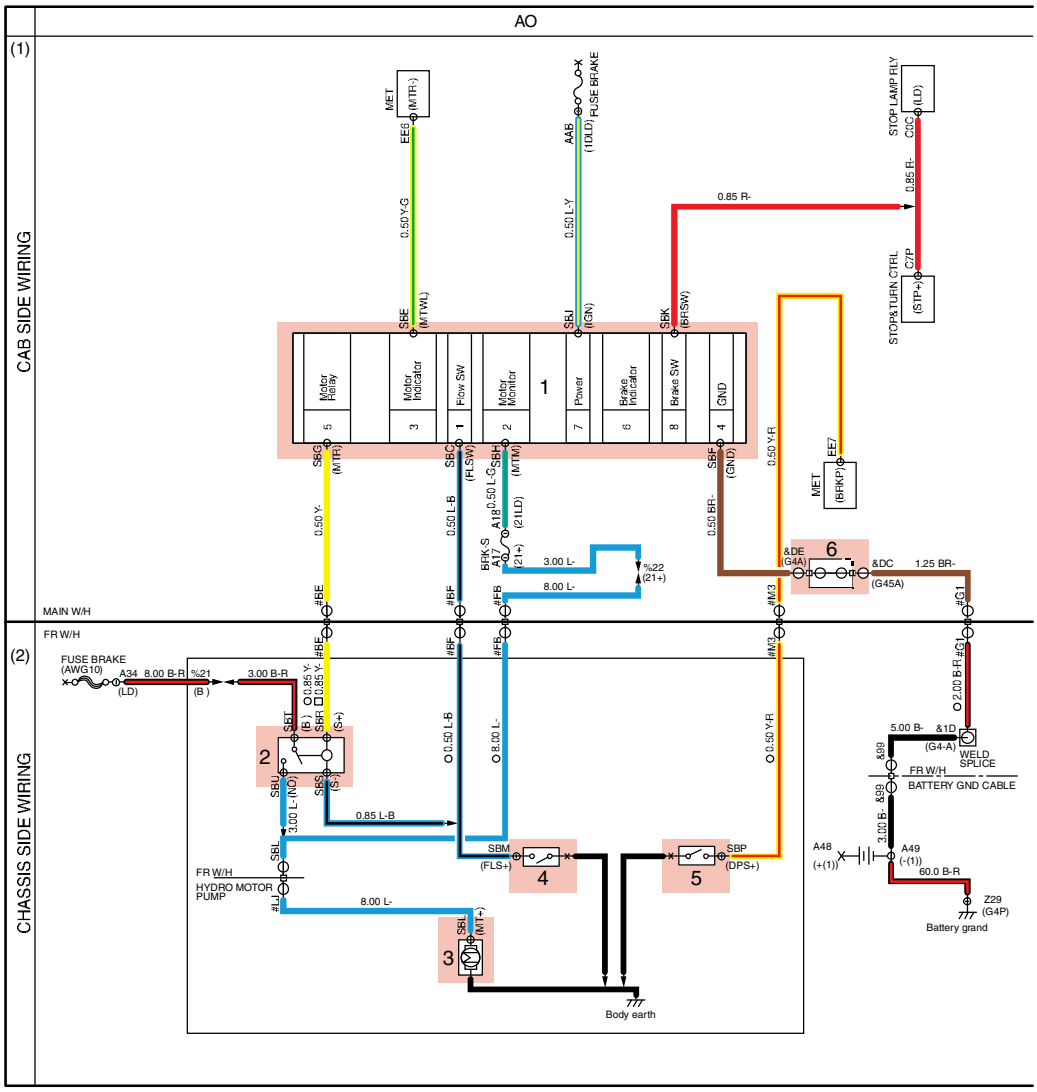
1	ABS HYDRO MAX unit with ECU	6	Fuse vehicle control actuator 2
2	ABS warning light relay	7	ABS sensor front LH
3	J/C EARTH	8	ABS sensor front RH
4	U2 J/C No.1	9	ABS sensor rear LH
5	ABS exhaust brake cut relay	10	ABS sensor rear RH

EL02_001.fm 117 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200127

EL02_001.fm 118 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200128

AO HYDRO MAX SYSTEM CIRCUIT

1 Monitor module

2 Motor relay

3 Motor pump

4 Flow switch

5 Differential switch

6 J/C EATRH

EL02_001.fm 119 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

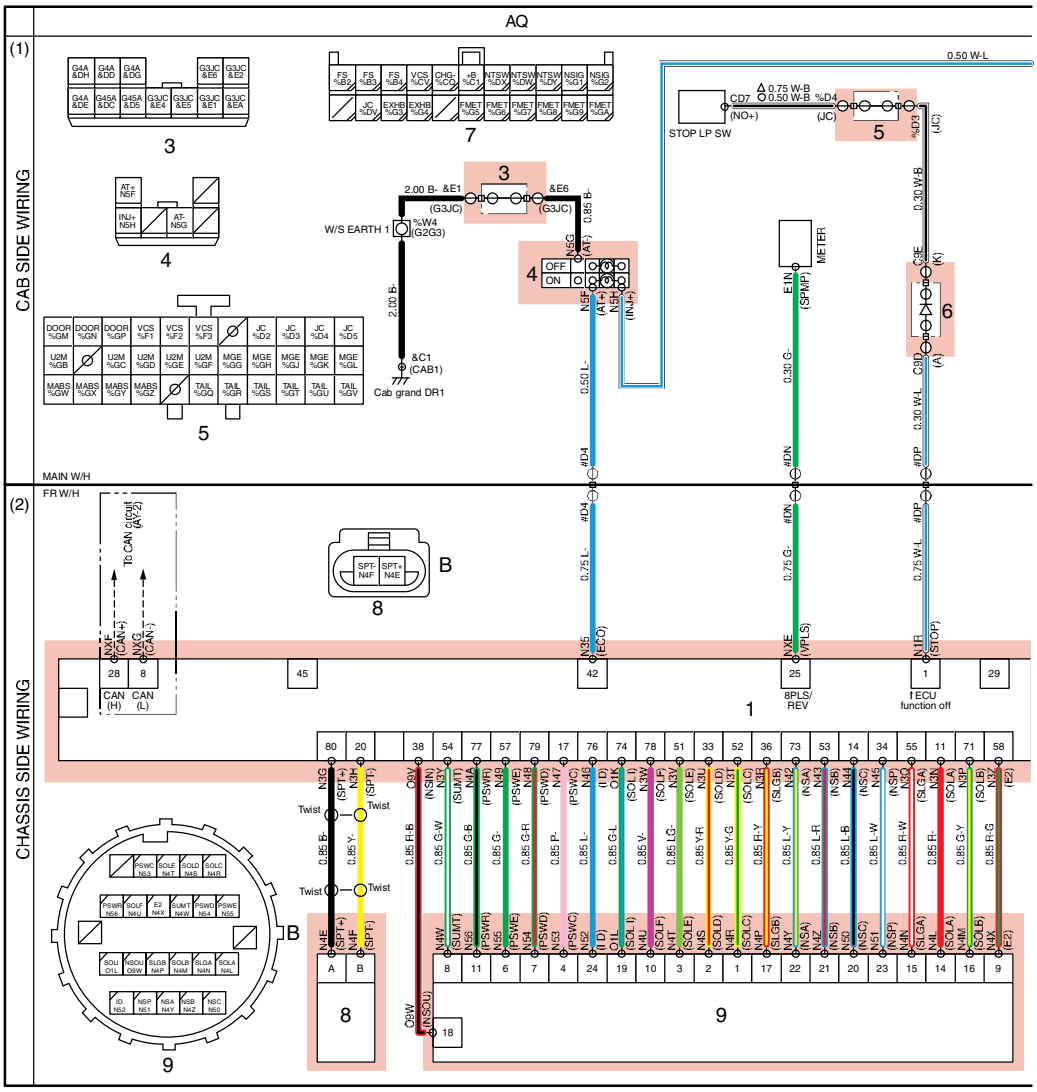
AO





SAPH12Z160200129

EL02_001.fm 120 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

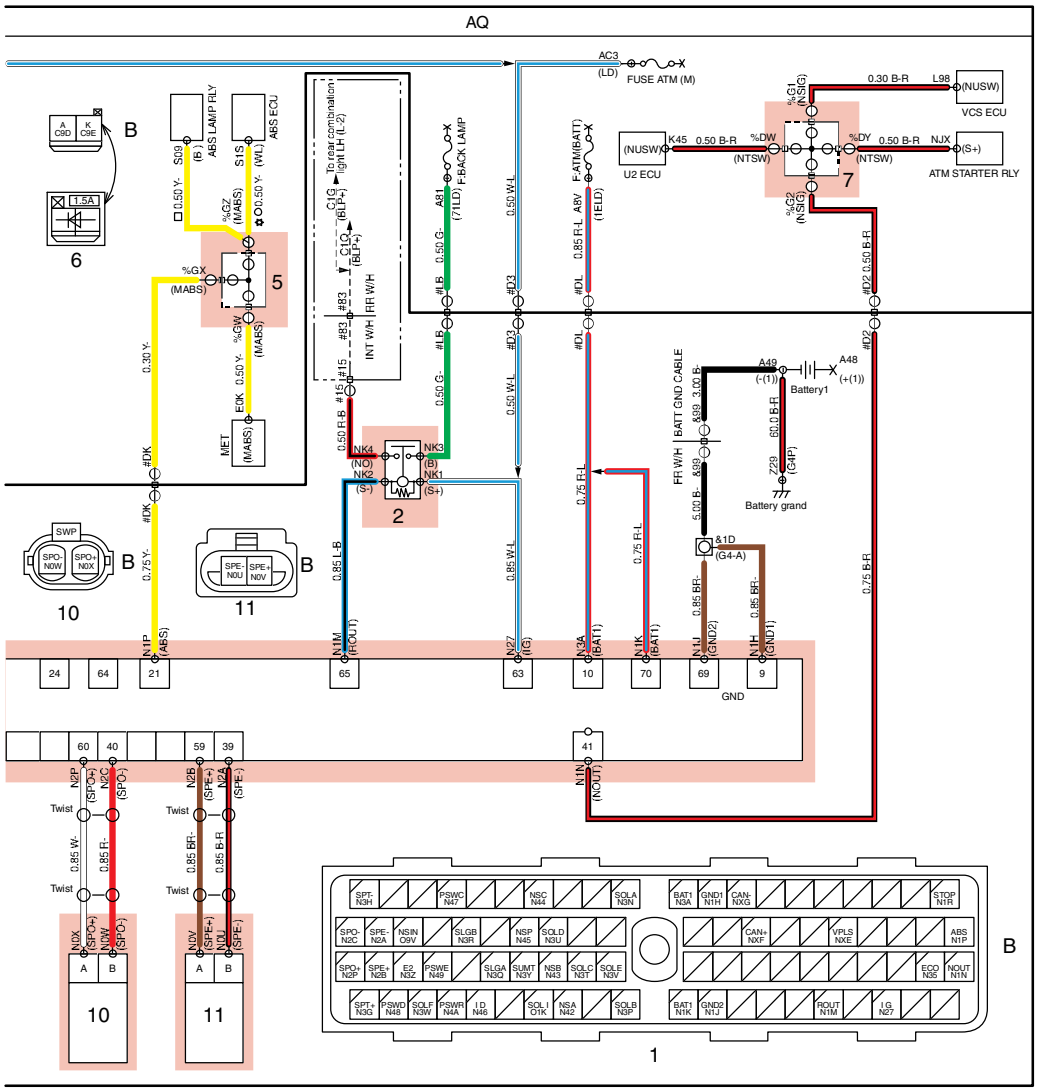


SAPH12Z160200130

AQ AUTOMATIC TRANSMISSION CIRCUIT-1: EQUIPPED WITH ALLISON 2000 AUTOMATIC TRANSMISSION

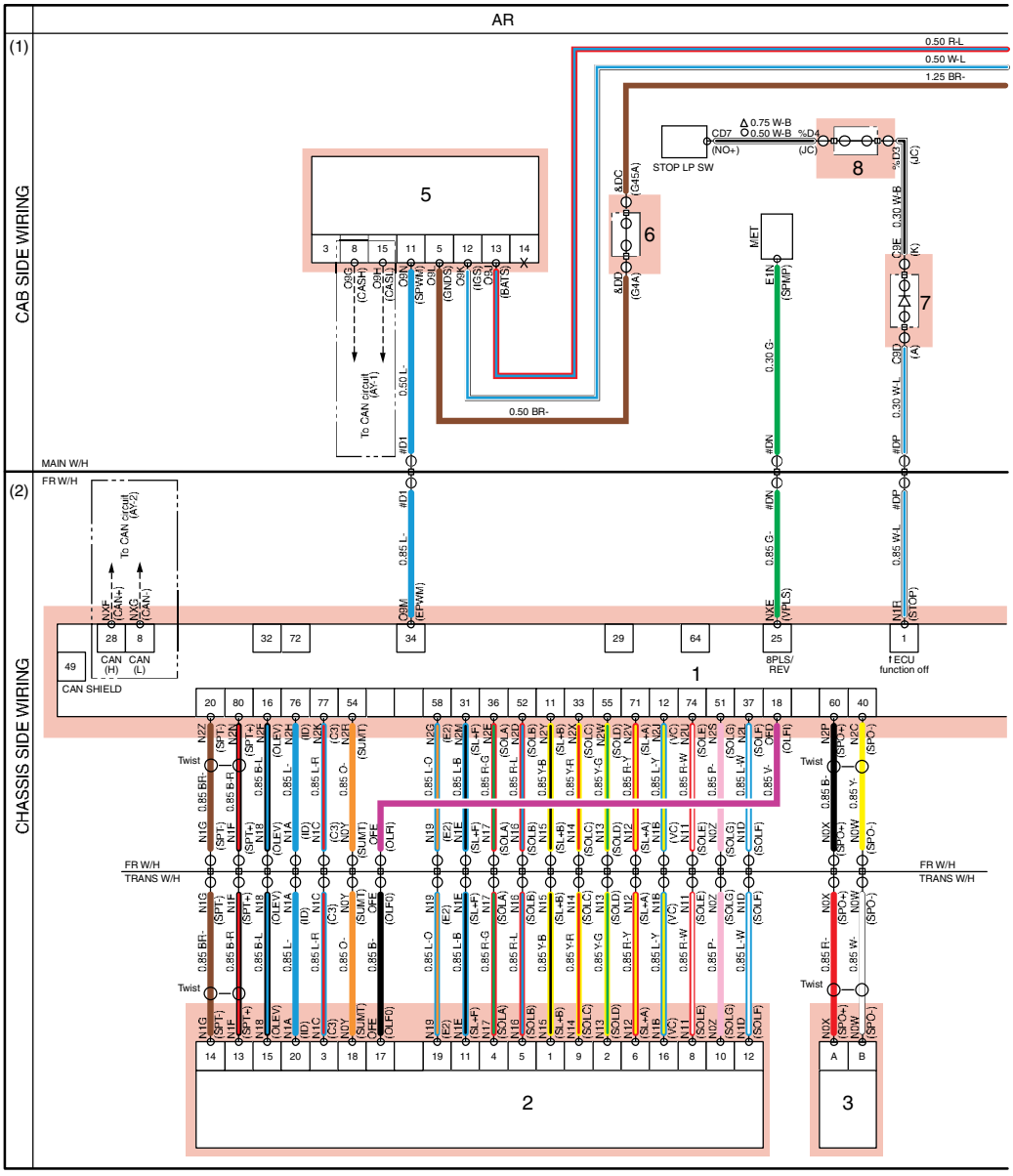
1	**ALLISON 2000 ATM ECU**	**7**	**J/C SIGNAL**
2	**ATM back-up light relay**	**8**	**Turbine speed sensor**
3	**J/C G3**	**9**	**Main transmission**
4	**ATM mode switch**	**10**	**Output speed sensor**
5	**U2 J/C No.1**	**11**	**Engine speed sensor**
6	**STP AT diode**		

EL02_001.fm 121 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200131

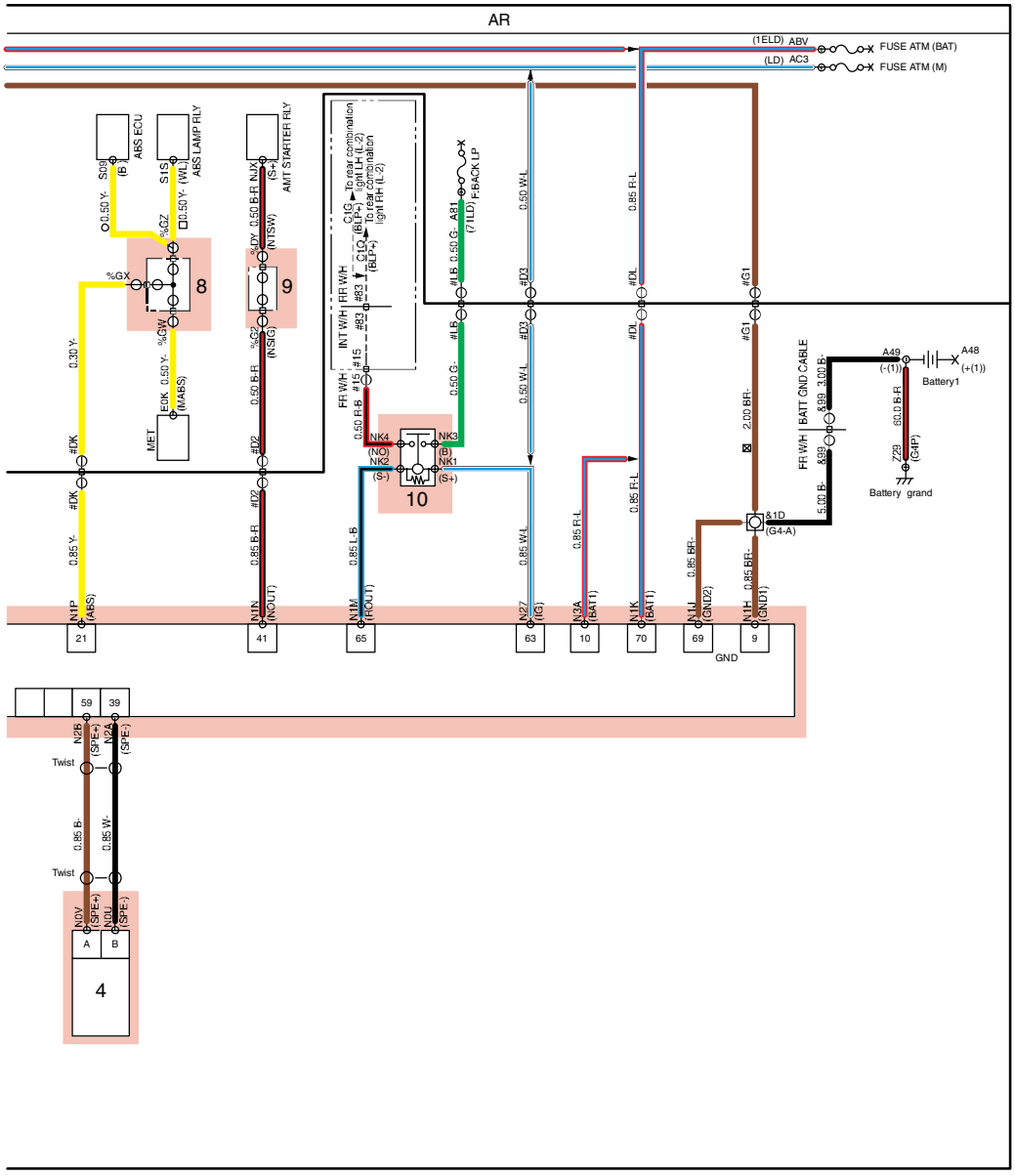
EL02_001.fm 122 ページ ２０１１年１２月１日 木曜日 午前１０時１８分



AR AUTOMATIC TRANSMISSION CIRCUIT-2: EQUIPPED WITH ALLISON 3000RDS AUTOMATIC TRANSMISSION

1	**ALLISON 3000RDS ATM ECU**	**6**	**J/C EARTH**
2	**Transmission MAIN TRANS**	**7**	**STP AT diode**
3	**Output speed sensor**	**8**	**U2 J/C No.1**
4	**Engine speed sensor**	**9**	**J/C SIGNAL**
5	**Selector**	**10**	**ATM back-up light relay**

EL02_001.fm 123 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



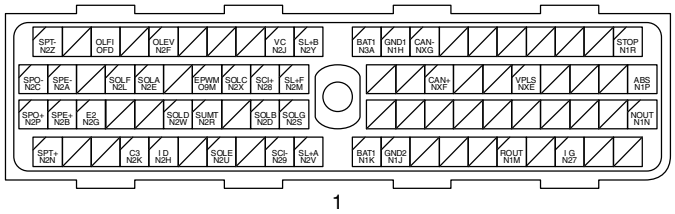
EL02_001.fm 124 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

AR

(1) CAB SIDE WIRING



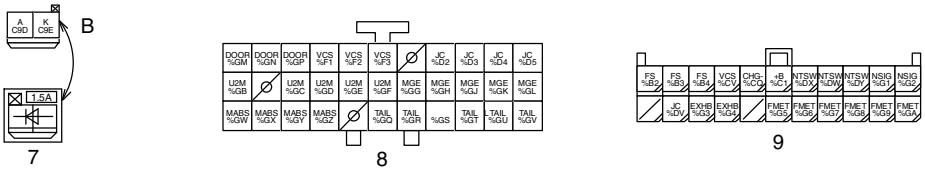
(2) CHASSIS SIDE WIRING

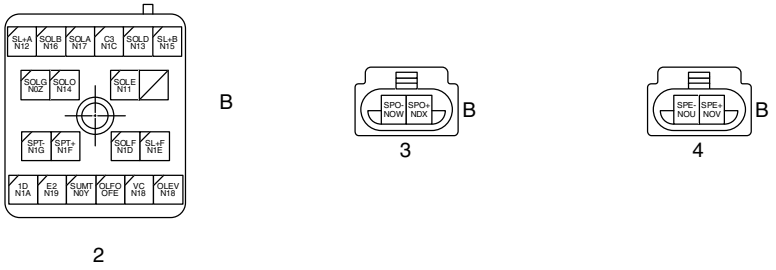


SAPH12Z160200134

EL02_001.fm 125 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

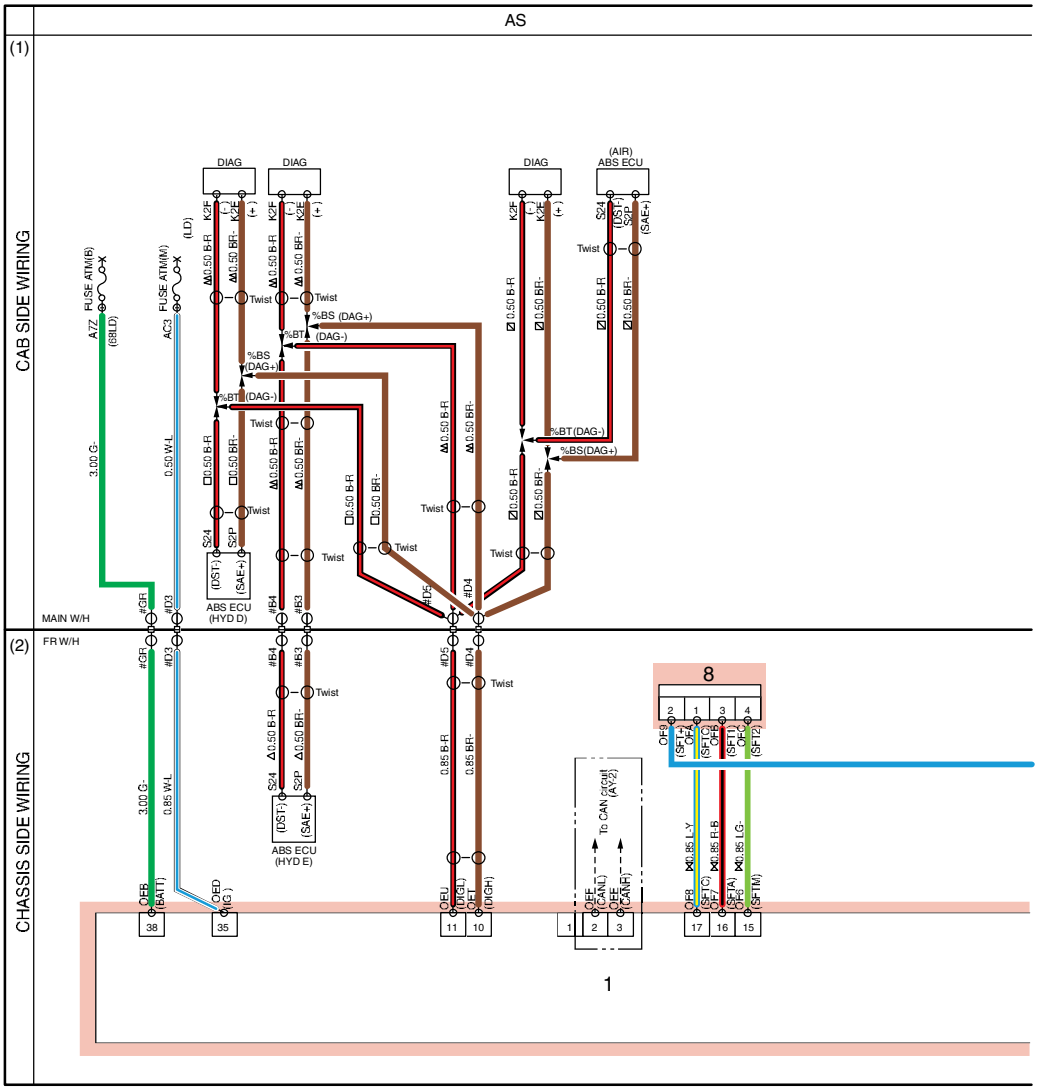
AR





SAPH12Z160200135

EL02_001.fm 126 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

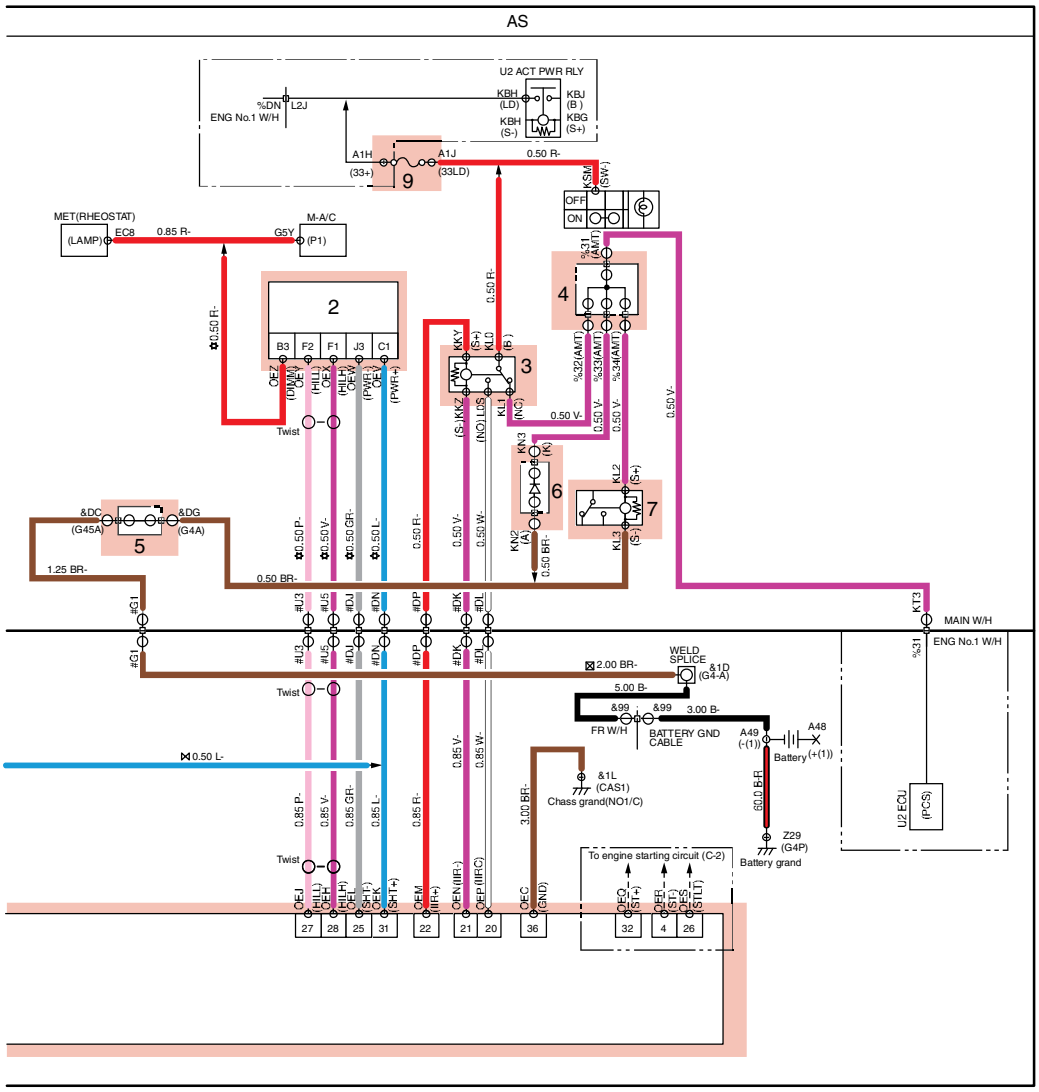


SAPH12Z160200136

AS EATON AUTOMATIC MECHANICAL TRANSMISSION CIRCUIT

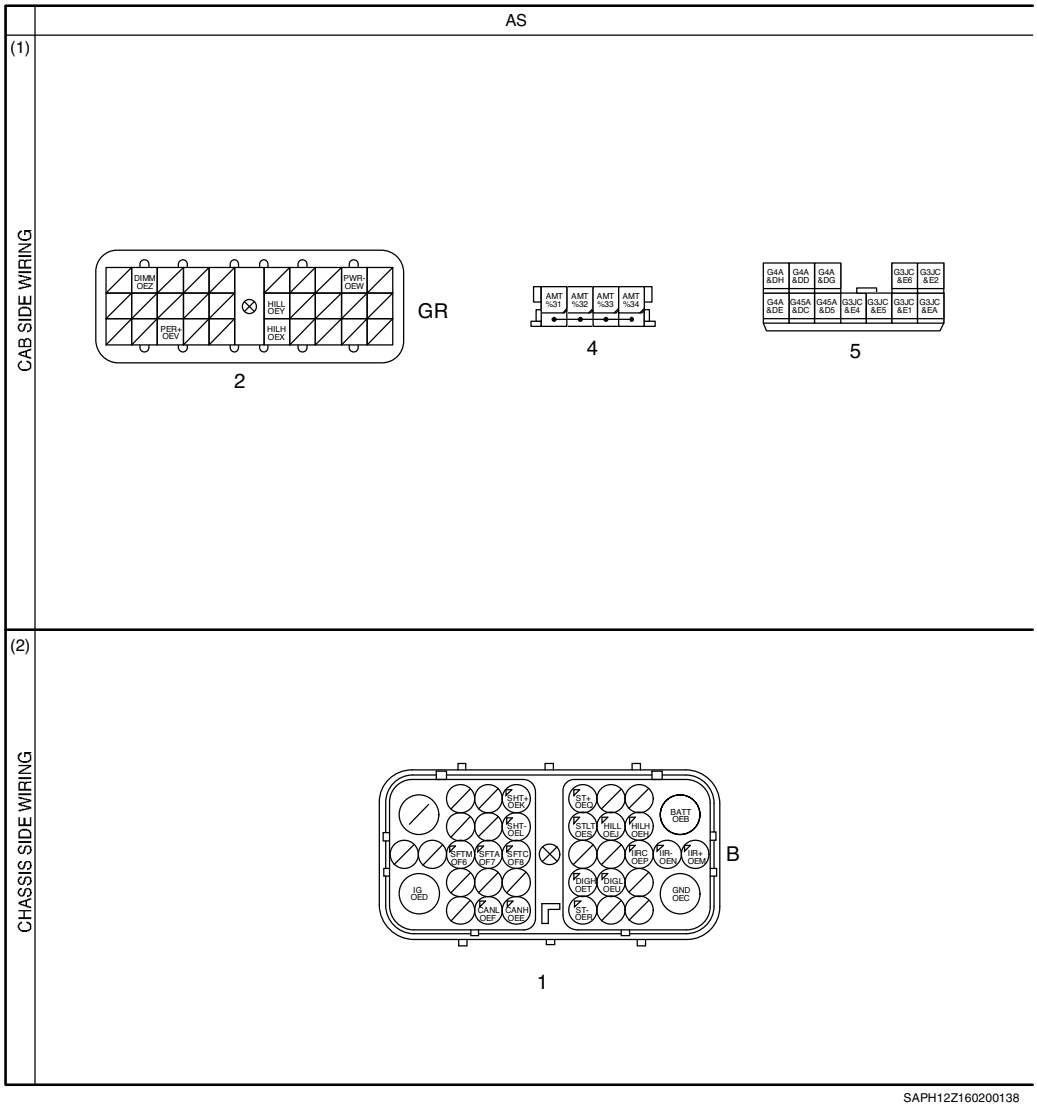
1	**EATON AMT ECU**	**6**	**Fuel cut dummy diode**
2	**Button selector**	**7**	**Fuel cut dummy relay**
3	**Fuel cut relay**	**8**	**Parking pawl sensor**
4	**Fuel cut 4P JP**	**9**	**Fuse U2 actuator 2**
5	**J/C G4**		

EL02_001.fm 127 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200137

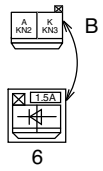
EL02_001.fm 128 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

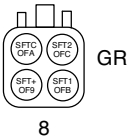


SAPH12Z160200138

EL02_001.fm 129 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

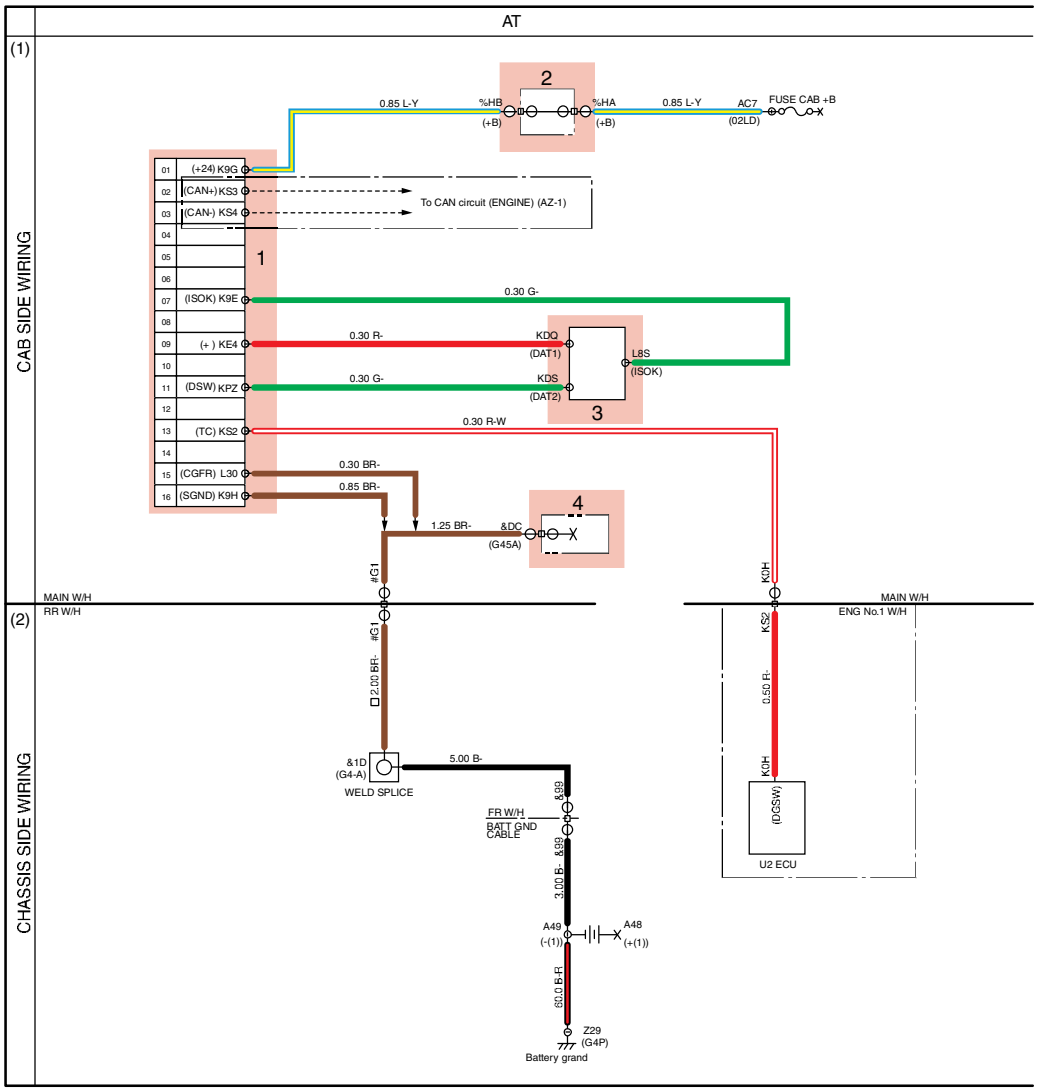
AS





SAPH12Z160200139

EL02_001.fm 130 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200140

AT DIAGNOSIS CONNECTOR CIRCUIT (16P)

1 Diagnosis connector (16P)

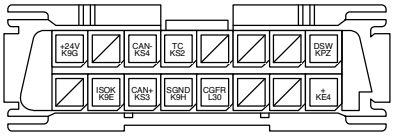
2 U2 J/C No.2

3 Vehicle control ECU

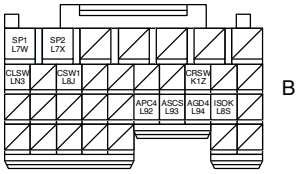
4 J/C EARTH

EL02_001.fm 131 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

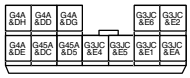
AT



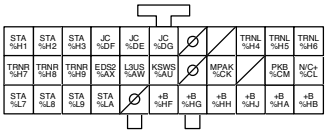
1



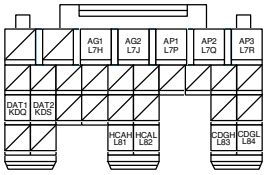
3-1



4



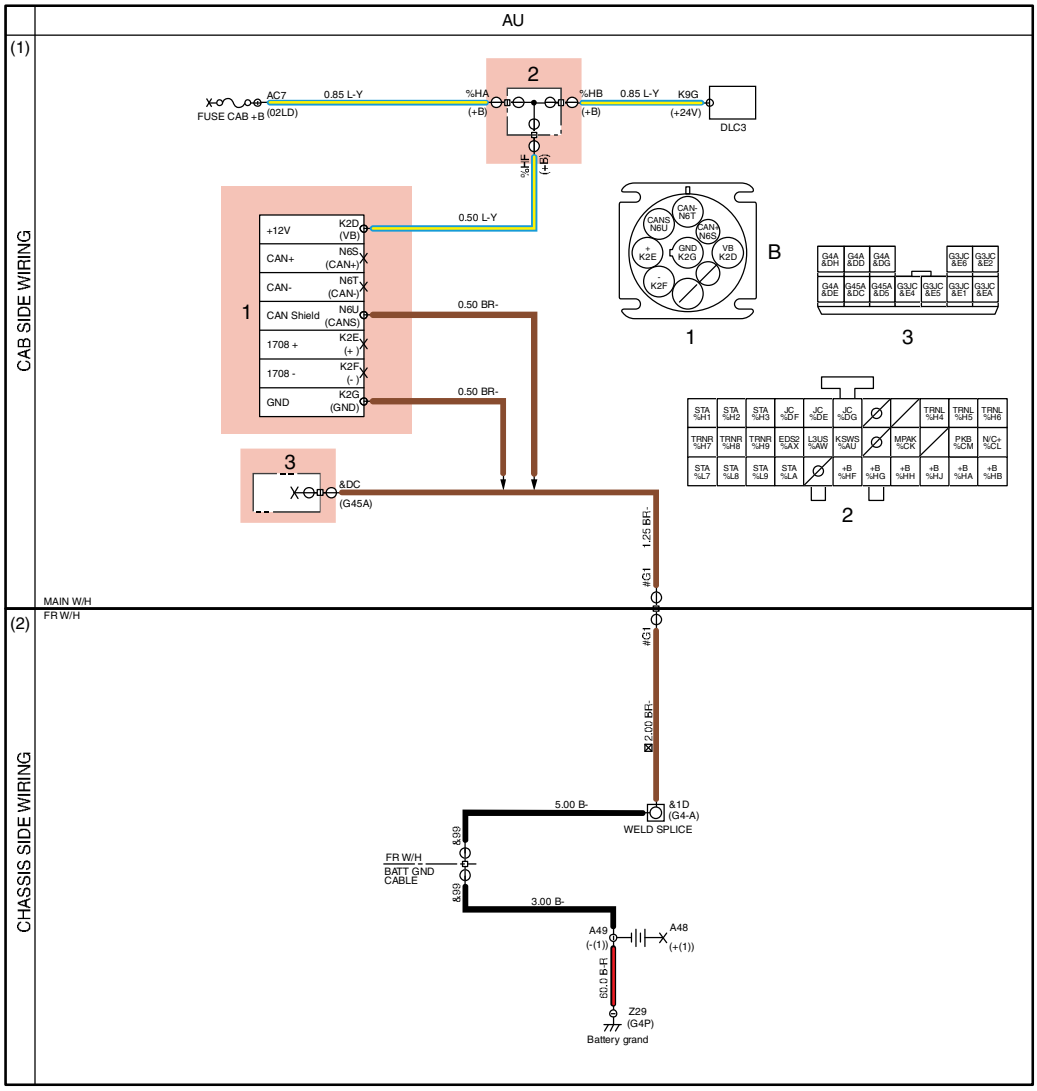
2



3-2

SAPH12Z160200141

EL02_001.fm 132 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200142

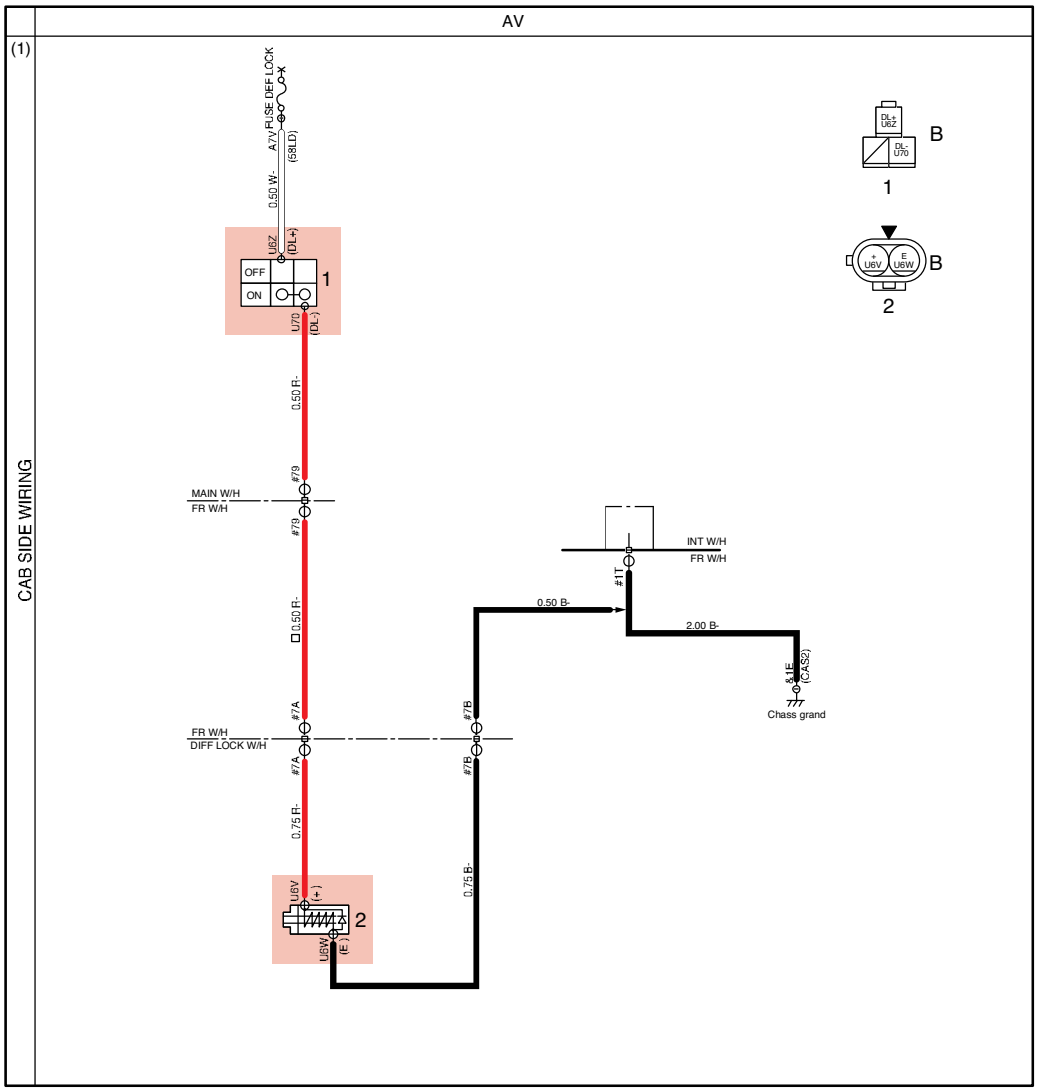
AU DIAGNOSIS CONNECTOR CIRCUIT (9P)

1 Diagnosis connector (9P)

2 U2 J/C No.2

3 J/C EARTH

EL02_001.fm 133 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



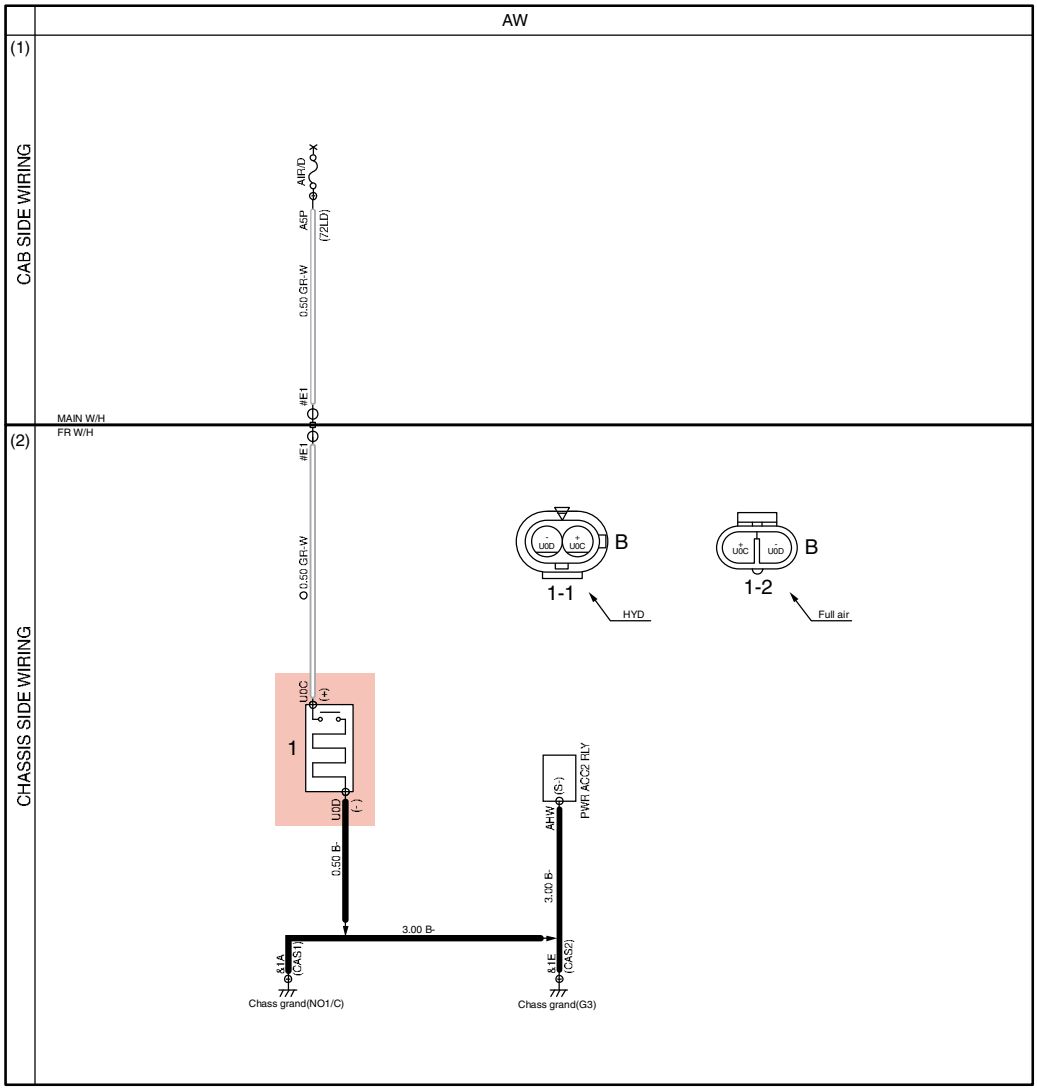
SAPH12Z160200143

AV MANUAL DIFFERENTIAL LOCK CIRCUIT

1 Differential lock switch

2 Manual differential lock magnetic valve

EL02_001.fm 134 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

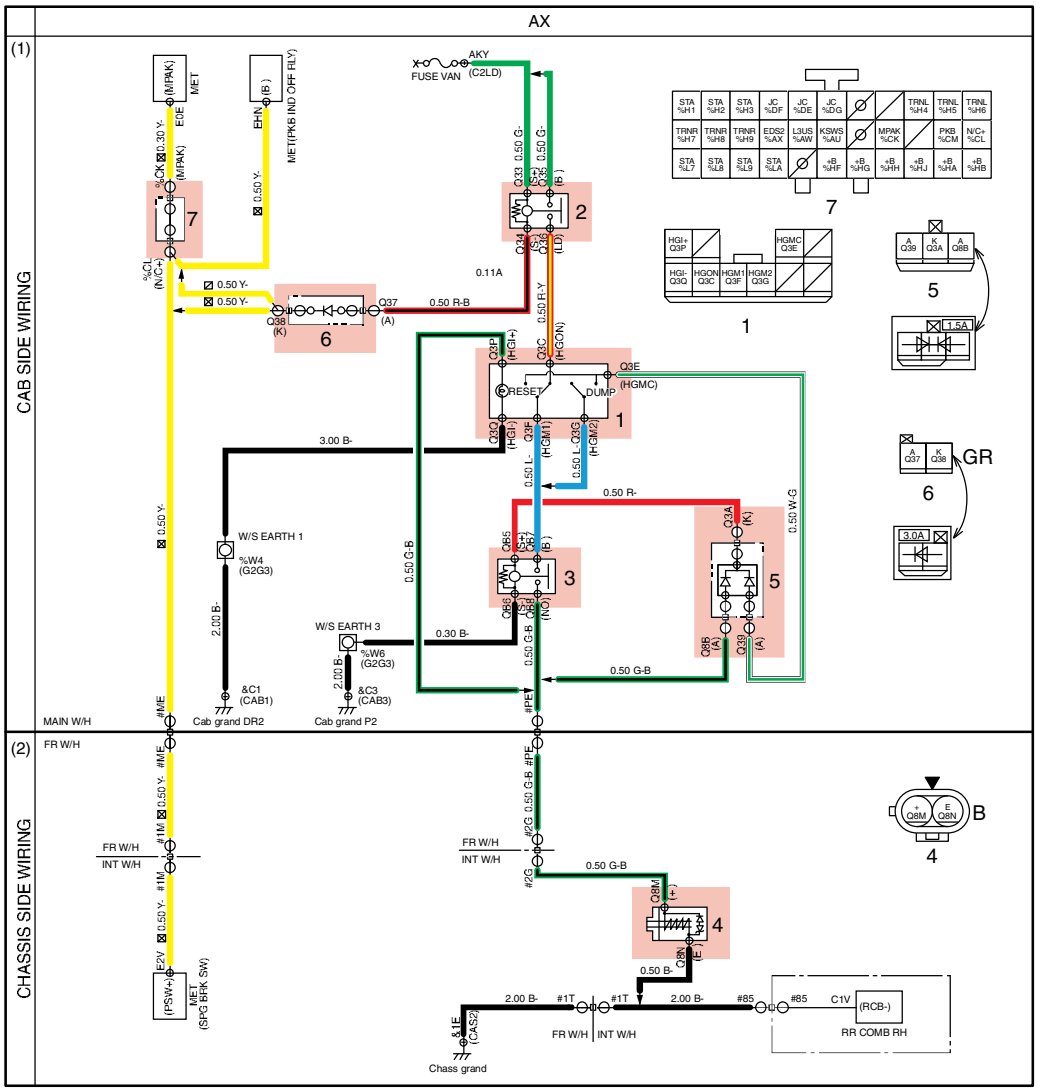


SAPH12Z160200144

AW AIR DRYER CIRCUIT

1 Air dryer

EL02_001.fm 135 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200145

AX AIR SUSPENSION DUMP CIRCUIT

1 Air suspension dump switch

2 Air suspension dump relay No.1

3 Air suspension dump relay No.2

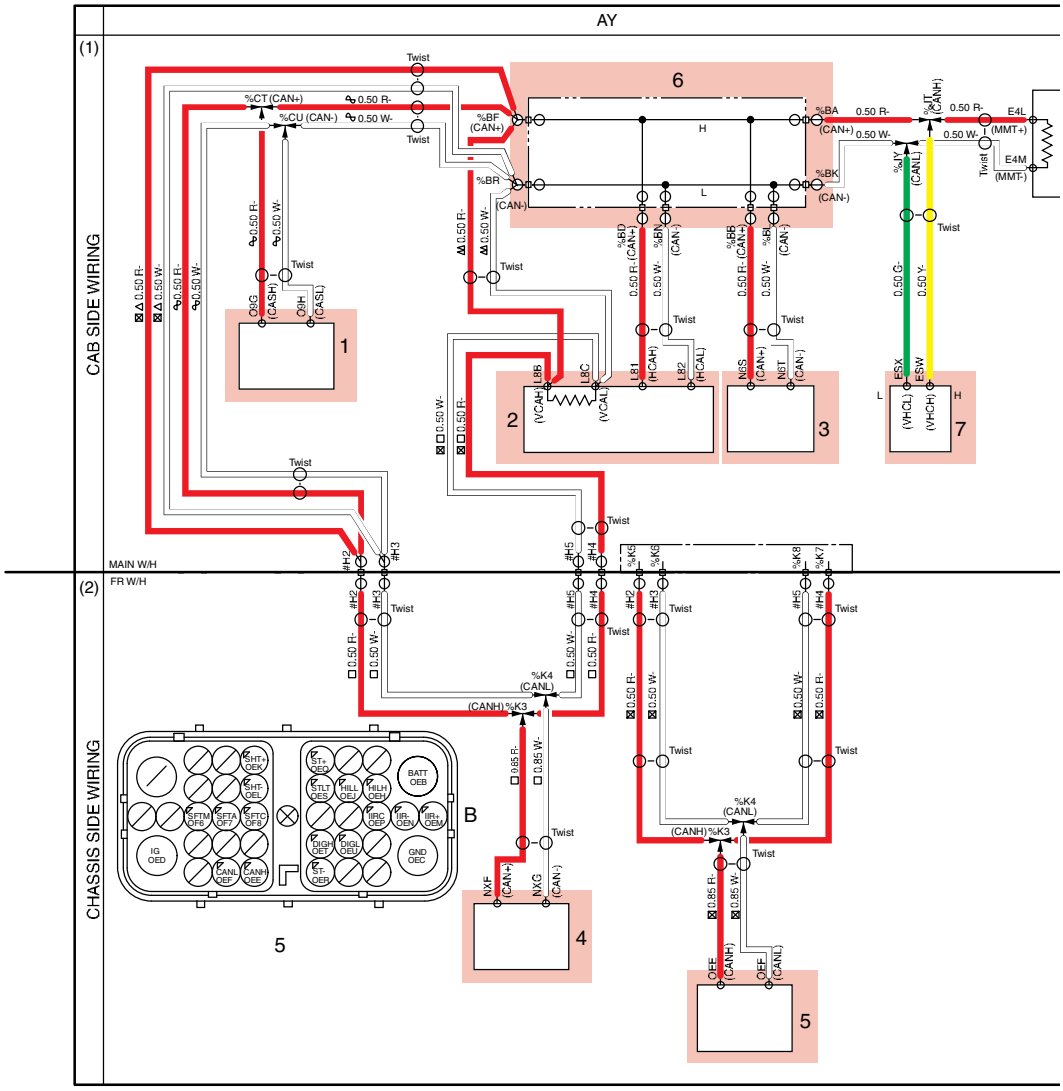
4 Air suspension dump magnetic valve

5 Air suspension dump diode No.2

6 Air suspension dump diode No.1

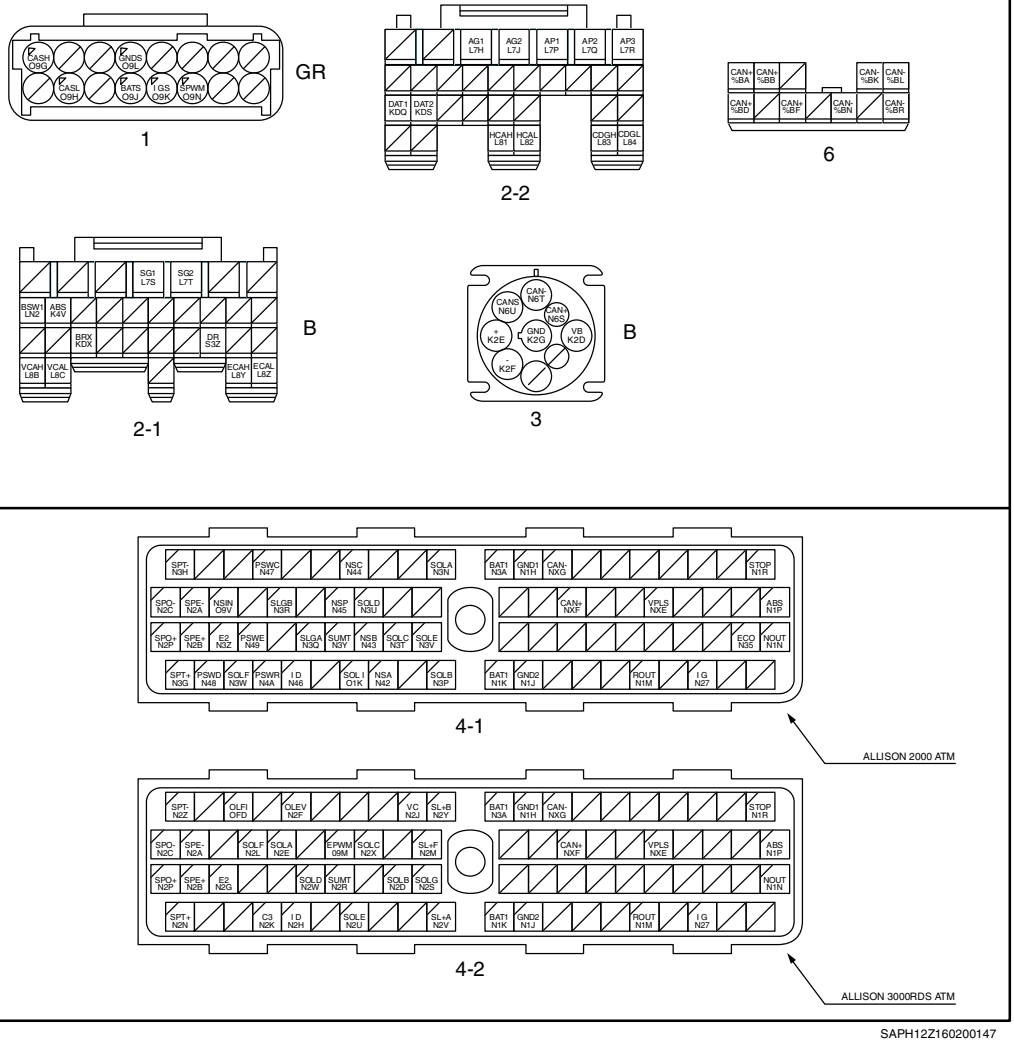
7 U2 J/C No.2

EL02_001.fm 136 ページ ２０１１年１１月２９日 火曜日 午後３時１２分


AY
(1)
CAB SIDE WIRING
MAIN W/H
FR W/H
(2)
CHASSIS SIDE WIRING
Twist
%CT (CAN+)
%CU (CAN-)
0.50 R-
0.50 W-
%BF (CAN+)
%BR (CAN-)
%BA (CAN+)
%BK (CAN-)
%IT (CANH)
%IY (CANL)
E4L (MMT+)
E4M (MMT-)
6
H
L
1
2
3
7
4
5
B
%K4 (CANL)
%K3 (CANH)
0.85 R-
0.85 W-
0.50 R-
0.50 W-
0.50 G-
0.50 Y-
0.50 B-
0.50 L-
0.50 O-
0.50 P-
0.50 Y-
0.50 LG-
0.50 SB-
0.50 V-
0.50 GR-
0.50 BR-
0.50 B-
0.50 W-
0.50 R

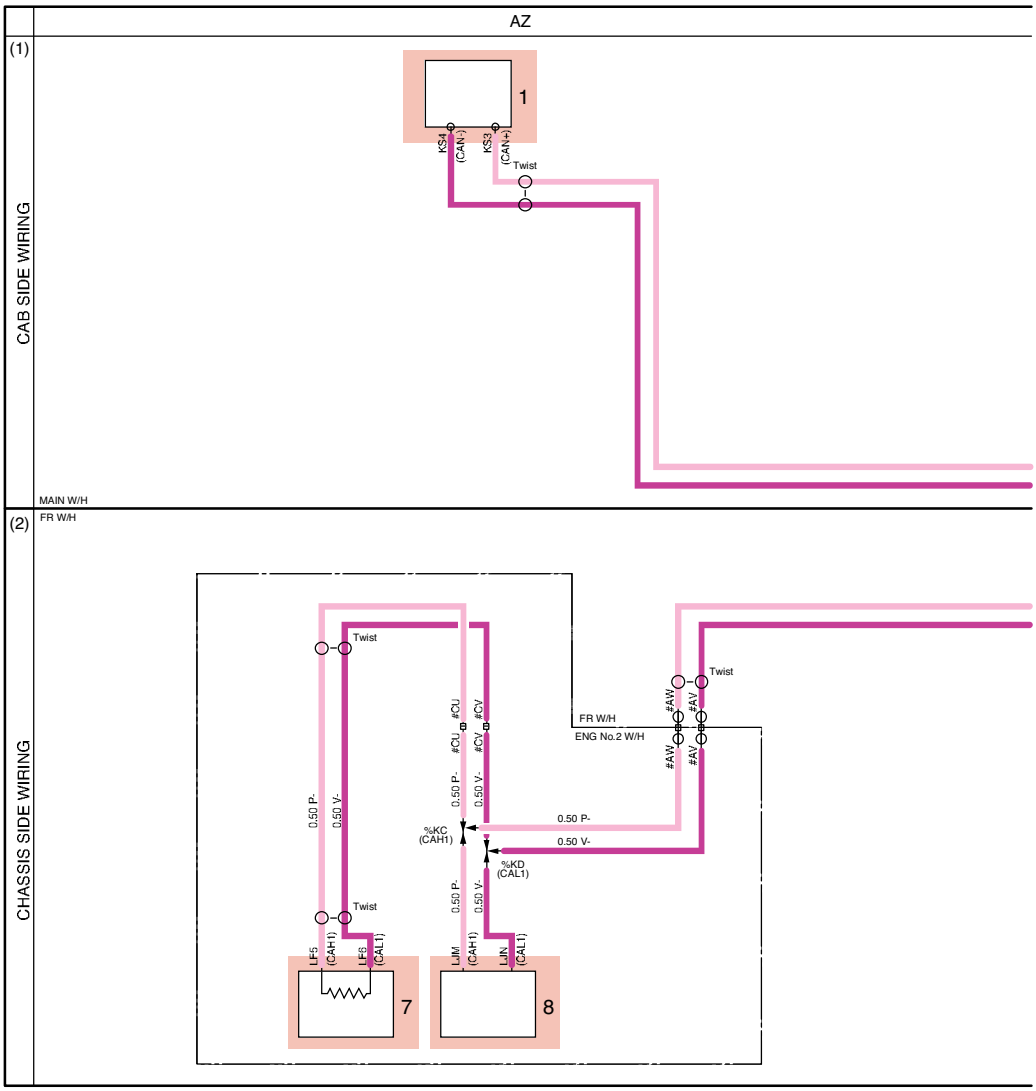
EL02_001.fm 137 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

AY



SAPH12Z160200147

EL02_001.fm 138 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

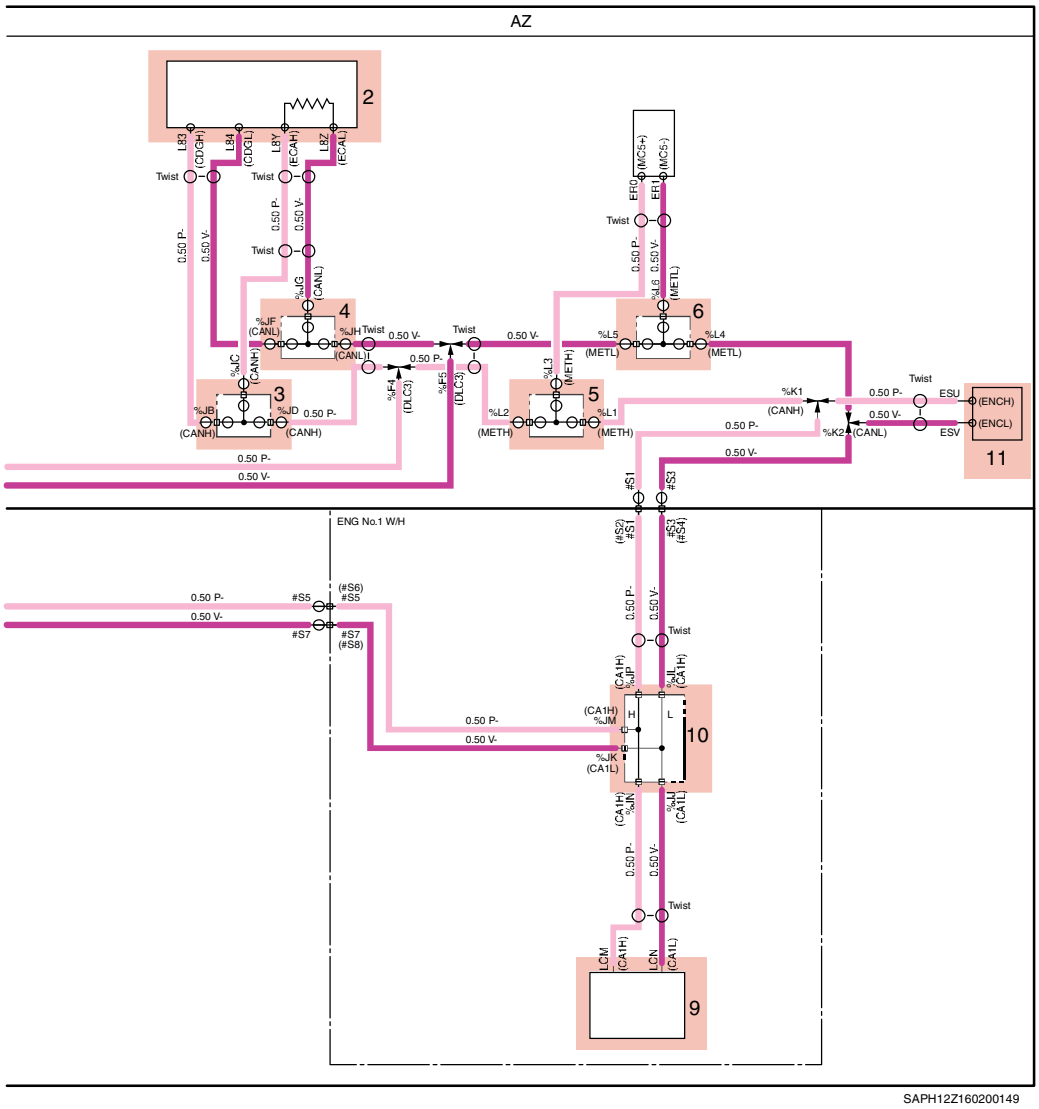


SAPH12Z160200148

AZ CAN (CONTROLLER AREA NETWORK) COMMUNICATION CIRCUIT (ENGINE)

1	**Diagnosis connector (16P)**	**7**	**DCU 53P**
2	**Vehicle control ECU**	**8**	**BCU 30P**
3	**CAN J/C 2 High**	**9**	**U2 ECU**
4	**CAN J/C 2 Low**	**10**	**No.30 J/C**
5	**CAN J/C 3 High**	**11**	**TELEMATICS UNIT**
6	**CAN J/C 3 Low**		

EL02_001.fm 139 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

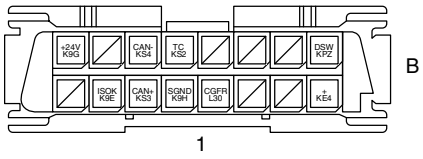


SAPH12Z160200149

EL02_001.fm 140 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

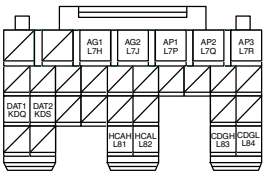
AZ

(1) CAB SIDE WIRING

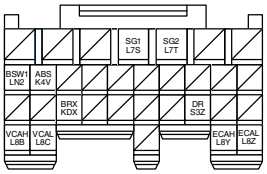


B

1
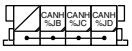


2-2



B

2-1

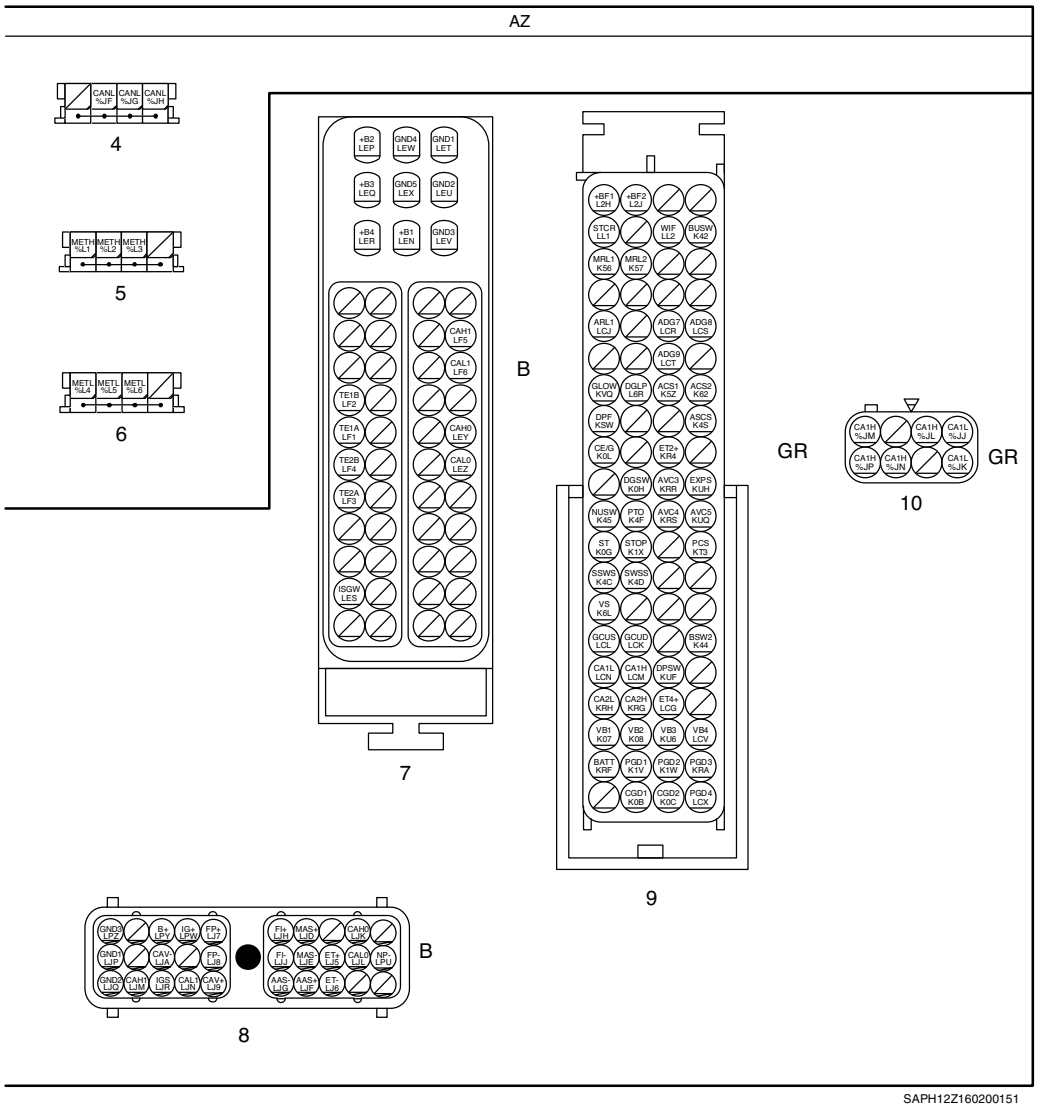


3

(2) CHASSIS SIDE WIRING

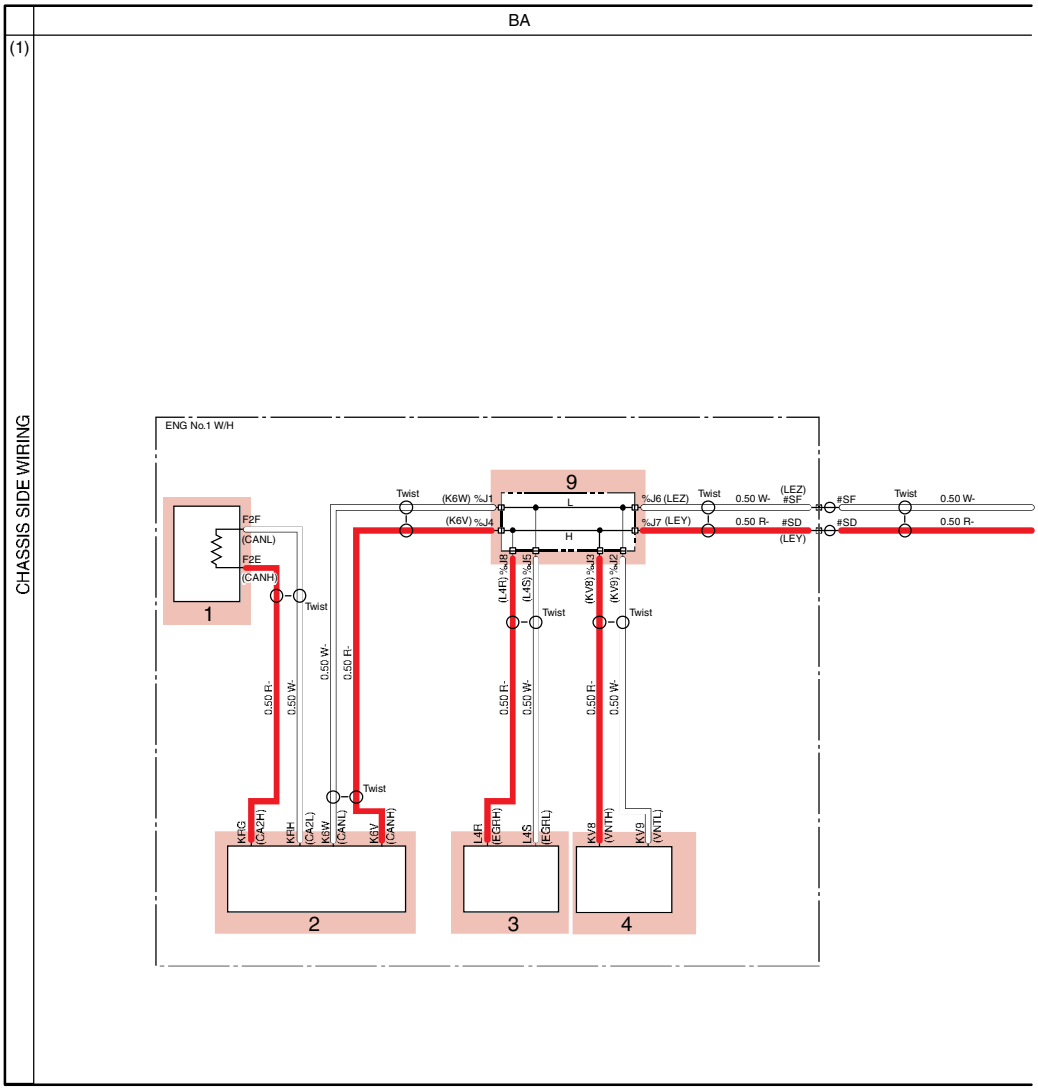
SAPH12Z160200150

EL02_001.fm 141 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200151

EL02_001.fm 142 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



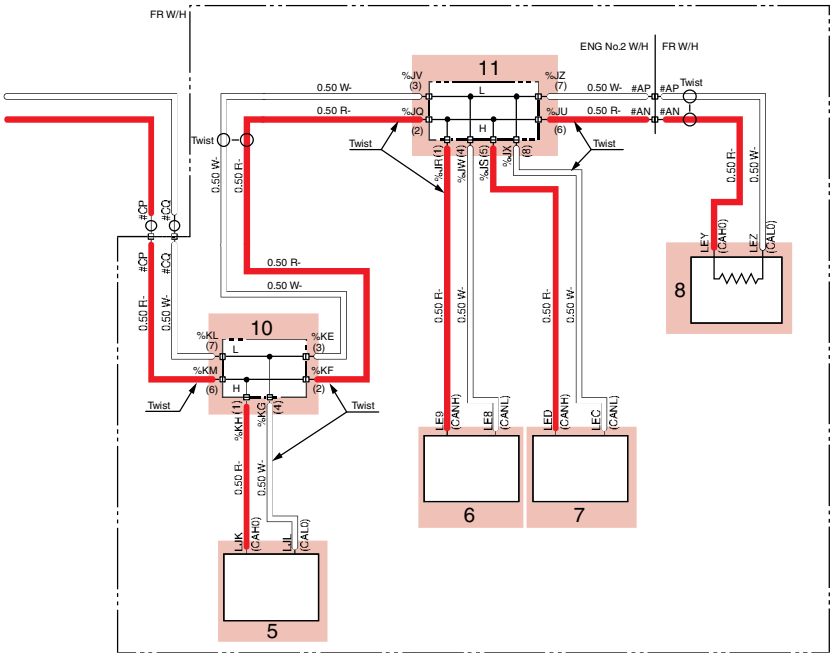
SAPH12Z160200152

BA CAN (CONTROLLER AREA NETWORK) COMMUNICATION CIRCUIT (DPR)

1	**CAN TMN 6**	**7**	**NOx sensor 2**
2	**U2 ECU**	**8**	**DCU 53P**
3	**EGR controller**	**9**	**No.29 J/C**
4	**VNT controller**	**10**	**U2 CAN J/C No.1**
5	**BCU 30P**	**11**	**U2 CAN J/C No.3**
6	**NOx sensor 1**		

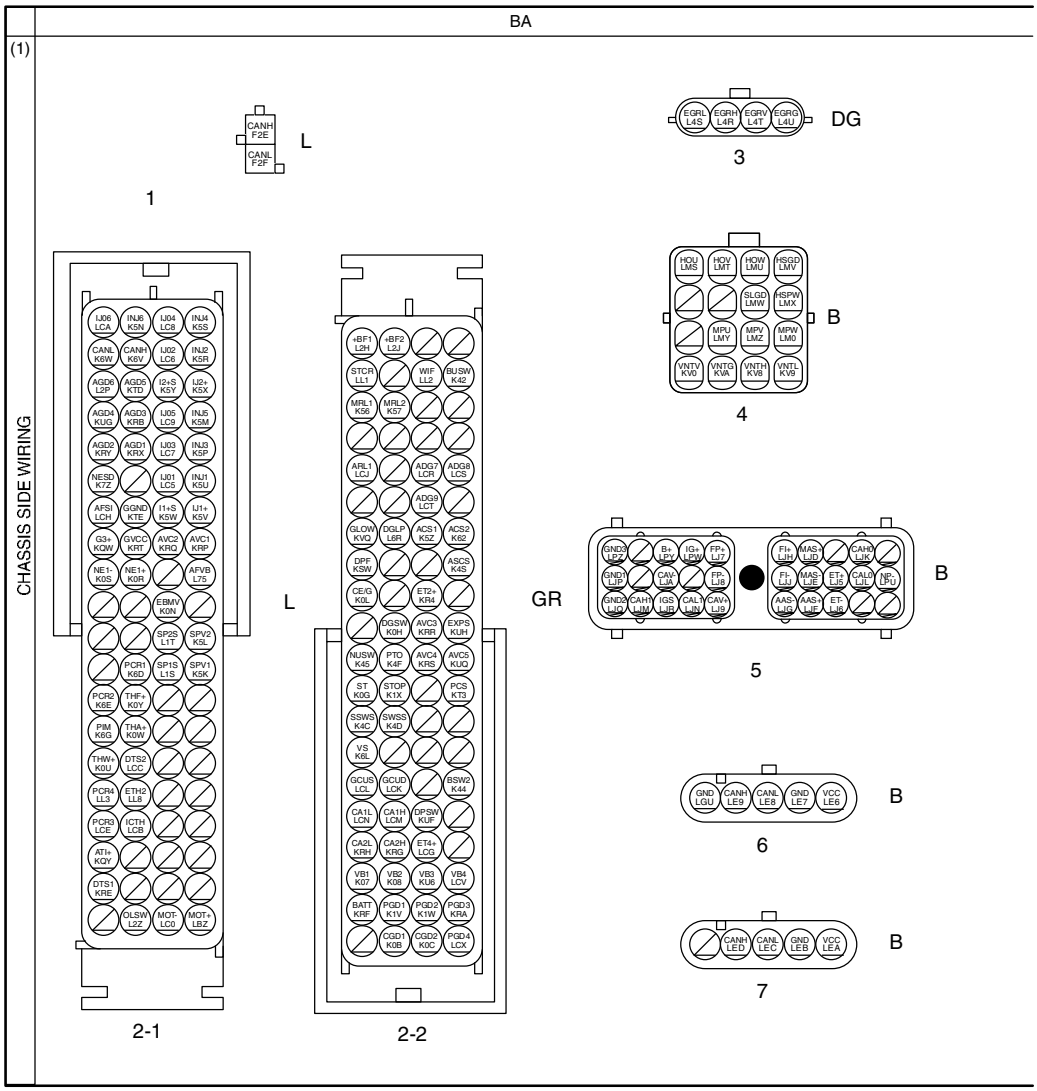
EL02_001.fm 143 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

BA



SAPH12Z160200153

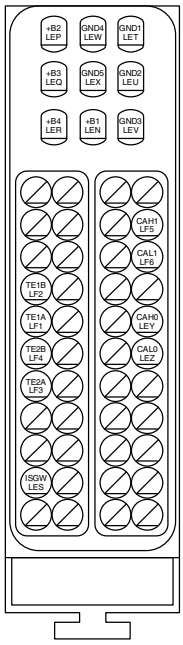
EL02_001.fm 144 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200154

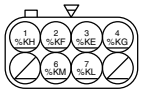
EL02_001.fm 145 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

BA



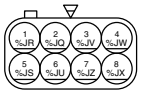
B

8



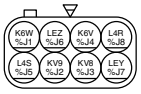
GR

10



GR

11

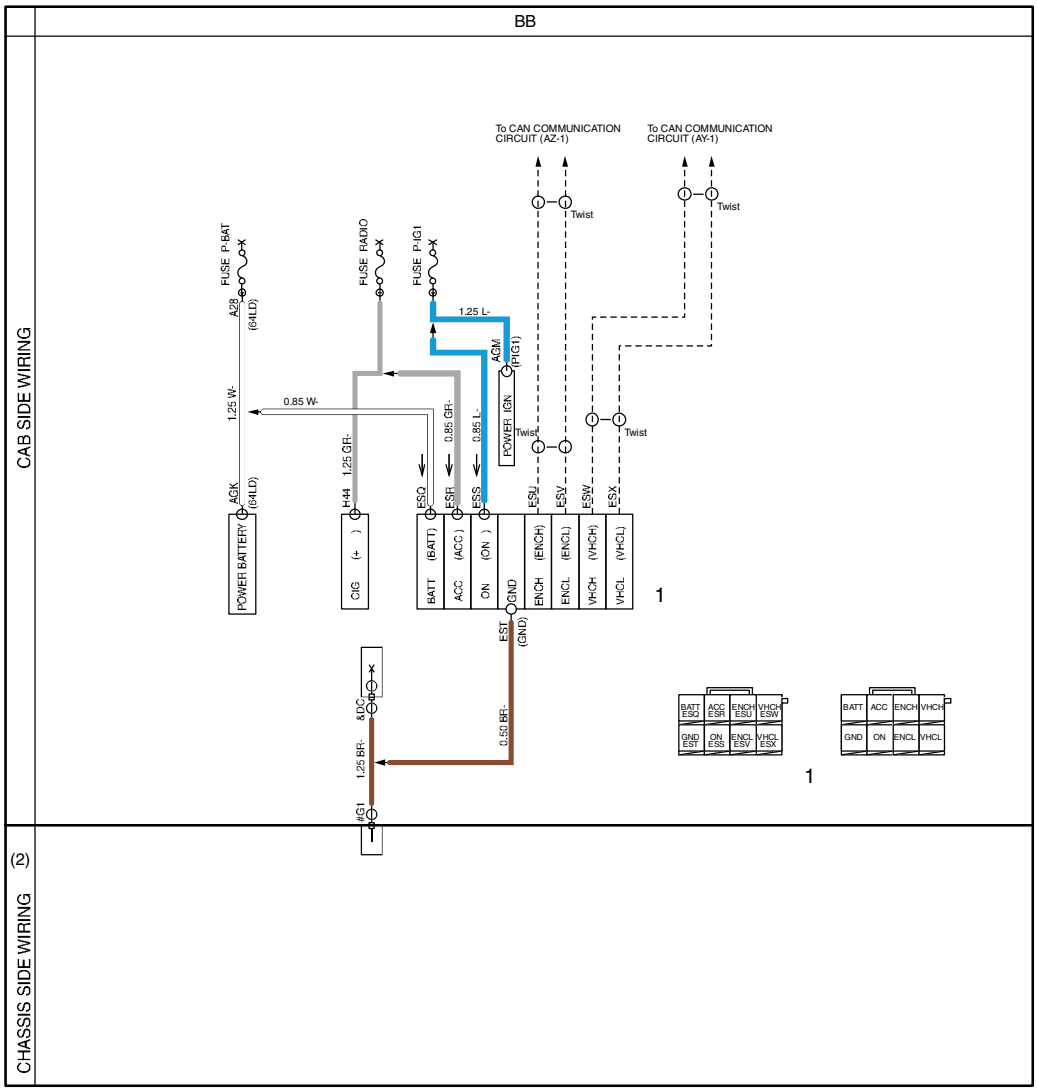


GR

9

SAPH12Z160200155

EL02_001.fm 146 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

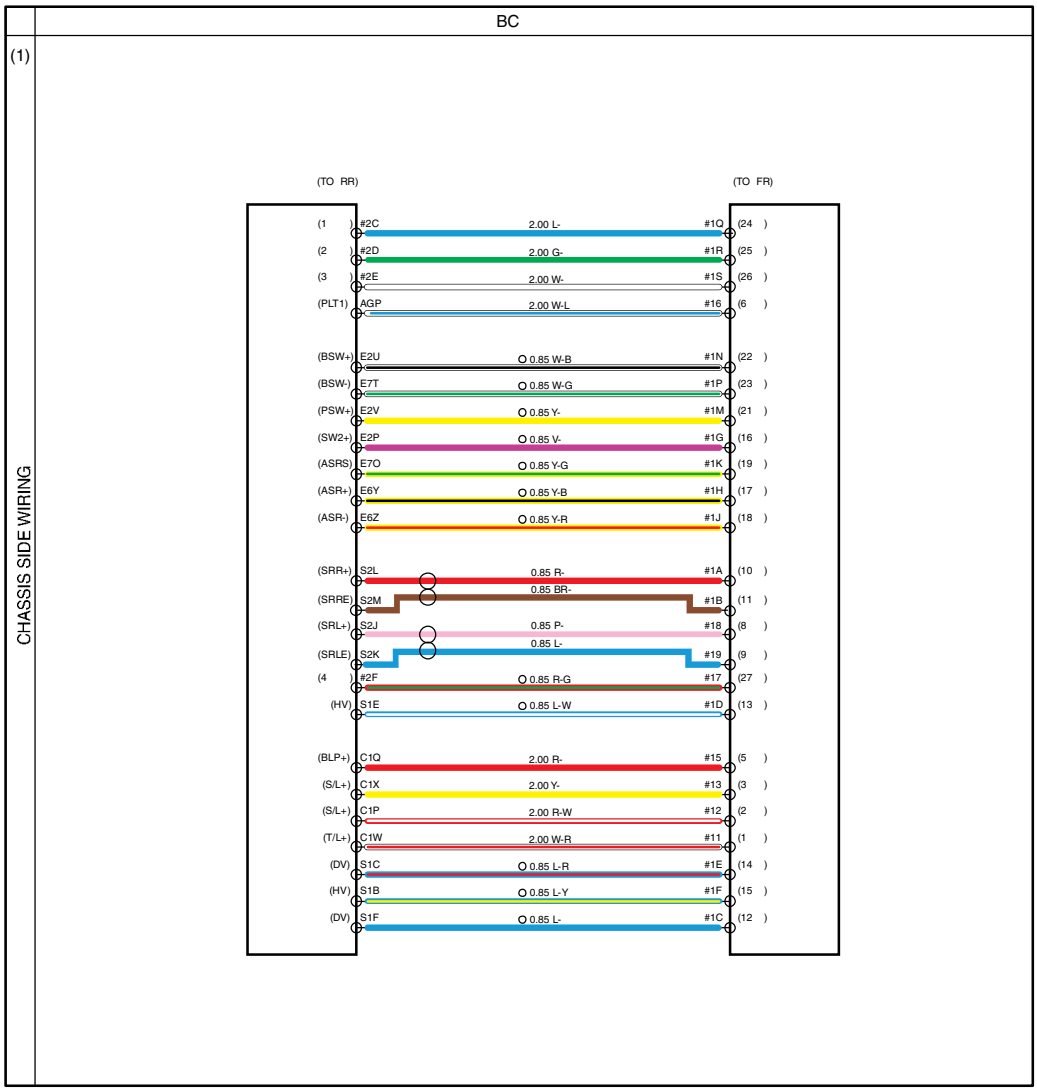


SAPH12Z160200156

BB TELEMATICS CIRCUIT

1 Telematics connector

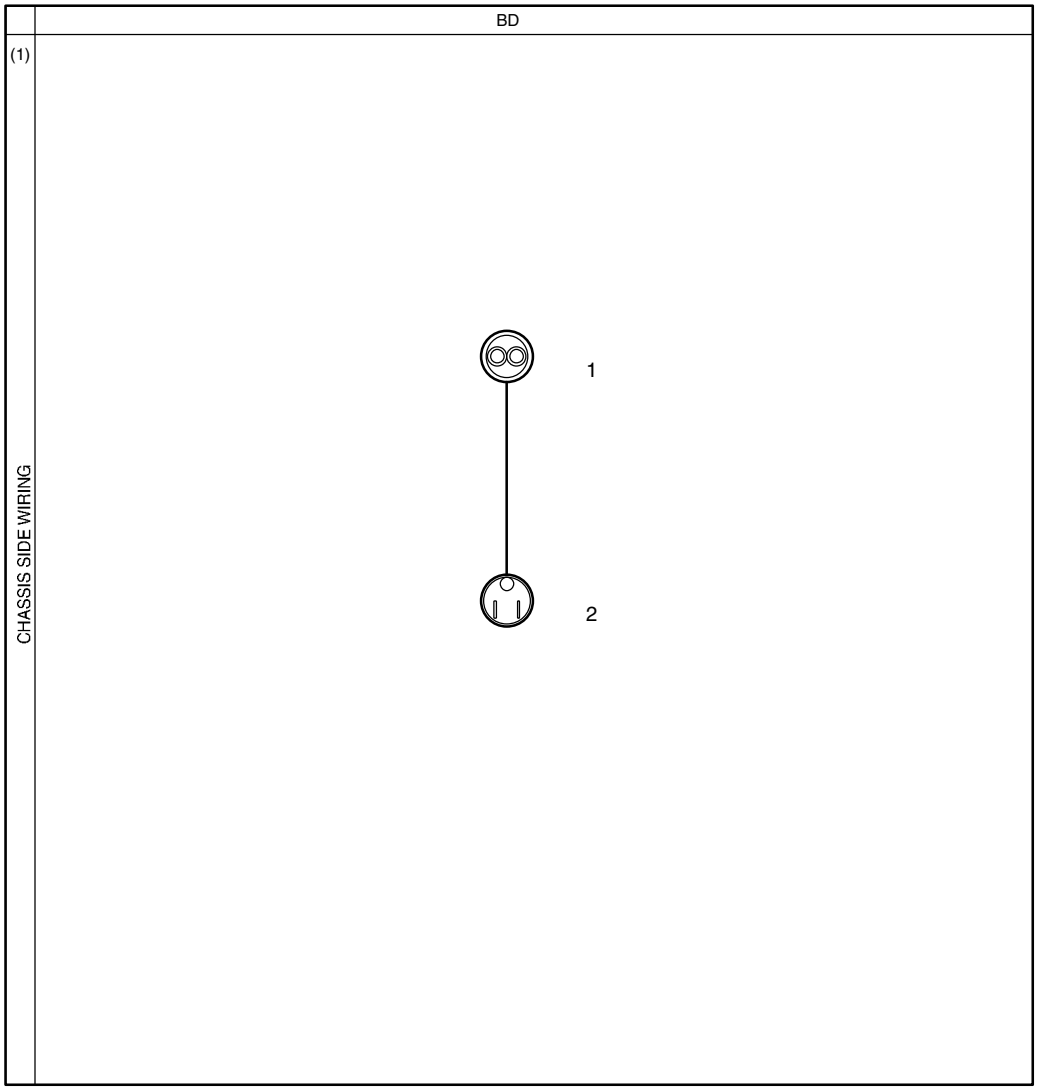
EL02_001.fm 147 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200157

BC EXTEND CIRCUIT

EL02_001.fm 148 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200158

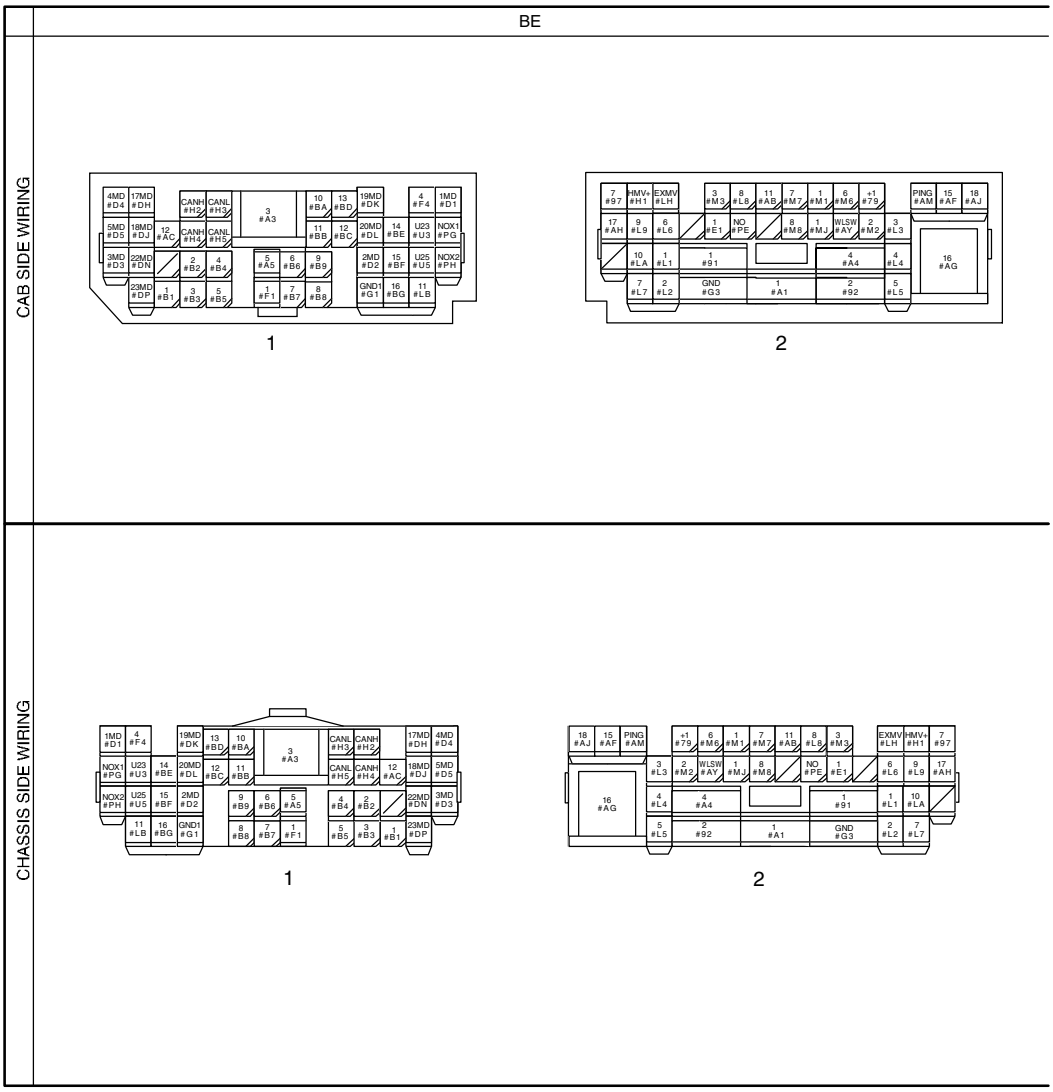
BD BLOCK HEATER CIRCUIT

1 Plug heater

2 Outlet cord

EL02_001.fm 149 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

EL02_001.fm 150 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



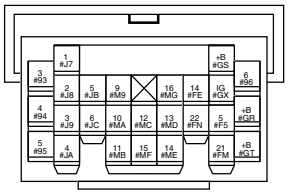
SAPH12Z160200159

BE WIRE TO WIRE CONNECTOR

1 Cab main harness to chassis front harness STD 1 2 Cab main harness to chassis front harness STD 2

EL02_001.fm 151 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

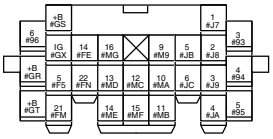
BE



3



4



3



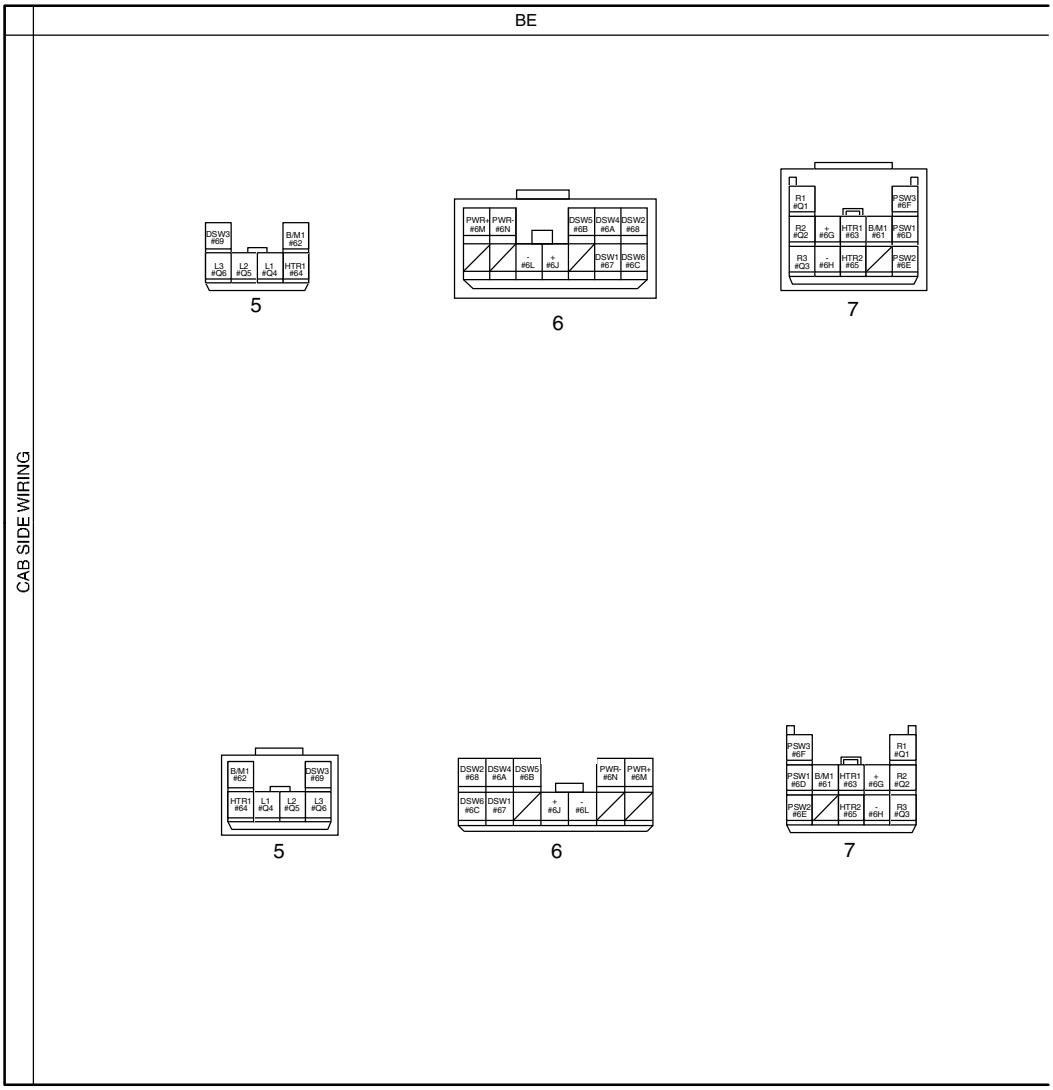
4

SAPH12Z160200160

3 Cab main harness to front harness OPT 1

4 Cab main harness to front harness PWR

EL02_001.fm 152 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



SAPH12Z160200161

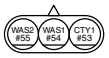
5 Cab main harness to door LH harness 1

6 Cab main harness to door LH harness 2

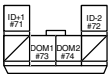
7 Cab main harness to door RH harness

EL02_001.fm 153 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

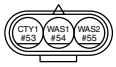
BE



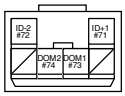
8



9



8



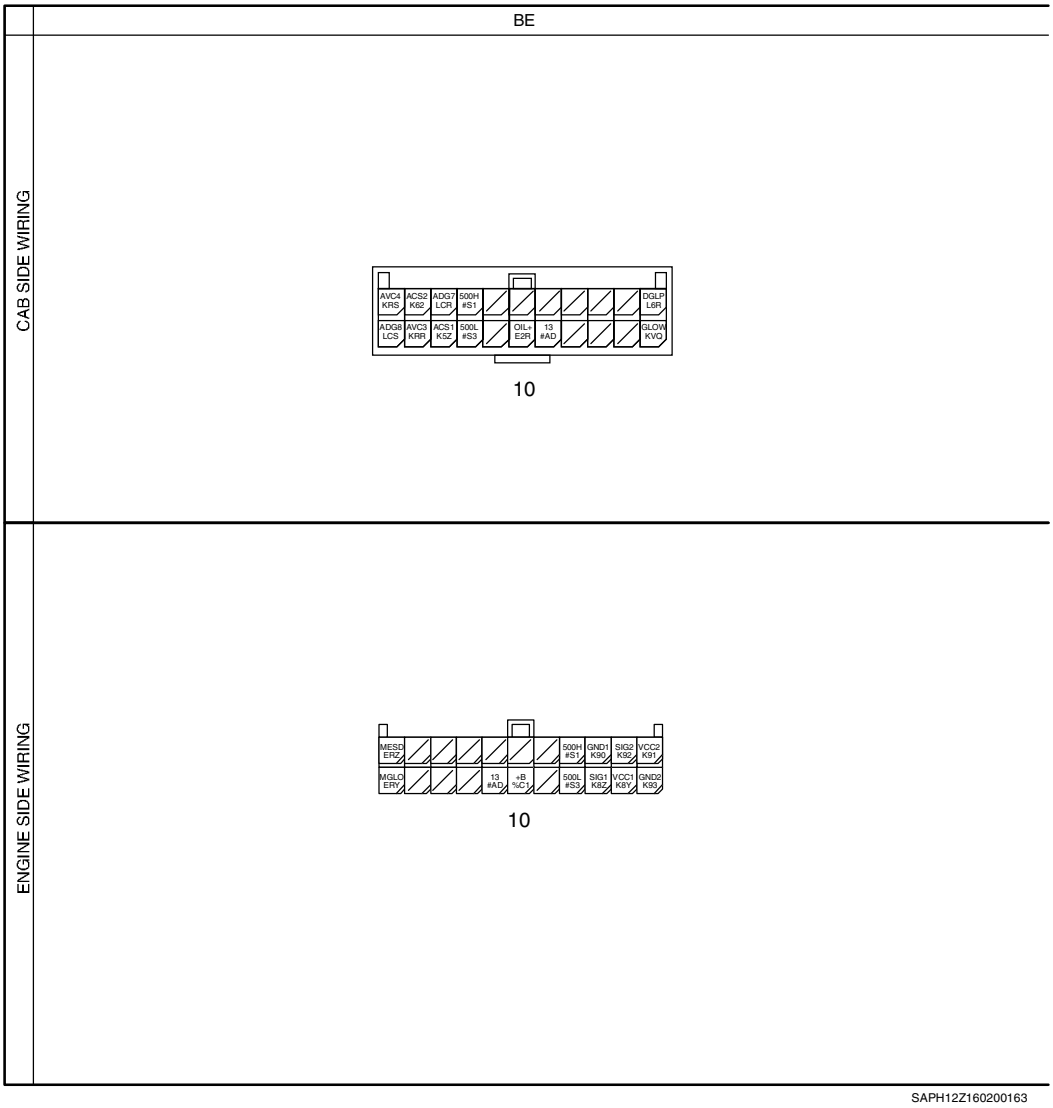
9

SAPH12Z160200162

8 Cab main harness to floor harness

9 Cab main harness to roof harness

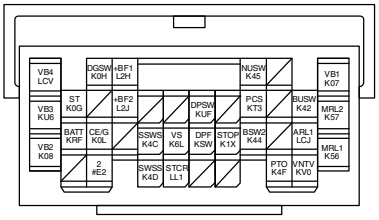
EL02_001.fm 154 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



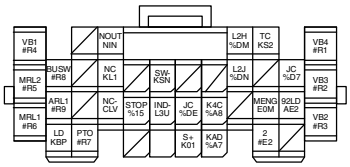
10 Cab main harness to engine No.1 harness 22P

EL02_001.fm 155 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

BE



11

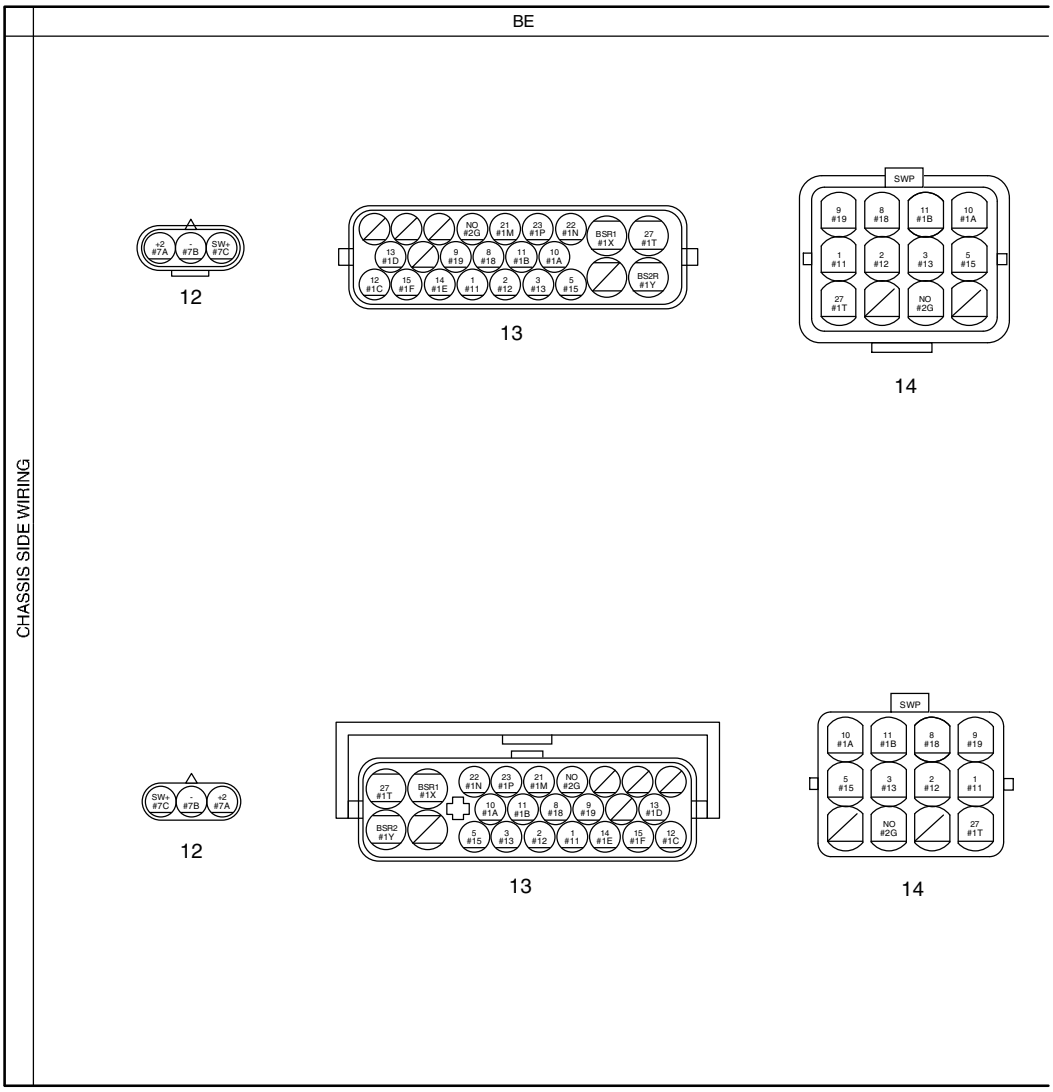


11

SAPH12Z160200164

11 Cab main harness engine No.1 harness 38P

EL02_001.fm 156 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



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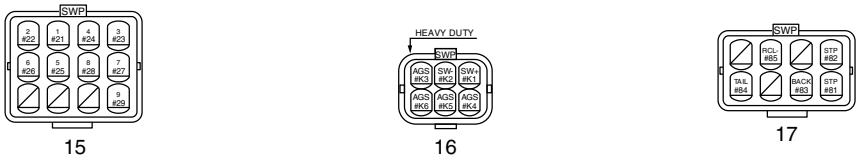
12 Chassis front harness to differential lock harness

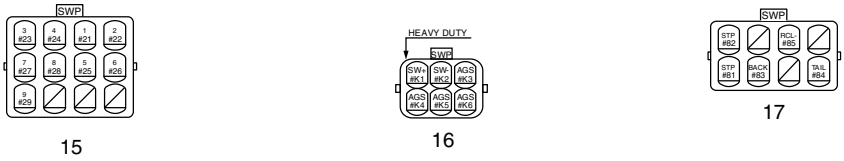
13 Chassis front harness to intermediate harness (For full air brake)

14 Chassis front harness to intermediate harness (For HYDRO MAX brake)

EL02_001.fm 157 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

BE





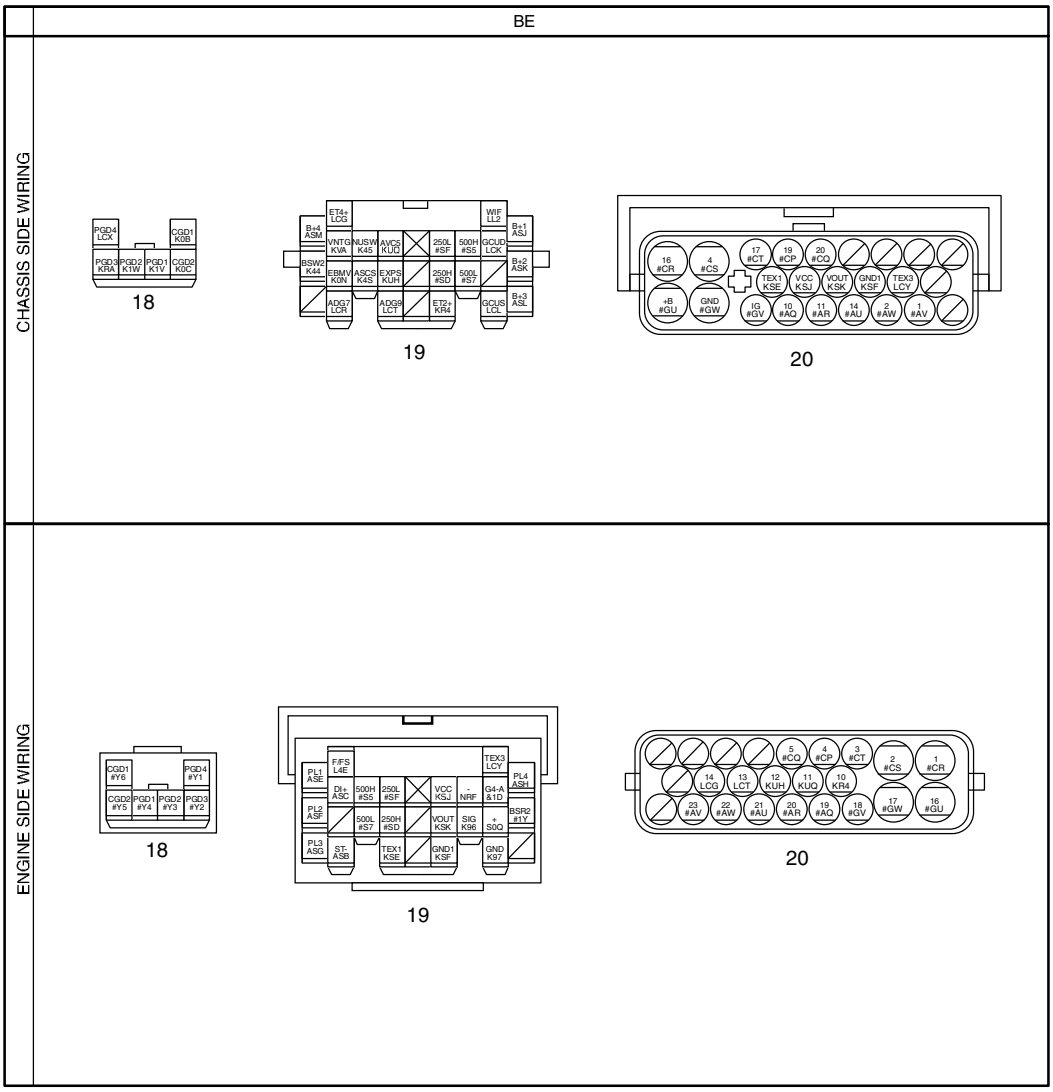
SAPH12Z160200166

15 Chassis front harness to head light harness

16 Chassis front harness to air tank sub harness

17 Intermediate harness to rear harness

EL02_001.fm 158 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



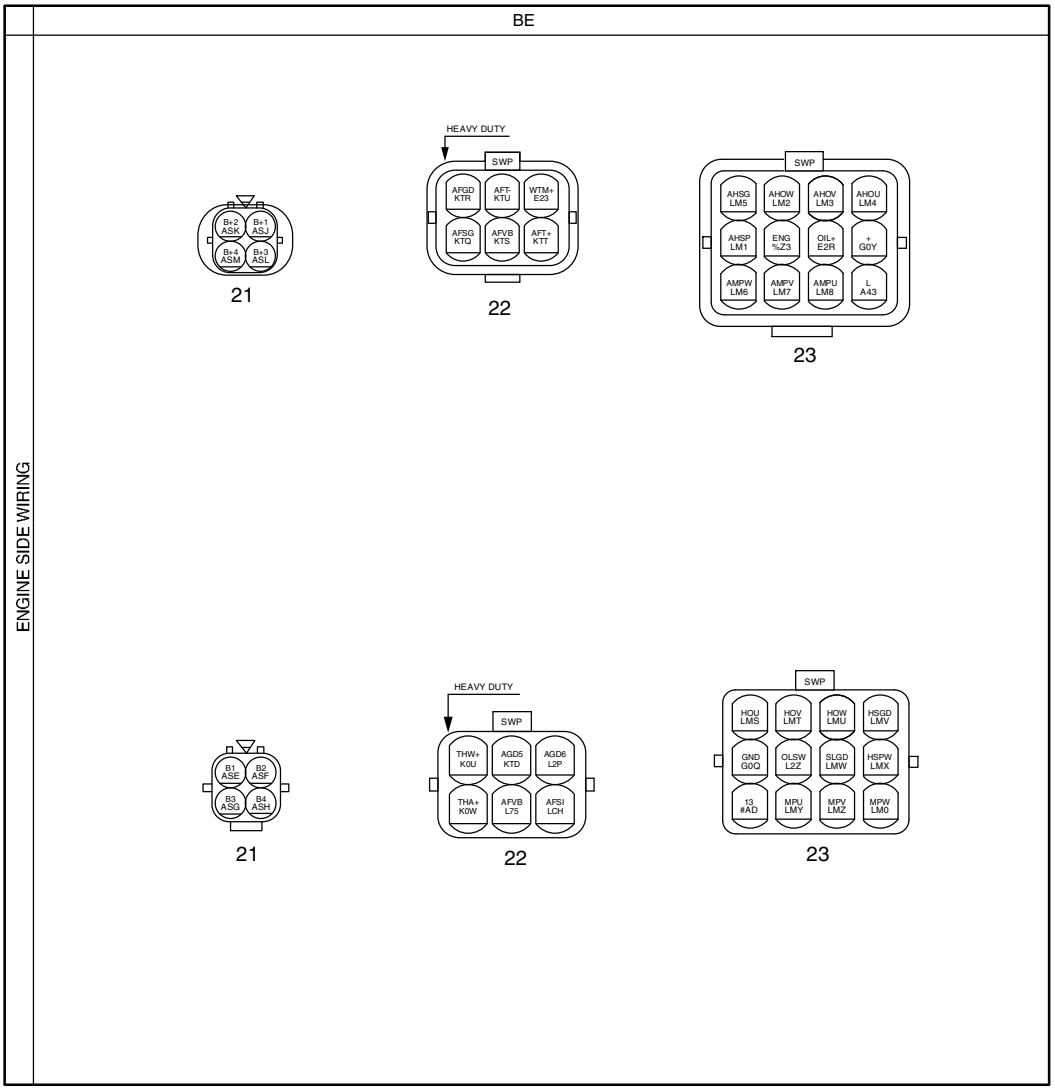
SAPH12Z160200167

18 Chassis front harness to engine No.1 harness 6P (GND)

19 Chassis front harness to engine No.1 harness 26P

20 Chassis front harness to engine No.2 harness

EL02_001.fm 159 ページ ２０１１年１１月２９日 火曜日 午後３時１２分



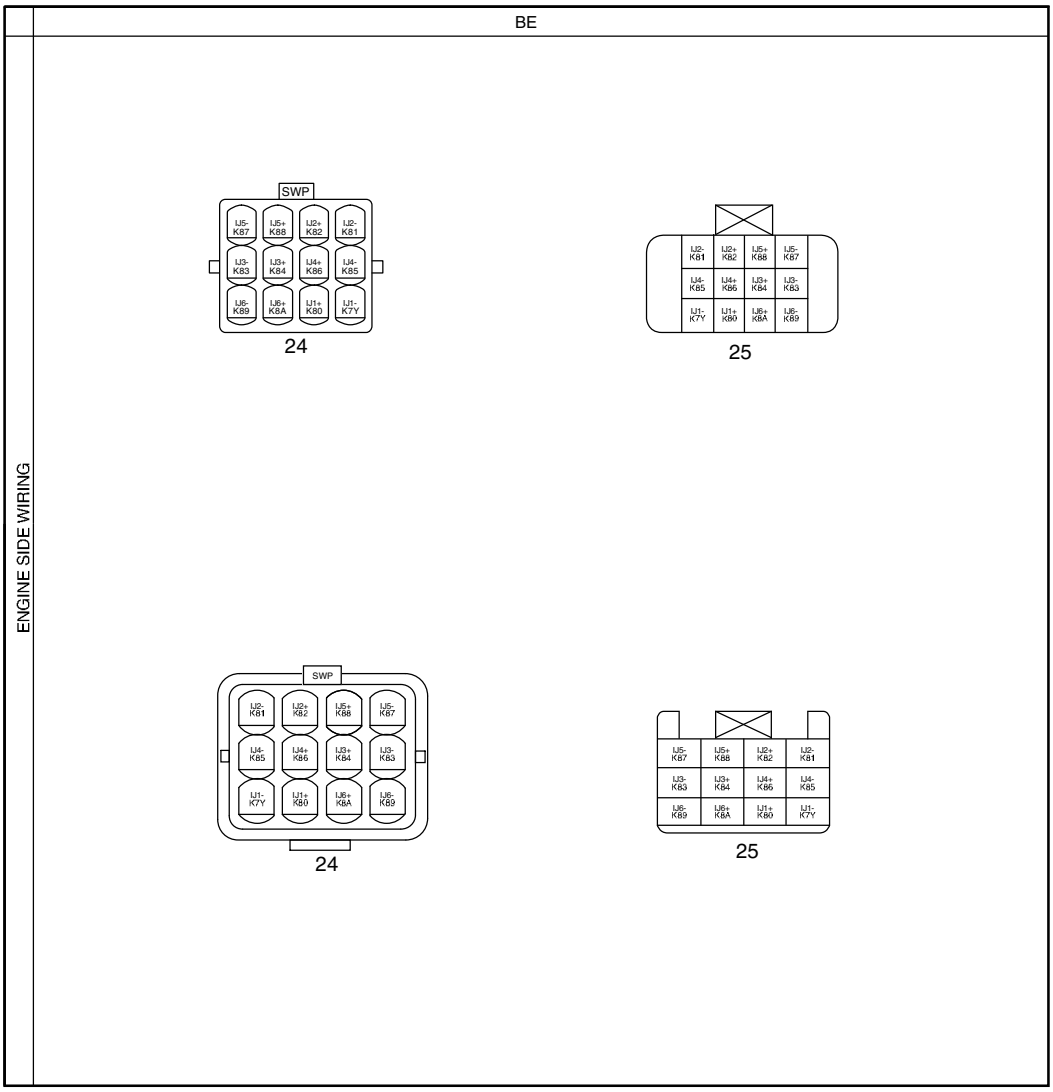
SAPH12Z160200168

21 Engine No.1 harness to engine No.3 harness glow (Glow plug)

22 Engine No.1 harness to engine No.1 sub harness 6P

23 Engine No.1 harness to engine No.1 sub harness 12P

EL02_001.fm 160 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

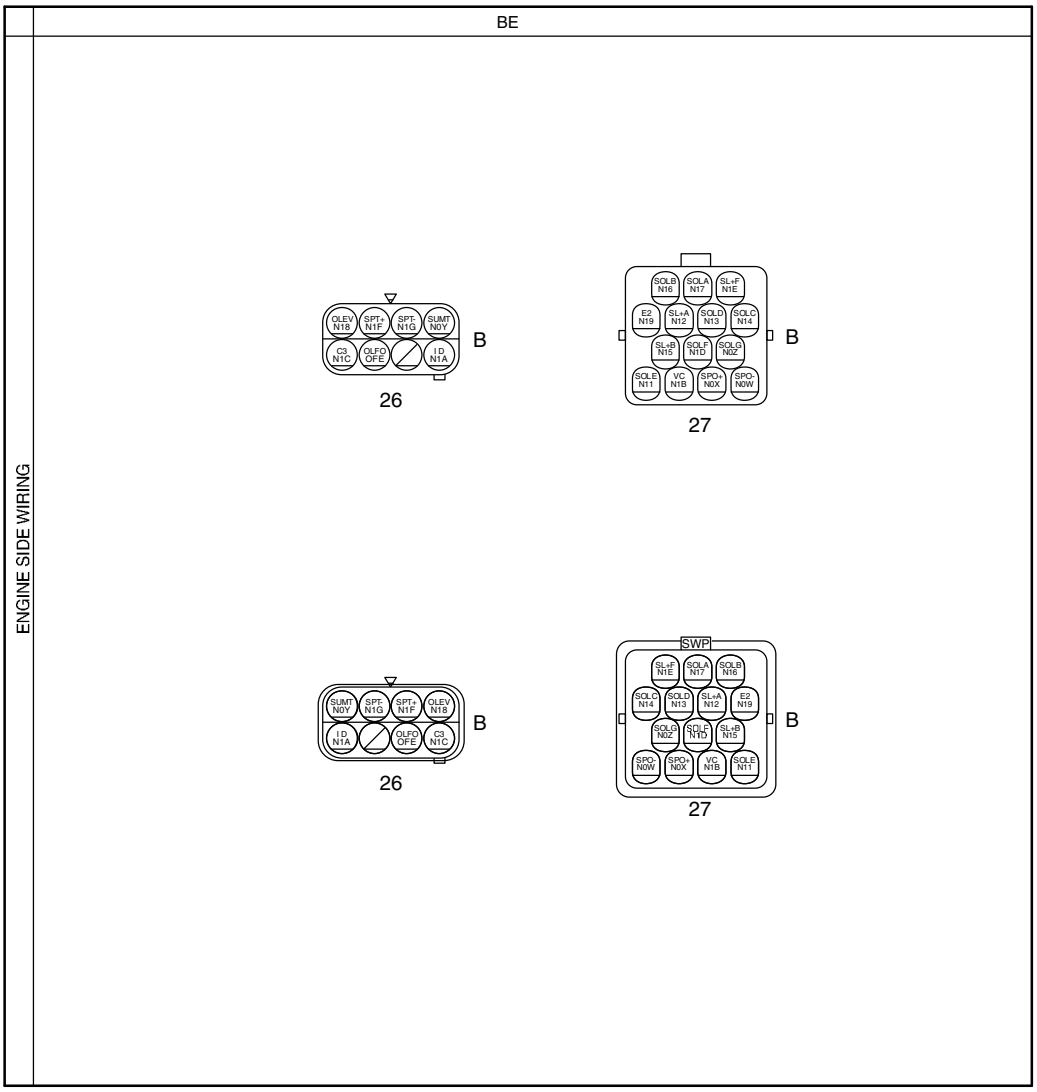


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24 Engine No.1 harness to link-up connector

25 Link-up connector to injector harness

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SAPH12Z160200170

26 Chassis front harness to transmission harness

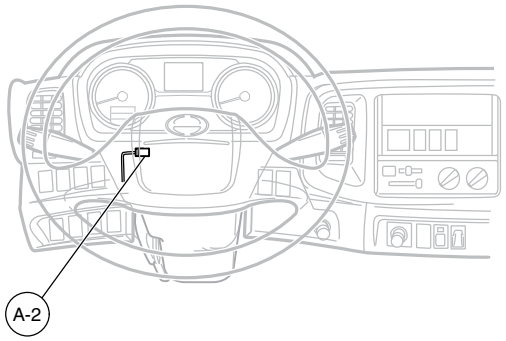
27 Chassis front harness to transmission harness

EL02_001.fm 162 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

POSITION OF CONNECTOR

EN12Z1602J100005

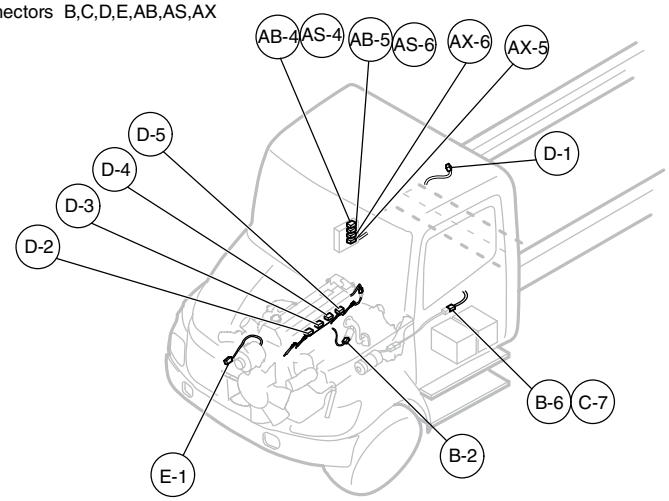
Position of connector A



A-2: Starter switch

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Position of connectors B,C,D,E,AB,AS,AX

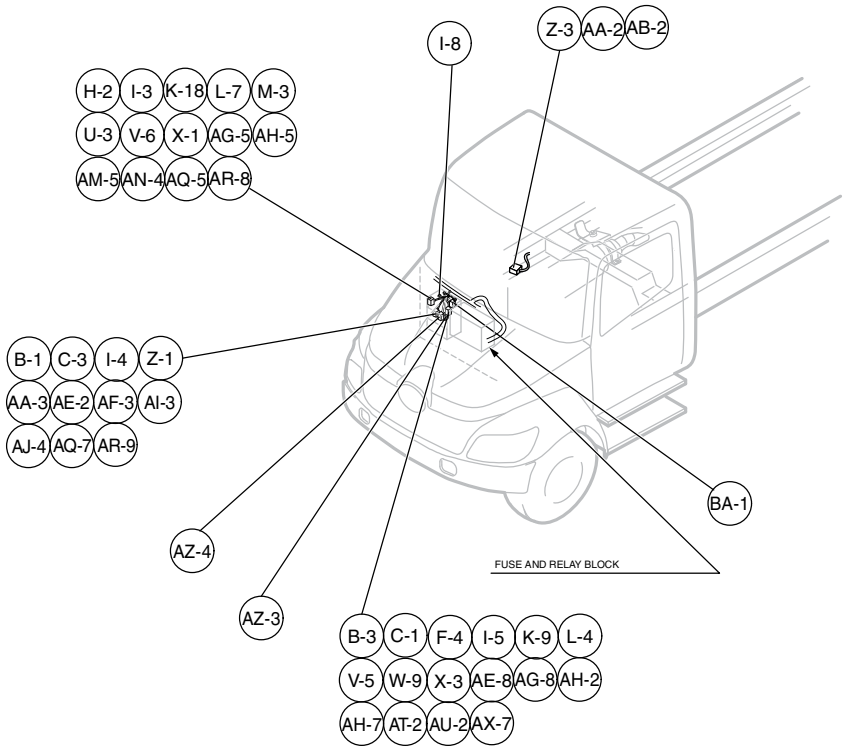


B-2: Clutch interlock switch
B-6: Starter
C-7: Starter
D-1: GCU
D-2: Glow plug No.1
D-3: Glow plug No.2
D-4: Glow plug No.3
D-5: Glow plug No.4
E-1: Alternator
AB-4: Fuel cut 4P JP
AB-5: Fuel cut dummy diode
AS-4: Fuel cut 4P JP
AS-6: Fuel cut dummy diode
AX-5: Air suspension dump diode No.2
AX-6: Air suspension dump diode No.1

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Position of connectors B,C,F,H,I,K,L,M,U,V,W,X,Z,AA,AB,AE,AF,AG,AH,AI,AJ,AM,AN,AP,AQ,AR,AT,AU,AX,AZ,BA

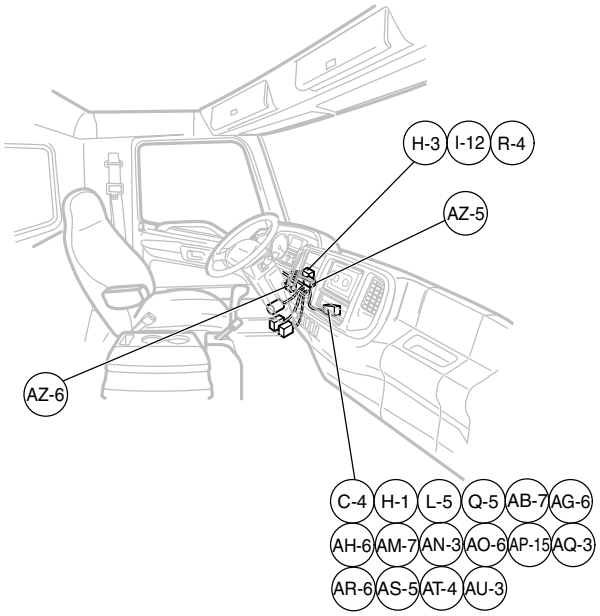


B-1: J/C SIGNAL
B-3: U2 J/C No.2
C-1: U2 J/C No.2
C-3: J/C SIGNAL
F-4: U2 J/C No.2
H-2: U2 J/C No.1
I-3: U2 J/C No.1
I-4: J/C SIGNAL
I-5: U2 J/C No.2
I-8: Parking brake off diode (For center parking)
K-9: U2 J/C No.2
K-18: U2 J/C No.1
L-4: U2 J/C No.2
L-7: U2 J/C No.1
M-3: U2 J/C No.1
U-3: U2 J/C No.1
V-5: U2 J/C No.2
V-6: U2 J/C No.1
W-9: U2 J/C No.2
X-1: U2 J/C No.1
X-3: U2 J/C No.2
Z-1: J/C SIGNAL
Z-3: Exhaust brake magnetic valve
AA-2: Exhaust brake magnetic valve
AA-3: J/C SIGNAL
AB-2 Exhaust brake magnetic valve
AE-2: J/C SIGNAL
AE-8: U2 J/C No.2
AF-3: J/C SIGNAL
AG-5: U2 J/C No.1
AG-8: U2 J/C No.2
AH-2: U2 J/C No.2
AH-5: U2 J/C No.1
AH-7: J/C SIGNAL
AI-3: J/C SIGNAL
AJ-4: J/C SIGNAL
AM-5: U2 J/C No.1
AN-4: U2 J/C No.1
AQ-5: U2 J/C No.1
AQ-7: J/C SIGNAL
AR-8: U2 J/C No.1
AR-9: J/C SIGNAL
AT-2: U2 J/C No.2
AU-2: U2 J/C No.2
AX-7: U2 J/C No.2
AZ-3: CAN J/C 2 High
AZ-4: CAN J/C 2 Low
BA-1: CAN TMN6

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Position of connectors C,H,I,L,Q,R,AB,AG,AH,AM,AN,AO,AP,AQ,AR,AS,AT,AU,AZ



C-4: J/C G3
H-1: J/C EARTH
H-3: J/C EARTH 4P
I-12: J/C EARTH 4P
L-5: J/C EARTH
Q-5: J/C G3
R-4: J/C EARTH 4P

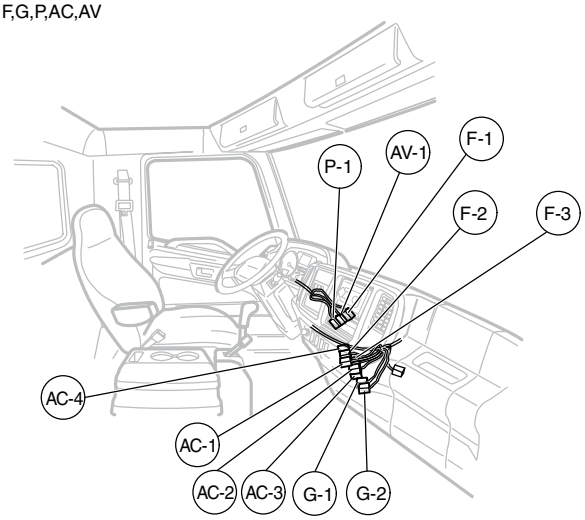
AB-7: J/C G4
AG-6: J/C G4
AH-6: J/C EARTH
AM-7: J/C EARTH
AN-3: J/C EARTH
AO-6: J/C EARTH
AP-15: J/C EARTH

AQ-3: J/C G3
AR-6: J/C EARTH
AS-5: J/C G4
AT-4: J/C EARTH
AU-3: J/C EARTH
AZ-5: CAN J/C 3 High
AZ-6: CAN J/C 3 Low

SAPH12Z160200174

EL02_001.fm 165 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

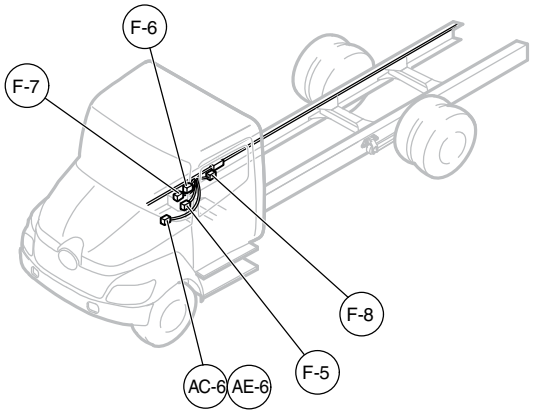
Position of connectors F,G,P,AC,AV



F-1: Van light switch
F-2: Spare power source (Battery)
F-3: Spare power source (Starter switch ON)
G-1: Fog light switch
G-2: Fog light power source
P-1: Remote control mirror switch
AC-1: P.T.O. switch 1
AC-2: P.T.O. switch 2
AC-3: P.T.O. cut relay
AC-4: Engine stop switch
AV-1: Differential lock switch

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Position of connectors F,AC,AE

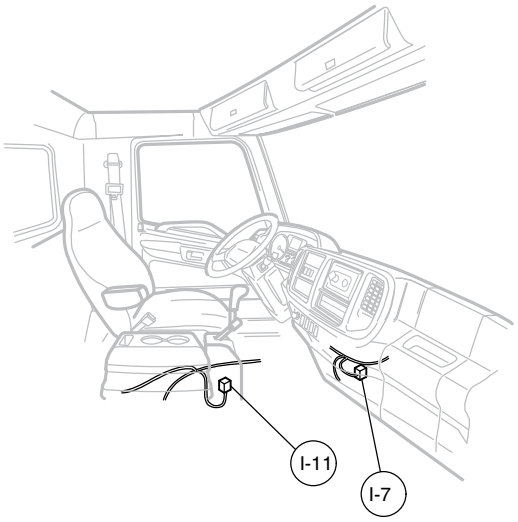


F-5: Van light connector
F-6: Spare power source (Tail) 2
F-7: Spare power source (Ignition chassis)
F-8: Spare power source (Signal side turn)
AC-6: P.T.O. Accelerator sensor
AE-6: P.T.O. Accelerator sensor

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EL02_001.fm 166 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

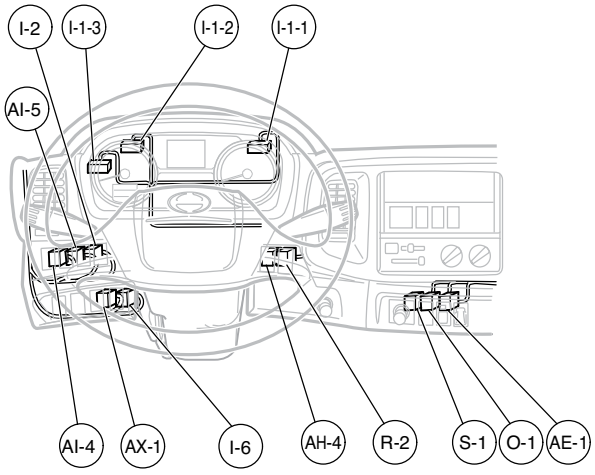
Position of connectors I



I-7: Coolant warning relay
I-11: Parking brake switch

SAPH12Z160200177

Position of connectors I,O,R,S,AE,AI,AH,AX

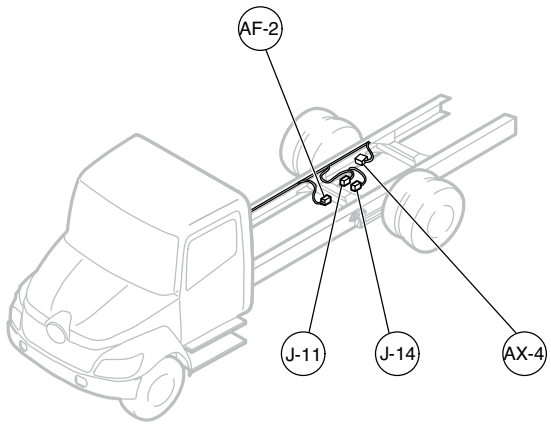


I-1-1: Combination meter
I-1-2: Combination meter
I-1-3: Combination meter
I-2: Rheostat
I-6: Multi indicator switch
O-1: Mirror heater switch
R-2: Air horn switch
S-1: Cigarette lighter
AE-1: DPR refresh switch
AH-4: Economy running switch
AI-4: Set/resume switch
AI-5: Auto cruising switch
AX-1: Air suspension dump switch

SAPH12Z160200178

EL02_001.fm 167 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

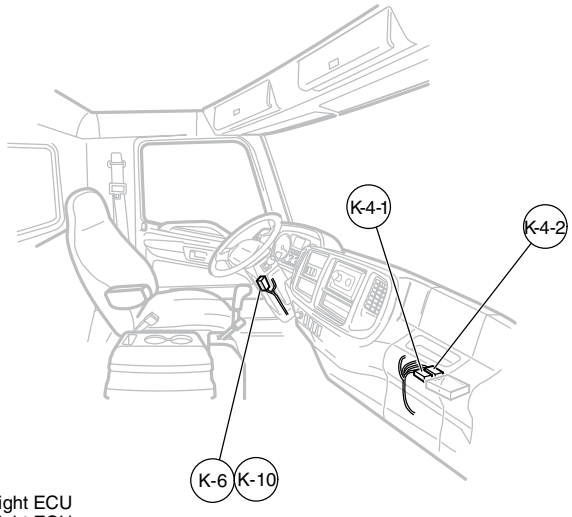
Position of connectors J,AF,AX



J-11: Spring brake switch (For wheel parking)
J-14: Buzzer off switch (For wheel parking)
AF-2: Brake switch (NC) (Full air)
AX-4: Air suspension dump magnetic valve

SAPH12Z160200179

Position of connectors K

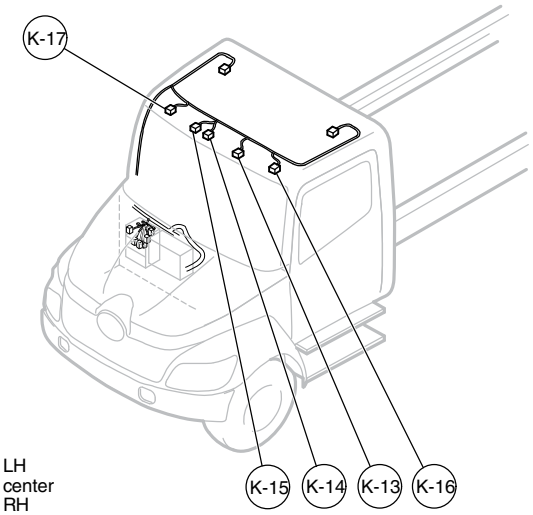


K-4-1: Daytime running light ECU
K-4-2: Daytime running light ECU
K-6: Light and turn switch
K-10: Light and turn switch

SAPH12Z160200180

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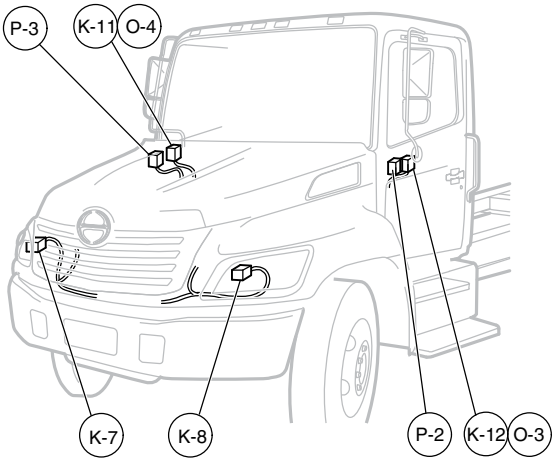
Position of connectors K



K-13: Identification light LH
K-14: Identification light center
K-15: Identification light RH
K-16: Roof clearance light LH
K-17: Roof clearance light RH

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Position of connectors K,O,P

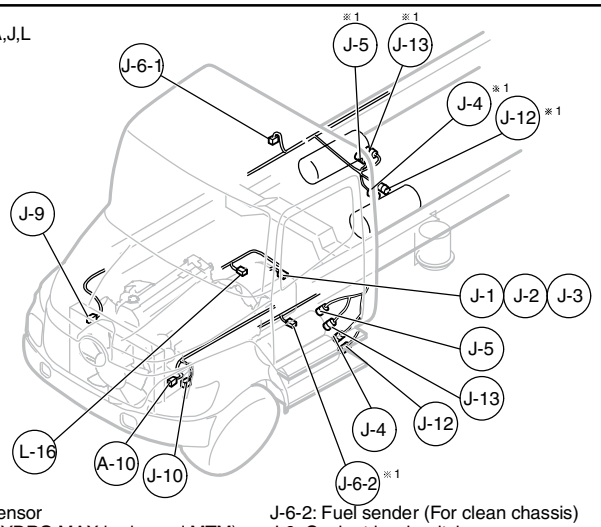


K-7: Head light RH
K-8: Head light LH
K-11: Heater and light mirror RH
K-12: Heater and light mirror LH
O-3: Heater and light mirror LH
O-4: Heater and light mirror RH
P-2: Remote control mirror LH
P-3: Remote control mirror RH

SAPH12Z160200182

EL02_001.fm 169 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

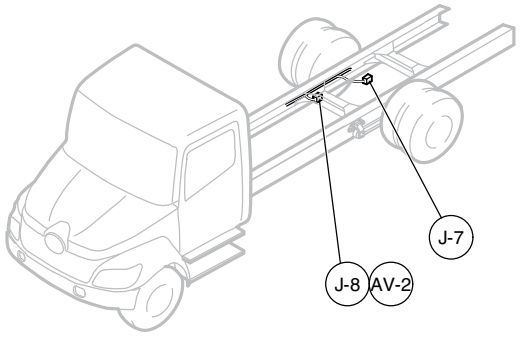
Position of connectors A,J,L



A-10 : Fuel filter heater sensor
J-1: Speed sensor (For HYDRO MAX brake and MTM)
J-2: Speed sensor (For EATON AMT)
J-3: Speed sensor (For Full air brake and MTM)
J-4: Air gauge sensor front (For full air brake)
J-5: Air gauge sensor rear (For full air brake)
J-6-1: Fuel sender (For standard chassis)
J-6-2: Fuel sender (For clean chassis)
J-9: Coolant level switch
J-10: Fuel filter water level sensor
J-12: Low pressure switch No.1
J-13: Low pressure switch No.2
L-16: Back-up light switch

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Position of connectors J,AV

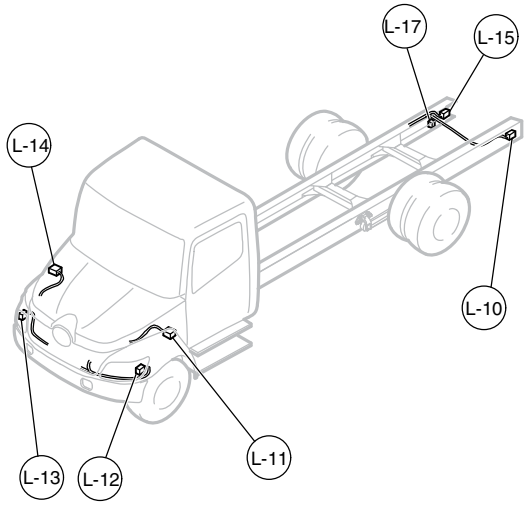


J-7: Manual differential lock switch
J-8: Manual differential lock magnetic valve
AV-2: Manual differential lock magnetic valve

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EL02_001.fm 170 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

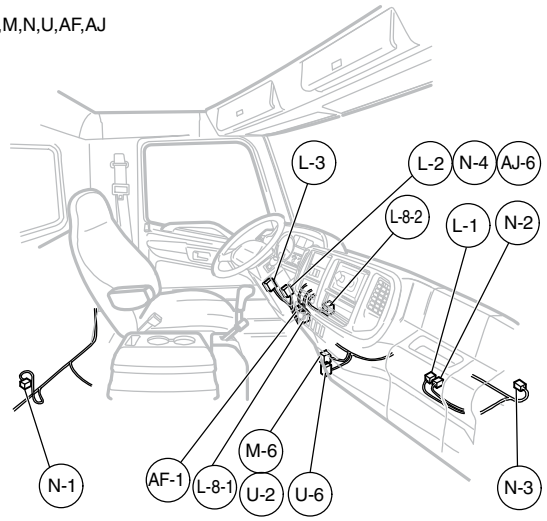
Position of connectors L



L-10: Rear combination light LH
L-11: Side turn light LH (Fender)
L-12: Front turn light LH
L-13: Front turn light RH
L-14: Side turn light RH (Fender)
L-15: Rear combination light RH
L-17: Back-up buzzer

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Position of connectors L,M,N,U,AF,AJ

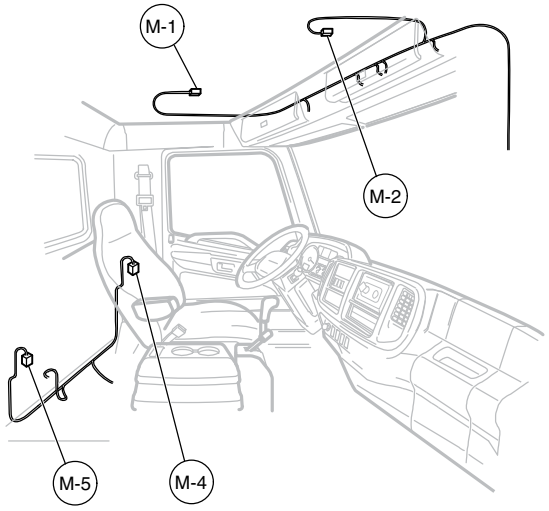


L-1: Stop and turn controller
L-2: Wiper and retarder switch
L-3: Light and turn switch
L-8-1: Stop light switch (Full air)
L-8-2: Stop light switch (HYD)
M-6: Key-less entry controller
N-1: Washer pump motor
N-2: Wiper relay
N-3: Wiper motor
N-4: Wiper and retarder switch
U-2: Key-less entry controller
U-6: Power door lock controller
AF-1: Brake switch (NC) (HYDRO MAX)
AJ-6: Wiper and retarder switch

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EL02_001.fm 171 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

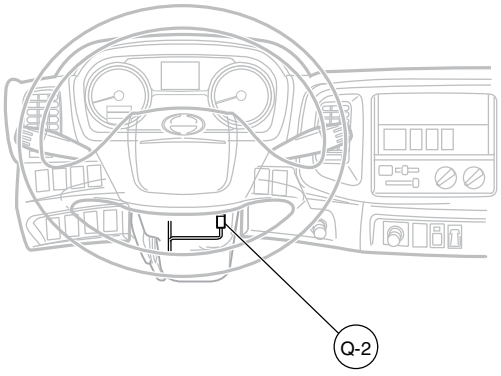
Position of connectors M



M-1: Dome light LH
M-2: Dome light RH
M-4: Courtesy switch front LH
M-5: Courtesy switch front RH

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Position of connector Q

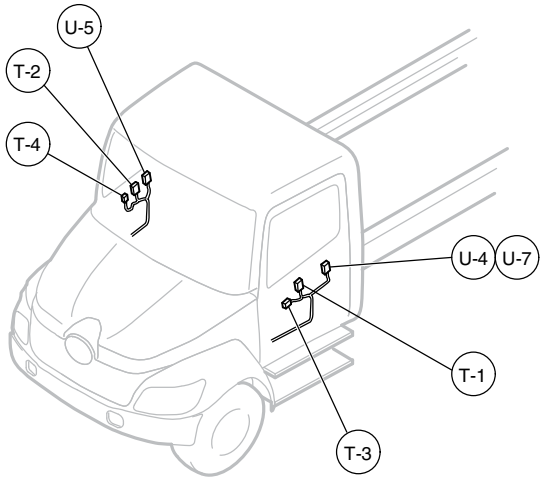


Q-2: Horn switch

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EL02_001.fm 172 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

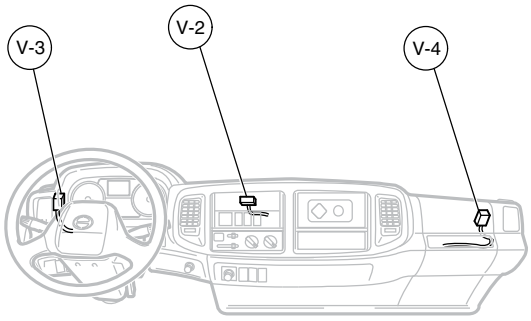
Position of connectors T,U



T-1: Driver seat master switch
T-2: Passenger seat sub switch
T-3: Power window motor (Driver seat)
T-4: Power window motor (Passenger seat)
U-4: Power door lock motor (Driver side)
U-5: Power door lock motor (Passenger side)
U-7: Power door lock switch (Driver side)

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Position of connectors V

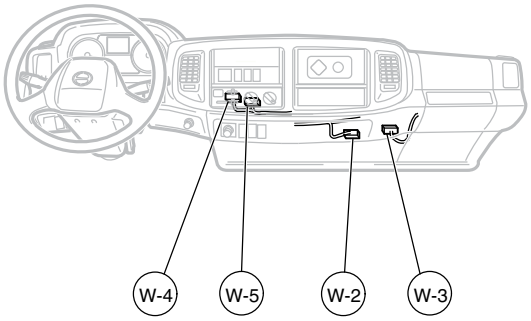


V-2: Radio/Audio unit
V-3: Front speaker LH
V-4: Front speaker RH

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EL02_001.fm 173 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

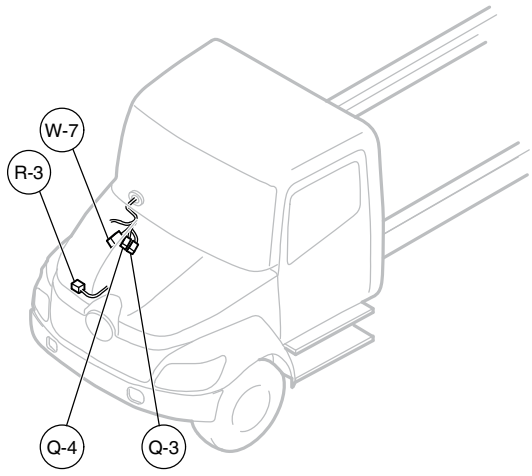
Position of connectors W



W-2: Heater and cooler unit
W-3: Blower motor
W-4: Blower switch
W-5: Air conditioner switch

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Position of connector Q,R,W

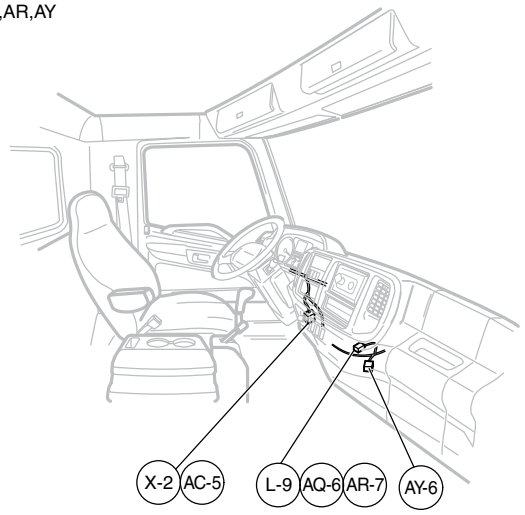


Q-3: Horn (Low)
Q-4: Horn (High)
R-3: Air horn magnetic valve
W-7: Pressure switch

SAPH12Z160200192

EL02_001.fm 174 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

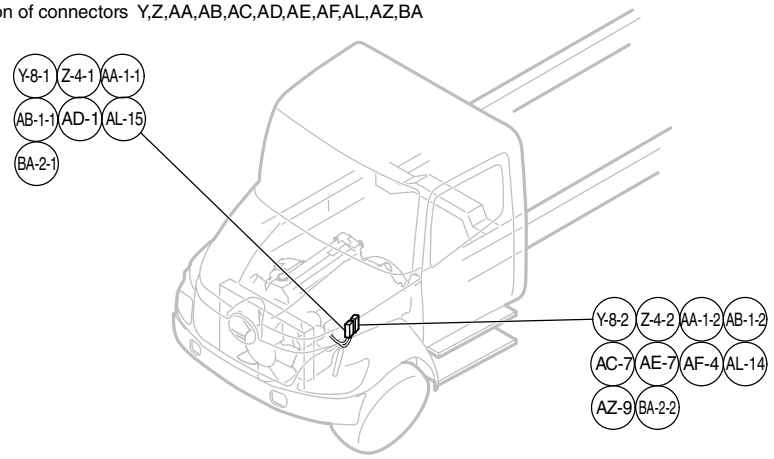
Position of connectors L,X,AC,AQ,AR,AY



L-9: STP AT diode
X-2: Accelerator sensor
AC-5: Accelerator sensor
AQ-6: STP AT diode
AR-7: STP AT diode
AY-6: CAN J/C

SAPH12Z160200193

Position of connectors Y,Z,AA,AB,AC,AD,AE,AF,AL,AZ,BA

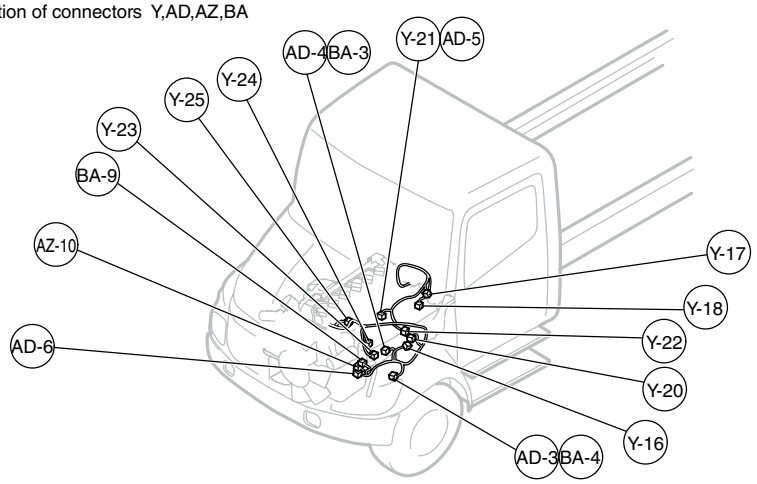


Y-8-1: U2 ECU (Engine side)
Y-8-2: U2 ECU (Vehicle side)
Z-4-1: U2 ECU (Engine side)
Z-4-2: U2 ECU (Vehicle side)
AA-1-1: U2 ECU (Engine side)
AA-1-2: U2 ECU (Vehicle side)
AB-1-1: U2 ECU (Engine side)
AB-1-2: U2 ECU (Vehicle side)
AC-7: U2 ECU (Vehicle side)
AD-1: U2 ECU (Engine side)
AE-7: U2 ECU (Vehicle side)
AF-4: U2 ECU (Vehicle side)
AL-14: U2 ECU (Vehicle side)
AL-15: U2 ECU (Engine side)
AZ-9: U2 ECU (Vehicle side)
BA-2-1: U2 ECU (Engine side)
BA-2-2: U2 ECU (Vehicle side)

SAPH12Z160200194

EL02_001.fm 175 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

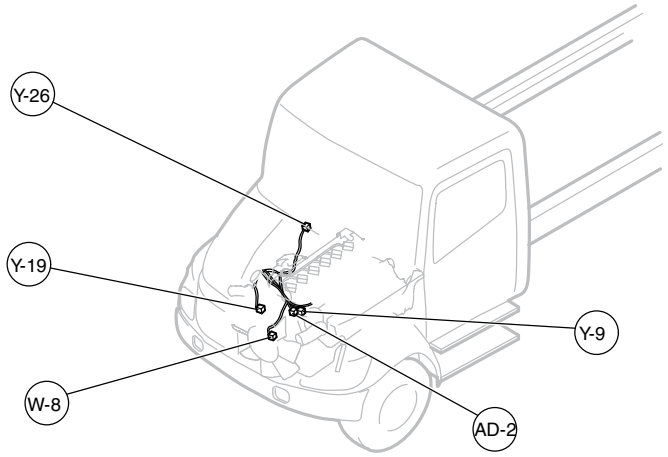
Position of connectors Y,AD,AZ,BA



Y-16: Suction control valve
Y-17: Cylinder angle sensor
Y-18: NE sensor
Y-20: Fuel temperature sensor
Y-21 PC sensor
Y-22: Intake manifold temperature sensor
Y-23: Boost sensor
Y-24: Intercooler exit temperature sensor
Y-25: EGR exit temperature sensor
AD-3: VNT controller
AD-4: EGR controller
AD-5: PC sensor
AD-6: Diesel throttle
AZ-10: No.30 J/C
BA-3: EGR controller
BA-4: VNT controller
BA-9: No.29 J/C

SAPH12Z160200195

Position of connectors W,Y,AD

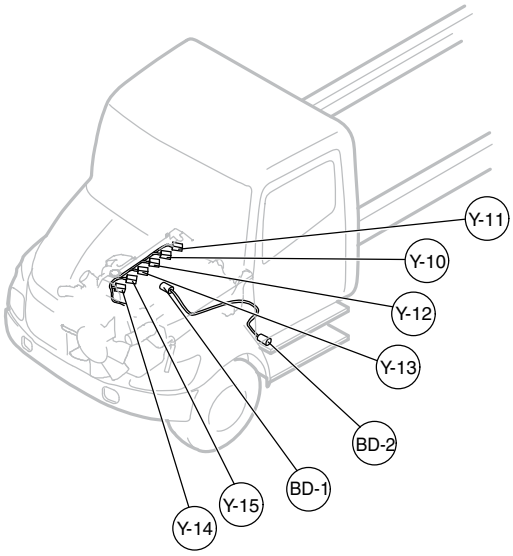


W-8: Compressor
Y-9: Oil pressure switch
Y-19: Water temperature sender
Y-26: Air flow sensor
AD-2: VNT actuator

SAPH12Z160200196

EL02_001.fm 176 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

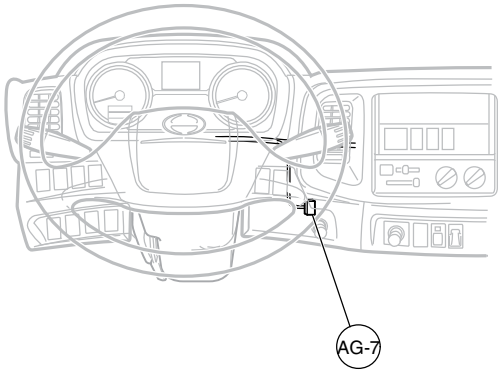
Position of connectors Y, BD



Y-10: Injector 6
Y-11 Injector 5
Y-12: Injector 4
Y-13: Injector 3
Y-14: Injector 2
Y-15: Injector 1
BD-1: Plug heater
BD-2: Outlet cord

SAPH12Z160200197

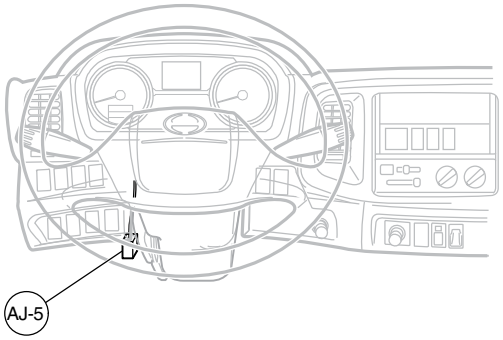
Position of connector AG



AG-7: Idling volume

SAPH12Z160200198

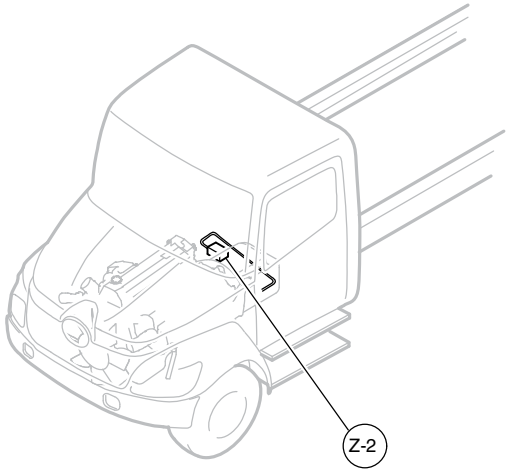
Position of connector AJ



AJ-5: Exhaust clutch switch

SAPH12Z160200199

Position of connector Z

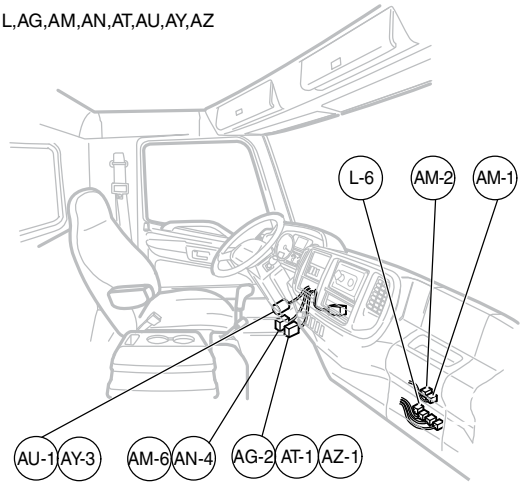


Z-2: Neutral switch

SAPH12Z160200200

EL02_001.fm 178 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

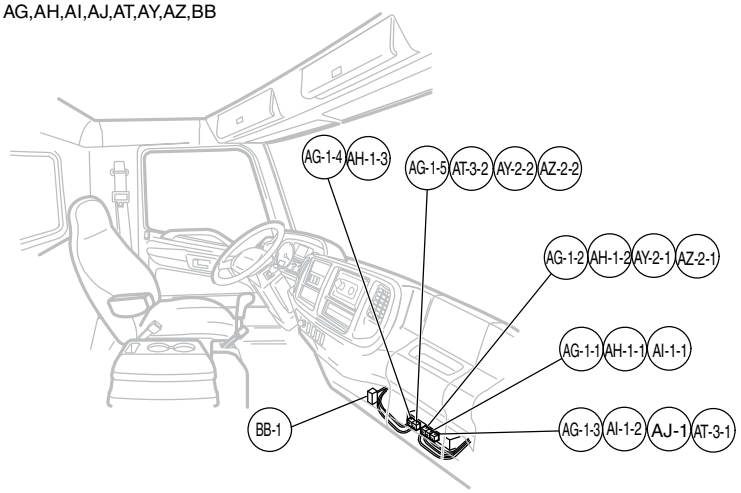
Position of connectors L,AG,AM,AN,AT,AU,AY,AZ



L-6: Stop light relay
AG-2: Diagnosis connector (16P)
AM-1: ABS ECU E
AM-2: ABS ECU F
AM-6: ABS Diagnosis switch
AN-4: ABS Diagnosis switch
AT-1: Diagnosis connector (16P)
AU-1: Diagnosis connector (9P)
AY-3: Diagnosis connector (9P)
AZ-1: Diagnosis connector (16P)

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Position of connectors AG,AH,AI,AJ,AT,AY,AZ,BB

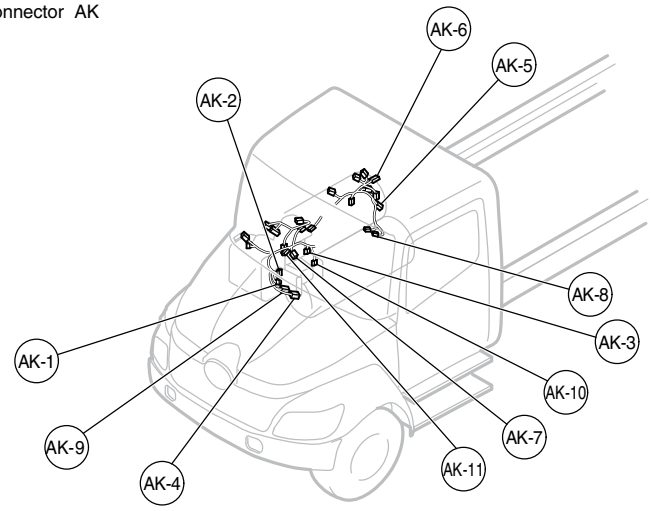


AG-1-1: Vehicle control ECU
AG-1-2: Vehicle control ECU
AG-1-3: Vehicle control ECU
AG-1-4: Vehicle control ECU
AG-1-5: Vehicle control ECU
AH-1-1: Vehicle control ECU
AH-1-2: Vehicle control ECU
AH-1-3: Vehicle control ECU
AI-1-1: Vehicle control ECU
AI-1-2: Vehicle control ECU
AJ-1: Vehicle control ECU
AT-3-1: Vehicle control ECU
AT-3-2: Vehicle control ECU
AY-2-1: Vehicle control ECU
AY-2-2: Vehicle control ECU
AZ-2-1: Vehicle control ECU
AZ-2-2: Vehicle control ECU
BB-1:Telematics unit

SAPH12Z160200202

EL02_001.fm 179 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

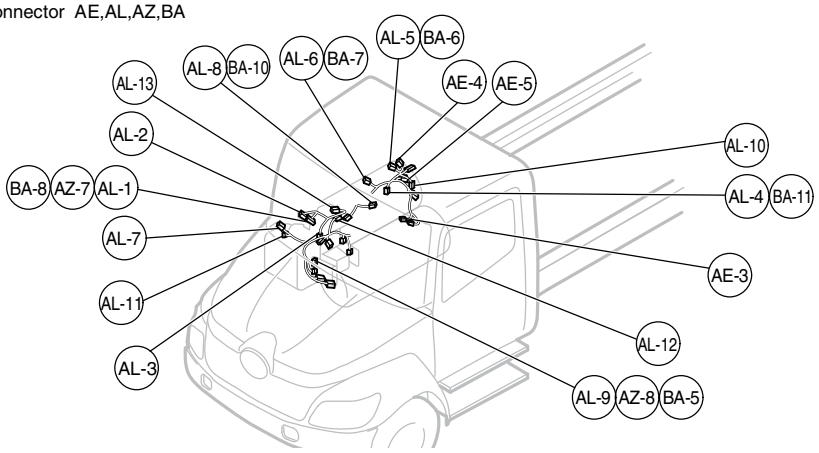
Position of connector AK



AK-1: BCU 18P
AK-2: BCU 30P
AK-3: Atomization module 2
AK-4: Exhaust temperature sensor
AK-5: Fuel pump
AK-6: Fuel pump 2
AK-7: Atomization module
AK-8: DPR intake temperature sensor
AK-9: Flame temperature sensor
AK-10: Ignition coil
AK-11: Combustion air valve

SAPH12Z160200203

Position of connector AE,AL,AZ,BA

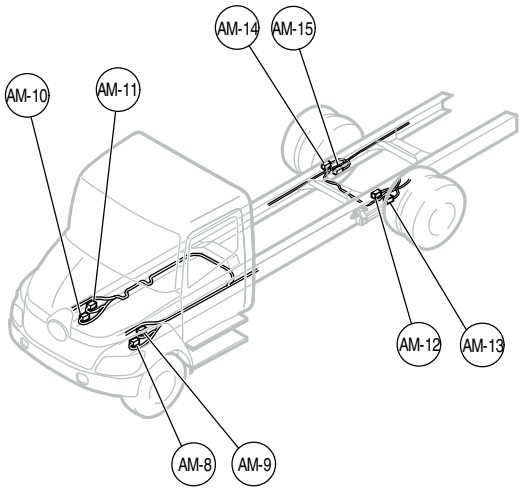


AE-3: Exhaust gas temperature sensor 1
AE-4: Exhaust gas temperature sensor 3
AE-5: Exhaust gas pressure sensor
AL-1: DCU 53P
AL-2: DCU 86P
AL-3: Supply module
AL-4: U2 CAN J/C No.3
AL-5: NOx sensor 1
AL-6: NOx sensor 2
AL-7: Ambient temperature sensor
AL-8: U2 CAN J/C No.1
AL-9: BCU 30P
AL-10:Dosing module
AL-11: Urea sensor
AL-12: Coolant cut off valve
AL-13: SCR front temperature sensor
AZ-7: DCU 53P
AZ-8: DCU 30P
BA-5: BCU 30P
BA-6: NOx sensor 1
BA-7: NOx sensor 2
BA-8: DCU 53P
BA-10: U2 CAN J/C No.1
BA-11: U2 CAN J/C No.3

SAPH12Z160200204

EL02_001.fm 180 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

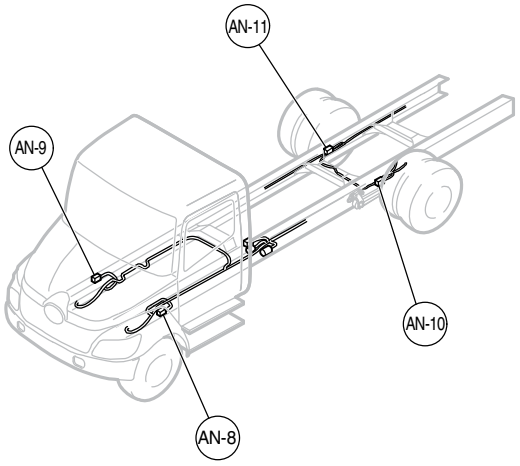
Position of connector AM



AM-8: Modulator front LH
AM-9: ABS sensor front LH
AM-10: Modulator front RH
AM-11: ABS sensor front RH
AM-12: Modulator rear LH
AM-13: ABS sensor rear LH
AM-14: Modulator rear RH
AM-15: ABS sensor rear RH

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Position of connector AN

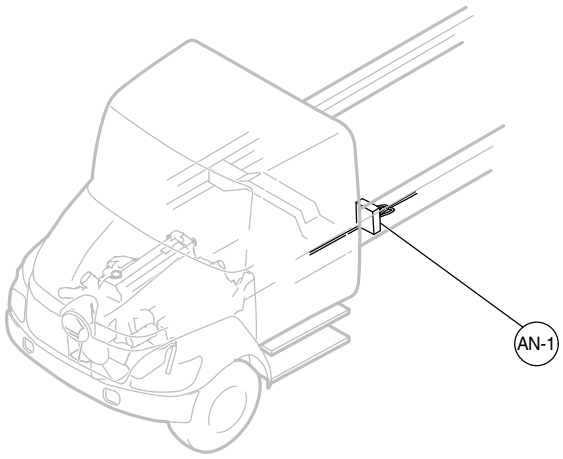


AN-8: ABS sensor front LH
AN-9: ABS sensor front RH
AN-10: ABS sensor rear LH
AN-11: ABS sensor rear RH

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EL02_001.fm 181 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

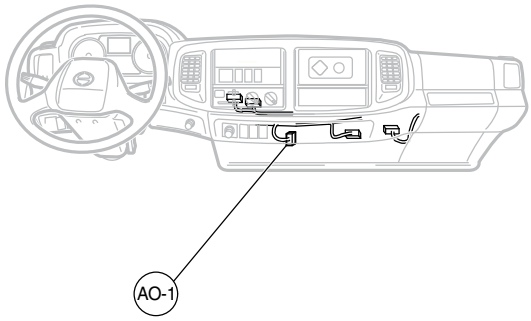
Position of connector AN



AN-1: ABS HYDRO MAX unit with ECU

SAPH12Z160200207

Position of connector AO

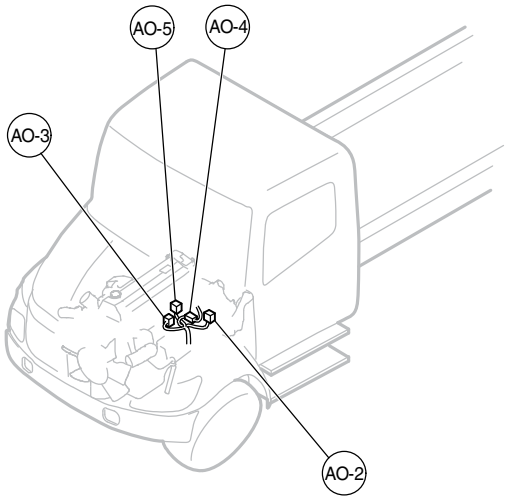


AO-1: Monitor module

SAPH12Z160200208

EL02_001.fm 182 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

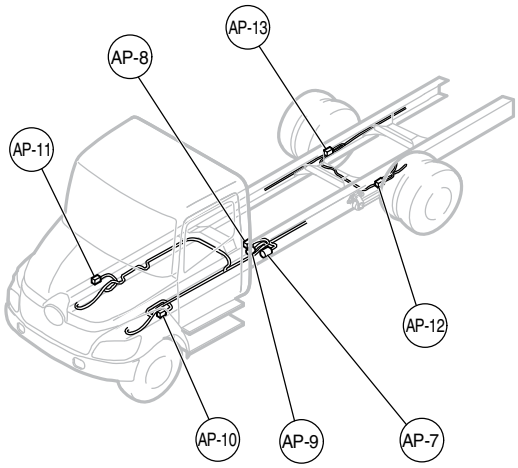
Position of connectors AO



AO-2: Motor relay
AO-3: Motor pump
AO-4: Flow switch
AO-5: Differential switch

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Position of connector AP

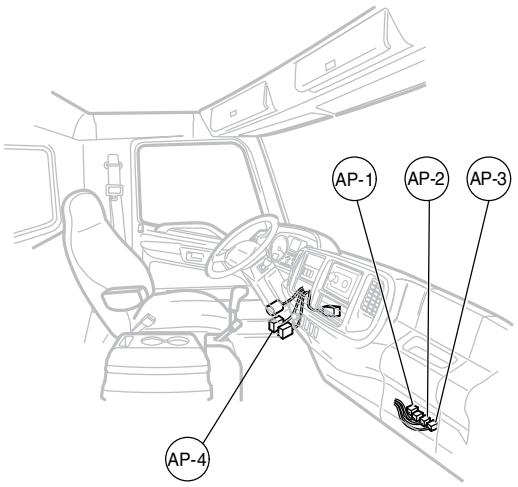


AP-7: HYDRO MAX unit 1
AP-8: HYDRO MAX unit 2
AP-9: HYDRO MAX unit 3
AP-10: ABS sensor front LH
AP-11: ABS sensor front RH
AP-12: ABS sensor rear LH
AP-13: ABS sensor rear RH

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EL02_001.fm 183 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

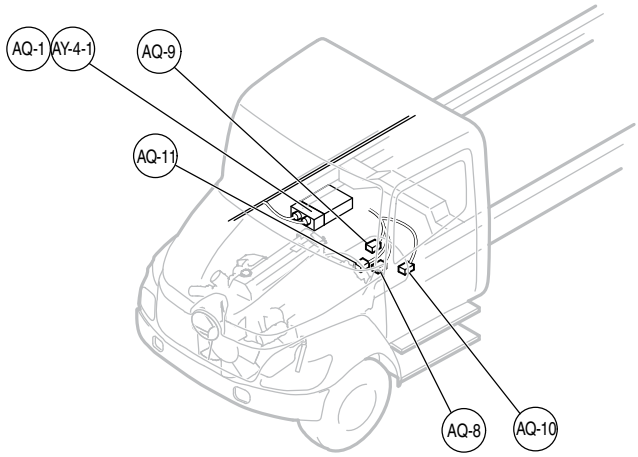
Position of connectors AP



AP-1: ABS ECU x1
AP-2: ABS ECU x2
AP-3: ABS ECU x3
AP-4: ABS Diagnosis switch

SAPH12Z160200211

Position of connectors AQ,AY

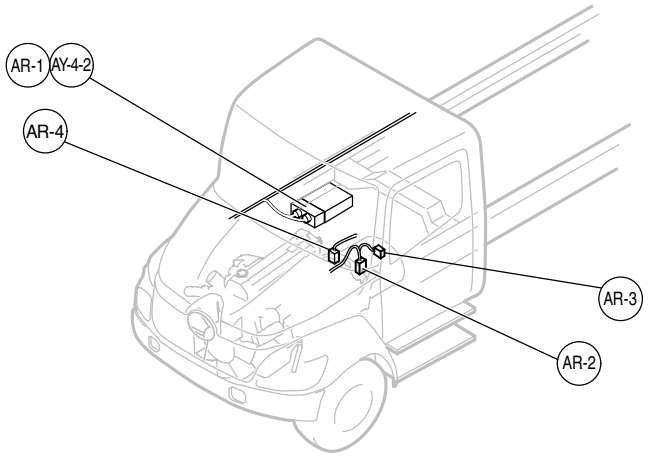


AQ-1: ALLISON 2000 ATM ECU
AQ-8: Turbine speed sensor
AQ-9: Main transmission
AQ-10: Out put speed sensor
AQ-11: Engine speed sensor
AY-4-1: ALLISON 2000 ATM ECU

SAPH12Z160200212

EL02_001.fm 184 ページ ２０１１年１１月３０日 水曜日 午前１０時５分

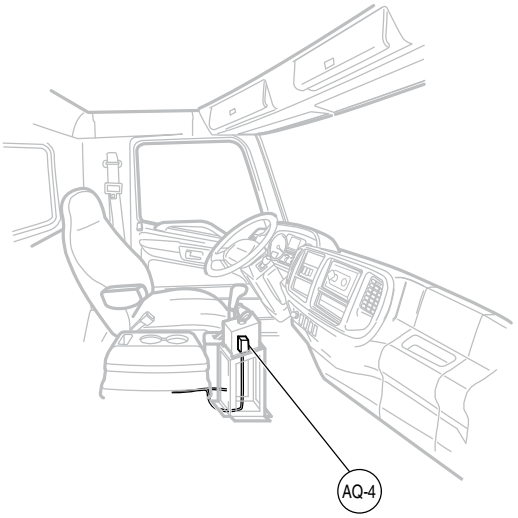
Position of connectors AR,AY



AR-1: ALLISON 3000RDS ATM ECU
AR-2: Transmission MAIN TRANS
AR-3: Output speed sensor
AR-4: Engine speed sensor
AY-4-2: ALLISON 3000RDS ATM ECU

SAPH12Z160200213

Position of connector AQ

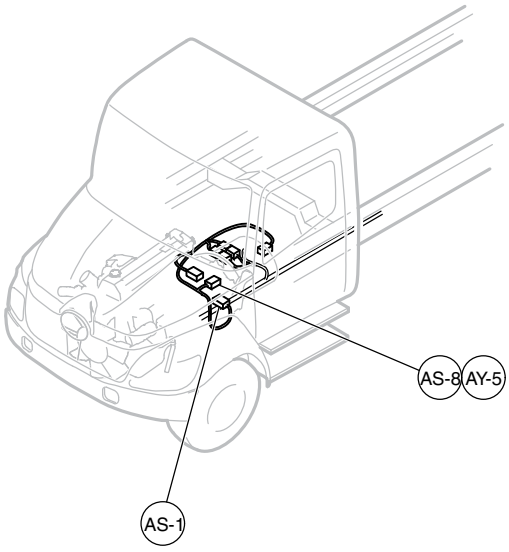


AQ-4: ATM mode switch

SAPH12Z160200214

EL02_001.fm 185 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

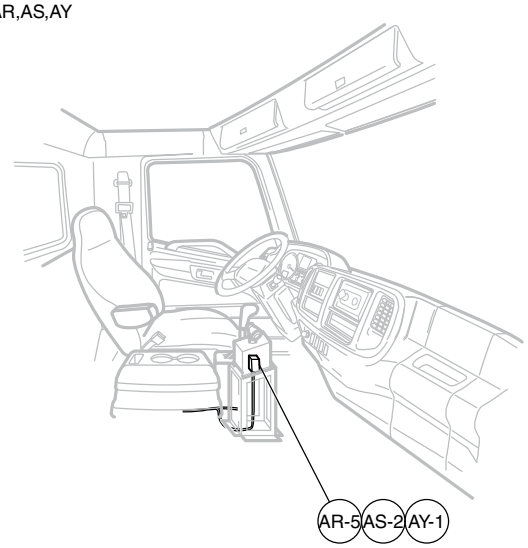
Position of connectors AS,AY



AS-1: EATON AMT ECU
AS-8: Parking pawl sensor
AY-5: EATON AMT ECU

SAPH12Z160200215

Position of connectors AR,AS,AY

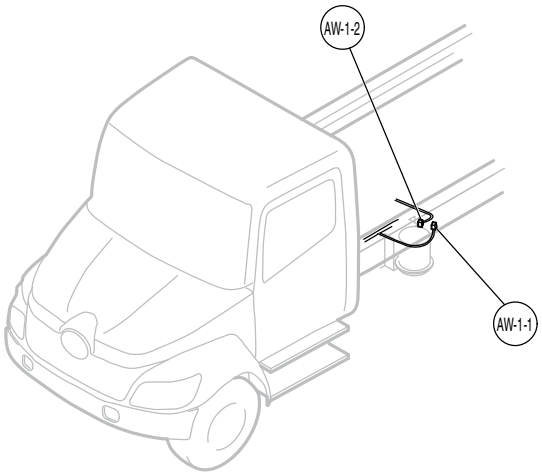


AR-5: Selector
AS-2: Button selector
AY-1: Button selector

SAPH12Z160200216

EL02_001.fm 186 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

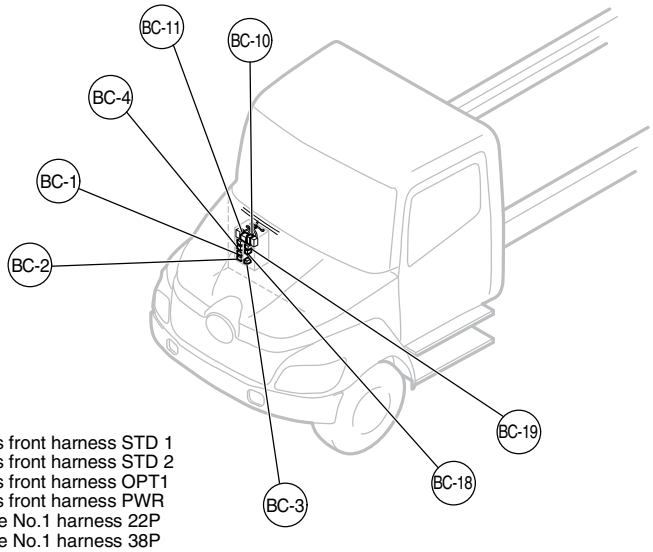
Position of connector AW



AW-1-1: Air dryer (HYD)
AW-1-2: Air dryer (Full air)

SAPH12Z160200217

Position of connectors BC

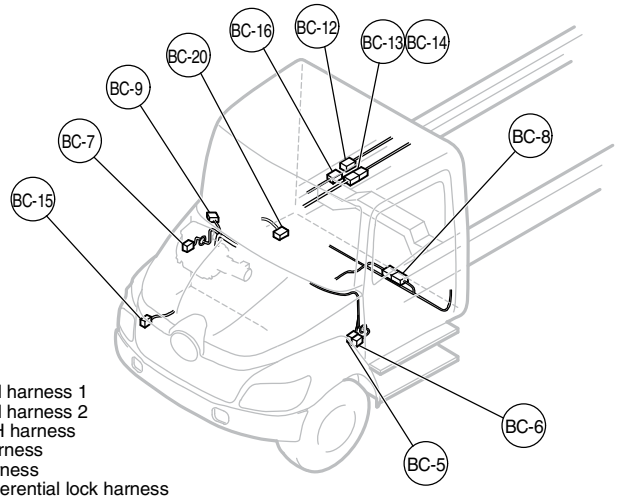


BC-1: Cab main harness to chassis front harness STD 1
BC-2: Cab main harness to chassis front harness STD 2
BC-3: Cab main harness to chassis front harness OPT1
BC-4: Cab main harness to chassis front harness PWR
BC-10: Cab main harness to engine No.1 harness 22P
BC-11: Cab main harness to engine No.1 harness 38P
BC-18: Chassis front harness to engine No.1 harness 6P (GND)
BC-19: Chassis front harness to engine No.1 harness 26P

SAPH12Z160200218

EL02_001.fm 187 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

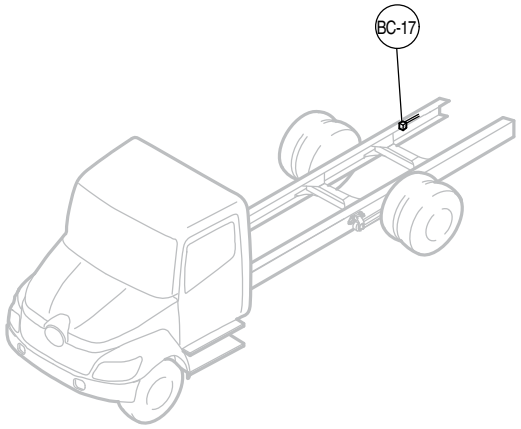
Position of connectors BC



BC-5: Cab main harness to door LH harness 1
BC-6: Cab main harness to door LH harness 2
BC-7: Cab main harness to door RH harness
BC-8: Cab main harness to floor harness
BC-9: Cab main harness to roof harness
BC-12: Chassis front harness to differential lock harness
BC-13: Chassis front harness to intermediate harness (For full air brake)
BC-14: Chassis front harness to intermediate harness (For HYDRO MAX brake)
BC-15: Chassis front harness to head light harness
BC-16: Chassis front harness to air tank sub harness
BC-20: Chassis front harness to engine No.2 harness

SAPH12Z160200219

Position of connectors BC

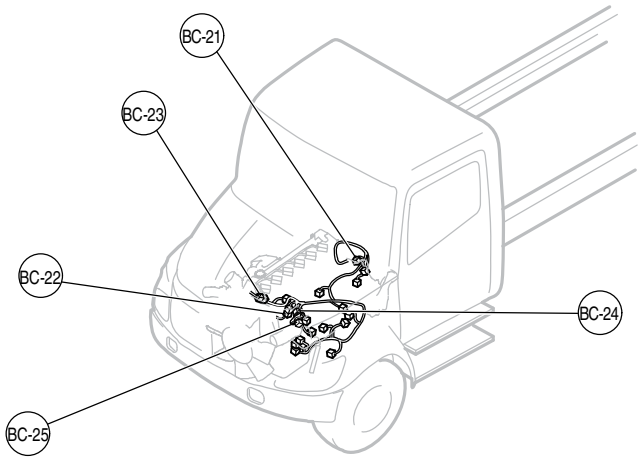


BC-17: Intermediate harness to rear harness

SAPH12Z160200220

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Position of connectors BC



BC-21: Engine No.1 harness to engine No.3 harness glow plug
BC-22: Engine No.1 harness to engine No.1 sub harness 6P
BC-23: Engine No.1 harness to engine No.1 sub harness 12P
BC-24: Engine No.1 harness to link-up connector
BC-25: Link-up connector to injector harness

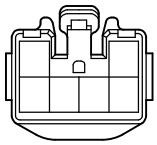
SAPH12Z160200221

EL02_001.fm 189 ページ ２０１１年１１月２９日 火曜日 午後３時１２分

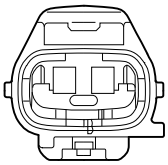
CONNECTOR

EN12Z1602J100006

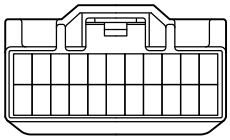
Connector : A-2
Color : Black
Part No. : 82824-E0U10



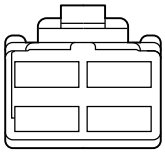
Connector : A-10
Color : Dark Gray
Part No. : 82560-3830



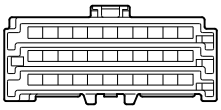
Connector : B-1
Color : White
Part No. : 82560-2470



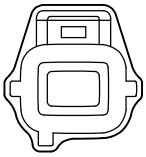
Connector : B-2
Color : Dark Gray
Part No. : 82560-3030



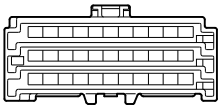
Connector : B-3
Color : White
Part No. : 82560-2430



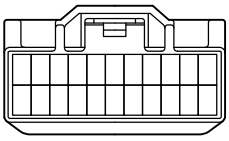
Connector : B-6
Color : Black
Part No. : 82580-6730



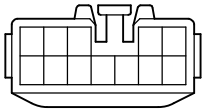
Connector : C-1
Color : White
Part No. : 82560-2430



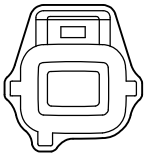
Connector : C-3
Color : White
Part No. : 82560-2470



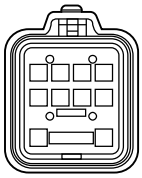
Connector : C-4
Color : White
Part No. : 82580-8740



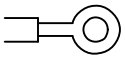
Connector : C-7
Color : White
Part No. : 82580-6730



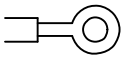
Connector : D-1
Color : Black
Part No. : S8281-E0730



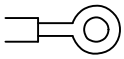
Connector : D-2
Color : ------
Part No. : 98060-5010



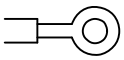
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Color : ------
Part No. : 98060-5010



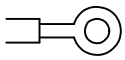
Connector : D-4
Color : ------
Part No. : 98060-5010



Connector : D-5
Color : ------
Part No. : 98060-5010



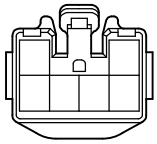
Connector : E-1
Color : ------
Part No. : 98060-6010



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Connector : F-1
Color : Blue
Part No. : 82580-6060



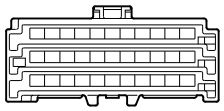
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Color : ------
Part No. : 97840-4050



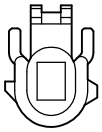
Connector : F-3
Color : ------
Part No. : 97840-4050



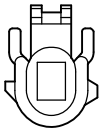
Connector : F-4
Color : White
Part No. : 82560-2430



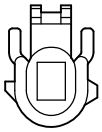
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Color : White
Part No. : 82580-4240



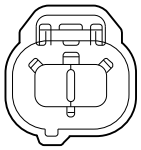
Connector : F-6
Color : White
Part No. : 82580-4240



Connector : F-7
Color : White
Part No. : 82580-4240



Connector : F-8
Color : White
Part No. : 82580-4100



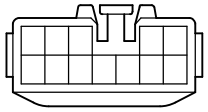
Connector : G-1
Color : ------
Part No. : 97840-4050



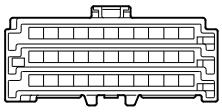
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Color : ------
Part No. : 97840-4050



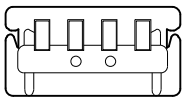
Connector : H-1
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Part No. : 82824-E0U90



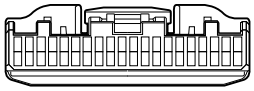
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Color : White
Part No. : 82560-2430



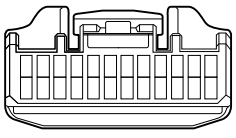
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Color : White
Part No. : 82550-1360



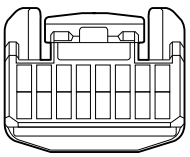
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Color : Black
Part No. : 82824-E0P30



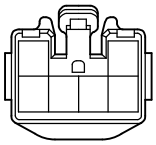
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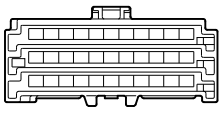
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Color : Black
Part No. : 82824-E0P50



Connector : I-2
Color : Gray
Part No. : 82580-6060



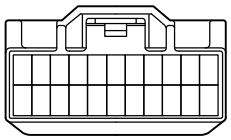
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Color : White
Part No. : 82560-2430



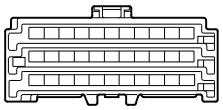
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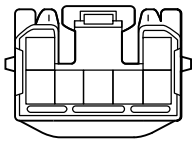
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Color : White
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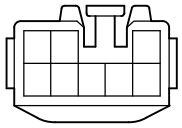
Connector : I-5
Color : White
Part No. : 82560-2430



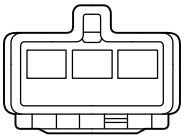
Connector : I-6
Color : Black
Part No. : 82560-1100

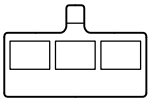


Connector : I-7
Color : White
Part No. : 82580-6870

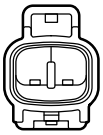


Connector : I-8
Color : White
Part No. : 82560-4180, 85902-1210

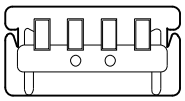




Connector : I-11
Color : Black
Part No. : 82560-2940



Connector : I-12
Color : White
Part No. : 82550-1360



Connector : J-1
Color : Black
Part No. : 82560-1990



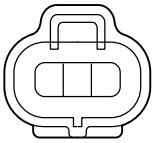
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Color : Black
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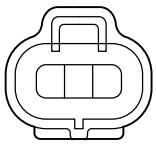
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Color : Black
Part No. : 82560-1990



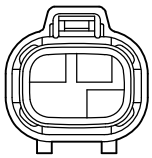
Connector : J-4
Color : Black
Part No. : 82560-3190



Connector : J-5
Color : Black
Part No. : 82560-3190



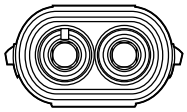
Connector : J-6-1
Color : Black
Part No. : 82580-5440



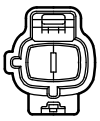
Connector : J-6-2
Color : Dark Gray
Part No. : 82560-4350



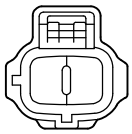
Connector : J-7
Color : Black
Part No. : S8281-E0A40



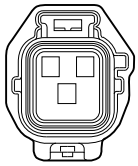
Connector : J-8
Color : Black
Part No. : 82580-9250



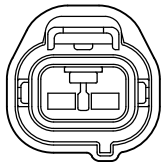
Connector : J-9
Color : Gray
Part No. : 82580-7180



Connector : J-10
Color : Dark Gray
Part No. : 82580-9970



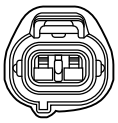
Connector : J-11
Color : Dark Gray
Part No. : 82580-6770



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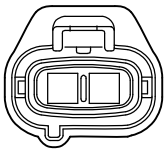
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Color : Black
Part No. : 82560-3180



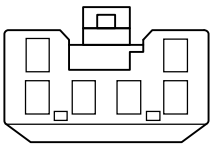
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Color : Black
Part No. : 82560-3180



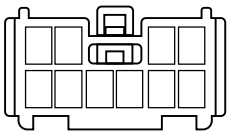
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Color : Black
Part No. : 82580-6820



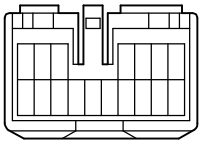
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Color : Black
Part No. : 82580-7380



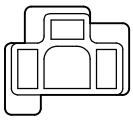
Connector : K-4-2
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Part No. : 82824-E0Y50



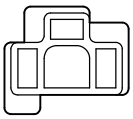
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Part No. : 82580-9310



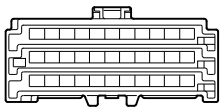
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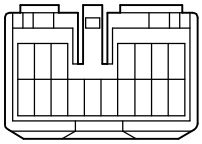
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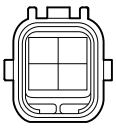
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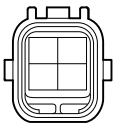
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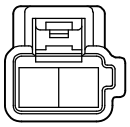
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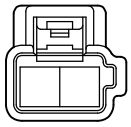
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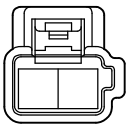
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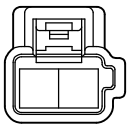
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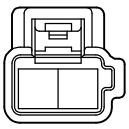
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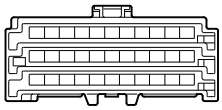
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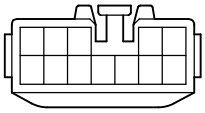
SAPH12Z160200225

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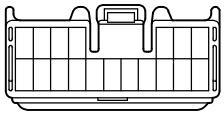
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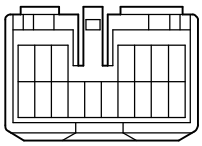
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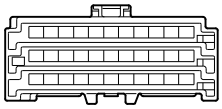
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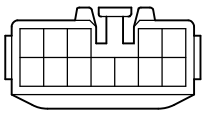
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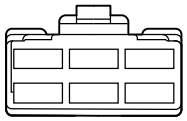
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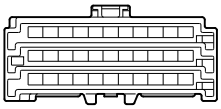
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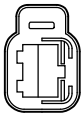
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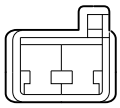
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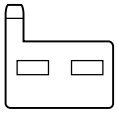


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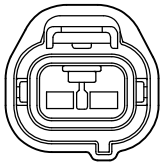




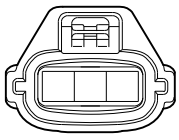
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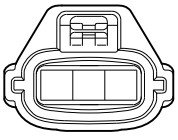
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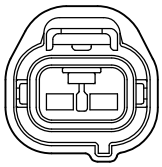
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Color : White
Part No. : 82560-1730



Connector : L-13
Color : Black
Part No. : 82560-1730



Connector : L-14
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Part No. : 82580-6770



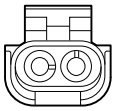
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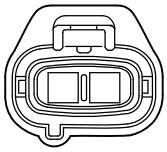
SAPH12Z160200226

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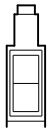
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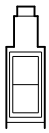
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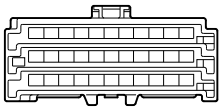
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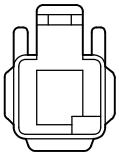
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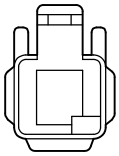
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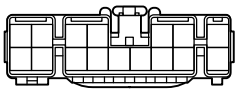
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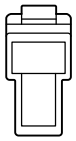
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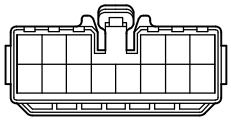
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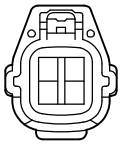
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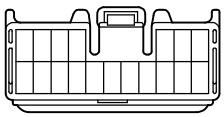
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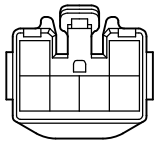
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Connector : N-4
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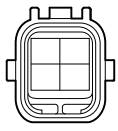
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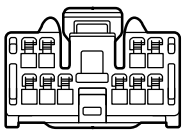
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Part No. : 82580-9460



Connector : O-4
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Part No. : 82580-9460



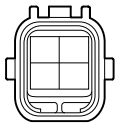
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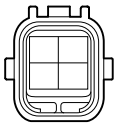
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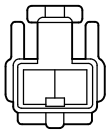
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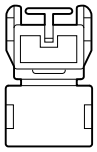
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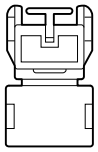
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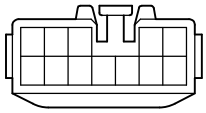
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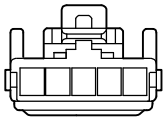
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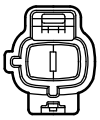
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Part No. : 82580-8740



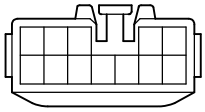
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Part No. : 82560-3250



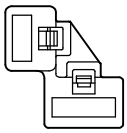
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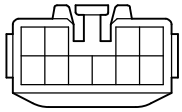
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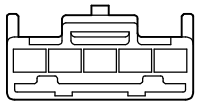
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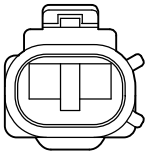
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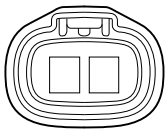
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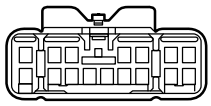
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Part No. : 82580-9420



Connector : T-4
Color : Black
Part No. : 82560-4400



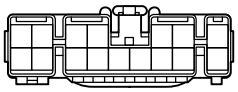
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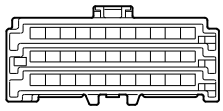
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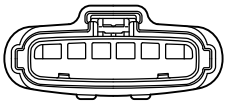
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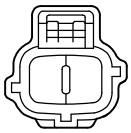
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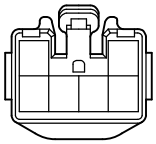
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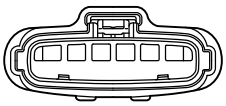
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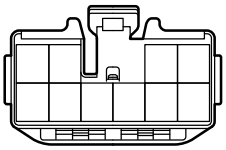
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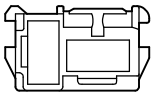
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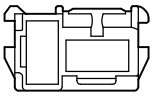
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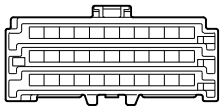
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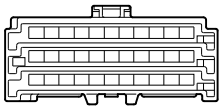
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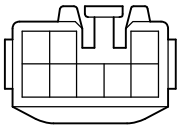
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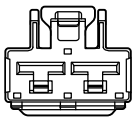
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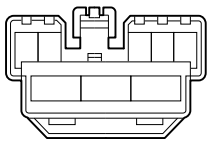
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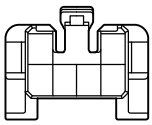
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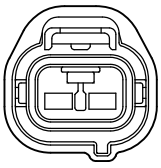
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Part No. : 82560-4480



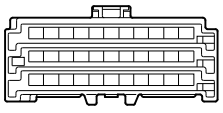
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Part No. : 82560-2400



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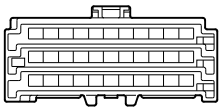
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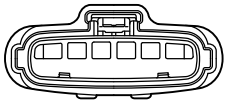
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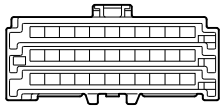
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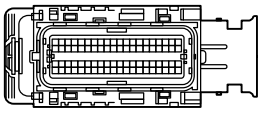
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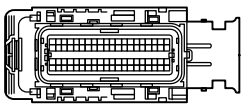
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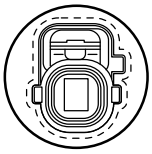
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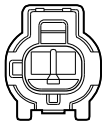
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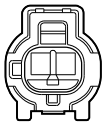
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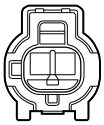
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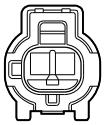
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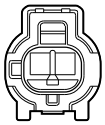
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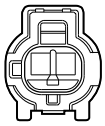
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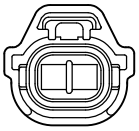
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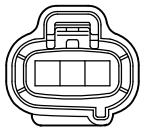
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Part No. : 82580-7990



Connector : Y-16
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Part No. : 82580-8260



Connector : Y-17
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Part No. : 82580-9960



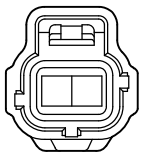
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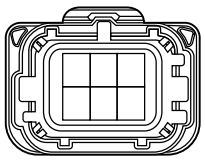
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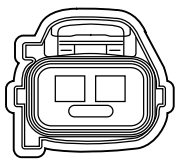
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Part No. : 82580-7120



Connector : Y-21
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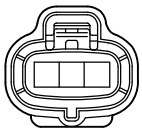
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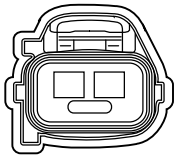
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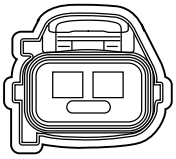
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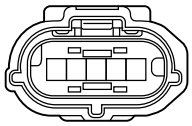
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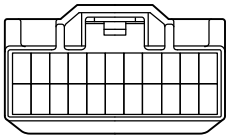
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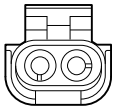
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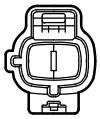
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Part No. : 82560-2470



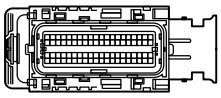
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Part No. : 82828-1200



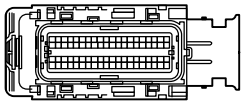
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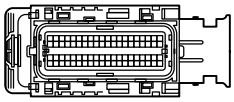
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Part No. : S8281-E0420



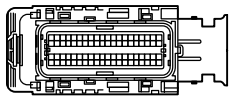
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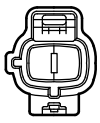
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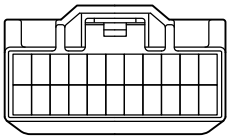
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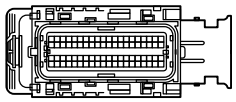
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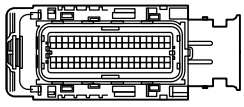
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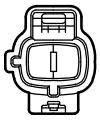
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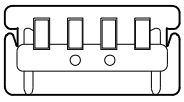
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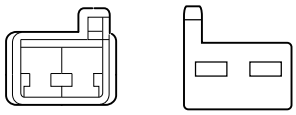
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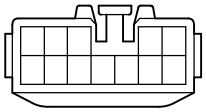
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Connector : AB-5
Color : Black
Part No. : 82560-3800, 85902-1200



Connector : AB-7
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Part No. : 82580-8740



Connector : AC-1
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Part No. : 97840-4050



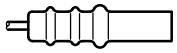
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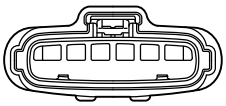
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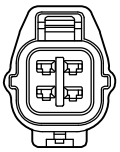
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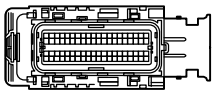
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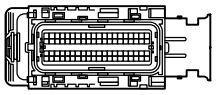
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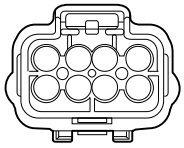
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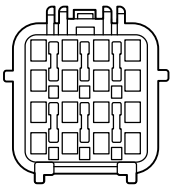
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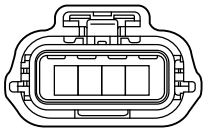
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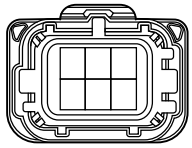
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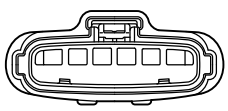
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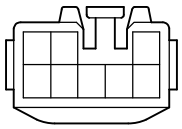
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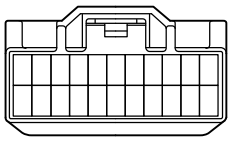
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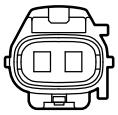
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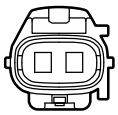
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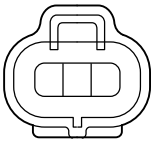
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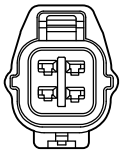
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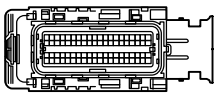
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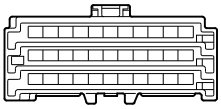
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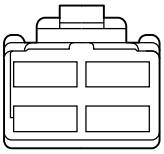
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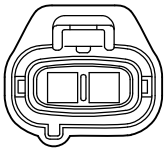
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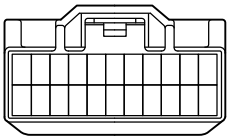
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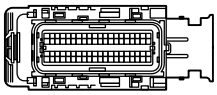
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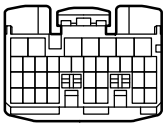
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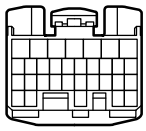
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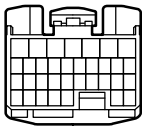
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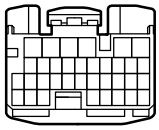
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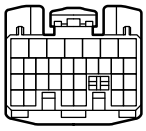
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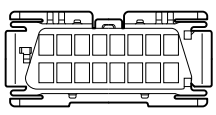
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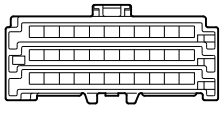
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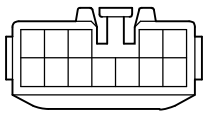
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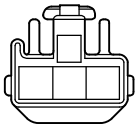
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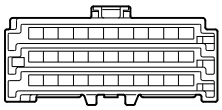
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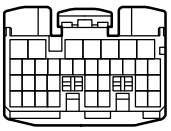
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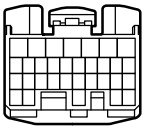
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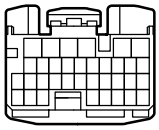
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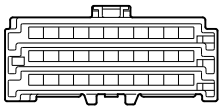
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Part No. : 82824-E0070



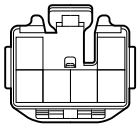
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Part No. : 82824-E0100



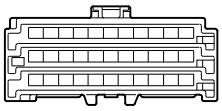
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Part No. : 82560-2430



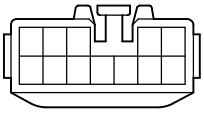
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Part No. : 82560-4120



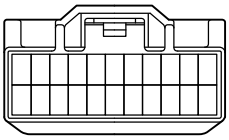
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Part No. : 82560-2430



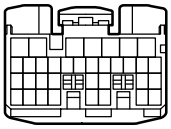
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Part No. : 82824-E0U90



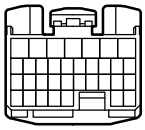
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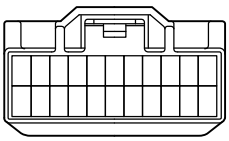
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Color : White
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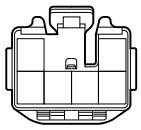
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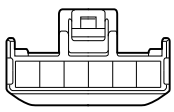
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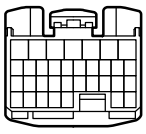
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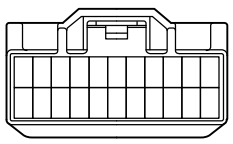
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Part No. : 82560-4080



Connector : AJ-1
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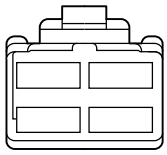
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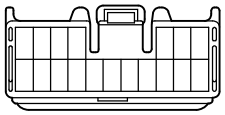
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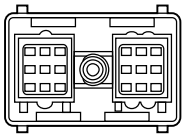
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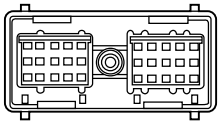
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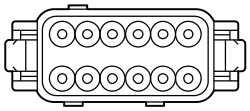
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Connector : AK-2
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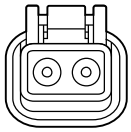
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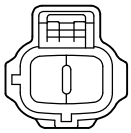
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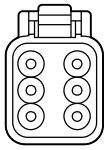
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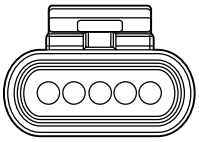
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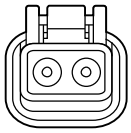
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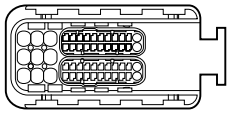
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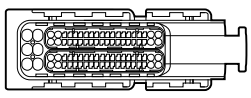
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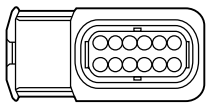
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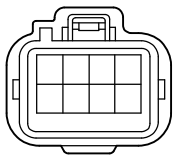
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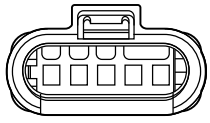
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Part No. : S8281-E0B50



Connector : AL-4
Color : Gray
Part No. : 82550-6040



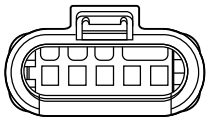
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Color : Black
Part No. : S8281-E0690



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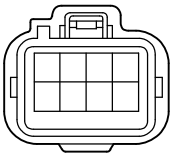
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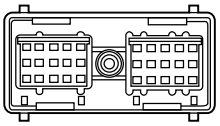
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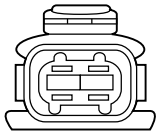
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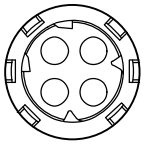
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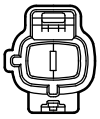
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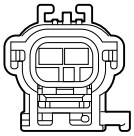
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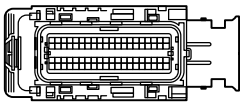
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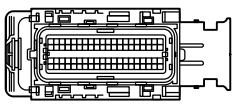
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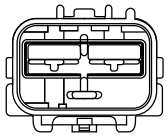
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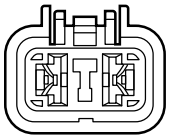
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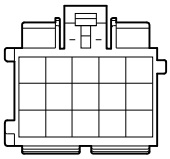
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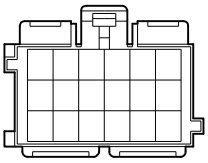
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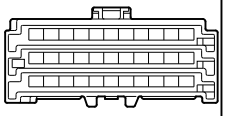
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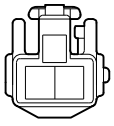
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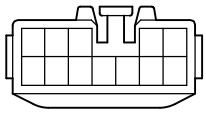
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Part No. : 82560-2430



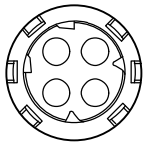
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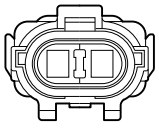
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Connector : AM-8
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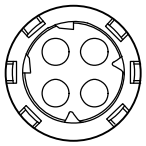
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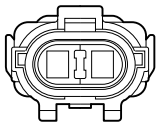
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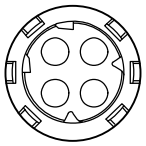
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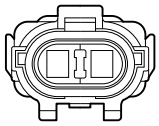
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Part No. : 82560-4720



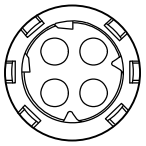
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Part No. : 82560-1340



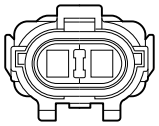
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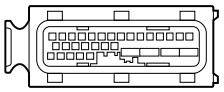
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Part No. : 82560-1340



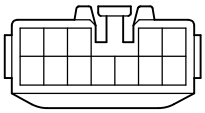
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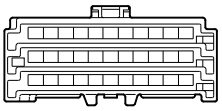
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Part No. : 82828-1560



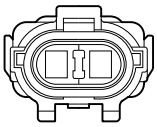
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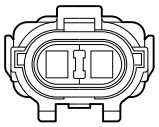
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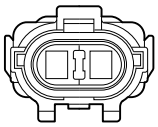
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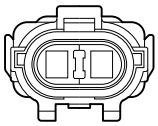
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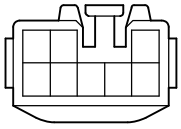
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Part No. : 82560-4720



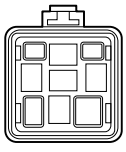
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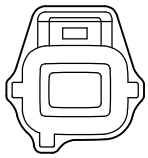
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Part No. : 82580-6870



Connector : AO-2
Color : Black
Part No. : 82828-1160



Connector : AO-3
Color : Black
Part No. : 82580-6730



Connector : AO-4
Color : Gray
Part No. : 82828-1170



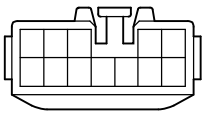
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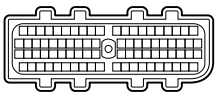
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Part No. : 82560-2530



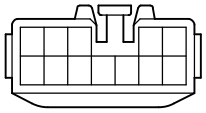
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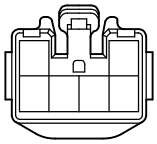
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Color : Black
Part No. : 82828-1570



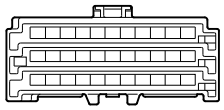
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Color : White
Part No. : 82580-8740



Connector : AQ-4
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Part No. : 82580-6060



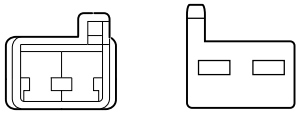
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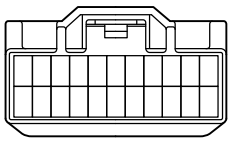
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Connector : AQ-6
Color : Black
Part No. : 82560-3800, 85902-1200



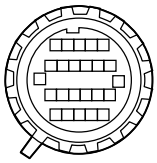
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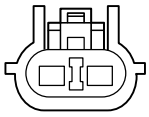
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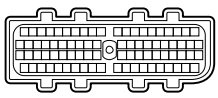
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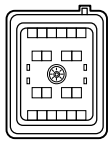
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Connector : AR-1
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Part No. : 82828-1570



Connector : AR-2
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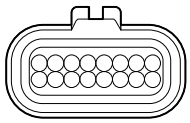
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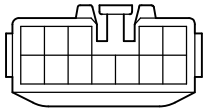
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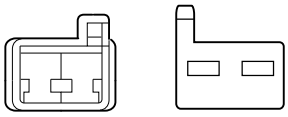
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Part No. : 82828-1600



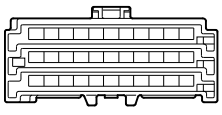
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Part No. : 82824-E0U90



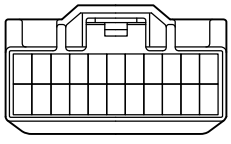
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Part No. : 82560-3800, 85902-1200



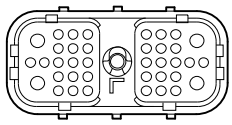
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Part No. : 82560-2430



Connector : AR-9
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Part No. : 82560-2470



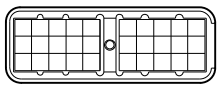
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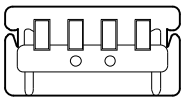
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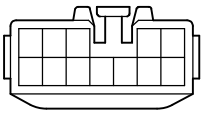
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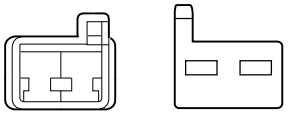
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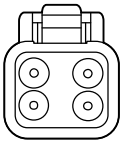
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Part No. : 82580-8740



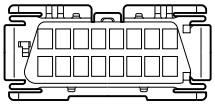
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Part No. : 82560-3800, 85902-1200



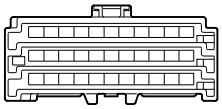
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Color : Gray
Part No. : S8281-E0A70



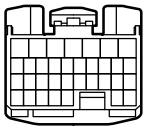
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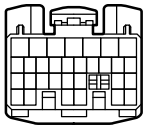
Connector : AT-2
Color : White
Part No. : 82560-2430



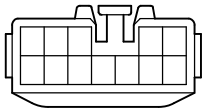
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Color : Black
Part No. : 82824-E0080



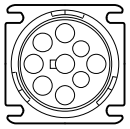
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Part No. : 82824-E0060



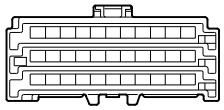
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Color : White
Part No. : 82824-E0U90



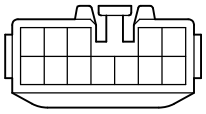
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Part No. : 82560-1920



Connector : AU-2
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Part No. : 82560-2430



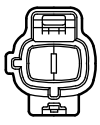
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Connector : AV-1
Color : Black
Part No. : 82560-3010



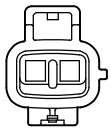
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Part No. : 82580-9250



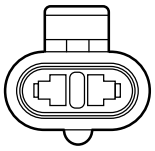
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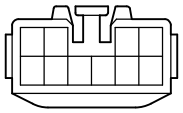
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Part No. : 82580-7170



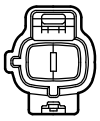
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Color : Black
Part No. : 82560-4660



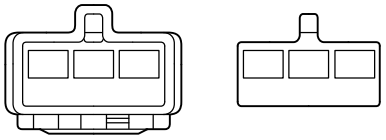
Connector : AX-1
Color : White
Part No. : 82580-7210



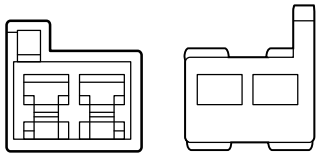
Connector : AX-4
Color : Blue
Part No. : 82580-9250



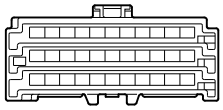
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Color : White
Part No. : 82560-4180 , 85902-1210



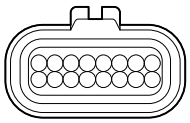
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Color : Gray
Part No. : 82580-4860, 85902-1100



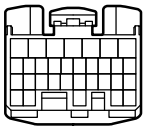
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Part No. : 82560-2430



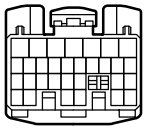
Connector : AY-1
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Part No. : 82828-1600



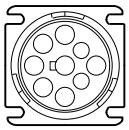
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Color : Black
Part No. : 82824-E0070



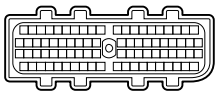
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Part No. : 82824-E0060



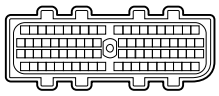
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Color : Black
Part No. : 82560-1920



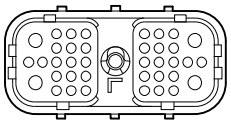
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Color : Black
Part No. : 82828-1570



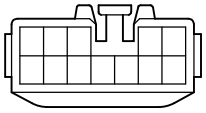
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Color : Black
Part No. : 82828-1570



Connector : AY-5
Color : Black
Part No. : S8281-E0610



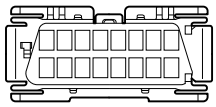
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Color : White
Part No. : 82824-E0U90



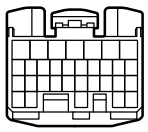
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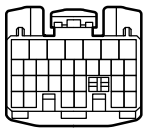
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Color : Black
Part No. : 82560-4320



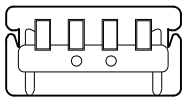
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Color : Black
Part No. : 82824-E0070



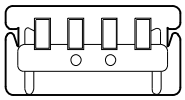
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Color : White
Part No. : 82824-E0060



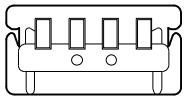
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Color : White
Part No. : 82550-1360



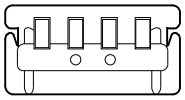
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Color : White
Part No. : 82550-1360



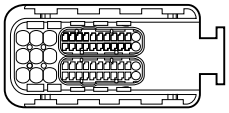
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Part No. : 82550-1360



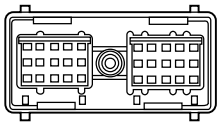
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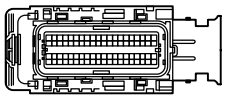
Connector : AZ-7
Color : Black
Part No. : S8281-E0A60



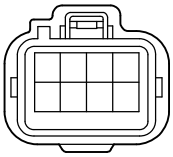
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Color : Black
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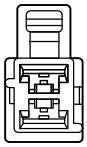
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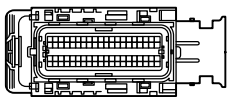
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Color : Gray
Part No. : 82580-6040



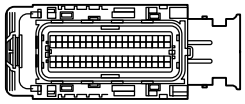
Connector : BA-1
Color : Blue
Part No. : 82560-1720



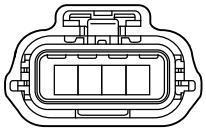
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Color : Blue
Part No. : S8281-E0420



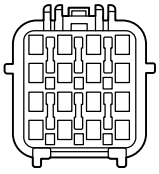
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Part No. : S8281-E0410



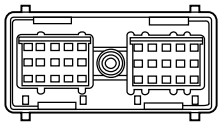
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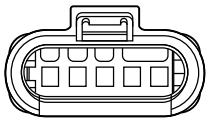
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Color : Black
Part No. : 82560-3560



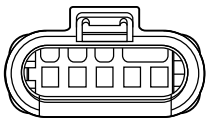
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Part No. : S8281-E0A90



Connector : BA-6
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Part No. : S8281-E0690



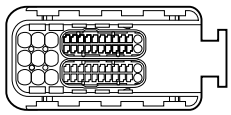
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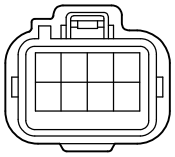
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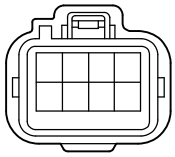
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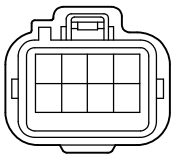
Connector : BA-9
Color : Gray
Part No. : 82580-6040



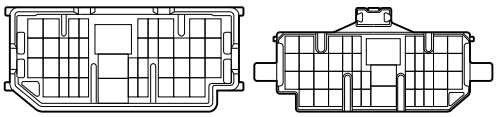
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Part No. : 82580-6040



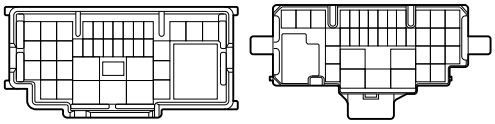
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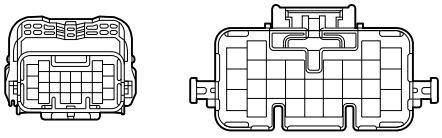
Connector : BC-1
Color : White
Parts No. : 82560-2110 , 82560-2120



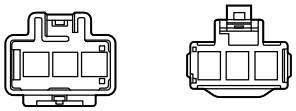
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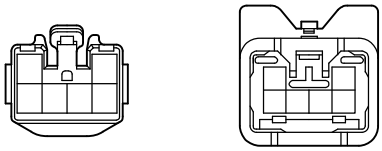
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Color : White
Parts No. : 82560-2070 , 82560-2080



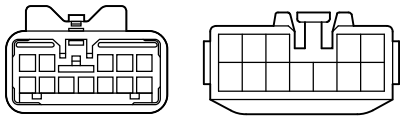
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Color : Black
Parts No. : 82580-9180, 82580-9190



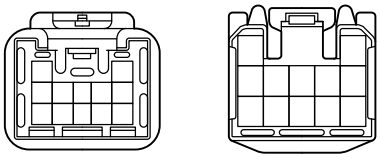
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Color : White
Parts No. : 82580-6050 , 82580-6060



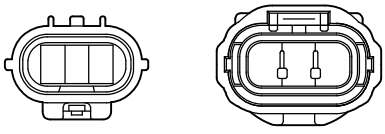
Connector : BC-6
Color : White
Parts No. : 82580-8730, 82580-8740



Connector : BC-7
Color : Orange
Parts No. : 82560-2610 , 82560-2620



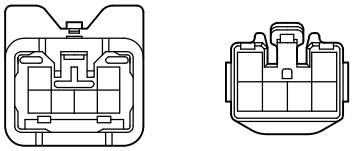
Connector : BC-8
Color : Gray
Parts No. : 82580-7140 , 82580-7130



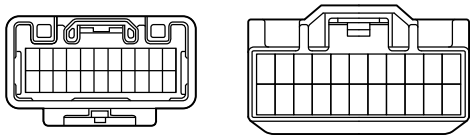
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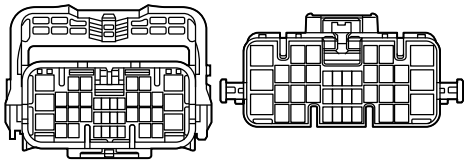
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Color : White
Parts No. : 82580-6060, 82580-6050



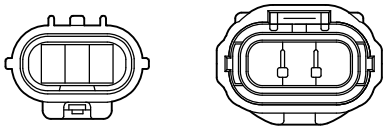
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Color : White
Parts No. : 82560-2460, 82560-2470



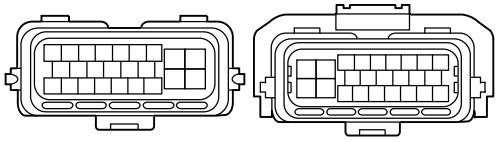
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Color : White
Parts No. : 82560-2150, 82824-E0D80



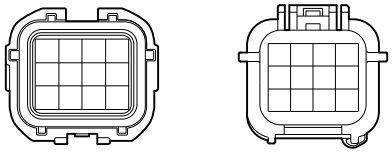
Connector : BC-12
Color : Black
Parts No. : 82580-7130 , 82580-7140



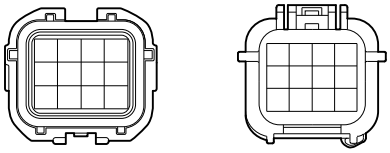
Connector : BC-13
Color : Black
Parts No. : 82560-1320 , 82560-1330



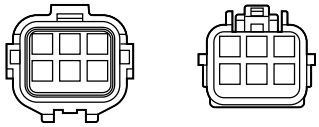
Connector : BC-14
Color : Black
Parts No. : 82560-3470 , 82560-3480



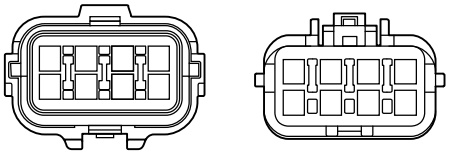
Connector : BC-15
Color : Black
Parts No. : 82560-3470 , 82560-3480



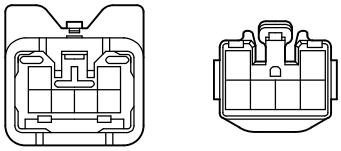
Connector : BC-16
Color : Black
Parts No. : 82560-3410, 82560-3420



Connector : BC-17
Color : Black
Parts No. : 82560-3450 , 82560-3460



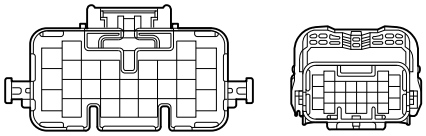
Connector : BC-18
Colors : Blue, White
Parts No. : 82580-6060, 82580-6050



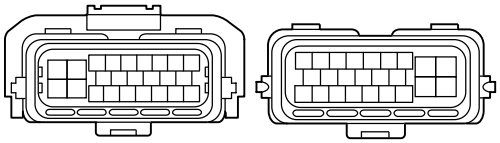
SAPH12Z160200244

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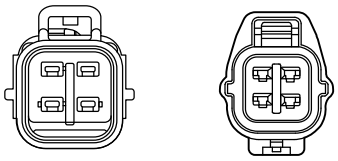
Connector : BC-19
Color : White, Gray
Parts No. : 82560-2080 , 82560-2070



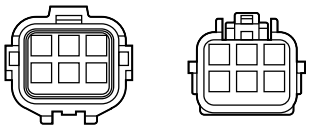
Connector : BC-20
Color : Black
Parts No. : 82560-1330 , 82560-1320



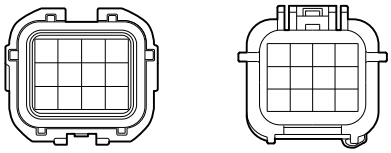
Connector : BC-21
Color : Gray
Part No. : 82560-1250, 82560-1260



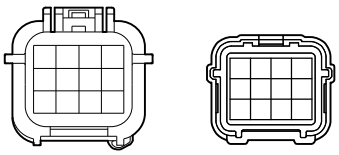
Connector : BC-22
Color : Black
Part No. : 82560-3410, 82560-3420



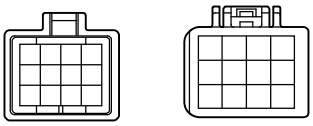
Connector : BC-23
Color : Black
Parts No. : 82560-3470 , 82560-3480



Connector : BC-24
Color : Gray, Dark gray
Part No. : 82560-3480, 82560-1200



Connector : BC-25
Color : Dark gray, Gray
Part No. : 82560-1200, 82560-7980



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BULK HEAD CONNECTOR BOX

EN12Z1602J100007

PIN	CONNECTOR NUMBER	PIN	CONNECTOR NUMBER	PIN	CONNECTOR NUMBER	PIN	CONNECTOR NUMBER	PIN	CONNECTOR NUMBER
11	#13	71	#9	1Y	#19	AH	#2	B7	#1
11	#14	72	#9	2G	#13	AJ	#2	B8	#1
12	#13	73	#9	2G	#14	AM	#2	B9	#1
12	#14	74	#9	6A	#6	AQ	#20	BA	#1
13	#13	79	#2	6B	#6	AR	#20	BB	#1
13	#14	81	#17	6C	#6	ASB	#19	BC	#1
15	#11	82	#17	6D	#7	ASC	#19	BD	#1
15	#13	83	#17	6E	#7	ASE	#19	BE	#1
15	#14	84	#17	6F	#7	ASE	#21	BF	#1
18	#13	85	#17	6G	#7	ASF	#19	BG	#1
18	#14	91	#2	6H	#7	ASF	#21	C1	#10
19	#13	92	#2	6J	#6	ASG	#19	CLV	#11
19	#14	93	#3	6L	#6	ASG	#21	CP	#20
21	#15	94	#3	6M	#6	ASH	#19	CQ	#20
22	#15	95	#3	6N	#6	ASH	#21	CR	#20
23	#15	96	#3	7A	#12	ASJ	#19	CS	#20
24	#15	97	#2	7B	#12	ASJ	#21	CT	#20
25	#15	1A	#13	7C	#12	ASK	#19	D1	#1
26	#15	1A	#14	A1	#2	ASK	#21	D2	#1
27	#15	1B	#13	A3	#1	ASL	#19	D3	#1
28	#15	1B	#14	A4	#2	ASL	#21	D4	#1
29	#15	1C	#13	A43	#23	ASM	#19	D5	#1
53	#8	1D	#13	A5	#1	ASM	#21	D7	#11
54	#8	1D	#19	A7	#11	AU	#20	DE	#11
55	#8	1E	#13	A8	#11	AV	#20	DH	#1
61	#7	1F	#13	AB	#2	AW	#20	DJ	#1
62	#5	1M	#13	AC	#1	AY	#2	DK	#1
63	#7	1N	#13	AD	#10	B1	#1	DL	#1
64	#5	1P	#13	AD	#23	B2	#1	DM	#11
65	#7	1T	#13	AE	#4	B3	#1	DN	#1
67	#6	1T	#14	AE2	#11	B4	#1	DN	#11
68	#6	1X	#13	AF	#2	B5	#1	DP	#1
69	#5	1Y	#13	AG	#2	B6	#1	E0M	#11

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PIN	CONNECTOR NUMBER	PIN	CONNECTOR NUMBER	PIN	CONNECTOR NUMBER	PIN	CONNECTOR NUMBER	PIN	CONNECTOR NUMBER
E1	#2	JB	#3	K62	#10	KSJ	#19	L75	#22
E2	#11	JC	#3	K6L	#11	KSJ	#20	L8	#2
E23	#22	K01	#11	K7Y	#24	KSK	#19	L9	#2
E2R	#10	K07	#11	K80	#24	KSK	#20	LA	#2
E2R	#23	K08	#11	K81	#24	KSN	#11	LB	#1
ERY	#10	K0B	#18	K82	#24	KSW	#11	LCG	#19
ERZ	#10	K0C	#18	K83	#24	KT3	#11	LCH	#22
F1	#1	K0G	#11	K84	#24	KTD	#22	LCJ	#11
F4	#1	K0H	#11	K85	#24	KTQ	#22	LCK	#19
F5	#3	K0L	#11	K86	#24	KTR	#22	LCL	#19
FB	#4	K0N	#19	K87	#24	KTS	#22	LCR	#10
FE	#3	K0U	#22	K88	#24	KTT	#22	LCR	#19
FM	#3	K0W	#22	K89	#24	KTU	#22	LCS	#10
FN	#3	K1	#16	K8A	#24	KU6	#11	LCT	#19
G0Q	#23	K1V	#18	K8Y	#10	KUF	#11	LCV	#11
G0Y	#23	K1W	#18	K8Z	#10	KUH	#19	LCX	#18
G1	#1	K1X	#11	K90	#10	KUQ	#19	LCY	#19
G3	#2	K2	#16	K91	#10	KV0	#11	LCY	#20
GR	#3	K3	#16	K92	#10	KVA	#19	LH	#2
GS	#3	K4	#16	K93	#10	KVQ	#10	LL1	#11
GT	#3	K42	#11	K96	#19	L1	#2	LL2	#19
GU	#20	K44	#11	K97	#19	L2	#2	LM0	#23
GV	#20	K44	#19	KBP	#11	L2H	#11	LM1	#23
GW	#20	K45	#11	KL1	#11	L2J	#11	LM2	#23
GX	#3	K45	#19	KR4	#19	K2P	#22	LM3	#23
H1	#2	K4C	#11	KRA	#18	K2Z	#23	LM4	#23
H2	#1	K4D	#11	KRF	#11	L3	#2	LM5	#23
H3	#1	K4F	#11	KRR	#10	L3U	#11	LM6	#23
H4	#1	K4S	#19	KRS	#10	L4	#2	LM7	#23
H5	#1	K5	#16	KS2	#11	L4E	#19	LM8	#23
J7	#3	K56	#11	KSE	#19	L5	#2	LMS	#23
J8	#3	K57	#11	KSE	#20	L6	#2	LMT	#23
J9	#3	K5Z	#10	KSF	#19	L6R	#10	LMU	#23
JA	#3	K6	#16	KSF	#20	L7	#2	LMV	#23

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PIN	CONNECTOR NUMBER	PIN	CONNECTOR NUMBER	PIN	CONNECTOR NUMBER	PIN	CONNECTOR NUMBER	PIN	CONNECTOR NUMBER
LMW	#23	MB	#3	PG	#1	R4	#11	SD	#19
LMX	#23	MC	#3	PH	#1	R5	#11	SF	#19
LMY	#23	MD	#3	Q1	#7	R6	#11	U3	#1
LMZ	#23	ME	#3	Q2	#7	R7	#11	U5	#1
M1	#2	MF	#3	Q3	#7	R8	#11	Y1	#18
M2	#2	MG	#3	Q4	#5	R9	#11	Y2	#18
M3	#2	MJ	#2	Q5	#5	S0Q	#19	Y3	#18
M6	#2	NIN	#11	Q6	#5	S1	#10	Y4	#18
M7	#2	NRF	#19	R1	#11	S3	#10	Y5	#18
M8	#2	PE	#2	R2	#11	S5	#19	Y6	#18
M9	#3	PF	#4	R3	#11	S7	#19	Z3	#23
MA	#3								

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CONNECTOR LIST

EN12Z1602J100008

Diagram symbol	Connector No.	Electrical equipment name	Wiring diagram listing page	Three-dimensional connector diagram (Position of connector) listing page
A	A-2	Starter switch	EL02-18	EL02-162
	A-10	Fuel filter heater sensor	EL02-18	EL02-169
B	B-1	J/C SIGNAL	EL02-24	EL02-163
	B-2	Clutch interlock switch	EL02-24	EL02-162
	B-3	U2 J/C No.2	EL02-24	EL02-163
	B-6	Starter	EL02-24	EL02-162
C	C-1	U2 J/C No.2	EL02-25	EL02-163
	C-3	J/C SIGNAL	EL02-25	EL02-163
	C-4	J/C G3	EL02-25	EL02-164
	C-7	Starter	EL02-25	EL02-162
D	D-1	GCU	EL02-28	EL02-162
	D-2	Glow plug No.1	EL02-28	EL02-162
	D-3	Glow plug No.2	EL02-28	EL02-162
	D-4	Glow plug No.3	EL02-28	EL02-162
	D-5	Glow plug No.4	EL02-28	EL02-162
E	E-1	Alternator	EL02-29	EL02-162
F	F-1	Van light switch	EL02-30	EL02-165
	F-2	Spare power source (Battery)	EL02-30	EL02-165
	F-3	Spare power source (Starter switch ON)	EL02-30	EL02-165
	F-4	U2 J/C No.2	EL02-31	EL02-163
	F-5	Van light connector	EL02-30	EL02-165
	F-6	Spare power source (Tail) 2	EL02-30	EL02-165
	F-7	Spare power source (Ignition chassis)	EL02-31	EL02-165
	F-8	Spare power source (Signal side turn)	EL02-31	EL02-165
G	G-1	Fog light switch	EL02-31	EL02-165
	G-2	Fog light power source	EL02-31	EL02-165
H	H-1	J/C EARTH	EL02-32	EL02-164
	H-2	U2 J/C No.1	EL02-32	EL02-163
	H-3	J/C EARTH 4P	EL02-33	EL02-164
I	I-1-1	Combination meter	EL02-36	EL02-166
	I-1-2	Combination meter	EL02-36	EL02-166

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Diagram symbol	Connector No.	Electrical equipment name	Wiring diagram listing page	Three-dimensional connector diagram (Position of connector) listing page
I	I-1-3	Combination meter	EL02-36	EL02-166
	I-2	Rheostat	EL02-36	EL02-166
	I-3	U2 J/C No.1	EL02-36	EL02-163
	I-4	J/C SIGNAL	EL02-36	EL02-163
	I-5	U2 J/C No.2	EL02-36	EL02-163
	I-6	Multi indicator switch	EL02-36	EL02-166
	I-7	Coolant warning relay	EL02-37	EL02-166
	I-8	Parking brake off diode (For center parking)	EL02-37	EL02-163
	I-11	Parking brake switch	EL02-37	EL02-166
	I-12	J/C EARTH 4P	EL02-37	EL02-164
J	J-1	Speed sensor (For HYDRO MAX brake and MTM)	EL02-40	EL02-169
	J-2	Speed sensor (For EATON AMT)	EL02-40	EL02-169
	J-3	Speed sensor (For full air brake and MTM)	EL02-40	EL02-169
	J-4	Air gauge sensor front (For full air brake)	EL02-40	EL02-169
	J-5	Air gauge sensor rear (For full air brake)	EL02-40	EL02-169
	J-6-1	Fuel sender (For standard chassis)	EL02-40	EL02-169
	J-6-2	Fuel sender (For clean chassis)	EL02-40	EL02-169
	J-7	Manual differential lock switch	EL02-40	EL02-169
	J-8	Manual differential lock magnetic valve	EL02-40	EL02-169
	J-9	Coolant level switch	EL02-41	EL02-169
	J-10	Fuel filter water level sensor	EL02-41	EL02-169
	J-11	Spring brake switch (For wheel parking)	EL02-41	EL02-167
	J-12	Low pressure switch No.1	EL02-41	EL02-169
	J-13	Low pressure switch No.2	EL02-41	EL02-169
	J-14	Buzzer off switch (For wheel parking)	EL02-41	EL02-167
K	K-4-1	Daytime running light ECU	EL02-44	EL02-167
	K-4-2	Daytime running light ECU	EL02-44	EL02-167
	K-6	Light and turn switch	EL02-44	EL02-167
	K-7	Head light RH	EL02-44	EL02-168
	K-8	Head light LH	EL02-44	EL02-168
	K-9	U2 J/C No.2	EL02-45	EL02-163
	K-10	Light and turn switch	EL02-45	EL02-167

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Diagram symbol	Connector No.	Electrical equipment name	Wiring diagram listing page	Three-dimensional connector diagram (Position of connector) listing page
K	K-11	Heater and light mirror RH	EL02-45	EL02-168
	K-12	Heater and light mirror LH	EL02-45	EL02-168
	K-13	Identification light LH	EL02-45	EL02-168
	K-14	Identification light center	EL02-45	EL02-168
	K-15	Identification light RH	EL02-45	EL02-168
	K-16	Roof clearance light LH	EL02-45	EL02-168
	K-17	Roof clearance light RH	EL02-45	EL02-168
	K-18	U2 J/C No.1	EL02-45	EL02-163
L	L-1	Stop and turn controller	EL02-48	EL02-170
	L-2	Wiper and retarder switch	EL02-48	EL02-170
	L-3	Light and turn switch	EL02-48	EL02-170
	L-4	U2 J/C No.2	EL02-48	EL02-162
	L-5	J/C EARTH	EL02-49	EL02-164
	L-6	Stop light relay	EL02-49	EL02-178
	L-7	U2 J/C No.1	EL02-48	EL02-163
	L-8-1	Stop light switch (Full air)	EL02-49	EL02-170
	L-8-2	Stop light switch (HYD)	EL02-49	EL02-170
	L-9	STP AT diode	EL02-49	EL02-174
	L-10	Rear combination light LH	EL02-48	EL02-170
	L-11	Side turn light LH (Fender)	EL02-48	EL02-170
	L-12	Front turn light LH	EL02-48	EL02-170
	L-13	Front turn light RH	EL02-48	EL02-170
	L-14	Side turn light RH (Fender)	EL02-48	EL02-170
	L-15	Rear combination light RH	EL02-49	EL02-170
	L-16	Back-up light switch	EL02-49	EL02-169
	L-17	Back-up buzzer	EL02-49	EL02-170
M	M-1	Dome light LH	EL02-52	EL02-171
	M-2	Dome light RH	EL02-52	EL02-171
	M-3	U2 J/C No.1	EL02-52	EL02-163
	M-4	Courtesy switch front LH	EL02-52	EL02-171
	M-5	Courtesy switch front RH	EL02-52	EL02-171
	M-6	Key-less entry controller	EL02-52	EL02-170

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Diagram symbol	Connector No.	Electrical equipment name	Wiring diagram listing page	Three-dimensional connector diagram (Position of connector) listing page
N	N-1	Washer pump motor	EL02-53	EL02-170
	N-2	Wiper relay	EL02-53	EL02-170
	N-3	Wiper motor	EL02-53	EL02-170
	N-4	Wiper and retarder switch	EL02-53	EL02-170
O	O-1	Mirror heater switch	EL02-54	EL02-166
	O-3	Heater and light mirror LH	EL02-54	EL02-168
	O-4	Heater and light mirror RH	EL02-54	EL02-168
P	P-1	Remote control mirror switch	EL02-55	EL02-165
	P-2	Remote control mirror LH	EL02-55	EL02-168
	P-3	Remote control mirror RH	EL02-55	EL02-168
Q	Q-2	Horn switch	EL02-56	EL02-171
	Q-3	Horn (Low)	EL02-56	EL02-173
	Q-4	Horn (High)	EL02-56	EL02-173
	Q-5	J/C G3	EL02-56	EL02-164
R	R-2	Air horn switch	EL02-57	EL02-166
	R-3	Air horn magnetic valve	EL02-57	EL02-173
	R-4	J/C EARTH 4P	EL02-57	EL02-164
S	S-1	Cigarette lighter	EL02-58	EL02-166
T	T-1	Driver seat master switch	EL02-59	EL02-172
	T-2	Passenger seat sub switch	EL02-59	EL02-172
	T-3	Power window motor (Driver seat)	EL02-59	EL02-172
	T-4	Power window motor (Passenger seat)	EL02-59	EL02-172
U	U-2	Key-less entry controller	EL02-60	EL02-170
	U-3	U2 J/C No.1	EL02-61	EL02-163
	U-4	Power door lock motor (Driver side)	EL02-61	EL02-172
	U-5	Power door lock motor (Passenger side)	EL02-60	EL02-172
	U-6	Power door lock controller	EL02-60	EL02-170
	U-7	Power door lock switch (Driver side)	EL02-61	EL02-172
V	V-2	Radio/Audio unit	EL02-62	EL02-172
	V-3	Front speaker LH	EL02-62	EL02-172
	V-4	Front speaker RH	EL02-62	EL02-172
	V-5	U2 J/C No.2	EL02-62	EL02-163
	V-6	U2 J/C No.1	EL02-62	EL02-163

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Diagram symbol	Connector No.	Electrical equipment name	Wiring diagram listing page	Three-dimensional connector diagram (Position of connector) listing page
W	W-2	Heater and cooler unit	EL02-64	EL02-173
	W-3	Blower motor	EL02-64	EL02-173
	W-4	Blower switch	EL02-64	EL02-173
	W-5	Air conditioner switch	EL02-65	EL02-173
	W-7	Pressure switch	EL02-65	EL02-173
	W-8	Compressor	EL02-65	EL02-175
	W-9	U2 J/C No.2	EL02-64	EL02-163
X	X-1	U2 J/C No.1	EL02-66	EL02-163
	X-2	Accelerator sensor	EL02-66	EL02-174
	X-3	U2 J/C No.2	EL02-66	EL02-163
Y	Y-8-1	U2 ECU (Engine side)	EL02-70	EL02-174
	Y-8-2	U2 ECU (Vehicle side)	EL02-70	EL02-174
	Y-9	Oil pressure switch	EL02-70	EL02-175
	Y-10	Injector 6	EL02-70	EL02-176
	Y-11	Injector 5	EL02-70	EL02-176
	Y-12	Injector 4	EL02-70	EL02-176
	Y-13	Injector 3	EL02-70	EL02-176
	Y-14	Injector 2	EL02-70	EL02-176
	Y-15	Injector 1	EL02-70	EL02-176
	Y-16	Suction control valve	EL02-70	EL02-175
	Y-17	Cylinder angle sensor	EL02-70	EL02-175
	Y-18	NE sensor	EL02-70	EL02-175
	Y-19	Water temperature sender	EL02-70	EL02-175
	Y-20	Fuel temperature sensor	EL02-70	EL02-175
	Y-21	PC sensor	EL02-71	EL02-175
	Y-22	Intake manifold temperature sensor	EL02-71	EL02-175
	Y-23	Boost sensor	EL02-71	EL02-175
	Y-24	Intercooler exit temperature sensor	EL02-71	EL02-175
	Y-25	EGR exit temperature sensor	EL02-71	EL02-175
	Y-26	Air flow sensor	EL02-71	EL02-175
Z	Z-1	J/C SIGNAL	EL02-74	EL02-163
	Z-2	Neutral switch	EL02-74	EL02-177

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Diagram symbol	Connector No.	Electrical equipment name	Wiring diagram listing page	Three-dimensional connector diagram (Position of connector) listing page
Z	Z-3	Exhaust brake magnetic valve	EL02-74	EL02-163
	Z-4-1	U2 ECU (Engine side)	EL02-74	EL02-174
	Z-4-2	U2 ECU (Vehicle side)	EL02-74	EL02-174
AA	AA-1-1	U2 ECU (Engine side)	EL02-76	EL02-174
	AA-1-2	U2 ECU (Vehicle side)	EL02-76	EL02-174
	AA-2	Exhaust brake magnetic valve	EL02-76	EL02-163
	AA-3	U2 J/C No.2	EL02-77	EL02-163
AB	AB-1-1	U2 ECU (Engine side)	EL02-80	EL02-174
	AB-1-2	U2 ECU (Vehicle side)	EL02-80	EL02-174
	AB-2	Exhaust brake magnetic valve	EL02-80	EL02-163
	AB-4	Fuel cut 4P JP	EL02-80	EL02-162
	AB-5	Fuel cut dummy diode	EL02-80	EL02-162
	AB-7	J/C G4	EL02-80	EL02-164
AC	AC-1	P.T.O. switch 1	EL02-82	EL02-165
	AC-2	P.T.O. switch 2	EL02-82	EL02-165
	AC-3	P.T.O. cut relay	EL02-82	EL02-165
	AC-4	Engine stop switch	EL02-82	EL02-165
	AC-5	Accelerator sensor	EL02-82	EL02-174
	AC-6	P.T.O. accelerator sensor	EL02-82	EL02-165
	AC-7	U2 ECU (Vehicle side)	EL02-82	EL02-174
AD	AD-1	U2 ECU (Engine side)	EL02-84	EL02-174
	AD-2	VNT actuator	EL02-84	EL02-175
	AD-3	VNT controller	EL02-84	EL02-175
	AD-4	EGR controller	EL02-84	EL02-175
	AD-5	PC sensor	EL02-85	EL02-175
	AD-6	Diesel throttle	EL02-85	EL02-175
AE	AE-1	DPR refresh switch	EL02-88	EL02-166
	AE-2	J/C SIGNAL	EL02-88	EL02-163
	AE-3	Exhaust gas temperature sensor 1	EL02-88	EL02-179
	AE-4	Exhaust gas temperature sensor 3	EL02-88	EL02-179
	AE-5	Exhaust gas pressure sensor	EL02-88	EL02-179
	AE-6	P.T.O. accelerator sensor	EL02-88	EL02-165
	AE-7	U2 ECU (Vehicle side)	EL02-88	EL02-174

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Diagram symbol	Connector No.	Electrical equipment name	Wiring diagram listing page	Three-dimensional connector diagram (Position of connector) listing page
AE	AE-8	U2 J/C No.2	EL02-88	EL02-163
AF	AF-1	Brake switch (NC) (HYDRO MAX)	EL02-90	EL02-170
	AF-2	Brake switch (NC) (Full air)	EL02-90	EL02-167
	AF-3	J/C SIGNAL	EL02-90	EL02-163
	AF-4	U2 ECU (Vehicle side)	EL02-90	EL02-174
AG	AG-1-1	Vehicle control ECU	EL02-92	EL02-178
	AG-1-2	Vehicle control ECU	EL02-92	EL02-178
	AG-1-3	Vehicle control ECU	EL02-92	EL02-178
	AG-1-4	Vehicle control ECU	EL02-92	EL02-178
	AG-1-5	Vehicle control ECU	EL02-92	EL02-178
	AG-2	Diagnosis connector (16P)	EL02-92	EL02-178
	AG-5	U2 J/C No.1	EL02-92	EL02-163
	AG-6	J/C G4	EL02-92	EL02-164
	AG-7	Idling volume	EL02-92	EL02-176
	AG-8	U2 J/C No.2	EL02-93	EL02-163
AH	AH-1-1	Vehicle control ECU	EL02-96	EL02-178
	AH-1-2	Vehicle control ECU	EL02-96	EL02-178
	AH-1-3	Vehicle control ECU	EL02-96	EL02-178
	AH-2	U2 J/C No.2	EL02-96	EL02-163
	AH-4	Economy running switch	EL02-97	EL02-166
	AH-5	U2 J/C No.1	EL02-97	EL02-163
	AH-6	J/C EARTH	EL02-97	EL02-164
	AH-7	J/C SIGNAL	EL02-96	EL02-163
AI	AI-1-1	Vehicle control ECU	EL02-100	EL02-178
	AI-1-2	Vehicle control ECU	EL02-100	EL02-178
	AI-3	J/C SIGNAL	EL02-100	EL02-163
	AI-4	Set/resume switch	EL02-100	EL02-166
	AI-5	Auto cruising switch	EL02-100	EL02-166
AJ	AJ-1	VCS ECU	EL02-102	EL02-178
	AJ-4	J/C SIGNAL	EL02-102	EL02-163
	AJ-5	Exhaust clutch switch	EL02-102	EL02-177
	AJ-6	Wiper and retarder switch	EL02-102	EL02-170
AK	AK-1	BCU 18P	EL02-104	EL02-179

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Diagram symbol	Connector No.	Electrical equipment name	Wiring diagram listing page	Three-dimensional connector diagram (Position of connector) listing page
AK	AK-2	BCU 30P	EL02-105	EL02-179
	AK-3	Atomization module 2	EL02-104	EL02-179
	AK-4	Exhaust temperature sensor	EL02-105	EL02-179
	AK-5	Fuel pump	EL02-105	EL02-179
	AK-6	Fuel pump 2	EL02-105	EL02-179
	AK-7	Atomization module	EL02-105	EL02-179
	AK-8	DPR intake temperature sensor	EL02-104	EL02-179
	AK-9	Flame temperature sensor	EL02-104	EL02-179
	AK-10	Ignition coil	EL02-105	EL02-179
	AK-11	Combustion air valve	EL02-105	EL02-179
AL	AL-1	DCU 53P	EL02-108	EL02-179
	AL-2	DCU 86P	EL02-109	EL02-179
	AL-3	Supply module	EL02-109	EL02-179
	AL-4	U2 CAN J/C No.3	EL02-108	EL02-179
	AL-5	NOx sensor 1	EL02-108	EL02-179
	AL-6	NOx sensor 2	EL02-108	EL02-179
	AL-7	Ambient temperature sensor	EL02-109	EL02-179
	AL-8	U2 CAN J/C No.1	EL02-108	EL02-179
	AL-9	BCU 30P	EL02-108	EL02-179
	AL-10	Dosing module	EL02-109	EL02-179
	AL-11	Urea sensor	EL02-109	EL02-179
	AL-12	Coolant cut off valve	EL02-109	EL02-179
	AL-13	SCR front temperature sensor	EL02-109	EL02-179
	AL-14	U2 ECU (Vehicle side)	EL02-108	EL02-174
	AL-15	U2 ECU (Engine side)	EL02-108	EL02-174
AM	AM-1	ABS ECU E	EL02-112	EL02-178
	AM-2	ABS ECU F	EL02-113	EL02-178
	AM-5	U2 J/C No.1	EL02-112	EL02-163
	AM-6	ABS diagnosis switch	EL02-112	EL02-178
	AM-7	J/C EARTH	EL02-112	EL02-164
	AM-8	Modulator front LH	EL02-113	EL02-180
	AM-9	ABS sensor front LH	EL02-113	EL02-180
	AM-10	Modulator front RH	EL02-113	EL02-180

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Diagram symbol	Connector No.	Electrical equipment name	Wiring diagram listing page	Three-dimensional connector diagram (Position of connector) listing page
AM	AM-11	ABS sensor front RH	EL02-113	EL02-180
	AM-12	Modulator rear LH	EL02-113	EL02-180
	AM-13	ABS sensor rear LH	EL02-113	EL02-180
	AM-14	Modulator rear RH	EL02-113	EL02-180
	AM-15	ABS sensor rear RH	EL02-113	EL02-180
AN	AN-1	ABS HYDRO MAX unit with ECU	EL02-116	EL02-181
	AN-3	J/C EARTH	EL02-116	EL02-164
	AN-4	U2 J/C No.1	EL02-116	EL02-163
	AN-7	ABS sensor front LH	EL02-117	EL02-180
	AN-8	ABS sensor front RH	EL02-117	EL02-180
	AN-9	ABS sensor rear LH	EL02-117	EL02-180
	AN-10	ABS sensor rear RH	EL02-117	EL02-180
AO	AO-1	Monitor module	EL02-118	EL02-181
	AO-2	Motor relay	EL02-118	EL02-182
	AO-3	Motor pump	EL02-118	EL02-182
	AO-4	Flow switch	EL02-118	EL02-182
	AO-5	Differential switch	EL02-118	EL02-182
	AO-6	J/C EARTH	EL02-118	EL02-164
AQ	AQ-1	ALLISON 2000 ATM ECU	EL02-124	EL02-183
	AQ-3	J/C G3	EL02-124	EL02-164
	AQ-4	ATM mode switch	EL02-124	EL02-184
	AQ-5	U2 J/C No.1	EL02-124	EL02-163
	AQ-6	STP AT diode	EL02-124	EL02-174
	AQ-7	J/C SIGNAL	EL02-125	EL02-163
	AQ-8	Turbine speed sensor	EL02-124	EL02-183
	AQ-9	Main transmission	EL02-124	EL02-183
	AQ-10	Output speed sensor	EL02-125	EL02-183
	AQ-11	Engine speed sensor	EL02-125	EL02-183
AR	AR-1	ALLISON 3000RDS ATM ECU	EL02-126	EL02-184
	AR-2	Transmission MAIN TRANS	EL02-126	EL02-184
	AR-3	Output speed sensor	EL02-126	EL02-184
	AR-4	Engine speed sensor	EL02-127	EL02-184
	AR-5	Selector	EL02-126	EL02-185

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Diagram symbol	Connector No.	Electrical equipment name	Wiring diagram listing page	Three-dimensional connector diagram (Position of connector) listing page
AR	AR-6	J/C EARTH	EL02-126	EL02-164
	AR-7	STP AT diode	EL02-126	EL02-174
	AR-8	U2 J/C No.1	EL02-126	EL02-163
	AR-9	J/C SIGNAL	EL02-127	EL02-163
AS	AS-1	EATON AMT ECU	EL02-130	EL02-185
	AS-2	Button selector	EL02-131	EL02-185
	AS-4	Fuel cut 4P JP	EL02-131	EL02-162
	AS-5	J/C G4	EL02-131	EL02-164
	AS-6	Fuel cut dummy diode	EL02-131	EL02-162
	AS-8	Parking pawl sensor	EL02-130	EL02-185
AT	AT-1	Diagnosis connector (16P)	EL02-134	EL02-178
	AT-2	U2 J/C No.2	EL02-134	EL02-163
	AT-3-1	Vehicle control ECU	EL02-134	EL02-178
	AT-3-2	Vehicle control ECU	EL02-134	EL02-178
	AT-4	J/C EARTH	EL02-134	EL02-164
AU	AU-1	Diagnosis connector (9P)	EL02-136	EL02-178
	AU-2	U2 J/C No.2	EL02-136	EL02-163
	AU-3	J/C EARTH	EL02-136	EL02-164
AV	AV-1	Differential lock switch	EL02-137	EL02-165
AV	AV-2	Manual differential lock magnetic valve	EL02-137	EL02-169
AW	AW-1-1	Air dryer (HYD)	EL02-138	EL02-186
	AW-1-2	Air dryer (Full air)	EL02-138	EL02-186
AX	AX-1	Air suspension dump switch	EL02-139	EL02-166
	AX-4	Air suspension dump magnetic valve	EL02-139	EL02-167
	AX-5	Air suspension dump diode No.2	EL02-139	EL02-162
	AX-6	Air suspension dump diode No.1	EL02-139	EL02-162
	AX-7	U2 J/C No.2	EL02-139	EL02-163
AY	AY-1	Selector	EL02-140	EL02-185
	AY-2-1	Vehicle control ECU	EL02-140	EL02-178
	AY-2-2	Vehicle control ECU	EL02-140	EL02-178
	AY-3	Diagnosis connector (9P)	EL02-140	EL02-178
	AY-4-1	ALLISON 2000 ATM ECU	EL02-140	EL02-183
	AY-4-2	ALLISON 3000RDS ATM ECU	EL02-140	EL02-184

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Diagram symbol	Connector No.	Electrical equipment name	Wiring diagram listing page	Three-dimensional connector diagram (Position of connector) listing page
AY	AY-5	EATON AMT ECU	EL02-140	EL02-185
	AY-6	CAN J/C	EL02-140	EL02-174
AZ	AZ-1	Diagnosis connector (16P)	EL02-142	EL02-178
	AZ-2-1	Vehicle control ECU	EL02-143	EL02-178
	AZ-2-2	Vehicle control ECU	EL02-143	EL02-178
	AZ-3	CAN J/C 2 High	EL02-143	EL02-163
	AZ-4	CAN J/C 2 Low	EL02-143	EL02-163
	AZ-5	CAN J/C 3 High	EL02-143	EL02-164
	AZ-6	CAN J/C 3 Low	EL02-143	EL02-164
	AZ-7	DCU 53P	EL02-142	EL02-179
	AZ-8	BCU 30P	EL02-142	EL02-179
	AZ-9	U2 ECU (Vehicle side)	EL02-143	EL02-174
	AZ-10	No.30 J/C	EL02-143	EL02-175
BA	BA-1	CAN TMN6	EL02-146	EL02-163
	BA-2-1	U2 ECU (Engine side)	EL02-146	EL02-174
	BA-2-2	U2 ECU (Vehicle side)	EL02-146	EL02-174
	BA-3	EGR controller	EL02-146	EL02-175
	BA-4	VNT controller	EL02-146	EL02-175
	BA-5	BCU 30P	EL02-147	EL02-179
BA	BA-6	NOx sensor 1	EL02-147	EL02-179
	BA-7	NOx sensor 2	EL02-147	EL02-179
	BA-8	DCU 53P	EL02-147	EL02-179
	BA-9	No.29 J/C	EL02-146	EL02-175
	BA-10	U2 CAN J/C No.1	EL02-147	EL02-179
	BA-11	U2 CAN J/C No.3	EL02-147	EL02-179
BB	BB-1	Telematics conector	EL02-150	EL02-178
BD	BD-1	Plug heater	EL02-152	EL02-176
	BD-2	Outlet cord	EL02-152	EL02-176

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BRAKE CONTROL (ABS : HYDRAULIC) (E VERSION)

DN03-001

ABS DN03-2
TROUBLESHOOTING DN03-2

S1-UNAE09A-2.book 2 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

ABS

TROUBLESHOOTING

EN1680103H500001

BEFORE YOU BEGIN

This manual provides maintenance and service instructions for Meritor WABCO's hydraulic ABS for medium-duty trucks, buses and motor home chassis. Before you begin procedures:

1. Read and understand all instructions and procedures before you begin to service components.
2. Read and observe all Caution and Warning safety alerts that precede instructions or procedures you will perform. These alerts help to avoid damage to components, serious personal injury, or both.
3. Follow your company's maintenance and service, installation, and diagnostics guidelines.
4. Use special tools when required to help avoid serious personal injury and damage to components.

1. SAFETY ALERTS, TORQUE SYMBOL AND NOTES

⚠ **WARNING**	A Warning alerts you to an instruction or procedure that you must follow exactly to avoid serious personal injury and damage to components.
⚠ **CAUTION**	A Caution alerts you to an instruction or procedure that you must follow exactly to avoid damage to components and possible serious injury.
NOTICE	A Note provides information or suggestions that help you correctly service a component.

2. ACCESS INFORMATION ON ARVINMERITOR'S WEB SITE

Additional maintenance and service information for ArvinMeritor's commercial vehicle systems component lineup is also available at www.arvinmeritor.com.

To access information, click on Products & Services/Tech Library Icon/HVS Publications. The screen will display an index of publications by type.

S1-UNAE09A-2.book 3 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

Hazard Summary

Because some brake linings contain asbestos, workers who service brakes must understand the potential hazards of asbestos and precautions for reducing risks. Exposure to airborne asbestos dust can cause serious and possibly fatal diseases, including asbestosis (a chronic lung disease) and cancer, principally lung cancer and mesothelioma (a cancer of the lining of the chest or abdominal cavities). Some studies show that the risk of lung cancer among persons who smoke and who are exposed to asbestos is much greater than the risk for non-smokers. Symptoms of these diseases may not become apparent for 15, 20 or more years after the first exposure to asbestos.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons. OSHA has set a maximum allowable level of exposure for asbestos of 0.1 f/cc as an 8-hour time-weighted average and 1.0 f/cc averaged over a 30-minute period. Scientists disagree, however, to what extent adherence to the maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling asbestos dust. OSHA requires that the following sign be posted at the entrance to areas where exposures exceed either of the maximum allowable levels:

DANGER: ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA.

2. Respiratory Protection. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA for use with asbestos at all times when servicing brakes, beginning with the removal of the wheels.

3. Procedures for Servicing Brakes.

a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.

b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

c. If an enclosed vacuum system or brake washing equipment is not available, employers may adopt their own written procedures for servicing brakes, provided that the exposure levels associated with the employer's procedures do not exceed the levels associated with the enclosed vacuum system or brake washing equipment. Consult OSHA regulations for more details.

d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.

e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.

4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.

5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.

6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

NON-ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to non-asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

Hazard Summary

Most recently manufactured brake linings do not contain asbestos fibers. These brake linings may contain one or more of a variety of ingredients, including glass fibers, mineral wool, aramid fibers, ceramic fibers and silica that can present health risks if inhaled. Scientists disagree on the extent of the risks from exposure to these substances. Nonetheless, exposure to silica dust can cause silicosis, a non-cancerous lung disease. Silicosis gradually reduces lung capacity and efficiency and can result in serious breathing difficulty. Some scientists believe other types of non-asbestos fibers, when inhaled, can cause similar diseases of the lung. In addition, silica dust and ceramic fiber dust are known to the State of California to cause lung cancer. U.S. and international agencies have also determined that dust from mineral wool, ceramic fibers and silica are potential causes of cancer.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to non-asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons.

2. Respiratory Protection. OSHA has set a maximum allowable level of exposure for silica of 0.1 mg/m^3 as an 8-hour time-weighted average. Some manufacturers of non-asbestos brake linings recommend that exposures to other ingredients found in non-asbestos brake linings be kept below 1.0 f/cc as an 8-hour time-weighted average. Scientists disagree, however, to what extent adherence to these maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling non-asbestos dust.

Therefore, wear respiratory protection at all times during brake servicing, beginning with the removal of the wheels. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA, if the exposure levels may exceed OSHA or manufacturer's recommended maximum levels. Even when exposures are expected to be within the maximum allowable levels, wearing such a respirator at all times during brake servicing will help minimize exposure.

3. Procedures for Servicing Brakes.

a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.

b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

c. If an enclosed vacuum system or brake washing equipment is not available, carefully clean the brake parts in the open air. Wet the parts with a solution applied with a pump-spray bottle that creates a fine mist. Use a solution containing water, and, if available, a biodegradable, non-phosphate, water-based detergent. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.

e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.

4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA, to minimize exposure. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.

5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.

6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

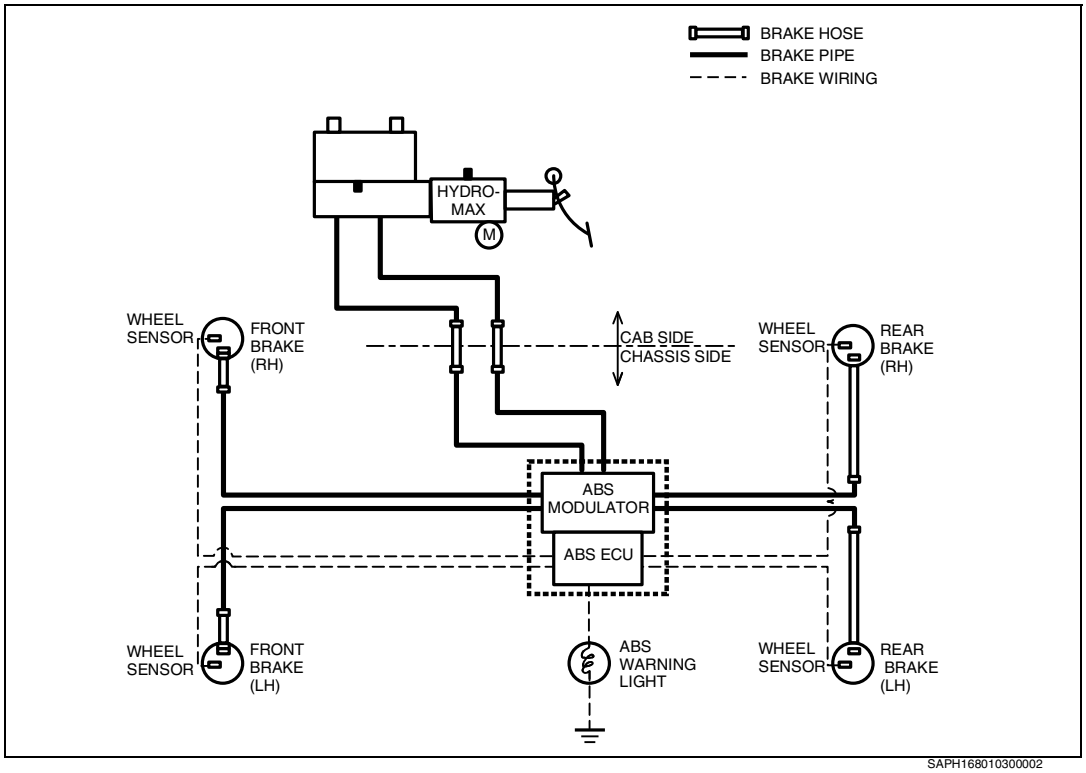
References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

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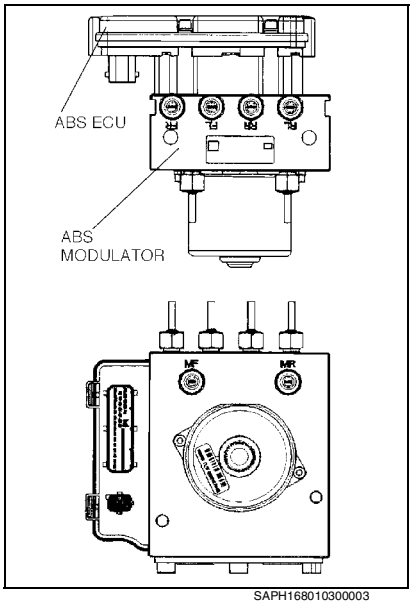
SYSTEM LAYOUT

A typical Meritor WABCO Hydraulic ABS is illustrated below.



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S1-UNAE09A-2.book 5 ページ ２０１１年１０月２７日 木曜日 午後５時２１分



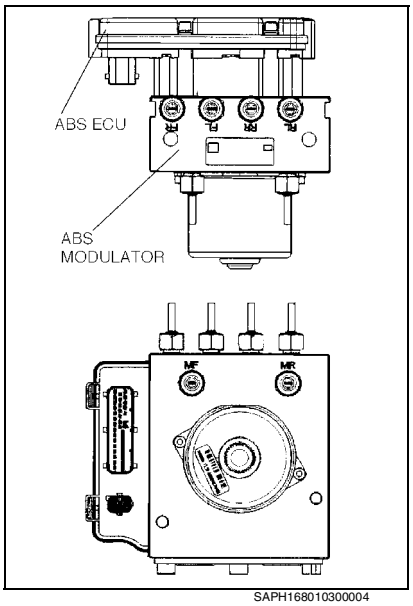
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SYSTEM COMPONENTS

The following components make up the Meritor WABCO Hydraulic ABS.

ELECTRONIC CONTROL UNIT (ECU)

- Processes sensor signals and generates solenoid valve commands to reduce, maintain or reapply brake pressure.
- This ECU is integrated with the ABS modulator.

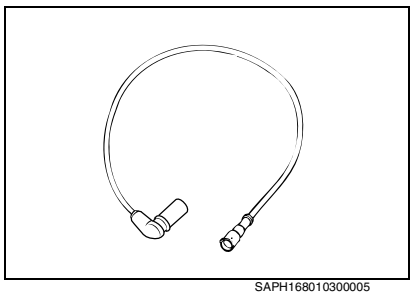


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MODULATOR ASSEMBLY

- Houses the ABS solenoid control valves (one inlet valve and one outlet valve per wheel), a pump motor and two accumulators.
- Contains brake fluid and must be handled with appropriate care. It should not be exposed to impact loads, excessive vibrations or compressed air blown into the hydraulic ports.

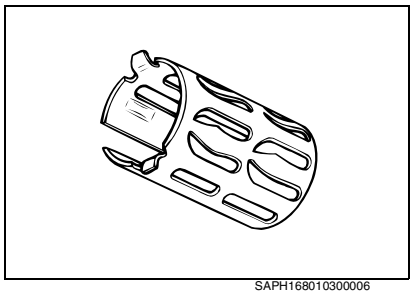
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SENSOR WITH MOLDED SOCKET

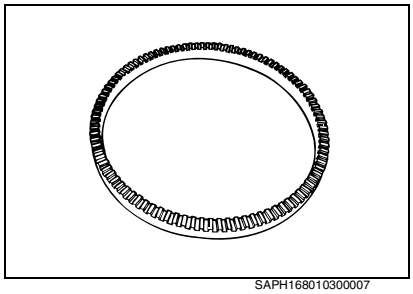
- Measures the speed of a tooth wheel rotating with the vehicle wheel.
- Produces an output voltage proportional to wheel speed.



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SENSOR SPRING CLIP

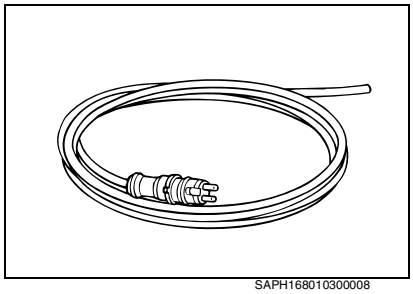
- Holds the wheel speed sensor in close proximity to the tooth wheel.



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TOOTH WHEEL

- A machined or stamped ring mounted to a machined surface on the hub of each ABS-monitored wheel.

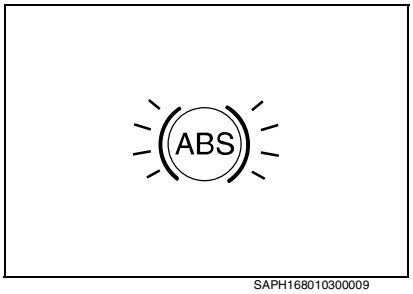


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SENSOR EXTENSION CABLES

- Two-wire cable with molded-on connector.
- Connects the wheel speed sensor to the ECU.

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ABS INDICATOR LIGHT

- Located on vehicle dash.
- Alerts drivers to a possible system fault.
- ABS indicator light is not provided by Meritor WABCO.

GENERAL INFORMATION

There is no regularly scheduled maintenance required for Meritor WABCO E Version Hydraulic ABS. However, ABS does not change current vehicle maintenance requirements. For example, it is important that the vehicle brake fluid level be correctly maintained.

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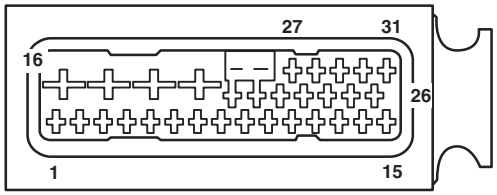
SYSTEM WIRING INFORMATION

NOTICE

Wiring may vary, according to the vehicle. Refer to the vehicle specifications for specific wiring diagrams. A typical Meritor WABCO 4S/4M Hydraulic ABS wiring diagram.

1. PIN NUMBERS AND LOCATIONS

(1) PIN IDENTIFICATION FOR WIRE HARNESS CONNECTORS TO THE ECU



(9511)

Count from the pin number at the end of each row, identify pin assembly to measure. Connector view shows the back of the connector.

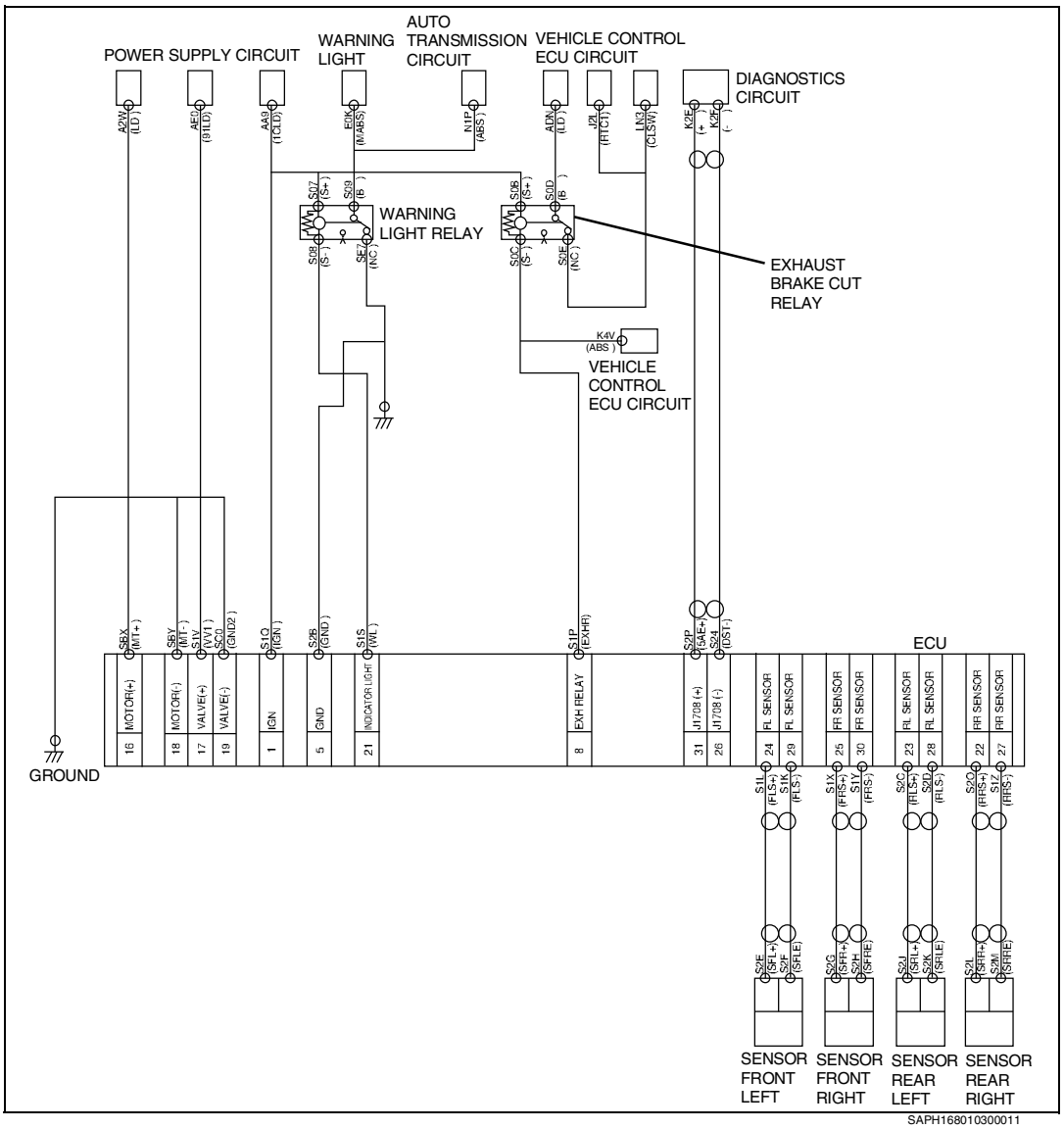
Pin #	Circuit Label
1	Ignition 12v
2	3rd Brake Relay (optional)
3	Not Used
4	Not Used
5	Not Used
6	Reference Ground
7	Not Used
8	Not Used
9	Not Used
10	Not Used
11	Not Used
12	Not Used
13	Not Used
14	J1939 + High - (optional)
15	J1939 - Low - (optional)

Pin #	Circuit Label
16	Pump Motor Supply 12v+
17	Solenoid Valve Supply 12v+
18	Pump Motor Ground -Gnd
19	Solenoid Valve Ground -Gnd
20	Not used
21	ABS Warning Light Relay
22	Rear Right Wheel Speed Sensor
23	Rear Left Wheel Speed Sensor
24	Front Left Wheel Speed Sensor
25	Front Right Wheel Speed Sensor
26	J1587 Diag. B + LOW
27	Rear Right Wheel Speed Sensor
28	Rear Left Wheel Speed Sensor
29	Front Left Wheel Speed Sensor
30	Front Right Wheel Speed Sensor
31	J1587 Diag. A + High

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2. E VERSION HYDRAULIC ABS WIRING DIAGRAM

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S1-UNAE09A-2.book 10 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

SYSTEM DIAGNOSTICS

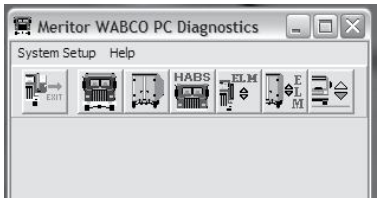
Use Meritor WABCO's PC-based diagnostic program, TOOLBOX Software.

1. TOOLBOX SOFTWARE

NOTICE

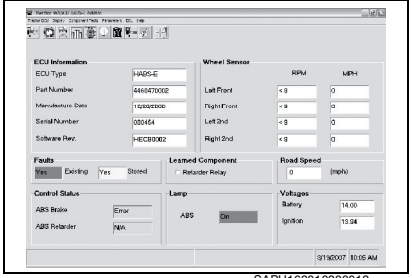
For complete instructions for using this program, refer to the User's Manual, TP-99102. Contact Meritor WABCO at 800-535-5560 for information about TOOLBOX Software.

If you have TOOLBOX Software installed on your computer, use it to identify system faults. Then, follow the on-screen repair information to make the necessary repairs or replacements.



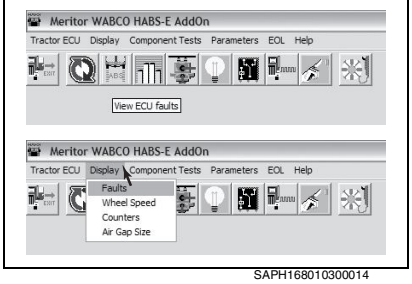
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To display Hydraulic ABS faults, use the pull-down menu or the HABS (Hydraulic ABS) icon to select HABS from the Main Menu. The HABS Main Menu will appear.



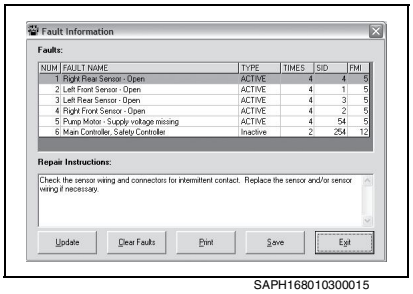
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Select the View ECU Faults icon or select Display Faults to use the pull-down menu.



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This will display the **Fault Information** screen.

The **Fault Information** Screen contains a description of the fault. Repair instructions for each fault appear at the bottom of the screen.

Faults that occur after the screen is displayed will not appear until a screen update is requested. Use the UPDATE button to refresh the fault information table.

After making the necessary repairs, use the CLEAR FAULTS button to clear the fault. Use the update button to refresh the fault information table and display the new list of faults.

2. TESTING THE SYSTEM

This section of the manual contains information for testing the hydraulic ABS with TOOLBOX Software, as well as procedures for conducting standard air and electrical tests.

⚠ WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Exhaust gas contains poison. When testing a vehicle with the engine running, test in a well-ventilated area or route the exhaust hose outside.

To avoid serious personal injury, keep away, and keep test equipment away, from all moving or hot engine parts.

Refer to, and follow, the vehicle manufacturer's Warnings, Cautions and Service Procedures.

When testing, set the parking brake and place the gear selector in NEUTRAL (manual transmission) or PARK (automatic transmission) unless otherwise directed.

(1) Meritor WABCO TOOLBOX™ Software

Use TOOLBOX™ Software to verify the activation of various system components:

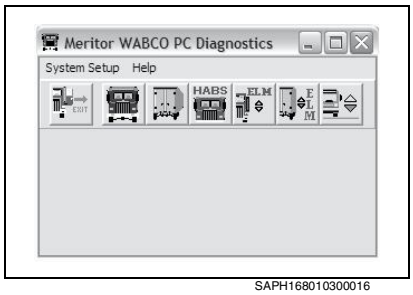
- Turn valves, pump and retarder relay on and off (Valve Activation Menu).
- Turn ABS warning light on and off (Miscellaneous Output Activation Menu).

NOTICE

- **TOOLBOX™ Software must be connected to the vehicle and the vehicle ignition must be ON in order to display information.**
- **For complete instructions for using this program, refer to the User's Manual, TP-99102. Contact Meritor WABCO at 800-535-5560 for information about TOOLBOX™ Software.**

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(2) E Version Hydraulic ABS Menus and Toolbars
Select Hydraulic ABS from the TOOLBOX™ **Main Menu**.
TOOLBOX™ senses the type of ECU being used and displays the **HABS Main Screen**.

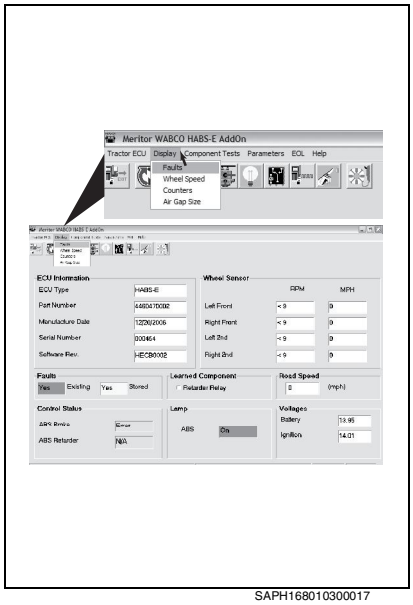


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(3) Main Screen
This screen provides icons and pull-down menu task selections. It also provides information about the current status of Meritor WABCO HABS.

ECU information is read once from the ECU and does not change. All other information (e.g., wheel sensors, voltages and fault information) is read and updated continuously.

(4) Display
Select **Display** from the HABS **Main Screen**. A pull-down menu will appear.



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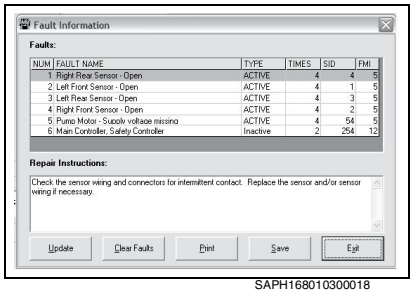
(5) Faults
Select **Faults** to display the **Fault Information** screen.

The **Fault Information** screen contains a description of each fault, including the type of fault (Active or Stored), number of occurrences, SID and FMI number. Repair instructions for the fault appear at the bottom of the screen.

Faults that occur after the screen is displayed will not appear until a screen update is requested. Use the **Update** button at the bottom of the screen to refresh the fault information table and display a new list of faults.

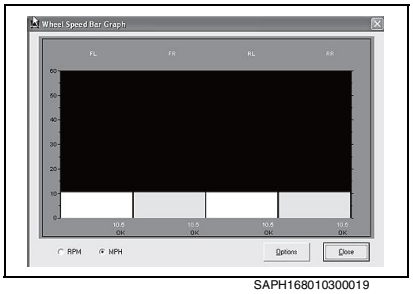
After making any required repairs, use the **Clear Faults** button to clear the fault. Clear each fault as it is repaired. Cycle the ignition after clearing the faults.

Use the **Save** or **Print** button to save or print the fault information data. Select **Exit** to close this section.



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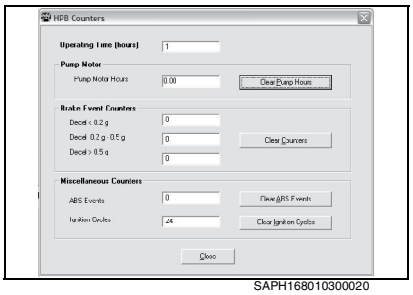
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(6) Wheel Speed
Select **Wheel Speed** to display the **Wheel Speed** screen.

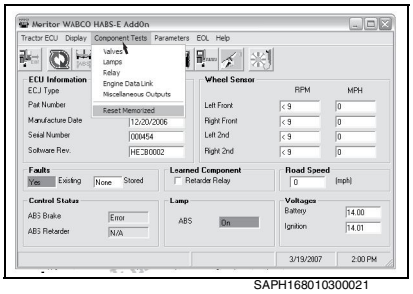
Use the **Wheel Speed** screen to verify that sensors are connected at each wheel. Speed at a sensed wheel (FL, FR, RL, RR) indicates sensors are installed, but does not verify correct sensor installation.



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(7) Counters
Select **Counters** to display the **Counters** screen.

The **Counters** screen provides an overview of HABS component performance (pump hours, brake events, etc.) as well as general vehicle activity such as ignition cycles. Occurrences displayed on this screen accumulate until the **Clear** button is selected.



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(8) Component Tests
Select **Component Tests** from the HABS **Main Screen**. A pull-down menu will appear.



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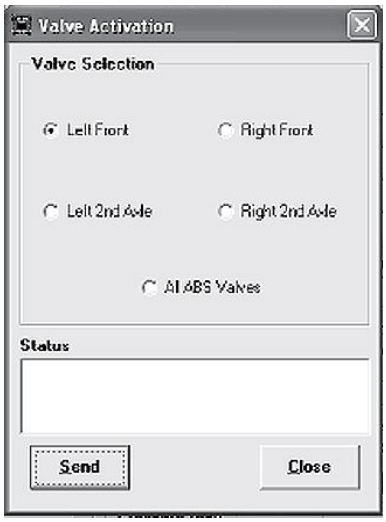
(9) Miscellaneous Outputs
Select **Miscellaneous Outputs** to display the **Actuate Miscellaneous Outputs** test screen.

NOTICE
Use TOOLBOX™ Software to test the following components: Retarder Relay, Brake Light Relay, Supply Valve, Cut-Off Valve, ABS Light, Traction Light, Brake Warning, Pump Front, Pump Rear, Buzzer.

This screen provides a check of several HABS components, as well as a way to check either inlet or outlet activity of the valves, pump or retarder relay.

Highlight the component you wish to test, then select the **Send** button to actuate the component. Component activation status appears in the **Status Box** field. Select **Close** to exit this screen.

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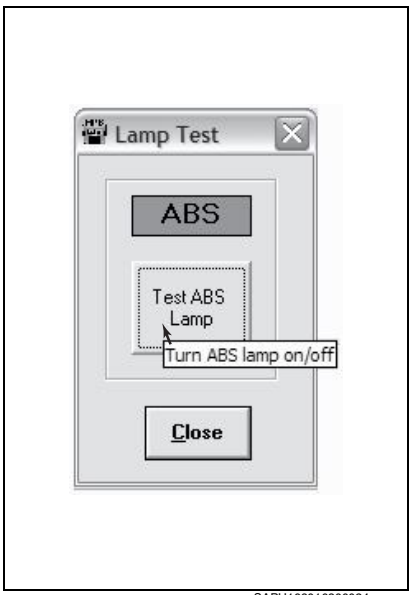


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(10) Valves
Select **Valves** to display the **Valve Activation** test screen.

The **Valve Activation** test screen lets you activate the HABS valves to check for correct activation and to verify correct brake line installation.

Click on the valve you wish to test, then click the **Send** button to actuate the component. Component activation status appears in the **Status** box field. Select **Close** to exit this screen.

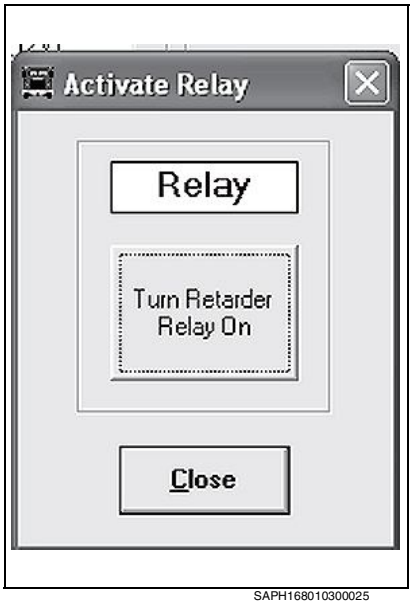


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(11) Lamps
Select **Lamps** to display the **Light Test** screen.

As each light is tested, check the actual light to verify correct operation. Select **Close** to exit this screen.

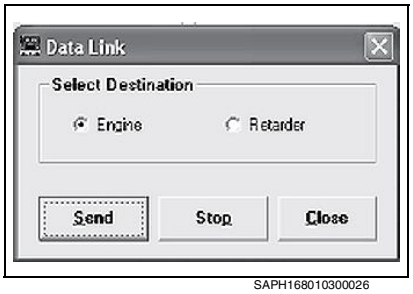
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(12) Relay
Select **Relay** to display the **Activate Relay** test screen.

This screen allows you to turn the retarder relay on or off. This is helpful in verifying correct operation, installation and wiring of the unit under test. Select **Close** to exit this screen.

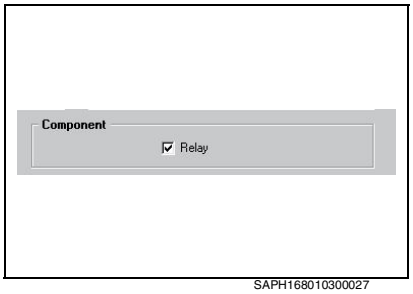


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(13) Engine Data Link
Select **Engine Data Link** to display the **Data Link** test screen.

This screen allows you to send a "limit engine torque" command to the engine or a "disable retarder" command to the retarder.

Select the data link destination (engine or retarder), then select **Send** to test. Use the **Stop** button to end testing. Select **Close** to exit this screen.

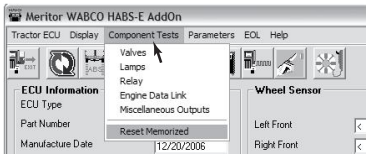


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(14) Reset Memorized
This is an automatic default and cannot be de-selected. It indicates the ECU has memorized the installed retarder relay. Once the ECU has seen a retarder, it expects to see it every time the vehicle is powered up.

Because there are times when an ECU is moved to another vehicle - or during diagnostic testing - you may want the ECU to disregard this learned component. Use the **Reset Memorized** command for this purpose.

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Select **Component Tests** from the Hydraulic ABS **Main Menu**. Then, select **Reset Memorized** from the pull-down menu to reset the **Learned Component** screen.

(15) Standard Testing
   a. Test Equipment: Volt-Ohm Meter (VOM)
      Use of a VOM with automatic polarity sensing is recommended. This eliminates the concern of the polarity of the meter leads during voltage measurements.

(16) System Requirements and Component Tests
   a. Tire Size Range
      For correct hydraulic ABS operation, front and rear tire sizes must be within 16% of each other.

      Contact the Meritor WABCO Customer Support Center at 800-535-5560 if you plan a tire size difference greater than 8%.

      Calculate the tire size with the following equation:
      % Difference = (RPM Steer/RPM Drive)-1 x 100
      RPM = tire revolutions per mile

⚠ CAUTION
When troubleshooting or testing the ABS system, do not damage the connector terminals. Damaged connector terminals may cause system malfunction.

   b. Voltage Check
      Voltage must be between 9.5 and 14 volts for the 12-volt hydraulic ABS to function correctly.

      Check voltage as follows.

- Turn ignition ON.
- Check for the correct voltage.
- Pins 16 to 18
- Pins 17 to 19
- Pins 1 to 6

(17) Standard Component Testing
   a. ABS Warning Light
      If the ABS warning light does not come on after the ignition is turned on, or it comes on but does not go out after three seconds, check all ABS fuses or circuit breakers and replace if necessary. Check the wiring to the ABS diagnostic switch and the warning light and repair or replace the wiring as required. When checking the warning light, follow these steps:
   b. Check voltage potential at the light socket.
   c. Check continuity of the wires to the socket.
   d. Replace the bulb.

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(18) Sensor Adjustment
On steering axles, the sensor is typically accessible on the in-board side of the steering knuckle.
On drive axles, the sensor is typically accessible on the in-board side of the rear axle spindle.
To adjust the sensor, push the sensor in until it contacts the tooth wheel.

- Do not pry or push sensors with sharp objects.
- Sensors will self-adjust during wheel rotation.

NOTICE
No gap is allowable at installation. During normal operation, a gap not to exceed 0.04 inch is allowable.

(19) Sensor Output Voltage Test
Sensor output voltage must be at least 0.2 volt AC at 30rpm. Test the sensor output voltage as follows:
a. Turn ignition OFF.
b. Disconnect the ECU to measure voltage at the pins on the ECU connector. Refer to Table D.

⚠ WARNING
Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

c. Place blocks under the front and rear tires to stop the vehicle from moving.
d. Raise the vehicle off the ground. Place safety stands under the axle.
e. Rotate the wheel by hand at 30 rpm (1/2 revolution per second).
f. Measure the voltage at the pins indicated in Table D. Voltage tolerance is ≥0.2 volts alternating current (VAC).

Table D: Sensor Check Pins

Sensor	HABS E Version ECU
	31-Pin Harness
Left Front	24 and 29
Right Front	25 and 30
Left Rear	23 and 28
Right Rear	22 and 27

(20) Sensor Resistance
The sensor circuit resistance must be between 900 and 2000 Ω. Measure resistance at the sensor connector, or at the pins on the ECU connector, as follows.
a. Turn ignition OFF.
b. To measure resistance at the pins on ECU connector, disconnect the ECU connector from the ECU.
To measure resistance at the sensor connector, disconnect the sensor from the sensor extension cable.
c. Measure output at the pins indicated in Table D.
If measurement is not between 900 and 2000 Ω, replace the sensor.

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COMPONENT REMOVAL AND INSTALLATION

1. SENSORS: WHEEL SPEED SENSOR REPLACEMENT — FRONT AXLE

Meritor WABCO specifications call for a sensor lubricant with the following characteristics:

Lube must be mineral oil-based and contain molydisulfide. It should have excellent anti-corrosion and adhesion characteristics and be capable of continuous function in a temperature range of -40°C to 300°F (-40° to 150°C).

(1) Removal

⚠ WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

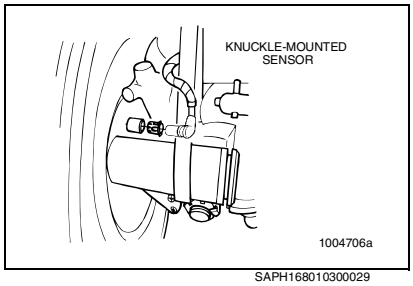
Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

To avoid damage to the electrical system or ABS components, when welding on an ABS-equipped vehicle disconnect the power connector from the ECU.

a. Apply the parking brakes. Chock the rear tires to prevent vehicle movement.

   If necessary, raise the front tires off the ground. Put safety stands under the axle.

b. Disconnect the fasteners that hold the sensor cable to other components.
c. Disconnect the sensor cable from the chassis harness.
d. Remove the sensor from the sensor holder. Twist and pull the sensor to remove it from the sensor bracket. **Do not pull on the cable.**



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(2) Installation
   a. Connect the sensor cable to the chassis harness.
   b. Install the fasteners used to hold the sensor cable in place.
   c. Apply a Meritor WABCO-recommended lubricant to the sensor spring clip and sensor.
   d. Install the sensor spring clip. Make sure the spring clip tabs are on the inboard side of the vehicle.
   e. With the tabs on the inboard side, push the sensor spring clip into the bushing in the steering knuckle until the clip stops.
   f. Push the sensor completely into the sensor spring clip until it contacts the tooth wheel.
   g. Fasten the sensor cable with tie wraps every 12 inches. Properly bundle and store excess cable in the sub frame.
   h. Remove the blocks and safety stands.
   i. Perform a voltage output check to ensure proper installation. Refer to "Voltage Check" in page DN03-16.

2. WHEEL SPEED SENSOR REPLACEMENT REAR AXLE

(1) Removal
   a. Apply the parking brake. Chock the front tires to prevent vehicle movement.
   b. Raise the rear tires off of the ground. Put safety stands under the axle.
   c. If the rear tire must be removed to gain access to the sensor, release the parking brake to release the brake shoe.

      Remove the wheel and tire assembly from the axle.

      Remove the sensor from the mounting block in the axle housing. Use a twisting motion if necessary. **Do not pull on the cable.**
   d. Disconnect the sensor cable from the chassis harness.
   e. Remove the sensor cable from any cable clamps or clips.
   f. Remove the sensor spring clip from the sensor bracket.

(2) Installation
   a. Connect the new sensor cable to the chassis harness.
   b. Press the sensor spring clip into the sensor bracket, located on the rear axle, until it stops. Make sure the tabs are on the inboard side.
   c. Apply a Meritor WABCO-recommended lubricant to the sensor.
   d. Push the sensor completely into the spring clip until it contacts the tooth wheel.
   e. Reattach the sensor cable to the cable clamps or clips.
   f. Replace the tire, remove the safety stands, lower the vehicle and remove the chocks from the front tires.
   g. Perform a voltage output check to ensure proper installation. Refer to "Voltage Check" in page DN03-16.

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3. MODULATOR ASSEMBLY

(1) Modulator Assembly Removal

⚠ CAUTION

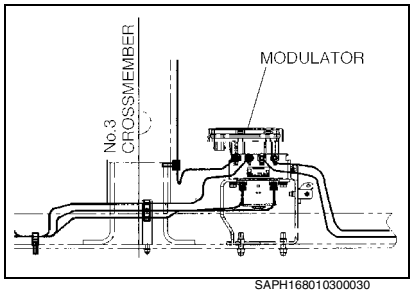
The modulator assembly contains hydraulic brake fluid, a caustic substance. Remove the valve carefully so that fluid does not leak and cause skin irritation or damage to components.

a. Apply the parking brakes. Chock the front and rear tires to prevent vehicle movement.
b. Place a container under the modulator assembly to catch leaking brake fluid.
c. Disconnect the electrical harness connectors from the modulator assembly.
d. Mark the six brake lines for ease of installation. Disconnect the lines from the modulator assembly.
e. Remove the three mounting capscrews, washers and nuts that attach the modulator assembly and bracket assembly to vehicle.

NOTICE

Whenever any hydraulic system fitting is loosened or disconnected, the entire system must be bled to remove any air that may have entered.

f. Remove the modulator assembly and bracket.



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(2) Modulator Assembly Installation

a. Position the modulator assembly and bracket in place on the vehicle.
b. Tighten the three mounting nuts.
Tightening torque
27-33 N·m (275-336 kgf.cm, 239-295 lbf-in)
c. Connect and tighten brake line connections as follows:

- Two small (MI0XI) adapters:
12N·m (122kgf.cm,108 lbf-in)
- Four large (MI2XI) adapters:
15N·m (153kgf.cm,132 lbf-in)

d. Bleed the brake system, per the following instructions.
e. Connect the electrical harnesses to the modulator assembly.

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4. BRAKE BLEEDING PROCEDURES

(1) General

The following brake bleeding methods explain how to bleed the hydraulic ABS modulator assembly during installation, or in the event of air in the brake system. There are instructions for both pressure and manual bleeding procedures.

These instructions include the procedure for bleeding both the master cylinder and the brake system. In some cases, for example, if you are replacing only the modulator assembly, it may not be necessary to bleed the master cylinder. If you have any questions, please contact the Meritor Service Center at 800-535-5560.

NOTICE

The modulator assembly must be handled with appropriate care and should not be exposed to excessive impact or compressed air at the hydraulic ports prior to assembly.

⚠ WARNING

Failure to bleed the system whenever any hydraulic system fitting is loosened or disconnected will allow air to remain in the system. This will prevent the hydraulic pressure in the brake system from rising enough to apply the brakes properly. This will cause the stopping distance to increase and can result in serious personal injury.

Properly discard hydraulic brake fluid that is removed from the brake system. Hydraulic brake fluid that is removed can be contaminated and can cause damage, loss of braking and serious personal injury.

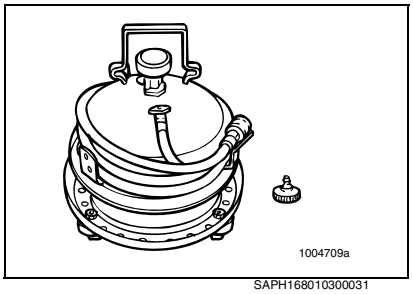
Use only the type of hydraulic brake fluid specified by the equipment manufacturer. Do not use or mix different types of hydraulic brake fluid. The wrong hydraulic brake fluid will damage the rubber parts of the brake caliper and can cause damage, loss of braking and serious personal injury.

NOTICE

Use DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specifications to determine which fluid to use.

⚠ CAUTION

Hydraulic brake fluid is a caustic substance. Contact with hydraulic brake fluid can cause skin irritation. Do not let hydraulic brake fluid touch any painted surfaces, as it will remove the paint. Hydraulic brake fluid may also damage certain non-metal surfaces. Do not let fluid get on brake pads, shoes, rotors or disks.



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(2) Pressure Fill and Bleed
Pressure fill and bleeding is the preferred method for bleeding the service brake system. It requires the use of a special pressure bleeder kit, consisting of a tank, pressure pump and valve, gauge, tubing and adapter. These kits are available from a number of manufacturers and include instructions for use.

(3) Pressure Fill and Bleed Procedure:

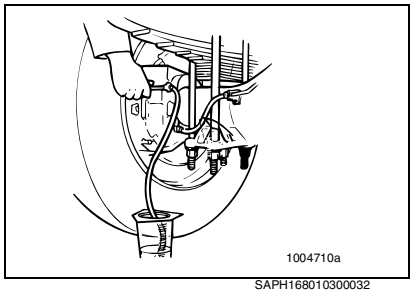
a. Apply the parking brake and chock the tires. Turn the ignition OFF and disconnect the battery terminals.

NOTICE
The ignition must remain off for the entire bleeding procedure; energizing the unit during bleeding must be impossible.

b. Fill the pressure bleeder with new DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specifications to determine which fluid to use.
c. Follow the manufacturer's instructions to connect the pressure bleeder to the brake master cylinder reservoir.
d. Set filling pressure to 20 to 30 psi (1.5 to 2.0 bar).
e. Turn on bleeding equipment until fluid level in reservoir reaches approximately 0.875-inches (20 mm).
f. Release pressure for 3 to 5 seconds. Apply pressure for 5 to 10 seconds.
g. Repeat Steps 5 and 6 approximately 10 times. After releasing the pressure, air bubbles should rise up into the reservoir.

⚠ **WARNING**
Do not let the brake master cylinder fluid get below the minimum level during the bleeding operation. Keep the master cylinder reservoir filled with new DOT-approved brake fluid, as specified by the original equipment manufacturer. Failure to keep the brake reservoir level above minimum could result in more air entering system, making it impossible to effectively bleed the system.

h. Bleed the brake system:



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- Set filling pressure to 20 to 30 psi (1.5 to 2.0 bar).
- Put a wrench on the brake actuator bleeder fitting. Start with the farthest from the modulator, (typically the right rear), then attach a length of clear plastic tubing to the bleeder fitting. Make sure the tube fits snugly.

i. Submerge the tubing in a container of clean hydraulic brake fluid.

NOTICE
Both the tubing and container must be able to withstand the effects of hydraulic brake fluid.

Loosen the bleeder fitting until the fluid begins to flow (about 3/4 turn). Let the hydraulic fluid flow out of the fitting until it is free of air bubbles.
j. Tighten firmly to secure the fitting.
k. Repeat Steps 5 through 8 to bleed the remaining three brake actuators. Bleed in sequence of the longest to shortest circuit from the modulator assembly.
l. Turn off bleeding equipment and remove pressure. Remove bleeding device and check fluid level in reservoir. Fill if required. Replace reservoir cap and dispose of used brake fluid.
m. Remove wheel chocks.

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(4) Manual Bleeding Procedure:

a. Apply the parking brake and chock the tires. Turn the ignition OFF and disconnect the battery terminals.

NOTICE

The ignition must remain off for the entire bleeding procedure; energizing the unit during bleeding must be impossible.

b. Fill the reservoir with DOT 3 or DOT 4 hydraulic brake fluid. Refer to the vehicle specifications to determine which fluid to use.
c. Depress the brake pedal five times using the stroke between 1/3 travel and maximum travel in 5 seconds.
d. Release the pedal for 5 to 10 seconds. Air bubbles will rise into the reservoir while depressing and releasing pedal.
e. Repeat Steps 3 and 4 another three times, or until sufficient pedal resistance is felt.

⚠ WARNING

Do not let the brake master cylinder fluid get below the minimum level during the bleeding operation. Keep the master cylinder reservoir filled with new DOT-approved brake fluid as specified by the original equipment manufacturer. Failure to keep the brake reservoir level above minimum could result in more air entering system, making it impossible to effectively bleed the system.

f. Bleed the brake system. Put a wrench on the brake actuator bleeder fitting. Start with the farthest from the modulator, (typically the right rear), then attach a length of clear plastic tubing to the bleeder fitting. Make sure the tube fits snugly.
g. Submerge the tubing in a container of clean brake fluid.

NOTICE

Both the tubing and container must be able to withstand the effects of brake fluid.

h. Depress the brake pedal 10 to 15 times, using the maximum available stroke.
i. Loosen the bleeder fitting until the fluid begins to flow, (about 3/4 turn), while depressing the brake pedal through its maximum available stroke.
j. Tighten the fitting firmly prior to releasing the brake pedal.
k. Repeat Steps 6 through 8 several times until the discharged fluid is free of air bubbles.
l. Repeat Steps 3 through 9 to bleed the remaining three brake actuators. Bleed in sequence of the longest to the shortest circuit from the modulator.
m. Check the travel of the brake pedal. If a firm resistance is felt the manual bleeding procedure is complete.
n. Check the fluid level in reservoir and fill if required. Replace reservoir cap and dispose of used brake fluid.
o. Remove wheel chocks.

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BRAKE CONTROL (ABS : FULL AIR)

DN03-002

ABS DN03-2
TROUBLESHOOTING DN03-2

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ABS

TROUBLESHOOTING

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BEFORE YOU BEGIN

This manual provides instructions for Meritor WABCO's anti-lock braking system for trucks, tractors and buses. Before you begin procedures:

1. Read and understand all instructions and procedures before you begin to service components.
2. Read and observe all Caution and Warning safety alerts that precede instructions or procedures you will perform. These alerts help to avoid damage to components, serious personal injury, or both.
3. Follow your company's maintenance and service, installation, and diagnostics guidelines.
4. Use special tools when required to help avoid serious personal injury and damage to components.

1. SAFETY ALERTS, TORQUE SYMBOL AND NOTES

⚠ **WARNING**	A Warning alerts you to an instruction or procedure that you must follow exactly to avoid serious personal injury and damage to components.
⚠ **CAUTION**	A Caution alerts you to an instruction or procedure that you must follow exactly to avoid damage to components and possible serious injury.
NOTICE	A Note provides information or suggestions that help you correctly service a component.

2. ACCESS INFORMATION ON ARVINMERITOR'S WEB SITE

Additional maintenance and service information for ArvinMeritor's commercial vehicle systems component lineup is also available at www.arvinmeritor.com.

To access information, click on Products & Services/Tech Library Icon/HVS Publications. The screen will display an index of publications by type.

3. ADDITIONAL INFORMATION

Call ArvinMeritor's Customer Service Center at 800-535-5560 to order the following item.

- Drivetrain Plus™ by ArvinMeritor Technical Electronic Library on CD. Features product and service information on most Meritor, ZF Meritor and Meritor WABCO products. $20. Order TP-9853.

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ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

Hazard Summary

Because some brake linings contain asbestos, workers who service brakes must understand the potential hazards of asbestos and precautions for reducing risks. Exposure to airborne asbestos dust can cause serious and possibly fatal diseases, including asbestosis (a chronic lung disease) and cancer, principally lung cancer and mesothelioma (a cancer of the lining of the chest or abdominal cavities). Some studies show that the risk of lung cancer among persons who smoke and who are exposed to asbestos is much greater than the risk for non-smokers. Symptoms of these diseases may not become apparent for 15, 20 or more years after the first exposure to asbestos.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons. OSHA has set a maximum allowable level of exposure for asbestos of 0.1 f/cc as an 8-hour time-weighted average and 1.0 f/cc averaged over a 30-minute period. Scientists disagree, however, to what extent adherence to the maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling asbestos dust. OSHA requires that the following sign be posted at the entrance to areas where exposures exceed either of the maximum allowable levels:

DANGER: ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA.

2. Respiratory Protection. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA for use with asbestos at all times when servicing brakes, beginning with the removal of the wheels.

3. Procedures for Servicing Brakes.

a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.

b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

c. If an enclosed vacuum system or brake washing equipment is not available, employers may adopt their own written procedures for servicing brakes, provided that the exposure levels associated with the employer's procedures do not exceed the levels associated with the enclosed vacuum system or brake washing equipment. Consult OSHA regulations for more details.

d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.

e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.

4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.

5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.

6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

NON-ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to non-asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

Hazard Summary

Most recently manufactured brake linings do not contain asbestos fibers. These brake linings may contain one or more of a variety of ingredients, including glass fibers, mineral wool, aramid fibers, ceramic fibers and silica that can present health risks if inhaled. Scientists disagree on the extent of the risks from exposure to these substances. Nonetheless, exposure to silica dust can cause silicosis, a non-cancerous lung disease. Silicosis gradually reduces lung capacity and efficiency and can result in serious breathing difficulty. Some scientists believe other types of non-asbestos fibers, when inhaled, can cause similar diseases of the lung. In addition, silica dust and ceramic fiber dust are known to the State of California to cause lung cancer. U.S. and international agencies have also determined that dust from mineral wool, ceramic fibers and silica are potential causes of cancer.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to non-asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons.

2. Respiratory Protection. OSHA has set a maximum allowable level of exposure for silica of 0.1 mg/m³ as an 8-hour time-weighted average. Some manufacturers of non-asbestos brake linings recommend that exposures to other ingredients found in non-asbestos brake linings be kept below 1.0 f/cc as an 8-hour time-weighted average. Scientists disagree, however, to what extent adherence to these maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling non-asbestos dust.

Therefore, wear respiratory protection at all times during brake servicing, beginning with the removal of the wheels. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA, if the exposure levels may exceed OSHA or manufacturer's recommended maximum levels. Even when exposures are expected to be within the maximum allowable levels, wearing such a respirator at all times during brake servicing will help minimize exposure.

3. Procedures for Servicing Brakes.

a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.

b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

c. If an enclosed vacuum system or brake washing equipment is not available, carefully clean the brake parts in the open air. Wet the parts with a solution applied with a pump-spray bottle that creates a fine mist. Use a solution containing water, and, if available, a biodegradable, non-phosphate, water-based detergent. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.

e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.

4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA, to minimize exposure. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.

5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.

6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

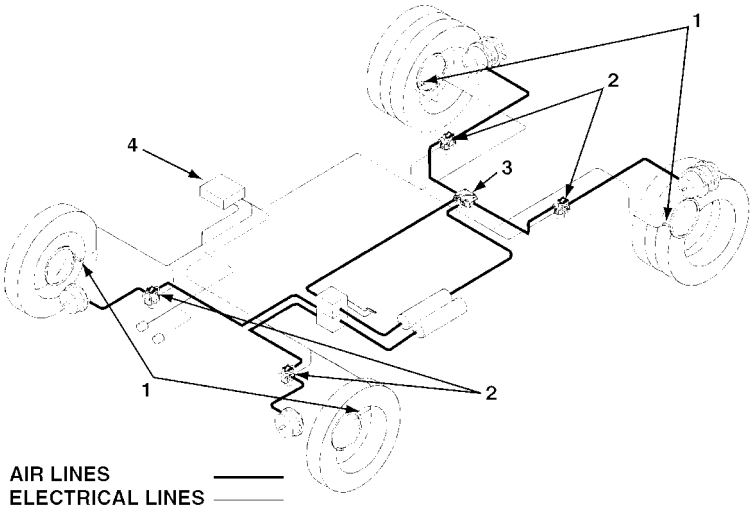
Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

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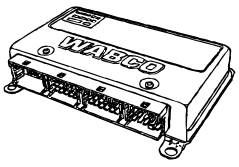
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ABS CONFIGURATION



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1	Wheel sensors	3	Relay valve
2	ABS control valves	4	ABS ECU



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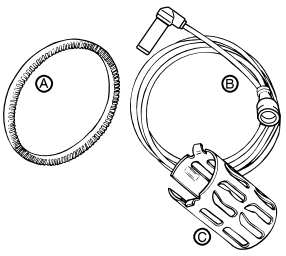
SYSTEM COMPONENTS

The ECU is the brain of the ABS system. It receives information from the sensors and sends signals to the ABS valves. The ECU is cab-mounted.

NOTICE

Do not open the ECU. Opening the ECU to gain access to the internal components will void the warranty.

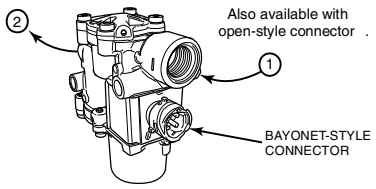
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A tooth wheel (A) is mounted at, or cast in, the hub of each sensed wheel, with a sensor (B) installed so that its end is against the tooth wheel. A sensor clip (C) holds the sensor in place at the tooth wheel.

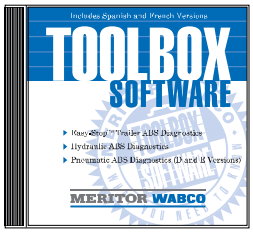
NOTICE
The sensor and clip must be greased with Meritor WABCO-recommended lubricant. Refer to "Sensor Lube Specification" page DN03-23 for lube specification.



1. Air In (Port 1)
2. Air Out (Port 2)

SHTS168020300005

An **ABS modulator valve** controls air pressure to each affected brake during an ABS event. The modulator valve is usually located on a frame rail or cross member near the brake chamber. The modulator valve is available in bayonet-style or open-style connector.



Available from SPX (Kent-Moore), 800-328-6657

SHTS168020300006

TOOLBOX Software is a PC-based diagnostics program that can display wheel speed data, test individual components, verify installation wiring and more. Runs in Windows® 95, 98 and NT. An RS232 to J1708 convertor box is required. Versions 3.2 and higher support E version ABS.



Available from SPX (Kent-Moore), 800-328-6657

SHTS168020300007

The **MPSI Pro-Link® 9000** with a multiple protocol cartridge (MPC) and Meritor WABCO applications card, version 2.0 or higher, provides diagnostic and testing capabilities for the E version ABS.

NOTICE
The Power Line Carrier Communication (PLC) functions of E version ABS cannot be tested with the Pro-Link.

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System Diagnostics

Use any of the following methods to diagnose E version ABS:

- TOOLBOX Software, version 3.2 or higher, a PC-based ABS diagnostic and testing program that runs in Windows 95, 98 or NT
- Blink Codes — Tractor ABS only
- MPSI Pro-Link with MPC and Meritor WABCO applications card, version 2.0 or higher
- OEM Diagnostic Displays (Refer to the Vehicle Operator's Manual)

Information about TOOLBOX Software, MPSI Pro-Link and Blink Codes follows. If you have any questions about system diagnostics, please contact ArvinMeritor's Customer Service Center at 800-535-5560.

1. TOOLBOX SOFTWARE

NOTICE

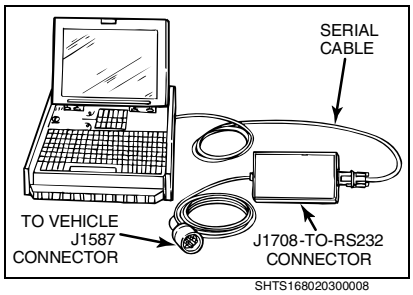
For complete instructions for using TOOLBOX Software, refer to the User's Manual.

If you have TOOLBOX Software installed on your computer, use it to identify system faults. Then, follow the on-screen repair information to make the necessary repairs or replacements.

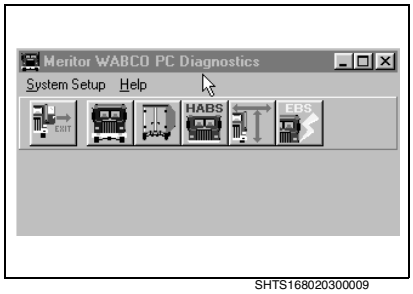
To display E version ABS faults:

(1) Connect the computer to the vehicle:

- Attach the cable from your computer to the J1708 to RS232 converter box.
- Attach the diagnostic cable (Deutsch) to the vehicle.



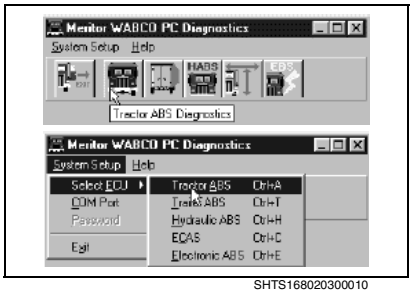
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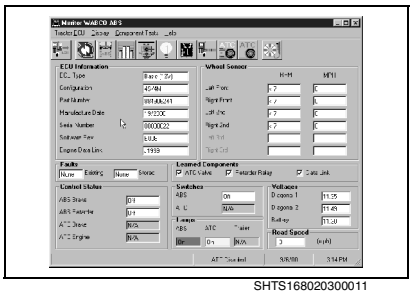
(2) Select TOOLBOX Software from Desktop or from the Windows Start Menu to display the TOOLBOX Main Menu.

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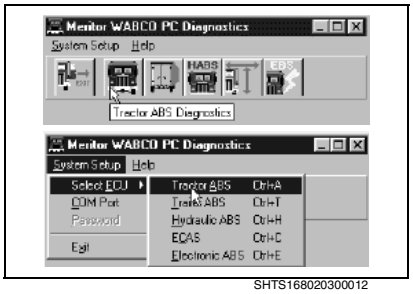


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(3) From the **Main Menu**, select **Tractor ABS** Diagnostics, or use the pull down menu to make your selection. The **ABS Main** Screen will appear.



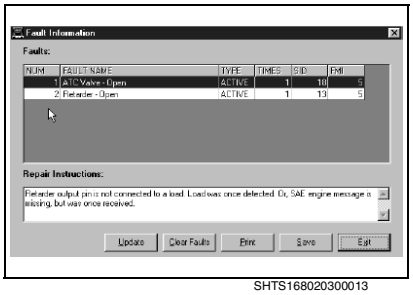
SHTS168020300011



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(4) From the **ABS Main Screen**, select the **Faults** icon, or use the pull down menu to display the faults from the ECU.

NOTICE
If there are Faults in the system (YES in existing or stores fields) double-click on the YES to display Fault Information.



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(5) The **Fault Information Screen** contains a description of the fault. Repair instructions for each fault appear at the bottom of the screen.

NOTICE
Faults that occur after the screen is displayed will not appear until a screen update is requested. Use the Update button at the bottom of the screen to refresh the fault information table.

(6) After making the necessary repairs, use the **Clear Faults** button at the bottom of the screen to clear the fault. Use the **Update** button to refresh the fault information table and display the new list of faults.

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2. BLINK CODE DIAGNOSTICS (TRACTOR ABS ONLY)

(1) Definitions

Before using blink code diagnostics, you should be familiar with a few basic terms. If you used previous versions of Meritor WABCO's blink code diagnostics, review these definitions to identify major changes.

ABS Indicator Light: This light serves two purposes: it alerts drivers to an ABS tractor fault and it is used during diagnostics to display the blink code.

Blink Code: A series of blinks or flashes that describe a particular ABS system fault or condition.

Blink Code Cycle: Two sets of flashes with each set separated by a one-and-one-half second pause. Blink codes are defined in Blink Code Identification in this section.

Blink Code Switch: A momentary switch that activates blink code diagnostic capabilities. Switch types and locations vary, depending on the make and model of the vehicle.

Clear: The process of erasing faults from the ECU.

Diagnostics: The process of using blink codes to determine ABS system faults.

Fault: An ABS malfunction detected and stored in memory by the Meritor WABCO ECU. System faults may be Active or Stored.

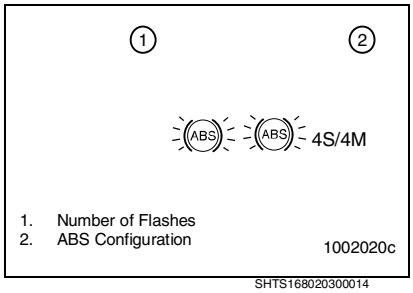
Active Fault: A condition that currently exists in the ABS system; for example, a sensor circuit malfunction on the left front steering axle. An active fault must be repaired before it can be cleared from memory — and before you can display additional blink code faults.

Stored Fault: There are two types of stored faults:

a. A repaired active fault that **has not been cleared** from the ECU.
b. A fault that occurred but **no longer exists.** For example, a loose wire that makes intermittent contact. Because stored faults are not currently active they do not have to be repaired before they can be cleared from memory.

   Meritor WABCO recommends you keep a record of these faults for future reference.

   System Configuration Code: One digit code displayed during the clear mode. Blink codes for common ABS system configurations are shown in figure.



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3. DIAGNOSTIC MODE

To enter the diagnostic mode, press and hold the blink code switch for one second, then release.

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4. CLEAR MODE

To erase faults from the ECU, you must be in the clear mode. To enter the clear mode, press and hold the blink code switch for at least three seconds, then release.

If the system displays eight quick flashes followed by a system configuration code, the clear was successful. Stored ABS faults have been cleared from memory.

If you do not receive eight flashes, there are still active faults that must be repaired before they can be cleared.

5. BLINK CODE DIAGNOSTICS

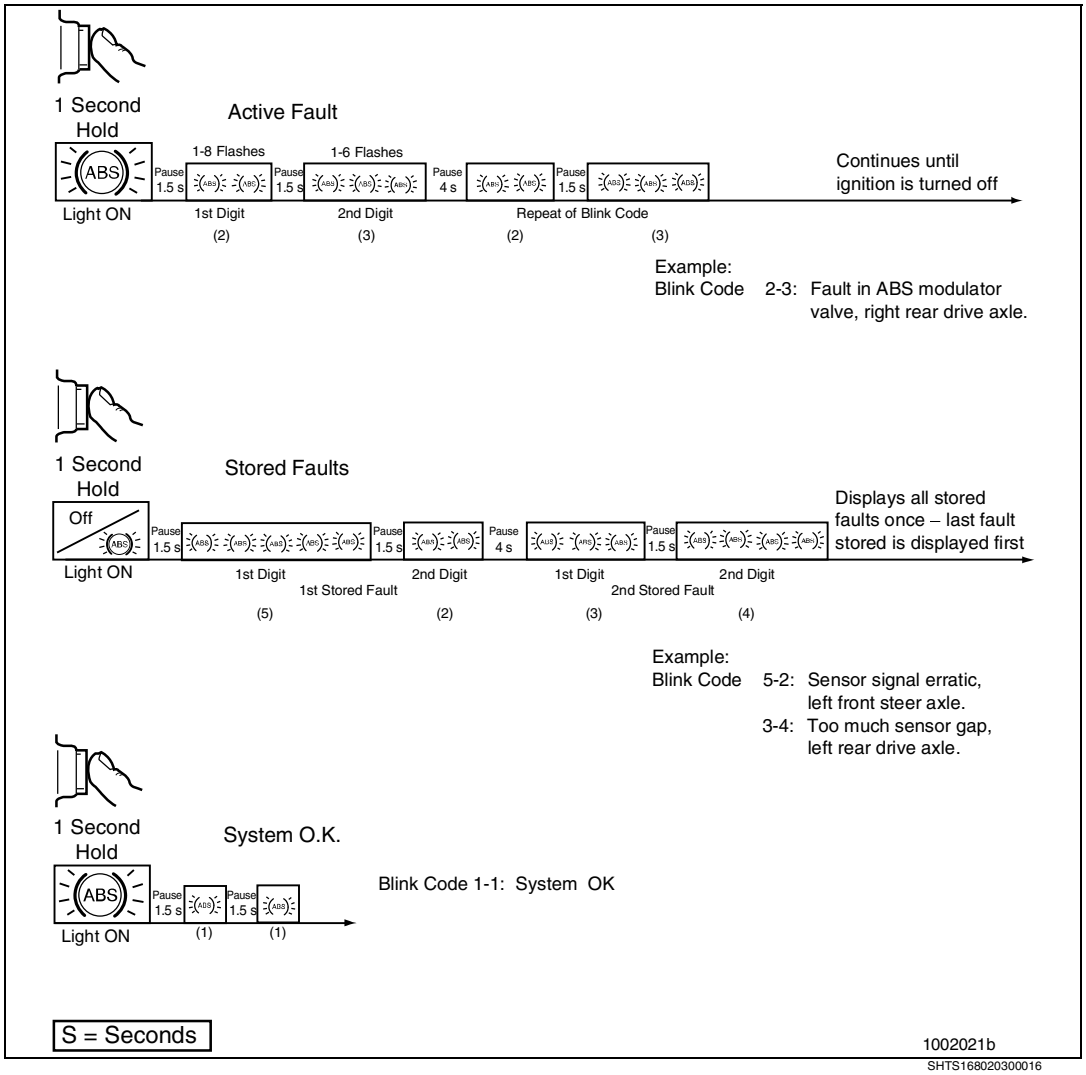
Troubleshooting with Blink Code Diagnostics

Mode	Procedure	System Response	Action
DIAGNOSTICS	**Step I.** Turn Ignition ON	Possible responses: A. ABS indicator light comes on momentarily then goes out, indicating System O.K. B. ABS indicator light does not light, indicating possible wiring fault or burned-out bulb. C. ABS indicator light stays on, indicating: • Fault, or faults, in the system. • Sensor fault during last operation. • Faults cleared from ECU, but vehicle not driven. • ECU disconnected.	 No recognizable active faults in the ABS. No action required. Inspect wiring. Inspect bulb. Make necessary repairs. Continue with blink code diagnostics. **(Go to Step II.)** Continue with blink code diagnostics. **(Go to Step II.)** Drive vehicle—light will go out when vehicle reaches 4 mph (6 km/h). Connect ECU.
	Step II. Press and hold Blink Code Switch for one second, then release.	ABS indicator light begins flashing two-digit blink code(s).	Determine if fault is active or stored: **Active Fault:** Light will repeatedly display one code. Stored Fault: Light will display code for each stored fault then stop blinking. Faults will be displayed **one time only**.
	Step III. Count the flashes to determine the blink code.	First Digit: 1 - 8 flashes, Pause (1-1/2 seconds). Second Digit: 1 - 6 flashes, Pause (4 seconds).	Find definition for blink code on blink code chart.
	Step IV. Turn Ignition OFF . Repair and Record faults.	Active Fault. Stored Faults.	Make the necessary repairs. Repeat Steps I, II, and III until System O.K. code (1-1) received. Record for future reference. **NOTE:** Last fault stored is first fault displayed.
CLEAR	**Step V**. Turn Ignition ON. Clear Faults from memory: **Press and hold** blink code switch for at least three seconds, then release.	ABS Indicator Light flashes eight times. Eight ßashes not received.	All stored faults successfully cleared. Turn ignition OFF. Active faults still exist, repeat Steps I through V.

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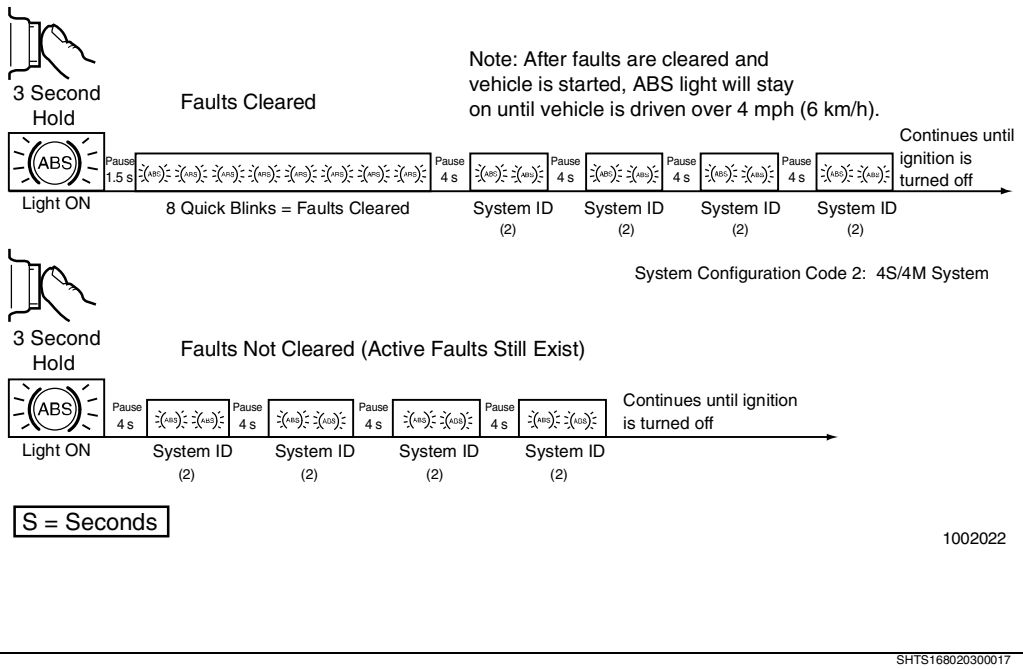
S1-UNAE09A-2.book 10 ページ ２０１１年１０月２７日 木曜日 午後５時２１分

6. BLINK CODES ILLUSTRATED



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WORKING WITH BLINK CODES

1. BLINK CODE CONDITIONS

When using blink code diagnostics, the following conditions could occur:

Blink Code Conditions		
Condition	Reason	Action
ABS indicator light does not come on at ignition.	Loose or burned-out bulb.	Check bulb. Check connections. Make necessary repairs.
	Voltage not within acceptable range (9.5-14.0 volts).	Check connections. Measure voltage. Make necessary repairs.
Can't use blink code diagnostics; ABS indicator light will not go off when blink code is activated.	Switch not held for proper length of time: 1 Second — Diagnostics Mode 3 Seconds — Clear All Mode	Repeat procedure, hold switch for proper length of time.
	Improper or faulty wiring.	Inspect and repair wiring.
Eight Flashes not received after blink code switch pressed for **at least** three seconds, then released.	Active Faults still exist.	Identify active faults, then make necessary repairs. Turn ignition OFF, then repeat Blink Code Diagnostics.

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2. BLINK CODE IDENTIFICATION

Use the following information to identify the blink code:

Blink Code Identification	
First Digit (Type of Fault)	**Second Digit — Specific Location of Fault**
1 No faults	1 No faults
2 ABS modulator valve 3 Too much sensor gap 4 Sensor short or open 5 Sensor signal erratic/tire size 6 Tooth wheel	1 Right front steer axle (curb side) 2 Left front steer axle (driver's side) 3 Right rear drive axle (curb side) 4 Left rear drive axle (driver's side)
7 System function**	1 J1939 datalink 2 ATC valve 3 Retarder relay (third brake) 4 ABS indicator light 5 ATC configuration 6 ATC prop./dif lock/stop valve
8 ECU	1 Low power supply 2 High power supply 3 Internal fault 4 System configuration error 5 Ground

*** Tandem, lift, tag or pusher axle depending upon the type of suspension.**

**** If this code continues after all repairs have been made — or if you receive a code for a component that is not installed on the vehicle — it may be necessary to reconfigure the ECU. Refer to the Reconfiguration Procedure described in page DN03-28. TOOLBOX Software may also be used to reconfigure the ECU (refer to page DN03-28). Contact ArvinMeritor's Customer Service Center at 800-535-5560 for reconfiguration information.**

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3. BLINK CODE TROUBLESHOOTING AND REPAIR

Blink Code	Action Required	Reference
2-1 2-4 2-2 2-5 2-3 2-6	Check ABS modulator valve, valve cable, and connectors. Verify 4.0-9.0 ohms resistance (ABS modulator valve).	Refer to "Valve Tests," page DN03-23.
3-1 3-4 3-2 3-5 3-3 3-6	Adjust wheel sensor to touch tooth wheel. Check sensor gap. Check for loose wheel bearings or excessive hub runout. Verify minimum 0.2 volts AC output @ 30 rpm.	Refer to "Sensor Adjustment," page DN03-22, "Sensor Output Voltage Test," page DN03-22, and "Component Tests and Functions," DN03-17.
4-1 4-4 4-2 4-5 4-3 4-6	Check sensor, sensor cable, and connectors. Verify 900-2000 ohms resistance.	Repair or replace as needed.
5-1 5-5 5-2 5-6 5-3 5-7	Check for tire size mismatch or tooth wheel difference. Check sensor, sensor cable, and connector for intermittent contact.	Refer to "Tire Size Range," page DN03-21.
6-1 6-4 6-2 6-5 6-3 6-6	Check for damaged tooth wheel.	Repair or replace as needed.
7-1*	Check for proper J1939 data link connection. Verify wheel spin on each axle.	Refer to wiring diagram in page DN03-27.
7-2*	Check ATC Valve, valve cables, and connectors. Verify 7.0-14.0 ohms resistance.	Refer to "Valve Tests," page DN03-23.
7-3*	Check retarder (third brake) connections.	Refer to wiring diagram in DN03-27.
7-4*	Check ABS indicator light connections. Verify blink code switch was activated longer than 16 seconds.	
7-5*	Verify proper ATC set-up.	
7-6*	Verify accuracy of blink code and clear from ECU memory.	Refer to "Blink Code Diagnostics (Tractor ABS only)," page DN03-9.
8-1	Check for low voltage. Check vehicle voltage, fuse, and supply to ECU (9.5-14.0 volts).	Refer to wiring diagram in page DN03-27 and "Voltage Check," page DN03-21.
8-2	Check for high voltage. Check vehicle voltage (9.5-14.0 volts). Verify accuracy of blink code and clear from ECU memory.	Refer to "Voltage Check," page DN03-21, and "Blink Code Diagnostics (Tractor ABS only)," page DN03-9.
8-3	Verify accuracy of blink code and clear from ECU memory.	Refer to "Blink Code Diagnostics (Tractor ABS only)" and "Clear Mode," page DN03-9.
8-4	Verify all ECU connectors are in place. Verify accuracy of blink code and clear from ECU memory. If code does not clear, it may be necessary to replace the ECU.	Contact ArvinMeritor's Customer Service Center at 800-535-5560.
8-5	Check all ABS, ECU and ATC valve grounds.	Refer to wiring diagram in page DN03-27.

*** If this code continues after all repairs have been made — or if you receive a code for a component that is not installed on the vehicle — it may be necessary to reconfigure the ECU. Refer to the Reconfiguration Procedure described in DN03-28. TOOLBOX Software may also be used to reconfigure the ECU (refer to page DN03-28). Contact ArvinMeritor's Customer Service Center at 800-535-5560 for reconfiguration information.**

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PRO-LINK® DIAGNOSTICS

NOTICE

You must use Multiple Protocol Cartridge (MPC) and Meritor WABCO application card, version 2.0 or higher, with E version ECUs. The PLC functions of E version ABS cannot be tested with the Pro-Link.

The Pro-Link® 9000 may be used in place of blink code diagnostic procedures.

The following Pro-Link information applies to E version ECUs. Refer to Maintenance Manual 28 if you are using the Pro-Link with C version ECUs or Maintenance Manual 30 if you are using the Pro-Link with D version ABS.

1. DIAGNOSTIC PROCEDURE

(1) Slide the MPC into the Pro-Link keypad until the connection is tight. Then, insert the Meritor WABCO applications card into the cartridge.

(2) Chock the wheels, apply the parking brake, and make sure ignition power is off.

(3) Locate the 6-pin diagnostic receptacle in the vehicle cab. Insert the 6-pin connector from the Pro-Link into the receptacle.

(4) Turn the ignition to the ON/RUN position. The Pro-Link screen should power up. If the Pro-Link does not power up, or if the screen indicates NO DATA RECEIVED:

- Check connections.
- Make sure the cartridge is properly connected to the Pro-Link keypad.
- Verify 9.5-14.0 volts DC power and ground at the connector and ABS ECU.
- Check the fuse panel for a blown fuse.
- Check for proper wiring in the diagnostic connector.

(5) Refer to the Pro-Link manual for complete diagnostic instructions.

The Pro-Link® 9000 is available from Kent-Moore, 800-328-6657.

2. PRO-LINK SCREENS

This information provides basic screen explanations for the Pro-Link® 9000 with an MPC and Meritor WABCO application card. For complete operating instructions and test information, refer to the Pro-Link manual.

(1) **Fault Information Screens:**

Existing Faults: Use these screens to identify existing faults. The Pro-Link screen displays a written description of the fault, including the location on the vehicle where each exists. As long as there is an active (existing) fault in the system, the Pro-Link will not let you clear faults.

Stored Faults: Use these screens to identify faults stored in the ECU memory. Stored faults may be existing faults that have been repaired, or faults that existed for a short time, then corrected themselves. After displaying the stored faults, the Pro-Link lets you erase them from memory. All stored faults are cleared at one time.

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J1939 DATALINK VERIFICATION — PRO-LINK 9000

The Pro-Link diagnostic tool may be used to verify J1939 datalink connection. If you do not have a Pro-Link, you can use the blink code switch to verify this connection.

1. Turn ignition ON. Press blink code switch — hold for 3 seconds.

   A. ATC indicator light will come on and stay on for the entire test.

   If vehicle is not equipped with ATC, the ATC indicator light will not come on.

   B. ABS indicator light will come on and blink 8 times.

   If the light does not blink 8 times, there are faults that must be cleared before you continue with this test.

   C. The eight quick flashes will be followed by the system configuration code. A 4S/4M (2 blinks) system is identified here.

   The system configuration code will continue during the entire test.

2. Activate the J1939 engine torque reduction code, as follows:

   A. Step on the accelerator. Bring the engine to 1000 rpm.

   Leave your foot on the accelerator during the entire test.

   B. While engine is at 1000 rpm, press the blink code switch twice, as follows:

   Press for one second

   Release for one second

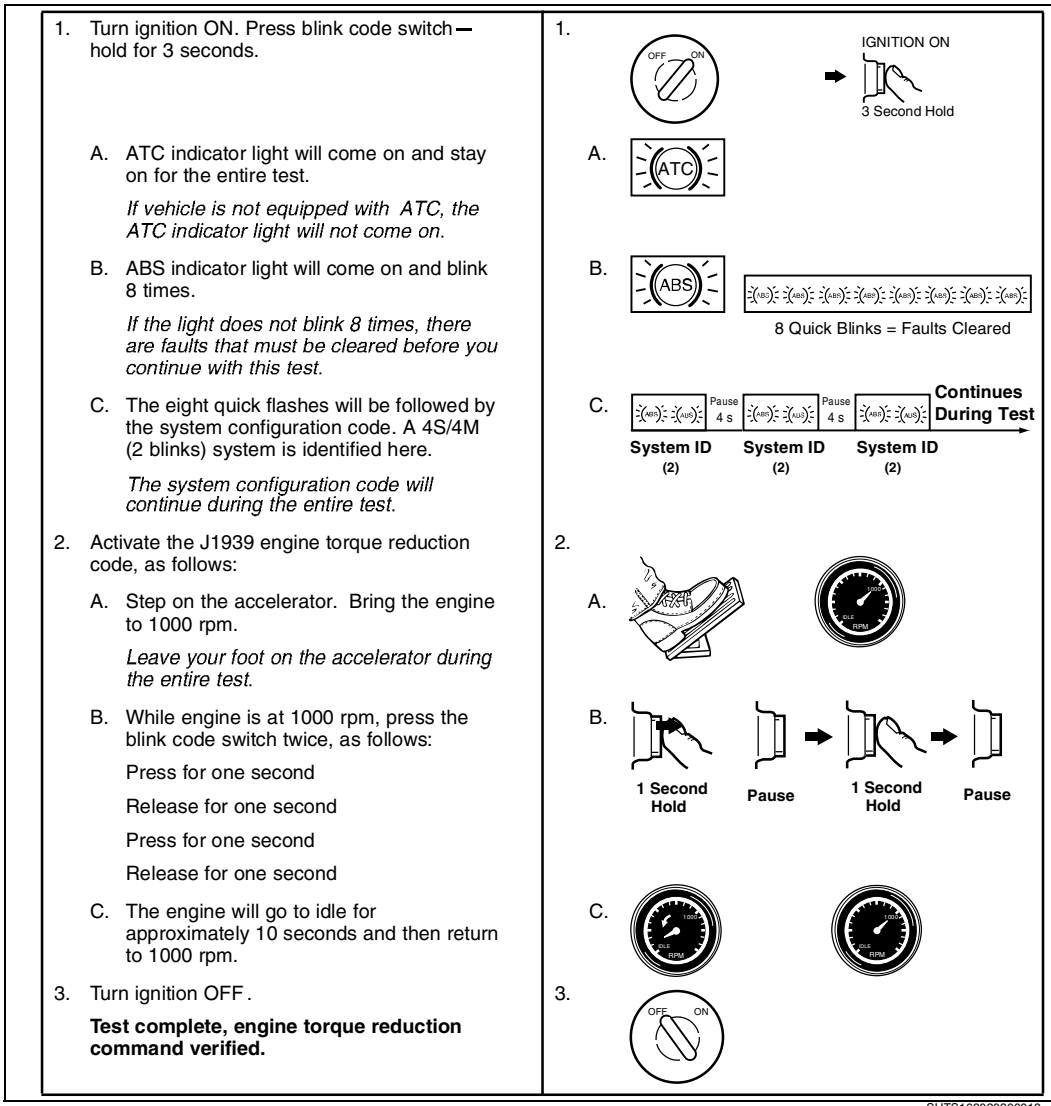
   Press for one second

   Release for one second

   C. The engine will go to idle for approximately 10 seconds and then return to 1000 rpm.

3. Turn ignition OFF.

   Test complete, engine torque reduction command verified.



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1. COMPONENT TEST SCREENS

These screens help you test ABS components. Select this function from the Tractor ABS/ATC menu.

ABS VALVES
ATC
ABS INDICATOR LIGHT
ABS TRAILER INDICATOR LIGHT
ATC INDICATOR LIGHT
ABS/ATC SWITCHES
SENSORS
ENGINE DATALINK
RETARDER RELAY
RETARDER DATALINK
VEHICLE VOLTAGES

Select the appropriate function. Each screen has instructions to guide you through the test. Refer to the Pro-Link Manual for complete instructions.

2. PRO-LINK 9000 DISPLAY

With some ECUs, the Pro-Link will display system information — components or options supported by the ECU. Access these screens through System Setup (main ABS menu).

The following screens illustrate:

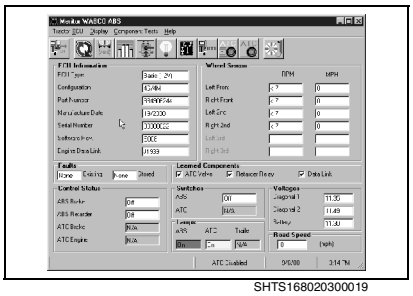
- A 4S/4M ABS/ATC system
- Where the ECU has not recognized a retarder relay
- Where the ECU has recognized a J1939 datalink
- The ECU is capable of supporting ABS and ATC switches.

NOTICE
Yes indicates the ECU is capable of supporting these options. These may or may not be installed on the vehicle.

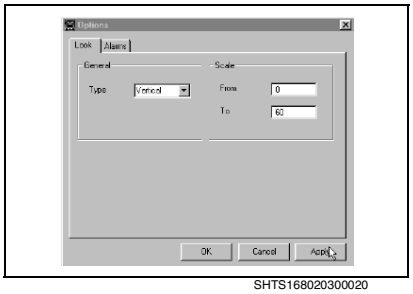
TRACTOR ABS/ATC	
SYSTEM INFORMATION	
SENSORS	**4**
MODULATORS	**4**

ATC VALVE	YES
RETARDER RELAY	NO
J1939	YES
DIFF LOCK	NO
ABS SWITCH	YES
ATC SWITCH	YES

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3. SYSTEM INFORMATION

(1) TOOLBOX Software Display

NOTICE

Refer to page 15 of this manual for instructions for running TOOLBOX Software, or refer to the Software Owner's Manual, TP-99102, for complete instructions.

The quickest method of verifying system information is the TOOLBOX Software ABS Main Screen.

This screen provides information about the current state of Meritor WABCO ABS. ECU information is read once from the ECU and does not change. All other information (e.g., wheel sensors, control status, voltages, faults and road speed) is read and updated continuously.

The status of ABS switches and lights, as well as other data, may also be observed from this screen.

4. COMPONENT TESTS AND FUNCTIONS

(1) TOOLBOX Software

NOTICE

Refer to page 15 of this manual for instructions for running TOOLBOX Software, or refer to the Software Owner's Manual, TP-99102, for complete instructions.

Use TOOLBOX Software to display wheel speeds, cycle ABS valves, activate ABS and ATC lights, including the trailer ABS light, and turn the retarder relay on or off. In addition, the J1939 engine datalink connection may be quickly verified by using TOOLBOX Software.

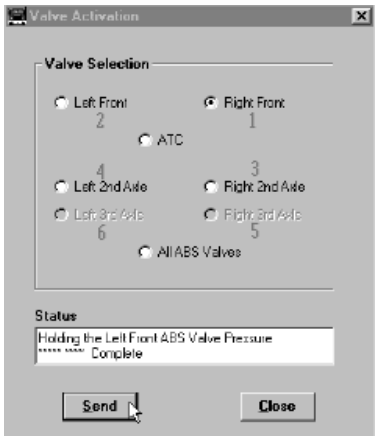
(2) Wheel Speed

Select the wheel speed icon or use the pull down menu from the ABS Main Screen to display wheel speed data in both numeric and graphical form. This data may be shown in RPM or MPH format and in vertical or horizontal graphs. Select the appearance and style from the options menu.

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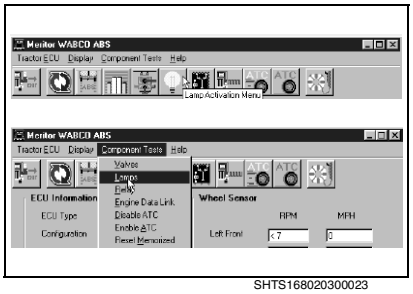


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(3) Valve Activation

Select the valve icon or use the pull down menu to select and cycle individual ABS valves. Then listen to ensure the correct valve is cycling. This is helpful when verifying proper operation, installation and wiring.

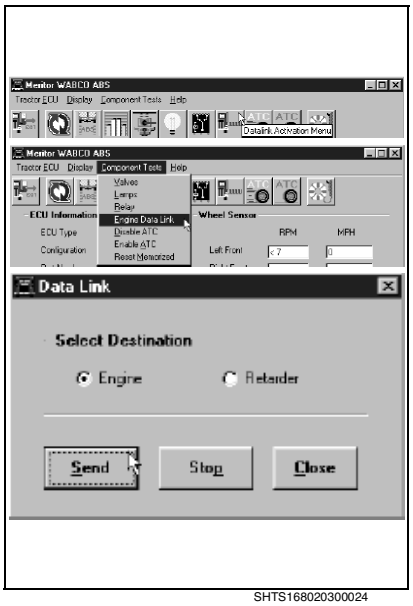
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(4) Light Activation

Select the light icon or use the pull down menu to turn the tractor and trailer ABS and/or the ATC (wheel spin) lights on or off. This is helpful when verifying proper operation, installation and wiring of the lights to the ECU.



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(5) Data Link Activation

Select the **Engine Data Link** icon from the Main ABS Screen or use the pull down menu to send a "limit engine torque" command to the engine or a "disable retarder" command to the retarder.

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(6) Component Tests and Functions (Pro-Link)
These screens help you test ABS components. Select this function from the Tractor ABS/ATC menu.

TRACTOR COMP TESTS
— SELECTIONS —
↑ VEHICLE VOLTAGES ↓

Select the appropriate function. Each screen has instructions to guide you through the test. Refer to the Pro-Link Manual for complete instructions.

The following definitions explain the function of each test.

Component Test	Function
Vehicle Voltages	Monitors the voltage signals powering the ECU.
ABS Valves	Cycles the valves, one at a time. With brake pedal applied, you should hear four short air exhausts, then one long air pressure hold. A menu selection lets you choose from four or six valves. This test is used to verify valve locations and proper wiring. **NOTICE** **The treadle must be applied to pressurize the brake chambers.**
ATC	Checks the ATC valve. You will hear a click as the valve cycles. **NOTICE** **TOOLBOX Software or the Pro-Link may be used to shut off ATC for dynamometer testing.**
ABS Tractor Light	Monitors the commanded (on/off) states of the ABS tractor light. Follow the screen prompts (1 On, 2 Off) to change the status of the light on the instrument panel.
ABS Trailer Light	Monitors the commanded (on/off) states of the ABS trailer light. Follow the screen prompts (1 On, 2 Off) to change the status of the light on the instrument panel.
ATC Tractor Light	Monitors the commanded (on/off) states of the ATC tractor light. Follow the screen prompts (1 On, 2 Off) to change the status of the light on the instrument panel.
ABS/ATC Switches	Checks the status of ABS and ATC/Deep Snow and Mud switches on the instrument panel.
Sensors	Monitors the input to the ECU from the wheel. Vehicle must be stationary and wheels must be rotated during this test.
Engine Datalink	Checks wiring connections and response between the engine and the ECU.
Retarder Relay	Activates the relay to verify function (a click will be heard). This test also checks wiring connections.
Retarder Datalink	Checks wiring connections and retarder response between the retarder and the ECU.

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a. Tire Size Range
For proper ABS/ATC operation with the standard ECU, front and rear tire sizes must be within ± 14% of each other. When this tire size range is exceeded without electronically modifying the ECU, the system performance can be affected and the indicator light can illuminate.

Call Meritor WABCO at 800-535-5560 if you plan a tire size difference greater than 14%.

Calculate the tire size with the following equation:

$$\% \text{ Difference} = \left\{ \frac{\text{RPM Steer}}{\text{RPM Drive}} - 1 \right\} \times 100$$

RPM — tire revolutions per mile

5. TESTING COMPONENTS

⚠ CAUTION
When troubleshooting and testing the ABS system, do not damage the connector terminals.

(1) Voltage Check
Measure voltage at the pins indicated in **Table C.**

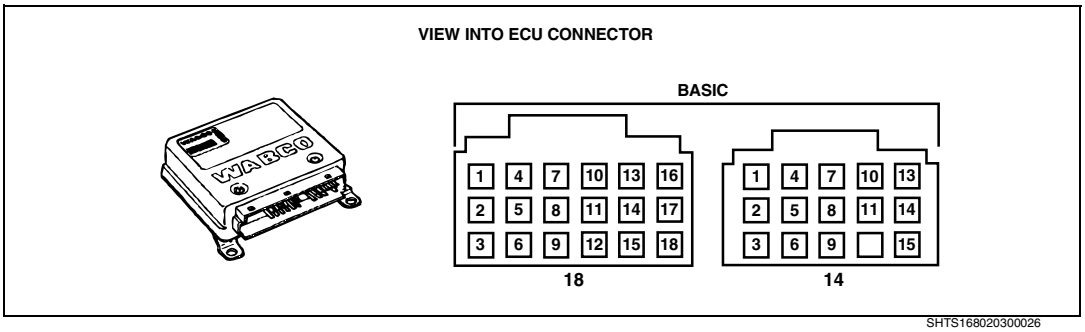
- Voltage must be between 9.5 and 14.0 volts.
- The ignition must be turned ON for this test.

Table C: Voltage check pins

ECU	Connector	Pins
Universal	14-Pin	4 and 9 9 and 4
Basic	14-Pin	7 and 4 8 and 9
Frame-mounted	X1-Grey	1 and 12 2 and 11

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NOTICE
Pin locations are illustrated in figure (Frame) and figure (Basic and Universal).



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(2) Location of Sensors
On steering axles, the sensor is accessible on the in-board side of the steering knuckle.

On drive axles, the drum assembly may have to be pulled to gain access to the sensor.

(3) Sensor Adjustment

- Push the sensor in until it contacts the tooth wheel.
- Do not pry or push sensors with sharp objects.
- Sensors will self-adjust during wheel rotation.

(4) Sensor Output Voltage Test
Voltage must be at least 0.2 volts AC at 30 rpm.
a. Turn ignition OFF.
b. Disconnect the appropriate connector from the ECU (refer to wiring diagram).
c. Rotate wheel by hand at 30 rpm (1/2 revolution per second).
d. Measure voltage at the pins indicated in **Table D**.

- If the minimum output voltage is less than 0.2, push the corresponding sensor toward the tooth wheel, then repeat the measurement.

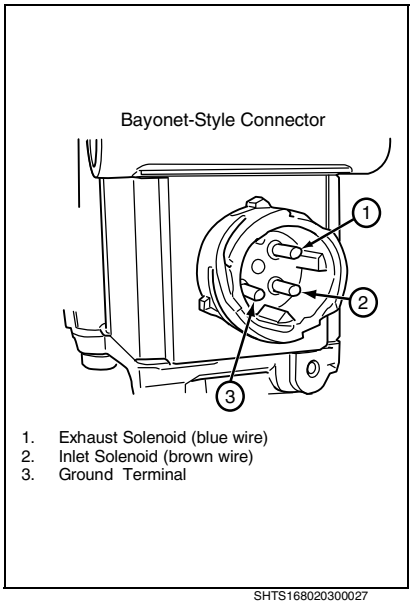
Table D: Sensor Check Pins

ECU	Sensor	Connector	Pins
Basic	LF RF LR RR	18-Pin 18-Pin 18-Pin 18-Pin	12 and 15 10 and 13 11 and 14 17 and 18

(5) Sensor Resistance
The sensor circuit resistance must be between 900 and 2000 ohms. Resistance can be measured at the sensor connector, or at the pins on the ECU connector. To measure resistance:
a. Turn ignition OFF.
b. To measure resistance at the sensor connector, disconnect the ECU connector from the ECU. To measure resistance at the sensor connector, disconnect the sensor from the sensor extension cable.
c. Measure output at the pins indicated in **Table D**.

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VALVE TESTS



1. Exhaust Solenoid (blue wire)
2. Inlet Solenoid (brown wire)
3. Ground Terminal

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1. ABS MODULATOR VALVE

Measure resistance across each valve solenoid coil terminal and ground on the ABS valve to ensure 4.0 to 9.0 ohms.

- If the resistance is greater than 9.0 ohms, clean the electrical contacts in the solenoid. Check the resistance again.
- To check the cable and the ABS valve as one unit, measure resistance across the pins on the ECU connector of the harness. Check the diagram of the system you are testing for pin numbers. (Refer to page DN03-27.)

COMPONENT REMOVAL AND INSTALLATION

1. VALVES

- ABS Modulator Valves

2. SENSOR LUBE SPECIFICATION

Meritor WABCO specifications call for a sensor lubricant with the following characteristics:

Lube must be mineral oil-based and contain molydisulfide. It should have excellent anti-corrosion and adhesion characteristics, and be capable of continuous function in a temperature range of -40° to 300°F (-40° to 150°C).

⚠ WARNING

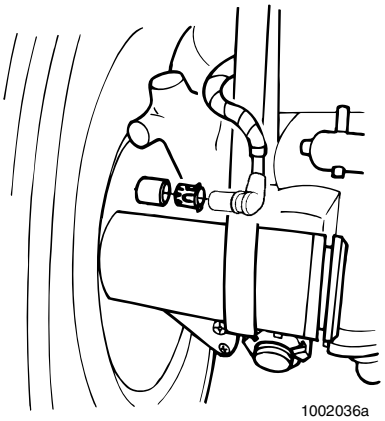
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Release all air from the air systems before you remove any components. Pressurized air can cause serious personal injury.

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⚠ CAUTION
Use the following procedures to avoid damage to the electrical system and ABS/ATC components.

When welding on an ABS- or ABS/ATC-equipped vehicle is necessary, disconnect the power connector from the ECU.


1002036a
Knuckle-Mounted Sensor
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3. WHEEL SPEED SENSOR REMOVAL — FRONT AXLE
To remove the sensor from the front axle:

⚠ WARNING
Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

(1) Put blocks under the rear tires to stop the vehicle from moving. Apply the parking brake.
(2) If necessary, raise the front tires off the ground. Put safety stands under the axle.
(3) Disconnect the fasteners that hold the sensor cable to other components.
(4) Disconnect the sensor cable from the chassis harness.
(5) Remove the sensor from the sensor holder. Use a twisting motion if necessary. **Do not pull on the cable.**

4. WHEEL SPEED SENSOR INSTALLATION — FRONT AXLE
To replace the sensor in the front axle:
(1) Connect the sensor cable to the chassis harness.
(2) Install the fasteners used to hold the sensor cable in place.
(3) Apply a Meritor WABCO recommended lubricant to the sensor spring clip and sensor.
(4) Install the sensor spring clip. Make sure the spring clip tabs are on the inboard side of the vehicle.
(5) Push the sensor spring clip into the bushing in the steering knuckle until the clip stops.
(6) Push the sensor completely into the sensor spring clip until it contacts the tooth wheel.

NOTICE
After installation, there should be no gap between the sensor and the tooth wheel. During normal operation, a gap of up to 0.04-inch is allowable.

(7) Remove the blocks and safety stands.

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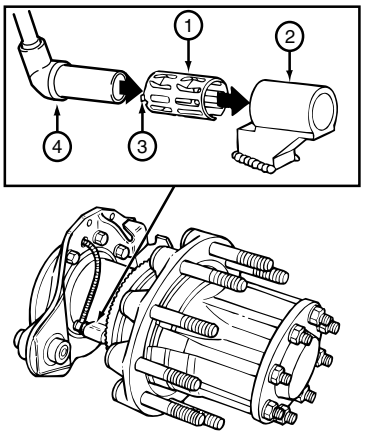
5. WHEEL SPEED SENSOR REMOVAL— REAR AXLE

To remove the sensor in the rear axle:

⚠ WARNING

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

(1) Put blocks under the front tires to stop the vehicle from moving.
(2) Raise the rear tire off the ground. Put safety stands under the axle.
(3) Release the parking brake and back off the slack adjuster to release the brake shoes.
(4) Remove the wheel and tire assembly from the axle.
(5) Remove the brake drum.
(6) Remove the sensor from the mounting block in the axle housing. Use a twisting motion if necessary. Do not pull on the cable.
(7) Remove the sensor spring clip from the mounting block.
(8) Disconnect the fasteners that hold the sensor cable and the hose clamp to other components.
(9) Disconnect the sensor cable from the chassis harness.



1002037a

1. Spring Clip
2. Sensor Holder
3. Spring Clip Tab
4. Sensor

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6. WHEEL SPEED SENSOR INSTALLATION—REAR AXLE

(1) Apply a Meritor WABCO recommended lubricant to the sensor spring clip and sensor.
(2) Install the sensor spring clip. Make sure the spring clip tabs are on the inboard side of the vehicle.
(3) Push the sensor spring clip into the mounting block until it stops.

NOTICE

After installation, there should be no gap between the sensor and the tooth wheel. During normal operation, a gap of up to 0.04-inch is allowable.

(4) Push the sensor completely into the sensor spring clip until it contacts the tooth wheel.
(5) Insert the sensor cable through the hole in the spider and axle housing flange. Route the cable to the frame rail. Be sure to route the cable in a way that will prevent pinching or chafing and will allow sufficient movement for suspension travel.
(6) Connect the sensor cable to the chassis harness.
(7) Install the fasteners that hold the sensor cable in place.
(8) Install the brake drum on the wheel hub.
(9) Complete the installation per vehicle manufacturer's manual.

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7. ABS MODULATOR VALVE

(1) Removal

a. Turn ignition switch to the OFF position, apply parking brake.

⚠ WARNING

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

b. Put blocks under the front and rear tires to stop the vehicle from moving.

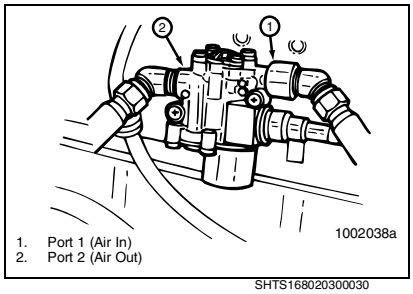
c. If necessary, raise the vehicle off the ground and put safety stands under the axle.

d. Disconnect the wiring connector from the ABS valve.

e. Disconnect the air lines from Ports 1 (air supply) and 2 (air discharge) of the ABS valve.

f. Remove the two mounting capscrews and nuts.

g. Remove the ABS valve.



1. Port 1 (Air In)
2. Port 2 (Air Out)

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(2) Installation

⚠ CAUTION

Moisture can affect the performance of all ABS/ATC systems, as well as the standard braking system. Moisture in air lines can cause air lines to freeze in cold weather.

To install the ABS modulator valve:

a. Install the ABS valve with two mounting capscrews and nuts. Tighten the capscrews per the manufacturer's recommendation.

b. Connect the line to the brake chambers to Port 2 of the ABS valve. Connect the air supply line to Port 1 of the ABS valve.

c. Connect the wiring connector to the ABS valve. Hand tighten only.

d. Remove the blocks and stands.

e. Test the installation. (Refer to below.)

f. Checking the installation

To test the modulator valve:

a. Apply the brakes. Listen for leaks at the modulator valve.

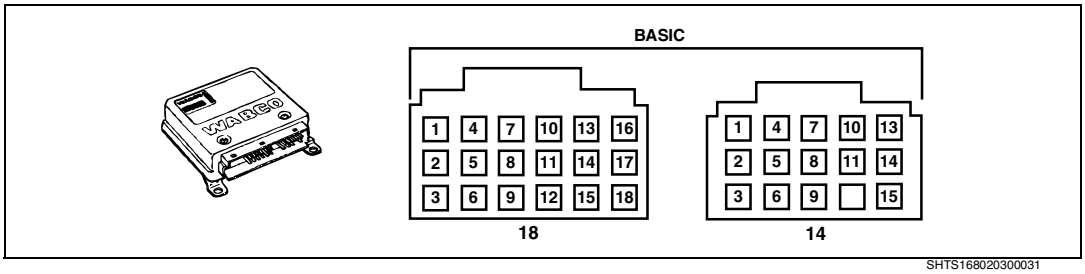
b. Turn the ignition on and listen to the modulator valve cycle. If the valve fails to cycle, check the electrical cable connection. Make repairs as needed.

c. Drive the vehicle. Verify that the ABS indicator light operates properly.

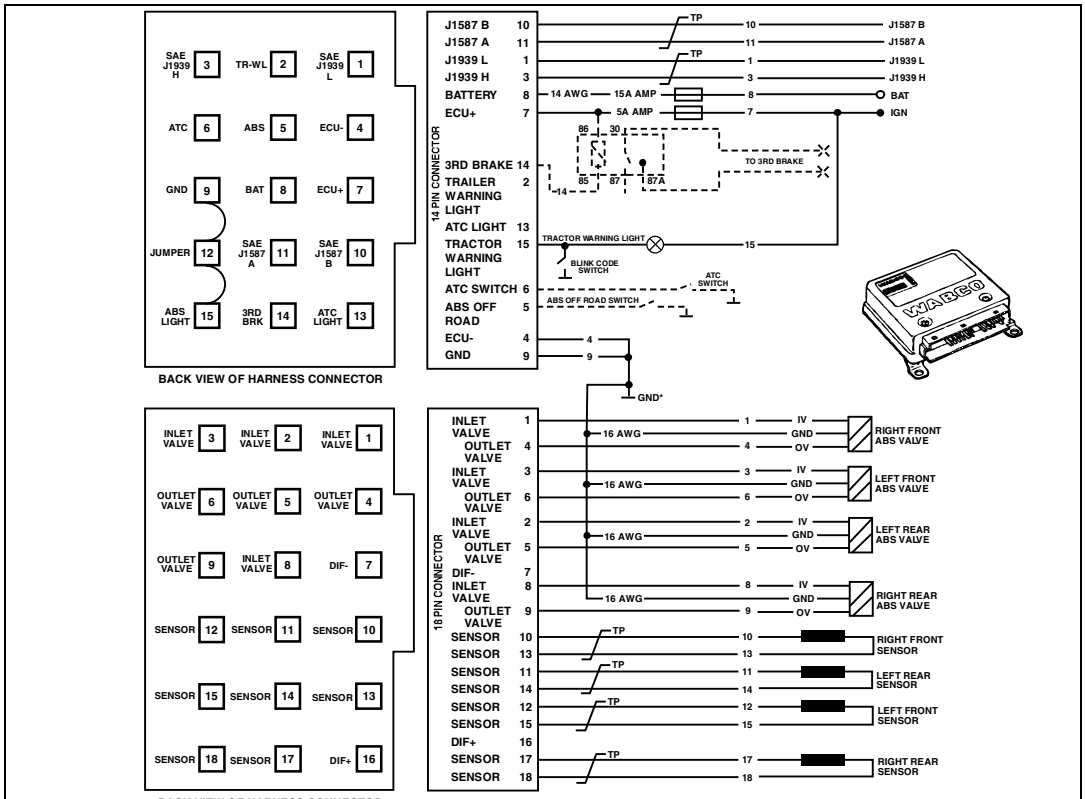
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WIRING DIAGRAM

1. BASIC ECU (CAB-MOUNTED)



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1. Momentary Switch
2. ------- Optional Equipment
3. Twisted Pair = TP
4. All unmarked wires should be 16 or 18 AWG.
5. All fuses should be blade type.

*All connected to a common star ground.

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RECONFIGURATION PROCEDURE

1. HOW TO RECONFIGURE AN ECU (E VERSION)
Before reconfiguring the ECU, contact ArvinMeritor's Customer Service Center at 800-535-5560 for additional information.

E version ECUs memorize the following components if they are connected at power-up:

- ATC valve
- Retarder relay
- Datalink SAE J1939

Once these components have been memorized, the ECU will look for them at each power-up. If memorized component is not present, the ECU will record a fault. For example, if an ATC valve memorized, but is not present at the next power-up, the ECU records a fault. This can occur if an ECU is moved from one truck to another and one or more of the memorized components are not available on the new truck. If this occurs, use TOOLBOX Software to reconfigure the ECU. If you do not have TOOLBOX Software, follow the Manual Reconfiguration instructions listed on DN03-29.

2. TOOLBOX SOFTWARE

NOTICE
For complete instructions for using TOOLBOX Software, refer to the TOOLBOX User's Manual, TP-99102.

To reconfigure the ECU with TOOLBOX Software, use the **Reset Memorized** command.

Select **Reset Memorized** from the pull down menu to tell the ECU to reset the memorized or "learned" components.

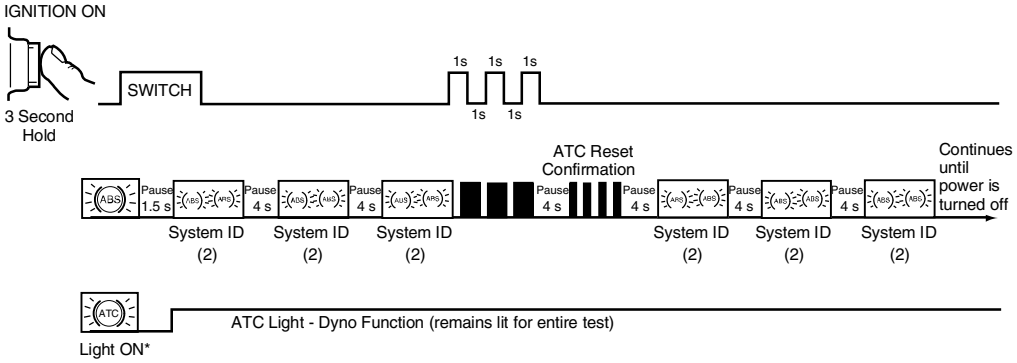
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3. MANUAL RECONFIGURATION

Action	Result	Reason
1. Turn ignition ON. 2. Press and hold blink switch for at least three seconds. NOTE: Do not hold this switch longer than seven seconds.	ABS light displays the ABS system configuration code*: O Two blinks: 4S/4M * The ABS light may display eight quick flashes before the system configuration code begins.	Stored faults cleared, no active faults present. Continue with reconfiguration. NOTE: The reconfiguration procedure can not be conducted if there are active faults present. These must be repaired before proceeding with the reconfiguration.
Observe the ABS and A TC lights.	ATC light comes on and stays on.	A complete A TC system — including an ATC light —is installed. If not, the A TC light will not come on.
	ABS light will continuously blink the system configuration code.	ECU reconfiguring the system. The ECU checks the following components and reprograms itself based on the new system: O Retarder relay AND/OR
While the configuration code is flashing, press the blink code switch three times (one second each, with a one second pause between each). Turn ignition OFF.	ABS light displays four quick flashes , followed by a continuous display of the system configuration code. NOTE: System configuration code continues until ignition is turned OFF.	Successfully reconfigured.

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A system reconfiguration is illustrated below:



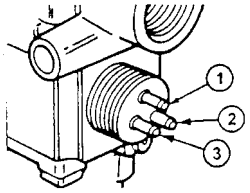
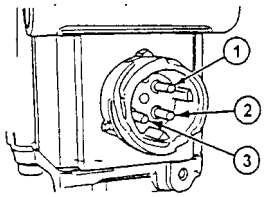
*ATC Light will light only if ATC is connected.

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TROUBLESHOOTING GUIDE - MERITOR WABCO ABS VALVE PACKAGE

This Troubleshooting Guide is a reference tool to help identify possible malfunctions of the ABS modulator or relay valves. It does not take the place of diagnostic tests or other service instructions.

ABS Valve Package Troubleshooting Guide		
Condition	**Possible Cause**	**Recommended Action**
Air constantly leaks from exhaust port of relay valve.	Internal relay valve problem.	• Replace the relay valve.
Air leaks from exhaust port of ABS modulator valve or relay valve when parking brake is released.	Parking brake problem. OR Anti-compound 2-way check valve problem.	• Service appropriate component. – Refer to manufacturer's service manual for instructions.
Rear service brakes releasing slowly (brakes dragging)	Kinked air line. Dirt buildup inside relay valve.	• Inspect/repair lines, brakes. ***If condition is not corrected:*** • Replace relay valve.
valves don't cycle at power-up. OR Indicator light comes on (blink code or diagnostic tool indicates electrical problem with ABS valve).	Broken wire. OR Loose or broken terminal connection. Corroded connector pins. OR Problem with solenoid. Open-Style Connector  1. Ground Terminal 2. Exhaust Solenoid (blue wire) 3. Inlet Solenoid (Brown wire) Bayonet-Style Connector  1. Exhaust Solenoid (blue wire) 2. Inlet Solenoid (Brown wire) 3. Ground Terminal	• Check wires and connectors. – Make repairs as needed. ***If condition is not corrected:*** • Measure resistance across each valve solenoid coil terminal and ground on the ABS modulator valve to ensure 4.0 to 8.0 ohms. – If greater than 8.0 ohms, clean valve and repeat measurement. – If cleaning does not solve problem, replace the ABS modulator valve. – If less than 4.0 ohms, replace ABS modulator valve.
ABS valve package damaged.	• Road Hazards. OR • Vehicle Damage.	• Replace complete ABS valve package or individual component as required.

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