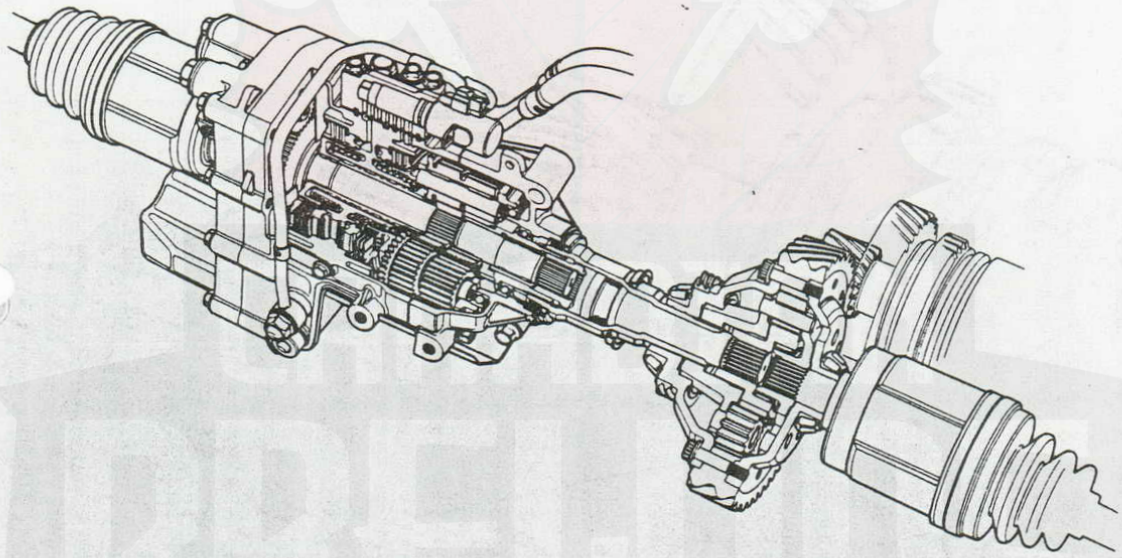
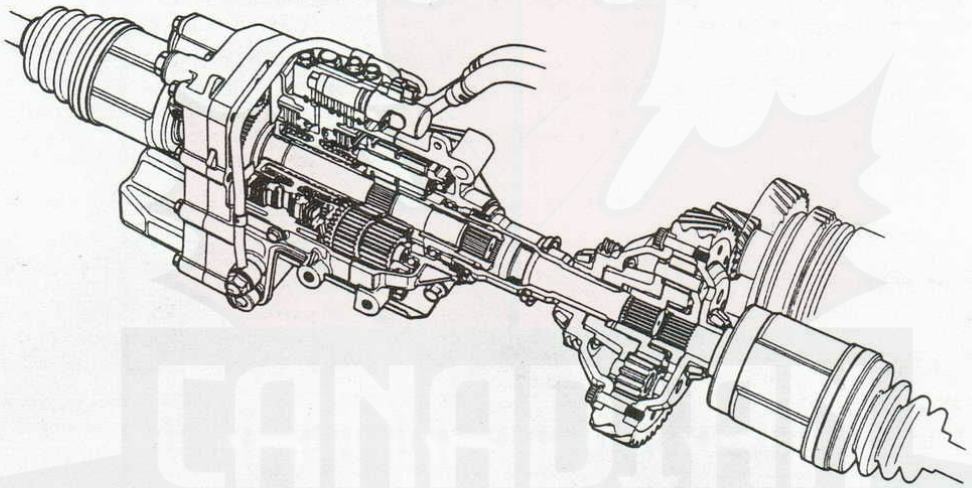
1997 PRELUDE TYPE SH



TECHNICIAN'S
INFORMATION GUIDE

HONDA
PROFORMANCE



Copyright

All information contained in this publication is based on the latest product information available at the time of printing.

For all repair methods and troubleshooting refer to the Service Manual.

TRANSAXLE

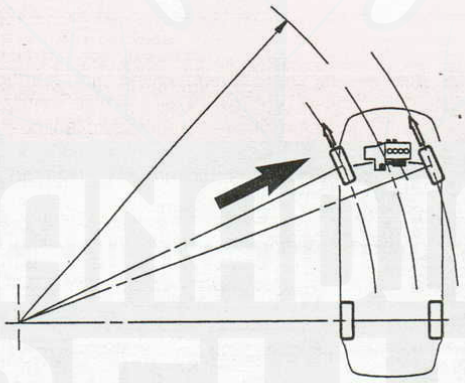
SUSPENSION

INTRODUCTION

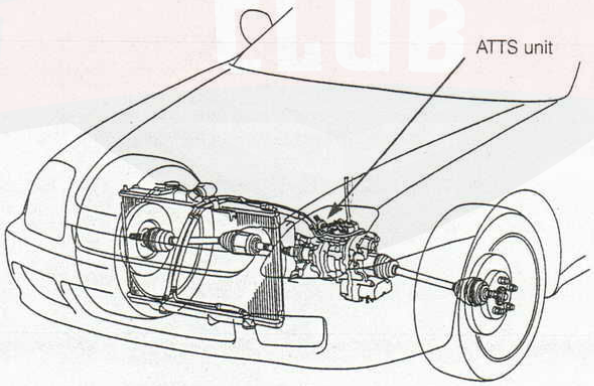
Purpose

Front wheel drive cars have become increasingly popular because of their efficient use of space and power transfer efficiency. However, this design has not been traditionally used for sports cars because of the tendency of front wheel drive cars to "understeer" when driven quickly.

With the center of gravity biased toward the front of the car, inertia causes the front end to slide toward the outside of the turn before the rear does as the traction limit of the tires is approached. The driver must then turn the steering wheel harder into the turn to maintain the desired turning angle. When power is applied, the rearward weight shift reduces the available traction at the front.



The Active Torque Transfer System (ATTS) helps to counteract the tendency to understeer by inducing a forced differential action on the front wheels. In the left hand turn situation pictured above the ATTS would cause the right front wheel to turn faster than the left front. This induces a left hand turning force that counteracts the understeer tendency. The result is that the car stays on the intended driving line without the driver having to make any additional steering correction.

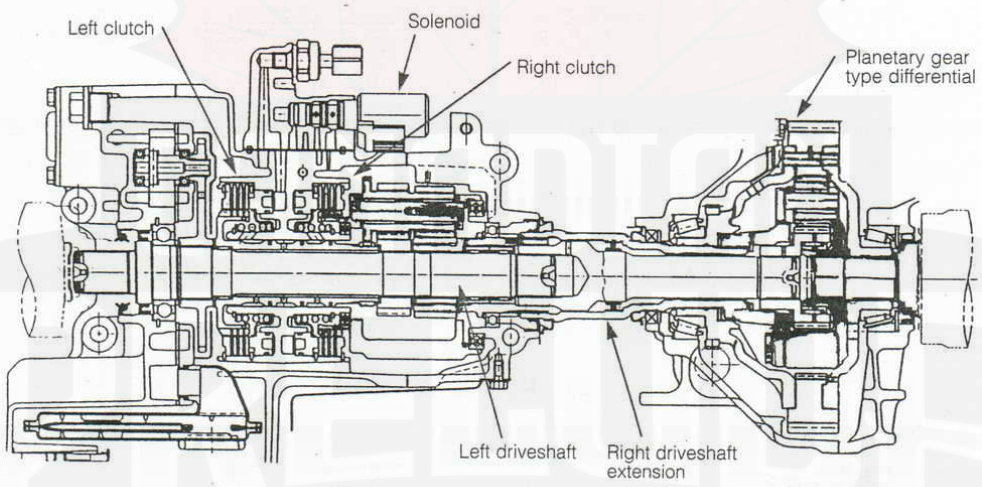


Overview

ATTS is only available mated with a manual transmission. The manual transmission is essentially the same as for non-ATTS cars, but it is equipped with a planetary gear type differential.

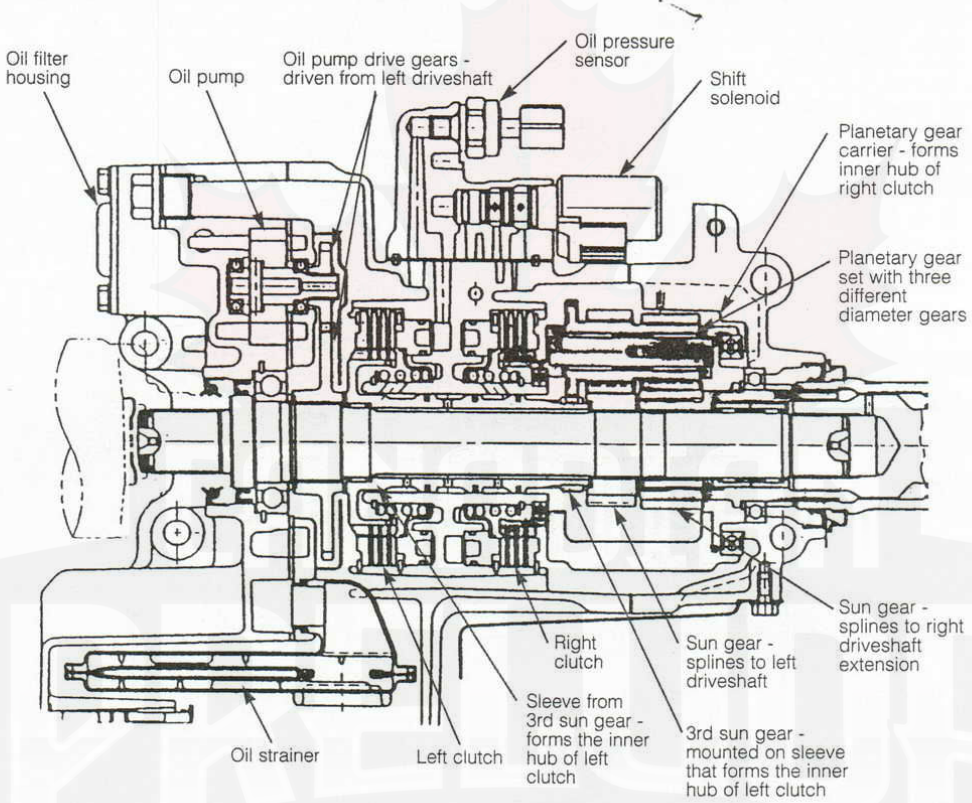
The ATTS unit is mounted on the back of the engine where the extension shaft would normally be located. The left driveshaft extends through the unit and an extension from the right driveshaft goes into the unit. Both engage a planetary gear set inside the unit. Two clutches are operated via three electronic solenoids. The clutches act on the planetary gear set to force a differential action on the driveshafts. The ATTS unit can induce up to a 15% speed difference between the left and right front wheels by fully applying one of the clutches.

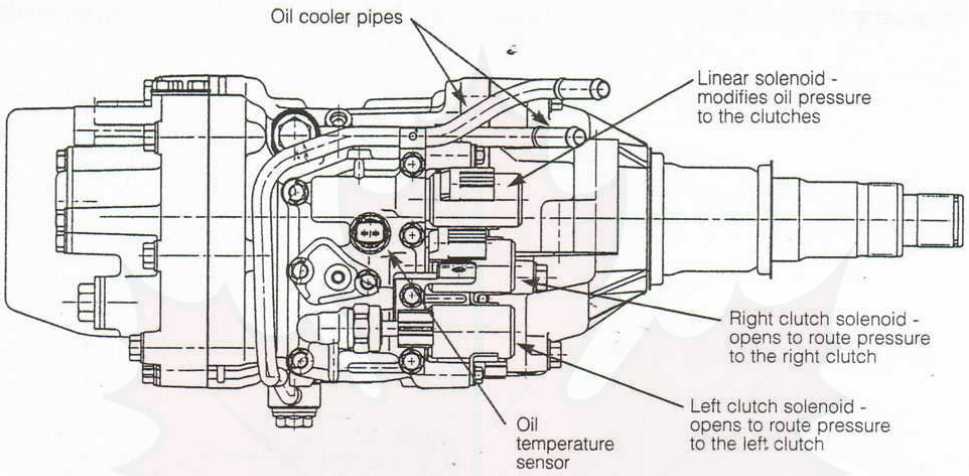
The solenoids are operated by an ATTS Control Unit that receives input from various sensors to determine when and how much clutch pressure to apply.



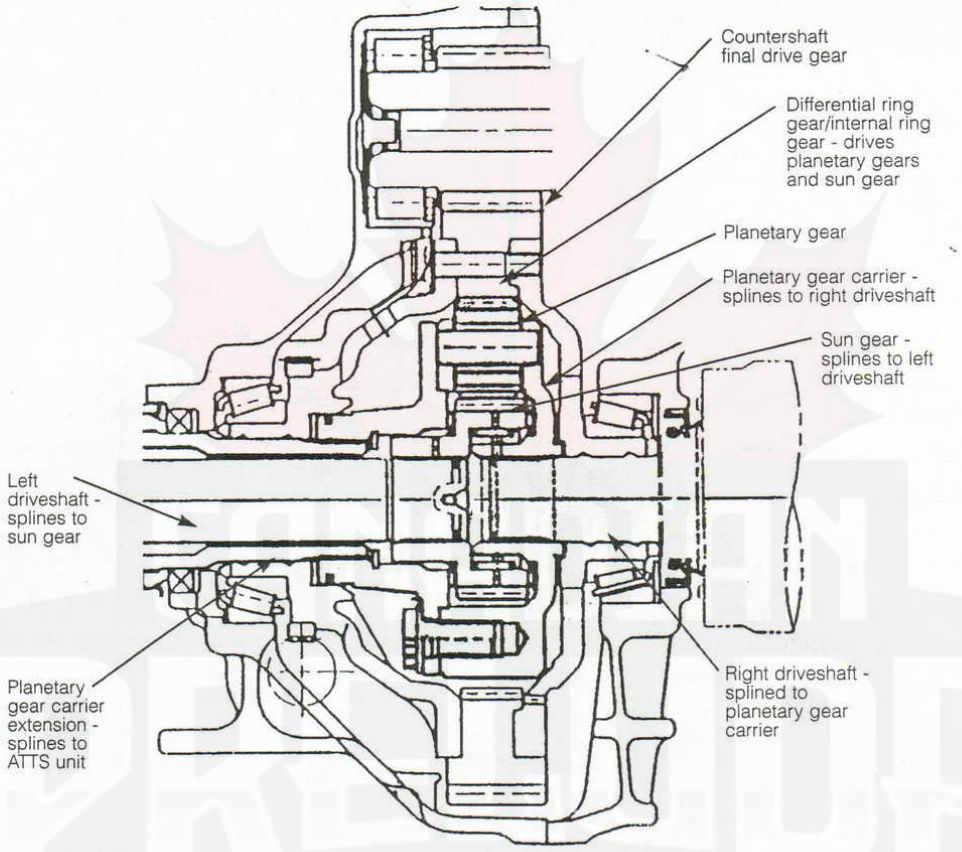
CONSTRUCTION

ATTS Unit





Planetary Gear Type Differential

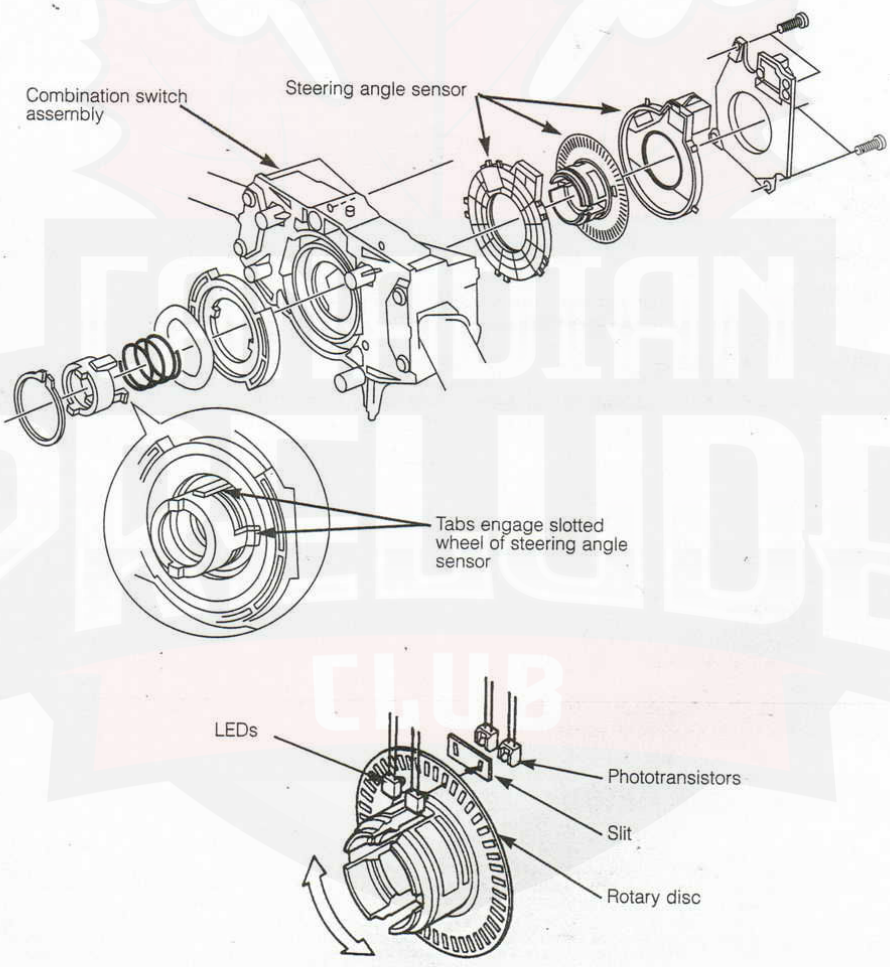


Optical Type Steering Angle Sensor

An optical type steering angle sensor located in the steering column informs the ATTS Control Unit what the steering angle is and what the steering wheel speed is.

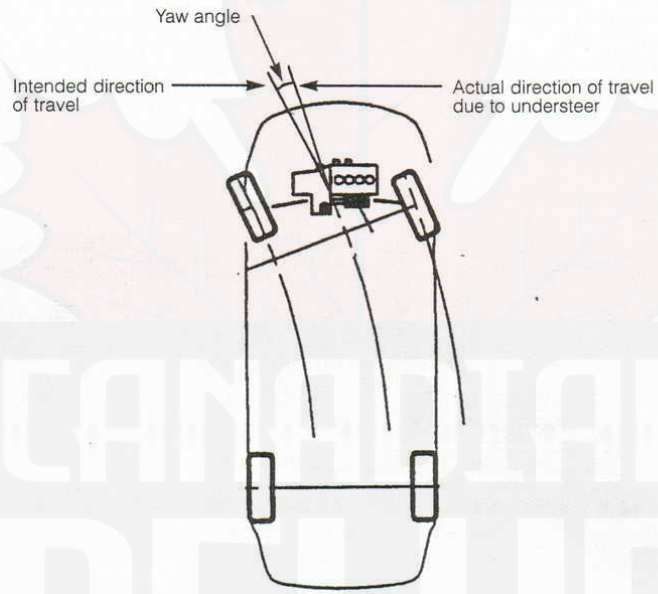
The sensor consists of an LED, a light sensing diode opposite the LED and a slotted wheel connected to the steering column that rotates between them.

Note that if the steering angle sensor is replaced there is a procedure for setting the steering angle sensor neutral position.

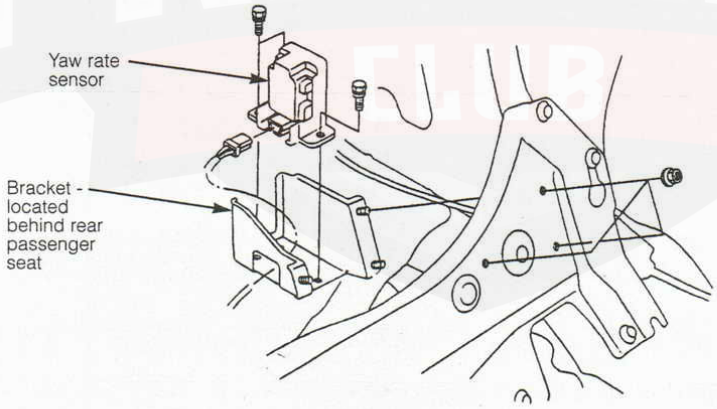


Yaw Rate Sensor

"Yaw" refers to the difference between the turn angle of the front wheels and the car's actual direction of travel. Under normal turning at slow to moderate speeds the yaw angle is zero. But if the car begins to understeer there is a yaw angle. The yaw rate sensor electronically detects the yaw angle and communicates this information to the ATTS control unit.

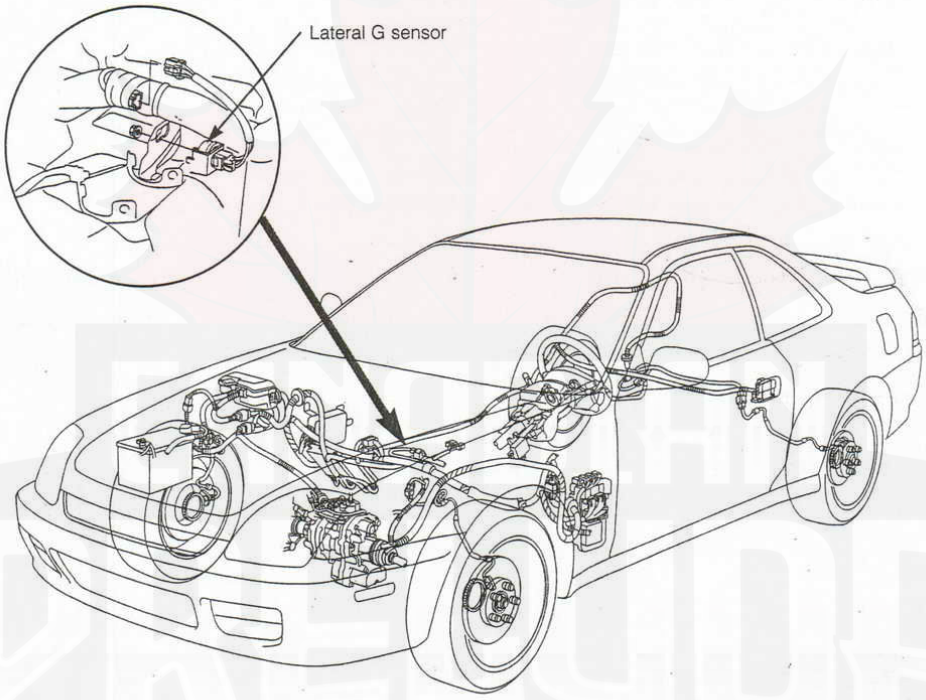


The yaw rate sensor is located behind the rear passenger seat back on the driver's side. It can be accessed by removing the rear seat back.



Lateral G Sensor

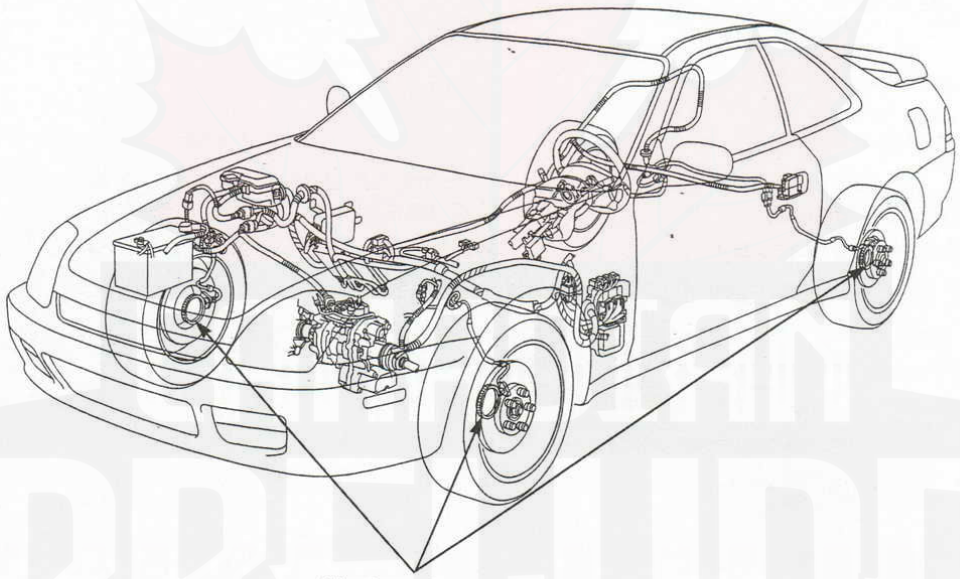
The Active Torque Transfer System uses a lateral G (acceleration) sensor to detect actual cornering force. The unit is an accelerometer that is oriented sideways in the car to detect the sideways acceleration force. It is mounted on the rear engine bulkhead inside the passenger compartment, just below the dashboard.



Wheel Speed Sensors

The ATTS control unit monitors the same wheel speed sensors as are used for ABS function. The difference in wheel speed from right to left is one of the indicators that a correction might be required.

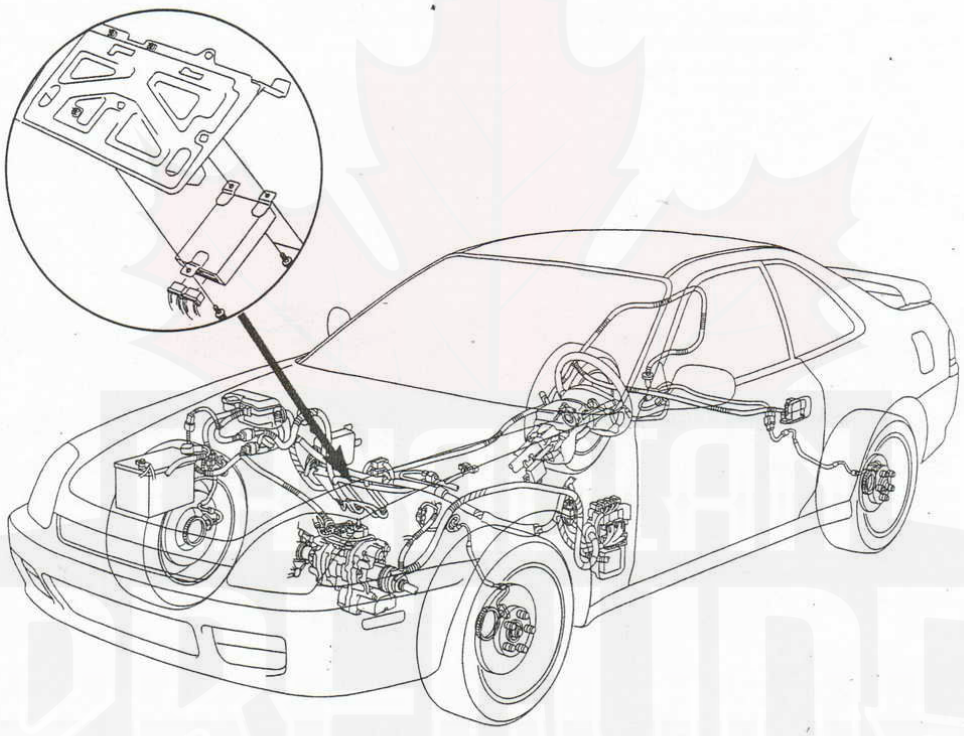
When the ATTS makes a correction by applying pressure to one of the clutches inside the ATTS unit, it monitors the effect of the change via the wheel speed sensors.



Wheel speed sensors

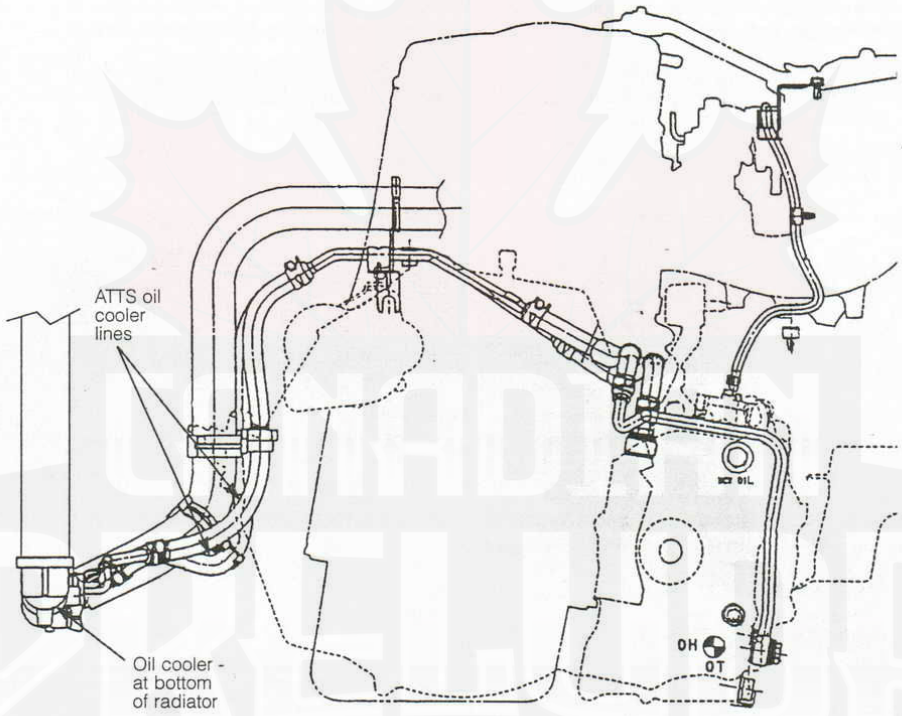
ATTS Control Unit

The ATTS control unit is located next to the ECM in the front passenger side foot well.



ATTS Oil Cooler

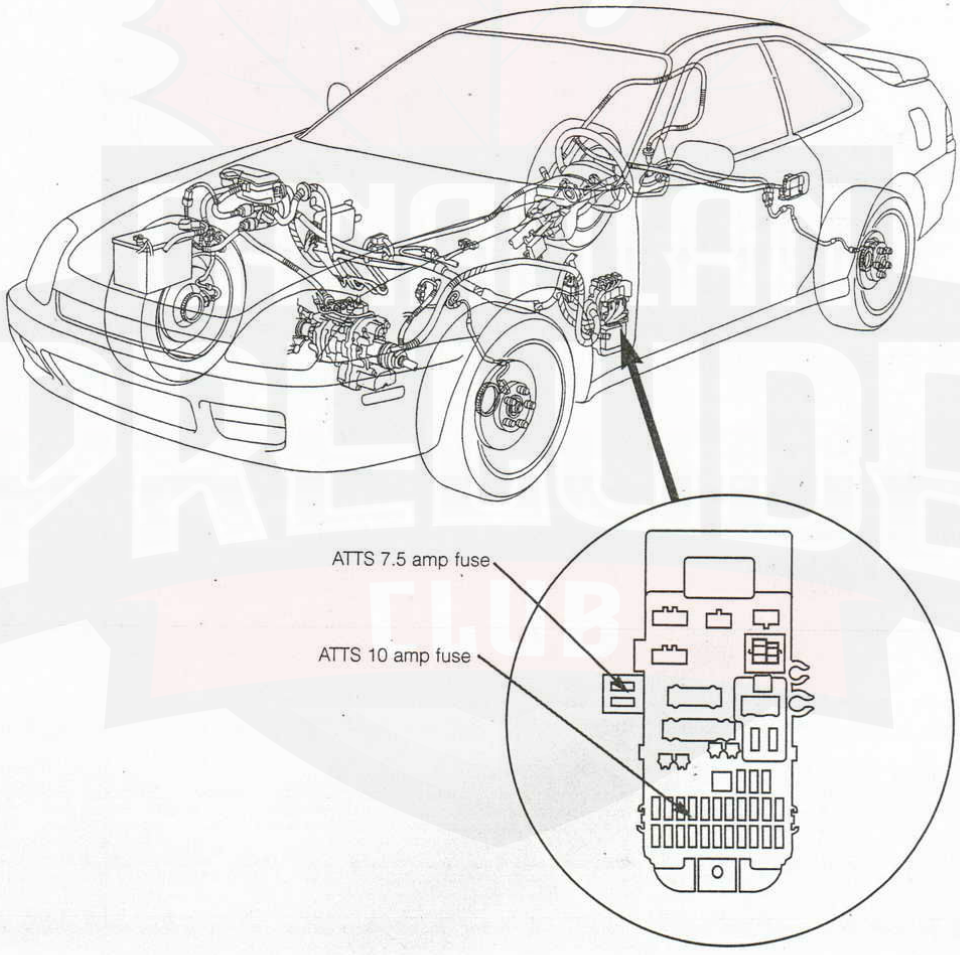
The ATTS unit uses ATF for hydraulic operation. This ATF is routed to an oil cooler located underneath the radiator. This is exactly the same oil cooler as is used in automatic transmission models. The oil cooler lines are routed over top of the transmission.



ATTS Fuses/Fail-Safe Relay

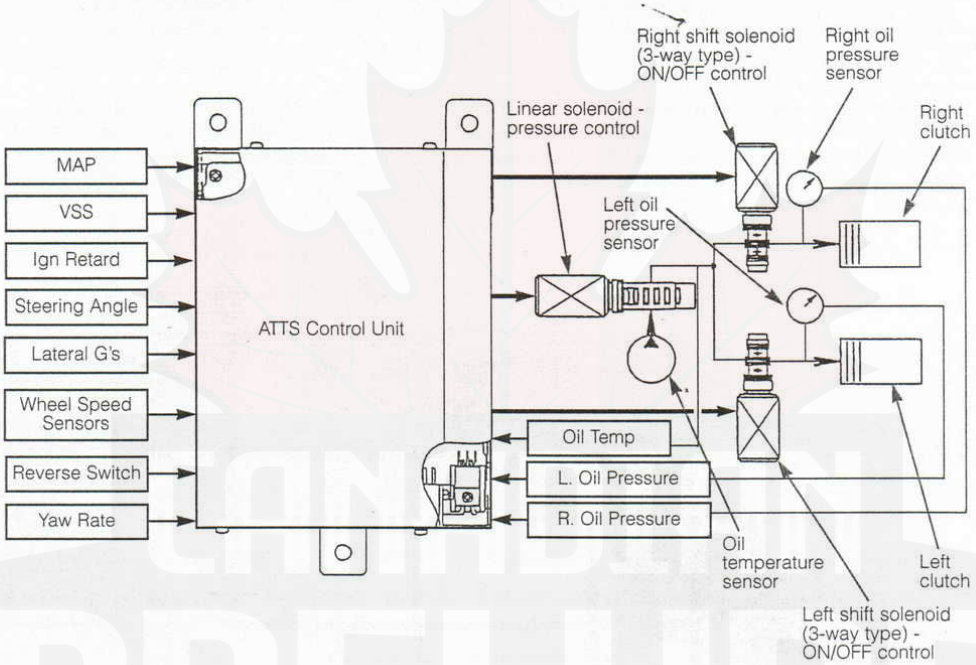
The ATTS control unit is supplied power via two fuses and a fail-safe relay. All are located in the under dash fuse box.

- The 7.5 amp fuse provides power to the fail-safe relay coil. Its circuit is completed in the control unit.
- The 10 amp fuse provides power to the control unit to operate the ATTS unit solenoids. Its circuit is completed through the fail-safe relay whenever the relay is activated by the control unit.
- The fail-safe relay must be activated by the ATTS control unit for the system to function. If the ATTS control unit determines that there is problem in the system, it will deactivate the fail-safe relay and the ATTS unit solenoids will default to the closed position, stopping all ATTS operation.



FUNCTION

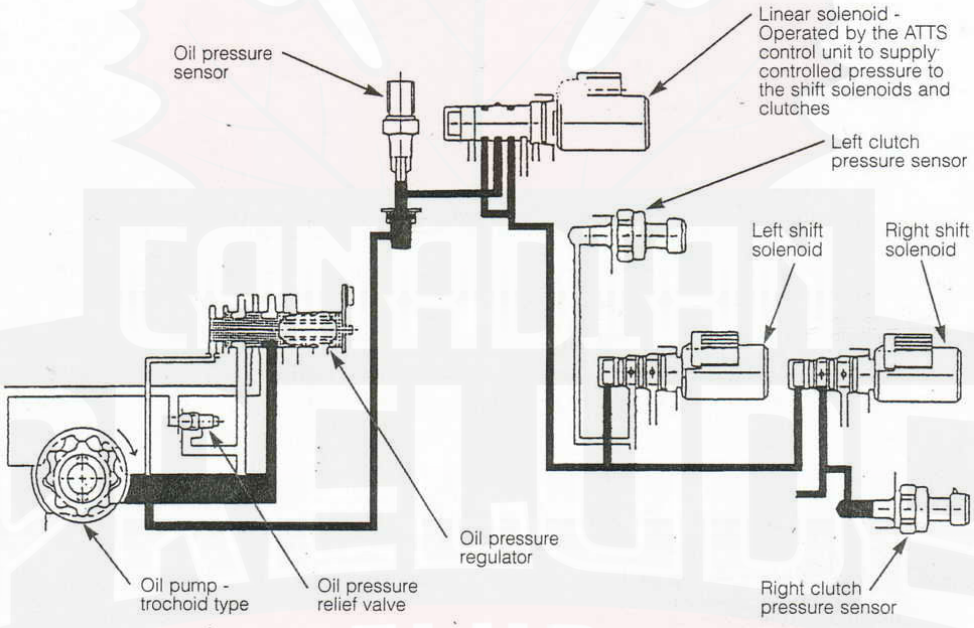
ATTS Control Unit - Main Inputs and Outputs



Oil Pressure Control

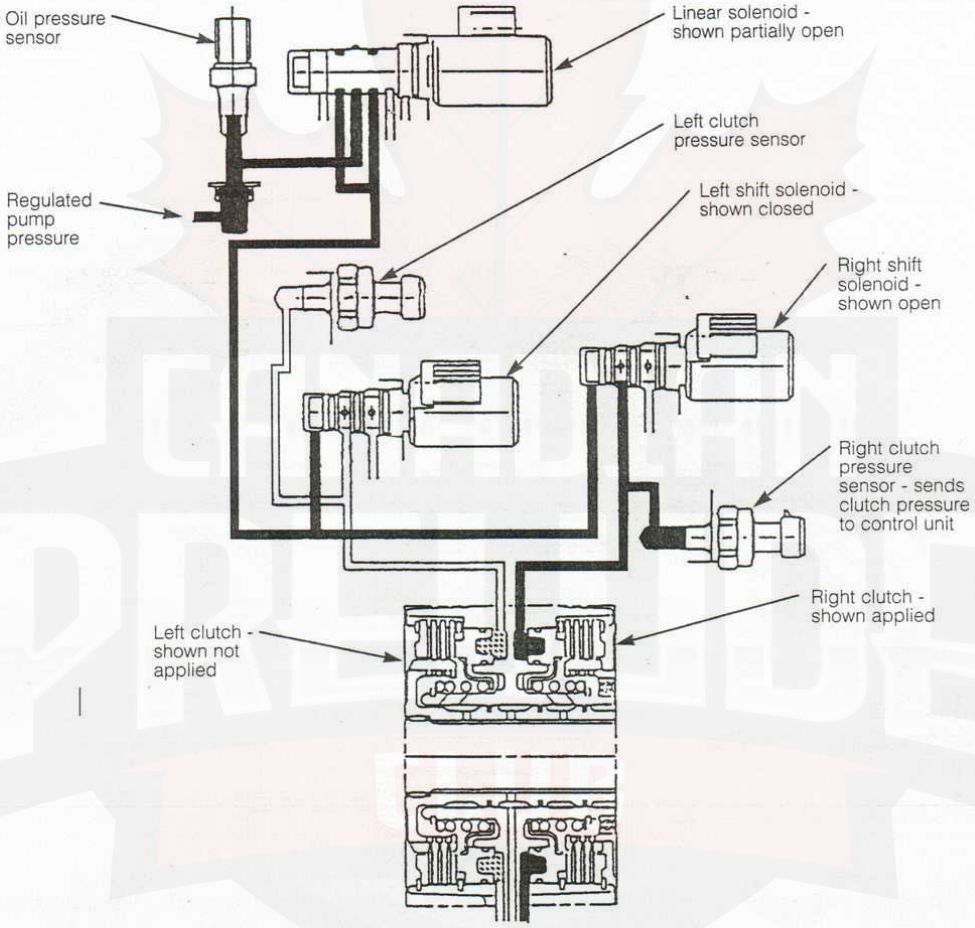
Basic oil pressure in the ATTS unit is supplied by a trochoid type oil pump that is driven by the left driveshaft. A pressure regulator valve maintains the oil pump output at a constant pressure and a pressure relief valve ensures that maximum pressure cannot be exceeded. This pressure is then applied to the linear solenoid.

When the ATTS control unit decides that ATTS function is required, it operates the linear solenoid to supply the desired amount of pressure to the left or right shift solenoid and clutch. The ATTS control unit monitors the oil pressure sensors to verify that the desired amount of pressure has been applied and adjusts the linear solenoid if necessary.



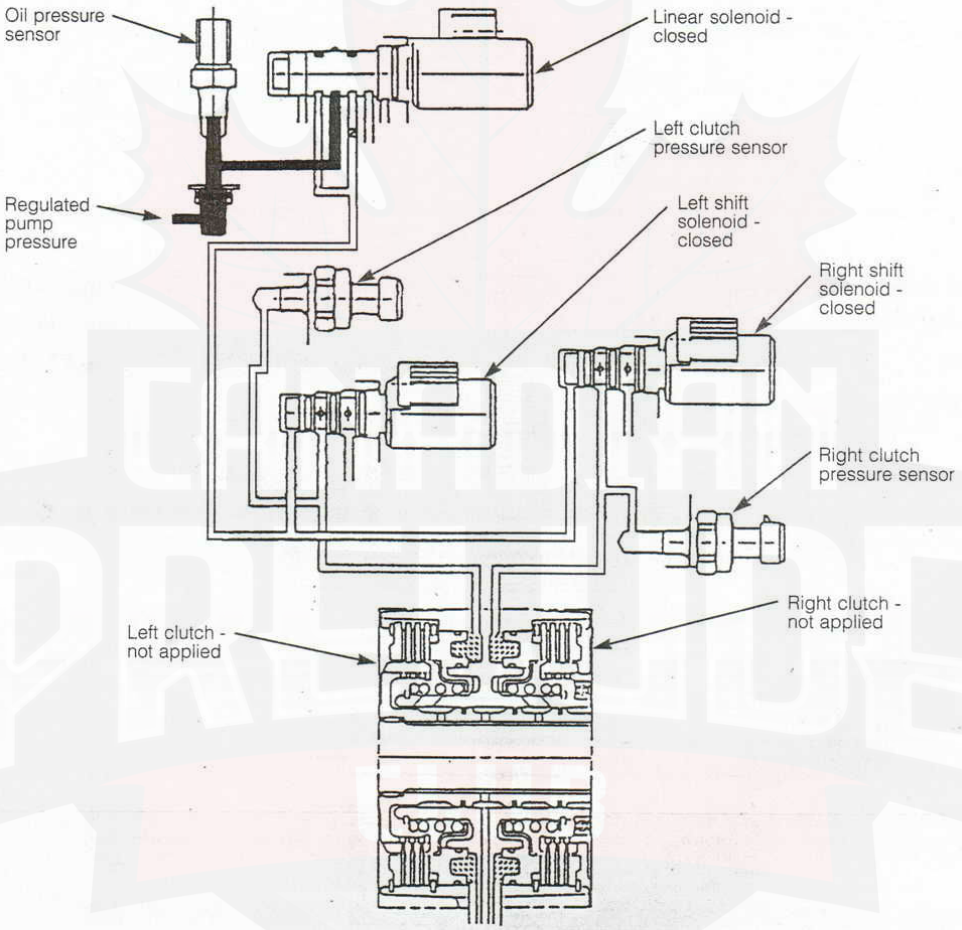
Clutch Application Control

When the ATTS control unit determines that ATTS action is required, it operates the linear solenoid to supply the required amount of pressure. Then it opens the appropriate shift solenoid to direct the pressure to correct clutch. It then monitors the clutch pressure sensor to ensure that the correct amount of pressure is being applied. A fully applied clutch will cause a 15% difference in front wheel speed.

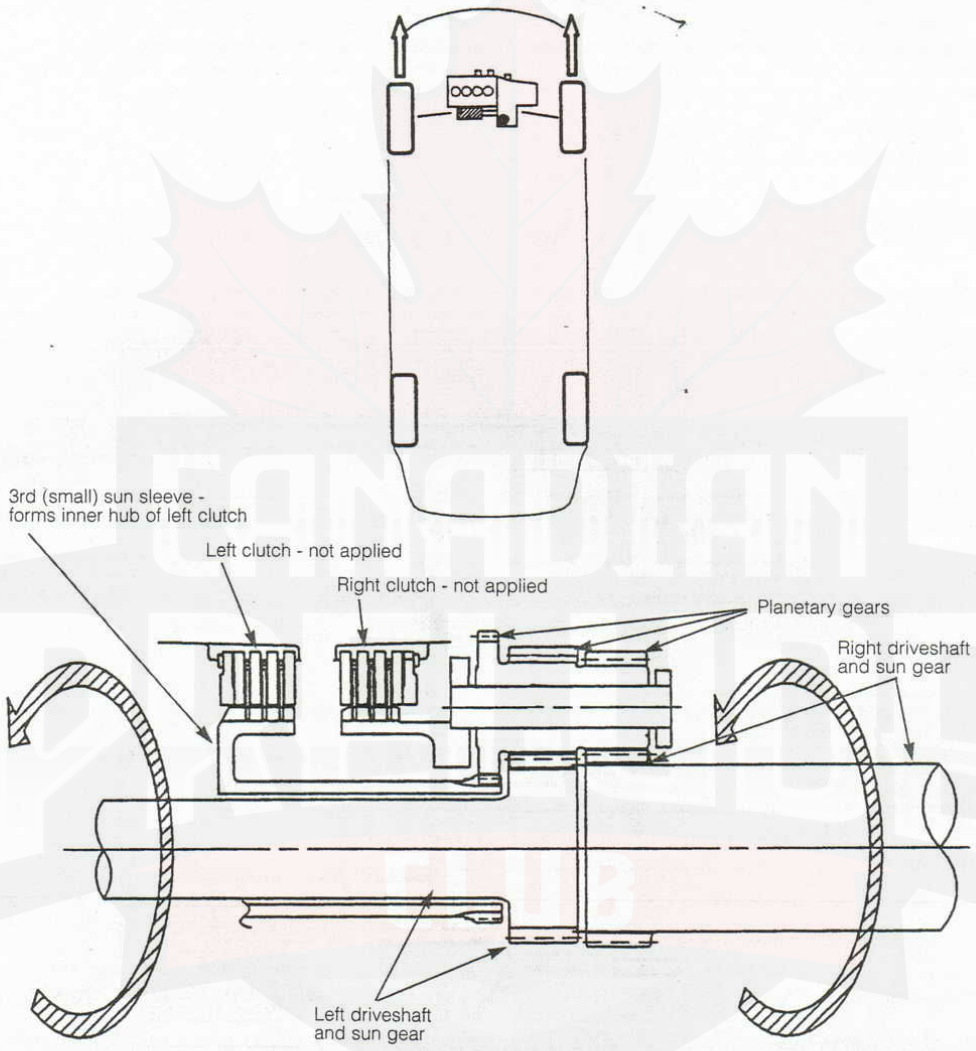


ATTS Operation – Car Going Straight

With the car going straight the ATTS control unit receives input from the lateral G (0 G's) and steering angle sensor (on center) that the car is going straight. Under this circumstance no ATTS action is required, so the linear solenoid and both shift solenoids are closed and neither clutch is applied.



With neither clutch applied the ATTS planetary gear assembly turns as a unit and the wheels turn at the same speed.

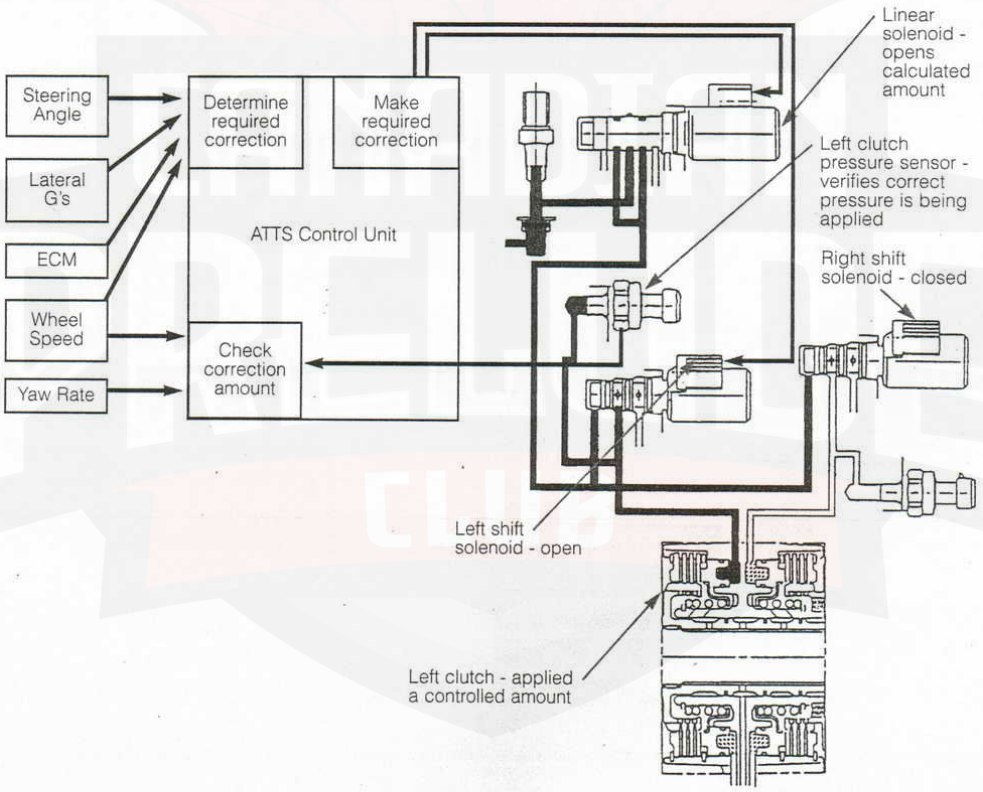


ATTS Operation – Car Turning Left with Understeer

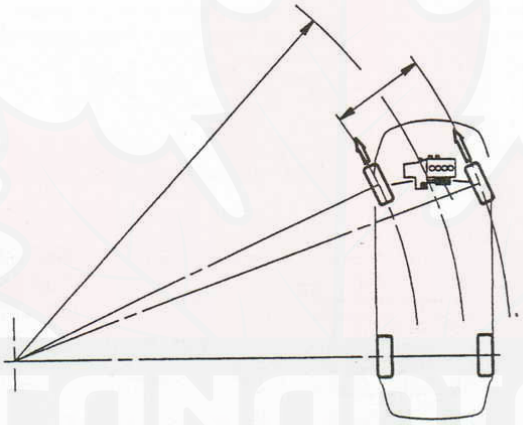
The ATTS control unit receives input from the ECM (engine torque and vehicle speed), the steering angle sensor (car turning left) and the lateral G-sensor. The control unit uses the steering angle and vehicle speed to determine a calculated lateral G figure called "YG." Lateral G sensor data is filtered to determine an "SG" figure.The YG and SG data are converted to obtain a left and right distribution ratio called "G1" and "G2." The sum of these figures becomes "KG" (KG=G1+G2). This KG figure is used to determine if ATTS operation is required. ATTS control begins when KG exceeds 0.12G and stops when KG drops below 0.06G.

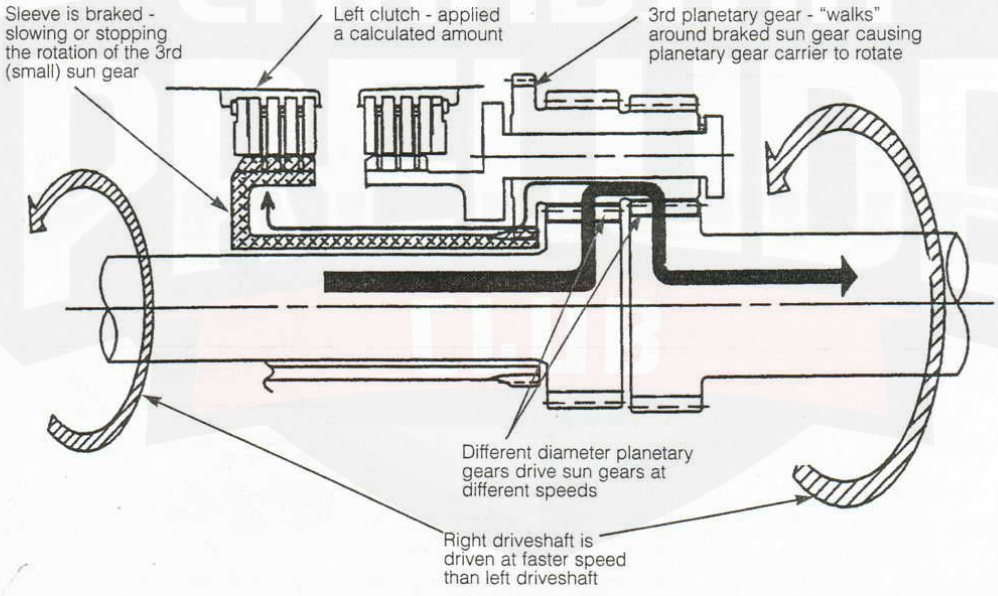
When the ATTS control unit determines that ATTS operation is required it opens the linear solenoid a calculated amount and opens the left shift solenoid to apply pressure to the left clutch. It then checks the left clutch pressure sensor to verify that the correct amount of pressure is being applied.

The control unit then checks the wheel speed sensors and the yaw rate sensor to see if the calculated torque distribution is appropriate to correct the understeer condition. It then fine tunes the clutch pressure as needed.



The left clutch applies a brake to the 3rd (small) sun gear in the planetary gear set. This action causes the planetary gears to rotate around the 3rd sun gear. This causes the planetary gear carrier to rotate and drive the right driveshaft sun gear at greater speed than the left driveshaft sun gear. This forced differential action causes the right wheel to turn faster than the left wheel, increasing the left cornering force and counteracting the understeer tendency.



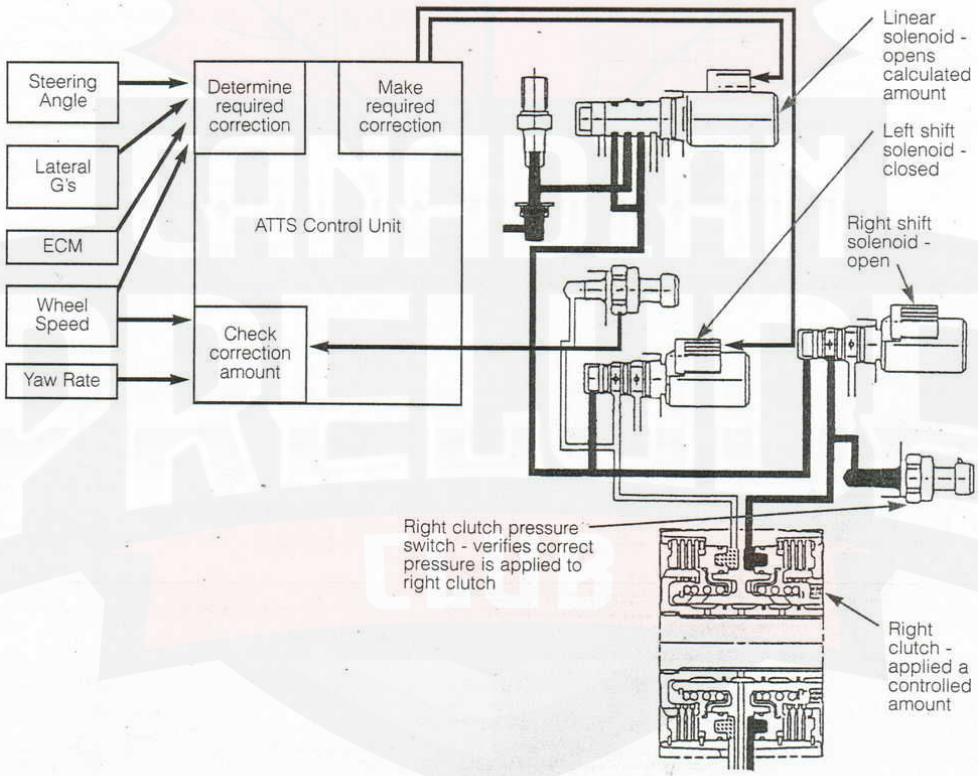


ATTS Operation – Car Turning Right with Understeer

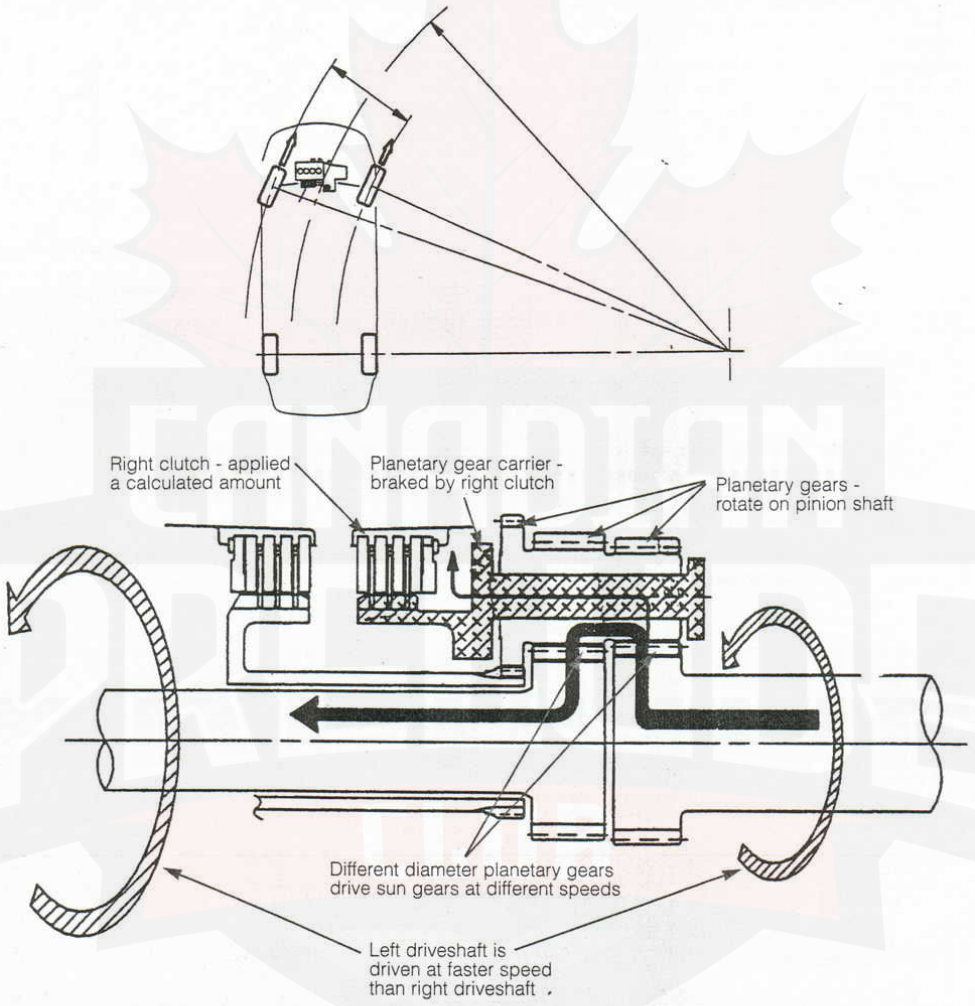
Just as when turning left, the ATTS control unit receives input from the ECM (engine torque and vehicle speed), the steering angle sensor (car turning right) and the lateral G-sensor and calculates a KG value. If KG exceeds 0.12G ATTS operation is begun.

When the ATTS control unit determines that ATTS operation is required in a right turn, it opens the linear solenoid a calculated amount and opens the right shift solenoid to apply pressure to the right clutch. It then checks the right clutch pressure sensor to verify that the correct amount of pressure is being applied.

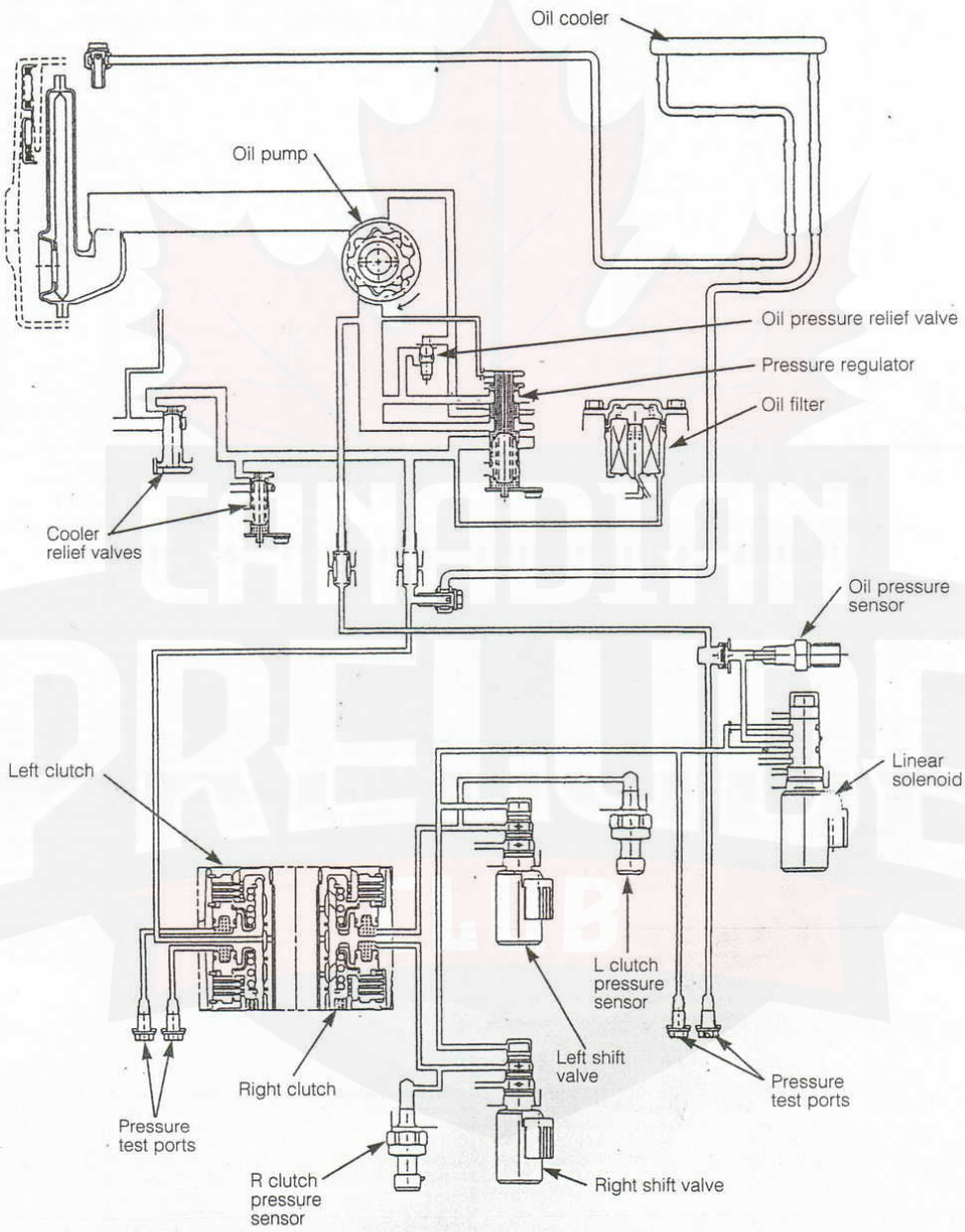
The control unit then checks the wheel speed sensors and the yaw rate sensor to see if the calculated torque distribution is appropriate to correct the understeer condition. It then fine tunes the clutch pressure as needed.



The right clutch applies a brake to the planetary gear carrier. This slows or stops the rotation of the planetary gear carrier. The two sun gears and their driveshafts are then driven via their respective ratios of sun gear to planetary gear. The result is that the left wheel is forced to turn faster than the right wheel, inducing right cornering force that counteracts the understeer tendency.



ATTS Hydraulic Schematic



Oversteer Operation

While ATTS is primarily designed to counteract understeer, it will correct for oversteer under the following circumstance:

If the car is accelerating around a corner and the driver suddenly backs off the throttle, the resulting forward weight shift can result in a "snap" oversteer condition. Under this circumstance, ATTS will correct for oversteer by applying the opposite clutch as for understeer correction. For example, if the car goes into an oversteer condition in a left hand turn, the ATTS control unit will apply the right clutch.

ATTS Fail-Safe Operation

The ATTS control unit will shut off operation if:

- A problem is detected with one of the electrical components
- An abnormal operating parameter is detected

If the ATTS detects a problem that causes it to stop operation in the middle of a turn it will signal the ECM to reduce engine torque for 2 seconds to prevent a sudden change in yaw.

TROUBLESHOOTING

Diagnostic Trouble Code Retrieval

As with most current Honda automobiles, the easiest way to retrieve DTC's is to use the PGM Tester. However, if the PGM Tester is not available, DTC's can be read on the ATTS indicator light by shorting the service check connector.

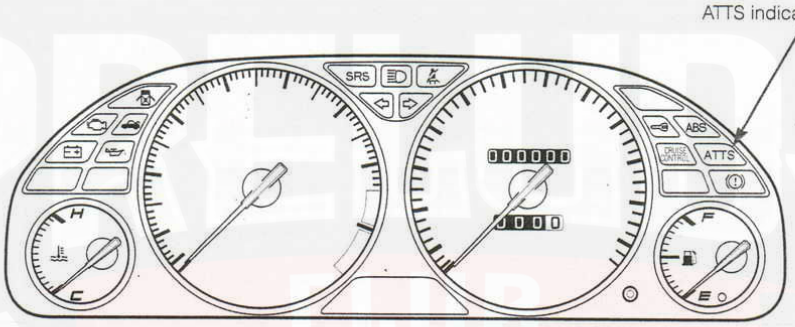
The procedure is as follows:

1. Connect the SCS short connector to the service check connector (2P) located to the lower right of the center console.
2. Release the parking brake.
3. Turn the ignition switch ON, but do not start the engine.
4. Record the number of blinks from the ATTS indicator light.

   NOTE: If there is no DTC memorized, the ATTS indicator light stays ON after it goes off for 3-4 seconds.
5. Turn the ignition switch OFF and remove the SCS short connector.

NOTE: The Malfunction Indicator Lamp will stay on after the engine is started if the SCS short connector is left connected.

6. Erase the DTC.

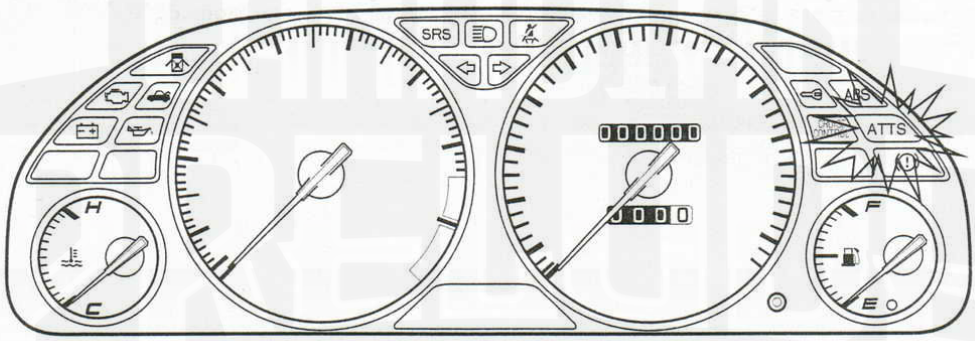


Diagnostic Trouble Code Erasing

The easiest way to erase ATTS DTC's is to use the PGM Tester. If the PGM Tester is not available, ATTS DTC's can be erased using the following procedure:

1. Connect the SCS short connector to the service check connector (2P) located to lower right of the center console.
2. Pull up the parking brake lever.
3. Turn the steering wheel to the neutral (straight ahead) position.
4. Turn the ignition switch ON, but do not start the engine.
5. After the ATTS indicator light comes on, turn the steering wheel to the right 45° or more.
6. After the indicator light goes off, return the steering wheel to the neutral position.
7. Repeat steps 5 and 6 once more.
8. After a few seconds, the indicator light should blink twice, then stay off. This means the DTC is erased.

NOTE: If the ATTS indicator light blinks repeatedly it indicates a problem with the ATTS control unit.



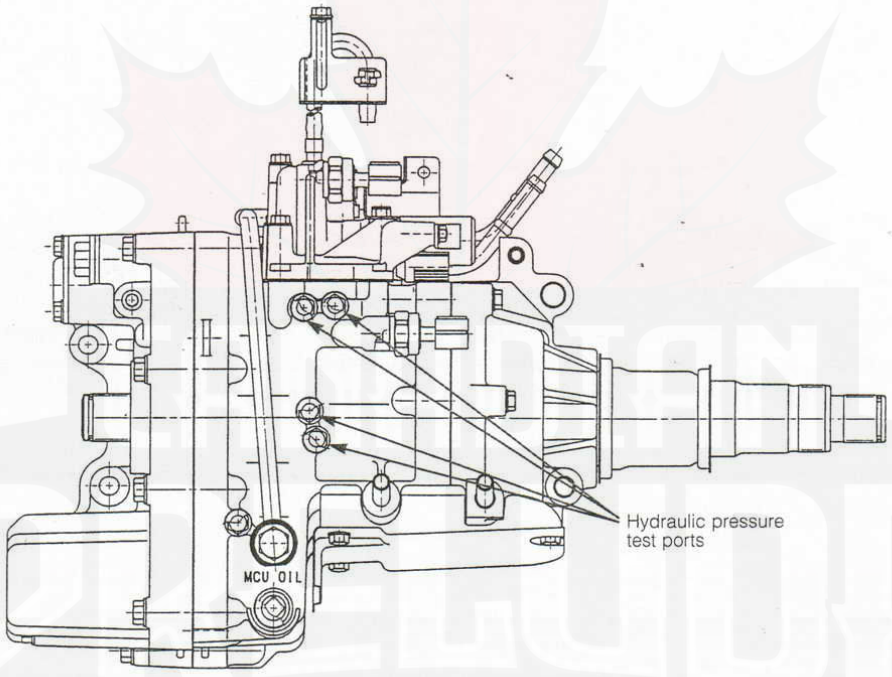
ATTS Diagnostic Trouble Codes

DTC	System Indicated
-	The ATTS indicator light does not come on when the ignition switch is turned on
-	The ATTS indicator light does not go off after the engine is started (no DTC)
11	Lateral G sensor
12	Lateral G sensor
13	Lateral G sensor
14	Lateral G sensor
16	Steering angle sensor
17	Steering angle sensor
18	Steering angle sensor
19	Steering angle sensor
21	Wheel sensor
22	Wheel sensor
23	Wheel sensor
24	Wheel sensor
25	Wheel sensor
29	Data link connector
32	Back-up light switch
33	MAP sensor
35	Reference voltage
36	Vehicle speed sensor
37	Vehicle speed sensor
41	ECM communication line
42	ECM communication line
43	ECM communication line
44	ABS function
45	ABS down
51	Fail-safe relay
52	Left and right shift solenoids
53	Left and right shift solenoids
54	Linear solenoid
55	Linear solenoid
56	Linear solenoid
57	Oil temperature sensor
58	Oil temperature sensor
61	Oil pressure
62	Oil pressure
63	Oil pressure
64	Oil pressure
65	Oil pressure
71	Steering angle sensor
72	Different diameter tires
73	Yaw rate sensor
74	Yaw rate sensor
75	Yaw rate sensor
76	Yaw rate sensor
77	Ignition voltage
78	ATTS control unit
79	ATTS control inhibition

Hydraulic Pressure Testing

The ATTS has four hydraulic pressure test ports:

- Left clutch pressure
- Right clutch pressure
- Pump pressure
- Linear solenoid pressure



MAINTENANCE

ATTS Oil Type and Amount

Oil Type - Genuine Honda Premium Automatic Transmission Fluid (ATF)
Oil Amount - 0.95 liter (1.0 U.S. qt, 0.83 Imp. qt.)

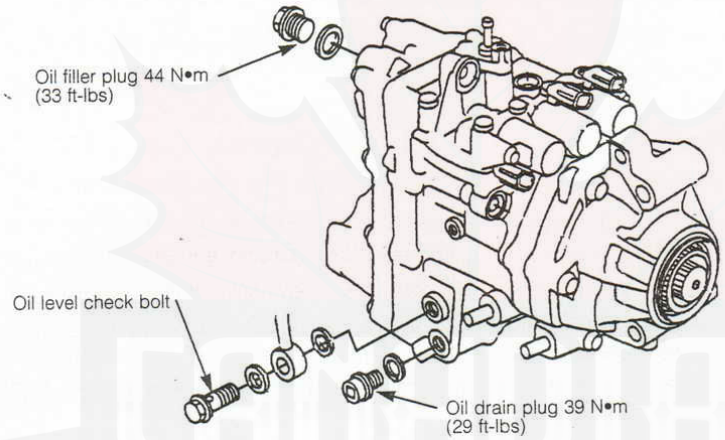
ATTS Oil Inspection Procedure

Perform when the ATTS unit is cool:

1. Raise the vehicle on a lift or support it on safety stands.
2. Remove the front wheels
3. Start the engine and shift the transmission into 2nd or 3rd gear.
4. Hold the speed at 31 MPH/50KPH for 1 minute.
5. Shift the transmission into neutral.
6. Wait until the wheels coast to a stop, then shut off the engine.
7. Wait for 1 minute, then remove the ATTS unit oil level inspection bolt.
8. Oil should flow out from the hole within 6 minutes. If it does not the oil level is too low. Remove the oil filler plug and add genuine Honda Premium ATF through the filler hole. Then wait for the ATTS unit to cool and repeat steps 3 through 8.
9. Install the oil level inspection bolt (note that the inspection bolt is at one of the cooler pipe fittings – you must replace both washers) and torque to specification. Install the oil filler plug (if you removed it) using a new washer and torque it to specification.
10. Install the front wheels.

ATTS Oil Replacement Procedure

1. Remove the oil drain plug and drain the old oil.
2. Reinstall the drain plug using a new washer. Torque to specification.
3. Install the specified amount of Honda Premium ATF through the filler hole.
4. Perform the oil level inspection procedure (previous page).



ATTS Maintenance Interval

Service at the indicated distance or time, whichever comes first								
X 1,000 km	24	48	72	96	120	144	168	192
X 1,000 miles	15	30	45	60	75	90	105	120
X months	12	24	36	48	60	72	84	96
Replace fluid (●) inspect								
Normal conditions						●		
Severe conditions	●		●		●		●	

NEW SERVICE PROCEDURES

ATTS Function Test

The ATTS control unit incorporates a test mode so you can do a dynamic check of ATTS function.

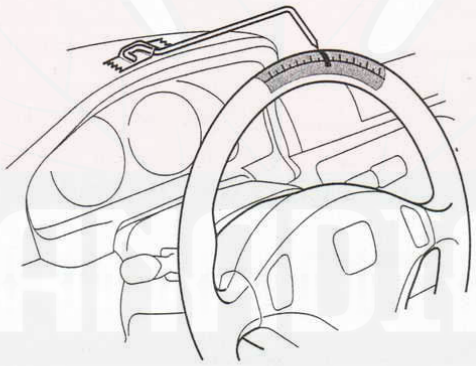
CAUTION: Drive the wheels by the engine only. If you drive only one wheel from an external source the ATTS unit may be damaged.

1. Raise the vehicle on a lift or support it on safety stands so the front wheels are clear of the floor.
2. Start the engine, then shift the transmission into reverse.
3. Accelerate to 6 MPH/10 KPH.
4. Shift the transmission into neutral and gently slow down to 0 MPH/0 KPH within 10 seconds.
5. The ATTS indicator light will start blinking.
6. Shift the transmission into 1st gear and gently accelerate to 12 MPH/20 KPH. The ATTS control unit will then go into test mode.
7. You should feel a vibration in the steering wheel twice, then the indicator light should go off.
   - If the indicator light stays on, check for a diagnostic trouble code.
   - If the indicator light continues blinking, start the procedure over again.

ATTS - Writing the Steering Angle Sensor Neutral Position

This procedure must be performed if the ATTS control unit is replaced, if the steering angle sensor is replaced, or if any disassembly/reassembly procedures are performed that affect the straight ahead position of the steering wheel.

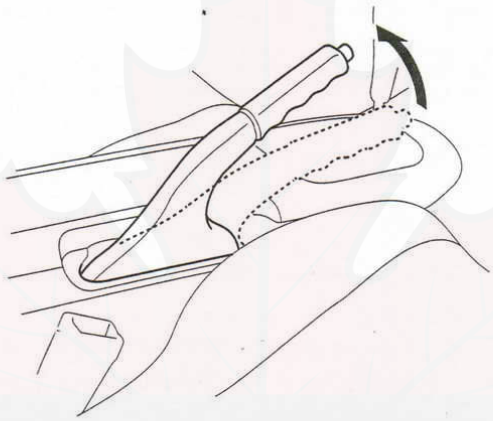
1. Make sure the front toe is adjusted correctly.
2. Set the steering wheel so it is in the straight ahead driving position.
3. Stick a piece of paper tape to the top of the steering wheel.
4. Secure a piece of stiff wire or coat hanger on the meter visor so the wire end points at the highest point of the steering wheel.



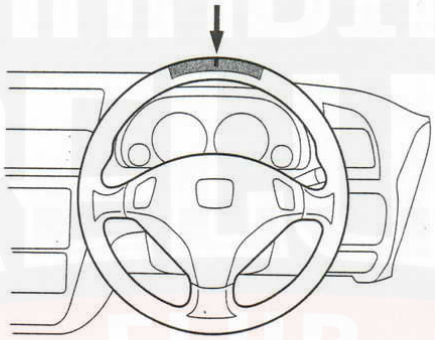
5. Start the engine and drive the vehicle straight ahead.
6. With the vehicle going straight ahead, carefully note the point on the steering wheel where the wire is pointing and make a mark on the tape at that point.
7. Stop the vehicle and turn off the ignition switch.

NOTE: The mark you have made on the steering wheel will become the reference point for ATTS inspection and adjustment. It is very important that it be made accurately.

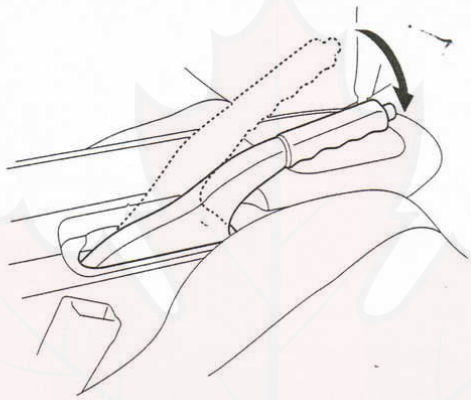
8. Check for DTC's. If any DTC's are present, erase them before proceeding.
9. Install the SCS short connector.
10. Apply the parking brake firmly.



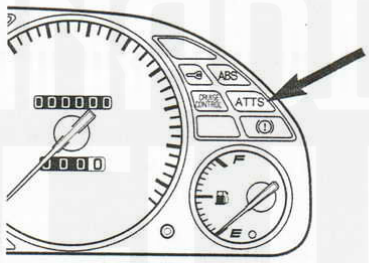
11. Set the steering wheel in the straight ahead driving position.



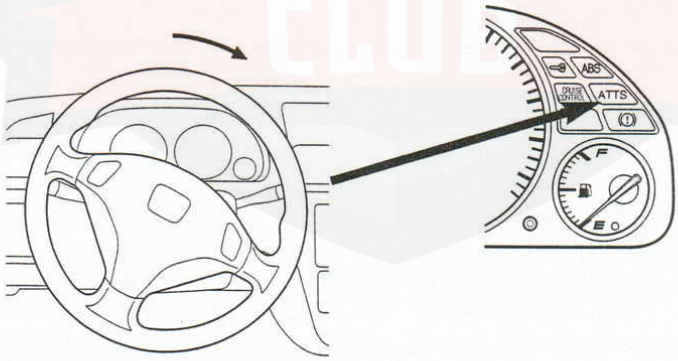
12. Turn the ignition switch ON, but do not start the engine. Release the parking brake, then apply the parking brake again. Repeat this procedure twice within 4 seconds.



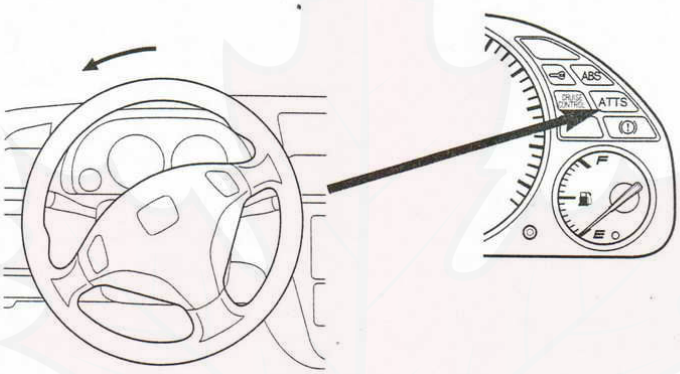
13. The ATTS indicator light should blink once, then stay on.



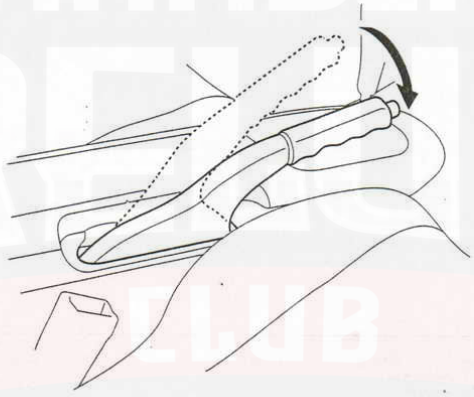
14. Turn the steering wheel slowly to the right until the ATTS indicator light goes off. Make a mark on the tape at the point where the indicator light went off.



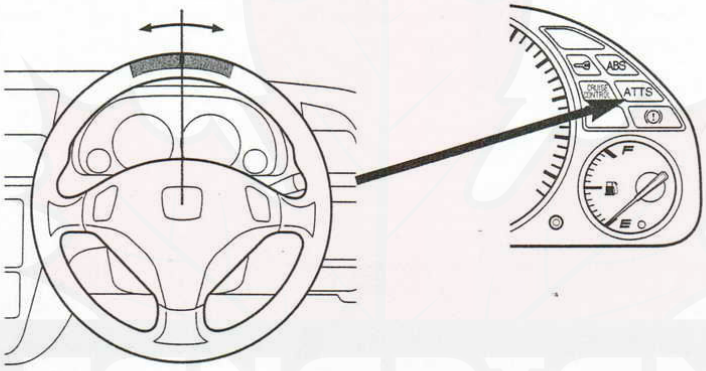
15. Return the steering wheel to the straight ahead position. The ATTS indicator light should come back on.
16. Then slowly turn the steering wheel to the left until the ATTS indicator light goes out. Mark the position on the tape where the light went out.



17. Perform steps 15 and 16 again, and verify the points where the ATTS light went out.
18. Set the steering wheel securely in the straight ahead driving position.
19. Release the parking brake. Then apply the parking brake again.



20. Check that the steering angle neutral position is memorized in the ATTS control unit. Slowly turn the steering wheel to the right and left, past the points where the ATTS indicator light went out. The ATTS system is normal if the ATTS indicator light comes on at the point where the straight ahead mark on the steering wheel lines up with the pointer.
    - If the light does not come on at the straight ahead position, turn the ignition switch ON, then OFF and repeat the procedure from the beginning.



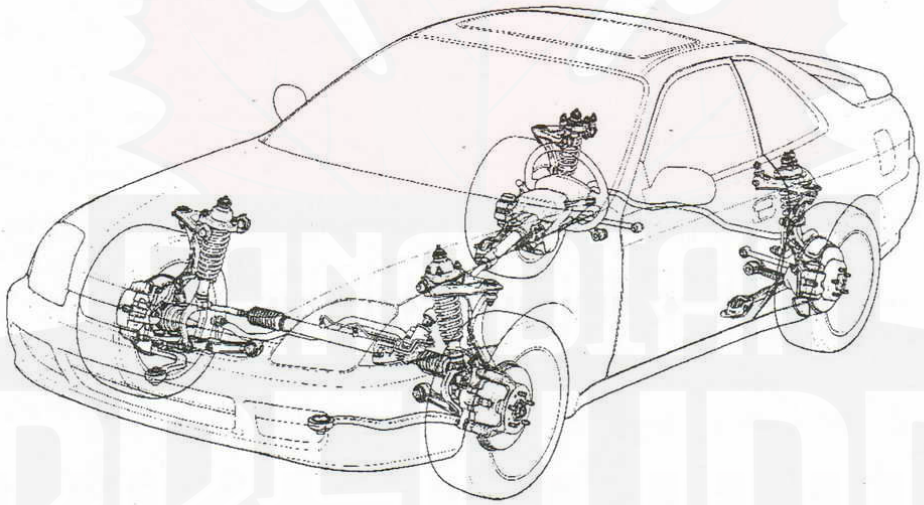
21. Release the parking brake. The ATTS indicator light should blink 5 times indicating that the writing of the neutral position procedure is completed.

NOTE: If the ATTS indicator light blinks quickly while performing this procedure, it indicates a mistake in the procedure. Stop the procedure and start over again from step 9.

INTRODUCTION

The double wishbone suspension on the Prelude SH model is essentially the same as previous designs with the following exceptions:

- The stabilizer bars use pillow-ball type bushings
- 16 inch, 5-bolt alloy wheels with low profile tires
- Double joint front suspension
- Revised front caster adjustment procedure



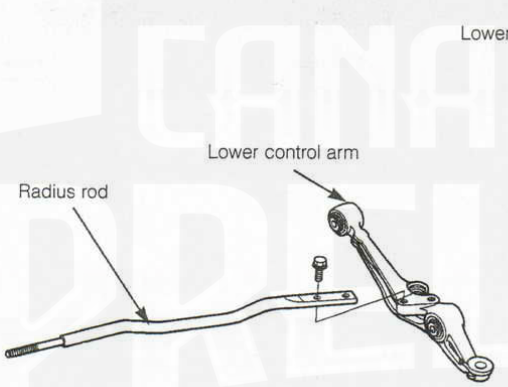
DOUBLE JOINT TYPE FRONT SUSPENSION

Overview

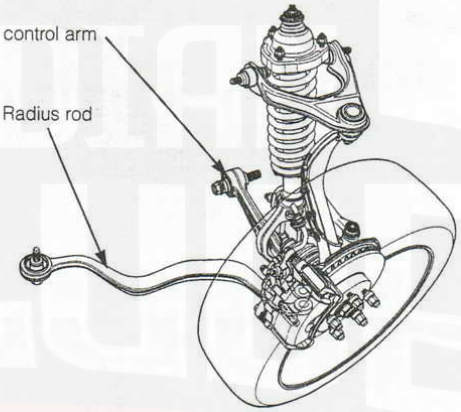
Superior handling was the primary design objective of the Prelude SH model. To achieve this the front suspension was redesigned to counteract the normal tendency of front wheel drive cars to "torque steer." That is, the tendency to change steering direction when the power is applied in a turn. In most front wheel drive cars, the driver must correct for torque steer with additional steering input. The Prelude SH model double joint front suspension eliminates torque steer and the necessity for the driver to make steering corrections when applying power in a turn.

Construction

In conventional front suspension design, the radius rod attaches to the front beam via a rubber bushing and bolts directly to the lower control arm. In the Prelude SH double joint design, the radius rod attaches to the front beam via a ball joint, and attaches to the steering knuckle (via a ball joint) rather than to the control arm. This construction gives the steering knuckle two lower pivot points.

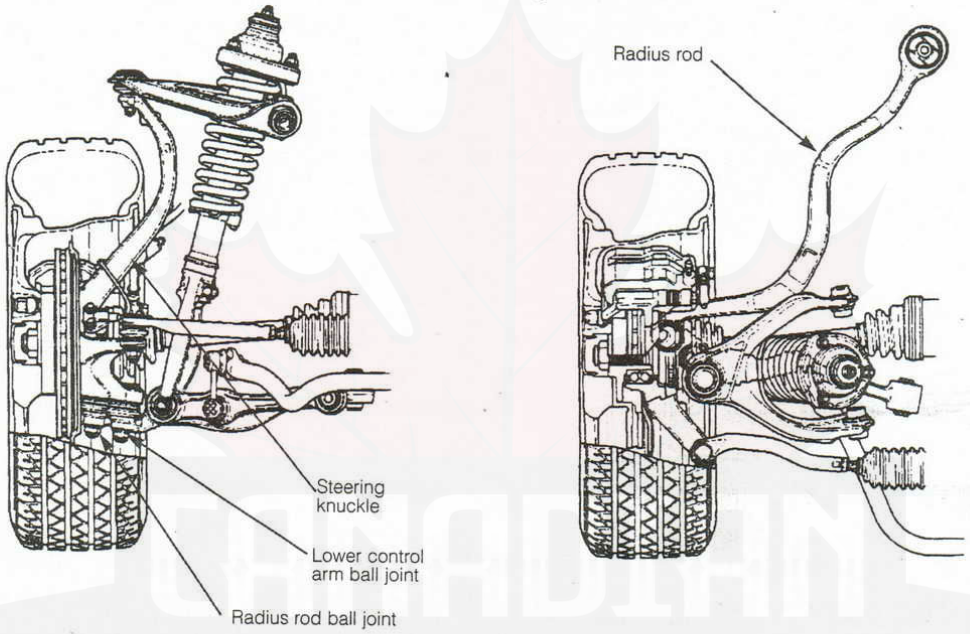


1997 Prelude VTEC Front Suspension



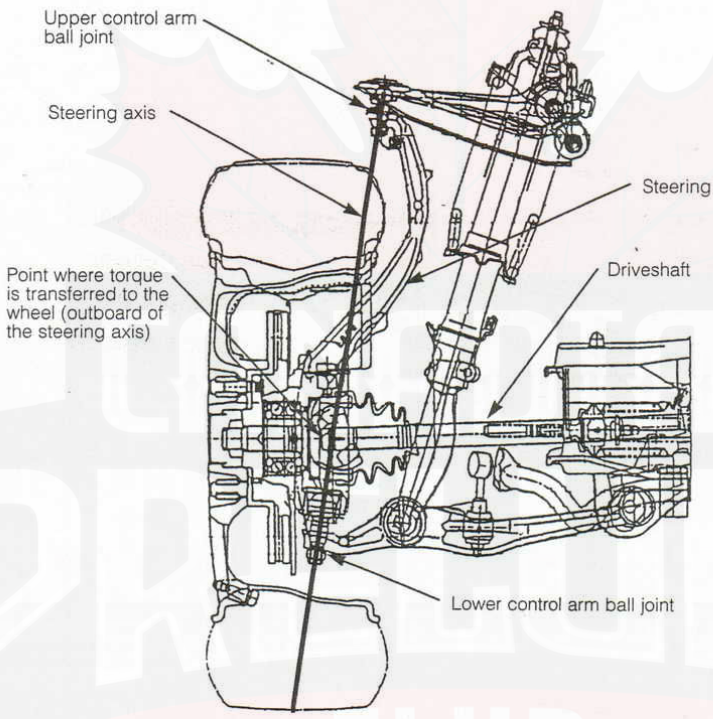
1997 Prelude SH Front Suspension

Prelude SH Front Suspension



Function

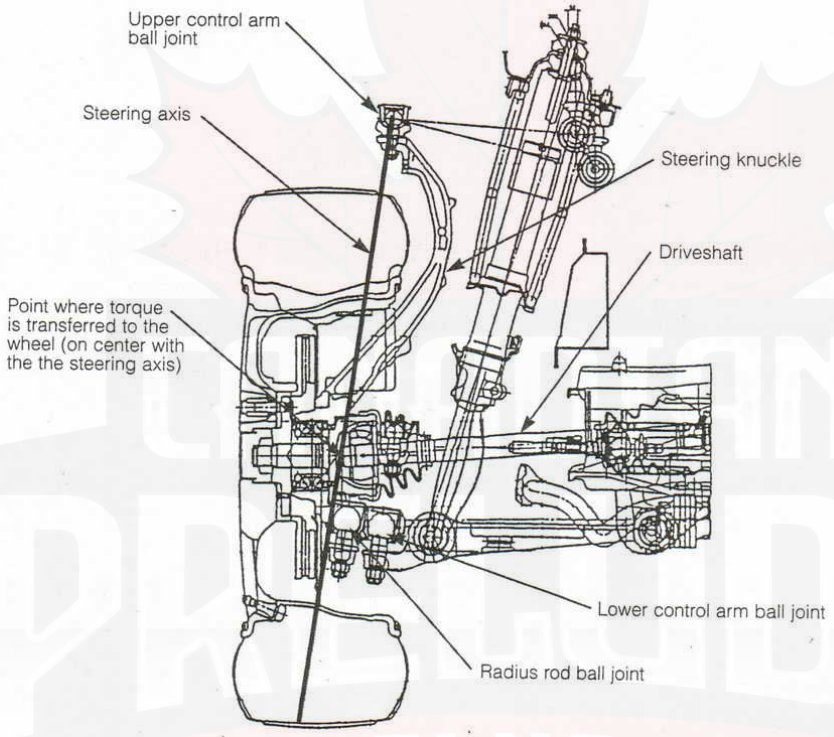
In conventional front suspension design the steering axis is defined by the knuckle attachment points (via ball joints) to the upper and lower control arms. In this design, the point where torque is transferred from the driveshaft to the wheel is outboard of the steering axis. This creates a lever length that allows the wheel to apply steering force around the steering axis when power is applied during a turn. The result is torque steer, which the driver must correct for with the steering wheel.



1997 Prelude VTEC Front Suspension

On the Prelude SH front suspension design, the lower end of the steering knuckle pivots on two ball joints. This design has the effect of moving the steering axis outboard of both ball joints, and the lower end of the steering axis turns through a small arc as the wheel is turned.

In this design, the steering axis is on center with the point where torque is transferred to the wheel, so there is no steering force applied when accelerating through a turn. Consequently, no additional steering input is required from the driver.



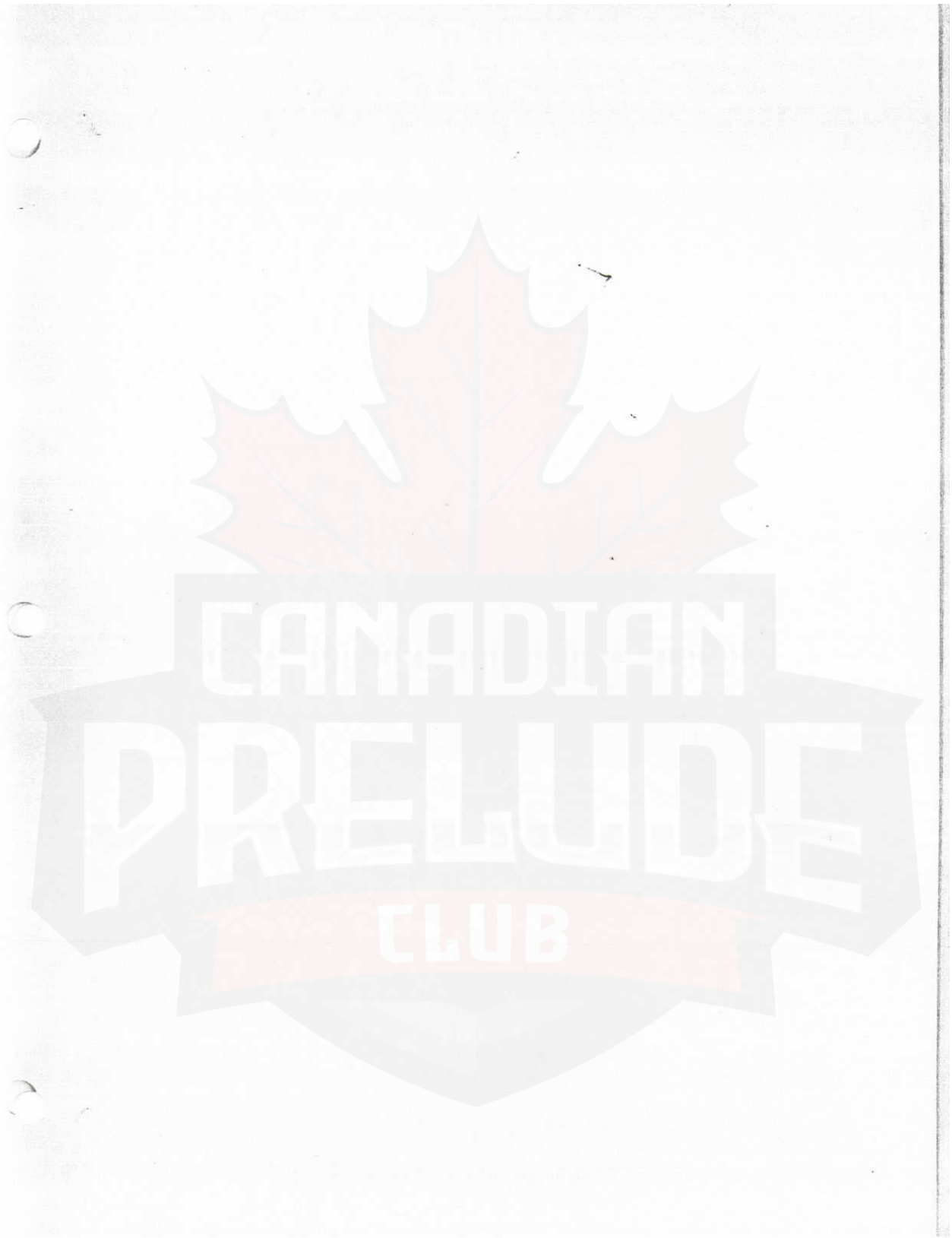
1997 Prelude SH
Front Suspension

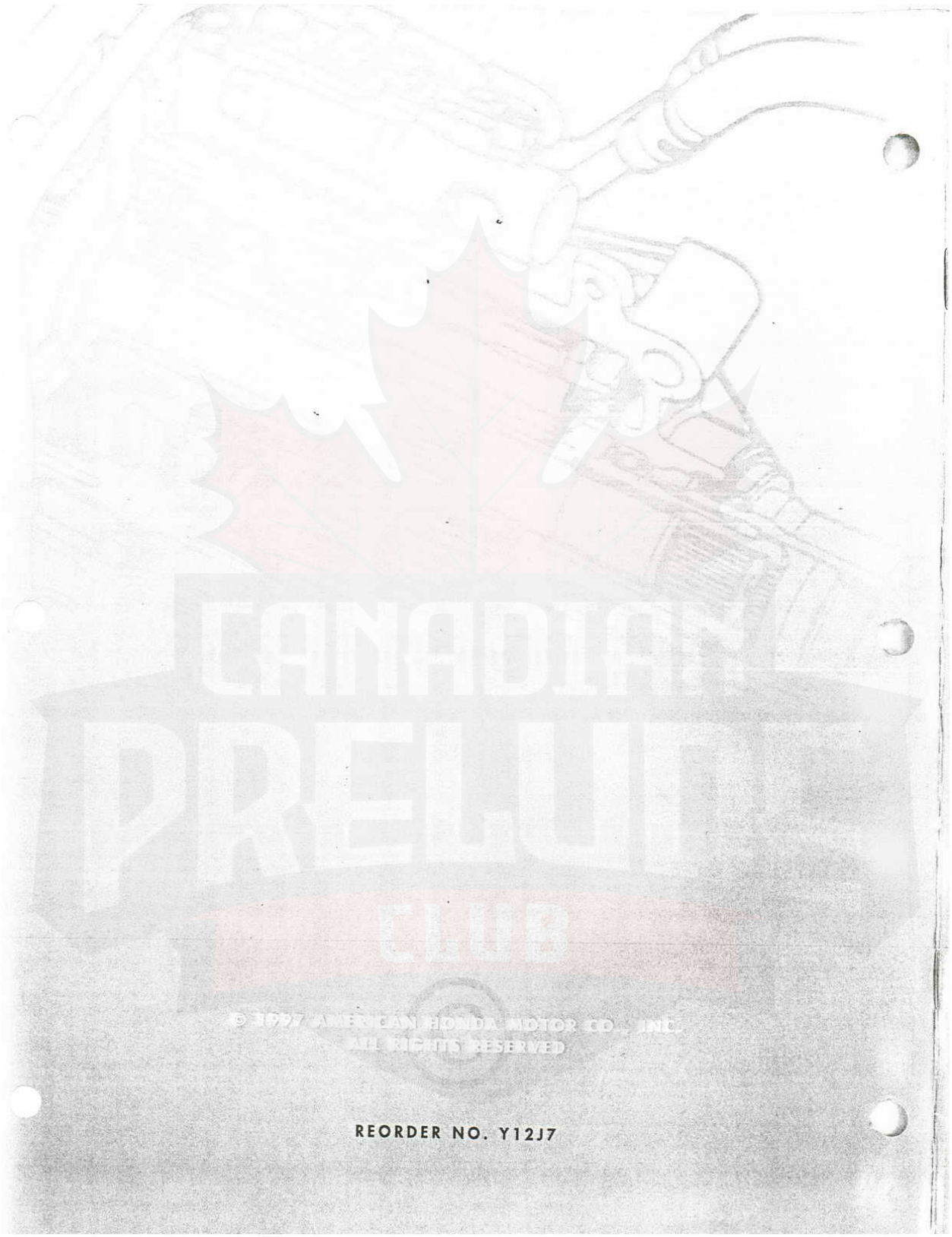
NEW SERVICE PROCEDURES

Caster Adjustment

Because of the new radius rod design on the Prelude SH front suspension, caster can no longer be adjusted via radius rod shims. Instead, three different length radius rods are available: Standard, +2.5mm and -2.5mm. A change of 2.5mm length changes the caster angle by 25 minutes.

Radius Rod Length	Identification marking on top of radius rod	Caster Angle Change
STD (592.2 ± 0.25mm)	"•" stamped, orange paint mark applied	STD
+2.5mm (594.7 ± 0.25mm)	"+" stamped, blue paint mark applied	- 25 minutes
-2.5mm (589.7 ± 0.25mm)	"-" stamped, white paint mark applied	+ 25 minutes





REORDER NO. Y12J7