

## IMPORTANT SAFETY NOTICE

**IT IS YOUR RESPONSIBILITY** to be completely familiar with the warnings and cautions described in this service manual. These warnings and cautions advise against the use of specific service methods that can result in personal injury, damage to the equipment, or cause a vehicle to be unsafe. It is, however, important to understand that these warnings and cautions are not exhaustive. Detroit Diesel Allison could not possibly know, evaluate and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way. Consequently, Detroit Diesel Allison has not undertaken any such broad evaluation. Accordingly, **ANYONE WHO USES A SERVICE PROCEDURE OR TOOL WHICH IS NOT RECOMMENDED BY DETROIT DIESEL ALLISON MUST** first satisfy himself thoroughly that neither his safety nor vehicle safety will be jeopardized by the service methods he selects.

Proper service and repair is important to the safe, reliable operation of all motor vehicles. The service procedures recommended by Detroit Diesel Allison and described in this service manual are effective methods for performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tools should be used when and as recommended.

Three types of headings are used in this manual to attract your attention.

**WARNING:** is used when an operating procedure, practice, etc., which, if not correctly followed could result in personal injury or loss of life.

**CAUTION:** is used when an operating procedure, practice, etc., which, if not strictly observed, could result in damage to or destruction of equipment.

**NOTE:** is used when an operating procedure, practice, etc., is essential to highlight.

This manual contains the following warnings. **IT IS YOUR RESPONSIBILITY** to be familiar with **ALL** the instructions contained herein.

**WARNING:** When conducting a transmission stall test, the vehicle must be prevented from moving. Both the parking and service brakes must be applied and, if necessary, the vehicle should be blocked to prevent movement. Warn personnel to keep clear of the vehicle and its travel path.

**WARNING:** Do not burn discarded Teflon seals. Toxic gases are produced.

**WARNING:** Never dry bearings by spinning them with compressed air. A spinning bearing can disintegrate, allowing balls or rollers to become lethal flying projectiles. Also, spinning a bearing without lubrication can damage the bearing.

# Service Manual

## Allison Transmissions

### V-DRIVE MODELS

VH 2, 4, 5, 7, 9

VS 1-8, 2-6, 2-8

1 JULY 1980



**Detroit Diesel Allison**

Division of General Motors Corporation

Indianapolis, Indiana 46206

**NOTE:** This publication is revised periodically to include improvements, new models, special tools, and procedures. Revision is indicated by letter suffix to publication number. Check with your Detroit Diesel Allison service outlet for currently applicable publication. Additional copies of this publication may be purchased from authorized Detroit Diesel Allison service outlets. See your yellow pages under Engines—Diesel or Transmissions—Truck, Tractor, etc.

# V-DRIVE AUTOMATIC TRANSMISSION

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## FOLDOUTS (back of manual)

### Cross Sections

1. Model VH9 V-drive transmission
2. Model VS1-8 and VS2-6 V-drive transmission

### Hydraulic Schematics

3. VH series, early model (with hydraulic governor)
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- A, 14. Oil pump and oil pan (VH, VS series)
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15. Splitter clutch control valve assembly (VS2 series)

## Section 1. GENERAL INFORMATION

### 1-1. SCOPE OF MANUAL

#### a. Coverage

(1) This Service Manual covers the description, operation, maintenance and overhaul of the VH and VS series coach transmissions (fig. 1-1 through 1-4).

(2) All text and illustrations in this manual are applicable to both the VH and VS series unless specifically designated.

#### b. Arrangement

(1) Eight sections. This manual consists of eight sections. Each paragraph and illustration number is prefixed with the applicable section number.

(2) Section content. Section 1 contains general information, specifications and data. Section 2 describes transmission components and explains their operation. Section 3 outlines preventive maintenance procedures. Section 4 contains general information on overhaul procedures. Section 5 covers disassembly of the transmission into subassemblies. Section 6 covers rebuild of the subassemblies. Section 7 covers assembly of the transmission from subassemblies. Section 8 covers wear limits and spring specifications.

(3) Foldout illustrations. Foldout illustrations at the back of the manual include cross-section views, hydraulic schematics and exploded views showing all parts in their assembly relationship.

c. Maintenance Information. Each task outlined in this Service Manual has been successfully accomplished by service organizations and individuals. It is not expected that every service organization or individual will possess the required special tooling, training, or experience to perform all the tasks outlined. However, any task outlined herein may be performed if the following conditions are met:

(1) The organization or individual has the required knowledge of the task through:

Formal instruction in a DDA or Distributor training facility.

"On-the-job" instruction by a DDA or Distributor representative.

Experience in performing the task.

(2) The work environment is suitable to prevent contamination or damage to transmission parts or assemblies.

(3) Required tools and fixtures are available as outlined in the Service Manual.

(4) Reasonable and prudent maintenance practices are utilized.

Note: Service organizations and individuals are encouraged to contact their local DDA Distributor for information and guidance on any of the tasks outlined herein.

### 1-2. MODEL SERIES DIFFERENCE

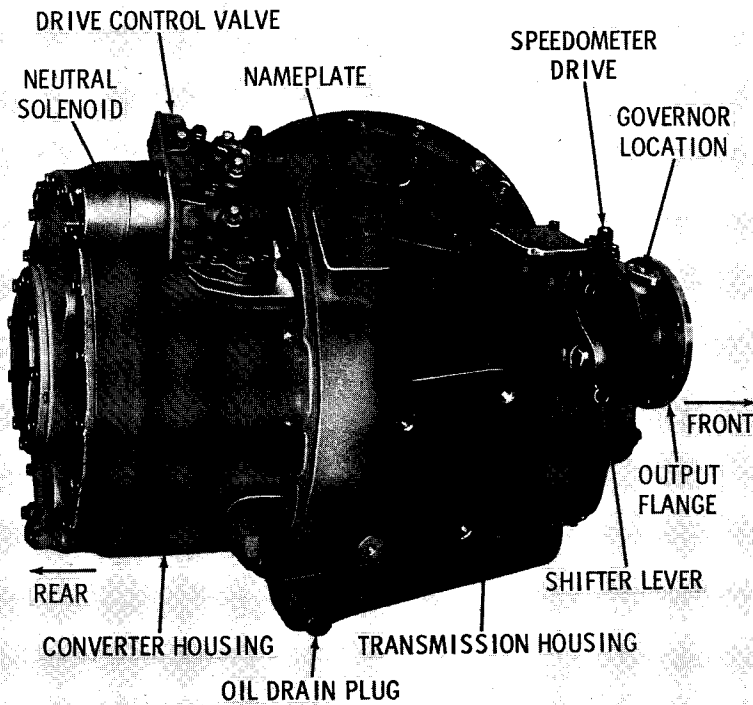
a. Two Series. Coach service which requires low-speed runs with frequent stops use the VH, and VS1 models. Coach service which includes longer, higher-speed runs between stops use the VS2 model.

b. Difference. The major differences in design, between the three models, are in the drive clutches and the inclusion of a splitter overdrive arrangement in the input of the VS2 series. These differences can be seen in foldout 1 and foldout 2. Foldouts 3 through 8 illustrate differences in the hydraulic systems in all the series.

### 1-3. SUPPLEMENTARY INFORMATION

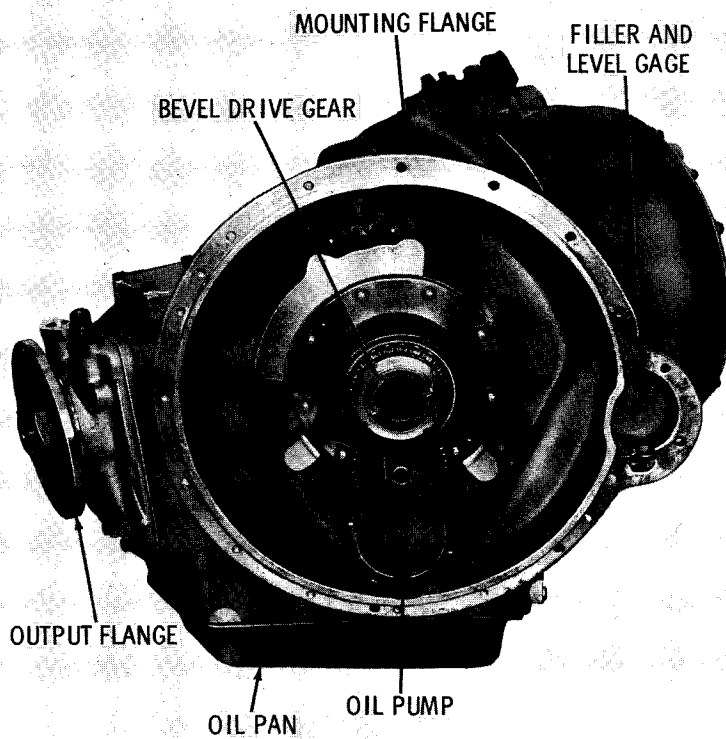
Supplementary information, to be used in conjunction with this Service Manual, will be

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S1915

*Fig. 1-1 Model VH9, VS1-8 transmission—right-rear view*

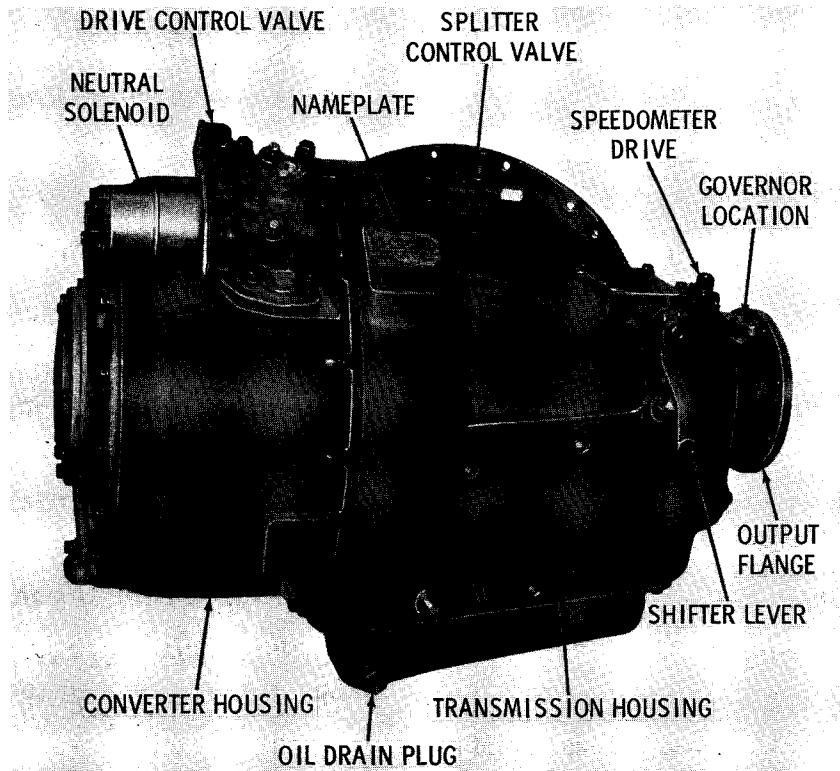


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*Fig. 1-2 Model VH9, VS1-8 transmission—left-front view*

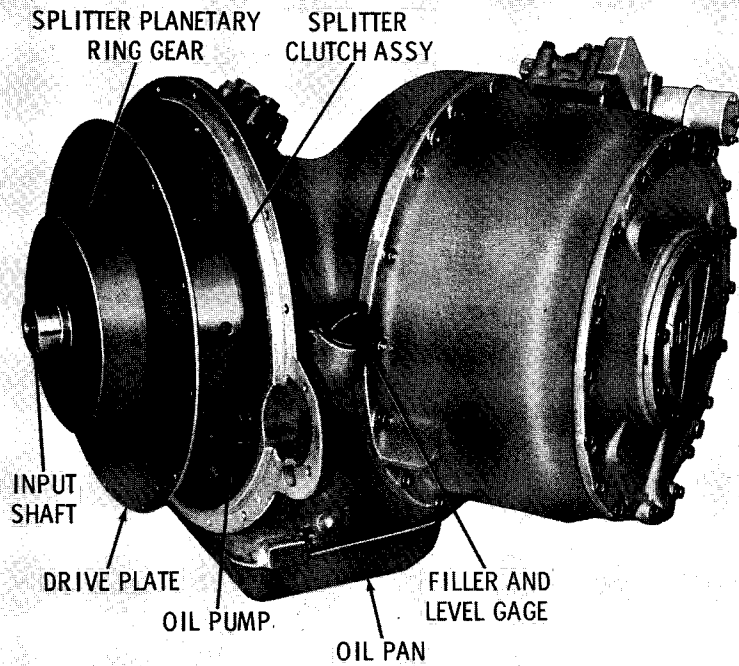
# INTRODUCTION

Para 1-1/1-3



81995

Fig. 1-3. Model VS2-6 transmission—right-rear view



81996

Fig. 1-4. Model VS2-6 transmission—left-rear view

# V-DRIVE AUTOMATIC TRANSMISSION

## Par 1-3/1-5

issued to cover any new models or major design changes.

### 1-4. ORDERING PARTS

a. Transmission Nameplate. The nameplate (fig. 1-5) gives the transmission model number, part number (assembly number) and serial number (refer to fig. 1-1 and 1-3 for nameplate location). To insure that the correct parts will be supplied, furnish all three numbers when ordering parts or requesting service information.

b. Parts Catalog. All replacement parts should be ordered through your dealer. Replacement parts are listed in the current General Motors V-Drive Transmission Parts Catalog (SA 1238). Do not order parts by illustration item numbers listed in this manual.

### 1-5. DESIGN FEATURES

a. Front, Rear Defined. Certain procedures and explanations in this manual must make reference to front, rear, right or left of the transmission. These references are not to be associated with such terms relating to the vehicle. The front of the transmission is at the output flange location (fig. 1-1). The rear is the torque converter end; right is the side opposite the engine mounting flange; left is the side which mounts on the engine.

#### b. Basic Design

(1) The VH and VS series are designed so that the input shaft engages the drive shaft at an angle, through spiral bevel gears. It is from this feature that the term V transmis-

sion is derived. This compact arrangement of internal drive units facilitates coupling of the transmission to the vehicle driveline when the engine is transversely mounted in the rear of the vehicle.

(2) The input shaft drives two clutches through spiral bevel gears. When the hydraulic drive clutch is engaged, its hub drives the torque converter pump. The torque converter pump drives the converter turbine and, through an over-running clutch, the transmission drive shaft. When the hydraulic clutch is released and the direct clutch is engaged, the direct clutch hub, splined to the transmission drive shaft, drives this shaft. The over-running clutch disengages and converter action stops.

(3) The output shaft, a sliding gear arrangement, and two countershafts at the output end of the transmission, provide forward and reverse. An external shifter lever actuates the sliding gears when the driver's control is manually shifted.

(4) The VH, VS1 series is coupled to the engine through a shaft splined directly to the bevel drive gear. The VH, VS1 series has only two drive modes — hydraulic drive through the torque converter or direct drive which bypasses the torque converter.

(5) The VS2 series is coupled to the engine through a drive plate, a splitter planetary gear set, two splitter clutches and a shaft splined to the bevel drive gear. This splitter drive arrangement permits either a direct or overdrive input, in addition to the converter and direct drive described in (4), above. When the splitter direct clutch is engaged, the input shaft rotates at engine speed. When the splitter direct clutch is released and the splitter overdrive clutch is engaged, the input shaft rotates at approximately 1.3 (VS2-6) or 1.45 (VS2-8) times engine speed.

c. Hydraulic System. A single, integral, hydraulic system serves the torque converter and transmission. Oil for all hydraulic operations is supplied from the same sump (oil pan). Oil pressure required for the various hydraulic operations is supplied by the input driven oil pump.

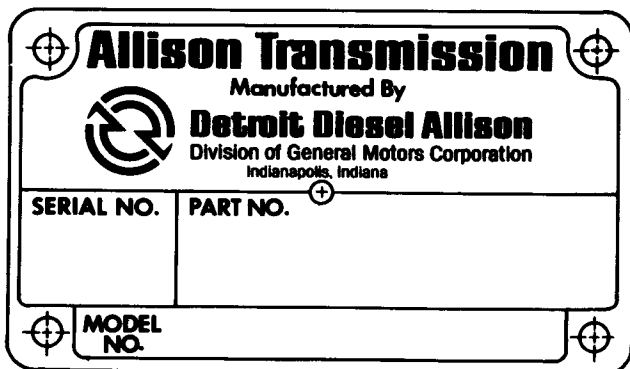


Fig. 1-5. Transmission nameplate

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## INTRODUCTION

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### d. Hydraulic, Electrical Controls

(1) Both the VH and VS series have clutches which are hydraulically controlled and a control system which is a combination of hydraulic and electrical circuits.

(2) A hydraulic pressure produced in the governor, driven by the transmission output shaft, determines the operating mode. The governor, in the VH series, controls the drive control valve which selects hydraulic drive or direct drive. The governor, in the VS2 series, controls both the drive control valve and the splitter clutch control valve in sequence. These valves select hydraulic drive, direct drive and splitter direct drive and overdrive.

### 1-6. OPERATING INSTRUCTIONS

Refer to vehicle operating instructions.

### 1-7. TOWING OR PUSH STARTING

The engine cannot be started by pushing or towing. Before pushing or towing a disabled vehicle more than one-half mile, remove the axle stub shaft from the drive wheels. Cover the hub openings to prevent loss of lubricant and entry of dust and dirt. Also provide an auxiliary air supply to the vehicle to actuate the brakes.

### 1-8. SPECIFICATIONS AND DATA

The following specifications and data apply to the VH and VS transmissions. Unless specifically designated, information is applicable to both models.

# V-DRIVE AUTOMATIC TRANSMISSION

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### SPECIFICATIONS, DATA

Transmission type . . . . . Torque converter, V drive

Rating:

	<u>VH</u>	<u>VS1-8</u>	<u>VS2-6</u>	<u>VS2-8</u>
max input speed . . . . .	2100 rpm	2100 rpm	2100 rpm	2100 rpm
max net input torque . . . . .	600 lb ft	750 lb ft	600 lb ft	750 lb ft
max net input power . . . . .	198 hp	259 hp	198 hp	259 hp

Rotation:

input (viewed from input side) . . . . . counterclockwise

output (viewed from output end) . . . . . clockwise

Mounting . . . . . modified SAE flange on converter housing bolts to engine flywheel housing

Gear ranges (forward):

VH series . . . . . 1 (hydraulic or direct drive)

VS2 series . . . . . 2 (hydraulic or direct drive in first gear; splitter overdrive in second gear)

VS1 series . . . . . 1 (hydraulic or direct drive)

Manual selector positions . . . . . Forward, neutral, reverse

Torque converter:

type . . . . . 2-stage, 1-phase, 3-element

torque ratio (at stall) . . . . . 3.75:1

#### Component ratios

<u>Model</u>	<u>Bevel gears</u>	<u>Splitter</u>	<u>Reverse</u>
VH	1.04	—	0.96
VH1-8	0.87	—	0.96
VS2-6	1.04	0.77	0.96
VS2-8	0.87	0.69	0.96
VS2-8	1.04	0.69	0.96

#### Overall ratios

<u>Model</u>	<u>First gear Mechanical</u>	<u>Second gear Mechanical</u>	<u>Reverse gear Mechanical</u>
VH	1.04:1	—	1.00:1
VS1-8	0.87:1	—	0.85:1
VS2-6	1.04:1	0.80:1	1.00:1
VS2-8	0.87:1	0.60:1	0.85:1
VS2-8	1.04:1	0.72:1	1.00:1

#### Gearing:

splitter (input of VS series) . . . . . straight-tooth planetary

bevel . . . . . spiral

reverse . . . . . straight-tooth spur, countershaft

#### Clutches:

VH series (2 clutches):

hydraulic drive . . . . . cone-type, oil-wetted, hydraulic-applied

direct drive . . . . . multidisk, oil-wetted, hydraulic-applied

VS1 series (2 clutches):

hydraulic drive . . . . . multidisk, oil-wetted, hydraulic-applied

direct drive . . . . . multidisk, oil-wetted, hydraulic-applied

VS2 series (4 clutches):

hydraulic drive, direct drive, splitter overdrive . . . . . multidisk, oil-wetted, hydraulic-applied

splitter direct drive . . . . . multidisk, oil-wetted, spring-applied



# INTRODUCTION

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## SPECIFICATIONS AND DATA — Continued

Oil system:  
 oil pump . . . . . 2-gear, positive displacement  
 sump . . . . . integral

oil specification:  
 above -30°F (-34°C) . . . . . Dexron<sup>®</sup> or Dexron II<sup>®</sup> transmission fluid  
 below -30°F (-34°C) . . . . . Dexron<sup>®</sup> or Dexron II<sup>®</sup> transmission fluid  
 (auxiliary preheat required to  
 raise temperature in the sump  
 to a temperature above -30°F)

oil capacity (total system):  
 all models . . . . . initial fill — 28 to 32 US quarts (26 to 30 liters)  
 depending upon installation

oil filters (1 on VH series; 2 on VS series) . . . . . full flow (furnished by customer)  
 oil cooler (heat exchanger). . . . . external (furnished by customer)

	VH	VS2	VS1
<b>Temperatures, pressures:</b>			
max oil temp	250°F (121°C)	250°F (121°C)	250°F (121°C)
normal operating temp	180 to 200°F (82 to 93°C)	180 to 200°F (82 to 93°C)	180 to 200°F (82 to 93°C)
<b>main oil pressure:</b>			
at idle (450 engine rpm) . . . . .	50 psi (345 kPa) min	50 psi (345 kPa) min	50 psi (345 kPa) min
at 2140 engine rpm . . . . .	80 to 100 psi (552 to 690 kPa)	80 to 100 psi (552 to 690 kPa)	80 to 100 psi (552 to 690 kPa)
<b>converter-in pressure:</b>			
at idle (450 engine rpm) . . . . .	12 psi (83 kPa) min	7 psi (48 kPa) min	7 psi (48 kPa) min
at 2140 engine rpm . . . . .	45 psi (310 kPa) min	45 psi (310 kPa) min	45 psi (310 kPa) min
<b>converter-out pressure:</b>			
at full-throttle stall . . . . .	55 psi (379 kPa) min	55 psi (379 kPa) min	55 psi (379 kPa) min
at idle (450 engine rpm) . . . . .	12 psi (83 kPa) min	7 psi (48 kPa) min	7 psi (48 kPa) min
lubrication . . . . .	8 psi (55 kPa) min	8 psi (55 kPa) min	6 psi (41 kPa) min
<b>Speedometer drive:</b>			
type . . . . .	SAE 5/32 heavy duty		
ratio . . . . .	1 x transmission output speed		
<b>Dimensions, weights:</b>			
length, overall . . . . .	33.33 in. (847 mm)		
weight, dry (VH series) . . . . .	539 lb (244.5 kg)		
weight, dry (VS2 series) . . . . .	595 lb (269.9 kg)		
weight, dry (VS1 series) . . . . .	539 lb (244.5 kg)		

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## Section 2. DESCRIPTION AND OPERATION

### 2-1. SCOPE OF SECTION 2

This section describes in detail, and explains the function of the transmission components. Hydraulic circuits and torque paths are explained and illustrated. Three series are covered — VH, VS1 and VS2. All text and illustrations in this section are applicable to all the V series, unless specifically designated.

### 2-2. MOUNTING AND INPUT DRIVE

#### a. VH and VS1 Series

(1) The transmission housing is bolted to the engine flywheel housing. Other mounting points are determined by the specific mounting method employed by the vehicle manufacturer.

(2) A flexible coupling, equipped with damper springs, is bolted to the engine flywheel. An input shaft, splined at both ends, connects the flexible coupling hub to the bevel drive gear in the transmission. The flexible coupling and the input shaft are not furnished as parts of the transmission.

#### b. VS2 Series

(1) The transmission housing is bolted to the engine. The bolts pass through an adapter located between the transmission housing flange and the engine flywheel housing. Other mounting points are determined by the specific mounting method employed by the vehicle manufacturer.

(2) In VS2-6 models, a drive plate 8 (A, foldout 9) is bolted to the engine flywheel. In VS2-8 models, a splined drive plate assembly 9 engages a torsional isolator which is bolted to the engine flywheel. A planetary carrier assembly (items 3 through 7) is bolted to the drive plate. A planetary ring gear 1,

in mesh with carrier pinions 6, rotates freely in a bore in the engine flywheel. A splined input shaft 23 (B, foldout 9) connects the planetary ring gear to the internal splines of bevel drive gear 34 in the transmission. Sun gear assembly 13, (A, foldout 9) for the input planetary, is attached to the front of the splitter clutch assembly.

### 2-3. SPLITTER CLUTCHES (VS2 series)

#### a. Two Input Speeds (A, foldout 9)

(1) The two multiplate splitter clutches control the input speed of the transmission. The splitter direct drive clutch, when engaged, locks ring gear 1 and sun gear assembly 13 of the input planetary together. This causes the input shaft (splined into the bevel drive gear) to rotate at engine speed.

(2) When the splitter overdrive clutch is engaged, the splitter clutch housing and planetary sun gear are stationary. Input carrier pinions 6, in mesh with the stationary sun gear, overdrives ring gear 1. This causes the ring gear, input shaft and bevel drive gear to rotate at faster than engine speed.

#### b. Engagement of Splitter Clutches (A, foldout 9)

(1) The splitter direct drive clutch is engaged any time the transmission output speed is below a predetermined point. This is due to the constant pressure of disk-type spring 29 acting against pressure plate 23.

(2) The splitter overdrive clutch engages (and the splitter direct drive clutch releases) when hydraulic pressure moves splitter clutch piston 44. This occurs when the transmission output has reached a desired speed. The increase in transmission output speed increases governor pressure which