

Comprehensive Engineering Guide to the Chrysler A606 (42LE) and 42RLE Transmission Systems

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The evolution of Chrysler's drivetrain engineering is perhaps most prominently represented by the **Ultradrive** family of transmissions. Among these, the **A606 (later designated as the 42LE)** and its rear-wheel-drive counterpart, the **42RLE**, stand as pivotal developments in the transition from hydraulically controlled to fully electronically controlled shifting systems. Introduced in the early 1990s, these transaxles and transmissions redefined how torque was managed in vehicles ranging from the sleek LH-platform sedans to the rugged Jeep Wrangler. Understanding the intricacies of these systems requires a deep dive into their mechanical architecture, hydraulic logic, and the electronic control strategies that govern their operation.

The Genesis of the A606/42LE Architecture

The **Chrysler A606 (42LE)** is essentially a longitudinal version of the transverse A604 (41TE) transaxle. Developed specifically for the Chrysler LH platform—which included the Dodge Intrepid, Chrysler Concorde, and Eagle Vision—the A606 was designed to accommodate a north-south engine orientation while maintaining a front-wheel-drive configuration. This necessitated the inclusion of a differential integrated into the transmission housing, driven by a chain or gear set depending on the specific application.

The nomenclature "42LE" provides a technical roadmap of the unit's capabilities: **4** forward gears, **2** (a relative torque capacity rating), **L** (longitudinal orientation), and **E** (electronic control). When Chrysler transitioned these internals to rear-wheel-drive applications in 2003, the unit became the **42RLE**, where the 'R' signifies Rear-wheel drive. Despite the change in orientation and the removal of the integrated differential, the internal clutch packs, planetary gear sets, and electronic solenoid blocks remain remarkably similar across both variants.

Core Mechanical Components

The A606/42LE utilizes a complex arrangement of five clutch packs to achieve four forward speeds and one reverse speed. Unlike traditional transmissions of the era, it does not use bands or sprags (one-way clutches) for shifting. This design, while reducing mechanical complexity in terms of hardware, places an immense burden on the **Transmission Control Module (TCM)** to perfectly time the hand-off between one clutch releasing and another engaging.

- Underdrive (UD) Clutch: Engaged in 1st, 2nd, and 3rd gears.
- Overdrive (OD) Clutch: Engaged in 3rd and 4th gears.
- Reverse Clutch: Engaged in reverse.
- 2/4 Clutch: Engaged in 2nd and 4th gears.
- Low/Reverse (L/R) Clutch: Engaged in 1st, Reverse, and Park/Neutral.

Technical Specifications and Comparison

To understand the operational limits and engineering differences between these units, we must examine their gear ratios and physical constraints. Both units share identical ratios, reflecting their shared internal DNA.

Gear	Ratio	42LE Application	42RLE Application
1st Gear	2.84:1	3.3L/3.5L V6 (LH Platform)	3.7L/4.0L V6 (Jeep/Dodge)
2nd Gear	1.57:1	Intrepid, Concorde, LHS	Wrangler, Liberty, Nitro
3rd Gear	1.00:1	Eagle Vision, Prowler	Charger, Magnum, 300
4th Gear (OD)	0.69:1	Longitudinal FWD	Rear Wheel Drive
Reverse	2.21:1	Internal Diff Included	External Transfer Case/Axle

The Solenoid Block: The Heart of the System

One of the most critical components of the A606/42LE is the **Solenoid and Pressure Switch Assembly**. Located externally on the 42RLE but internally/side-mounted on the 42LE, this unit houses the four solenoids that control fluid flow to the clutch packs. The TCM uses **Pulse Width Modulation (PWM)** to control these solenoids, allowing for precise pressure ramping which results in smoother shifts and better durability. The pressure switches provide feedback to the TCM, confirming that the hydraulic circuit has actually pressurized, allowing the system to adjust for wear over the life of the vehicle.

The Role of the Transmission Control Module (TCM)

The A606/42LE was one of the first truly "smart" transmissions. The TCM monitors a vast array of inputs to determine the optimal shift point and clutch pressure. These inputs include:

1. Input Speed Sensor (ISS): Measures the speed of the input shaft (engine speed after the torque converter).
2. Output Speed Sensor (OSS): Measures the speed of the output shaft (relative to vehicle speed).
3. Throttle Position Sensor (TPS): Determines engine load and driver intent.
4. Engine Coolant Temperature (ECT): Adjusts shift logic for cold starts or overheating conditions.

By comparing the ISS and OSS, the TCM can calculate the exact gear ratio in real-time. If the ratio does not match the expected value (indicating clutch slippage), the TCM will trigger **Limp-In Mode**. In this state, the transmission defaults to 2nd gear, and all solenoids are de-energized, allowing the vehicle to be driven to a service center without destroying the internal components.

Hydraulic Circuits and Valve Body Logic

The valve body in a 42LE or 42RLE serves as the mechanical nervous system. While the solenoids initiate the flow, the valve body directs that flow through a labyrinth of passages. A key feature of this system is the **Torque Converter Clutch (TCC)** control. The TCC is applied to create a mechanical link between the engine and transmission, eliminating slip and improving fuel economy. In the 42RLE, the TCC application is particularly aggressive to meet modern CAFE fuel standards.

Mathematical Analysis of Clutch Volume Tracking

The TCM maintains an internal data set known as **Clutch Volume Index (CVI)**. This is a mathematical model of the volume of fluid required to fully apply a clutch pack. As clutches wear, the volume of fluid needed to compress the return springs and engage the plates increases. The TCM tracks this in milliseconds.

The calculation is essentially: $V = \text{Flow Rate} \times \text{Time}$. If the CVI for the UD clutch is too high, it indicates thin friction material or a leaking seal. Typical CVI ranges for a healthy 42RLE are:

- L/R Clutch: 45 to 134
- 2/4 Clutch: 20 to 77
- OD Clutch: 75 to 150
- UD Clutch: 24 to 70

Common Failure Modes and Diagnostic Procedures

Despite their robust design, the A606 and 42RLE series are prone to specific failure modes that technicians must be adept at identifying. Diagnostics should always begin with a scan tool to check for **P-codes**, but mechanical inspection is equally vital.

1. Solenoid Block Failure

Symptoms include harsh shifting, delayed engagement, or the transmission getting stuck in one gear. Often, the internal gaskets or the electrical connectors fail due to heat cycles. Replacing the solenoid block (often updated to the latest revision) is a common and effective fix.

2. Input/Output Speed Sensor Malfunction

Because the TCM relies on the ISS and OSS for ratio calculations, a failing sensor will cause immediate Limp-In mode. These sensors are magnetic and often attract metallic debris from the fluid, which interferes with their readings. Cleaning or replacing these sensors is a standard maintenance step.

3. The Importance of ATF+4

The Chrysler Ultradrive family is notoriously sensitive to fluid type. Using generic Dexron or Mercon fluids will lead to **TCC Shudder** and eventual clutch destruction. **ATF+4** is a synthetic-based fluid with specific friction modifiers required for the PWM controlled clutches. The fluid must be changed every 30,000 to 60,000 miles depending on towing and heat conditions.

Field Guide: Step-by-Step Valve Body Identification

When servicing or replacing a valve body in a 42LE or 42RLE, identification is crucial as there were several revisions throughout the production run. Use the following checklist for identification:

1. Check the Case Connector: Early A606 models used a different pin configuration than later 42RLE models.
2. Identify the Manual Valve: Ensure the manual valve link matches the shifter cable orientation of the specific vehicle.
3. Inspect the Separator Plate: The hole patterns in the separator plate changed in 2003 with the introduction of the 42RLE to improve lubrication to the rear gear train.
4. Check for the Thermal Valve: Some 42RLE units include a thermal valve in the cooling line circuit to help the transmission reach operating temperature faster.

Case Study: 42RLE Shifting Anomalies in Jeep Wranglers

A common case encountered in the field involves a 2005 Jeep Wrangler with a 42RLE transmission exhibiting "hunting" between 3rd and 4th gear at highway speeds. Initial diagnostics might suggest a failing OD clutch. However, deeper analysis using a high-level scan tool often reveals that the **Throttle Position Sensor (TPS)** is sending a noisy signal.

Because the TCM uses the TPS to calculate engine load, a fluttering signal causes the TCM to believe the driver is rapidly toggling the accelerator. This triggers constant shifting. The solution in this case is not a transmission rebuild, but a simple TPS replacement and a **Quick Learn** procedure. The Quick Learn is a software routine where the TCM re-calibrates its CVI values and shift pressures based on current mechanical tolerances.

Advanced Troubleshooting Matrix

Symptom	Potential Cause	Recommended Action
Code P0700	General TCM Fault	Retrieve specific sub-codes from the TCM.
Code P0731 (Ratio Error in 1st)	UD Clutch Slip or L/R Solenoid	Check CVI values for UD clutch; inspect solenoid pack.
No Reverse	L/R Clutch or Reverse Clutch Seal	Pressure test the Reverse circuit; inspect L/R seals.
Limp-In (2nd Gear Only)	Electrical Power Loss to Solenoids	Check the EATX relay and transmission fuse.
Fluid Leaks at Front	Pump Seal or Bushing Wear	Inspect the torque converter hub for scoring.

Maintenance and Performance Optimization

For high-mileage A606/42LE units, longevity is tied directly to heat management. Excessive heat breaks down the friction modifiers in the ATF+4 fluid, leading to clutch glazing. Installing an auxiliary transmission cooler is highly recommended for vehicles used for towing or in mountainous terrain.

Furthermore, when rebuilding these units, technicians often utilize aftermarket shift kits (such as those from Sonnax or TransGo). These kits address inherent weaknesses in the valve body, such as the **L/R Switch Valve** which can wear out its bore and cause pressure losses. Hardened sun gear shells and upgraded heavy-duty clutch materials can also be used to increase the torque capacity for modified Jeep applications.

The Engineering Legacy of the 42-Series

The A606 (42LE) and 42RLE represent a significant era in automotive history where mechanical engineering met advanced computer logic. While they earned a reputation for being temperamental in their early years, the maturation of the ATF+4 fluid standard and the refinement of TCM software eventually made them reliable workhorses. They paved the way for the 6-speed 62TE and the subsequent ZF-sourced 8-speed and 9-speed transmissions that Chrysler uses today. For the technical professional, mastering the diagnostics of these units remains a core skill, as thousands remain on the road, requiring the precise application of hydraulic theory and electronic diagnostic prowess to keep them shifting smoothly into the next decade.

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