



WARN INDUSTRIES, INC.

Pulse Vacuum Locking Hub Pulse Vacuum Locking Hub with Manual Override (PVH)

Warn Industries is an ISO 9001, ISO/TS 16949 and ISO 14001 certified supplier to the automotive industry.

OEM Applications

Ford Motor Company

- Excursion SUV*
- F250 Pickup*
- F350 Pickup*

* Equipped with automatic pulse vacuum locking hub with manual override

OEM Applications in Development

- Full Size Pickup



Standard Specifications

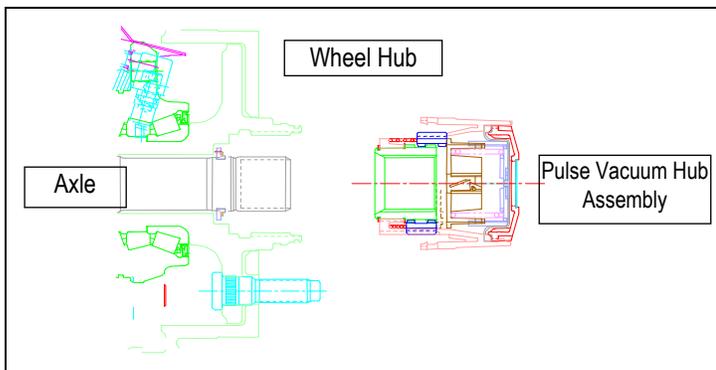
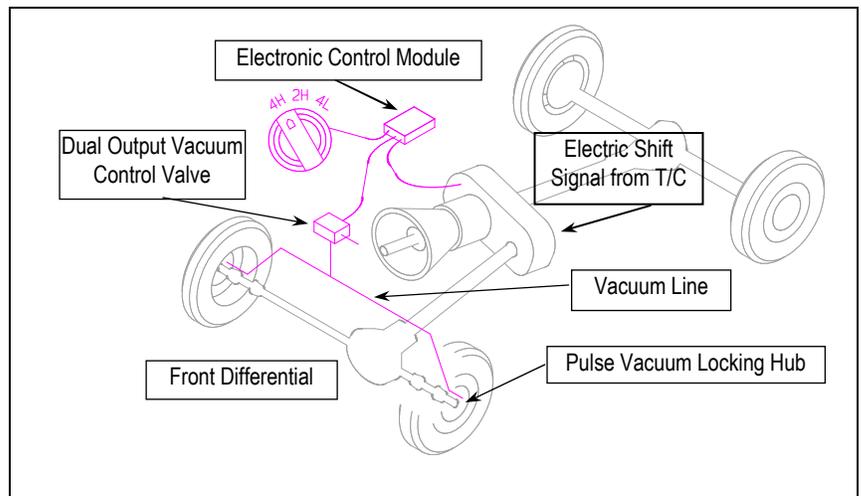
	Auto Only	Manual Override
Weight, g:	350	1100
Length, mm:	75	90
Overall Size, mm:	Ø70	Ø95
Load Capacity, N-m:	4500	6000
Dial Torque, N-cm:	N/A	170 max
Operating Temp:	-30°C to 160°C	
Operating Vacuum:		
Engage:	225 mm-hg minimum	
Disengage:	145 mm-hg	
Max Velocity:	800 rpm	
Corrosion Resistance:	200 hrs Salt Spray	
Durability:	240,000 km	
Required Service:	NONE	

Pulse Vacuum Locking Hub Operation:

- The locking hubs engage automatically when the driver shifts the transfer case (T/C) to 4WD operation.
- The engage signal from the Electronic Control Module (ECM) triggers the dual output vacuum control valve to send vacuum to the wheel end. The vacuum is on until the PVH is engaged then the vacuum is vented.
- The locking hubs disengage automatically when the driver shifts the T/C to 2WD operation. No backing-up is necessary.
- The disengage signal from the Electronic Control Module (ECM) triggers the dual output vacuum control valve to send vacuum to the wheel end. The vacuum is on until the PVH is disengaged then the vacuum is vented.

Vehicle 4x4 System Requirements:

- Vacuum source such as the engine or vacuum pump.
- Vacuum lines to each wheel end.
- Vacuum passage through the steering knuckle.
- Appropriate-sized check-valved vacuum reservoir.
- Electronic Control Module (ECM).
- Dual output vacuum control valve.
- Electric signal from the transfer case to the ECM.
- Wheel end seals designed for holding vacuum.



Assembly Procedure

Auto Only: (shown at left)

- Clean axle and wheel hub-mounting surface of grease and debris.
- Slide the Vacuum Locking Hub assembly over the axle until the hub snaps into place over the wheel hub.

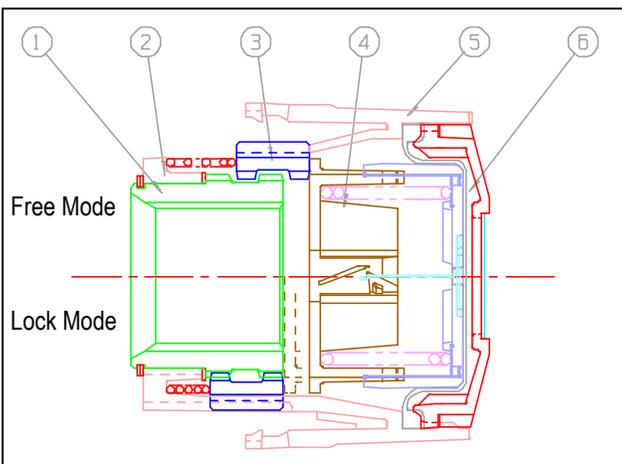
Auto with Manual Override: (not shown)

- Clean axle and wheel hub-mounting surface of grease and debris.
- Slide the Vacuum Locking Hub assembly over the axle until the hub seats into place inside the wheel hub.
- Install the locking clip to secure locking hub.



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Pulse Vacuum Locking Hub (PVH) Components

1. Inner Drive Gear (IDG): Splined to match axle. Transmits torque from axle to other components.
2. Bearing: Provides a bearing for 2WD operation.
3. Clutch Ring (CR): Splined to engage the IDG. Moves into engagement for 4WD operation (locked mode) and moves out of engagement for 2WD operation (2WD mode).
4. Latching Mechanism: Applies force to move the CR into engagement for 4WD operation when vacuum is applied.
5. Housing Contains the components with in the vehicle wheel end.
6. Vacuum Diaphragm Assembly: Activates the latching mechanism.

Warn's Standard Bench Tests

PVH test samples must function after each of the following tests:

1. Static Strength: Apply specified torque load through the IDG with the sample in the locked mode.
2. Ratcheting Durability: Rotate the sample at a specified speed. Attempt engagement by applying vacuum. Allow the IDG and CR splines to grind together (ratchet) for a specified amount of time.
3. Free Running (2WD Mode) Durability: Rotate the sample in the 2WD mode at a specified speed for a specified amount of time.
4. Latching Mechanism Durability: Cycle the latching mechanism between 2WD and 4WD positions under load.
5. Sealing Requirements: No vacuum leak at a specified airflow.
6. Low Temperature Operation: Soak the sample for a specified amount of time at extreme temperature.

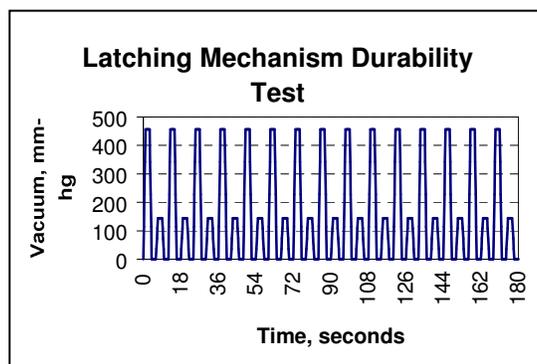
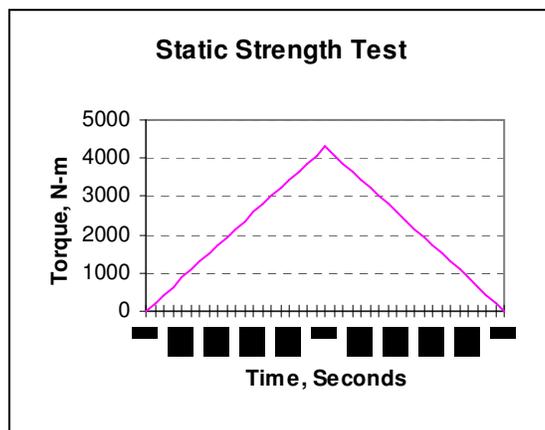
PVH with Manual Override samples must also pass the following tests:

1. Dial Operation Durability: Apply torque in the lock and free positions.

Typical Vehicle Tests: PVH test samples must function after each of the tests:

1. Rapid Start: Locking hub torsional strength under maximum engine power.
2. Water Sealing: No water leaks when engaging the locking hub under water.
3. Off Road Durability: Locking hub torsional strength under frame twist conditions.
4. High and Low Temperature Operation: Locking hub operation at extreme temperature conditions.
5. High Speed Durability: Locking hub durability under high speed 2WD driving conditions.
6. High Altitude Operation: Low atmospheric pressure operation.
7. Shift-on-the-Fly Operation: Engage (4WD mode) while traveling at freeway speeds.

- Warn's OEM Products: Center Axle Disconnect Systems (electric and pneumatic) • Continuous Vacuum Locking Hubs • Manual Locking Hubs • Wheel Bearing Retention Systems • Pulse Type Vacuum Locking Hubs • Cam Type Automatic Locking Hubs • Integrated Wheel End Disconnect Systems
- Warn's Products are patent protected in the United States and overseas countries.



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