



WARN INDUSTRIES, INC.

Integrated Wheel End Disconnect (IWE)

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

Standard Specifications

Max Torque Capacity, N-m:	5700	9500
Overall Width, mm:	42	49
Mounting Bolt Circle, mm:	Ø128	Ø140
Weight, g:	400	500
Max Axle Velocity, rpm:	1600	1600
Min Operating Vacuum:	200 mm-Hg	
Disengage:	-40°C to 160°C	
Operating Temp:	240 hrs Salt Spray	
Corrosion Resistance:	240,000 km	
Durability:	NONE	
Required Service:	NONE	

OEM Applications

Ford Motor Company

- F150 Pickup
- Expedition SUV
- Navigator SUV

Ssangyong Motor Company

- Kyron SUV
- Rodius MPV

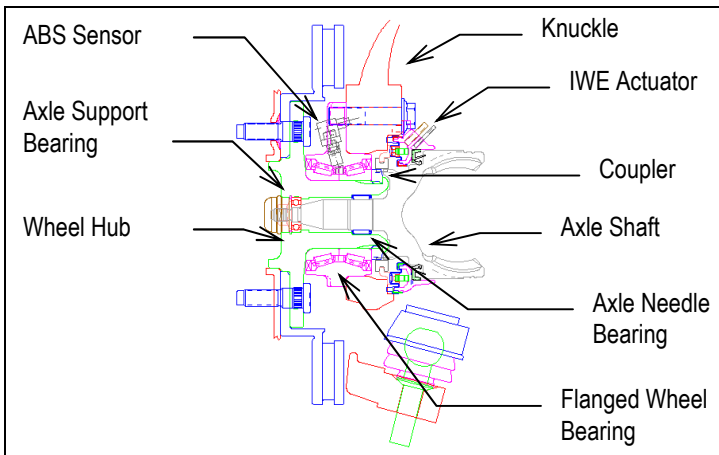
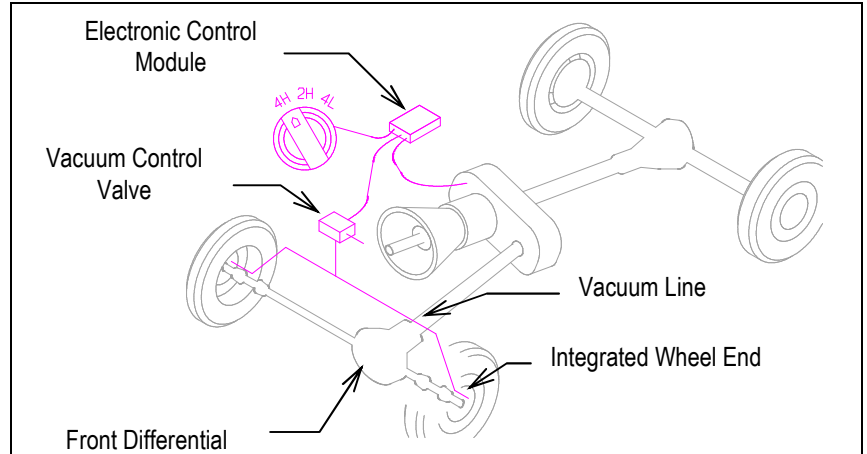


Integrated Wheel End Benefits and Operation:

- A full sized pickup, in 2WD mode, equipped with an IWE system saves up to 0.5 mpg (1.5 hp) over the same vehicle equipped with a center disconnect system.
- The wheel end engages automatically when the driver shifts the transfer case (T/C) to 4WD operation (shift on the fly capable.)
- An electric engage shift signal from the transfer case triggers the vacuum control valve to release vacuum from the wheel ends. Springs provide the necessary force to engage the wheel ends both at speed and when stationary.
- The wheel ends disengage automatically when the driver shifts the T/C to 2WD operation. No backing-up is necessary and only the wheel hub and bearing rotate in 2WD.
- The electric disengage shift signal from the transfer case triggers the vacuum control valve to apply vacuum at the wheel ends. The vacuum overcomes the spring force and disengages the wheel ends. The vacuum remains on during 2WD operation.
- The IWE system is compatible with automatic 4WD systems.

Vehicle 4x4 System Requirements:

- Vacuum source from the engine or a vacuum pump.
- Vacuum lines to each wheel end.
- Appropriate-sized vacuum reservoir with check-valve.
- Vacuum control valve.
- Electric signal from the transfer case to the 4X4 light.



Assembly Procedure

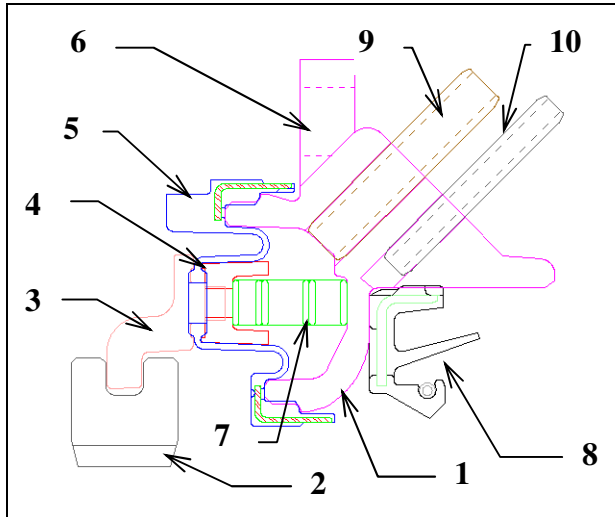
IWE: (shown at left)

1. Clean axle and actuator mounting surface of grease and debris.
2. Insert the wheel hub/bearing assembly into the knuckle.
3. Attach the wheel hub/bearing assembly to the knuckle using the wheel bearing bolts. Torque bolts
4. Attach the actuator to the knuckle using the actuator attachment bolts. Torque bolts.
5. Pilot the axle shaft through the wheel hub/bearing and attach the outboard axle shaft nut. Torque nut. Seal the outboard side with dust cap.
6. Attach the wheel end assembly to the upper and lower control arms. Attach the axle shaft to its mating inboard axle flange. Torque nuts and bolts.



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IWE Actuator Components

1. Actuator Housing: Contains the vacuum actuated components that control 4WD (locked mode) operation.
2. Clutch Ring: Splined to match axle shaft and coupler. Transmits torque from axle shaft to coupler. Moves into engagement for 4WD operation (locked mode) and moves out of engagement for 2WD operation (2WD mode).
3. Shift Fork: Applies linear motion to the clutch ring during actuation process. Attaches to the piston through the diaphragm.
4. Piston: Provides base for shift fork inside the sealed vacuum chamber.
5. Vacuum Diaphragm: Statically seals vacuum chamber inside the actuator housing. Allows for linear motion of the shift fork and piston by flexing.
6. Mounting Bolt Holes: Bolts attach actuator assembly to knuckle.
7. Wave Spring: Applies force required to slide clutch ring into 4WD (locked mode). Also provides blocked shift capability.
8. Axle Shaft Seal: Inboard wheel end assembly environmental seal.
9. Vacuum Port: Provides vacuum route to sealed housing.
10. Vent Port: Allows cavity pressure vent to atmosphere.

Warn's Standard Bench Tests

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

1. Static Strength: Apply specified torque load through the axle shaft/clutch ring/coupler with the sample in the locked mode.
2. Ratcheting Durability: Rotate the sample at a specified speed. Attempt engagement by releasing vacuum. Allow the coupler and clutch ring 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 with vacuum applied.
4. Sealing Requirements: No vacuum leak at a specified air flow.
5. Low Temperature Operation: Soak the sample for a specified amount of time at extreme temperature (-40°C).

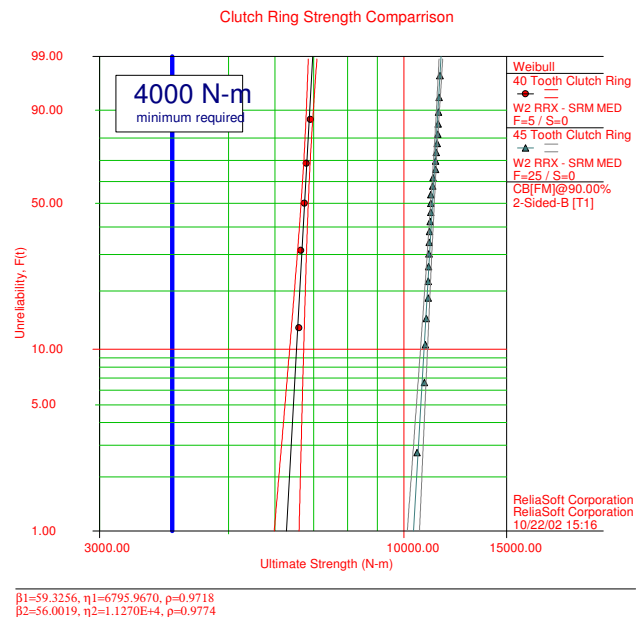
Typical Vehicle Tests:

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

1. Rapid Start: Wheel end torsional strength under maximum engine power.
2. Water Sealing: No water leaks when engaging the actuator under water.
3. Off Road Durability: Wheel end torsional strength under frame twist conditions.
4. High and Low Temperature Operation: Actuator operation at extreme temperature conditions (-40°C to 160°C).
5. High Speed Durability: Wheel end durability under high speed 2WD driving conditions.
6. High Altitude Operation: Actuator operation in low atmospheric pressure.
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.

ReliaSoft's Weibull++ 6.0 - www.Weibull.com



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