TRUCK CUSTOMS BY CHRIS

Augusta, Georgia • Established 2001

HCF450 TRANSFER CASE

Installation, Air Plumbing & Electrical Hook-Up Manual



Figure 1 — HCF450 display stand (show unit)

2004–Present medium-duty trucks • Up to 14,000 lb front axle
Hydraulic brakes and air brakes

Two-speed air-shifted transfer case with lock / unlock and High / Low range control

Document Revision 2.2 — September 2026

This manual covers installation hook-up of the air-shift valves and cab controls, plus operation, lubrication, break-in, service specifications, and illustrated views of the HCF450 transfer case.

1. Important Safety Information

Read this entire manual before connecting air or electrical power to the transfer case. Improper hook-up can cause unexpected range or lock engagement, driveline damage, or loss of vehicle control.

WARNING

Never shift High/Low range while the vehicle is moving at road speed. Come to a complete stop, place the transmission in Neutral (or Park), then shift range. Lock / unlock (In/Out) may be operated at low speed per the notes in Section 7. An electric front locker, if fitted, follows the locker maker's instructions. Always confirm selected range with a visual or audible check before moving the vehicle.

Support the vehicle securely on jack stands rated for the GVWR before working under it. Relieve air system pressure before disconnecting lines. Disconnect the battery negative cable before making electrical connections.

- Wear eye protection when working with compressed air.
- Use only clean, dry air. Water or oil contamination will damage the solenoid valves and shift cylinders.
- Do not exceed 120 PSI (0.83 MPa) at the valve inlet. The RIH 4V210-08 valves are rated 0.15–0.8 MPa (approx. 22–116 PSI).
- Fuse every 12-volt feed. Recommended: 5 A per solenoid circuit or a single 10 A fused ignition/accessory source.
- After plumbing, leak-test every fitting with soapy water before putting the truck in service.
- This system is intended for the HCF450 transfer case as installed by Truck Customs By Chris. Do not substitute unmarked valves or unrated air cylinders.

2. System Overview

The HCF450 is a heavy-duty two-speed, part-time 4WD transfer case for 2004–present medium-duty trucks with front axles up to 14,000 lb, including Ford F-650 / F-750 and similar chassis with hydraulic or air brakes. High/Low range and in/out engage/disengage are air-shifted. Cab control uses two 12 V 5/2 solenoid valves and two rocker switches (IN/OUT and HI/LO). A third switch is added only for an electric front locker — not for a manual front locker.

What each control does

Control	Function
IN / OUT	Lock / Unlock (front output engagement). One position drives the front axle; the other disconnects it for 2WD. This is the valve labeled for in/out (lock/unlock).
HI / LO	Range select. High = 1:1 (direct). Low = underdrive (typically ~2.17:1 on this family of cases). Vehicle MUST be stopped and transmission in Neutral to shift range.
FRT LOCK (electric locker only)	Front locker switch (third rocker). Install this switch ONLY if the truck has an electric front locker. If the front end has a manual locker, do not install a front locker switch.

Two RIH 4V210-08 valves are used. Each valve has a single 12 V DC solenoid and a spring return. Energizing the coil shifts the spool one way; removing power lets the spring return the spool to the opposite position. That is why a simple on/off rocker is sufficient for each function.

3. Component Identification

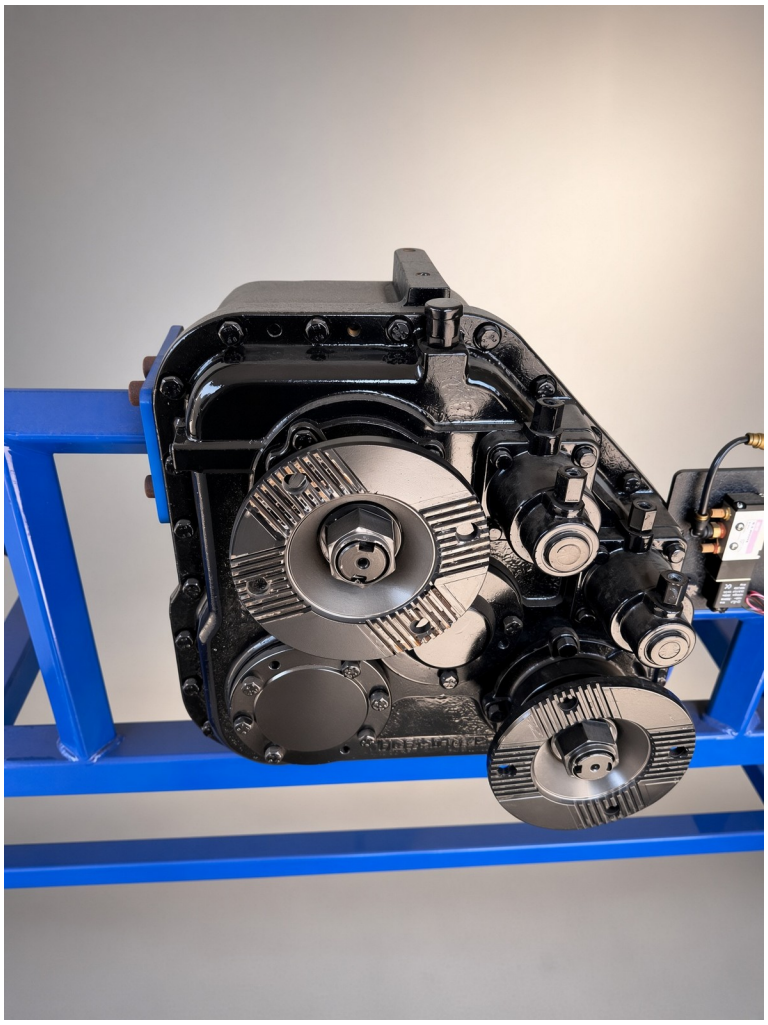


Figure 2 — Transfer case (input / output / shift-cylinder side)

Identify the air fittings on the transfer case before running hose. Typical air-shift cases in this class have two cylinders:

- Range cylinder (High / Low) — usually on the rear or side of the case, two ports (extend / retract).
- Front-drive / lock cylinder (In / Out) — usually on the front or opposite side, two ports.

Ports are 1/8" or 1/4" NPT (or push-to-connect adapters already installed on show units). Label every hose at both ends as you assemble: “H/L-A”, “H/L-B”, “LOCK-A”, “LOCK-B”.

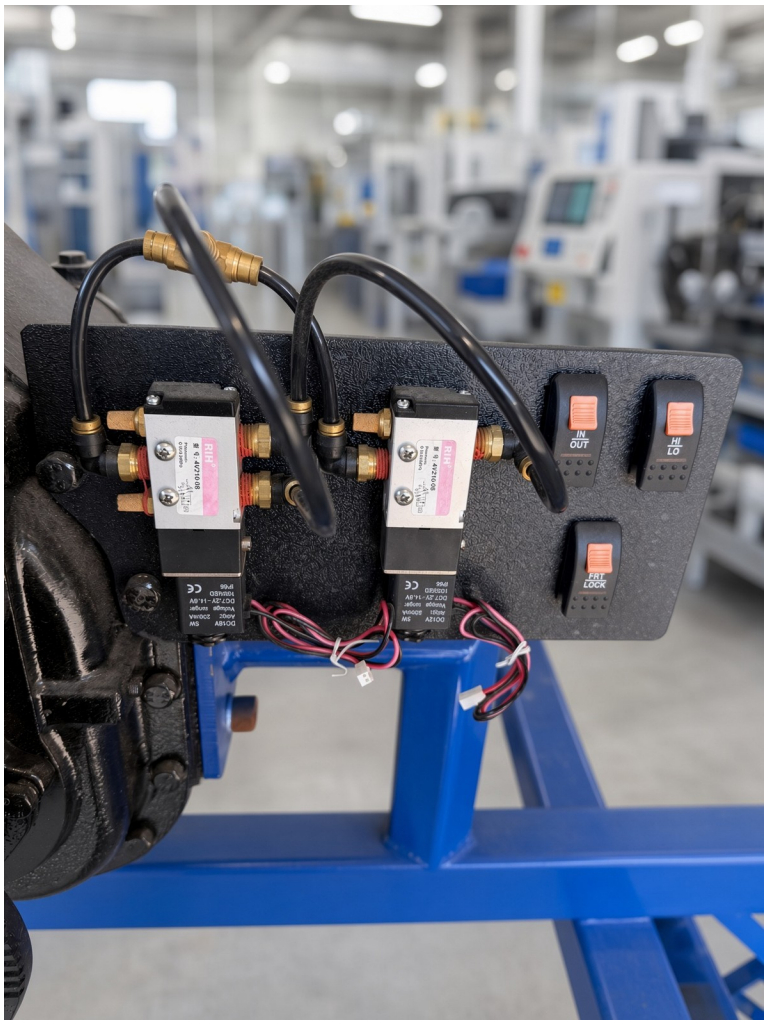


Figure 3 — Control panel: valves, supply tee, and rocker switches



Figure 4 — RIH 4V210-08 valves (close-up of ports and coil labels)

Valve specifications (as installed)

Manufacturer / model	RIH 4V210-08
Type	5-port, 2-position, single solenoid, spring return
Coil	DC 12 V • 5 W • ~230 mA • voltage range 7.2–14.8 V
Pressure range	0.15 – 0.8 MPa (22 – 116 PSI)
Ports	1/4" (inlet & cylinder) • 1/8" exhaust
Protection	IP65 • 100% ED (continuous duty)

4. Air Supply

The truck must provide a dedicated, regulated air source. Hydraulic-brake chassis usually have no factory air-brake compressor; air-brake chassis may tap a regulated accessory feed. Options:

- Small onboard 12 V compressor + 1–2 gallon tank (most common for these conversions).
- Engine-driven compressor if the chassis was ordered with one.

- Tapped, regulated feed from an existing accessory air system (air horns, suspension) provided the regulator is set to 90–100 PSI and a check valve isolates the T-case circuit.

Supply requirements

- Case shift-cylinder pressure: 4–6 bar (58–87 PSI). Set the regulator to about 70–85 PSI. Do not exceed 6 bar (87 PSI) at the case or 116 PSI at the valves.
- Air must be clean and dry. Install a filter/regulator (FRL) upstream of the valves. A 5-micron filter is sufficient. A lubricator is NOT required for these valves and can damage seals if over-oiled.
- Minimum hose ID from tank to valves: 1/4" OD nylon or 5/16" if runs are long (>15 ft).
- Fit a 1/4" NPT shut-off valve and a pressure gauge at the panel so the installer can isolate and verify pressure.

Hook-up uses the truck's existing air supply. A brass tee on the panel splits the BLUE supply into both valve inlet (P) ports. Vehicle system pressure is already correct; a separate regulator is not required.

5. Pneumatic Plumbing

5/2 valve port map (standard 4V210 numbering)

Port	Connection
1 (P)	Pressure supply from regulator / tank
2 (A)	Cylinder port A — one side of the shift cylinder
4 (B)	Cylinder port B — opposite side of the same cylinder
3 & 5	Exhaust. Install sintered mufflers to quiet the shift and keep dirt out.

Color code used on the display unit and in this manual

Hose colors in this manual match the hook-up photo: BLUE is supply, YELLOW is the two right-side case fittings to the valves, and RED is the two left-side case fittings to the valves.

Line color	Goes where
BLUE	SUPPLY. Existing vehicle air tank → brass tee → Port 1 (P) of BOTH solenoid valves.
YELLOW	The two right-side case fittings to the valves. Two yellow hoses.
RED	The two left-side case fittings (upper fitting by the output flange and the lower fitting) to the valves. Two red hoses.

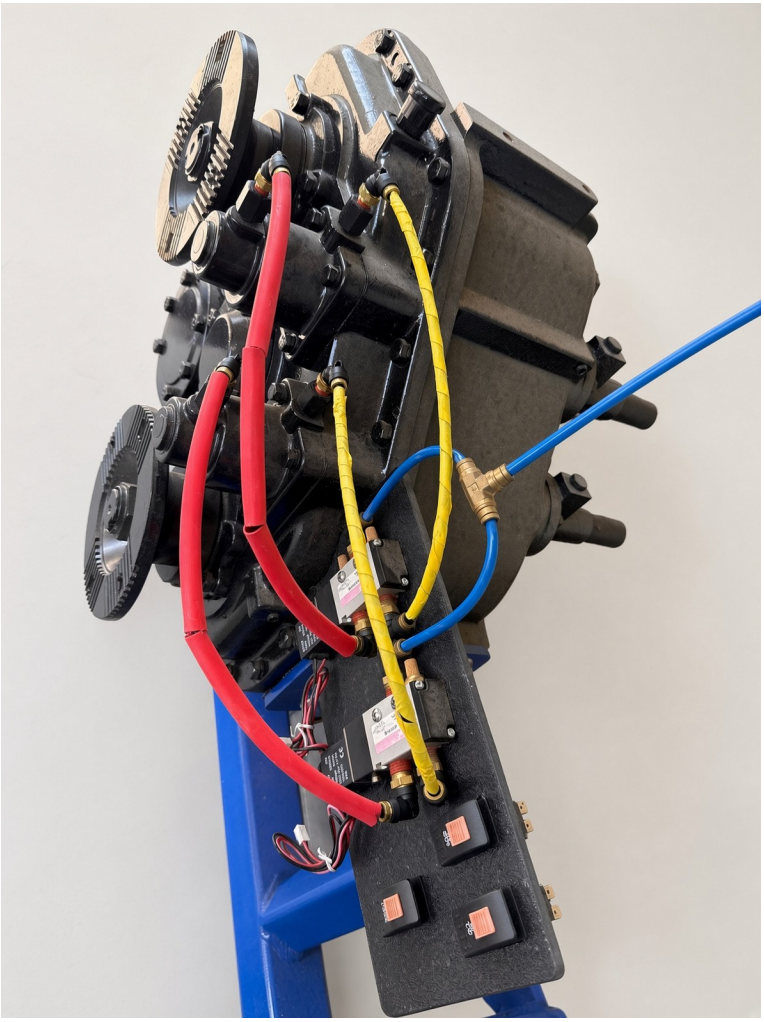


Figure 6 — Hook-up: two red hoses from the left-side case fittings; two yellow hoses from the right-side case fittings; blue supply at the brass tee.

Which valve is which

- The valve nearest the IN/OUT rocker is the In/Out (lock/unlock) valve. Match the hose colors on the case: yellow to the right-side fittings, red to the left-side fittings.
- The other valve is High/Low range. Its two cylinder hoses go to the remaining pair of case fittings.
- The third rocker (FRT LOCK (electric locker only)) is used only with an electric front locker. A manual front locker does not need this switch. The transfer case itself only needs two switches: IN/OUT and HI/LO.

Hook-up procedure

1. Mount the valve plate where it is protected and reachable. Keep coil connectors pointing down or sideways so water cannot pool on them.
2. Connect a BLUE 1/4" air line from the existing vehicle air tank to the brass tee, then a short BLUE jumper from each tee branch to Port 1 (P) of each valve. Vehicle system pressure is already correct; a separate regulator is not required.
3. YELLOW: connect the two yellow hoses from the right-side case fittings to the valves.

4. RED: connect the two red hoses from the valves to the two left-side fittings on the transfer case (one by the output flange, one lower).
5. Do not cross the two hoses of the same color. If a function runs backward after the first test, swap only that color pair at the case — leave the valve wiring alone.
6. Install exhaust mufflers on ports 3 and 5 of each valve.
7. Clamp every hose every 18–24 inches. Keep lines off the exhaust, drivelines, and sharp frame edges. Loom anything that passes through the cab or frame.
8. Pressurize to 90 PSI with the solenoids off. Soap-test every joint. Cycle each rocker and soap-test again in both positions.

6. Electrical Hook-Up

Each solenoid coil is two-wire, 12 V DC, 5 W. Polarity on the coil itself does not matter. The two required rockers are IN/OUT and HI/LO. Add a third FRT LOCK (electric locker only) rocker only when the truck has an electric front locker. Do not add that switch for a manual front locker.

Rocker switch pinout

Use this pinout on the IN/OUT and HI/LO rockers.

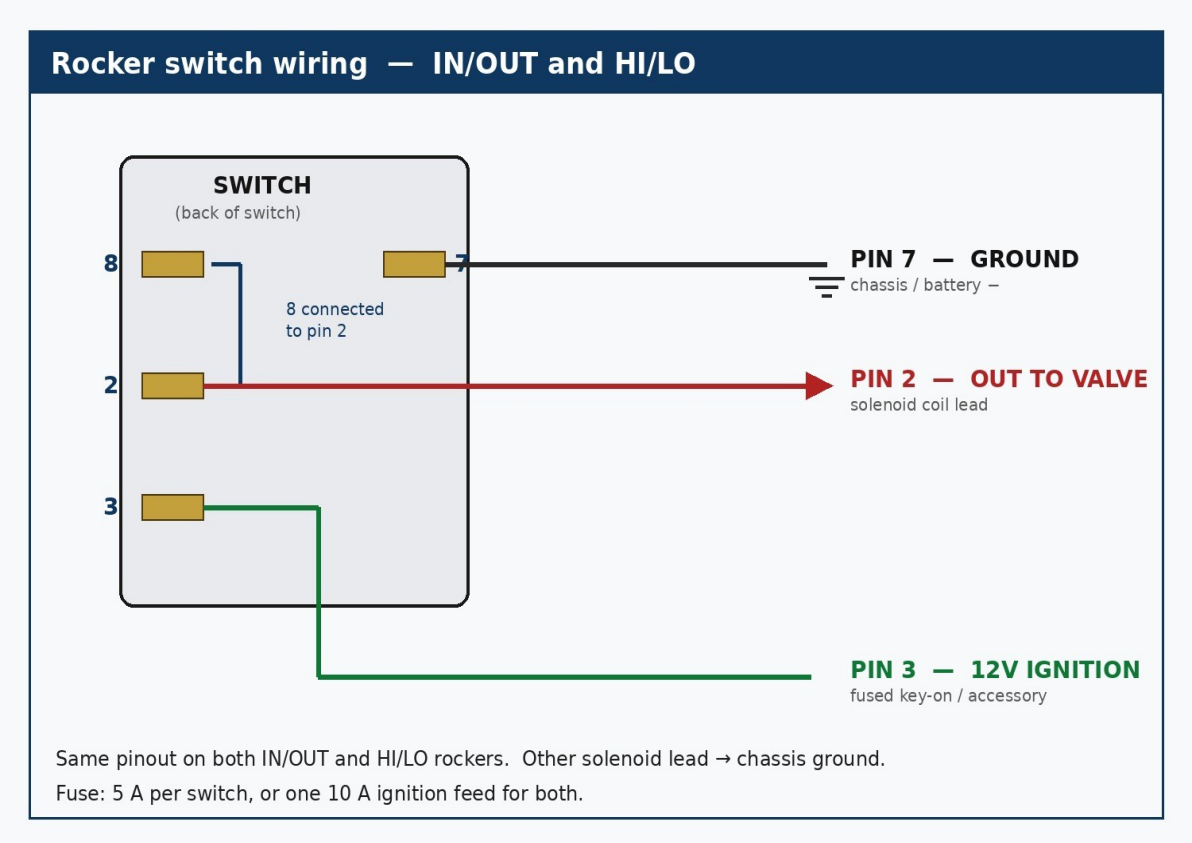


Figure 11 — Switch wiring: pin 3 = 12V ignition, pin 2 = out to valve, pin 8 ties to pin 2, pin 7 = ground. Same on both shift rockers.

Pin 3: fused 12V ignition. Pin 2: output to the solenoid valve. Pin 8 connects to pin 2. Pin 7: ground. The other solenoid wire goes to chassis ground.

Recommended circuit

- Source: ignition-switched or accessory 12 V (so the valves cannot be left energized with the key off for weeks). Do not tap an unfused battery cable.
- Protect the feed with a 10 A blade fuse (or two 5 A fuses, one per valve).
- Run 16 AWG (minimum) from the fuse to the common side of the rocker switches.
- From each switch output, run 16–18 AWG to the corresponding solenoid + lead. The other solenoid lead goes to a clean chassis ground (or the ground side of the switch if you prefer switched-ground).
- The supplied coils have flying leads with small connectors. Use heat-shrink butt splices or the mating connector. Do not leave bare crimps in the weather.

Switch assignment. Two switches are standard. The third switch is only for an electric front locker.

Rocker	Energized =	De-energized (spring) =
IN / OUT	Confirm on vehicle (Lock or Unlock)	Opposite state
HI / LO	Confirm on vehicle (High or Low)	Opposite state
FRT LOCK (electric locker only)	Front lock ON	Front lock OFF

Because the valves are spring-return, the “off” position of the rocker is a valid, powered-down shift state. That is the correct design — do not add a second solenoid or latching relay unless the particular case uses a dual-coil 5/3 valve (the 4V210-08 is not).

Verification before first drive

9. Key on, engine off, air pressure 90 PSI.
10. Flip HI/LO. You should hear the range cylinder slam positively in both directions. Confirm the case output rotation / indicator (if fitted) matches the label.
11. Flip IN/OUT. Confirm front output engages and disengages.
12. If the truck has an electric front locker, flip FRT LOCK (electric locker only) and confirm the locker engages. Skip this step if the front locker is manual — that setup does not use a front locker switch.
13. If any function is reversed, swap the two air hoses on that cylinder. Do not reverse switch wiring as a first step.
14. Reconnect the battery. Start the engine and repeat the shifts with the transmission in Neutral and the parking brake set.

7. Operating Instructions

High / Low range

- Stop the vehicle completely.
- Place the automatic transmission in Neutral (or Park). Manual transmissions: depress the clutch.

- Move the HI/LO rocker to the desired range. Wait one full second for the cylinder to complete travel.
- Do not force the shift if it feels incomplete — check air pressure first.

required interlock (do not skip)

When the transfer case is in HIGH, the transmission may be shifted normally. When the transfer case is in LOW, the control system MUST have the front axle engaged first. The front axle cannot be disconnected until the case is shifted back out of low. Sequence: engage front (IN) → then Low. To leave 4-Low: High first → then OUT.

In / Out (lock / unlock). Front locker switch only on electric-locker trucks.

- May be shifted at a crawl (under 5 mph) in a straight line on high-traction surface. When in doubt, stop first.
- Never lock the front output on dry pavement at highway speed.
- After returning to 2WD (OUT), drive a short distance straight so the driveline can unload.

Recommended shift sequence

15. Start in High range, unlocked (2WD / OUT).
16. For extra traction: IN (front engaged) first, still in High.
17. For steep / loose terrain: stop, Neutral, confirm IN, then LO.
18. Returning to pavement: stop, Neutral, HI first, then OUT.

8. Maintenance

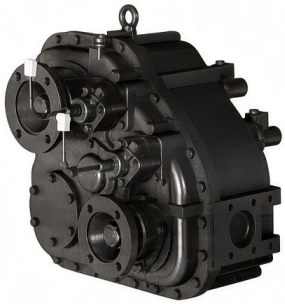
- Every oil-change interval: inspect all air hoses and fittings for abrasion, leaks, and loose clamps. Soap-test if in doubt.
- Drain the air-tank / water separator weekly in humid climates.
- Transfer-case lubricant: use the grade specified on the case tag (typically GL-5 80W-90 or SAE 50 for this class of case). Capacity on comparable two-speed cases is in the 16–20 quart range — always fill to the level plug, not by volume guess.
- Do not pressure-wash the solenoid coils directly. IP65 is splash-proof, not a license for a hot-water wand.
- If a valve becomes sluggish, remove the coil, cycle the manual override (small slotted button on the coil end of many 4V210 bodies), and check for contamination. Replacement valves are inexpensive; do not attempt to rebuild the spool in the field.
- After any collision or frame work, re-check hose routing so nothing can be pinched by the driveline or suspension.

9. Troubleshooting

Symptom	Likely cause	Action
No movement either way	No air, no 12 V, or seized cylinder	Gauge at panel. Test coil for 12 V and ~20–25 Ω. Listen for click.

Shifts one way only	Hose off one port, or exhaust blocked	Confirm both A and B hoses are live. Clear mufflers.
Partial engagement / grinding	Low pressure or leaking piston seal	Raise pressure to 90–100 PSI. Do not drive if gears are not fully meshed.
Wrong range vs. switch label	A/B hoses reversed on that cylinder	Swap the two hoses on that cylinder only.
Coil hot / fuse blows	Shorted coil or wrong voltage	Replace coil / valve. Confirm 12 V, not 24 V.
Slow or weak shift when hot	Water in lines or undersized supply	Drain tank. Upsize supply hose. Add a small accumulator at the panel.

10. Specifications



Type		Part-time four wheel drive
Shift Pressure		4-6 Bar
Max input torque		5000 Nm
Max input speed		3500 RPM
Ratio	High	1.00
	Low	2.11
Torque ratio		1:1
Lubricating oil		GL4 80W-90 Or GL5 85W-90
Weight		Approx. 200 kg
Odometer ratio		14/6

Figure 7 — HCF450 transfer case and factory specification table

Model	HCF450 • part-time four-wheel drive

Application	2004–present medium-duty trucks, front axle up to 14,000 lb, hydraulic or air brakes
Max input torque	5,000 N·m (3,688 lb-ft)
Max input speed	3,500 rpm
Ratios	High 1.00 • Low 2.11
Torque split	1:1 part-time 4WD
Shift pressure	4–6 bar (58–87 PSI)
Lubricant	GL-4 80W-90 (all season) or GL-5 85W-90 (summer)
Fill method	Fill until oil reaches the bottom edge of the observation / level hole
Dry weight	Approx. 200 kg (440 lb)
Speedometer	Odometer ratio 14/6
Max oil temperature	130 °C (266 °F)
Cab valves	RIH 4V210-08 × 2, 12 V DC, 5 W each

11. Structure & Working Principle

- One input, two outputs (front and rear). Additional PTO / auxiliary output available on some builds.
- Helical gear train for smooth, quiet operation.
- Pneumatic meshing-sleeve shift for High/Low and in/out engage.
- Position / signal switches for High/Low and front-axle status on the case.

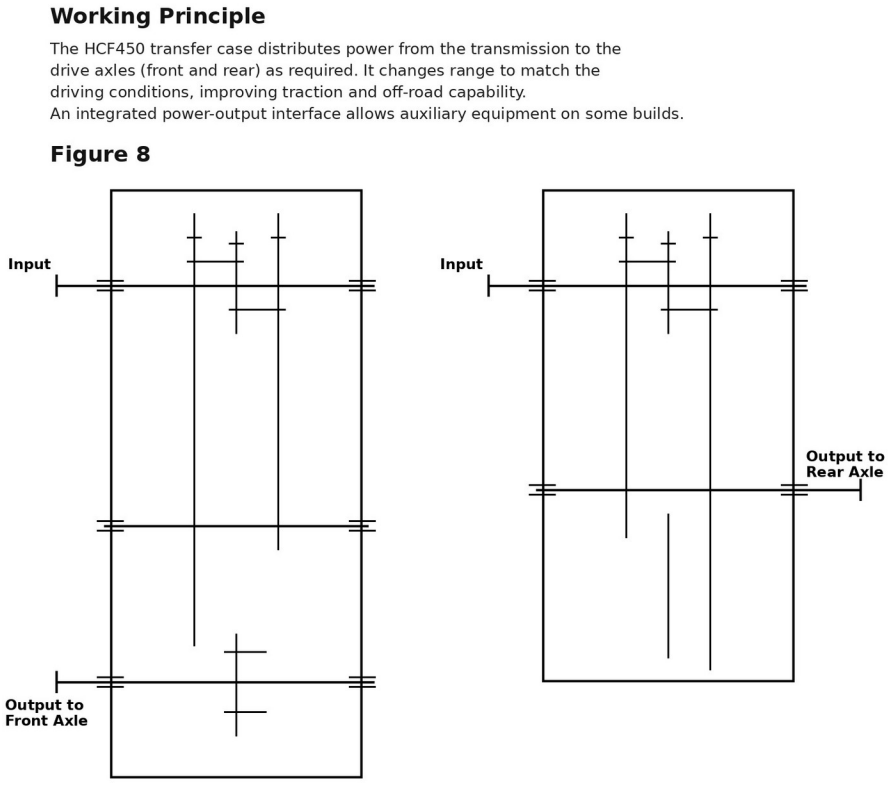


Figure 8 — Power flow: input to front output (left) and input to rear output (right)

High/Low air cylinder ports are marked A (High) and B (Low) on the case drawings. In/Out cylinder ports are marked C (engage) and D (disengage). Match those letters to the color-coded hoses in Section 5 after the first test shift.

12. Lubrication, Break-In & Maintenance

Fill

- Use 80W-90 GL-4 (all season) or 85W-90 GL-5 (hot weather).
- Fill through the fill plug until oil reaches the bottom edge of the level / observation hole. Do not overfill.

Break-in (first 1,000 km / 620 miles)

- Keep load at or below 50%. Do not tow a trailer.
- Avoid mud, sudden acceleration, and hard braking.
- First 500 km (310 miles): do not exceed 65% of the maximum speed in that gear.
- Watch case temperature. Maximum oil temperature is 130 °C (266 °F). Stop and find the cause if it runs hotter.
- Retorque mounts and driveline fasteners during break-in. Change the oil at the end of break-in.

Oil-change intervals

- First change: 5,000 km (3,100 miles) or 125 hours (new or after rebuild).
- Normal service: 80,000 km (50,000 miles) or 2,000 hours.
- Severe service: 40,000 km (25,000 miles) or 1,000 hours.
- At least once per year regardless of miles.

Routine checks

- Oil level at the observation hole.
- Mount bolts, yoke nuts, and air-line fittings.
- Leaks at seals and the breather / vent.

13. Additional Troubleshooting

Fault	Possible cause	Action
Hard to shift	Low air, leak, binding fork, dirty oil, incomplete sleeve travel	Fix air first. Then inspect oil and shift forks.
Noise in the case	Gear wear, bearing wear, excessive backlash	Do not keep driving. Inspect gears and bearings.
Jumps out of gear	Worn sleeve teeth, weak detent, bent fork	Repair or replace worn shift parts.
Oil leak	Overfill, blocked vent, failed seal	Set level to the observation hole. Clear the vent. Replace seals.

14. Service Data

Tightening torques

Item	Torque
M10 bolt	35–47 N·m (26–35 lb-ft)
M12 bolt	60–72 N·m (44–53 lb-ft)
Lock nut	250–300 N·m (184–221 lb-ft)
Fill / drain plugs	50–60 N·m (37–44 lb-ft)

Axial bearing clearance

Driving shaft, intermediate shaft, and output shaft bearings: 0–0.05 mm (0–0.002 in).

Bearings

#	Part no.	Description	Qty
1	33212	Front bearing, driving / front-axle shaft	2
2	33112	Rear bearing, driving / front-axle shaft	2

3	32308	Intermediate shaft bearing	2
4	32309	Front bearing, rear-axle shaft	1
5	31311	Rear bearing, rear-axle shaft	1
6	K70×78×32.5	Needle roller bearing	2

Oil seals

Seal FB65 × 90 × 12 (part 2402E03-060) — quantity 3.

Rebuild notes

- Remove the case only to repair worn or damaged parts. Do not shock or drop it.
- Work on a clean bench. Clean all joint faces. Remove old sealant and burrs.
- Replace gaskets, oil seals, and locking plates that were disturbed.
- Keep metal chips out of oil passages.
- Assemble to the torques and 0–0.05 mm bearing clearances above.

15. Drawings

Factory views of the HCF450. Air-cylinder letters: High/Low A–B, front axle C–D. Oil fill, level, and drain are marked on the end view.

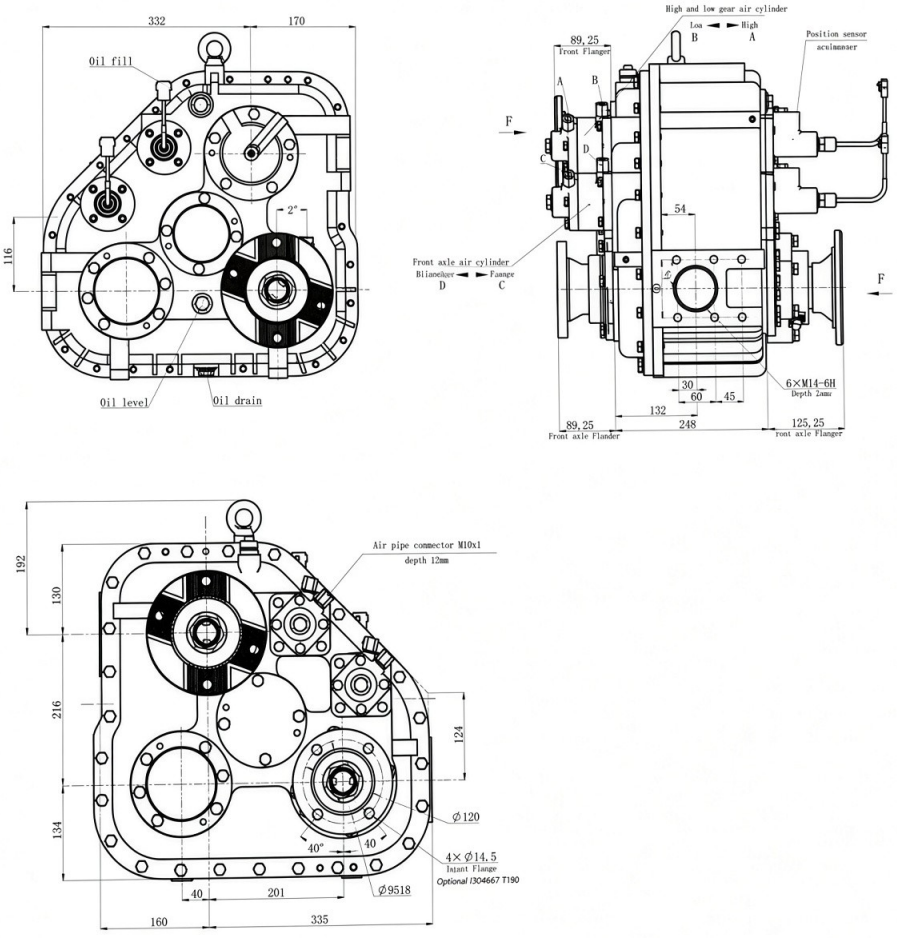


Figure 9 — Outline dimensions, oil plugs, and air-cylinder ports (A/B High-Low, C/D front axle)

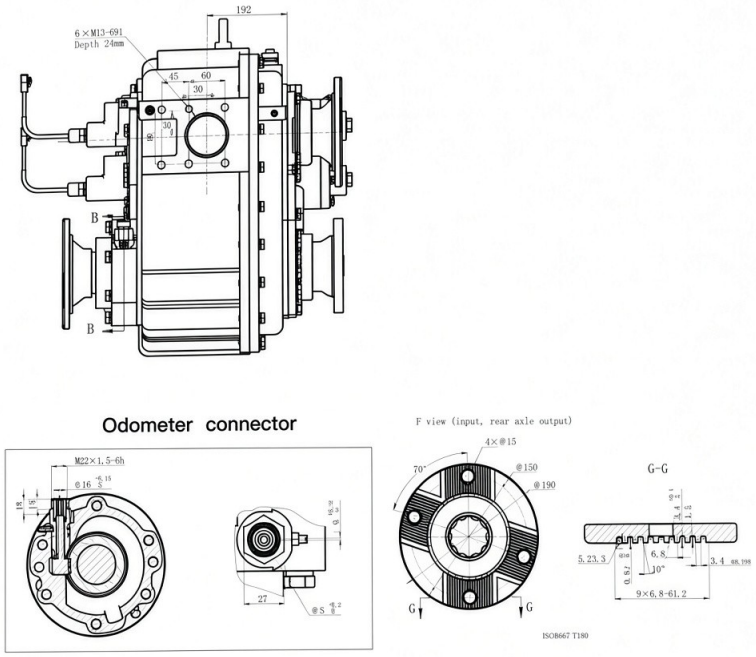


Figure 10 — Side view, odometer connector, and output flange detail

16. Support

For questions on a specific serial-numbered case, hose routing unique to a chassis, or replacement parts:

Truck Customs By Chris / F650 Supertrucks
700 Dobie Industrial Drive
Augusta, Georgia 30909

Office: 706-733-6271
Sales: 716-446-3859
Web: www.f650pickups.com

Have the truck year, VIN last six, and photos of the valve plate and case fittings ready when you call. Do not modify porting or substitute a different valve body without factory guidance — shift-cylinder timing and spring rates are matched to the 4V210-08.

— End of Manual —

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