E4OD/4R 100

Check Ball Identification and Symptom Chart

Repeated failures are caused by only two types of problems: parts or technique. If a *part* is causing the failure, it should be no surprise that using the same no-good part causes the same failure.
If the problem is *technique*, it means a process you are doing is actually *causing* the failure. An example would be drilling out a separator plate hole, changing the servo size, or leaving a checkball out. Sure, there are valid reasons for making modifications.

Checkballs are one of those *technique* issues: "yeah, leave that checkball out for a better 2-3 shift." We've all heard it, and we've all done it at one point or another, sometimes successfully, sometimes we're not so sure. But what we *can* be sure of is what those little checkballs do, and what effect leaving them out will have.

Early 1989 E4ODs...

The first E4OD had 16 checkballs.

Late 1989 E4ODs...

The second release of the E4OD was during the mid-year production. This change omitted CB3, CB4 and CB5. These are orificing checkballs for the intermediate, overdrive and direct accumulators. When these checkballs were omitted, so were the separator plate holes where they seated.
Leaving these checkballs out on an early 1989 model will cause a slide-bump during the shifts. Leaving the check balls in will cause no problem in late '89.

1990 – 1993 E4ODs...

In 1990, Ford omitted CB12 and BS5. BS5 was a shuttle for direct clutch oil and would shuttle between the direct clutch accumulator feed and engagement control valve feed. This ball didn't do anything in reverse, and wasn't needed for third because the engagement control valve blocked fluid flowing back through the system.
CB12 worked *with* BS5 in that it was part of the direct clutch feed circuit. It simply forced any oil on one side of BS5 to go through the engagement control valve during the apply, and then allowed for a quick drain of the circuit during release (reverse only).

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Check Ball Identification and Symptom Chart (continued)

1990 – 1993 E4ODs...(continued)

After the spearator plate hole for CB12 was eliminated, there was no more need for BS5. These two checkballs are a matched set; that is, it either has both or neither. If you install them on models that don't use them it's no big deal; they won't interfere with anything.

If you leave out the BS5 on models that require it, direct clutch oil will leak from the CB12 plate hole in third gear — regardless of whether you install the CB12 ball. When they eliminated CB12 they got rid of the hole in the plate for it. If your plate doesn't have a hole for CB12, leave both balls out (CB12 and BS5).

If you leave out CB12 on models that use it, it'll bypass the engagement control valve during reverse engagements, resulting in a *more aggressive engagement* in reverse.

1994 – 1995 E4ODs...

Some '94-'95 repair manuals labeled CB13 as CB12 in the hydraulics and in the check ball ID section. The function of this ball has always been the same. It's still the same ol' checkball in the lower valve body section that's been around since the beginning.

1996 – On E4ODs...

The changes in 1996 include two checkballs that were added (CB15 and CB16) and BS6 was moved from the case to the lower valve body. This change was to prime the low/reverse circuit in 1st gear, park and neutral.

Moving BS6 to the lower valve body put it near the SS2 (shift solenoid 2) circuit, so low/reverse clutch oil would dump when SS2 came on for the shift to 2nd. In addition, the 1-2 manual transition valve prevents SS2 oil from reaching the 1-2 shift valve until the low/reverse clutch is fully drained. CB16 is part of that circuit.

If you forget to install CB16, you may not realize it for a while. That's because it'll only leak low/reverse oil in manual low; reverse will be fine. BS6 was eliminated on some models and the reverse circuit to it was eliminated. But if you leave it out on models that use it, the transmission will shift 1-4, or in some cases (depending on condition of SS2) you'll get a 1-3-4 shift. Some models don't use BS6, but it won't cause any problem if you accidentally install it, because the hole in the separator is oblong, so the ball won't seal the hole. If the plate has two holes over the bath tub you must use a check ball in that location. If the plate has one hole, do not install a check ball.

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Check Ball Identification and Symptom Chart

1996 – On E4ODs...

The CB15 is used in the exhaust circuit of the L/R modulator valve. The idea is that anytime you block off a regulator valve exhaust circuit it'll open fully to line (or whatever is feeding the circuit). So in park or neutral the L/R modulator valve primes the L/R clutch circuit, and CB15 allows the L/R modulator valve exhaust circuit to drain.

When you go to reverse, reverse oil begins to flow through the circuits, pushing CB15 into the L/R modulator valve exhaust, and BAM! — the low/reverse clutch applies. Applying the L/R clutch before the direct clutch in reverse makes for a much smoother apply. The L/R clutch will still apply if you leave out CB15, but not as quickly, so you may get a bang going from park to reverse.

The Rest of the Checkballs...

So far we've only talked about the checkballs that have changed over the years. Let's do a quick rundown on the ones that *haven't* changed:

CB1: Blocks manual 2 and L oil going to the 4-3-2 manual timing valve from leaking through the reverse circuit. Leave it out and it'll dump line oil out of the manual control valve.

CB6: Orificing checkball for the direct clutch exhaust. During a 3-2 kickdown it forces direct clutch oil to drain through an orifice, slowing the release. If you leave it out, you'll get a clunk on a 3-2 kickdown.

CB7: Orificing checkball for the overdrive clutch exhaust. During a 4-3 kickdown it forces overdrive clutch oil to drain through an orifice, slowing the release. If you leave it out, you'll get a clunk on a 4-3 kickdown.

CB8: Orificing checkball for the coast clutch apply. If you leave it out, you'll get a clunk when the coast clutch applies for engine braking.

CB9: Orificing checkball for intermediate servo apply. If you leave it out, the intermediate band will apply more aggressively during a manual 3-2 downshift.

CB14: Orificing checkball for intermediate clutch release. If you leave it out you'll get a clunk on the 2-1 kickdown.

E4OD/4R 1OO

Check Ball Identification and Symptom Chart

The Rest of the Checkballs...

BS1: Shuttles between reverse oil and manual 2/low oil to stroke the coast clutch shift valve. If you leave it out, line oil dumps through the manual control valve in all of these ranges... not to mention the coast clutch won't apply for engine braking, *except* in drive when you cancel OD.

BS2: Shuttles between SS2 oil and manual 2 oil to stroke the 1-2 shift valve and L/R modulator valve. If you leave it out, the transmission will shift from 1st to 4th. That is, when the computer commands 2nd it stays in 1st. When it commands 3rd, it goes to 4th (just like BS6 on 1996-98 model E4ODs). The problem is, if the SS2 is stuck off it'll cause the same thing, so be careful. One more thing, depending on the condition of SS2, and well it flows, you may get a 1-3-4 shift.

BS3: Shuttles between reverse/manual 2 oil and the coast clutch solenoid to stroke the coast clutch shift valve. If you leave it out, you won't have any engine braking when you cancel overdrive. You'll also lose engine braking in reverse, manual 2 and manual low, just like leaving out BS1.

E4OD/4R IOO

Check Ball Identification and Symptom Chart (continued)

All Checkball Locations For E4OD and 4R100						
Ball Location	**Early 1989**	**Late 1989**	**1990-93**	**1994-95**	**1996-on**	**4R100**
CB1	X	X	X	X	X	X
CB3	X	{1}				
CB4	X	{1}				
CB5	X	{1}				
CB6	X	X	X	X	X	X
CB7	X	X	X	X	X	X
CB8	X	X	X	X	X	X
CB9	X	X	X	X	X	X
CB12	X	X				
CB13	X	X	X {2}	X	X	X
CB14	X	X	X	X	X	X
CB15					X	X
CB16					X	X
BS1	X	X	X	X	X	X
BS2	X	X	X	X	X	X
BS3	X	X	X	X	X	X
BS5	X	X {3}				
BS6 {4}	X	X	X	X	X {5}	X {5}

{1} CB3, CB4, CB5 (See early '89 check ball location page) If the plate has seats for these check balls, a ball must be installed.
{2} Some '94-'95 manuals labeled CB13 as CB12 in the hydraulics and in the check ball ID section. The function of this ball has always been the same.
{3} 5/16 steel ball in late '89
{4} '89-'95-BS6 Check ball was located in the case. '96-on BS6 was moved to the upper Valve body. (Also see note #5)
{5} The BS6 check ball was deleted in some models. If the plate has two holes over the bath tub you must use a check ball in that location. If the plate has one hole, do not install a check ball.

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Check Ball Identification and Symptom Chart (continued)

Common Complaint Associated to Missing or Damaged Check Balls		
Ball Location	**Comments**	**Complaint**
CB1		Low line in Manual 2 and L
CB3		1-2 Slide Bump
CB4		3-4 Slide Bump
CB5		2-3 Slide Bump
CB6		Harsh 3-2 kickdown
CB7		Harsh 4-3 Kickdown
CB8		Clunk when applying the coast clutch
CB9		Harsh manual 3-2 coastdown shift
CB12	1994-95	Aggressive forward engagement
CB13	Except '94-95	Aggressive forward engagement
CB14		Harsh 2-1 Kickdown
CB15	96-on	Bump into Reverse
CB16	96-on	Repeat Low/Reverse Clutch Failure
BS1		No Coast clutch apply. Low line in Reverse, Manual 2 &L. The coast clutch will work in Drive when you cancel OD
BS2		Shifts 1-4*
BS3		No coast clutch apply
BS5	89 only	Slips in third and fourth, Burnt Direct Clutch
BS6	1989-95	Low line in Reverse and Manual 2
BS6	1996-on some models	Low line in Reverse and Manual 2, Shifts 1-4*

*Can shift 1-3-4 depending on the condition of SS2

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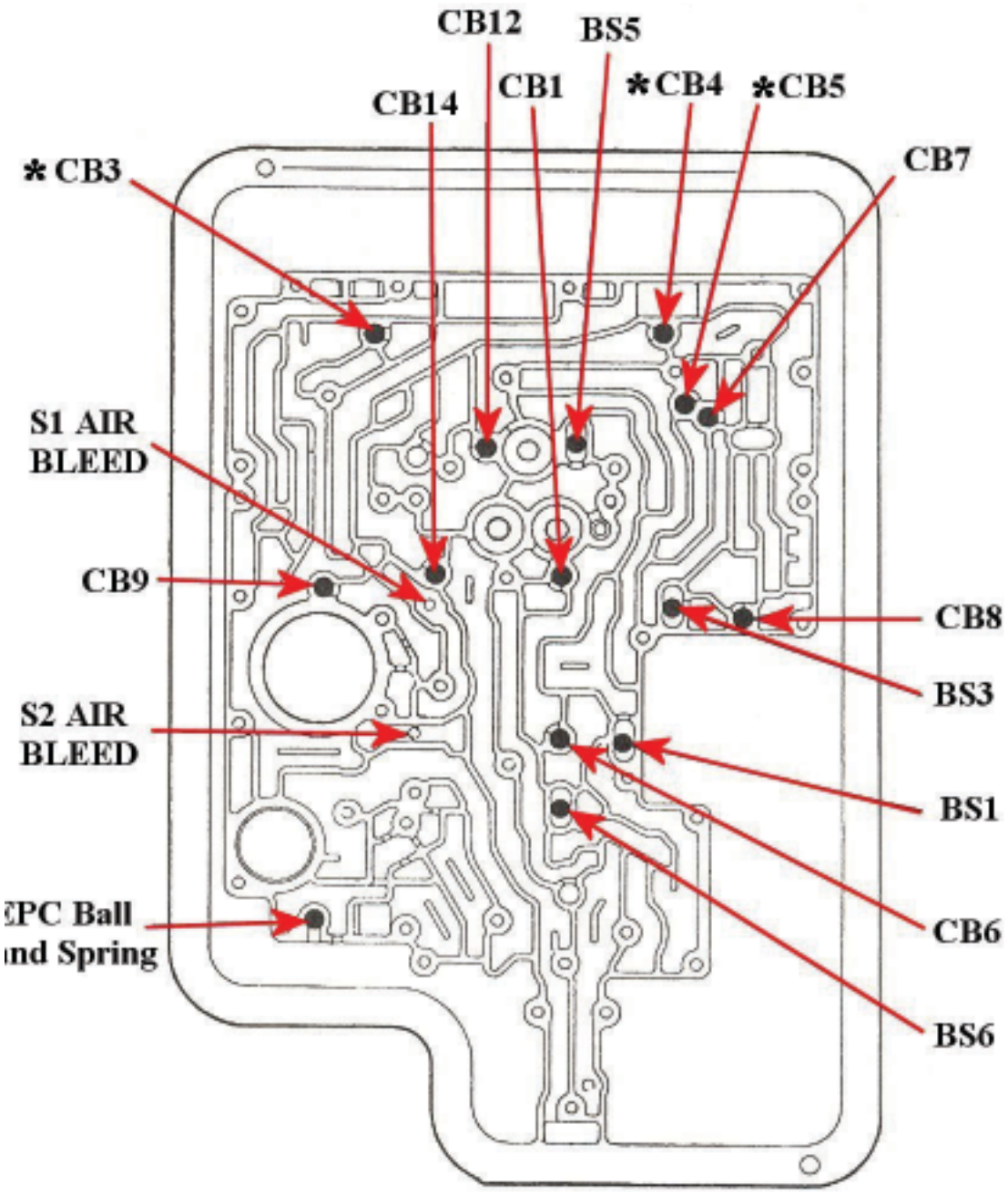
Check Ball Identification and Symptom Chart (continued)

Early 1989

*CB3, CB4, CB5
If the plate has seats for these check balls, a ball must be installed.



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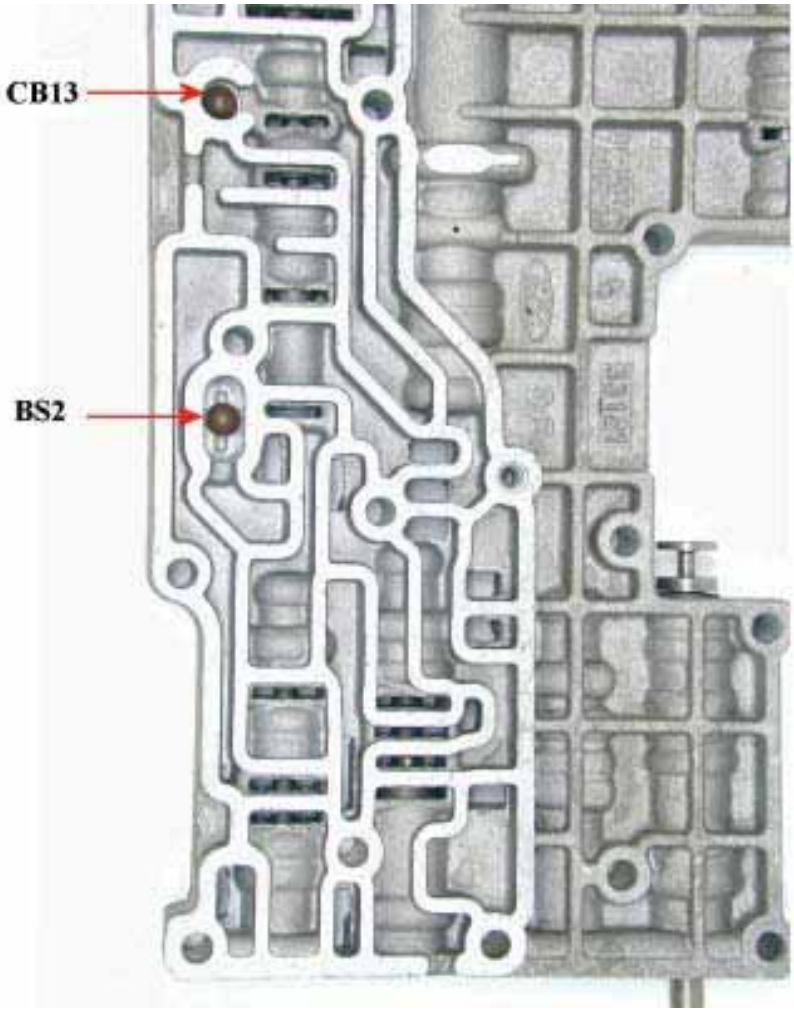
Check Ball Identification and Symptom Chart (continued)

Early 1989



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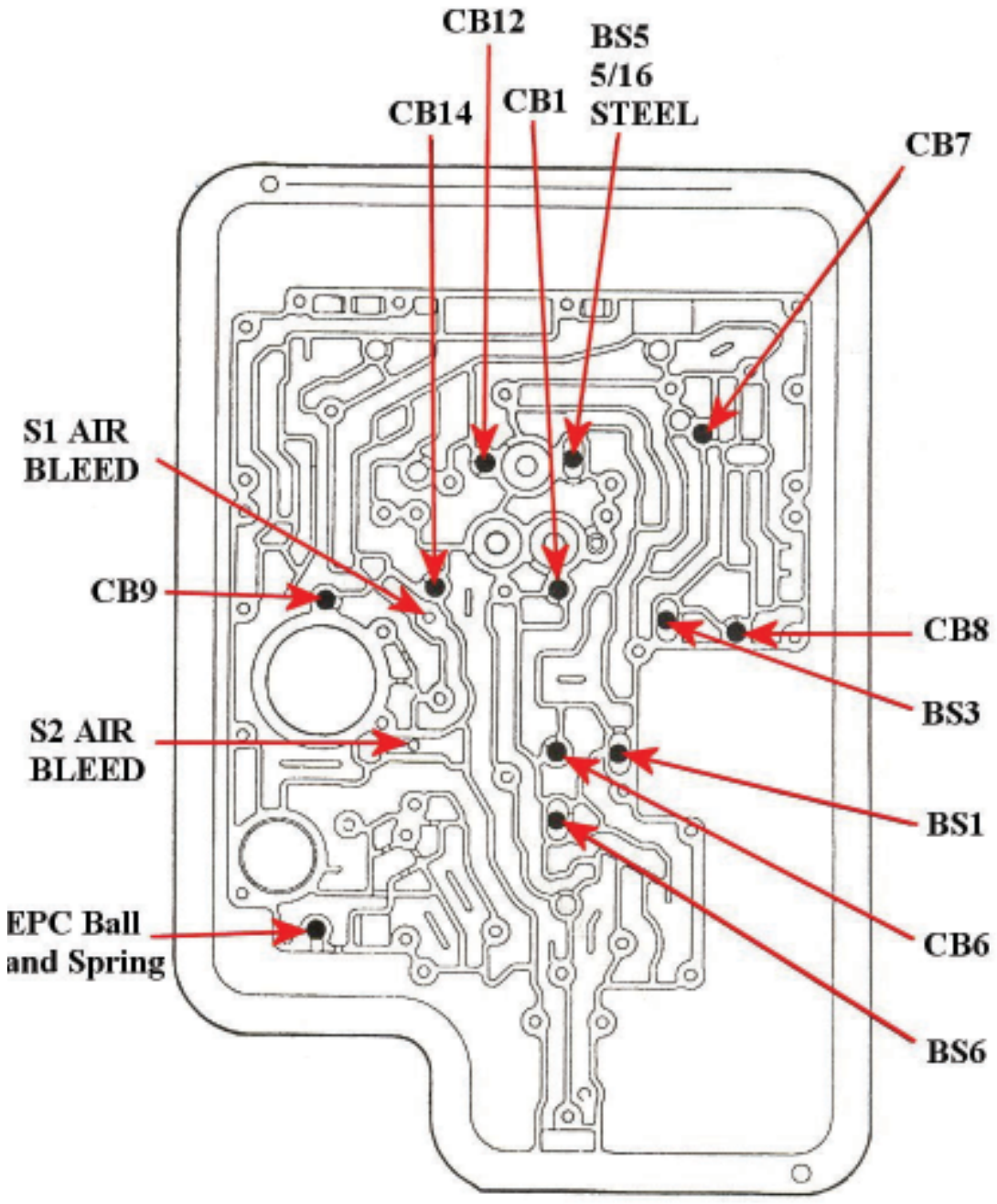
Check Ball Identification and Symptom Chart (continued)

Late 1989

*CB3, CB4, CB5 (See early '89 check ball location page)
If the plate has seats for these check balls, a ball must be installed.



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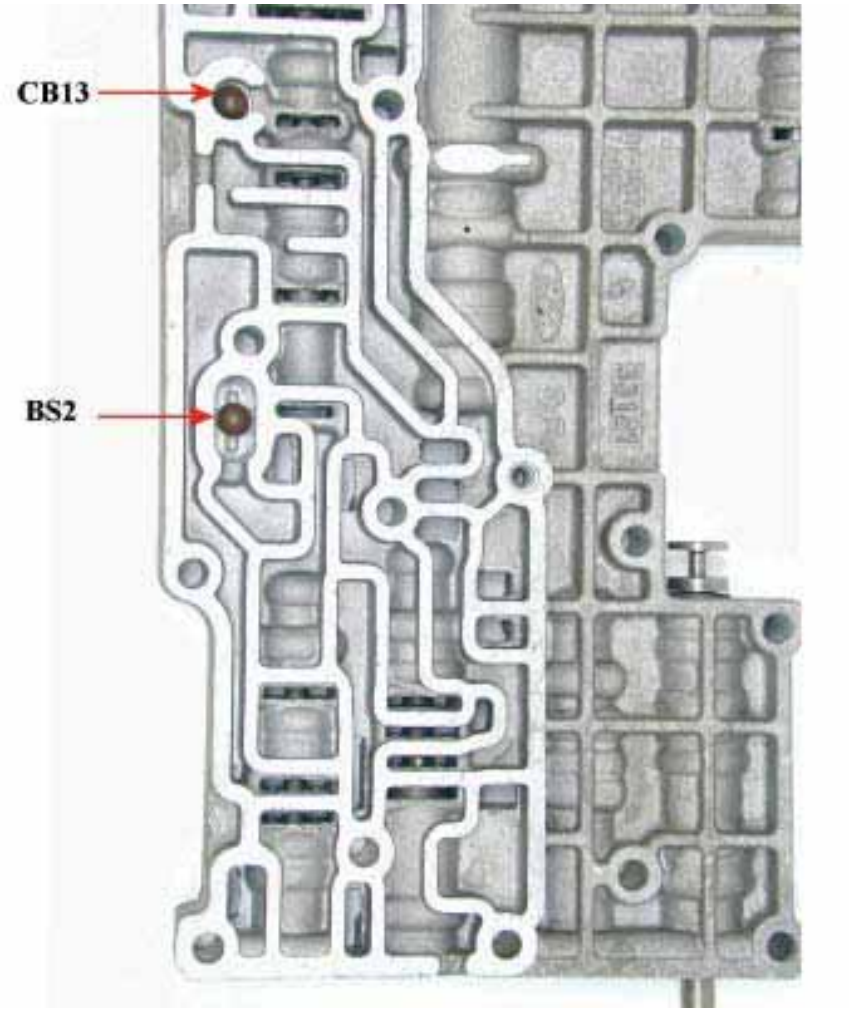
Check Ball Identification and Symptom Chart (continued)

Late 1989



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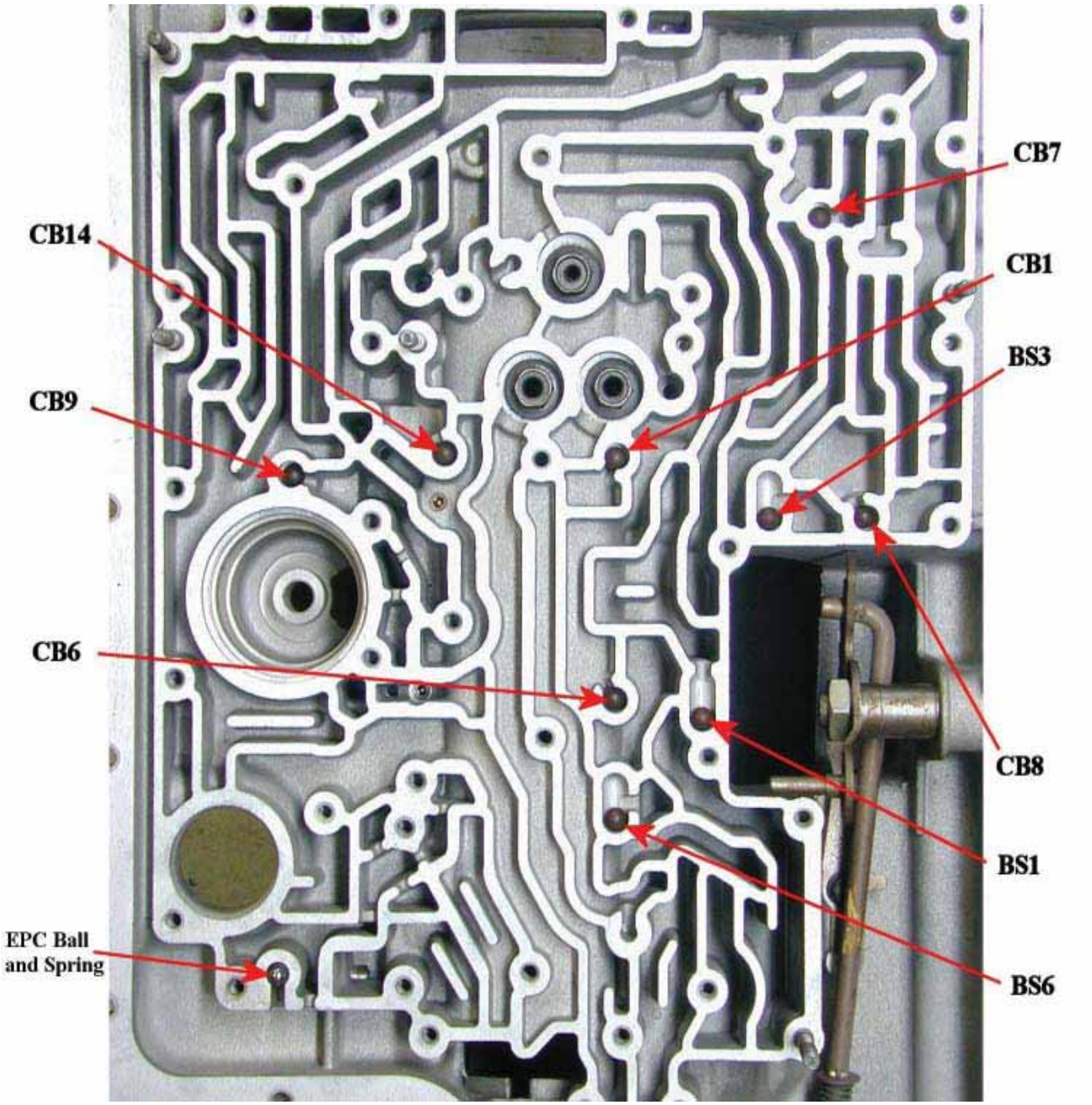
Check Ball Identification and Symptom Chart (continued)

1990-1995



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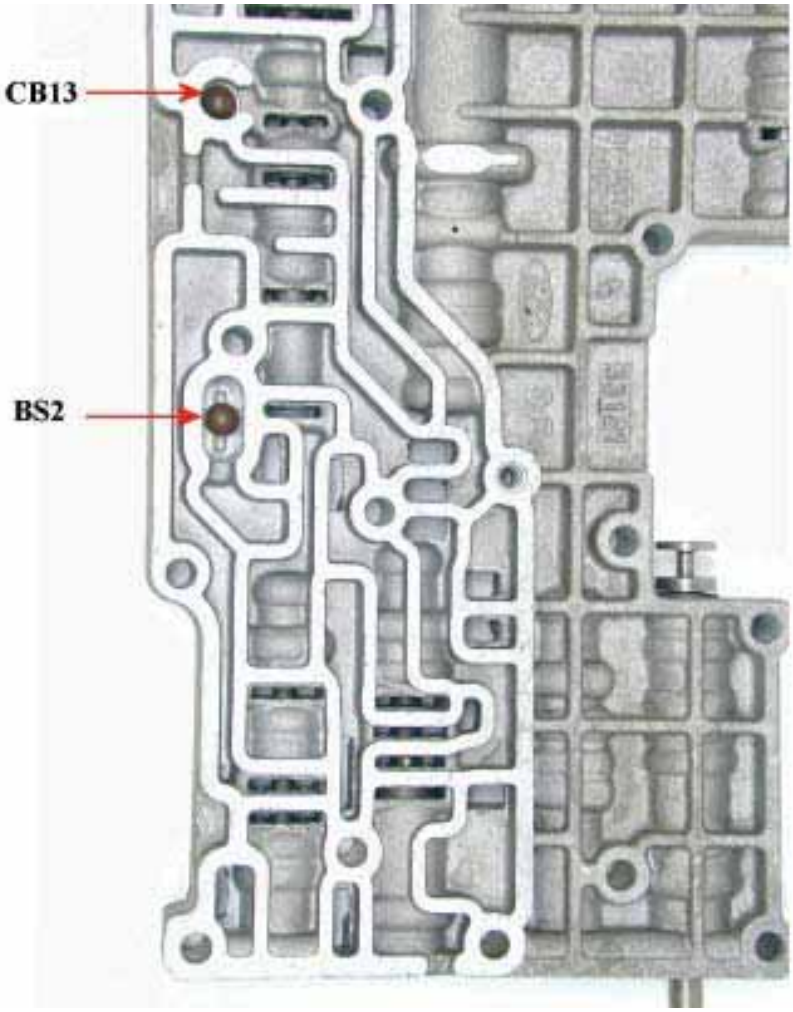
Check Ball Identification and Symptom Chart (continued)

1990-1995

Some '94-'95 manuals labeled CB13 as CB12 in the hydraulics and in the check ball ID section. The function of this ball has always been the same.



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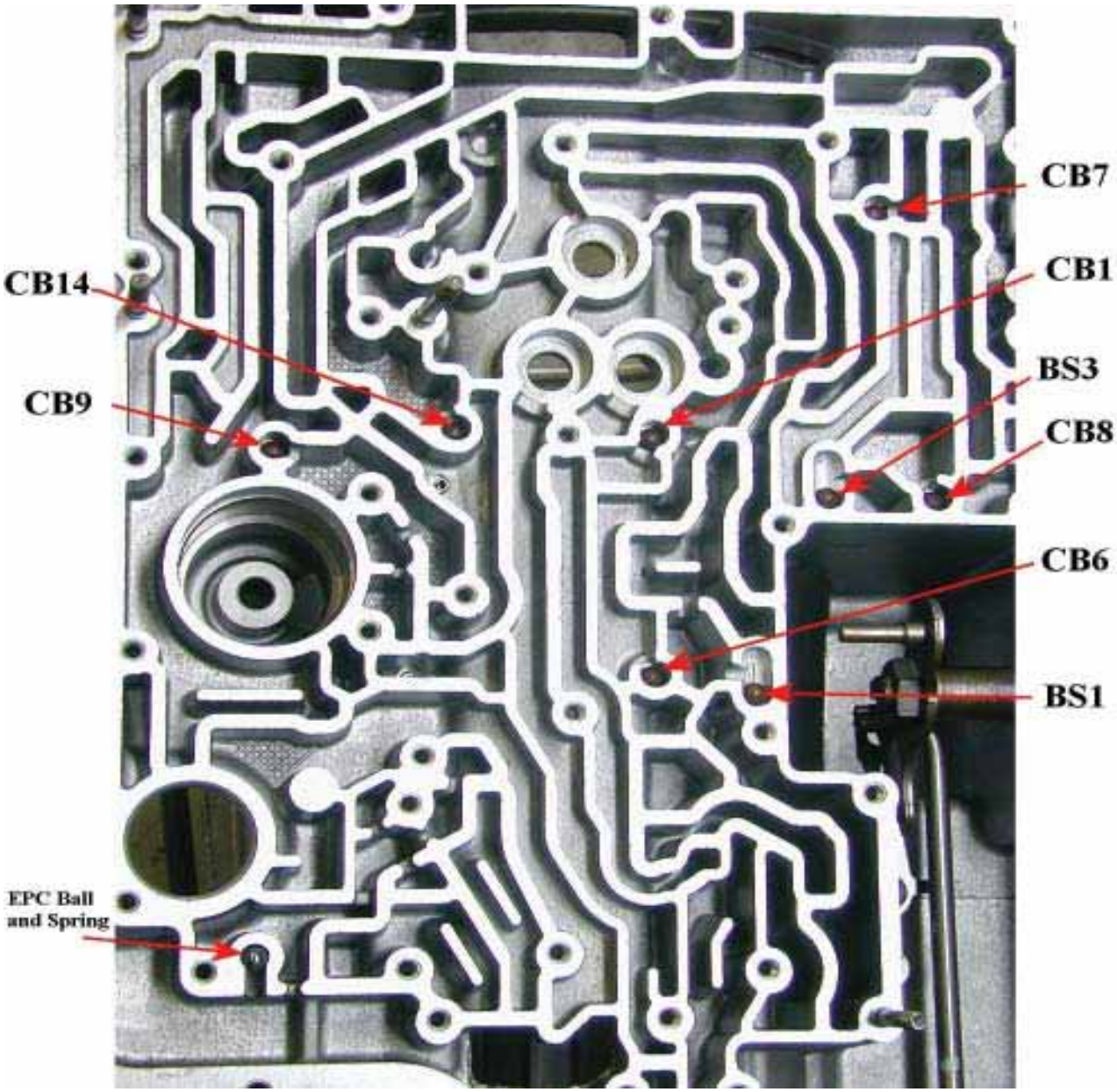
Check Ball Identification and Symtom Chart (continued)

1996-On

Some manuals labeled CB 14 and CB 9 incorrectly.



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Check Ball Identification and Symtom Chart (continued)

1996-On

The BS6 check ball was deleted in some models. If the plate has two holes over the bath tub you must use a check ball in that location. If the plate has one hole, do not install a check ball.