Service Manual: MANUAL TRANSMISSION - TREMEC
6-SPEED (MM6 M13)

SPECIFICATIONS > FASTENER SPECIFICATIONS (M13)

Application	Specification	
	Metric	English
Back up Sensor	27 N.m	20 lb ft
Clutch Housing Bolt/Screw	33 N.m	24 lb ft
Cooler Line Inlet Fitting	22 N.m	16 lb ft
Cooler Line Exit Fitting	22 N.m	16 lb ft
Engine to Clutch Housing Fasteners	50 N.m	37 lb ft
Extension Housing Bolt/Screw	33 N.m	24 lb ft
Manual Shift Detent Bolt	22 N.m	16 lb ft
Manual Transmission Selector Lever Pivot Pin (5th Gear)	41 N.m	30 lb ft
Propeller Shaft Transmission Yoke Nut	140 N.m	103 lb ft
Shift Control Assembly Fasteners	18 N.m	13 lb ft
Shift Control Assembly to the Tunnel Reinforcement	12 N.m	106 lb in
Shift Interlock Detent Assembly	40 N.m	30 lb ft
Shift Control Shaft Position Guide Bolt/Screw	12 N.m	106 lb in
Shift Shaft Detent Plug	50 N.m	37 lb ft
Shift Shaft Detent Spring Cover Bolt	28 N.m	21 lb ft
Transmission Control Lever Knob Fastener	7 N.m	62 lb in
Transmission Oil Drain Plug	27 N.m	20 lb ft
Transmission Oil Fill Plug	27 N.m	20 lb ft
Transmission Speed Sensor Bolt/Screw	10 N.m	89 lb in
Transmission Support Fasteners	60 N.m	44 lb ft
Transmission Temperature Sensor	39 N.m	29 lb ft

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SPECIFICATIONS > FASTENER SPECIFICATIONS (MM6)

Application	Specification	
	Metric	English

Clutch Housing Assembly to Transmission Case Bolts	48 N.m	36 lb ft
Clutch Housing Pump Plug	27 N.m	20 lb ft
Concentric Slave Cylinder Bolt	12 N.m	106 lb in
Coolant Temperature Sensor	39 N.m	29 lb ft
Cooler Line Return Fitting	22 N.m	163 lb ft
Cover Plate Bolts	20 N.m	15 lb ft
Extension Housing Plug	27 N.m	20 lb ft
Extension Housing to Transmission Case Bolts	48 N.m	36 lb ft
Gear Select/Skip Shift Solenoid	40 N.m	30 lb ft
Neutral Return Cam Spring Retaining Bolt	25 N.m	18 lb ft
Propshaft Transmission Yoke Nut	136 N.m	100 lb ft
Pump Outlet Cooler Fitting	22 N.m	16 lb ft
Reverse Idler Shaft Bracket Bolts	25 N.m	18 lb ft
Reverse Lockout Assembly Bolt	18 N.m	13 lb ft
Reverse Lockout Solenoid	40 N.m	30 lb ft
Shift Control Adapter Plate Bolt	18 N.m	13 lb ft
Shift Control Adapter Plate Nut	12 N.m	106 lb in
Shift Control Assembly to the Tunnel Reinforcement	12 N.m	106 lb in
Shift Detent Assembly	40 N.m	30 lb ft
Shift Fork Posistion Sensor	8 N.m	72 lb in
Shift Guide Plate Bolts	22 N.m	16 lb ft
Shift Knob Fastener	7 N.m	62 lb in
Shift Lever Guide Bolts	27 N.m	20 lb ft
Shift Shaft Detent Plug	21 N.m	16 lb ft
Transmission Bolt	48 N.m	35 lb ft
Transmission Case Drain Plug	27 N.m	20 lb ft
Transmission Case Fill Plug	27 N.m	20 lb ft
Transmission Mount to Transmission Case Bolts	60 N.m	44 lb ft
Vehicle Speed Sensor (VSS) Bolt	11 N.m	96 lb in

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SPECIFICATIONS > APPROXIMATE FLUID CAPACITIES (MM6)

Application	Specification

	Metric	English
Transmission Only	3.46 liters	3.66 quarts
Total Capacity with Transmission Cooler	4.9 liters	5.2 quarts
When filled, fluid level should be 3.2 mm (1/8 in) below fill hole.		

SPECIFICATIONS > APPROXIMATE FLUID CAPACITIES (M13)

Application	Specification	
	Metric	English
DEXRON®VI P/N 88861037 (Canadian P/N 19264717)	3.45 liters	3.65 quarts
M13 with Y4Q (Auxiliary Transmission Cooler)	3.6 liters	3.8 quarts
When filled, fluid level should be at the bottom of the fluid check plug hole.		

SPECIFICATIONS > ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS (MM6)

Sealers, Adhesives, and Lubricants

Application	Type Of Material	GM Part Number	
		United States	Canada
Clutch Housing Assembly Plug	Sealant	12346004	10953480
Cover Plate	Sealant	12346141	89022195
Extension Housing Bolts	Sealant	12346004	10953480
Reverse Idler Shaft Bracket Bolts	Threadlocker	12345382	10953489
Reverse Lamp Switch	Sealant	12346004	10953480
Shift Lever Guide Bolts	Sealant	12346004	10953480
Temperature Switch	Sealant	12346004	10953480
Transmission Case Drain Plug	Sealant	12346004	10953480
Transmission Control Lever Knob Fastener	Threadlocker	12345382	10953489
Transmission Fluid	Manual Transmission Fluid	88861800	88861801

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SPECIFICATIONS > ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS (M13)

Sealers, Adhesives, and Lubricants

Application	Type Of Material	GM Part Number	
		United States	Canada
Clutch Housing Assembly Plug	Sealant	12346004	10953480
Extension Housing - Model Dependent	Sealant	12346141	89022195
Extension Housing Bolts	Sealant	12346004	10953480
Neutral Position Sensor Bolt/Screw - Model Dependent	Threadlocker	12345382	10953489
Reverse Idler Shaft Bracket Bolts	Threadlocker	12345382	10953489
Reverse Lamp Switch	Sealant	12346004	10953480
Shift Lever Guide Bolts	Sealant	12346004	10953480
Temperature Switch	Sealant	12346004	10953480
Transmission Case Drain Plug	Sealant	12346004	10953480
Transmission Case to Clutch Housing Mating Surface - Model Dependent	Sealant	12346141	89022195
Transmission Control Lever Knob Fastener	Threadlocker	12345382	10953489
Transmission Fluid	DEXRON®VI	88861037	19264717

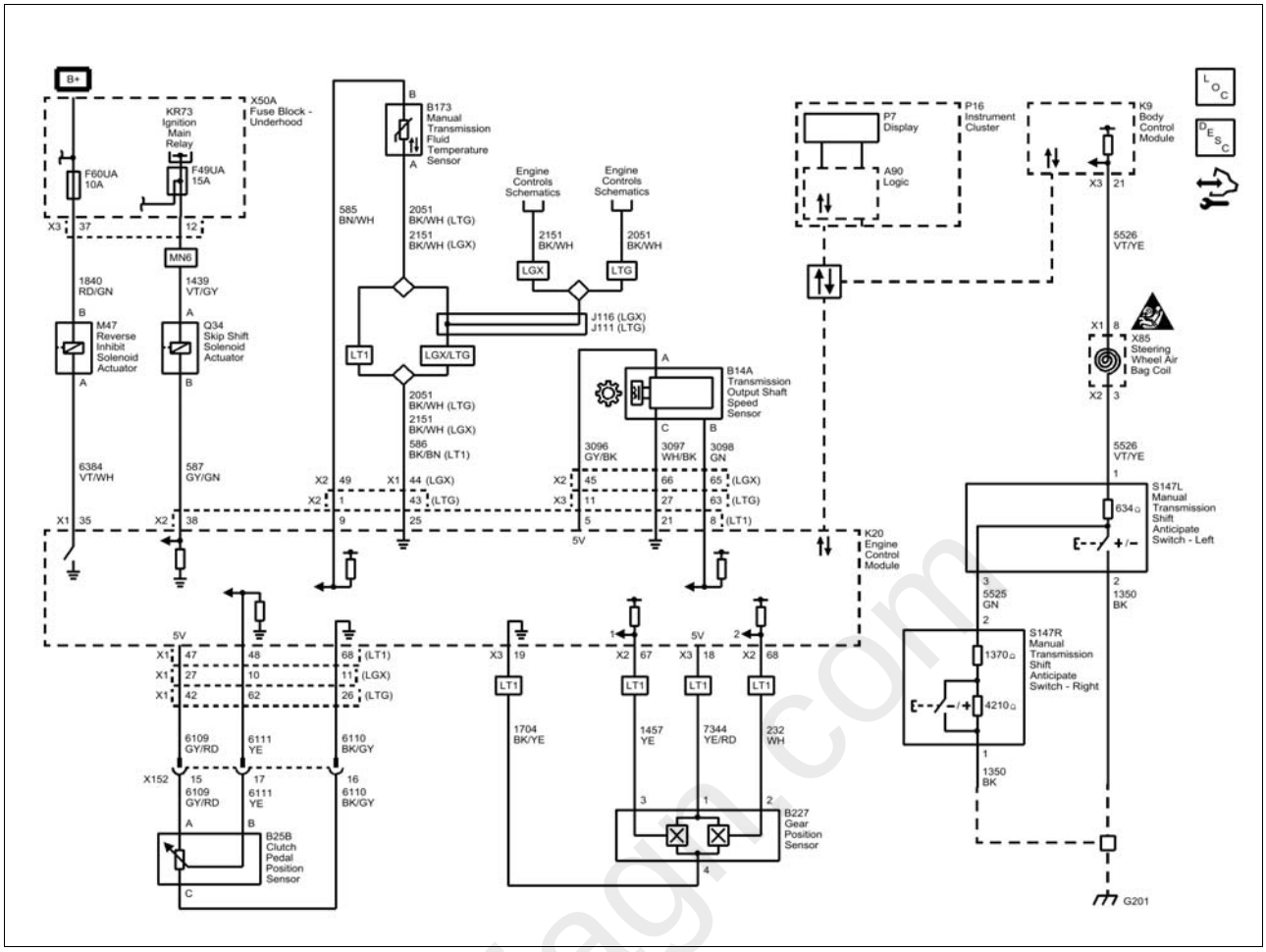
SPECIFICATIONS > SHIM SIZE SPECIFICATIONS

Application	Specification	
	Metric	English
Countershaft Shim Preload	0.0-0.05 mm	0.0-0.002 in
Input Shaft/Mainshaft Shim Preload	0.0-0.05 mm	0.0-0.002 in

SCHEMATIC WIRING DIAGRAMS > MANUAL TRANSMISSION WIRING SCHEMATICS > MANUAL TRANSMISSION

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Fig 1: Manual Transmission

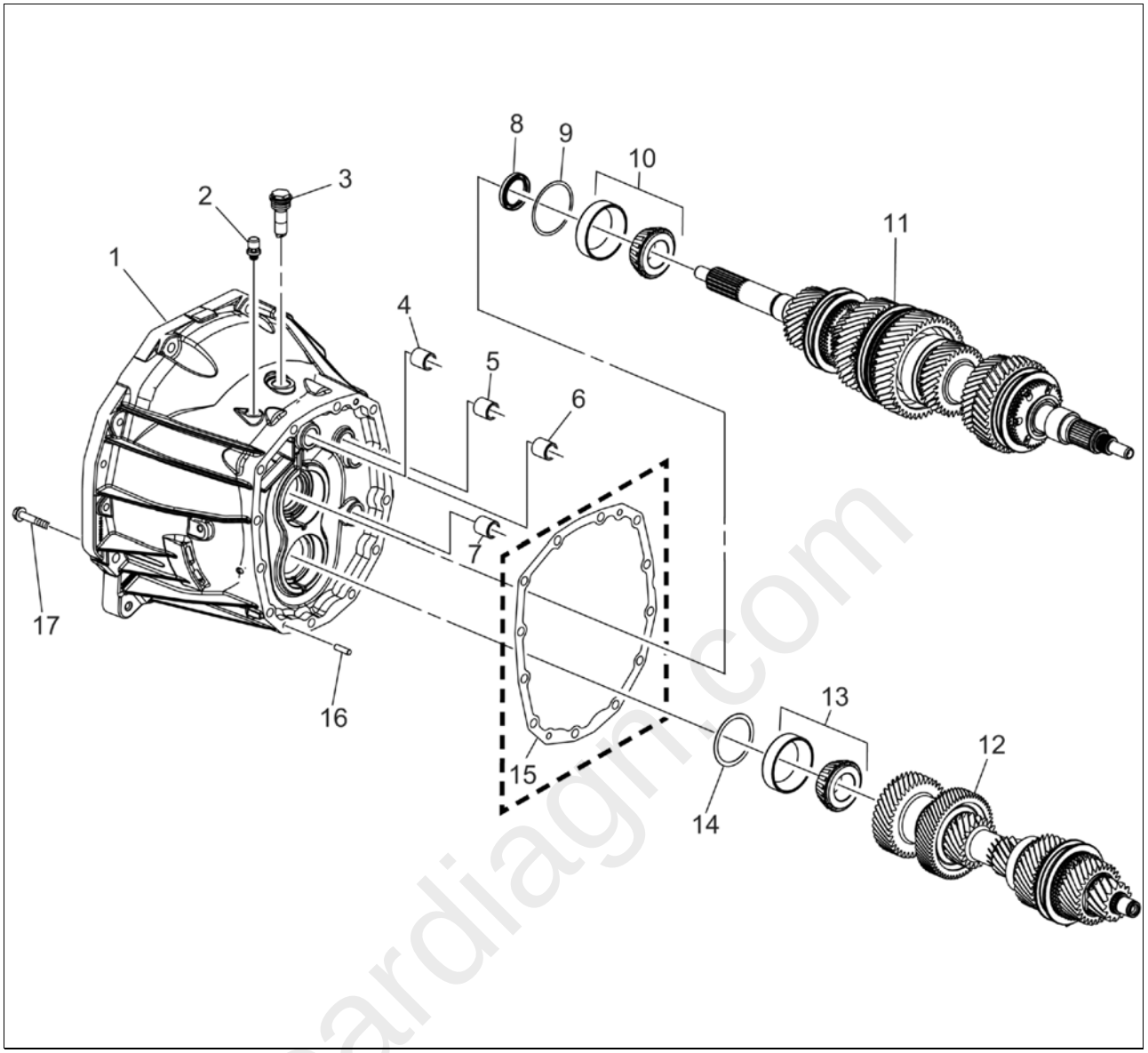


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VISUAL IDENTIFICATION > DISASSEMBLED VIEWS (M13) > CLUTCH HOUSING ASSEMBLY

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Fig 1: Clutch Housing Assembly Components



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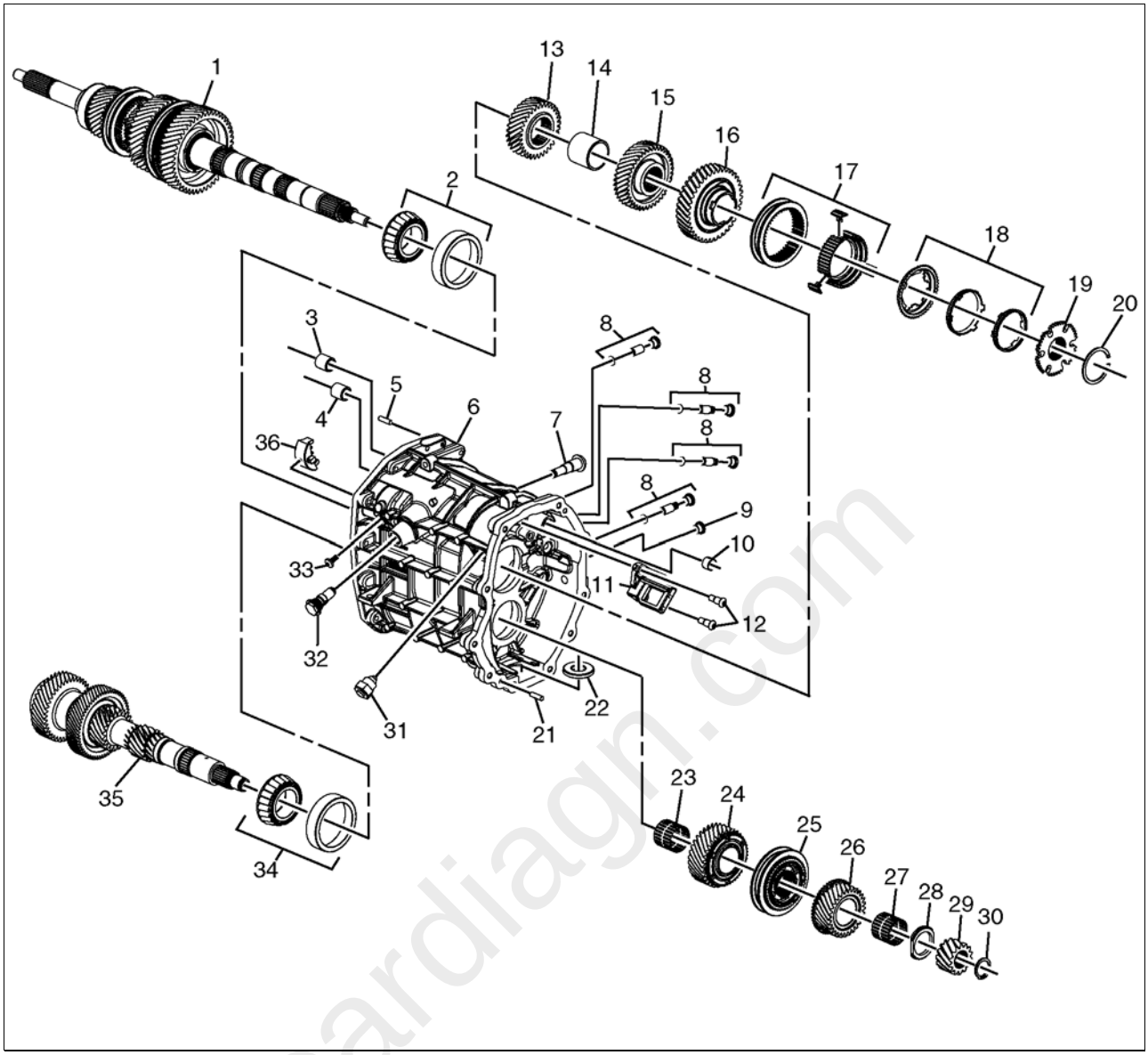
Callout	Component Name
1	Clutch Housing Assembly
2	Manual Transmission Vent Assembly
3	Shift Shaft Detent Plug
4	Shift Shaft Bearing Assembly
5	Shift Shaft Bearing Assembly
6	Shift Shaft Bearing Assembly
7	Shift Shaft Bearing Assembly
8	Input Shaft Seal

9	Input Shaft Bearing Shim
10	Input Shaft Bearing Assembly
11	Input Shaft and Main Shaft Assembly
12	Counter Gear Assembly
13	Counter Gear Front Bearing Assembly
14	Counter Gear Bearing Shim
15	Clutch Housing Gasket - Model Dependent
16	Transmission Intermediate Case Locating Pin
17	Clutch Housing Bolt

VISUAL IDENTIFICATION > DISASSEMBLED VIEWS (M13) > TRANSMISSION CASE ASSEMBLY

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Fig 1: Transmission Case Assembly Components



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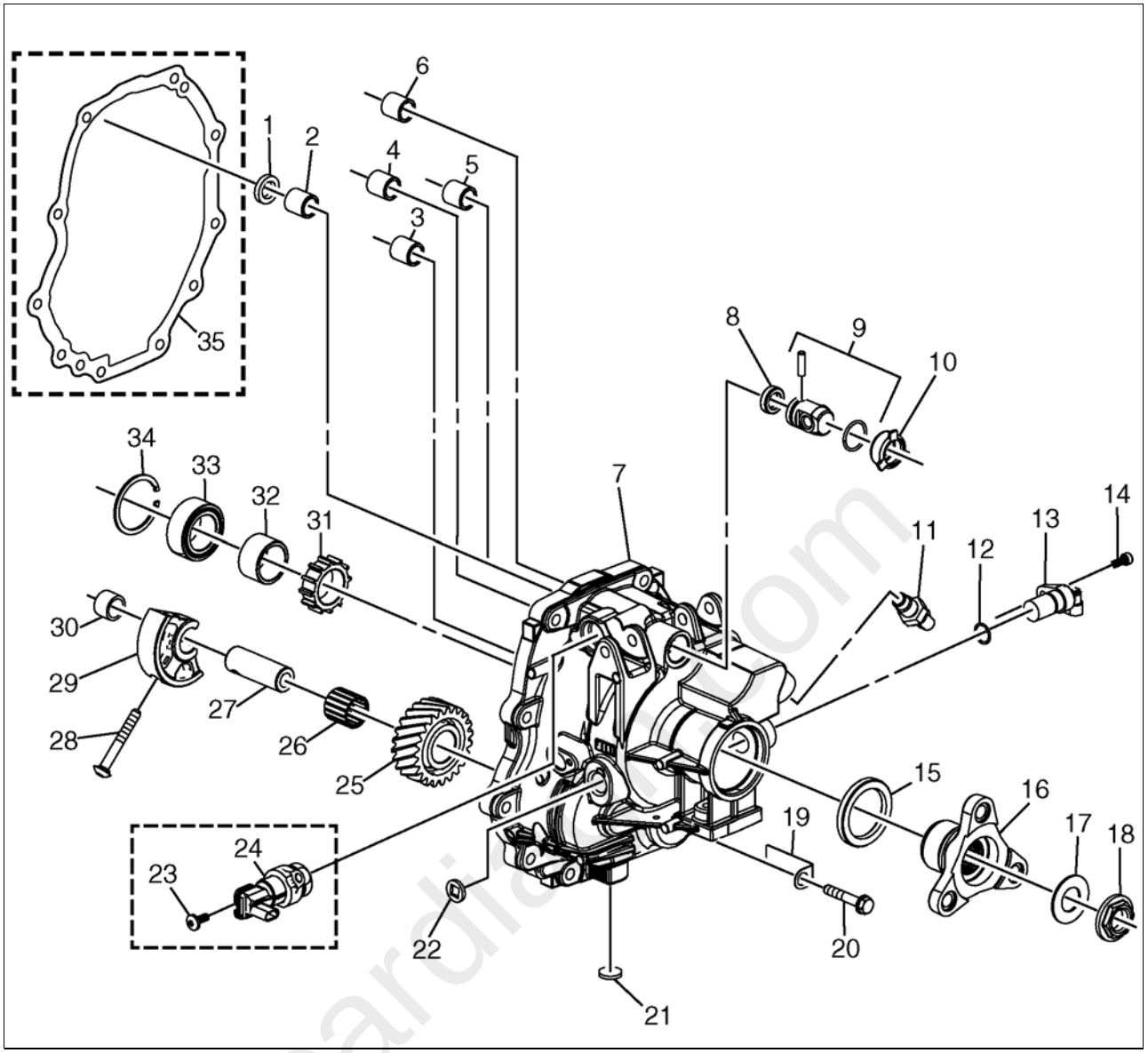
Callout	Component Name
1	Main Shaft Assembly
2	Main Shaft Bearing Assembly
3	Shift Shaft Bearing Assembly
4	Shift Shaft Bearing Assembly
5	Transmission Intermediate Case Locating Pin
6	Transmission Case Assembly
7	Manual Transmission Selector Lever Pivot Pin (5th Gear)
8	Shift Shaft Detent Assembly

9	Shift Shaft Plug
10	Manual Transmission Shift Lever Rod Bushing
11	Shift Bar Support (Interlock)
12	Shift Interlock Plate Retainer Bolt
13	4th Speed Gear (Driven)
14	3rd & 4th Gear Spacer
15	3rd Gear Assembly (Driven)
16	Reverse Gear Kit
17	Reverse Synchronizer Assembly
18	Reverse Blocking Ring Assembly
19	Reverse Gear
20	Reverse Gear Retainer
21	Transmission Intermediate Case Locating Pin
22	Transmission Magnet
23	4th Gear Bearing Assembly (Drive)
24	4th Gear Assembly (Drive)
25	3rd & 4th Synchronizer Assembly
26	3rd Gear Assembly (Drive)
27	3rd Gear Bearing Assembly (Drive)
28	3rd Gear Thrust Washer
29	Reverse Gear (Drive)
30	Counter Gear Rear Bearing Inner Race Retainer
31	Shift Interlock Detent Assembly
32	Manual Shift Detent Bolt
33	Shift Control Shaft Position Guide Bolt/Screw
34	Counter Gear Bearing Assembly
35	Counter Gear Assembly
36	Shift Control Shaft Position Guide

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VISUAL IDENTIFICATION > DISASSEMBLED VIEWS (M13) > TRANSMISSION EXTENSION ASSEMBLY

Fig 1: Transmission Extension Assembly Components



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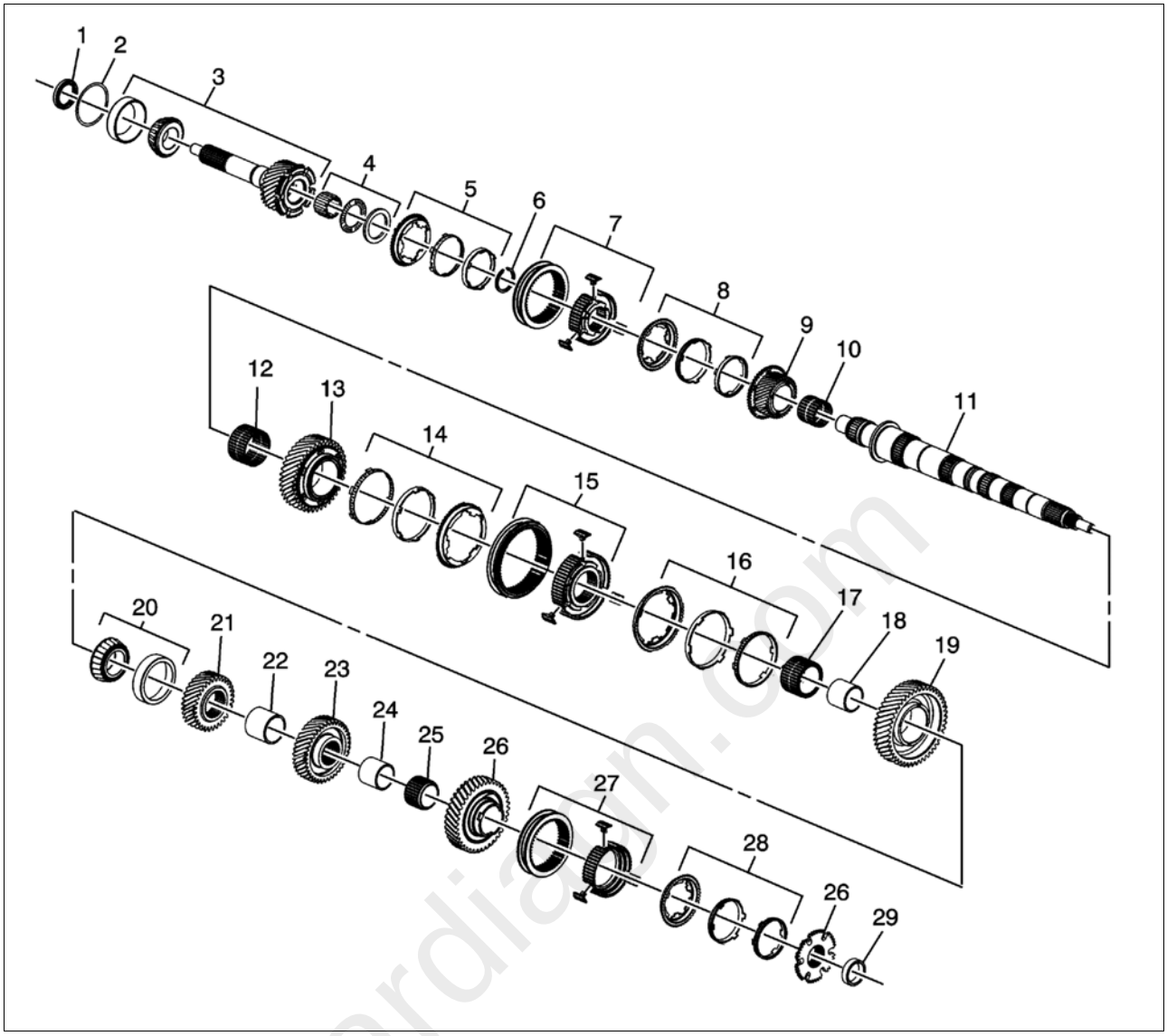
Callout	Component Name
1	Shift Control Spacer
2	Shift Shaft Bearing Assembly
3	Shift Shaft Bearing Assembly
4	Shift Shaft Bearing Assembly
5	Shift Shaft Bearing Assembly
6	Shift Shaft Bearing Assembly
7	Transmission Extension Assembly
8	Manual Transmission Control Lever Seal

9	Manual Transmission Shift Lever Shaft Joint Assembly
10	Manual Transmission Control Shaft Boot
11	Reverse Sensor
12	Vehicle Speed Sensor Seal (O-ring)
13	Manual Transmission Output Speed Sensor Assembly
14	Transmission Speed Sensor Bolt/Screw
15	Propeller Shaft Oil Seal
16	Propeller Shaft Transmission Yoke
17	Propeller Shaft Transmission Flange Washer
18	Propeller Shaft Transmission Yoke Nut
19	Transmission Identification Tag
20	Extension Housing Bolt/Screw
21	Transmission Oil Drain Plug
22	Transmission Oil Fill Plug
23	Neutral Position Sensor Bolt - model dependant
24	Neutral Position Sensor - model dependant
25	Reverse Idler Gear - not serviced - POA
26	Reverse Idler Gear Bearing Assembly - not serviced - POA
27	Reverse Idler Gear Shaft - not serviced - POA
28	Reverse Idler Gear Shaft Bolt - not serviced - POA
29	Reverse Idler Gear Shaft Support - not serviced - POA
30	Counter Gear Rear Bearing Inner Race
31	Vehicle Speed Sensor Reluctor Wheel
32	Spacer
33	Main Shaft Rear Bearing Assembly
34	Main Shaft Rear Bearing Retainer
35	Extension Housing Gasket - Model Dependent

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VISUAL IDENTIFICATION > DISASSEMBLED VIEWS (M13) > MAIN SHAFT ASSEMBLY

Fig 1: Main Shaft Assembly Components



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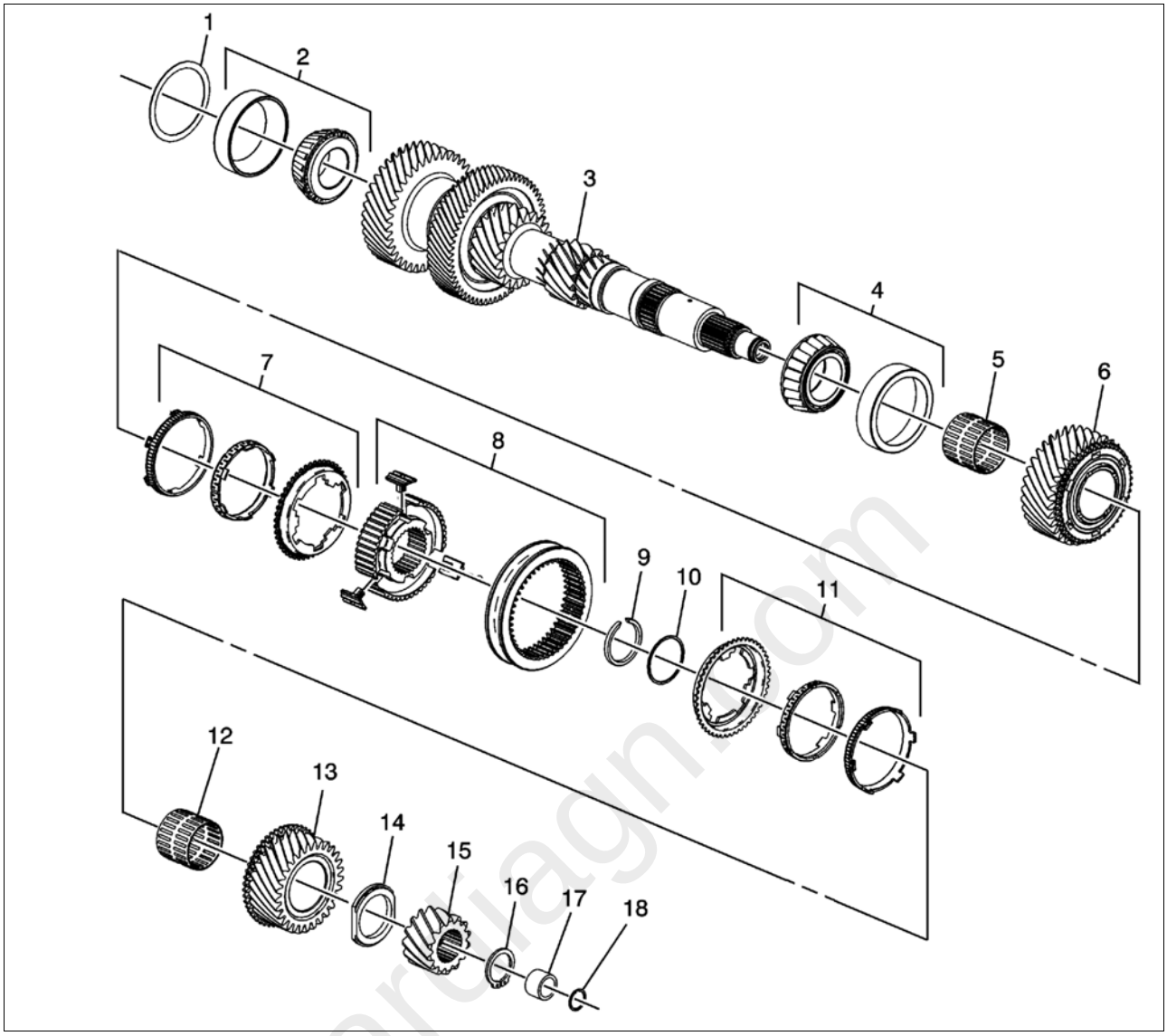
Callout	Component Name
1	Input Shaft Seal
2	Input Shaft Bearing Shim
3	Input Shaft Kit
4	Main Shaft Front Bearing Kit
5	5th Gear Blocking Ring Assembly
6	Main Shaft Retaining Ring
7	5th and 6th Gear Synchronizer Assembly
8	6th Gear Blocking Ring Assembly
9	6th Gear Assembly (Driven)

10	6th Gear Bearing Assembly (Driven)
11	Main Shaft
12	2nd Gear Bearing Assembly (Driven)
13	2nd Gear Assembly (Driven)
14	2nd Gear Blocking Ring Assembly
15	1st & 2nd Gear Synchronizer Assembly
16	1st Gear Blocking Ring Assembly
17	1st Gear Bearing Assembly (Driven)
18	1st Gear Bushing
19	1st Gear Assembly (Driven)
20	Main Shaft Rear Bearing Assembly
21	4th Gear Assembly (Driven)
22	3rd & 4th Gear Spacer
23	3rd Gear Assembly (Driven)
24	3rd Gear Bushing
25	3rd Gear Bearing Assembly (Driven)
26	Reverse Gear Kit
27	Reverse Gear Synchronizer Assembly
28	Reverse Gear Blocking Ring Assembly
29	Main Shaft Bearing Spacer (Rear)

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VISUAL IDENTIFICATION > DISASSEMBLED VIEWS (M13) > COUNTER GEAR ASSEMBLY

Fig 1: Counter Gear Assembly Components



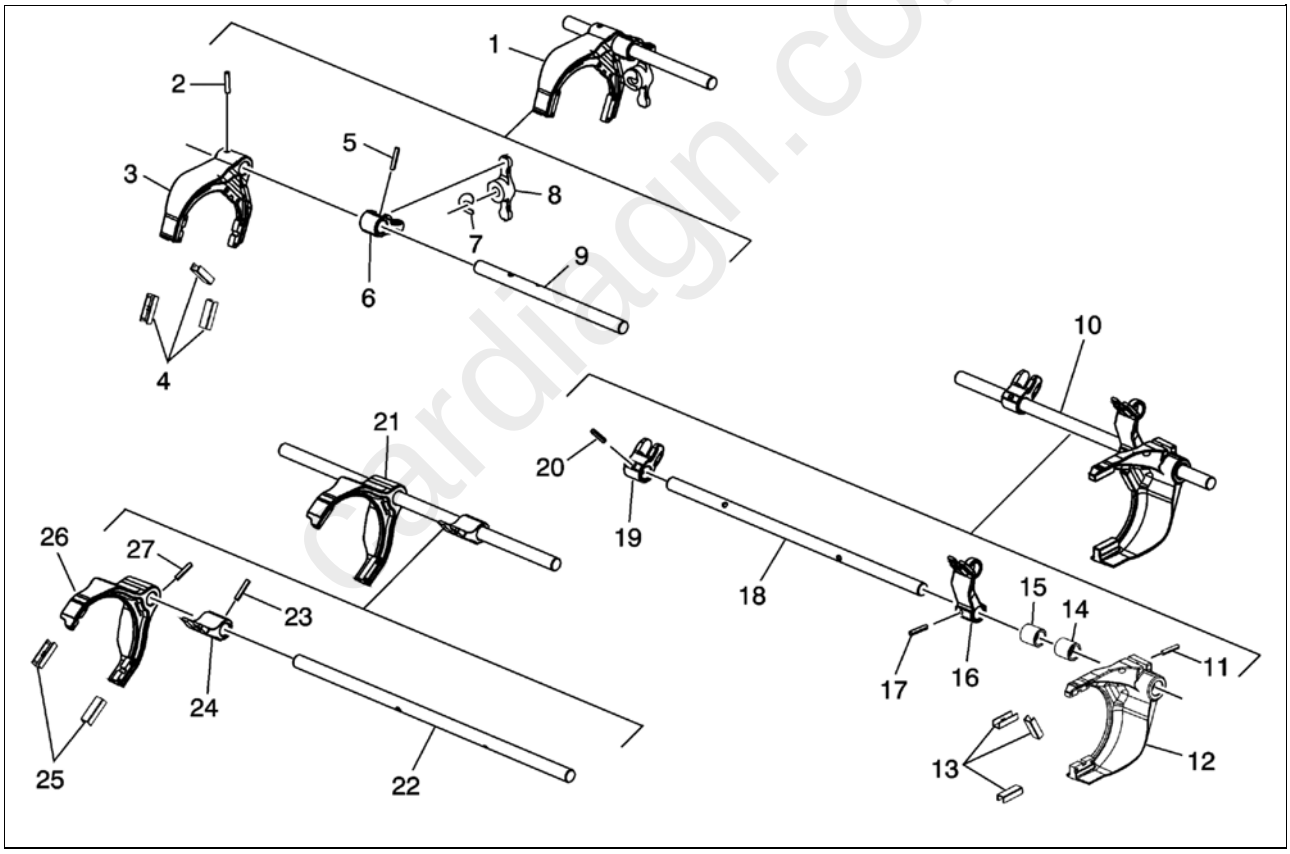
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Callout	Component Name
1	Counter Gear Bearing Shim
2	Counter Gear Front Bearing Assembly
3	Counter Gear Assembly
4	Counter Gear Bearing Assembly
5	4th Gear Bearing Assembly
6	4th Gear Drive Gear Assembly
7	4th Gear Blocking Ring Assembly
8	3rd & 4th Gear Synchronizer Assembly
9	Retaining Ring

10	3rd Gear Bearing Roller Spacer
11	3rd Gear Blocking Ring Assembly
12	3rd Gear Bearing Assembly (Drive)
13	3rd Gear Drive Gear Assembly
14	3rd Gear Thrust Washer
15	Reverse Gear Assembly (Drive)
16	Reverse Gear Assembly Retainer
17	Counter Gear Rear Bearing Inner Race
18	Counter Gear Rear Bearing Inner Race Retainer

VISUAL IDENTIFICATION > DISASSEMBLED VIEWS (M13) > SHIFT SHAFTS (1 OF 2)

Fig 1: Shift Shaft Components (1 of 2)



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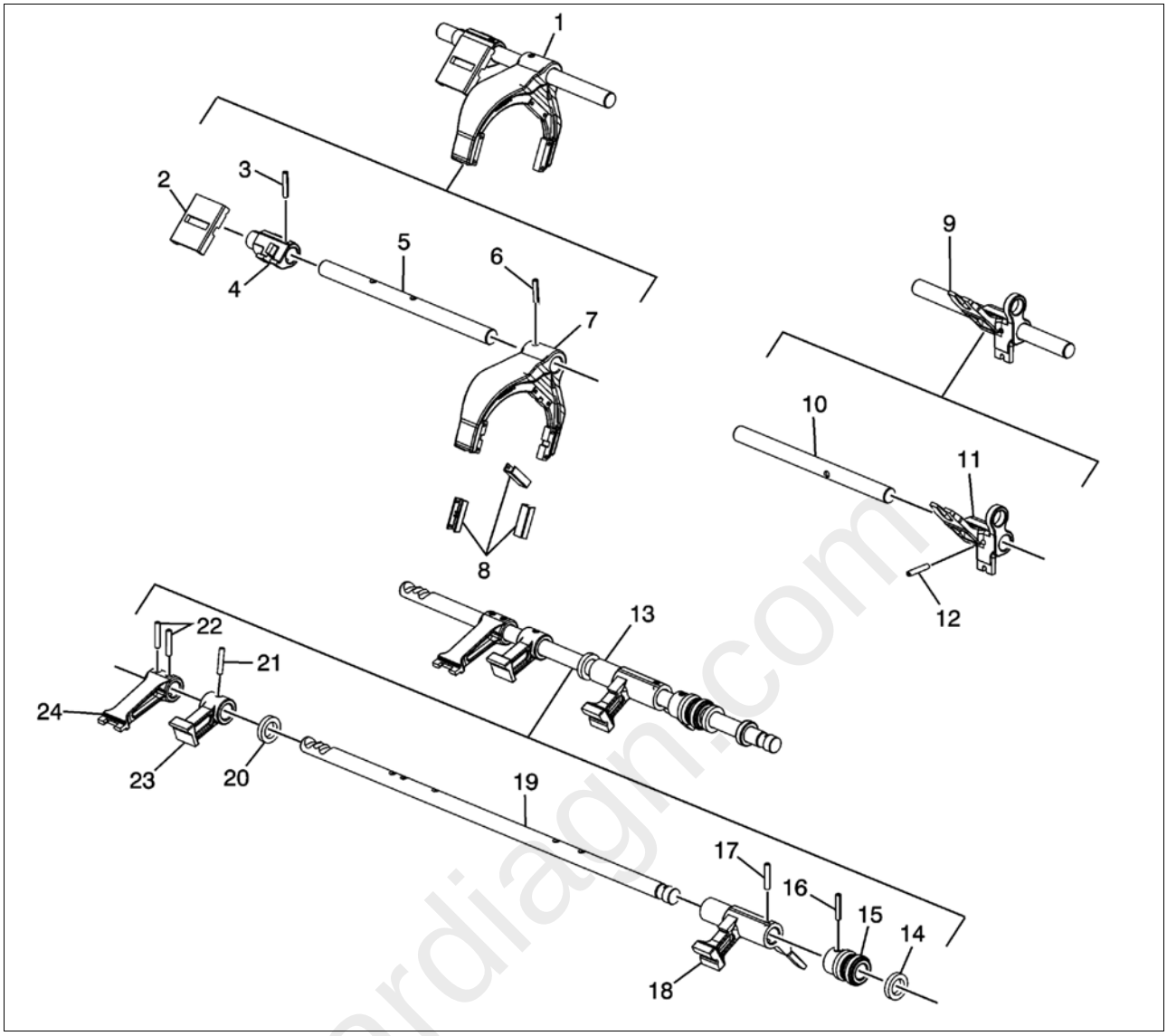
Callout	Component Name
1	5th & 6th Shift Fork and Shaft Assembly
2	Coiled Spring Pin

3	3rd & 4th Shift Fork Assembly
4	3rd & 4th Shift Fork Insert
5	Coiled Spring Pin
6	Manual Transmission Control Lever (Inverter)
7	Manual Transmission Shift Lever Retainer (Inverter)
8	Manual Transmission Selector Lever Pivot Pin (5th Gear)
9	5th & 6th Shift Shaft (Long)
10	3rd & 4th Shift Fork and Shaft Assembly
11	Coiled Spring Pin
12	3rd & 4th Shift Fork Assembly
13	3rd & 4th Shift Fork Insert
14	Shift Rail Bushing
15	Shift Rail Bushing
16	Manual Transmission Shift Lever (5th & 6th)
17	Coiled Spring Pin
18	5th & 6th Shift Shaft (Short)
19	Manual Transmission Control Lever (Inverter)
20	Coiled Spring Pin
21	1st & 2nd Shift Fork and Shaft Assembly
22	1st & 2nd Shift Shaft Assembly
23	Coiled Spring Pin
24	Manual Transmission 1st & 2nd Selector Lever
25	1st & 2nd Shift Fork Inserts
26	1st & 2nd Shift Fork Assembly
27	Coiled Spring Pin

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VISUAL IDENTIFICATION > DISASSEMBLED VIEWS (M13) > SHIFT SHAFTS (2 OF 2)

Fig 1: Shift Shaft Components (2 of 2)



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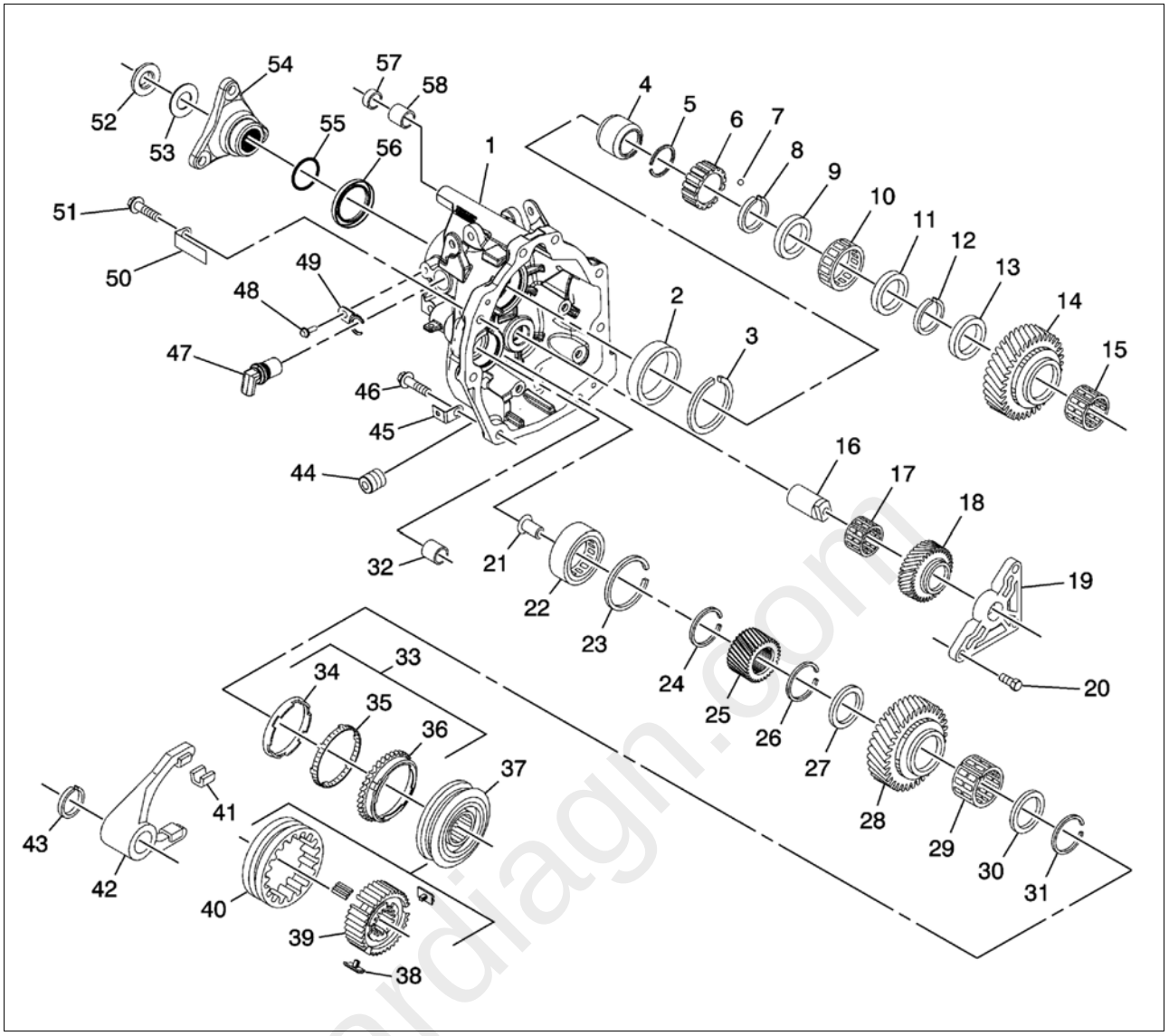
Callout	Component Name
1	Reverse Shift Fork and Shaft Assembly
2	Manual Transmission Shift Lever Bracket (Interlock)
3	Coiled Spring Pin
4	Manual Transmission Reverse Selector Lever
5	Reverse Shift Shaft Assembly
6	Coiled Spring Pin
7	5th & 6th Shift Fork Assembly (Includes Reverse)
8	5th & 6th Shift Fork Insert
9	3rd & 4th Rail Assembly

10	3rd & 4th Shift Shaft Assembly
11	Manual Transmission 3rd & 4th Selector Lever
12	Coiled Spring Pin
13	Main Control Shift Rail Assembly
14	Shift Control Spacer
15	Neutral Cam
16	Coiled Spring Pin
17	Coiled Spring Pin
18	Selector Finger & Cam
19	Main Shaft Assembly
20	Shift Control Spacer
21	Coiled Spring Pin
22	Coiled Spring Pin
23	Reverse Cam
24	Selector Finger Guide Plate

VISUAL IDENTIFICATION > DISASSEMBLED VIEWS (MM6) > TRANSMISSION EXTENSION ASSEMBLY

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Fig 1: Transmission Extension Assembly Components



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Callout	Component Name
1	Transmission Extension Assembly
2	Mainshaft Bearing Race
3	Mainshaft Rear Bearing Race Retainer Ring
4	Extension Housing Mainshaft Bearing Race
5	Vehicle Speed Sensor Reluctor Wheel Retaining Ring
6	Vehicle Speed Sensor Reluctor Wheel
7	Vehicle Speed Sensor Reluctor Wheel Locking Ball
8	Mainshaft Rear Bearing Retainer Ring
9	Mainshaft Rear Bearing Spacer

10	Mainshaft Rear Bearing
11	Mainshaft Rear Bearing Spacer
12	Synchronizer Retainer Ring
13	Reverse Gear Thrust Washer
14	Mainshaft Reverse Speed Gear
15	Reverse Gear Bearing
16	Reverse Idler Gear Shaft
17	Reverse Idler Gear Needle Bearing
18	Reverse Idler Gear
19	Reverse Idler Bracket
20	Reverse Idler Bracket Bolt
21	Transmission Lubrication Funnel
22	Counter Gear Rear Bearing Assembly
23	Counter Gear Rear Bearing Retaining Ring
24	Reverse Counter Drive Gear Retaining Ring
25	Reverse Counter Drive Gear
26	5th Gear Retaining Ring
27	5th Gear Bearing Assembly Spacer
28	5th Speed Drive Gear
29	5th Gear Bearing Assembly
30	5th Gear Spacer
31	5th and 6th Gear Synchronizer Hub Retaining Ring
32	Reverse Rail Bushing
33	5th Gear Blocking Ring Assembly
34	5th Speed Gear Inner Cone
35	5th Speed Gear Friction Cone
36	5th Gear Synchronizer Blocking Ring
37	5th/6th Synchronizer Assembly
38	5th/6th and Reverse Synchronizer Insert
39	5th/6th Synchronizer Hub
40	5th/6th Synchronizer Sleeve
41	Shift Fork Pad
42	5th/6th Shift Fork

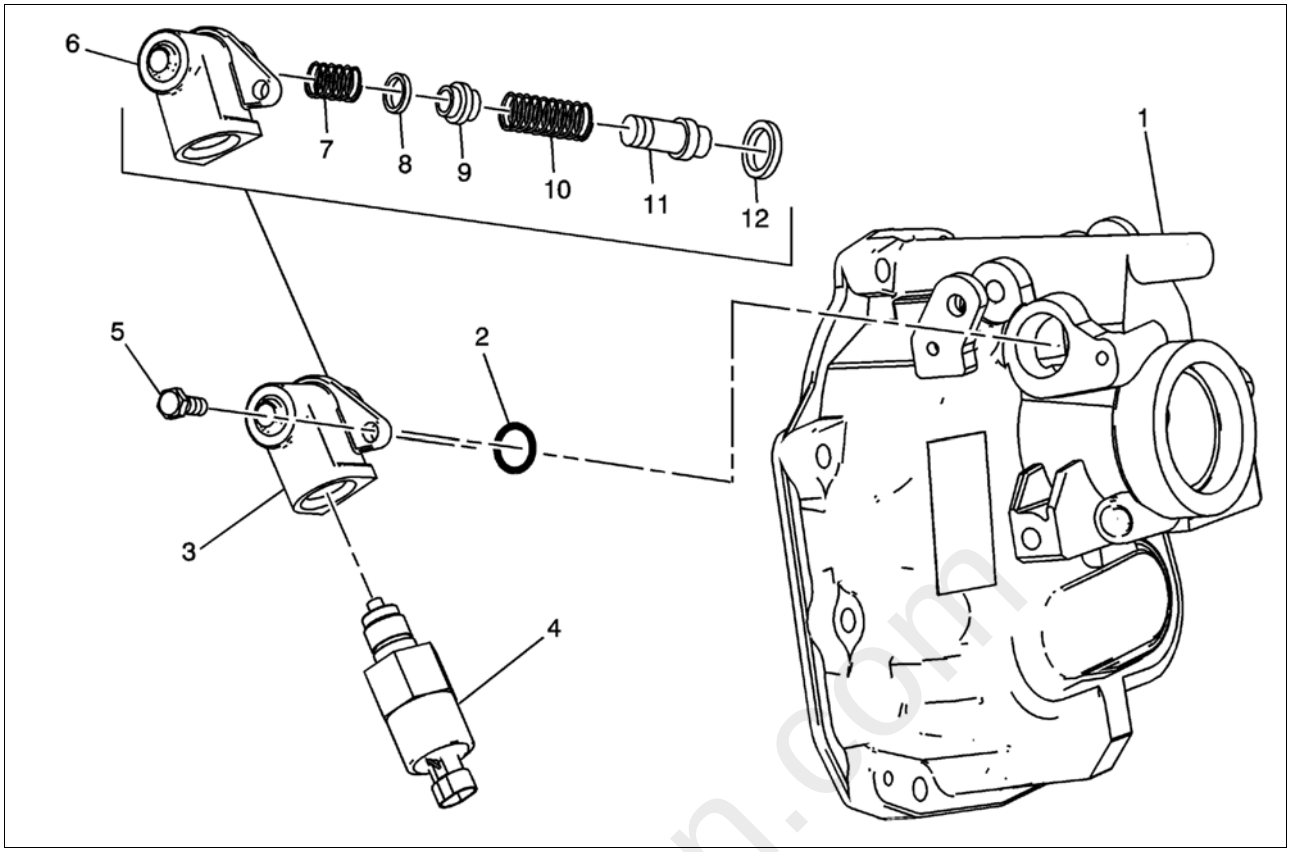
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43	5th Gear Shift Fork Retaining Ring
44	Transmission Oil Drain Plug
45	Retaining Bracket
46	Transmission Extension Assembly Bolt
47	Vehicle Speed Sensor
48	Vehicle Speed Sensor Bolt
49	Vehicle Speed Sensor Retainer
50	Retaining Bracket
51	Transmission Extension Assembly Bolt
52	Propshaft Transmission Yoke Nut
53	Propshaft Transmission Yoke Washer
54	Propshaft Transmission Yoke
55	Propshaft O-ring
56	Output Shaft Seal
57	Shift Rail Seal
58	Shift Rail Bearing

VISUAL IDENTIFICATION > DISASSEMBLED VIEWS (MM6) > REVERSE LOCKOUT

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Fig 1: Reverse Lockout Component Location (CTSV)



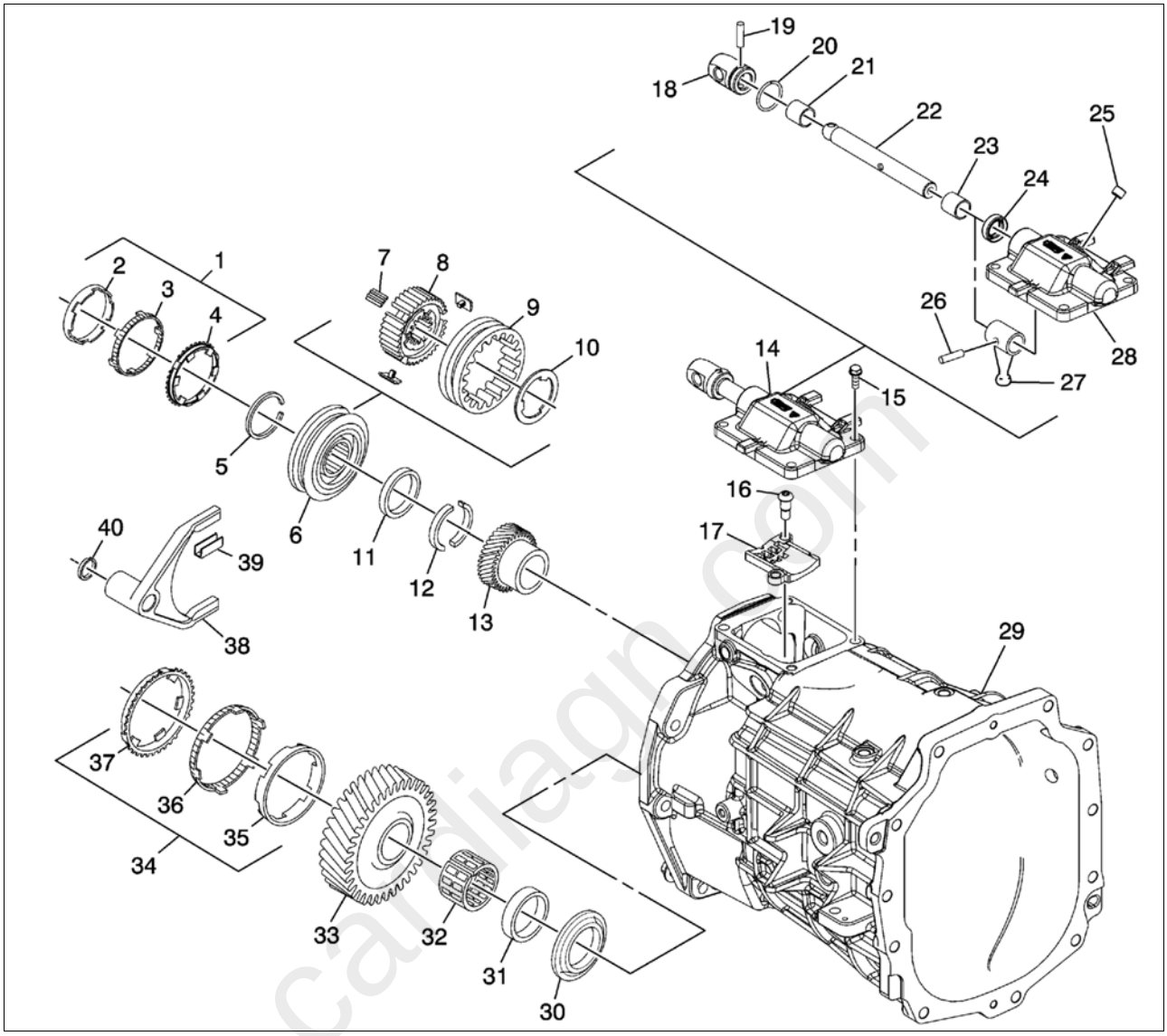
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Callout	Component Name
1	Extension Housing
2	O-ring
3	Reverse Lockout Assembly
4	Reverse Lockout Solenoid
5	Reverse Lockout Solenoid Mounting Bolt
6	Reverse Lockout Body
7	Reverse Lockout Inner Spring
8	Snap Ring
9	Reverse Lockout Collar
10	Reverse Lockout Outer Spring
11	Reverse Lockout Plunger
12	Snap Ring

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VISUAL IDENTIFICATION > DISASSEMBLED VIEWS (MM6) > TRANSMISSION CASE (1 OF 2)

Fig 1: Transmission Case Components (1 of 2)



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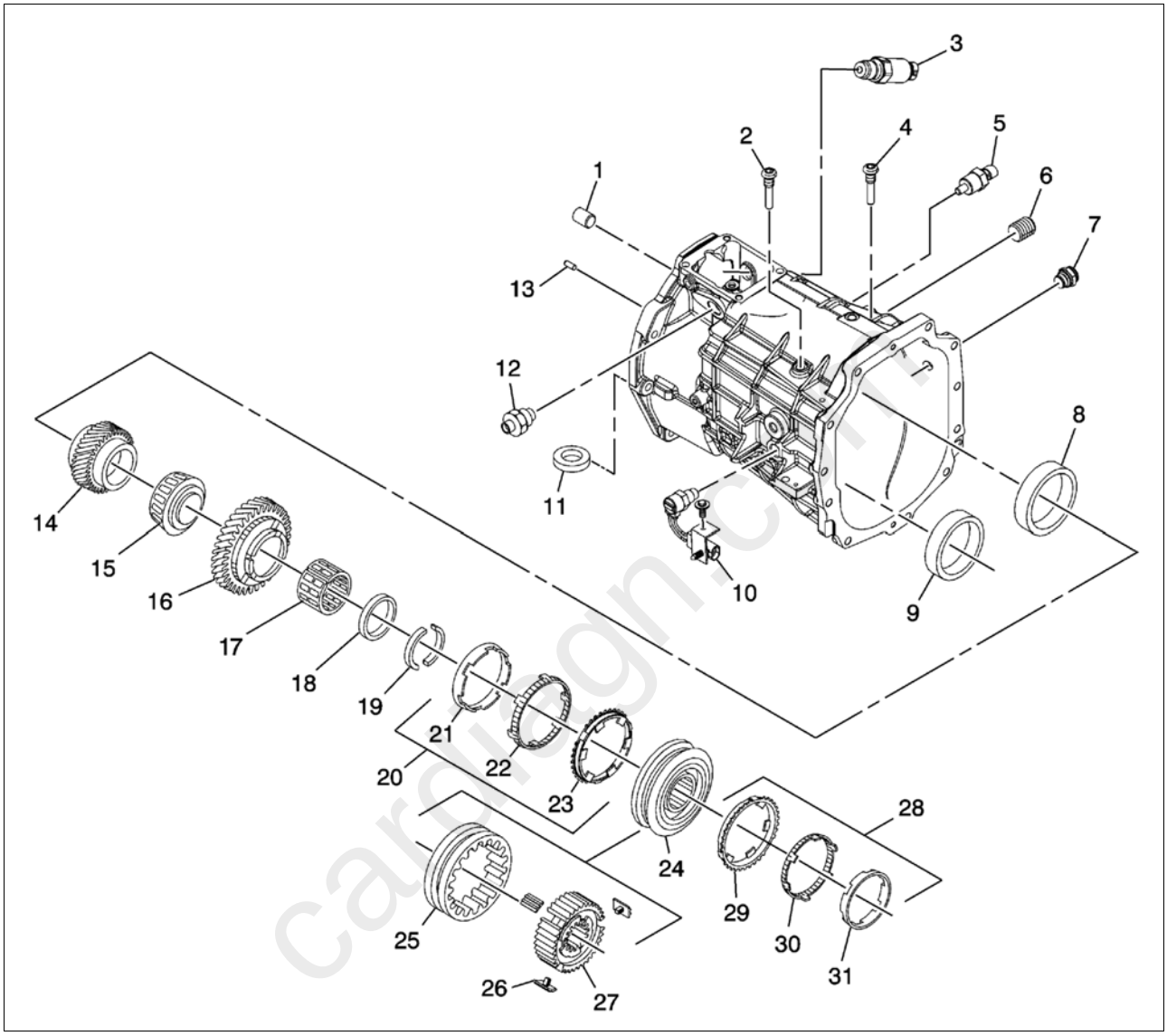
Callout	Component Name
1	Reverse Gear Blocking Ring Assembly
2	Reverse Gear Inner Cone
3	Reverse Gear Outer Cone
4	Reverse Gear Blocker Ring
5	Reverse Synchronizer Retaining Ring
6	Reverse Synchronizer Assembly
7	Reverse Synchronizer Insert

8	Reverse Synchronizer Hub
9	Reverse Synchronizer Sleeve
10	Reverse Synchronizer Key Retainer
11	Reverse Gear Thrust Washer Locking Ring
12	Reverse Synchronizer Two Piece Washer
13	5th Speed Driven Gear
14	Shift Control Shaft Cover Assembly
15	Shift Control Shaft Cover Bolt
16	Guide Plate Bolt
17	Guide Plate
18	Shift Lever Rod Universal Joint Assembly
19	Shift Lever Pin
20	Select Lever Swivel Rod Retainer
21	Shift Control Shaft Bushing
22	Shift Control Lever Shaft
23	Shift Control Shaft Bushing
24	Shift Control Seal
25	Shift Control Shaft Cover Bolt
26	Shift Control Lever Shaft Pin
27	Shift Control Lever
28	Shift Control Shaft Cover
29	Transmission Case
30	Spacer
31	6th Speed Drive Gear Bearing Spacer
32	6th Speed Drive Gear Needle Bearing
33	6th Speed Drive Gear
34	6th Gear Blocking Ring Assembly
35	6th Speed Drive Gear Inner Cone
36	6th Speed Drive Gear Outer Cone
37	6th Speed Drive Gear Synchronizer Blocking Ring
38	Reverse Shift Fork
39	Reverse Shift Fork Pad
40	Reverse Shift Fork Retainer Ring

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Fig 1: Transmission Case (2 of 2)



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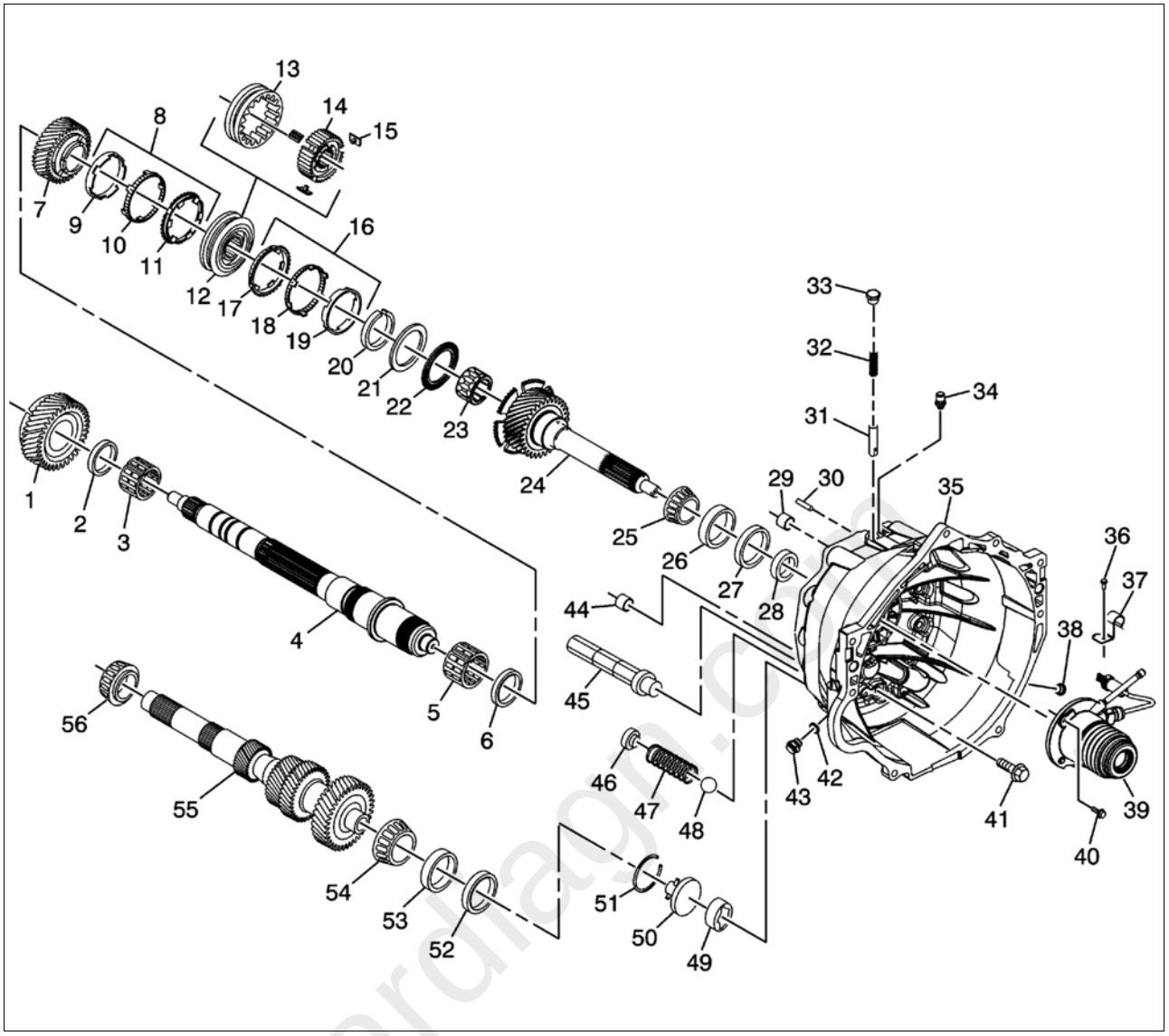
Callout	Component Name
1	1st/2nd and 3rd/4th Shift Shaft Bearing
2	5th/6th Lever Guide Bolt
3	Skip Shift Solenoid
4	Interlock Guide Bolt
5	Coolant Temperature Sensor

6	Oil Fill Plug
7	Cooler Line Return Fitting
8	Mainshaft Center Bearing Race
9	Countershaft Bearing Race
10	Backup Lamp Switch Assembly
11	Magnet
12	Shift Detent Assembly
13	Case Rear Extension Pin
14	6th Speed Driven Gear
15	Mainshaft Center Bearing
16	1st Speed Drive Gear
17	1st Speed Drive Gear Needle Bearing
18	1st Speed Drive Gear Locking Ring
19	1st Speed Gear Two Piece Washer
20	1st Gear Blocking Ring Assembly
21	1st Speed Drive Gear Inner Cone
22	1st Speed Drive Gear Outer Cone
23	1st Gear Synchronizer Blocking Ring
24	1st/2nd Synchronizer Assembly
25	1st/2nd Synchronizer Sleeve
26	1st/2nd Synchronizer Insert
27	1st/2nd Synchronizer Hub
28	2nd Gear Blocking Ring Assembly
29	2nd Gear Synchronizer Blocking Ring
30	2nd Speed Drive Gear Outer Cone
31	2nd Speed Drive Gear Inner Cone

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VISUAL IDENTIFICATION > DISASSEMBLED VIEWS (MM6) > CLUTCH HOUSING ASSEMBLY AND GEARS

Fig 1: Clutch Housing Assembly and Gears



Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	2nd Speed Drive Gear
2	2nd Speed Drive Gear Bearing Spacer
3	2nd Speed Drive Gear Needle Bearing
4	Mainshaft
5	3rd Speed Drive Gear Bearing
6	3rd Speed Drive Gear Spacer
7	3rd Speed Drive Gear
8	3rd Gear Blocking Ring Assembly
9	3rd Speed Drive Gear Inner Cone

10	3rd Speed Drive Gear Friction Cone
11	3rd Speed Drive Gear Synchronizer Blocking Ring
12	3rd/4th Synchronizer Assembly
13	3rd/4th Synchronizer Sleeve
14	3rd/4th Synchronizer Hub
15	3rd/4th Synchronizer Insert
16	4th Gear Blocking Ring Assembly
17	4th Speed Drive Gear Blocking Ring
18	4th Speed Drive Gear Outer Cone
19	4th Speed Drive Gear Inner Cone
20	3rd/4th Synchronizer Retaining Ring
21	Input Shaft Thrust Washer
22	Input Shaft Thrust Bearing
23	Input Shaft Bearing
24	Input Shaft
25	Input Shaft Bearing
26	Input Shaft Bearing Race
27	Input Shaft Bearing Shim
28	Input Shaft Seal
29	1st/2nd Shift Shaft Bearing
30	Transmission Case Locating Pin
31	Shift Shaft Detent Roller
32	Shift Shaft Detent Spring
33	Shift Shaft Detent Plug
34	Vent Assembly
35	Clutch Housing Assembly
36	Retainer Bolt
37	Retainer
38	Transmission Fluid Pump Outlet Pipe Fitting
39	Slave Cylinder
40	Slave Cylinder Bolt
41	Clutch Housing Assembly to Transmission Case Bolt
42	Pump Outlet Cooler Fitting O-ring

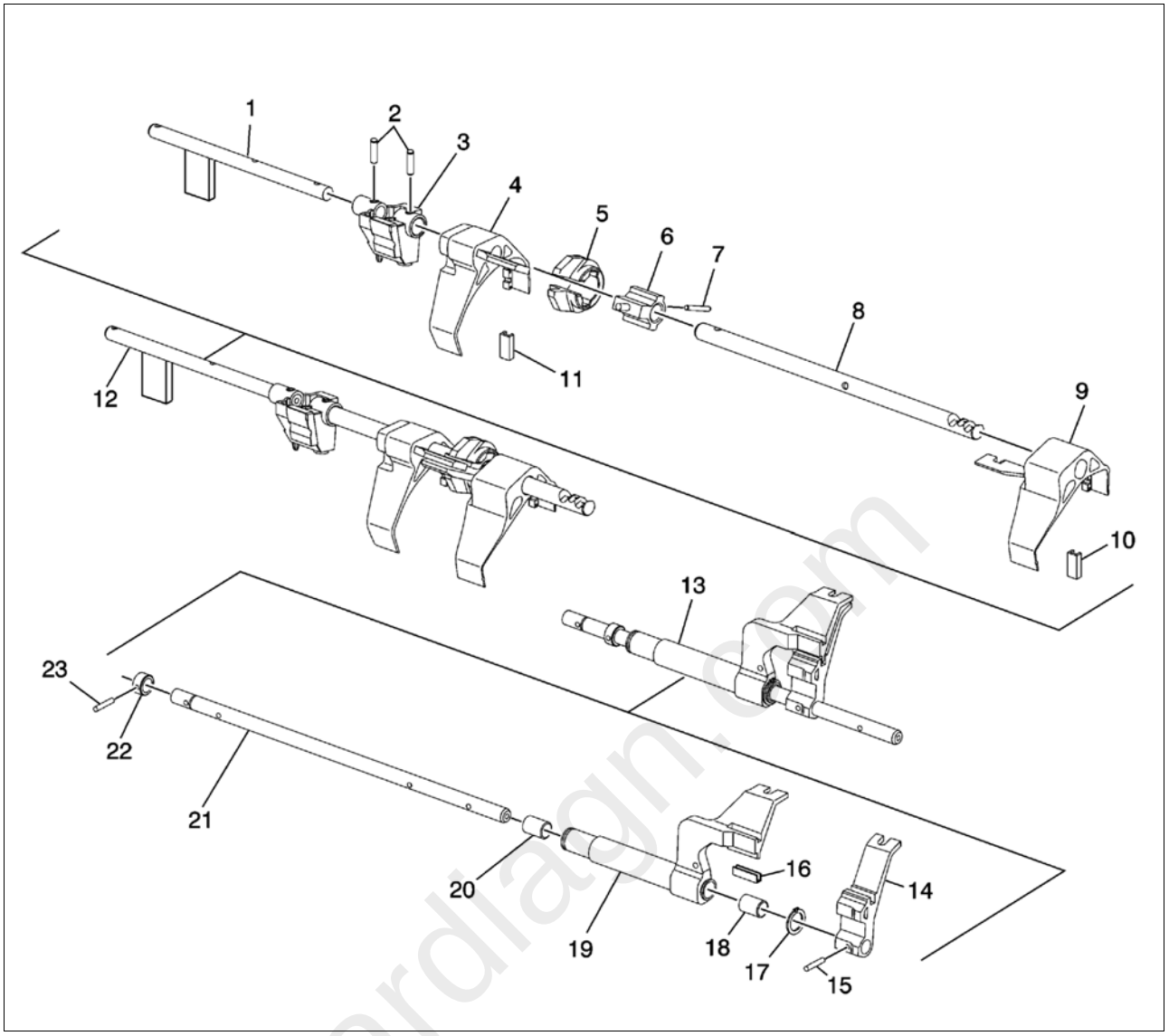
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43	Pump Outlet Cooler Fitting
44	3rd/4th Shift Shaft Bushing
45	Oil Filter Assembly
46	Transmission Fluid Pump Spring Retaining Plug
47	Transmission Fluid Pump Spring
48	Transmission Fluid Pump Check Ball
49	Oil Pump
50	Oil Pump Cover
51	Oil Pump Cover Retainer Ring
52	Countershaft Bearing Adjust Shim
53	Countershaft Bearing Race
54	Countershaft Front Bearing
55	Counter Gear Shaft
56	Countershaft Rear Bearing

VISUAL IDENTIFICATION > DISASSEMBLED VIEWS (MM6) > SHIFT SHAFTS

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Fig 1: Shift Shafts



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Callout	Component Name
1	Offset Shift Lever Shaft
2	Control Select Arm Pin
3	Control Select Arm
4	1st/2nd Shift Fork Assembly
5	Gear Select Interlock Plate
6	Select Control Lever Assembly
7	Select Control Lever Assembly Pin
8	1st/2nd/3rd/4th Shift Shaft
9	3rd/4th Shift Fork Assembly

10	3rd/4th Shift Fork Insert
11	1st/2nd Shift Fork Insert
12	1st/2nd/3rd/4th Shift Rail Assembly
13	5th, 6th, and Reverse Shift Rail Assembly
14	Reverse Shift Lever
15	Reverse Shift Lever Pin
16	5th and Reverse Shift Fork Insert
17	5th/6th Shift Lever Retaining Ring
18	Shift Shaft Bushing
19	5th/6th Shift Lever Assembly
20	Shift Shaft Bushing
21	5th, 6th, and Reverse Shift Shaft
22	Transmission Reverse Shift Lever Collar
23	Reverse Shift Collar Pin

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LGX, LT1): VEHICLE SPEED SENSOR CIRCUIT > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LGX, LT1): VEHICLE SPEED SENSOR CIRCUIT > DTC DESCRIPTORS

DTC P0502

Vehicle Speed Sensor Circuit Low Voltage

DTC P0503

Vehicle Speed Sensor Circuit Intermittent

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LGX, LT1): VEHICLE SPEED SENSOR CIRCUIT > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0502, P0503, P0651	P0502, P0503	P0502, P0503, P0651	P0502, P0503
Signal	P0502, P0503	P0502, P0503	P0502, P0503	P0502, P0503
Low Reference	-	P0502, P0503	-	-

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LGX, LT1): VEHICLE SPEED SENSOR CIRCUIT > CIRCUIT/SYSTEM DESCRIPTION

The output speed sensor (OSS) is a 3 wire sensor. The engine control module (ECM) provides a 5 volt reference circuit, low reference circuit and a signal circuit to the OSS. The OSS is a Hall Effect type sensor that produces a square wave output signal to the ECM. As vehicle speed increases, the output frequency of the OSS signal increases. The ECM converts the square wave output signal into km/h (mph). The ECM supplies the VSS signal to other control modules on the vehicle through the serial data communications circuit.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LGX, LT1): VEHICLE SPEED SENSOR CIRCUIT > CONDITIONS FOR RUNNING THE DTC

P0502

- DTC P0503 is not set.
- TP sensor angle is greater than 8%.
- Engine is running.
- Ignition voltage is between 9-32 V.
- Engine speed is between 1, 500-6, 500 RPM.
- Engine torque is greater than 54 N.m (40 lb ft).

P0503

- Ignition voltage is between 9-32 V.
- Engine speed is between 200-7, 500 RPM for 5 s.
- Transmission output shaft speed change is less than 124 RPM for 5 s.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LGX, LT1): VEHICLE SPEED SENSOR CIRCUIT > CONDITIONS FOR SETTING THE DTC

P0502

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Transmission output shaft speed is 60 RPM or less for 4.5 s.

P0503

Transmission output shaft speed drops 350 RPM in less than 3 s.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LGX, LT1): VEHICLE SPEED SENSOR CIRCUIT > ACTION TAKEN WHEN THE DTC SETS

P0502 and P0503 are Type A DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LGX, LT1): VEHICLE SPEED SENSOR CIRCUIT > CONDITIONS FOR CLEARING THE DTC

P0502 and P0503 are Type A DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LGX, LT1): VEHICLE SPEED SENSOR CIRCUIT > DIAGNOSTIC AIDS

- Remove and inspect the B14A Output Speed Sensor for metal debris on the output shaft facing end of the sensor.
- Inspect the transmission output shaft target wheel teeth for damage or looseness.
- Visually inspect the B14A Output Speed Sensor for cracks or damage.
- Ensure the B14A Output Speed Sensor is not loose and is properly torqued to the transmission.
- When a speed sensor fault is present, the scan tool Output Shaft Speed Sensor parameter may show a defaulted processed speed, based on another source such as Antilock Brake System (ABS) wheel speed. Use of this parameter is not recommended for fault diagnosis.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LGX, LT1): VEHICLE SPEED SENSOR CIRCUIT > REFERENCE INFORMATION

Schematic Reference

Manual Transmission Schematics

Connector End View Reference

- COMPONENT CONNECTOR END VIEWS - INDEX
- INLINE HARNESS CONNECTOR END VIEWS - INDEX

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Manual Transmission Description and Operation (M13) Manual Transmission Description and Operation (MM6)

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- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **J-35616** GM-Approved Terminal Test Kit
- **J-38522** Vehicle Signal Generator

For equivalent regional tools, refer to Special Tools (MM6) Special Tools (M13) .

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LGX, LT1): VEHICLE SPEED SENSOR CIRCUIT > CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON.
2. Verify DTC P0651 is not set
    1. **If DTC P0651 is set**

        Refer to Diagnostic Trouble Code (DTC) List - Vehicle .

    1. **If DTC P0651 is not set**

> ⚠ *CAUTION:*
>
> *Support the lower control arms in the normal horizontal position in order to avoid damage to the drive axles. Do not operate the vehicle in gear with the wheels hanging down at full travel.*

3. Raise and support the drive wheels in a horizontal position.
4. Start and idle the engine.
5. Place the transmission in second gear and release the clutch pedal.

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6. Verify the scan tool Vehicle Speed Sensor parameter increases as the drive wheel speed increases.
    1. **If the Vehicle Speed Sensor does not increase**

       Refer to Circuit/System Testing.

    1. **If the Vehicle Speed Sensor increases**
7. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
8. Verify the DTC does not set.
    1. **If the DTC sets**

       Refer to Circuit/System Testing.

    1. **If the DTC does not set**
9. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LGX, LT1): VEHICLE SPEED SENSOR CIRCUIT > CIRCUIT/SYSTEM TESTING

1. Ignition OFF, and all vehicle systems OFF, disconnect the harness connector at the B14A Output Speed Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal C and ground.
    1. **If 10 Ω or greater**
        1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for less than 2 Ω in the low reference circuit, end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K20 Engine Control Module.
    1. **If less than 10 Ω**
3. Ignition ON.
4. Test for 4.8-5.2 V between the 5 V reference circuit terminal A and ground.
    1. **If less than 4.8 V**
        1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the 5 V reference circuit and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.

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1. If infinite resistance.

3. Test for less than 2 Ω in the 5 V reference circuit, end to end.

    1. If 2 Ω or greater, repair the open/high resistance in the circuit.

    2. If less than 2 Ω, replace the K20 Engine Control Module.

1. **If greater than 5.2 V**

    1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module. Ignition ON.

    2. Test for less than 1 V between the 5 V reference circuit and ground.

        1. If 1 V or greater, repair the short to voltage on the circuit.

        2. If less than 1 V, replace the K20 Engine Control Module.

1. **If between 4.8-5.2 V**

5. Ignition OFF, connect the test leads of the **J 38522** Vehicle Signal Generator as follows.

    1. Red test lead to the signal circuit terminal B at the B14A Output Speed Sensor harness connector.

    2. Black test lead to ground at the transmission case.

    3. Signal generator double black power cord to B+ and ground.

6. Set and adjust the **J 38522** Vehicle Signal Generator to the following switch positions.

    1. Signal switch to 5 V

    2. Frequency switch to 600 Hz

    3. Duty cycle switch to 50% or normal position

7. Ignition ON.

8. Verify the scan tool vehicle speed sensor parameter displays between 100-113 km/h (62-70 mph).

    1. **If not between 100-113 km/h (62-70 mph)**

        1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module, Ignition ON.

        2. Test for less than 1 V between the signal circuit terminal B and ground.

            1. If 1 V or greater, repair the short to voltage on the circuit.

            1. If less than 1 V

        3. Ignition OFF.

        4. Test for infinite resistance between the signal circuit terminal B and ground.

            1. If less than infinite resistance, repair the short to ground on the circuit.

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1. If infinite resistance

5. Test for less than 2 Ω in the signal circuit end to end.

    1. If 2 Ω or greater, repair the open/high resistance in the circuit.

    2. If less than 2 Ω, replace the K20 Engine Control Module.

1. **If between 100-113 km/h (62-70 mph)**

9. Replace the B14A Output Speed Sensor.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LGX, LT1): VEHICLE SPEED SENSOR CIRCUIT > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Vehicle Speed Sensor Replacement (M13) Vehicle Speed Sensor Replacement (MM6)
- Control Module References for ECM replacement, programming and setup

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LTG): VEHICLE SPEED SENSOR CIRCUIT > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LTG): VEHICLE SPEED SENSOR CIRCUIT > DTC DESCRIPTORS

DTC P0502

Vehicle Speed Sensor Circuit Low Voltage

DTC P0503

Vehicle Speed Sensor Circuit Intermittent

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LTG): VEHICLE SPEED SENSOR CIRCUIT > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance

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5 V Reference	P0502, P0503, P0651	P0502, P0503	P0502, P0503, P0651	P0502, P0503
Signal	P0502, P0503	P0502, P0503	P0502, P0503	P0502, P0503
Low Reference	-	P0502, P0503	-	-

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LTG): VEHICLE SPEED SENSOR CIRCUIT > CIRCUIT/SYSTEM DESCRIPTION

The output speed sensor (OSS) is a 3 wire sensor. The engine control module (ECM) provides a 5 volt reference circuit, low reference circuit and a signal circuit to the OSS. The OSS is a Hall Effect type sensor that produces a square wave output signal to the ECM. As vehicle speed increases, the output frequency of the OSS signal increases. The ECM converts the square wave output signal into km/h (mph). The ECM supplies the VSS signal to other control modules on the vehicle through the serial data communications circuit.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LTG): VEHICLE SPEED SENSOR CIRCUIT > CONDITIONS FOR RUNNING THE DTC

P0502

- DTC P0503 is not set.
- TP sensor angle is greater than 8%.
- Engine is running.
- Ignition voltage is between 9-32 V.
- Engine speed is between 1, 500-6, 500 RPM.
- Engine torque is greater than 54 N.m (40 lb ft).

P0503

- Ignition voltage is between 9-32 V.
- Engine speed is between 200-7, 500 RPM for 5 s.
- Transmission output shaft speed change is less than 124 RPM for 5 s.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LTG): VEHICLE SPEED SENSOR CIRCUIT > CONDITIONS FOR SETTING THE DTC

P0502

Transmission output shaft speed is 60 RPM or less for 4.5 s.

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P0503

Transmission output shaft speed drops 350 RPM in less than 3 s.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LTG): VEHICLE SPEED SENSOR CIRCUIT > ACTION TAKEN WHEN THE DTC SETS

P0502 and P0503 are Type A DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LTG): VEHICLE SPEED SENSOR CIRCUIT > CONDITIONS FOR CLEARING THE DTC

P0502 and P0503 are Type A DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LTG): VEHICLE SPEED SENSOR CIRCUIT > DIAGNOSTIC AIDS

- Remove and inspect the B14A Output Speed Sensor for metal debris on the output shaft facing end of the sensor.
- Inspect the transmission output shaft target wheel teeth for damage or looseness.
- Visually inspect the B14A Output Speed Sensor for cracks or damage.
- Ensure the B14A Output Speed Sensor is not loose and is properly torqued to the transmission.
- When a speed sensor fault is present, the scan tool Output Shaft Speed Sensor parameter may show a defaulted processed speed, based on another source such as Antilock Brake System (ABS) wheel speed. Use of this parameter is not recommended for fault diagnosis.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LTG): VEHICLE SPEED SENSOR CIRCUIT > REFERENCE INFORMATION

Schematic Reference

Manual Transmission Schematics

Connector End View Reference

- COMPONENT CONNECTOR END VIEWS - INDEX
- INLINE HARNESS CONNECTOR END VIEWS - INDEX

Description and Operation

Manual Transmission Description and Operation (M13) Manual Transmission Description and Operation

(MM6)

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **J-35616** GM-Approved Terminal Test Kit
- **J-38522** Vehicle Signal Generator

For equivalent regional tools, refer to Special Tools (MM6) Special Tools (M13) .

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LTG): VEHICLE SPEED SENSOR CIRCUIT > CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON.
2. Verify DTC P0651 is not set
    1. **If DTC P0651 is set**

       Refer to Diagnostic Trouble Code (DTC) List - Vehicle .

    1. **If DTC P0651 is not set**

> ⚠ *CAUTION:*
>
> *Support the lower control arms in the normal horizontal position in order to avoid damage to the drive axles. Do not operate the vehicle in gear with the wheels hanging down at full travel.*

3. Raise and support the drive wheels in a horizontal position.
4. Start and idle the engine.
5. Place the transmission in second gear and release the clutch pedal.

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6. Verify the scan tool Vehicle Speed Sensor parameter increases as the drive wheel speed increases.
    1. **If the Vehicle Speed Sensor does not increase**

       Refer to Circuit/System Testing.

    1. **If the Vehicle Speed Sensor increases**
7. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observe from the Freeze Frame/Failure Records data.
8. Verify the DTC does not set.
    1. **If the DTC sets**

       Refer to Circuit/System Testing.

    1. **If the DTC does not set**
9. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LTG): VEHICLE SPEED SENSOR CIRCUIT > CIRCUIT/SYSTEM TESTING

1. Ignition OFF, and all vehicle systems OFF, disconnect the harness connector at the B14A Output Speed Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal C and ground.
    1. **If 10 Ω or greater**
        1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
        2. Test for less than 2 Ω in the low reference circuit, end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K20 Engine Control Module.
    1. **If less than 10 Ω**
3. Ignition ON.
4. Test for 4.8-5.2 V between the 5 V reference circuit terminal A and ground.
    1. **If less than 4.8 V**
        1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the 5 V reference circuit and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.

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        1. If infinite resistance.

    3. Test for less than 2 Ω in the 5 V reference circuit, end to end.

        1. If 2 Ω or greater, repair the open/high resistance in the circuit.

        2. If less than 2 Ω, replace the K20 Engine Control Module.

1. **If greater than 5.2 V**

    1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module. Ignition ON.

    2. Test for less than 1 V between the 5 V reference circuit and ground.

        1. If 1 V or greater, repair the short to voltage on the circuit.

        2. If less than 1 V, replace the K20 Engine Control Module.

1. **If between 4.8-5.2 V**

5. Ignition OFF, connect the test leads of the **J 38522** Vehicle Signal Generator as follows.

    1. Red test lead to the signal circuit terminal B at the B14A Output Speed Sensor harness connector.

    2. Black test lead to ground at the transmission case.

    3. Signal generator double black power cord to B+ and ground.

6. Set and adjust the **J 38522** Vehicle Signal Generator to the following switch positions.

    1. Signal switch to 5 V

    2. Frequency switch to 600 Hz

    3. Duty cycle switch to 50% or normal position

7. Ignition ON.

8. Verify the scan tool vehicle speed sensor parameter displays between 100-113 km/h (62-70 mph).

    1. **If not between 100-113 km/h (62-70 mph)**

        1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module, Ignition ON.

        2. Test for less than 1 V between the signal circuit terminal B and ground.

            1. If 1 V or greater, repair the short to voltage on the circuit.

            1. If less than 1 V

        3. Ignition OFF.

        4. Test for infinite resistance between the signal circuit terminal B and ground.

            1. If less than infinite resistance, repair the short to ground on the circuit.

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1. If infinite resistance

5. Test for less than 2 Ω in the signal circuit end to end.

    1. If 2 Ω or greater, repair the open/high resistance in the circuit.

    2. If less than 2 Ω, replace the K20 Engine Control Module.

1. **If between 100-113 km/h (62-70 mph)**

9. Replace the B14A Output Speed Sensor.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0502 OR P0503 (LTG): VEHICLE SPEED SENSOR CIRCUIT > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Vehicle Speed Sensor Replacement (M13) Vehicle Speed Sensor Replacement (MM6)
- Control Module References for ECM replacement, programming and setup

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713: TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713: TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > DTC DESCRIPTORS

DTC P0712

Transmission Fluid Temperature Sensor Circuit Low Voltage

DTC P0713

Transmission Fluid Temperature Sensor Circuit High Voltage

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713: TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > DIAGNOSTIC

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FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Transmission Fluid Temperature Sensor Signal	P0712	P0713	P0713[1]	-
Low Reference	-	P0713	P0713[1]	-
[1] Internal ECM damage may occur if the circuit is shorted to B+.				

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713: TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > CIRCUIT/SYSTEM DESCRIPTION

The transmission fluid temperature sensor is a variable resistor that measures the temperature of the transmission fluid. The engine control module (ECM) supplies 5 volts to the transmission fluid temperature sensor signal circuit and supplies a ground to the low reference circuit.

The following table illustrates the difference between temperature, resistance, and voltage:

Transmission Fluid Temperature Sensor	Transmission Fluid Temperature Sensor Resistance	Transmission Fluid Temperature Sensor Signal Voltage
Cold	High	High
Warm	Low	Low

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713: TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > CONDITIONS FOR RUNNING THE DTC

P0712

- The engine speed is above 1, 000 RPM for 7 seconds.
- This DTC runs continuously when the above condition is met.

P0713

- The engine speed is above 1, 000 RPM for 7 seconds.
- Vehicle speed is greater than 30 KPH (18 MPH) for 200 s.
- This DTC runs continuously when the above conditions are met.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713:

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TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > CONDITIONS FOR SETTING THE DTC

P0712

The transmission fluid temperature is greater than 170°C (338°F) for more than 12 seconds.

P0713

The transmission fluid temperature is less than -40°C (-40°F) for more than 80 seconds.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713: TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > ACTION TAKEN WHEN THE DTC SETS

DTC P0712 and P0713 are Type B DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713: TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > CONDITIONS FOR CLEARING THE MIL/DTC

DTC P0712 and P0713 are Type B DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713: TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > REFERENCE INFORMATION

Schematic Reference

Manual Transmission Schematics

Connector End View Reference

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Description and Operation

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- Circuit Testing
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- Testing for Intermittent Conditions and Poor Connections

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- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713: TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > CIRCUIT/SYSTEM VERIFICATION

1. Engine running.
2. Operate the vehicle within the conditions for running the DTC to verify DTC P0712 or P0713 does not set. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
    1. **If the DTC sets**

       Refer to Circuit/System Testing.

    1. **If the DTC does not set**
3. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713: TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > CIRCUIT/SYSTEM TESTING

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector of the B13 Transmission Fluid Temperature Sensor. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal A and ground.
    1. **If 10 Ω or greater**
        1. Disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for less than 2 Ω in the low reference circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K20 Engine Control Module.
    1. **If less than 10 Ω**
3. Ignition ON.

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4. Verify the scan tool Transmission Fluid Temperature Sensor parameter is at -40°C (-40°F).
    1. **If greater than -40°C (-40°F)**
        1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the signal circuit terminal B and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance, replace the K20 Engine Control Module.
    1. **If at -40°C (-40°F)**

> *NOTE:*
>
> *If the signal circuit of the B13 Transmission Fluid Temperature Sensor is shorted to voltage the sensor may be damaged.*

5. Install a 3-amp fused jumper wire between the signal circuit terminal B and the low reference circuit terminal A.
6. Verify the scan tool Transmission Fluid Temperature Sensor parameter is greater than 169°C (337°F).
    1. **If 169°C (337°F) or less**
        1. Ignition OFF, remove the jumper wire, disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for less than 1 V between the signal circuit terminal B and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            1. If less than 1 V
        3. Test for less than 2 Ω in the signal circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K20 Engine Control Module.
    1. **If greater than 169°C (337°F)**
7. Replace the B13 Transmission Fluid Temperature Sensor.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713: TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

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- Transmission Fluid Temperature Sensor Replacement
- Control Module References for ECM replacement, setup and programming.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713 (LGX): TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713 (LGX): TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > DTC DESCRIPTORS

DTC P0712

Transmission Fluid Temperature Sensor Circuit Low Voltage

DTC P0713

Transmission Fluid Temperature Sensor Circuit High Voltage

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713 (LGX): TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Transmission Fluid Temperature Sensor Signal	P0712	P0713	P0713[1]	-
Low Reference	-	P0713	P0713[1]	-
[1] Internal ECM damage may occur if the circuit is shorted to B+.				

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713 (LGX): TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > CIRCUIT/SYSTEM DESCRIPTION

The transmission fluid temperature sensor is a variable resistor that measures the temperature of the

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transmission fluid. The engine control module (ECM) supplies 5 volts to the transmission fluid temperature sensor signal circuit and supplies a ground to the low reference circuit.

The following table illustrates the difference between temperature, resistance, and voltage:

Transmission Fluid Temperature Sensor	Transmission Fluid Temperature Sensor Resistance	Transmission Fluid Temperature Sensor Signal Voltage
Cold	High	High
Warm	Low	Low

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713 (LGX): TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > CONDITIONS FOR RUNNING THE DTC

P0712

- The engine speed is above 1, 000 RPM for 7 seconds.
- This DTC runs continuously when the above condition is met.

P0713

- The engine speed is above 1, 000 RPM for 7 seconds.
- Vehicle speed is greater than 30 KPH (18 MPH) for 200 s.
- This DTC runs continuously when the above conditions are met.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713 (LGX): TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > CONDITIONS FOR SETTING THE DTC

P0712

The transmission fluid temperature is greater than 170°C (338°F) for more than 12 seconds.

P0713

The transmission fluid temperature is less than -40°C (-40°F) for more than 80 seconds.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713 (LGX): TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > ACTION TAKEN WHEN THE DTC SETS

DTC P0712 and P0713 are Type B DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713 (LGX): TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > CONDITIONS FOR CLEARING THE MIL/DTC

DTC P0712 and P0713 are Type B DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713 (LGX): TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > REFERENCE INFORMATION

Schematic Reference

Manual Transmission Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Manual Transmission Description and Operation (M13) Manual Transmission Description and Operation (MM6)

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713 (LGX): TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > CIRCUIT/SYSTEM VERIFICATION

1. Engine running.
2. Operate the vehicle within the conditions for running the DTC to verify DTC P0712 or P0713

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does not set. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

1. **If the DTC sets**

   Refer to Circuit/System Testing.

1. **If the DTC does not set**

3. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713 (LGX): TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > CIRCUIT/SYSTEM TESTING

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector of the B13 Transmission Fluid Temperature Sensor. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal A and ground.
   1. **If 10 Ω or greater**
      1. Disconnect the X1 harness connector at the K20 Engine Control Module.
      2. Test for less than 2 Ω in the low reference circuit end to end.
         1. If 2 Ω or greater, repair the open/high resistance in the circuit.
         2. If less than 2 Ω, replace the K20 Engine Control Module.
   1. **If less than 10 Ω**
3. Ignition ON.
4. Verify the scan tool Transmission Fluid Temperature Sensor parameter is at -40°C (-40°F).
   1. **If greater than -40°C (-40°F)**
      1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
      2. Test for infinite resistance between the signal circuit terminal B and ground.
         1. If less than infinite resistance, repair the short to ground on the circuit.
         1. If infinite resistance, replace the K20 Engine Control Module.
   1. **If at -40°C (-40°F)**

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> *NOTE:*
>
> *If the signal circuit of the B13 Transmission Fluid Temperature Sensor is shorted to voltage the sensor may be damaged.*

5. Install a 3-amp fused jumper wire between the signal circuit terminal B and the low reference circuit terminal A.
6. Verify the scan tool Transmission Fluid Temperature Sensor parameter is greater than 169°C (337°F).
    1. **If 169°C (337°F) or less**
        1. Ignition OFF, remove the jumper wire, disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for less than 1 V between the signal circuit terminal B and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            1. If less than 1 V
        3. Test for less than 2 Ω in the signal circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K20 Engine Control Module.
    1. **If greater than 169°C (337°F)**
7. Replace the B13 Transmission Fluid Temperature Sensor.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0712 OR P0713 (LGX): TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT VOLTAGE > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Transmission Fluid Temperature Sensor Replacement
- Control Module References for ECM replacement, setup and programming.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0729 OR P0731-P0735: GEAR RATIO INCORRECT > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.

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- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0729 OR P0731-P0735: GEAR RATIO INCORRECT > DTC DESCRIPTORS

DTC P0729

6th Gear Ratio Incorrect

DTC P0731

1st Gear Ratio Incorrect

DTC P0732

2nd Gear Ratio Incorrect

DTC P0733

3rd Gear Ratio Incorrect

DTC P0734

4th Gear Ratio Incorrect

DTC P0735

5th Gear Ratio Incorrect

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0729 OR P0731-P0735: GEAR RATIO INCORRECT > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0651, P18C5, P18C7	P18C5, P18C7	P0651	-
Signal 1	P18C4	P18C5	P18C5	P0729, P0731, P0732, P0733, P0734, P0735, P18C9
Signal 2	P18C6	P18C7	P18C7	P0729, P0731, P0732, P0733, P0734, P0735, P18C9
Low Reference	-	P18C5, P18C7	-	-

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0729 OR P0731-P0735: GEAR RATIO INCORRECT > CIRCUIT/SYSTEM DESCRIPTION

The gear position sensor is a switching transistor mounted to the transmission extension housing. The four wire sensor interfaces directly with the Engine Control Module (ECM). The ECM supplies 5 V to the gear position sensor on a 5 V reference circuit, and also provides a ground path on a low reference circuit. The sensor provides a Pulse Width Modulated (PWM) duty cycle to the ECM on two signal circuits that is proportional to the linear and radial position of the corresponding magnet assembly mounted to the shift shaft. The vehicle uses the gear position sensor information primarily for Active Rev Matching and Active Fuel Management. The ECM monitors the sensor signal input for an incorrect forward gear condition.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0729 OR P0731-P0735: GEAR RATIO INCORRECT > CONDITIONS FOR RUNNING THE DTC

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0401, P042E, P0502, P0503, P0806, P0807, P0808, P080A, P1248, P1249, P124A, P124B, P124C, P124D, P124E, P124F, P18C4, P18C5, P18C6, P18C7, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P216B, P216C, P216E, P216F, P217B, P217C, P217E, P217F, or P2771 is not set.
- Ignition voltage is between 9-32 V.
- Throttle position is 8 % or greater.
- Engine torque is 50 N.m (37 lb ft) or greater
- Gear position sensor learn status is Learned
- Clutch pedal is released
- Transmission output speed is 120 RPM or greater
- The above conditions are met for 1.5 s.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0729 OR P0731-P0735: GEAR RATIO INCORRECT > CONDITIONS FOR SETTING THE DTC

P0729

ECM detects the measured gear ratio indicates 6th gear but the gear position sensor does not indicate 6th gear for 1 s.

P0731

ECM detects the measured gear ratio indicates 1st gear but the gear position sensor does not indicate 1st gear for 1 s.

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P0732

ECM detects the measured gear ratio indicates 2nd gear but the gear position sensor does not indicate 2nd gear for 1 s.

P0733

ECM detects the measured gear ratio indicates 3rd gear but the gear position sensor does not indicate 3rd gear for 1 s.

P0734

ECM detects the measured gear ratio indicates 4th gear but the gear position sensor does not indicate 4th gear for 1 s.

P0735

ECM detects the measured gear ratio indicates 5th gear but the gear position sensor does not indicate 5th gear for 1 s.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0729 OR P0731-P0735: GEAR RATIO INCORRECT > ACTION TAKEN WHEN THE DTC SETS

- P0729, P0731, P0732, P0733, P0734, and P0735, are Type A DTCs.
- ECM inhibits Active Rev Matching.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0729 OR P0731-P0735: GEAR RATIO INCORRECT > CONDITIONS FOR CLEARING THE DTC

P0729, P0731, P0732, P0733, P0734, and P0735, are Type A DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0729 OR P0731-P0735: GEAR RATIO INCORRECT > REFERENCE INFORMATION

Schematic Reference

Manual Transmission Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

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- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

K20 Engine Control Module: Scan Tool Information

Special Tools

J-38522-A Vehicle Signal Generator

For equivalent regional tools, refer to Special Tools (MM6) Special Tools (M13) .

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0729 OR P0731-P0735: GEAR RATIO INCORRECT > CIRCUIT/SYSTEM VERIFICATION

WARNING:

Refer to Road Test Warning .

1. Ignition ON.
2. Verify DTC P0651, P18C4, P18C5, P18C6, or P18C7 is not set.
    1. **If any of the DTCs are set**

        Refer to Diagnostic Trouble Code (DTC) List - Vehicle .

    1. **If none of the DTCs are set**
3. Test drive the vehicle shifting the transmission through all gear ranges.
4. Verify the transmission shifts smoothly through all gears, the clutch engagement is firm, and engine speed remains constant during steady state driving.
5. Verify the scan tool Current Gear parameter matches the Gear Shift Position parameter when the clutch is released for each forward gear.
    1. **If the transmission does not shift smoothly**

        Refer to Symptoms - Manual Transmission (MM6) Symptoms - Manual Transmission (M13) .

    1. **If the engine speed flares during steady state driving and the Current Gear and**

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Gear Shift Position parameters don't match

Refer to Symptoms - Clutch .

1. **If the Current Gear and Gear Shift Position parameters don't match**

   Refer to Circuit/System Testing.

1. **If the transmission shifts smoothly, engine speed remains constant during steady state driving, and Current Gear and Gear Shift Position parameters match**

6. Ignition ON.
7. Verify the scan tool Gear Shift Position Sensor parameter displays the following duty cycle as the gear shift lever is moved to each gear position:
   1. 10-31% duty cycle for Gear 1 and Gear 2
   2. 28-53% duty cycle for Gear 3, Neutral 3-4 Gate, and Gear 4
   3. 44-73% duty cycle for Gear 5 and Gear 6
   4. 60-90% duty cycle for Reverse Gear

   1. **If the Gear Shift Position Sensor parameter is not within the specified range**

      Refer to Circuit/System Testing.

   1. **If the Gear Shift Position Sensor parameter is within the specified range**

8. Verify the scan tool Gate Select Position Sensor parameter displays the following duty cycle as the gear shift lever is moved to each gear position:
   1. 73-87% duty cycle for Gear 1, Gear 3, Gear 5, and Reverse Gear
   2. 48-60% duty cycle for Neutral 3-4 Gate
   3. 25-34% duty cycle for Gear 2, Gear 4, and Gear 6

   1. **If the Gate Select Position Sensor parameter is not within the specified range**

      Refer to Circuit/System Testing.

   1. **If the Gate Select Position Sensor parameter is within the specified range**

9. Operate the vehicle within the conditions for running the DTC to verify the DTC does not set. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records.

   1. **If the DTC sets**

      Refer to Circuit/System Testing.

   1. **If the DTC does not set**

10. All OK.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0729 OR P0731-P0735: GEAR RATIO INCORRECT > CIRCUIT/SYSTEM TESTING

WARNING:

Refer to Hot Exhaust System Warning .

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B227 Gear Position Sensor. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 4 and ground.
    1. **If 10 Ω or greater**
        1. Disconnect the X3 harness connector at the K20 Engine Control Module.
        2. Test for less than 2 Ω in the circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K20 Engine Control Module.
    1. **If less than 10 Ω**
3. Ignition ON.
4. Test for 4.8-5.2 V between the 5 V reference circuit terminal 1 and ground.
    1. **If less than 4.8 V**
        1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the 5 V reference circuit and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance
        3. Test for less than 2 Ω in the 5 V reference circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K20 Engine Control Module.
    1. **If greater than 5.2 V**
        1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module, Ignition ON.
        2. Test for less than 1 V between the 5 V reference circuit and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            2. If less than 1 V, replace the K20 Engine Control Module.

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1. **If between 4.8-5.2 V**

5. Verify the scan tool Gear Shift Position Sensor parameter duty cycle is greater than 99%.
    1. **If 99% or less**
        1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the signal circuit 1 terminal 3 and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance, test or replace the K20 Engine Control Module.
    1. **If greater than 99%**
6. Install a 3 A fused jumper wire between the signal circuit 1 terminal 3 and ground.
7. Verify the scan tool Gear Shift Position Sensor parameter duty cycle is less than 1%.
    1. **If 1% or greater**
        1. Ignition OFF, remove the jumper wire, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.
        2. Test for less than 1 V between the signal circuit 1 terminal 3 and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            1. If less than 1 V
        3. Ignition OFF.
        4. Test for less than 2 Ω in the signal circuit 1 end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, test or replace the K20 Engine Control Module.
    1. **If less than 1%**
8. Verify the scan tool Gate Select Position Sensor parameter duty cycle is greater than 99%.
    1. **If 99% or less**
        1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the signal circuit 2 terminal 2 and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance, test or replace the K20 Engine Control Module.
    1. **If greater than 99%**
9. Install a 3 A fused jumper wire between the signal circuit 2 terminal 2 and ground.

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10. Verify the scan tool Gate Select Position Sensor parameter duty cycle is less than 1%.
    1. **If 1% or greater**
        1. Ignition OFF, remove the jumper wire, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.
        2. Test for less than 1 V between the signal circuit 2 terminal 2 and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            1. If less than 1 V
        3. Ignition OFF.
        4. Test for less than 2 Ω in the signal circuit 2 end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, test or replace the K20 Engine Control Module.
    1. **If less than 1%**
11. Install a 3 A fused jumper wire between the signal circuit 1 terminal 3 and ground.
12. Verify the scan tool Gate Select Position Sensor parameter duty cycle remains greater than 99%.
    1. **If 99% or less**
        1. Disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between signal circuit 2 terminal 2 and signal circuit 1 terminal 3 at the B227 Gear Position Sensor wire harness connector.
            1. If less than infinite resistance, repair signal circuits shorted together condition.
            2. If infinite resistance, replace the K20 Engine Control Module.
    1. **If greater than 99%**

> *NOTE:*
>
> *The gear position sensor magnet can be viewed when the gear position sensor is removed from the transmission extension housing.*

13. Verify the gear position sensor magnet is undamaged and fastened in proper position on the shift shaft.
    1. **If the gear position sensor magnet is damaged or out of position**

       Replace the gear position sensor magnet.

    1. **If the gear position sensor magnet is undamaged and fastened properly on the shift shaft**

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14. Replace the B227 Gear Position Sensor.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0729 OR P0731-P0735: GEAR RATIO INCORRECT > COMPONENT TESTING

> *WARNING:*
>
> *Refer to Hot Exhaust System Warning .*

Dynamic Test

1. Ignition OFF, disconnect the harness connector at the B227 Gear Position Sensor.
2. Connect the test leads of the J-38522-A vehicle signal generator as follows:
    1. Red test lead to the signal circuit 1 terminal 3 at the B227 Gear Position Sensor wire harness connector.
    2. Black test lead to ground at the transmission case.
    3. Double black power and ground lead wire to B+ and ground.
3. Set and adjust the J-38522-A vehicle signal generator to the following switch positions:
    1. Signal switch to 5 V.
    2. Frequency switch to 600 Hz.
    3. Duty cycle switch to 10%.
4. Ignition ON.
5. Verify the scan tool Gear Shift Position Sensor parameter duty cycle is 10% ± 2%.
6. Set duty cycle switch to 20%, then 30% and so on through 90%.
7. Verify the scan tool Gear Shift Position Sensor parameter duty cycle matches the duty cycle for each switch position on the vehicle signal generator ± 2%.
    1. **If the Gear Shift Position Sensor parameter does not match vehicle signal generator duty cycle ± 2%**

        Replace the K20 Engine Control Module.

    1. **If the Gear Shift Position Sensor parameter matches the vehicle signal generator duty cycle**
8. Repeat the above test, changing only the J-38522-A vehicle signal generator Red test lead to the signal circuit 2 terminal 2 at the B227 Gear Position Sensor wire harness connector.
9. Verify the scan tool Gate Select Position Sensor parameter duty cycle matches the duty cycle for each switch position on the vehicle signal generator ± 2%.

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1. **If the Gate Select Position Sensor parameter does not match vehicle signal generator duty cycle ± 2%**

   Replace the K20 Engine Control Module.

1. **If the Gate Select Position Sensor parameter does match vehicle signal generator duty cycle**

10. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0729 OR P0731-P0735: GEAR RATIO INCORRECT > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Shift Fork Position Sensor Replacement
- Disassembled Views (M13) Disassembled Views (MM6)
- Transmission Disassemble (M13 - LGX w/L4Q) Transmission Disassemble (MM6) Transmission Disassemble (M13 - LGX w/o Y4Q, LTG)
- Transmission Assemble (M13 - LGX w/Y4Q) Transmission Assemble (MM6) Transmission Assemble (M13 - LGX w/o L4Q, LTG)
- Control Module References for ECM replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > DTC DESCRIPTOR

DTC P0801

Reverse Inhibit Solenoid Actuator Control Circuit

DTC P088C

Reverse Inhibit Solenoid Actuator Control Circuit Low Voltage

DTC P088D

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
12 V Battery Circuit (B+)	P0801	P0801	-	-
Reverse Inhibit Solenoid Actuator Control	P088C	P0801	P088D	-

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > TYPICAL SCAN TOOL DATA

Reverse Inhibit Solenoid Actuator Control Circuit High Voltage Test Status

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Operating Conditions: Ignition On or Engine Running, Vehicle stopped. **Parameter Normal Range:** OK.			
12 V Battery Circuit (B+)	OK	OK	-
Reverse Inhibit Solenoid Actuator Control Circuit	OK	OK	Malfunction

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > TYPICAL SCAN TOOL DATA

Reverse Inhibit Solenoid Actuator Control Circuit Low Voltage Test Status

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Operating Conditions: Engine Running, Vehicle speed more than 3 km/h (2 mph). **Parameter Normal Range:** OK.			
12 V Battery Circuit (B+)	OK	OK	-

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Reverse Inhibit Solenoid Actuator Control Circuit	Malfunction	OK	OK

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > TYPICAL SCAN TOOL DATA

Reverse Inhibit Solenoid Actuator Control Circuit Open Test Status

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Operating Conditions: Engine Running, Vehicle speed more than 3 km/h (2 mph). **Parameter Normal Range:** OK.			
12 V Battery Circuit (B+)	Malfunction	Malfunction	-
Reverse Inhibit Solenoid Actuator Control Circuit	OK	Malfunction	OK

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > CIRCUIT/SYSTEM DESCRIPTION

Battery voltage (B+) is supplied directly to the reverse inhibit solenoid actuator. The engine control module (ECM) controls the reverse inhibit solenoid actuator by grounding the control circuit via an internal switch called a low side driver. The low side driver has a fault line which monitors the control circuit. When the ECM commands the reverse lockout solenoid ON, at vehicle speeds below 3 km/h (2 mph), the voltage on the control circuit should be low, near 0 volts. When the ECM commands the control circuit to the reverse lockout solenoid OFF, the voltage should be high, near battery voltage.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > CONDITIONS FOR RUNNING THE DTC

- The engine is running.
- The vehicle speed is less than 3 km/h (2 mph).

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > CONDITIONS FOR SETTING THE DTC

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- The ECM detects that the commanded state of the driver and the actual state of the control circuit does not match.
- The condition exists for 2 s.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > ACTION TAKEN WHEN THE DTC SETS

P0801, P088C, and P088D are Type C DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > CONDITIONS FOR CLEARING THE MIL/DTC

P0801, P088C, and P088D are Type C DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > DIAGNOSTIC AIDS

The battery must be fully charged and pass a battery test. Refer to Battery Inspection/Test .

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > REFERENCE INFORMATION

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Manual Transmission Schematics

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- Manual Transmission Description and Operation (M13) Manual Transmission Description and Operation (MM6)
- Reverse Inhibit Description and Operation

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- Circuit Testing

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- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > CIRCUIT/SYSTEM VERIFICATION

WARNING:

Refer to Road Test Warning .

1. Engine running, operate the vehicle at speeds up to 16 km/h (10 mph)
2. Verify the scan tool Reverse Inhibit Solenoid Actuator Command parameter is On at vehicle speeds 3 km/h (2 mph) or less and Off at vehicle speeds greater than 3 km/h (2 mph).
    1. **If not as specified**

       Refer to Circuit/System Testing.

    1. **If as specified**
3. Ignition ON, Engine OFF.
4. Verify the circuit status parameters listed below do not display Malfunction when commanding the reverse inhibit solenoid actuator between Off and On with a scan tool.
    1. Reverse Inhibit Solenoid Actuator Control Circuit Low Voltage Test Status
    2. Reverse Inhibit Solenoid Actuator Control Circuit Open Test Status
    3. Reverse Inhibit Solenoid Actuator Control Circuit High Voltage Test Status
    1. **If Malfunction is displayed**

       Refer to Circuit/System Testing.

    1. **If Malfunction is not displayed**
5. Place the transmission shift lever in the Reverse position.

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1. **If the transmission shift lever does not move to the Reverse position**

   Refer to Circuit/System Testing.

1. **If the transmission shift lever moves to the Reverse position**

6. Operate the vehicle within the conditions for running the DTC to verify the DTC does not set. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records.

   1. **If the DTC sets**

      Refer to Circuit/System Testing.

   1. **If the DTC does not set**

7. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > CIRCUIT/SYSTEM TESTING

> *NOTE:*
>
> *You must perform the Circuit/System Verification first.*

1. Ignition OFF, disconnect the M47 Reverse Inhibit Solenoid Actuator harness connector.
2. Verify that a test lamp illuminates between the B+ circuit terminal B and ground.

   1. **If the test lamp does not illuminate and the circuit fuse is good**

      1. Remove the test lamp. Remove the fuse.
      2. Test for less than 2 Ω in the B+ circuit end to end.

         1. If 2 Ω or greater, repair the open/high resistance in the circuit.
         2. If less than 2 Ω, verify the fuse is not open and there is voltage at the fuse.

   1. **If the test lamp does not illuminate and the circuit fuse is open**

      1. Remove the test lamp.
      2. Test for infinite resistance between the B+ circuit and ground.

         1. If less than infinite resistance, repair the short to ground on the circuit.
         2. If infinite resistance, replace the M47 Reverse Inhibit Solenoid Actuator.

   1. **If the test lamp illuminates**

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3. Verify that a test lamp does not illuminate between the B+ circuit terminal B and the control circuit terminal A.
    1. **If the test lamp illuminates**
        1. Remove the test lamp, disconnect the X1 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the control circuit and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            2. If infinite resistance, replace the K20 Engine Control Module.
    1. **If the test lamp does not illuminate**
4. Ignition ON.
5. Verify that a test lamp illuminates between the B+ circuit terminal B and the control circuit terminal A.
    1. **If the test lamp does not illuminate**
        1. Ignition OFF, remove the test lamp, disconnect the X1 harness connector at the K20 Engine Control Module.
        2. Test for less than 2 Ω in the control circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K20 Engine Control Module.
    1. **If the test lamp illuminates**
6. Remove the test lamp.
7. Verify the scan tool Reverse Inhibit Solenoid Actuator Control High Voltage Test Status parameter displays OK.
    1. **If not OK**
        1. Ignition OFF, disconnect the X1 harness connector at the K20 Engine Control Module, ignition ON.
        2. Test for less than 1 V between the control circuit and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            2. If less than 1 V, replace the K20 Engine Control Module.
    1. **If OK**
8. Replace the M47 reverse inhibit solenoid actuator.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0801, P088C, OR P088D: REVERSE INHIBIT SOLENOID ACTUATOR CONTROL CIRCUIT > REPAIR

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INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Reverse Lockout Solenoid Replacement
- Control Module References for ECM replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > DTC DESCRIPTOR

DTC P0803

Skip Shift Solenoid Actuator Control Circuit

DTC P080C

Skip Shift Solenoid Actuator Control Circuit Low Voltage

DTC P080D

Skip Shift Solenoid Actuator Control Circuit High Voltage

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition Circuit	P080C	P0803	-	-
Skip Shift Solenoid Actuator Control Circuit	P080C	P0803	P080D	-

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > TYPICAL SCAN TOOL DATA

Skip Shift Solenoid Actuator Control Circuit High Voltage Test Status

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Operating Conditions: Vehicle driven during a skip shift event. **Parameter Normal Range:** OK.			
Ignition Circuit	OK	OK	-
Skip Shift Solenoid Actuator Control Circuit	OK	OK	Malfunction

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > TYPICAL SCAN TOOL DATA

Skip Shift Solenoid Actuator Control Circuit Low Voltage Test Status

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Operating Conditions: Engine Running, Vehicle stopped. **Parameter Normal Range:** OK.			
Ignition Circuit	OK	OK	-
Skip Shift Solenoid Actuator Control Circuit	Malfunction	OK	OK

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > TYPICAL SCAN TOOL DATA

Skip Shift Solenoid Actuator Control Circuit Open Test Status

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Operating Conditions: Engine Running, Vehicle stopped. **Parameter Normal Range:** OK.			
Ignition Circuit	Malfunction	Malfunction	-
Skip Shift Solenoid Actuator Control Circuit	OK	Malfunction	OK

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > CIRCUIT/SYSTEM DESCRIPTION

The skip shift mechanism is a fuel economy feature that is activated automatically under light acceleration and low engine load conditions. When active a transmission mounted solenoid actuates the internal skip shift mechanism which allows the driver to shift from first gear to forth gear only. Second, third, and fifth gear ranges are blocked. Ignition voltage is supplied directly to the skip shift solenoid actuator. The engine control module (ECM) controls the skip shift solenoid actuator by grounding the control circuit via an internal switch called a low side driver. The low side driver has a fault line which monitors the control circuit. When the ECM commands the skip shift solenoid actuator ON, the voltage on the control circuit should be low, near 0 volts. When the ECM commands the control circuit to the skip shift solenoid actuator OFF, the voltage should be high, near battery voltage.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > CONDITIONS FOR RUNNING THE DTC

P0803 and P080C

- System voltage is 9-32 V.
- Engine speed is greater than 250 RPM.
- DTC runs continuously while the actuator is OFF.

P080D

- System voltage is 9-32 V.
- Engine speed is greater than 250 RPM.
- DTC runs continuously while the actuator is ON.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > CONDITIONS FOR SETTING THE DTC

P0803

ECM detects that the voltage on the control circuit is low during the driver OFF state, indicating an open, for 1.5 s.

P080C

ECM detects that the voltage on the control circuit is low during the driver OFF state, indicating a short to ground, for 1.5 s.

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P080D

ECM detects that the voltage on the control circuit is high during the driver ON state for 1.5 s.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > ACTION TAKEN WHEN THE DTC SETS

P0803, P080C, and P080D are Type B DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > CONDITIONS FOR CLEARING THE MIL/DTC

P0803, P080C, and P080D are Type B DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > DIAGNOSTIC AIDS

- The battery must be fully charged and pass a battery test. Refer to Battery Inspection/Test .
- The engine must be running for the ECM to update the skip shift solenoid actuator circuit status parameters.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > REFERENCE INFORMATION

Schematic Reference

- Manual Transmission Schematics
- Engine Controls Schematics

Connector End View Reference

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- Skip Shift Description and Operation (MM6)
- Manual Transmission Description and Operation (M13) Manual Transmission Description and Operation (MM6)

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Electrical Information Reference

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > CIRCUIT/SYSTEM VERIFICATION

1. Engine running.
2. Verify the scan tool Skip Shift Solenoid Actuator Control Circuit Status parameters listed below toggle between OK and Not Run or Not Run and OK while commanding the skip shift solenoid actuator ON and OFF.
    1. Skip Shift Solenoid Actuator Control Circuit Low Voltage Test Status
    2. Skip Shift Solenoid Actuator Control Circuit Open Test Status
    3. Skip Shift Solenoid Actuator Control Circuit High Voltage Test Status
        1. **If each parameter does not change between OK and Not Run or Not Run and OK**

            Refer to Circuit/System Testing.

        1. **If each parameter changes between OK and Not Run or Not Run and OK**
3. Ignition ON, Engine OFF.
4. Verify the shift lever will enter all gear ranges.
        1. **If the shift lever will not enter all gear ranges**

            Refer to Circuit/System Testing.

        1. **If the shift lever will enter all gear ranges**
5. Verify the second, third, and fifth gear ranges are blocked, while commanding the skip shift solenoid actuator ON.
        1. **If the specified gear ranges are not blocked**

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Refer to Circuit/System Testing.

1. **If the specified gear ranges are blocked**

6. Operate the vehicle within the conditions for running the DTC to verify the DTC does not set. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

    1. **If the DTC sets**

        Refer to Circuit/System Testing.

    1. **If the DTC does not set**

7. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > CIRCUIT/SYSTEM TESTING

> *IMPORTANT:*
>
> *You must perform the Circuit/System Verification first.*

1. Ignition OFF, disconnect the Q34 Skip Shift Solenoid Actuator harness connector.
2. Ignition ON.
3. Verify that a test lamp illuminates between the Ignition circuit terminal A and ground.

    1. **If the test lamp does not illuminate and the circuit fuse is good**

        1. Ignition OFF, remove the test lamp. Remove the fuse.
        2. Test for less than 2 Ω in the Ignition circuit end to end.

            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, verify the fuse is not open and there is voltage at the fuse.

    1. **If the test lamp does not illuminate and the circuit fuse is open**

        1. Ignition OFF, remove the test lamp.
        2. Test for infinite resistance between the Ignition circuit and ground.

            1. If less than infinite resistance, repair the short to ground on the circuit.
            2. If infinite resistance, replace the Q34 Skip Shift Solenoid Actuator.

    1. **If the test lamp illuminates**

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4. Verify that a test lamp does not illuminate between the Ignition circuit terminal A and the control circuit terminal B.
    1. **If the test lamp illuminates**
        1. Ignition OFF, remove the test lamp, disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the control circuit and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            2. If infinite resistance, replace the K20 Engine Control Module.
    1. **If the test lamp does not illuminate**
5. Remove the test lamp.
6. Engine running.
7. Verify the scan tool Skip Shift Solenoid Actuator Control Circuit High Voltage Test Status parameter is OK while commanding the Q34 Skip Shift Solenoid Actuator ON.
    1. **If not OK**
        1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.
        2. Test for less than 1 V between the control circuit and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            2. If less than 1 V, replace the K20 Engine Control Module.
    1. **If OK**
8. Ignition OFF.
9. Install a 3A fused jumper wire between the control circuit terminal B and the Ignition circuit terminal A.
10. Engine running.
11. Verify the scan tool Skip Shift Solenoid Actuator Control Circuit High Voltage Test Status parameter is Malfunction while commanding the Q34 Skip Shift Solenoid Actuator ON.
    1. **If not Malfunction**
        1. Ignition OFF, remove the jumper wire, disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for less than 2 Ω in the control circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K20 Engine Control Module.
    1. **If Malfunction**

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12. Replace the Q34 Skip Shift Solenoid Actuator.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0803, P080C, OR P080D: SKIP SHIFT SOLENOID ACTUATOR CONTROL CIRCUIT > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Gear Select/Skip Shift Solenoid Replacement
- Control Module References for ECM replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0806-P0808: CLUTCH PEDAL POSITION (CPP) SENSOR > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0806-P0808: CLUTCH PEDAL POSITION (CPP) SENSOR > DTC DESCRIPTORS

DTC P0806

Clutch Pedal Position (CPP) Sensor Performance

DTC P0807

Clutch Pedal Position (CPP) Sensor Circuit Low Voltage

DTC P0808

Clutch Pedal Position (CPP) Sensor Circuit High Voltage

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0806-P0808: CLUTCH PEDAL POSITION (CPP) SENSOR > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0651, P0807	P0807	P0651, P0808	-
Signal	P0807	P0807	P0808	P0806
Low Reference	-	P0808	-	-

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0806-P0808: CLUTCH PEDAL POSITION (CPP) SENSOR > TYPICAL SCAN TOOL DATA

CPP Sensor Voltage

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON. **Parameter Normal Range:** 1V with clutch pedal applied to 4V when clutch pedal is released.			
5 Volt Reference	0V	0V	5V
Signal	0V	0V	5V
Low Reference	-	5V	-

CPP Sensor Percentage

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON. **Parameter Normal Range:** 0% with clutch pedal released to 100% when clutch pedal is applied.			
5 Volt Reference	100%	100%	0%
Signal	100%	100%	0%
Low Reference	-	0%	-

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0806-P0808: CLUTCH PEDAL POSITION (CPP) SENSOR > CIRCUIT/SYSTEM DESCRIPTION

The clutch pedal position (CPP) is a three wire sensor, connected to a 5-volt reference circuit, a low reference circuit, and a signal circuit. The engine control module (ECM) supplies 5 volts to the CPP sensor, and also provides a sensor ground path on the low reference circuit. The CPP sensor sends a voltage signal to the ECM on the signal circuit. The voltage on the signal circuit will vary from a voltage near 4 V when the clutch pedal is released to a voltage near 1 V when the clutch pedal is applied.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0806-P0808: CLUTCH PEDAL POSITION (CPP) SENSOR > CONDITIONS FOR RUNNING THE DTC

P0806

- DTCs P0335, P0336, P0502, P0503, P0807, or P0808 is not set.

- Vehicle Speed is greater than 10 km/h (6 mph).
- Measured transmission gear ratio matches a valid gear ratio.
- DTC runs continuously when the above conditions are met.

P0807 and P0808

- System voltage is greater than 11 V.
- Ignition is ON.
- DTC runs continuously when the above conditions are met.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0806-P0808: CLUTCH PEDAL POSITION (CPP) SENSOR > CONDITIONS FOR SETTING THE DTC

P0806

The CPP sensor voltage is stuck in range.

P0807

The CPP sensor signal voltage is less than 0.2 V.

P0808

The CPP sensor signal voltage is greater than 4.8 V.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0806-P0808: CLUTCH PEDAL POSITION (CPP) SENSOR > ACTION TAKEN WHEN THE DTC SETS

P0806, P0807 and P0808 are Type A DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0806-P0808: CLUTCH PEDAL POSITION (CPP) SENSOR > CONDITIONS FOR CLEARING THE MIL/DTC

P0806, P0807 and P0808 are Type A DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0806-P0808: CLUTCH PEDAL POSITION (CPP) SENSOR > REFERENCE INFORMATION

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Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

J 35616 GM-Approved Terminal Test Kit

For equivalent regional tools, refer to Special Tools (MM6) Special Tools (M13) .

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0806-P0808: CLUTCH PEDAL POSITION (CPP) SENSOR > CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON, Engine OFF.
2. Verify DTC P0651 is not set.
    1. **If DTC P0651 is set**

       Refer to Diagnostic Trouble Code (DTC) List - Vehicle .

    1. **If DTC P0651 is not set**
3. Verify the scan tool CPP Sensor parameter is 0% with the clutch pedal in the full release position.
    1. **If greater than the specified value**

       Refer to Circuit/System Testing.

    1. **If equal to the specified value**
4. Verify with a scan tool the CPP Sensor parameter is between 98-100% with the clutch pedal in the fully depressed position.

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1. **If less than the specified value**

   Refer to Circuit/System Testing.

1. **If within the specified values**

5. Verify the scan tool CPP Sensor parameter transitions smoothly through the range between 0% - 100% when the clutch pedal is fully depressed.

   1. **If the parameter does not transition smoothly, drops out, or momentarily spikes during clutch pedal movement**

      Refer to Circuit/System Testing.

   1. **If the parameter does transition smoothly and does not spike or dropout, during clutch pedal movement**

6. Operate the vehicle within the conditions for running the DTC to verify the DTC does not set. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

   1. **If the DTC sets**

      Refer to Circuit/System Testing.

   1. **If the DTC does not set**

7. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0806-P0808: CLUTCH PEDAL POSITION (CPP) SENSOR > CIRCUIT/SYSTEM TESTING

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B25B Clutch Pedal Position Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 5 Ω between the low reference circuit terminal C and ground.

   1. **If 5 Ω or greater**

      1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
      2. Test for less than 2 Ω in the low reference circuit, end to end.

         1. If 2 Ω or greater, repair the open/high resistance in the circuit.
         2. If less than 2 Ω, replace the K20 Engine Control Module.

   1. **If less than 5 Ω**

3. Ignition ON.
4. Test for 4.8-5.2 V between the 5 V reference circuit terminal A and ground.

   1. **If less than 4.8 V**

      1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.

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2. Test for infinite resistance between the 5 V reference circuit and ground.
    1. If less than infinite resistance, repair the short to ground on the circuit.
    1. If infinite resistance.
3. Test for less than 2 Ω in the 5 V reference circuit, end to end.
    1. If 2 Ω or greater, repair the open/high resistance in the circuit.
    2. If less than 2 Ω, replace the K20 Engine Control Module.

1. **If greater than 5.2 V**
    1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module. Ignition ON.
    2. Test for less than 1 V between the 5 V reference circuit and ground.
        1. If 1 V or greater, repair the short to voltage on the circuit.
        2. If less than 1 V, replace the K20 engine control module.

1. **If between 4.8-5.2 V**

5. Verify the scan tool CPP Sensor parameter is less than 0.2 V.
    1. **If 0.2 V or greater**
        1. Ignition OFF, disconnect the X1 harness connector at the K20 Engine Control Module. Ignition ON.
        2. Test for less than 1 V between the signal circuit terminal B and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            2. If less than 1 V, replace the K20 Engine Control Module.

    1. **If less than the 0.2 V**

6. Install a 3 A fused jumper wire between the signal circuit terminal B and the 5 V reference circuit terminal A.

7. Verify the scan tool CPP Sensor parameter is greater than 4.8 V.
    1. **If 4.8 V or less**
        1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the signal circuit terminal B and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance.
        3. Test for less than 2 Ω in the signal circuit, end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.

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2. If less than 2 Ω, replace the K20 Engine Control Module.

1. **If greater than 4.8 V**

8. Test or replace the B25B Clutch Pedal Position Sensor.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0806-P0808: CLUTCH PEDAL POSITION (CPP) SENSOR > COMPONENT TESTING

1. Install a 3 A fused jumper wire between the 5 V reference terminal A and 5 V.
2. Install a jumper wire between the low reference terminal C and ground.
3. Test for 0.5-5.2 V without any spikes or dropouts between the signal terminal B and the low reference circuit terminal C while moving the sensor through the entire range.
    1. **If not 0.5-5.2 V or has spikes or dropouts**

       Replace the B25B Clutch Pedal Position Sensor.

    1. **If 0.5-5.2 V and there are no spikes or dropouts**
4. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P0806-P0808: CLUTCH PEDAL POSITION (CPP) SENSOR > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Clutch Pedal Position Sensor Replacement
- Control Module References for ECM replacement, programming and setup

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P080A: CLUTCH PEDAL POSITION (CPP) NOT LEARNED > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P080A: CLUTCH PEDAL POSITION (CPP) NOT LEARNED > DTC DESCRIPTOR

DTC P080A

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Clutch Pedal Position (CPP) Not Learned

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P080A: CLUTCH PEDAL POSITION (CPP) NOT LEARNED > CIRCUIT/SYSTEM DESCRIPTION

The clutch pedal position (CPP) is a 3-wire sensor, connected to a 5 V reference circuit, a low reference circuit, and a signal circuit. The engine control module supplies 5 V to the CPP sensor, and also provides a sensor ground path on the low reference circuit. The CPP sensor sends a voltage signal to the ECM on the signal circuit. The voltage on the signal circuit will vary from a voltage near 4 V when the clutch pedal is released to a voltage near 1 V when the clutch pedal is applied.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P080A: CLUTCH PEDAL POSITION (CPP) NOT LEARNED > CONDITIONS FOR RUNNING THE DTC

Ignition is ON.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P080A: CLUTCH PEDAL POSITION (CPP) NOT LEARNED > CONDITIONS FOR SETTING THE DTC

CPP sensor learned apply position not learned.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P080A: CLUTCH PEDAL POSITION (CPP) NOT LEARNED > ACTION TAKEN WHEN THE DTC SETS

P080A is a Type A DTC.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P080A: CLUTCH PEDAL POSITION (CPP) NOT LEARNED > CONDITIONS FOR CLEARING THE MIL/DTC

P080A is a Type A DTC.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P080A: CLUTCH PEDAL POSITION (CPP) NOT LEARNED > REFERENCE INFORMATION

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Manual Transmission Schematics

Connector End View Reference

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- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P080A: CLUTCH PEDAL POSITION (CPP) NOT LEARNED > CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON.
2. Verify DTC P0651, P0806, P0807, or P0808 is not set.
    1. **If DTC P0651, P0806, P0807, or P0808 is set**

       Refer to Diagnostic Trouble Code (DTC) List - Vehicle .

    1. **If DTC P0651, P0806, P0807, or P0808 is not set**
3. Perform the clutch pedal position sensor learn procedure.
    1. **If the clutch pedal position sensor learn was not successful**

       Refer to Circuit/System Testing.

    1. **If the clutch pedal position sensor learn was successful**
4. Ignition ON.
5. Verify DTC P080A ran and passed this ignition cycle. Operate the vehicle within the conditions for running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records.
    1. **If the scan tool indicates DTC P080A failed**

       Refer to Circuit/System Testing.

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1. **If the scan tool indicates DTC P080A ran and passed this ignition cycle**

6. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P080A: CLUTCH PEDAL POSITION (CPP) NOT LEARNED > CIRCUIT/SYSTEM TESTING

1. Verify the clutch pedal is not loose and is properly torqued. Refer to Clutch Pedal Replacement .

    1. **If a condition is found with the clutch pedal**

       Repair or replace as necessary.

    1. **If no condition is found with the clutch pedal**

2. Replace the K20 Engine Control Module.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P080A: CLUTCH PEDAL POSITION (CPP) NOT LEARNED > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Clutch Pedal Position Sensor Learn
- Control Module References for ECM replacement, setup and programming

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C4 OR P18C5: GEAR POSITION SENSOR CIRCUIT 1 VOLTAGE > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C4 OR P18C5: GEAR POSITION SENSOR CIRCUIT 1 VOLTAGE > DTC DESCRIPTORS

DTC P18C4

Gear Position Sensor Circuit 1 Low Voltage

DTC P18C5

Gear Position Sensor Circuit 1 High Voltage

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C4 OR P18C5: GEAR POSITION SENSOR CIRCUIT 1 VOLTAGE > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0651, P18C5, P18C7	P18C5, P18C7	P0651, P18C5, P18C7	-
Signal 1	P18C4	P18C5	P18C5	P0729, P0731, P0732, P0733, P0734, P0735, P076F, P18C9
Signal 2	P18C6	P18C7	P18C7	P0729, P0731, P0732, P0733, P0734, P0735, P076F, P18C9
Low Reference	-	P18C5, P18C7	-	-

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C4 OR P18C5: GEAR POSITION SENSOR CIRCUIT 1 VOLTAGE > TYPICAL SCAN TOOL DATA

Gear Shift Position Sensor

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Operating Conditions: Ignition On or Engine Running, shift lever in Neutral 3-4 Gate. **Parameter Normal Range:** 28-53%.			
5 V Reference	0%	100%	100%
Signal 1	0%	100%	100%
Low Reference	-	100%	-

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C4 OR P18C5: GEAR POSITION SENSOR CIRCUIT 1 VOLTAGE > CIRCUIT/SYSTEM DESCRIPTION

The gear position sensor is a switching transistor mounted to the transmission extension housing. The four wire sensor interfaces directly with the Engine Control Module (ECM). The ECM supplies 5 V to the gear position sensor on a 5 V reference circuit, and also provides a ground path on a low reference circuit. The sensor provides a Pulse Width Modulated (PWM) duty cycle to the ECM on two signal circuits that is proportional to the linear and radial position of the corresponding magnet assembly mounted to the shift shaft. The vehicle uses the gear position sensor information primarily for Active Rev

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Matching and Active Fuel Management. The ECM monitors the radial position signal 1 circuit for low and high voltage conditions.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C4 OR P18C5: GEAR POSITION SENSOR CIRCUIT 1 VOLTAGE > CONDITIONS FOR RUNNING THE DTC

Ignition voltage is between 9-32 V.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C4 OR P18C5: GEAR POSITION SENSOR CIRCUIT 1 VOLTAGE > CONDITIONS FOR SETTING THE DTC

P18C4

Gear position sensor signal 1 duty cycle is less than 10% for 3 s.

P18C5

Gear position sensor signal 1 duty cycle is more than 90% for 3 s.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C4 OR P18C5: GEAR POSITION SENSOR CIRCUIT 1 VOLTAGE > ACTION TAKEN WHEN THE DTC SETS

- P18C4 and P18C5 are Type A DTCs.
- ECM inhibits Active Rev Matching.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C4 OR P18C5: GEAR POSITION SENSOR CIRCUIT 1 VOLTAGE > CONDITIONS FOR CLEARING THE DTC

P18C4 and P18C5 are Type A DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C4 OR P18C5: GEAR POSITION SENSOR CIRCUIT 1 VOLTAGE > REFERENCE INFORMATION

Schematic Reference

Manual Transmission Schematics

Connector End View Reference

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

K20 Engine Control Module: Scan Tool Information

Special Tools

J-38522-A Vehicle Signal Generator

For equivalent regional tools, refer to Special Tools (MM6) Special Tools (M13) .

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C4 OR P18C5: GEAR POSITION SENSOR CIRCUIT 1 VOLTAGE > CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON.
2. Verify DTC P0651 is not set.
    1. **If the DTC is set**

       Refer to DTC P0641, P0651, P0697, or P06A3 .

    1. **If the DTC is not set**
3. Verify the scan tool Gear Shift Position Sensor parameter displays the following duty cycle as the gear shift lever is moved through each gear position:
    1. 10-31% duty cycle for Gear 1 and Gear 2
    2. 28-53% duty cycle for Gear 3, Neutral 3-4 Gate, and Gear 4
    3. 44-73% duty cycle for Gear 5 and Gear 6
    4. 60-90% duty cycle for Reverse Gear
    1. **If the Gear Shift Position Sensor parameter is not within the specified range**

       Refer to Circuit/System Testing.

    1. **If the Gear Shift Position Sensor parameter is within the specified range**

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4. Operate the vehicle within the conditions for running the DTC to verify the DTC does not set. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records.
    1. **If the DTC sets**

       Refer to Circuit/System Testing.

    1. **If the DTC does not set**

5. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C4 OR P18C5: GEAR POSITION SENSOR CIRCUIT 1 VOLTAGE > CIRCUIT/SYSTEM TESTING

WARNING:

Refer to Hot Exhaust System Warning .

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B227 Gear Position Sensor. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 4 and ground.
    1. **If 10 Ω or greater**
        1. Disconnect the X3 harness connector at the K20 Engine Control Module.
        2. Test for less than 2 Ω in the circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K20 Engine Control Module.
    1. **If less than 10 Ω**
3. Ignition ON.
4. Test for 4.8-5.2 V between the 5 V reference circuit terminal 1 and ground.
    1. **If less than 4.8 V**
        1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the 5 V reference circuit and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance
        3. Test for less than 2 Ω in the 5 V reference circuit end to end.

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1. If 2 Ω or greater, repair the open/high resistance in the circuit.
2. If less than 2 Ω, replace the K20 Engine Control Module.

1. **If greater than 5.2 V**
    1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module, Ignition ON.
    2. Test for less than 1 V between the 5 V reference circuit and ground.
        1. If 1 V or greater, repair the short to voltage on the circuit.
        2. If less than 1 V, replace the K20 Engine Control Module.

1. **If between 4.8-5.2 V**

5. Verify the scan tool Gear Shift Position Sensor parameter duty cycle is greater than 99%.
    1. **If 99% or less**
        1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the signal circuit 1 terminal 3 and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance, test or replace the K20 Engine Control Module.
    1. **If greater than 99%**
6. Install a 3 A fused jumper wire between the signal circuit 1 terminal 3 and ground.
7. Verify the scan tool Gear Shift Position Sensor parameter duty cycle is less than 1%.
    1. **If 1% or greater**
        1. Ignition OFF, remove the jumper wire, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.
        2. Test for less than 1 V between the signal circuit 1 terminal 3 and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            1. If less than 1 V
        3. Ignition OFF.
        4. Test for less than 2 Ω in the signal circuit 1 end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, test or replace the K20 Engine Control Module.
    1. **If less than 1%**
8. Replace the B227 Gear Position Sensor.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C4 OR P18C5: GEAR POSITION SENSOR CIRCUIT 1 VOLTAGE > COMPONENT TESTING

WARNING:

Refer to Hot Exhaust System Warning .

Dynamic Test

1. Ignition OFF, disconnect the harness connector at the B227 Gear Position Sensor.
2. Connect the test leads of the J-38522-A vehicle signal generator as follows:
    1. Red test lead to the signal circuit 1 terminal 3 at the B227 Gear Position Sensor wire harness connector.
    2. Black test lead to ground at the transmission case.
    3. Double black power and ground lead wire to B+ and ground.
3. Set and adjust the J-38522-A vehicle signal generator to the following switch positions:
    1. Signal switch to 5 V.
    2. Frequency switch to 600 Hz.
    3. Duty cycle switch to 10%.
4. Ignition ON.
5. Verify the scan tool Gear Shift Position Sensor parameter duty cycle is 10% ± 2%.
6. Set duty cycle switch to 20%, then 30% and so on through 90%.
7. Verify the scan tool Gear Shift Position Sensor parameter duty cycle matches the duty cycle for each switch position on the vehicle signal generator ± 2%.
    1. **If the Gear Shift Position Sensor parameter does not match vehicle signal generator duty cycle ± 2%**

        Replace the K20 Engine Control Module.

    1. **If the Gear Shift Position Sensor parameter matches the vehicle signal generator duty cycle**
8. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C4 OR P18C5: GEAR POSITION SENSOR CIRCUIT 1 VOLTAGE > REPAIR INSTRUCTIONS

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Perform the Diagnostic Repair Verification after completing the repair.

- Shift Fork Position Sensor Replacement
- Control Module References for ECM replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C6 OR P18C7: GEAR POSITION SENSOR CIRCUIT 2 VOLTAGE > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C6 OR P18C7: GEAR POSITION SENSOR CIRCUIT 2 VOLTAGE > DTC DESCRIPTORS

DTC P18C6

Gear Position Sensor Circuit 2 Low Voltage

DTC P18C7

Gear Position Sensor Circuit 2 High Voltage

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C6 OR P18C7: GEAR POSITION SENSOR CIRCUIT 2 VOLTAGE > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0651, P18C5, P18C7	P18C5, P18C7	P0651, P18C5, P18C7	-
Signal 1	P18C4	P18C5	P18C5	P0729, P0731, P0732, P0733, P0734, P0735, P076F, P18C9
Signal 2	P18C6	P18C7	P18C7	P0729, P0731, P0732, P0733, P0734, P0735, P076F, P18C9
Low Reference	-	P18C5, P18C7	-	-

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C6 OR P18C7: GEAR POSITION SENSOR CIRCUIT 2 VOLTAGE > TYPICAL SCAN TOOL DATA

Gate Select Position Sensor

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Operating Conditions: Ignition On or Engine Running, shift lever in Neutral 3-4 Gate. **Parameter Normal Range:** 48-60%.			
5 V Reference	100%	100%	100%
Signal 2	0%	100%	100%
Low Reference	-	100%	-

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C6 OR P18C7: GEAR POSITION SENSOR CIRCUIT 2 VOLTAGE > CIRCUIT/SYSTEM DESCRIPTION

The gear position sensor is a switching transistor mounted to the transmission extension housing. The four wire sensor interfaces directly with the Engine Control Module (ECM). The ECM supplies 5 V to the gear position sensor on a 5 V reference circuit, and also provides a ground path on a low reference circuit. The sensor provides a Pulse Width Modulated (PWM) duty cycle to the ECM on two signal circuits that is proportional to the linear and radial position of the corresponding magnet assembly mounted to the shift shaft. The vehicle uses the gear position sensor information primarily for Active Rev Matching and Active Fuel Management. The ECM monitors the linear position signal 2 circuit for low and high voltage conditions.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C6 OR P18C7: GEAR POSITION SENSOR CIRCUIT 2 VOLTAGE > CONDITIONS FOR RUNNING THE DTC

Ignition voltage is between 9-32 V.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C6 OR P18C7: GEAR POSITION SENSOR CIRCUIT 2 VOLTAGE > CONDITIONS FOR SETTING THE DTC

P18C6

Gear position sensor signal 2 duty cycle is less than 10% for 3 s.

P18C7

Gear position sensor signal 2 duty cycle is more than 90% for 3 s.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C6 OR P18C7: GEAR POSITION SENSOR CIRCUIT 2 VOLTAGE > ACTION TAKEN WHEN THE DTC SETS

- P18C6 and P18C7 are Type A DTCs.
- ECM inhibits Active Rev Matching.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C6 OR P18C7: GEAR POSITION SENSOR CIRCUIT 2 VOLTAGE > CONDITIONS FOR CLEARING THE DTC

P18C6 and P18C7 are Type A DTCs.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C6 OR P18C7: GEAR POSITION SENSOR CIRCUIT 2 VOLTAGE > REFERENCE INFORMATION

Schematic Reference

Manual Transmission Schematics

Connector End View Reference

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

K20 Engine Control Module: Scan Tool Information

Special Tools

J-38522-A Vehicle Signal Generator

For equivalent regional tools, refer to Special Tools (MM6) Special Tools (M13) .

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C6 OR P18C7: GEAR POSITION SENSOR CIRCUIT 2 VOLTAGE > CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON.
2. Verify DTC P0651 is not set.
    1. **If the DTC is set**

       Refer to DTC P0641, P0651, P0697, or P06A3 .
    1. **If the DTC is not set**
3. Verify the scan tool Gate Select Position Sensor parameter displays the following duty cycle as the gear shift lever is moved through each gear position:
    1. 73-87% duty cycle for Gear 1, Gear 3, Gear 5, and Reverse Gear
    2. 48-60% duty cycle for Neutral 3-4 Gate
    3. 25-34% duty cycle for Gear 2, Gear 4, and Gear 6
    1. **If the Gate Select Position Sensor parameter is not within the specified range**

       Refer to Circuit/System Testing.
    1. **If the Gate Select Position Sensor parameter is within the specified range**
4. Operate the vehicle within the conditions for running the DTC to verify the DTC does not set. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records.
    1. **If the DTC sets**

       Refer to Circuit/System Testing.
    1. **If the DTC does not set**
5. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C6 OR P18C7: GEAR POSITION SENSOR CIRCUIT 2 VOLTAGE > CIRCUIT/SYSTEM TESTING

> *WARNING:*
>
> *Refer to Hot Exhaust System Warning .*

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B227 Gear Position Sensor. It may take up to 2 minutes for all vehicle systems to power down.

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2. Test for less than 10 Ω between the low reference circuit terminal 4 and ground.
    1. **If 10 Ω or greater**
        1. Disconnect the X3 harness connector at the K20 Engine Control Module.
        2. Test for less than 2 Ω in the circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K20 Engine Control Module.
    1. **If less than 10 Ω**
3. Ignition ON.
4. Test for 4.8-5.2 V between the 5 V reference circuit terminal 1 and ground.
    1. **If less than 4.8 V**
        1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the 5 V reference circuit and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance
        3. Test for less than 2 Ω in the 5 V reference circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K20 Engine Control Module.
    1. **If greater than 5.2 V**
        1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module, Ignition ON.
        2. Test for less than 1 V between the 5 V reference circuit and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            2. If less than 1 V, replace the K20 Engine Control Module.
    1. **If between 4.8-5.2 V**
5. Verify the scan tool Gate Select Position Sensor parameter duty cycle is greater than 99%.
    1. **If 99% or less**
        1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the signal circuit 2 terminal 2 and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.

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1. If infinite resistance, test or replace the K20 Engine Control Module.

1. **If greater than 99%**

6. Install a 3 A fused jumper wire between the signal circuit 2 terminal 2 and ground.
7. Verify the scan tool Gate Select Position Sensor parameter duty cycle is less than 1%.
    1. **If 1% or greater**
        1. Ignition OFF, remove the jumper wire, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.
        2. Test for less than 1 V between the signal circuit 2 terminal 2 and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            1. If less than 1 V
        3. Ignition OFF.
        4. Test for less than 2 Ω in the signal circuit 2 end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, test or replace the K20 Engine Control Module.
    1. **If less than 1%**
8. Replace the B227 Gear Position Sensor.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C6 OR P18C7: GEAR POSITION SENSOR CIRCUIT 2 VOLTAGE > COMPONENT TESTING

> *WARNING:*
>
> *Refer to Hot Exhaust System Warning .*

Dynamic Test

1. Ignition OFF, disconnect the harness connector at the B227 Gear Position Sensor.
2. Connect the test leads of the J-38522-A vehicle signal generator as follows:
    1. Red test lead to the signal circuit 2 terminal 2 at the B227 Gear Position Sensor wire harness connector.
    2. Black test lead to ground at the transmission case.
    3. Double black power and ground lead wire to B+ and ground.
3. Set and adjust the J-38522-A vehicle signal generator to the following switch positions:

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1. Signal switch to 5 V.
2. Frequency switch to 600 Hz.
3. Duty cycle switch to 10%.

4. Ignition ON.
5. Verify the scan tool Gate Select Position Sensor parameter duty cycle is 10% ± 2%.
6. Set duty cycle switch to 20%, then 30% and so on through 90%.
7. Verify the scan tool Gate Select Position Sensor parameter duty cycle matches the duty cycle for each switch position on the vehicle signal generator ± 2%.
    1. **If the Gate Select Position Sensor parameter does not match vehicle signal generator duty cycle ± 2%**

       Replace the K20 Engine Control Module.

    1. **If the Gate Select Position Sensor parameter matches the vehicle signal generator duty cycle**
8. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C6 OR P18C7: GEAR POSITION SENSOR CIRCUIT 2 VOLTAGE > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Shift Fork Position Sensor Replacement
- Control Module References for ECM replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C9: GEAR POSITION SENSOR - GEAR RATIO NOT PLAUSIBLE > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C9: GEAR POSITION SENSOR - GEAR RATIO NOT PLAUSIBLE > DTC DESCRIPTORS

DTC P18C9

Gear Position Sensor - Gear Ratio Not Plausible

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C9: GEAR POSITION SENSOR - GEAR RATIO NOT PLAUSIBLE > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0651, P18C5, P18C7	P18C5, P18C7	P0651	-
Signal 1	P18C4	P18C5	P18C5	P0729, P0731, P0732, P0733, P0734, P0735, P18C9
Signal 2	P18C6	P18C7	P18C7	P0729, P0731, P0732, P0733, P0734, P0735, P18C9
Low Reference	-	P18C5, P18C7	-	-

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C9: GEAR POSITION SENSOR - GEAR RATIO NOT PLAUSIBLE > CIRCUIT/SYSTEM DESCRIPTION

The gear position sensor is a switching transistor mounted to the transmission extension housing. The four wire sensor interfaces directly with the Engine Control Module (ECM). The ECM supplies 5 V to the gear position sensor on a 5 V reference circuit, and also provides a ground path on a low reference circuit. The sensor provides a Pulse Width Modulated (PWM) duty cycle to the ECM on two signal circuits that is proportional to the linear and radial position of the corresponding magnet assembly mounted to the shift shaft. The vehicle uses the gear position sensor information primarily for Active Rev Matching and Active Fuel Management. The ECM monitors the sensor signal input for an incorrect neutral condition.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C9: GEAR POSITION SENSOR - GEAR RATIO NOT PLAUSIBLE > CONDITIONS FOR RUNNING THE DTC

- DTC P0502, P0503, P0806, P0807, P0808, P080A, P18C4, P18C5, P18C6, or P18C7 is not set.
- Ignition voltage is between 9-32 V.
- Engine speed is 450 RPM or greater.
- Gear position sensor learn status is Learned.
- Clutch pedal is released.
- Transmission output shaft speed is 10 RPM or less.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C9: GEAR POSITION SENSOR - GEAR RATIO NOT PLAUSIBLE > CONDITIONS FOR SETTING THE DTC

P18C9

ECM detects the transmission is in neutral and gear position sensor does not indicate neutral for 3 s.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C9: GEAR POSITION SENSOR - GEAR RATIO NOT PLAUSIBLE > ACTION TAKEN WHEN THE DTC SETS

- P18C9 is a Type A DTC.
- ECM inhibits Active Rev Matching.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C9: GEAR POSITION SENSOR - GEAR RATIO NOT PLAUSIBLE > CONDITIONS FOR CLEARING THE DTC

P18C9 is a Type A DTC.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C9: GEAR POSITION SENSOR - GEAR RATIO NOT PLAUSIBLE > DIAGNOSTIC AIDS

A vehicle speed sensor fault may cause DTC P18C9 to set.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C9: GEAR POSITION SENSOR - GEAR RATIO NOT PLAUSIBLE > REFERENCE INFORMATION

Schematic Reference

Manual Transmission Schematics

Connector End View Reference

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Description and Operation

Manual Transmission Description and Operation (M13) Manual Transmission Description and Operation (MM6)

Electrical Information Reference

- Circuit Testing

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- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

K20 Engine Control Module: Scan Tool Information

Special Tools

J-38522-A Vehicle Signal Generator

For equivalent regional tools, refer to Special Tools (MM6) Special Tools (M13) .

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C9: GEAR POSITION SENSOR - GEAR RATIO NOT PLAUSIBLE > CIRCUIT/SYSTEM VERIFICATION

WARNING:

Refer to Road Test Warning .

1. Ignition ON.
2. Verify DTC P0502 or P0503 is not set.
    1. **If DTC P0502 or P0503 is set**

       Refer to DTC P0502 or P0503 (LGX, LT1) DTC P0502 or P0503 (LTG) .
    1. **If DTC P0502 or P0503 is not set**
3. Engine running, clutch pedal applied, place the gear shift lever in Gear 1.
4. Release the clutch pedal.
5. Verify the vehicle moves without any mechanical clutch symptoms.
    1. **If mechanical clutch symptoms exist**

       Refer to Symptoms - Clutch .
    1. **If no mechanical clutch symptoms exist**
6. Ignition ON, engine OFF.
7. Verify the scan tool Gear Shift Position Sensor parameter displays the following duty cycle as the gear shift lever is moved through each gear position:

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1. 10-31% duty cycle for Gear 1 and Gear 2
2. 28-53% duty cycle for Gear 3, Neutral 3-4 Gate, and Gear 4
3. 44-73% duty cycle for Gear 5 and Gear 6
4. 60-90% duty cycle for Reverse Gear

1. **If the Gear Shift Position Sensor parameter is not within the specified range**

   Refer to Circuit/System Testing.

1. **If the Gear Shift Position Sensor parameter is within the specified range**

8. Verify the scan tool Gate Select Position Sensor parameter displays the following duty cycle as the gear shift lever is moved to each gear position:
   1. 73-87% duty cycle for Gear 1, Gear 3, Gear 5, and Reverse Gear
   2. 48-60% duty cycle for Neutral 3-4 Gate
   3. 25-34% duty cycle for Gear 2, Gear 4, and Gear 6

   1. **If the Gate Select Position Sensor parameter is not within the specified range**

      Refer to Circuit/System Testing.

   1. **If the Gate Select Position Sensor parameter is within the specified range**

9. Operate the vehicle within the conditions for running the DTC to verify the DTC does not set. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records.

   1. **If the DTC sets**

      Refer to Circuit/System Testing.

   1. **If the DTC does not set**

10. All OK.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C9: GEAR POSITION SENSOR - GEAR RATIO NOT PLAUSIBLE > CIRCUIT/SYSTEM TESTING

> *WARNING:*
>
> *Refer to Hot Exhaust System Warning .*

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B227 Gear Position Sensor. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 4 and ground.

1. **If 10 Ω or greater**
    1. Disconnect the X3 harness connector at the K20 Engine Control Module.
    2. Test for less than 2 Ω in the circuit end to end.
        1. If 2 Ω or greater, repair the open/high resistance in the circuit.
        2. If less than 2 Ω, replace the K20 Engine Control Module.
1. **If less than 10 Ω**

3. Ignition ON.
4. Test for 4.8-5.2 V between the 5 V reference circuit terminal 1 and ground.
    1. **If less than 4.8 V**
        1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the 5 V reference circuit and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance
        3. Test for less than 2 Ω in the 5 V reference circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K20 Engine Control Module.
    1. **If greater than 5.2 V**
        1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module, Ignition ON.
        2. Test for less than 1 V between the 5 V reference circuit and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            2. If less than 1 V, replace the K20 Engine Control Module.
    1. **If between 4.8-5.2 V**
5. Verify the scan tool Gear Shift Position Sensor parameter duty cycle is greater than 99%.
    1. **If 99% or less**
        1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the signal circuit 1 terminal 3 and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance, test or replace the K20 Engine Control Module.

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1. **If greater than 99%**

6. Install a 3 A fused jumper wire between the signal circuit 1 terminal 3 and ground.
7. Verify the scan tool Gear Shift Position Sensor parameter duty cycle is less than 1%.
    1. **If 1% or greater**
        1. Ignition OFF, remove the jumper wire, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.
        2. Test for less than 1 V between the signal circuit 1 terminal 3 and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            1. If less than 1 V
        3. Ignition OFF.
        4. Test for less than 2 Ω in the signal circuit 1 end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, test or replace the K20 Engine Control Module.
    1. **If less than 1%**
8. Verify the scan tool Gate Select Position Sensor parameter duty cycle is greater than 99%.
    1. **If 99% or less**
        1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the signal circuit 2 terminal 2 and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance, test or replace the K20 Engine Control Module.
    1. **If greater than 99%**
9. Install a 3 A fused jumper wire between the signal circuit 2 terminal 2 and ground.
10. Verify the scan tool Gate Select Position Sensor parameter duty cycle is less than 1%.
    1. **If 1% or greater**
        1. Ignition OFF, remove the jumper wire, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.
        2. Test for less than 1 V between the signal circuit 2 terminal 2 and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            1. If less than 1 V
        3. Ignition OFF.

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4. Test for less than 2 Ω in the signal circuit 2 end to end.
    1. If 2 Ω or greater, repair the open/high resistance in the circuit.
    2. If less than 2 Ω, test or replace the K20 Engine Control Module.

1. **If less than 1%**

> *NOTE:*
>
> *The gear position sensor magnet can be viewed when the gear position sensor is removed from the transmission extension housing.*

11. Verify the gear position sensor magnet is undamaged and fastened in proper position on the shift shaft.
    1. **If the gear position sensor magnet is damaged or out of position**

       Replace the gear position sensor magnet.

    1. **If the gear position sensor magnet is undamaged and fastened properly on the shift shaft**
12. Replace the B227 Gear Position Sensor.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C9: GEAR POSITION SENSOR - GEAR RATIO NOT PLAUSIBLE > COMPONENT TESTING

> *WARNING:*
>
> *Refer to Hot Exhaust System Warning .*

Dynamic Test

1. Ignition OFF, disconnect the harness connector at the B227 Gear Position Sensor.
2. Connect the test leads of the J-38522-A vehicle signal generator as follows:
    1. Red test lead to the signal circuit 1 terminal 3 at the B227 Gear Position Sensor wire harness connector.
    2. Black test lead to ground at the transmission case.
    3. Double black power and ground lead wire to B+ and ground.
3. Set and adjust the J-38522-A vehicle signal generator to the following switch positions:
    1. Signal switch to 5 V.
    2. Frequency switch to 600 Hz.

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3. Duty cycle switch to 10%.

4. Ignition ON.

5. Verify the scan tool Gear Shift Position Sensor parameter duty cycle is 10% ± 2%.

6. Set duty cycle switch to 20%, then 30% and so on through 90%.

7. Verify the scan tool Gear Shift Position Sensor parameter duty cycle matches the duty cycle for each switch position on the vehicle signal generator ± 2%.

    1. **If the Gear Shift Position Sensor parameter does not match vehicle signal generator duty cycle ± 2%**

       Replace the K20 Engine Control Module.

    1. **If the Gear Shift Position Sensor parameter matches the vehicle signal generator duty cycle**

8. Repeat the above test, changing only the J-38522-A vehicle signal generator Red test lead to the signal circuit 2 terminal 2 at the B227 Gear Position Sensor wire harness connector.

9. Verify the scan tool Gate Select Position Sensor parameter duty cycle matches the duty cycle for each switch position on the vehicle signal generator ± 2%.

    1. **If the Gate Select Position Sensor parameter does not match vehicle signal generator duty cycle ± 2%**

       Replace the K20 Engine Control Module.

    1. **If the Gate Select Position Sensor parameter does match vehicle signal generator duty cycle**

10. All OK.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18C9: GEAR POSITION SENSOR - GEAR RATIO NOT PLAUSIBLE > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Shift Fork Position Sensor Replacement
- Disassembled Views (M13) Disassembled Views (MM6)
- Transmission Disassemble (M13 - LGX w/L4Q) Transmission Disassemble (MM6) Transmission Disassemble (M13 - LGX w/o Y4Q, LTG)
- Transmission Assemble (M13 - LGX w/Y4Q) Transmission Assemble (MM6) Transmission Assemble (M13 - LGX w/o L4Q, LTG)
- Control Module References for ECM replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18CA: GEAR POSITION

SENSOR NOT LEARNED > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18CA: GEAR POSITION SENSOR NOT LEARNED > DTC DESCRIPTOR

DTC P18CA

Gear Position Sensor Not Learned

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18CA: GEAR POSITION SENSOR NOT LEARNED > CIRCUIT/SYSTEM DESCRIPTION

The gear position sensor is a switching transistor mounted to the transmission extension housing. The four wire sensor interfaces directly with the Engine Control Module (ECM). The ECM supplies 5 V to the gear position sensor on a 5 V reference circuit, and also provides a ground path on a low reference circuit. The sensor provides a Pulse Width Modulated (PWM) duty cycle to the ECM on two signal circuits that is proportional to the linear and radial position of the corresponding magnet assembly mounted to the shift shaft. The vehicle uses the gear position sensor information primarily for Active Rev Matching and Active Fuel Management.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18CA: GEAR POSITION SENSOR NOT LEARNED > CONDITIONS FOR RUNNING THE DTC

Ignition ON.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18CA: GEAR POSITION SENSOR NOT LEARNED > CONDITIONS FOR SETTING THE DTC

Gear position sensor not learned.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18CA: GEAR POSITION SENSOR NOT LEARNED > ACTION TAKEN WHEN THE DTC SETS

- P18CA is a Type A DTC.
- ECM inhibits Active Rev Matching.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18CA: GEAR POSITION SENSOR NOT LEARNED > CONDITIONS FOR CLEARING THE DTC

P18CA is a Type A DTC.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18CA: GEAR POSITION SENSOR NOT LEARNED > REFERENCE INFORMATION

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Manual Transmission Schematics

Connector End View Reference

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- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

K20 Engine Control Module: Scan Tool Information

Special Tools

J-38522-A Vehicle Signal Generator

For equivalent regional tools, refer to Special Tools (MM6) Special Tools (M13) .

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18CA: GEAR POSITION SENSOR NOT LEARNED > CIRCUIT/SYSTEM VERIFICATION

1. Perform the gear position sensor learn procedure.

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1. **If the gear position sensor learn was not successful**

   Refer to Circuit/System Testing.

1. **If the gear position sensor learn was successful**

2. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18CA: GEAR POSITION SENSOR NOT LEARNED > CIRCUIT/SYSTEM TESTING

> *WARNING:*
>
> *Refer to Hot Exhaust System Warning .*

> *NOTE:*
>
> *You must perform the Circuit/System Verification first.*

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B227 Gear Position Sensor. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 4 and ground.
    1. **If 10 Ω or greater**
        1. Disconnect the X3 harness connector at the K20 Engine Control Module.
        2. Test for less than 2 Ω in the circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K20 Engine Control Module.
    1. **If less than 10 Ω**
3. Ignition ON.
4. Test for 4.8-5.2 V between the 5 V reference circuit terminal 1 and ground.
    1. **If less than 4.8 V**
        1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the 5 V reference circuit and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance

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3. Test for less than 2 Ω in the 5 V reference circuit end to end.
    1. If 2 Ω or greater, repair the open/high resistance in the circuit.
    2. If less than 2 Ω, replace the K20 Engine Control Module.

1. **If greater than 5.2 V**
    1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module, Ignition ON.
    2. Test for less than 1 V between the 5 V reference circuit and ground.
        1. If 1 V or greater, repair the short to voltage on the circuit.
        2. If less than 1 V, replace the K20 Engine Control Module.

1. **If between 4.8-5.2 V**

5. Verify the scan tool Gear Shift Position Sensor parameter duty cycle is greater than 99%.
    1. **If 99% or less**
        1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the signal circuit 1 terminal 3 and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance, test or replace the K20 Engine Control Module.

    1. **If greater than 99%**

6. Install a 3 A fused jumper wire between the signal circuit 1 terminal 3 and ground.
7. Verify the scan tool Gear Shift Position Sensor parameter duty cycle is less than 1%.
    1. **If 1% or greater**
        1. Ignition OFF, remove the jumper wire, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.
        2. Test for less than 1 V between the signal circuit 1 terminal 3 and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            1. If less than 1 V
        3. Ignition OFF.
        4. Test for less than 2 Ω in the signal circuit 1 end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, test or replace the K20 Engine Control Module.

    1. **If less than 1%**

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8. Verify the scan tool Gate Select Position Sensor parameter duty cycle is greater than 99%.
    1. **If 99% or less**
        1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
        2. Test for infinite resistance between the signal circuit 2 terminal 2 and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance, test or replace the K20 Engine Control Module.
    1. **If greater than 99%**
9. Install a 3 A fused jumper wire between the signal circuit 2 terminal 2 and ground.
10. Verify the scan tool Gate Select Position Sensor parameter duty cycle is less than 1%.
    1. **If 1% or greater**
        1. Ignition OFF, remove the jumper wire, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.
        2. Test for less than 1 V between the signal circuit 2 terminal 2 and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            1. If less than 1 V
        3. Ignition OFF.
        4. Test for less than 2 Ω in the signal circuit 2 end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, test or replace the K20 Engine Control Module.
    1. **If less than 1%**

> *NOTE:*
>
> *The gear position sensor magnet can be viewed when the gear position sensor is removed from the transmission extension housing.*

11. Verify the gear position sensor magnet is undamaged and fastened in proper position on the shift shaft.
    1. **If the gear position sensor magnet is damaged or out of position**

       Replace the gear position sensor magnet.
    1. **If the gear position sensor magnet is undamaged and fastened properly on the shift shaft**
12. Replace the B227 Gear Position Sensor.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18CA: GEAR POSITION SENSOR NOT LEARNED > COMPONENT TESTING

WARNING:

Refer to Hot Exhaust System Warning .

Dynamic Test

1. Ignition OFF, disconnect the harness connector at the B227 Gear Position Sensor.
2. Connect the test leads of the J-38522-A vehicle signal generator as follows:
    1. Red test lead to the signal circuit 1 terminal 3 at the B227 Gear Position Sensor wire harness connector.
    2. Black test lead to ground at the transmission case.
    3. Double black power and ground lead wire to B+ and ground.
3. Set and adjust the J-38522-A vehicle signal generator to the following switch positions:
    1. Signal switch to 5 V.
    2. Frequency switch to 600 Hz.
    3. Duty cycle switch to 10%.
4. Ignition ON.
5. Verify the scan tool Gear Shift Position Sensor parameter duty cycle is 10% ± 2%.
6. Set duty cycle switch to 20%, then 30% and so on through 90%.
7. Verify the scan tool Gear Shift Position Sensor parameter duty cycle matches the duty cycle for each switch position on the vehicle signal generator ± 2%.
    1. **If the Gear Shift Position Sensor parameter does not match vehicle signal generator duty cycle ± 2%**

        Replace the K20 Engine Control Module.

    1. **If the Gear Shift Position Sensor parameter matches the vehicle signal generator duty cycle**
8. Repeat the above test, changing only the J-38522-A vehicle signal generator Red test lead to the signal circuit 2 terminal 2 at the B227 Gear Position Sensor wire harness connector.
9. Verify the scan tool Gate Select Position Sensor parameter duty cycle matches the duty cycle for each switch position on the vehicle signal generator ± 2%.
    1. **If the Gate Select Position Sensor parameter does not match vehicle signal**

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generator duty cycle ± 2%

Replace the K20 Engine Control Module.

1. **If the Gate Select Position Sensor parameter does match vehicle signal generator duty cycle**

10. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P18CA: GEAR POSITION SENSOR NOT LEARNED > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Shift Fork Position Sensor Replacement
- Gear Position Sensor Learn
- Disassembled Views (M13) Disassembled Views (MM6)
- Transmission Disassemble (M13 - LGX w/L4Q) Transmission Disassemble (MM6) Transmission Disassemble (M13 - LGX w/o Y4Q, LTG)
- Transmission Assemble (M13 - LGX w/Y4Q) Transmission Assemble (MM6) Transmission Assemble (M13 - LGX w/o L4Q, LTG)
- Control Module References for replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P17A2: EXCESSIVE CLUTCH SLIPPAGE - MANUAL TRANSMISSION > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P17A2: EXCESSIVE CLUTCH SLIPPAGE - MANUAL TRANSMISSION > DTC DESCRIPTORS

DTC P17A2

Excessive Clutch Slippage - Manual Transmission

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P17A2: EXCESSIVE CLUTCH SLIPPAGE - MANUAL TRANSMISSION > CIRCUIT/SYSTEM DESCRIPTION

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The engine control module (ECM) uses input information including clutch pedal position, vehicle speed, engine speed and engine torque for detection of an excessive clutch slipping condition.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P17A2: EXCESSIVE CLUTCH SLIPPAGE - MANUAL TRANSMISSION > CONDITIONS FOR RUNNING THE DTC

- DTC P0010, P0011, P0013, P0014, P0016, P0017, P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0222, P0223, P0315, P0335, P0336, P0502, P0651, or P2135 is not set.
- Engine Torque is greater than 80 N.m (59 lb ft)
- Ignition voltage is 11-18 V.
- Clutch pedal position is less than 10%.
- Vehicle Speed is greater than 20 km/h (12 mph).
- P17A2 runs continuously when the above conditions are met.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P17A2: EXCESSIVE CLUTCH SLIPPAGE - MANUAL TRANSMISSION > CONDITIONS FOR SETTING THE DTC

The ECM detects excessive slipping of the clutch system if the measured gear ratio is greater than 108% of the actual gear ratio, and accumulated slip time is greater than 5 s within 10 km (6 mi).

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P17A2: EXCESSIVE CLUTCH SLIPPAGE - MANUAL TRANSMISSION > ACTION TAKEN WHEN THE DTC SETS

- P17A2 is a Type C DTC.
- ECM will momentarily reduce engine torque.
- Driver information center (DIC) messages are displayed to alert the driver that engine performance has been reduced, use of the clutch needs to be reduced, and to service the transmission.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P17A2: EXCESSIVE CLUTCH SLIPPAGE - MANUAL TRANSMISSION > CONDITIONS FOR CLEARING THE MIL/DTC

P17A2 is a Type C DTC.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P17A2: EXCESSIVE CLUTCH SLIPPAGE - MANUAL TRANSMISSION > DIAGNOSTIC AIDS

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- Excessive slipping of the clutch can occur if the system is overheated for example by vehicle launches with high engine speed and torque, an abusive customer behavior, or a defective/worn clutch system.
- The scan tool Distance Since Excessive Clutch Slip Detected parameter may aid in determining conditions of the last clutch slip event.
- A vehicle speed sensor/transmission output shaft speed sensor fault may cause DTC P17A2 to set.
- A vehicle speed sensor rotor that is loose on the output shaft may cause DTC P17A2 to set.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P17A2: EXCESSIVE CLUTCH SLIPPAGE - MANUAL TRANSMISSION > REFERENCE INFORMATION

Schematic Reference

- Manual Transmission Schematics
- Engine Controls Schematics

Connector End View Reference

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- Manual Transmission Protection Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

K20 Engine Control Module: Scan Tool Information for scan tool information

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P17A2: EXCESSIVE CLUTCH SLIPPAGE - MANUAL TRANSMISSION > CIRCUIT/SYSTEM VERIFICATION

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1. Ignition ON.
2. Verify that no other DTCs are set.
    1. **If any other DTCs are set**

       Refer to Diagnostic Trouble Code (DTC) List - Vehicle .

    1. **If no other DTCs are set**
3. Verify the scan tool Total Excessive Clutch Slip Time parameter is 0 s.
    1. **If Total Excessive Clutch Slip Time is more than 0 s**

       Refer to Component Testing.

    1. **If Total Excessive Clutch Slip Time is 0 s**

> *WARNING:*
>
> *Refer to Road Test Warning .*

4.
5. Test drive the vehicle, shifting the transmission through all gear ranges, ensuring the clutch pedal is fully released after each shift.
6. Verify the scan tool Total Excessive Clutch Slip Time parameter remains 0 s.
    1. **If Total Excessive Clutch Slip Time is more than 0 s**

       Refer to Component Testing.

    1. **If Total Excessive Clutch Slip Time is 0 s**
7. Operate the vehicle within the conditions for running the DTC to verify the DTC does not set. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
    1. **If the DTC sets**

       Refer to Component Testing.

    1. **If the DTC does not set**
8. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P17A2: EXCESSIVE CLUTCH SLIPPAGE - MANUAL TRANSMISSION > COMPONENT TESTING

Refer to Symptoms - Clutch .

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC P17A2: EXCESSIVE CLUTCH SLIPPAGE - MANUAL TRANSMISSION > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

DIAGNOSTIC INFORMATION AND PROCEDURES > CLUTCH PEDAL POSITION SENSOR LEARN

NOTE:

The clutch pedal position (CPP) sensor learn procedure is required when the following service procedures have been performed regardless of whether DTC P080A is set:

- *An engine control module (ECM) replacement*
- *A CPP sensor replacement*
- *Any repairs which affect the CPP sensor relationship*

1. Perform each step listed below:
    1. Set parking brake
    2. Block drive wheels

    NOTE:

    For vehicles equipped with the push button ignition switch, ensure the power mode is RUN.
2. Engine OFF, with the ignition ON.
3. Verify no other DTCs are set, except DTC P080A.
    1. **If other DTCs are set**

        Refer to Diagnostic Trouble Code (DTC) List - Vehicle .
    1. **If no other DTCs are set**
4. Using a scan tool, select Clutch Pedal Position Sensor Learn.

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NOTE:

The CPP sensor learn procedure cannot be performed more than once per ignition cycle.

5. Fully depress and hold the clutch pedal and select Continue.
6. Select Learn.
    1. **If the scan tool CPP Learn Status is Unsuccessful - Sensor Detected Movement**

       Verify vehicle is stopped with the parking brake set, and repeat the procedure.

    1. **If the scan tool CPP Learn Status is Unsuccessful - Sensor Low Voltage or Unsuccessful - Sensor High Voltage**

       Refer to DTC P0806-P0808 .

    1. **If the scan tool CPP Learn Status is Not Learned**

       Refer to DTC P080A .

    1. **If the scan tool CPP Learn Status is Complete or Performed Successfully**
7. Verify DTC P080A ran and passed this ignition cycle.
    1. **If the scan tool indicates DTC P080A failed or did not run this ignition**

       Refer to DTC P080A .

    1. **If the scan tool indicates DTC P080A ran and passed this ignition cycle**
8. Turn OFF the ignition for 30 seconds after the learn procedure has successfully completed in order to store the CPP sensor variation values in ECM history.

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DIAGNOSTIC INFORMATION AND PROCEDURES > GEAR POSITION SENSOR LEARN

NOTE:

The gear position sensor learn procedure is required after any of the conditions listed below regardless of whether DTC P18CA is set or not:

The ECM must be powered down and go to sleep for at least 2 minutes before the new learned values will take effect.

- *An engine control module (ECM) replacement*
- *A gear position sensor replacement*
- *A gear position sensor magnet replacement*
- *Any repairs which affect the gear position sensor relationship, including internal*

transmission repairs or full transmission replacement

1. Ignition ON.
2. Verify the Power Mode parameter is Run, using a scan tool.
3. Verify no DTCs are set, except DTC P18CA.
    1. **If other DTCs are set**

       Refer to Diagnostic Trouble Code (DTC) List - Vehicle .

    1. **If no other DTCs are set**
4. Perform each step listed below:
    1. Set parking brake
    2. Block drive wheels
5. Place the transmission gear shifter in the Neutral 3-4 gate position.

    NOTE:

    When starting the learn process a timer in the Engine Control Module is activated. The learn process should be completed within 2 min.

6. With the scan tool, select Gear Position Sensor Learn, and select Learn.
7. The scan tool Gear Position Sensor Learn Status parameter should change from Not Learned to Stage 1.
8. Place the transmission gear shifter in the Neutral 1-2 gate position or the Neutral 5-6 gate position.
9. The scan tool Gear Position Sensor Learn Status parameter should change from Stage 1 to Stage 2.
10. Return the transmission gear shifter to the Neutral 3-4 gate position.
11. The scan tool Gear Position Sensor Learn Status parameter should change from Stage 2 to Stage 3.
12. The scan tool Gear Position Sensor Learn Status parameter should change from Stage 3 to Complete if the learn was successful. The scan tool Gear Position Sensor Learn Status parameter will display Abort if the process was not successful and the Gear Position Sensor Learn Abort Reason parameter will give the reason.
    1. **If the gear position sensor learn was not successful**

       Repeat the gear position sensor learn procedure, or refer to DTC P18CA for further diagnosis.

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1. **If the gear position sensor learn was successful**

13. Clear DTCs with a scan tool.

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - MANUAL TRANSMISSION (MM6) > STRATEGY BASED DIAGNOSTICS

Review the system operations in order to familiarize yourself with the system functions. Refer to Manual Transmission Description and Operation (MM6) .

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - MANUAL TRANSMISSION (MM6) > VISUAL/PHYSICAL INSPECTION

- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the manual transmission for the correct fluid level.
- Inspect the manual transmission for fluid leaks.
- Inspect the manual transmission for broken or loose transmission mounts.

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - MANUAL TRANSMISSION (MM6) > INTERMITTENT

Test the vehicle under the same conditions that the customer reported in order to verify the system is operating properly.

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - MANUAL TRANSMISSION (MM6) > SYMPTOM LIST

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- Transmission Shifts Hard (MM6)
- Transmission Gear Clash When Shifting Gears
- Transmission Noisy (MM6)
- Transmission Jumps Out of Gear (MM6)
- Transmission Does Not Shift into One Gear
- Transmission Locked in One Gear
- Transmission Clunk on Acceleration or Deceleration

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- Transmission Fluid Leak Diagnosis

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - MANUAL TRANSMISSION (M13) > STRATEGY BASED DIAGNOSTICS

Review the system operations in order to familiarize yourself with the system functions. Refer to Manual Transmission Description and Operation (M13) .

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - MANUAL TRANSMISSION (M13) > VISUAL/PHYSICAL INSPECTION

- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the manual transmission for the correct fluid level.
- Inspect the manual transmission for fluid leaks.
- Inspect the manual transmission for broken or loose transmission mounts.

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - MANUAL TRANSMISSION (M13) > INTERMITTENT

Test the vehicle under the same conditions that the customer reported in order to verify the system is operating properly.

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - MANUAL TRANSMISSION (M13) > SYMPTOM LIST

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- Transmission Shifts Hard (M13)
- Transmission Gear Clash When Shifting Gears
- Transmission Noisy (M13)
- Transmission Jumps Out of Gear (M13)
- Transmission Does Not Shift into One Gear
- Transmission Locked in One Gear
- Transmission Clunk on Acceleration or Deceleration
- Transmission Fluid Leak Diagnosis

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DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION SHIFTS HARD (MM6) > DIAGNOSTIC AIDS

An intermittent hard shift may be caused after installation of a new clutch actuator. With a new clutch actuator, the annular seal may not be in the forward position and not allow full clutch release. With a self adjusting clutch, the clutch may be between adjustments and not allow full clutch release. This might be felt by a low clutch pedal load. After several applications, the clutch may adjust properly to give the proper pedal feel.

DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION SHIFTS HARD (MM6) > TEST DESCRIPTION

The numbers below refer to the step numbers on the diagnostic table.

3

A static shift test is performed by shifting into all of the gear positions with the engine not operating. While performing the test, one should note how the shift lever movement is felt. Also while shifting from one gear to the other, feel for binding in the shift rails. You should be able to feel the detent plungers operating when coming out of a gear and when going into a gear.

5

A dynamic shift test is performed by shifting into one of the gear positions with the engine operating. Test for the correct mesh of the synchronizers and for the clutch releasing correctly. When shifting into a gear, and shifting out of a gear, you should feel the shift detent plungers operating, and the synchronizers sleeve moving freely.

6

The transmission uses a transmission fluid that allows proper synchronizer operation. The incorrect fluid may cause hard shifting from varnish build up, or from not enough lubrication for proper synchronizer operation. Only use the proper transmission fluid.

Step	Action	Yes	No
DEFINITION: The transmission does not shift smoothly or without difficulty from one gear to the other.			
1	Did you review the Symptoms - Manual Transmission (MM6) operations and perform the necessary inspections?	Go to **Step 2**	Go to Symptoms - Manual Transmission (MM6)
2	Inspect the clutch system for proper operation. Refer to Clutch System Description and Operation . Did you find or repair the condition?	Go to **Step 11**	Go to **Step 3**
3	1. Perform a static shift test on the transmission.	Go to **Step 7**	Go to **Step 4**

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	2. Test for the following conditions: 1. Blockage preventing full shift lever movement 2. Excessive movement in the shift lever 3. Binding in the shift lever 4. Detent plungers or shift rails binding 5. Shift linkage binding 6. Shift linkage proper adjustment Are you able to shift into all gears?		
4	Remove the shift control shift closeout boot and foam isolator. Refer to Transmission Control Lever Knob Replacement . Inspect for the following: • Loose mounting • Foreign debris • Interference to foam isolator Did you find and repair the condition?	Go to **Step 11**	Go to **Step 5**
5	1. Perform a dynamic shift test on the transmission. 2. Test for the following conditions: 1. Detent plungers or shift rails binding 2. Synchronizer sleeve binding 3. Gear clash into only one gear 4. Gear clash into all gears Did the transmission shift hard into all gears?	Go to **Step 6**	Go to **Step 10**
6	Inspect the transmission for the correct fluid level and the correct type of transmission fluid. Refer to Transmission Fluid Drain and Fill (MM6) , and Approximate Fluid Capacities (MM6) . Is the transmission at the correct level and proper fluid being used?	Go to **Step 8**	Go to **Step 7**
7	Drain and fill the transmission with the correct type fluid. Refer to Transmission Fluid Drain and Fill (MM6) . Did you find and repair the condition?	Go to **Step 11**	Go to **Step 8**

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8	1. Remove the transmission. Refer to Transmission Replacement (MM6 with LT1 Engine) . 2. Inspect the clutch pressure plate and/or clutch driven plate. Is the clutch pressure plate and/or clutch driven plate worn or faulty?	Go to **Step 9**	Go to **Step 10**
9	Replace the clutch assembly. Refer to Clutch Assembly Replacement (MM6 Transmission) . Did you find and repair the condition?	Go to **Step 11**	Go to **Step 10**
10	1. Disassemble the transmission. Refer to Transmission Disassemble (MM6) . 2. Inspect the transmission for the following faulty components in the gear that is hard to shift or clashing: 1. Excessive synchronizers blocking ring to gear clearance 2. Synchronizer hub external splines worn or damaged 3. Excessive axial clearance in the speed gear 4. Mainshaft to speed gear bearing or journal worn 5. Shift rail and the internal shift control lever components for wear or damage 3. Replace worn or damaged components as necessary. Did you find and repair the condition?	Go to **Step 10**	Go to Diagnostic Aids
11	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 1**

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DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION SHIFTS HARD (M13) > DIAGNOSTIC AIDS

An intermittent hard shift may be caused after installation of a new clutch actuator. With a new clutch actuator, the annular seal may not be in the forward position and not allow full clutch release. With a self adjusting clutch, the clutch may be between adjustments and not allow full clutch release. This might be felt by a low clutch pedal load. After several applications, the clutch may adjust properly to give the proper pedal feel.

DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION SHIFTS HARD (M13) > TEST DESCRIPTION

The numbers below refer to the step numbers on the diagnostic table.

3

A static shift test is performed by shifting into all of the gear positions with the engine not operating. While performing the test, one should note how the shift lever movement is felt. Also while shifting from one gear to the other, feel for binding in the shift rails. You should be able to feel the detent plungers operating when coming out of a gear and when going into a gear.

5

A dynamic shift test is performed by shifting into one of the gear positions with the engine operating. Test for the correct mesh of the synchronizers and for the clutch releasing correctly. When shifting into a gear, and shifting out of a gear, you should feel the shift detent plungers operating, and the synchronizers sleeve moving freely.

6

The transmission uses a transmission fluid that allows proper synchronizer operation. The incorrect fluid may cause hard shifting from varnish build up, or from not enough lubrication for proper synchronizer operation. Only use the proper transmission fluid.

Step	Action	Yes	No
DEFINITION: The transmission does not shift smoothly or without difficulty from one gear to the other.			
1	Did you review the Symptoms - Manual Transmission (M13) operations and perform the necessary inspections?	Go to **Step 2**	Go to Symptoms - Manual Transmission (M13)
2	Inspect the clutch system for proper operation. Refer to Clutch System Description and Operation . Did you find or repair the condition?	Go to **Step 11**	Go to **Step 3**
3	1. Perform a static shift test on the transmission. 2. Test for the following conditions: 1. Blockage preventing full shift lever movement 2. Excessive movement in the shift lever 3. Binding in the shift lever 4. Detent plungers or shift rails binding 5. Shift linkage binding	Go to **Step 7**	Go to **Step 4**

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	6. Shift linkage proper adjustment Are you able to shift into all gears?		
4	Remove the shift control shift closeout boot and foam isolator. Refer to Transmission Control Lever Knob Replacement . Inspect for the following: • Loose mounting • Foreign debris • Interference to foam isolator Did you find and repair the condition?	Go to **Step 11**	Go to **Step 5**
5	1. Perform a dynamic shift test on the transmission. 2. Test for the following conditions: 1. Detent plungers or shift rails binding 2. Synchronizer sleeve binding 3. Gear clash into only one gear 4. Gear clash into all gears Did the transmission shift hard into all gears?	Go to **Step 6**	Go to **Step 10**
6	Inspect the transmission for the correct fluid level and the correct type of transmission fluid. Refer to Transmission Fluid Drain and Fill (M13 Without Y4Q) , and Approximate Fluid Capacities (M13) . Is the transmission at the correct level and proper fluid being used?	Go to **Step 8**	Go to **Step 7**
7	Drain and fill the transmission with the correct type fluid. Refer to Transmission Fluid Drain and Fill (M13 Without Y4Q) . Did you find and repair the condition?	Go to **Step 11**	Go to **Step 8**
8	1. Remove the transmission. Refer to Transmission Replacement (M13 with LGX Engine) Transmission Replacement (M13 with LTG Engine) . 2. Inspect the clutch pressure plate and/or clutch driven plate. Is the clutch pressure plate and/or clutch driven plate worn or faulty?	Go to **Step 9**	Go to **Step 10**

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9	Replace the clutch assembly. Refer to Clutch Assembly Replacement (M13 Transmission) . Did you find and repair the condition?	Go to **Step 11**	Go to **Step 10**
10	1. Disassemble the transmission. Refer to Transmission Disassemble (M13 - LGX w/L4Q) Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) . 2. Inspect the transmission for the following faulty components in the gear that is hard to shift or clashing: 1. Excessive synchronizers blocking ring to gear clearance 2. Synchronizer hub external splines worn or damaged 3. Excessive axial clearance in the speed gear 4. Mainshaft to speed gear bearing or journal worn 5. Shift rail and the internal shift control lever components for wear or damage 3. Replace worn or damaged components as necessary. Did you find and repair the condition?	Go to **Step 10**	Go to Diagnostic Aids
11	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 1**

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DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION GEAR CLASH WHEN SHIFTING GEARS > DIAGNOSTIC AIDS

Gear clashing may be caused by shifting above 5000 RPM or not fully depressing the clutch pedal. If gear clashing is occurring in more than one gear, the clutch may not be releasing properly for proper synchronizer operation.

DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION GEAR CLASH WHEN SHIFTING GEARS > TEST DESCRIPTION

The numbers below refer to the step numbers on the diagnostic table.

2

This step tests for the proper release of the clutch. If the clutch reserve is not correct, the mainshaft gears may be turning, causing the gear to clash.

5

This step inspects for the proper transmission fluid. The proper fluid is required for the correct lubrication of the synchronizers.

7

A static shift test is performed by shifting into all of the gear positions with the engine not operating. While performing the test, you should note how the shift lever movement feels. Also, while shifting from one gear to another, feel for binding in the shift rails. You should be able to feel the detent plungers operating when coming out of a gear and going into a gear. Excessive play in the gear shift lever may prevent the shift forks from fully engaging the synchronizer.

9

A dynamic shift test is performed by shifting into all of the gear positions with the engine operating at idle. Test for the correct mesh of the synchronizers and for the clutch releasing correctly. Move the shift lever and feel for the synchronizer sleeve to just release from the gear then let up on the clutch pedal. Press the clutch pedal and move the shift lever to engage that gear again. If the transmission shifts back into the gear without clashing, the clutch is releasing correctly and the synchronizer is operating. If clashing occurs, test another gear. If all gears clash, the clutch is not releasing correctly.

Step	Action	Yes	No
DEFINITION: Noise from the transmission when shifting gears. A grinding or grating sound when the synchronizer sleeve is engaging with the selector teeth on the speed gear. A suspected internal transmission condition if the noise is only happens in one gear.			
1	Did you review the Symptoms - Manual Transmission (MM6) Symptoms - Manual Transmission (M13) and perform the necessary inspections?	Go to **Step 2**	Go to Symptoms - Manual Transmission (MM6) Symptoms - Manual Transmission (M13)
2	With the engine operating at idle, does the transmission shift from neutral to any gear without the vehicle lurching or gear clashing?	Go to **Step 5**	Go to **Step 3**
3	1. Check clutch fluid for proper level. Refer to Transmission Fluid Level Inspection (MM6) Transmission Fluid Level Inspection (M13 Without Y4Q) . 2. Inspect for proper clutch operation. Refer to Symptoms - Clutch . Does the clutch operate properly?	Go to **Step 5**	Go to **Step 4**
4	Repair the clutch system. Did you find and repair the condition?	Go to **Step 11**	Go to **Step 5**

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5	Inspect for the correct transmission fluid level and for the correct fluid. Refer to Transmission Fluid Drain and Fill (M13 Without Y4Q) Transmission Fluid Drain and Fill (MM6) . Is the transmission fluid level correct and at the correct level?	Go to **Step 7**	Go to **Step 6**
6	Fill the transmission to the correct level or change the fluid if it is the incorrect type. Does the transmission still have gear clash?	Go to **Step 7**	Go to **Step 11**
7	1. Perform a static shift test on the transmission. 2. Test for the following conditions: 1. Blockage preventing full shift lever movement 2. Excessive movement in the shift lever 3. Binding in the shift lever 4. Detent plungers or shift rails binding 5. Shift linkage binding 6. Shift linkage proper adjustment Did the transmission shift smoothly into the gear that is clashing?	Go to **Step 9**	Go to **Step 8**
8	1. Remove the shift lever. 2. Inspect for damaged or worn components. Refer to Shift Control Assembly Replacement (M13) Shift Control Assembly Replacement (MM6) . Did you find and repair the condition?	Go to **Step 11**	Go to **Step 9**
9	1. Perform a dynamic shift test on the transmission. 2. Test for the following conditions: 1. Detent plungers or shift rails binding 2. Synchronizer sleeve binding 3. Gear clashing in more than the	Go to Transmission Shifts Hard (MM6) Transmission Shifts Hard (M13)	Go to **Step 10**

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	suspected gear Is the transmission hard to shift into all gears?		
10	1. Disassemble the transmission. Refer to Transmission Disassemble (M13 - LGX w/L4Q) Transmission Disassemble (MM6) Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) . 2. Inspect the following transmission components for the suspect gear that is clashing: 1. Excessive synchronizer blocking ring to gear clearance 2. Synchronizer sleeve to hub lash or rock excessive 3. Excessive axial clearance in the speed gear 4. Mainshaft to speed gear bearing or journal worn 5. Shift fork worn or damaged 6. Internal shift control worn or damaged 7. Mainshaft bearing worn or damaged 8. Input gear bearing or pilot bearing worn Did you find and repair the condition?	Go to **Step 11**	Go to Diagnostic Aids
11	Operate the system and verify the repair. Did you correct the condition?	System OK	Go to **Step 1**

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DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION NOISY (MM6) > DIAGNOSTIC AIDS

If the transmission is in neutral with the engine operating, and a whirling noise - a neutral gear rattle is heard outside the vehicle, the sound is a normal condition.

DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION NOISY (MM6) >

TEST DESCRIPTION

The numbers below refer to the step numbers on the diagnostic table.

5

This step inspects for the correct transmission fluid level. If the transmission fluid level is excessively low, damage may have occurred to the transmission components.

7

This step inspects for the correct type of transmission fluid. If the incorrect fluid was used, there may have been an overheating condition. Overheating may cause damage to the transmission components.

9

This step inspects for noise coming into the driver compartment. Improper sealing of the shift tower may be allowing normal transmission noise to be heard by the driver.

13

This step tests to determine if clutch components are making the noise. Press the clutch pedal slowly and listen for the change in noise. If the noise changes while pressing the pedal, it may be a faulty clutch component. If the noise does not change until the clutch is completely disengaged, the transmission component is faulty.

Step	Action	Yes	No
DEFINITION: The transmission is making a noise. The noise may be a whine or a growl caused by faulty bearings or gears. The noise may also be caused from a faulty component causing a vibration noise.			
1	Did you review the Symptoms - Manual Transmission (MM6) operations and perform the necessary inspections?	Go to **Step 2**	Go to Symptoms - Manual Transmission (MM6)
2	Is the noise present while in neutral, with the engine operating?	Go to Diagnostic Aids	Go to **Step 3**
3	Is the noise present in all gears?	Go to **Step 5**	Go to **Step 4**
4	Is the noise present in just one gear?	Go to **Step 15**	Go to **Step 5**
5	Inspect the transmission fluid level. Is the fluid level correct?	Go to **Step 7**	Go to **Step 6**
6	Add transmission fluid. Refer to Transmission Fluid Drain and Fill (MM6) . Did you find and repair the condition?	Go to **Step 16**	Go to **Step 7**
7	Inspect the transmission for the correct fluid type. Refer to Approximate Fluid Capacities (MM6) . Is the transmission fluid the correct type?	Go to **Step 9**	Go to **Step 8**

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8	Drain and fill the transmission with the correct type of fluid. Refer to Transmission Fluid Drain and Fill (MM6) . Did you find and repair the condition?	Go to **Step 16**	Go to **Step 9**
9	Inspect the shift tower boot. Is the closeout boot loose or damaged?	Go to **Step 10**	Go to **Step 11**
10	Position and tighten the shift tower boot to specifications. Refer to Transmission Control Lever Knob Replacement . Did you find and repair the condition?	Go to **Step 16**	Go to **Step 11**
11	Inspect for loose transmission mounting bolts. Are there any loose transmission mounting bolts?	Go to **Step 12**	Go to **Step 15**
12	Replace and tighten the transmission mounting bolts. Refer to Fastener Specifications (MM6) . Is the noise still present?	Go to **Step 13**	Go to **Step 16**
13	With the engine operating, press the clutch pedal. Is the noise still present?	Go to **Step 14**	Go to **Step 15**
14	1. Remove the clutch. Refer to Clutch Assembly Replacement (MM6 Transmission) . 2. Inspect the following components for being the cause of the noise: 1. The release bearing 2. The pilot bearing 3. The dual mass flywheel, if equipped 4. The pressure plate 5. The clutch disc 6. The input shaft bearing 7. The engine crankshaft end play Did you find and repair the condition?	Go to **Step 16**	Go to **Step 15**
15	1. Remove the transmission. Refer to Transmission Replacement (MM6 with LT1 Engine) . 2. Disassemble the transmission. Refer to one of the following: Transmission Disassemble Transmission Disassemble (MM6) . Use the information in the Cleaning and Inspection section to determine if any of the transmission components are faulty. Did you find and repair the condition?	Go to **Step 16**	-

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16	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 1**

DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION NOISY (M13) > DIAGNOSTIC AIDS

If the transmission is in neutral with the engine operating, and a whirling noise - a neutral gear rattle is heard outside the vehicle, the sound is a normal condition.

DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION NOISY (M13) > TEST DESCRIPTION

The numbers below refer to the step numbers on the diagnostic table.

5

This step inspects for the correct transmission fluid level. If the transmission fluid level is excessively low, damage may have occurred to the transmission components.

7

This step inspects for the correct type of transmission fluid. If the incorrect fluid was used, there may have been an overheating condition. Overheating may cause damage to the transmission components.

9

This step inspects for noise coming into the driver compartment. Improper sealing of the shift tower may be allowing normal transmission noise to be heard by the driver.

13

This step tests to determine if clutch components are making the noise. Press the clutch pedal slowly and listen for the change in noise. If the noise changes while pressing the pedal, it may be a faulty clutch component. If the noise does not change until the clutch is completely disengaged, the transmission component is faulty.

Step	Action	Yes	No
DEFINITION: The transmission is making a noise. The noise may be a whine or a growl caused by faulty bearings or gears. The noise may also be caused from a faulty component causing a vibration noise.			
1	Did you review the Symptoms - Manual Transmission (M13) operations and perform the necessary inspections?	Go to **Step 2**	Go to Symptoms - Manual Transmission (M13)
2	Is the noise present while in neutral, with the engine operating?	Go to Diagnostic Aids	Go to **Step 3**

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3	Is the noise present in all gears?	Go to **Step 5**	Go to **Step 4**
4	Is the noise present in just one gear?	Go to **Step 15**	Go to **Step 5**
5	Inspect the transmission fluid level. Is the fluid level correct?	Go to **Step 7**	Go to **Step 6**
6	Add transmission fluid. Refer to Transmission Fluid Drain and Fill (M13 Without Y4Q) . Did you find and repair the condition?	Go to **Step 16**	Go to **Step 7**
7	Inspect the transmission for the correct fluid type. Refer to Approximate Fluid Capacities (M13) . Is the transmission fluid the correct type?	Go to **Step 9**	Go to **Step 8**
8	Drain and fill the transmission with the correct type of fluid. Refer to Transmission Fluid Drain and Fill (M13 Without Y4Q) . Did you find and repair the condition?	Go to **Step 16**	Go to **Step 9**
9	Inspect the shift tower boot. Is the closeout boot loose or damaged?	Go to **Step 10**	Go to **Step 11**
10	Position and tighten the shift tower boot to specifications. Refer to Transmission Control Lever Knob Replacement . Did you find and repair the condition?	Go to **Step 16**	Go to **Step 11**
11	Inspect for loose transmission mounting bolts. Are there any loose transmission mounting bolts?	Go to **Step 12**	Go to **Step 15**
12	Replace and tighten the transmission mounting bolts. Refer to Fastener Specifications (M13) . Is the noise still present?	Go to **Step 13**	Go to **Step 16**
13	With the engine operating, press the clutch pedal. Is the noise still present?	Go to **Step 14**	Go to **Step 15**
14	1. Remove the clutch. Refer to Clutch Assembly Replacement (M13 Transmission) . 2. Inspect the following components for being the cause of the noise: 1. The release bearing 2. The pilot bearing 3. The dual mass flywheel, if equipped 4. The pressure plate 5. The clutch disc 6. The input shaft bearing	Go to **Step 16**	Go to **Step 15**

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	7. The engine crankshaft end play Did you find and repair the condition?		
15	1. Remove the transmission. Refer to Transmission Replacement (M13 with LGX Engine) Transmission Replacement (M13 with LTG Engine) . 2. Disassemble the transmission. Refer to one of the following: Transmission Disassemble (M13 - LGX w/L4Q) Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) . Use the information in the Cleaning and Inspection section to determine if any of the transmission components are faulty. Did you find and repair the condition?	Go to **Step 16**	-
16	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 1**

DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION JUMPS OUT OF GEAR (MM6) > DIAGNOSTIC AIDS

If the transmission jumps out of gear during deceleration, inspect the components that may allow for the gears or shafts to tip. If the gears or shafts tip, the synchronizer sleeve can disengage from the selector teeth on the speed gear. If the transmission jumps out of gear during acceleration, inspect the components that may not allow full engagement of the synchronizer sleeve to the selector teeth on the speed gear. Insufficient engagement of the selector teeth under torque may cause the transmission to jump out of gear.

DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION JUMPS OUT OF GEAR (MM6) > TEST DESCRIPTION

The numbers below refer to the step numbers on the diagnostic table.

2

A static shift test is performed by shifting into all gear positions with the engine not operating. While performing the test, slowly move the shift lever. Feel for proper movement of the shift lever and transmission internal shift components.

5

A dynamic shift test is performed by shifting into all gear positions with the engine operating. Test for the correct mesh of the synchronizers sleeve and the speed gear selector teeth. Move the shift lever, and feel for the synchronizer sleeve to release from the gear, then let up on the clutch pedal. Depress the clutch pedal and move the shift lever to engage the gear again, to ensure full travel of the shift components.

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6

This step inspects for worn or damaged transmission or engine mounts. Loose mounts may cause a shock on the transmission allowing for gear disengagement.

7

This step inspects for the misalignment of the engine to transmission. Misalignment may put a bind on the input shaft, allowing for the input shaft or the mainshaft to tip.

9

This step inspects the pilot bearing and the pilot bearing journal on the input shaft. A worn pilot bearing or input shaft may allow the input shaft to tip, causing gear disengagement.

Step	Action	Yes	No
DEFINITION: Gear disengagement occurs during acceleration or deceleration.			
1	Did you review the Symptoms - Manual Transmission (MM6) operations and perform the necessary inspections?	Go to **Step 2**	Go to Symptoms - Manual Transmission (MM6)
2	1. Perform a static shift test. 2. Test for the following conditions: 1. Blockage preventing full shift lever movement 2. Excessive movement in the shift lever 3. Detent plungers engaging in the shift rails 4. Synchronizer pressure pieces on the synchronizer sleeves 5. Shift linkage binding 6. Shift linkage proper adjustment Did the transmission shift completely into all gears?	Go to **Step 5**	Go to **Step 3**

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3	1. Remove the shift control shift closeout boot and foam isolator. Refer to Transmission Control Lever Knob Replacement . 2. Inspect for the following: 1. Loose mounting 2. Foreign debris 3. Interference to foam isolator Did you find and repair the condition?	Go to **Step 10**	Go to **Step 4**
4	1. Perform a dynamic shift test on the transmission. 2. Test for the following conditions: 1. Synchronizer sleeve engagement to the speed gear selector teeth 2. Detent plungers engaging in the shift rails Did the transmission shift completely into all gears?	Go to **Step 5**	Go to **Step 8**
5	Inspect the engine and/or transmission mounts. Refer to Transmission Mount Inspection , and Engine Mount Inspection . Did you find and repair the condition?	Go to **Step 10**	Go to **Step 6**
6	Inspect the clutch housing for loose bolts or misalignment. Are there any loose bolts or misalignment?	Go to **Step 9**	Go to **Step 8**
7	Tighten any loose housing bolts and/or align the housing. Refer to Clutch Assembly Replacement (MM6 Transmission) . Did you find and repair the condition?	Go to **Step 10**	Go to **Step 8**
8	1. Remove the transmission. Refer to Transmission Replacement (MM6 with LT1 Engine) . 2. Remove the clutch assembly. Refer to Clutch Assembly Replacement (MM6 Transmission) . 3. Inspect the pilot bearing for being faulty. 4. Inspect the input shaft for excessive wear at the pilot bearing. Did you find and repair the condition?	Go to **Step 10**	Go to **Step 9**

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9	1. Disassemble the transmission. Refer to Transmission Disassemble (MM6) . 2. Inspect the following components for wear or damage: 1. The shift rails 2. The detent plungers and springs 3. The shift forks 4. The synchronizer sleeve and speed gear selector teeth 5. The mainshaft to input shaft bearing and journals 6. The speed gear bearings and journals 7. The speed gear axial clearance 8. The mainshaft center and rear bearings 9. The shift guide plate Did you find and repair the condition?	Go to **Step 10**	Go to Diagnostic Aids
10	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 1**

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DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION JUMPS OUT OF GEAR (M13) > DIAGNOSTIC AIDS

If the transmission jumps out of gear during deceleration, inspect the components that may allow for the gears or shafts to tip. If the gears or shafts tip, the synchronizer sleeve can disengage from the selector teeth on the speed gear. If the transmission jumps out of gear during acceleration, inspect the components that may not allow full engagement of the synchronizer sleeve to the selector teeth on the speed gear. Insufficient engagement of the selector teeth under torque may cause the transmission to jump out of gear.

DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION JUMPS OUT OF GEAR (M13) > TEST DESCRIPTION

The numbers below refer to the step numbers on the diagnostic table.

2

A static shift test is performed by shifting into all gear positions with the engine not operating. While performing the test, slowly move the shift lever. Feel for proper movement of the shift

lever and transmission internal shift components.

5

A dynamic shift test is performed by shifting into all gear positions with the engine operating. Test for the correct mesh of the synchronizers sleeve and the speed gear selector teeth. Move the shift lever, and feel for the synchronizer sleeve to release from the gear, then let up on the clutch pedal. Depress the clutch pedal and move the shift lever to engage the gear again, to ensure full travel of the shift components.

6

This step inspects for worn or damaged transmission or engine mounts. Loose mounts may cause a shock on the transmission allowing for gear disengagement.

7

This step inspects for the misalignment of the engine to transmission. Misalignment may put a bind on the input shaft, allowing for the input shaft or the mainshaft to tip.

9

This step inspects the pilot bearing and the pilot bearing journal on the input shaft. A worn pilot bearing or input shaft may allow the input shaft to tip, causing gear disengagement.

Step	Action	Yes	No
DEFINITION: Gear disengagement occurs during acceleration or deceleration.			
1	Did you review the Symptoms - Manual Transmission (M13) operations and perform the necessary inspections?	Go to **Step 2**	Go to Symptoms - Manual Transmission (M13)
2	1. Perform a static shift test. 2. Test for the following conditions: 1. Blockage preventing full shift lever movement 2. Excessive movement in the shift lever 3. Detent plungers engaging in the shift rails 4. Synchronizer pressure pieces on the synchronizer sleeves 5. Shift linkage binding 6. Shift linkage proper adjustment Did the transmission shift completely into all gears?	Go to **Step 5**	Go to **Step 3**

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3	1. Remove the shift control shift closeout boot and foam isolator. Refer to Transmission Control Lever Knob Replacement . 2. Inspect for the following: 1. Loose mounting 2. Foreign debris 3. Interference to foam isolator Did you find and repair the condition?	Go to **Step 10**	Go to **Step 4**
4	1. Perform a dynamic shift test on the transmission. 2. Test for the following conditions: 1. Synchronizer sleeve engagement to the speed gear selector teeth 2. Detent plungers engaging in the shift rails Did the transmission shift completely into all gears?	Go to **Step 5**	Go to **Step 8**
5	Inspect the engine and/or transmission mounts. Refer to Transmission Mount Inspection , and Engine Mount Inspection . Did you find and repair the condition?	Go to **Step 10**	Go to **Step 6**
6	Inspect the clutch housing for loose bolts or misalignment. Are there any loose bolts or misalignment?	Go to **Step 9**	Go to **Step 8**
7	Tighten any loose housing bolts and/or align the housing. Refer to Clutch Assembly Replacement (M13 Transmission) . Did you find and repair the condition?	Go to **Step 10**	Go to **Step 8**
8	1. Remove the transmission. Refer to Transmission Replacement (M13 with LGX Engine) Transmission Replacement (M13 with LTG Engine) . 2. Remove the clutch assembly. Refer to Clutch Assembly Replacement (M13 Transmission) . 3. Inspect the pilot bearing for being faulty. 4. Inspect the input shaft for excessive wear at the pilot bearing. Did you find and repair the condition?	Go to **Step 10**	Go to **Step 9**

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9	1. Disassemble the transmission. Refer to Transmission Disassemble (M13 - LGX w/L4Q) Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) . 2. Inspect the following components for wear or damage: 1. The shift rails 2. The detent plungers and springs 3. The shift forks 4. The synchronizer sleeve and speed gear selector teeth 5. The mainshaft to input shaft bearing and journals 6. The speed gear bearings and journals 7. The speed gear axial clearance 8. The mainshaft center and rear bearings 9. The shift guide plate Did you find and repair the condition?	Go to **Step 10**	Go to Diagnostic Aids
10	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 1**

DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION DOES NOT SHIFT INTO ONE GEAR > DIAGNOSTIC AIDS

If the transmission shifts into gear and then jumps out of gear, refer to Transmission Jumps Out of Gear (MM6) Transmission Jumps Out of Gear (M13) . If it is an intermittent condition, other driveline components may be faulty.

DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION DOES NOT SHIFT INTO ONE GEAR > TEST DESCRIPTION

The numbers below refer to the step numbers on the diagnostic table.

2

This test is to confirm that the clutch is not slipping. During certain conditions, the clutch may slip and feel as though the transmission is not in gear.

3

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A static shift test is performed by shifting into all gears with the engine not operating. While performing the test, you should note how the shift lever movement feels. Also feel for the shift rails moving freely, the detent plungers operating when coming out of a gear and going into the next gear, and for the synchronizer sleeve movement.

6

A dynamic shift test is performed by shifting into all gears with the engine operating. Test for the correct mesh of the synchronizers sleeve and the speed gear selector teeth. Move the shift lever and feel for the synchronizer sleeve to just release from the gear, then let up on the clutch pedal. Press the clutch pedal and move the shift lever to engage that gear again, to ensure full travel of the shift components.

Step	Action	Yes	No
DEFINITION: The shift lever will not move into a particular gear position, or when in a gear position, power is not delivered through the transmission.			
1	Did you review the Symptoms - Manual Transmission (MM6) Symptoms - Manual Transmission (M13) and perform the necessary inspections?	Go to **Step 2**	Go to Symptoms - Manual Transmission (MM6) Symptoms - Manual Transmission (M13)
2	Inspect the clutch system for slipping. Refer to Clutch Slipping . Is the clutch operating properly?	Go to **Step 2**	Go to Clutch Assembly Replacement (M13 Transmission)Clutch Assembly Replacement (MM6 Transmission)
3	1. Perform a static shift test on the transmission. 2. Test for the following conditions: 1. Blockage preventing full shift lever movement 2. Excessive movement in the shift lever 3. Binding in the shift lever 4. Detent plungers or shift rails binding 5. Synchronizer sleeve moving on the hub and pressure pieces 6. Shift linkage binding 7. Shift linkage proper adjustment Were you able to shift into the gear position with the concern?	Go to **Step 5**	Go to **Step 4**

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4	1. Remove the shift control shift closeout boot and foam isolator. Refer to Transmission Control Lever Knob Replacement . 2. Inspect for the following: 1. Loose mounting 2. Foreign debris 3. Interference to foam isolator Did you find and repair the condition?	Go to **Step 8**	Go to **Step 5**
5	1. Perform a dynamic shift test on the transmission. 2. Test for the following conditions: 1. Detent plungers or shift rails binding 2. Synchronizer sleeve binding 3. Synchronizer sleeve engaging on the speed gear selector teeth Were you able to shift into the gear position with the concern?	Go to **Step 7**	Go to **Step 6**
6	1. Remove the transmission. Refer to Transmission Replacement (MM6 with LT1 Engine) Transmission Replacement (M13 with LGX Engine) Transmission Replacement (M13 with LTG Engine) . 2. Disassemble the transmission. Refer to Transmission Disassemble (M13 - LGX w/L4Q) Transmission Disassemble (MM6) Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) . 3. Inspect the following transmission internal components for wear or damage: 1. The shift forks 2. The internal shift control lever Did you find and repair the condition?	Go to **Step 8**	Go to **Step 7**
7	1. Remove the transmission. Refer to Transmission Replacement (MM6 with LT1 Engine) Transmission Replacement (M13	Go to **Step 8**	Go to Diagnostic Aids

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	with LGX Engine) Transmission Replacement (M13 with LTG Engine) . 2. Disassemble the transmission. Refer to Transmission Disassemble (M13 - LGX w/L4Q) Transmission Disassemble (MM6) Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) . 3. Inspect the following transmission internal components for wear or damage: 1. The synchronizer sleeve selector teeth 2. The speed gear selector teeth 3. The speed gear axial clearance for being excessive 4. The speed gear to mainshaft bearings and journals 5. The countershaft for being broken 6. The mainshaft for being broken 7. The countershaft gear for being stripped 8. The mainshaft gear for being stripped Did you find and repair the condition?		
8	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 1**

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DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION LOCKED IN ONE GEAR > TEST DESCRIPTION

The numbers below refer to the step numbers on the diagnostic table.

2

This step is to ensure the use of the proper transmission fluid. The transmission fluid is used to ensure proper synchronizer operation, and for sufficient lubrication. Improper fluid may cause the synchronizers to stick or cause overheating of the transmission components.

4

A static shift test is performed by shifting into all gears with the engine not operating. By confirming that the transmission can be shifted into all positions, ensures that the shift lever is not excessively worn or damaged.

6

A dynamic shift test is performed by shifting into all of the gear positions with the engine operating. Test to ensure that the internal shift components are properly functioning.

Step	Action	Yes	No
DEFINITION: The transmission cannot be shifted out of a gear or the vehicle will not move because the transmission is locked.			
1	Did you review the Symptoms - Manual Transmission (MM6) Symptoms - Manual Transmission (M13) and perform the necessary inspections?	Go to **Step 2**	Go to Symptoms - Manual Transmission (MM6) Symptoms - Manual Transmission (M13)
2	Inspect for the correct type of transmission fluid. Refer to Approximate Fluid Capacities (MM6) Approximate Fluid Capacities (M13) . Is the correct type of transmission fluid being used?	Go to **Step 6**	Go to **Step 5**
3	Drain and fill the transmission with the correct type of fluid. Refer to Transmission Fluid Drain and Fill (M13 Without Y4Q) Transmission Fluid Drain and Fill (MM6) . Did you find and repair the condition?	Go to **Step 9**	Go to **Step 6**
4	1. Perform a static shift test on the transmission. 2. Test for the shift lever moving to all positions. Were you able to shift into all positions?	Go to **Step 6**	Go to **Step 5**
5	1. Remove the shift lever. Refer to Shift Control Assembly Replacement (M13) Shift Control Assembly Replacement (MM6) . 2. Inspect for worn or faulty components. Did you find and repair the conditions?	Go to **Step 9**	Go to **Step 6**
6	1. Perform a dynamic shift test on the transmission. 2. Test for being able to shift in and out of the gear with the concern. Were you able to shift the transmission correctly?	Go to **Step 7**	Go to **Step 8**
7	1. Remove the transmission. Refer to Transmission Replacement (MM6 with LT1 Engine) Transmission Replacement (M13	Go to **Step 9**	Go to **Step 8**

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	with LGX Engine) Transmission Replacement (M13 with LTG Engine) . 2. Inspect the clutch system for the clutch not releasing properly. Refer to Clutch System Description and Operation . Did you find and repair the condition?		
8	1. Disassemble the transmission. Refer to Transmission Disassemble (M13 - LGX w/L4Q) Transmission Disassemble (MM6) Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) . 2. Inspect the following transmission internal components for wear or damage: • The shift rail • The internal shift control lever • The synchronizer components for being broken or faulty • The speed gears for being seized to the mainshaft • The shift turret rail Did you find and repair the conditions?	Go to **Step 9**	Go to Diagnostic Aids
9	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 1**

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DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION CLUNK ON ACCELERATION OR DECELERATION > DIAGNOSTIC AIDS

All manual transmissions have gear play that might cause a clunk. If the transmission is suspected of causing the clunk, compare it with a similar vehicle. An internal clunk in the transmission is usually caused by wear between two components, or from improper assembly, which would also cause other symptoms.

DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION CLUNK ON ACCELERATION OR DECELERATION > TEST DESCRIPTION

The number below refers to the step number on the diagnostic table.

5

This step inspects the driveline components that may be the cause of the clunk noise. The

noise may resonate to the transmission.

Step	Action	Yes	No
DEFINITION: A clunk is heard and/or felt on acceleration or deceleration.			
1	Did you review the Symptoms - Manual Transmission (MM6) Symptoms - Manual Transmission (M13) and perform the necessary inspections?	Go to **Step 2**	Go to Symptoms - Manual Transmission (MM6) Symptoms - Manual Transmission (M13)
2	Inspect the engine mounts for being loose or damaged. Refer to Engine Mount Inspection . Did you find and repair the condition?	Go to **Step 7**	Go to **Step 3**
3	Inspect the transmission mounts for being loose or damaged. Refer to Transmission Mount Inspection . Did you find and repair the condition?	Go to **Step 7**	Go to **Step 4**
4	Inspect the transmission to engine fasteners for being loose or missing. Refer to Fastener Specifications (M13) Fastener Specifications (MM6) . Did you find and repair the condition?	Go to **Step 7**	Go to **Step 5**
5	Inspect the driveline for causing the clunk. Refer to Diagnostic Starting Point - Vehicle . Did you find and repair the condition?	Go to **Step 7**	Go to **Step 6**
6	1. Remove the transmission. Refer to Transmission Replacement (MM6 with LT1 Engine) Transmission Replacement (M13 with LGX Engine) Transmission Replacement (M13 with LTG Engine) . 2. Disassemble the transmission. Refer to Transmission Disassemble (M13 - LGX w/L4Q) Transmission Disassemble (MM6) Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) . 3. Inspect the following transmission components that maybe causing the clunk: 1. Faulty mainshaft bearings 2. Faulty counter gear shaft bearings 3. Worn speed gear teeth 4. Worn counter gear shaft gear teeth 5. Worn synchronizer sleeve to hub 6. Worn thrust washers and thrust	Go to **Step 7**	Go to Diagnostic Aids

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	surfaces on the speed gears or mainshaft Did you find and repair the condition?		
7	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 1**

DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION FLUID LEAK DIAGNOSIS > DIAGNOSTIC AIDS

Using the incorrect type of transmission fluid may affect the sealing ability of the seals. Ensure the use of the correct type of transmission fluid. The incorrect type of sealer may not be compatible with the transmission fluid or may not have the correct characteristics for sealing the affected components. Ensure the use of the correct type of sealers. Refer to Adhesives, Fluids, Lubricants, and Sealers (MM6) Adhesives, Fluids, Lubricants, and Sealers (M13) .

DIAGNOSTIC INFORMATION AND PROCEDURES > TRANSMISSION FLUID LEAK DIAGNOSIS > TEST DESCRIPTION

The number below refers to the step number on the diagnostic table.

5

Use an approved method to clean the transmission to ensure the leak location is correctly identified. If using a powder method or dye method, ensure the products are compatible with the transmission fluid.

Step	Action	Yes	No
DEFINITION: Visible sign of the transmission fluid leaking from the transmission.			
1	Did you review the Symptoms - Manual Transmission (MM6) Symptoms - Manual Transmission (M13) and perform the necessary inspections?	Go to **Step 2**	Go to Symptoms - Manual Transmission (MM6) Symptoms - Manual Transmission (M13)
2	1. Inspect for the transmission fluid level higher than the recommended level. Refer to Transmission Fluid Drain and Fill (M13 Without Y4Q) Transmission Fluid Drain and Fill (MM6) . 2. Adjust the transmission level if incorrect. Was the transmission fluid level too high?	Go to **Step 19**	Go to **Step 3**
3	Inspect the transmission vent for a blockage. Is the transmission vent blocked?	Go to **Step 4**	Go to **Step 5**

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4	Repair or replace the transmission vent. Did you find and repair the condition?	Go to **Step 19**	Go to **Step 5**
5	Verify the location of the leak. 1. Clean the transmission assembly. 2. Operate the vehicle for 24 km (15 mi), or until normal operating temperatures are reached. 3. Visual inspect or use the powder method or dye and black light method to locate the leak. Is the leak occurring at the drain or fill plug?	Go to **Step 6**	Go to **Step 7**
6	Replace the drain or fill plug. Refer to Transmission Fluid Drain and Fill (M13 Without Y4Q) Transmission Fluid Drain and Fill (MM6) . Did you find and repair the condition?	Go to **Step 19**	Go to Diagnostic Aids
7	Is the leak at the transmission output shaft seal?	Go to **Step 8**	Go to **Step 9**
8	Remove the output shaft seal and inspect for the following. Refer to Main Shaft Rear Seal Replacement . • Damaged or worn seal • Damaged seal bore • Improper installation • Cracks in the component • Propeller shaft yoke sealing surface is scratched, nicked, damaged, or worn • Loose or worn bearing causing excessive seal wear • Yoke flange nut loose Did you find and repair the condition?	Go to **Step 19**	Go to Diagnostic Aids
9	Is the leak at the front of the transmission?	Go to **Step 10**	Go to **Step 12**
10	1. Inspect for the leak at the input shaft seal. 2. Inspect for the following if the input shaft seal is leaking: 1. Damaged or worn seal 2. Damaged seal bore	Go to **Step 19**	Go to **Step 11**

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	3. Improper installation 4. Cracks in the component 5. Input shaft sealing surface is scratched, nicked, damaged or worn 6. Loose or worn bearing causing excessive seal wear 3. Replace the input shaft seal if leaking. Refer to Main Shaft Rear Seal Replacement . Did you find and repair the condition?		
11	1. Inspect the case for cracks or porosity. 2. Replace the transmission front case half if it is faulty. Refer to Transmission Disassemble (M13 - LGX w/L4Q) Transmission Disassemble (MM6) Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) . Did you find and repair the condition?	Go to **Step 19**	Go to Diagnostic Aids
12	Is the leak at the backup light switch?	Go to **Step 13**	Go to **Step 15**
13	1. Remove the backup light switch. Refer to Backup Lamp Switch Replacement . 2. Inspect for the following: 1. Cross threaded or damaged threads 2. Insufficient sealant 3. Leaking switch, sensor or solenoid 4. Improper installation Did you find and repair the condition?	Go to **Step 19**	Go to **Step 1**
14	1. Remove the shift shaft detent sleeve. Refer to the applicable procedure: 1. Transmission Disassemble (M13 - LGX w/L4Q) Transmission Disassemble (MM6) Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) 2. Transmission Assemble (M13 - LGX w/Y4Q) Transmission Assemble (MM6) Transmission Assemble (M13 - LGX w/o L4Q, LTG)	Go to **Step 19**	Go to **Step 1**

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	2. Inspect for the following: 1. Cross threaded or damaged threads 2. Insufficient sealant 3. Cracked sleeve or case 4. Improper installation Did you find and repair the condition?		
15	Is the leak at the sealing flanges of the transmission case?	Go to **Step 16**	Go to **Step 17**
16	1. Remove the transmission. Refer to Transmission Replacement (MM6 with LT1 Engine) Transmission Replacement (M13 with LGX Engine) Transmission Replacement (M13 with LTG Engine) . 2. Disassemble the transmission. Refer to Transmission Disassemble (M13 - LGX w/L4Q) Transmission Disassemble (MM6) Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) . 3. Inspect the sealing surfaces. Refer to the applicable procedure: 1. Transmission Case and Clutch Housing Cleaning and Inspection (M13) Transmission Case and Clutch Housing Cleaning and Inspection (MM6) 2. Extension Cleaning and Inspection (MM6) Extension Cleaning and Inspection (M13) Did you find and repair the condition?	Go to **Step 19**	Go to **Step 17**
17	Is the leak coming from a crack or porosity in the transmission case?	Go to **Step 18**	Go to Diagnostic Aids
18	1. Remove the transmission. Refer to Transmission Replacement (MM6 with LT1 Engine) Transmission Replacement (M13 with LGX Engine) Transmission Replacement (M13 with LTG Engine) . 2. Disassemble the transmission. Refer to Transmission Disassemble (M13 - LGX w/L4Q) Transmission Disassemble (MM6) Transmission Disassemble (M13 -	Go to **Step 19**	Go to Diagnostic Aids

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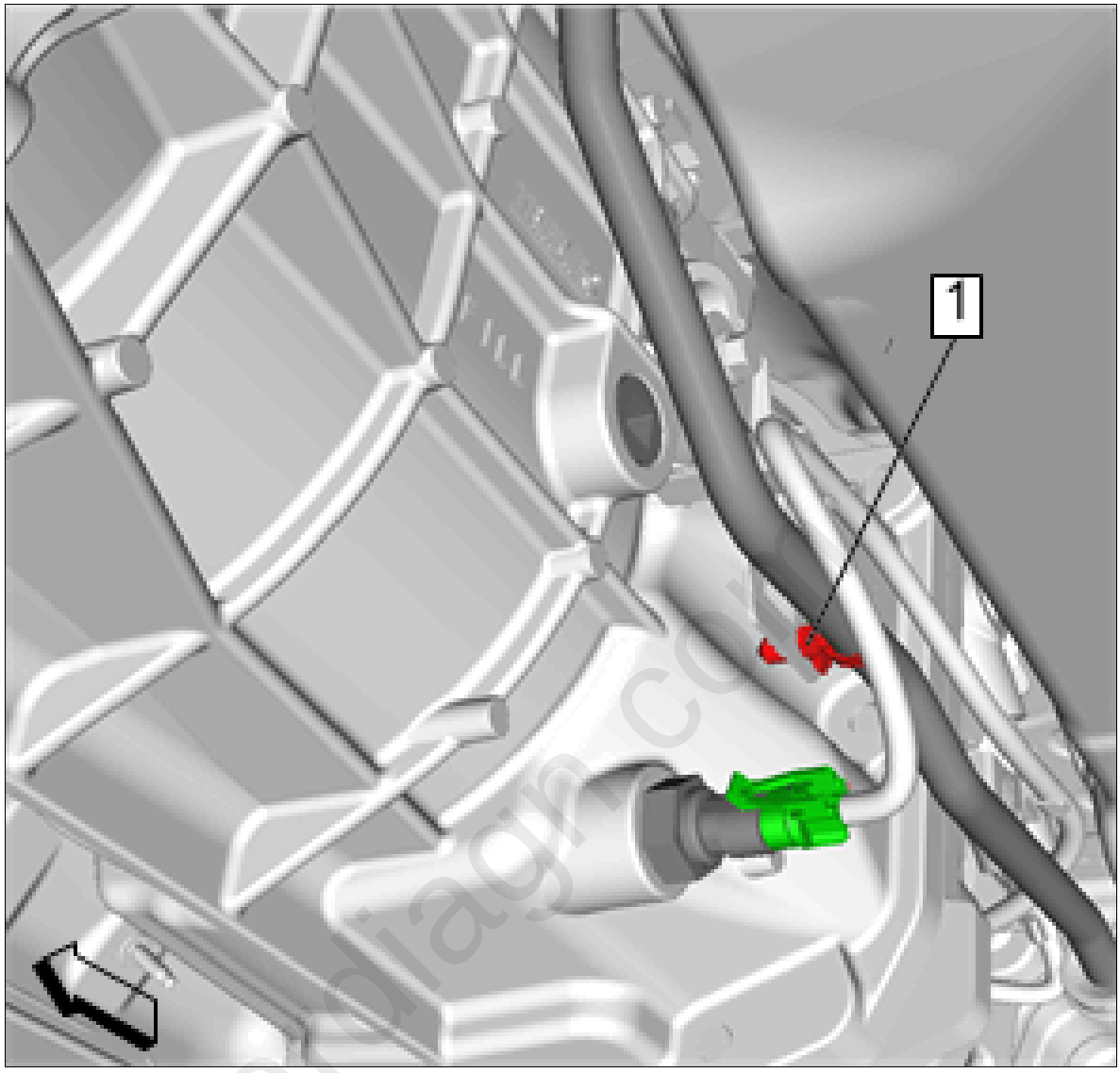
	LGX w/o Y4Q, LTG) . 3. Replace the faulty case. Refer to Transmission Assemble (M13 - LGX w/Y4Q) Transmission Assemble (MM6) Transmission Assemble (M13 - LGX w/o L4Q, LTG) Did you find and repair the condition?		
19	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 1**

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION FLUID LEVEL INSPECTION (MM6)

1. Raise and suitably support the vehicle. Refer to Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP) .

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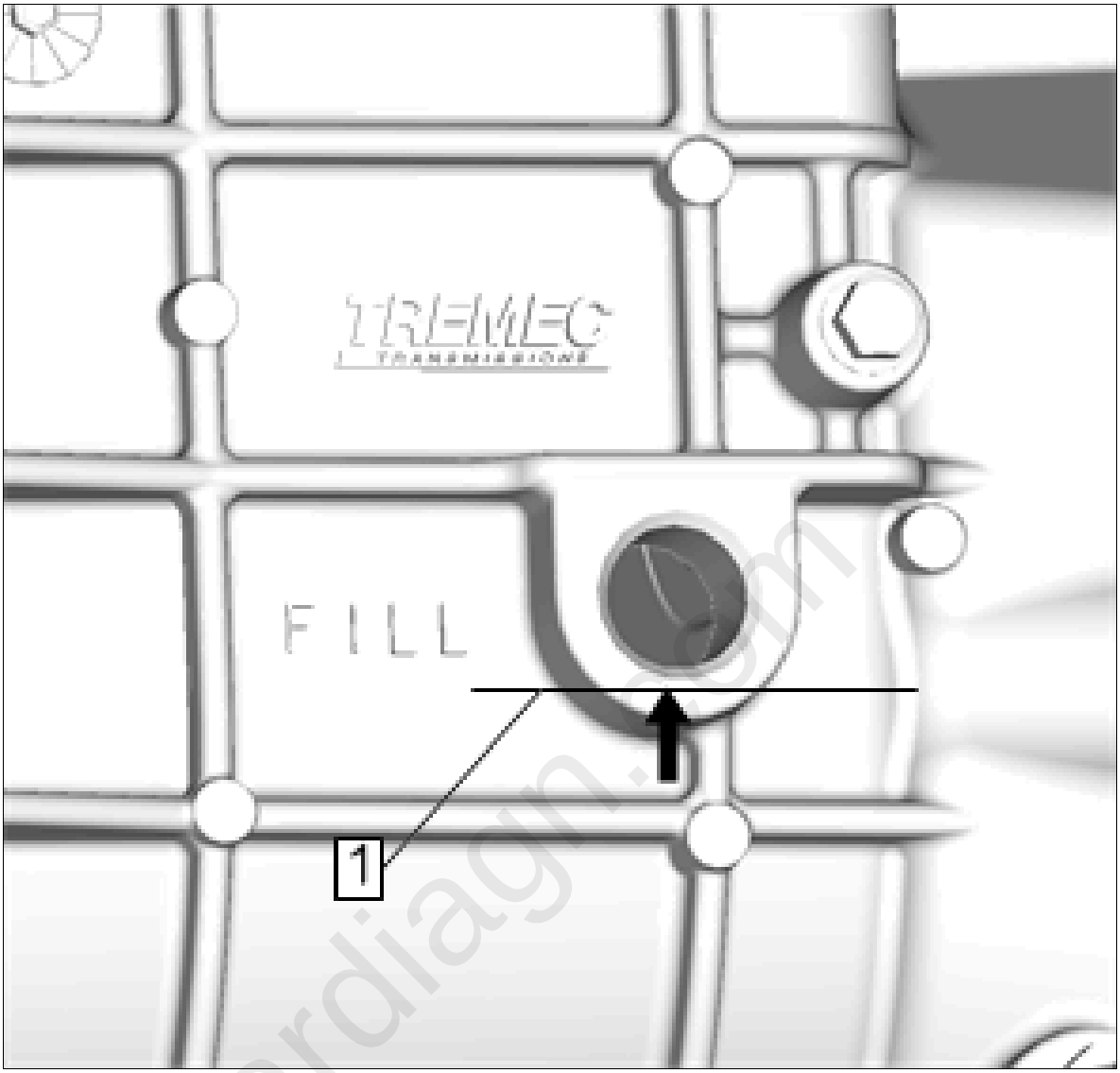
Fig 1: Cooler Pipe Retaining Clips



Courtesy of GENERAL MOTORS COMPANY

2. Disconnect the clip (1) retaining the cooler pipe to the transmission bracket.
3. Reposition the cooler pipe to allow access to the fill plug.
4. Remove the transmission fill plug from the transmission.

Fig 2: Fill Plug



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> *IMPORTANT:*
>
> *Transmission fluid level setting must be followed exactly as written or the transmission may be overfilled or under filled.*

5. For fluid recommendations, Refer to Adhesives, Fluids, Lubricants, and Sealers (MM6)

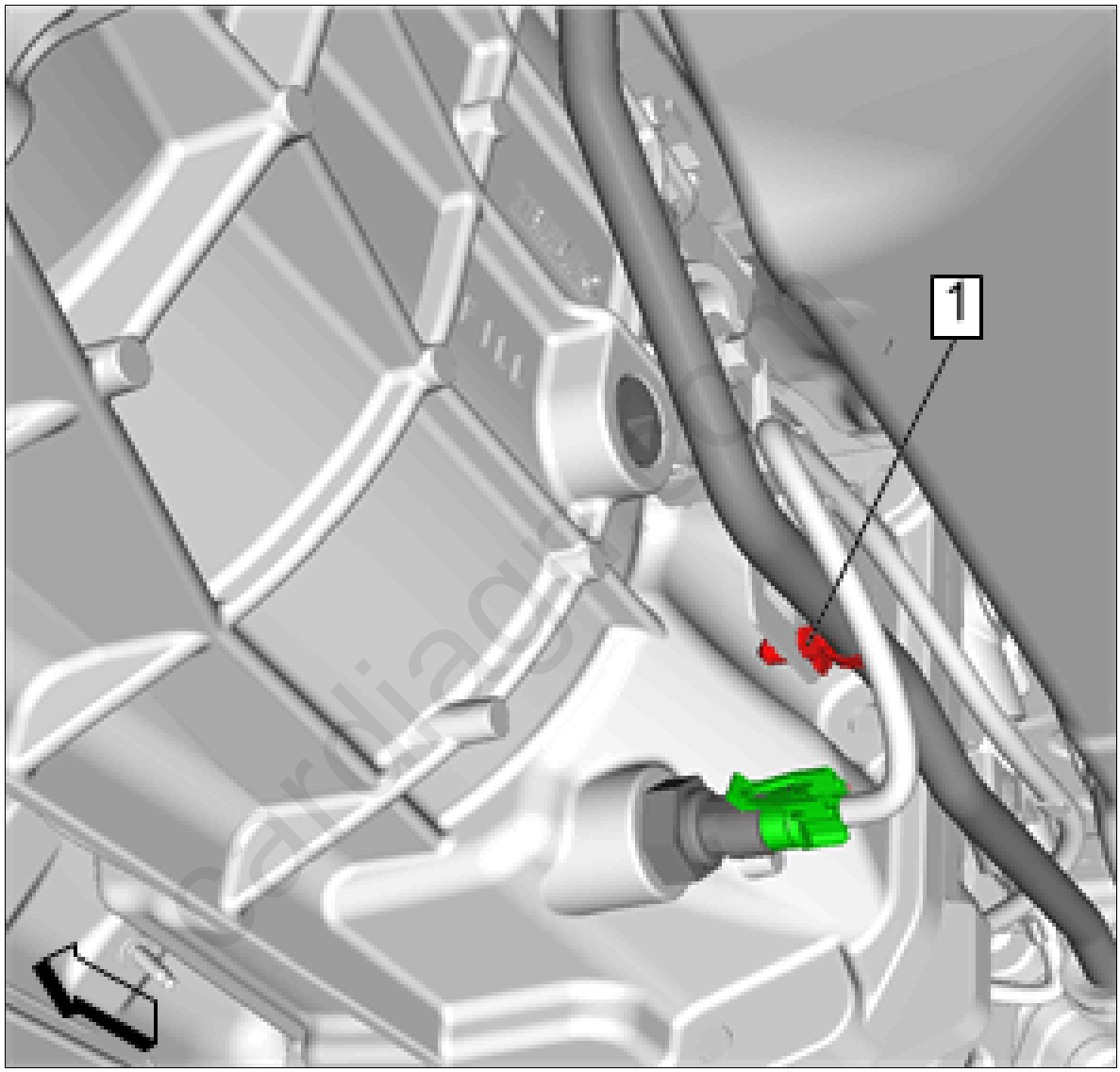
   Transmission fluid level MUST be 3.2 mm (1/8 inch) below (1) the fill plug. This can be done by one of the following methods:

   1. Bend mechanics wire to 3.2 mm (1/8 inch) to check fluid level. Add or remove fluid as necessary.
   2. Fill transmission until level with the bottom of the fill plug hole, then remove 240 ml (8 ounces) of fluid.

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

6. Install the transmission fill plug to the transmission and tighten to 27 N.m (20 lb ft).

Fig 3: Cooler Pipe Retaining Clips



Courtesy of GENERAL MOTORS COMPANY

> 📌 *NOTE:*
>
> *Inspect the clip for proper retention on the cooler line to the bracket. Replace the clip as necessary.*

7. Reconnect the clip (1) retaining the cooler pipe to the transmission bracket.

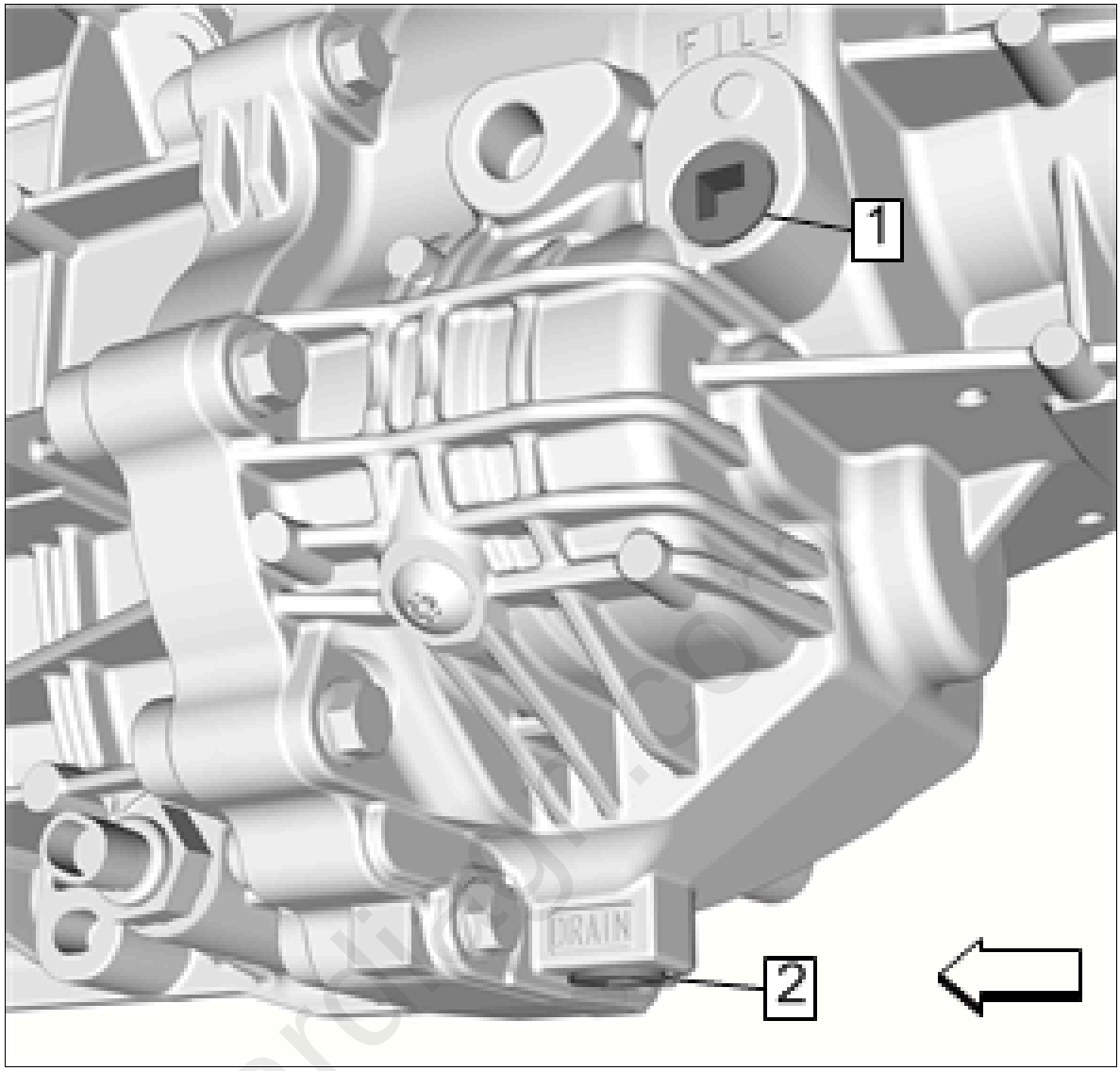
> *NOTE:*
>
> *Ensure the clutch pedal is NOT depressed.*

8. Run the engine in Neutral for two minutes to allow the fluid to recirculate.
9. Remove the fill plug and verify the fluid level is 3.2 mm (1/8 inch) below the fill plug hole. Add or remove transmission fluid as necessary.
10. Install the transmission fill plug to the transmission and tighten to 27 N.m (20 lb ft).
11. Lower the vehicle.

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION FLUID LEVEL INSPECTION (M13 WITHOUT Y4Q)

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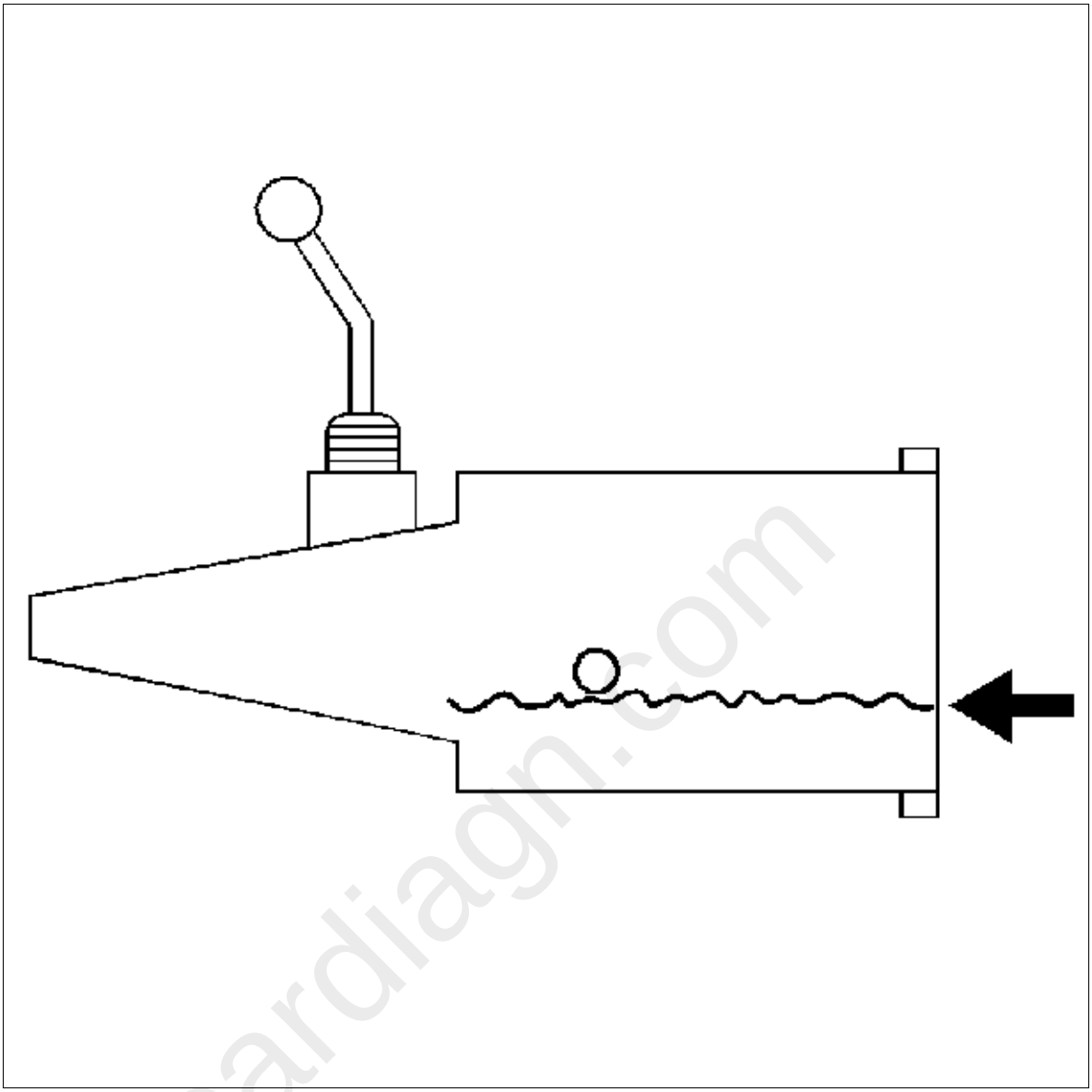
Fig 1: Fill And Drain Plugs



Courtesy of GENERAL MOTORS COMPANY

1. Raise and suitably support the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP) .
2. Clean any dirt from around the fill plug (1).
3. Remove the transmission fill plug from the transmission.

Fig 2: Checking Transmission Fluid Level

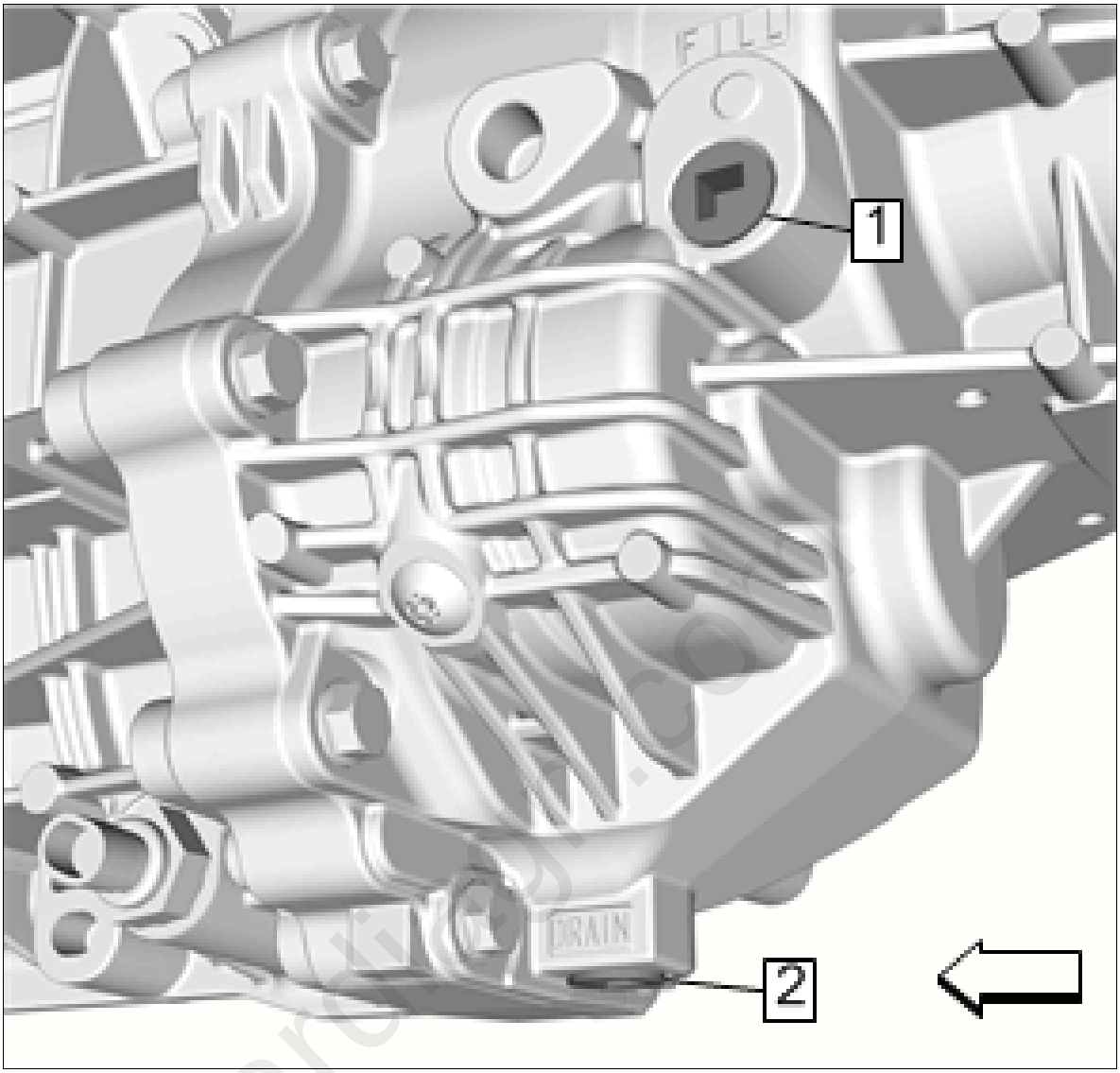


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4. Check that the transmission fluid level is even with the bottom of the fill plug hole.
5. Add fluid, if necessary. Adhesives, Fluids, Lubricants, and Sealers (M13)

Fig 3: Fill And Drain Plugs



Courtesy of GENERAL MOTORS COMPANY

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

6. Install the transmission fill plug (1) to the transmission and tighten the fill plug to 27 N.m (20 lb ft).
7. Lower the vehicle.

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION MOUNT INSPECTION

> *CAUTION:*
>
> *In order to avoid oil pan damage and possible engine failure, insert a block of wood that spans the width of the oil pan bottom between the oil pan and the jack support.*

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP) .

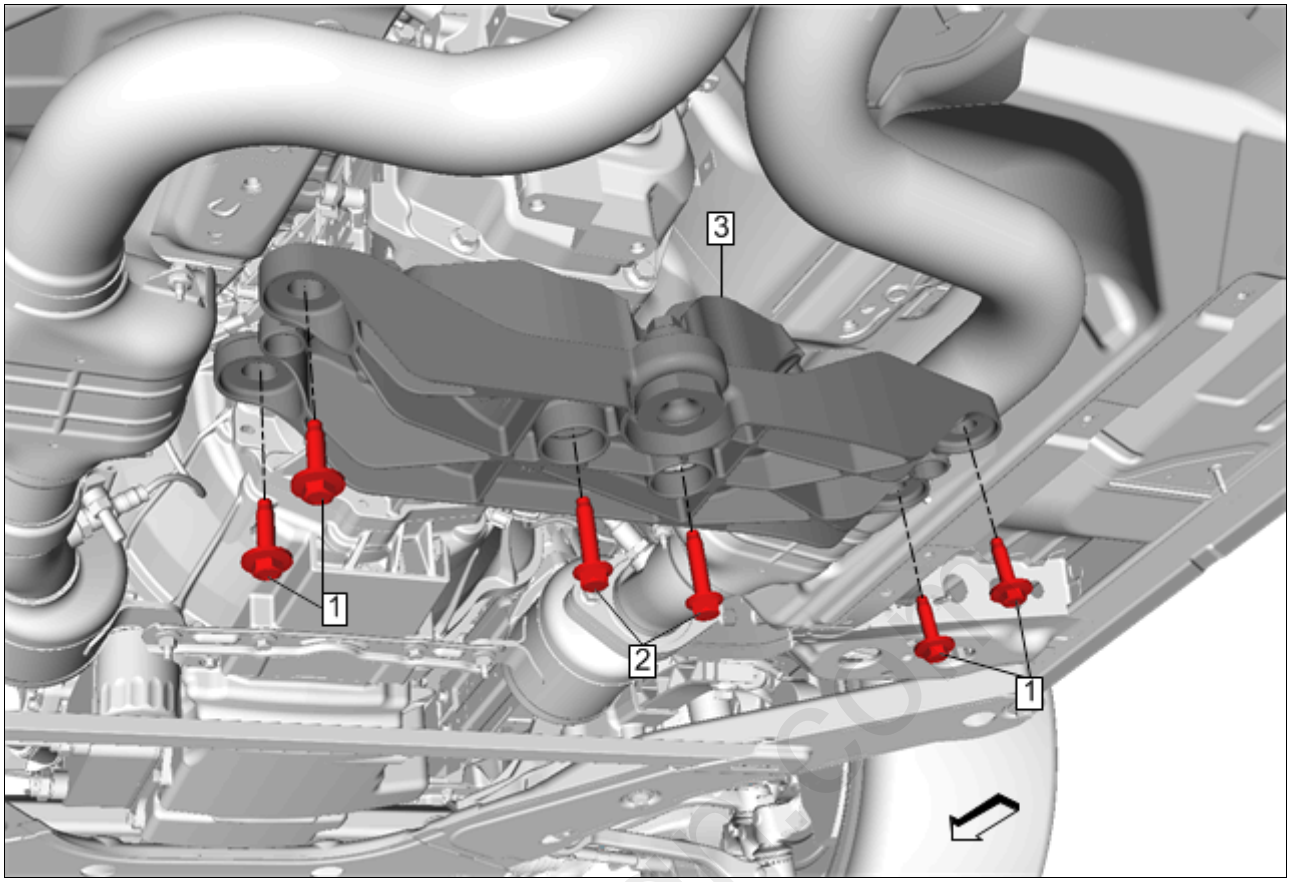
> *NOTE:*
>
> *Before replacing any transmission mount due to suspected fluid loss, verify that the source of the fluid is the transmission mount, not the engine, transmission or accessories.*

2. Raise the transmission in order to remove the weight from the transmission mount and create slight tension in the rubber.
3. Observe the transmission mount while raising the transmission. Replace the transmission mount if the transmission mount exhibits any of the following conditions:
    1. The hard rubber surface is covered with heat check cracks.
    2. The rubber is separated from the metal plate of the transmission mount.
    3. The rubber is split through the center of the transmission mount.
4. If there is movement between the metal plate of the transmission mount and its attaching points, lower the transmission on the transmission mount. Tighten the bolts or nuts attaching the transmission mount to the frame or transmission mount bracket. Refer to Transmission Rear Mount Replacement (MM6 Transmission) Transmission Rear Mount Replacement (M13 Transmission) .
5. Lower the vehicle.

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REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION REAR MOUNT REPLACEMENT (MM6 TRANSMISSION)

Fig 1: Mount Bolts



Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

NOTE:

The transmission support and the transmission mount are replaced as an assembly.

Preliminary Procedures

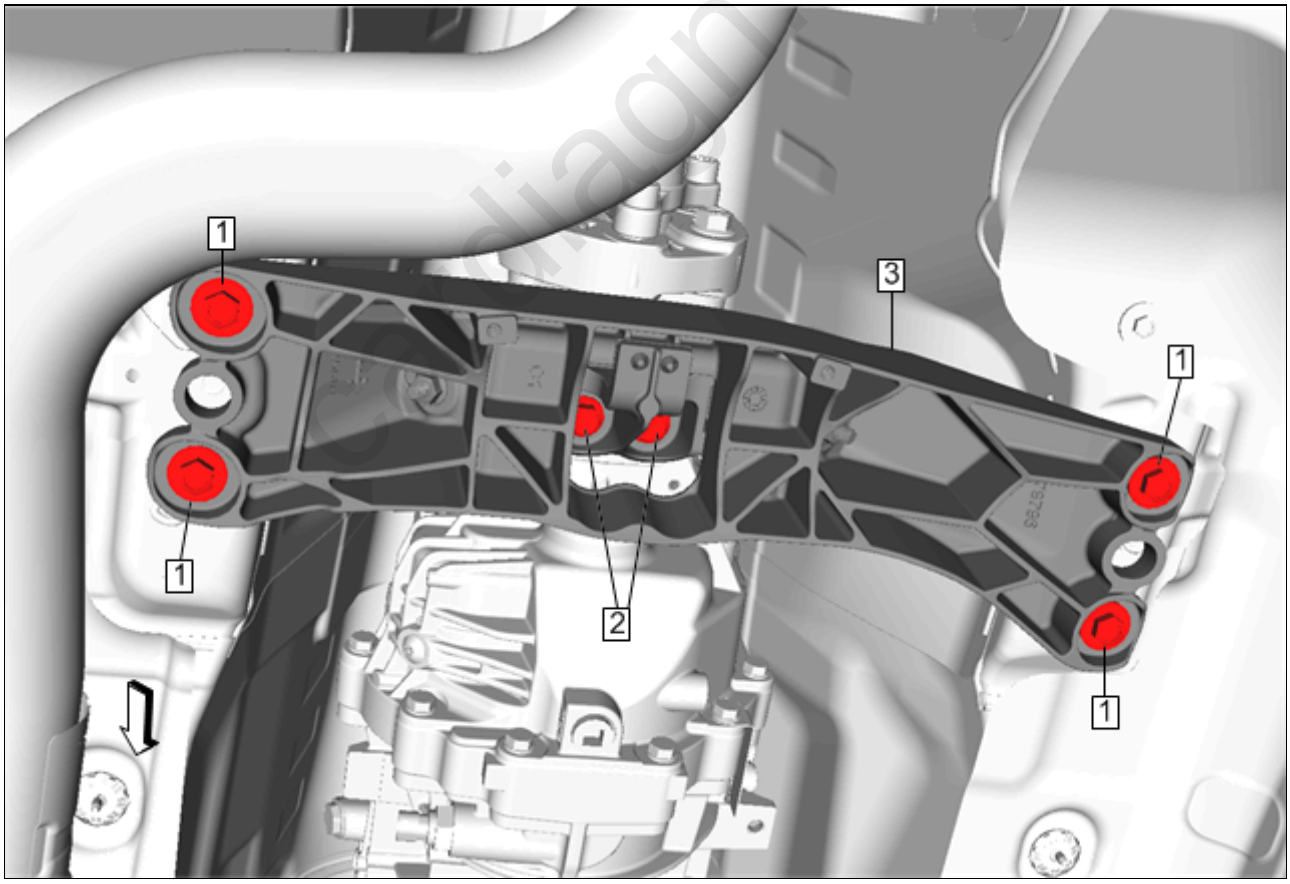
1. Raise and support the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP)
2. Support the transmission with a suitable jack.

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1	Transmission Support Crossmember Bolt (Qty: 4) *CAUTION:* *Refer to Fastener Caution* **Tighten** 58 N.m (43 lb ft)
2	Transmission Mount Bolt (Qty: 2) **Tighten** 58 N.m (43 lb ft)
3	Transmission Support Crossmember

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION REAR MOUNT REPLACEMENT (M13 TRANSMISSION)

Fig 1: Transmission Rear Mount (M13 Transmission)



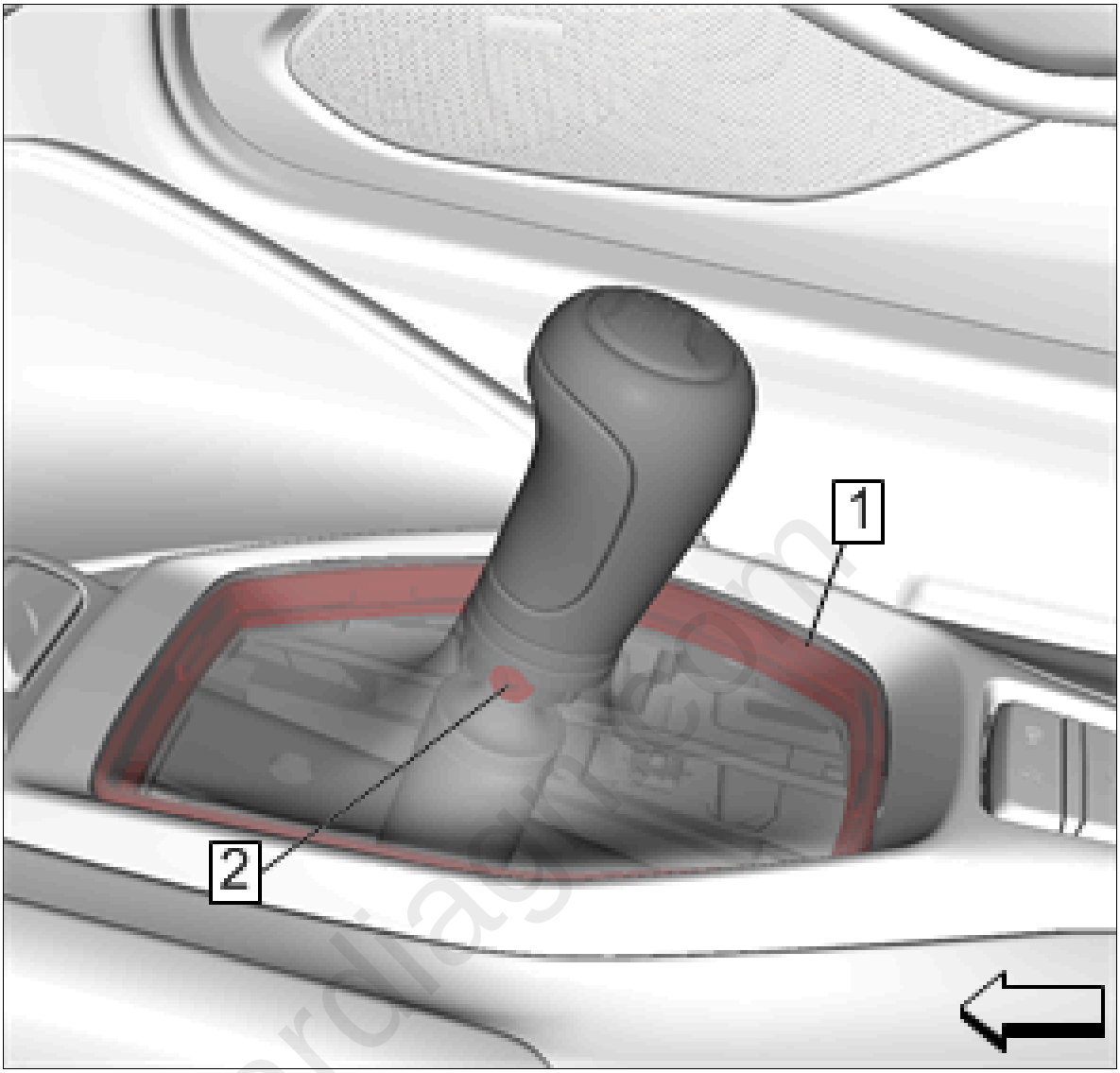
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
	NOTE: *The transmission support and the transmission mount are replaced as an assembly.* Preliminary Procedures 1. Raise and support the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP) 2. Support the transmission with a suitable jack.
1	Transmission Support Crossmember Bolt (Qty: 4) *CAUTION:* *Refer to Fastener Caution* **Tighten** 58 N.m (43 lb ft)
2	Transmission Mount Bolt (Qty: 2) **Tighten** 58 N.m (43 lb ft)
3	Transmission Support Crossmember

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REPAIR INSTRUCTIONS - ON VEHICLE > SHIFT CONTROL ASSEMBLY REPLACEMENT (M13) > REMOVAL PROCEDURE

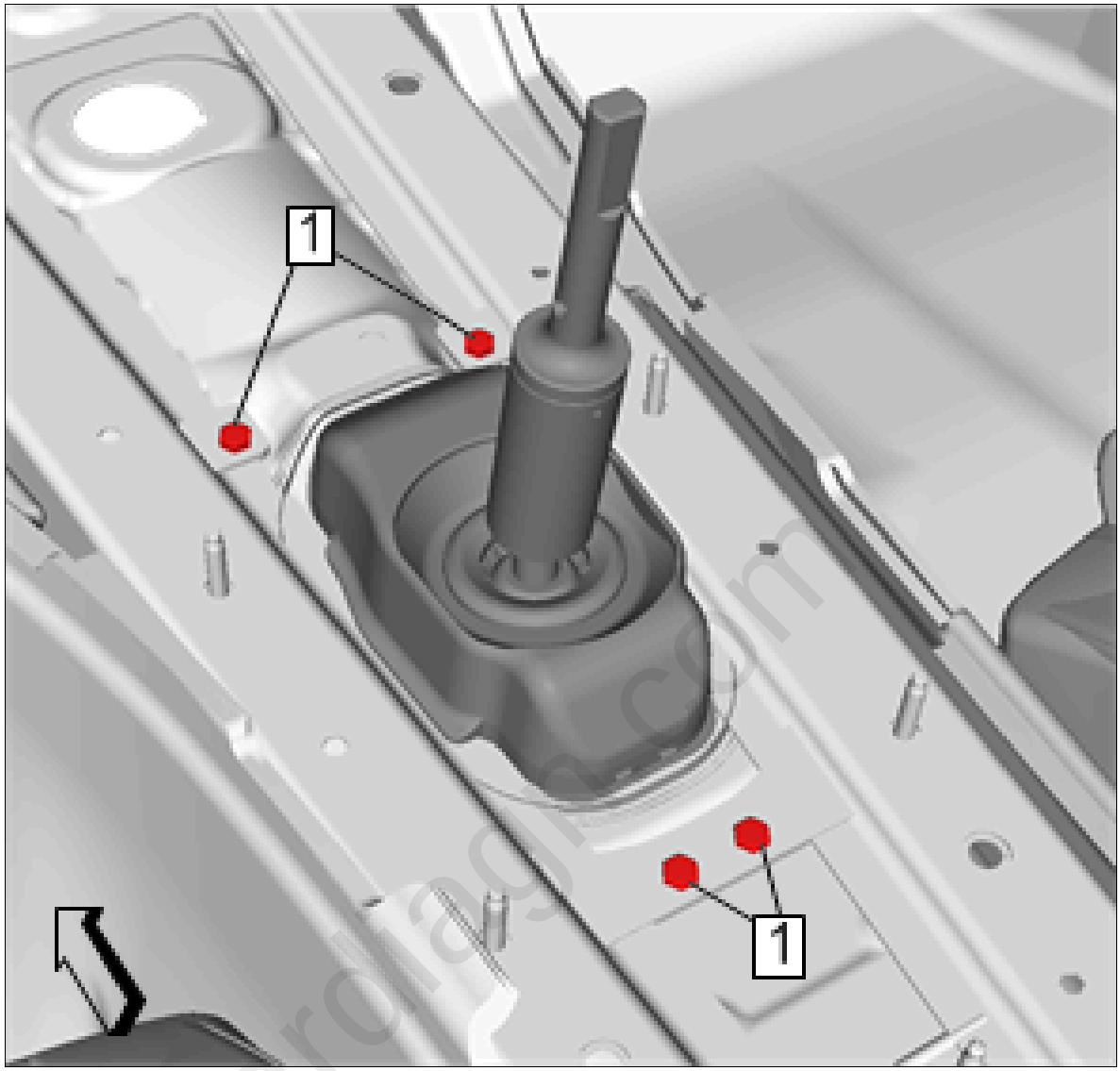
Fig 1: Shift Control Knob



Courtesy of GENERAL MOTORS COMPANY

1. Remove the shift control knob (1). Transmission Control Lever Knob Replacement
2. Place the shifter in the Neutral position.

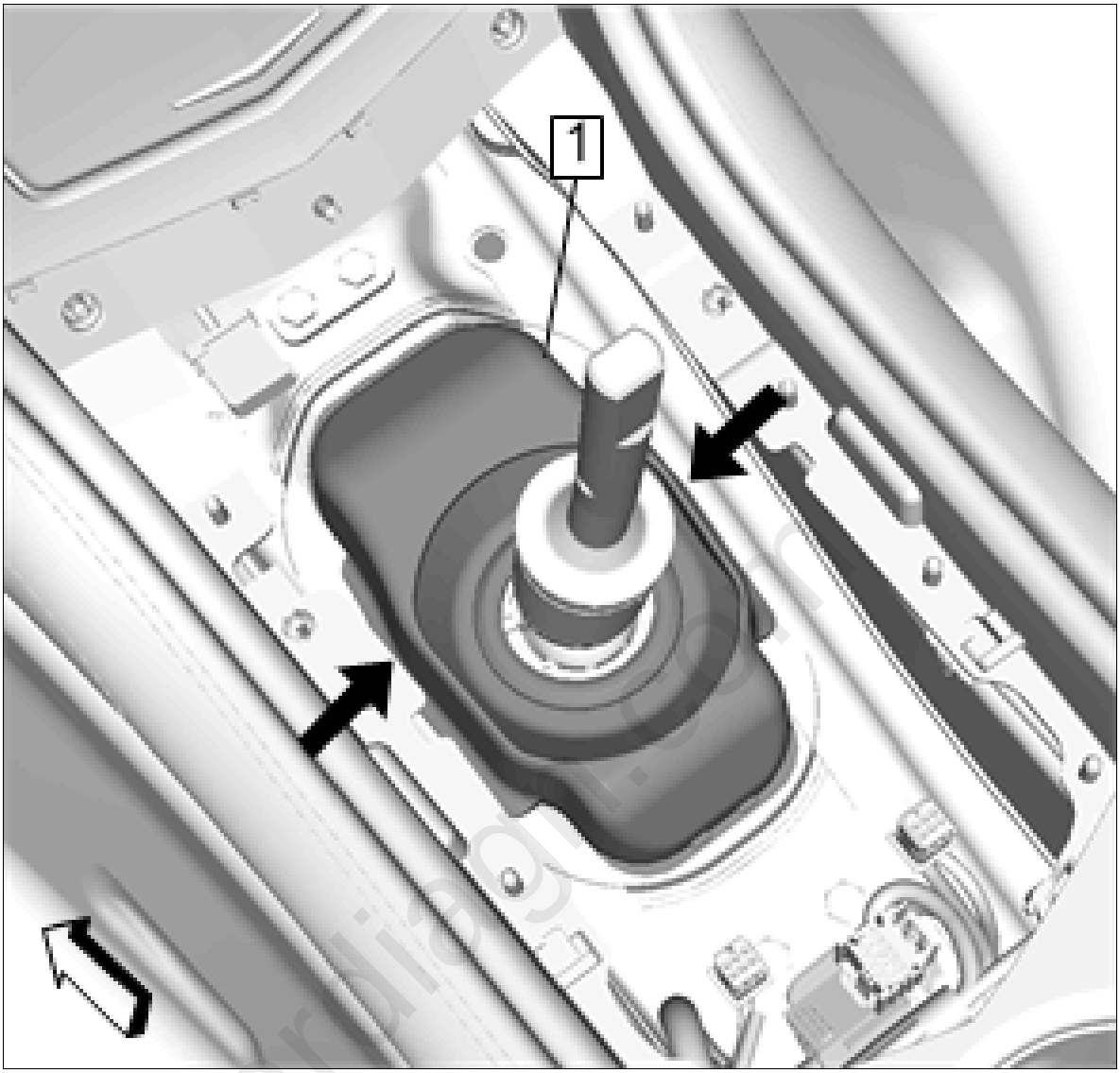
Fig 2: Shift Control Assembly Fasteners



Courtesy of GENERAL MOTORS COMPANY

3. Remove the 4 fasteners (1) securing the shift control assembly to the tunnel reinforcement.

Fig 3: Closeout Boot

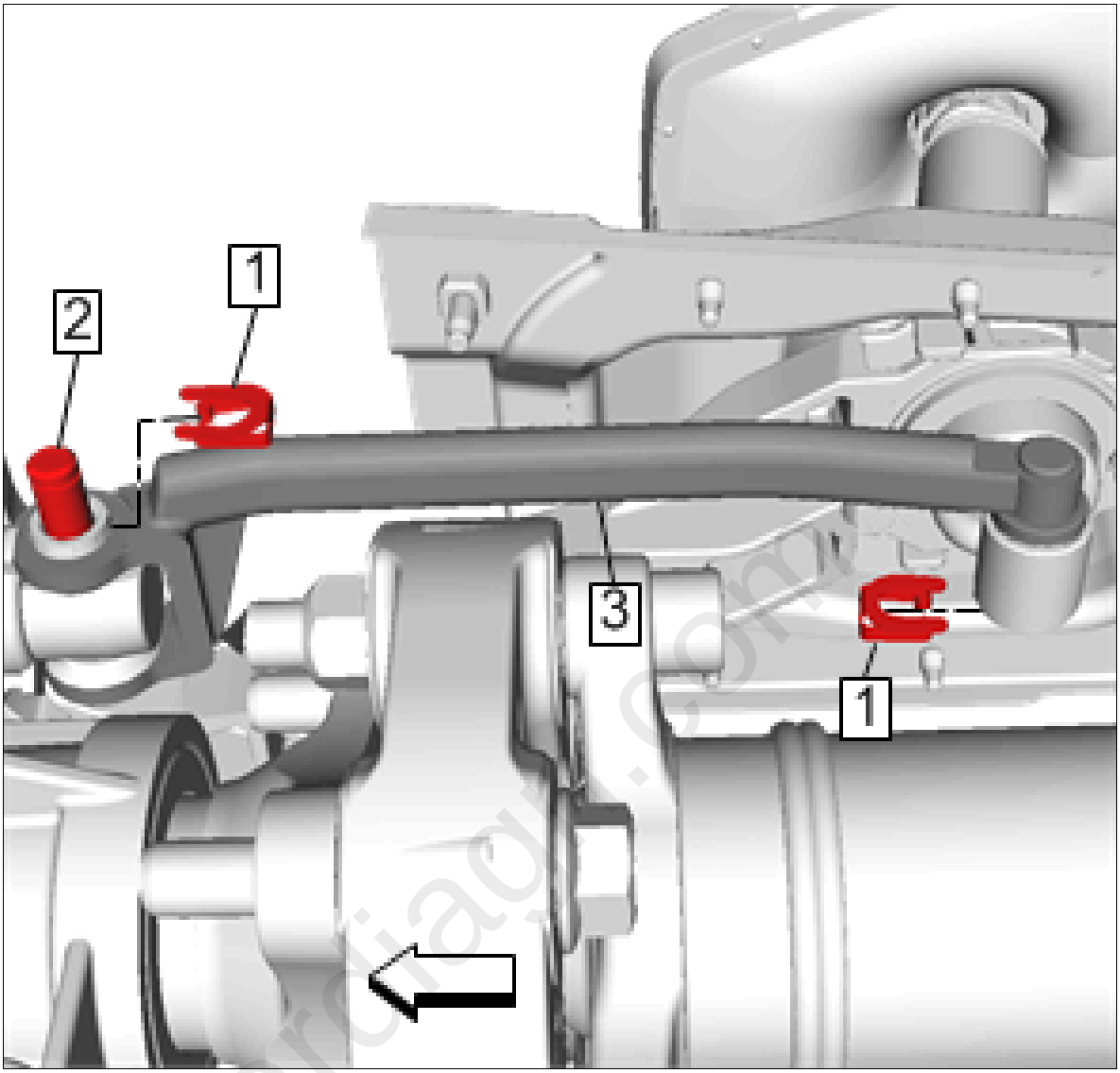


Courtesy of GENERAL MOTORS COMPANY

4. Push the tabs on the closeout boot (1) inward and down to clear the body structure.
5. Raise the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP)
6. Remove the propeller shaft. Two-Piece Propeller Shaft Replacement (Coupe MM6, M13)Two-Piece Propeller Shaft Replacement (Convertible MM6, M13)

> *NOTE:*
>
> *Note the position of the shift linkage (3) fork end. If the shift linkage fork is installed in the reversed position the transmission will not function correctly. The shift linkage fork end MUST be installed as shown.*

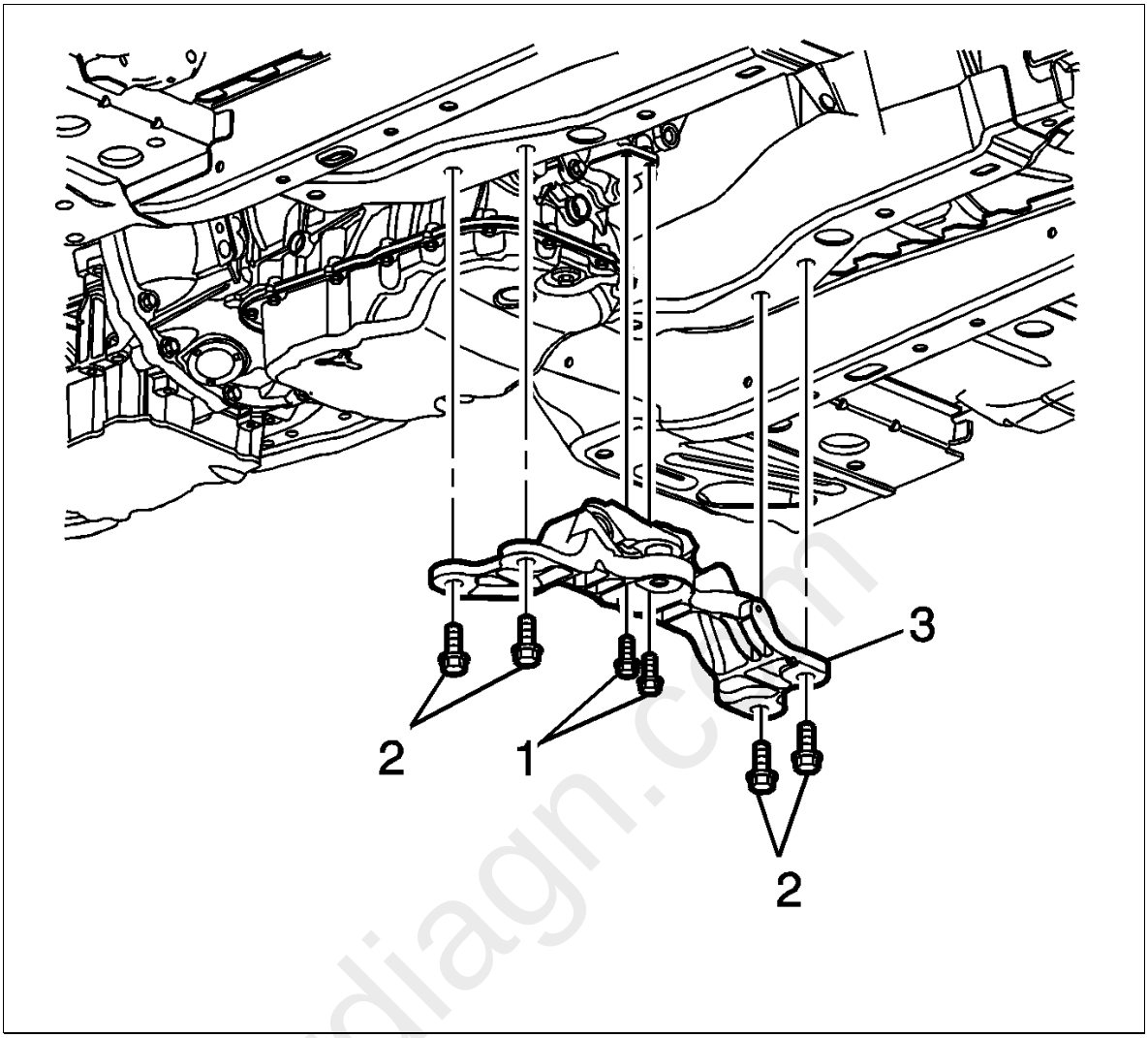
Fig 4: Shift Linkage Retaining Clip



Courtesy of GENERAL MOTORS COMPANY

7. Remove the shift linkage retaining clips (1).
8. Remove the shift linkage pin (2).
9. Remove the shift linkage assembly (3).
10. Support the transmission with a suitable jack.

Fig 5: Transmission Support Fasteners

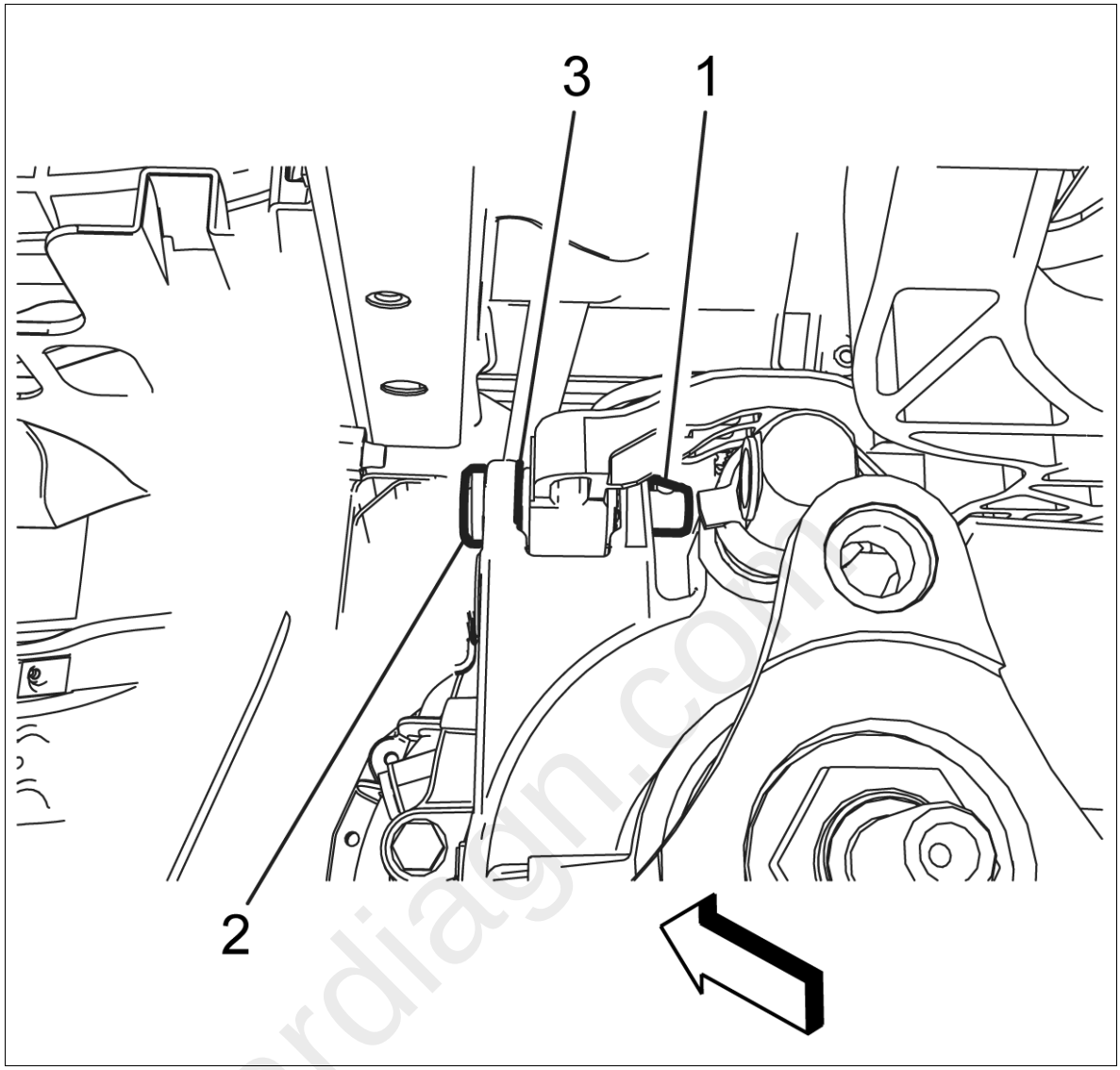


Courtesy of GENERAL MOTORS COMPANY

11. Remove the 6 fasteners (1, 2) securing the transmission support.
12. Lower the transmission assembly to gain access to the top of the transmission.

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Fig 6: Transmission Boss, Shift Control Rod Pin & Retaining Tab

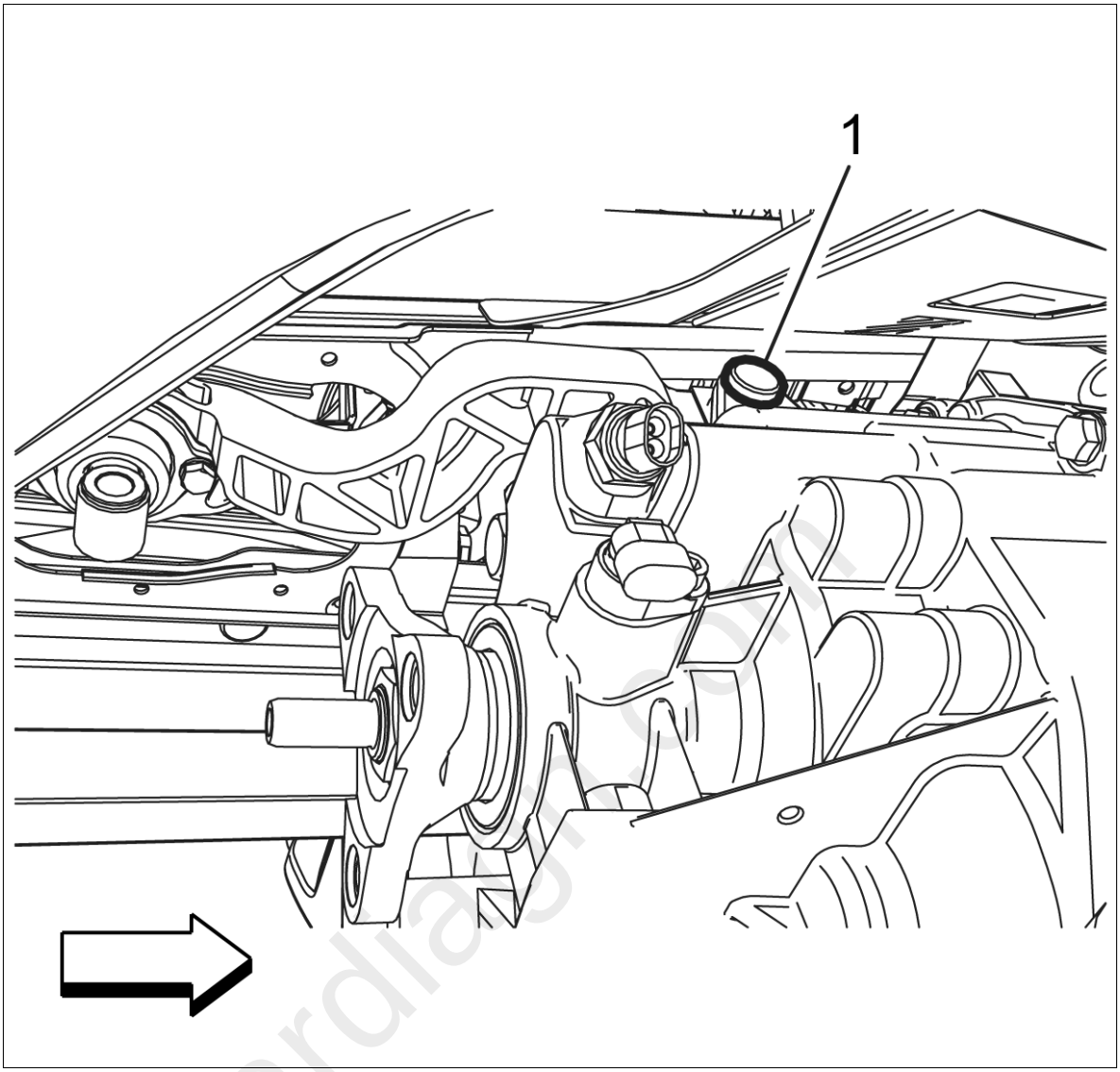


Courtesy of GENERAL MOTORS COMPANY

13. Using a suitable flat-blade tool, release the left side shift control rod pin retaining tab (1), while sliding the pin outward. The pin will lock again at the outer transmission boss (3). Using a suitable flat-blade tool, insert the tool between the boss (3) and the rubber mount on the shift control assembly to release the shift control rod pin retaining tab to slide it further out of the transmission boss. Reposition the transmission slightly to allow extra clearance to completely remove the pin.

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Fig 7: Right Side Shift Control Rod Pin Retaining Tab



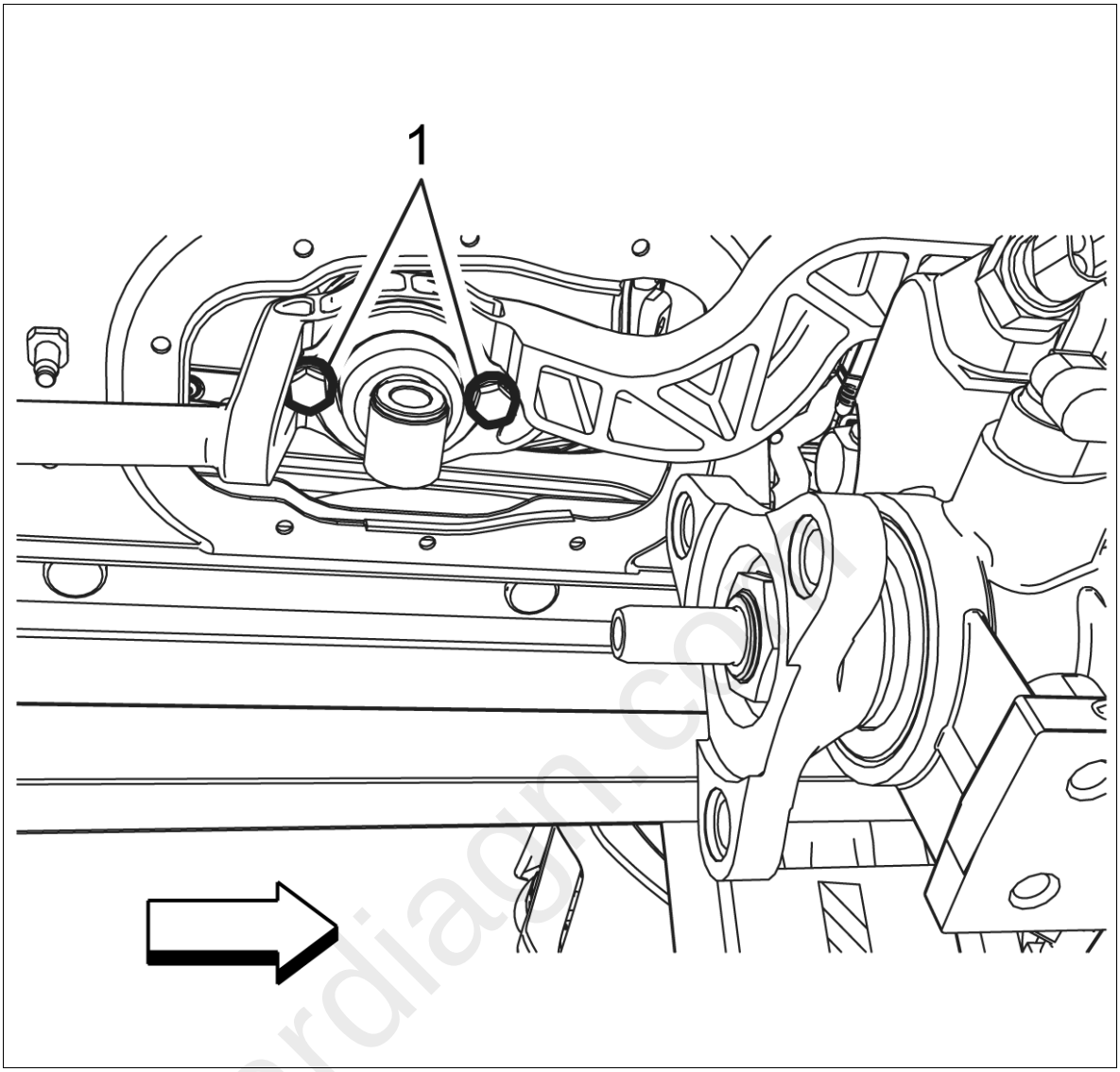
Courtesy of GENERAL MOTORS COMPANY

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14. Using a suitable flat-blade tool, release the right side shift control rod pin retaining tab (1), while sliding the pin outward. The pin will lock again at the outer transmission boss. Using a suitable flat-blade tool, insert the tool between the boss and the rubber mount on the shift control assembly to release the shift control rod pin retaining tab to slide it further out of the transmission boss. Reposition the transmission slightly to allow extra clearance to completely remove the pin.

15. Remove the shift control assembly from the transmission. Remove the shift control assembly from the vehicle.

Fig 8: Shift Control Assembly Lower Fasteners



Courtesy of GENERAL MOTORS COMPANY

16. Loosen the two lower fasteners (1) on the shift control assembly enough to allow the removal of the shift control assembly.

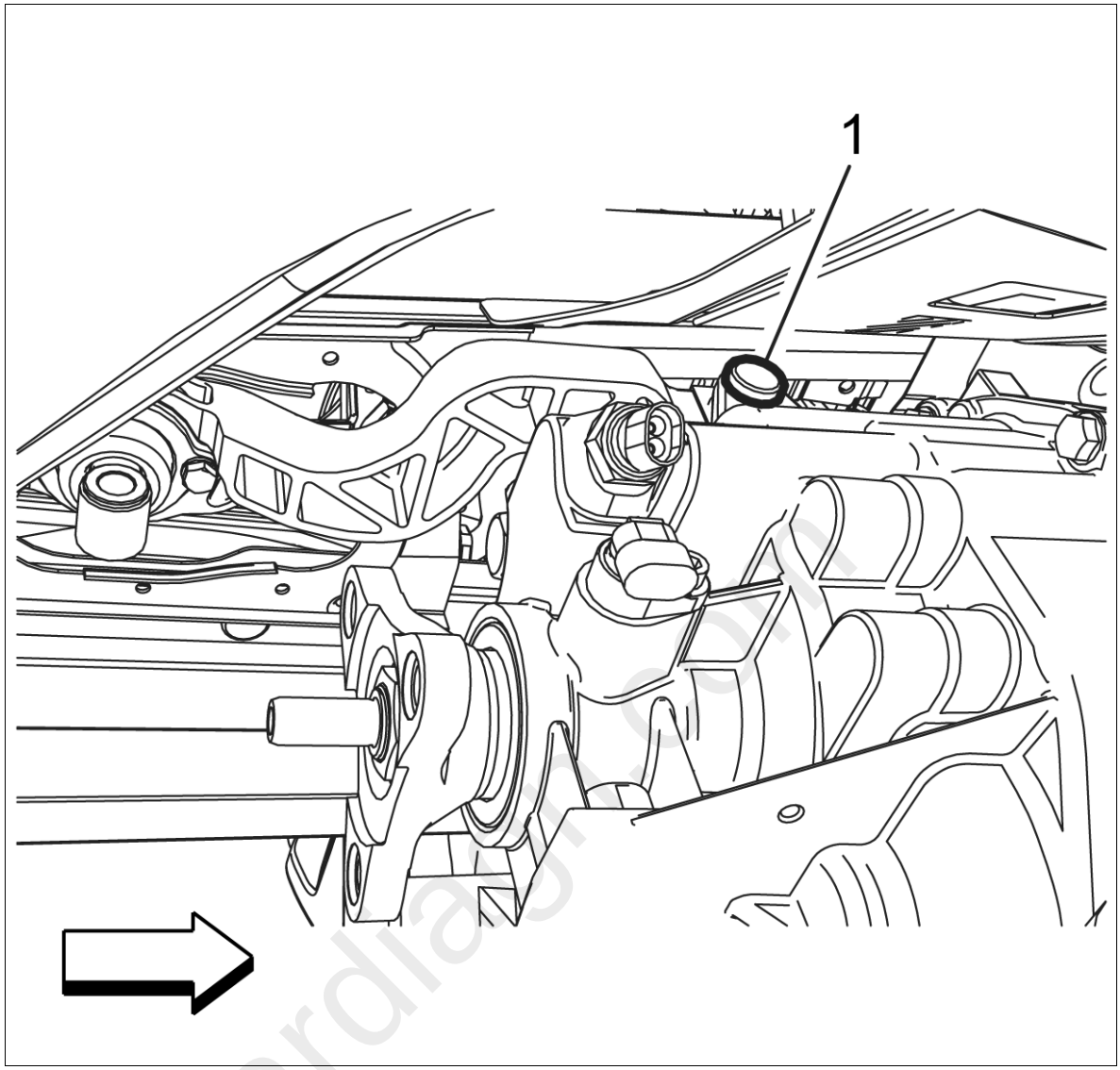
REPAIR INSTRUCTIONS - ON VEHICLE > SHIFT CONTROL ASSEMBLY REPLACEMENT (M13) > INSTALLATION PROCEDURE

NOTE:

Before installing the shifter, ensure that the shift shaft it is clean of dirt or lubricants.

1. Install the shift control assembly to the transmission.

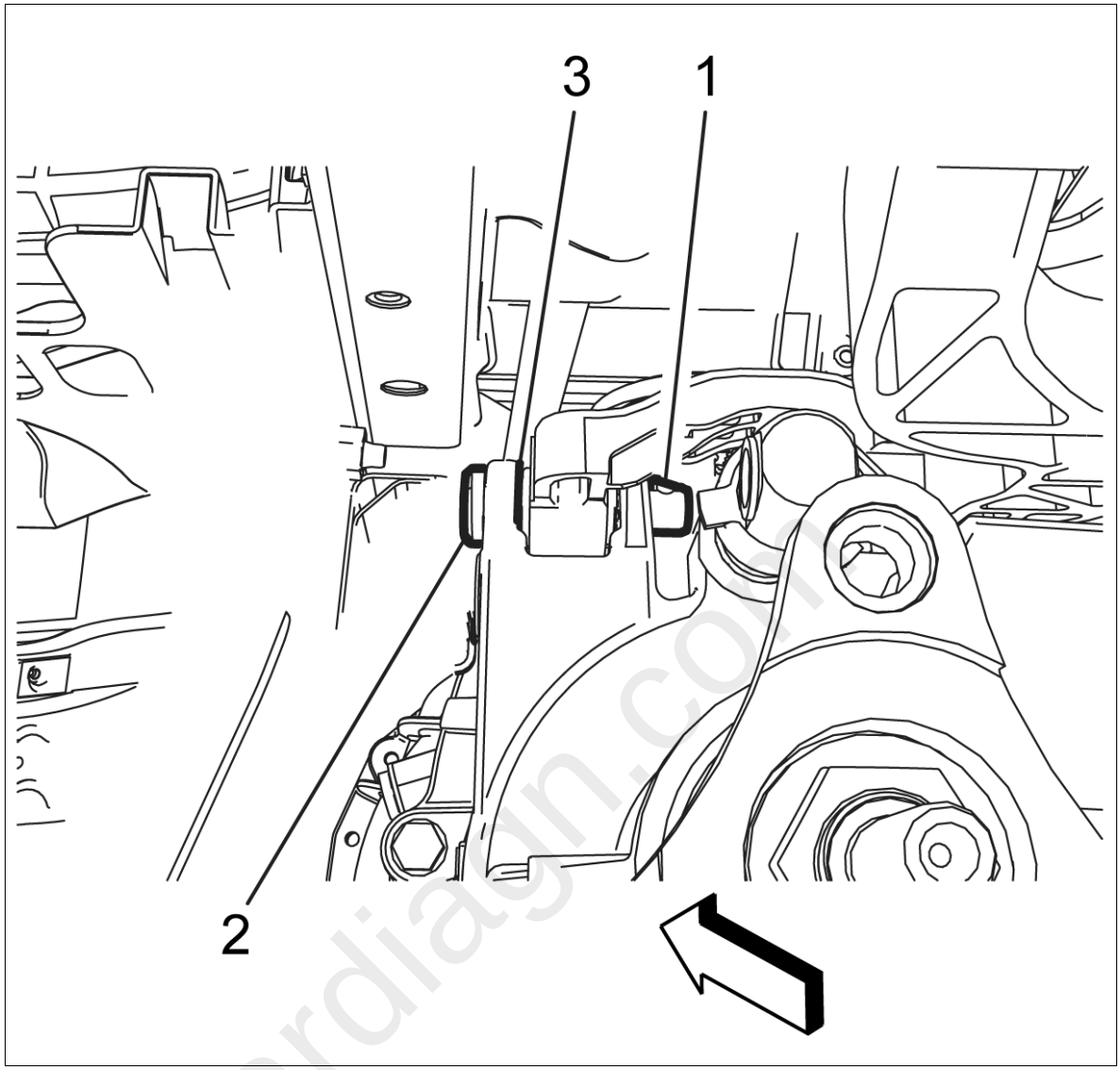
Fig 1: Right Side Shift Control Rod Pin Retaining Tab



Courtesy of GENERAL MOTORS COMPANY

2. Install the right shift control assembly rod pin (1).

Fig 2: Transmission Boss, Shift Control Rod Pin & Retaining Tab

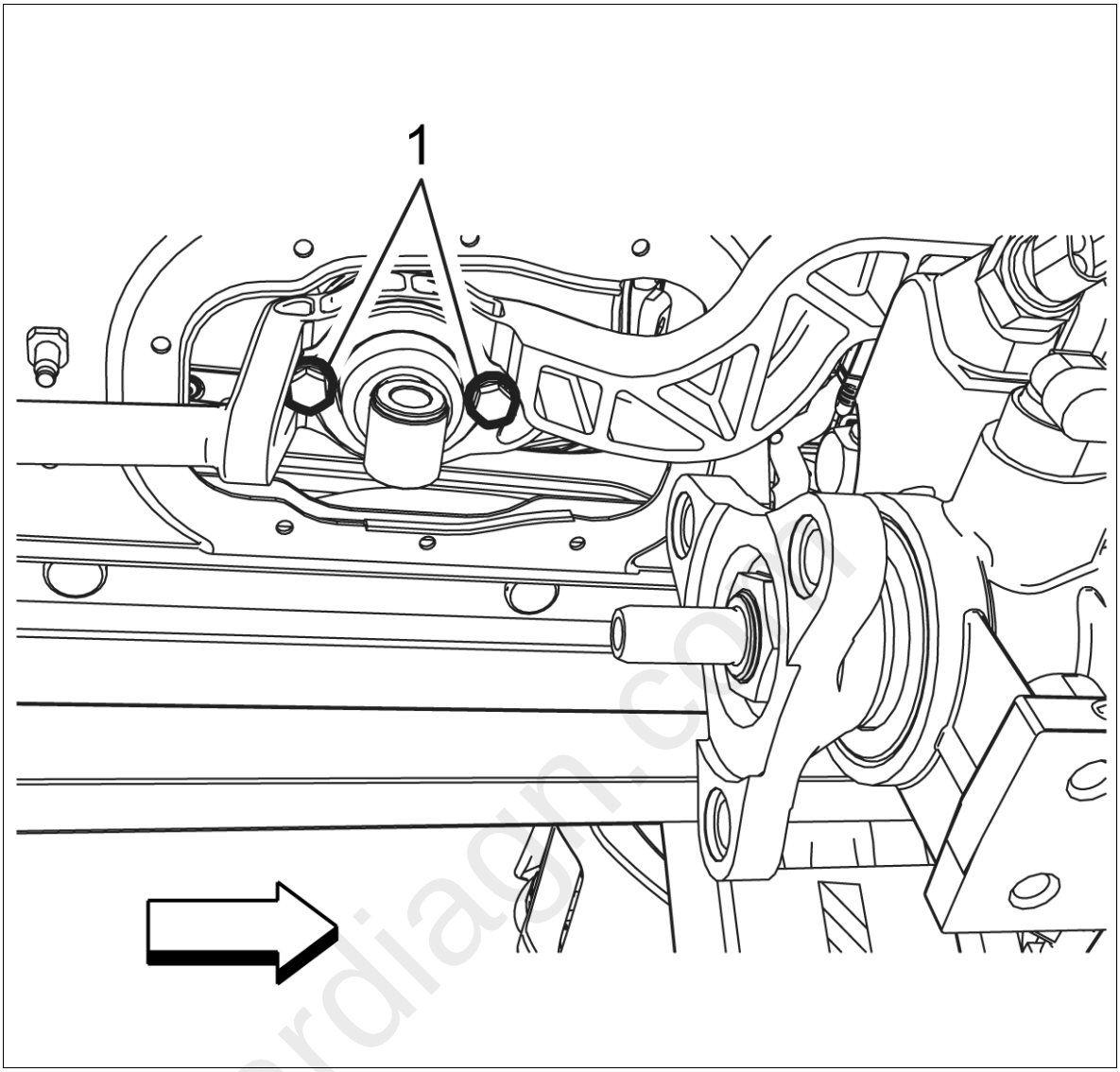


Courtesy of GENERAL MOTORS COMPANY

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3. Install the left shift control assembly rod pin (2).

Fig 3: Shift Control Assembly Lower Fasteners

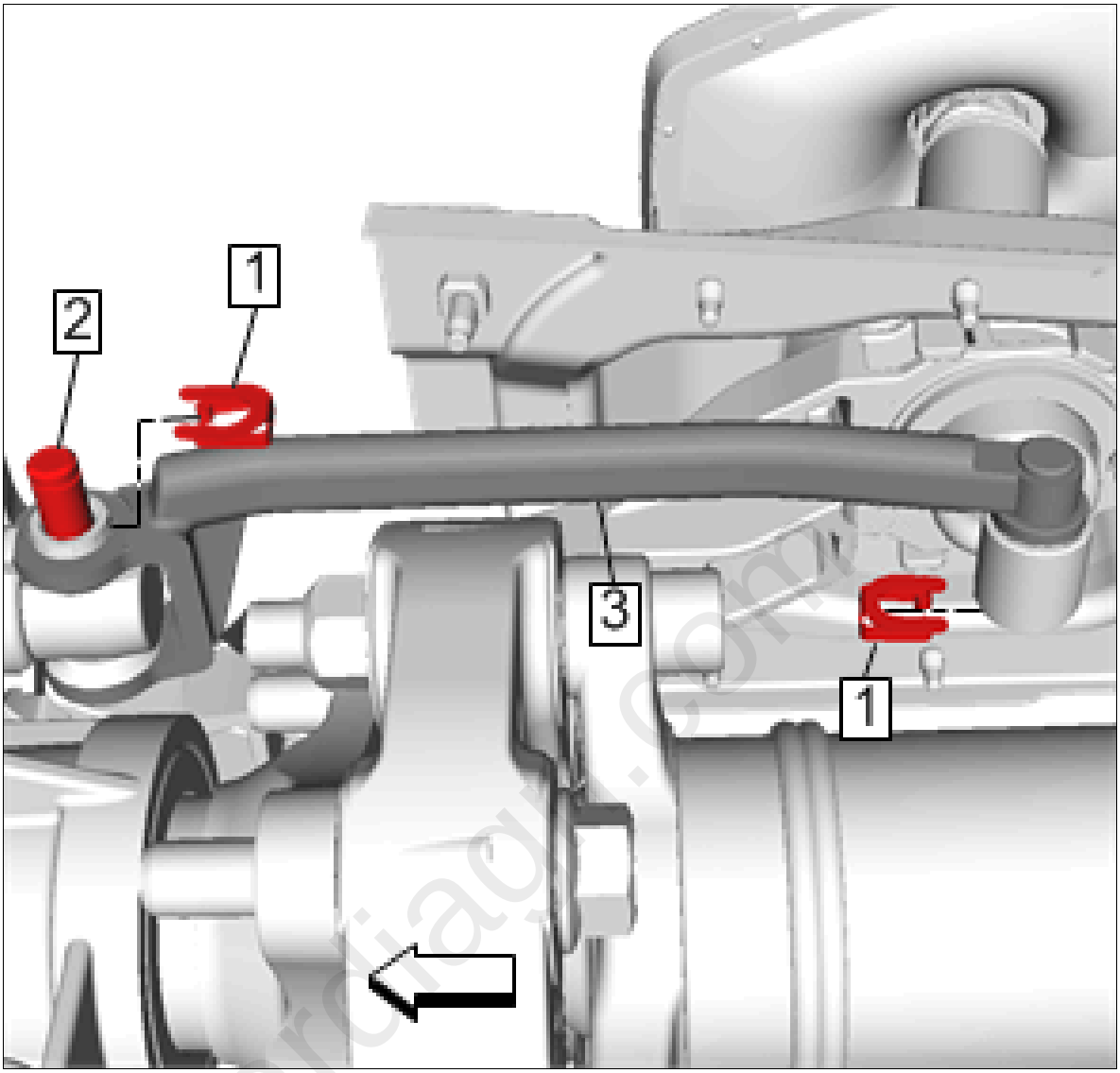


Courtesy of GENERAL MOTORS COMPANY

4. Tighten the two lower fasteners (1) on the shift control assembly to 18 N.m (13 lb ft).

> *NOTE:*
>
> *Note the position of the shift linkage (3) fork end. If the shift linkage fork is installed in the reversed position the transmission will not function correctly. The shift linkage fork end MUST be installed as shown.*

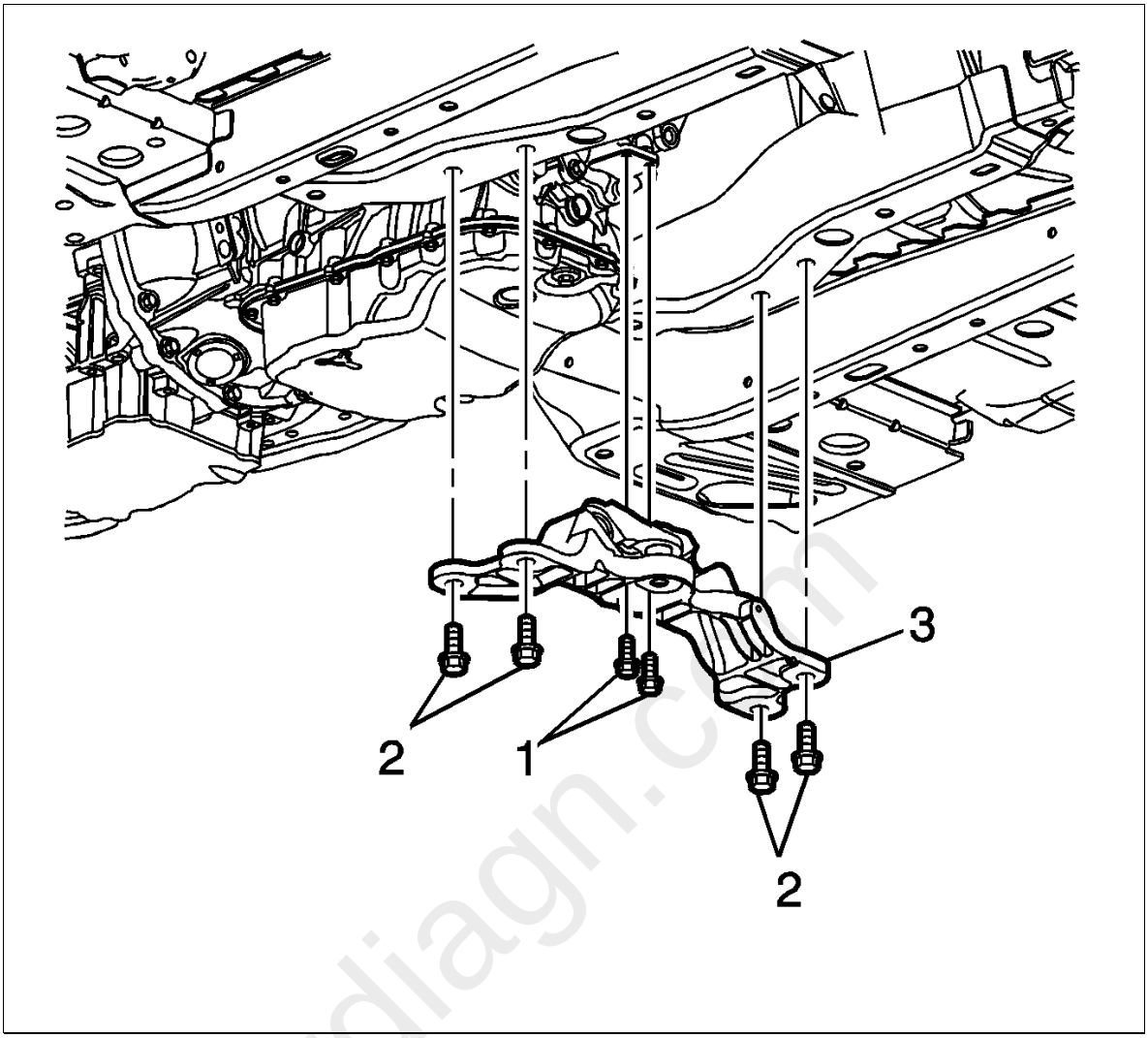
Fig 4: Shift Linkage Assembly



Courtesy of GENERAL MOTORS COMPANY

5. Install the shift linkage assembly (3).
6. Install the shift linkage pin (2).
7. Install the shift linkage retaining clips (1).

Fig 5: Transmission Support Fasteners



Courtesy of GENERAL MOTORS COMPANY

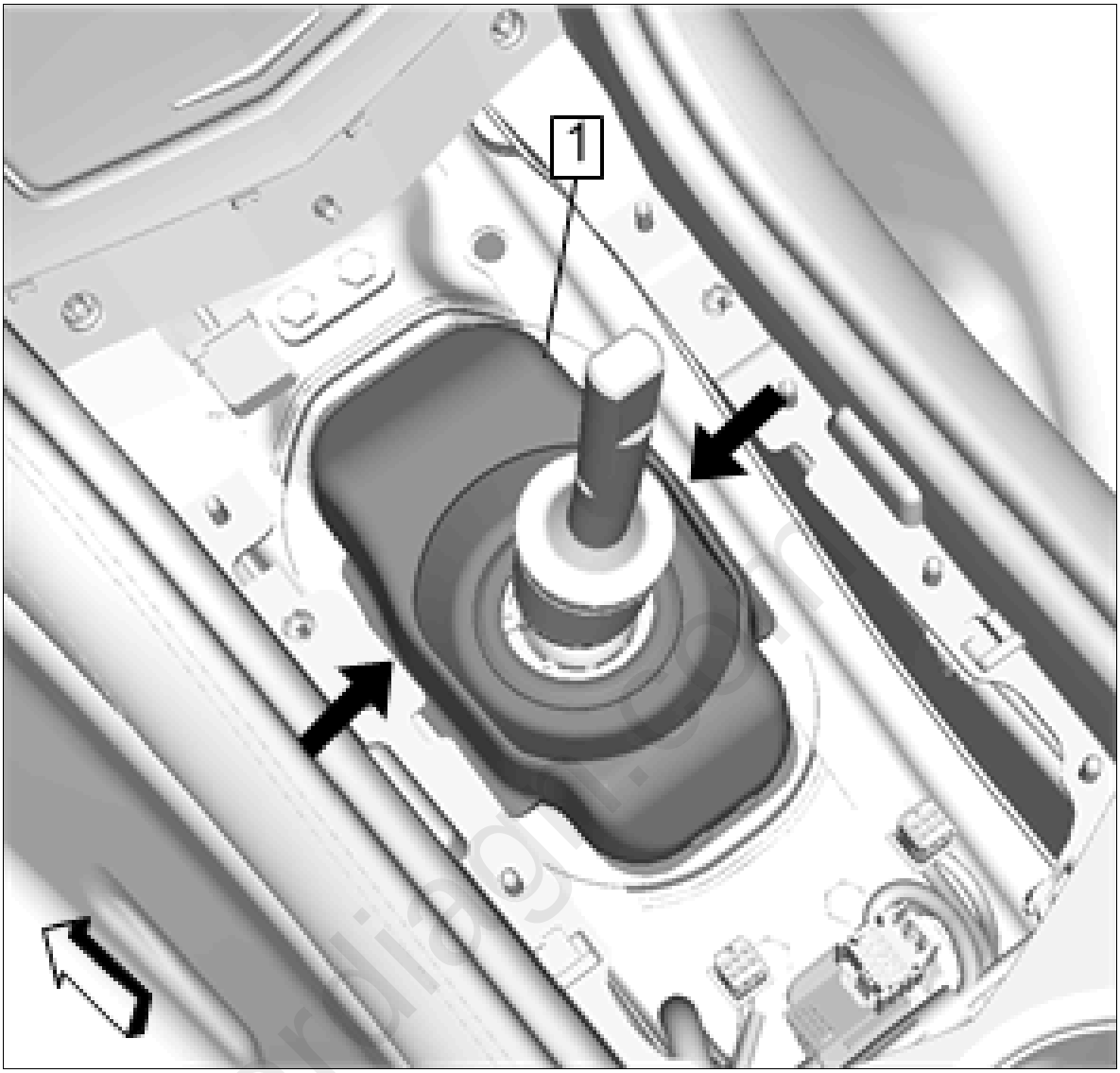
8. Raise the transmission.

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

9. Install the 6 transmission support fasteners (1, 2), then tighten to 60 N.m (44 lb ft).
10. Remove the jack supporting the transmission.
11. Install the propeller shaft. Two-Piece Propeller Shaft Replacement (Coupe MM6, M13)Two-Piece Propeller Shaft Replacement (Convertible MM6, M13)
12. Lower the vehicle.

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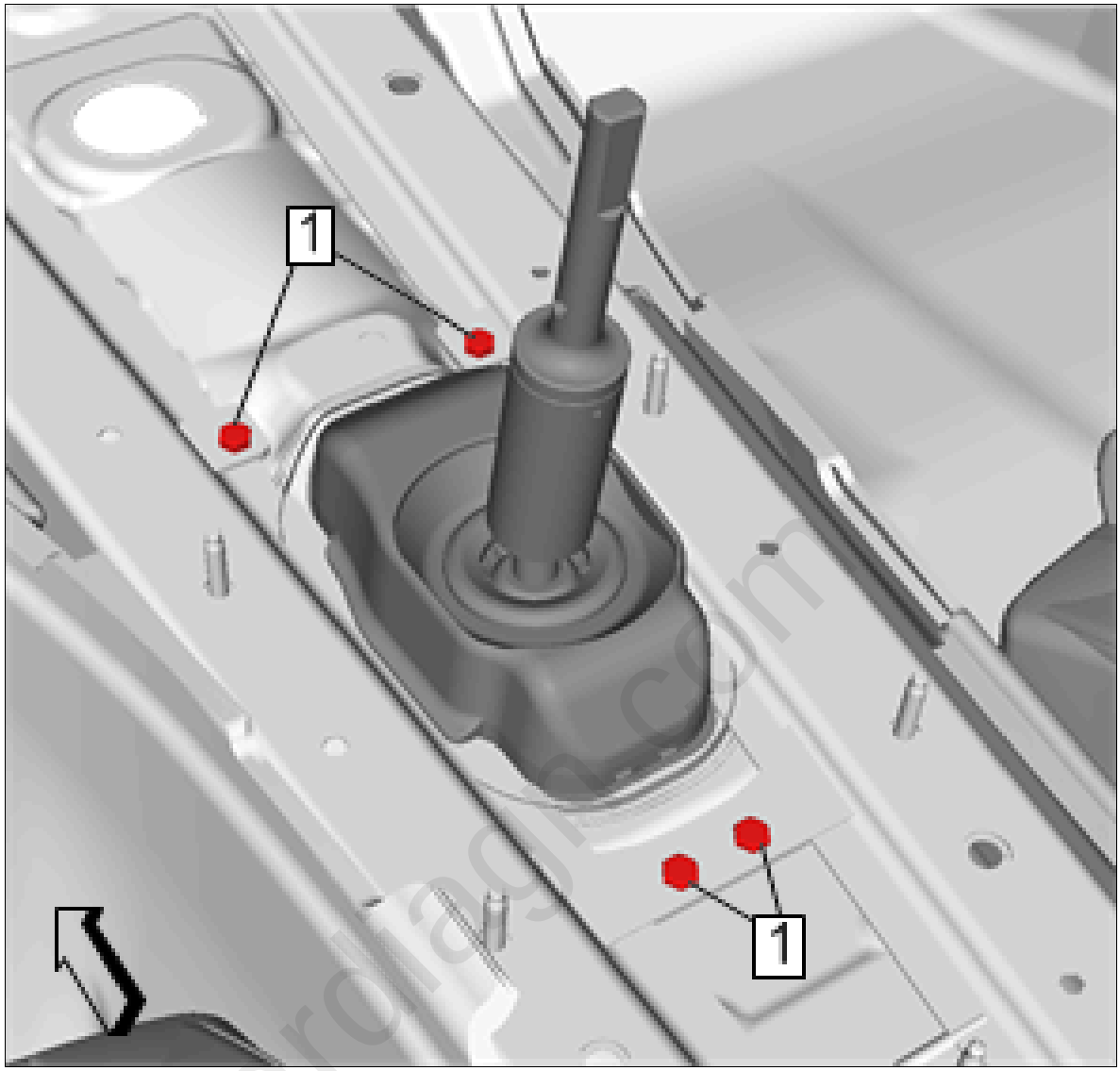
Fig 6: Closeout Boot



Courtesy of GENERAL MOTORS COMPANY

13. Pull up and outward on the tabs on the closeout boot (1) to clear the body structure.

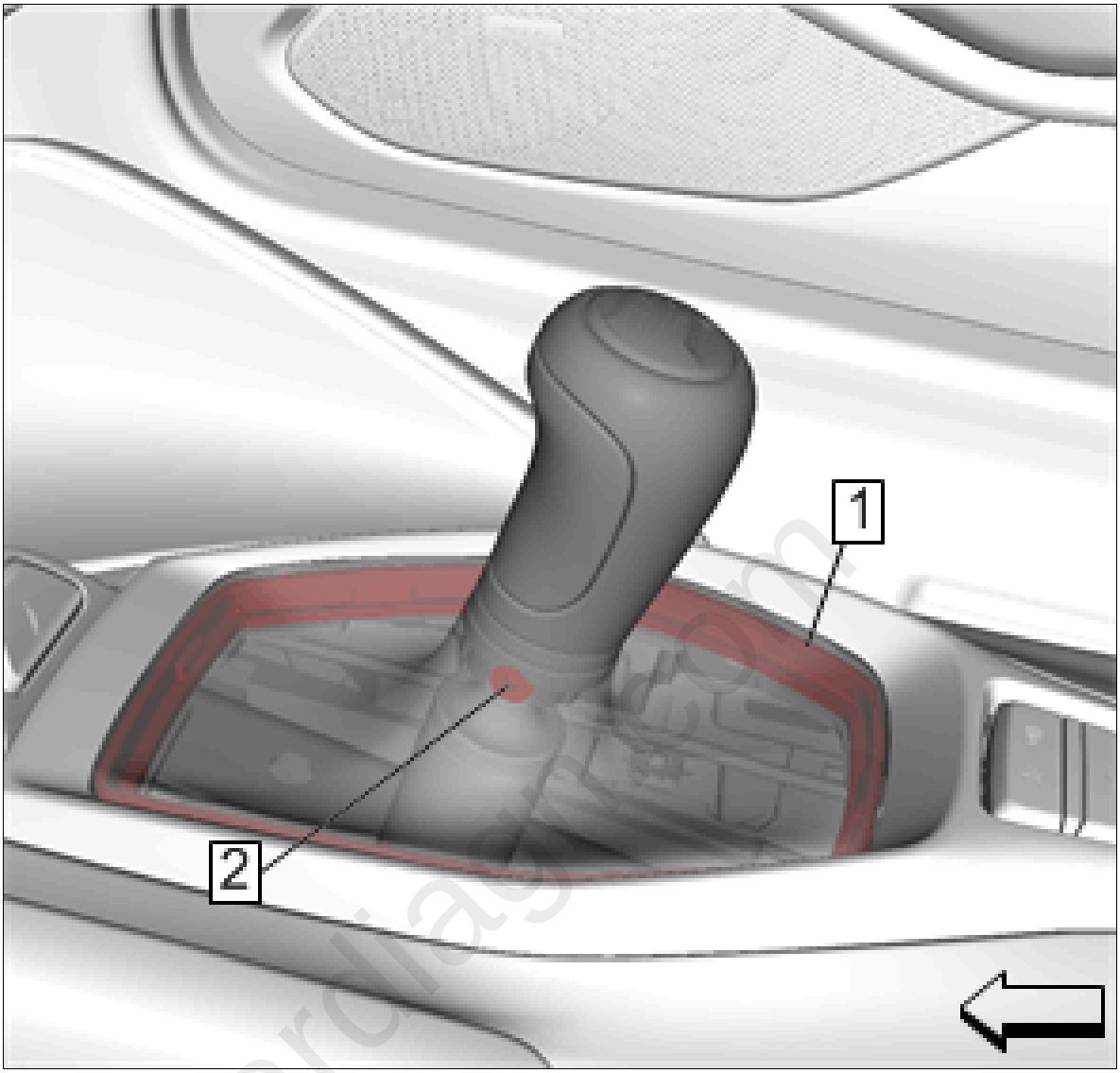
Fig 7: Shift Control Assembly Fasteners



Courtesy of GENERAL MOTORS COMPANY

14. Install the 4 fasteners (1) securing the shift control assembly to the tunnel reinforcement, then tighten to 12 N.m (106 lb in).

Fig 8: Shift Control Knob

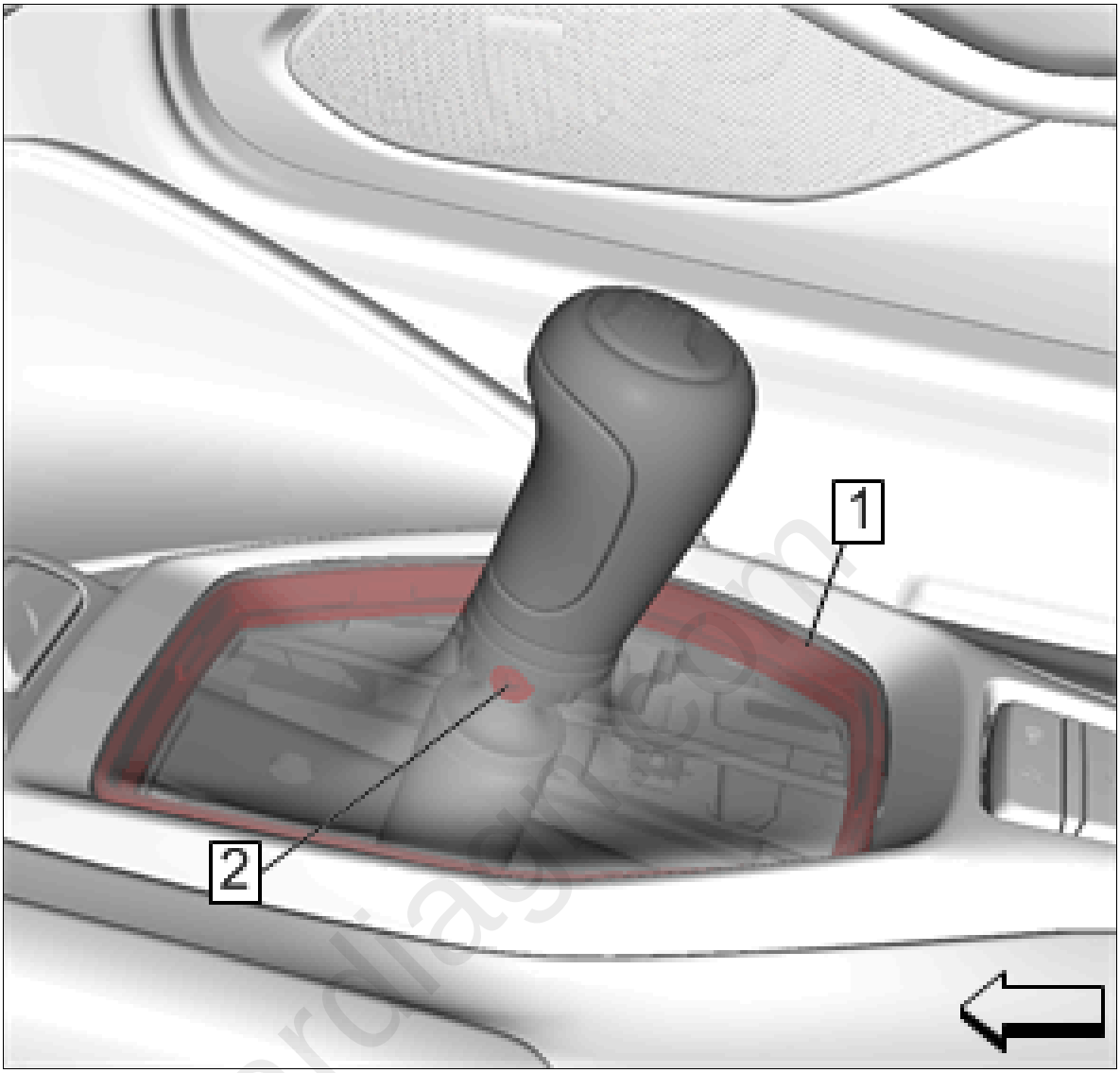


Courtesy of GENERAL MOTORS COMPANY

15. Install the shift control knob (1). Transmission Control Lever Knob Replacement

REPAIR INSTRUCTIONS - ON VEHICLE > SHIFT CONTROL ASSEMBLY REPLACEMENT (MM6) > REMOVAL PROCEDURE

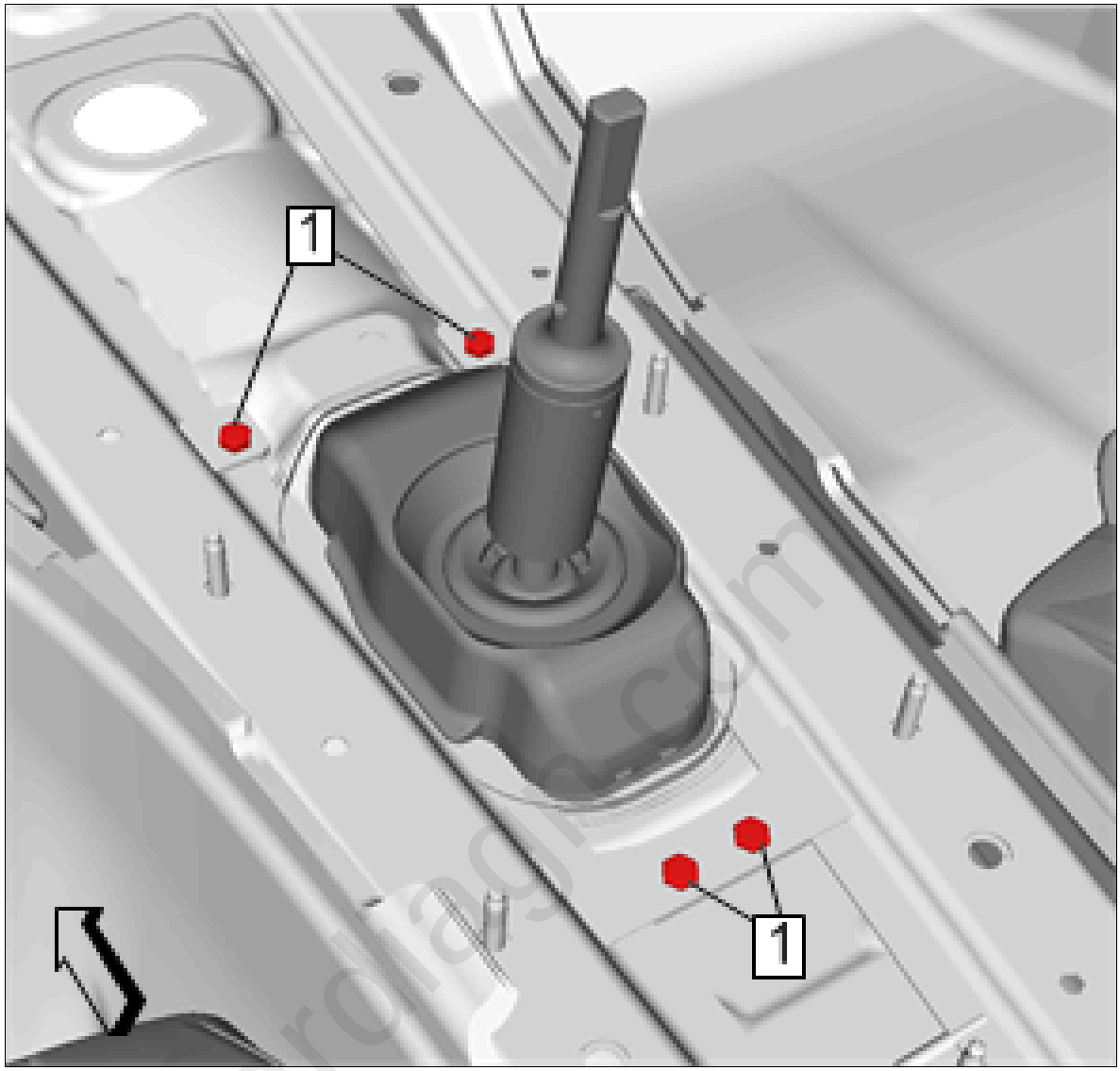
Fig 1: Shift Control Knob



Courtesy of GENERAL MOTORS COMPANY

1. Remove the shift control knob (1). Transmission Control Lever Knob Replacement
2. Place the shifter in the Neutral position.
3. Remove the front floor console trim plate. Front Floor Console Trim Plate Replacement (Automatic)Front Floor Console Trim Plate Replacement (Manual)
4. Remove the upper shifter closeout boot from the lower closeout boot.

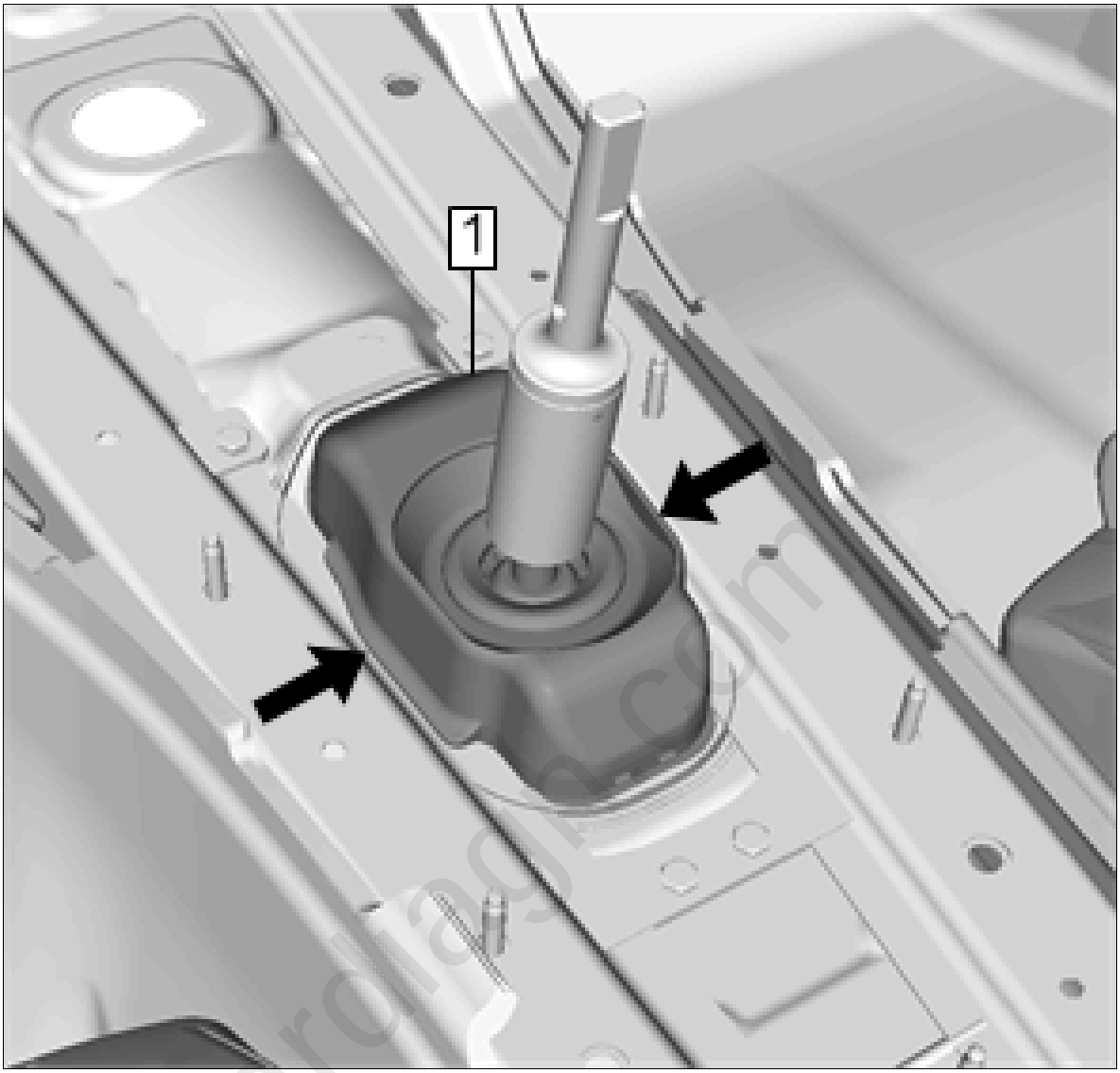
Fig 2: Shift Control Assembly Fasteners



Courtesy of GENERAL MOTORS COMPANY

5. Remove the 4 fasteners (1) securing the shift control assembly to the tunnel reinforcement.

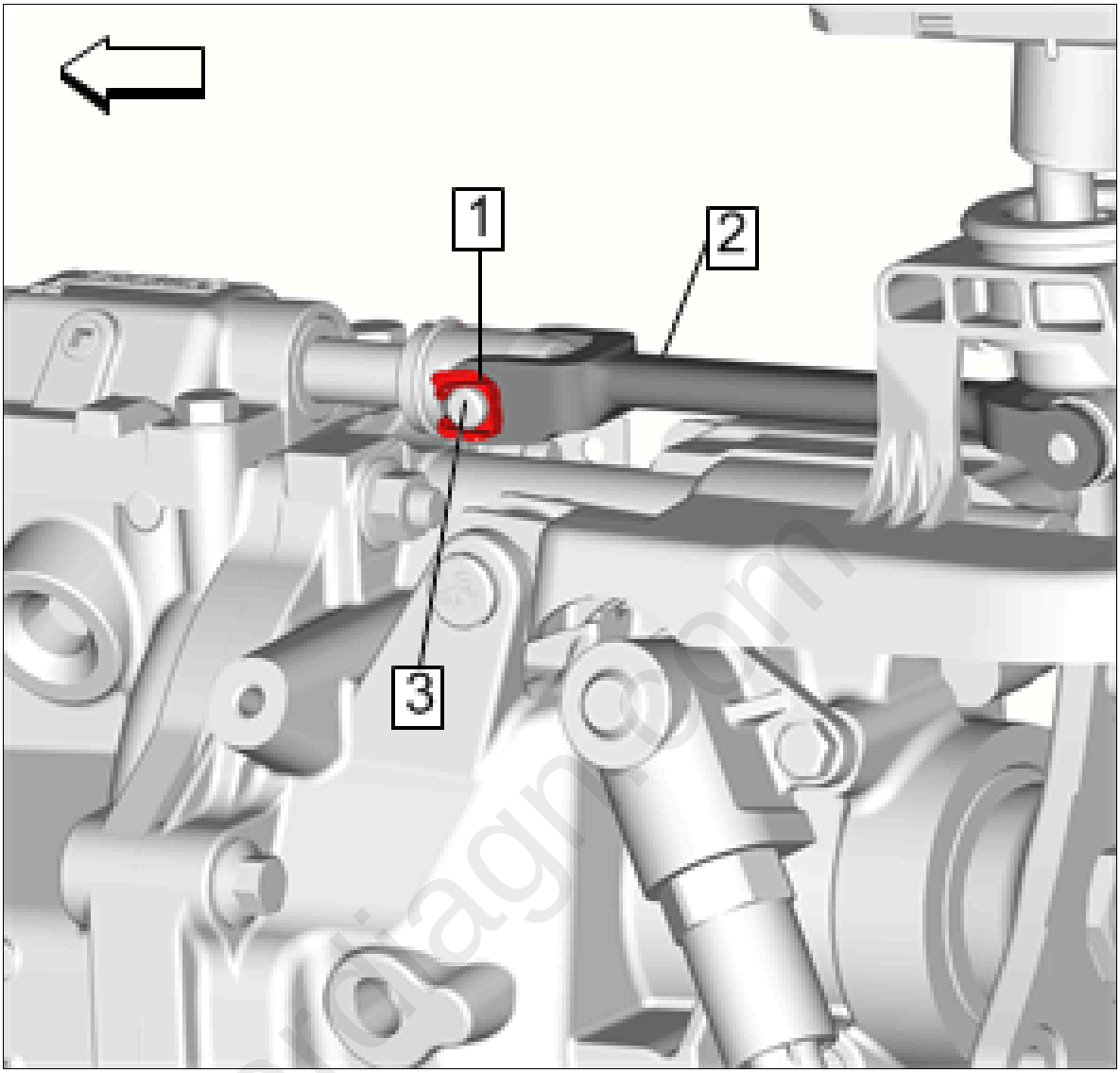
Fig 3: Closeout Boot Tabs



Courtesy of GENERAL MOTORS COMPANY

6. Push the tabs on the closeout boot (1) inward and down to clear the body structure.
7. Raise the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP)
8. Remove the propeller shaft. Two-Piece Propeller Shaft Replacement (Coupe MM6, M13)Two-Piece Propeller Shaft Replacement (Convertible MM6, M13)

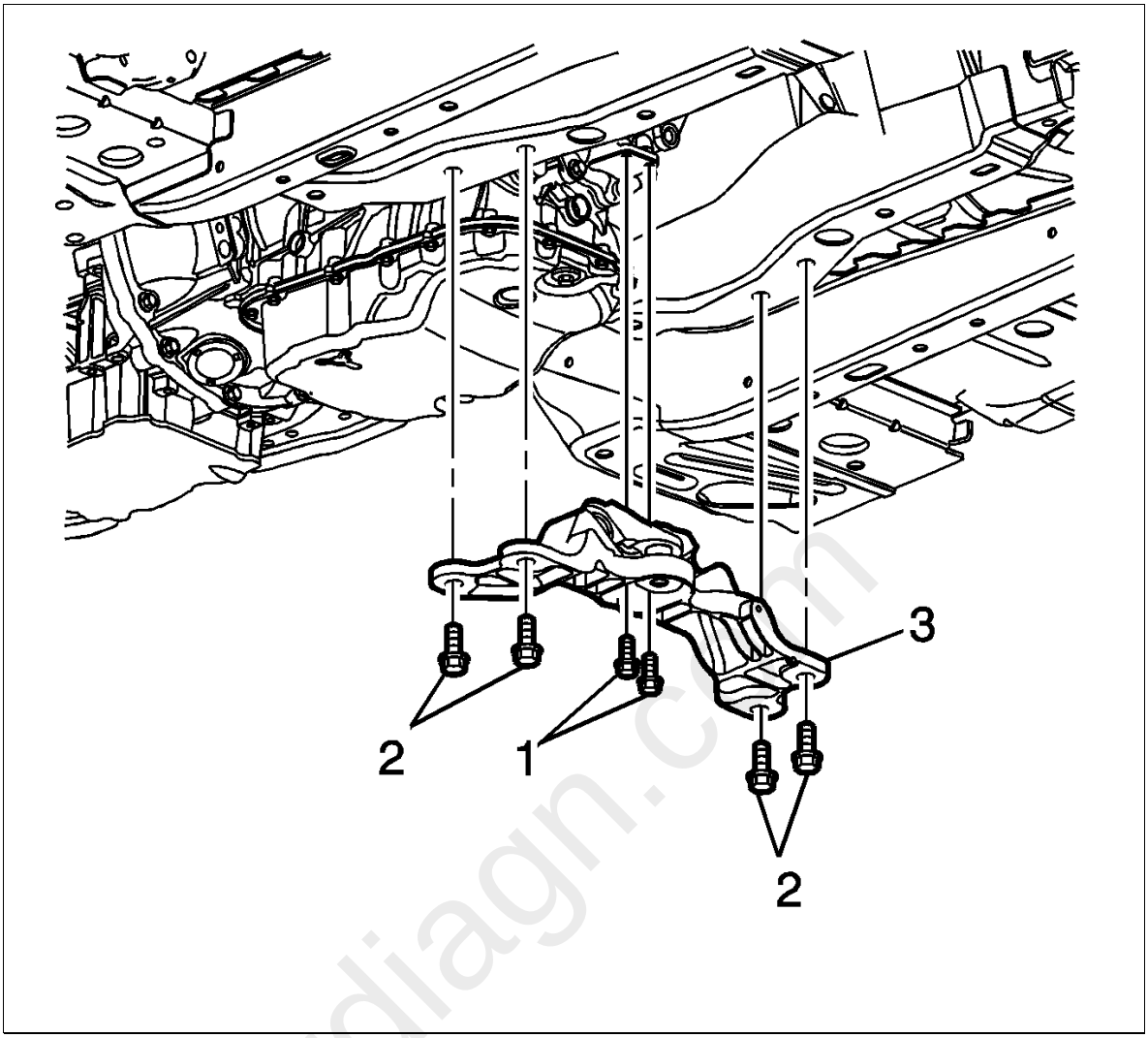
Fig 4: Shift Linkage Pin



Courtesy of GENERAL MOTORS COMPANY

9. Remove the shift linkage retaining clip (1).
10. Remove the shift linkage pin (3).
11. Support the transmission with a suitable jack.

Fig 5: Transmission Support Fasteners

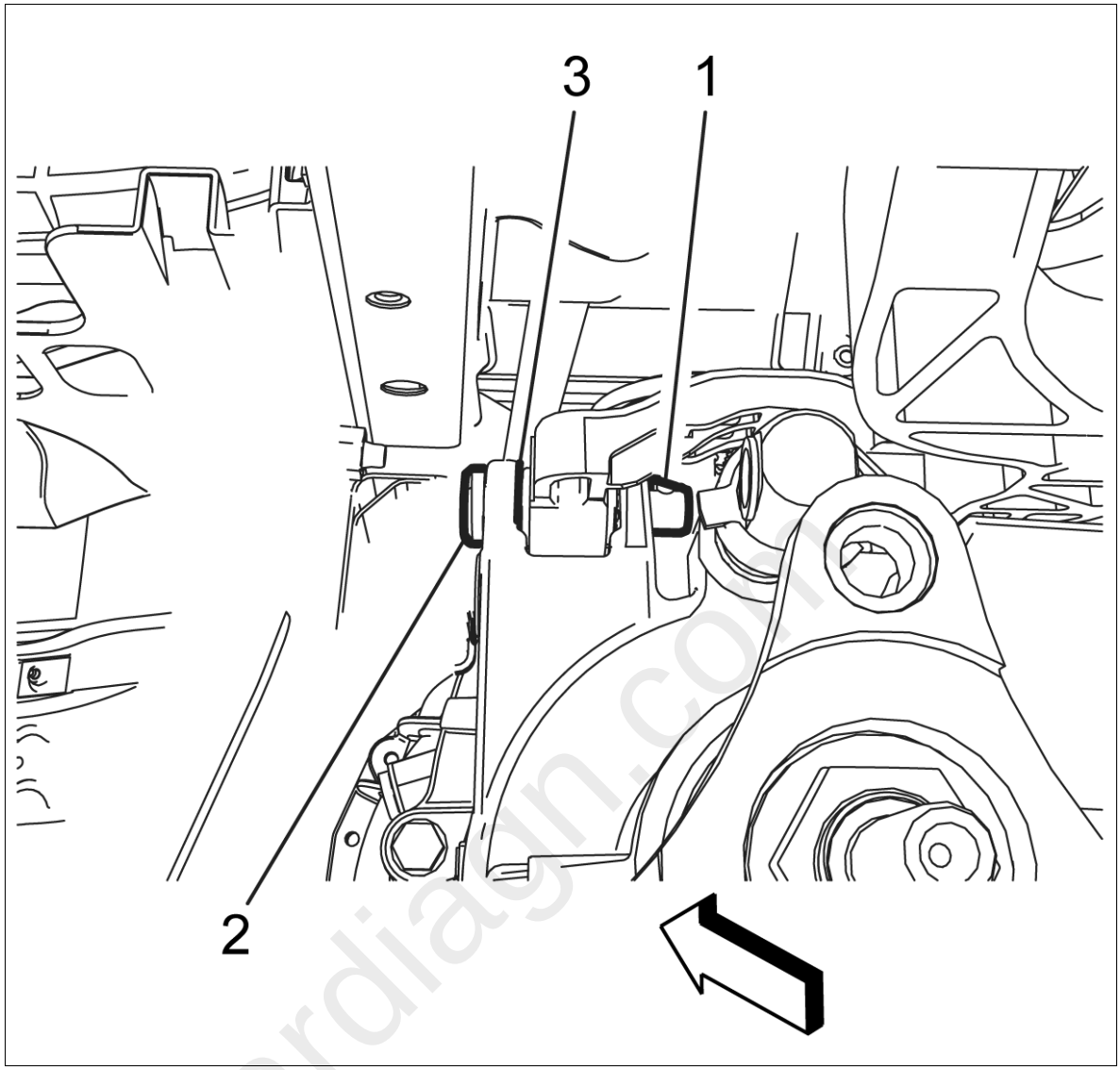


Courtesy of GENERAL MOTORS COMPANY

12. Remove the 4 fasteners (2) securing the transmission support.
13. Lower the transmission assembly to gain access to the top of the transmission.

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Fig 6: Transmission Boss, Shift Control Rod Pin & Retaining Tab

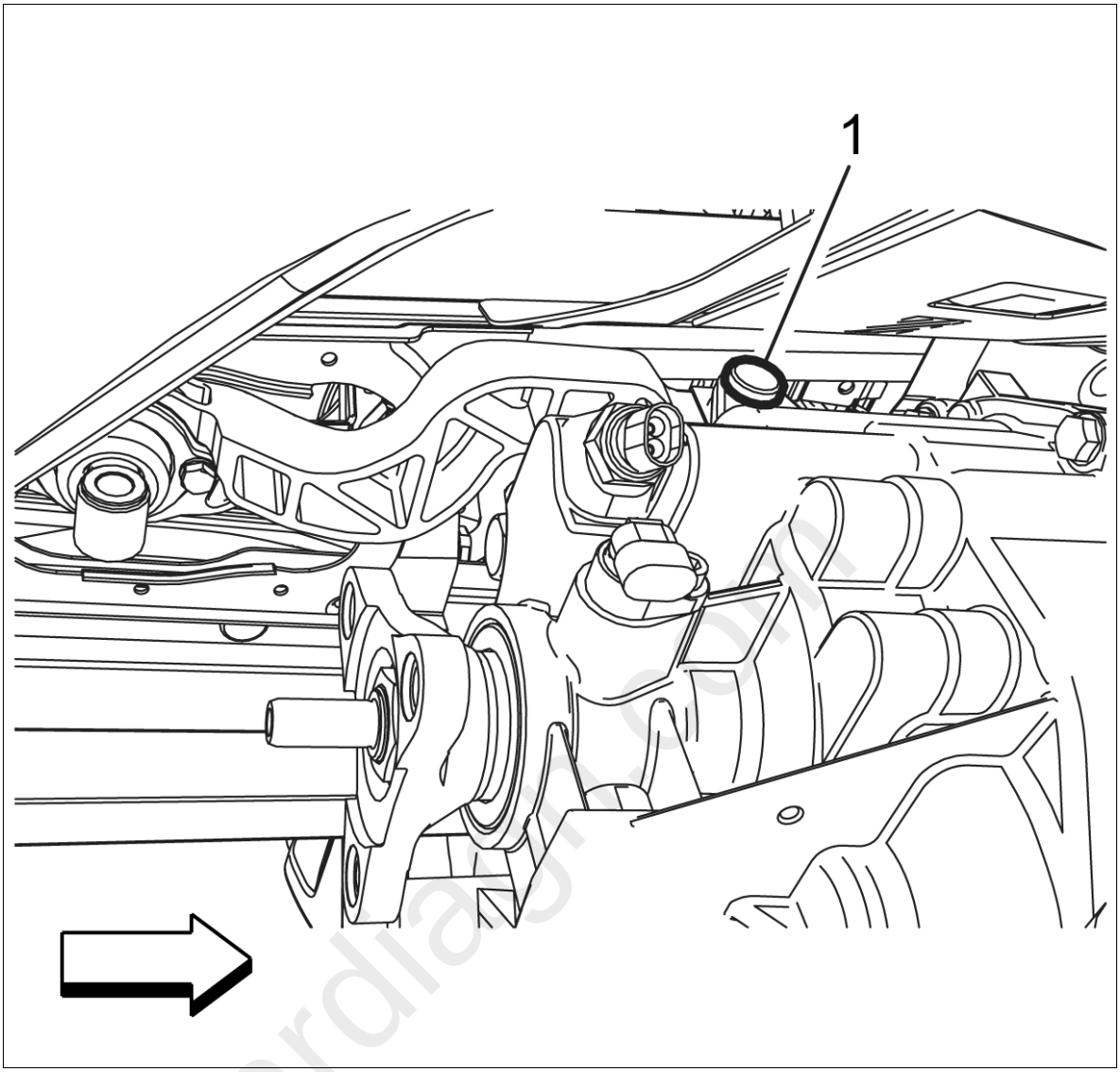


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14. Using a suitable flat-blade tool, release the left side shift control rod pin retaining tab (1), while sliding the pin outward. The pin will lock again at the outer transmission boss (3). Using a suitable flat-blade tool, insert the tool between the boss (3) and the rubber mount on the shift control assembly to release the shift control rod pin retaining tab to slide it further out of the transmission boss. Reposition the transmission slightly to allow extra clearance to completely remove the pin.

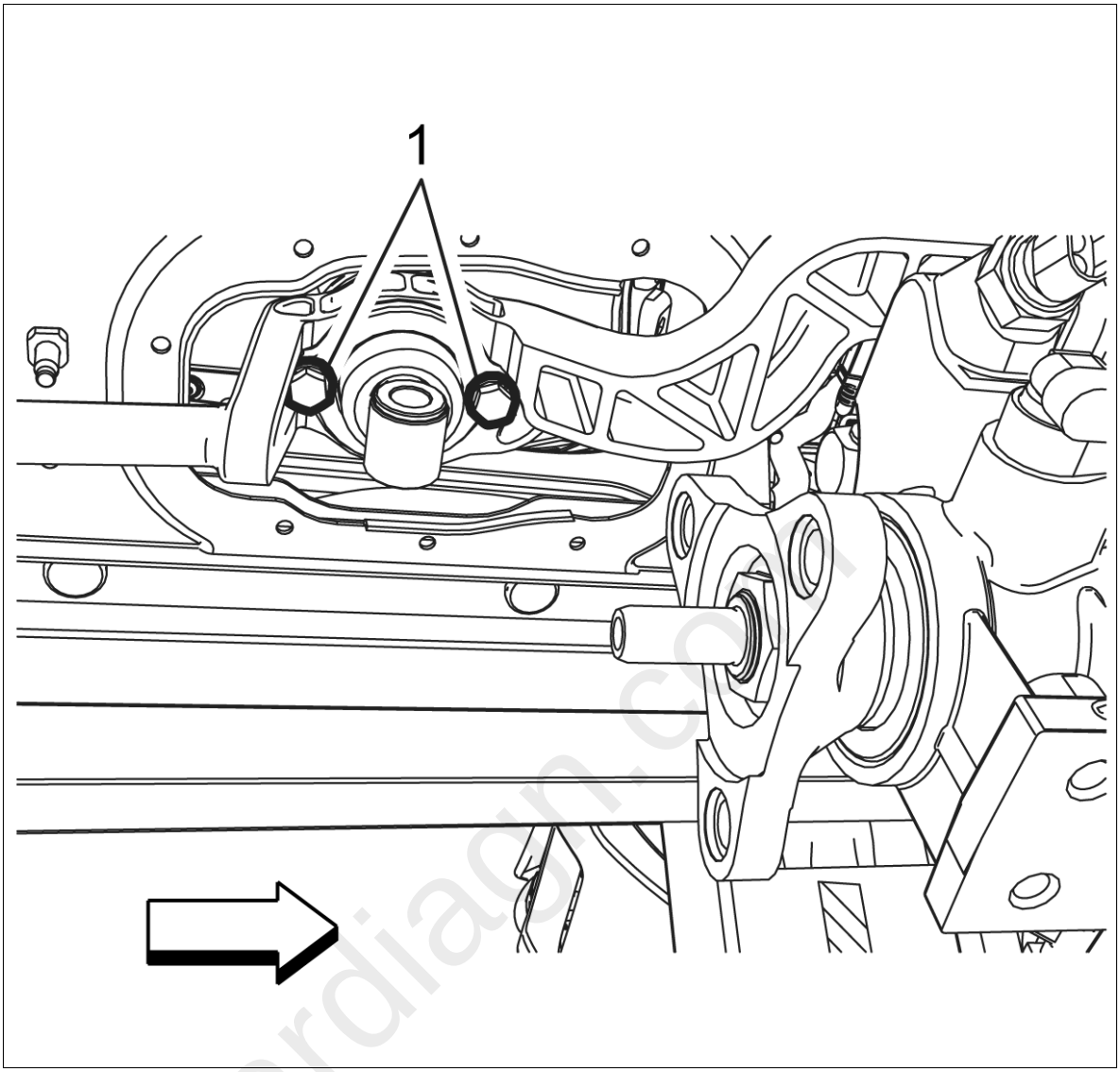
Fig 7: Right Side Shift Control Rod Pin Retaining Tab



Courtesy of GENERAL MOTORS COMPANY

15. Using a suitable flat-blade tool, release the right side shift control rod pin retaining tab (1), while sliding the pin outward. The pin will lock again at the outer transmission boss. Using a suitable flat-blade tool, insert the tool between the boss and the rubber mount on the shift control assembly to release the shift control rod pin retaining tab to slide it further out of the transmission boss. Reposition the transmission slightly to allow extra clearance to completely remove the pin.

Fig 8: Shift Control Assembly Lower Fasteners



Courtesy of GENERAL MOTORS COMPANY

16. Loosen the two lower fasteners (1) on the shift control assembly enough to allow the removal of the shift control assembly.
17. Remove the shift control assembly from the transmission.

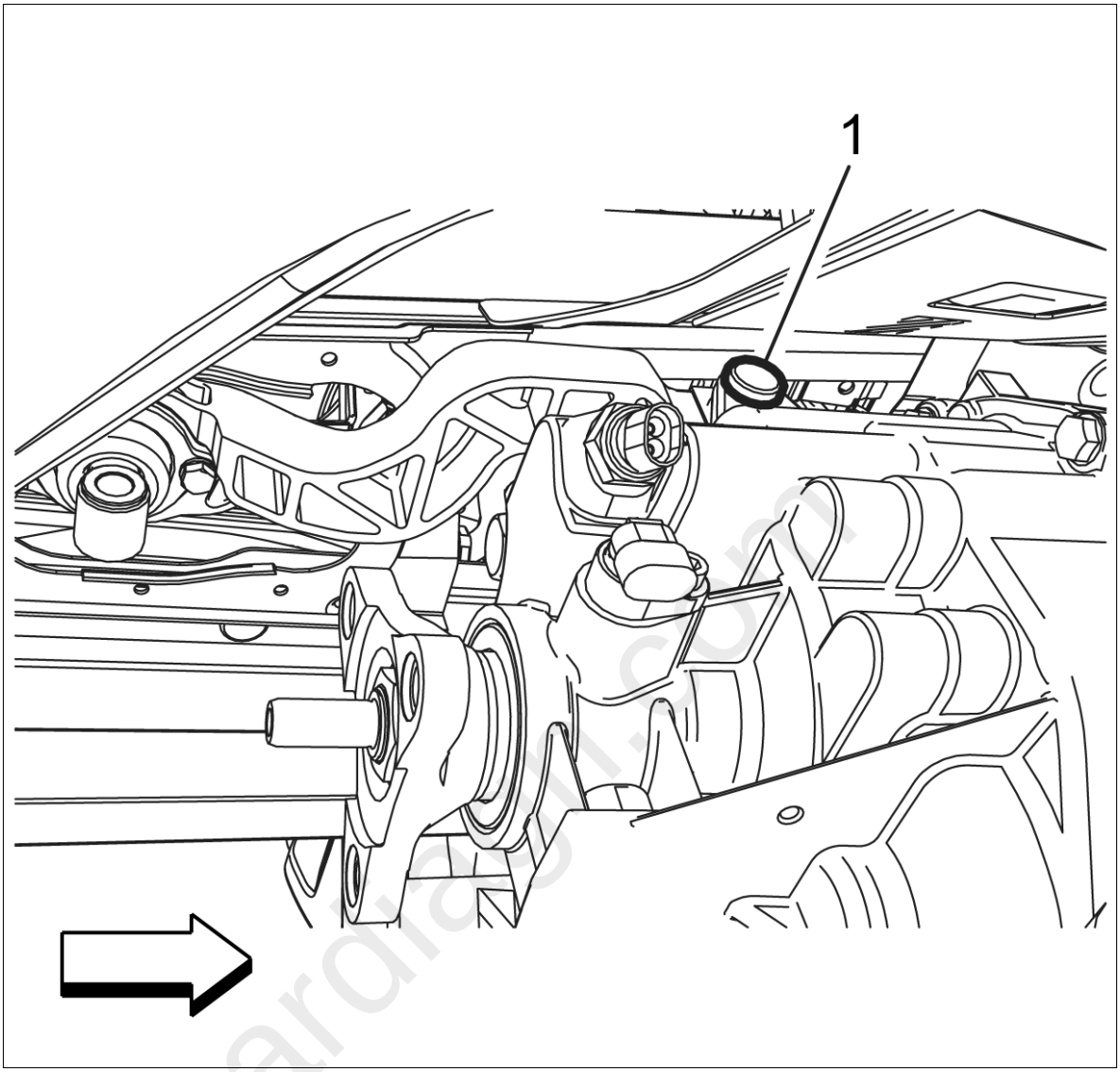
REPAIR INSTRUCTIONS - ON VEHICLE > SHIFT CONTROL ASSEMBLY REPLACEMENT (MM6) > INSTALLATION PROCEDURE

NOTE:

Before installing the shifter, ensure that the shift shaft it is clean of dirt or lubricants.

1. Install the shift control assembly to the transmission.

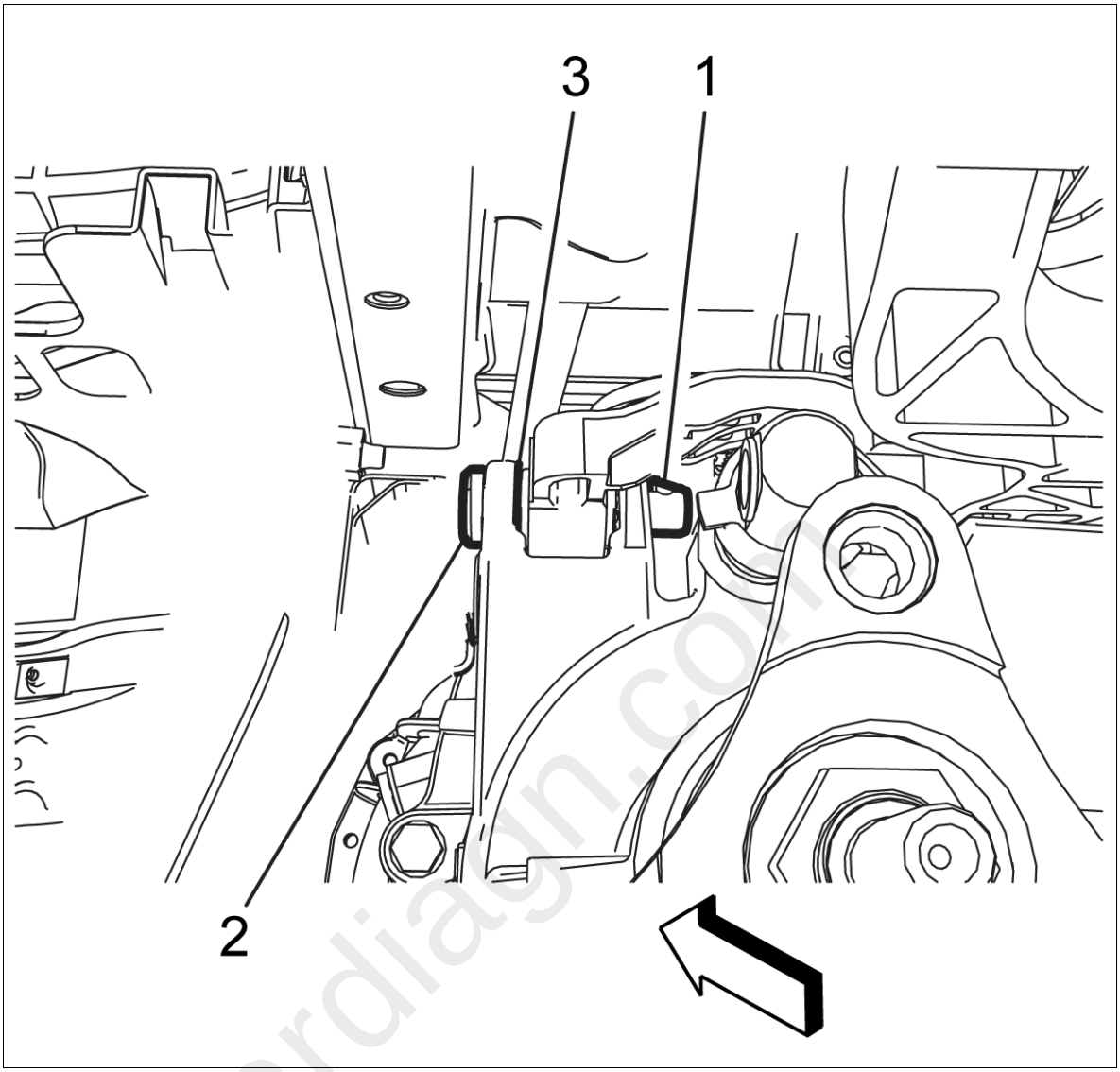
Fig 1: Right Side Shift Control Rod Pin Retaining Tab



Courtesy of GENERAL MOTORS COMPANY

2. Install the right shift control assembly rod pin (1).

Fig 2: Transmission Boss, Shift Control Rod Pin & Retaining Tab



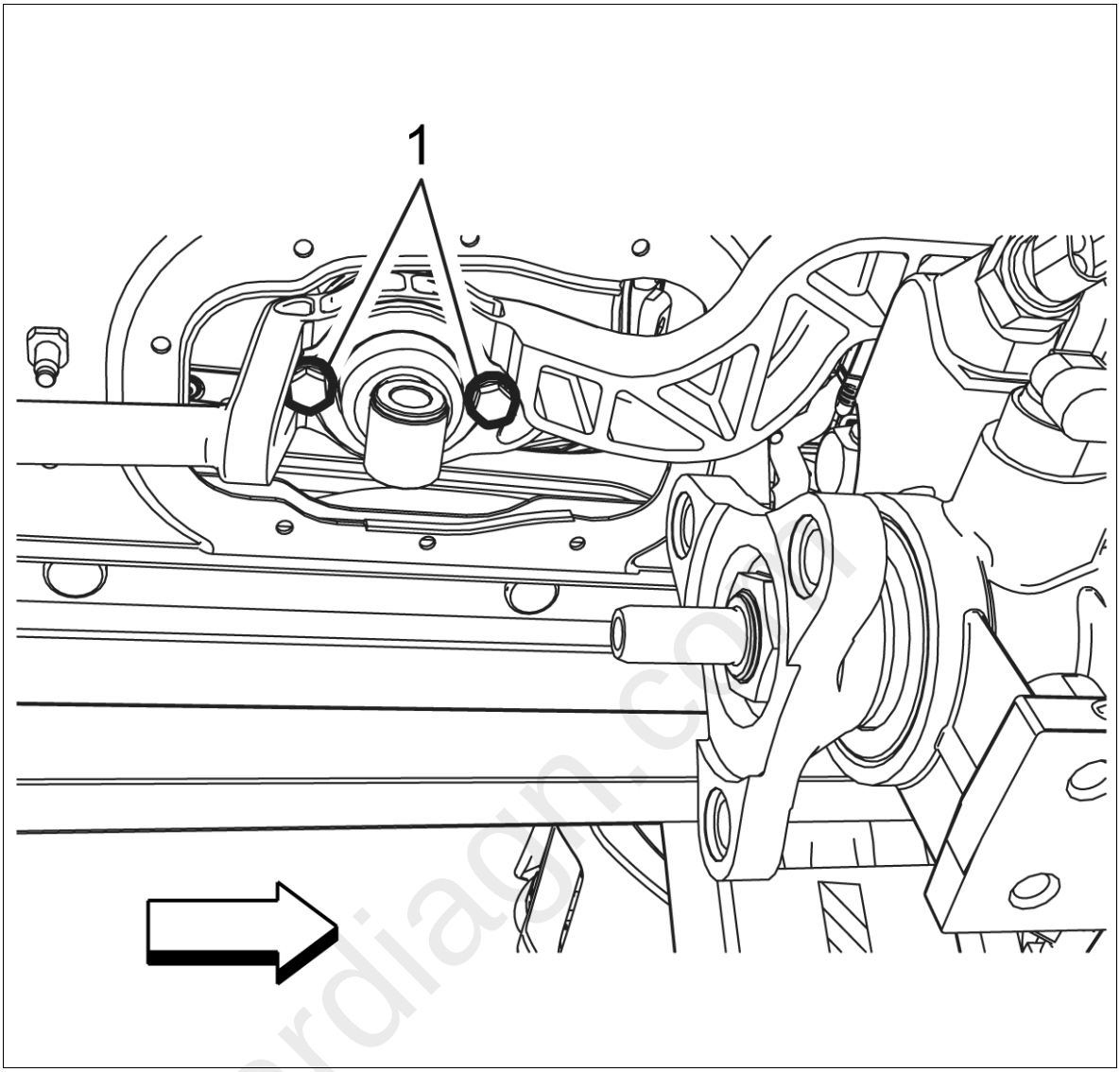
Courtesy of GENERAL MOTORS COMPANY

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> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

3. Install the left shift control assembly rod pin (2).

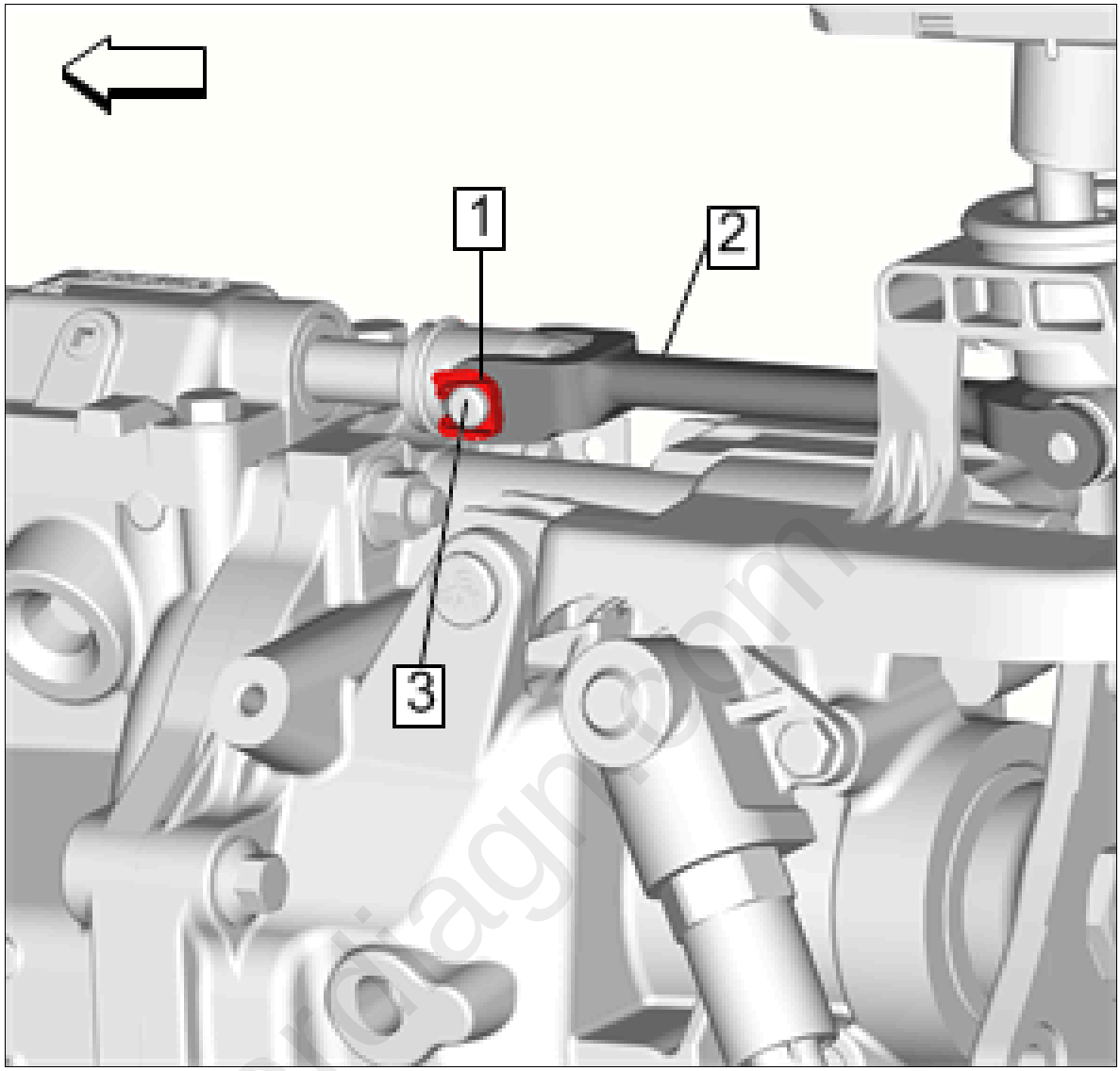
Fig 3: Shift Control Assembly Lower Fasteners



Courtesy of GENERAL MOTORS COMPANY

4. Tighten the two lower fasteners (1) on the shift control assembly to 18 N.m (13 lb ft).

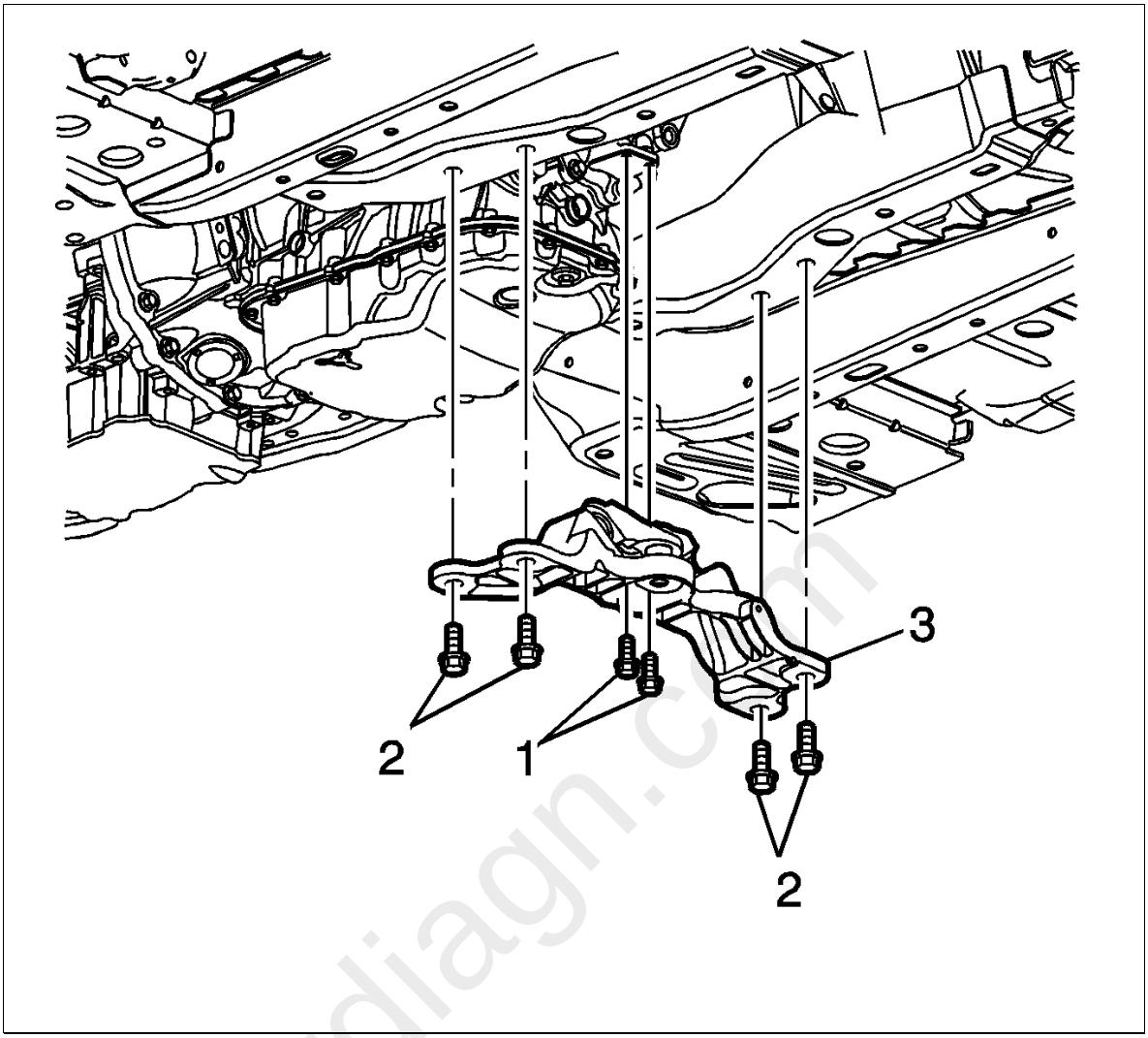
Fig 4: Shift Linkage Pin



Courtesy of GENERAL MOTORS COMPANY

5. Install the shift linkage pin (3).
6. Install the shift linkage retaining clip (1).

Fig 5: Transmission Support Fasteners

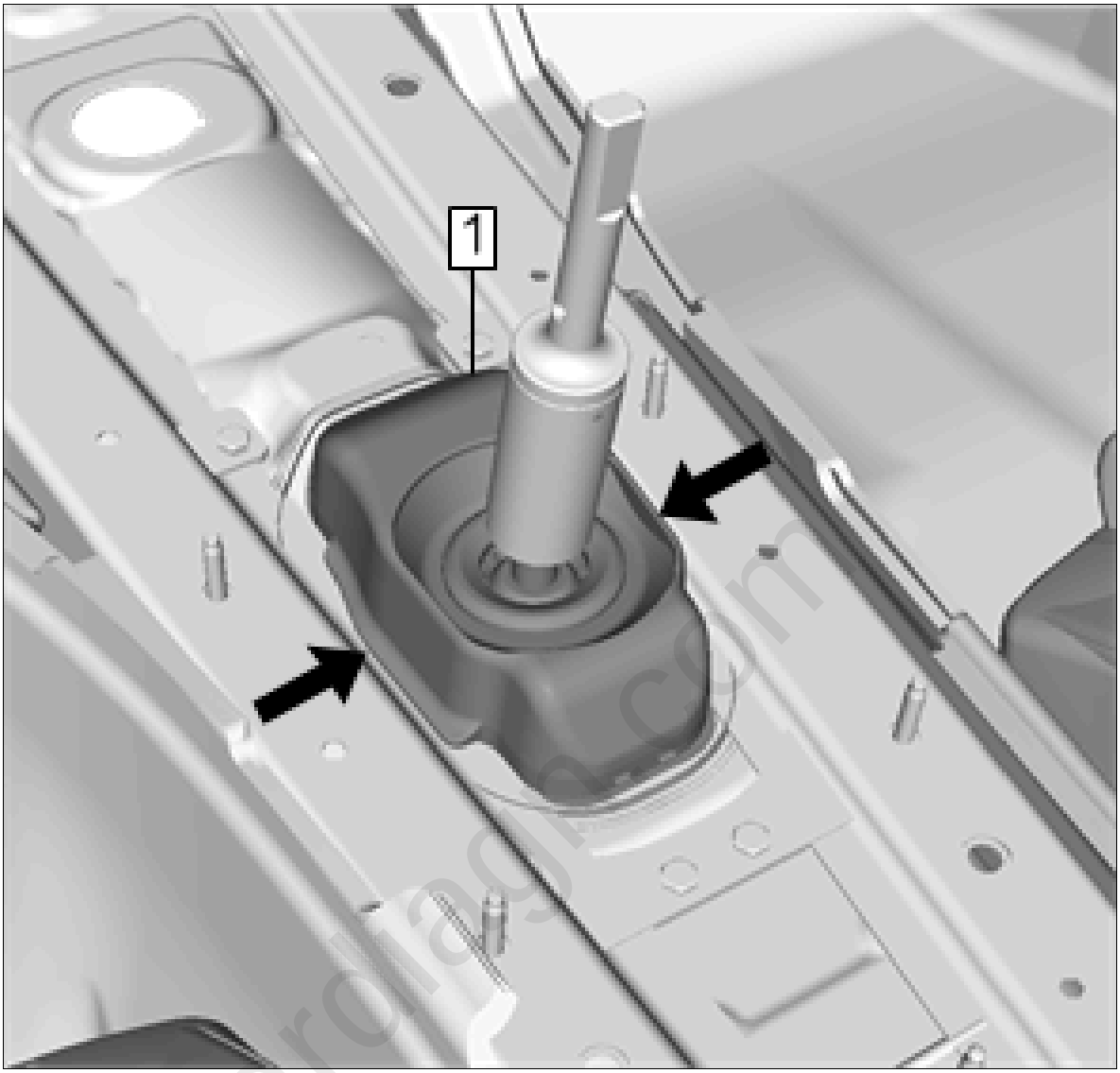


Courtesy of GENERAL MOTORS COMPANY

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7. Raise the transmission.
8. Install the 4 transmission support fasteners (2), then tighten to 60 N.m (44 lb ft).
9. Remove the jack supporting the transmission.
10. Install the propeller shaft. Two-Piece Propeller Shaft Replacement (Coupe MM6, M13)Two-Piece Propeller Shaft Replacement (Convertible MM6, M13)
11. Lower the vehicle.

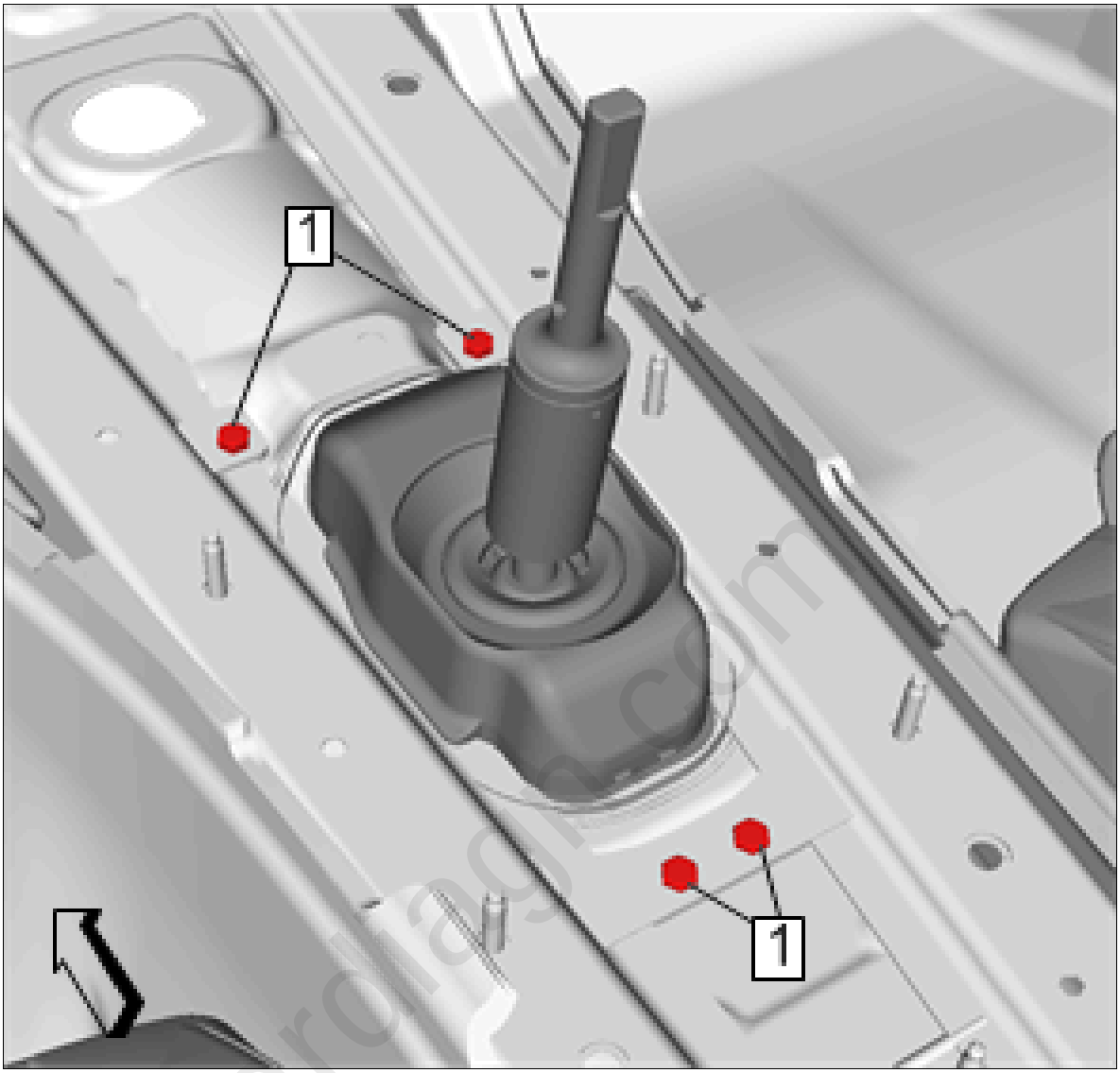
Fig 6: Closeout Boot Tabs



Courtesy of GENERAL MOTORS COMPANY

12. Pull up and outward on the tabs on the closeout boot (1) to clear the body structure.

Fig 7: Shift Control Assembly Fasteners



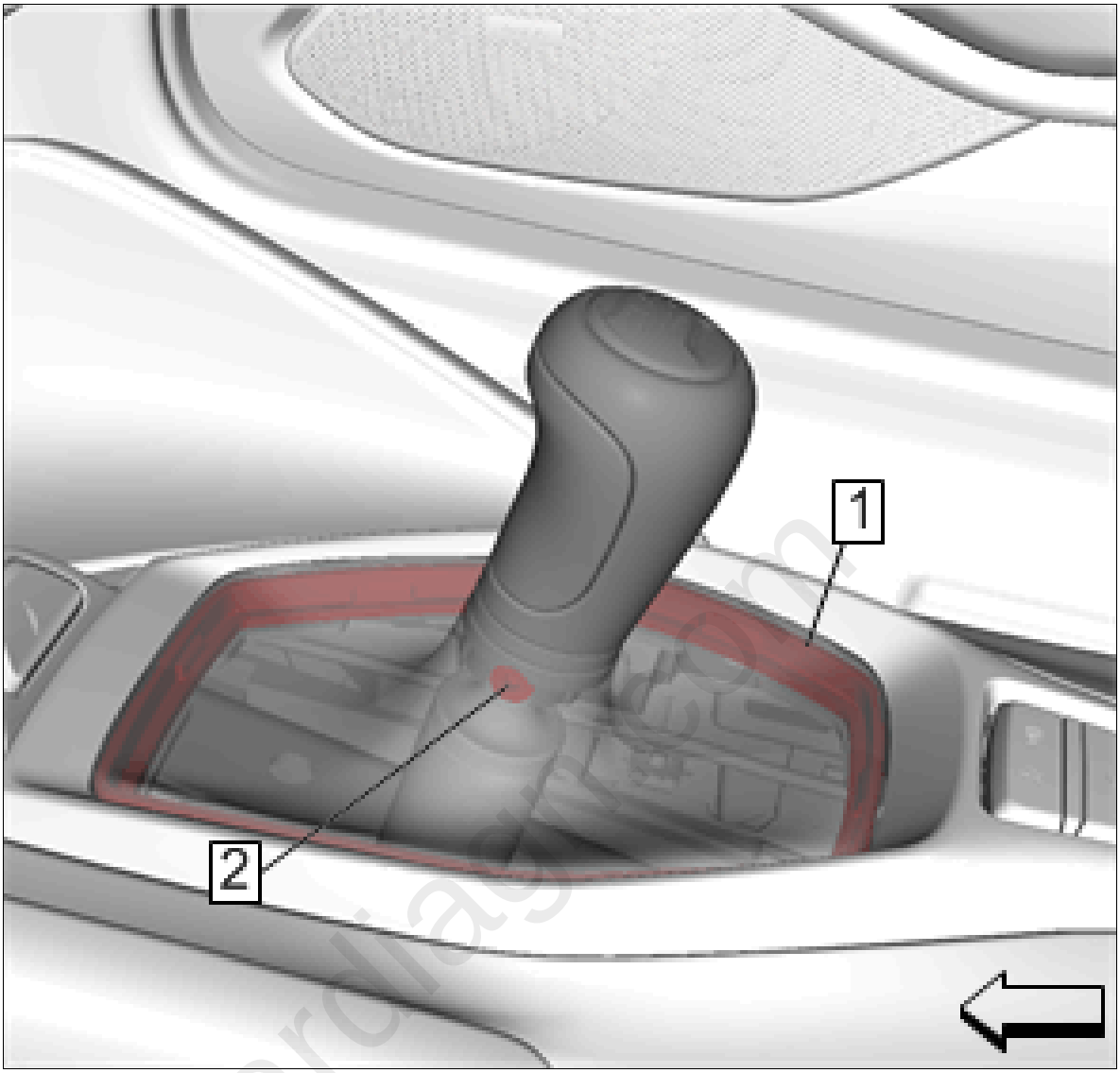
Courtesy of GENERAL MOTORS COMPANY

13. Install the 4 fasteners (1) securing the shift control assembly to the tunnel reinforcement, then tighten to 12 N.m (106 lb in).

> *NOTE:*
>
> *Ensure the directional arrow on the boot is installed pointing to the front of the vehicle. If it is installed backwards it will create a squeak.*

14. Install the upper shifter closeout boot to the lower closeout boot.
15. Install the front floor console trim plate. Front Floor Console Trim Plate Replacement (Automatic)Front Floor Console Trim Plate Replacement (Manual)

Fig 8: Shift Control Knob



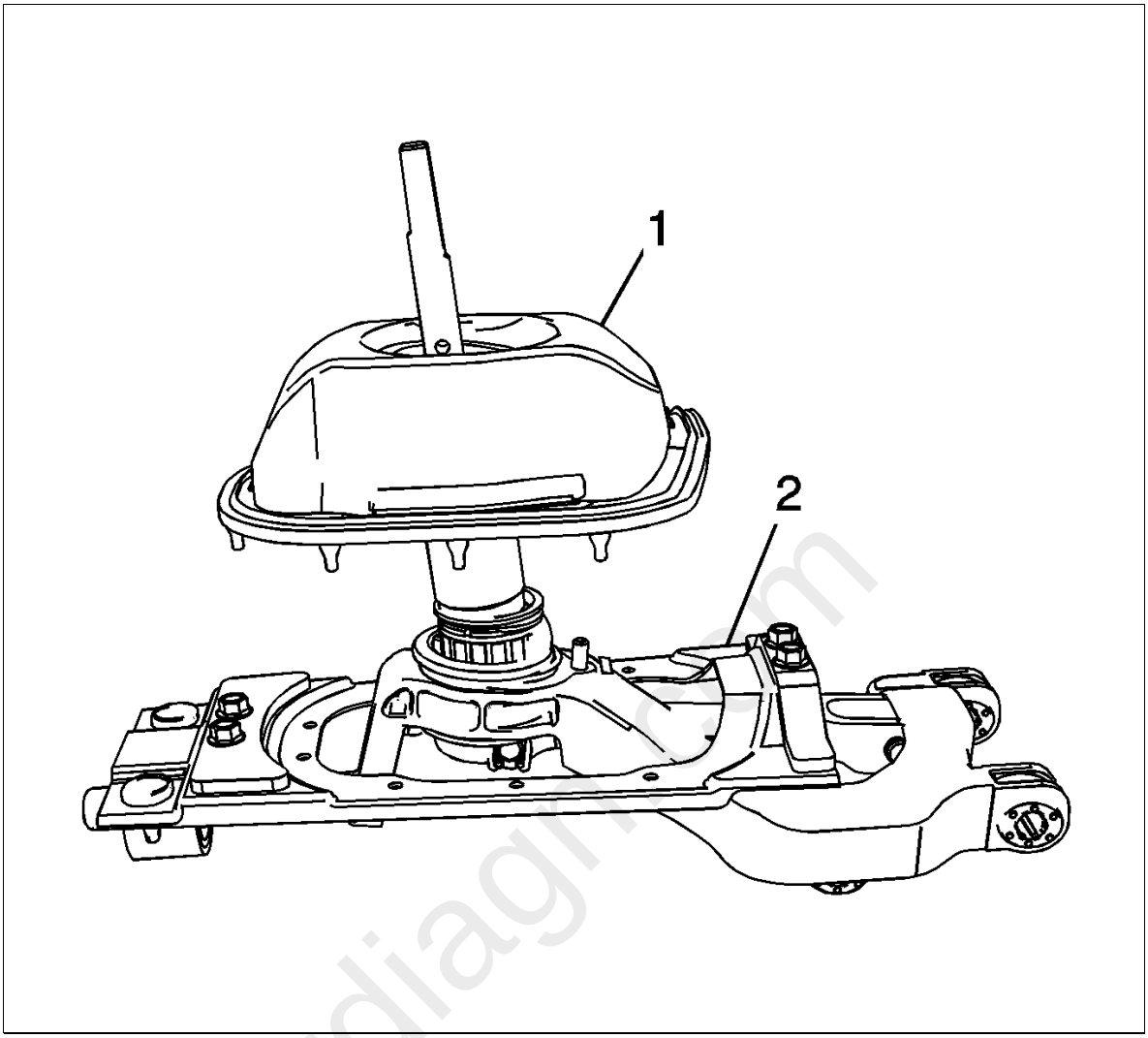
Courtesy of GENERAL MOTORS COMPANY

16. Install the shift control knob (1). Transmission Control Lever Knob Replacement
17. Perform the gear position relearn. Gear Position Sensor Learn

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION CONTROL LEVER LOWER BOOT REPLACEMENT > REMOVAL PROCEDURE

1. Remove the shift front floor console trim plate from the vehicle. Front Floor Console Trim Plate Replacement (Automatic)Front Floor Console Trim Plate Replacement (Manual)

Fig 1: Shift Control Assembly & Closeout Boot

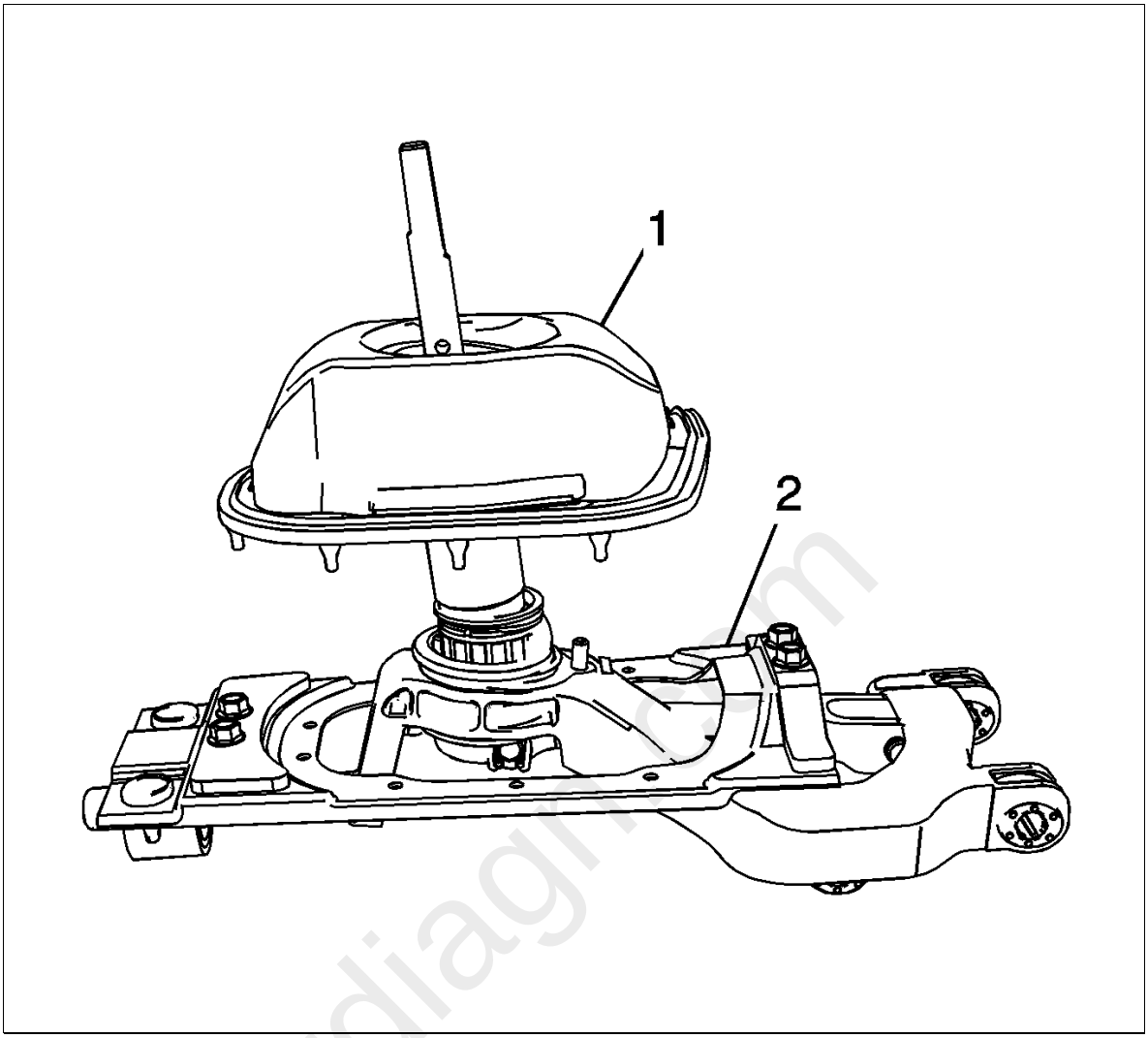


Courtesy of GENERAL MOTORS COMPANY

2. Remove the shift control lever lower boot (1) from the shift control assembly (2).

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION CONTROL LEVER LOWER BOOT REPLACEMENT > INSTALLATION PROCEDURE

Fig 1: Shift Control Assembly & Closeout Boot



Courtesy of GENERAL MOTORS COMPANY

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1. Install the shift control lever lower boot (1) to the shift control assembly (2).
2. Install the shift front floor console trim plate to the vehicle. Front Floor Console Trim Plate Replacement (Automatic)Front Floor Console Trim Plate Replacement (Manual)

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION CONTROL LEVER BOOT REPLACEMENT > REMOVAL PROCEDURE

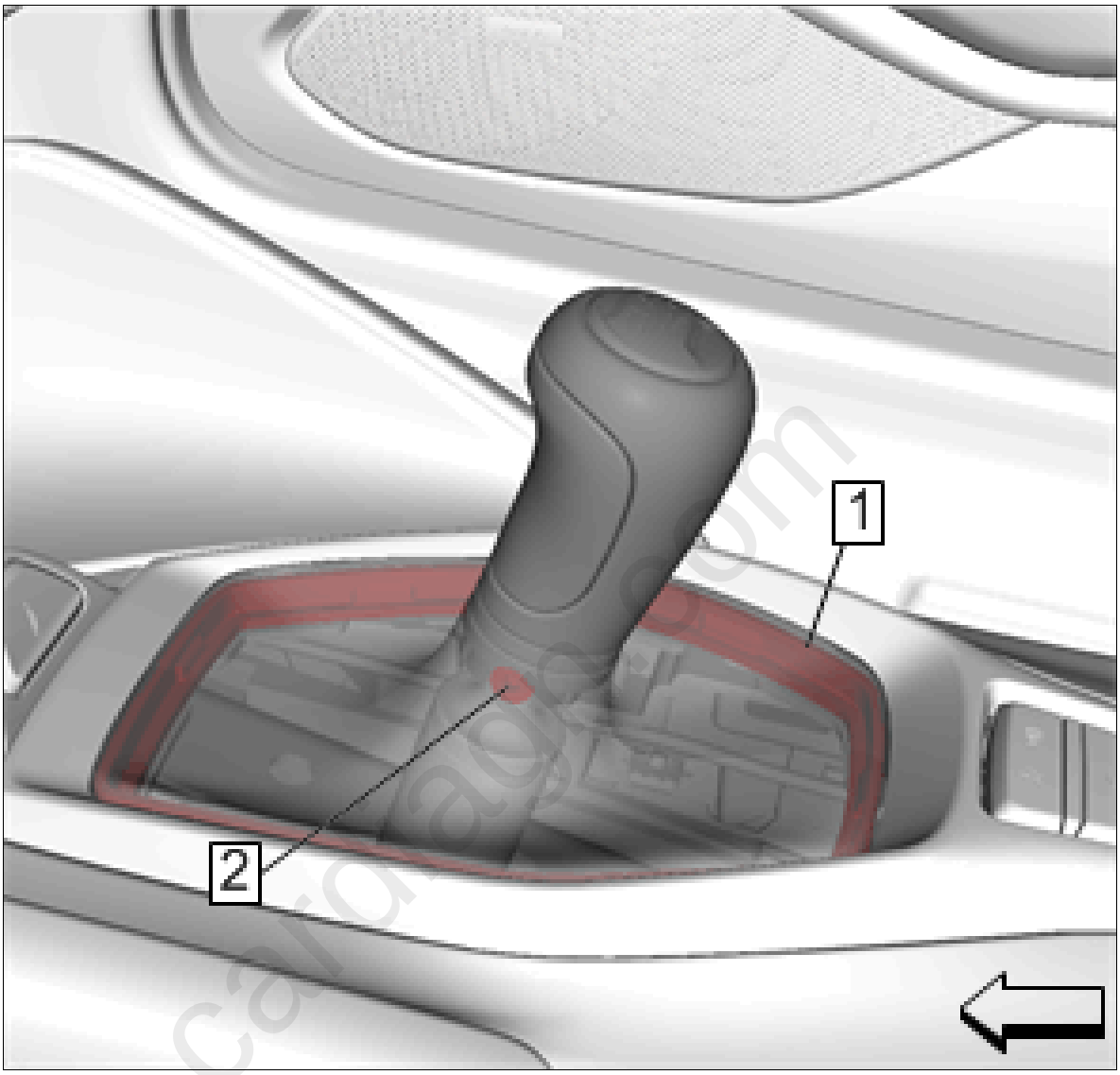
NOTE:

The shift boot is shown semi-transparent for fastener location.

NOTE:

The transmission control lever boot and knob are replaced as an assembly.

Fig 1: Transmission Control Lever Boot

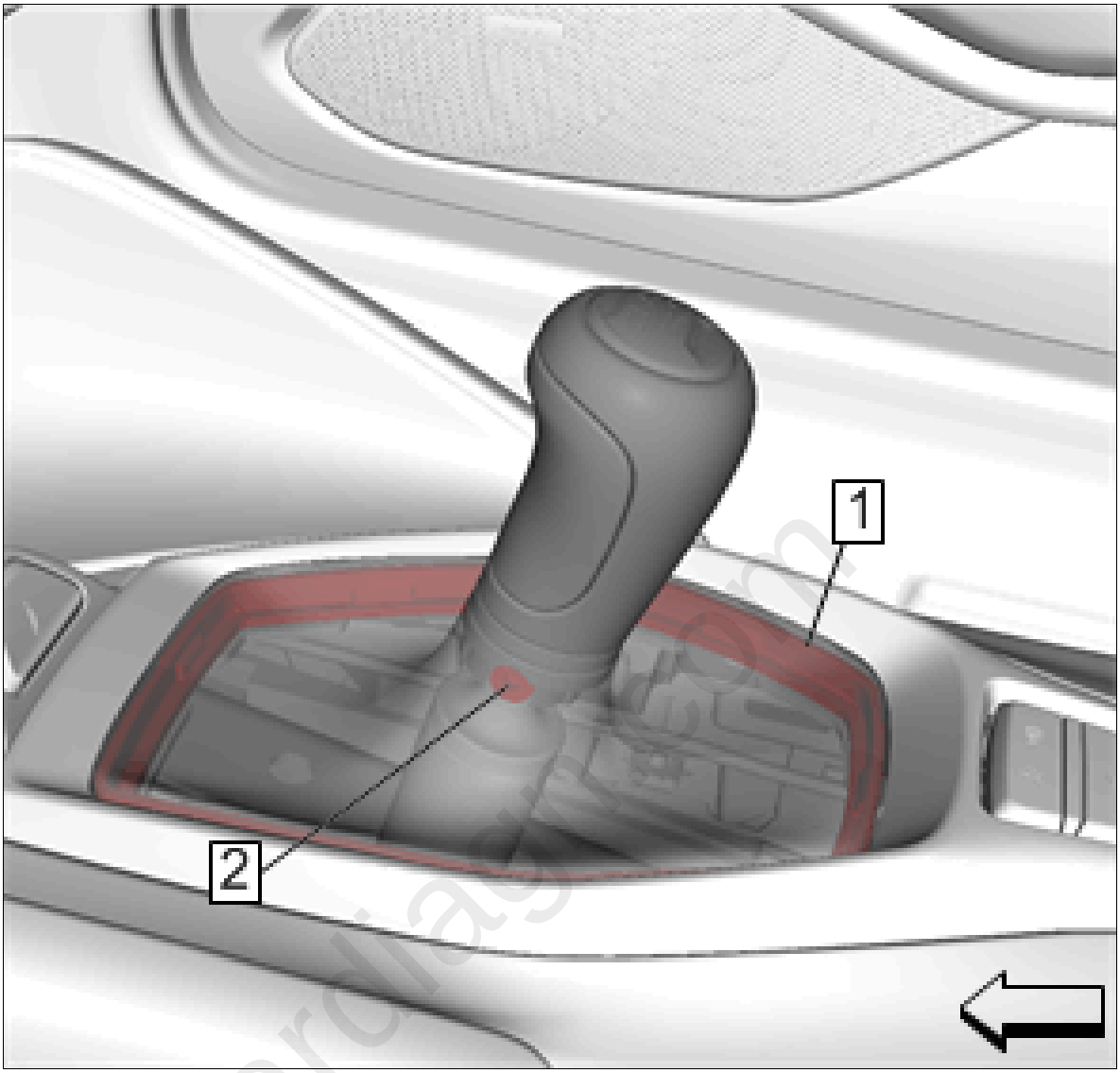


Courtesy of GENERAL MOTORS COMPANY

1. Using a flat bladed trim tool, detach the transmission control lever boot (1) from the console.
2. Lift the transmission control lever boot to access the shift knob fastener (2).
3. Remove the fastener, then lift off the transmission control lever boot and knob assembly.

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION CONTROL LEVER BOOT REPLACEMENT > INSTALLATION PROCEDURE

Fig 1: Transmission Control Lever Boot



Courtesy of GENERAL MOTORS COMPANY

1. Clean the stub shaft and fastener (2) threads prior to reinstalling the shift knob to remove residual threadlocker using a (recommended) tap and die set.
2. Position the transmission control lever boot and knob assembly on the transmission control lever.
3. Apply threadlocker to the shift knob fastener (2) and install the fastener. Adhesives, Fluids, Lubricants, and Sealers (MM6) Adhesives, Fluids, Lubricants, and Sealers (M13) .

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

4. Tighten the fastener to 7 N.m (62 lb in).

5. Install the transmission control lever boot (1) to the console.

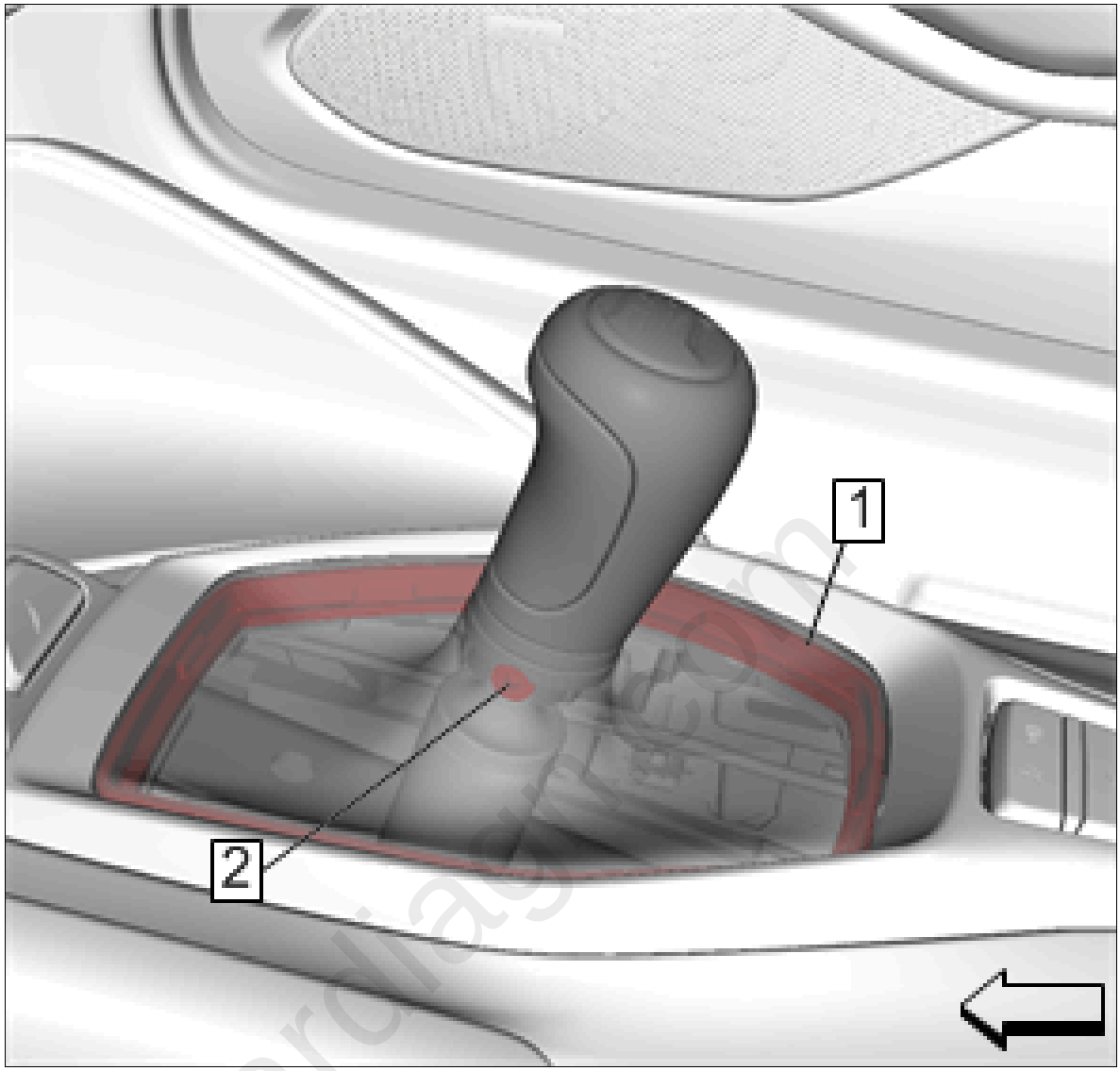
REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION CONTROL LEVER KNOB REPLACEMENT > REMOVAL PROCEDURE

> *NOTE:*
>
> *The shift boot is shown semi-transparent for fastener location.*

> *NOTE:*
>
> *The transmission control lever boot and knob are replaced as an assembly.*

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Fig 1: Transmission Control Lever Boot

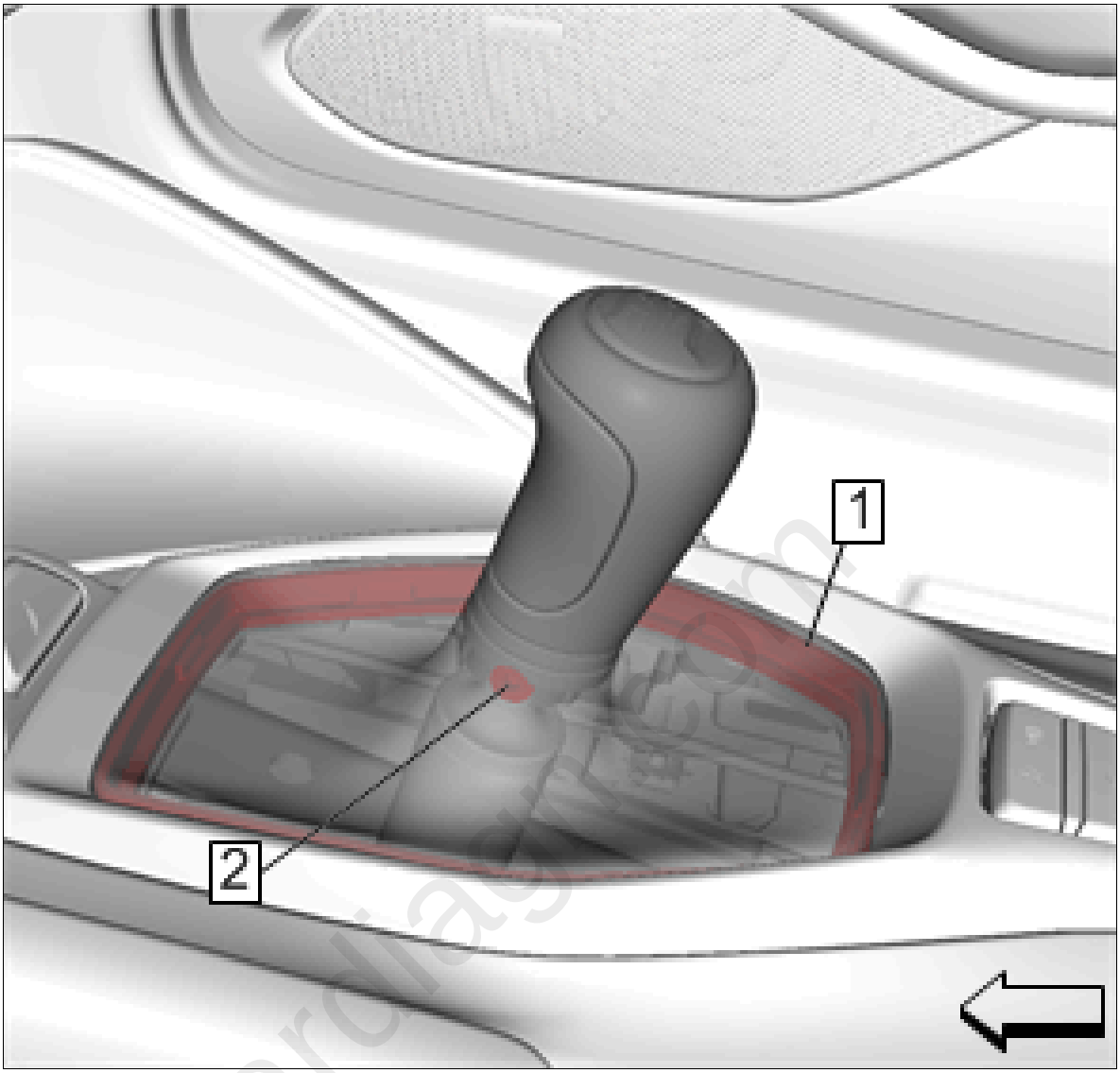


Courtesy of GENERAL MOTORS COMPANY

1. Using a flat bladed trim tool, detach the transmission control lever boot (1) from the console.
2. Lift the transmission control lever boot to access the shift knob fastener (2).
3. Remove the fastener, then lift off the transmission control lever boot and knob assembly.

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION CONTROL LEVER KNOB REPLACEMENT > INSTALLATION PROCEDURE

Fig 1: Stub Shaft And Fastener



Courtesy of GENERAL MOTORS COMPANY

1. Clean the stub shaft and fastener (2) threads prior to reinstalling the shift knob to remove residual threadlocker using a (recommended) tap and die set.
2. Position the transmission control lever boot and knob assembly on the transmission control lever.
3. Apply threadlocker to the shift knob fastener (2) and install the fastener. Adhesives, Fluids, Lubricants, and Sealers (MM6) Adhesives, Fluids, Lubricants, and Sealers (M13) .

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

4. Tighten the fastener to 7 N.m (62 lb in).

5. Install the transmission control lever boot (1) to the console.

REPAIR INSTRUCTIONS - ON VEHICLE > MAIN SHAFT REAR SEAL REPLACEMENT

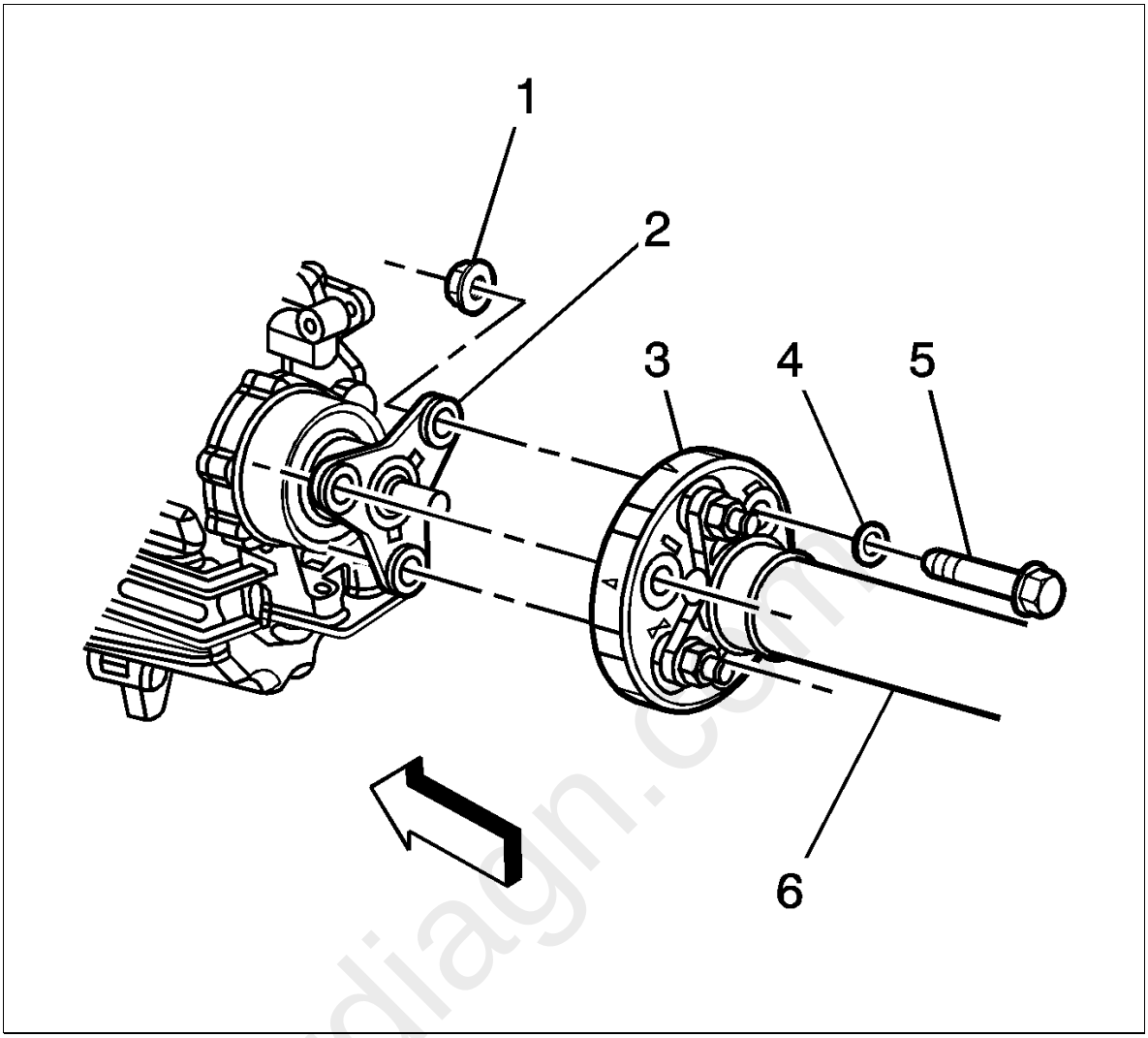
Special Tools

- **J 6125-1B** Slide Hammer
- **J 23129** Universal Seal Remover
- **J 29873** Injector Nozzle Socket 30 mm
- **J 44765** Seal Installer
- **J 45012** Holding Fixture
- **J 45019** Flange and Pinion Gauge Remover

REPAIR INSTRUCTIONS - ON VEHICLE > MAIN SHAFT REAR SEAL REPLACEMENT > REMOVAL PROCEDURE

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Fig 1: Propeller Shaft Nounting Components

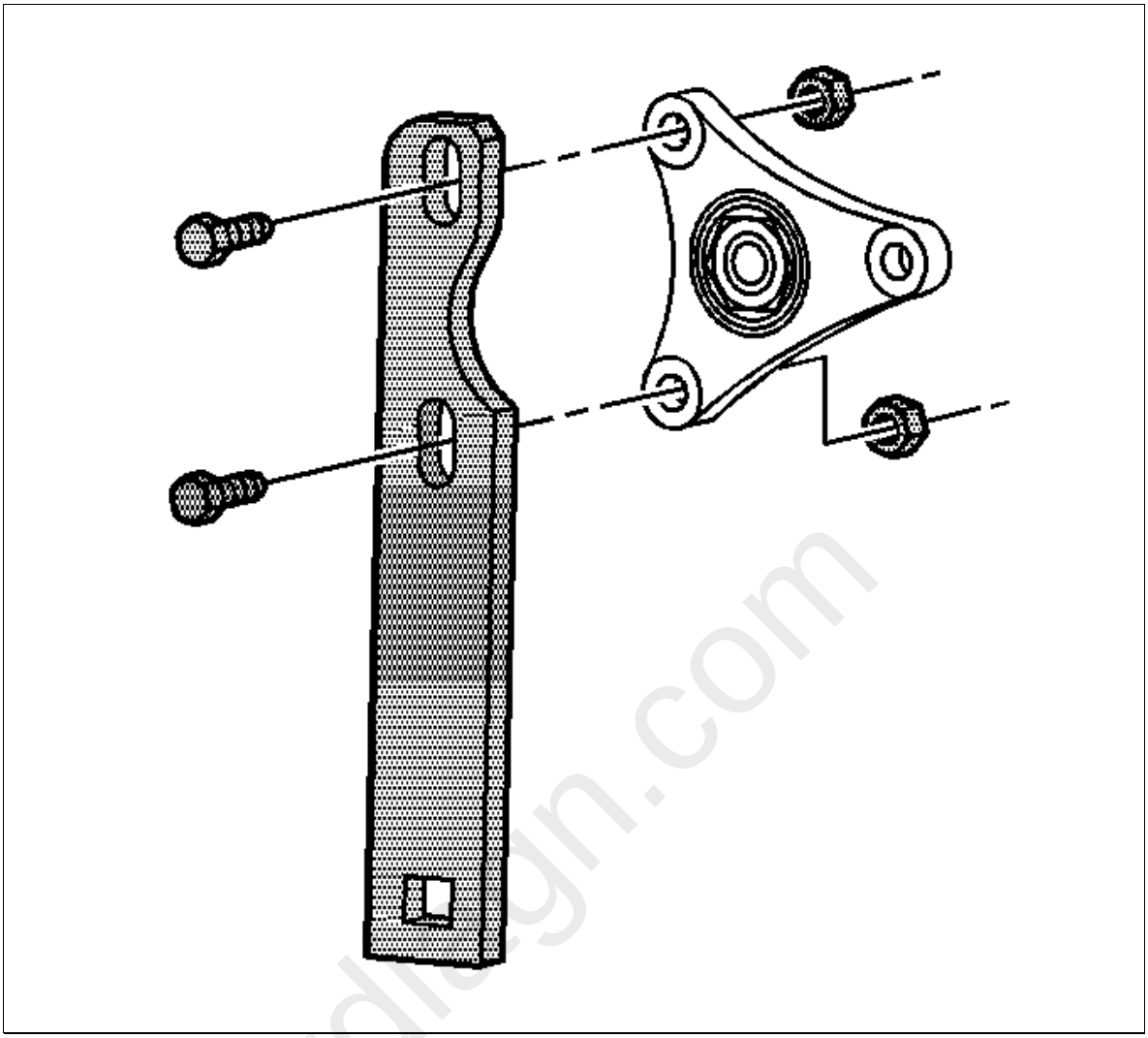


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1. Place the transmission in neutral.
2. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP)
3. Remove the propeller shaft (6). Refer to Two-Piece Propeller Shaft Replacement (Coupe MM6, M13)Two-Piece Propeller Shaft Replacement (Convertible MM6, M13)

Fig 2: Flange Tool

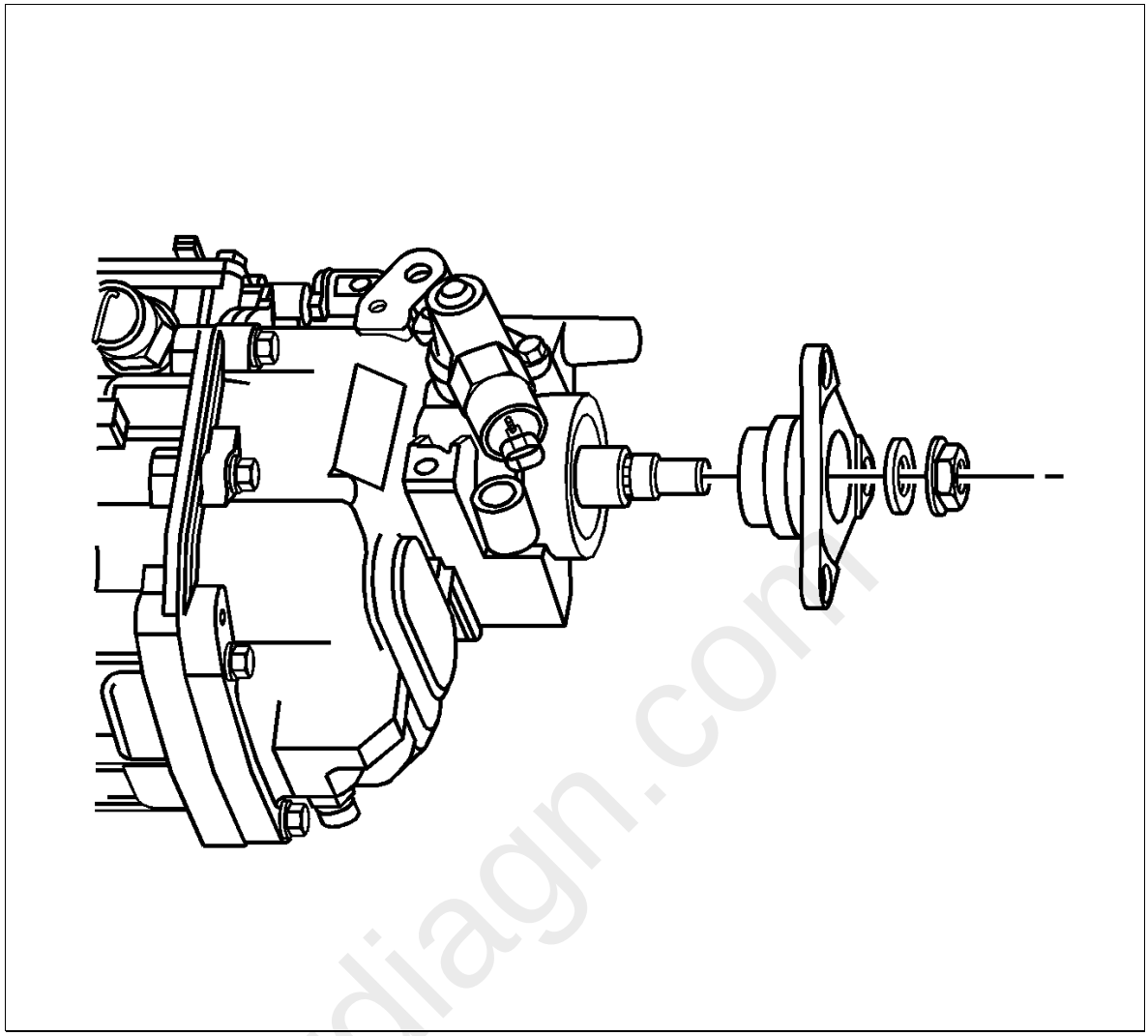


Courtesy of GENERAL MOTORS COMPANY

4. Install the **J 45012** holding fixture to the drive flange.
5. While holding the **J 45012** holding fixture, remove the flange nut using the **J 29873** injector nozzle socket.
6. Remove the **J 45012** holding fixture.

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Fig 3: Drive Flange Thrust Washer

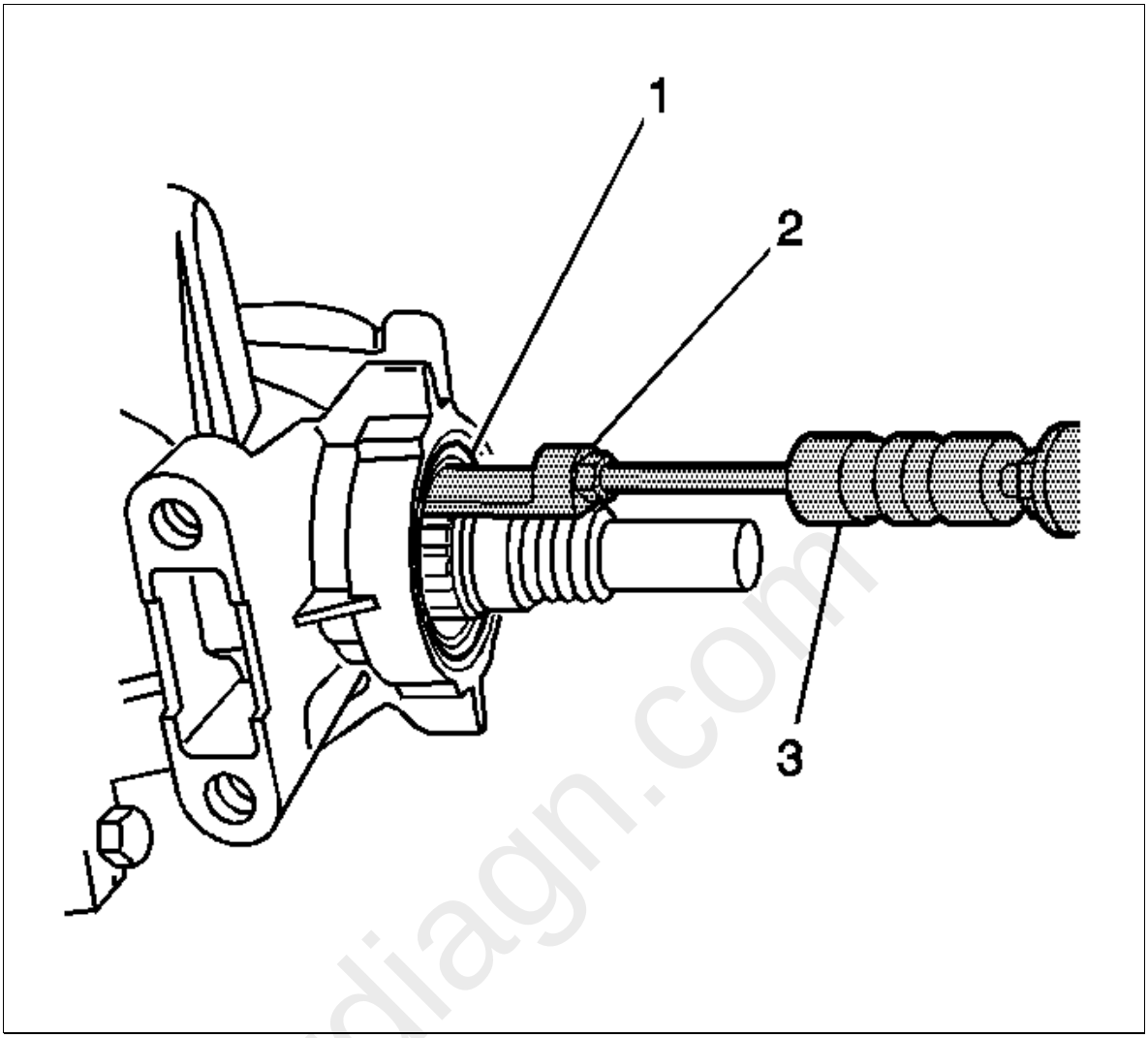


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7. Remove the drive flange thrust washer.
8. Remove the drive flange using the **J 45019** flange and pinion gauge remover.

Fig 4: Transmission Case Extension Seal

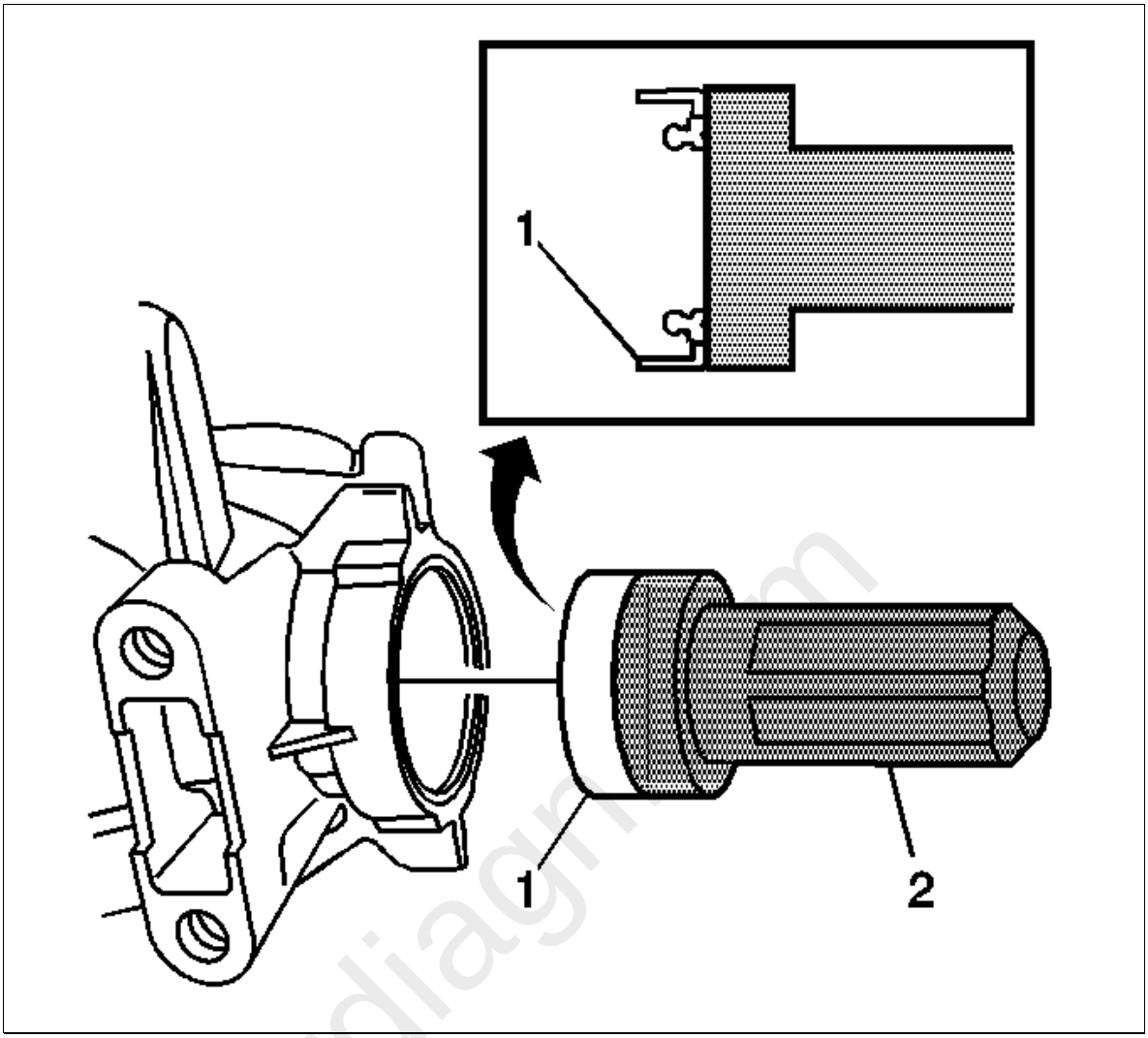


Courtesy of GENERAL MOTORS COMPANY

9. Use the **J 6125-1B** slide hammer and **J 23129** universal seal remover to remove the transmission case extension seal (1).

REPAIR INSTRUCTIONS - ON VEHICLE > MAIN SHAFT REAR SEAL REPLACEMENT > INSTALLATION PROCEDURE

Fig 1: Transmission Case Extension Seal



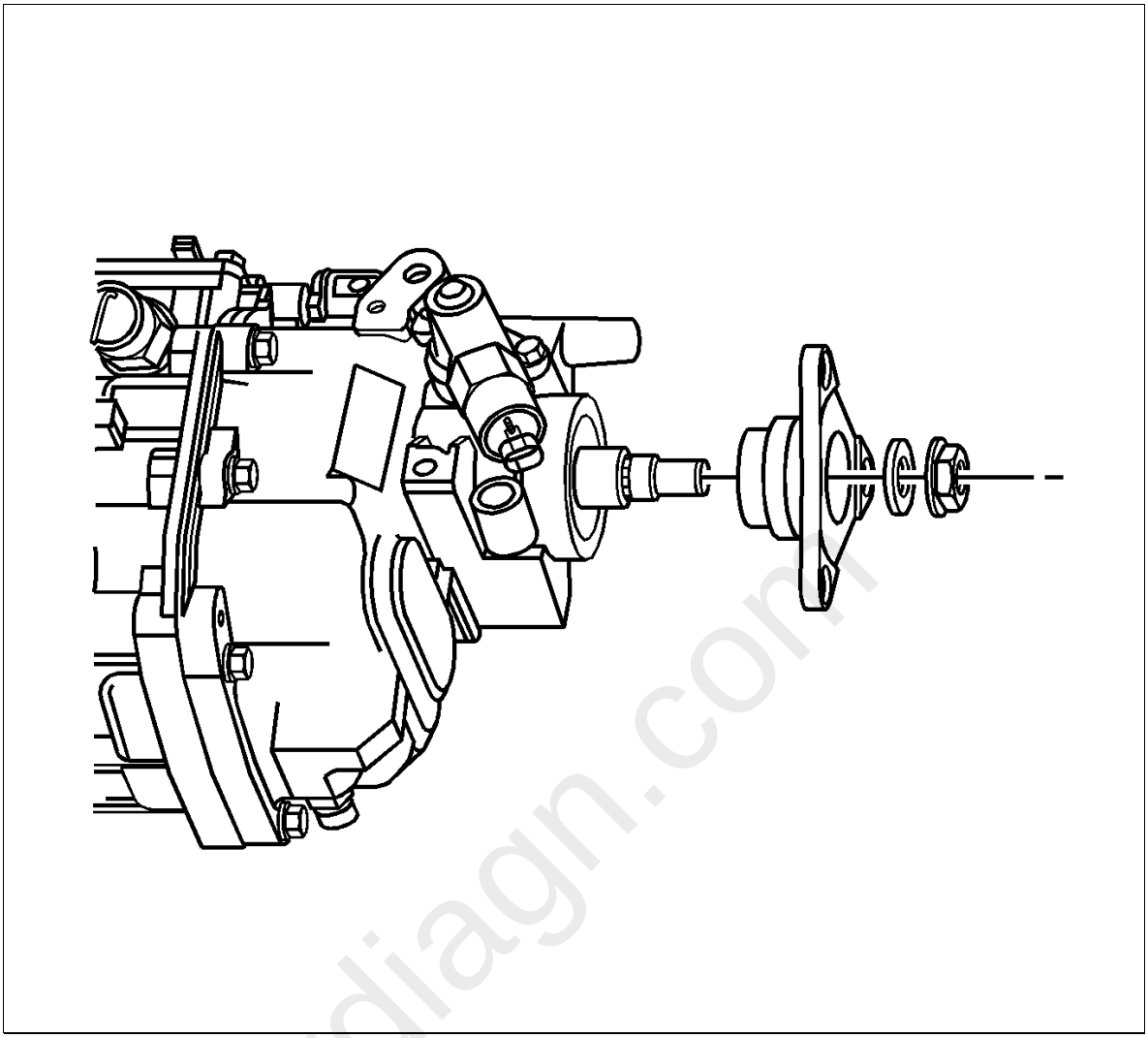
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Install the seal onto the tool before installing into the case to prevent damage to the seal.

1. Using **J 44765** seal installer, install the new transmission case extension seal (1).

Fig 2: Drive Flange Thrust Washer

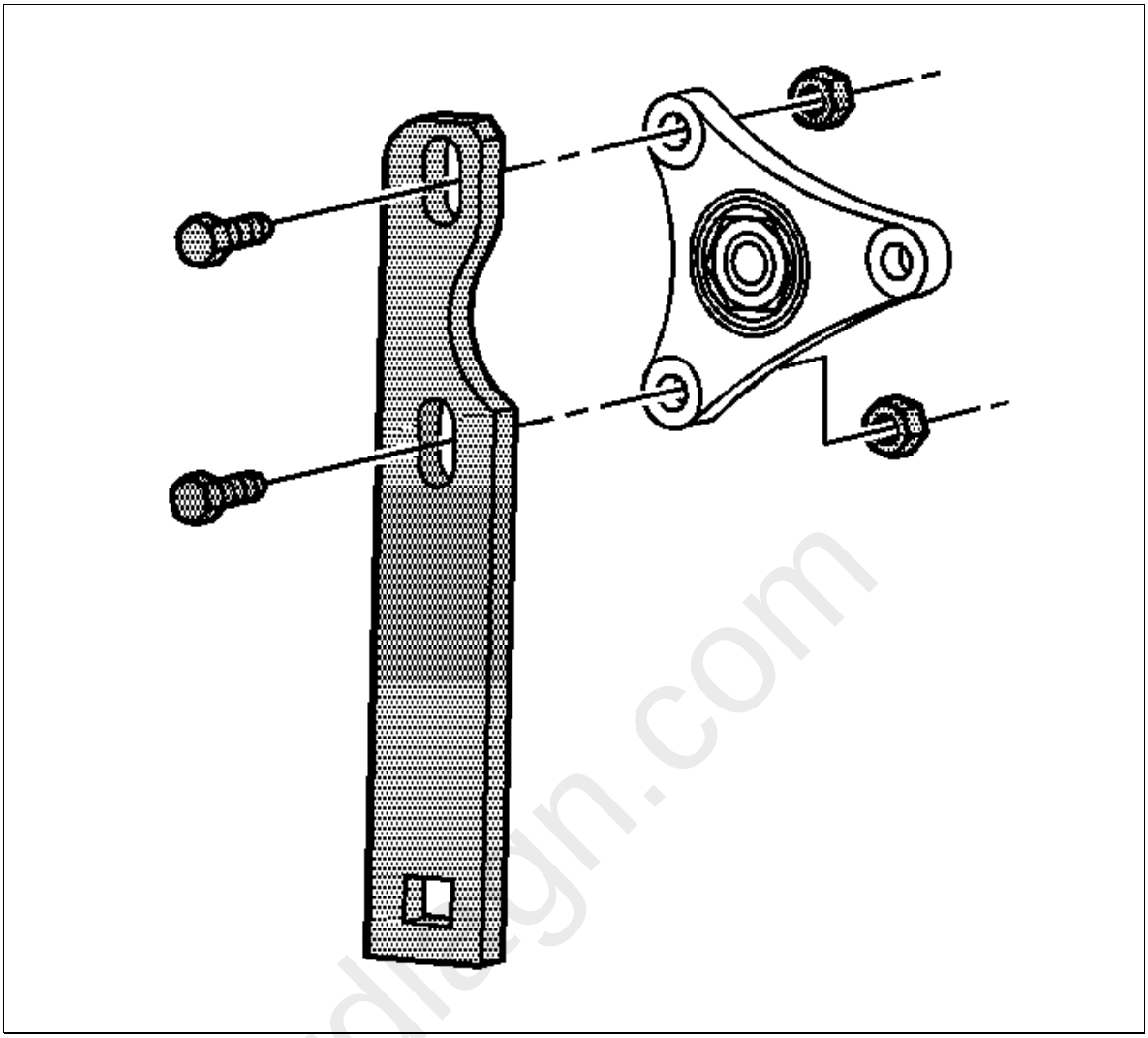


Courtesy of GENERAL MOTORS COMPANY

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2. Install the drive flange to the transmission output shaft.
3. Install a NEW drive flange thrust washer.

Fig 3: Flange Tool



Courtesy of GENERAL MOTORS COMPANY

4. Install the **J 45012** holding fixture to the drive flange.

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

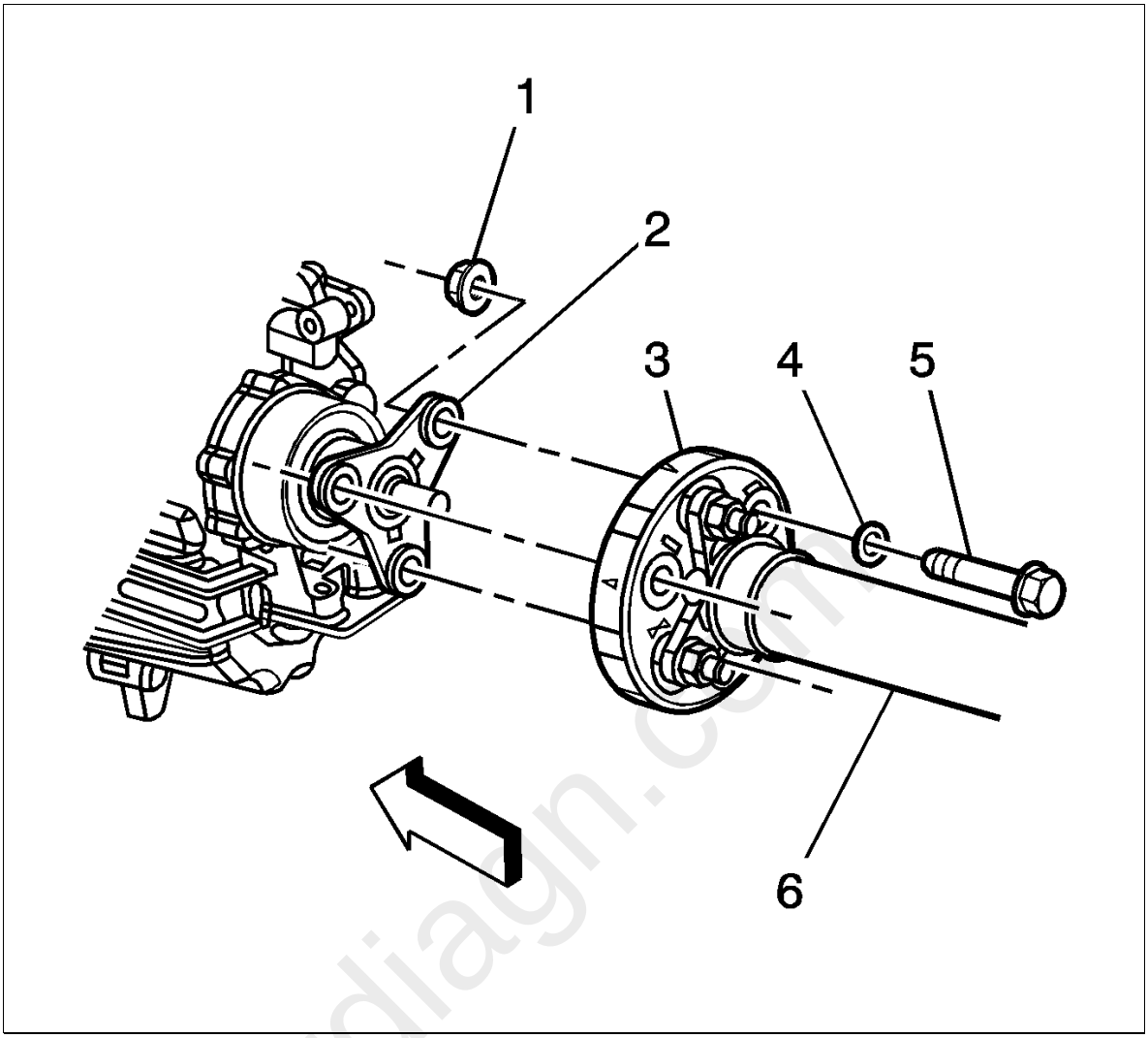
5. While holding **J 45012** holding fixture, install a NEW drive flange nut using **J 29873** injector nozzle socket.

   Tighten the drive flange nut to 136 N.m (100 lb ft).

6. Remove the **J 45012** holding fixture from the drive flange.

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Fig 4: Propeller Shaft Nounting Components



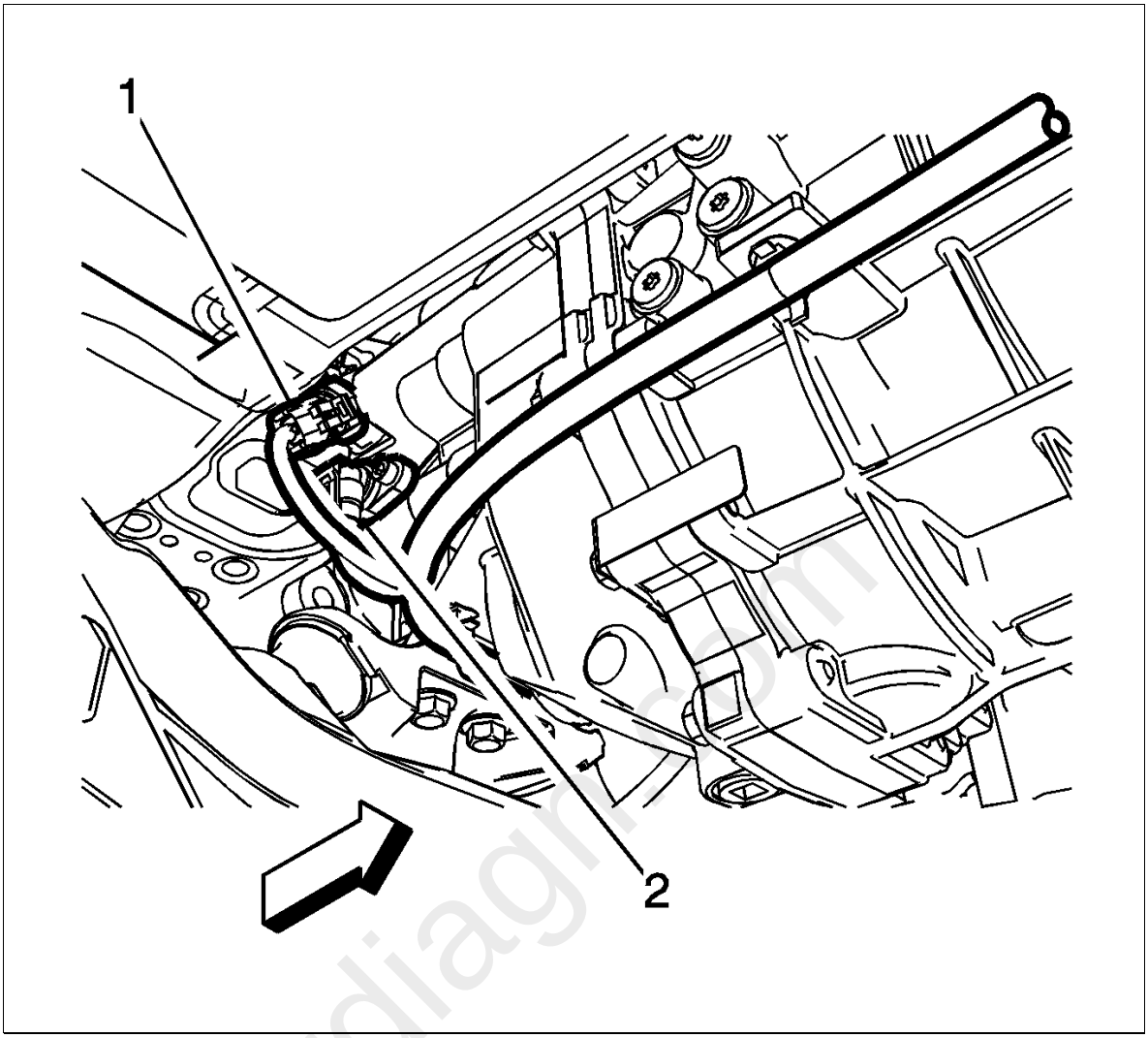
Courtesy of GENERAL MOTORS COMPANY

7. Install the propeller shaft (6). Refer to Two-Piece Propeller Shaft Replacement (Coupe MM6, M13)Two-Piece Propeller Shaft Replacement (Convertible MM6, M13)
8. Lower the vehicle.

REPAIR INSTRUCTIONS - ON VEHICLE > BACKUP LAMP SWITCH REPLACEMENT > REMOVAL PROCEDURE

1. Raise and suitably support the vehicle. Refer to Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP) .

Fig 1: Vehicle Speed Sensor Electrical Connector

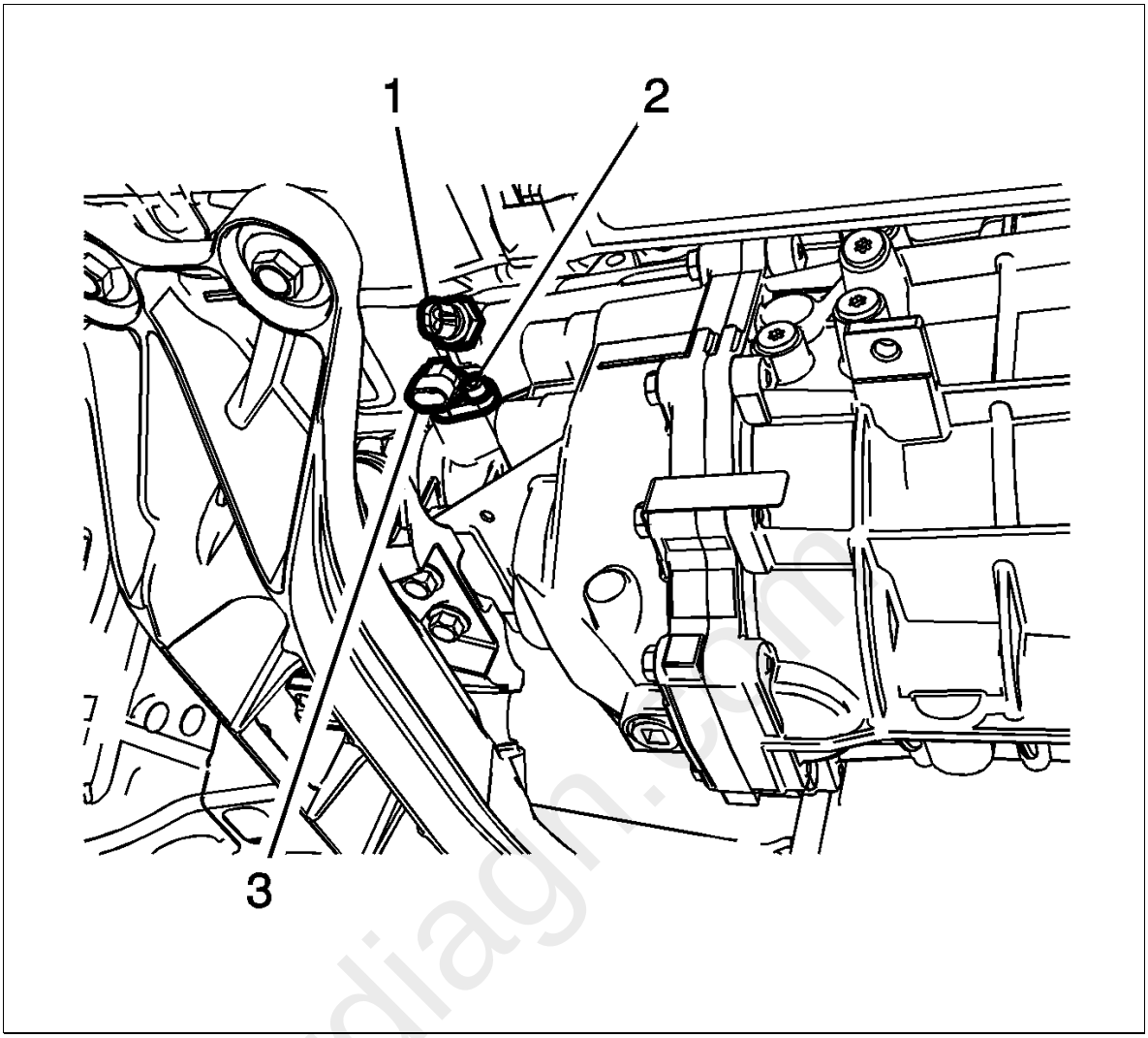


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2. Disconnect the backup lamp switch electrical connector (1).

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Fig 2: Vehicle Speed Sensor & Bolt

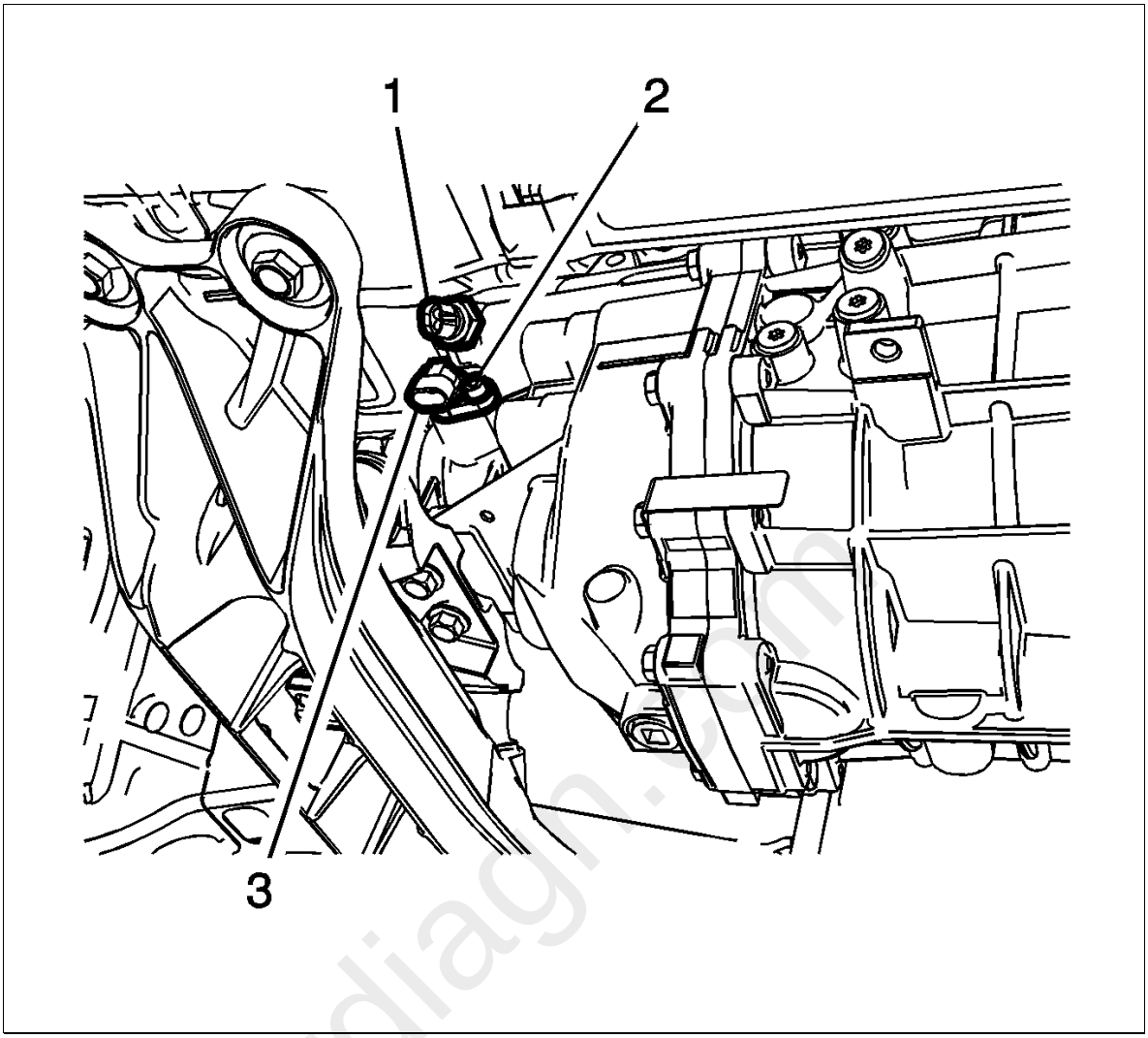


Courtesy of GENERAL MOTORS COMPANY

3. Using a 22 mm angle head open end wrench, or equivalent, remove the backup lamp switch (1).

REPAIR INSTRUCTIONS - ON VEHICLE > BACKUP LAMP SWITCH REPLACEMENT > INSTALLATION PROCEDURE

Fig 1: Vehicle Speed Sensor & Bolt



Courtesy of GENERAL MOTORS COMPANY

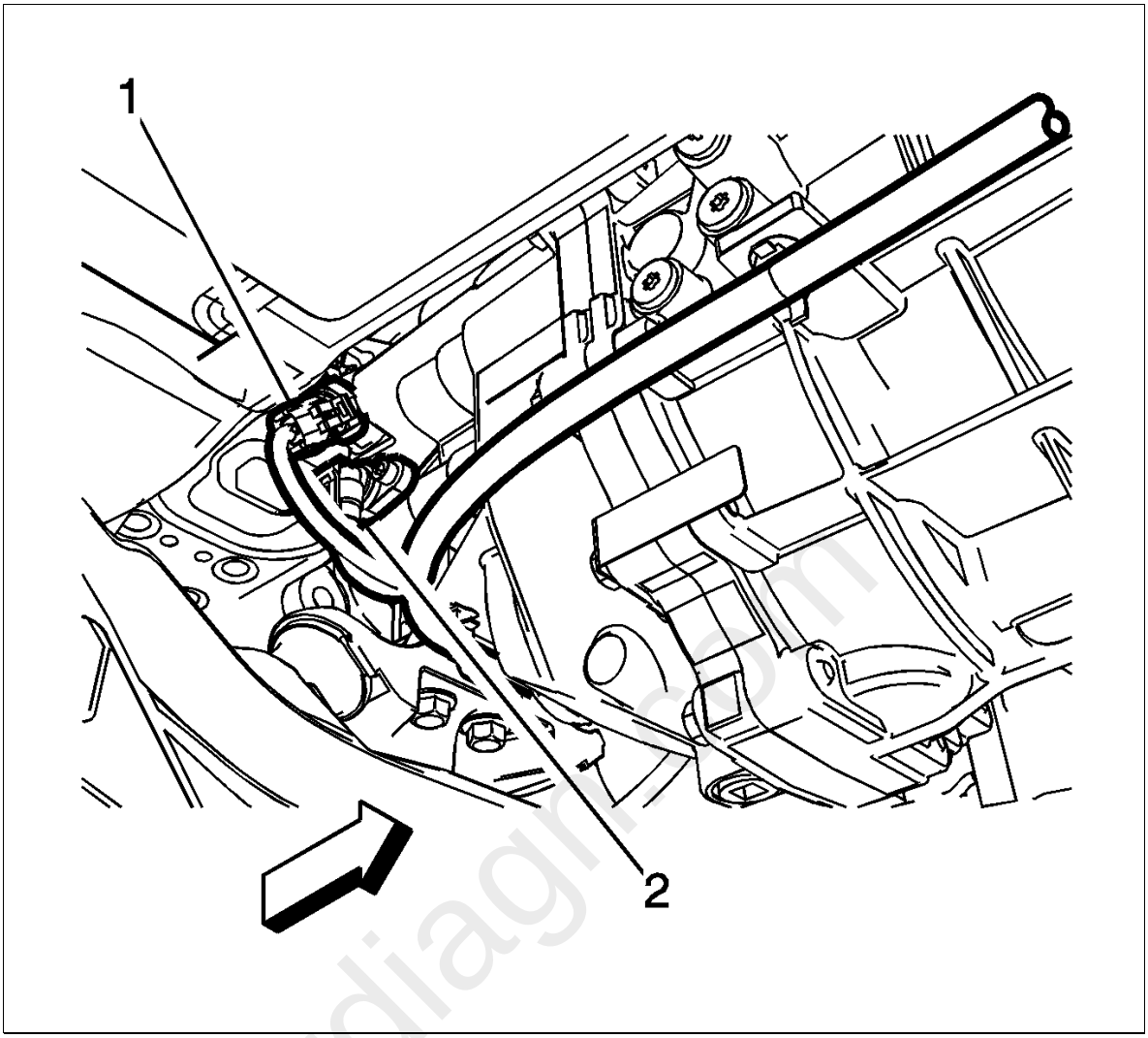
1. Apply sealant to the threads of the backup lamp switch. Refer to Adhesives, Fluids, Lubricants, and Sealers (MM6) Adhesives, Fluids, Lubricants, and Sealers (M13) for the recommended sealant material.

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

2. Install the backup lamp switch (2) and tighten the switch to 27 N.m (20 lb ft).

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Fig 2: Vehicle Speed Sensor Electrical Connector

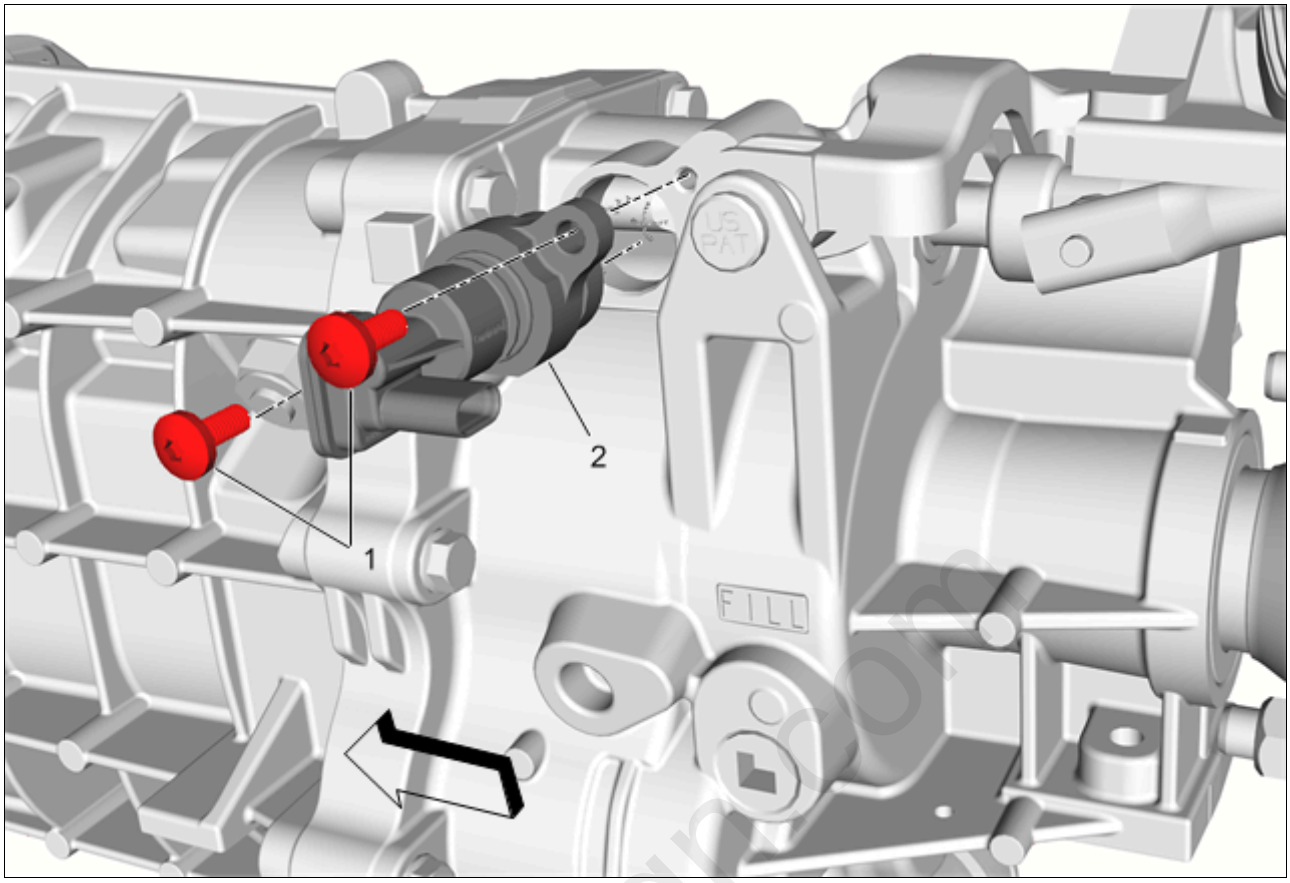


Courtesy of GENERAL MOTORS COMPANY

3. Connect the backup lamp switch electrical connector (1).
4. Lower the vehicle.

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION NEUTRAL POSITION SENSOR REPLACEMENT

Fig 1: Transmission Neutral Position Sensor



Courtesy of GENERAL MOTORS COMPANY

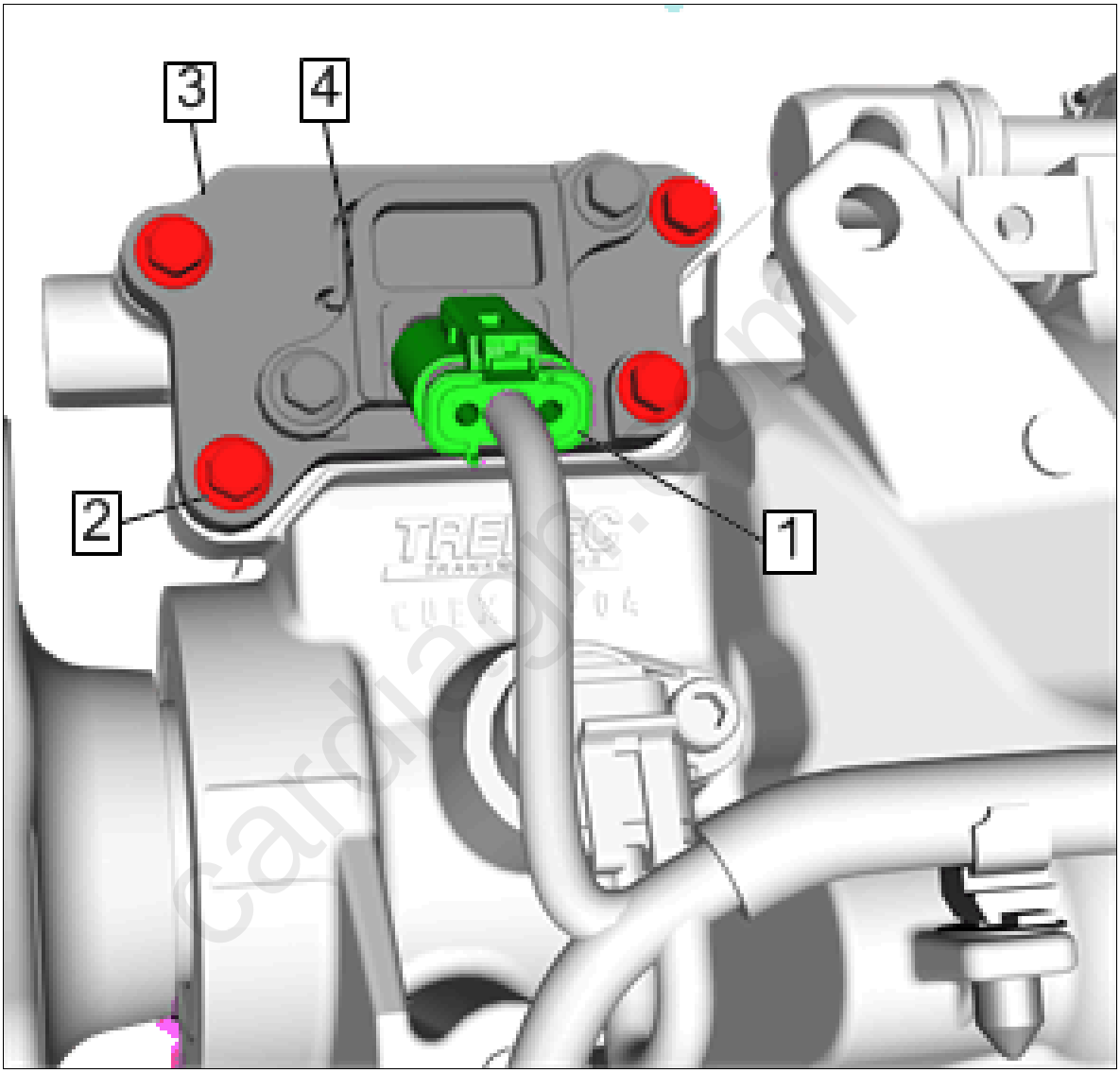
Callout	Component Name
Preliminary Procedure Lower the transmission to gain access to the sensor. Refer to Transmission Replacement (MM6 with LT1 Engine) Transmission Replacement (M13 with LGX Engine) Transmission Replacement (M13 with LTG Engine) .	
1	Transmission Neutral Position Sensor Fastener (Qty: 2) *CAUTION:* *Refer to Fastener Caution .* **Procedure** Clean the threads and apply a threadlocker. Refer to Adhesives, Fluids, Lubricants, and Sealers (MM6) Adhesives, Fluids, Lubricants, and Sealers (M13) . **Tighten** 11 N.m (96 lb in)
2	Transmission Neutral Position Sensor Assembly

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REPAIR INSTRUCTIONS - ON VEHICLE > SHIFT FORK POSITION SENSOR REPLACEMENT > REMOVAL PROCEDURE

1. Remove the shift control assembly from the vehicle. Shift Control Assembly Replacement (M13) Shift Control Assembly Replacement (MM6) .

   Fig 1: Gear Position Sensor



Courtesy of GENERAL MOTORS COMPANY

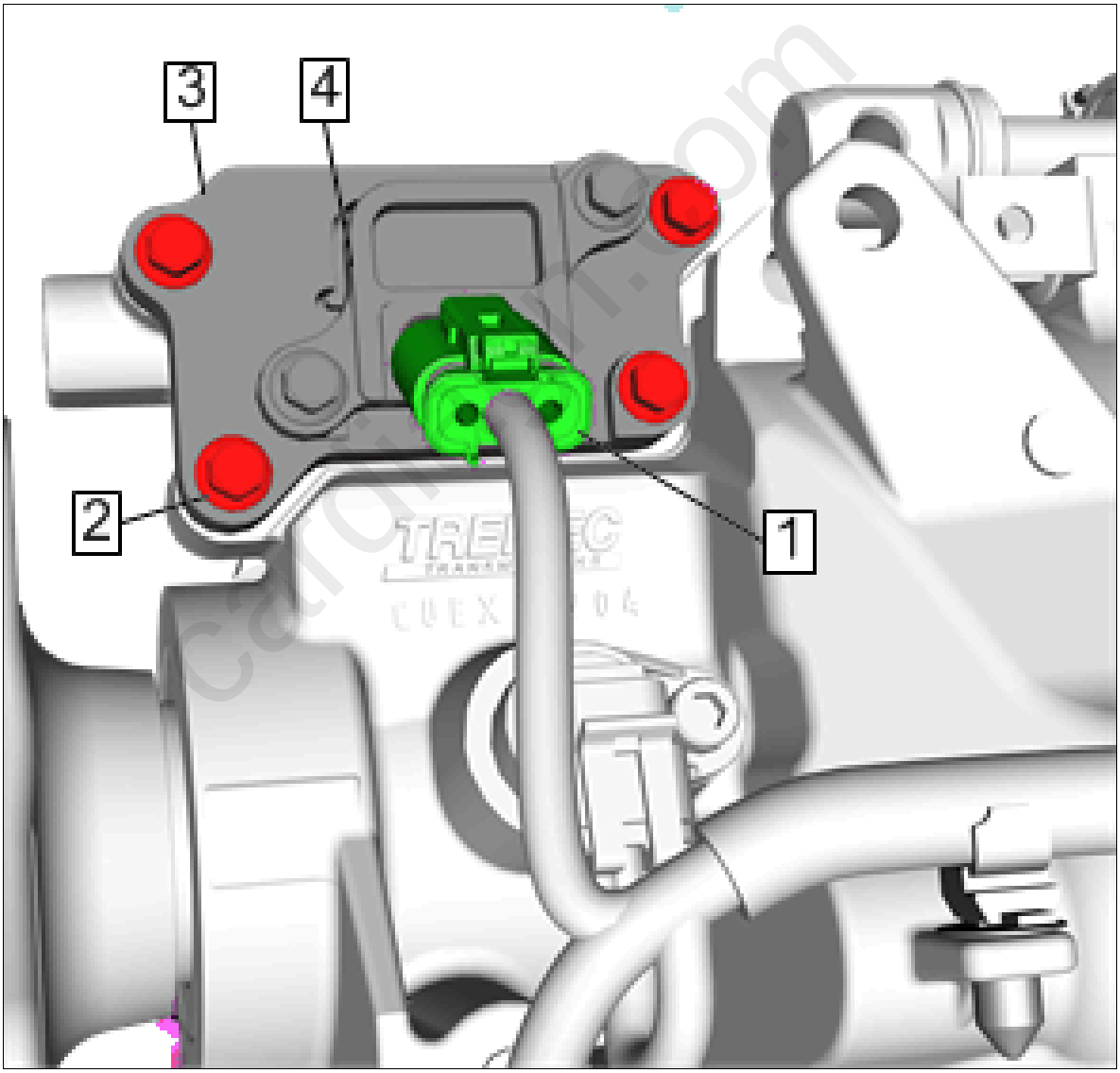
2. Disconnect the gear position sensor electrical connector (1).
3. Remove the four gear position sensor retainers (2).

> *NOTE:*
>
> *Do Not remove component (4) from the mounting plate (3). These components are serviced as a assembly.*

4. Remove the gear position sensor assembly (3) from the transmission.

REPAIR INSTRUCTIONS - ON VEHICLE > SHIFT FORK POSITION SENSOR REPLACEMENT > INSTALLATION PROCEDURE

Fig 1: Gear Position Sensor



Courtesy of GENERAL MOTORS COMPANY

1. Position the gear position sensor assembly (3) to the transmission.

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

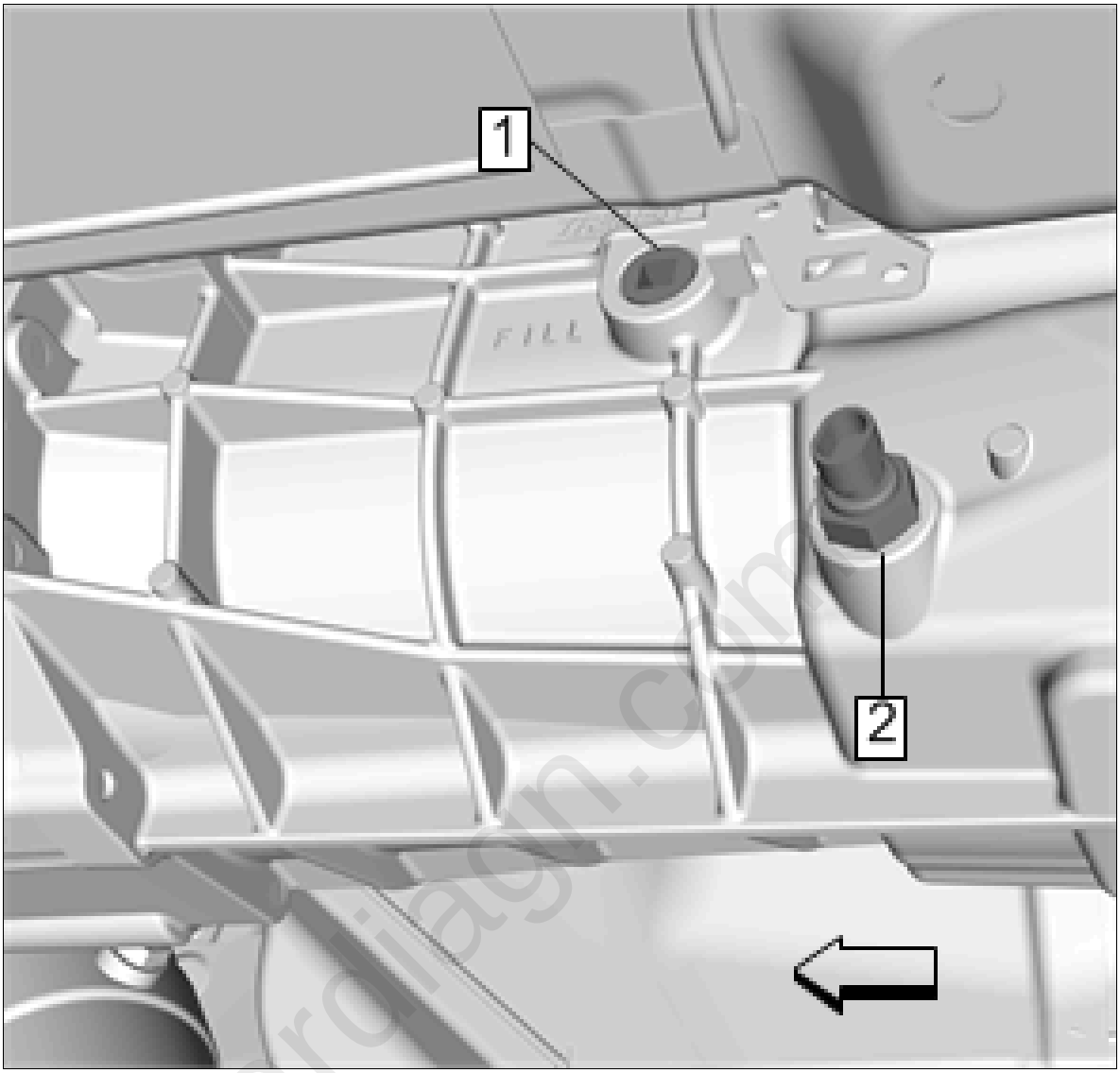
2. Install the four gear position sensor retainers (2) and tighten to 10 N.m (89 lb in).
3. Connect the gear position sensor electrical connector (1).
4. Install the shift control assembly to the vehicle. Shift Control Assembly Replacement (M13) Shift Control Assembly Replacement (MM6) .
5. Perform the gear position sensor learn procedure. Gear Position Sensor Learn

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION FLUID TEMPERATURE SENSOR REPLACEMENT

Removal Procedure

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Fig 1: Fluid Temperature Sensor Connector



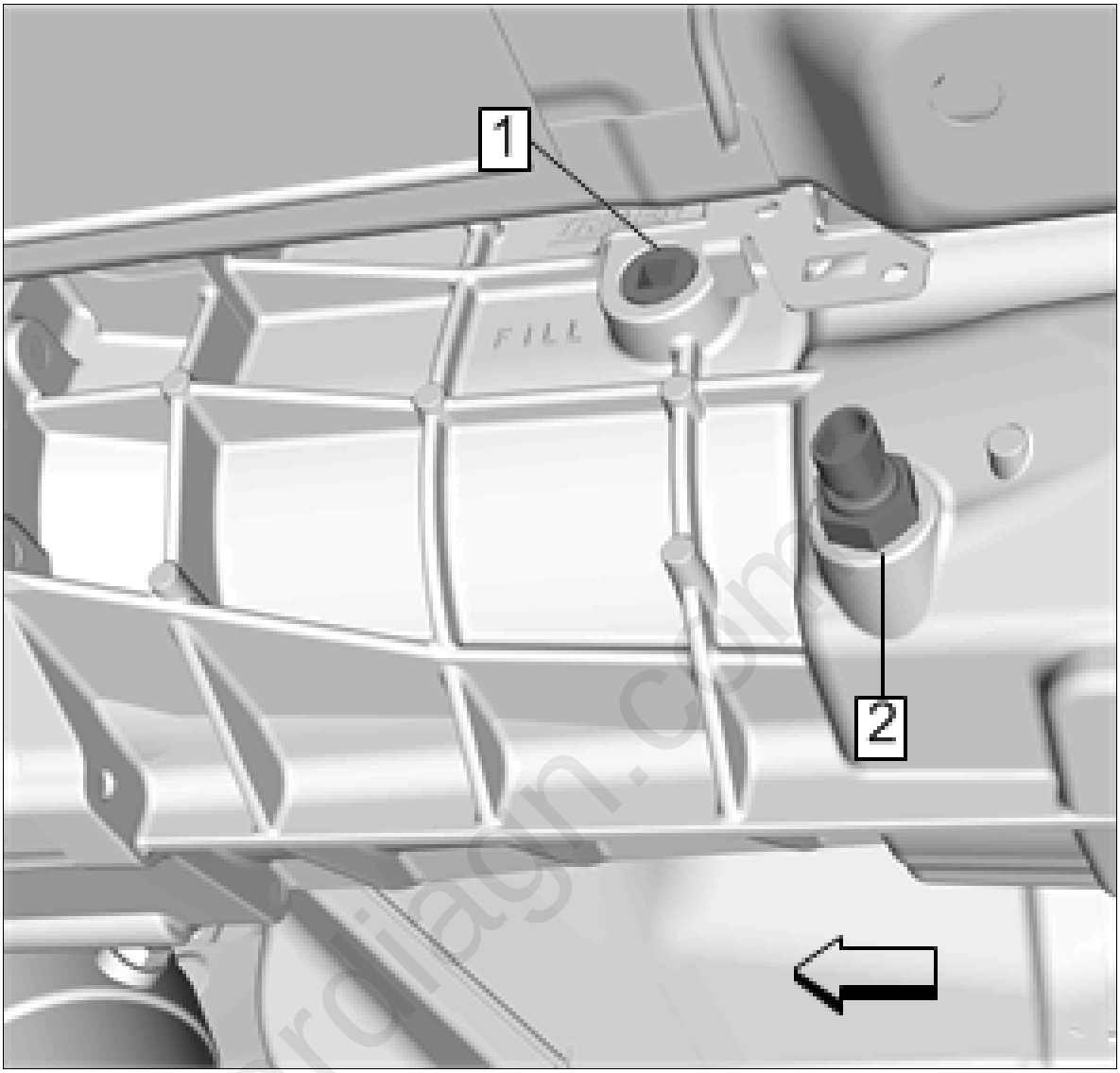
Courtesy of GENERAL MOTORS COMPANY

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1. Raise and suitably support the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP)
2. Clean away all dirt and debris from the transmission fluid temperature sensor/drain plug (2) area.
3. Place a suitable drain pan under the transmission.
4. Disconnect the electrical connector from the transmission fluid temperature sensor/drain plug.
5. Remove the transmission fluid temperature sensor/drain plug (2).
6. Allow the system to drain.

Installation Procedure

Fig 2: Fluid Temperature Sensor Connector



Courtesy of GENERAL MOTORS COMPANY

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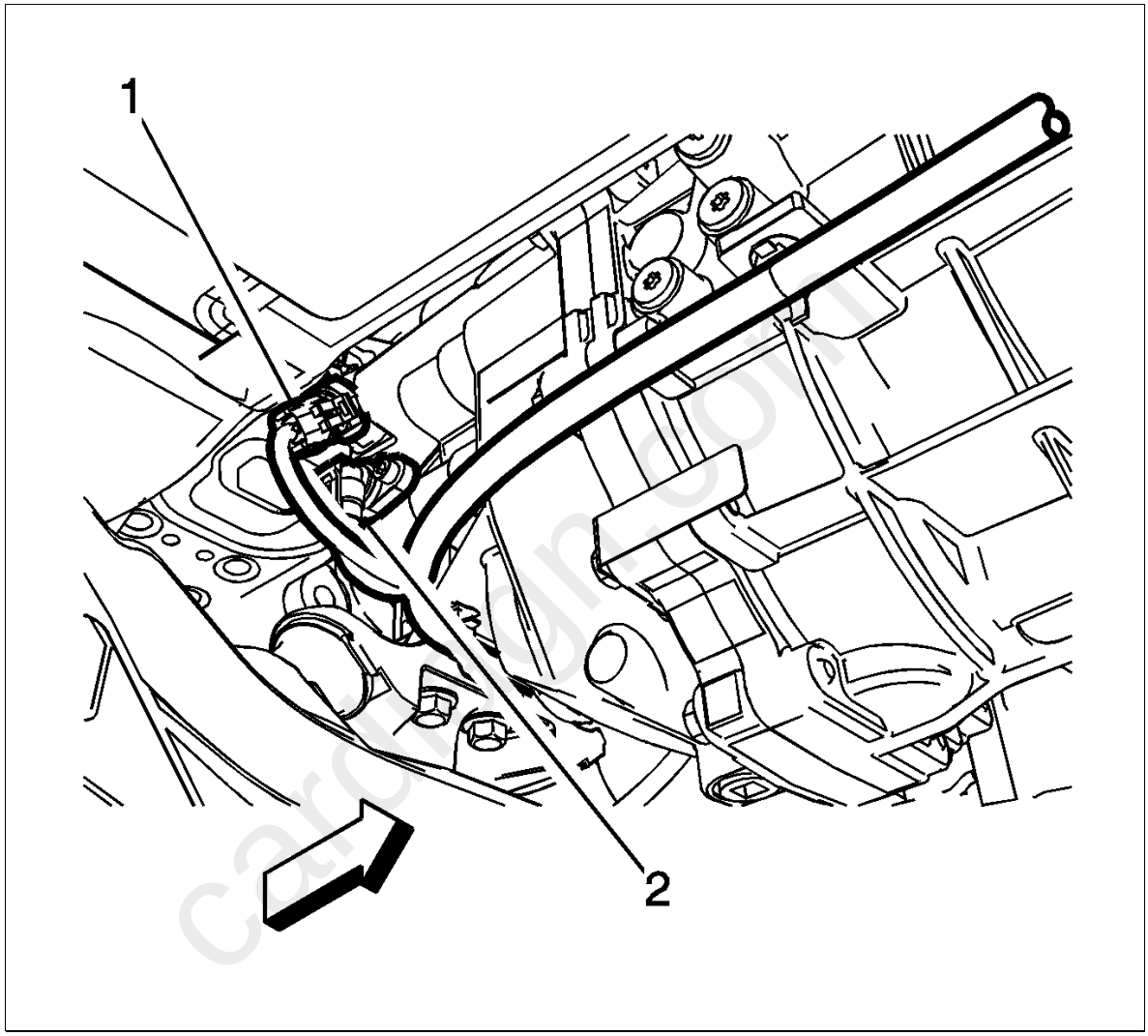
> ⚠ *CAUTION:*
>
> *Refer to Component Fastener Tightening Caution .*

1. Install the transmission fluid temperature sensor/drain plug (2) and tighten to 27 N.m (20 lb ft).
2. Connect the electrical connector to the transmission fluid temperature sensor/drain plug.
3. Fill the transmission with transmission fluid. Transmission Fluid Level Inspection (MM6) Transmission Fluid Level Inspection (M13 Without Y4Q)
4. Remove the drain pan.
5. Lower the vehicle.

REPAIR INSTRUCTIONS - ON VEHICLE > VEHICLE SPEED SENSOR REPLACEMENT (M13) > REMOVAL PROCEDURE

1. Raise and suitably support the vehicle. Refer to Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP) .

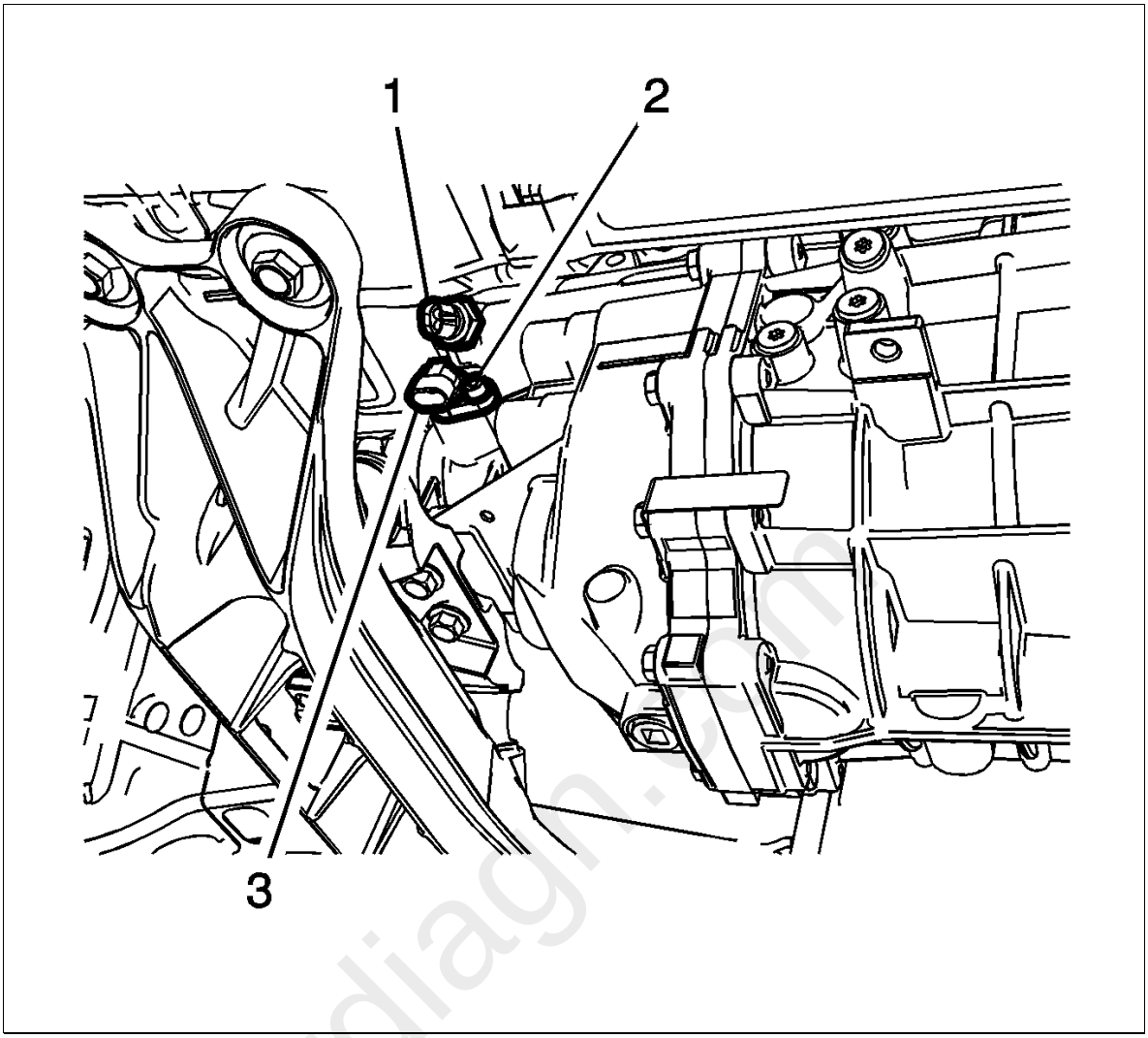
   Fig 1: Vehicle Speed Sensor Electrical Connector



Courtesy of GENERAL MOTORS COMPANY

2. Disconnect the vehicle speed sensor electrical connector (2).

Fig 2: Vehicle Speed Sensor & Bolt

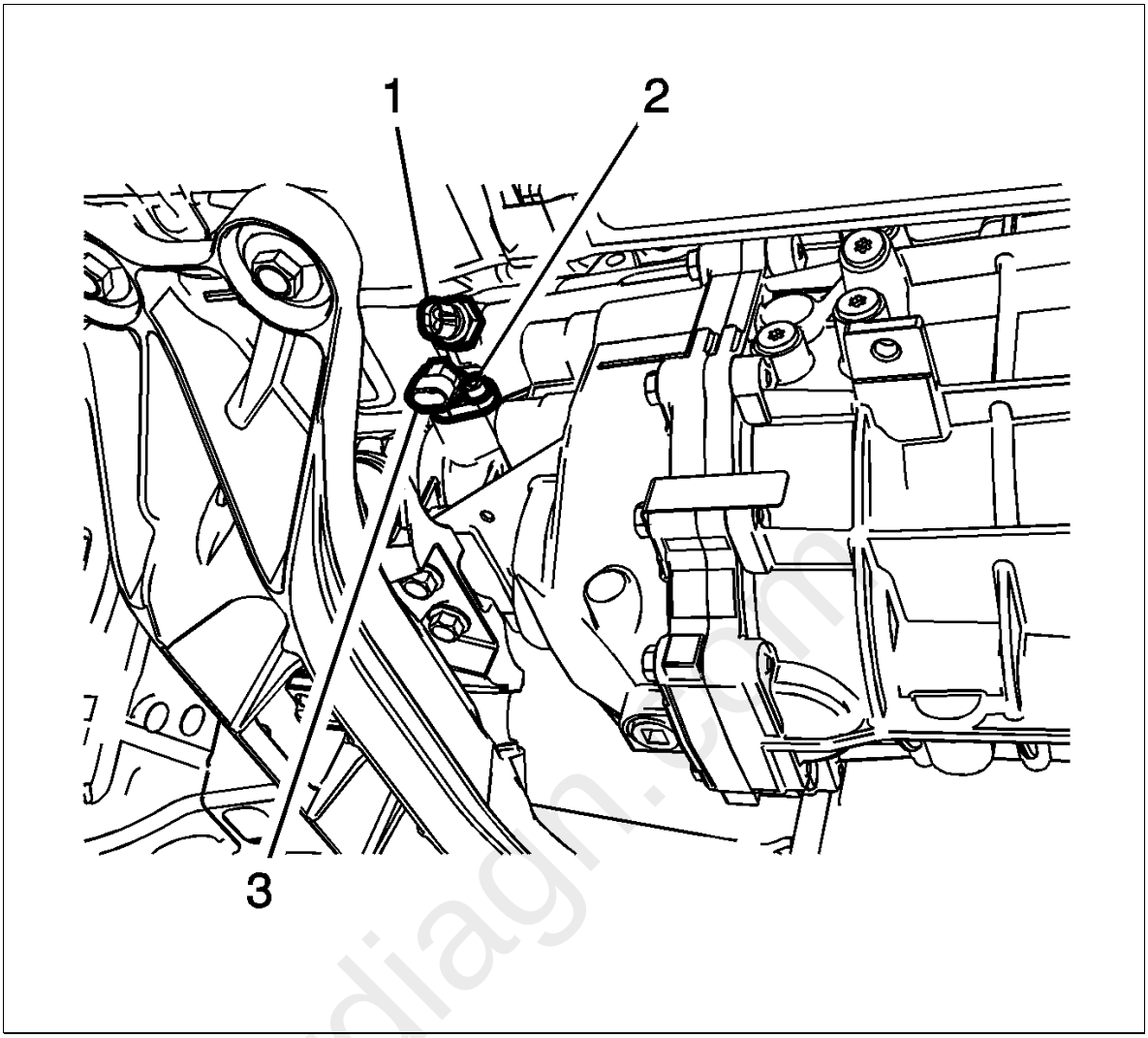


Courtesy of GENERAL MOTORS COMPANY

3. Remove the vehicle speed sensor bolt (2).
4. Remove the vehicle speed sensor (3).

REPAIR INSTRUCTIONS - ON VEHICLE > VEHICLE SPEED SENSOR REPLACEMENT (M13) > INSTALLATION PROCEDURE

Fig 1: Vehicle Speed Sensor & Bolt



Courtesy of GENERAL MOTORS COMPANY

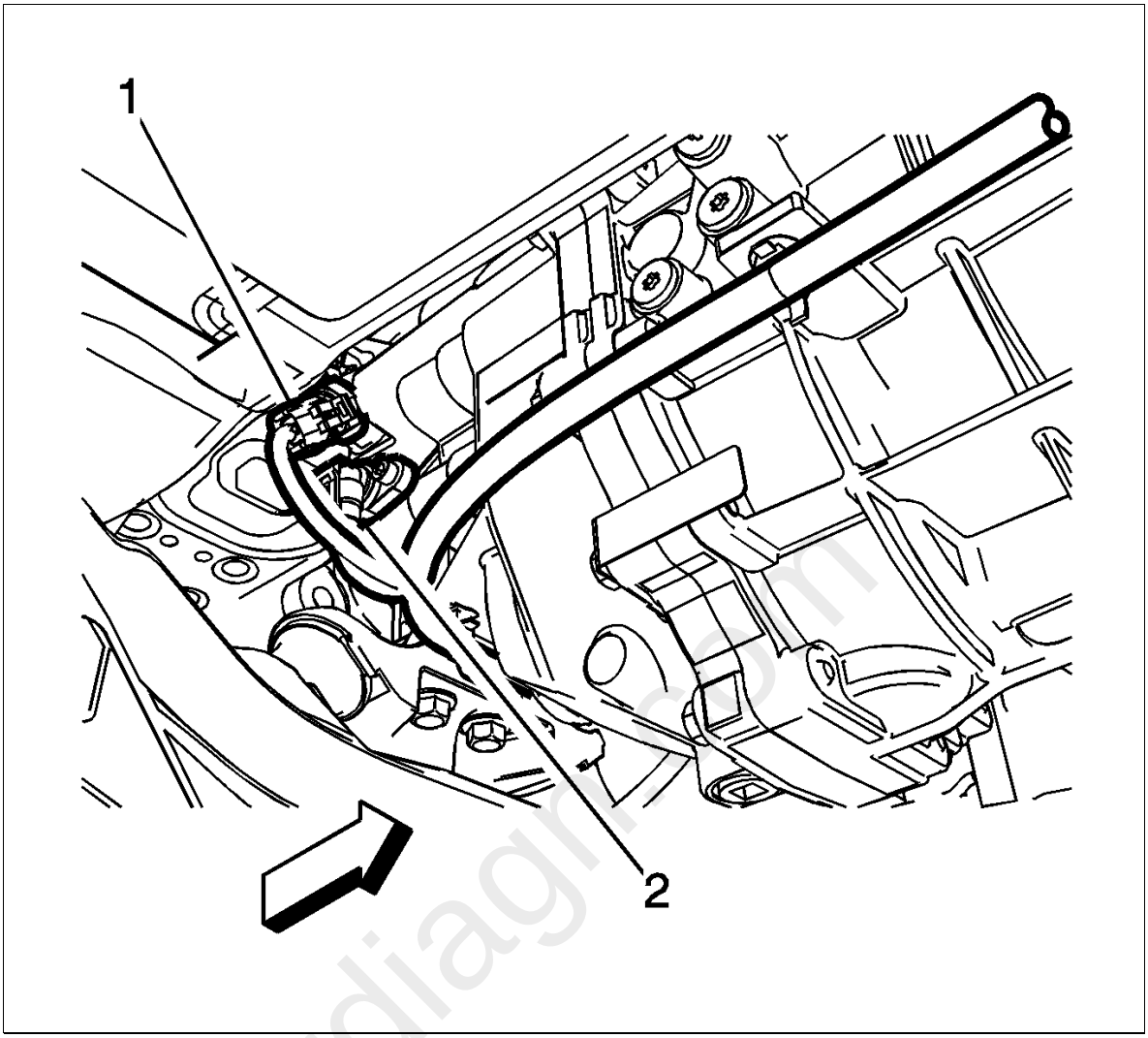
1. Install the vehicle speed sensor (3).

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

2. Install the vehicle speed sensor bolt (2) and tighten to 10 N.m (89 lb in).

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Fig 2: Vehicle Speed Sensor Electrical Connector



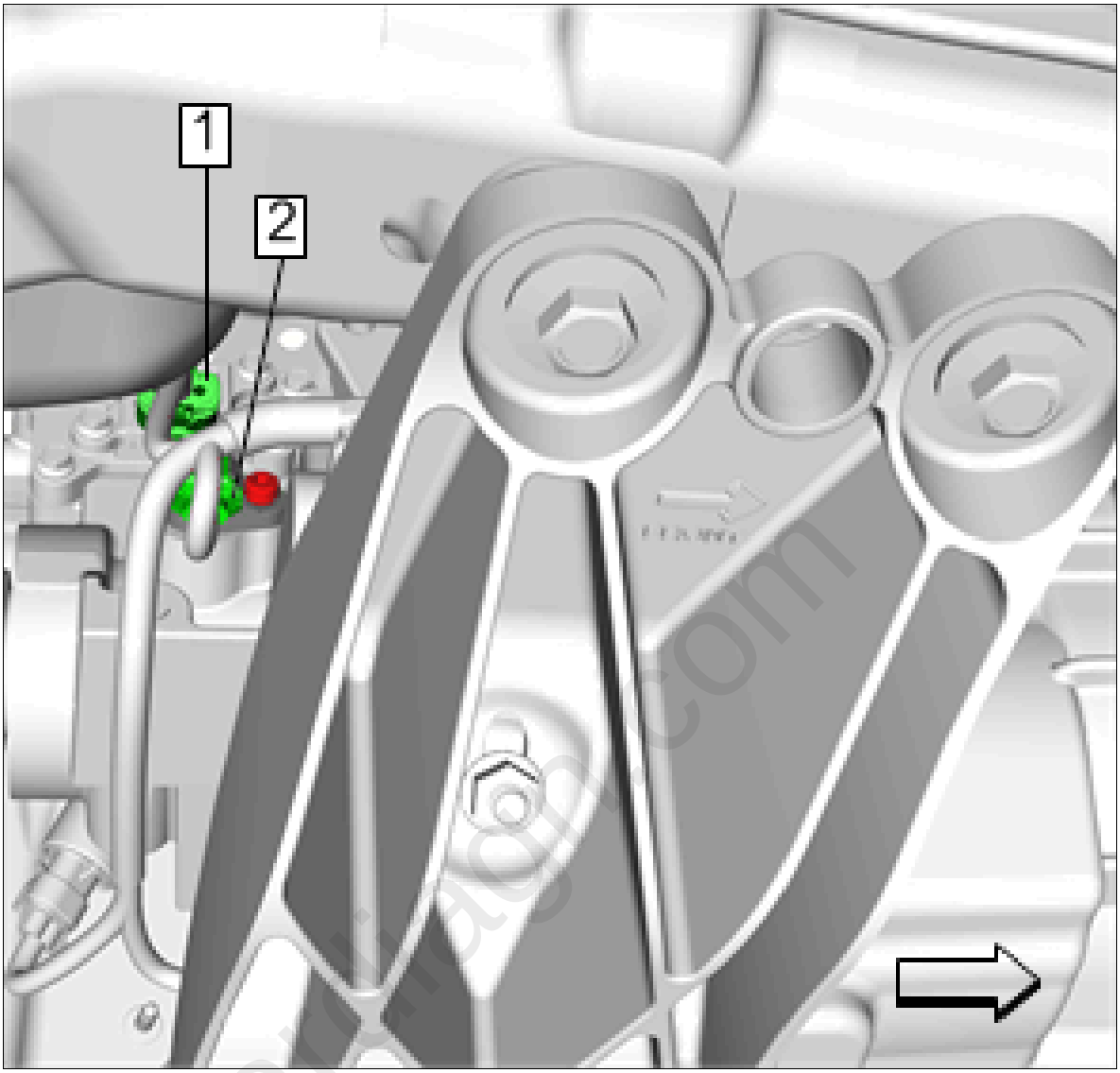
Courtesy of GENERAL MOTORS COMPANY

3. Connect the vehicle speed sensor electrical connector (2).
4. Lower the vehicle.

REPAIR INSTRUCTIONS - ON VEHICLE > VEHICLE SPEED SENSOR REPLACEMENT (MM6) > REMOVAL PROCEDURE

1. Raise and suitably support the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP)

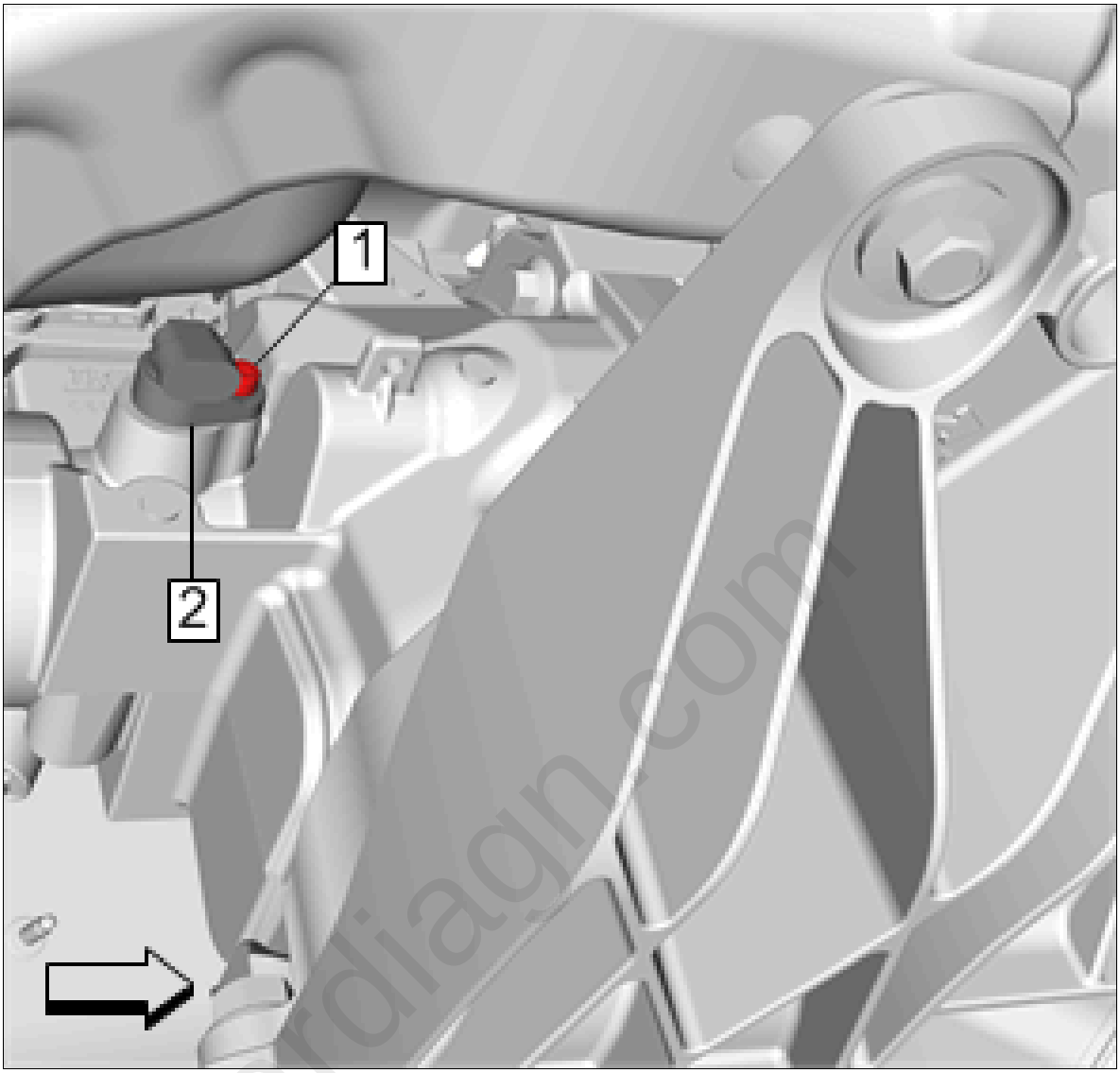
Fig 1: Vehicle Speed Sensor Electrical Connector



Courtesy of GENERAL MOTORS COMPANY

2. Disconnect the vehicle speed sensor electrical connector (2).

Fig 2: Vehicle Speed Sensor



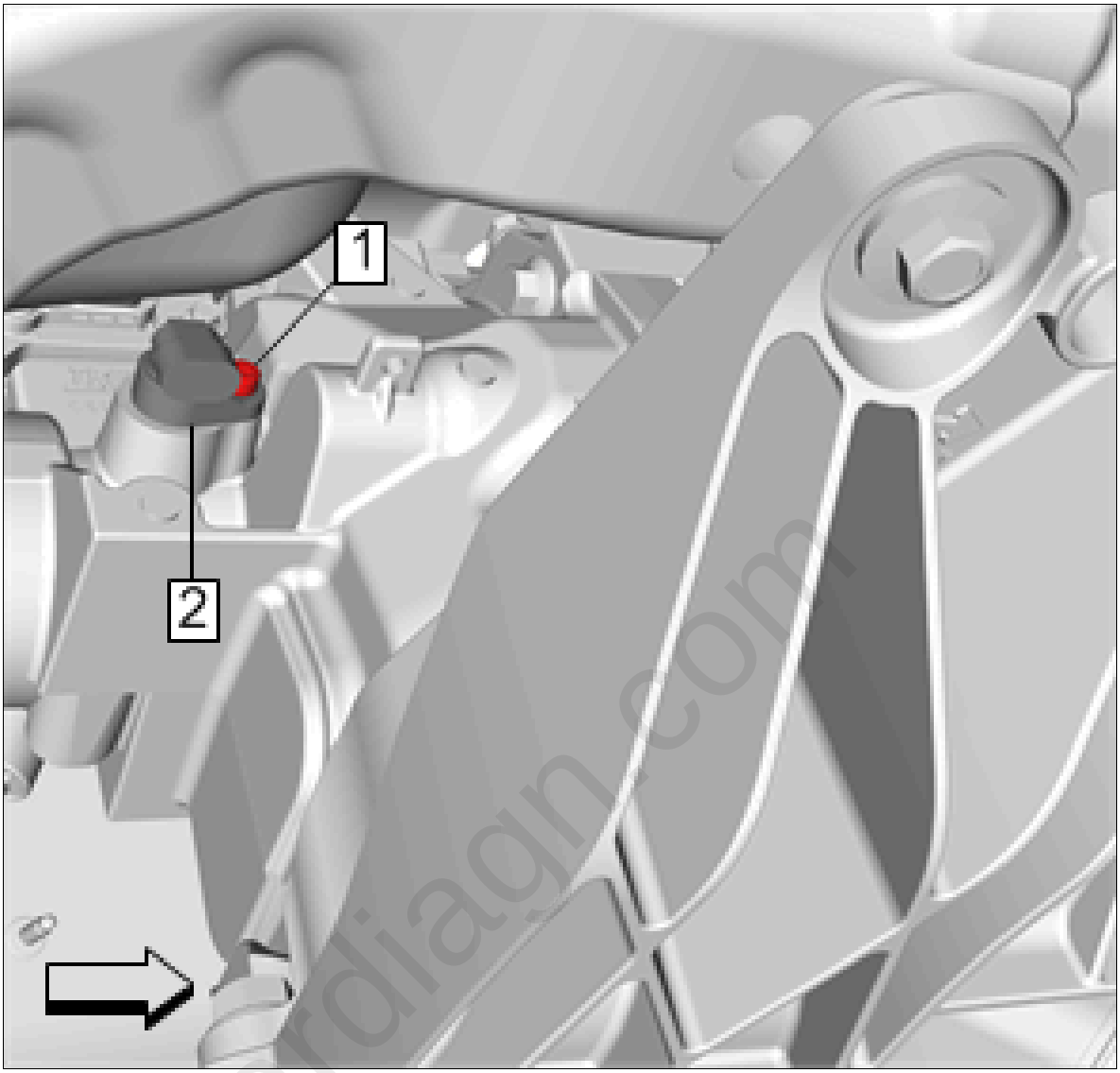
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3. Remove the vehicle speed sensor bolt (1).
4. Remove the vehicle speed sensor (2).

REPAIR INSTRUCTIONS - ON VEHICLE > VEHICLE SPEED SENSOR REPLACEMENT (MM6) > INSTALLATION PROCEDURE

Fig 1: Vehicle Speed Sensor



Courtesy of GENERAL MOTORS COMPANY

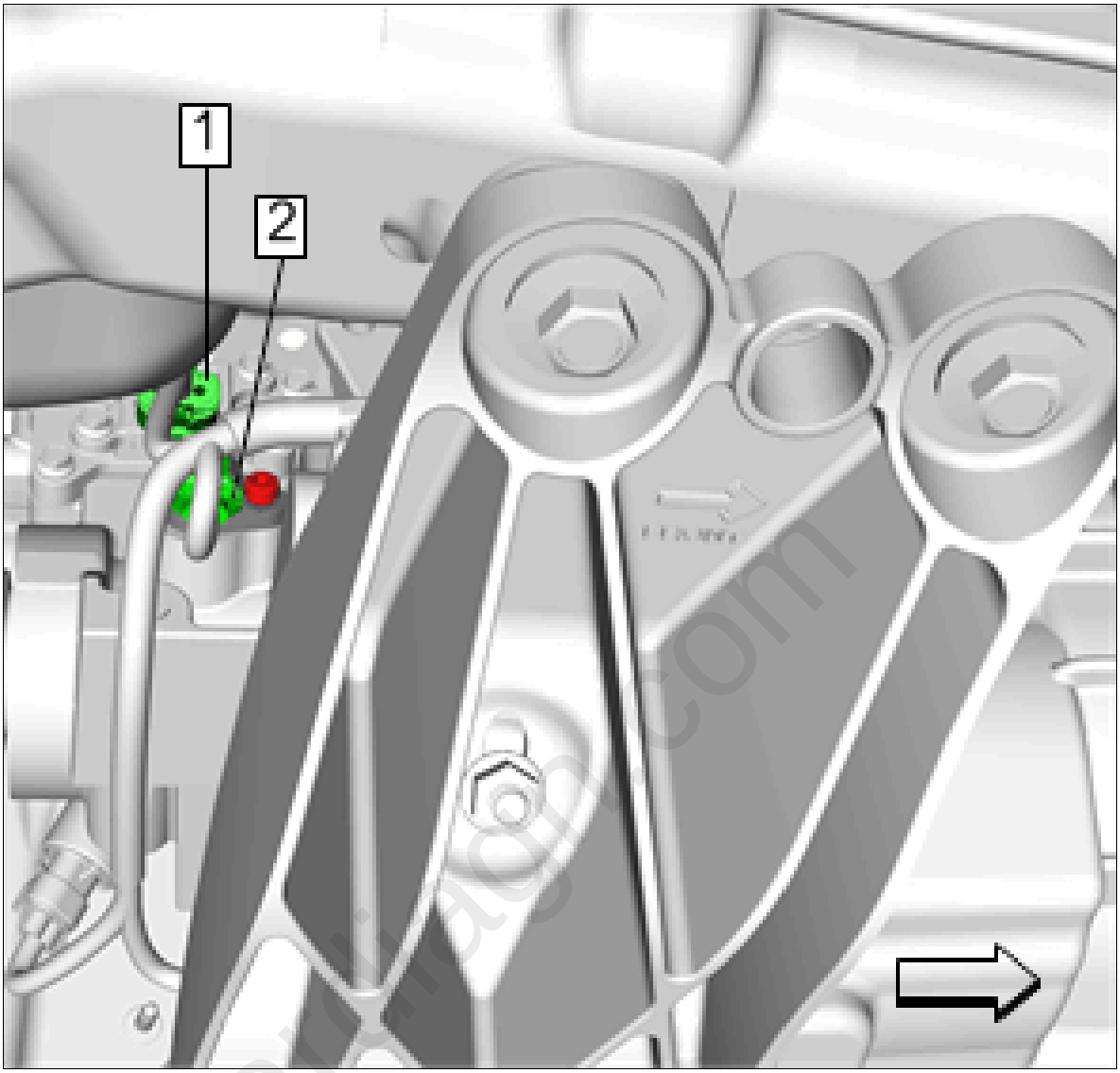
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1. Install the vehicle speed sensor (2).

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

2. Install the vehicle speed sensor bolt (1) and tighten to 10 N.m (89 lb in).

Fig 2: Vehicle Speed Sensor Electrical Connector



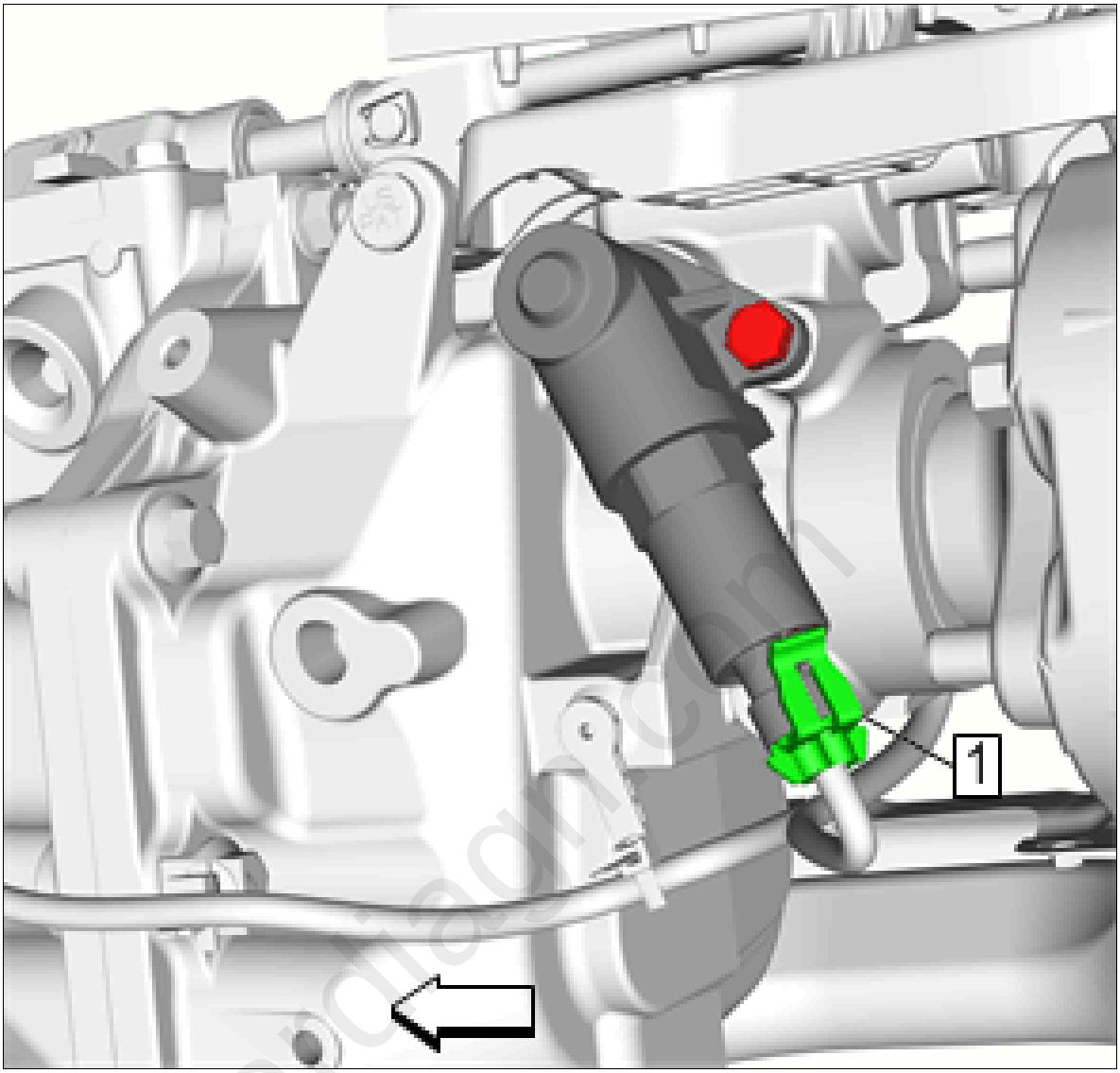
Courtesy of GENERAL MOTORS COMPANY

3. Connect the vehicle speed sensor electrical connector (2).
4. Lower the vehicle.

REPAIR INSTRUCTIONS - ON VEHICLE > REVERSE LOCKOUT SOLENOID REPLACEMENT > REMOVAL PROCEDURE

1. Raise and suitably support the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP) .

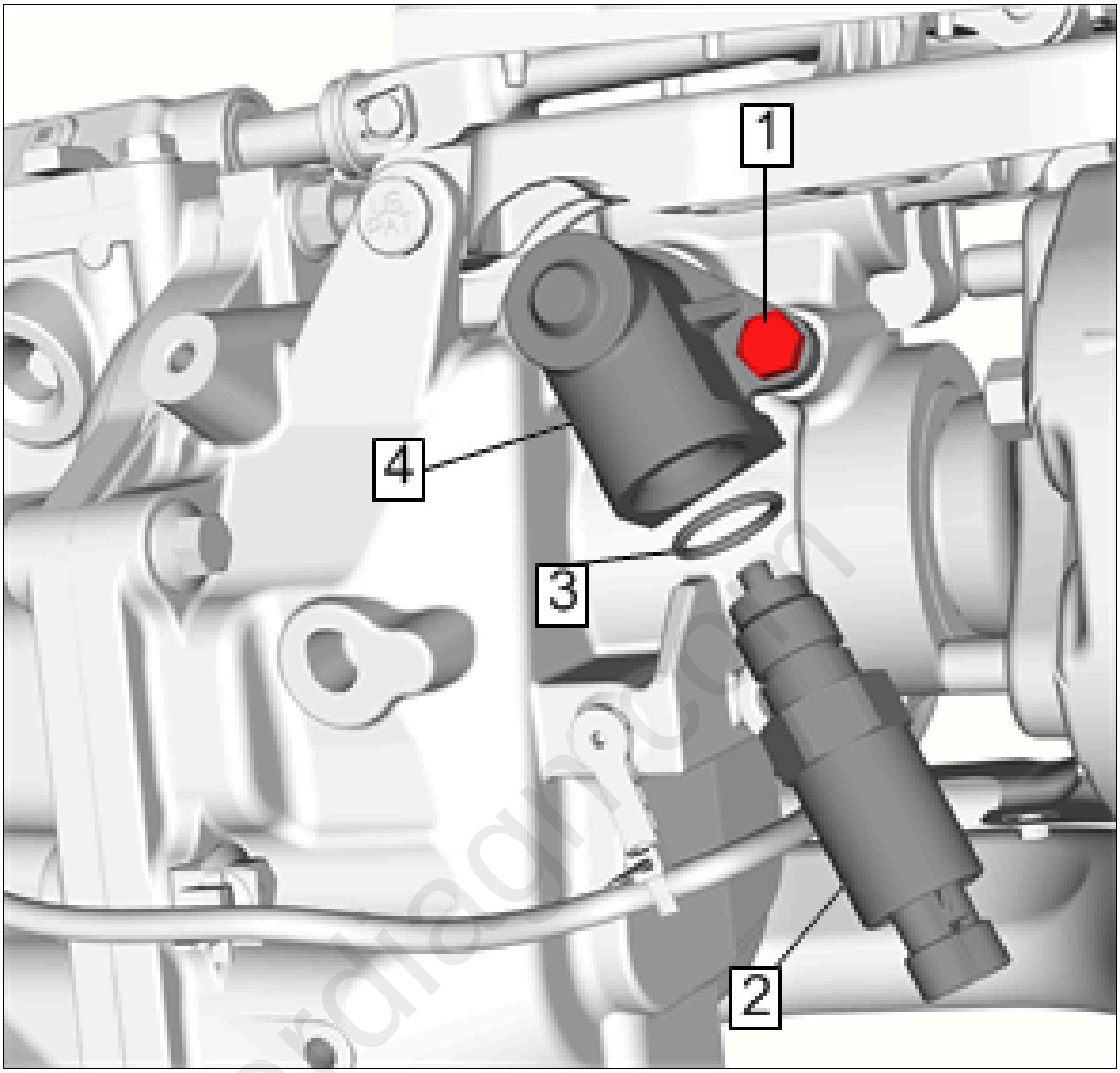
Fig 1: Reverse Lockout Solenoid Electrical Connector



Courtesy of GENERAL MOTORS COMPANY

2. Disconnect the reverse lockout solenoid electrical connector (1).

Fig 2: Reverse Lockout Solenoid O-Ring

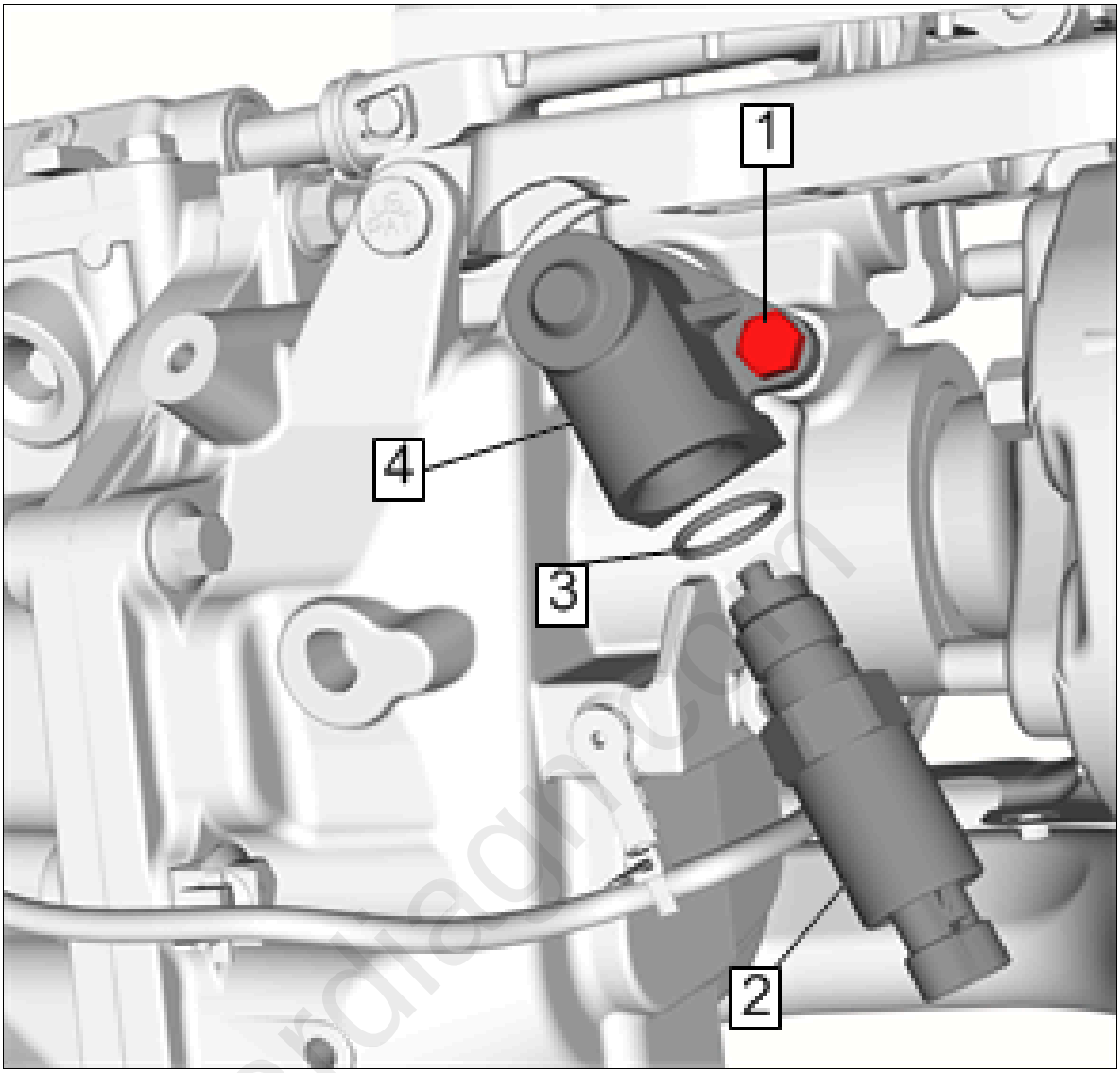


Courtesy of GENERAL MOTORS COMPANY

3. Remove the reverse lockout solenoid (2).
4. Remove the bolt (1) and the reverse lockout assembly (4), if necessary.

REPAIR INSTRUCTIONS - ON VEHICLE > REVERSE LOCKOUT SOLENOID REPLACEMENT > INSTALLATION PROCEDURE

Fig 1: Reverse Lockout Solenoid O-Ring



Courtesy of GENERAL MOTORS COMPANY

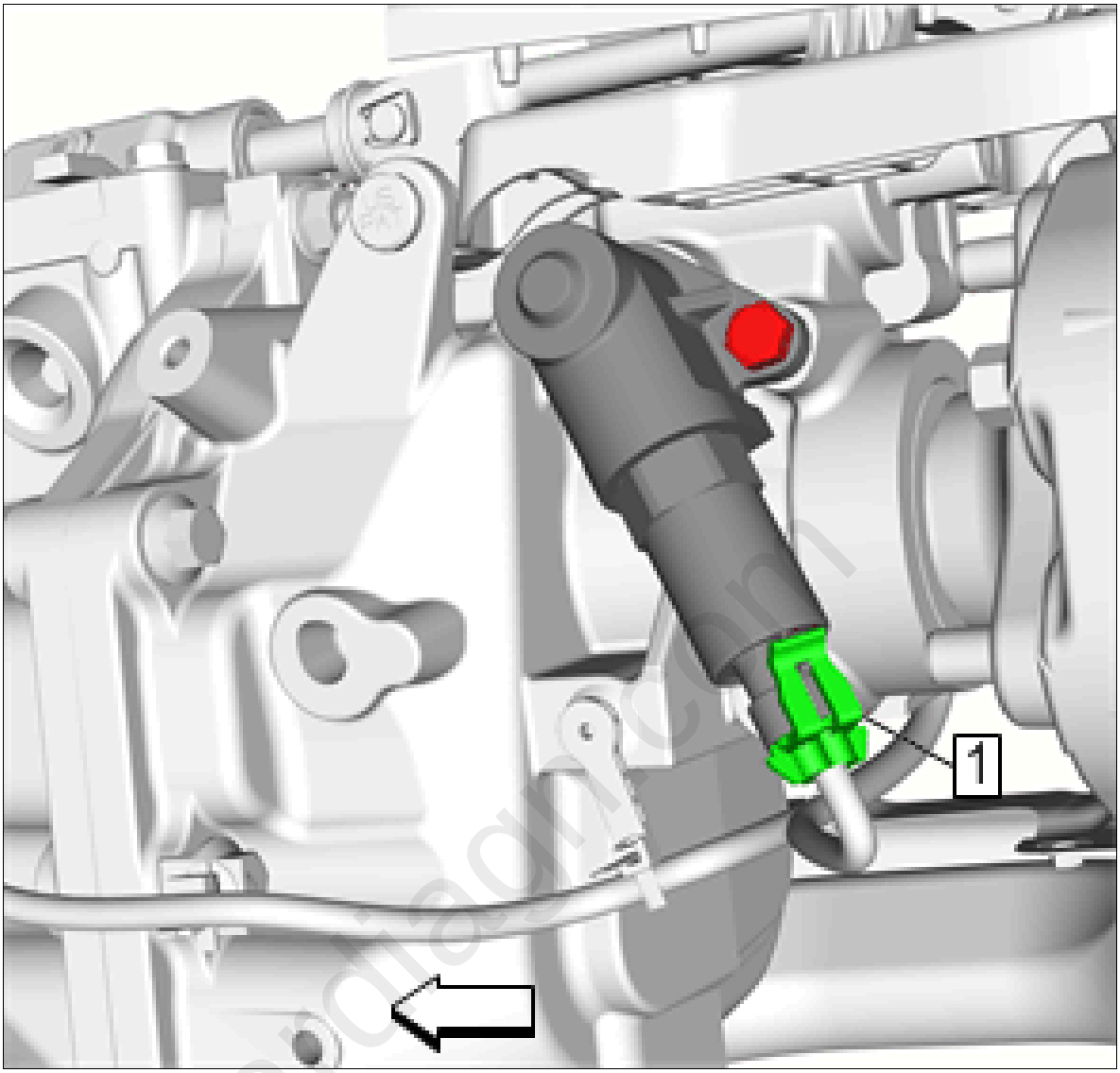
1. If removed, inspect the reverse lockout assembly O-ring (3). Replace the reverse lockout assembly O-ring if necessary.

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

2. Install the reverse lockout assembly (4) and bolt (1) and tighten to 18 N.m (13 lb ft).
3. Install the reverse lockout solenoid (2).

   Tighten the reverse lockout solenoid (2) to 40 N.m (30 lb ft).

Fig 2: Reverse Lockout Solenoid Electrical Connector



Courtesy of GENERAL MOTORS COMPANY

4. Connect the reverse lockout solenoid electrical connector (1).
5. Lower the vehicle.

REPAIR INSTRUCTIONS - ON VEHICLE > GEAR SELECT/SKIP SHIFT SOLENOID REPLACEMENT

Special Tools

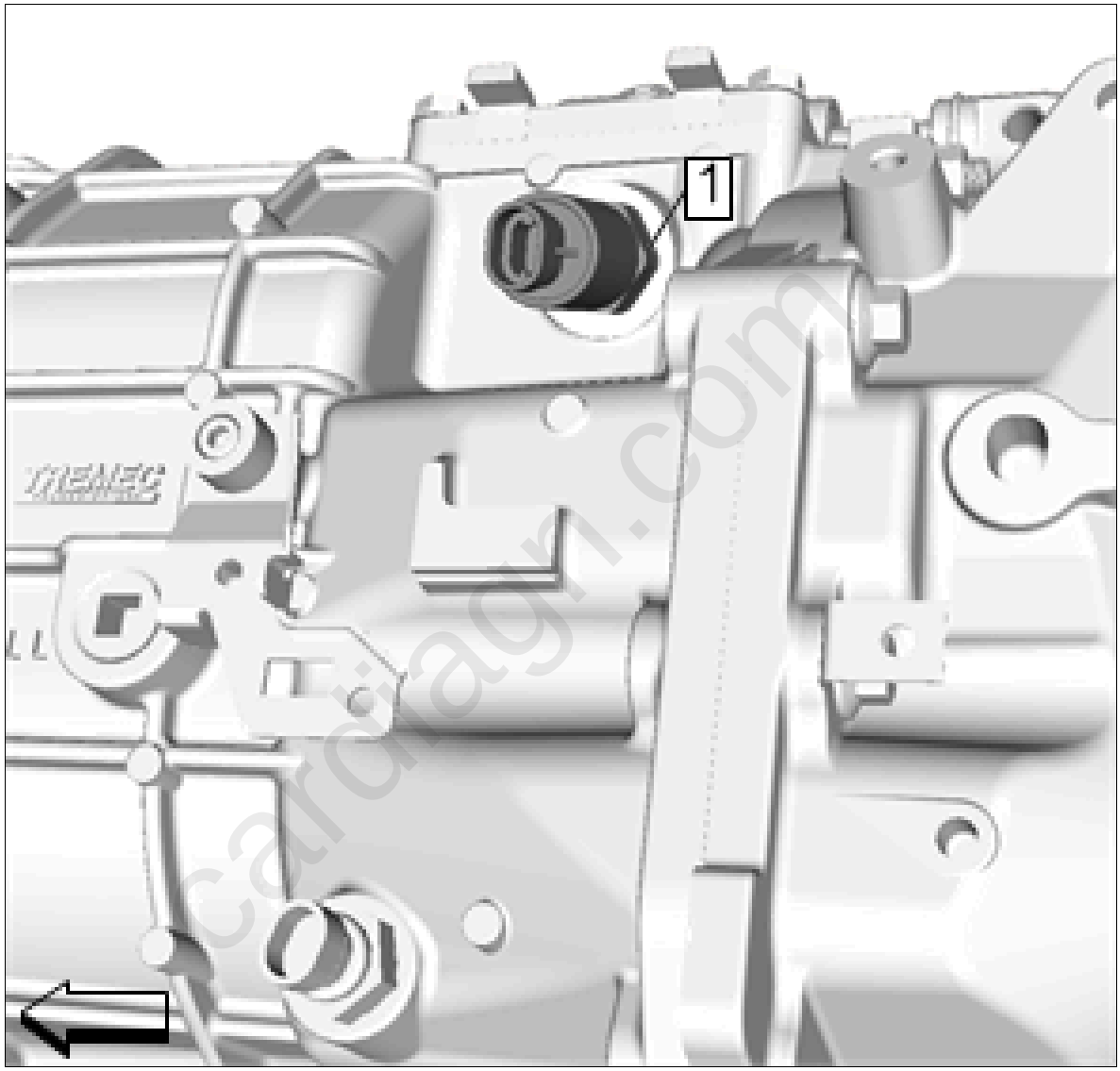
DT-49293 Gear Select/Skip Shift Solenoid Socket

For equivalent regional tools, refer to Special Tools .

REPAIR INSTRUCTIONS - ON VEHICLE > GEAR SELECT/SKIP SHIFT SOLENOID REPLACEMENT > REMOVAL PROCEDURE

1. Lower the rear of the transmission to gain access to the gear select/skip shift solenoid. Shift Control Assembly Replacement (M13) Shift Control Assembly Replacement (MM6) .
2. Disconnect the gear select/skip shift solenoid electrical connector.

   Fig 1: Gear Select/Skip Shift Solenoid

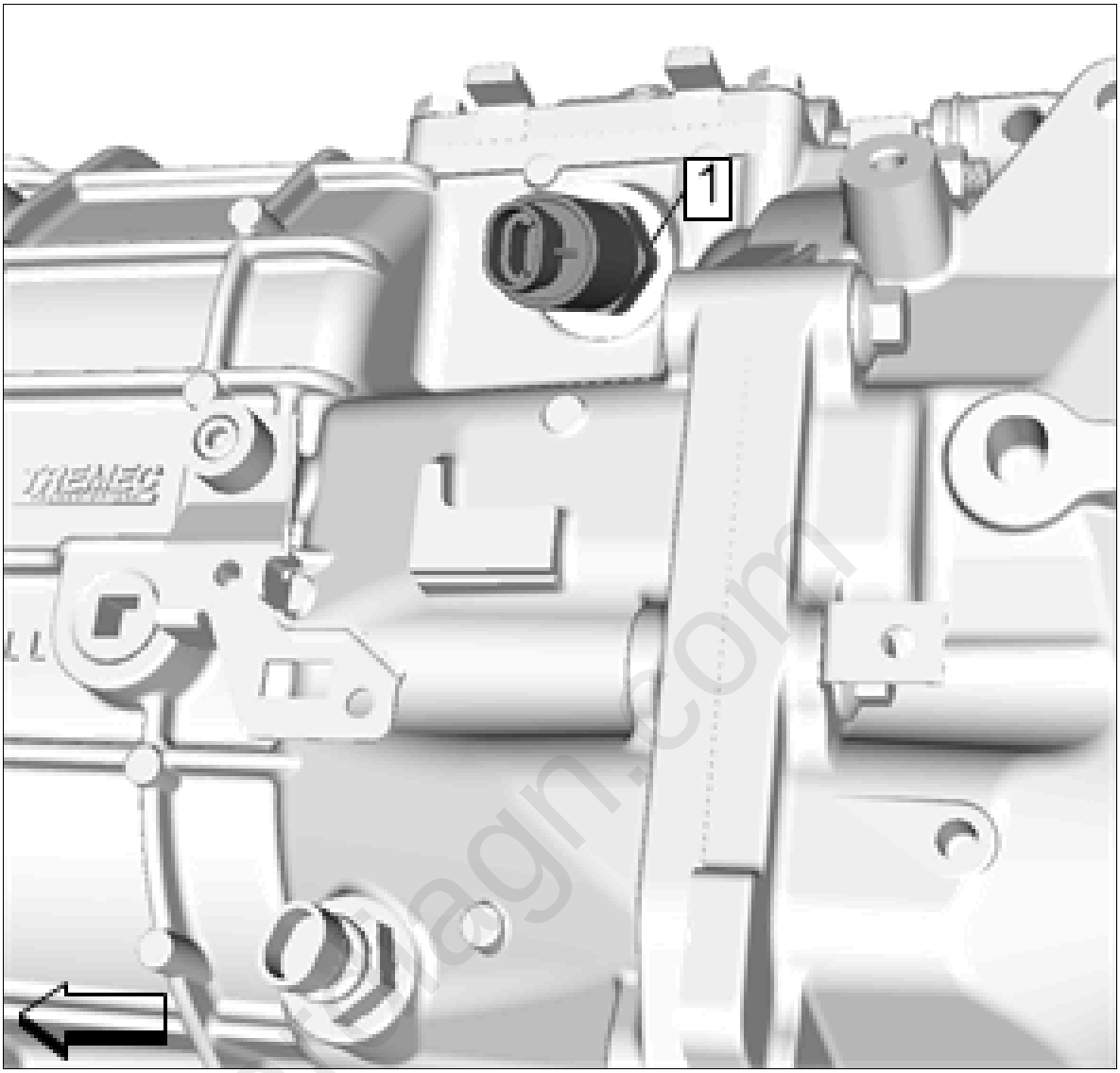


Courtesy of GENERAL MOTORS COMPANY

3. Using the **DT-49293** Gear Select/Skip Shift Solenoid Socket, remove the gear select/skip shift solenoid (1).

REPAIR INSTRUCTIONS - ON VEHICLE > GEAR SELECT/SKIP SHIFT SOLENOID REPLACEMENT > INSTALLATION PROCEDURE

Fig 1: Gear Select/Skip Shift Solenoid



Courtesy of GENERAL MOTORS COMPANY

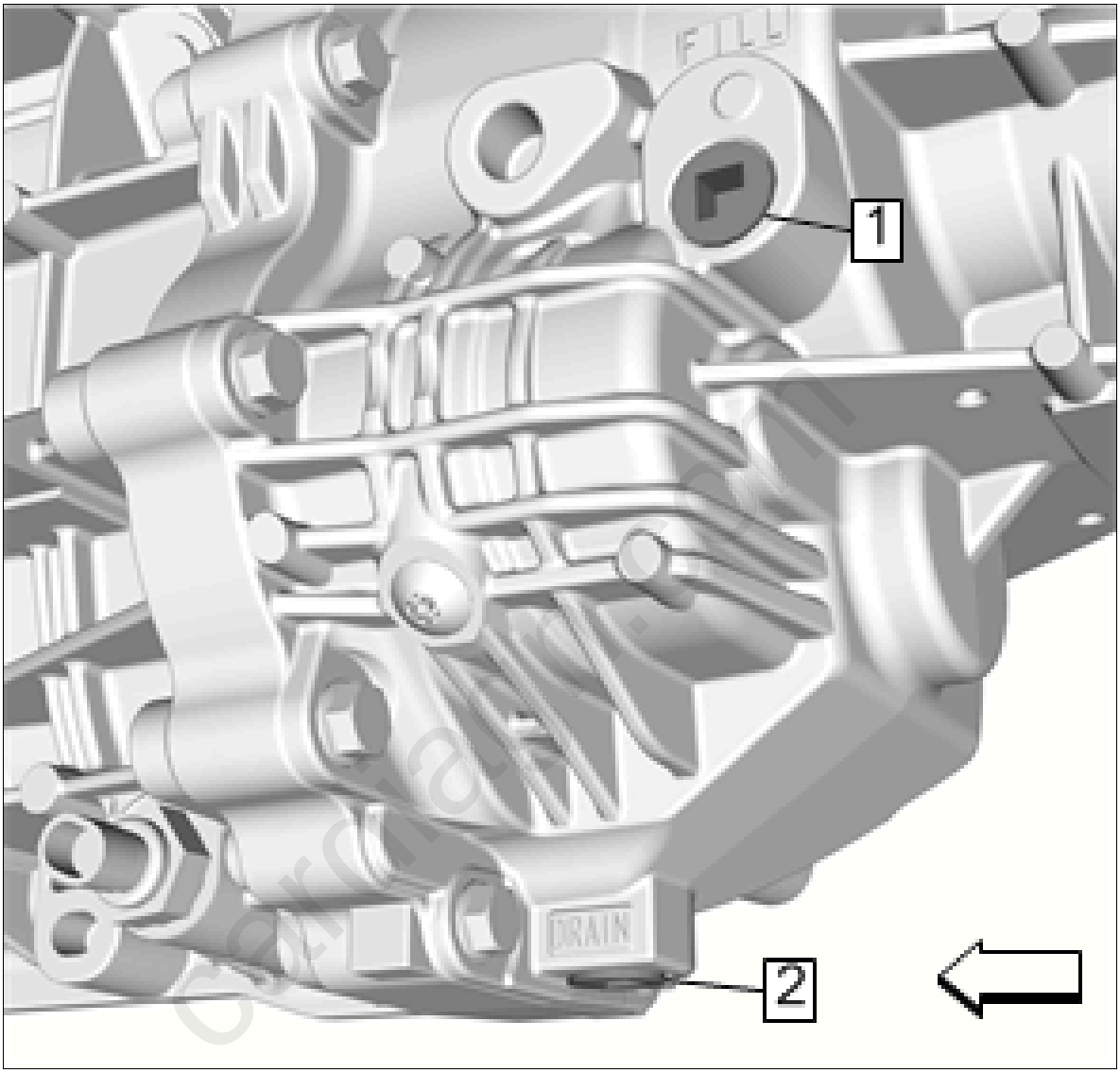
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> ⚠ *CAUTION:*
>
> *Refer to Component Fastener Tightening Caution .*

1. Using the **DT-49293** Gear Select/Skip Shift Solenoid Socket, install the gear select/skip shift solenoid (1) and tighten to 40 N.m (30 lb ft).
2. Connect the gear select/skip shift solenoid electrical connector.
3. Raise the rear of the transmission. Shift Control Assembly Replacement (M13) Shift Control Assembly Replacement (MM6) .
4. Lower the vehicle.

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION FLUID DRAIN AND FILL (M13 WITHOUT Y4Q) > DRAINING PROCEDURE

Fig 1: Fill And Drain Plugs



Courtesy of GENERAL MOTORS COMPANY

1. Raise and suitably support the vehicle. Refer to Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP) .
2. Clean away all dirt and debris from the transmission fluid temperature sensor/drain plug area.
3. Place a suitable drain pan under the transmission.
4. Remove the drain plug (2).
5. Allow the system to drain.

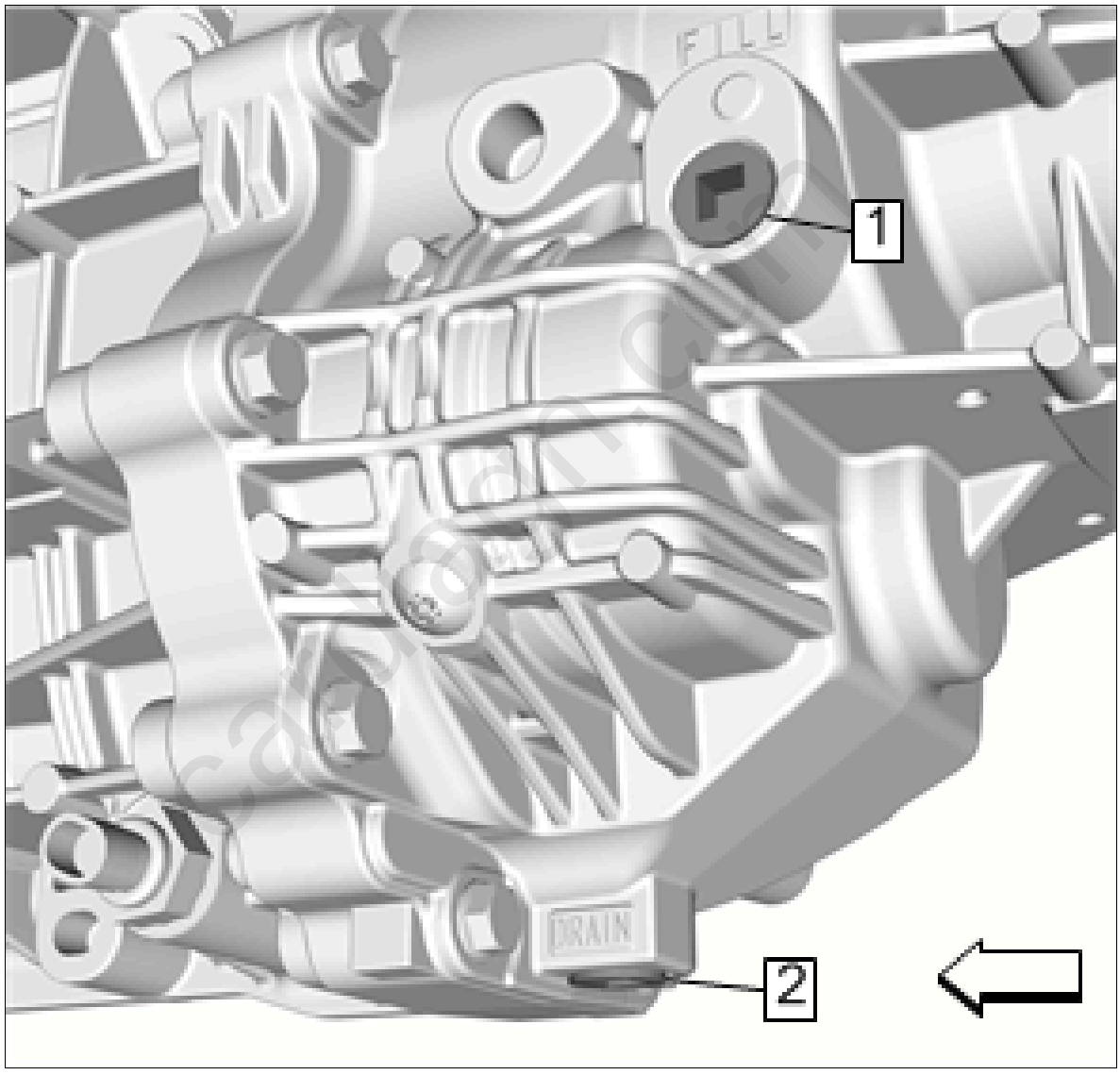
⚠ *CAUTION:*

Refer to Fastener Caution .

6. Install the drain plug (2) and tighten to 27 N.m (20 lb ft).

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION FLUID DRAIN AND FILL (M13 WITHOUT Y4Q) > FILLING PROCEDURE

Fig 1: Fill And Drain Plugs



Courtesy of GENERAL MOTORS COMPANY

1. Clean away all dirt and debris from the transmission fluid fill plug area.
2. Remove the transmission fluid fill plug (1).
3. Fill the transmission with transmission fluid, until even with the bottom of the fill plug hole. Refer to Adhesives, Fluids, Lubricants, and Sealers (M13) .

4. Install the transmission fluid fill plug and tighten to 27 N.m (20 lb ft).

> *NOTE:*
>
> *Ensure the clutch pedal is NOT depressed.*

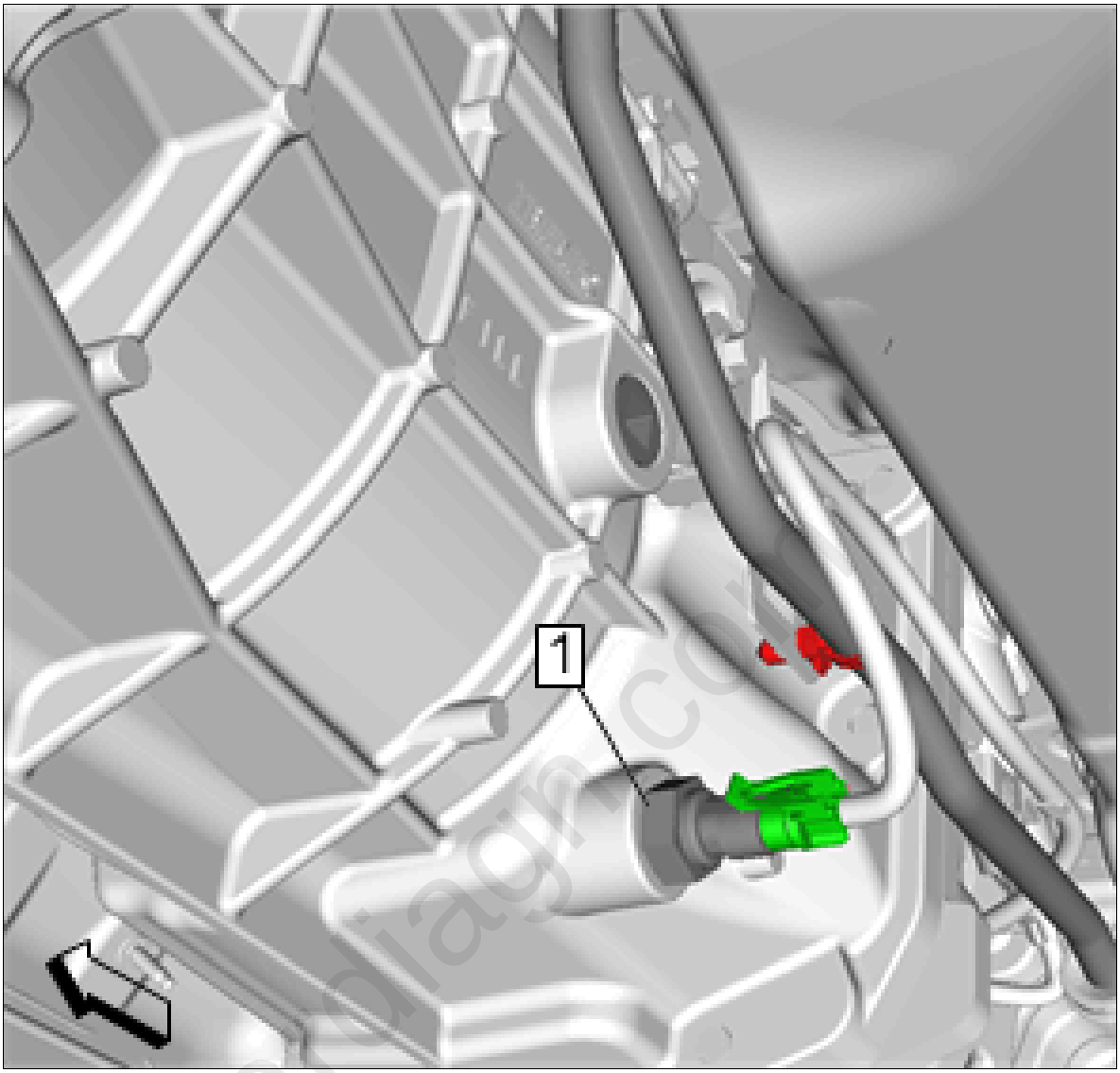
5. Run the engine in the Neutral position at 2800 RPM's for 2 minutes to allow the fluid to recirculate.
6. Remove the fill plug and verify the fluid is even with the bottom of fill plug hole. Add or remove fluid as necessary.
7. Install the transmission fluid fill plug and tighten to 27 N.m (20 lb ft).
8. Remove the drain pan.
9. Lower the vehicle.

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION FLUID DRAIN AND FILL (MM6) > DRAINING PROCEDURE

1. Raise and suitably support the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP)
2. Place a suitable drain pan under the transmission.

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Fig 1: Transmission Fluid Temperature Sensor



Courtesy of GENERAL MOTORS COMPANY

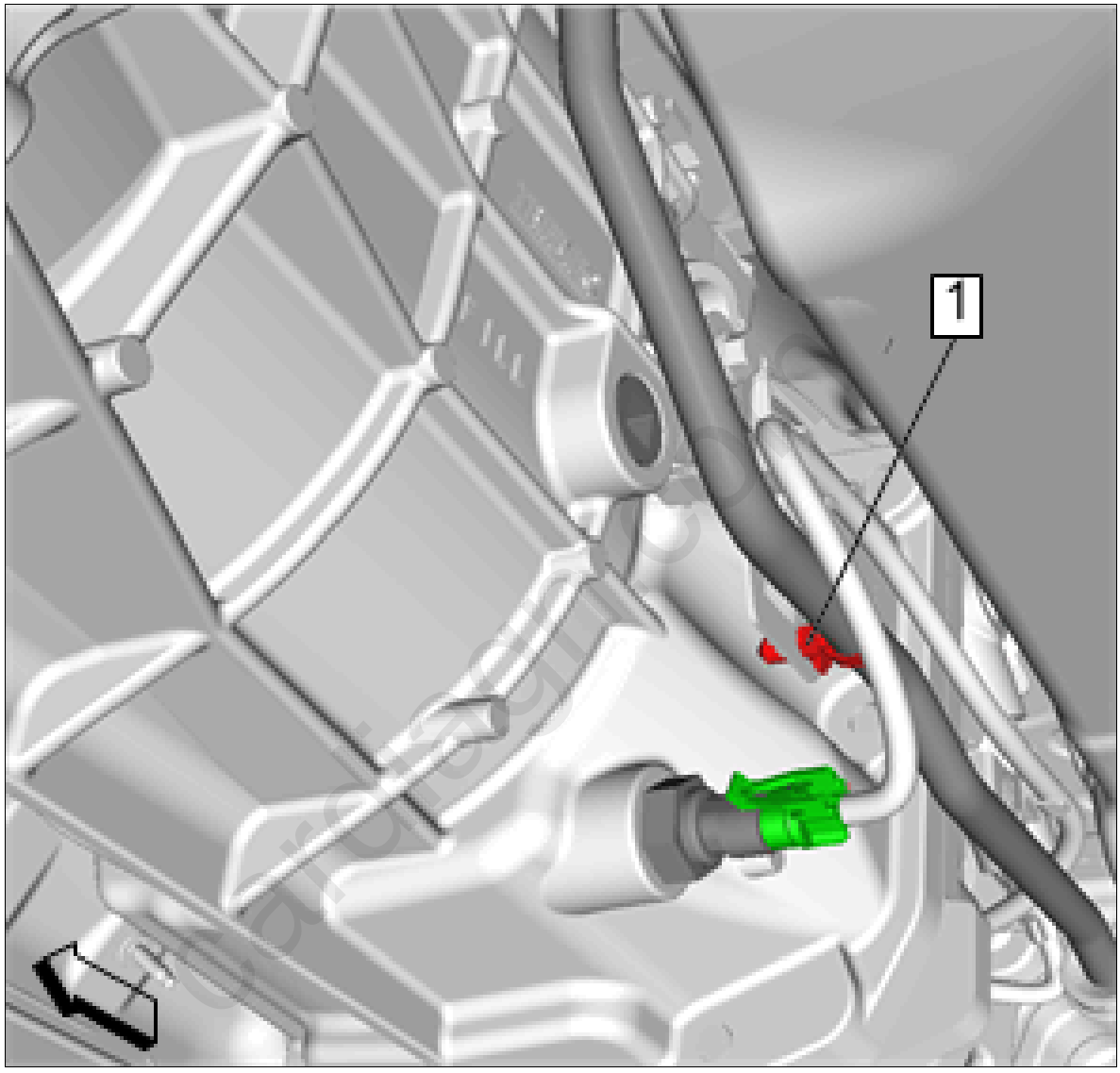
3. Disconnect the electrical connector from the transmission fluid temperature sensor/drain plug (1).
4. Remove the transmission fluid temperature sensor/drain plug (1).
5. Allow the system to drain.

> ⚠ *CAUTION:*
>
> *Refer to Component Fastener Tightening Caution .*

6. Install the transmission fluid temperature sensor/drain plug (1) and tighten to 27 N.m (20 lb ft).
7. Connect the electrical connector to the transmission fluid temperature sensor/drain plug.

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION FLUID DRAIN AND FILL (MM6) > FILLING PROCEDURE

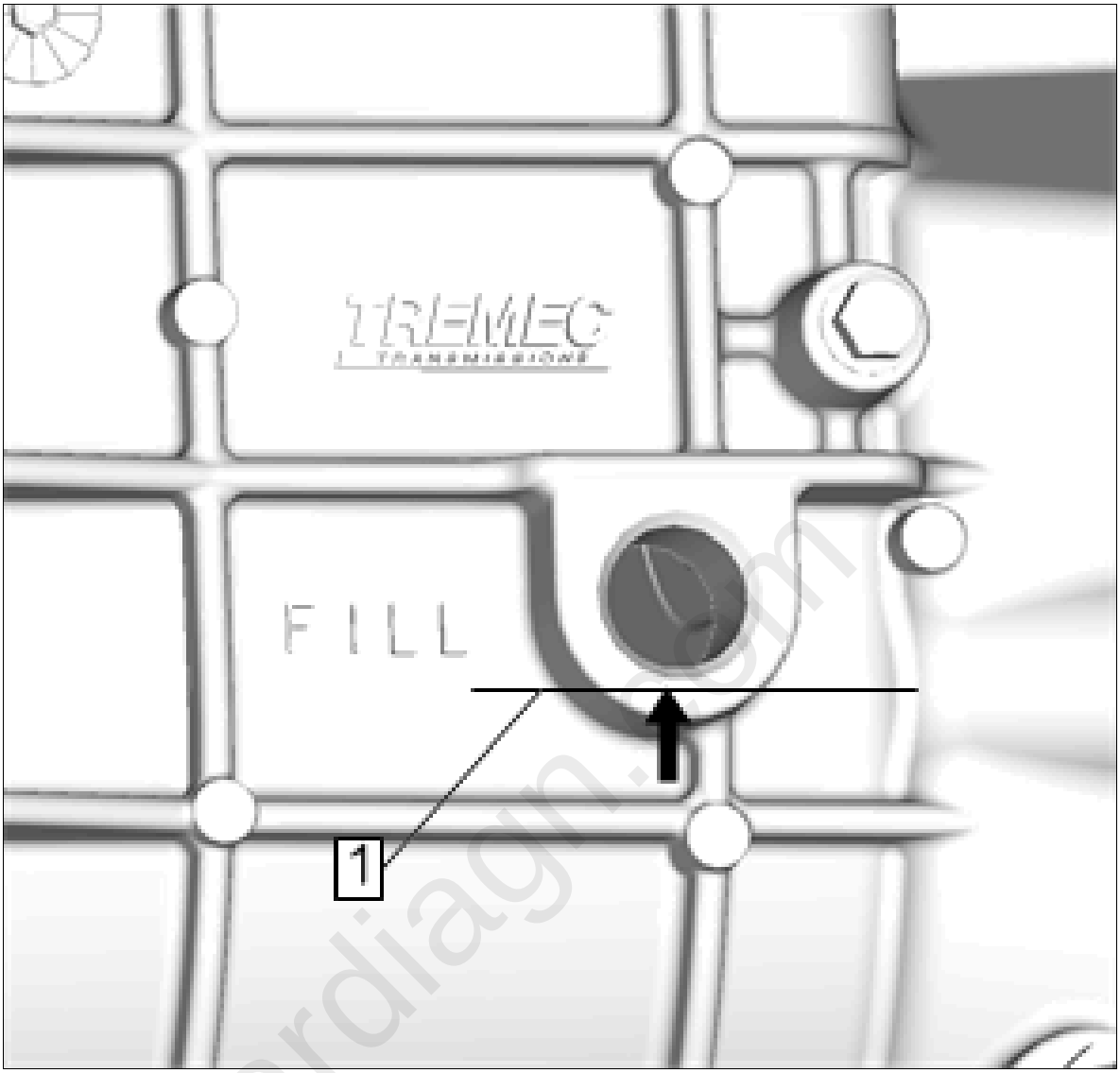
Fig 1: Cooler Pipe Retaining Clips



Courtesy of GENERAL MOTORS COMPANY

1. Disconnect the clip (1) retaining the cooler pipe to the transmission bracket.
2. Reposition the cooler pipe to allow access to the fill plug.
3. Remove the transmission fluid fill plug.

Fig 2: Fill Plug



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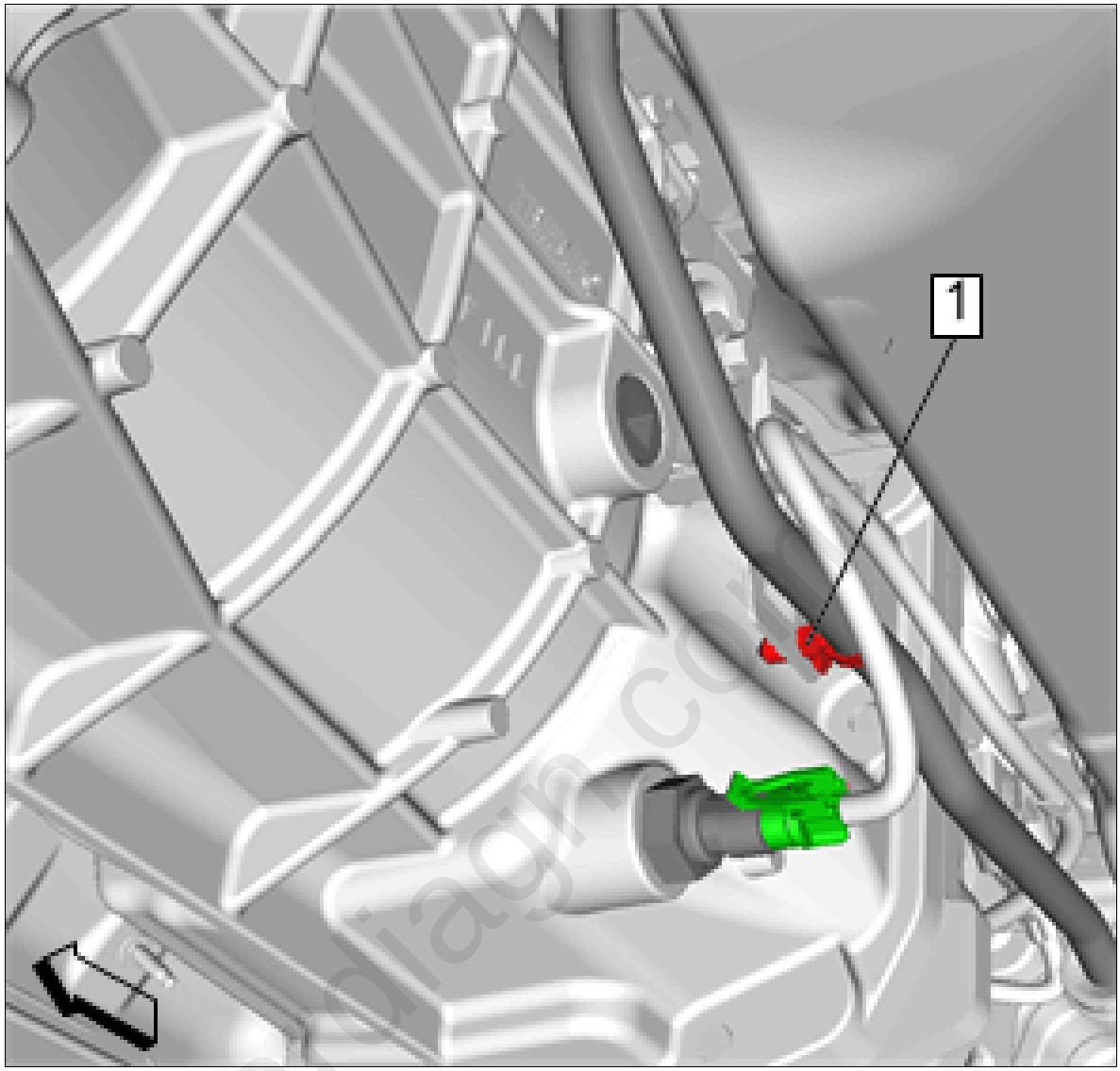
> *IMPORTANT:*
>
> *Transmission fluid level setting must be followed exactly as written or the transmission may be overfilled or under filled.*

4. For fluid recommendations, Refer to Adhesives, Fluids, Lubricants, and Sealers (MM6) .

   Transmission fluid level MUST be 3.2 mm (1/8 inch) below (1) the fill plug. This can be done by one of the following two methods:

   1. Bend mechanics wire to 3.2 mm (1/8 inch) to check fluid level. Add or remove fluid as necessary.
   2. Fill transmission until level with the bottom of the fill plug hole, then remove 240 ml (8 ounces) of fluid.

Fig 3: Cooler Pipe Retaining Clips



Courtesy of GENERAL MOTORS COMPANY

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

5. Install the transmission fill plug to the transmission and tighten the fill plug to 27 N.m (20 lb ft).

> *NOTE:*
>
> *Inspect the clip for proper retention on the cooler line to the bracket. Replace the clip as necessary.*

6. Reconnect the clip (1) retaining the cooler pipe to the transmission bracket.

NOTE:

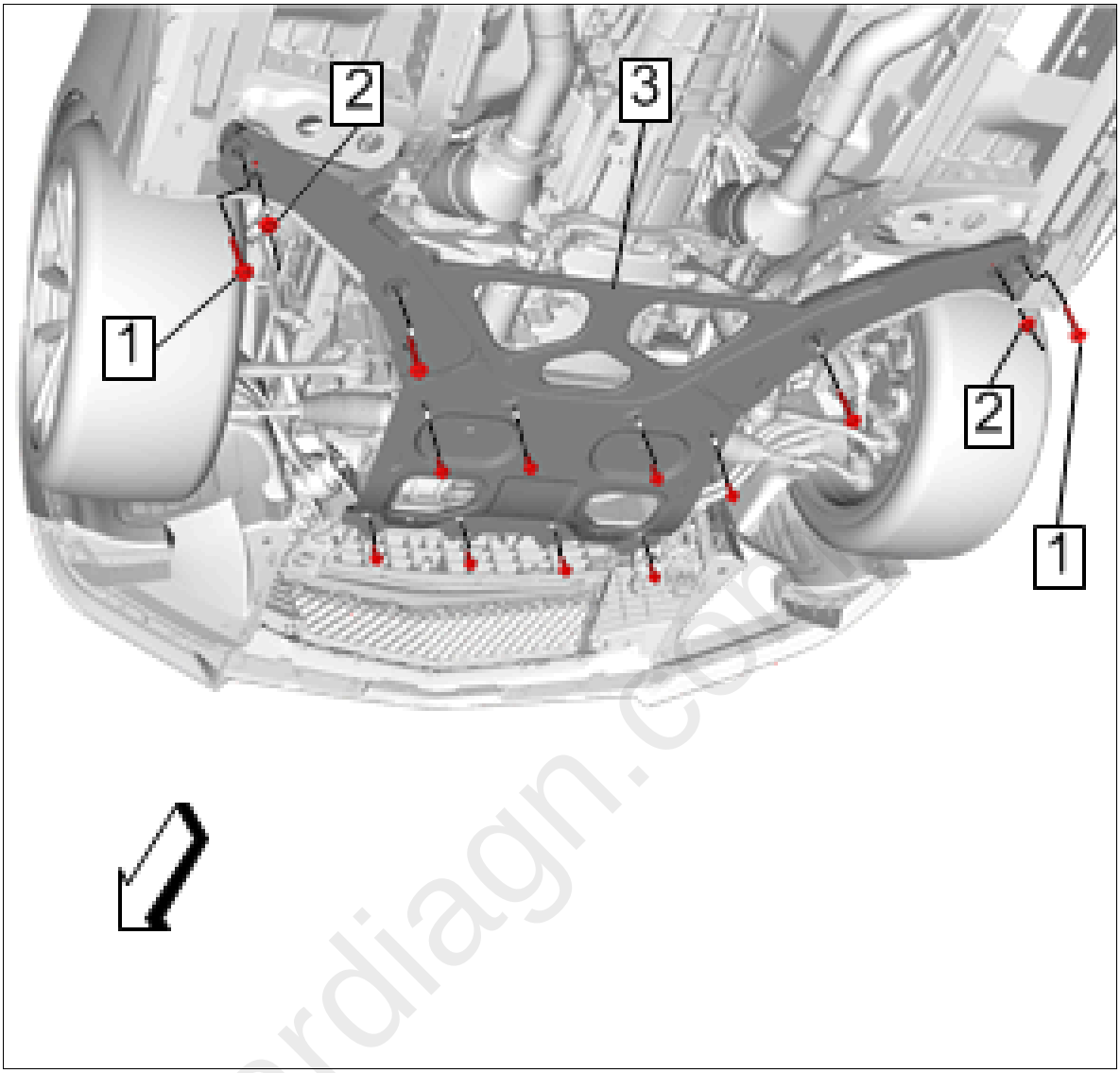
Ensure the clutch pedal is NOT depressed.

7. Run the engine in Neutral for two minutes to allow the fluid to recirculate.
8. Remove the fill plug and verify the fluid level is 3.2 mm (1/8 inch) below the fill plug hole. Add or remove transmission fluid as necessary.
9. Install the transmission fill plug to the transmission and tighten the fill plug to 27 N.m (20 lb ft).
10. Lower the vehicle.

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION REPLACEMENT (MM6 WITH LT1 ENGINE) > REMOVAL PROCEDURE

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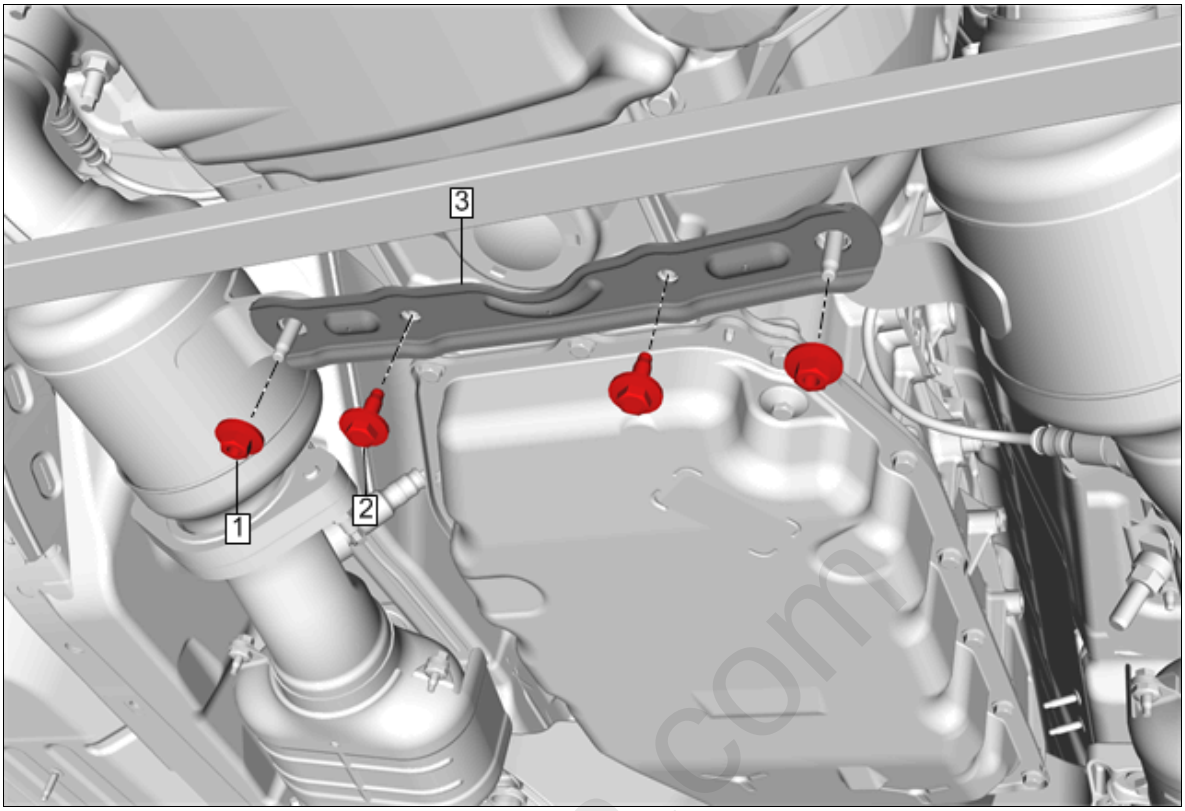
Fig 1: Front Cradle Shear Plate



Courtesy of GENERAL MOTORS COMPANY

1. Remove the front cradle shear plate (3). Front Cradle Shear Plate Replacement

Fig 2: Catalytic Converter Brace Bracket

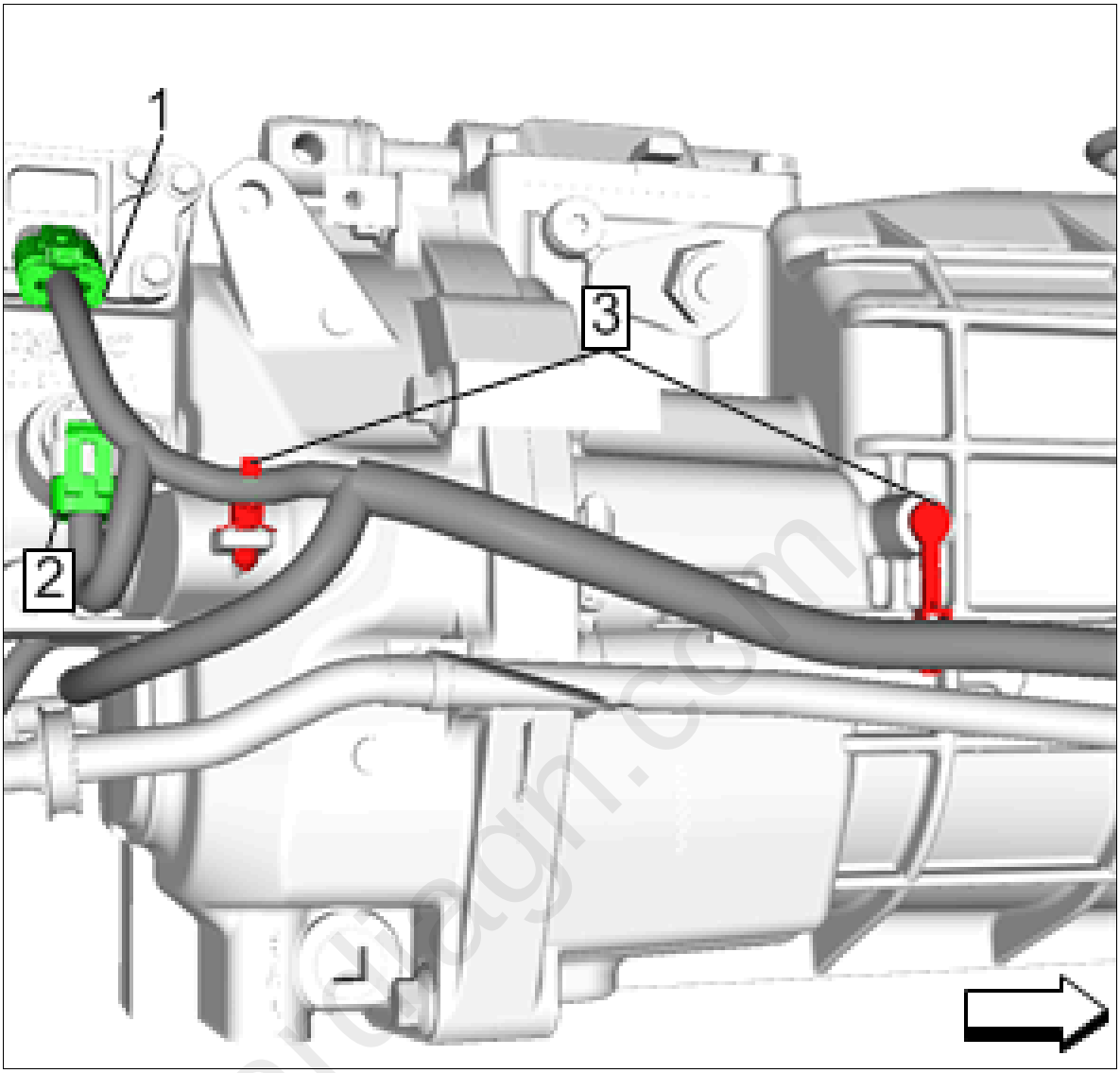


Courtesy of GENERAL MOTORS COMPANY

2. Remove the catalytic converter brace bracket. Catalytic Converter Brace Bracket Replacement (LT1)
3. Support the transmission using a suitable transmission jack.
4. Disconnect the shift control assembly from the transmission. Shift Control Assembly Replacement (MM6)

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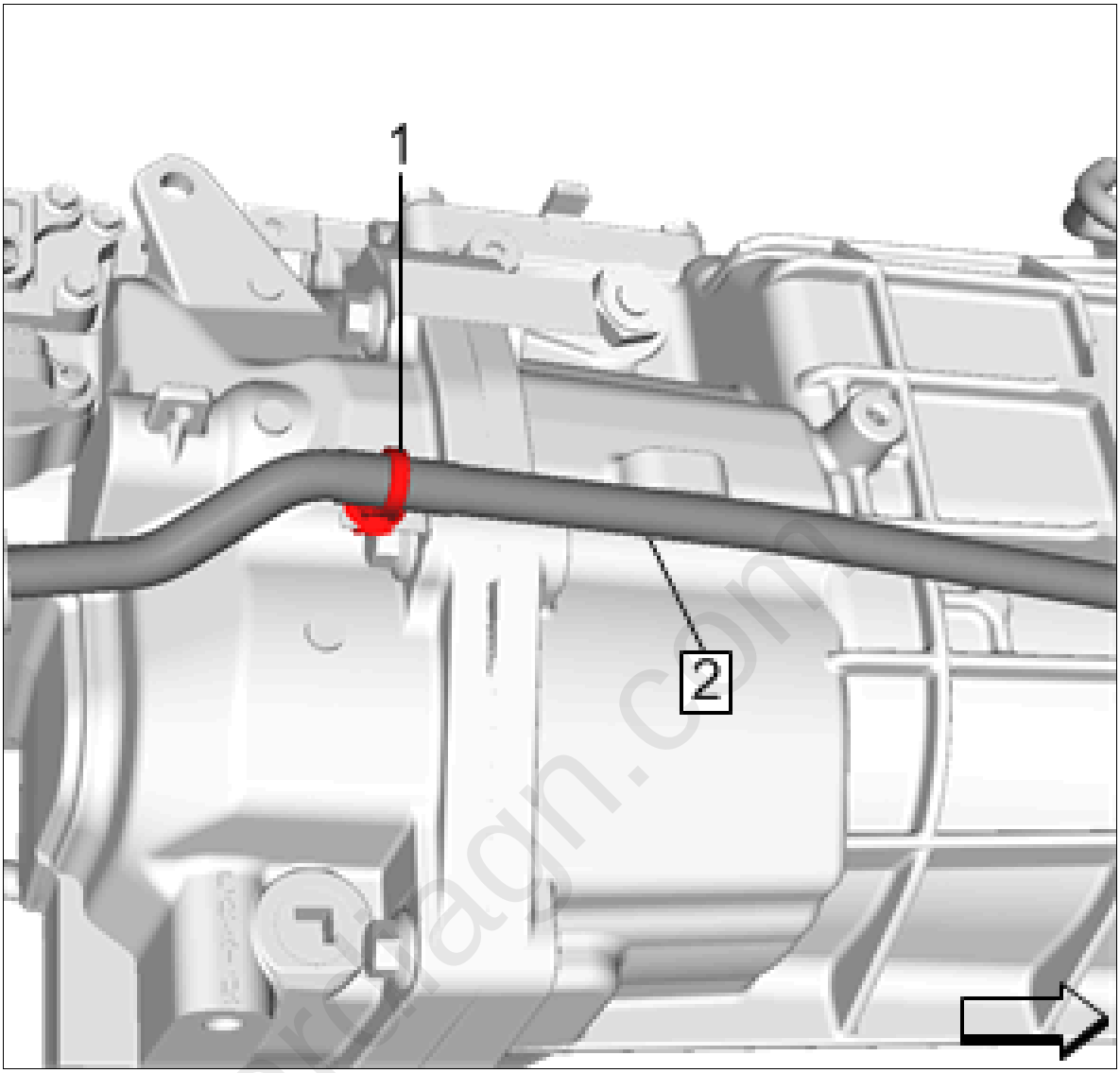
Fig 3: Shift Fork Position Sensor, Vehicle Speed Sensor, Wiring Harness Clips



Courtesy of GENERAL MOTORS COMPANY

5. Disconnect the following electrical connectors:
    1. Shift Fork Position Sensor (1)
    2. Vehicle Speed Sensor (2)
6. Disconnect the wiring harness clips (3) from the transmission.

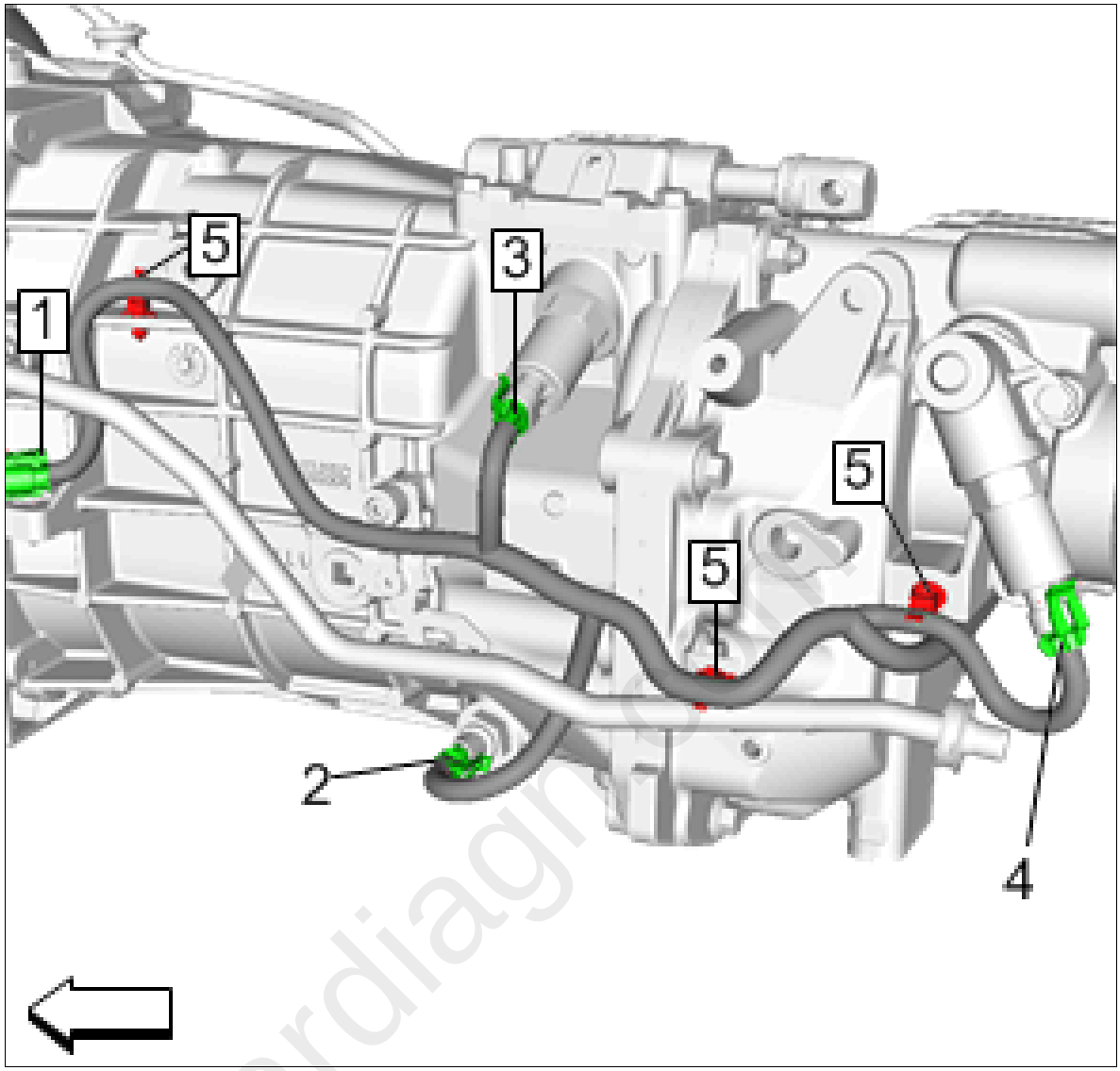
Fig 4: Oil Cooler Line Clip



Courtesy of GENERAL MOTORS COMPANY

7. Disconnect the oil cooler line clip (1) from the transmission.

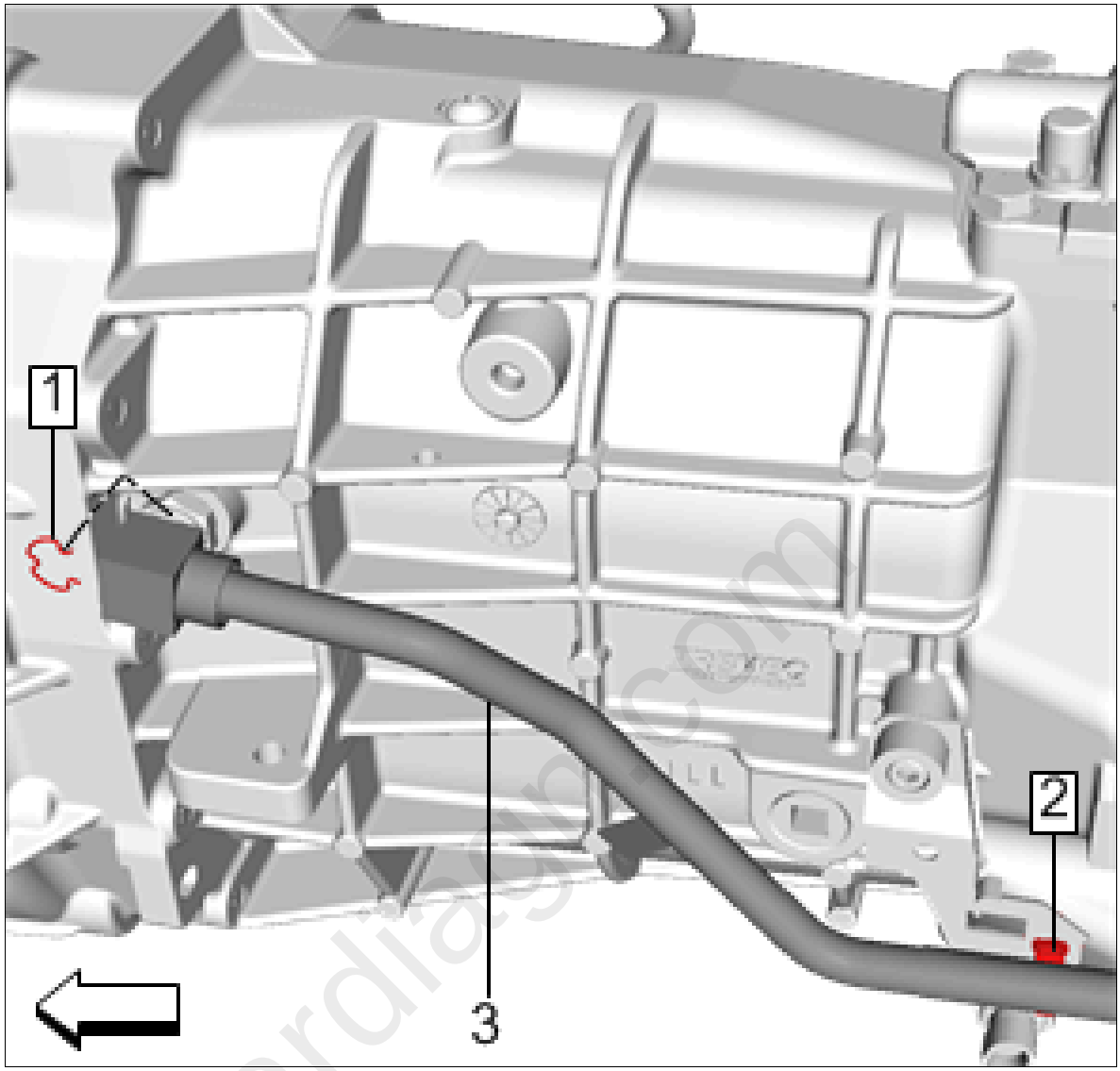
Fig 5: Electrical Connectors



Courtesy of GENERAL MOTORS COMPANY

8. Disconnect the following electrical connectors:
    1. Oxygen Sensor (1)
    2. Fluid Temperature Sensor (2)
    3. Skip Shift Solenoid (3)
    4. Reverse Lockout Solenoid (4)
9. Disconnect the wiring harness clips (5) from the transmission.

Fig 6: Retaining Clip



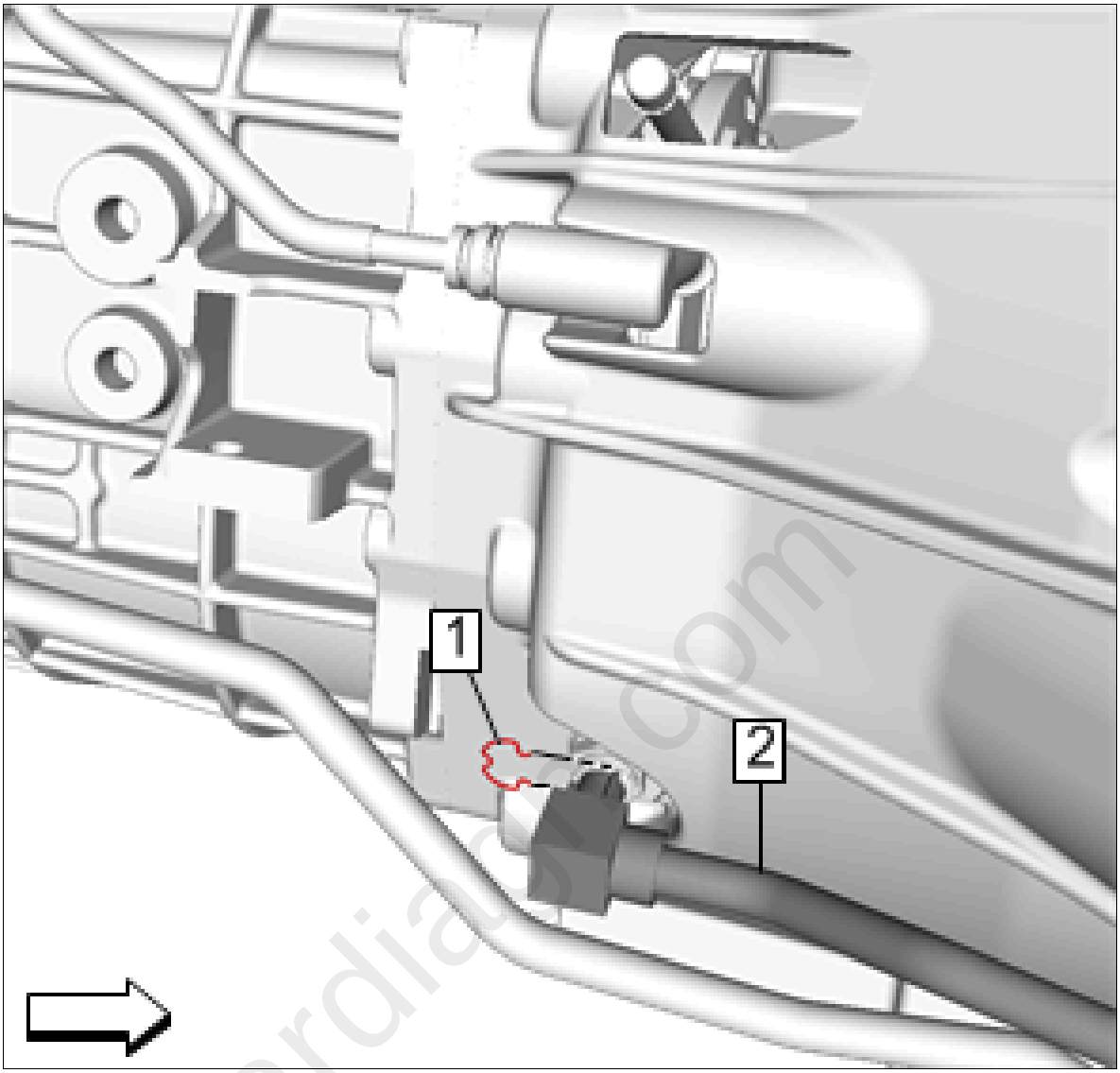
Courtesy of GENERAL MOTORS COMPANY

10. Remove the retaining clip (1).
11. Disconnect the cooler pipe retainer (2).

> *NOTE:*
>
> *Plug or cap all open transmission fluid cooler pipe connections.*

12. Disconnect the cooler pipe (3) from the transmission.

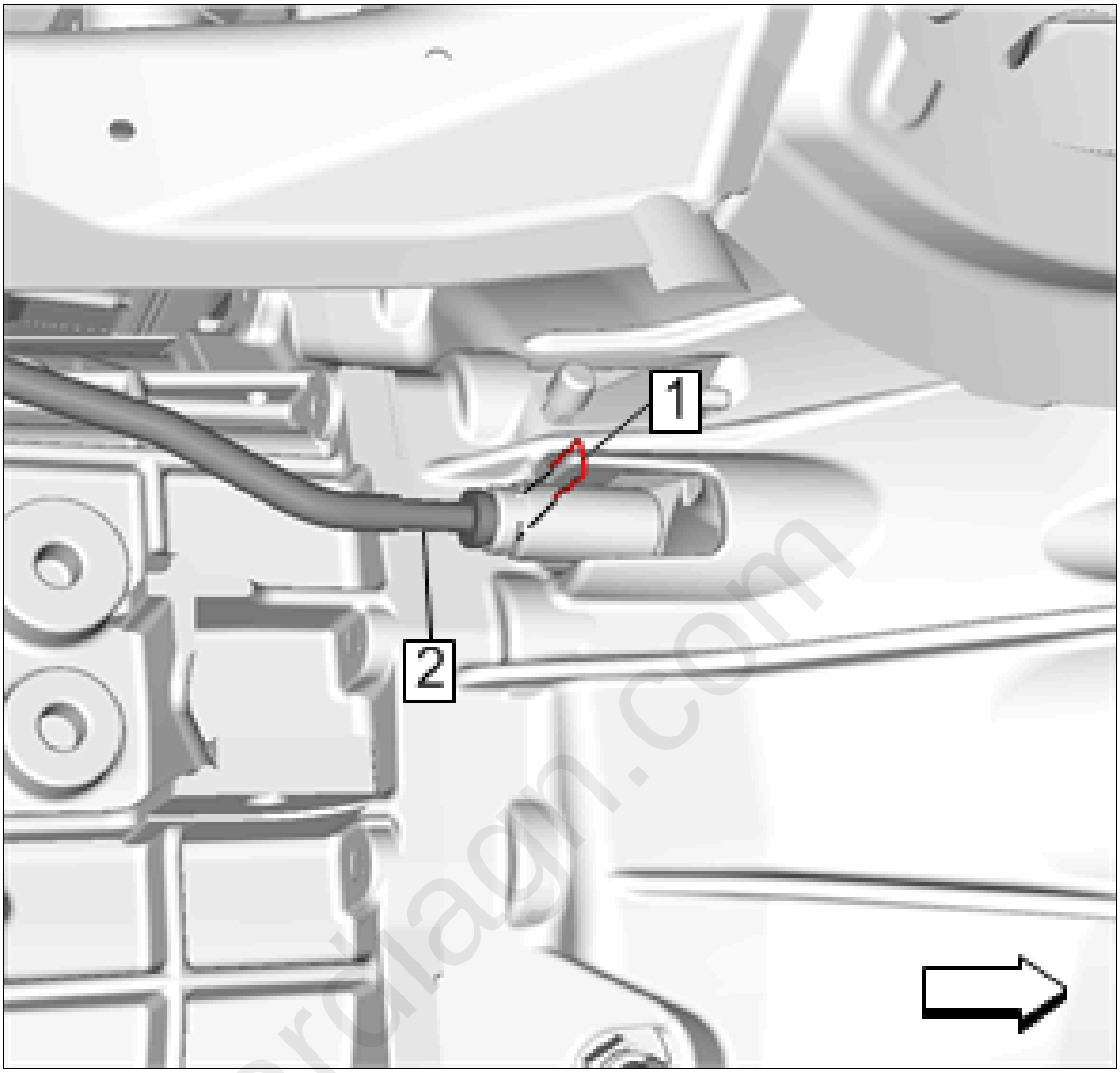
Fig 7: Retaining Clip



Courtesy of GENERAL MOTORS COMPANY

13. Remove the retaining clip (1).
14. Disconnect the cooler pipe (2) from the transmission.

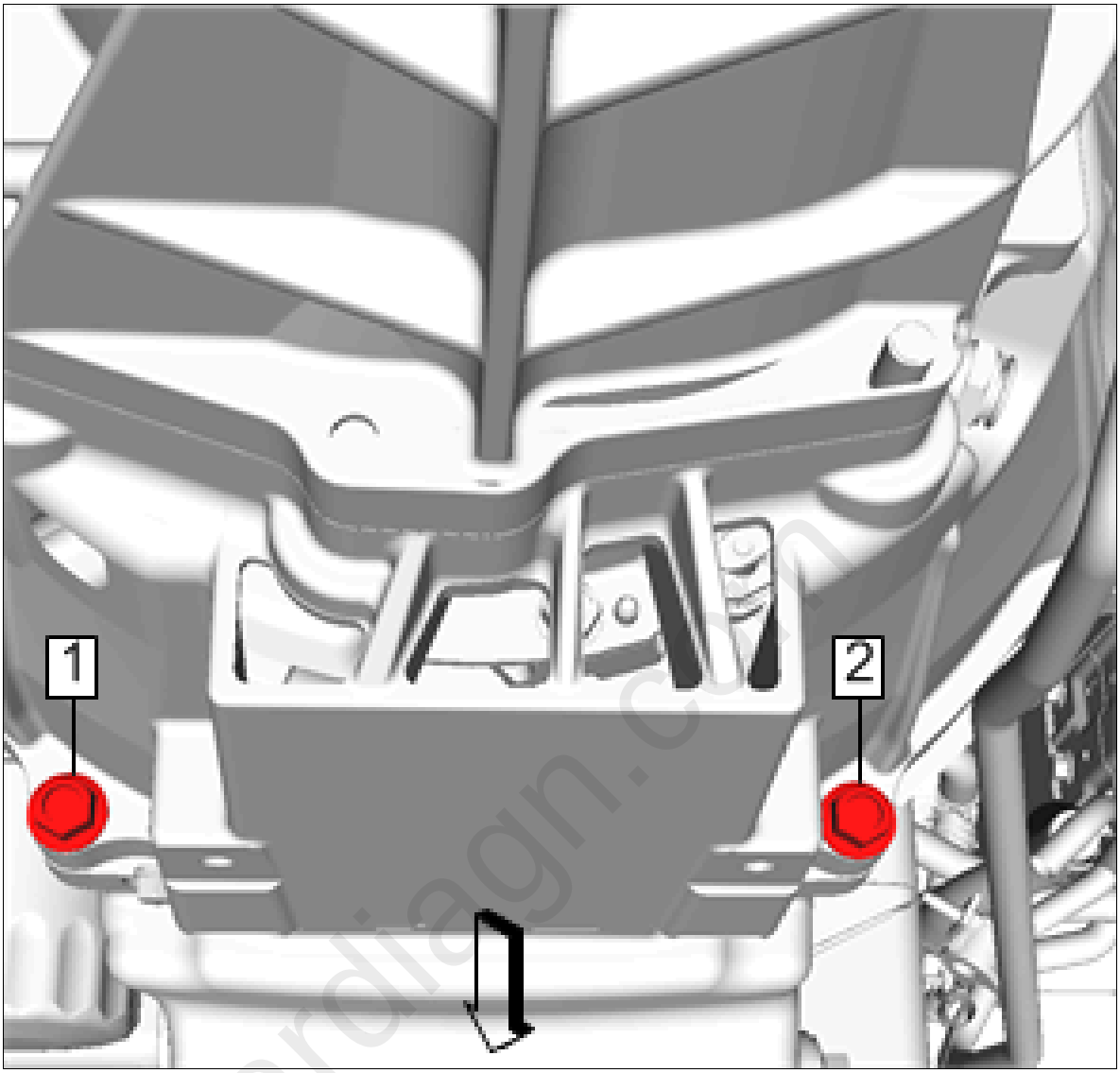
Fig 8: Hydraulic Clutch Hose/Pipe Retaining Clip To Clutch Slave Cylinder



Courtesy of GENERAL MOTORS COMPANY

15. Remove the hydraulic clutch hose/pipe (1) retaining clip from the clutch slave cylinder.
16. Disconnect the hydraulic clutch hose/pipe (2) from the clutch slave cylinder. Plug the lower hose end.

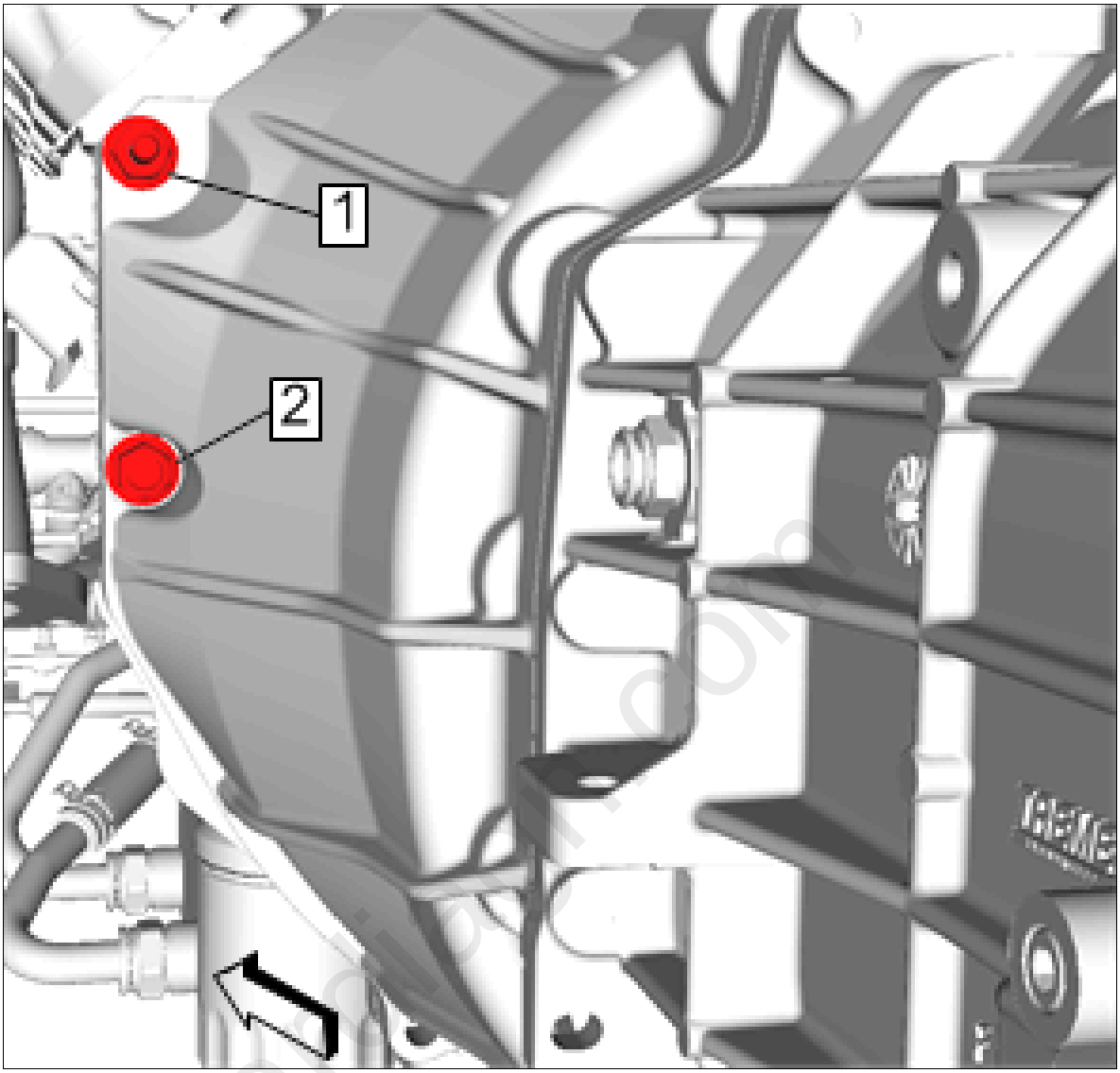
Fig 9: Lower Transmission Clutch Housing To Engine Fasteners



Courtesy of GENERAL MOTORS COMPANY

17. Remove the lower transmission clutch housing to engine fasteners (1, 2).

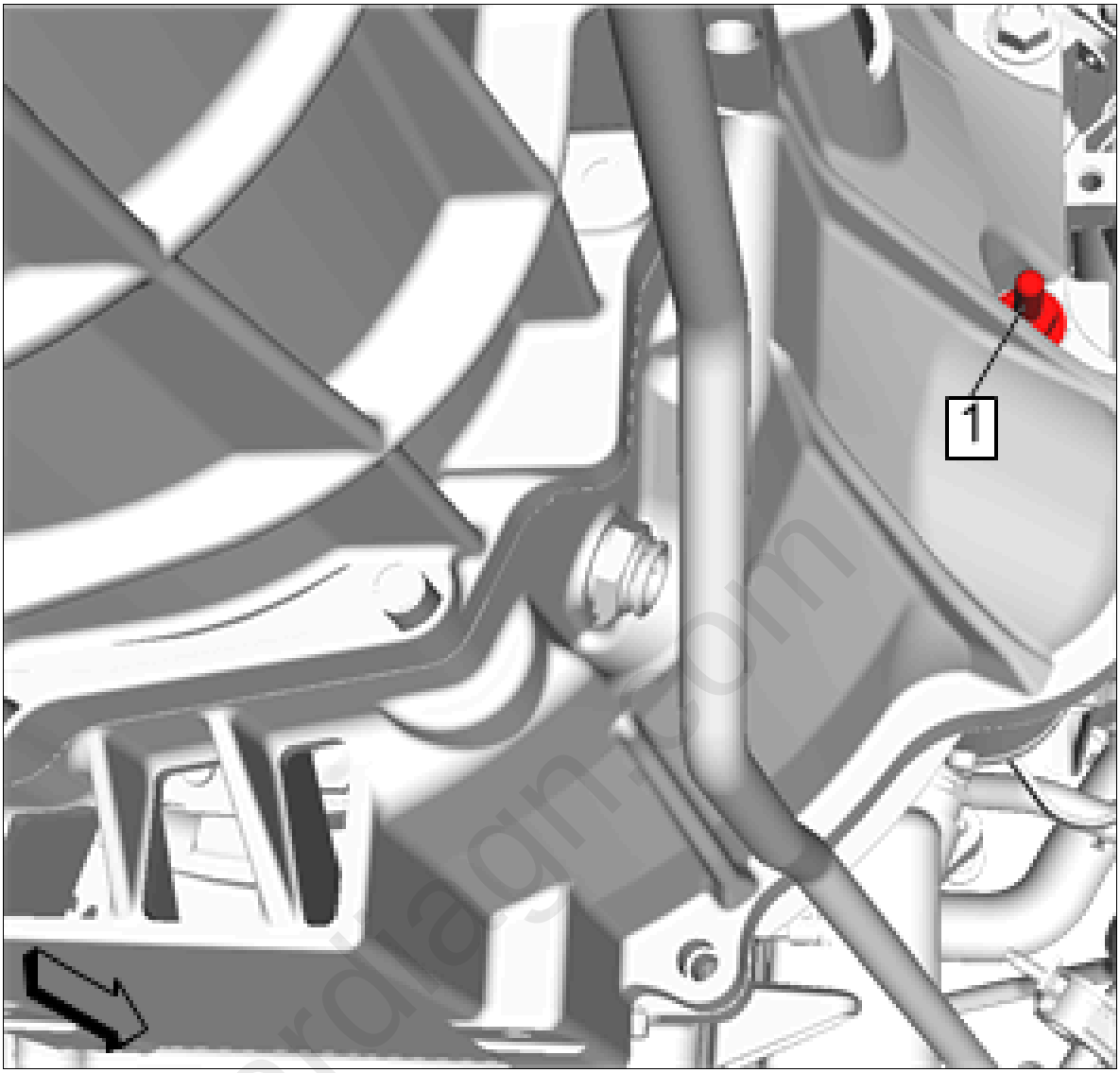
Fig 10: Left Side Transmission Clutch Housing To Engine Fasteners



Courtesy of GENERAL MOTORS COMPANY

18. Remove the left side transmission clutch housing to engine fasteners (1, 2).

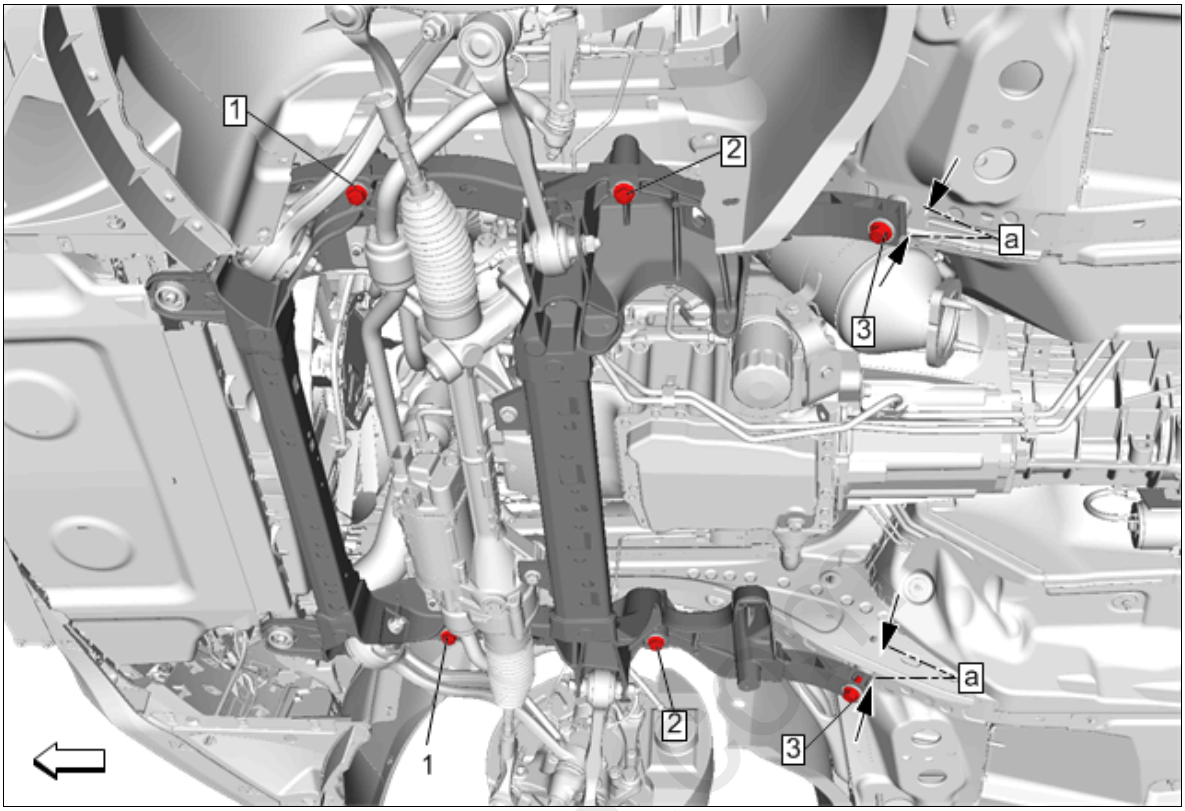
Fig 11: Right Side Lower Transmission Clutch Housing To Engine Fastener



Courtesy of GENERAL MOTORS COMPANY

19. Remove the right side lower transmission clutch housing to engine fastener (1).

Fig 12: Front And Rear Cradle Bolts



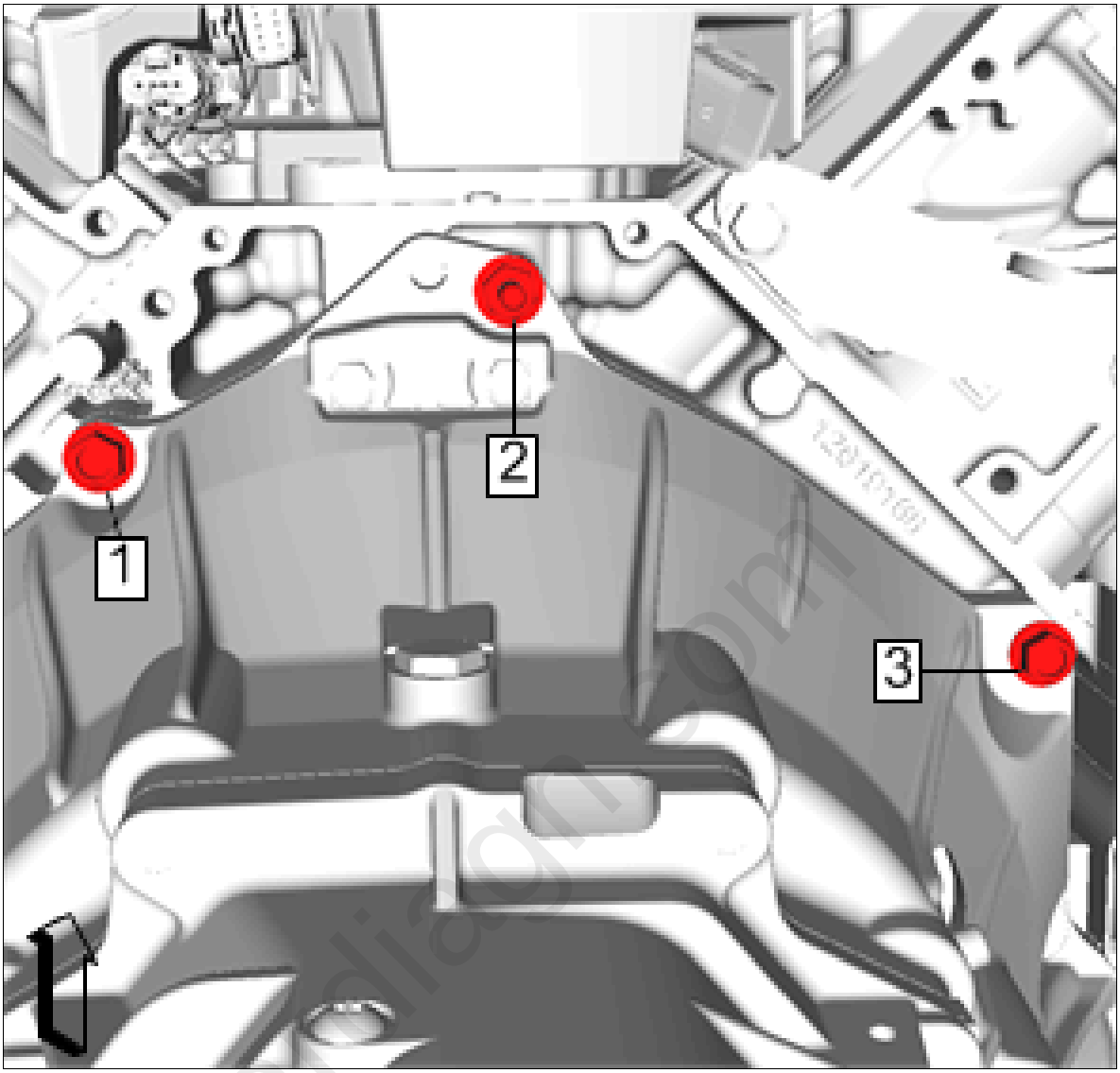
Courtesy of GENERAL MOTORS COMPANY

> *NOTE:*
>
> *Securely support the drivetrain and front suspension cradle with an adjustable jack.*

20. Loosen the front cradle bolts (1) one turn, remove the rear cradle bolts (3) completely, loosen the middle cradle bolts (2) enough to allow the rear of the cradle support to tilt down with the jack approximately 25 mm (1 in) (a).

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Fig 13: Upper Transmission Clutch Housing To Engine Fasteners



Courtesy of GENERAL MOTORS COMPANY

21. Remove the three upper transmission clutch housing to engine fasteners (1, 2, 3).

> *NOTE:*
>
> *Do not leave the engine tilted on its mounts for an extended amount of time.*

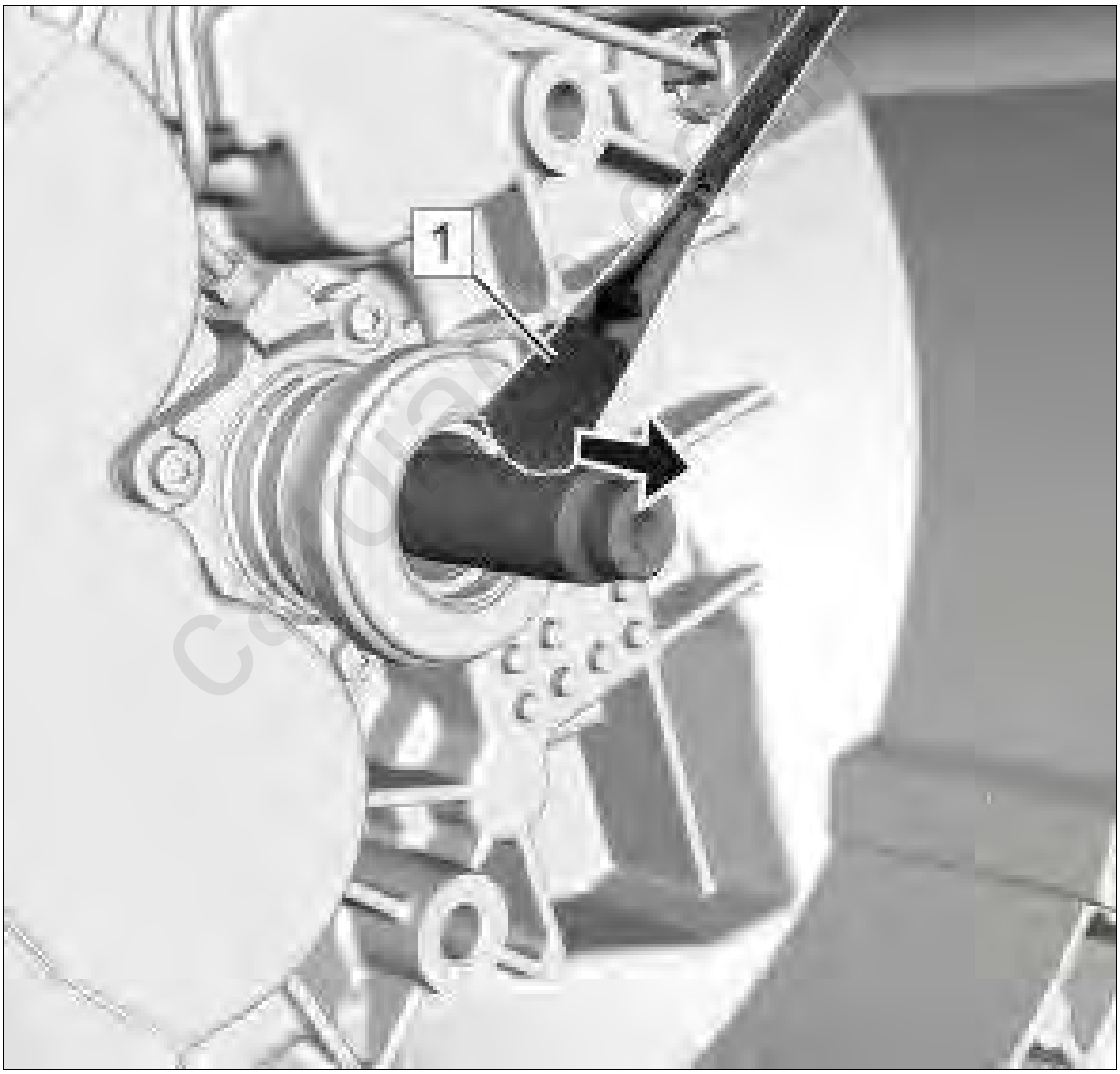
22. Remove the transmission from the vehicle. To clear the body structure, the front of the engine can be pushed up to tilt the engine and transmission.
23. Flush and flow test the transmission oil cooler and lines. Transmission Fluid Cooler Flushing and Flow Test (Tremec 6-Speed)Transmission Fluid Cooler Flushing and Flow Test (8L90)
24. Transfer components as necessary.

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION REPLACEMENT (MM6 WITH LT1 ENGINE) > INSTALLATION PROCEDURE

> *WARNING:*
>
> *Use care when cleaning the clutch hub. The clutch hub may have sharp edges and can cause personal injury if contact is made. Wear protective gloves to avoid personal injury.*

1. Clean the clutch hub and the input shaft from any debris and contaminates with a lint-free towel.

Fig 1: Flat Brush To Apply Light Coating Of Multi-Purpose Grease



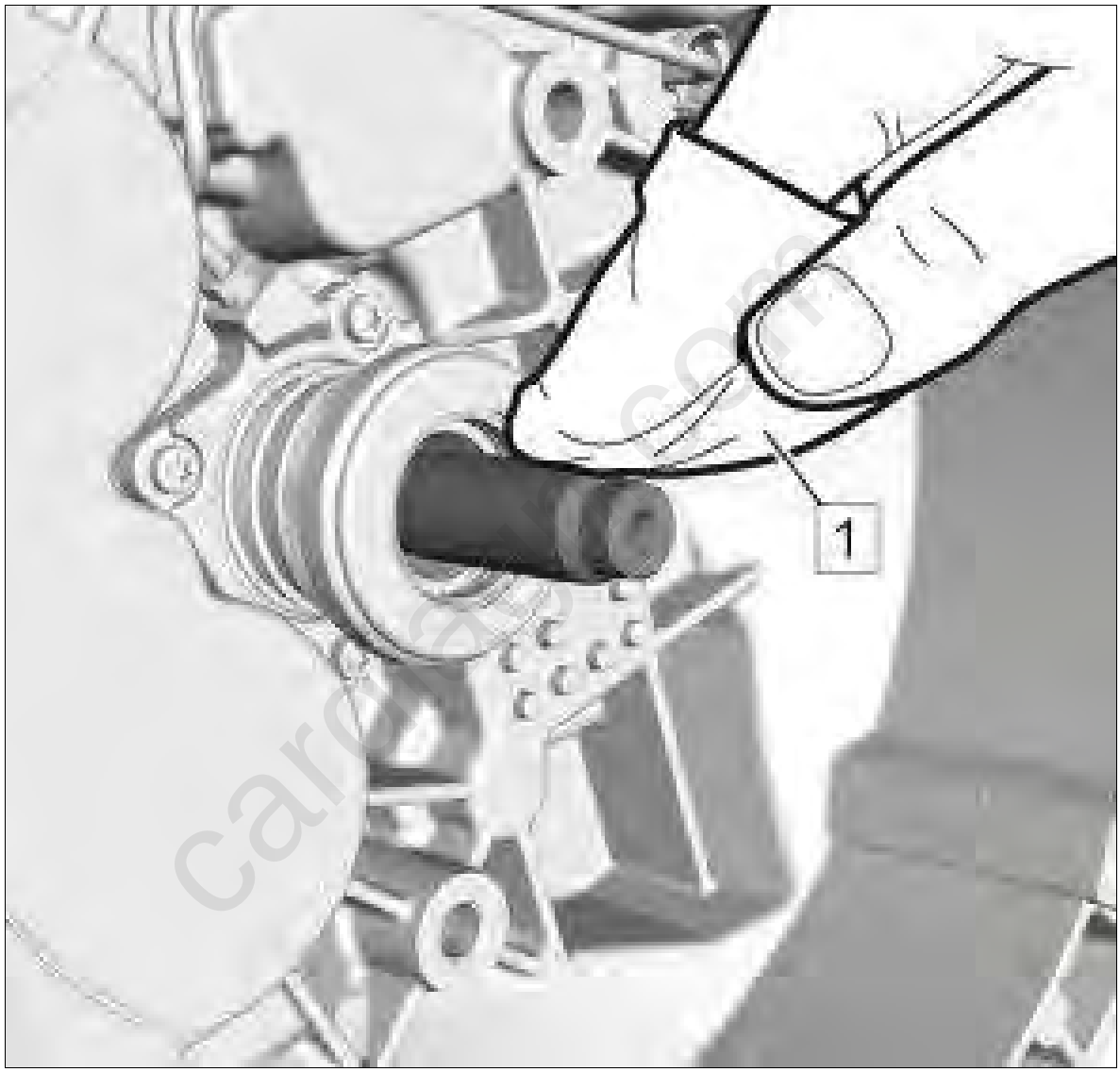
Courtesy of GENERAL MOTORS COMPANY

> *CAUTION:*

Applying too much or the wrong type of grease on the transmission input shaft may cause damage, clutch slippage or failure. Always apply the correct type of grease. Never apply more grease than is necessary to coat the transmission input shaft with a very thin film of grease.

2. Use a clean flat brush (1) to apply very light coating of multi-purpose grease to input shaft until the metal is only shiny. No visible clumps of grease are permissible regardless of size.

Fig 2: Lead Surface Of Input Shaft With Lint-Free Towel



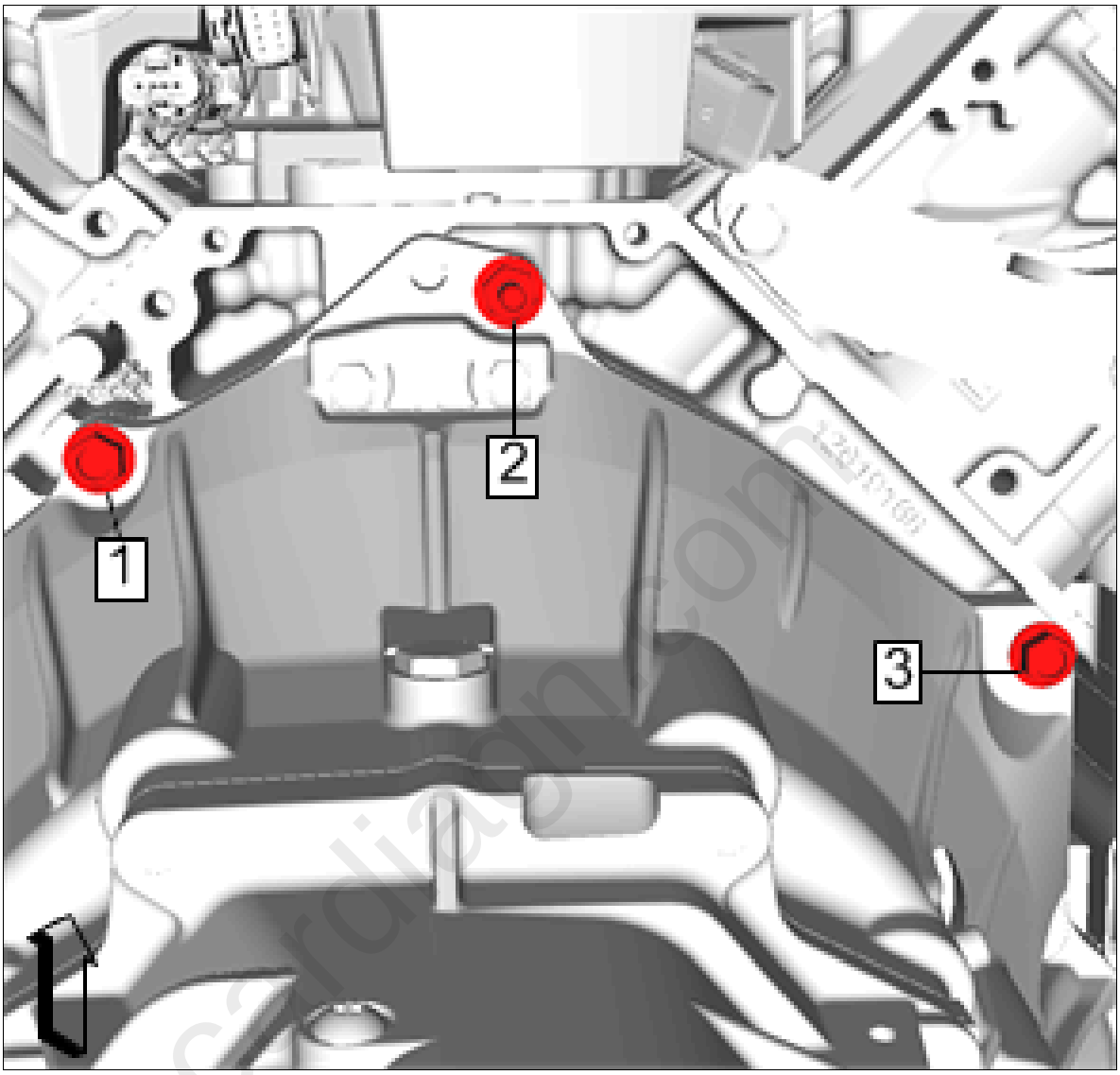
Courtesy of GENERAL MOTORS COMPANY

⚠ *CAUTION:*

Ensure that no grease remains on the lead surface of the transmission input shaft. Clean the lead surface of the transmission input shaft prior to the assembly of the transmission to the engine. Failure to maintain a clean surface may cause clutch slippage or failure.

3. Clean the entire lead surface of the input shaft with a NEW, lint-free towel (1).
4. Position the transmission to the engine.

Fig 3: Upper Transmission Clutch Housing To Engine Fasteners

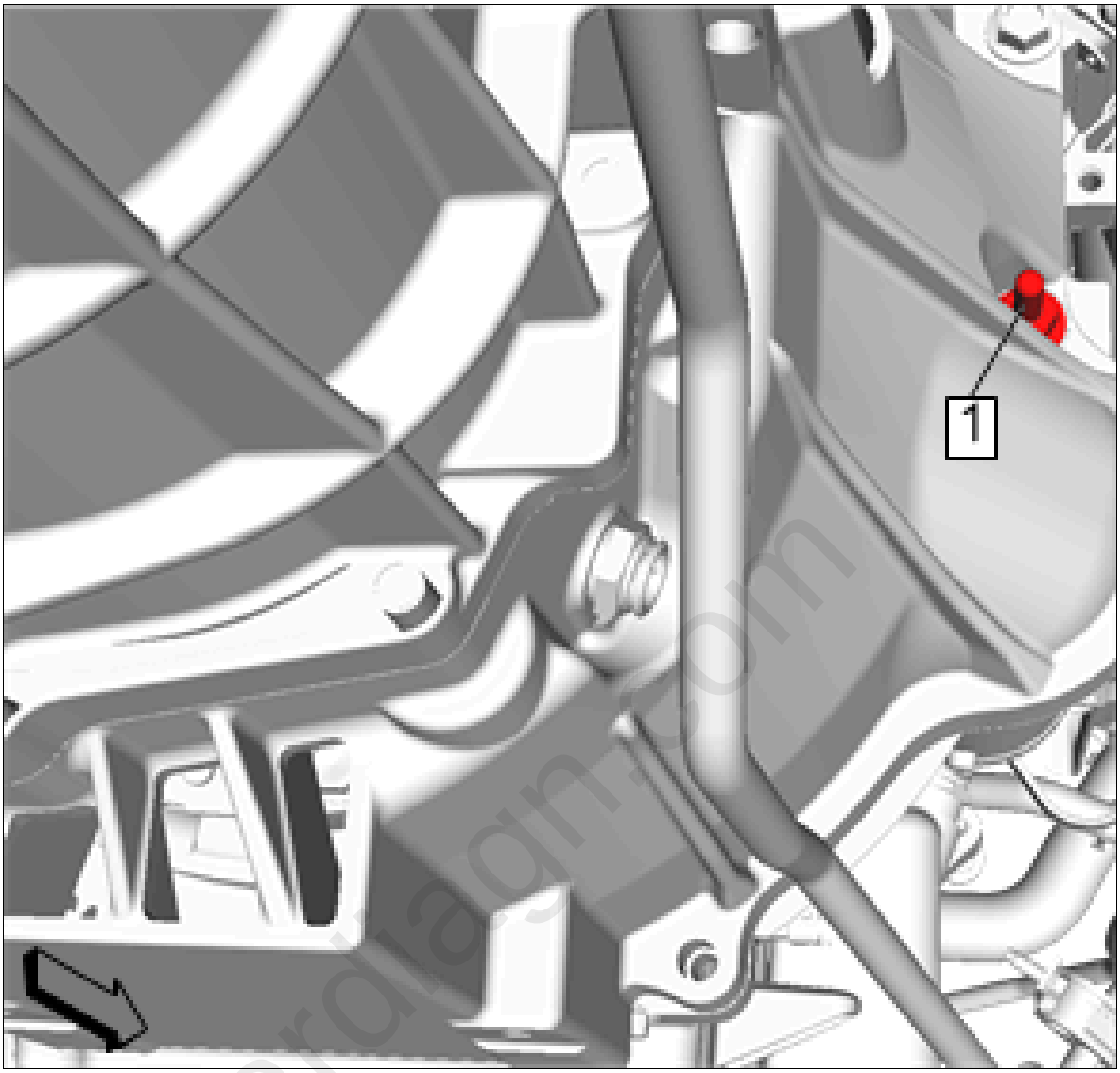


Courtesy of GENERAL MOTORS COMPANY

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

5. Install the three upper transmission clutch housing to engine fasteners (1, 2, 3) and tighten to 50 N.m (37 lb ft).

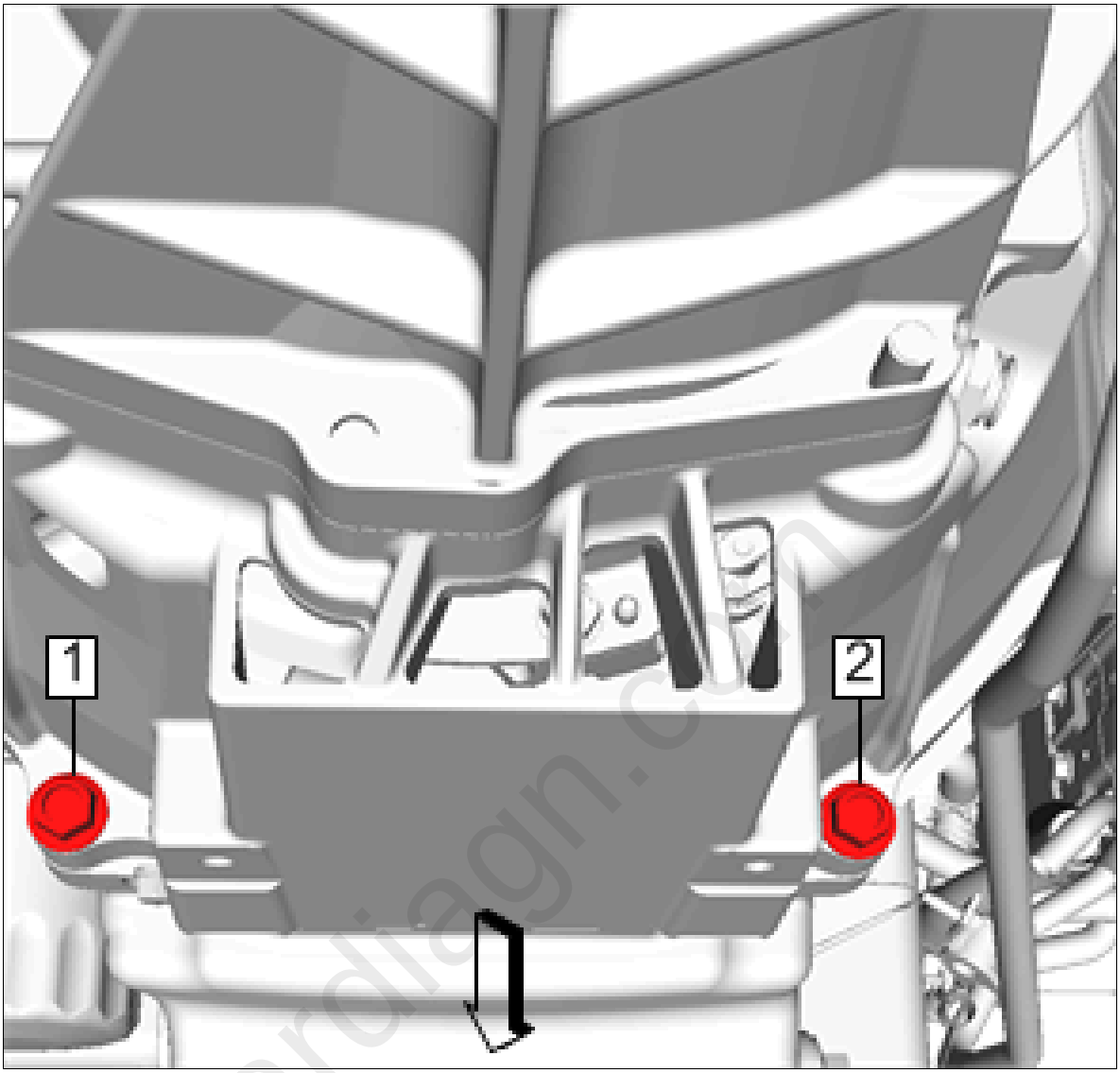
Fig 4: Right Lower Transmission Clutch Housing To Engine Fastener



Courtesy of GENERAL MOTORS COMPANY

6. Install the right lower transmission clutch housing to engine fastener (1) and tighten to 50 N.m (37 lb ft).

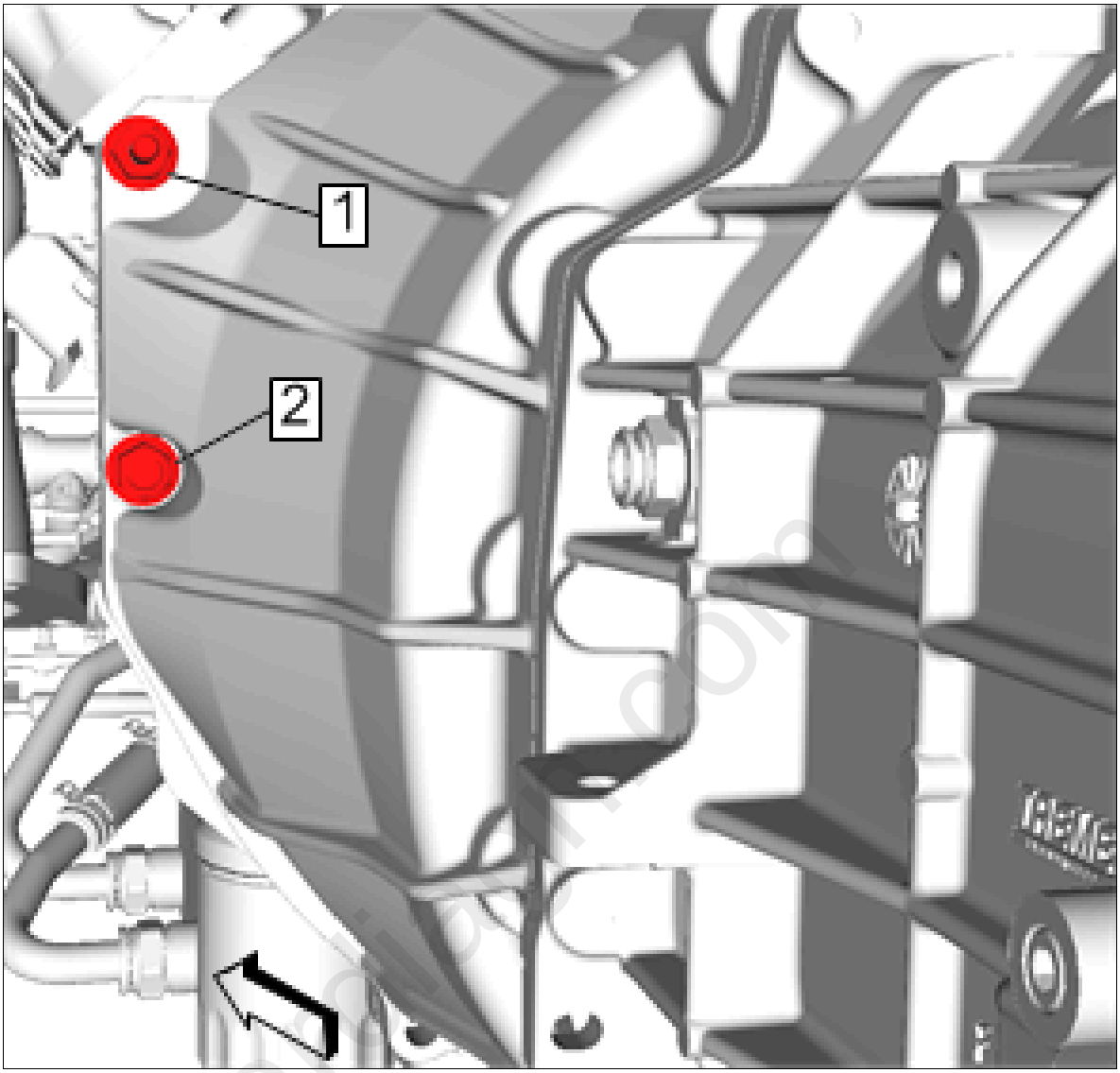
Fig 5: Lower Transmission Clutch Housing To Engine Fasteners



Courtesy of GENERAL MOTORS COMPANY

7. Install the lower transmission clutch housing to engine fasteners (1, 2) and tighten to 50 N.m (37 lb ft).

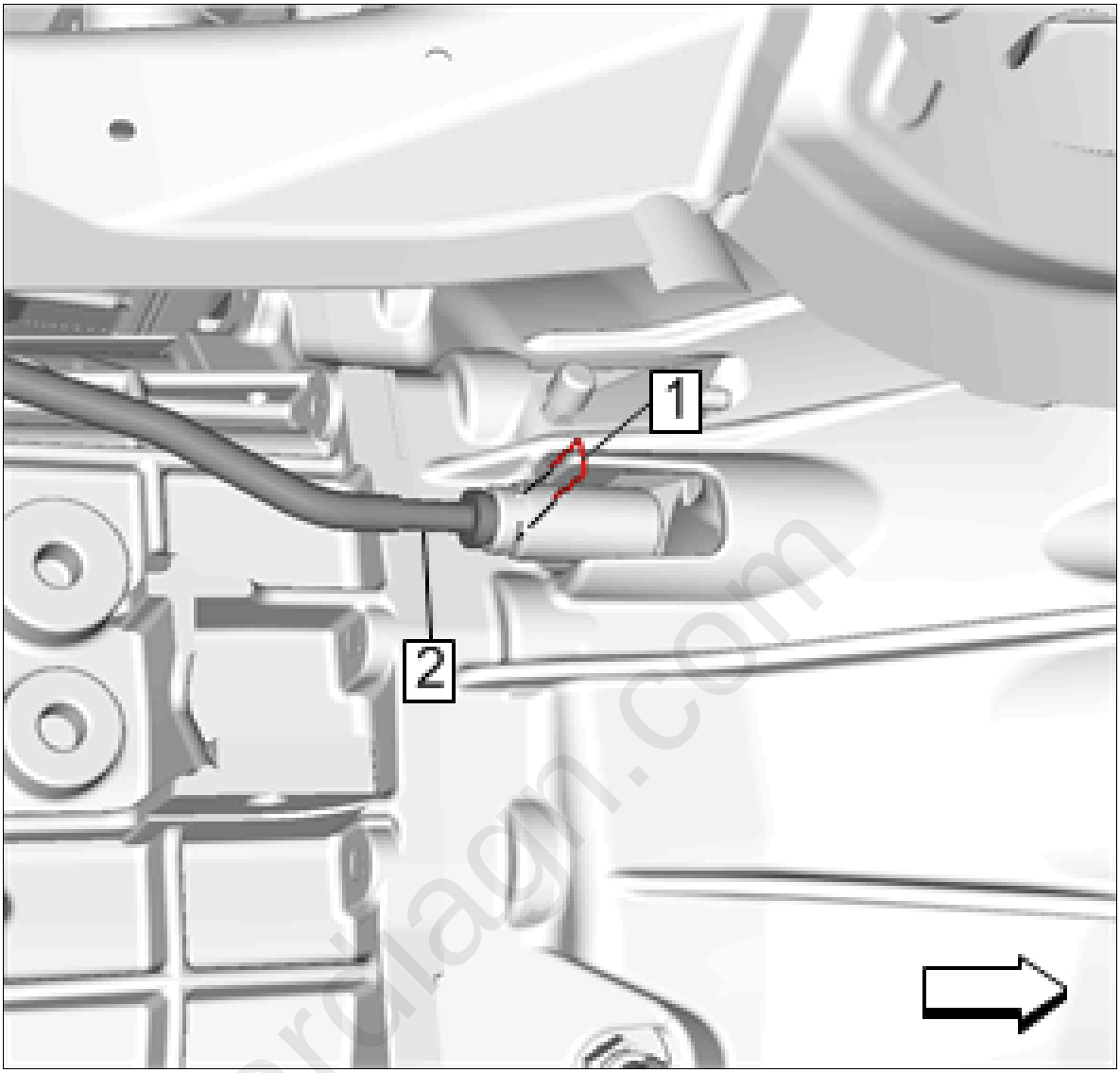
Fig 6: Left Side Transmission Clutch Housing To Engine Fasteners



Courtesy of GENERAL MOTORS COMPANY

8. Install the left side transmission clutch housing to engine fasteners (1, 2) and tighten to 50 N.m (37 lb ft).
9. Connect the shift control assembly to the transmission. Shift Control Assembly Replacement (MM6)
10. Tilt engine and transmission up and tighten all cradle bolts. Refer to Drivetrain and Front Suspension Cradle Replacement (LT1) .
11. Install the transmission mount. Refer to Transmission Rear Mount Replacement (MM6 Transmission) .

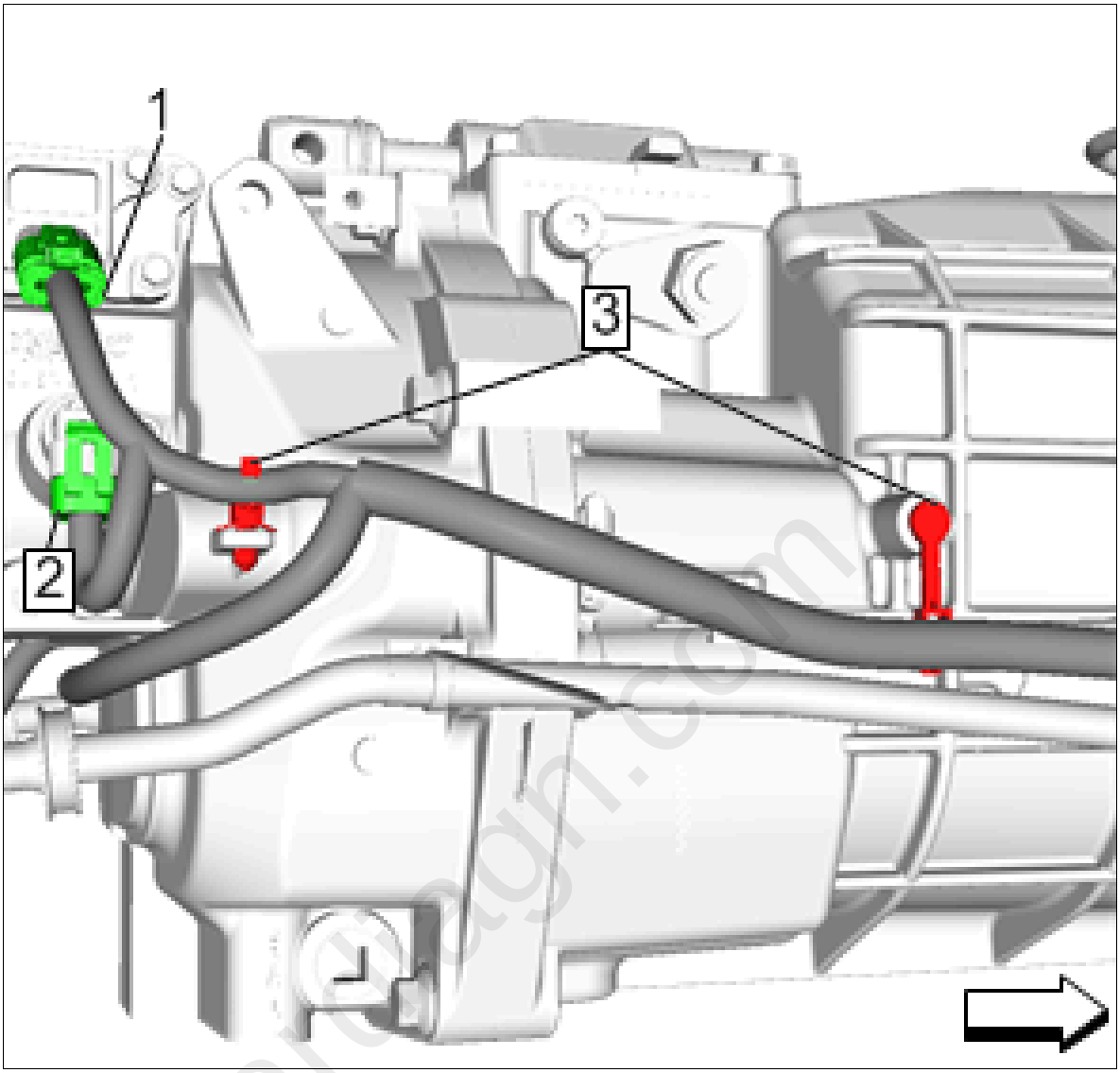
Fig 7: Hydraulic Clutch Hose/Pipe Retaining Clip To Clutch Slave Cylinder



Courtesy of GENERAL MOTORS COMPANY

12. Connect the lower slave cylinder hose (2) to the slave cylinder.
13. Install the hydraulic clutch hose/pipe retaining clip (1) to the clutch slave cylinder.

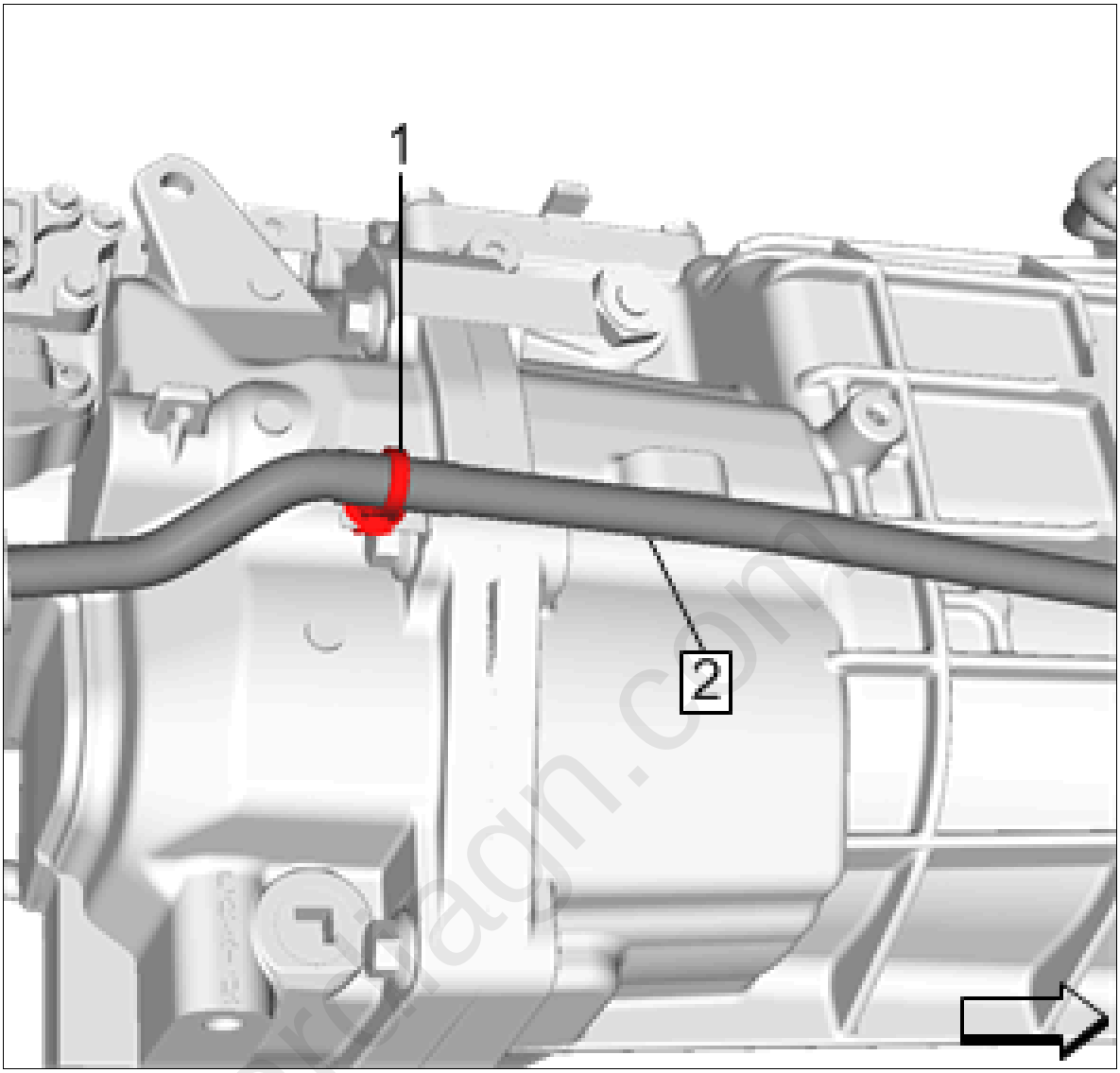
Fig 8: Electrical Connectors



Courtesy of GENERAL MOTORS COMPANY

14. Connect the following electrical connectors:
    1. Shift Fork Position Sensor (1)
    2. Vehicle Speed Sensor (2)
15. Connect the wiring harness clips (3) to the transmission.

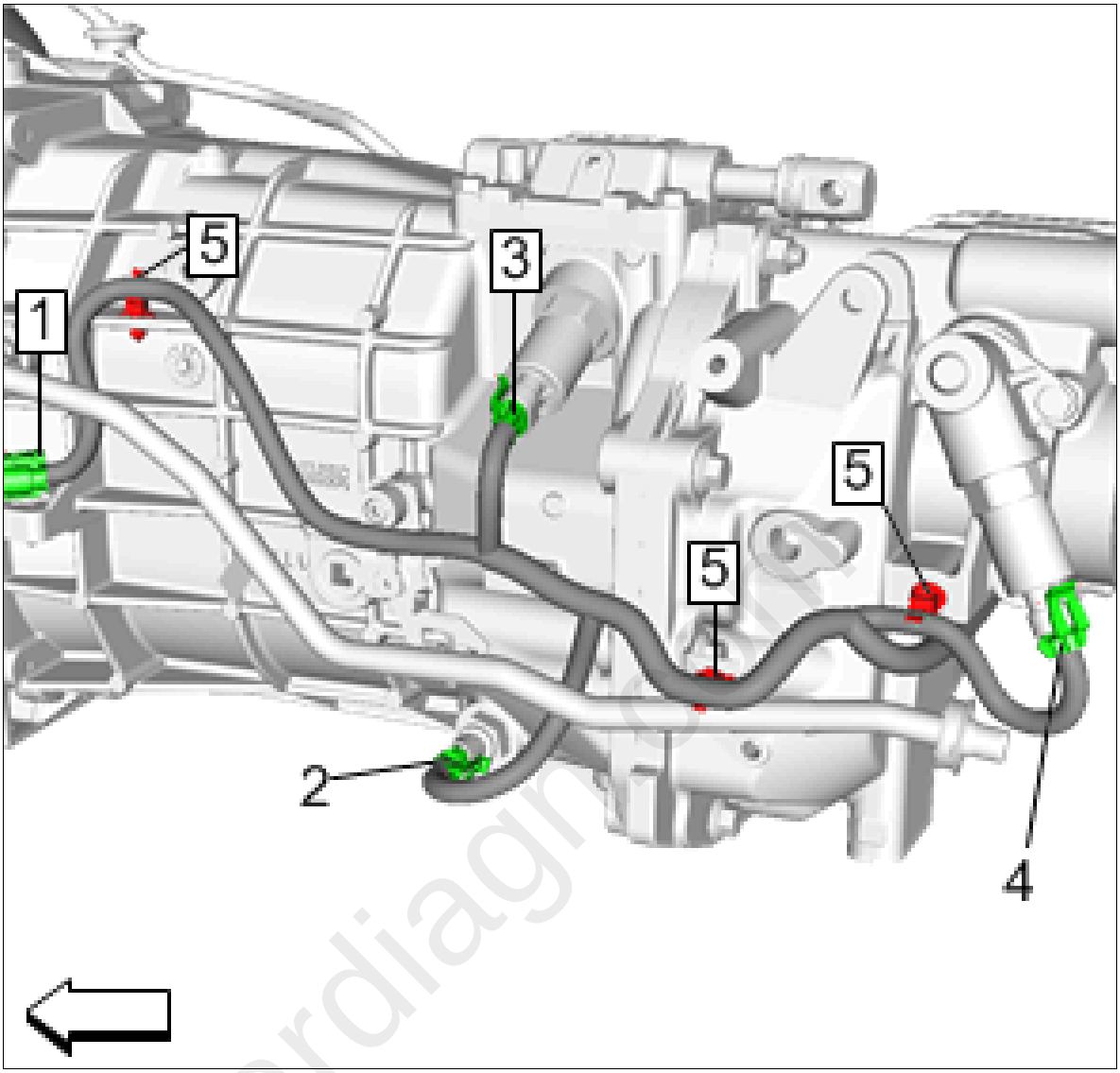
Fig 9: Oil Cooler Line Clip



Courtesy of GENERAL MOTORS COMPANY

16. Connect the oil cooler line clip (1) to the transmission.

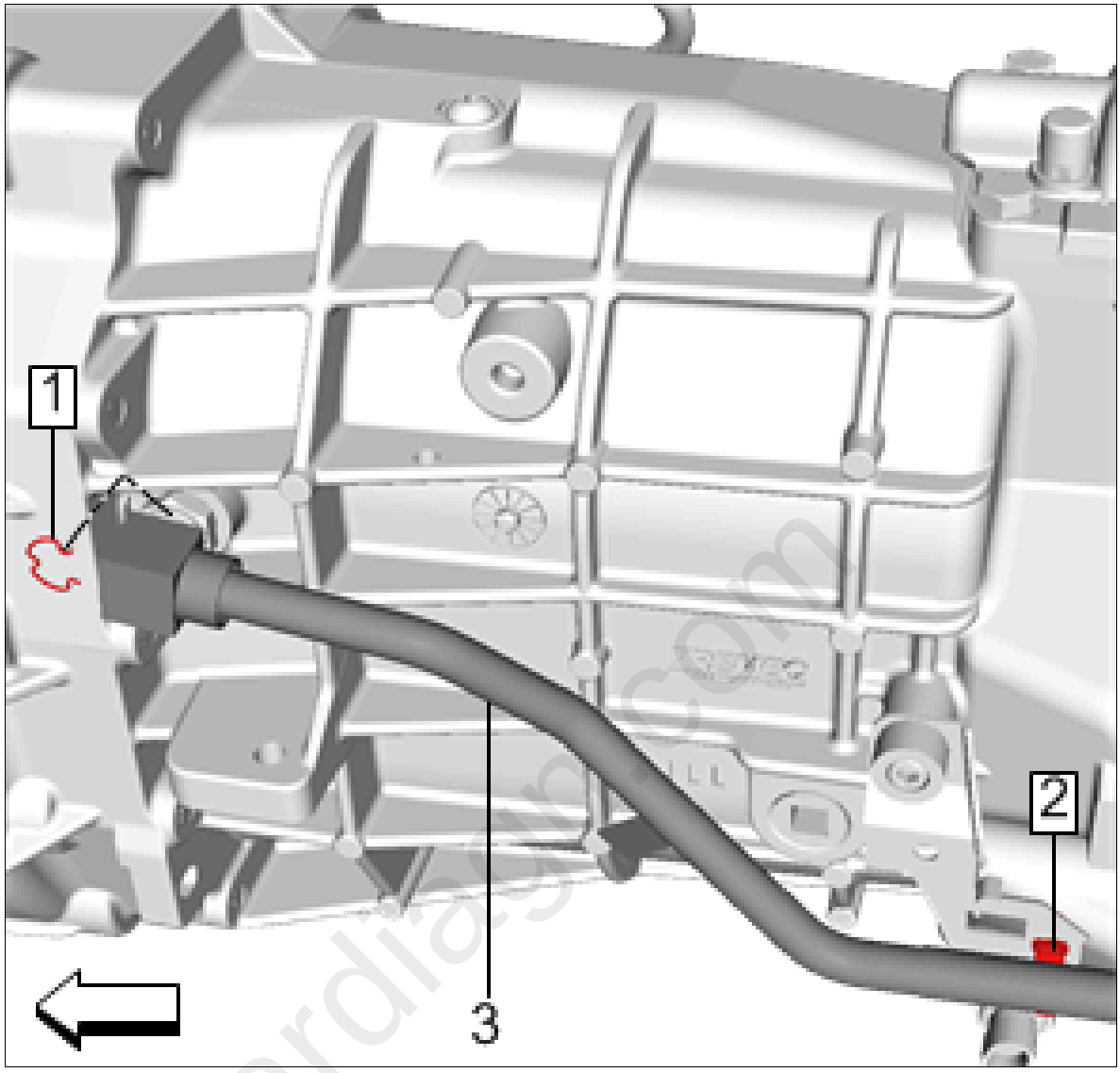
Fig 10: Electrical Connectors



Courtesy of GENERAL MOTORS COMPANY

17. Connect the following electrical connectors:
    1. Oxygen Sensor (1)
    2. Fluid Temperature Sensor (2)
    3. Skip Shift Solenoid (3)
    4. Reverse Lockout Solenoid (4)

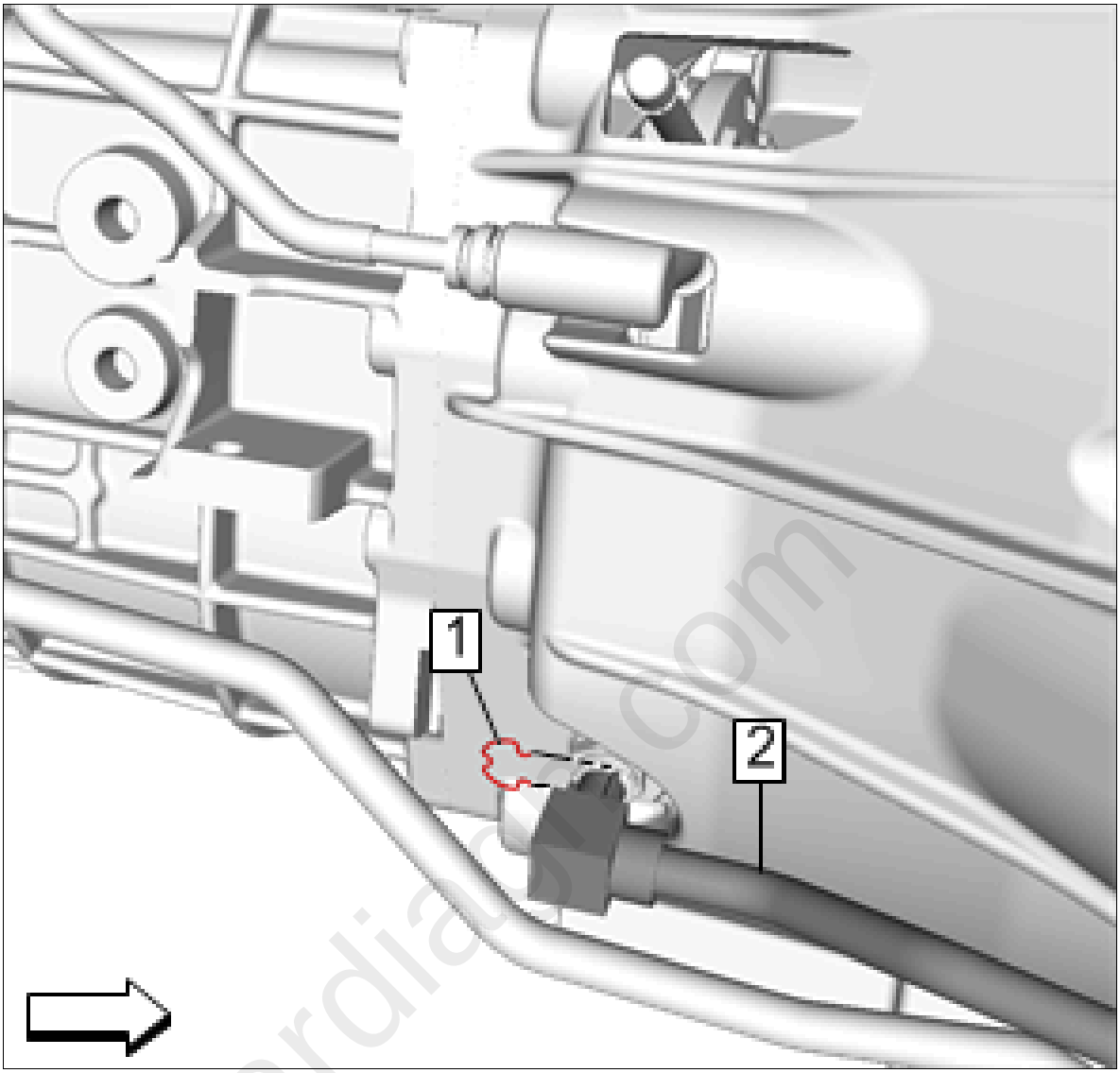
Fig 11: Cooler Pipe Retainer



Courtesy of GENERAL MOTORS COMPANY

18. Connect the cooler pipe retainer (2).
19. Connect the cooler pipe (3) to the transmission.
20. Install the retaining clip (1).

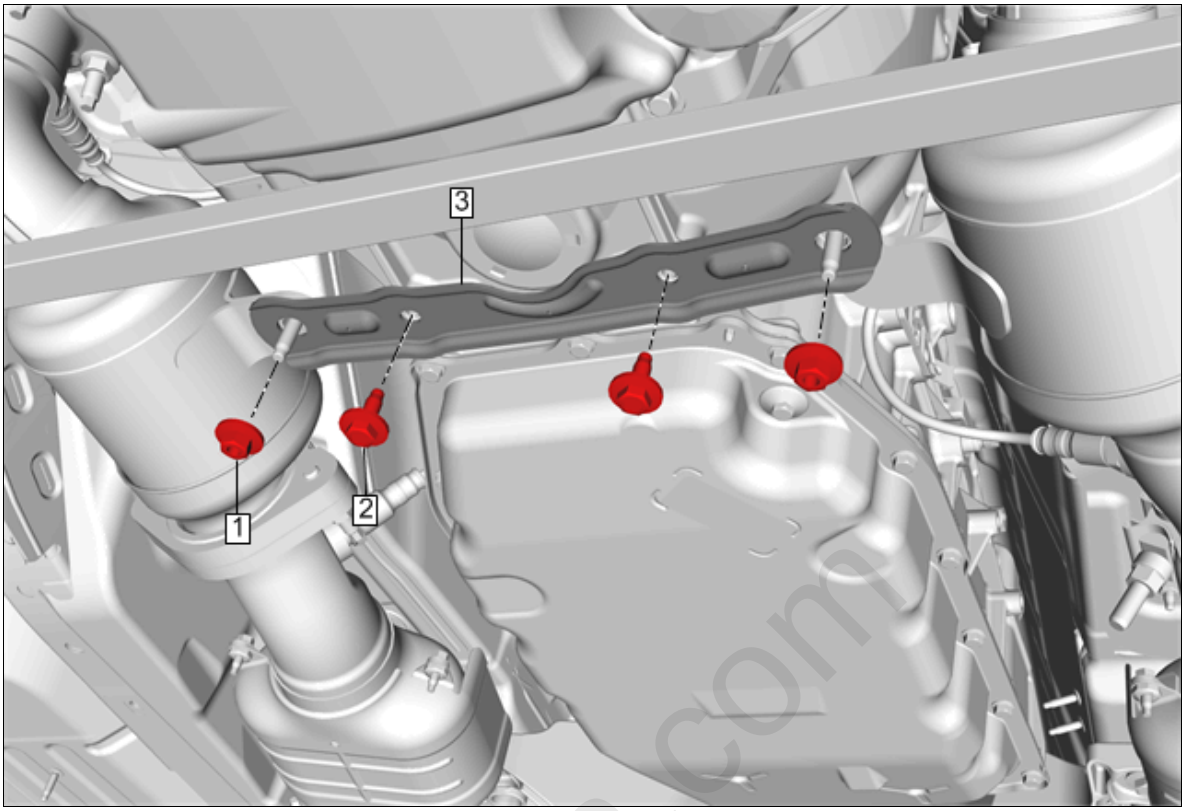
Fig 12: Cooler Pipe



Courtesy of GENERAL MOTORS COMPANY

21. Connect the cooler pipe (2) to the transmission.
22. Install the retaining clip (1).
23. Bleed to hydraulic clutch system. Refer to Hydraulic Clutch System Bleeding .
24. Check the transmission fluid and fill as necessary. Refer to Transmission Fluid Level Inspection (MM6) .

Fig 13: Catalytic Converter Brace Bracket

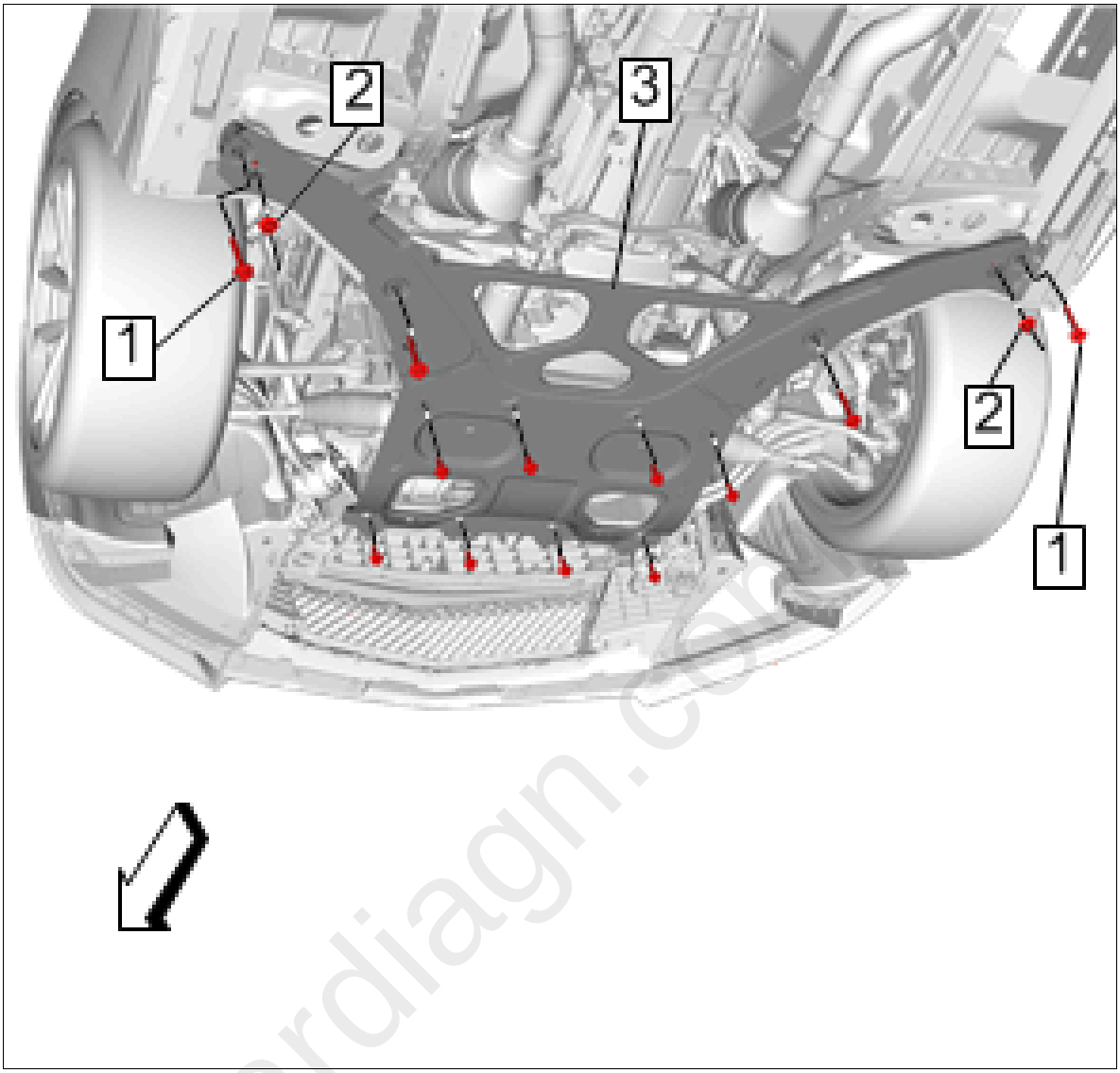


Courtesy of GENERAL MOTORS COMPANY

25. Install the catalytic converter brace bracket. Catalytic Converter Brace Bracket Replacement (LT1)

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Fig 14: Front Cradle Shear Plate



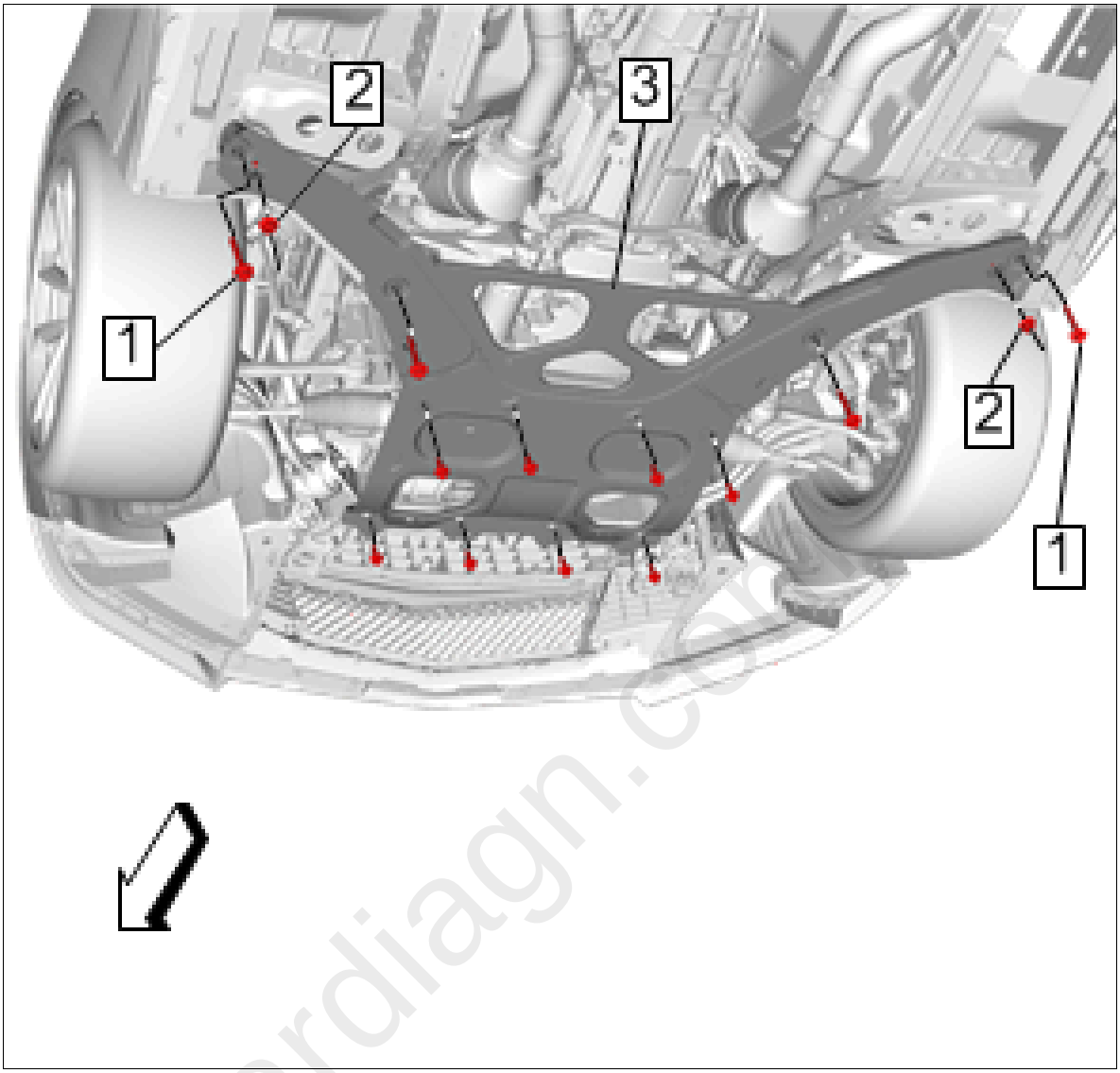
Courtesy of GENERAL MOTORS COMPANY

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26. Install the front cradle shear plate (3). Front Cradle Shear Plate Replacement

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION REPLACEMENT (M13 WITH LGX ENGINE) > REMOVAL PROCEDURE

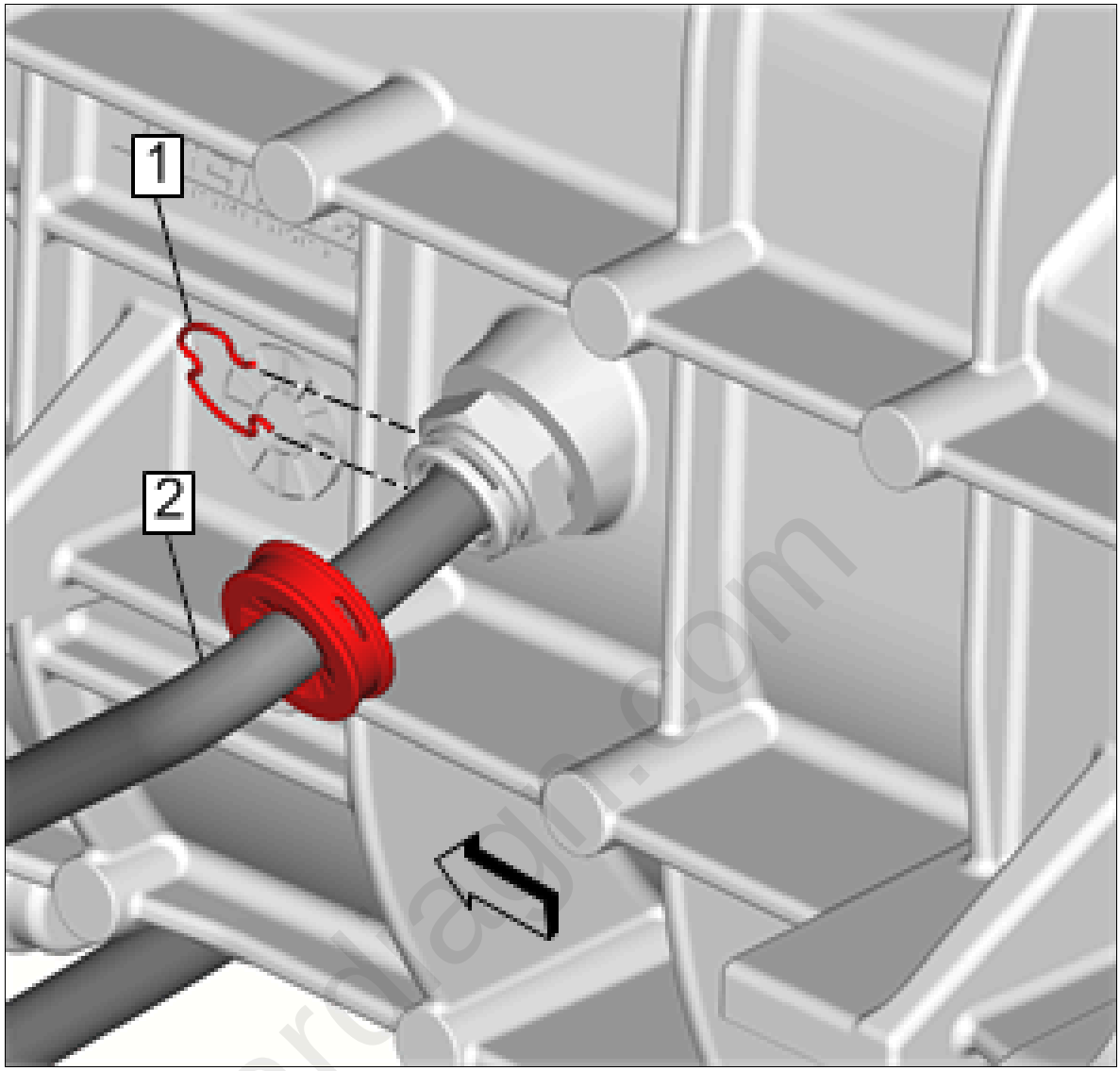
Fig 1: Front Cradle Shear Plate



Courtesy of GENERAL MOTORS COMPANY

1. Remove the front compartment lower noise shield (3) from the vehicle, if equipped. Front Compartment Lower Noise Shield Replacement (Coupe - LGX, LTG)
2. Remove the fluid cooler pipe clip retainer.

Fig 2: Transmission Fluid Cooler Pipe And Pipe Fitting Retainer (Left Side)



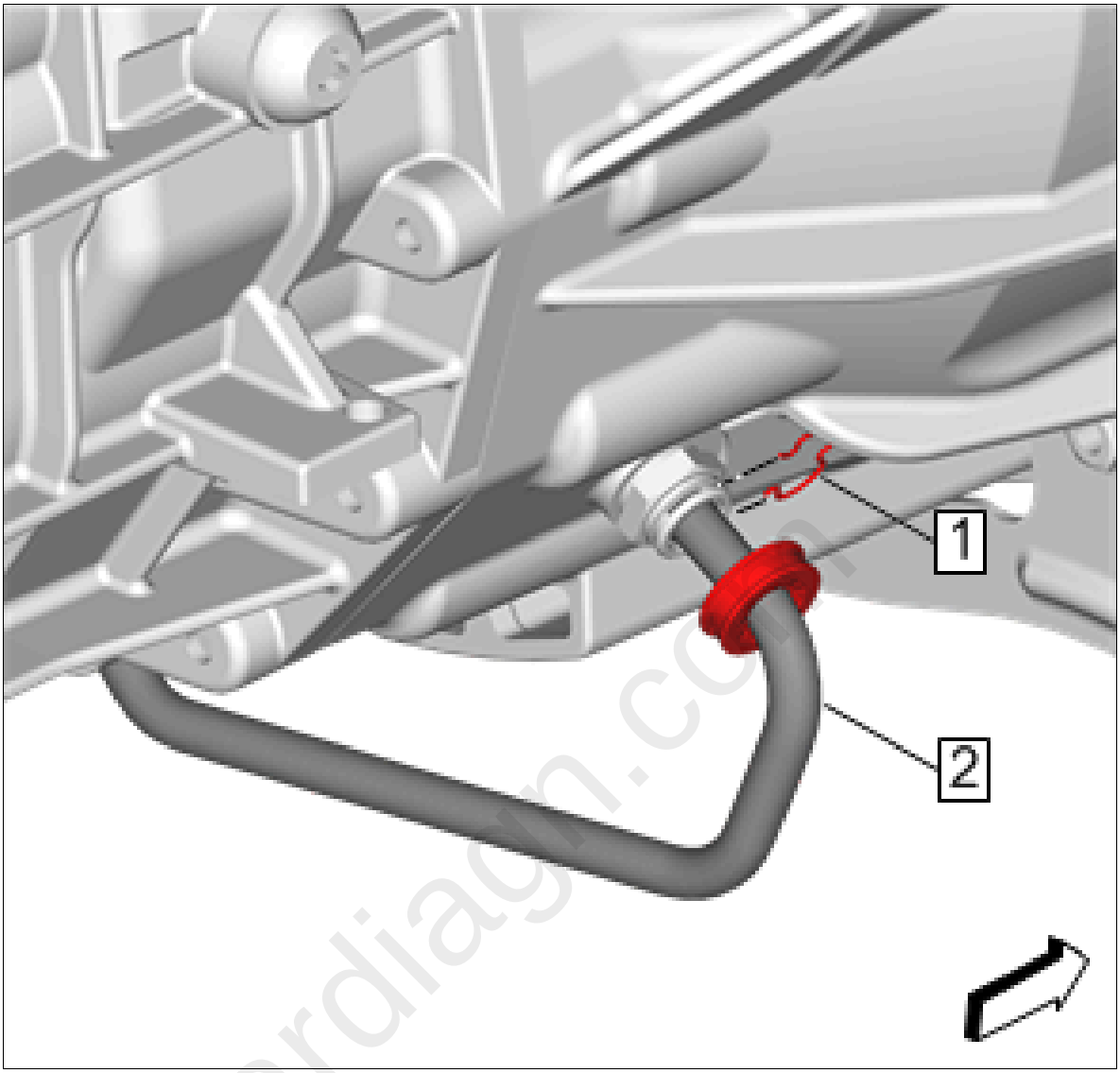
Courtesy of GENERAL MOTORS COMPANY

3. If equipped with an auxiliary cooler (Y4Q) Package) Remove Transmission Fluid Cooler Pipe Fitting Retainer (1) at Transmission Left Side - Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection

> *NOTE:*
>
> *Cover or plug all open transmission fluid cooler pipe connection points to help avoid any accidental contamination.*

4. Remove Transmission Fluid Cooler Inlet and Outlet Pipe (2) at Transmission Left Side.

Fig 3: Transmission Fluid Cooler Pipe And Pipe Fitting Retainer (Right Side)



Courtesy of GENERAL MOTORS COMPANY

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5. Remove Transmission Fluid Cooler Pipe Fitting Retainer (1) at Transmission Right Side - Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection

> *NOTE:*
>
> *Cover or plug all open transmission fluid cooler pipe connection points to help avoid any accidental contamination.*

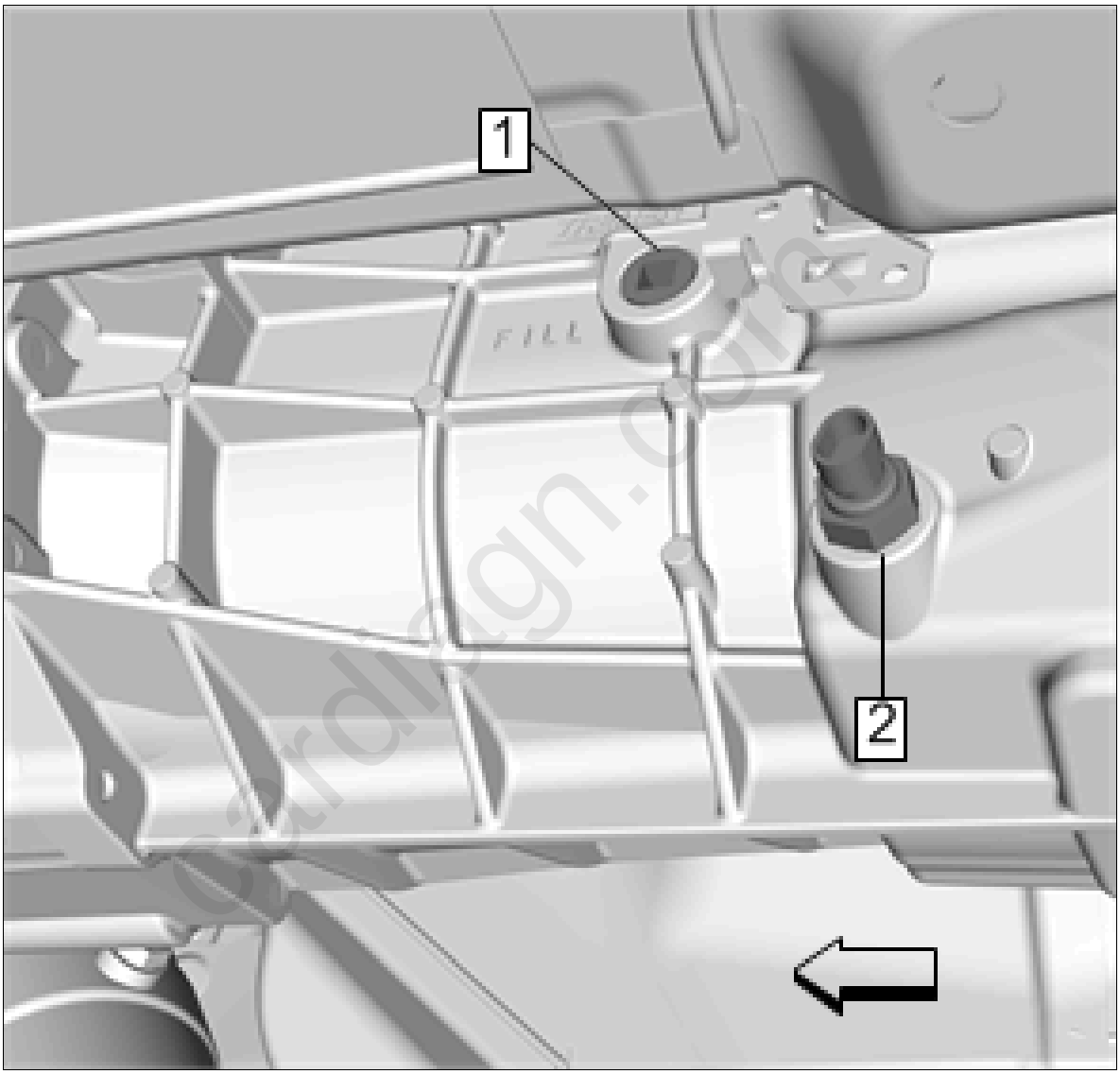
6. Remove Transmission Fluid Cooler Inlet and Outlet Pipe (2) at Transmission Right Side.

NOTE:

Transmission jack is installed to transmission in this step.

7. Disconnect the shift control assembly from the transmission. Shift Control Assembly Replacement (M13)

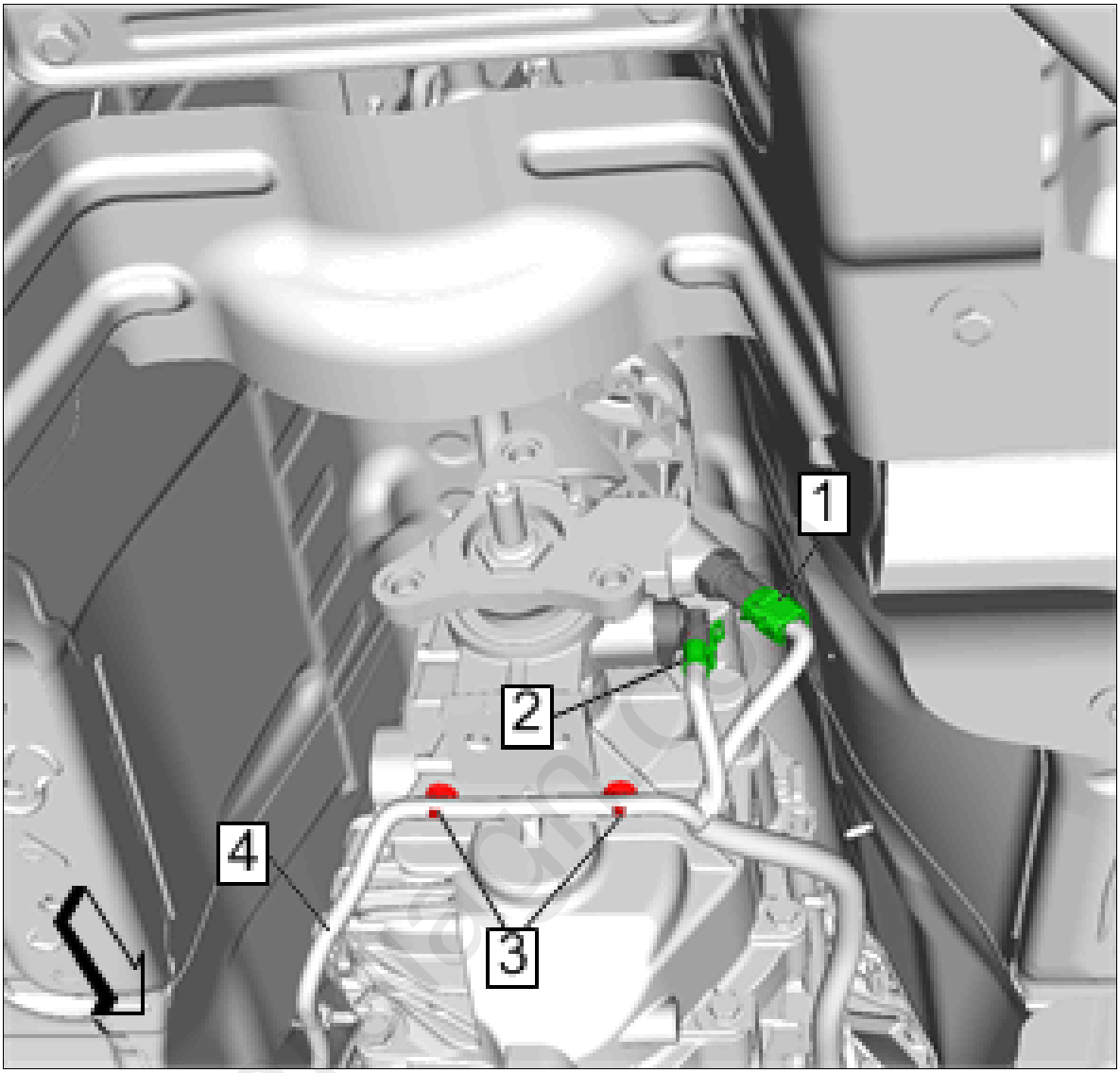
Fig 4: Fluid Temperature Sensor Connector



Courtesy of GENERAL MOTORS COMPANY

8. Disconnect the electrical connector from the transmission fluid temperature sensor (2).

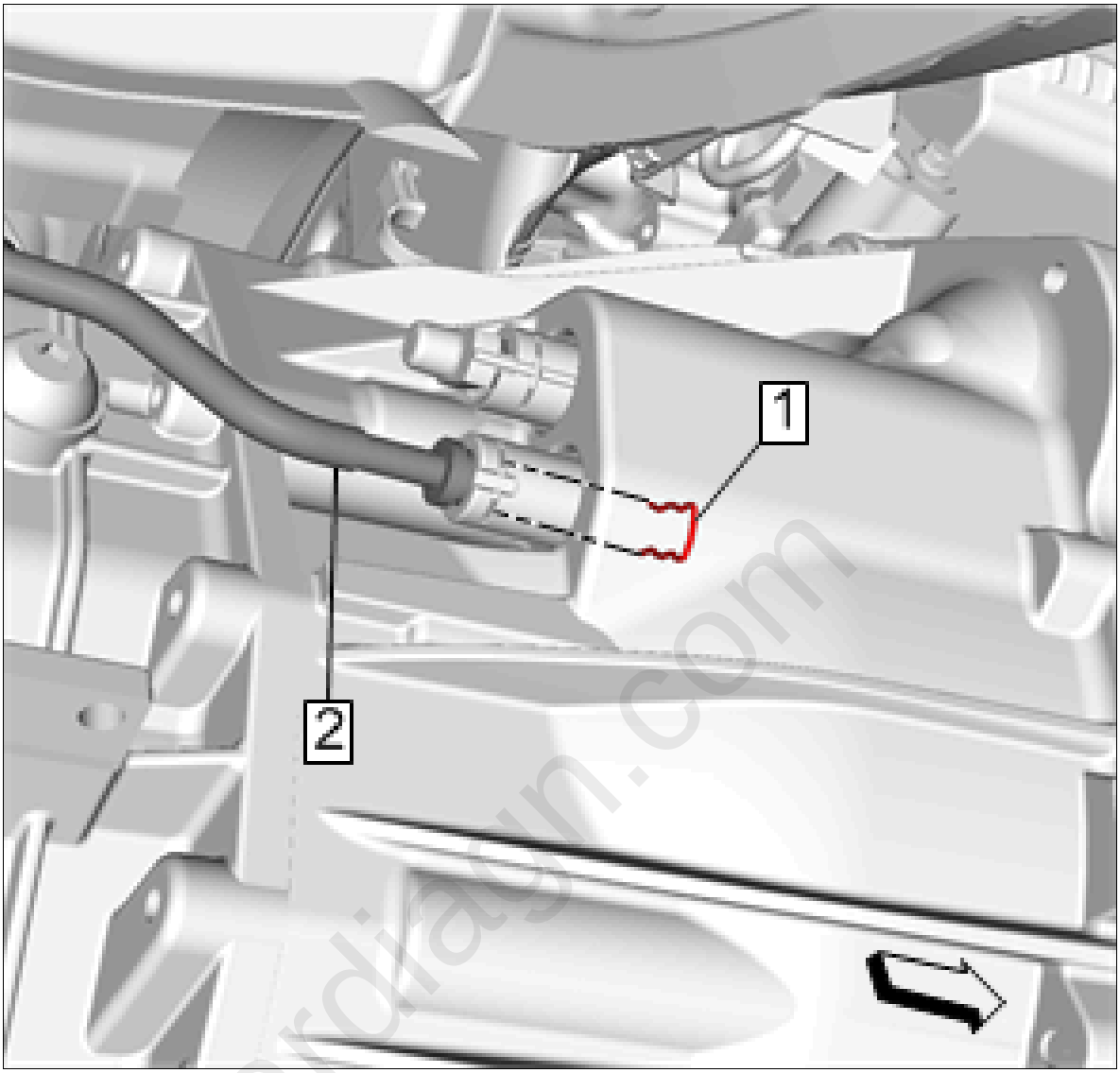
Fig 5: Electrical Connectors



Courtesy of GENERAL MOTORS COMPANY

9. Disconnect the following electrical connectors:
    1. Backup lamp switch (1)
    2. Vehicle speed sensor (2)
10. Disconnect the wiring harness retainers (3) from the transmission.
11. Position the wiring harness (4) out of the way.

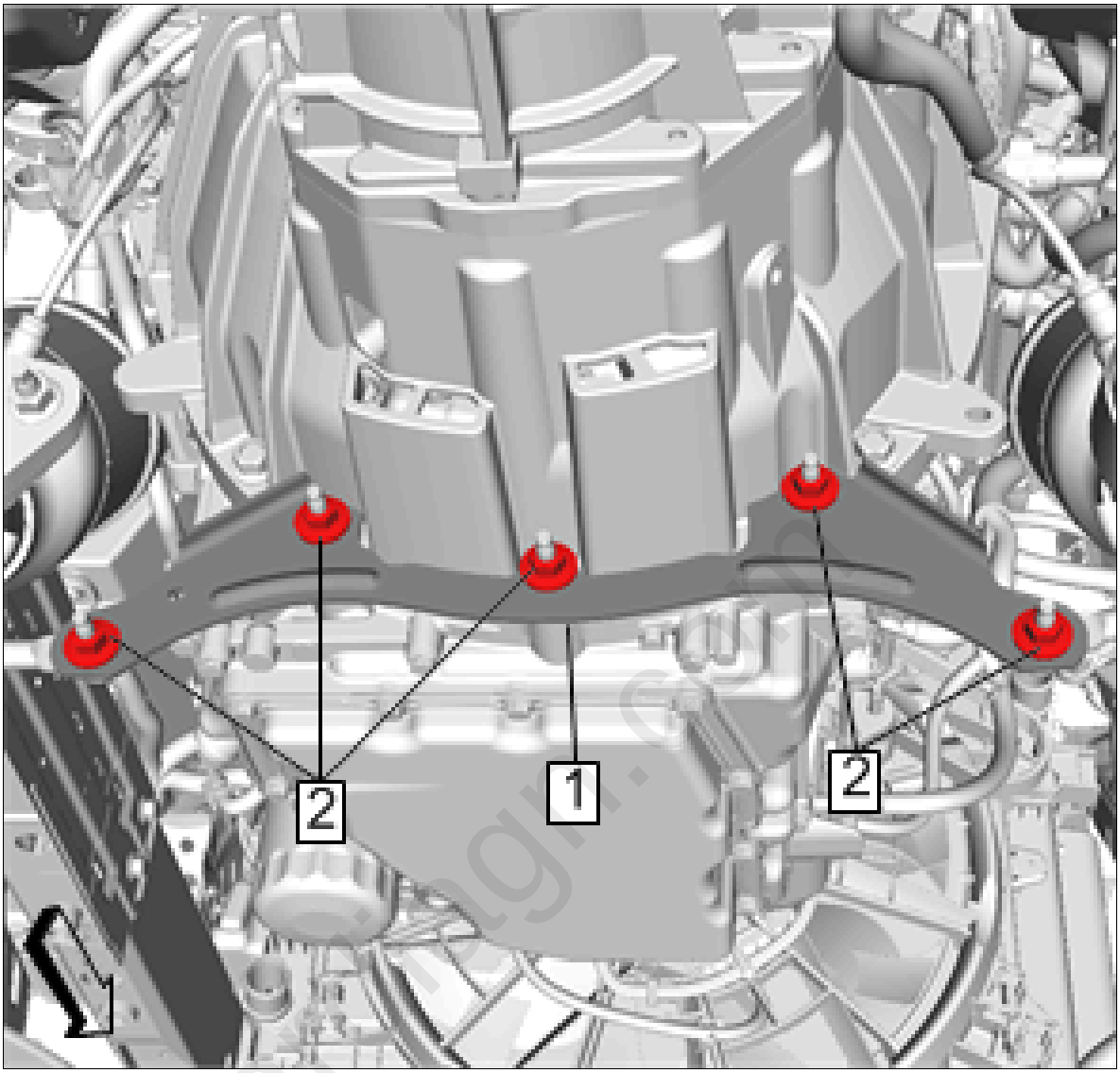
Fig 6: Lower Slave Cylinder Hose



Courtesy of GENERAL MOTORS COMPANY

12. Remove the hydraulic clutch hose/pipe (1) retaining clip from the clutch slave cylinder.
13. Disconnect the hydraulic clutch hose/pipe (2) from the clutch slave cylinder. Plug the lower hose end.

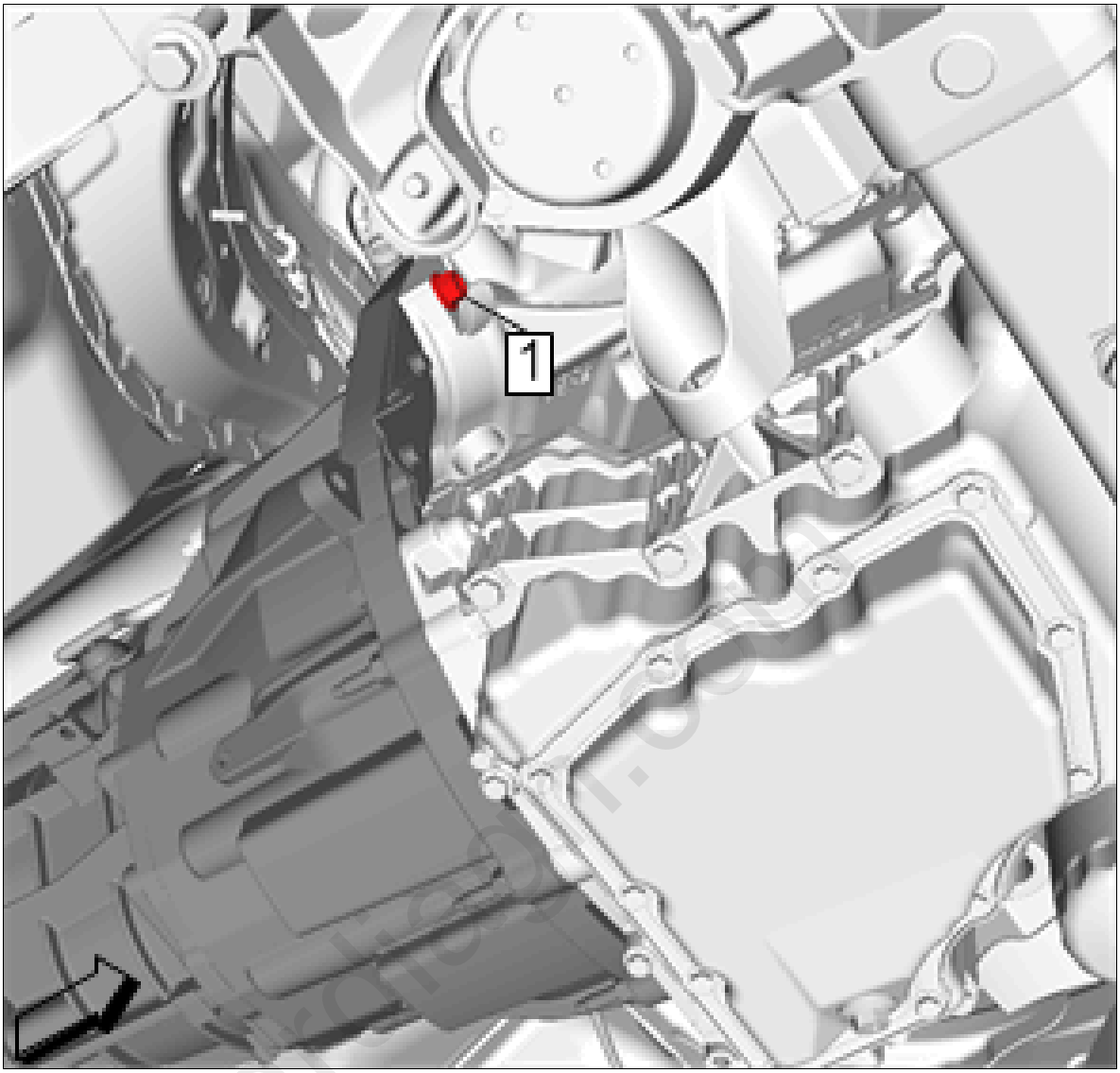
Fig 7: Catalytic Converter Bracket



Courtesy of GENERAL MOTORS COMPANY

14. Remove the catalytic converter bracket (1) from the transmission. Catalytic Converter Brace Bracket Replacement (LGX)

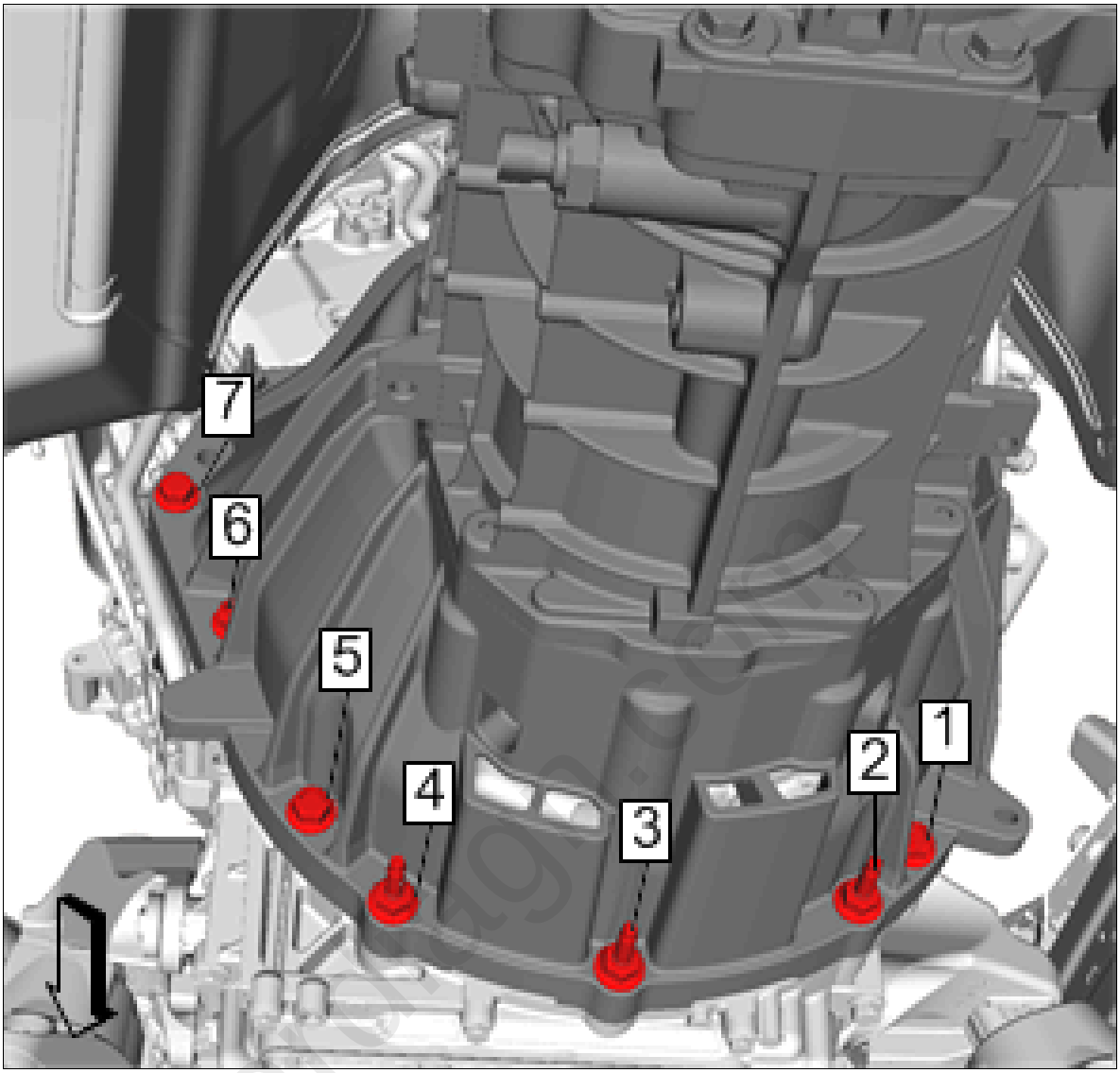
Fig 8: Upper Right Transmission Clutch Housing To Engine Fastener (Engine Side)



Courtesy of GENERAL MOTORS COMPANY

15. Remove the upper right (engine side) transmission clutch housing to engine fastener (1).

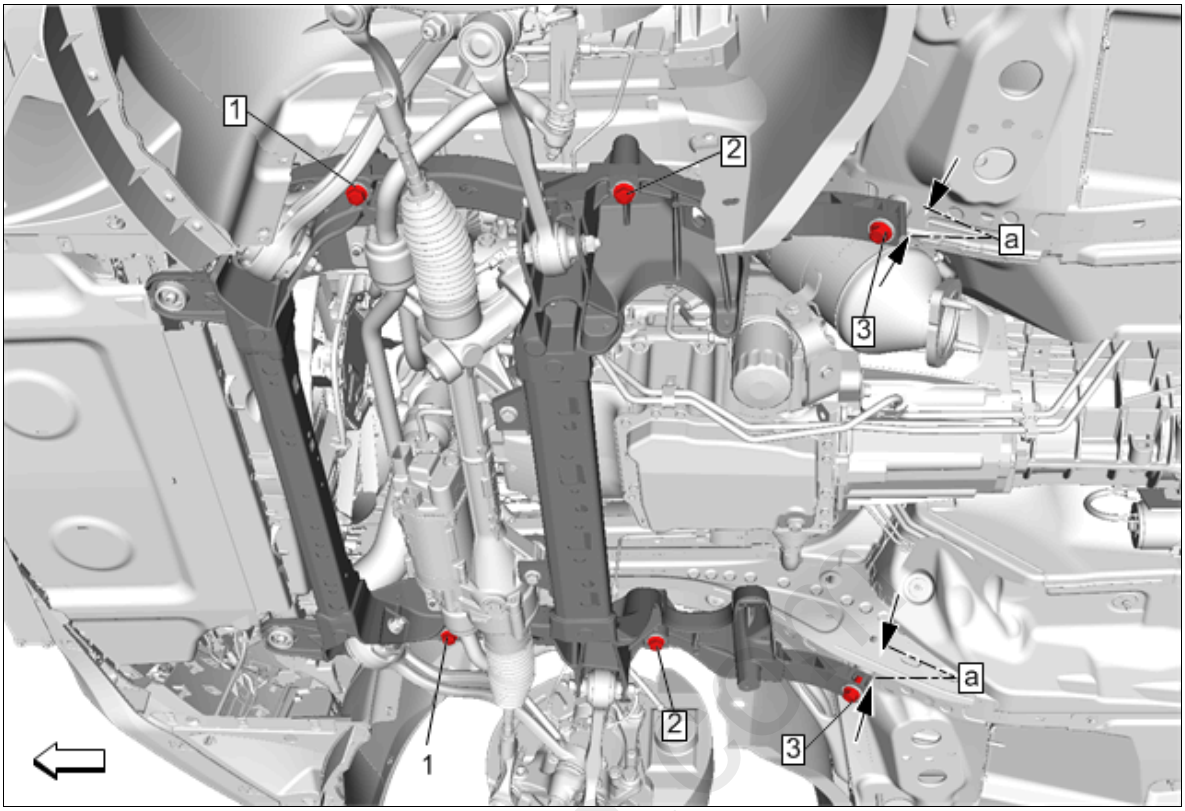
Fig 9: Lower Transmission Clutch Housing To Engine Fasteners



Courtesy of GENERAL MOTORS COMPANY

16. Remove the seven lower transmission clutch housing to engine fasteners (1, 2, 3, 4, 5, 6, 7).

Fig 10: Front And Rear Cradle Bolts



Courtesy of GENERAL MOTORS COMPANY

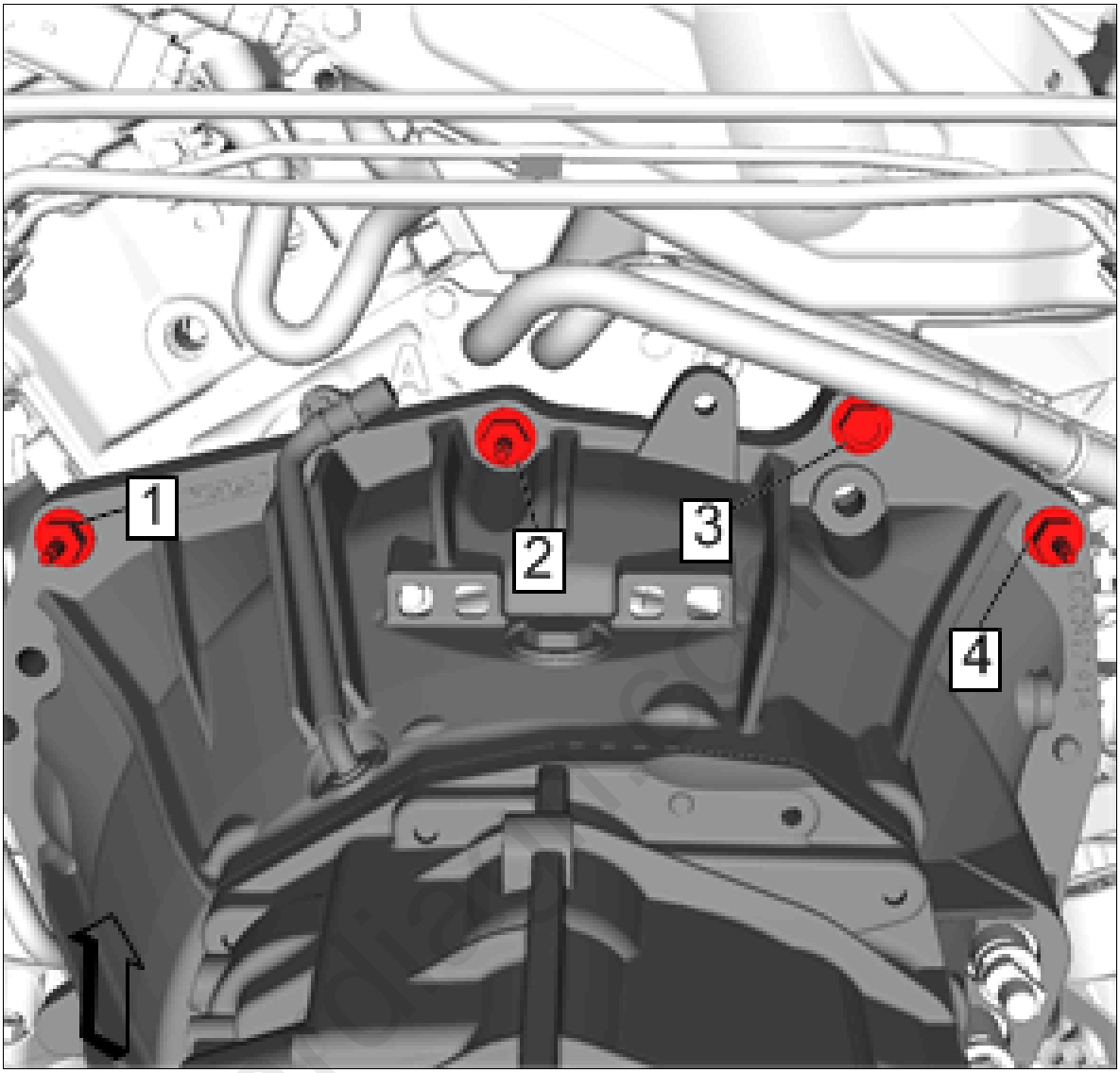
NOTE:

Securely support the drivetrain and front suspension cradle with an adjustable jack.

17. Loosen the front cradle bolts (1) one turn, remove the rear cradle bolts (3) completely, loosen the middle cradle bolts (2) enough to allow the rear of the cradle support to tilt down with the jack approximately 25 mm (1 in) (a).
18. Remove the wiring harness retainers from the upper transmission clutch housing stud bolts.

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Fig 11: Upper Transmission Clutch Housing To Engine Fasteners



Courtesy of GENERAL MOTORS COMPANY

19. Remove the four upper transmission clutch housing to engine fasteners (1, 2, 3, 4).

> *NOTE:*
>
> *Do not leave the engine tilted on its mounts for an extended amount of time.*

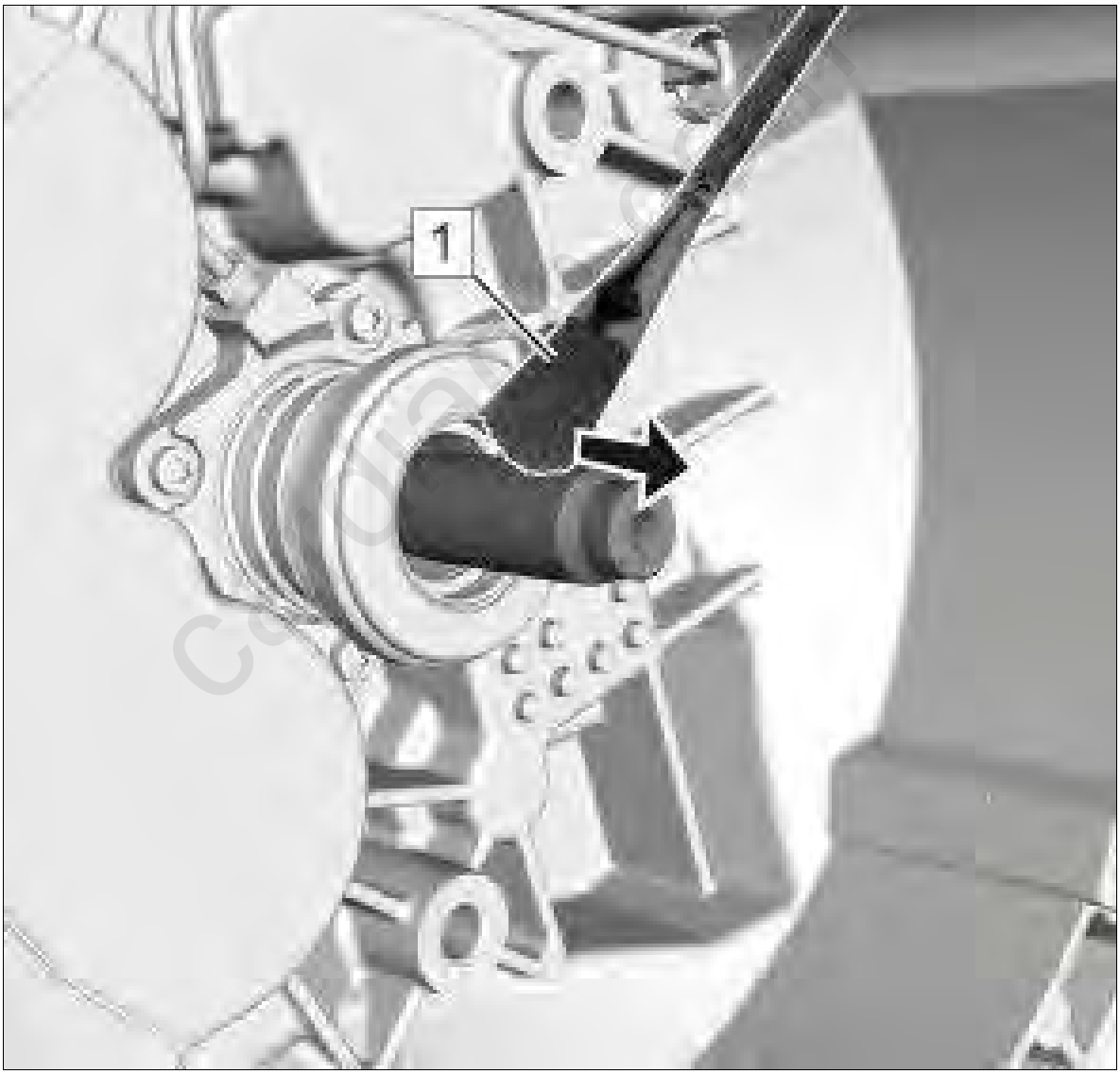
20. Remove the transmission from the vehicle. To clear the body structure, the front of the engine can be pushed up to tilt the engine and transmission.
21. Flush and flow test the transmission oil cooler and lines. Transmission Fluid Cooler Flushing and Flow Test (Tremec 6-Speed)Transmission Fluid Cooler Flushing and Flow Test (8L90)
22. Transfer components as necessary.

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION REPLACEMENT (M13 WITH LGX ENGINE) > INSTALLATION PROCEDURE

> *WARNING:*
>
> *Use care when cleaning the clutch hub. The clutch hub may have sharp edges and can cause personal injury if contact is made. Wear protective gloves to avoid personal injury.*

1. Clean the clutch hub and the input shaft from any debris and contaminates with a lint-free towel.

Fig 1: Flat Brush To Apply Light Coating Of Multi-Purpose Grease



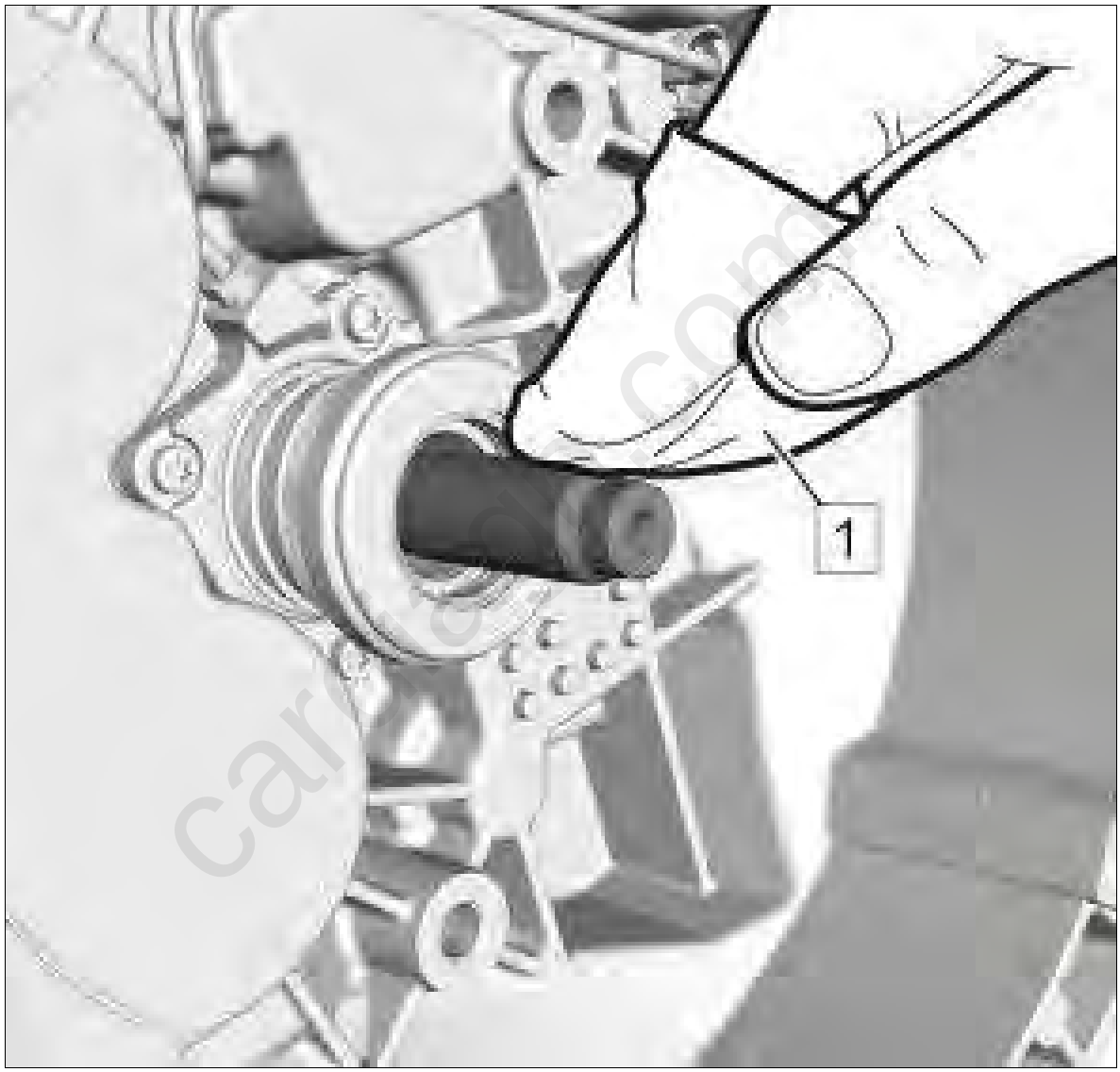
Courtesy of GENERAL MOTORS COMPANY

> *CAUTION:*

Applying too much or the wrong type of grease on the transmission input shaft may cause damage, clutch slippage or failure. Always apply the correct type of grease. Never apply more grease than is necessary to coat the transmission input shaft with a very thin film of grease.

2. Use a clean flat brush (1) to apply very light coating of multi-purpose grease to input shaft until the metal is only shiny. No visible clumps of grease are permissible regardless of size. Smear away from the transmission in direction of the shown arrow.

Fig 2: Lead Surface Of Input Shaft With Lint-Free Towel

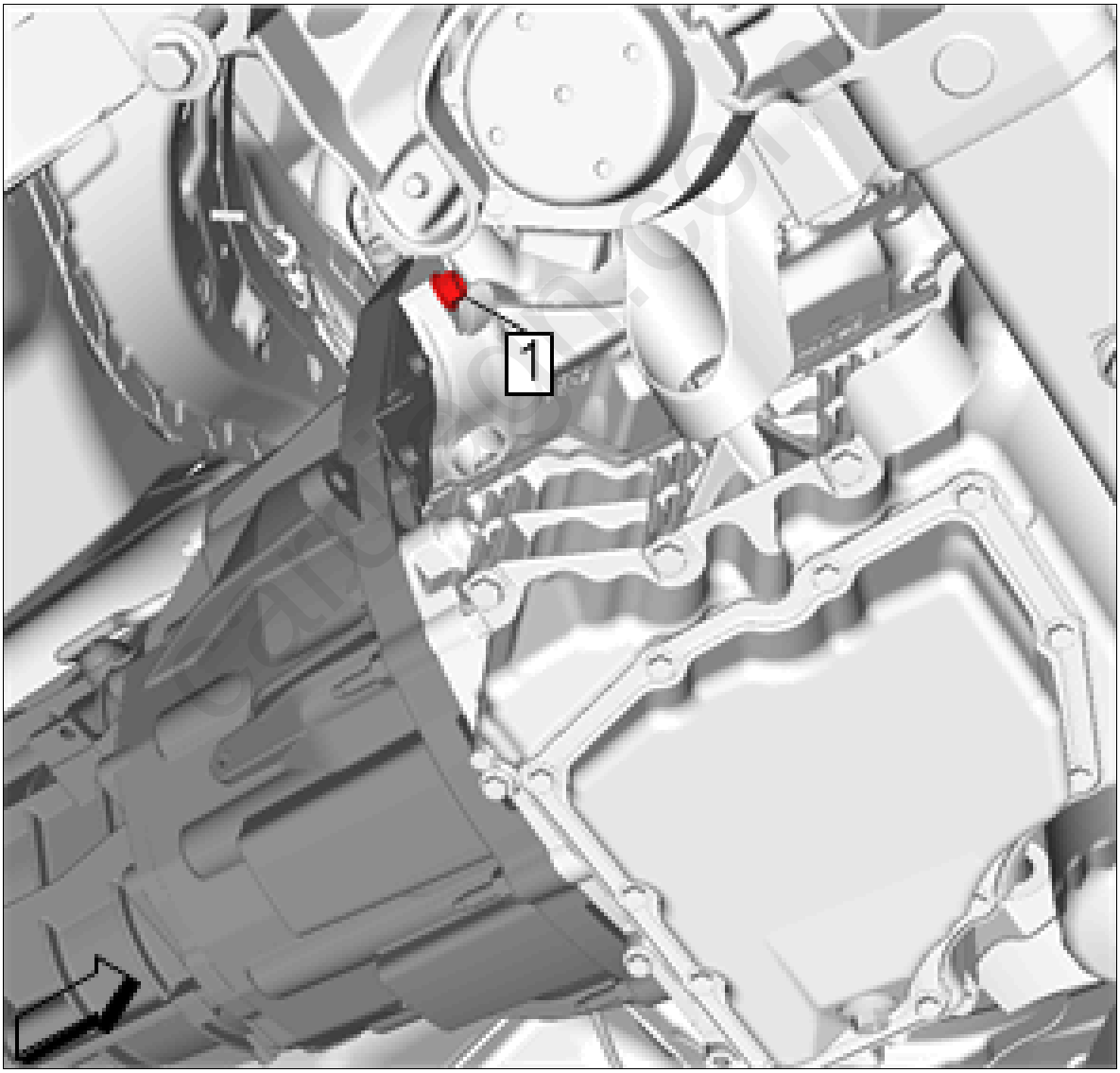


Courtesy of GENERAL MOTORS COMPANY

> ⚠ *CAUTION:*
>
> *Ensure that no grease remains on the lead surface of the transmission input shaft. Clean the lead surface of the transmission input shaft prior to the assembly of the transmission to the engine. Failure to maintain a clean surface may cause clutch slippage or failure.*

3. Clean the entire lead surface of the input shaft with a NEW, lint-free towel (1).
4. With the cradle in the lowered position, position the transmission to the vehicle. It may be necessary to push up on the front of the engine to gain enough clearance to the body structure.

Fig 3: Right Transmission Clutch Housing To Engine Fastener (Engine Side)



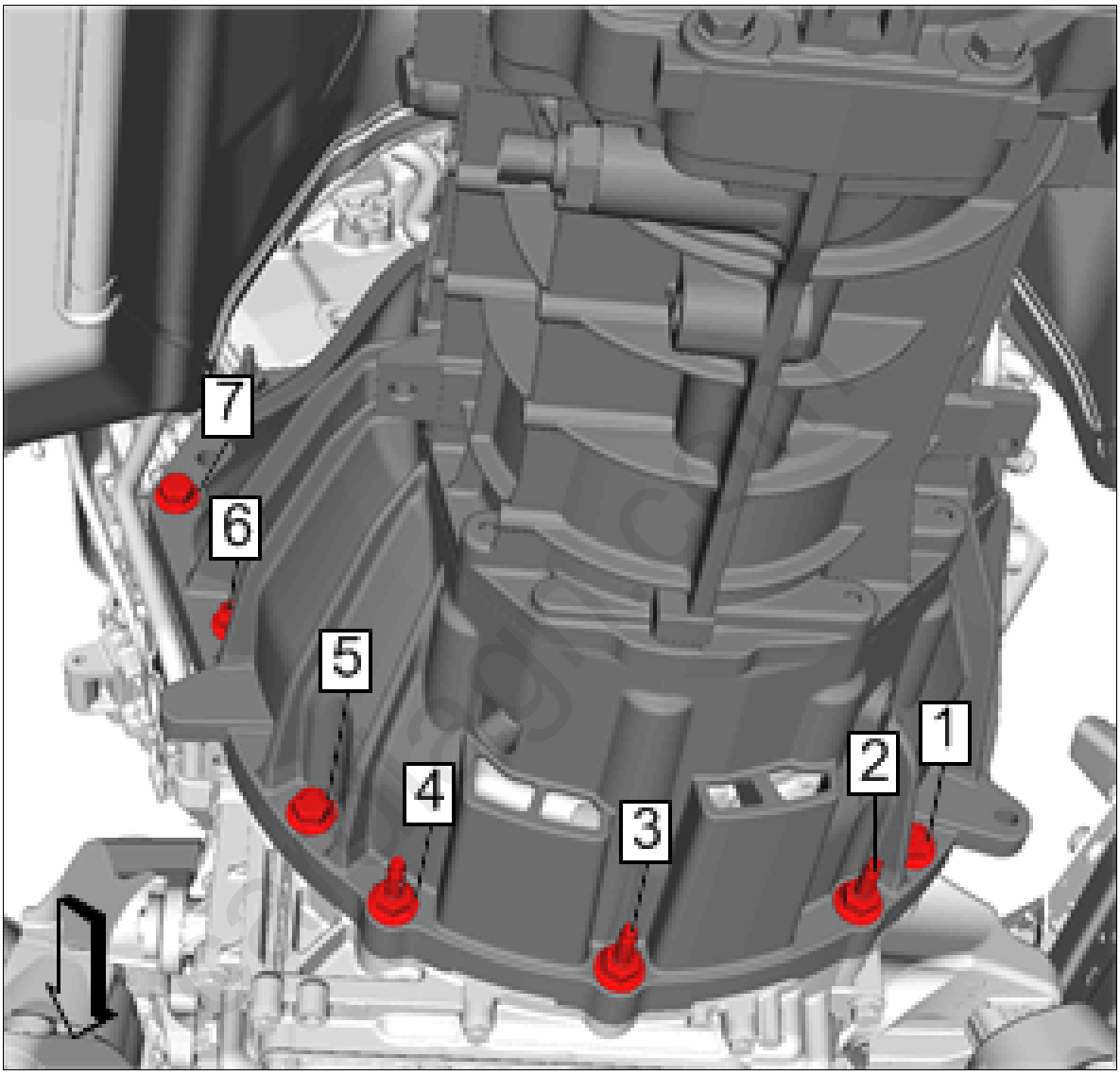
Courtesy of GENERAL MOTORS COMPANY

> ⚠ *CAUTION:*

Refer to Fastener Caution .

5. Install the right (engine side) transmission clutch housing to engine fastener (1) and tighten to 58 N.m (43 lb ft).

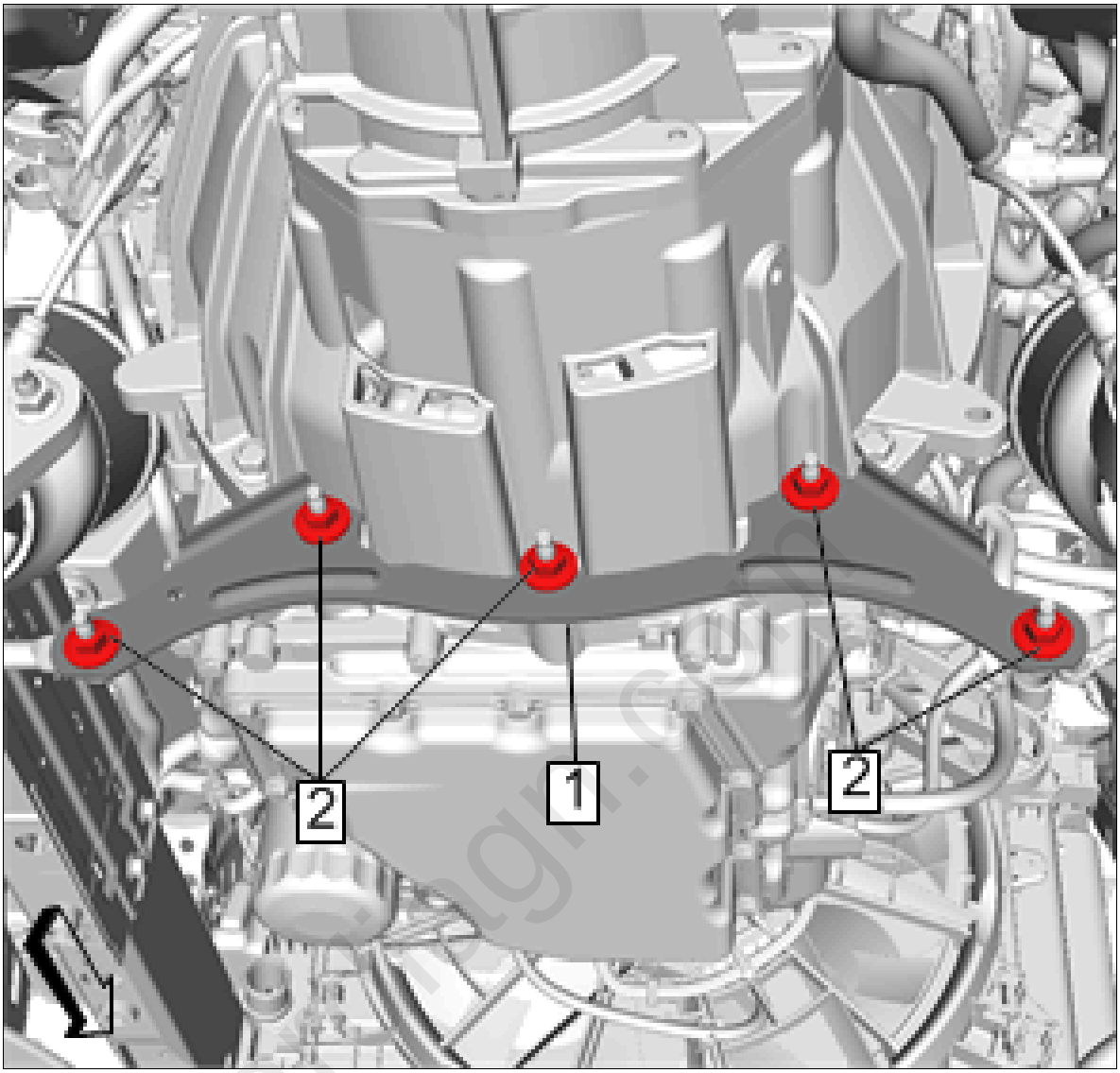
Fig 4: Lower Transmission Clutch Housing To Engine Fasteners



Courtesy of GENERAL MOTORS COMPANY

6. Install the seven lower transmission clutch housing to engine fasteners (1, 2, 3, 4, 5, 6, 7) and tighten to 58 N.m (43 lb ft).

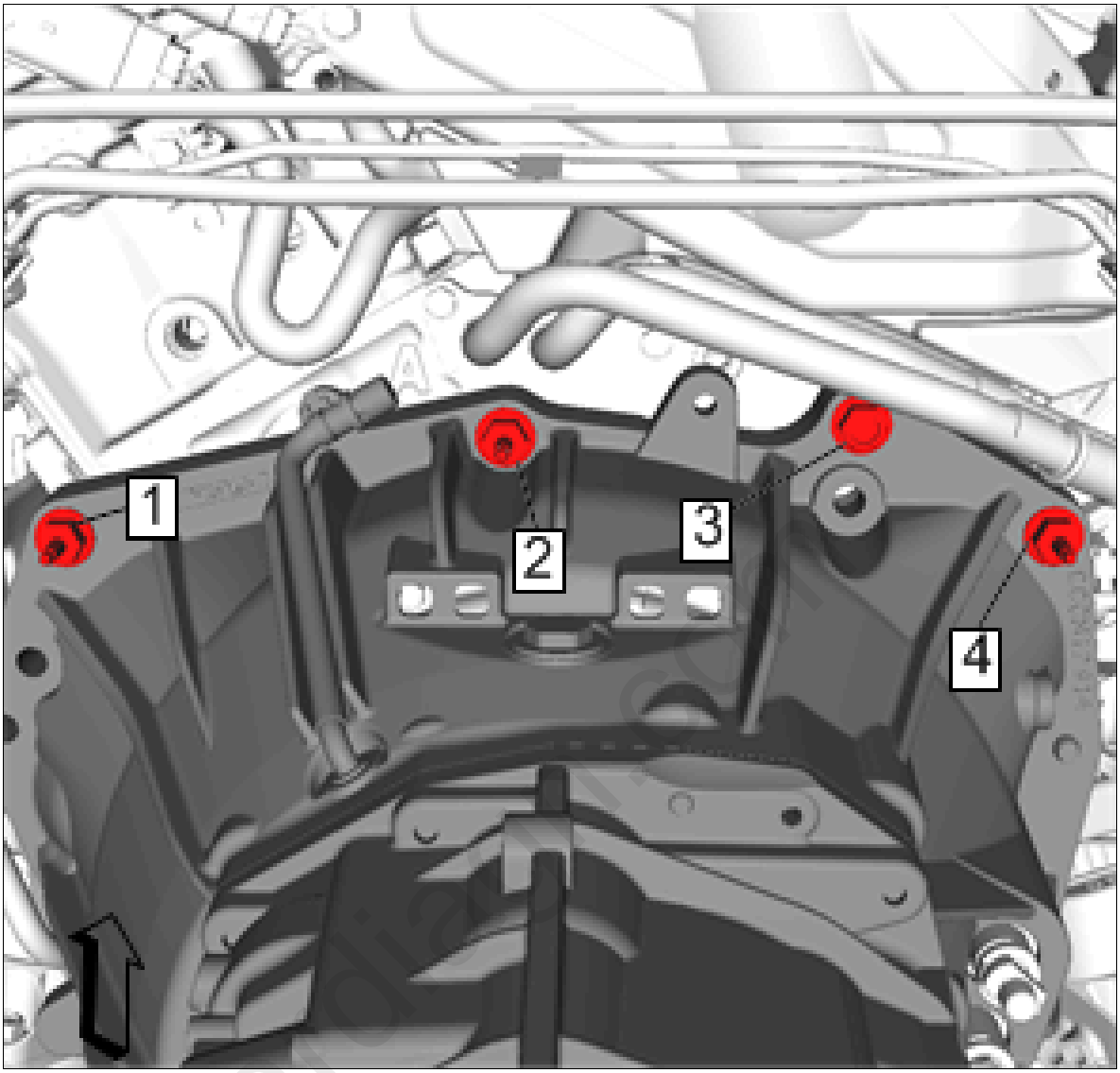
Fig 5: Catalytic Converter Bracket



Courtesy of GENERAL MOTORS COMPANY

7. Install the catalytic converter bracket (1) to the transmission. Catalytic Converter Brace Bracket Replacement (LGX)

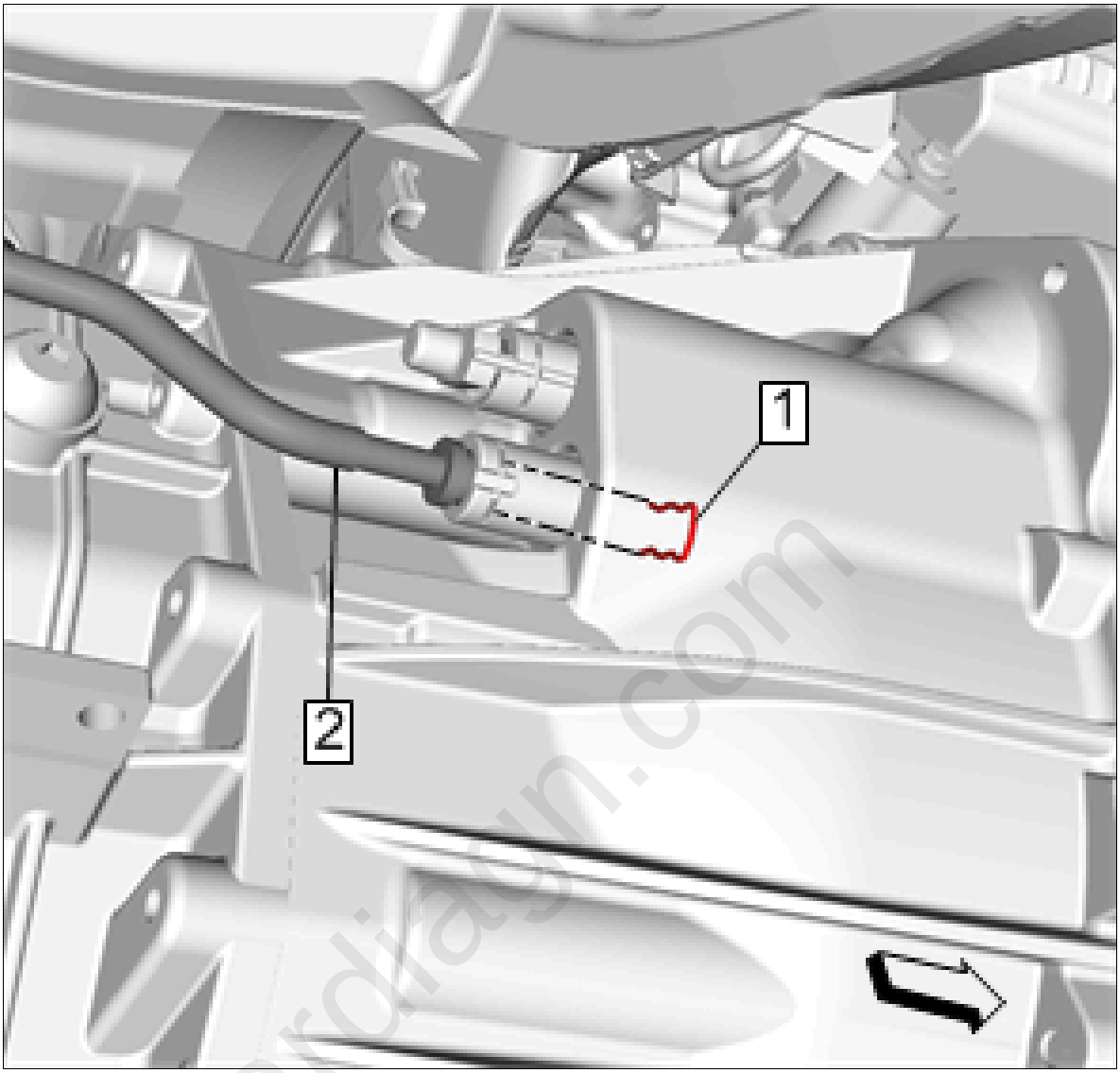
Fig 6: Upper Transmission Clutch Housing To Engine Fasteners



Courtesy of GENERAL MOTORS COMPANY

8. Install the four upper transmission clutch housing to engine fasteners (1, 2, 3, 4) and tighten to 58 N.m (43 lb ft).
9. Install the wiring harness retainers to the upper transmission clutch housing stud bolts.

Fig 7: Lower Slave Cylinder Hose

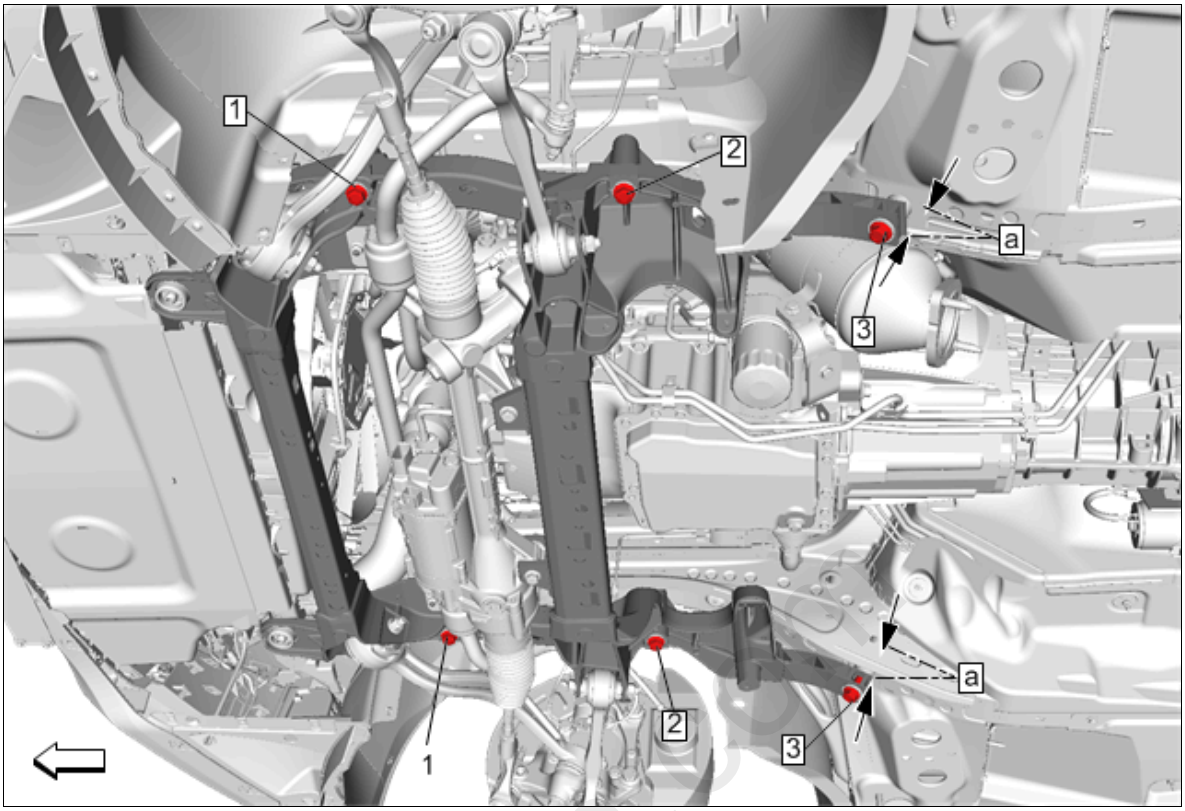


Courtesy of GENERAL MOTORS COMPANY

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10. Connect the lower slave cylinder hose (2) to the slave cylinder.
11. Install the hydraulic clutch hose/pipe retaining clip (1) to the clutch slave cylinder.
12. Connect the shift control assembly to the transmission. Shift Control Assembly Replacement (M13)

Fig 8: Front And Rear Cradle Bolts



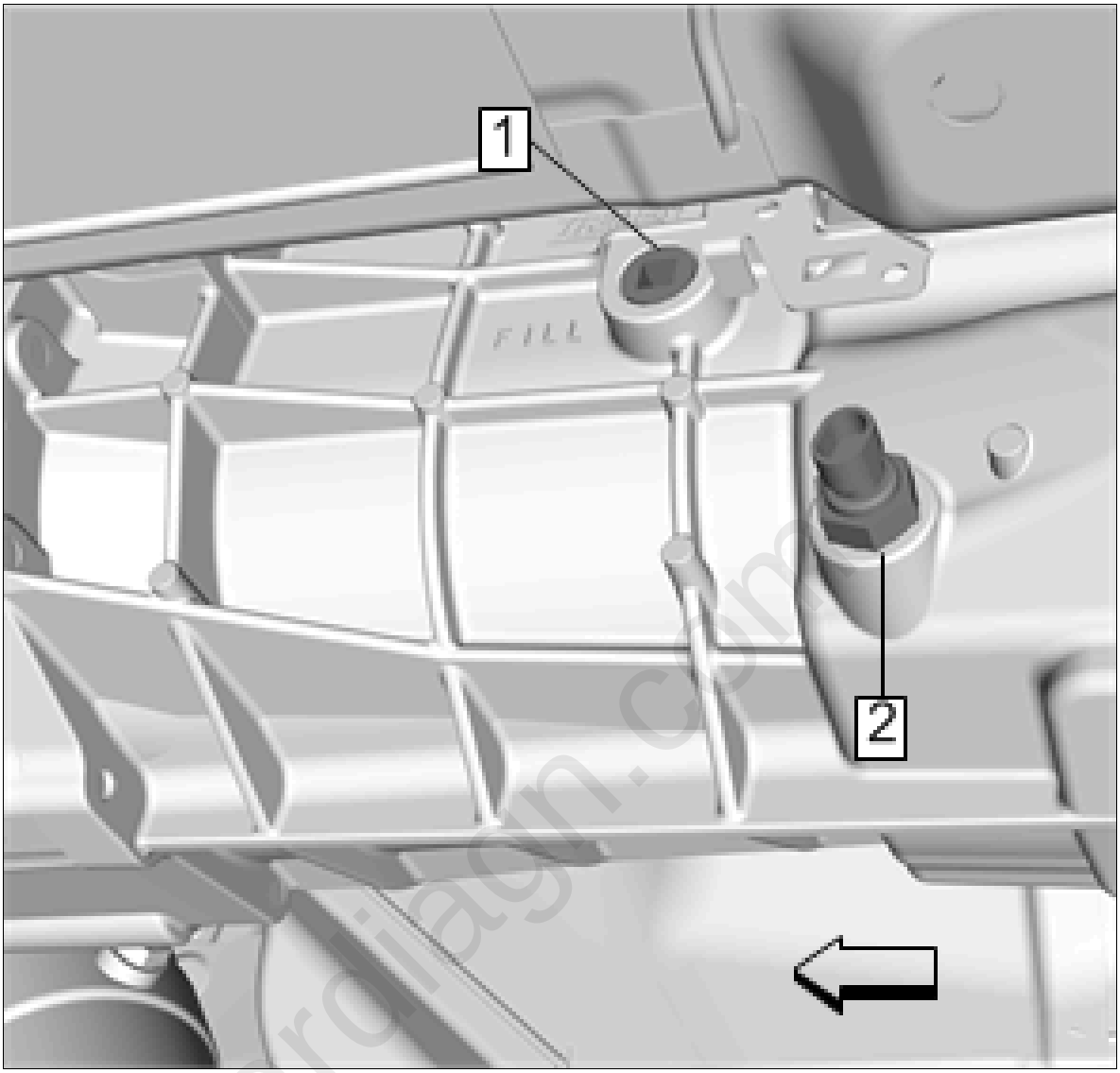
Courtesy of GENERAL MOTORS COMPANY

13. Tilt engine and transmission up and tighten all cradle bolts (1, 2, 3). Drivetrain and Front Suspension Cradle Replacement (LGX)

14. Install the transmission mount. Transmission Rear Mount Replacement (M13 Transmission)

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Fig 9: Fluid Temperature Sensor Connector

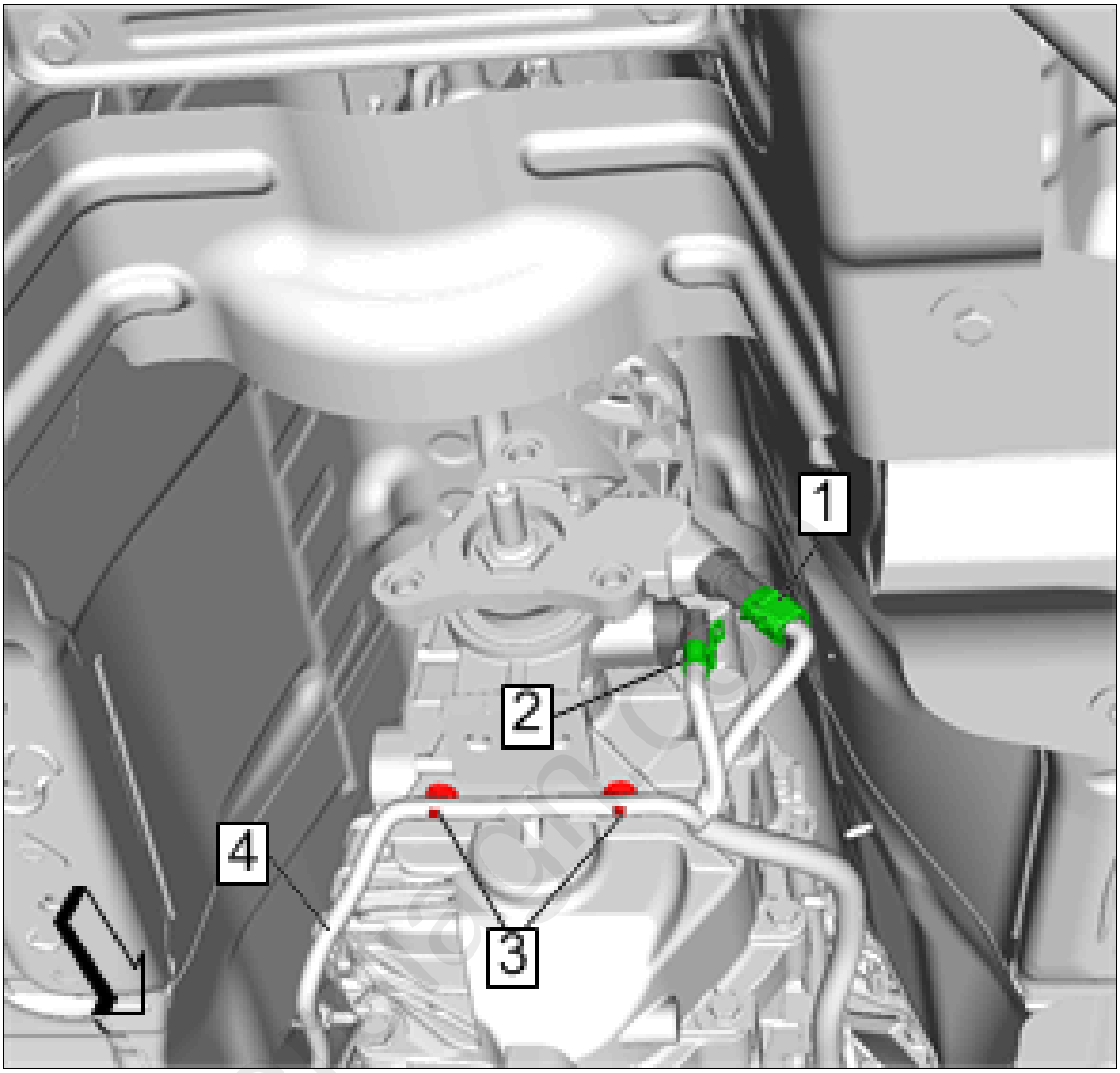


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15. Connect the electrical connector to the transmission fluid temperature sensor (2).

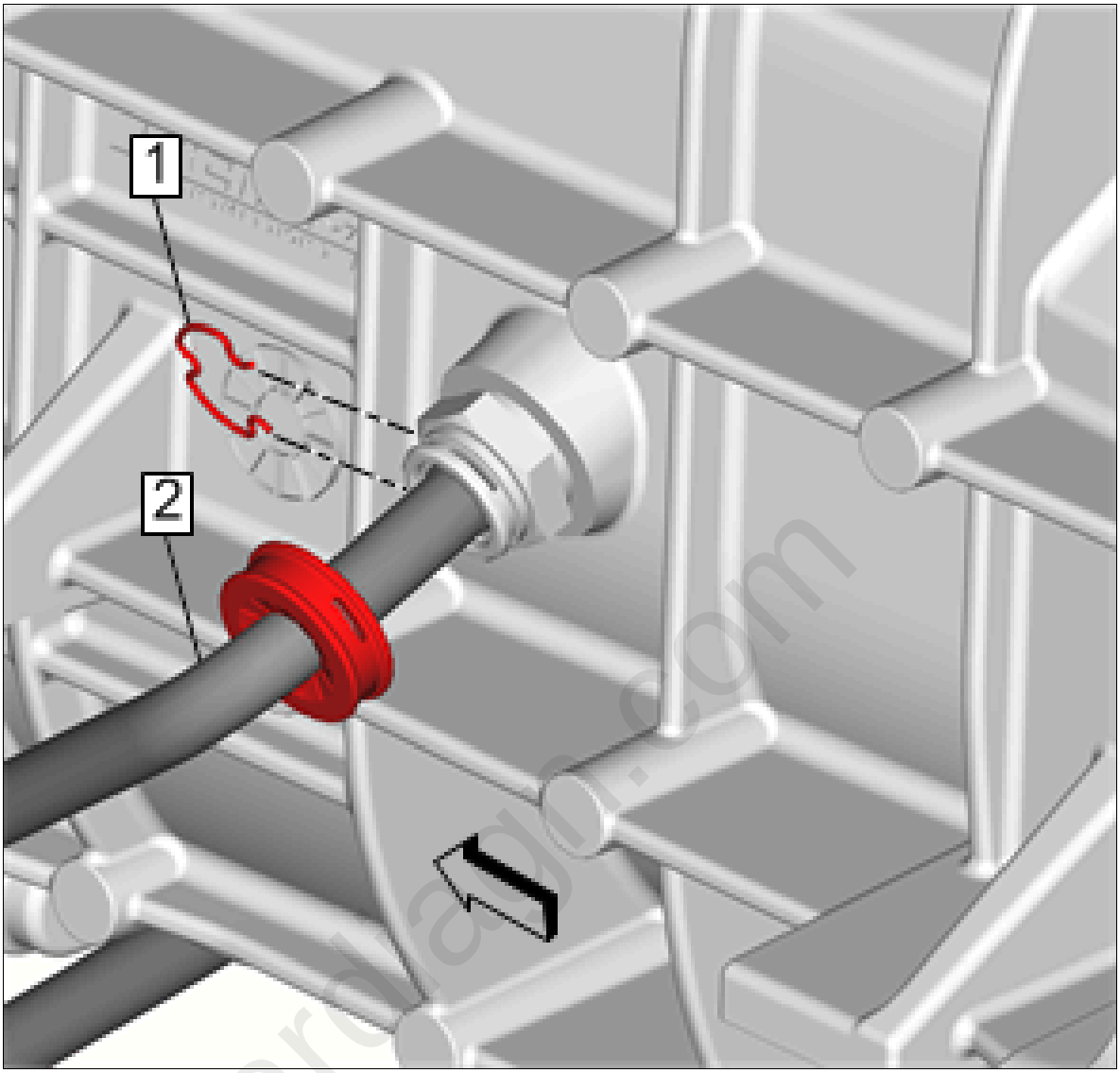
Fig 10: Electrical Connectors



Courtesy of GENERAL MOTORS COMPANY

16. Connect the following electrical connectors:
    1. Backup lamp switch (1)
    2. Vehicle speed sensor (2)
17. Connect the wiring harness retainers (3) to the transmission.
18. Bleed to hydraulic clutch system. Hydraulic Clutch System Bleeding

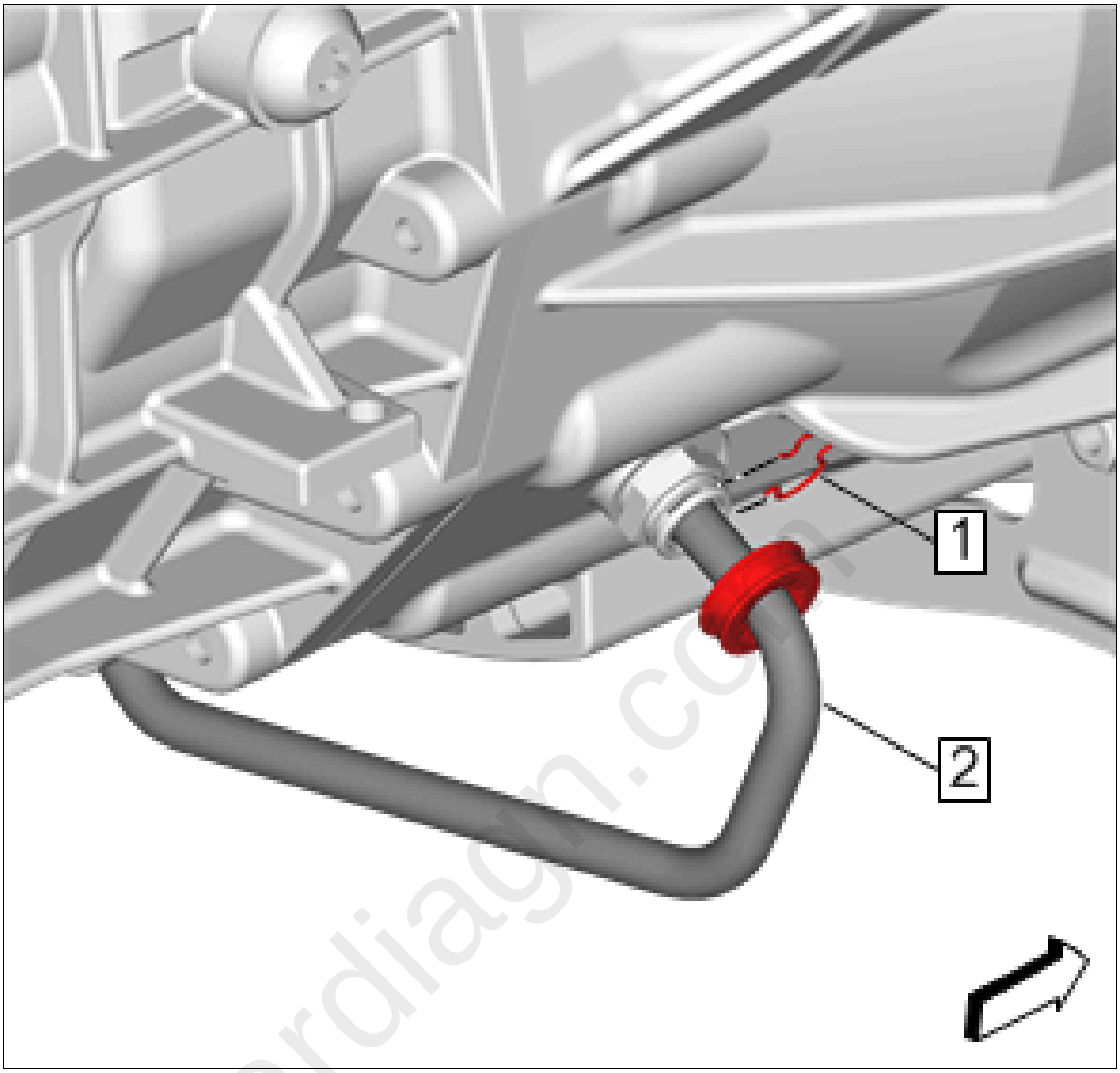
Fig 11: Transmission Fluid Cooler Pipe Fitting Retainer (Left Side)



Courtesy of GENERAL MOTORS COMPANY

19. Install Transmission Fluid Cooler Pipe Fitting Retainer (1) at Transmission Left Side - Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection
20. Install Transmission Fluid Cooler Inlet and Outlet Pipe (2) at Transmission Left Side.

Fig 12: Transmission Fluid Cooler Pipe Fitting Retainer (Rigth Side)

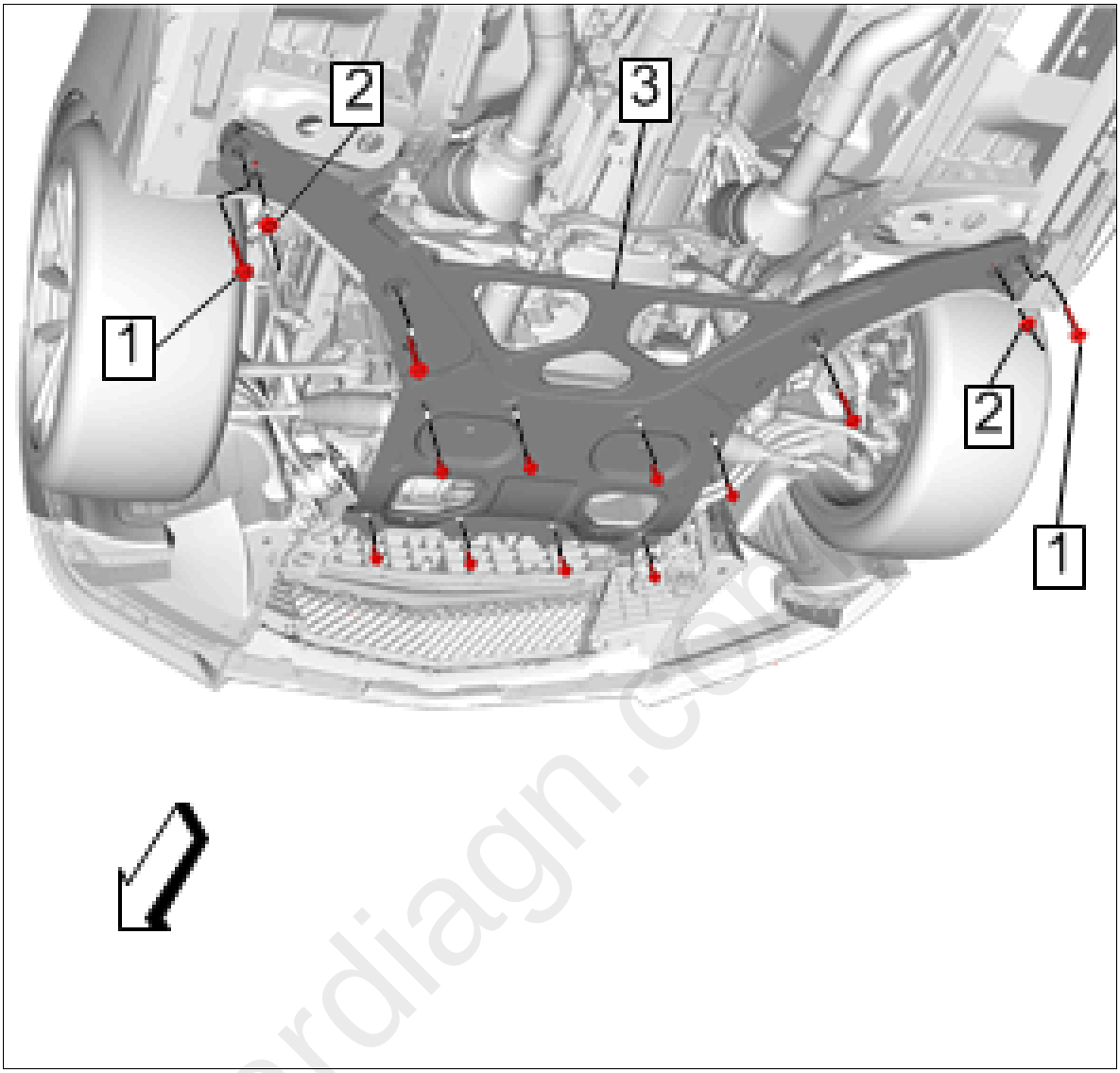


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21. Install Transmission Fluid Cooler Pipe Fitting Retainer (1) at Transmission Right Side - Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection
22. Install Transmission Fluid Cooler Inlet and Outlet Pipe (2) at Transmission Right Side.
23. Install the fluid cooler pipe clip retainer.
24. Check the transmission fluid and fill as necessary. Transmission Fluid Level Inspection (M13 Without Y4Q)

Fig 13: Front Cradle Shear Plate

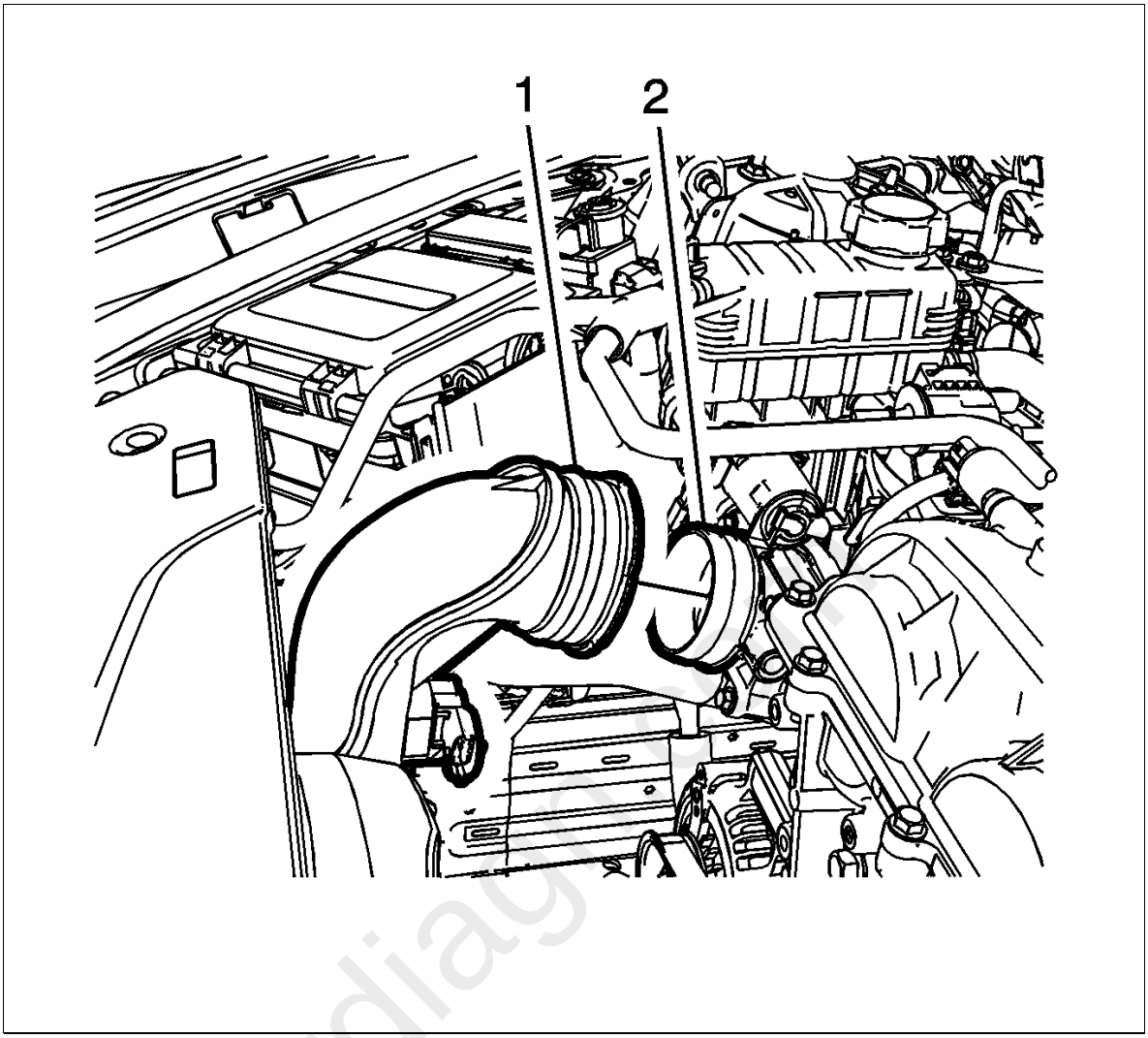


Courtesy of GENERAL MOTORS COMPANY

25. Install the front compartment lower noise shield (3) to the vehicle, if equipped. Front Compartment Lower Noise Shield Replacement (Coupe - LGX, LTG)

REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION REPLACEMENT (M13 WITH LTG ENGINE) > REMOVAL PROCEDURE

Fig 1: Charge Air Cooler Outlet Air Tube And Throttle Body



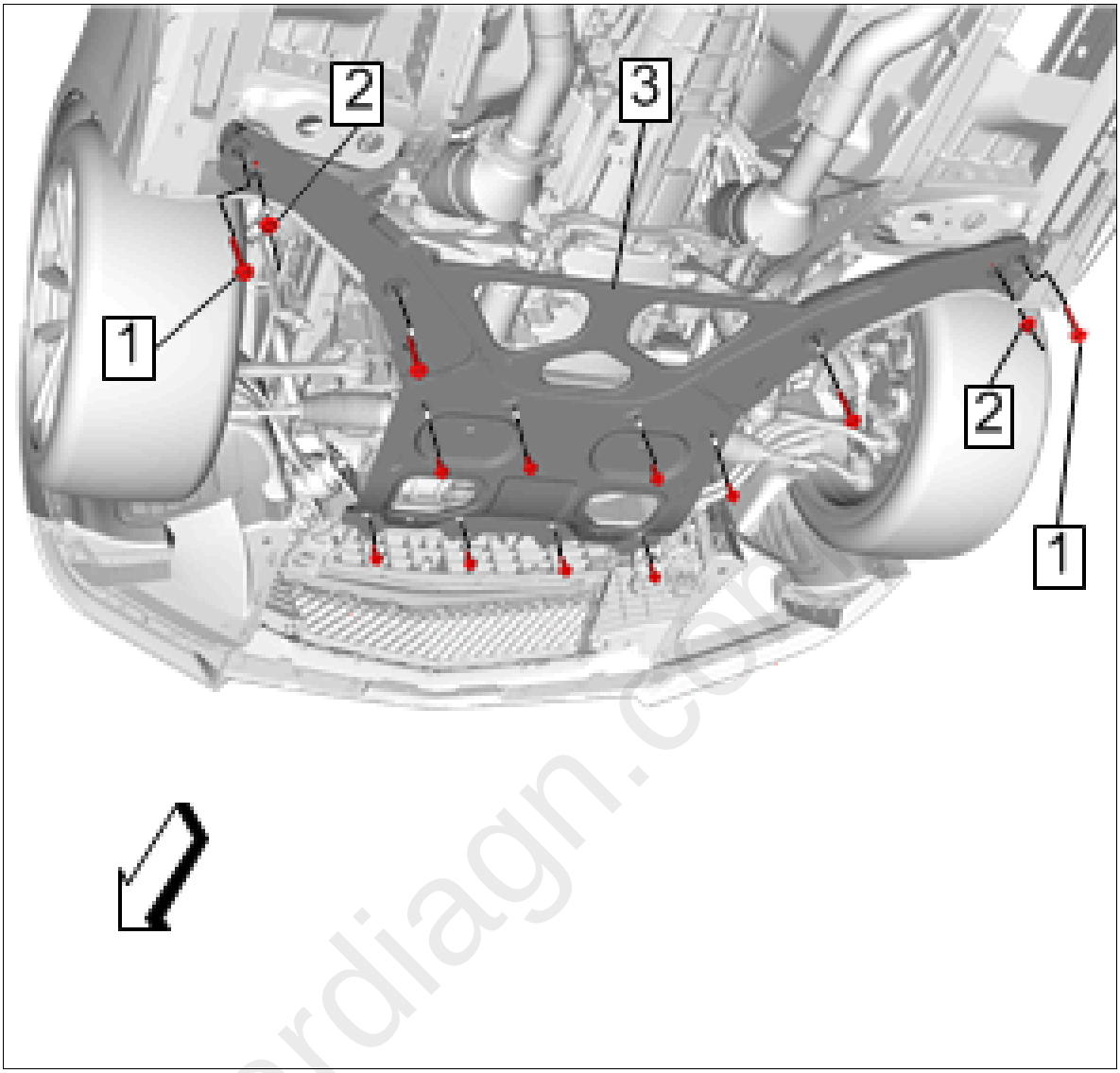
Courtesy of GENERAL MOTORS COMPANY

1. Disconnect the charge air cooler outlet tube (1) from the throttle body (2). Charge Air Cooler Outlet Air Tube Replacement

> *NOTE:*
>
> *Transmission jack is installed to transmission in this step.*

2. Disconnect the shift control assembly from the transmission. Shift Control Assembly Replacement (M13)

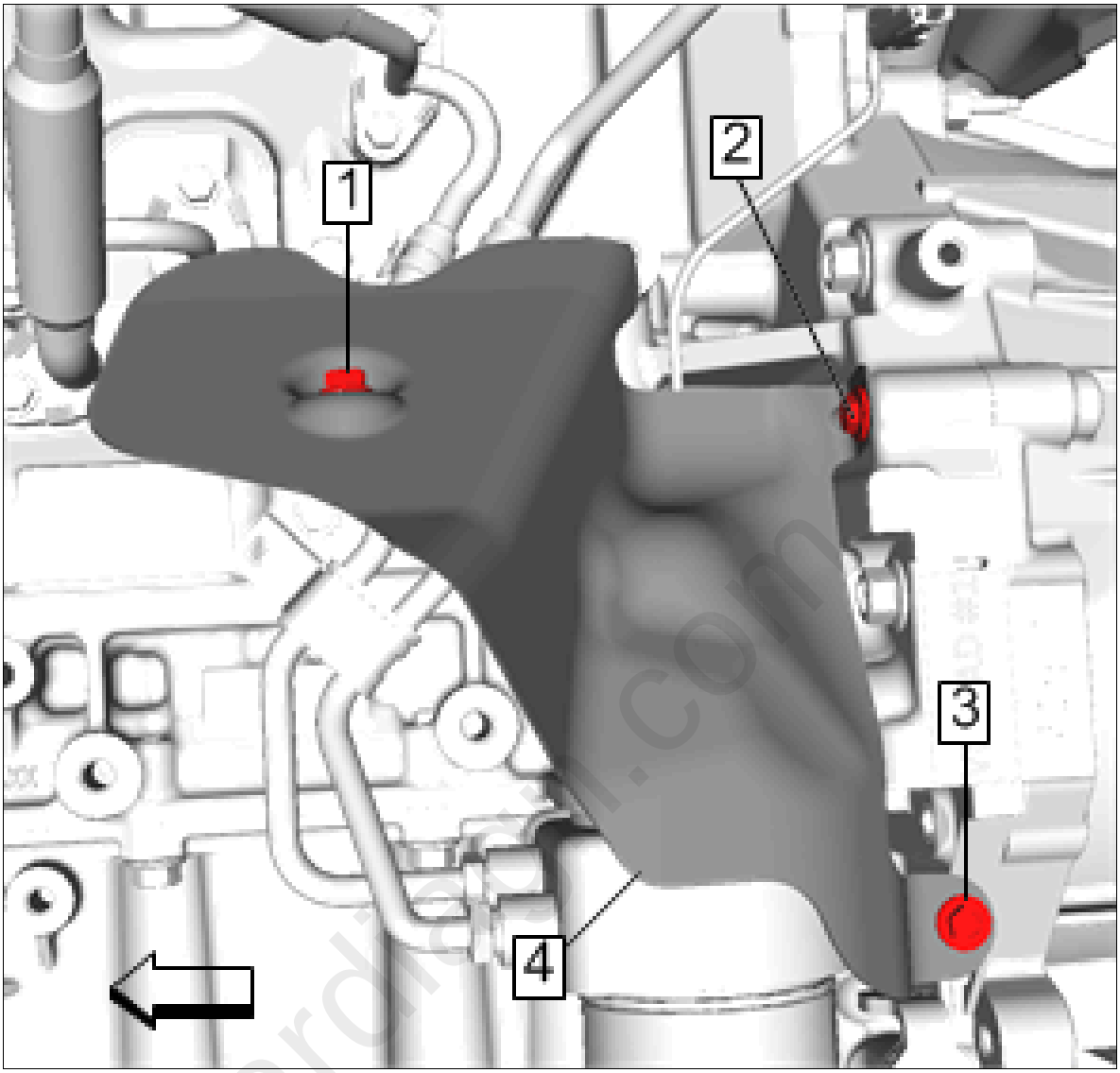
Fig 2: Front Cradle Shear Plate



Courtesy of GENERAL MOTORS COMPANY

3. Remove the front compartment lower noise shield (3) from the vehicle. Front Compartment Lower Noise Shield Replacement (Coupe - LGX, LTG)

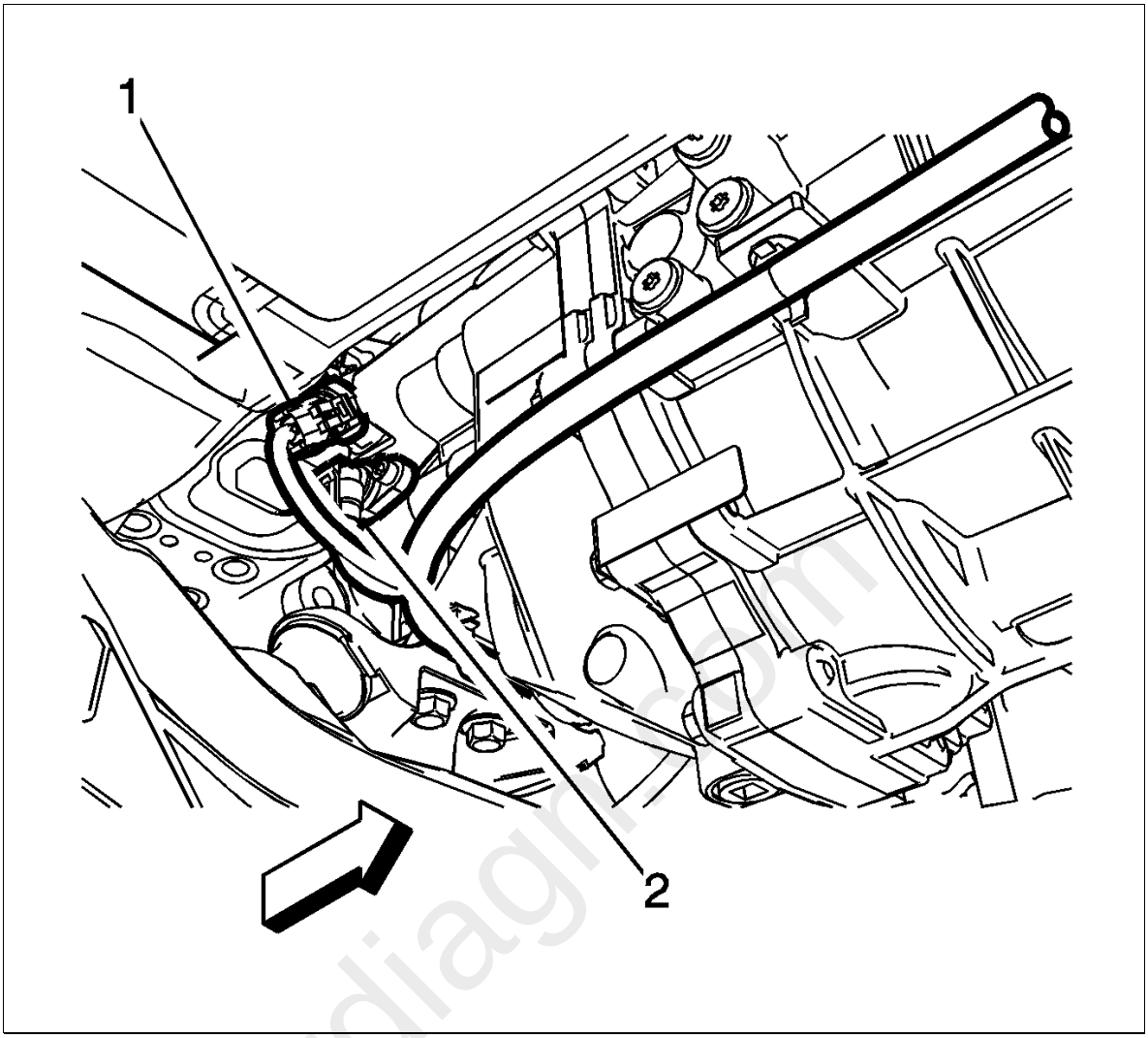
Fig 3: Catalytic Converter Shield



Courtesy of GENERAL MOTORS COMPANY

4. Remove the oil pump flow control valve heat shield (4) from the engine assembly. Oil Pump Flow Control Valve Heat Shield Replacement

Fig 4: Vehicle Speed Sensor Electrical Connector

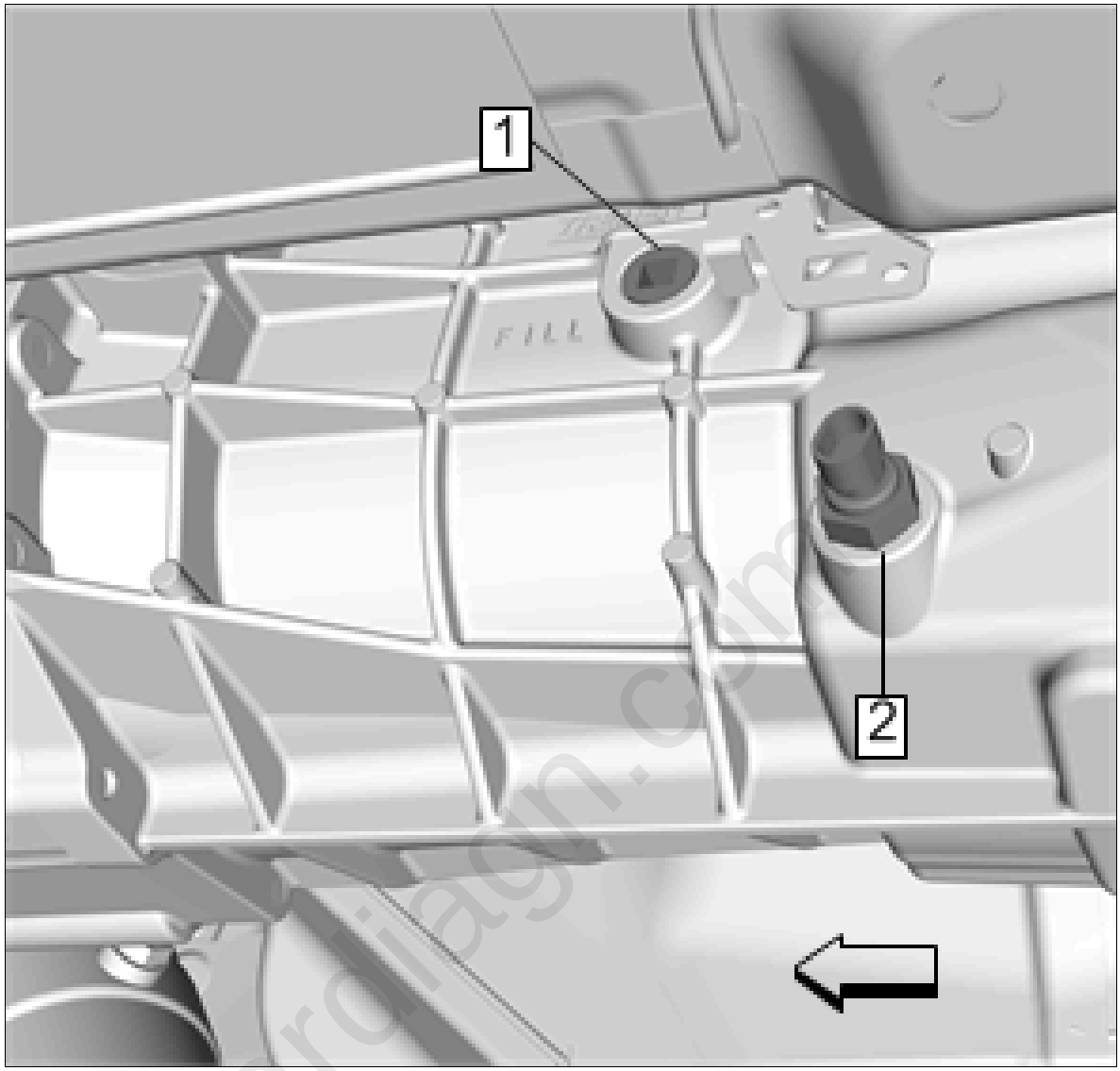


Courtesy of GENERAL MOTORS COMPANY

5. Disconnect the following electrical connectors:
    1. Backup lamp switch (1)
    2. Vehicle speed sensor (2)

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Fig 5: Fluid Temperature Sensor Connector

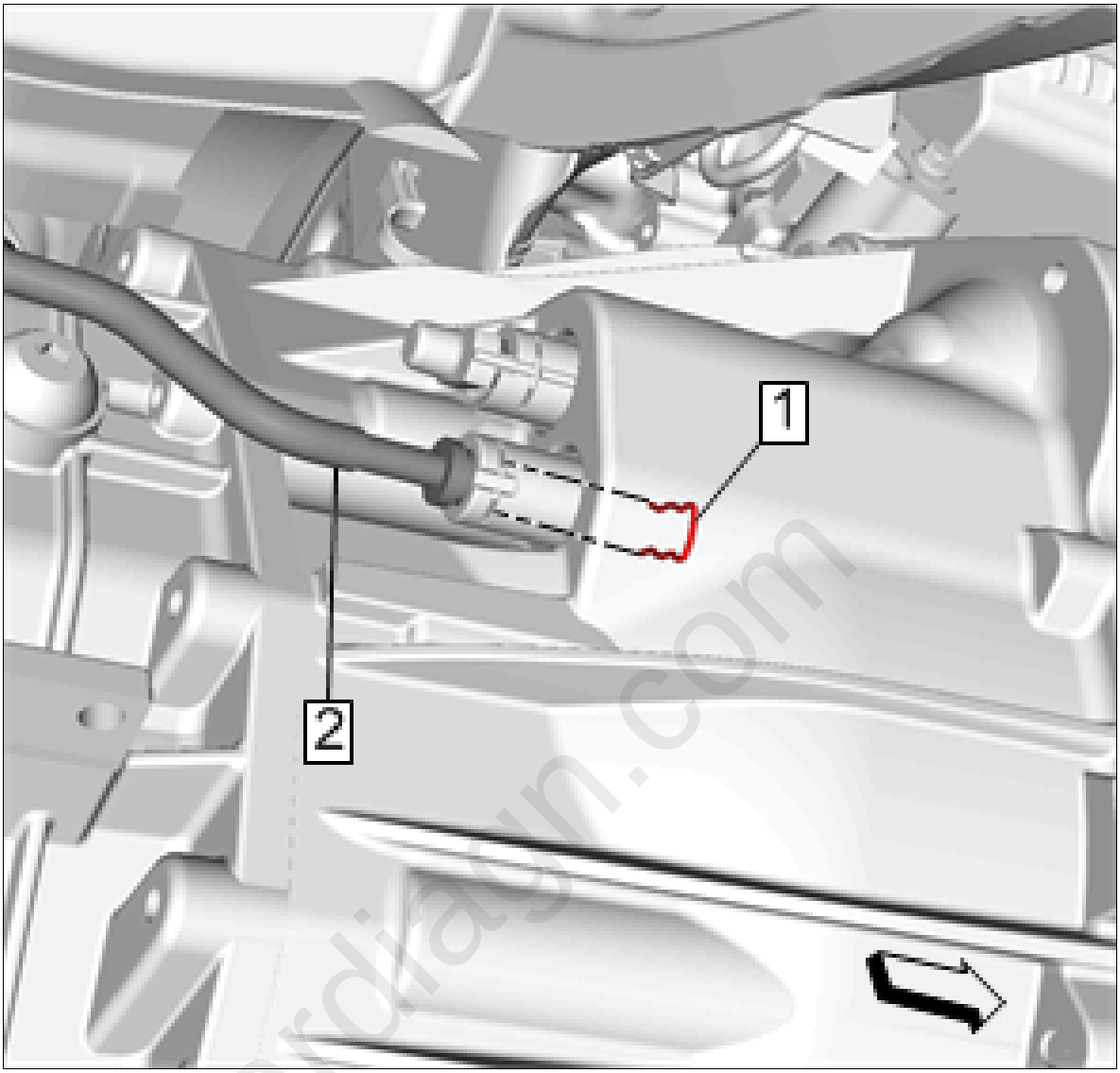


Courtesy of GENERAL MOTORS COMPANY

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6. Disconnect the electrical connector from the transmission temperature sensor (2).

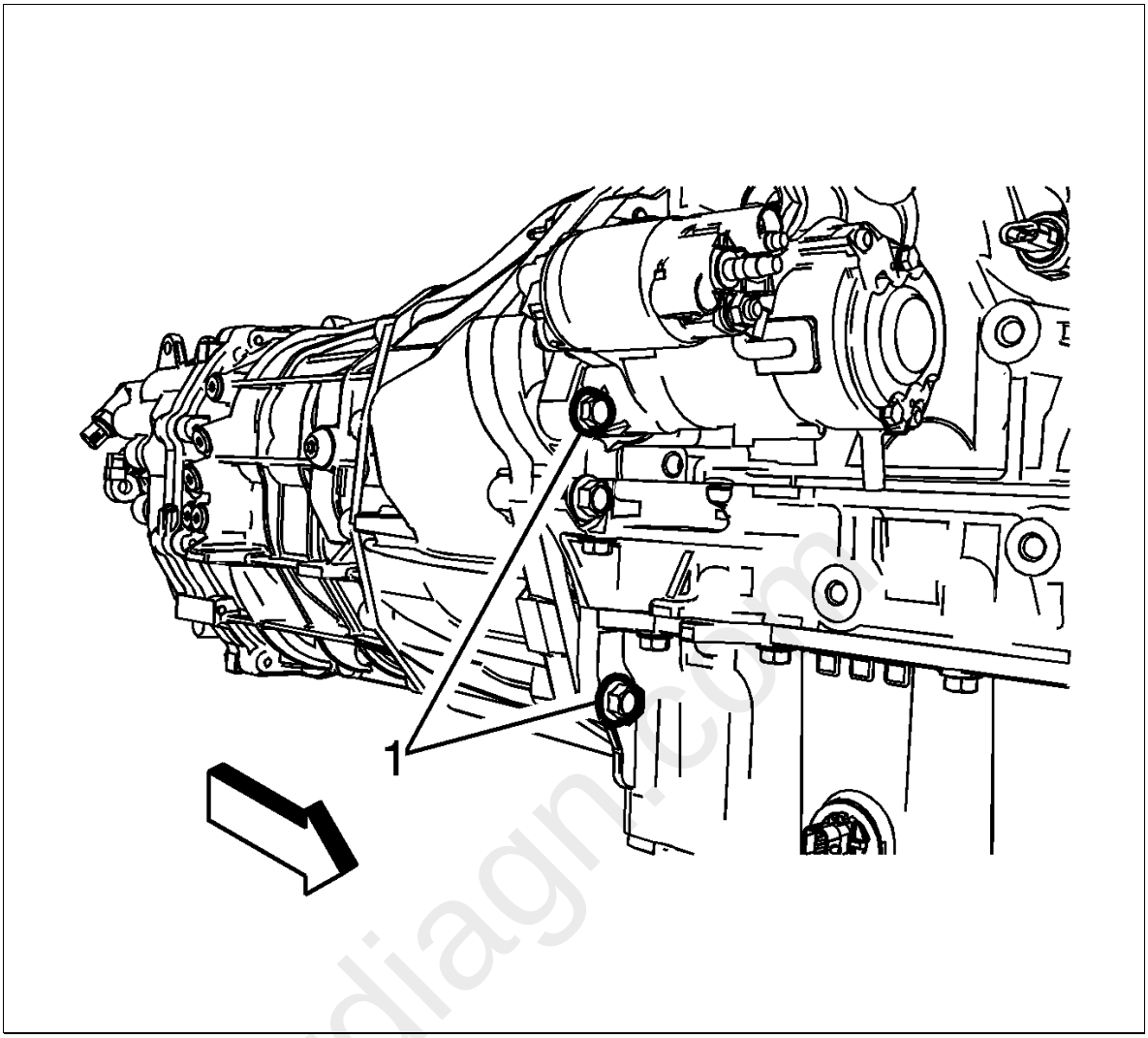
Fig 6: Lower Slave Cylinder Hose



Courtesy of GENERAL MOTORS COMPANY

7. Remove the hydraulic clutch hose/pipe (1) retaining clip from the clutch slave cylinder.
8. Disconnect the hydraulic clutch hose/pipe (2) from the clutch slave cylinder. Plug the lower hose end.

Fig 7: Lower Transmission Clutch Housing To Engine Fasteners (Engine Side)

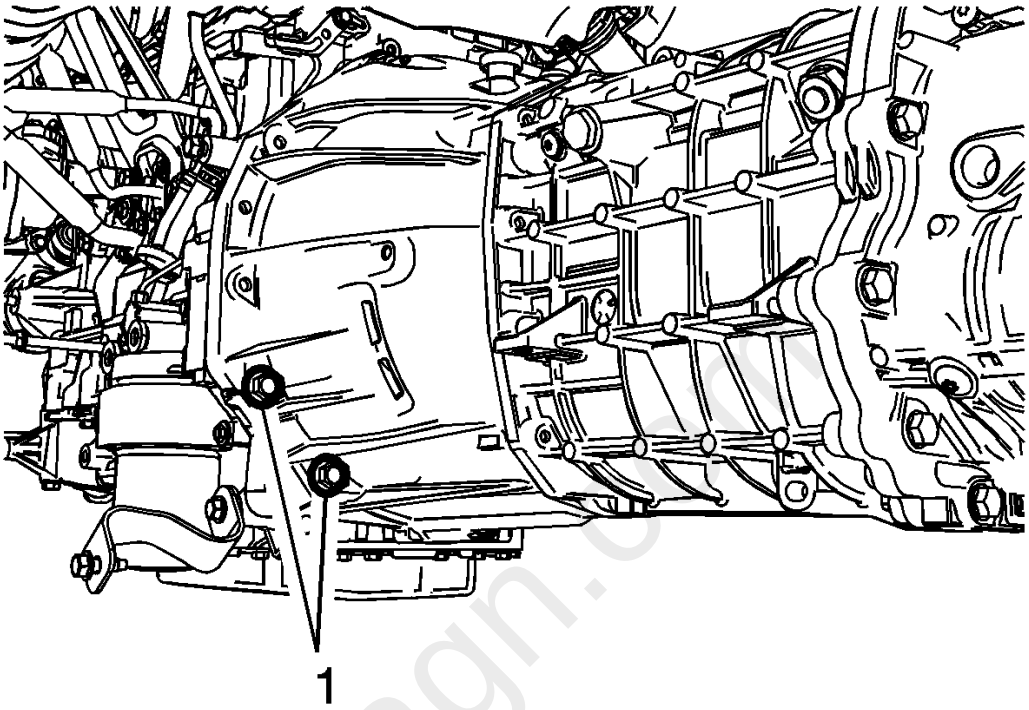


Courtesy of GENERAL MOTORS COMPANY

9. Remove the two right (engine side) lower transmission clutch housing to engine fasteners (1).

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Fig 8: Lower Transmission Clutch Housing To Engine Fasteners (Transmission Side)

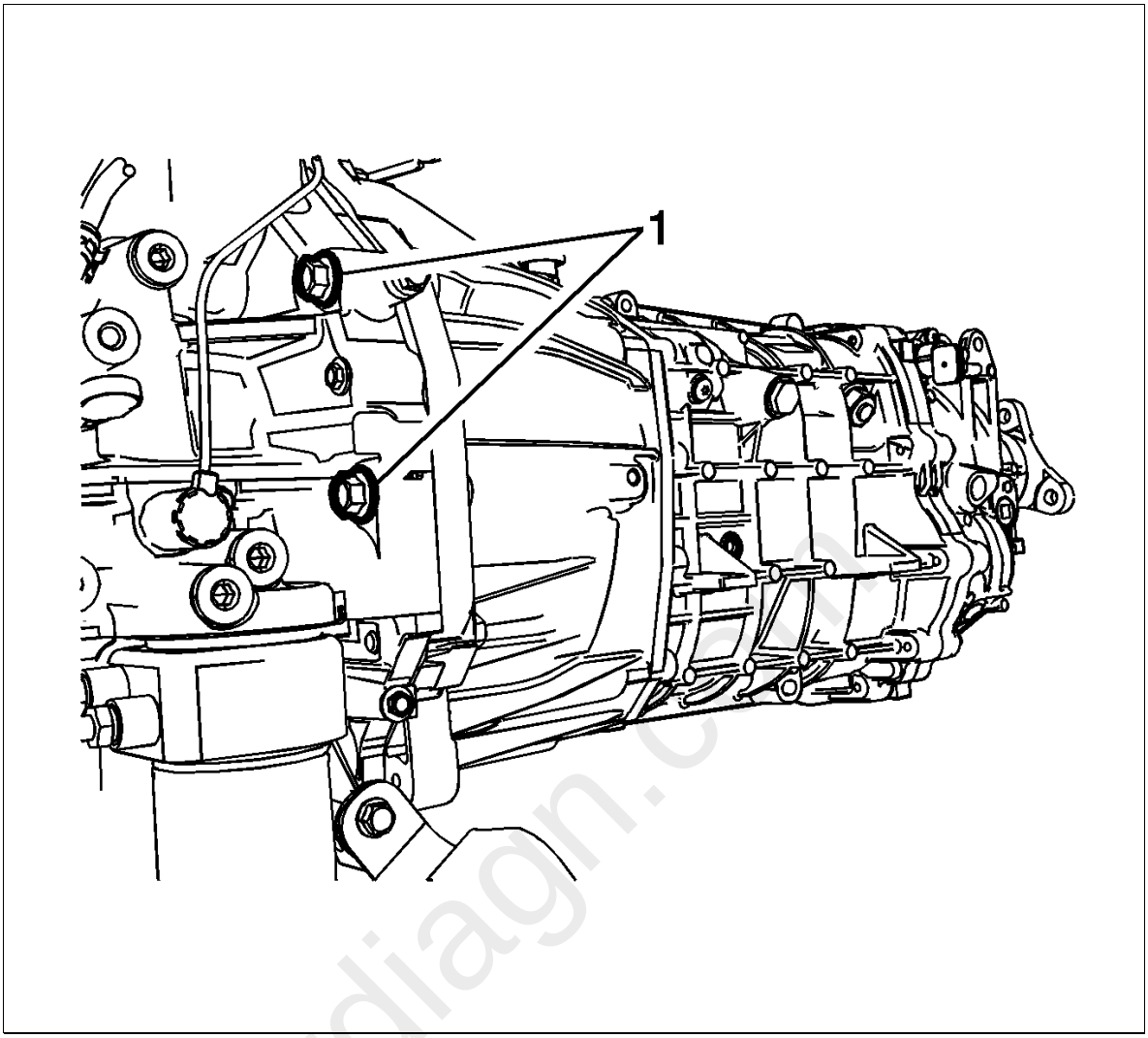


Courtesy of GENERAL MOTORS COMPANY

10. Remove the two right (transmission side) lower transmission clutch housing to engine fasteners (1).

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Fig 9: Left Lower Transmission Clutch Housing To Engine Fasteners

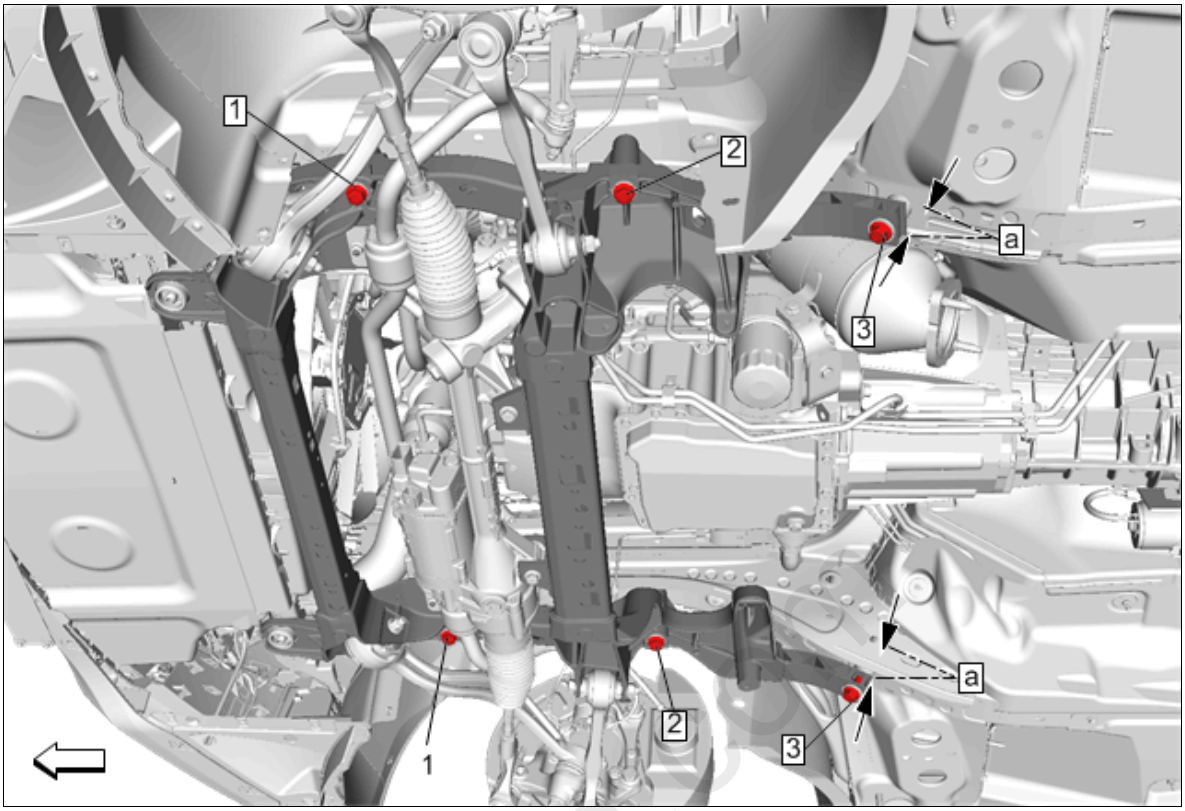


Courtesy of GENERAL MOTORS COMPANY

11. Remove the two left lower transmission clutch housing to engine fasteners (1).

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Fig 10: Front And Rear Cradle Bolts



Courtesy of GENERAL MOTORS COMPANY

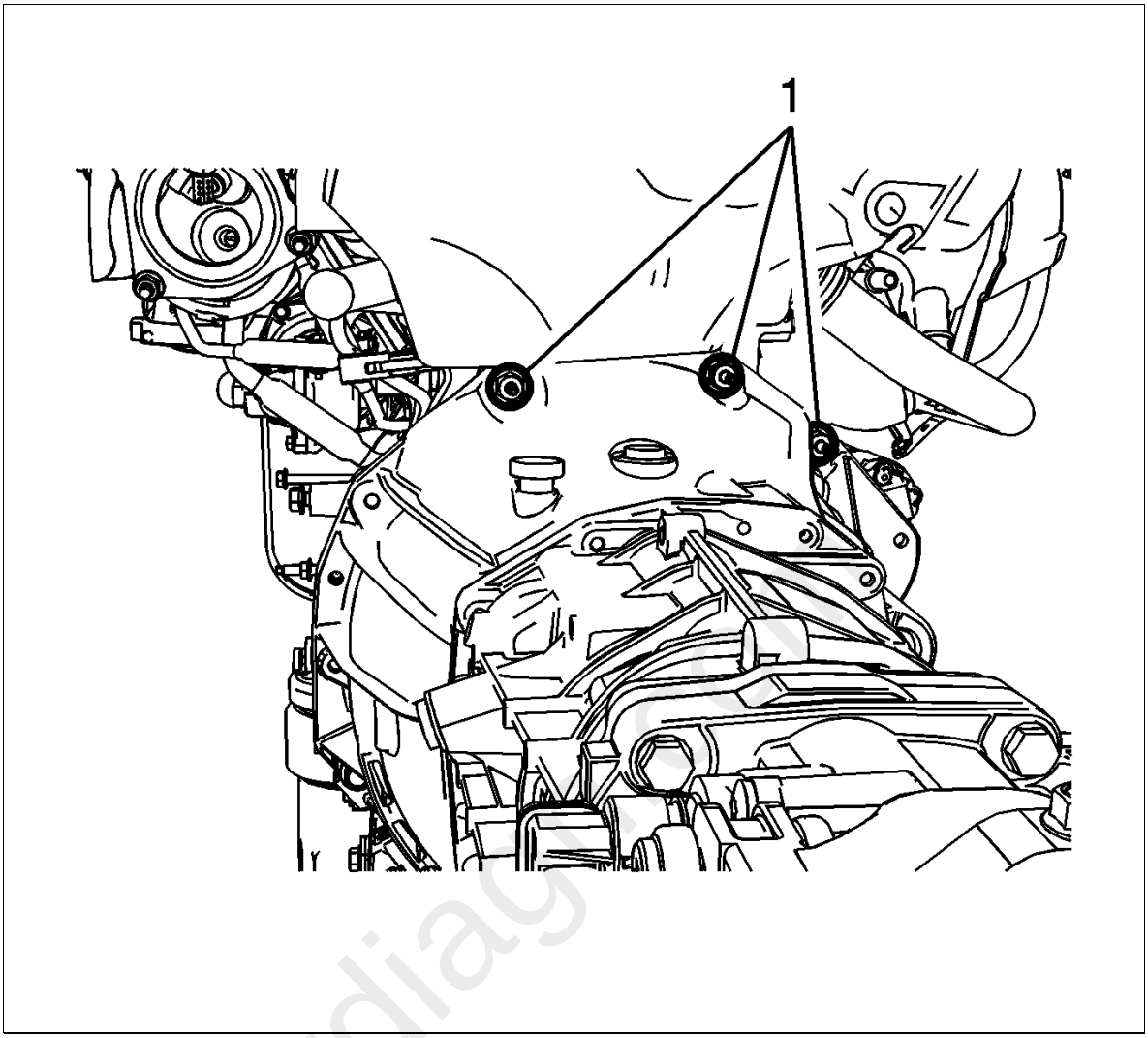
NOTE:

Securely support the drivetrain and front suspension cradle with an adjustable jack.

12. Loosen the front cradle bolts (1) one turn, remove the rear cradle bolts (3) completely, loosen the middle cradle bolts (2) enough to allow the rear of the cradle support to tilt down with the jack approximately 25 mm (1 in) (a).

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Fig 11: Upper Transmission Clutch Housing To Engine Fasteners



Courtesy of GENERAL MOTORS COMPANY

13. Remove the three upper transmission clutch housing to engine fasteners (1).

> *NOTE:*
>
> *Do not leave the engine tilted on its mounts for an extended amount of time.*

14. Remove the transmission from the vehicle. To clear the body structure, the front of the engine can be pushed up to tilt the engine and transmission.

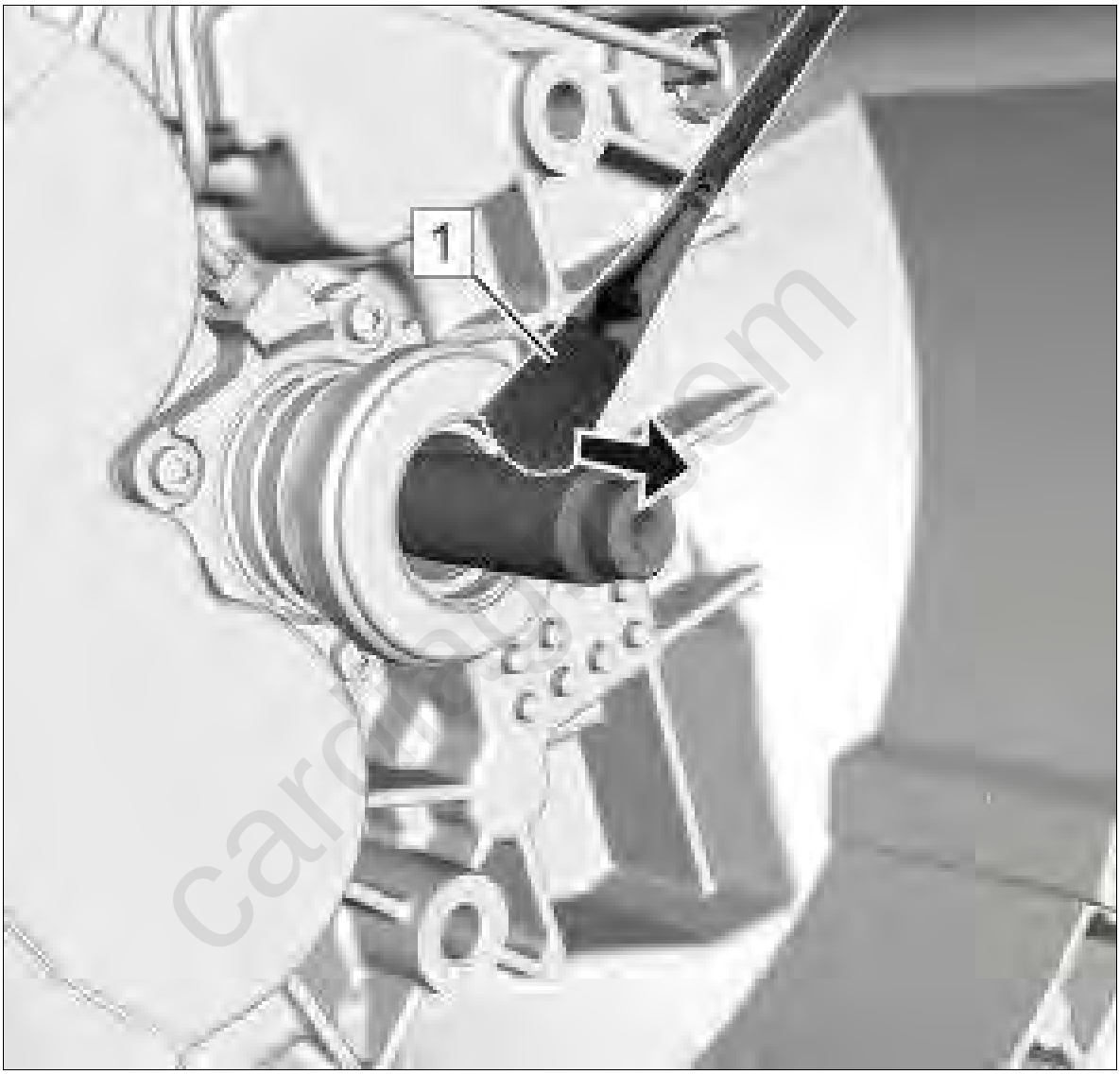
REPAIR INSTRUCTIONS - ON VEHICLE > TRANSMISSION REPLACEMENT (M13 WITH LTG ENGINE) > INSTALLATION PROCEDURE

> *WARNING:*

Use care when cleaning the clutch hub. The clutch hub may have sharp edges and can cause personal injury if contact is made. Wear protective gloves to avoid personal injury.

1. Clean the clutch hub and the input shaft from any debris and contaminates with a lint-free towel.

Fig 1: Flat Brush To Apply Light Coating Of Multi-Purpose Grease



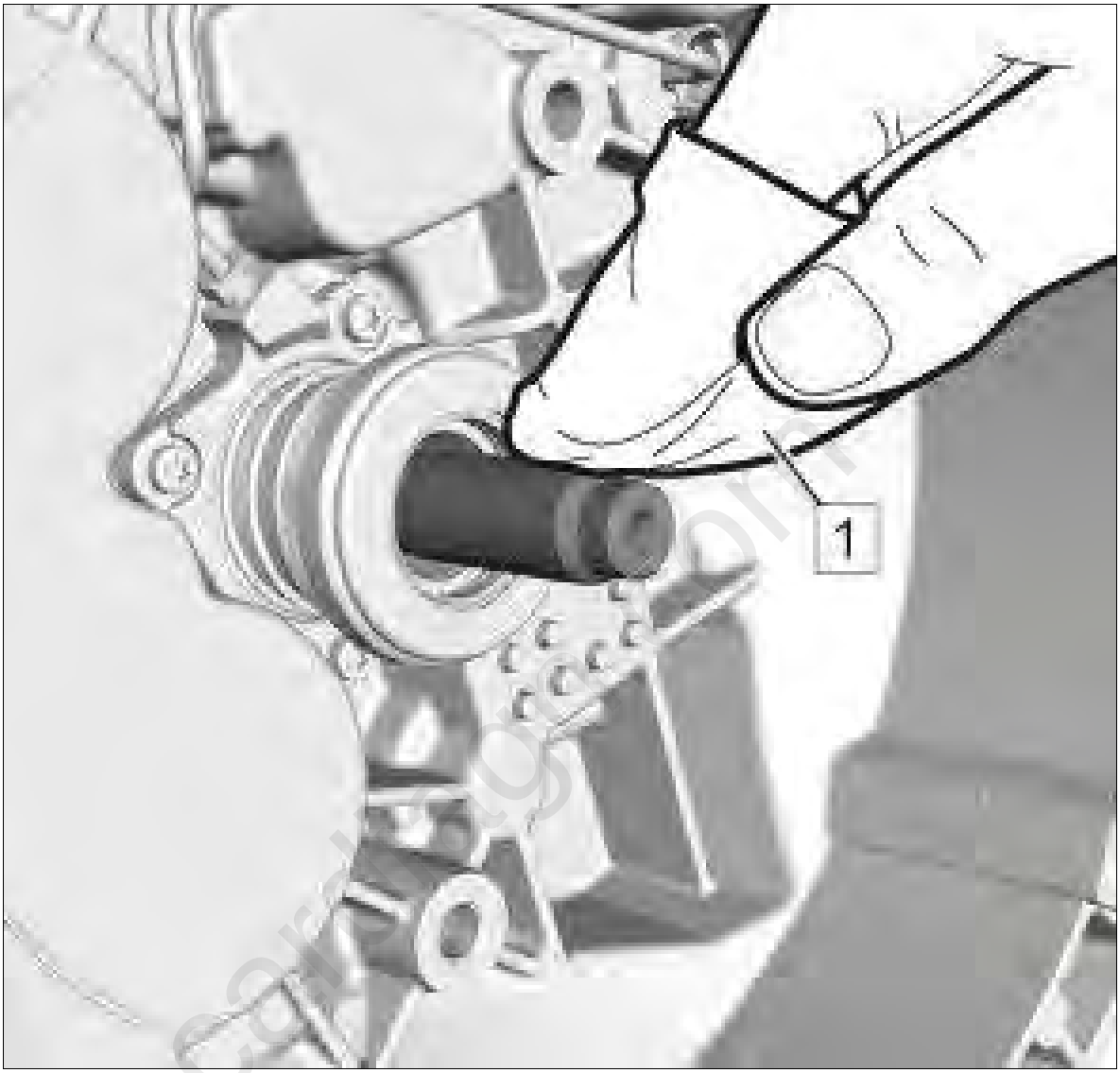
Courtesy of GENERAL MOTORS COMPANY

⚠ *CAUTION:*

Applying too much or the wrong type of grease on the transmission input shaft may cause damage, clutch slippage or failure. Always apply the correct type of grease. Never apply more grease than is necessary to coat the transmission input shaft with a very thin film of grease.

2. Use a clean flat brush (1) to apply very light coating of multi-purpose grease to input shaft until the metal is only shiny. No visible clumps of grease are permissible regardless of size. Smear away from the transmission in direction of the shown arrow.

   Fig 2: Lead Surface Of Input Shaft With Lint-Free Towel



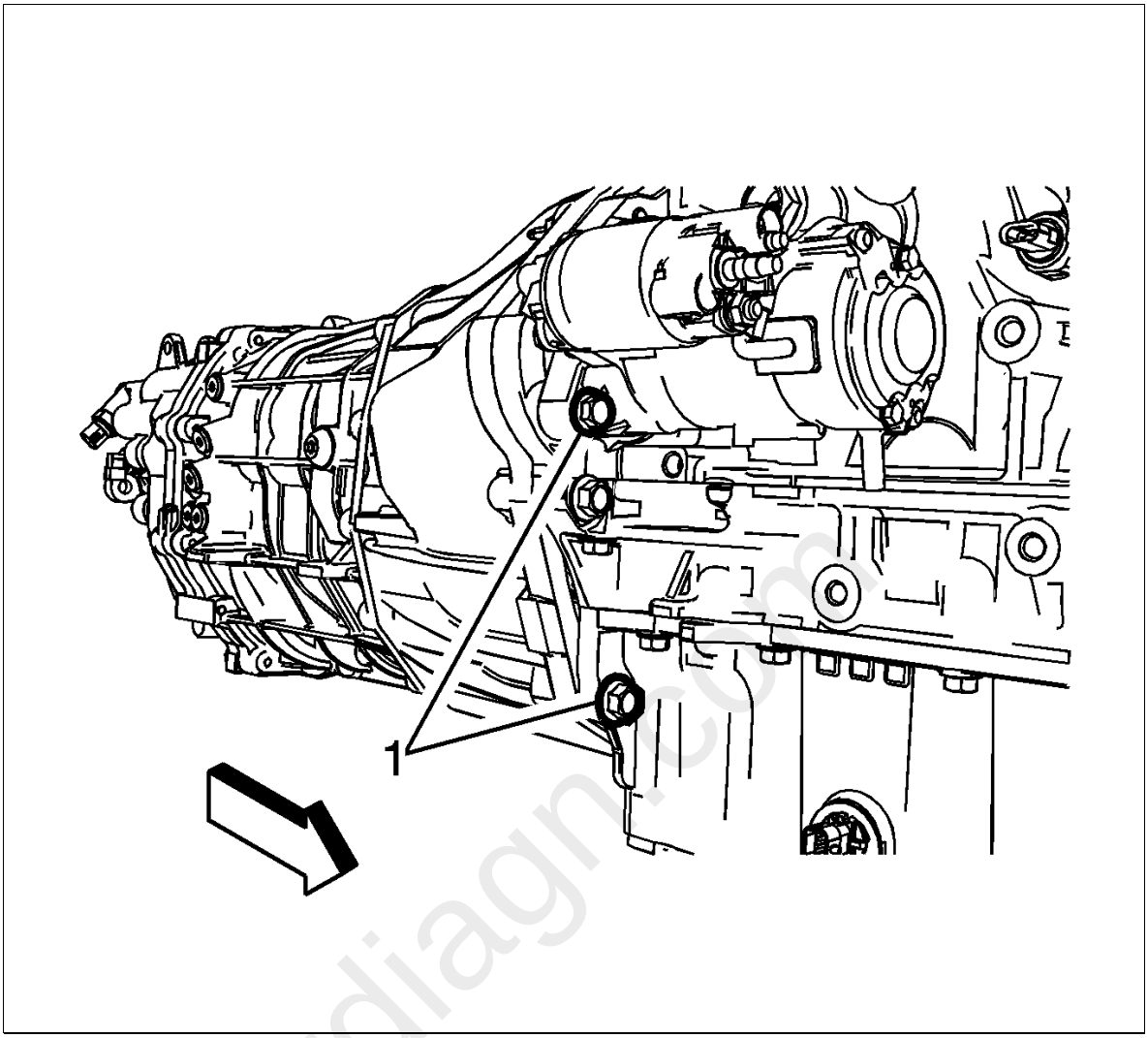
Courtesy of GENERAL MOTORS COMPANY

> ⚠ *CAUTION:*
>
> *Ensure that no grease remains on the lead surface of the transmission input shaft. Clean the lead surface of the transmission input shaft prior to the assembly of the transmission to the engine. Failure to maintain a clean surface may cause clutch slippage or failure.*

3. Clean the entire lead surface of the input shaft with a NEW, lint-free towel (1).

4. With the cradle in the lowered position, fit the transmission to the vehicle. It may be necessary to push up on the front of the engine to gain enough clearance to the body structure.

Fig 3: Lower Transmission Clutch Housing To Engine Fasteners (Engine Side)



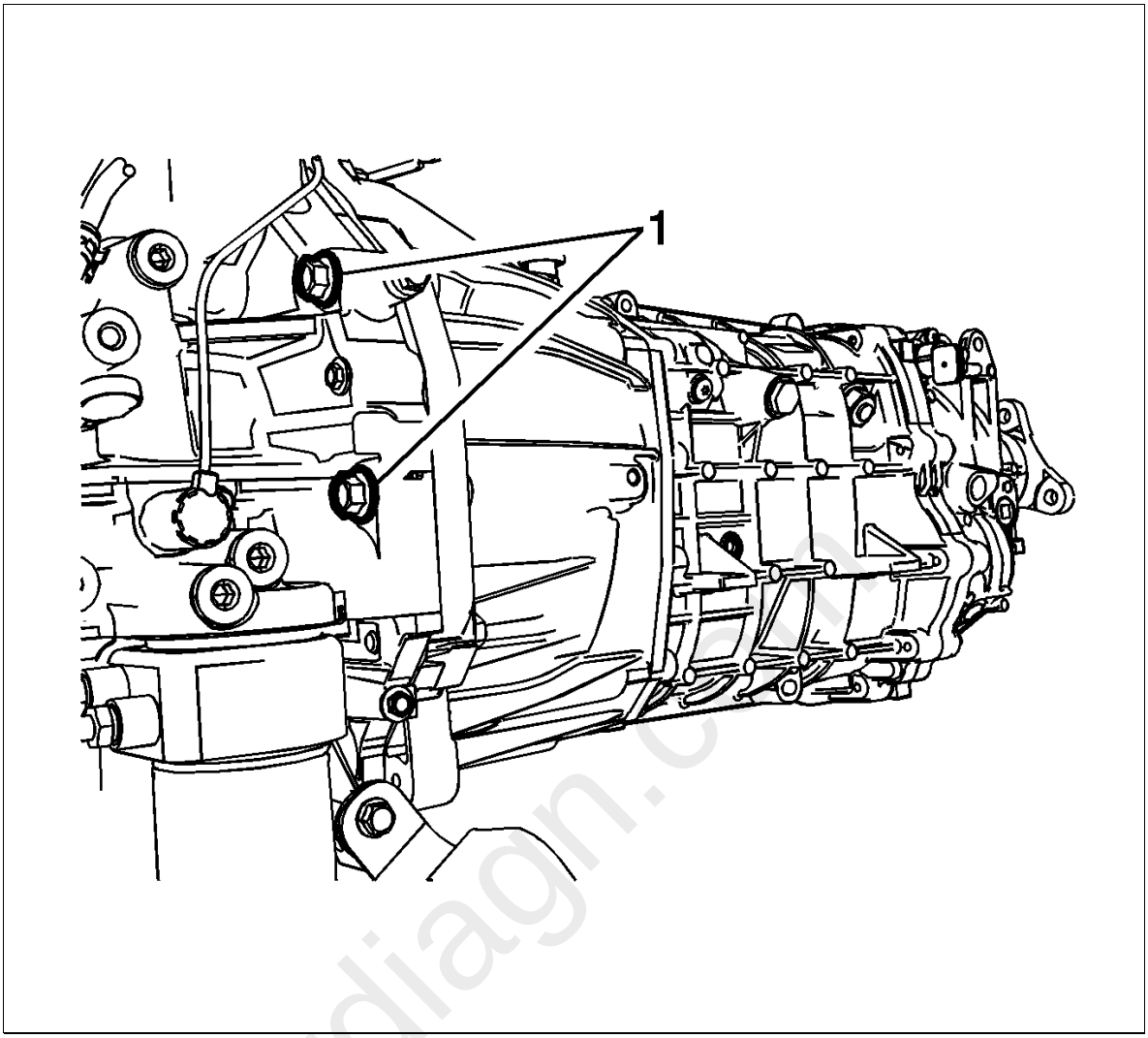
Courtesy of GENERAL MOTORS COMPANY

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> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

5. Install the two right (engine side) lower transmission clutch housing to engine fasteners (1) and tighten to 50 N.m (37 lb ft).

Fig 4: Left Lower Transmission Clutch Housing To Engine Fasteners

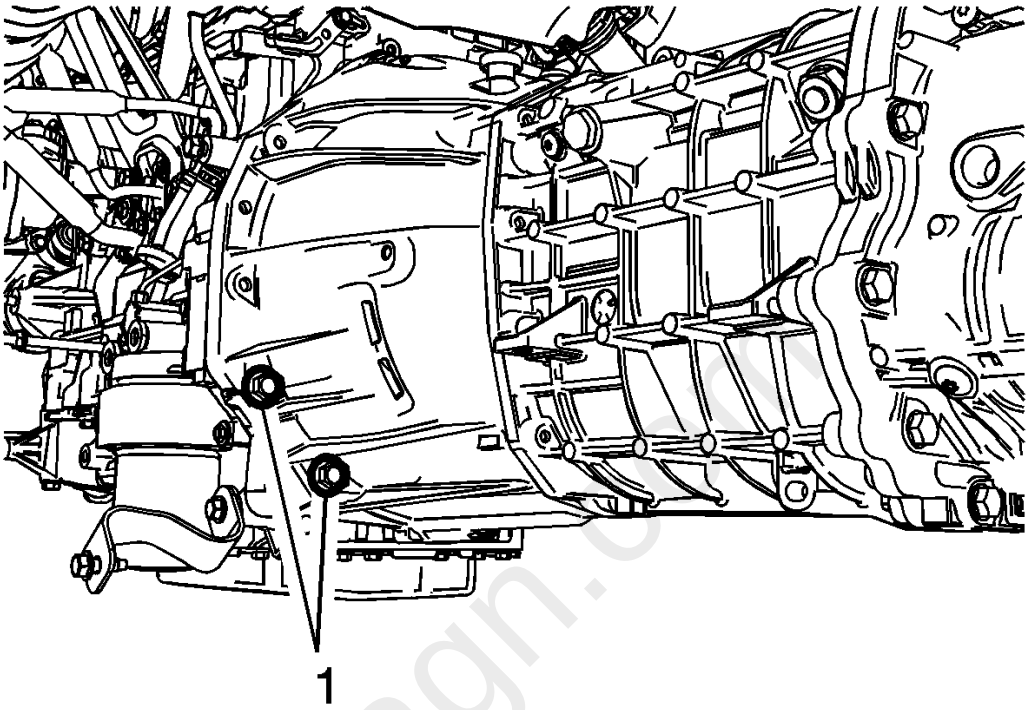


Courtesy of GENERAL MOTORS COMPANY

6. Install the two left lower transmission clutch housing to engine fasteners (1) and tighten to 50 N.m (37 lb ft).

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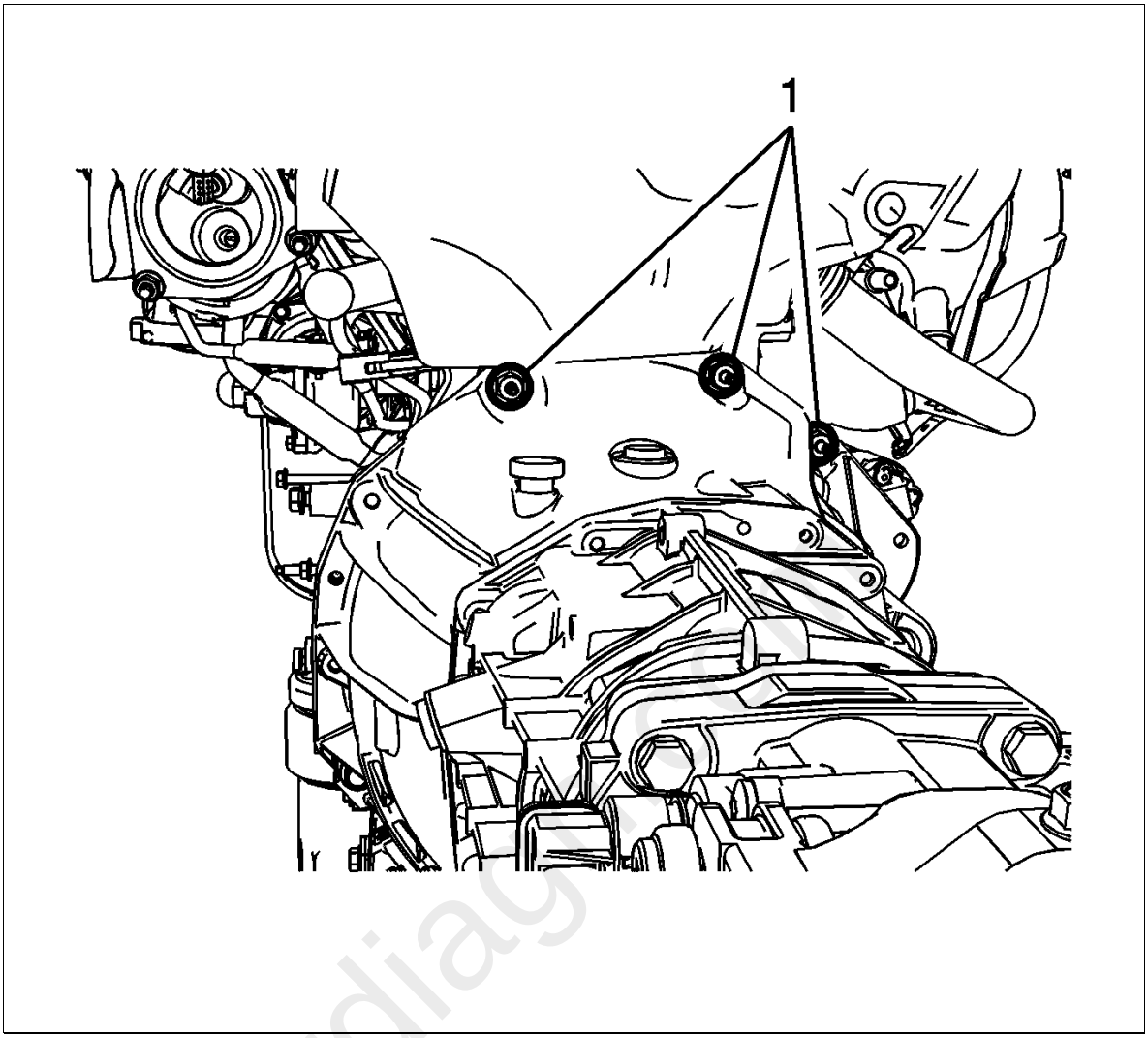
Fig 5: Lower Transmission Clutch Housing To Engine Fasteners (Transmission Side)



Courtesy of GENERAL MOTORS COMPANY

7. Install the two right (transmission side) lower transmission clutch housing to engine fasteners (1) and tighten to 50 N.m (37 lb ft).

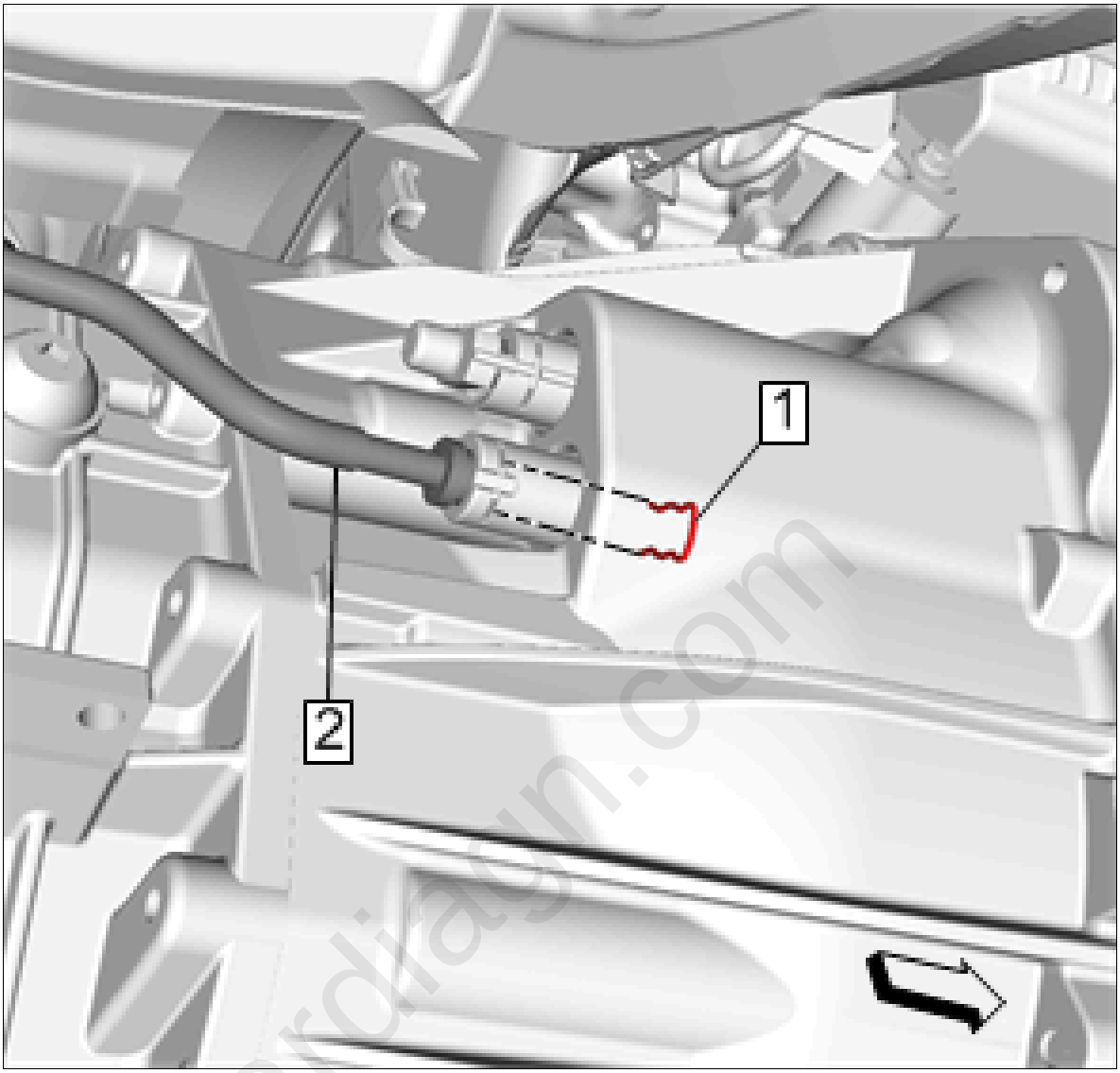
Fig 6: Upper Transmission Clutch Housing To Engine Fasteners



Courtesy of GENERAL MOTORS COMPANY

8. Install the upper transmission clutch housing to engine bolts and studs (1) and tighten to 50 N.m (37 lb ft).

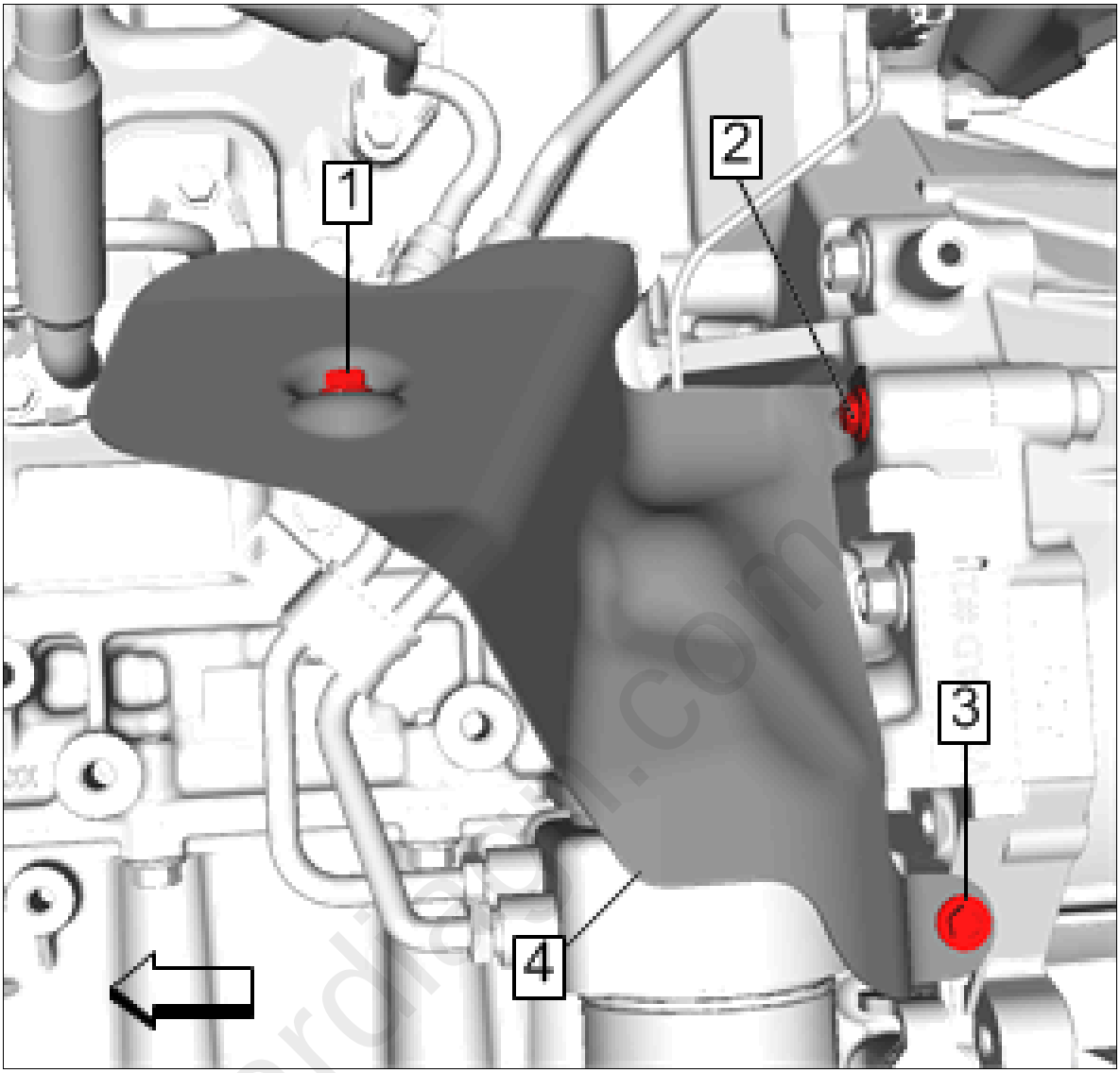
Fig 7: Lower Slave Cylinder Hose



Courtesy of GENERAL MOTORS COMPANY

9. Connect the lower slave cylinder hose (2) to the slave cylinder.
10. Install the hydraulic clutch hose/pipe retaining clip (1) to the clutch slave cylinder.
11. Connect the shift control assembly to the transmission. Shift Control Assembly Replacement (M13)
12. Tilt engine and transmission up and tighten all cradle bolts. Drivetrain and Front Suspension Cradle Replacement (LTG)
13. Install the transmission mount. Transmission Rear Mount Replacement (M13 Transmission)

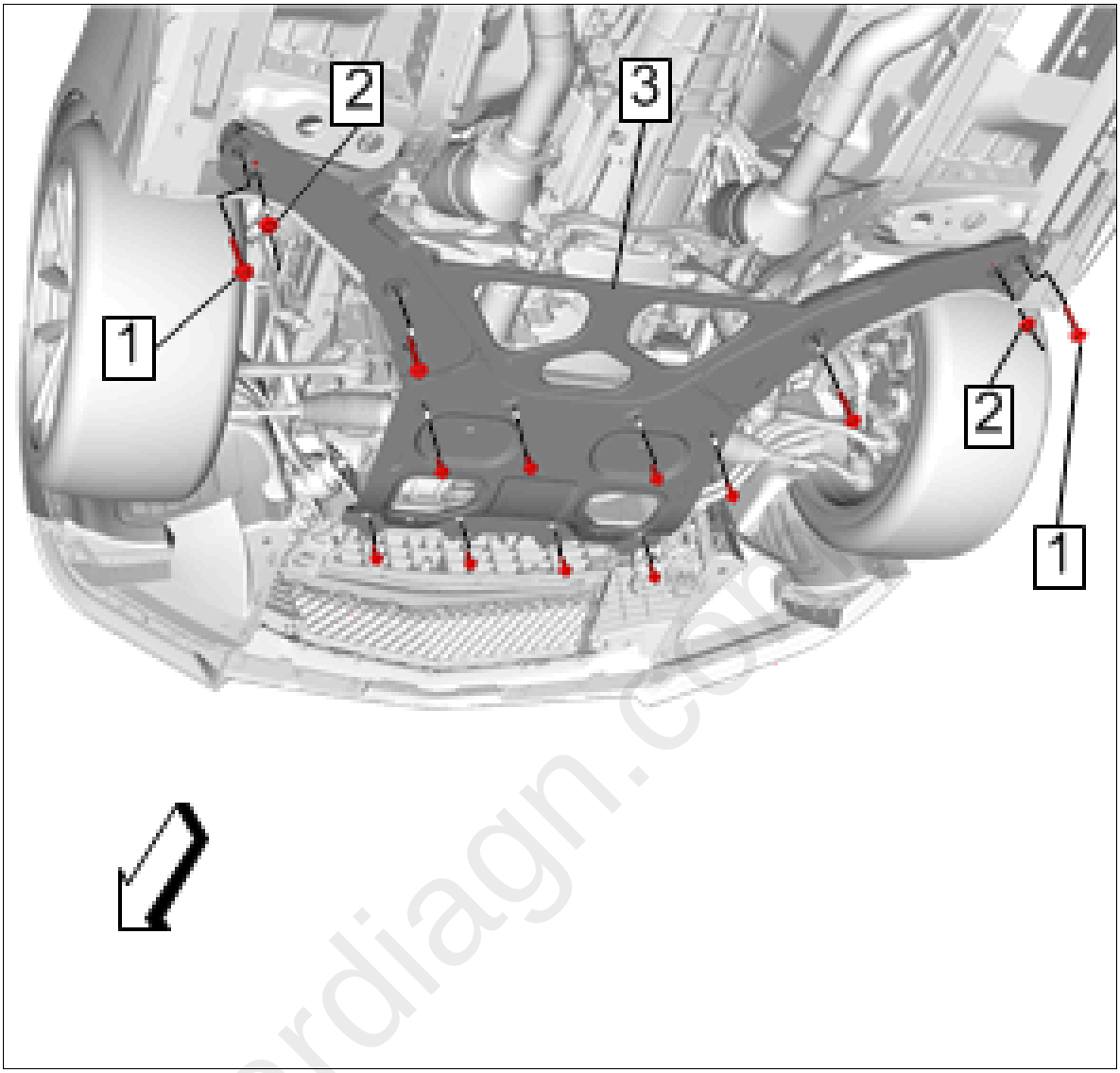
Fig 8: Catalytic Converter Shield



Courtesy of GENERAL MOTORS COMPANY

14. Install the oil pump flow control valve heat shield (4) to the engine assembly. Oil Pump Flow Control Valve Heat Shield Replacement

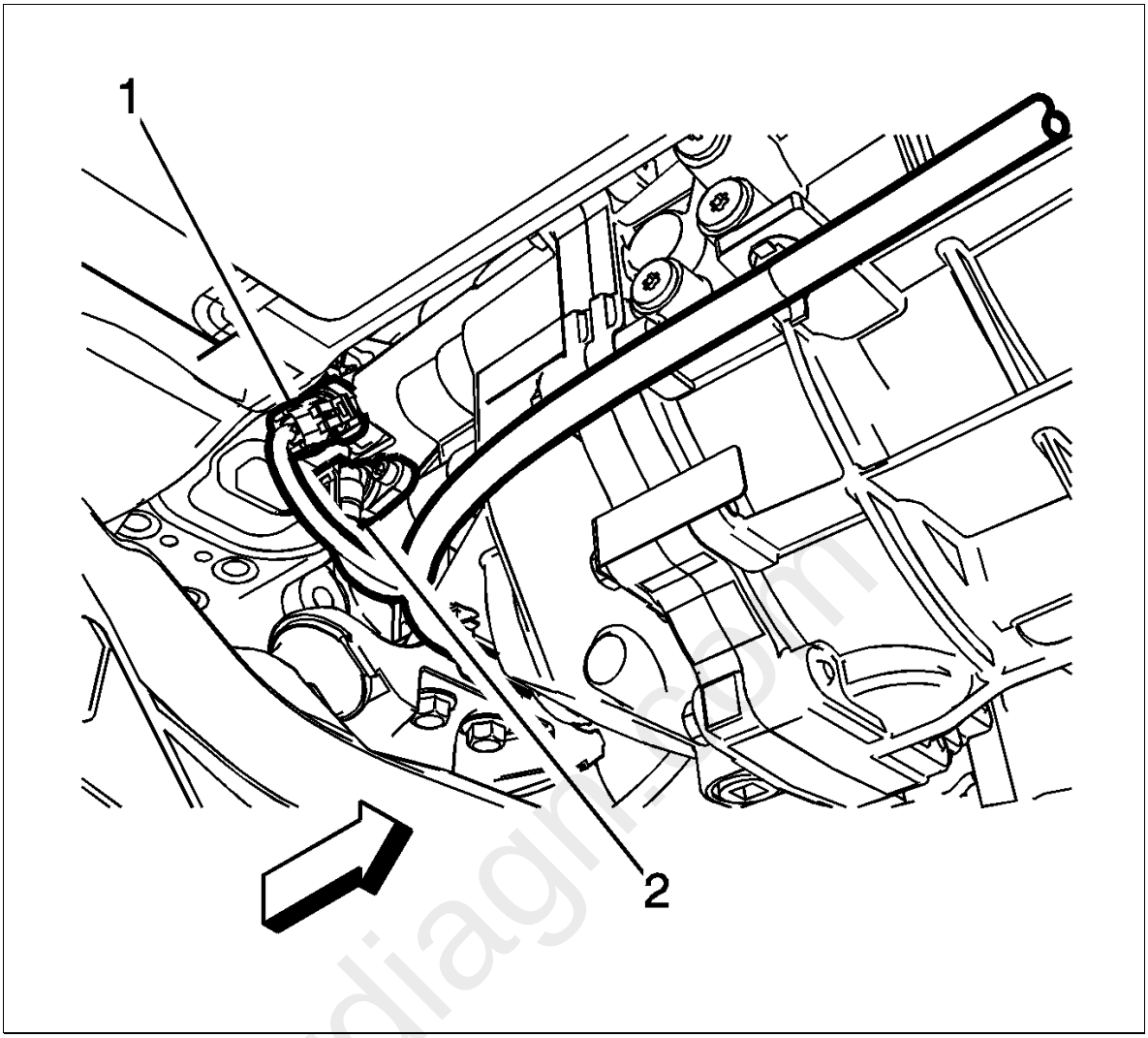
Fig 9: Front Cradle Shear Plate



Courtesy of GENERAL MOTORS COMPANY

15. Install the front compartment lower noise shield (3) to the vehicle. Front Compartment Lower Noise Shield Replacement (Coupe - LGX, LTG)

Fig 10: Vehicle Speed Sensor Electrical Connector

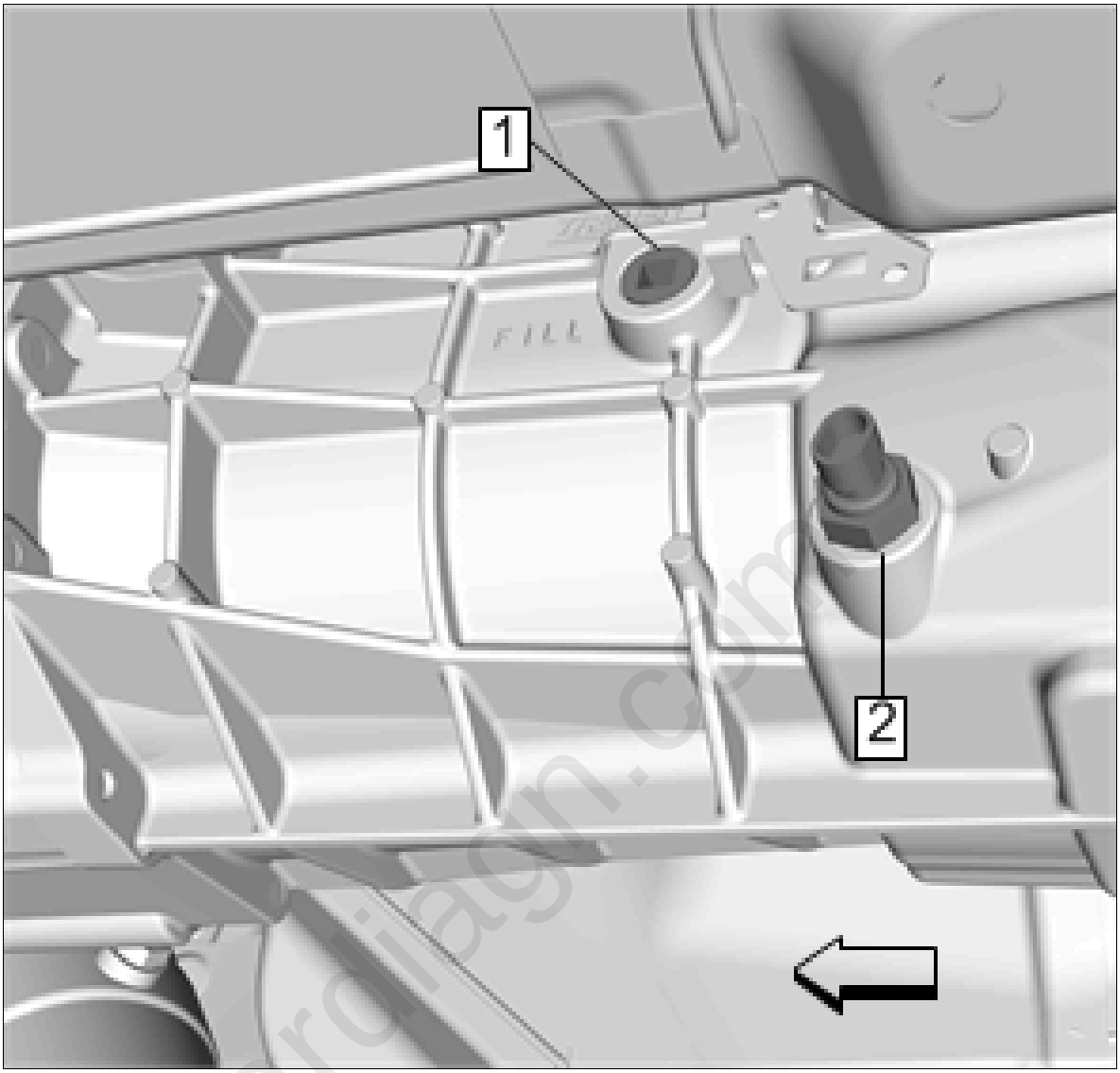


Courtesy of GENERAL MOTORS COMPANY

16. Connect the following electrical connectors:
    1. Backup lamp switch (1)
    2. Vehicle speed sensor (2)

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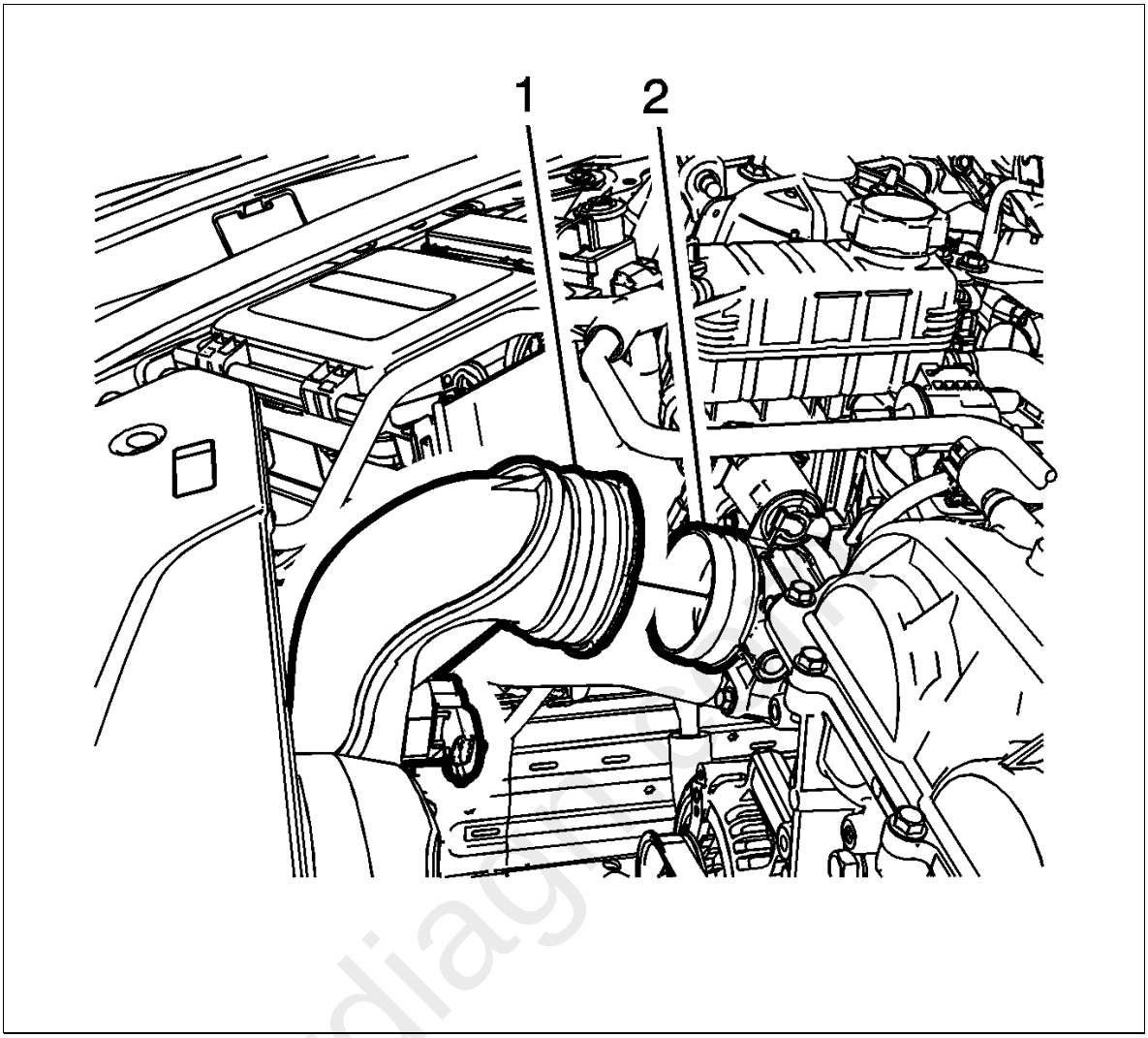
Fig 11: Fluid Temperature Sensor Connector



Courtesy of GENERAL MOTORS COMPANY

17. Connect the electrical connector to the transmission temperature sensor (2).

Fig 12: Charge Air Cooler Outlet Air Tube And Throttle Body



Courtesy of GENERAL MOTORS COMPANY

18. Connect the charge air cooler outlet tube (1) to the throttle body (2). Charge Air Cooler Outlet Air Tube Replacement
19. Bleed to hydraulic clutch system. Hydraulic Clutch System Bleeding
20. Check the transmission fluid and fill as necessary. Transmission Fluid Level Inspection (M13 Without Y4Q)

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (M13 - LGX W/L4Q)

Special Tools

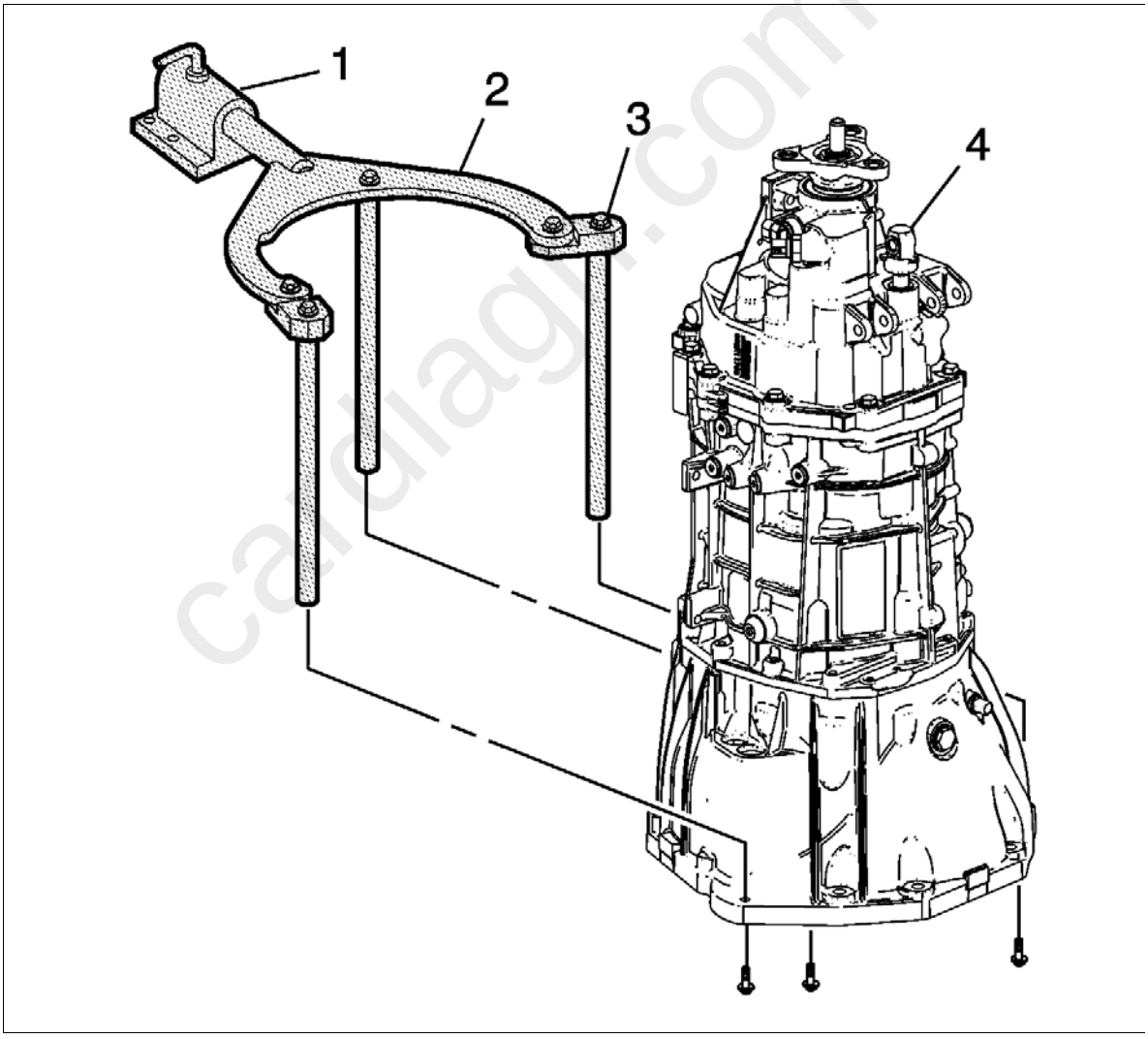
- **DT 47678** Transmission Holding Flange
- **DT 47678-10** Transmission Holding Flange Adapter

- **J 3289-20** Holding Fixture
- **J 22888-D** Right Sight Differential Side Bearing Puller
- **J 45012** Holding Fixture
- **DT 45019** Flange and Pinion Cage Remover
- **DT 51075** Puller Adapter Set

For equivalent regional tools, refer to Special Tools (M13) .

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (M13 - LGX W/L4Q) > EXTENSION HOUSING REMOVAL

Fig 1: Transmission Holding Flange, Adapter & Fixture



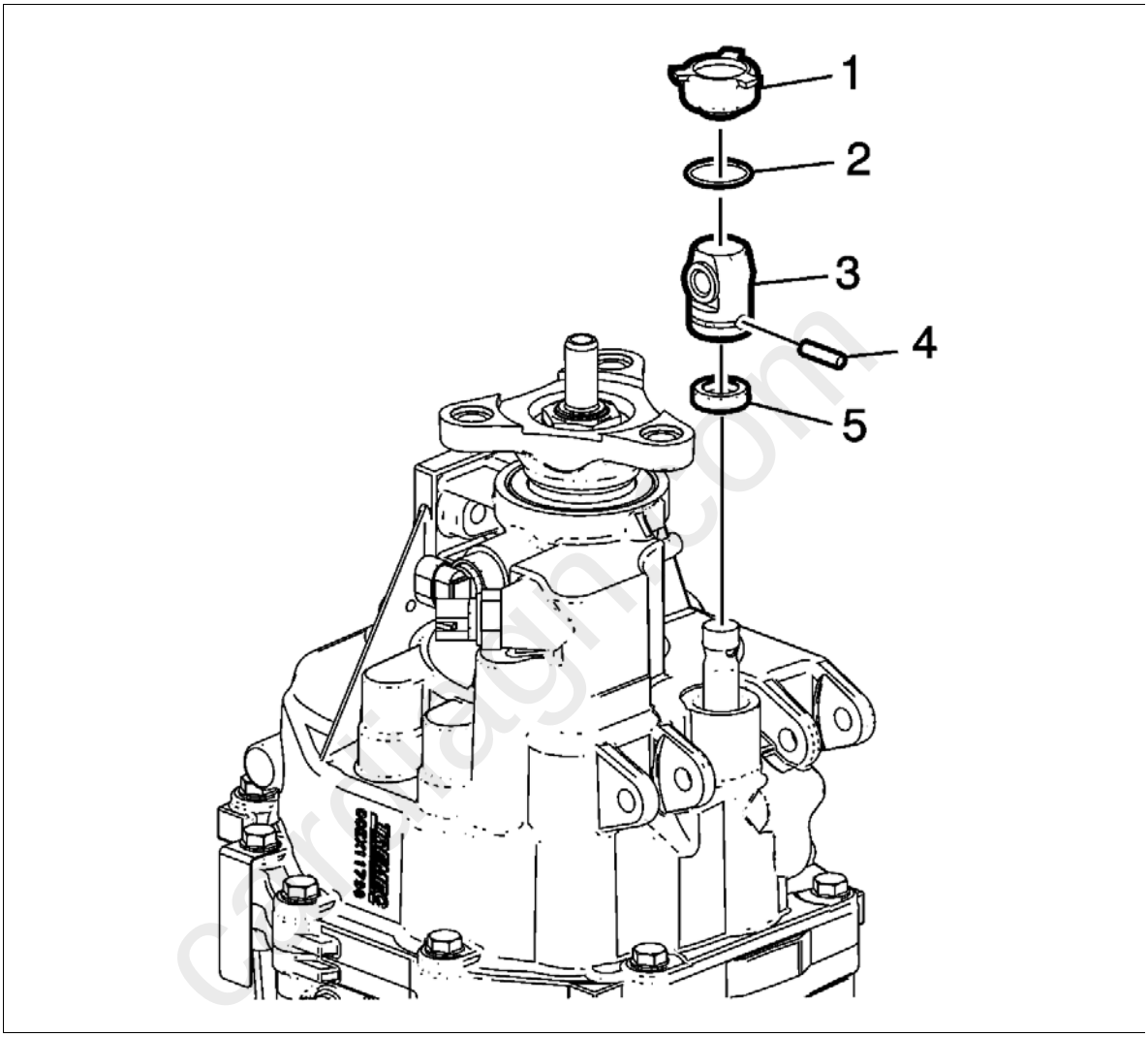
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Courtesy of GENERAL MOTORS COMPANY

1. Install the **DT 47678** flange (2) and the **DT 47678-10** flange adapter (3).

2. Mount the transmission on a workbench using the **J 3289-20** holding fixture (1).
3. Rotate the transmission into a horizontal position.
4. Remove the transmission oil drain plug and drain the transmission fluid.
5. Shift the transmission into NEUTRAL (N).

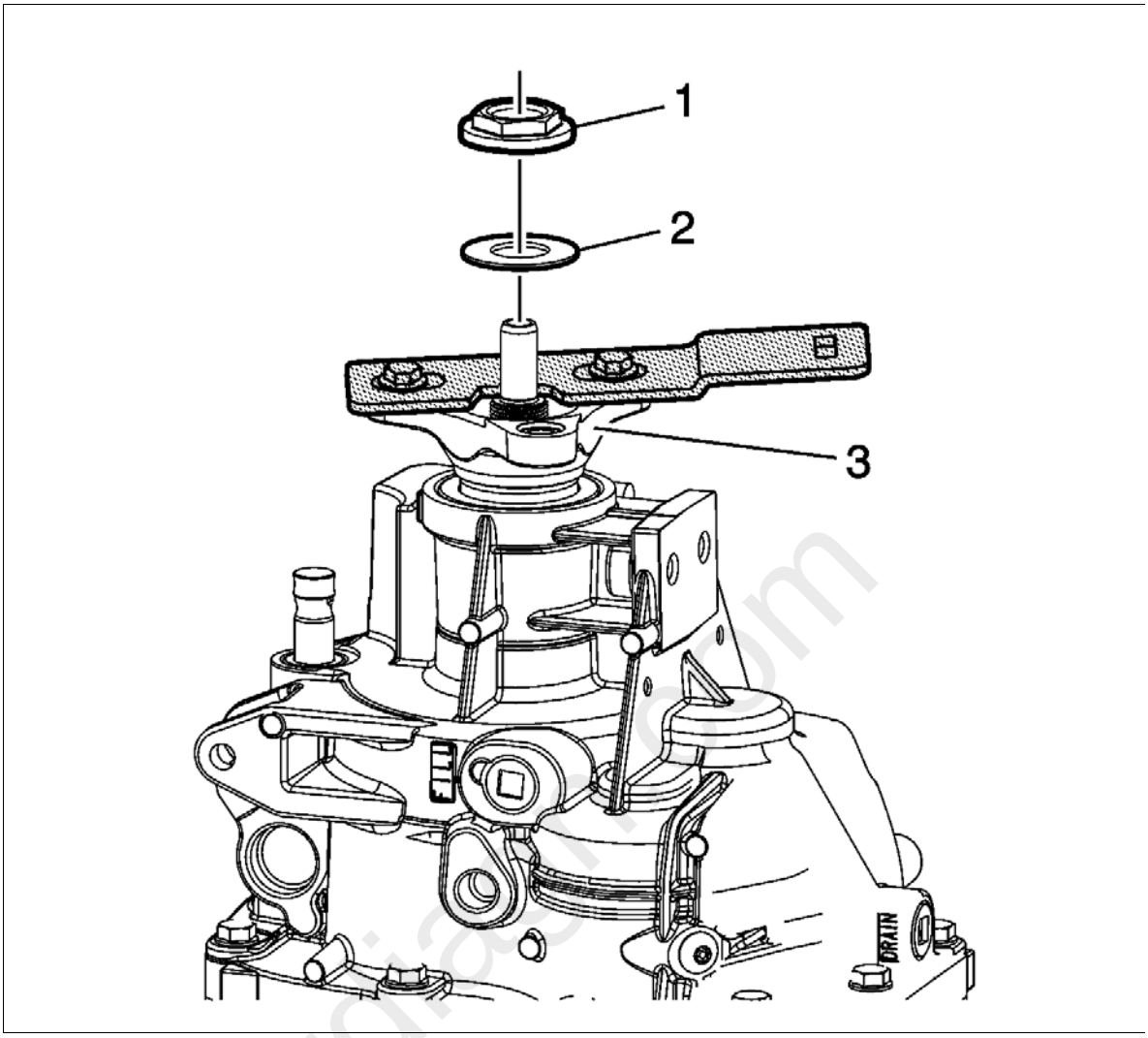
Fig 2: Manual Transmission Control Lever Components



Courtesy of GENERAL MOTORS COMPANY

6. Remove the manual transmission control shaft boot (1) and the manual transmission control lever retainer (2).
7. Remove the manual transmission control lever pin (4) and the manual transmission shift lever shaft joint (3).
8. Remove the manual transmission control lever seal (5).

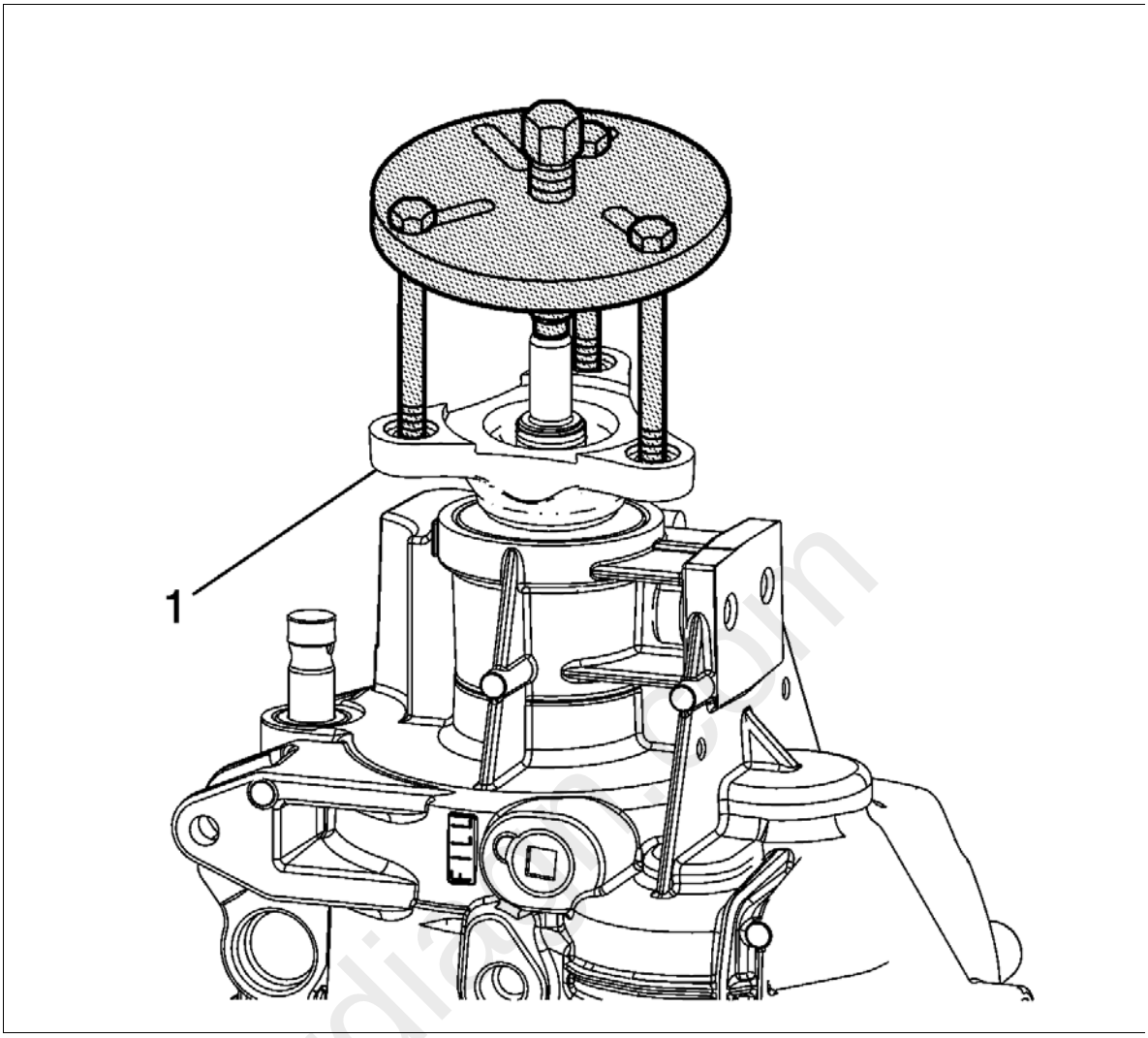
Fig 3: Propeller Shaft Transmission Yoke, Washer & Nut



Courtesy of GENERAL MOTORS COMPANY

9. Install the **J 45012** holding fixture with the mounting bolts to the propeller shaft transmission yoke (3).
10. Using a socket wrench, remove the propeller shaft transmission yoke nut (1).
11. Remove the propeller shaft transmission yoke flange washer (2).

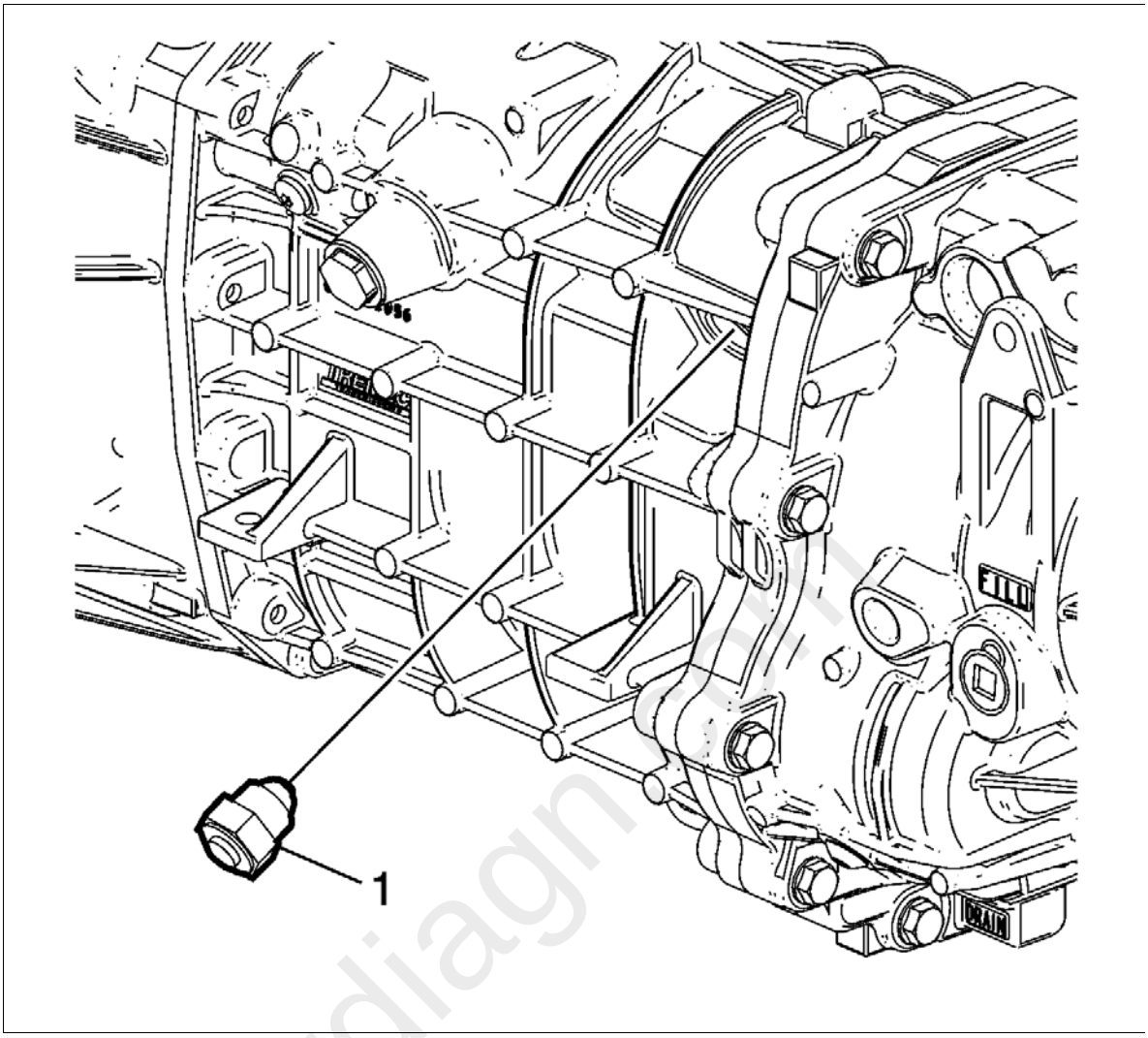
Fig 4: Flange & Pinion Cage Remover At Propeller Shaft Transmission Yoke



Courtesy of GENERAL MOTORS COMPANY

12. Using **DT 45019** flange and pinion cage remover, remove the propeller shaft transmission yoke (1).

Fig 5: Shift Interlock Detent Assembly

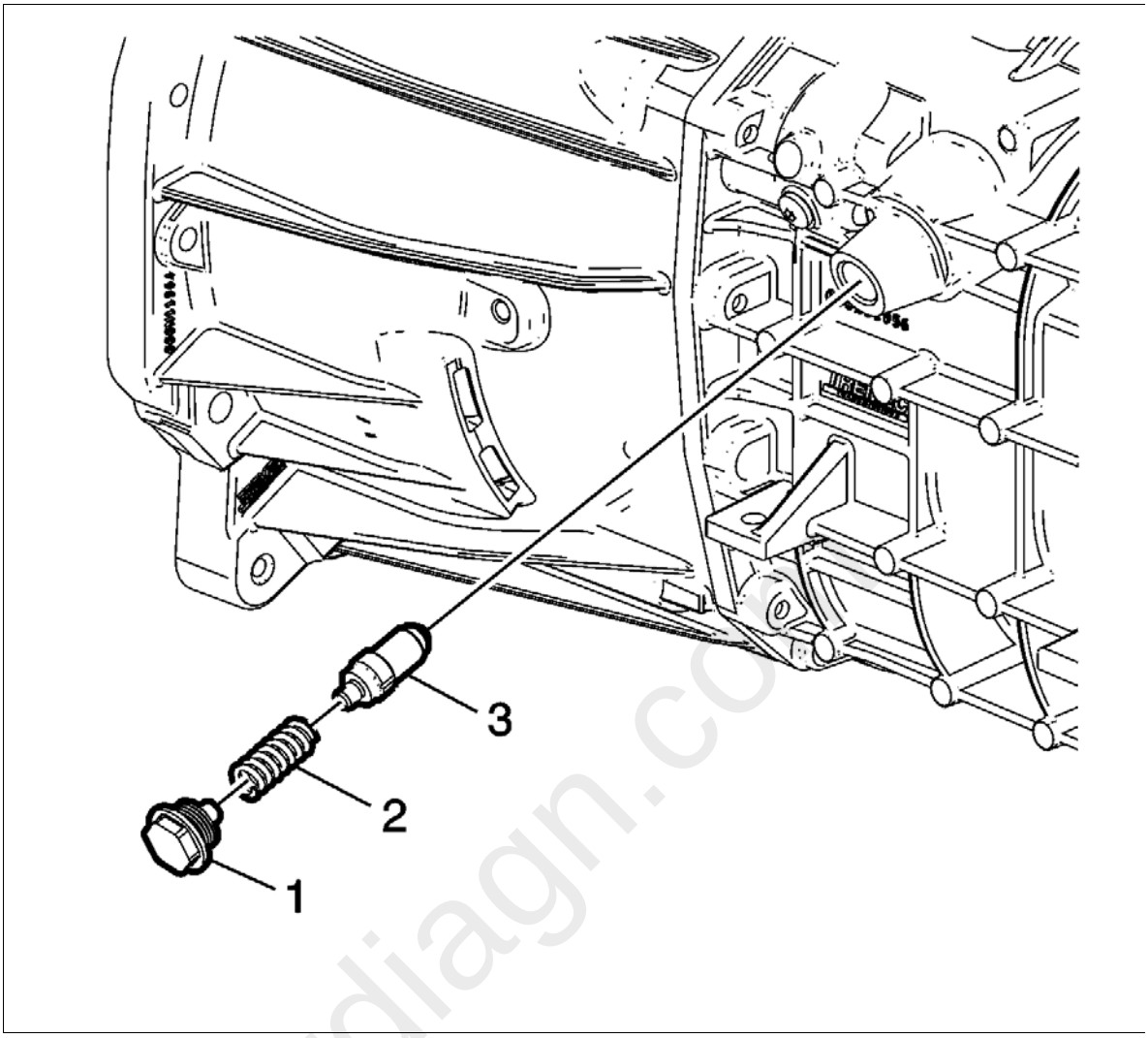


Courtesy of GENERAL MOTORS COMPANY

13. Remove the shift interlock detent assembly (1).

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Fig 6: Manual Shift Detent, Spring & Bolt

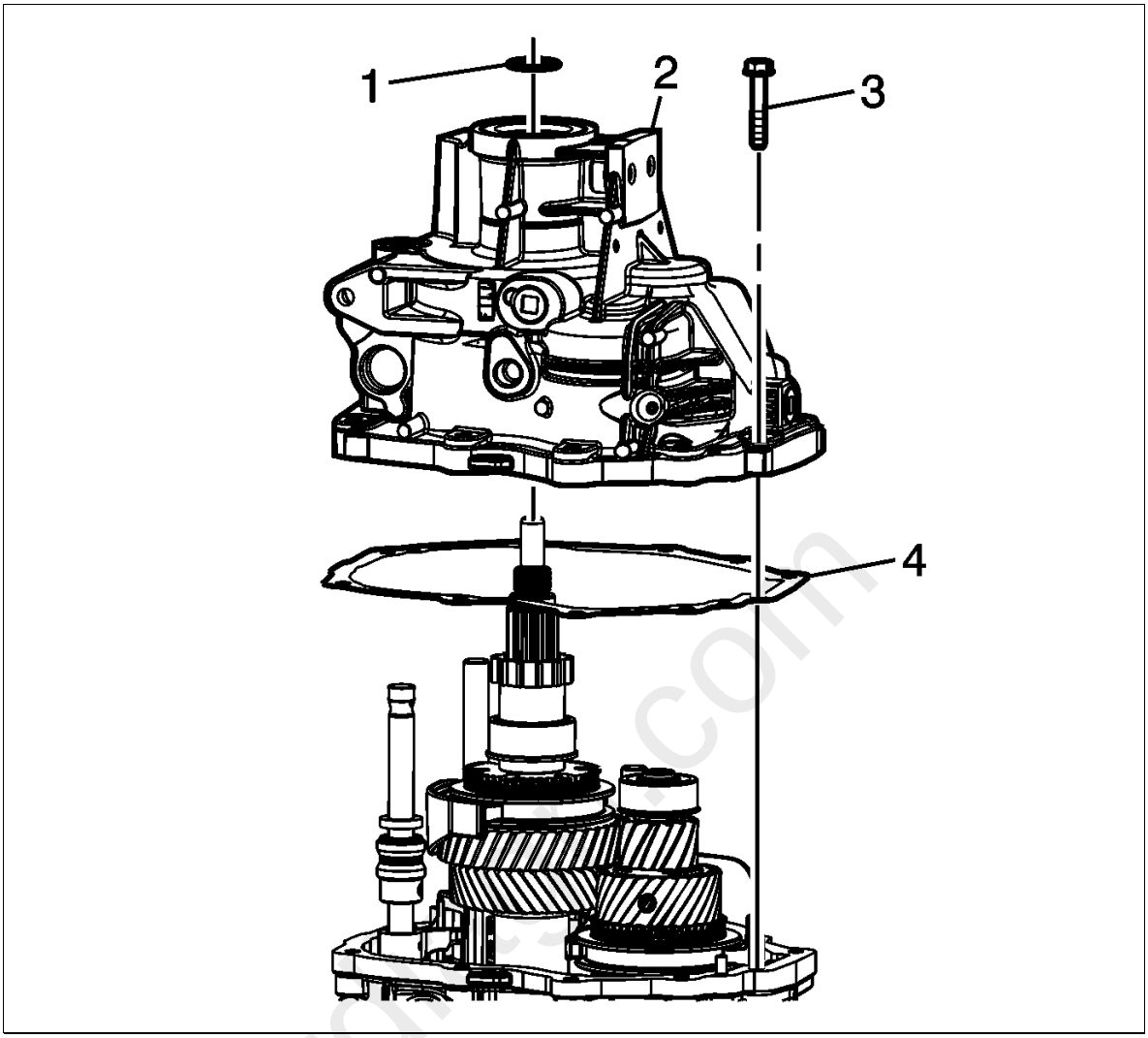


Courtesy of GENERAL MOTORS COMPANY

14. Remove the manual shift detent bolt (1), detent spring (2) and the detent (3).

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Fig 7: Propeller Shaft O-Ring

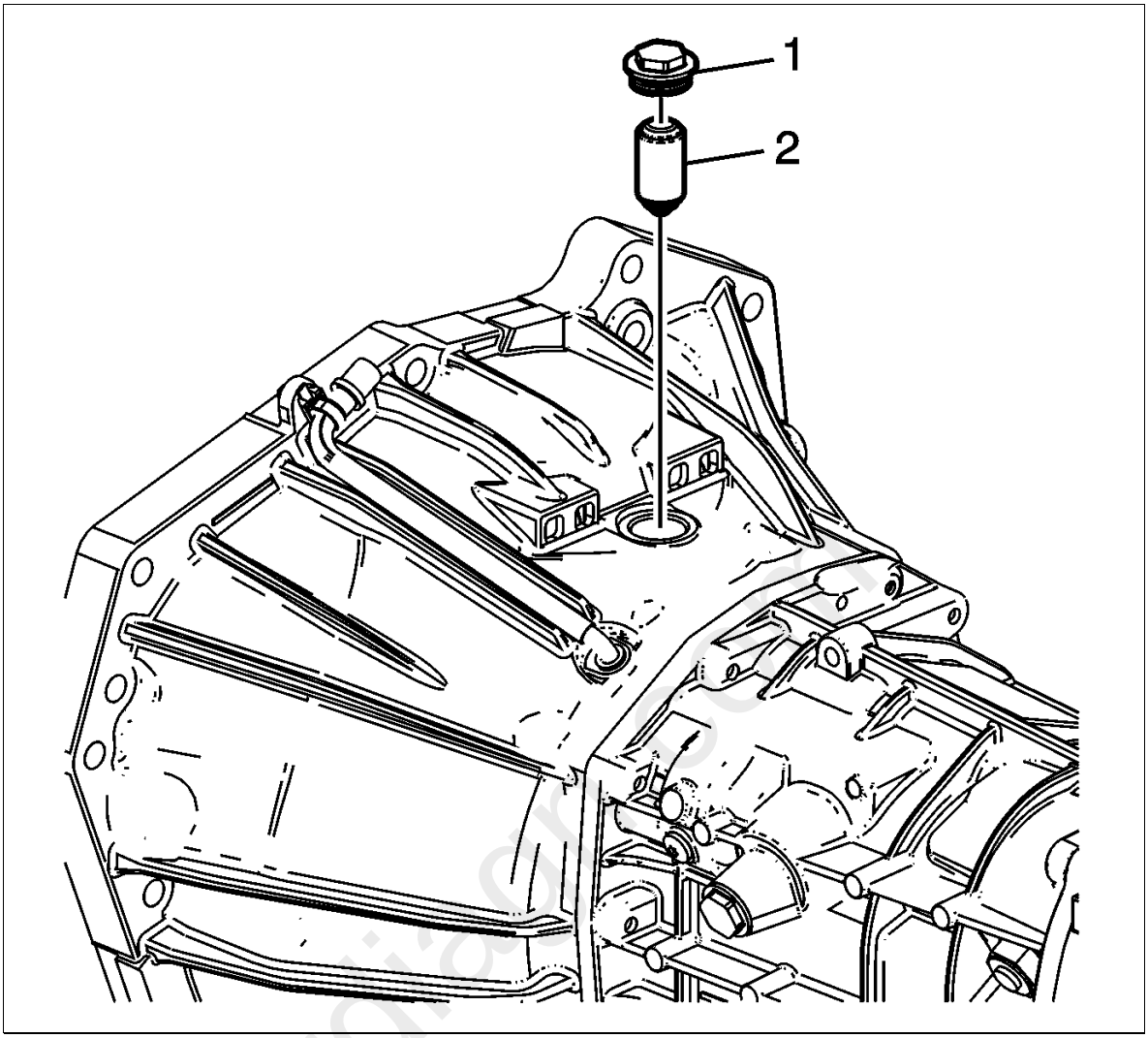


Courtesy of GENERAL MOTORS COMPANY

15. Remove the propeller shaft O-ring (1).
16. Remove the extension housing bolts (3), the extension housing assembly (2), and the gasket (4).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (M13 - LGX W/L4Q) > INVERTER LEVER REMOVAL

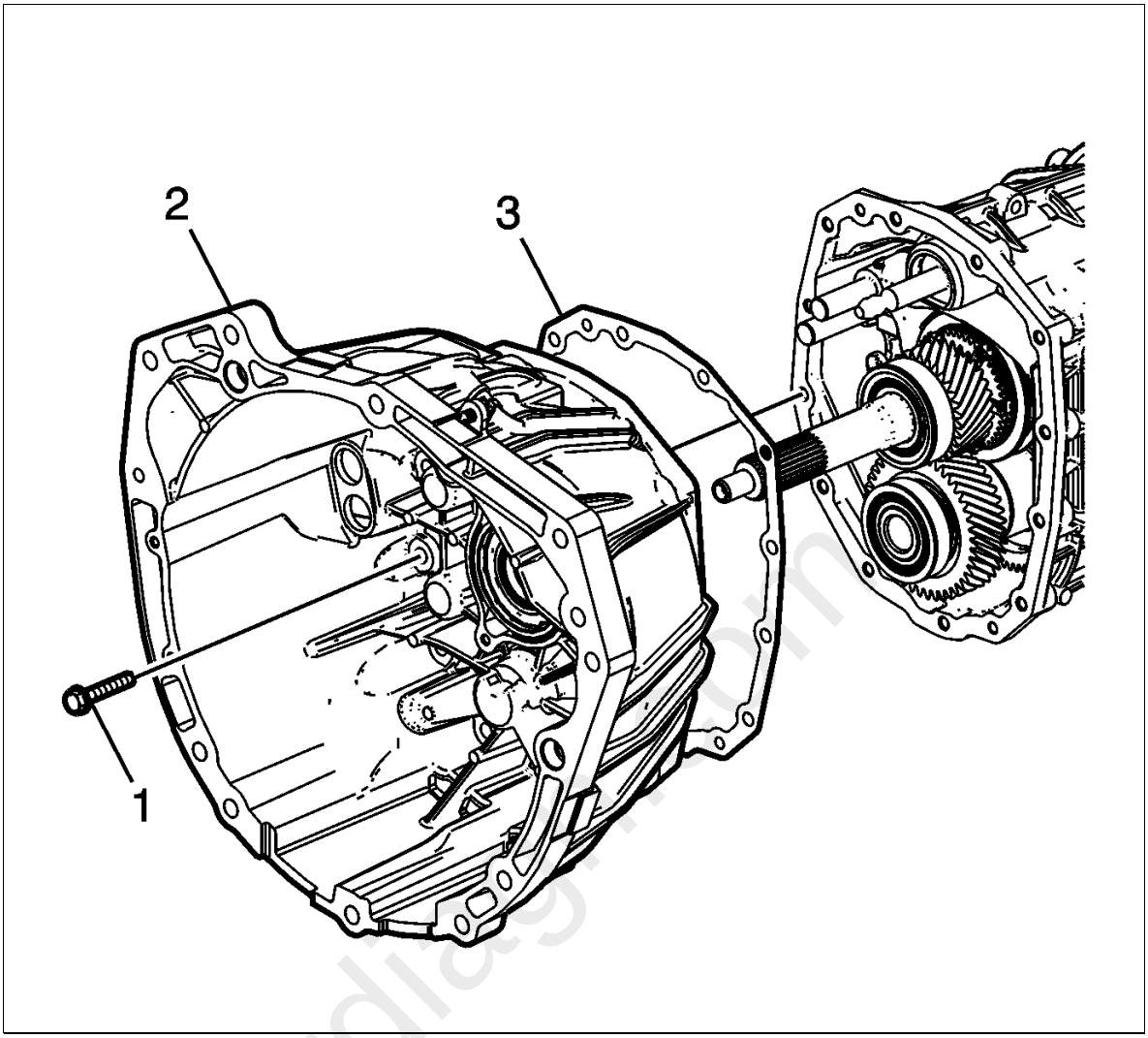
Fig 1: Shift Shaft Detent Plug And Roller Detent



Courtesy of GENERAL MOTORS COMPANY

1. Remove the shift shaft detent plug (1) and the roller detent (2).

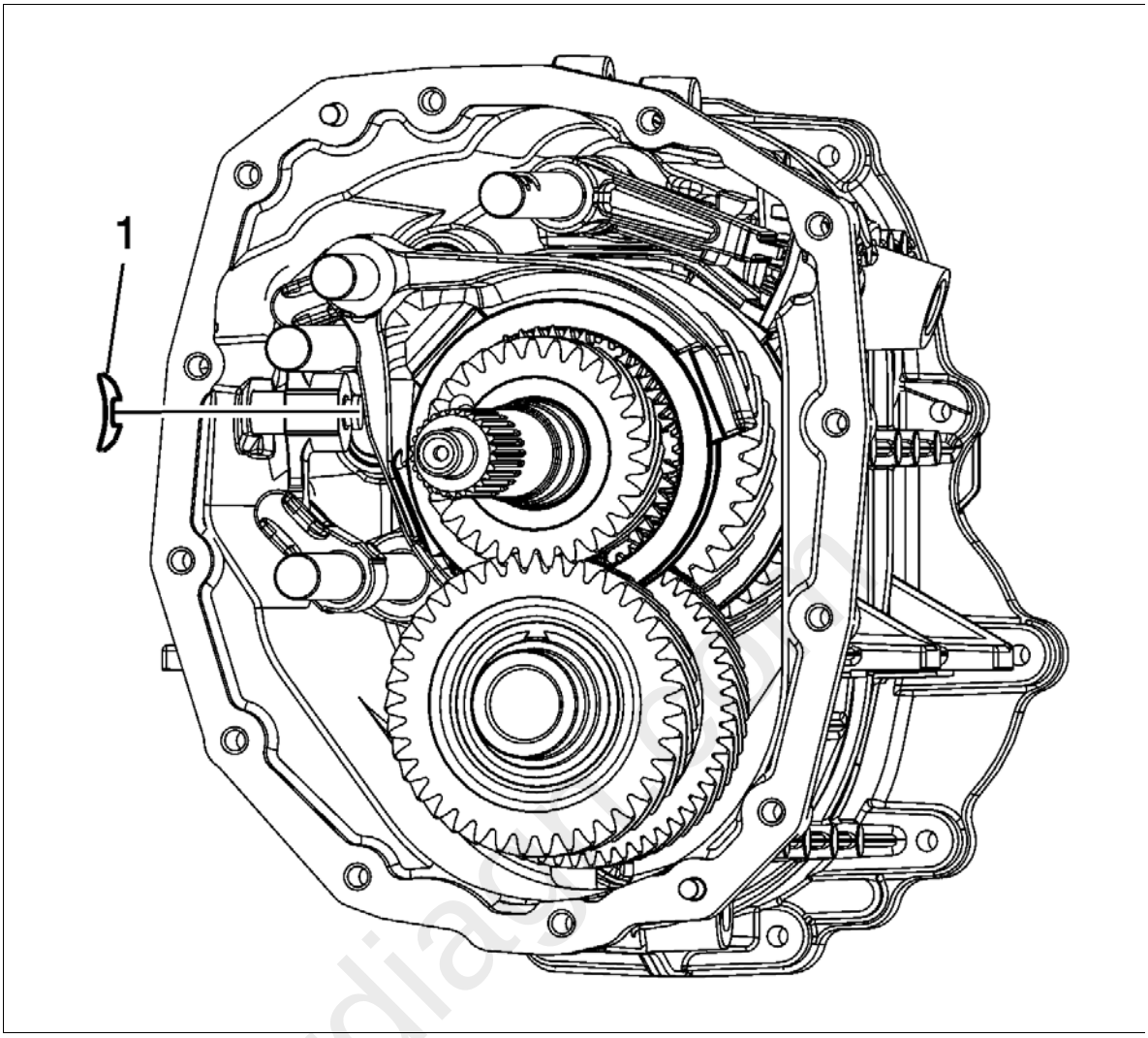
Fig 2: Clutch Housing Bolts, Clutch Housing Assembly And Gasket



Courtesy of GENERAL MOTORS COMPANY

2. Remove the clutch housing bolts (1), the clutch housing assembly (2) and the gasket (3).

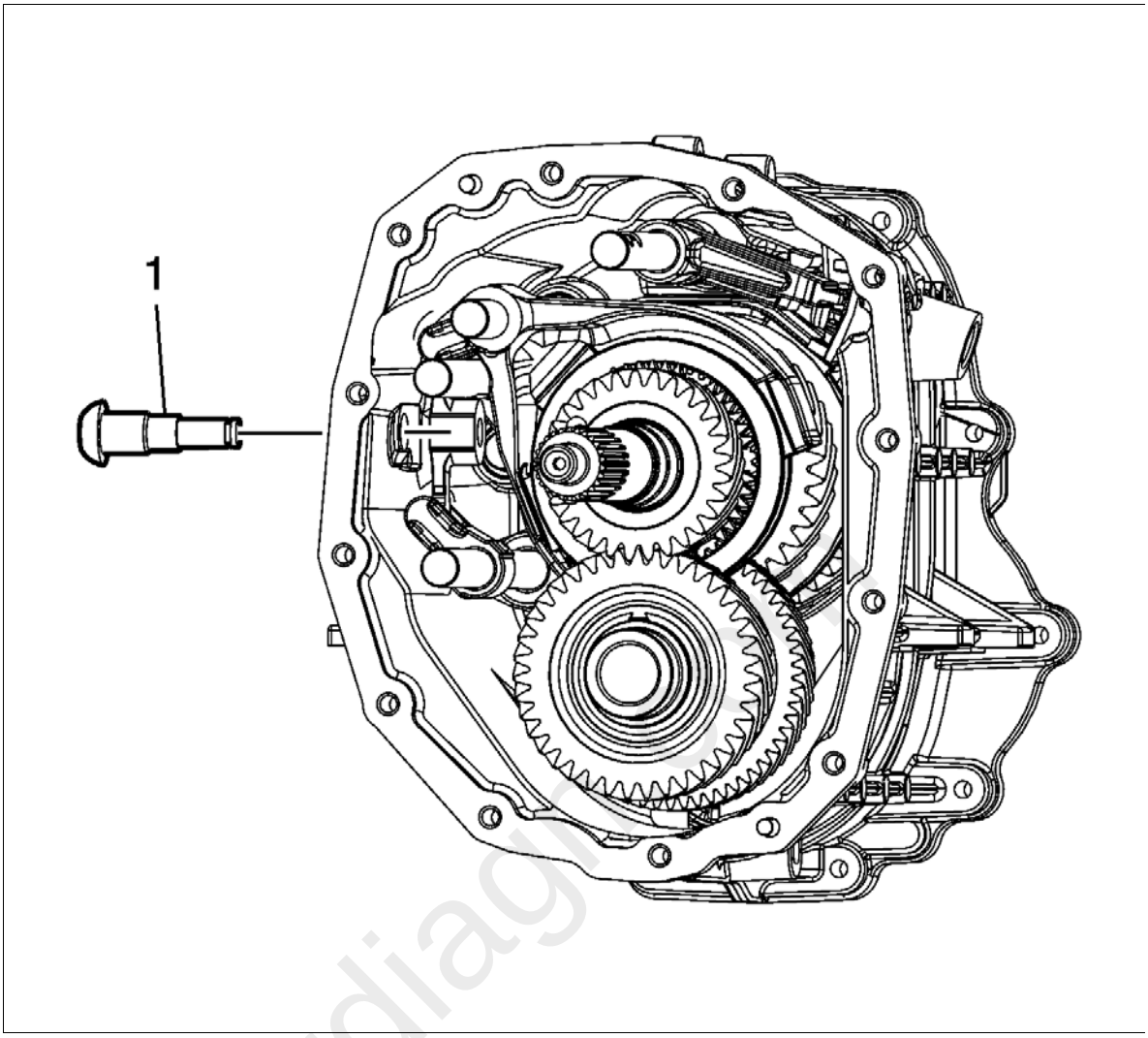
Fig 3: Manual Transmission Shift Lever Retainer



Courtesy of GENERAL MOTORS COMPANY

3. Remove the manual transmission shift lever retainer (1).

Fig 4: Manual Transmission Selector Lever Pivot Pin

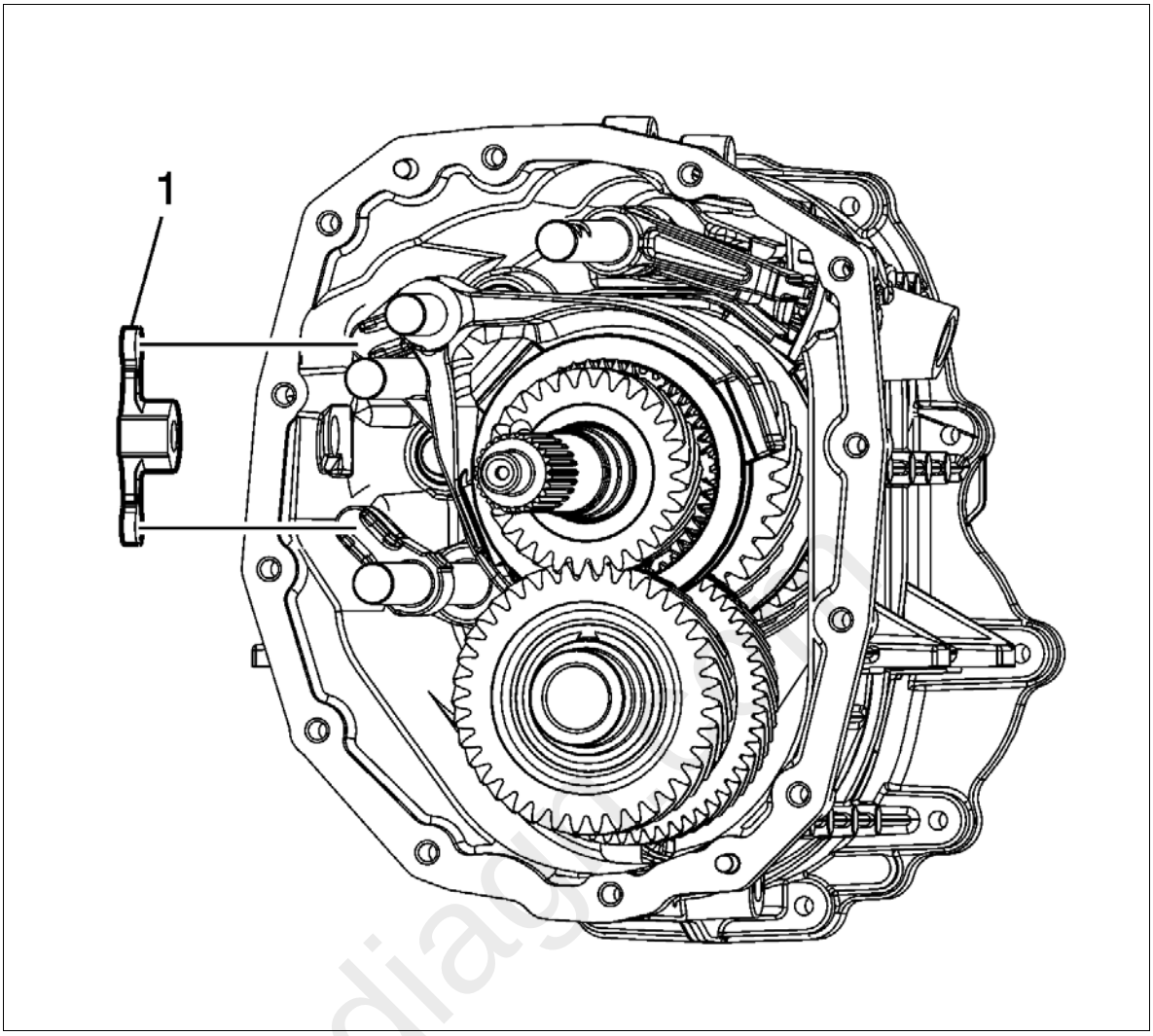


Courtesy of GENERAL MOTORS COMPANY

4. Remove the manual transmission selector lever pivot pin (1).

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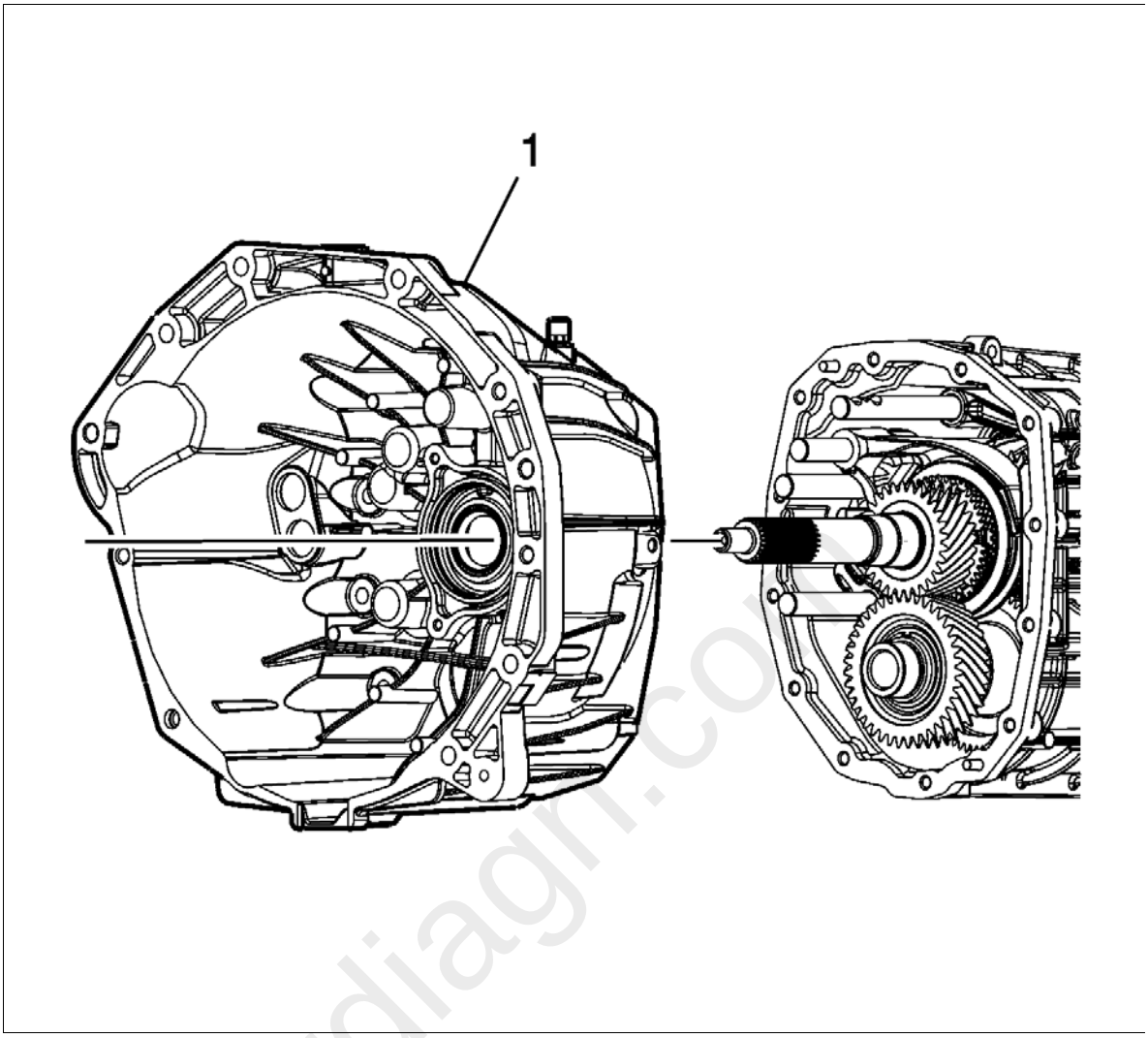
Fig 5: Manual Transmission Selector Lever



Courtesy of GENERAL MOTORS COMPANY

5. Remove the manual transmission selector lever (1).

Fig 6: Clutch Housing Assembly

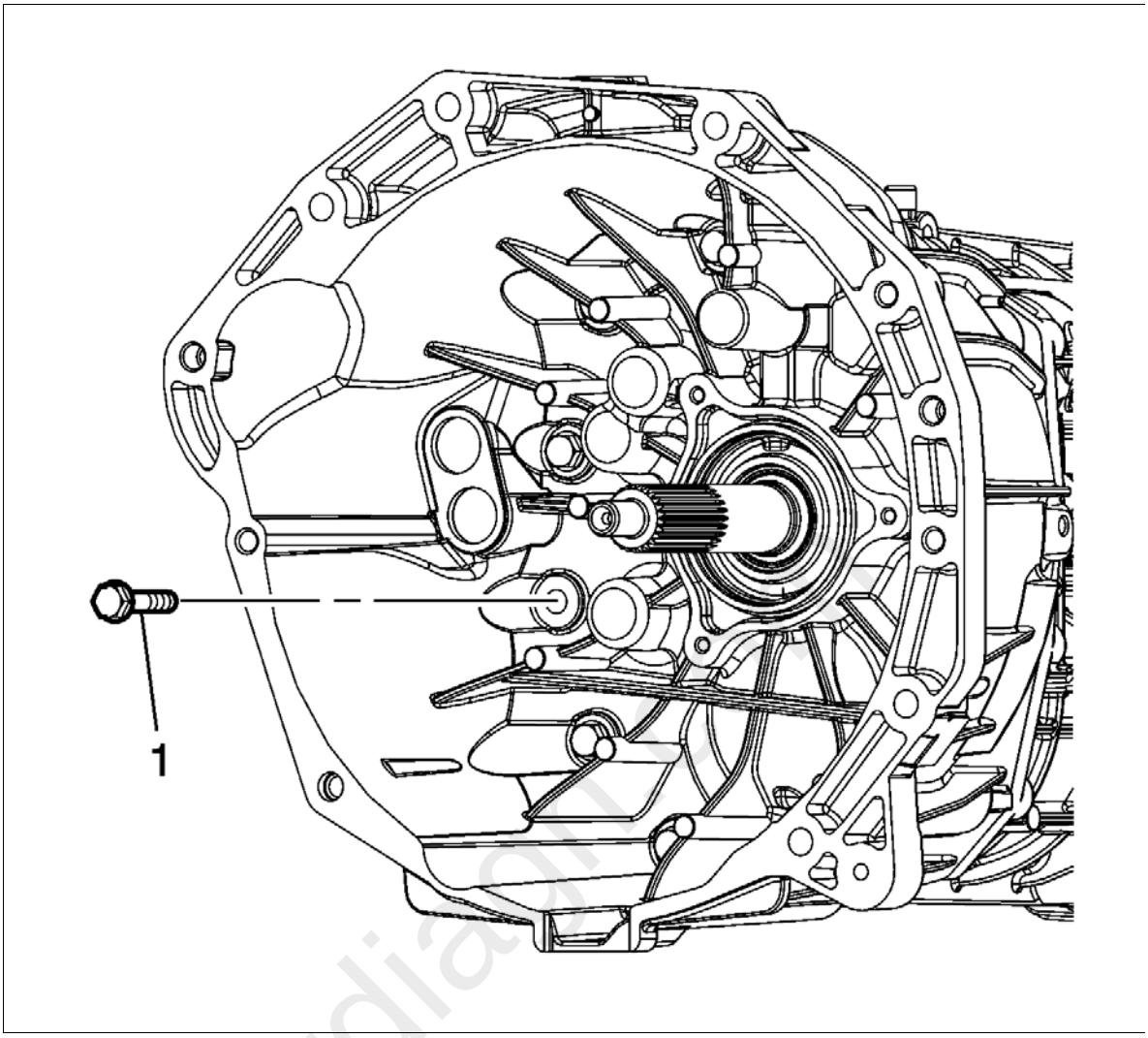


Courtesy of GENERAL MOTORS COMPANY

6. Temporarily reinstall the clutch housing assembly (1).

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Fig 7: Clutch Housing Bolts

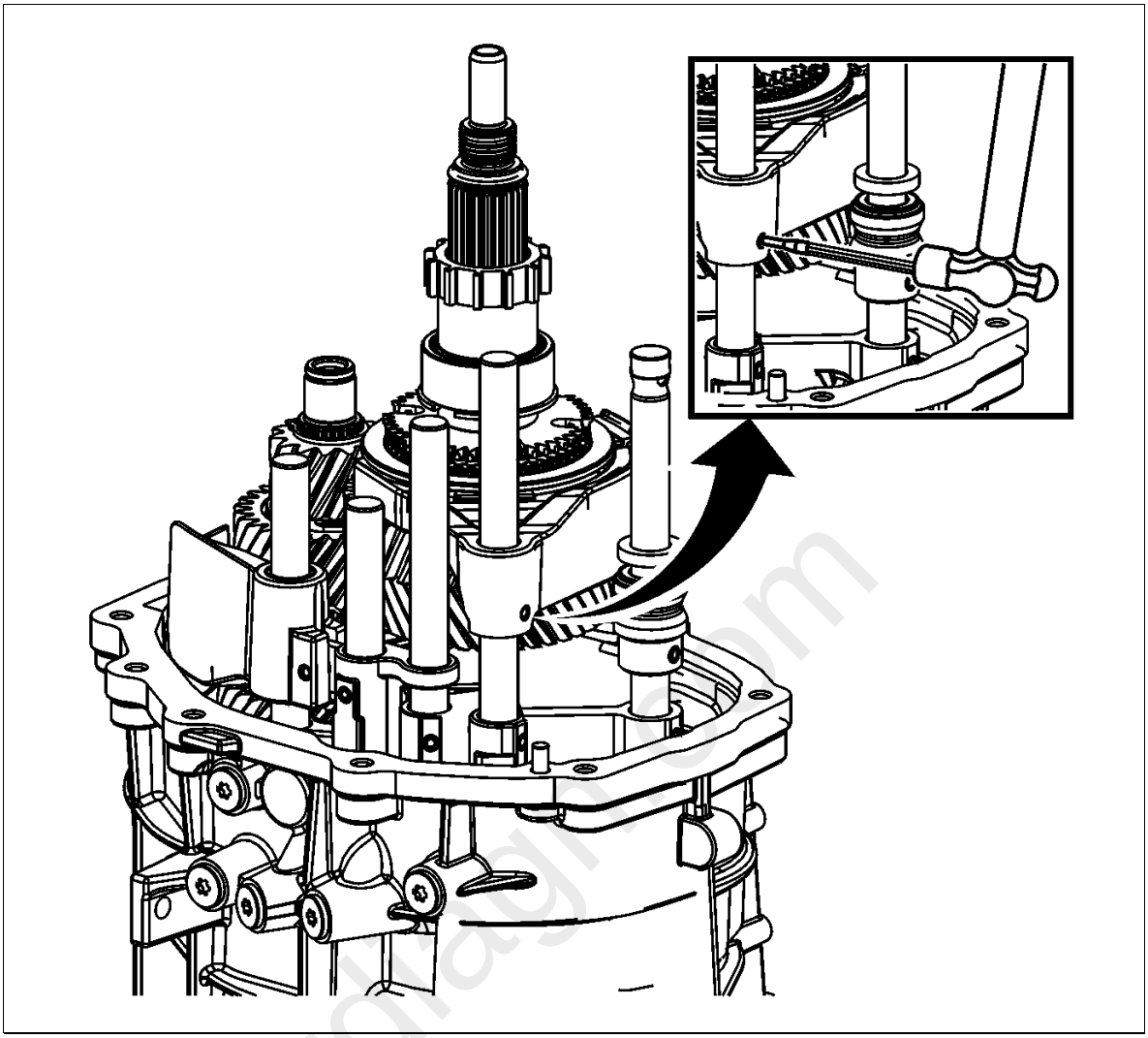


Courtesy of GENERAL MOTORS COMPANY

7. Temporarily reinstall the clutch housing bolts (1).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (M13 - LGX W/L4Q) > SHIFT SHAFT ASSEMBLIES AND GEAR CLUSTER REMOVAL

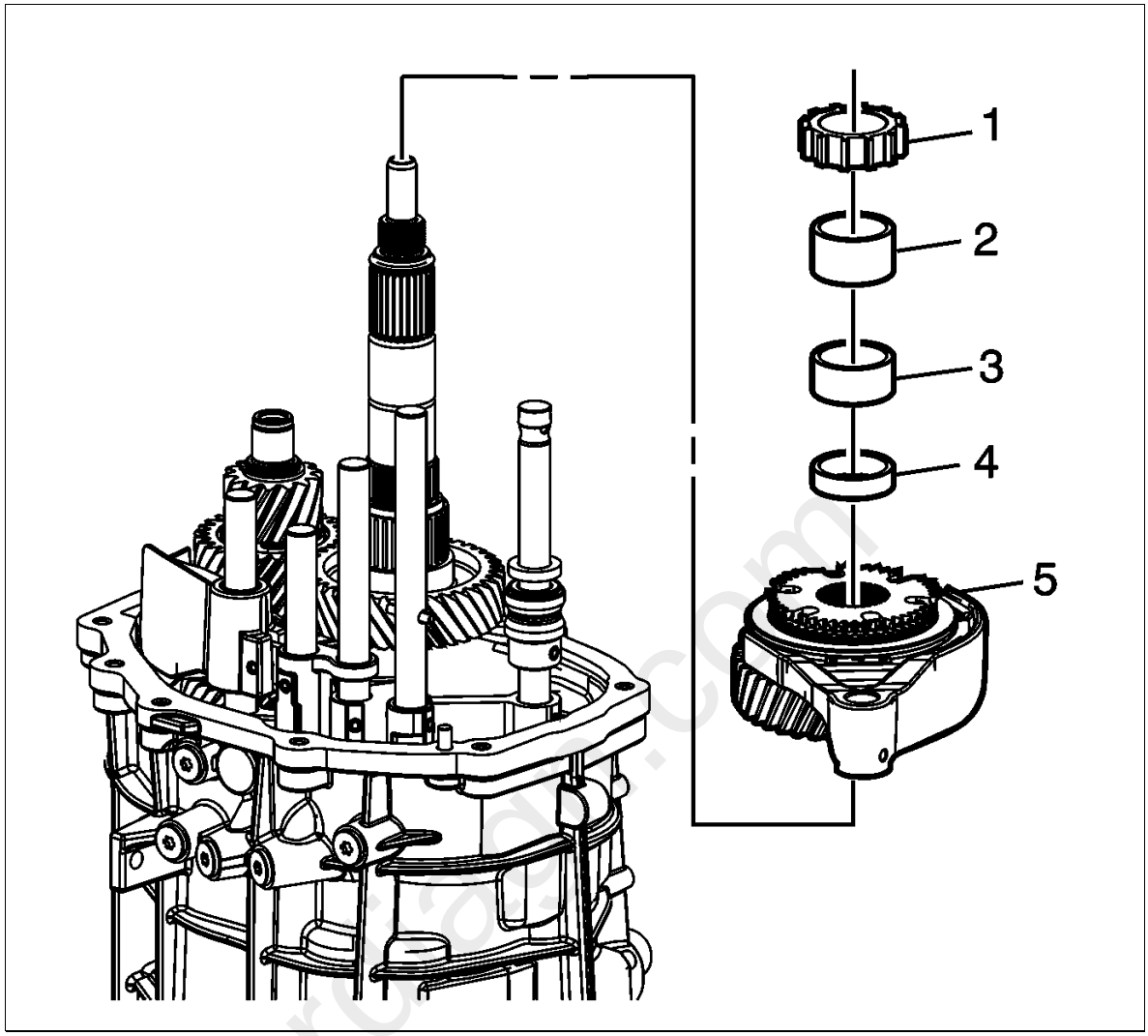
Fig 1: Coiled Spring Pin



Courtesy of GENERAL MOTORS COMPANY

1. Using a 3/16 in drift punch and hammer drive the coiled spring pin downward and remove.

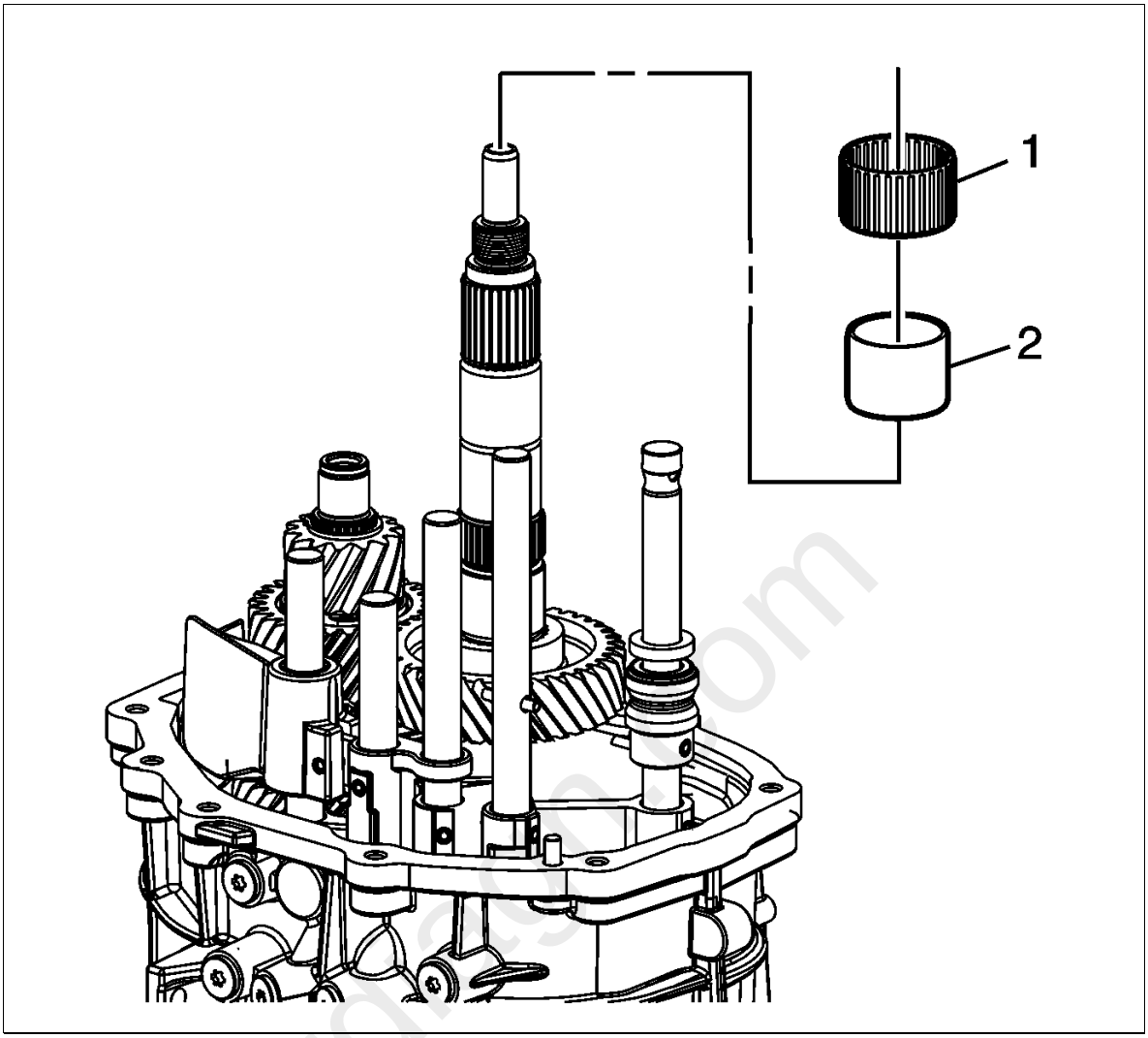
Fig 2: Vehicle Speed Sensor Reluctor Wheel, Spacer, Main Shaft Rear Bearing Race, Main Shaft Bearing Spacer And Reverse Gear And Synchronizer



Courtesy of GENERAL MOTORS COMPANY

2. Remove the vehicle speed sensor reluctor wheel (1), spacer (2), main shaft rear bearing race (3), and main shaft bearing spacer (4).
3. Remove the reverse gear and synchronizer (5) together as an assembly.

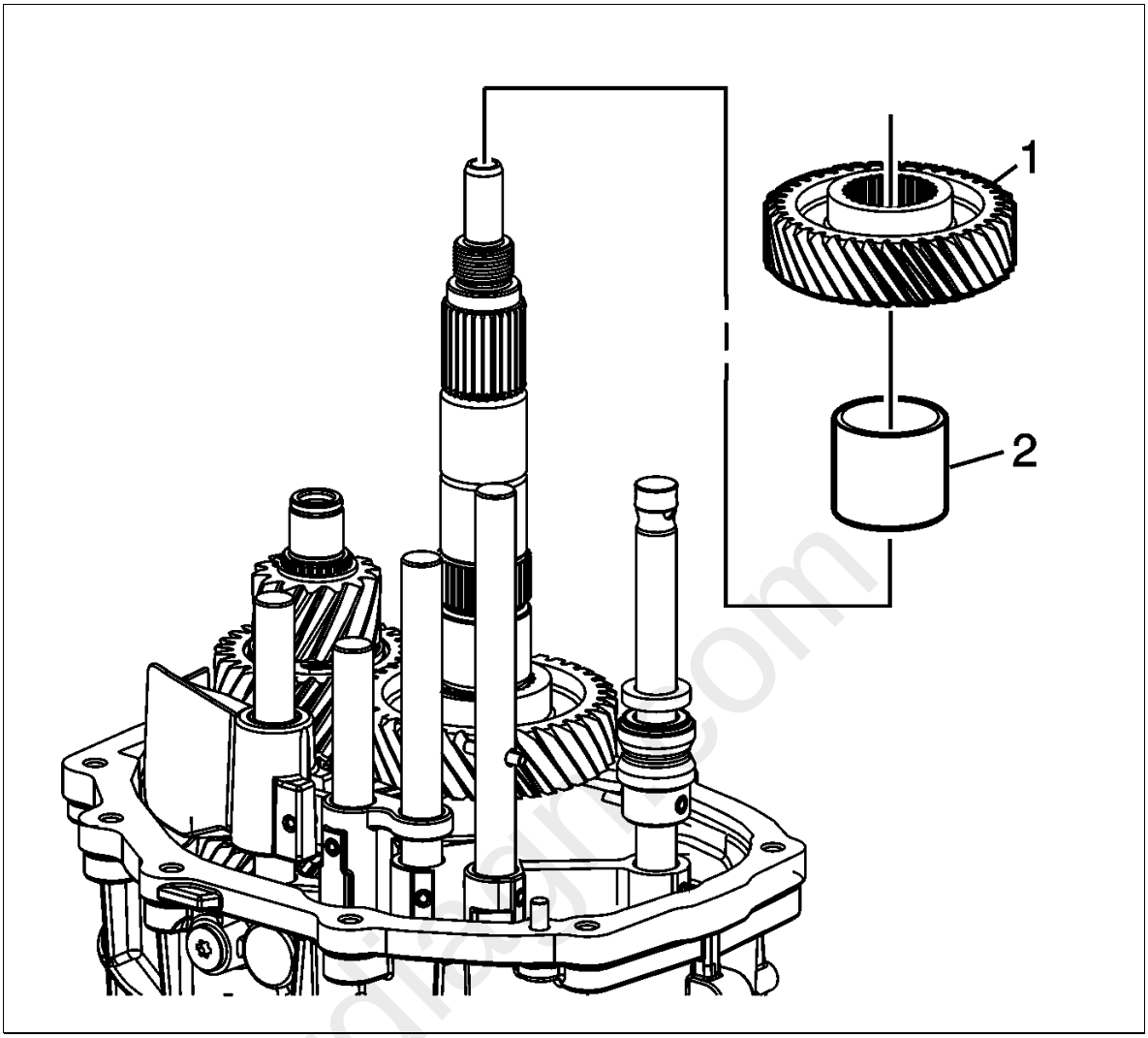
Fig 3: Reverse Gear Bearing Assembly And Bushing



Courtesy of GENERAL MOTORS COMPANY

4. Remove the reverse gear bearing assembly (1) and bushing (2).

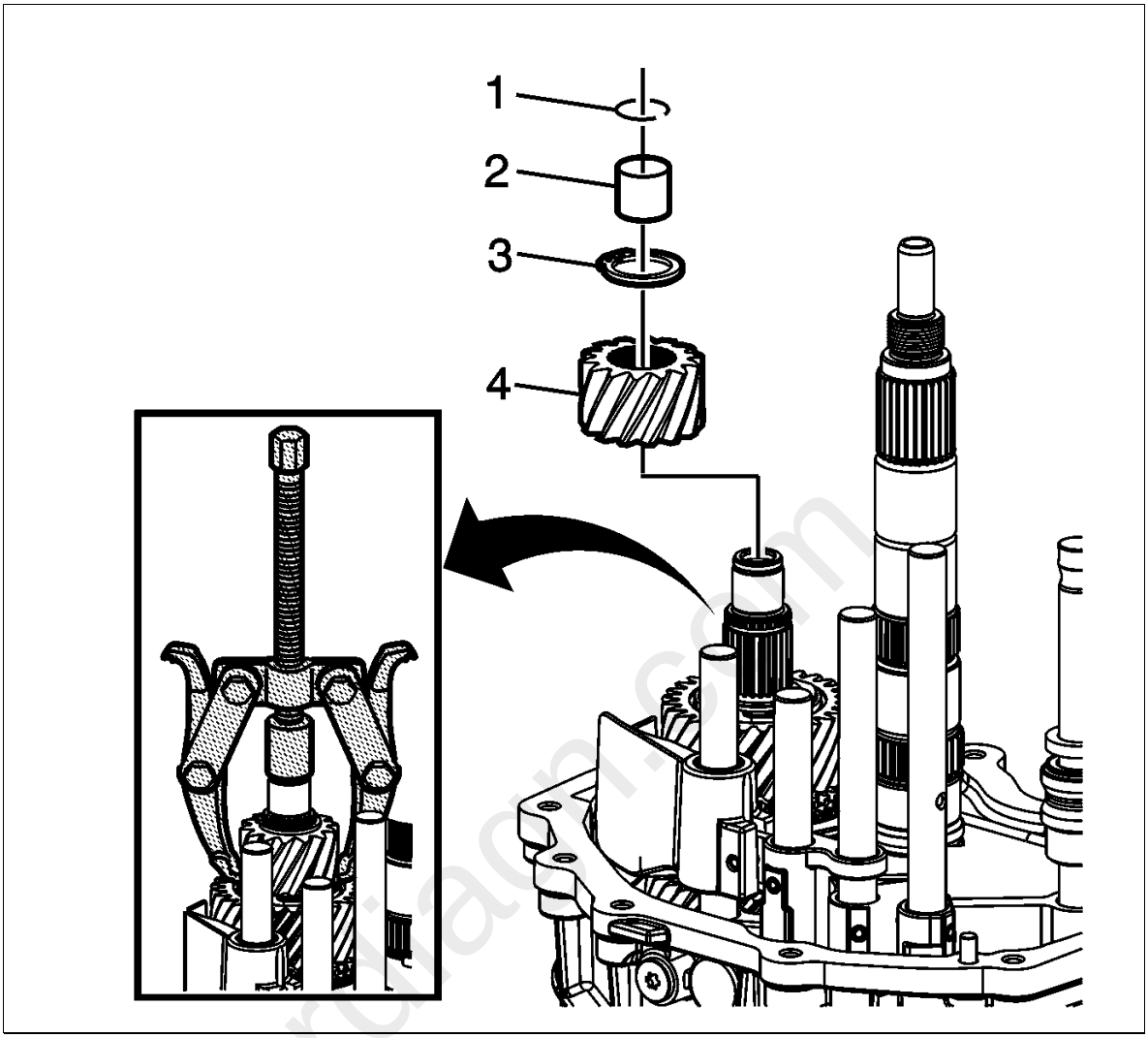
Fig 4: 3rd Gear Assembly And 3rd & 4th Gear Spacer



Courtesy of GENERAL MOTORS COMPANY

5. Remove the 3rd gear assembly (1) and the 3rd & 4th gear spacer (2).

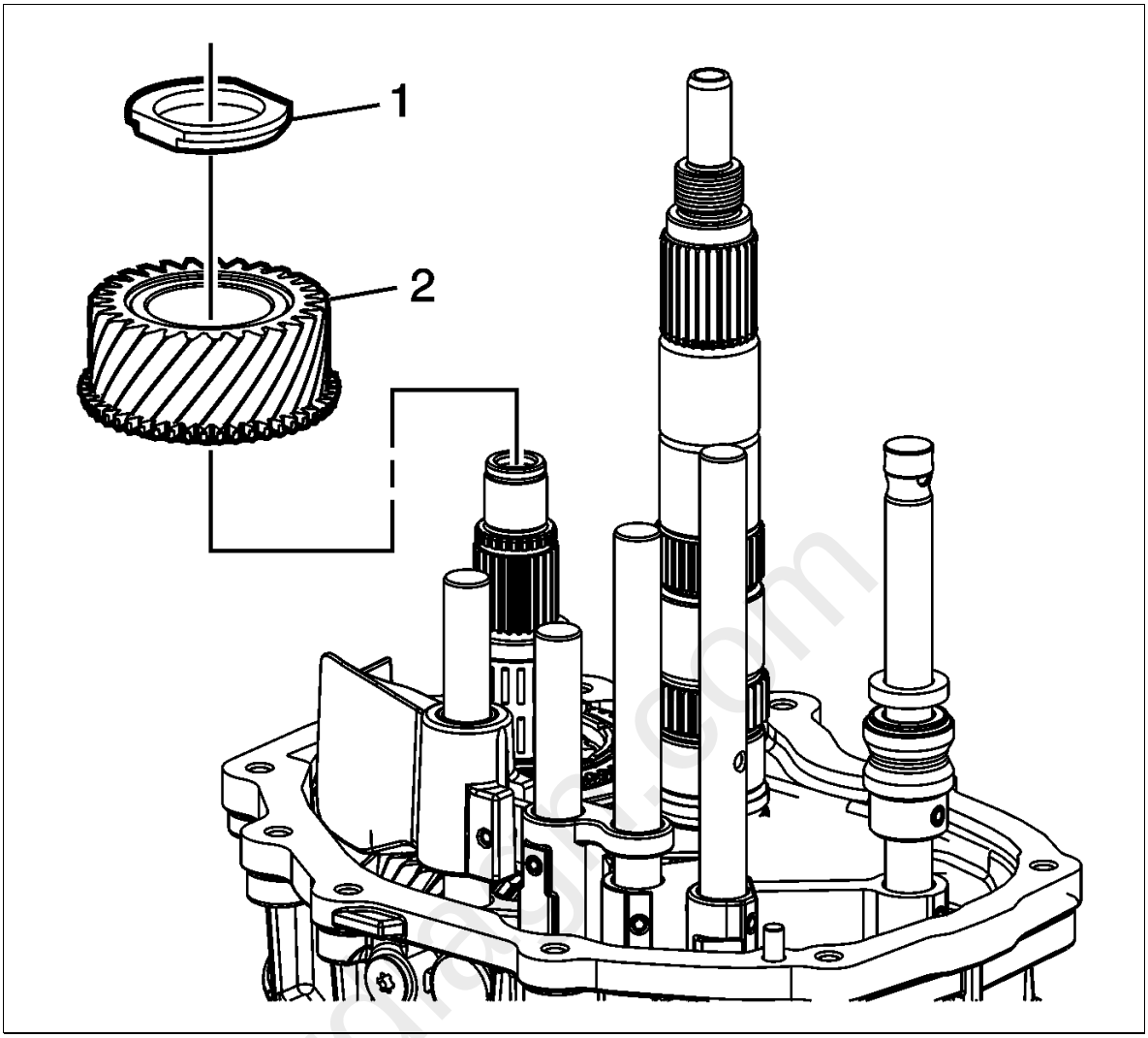
Fig 5: Counter Gear Rear Bearing Inner Race Retainer, Counter Gear Rear Bearing Inner Race, Reverse Gear Assembly Retainer And Reverse Drive Gear Assembly



Courtesy of GENERAL MOTORS COMPANY

6. Using snap ring pliers, remove the counter gear rear bearing inner race retainer (1) and remove the counter gear rear bearing inner race (2).
7. Using snap ring pliers, remove the reverse gear assembly retainer (3).
8. Using **DT 22888-D** Right Differential Side Bearing Puller remove the reverse drive gear assembly (4).

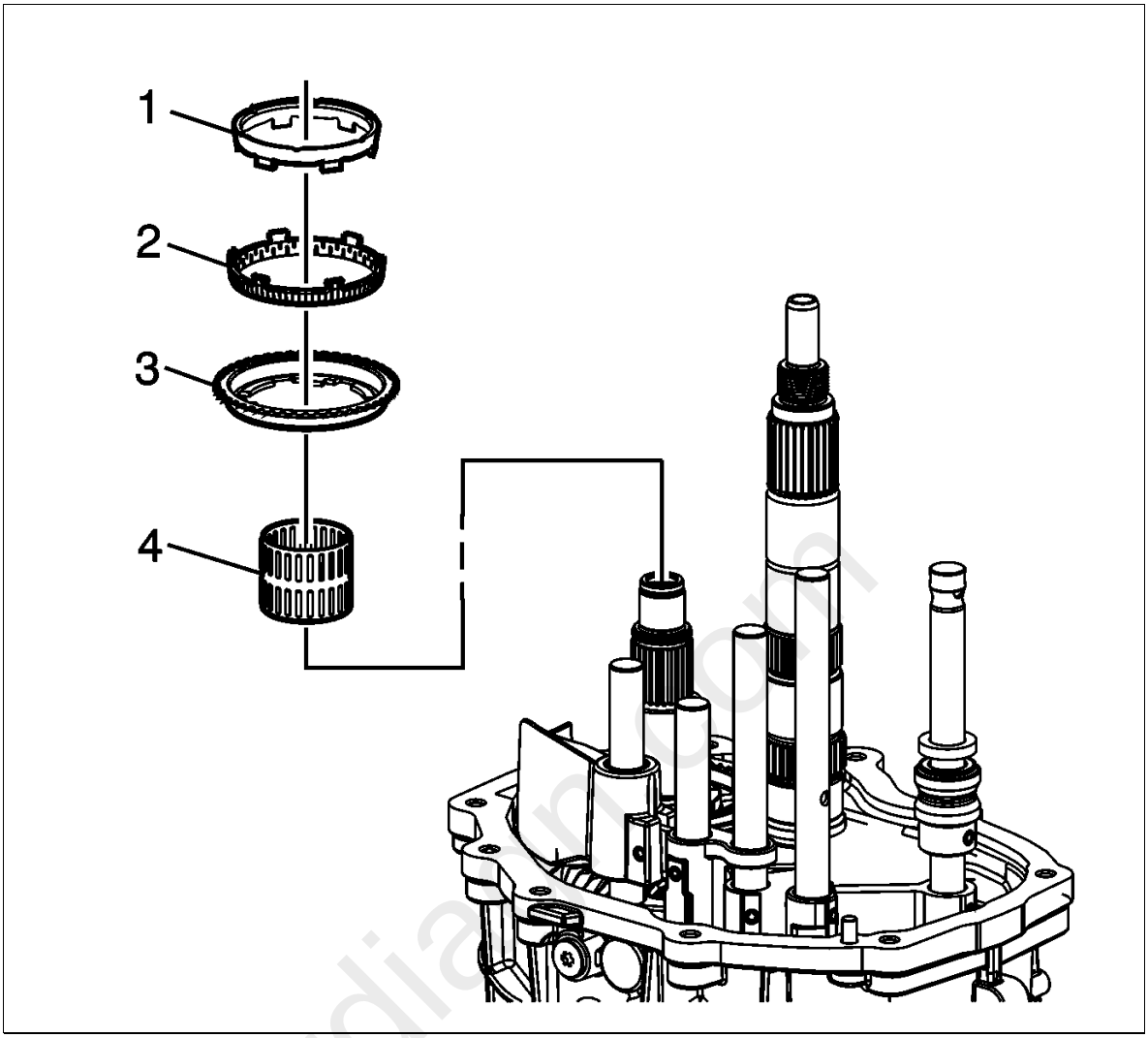
Fig 6: 3rd Gear Thrust Washer And Drive Gear Assembly



Courtesy of GENERAL MOTORS COMPANY

9. Remove the 3rd gear thrust washer (1) and the 3rd gear drive gear assembly (2).

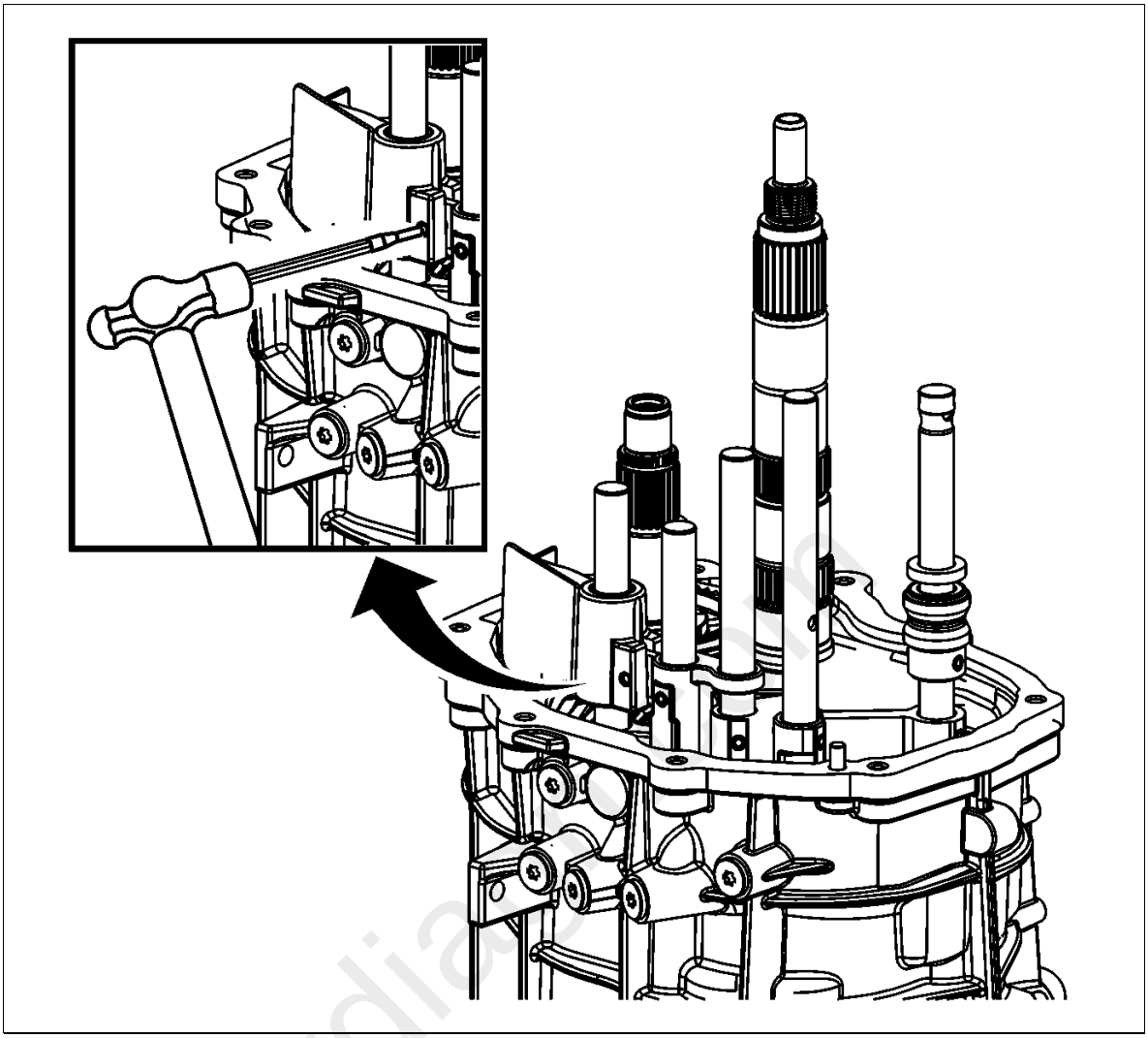
Fig 7: 3rd Gear Blocking Ring Assemblies



Courtesy of GENERAL MOTORS COMPANY

10. Remove the 3rd gear blocking ring assemblies (1, 2, and 3).
11. Remove the 3rd gear bearing assembly (4).

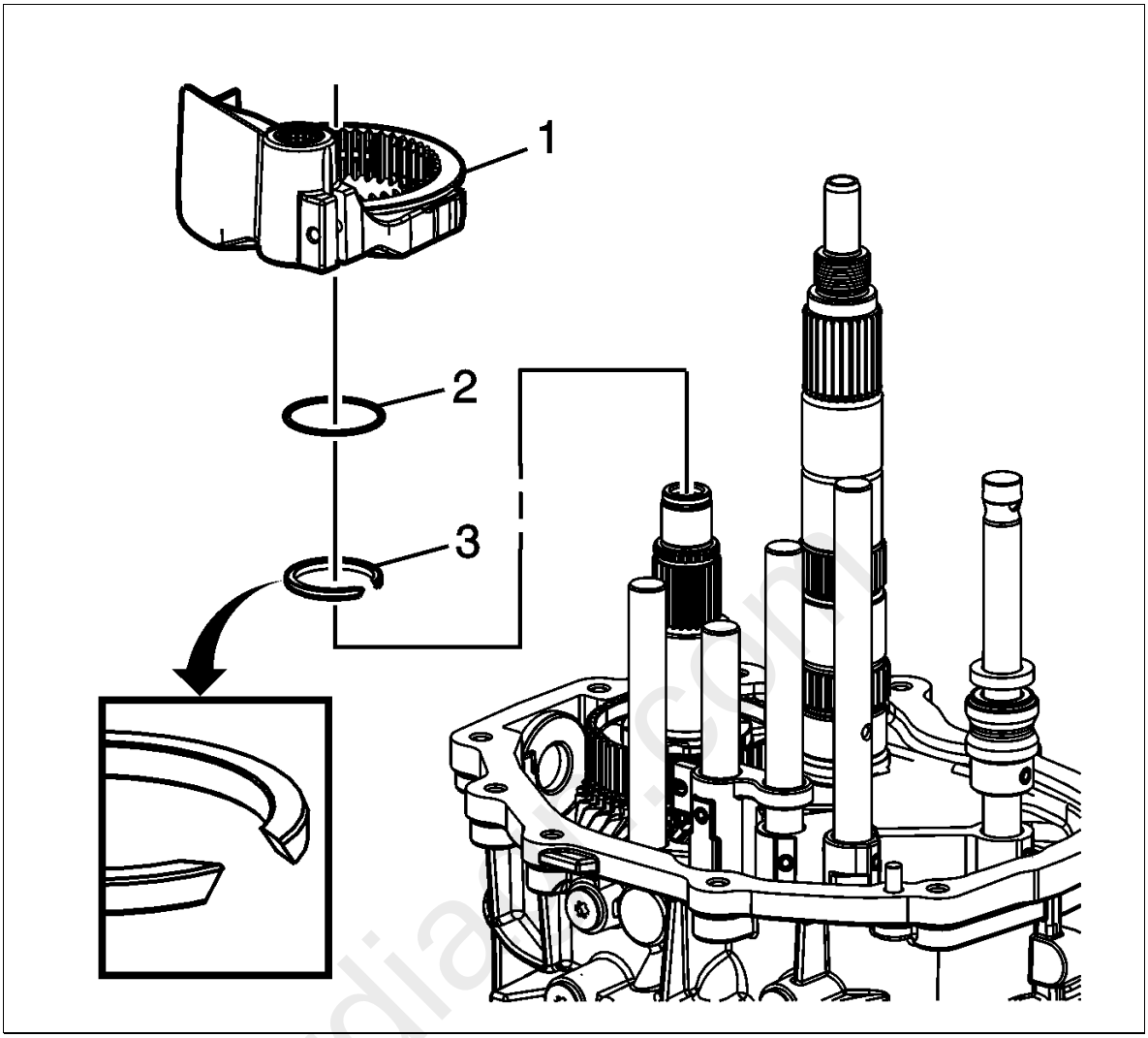
Fig 8: Coiled Spring Pin



Courtesy of GENERAL MOTORS COMPANY

12. Using a 3/16 in drift and hammer, drive the coiled spring pin downward and remove.

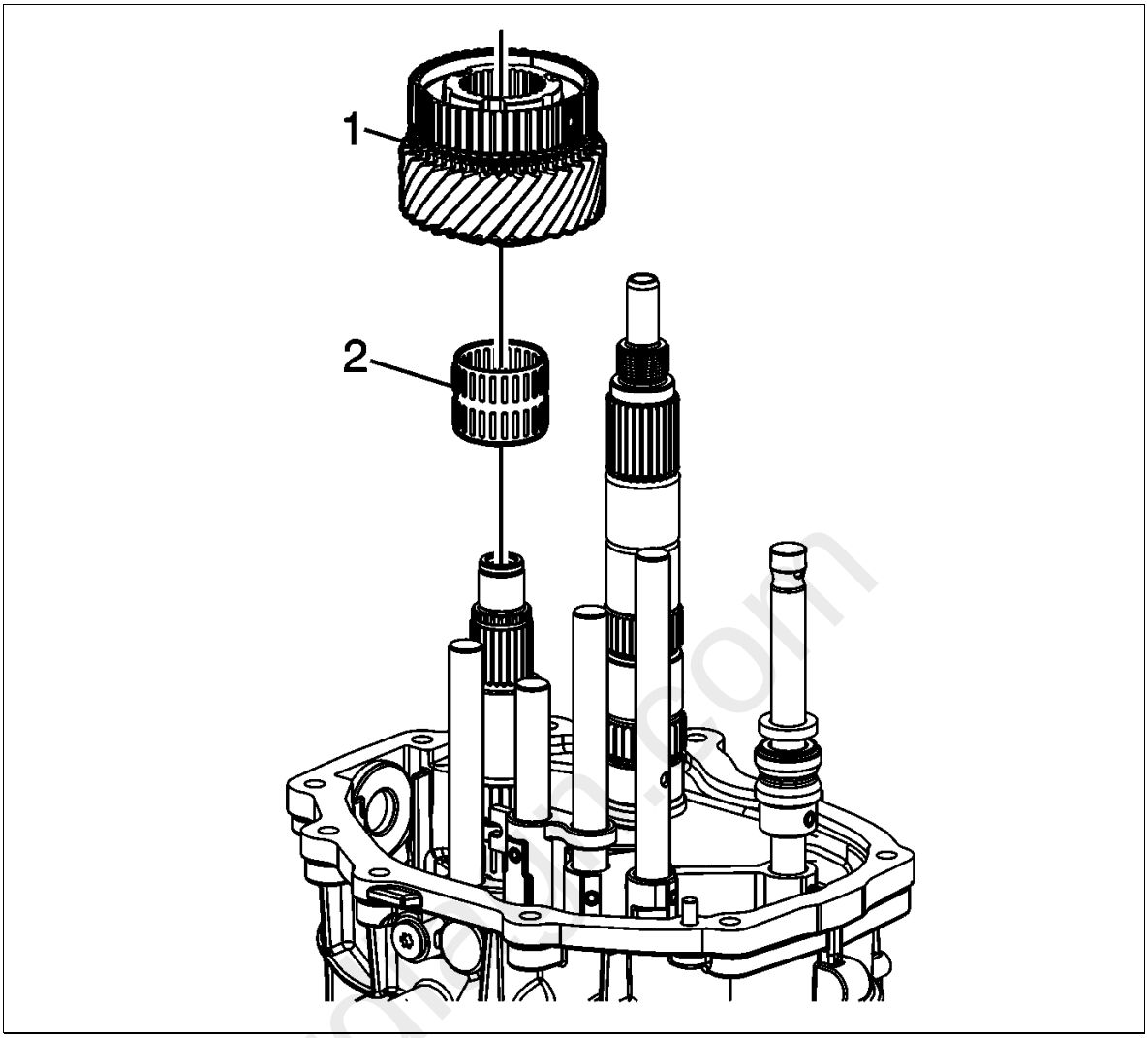
Fig 9: 3rd & 4th Synchronizer Sleeve And Fork Assembly



Courtesy of GENERAL MOTORS COMPANY

13. Remove the 3rd & 4th synchronizer sleeve and fork assembly (1).
14. Remove the 3rd gear bearing roller spacer (2). Using snap ring pliers remove the retaining ring (3).

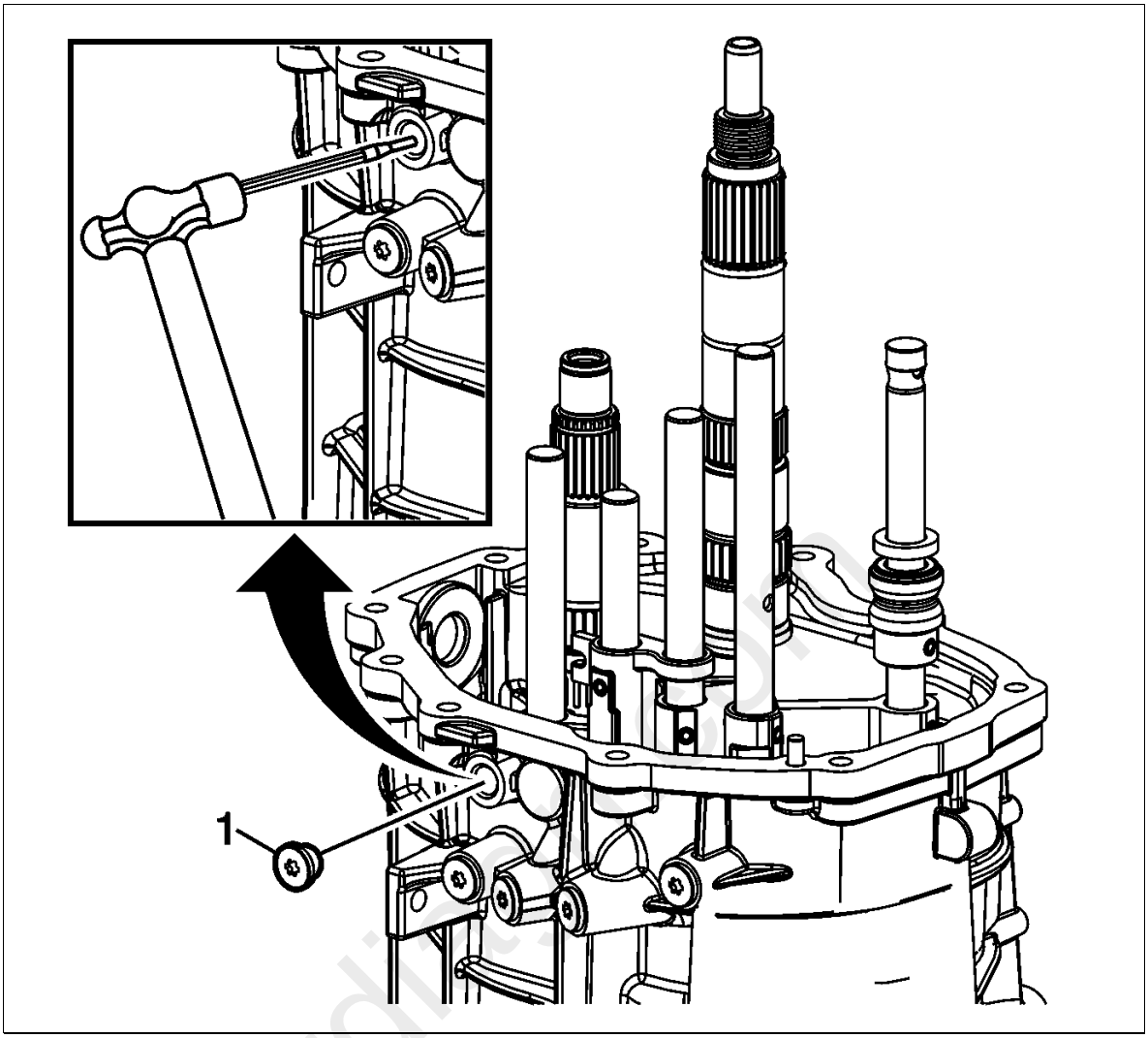
Fig 10: 3rd & 4th Hub, 4th Gear Blocking Rings, And 4th Gear Drive Gear



Courtesy of GENERAL MOTORS COMPANY

15. Remove the 3rd & 4th hub, 4th gear blocking rings, and 4th gear drive gear (1) as an assembly.
16. Remove the 4th gear bearing assembly (2).

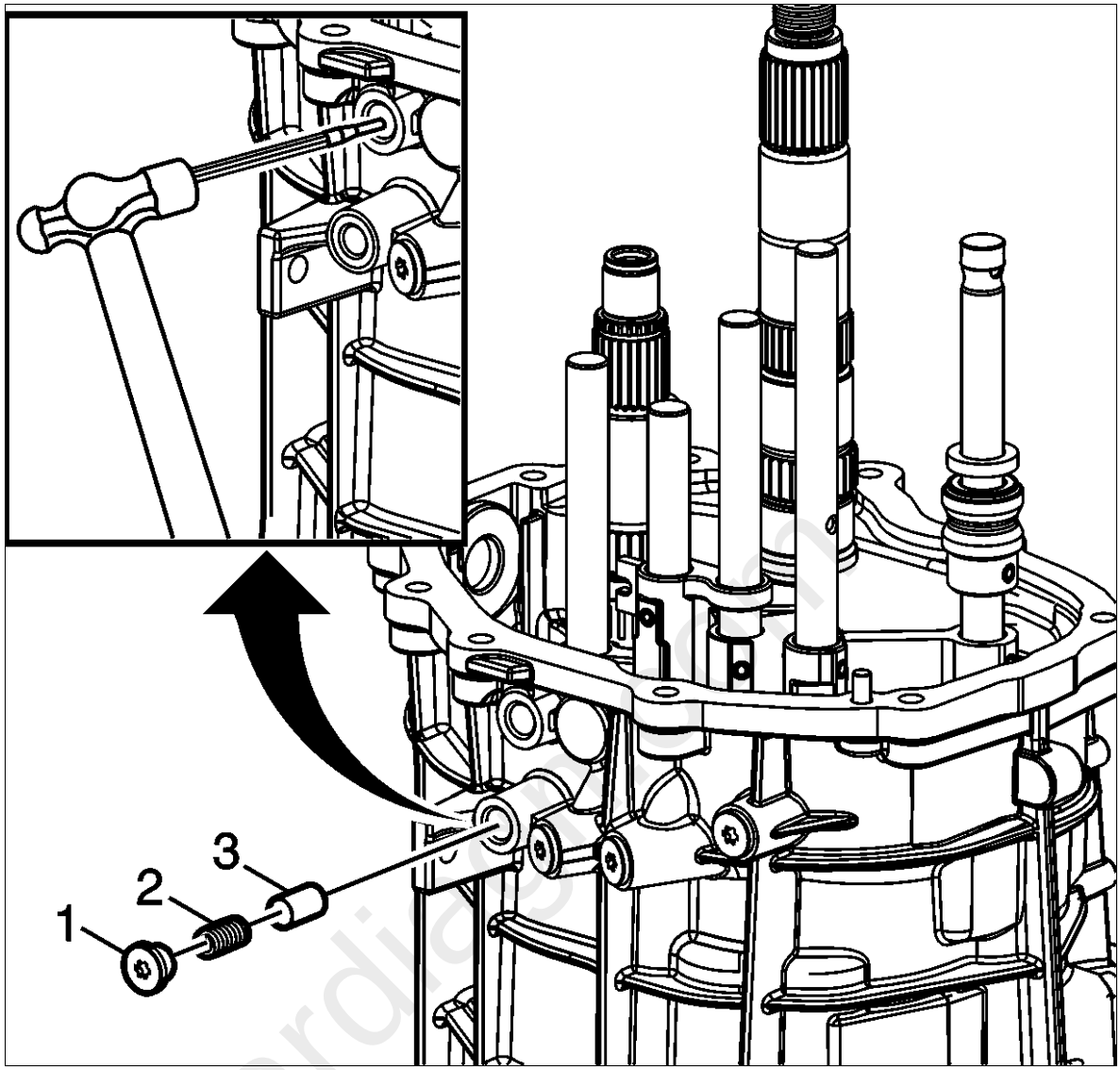
Fig 11: Shift Shaft Detent Plug



Courtesy of GENERAL MOTORS COMPANY

17. Remove the shift shaft detent plug (1). Then using a 3/16 in drift and hammer drive the coiled spring pin downward and remove.

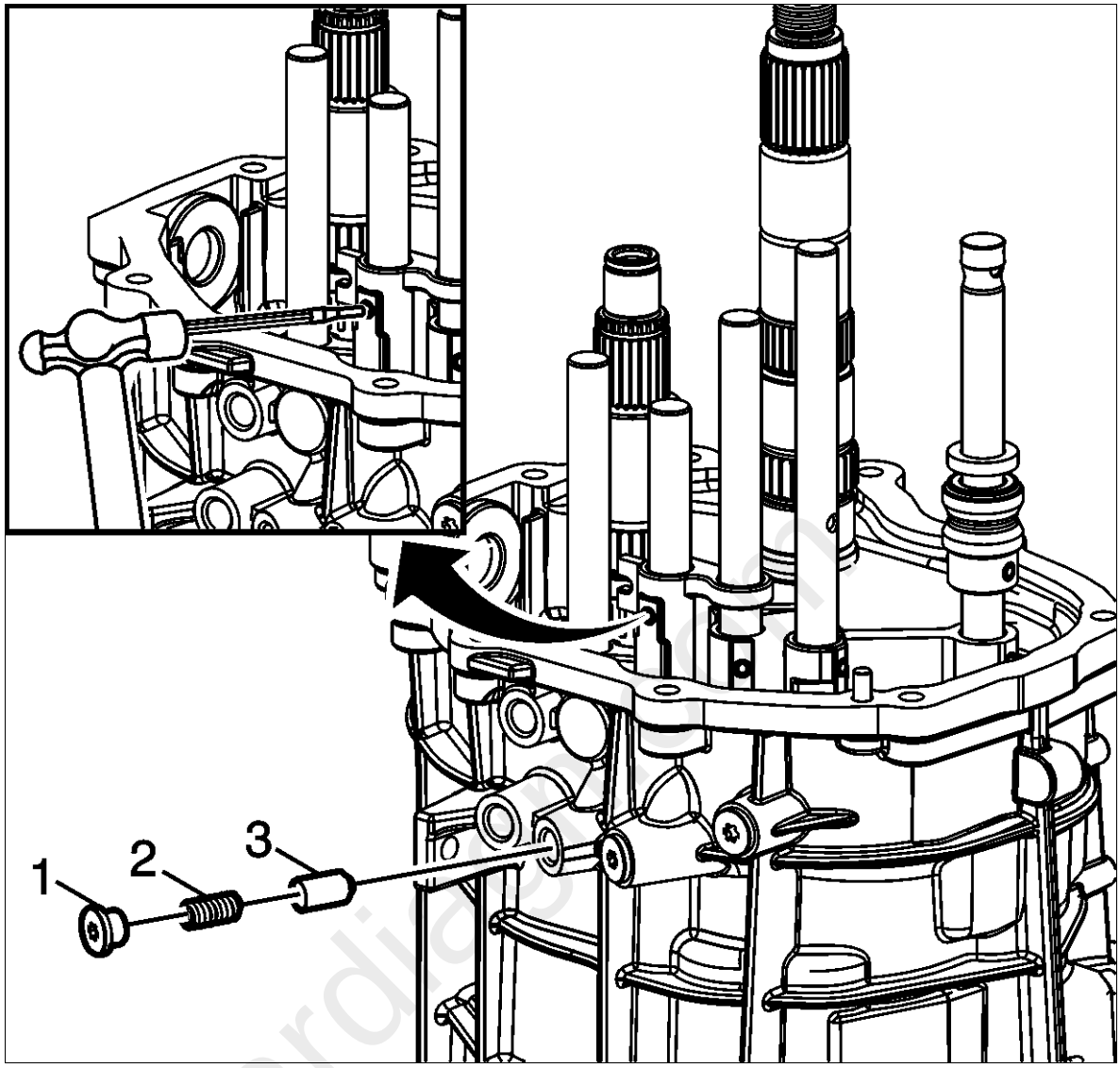
Fig 12: Shift Shaft Detent Spring And Detent



Courtesy of GENERAL MOTORS COMPANY

18. With the same drift still in the shift shaft, remove the shift shaft detent spring cover bolt (1), shift shaft detent spring (2), and shift shaft detent (3).

Fig 13: Coiled Spring Pin

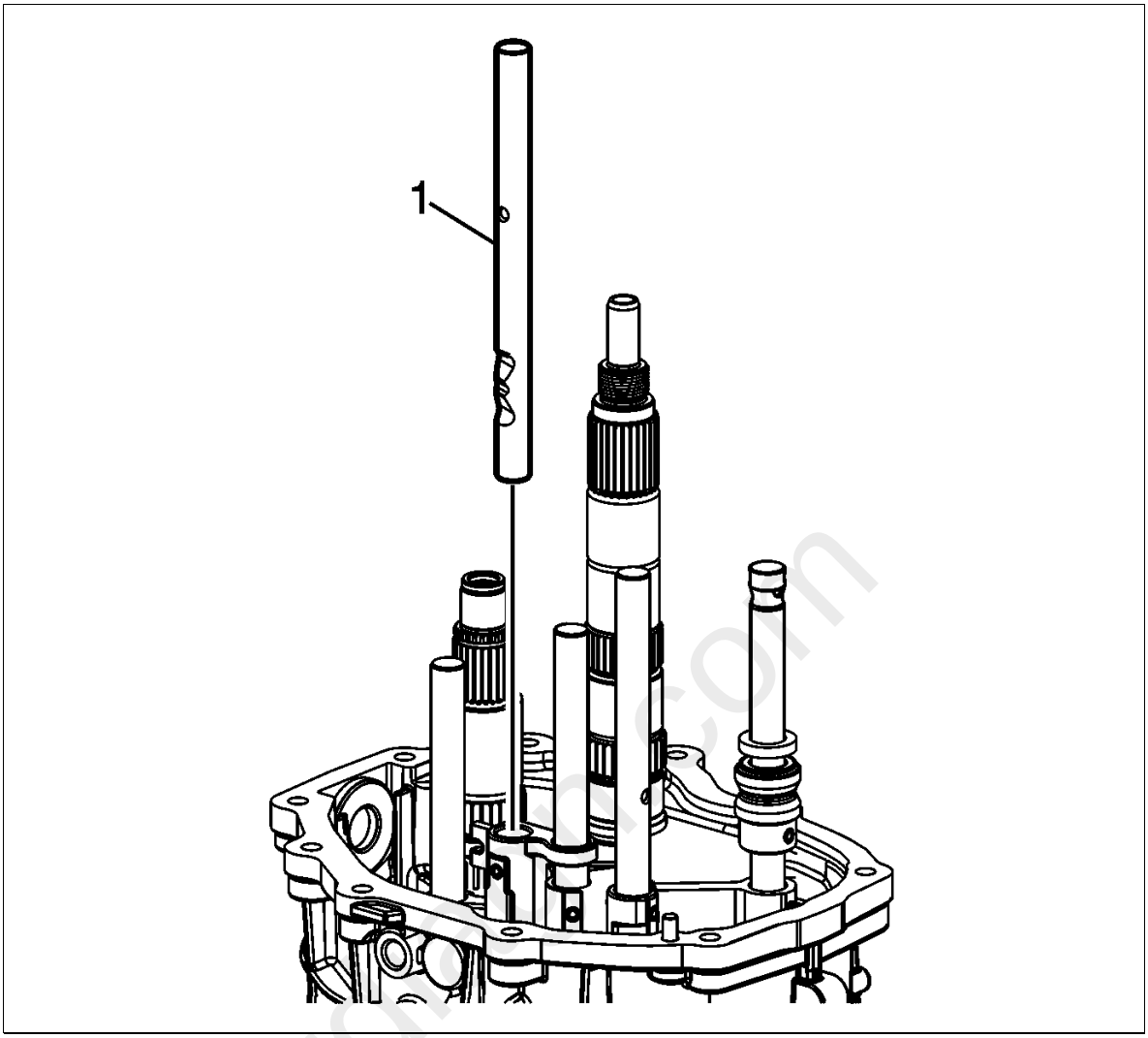


Courtesy of GENERAL MOTORS COMPANY

19. Using a 3/16 in punch drive the coiled spring pin downward and remove.

20. With the drift still in the shift shaft, remove the shift shaft detent spring cover bolt (1), shift shaft detent spring (2), and shift shaft detent (3).

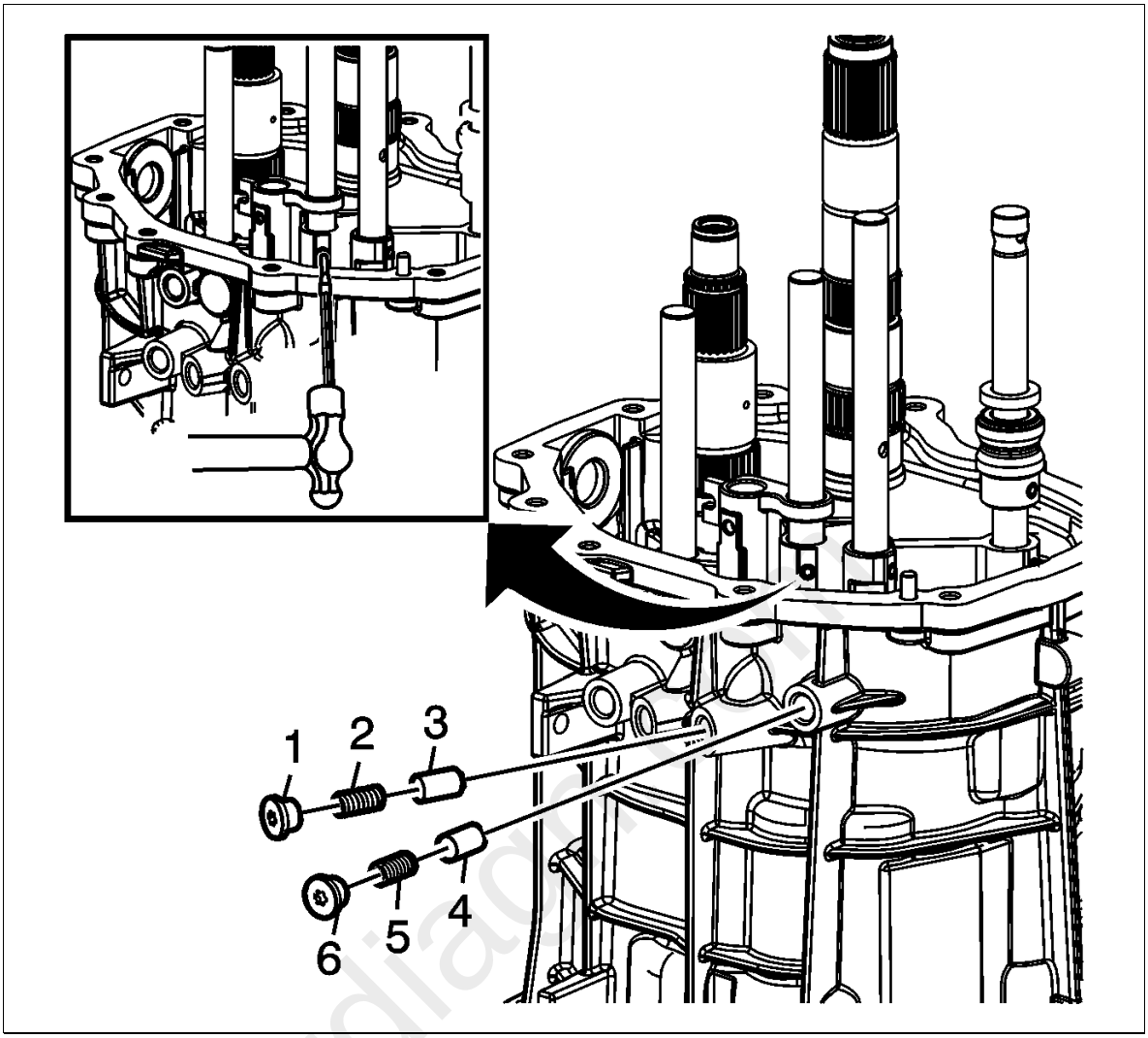
Fig 14: 3rd And 4th Shift Shaft



Courtesy of GENERAL MOTORS COMPANY

21. Remove the 3rd & 4th shift shaft (1).

Fig 15: Shift Shaft, Detent And Spring

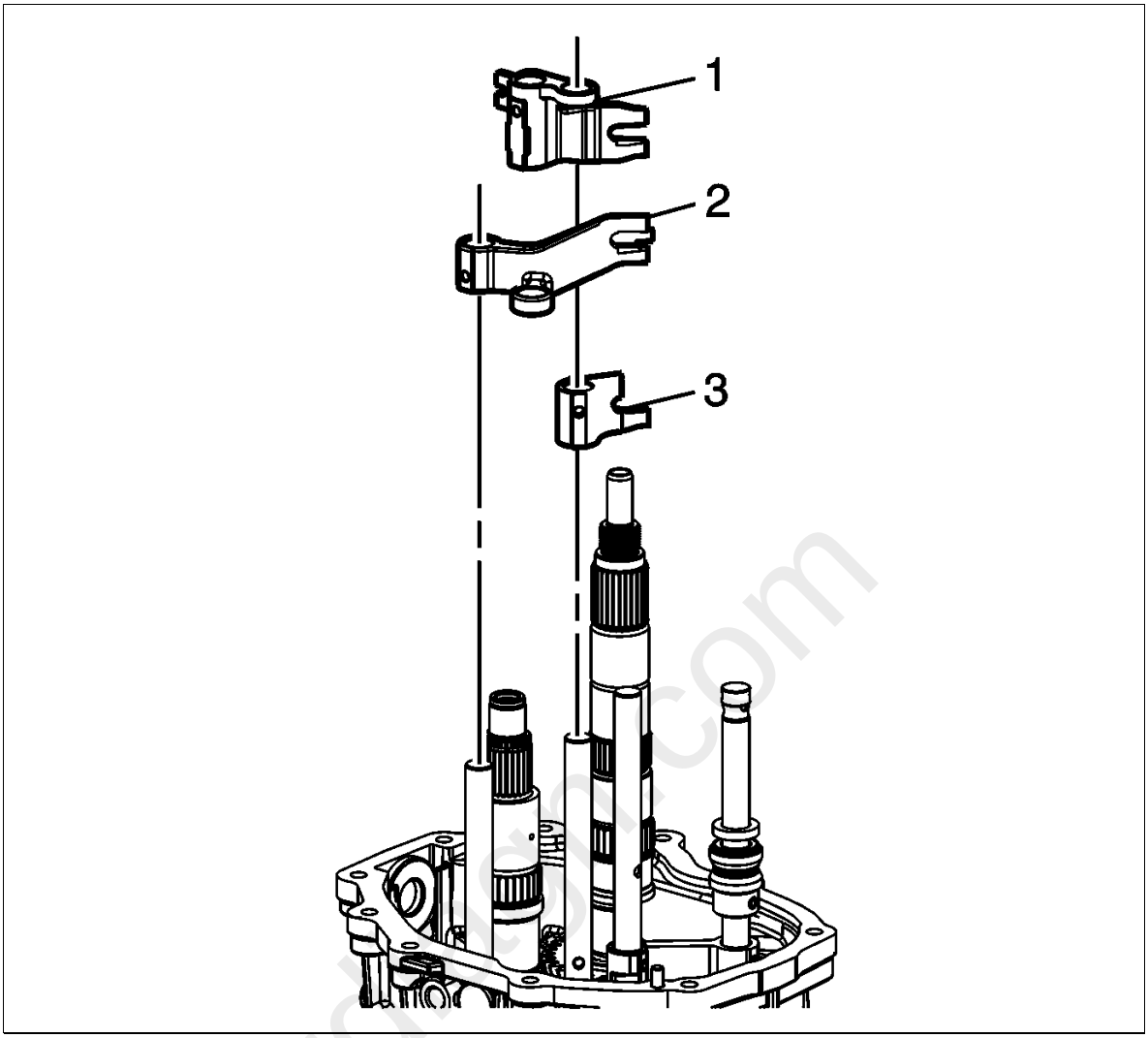


Courtesy of GENERAL MOTORS COMPANY

22. Remove the shift shaft detent spring cover bolt (1 and 6), shift shaft detent springs (2 and 5) and shift shaft detents (3 and 4).

23. Using a 3/16 in punch drive the coiled spring pin downward and remove.

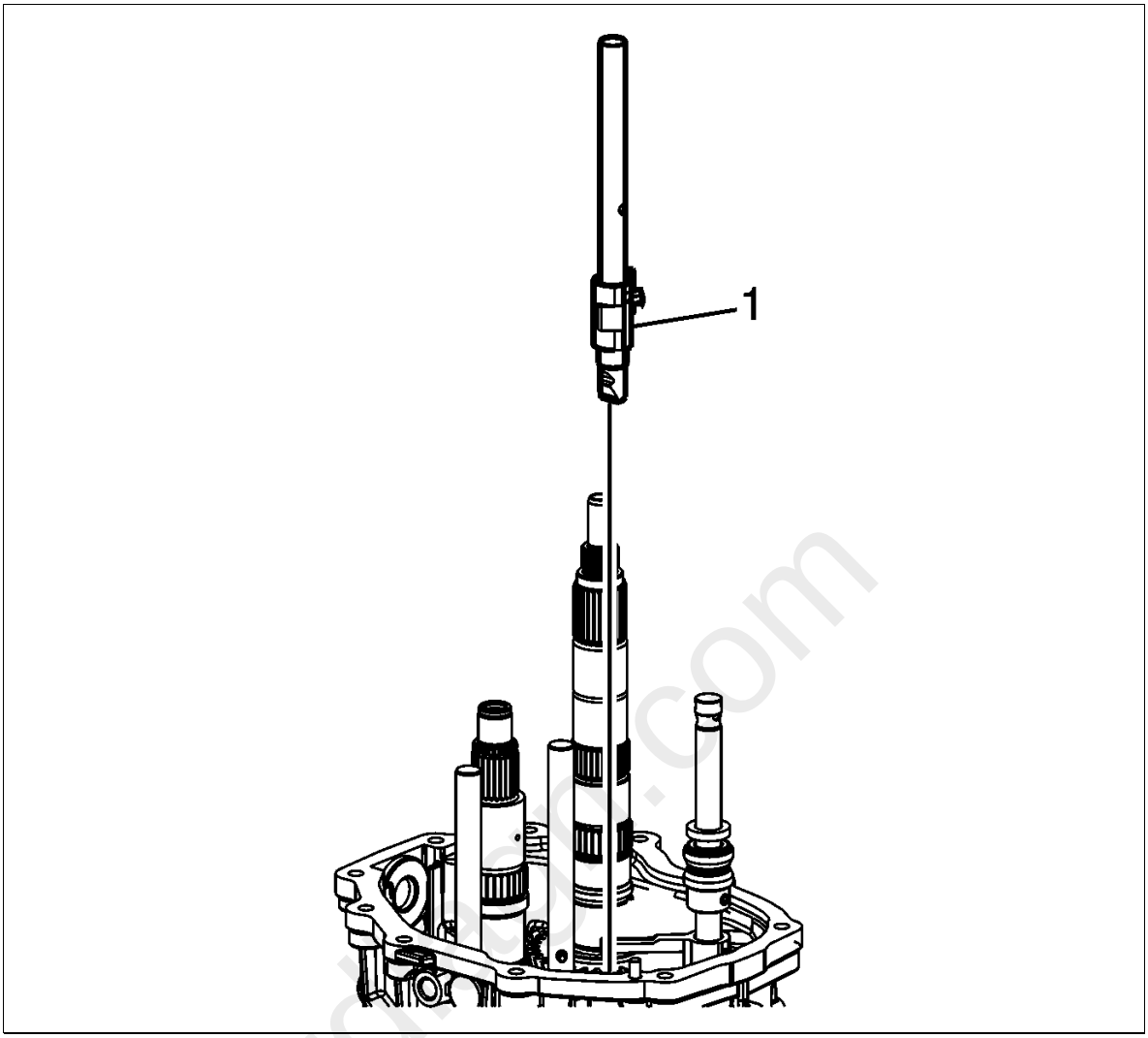
Fig 16: Selector Levers



Courtesy of GENERAL MOTORS COMPANY

24. Remove the manual transmission 3rd & 4th selector lever (1), manual transmission 5th & 6th selector lever (2), and the manual transmission 1st & 2nd selector lever (3).

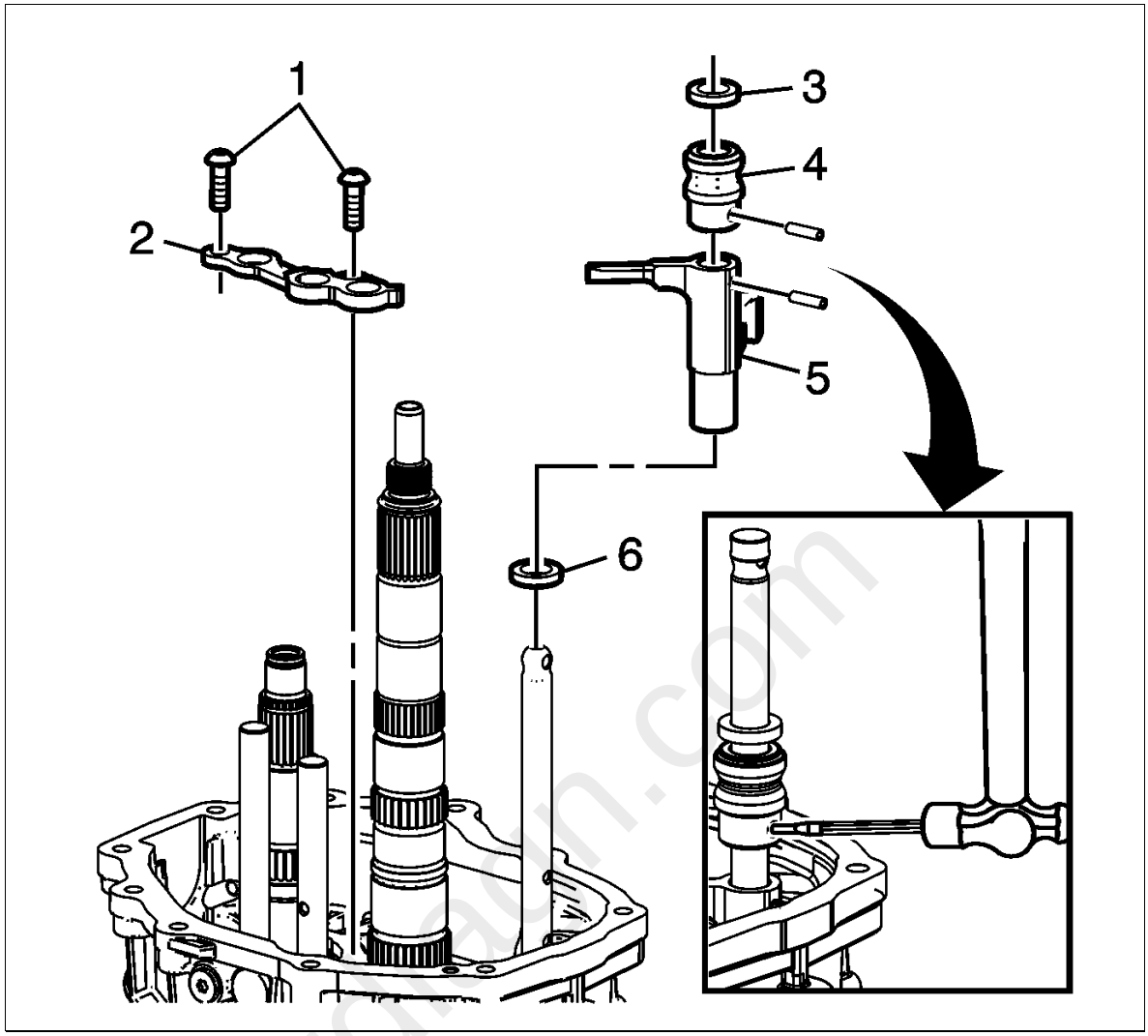
Fig 17: Reverse Shift Shaft Assembly And Manual Transmission Reverse Selector Lever



Courtesy of GENERAL MOTORS COMPANY

25. Remove the reverse shift shaft assembly and manual transmission reverse selector lever (1) as an assembly.

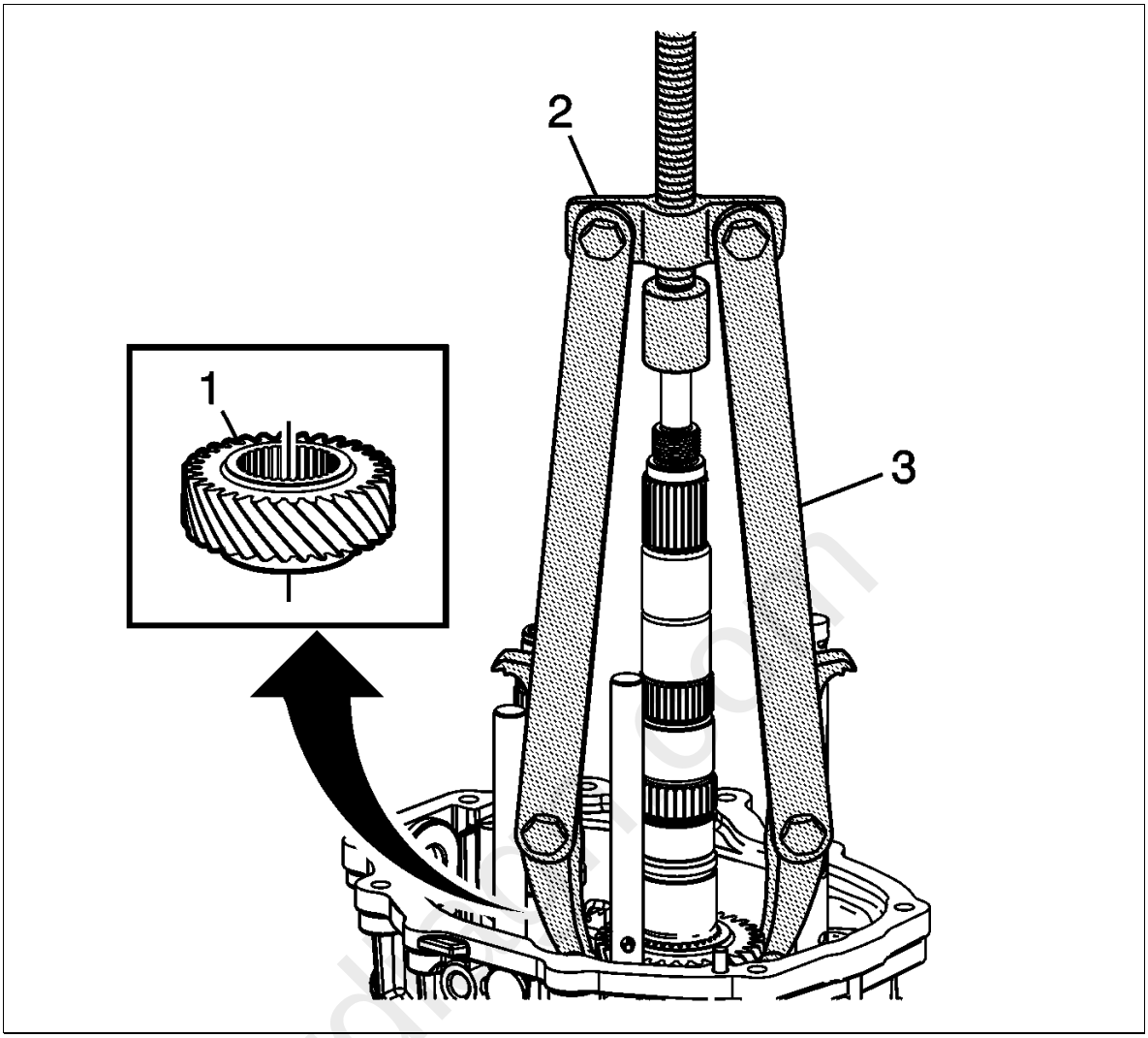
Fig 18: Shift Control Spacer



Courtesy of GENERAL MOTORS COMPANY

26. Using a drift punch and hammer drive the roll pins downward and remove.
27. Remove the shift interlock plate retainer bolts (1), shift control spacer (3), and neutral cam (4).
28. Remove the shift bar support (interlock) (2) and selector finger and cam (5) at the same time.
29. Remove the second shift control spacer (6)

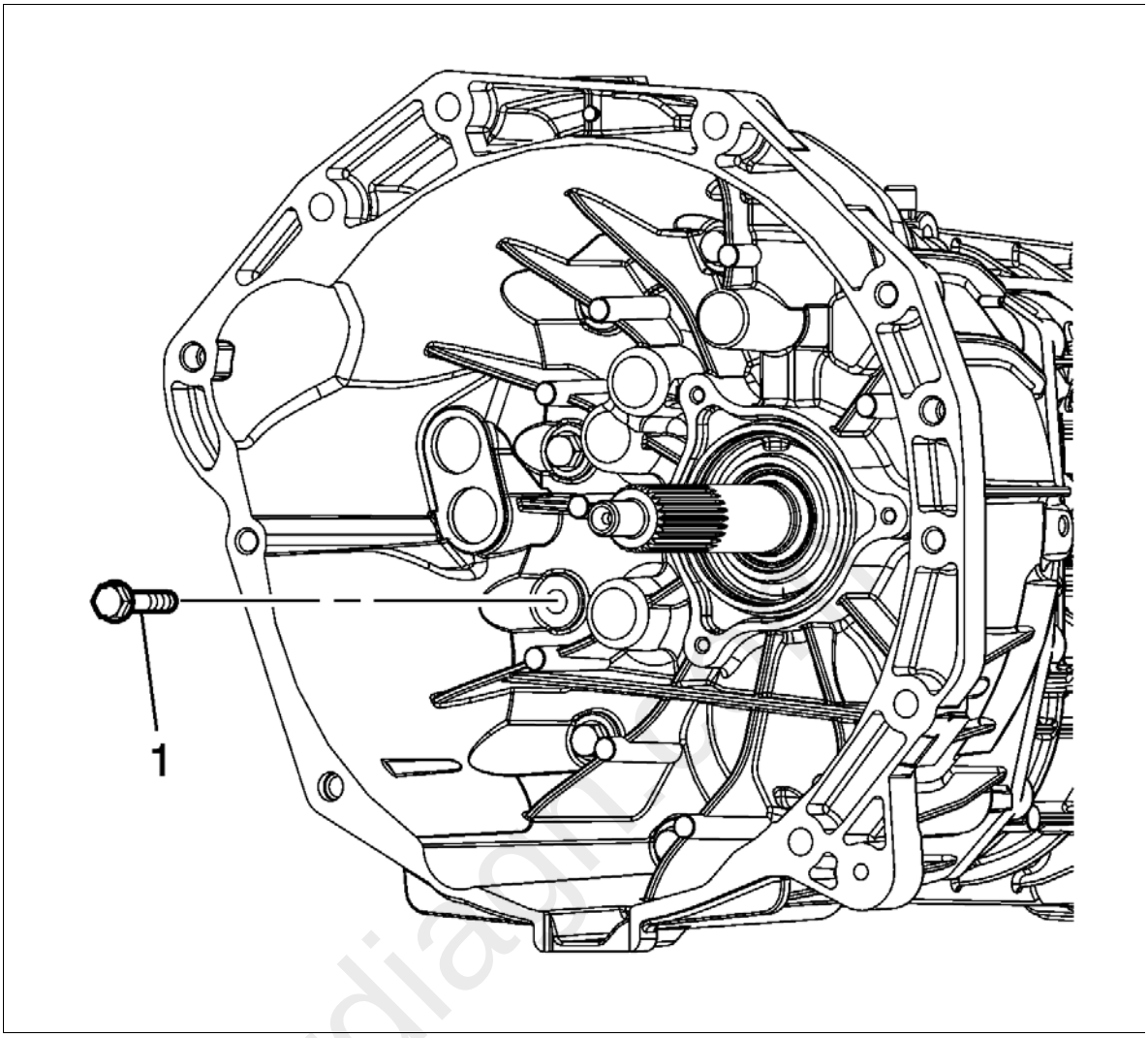
Fig 19: 4th Gear Assembly & Special Tools



Courtesy of GENERAL MOTORS COMPANY

30. Remove the 4th gear assembly (1) using **J 22888-D** side bearing remover (2) with **DT 51075** puller adapter set (3).

Fig 20: Clutch Housing Bolts

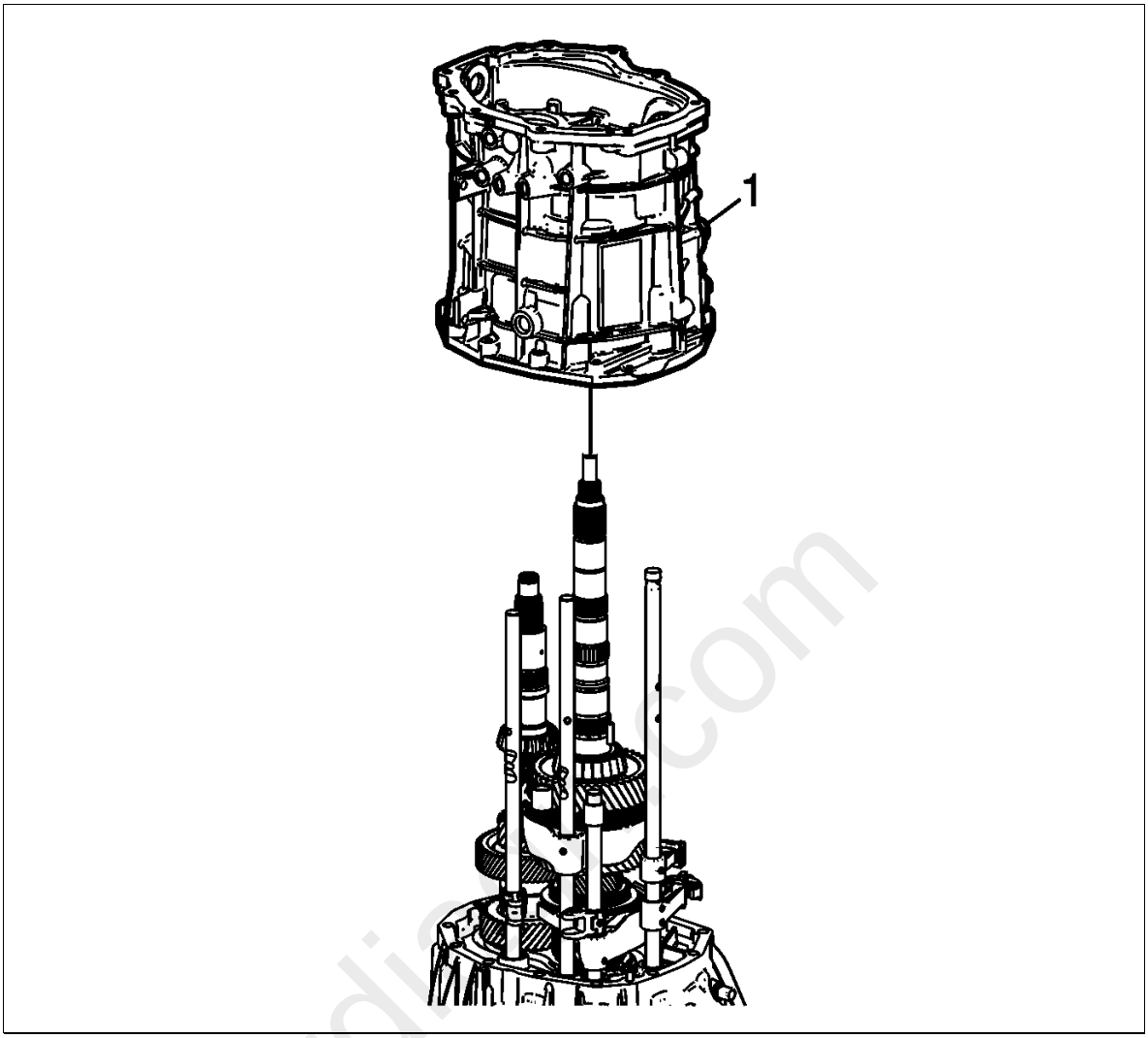


Courtesy of GENERAL MOTORS COMPANY

31. Remove the clutch housing bolts (1).

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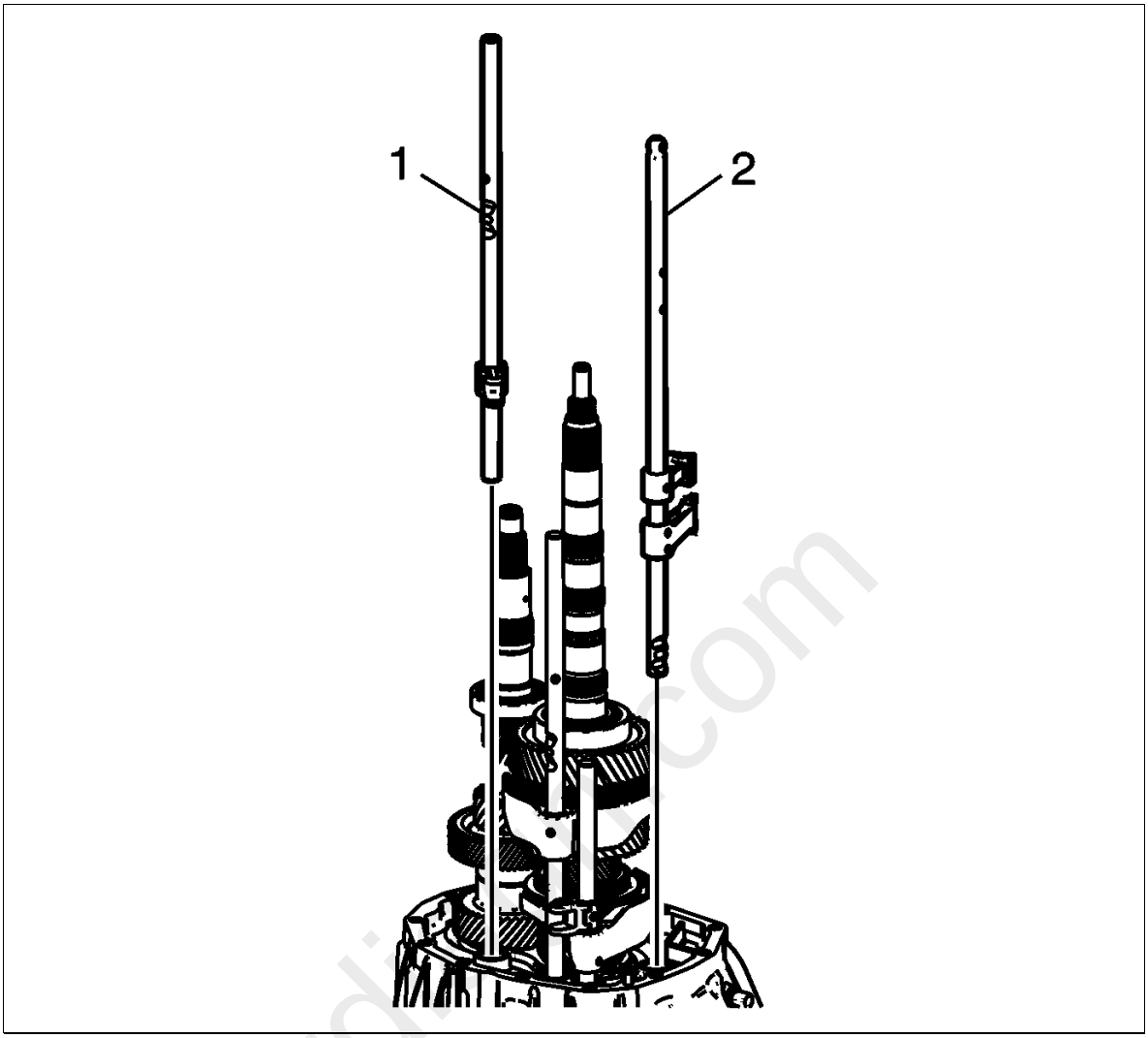
Fig 21: Transmission Case Assembly



Courtesy of GENERAL MOTORS COMPANY

32. Remove the transmission case assembly (1).

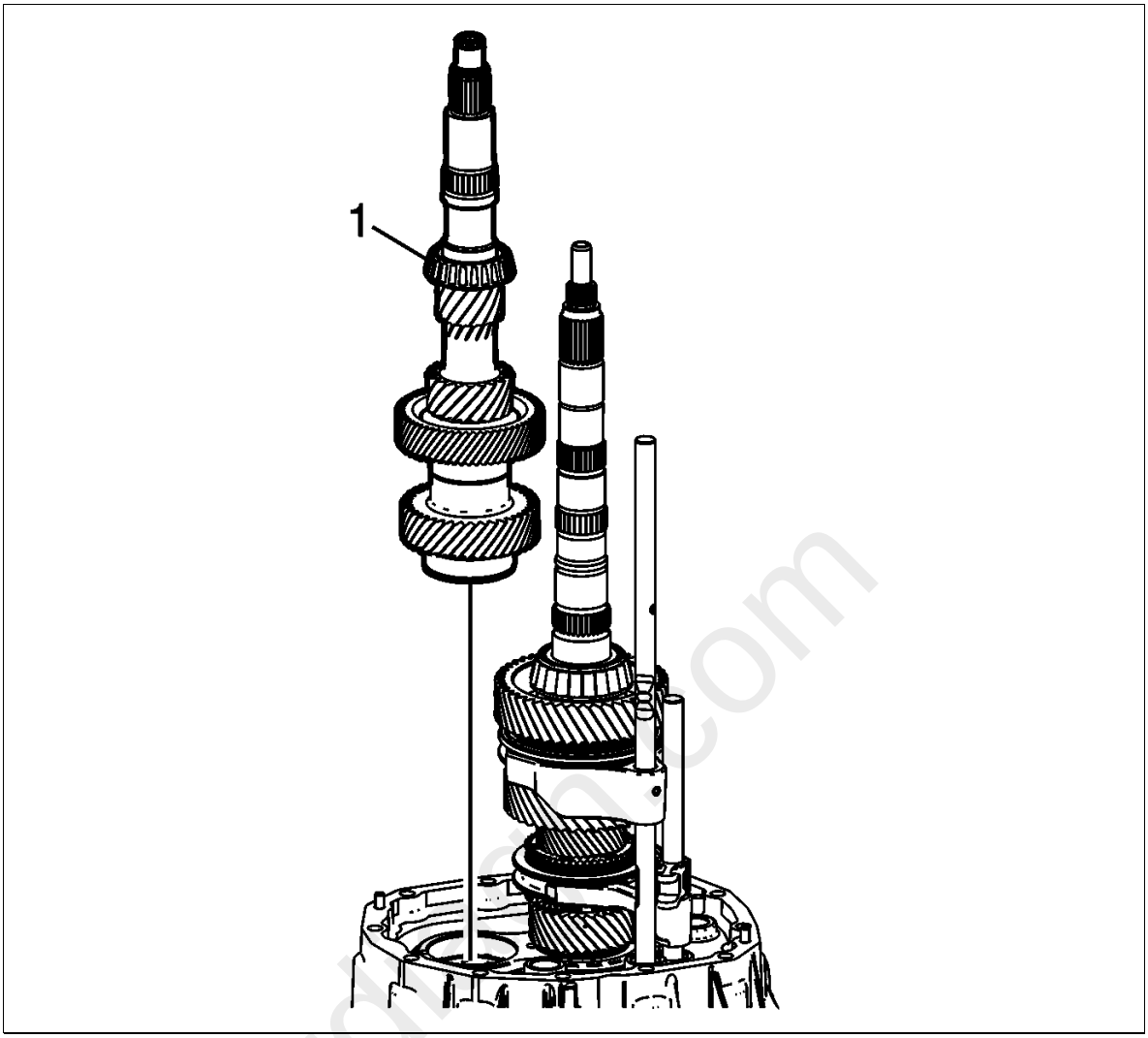
Fig 22: Shift Shaft Assemblies



Courtesy of GENERAL MOTORS COMPANY

33. Remove the Shift Shaft Assemblies (1 & 2).

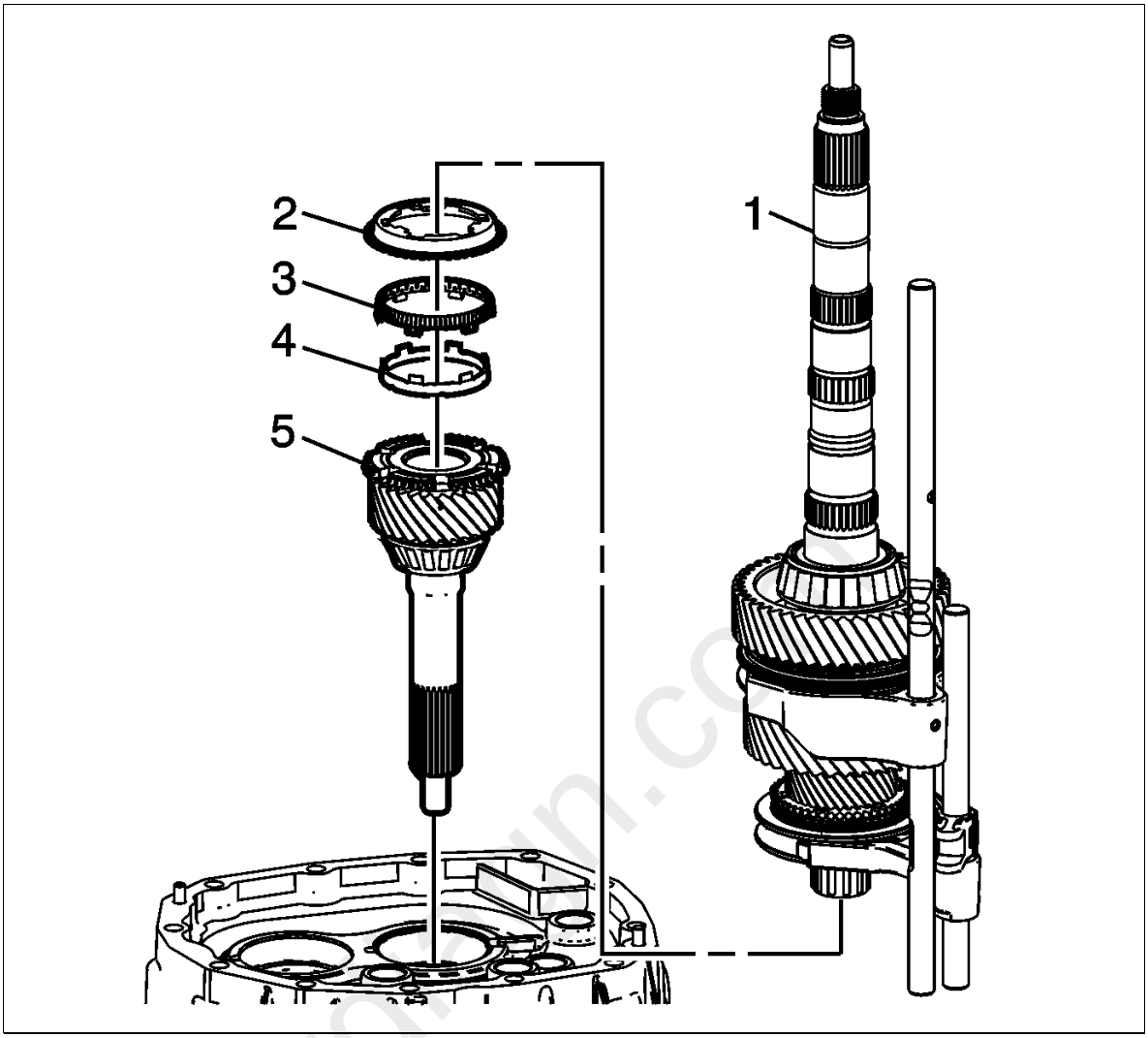
Fig 23: Counter Gear Assembly



Courtesy of GENERAL MOTORS COMPANY

34. Remove the counter gear assembly (1).

Fig 24: Input Shaft Assembly & Related Components



Courtesy of GENERAL MOTORS COMPANY

35. Remove the main shaft, shift rails, and shift forks as an assembly (1).
36. Remove the blocking ring (2), intermediate cone (3), and inner cone (4).
37. Remove the input shaft assembly (5).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (MM6)

Special Tools

- **DT 47678** Transmission Holding Flange
- **DT 47678-10** Transmission Holding Flange Adapter
- **DT 49139** Hub Remover Tool
- **DT 49293** Gear Select/Skip Shift Solenoid Socket

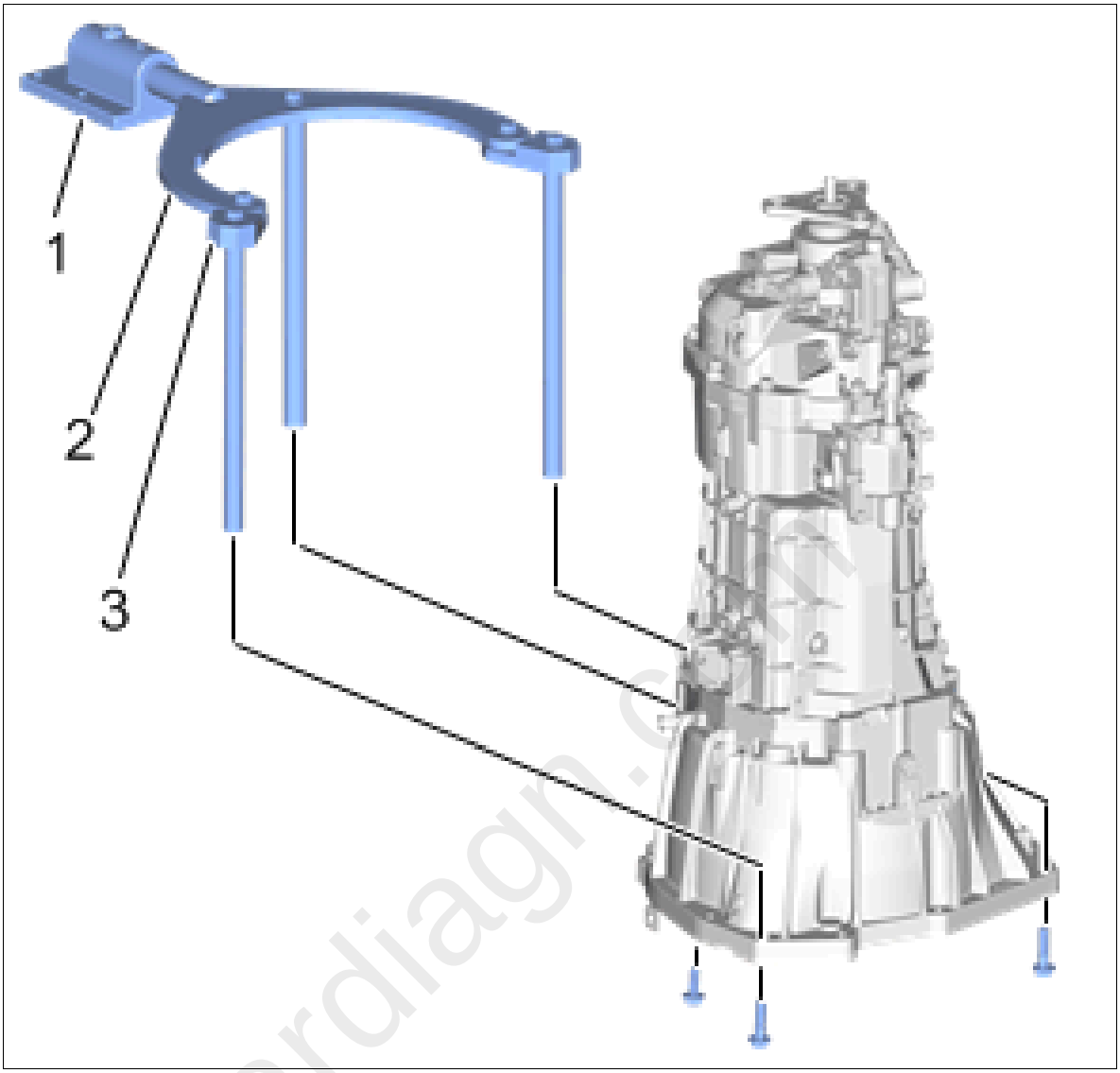
- **J 6125-1B** Slider Hammer
- **J 8433** Universal Bridge Puller
- **J 3289-20** Holding Fixture
- **J 22888-20A** Puller
- **J 23907** Slide Hammer
- **J 36017** Valve Seal Remover
- **J 38416-B** Harmonic Balancer Remover
- **J 39431** 5th/6th Driven Gear Puller
- **J 39431-3** 5th Gear Puller Adapter Bolts
- **J 41816** Crankshaft Balancer Remover
- **J 44873-3** Mounting Bolts
- **J 45012** Holding Fixture

For equivalent regional tools, refer to Special Tools (MM6) .

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (MM6) > EXTENSION HOUSING REMOVAL

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Fig 1: Holding Fixture

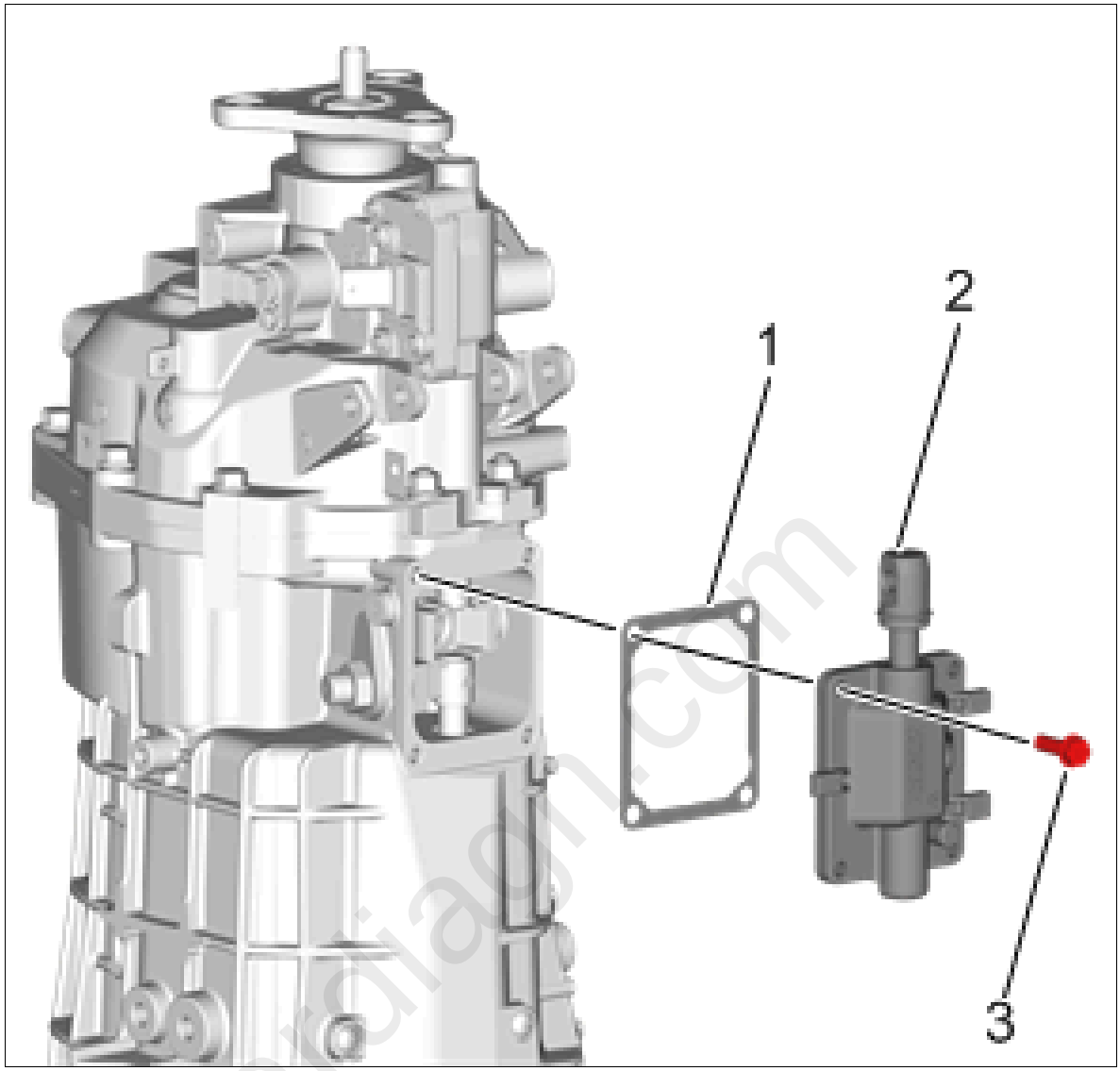


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1. Install the **DT-47678** flange (2) and the **DT-47678-10** flange adapter (3).
2. Mount the transmission on a workbench using the **J-3289-20** holding fixture (1).
3. Rotate the transmission into a horizontal position.
4. Remove the transmission drain plug and drain the transmission fluid.
5. Shift the transmission into NEUTRAL (N).

Fig 2: Shifter Cover Plate Bolts

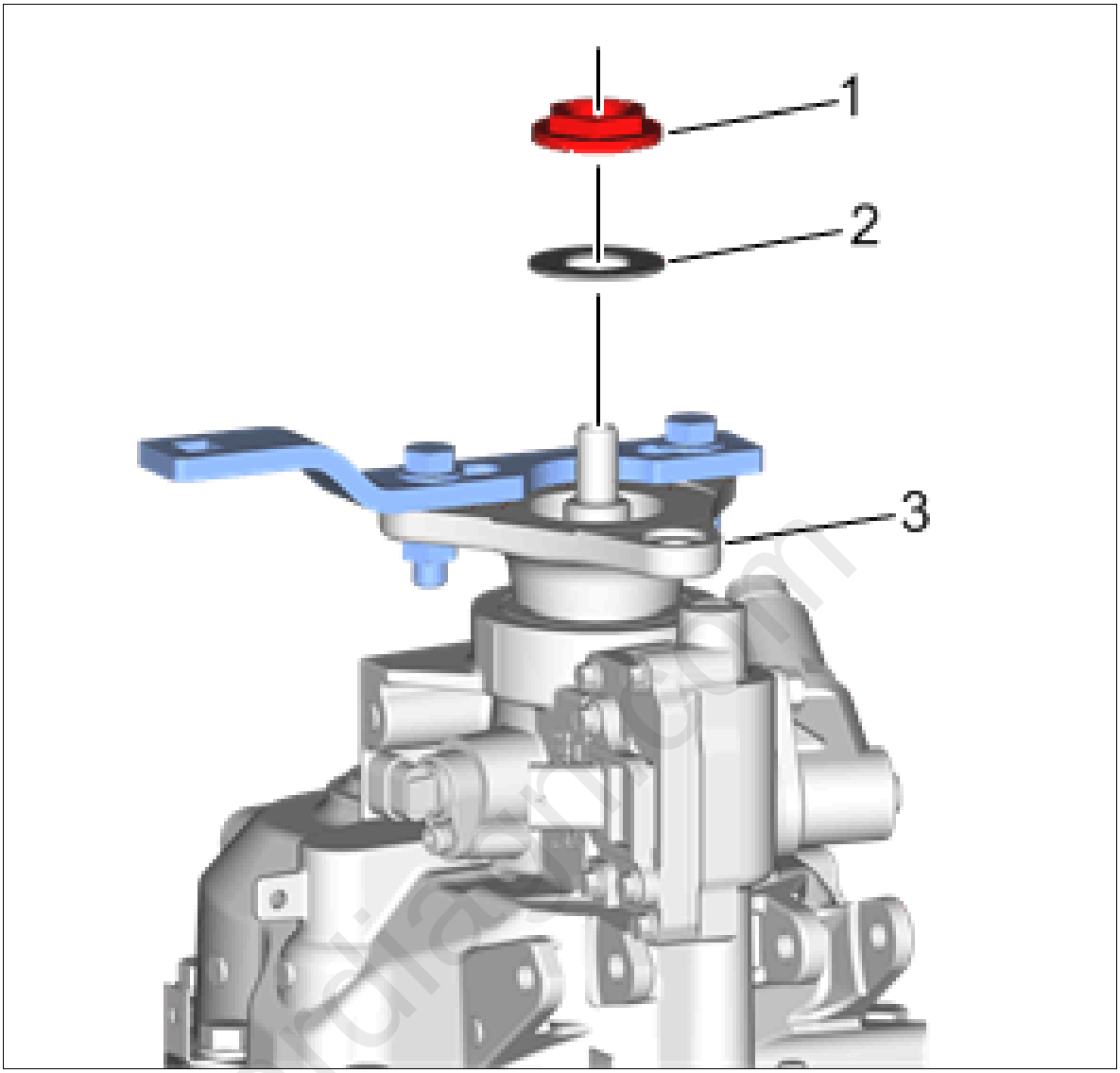


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6. Remove the shifter cover plate bolts (3).
7. Remove the shifter cover plate (2) and gasket (1).

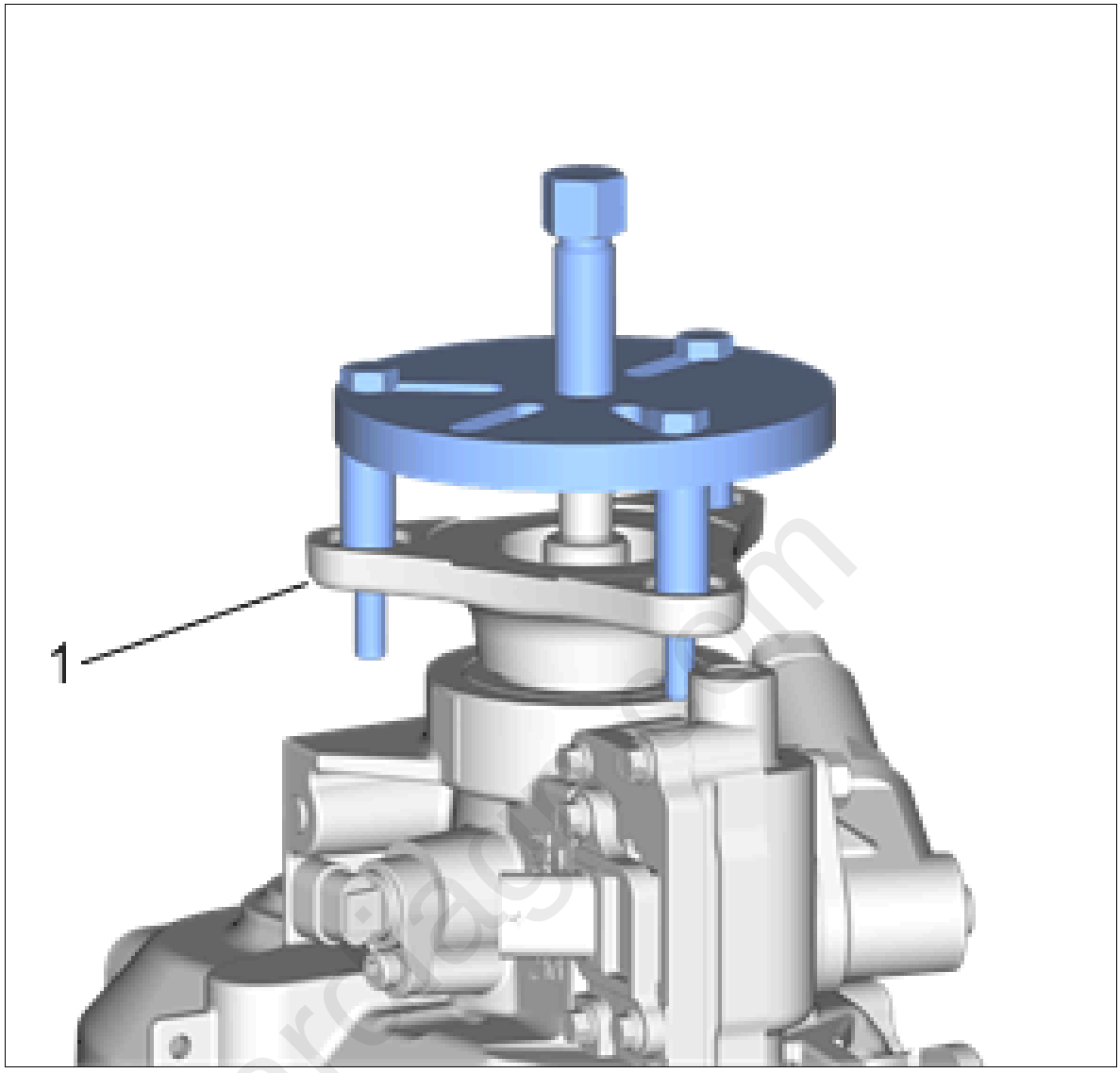
Fig 3: Propeller Shaft Washer



Courtesy of GENERAL MOTORS COMPANY

8. Install the **J-45012** holding fixture with the mounting bolts to the propeller shaft transmission yoke (3).
9. Using a socket wrench, remove the propeller shaft transmission yoke nut (1).
10. Remove the propeller shaft transmission yoke washer (2).

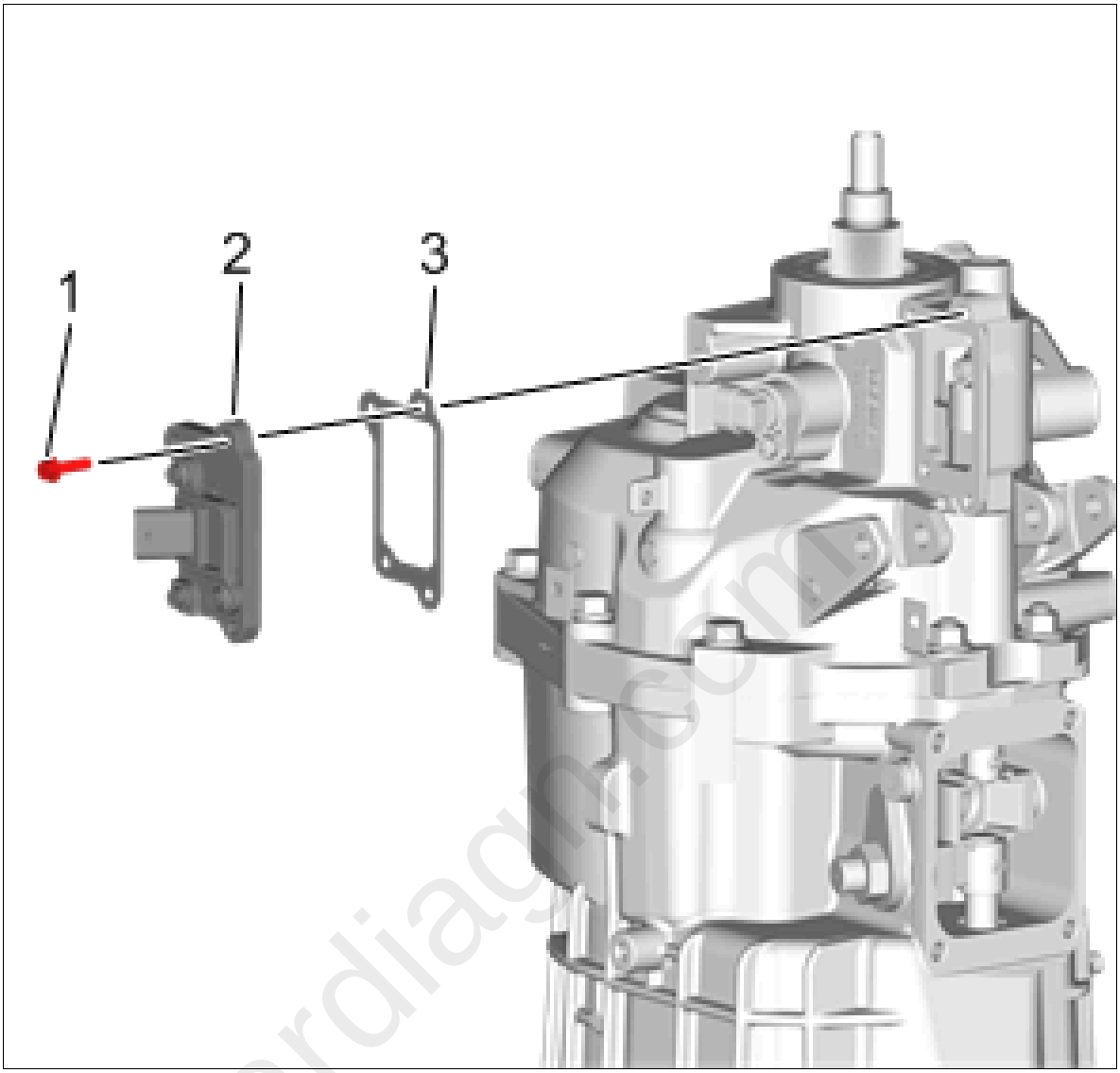
Fig 4: Propeller Shaft Transmission Yoke



Courtesy of GENERAL MOTORS COMPANY

11. Using **DT-45019** flange and pinion cage remover, remove the propeller shaft transmission yoke (1).

Fig 5: Transmission Gear Position Sensor

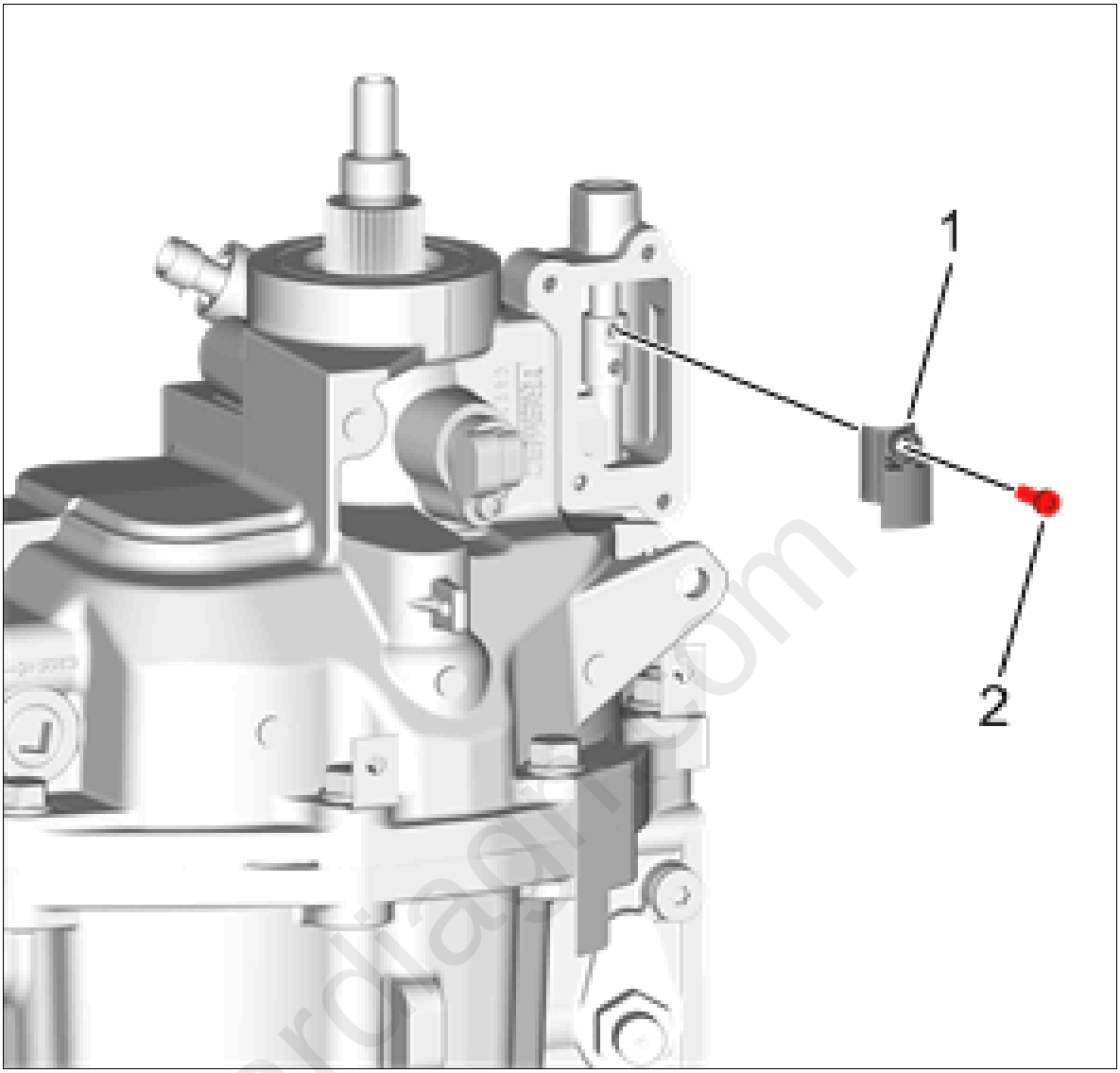


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12. Remove the manual transmission gear position sensor bolt (1).
13. Remove the manual transmission gear position sensor (2) and the manual transmission gear position sensor gasket (3).

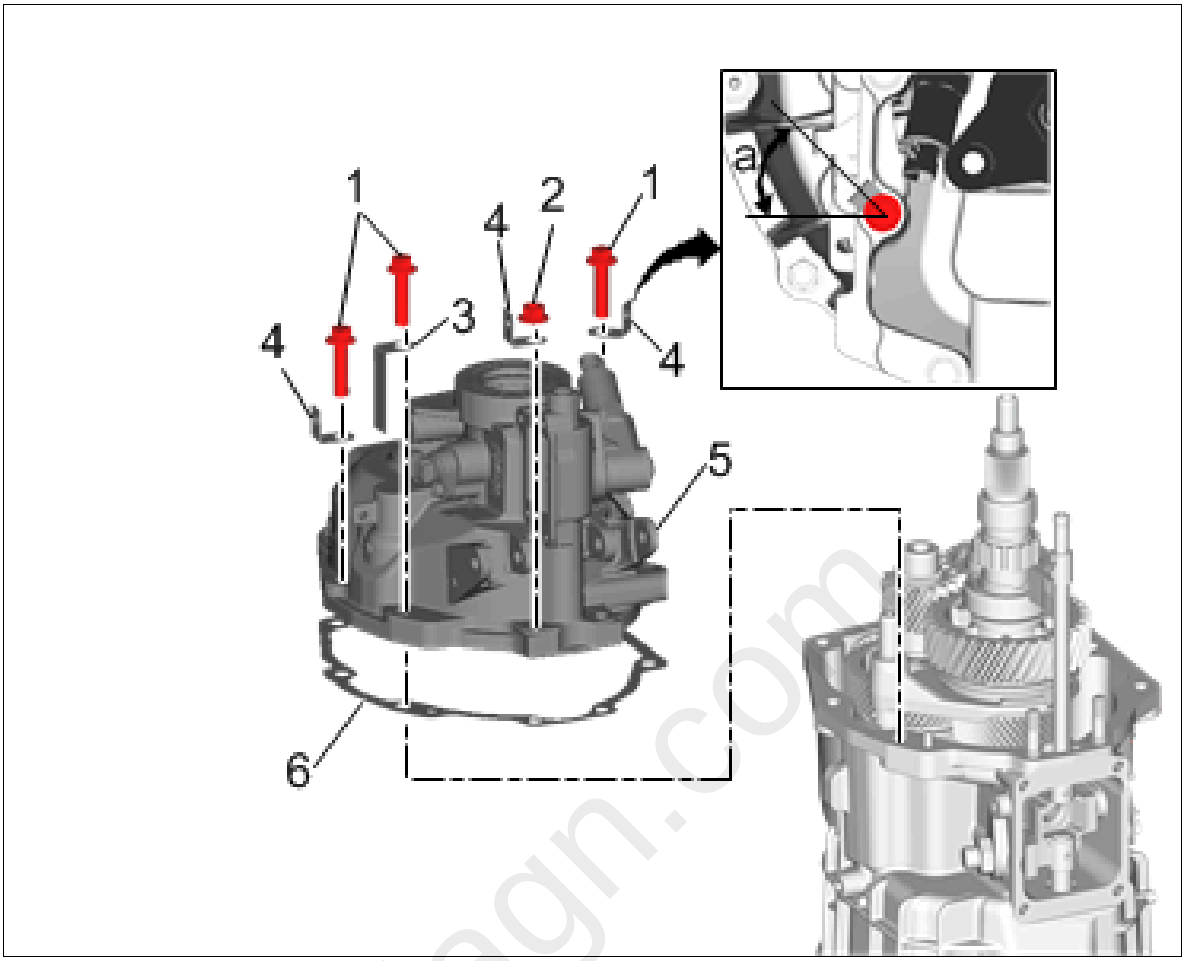
Fig 6: Transmission Gap Magnet



Courtesy of GENERAL MOTORS COMPANY

14. Remove the transmission gap magnet bolt (1) and the transmission gap magnet (2).

Fig 7: Rear Extension Housing Bolts



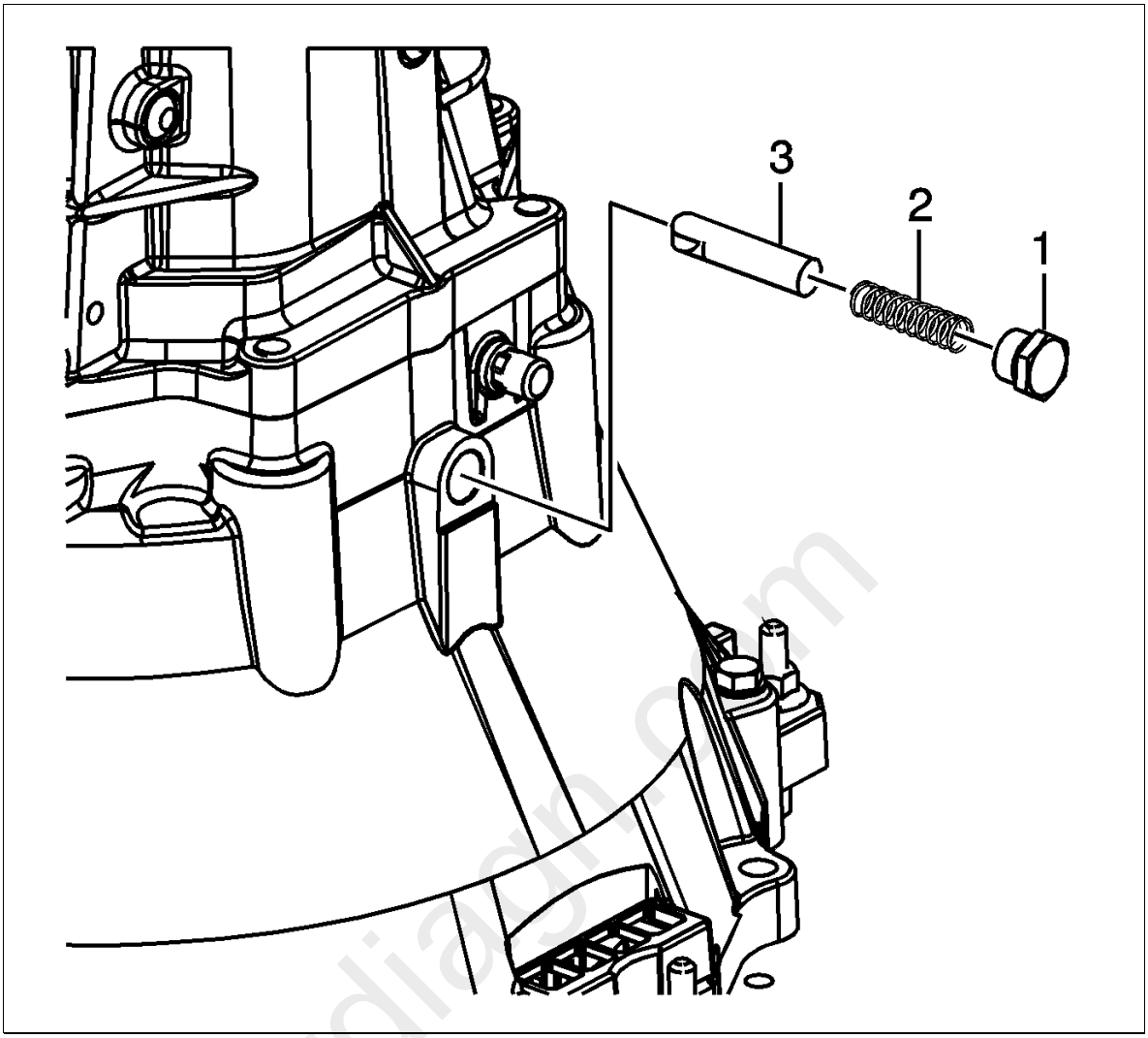
Courtesy of GENERAL MOTORS COMPANY

15. Remove the rear extension housing bolts (1).
16. Remove the extension housing (2) and transmission extension gasket (3).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (MM6) > REVERSE SPEED GEAR REMOVAL

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Fig 1: Plug, Spring & Shift Detent Roller

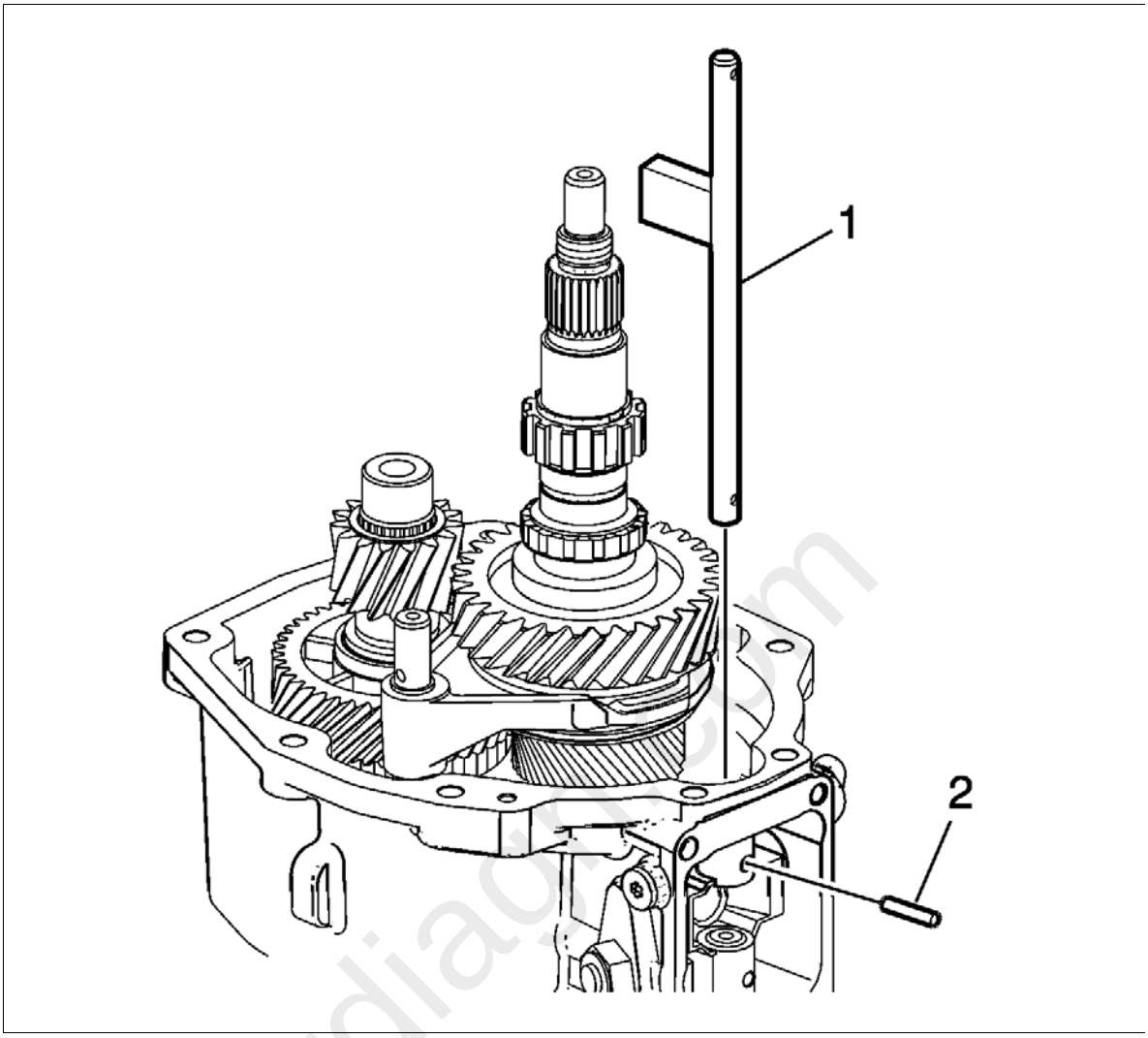


Courtesy of GENERAL MOTORS COMPANY

1. Remove the plug (1), spring (2), and shift detent roller (3).

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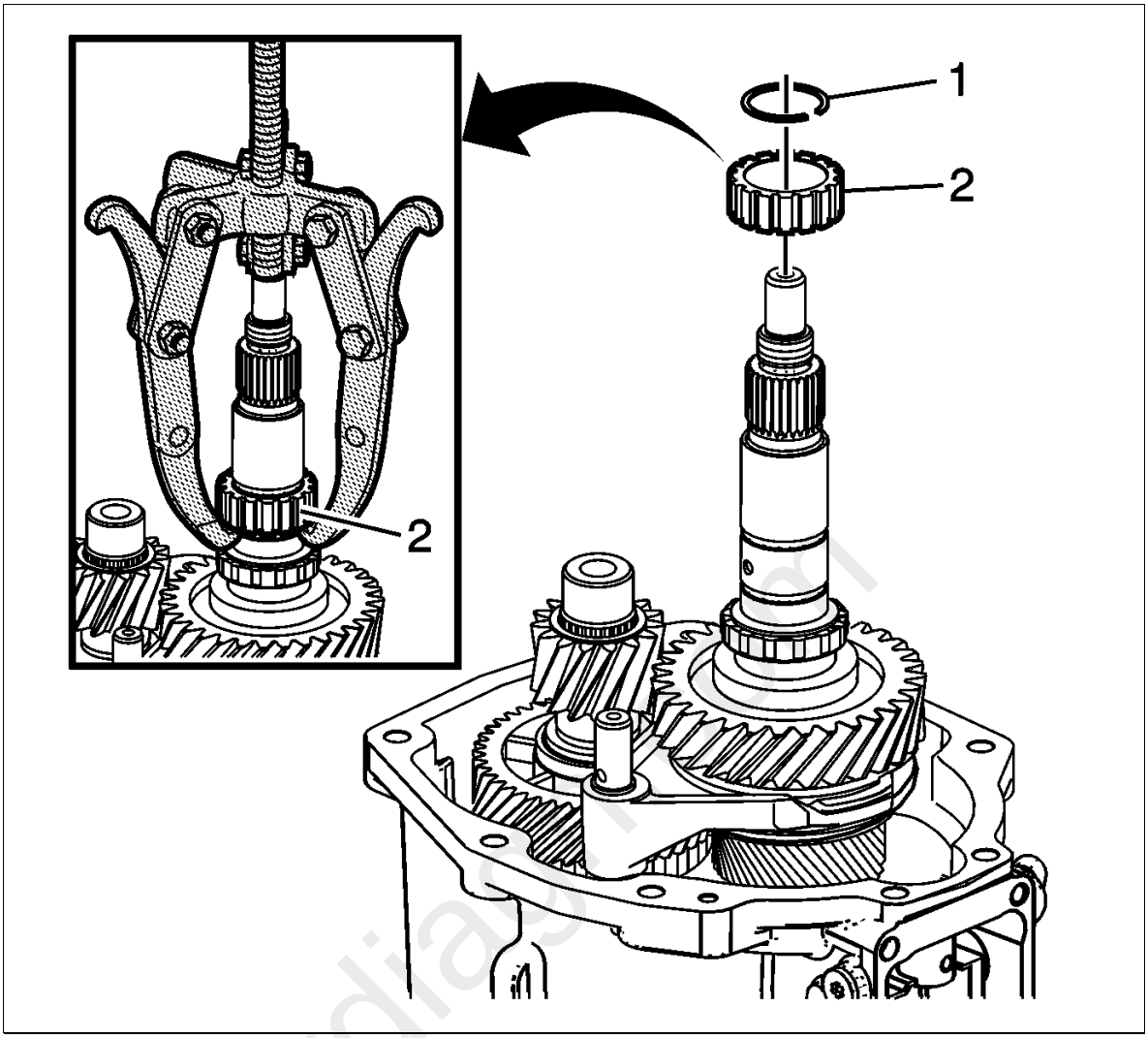
Fig 2: Offset Shift Lever & Shift Guide Rollpin



Courtesy of GENERAL MOTORS COMPANY

2. Remove the shift guide rollpin (2). Drive into the housing and remove with guide.
3. Remove the offset shift lever (1).

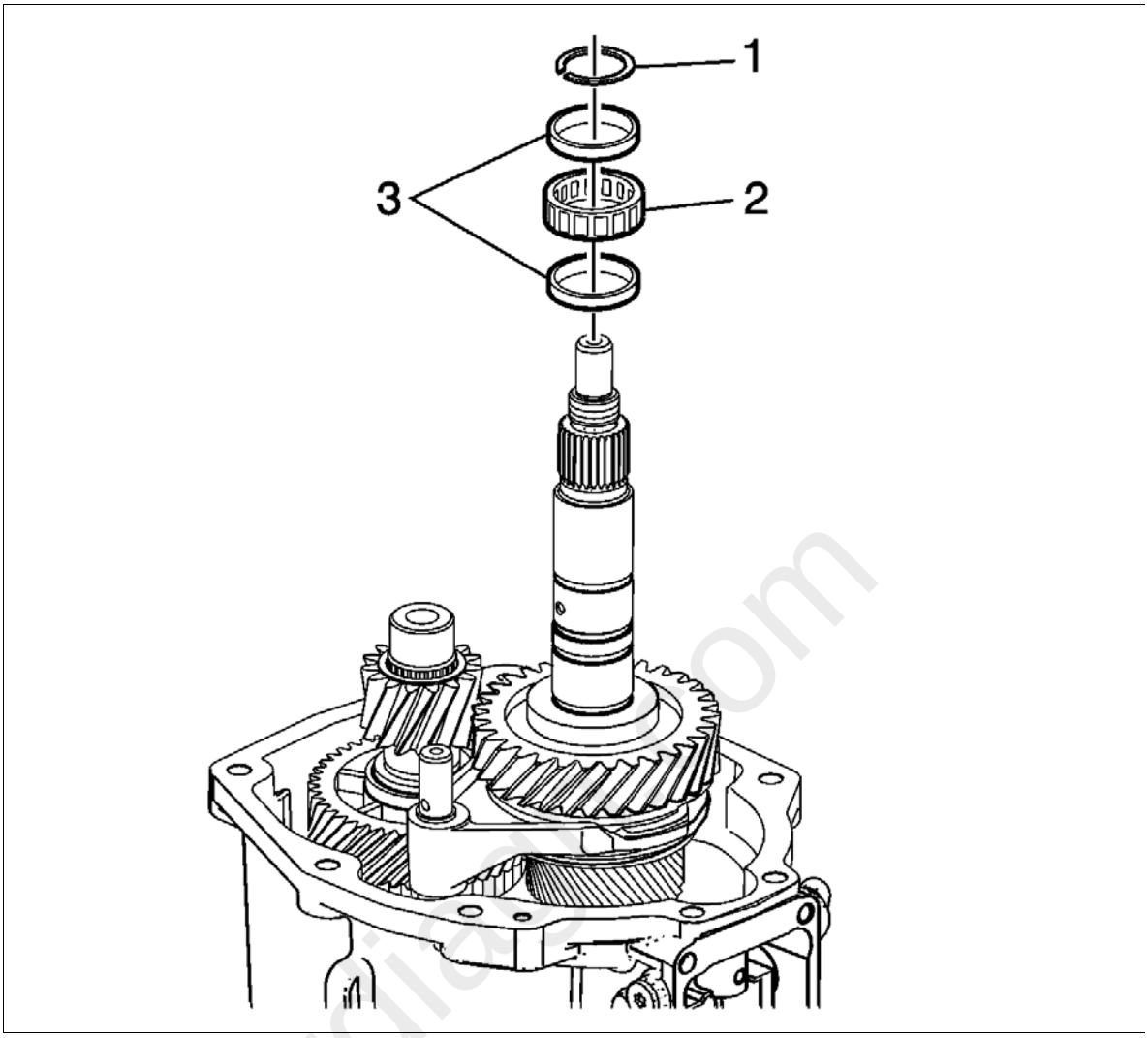
Fig 3: Retaining Ring, Speed Sensor Rotor & Locking Ball



Courtesy of GENERAL MOTORS COMPANY

4. Remove the retaining ring (1).
5. Using **J 38416-B** 3 jaw puller, remove the speed sensor rotor (2).

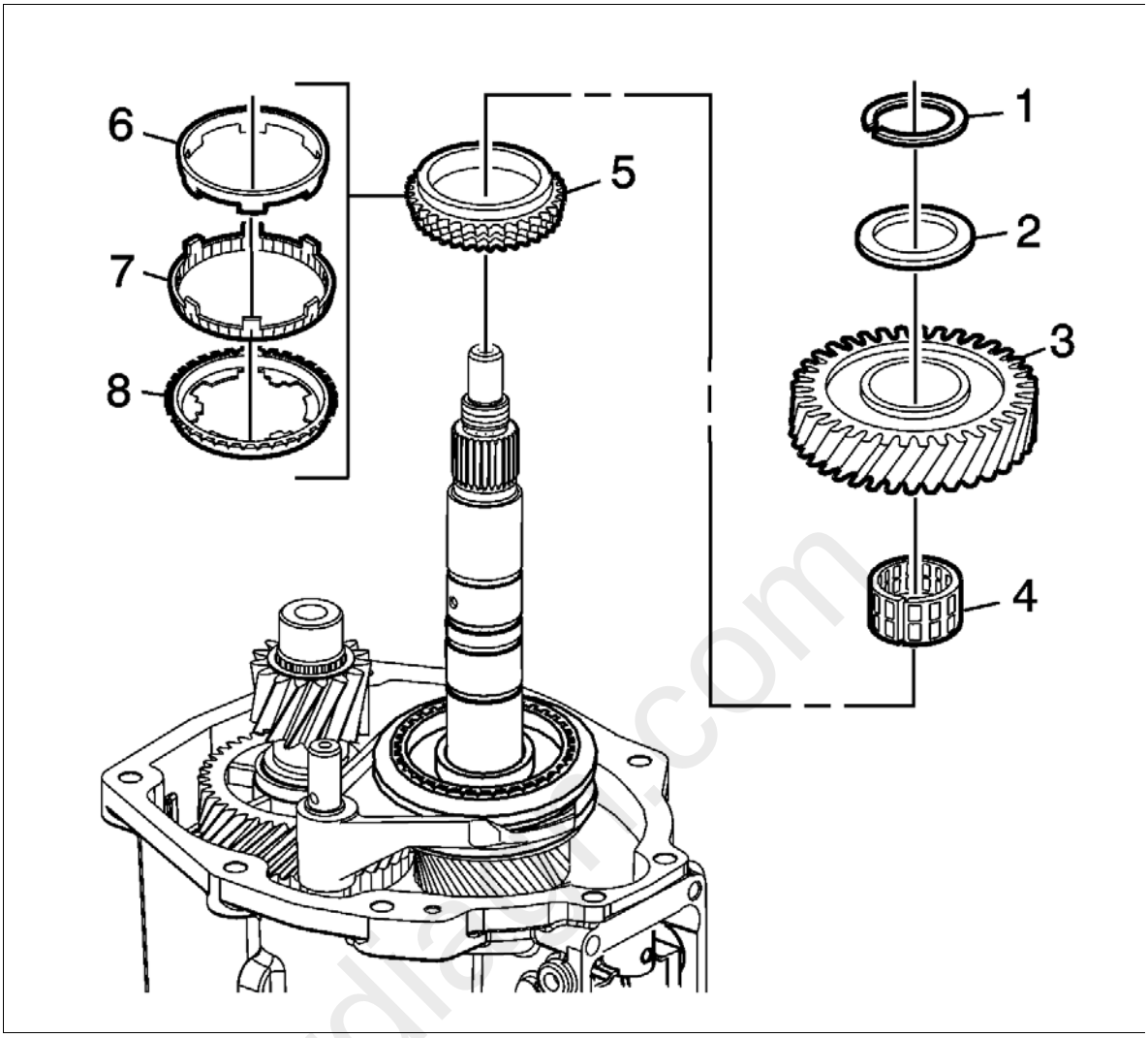
Fig 4: Rear Bearing Retainer Ring, Spacers & Mainshaft Rear Roller Bearing



Courtesy of GENERAL MOTORS COMPANY

6. Remove the rear bearing retainer ring (1).
7. Remove the spacer (3).
8. Remove the mainshaft rear roller bearing (2).
9. Remove the spacer (3).

Fig 5: Reverse Gear Components



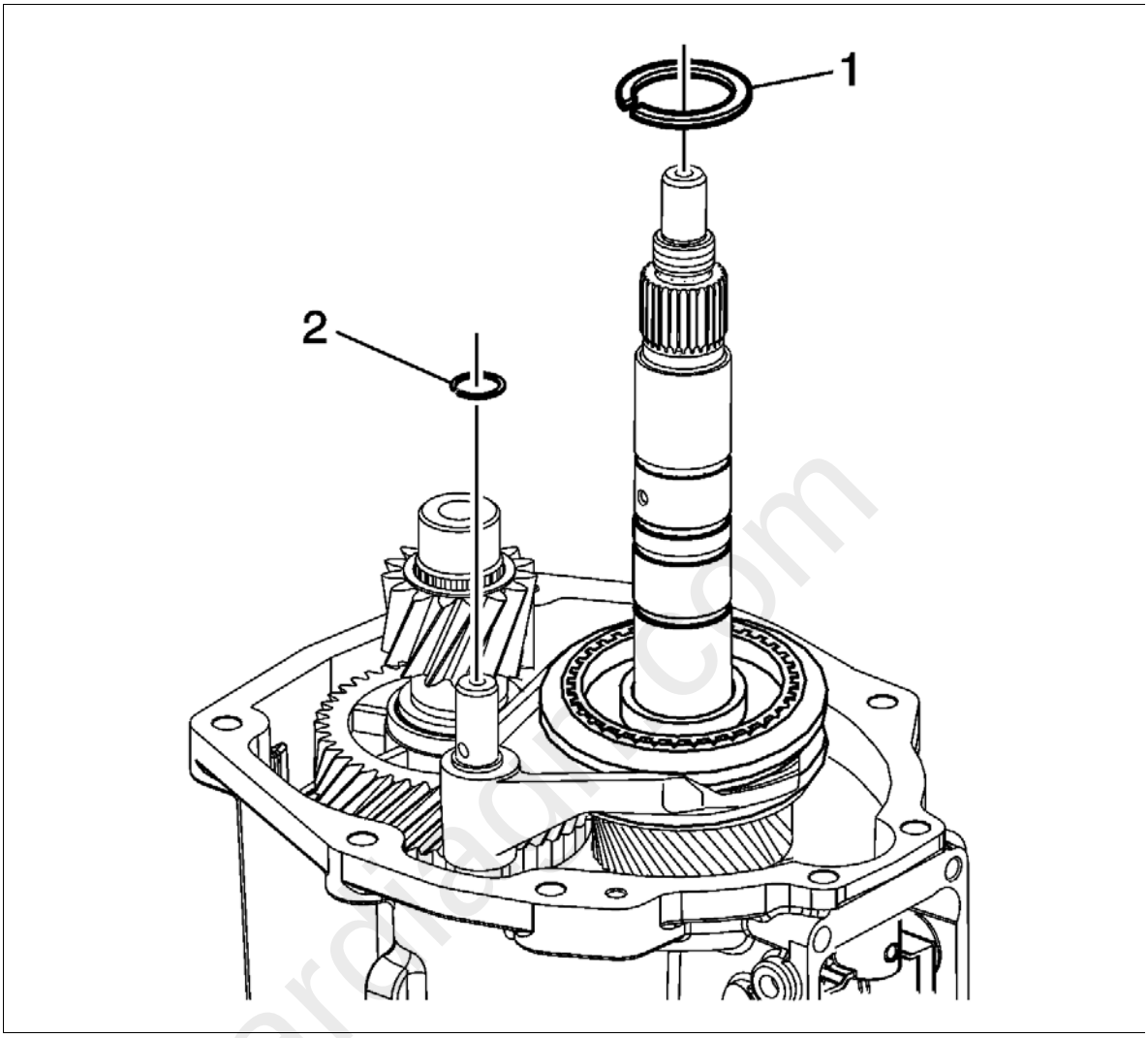
Courtesy of GENERAL MOTORS COMPANY

10. Remove the retainer ring (1).
11. Remove the reverse gear thrust washer (2).
12. Remove the reverse gear (3).
13. Remove the reverse gear caged needle bearing (4).
14. Remove the reverse gear blocking ring assembly (5), which includes the following components:
    1. Reverse drive gear inner cone (6)
    2. Reverse drive gear outer cone (7)
    3. Reverse gear blocking ring (8)

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (MM6) >

REVERSE SHIFT FORK REMOVAL

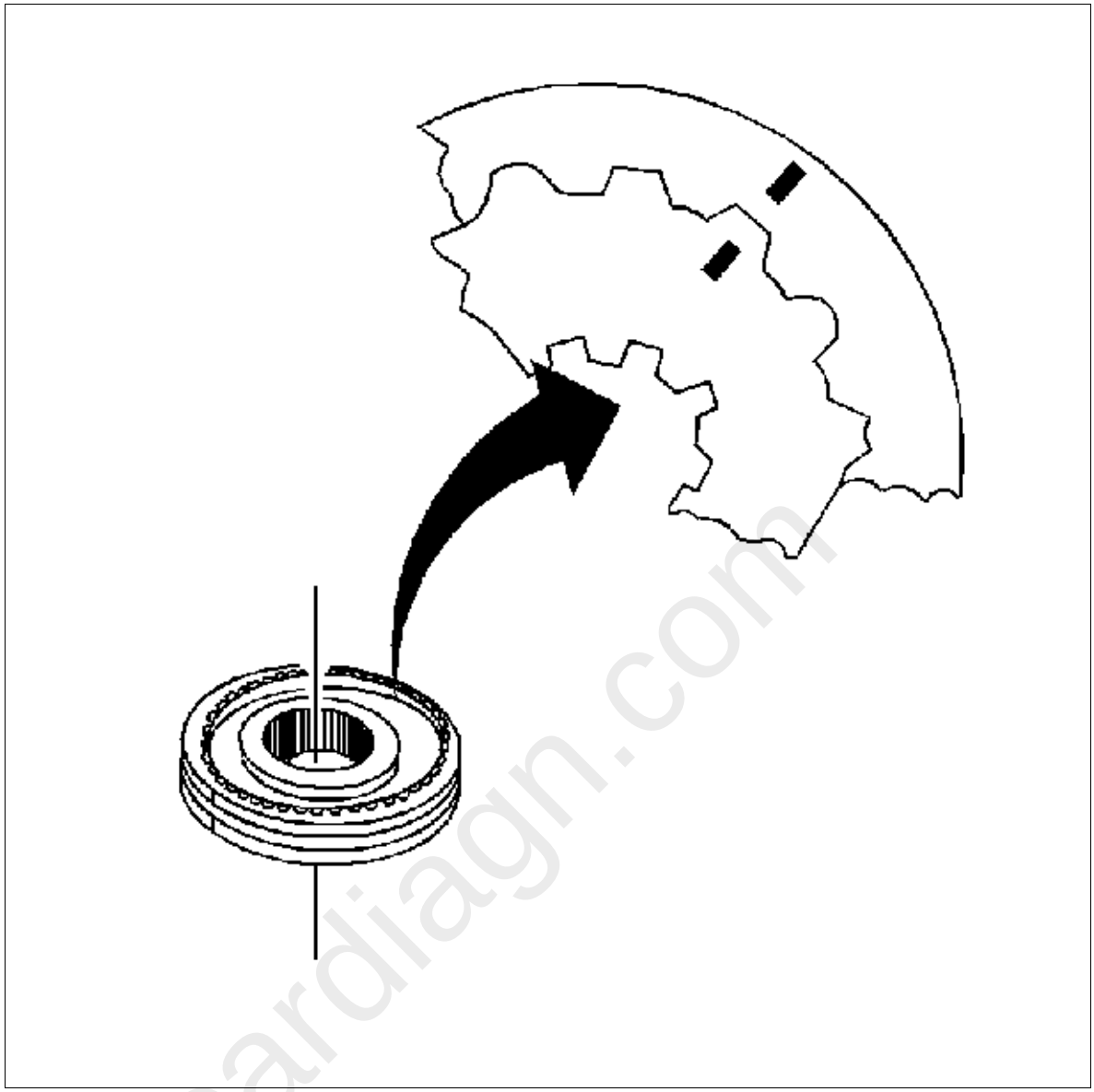
Fig 1: Reverse Synchronizer & Reverse Shift Fork Retainer Rings



Courtesy of GENERAL MOTORS COMPANY

1. Remove the reverse synchronizer retainer ring (1).
2. Remove and discard the reverse shift fork retainer ring (2).

Fig 2: Alignment Marks On Synchronizer Hub & Synchronizer Sleeve

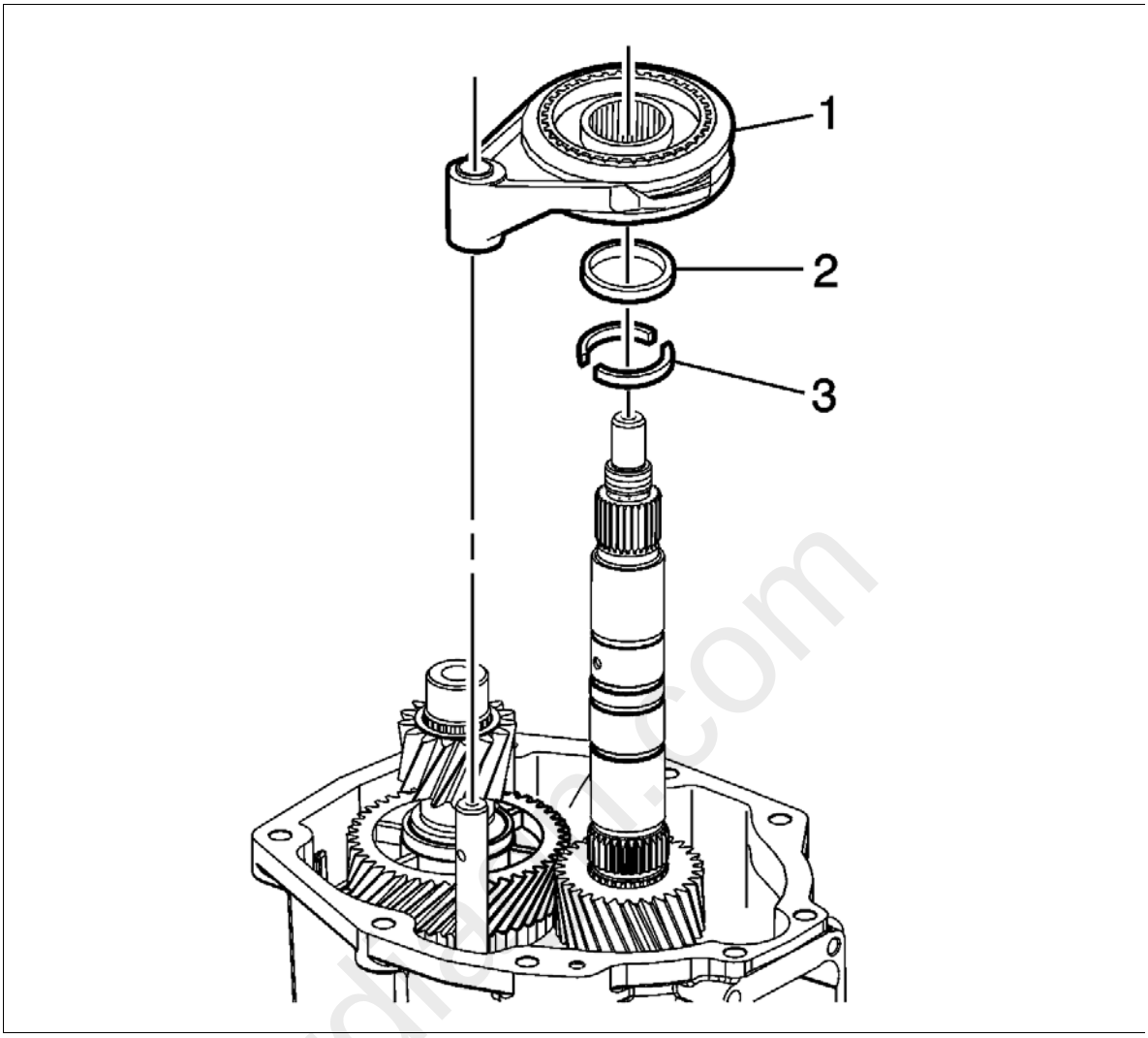


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3. Scribe a mark on the synchronizer hub and on the sleeve. This will help you to reinstall the parts in the same position.

Fig 3: Reverse Shift Fork Components

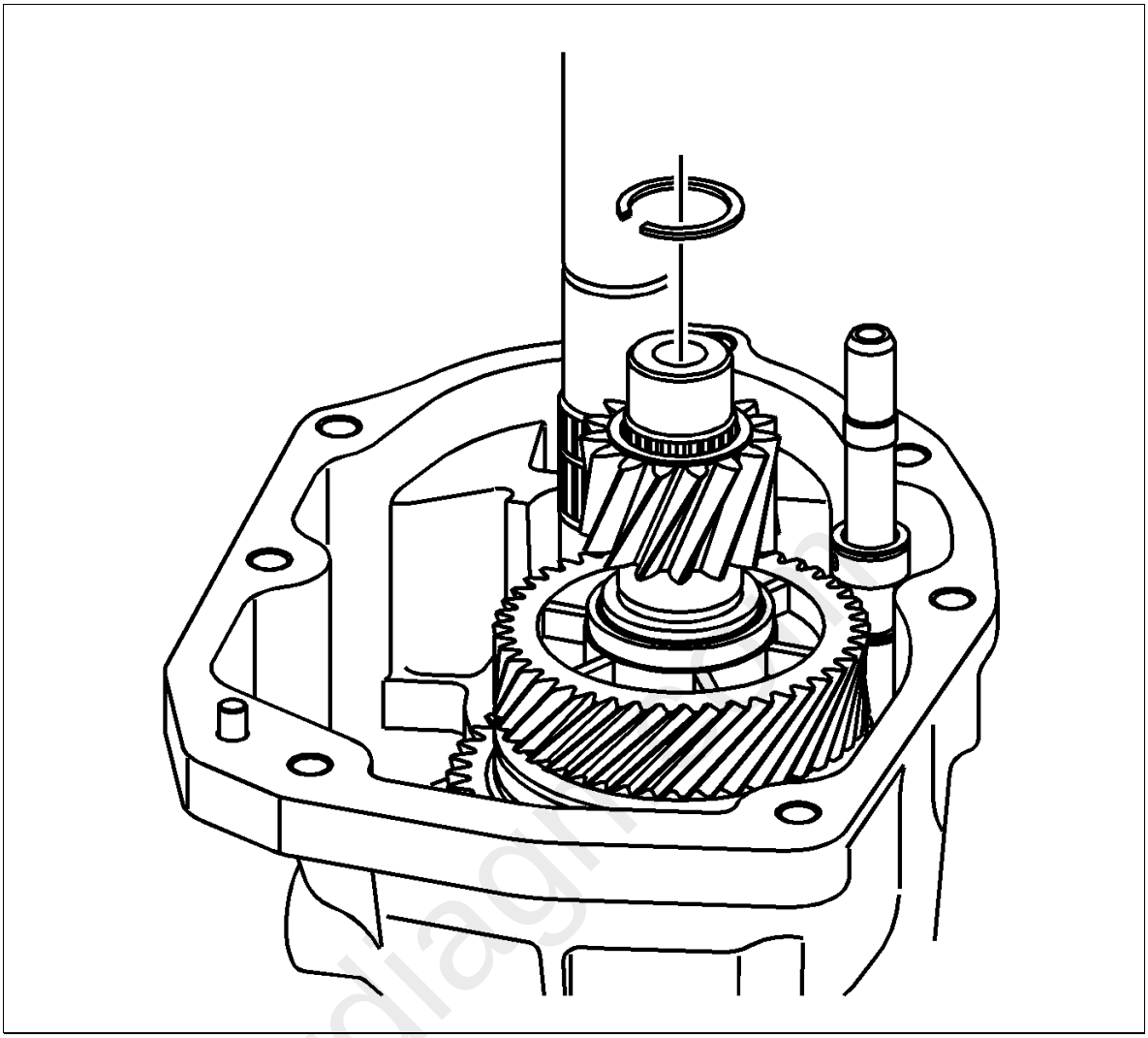


Courtesy of GENERAL MOTORS COMPANY

4. Remove the reverse shift fork and synchronizer (1) and inserts.
5. Pry to remove the reverse synchronizer hub.
6. Remove the locking ring (2).
7. Remove the two piece thrust washer (3).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (MM6) > COUNTERSHAFT GEAR REMOVAL

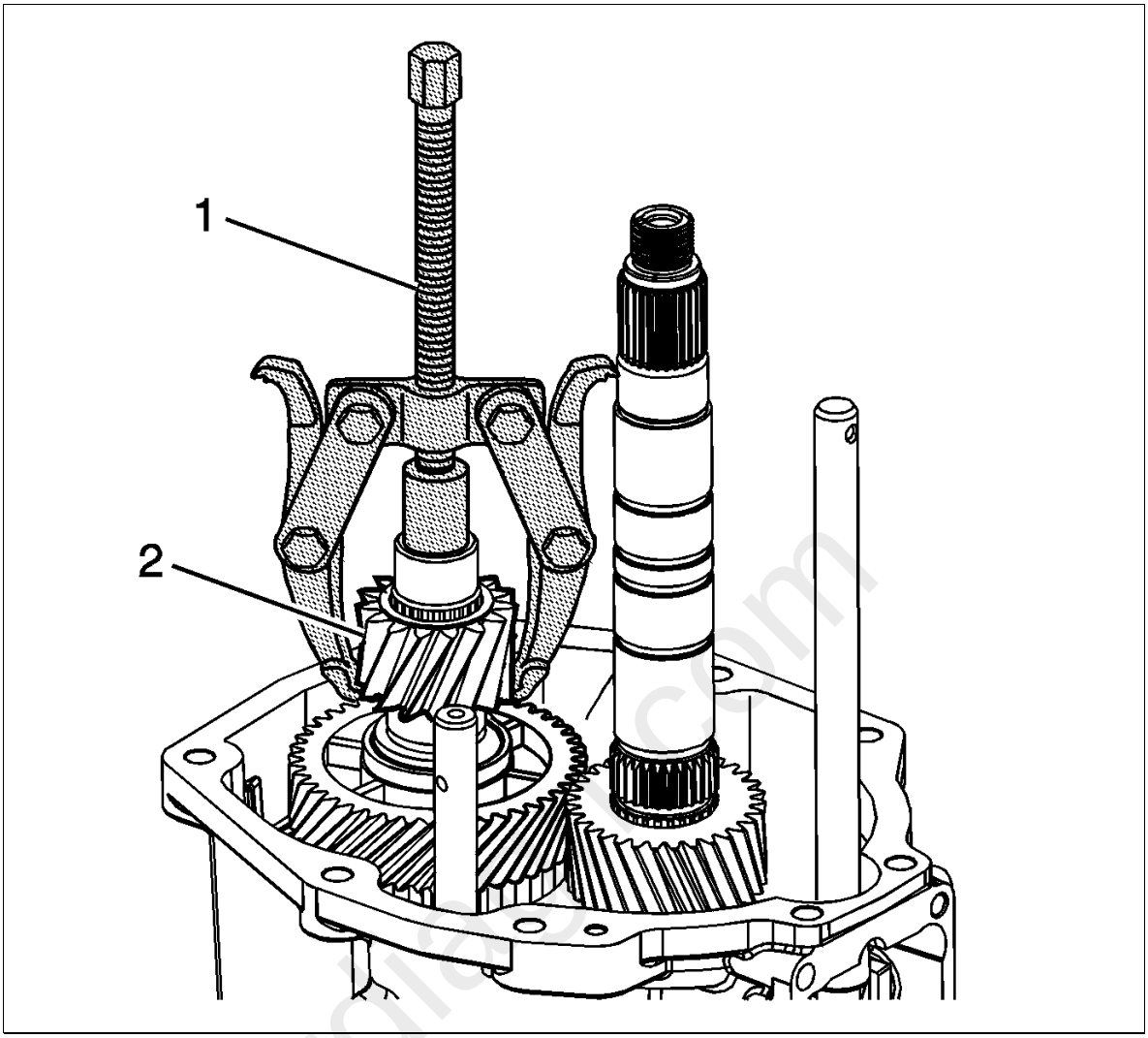
Fig 1: Countershaft Retainer Clip



Courtesy of GENERAL MOTORS COMPANY

1. Remove the reverse counter shaft retainer ring.

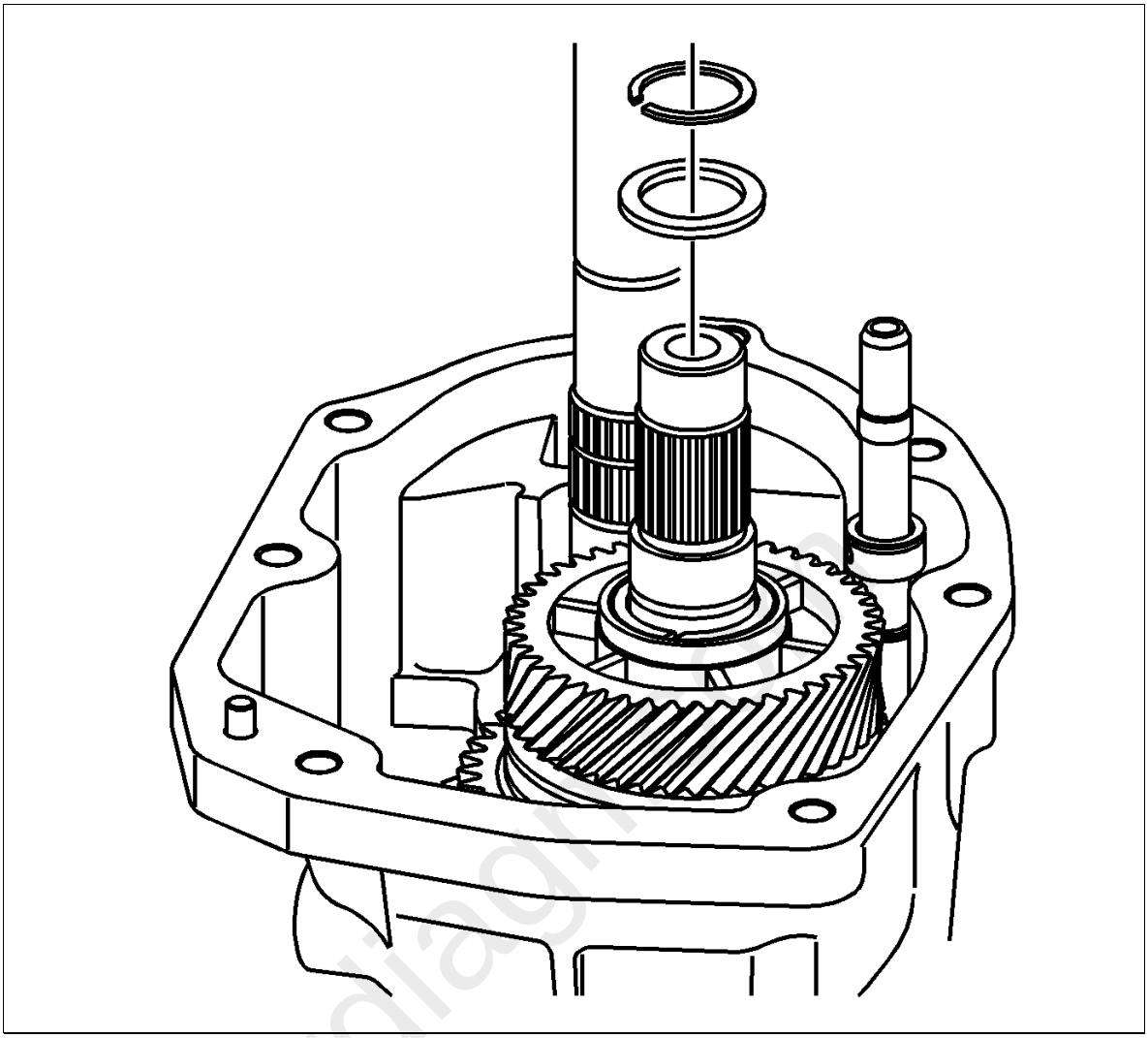
Fig 2: Countershaft Gear Puller



Courtesy of GENERAL MOTORS COMPANY

2. Remove the reverse countershaft gear (2) using **J 22888-20A** puller (1).

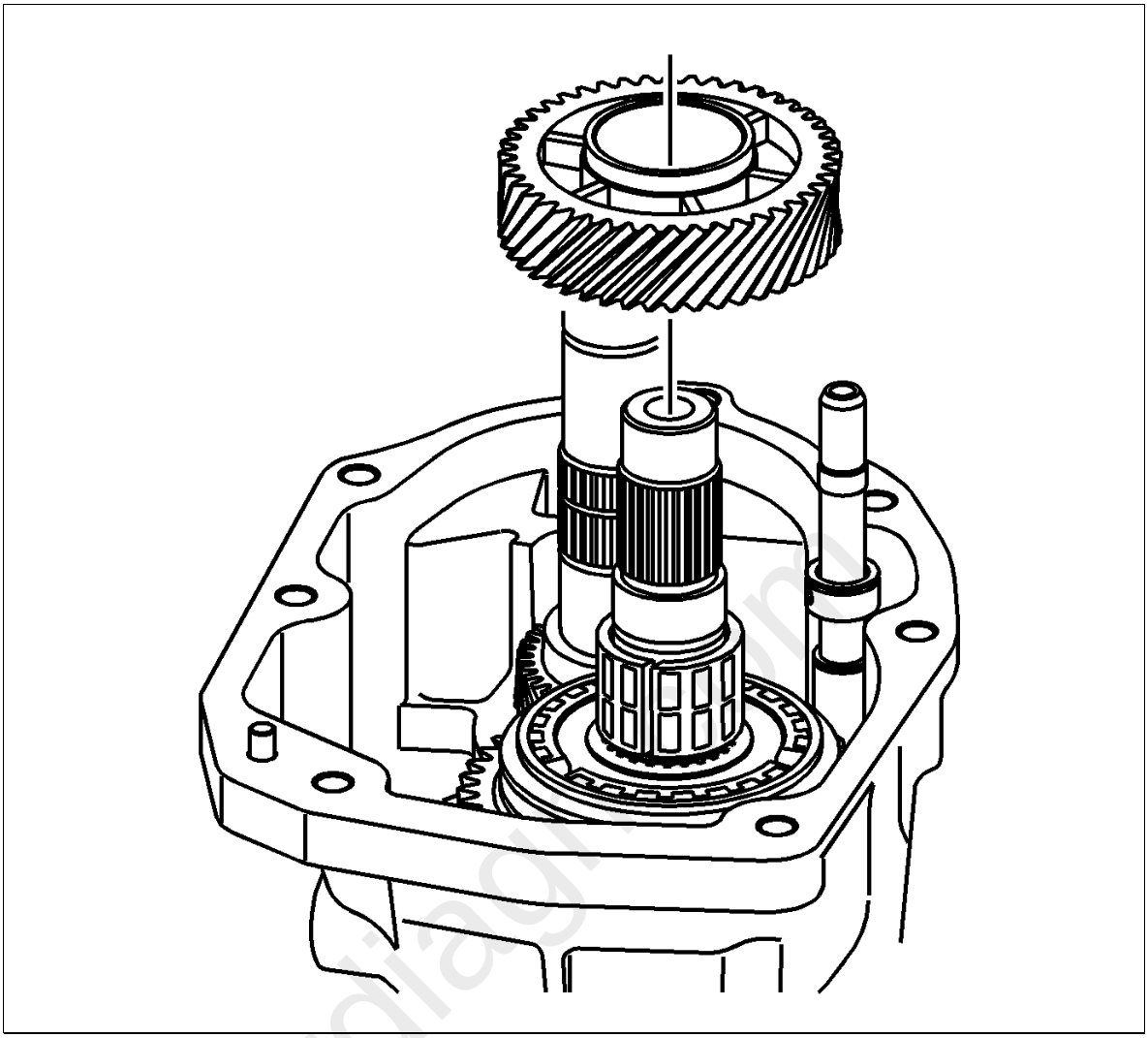
Fig 3: Countershaft Retainer And Spacer



Courtesy of GENERAL MOTORS COMPANY

3. Remove the 5th gear countershaft retainer and spacer.

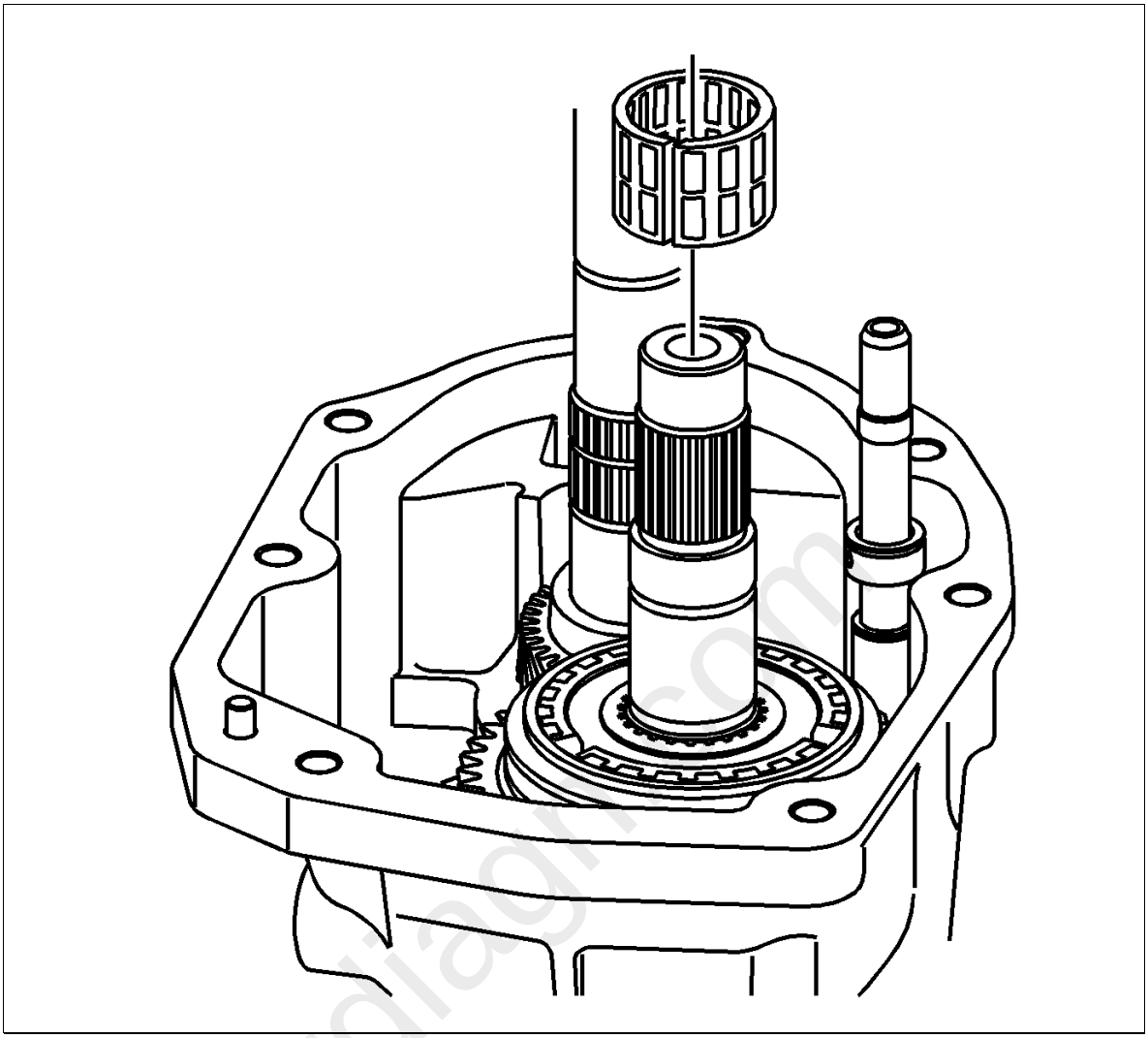
Fig 4: Gear & Countershaft



Courtesy of GENERAL MOTORS COMPANY

4. Remove the 5th gear from the countershaft.

Fig 5: Needle Bearing & Countershaft

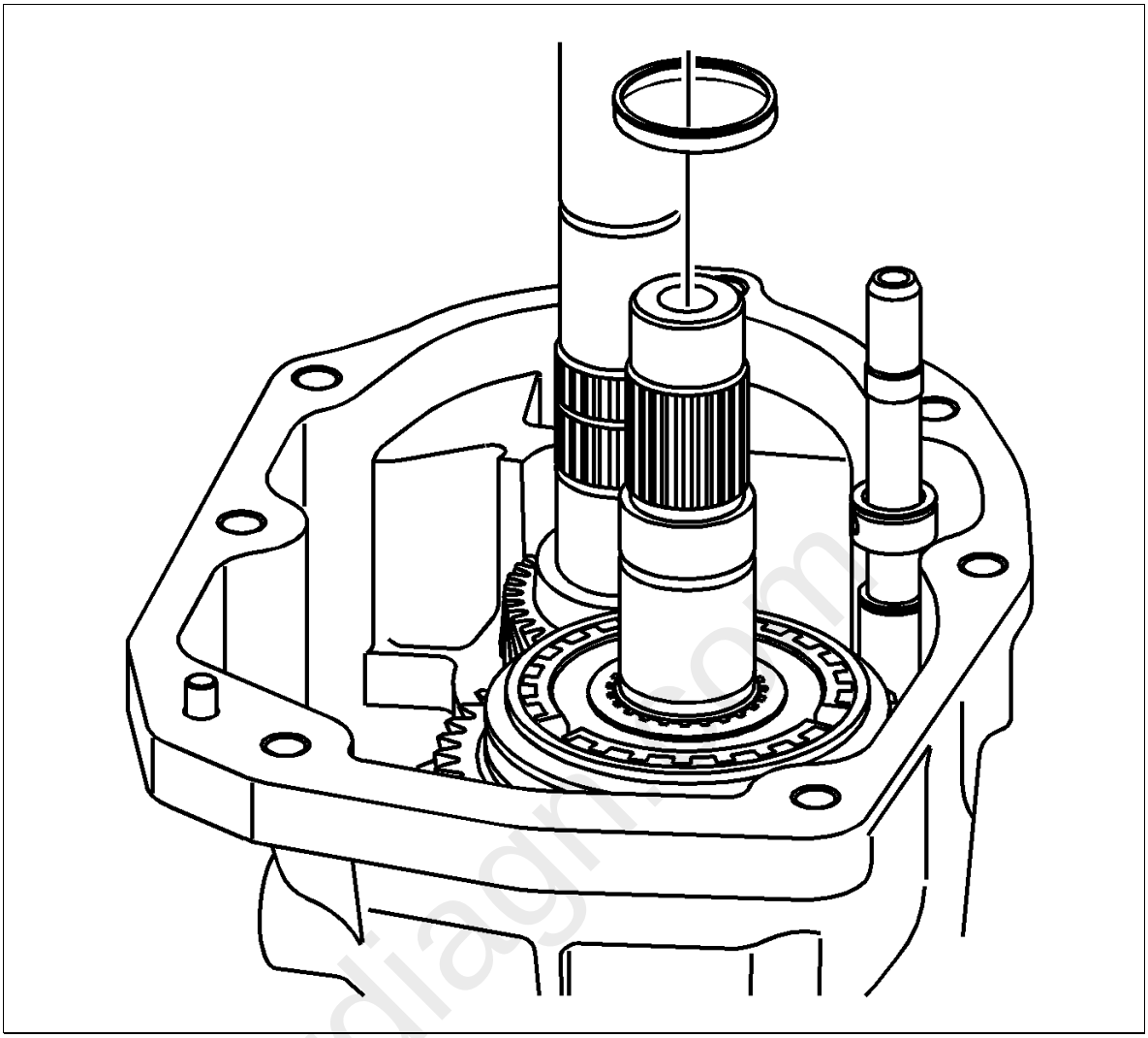


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5. Remove the 5th gear needle bearing from the countershaft.

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Fig 6: Spacer & Countershaft

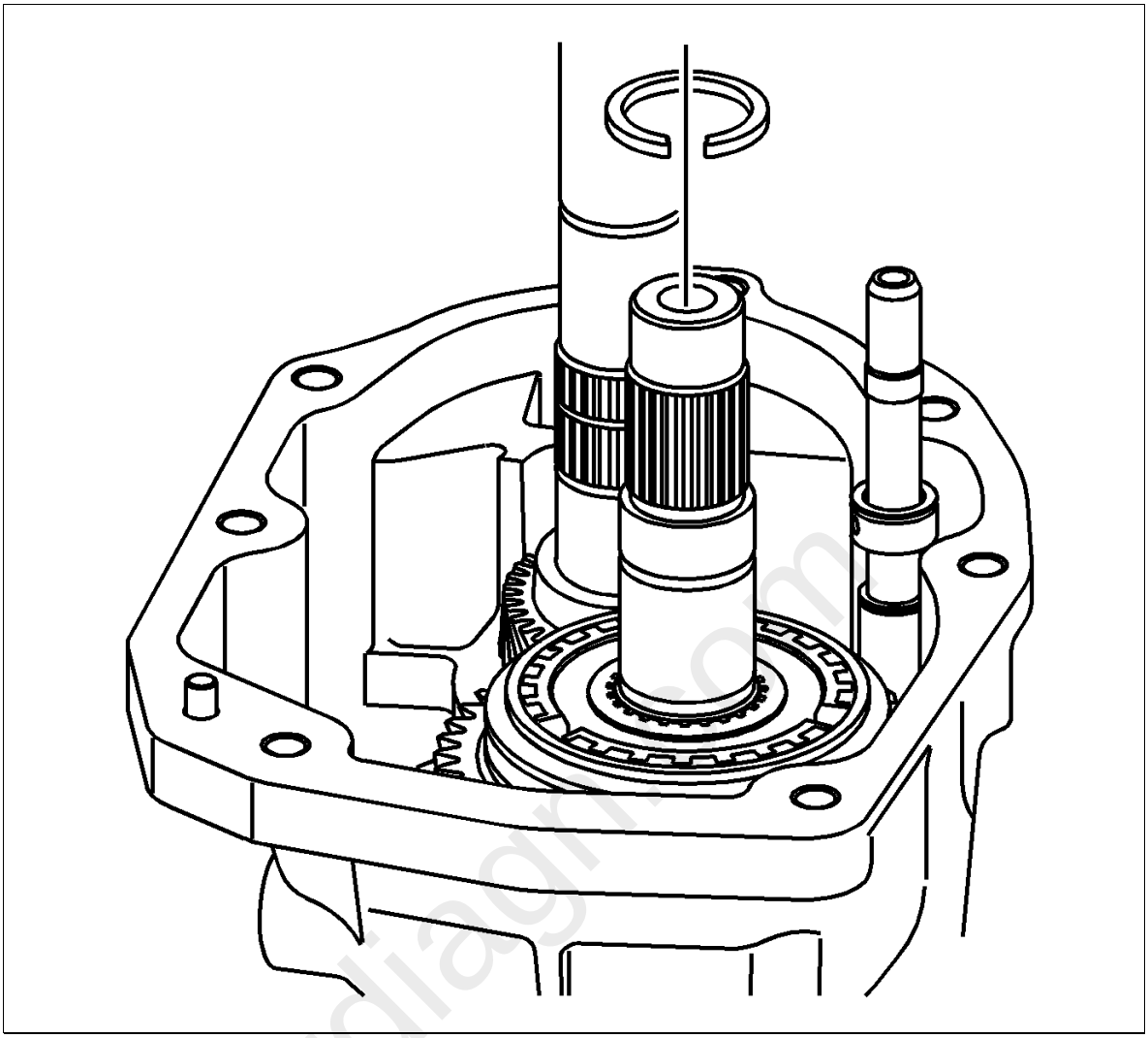


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6. Remove the 5th gear spacer from the countershaft.

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Fig 7: Retainer Clip & Countershaft

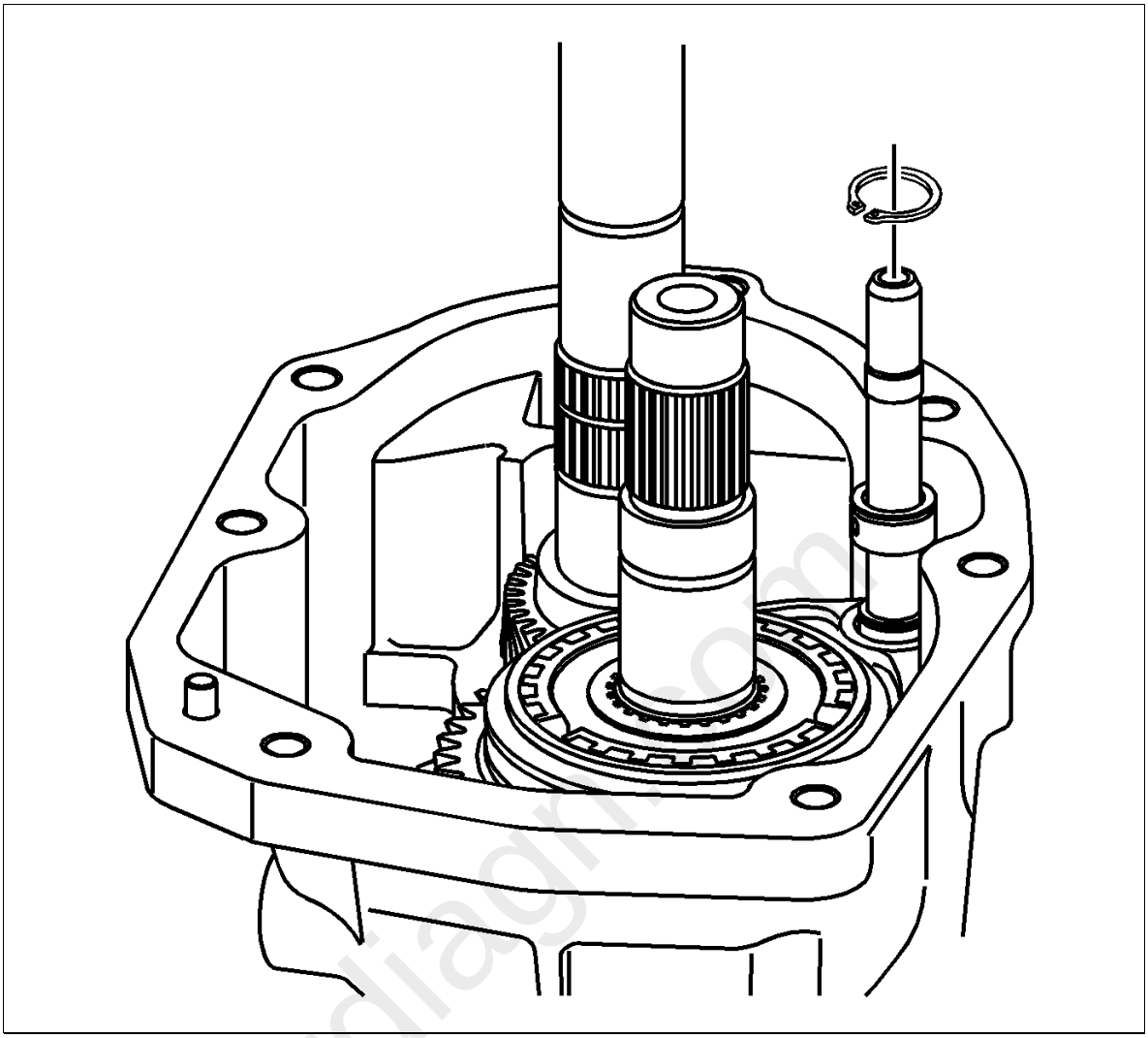


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7. Remove the 5th and 6th gear synchronizer hub retainer ring from the countershaft.

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Fig 8: 5th/6th Speed Shift Fork Retainer Ring

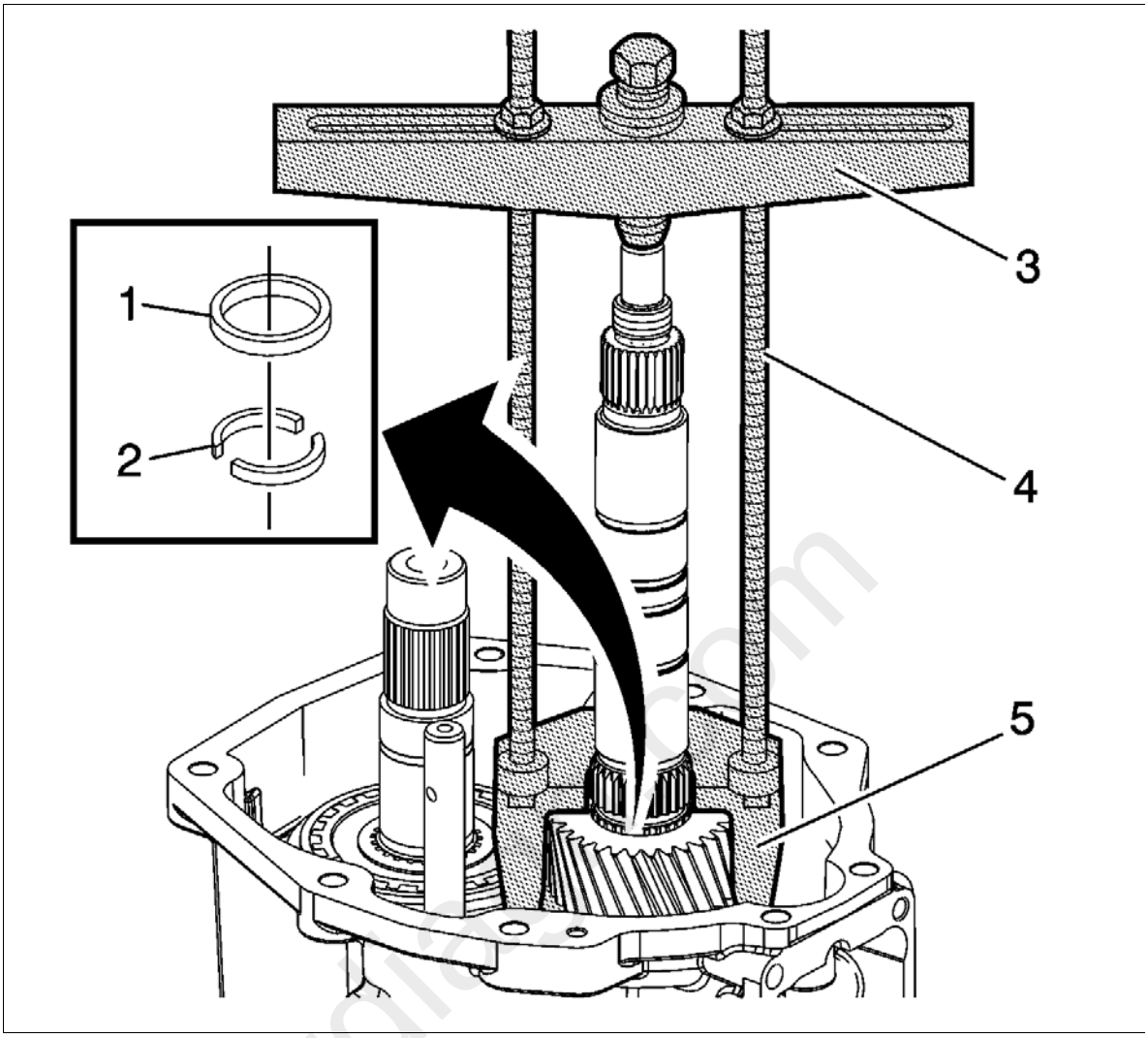


Courtesy of GENERAL MOTORS COMPANY

8. Remove the 5th/6th speed shift fork retainer ring.

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (MM6) > 5TH/6TH SPEED DRIVEN GEAR REMOVAL

Fig 1: 5th/6th Speed Driven Gear



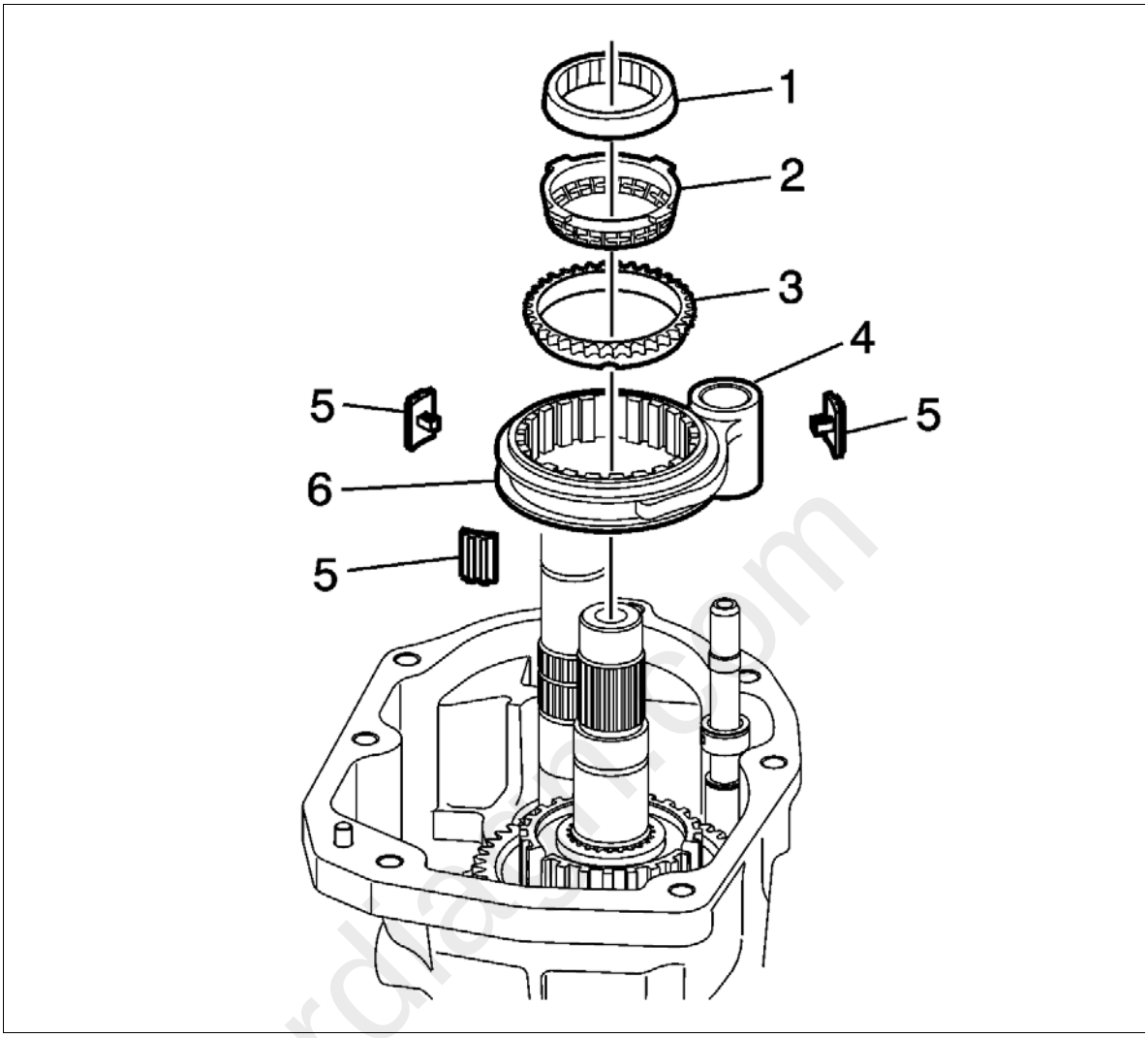
Courtesy of GENERAL MOTORS COMPANY

1. Remove the locking ring (1) and the two piece thrust washer (2).

> *NOTE:*
>
> *Ensure the remover tools are aligned level to pull the gear evenly off the shaft.*

2. Using the **J 8433** puller (3), **J 39431** gear remover (5), and the **J 39431-3** adapter bolts (4), remove the 5th/6th speed driven gear.

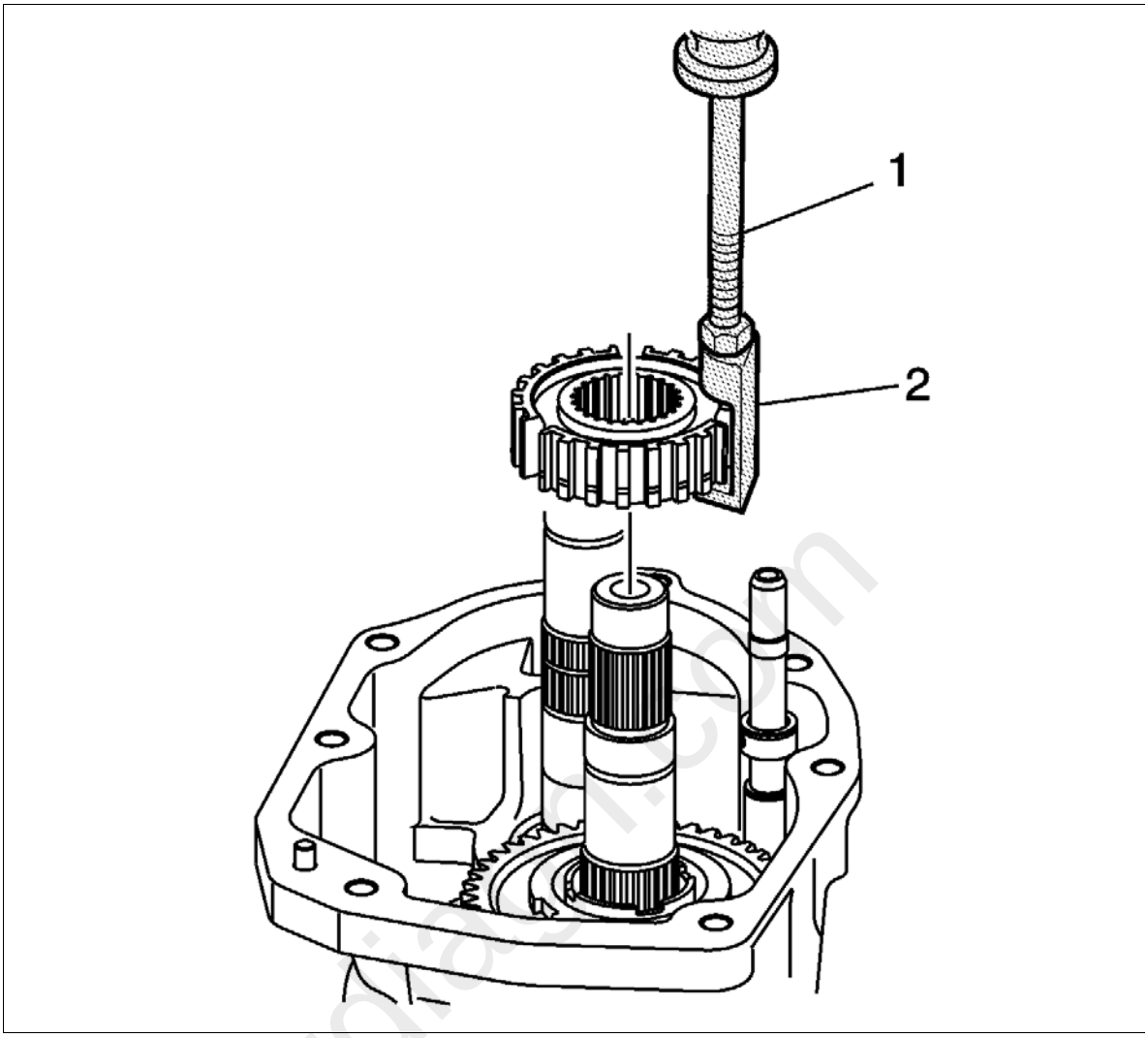
Fig 2: 5th/6th Shift Fork, Synchronizer Sleeve, Synchronizer Inserts, Speed Drive Gear Synchronizer Blocking Ring, Friction Cone and Inner Cone



Courtesy of GENERAL MOTORS COMPANY

3. Remove the following 5th/6th synchronizer components:
    1. The speed drive gear inner cone (1)
    2. The speed drive gear friction cone (2)
    3. The speed drive gear synchronizer blocking ring (3)
    4. The 5th/6th shift fork (4) with the synchronizer sleeve (6)
    5. The synchronizer inserts (5)

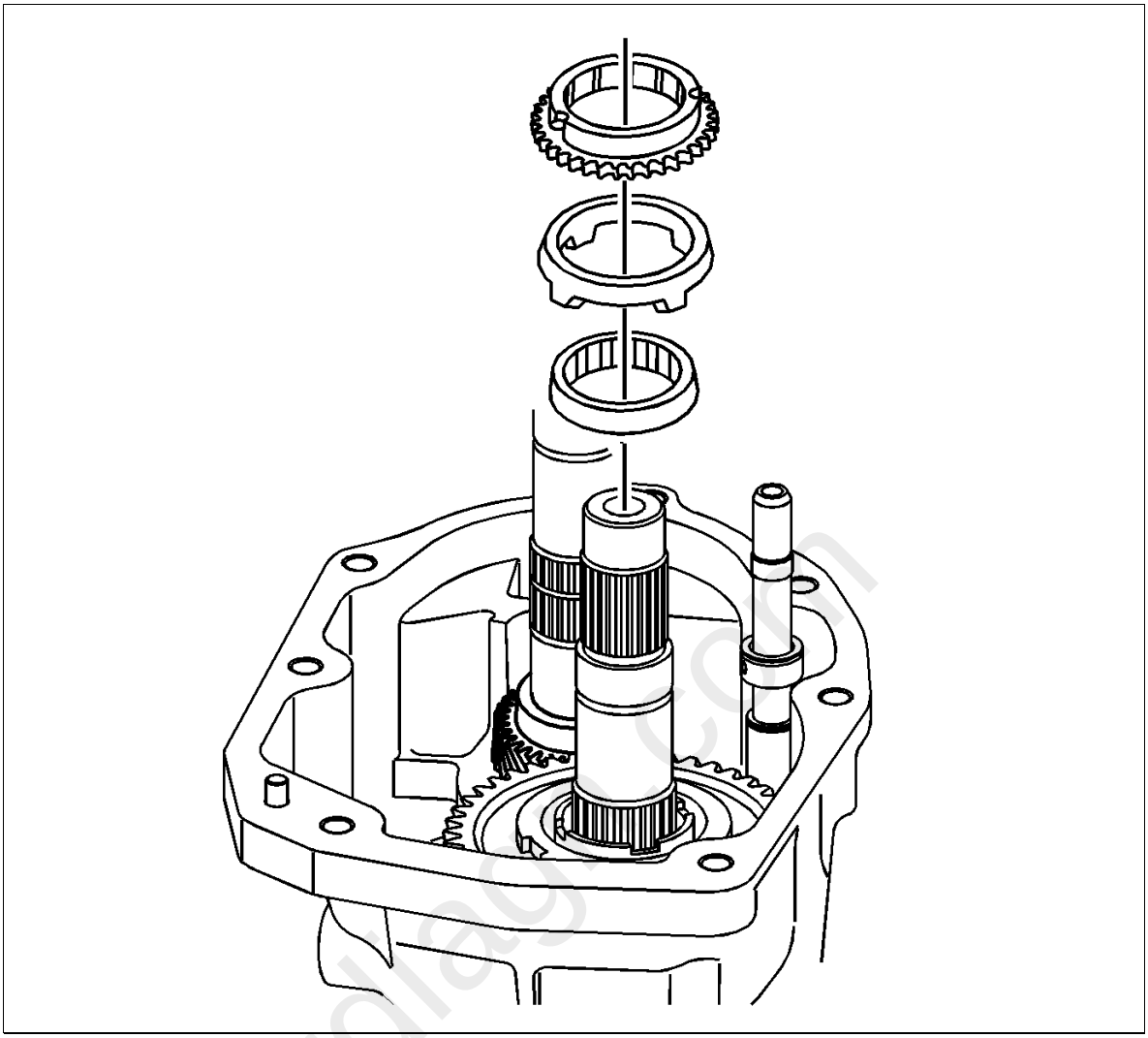
Fig 3: Synchronizer Hub Assembly



Courtesy of GENERAL MOTORS COMPANY

4. Using the **DT-49139** remover (2) and **J-6125-1B** slide hammer (1), remove the synchronizer hub assembly.

Fig 4: Speed Drive Gear Synchronizer Blocking Ring, Gear Friction Cone And Gear Inner Cone

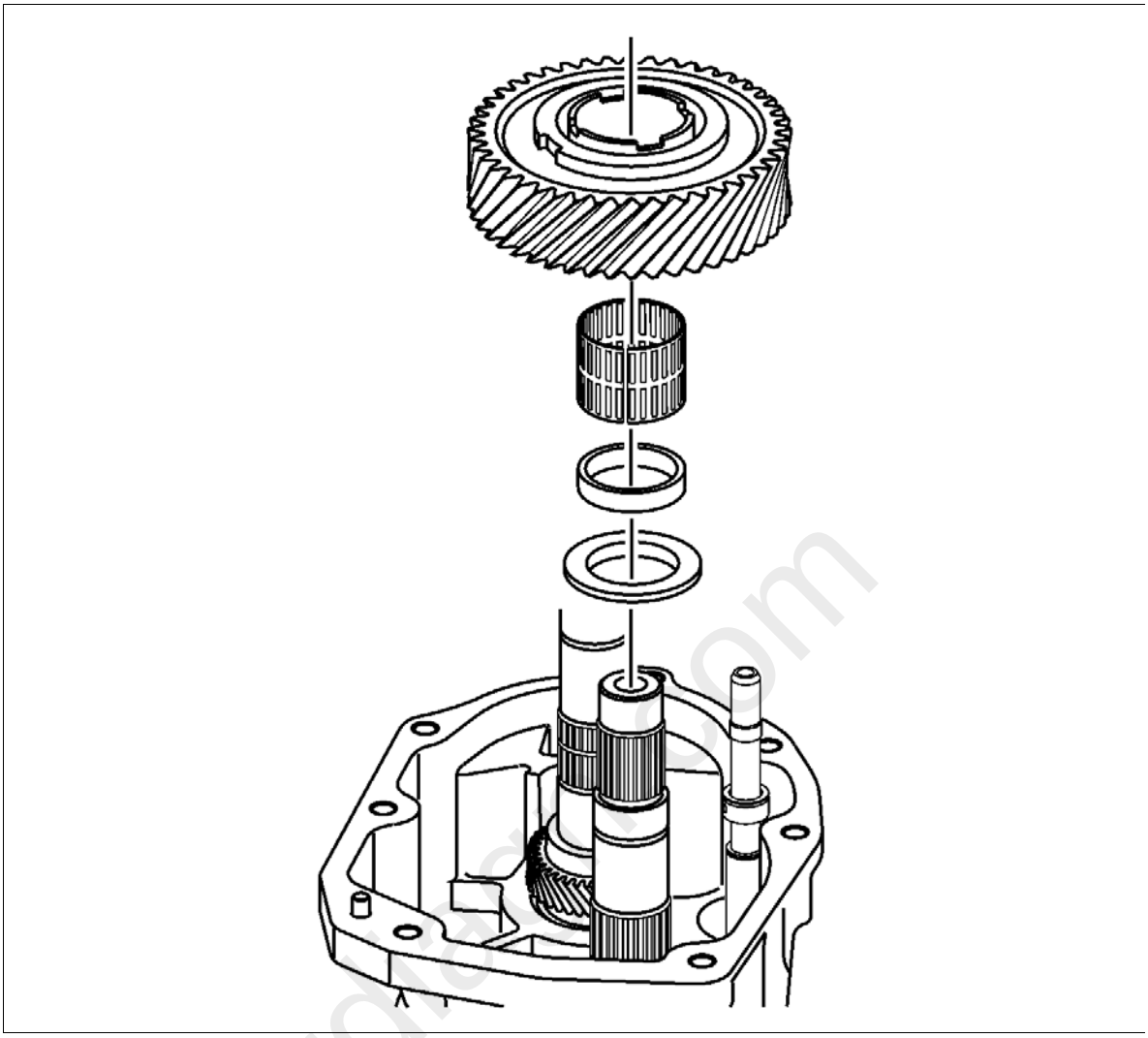


Courtesy of GENERAL MOTORS COMPANY

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5. Remove the following components:
    1. The 6th speed drive gear synchronizer blocking ring
    2. The 6th speed drive gear friction cone
    3. The 6th speed drive gear inner cone

Fig 5: 6th Driven Gear, Caged Needle Bearing, And Spacer

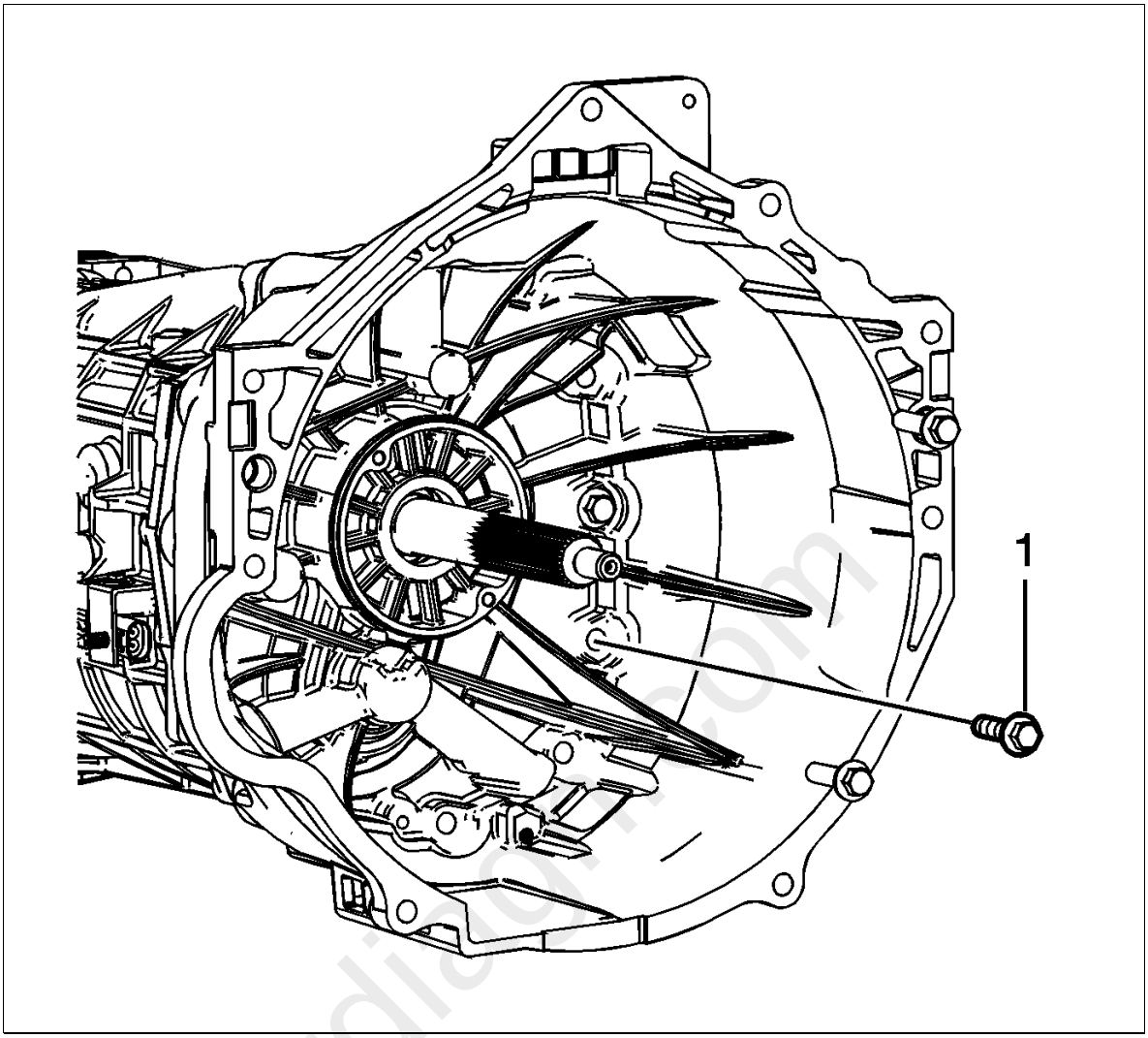


Courtesy of GENERAL MOTORS COMPANY

6. Remove the 6th driven gear, caged needle bearing, and 2 spacers from the countershaft.

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (MM6) > TRANSMISSION CASE REMOVAL

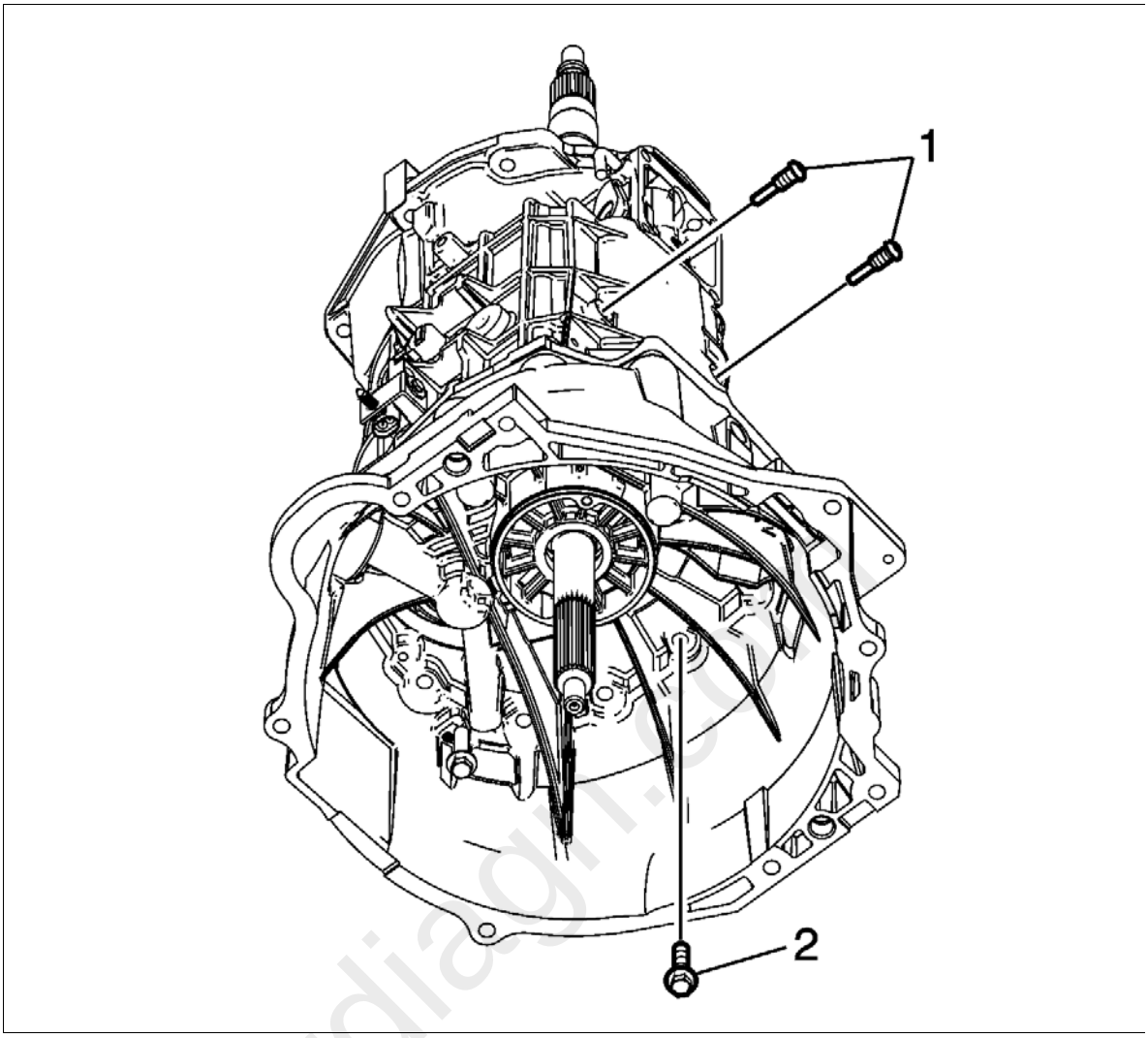
Fig 1: Clutch Housing To Transmission Case Bolts



Courtesy of GENERAL MOTORS COMPANY

1. Remove the clutch concentric actuator cylinder. Refer to Clutch Concentric Actuator Cylinder Replacement .
2. Remove 9 of the 11 clutch housing to transmission case bolts (1).
3. Rotate the transmission into the vertical position.

Fig 2: Clutch Housing To Transmission Case Bolts & Shift Lever Guide Bolts

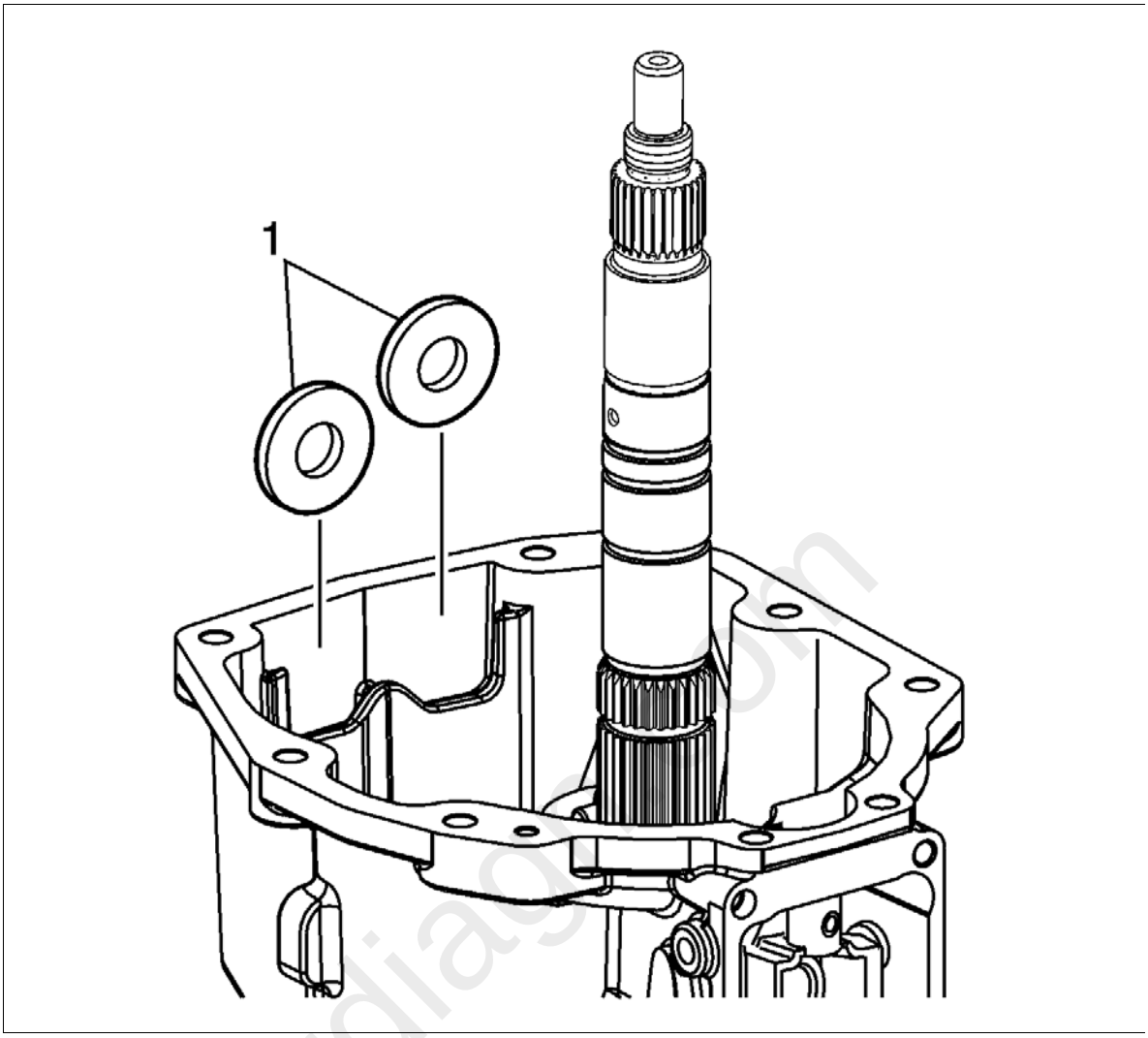


Courtesy of GENERAL MOTORS COMPANY

4. Remove the last 2 clutch housing to transmission case bolts (2).
5. Remove the shift lever guide bolts (1).

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Fig 3: Transmission Case Magnets

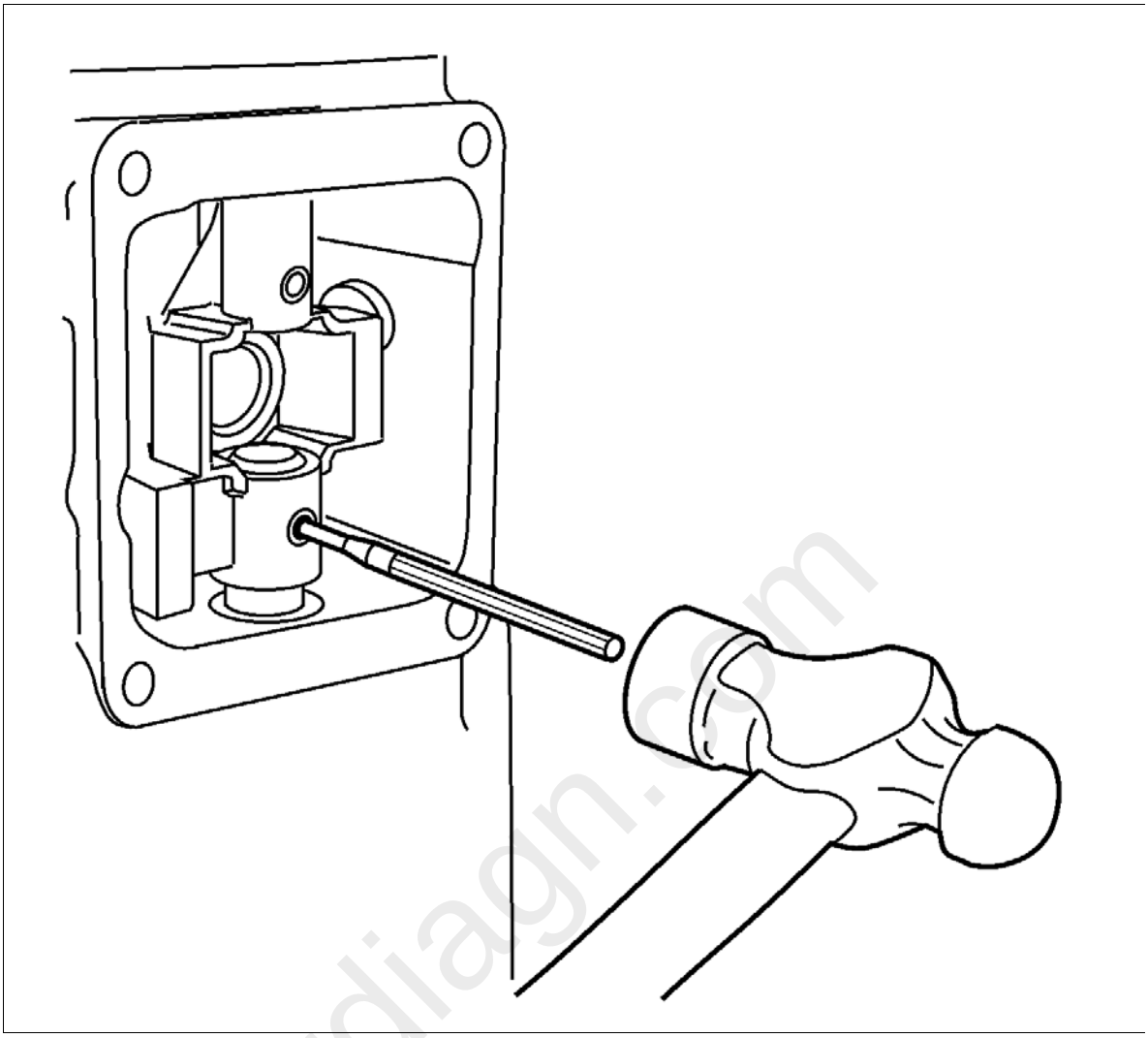


Courtesy of GENERAL MOTORS COMPANY

6. Remove the magnets (1) from the transmission case.

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Fig 4: Driving In Select Control Lever Assembly Pin

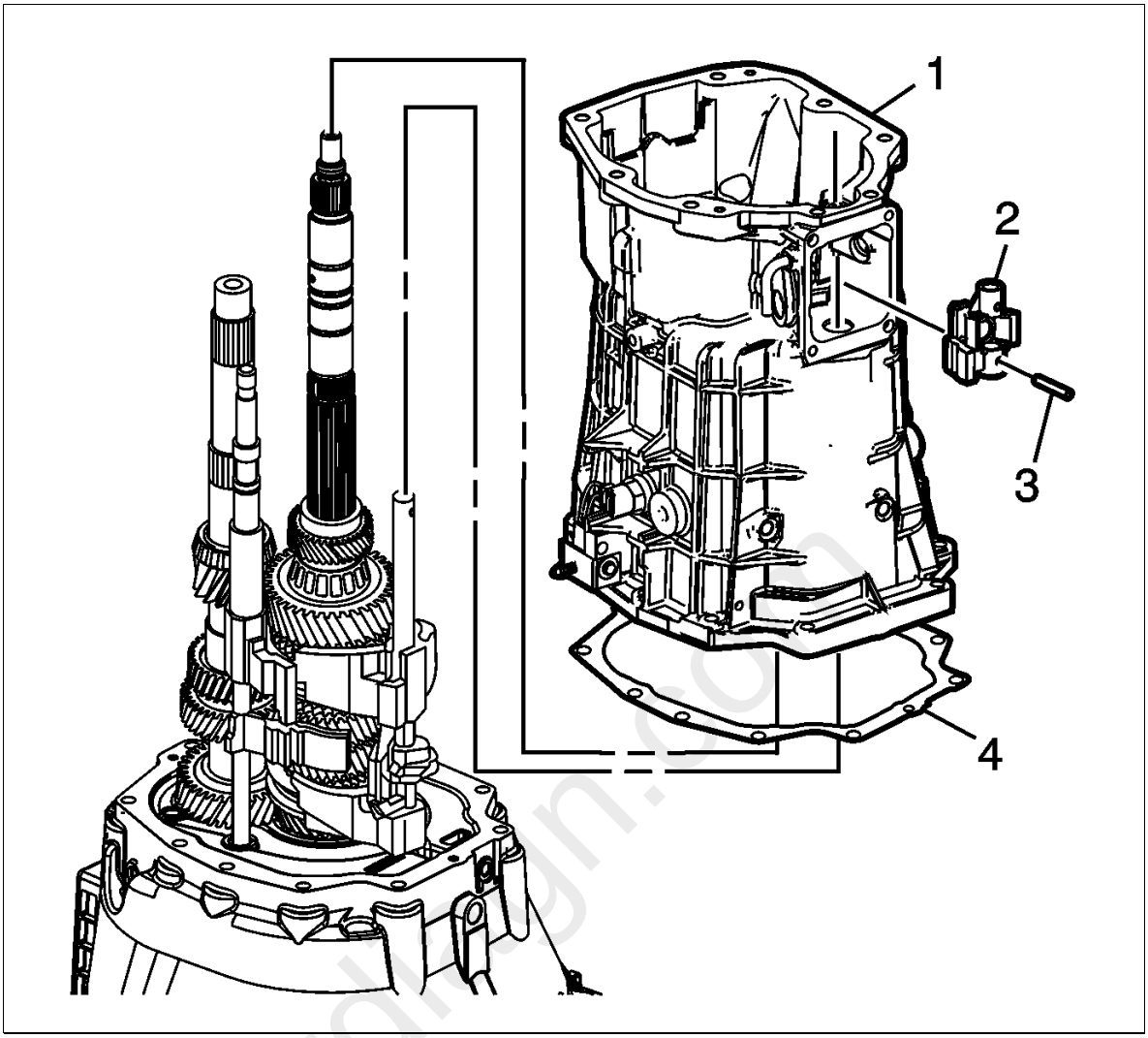


Courtesy of GENERAL MOTORS COMPANY

7. Drive in the select control lever assembly pin.

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Fig 5: Transmission Case, And Select Control Lever Assembly

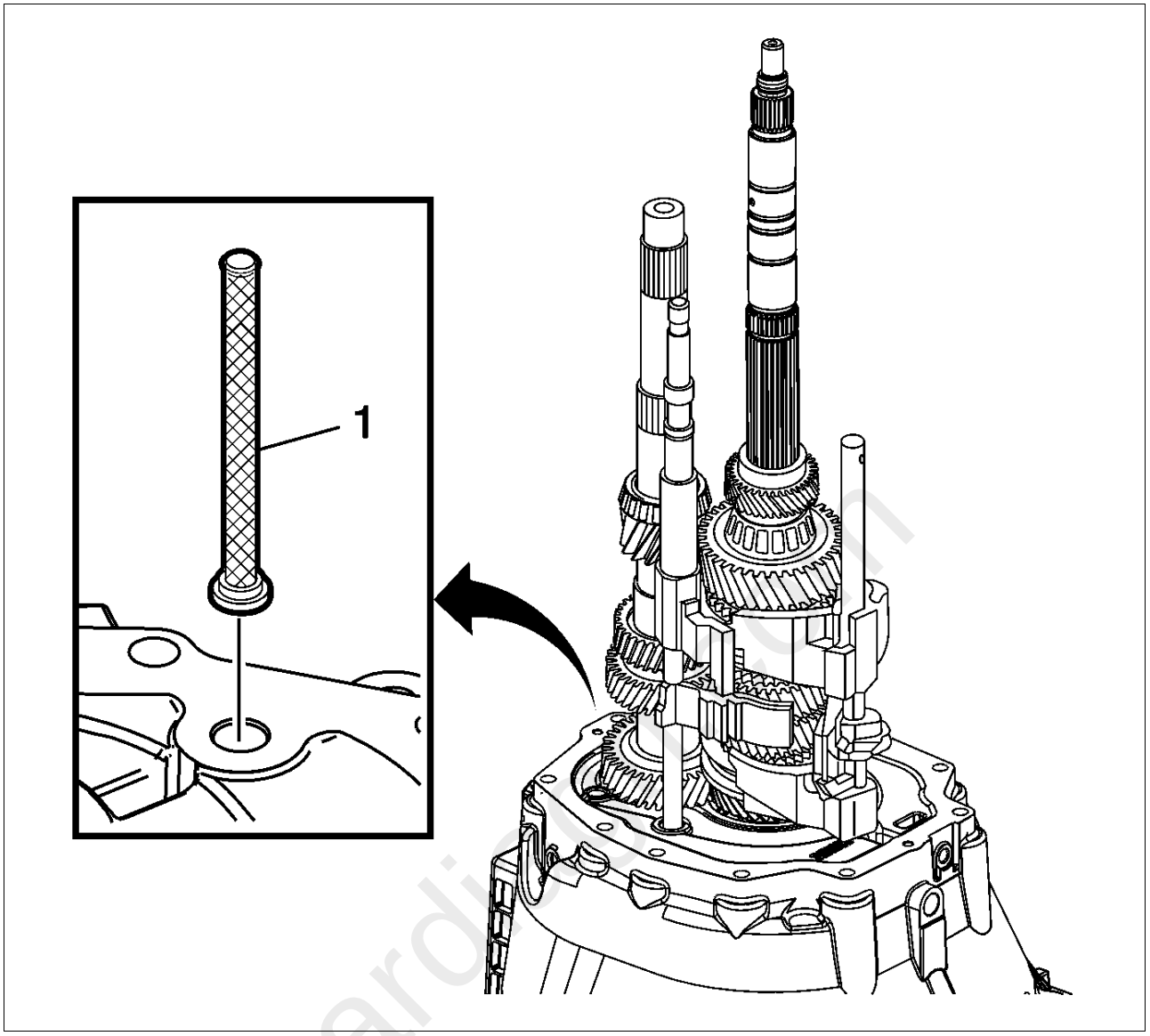


Courtesy of GENERAL MOTORS COMPANY

8. Remove the transmission case (1) and the select control lever assembly (2) together as follows:
    1. Slide the transmission case up and off of the gear clusters and the shift shaft components.
    2. Hold the select control lever assembly against the guide plate in order to prevent the release of the detent ball and the spring.
    3. Remove the select control lever assembly (2) from the transmission case.
9. Remove the gasket (4).

Oil Filter Removal

Fig 6: Oil Filter

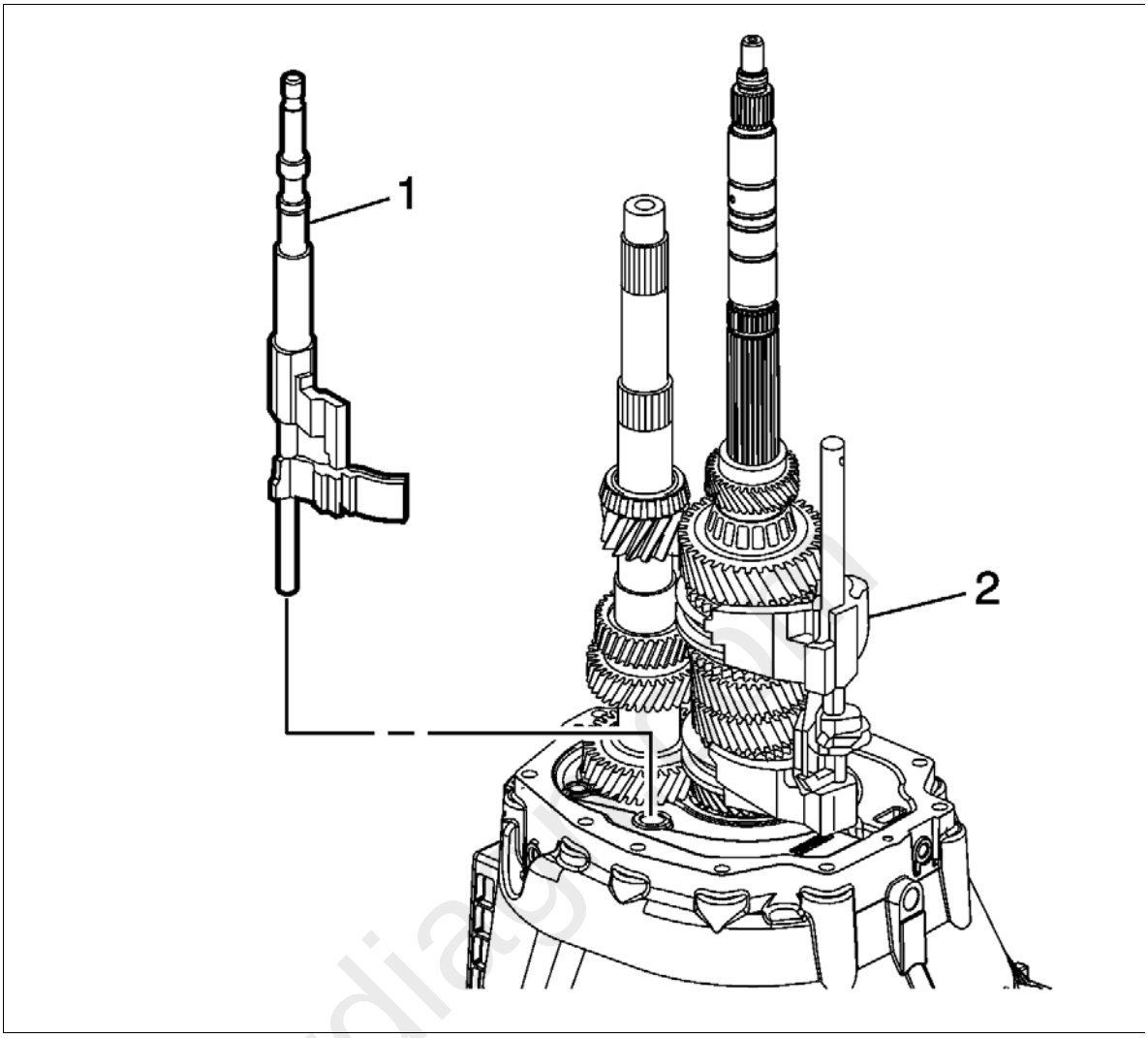


Courtesy of GENERAL MOTORS COMPANY

Remove the oil filter (1).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (MM6) > SHIFT SHAFT ASSEMBLIES AND GEAR CLUSTER REMOVAL

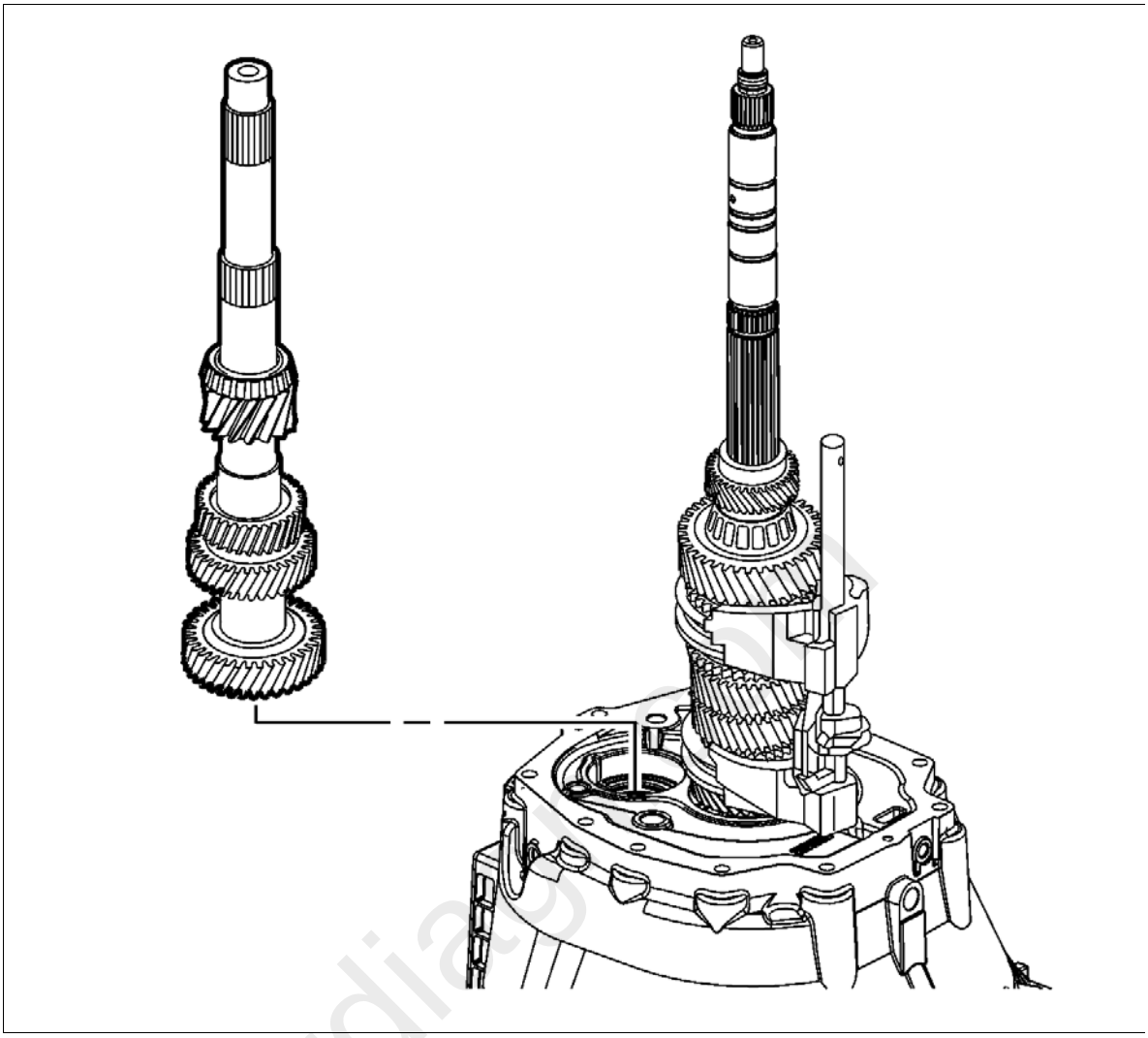
Fig 1: 3rd/4th Shift Fork & 5th/6th & Reverse Shift Shaft Assemblies



Courtesy of GENERAL MOTORS COMPANY

1. Pull up on the 3rd/4th shift fork assembly (2) and rotate the 5th/6th and the reverse shift shaft levers off the shift interlock plate.
2. Remove the 5th/6th and the reverse shift shaft assembly (1).

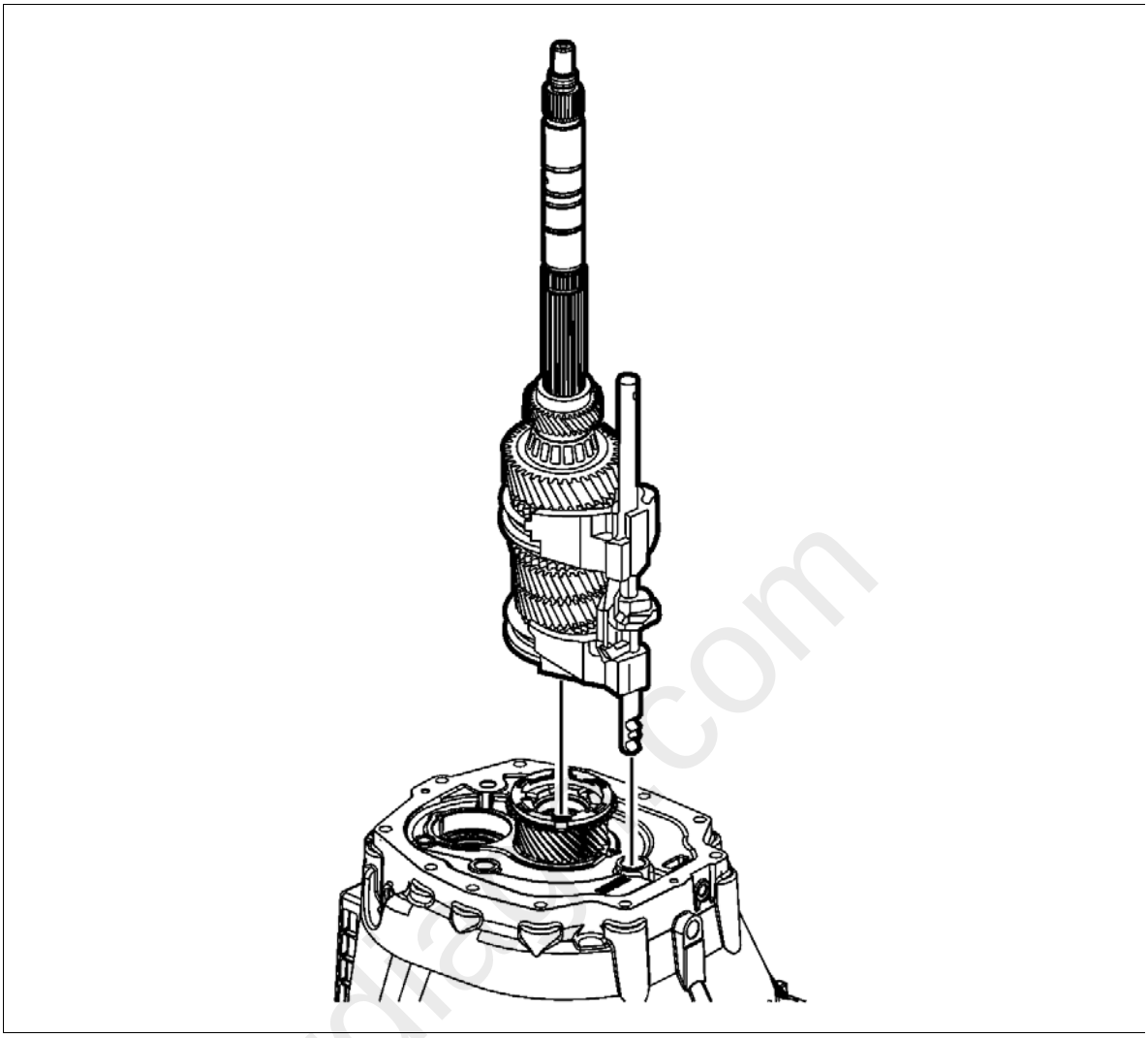
Fig 2: Countershaft



Courtesy of GENERAL MOTORS COMPANY

3. Remove the countershaft. Lift up the mainshaft enough in order to remove the countershaft.

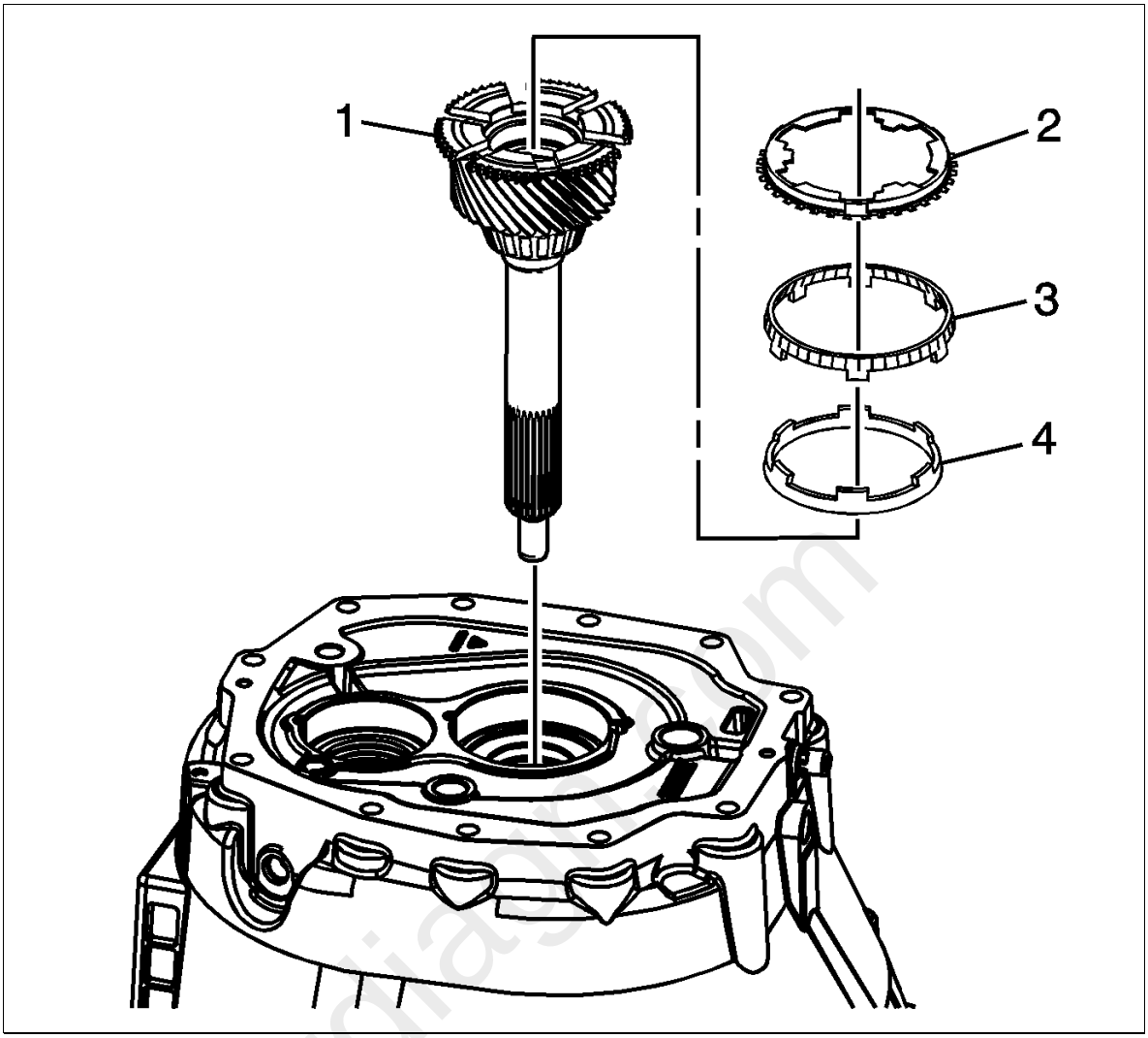
Fig 3: Mainshaft & Shift Shaft Components



Courtesy of GENERAL MOTORS COMPANY

4. Remove the mainshaft and the shift shaft components as an assembly.
5. Remove the shift shaft assembly from the mainshaft.

Fig 4: 4th Gear Blocking Ring Assembly Components



Courtesy of GENERAL MOTORS COMPANY

6. Remove the 4th gear blocking ring assembly, which includes the following components:
    1. 4th speed drive gear blocking ring (2)
    2. 4th speed drive gear outer cone (3)
    3. 4th speed drive gear inner cone (4)
7. Remove the input shaft (1).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (M13 - LGX W/O Y4Q, LTG)

Special Tools

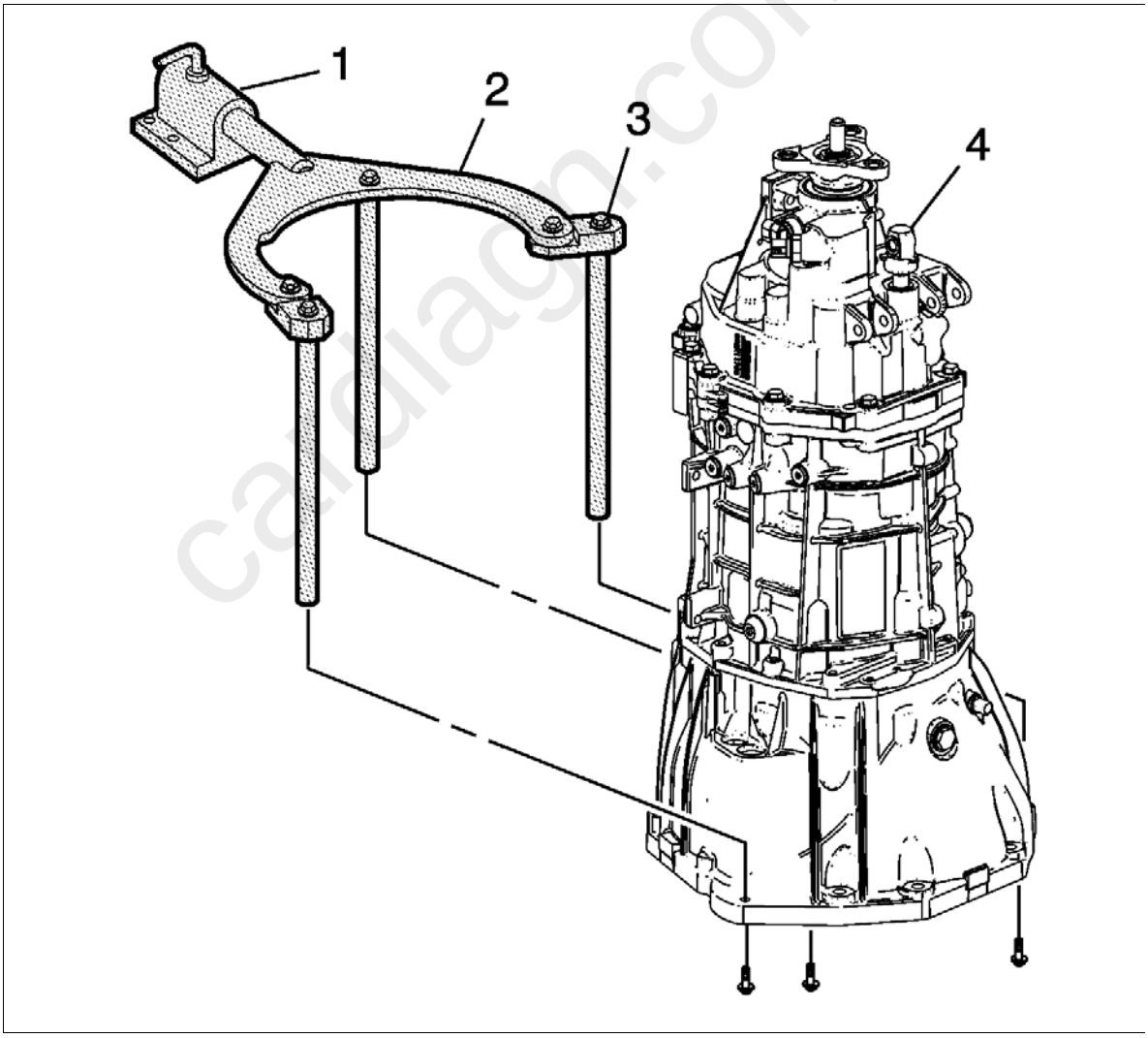
- **DT 47678** Transmission Holding Flange

- **DT 47678-10** Transmission Holding Flange Adapter
- **J 3289-20** Holding Fixture
- **J 22888-D** Right Sight Differential Side Bearing Puller
- **J 45012** Holding Fixture
- **DT 45019** Flange and Pinion Cage Remover
- **DT 51075** Puller Adapter Set

For equivalent regional tools, refer to Special Tools (M13) .

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (M13 - LGX W/O Y4Q, LTG) > EXTENSION HOUSING REMOVAL

Fig 1: Transmission Holding Flange, Adapter & Fixture

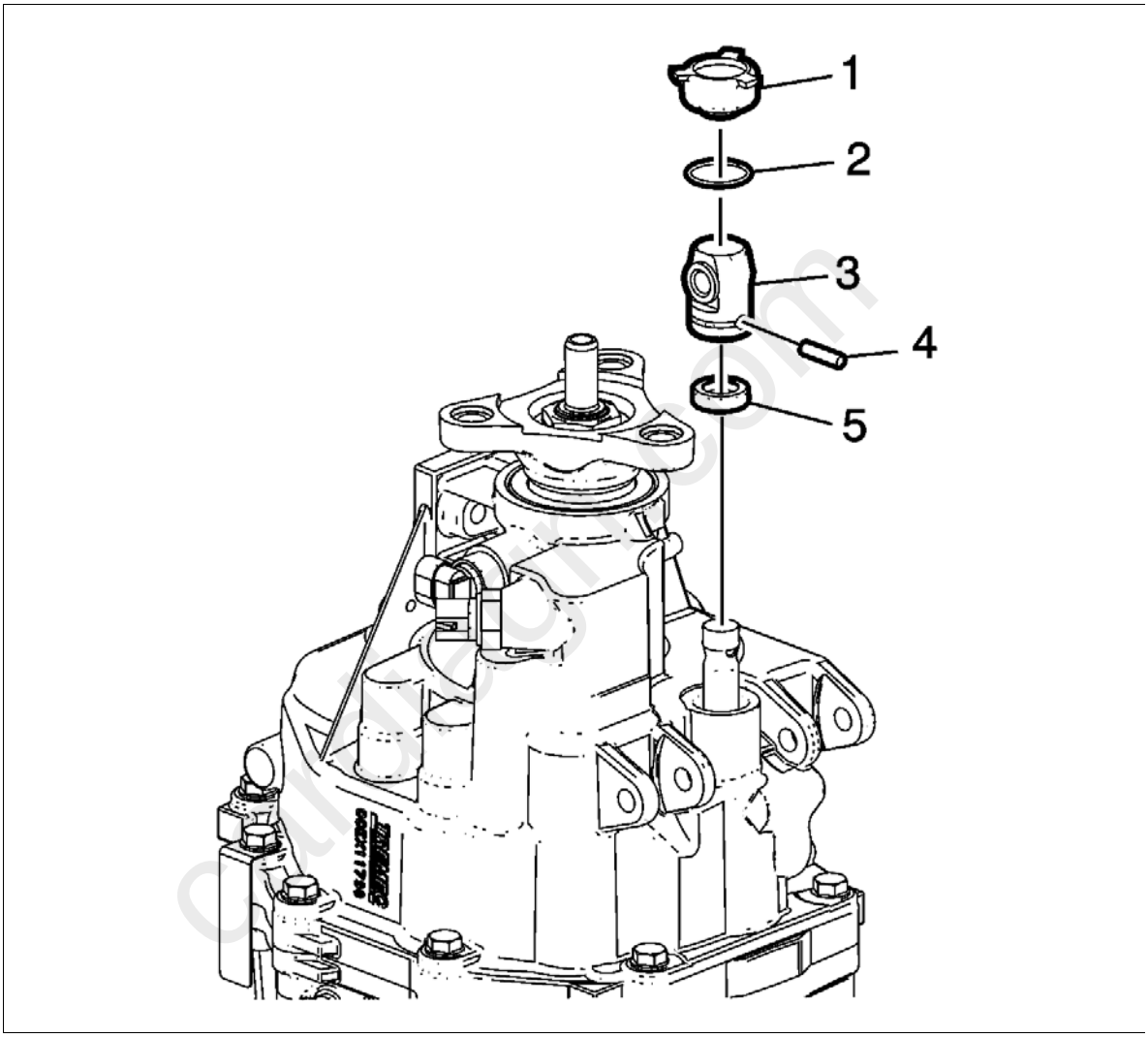


Courtesy of GENERAL MOTORS COMPANY

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1. Install the **DT 47678** flange (2) and the **DT 47678-10** flange adapter (3).
2. Mount the transmission on a workbench using the **J 3289-20** holding fixture (1).
3. Rotate the transmission into a horizontal position.
4. Remove the transmission oil drain plug and drain the transmission fluid.
5. Shift the transmission into NEUTRAL (N).

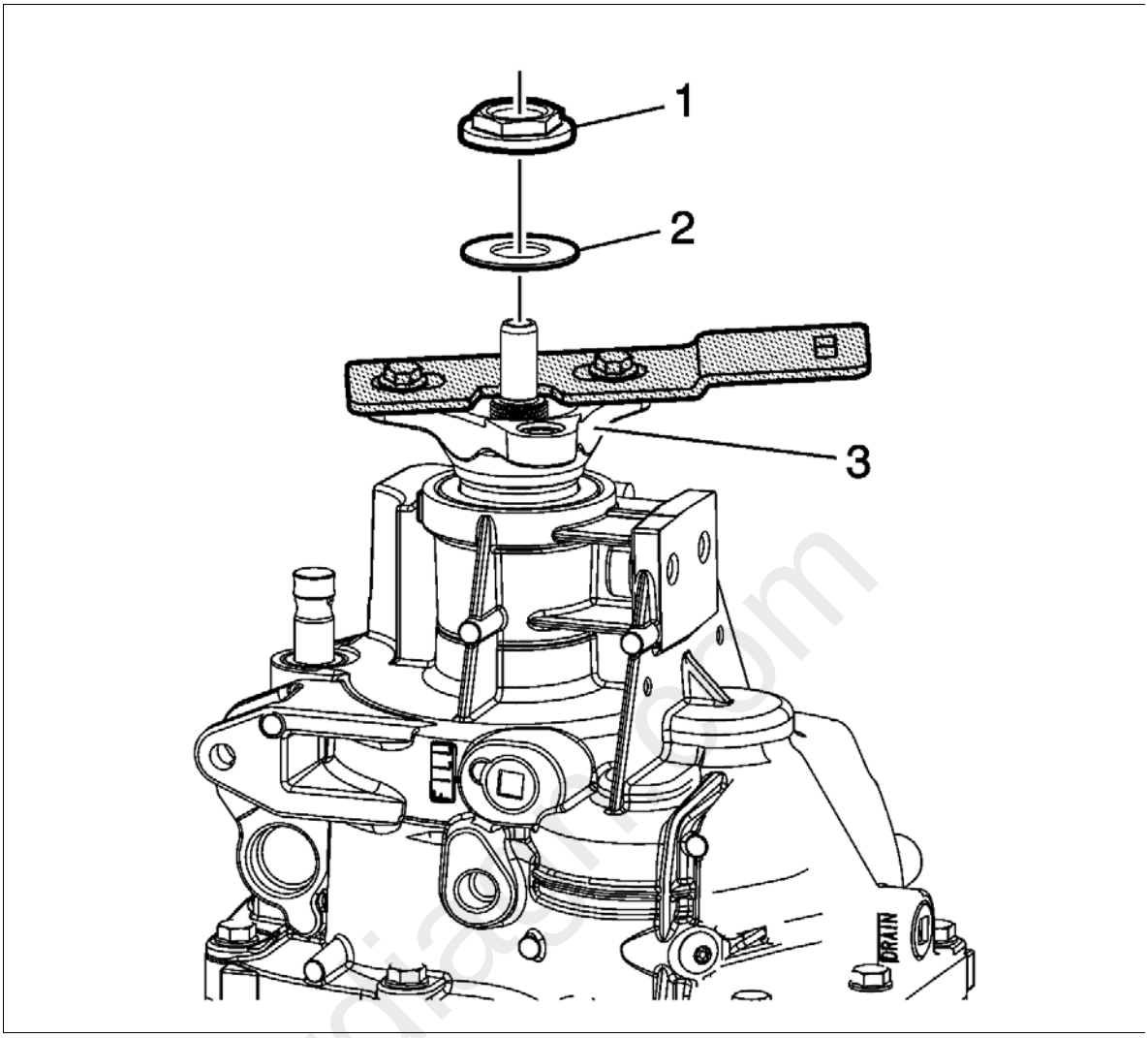
Fig 2: Manual Transmission Control Lever Components



Courtesy of GENERAL MOTORS COMPANY

6. Remove the manual transmission control shaft boot (1) and the manual transmission control lever retainer (2).
7. Remove the manual transmission control lever pin (4) and the manual transmission shift lever shaft joint (3).
8. Remove the manual transmission control lever seal (5).

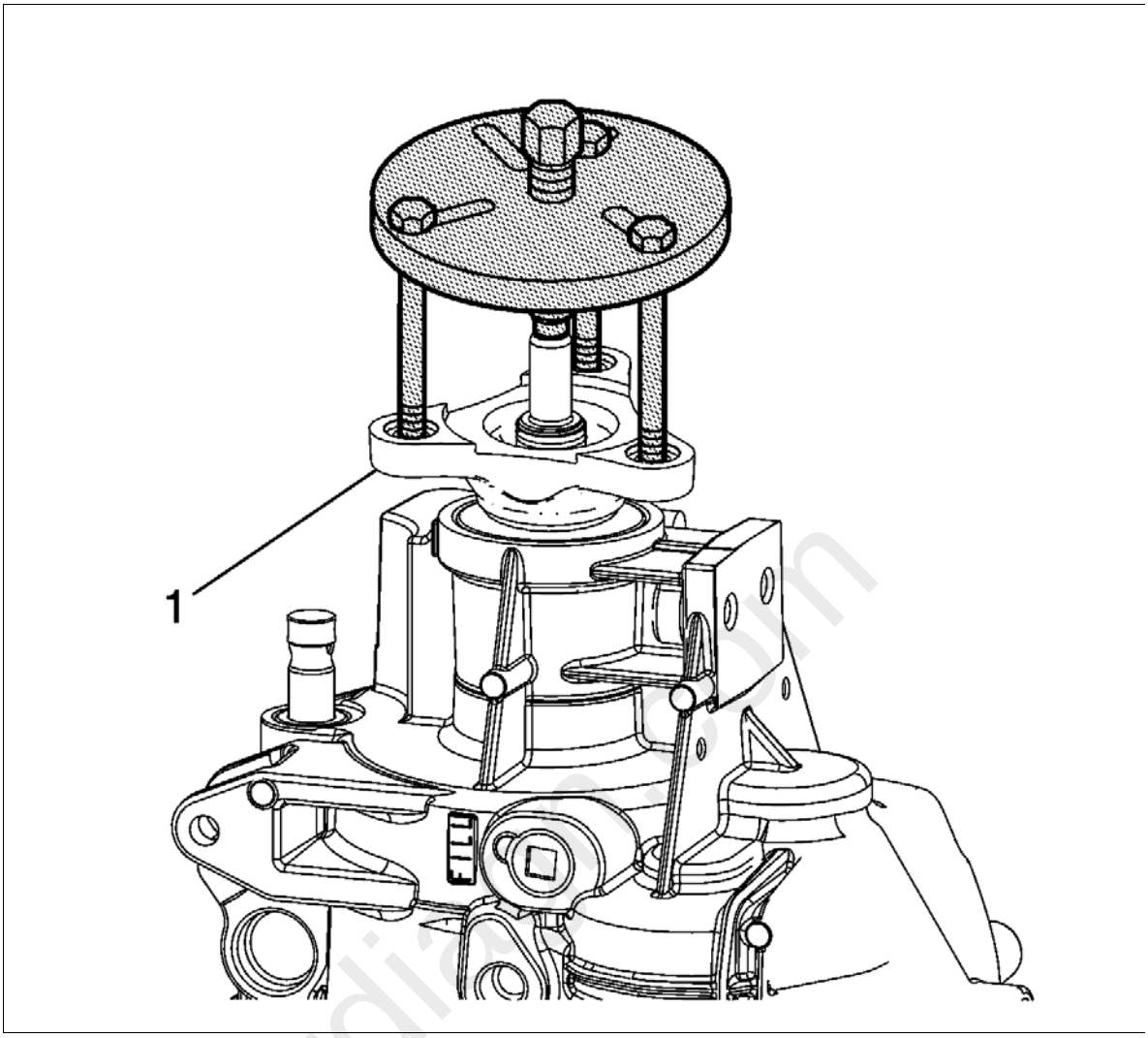
Fig 3: Propeller Shaft Transmission Yoke, Washer & Nut



Courtesy of GENERAL MOTORS COMPANY

9. Install the **J 45012** holding fixture with the mounting bolts to the propeller shaft transmission yoke (3).
10. Using a socket wrench, remove the propeller shaft transmission yoke nut (1).
11. Remove the propeller shaft transmission yoke flange washer (2).

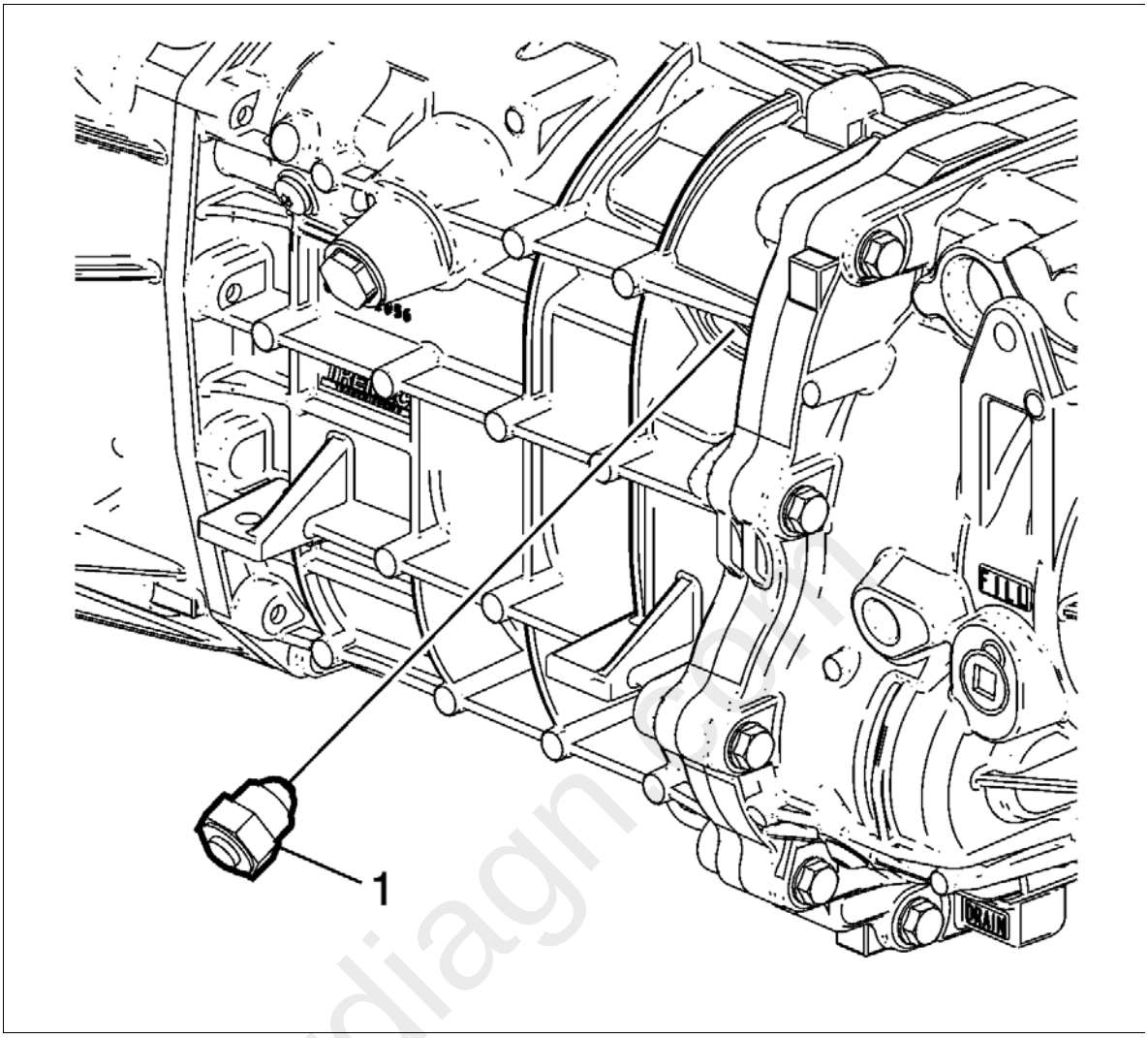
Fig 4: Flange & Pinion Cage Remover At Propeller Shaft Transmission Yoke



Courtesy of GENERAL MOTORS COMPANY

12. Using **DT 45019** flange and pinion cage remover, remove the propeller shaft transmission yoke (1).

Fig 5: Shift Interlock Detent Assembly

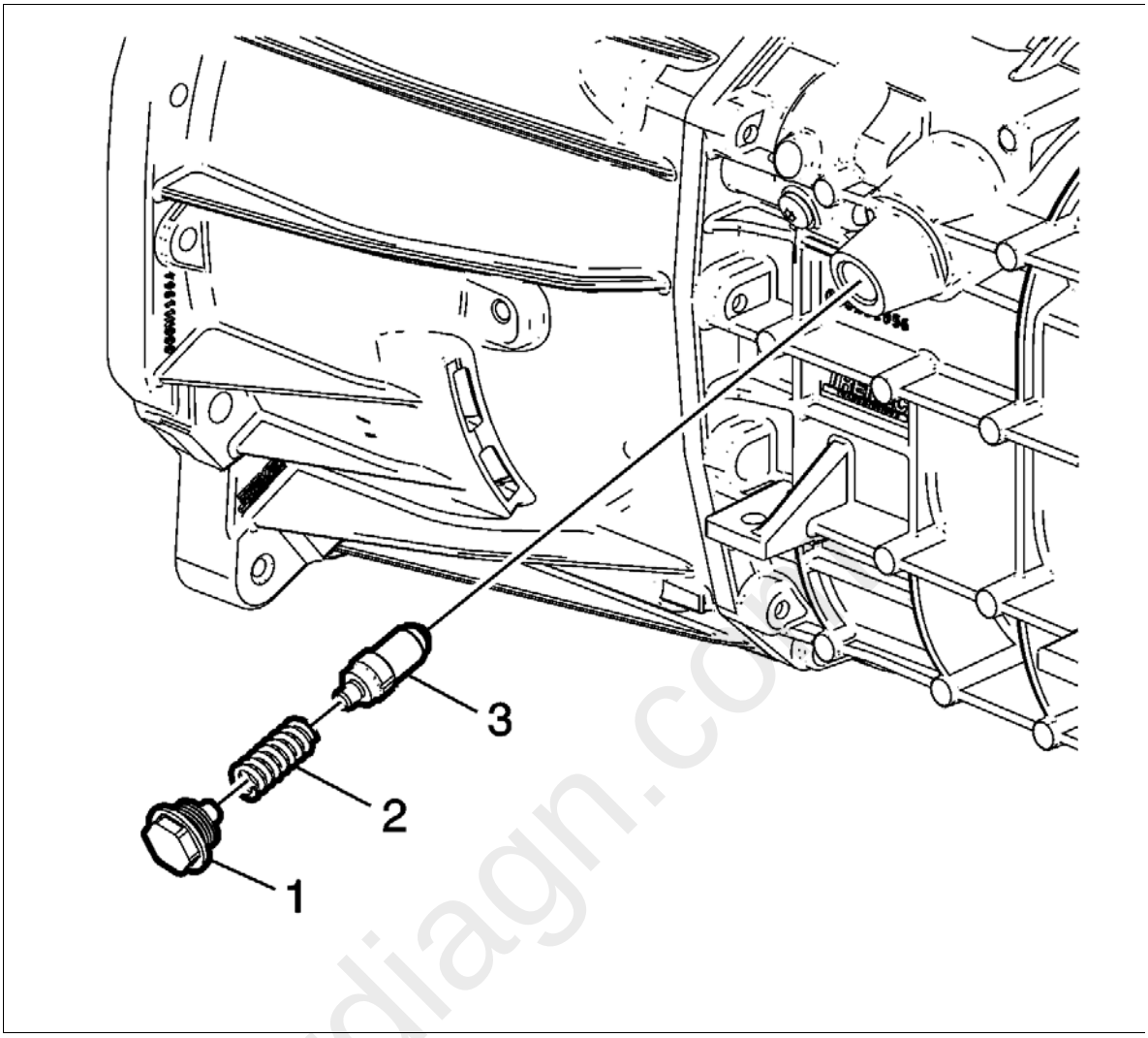


Courtesy of GENERAL MOTORS COMPANY

13. Remove the shift interlock detent assembly (1).

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Fig 6: Manual Shift Detent, Spring & Bolt

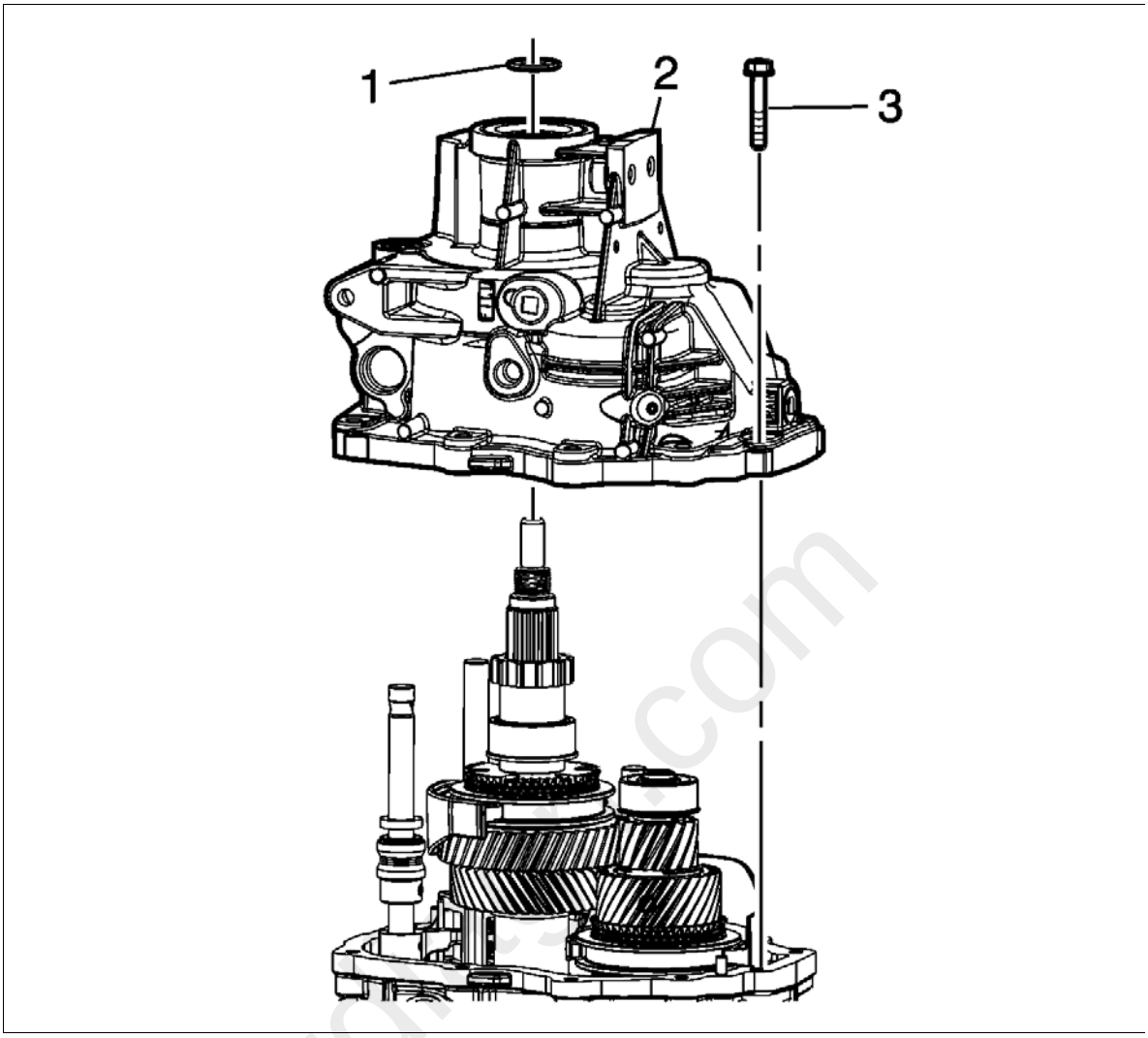


Courtesy of GENERAL MOTORS COMPANY

14. Remove the manual shift detent bolt (1), detent spring (2) and the detent (3).

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Fig 7: Extension Housing Assembly, Bolts & Propeller Shaft O-ring

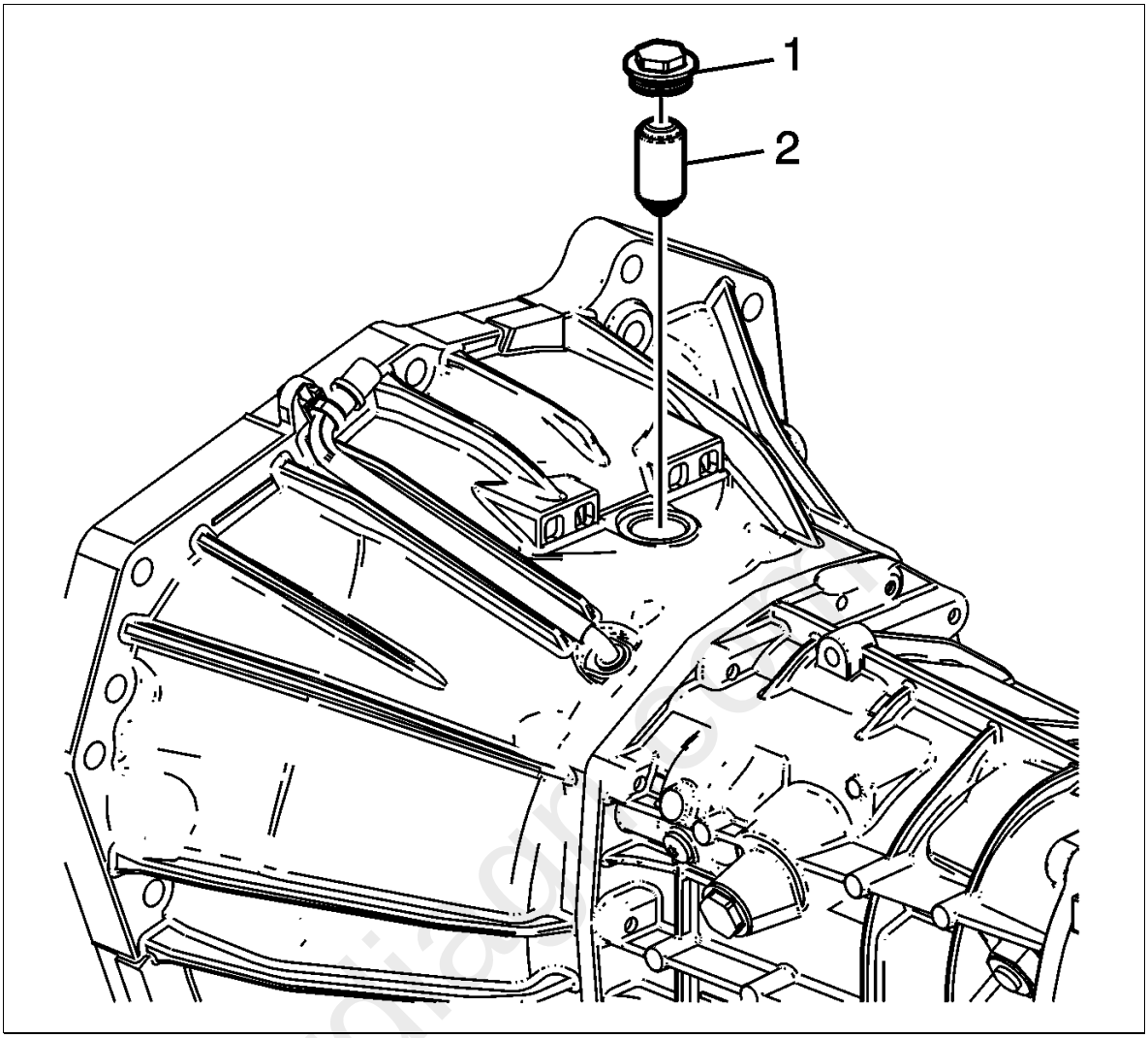


Courtesy of GENERAL MOTORS COMPANY

15. Remove the propeller shaft O-ring (1).
16. Remove the extension housing bolts (3) and the extension housing assembly (2).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (M13 - LGX W/O Y4Q, LTG) > INVERTER LEVER REMOVAL

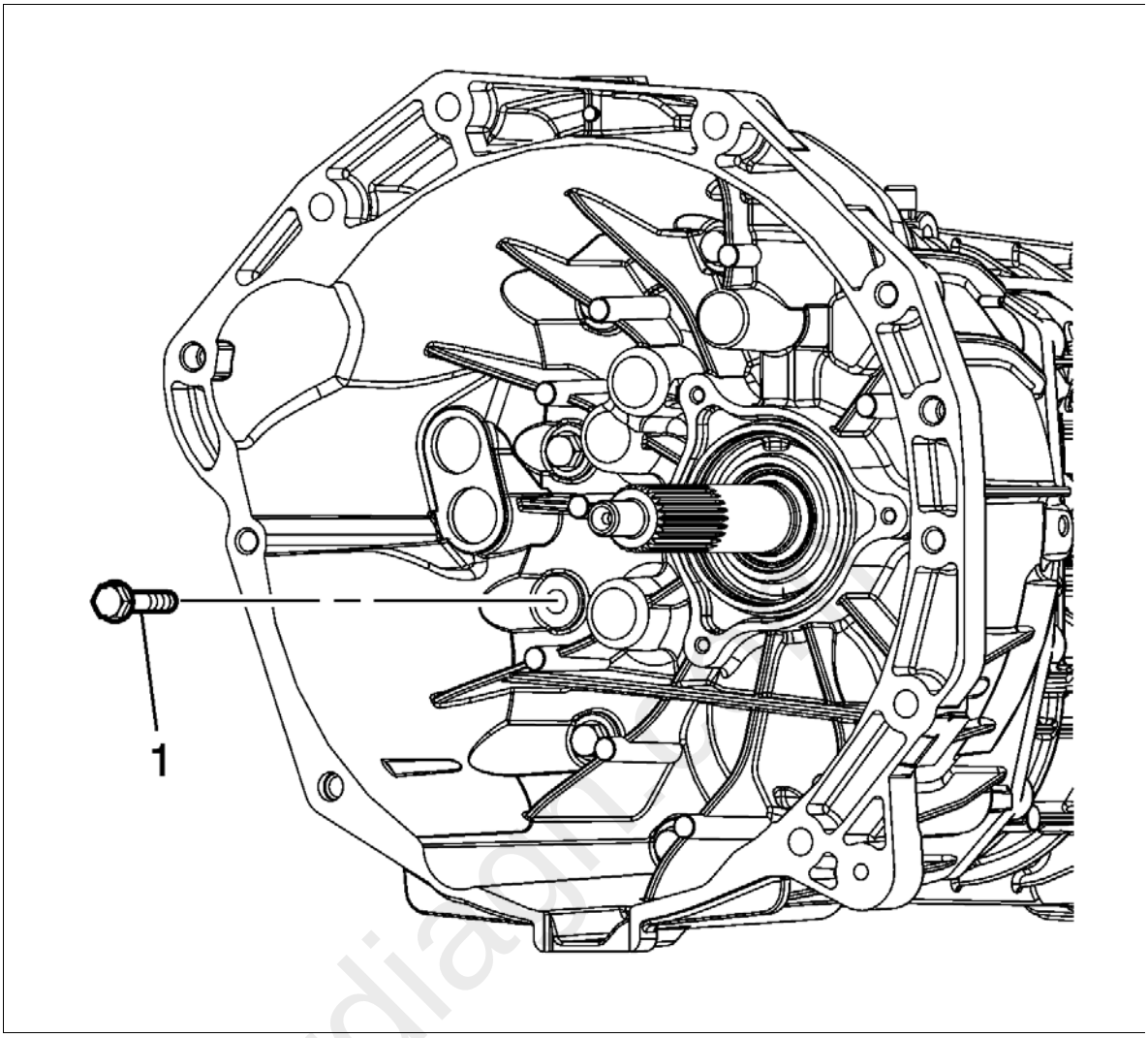
Fig 1: Shift Shaft Detent Plug And Roller Detent



Courtesy of GENERAL MOTORS COMPANY

1. Remove the shift shaft detent plug (1) and the roller detent (2).

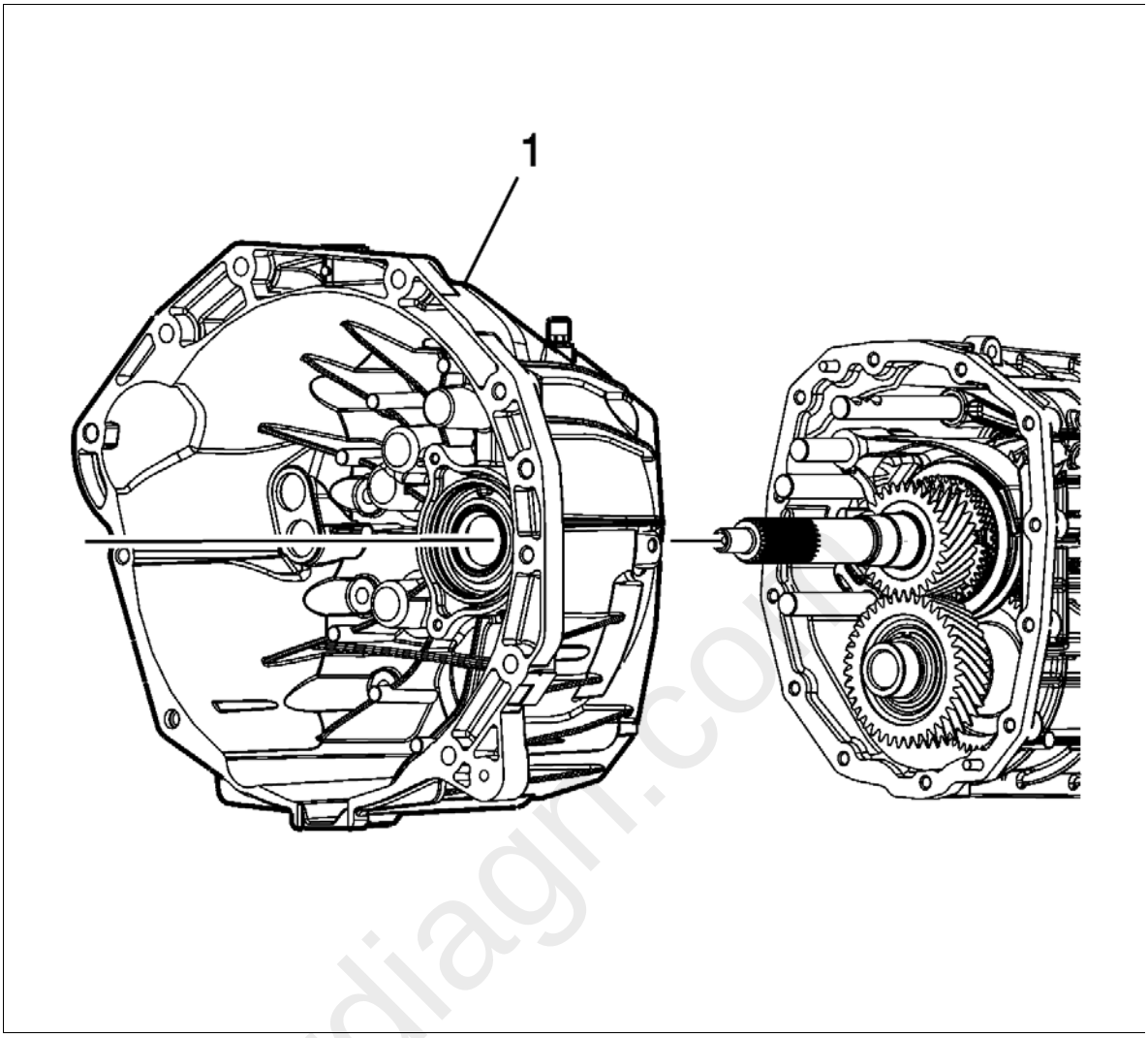
Fig 2: Clutch Housing Bolts



Courtesy of GENERAL MOTORS COMPANY

2. Remove the clutch housing bolts (1).

Fig 3: Clutch Housing Assembly

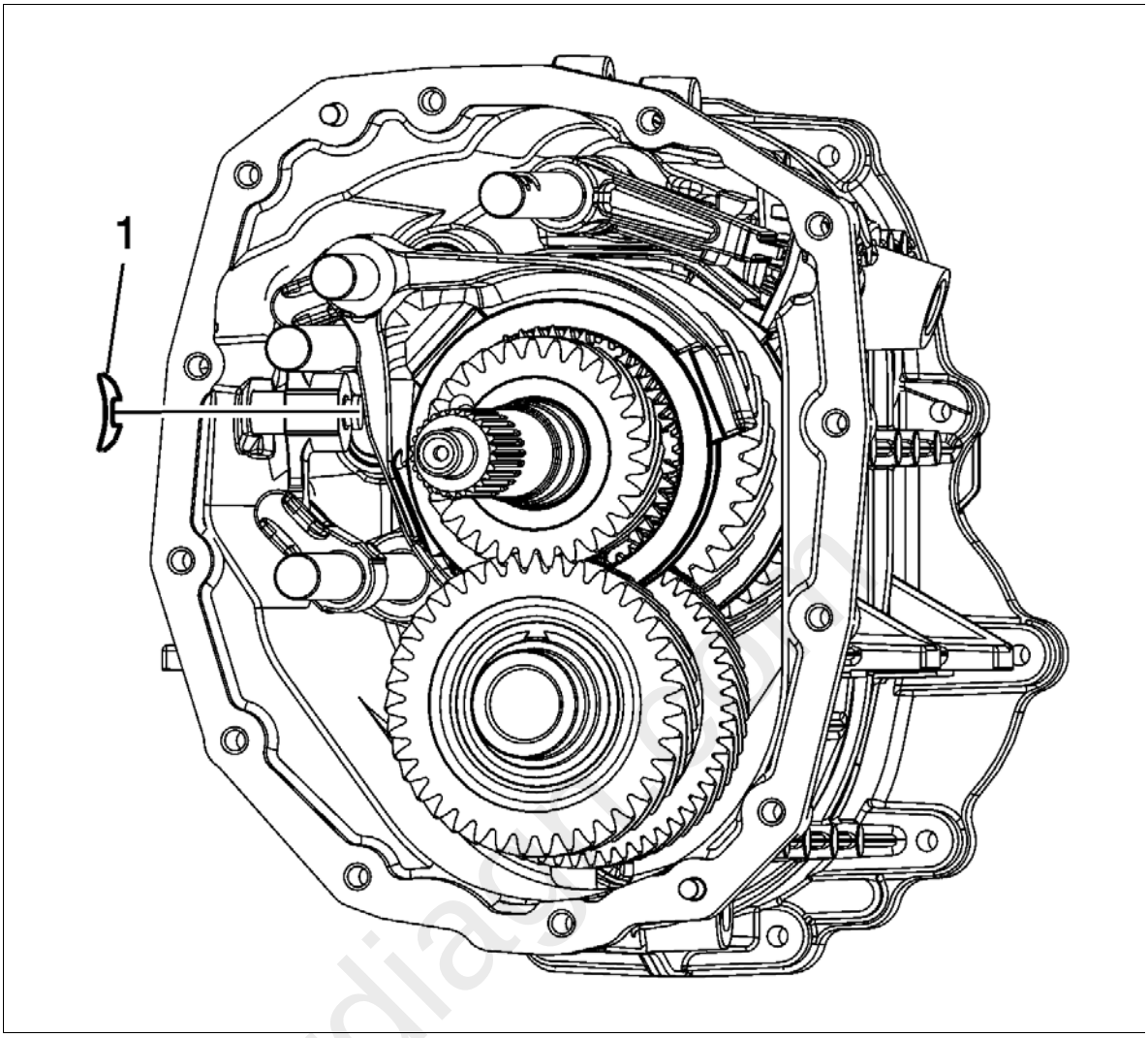


Courtesy of GENERAL MOTORS COMPANY

3. Remove the clutch housing assembly (1).

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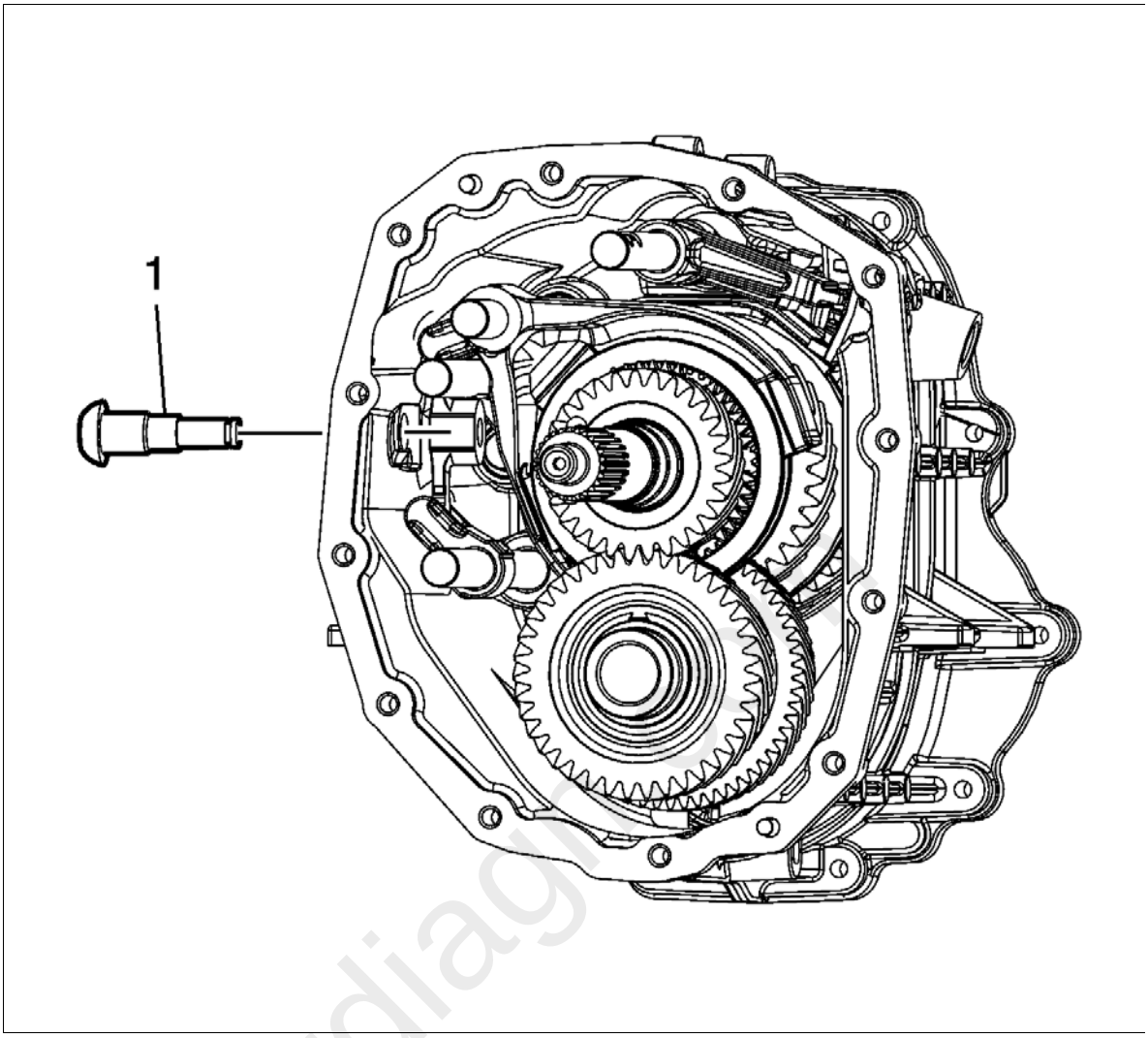
Fig 4: Manual Transmission Shift Lever Retainer



Courtesy of GENERAL MOTORS COMPANY

4. Remove the manual transmission shift lever retainer (1).

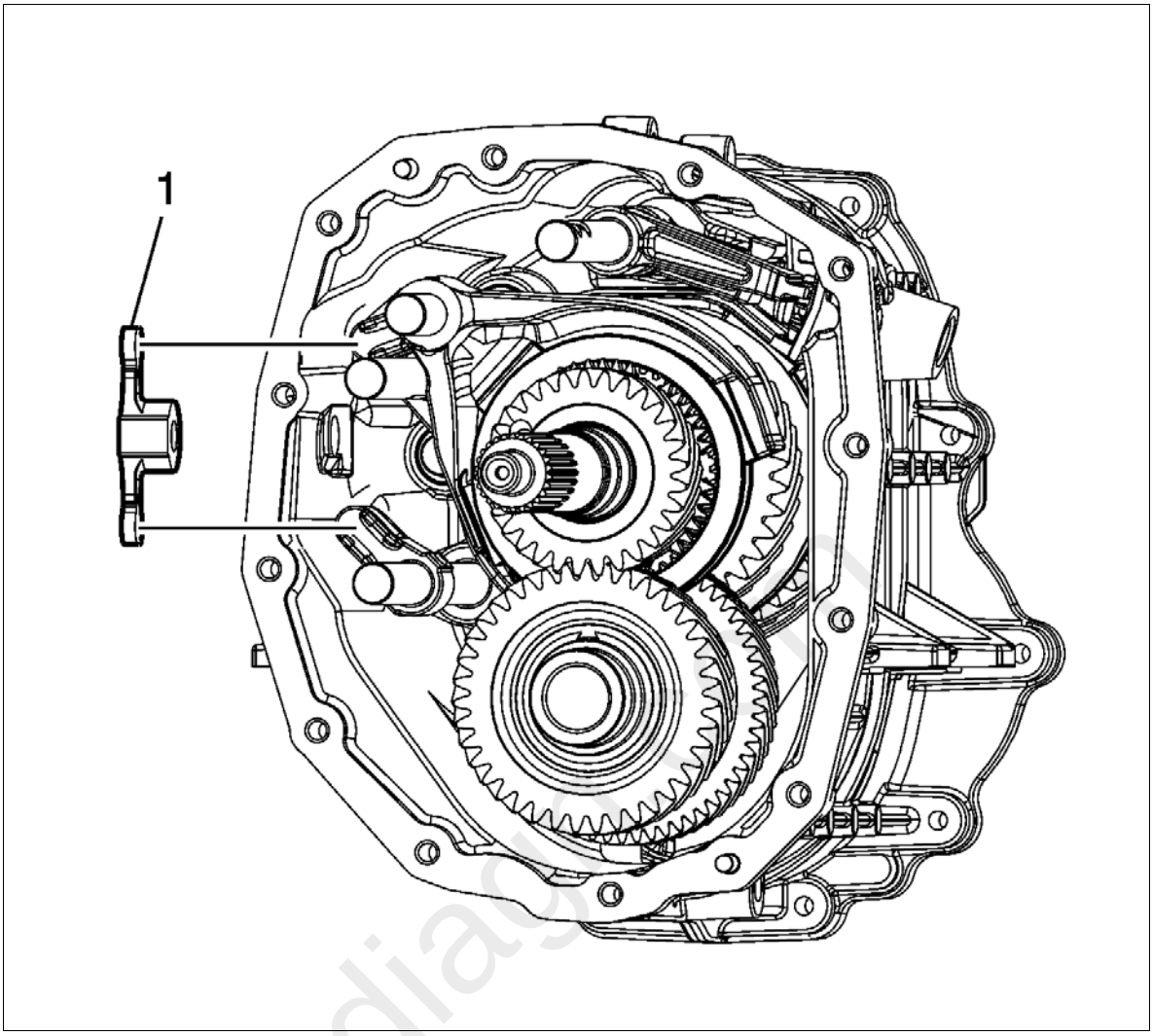
Fig 5: Manual Transmission Selector Lever Pivot Pin



Courtesy of GENERAL MOTORS COMPANY

5. Remove the manual transmission selector lever pivot pin (1).

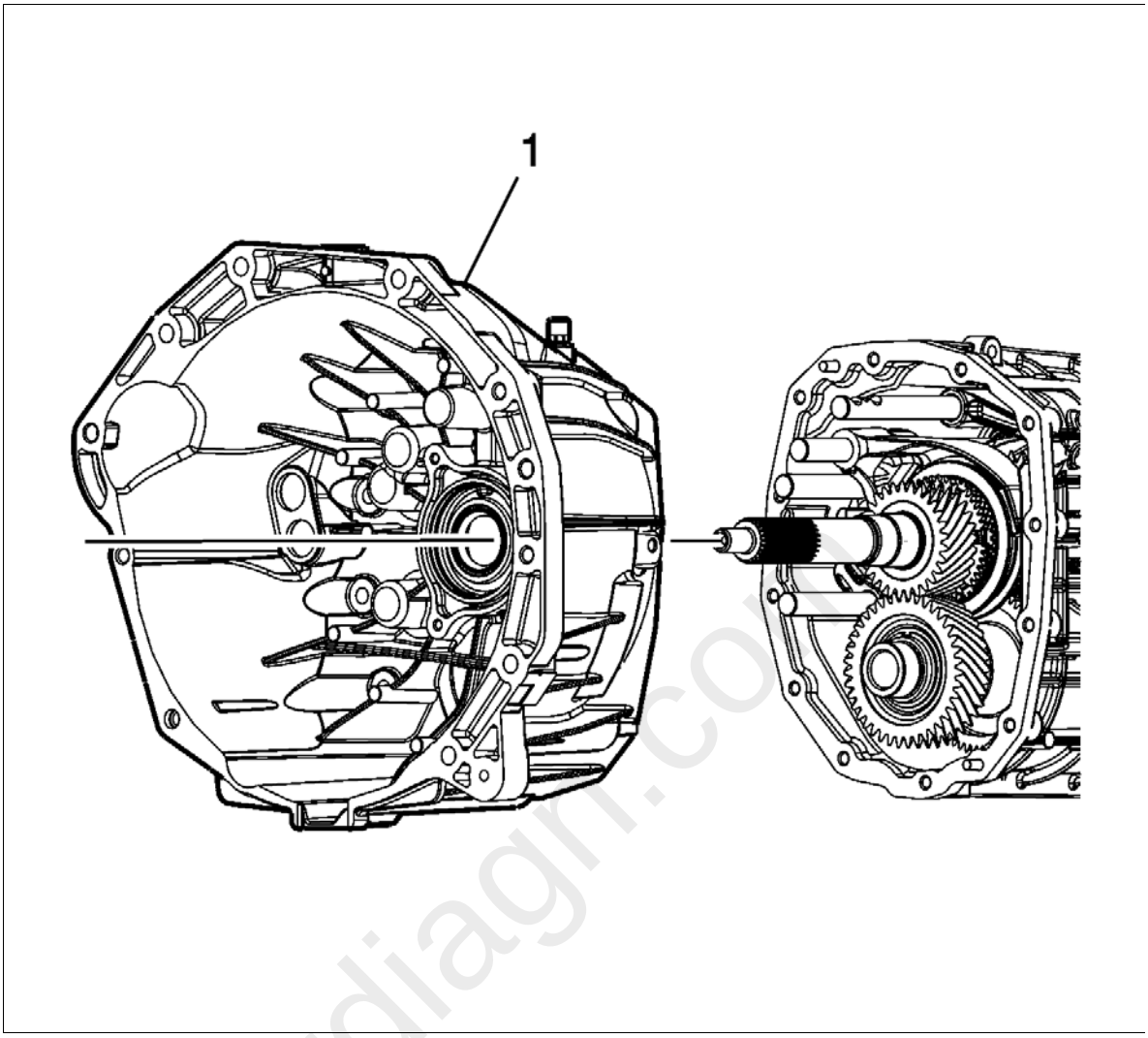
Fig 6: Manual Transmission Selector Lever



Courtesy of GENERAL MOTORS COMPANY

6. Remove the manual transmission selector lever (1).

Fig 7: Clutch Housing Assembly

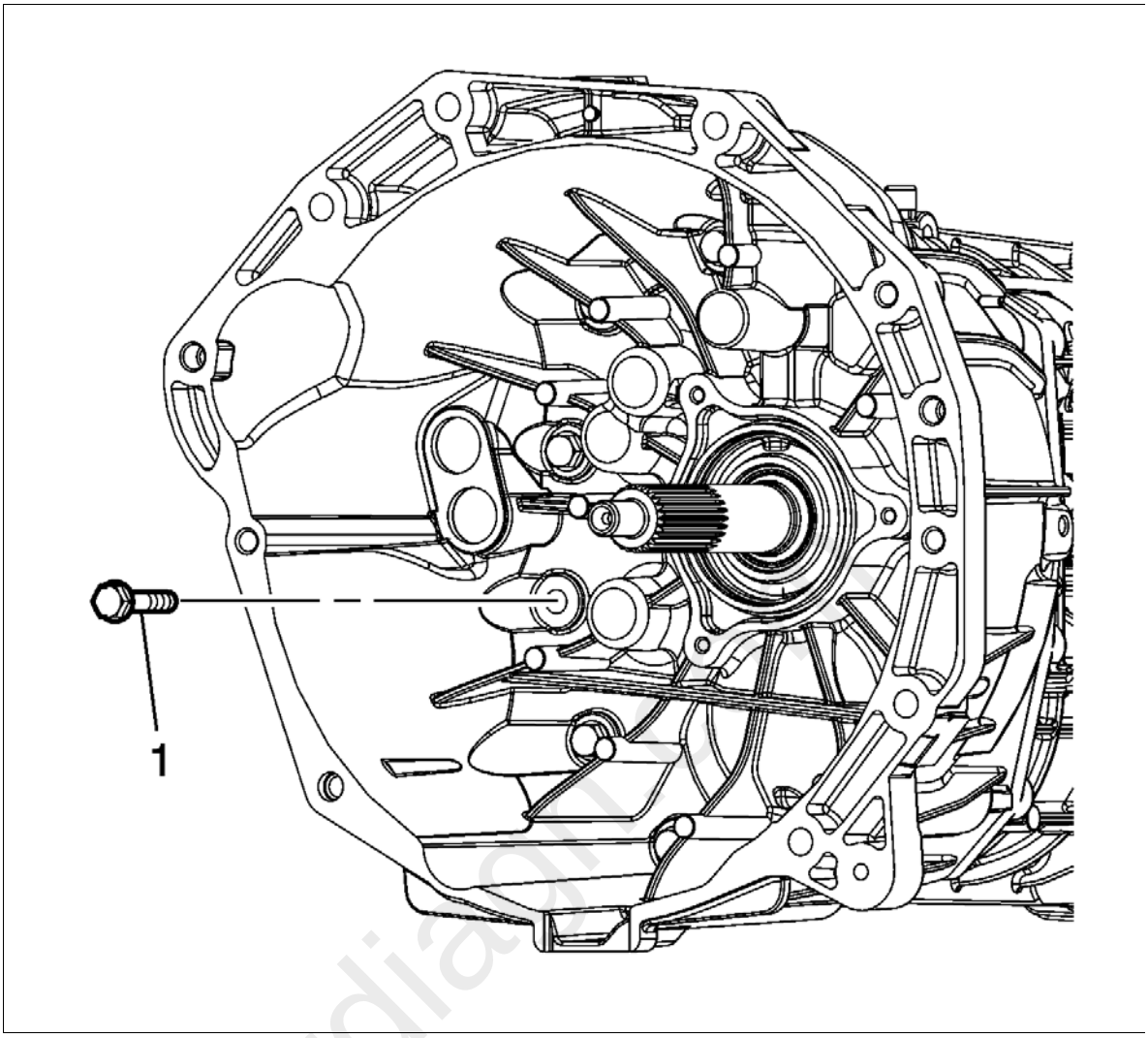


Courtesy of GENERAL MOTORS COMPANY

7. Temporarily reinstall the clutch housing assembly (1).

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Fig 8: Clutch Housing Bolts

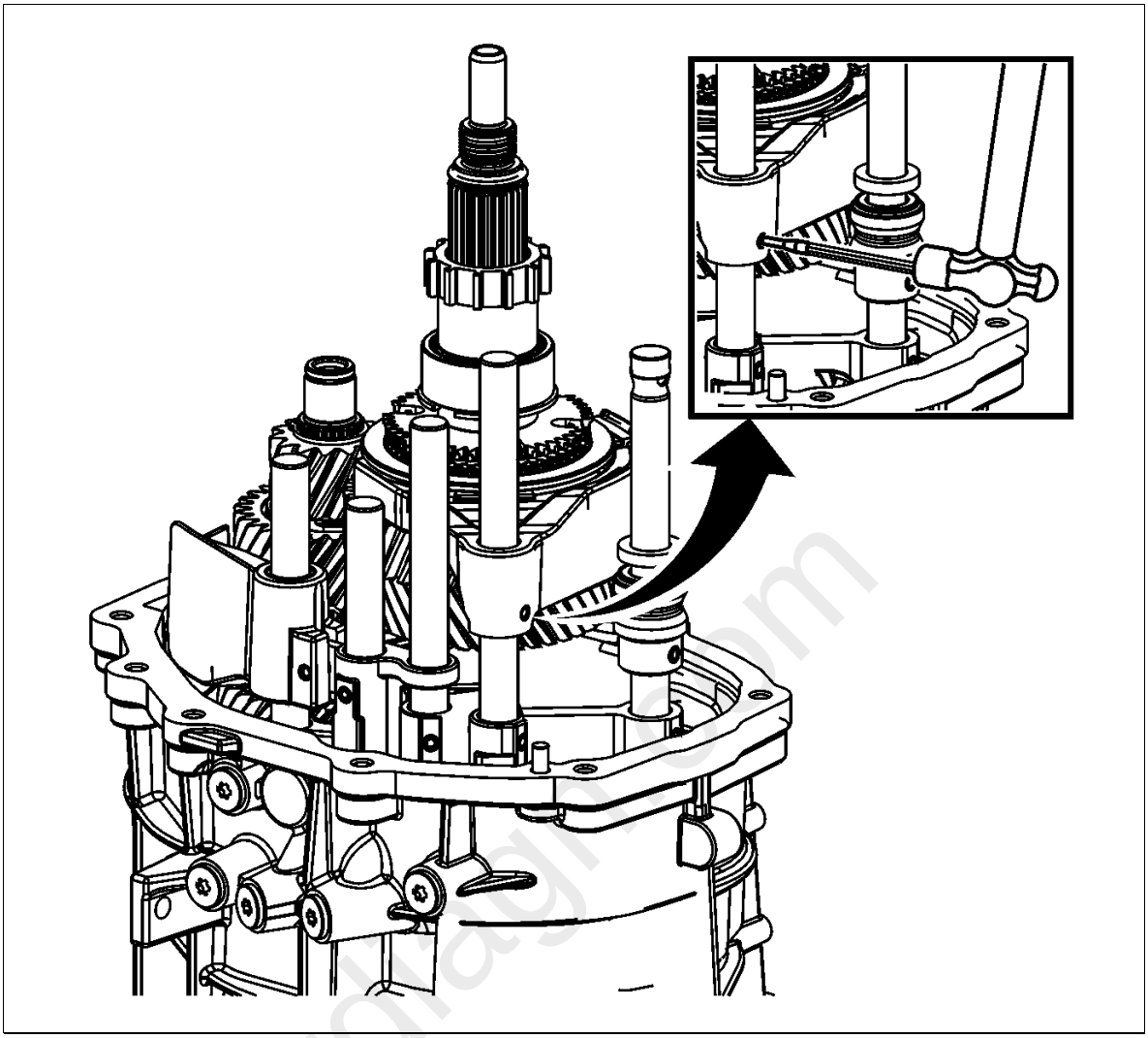


Courtesy of GENERAL MOTORS COMPANY

8. Temporarily reinstall the clutch housing bolts (1).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION DISASSEMBLE (M13 - LGX W/O Y4Q, LTG) > SHIFT SHAFT ASSEMBLIES AND GEAR CLUSTER REMOVAL

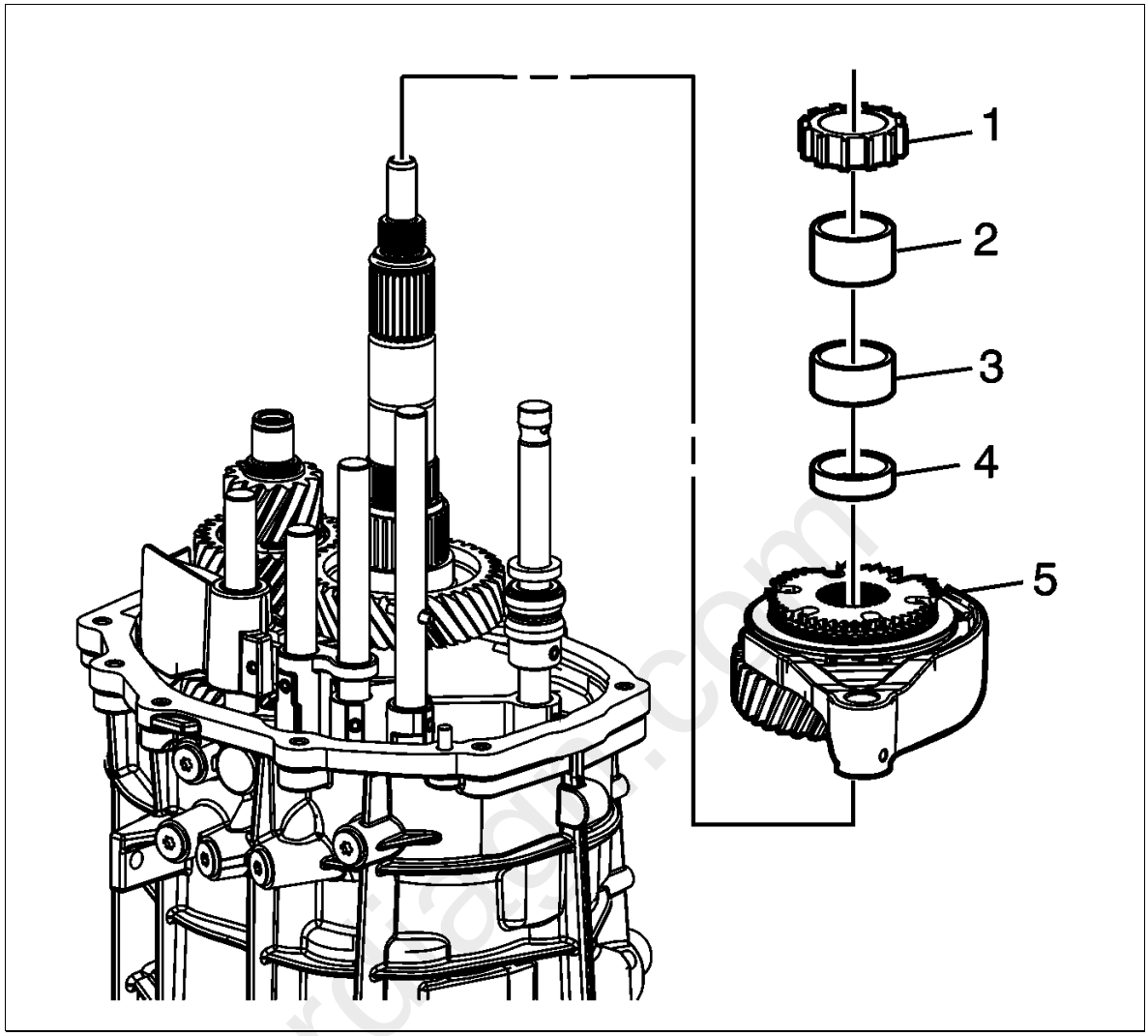
Fig 1: Coiled Spring Pin



Courtesy of GENERAL MOTORS COMPANY

1. Using a 3/16 in drift punch and hammer drive the coiled spring pin downward and remove.

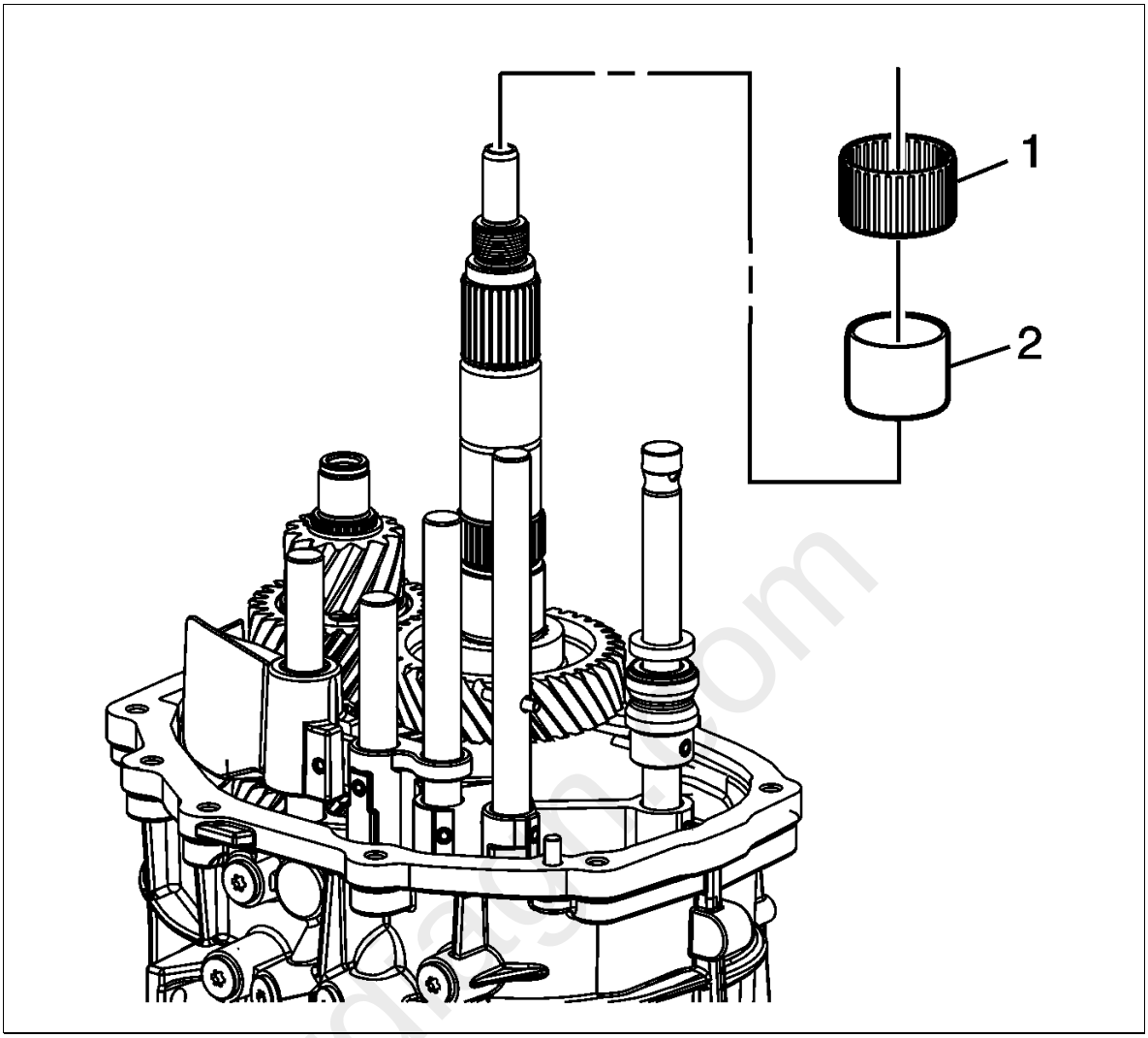
Fig 2: Vehicle Speed Sensor Reluctor Wheel, Spacer, Main Shaft Rear Bearing Race, Main Shaft Bearing Spacer And Reverse Gear And Synchronizer



Courtesy of GENERAL MOTORS COMPANY

2. Remove the vehicle speed sensor reluctor wheel (1), spacer (2), main shaft rear bearing race (3), and main shaft bearing spacer (4).
3. Remove the reverse gear and synchronizer (5) together as an assembly.

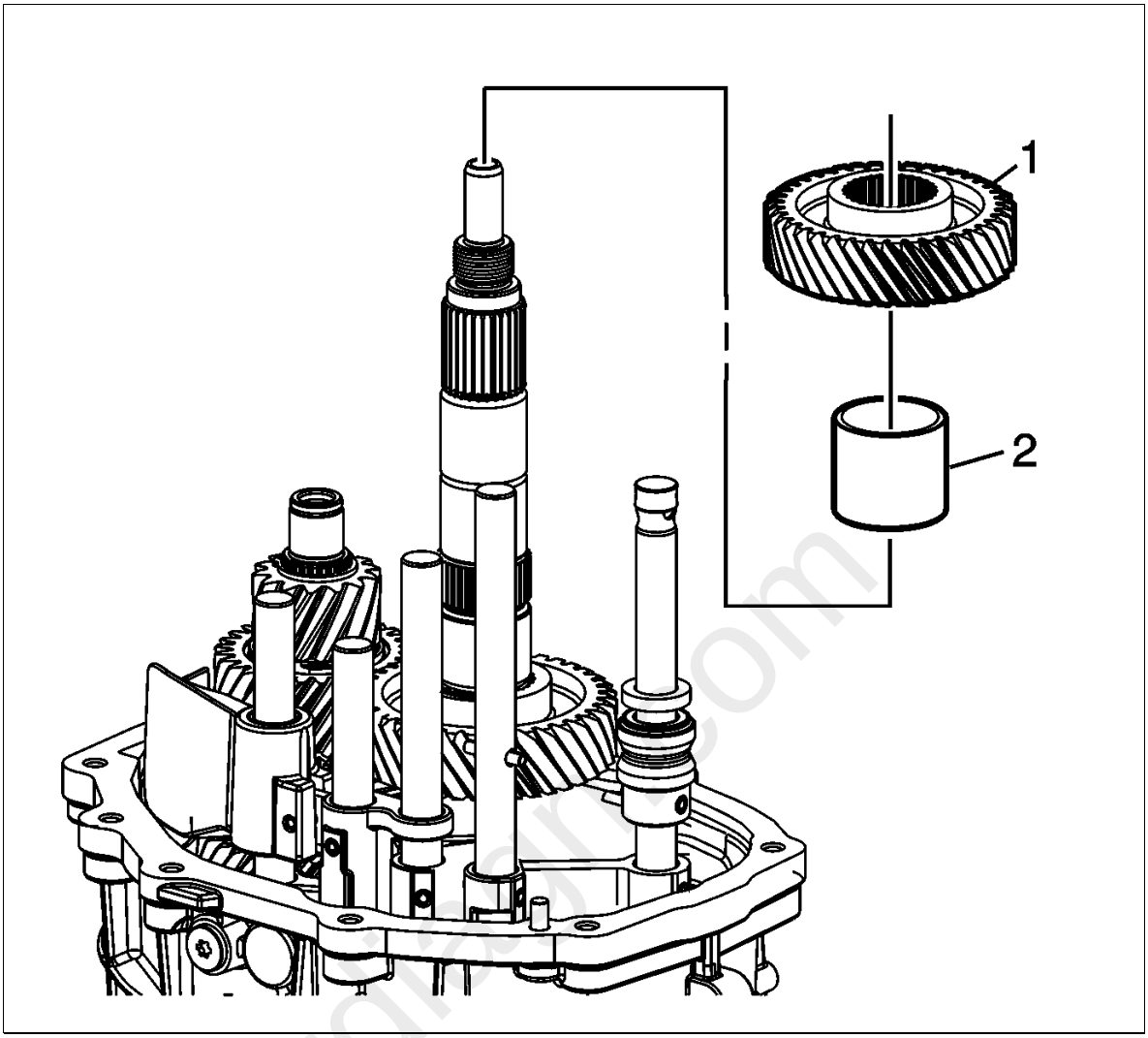
Fig 3: Reverse Gear Bearing Assembly And Bushing



Courtesy of GENERAL MOTORS COMPANY

4. Remove the reverse gear bearing assembly (1) and bushing (2).

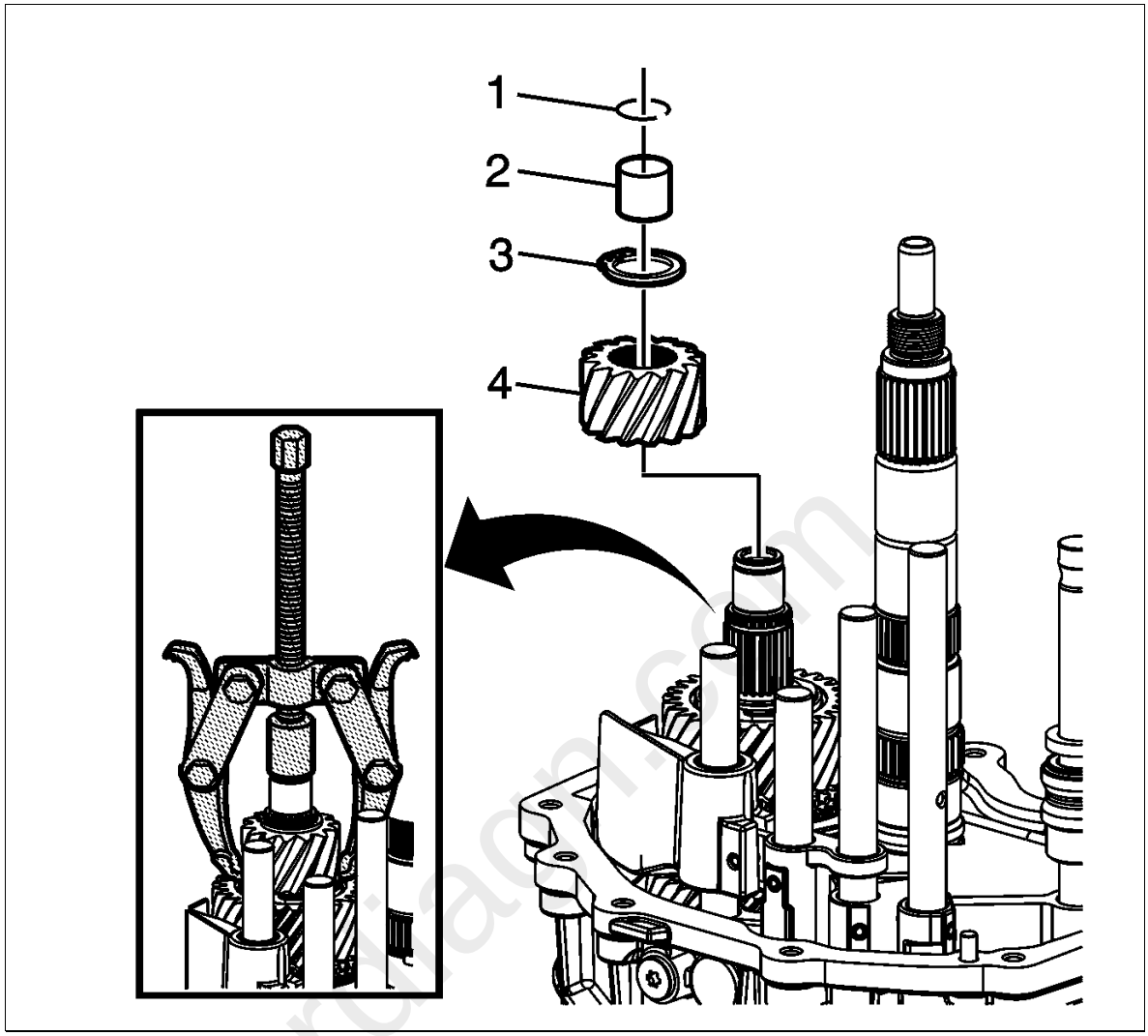
Fig 4: 3rd Gear Assembly And 3rd And 4th Gear Spacer



Courtesy of GENERAL MOTORS COMPANY

5. Remove the 3rd gear assembly (1) and the 3rd & 4th gear spacer (2).

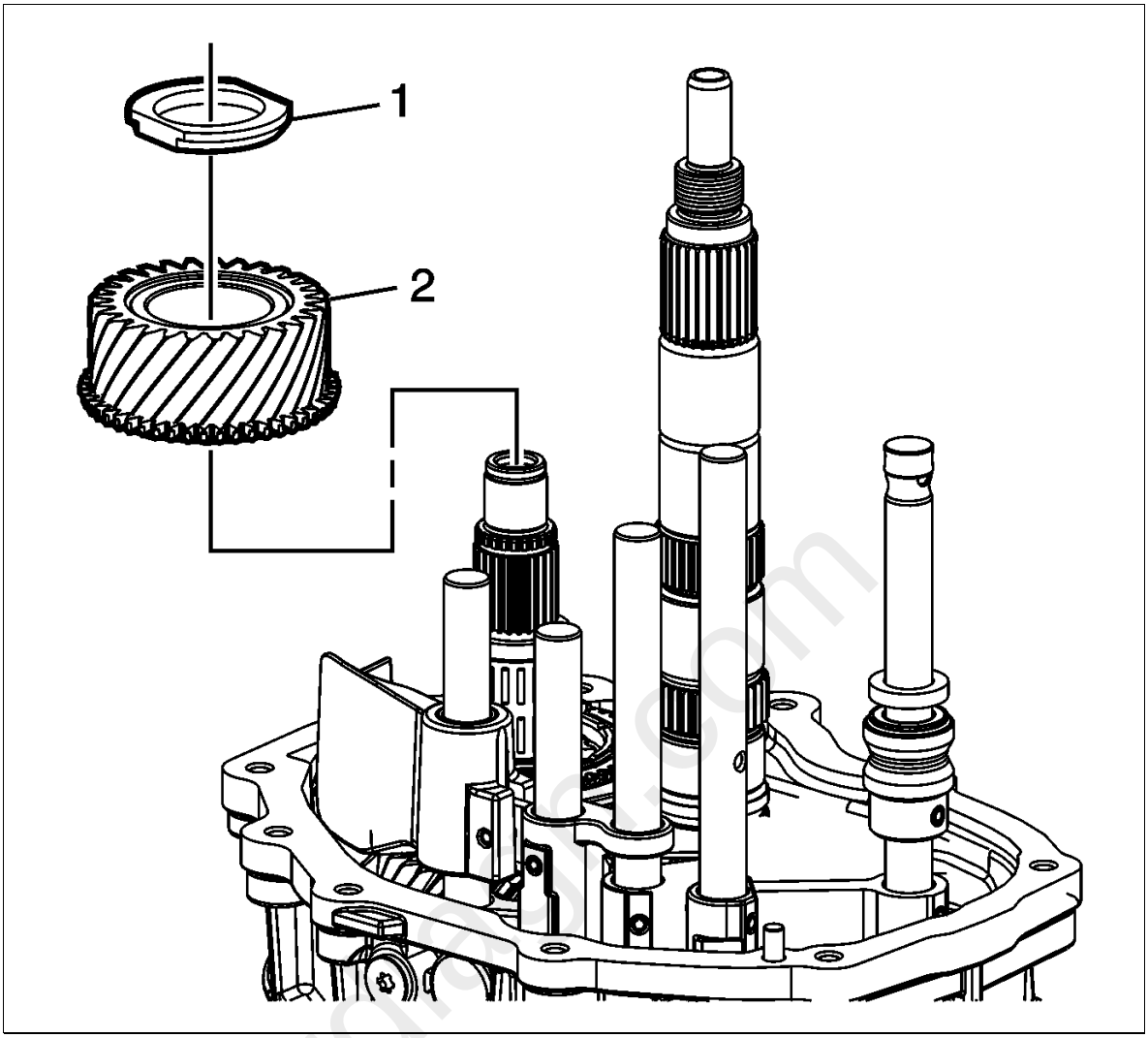
Fig 5: Counter Gear Rear Bearing Inner Race Retainer, Counter Gear Rear Bearing Inner Race And Reverse Gear Assembly Retainer



Courtesy of GENERAL MOTORS COMPANY

6. Using snap ring pliers, remove the counter gear rear bearing inner race retainer (1) and remove the counter gear rear bearing inner race (2).
7. Using snap ring pliers, remove the reverse gear assembly retainer (3).
8. Using **DT 22888-D** Right Differential Side Bearing Puller remove the reverse drive gear assembly (4).

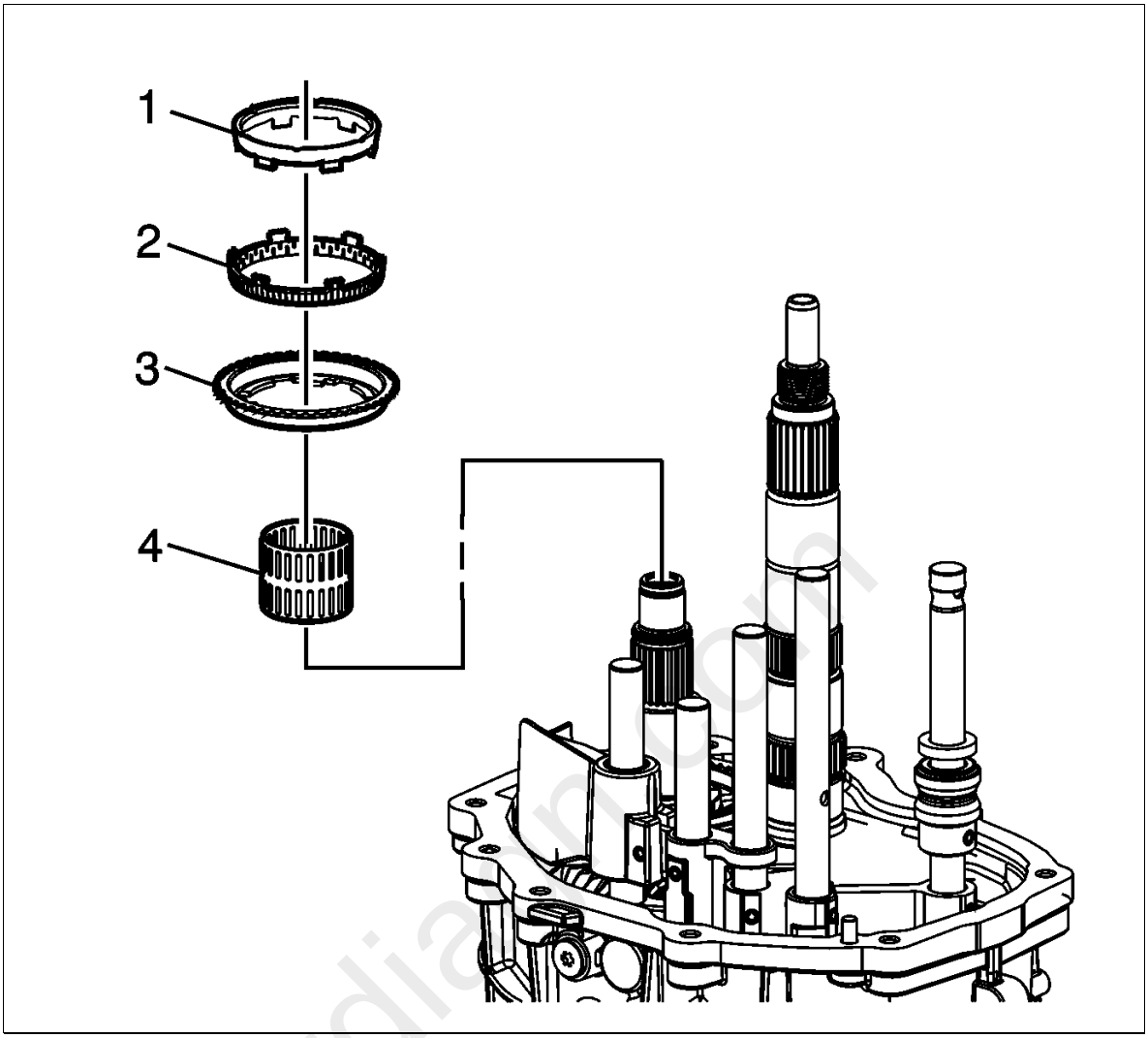
Fig 6: 3rd Gear Thrust Washer And Drive Gear Assembly



Courtesy of GENERAL MOTORS COMPANY

9. Remove the 3rd gear thrust washer (1) and the 3rd gear drive gear assembly (2).

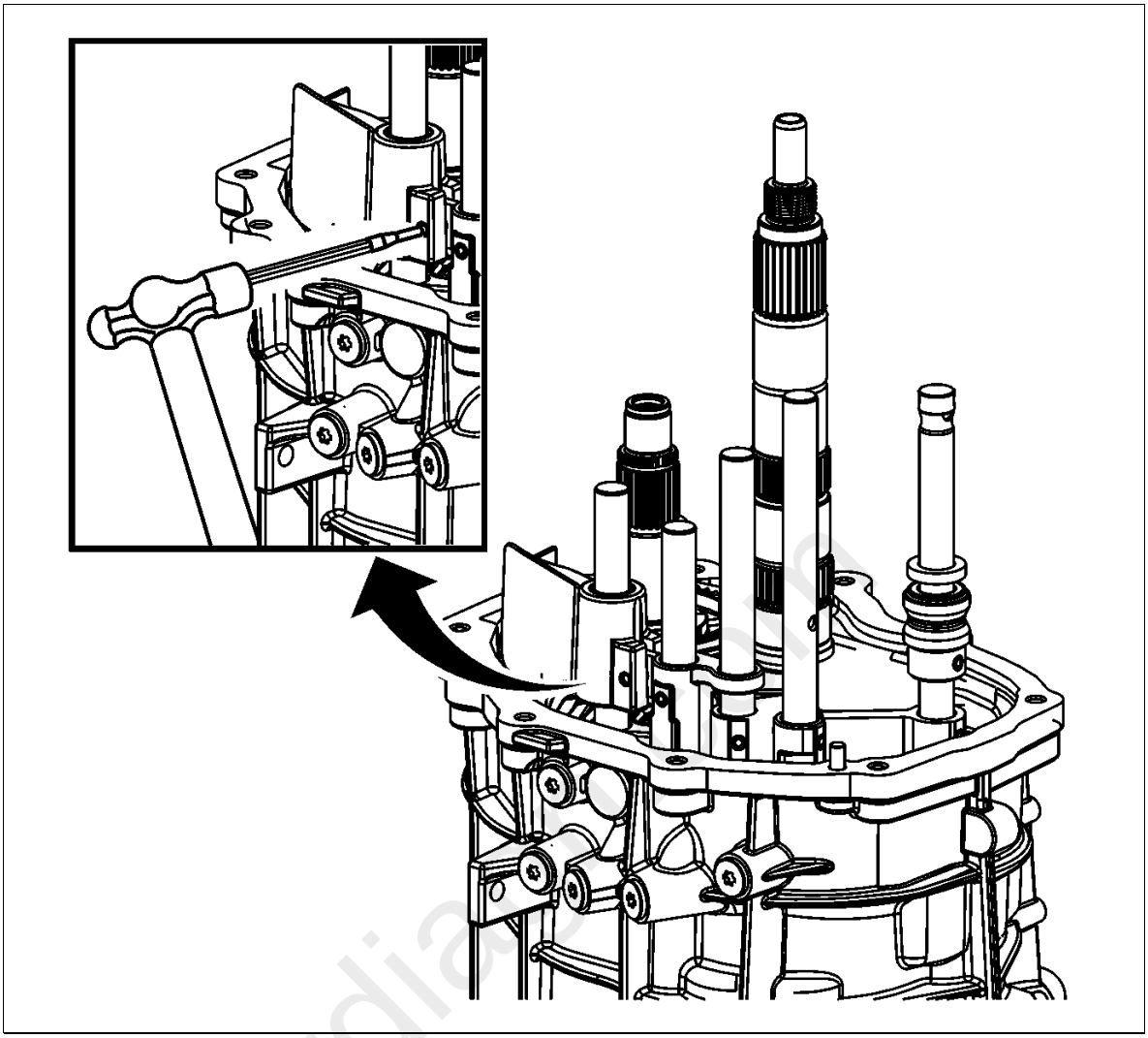
Fig 7: 3rd Gear Blocking Ring Assemblies



Courtesy of GENERAL MOTORS COMPANY

10. Remove the 3rd gear blocking ring assemblies (1, 2, and 3).
11. Remove the 3rd gear bearing assembly (4).

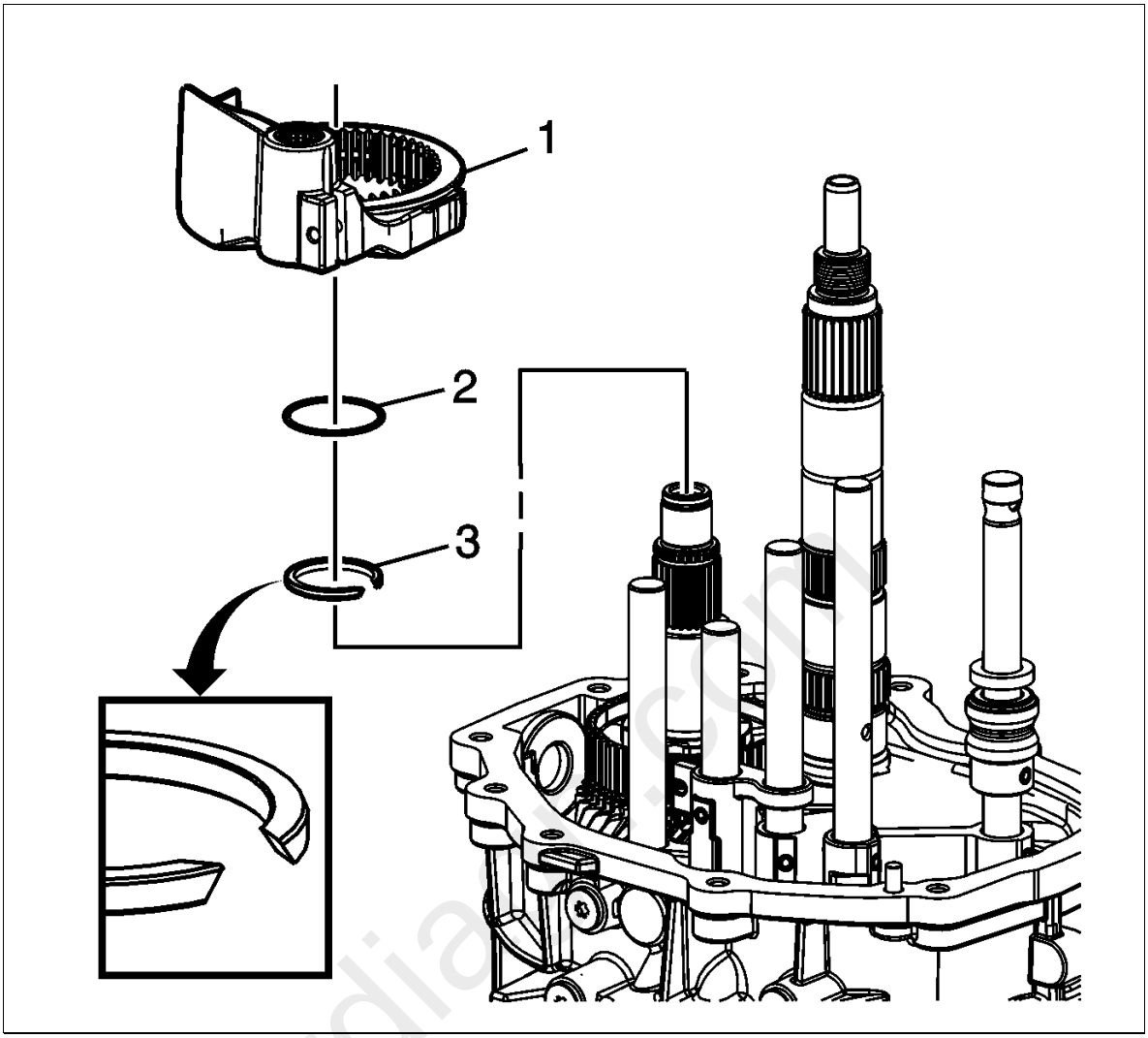
Fig 8: Coiled Spring Pin



Courtesy of GENERAL MOTORS COMPANY

12. Using a 3/16 in drift and hammer, drive the coiled spring pin downward and remove.

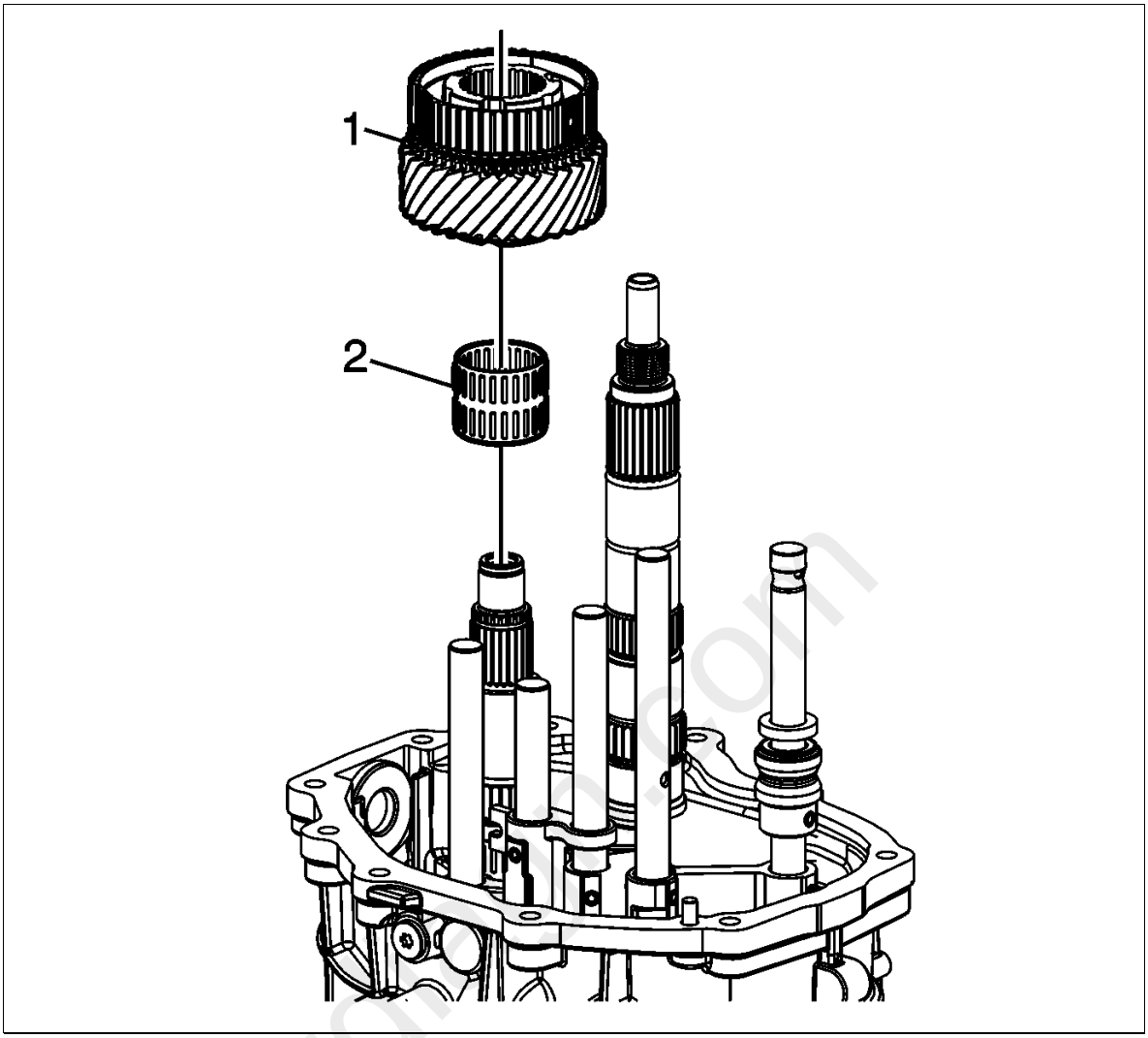
Fig 9: 3rd & 4th Synchronizer Sleeve And Fork Assembly



Courtesy of GENERAL MOTORS COMPANY

13. Remove the 3rd & 4th synchronizer sleeve and fork assembly (1).
14. Remove the 3rd gear bearing roller spacer (2). Using snap ring pliers remove the retaining ring (3).

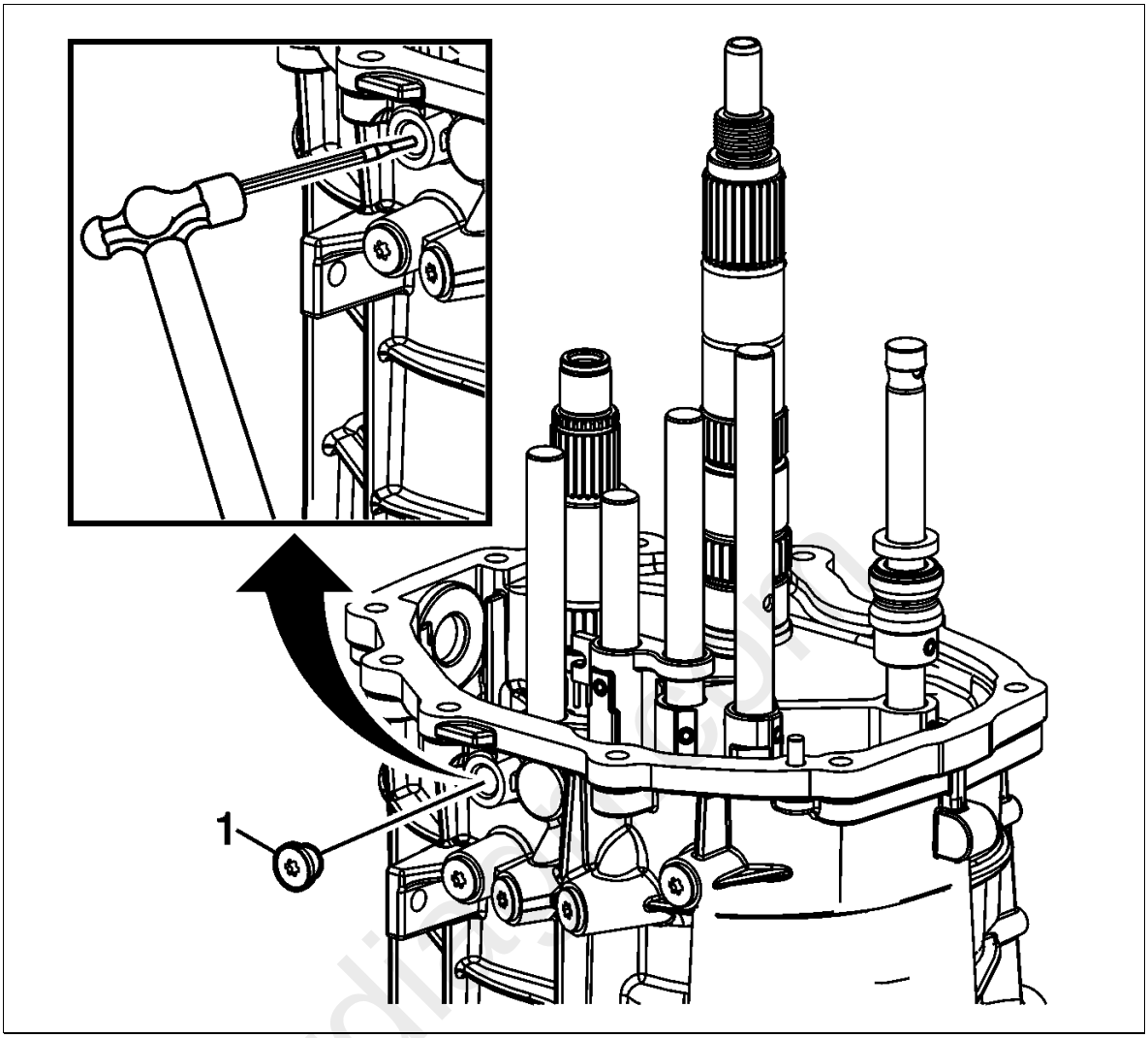
Fig 10: 3rd & 4th Hub, 4th Gear Blocking Rings, And 4th Gear Drive Gear



Courtesy of GENERAL MOTORS COMPANY

15. Remove the 3rd & 4th hub, 4th gear blocking rings, and 4th gear drive gear (1) as an assembly.
16. Remove the 4th gear bearing assembly (2).

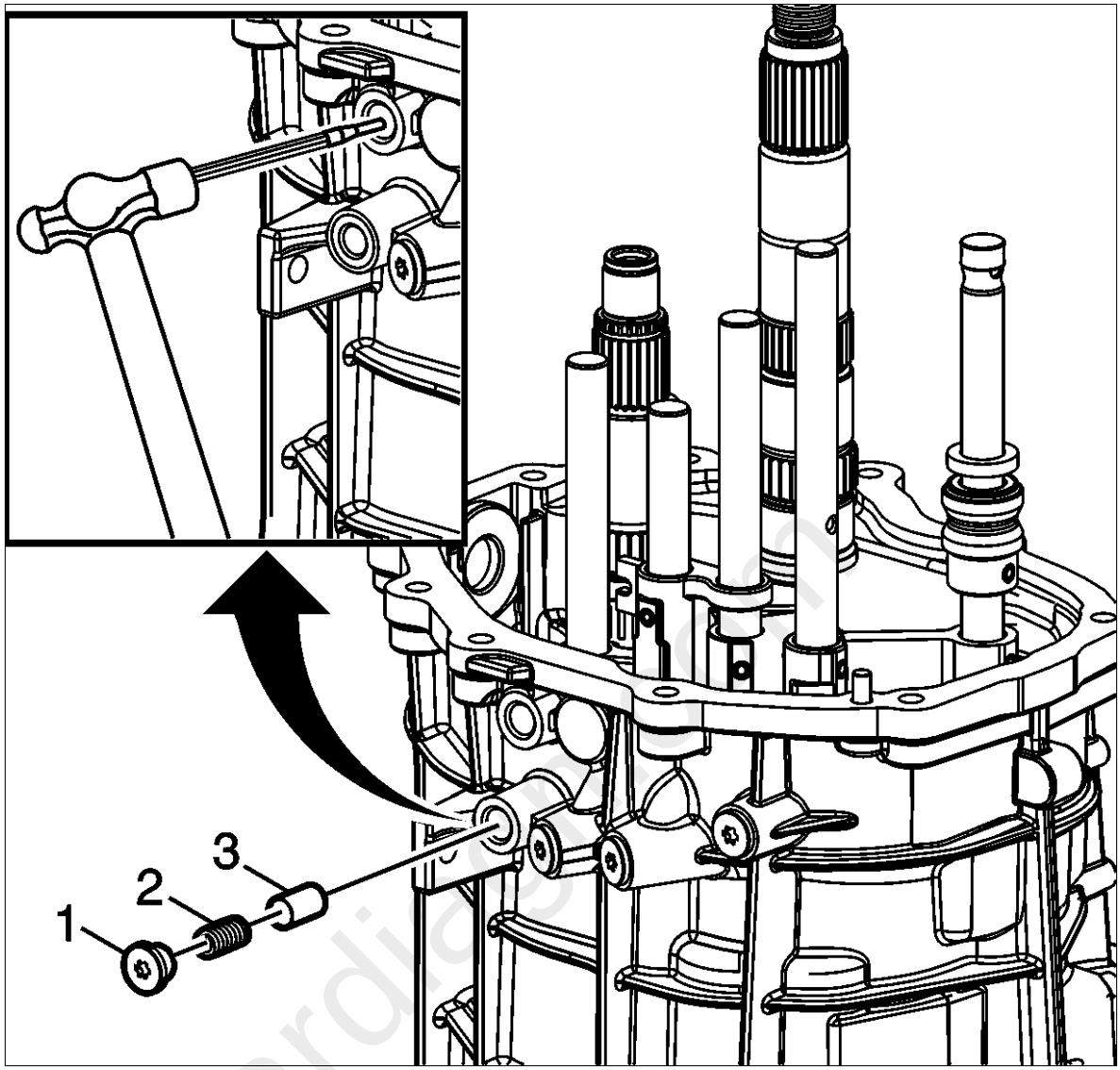
Fig 11: Shift Shaft Detent Plug



Courtesy of GENERAL MOTORS COMPANY

17. Remove the shift shaft detent plug (1). Then using a 3/16 in drift and hammer drive the coiled spring pin downward and remove.

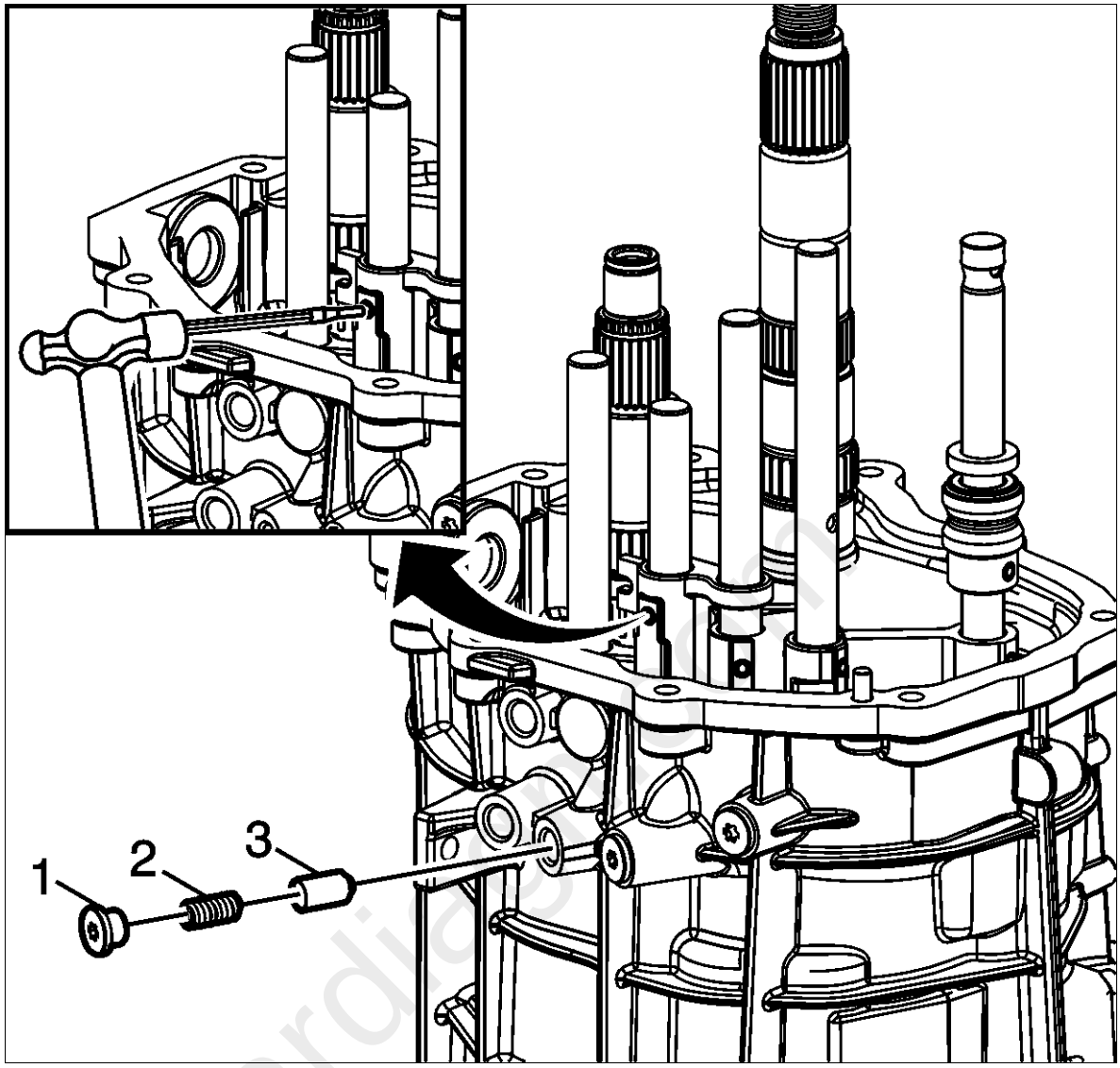
Fig 12: Shift Shaft Detent Spring And Detent



Courtesy of GENERAL MOTORS COMPANY

18. With the same drift still in the shift shaft, remove the shift shaft detent spring cover bolt (1), shift shaft detent spring (2), and shift shaft detent (3).

Fig 13: Coiled Spring Pin

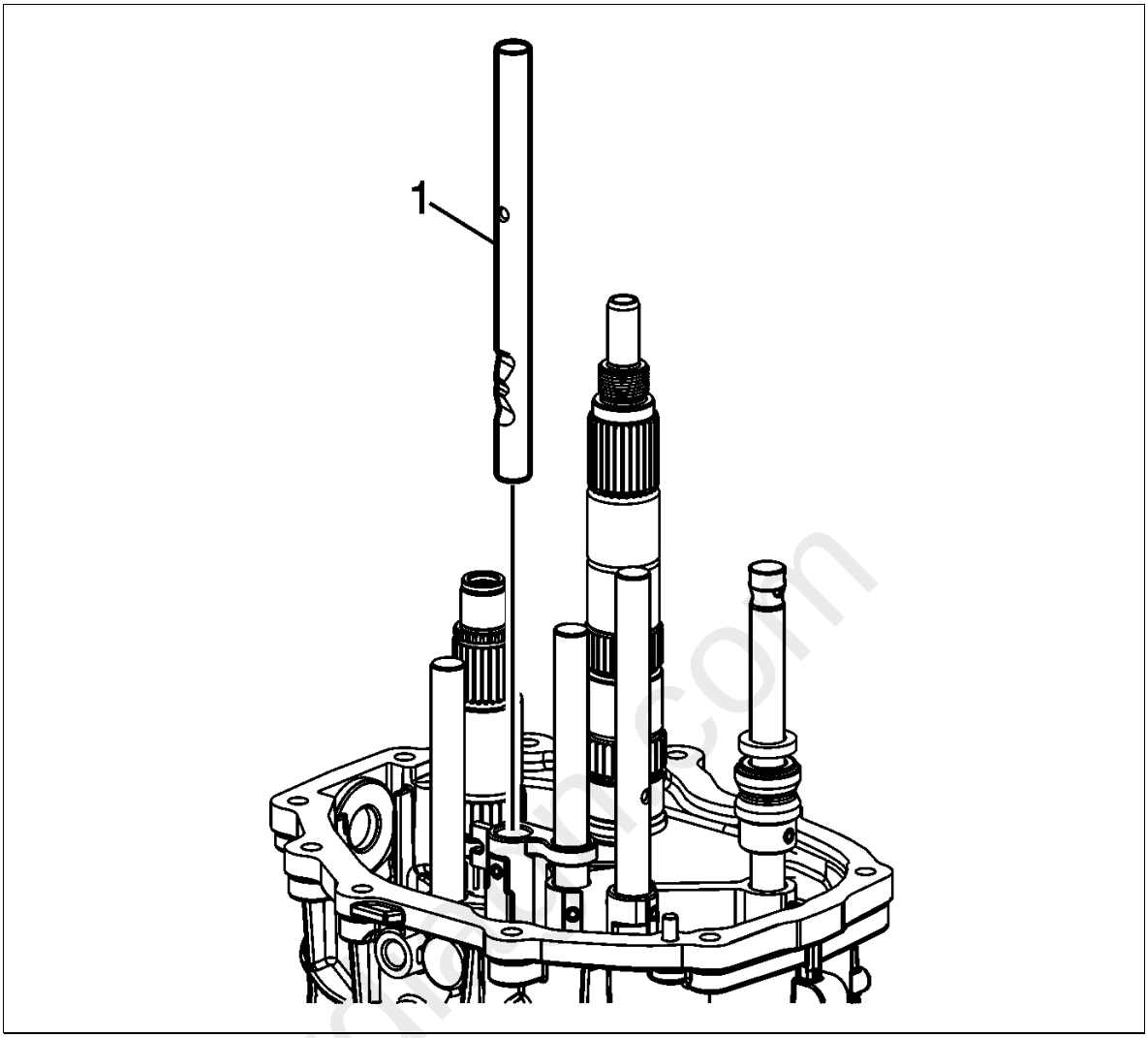


Courtesy of GENERAL MOTORS COMPANY

19. Using a 3/16 in punch drive the coiled spring pin downward and remove.

20. With the drift still in the shift shaft, remove the shift shaft detent spring cover bolt (1), shift shaft detent spring (2), and shift shaft detent (3).

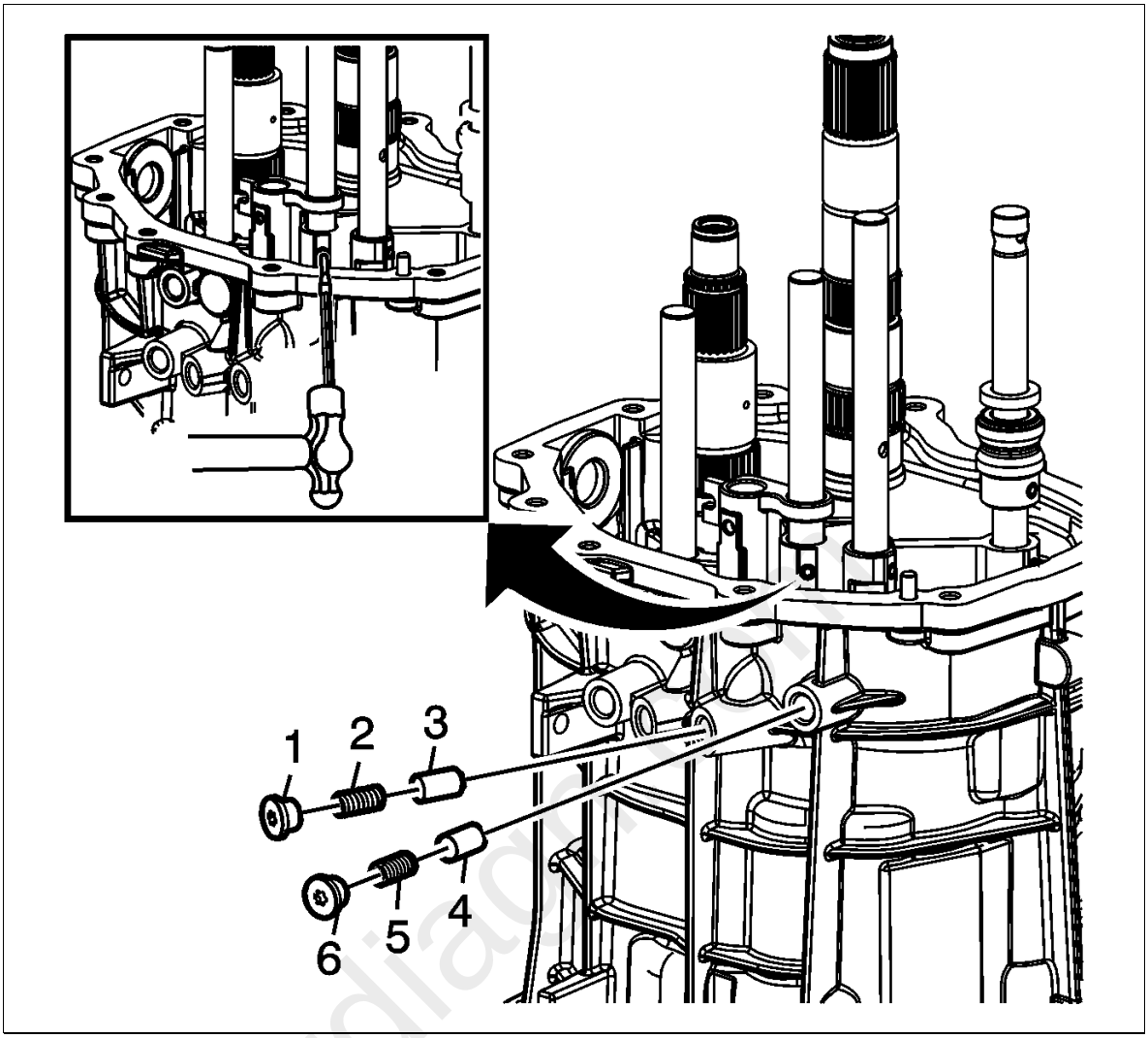
Fig 14: 3rd And 4th Shift Shaft



Courtesy of GENERAL MOTORS COMPANY

21. Remove the 3rd & 4th shift shaft (1).

Fig 15: Shift Shaft, Detent And Spring

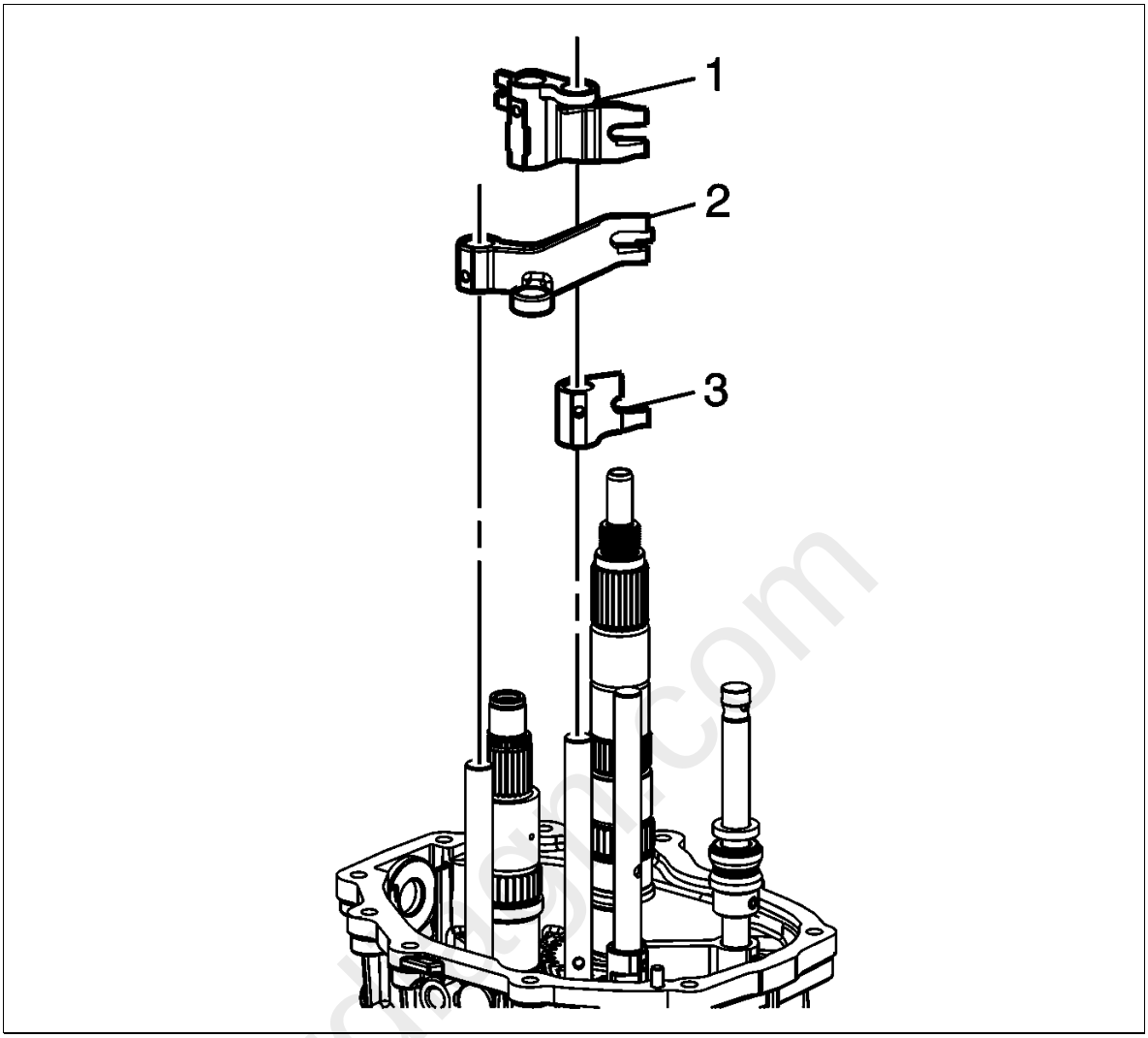


Courtesy of GENERAL MOTORS COMPANY

22. Remove the shift shaft detent spring cover bolt (1 and 6), shift shaft detent springs (2 and 5) and shift shaft detents (3 and 4).

23. Using a 3/16 in punch drive the coiled spring pin downward and remove.

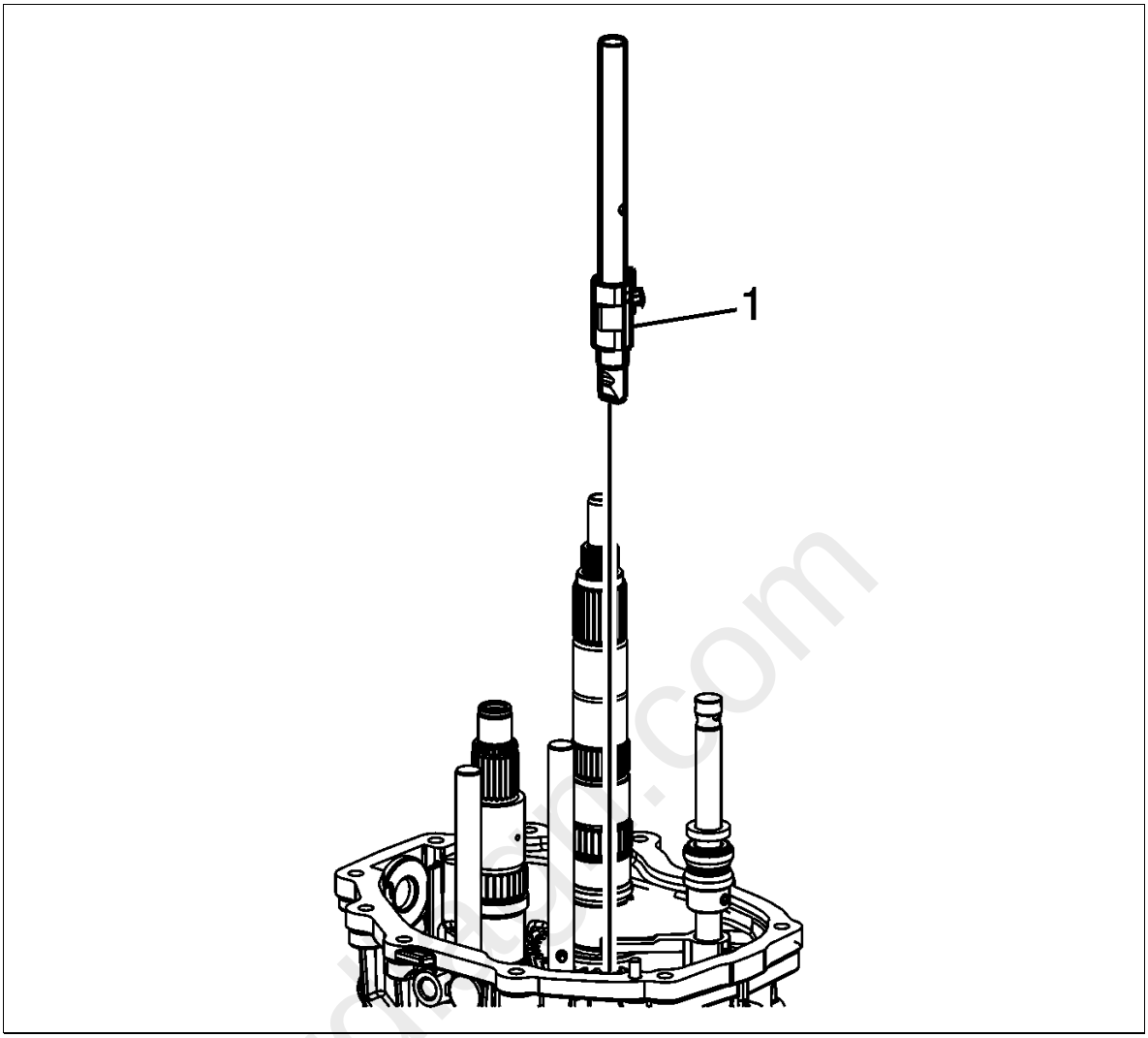
Fig 16: Selector Levers



Courtesy of GENERAL MOTORS COMPANY

24. Remove the manual transmission 3rd & 4th selector lever (1), manual transmission 5th & 6th selector lever (2), and the manual transmission 1st & 2nd selector lever (3).

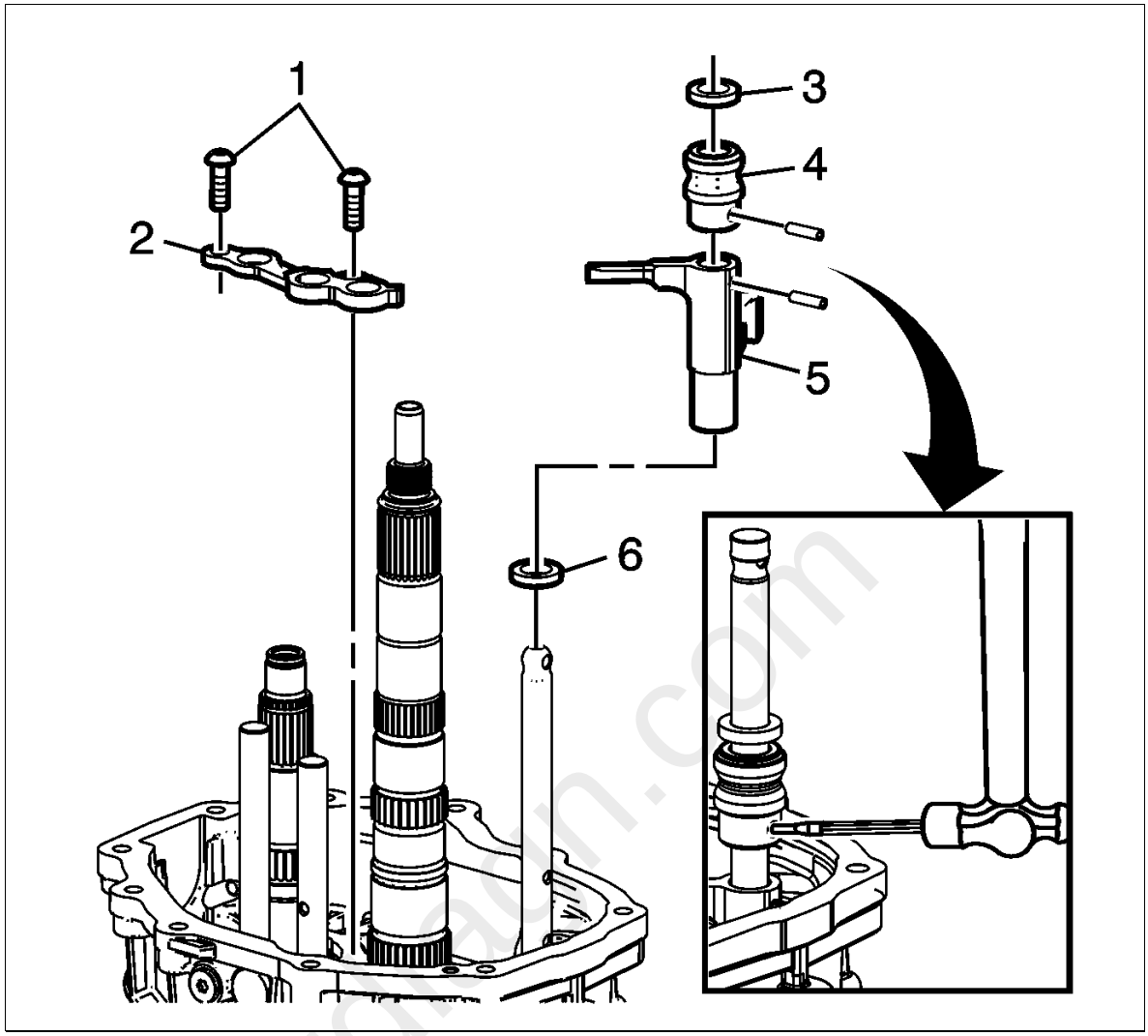
Fig 17: Reverse Shift Shaft Assembly And Manual Transmission Reverse Selector Lever



Courtesy of GENERAL MOTORS COMPANY

25. Remove the reverse shift shaft assembly and manual transmission reverse selector lever (1) as an assembly.

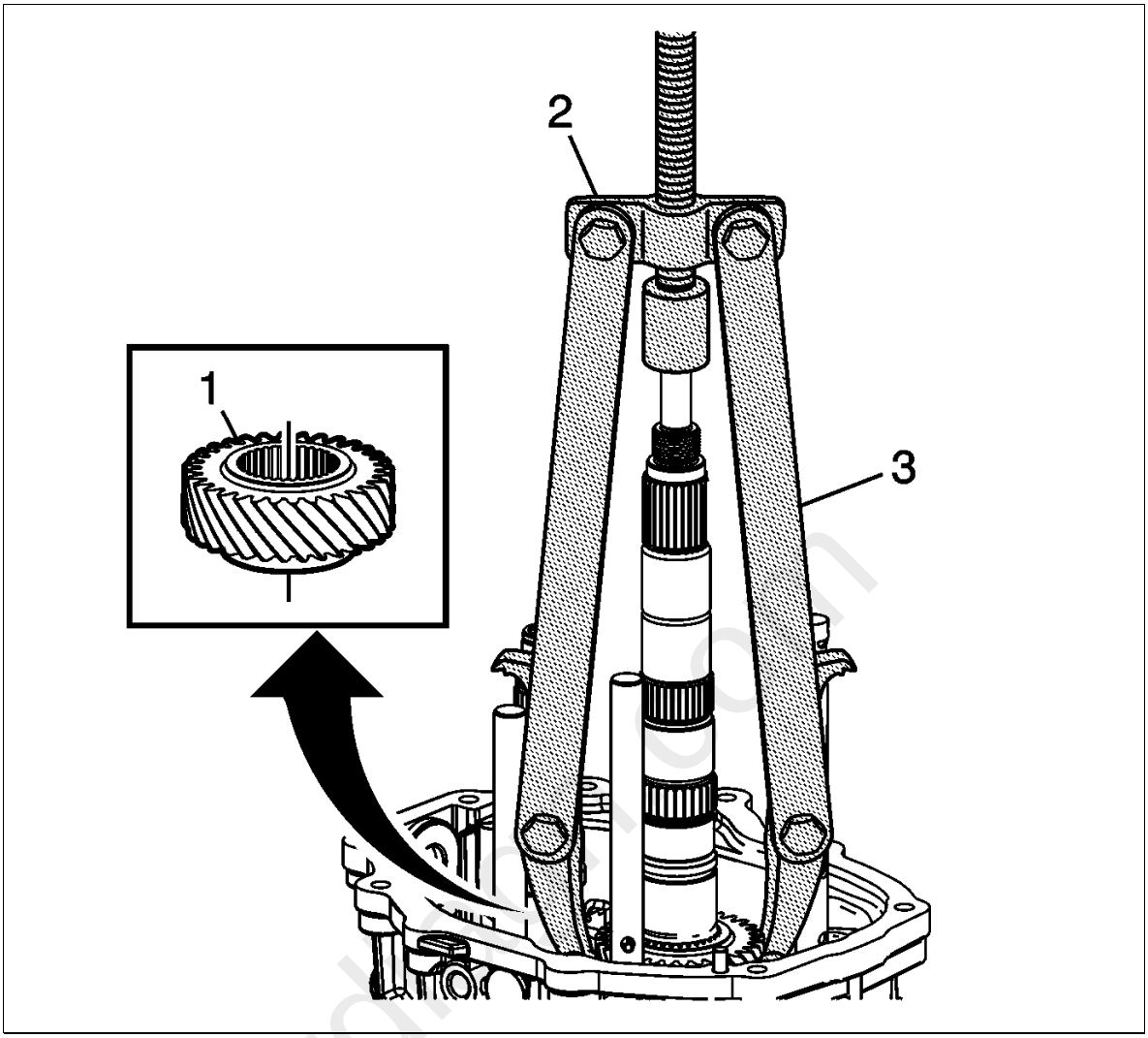
Fig 18: Shift Control Spacer



Courtesy of GENERAL MOTORS COMPANY

26. Using a drift punch and hammer drive the roll pins downward and remove.
27. Remove the shift interlock plate retainer bolts (1), shift control spacer (3), and neutral cam (4).
28. Remove the shift bar support (interlock) (2) and selector finger and cam (5) at the same time.
29. Remove the second shift control spacer (6)

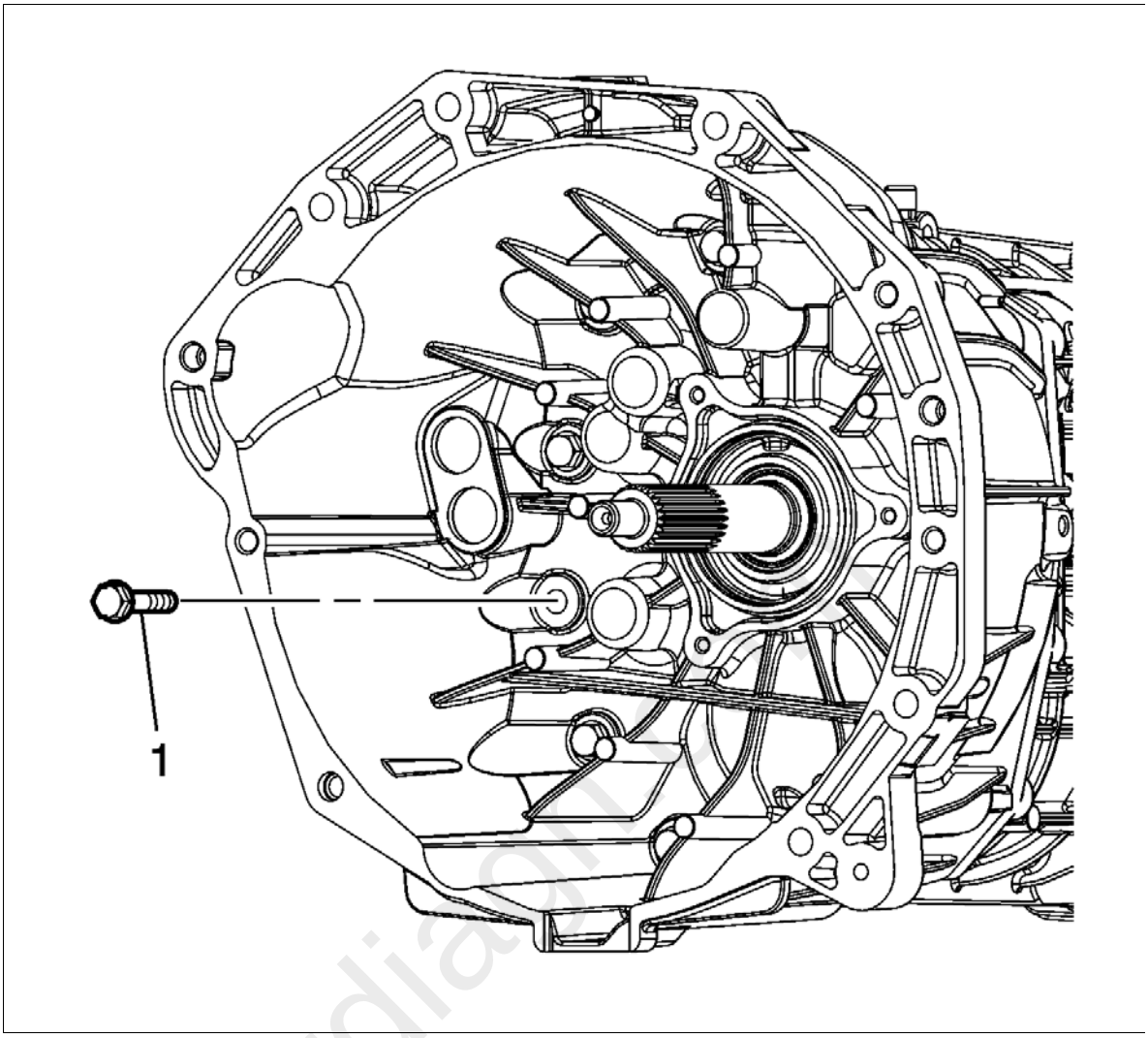
Fig 19: 4th Gear Assembly & Special Tools



Courtesy of GENERAL MOTORS COMPANY

30. Remove the 4th gear assembly (1) using **J 22888-D** side bearing remover (2) with **DT 51075** puller adapter set (3).

Fig 20: Clutch Housing Bolts

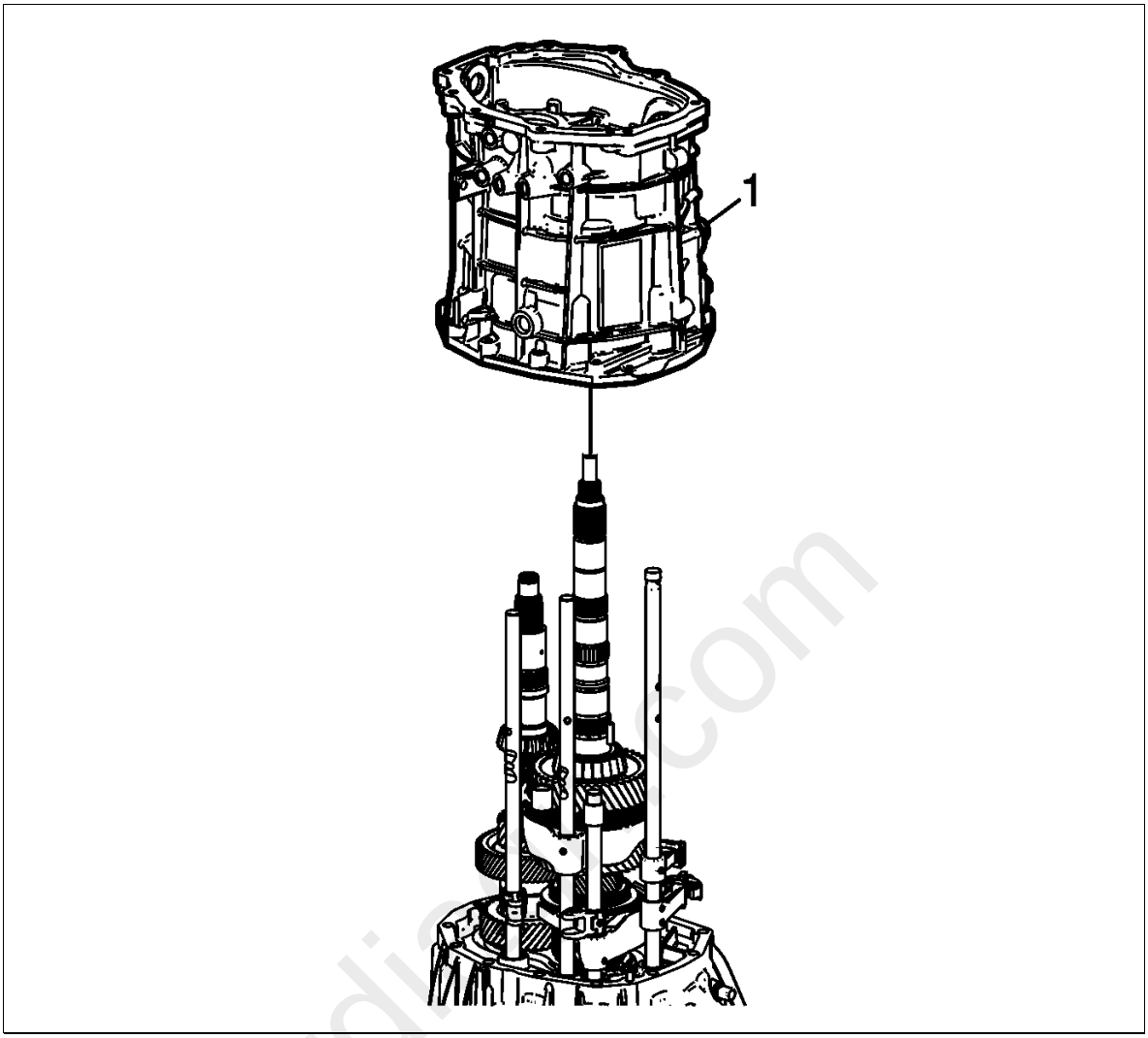


Courtesy of GENERAL MOTORS COMPANY

31. Remove the clutch housing bolts (1).

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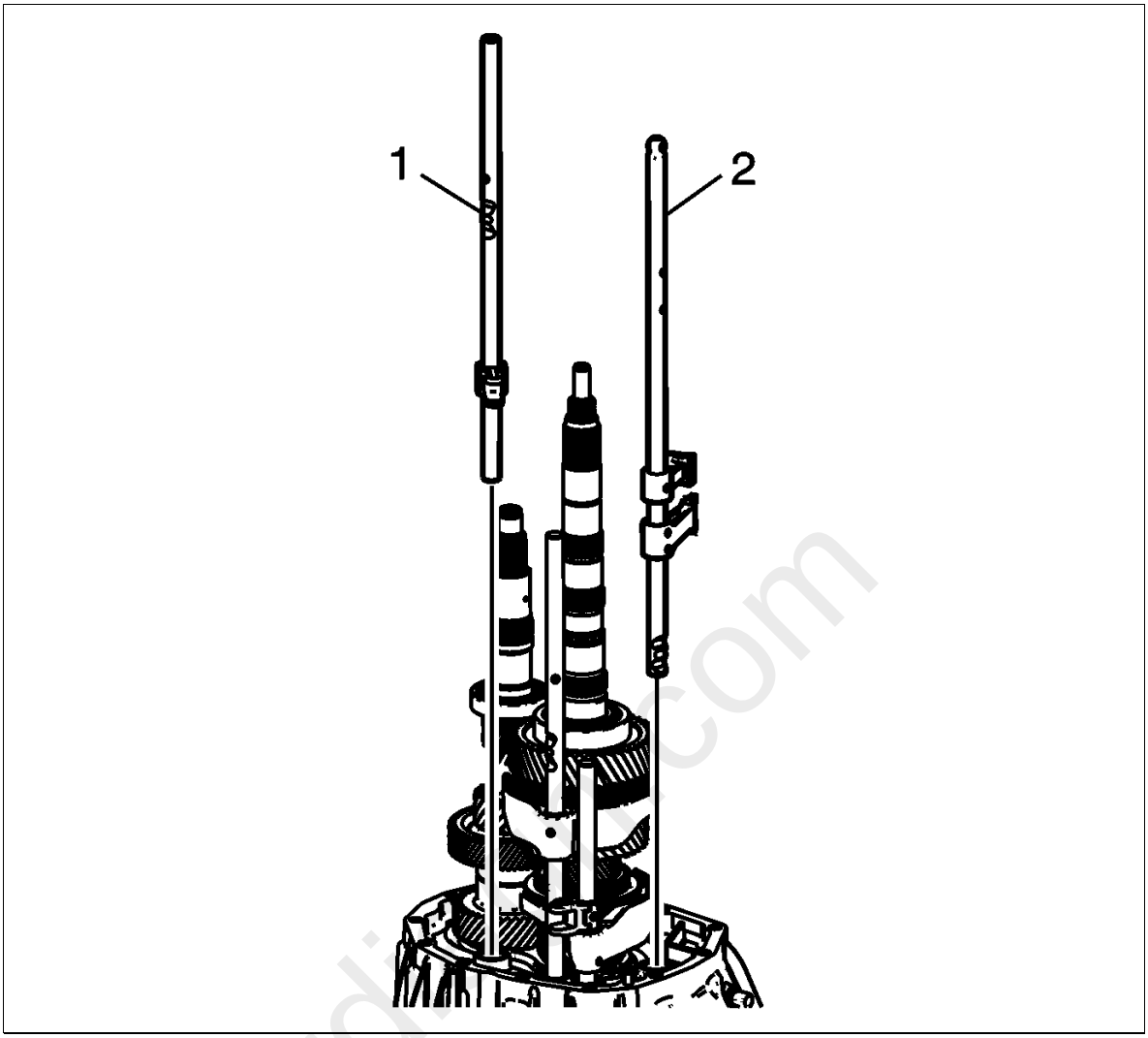
Fig 21: Transmission Case Assembly



Courtesy of GENERAL MOTORS COMPANY

32. Remove the transmission case assembly (1).

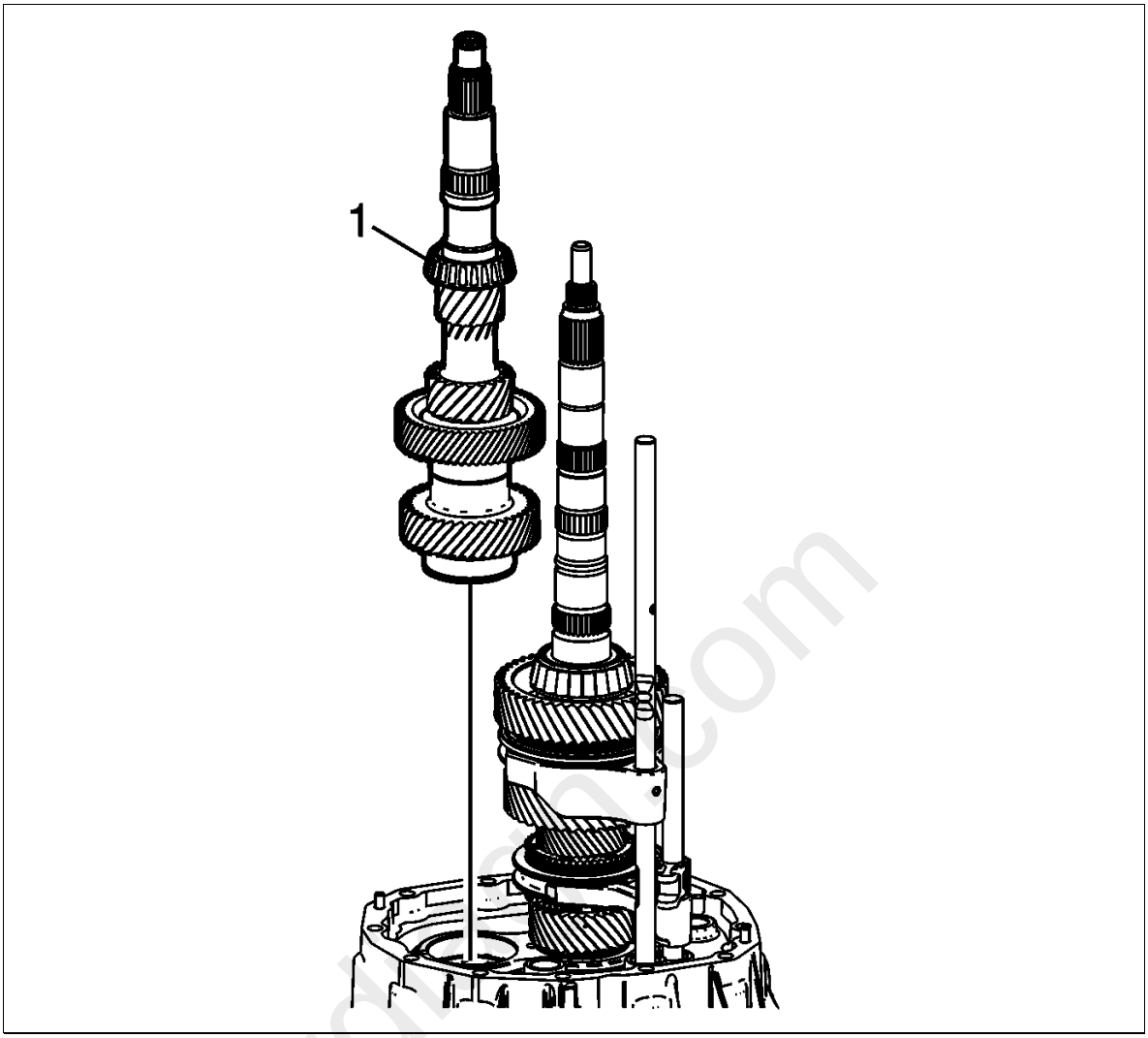
Fig 22: Shift Shaft Assemblies



Courtesy of GENERAL MOTORS COMPANY

33. Remove the Shift Shaft Assemblies (1 & 2).

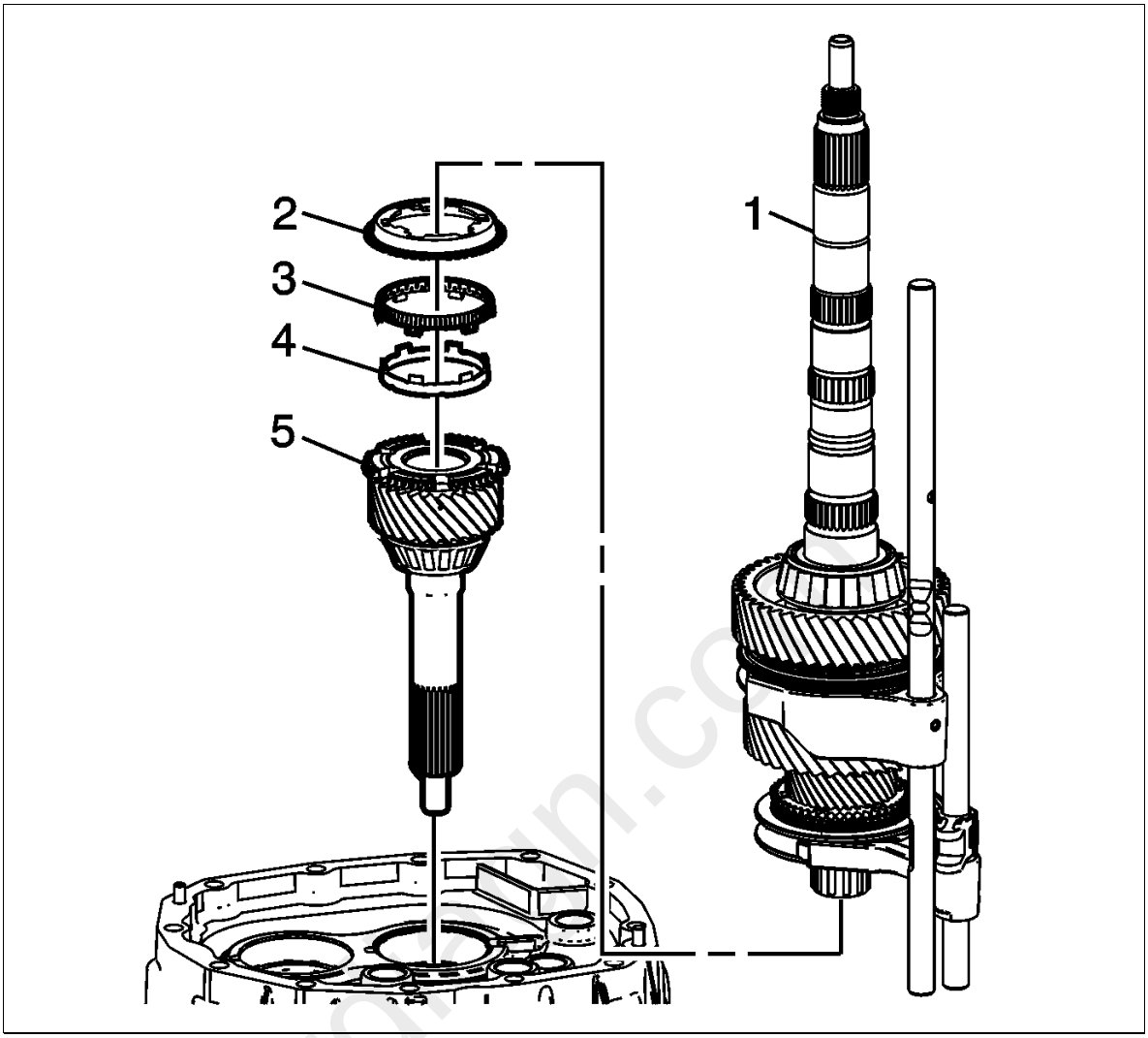
Fig 23: Counter Gear Assembly



Courtesy of GENERAL MOTORS COMPANY

34. Remove the counter gear assembly (1).

Fig 24: Input Shaft Assembly & Related Components

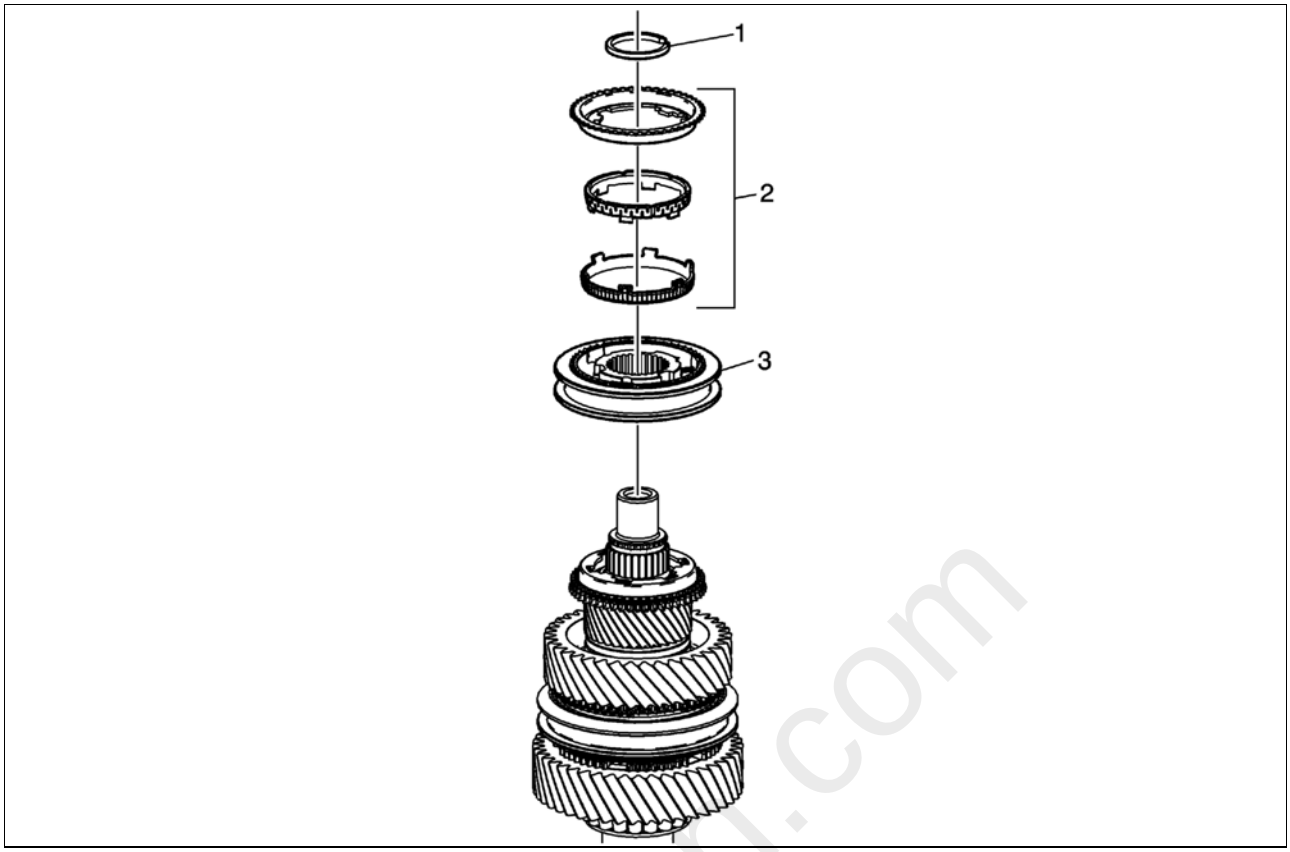


Courtesy of GENERAL MOTORS COMPANY

35. Remove the main shaft, shift rails, and shift forks as an assembly (1).
36. Remove the blocking ring (2), intermediate cone (3), and inner cone (4).
37. Remove the input shaft assembly (5).

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT DISASSEMBLE (M13) > 5TH & 6TH SYNCHRONIZER REMOVAL

Fig 1: 5th & 6th Synchronizer Assembly



Courtesy of GENERAL MOTORS COMPANY

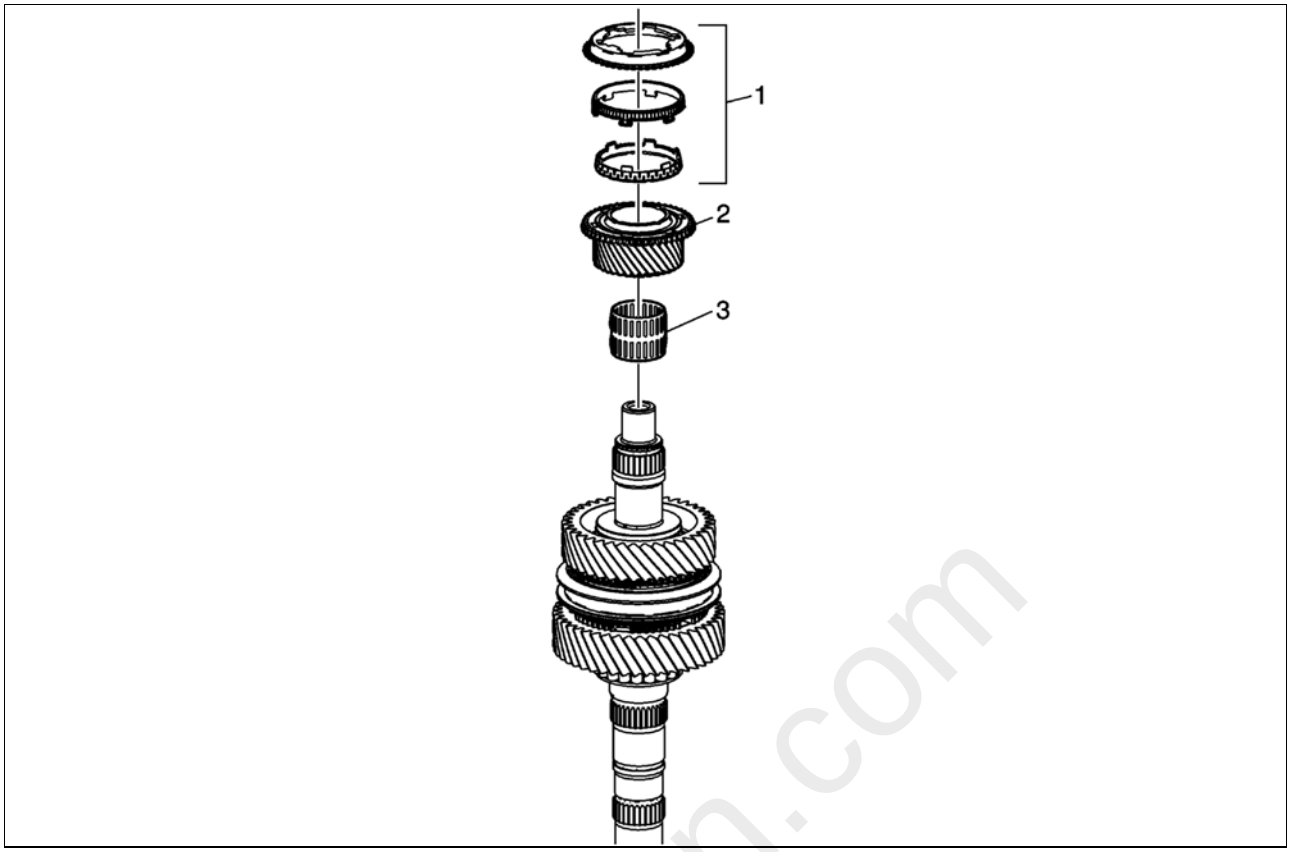
5th & 6th Synchronizer Removal

Callout	Component Name
1	Main Shaft Retaining Ring
2	5th Gear Blocking Ring Assembly
3	5th & 6th Gear Synchronizer Assembly

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT DISASSEMBLE (M13) > 6TH SPEED GEAR REMOVAL

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Fig 1: 6th Speed Gear Components



Courtesy of GENERAL MOTORS COMPANY

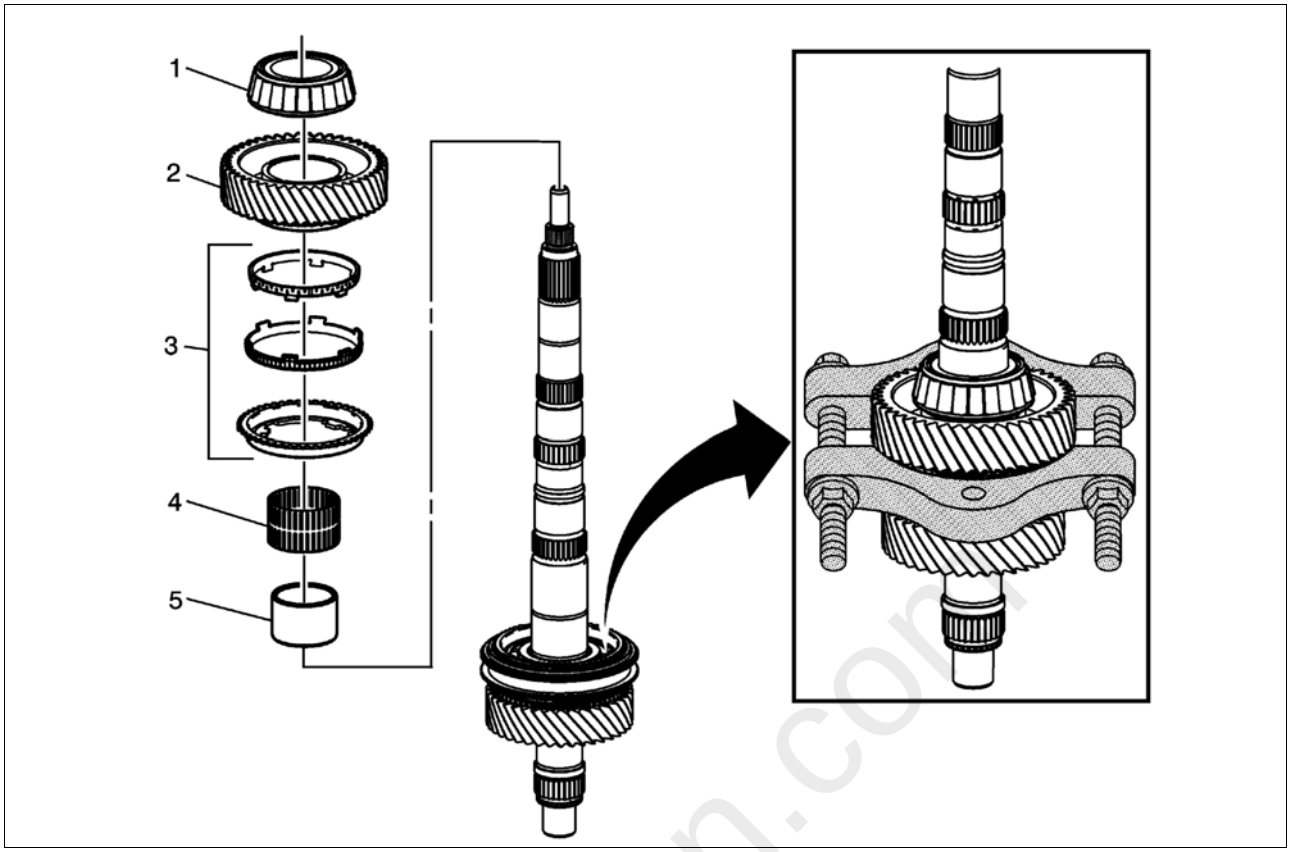
6th Speed Gear Removal

Callout	Component Name
1	6th Gear Blocking Ring Assembly
2	6th Gear Assembly (Driven)
3	6th Gear Bearing Assembly (Driven)

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT DISASSEMBLE (M13) > 1ST GEAR REMOVAL

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Fig 1: 1st Gear Components



Courtesy of GENERAL MOTORS COMPANY

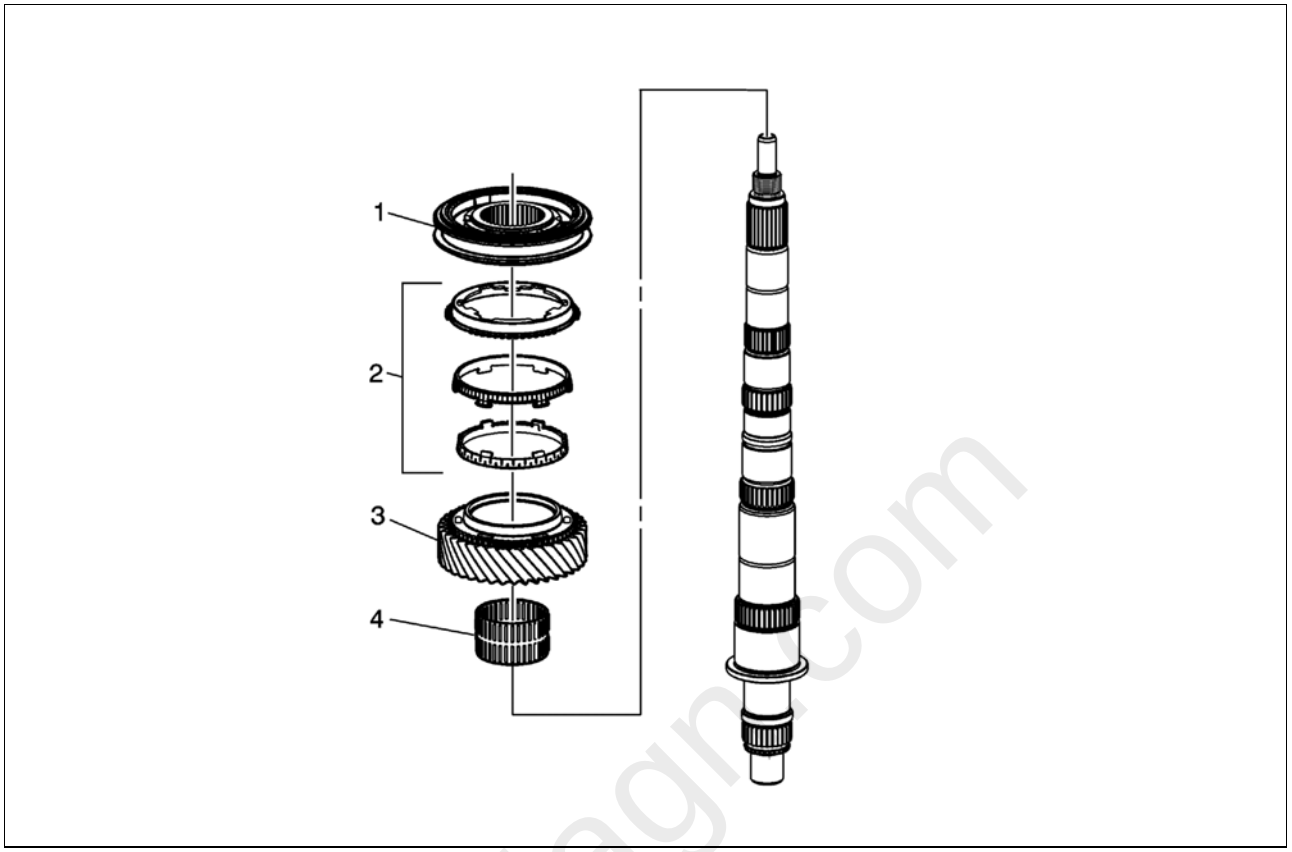
1st Gear Removal

Callout	Component Name
1	Main Shaft Rear Bearing Assembly
2	1st Gear Assembly (Driven) Procedure 1. Remove the 1st gear and main shaft rear bearing, using the **DT 36513** gear and bearing separator plate, and a hydraulic press **Special Tools** **DT 36513** Gear and Bearing Separator Plate For equivalent regional tools, refer to Special Tools (MM6) Special Tools (M13) .
3	1st Gear Blocking Ring Assembly
4	1st Gear Bearing Assembly (Driven)
5	1st Gear Bushing

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REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT DISASSEMBLE (M13) > 2ND GEAR REMOVAL

Fig 1: 2nd Gear Components



Courtesy of GENERAL MOTORS COMPANY

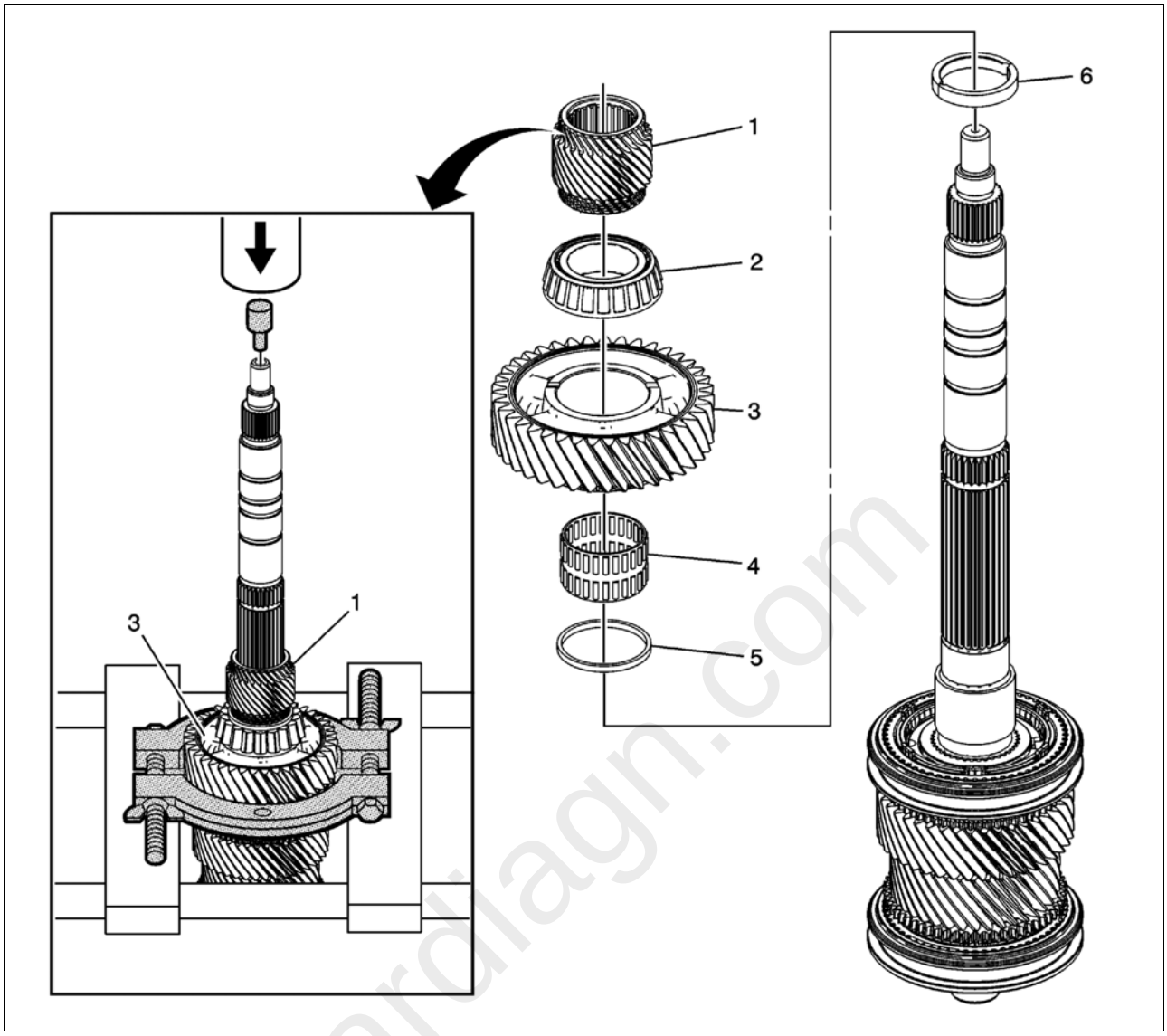
2nd Gear Removal

Callout	Component Name
1	1st & 2nd Gear Synchronizer Assembly
2	2nd Gear Blocking Ring Assembly
4	2nd Gear Assembly (Driven)
5	2nd Gear Bearing Assembly (Driven)

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT DISASSEMBLE (MM6) > 6TH SPEED DRIVEN AND 1ST SPEED DRIVE GEAR REMOVAL

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Fig 1: 6th Speed Driven and 1st Speed Drive Gear Components



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6th Speed Driven and 1st Speed Drive Gear Removal

Callout	Component Name

NOTE:

Measure the 4th speed gear synchronizer wear gap before disassembling the main shaft.

Preliminary Procedure

1. Install the input shaft in the clutch housing.

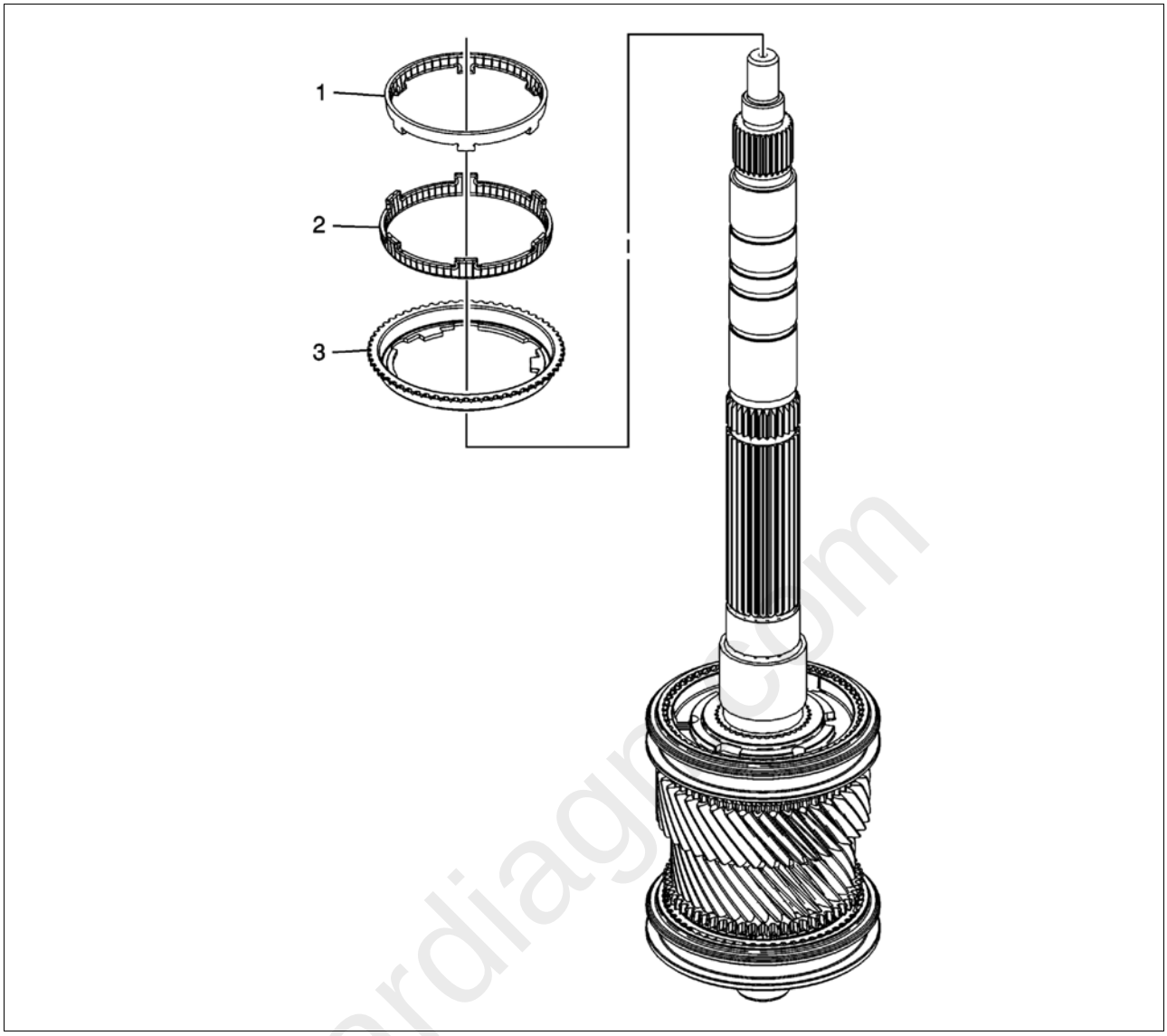
2. Install the main shaft on the input shaft.
3. Using a feeler gauge, measure the gap between the 4th speed gear blocking ring and the 4th speed gear.
4. Replace the 4th speed gear friction cone and blocking ring when the gap is less than 1.27 mm (0.050 in).

1	6th Speed Driven Gear
2	Main Shaft Bearing
3	1st Speed Drive Gear *CAUTION:* *Do not overtighten the J 36513 split plate past the gear teeth or damage to gear may occur.* Special Tools • **J-36513** Split Plate • **J-39442** Press Adapter For equivalent regional tools, refer to Special Tools (MM6) .
4	1st Speed Drive Gear Needle Bearing
5	1st Speed Drive Gear Locking Ring
6	1st Speed Drive Gear Two Piece Washer

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REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT DISASSEMBLE (MM6) > 1ST SPEED DRIVE GEAR BLOCKING RING ASSEMBLY REMOVAL

Fig 1: 1st Speed Drive Gear Blocking Ring Assembly Components



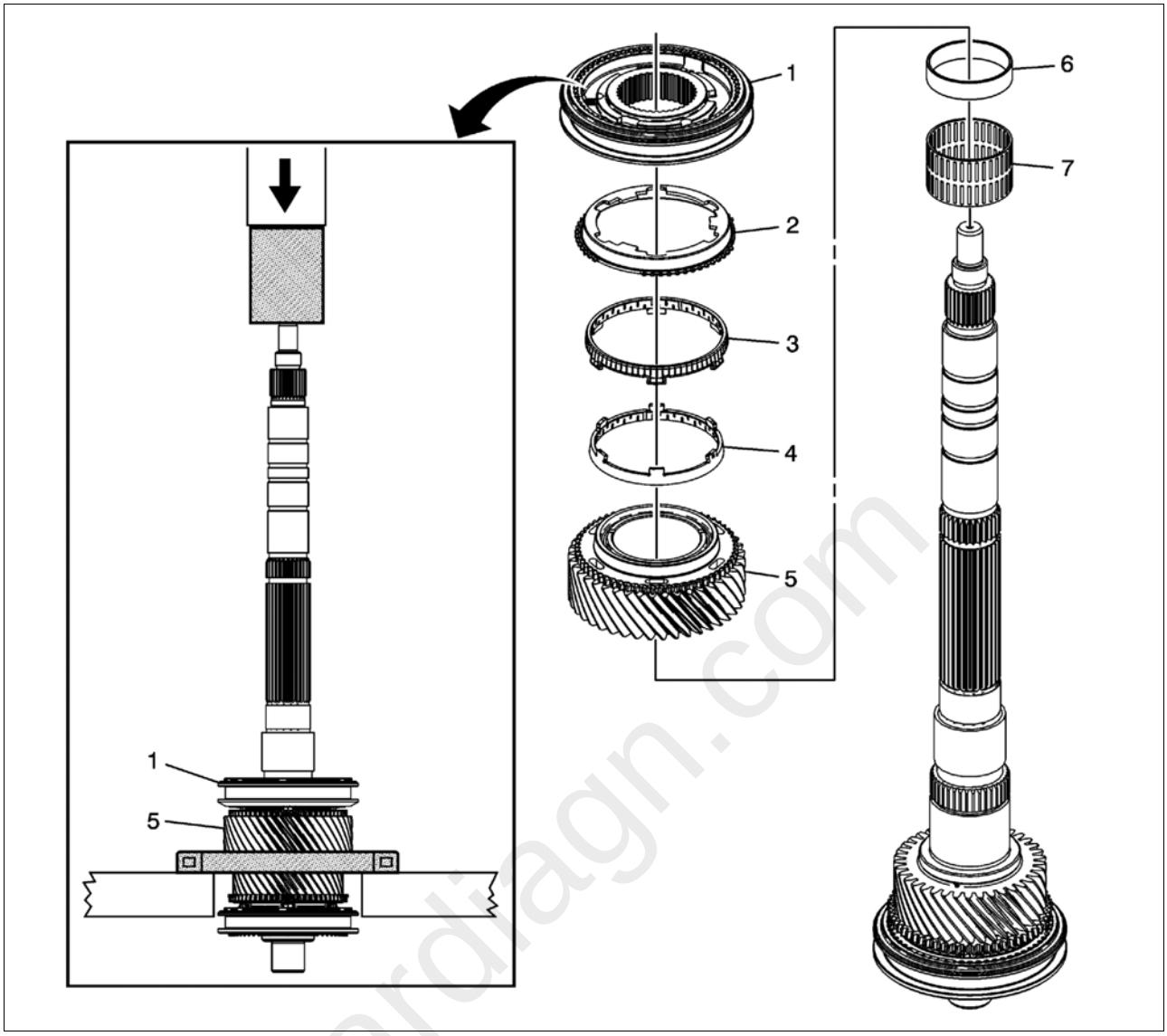
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1st Speed Drive Gear Blocking Ring Assembly Removal

Callout	Component Name
1	1st Speed Drive Gear Inner Cone
2	1st Speed Drive Gear Friction Cone
3	1st Speed Drive Gear Synchronizer Blocking Ring

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT DISASSEMBLE (MM6) > 2ND SPEED DRIVE GEAR REMOVAL

Fig 1: 2nd Speed Drive Gear Components



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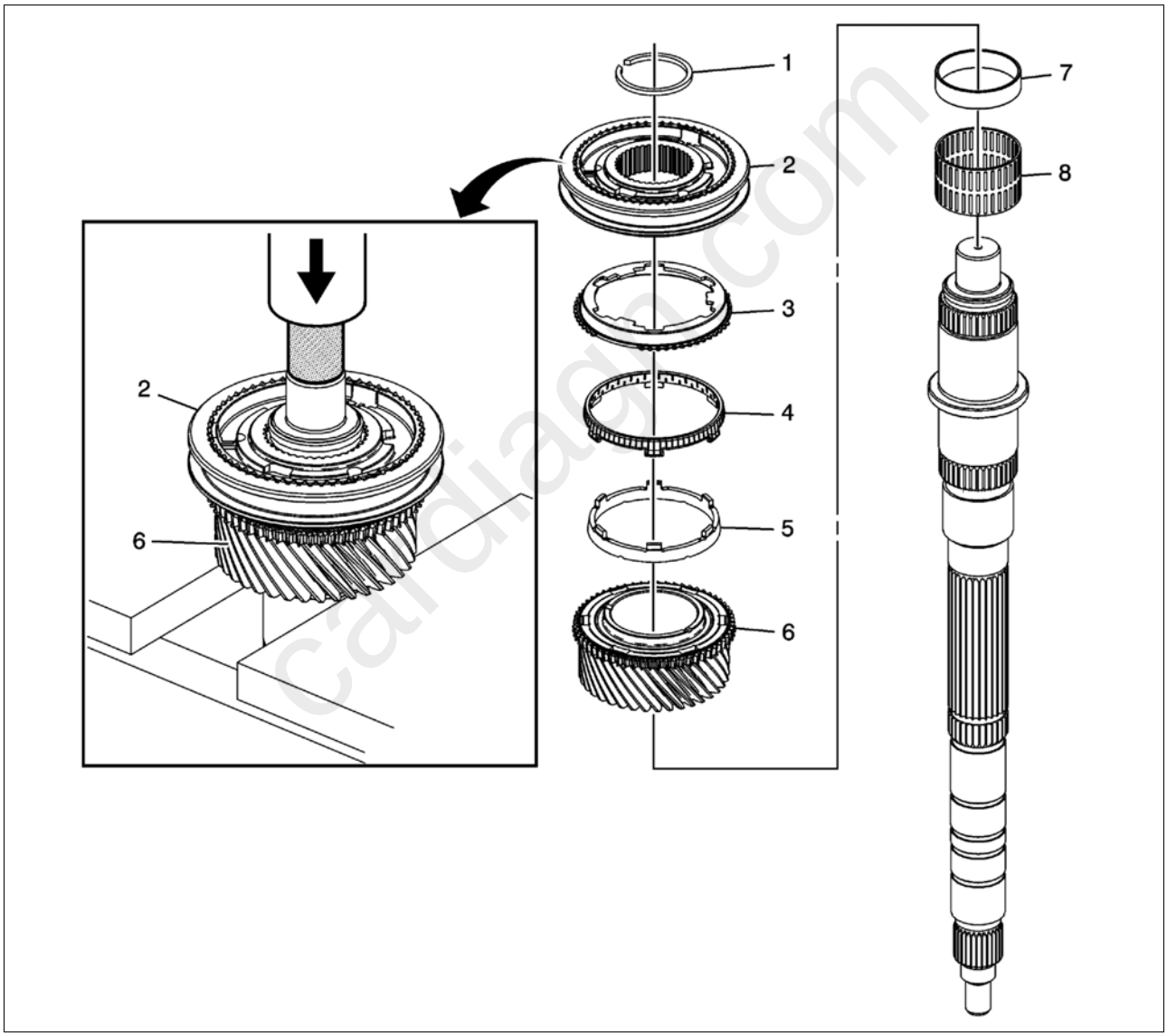
2nd Speed Drive Gear Removal

Callout	Component Name
1	1st/2nd Synchronizer Assembly
2	2nd Speed Drive Gear Synchronizer Blocking Ring
3	2nd Speed Drive Gear Friction Cone
4	2nd Speed Drive Gear Inner Cone
5	2nd Speed Drive Gear Special Tools • **J-36513** Split Plate

	• **J-39442** Press Adapter For equivalent regional tools, refer to Special Tools (MM6) .
6	2nd Speed Drive Gear Bearing Spacer
7	2nd Speed Drive Gear Needle Bearing

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT DISASSEMBLE (MM6) > 3RD SPEED DRIVE GEAR REMOVAL

Fig 1: 3rd Speed Drive Gear Components



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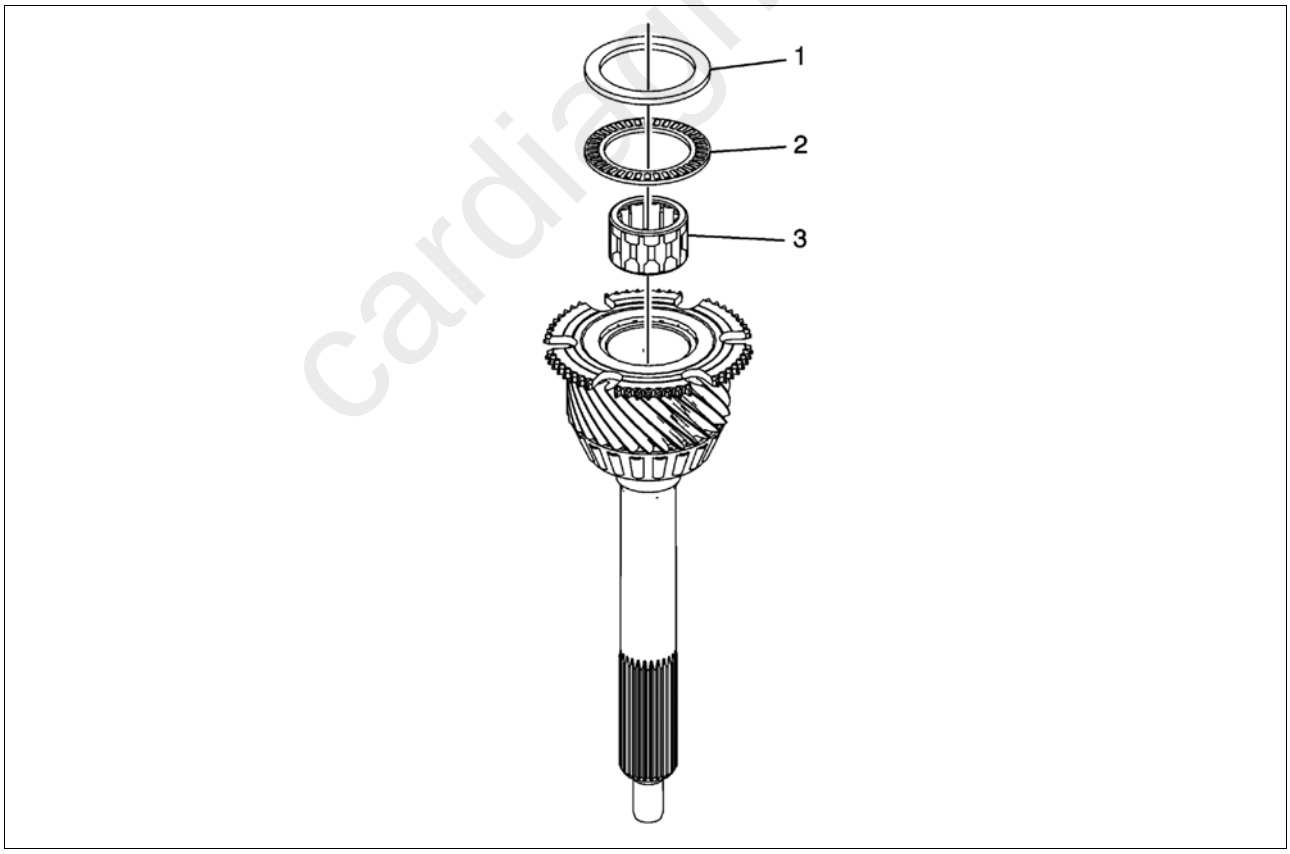
Courtesy of GENERAL MOTORS COMPANY

3rd Speed Drive Gear Removal

Callout	Component Name
1	3rd/4th Synchronizer Retaining Ring
2	3rd/4th Synchronizer Assembly
3	3rd Speed Drive Gear Synchronizer Blocking Ring
4	3rd Speed Drive Gear Friction Cone
5	3rd Speed Drive Gear Inner Cone
6	3rd Speed Drive Gear **Special Tools** **J-39473** Main Shaft Bearing Installer For equivalent regional tools, refer to Special Tools (MM6) .
7	3rd Speed Drive Gear Bearing Spacer
8	3rd Speed Drive Gear Needle Bearing

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT DISASSEMBLE (MM6) > INPUT SHAFT POCKET BEARING REMOVAL

Fig 1: Input Shaft Pocket Bearing Components



Courtesy of GENERAL MOTORS COMPANY

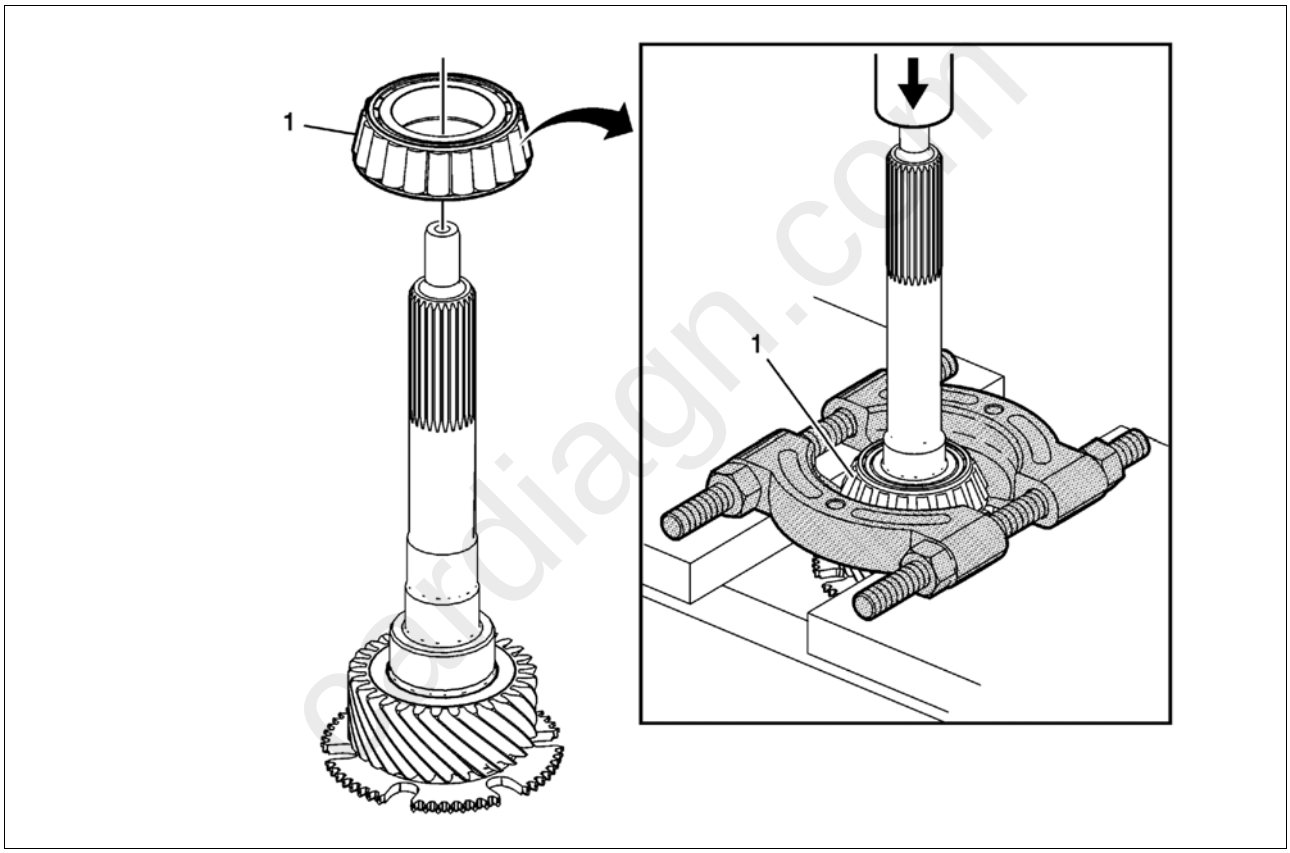
Input Shaft Pocket Bearing Removal

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Callout	Component Name
1	Input Shaft Thrust Washer
2	Input Shaft Thrust Bearing
3	Input Shaft Bearing

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT DISASSEMBLE (MM6) > INPUT SHAFT BEARING REMOVAL

Fig 1: Input Shaft Bearing



Courtesy of GENERAL MOTORS COMPANY

Input Shaft Bearing Removal

Callout	Component Name
1	Input Shaft Bearing *NOTE:*

DO NOT replace the tapered bearing unless inspection shows that the bearing is damaged.

Special Tools
J-22912-B Rear Pinion and Axle Bearing Remover
For equivalent regional tools, refer to Special Tools (MM6) .

REPAIR INSTRUCTIONS - OFF VEHICLE > COUNTER GEAR SHAFT DISASSEMBLE (MM6)

Special Tools

- **J 22912-B** Rear Pinion and Axle Bearing Remover/Split Plate
- **J 39473** Mainshaft Bearing Installer
- **J 39547** Press Adapter

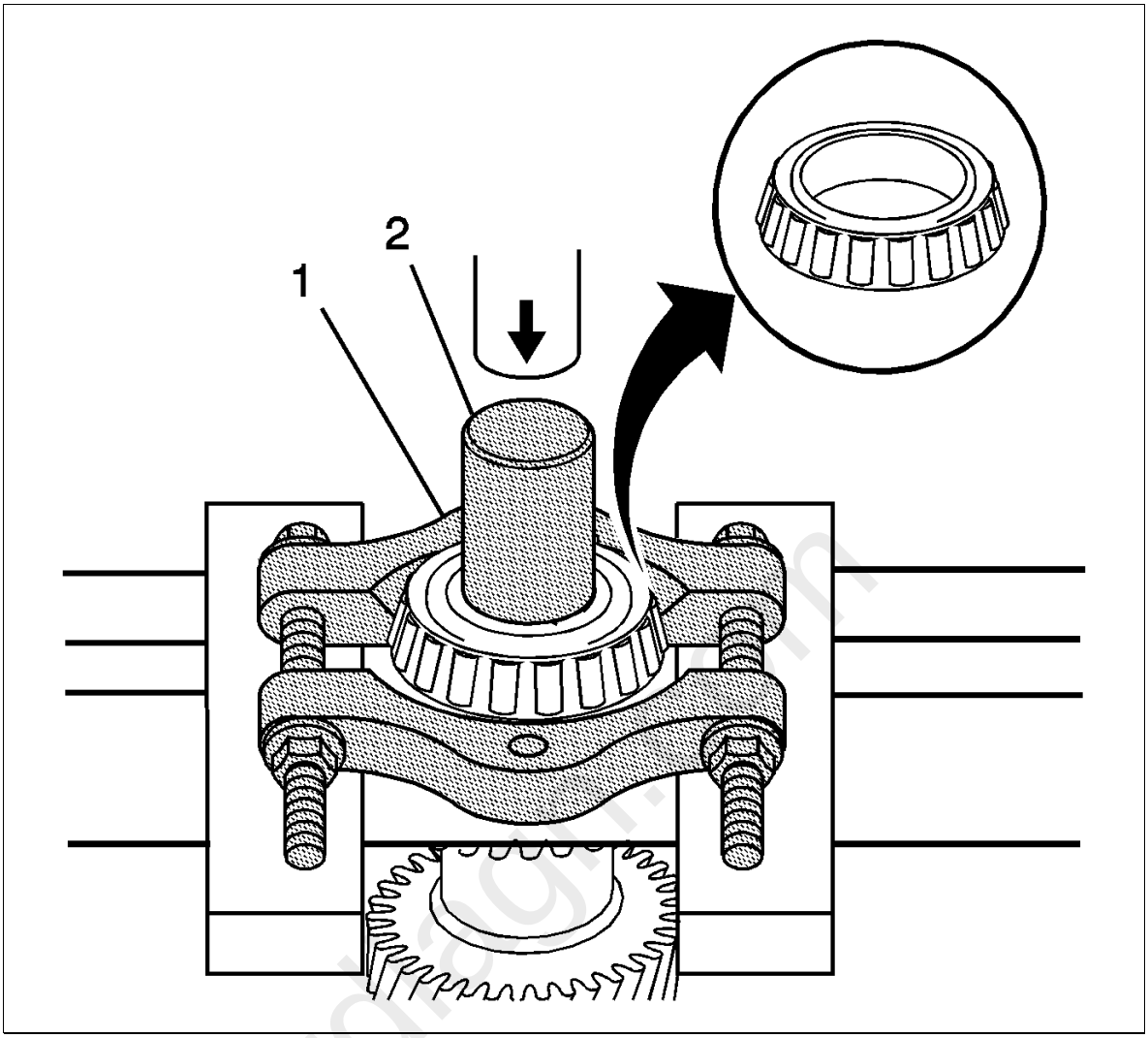
For equivalent regional tools, refer to Special Tools (MM6) .

NOTE:

Do not replace tapered bearings unless inspection shows bearing damage.

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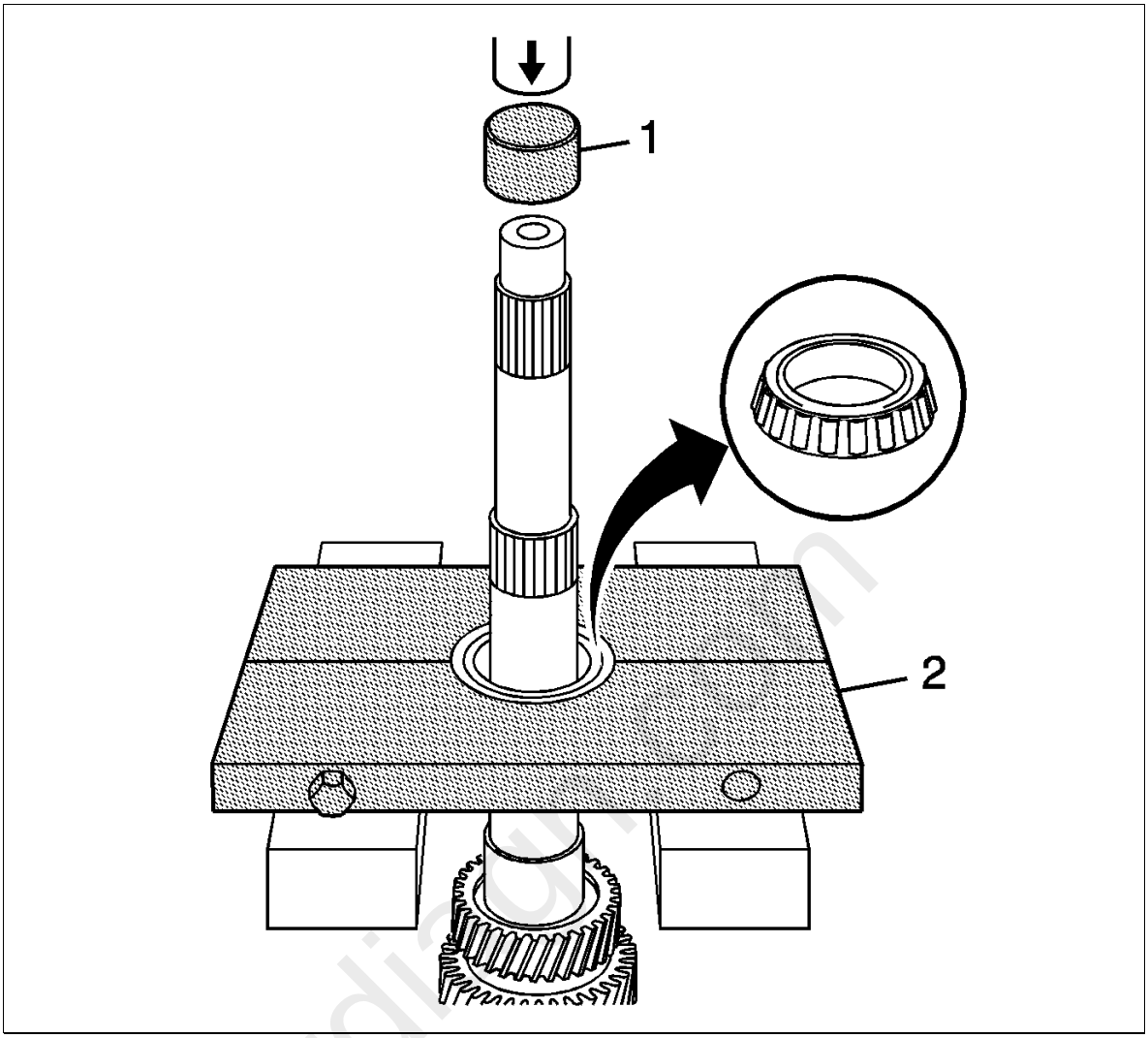
Fig 1: Special Tools



Courtesy of GENERAL MOTORS COMPANY

1. Remove the countershaft front bearing, using the **J 22912-B** remover (1) with the **J 39473** installer (2) and a hydraulic press.
2. Discard the countershaft front bearing.

Fig 2: Special Tools

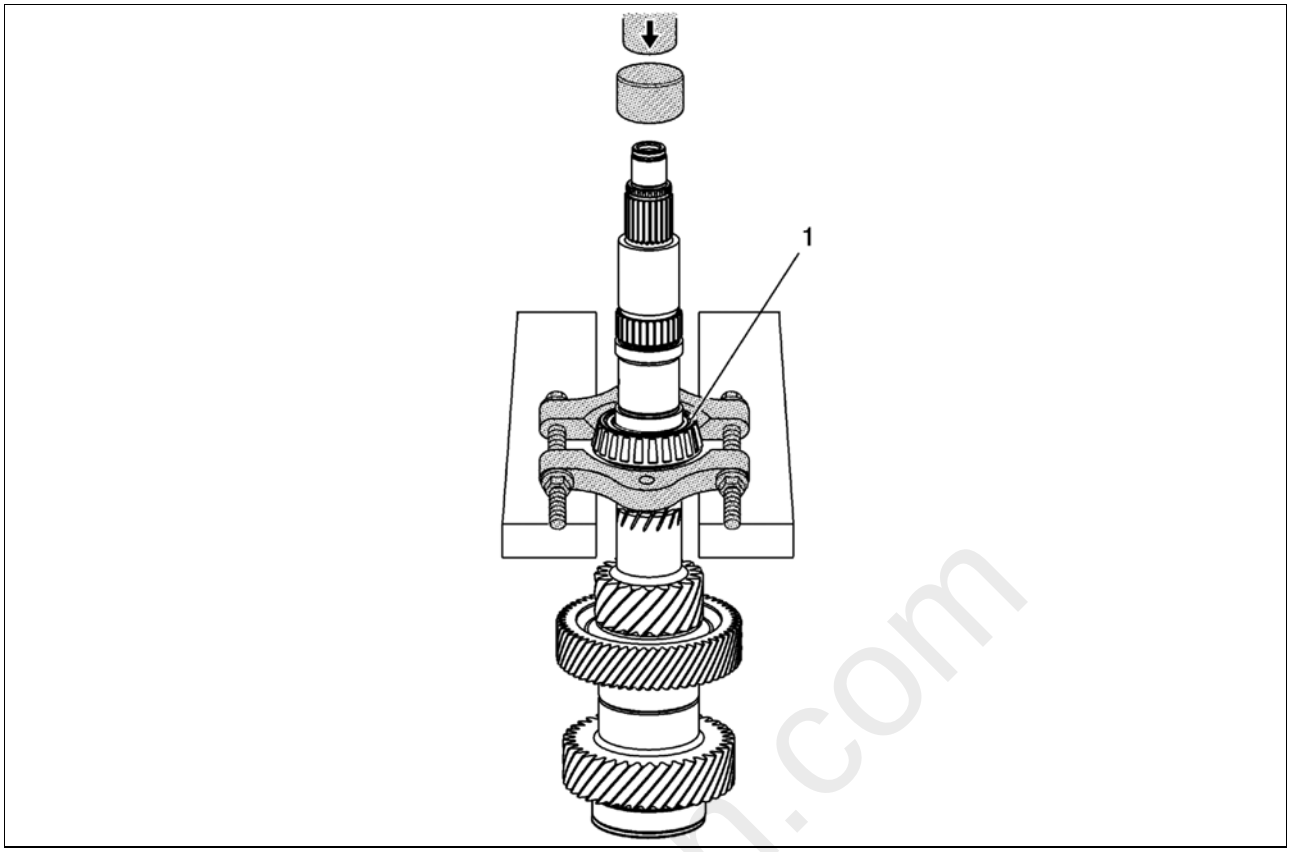


Courtesy of GENERAL MOTORS COMPANY

3. Remove the countershaft rear bearing, using the **J 22912-B** split plate (2), the **J 39547** adapter (1) and a hydraulic press.
4. Discard the countershaft rear bearing.

REPAIR INSTRUCTIONS - OFF VEHICLE > COUNTER GEAR SHAFT DISASSEMBLE (M13) > BEARING REMOVAL

Fig 1: Counter Gear Bearing Assembly



Courtesy of GENERAL MOTORS COMPANY

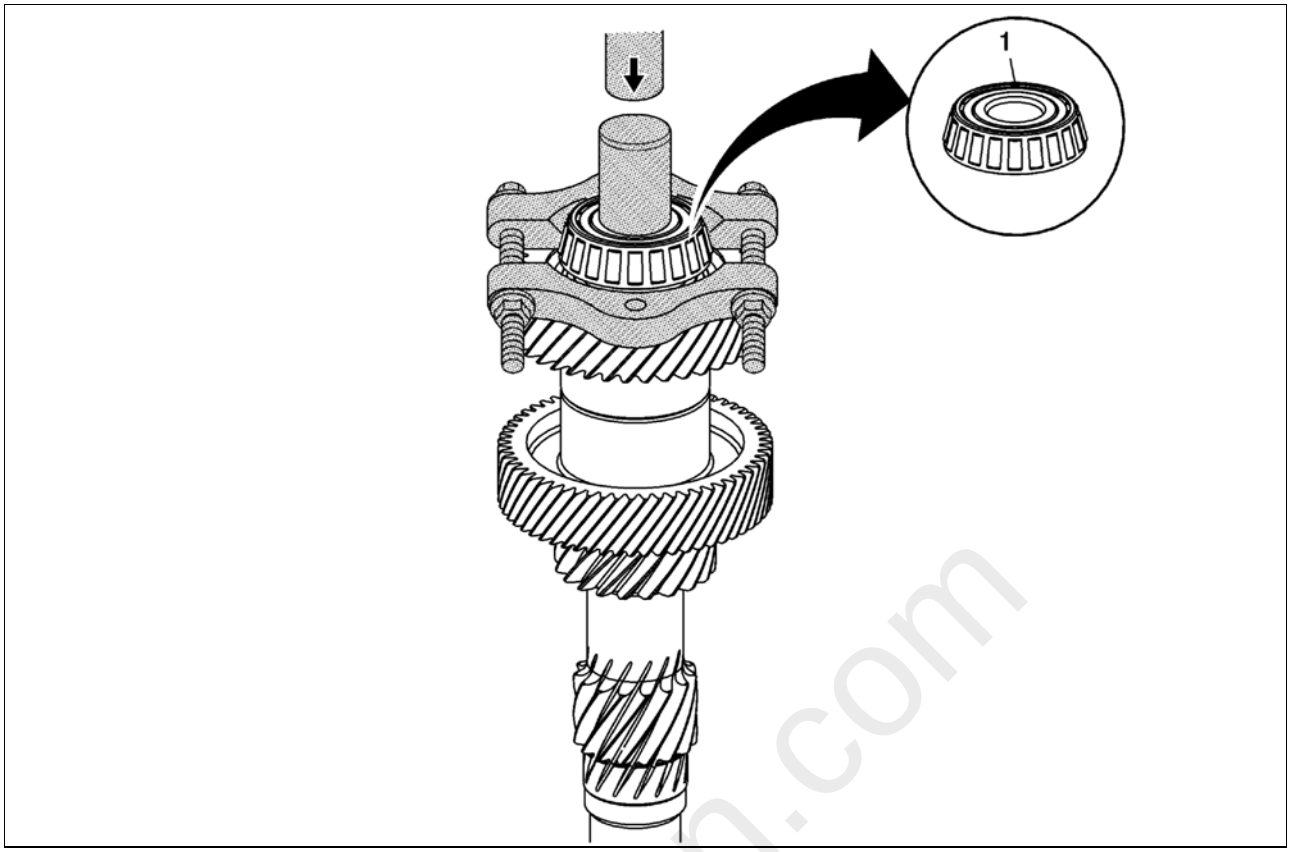
Bearing Removal

Callout	Component Name
1	Counter Gear Bearing Assembly Procedure 1. Remove the counter gear bearing, using the **DT 22912-B** split plate bearing puller, the **DT 39473** mainshaft bearing installer, and a hydraulic press **Special Tools** **DT 22919-B** Split Plate Bearing Puller **DT 39473** Mainshaft Bearing Installer For equivalent regional tools, refer to Special Tools (M13) .

REPAIR INSTRUCTIONS - OFF VEHICLE > COUNTER GEAR SHAFT DISASSEMBLE (M13) > FRONT BEARING REMOVAL

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Fig 1: Counters Gear Front Bearing Assembly



Courtesy of GENERAL MOTORS COMPANY

Front Bearing Removal

Callout	Component Name
1	Counters Gear Front Bearing Assembly Procedure 1. Remove the counter gear front bearing, using the **DT 22912-B** split plate bearing puller with the **DT 46627** pump seal installer, and a hydraulic press **Special Tools** **DT 22919-B** Split Plate Bearing Puller **DT 46627** Pump Seal Installer For equivalent regional tools, refer to Special Tools (M13) .

REPAIR INSTRUCTIONS - OFF VEHICLE > SYNCHRONIZERS DISASSEMBLE (MM6)

If you are servicing this transmission for a shifting concern such as clash, hop out of gear, or block-out in a particular gear, the following hardware must be replaced as a set for the gear in question. Adjoining gears do not need to be serviced unless necessary:

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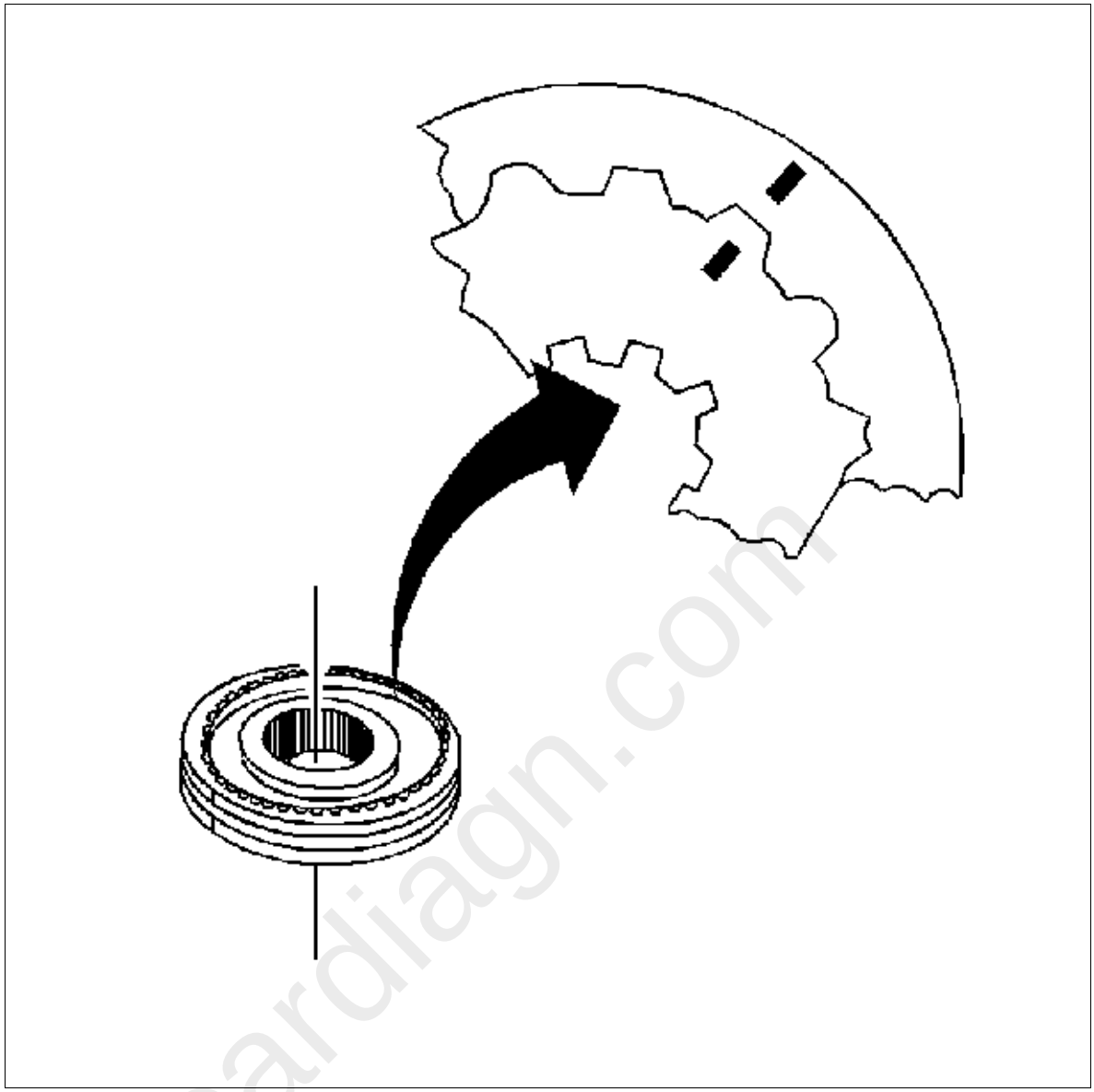
- Main gear in question - for example 2nd, 3rd
- Synchronizer assembly, slider sleeve assembly
- Blocker ring assembly
- Shift fork inserts, pads

1st/2nd, 3rd/4th, 5th/6th Synchronizers

> *IMPORTANT:*
>
> *Synchronizer components are not interchangeable. Keep all the synchronizer components separate. The synchronizer hubs and the sliding sleeves are a selected assembly. Keep the hubs and the sliding sleeves together as originally assembled.*

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Fig 1: Alignment Marks On Synchronizer Hub & Synchronizer Sleeve

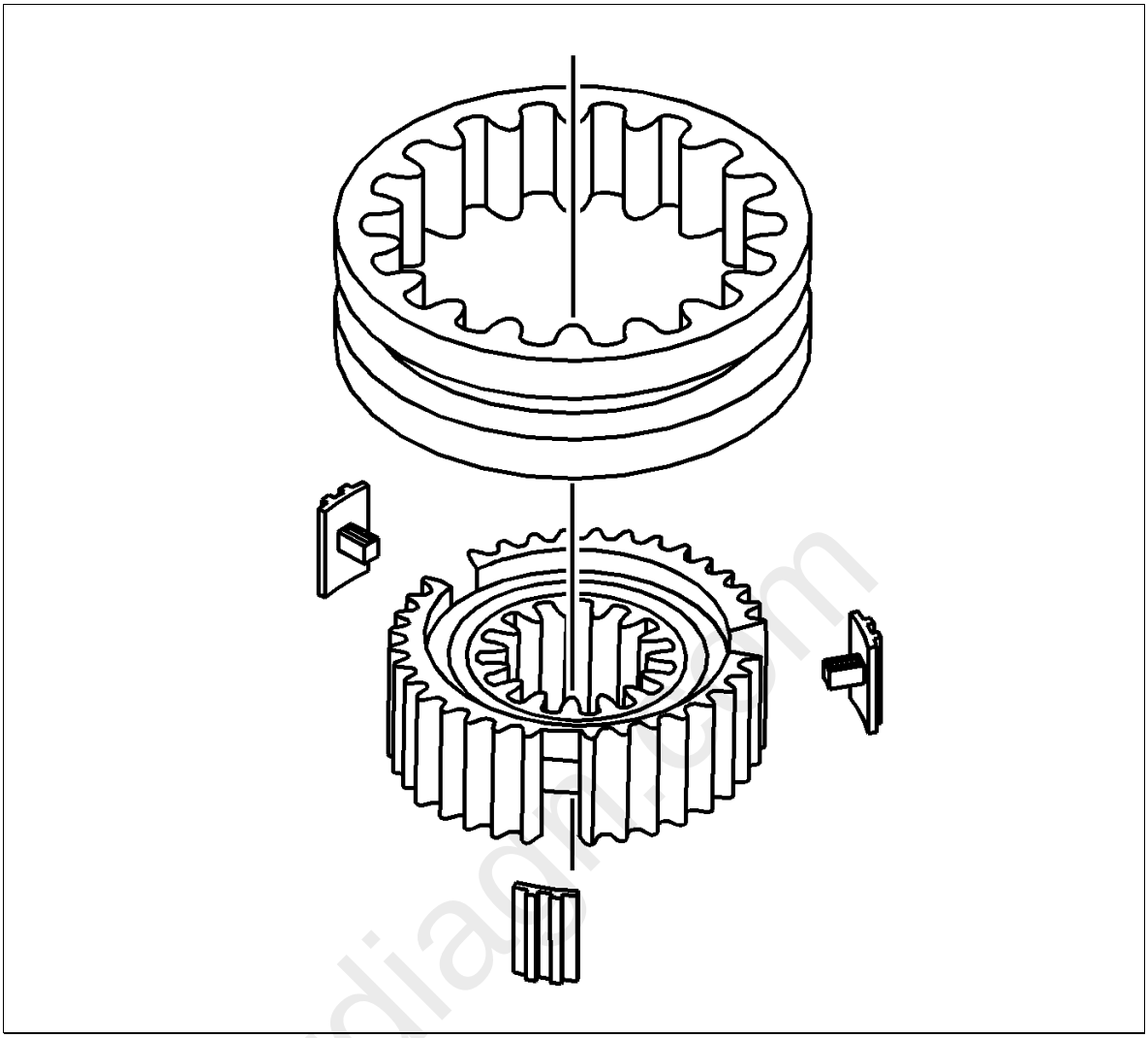


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1. Scribe a mark on the synchronizer hub and on the sleeve. This will help you to reinstall the parts in the same position.

Fig 2: Synchronizer Inserts

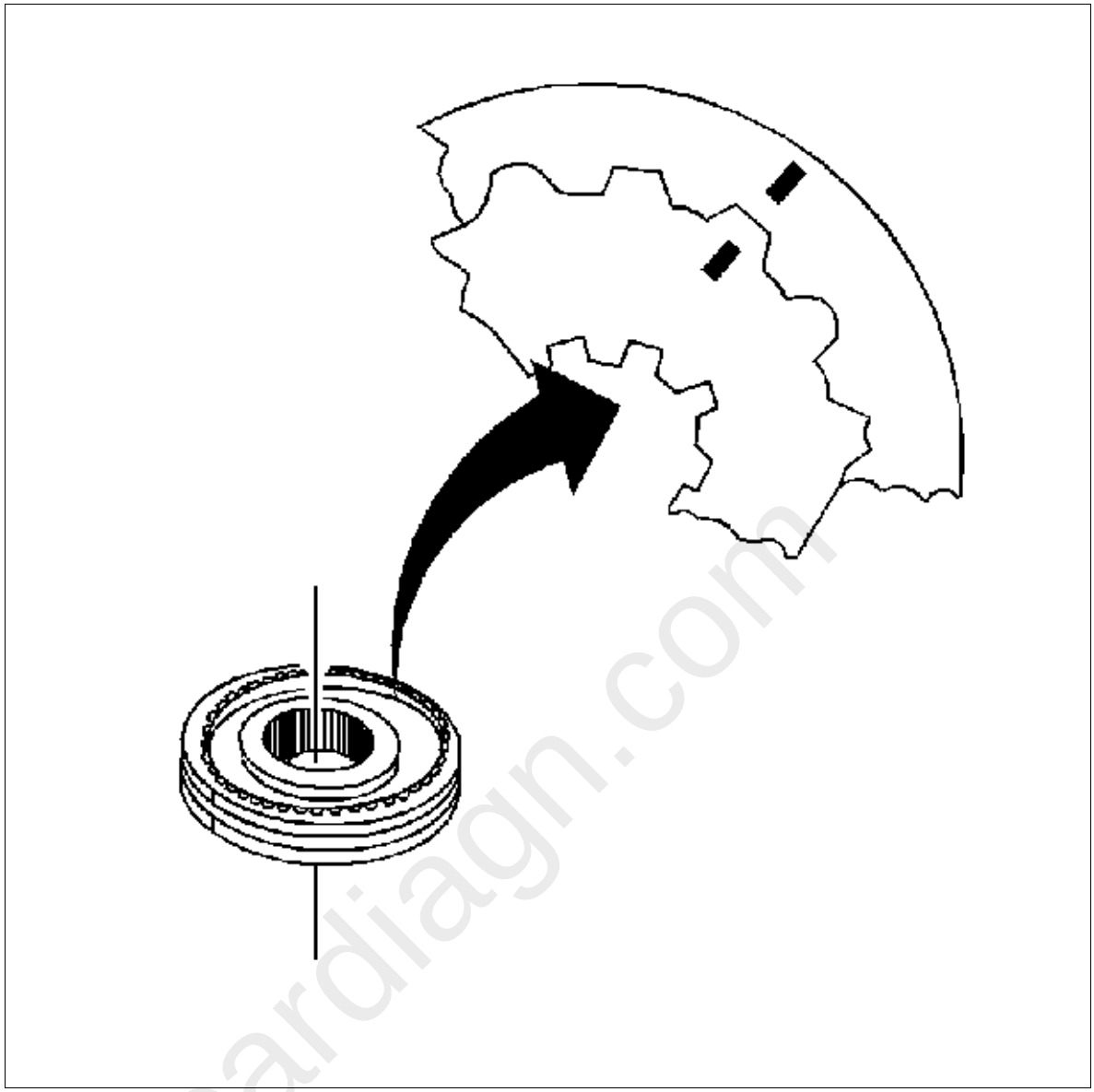


Courtesy of GENERAL MOTORS COMPANY

2. Remove the synchronizer inserts from the hub.

Reverse Synchronizer

Fig 3: Alignment Marks On Synchronizer Hub & Synchronizer Sleeve

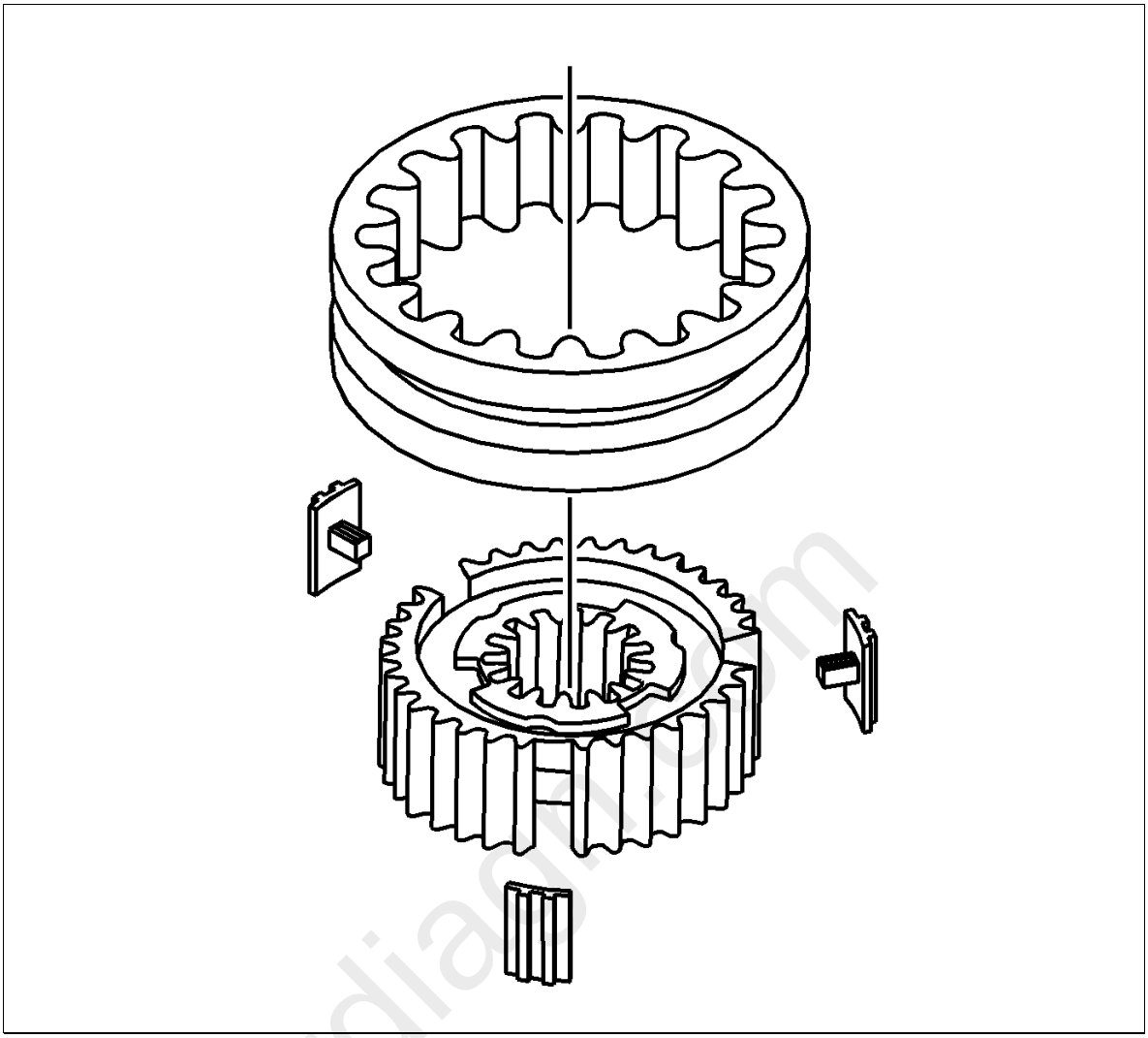


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1. Scribe a mark on the synchronizer hub and on the sleeve. This will help you to reinstall the parts in the same position.

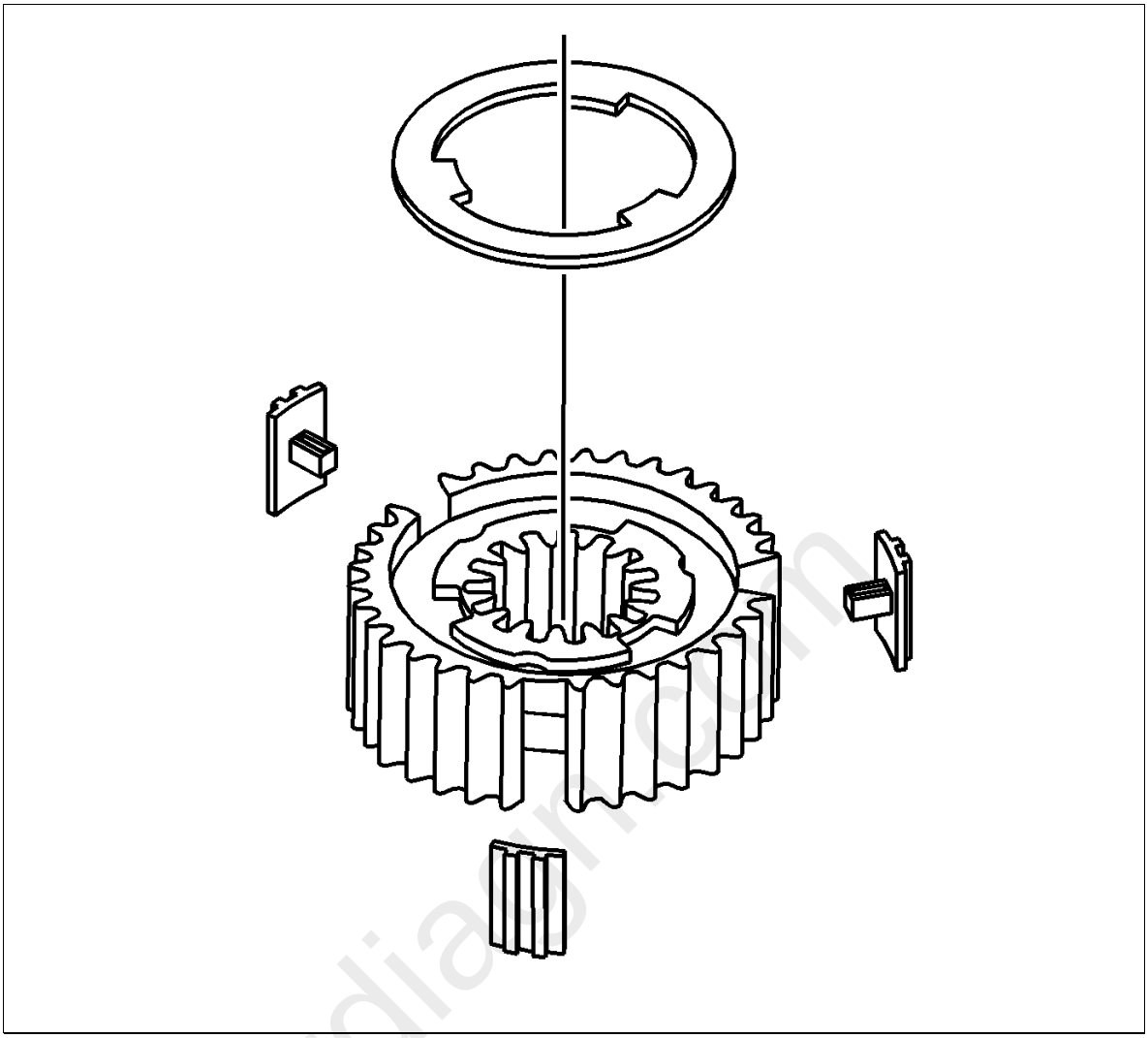
Fig 4: Synchronizer Sleeve & Hub



Courtesy of GENERAL MOTORS COMPANY

2. Remove the synchronizer sleeve from the hub. Press against the inner hub.
3. Turn the hub over. The inserts will slide out from the hub.

Fig 5: Synchronizer Key Retainer



Courtesy of GENERAL MOTORS COMPANY

4. Using a small-blade screwdriver, remove the synchronizer key retainer, and discard.

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REPAIR INSTRUCTIONS - OFF VEHICLE > SYNCHRONIZERS DISASSEMBLE (M13)

If you are servicing this transmission for a shifting concern such as clash, hop out of gear, or block-out in a particular gear, the following hardware must be replaced as a set for the gear in question. Adjoining gears do not need to be serviced unless necessary:

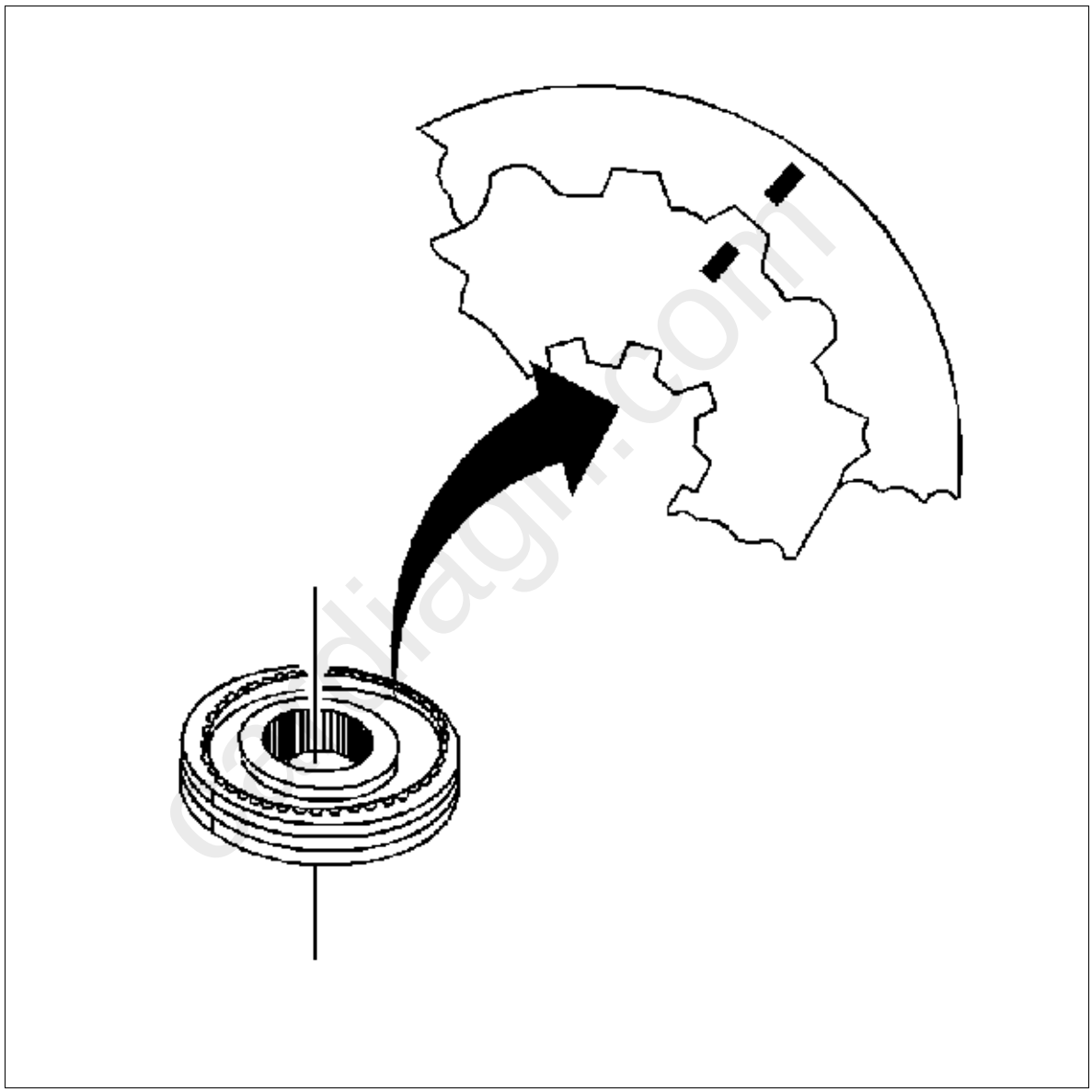
- Main gear in question - for example 2nd, 3rd
- Synchronizer assembly, slider sleeve assembly
- Blocker ring assembly
- Shift fork inserts, pads

1st/2nd, 3rd/4th, 5th/6th Synchronizers

IMPORTANT:

Synchronizer components are not interchangeable. Keep all the synchronizer components separate. The synchronizer hubs and the sliding sleeves are a selected assembly. Keep the hubs and the sliding sleeves together as originally assembled.

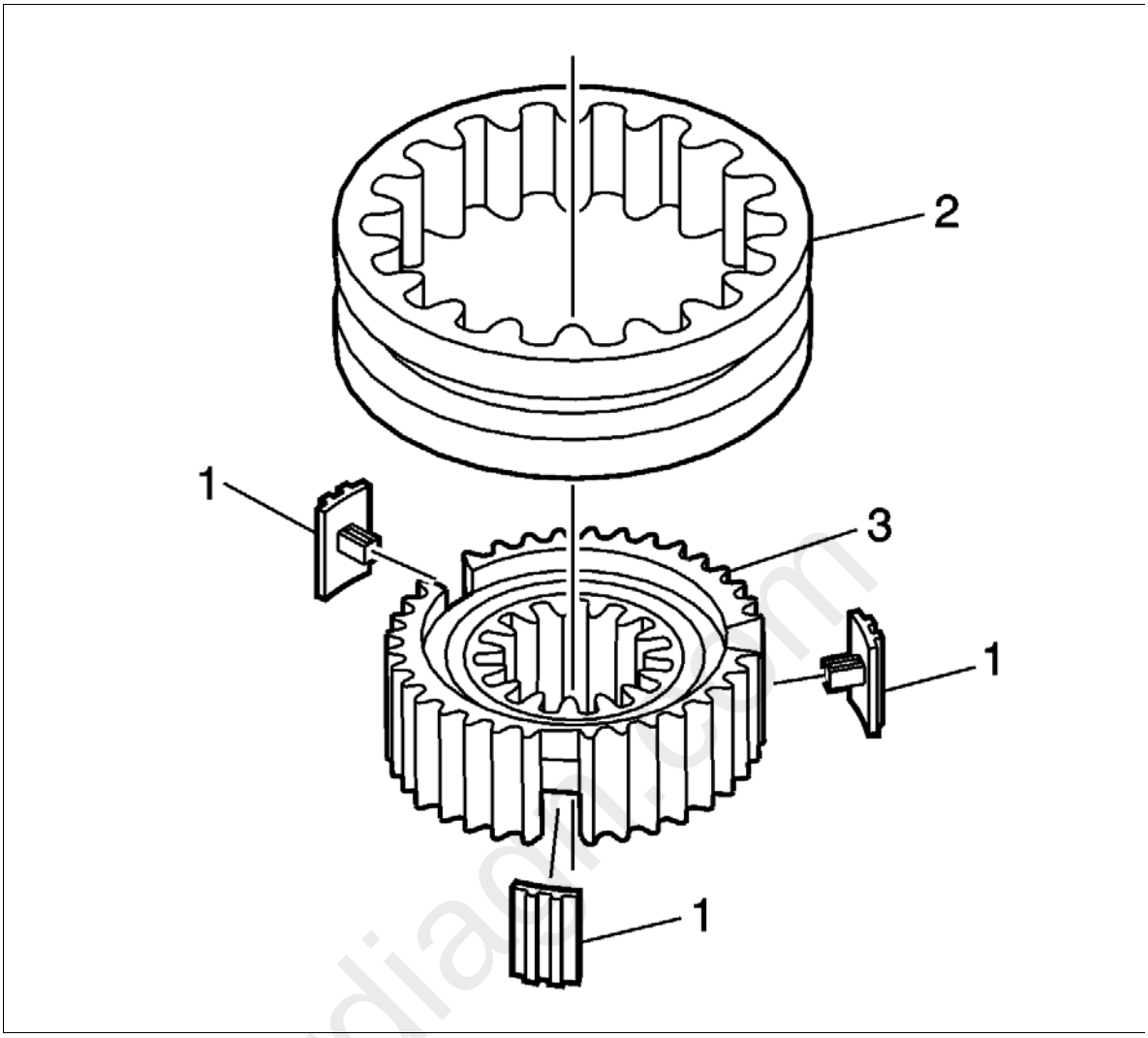
Fig 1: Alignment Marks On Synchronizer Hub & Synchronizer Sleeve



Courtesy of GENERAL MOTORS COMPANY

1. Scribe a mark on the synchronizer hub and on the sleeve. This will help you to reinstall the parts in the same position.

Fig 2: Assembling 1st/2nd Synchronizer

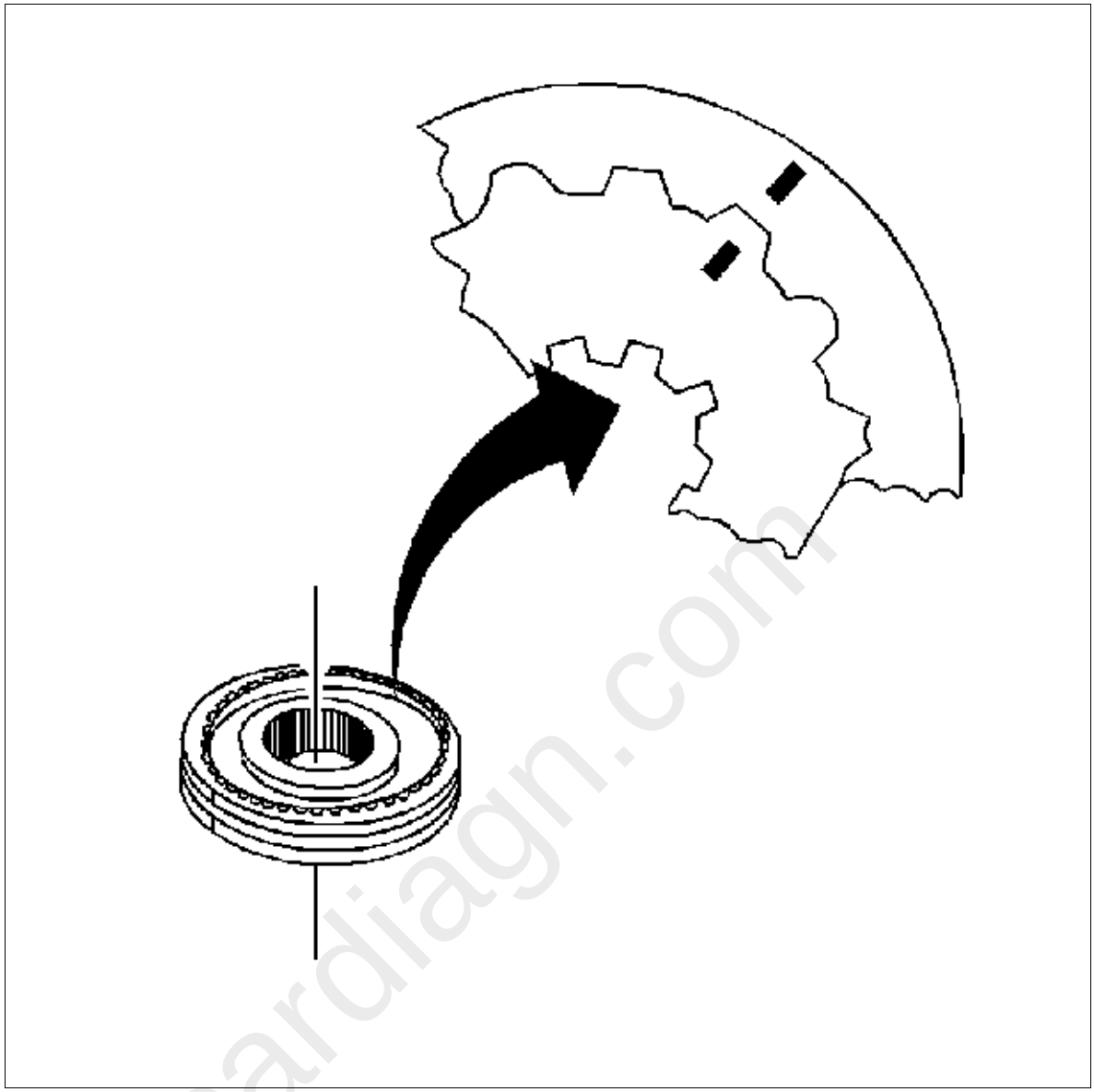


Courtesy of GENERAL MOTORS COMPANY

2. Remove the synchronizer sleeve (2) and synchronizer inserts (1) from the hub (3).

Reverse Synchronizer

Fig 3: Alignment Marks On Synchronizer Hub & Synchronizer Sleeve

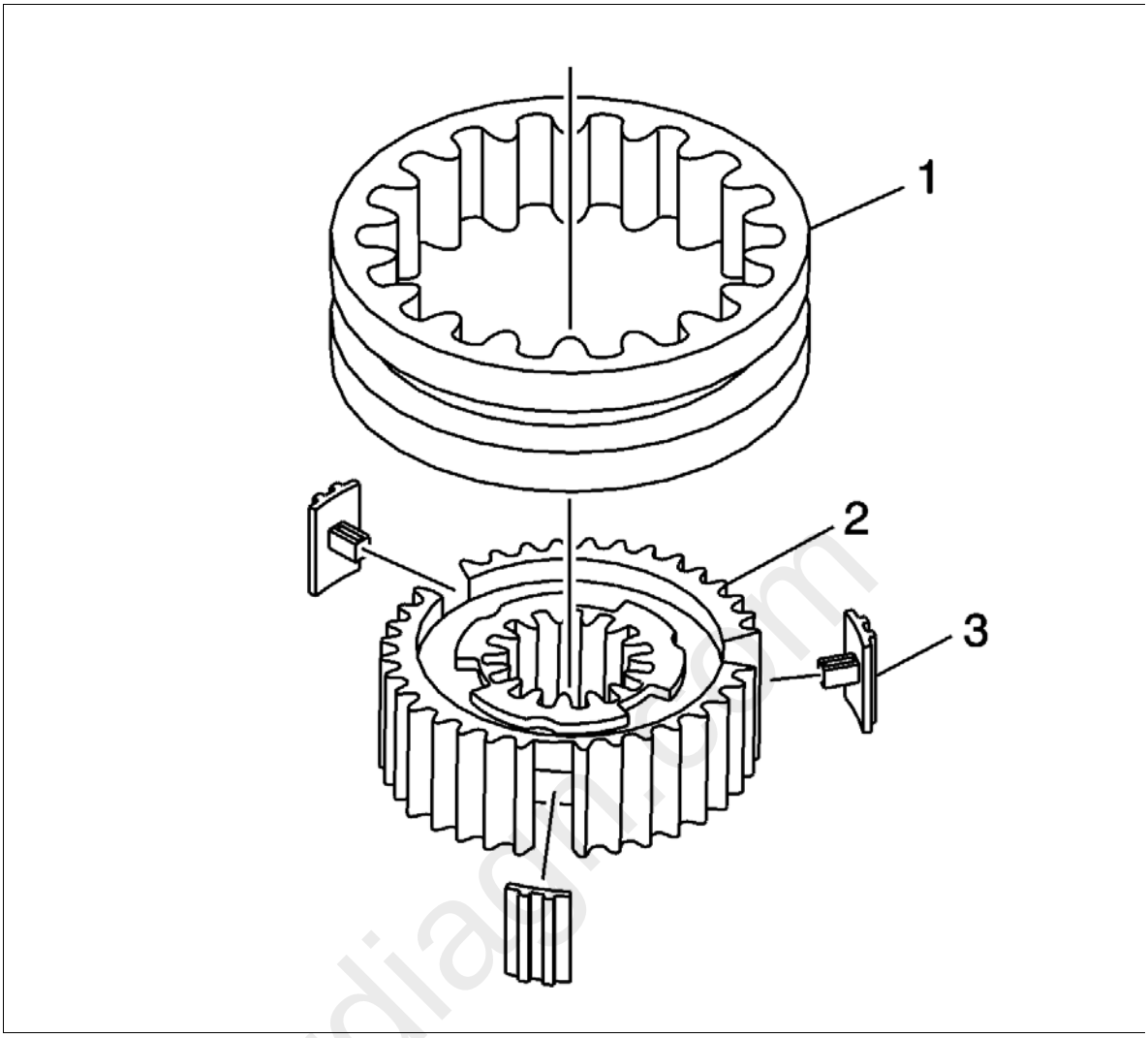


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Courtesy of GENERAL MOTORS COMPANY

1. Scribe a mark on the synchronizer hub and on the sleeve. This will help you to reinstall the parts in the same position.

Fig 4: Synchronizer Sleeve, Hub & Inserts



Courtesy of GENERAL MOTORS COMPANY

2. Remove the synchronizer sleeve (1) from the hub (2). Press against the inner hub.
3. Turn the hub over. The inserts (3) will slide out from the hub.

REPAIR INSTRUCTIONS - OFF VEHICLE > SYNCHRONIZERS CLEANING AND INSPECTION

If you are servicing this transmission for a shifting concern such as clash, hop out of gear, or block-out in a particular gear, the following hardware must be replaced as a set for the gear in question. Adjoining gears do not need to be serviced unless necessary:

- Main gear in question - for example 2nd, 3rd
- Synchronizer assembly, slider sleeve assembly
- Blocker ring assembly

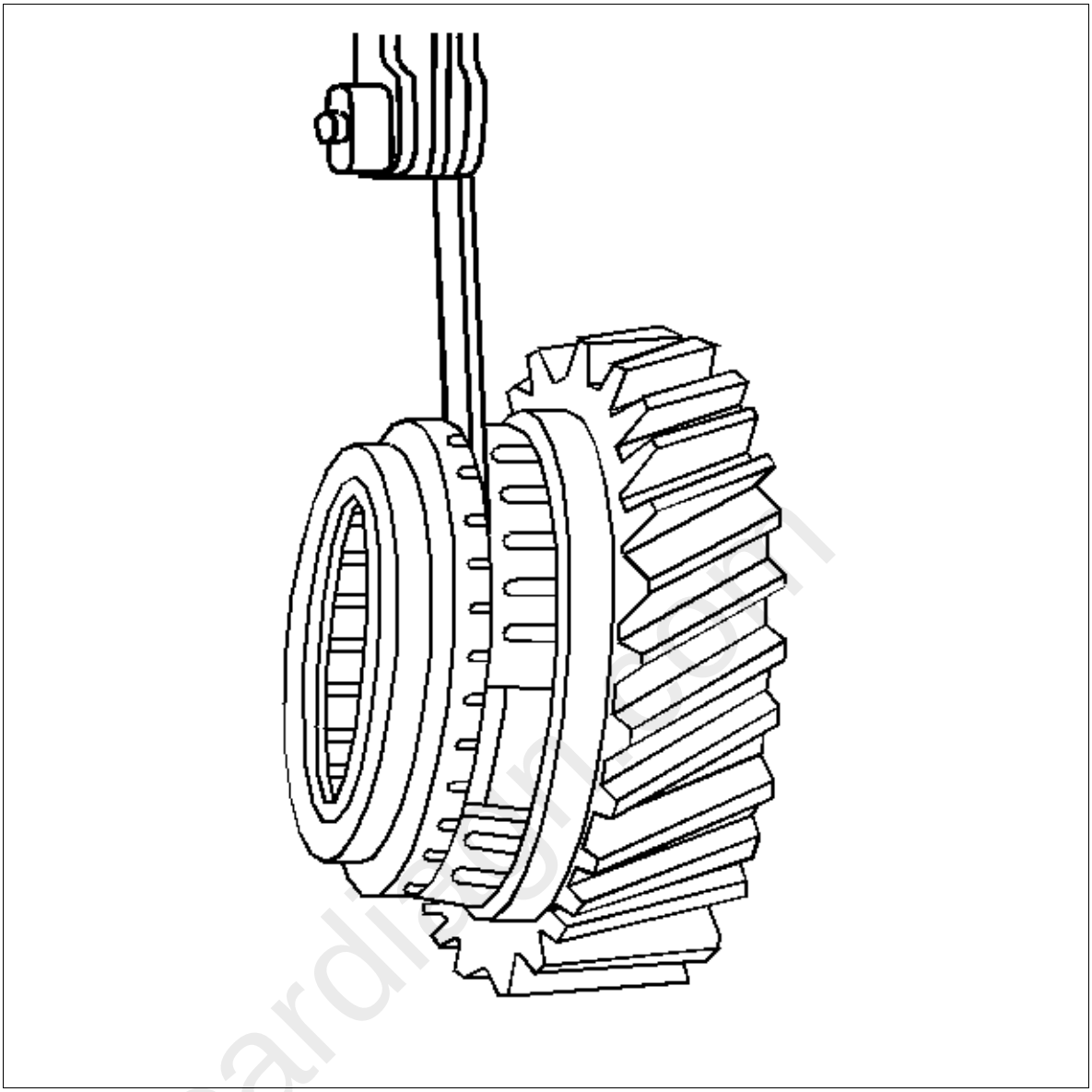
- Shift fork inserts, pads

1. Clean all the synchronizer parts in a suitable solvent. Air dry all the synchronizer parts.
2. Inspect the synchronizer parts for the following conditions:
    1. Burrs
    2. Cracks
    3. Hicks
    4. Chamfer for excessive wear
    5. Free movement of the clutching sleeves on their hubs
    6. Worn or damaged clutch teeth
    7. Distorted springs
3. Replace synchronizer parts that are worn or damaged.

    Replace a burred or nicked part that cannot be reconditioned by hand. Use a soft stone or a crocus cloth.

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Fig 1: Measuring Gap Between Blocking Ring & Speed Gear



Courtesy of GENERAL MOTORS COMPANY

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NOTE:

Measure the gap without the wave washer in between the blocking ring and the reverse gear.

4. Measure the gap between the vertical faces of the blocking ring teeth and the speed gear as follows:
    1. Assemble the correct blocking ring with the correct speed gear.
    2. The blocking ring must be fully seated on the gear.
    3. Use a feeler gauge to measure the forward gear gap.

4. Use a feeler gauge to measure the reverse gear gap.

   The nominal gap is 1.27-2.16 mm (0.050-0.085 in) for the 1st and 2nd gear.

   The nominal gap is 1.27-2.03 mm (0.050-0.080 in) for the 3rd, 4th, 5th and 6th gear.

   Replace the friction cones and blocker rings when the gap is less than specified.

REPAIR INSTRUCTIONS - OFF VEHICLE > SYNCHRONIZERS ASSEMBLE (MM6)

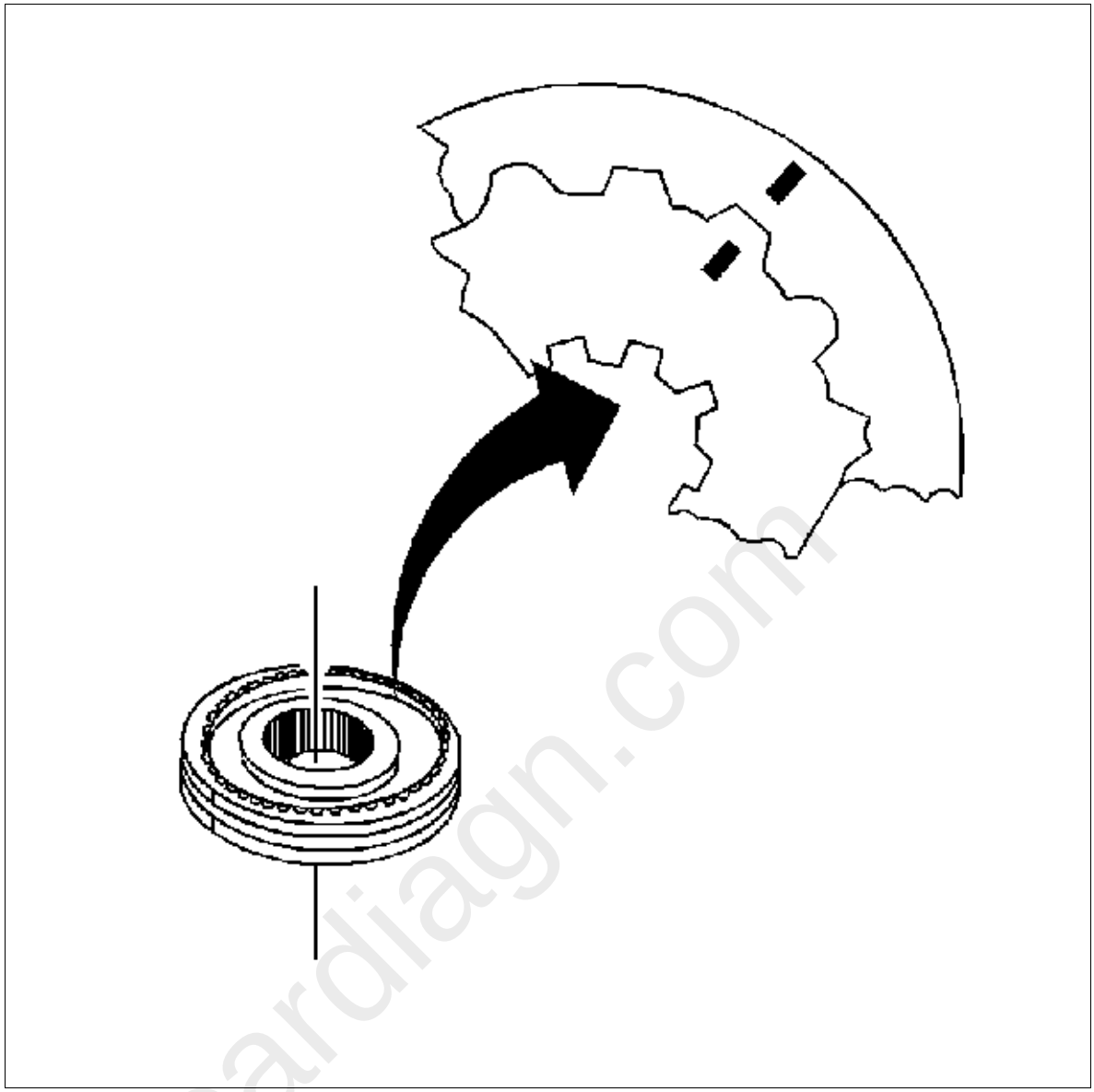
If you are servicing this transmission for a shifting concern such as clash, hop out of gear, or block-out in a particular gear, the following hardware must be replaced as a set for the gear in question. Adjoining gears do not need to be serviced unless necessary:

- Main gear in question - for example 2nd, 3rd
- Synchronizer assembly, slider sleeve assembly
- Blocker ring assembly
- Shift fork inserts, pads

1st/2nd Synchronizer

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Fig 1: Alignment Marks On Synchronizer Hub & Synchronizer Sleeve

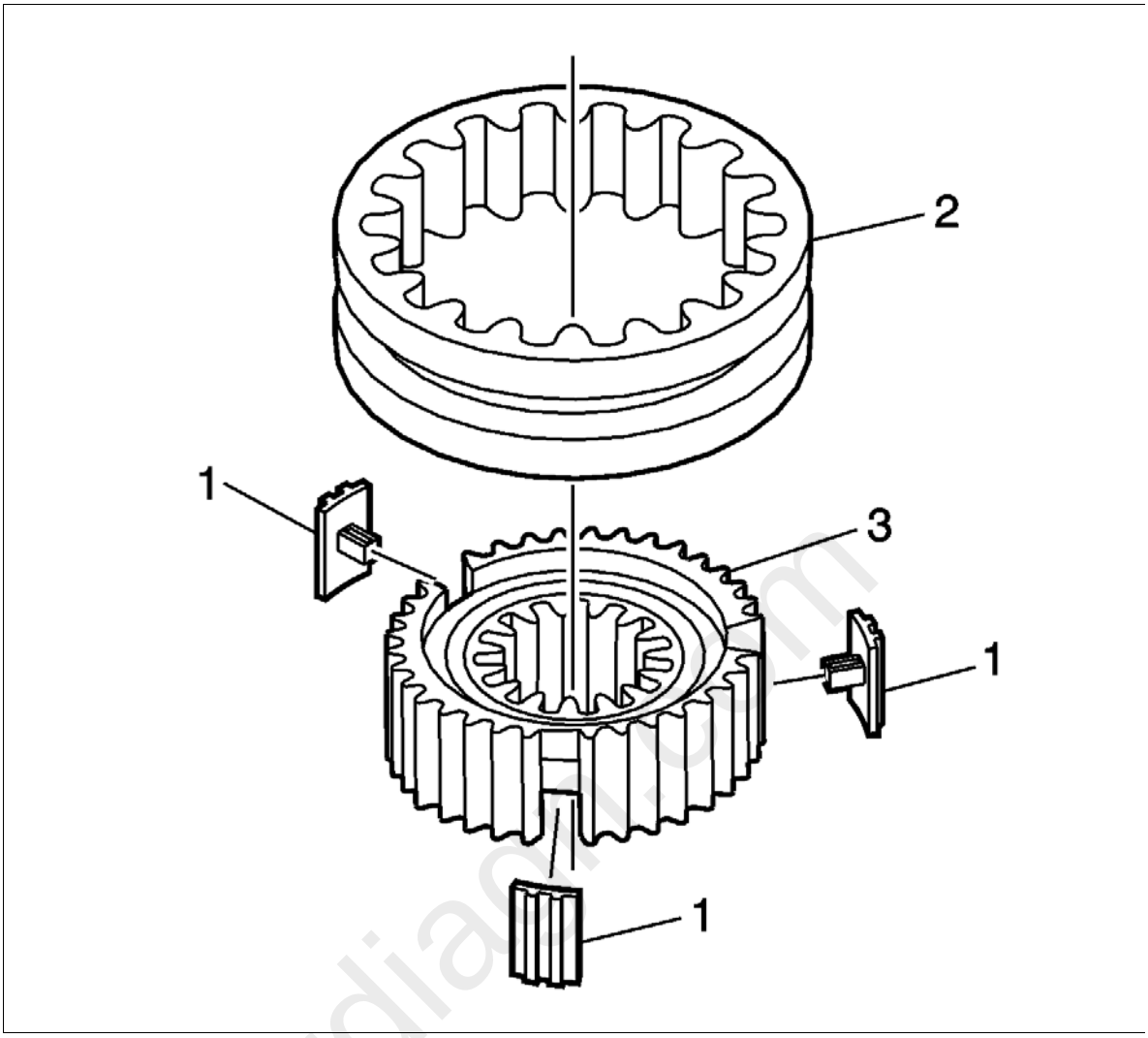


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1. Check the synchronizer assembly scribe marks for correct positions.

Fig 2: Assembling 1st/2nd Synchronizer

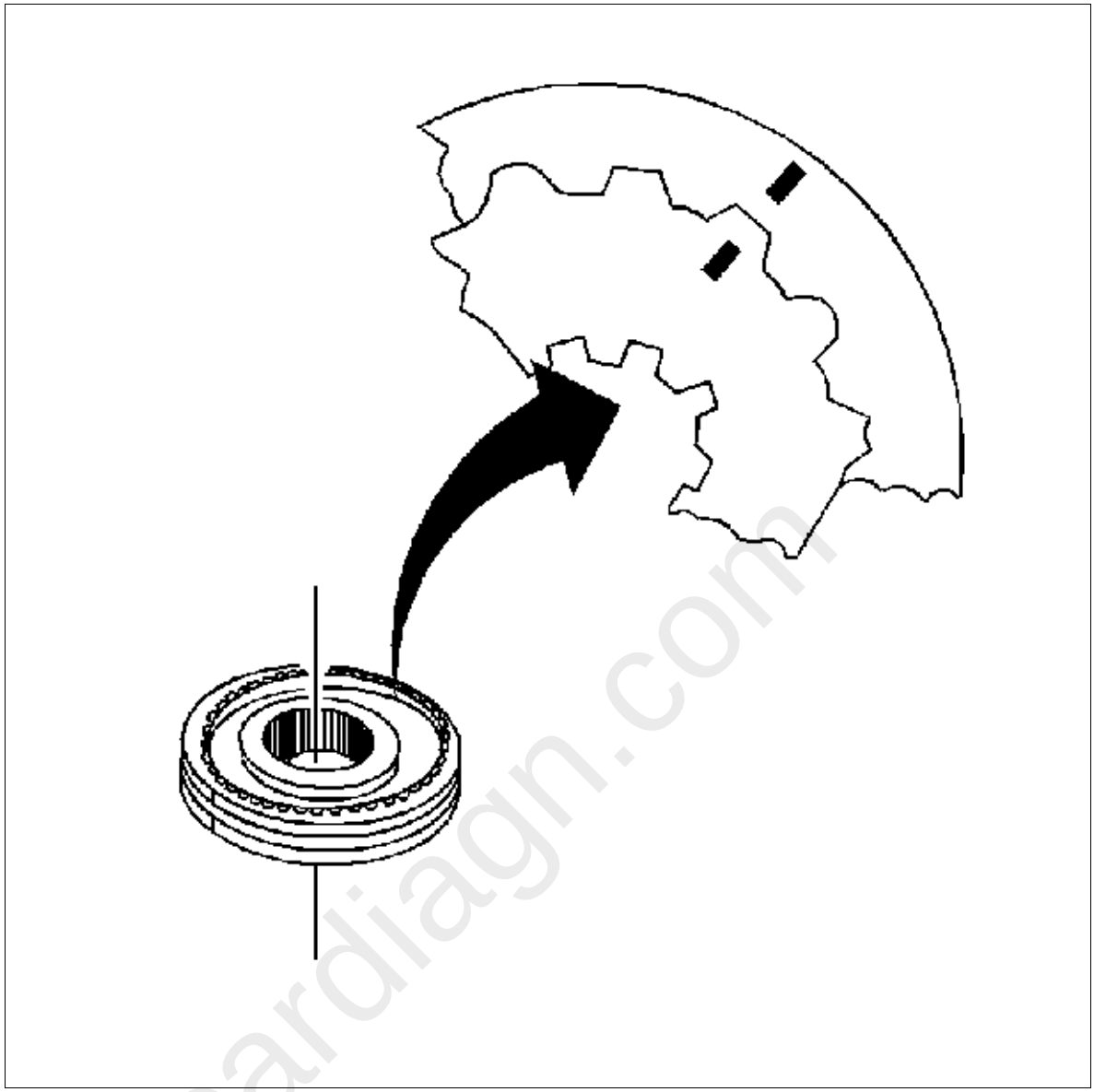


Courtesy of GENERAL MOTORS COMPANY

2. Install the synchronizer sleeve (2) to the hub (3) (align the insert openings in the hub with the cuts in the synchronizer sleeve).
3. Install the inserts (1) with the slots facing the hub.

3rd/4th, 5th/6th Synchronizers

Fig 3: Alignment Marks On Synchronizer Hub & Synchronizer Sleeve

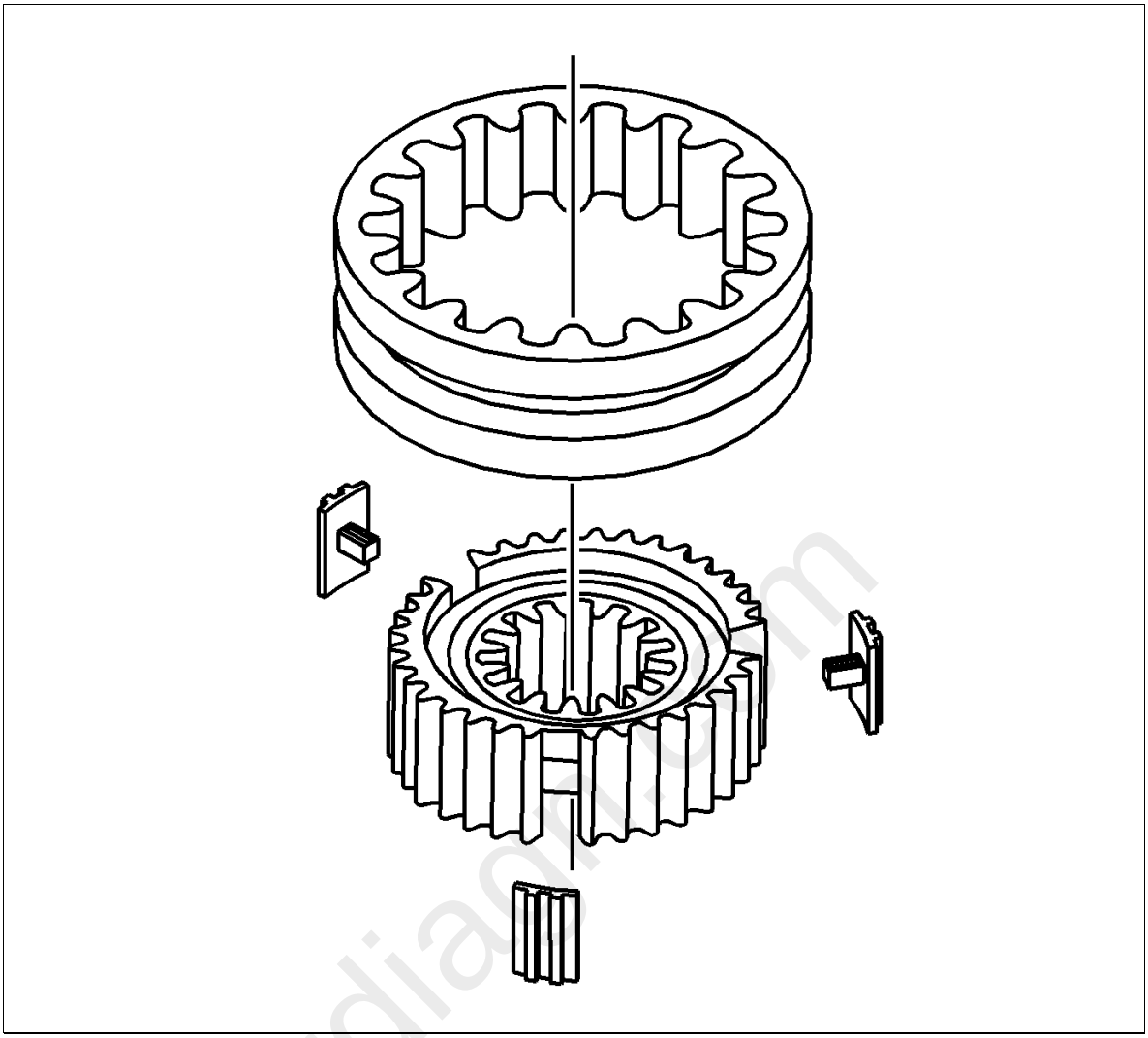


Courtesy of GENERAL MOTORS COMPANY

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1. Check the synchronizer assembly scribe marks for correct positions.

Fig 4: Synchronizer Inserts

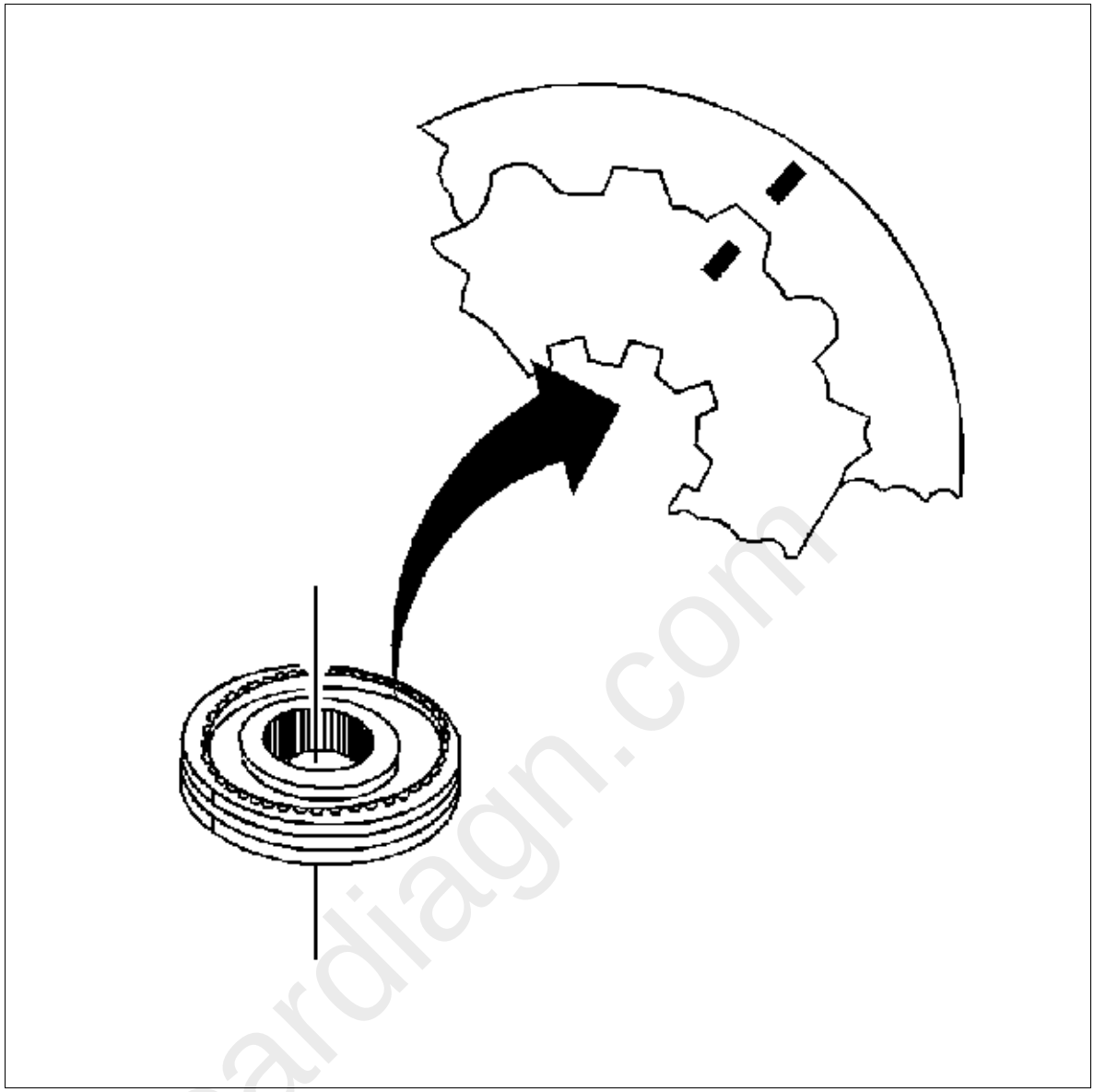


Courtesy of GENERAL MOTORS COMPANY

2. Install the synchronizer sleeve to the hub (align the insert openings in the hub with the cuts in the synchronizer sleeve).
3. Install the inserts with the slots facing the hub.

Reverse Synchronizer

Fig 5: Alignment Marks On Synchronizer Hub & Synchronizer Sleeve

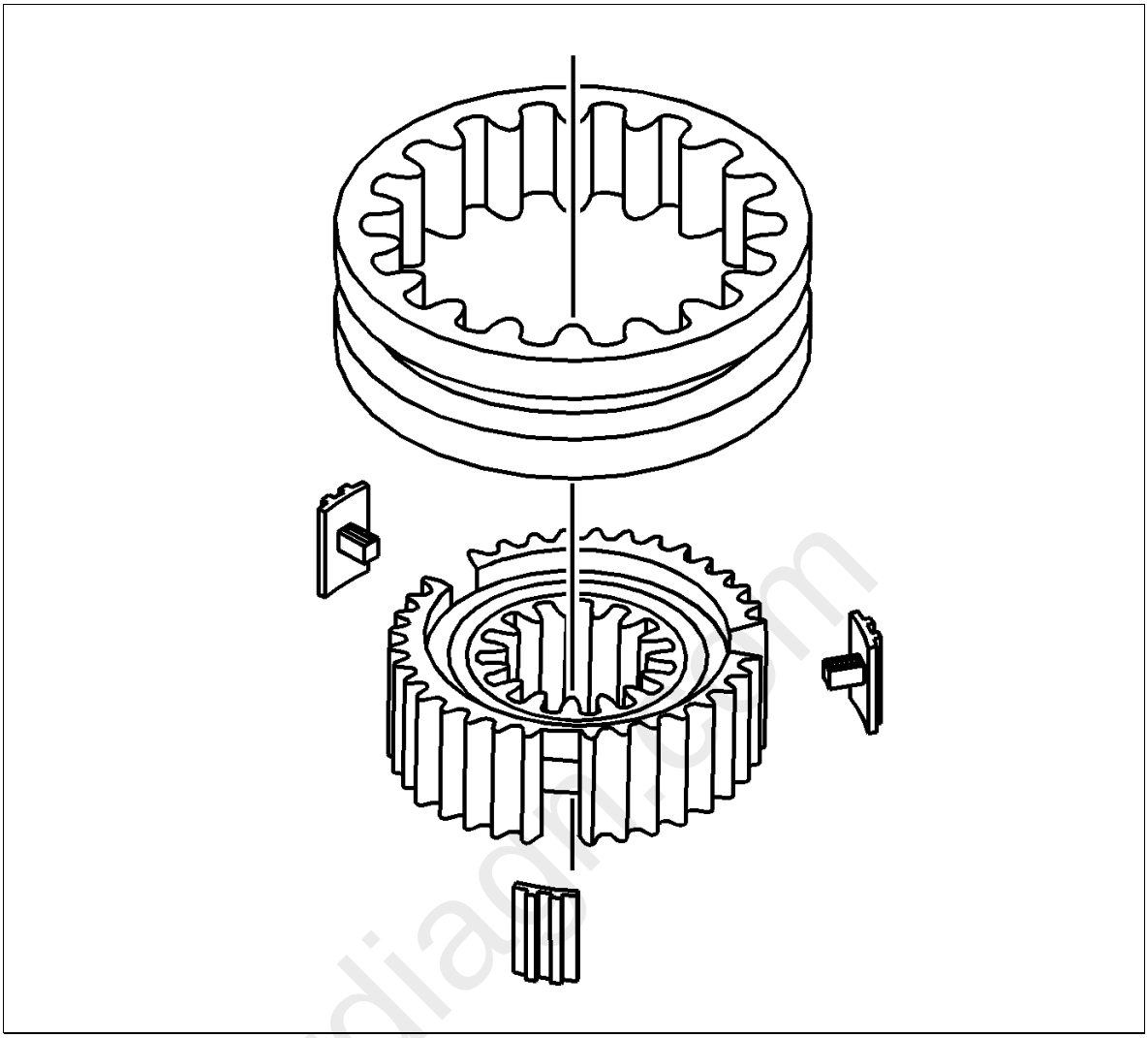


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1. Check the synchronizer assembly scribe marks for correct positions.

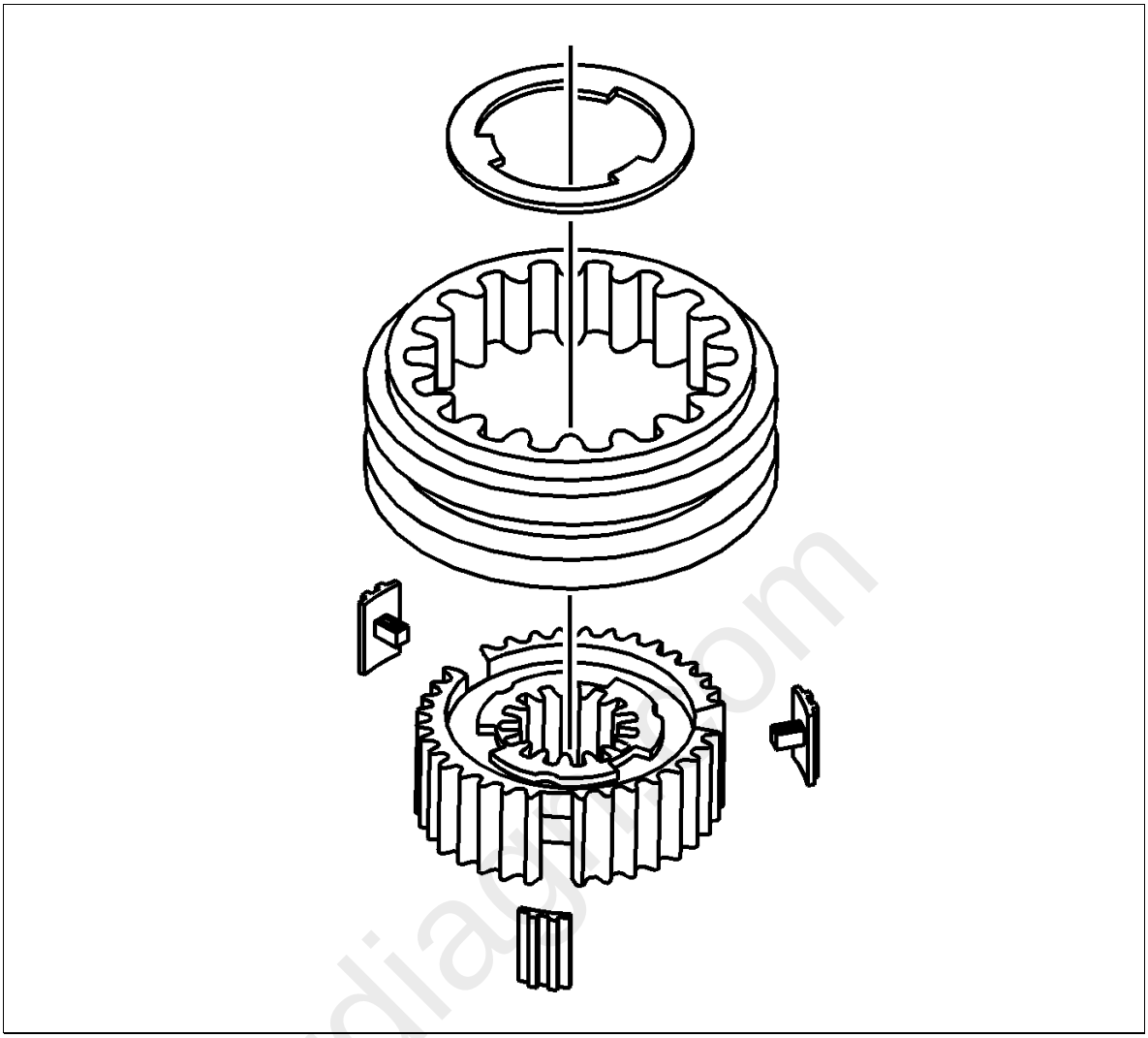
Fig 6: Synchronizer Inserts



Courtesy of GENERAL MOTORS COMPANY

2. Install the synchronizer sleeve to the hub (align the insert openings in the hub with the cuts in the synchronizer sleeve).
3. Install the inserts with the slots facing the hub.

Fig 7: New Synchronizer Insert Retainer & Key Retainer Tangs



Courtesy of GENERAL MOTORS COMPANY

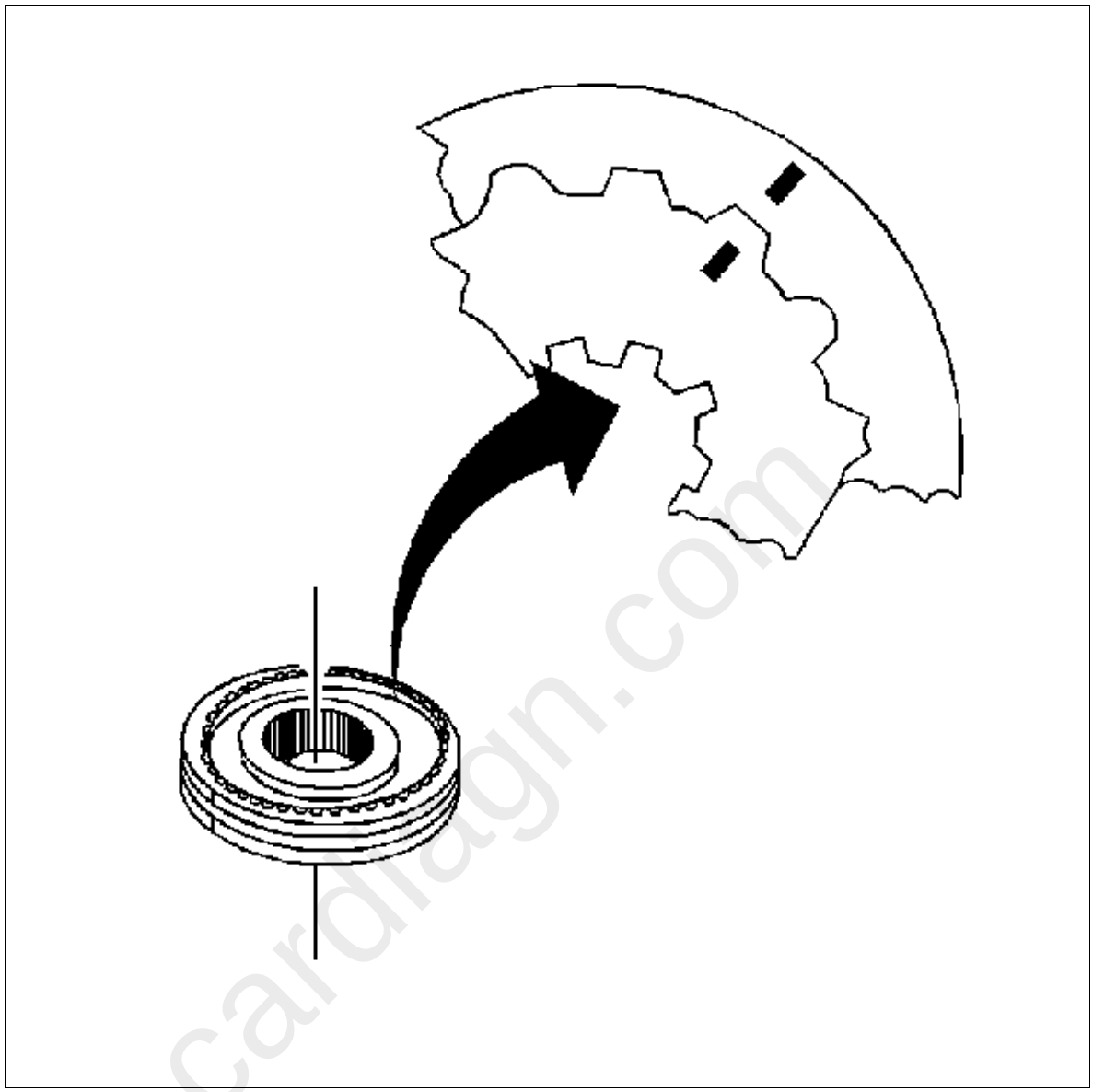
4. Install a new synchronizer insert retainer with the key retainer tangs over the synchronizer inserts.

REPAIR INSTRUCTIONS - OFF VEHICLE > SYNCHRONIZERS ASSEMBLE (M13)

If you are servicing this transmission for a shifting concern such as clash, hop out of gear, or block-out in a particular gear, the following hardware must be replaced as a set for the gear in question. Adjoining gears do not need to be serviced unless necessary:

- Main gear in question - for example 2nd, 3rd
- Synchronizer assembly, slider sleeve assembly
- Blocker ring assembly
- Shift fork inserts, pads

Fig 1: Alignment Marks On Synchronizer Hub & Synchronizer Sleeve

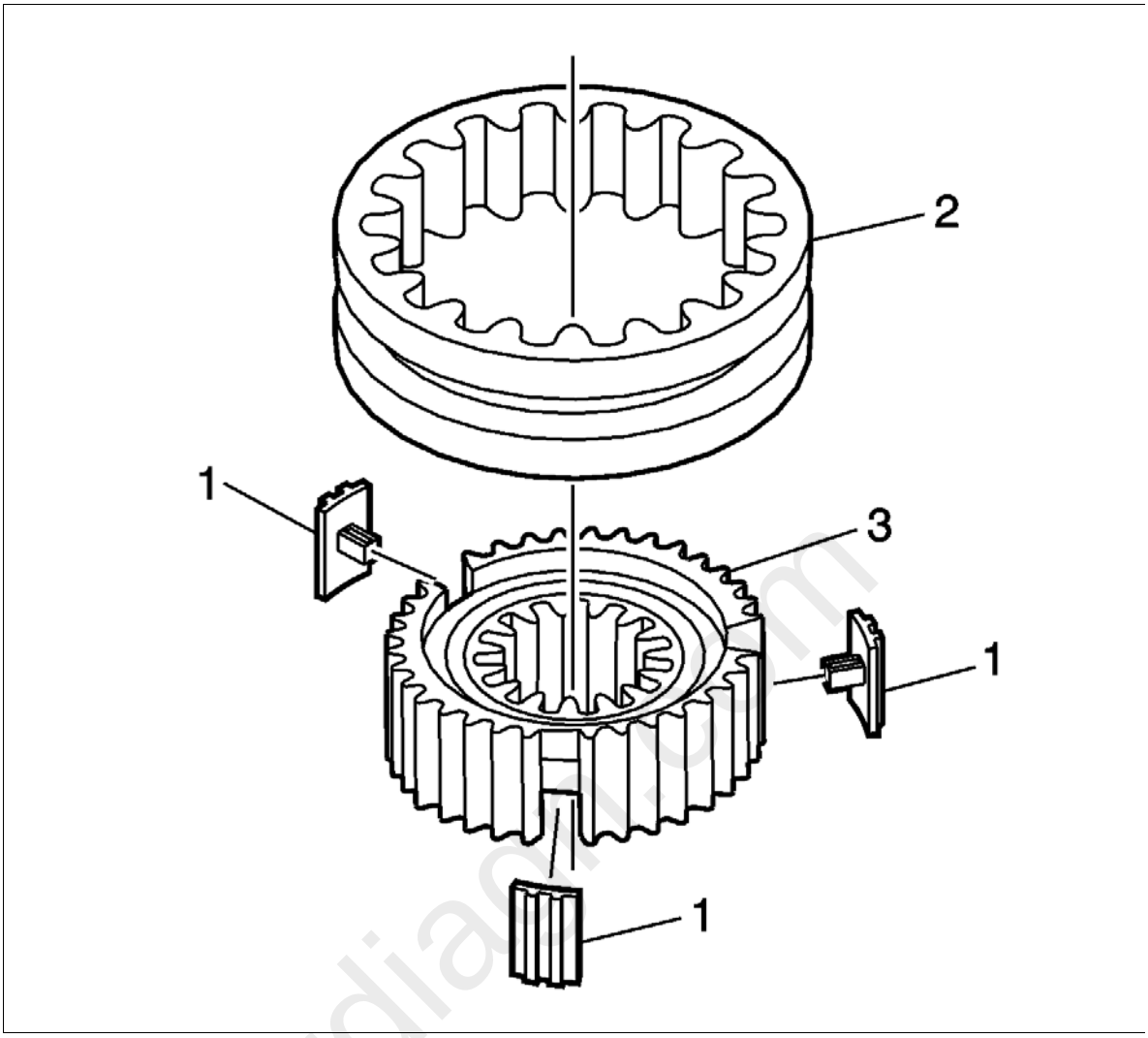


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Courtesy of GENERAL MOTORS COMPANY

1. Check the synchronizer assembly scribe marks for correct positions.

Fig 2: Assembling 1st/2nd Synchronizer

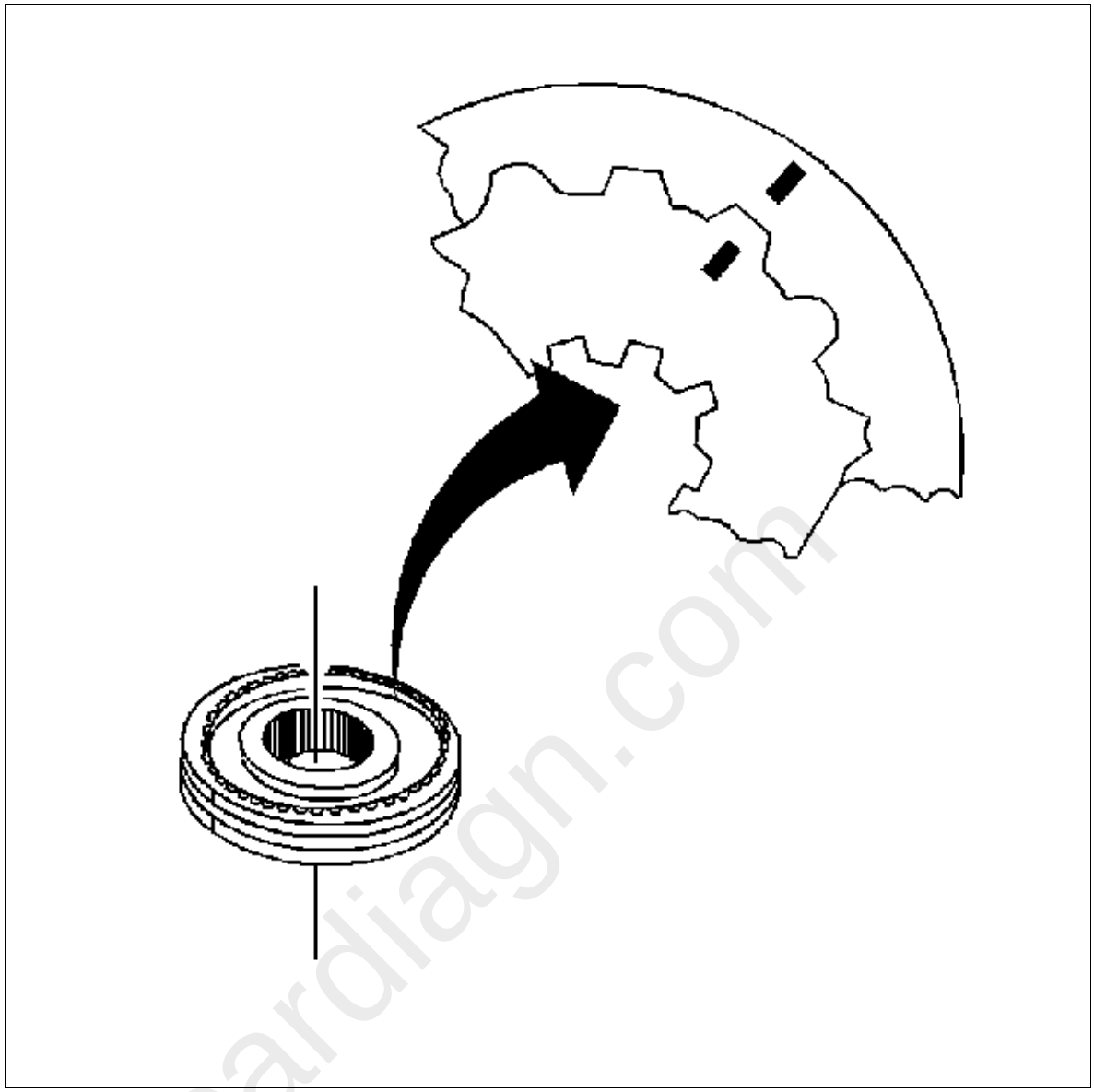


Courtesy of GENERAL MOTORS COMPANY

2. Install the inserts (1) with the slots facing the hub.
3. Install the synchronizer sleeve (2) to the hub (3) (align the insert openings in the hub with the cuts in the synchronizer sleeve).

Reverse Synchronizer

Fig 3: Alignment Marks On Synchronizer Hub & Synchronizer Sleeve

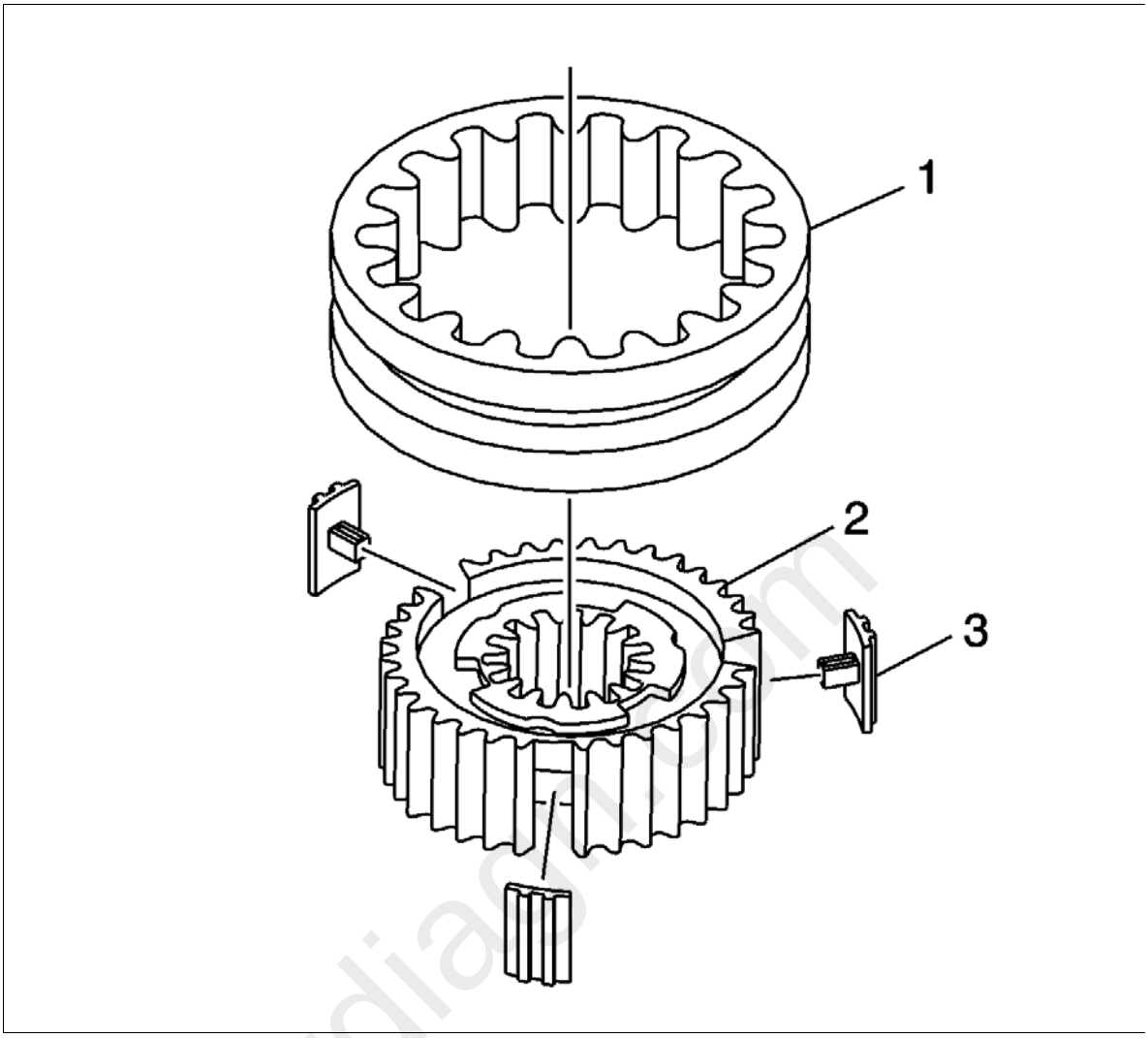


Courtesy of GENERAL MOTORS COMPANY

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1. Check the synchronizer assembly scribe marks for correct positions.

Fig 4: Synchronizer Sleeve, Hub & Inserts



Courtesy of GENERAL MOTORS COMPANY

2. Install the inserts (3) with the slots facing the hub.
3. Install the synchronizer sleeve (1) to the hub (2) (align the insert openings in the hub with the cuts in the synchronizer sleeve).

REPAIR INSTRUCTIONS - OFF VEHICLE > SHIFT SHAFT AND FORK ASSEMBLIES DISASSEMBLE (MM6)

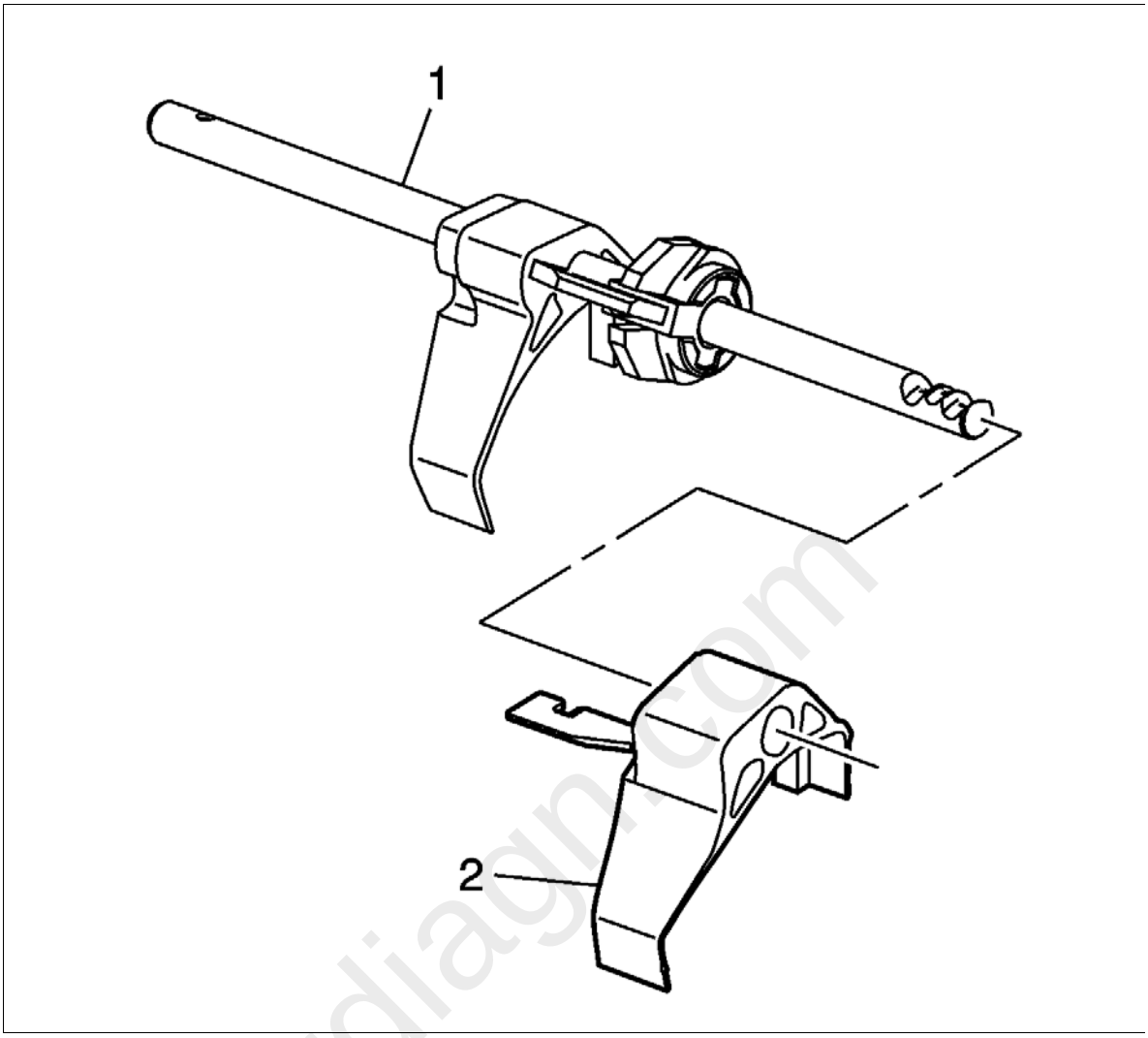
Special Tools

- **J 23907** Slide Hammer
- **J 39439-2** Bushing Remover

For equivalent regional tools, refer to Special Tools (MM6) .

1st/2nd, 3rd/4th Shift Rail Assembly

Fig 1: 1st/2nd Shift Fork & Shift Shaft

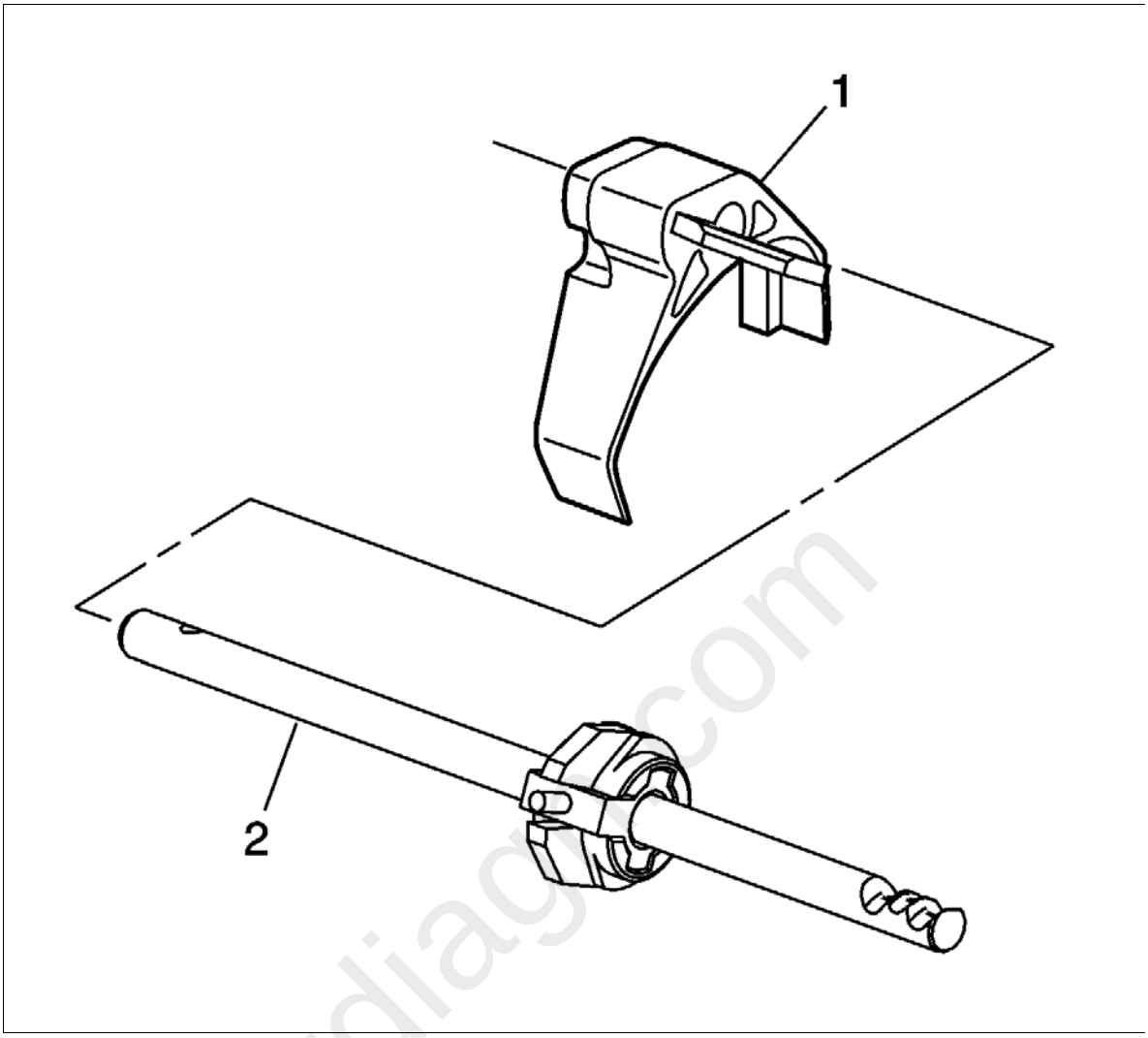


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1. Remove the 3rd/4th shift fork (2) from the shift shaft (1).

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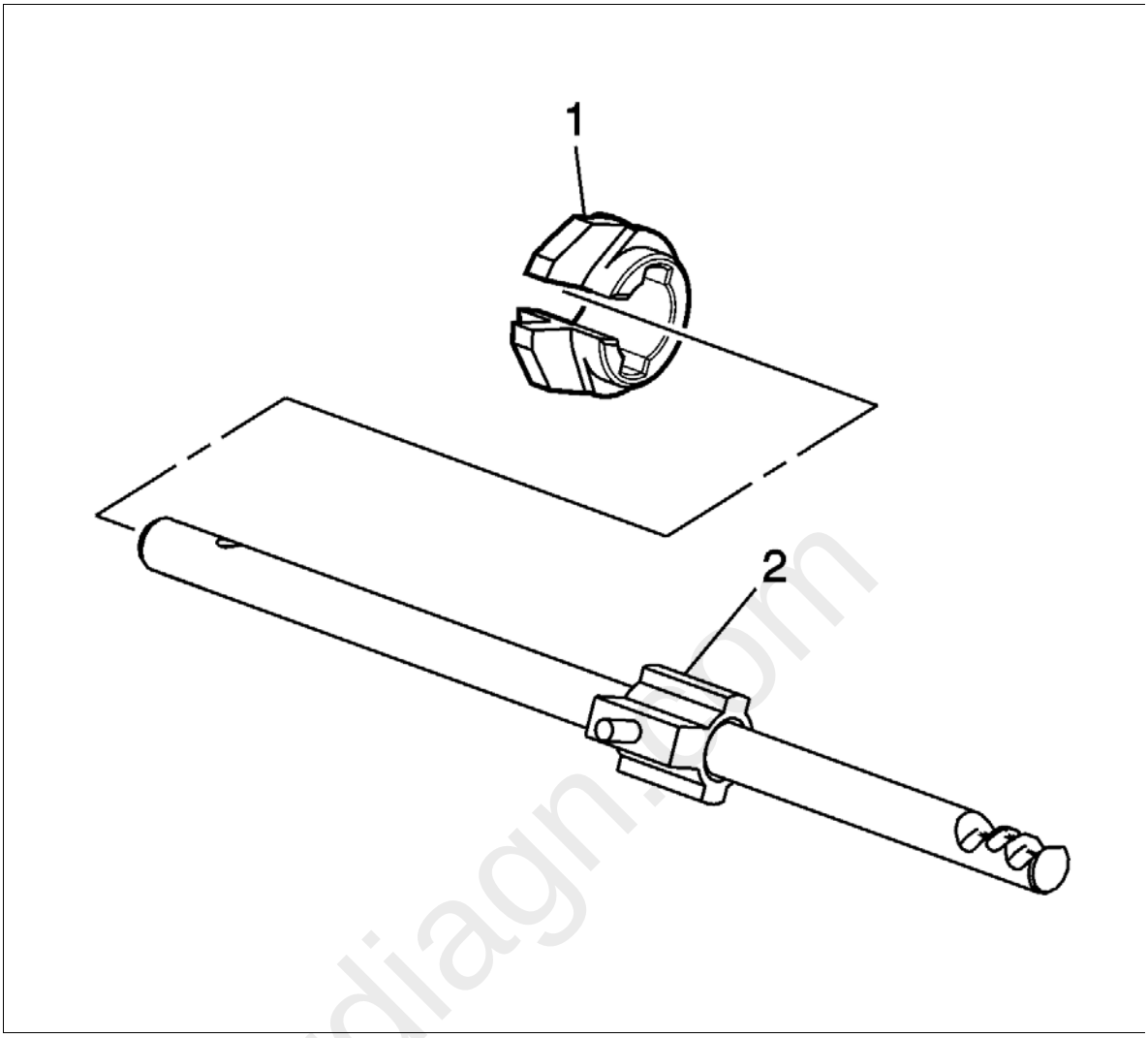
Fig 2: 3rd/4th Shift Fork & Shift Shaft



Courtesy of GENERAL MOTORS COMPANY

2. Remove the 1st/2nd shift fork (1) from the shift shaft (2).

Fig 3: Interlock Plate & Selector Pin

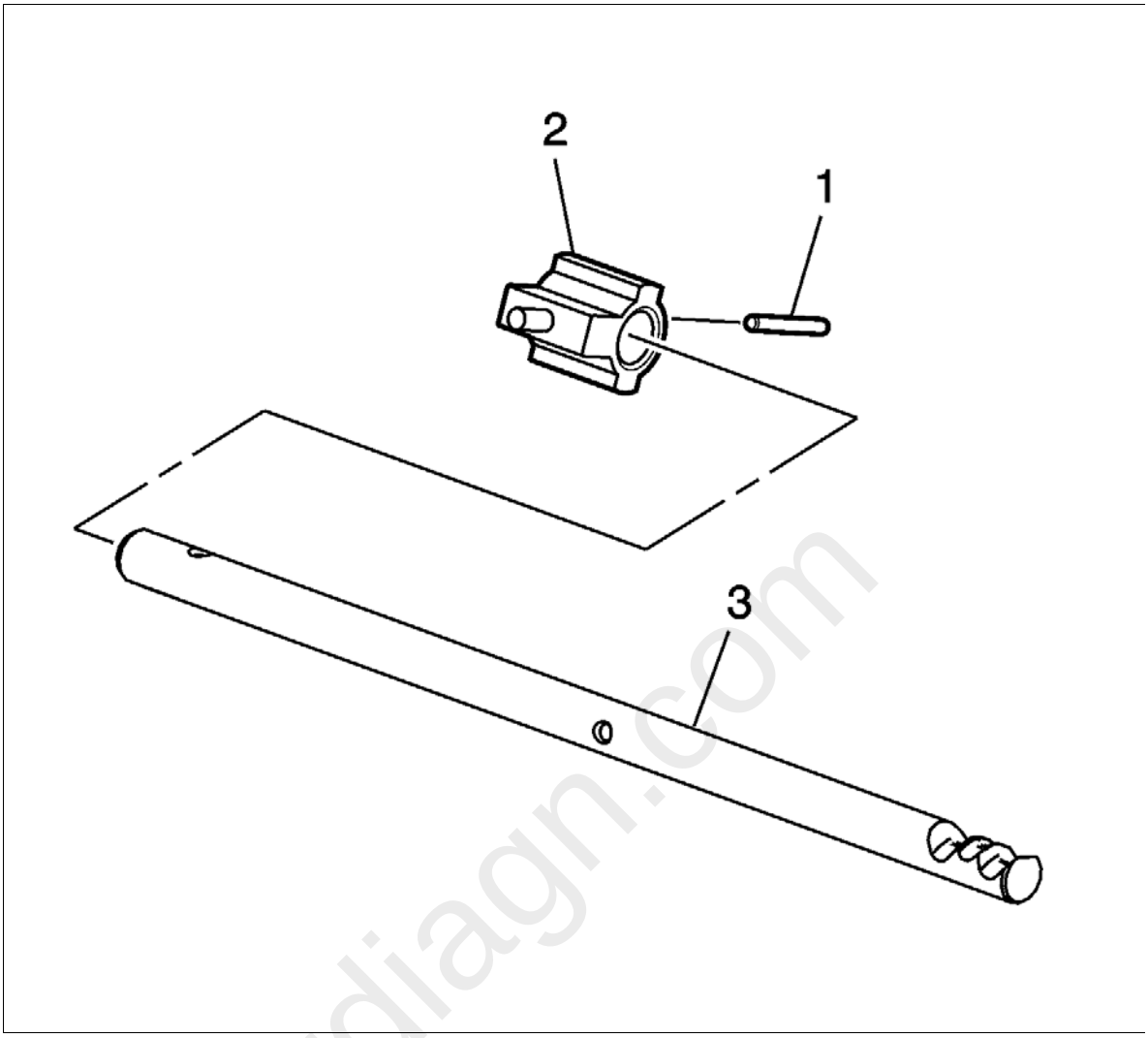


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3. Remove the interlock plate (1) from the selector pin (2).

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Fig 4: Selector Roll Pin, Selector Pin & Shift Shaft



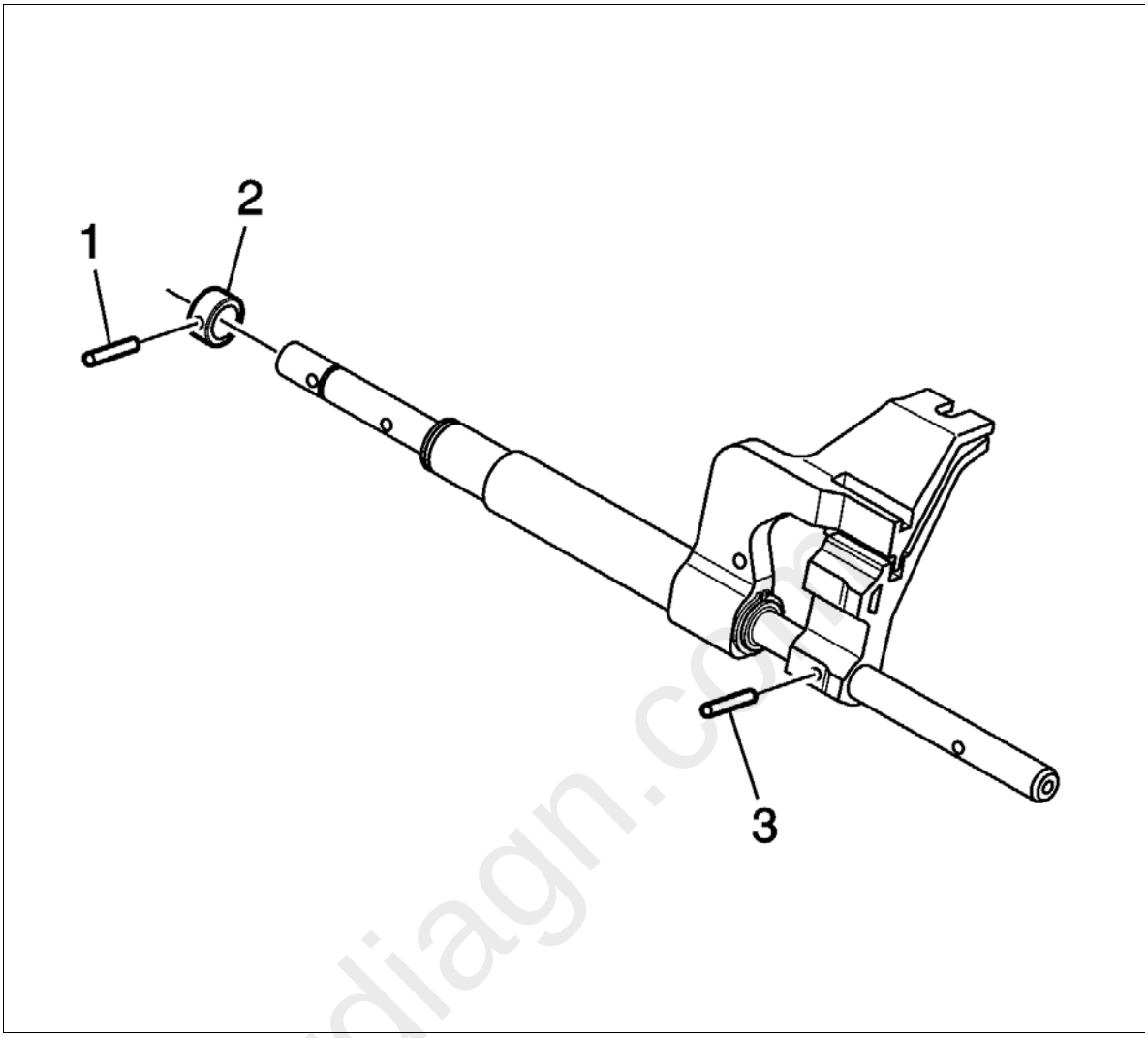
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4. Remove the selector roll pin (1).
5. Remove the selector pin (2) from the shift shaft (3).

5th/6th, Reverse Shift Rail Assembly

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Fig 5: Reverse Lever Roll Pin

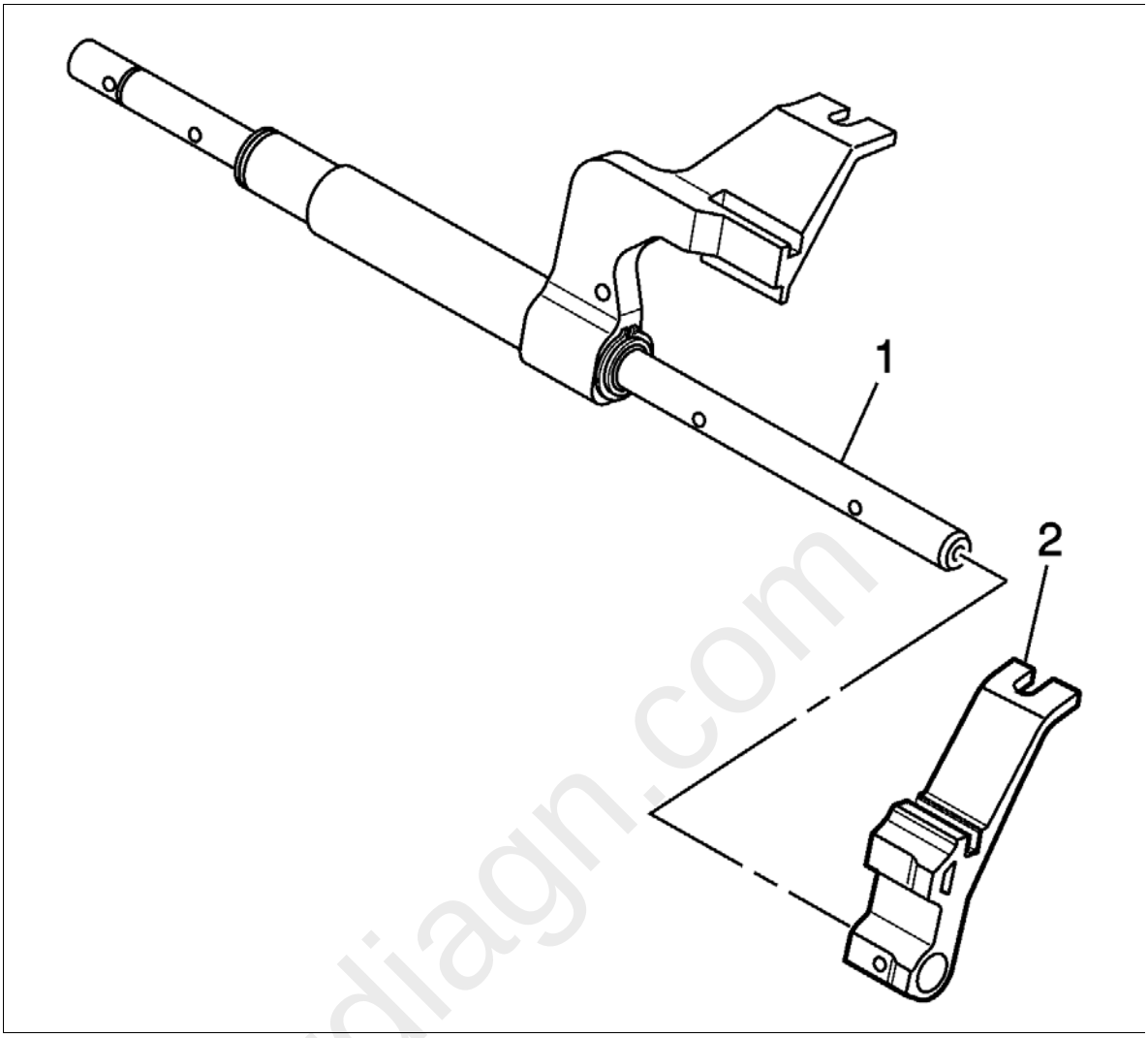


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1. Remove the reverse shift collar pin (1).
2. Remove the reverse shift lever collar (2).
3. Remove the reverse shift lever pin (3).

Fig 6: Reverse Shift Lever On The Shift Shaft

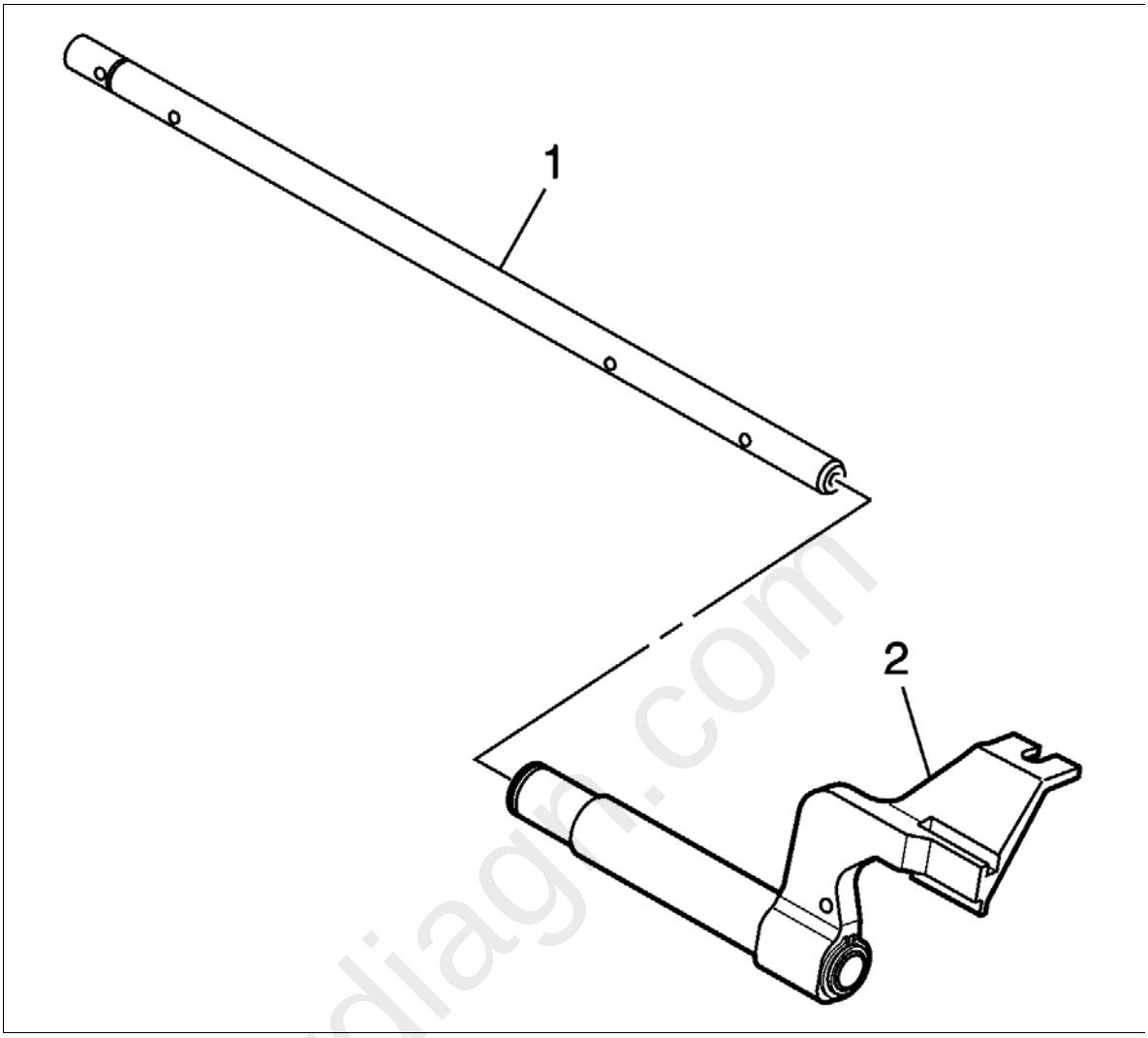


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4. Remove the reverse shift lever (2) from the shift shaft (1).

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Fig 7: 5th/6th Shift Lever & Shift Shaft

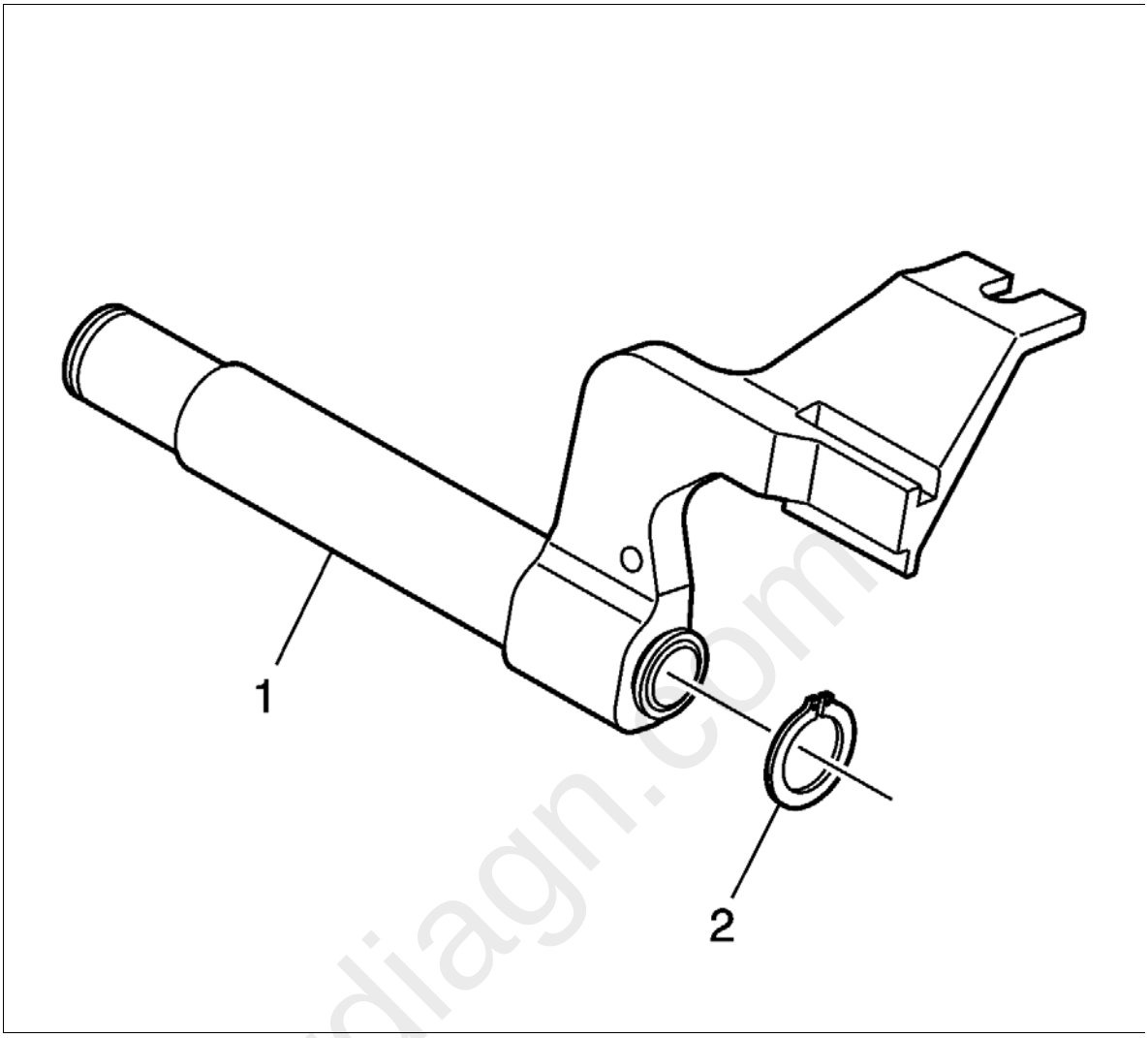


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5. Remove the 5th/6th shift lever (2) from the shift shaft (1).

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Fig 8: Retainer Ring & 5th/6th Shift Lever

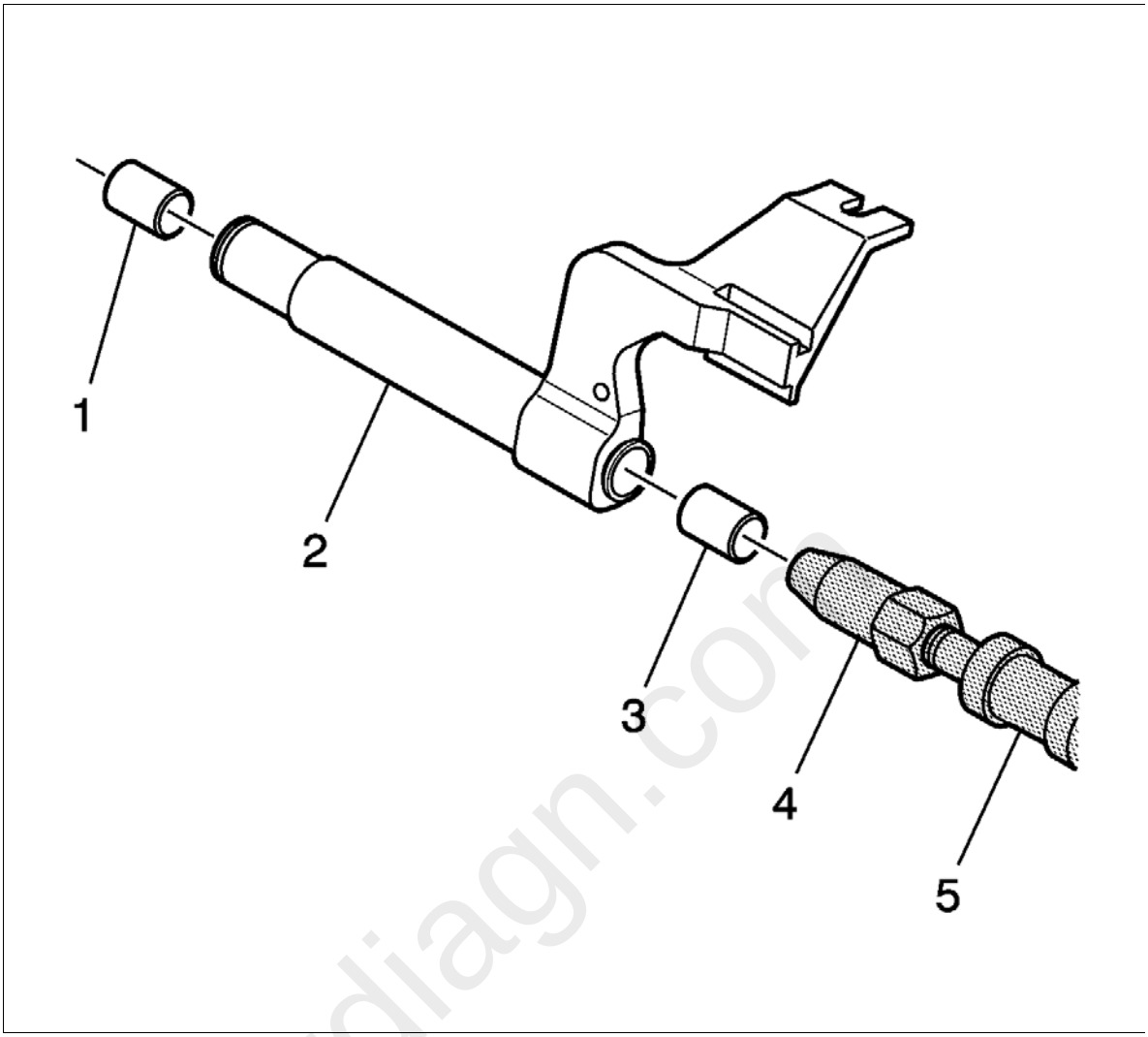


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6. Remove the snap ring (2) from the 5th/6th shift lever (1).

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Fig 9: 5th/6th Shift Shaft Lever Bushings



Courtesy of GENERAL MOTORS COMPANY

NOTE:

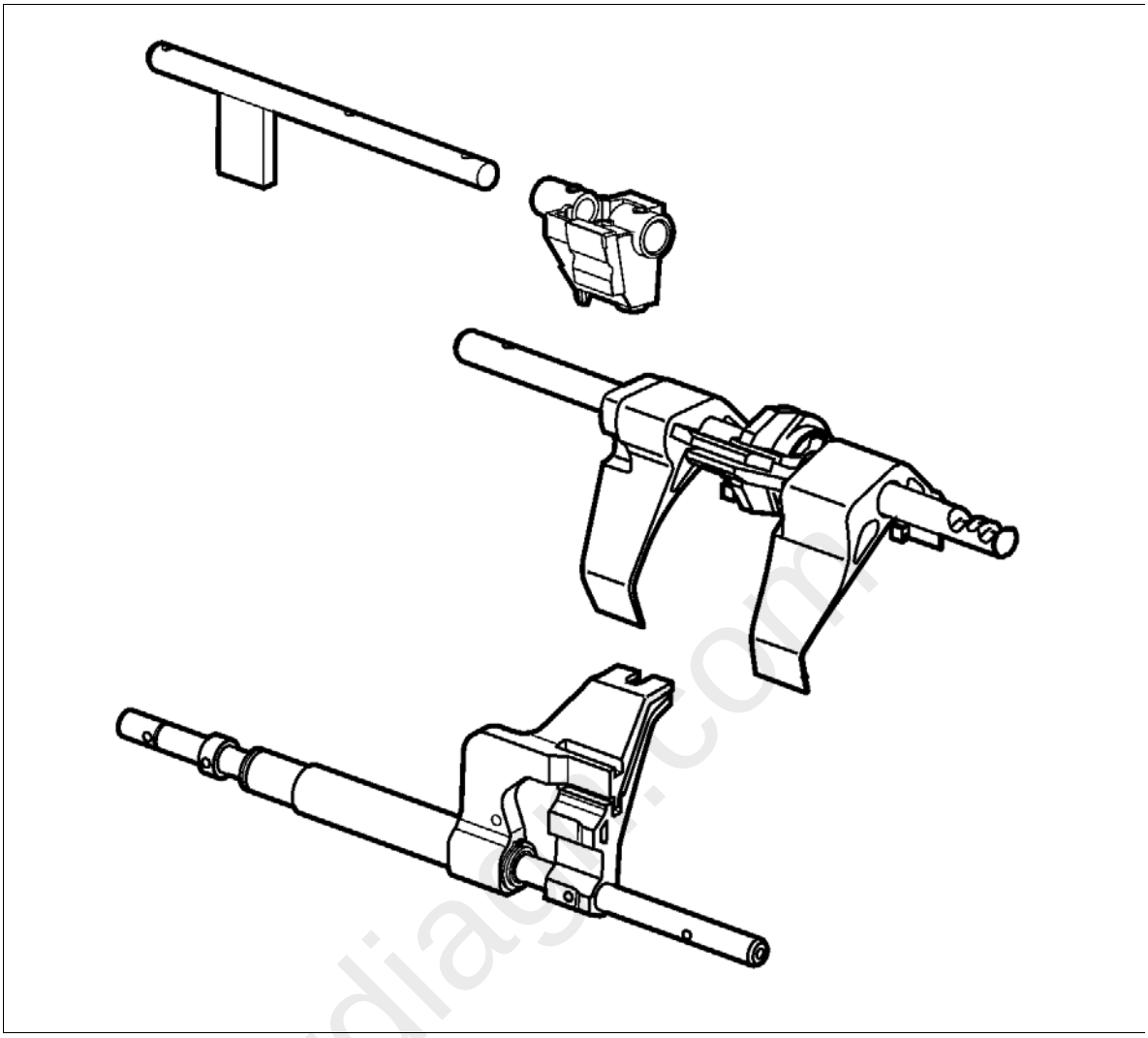
Do not replace the bushings unless inspection shows bushing damage.

7. Remove the shift shaft bushings (1, 3) from the 5th/6th and reverse shift lever (2) using the **J 23907** slide hammer (5) and the **J 39439-2** remover (4).

REPAIR INSTRUCTIONS - OFF VEHICLE > SHIFT SHAFT AND FORK ASSEMBLIES CLEANING AND INSPECTION (MM6)

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Fig 1: Shift Shaft & Fork Assembly Parts



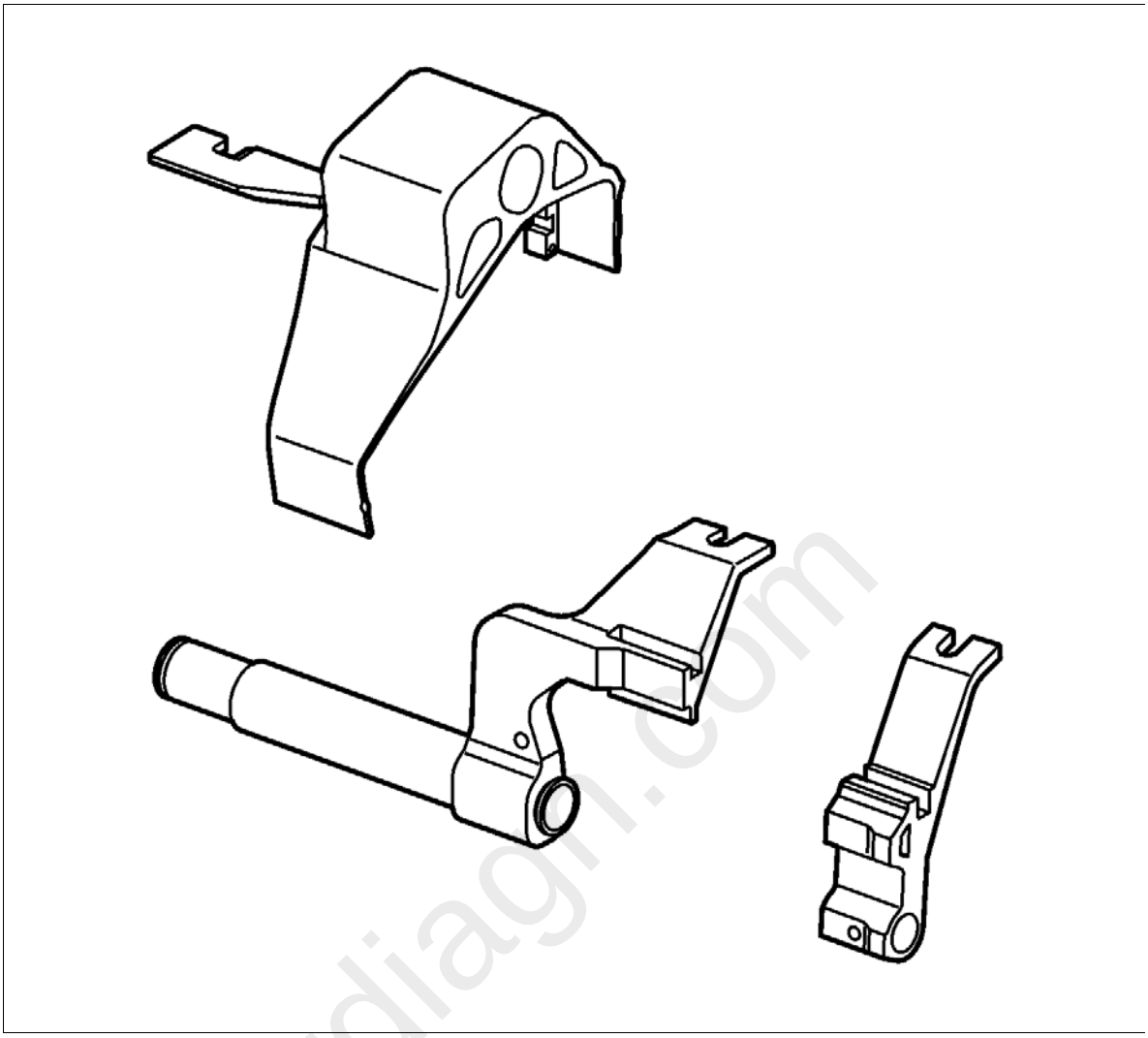
Courtesy of GENERAL MOTORS COMPANY

WARNING:

Wear safety glasses to avoid injury when using compressed air or any cleaning solvent. Bodily injury may occur if fumes are inhaled or if skin is exposed to chemicals.

1. Clean the shift shaft and fork assembly parts with a suitable solvent. Air dry all the parts.

Fig 2: Shift Forks And Shift Links

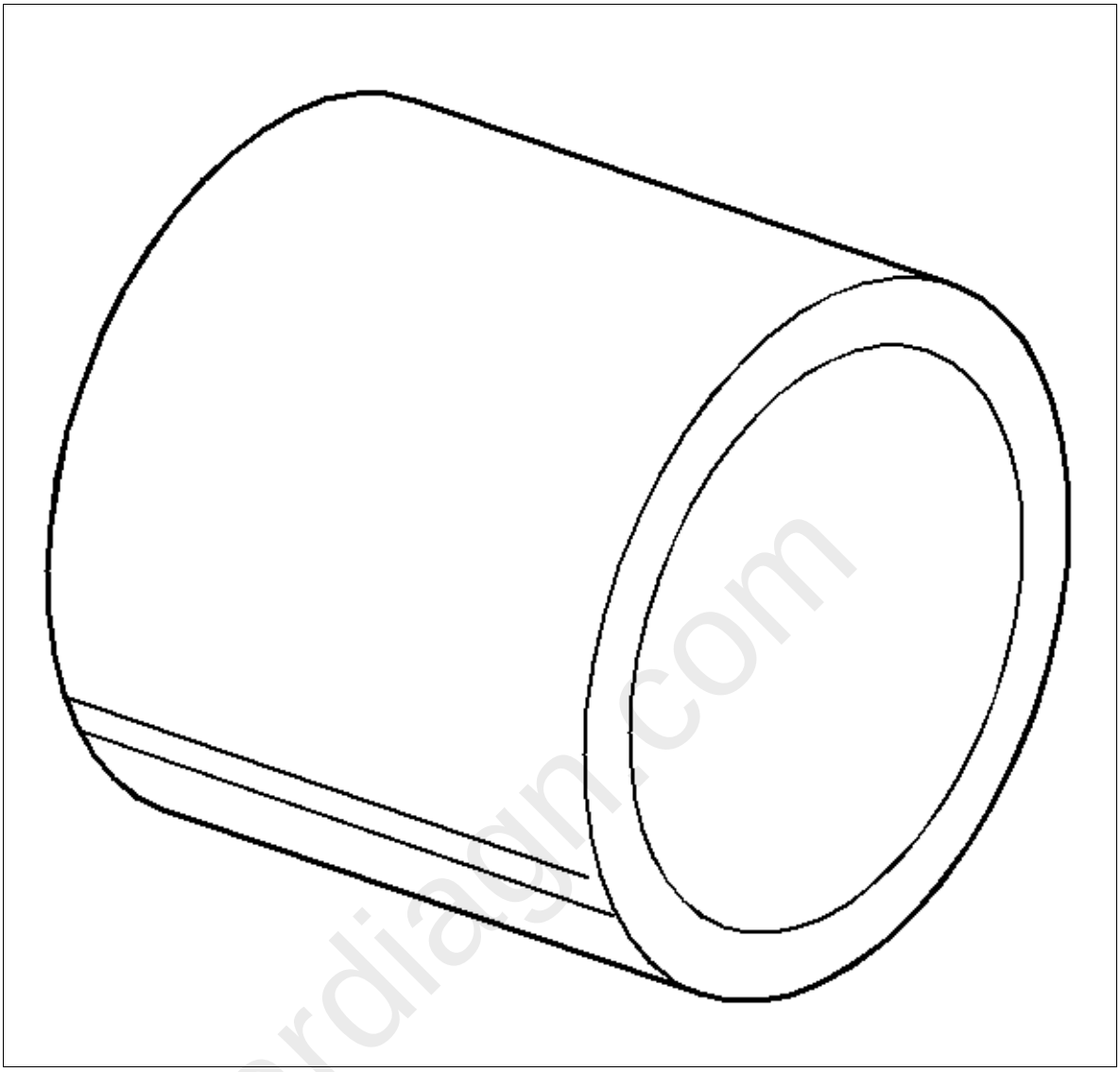


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2. Inspect the shift forks, shift levers, and the shift links for excessive wear, fractures or distortion.

Fig 3: Shift Shaft Lever Bushing

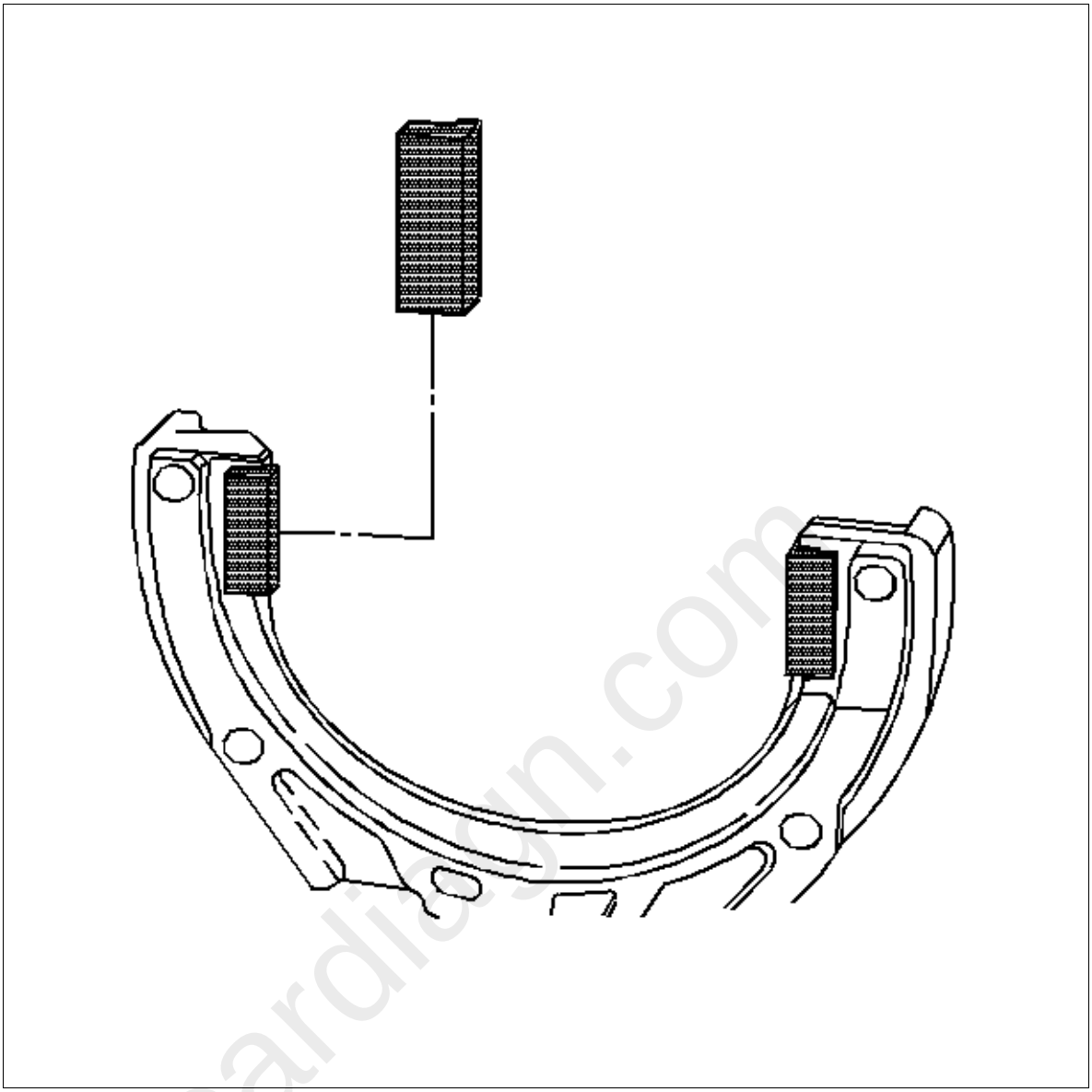


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3. Inspect the shift shaft lever bushings for excessive wear.

Fig 4: Inspection Areas On Shift Fork Nylon Inserts

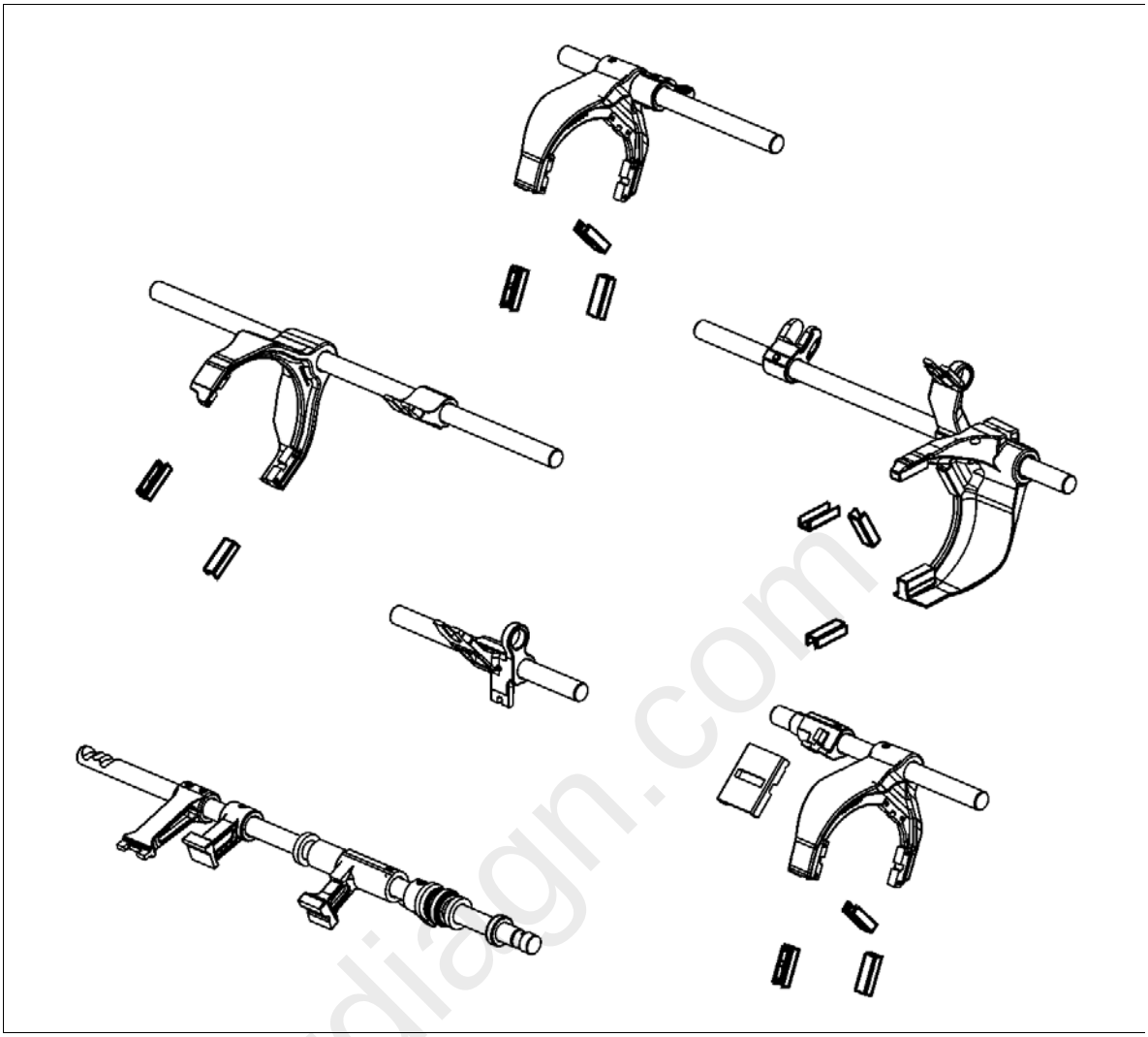


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4. Inspect the shift fork nylon inserts for wear.
5. Replace parts that are fractured, excessively worn, or distorted.
6. Replace an excessively worn or burred shift shaft.

REPAIR INSTRUCTIONS - OFF VEHICLE > SHIFT SHAFT AND FORK ASSEMBLIES CLEANING AND INSPECTION (M13)

Fig 1: Shift Shaft & Fork Assembly Components



Courtesy of GENERAL MOTORS COMPANY

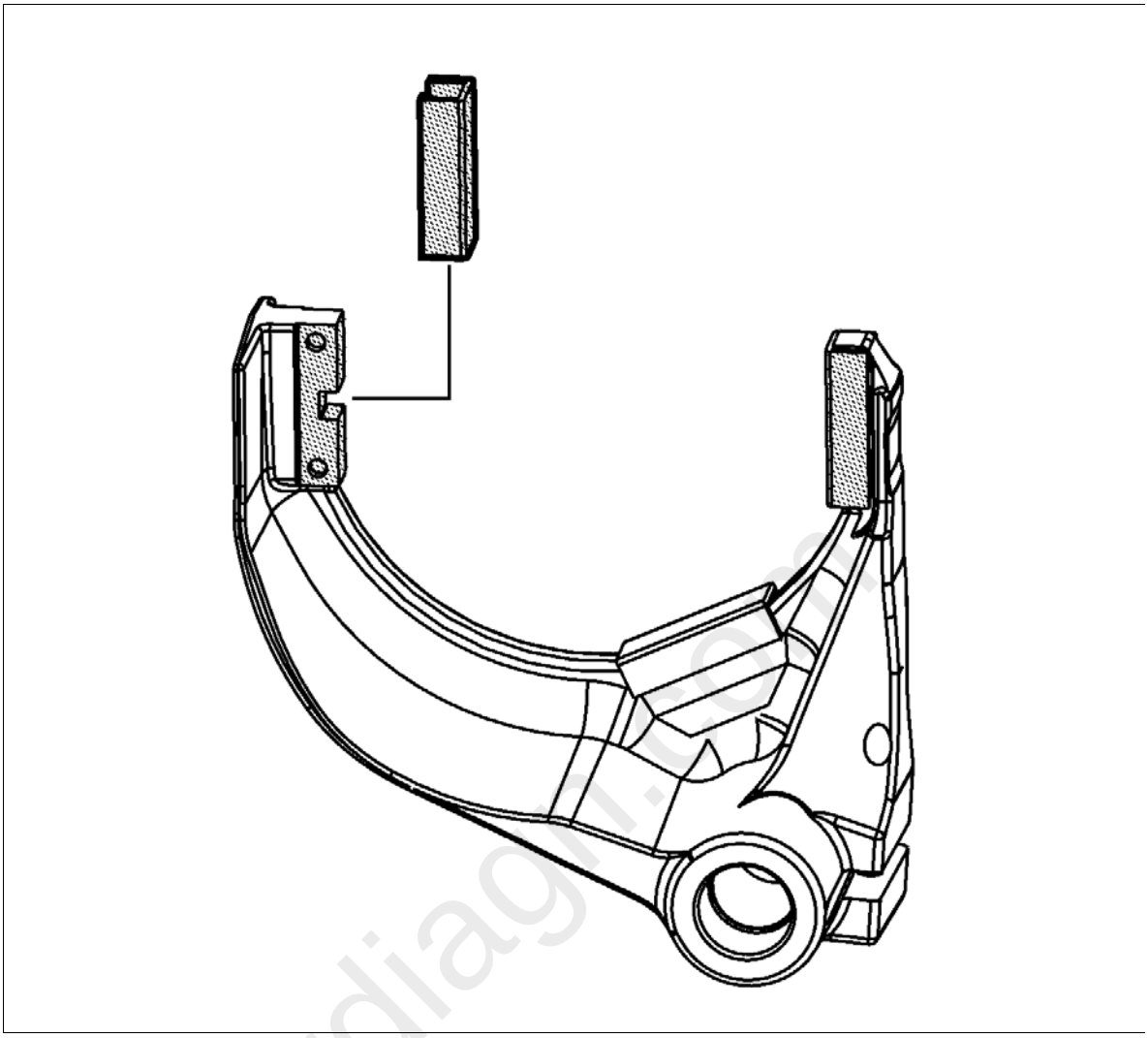
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WARNING:

Wear safety glasses to avoid injury when using compressed air or any cleaning solvent. Bodily injury may occur if fumes are inhaled or if skin is exposed to chemicals.

1. Clean the shift shaft and fork assembly parts with a suitable solvent. Air dry all the parts.
2. Inspect the shift forks, shift levers, and the shift links for excessive wear, fractures or distortion.

Fig 2: Shift Shaft & Fork Assembly Cleaning & Inspection Points



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3. Inspect the shift fork nylon inserts for wear.
4. Replace parts that are fractured, excessively worn, or distorted.
5. Replace an excessively worn or burred shift shaft.

REPAIR INSTRUCTIONS - OFF VEHICLE > SHIFT SHAFT AND FORK ASSEMBLIES ASSEMBLE (MM6)

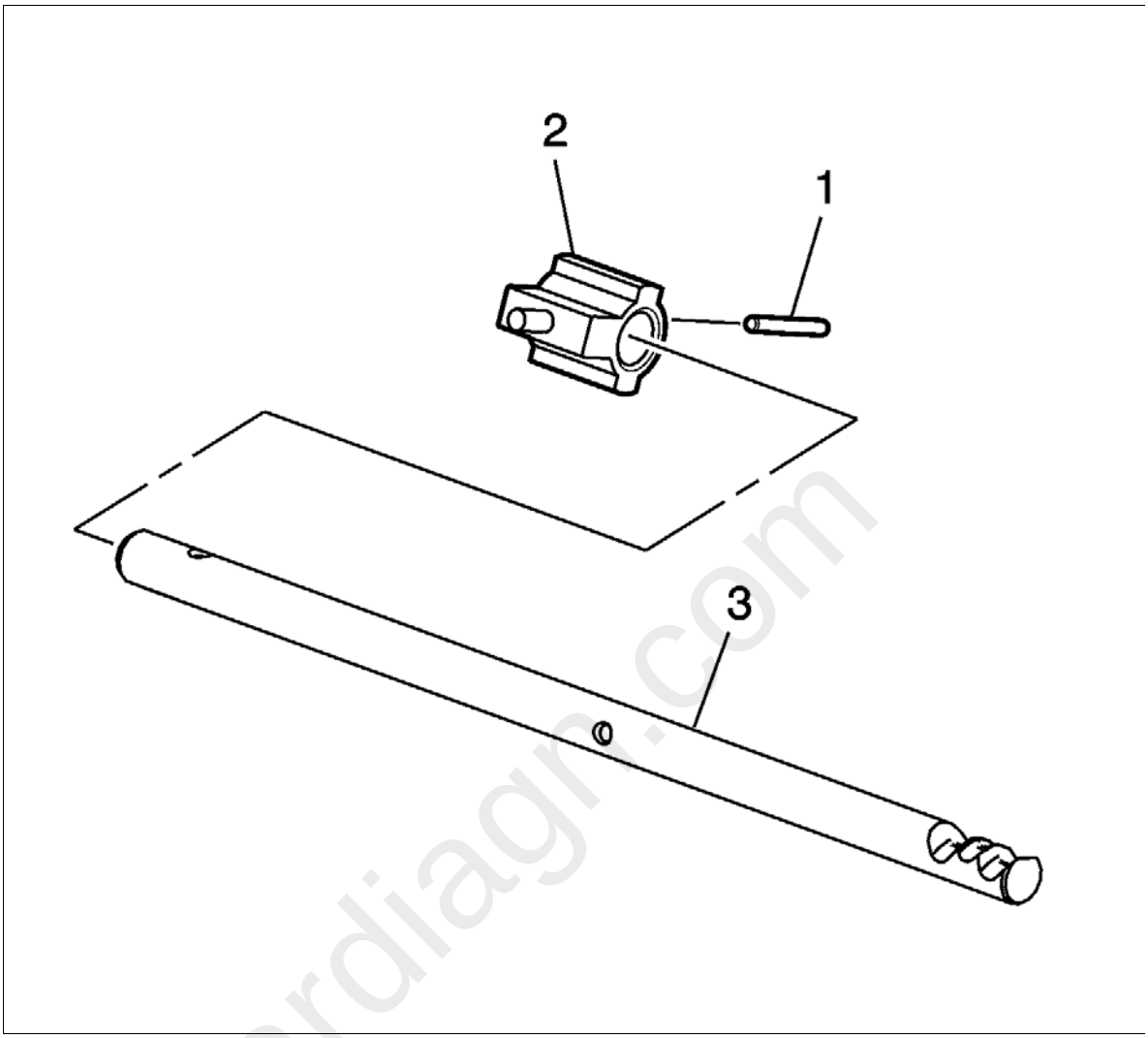
Special Tools

- **J 36850** Transjel Lubricant
- **J 39437** Bushing Installer

For equivalent regional tools, refer to Special Tools (MM6) .

1st/2nd, 3rd/4th Shift Rail Assembly

Fig 1: Selector Roll Pin, Selector Pin & Shift Shaft

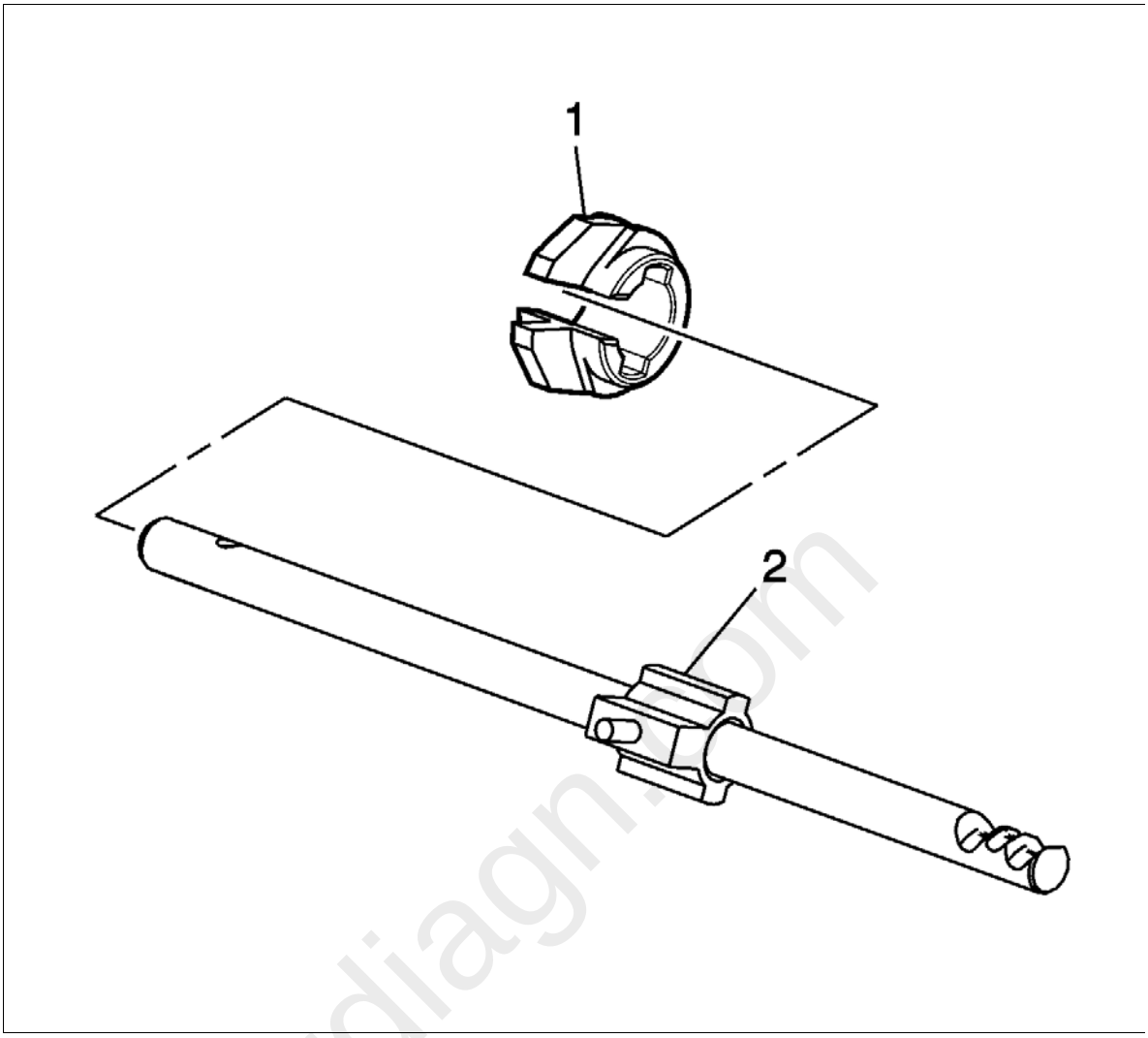


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1. Install the selector pin (2) on the shift shaft (3).
2. Align the roll pin hole on the selector pin with the roll pin hole on the shift shaft.
3. Install the roll pin (1) through the selector pin (2) and the shift shaft (3).

Fig 2: Interlock Plate & Selector Pin



Courtesy of GENERAL MOTORS COMPANY

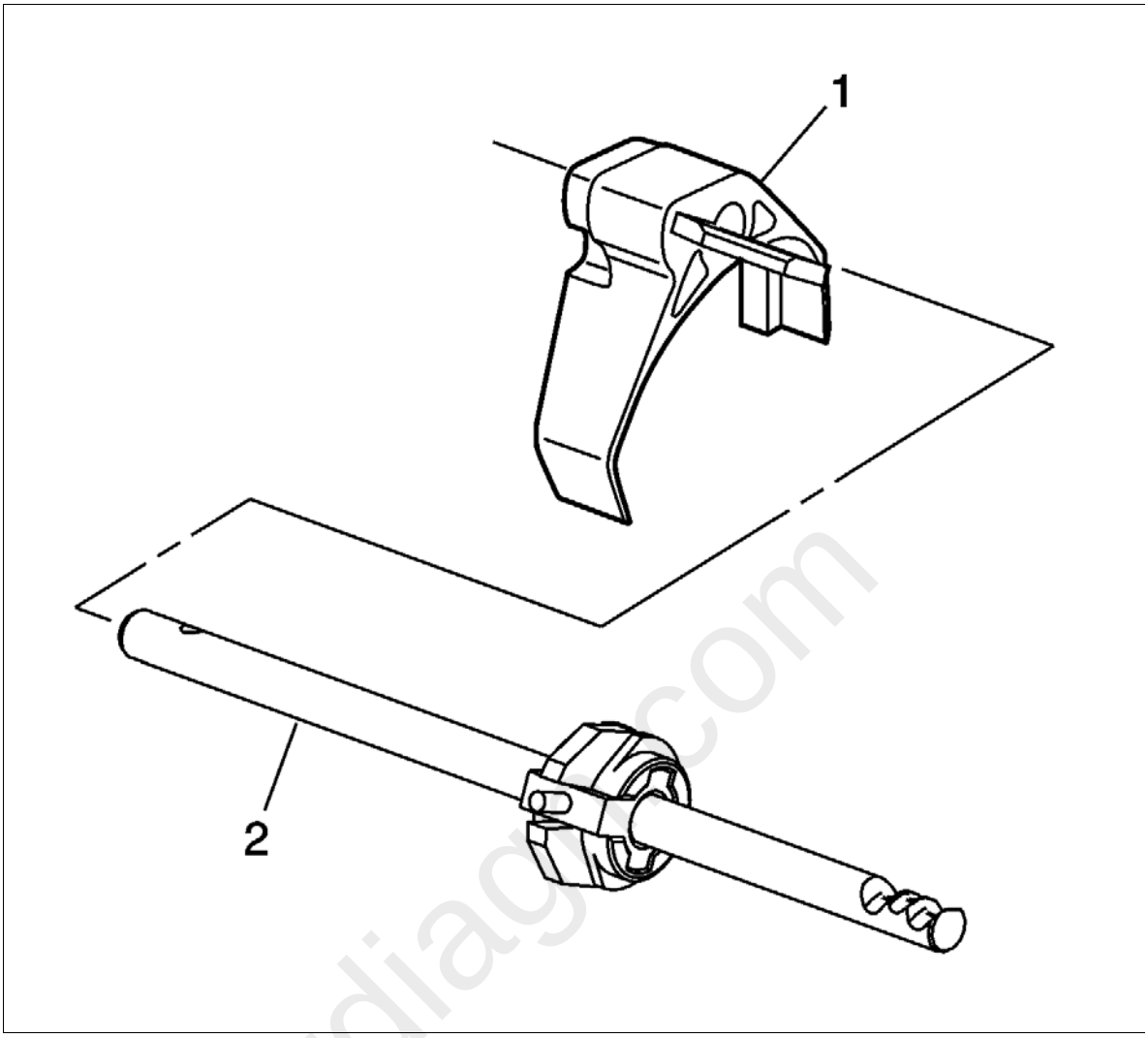
NOTE:

The interlock plate fits loosely on the shift shaft and selector pin assembly. Use the ***J 36850*** *transjel lubricant to hold the neutral return cam pin in place.*

4. Install the interlock plate (1) on the selector pin (2).

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Fig 3: 3rd/4th Shift Fork & Shift Shaft

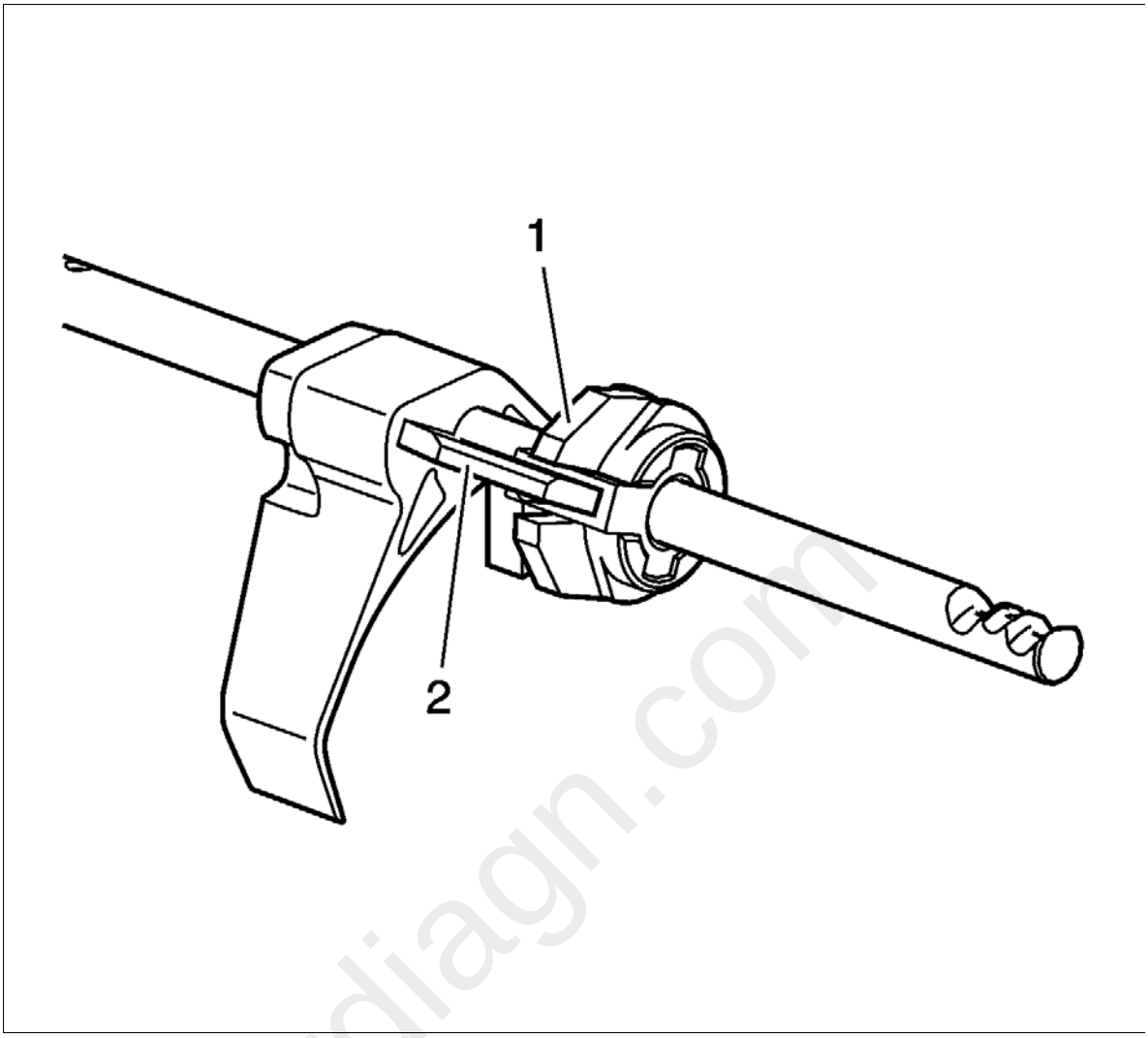


Courtesy of GENERAL MOTORS COMPANY

5. Install the 1st/2nd shift fork (1) on the shift shaft (2).

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Fig 4: Aligning Notch On Shift Link With Shift Interlock Plate

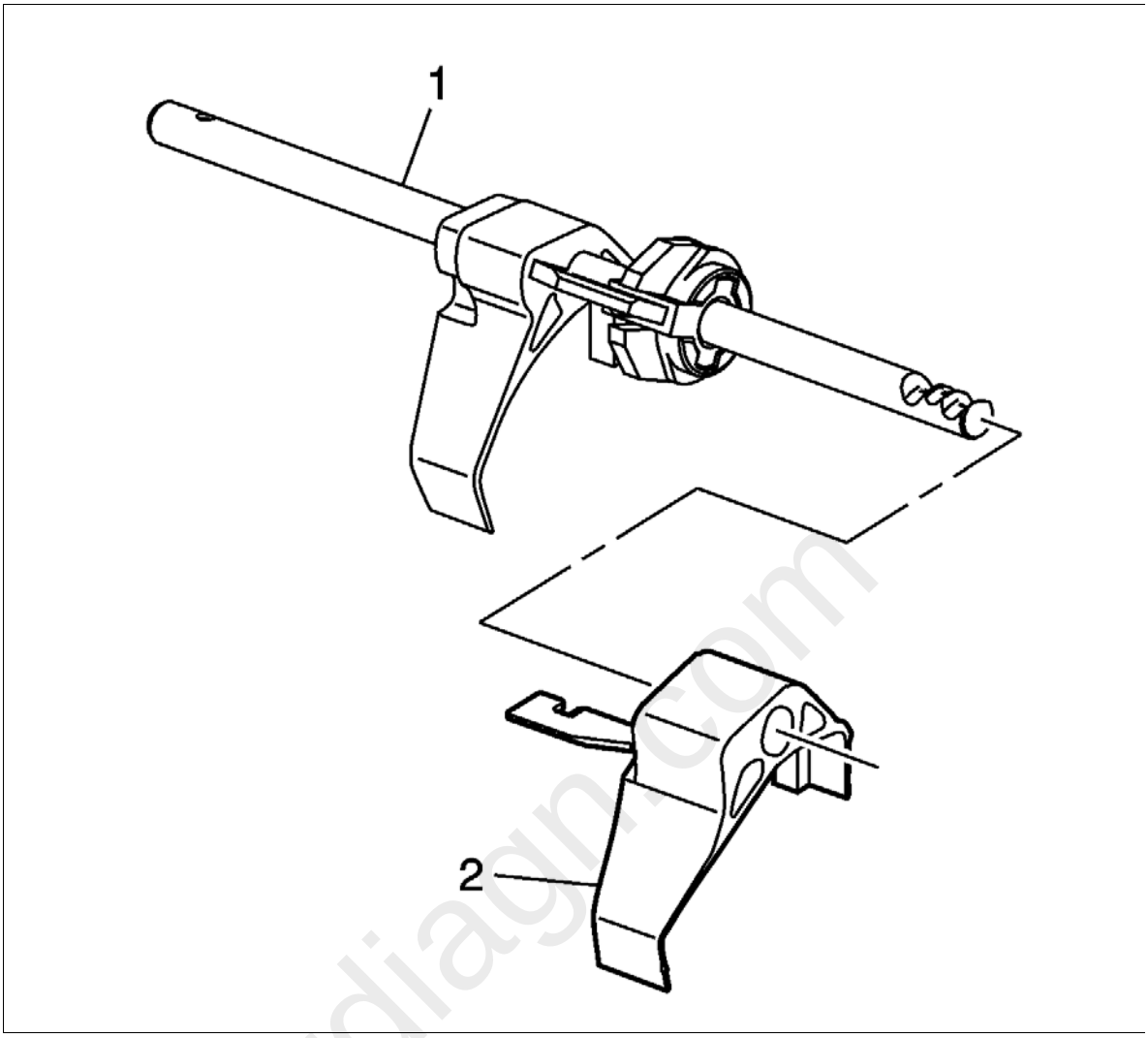


Courtesy of GENERAL MOTORS COMPANY

6. Align the notch on the shift link (2) with the shift interlock plate (1).

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Fig 5: 1st/2nd Shift Fork & Shift Shaft

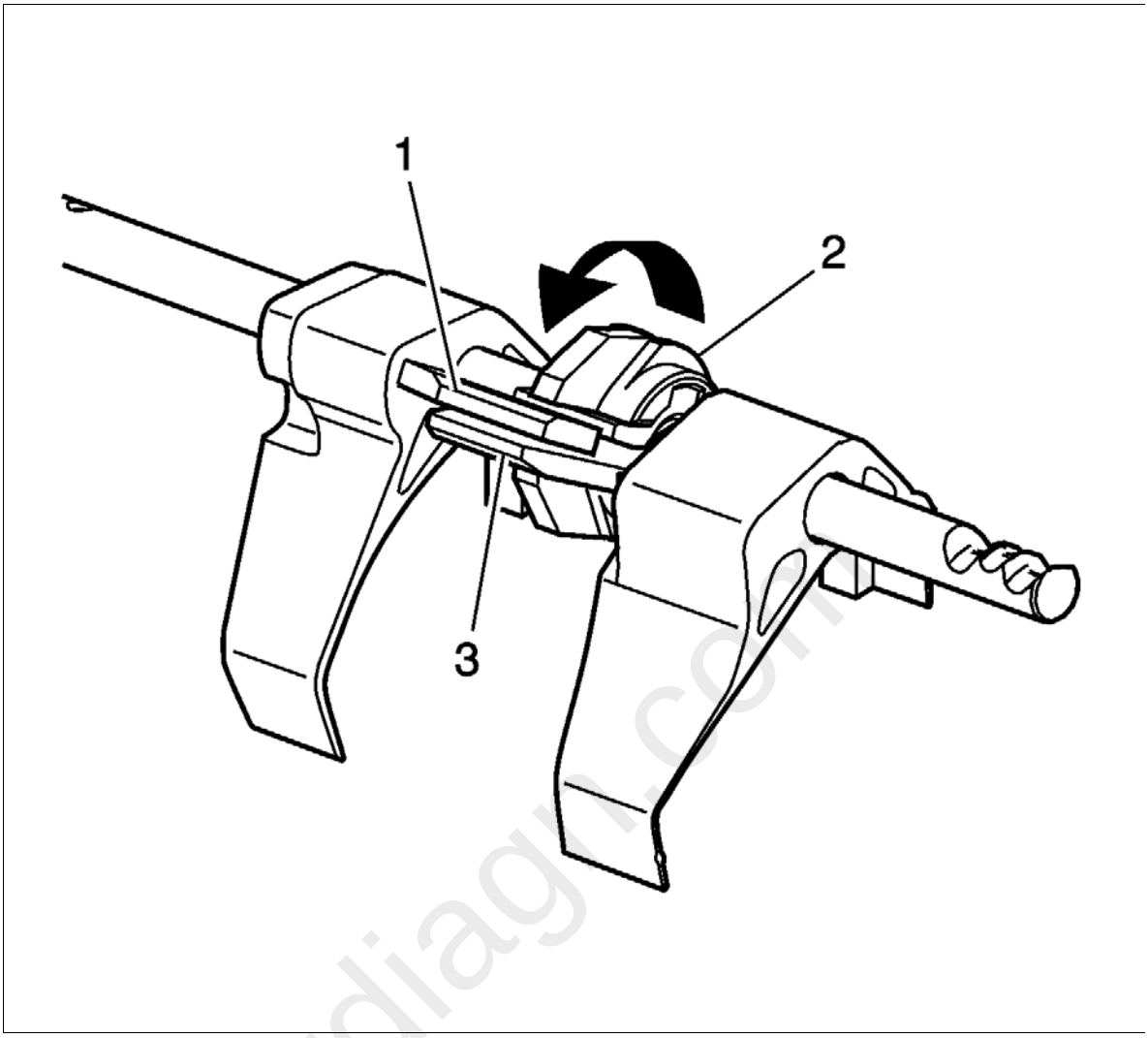


Courtesy of GENERAL MOTORS COMPANY

7. Install the 3rd/4th shift fork (2) on the shift shaft (1).

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Fig 6: 1st/2nd Shift Shaft Link

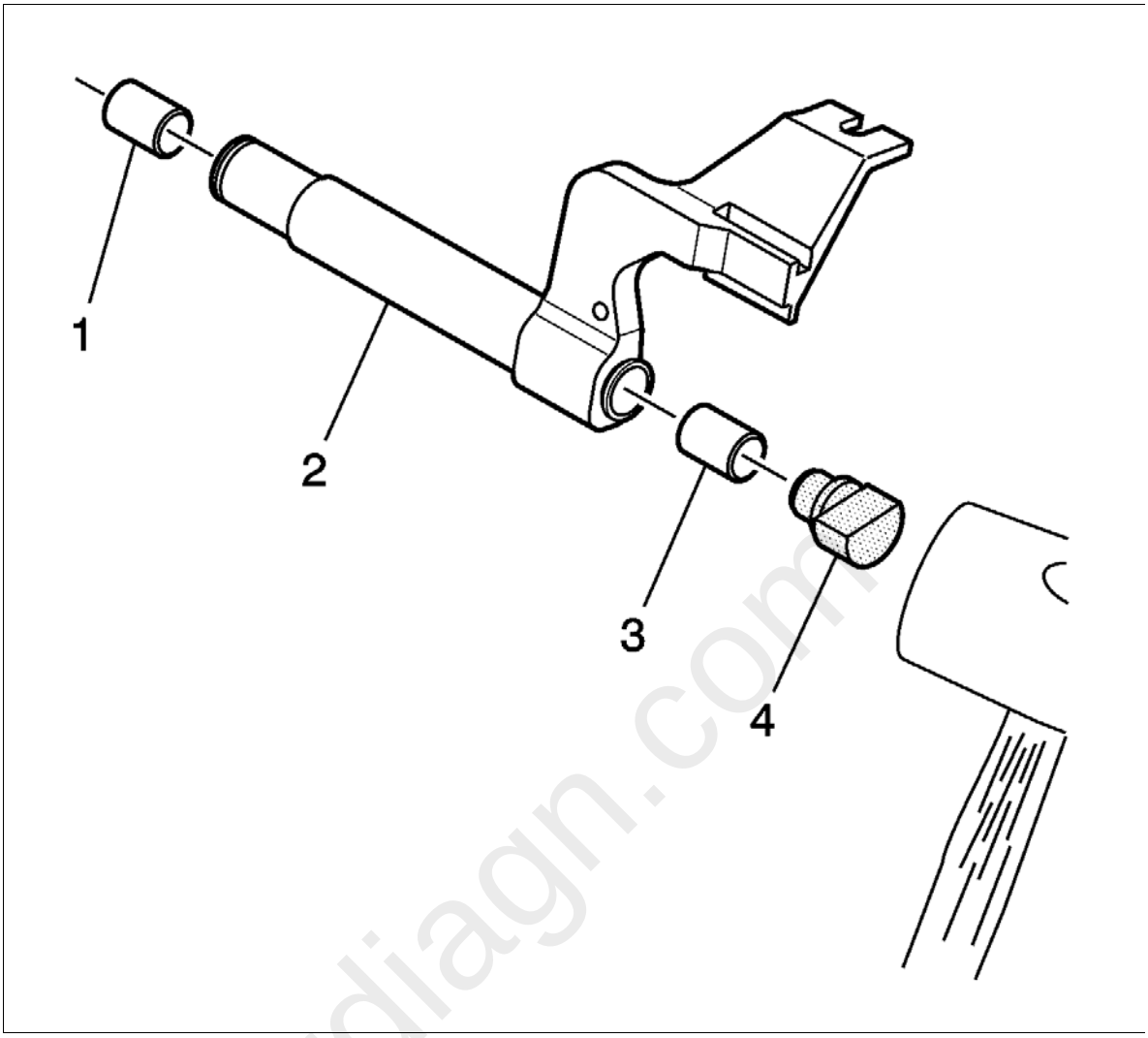


Courtesy of GENERAL MOTORS COMPANY

8. Install the 3rd/4th shift shaft link (3) beneath the 1st/2nd shift shaft link (1) on the interlock plate and the selector roll pin assembly (2).

5th/6th, Reverse Shift Rail Assembly

Fig 7: 5th/6th Shift Shaft Lever Bushings And Lever

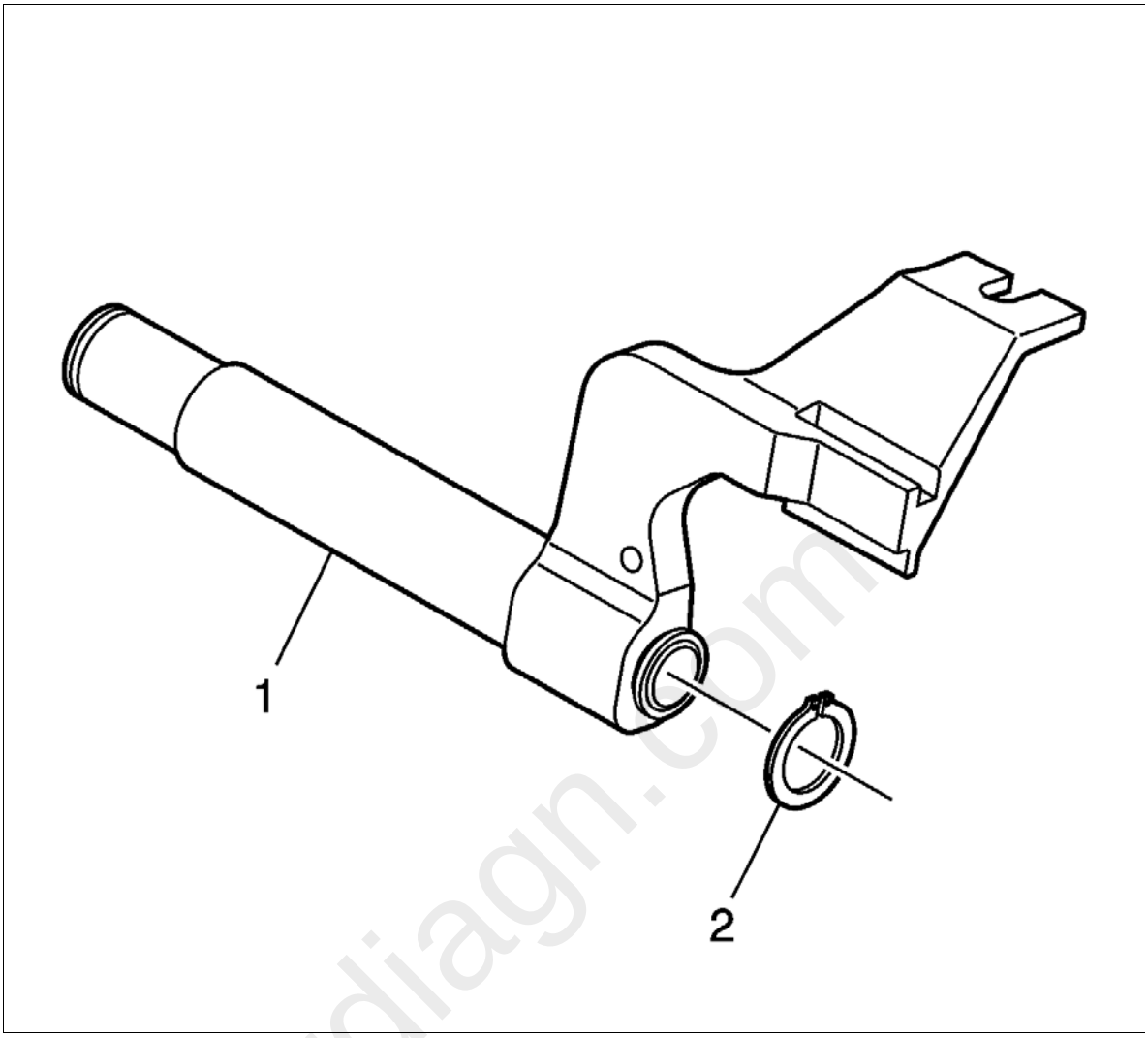


Courtesy of GENERAL MOTORS COMPANY

1. Install the 5th/6th shift shaft lever bushings (1) and (3) in the 5th/6th shift lever (2) using the **J 39437** bushing installer (4) and a hammer.

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Fig 8: Retainer Ring & 5th/6th Shift Lever

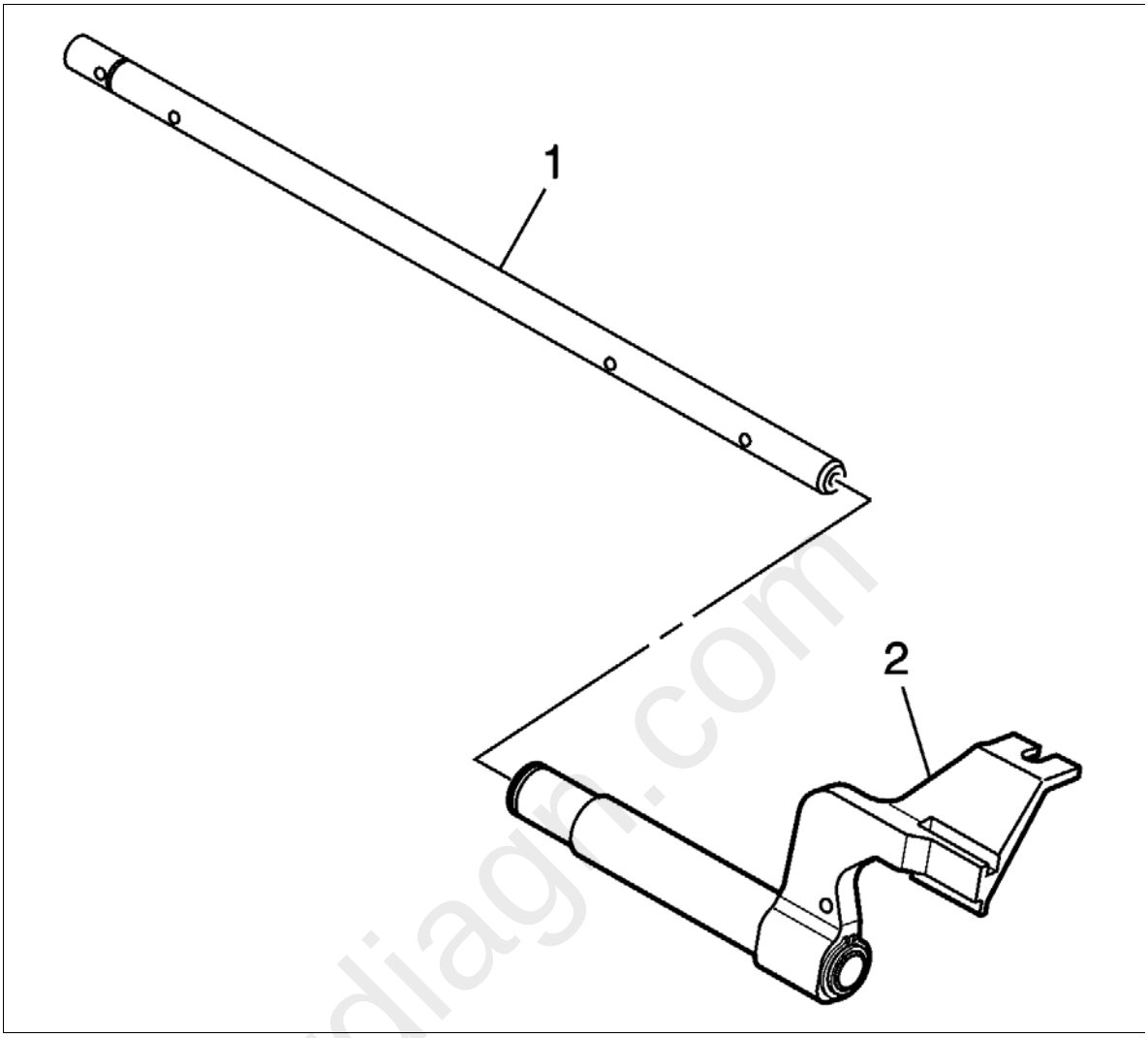


Courtesy of GENERAL MOTORS COMPANY

2. Install the retainer ring (2) on the 5th/6th shift lever (1).

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Fig 9: 5th/6th Shift Lever & Shift Shaft

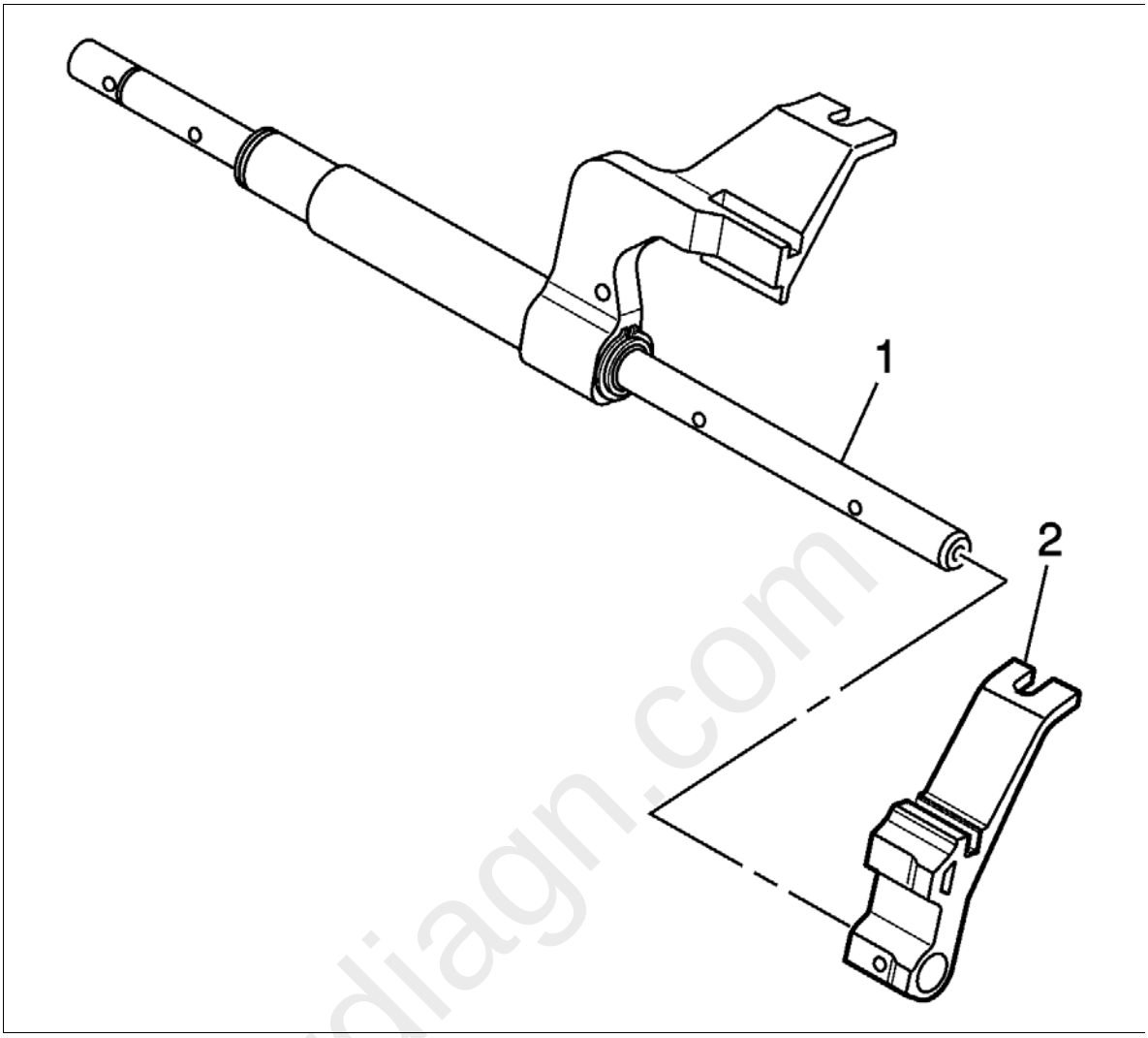


Courtesy of GENERAL MOTORS COMPANY

3. Install the 5th/6th shift lever (2) on the shift shaft (1).

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Fig 10: Reverse Shift Lever On The Shift Shaft

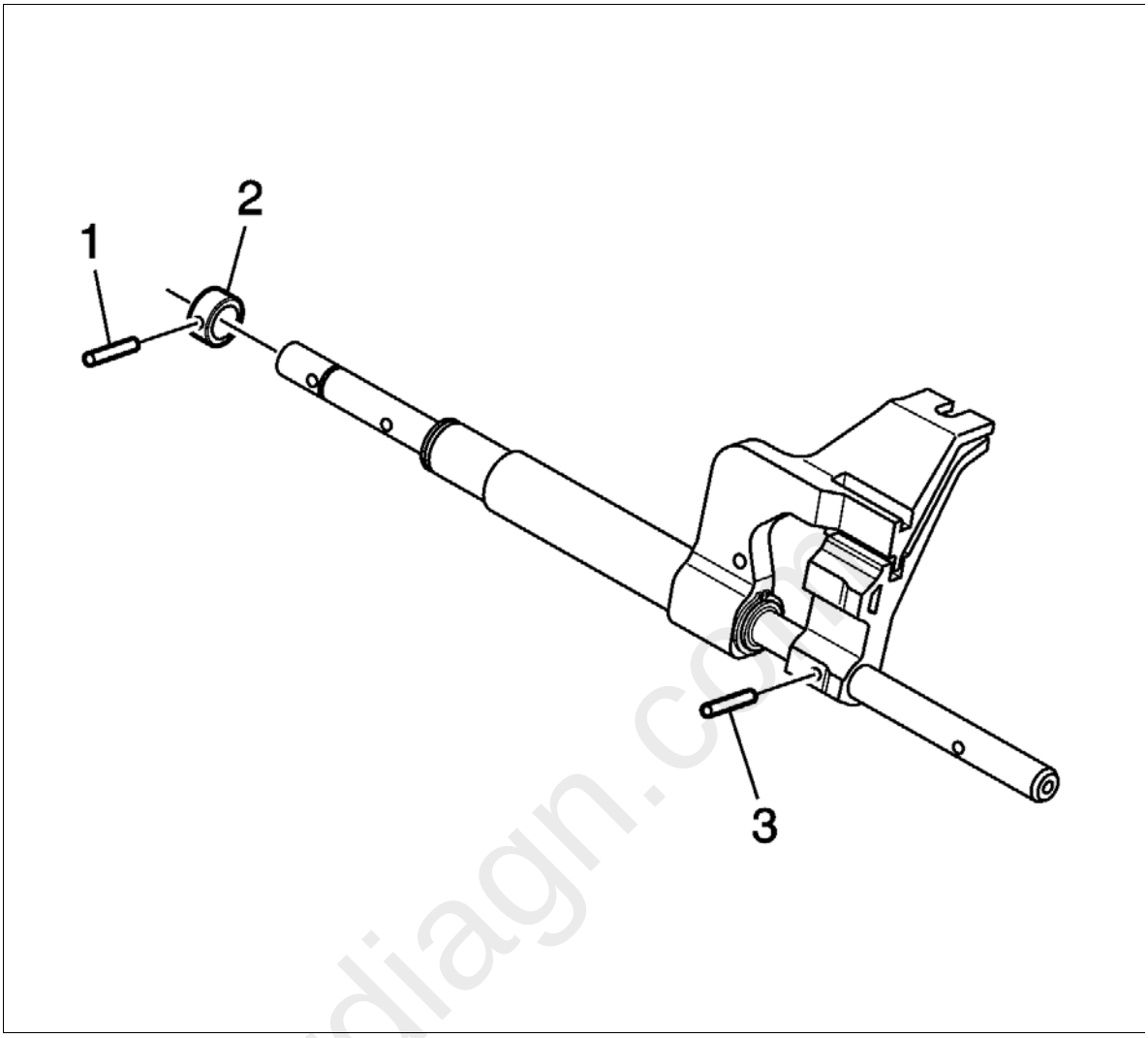


Courtesy of GENERAL MOTORS COMPANY

4. Install the reverse shift lever (2) on the shift shaft (1).

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Fig 11: Reverse Lever Roll Pin



Courtesy of GENERAL MOTORS COMPANY

5. Install the reverse lever roll pin (3).
6. Install the reverse collar (2).
7. Install the reverse collar roll pin (1).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION CASE AND CLUTCH HOUSING DISASSEMBLE (MM6)

Special Tools

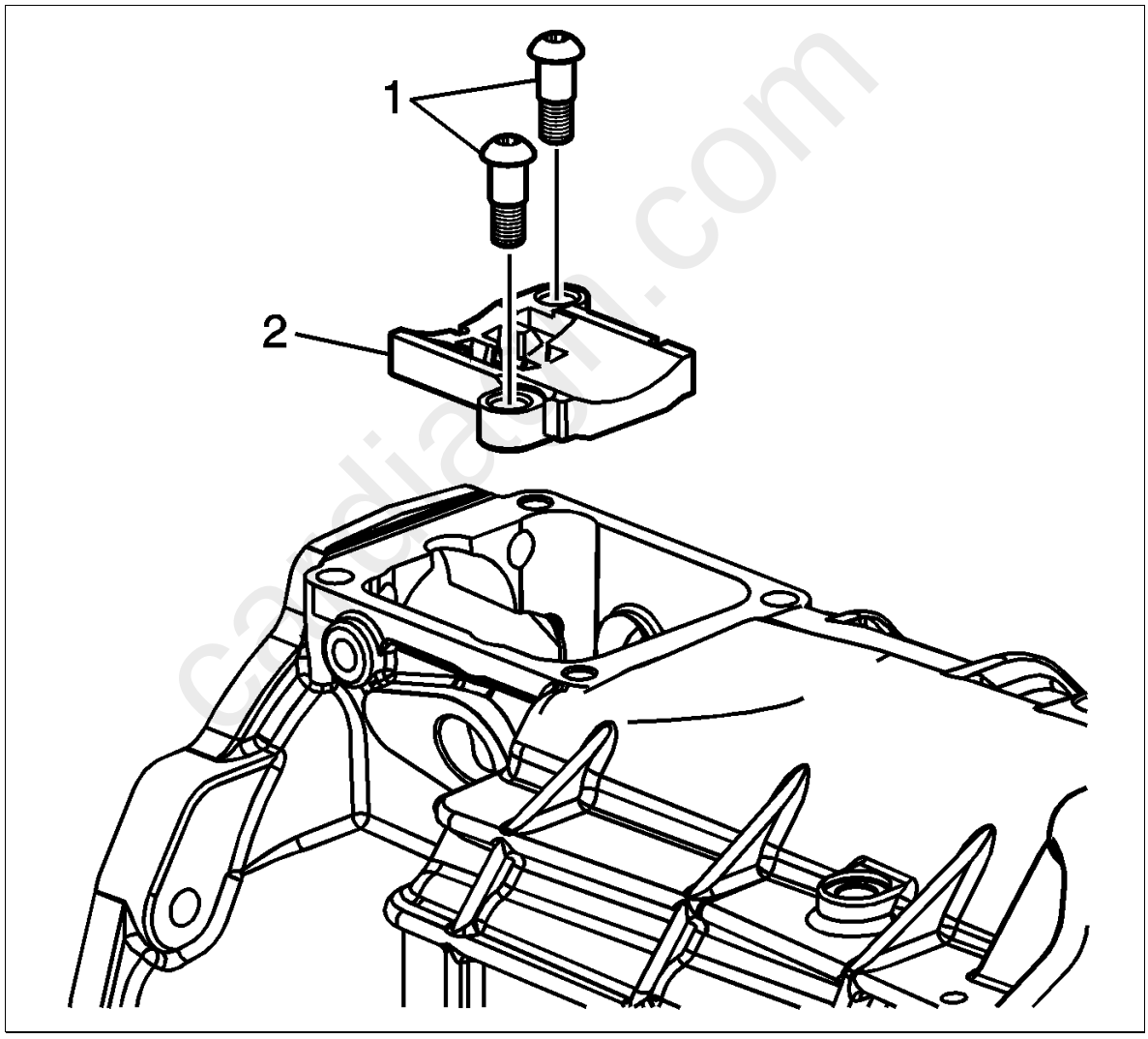
- **DT 49216** Bushing Remover
- **J 8092** Drive Handle
- **J 36190** Driver Handle

- **J 39439-2** Bushing Remover
- **J 39790-A** Mainshaft Bearing Race Remover
- **J 44384** Shift Fork Bearing Installer
- **J 45124** Removal Bridge

For equivalent regional tools, refer to Special Tools (MM6) .

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION CASE AND CLUTCH HOUSING DISASSEMBLE (MM6) > GUIDE PLATE REMOVAL

Fig 1: Detent Guide Plate & Attaching Bolts

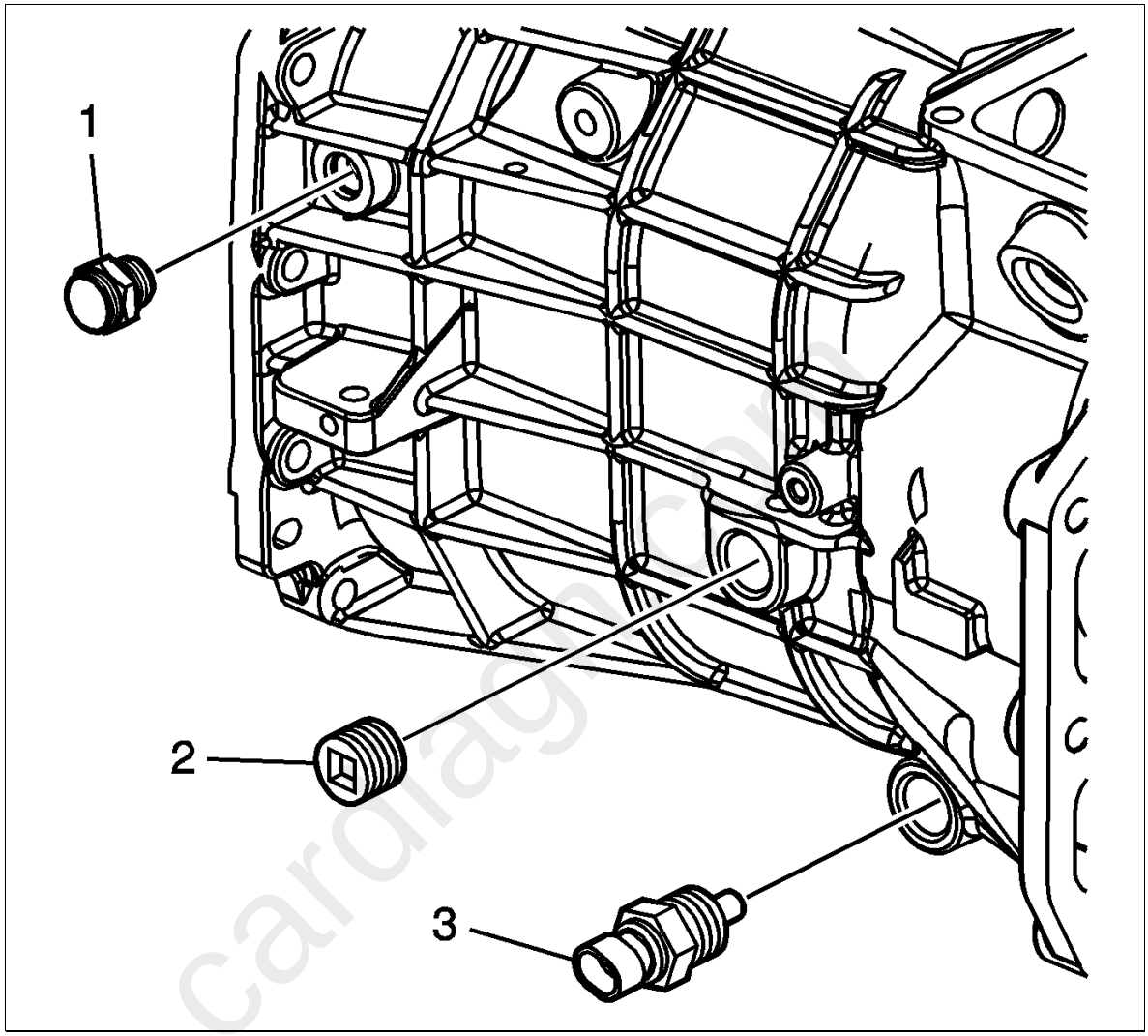


Courtesy of GENERAL MOTORS COMPANY

1. Remove the detent guide plate attaching bolts (1).
2. Remove the detent guide plate (2).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION CASE AND CLUTCH HOUSING DISASSEMBLE (MM6) > TRANSMISSION CASE

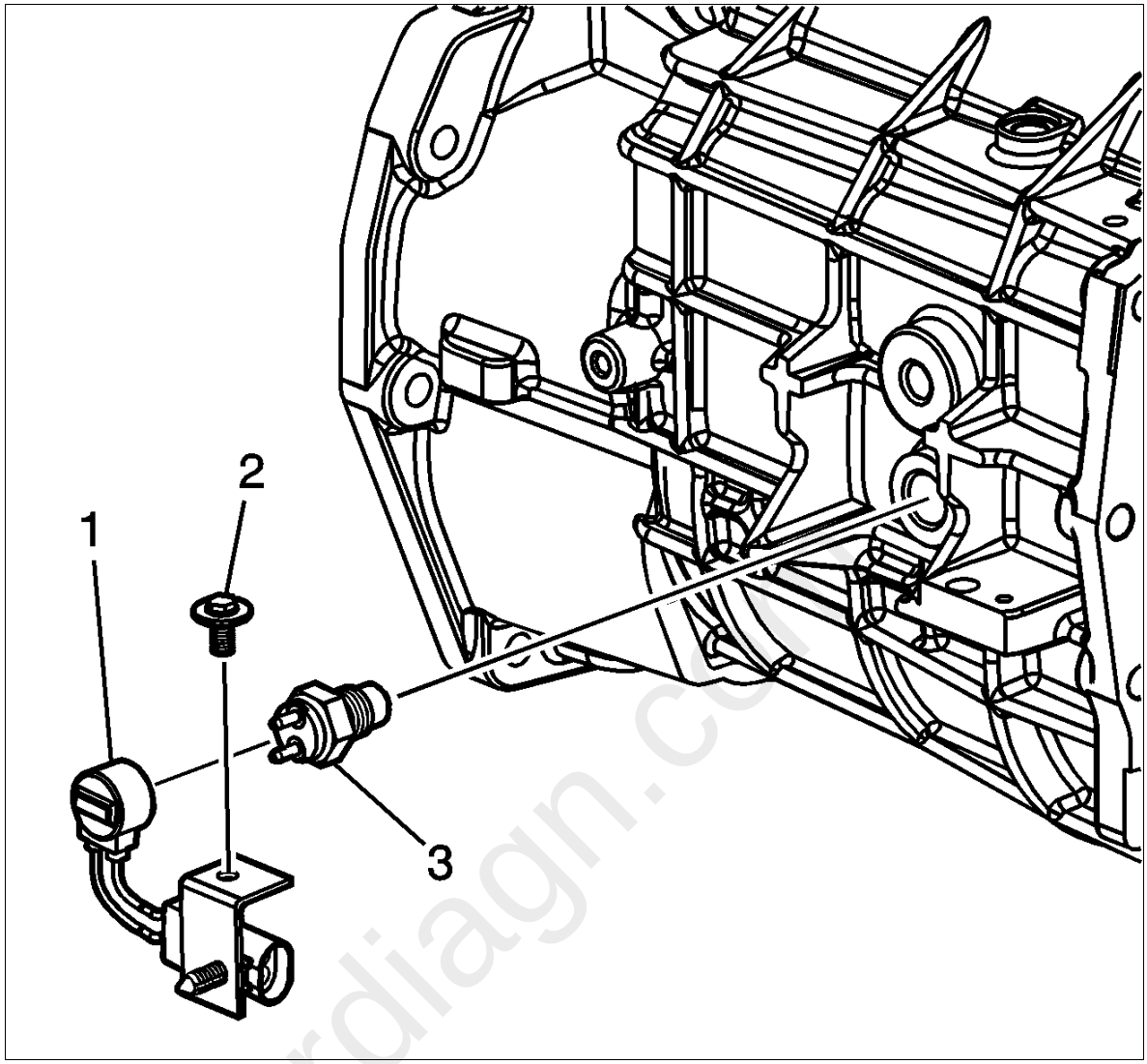
Fig 1: Cooler Line Return Fitting, Fill Plug & Coolant Temperature Sensor



Courtesy of GENERAL MOTORS COMPANY

1. Remove the cooler line return fitting (1).
2. Remove the transmission case fill plug (2).
3. Remove the coolant temperature sensor (3).

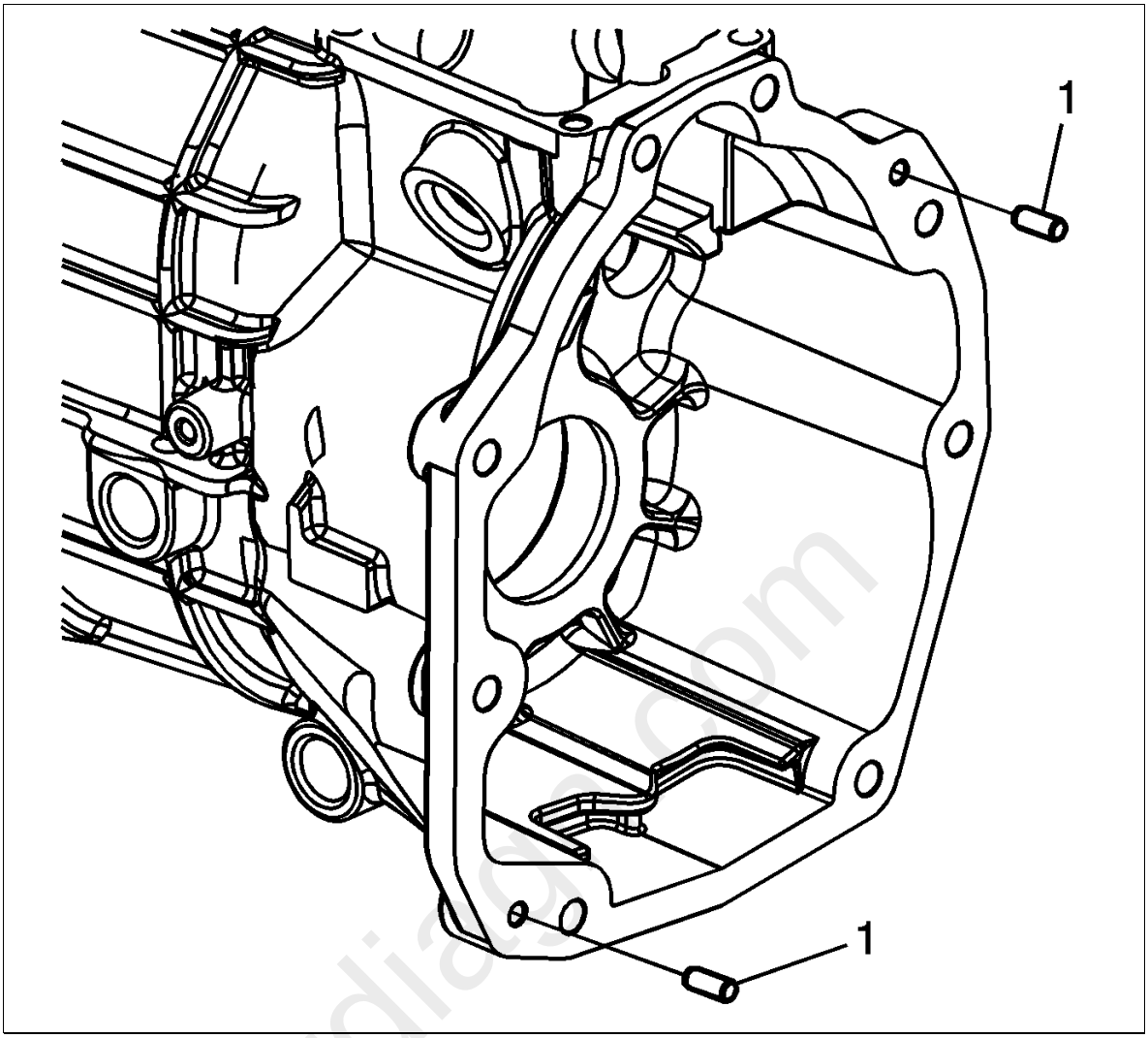
Fig 2: Backup Lamp Switch Components



Courtesy of GENERAL MOTORS COMPANY

4. Remove the backup lamp switch connector harness bolt (2).
5. Remove the backup lamp switch connector harness (1).
6. Remove the backup lamp switch (3).

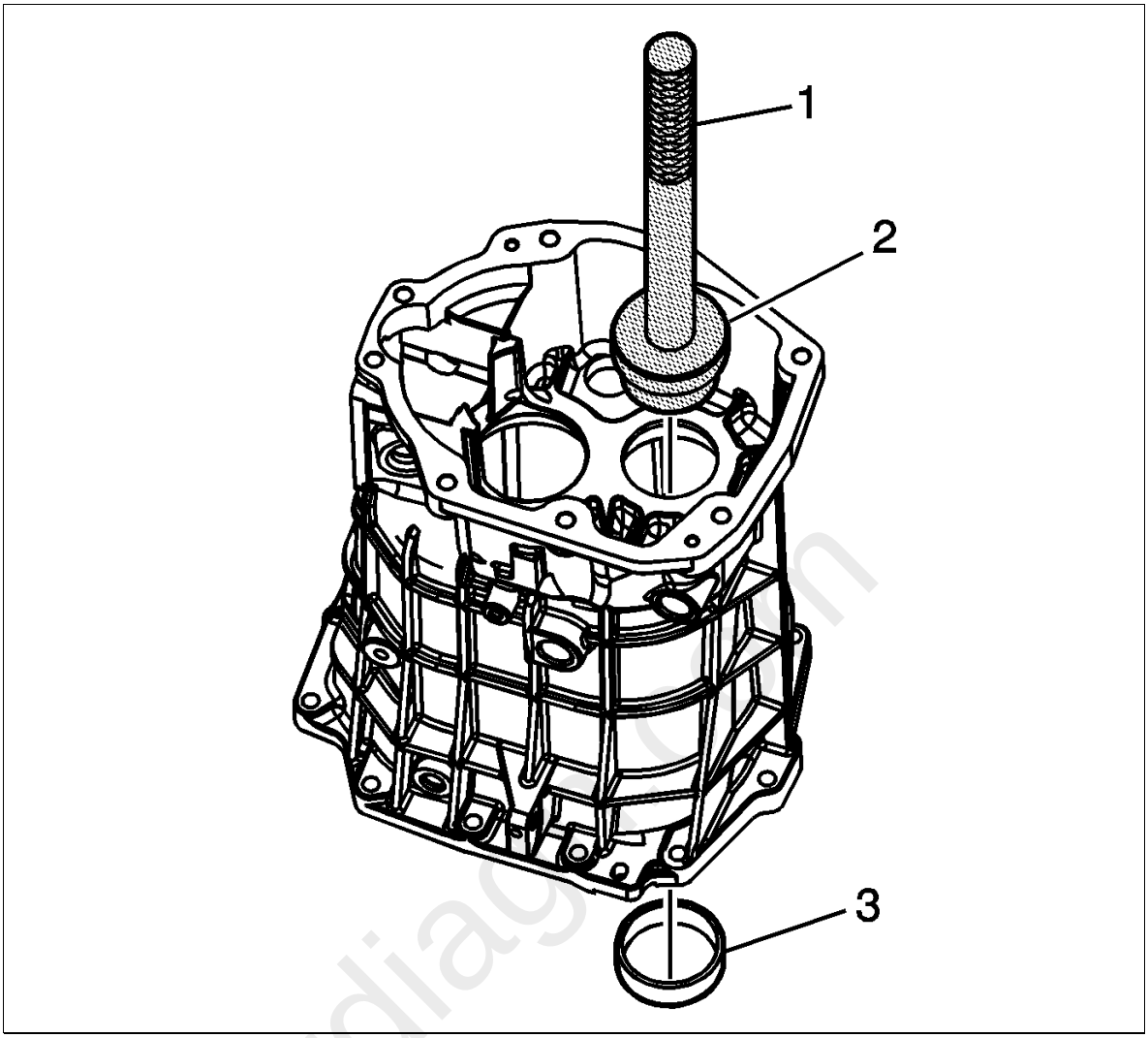
Fig 3: Dowel Pins



Courtesy of GENERAL MOTORS COMPANY

7. Remove the dowel pins (1).

Fig 4: Countershaft Bearing Race



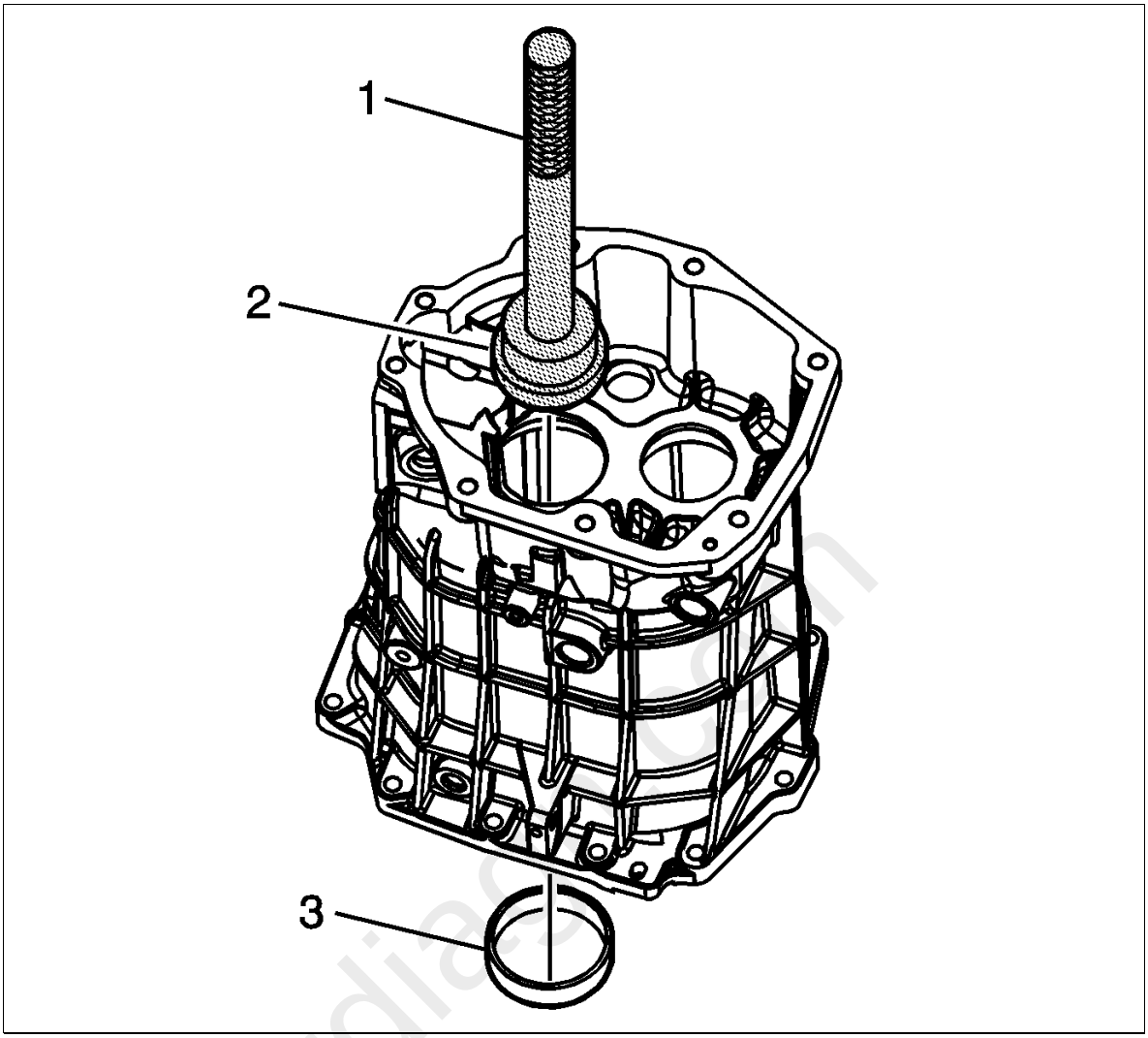
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Do not replace the bearing race unless inspection shows bearing race damage.

8. Remove the countershaft bearing race (3), using the **J 8092** drive handle (1) and the **J 39790-A** race remover (2).

Fig 5: Mainshaft Bearing Race



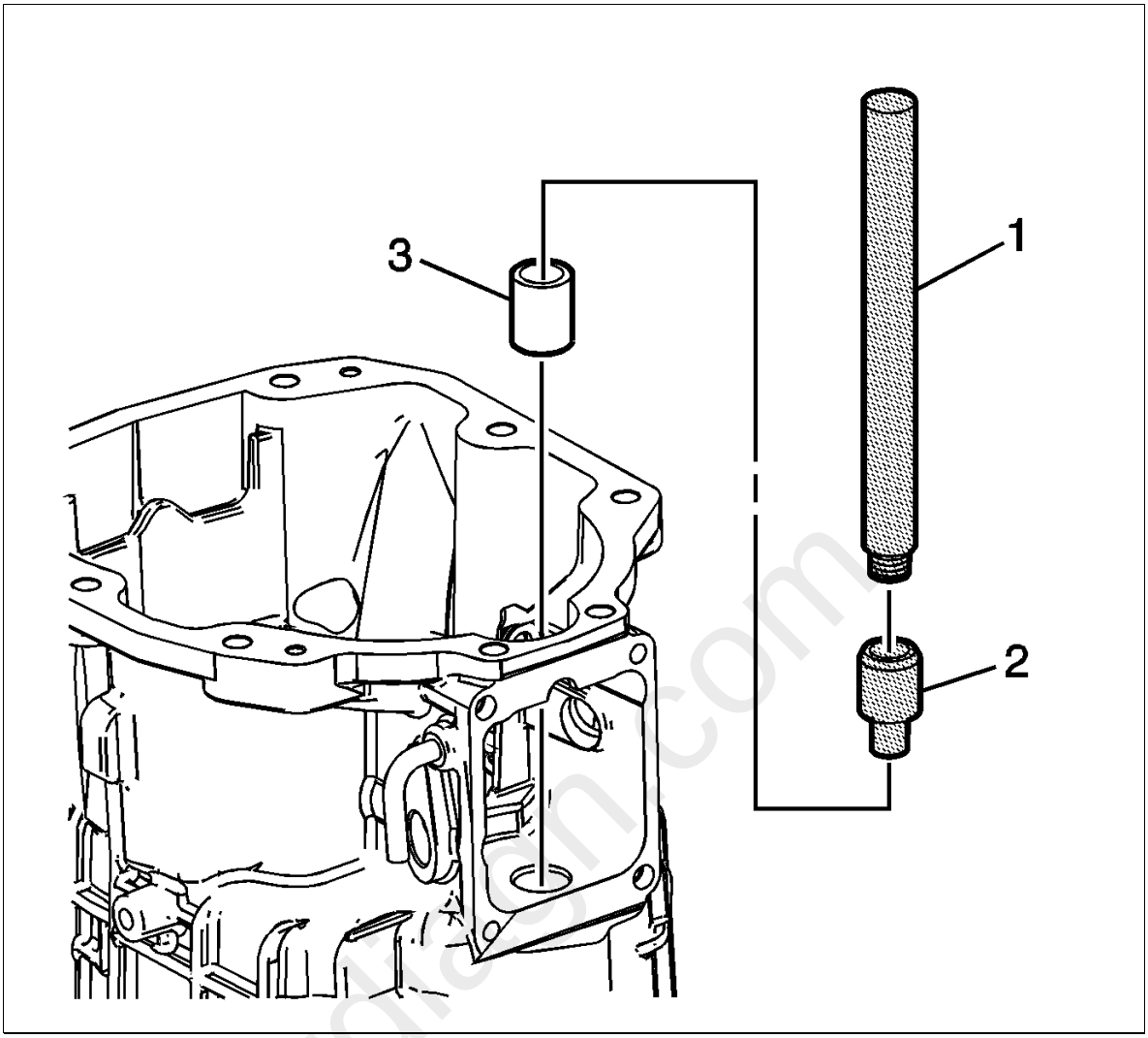
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Do not replace the bearing race unless inspection shows bearing race damage.

9. Remove the mainshaft bearing race (3), using the **J 8092** drive handle (1) and the **J 39790-A** race remover (2).

Fig 6: Ist/2nd & 3rd/4th Shift Shaft Bearing

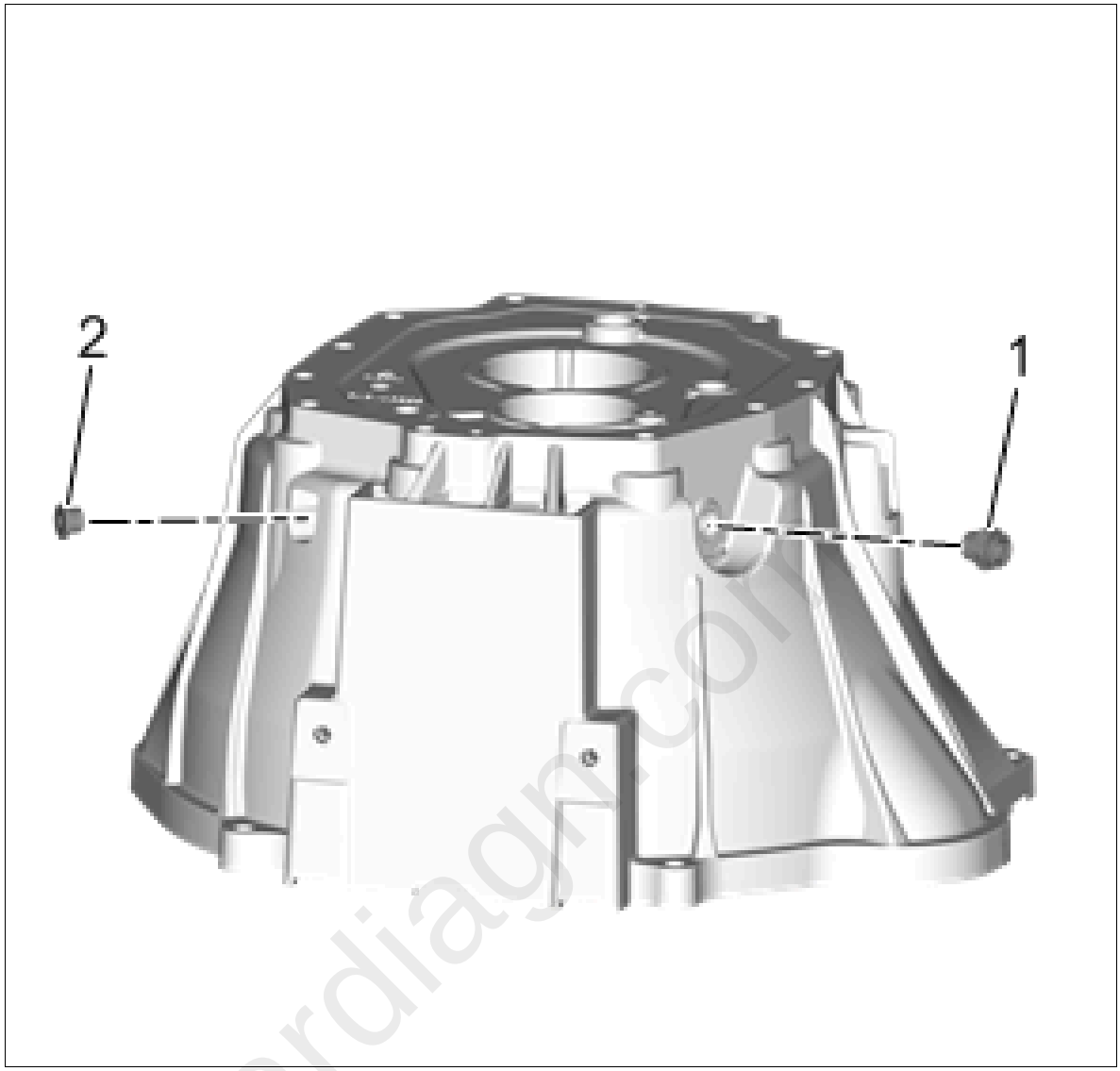


Courtesy of GENERAL MOTORS COMPANY

10. Remove the Ist/2nd and the 3rd/4th shift shaft bearing (3), using the **J 36190** driver handle (1) and the **J 44384** remover (2).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION CASE AND CLUTCH HOUSING DISASSEMBLE (MM6) > CLUTCH HOUSING

Fig 1: Pump Outlet Cooler Fitting With O-Ring And Transmission Fluid Pump Outlet Pipe Fitting

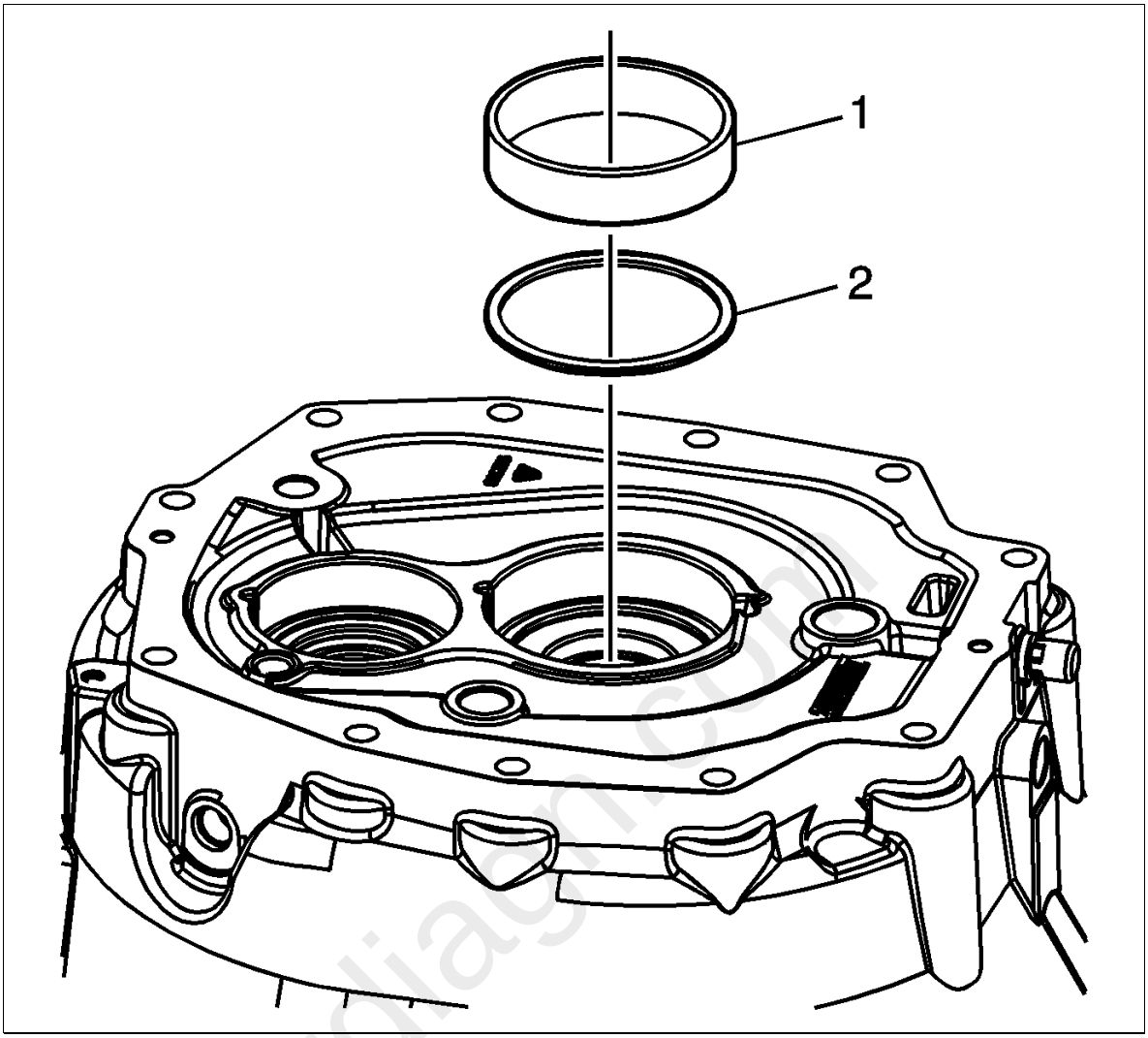


Courtesy of GENERAL MOTORS COMPANY

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1. Remove the pump outlet cooler fitting with o-ring (1).
2. Remove the transmission fluid pump outlet pipe fitting (2).

Fig 2: Input Shaft Bearing Race & Shim



Courtesy of GENERAL MOTORS COMPANY

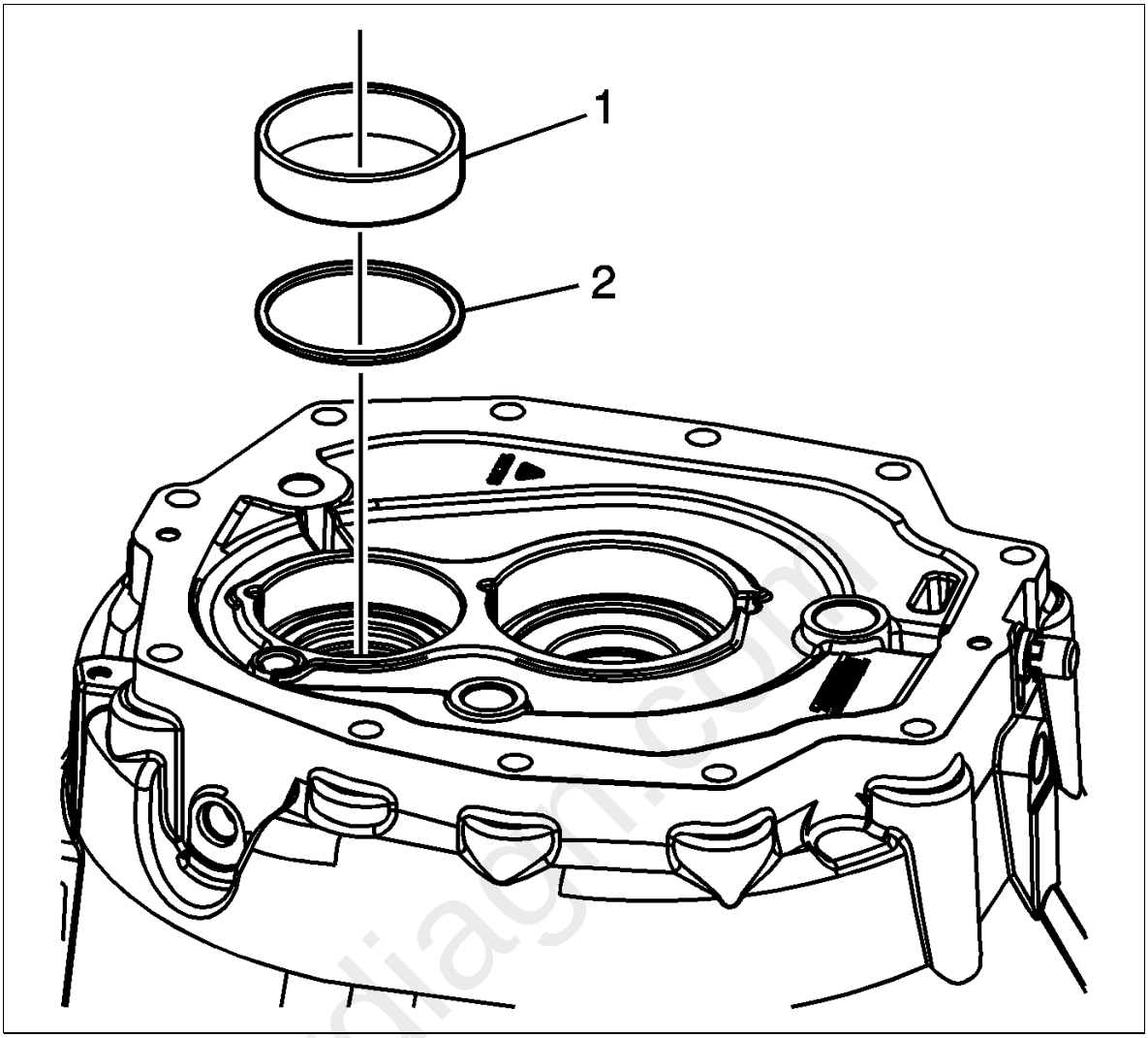
NOTE:

There may be one or more shims.

3. Remove the input shaft bearing race (1) and one or more shims (2).

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Fig 3: Countershaft Bearing Race & Shim

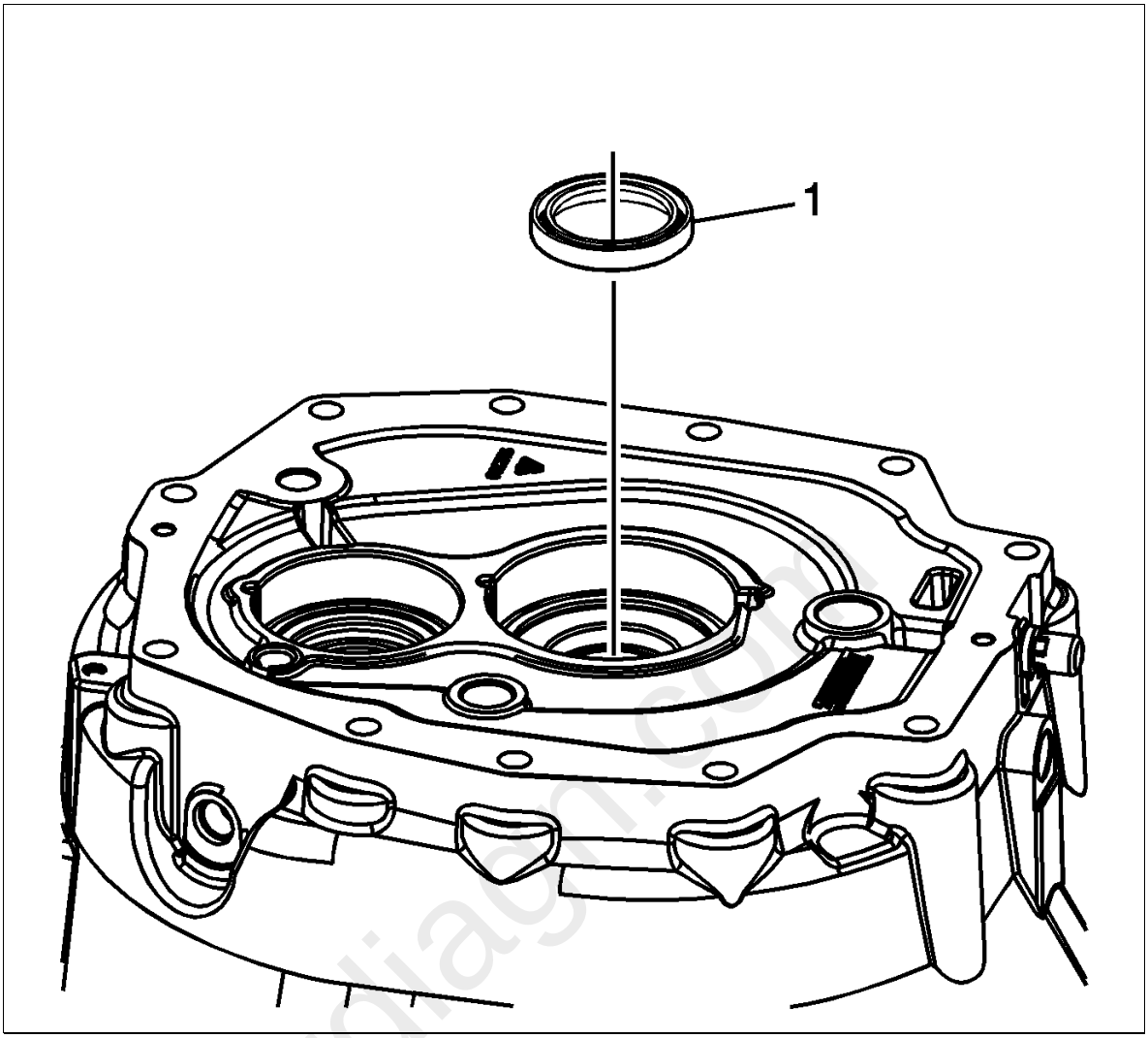


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4. Remove the countershaft bearing race (1) and one or more the shims (2).

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Fig 4: Input Shaft Seal

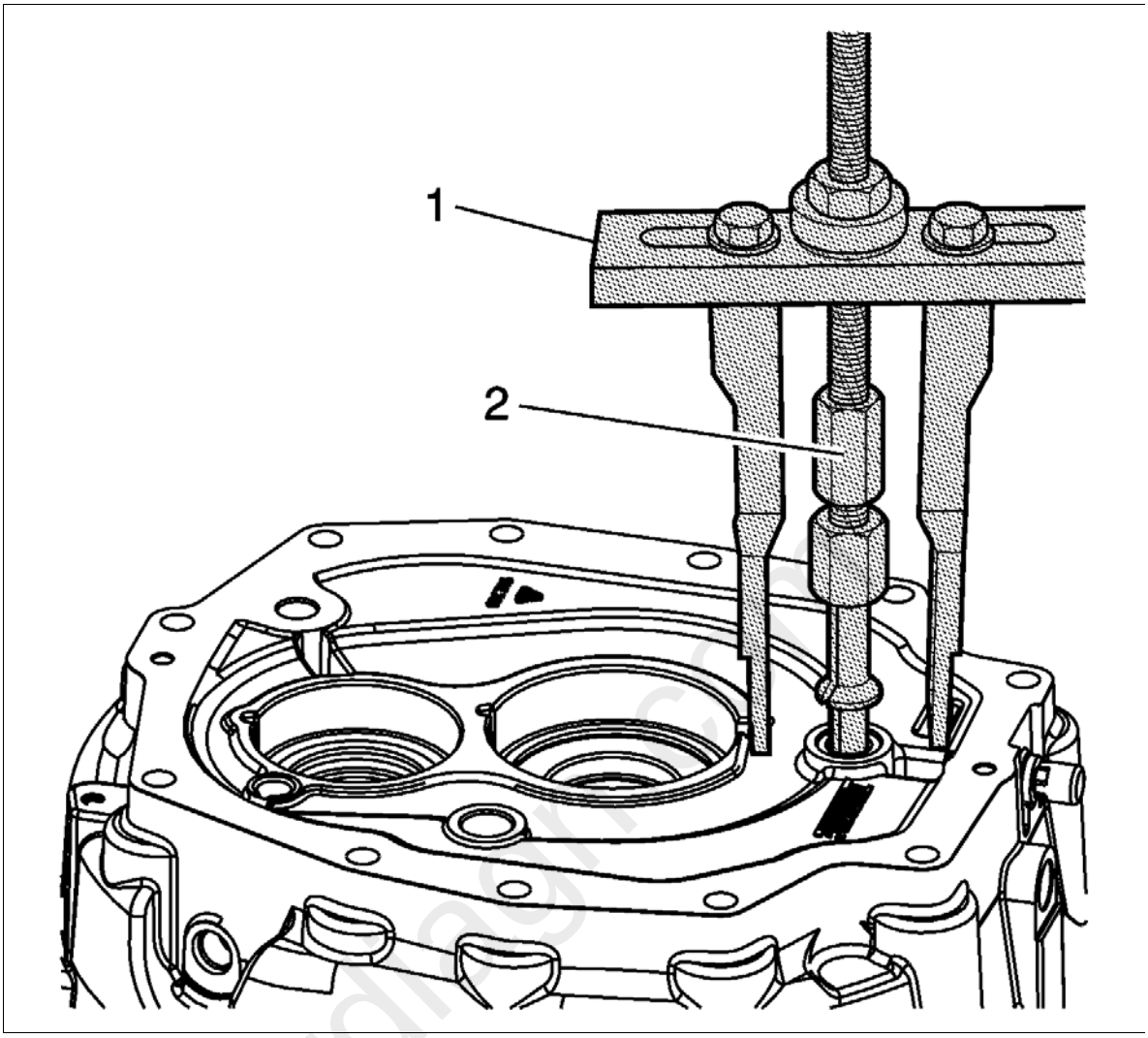


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5. Remove and discard the input shaft seal (1).

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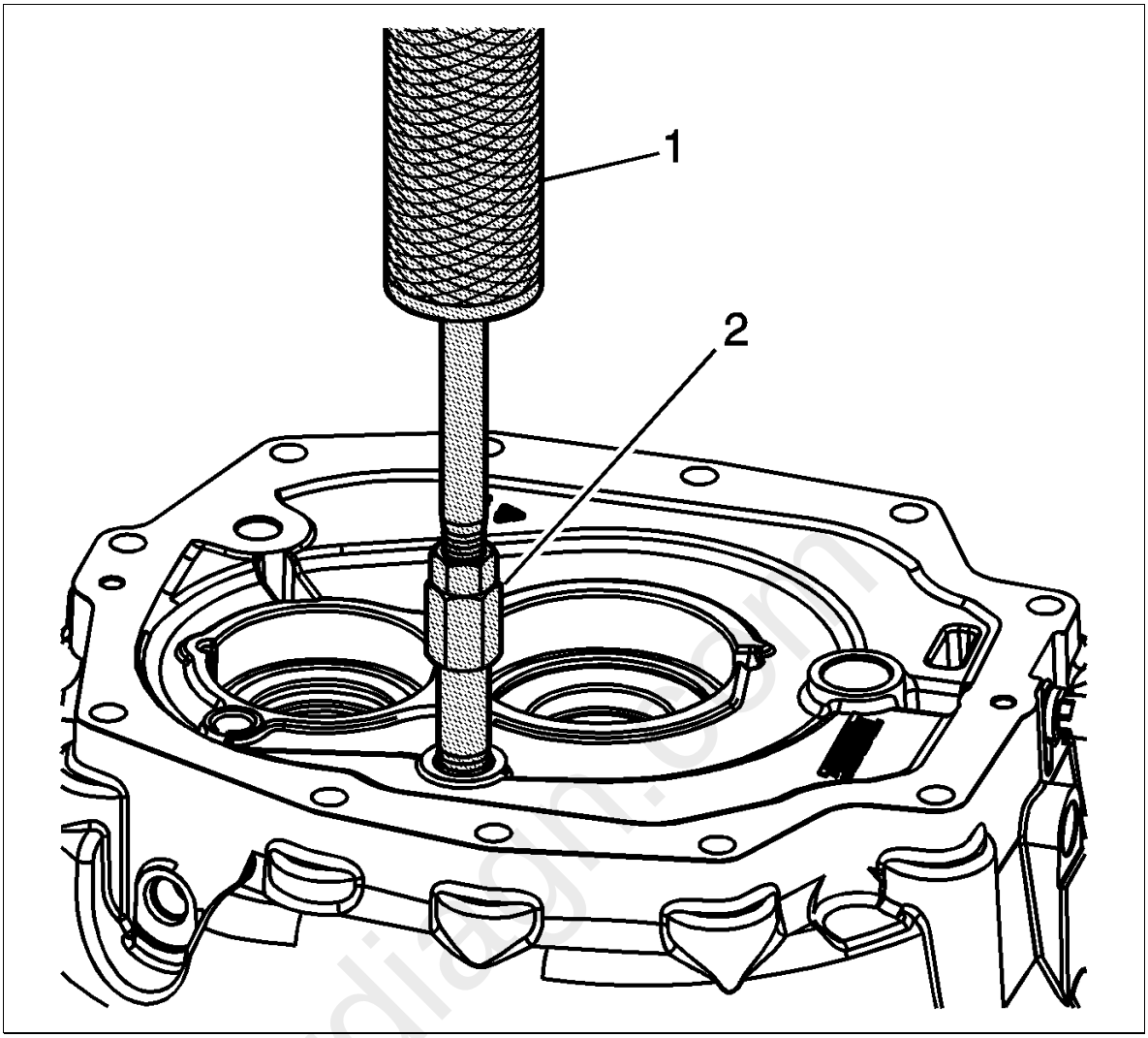
Fig 5: 1st/2nd Shift Shaft Bearing



Courtesy of GENERAL MOTORS COMPANY

6. Remove the 1st/2nd shift shaft bearing, using the **J 45124** removal bridge (1) with the **DT 49216** bushing remover (2) and a wrench.

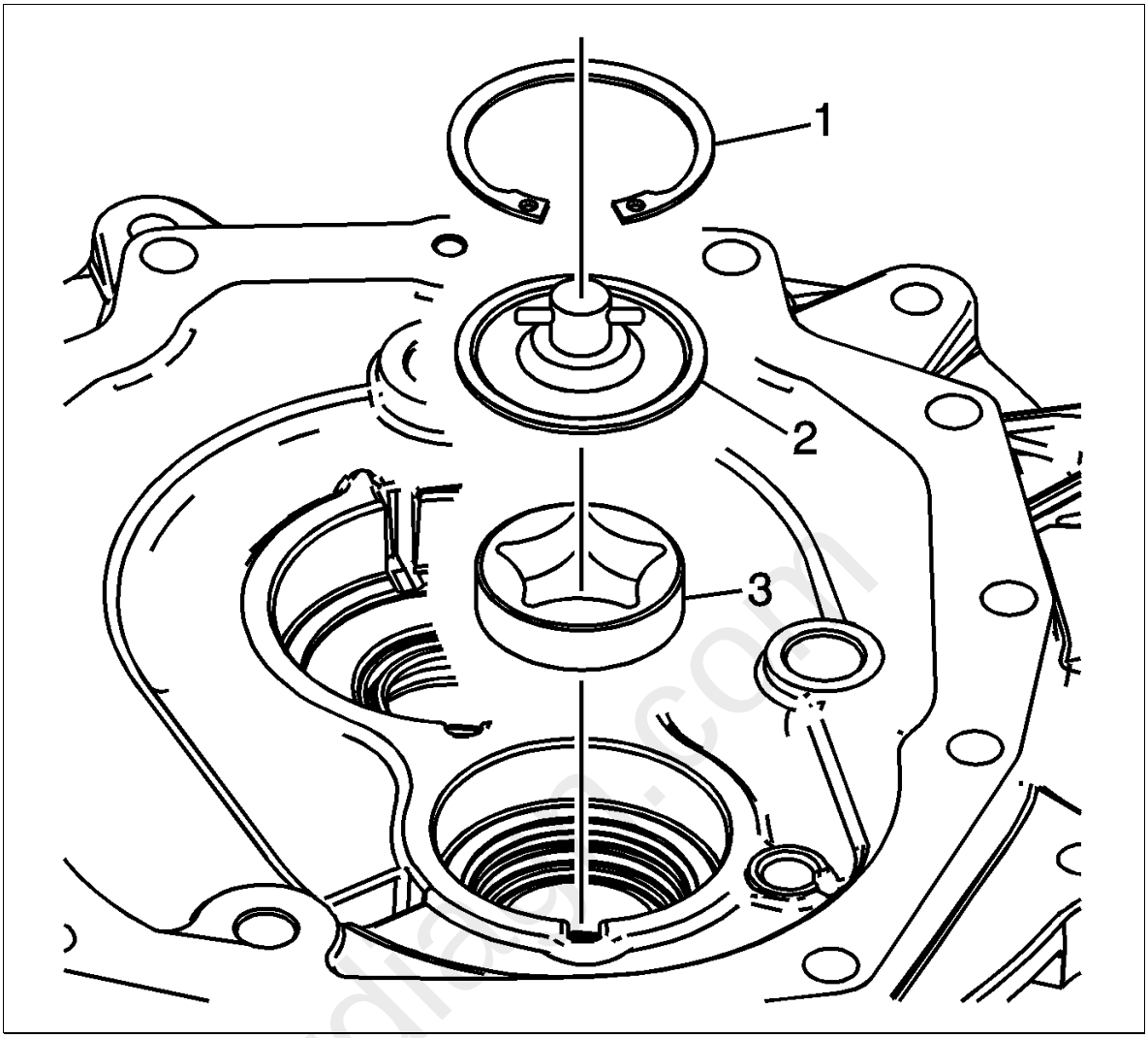
Fig 6: 3rd/4th Shift Shaft Bushing



Courtesy of GENERAL MOTORS COMPANY

7. Remove the 3rd/4th shift shaft bushing, using the **J 23907-1** slide hammer (1) with the **J 39439-2** bushing remover (2).

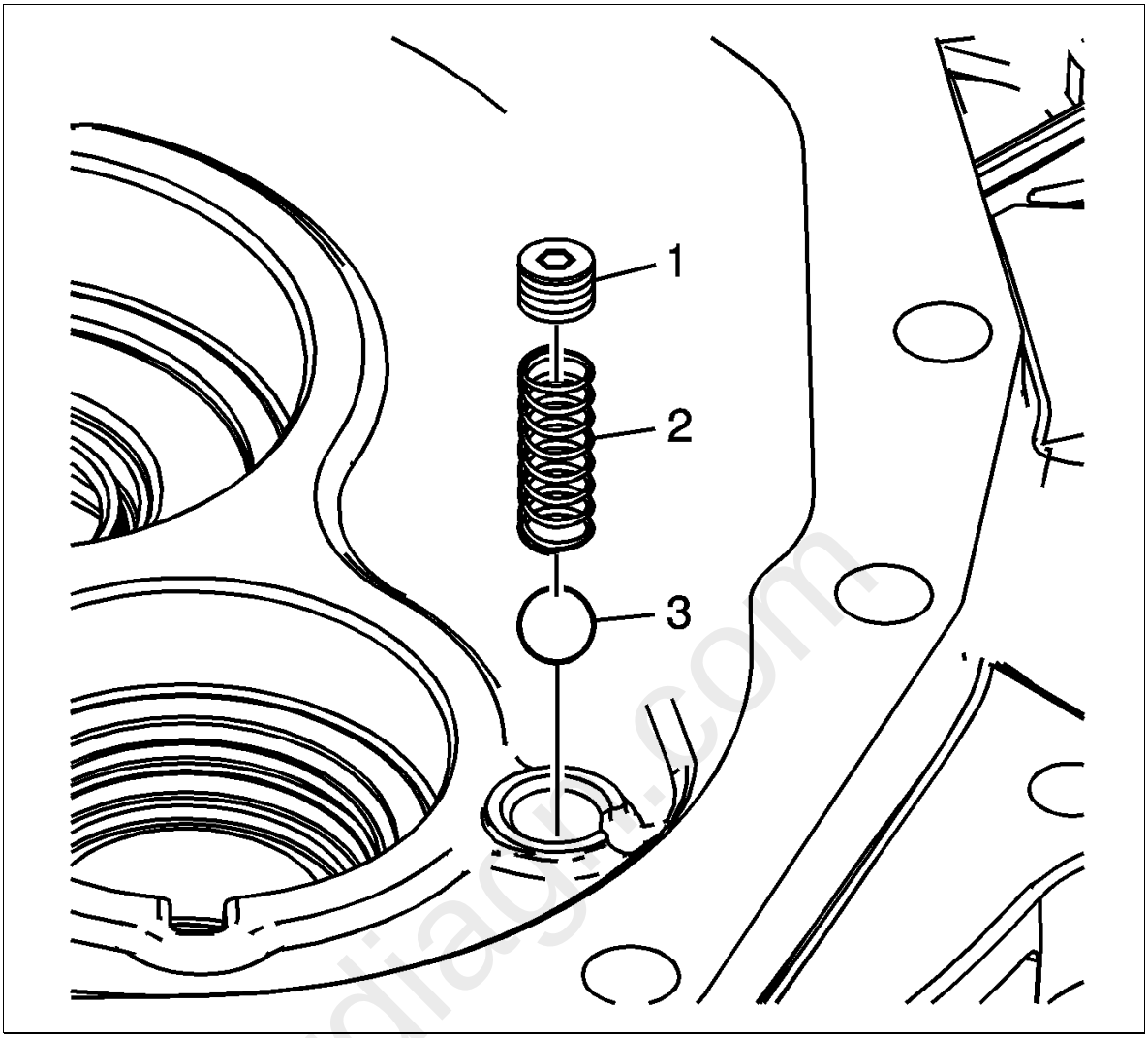
Fig 7: Oil Pump & Oil Pump Cover Assembly



Courtesy of GENERAL MOTORS COMPANY

8. Remove the retainer ring (1).
9. Remove the oil pump cover assembly (2).
10. Remove the oil pump (3).

Fig 8: Plug & Spring

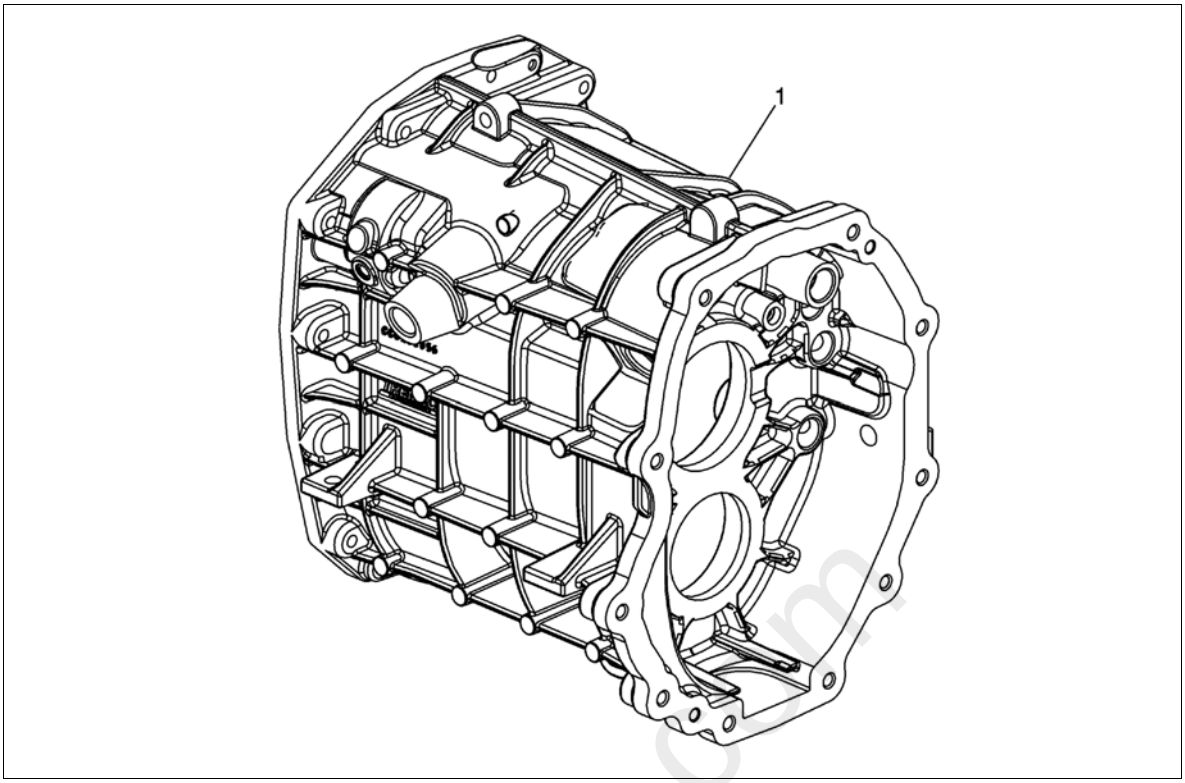


Courtesy of GENERAL MOTORS COMPANY

11. Remove the transmission fluid pump spring retaining plug (1).
12. Remove the transmission fluid pump spring (2).
13. Remove the transmission fluid pump check ball (3).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION CASE AND CLUTCH HOUSING CLEANING AND INSPECTION (M13) > TRANSMISSION CASE

Fig 1: Transmission Case



Courtesy of GENERAL MOTORS COMPANY

WARNING:

Wear safety glasses to avoid injury when using compressed air or any cleaning solvent. Bodily injury may occur if fumes are inhaled or if skin is exposed to chemicals.

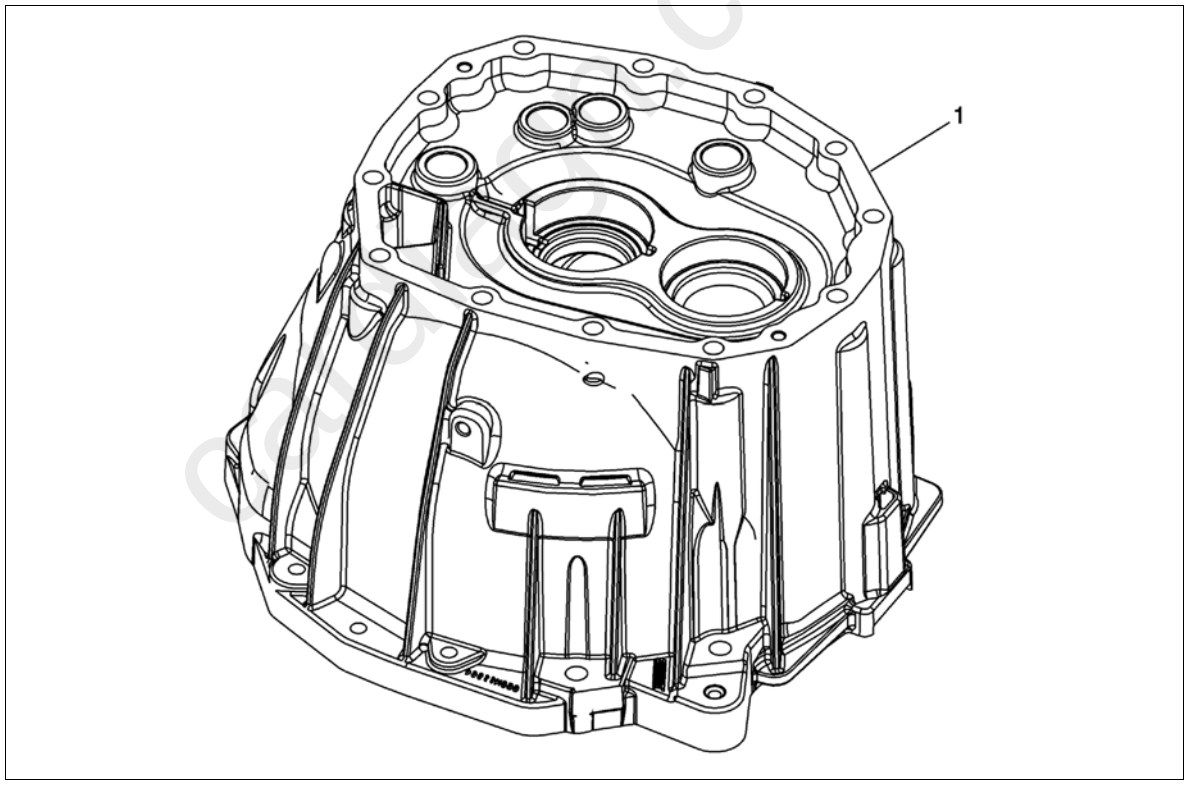
1. Clean the transmission case (1) in a suitable solvent. Air dry the transmission case.
2. Clean all sealant material from retainer bolt threads.
3. Inspect the transmission case for the following conditions:
    1. Cracks
    2. Scratches
    3. Damaged threads
    4. Burrs
    5. Nicked mounting surfaces
    6. Damaged sealing surfaces
    7. Damaged front or rear bearing bores

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4. Inspect the machined mating surfaces for flatness with a straight edge.
5. Inspect the bearing races and bores for wear, scratches or grooves.
6. Inspect the bushing for excessive wear.
7. Use a fine mill file to dress minor scratches or burrs.
8. If scratches, or grooves or scoring cannot be removed by hand with a soft stone or crocus cloth, replace the component.
9. Clean up damaged threads with the correct size tap.
10. Replace a cracked housing.
11. Replace worn bushings.

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION CASE AND CLUTCH HOUSING CLEANING AND INSPECTION (M13) > CLUTCH HOUSING ASSEMBLY

Fig 1: Clutch Housing



Courtesy of GENERAL MOTORS COMPANY

WARNING:

Wear safety glasses to avoid injury when using compressed air or any cleaning solvent. Bodily injury may occur if fumes are inhaled or if skin is exposed to chemicals.

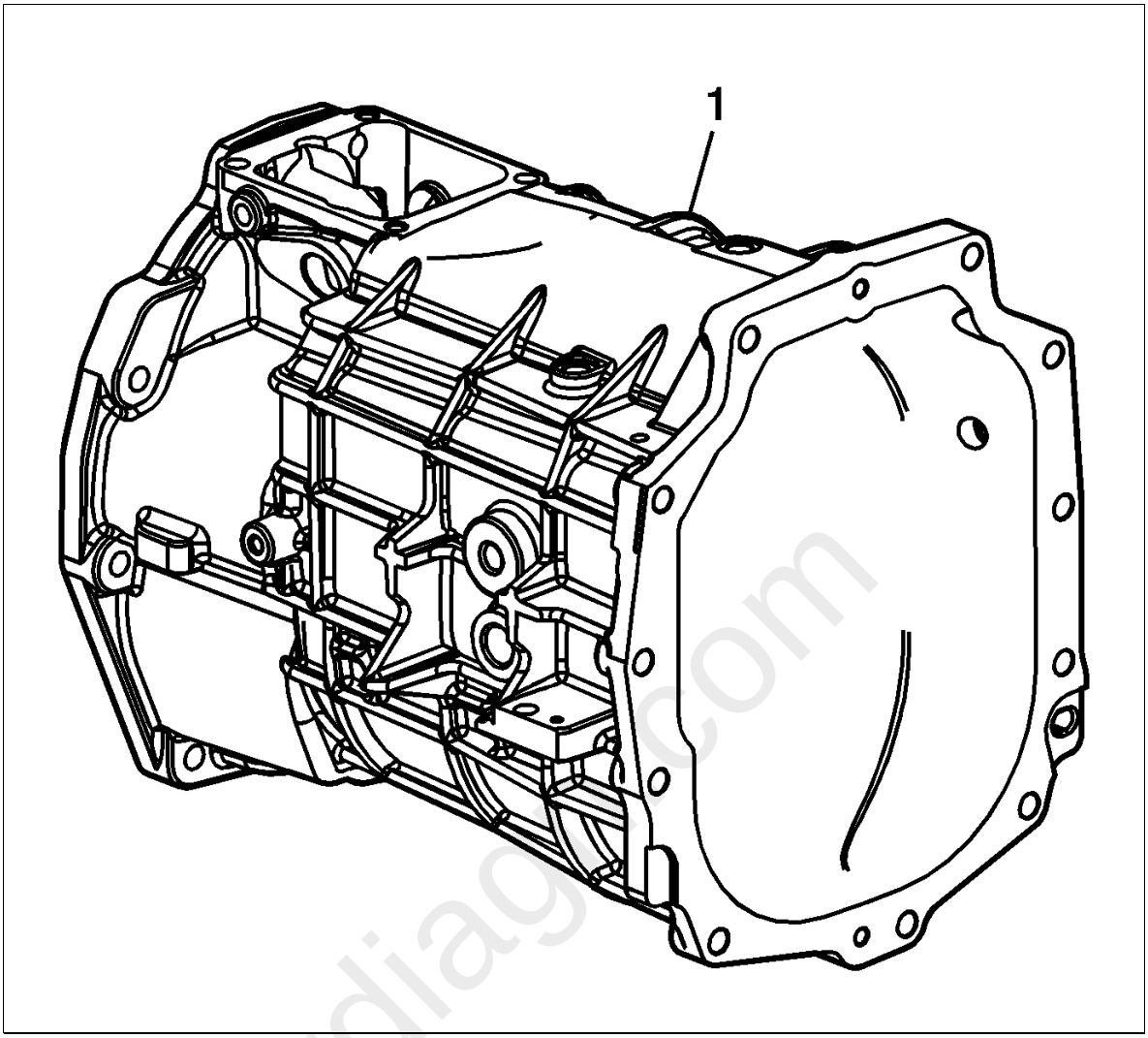
1. Clean the clutch housing (1) parts with a suitable solvent. Air dry all the parts.
2. Inspect the clutch housing parts for the following conditions:
    1. Cracks

       Replace the clutch housing part if cracks are found.
    2. Scratches
    3. Burrs
    4. Nicked mounting surfaces
    5. Damaged sealing surfaces
    6. Damaged front or rear bearing bores
3. Inspect the machined mating surfaces for flatness. Check the mating surfaces with a straight edge.
4. Inspect the bearing races and bores for wear, scratches or grooves.
5. Inspect the bushing for excessive wear. Replace worn bushings.
6. Use a fine mill file to dress minor scratches or burrs.
7. If scratches, or grooves or scoring cannot be removed by hand with a soft stone or crocus cloth, replace the component.

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REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION CASE AND CLUTCH HOUSING CLEANING AND INSPECTION (MM6) > TRANSMISSION CASE

Fig 1: Transmission Case



Courtesy of GENERAL MOTORS COMPANY

WARNING:

Wear safety glasses to avoid injury when using compressed air or any cleaning solvent. Bodily injury may occur if fumes are inhaled or if skin is exposed to chemicals.

1. Clean the transmission case (1) in a suitable solvent. Air dry the transmission case.
2. Clean all sealant material from retainer bolt threads.
3. Inspect the transmission case for the following conditions:
    1. Cracks
    2. Scratches
    3. Damaged threads

4. Burrs
5. Nicked mounting surfaces
6. Damaged sealing surfaces
7. Damaged front or rear bearing bores

4. Inspect the machined mating surfaces for flatness with a straight edge.
5. Inspect the bearing races and bores for wear, scratches or grooves.
6. Inspect the bushing for excessive wear.
7. Use a fine mill file to dress minor scratches or burrs.
8. If scratches, or grooves or scoring cannot be removed by hand with a soft stone or crocus cloth, replace the component.
9. Clean up damaged threads with the correct size tap.
10. Replace a cracked housing.
11. Replace worn bushings.

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION CASE AND CLUTCH HOUSING CLEANING AND INSPECTION (MM6) > CLUTCH HOUSING ASSEMBLY

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Fig 1: Clutch Housing



Courtesy of GENERAL MOTORS COMPANY

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WARNING:

Wear safety glasses to avoid injury when using compressed air or any cleaning solvent. Bodily injury may occur if fumes are inhaled or if skin is exposed to chemicals.

1. Clean the clutch housing (1) parts with a suitable solvent. Air dry all the parts.
2. Inspect the clutch housing parts for the following conditions:
    1. Cracks

       Replace the clutch housing part if cracks are found.
    2. Scratches

3. Burrs
4. Nicked mounting surfaces
5. Damaged sealing surfaces
6. Damaged front or rear bearing bores

3. Inspect the machined mating surfaces for flatness. Check the mating surfaces with a straight edge.
4. Inspect the bearing races and bores for wear, scratches or grooves.
5. Inspect the bushing for excessive wear. Replace worn bushings.
6. Use a fine mill file to dress minor scratches or burrs.
7. If scratches, or grooves or scoring cannot be removed by hand with a soft stone or crocus cloth, replace the component.

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION CASE AND CLUTCH HOUSING ASSEMBLE (MM6)

Special Tools

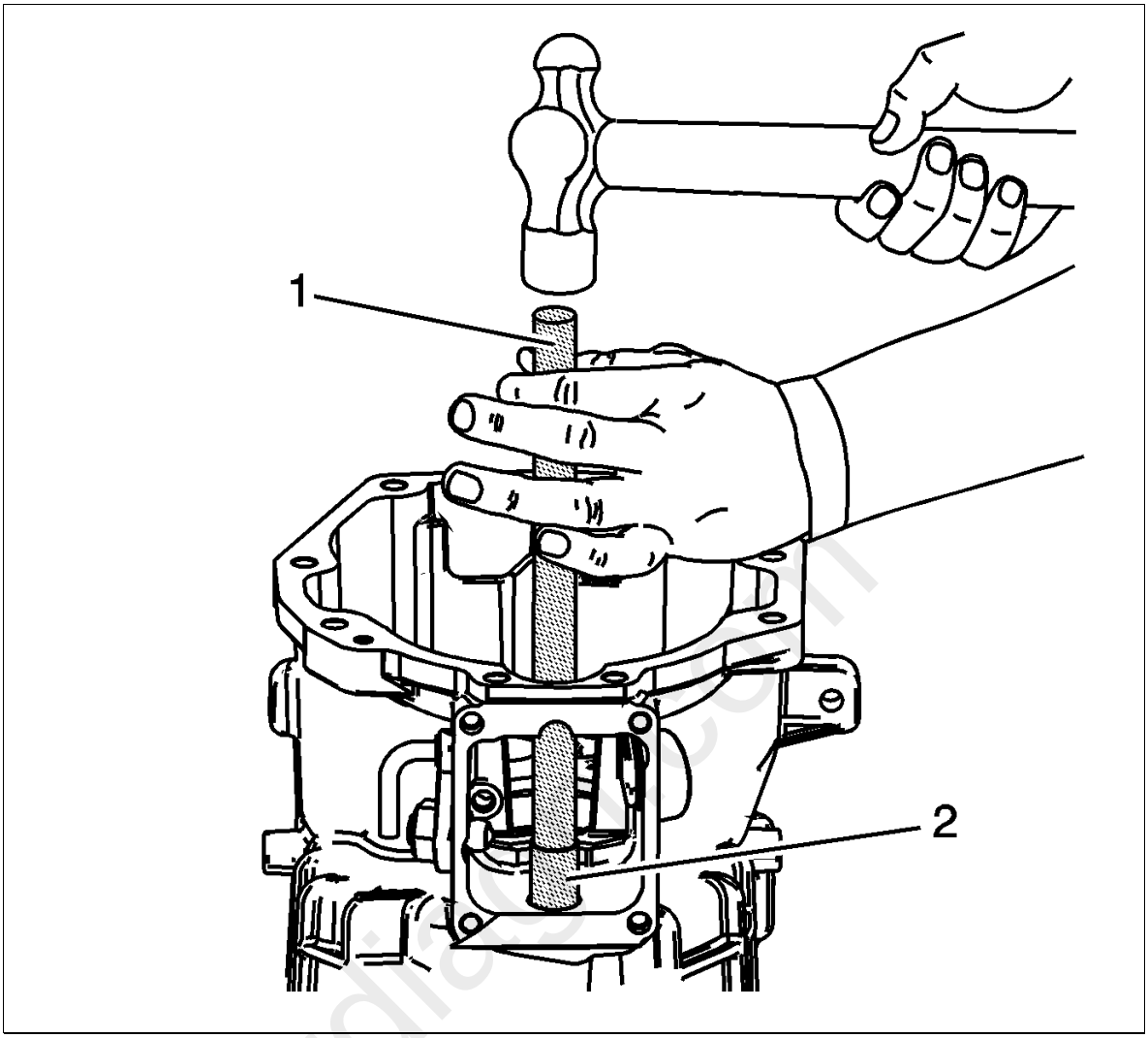
- **J 8092** Universal Driver Handle
- **J 23907-1** Slide Hammer
- **J 36017** Valve Seal Remover
- **J 36190** Universal Driver Handle
- **J 39433** Input Shaft Seal Installer
- **J 39435** Bearing Race Installer
- **J 39439-3** Bushing Installer
- **J 39439-1** Shift Rail Bushing Removal/Installer
- **J 39442** Mainshaft and Countershaft Press Adapter
- **J 42464** Shift Shaft Seal Installer
- **J 44384** Bearing Installer

For equivalent regional tools, refer to Special Tools (MM6) .

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION CASE AND CLUTCH HOUSING ASSEMBLE (MM6) > TRANSMISSION CASE

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Fig 1: lst/2nd, 3rd/4th Shift Shaft Bushings



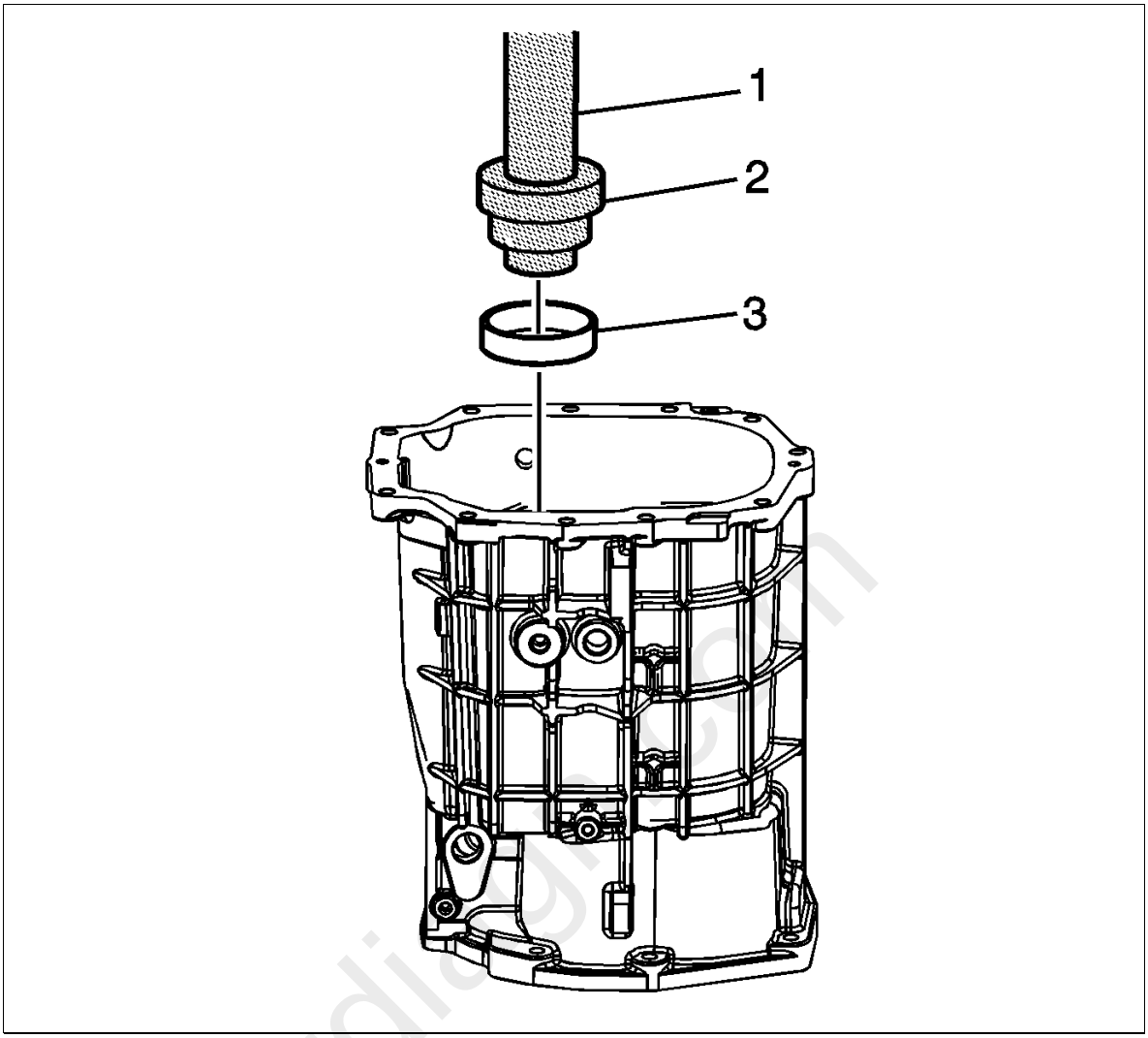
Courtesy of GENERAL MOTORS COMPANY

NOTE:

*The end of the bearing that has numbers stamped on it must face the **J 44384** bearing installer, so that the numbers are visible when the bearing is installed.*

1. Install the 1st/2nd and the 3rd/4th shift shaft bearing. Use the **J 36190** driver handle (1) and the **J 44384** bearing installer (2).

Fig 2: Mainshaft Bearing Race



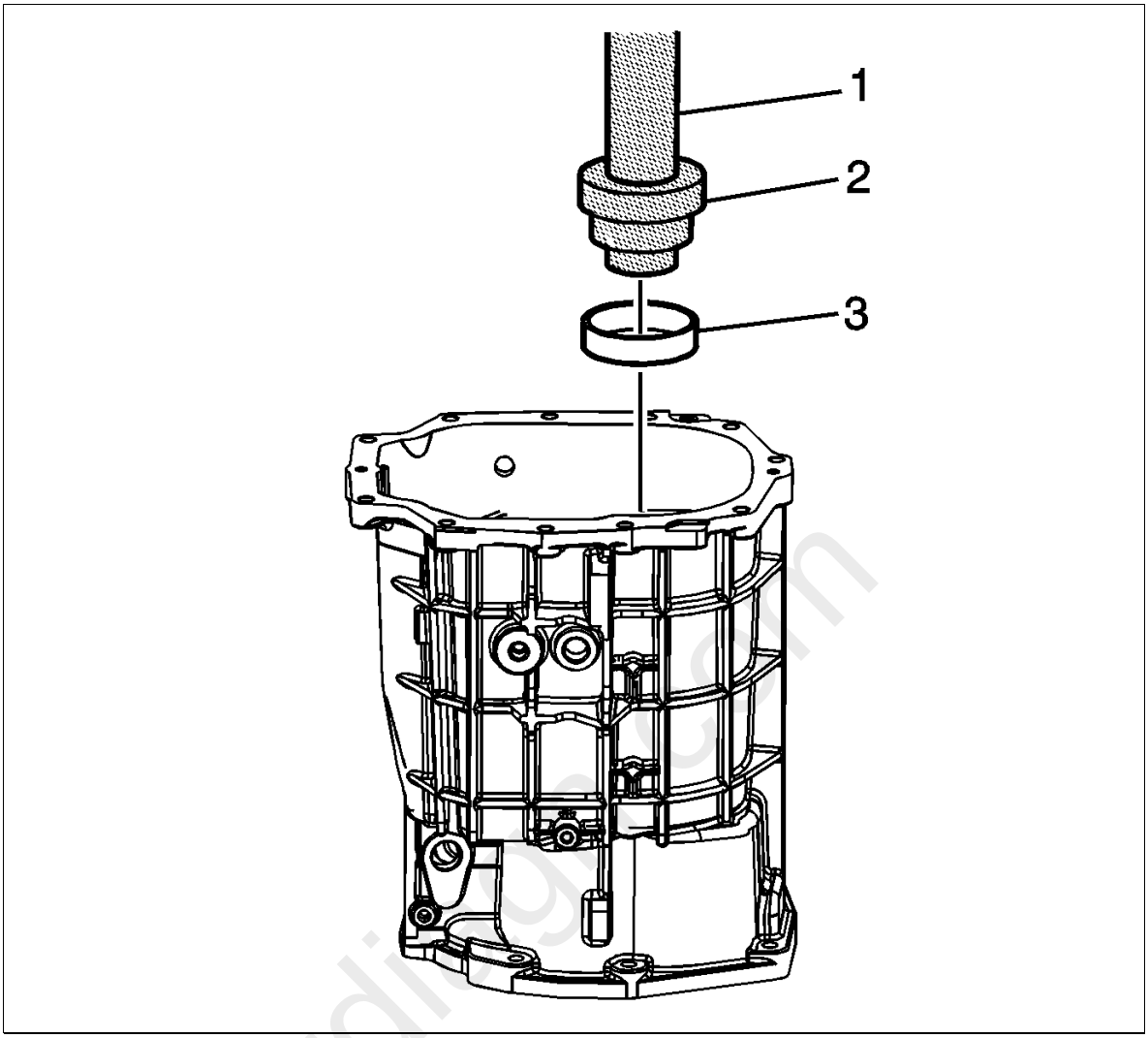
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Bearings and Races are replaced as sets.

2. Install the mainshaft bearing race (3), using the **J 8092** driver handle (1) and the **J 39435** installer (2).

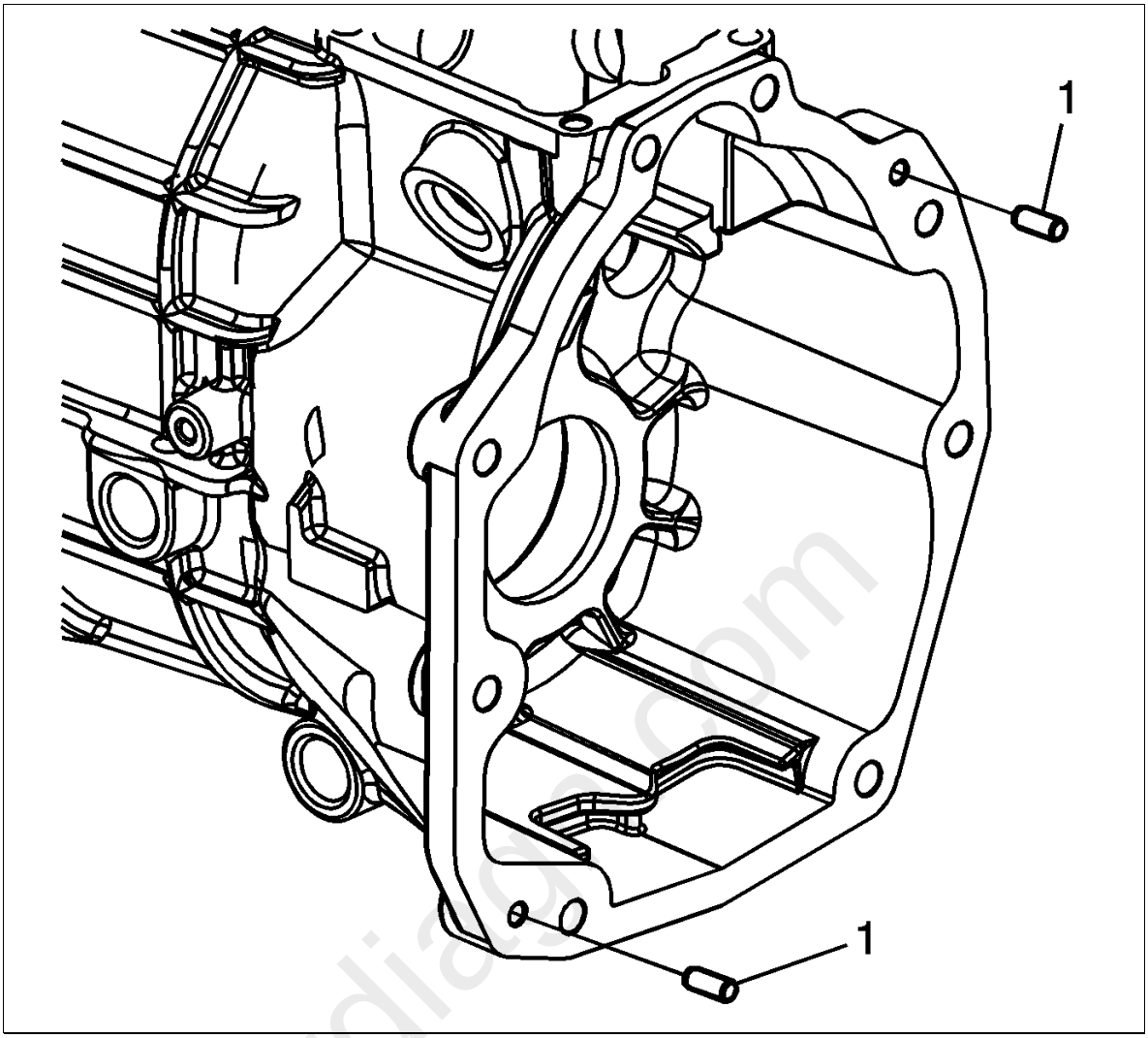
Fig 3: Countershaft Bearing Race



Courtesy of GENERAL MOTORS COMPANY

3. Install the countershaft bearing race (3), using the **J 8092** driver handle (1) and the **J 39435** installer (2).

Fig 4: Dowel Pins

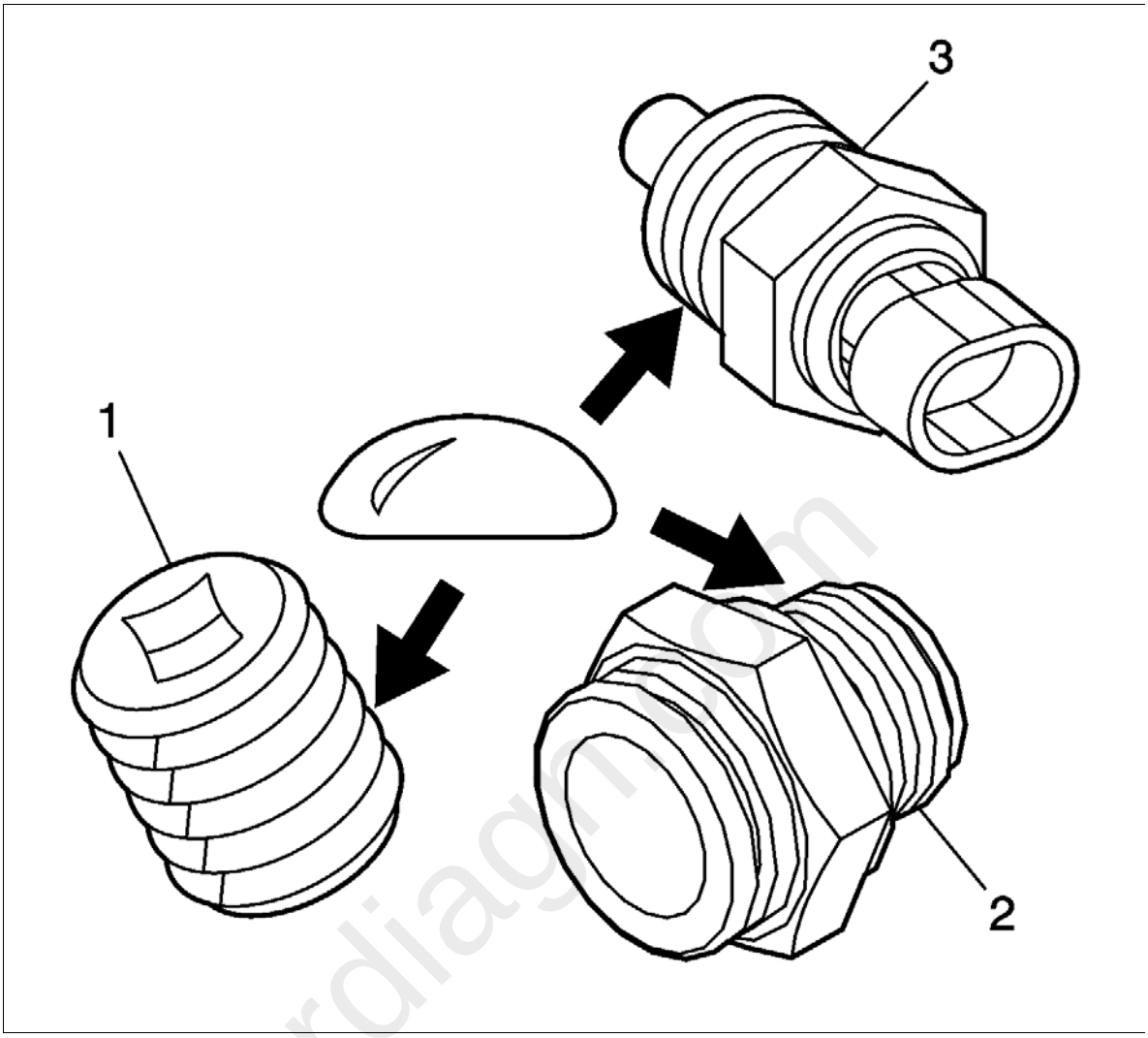


Courtesy of GENERAL MOTORS COMPANY

4. Install the dowel pins (1).

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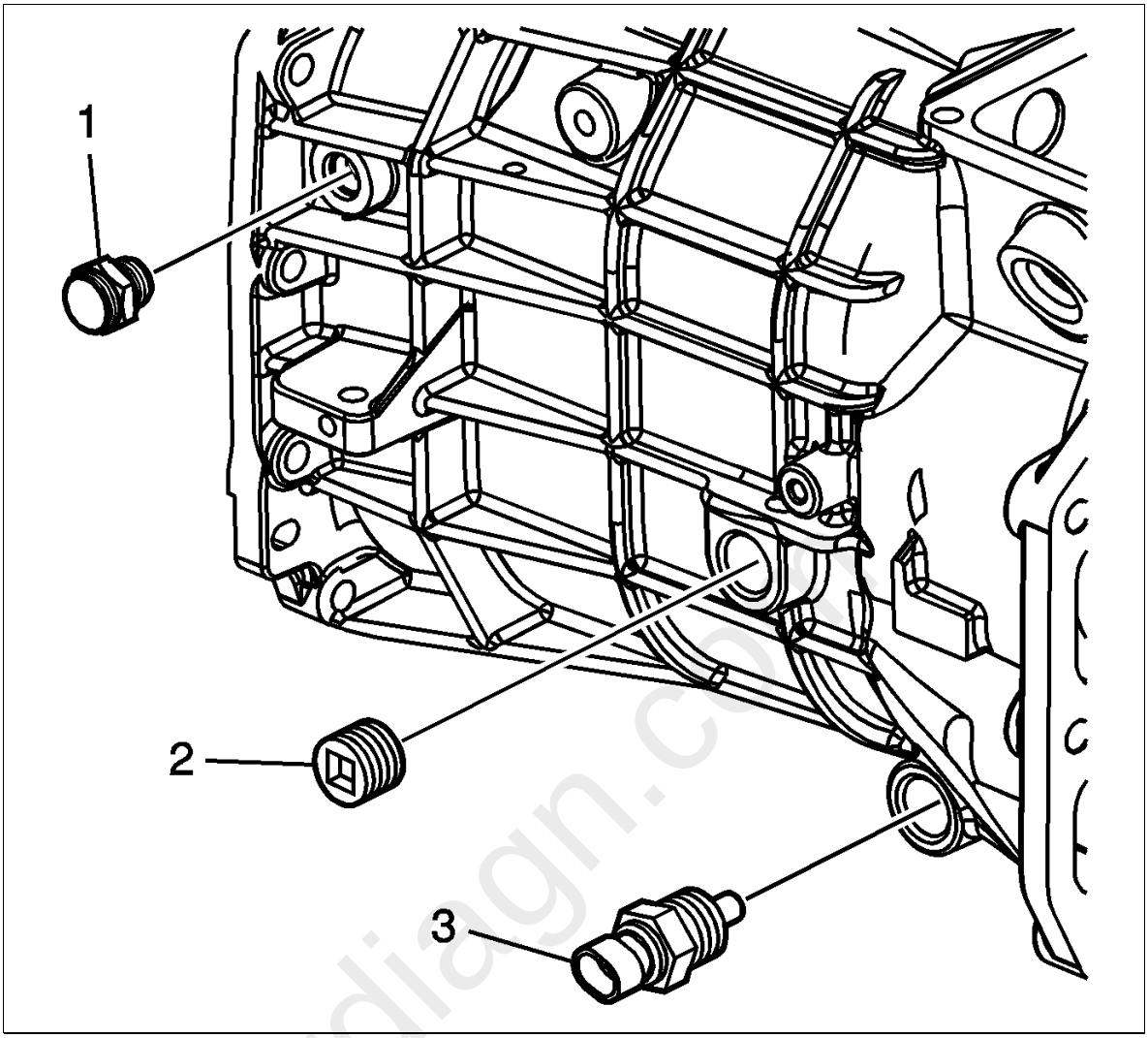
Fig 5: Sealant To Threads Of Transmission Case Fill Plug, Temperature Sensor & Cooler Line Return Fitting



Courtesy of GENERAL MOTORS COMPANY

5. Apply sealant GM P/N 12346004 (Canadian P/N 10953480) or equivalent to the threads of the transmission case fill plug (1), the temperature sensor (3) and the cooler line return fitting (2).

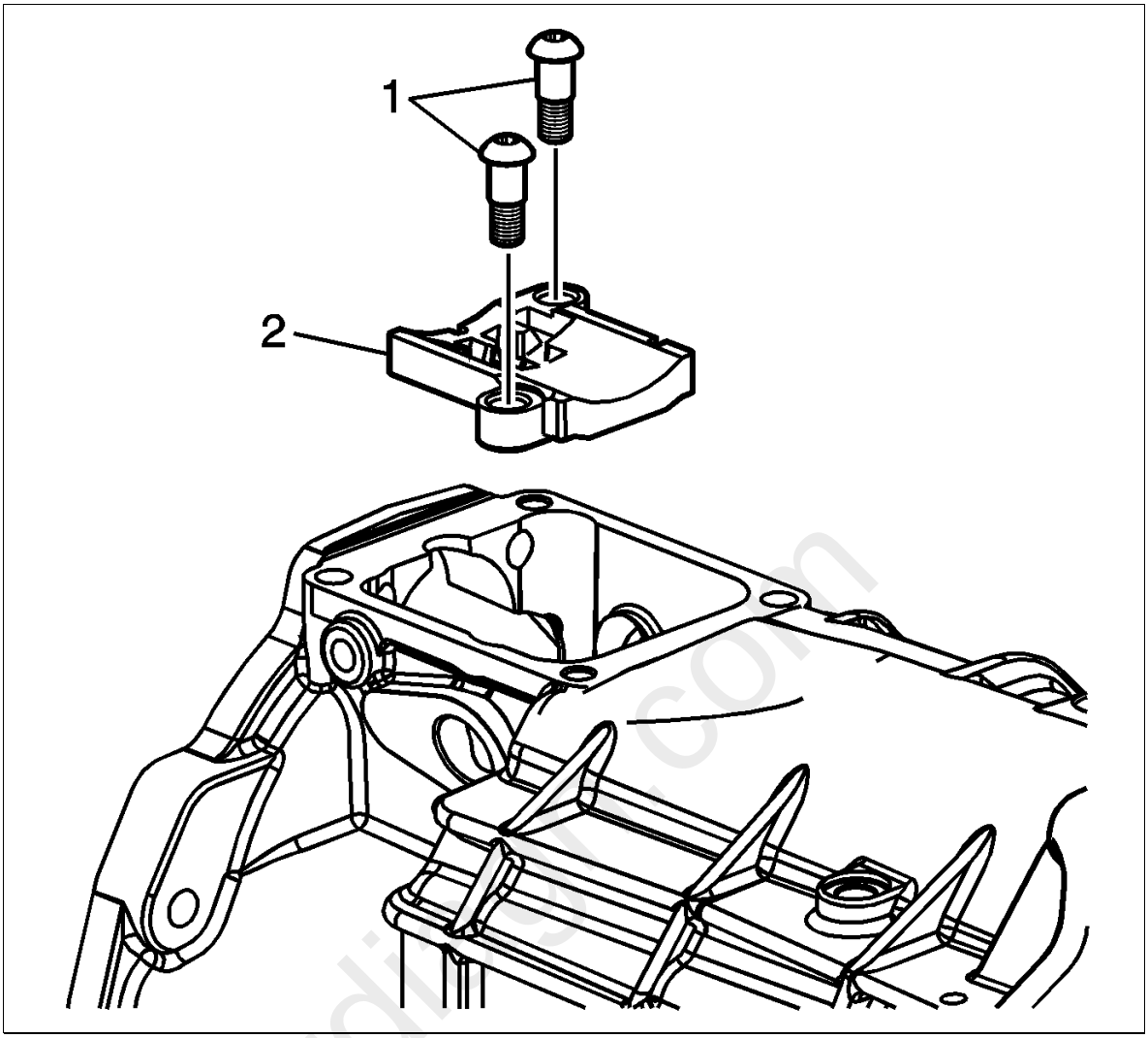
Fig 6: Cooler Line Return Fitting, Fill Plug & Coolant Temperature Sensor



Courtesy of GENERAL MOTORS COMPANY

6. Install the transmission case cooler line return fitting (1) and tighten to 22 N.m (16 lb ft).
7. Install the transmission case fill plug (2) and tighten to 27 N.m (20 lb ft).
8. Install the coolant temperature sensor (3) and tighten to 39 N.m (29 lb ft).

Fig 7: Detent Guide Plate & Attaching Bolts



Courtesy of GENERAL MOTORS COMPANY

> ⚠ *CAUTION:*
>
> *The H-pattern on the guide plate must face the extension housing. If the guide plate is installed incorrectly, then damage will occur.*

9. Install the guide plate (2) and the guide plate bolts (1) and tighten to 22 N.m (16 lb ft).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION CASE AND CLUTCH HOUSING ASSEMBLE (MM6) > CLUTCH HOUSING ASSEMBLY

Fig 1: Transmission Fluid Pump Outlet Pipe Fitting And Pump Outlet Cooler Fitting

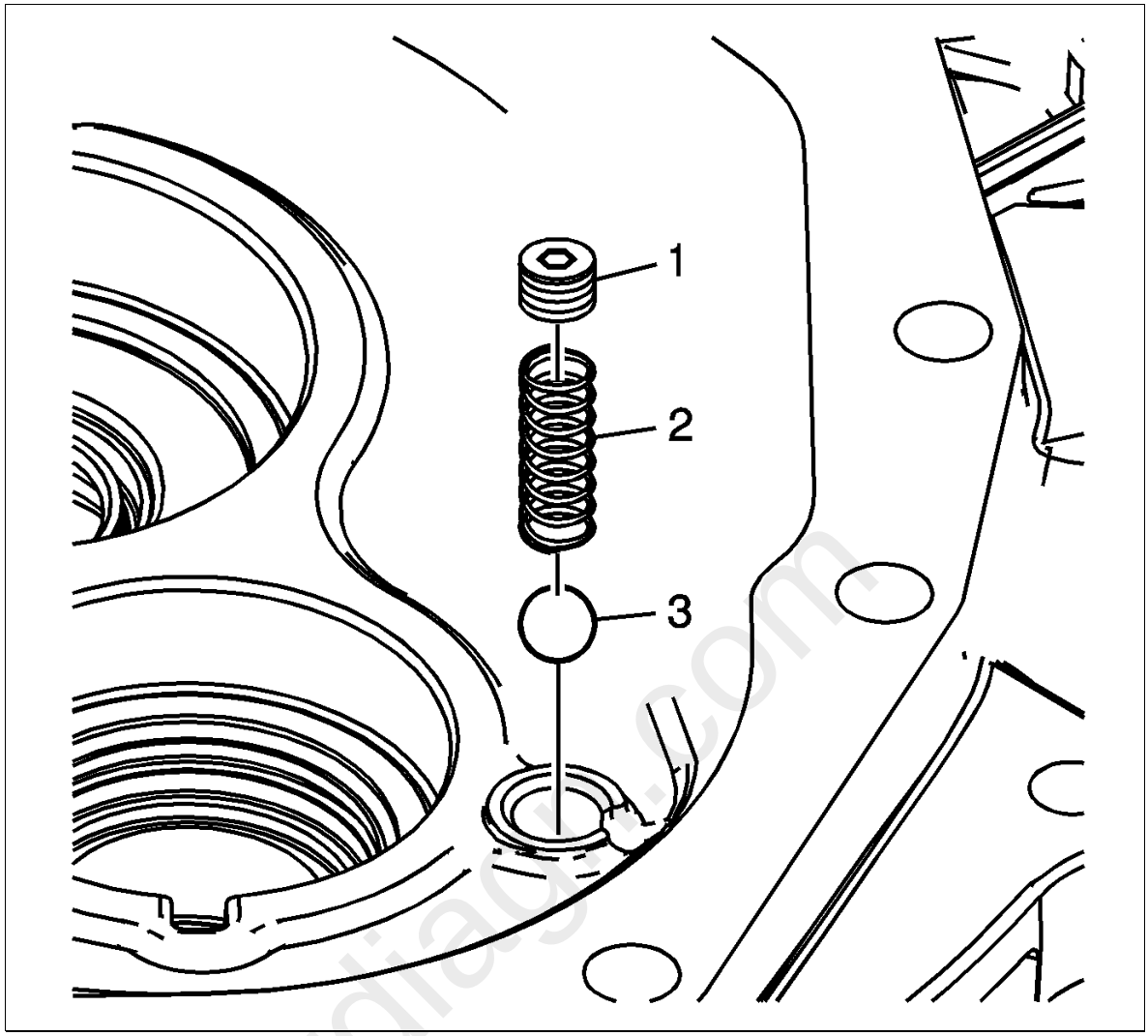


Courtesy of GENERAL MOTORS COMPANY

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1. Install the transmission fluid pump outlet pipe fitting (2) and tighten to 27 N.m (20 lb ft).
2. Install the pump outlet cooler fitting (1), and tighten to 22 N.m (16 lb ft).

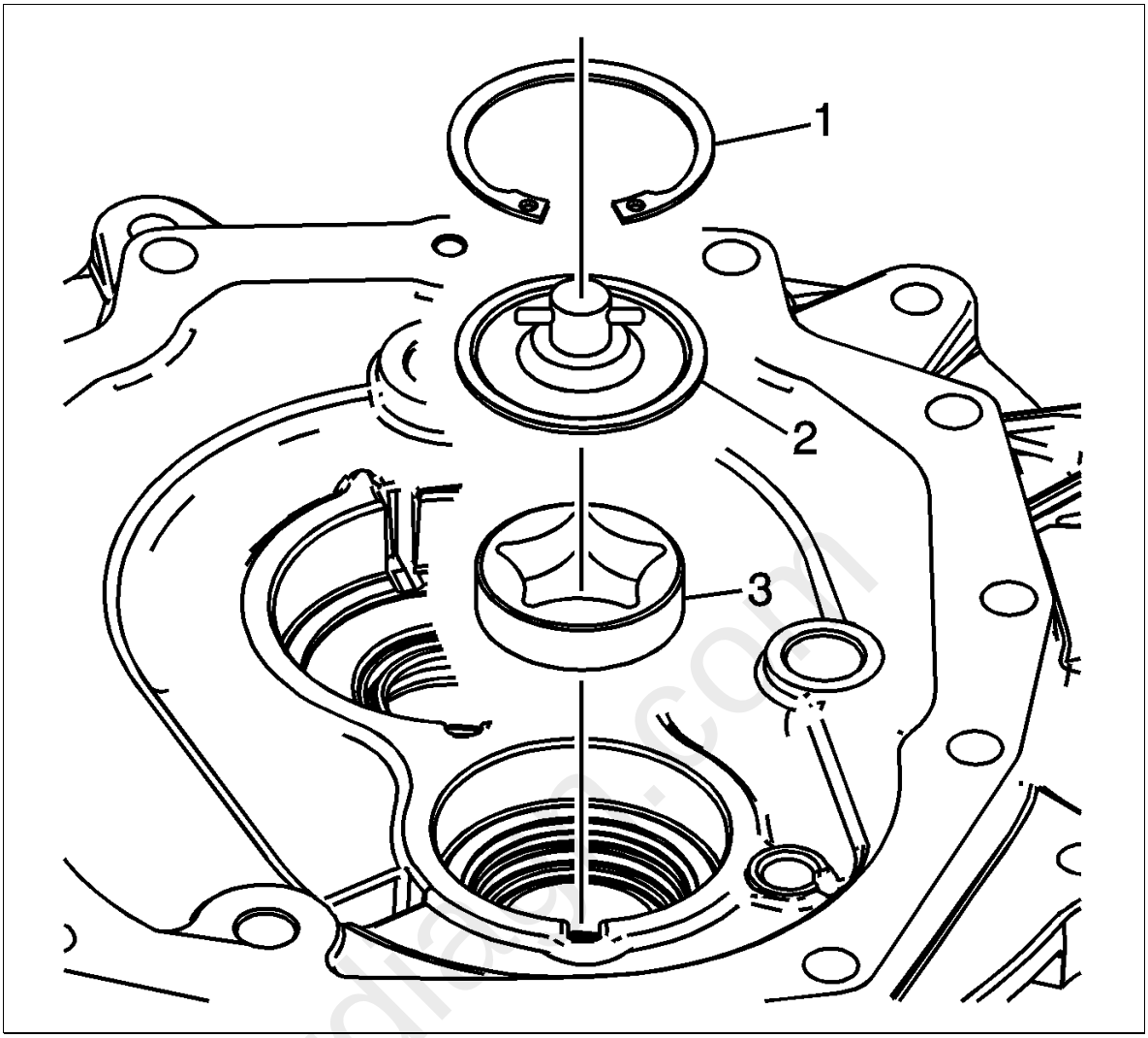
Fig 2: Plug & Spring



Courtesy of GENERAL MOTORS COMPANY

3. Install the transmission fluid pump check ball (3).
4. Install the transmission fluid pump spring (2).
5. Install the transmission fluid pump spring retaining plug (1). Tighten the plug to 27 N.m (20 lb ft).

Fig 3: Oil Pump & Oil Pump Cover Assembly



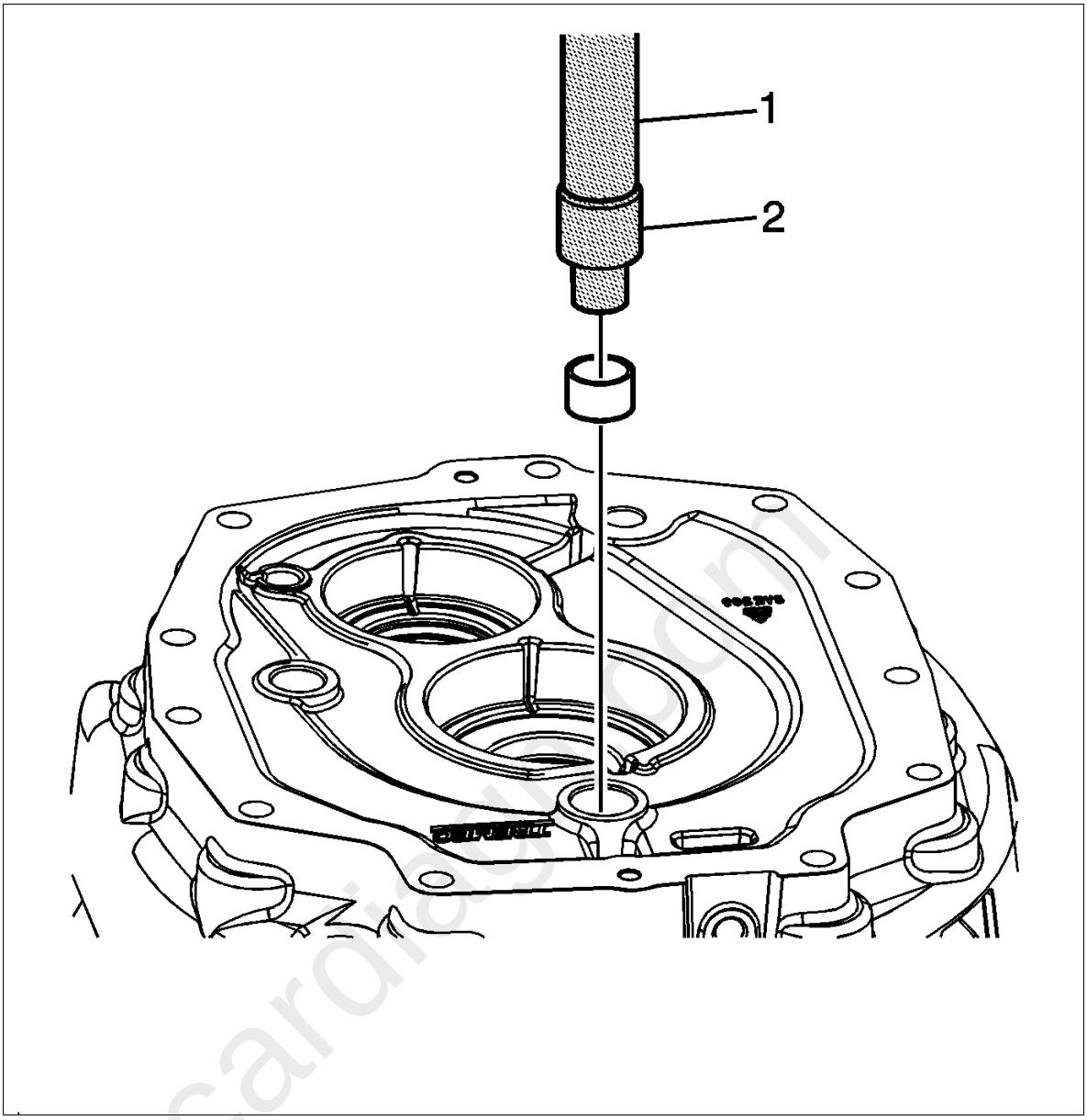
Courtesy of GENERAL MOTORS COMPANY

NOTE:

The pump needs to be coated and filled with transmission fluid before installation. Refer to Adhesives, Fluids, Lubricants, and Sealers (MM6) for the correct fluid.

6. Install the oil pump (3).
7. Install the oil pump cover assembly (2).
8. Install the retainer ring (1).

Fig 4: 1st/2nd Speed Shift Shaft Bearing

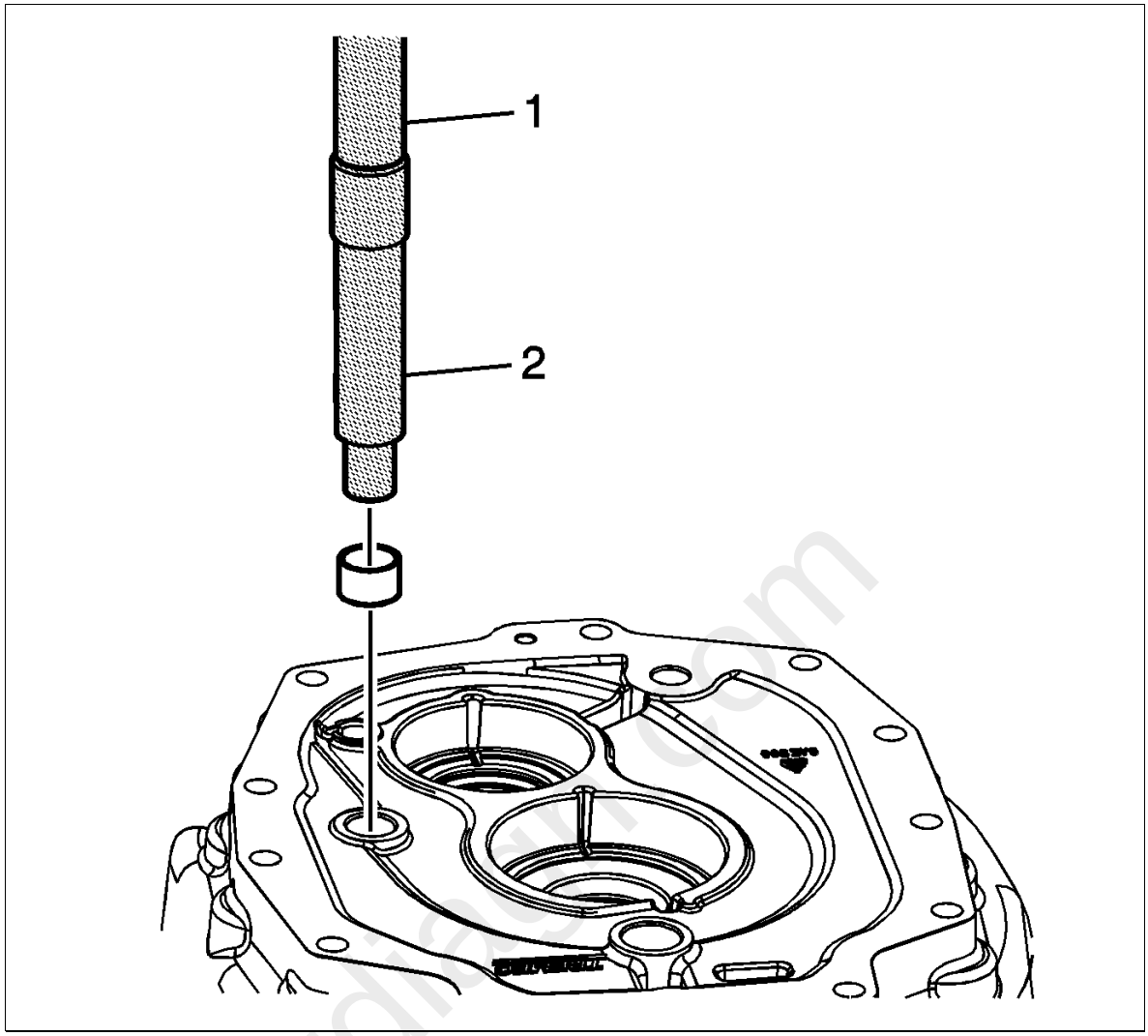


Courtesy of GENERAL MOTORS COMPANY

> ⚠ *CAUTION:*
>
> *If the 1st/2nd speed shift shaft bearing is installed incorrectly it will interfere with the inner shift rail seal causing a leak.*

9. Install the 1st/2nd speed shift shaft bearing flush with the clutch housing, using the **J 36190** driver handle (1) with the **J 44384** bearing installer (2).

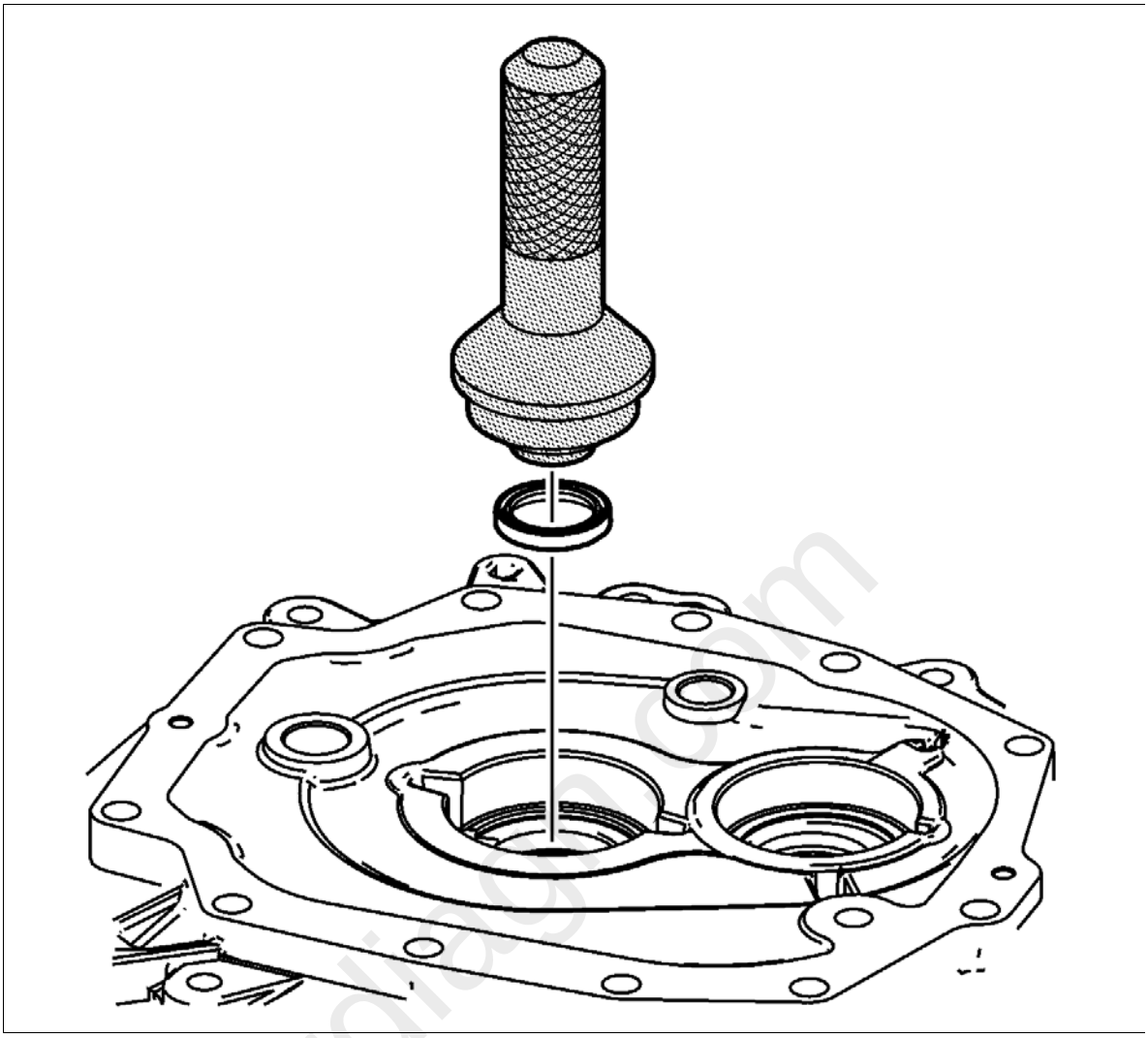
Fig 5: 3rd/4th Speed Shift Shaft Bushing



Courtesy of GENERAL MOTORS COMPANY

10. Install the 3rd/4th speed shift shaft bushing flush with the clutch housing, using the **J 36190** driver handle (1) with the **J 39439-1** bushing removal/installer (2).

Fig 6: Input Shaft Seal

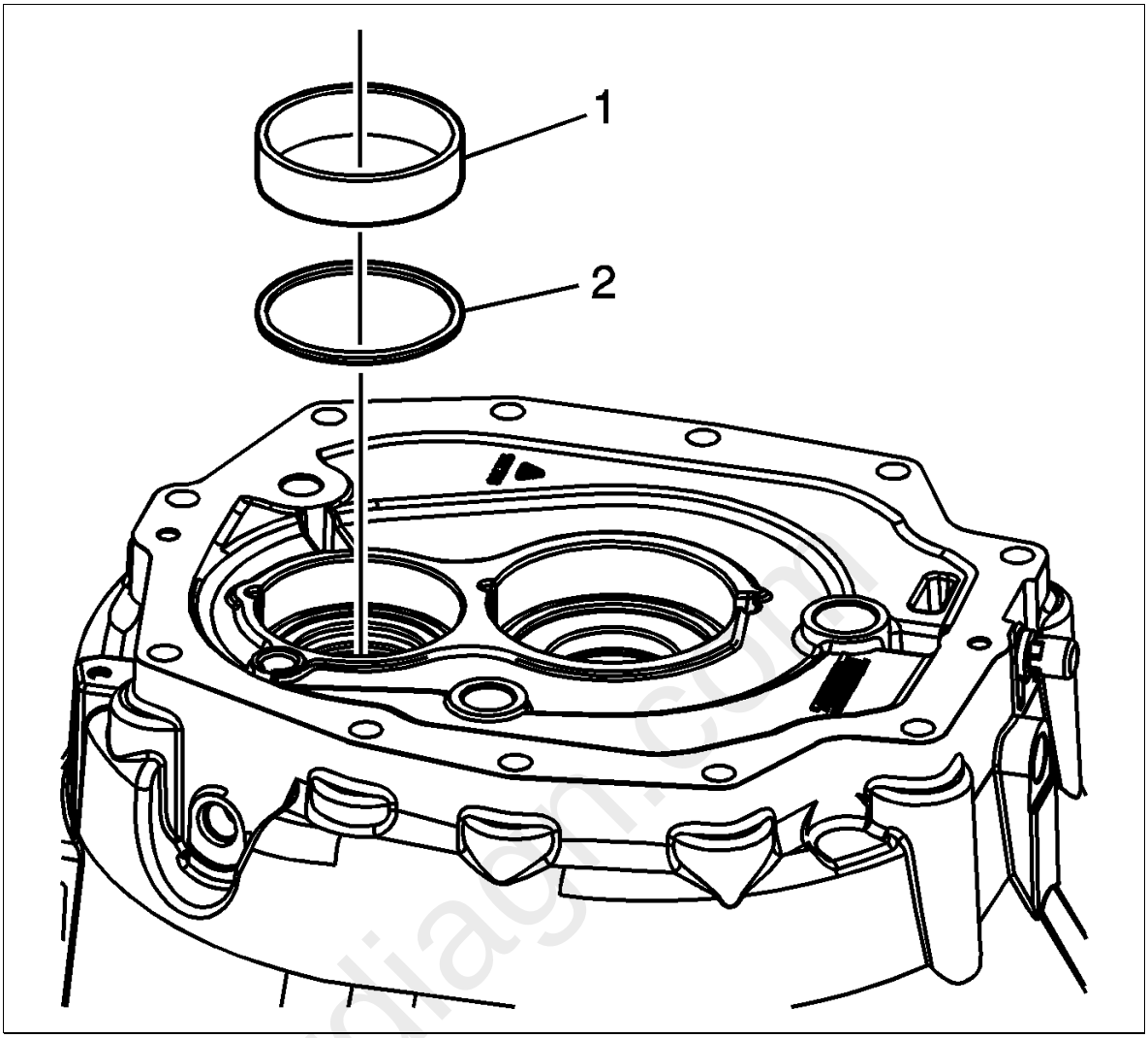


Courtesy of GENERAL MOTORS COMPANY

11. Install the input shaft seal, using the **J 39433** input installer.

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Fig 7: Countershaft Bearing Race & Shim



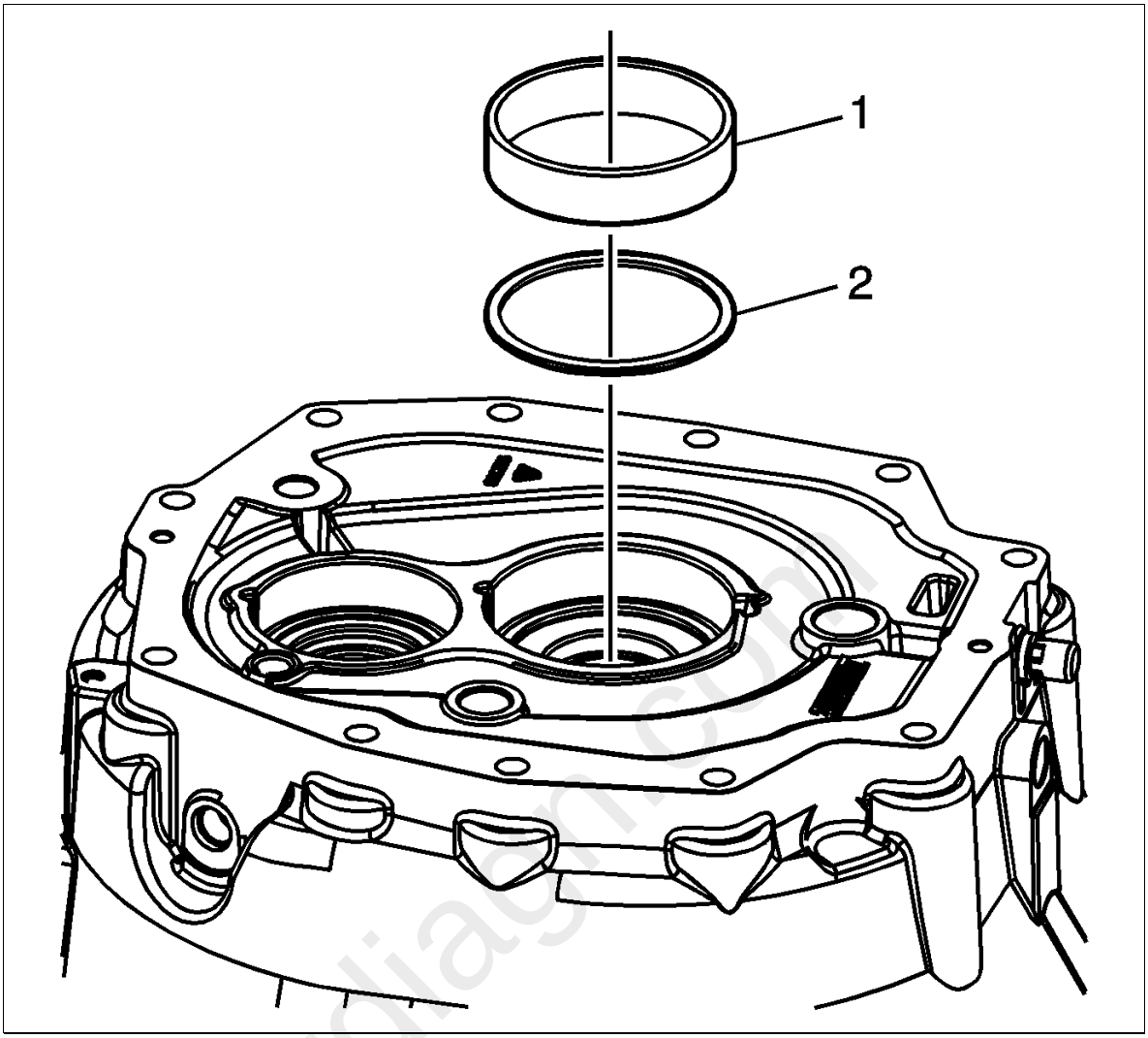
Courtesy of GENERAL MOTORS COMPANY

NOTE:

One or more shims may be used.

12. Install one or more countershaft bearing shims (2) and the bearing race (1). Refer to Input Shaft, Mainshaft and Countershaft in Shimming Procedures (MM6) .

Fig 8: Input Shaft Bearing Race & Shim

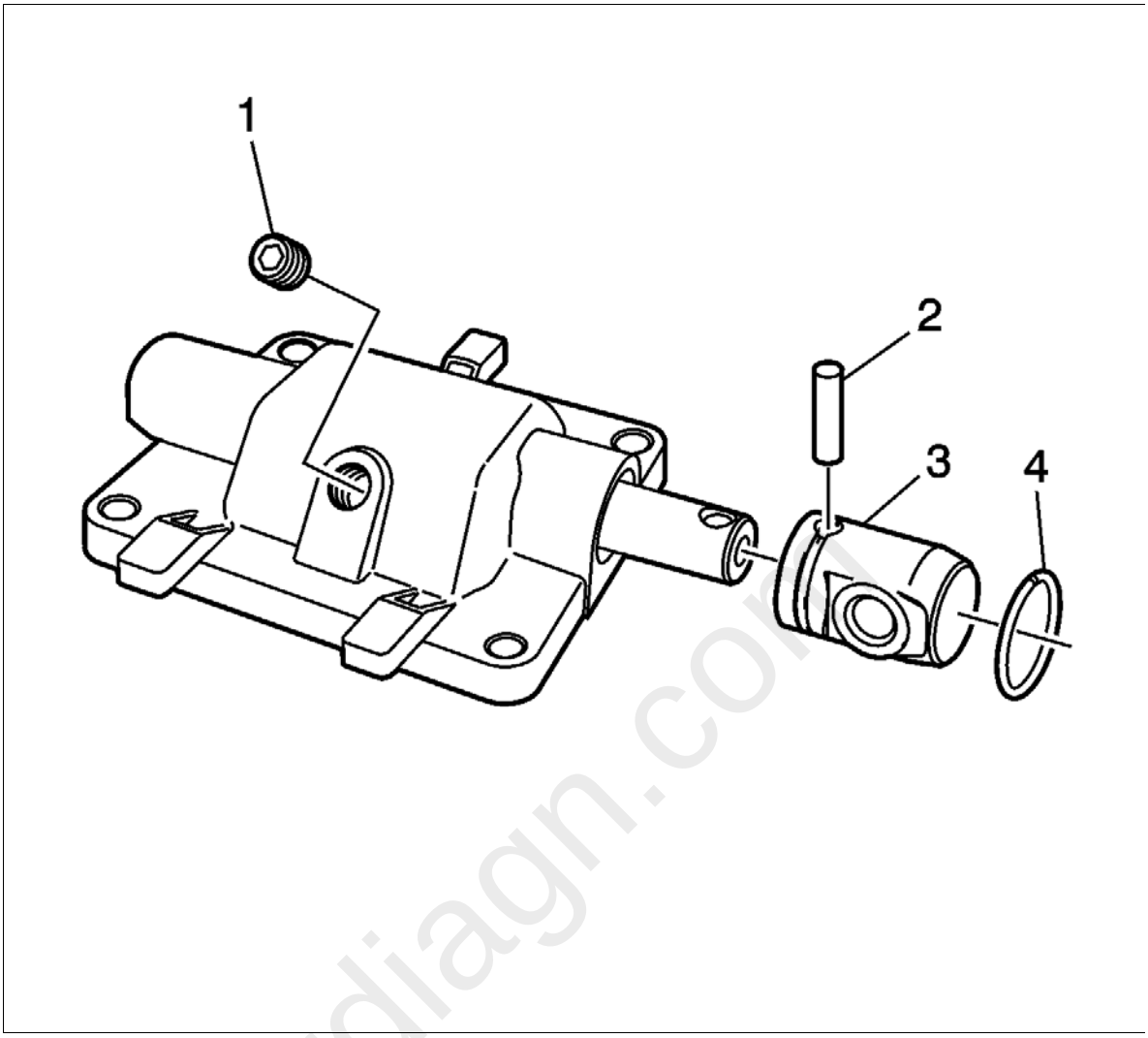


Courtesy of GENERAL MOTORS COMPANY

13. Install one or more input shaft bearing shims 2) and the bearing race (1). Refer to Input Shaft, Mainshaft and Countershaft in Shimming Procedures (MM6) .

REPAIR INSTRUCTIONS - OFF VEHICLE > SHIFT CONTROL SHAFT COVER ASSEMBLY DISASSEMBLE (MM6)

Fig 1: Shift Lever Pin And Shift Control Shaft Cover Set Screw

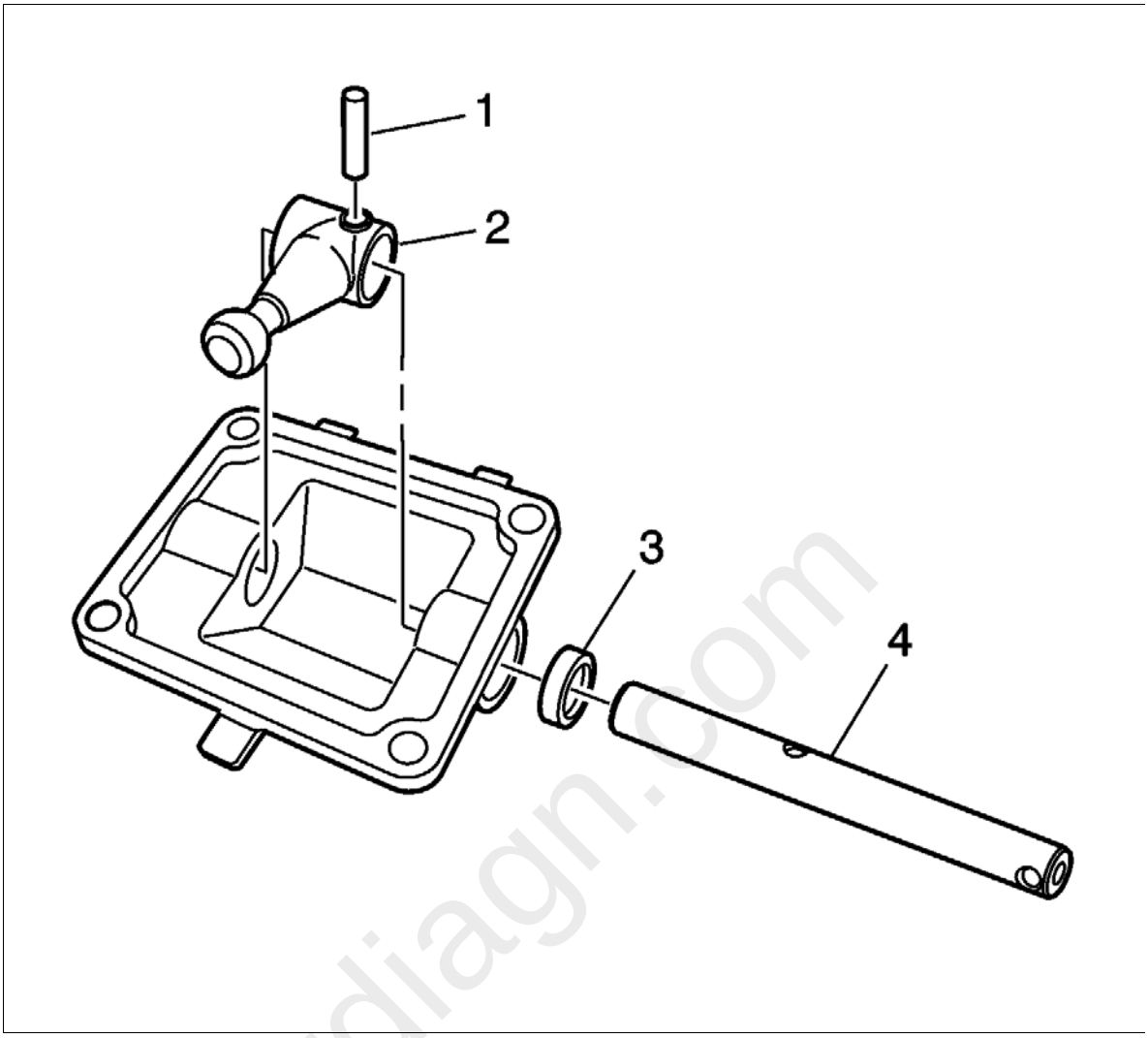


Courtesy of GENERAL MOTORS COMPANY

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1. Remove the manual transmission selector lever rod swivel retainer (4).
2. Remove the manual transmission shift lever pin (2).
3. Remove the manual transmission shift lever rod universal joint assembly (3).
4. Remove the shift control shaft cover set screw (1).

Fig 2: Shift Control Lever Shaft Pin



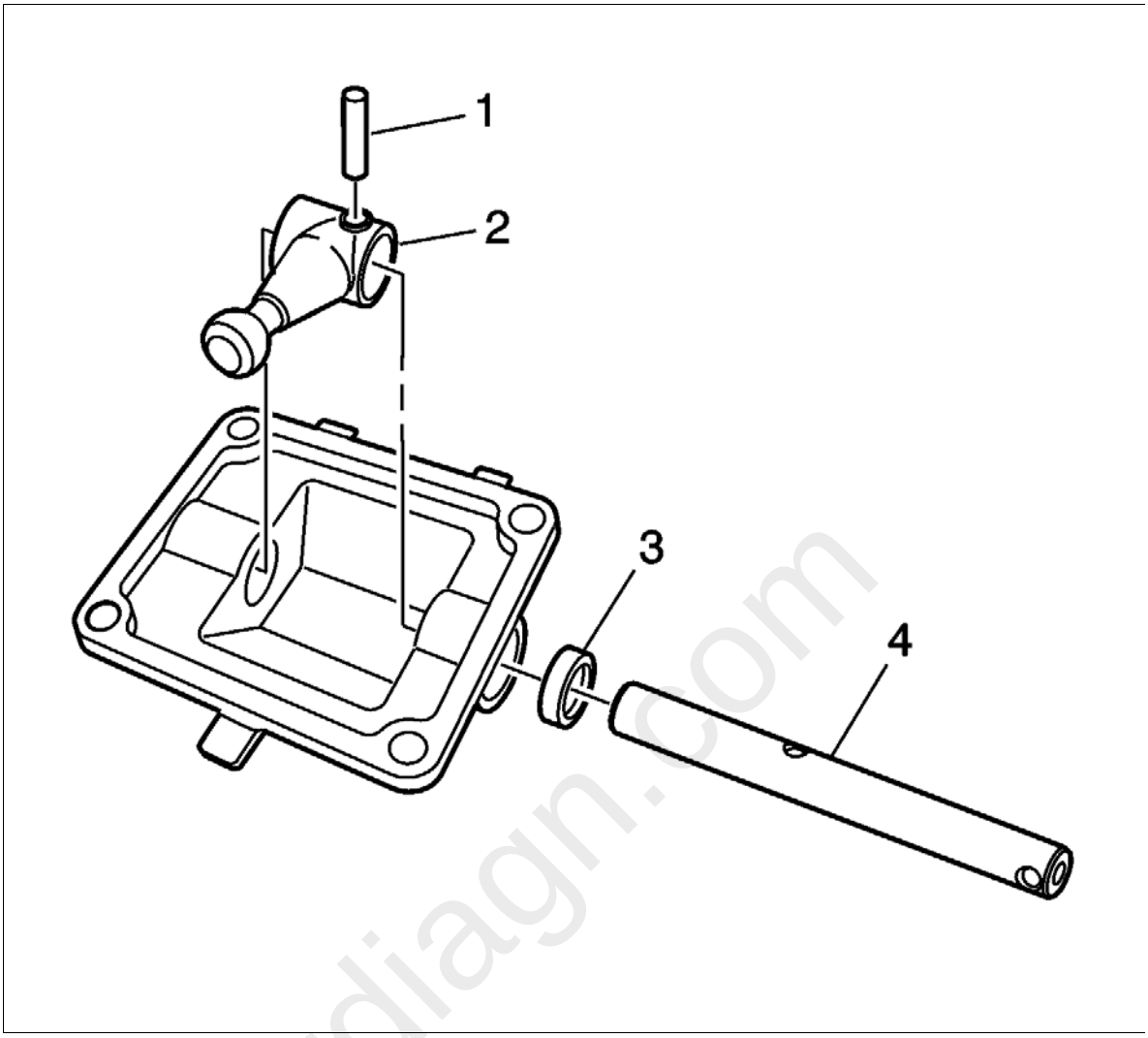
Courtesy of GENERAL MOTORS COMPANY

5. Remove the shift control lever shaft pin (1).
6. Remove the shift control lever (2) and the shift control lever shaft (4).
7. Remove the shift control shaft cover seal (3).

REPAIR INSTRUCTIONS - OFF VEHICLE > SHIFT CONTROL SHAFT COVER ASSEMBLY ASSEMBLE (MM6)

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Fig 1: Shift Control Lever Shaft Pin

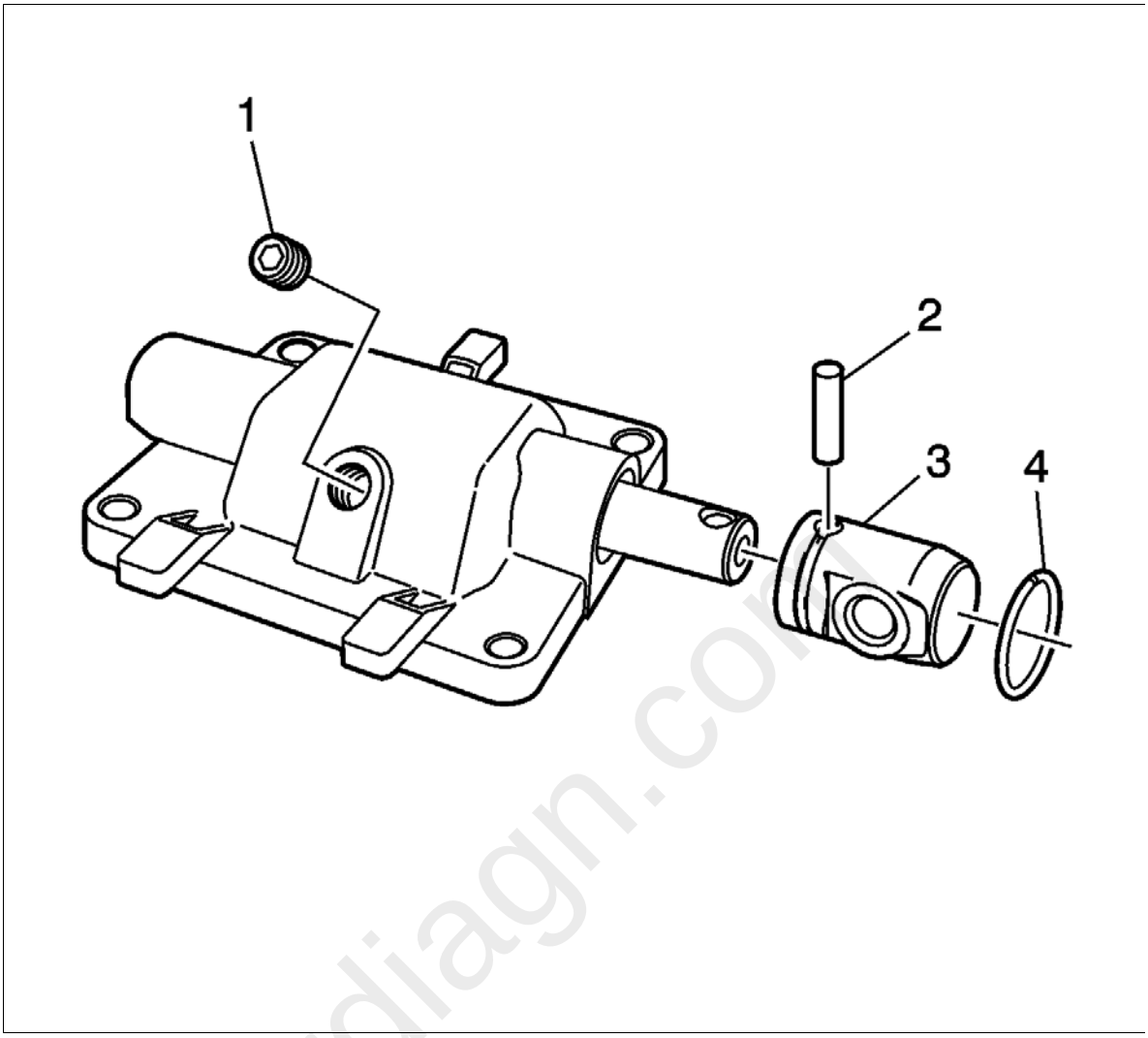


Courtesy of GENERAL MOTORS COMPANY

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1. Install the shift control shaft cover seal (3).
2. Install the shift control lever (2) and the shift control lever shaft (4).
3. Install the shift control lever shaft pin (1).

Fig 2: Shift Lever Pin And Shift Control Shaft Cover Set Screw



Courtesy of GENERAL MOTORS COMPANY

4. Install the shift control shaft cover set screw (1).
5. Install the manual transmission shift lever rod universal joint assembly (3).
6. Install the manual transmission shift lever pin (2).
7. Install the manual transmission selector lever rod swivel retainer (4).

REPAIR INSTRUCTIONS - OFF VEHICLE > EXTENSION DISASSEMBLE (MM6)

Special Tools

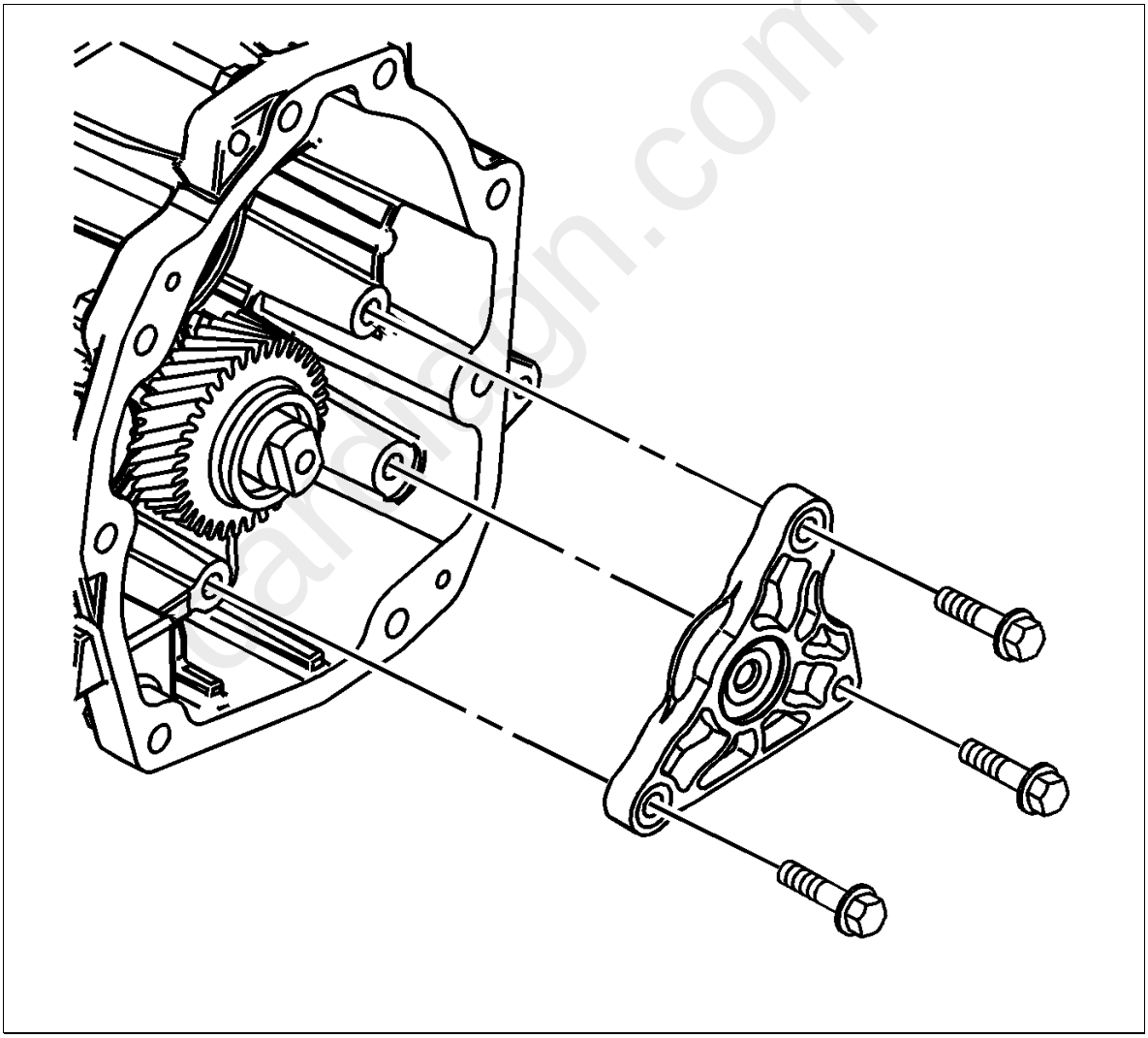
- **DT 49216** Shift Rail Bearing Remover
- **J 23907** Slide Hammer with Bearing Adapter
- **J 26941** Bearing Race Remover

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- **J 29369-2** Bushing and Bearing Remover - 2-3 in
- **J 36190** Universal Driver Handle
- **J 39431** Fifth/Sixth Driven Gear Puller
- **J 39439-1** Bushing Installer
- **J 39439-2** Shift Rail Bushing Remover
- **J 39439-3** Bushing Installer
- **J 45124** Removal Bridge
- **J 45124-9** Puller Leg

For equivalent regional tools, refer to Special Tools (MM6) .

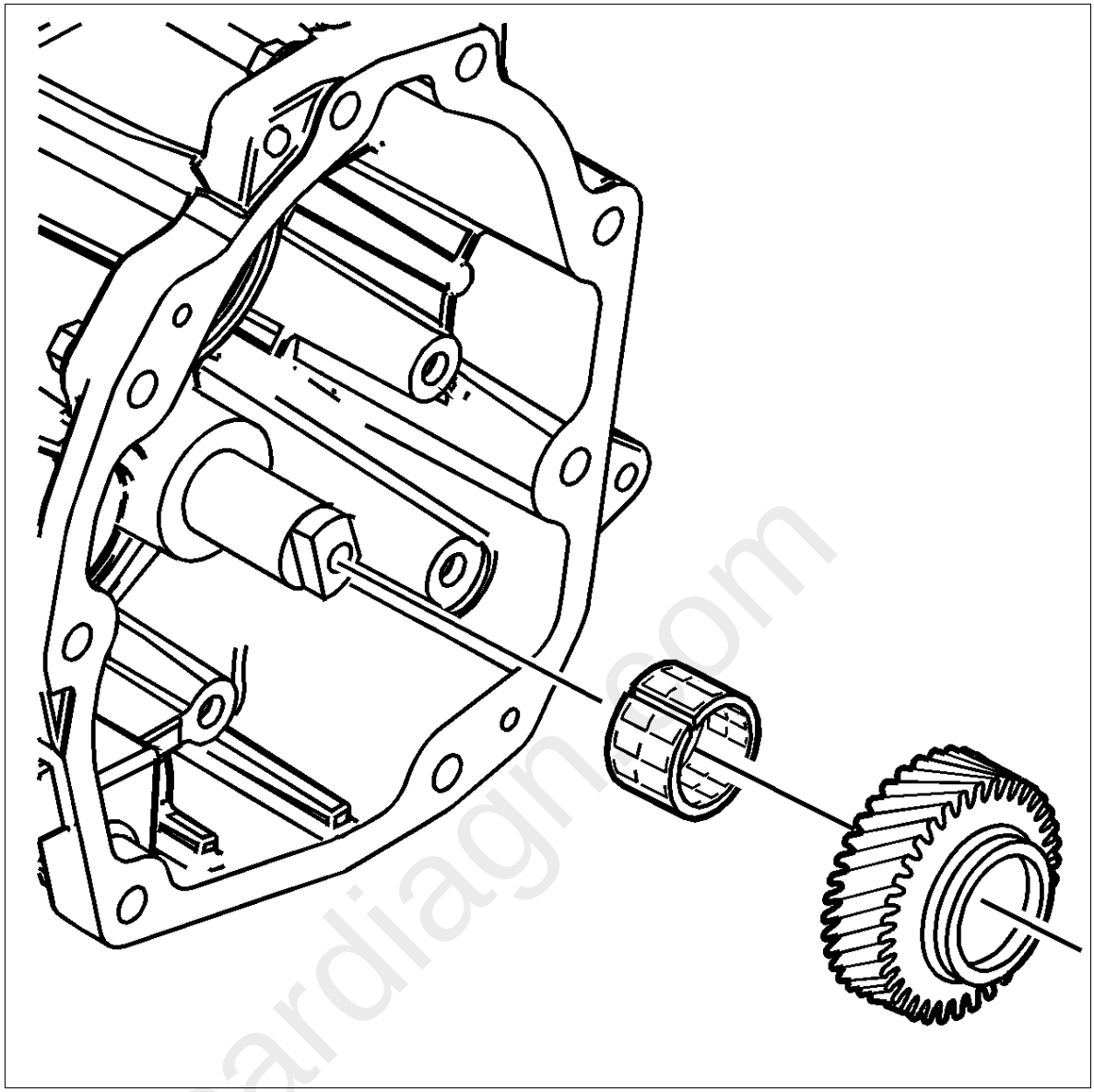
Fig 1: Reverse Idler Shaft Bracket Bolts



Courtesy of GENERAL MOTORS COMPANY

1. Remove the reverse idler shaft bracket bolts and bracket.

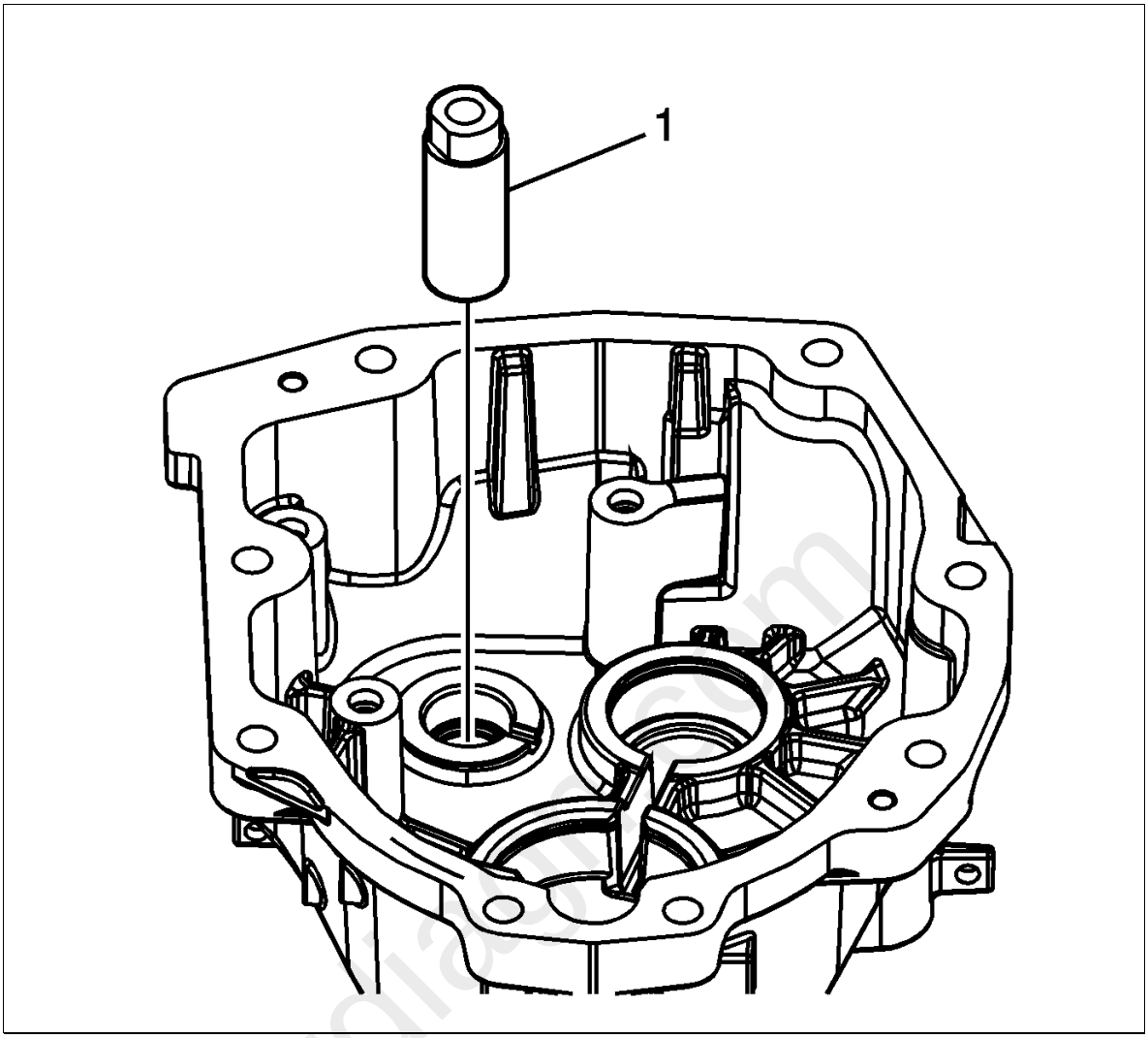
Fig 2: Reverse Idler Gear And The Roller Bearing



Courtesy of GENERAL MOTORS COMPANY

2. Remove the reverse idler gear and the roller bearing.

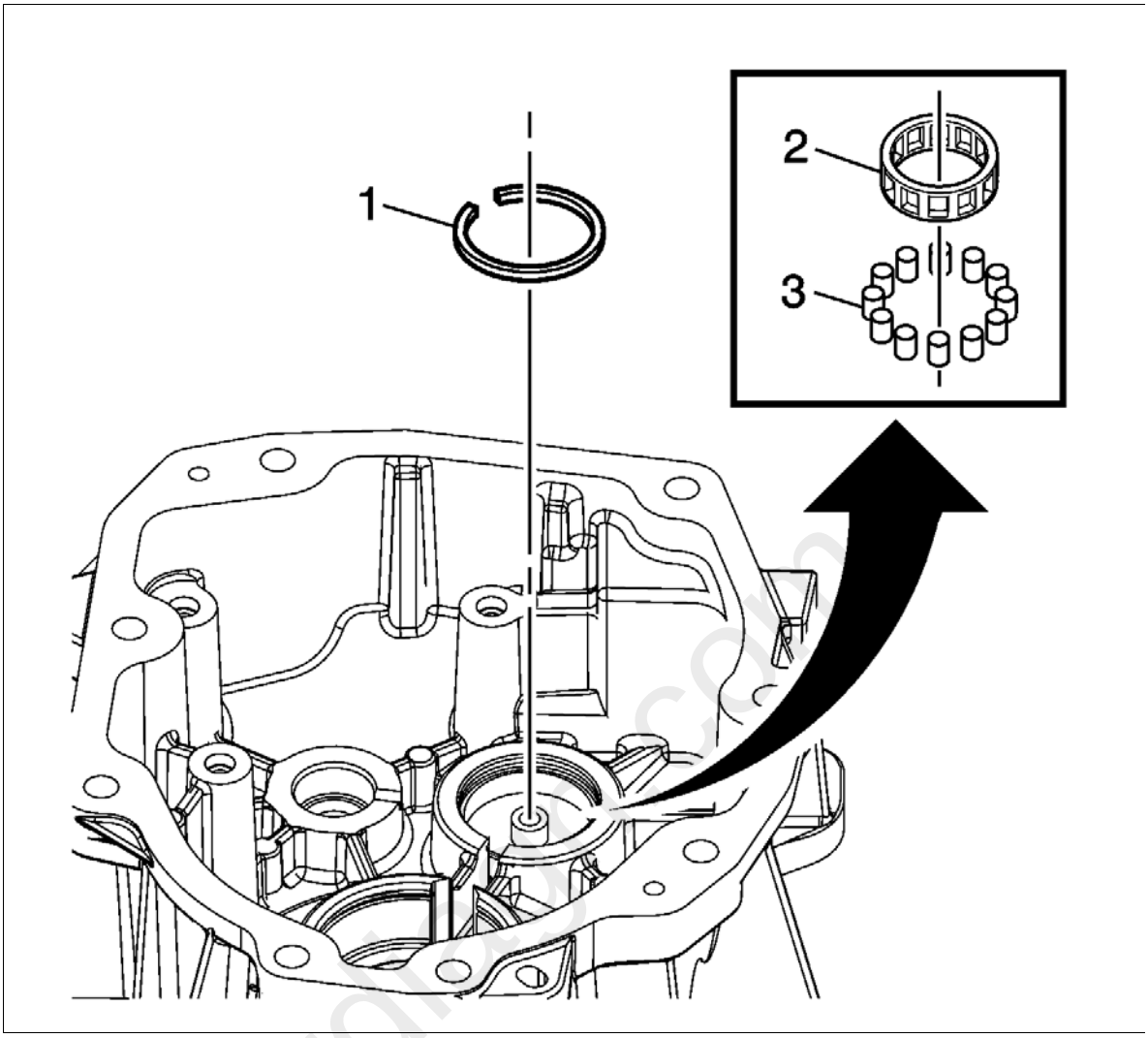
Fig 3: Reverse Idler Gear Shaft



Courtesy of GENERAL MOTORS COMPANY

3. Remove the reverse idler gear shaft (1).

Fig 4: Countershaft Rear Bearing Retainer



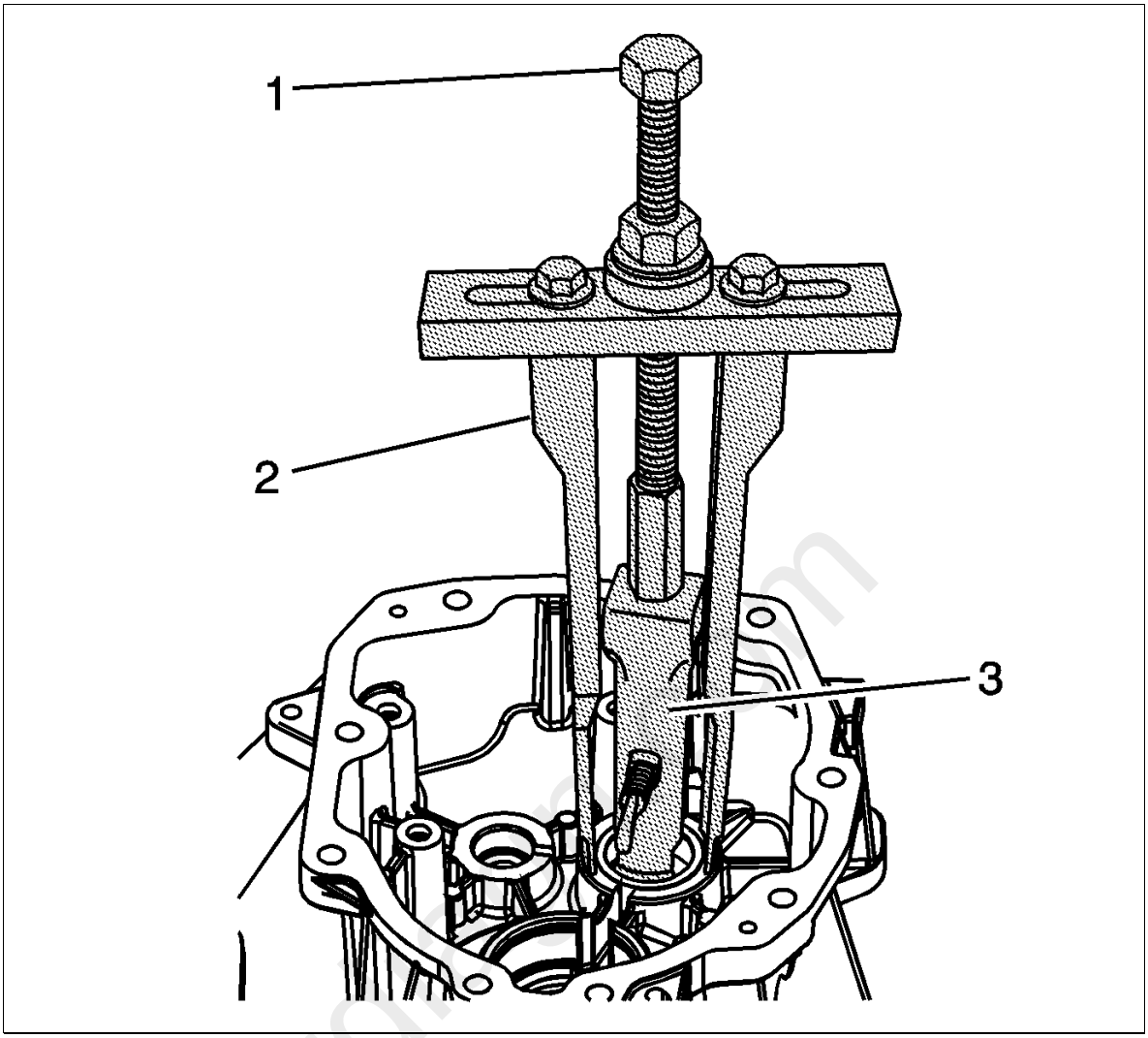
Courtesy of GENERAL MOTORS COMPANY

4. Remove the countershaft rear bearing retainer (1).

> *NOTE:*
>
> *The plastic roller bearing cage (2) and bearings are part of the countershaft bearing assembly. Always use a new countershaft bearing assembly.*

5. Cut away the plastic roller bearing cage (2) from the countershaft bearing assembly.
6. Remove the bearings (3). Discard the cage and bearings.

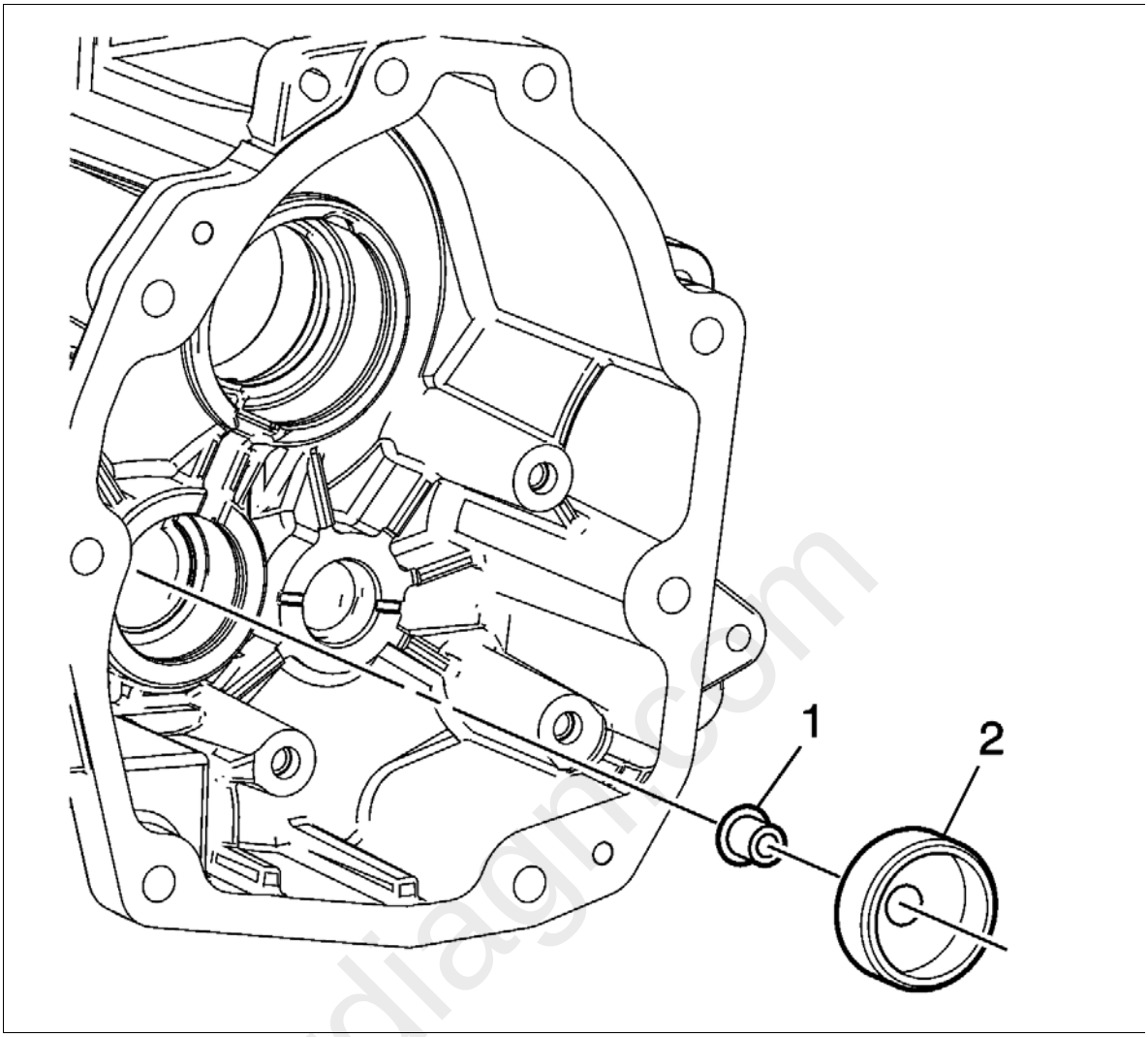
Fig 5: Extension Bearing Race & Extension Housing



Courtesy of GENERAL MOTORS COMPANY

7. Install **J 45124-1** removal bridge (1), **J 45124-9** puller leg (2), and **J 29369-2** remover (3) in the race from the countershaft bearing assembly in the extension housing.
8. Remove the race.

Fig 6: Oil Funnel & Bearing Assembly



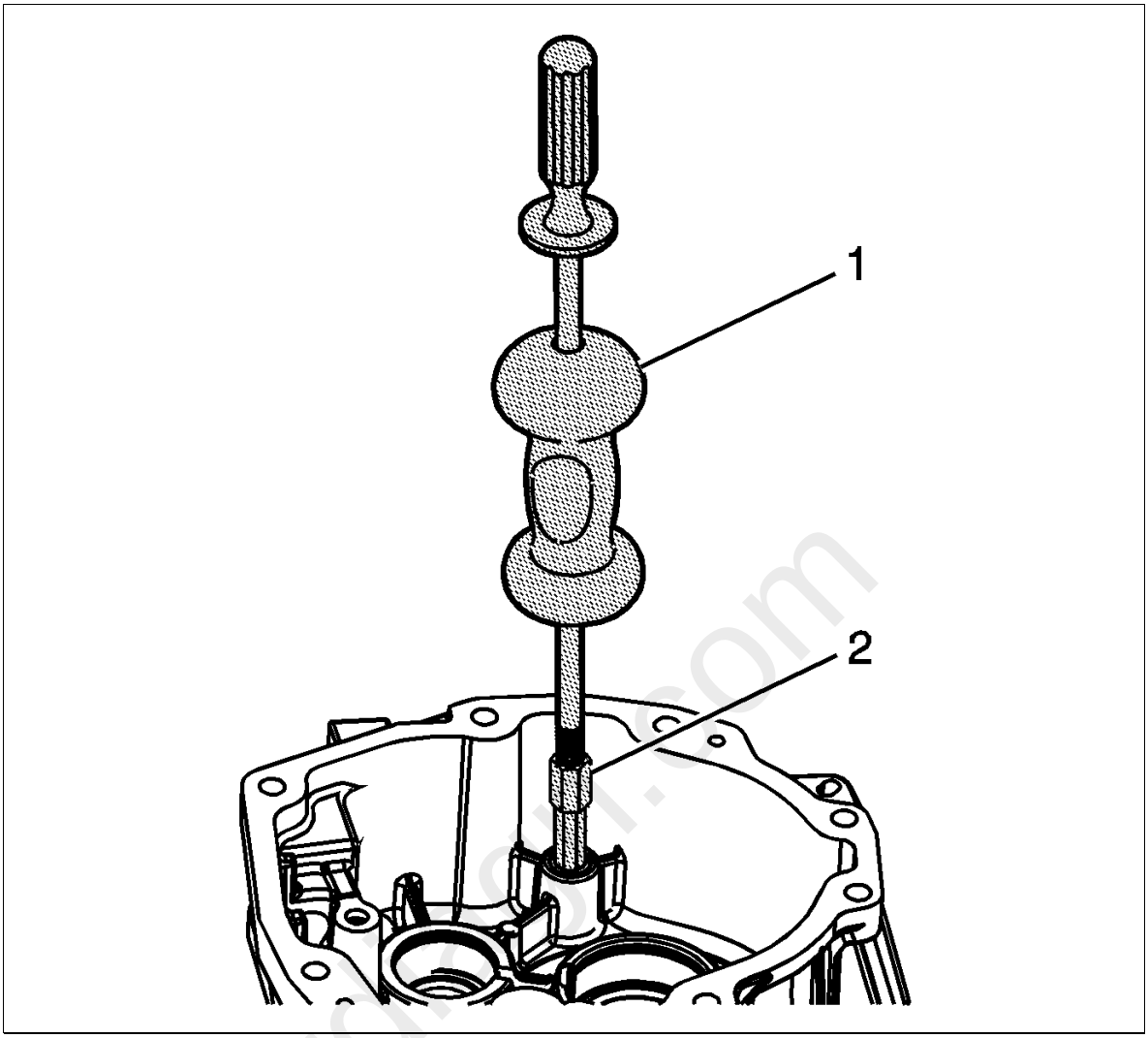
Courtesy of GENERAL MOTORS COMPANY

NOTE:

The bearing race is part of the countershaft bearing assembly. Always use a new countershaft bearing assembly.

9. Remove the oil funnel (1) from the bearing race (2). Discard the bearing race.

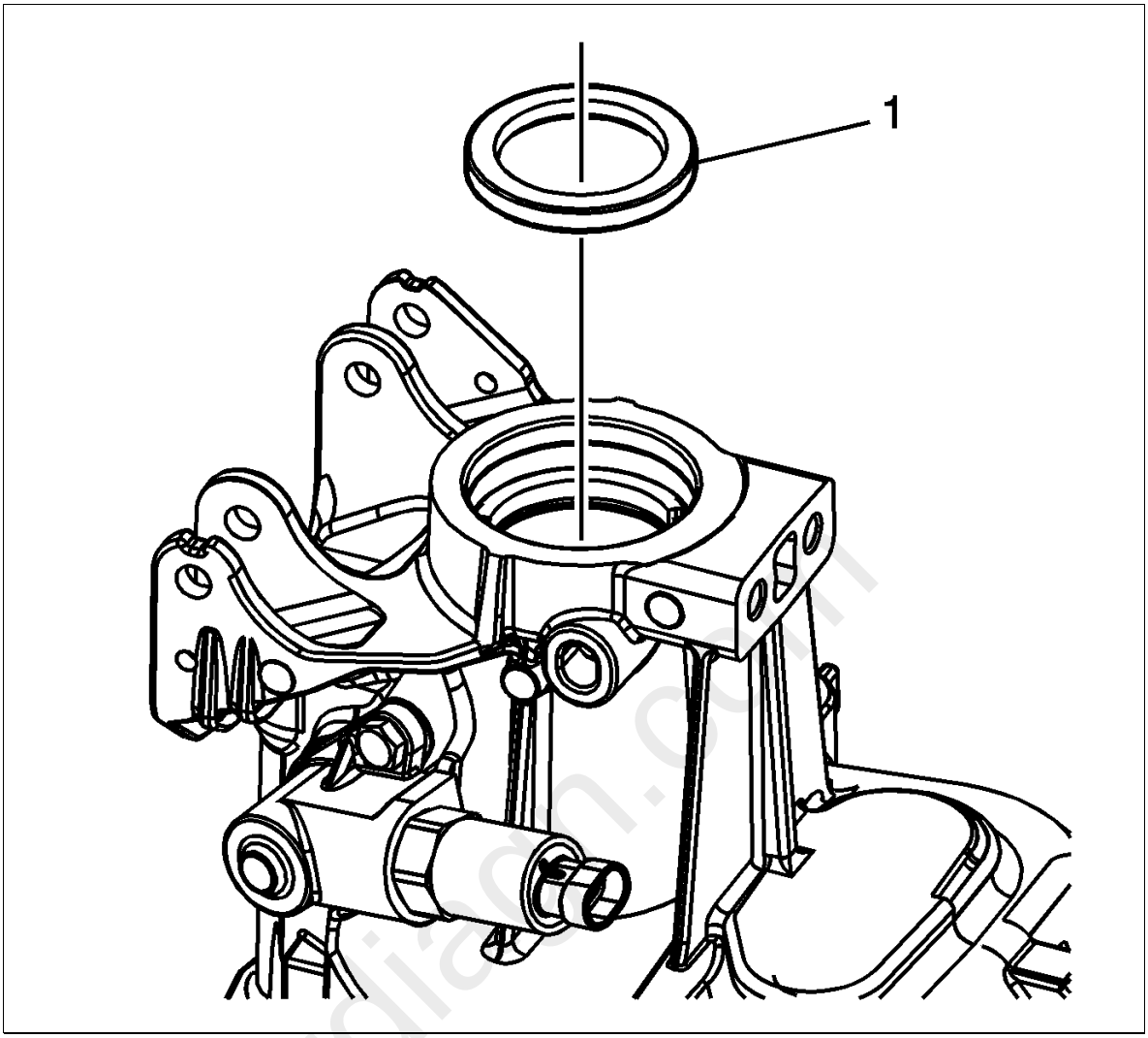
Fig 7: Special Tools



Courtesy of GENERAL MOTORS COMPANY

10. Using **J 39439-2** remover (2) and **J 23907** slide hammer (1), remove the bushing.

Fig 8: Output Shaft Seal



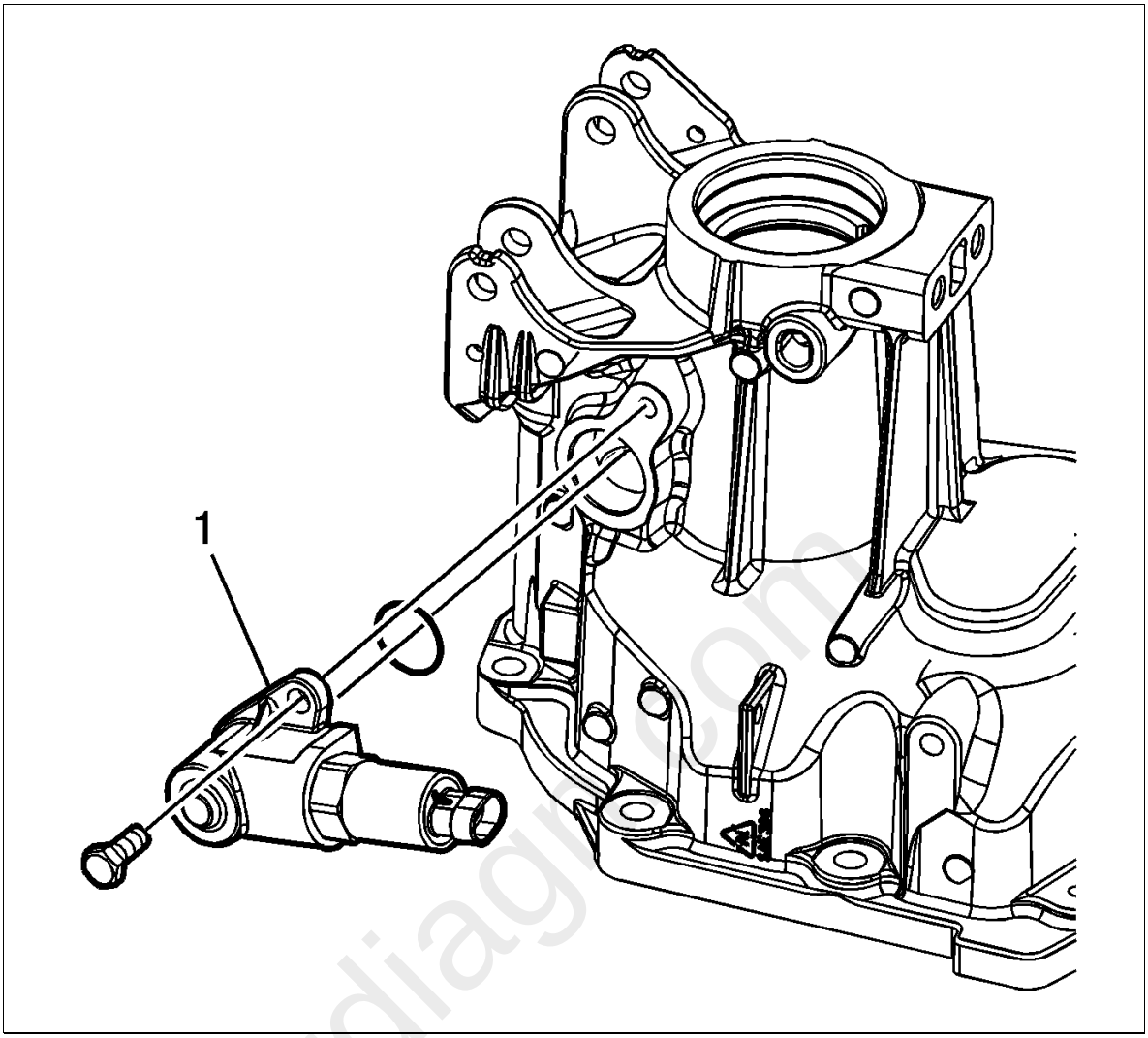
Courtesy of GENERAL MOTORS COMPANY

11. Remove the output shaft seal (1).

    Pry out the seal with a suitable tool.

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Fig 9: Reverse Lockout Assembly

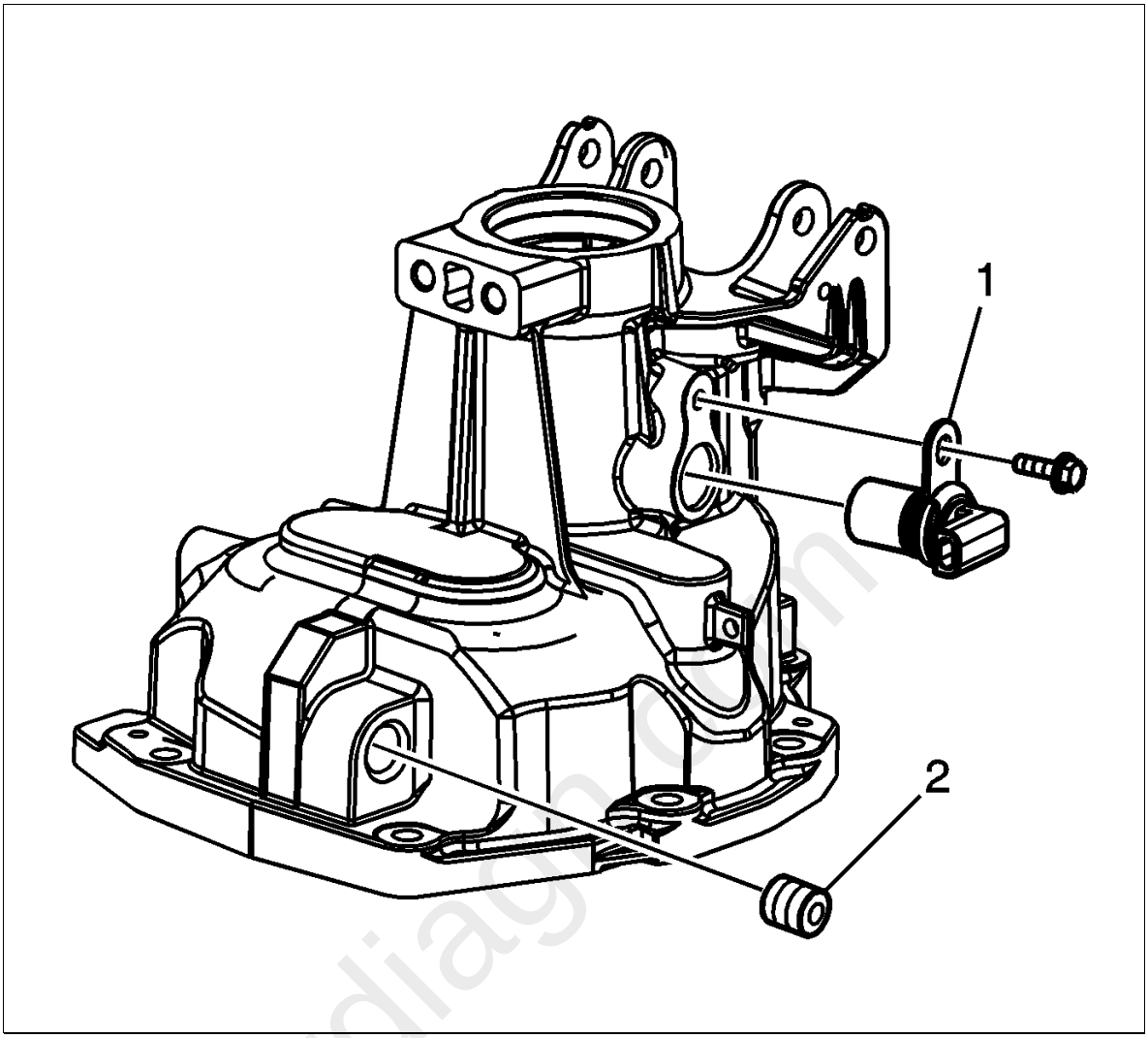


Courtesy of GENERAL MOTORS COMPANY

12. Remove the mounting bolt, the reverse lockout assembly (1) and the O-ring.

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Fig 10: Transmission Case Drain Plug & Vehicle Speed Sensor

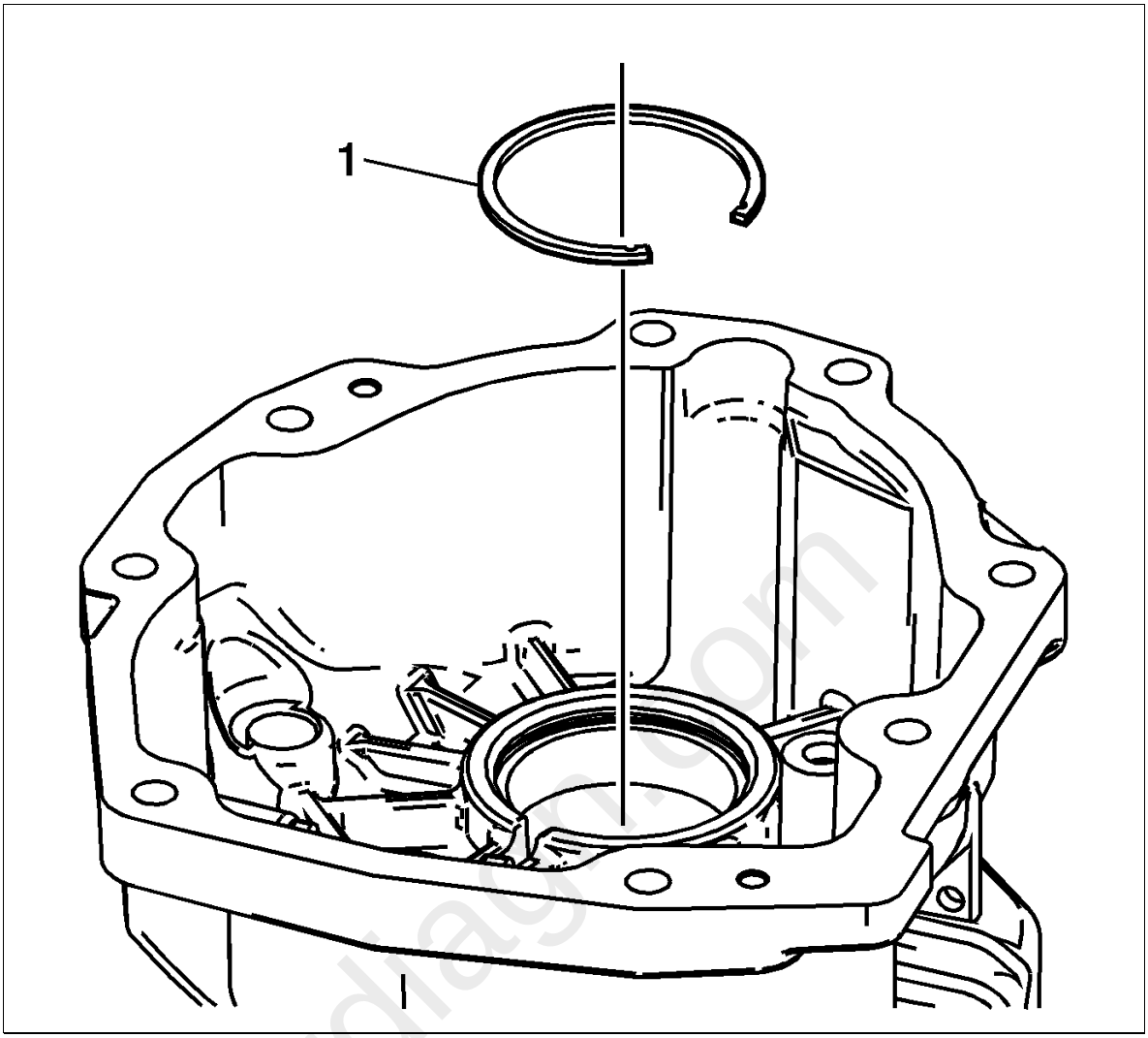


Courtesy of GENERAL MOTORS COMPANY

13. Remove the bolt and the vehicle speed sensor (1).
14. Remove the plug (2).

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Fig 11: Mainshaft Bearing Race Retainer Ring

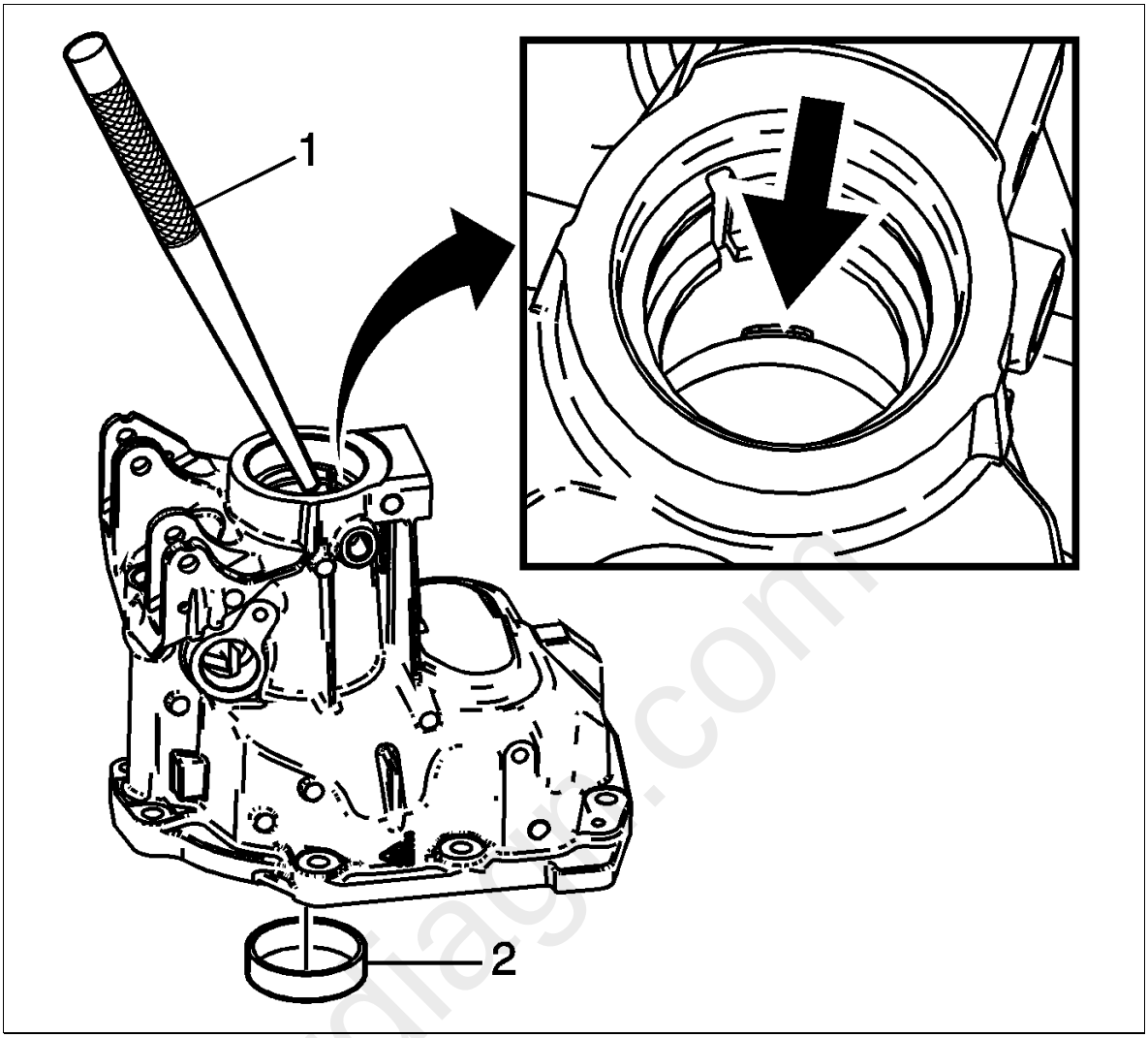


Courtesy of GENERAL MOTORS COMPANY

15. Remove the mainshaft bearing race retainer ring (1).

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Fig 12: Mainshaft Bearing Race



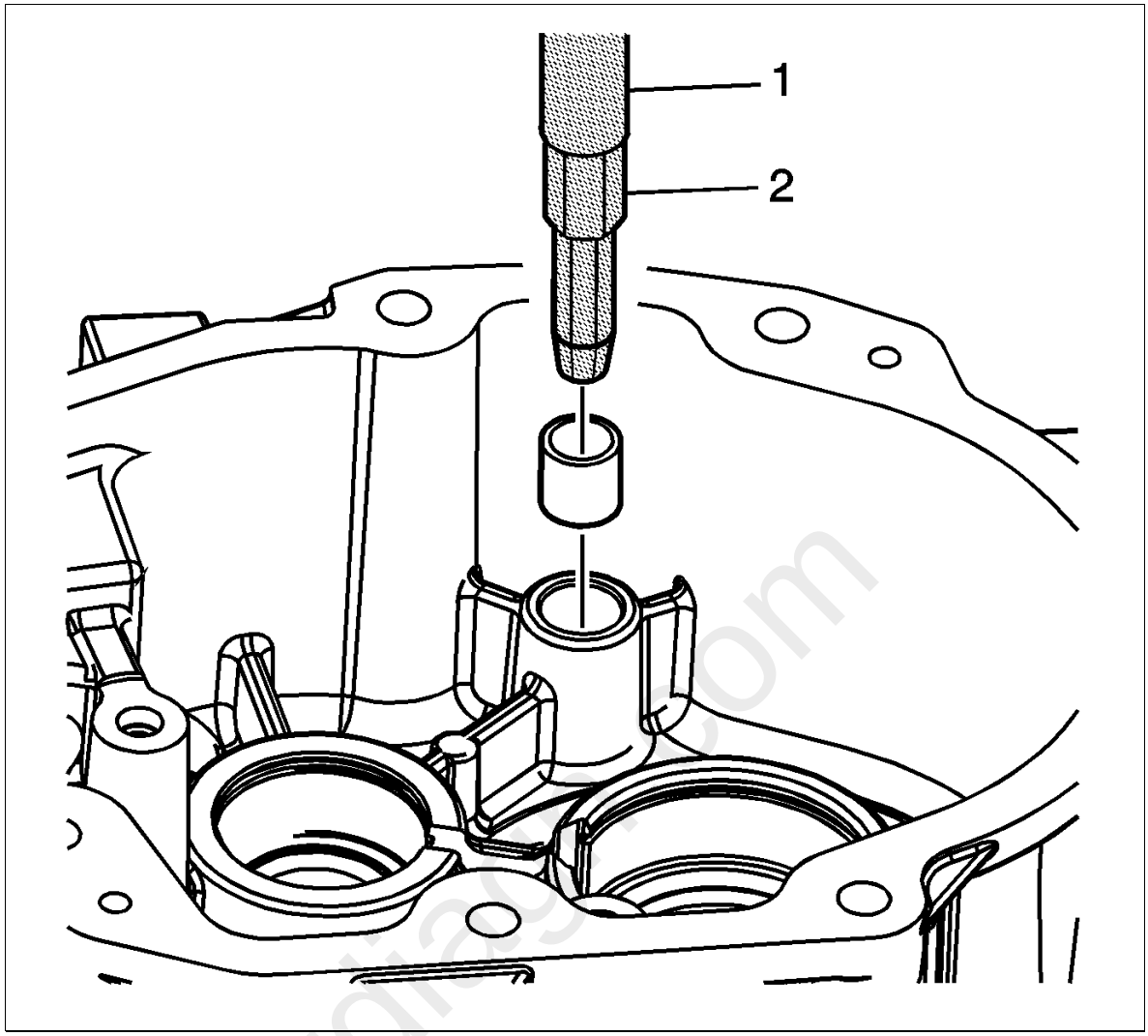
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Do not replace the bearing race unless inspection shows bearing race damage.

16. Place the extension housing on a flat work surface. Locate the oil clearance gap between the housing and the main shaft bearing race.
17. Insert a brass drift (1) through the mainshaft opening of the extension housing, into the oil clearance gap. Using a mallet, tap down on the drift to remove the mainshaft bearing race (2).

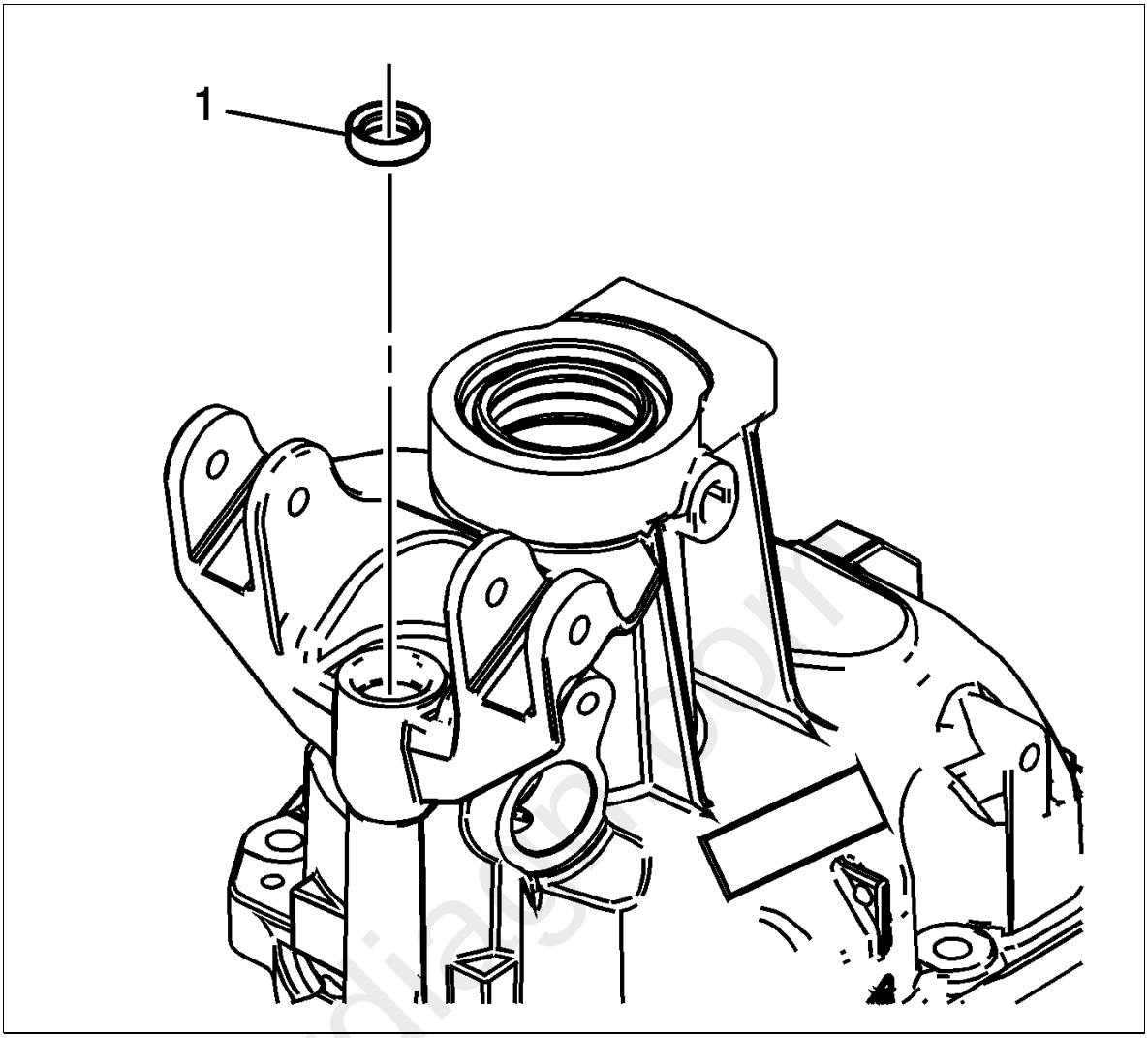
Fig 13: Reverse Rail Bushing



Courtesy of GENERAL MOTORS COMPANY

18. Remove the reverse rail bushing using the **J 36190** handle (1) and **J 39439-2** installer (2).

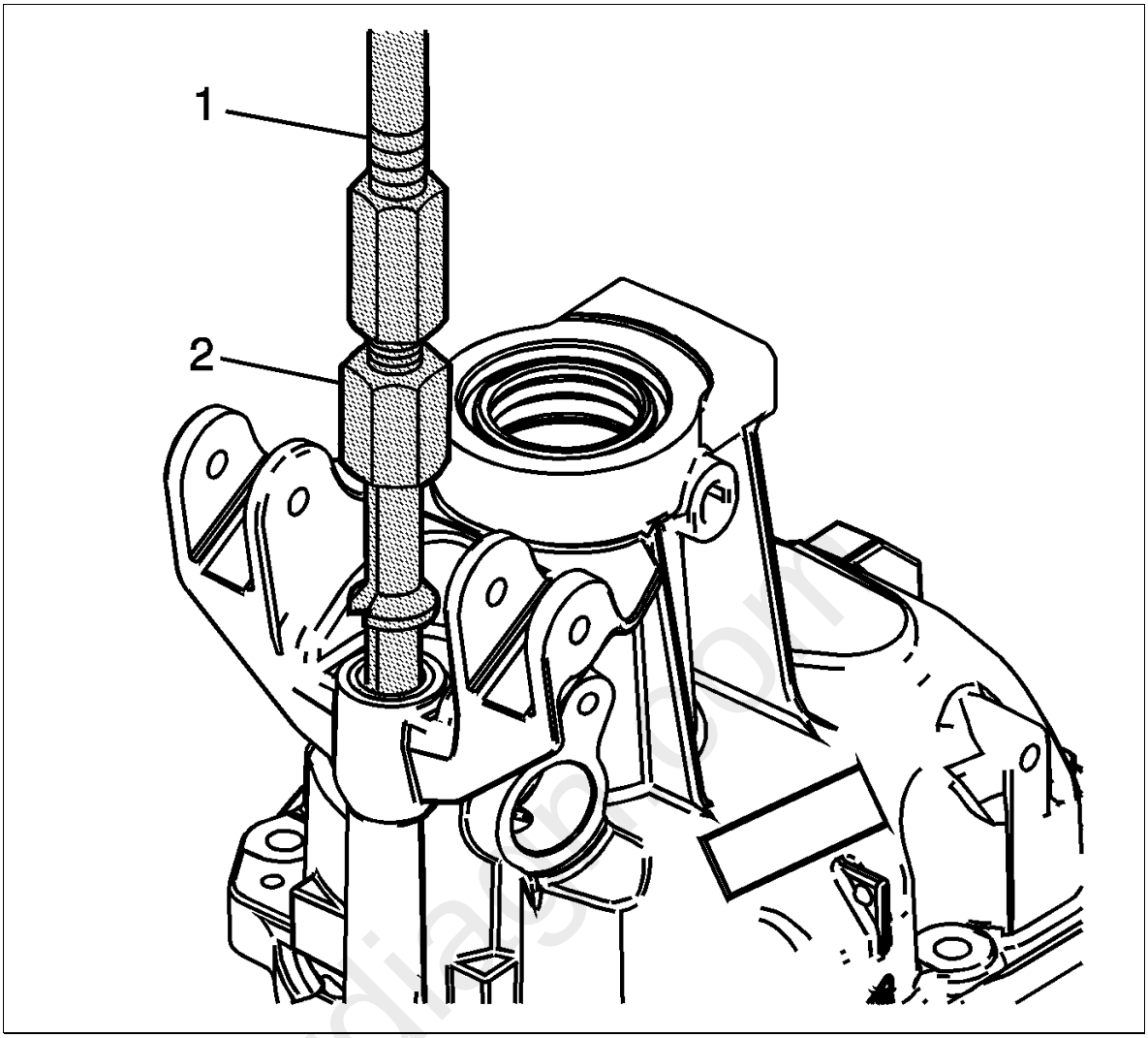
Fig 14: Rear Housing Shift Rail Seal



Courtesy of GENERAL MOTORS COMPANY

19. Remove the rear housing shift rail seal (1).

Fig 15: Shift Rail Bearing

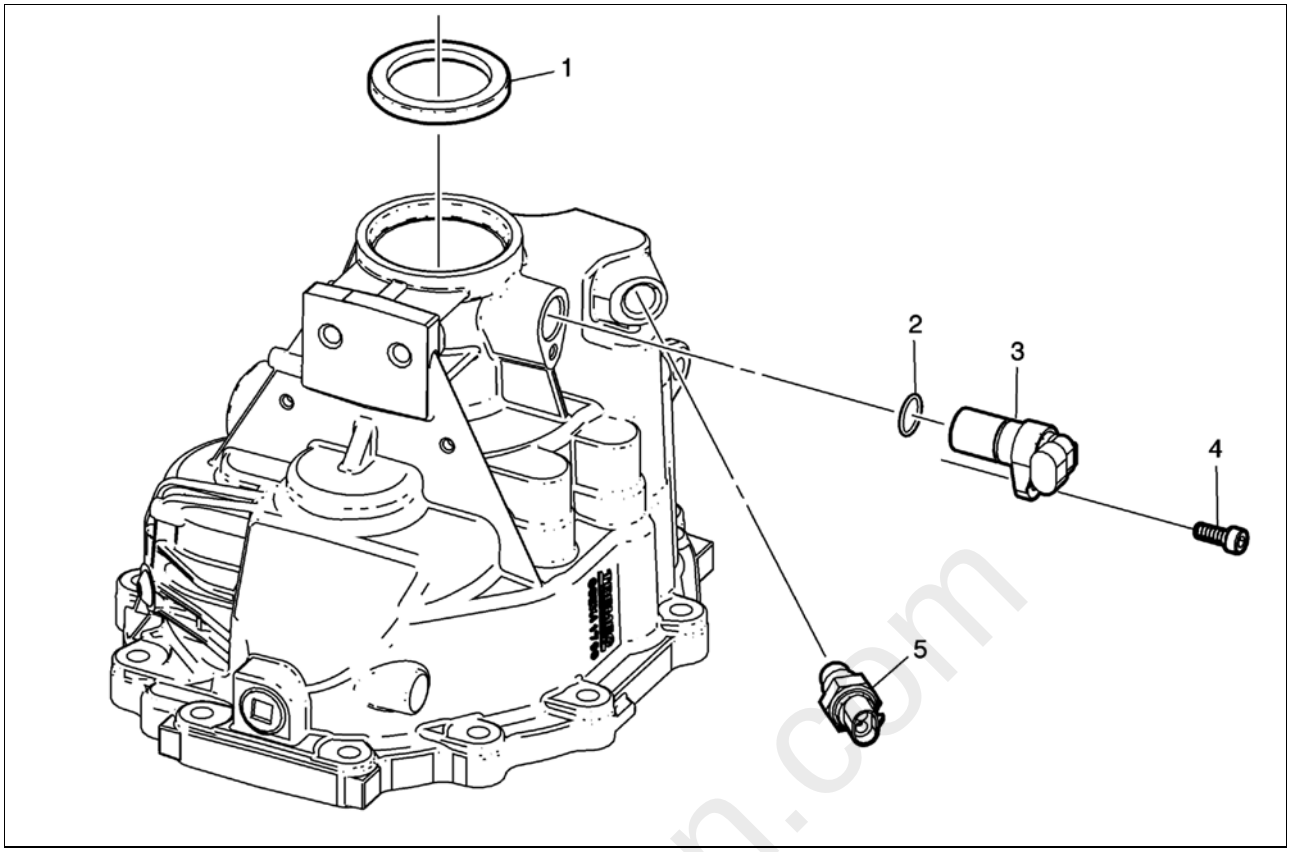


Courtesy of GENERAL MOTORS COMPANY

20. Remove the shift rail bearing using the **J 23907** slide hammer (1) and **DT 49216** remover (2).

REPAIR INSTRUCTIONS - OFF VEHICLE > EXTENSION DISASSEMBLE (M13) > PROPELLER SHAFT OIL SEAL, REVERSE SENSOR, AND SPEED SENSOR REMOVAL

Fig 1: Propeller Shaft Oil Seal, Reverse Sensor & Speed Sensor



Courtesy of GENERAL MOTORS COMPANY

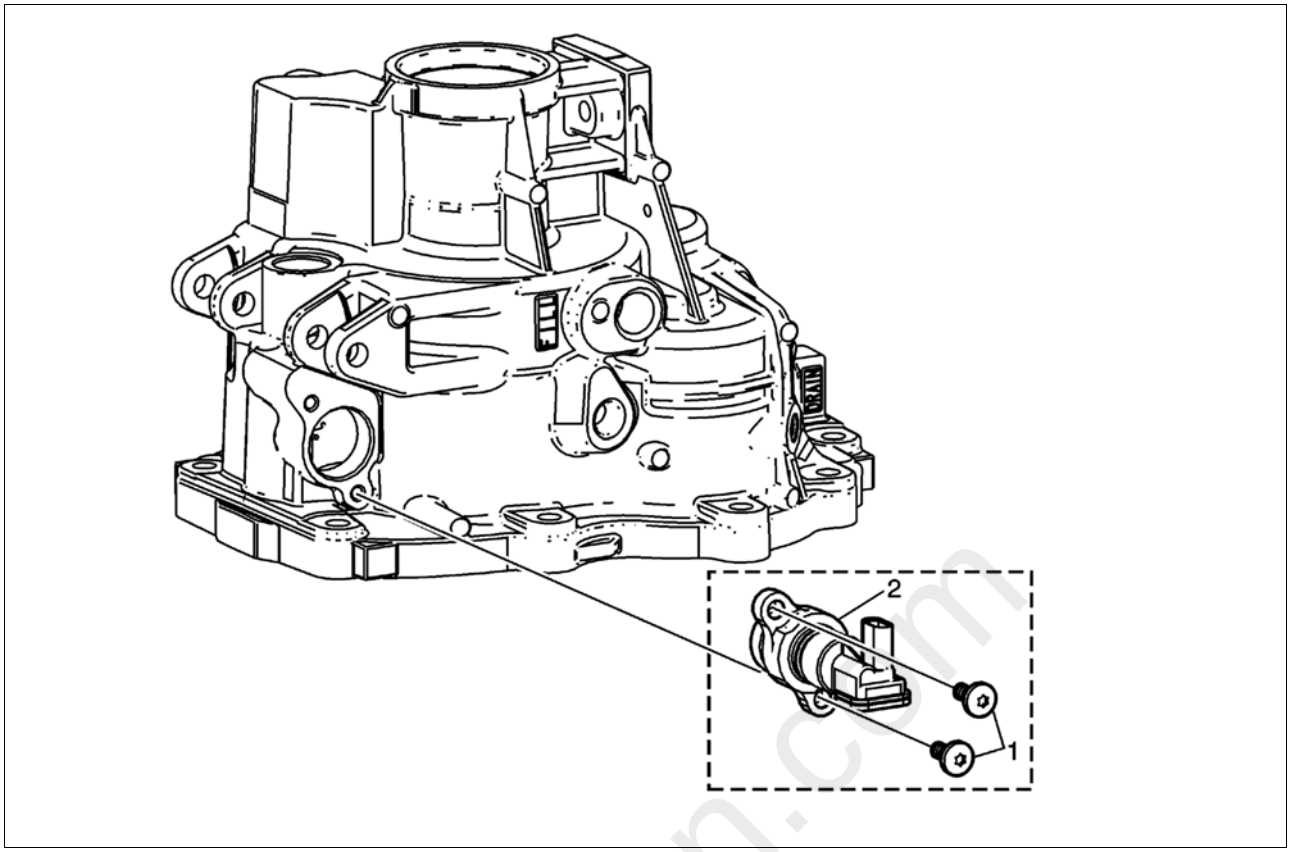
Propeller Shaft Oil Seal, Reverse Sensor, and Speed Sensor Removal

Callout	Component Name
1	Propeller Shaft Oil Seal
2	Vehicle Speed Sensor Seal (O-ring)
3	Manual Transmission Output Speed Sensor Assembly
4	Transmission Speed Sensor Bolt/Screw
5	Reverse Sensor

REPAIR INSTRUCTIONS - OFF VEHICLE > EXTENSION DISASSEMBLE (M13) > NEUTRAL SENSOR REMOVAL

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Fig 1: Neutral Sensor



Courtesy of GENERAL MOTORS COMPANY

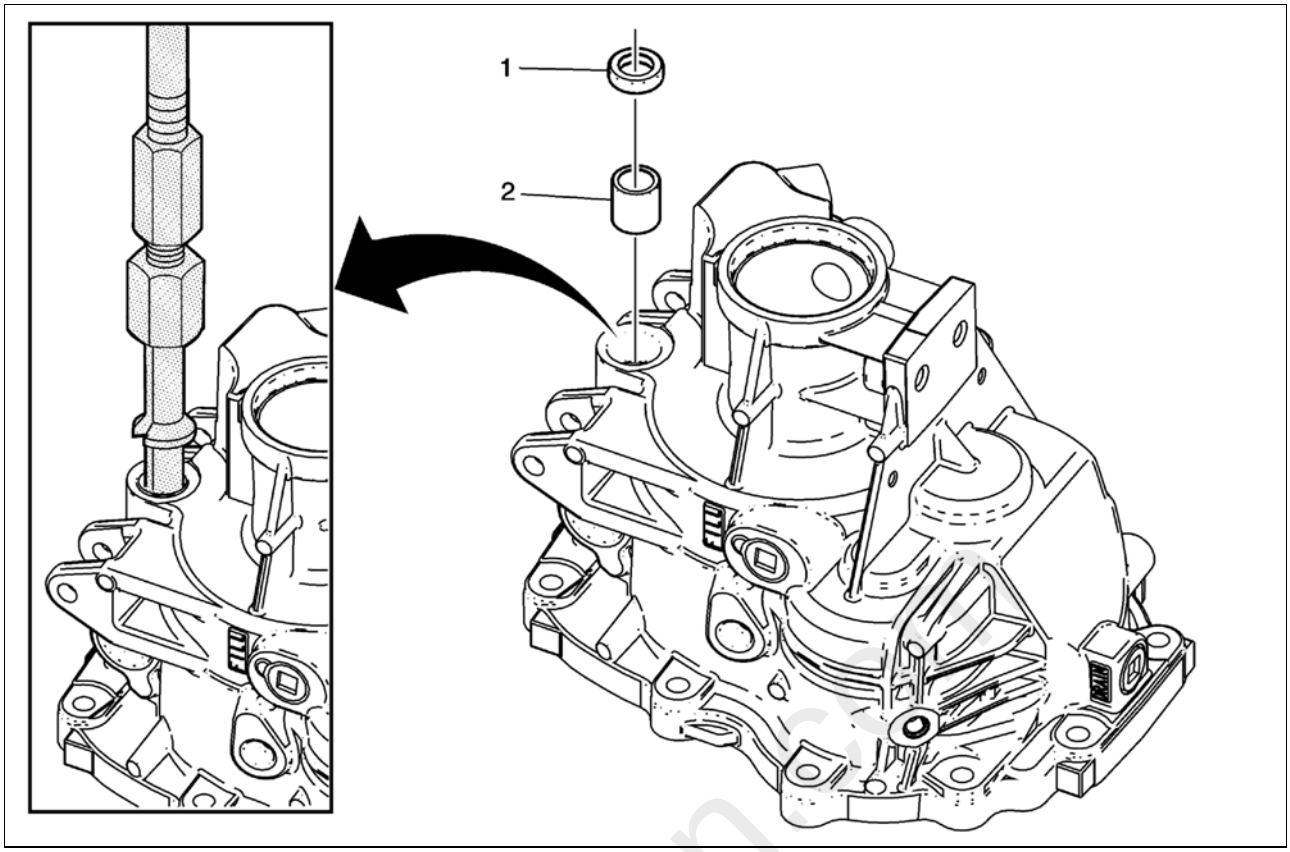
Neutral Sensor Removal

Callout	Component Name
1	Neutral Position Sensor Bolt/Screw - Model Dependent
2	Neutral Position Sensor Assembly - Model Dependent

REPAIR INSTRUCTIONS - OFF VEHICLE > EXTENSION DISASSEMBLE (M13) > SHIFT SHAFT BEARING AND CONTROL LEVER SEAL REMOVAL

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Fig 1: Shift Shaft Bearing & Control Lever Seal



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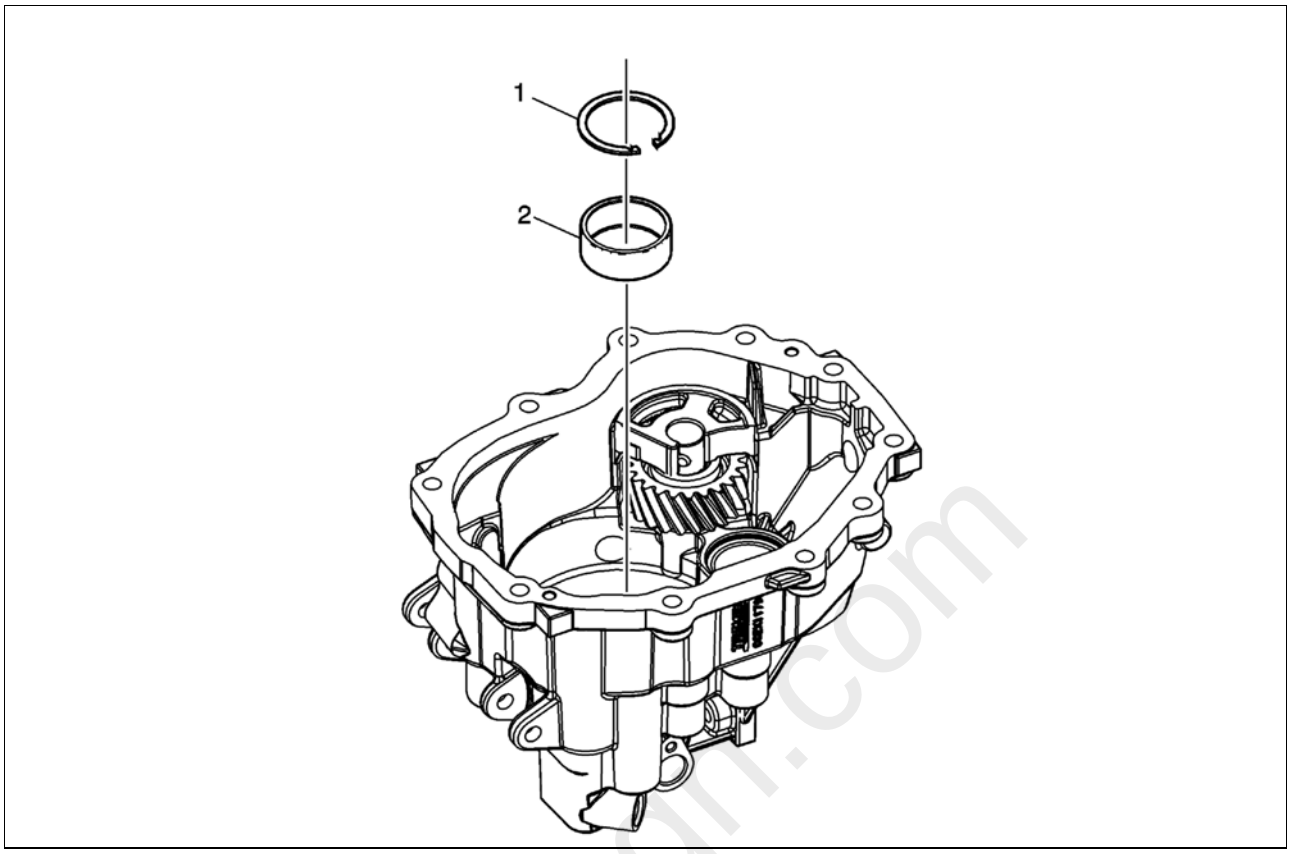
Shift Shaft Bearing and Control Lever Seal Removal

Callout	Component Name
1	Manual Transmission Control Lever Seal
2	Shift Shaft Bearing Assembly Procedure 1. Install the **DT 49216** bushing remover (3) into the bearing. 2. Install the **J 23907-1** slide hammer (4) into the remover. 3. Remove the bearing. **Special Tools** **DT 49216** Bushing Remover **J 23907-1** Slide Hammer For equivalent regional tools, refer to Special Tools (M13) .

REPAIR INSTRUCTIONS - OFF VEHICLE > EXTENSION DISASSEMBLE (M13) > MAIN

SHAFT REAR BEARING REMOVAL

Fig 1: Main Shaft Rear Bearing Race & Retainers



Courtesy of GENERAL MOTORS COMPANY

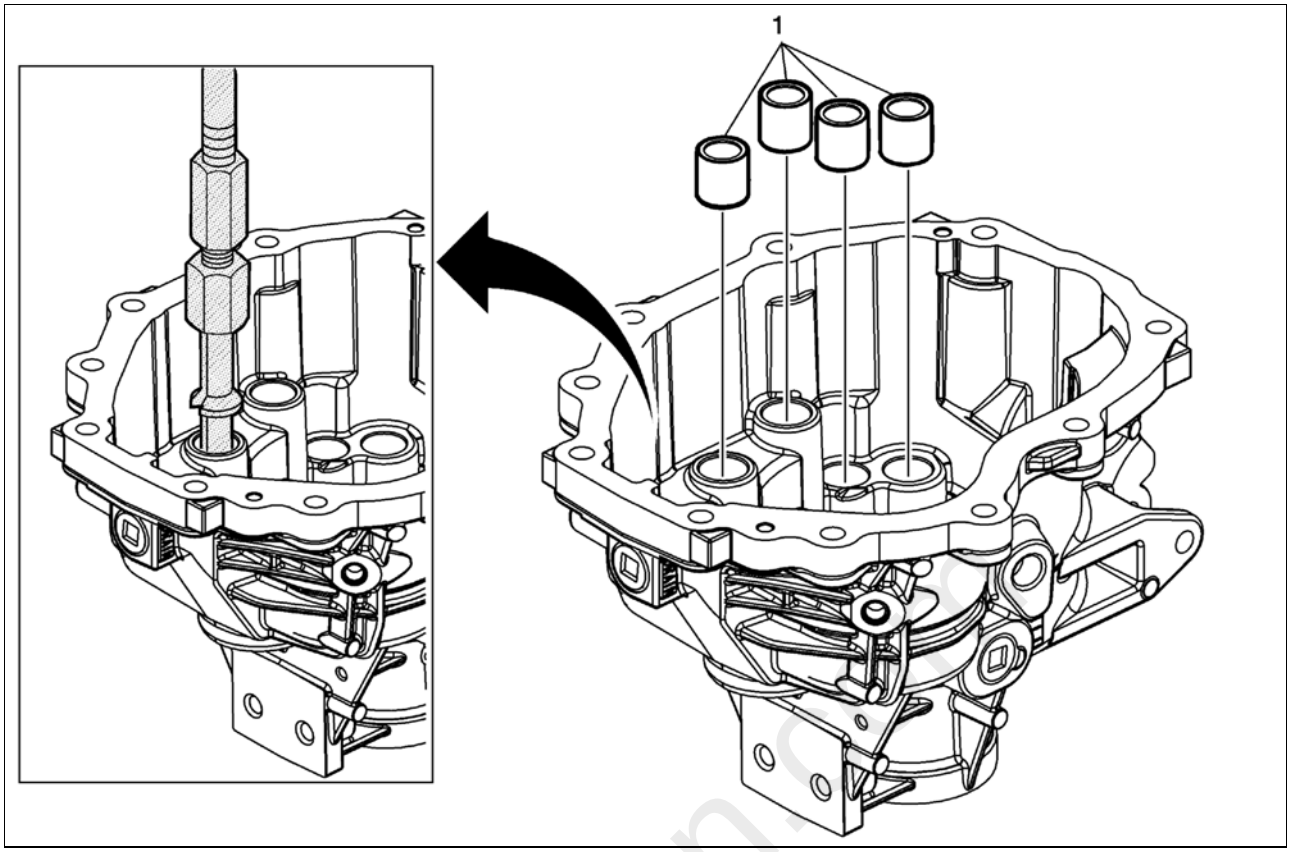
Main Shaft Rear Bearing Removal

Callout	Component Name
1	Main Shaft Rear Bearing Retainer
2	Main Shaft Rear Bearing Race

REPAIR INSTRUCTIONS - OFF VEHICLE > EXTENSION DISASSEMBLE (M13) > SHIFT SHAFT BEARING REMOVAL

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Fig 1: Shift Shaft Bearing



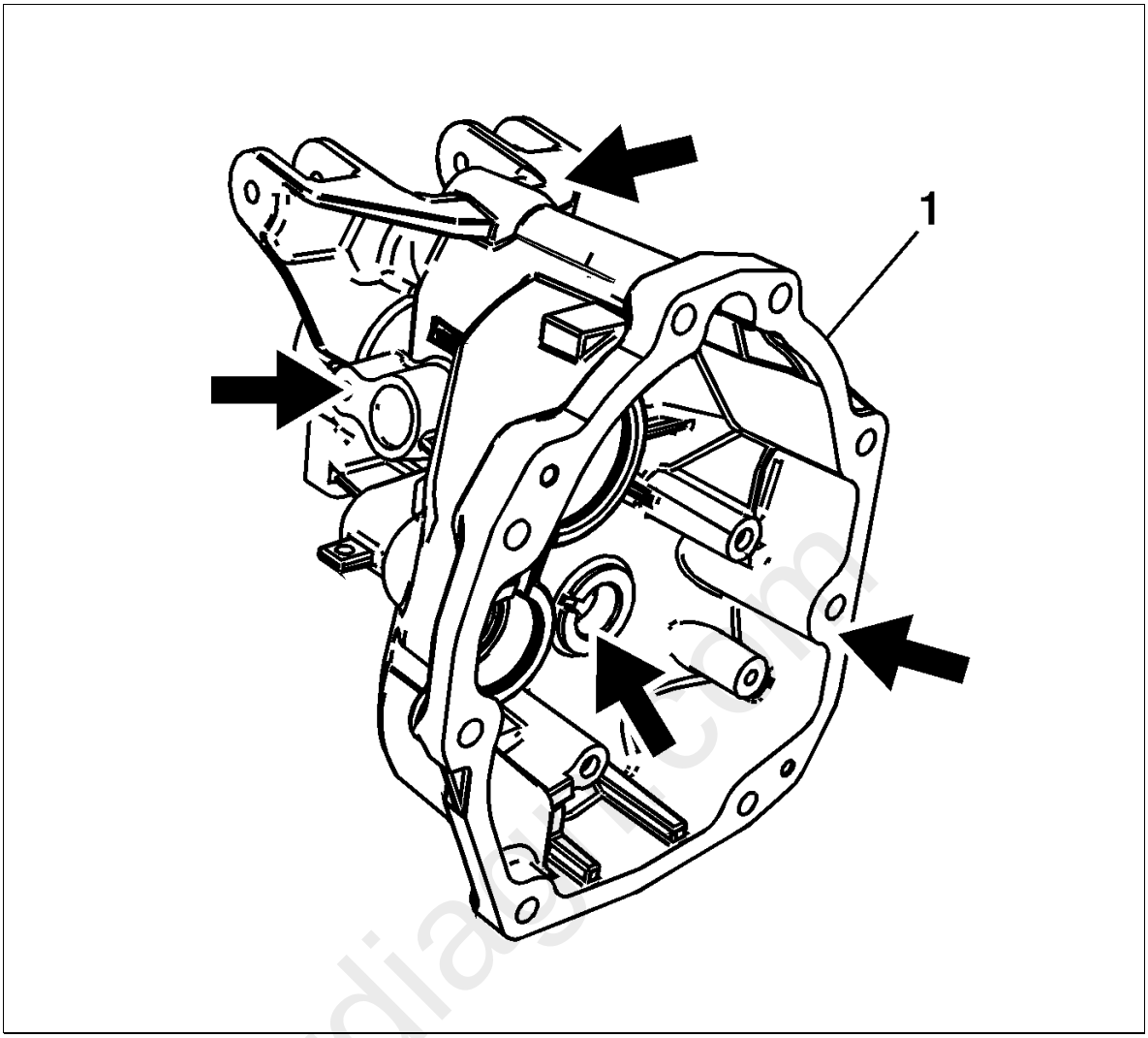
Courtesy of GENERAL MOTORS COMPANY

Shift Shaft Bearing Removal

Callout	Component Name
1	Shift Shaft Bearing Assembly Procedure 1. Install the **DT 49216** bushing remover (2) into the bearing. 2. Install the **J 23907-1** slide hammer (3) into the remover. 3. Remove the bearing. **Special Tools** **DT 49216** Bushing Remover **J 23907-1** Slide Hammer For equivalent regional tools, refer to Special Tools (M13) .

REPAIR INSTRUCTIONS - OFF VEHICLE > EXTENSION CLEANING AND INSPECTION (MM6)

Fig 1: Extension Housing



Courtesy of GENERAL MOTORS COMPANY

WARNING:

Refer to Safety Glasses and Compressed Air Warning .

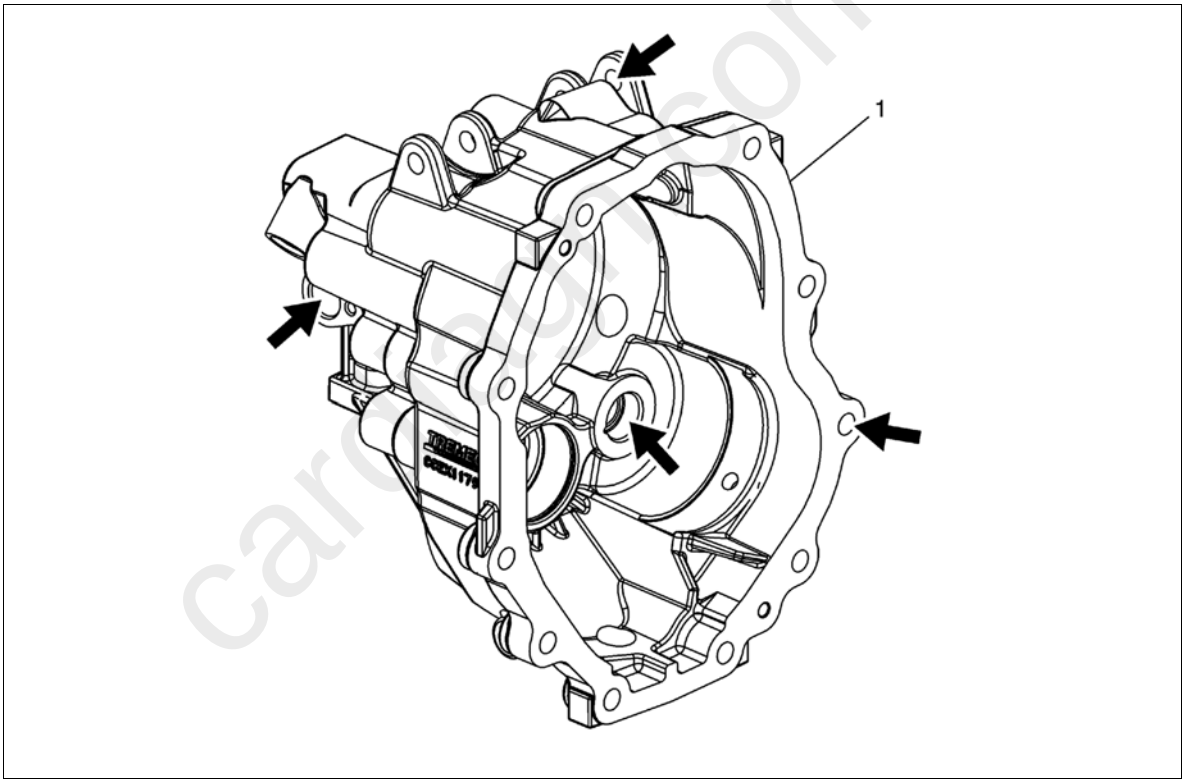
1. Clean the rear extension housing (1) in a suitable solvent. Air dry the housing.
2. Inspect the extension housing for the following:
    1. Cracks
    2. Scratches
    3. Damaged threads
    4. Burrs
    5. Nicked mounting surfaces

6. Damaged sealing surfaces
7. Damaged front or rear bearing bores

3. Replace a cracked housing.
4. Clean up damaged threads with the correct size thread tap.
5. Inspect the machined mating surfaces for flatness. Check the mating surfaces with a straight edge.
6. Use a fine mill file to dress minor scratches or burrs.

REPAIR INSTRUCTIONS - OFF VEHICLE > EXTENSION CLEANING AND INSPECTION (M13)

Fig 1: Rear Extension Housing



Courtesy of GENERAL MOTORS COMPANY

WARNING:

Refer to Safety Glasses and Compressed Air Warning .

1. Clean the rear extension housing (1) in a suitable solvent. Air dry the housing.
2. Inspect the extension housing for the following:

1. Cracks
2. Scratches
3. Damaged threads
4. Burrs
5. Nicked mounting surfaces
6. Damaged sealing surfaces
7. Damaged front or rear bearing bores

3. Replace a cracked housing.
4. Clean up damaged threads with the correct size thread tap.
5. Inspect the machined mating surfaces for flatness. Check the mating surfaces with a straight edge.
6. Use a fine mill file to dress minor scratches or burrs.

REPAIR INSTRUCTIONS - OFF VEHICLE > EXTENSION ASSEMBLE (MM6)

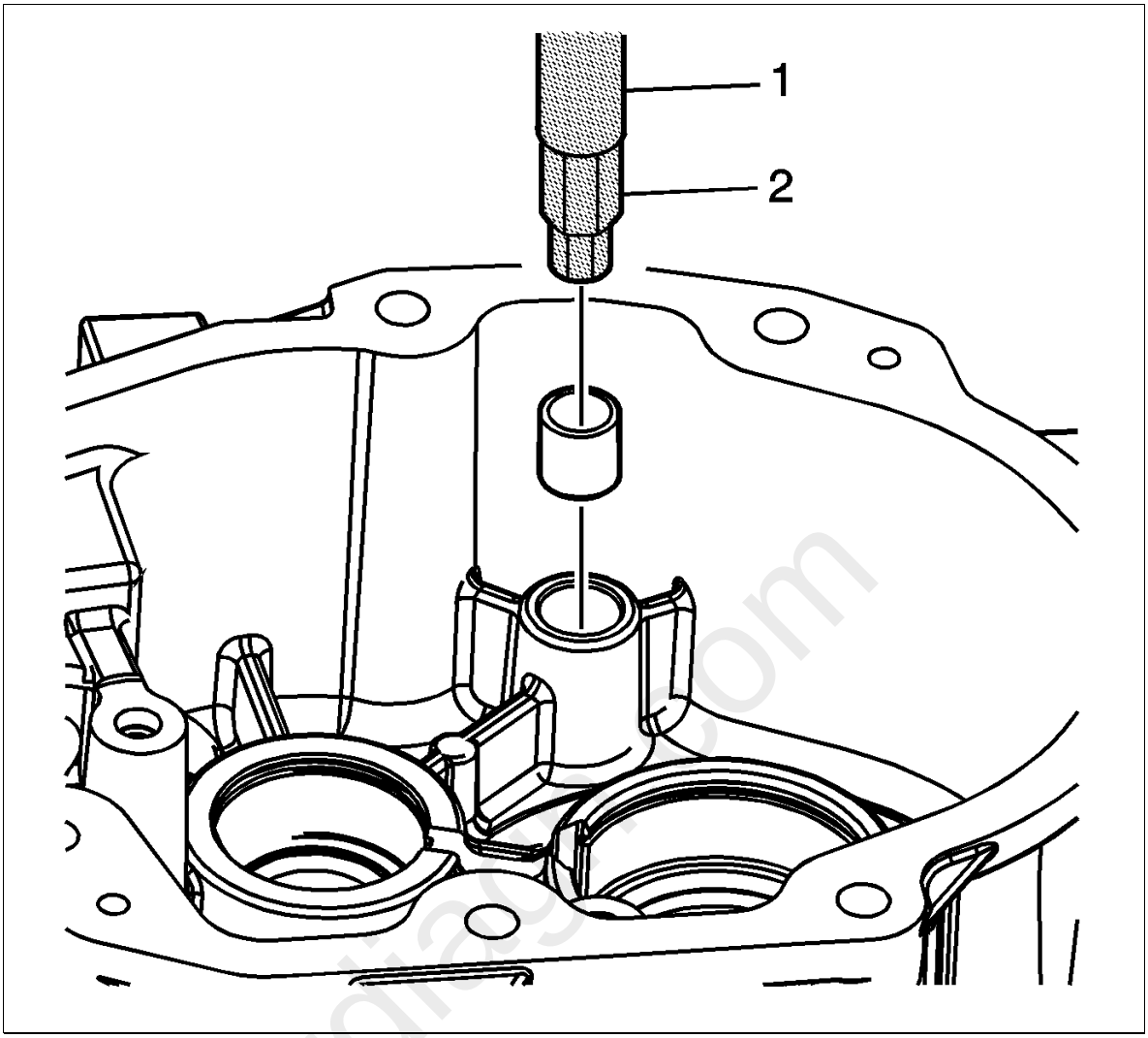
Special Tools

- **DT 48074** Input and Output Shaft Seal Installer
- **DT 48802** Bearing Installer
- **J 8092** Drive Handle
- **J 21426** Outer Output Shaft Seal Installer
- **J 36190** Universal Driver Handle
- **J 39437** Bushing Installer
- **J 39439-3** Rear Case Bushing Installer
- **J 39546** Bearing Race Installer
- **J 44384** Shifter Fork Bearing Installer

For equivalent regional tools, refer to Special Tools (MM6) .

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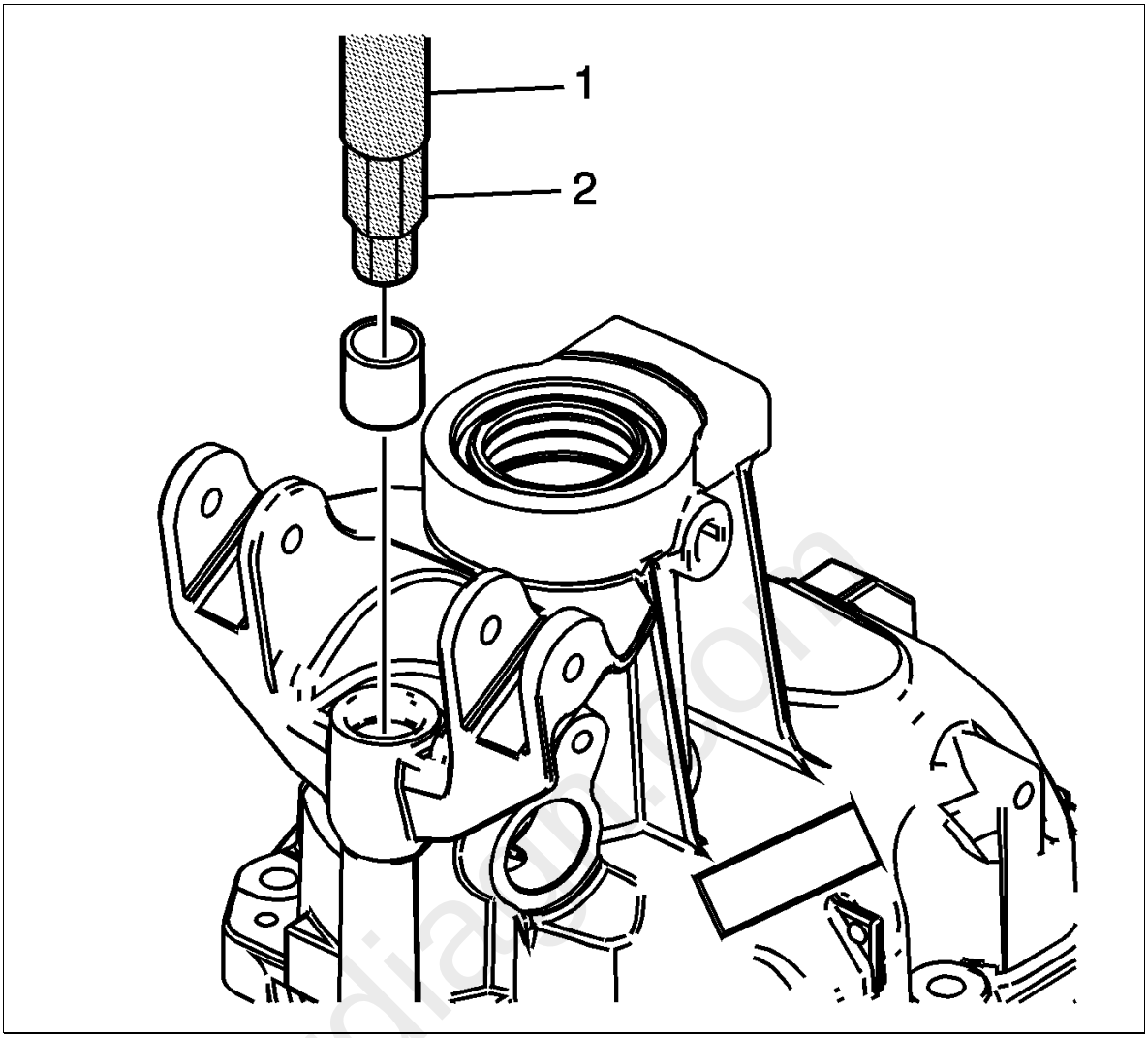
Fig 1: Extension Housing Bearing



Courtesy of GENERAL MOTORS COMPANY

1. Using **J 36190** handle (1) and **J 39439-3** installer (2), install the reverse rail bushing.

Fig 2: Shift Rail Bearing

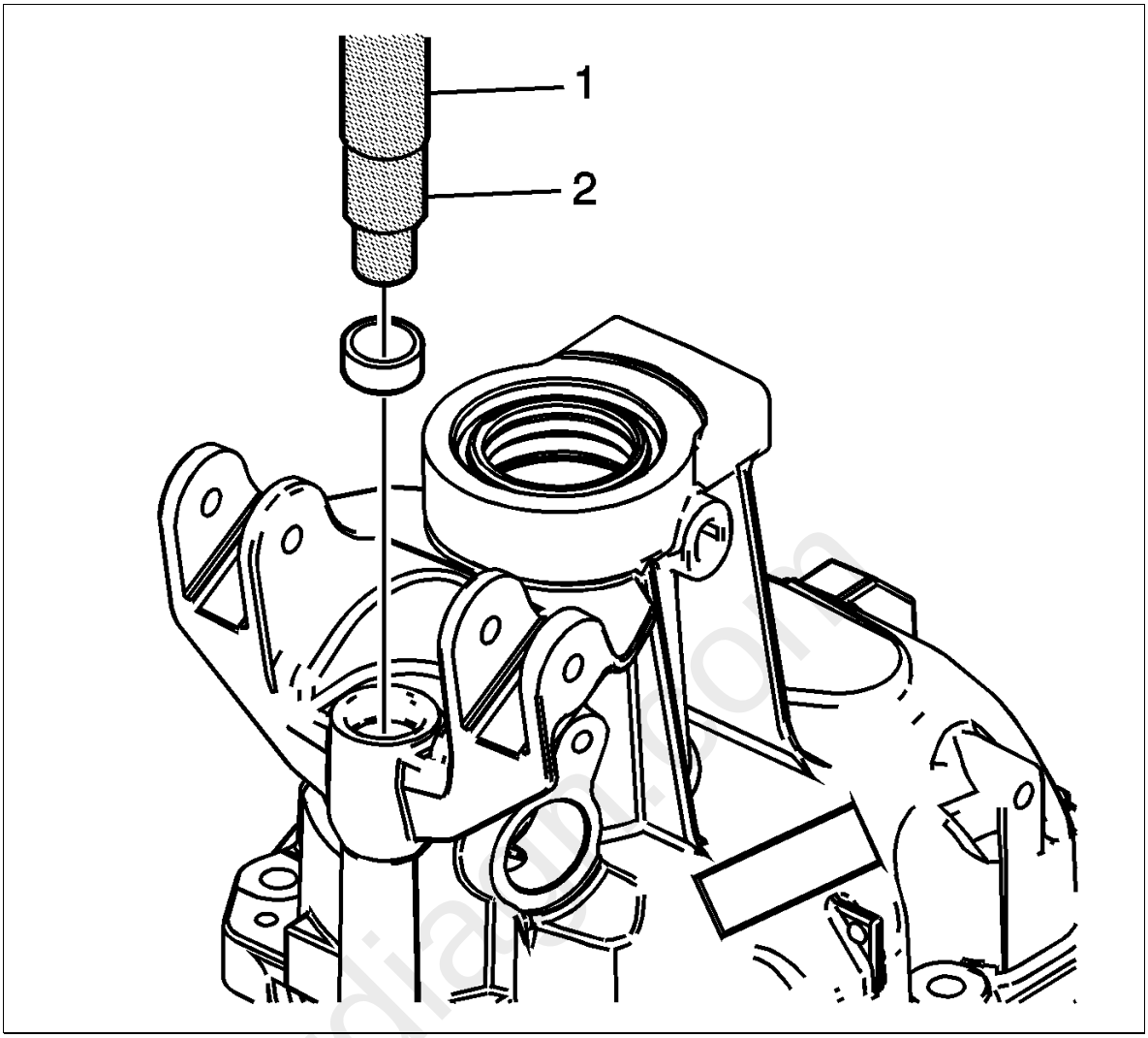


Courtesy of GENERAL MOTORS COMPANY

2. Install the shift rail bearing using the **J 36190** handle (1) and the **J 44384** installer (2).

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Fig 3: Seal

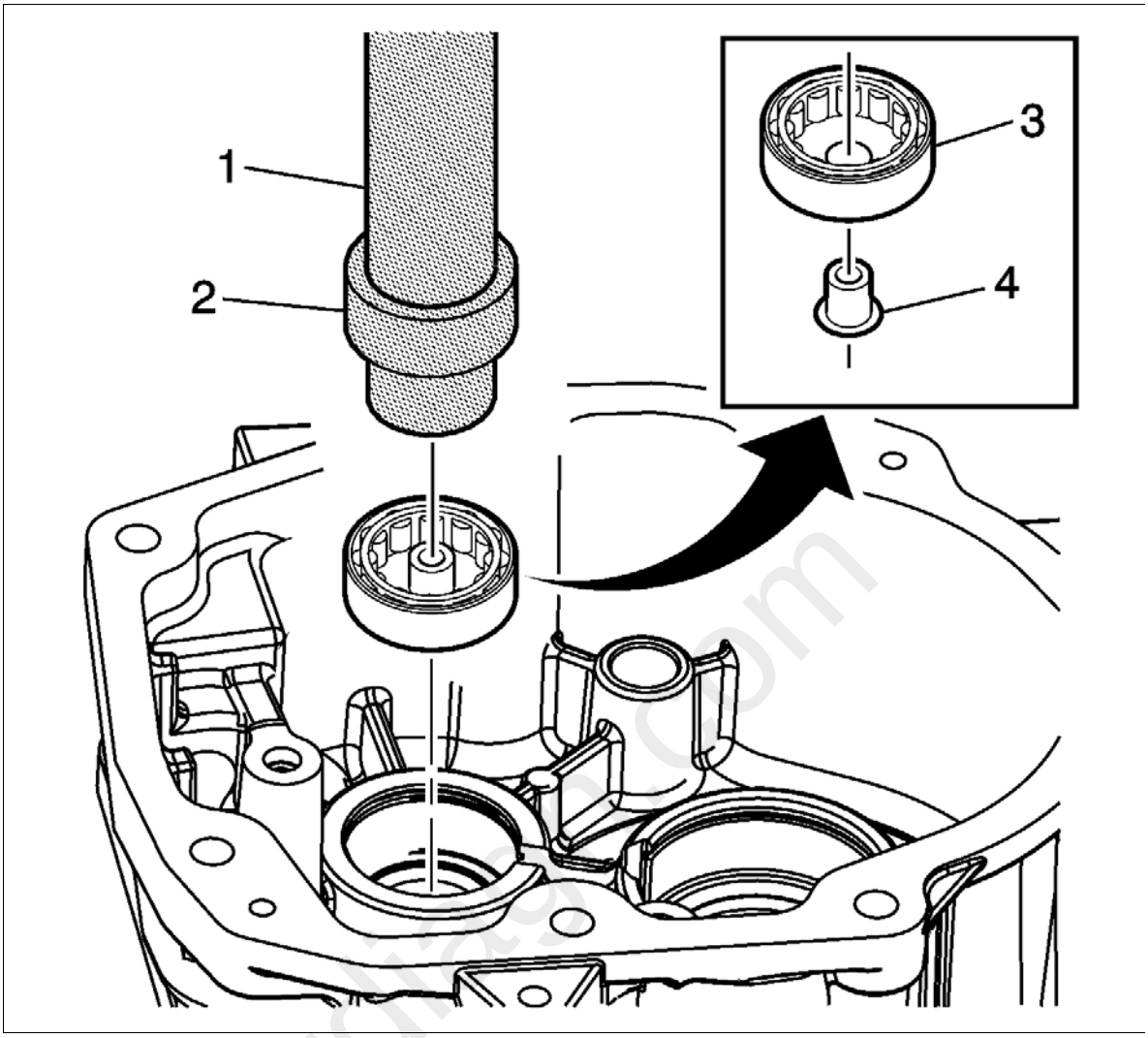


Courtesy of GENERAL MOTORS COMPANY

3. Install the seal using the **J 36190** handle (1) and **J 44384** installer (2).

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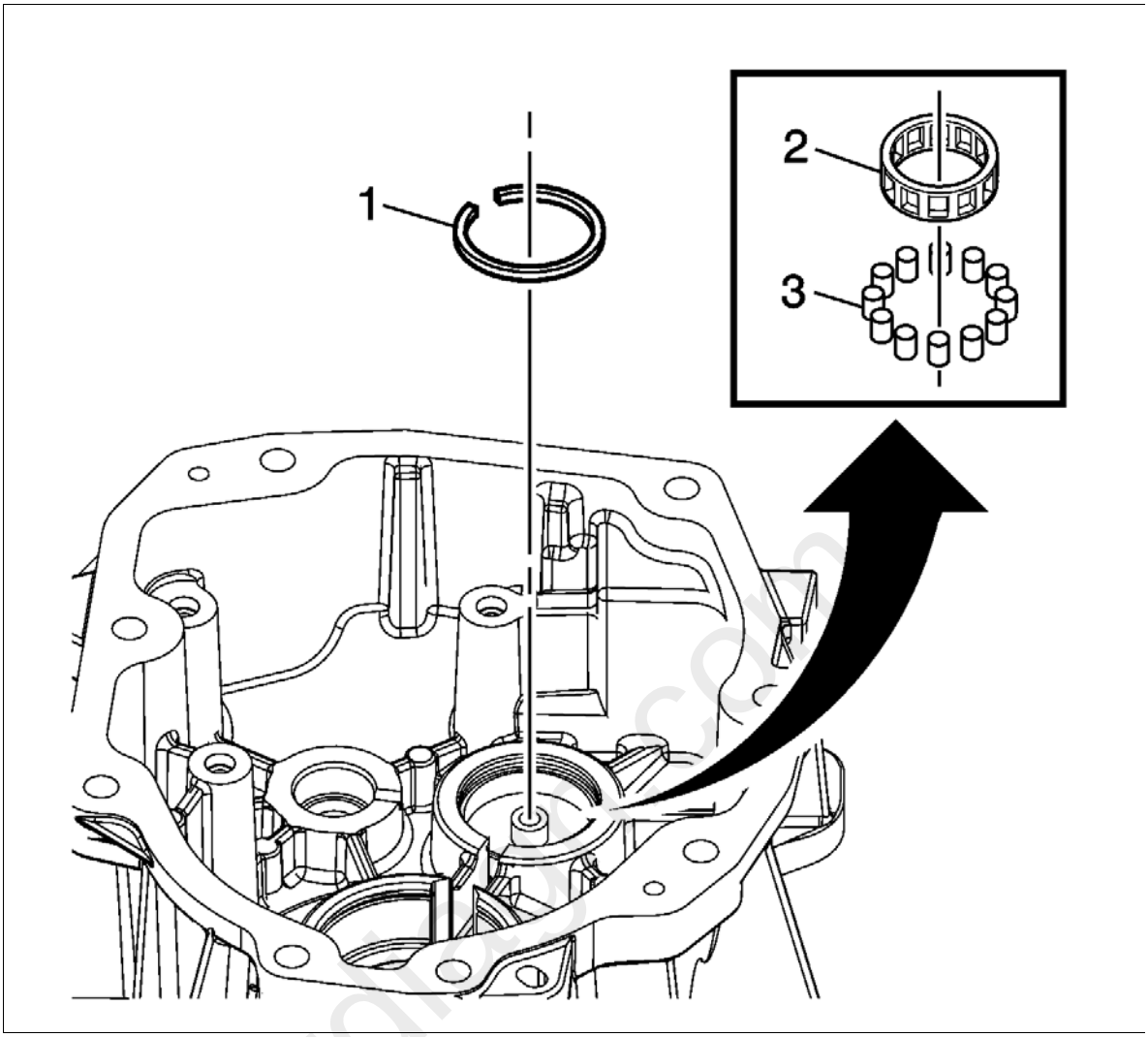
Fig 4: Oil Funnel Into The Extension Housing Countershaft Bearing



Courtesy of GENERAL MOTORS COMPANY

4. Snap the oil funnel into a NEW extension housing countershaft bearing assembly.
5. Using the **J 36190** handle (1) and **DT 48802** installer (2), install the countershaft bearing.

Fig 5: Countershaft Rear Bearing Retainer



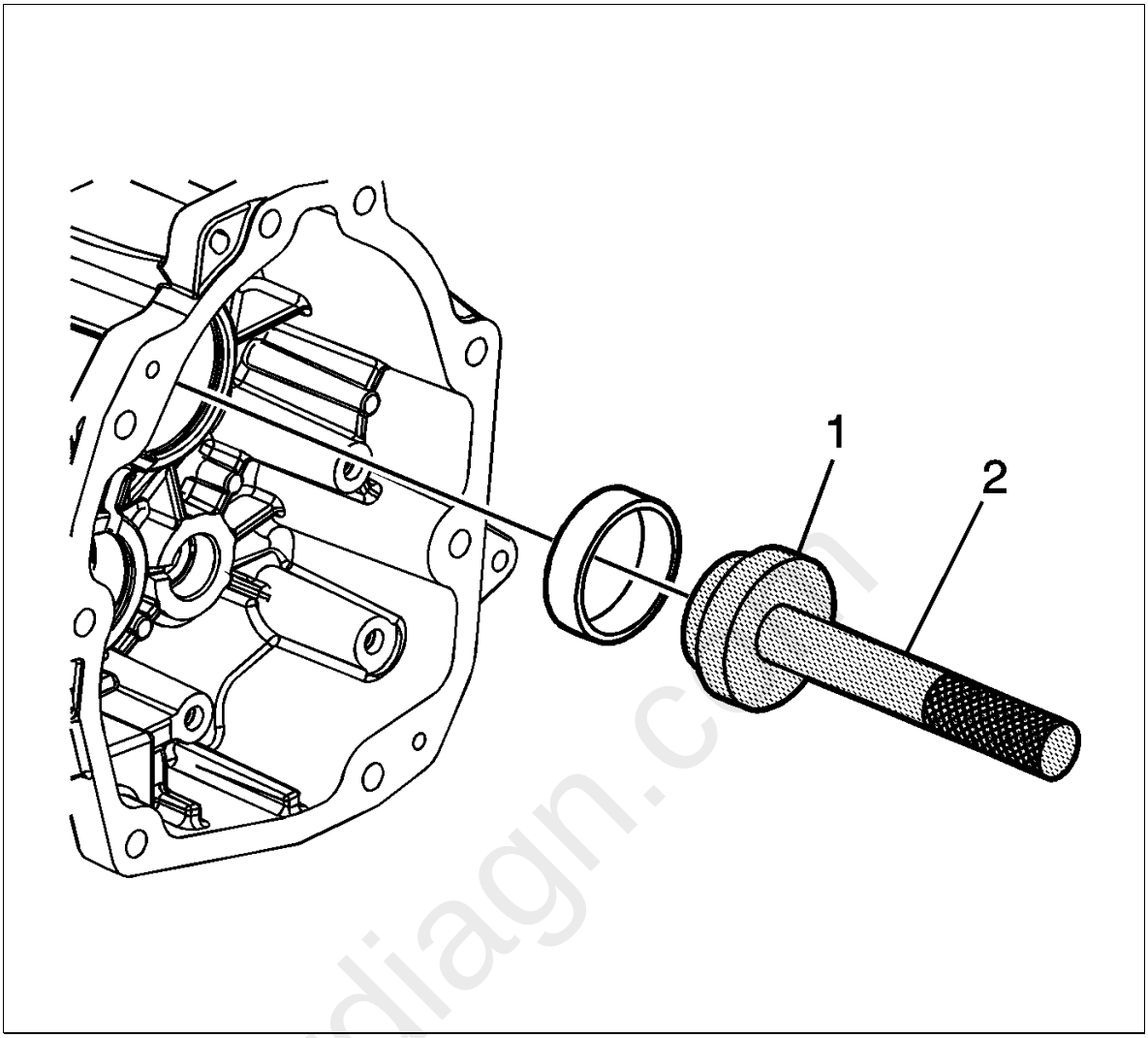
Courtesy of GENERAL MOTORS COMPANY

NOTE:

The plastic roller bearing cage (2) and bearings (3) are part of the countershaft bearing assembly.

6. Install the countershaft rear bearing retainer (1).

Fig 6: Mainshaft Bearing Race

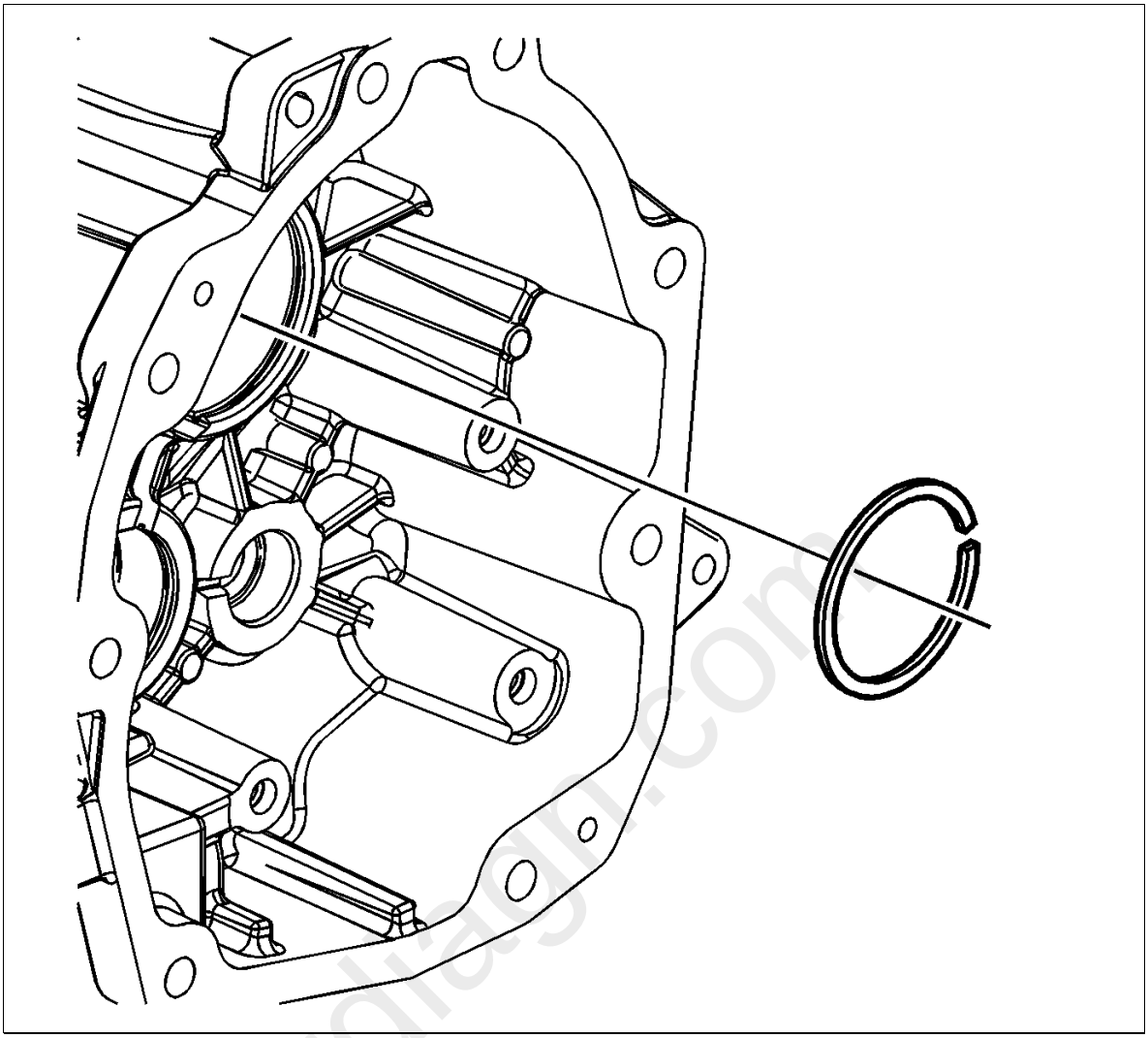


Courtesy of GENERAL MOTORS COMPANY

7. Install the mainshaft bearing race, using the **J 39546** installer (1) and the **J 8092** drive handle (2).

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Fig 7: Mainshaft Bearing Race Retainer Ring

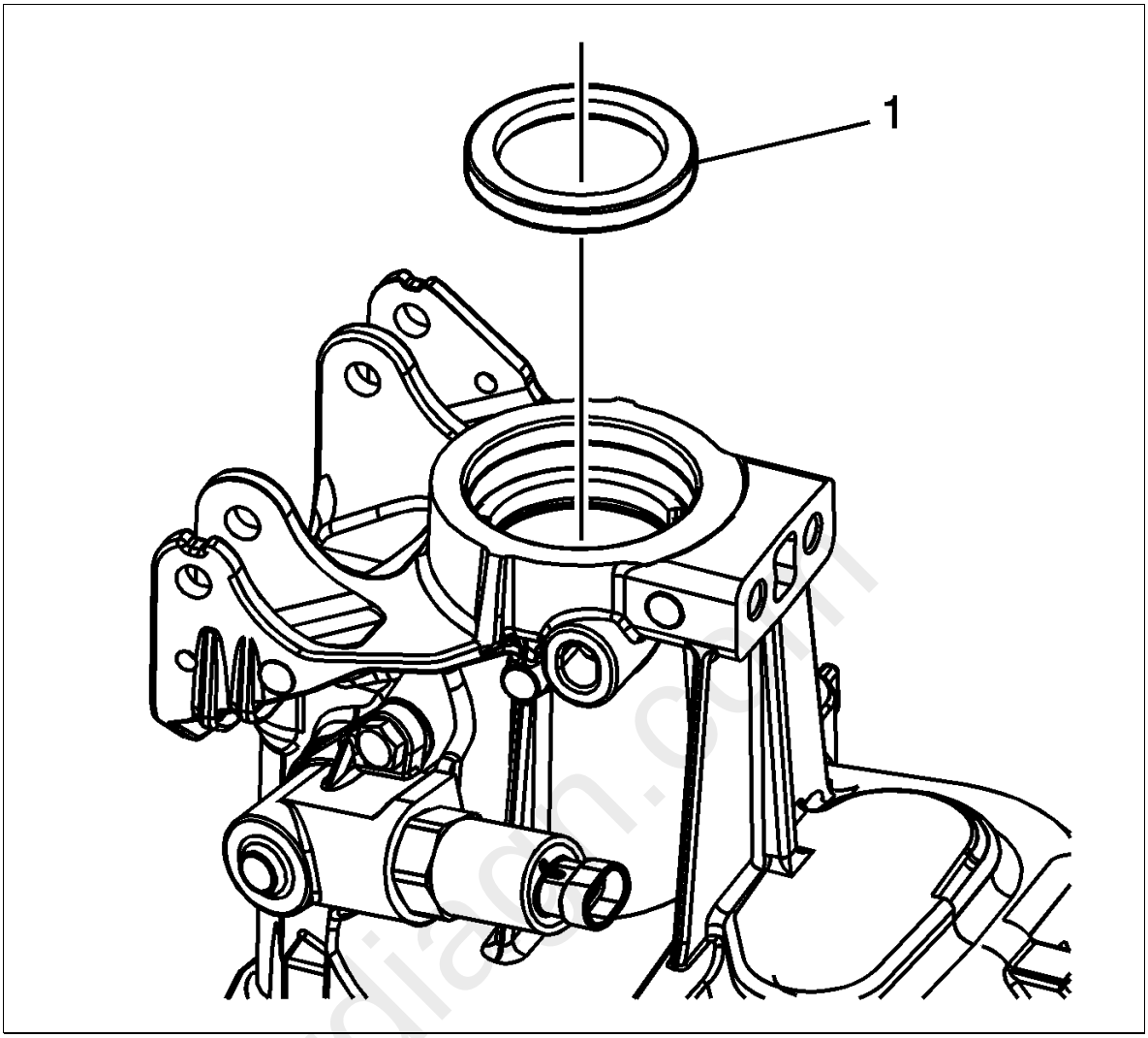


Courtesy of GENERAL MOTORS COMPANY

8. Install the mainshaft bearing race retainer ring.

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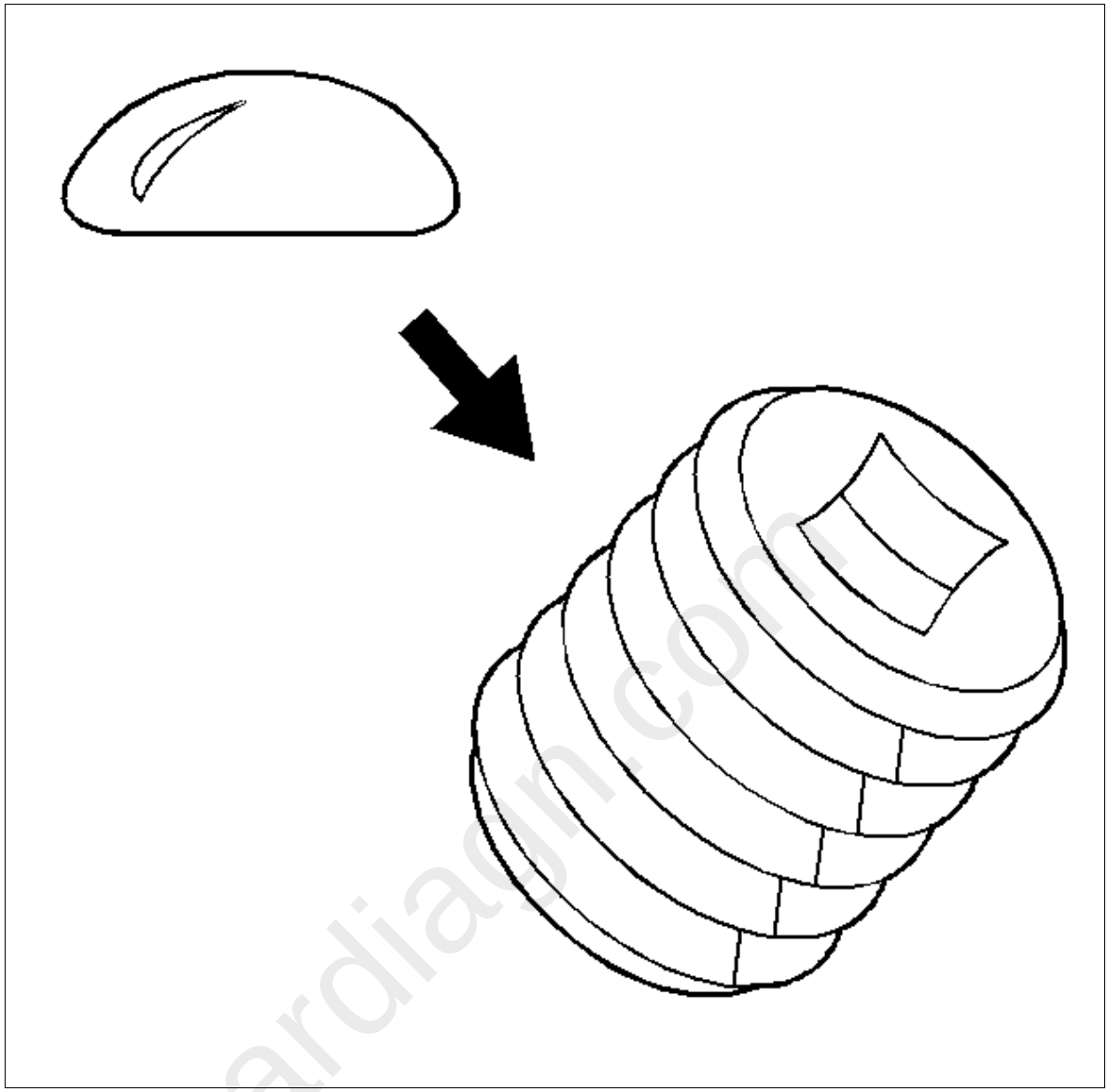
Fig 8: Output Shaft Seal



Courtesy of GENERAL MOTORS COMPANY

9. Install the NEW output shaft seal (1) using the **J 8092** drive handle and the **DT 48074** input/output Shaft installer.

Fig 9: Sealant To Adapter Plate Plug Threads

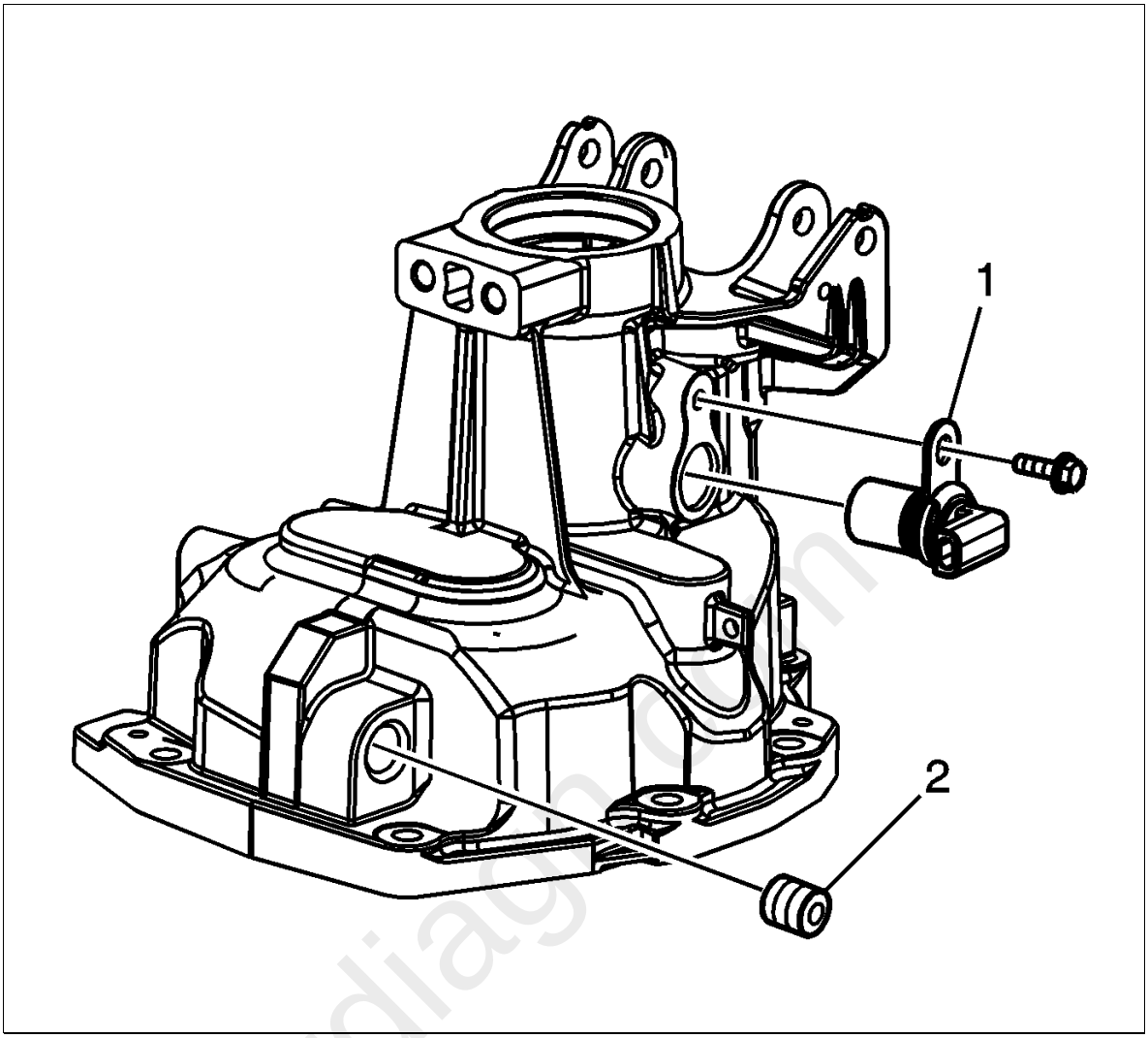


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10. Apply sealer GM P/N 12346004 (Canadian P/N 10953480) or equivalent to the transmission case drain plug.

Fig 10: Transmission Case Drain Plug & Vehicle Speed Sensor



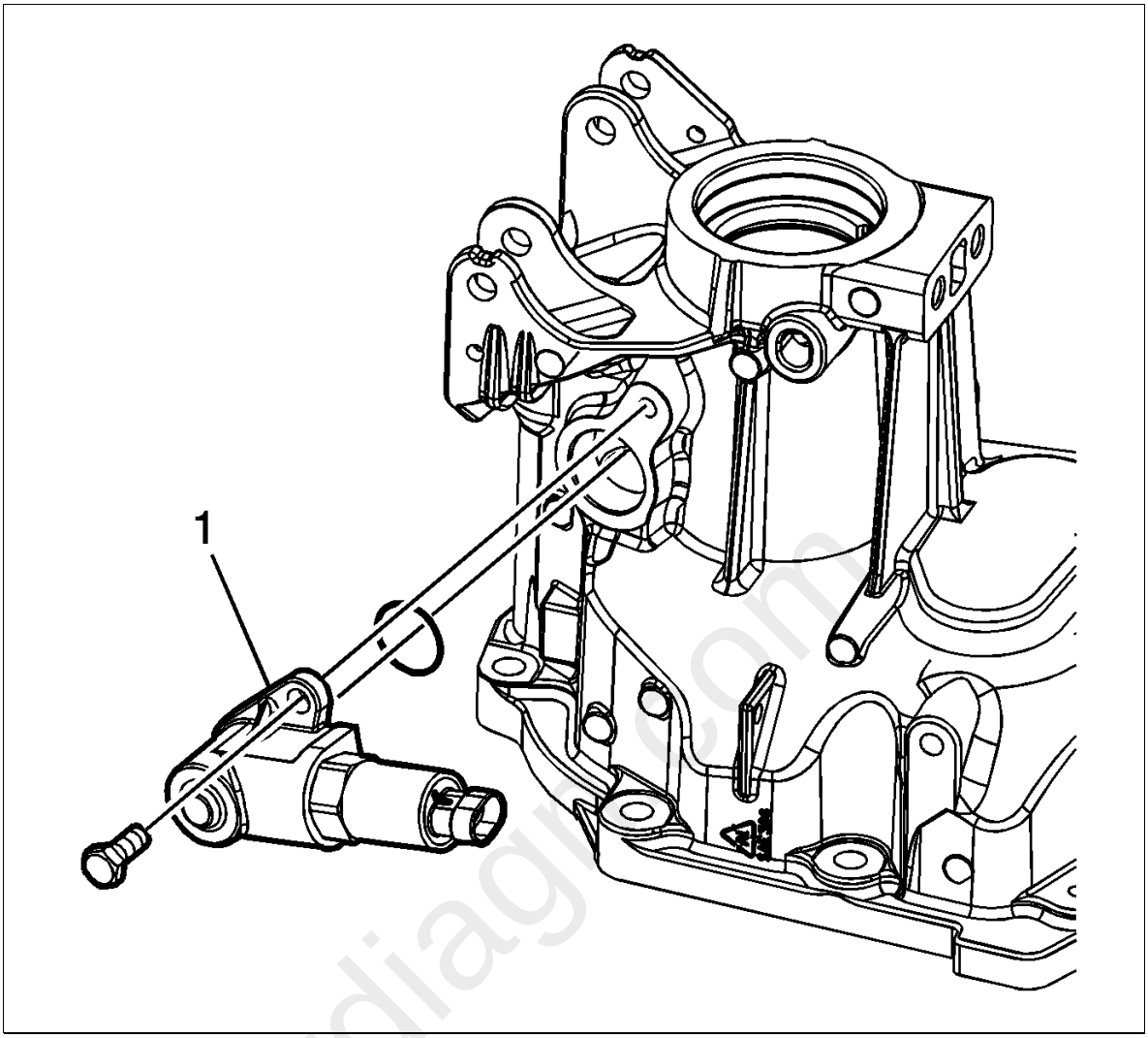
Courtesy of GENERAL MOTORS COMPANY

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> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

11. Install the transmission case drain plug (2) and tighten to 27 N.m (20 lb ft).
12. Install the vehicle speed sensor (1).
13. Install the vehicle speed sensor bolt and tighten to 11 N.m (96 lb in).

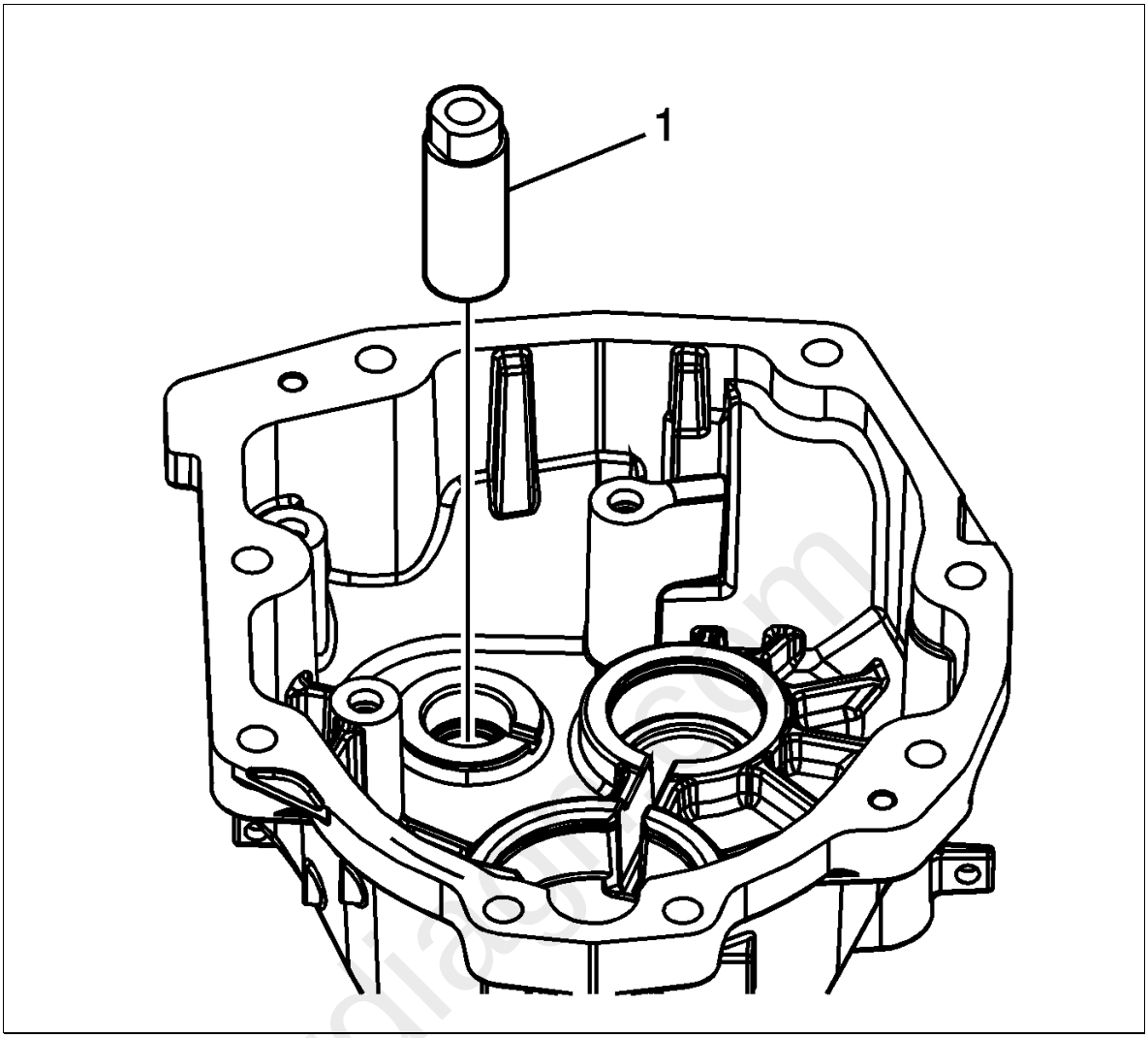
Fig 11: Reverse Lockout Assembly



Courtesy of GENERAL MOTORS COMPANY

14. Install a NEW O-ring onto the reverse lockout assembly (1).
15. Install the reverse lockout assembly into the extension housing.
16. Install the reverse lockout assembly bolt and tighten to 18 N.m (13 lb ft).

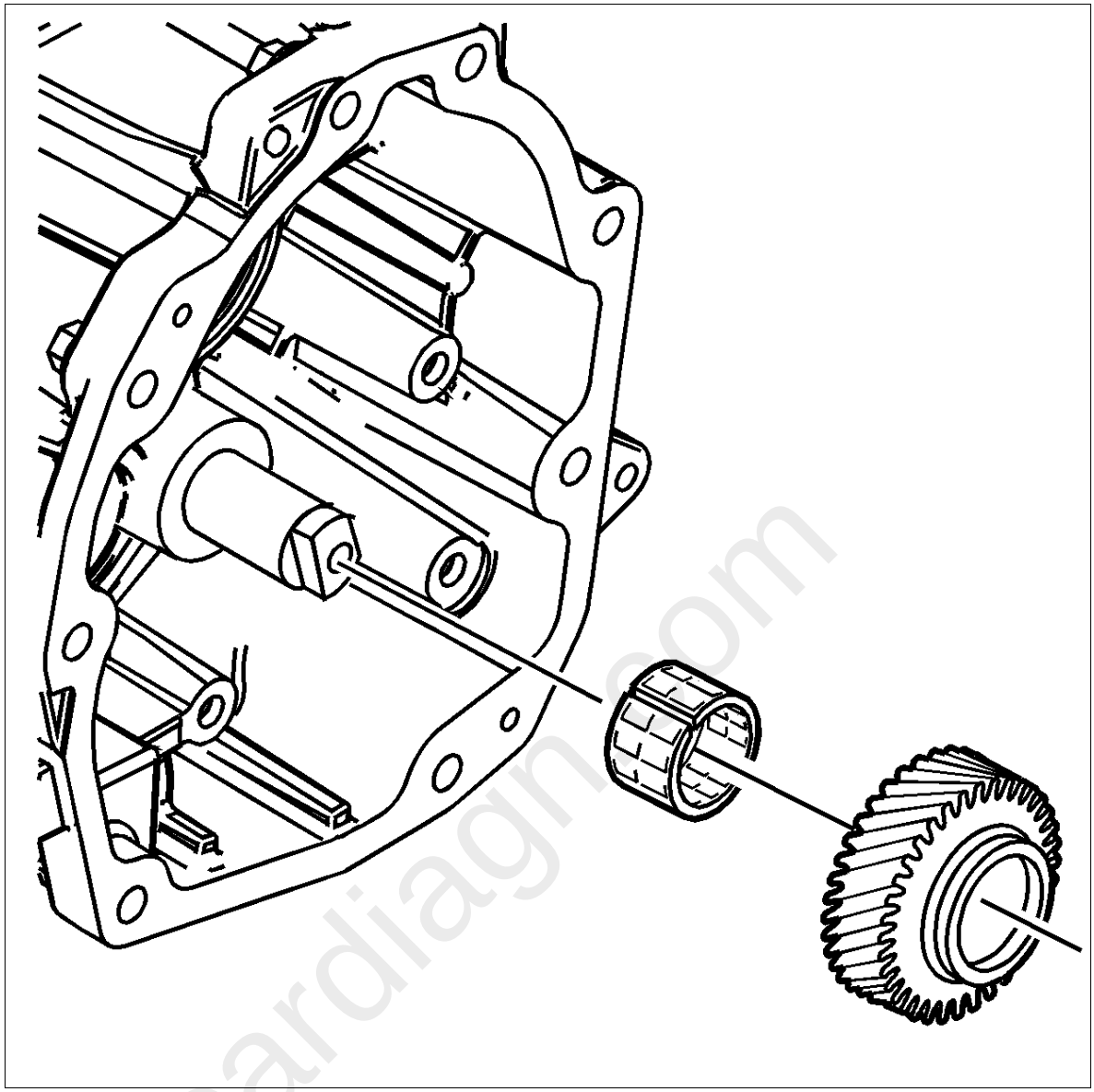
Fig 12: Reverse Idler Gear Shaft



Courtesy of GENERAL MOTORS COMPANY

17. Install the reverse idler gear shaft (1).

Fig 13: Reverse Idler Gear And The Roller Bearing

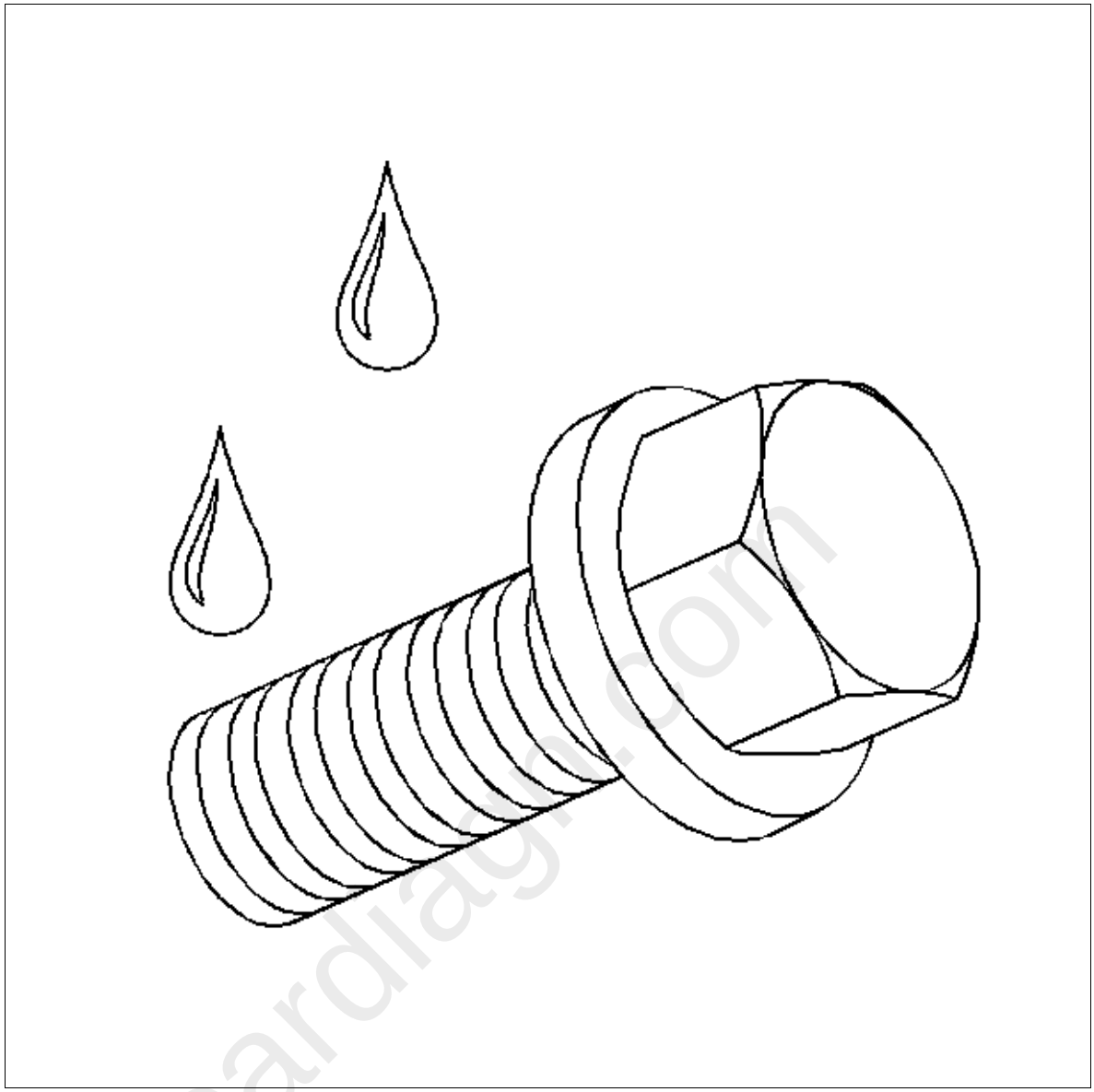


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Courtesy of GENERAL MOTORS COMPANY

18. Install the roller bearing and reverse idler gear.

Fig 14: Sealant To Reverse Idler Shaft Brackets Bolt Threads

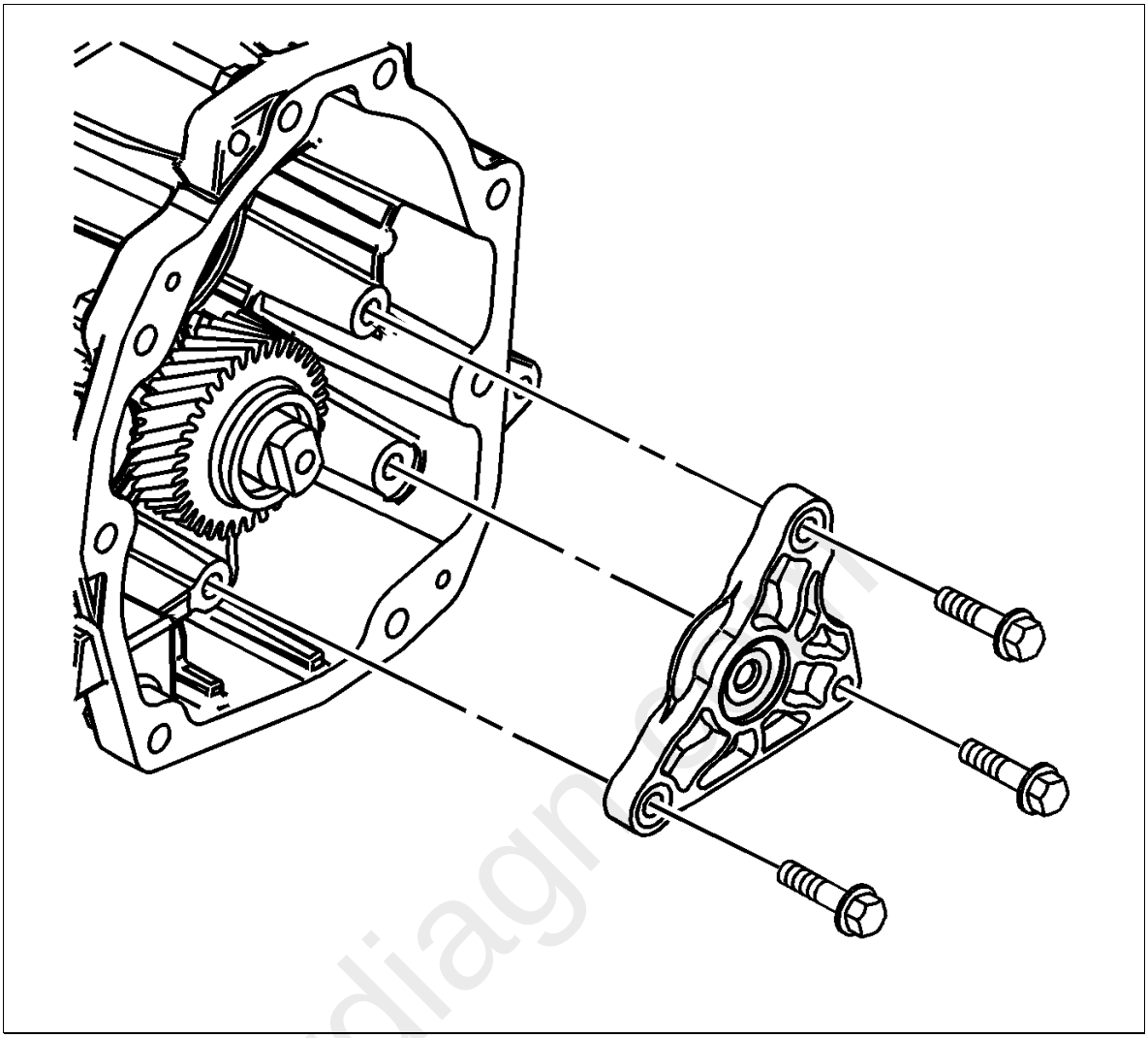


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19. Apply GM P/N 12345382, (Canadian P/N 10953489) or equivalent to the reverse idler shaft bracket bolt threads.

Fig 15: Reverse Idler Shaft Bracket Bolts

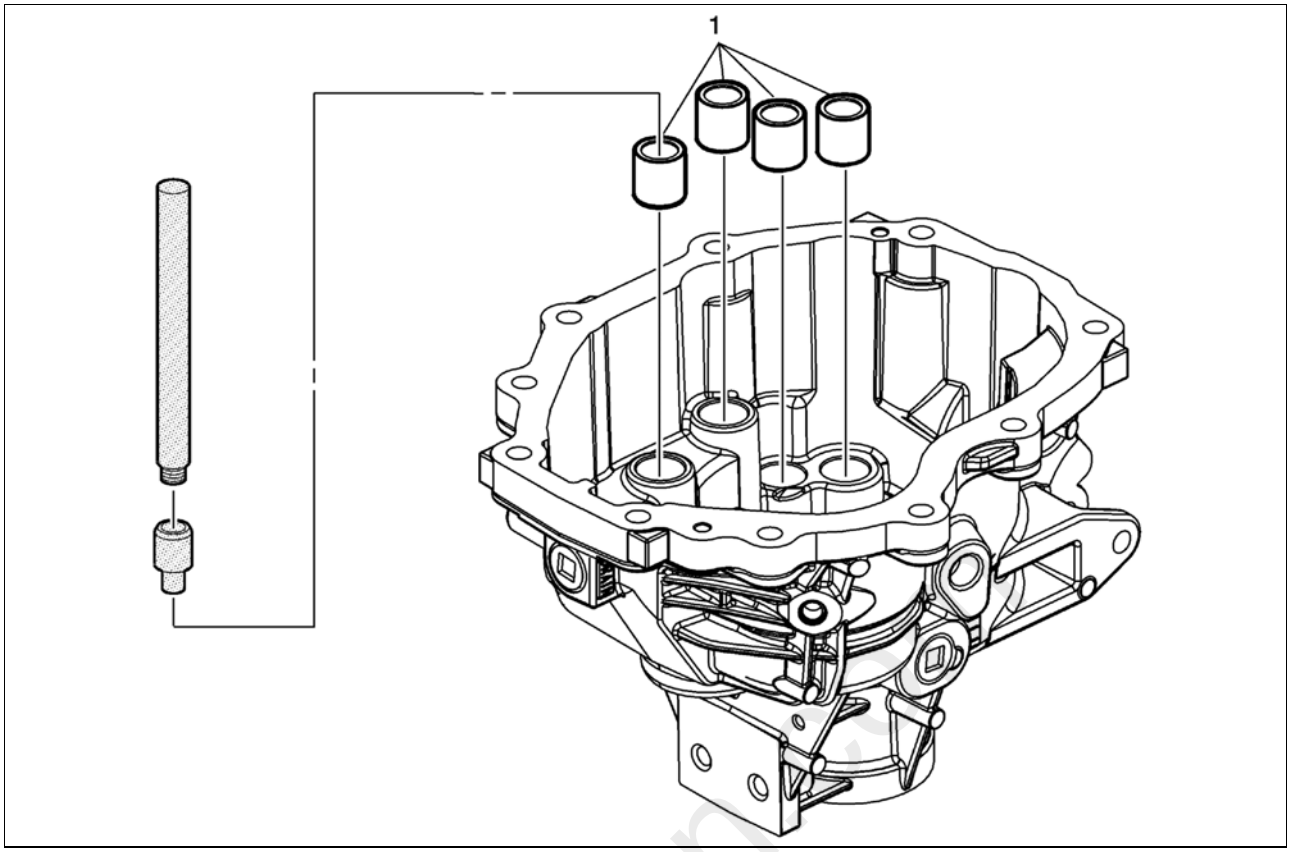


Courtesy of GENERAL MOTORS COMPANY

20. Install the reverse idler shaft bracket and bolts. Tighten the bolts to 25 N.m (18 lb ft).

REPAIR INSTRUCTIONS - OFF VEHICLE > EXTENSION ASSEMBLE (M13) > SHIFT SHAFT BEARING INSTALLATION

Fig 1: Shift Shaft Bearing Assembly



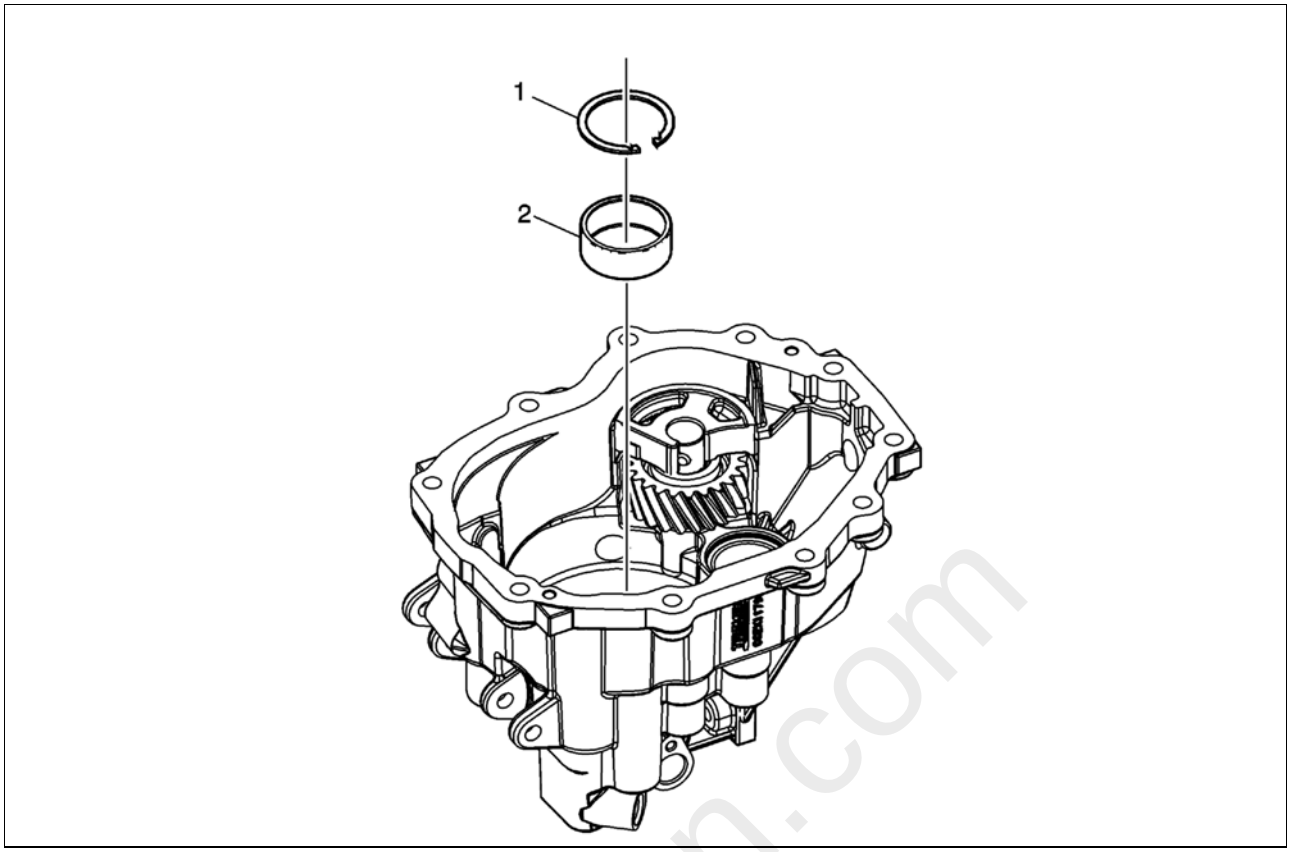
Courtesy of GENERAL MOTORS COMPANY

Shift Shaft Bearing Installation

Callout	Component Name
1	Shift Shaft Bearing Assembly Procedure 1. Install the **DT 44384** shift fork bearing installer into the bearing. 2. Install the **GE 36190** driver handle into the installer. 3. Install the bearing. **Special Tools** **GE 36190** Driver Handle **DT 44384** Shift Fork Bearing Installer For equivalent regional tools, refer to Special Tools (M13) .

REPAIR INSTRUCTIONS - OFF VEHICLE > EXTENSION ASSEMBLE (M13) > MAIN SHAFT REAR BEARING INSTALLATION

Fig 1: Main Shaft Rear Bearing Race & Retainers



Courtesy of GENERAL MOTORS COMPANY

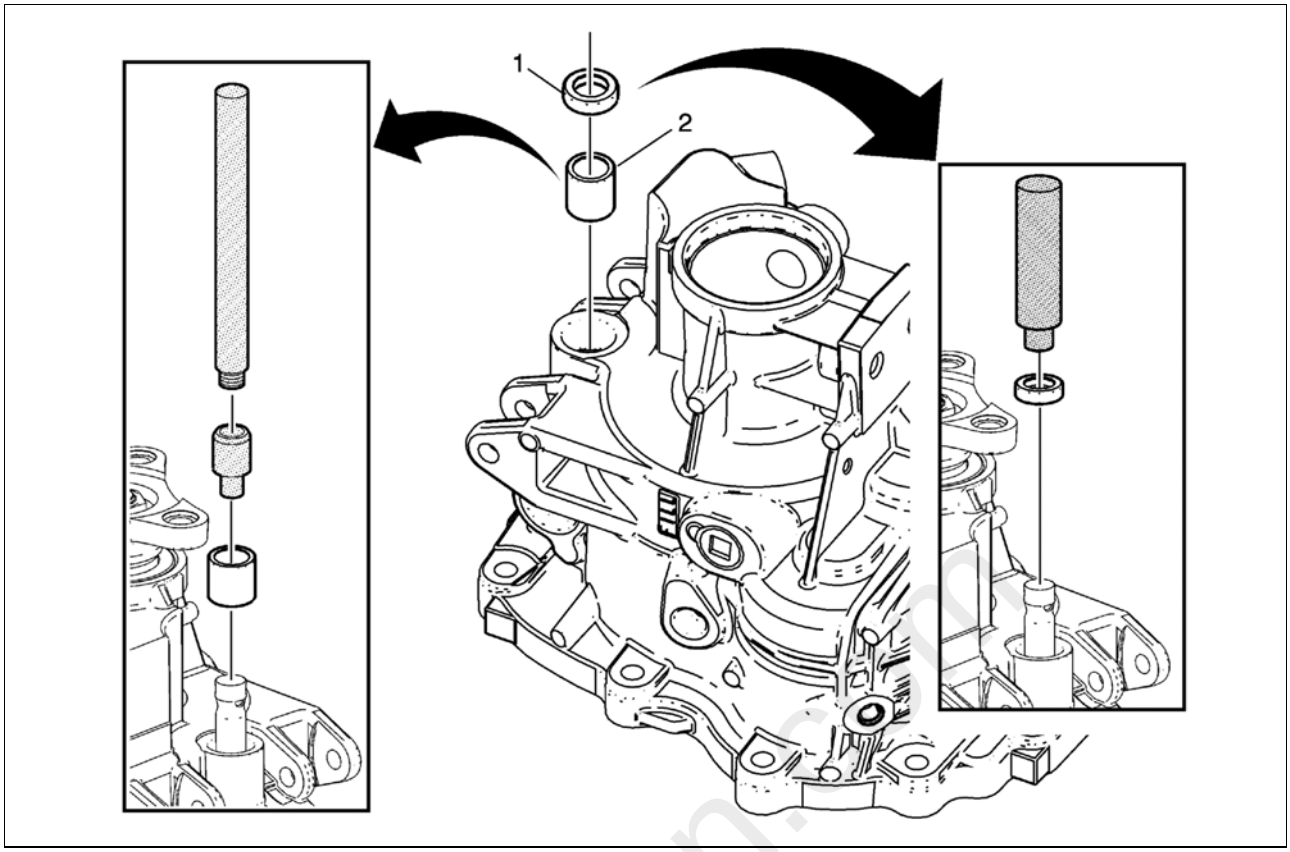
Main Shaft Rear Bearing Installation

Callout	Component Name
1	Main Shaft Rear Bearing Retainer
2	Main Shaft Rear Bearing Race

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REPAIR INSTRUCTIONS - OFF VEHICLE > EXTENSION ASSEMBLE (M13) > SHIFT SHAFT BEARING AND CONTROL LEVER SEAL INSTALLATION

Fig 1: Shift Shaft Bearing & Control Lever Seal



Courtesy of GENERAL MOTORS COMPANY

Shift Shaft Bearing and Control Lever Seal Installation

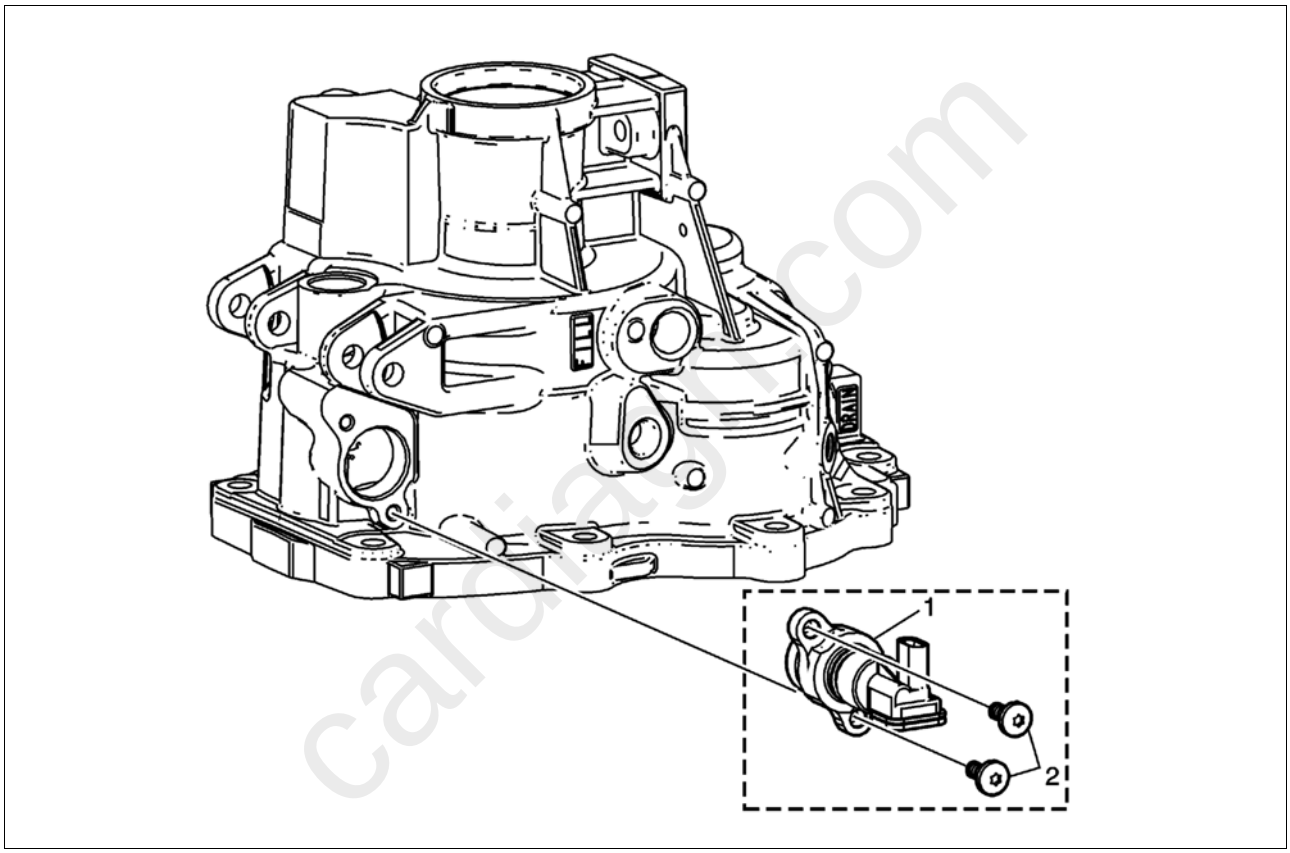
Callout	Component Name
1	Manual Transmission Control Lever Seal Procedure 1. Install the **DT 51077** shift shaft seal installer into the seal. 2. Install the seal. **Special Tools** **DT 51077** Shift Shaft Seal Installer For equivalent regional tools, refer to Special Tools (M13) .
2	Shift Shaft Bearing Assembly Procedure 1. Install the **DT 44384** shift fork bearing installer into the bearing. 2. Install the **GE 36190** driver handle into the installer.

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	3. Install the bearing. **Special Tools** **GE 36190** Driver Handle **DT 44384** Shift Fork Bearing Installer For equivalent regional tools, refer to Special Tools (M13) .

REPAIR INSTRUCTIONS - OFF VEHICLE > EXTENSION ASSEMBLE (M13) > NEUTRAL SENSOR INSTALLATION

Fig 1: Neutral Sensor



Courtesy of GENERAL MOTORS COMPANY

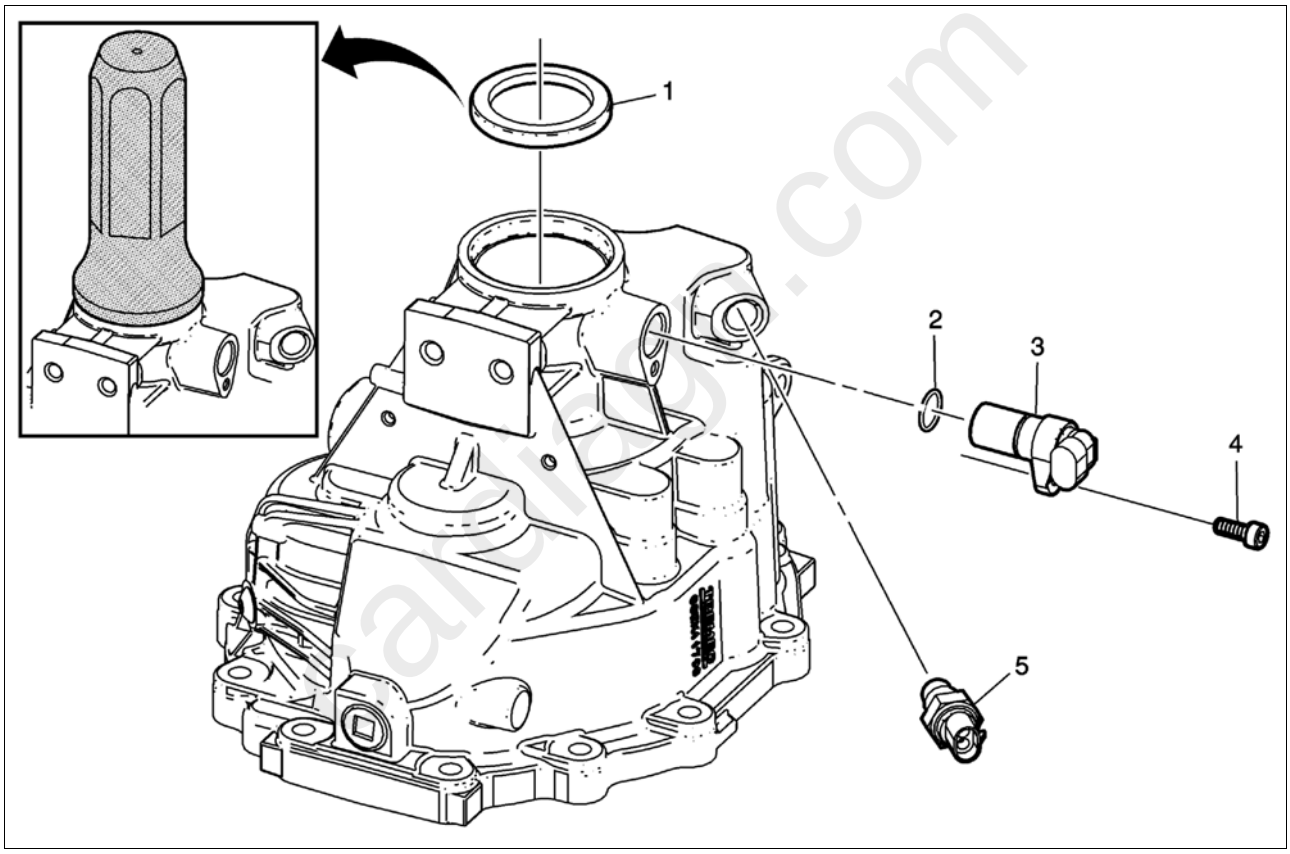
Neutral Sensor Installation

Callout	Component Name
1	Neutral Position Sensor Assembly - Model Dependent
2	Neutral Position Sensor Bolt/Screw - Model Dependent *NOTE:*

	Clean the threads and apply a threadlocker. Refer to Adhesives, Fluids, Lubricants, and Sealers (M13) **Tighten** 11Y (96 lb in)

REPAIR INSTRUCTIONS - OFF VEHICLE > EXTENSION ASSEMBLE (M13) > PROPELLER SHAFT OIL SEAL, REVERSE SENSOR, AND SPEED SENSOR INSTALLATION

Fig 1: Propeller Shaft Oil Seal, Reverse Sensor, Speed Sensor & Seal



Courtesy of GENERAL MOTORS COMPANY

Propeller Shaft Oil Seal, Reverse Sensor, and Speed Sensor Installation

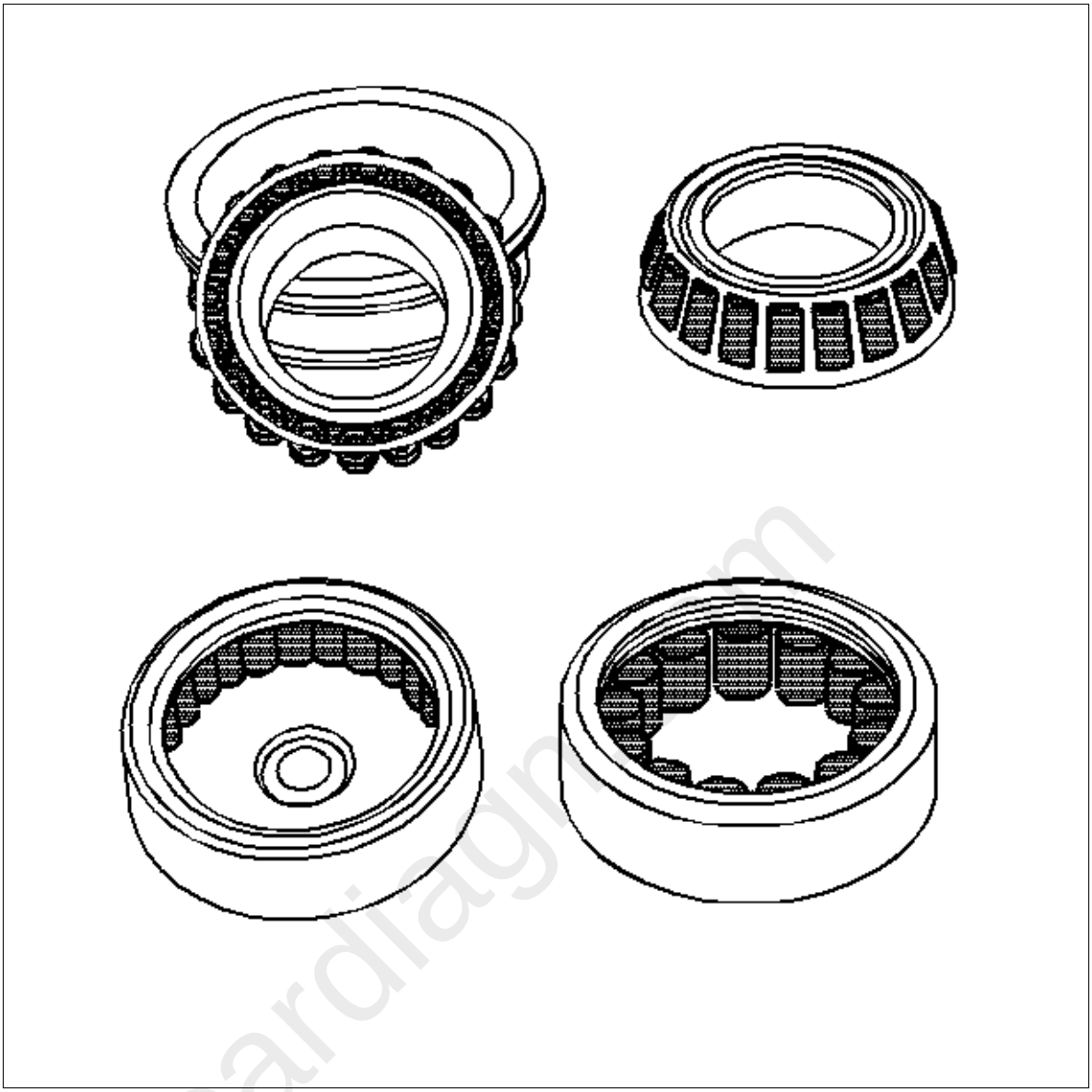
Callout	Component Name
1	Propeller Shaft Oil Seal Procedure 1. Install the **DT 37212** front output shaft seal installer into the seal.

	2. Install the seal. **Special Tools** **DT 37212** Front Output Shaft Seal Installer For equivalent regional tools, refer to Special Tools (M13) .
2	Vehicle Speed Sensor Seal (O-ring)
3	Manual Transmission Output Speed Sensor Assembly
4	Transmission Speed Sensor Bolt/Screw **Tighten** 10 N.m (89 lb in)
5	Reverse Sensor **Tighten** 27 N.m (20 lb ft)

REPAIR INSTRUCTIONS - OFF VEHICLE > BEARINGS AND SPACERS CLEANING AND INSPECTION

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Fig 1: Bearings & Spacers



Courtesy of GENERAL MOTORS COMPANY

WARNING:

Wear safety glasses to avoid injury when using compressed air or any cleaning solvent. Bodily injury may occur if fumes are inhaled or if skin is exposed to chemicals.

CAUTION:

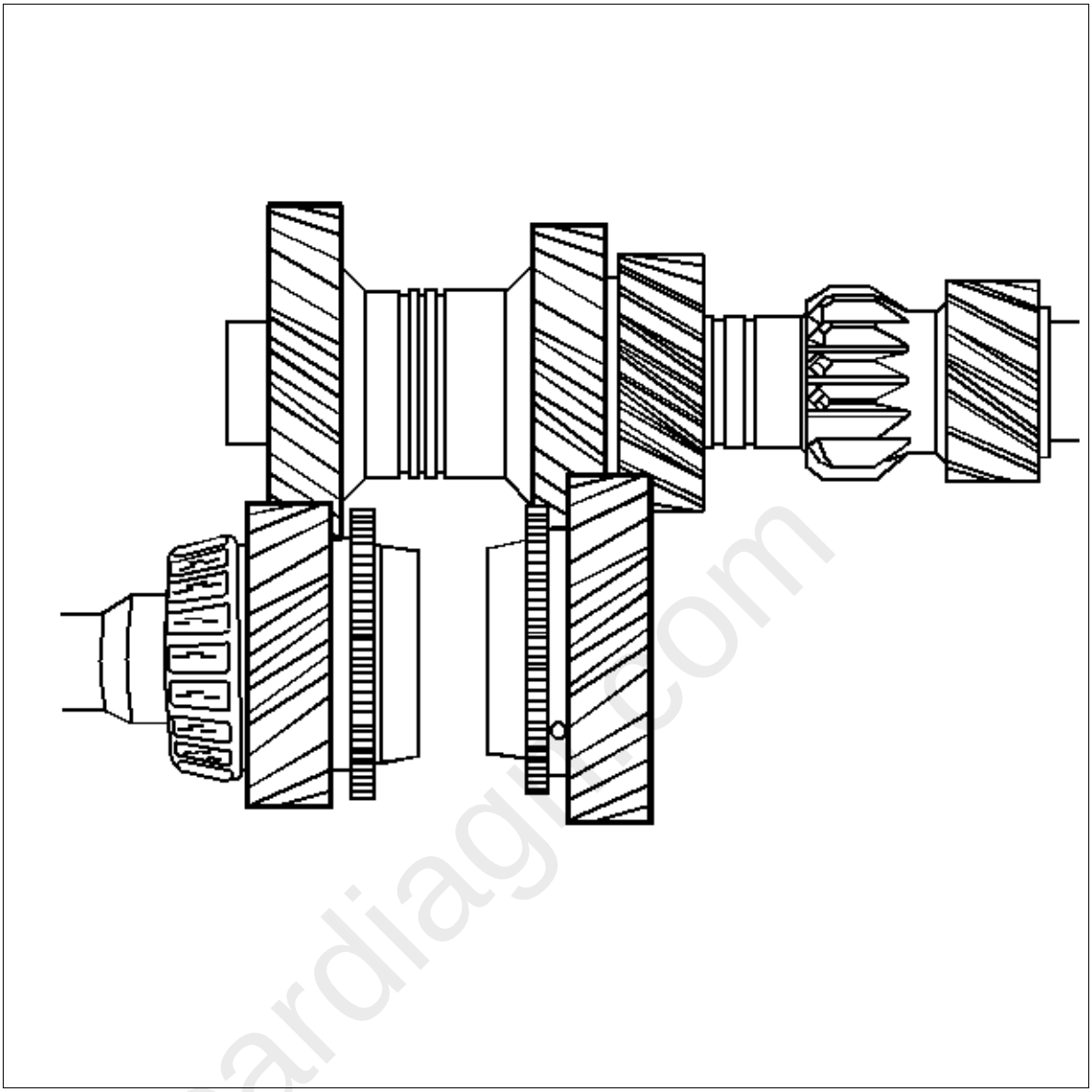
Do not allow the bearings to spin. Turn them slowly by hand. Spinning the bearings may damage the race and the rollers.

1. Clean all the bearing parts in a suitable solvent. Air dry all the parts.
2. Lubricate the bearings. Refer to Approximate Fluid Capacities (MM6) Approximate Fluid Capacities (M13) for the proper transmission lubricant.
3. Inspect the bearings and journals for roughness and unusual wear or damage.
4. Inspect the mainshaft bearing journals for wear.
5. Inspect the mainshaft speed gear bearings for wear.
6. Inspect the main drive gear pilot bearing rollers for wear.
7. Replace parts which show signs of excessive wear.
8. Do not file surfaces which have been hardened and precision ground.
9. Replace worn or damaged bearings.
10. Replace mated bearing parts when only one part is damaged.

REPAIR INSTRUCTIONS - OFF VEHICLE > GEARS CLEANING AND INSPECTION

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Fig 1: Gears



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WARNING:

Wear safety glasses to avoid injury when using compressed air or any cleaning solvent. Bodily injury may occur if fumes are inhaled or if skin is exposed to chemicals.

1. Clean all the parts in a suitable solvent. Air dry all the parts.
2. Inspect the gear tooth surfaces on all the gear sets for the following conditions:
    1. Cracks
    2. Pitting

3. Nicks
4. Chipped gear teeth
5. High spots - small shiny spots on the gear teeth mating surfaces

3. Inspect for damaged splines on the input shaft, mainshaft, and the countershaft extension.
4. Remove nicks and burrs with a soft stone or a crocus cloth.
5. Replace a burred or nicked part that cannot be reconditioned by hand.
6. Replace gears and gear assemblies that are worn or damaged.

REPAIR INSTRUCTIONS - OFF VEHICLE > COUNTER GEAR SHAFT ASSEMBLE (MM6)

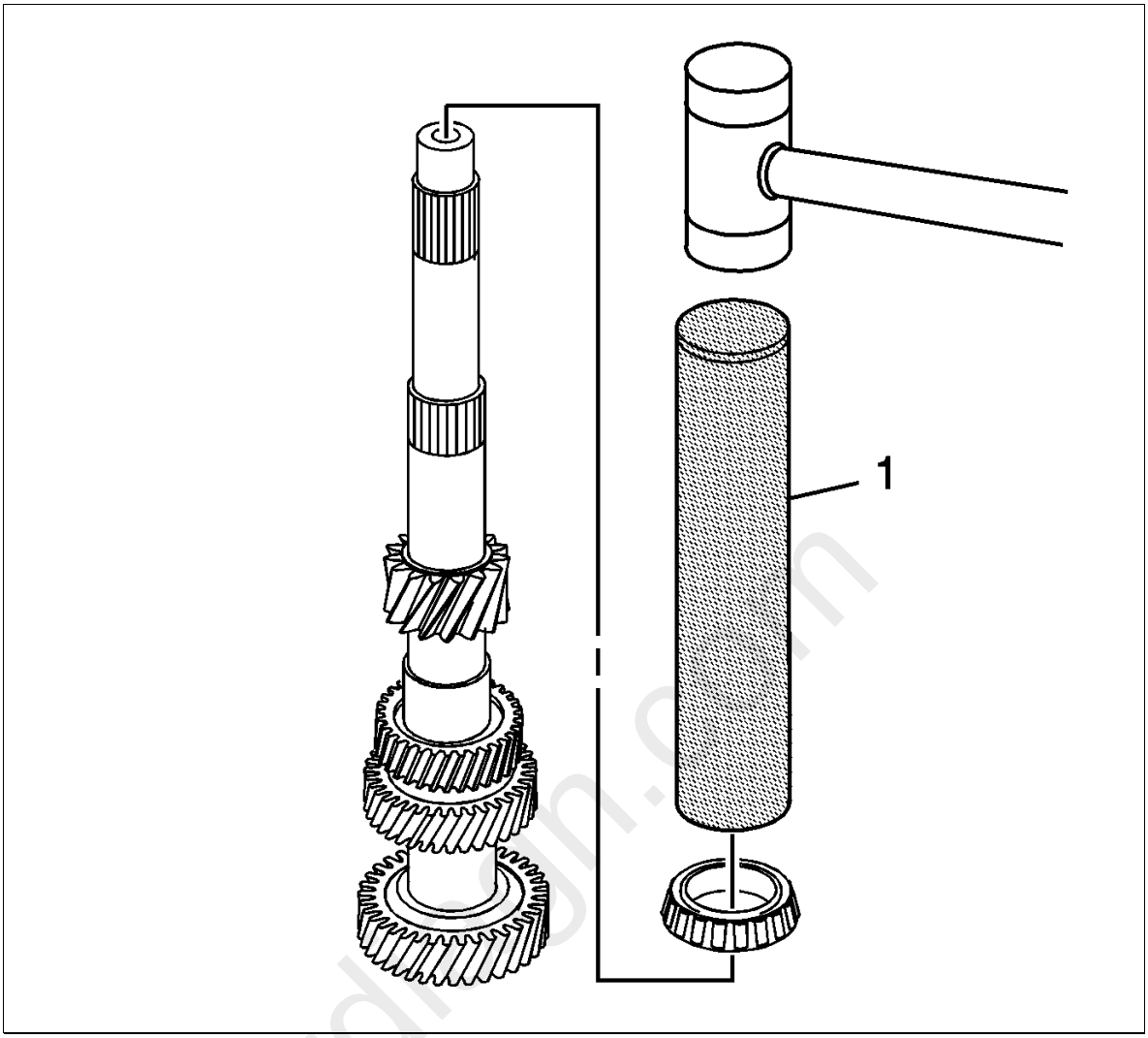
Special Tools

J 38205-1 Press Tube

For equivalent regional tools, refer to Special Tools (MM6) .

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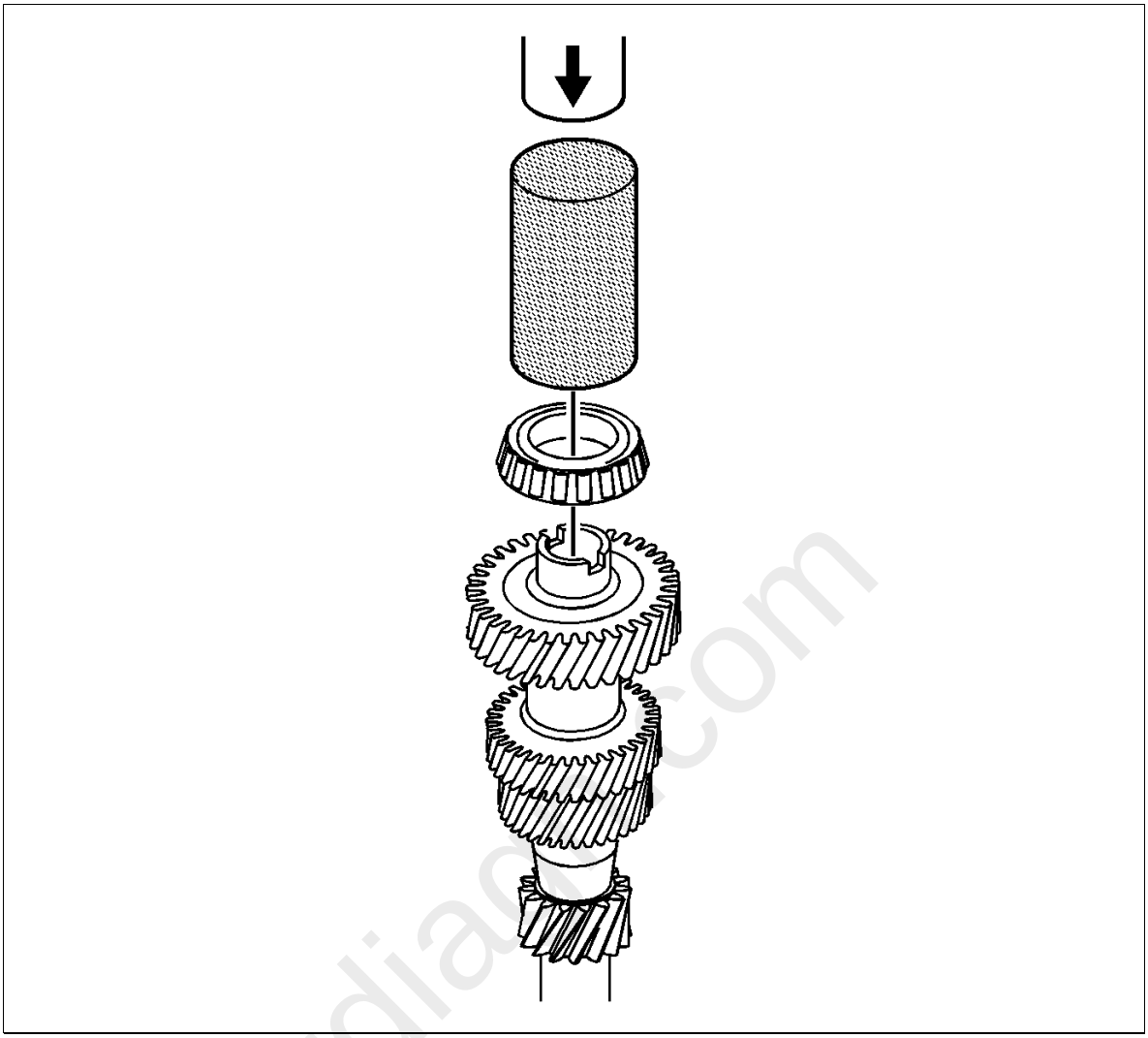
Fig 1: Large Tapered Bearing



Courtesy of GENERAL MOTORS COMPANY

1. Install a NEW countershaft rear bearing, using the **J 38205-1** press tube (1) and a rubber mallet.

Fig 2: Small Tapered Bearing & Special Tool

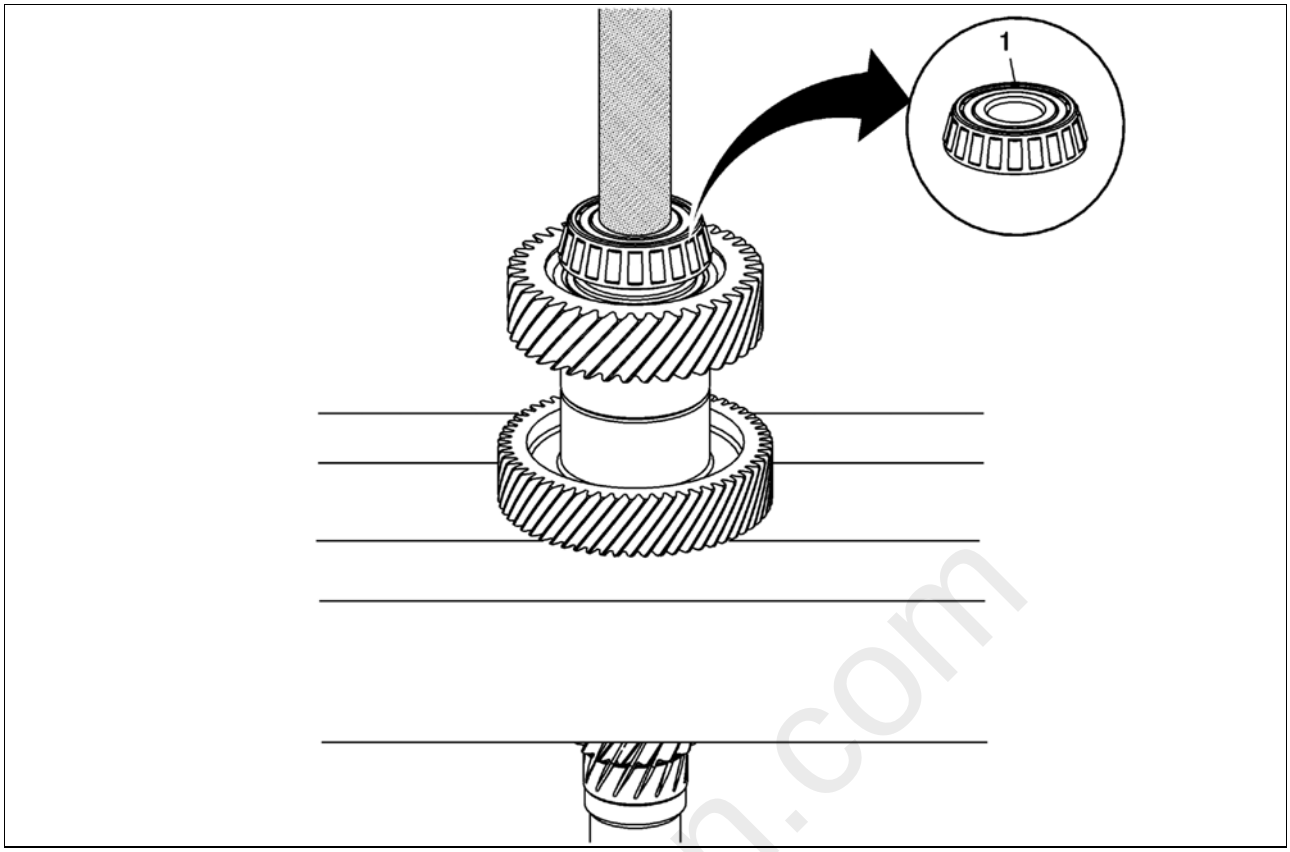


Courtesy of GENERAL MOTORS COMPANY

2. Install a NEW countershaft front bearing, using the **J 38205-1** press tube and a hydraulic press.

REPAIR INSTRUCTIONS - OFF VEHICLE > COUNTER GEAR SHAFT ASSEMBLE (M13) > FRONT BEARING INSTALLATION

Fig 1: Counter Gear Front Bearing Assembly



Courtesy of GENERAL MOTORS COMPANY

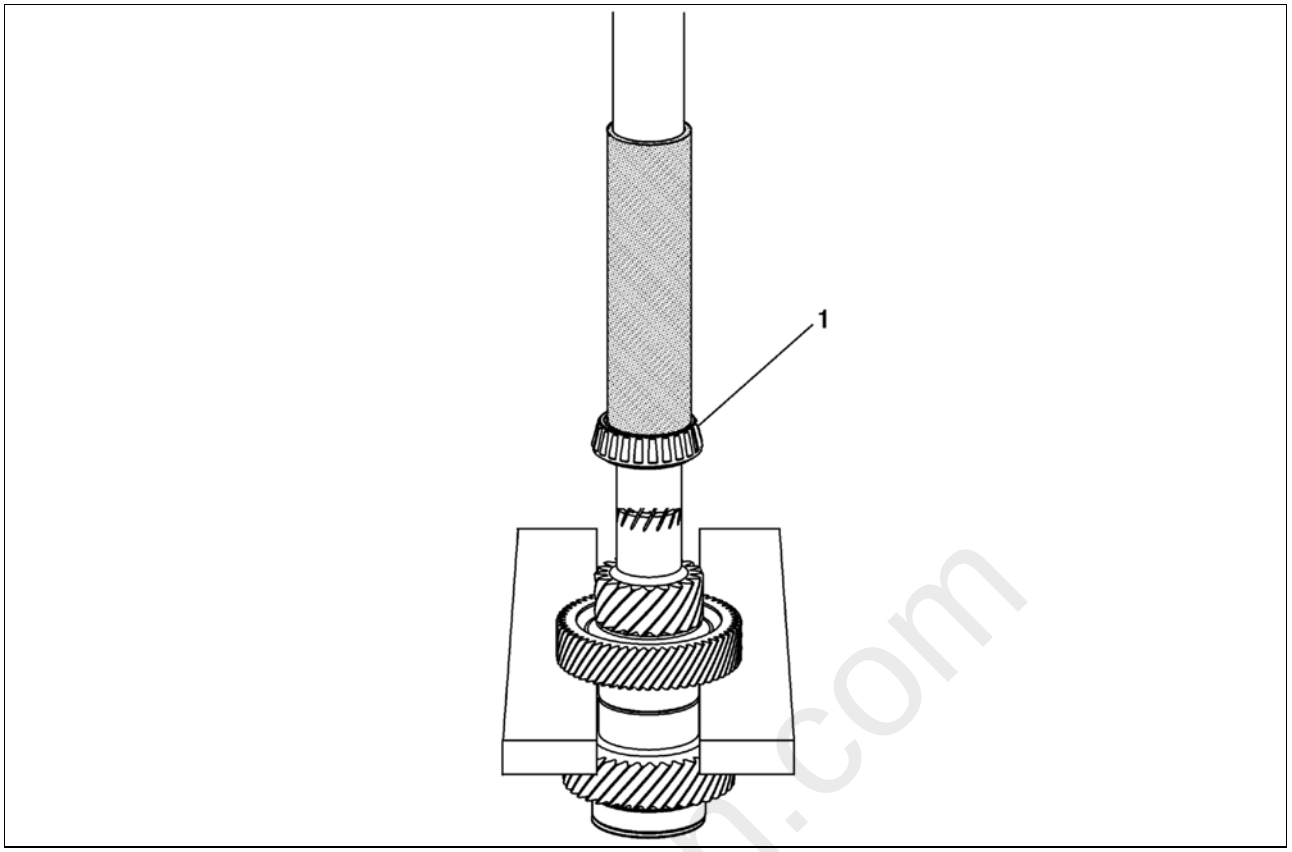
Front Bearing Installation

Callout	Component Name
1	Counter Gear Front Bearing Assembly Procedure 1. Install the counter gear front bearing, using the **DT 25234** gear and bearing installer with a hydraulic press. **Special Tools** **DT 25234** Gear and Bearing Installer For equivalent regional tools, refer to Special Tools (M13) .

REPAIR INSTRUCTIONS - OFF VEHICLE > COUNTER GEAR SHAFT ASSEMBLE (M13) > BEARING INSTALLATION

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Fig 1: Counter Gear Bearing Assembly



Courtesy of GENERAL MOTORS COMPANY

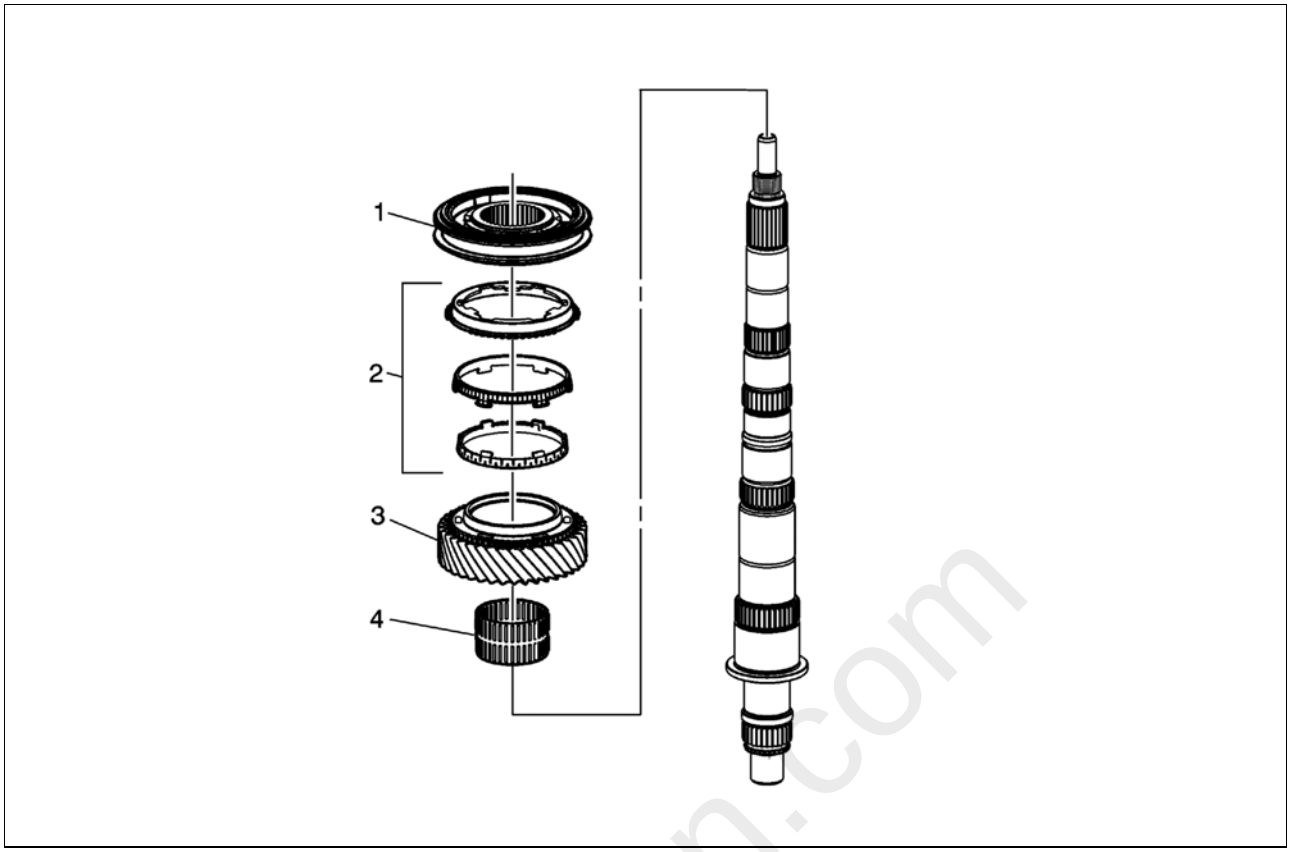
Bearing Installation

Callout	Component Name
1	Counter Gear Bearing Assembly Procedure 1. Install the counter gear bearing, using the **DT 25234** gear and bearing installer with a hydraulic press. **Special Tools** **DT 25234** Gear and Bearing Installer For equivalent regional tools, refer to Special Tools (M13) .

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT ASSEMBLE (M13) > 2ND GEAR INSTALLATION

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Fig 1: 2nd Gear Components



Courtesy of GENERAL MOTORS COMPANY

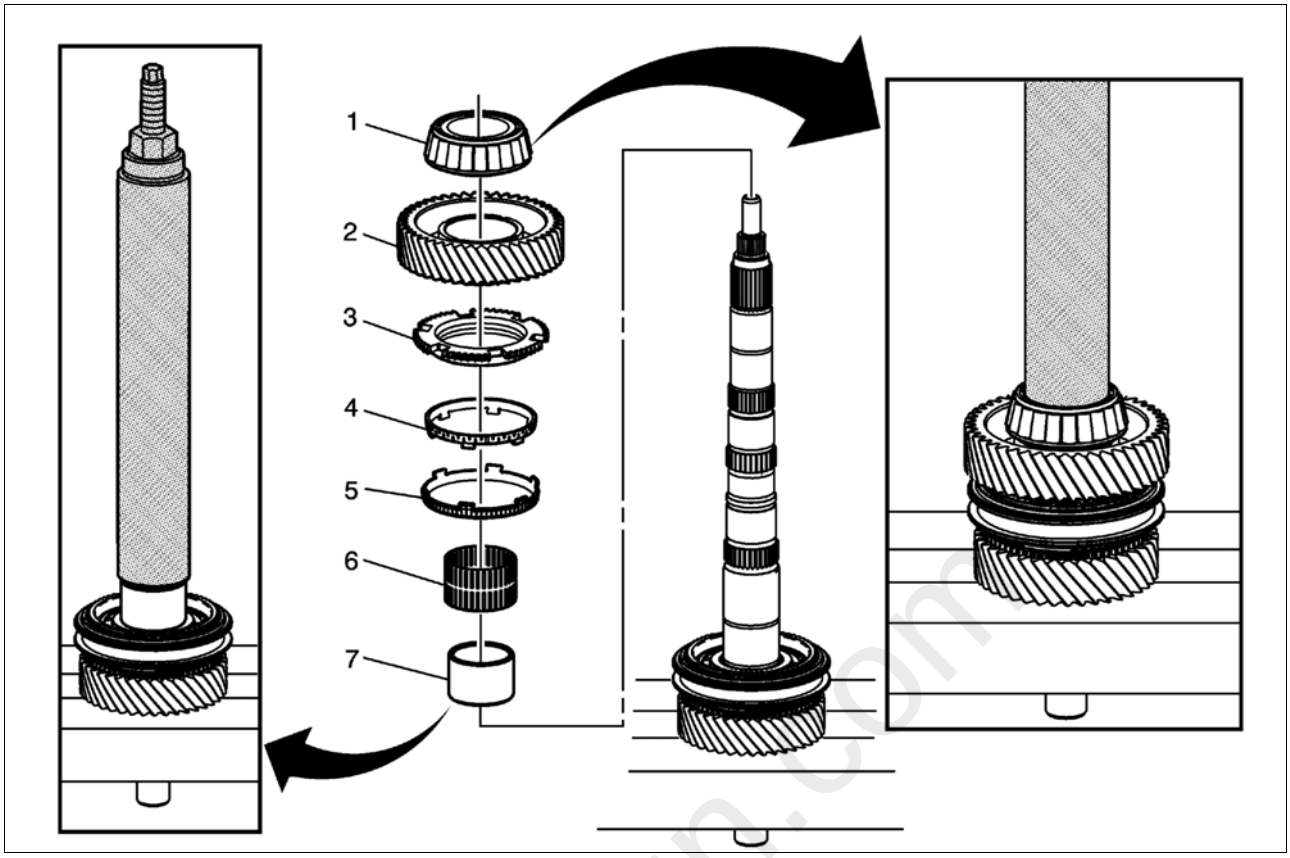
2nd Gear Installation

Callout	Component Name
1	1st-2nd Synchronizer Assembly
2	2nd Gear Blocking Ring Assembly
3	2nd Gear Assembly
4	2nd Gear Bearing Assembly

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT ASSEMBLE (M13) > 1ST GEAR INSTALLATION

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Fig 1: 1st Gear Components



Courtesy of GENERAL MOTORS COMPANY

1st Gear Installation

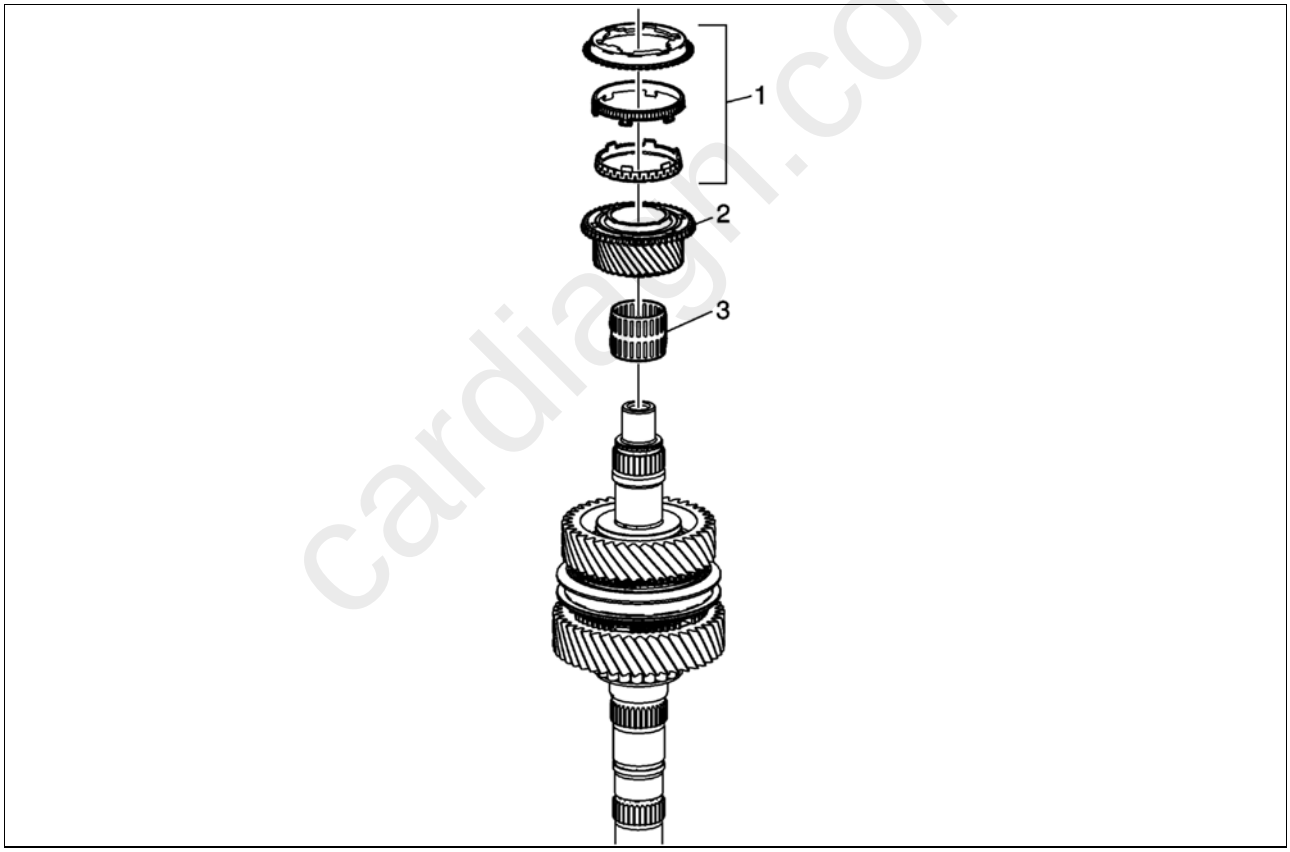
Callout	Component Name
1	Main Shaft Rear Bearing Assembly Procedure 1. Using the **DT-51076** bearing and gear installer install the bearing onto the main shaft. 2. **Special Tools** **DT-51076** Bearing And Gear Installer For equivalent regional tools, refer to Special Tools (M13) .
2	1st Gear Assembly
3	1st Gear Blocking Ring Assembly
4	1st Gear Blocking Ring Assembly
5	1st Gear Blocking Ring Assembly

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6	1st Gear Bearing Assembly
7	1st Gear Bearing Race Procedure 1. Using the **DT-51076** bearing and gear installer install the race onto the main shaft. **Special Tools** **DT-51076** Bearing And Gear Installer For equivalent regional tools, refer to Special Tools (M13) .

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT ASSEMBLE (M13) > 6TH GEAR INSTALLATION

Fig 1: 6th Speed Gear Components



Courtesy of GENERAL MOTORS COMPANY

6th Gear Installation

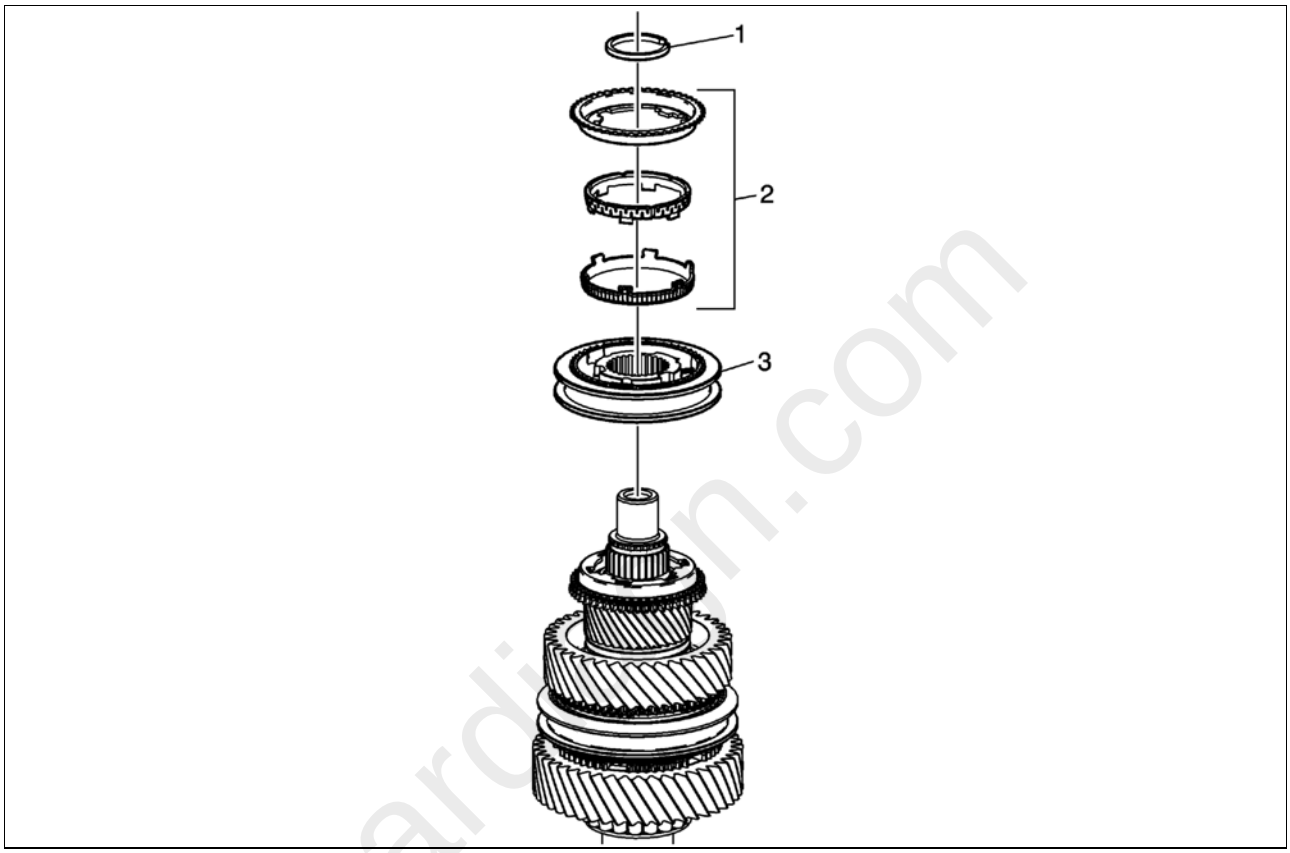
Callout	Component Name
1	6th Gear Blocking Ring Assembly

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2	6th Gear Assembly
3	6th Gear Bearing Assembly

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT ASSEMBLE (M13) > 3RD-4TH/5TH-6TH SYNCHRONIZER INSTALLATION

Fig 1: 5th & 6th Synchronizer Assembly



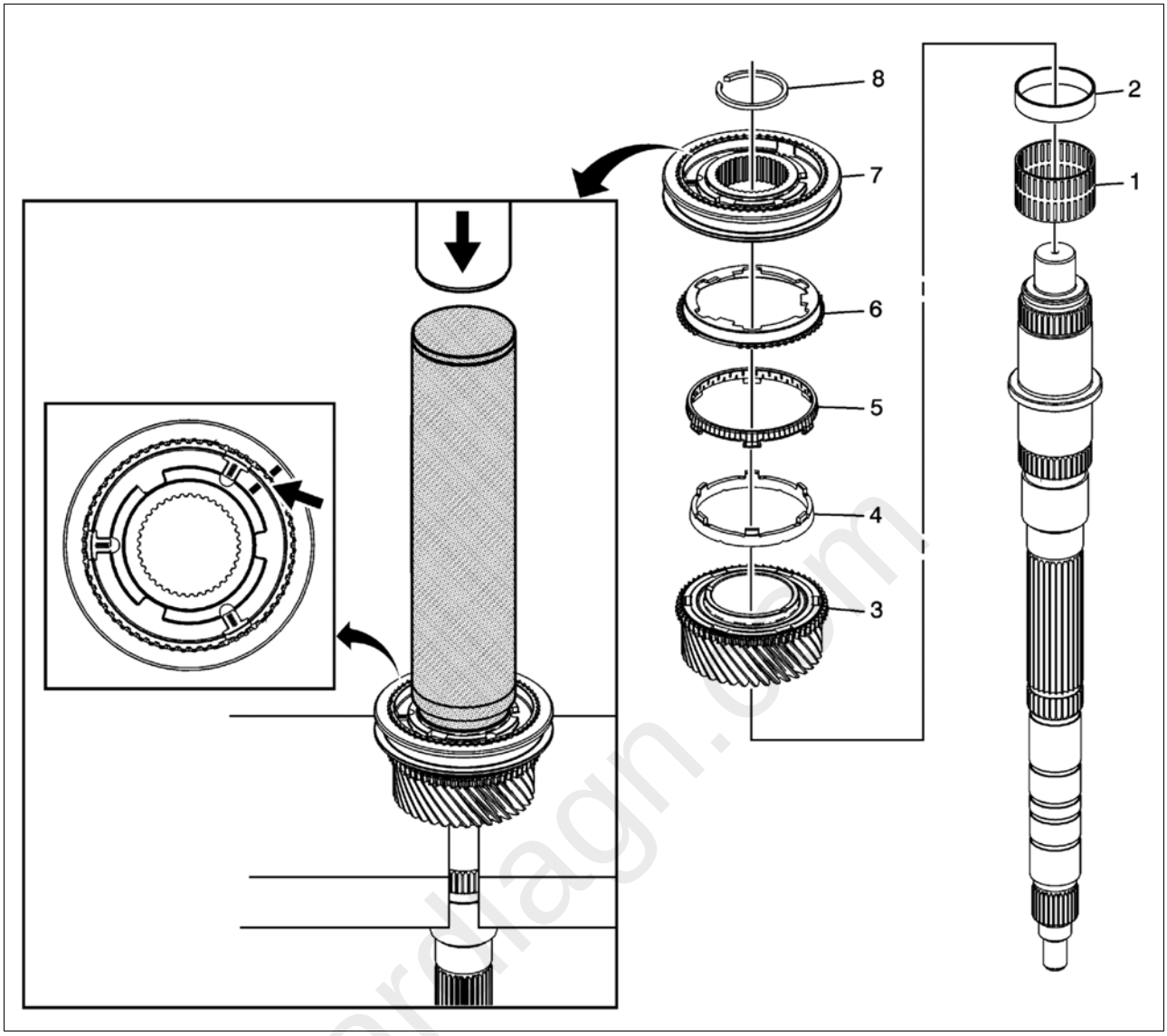
Courtesy of GENERAL MOTORS COMPANY

3rd-4th/5th-6th Synchronizer Installation

Callout	Component Name
1	Main Shaft Retaining Ring
2	5th Gear Blocking Ring Assembly
3	3rd-4th/5th-6th Gear Synchronizer Hub Assembly

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT ASSEMBLE (MM6) > 3RD SPEED DRIVE GEAR INSTALLATION

Fig 1: 3rd Speed Drive Gear Components



Courtesy of GENERAL MOTORS COMPANY

3rd Speed Drive Gear Installation

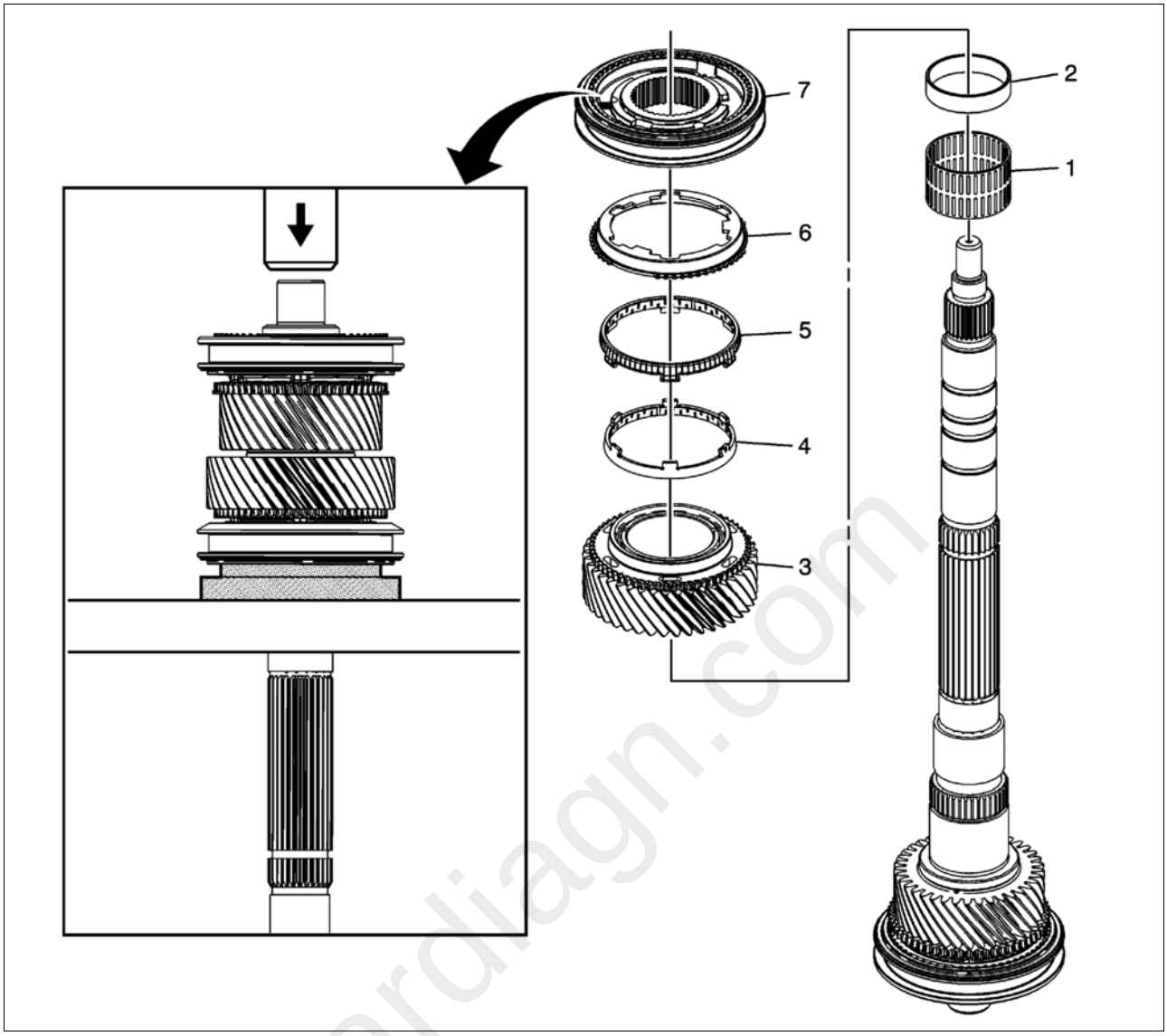
Callout	Component Name
1	3rd Speed Drive Gear Needle Bearing
2	3rd Speed Drive Gear Bearing Spacer
3	3rd Speed Drive Gear
4	3rd Speed Drive Gear Inner Cone
5	3rd Speed Gear Friction Cone
6	3rd Speed Drive Gear Synchronizer Blocking Ring

	NOTE: *Ensure the tabs on the blocking ring align with the corresponding pockets in the synchronizer hub.*
7	3rd/4th Synchronizer Assembly *NOTE:* *The groove on the sleeve faces the 3rd speed gear.* Procedure 1. Check the 3rd/4th speed gear synchronizer assembly scribe marks for correct position. 2. Start the hydraulic press operation. 3. STOP pressing before the keys engage the blocking ring slots. 4. Lift and rotate the 3rd speed gear in order to engage the keys with the blocking ring. 5. Continue pressing until the synchronizer is seated. Special Tools • **J-36183** Press Tube • **J-36184** Press Tube Adapter For equivalent regional tools, refer to Special Tools (MM6) .
8	3rd/4th Synchronizer Retaining Ring

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REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT ASSEMBLE (MM6) > 2ND SPEED DRIVE GEAR INSTALLATION

Fig 1: 2nd Speed Drive Gear Components



Courtesy of GENERAL MOTORS COMPANY

2nd Speed Drive Gear Installation

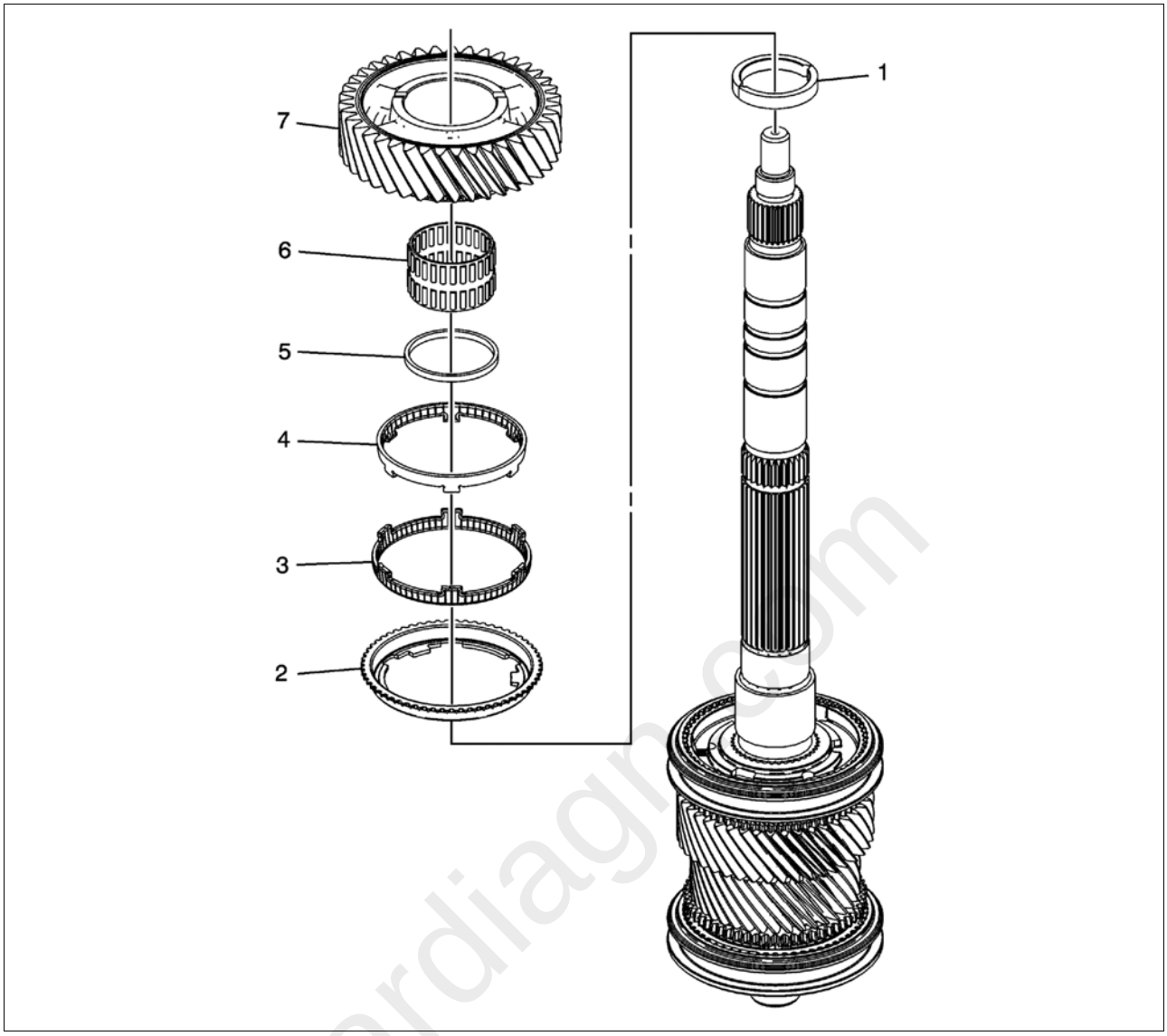
Callout	Component Name
1	2nd Speed Drive Gear Needle Bearing
2	2nd Speed Drive Gear Bearing Spacer
3	2nd Speed Drive Gear
4	2nd Speed Drive Gear Inner Cone
5	2nd Speed Drive Gear Friction Cone
6	2nd Speed Drive Gear Synchronizer Blocking Ring

	NOTE: *Ensure the tabs on the blocking ring align with the corresponding pockets in the synchronizer hub.*
7	1st/2nd Synchronizer Assembly *NOTE:* *The ID groove on the sleeve faces the 2nd speed gear.* Procedure 1. Start the hydraulic press operation. 2. STOP pressing before the keys engage the blocking ring slots. 3. Lift and rotate the 2nd speed gear in order to engage the keys with the blocking ring. 4. Continue pressing until the synchronizer is seated. **Special Tools** **J-39371** 1st/2nd Synchronizer Installer For equivalent regional tools, refer to Special Tools (MM6) .

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT ASSEMBLE (MM6) > 1ST SPEED DRIVE GEAR INSTALLATION

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Fig 1: 1st Speed Drive Gear Components



Courtesy of GENERAL MOTORS COMPANY

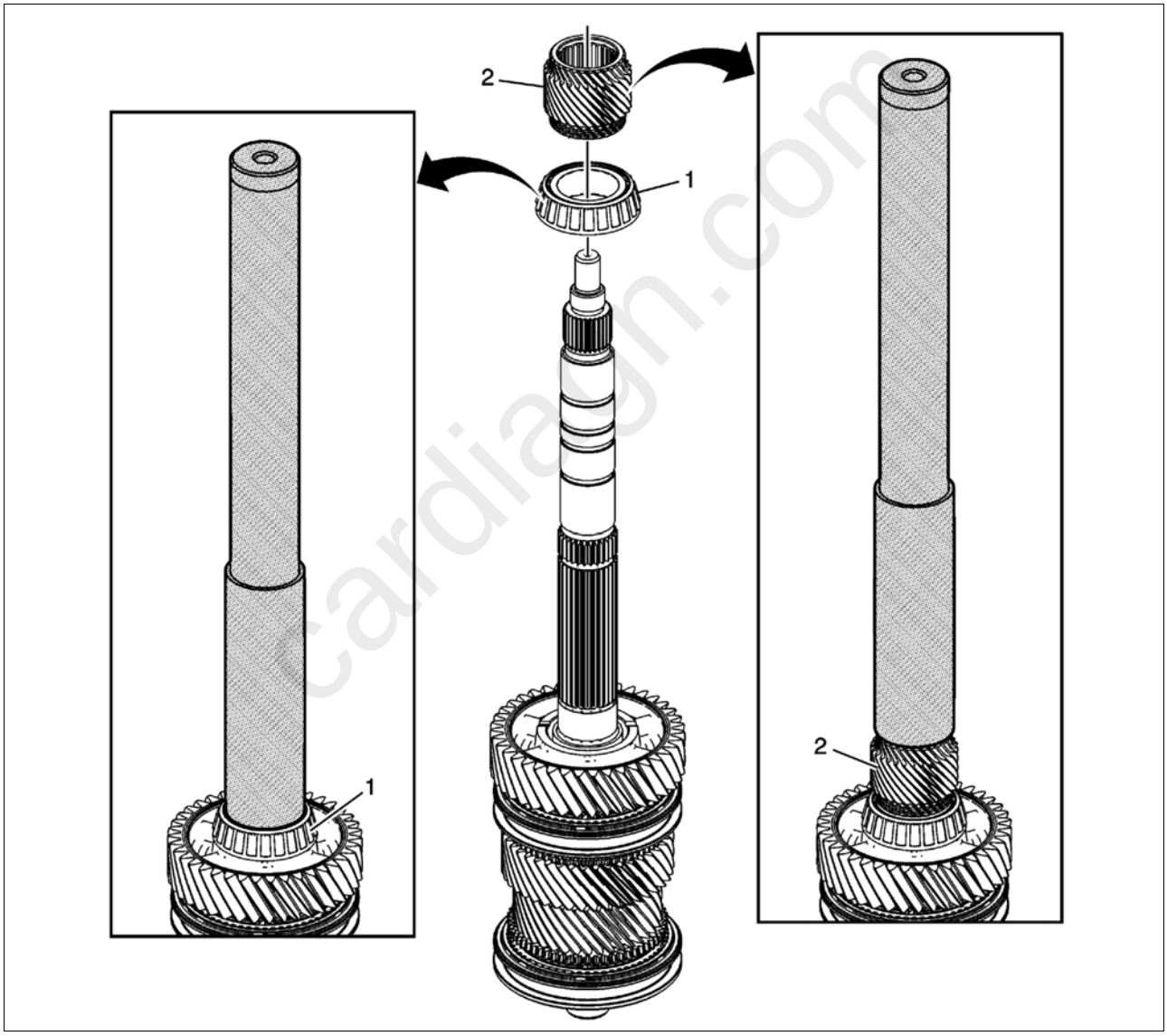
1st Speed Drive Gear Installation

Callout	Component Name
1	1st Speed Drive Gear Two Piece Washer
2	1st Speed Drive Gear Synchronizer Blocking Ring *NOTE:* *Ensure the tabs on the blocking ring align with the corresponding pockets in the synchronizer hub.*

3	1st Speed Drive Gear Friction Cone
4	1st Speed Drive Gear Inner Cone
5	1st Speed Drive Gear Locking Ring
6	1st Speed Drive Gear Needle Bearing
7	1st Speed Drive Gear

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT ASSEMBLE (MM6) > 6TH SPEED DRIVEN GEAR INSTALLATION

Fig 1: 6th Speed Driven Gear Components



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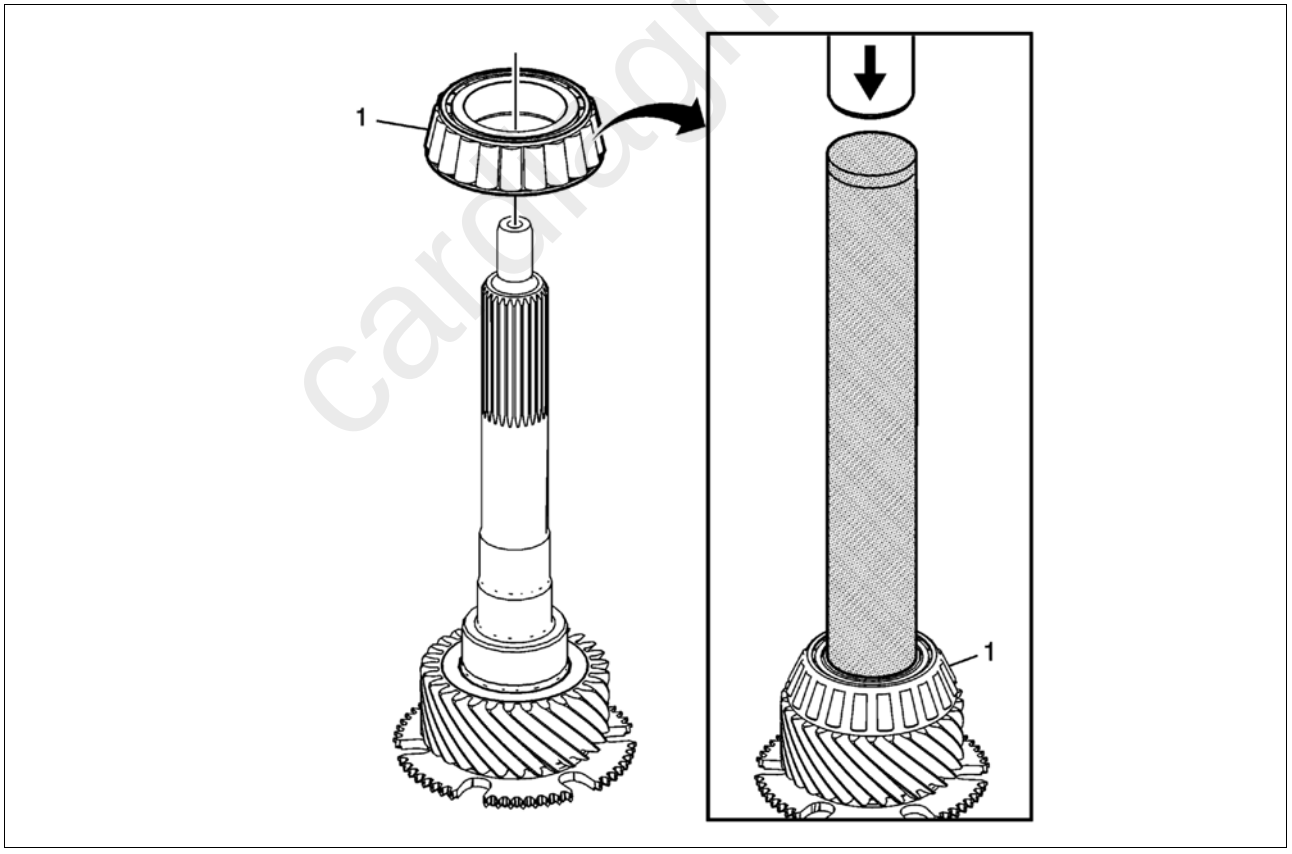
Courtesy of GENERAL MOTORS COMPANY

6th Speed Driven Gear Installation

Callout	Component Name
1	Main Shaft Bearing Special Tools • **J-39441** 5th/6th Driven Gear Installer • **J-39441-20** 5th Gear Installer Adapter
2	6th Speed Driven Gear Special Tools • **J-39441** 5th/6th Driven Gear Installer • **J-39441-10** 5th Gear Installer Adapter

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT ASSEMBLE (MM6) > INPUT SHAFT BEARING INSTALLATION

Fig 1: Input Shaft Bearing



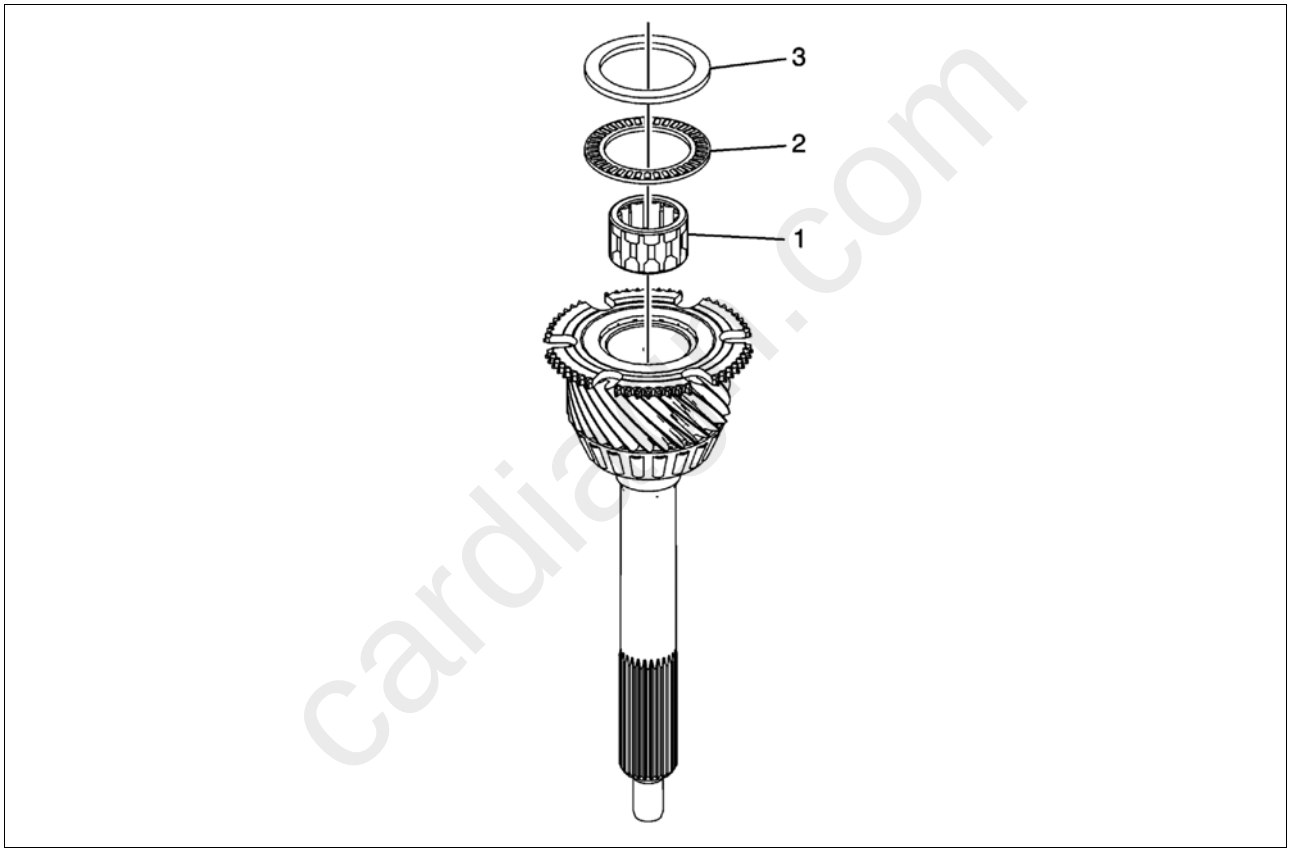
Courtesy of GENERAL MOTORS COMPANY

Input Shaft Bearing Installation

Callout	Component Name
1	Input Shaft Bearing **Special Tools** **J-44735** Installation Tube For equivalent regional tools, refer to Special Tools (MM6) .

REPAIR INSTRUCTIONS - OFF VEHICLE > MAIN SHAFT AND INPUT SHAFT ASSEMBLE (MM6) > INPUT SHAFT POCKET BEARING INSTALLATION

Fig 1: Input Shaft Pocket Bearing Components



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Input Shaft Pocket Bearing Installation

Callout	Component Name
1	Input Shaft Bearing
2	Input Shaft Thrust Bearing
3	Input Shaft Thrust Washer

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION ASSEMBLE (M13 - LGX W/Y4Q)

Special Tools

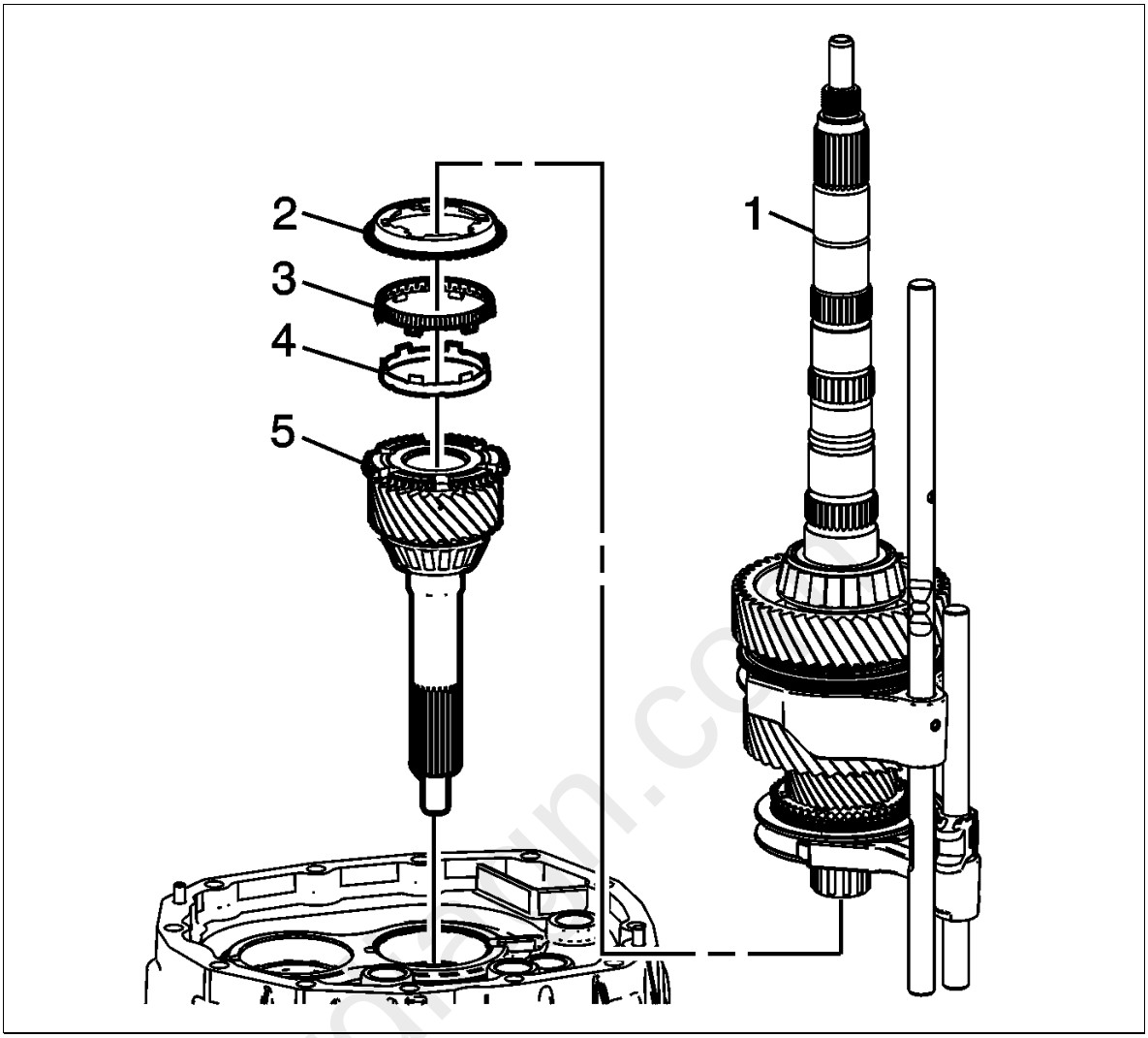
- **DT-51076** Bearing and Gear Installer
- **DT-47678** Transmission Holding Flange
- **DT-47678-10** Transmission Holding Flange Adapter
- **J-45012** Holding Fixture

Equivalent regional tools:Special Tools (M13) .

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION ASSEMBLE (M13 - LGX W/Y4Q) > SHIFT SHAFT ASSEMBLIES AND GEAR CLUSTER INSTALL

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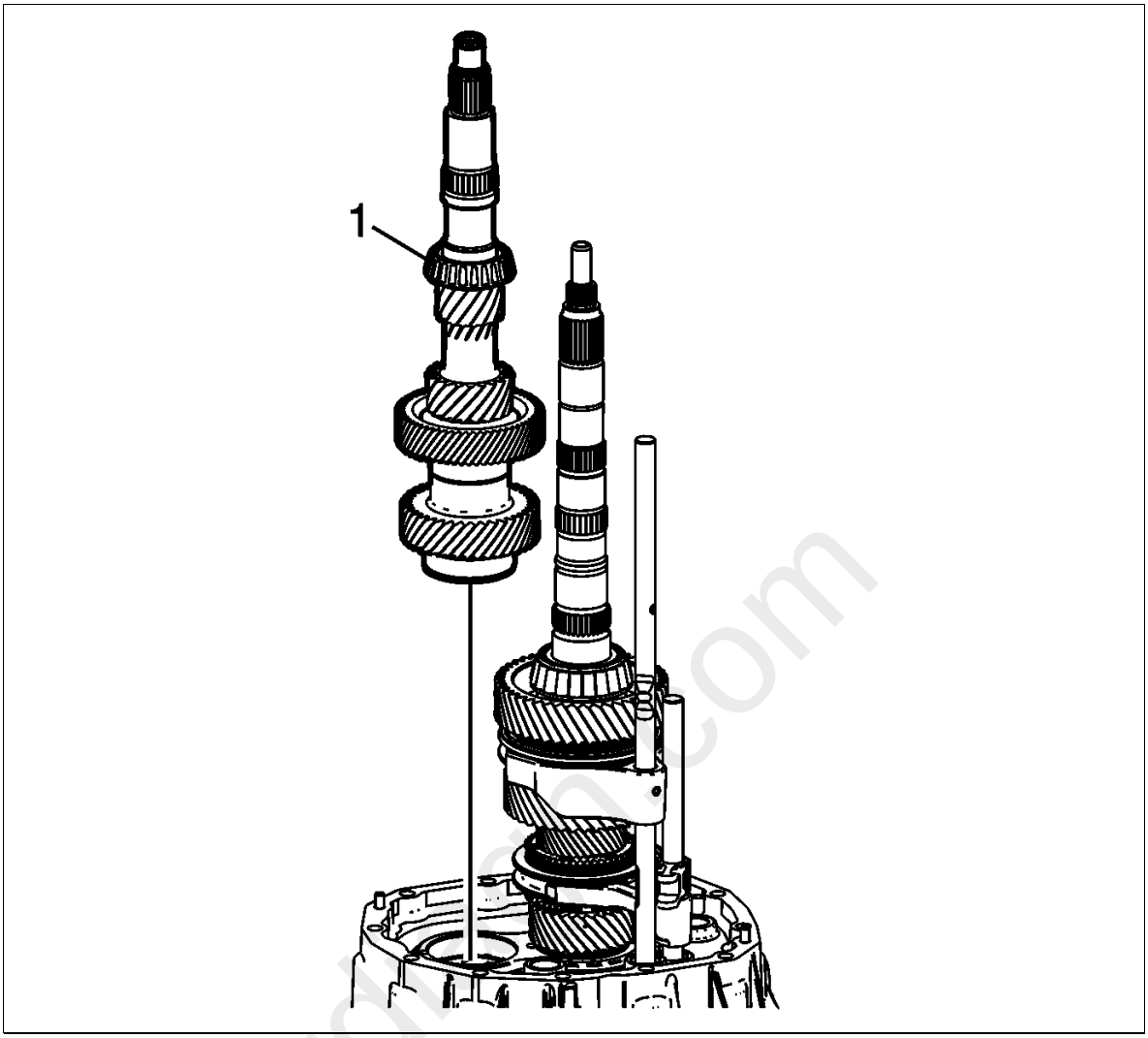
Fig 1: Input Shaft Assembly & Related Components



Courtesy of GENERAL MOTORS COMPANY

1. Install the input shaft (5).
2. Install the 5th gear blocking ring assembly (2, 3, 4).
3. Install the main shaft, shift shafts, and shift forks as an assembly (1).

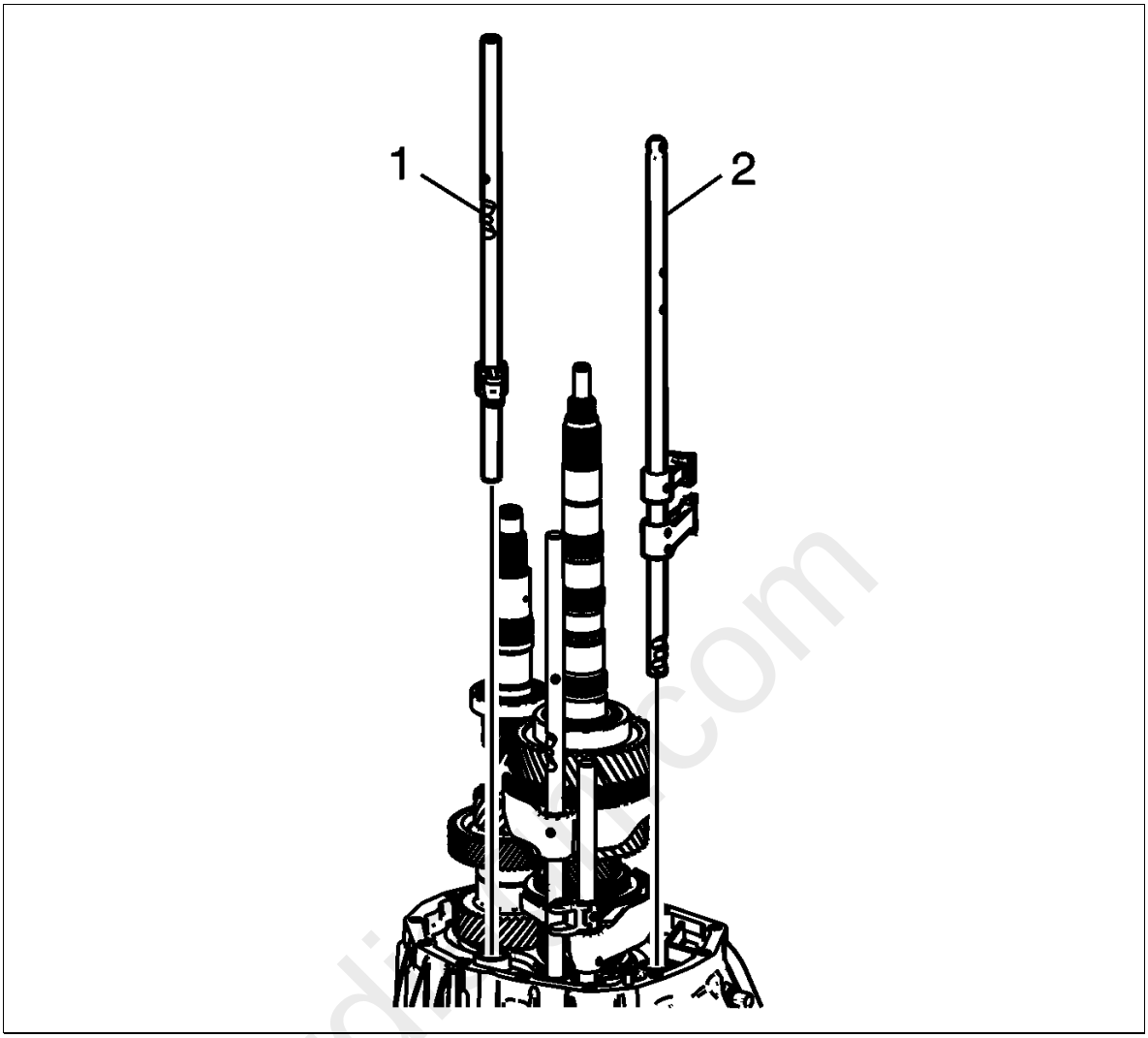
Fig 2: Counter Gear Assembly



Courtesy of GENERAL MOTORS COMPANY

4. Install the counter gear assembly (1).

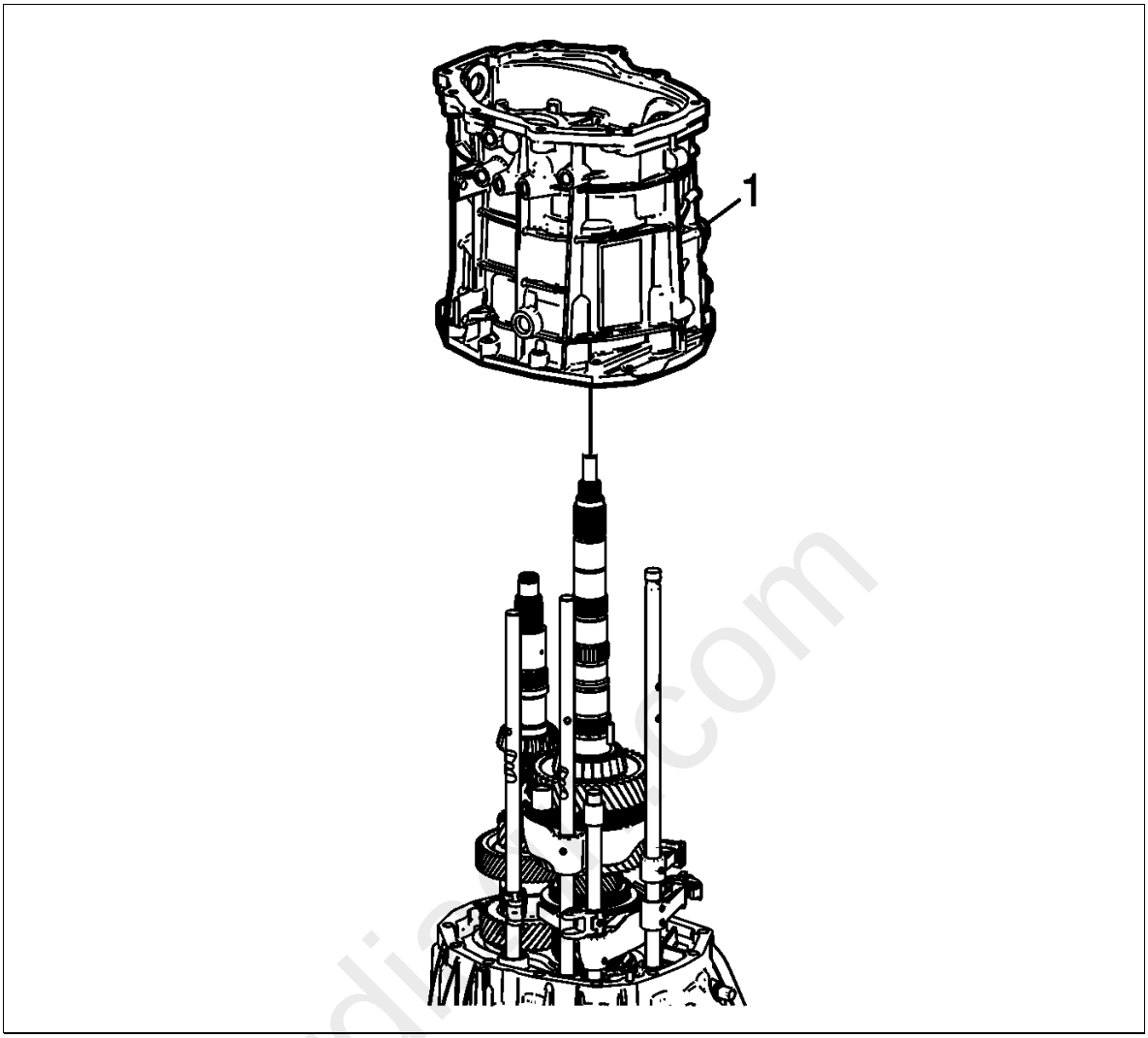
Fig 3: Shift Shaft Assemblies



Courtesy of GENERAL MOTORS COMPANY

5. Install the Shift Shaft Assemblies (1 & 2).

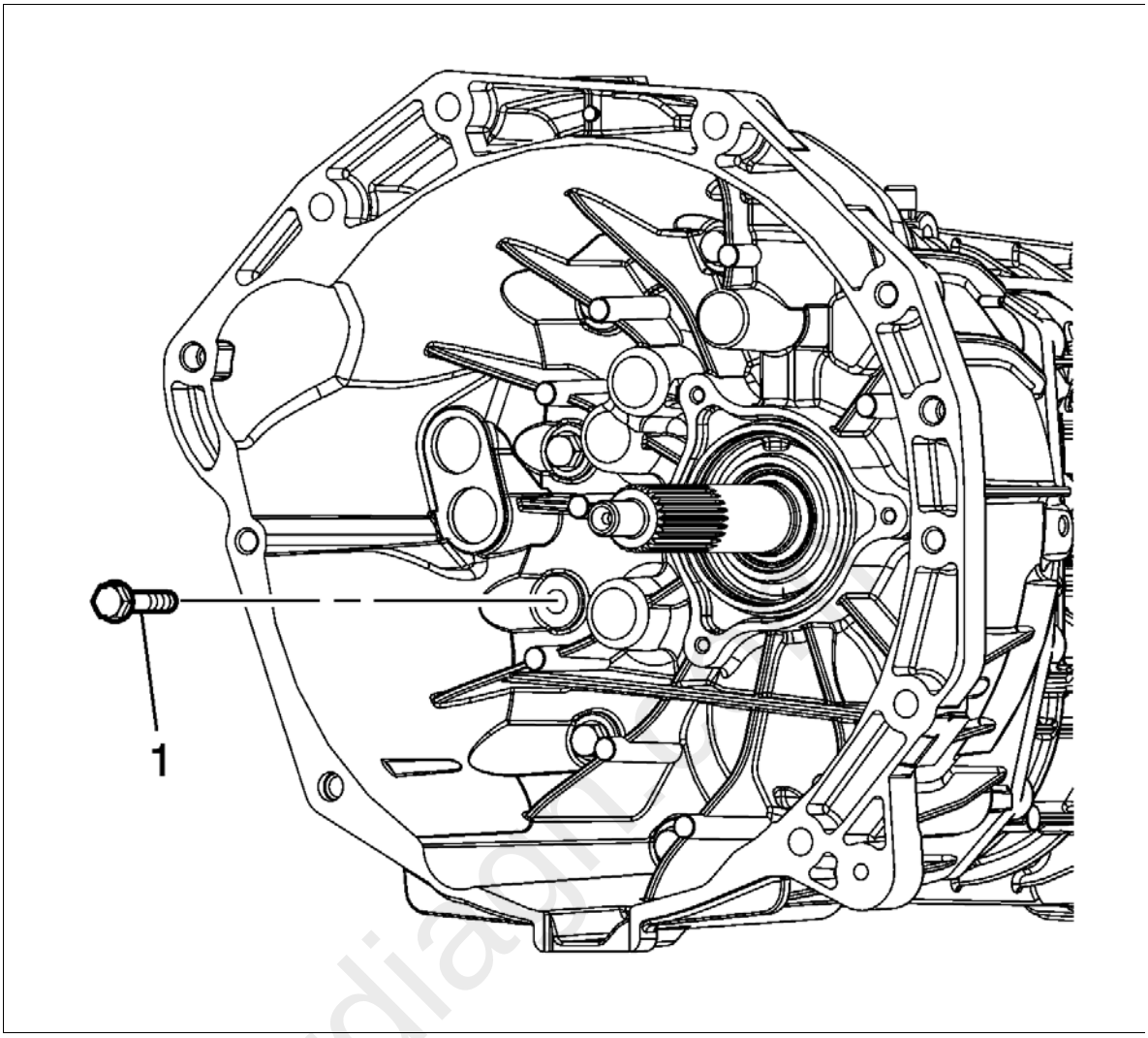
Fig 4: Transmission Case Assembly



Courtesy of GENERAL MOTORS COMPANY

6. Install the transmission case (1).

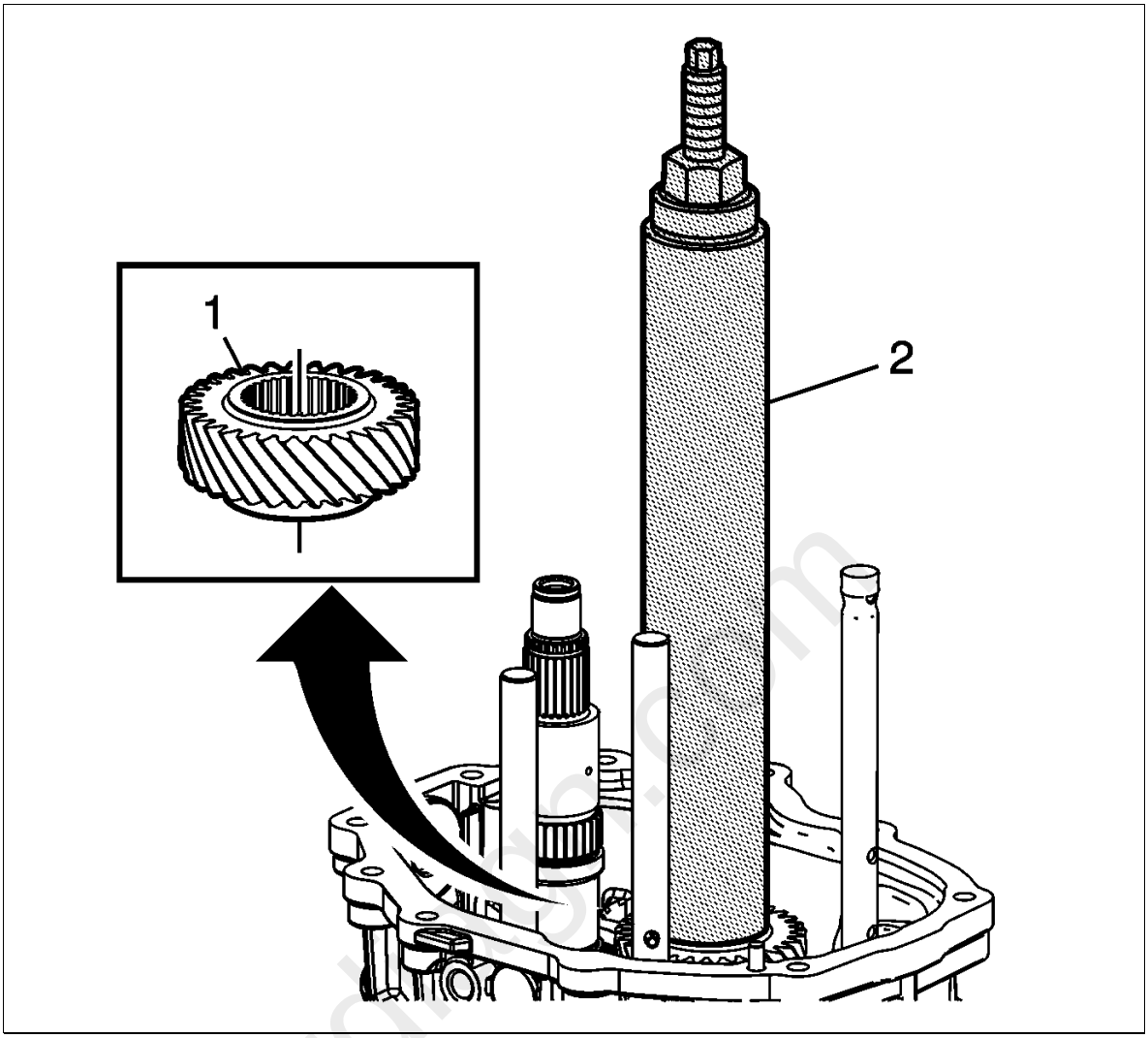
Fig 5: Clutch Housing Bolts



Courtesy of GENERAL MOTORS COMPANY

7. Install the clutch housing bolts (1) temporarily.

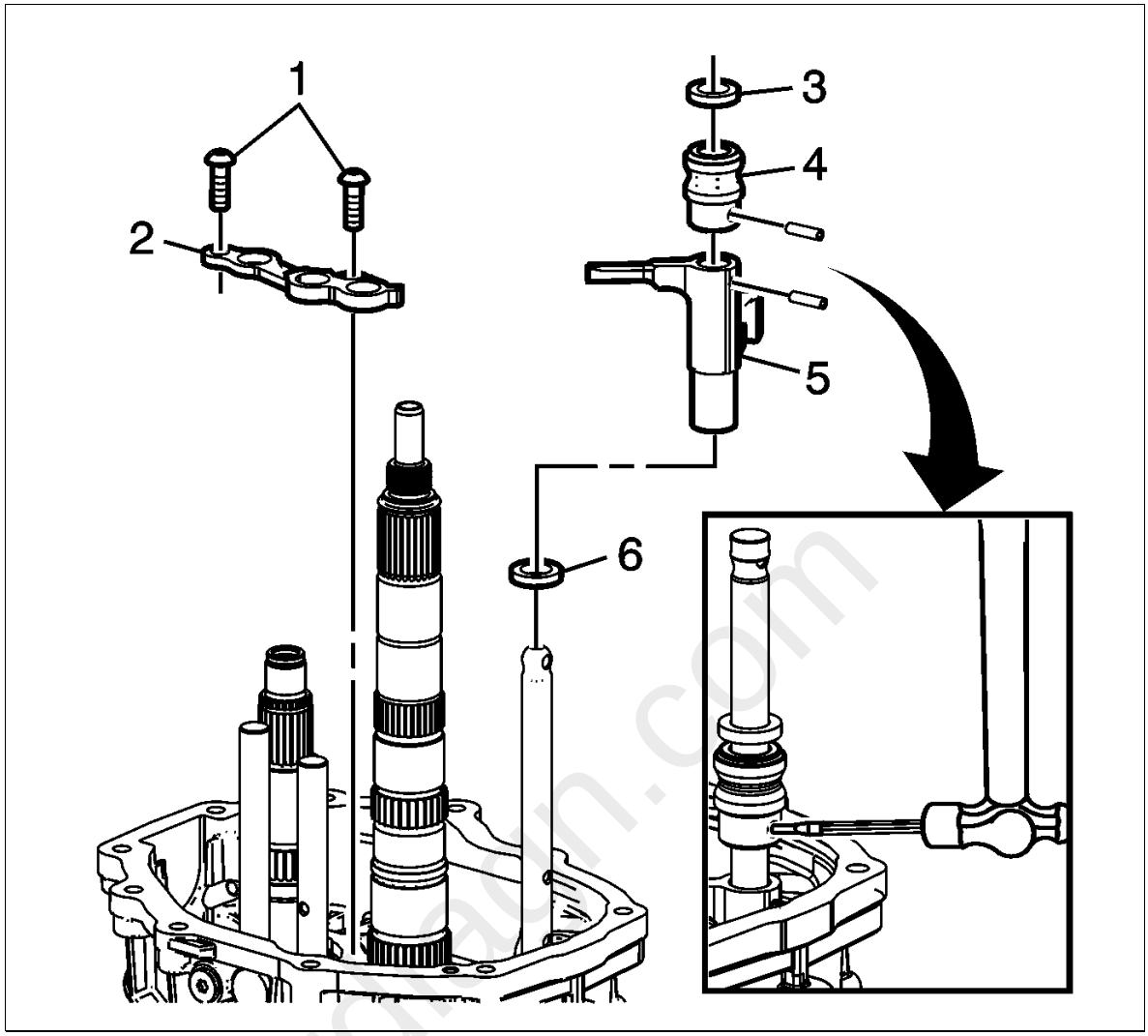
Fig 6: 4th Gear Assembly & Installer



Courtesy of GENERAL MOTORS COMPANY

8. Install the 4th gear assembly (1) using the **DT-51076** bearing and gear installer (2).

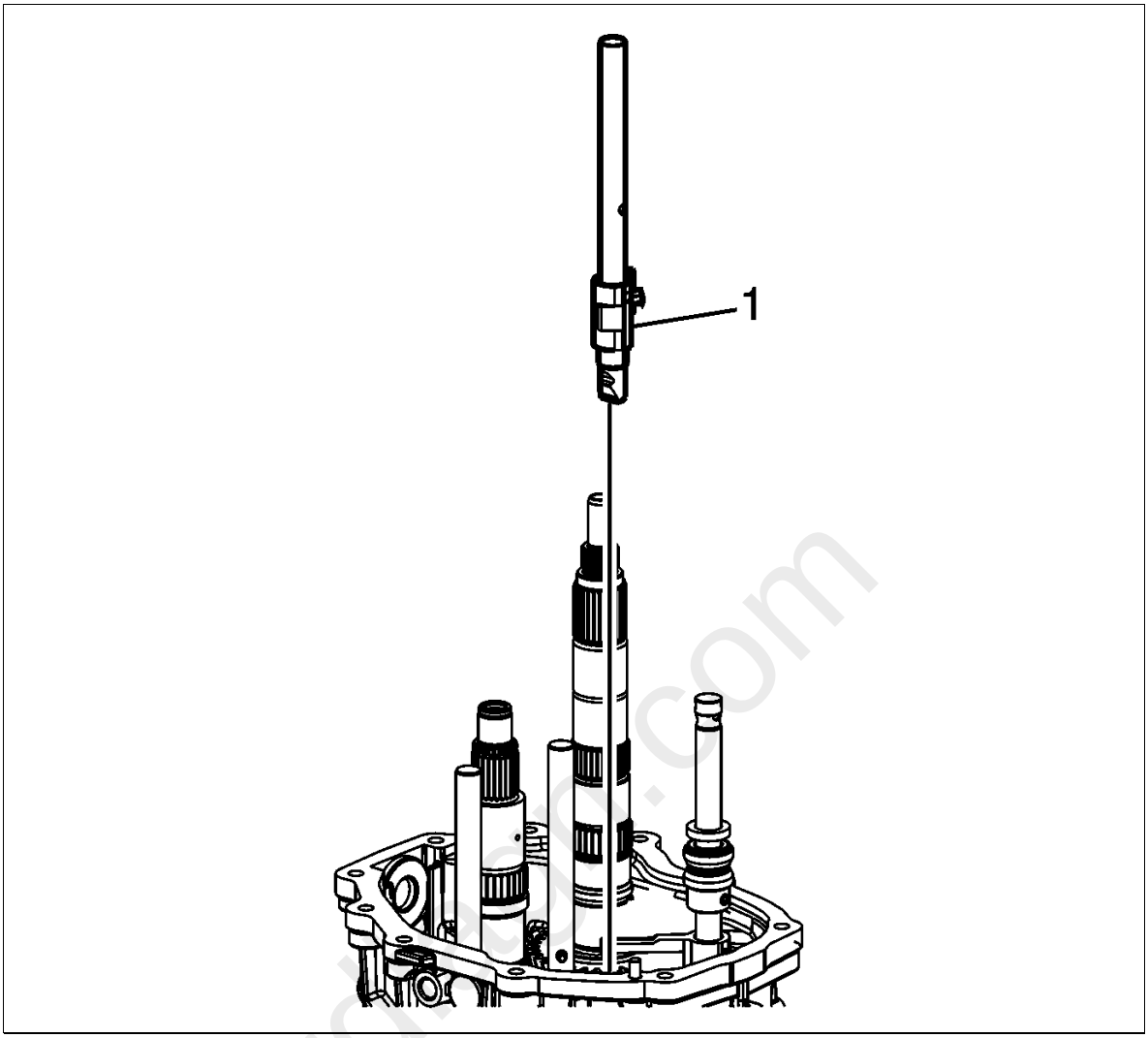
Fig 7: Shift Control Spacer



Courtesy of GENERAL MOTORS COMPANY

9. Install the shift control spacer (6)
10. Install the shift bar support (interlock) (2) and selector finger and cam (5) at the same time.
11. Install the shift interlock plate retainer bolts (1), shift control spacer (3), and neutral cam (4). Tighten the shift interlock plate retainer bolts to 31 N.m (23 lb ft).
12. Using a 3/16 in drift punch and hammer drive the coiled spring pins downward and Install.

Fig 8: Reverse Shift Shaft Assembly And Manual Transmission Reverse Selector Lever

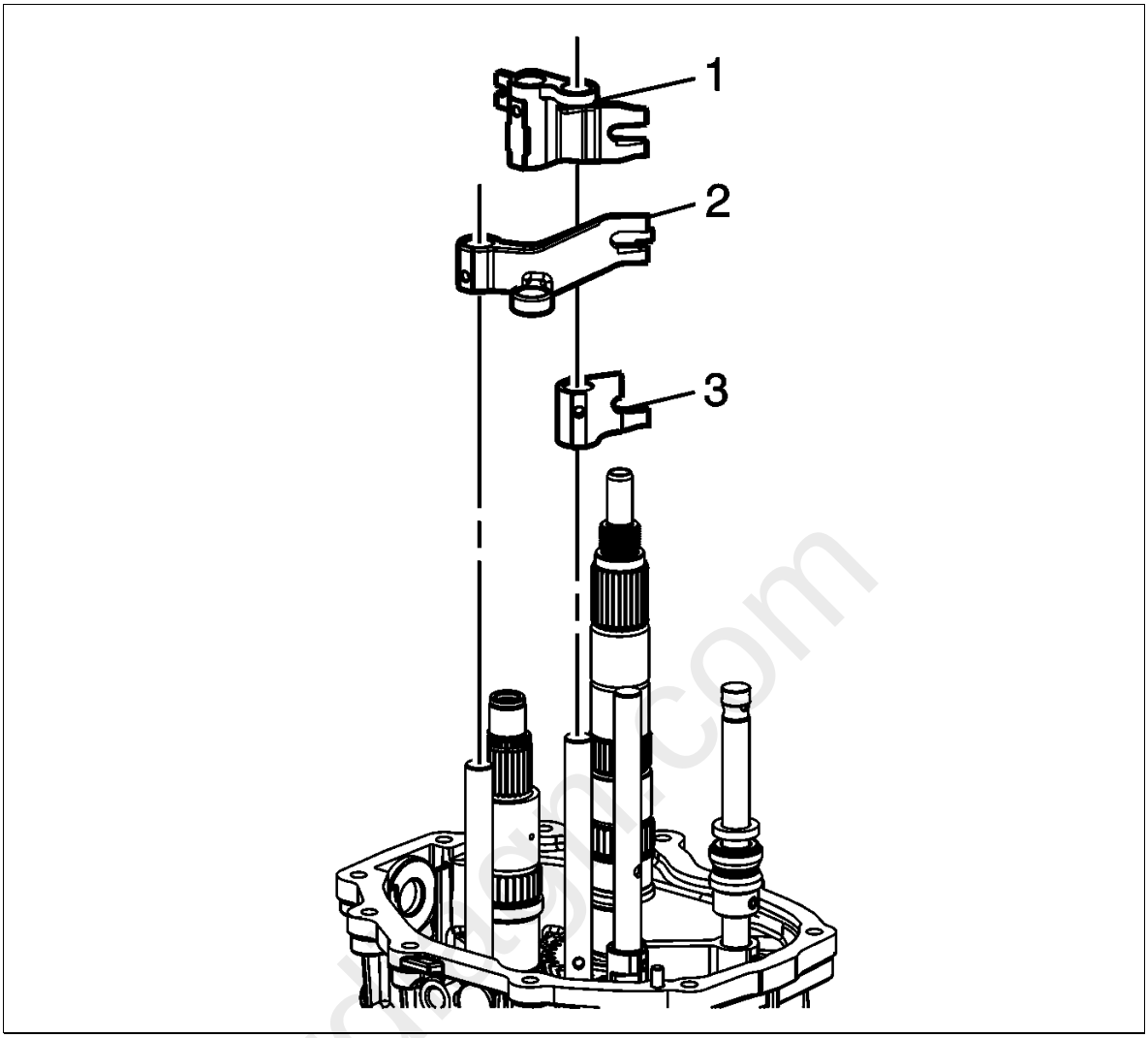


Courtesy of GENERAL MOTORS COMPANY

13.

14. Install the reverse shift shaft assembly and manual transmission reverse selector lever (1) as an assembly.

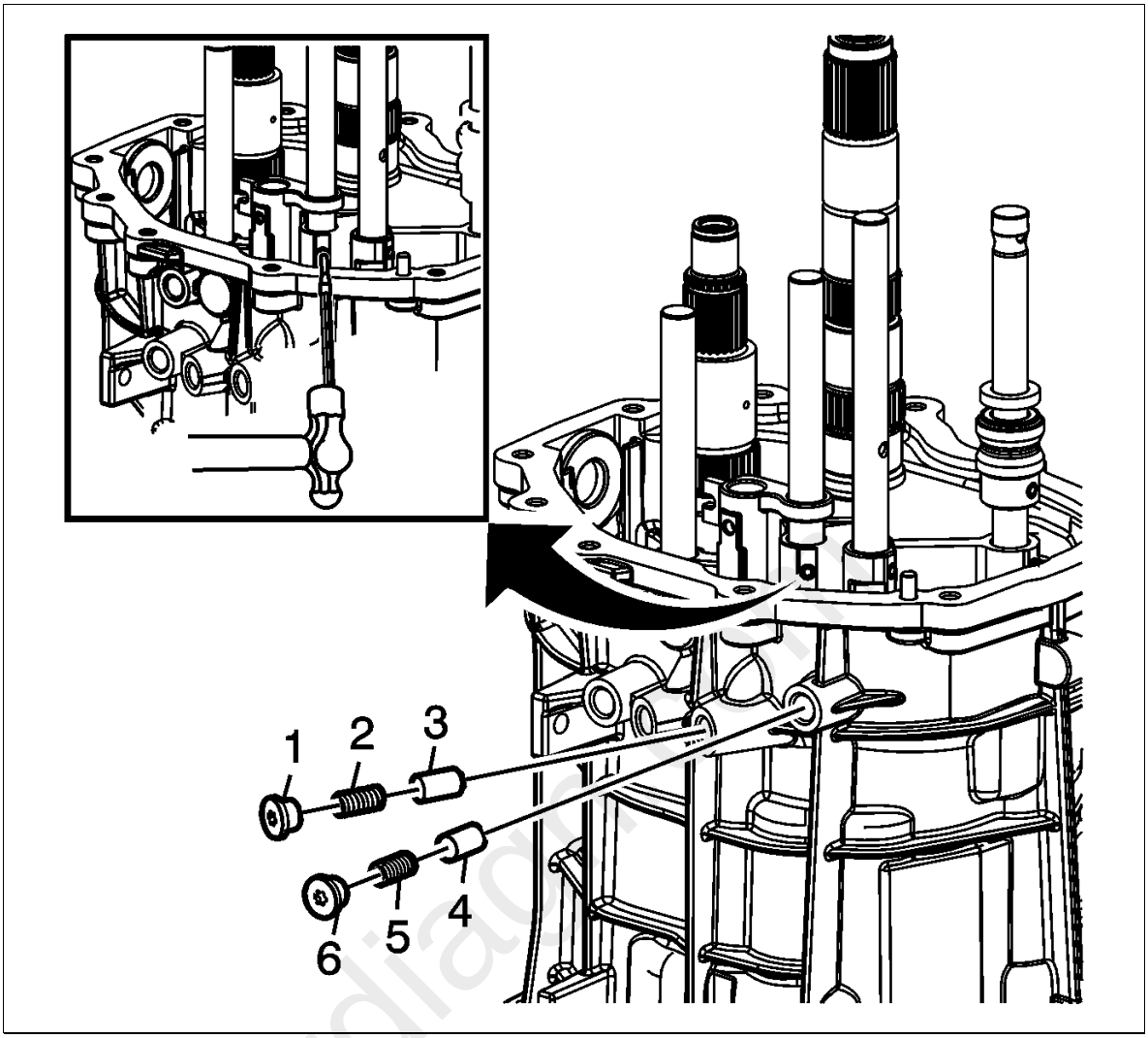
Fig 9: Selector Levers



Courtesy of GENERAL MOTORS COMPANY

15. Install the manual transmission 3rd & 4th selector lever (1), manual transmission 5th & 6th selector lever (2), and the manual transmission 1st & 2nd selector lever (3).

Fig 10: Shift Shaft, Detent And Spring

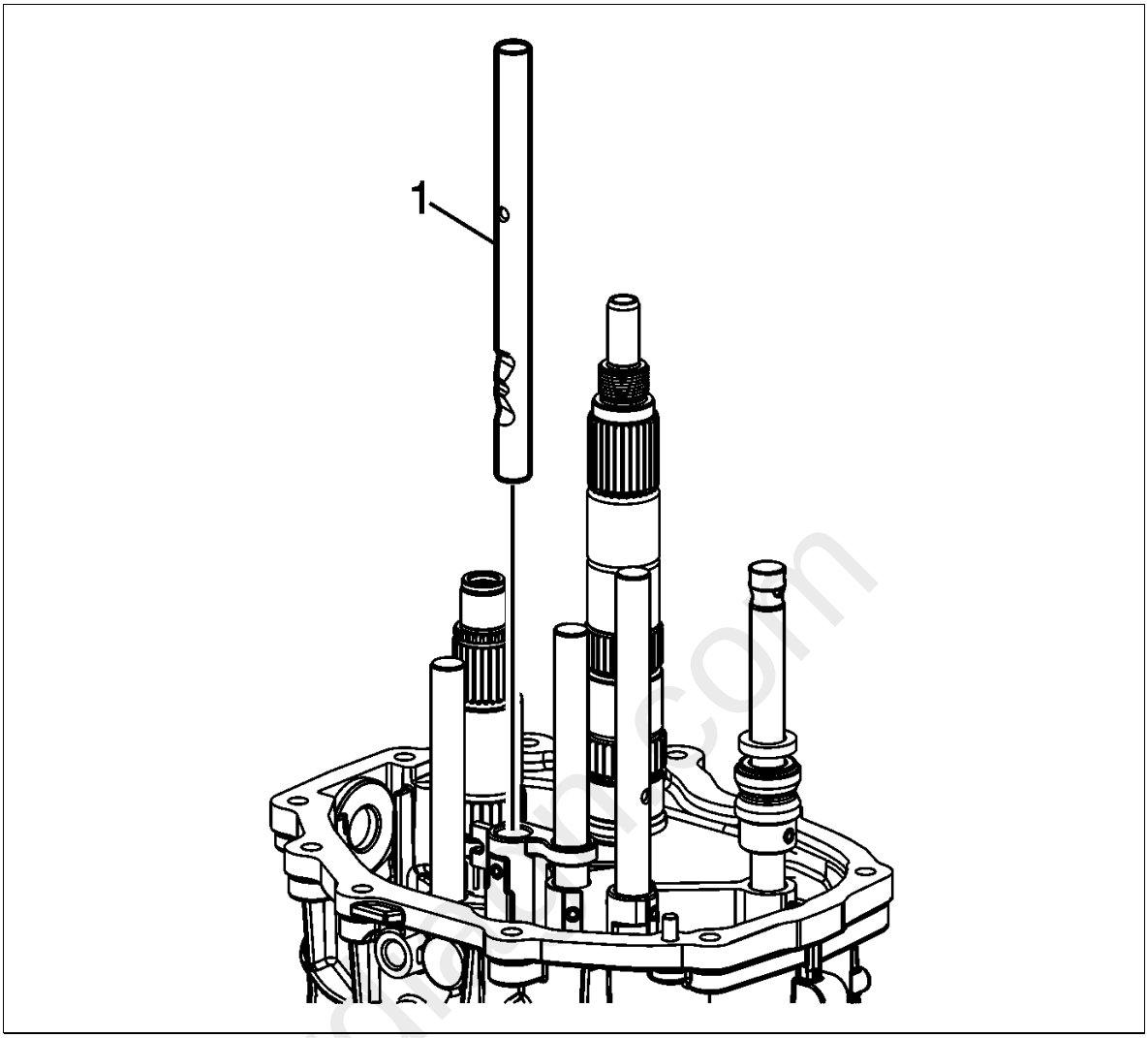


Courtesy of GENERAL MOTORS COMPANY

16. Install the shift shaft detent spring cover bolt (1 and 6), shift shaft detent springs (2 and 5) and shift shaft detents (3 and 4). Tighten shift shaft detent spring cover bolt to 28 N.m (21 lb ft).

17. Using a 3/16 in drift punch and hammer drive the coiled spring pin downward and Install.

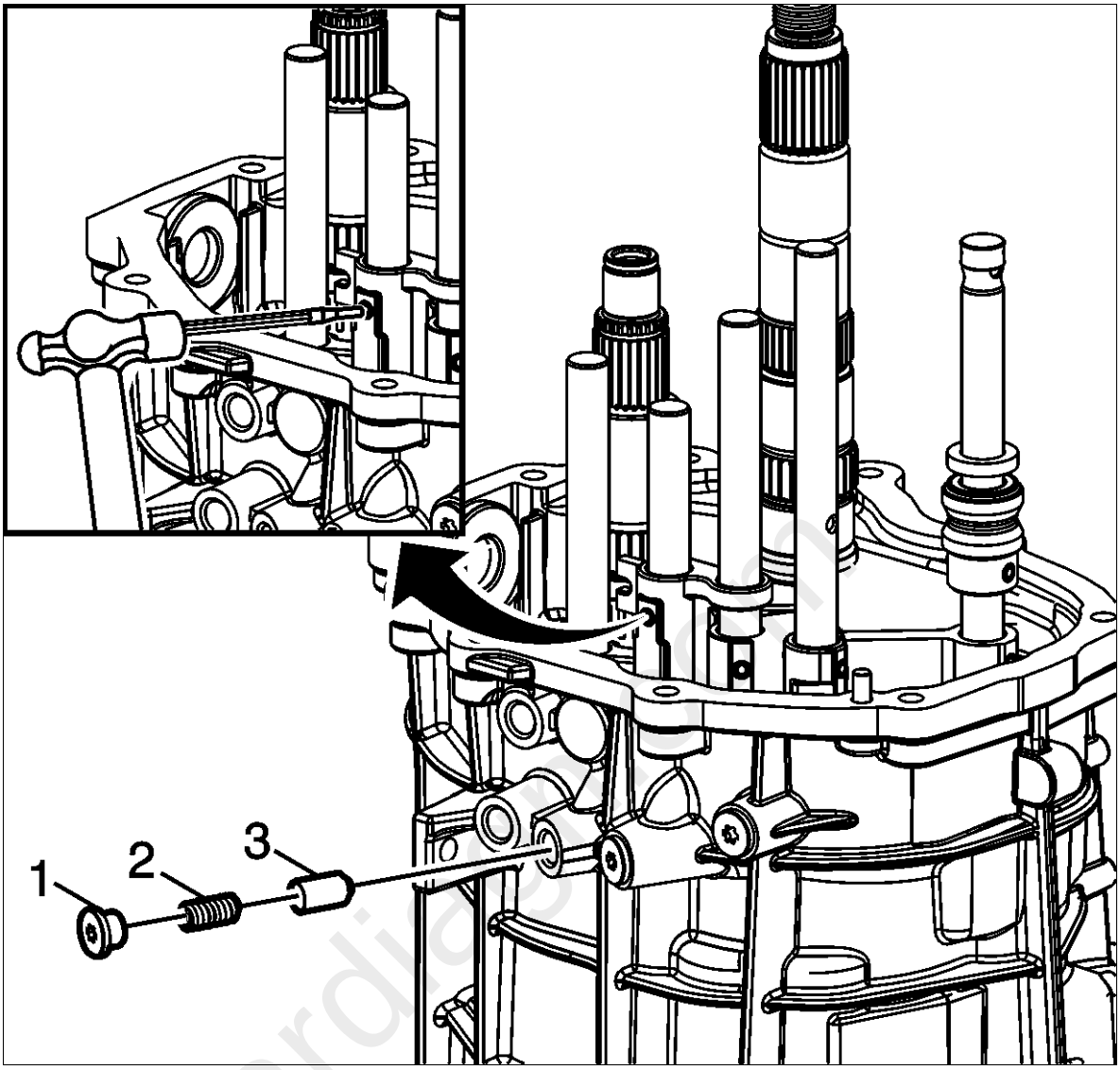
Fig 11: 3rd And 4th Shift Shaft



Courtesy of GENERAL MOTORS COMPANY

18. Install the 3rd & 4th shift shaft (1).

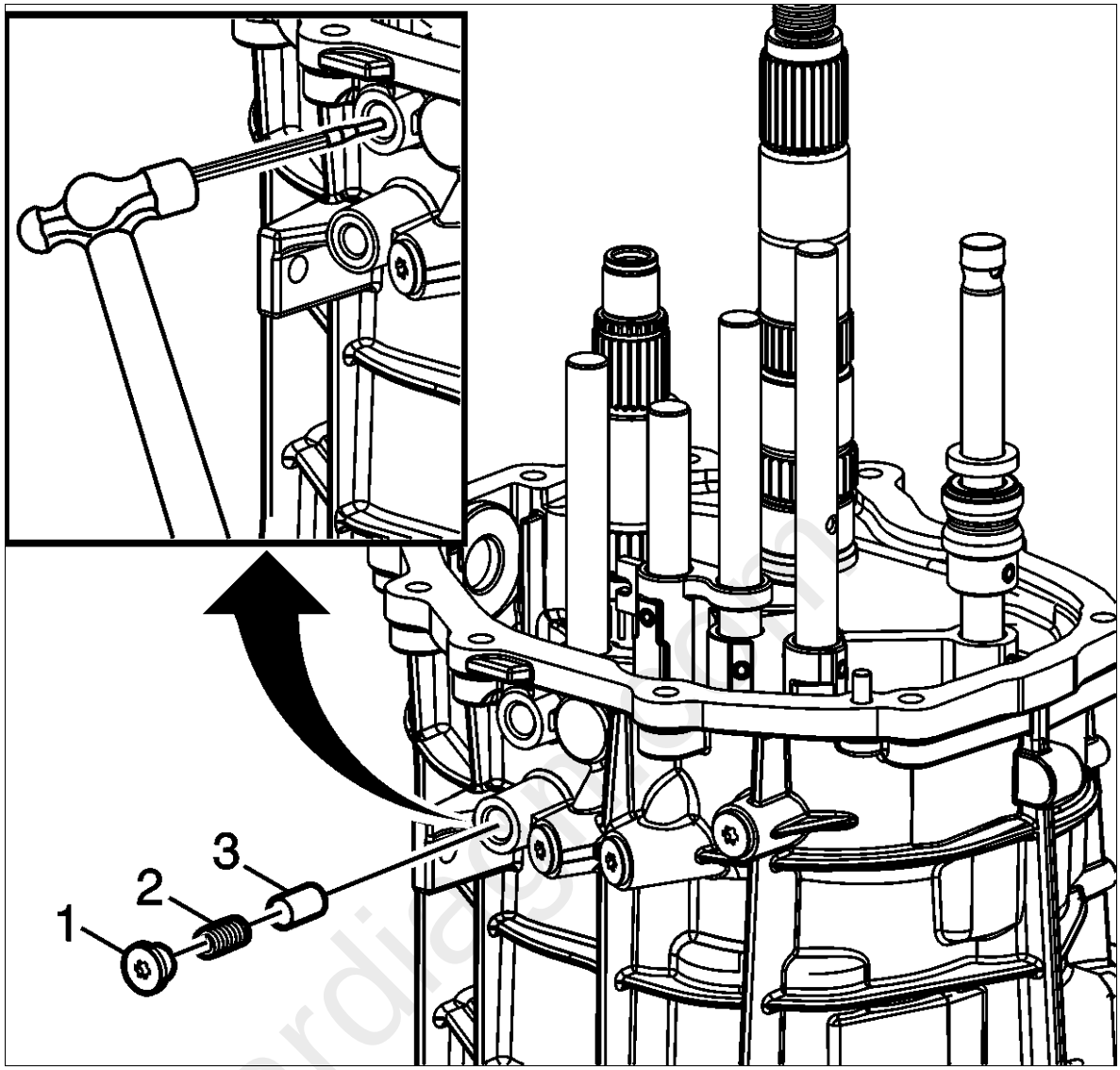
Fig 12: Coiled Spring Pin



Courtesy of GENERAL MOTORS COMPANY

19. Using a 3/16 in punch drive the coiled spring pin downward and Install.
20. Install the shift shaft detent spring cover bolt (1), shift shaft detent spring (2), and shift shaft detent (3). Tighten shift shaft detent spring cover bolt to 28 N.m (21 lb ft).

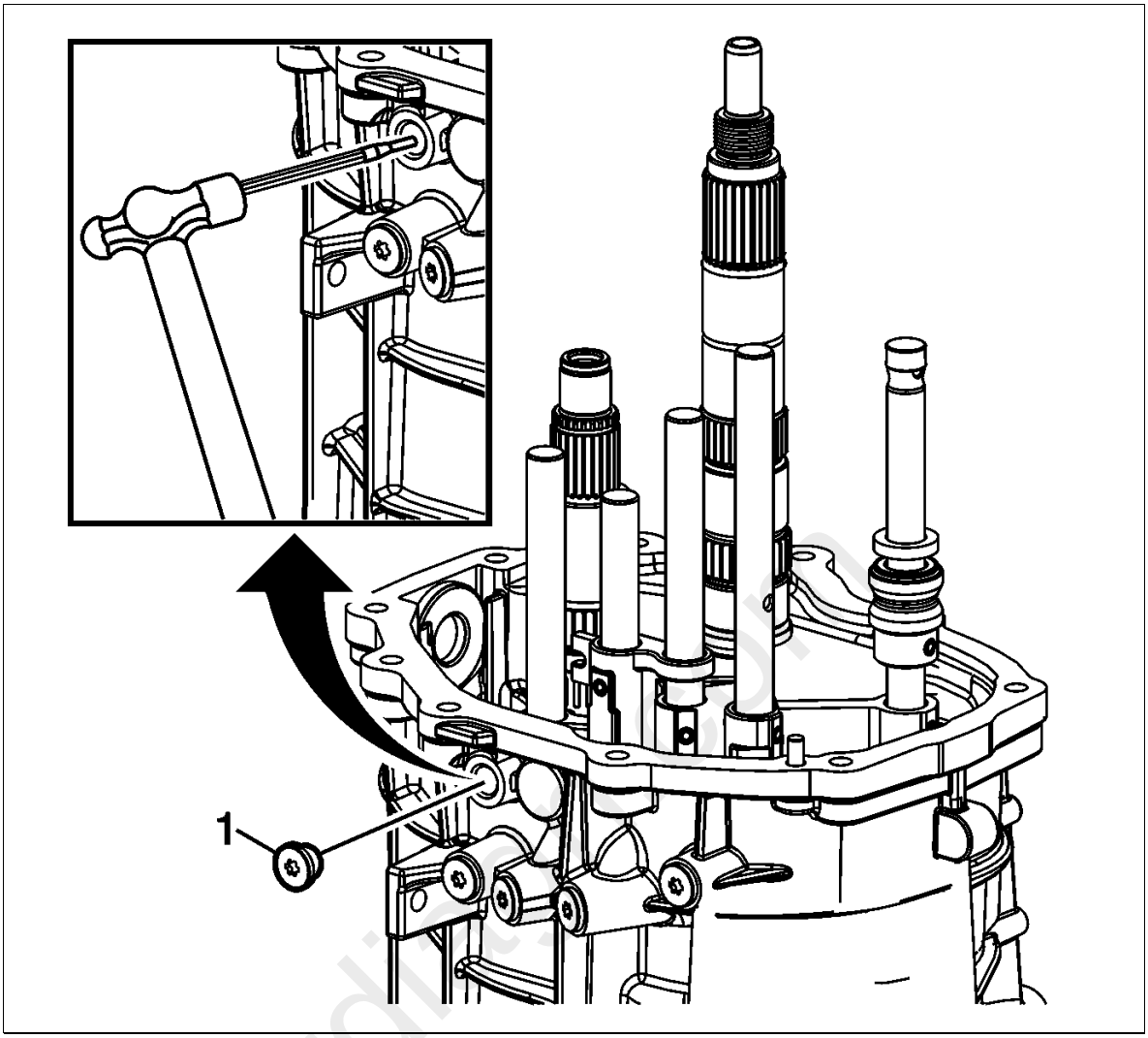
Fig 13: Shift Shaft Detent Spring And Detent



Courtesy of GENERAL MOTORS COMPANY

21. With the same drift in the shift rail, Install the shift shaft detent spring cover bolt (1), shift shaft detent spring (2), and shift shaft detent (3). Tighten shift shaft detent spring cover bolt to 28 N.m (21 lb ft).

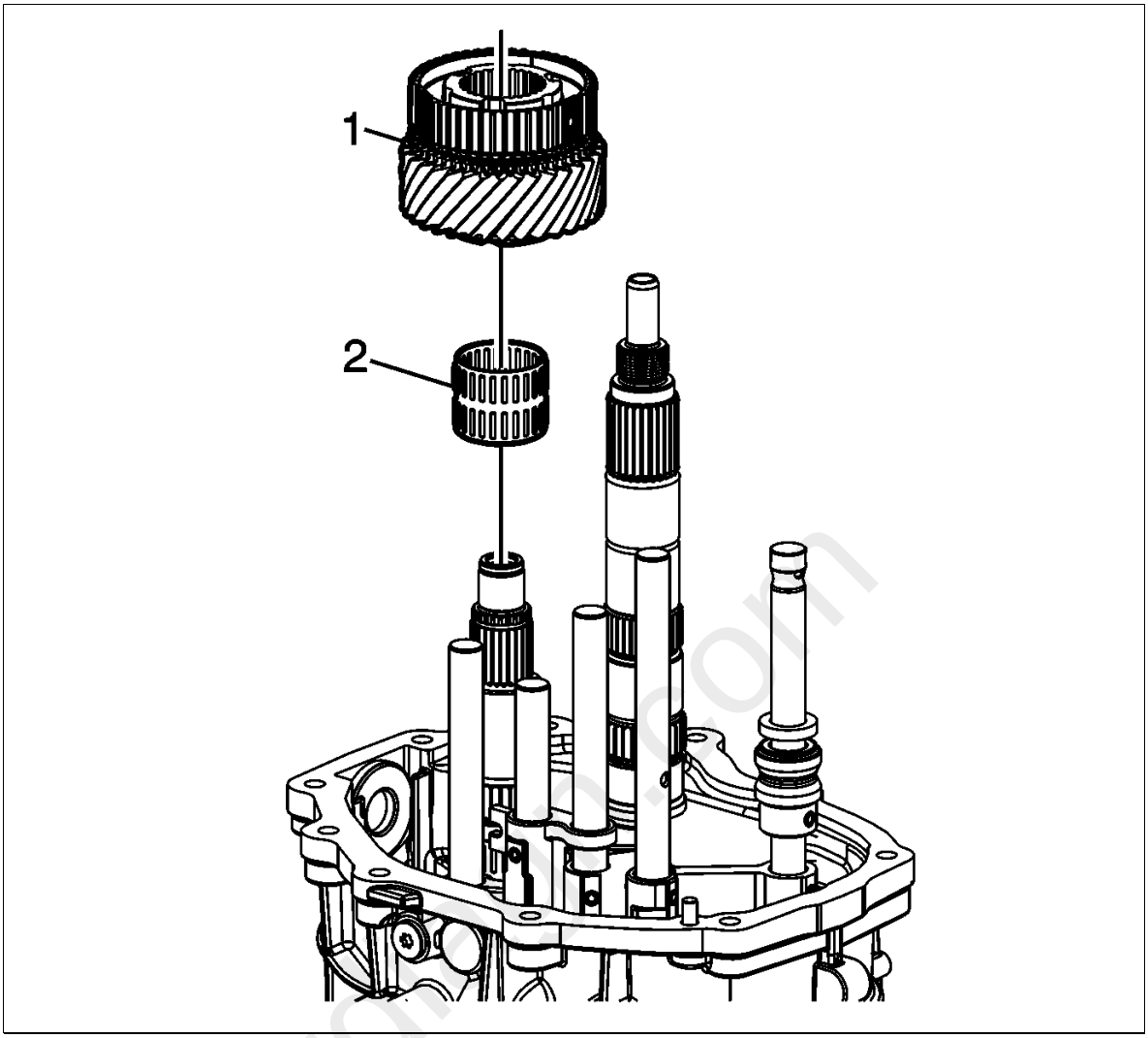
Fig 14: Shift Shaft Detent Plug



Courtesy of GENERAL MOTORS COMPANY

22. Using a 3/16 in drift punch and hammer drive the coiled spring pin downward and Install.
23. Install the shift shaft detent spring cover bolt to 28 N.m (21 lb ft).

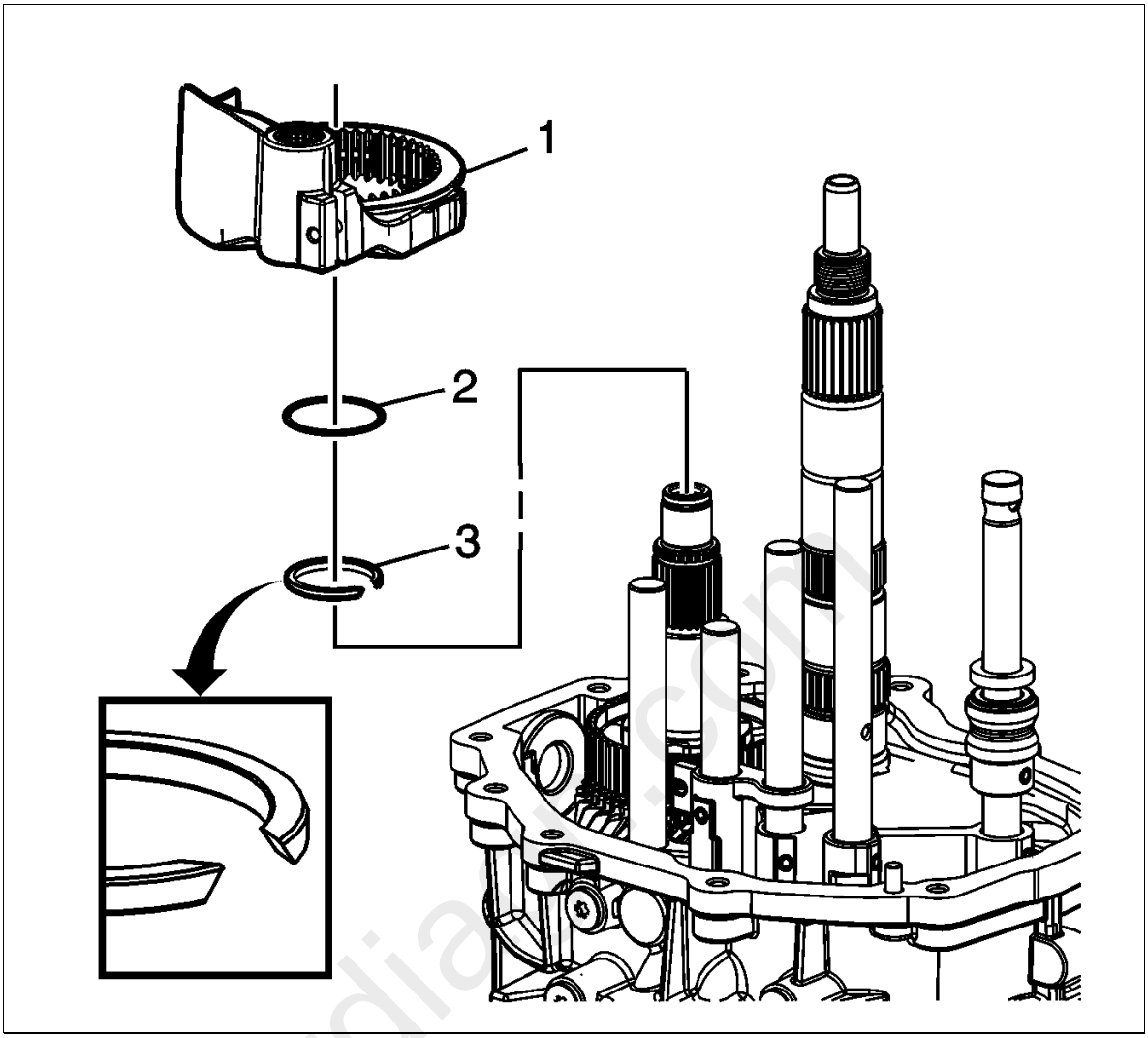
Fig 15: 3rd & 4th Hub, 4th Gear Blocking Rings, And 4th Gear Drive Gear



Courtesy of GENERAL MOTORS COMPANY

24. Install the 4th gear bearing assembly (2).
25. Install the 3rd & 4th hub, 4th gear blocking rings, and 4th gear drive gear (1) as an assembly.

Fig 16: 3rd & 4th Synchronizer Sleeve And Fork Assembly



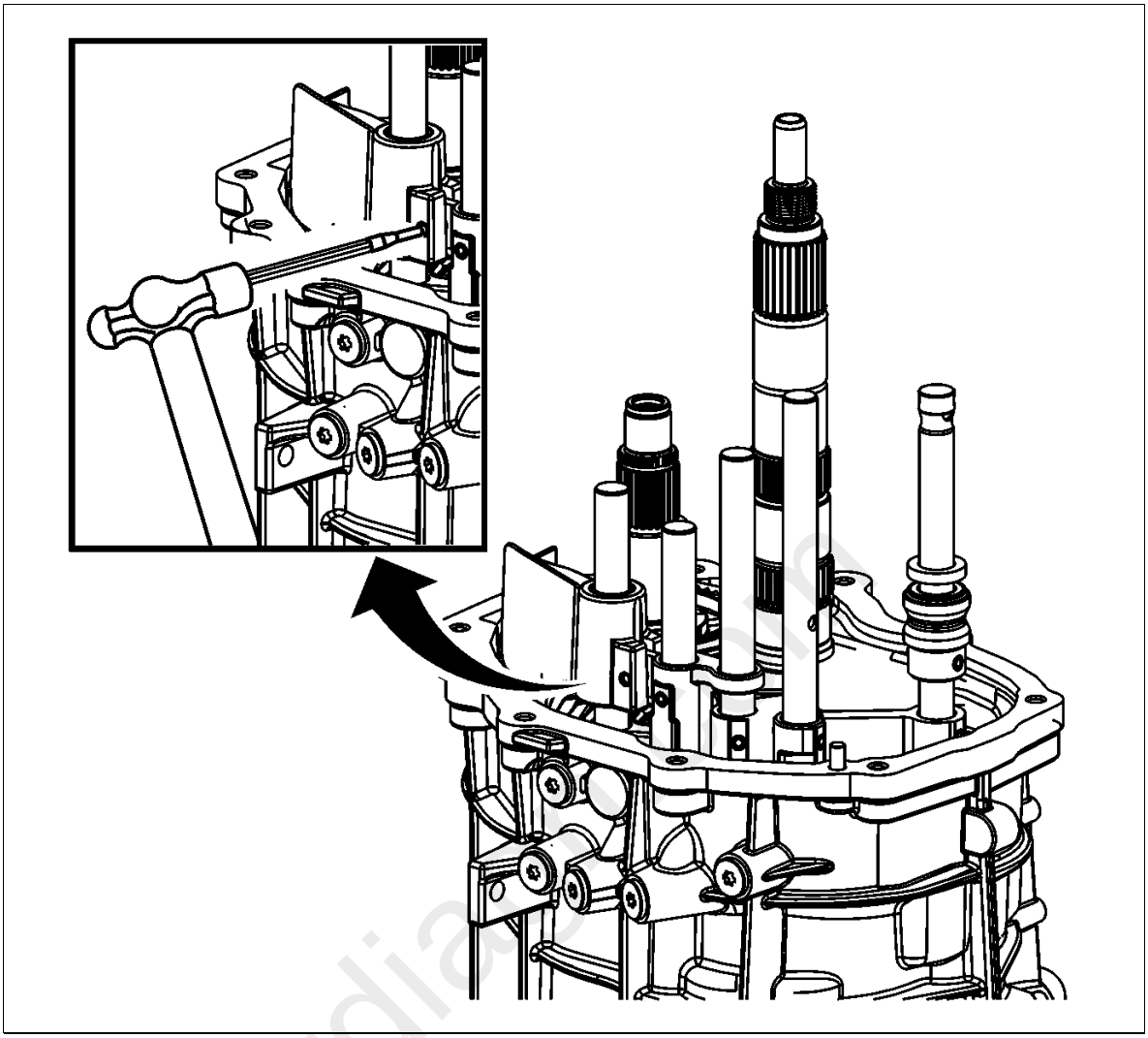
Courtesy of GENERAL MOTORS COMPANY

NOTE:

The retaining ring must be installed as shown in graphic, with the points facing up.

26. Using snap ring pliers Install the retaining ring (3). Install the 3rd gear spacer (2).
27. Install the 3rd & 4th synchronizer sleeve and fork assembly (1).

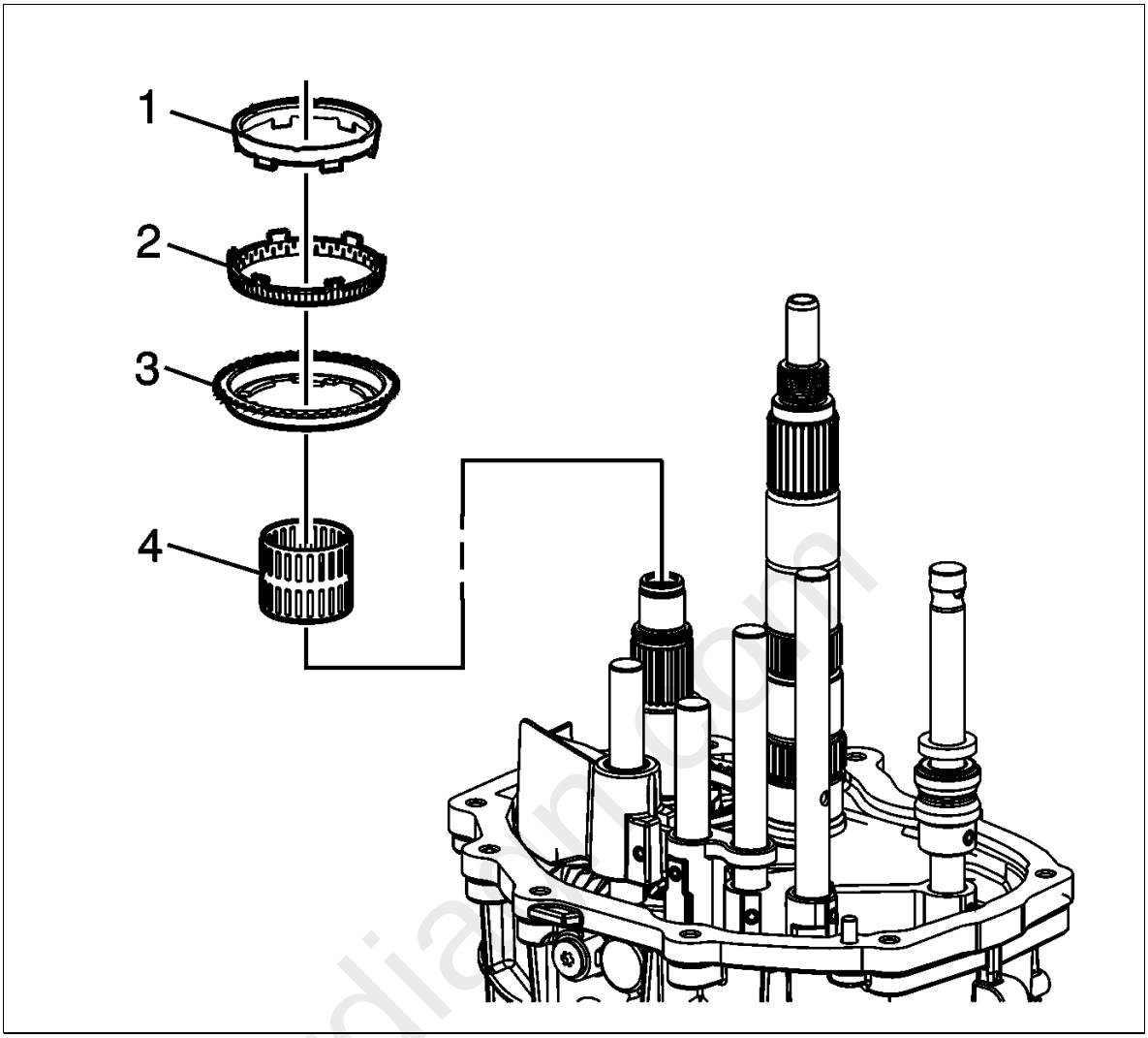
Fig 17: Coiled Spring Pin



Courtesy of GENERAL MOTORS COMPANY

28. Using a 3/16 in drift and hammer, drive the coiled spring pin downward and Install.

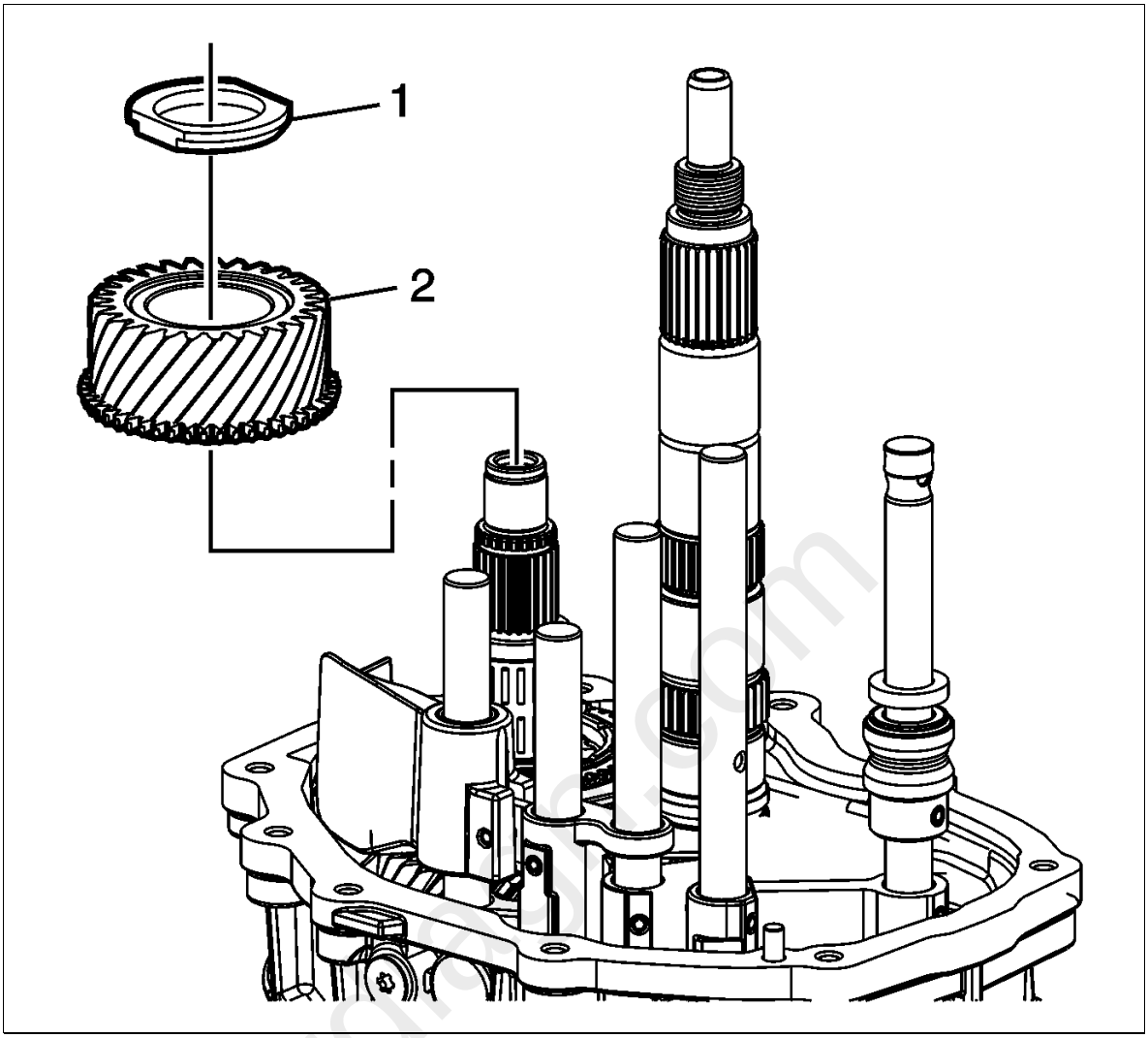
Fig 18: 3rd Gear Blocking Ring Assemblies



Courtesy of GENERAL MOTORS COMPANY

29. Install the 3rd gear bearing assembly (4).
30. Install the 3rd gear blocking ring assembly (1, 2, and 3).

Fig 19: 3rd Gear Thrust Washer And Drive Gear Assembly



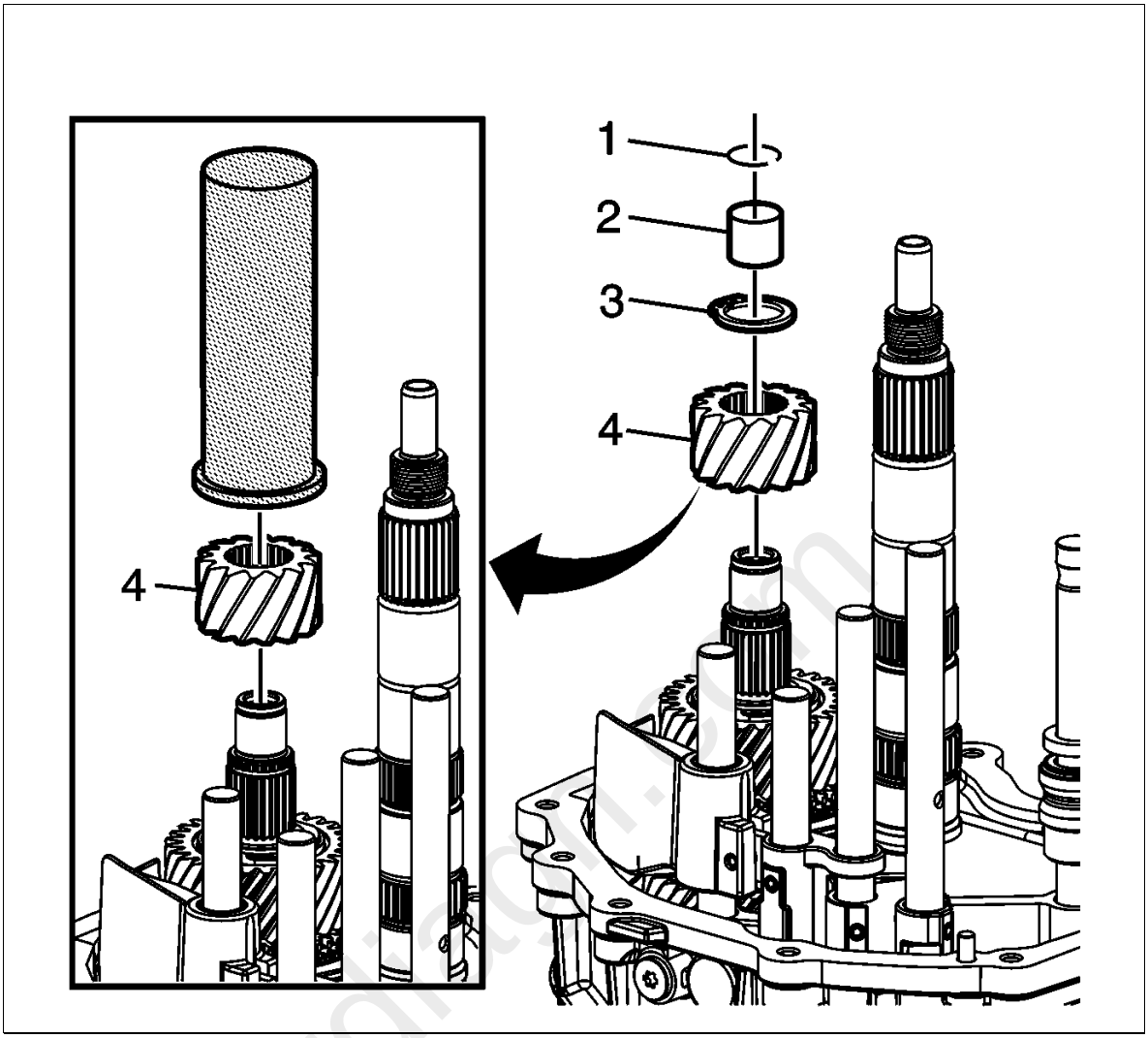
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Thrust washer (1) must be installed with lip facing upwards as shown in picture.

31. Install the 3rd gear drive gear assembly (2) and the 3rd gear thrust washer (1).

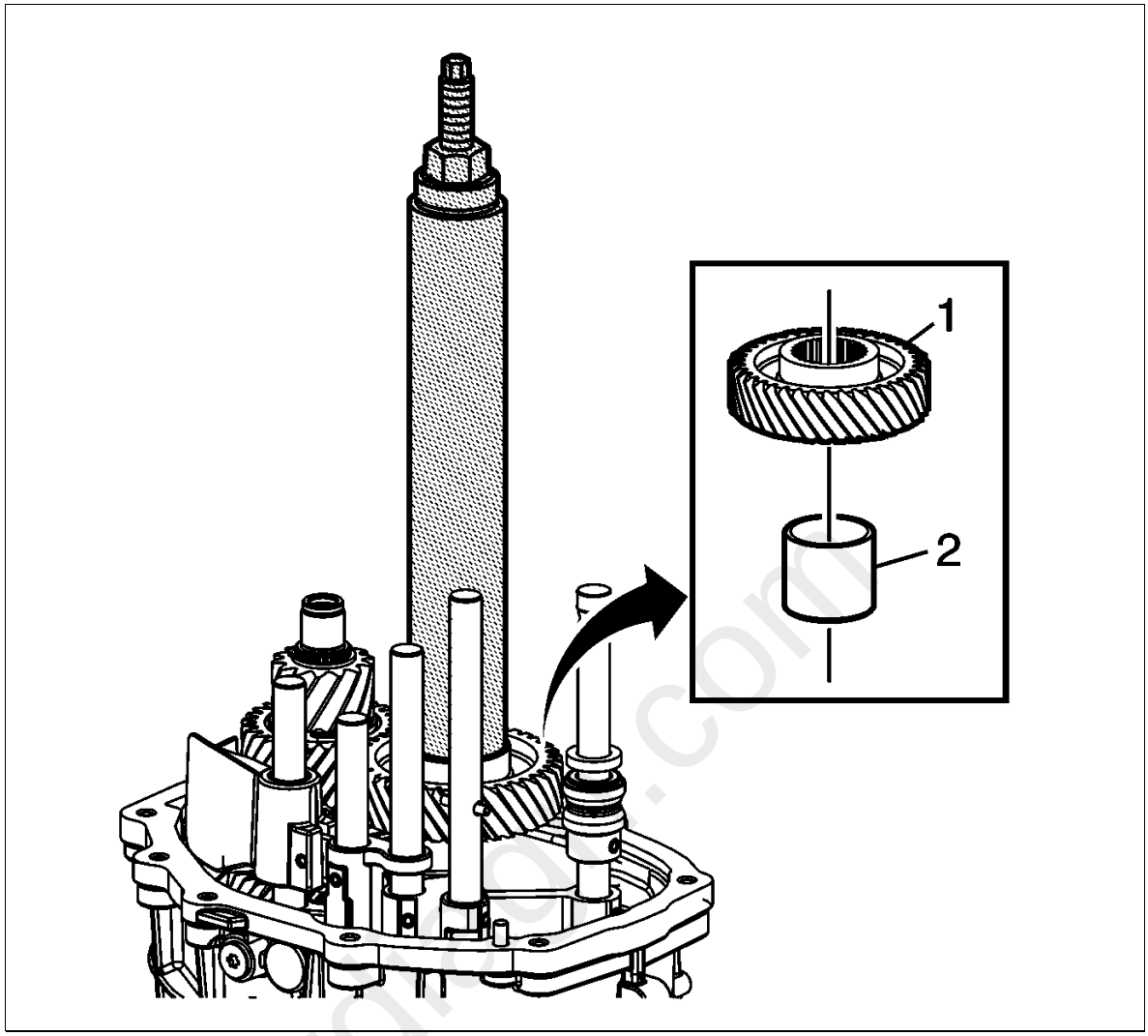
Fig 20: Reverse Drive Gear Assembly



Courtesy of GENERAL MOTORS COMPANY

32. Install the reverse drive gear assembly (4) using **DT 25234** gear and bearing installer.
33. Using snap ring pliers install the reverse drive gear assembly retainer (3).
34. Install the counter gear rear bearing race (2) and snap ring (1).

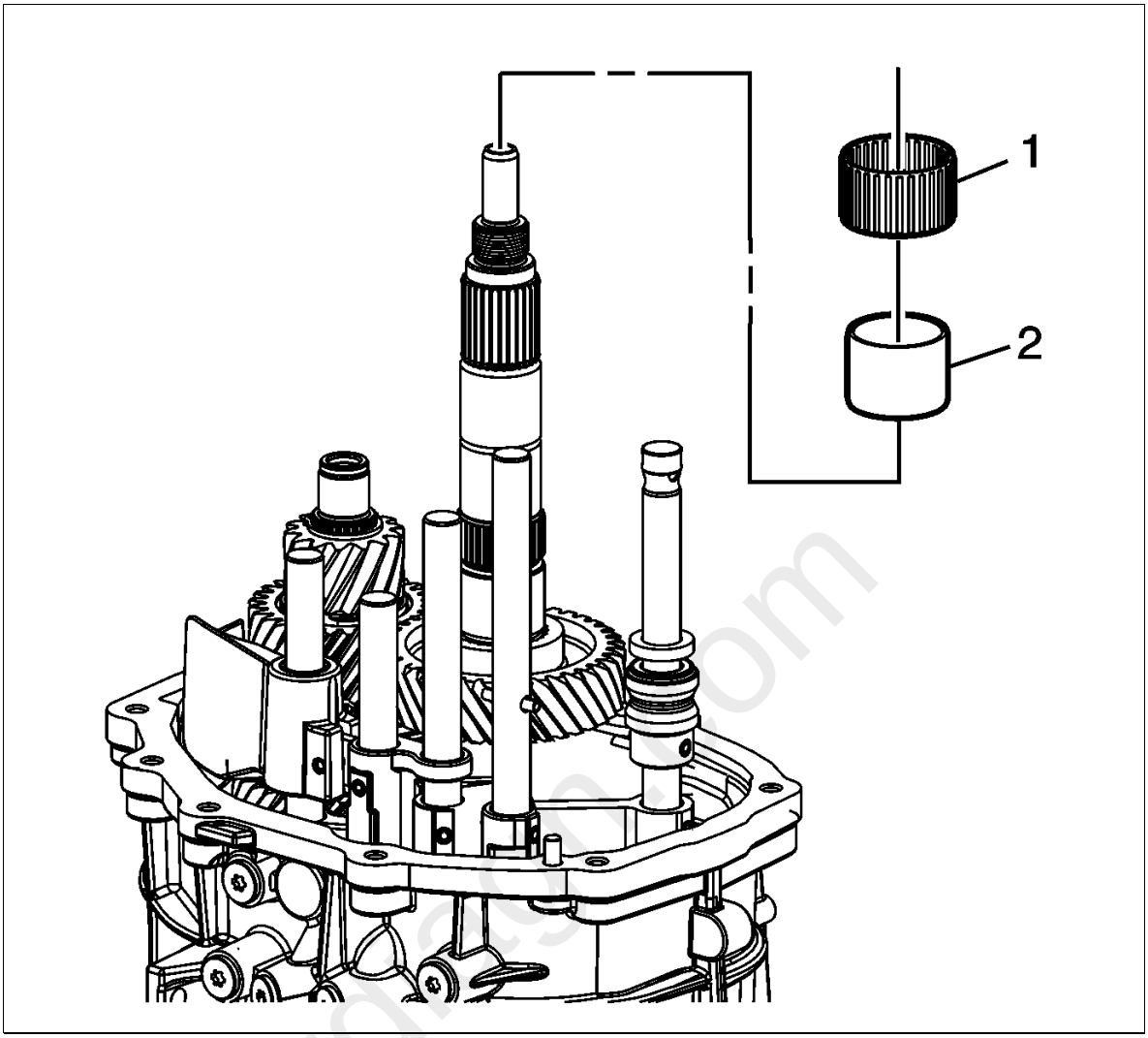
Fig 21: 3rd Gear And 3rd & 4th Gear Spacer



Courtesy of GENERAL MOTORS COMPANY

35. Install the 3rd gear assembly (1) and the 3rd & 4th gear spacer (2) using **DT-51076** bearing and gear installer.

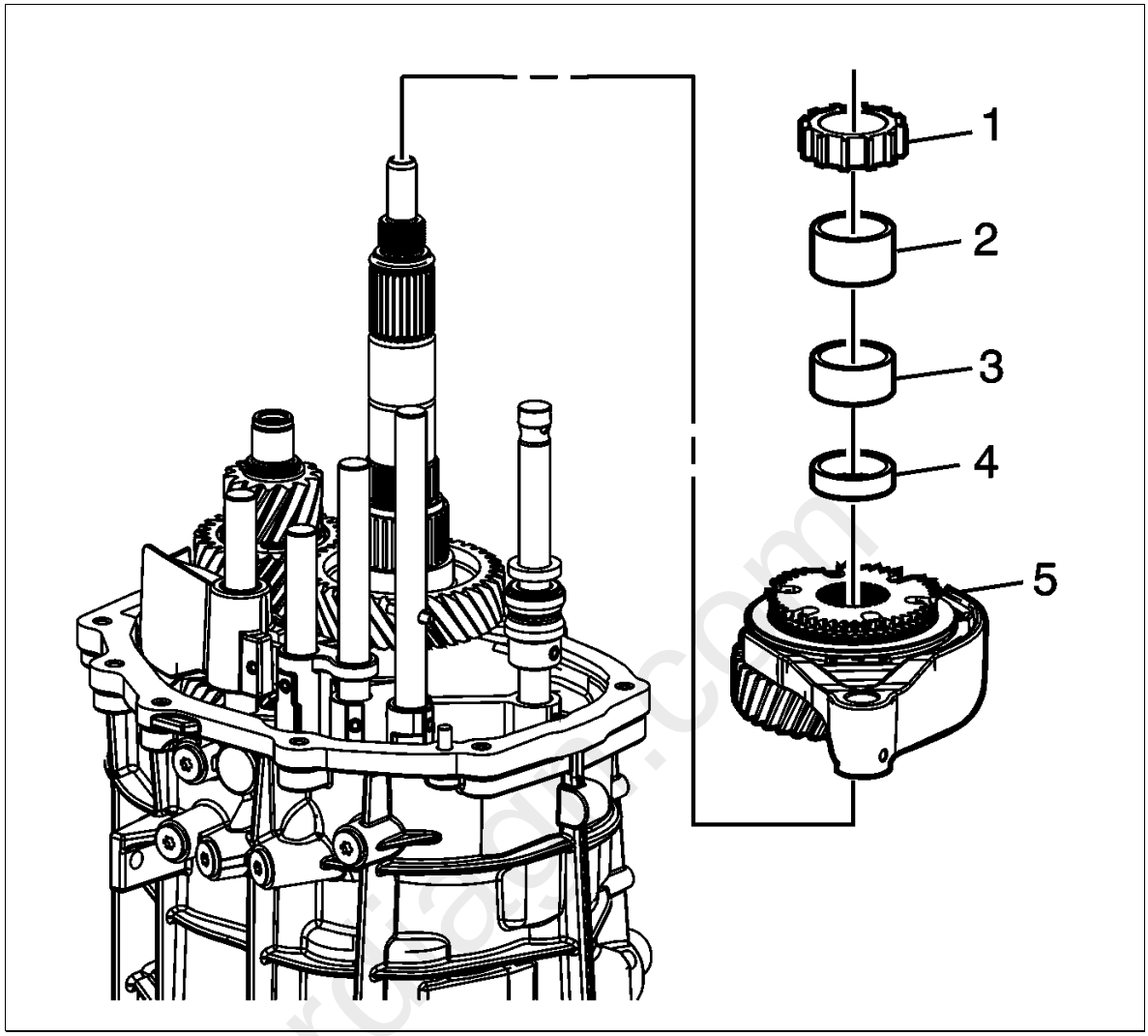
Fig 22: Reverse Gear Bearing Assembly And Bushing



Courtesy of GENERAL MOTORS COMPANY

36. Install the reverse gear bearing assembly (1) and bushing (2).

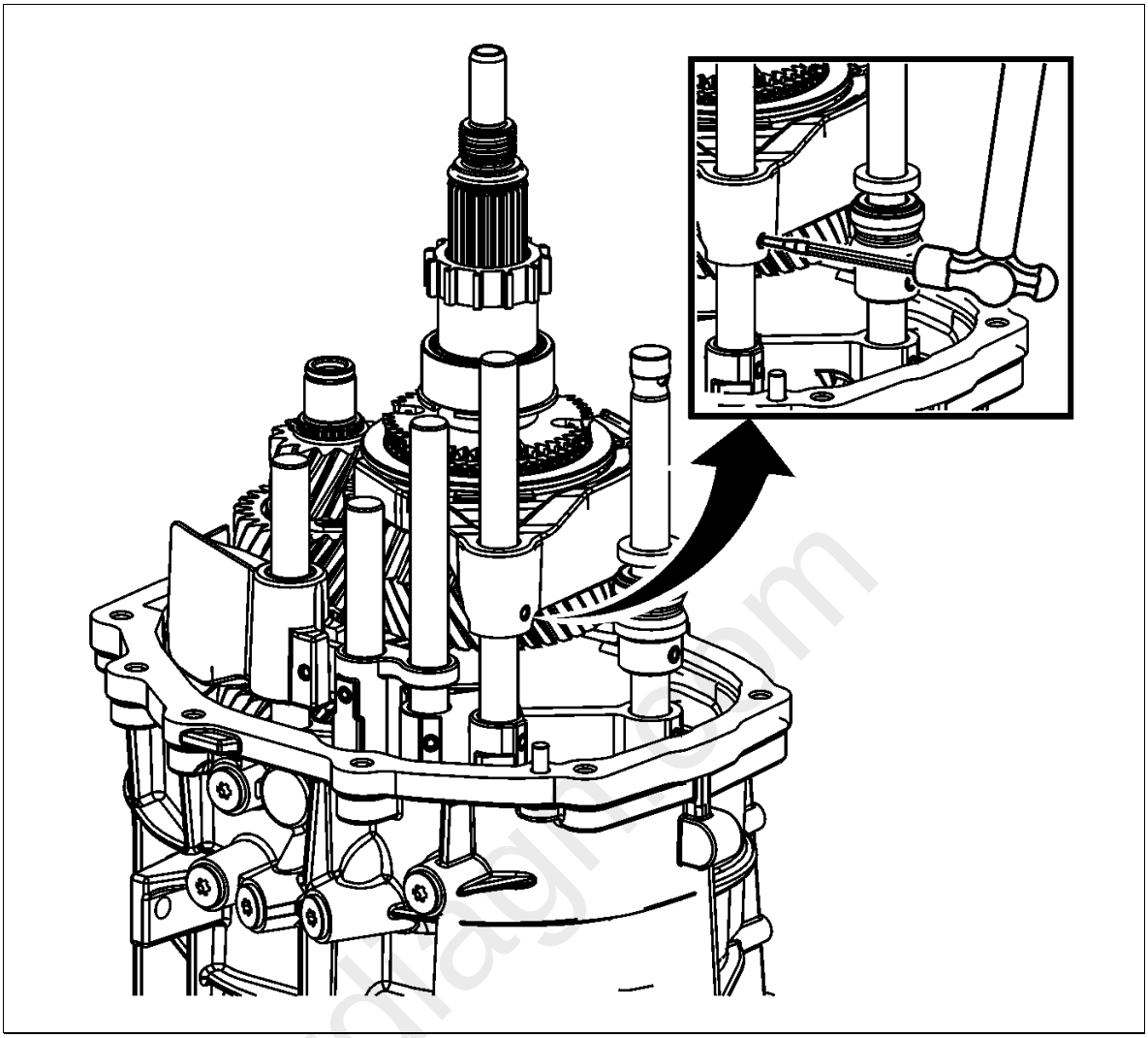
Fig 23: Vehicle Speed Sensor Reluctor Wheel, Spacer, Main Shaft Rear Bearing Race, Main Shaft Bearing Spacer And Reverse Gear And Synchronizer



Courtesy of GENERAL MOTORS COMPANY

37. Install the reverse gear and synchronizer (5) together as an assembly.
38. Install the vehicle speed sensor reluctor wheel (1), spacer (2), main shaft rear bearing race (3), and main shaft bearing spacer (4).

Fig 24: Coiled Spring Pin

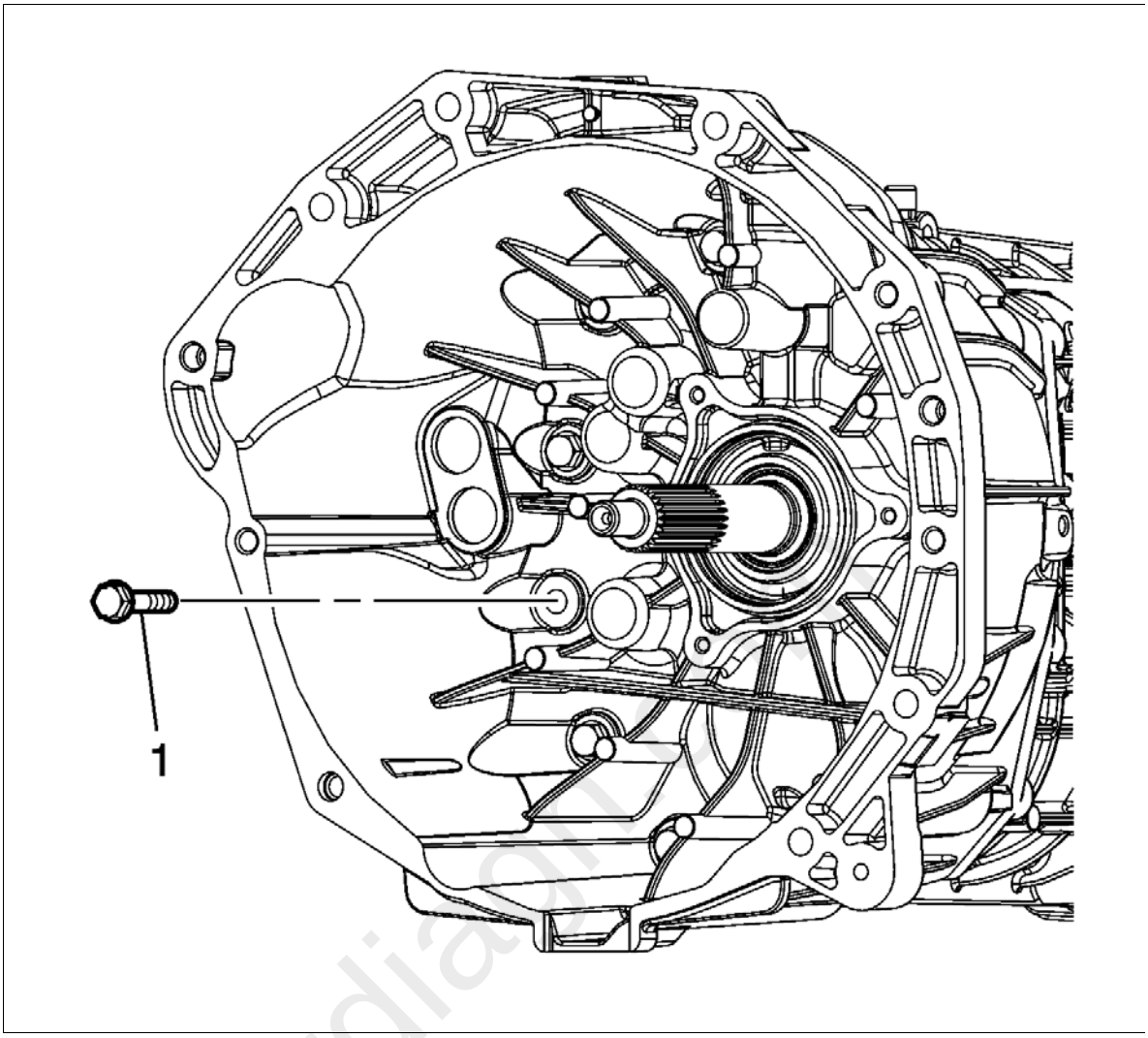


Courtesy of GENERAL MOTORS COMPANY

39. Using a 3/16 in drift punch and hammer drive the coiled spring pin downward and Install.

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION ASSEMBLE (M13 - LGX W/Y4Q) > INVERTER LEVER INSTALL

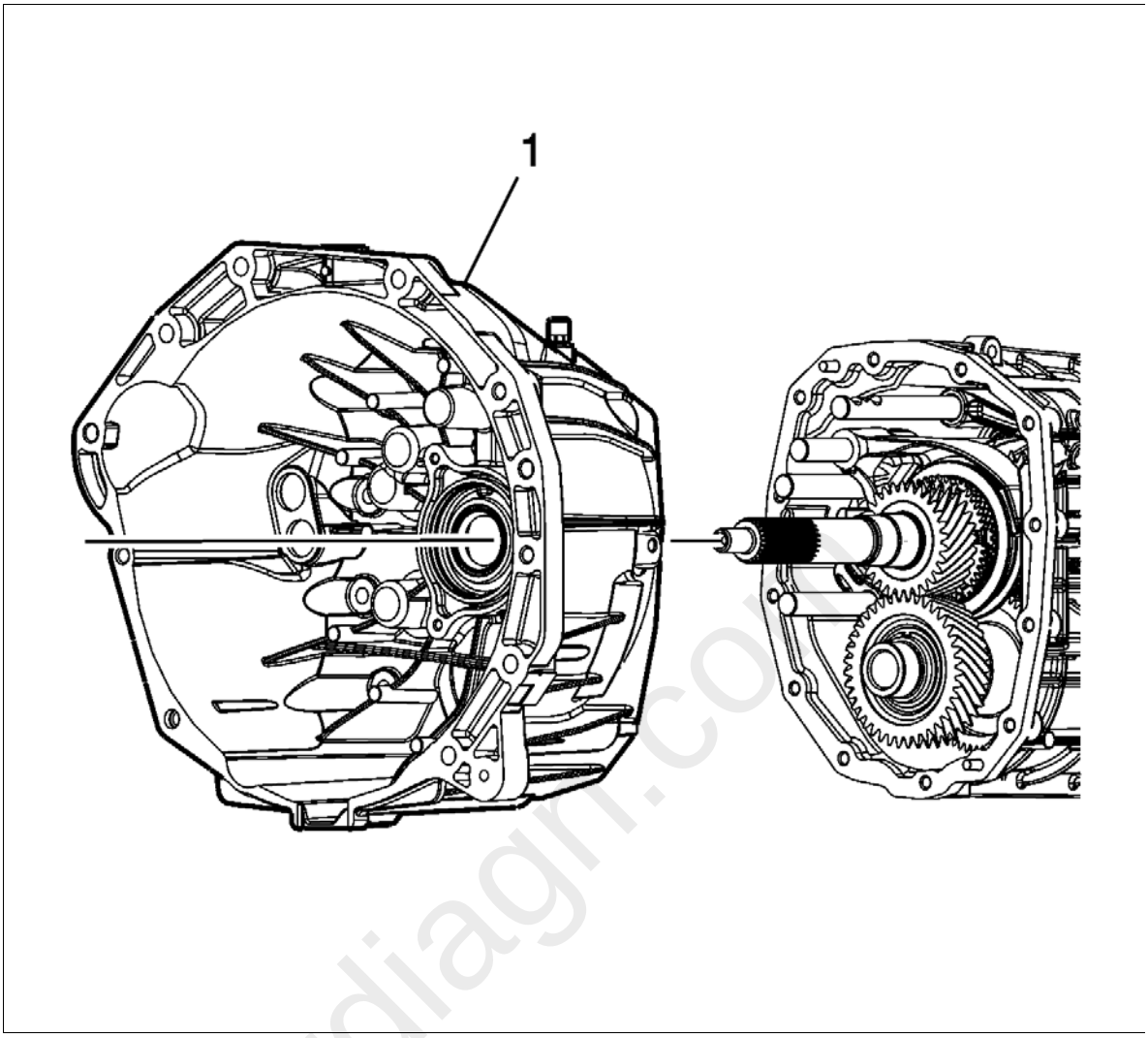
Fig 1: Clutch Housing Bolts



Courtesy of GENERAL MOTORS COMPANY

1. Temporarily remove the clutch housing bolts (1).

Fig 2: Clutch Housing Assembly

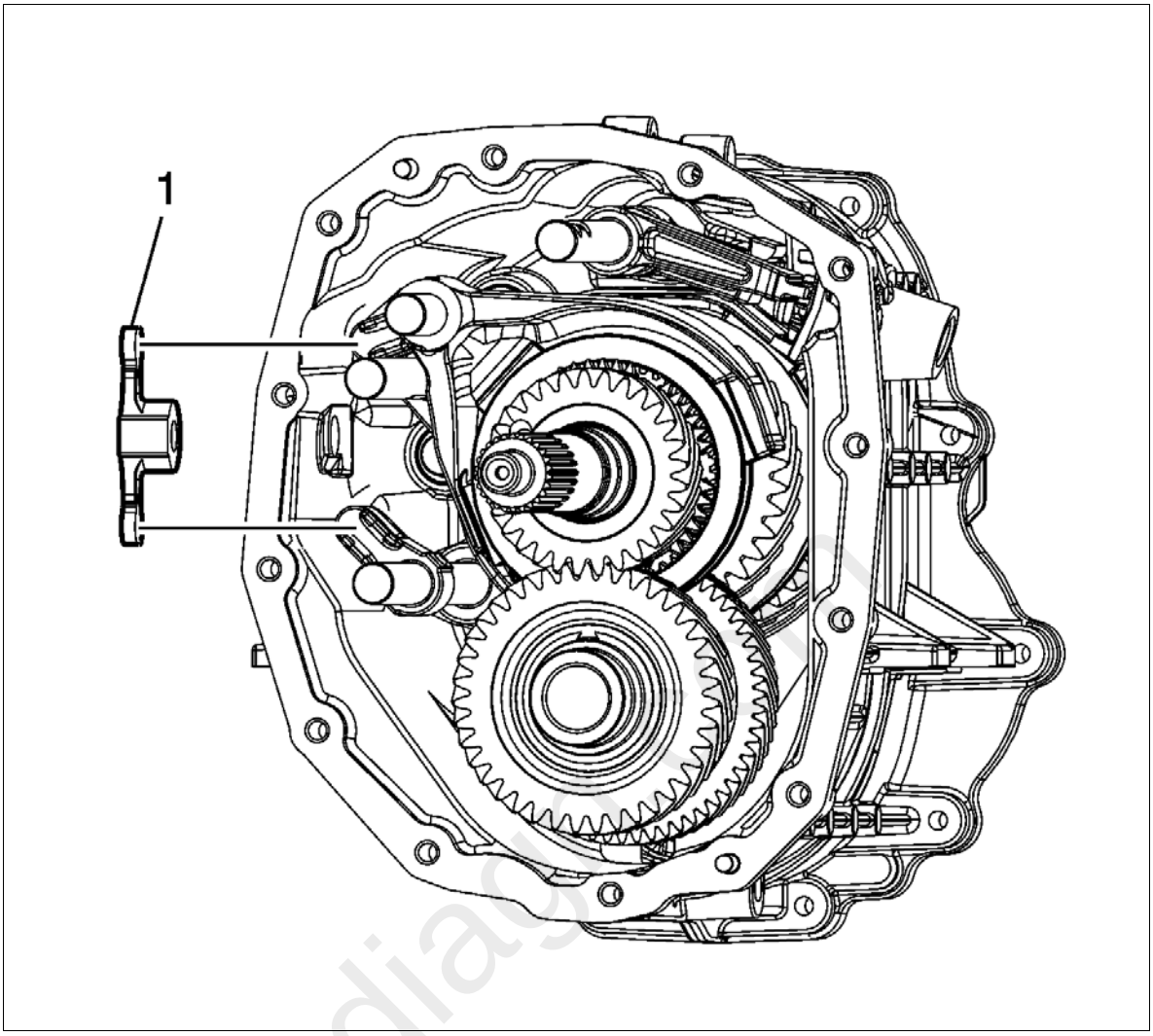


Courtesy of GENERAL MOTORS COMPANY

2. Temporarily remove the clutch housing assembly (1).

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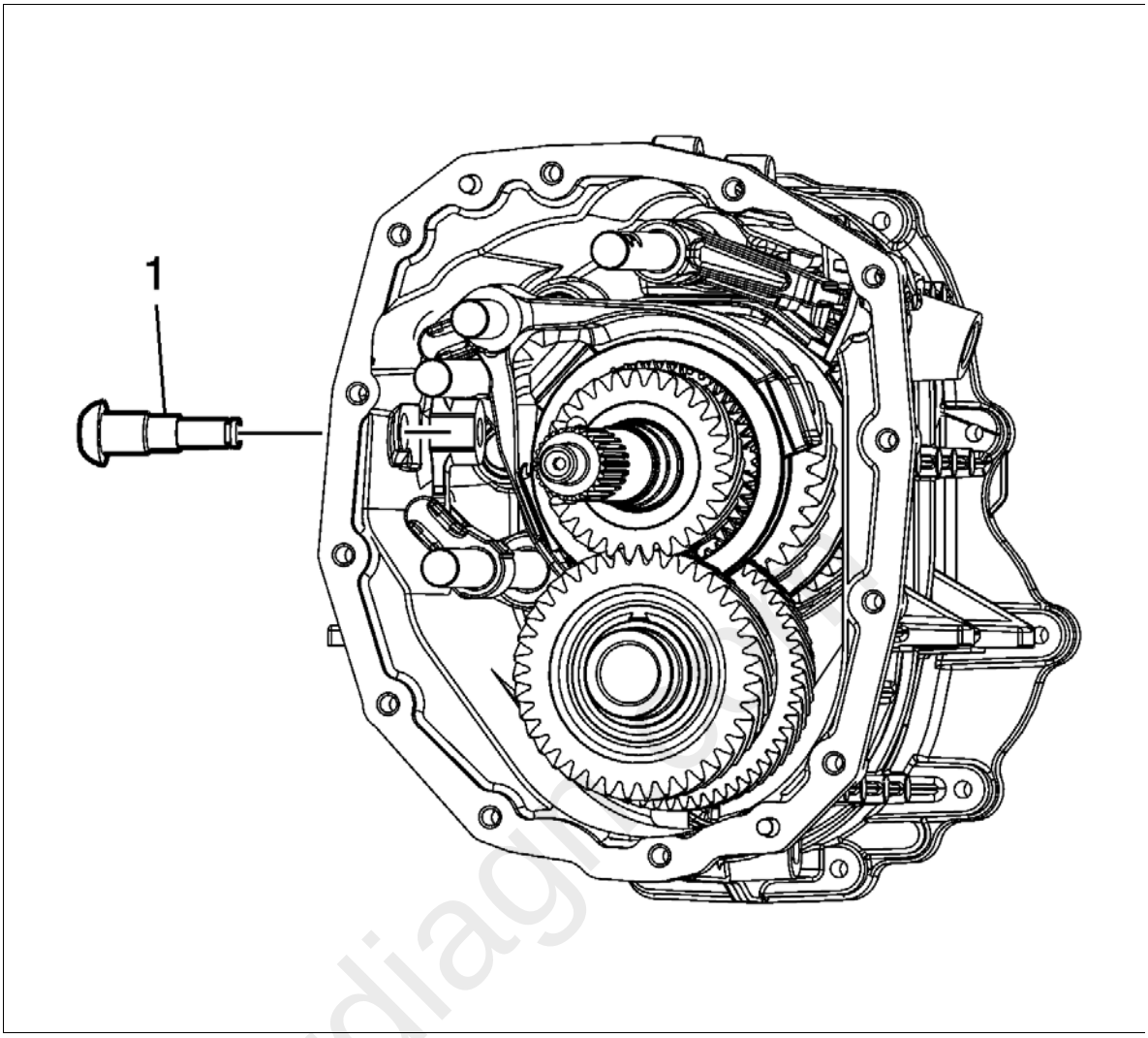
Fig 3: Manual Transmission Selector Lever



Courtesy of GENERAL MOTORS COMPANY

3. Install the manual transmission selector lever (1).

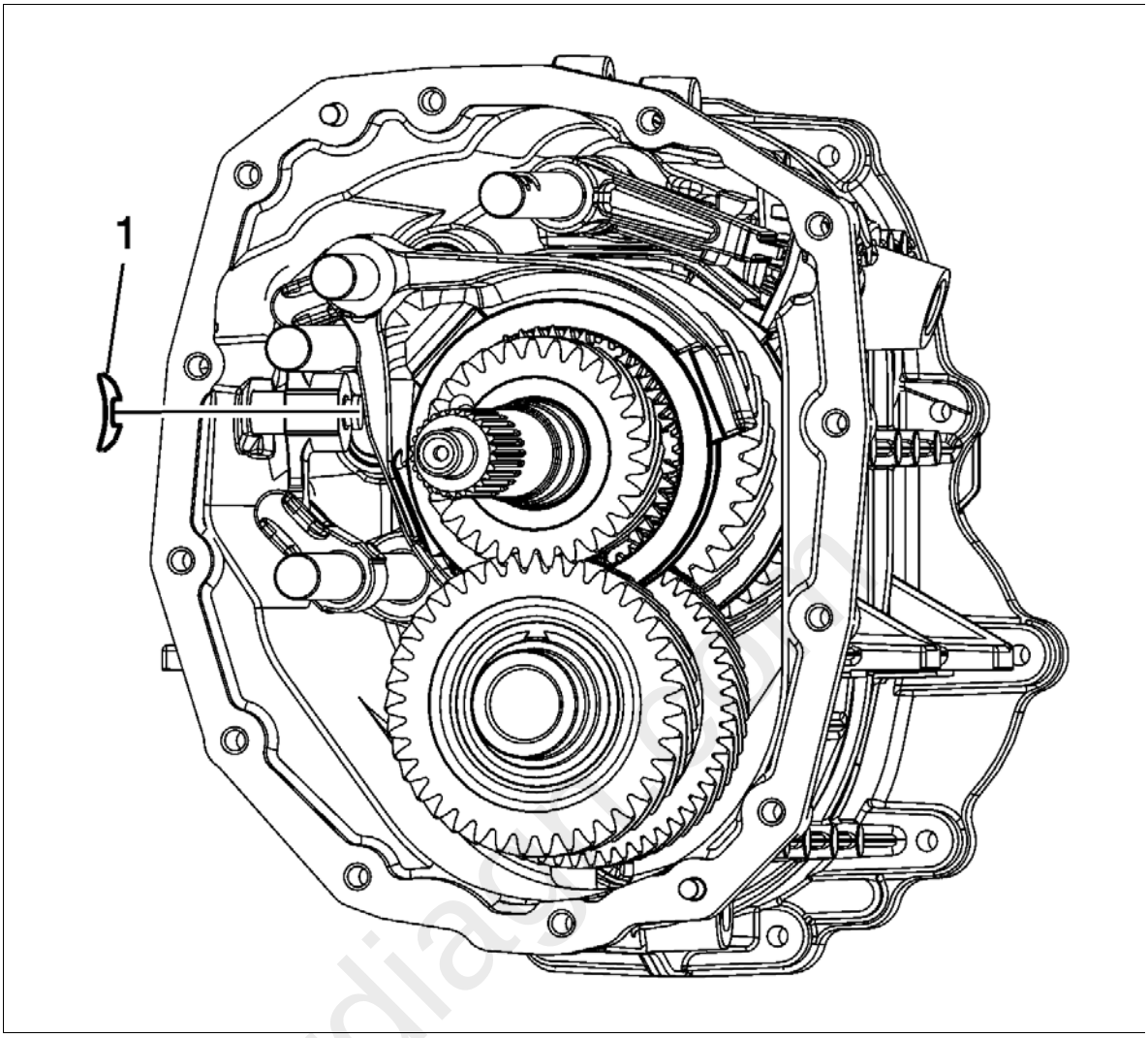
Fig 4: Manual Transmission Selector Lever Pivot Pin



Courtesy of GENERAL MOTORS COMPANY

4. Install the manual transmission selector lever pivot pin (1). Tighten to 41 N.m (30 lb ft).

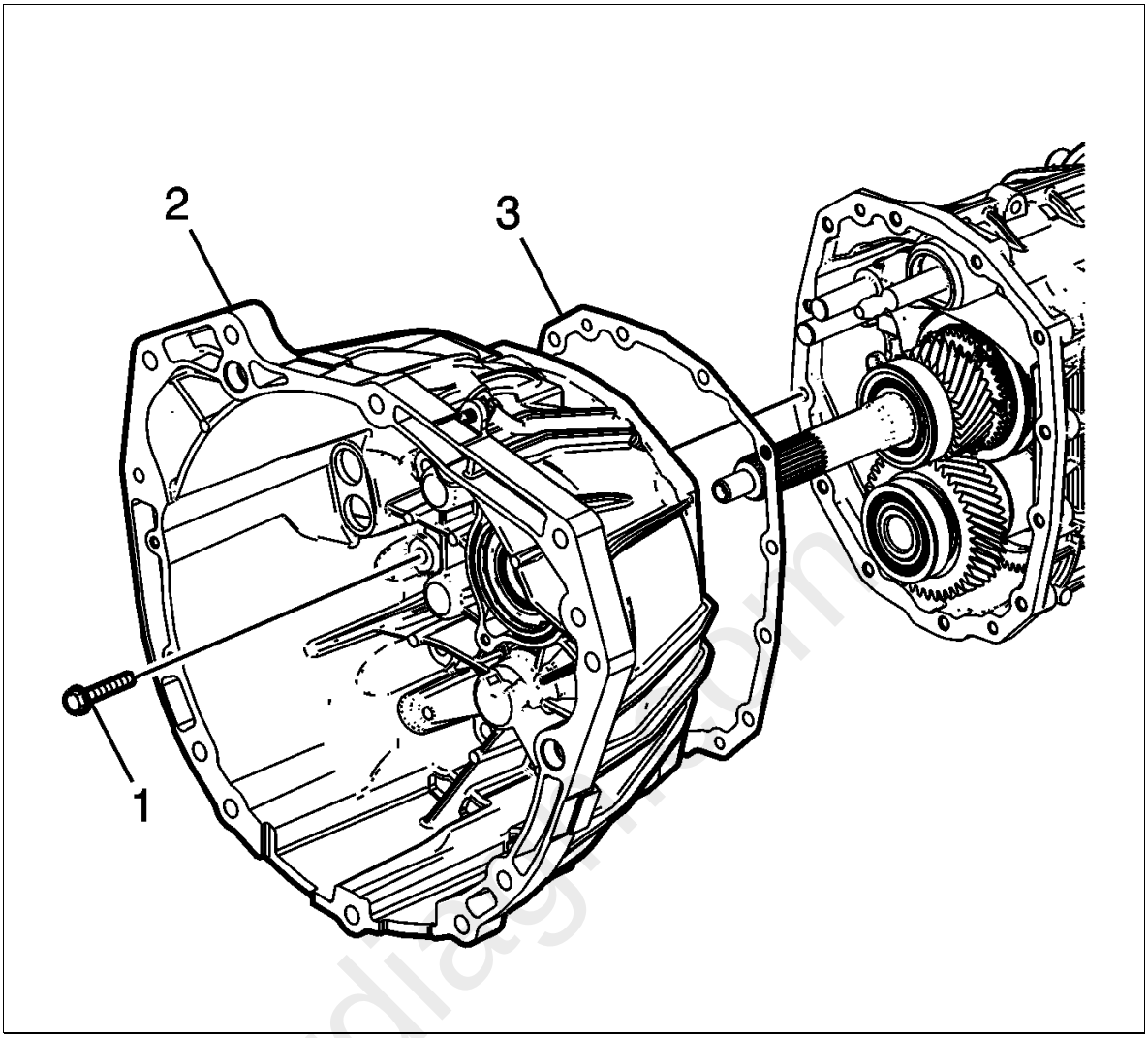
Fig 5: Manual Transmission Shift Lever Retainer



Courtesy of GENERAL MOTORS COMPANY

5. Install the manual transmission shift lever retainer (1).

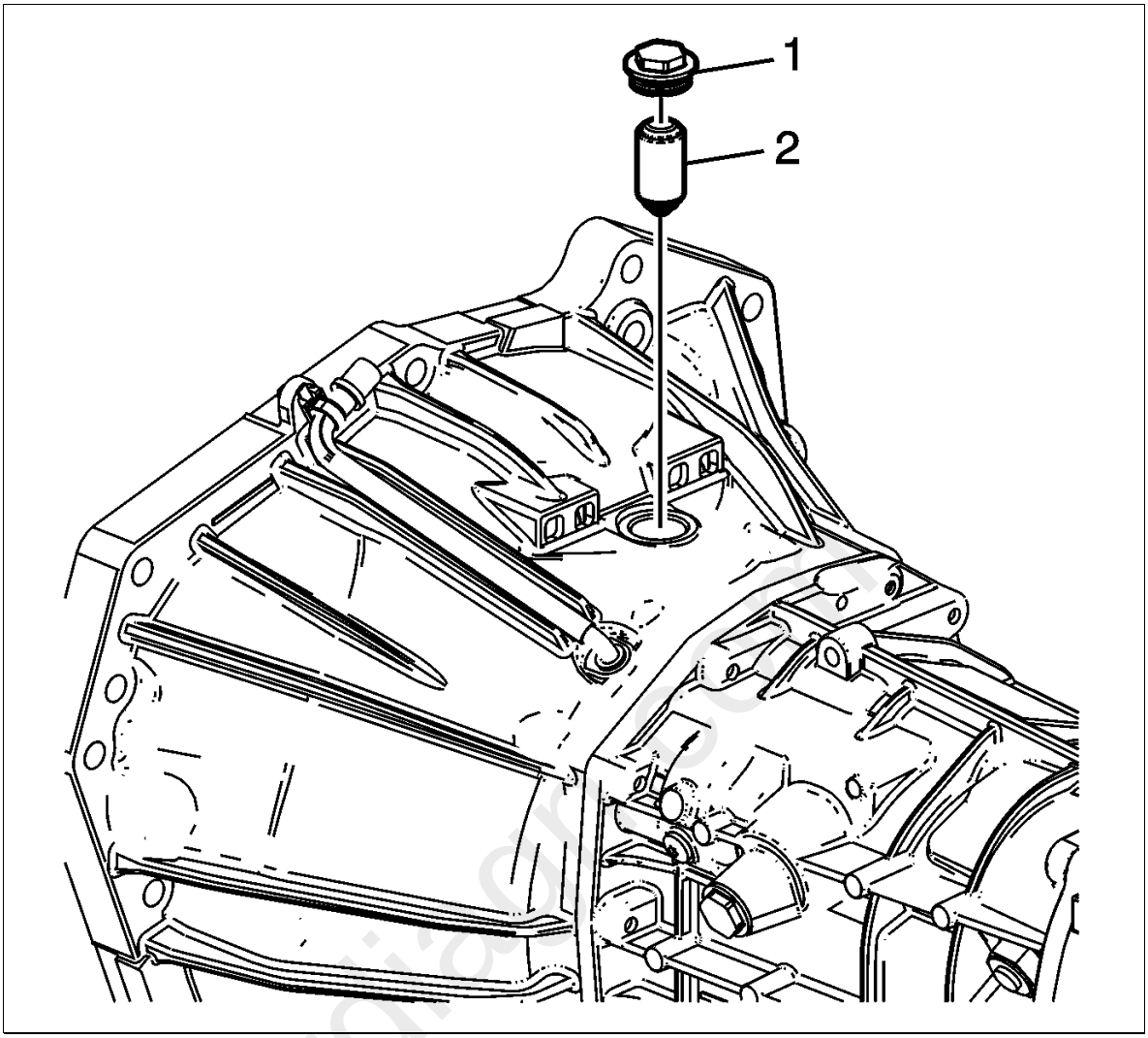
Fig 6: Clutch Housing Assembly, Clutch Housing Gasket And Clutch Housing Bolts



Courtesy of GENERAL MOTORS COMPANY

6. Install the clutch housing assembly (2), clutch housing gasket (3), and the the clutch housing bolts (1). Tighten to 33 N.m (24 lb ft).

Fig 7: Shift Shaft Detent Plug And Roller Detent

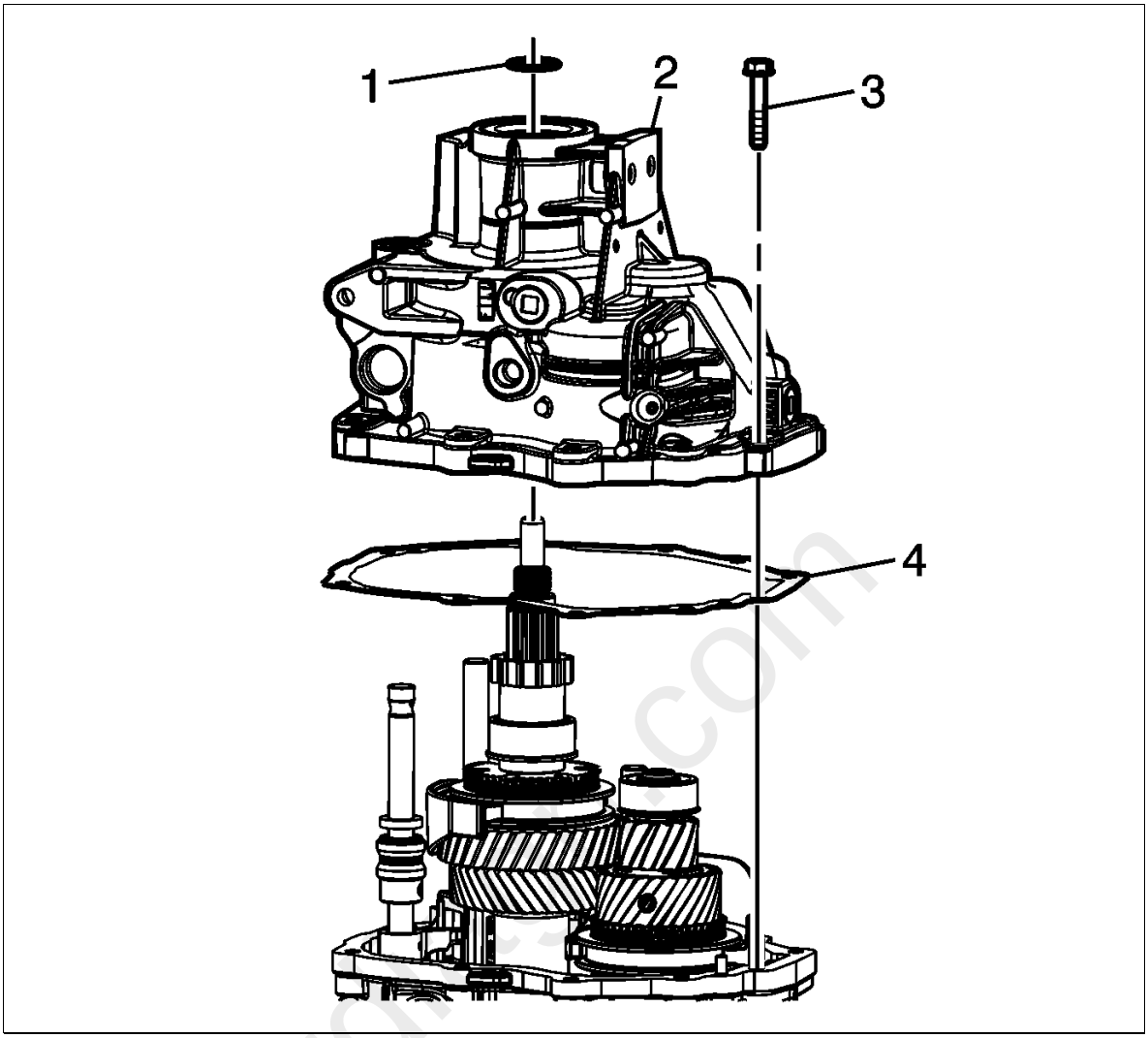


Courtesy of GENERAL MOTORS COMPANY

7. Install the shift shaft detent plug (1) and the roller detent (2). Tighten shift shaft detent plug to 50 N.m (37 lb ft).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION ASSEMBLE (M13 - LGX W/Y4Q) > EXTENSION HOUSING INSTALL

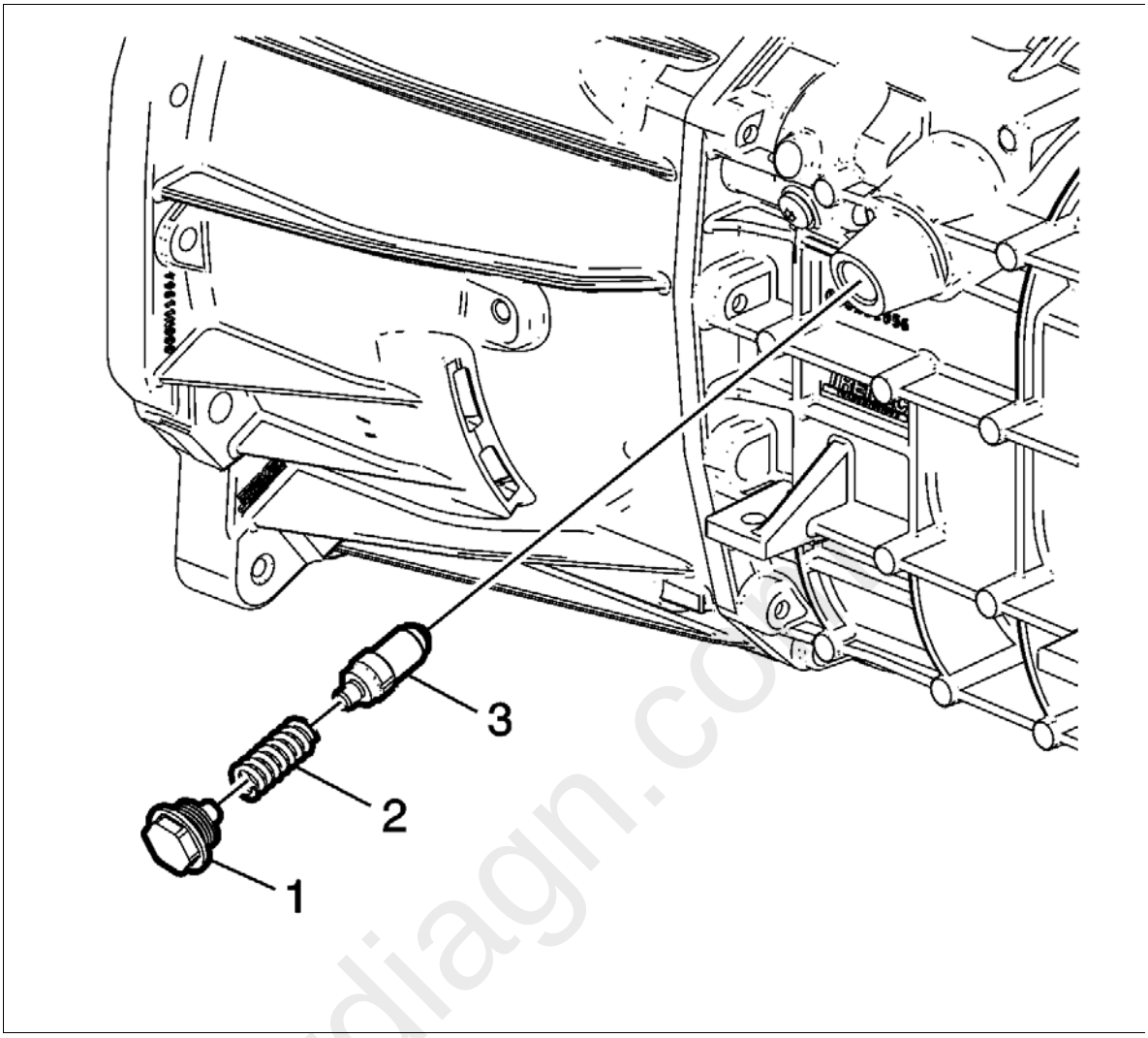
Fig 1: Propeller Shaft O-Ring



Courtesy of GENERAL MOTORS COMPANY

1. Install the O-ring (1) onto the propeller shaft.
2. Install the extension housing assembly gasket (4), the extension housing assembly (2), and the extension housing bolts (3). Tighten the bolts to 33 N.m (24 lb ft).

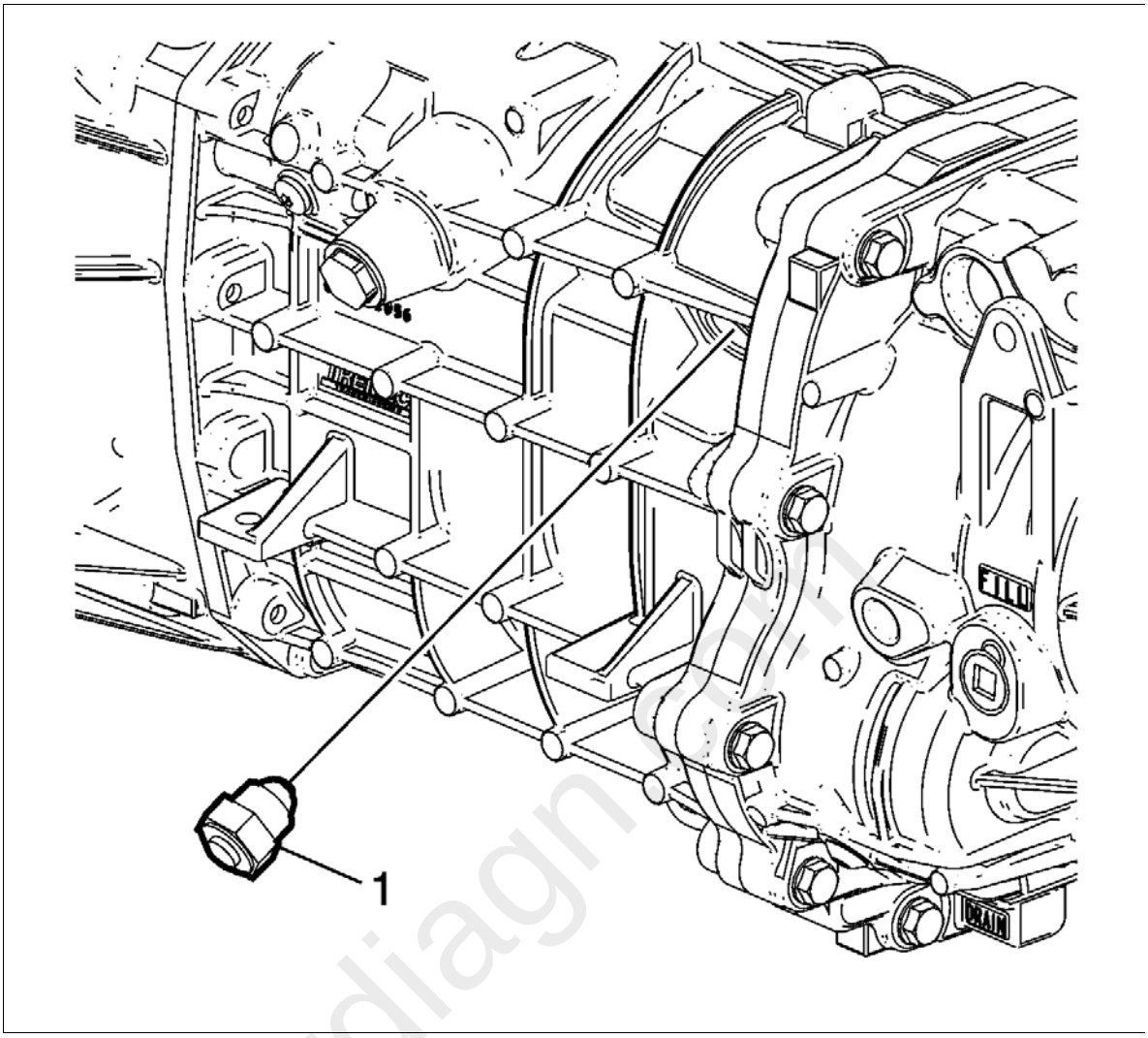
Fig 2: Manual Shift Detent, Spring & Bolt



Courtesy of GENERAL MOTORS COMPANY

3. Install the manual shift detent bolt (1), detent spring (2) and the detent (3). Tighten the bolt to 28 N.m (21 lb ft).

Fig 3: Shift Interlock Detent Assembly

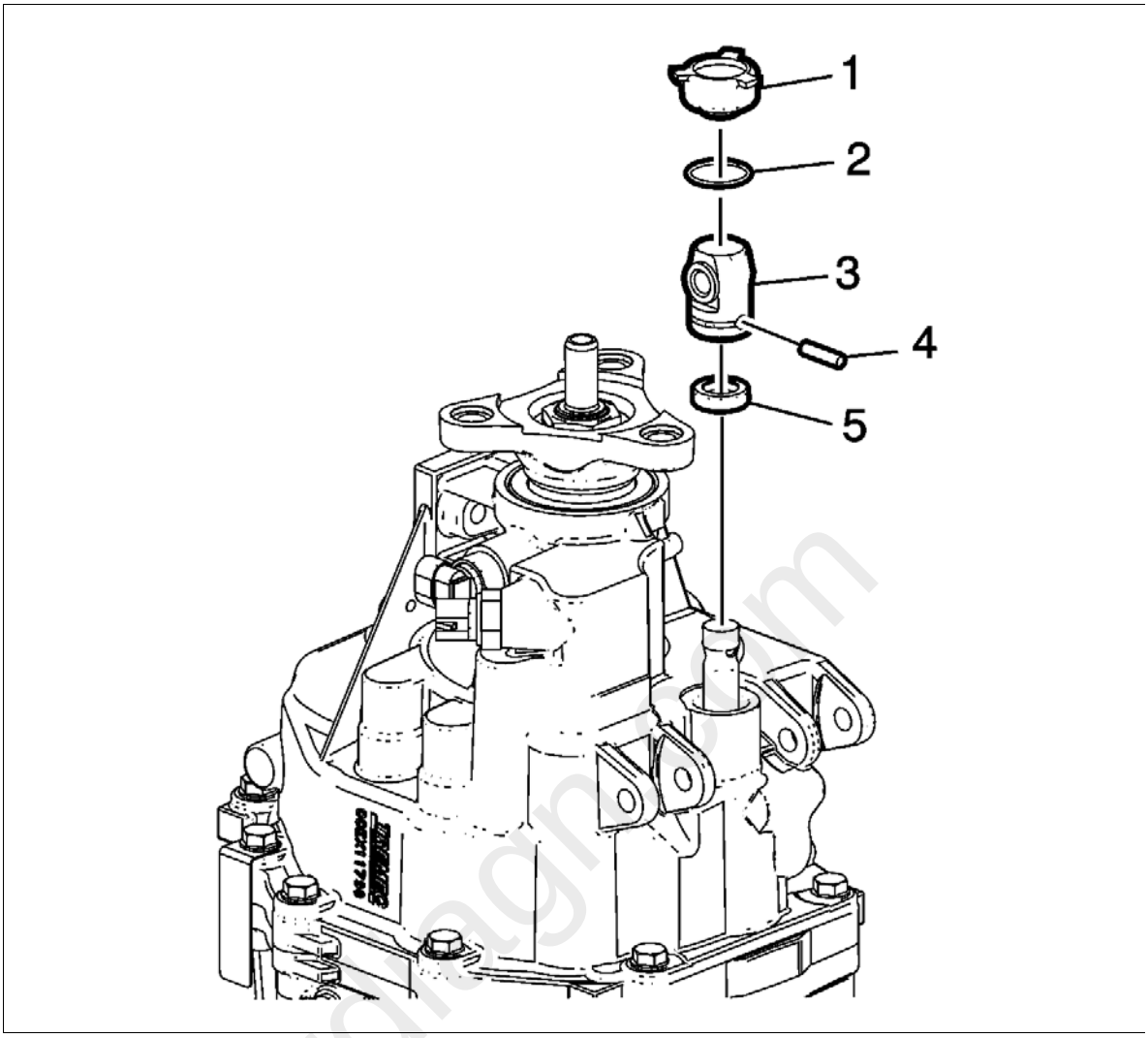


Courtesy of GENERAL MOTORS COMPANY

4. Install the shift interlock detent assembly (1). Tighten to 40 N.m (30 lb ft)

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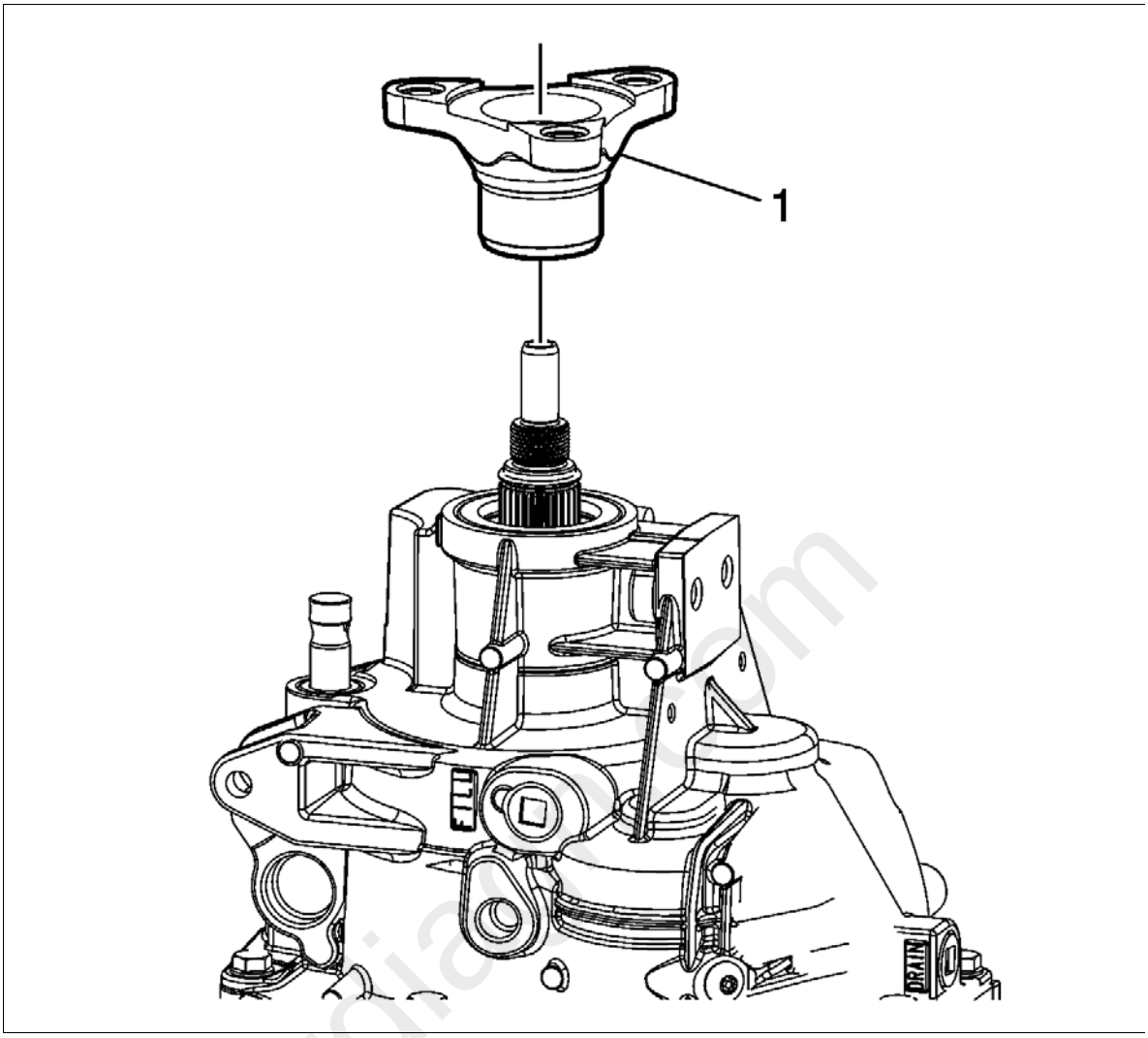
Fig 4: Manual Transmission Control Lever Components



Courtesy of GENERAL MOTORS COMPANY

5. Install the manual transmission control lever seal (5).
6. Install the manual transmission shift lever shaft joint (3) and manual transmission control lever pin (4).
7. Install the manual transmission control lever retainer (2) and manual transmission control shaft boot (1).

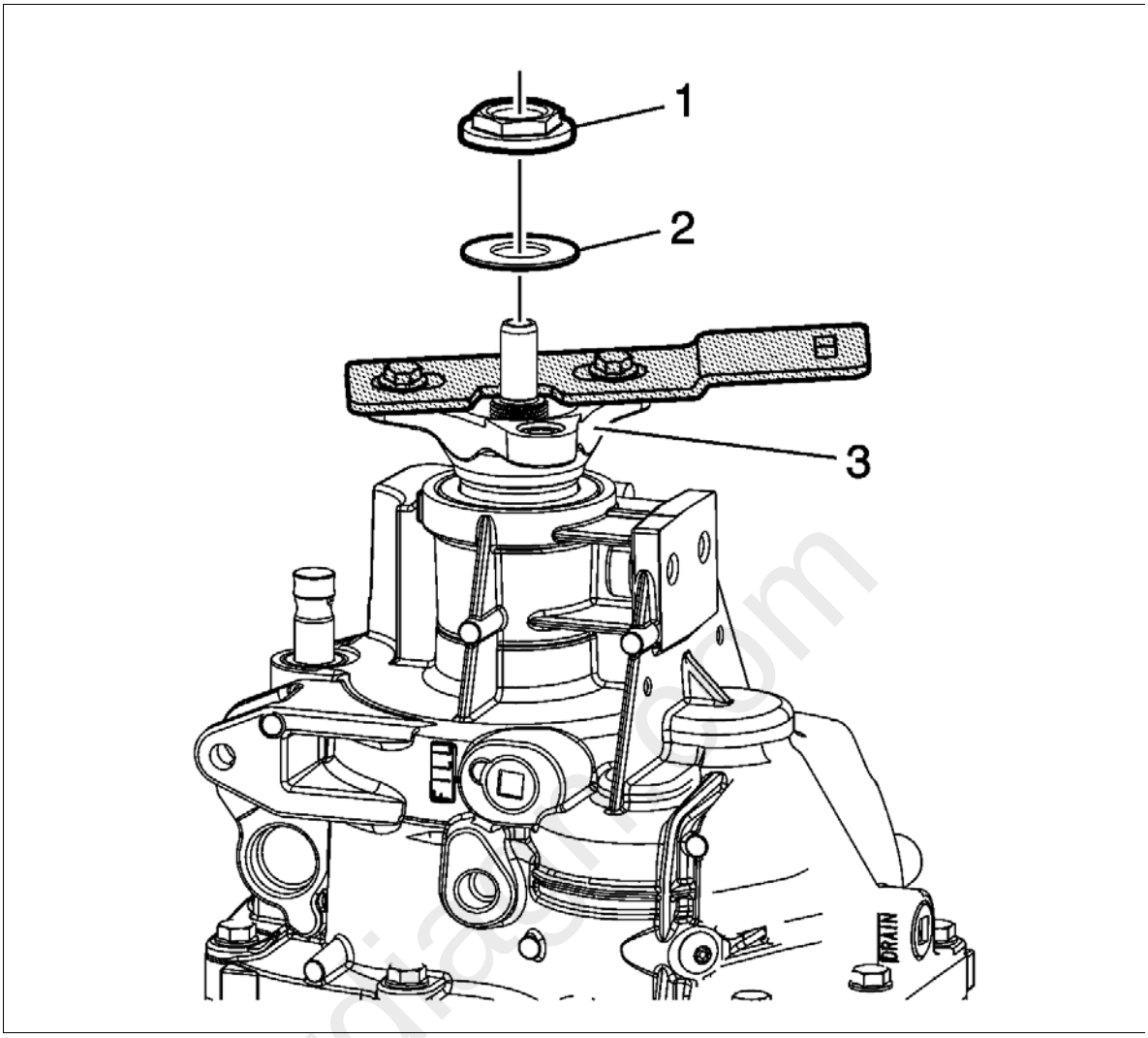
Fig 5: Propeller Shaft Transmission Yoke



Courtesy of GENERAL MOTORS COMPANY

8. Install the propeller shaft transmission yoke (1).

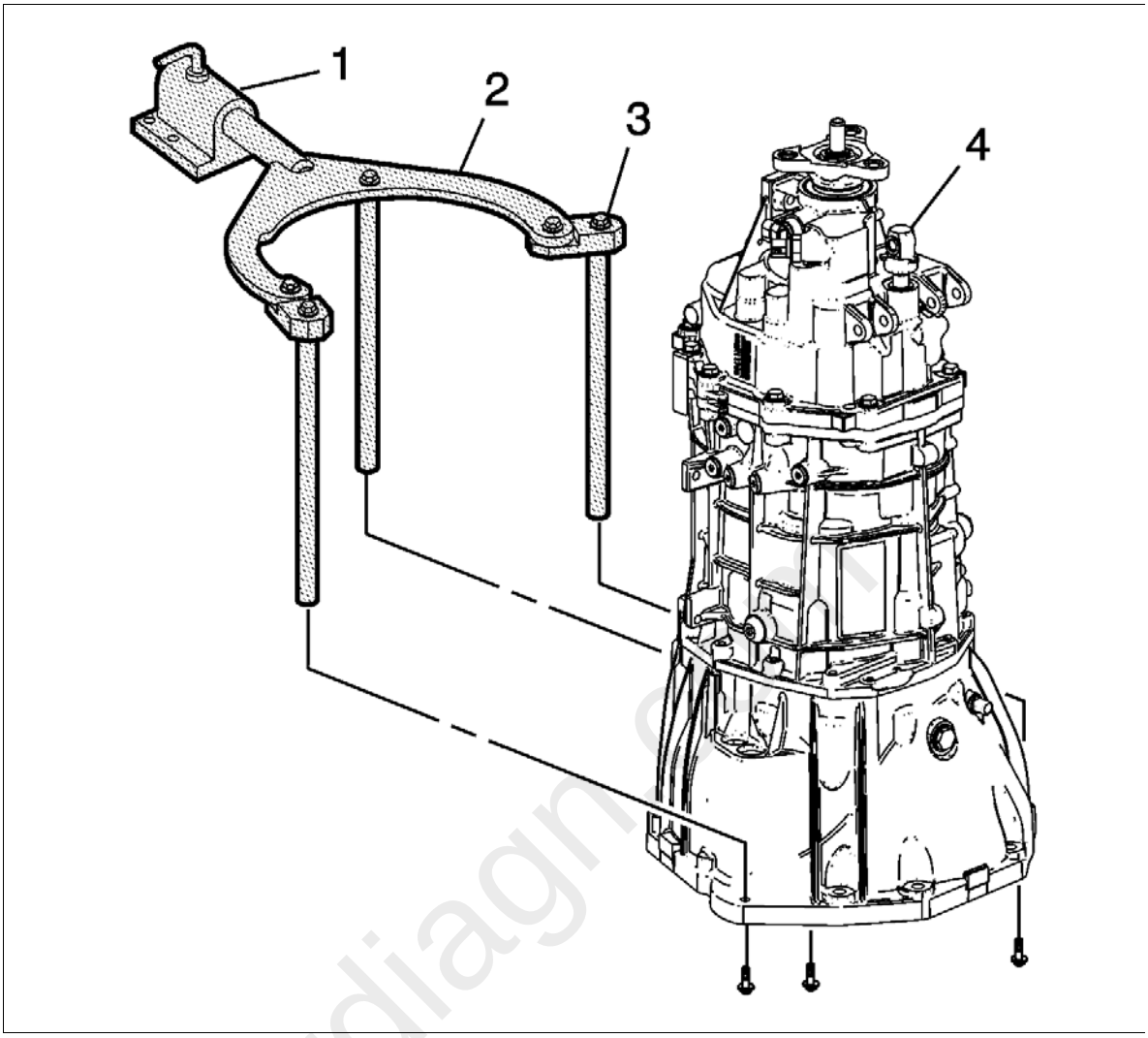
Fig 6: Propeller Shaft Transmission Yoke, Washer & Nut



Courtesy of GENERAL MOTORS COMPANY

9. Install the propeller shaft transmission yoke flange washer (2).
10. Install the **J-45012** holder with the mounting bolts to the propshaft transmission yoke (3).
11. Using a socket wrench, Install the propeller shaft transmission yoke nut (1) and tighten to 140 N.m (103 lb ft).
12. Remove the **J-45012** holder.

Fig 7: Transmission Holding Flange, Adapter & Fixture



Courtesy of GENERAL MOTORS COMPANY

13. Remove the transmission (4) from the **DT-47678** flange (2) and the **DT-47678-10** flange adapter (3).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION ASSEMBLE (MM6)

Special Tools

- **DT 47678** Transmission Holding Flange
- **DT 47678-10** Transmission Holding Flange Adapter
- **DT 49293** Gear Select/Skip Shift Solenoid Socket
- **J 08614A** Pinion Flange Holder and Remover
- **J 3289-20** Holding Fixture
- **J 36017** Valve Seal Remover

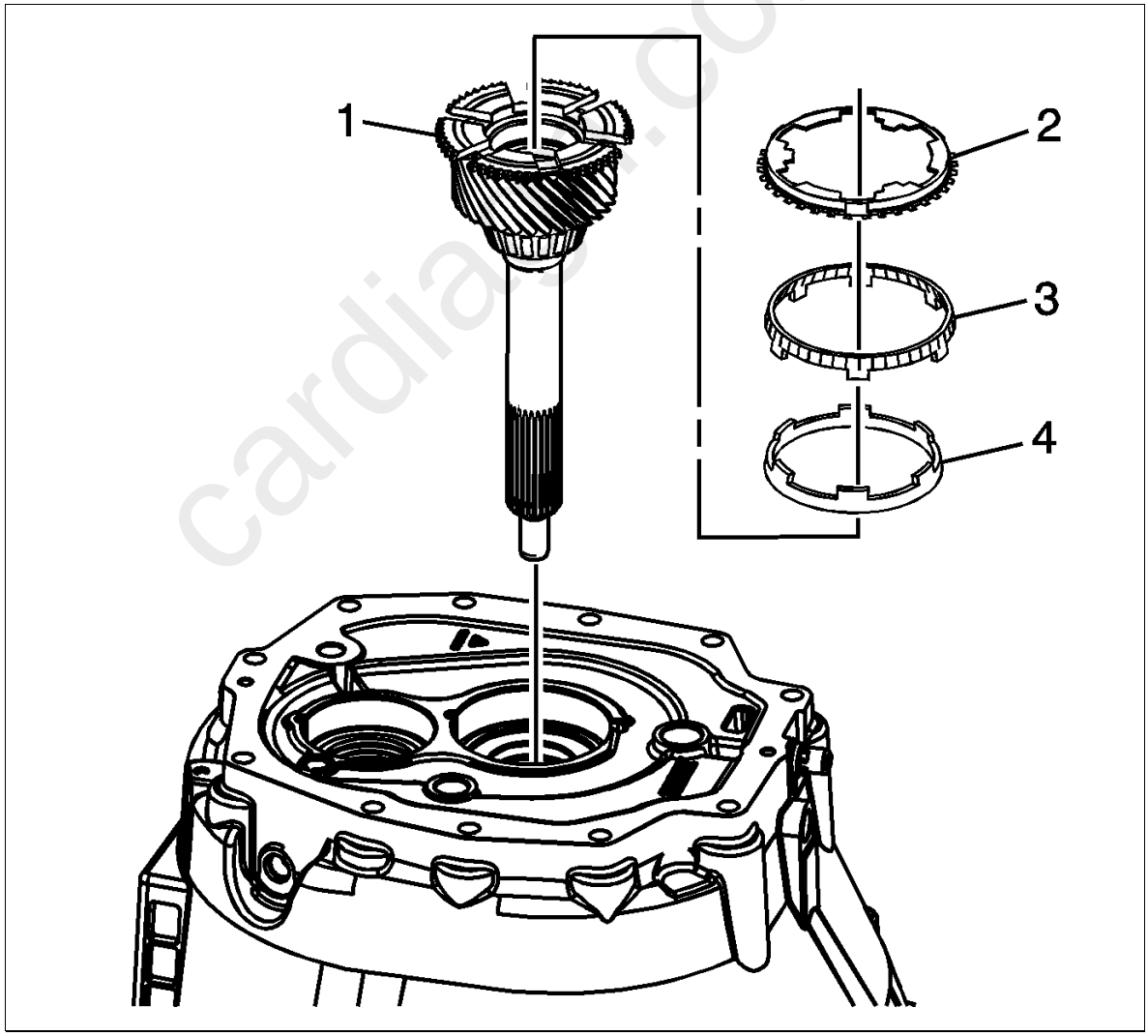
- **J 36850** Transjel® Lubricant Assembly Lube
- **J 38205-1** Press Tube
- **J 39441-20** Fifth Gear Installer Adapter
- **J 39441-30** 5th/6th Gear Installer Adapter
- **J 39442** Mainshaft and Countershaft Press Adapter
- **J 44395** Transmission Holding Fixture

For equivalent regional tools, refer to Special Tools (MM6) .

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION ASSEMBLE (MM6) > SHIFT SHAFT ASSEMBLIES AND GEAR CLUSTERS INSTALLATION

1. Lubricate all components as assembly progresses, using **J 36850** transjel® lubricant.

Fig 1: 4th Gear Blocking Ring Assembly Components

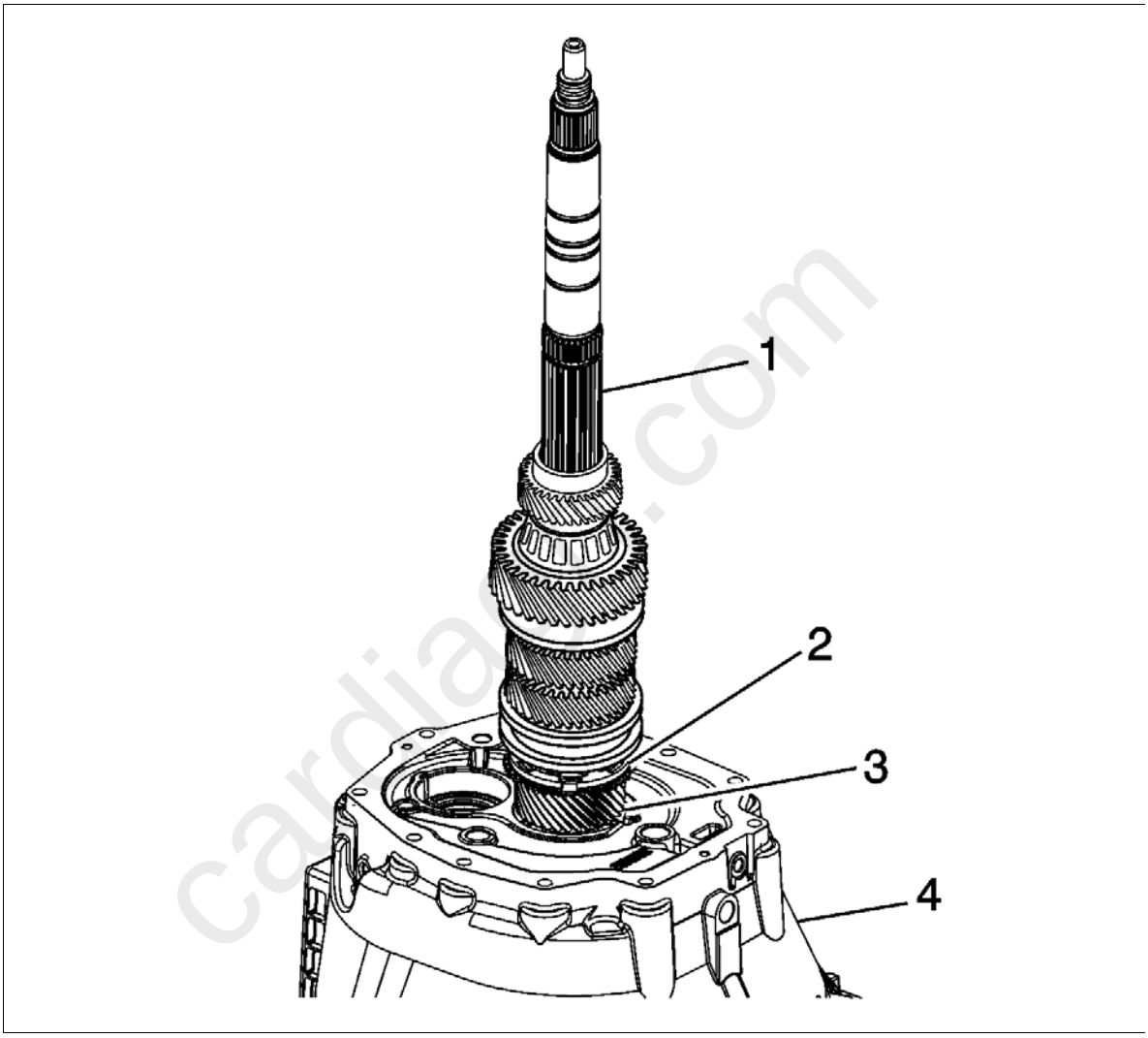


Courtesy of GENERAL MOTORS COMPANY

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2. Install the input shaft (1) in the clutch housing.
3. Install the 4th gear blocking assembly:
    1. Install the 4th speed drive gear inner cone (4).
    2. Install the 4th speed drive gear outer cone (3).
    3. Install the 4th speed drive gear blocking ring (2).

Fig 2: Mainshaft Components



Courtesy of GENERAL MOTORS COMPANY

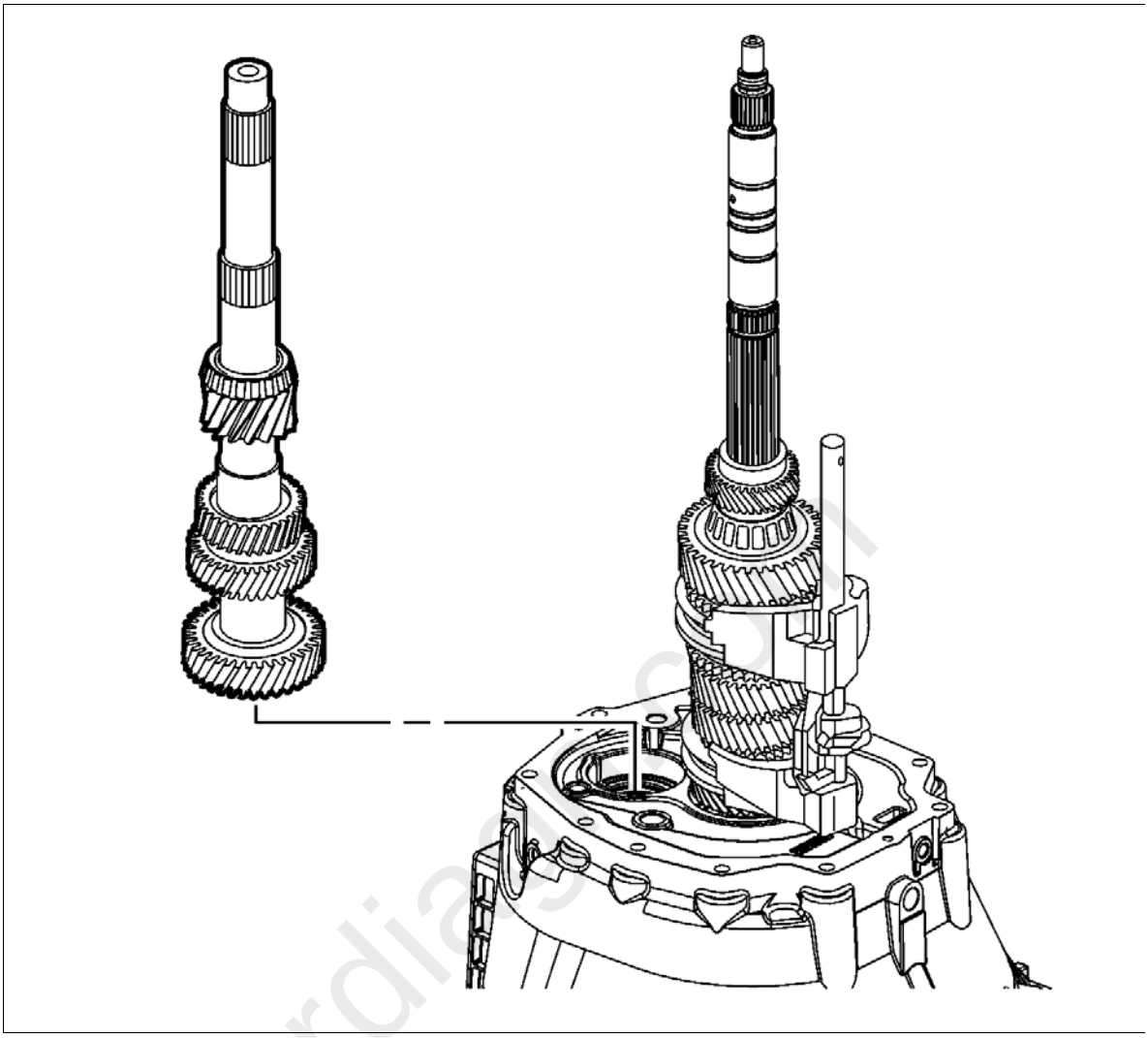
NOTE:

In order for the shift forks to properly line up with the synchronizers, the shift shaft assembly must be assembled correctly. Refer to Shift Shaft and Fork Assemblies Assemble (MM6) .

4. Assemble the shift shaft to the mainshaft.

5. Install the mainshaft and the shift shaft assembly into the clutch housing.

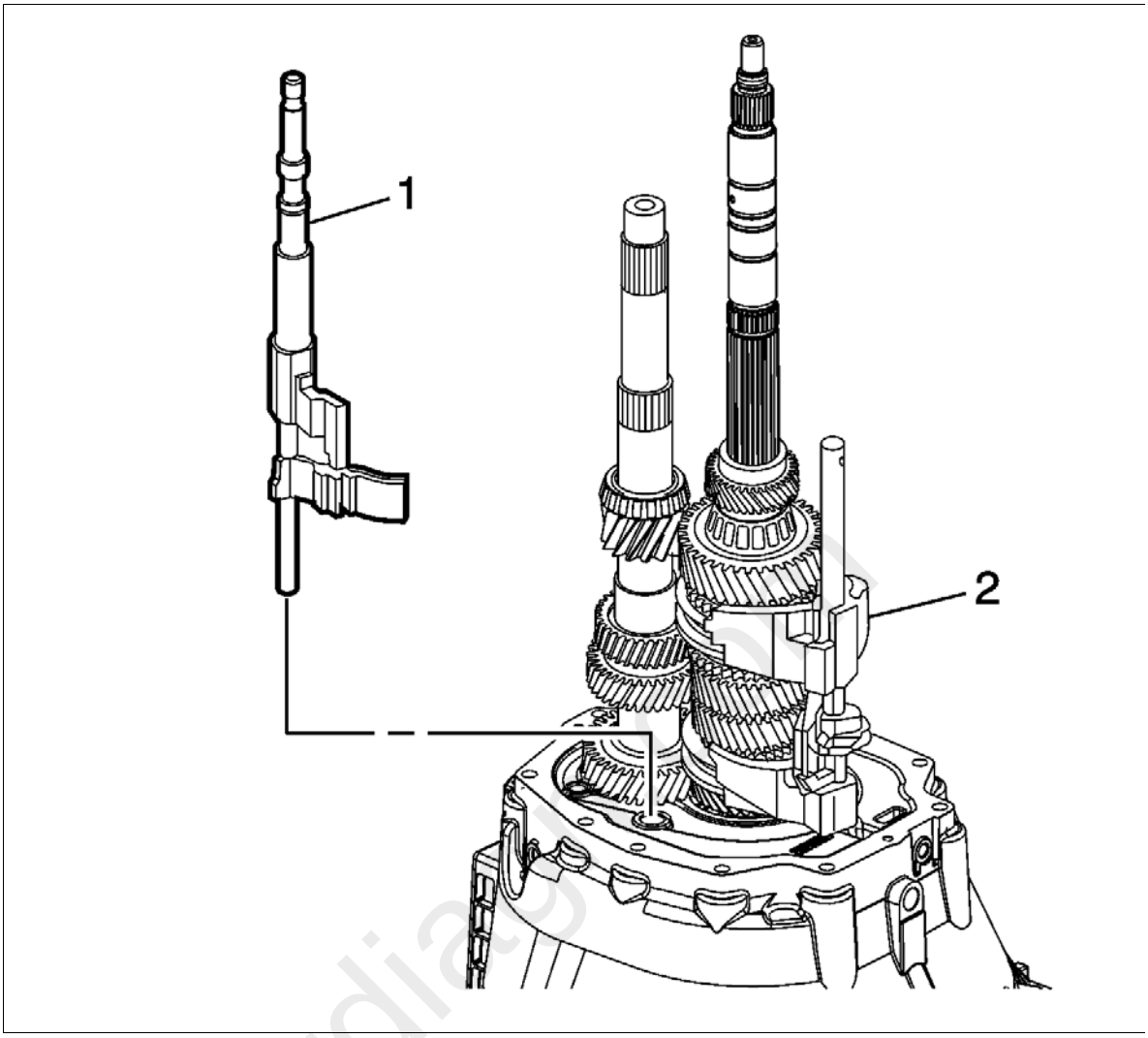
Fig 3: Countershaft



Courtesy of GENERAL MOTORS COMPANY

6. Install the countershaft assembly using the following sequence:
    1. Lift up the mainshaft assembly enough in order to install the countershaft assembly.
    2. Install the countershaft assembly.
    3. Lift the mainshaft assembly enough in order to rotate the input shaft to engage the synchronizer keys with 4th gear blocking ring.

Fig 4: 3rd/4th Shift Fork & 5th/6th & Reverse Shift Shaft Assemblies



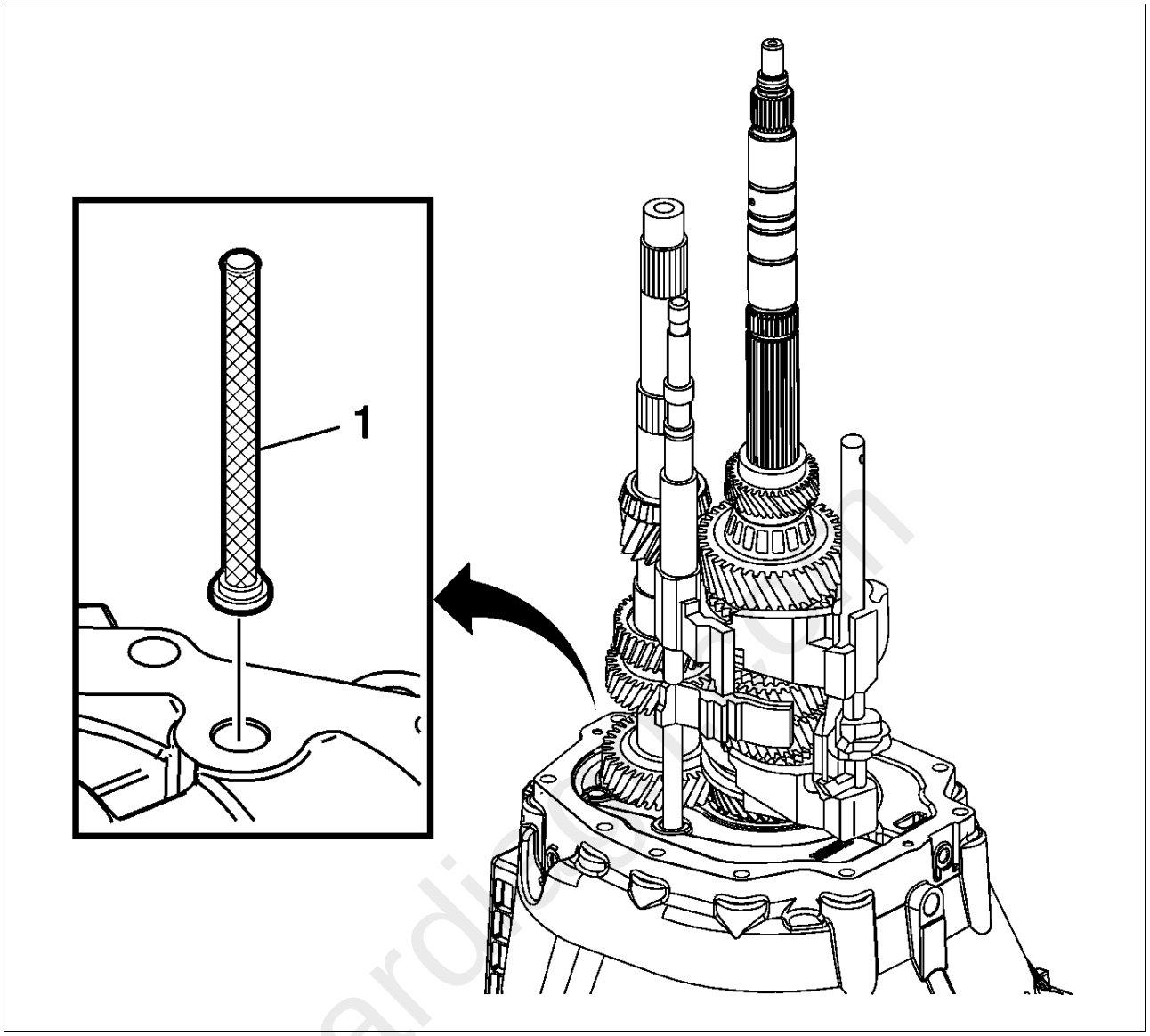
Courtesy of GENERAL MOTORS COMPANY

7. Install the 5th/6th and the reverse shift shaft.

   Align the slots of the shift shaft levers with the interlock plate.

Oil Filter Installation

Fig 5: Oil Filter

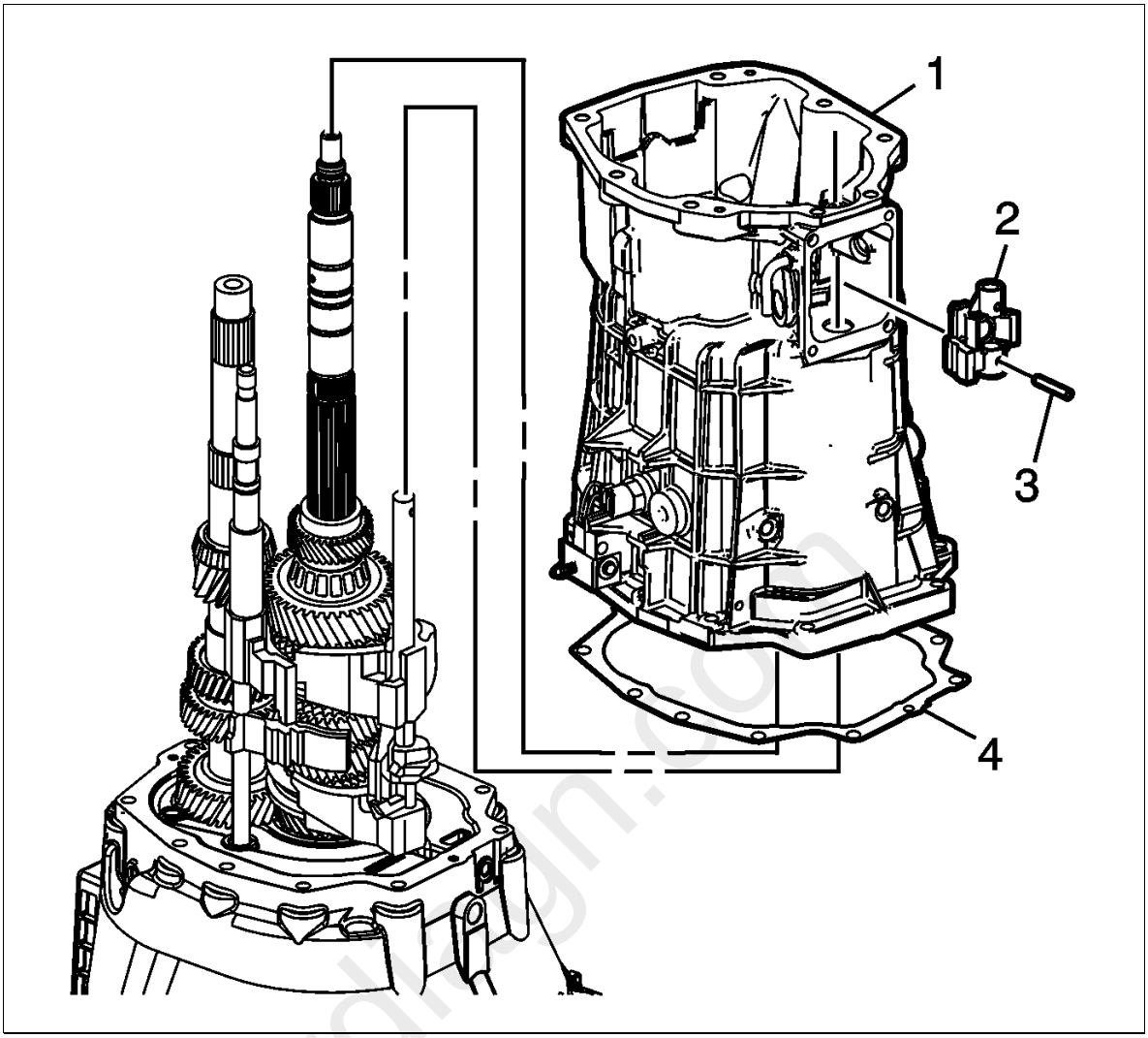


Courtesy of GENERAL MOTORS COMPANY

Install the oil filter assembly (1).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION ASSEMBLE (MM6) > TRANSMISSION CASE INSTALLATION

Fig 1: Gasket

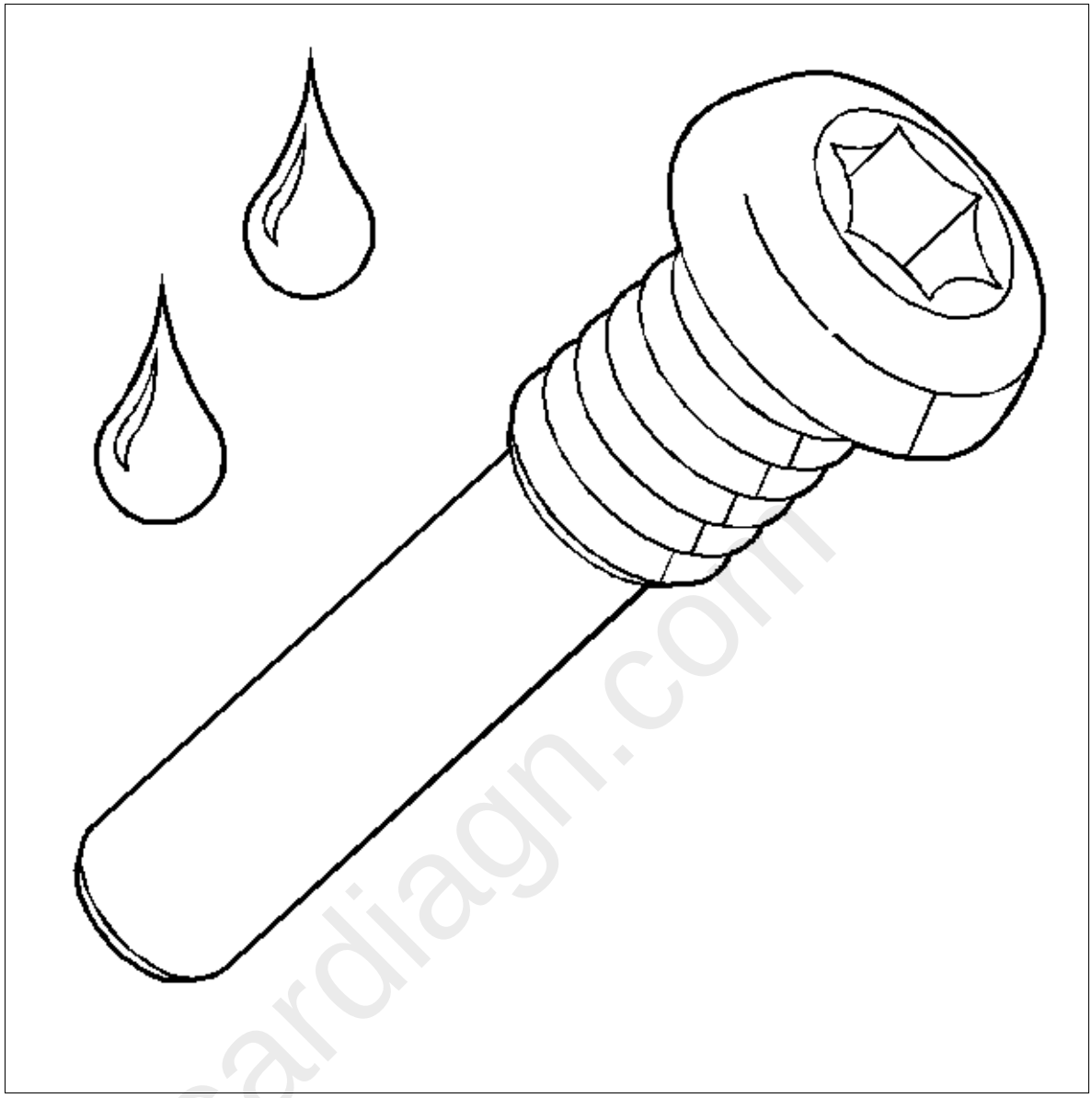


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1. Install the gasket (4).
2. Do the following in order to install the transmission case and the select control lever assembly:
    1. Shift the transmission into NEUTRAL in order to keep the 3rd/4th shift shaft from engaging.
    2. Install the select control lever assembly (2), through the transmission case opening, while sliding the transmission case (1) onto the gear clusters and the shift rail components.
    3. Install the select control lever assembly pin (3).

Fig 2: Sealer To Shift Lever Guide Bolts Threads

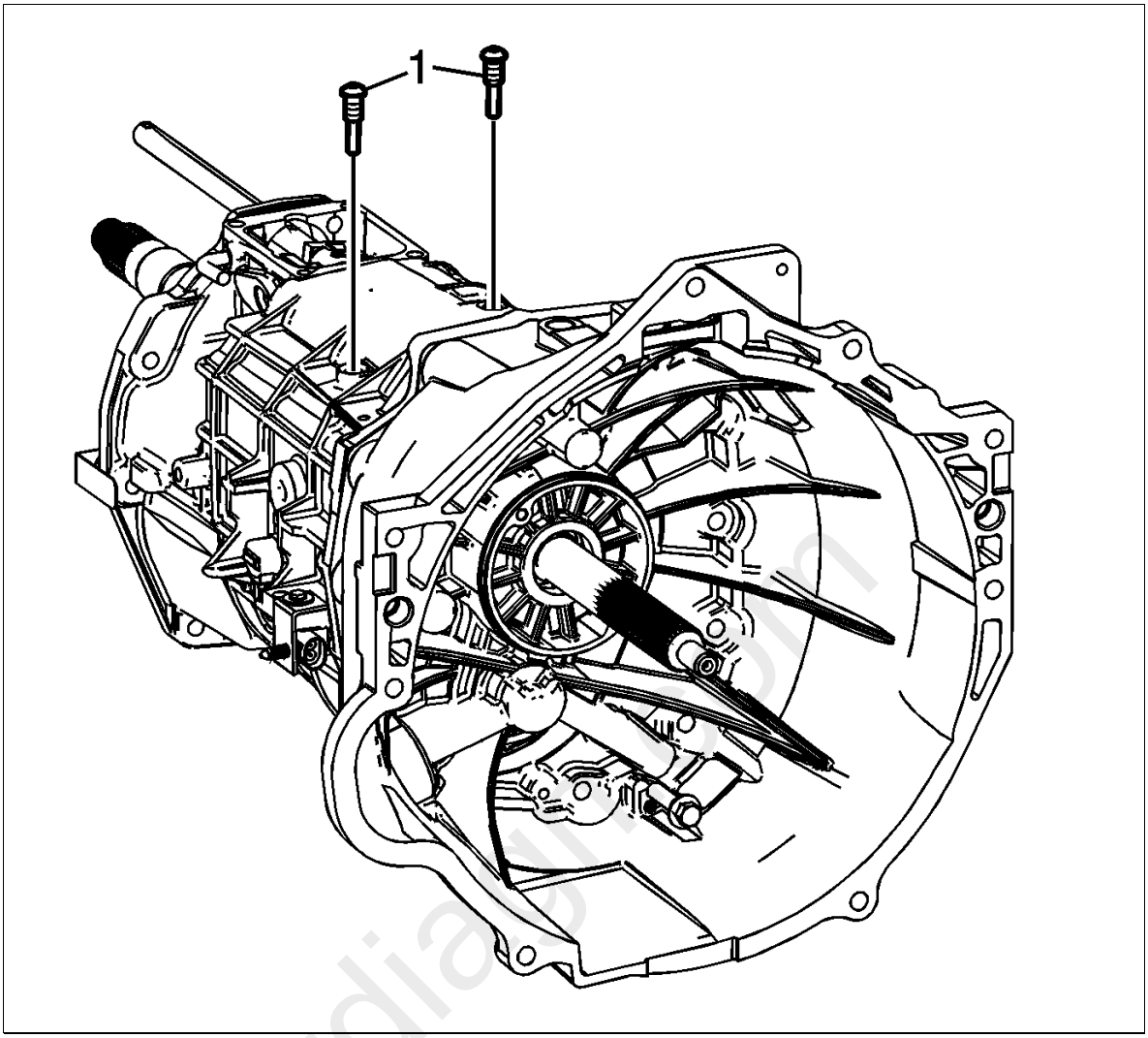


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3. Apply threadlock GM P/N 12346004, (Canadian P/N 10953480) or equivalent to the threads of the shift lever guide bolts.

Fig 3: Shift Lever Guide Bolts



Courtesy of GENERAL MOTORS COMPANY

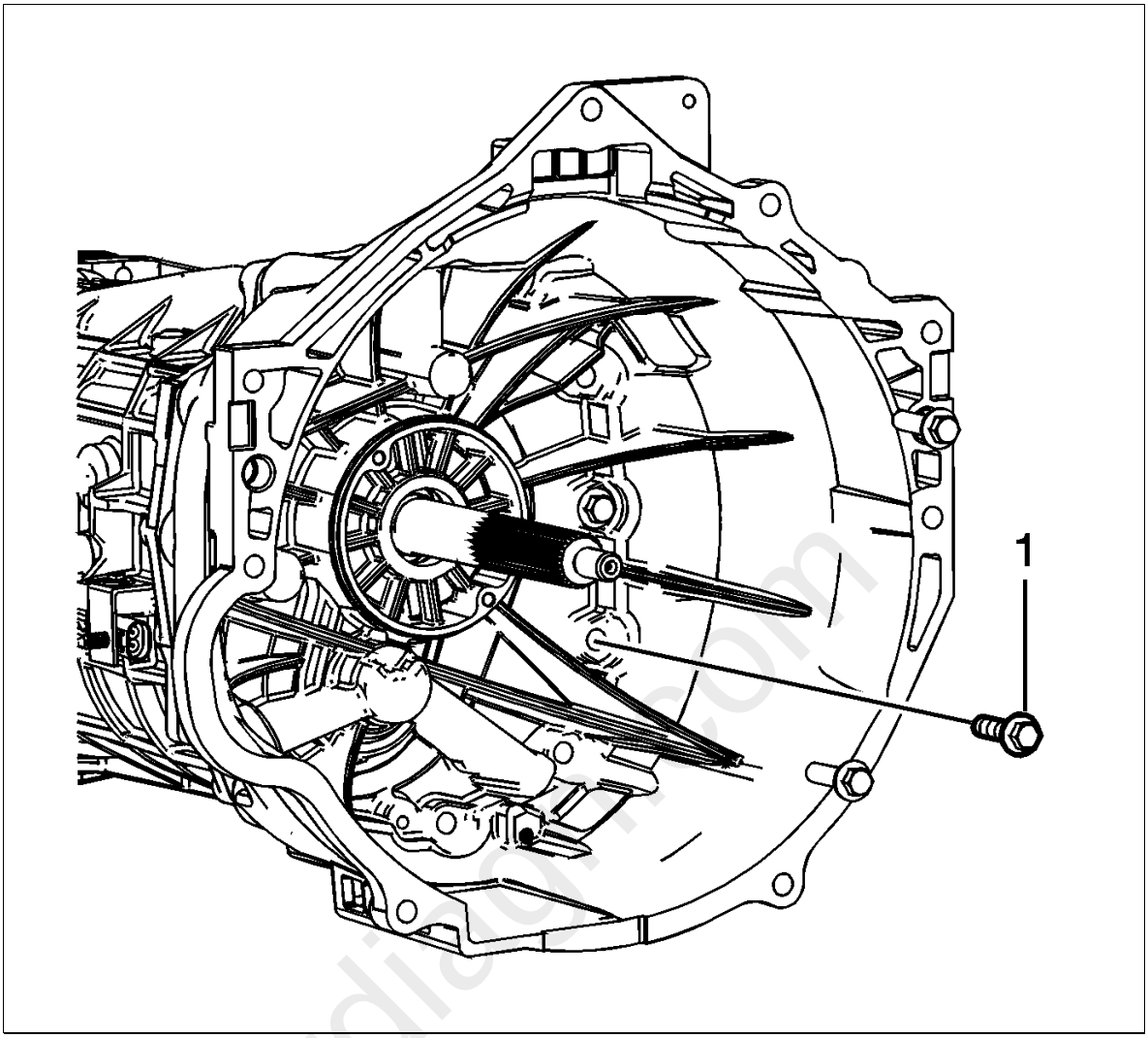
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> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

> 📌 *NOTE:*
>
> *In order to align the shift interlock plate slot with the shift lever guide bolt holes, pull up on the 5th/6th and reverse shift rail assembly while installing the shift lever guide bolts.*

4. Install the shift lever guide bolts (1) while pulling up on 5th/6th and reverse shift rail assembly. Tighten the bolts to 27 N.m (20 lb ft).

Fig 4: Clutch Housing To Transmission Case Bolts

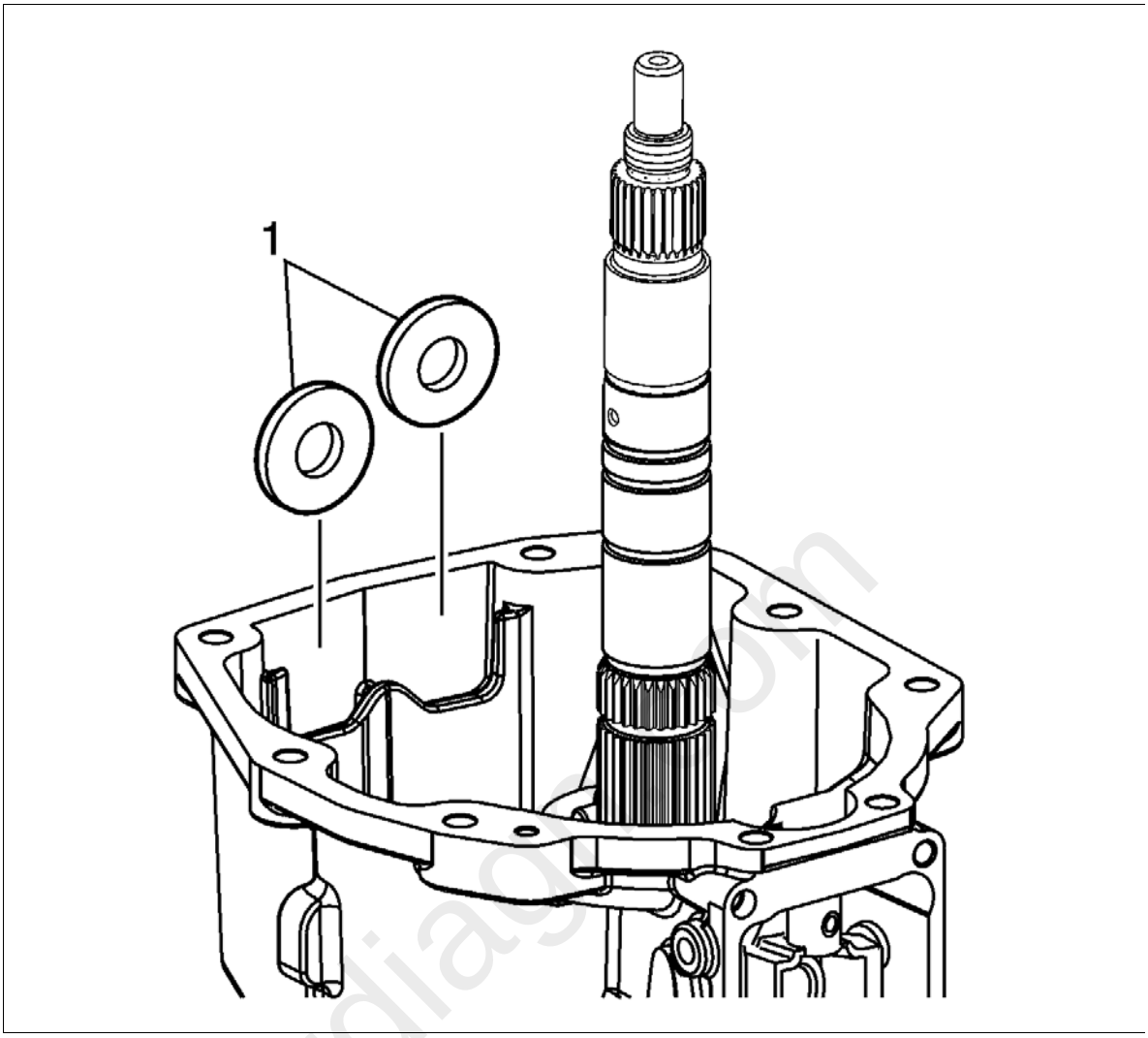


Courtesy of GENERAL MOTORS COMPANY

5. Install the clutch housing to transmission case bolts (1) and tighten to 48 N.m (36 lb ft).
6. Install the clutch concentric actuator cylinder. Refer to Clutch Concentric Actuator Cylinder Replacement .

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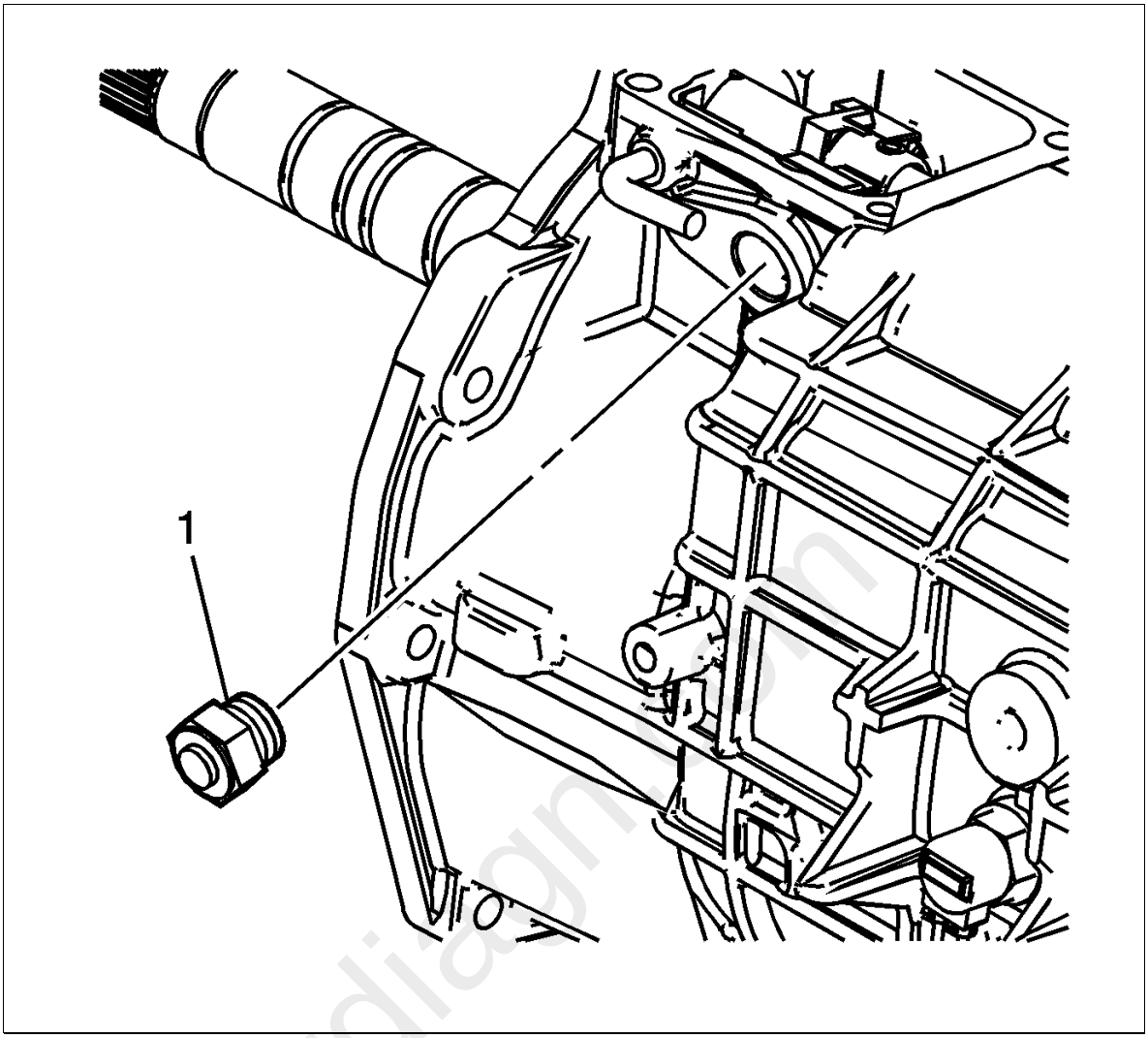
Fig 5: Transmission Case Magnets



Courtesy of GENERAL MOTORS COMPANY

7. Install the magnets (1) into the transmission case.

Fig 6: Shift Detent Assembly

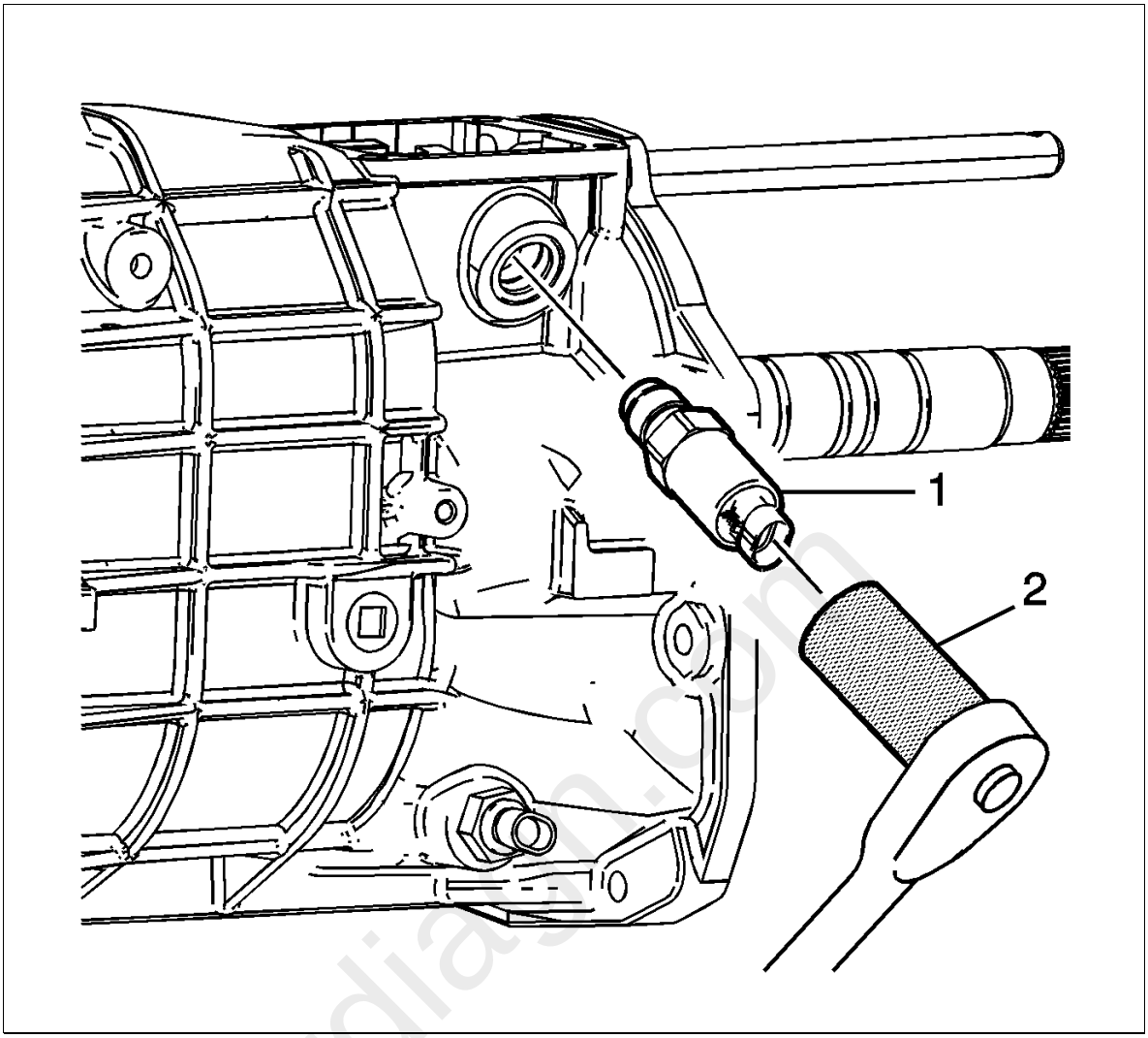


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8. Install the shift detent assembly (1) and tighten to 40 N.m (30 lb ft).

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Fig 7: Gear Select/Skip Shift Solenoid

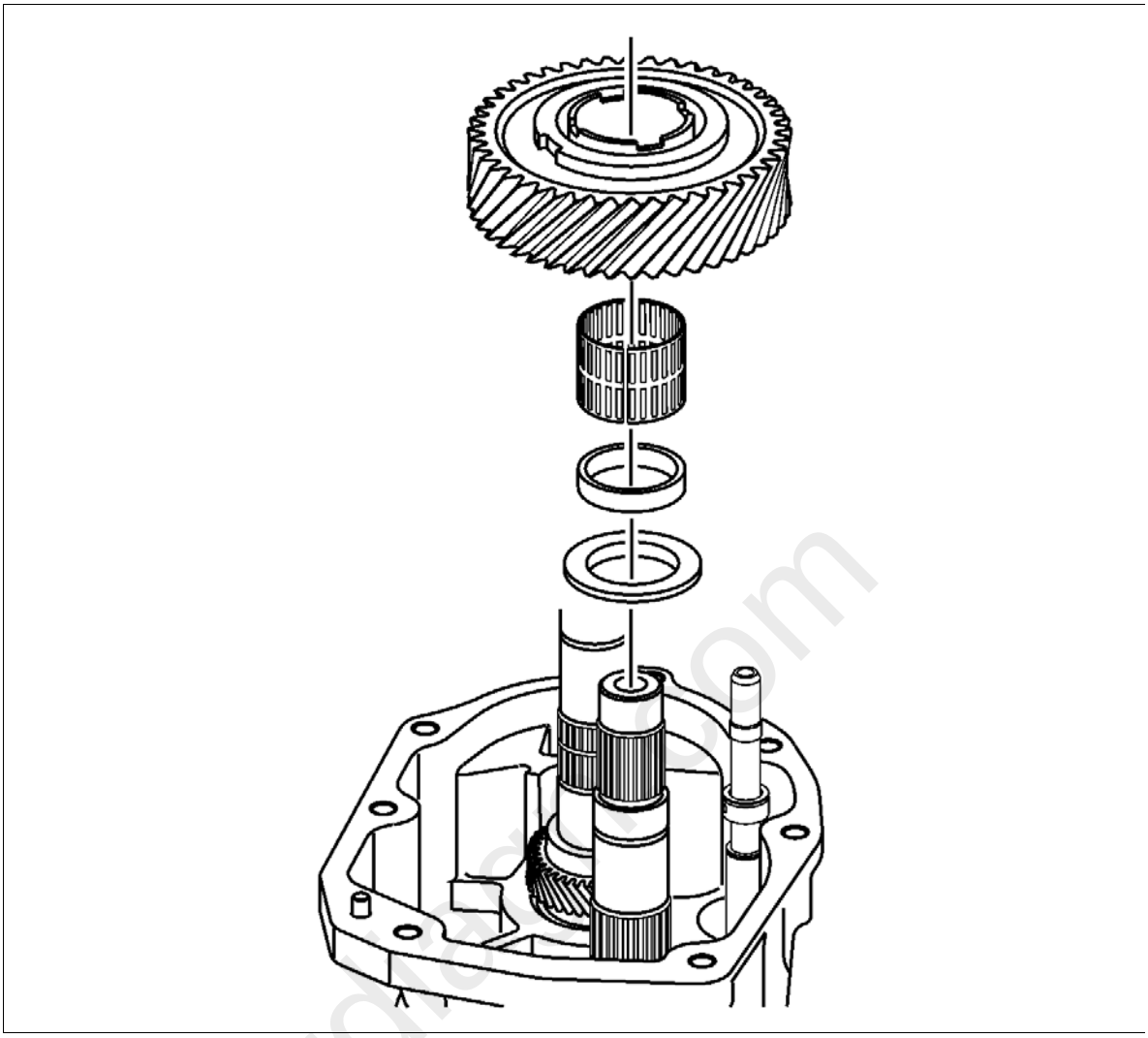


Courtesy of GENERAL MOTORS COMPANY

9. Using **DT 49293** socket (2), install the gear select/skip shift solenoid (1) and tighten to 40 N.m (30 lb ft).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION ASSEMBLE (MM6) > 5TH SPEED DRIVEN GEAR AND 6TH SPEED DRIVE GEAR INSTALLATION

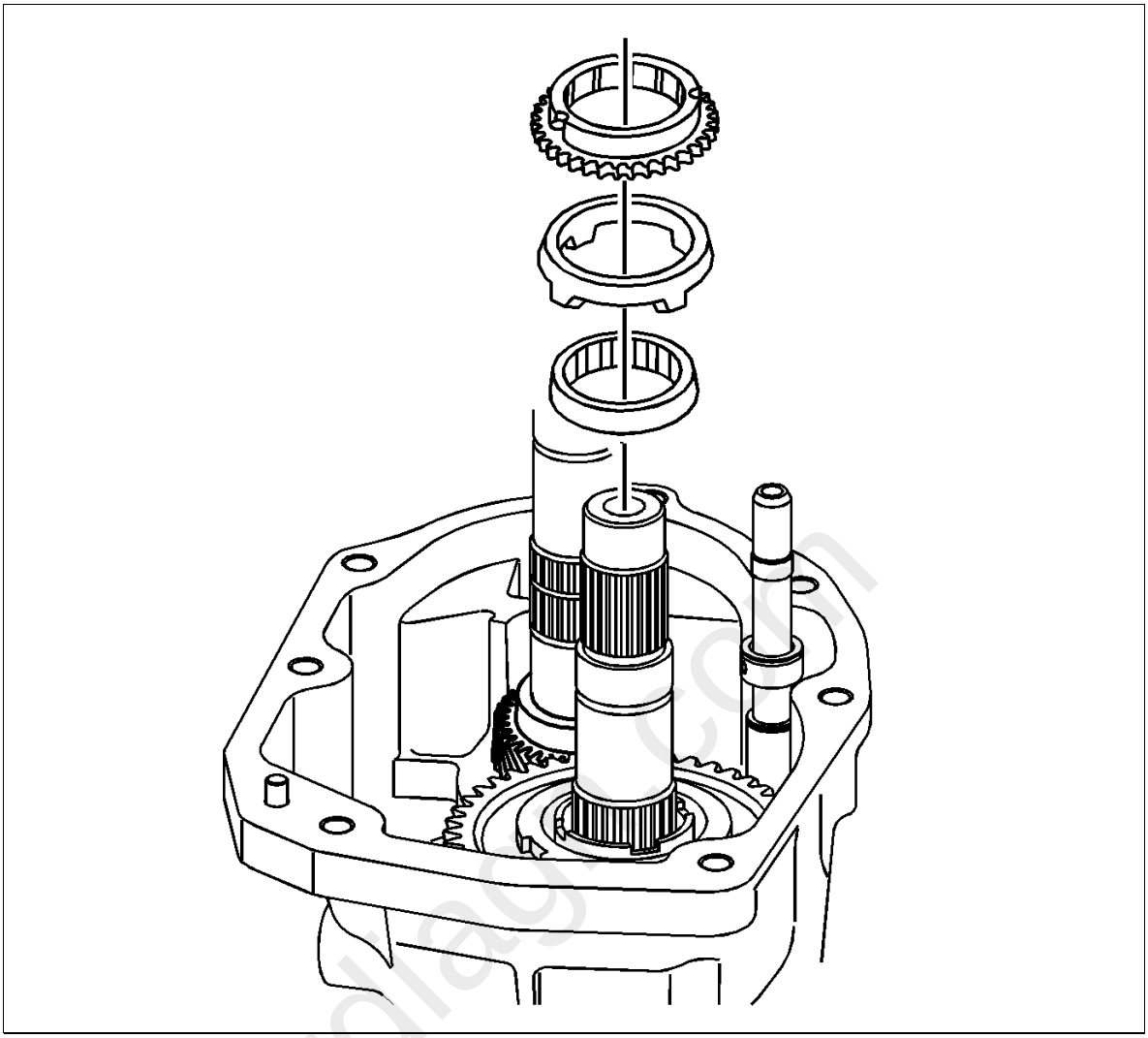
Fig 1: 6th Driven Gear, Caged Needle Bearing, And Spacer



Courtesy of GENERAL MOTORS COMPANY

1. Install two spacers, caged needle bearing, and 6th drive gear.

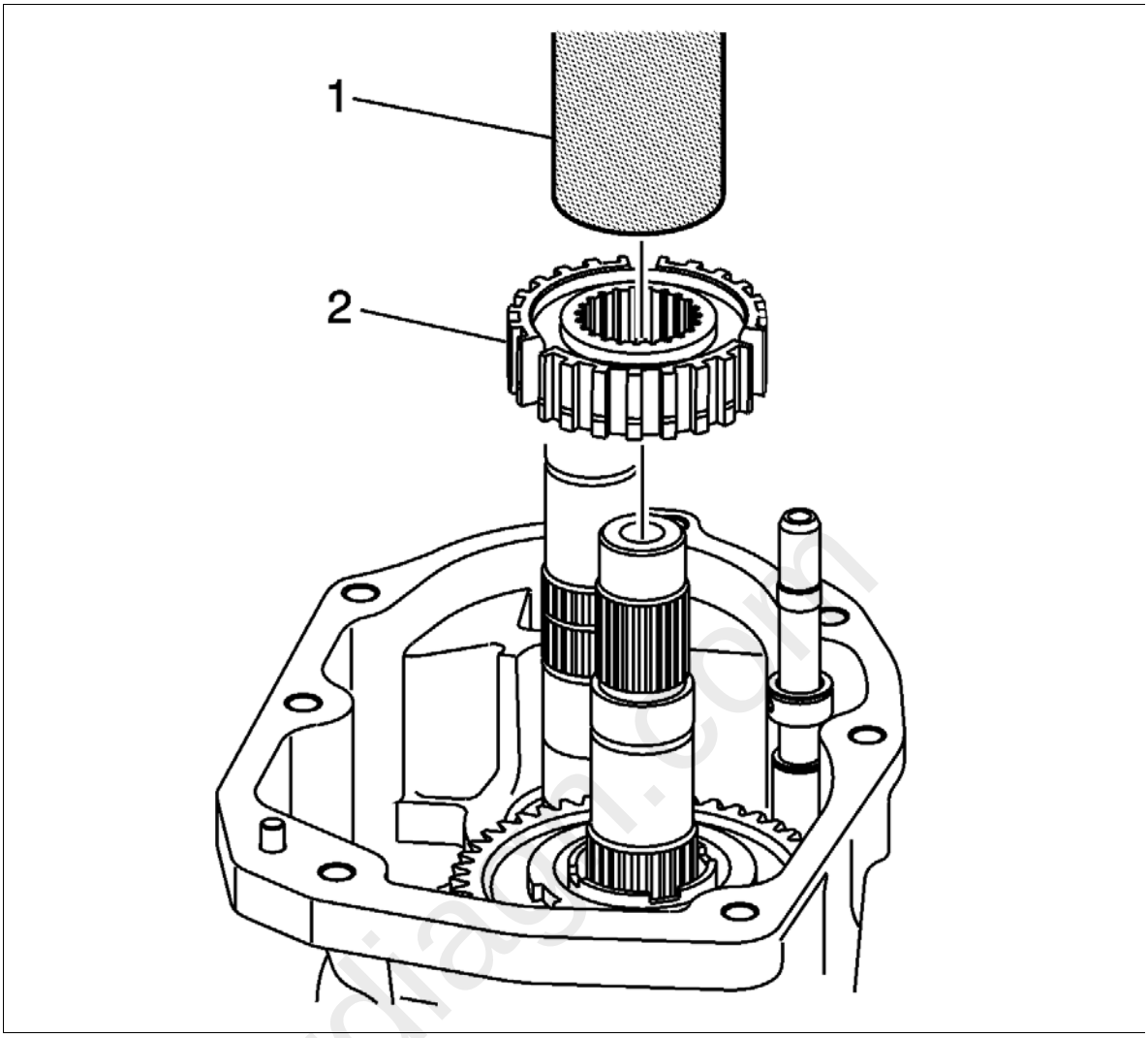
Fig 2: Speed Drive Gear Synchronizer Blocking Ring, Gear Friction Cone And Gear Inner Cone



Courtesy of GENERAL MOTORS COMPANY

2. Install the 6th speed drive gear inner cone, 6th speed drive gear friction cone, and synchronizer blocking ring.

Fig 3: Synchronizer Hub Assembly

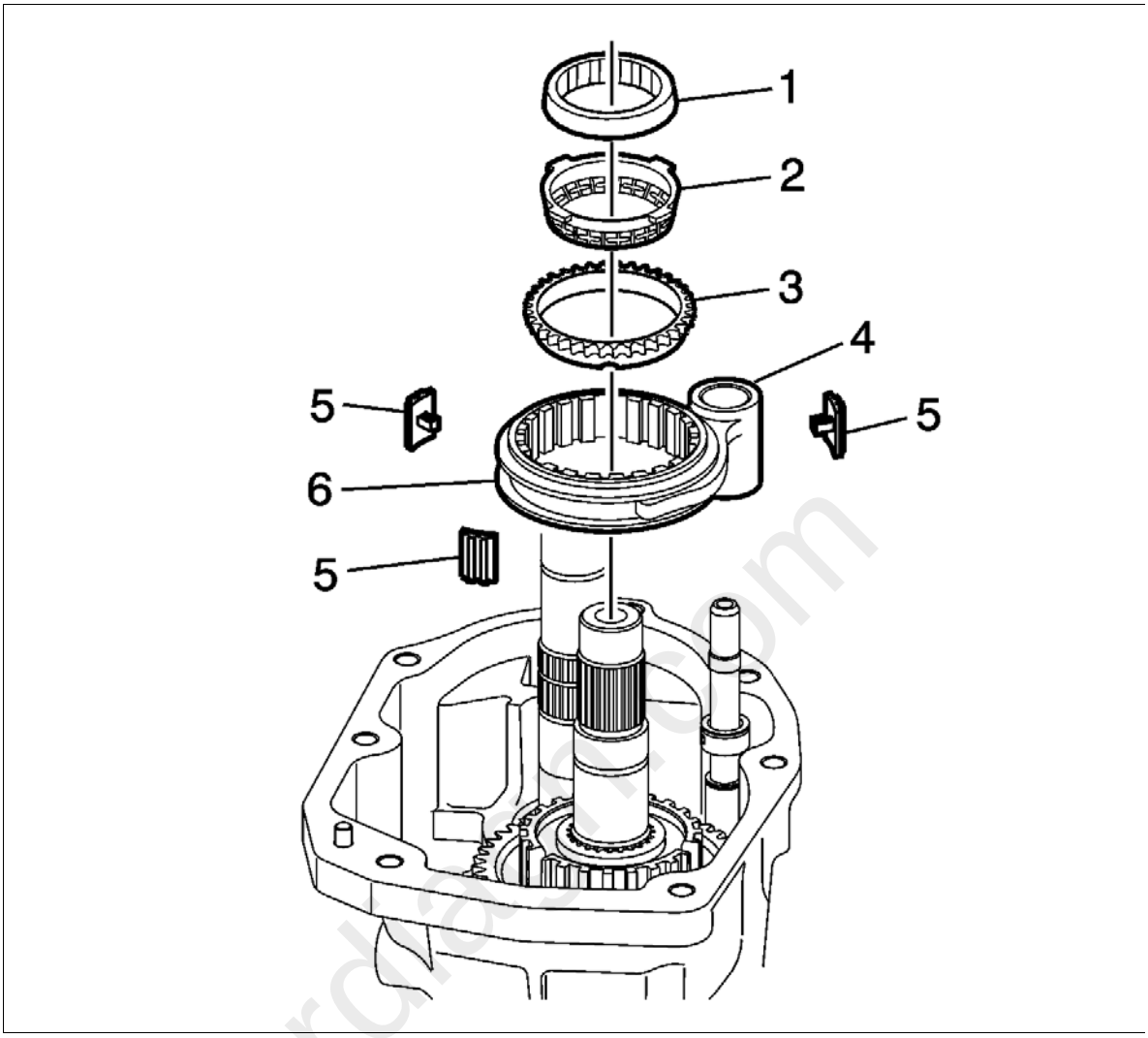


Courtesy of GENERAL MOTORS COMPANY

3. Install the 5th/6th synchronizer hub assembly (2) using **J 38205-1** tube (1).

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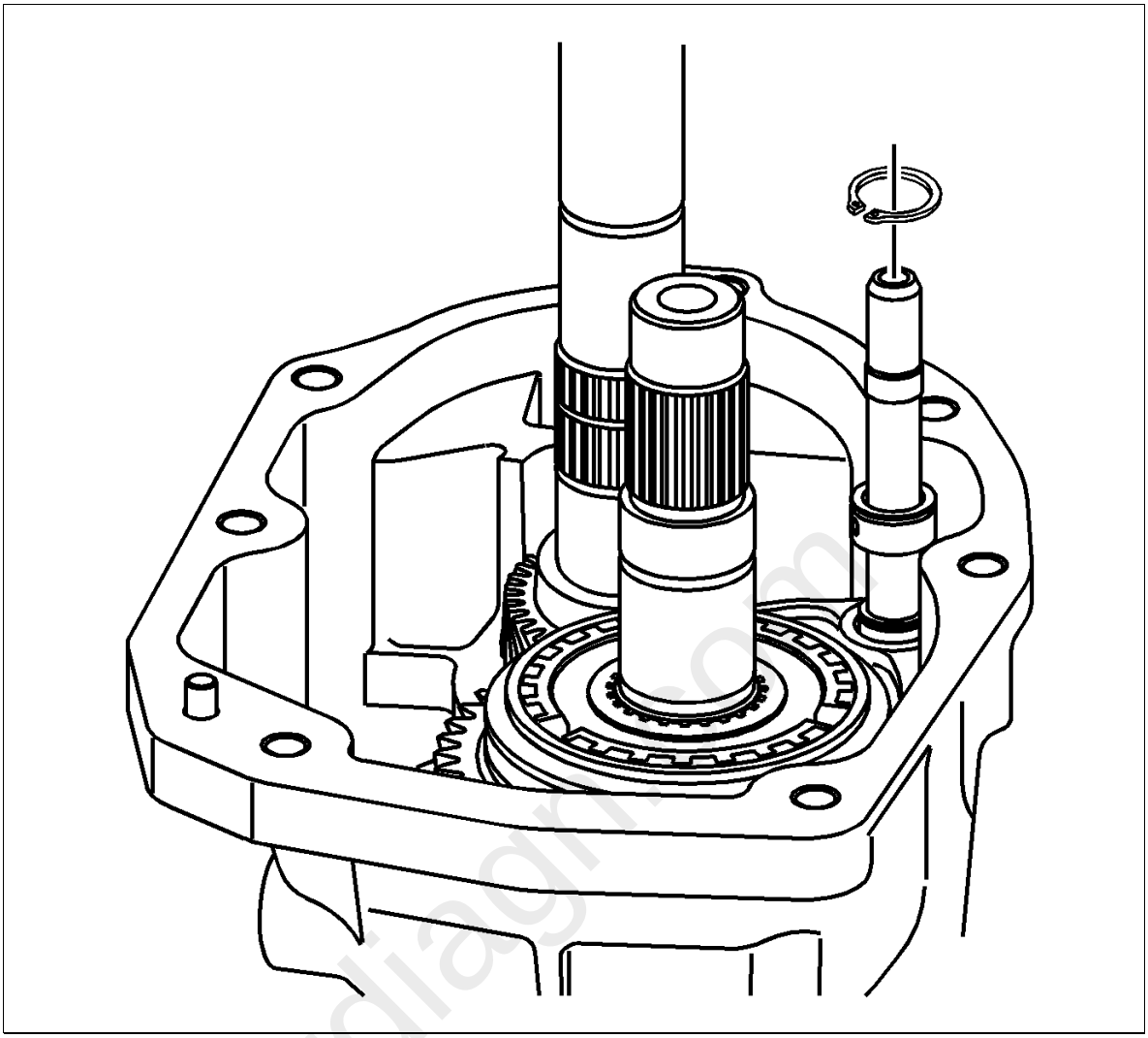
Fig 4: 5th/6th Shift Fork, Synchronizer Sleeve, Synchronizer Inserts, Speed Drive Gear Synchronizer Blocking Ring, Friction Cone and Inner Cone



Courtesy of GENERAL MOTORS COMPANY

4. Install the following components:
    1. Drive gear inner cone
    2. Drive gear friction cone
    3. Synchronizer blocking ring
    4. Synchronizer inserts
    5. Synchronizer sleeve
    6. 5th/6th shift fork

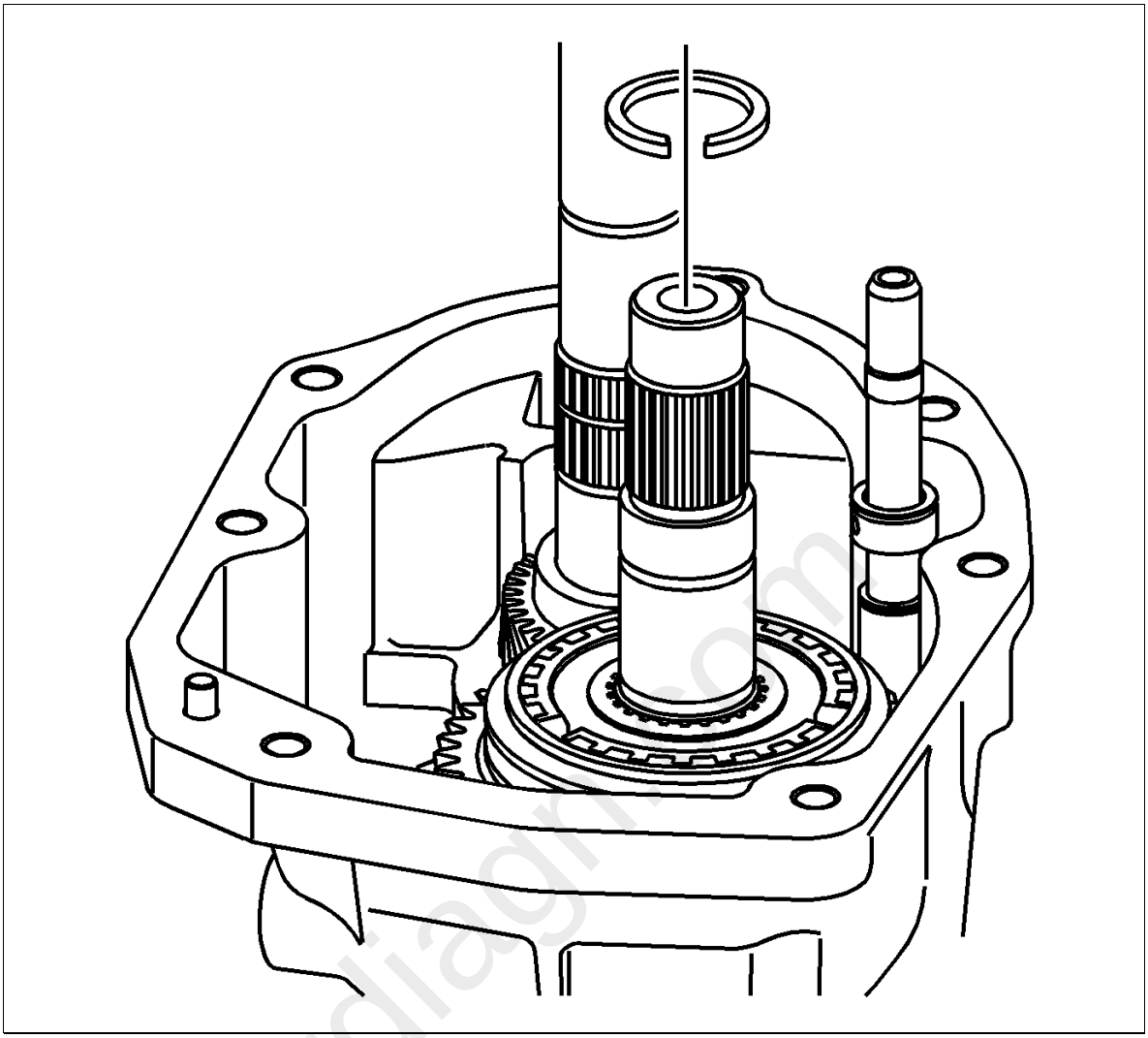
Fig 5: 5th/6th Speed Shift Fork Retainer Ring



Courtesy of GENERAL MOTORS COMPANY

5. Install the 5th/6th speed shift fork retainer ring.

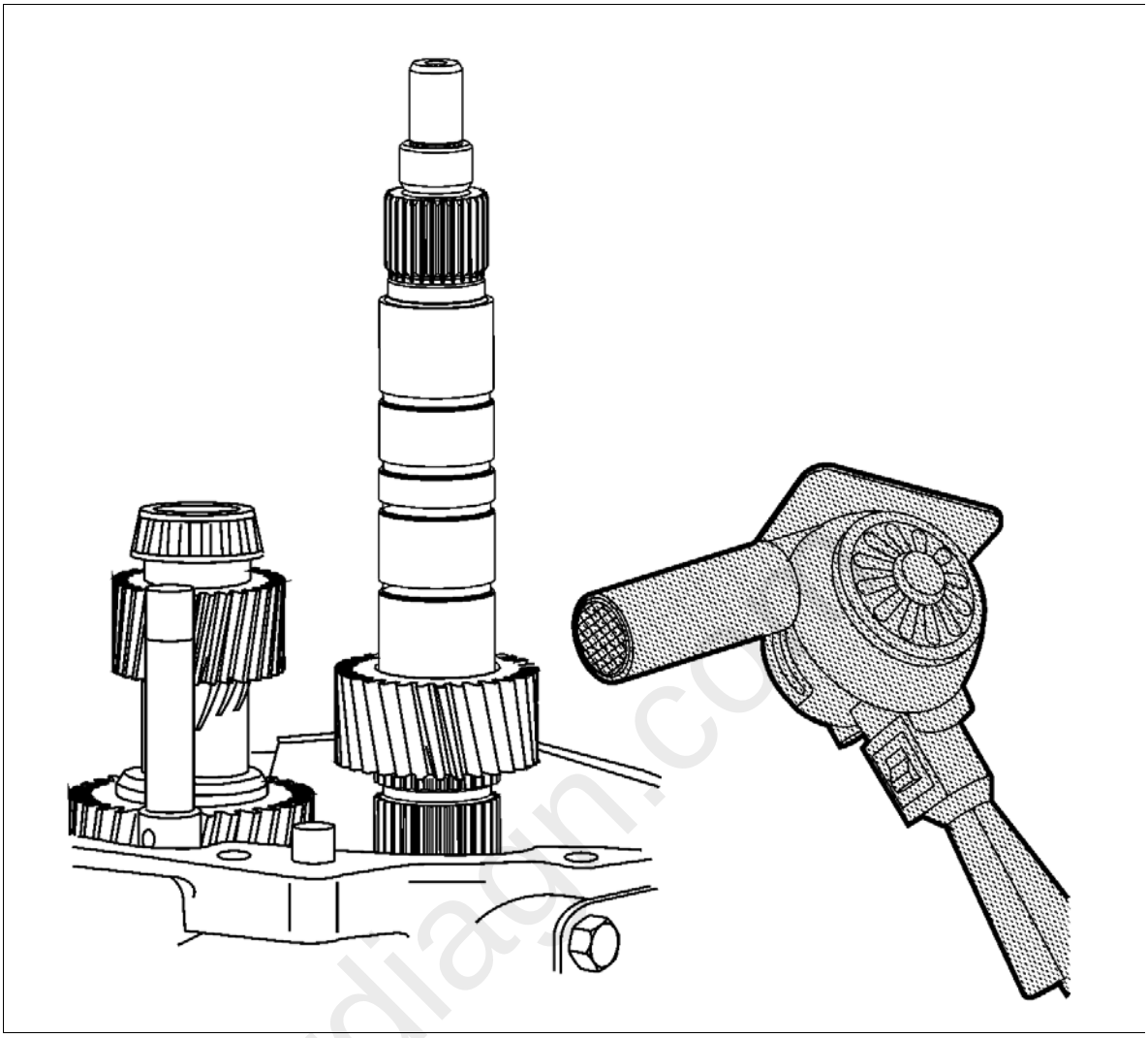
Fig 6: Retainer Clip & Countershaft



Courtesy of GENERAL MOTORS COMPANY

6. Install the retainer clip to the countershaft.

Fig 7: 5th/6th Speed Driven Gear

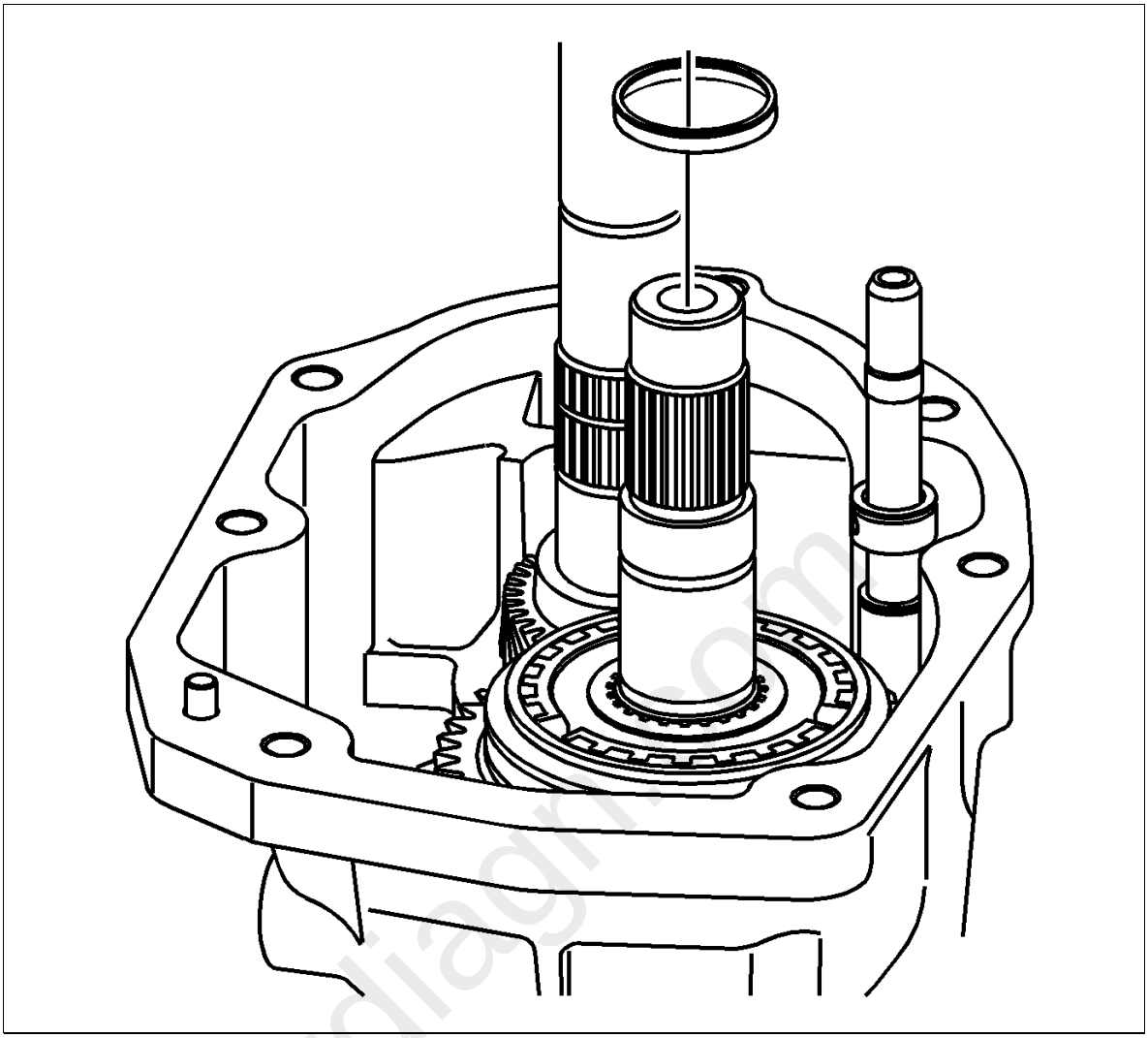


Courtesy of GENERAL MOTORS COMPANY

7. Install the 5th/6th speed driven gear (1) by heating to 54°C (130°F). The smaller outside diameter (OD) of the gear faces down.

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION ASSEMBLE (MM6) > REVERSE SHIFT FORK INSTALLATION

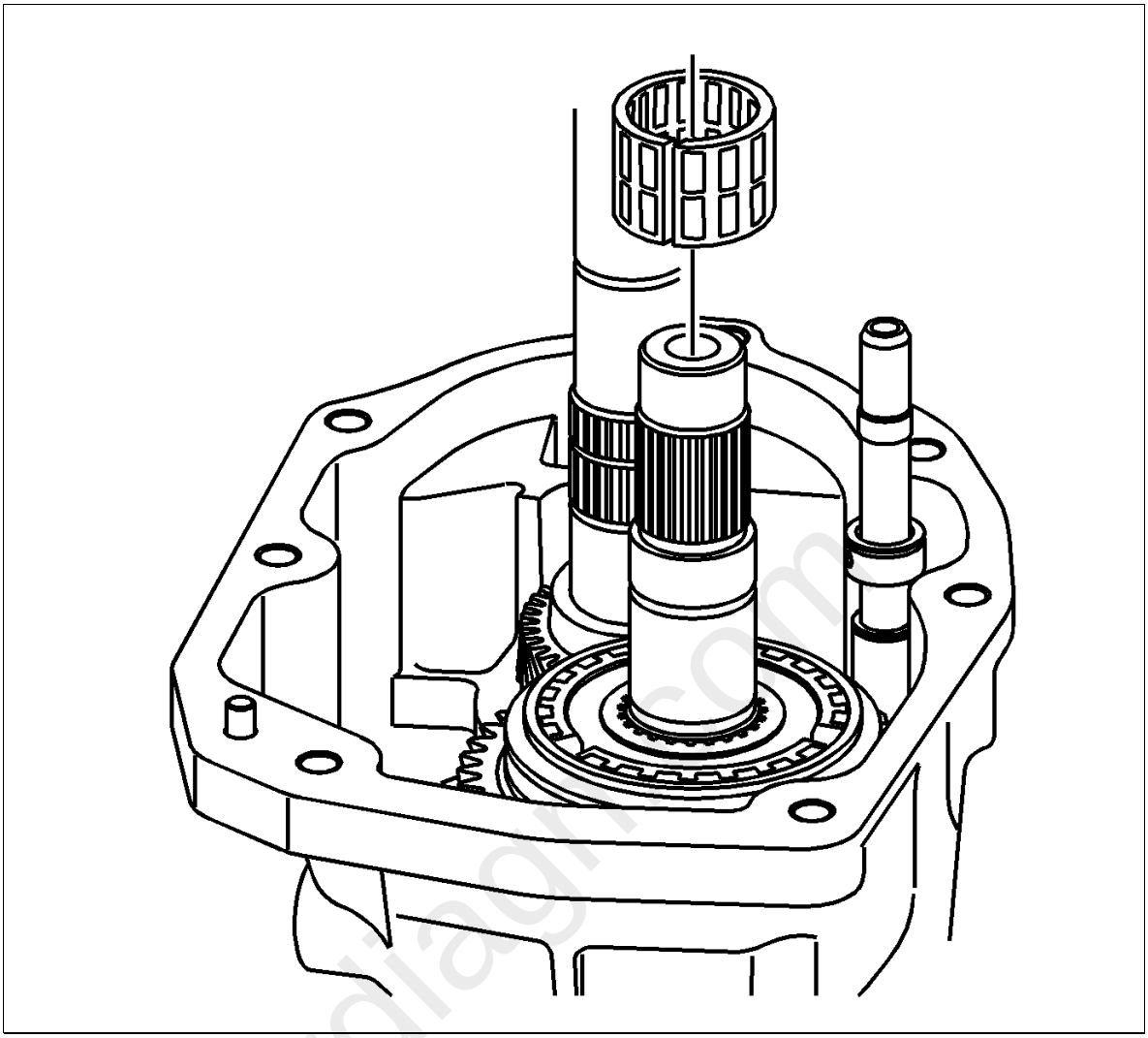
Fig 1: Spacer & Countershaft



Courtesy of GENERAL MOTORS COMPANY

1. Install the spacer to the countershaft.

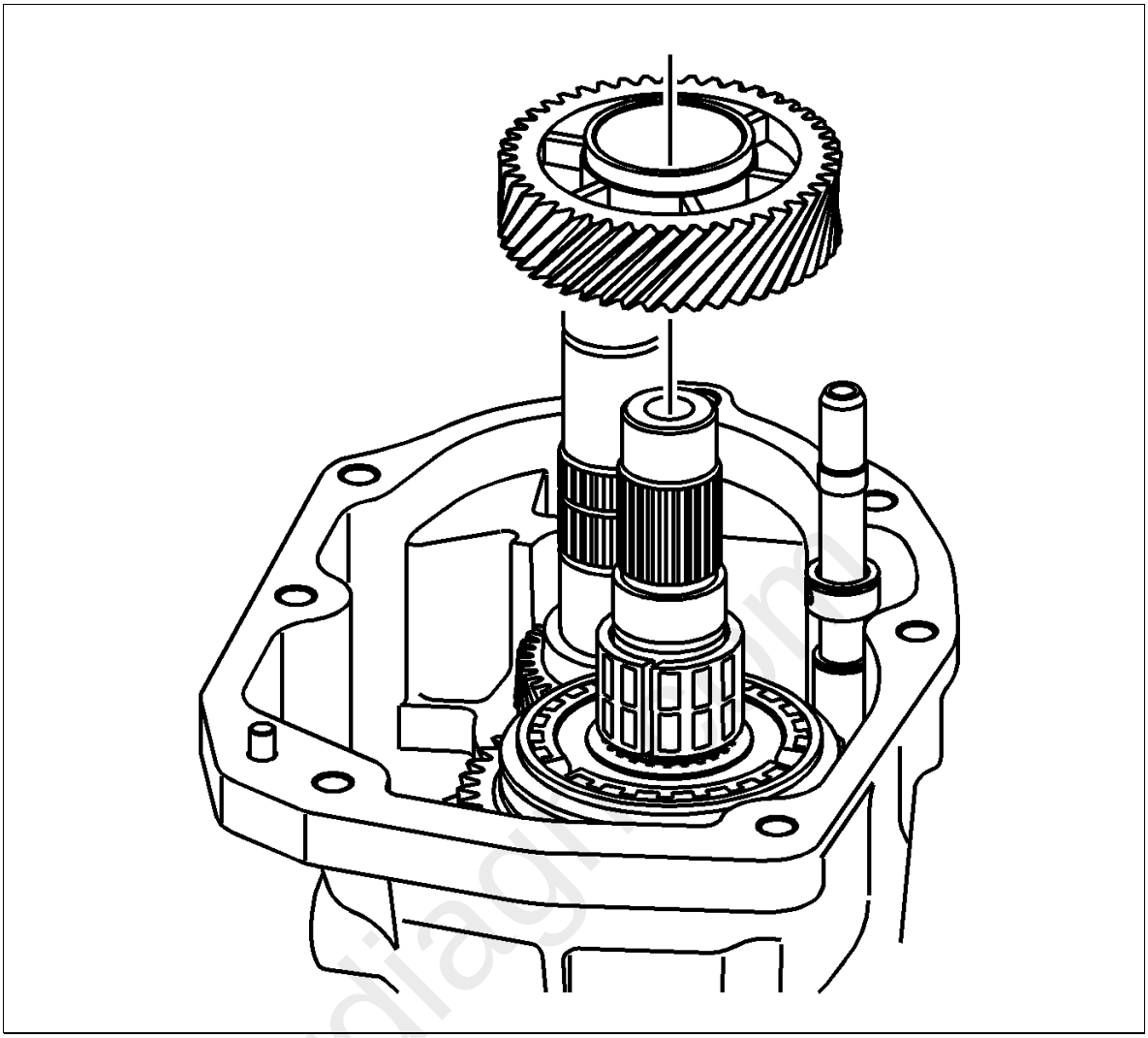
Fig 2: Needle Bearing & Countershaft



Courtesy of GENERAL MOTORS COMPANY

2. Install the needle bearing to the countershaft.

Fig 3: Gear & Countershaft



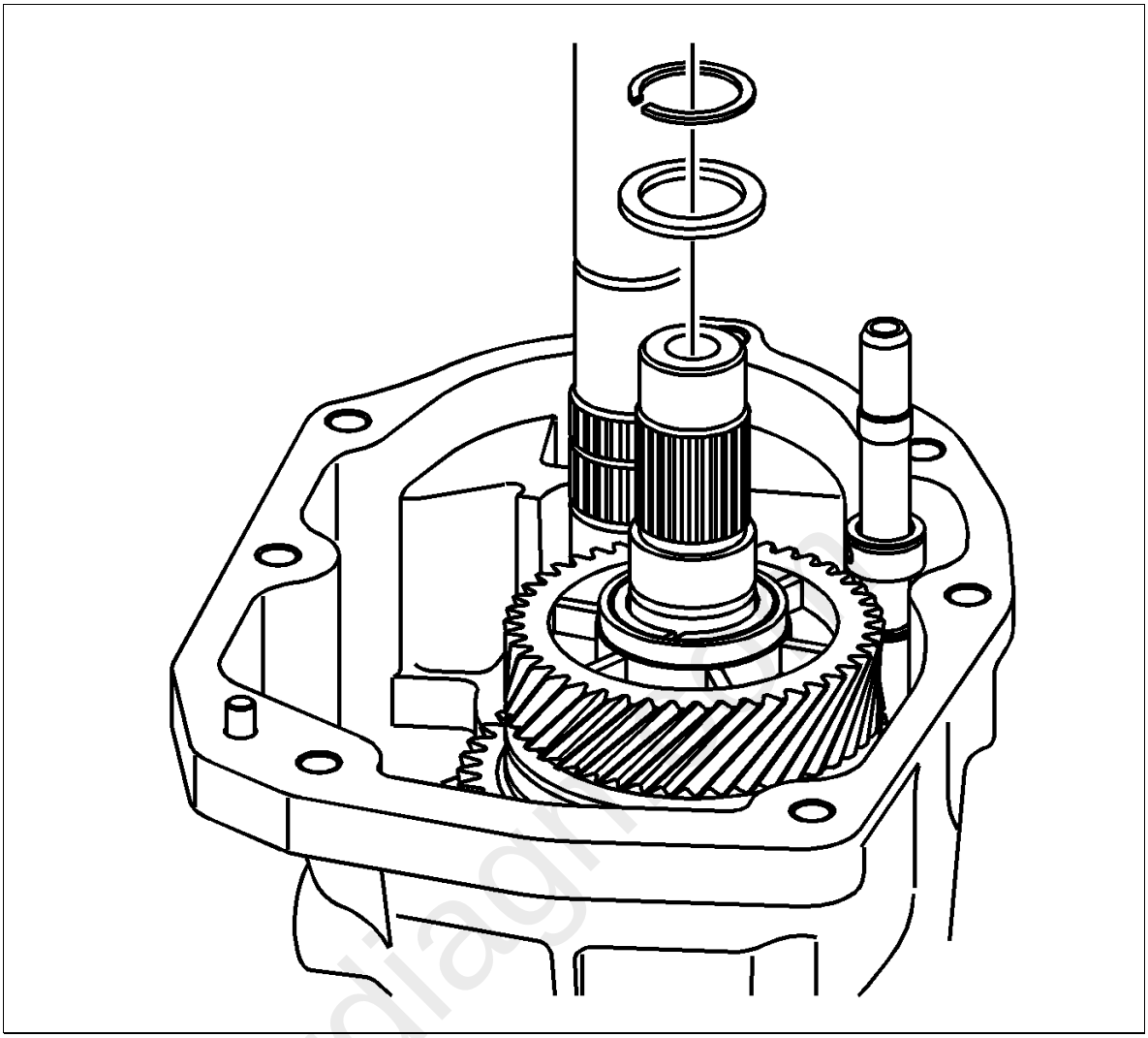
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Align the gear with the raised tabs on the synchronizer to ensure the gear sets flush.

3. Install the gear to the countershaft.

Fig 4: Countershaft Retainer And Spacer

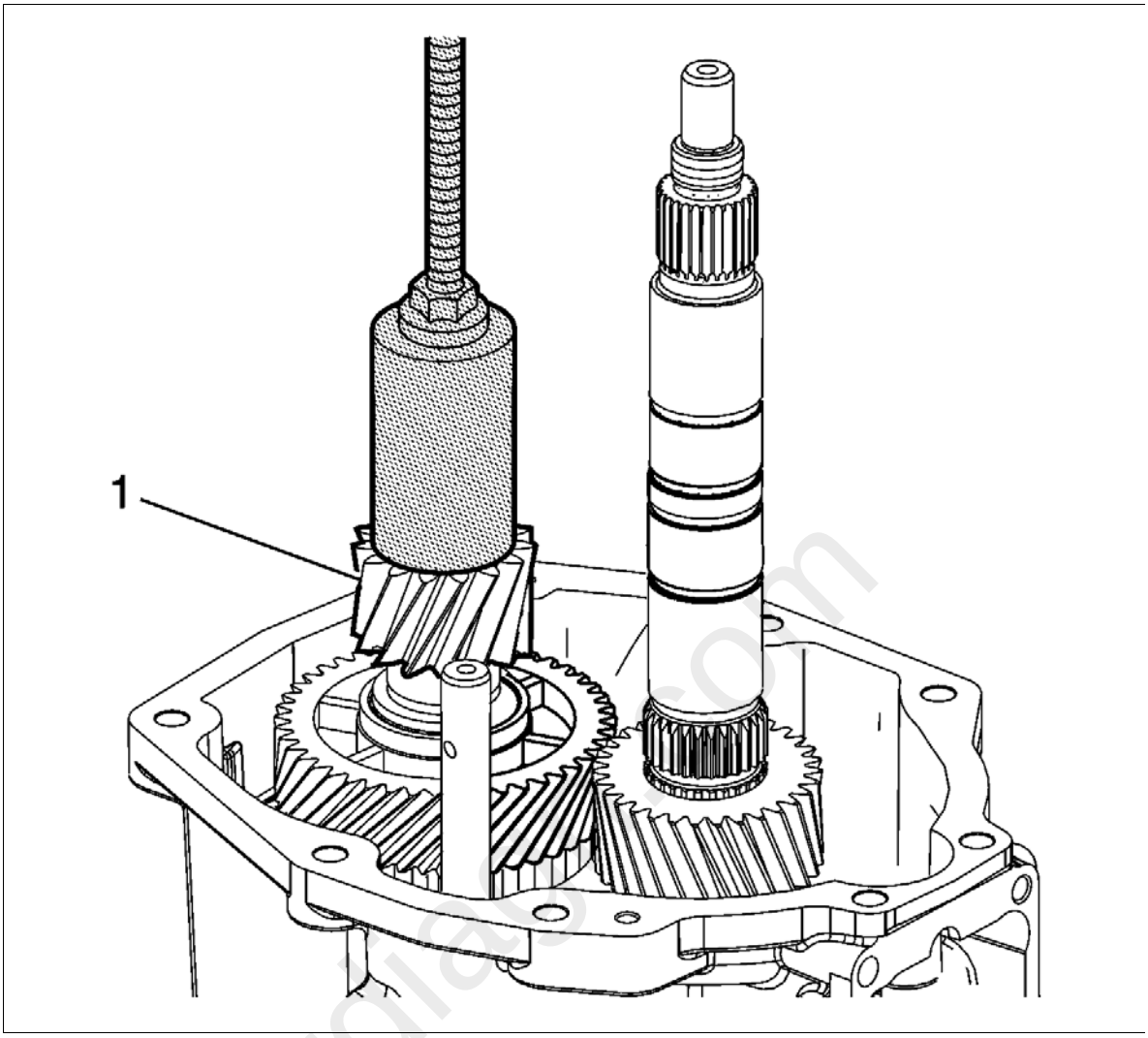


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4. Install the countershaft retainer and spacer.

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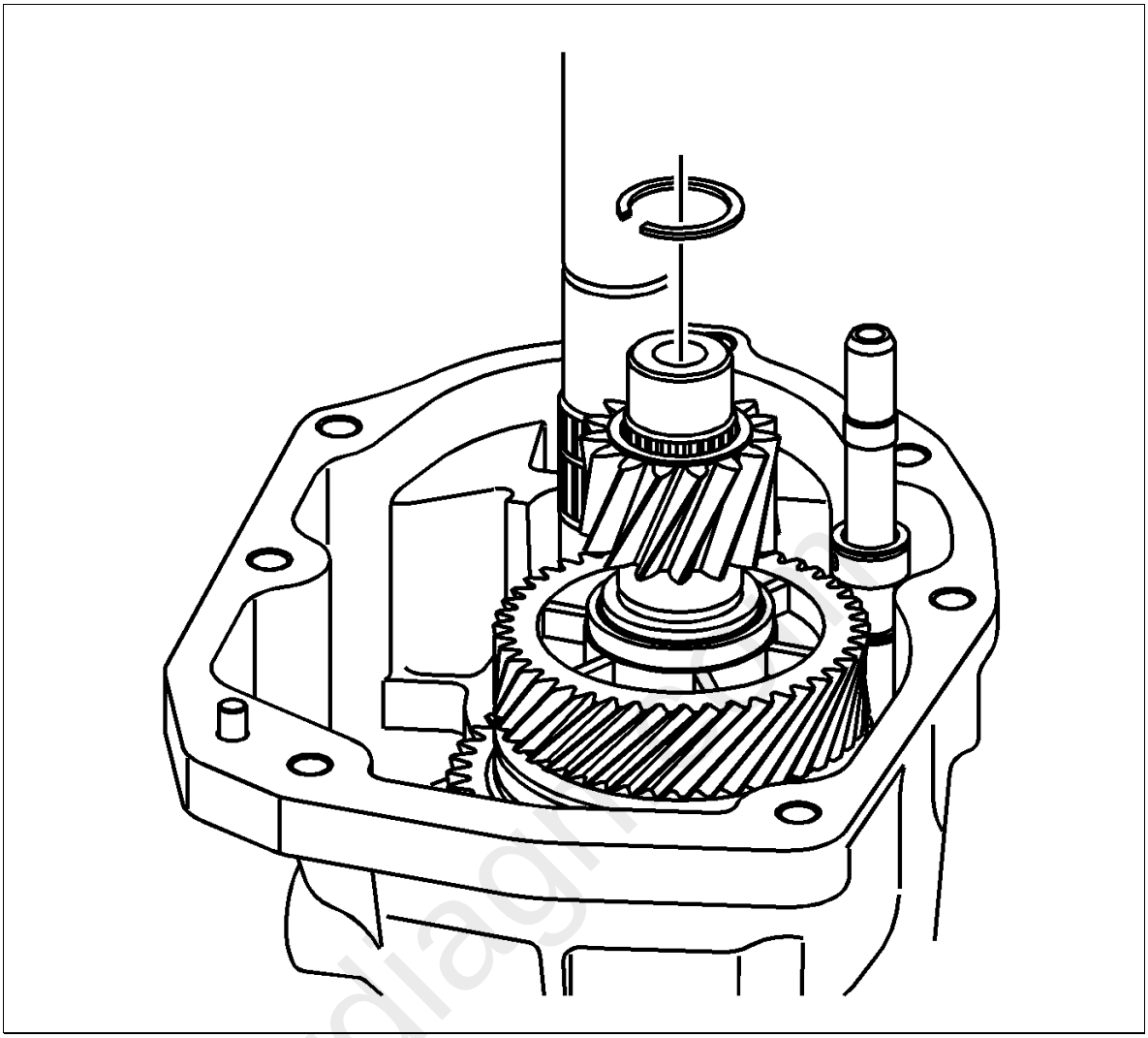
Fig 5: Countershaft Gear



Courtesy of GENERAL MOTORS COMPANY

5. Install the countershaft gear (1) using **J 39441-30** gear installer.

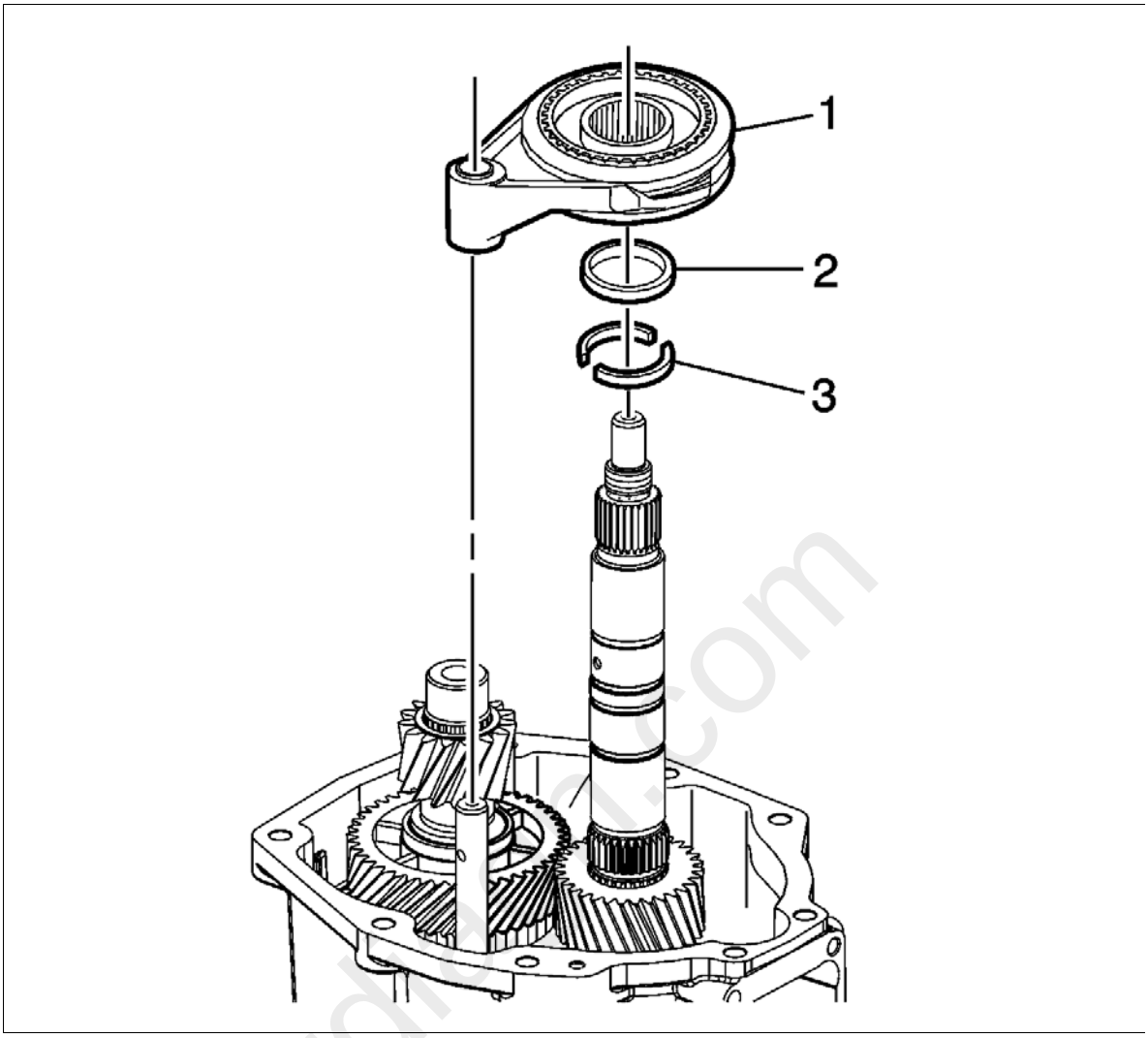
Fig 6: Countershaft Retainer Clip



Courtesy of GENERAL MOTORS COMPANY

6. Install the countershaft retainer ring.

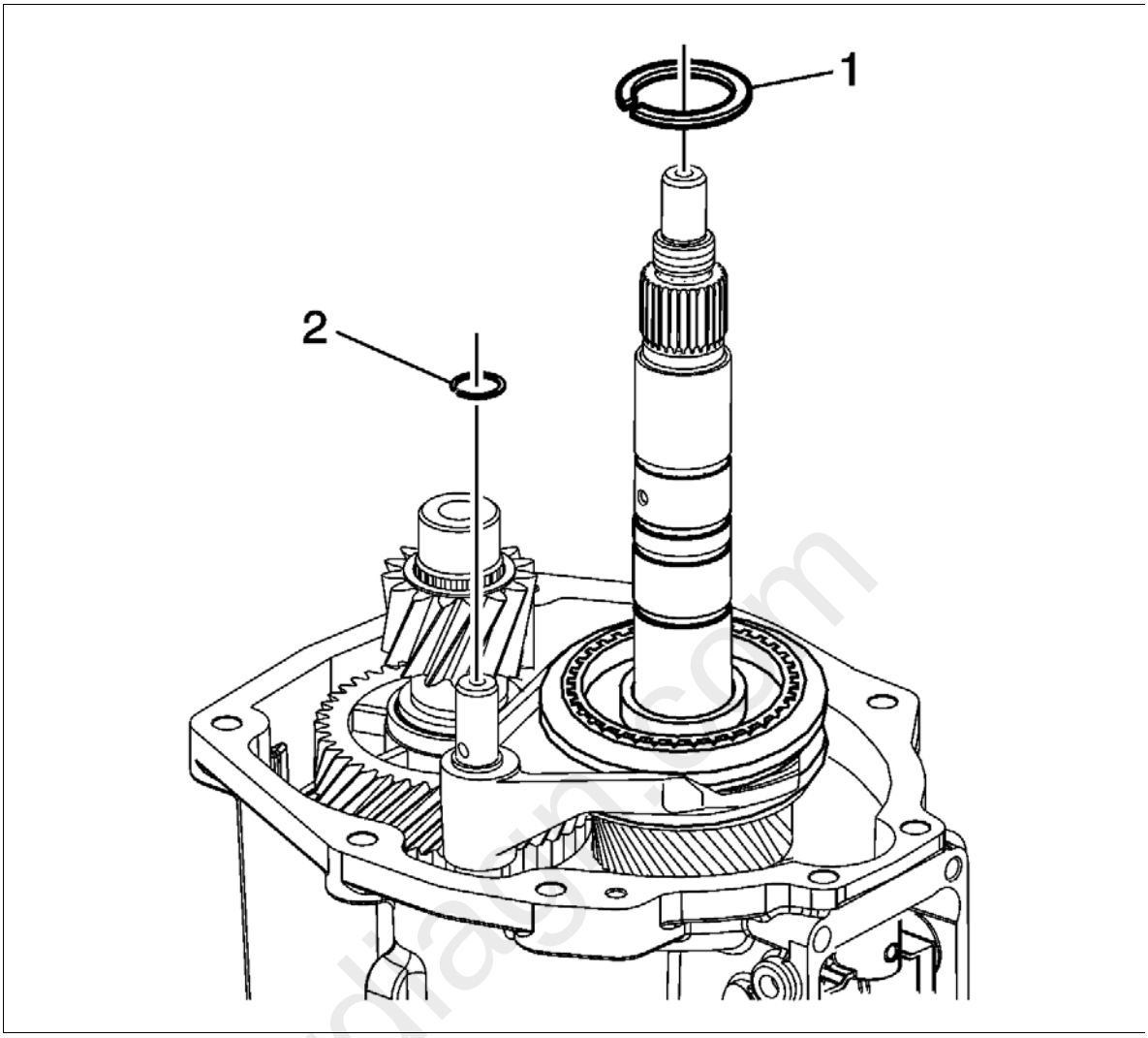
Fig 7: Reverse Shift Fork Components



Courtesy of GENERAL MOTORS COMPANY

7. Install the two piece thrust washer (3).
8. Install the locking ring (2).
9. Install the reverse shift fork and the synchronizer (1).

Fig 8: Reverse Synchronizer & Reverse Shift Fork Retainer Rings

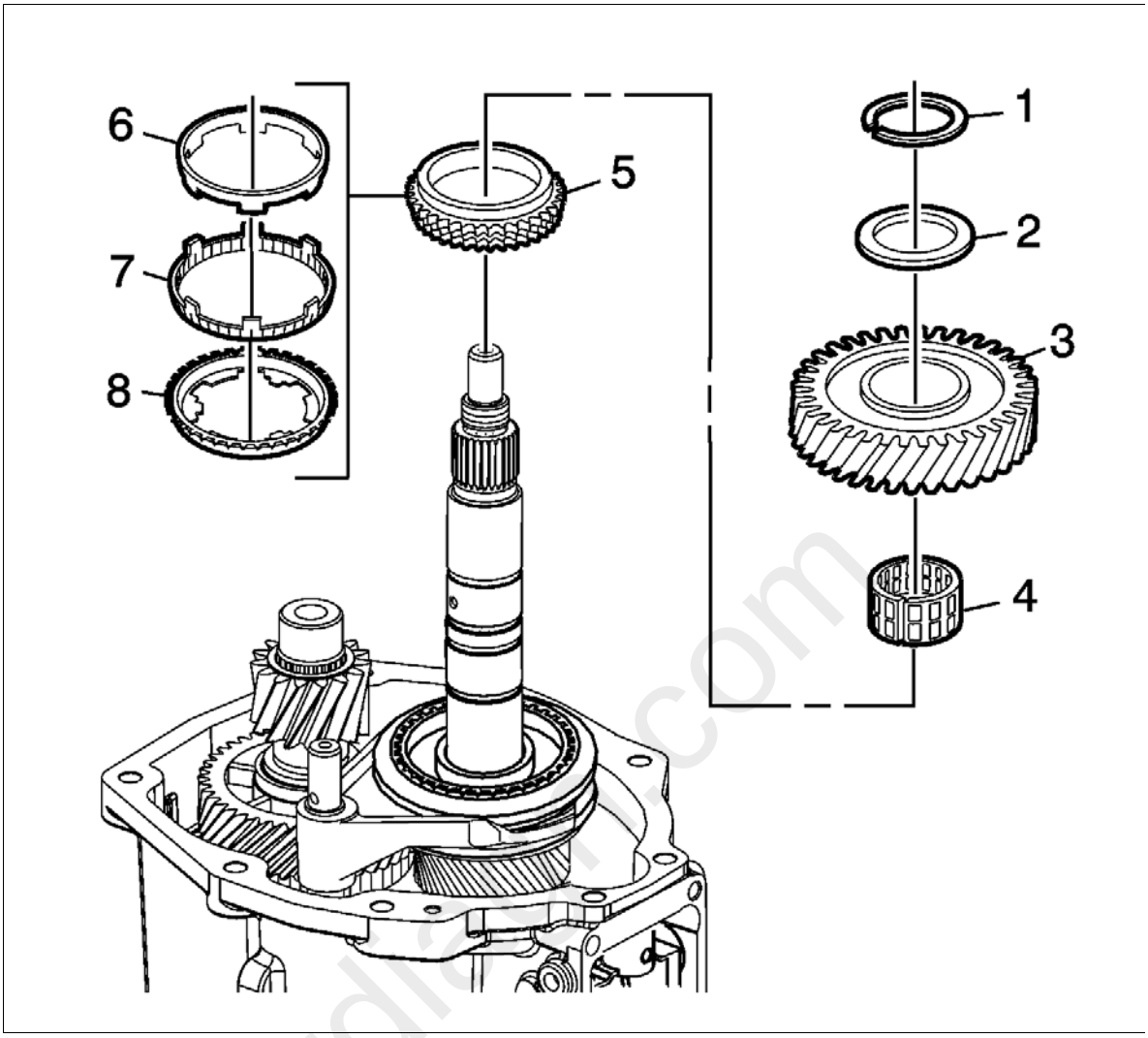


Courtesy of GENERAL MOTORS COMPANY

10. Install a NEW shift fork retainer ring (2).
11. Install the reverse synchronizer retainer ring (1).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION ASSEMBLE (MM6) > REVERSE SPEED GEAR INSTALLATION

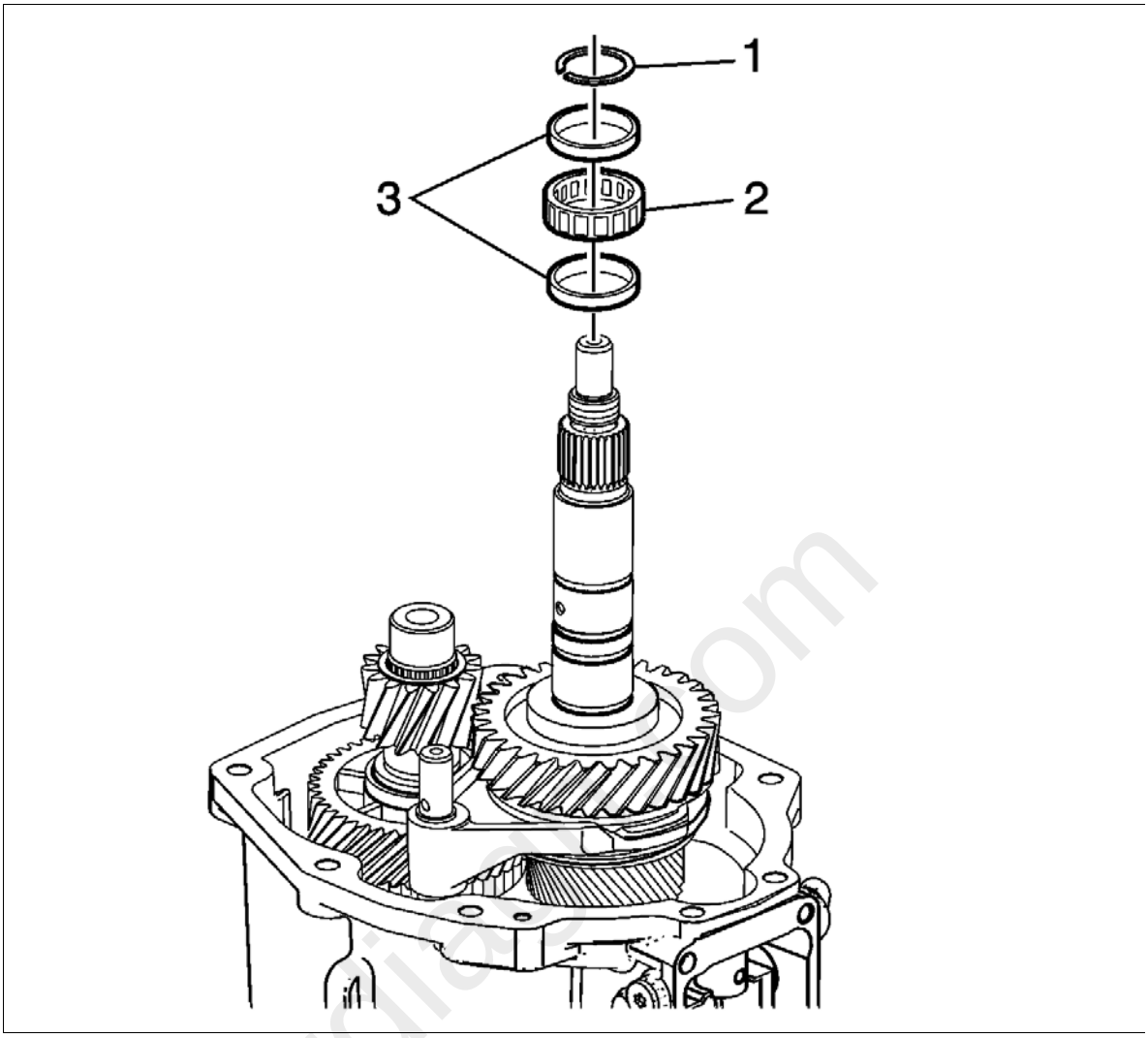
Fig 1: Reverse Gear Components



Courtesy of GENERAL MOTORS COMPANY

1. Install the following parts in order:
    1. The reverse gear blocking ring assembly (5), including the following components:
        1. Reverse gear inner ring (6)
        2. Reverse gear outer ring (7)
        3. Reverse gear blocking ring (8)
    2. The caged needle bearing (4)
    3. The reverse speed gear (3)
    4. The thrust washer (2)
    5. The retainer ring (1)

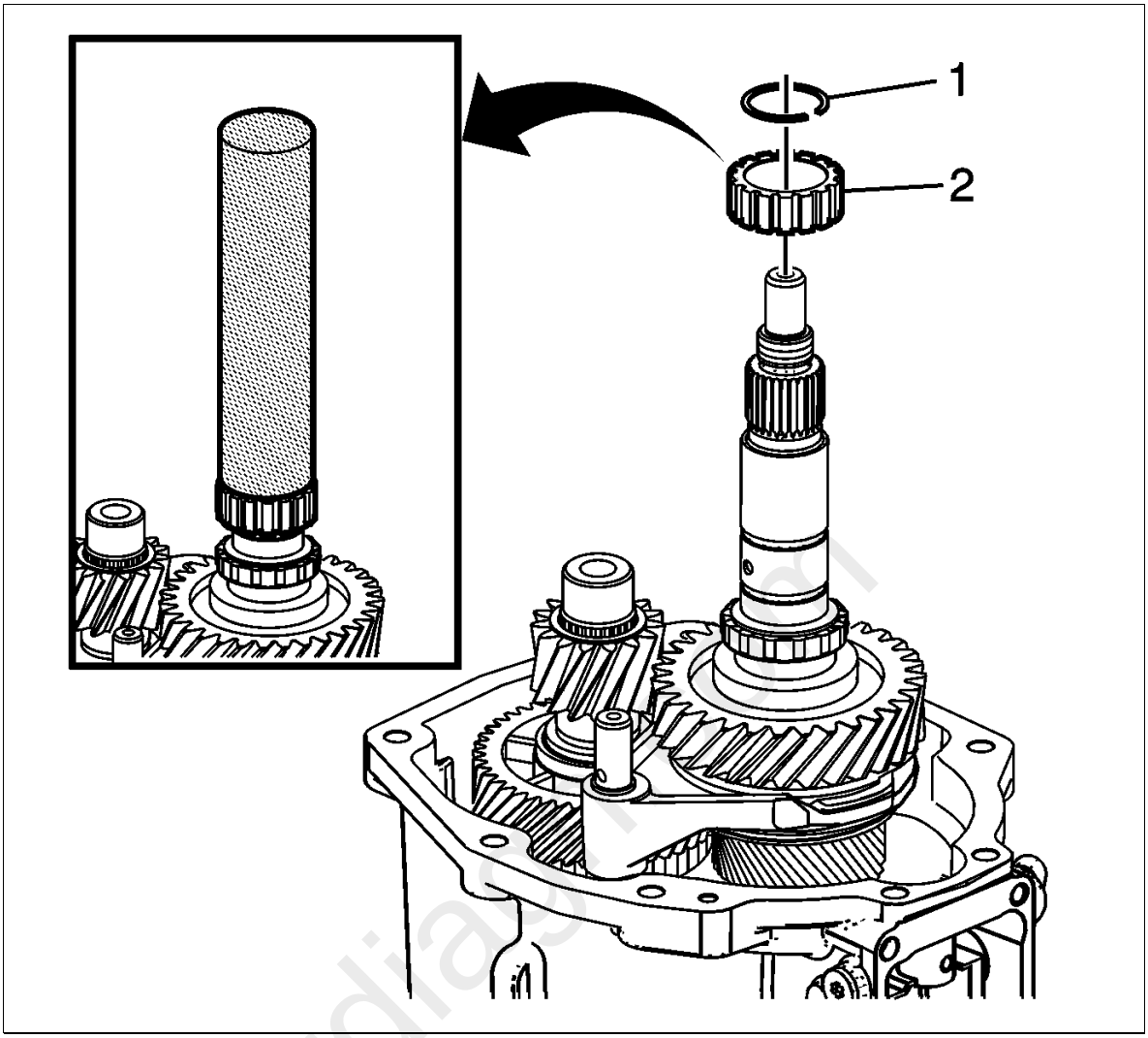
Fig 2: Rear Bearing Retainer Ring, Spacers & Mainshaft Rear Roller Bearing



Courtesy of GENERAL MOTORS COMPANY

2. Install the following parts in order:
    1. The spacer (3)
    2. The roller bearing (2)
    3. The spacer (3)
    4. The roller bearing retainer ring (1)

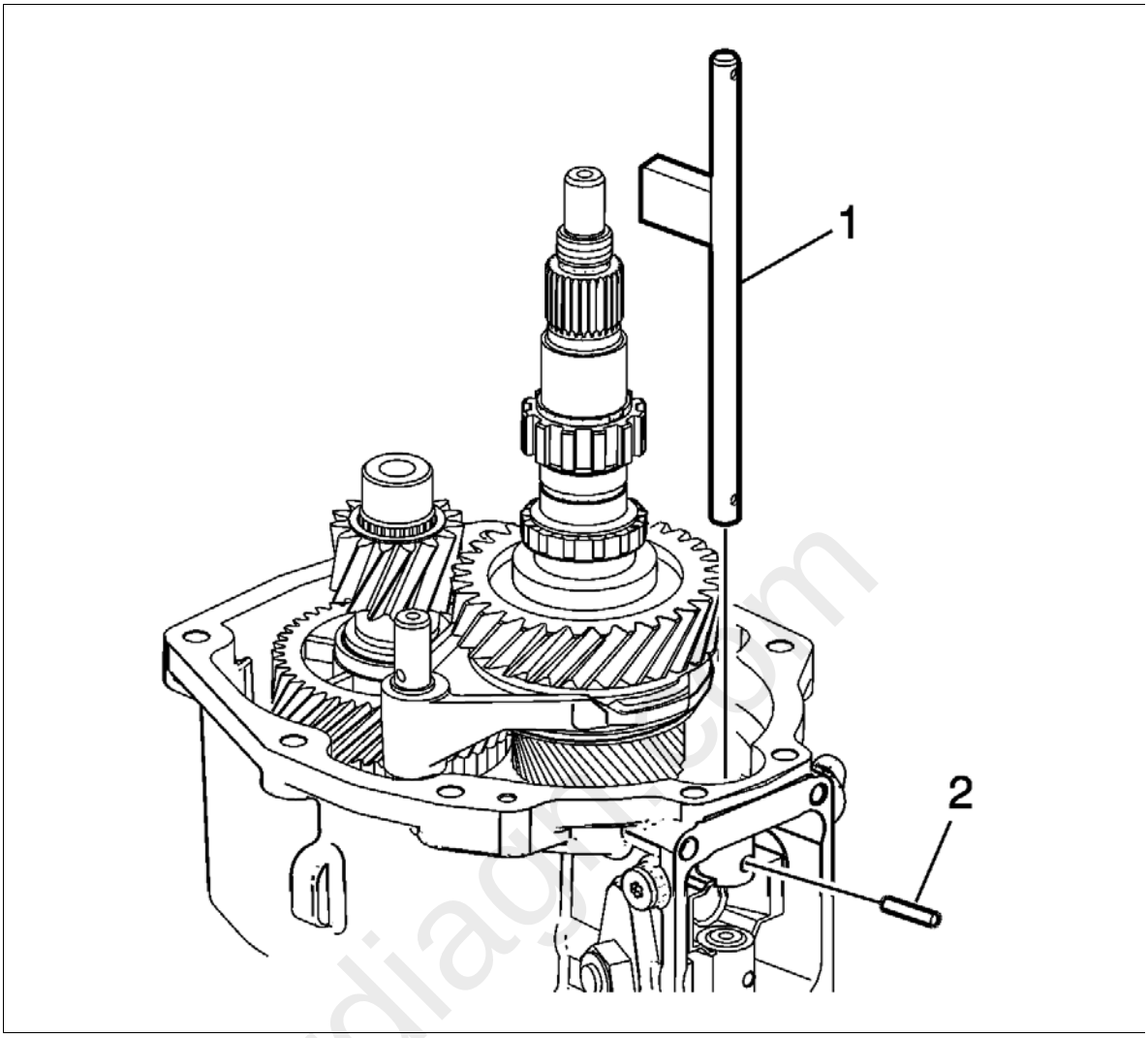
Fig 3: Locking Ball, Speed Sensor Rotor & Snap Ring



Courtesy of GENERAL MOTORS COMPANY

3. Install the following parts in order:
    1. The speed sensor rotor (2) using **J 38205-1** press tube
    2. The snap ring (1)

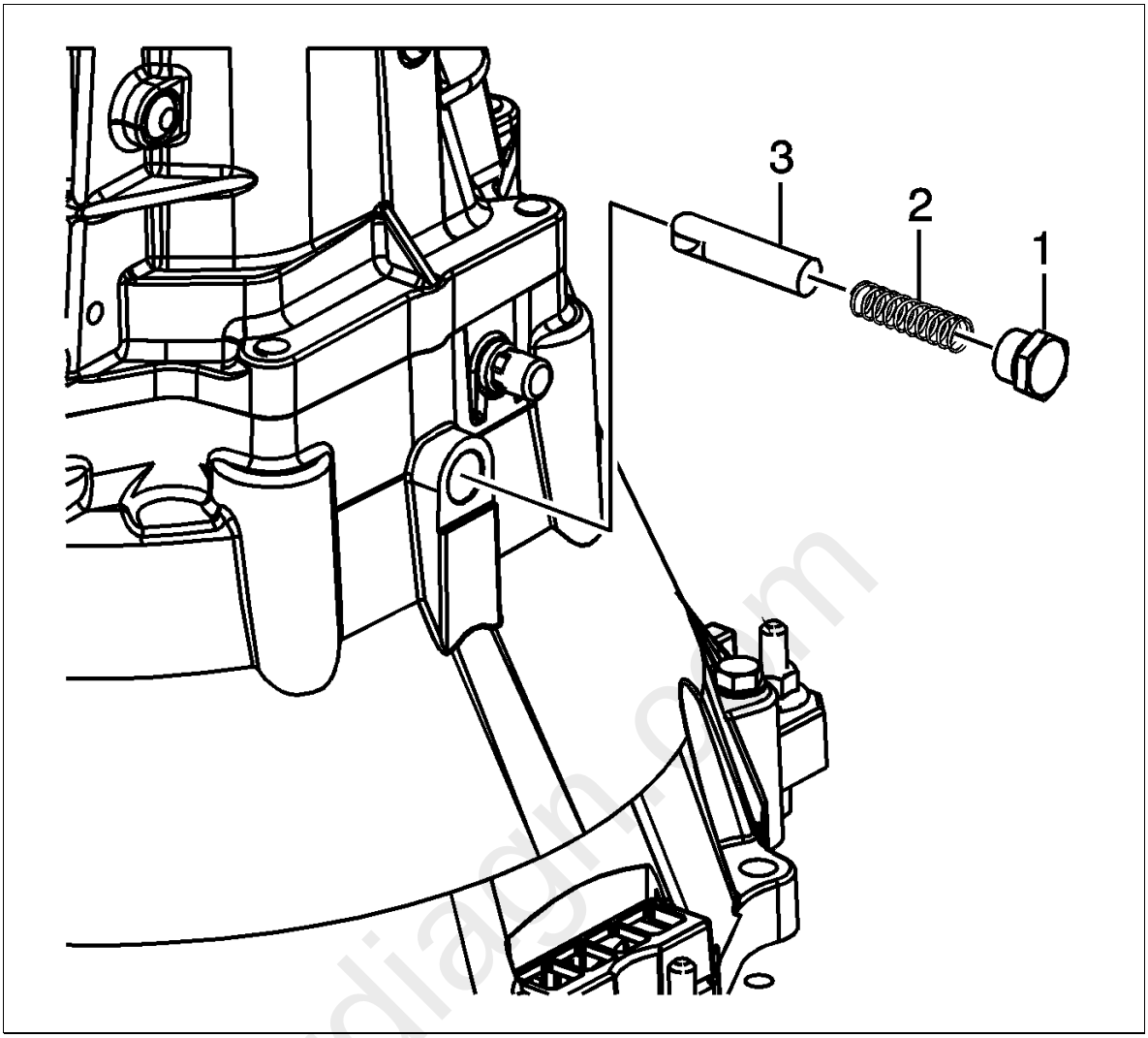
Fig 4: Offset Shift Lever & Shift Guide Rollpin



Courtesy of GENERAL MOTORS COMPANY

4. Install the extension housing main shaft bearing race (3).
5. Install the shift shaft extension (2).
6. Install NEW shift guide roll pin (1).

Fig 5: Plug, Spring & Shift Detent Roller

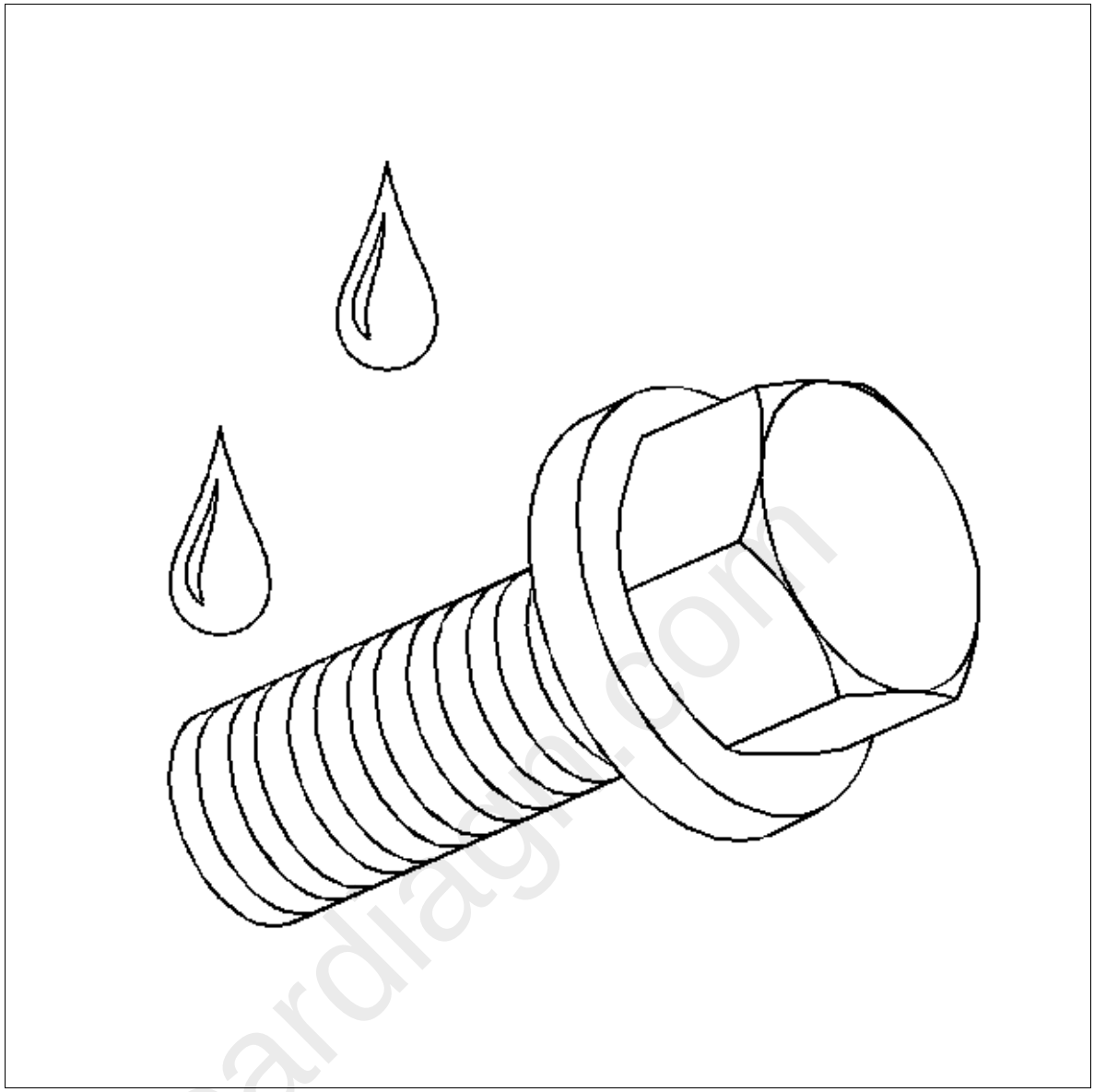


Courtesy of GENERAL MOTORS COMPANY

7. Lift up on the shift shaft extension while installing the shift detent roller (3), spring (2) and plug (1). Tighten the plug to 21 N.m (16 lb in).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION ASSEMBLE (MM6) > EXTENSION HOUSING ASSEMBLY INSTALLATION

Fig 1: Sealant To Reverse Idler Shaft Brackets Bolt Threads

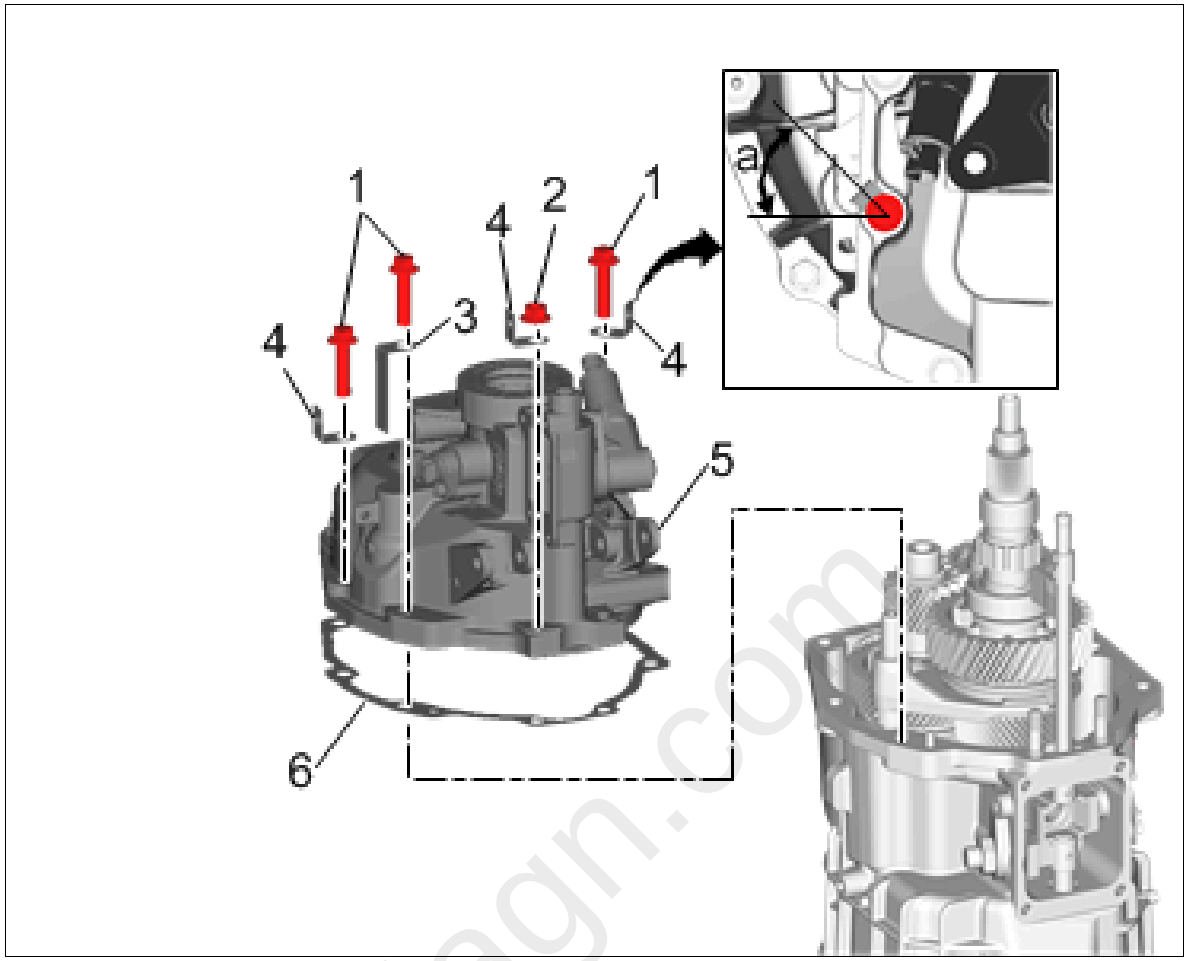


Courtesy of GENERAL MOTORS COMPANY

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1. Apply thread sealer GM P/N 12346004, (Canadian P/N 10953480) or equivalent to the top 2 extension housing bolts.

Fig 2: Rear Extension Housing Bolts



Courtesy of GENERAL MOTORS COMPANY

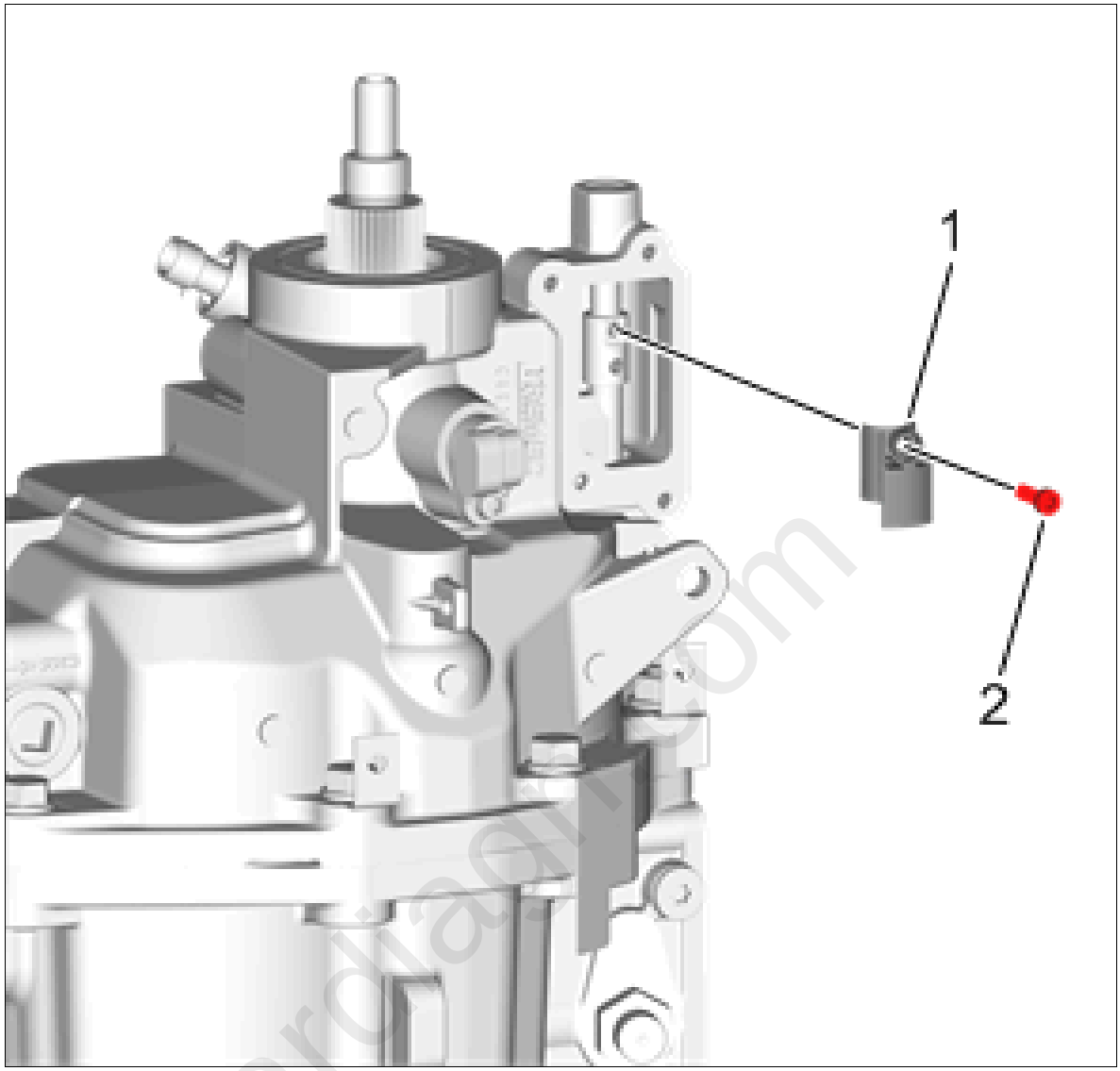
NOTE:

Align the 5th/6th shift shaft to the extension housing bore in order to install the extension housing.

2. Install the extension housing gasket (3).
3. Install the extension housing (2) and bolts (1). Tighten to 48 N.m (36 lb ft).

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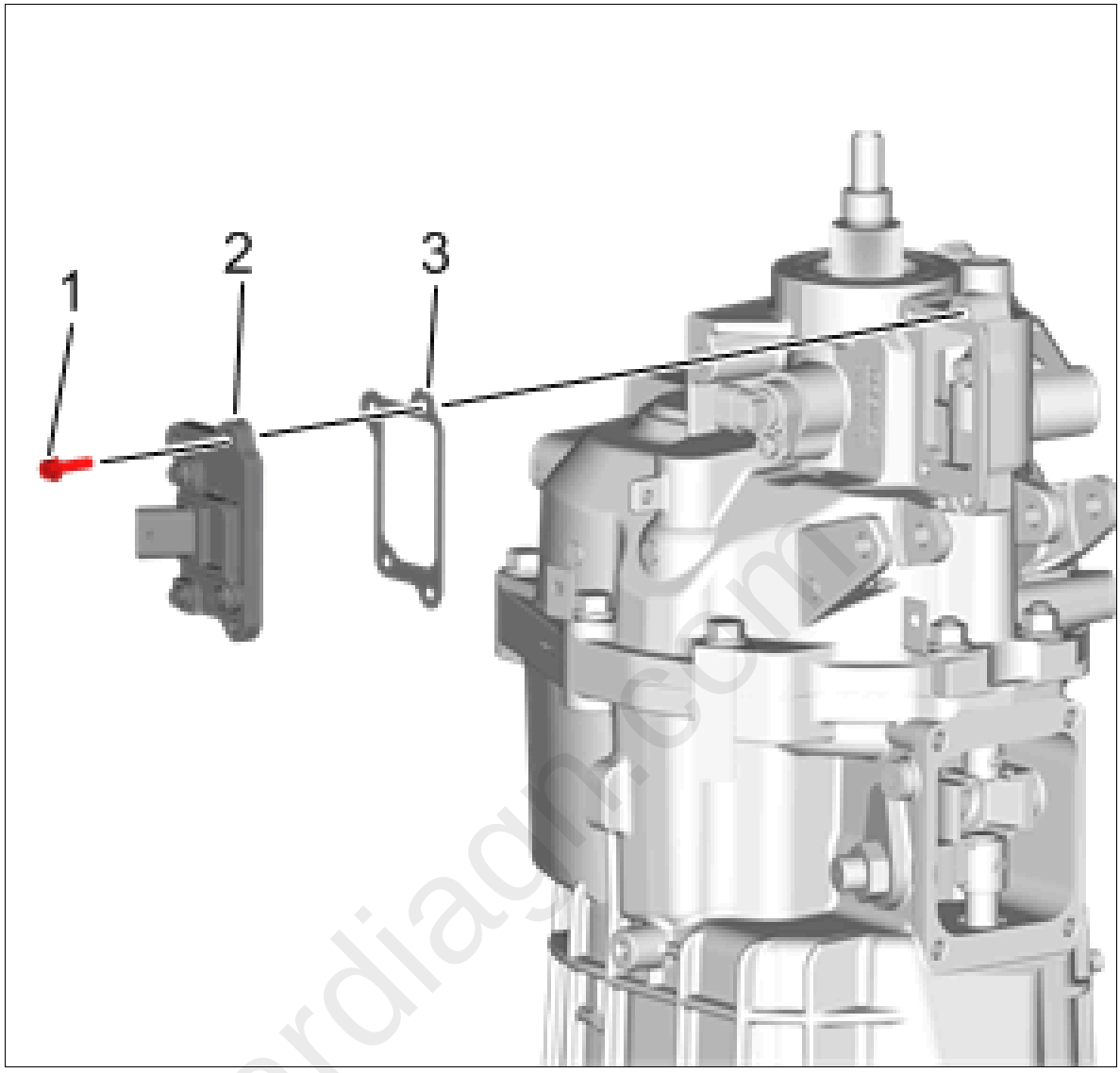
Fig 3: Transmission Gap Magnet



Courtesy of GENERAL MOTORS COMPANY

4. Install the transmssion gap magnet (2) and bolt (1).

Fig 4: Transmission Gear Position Sensor

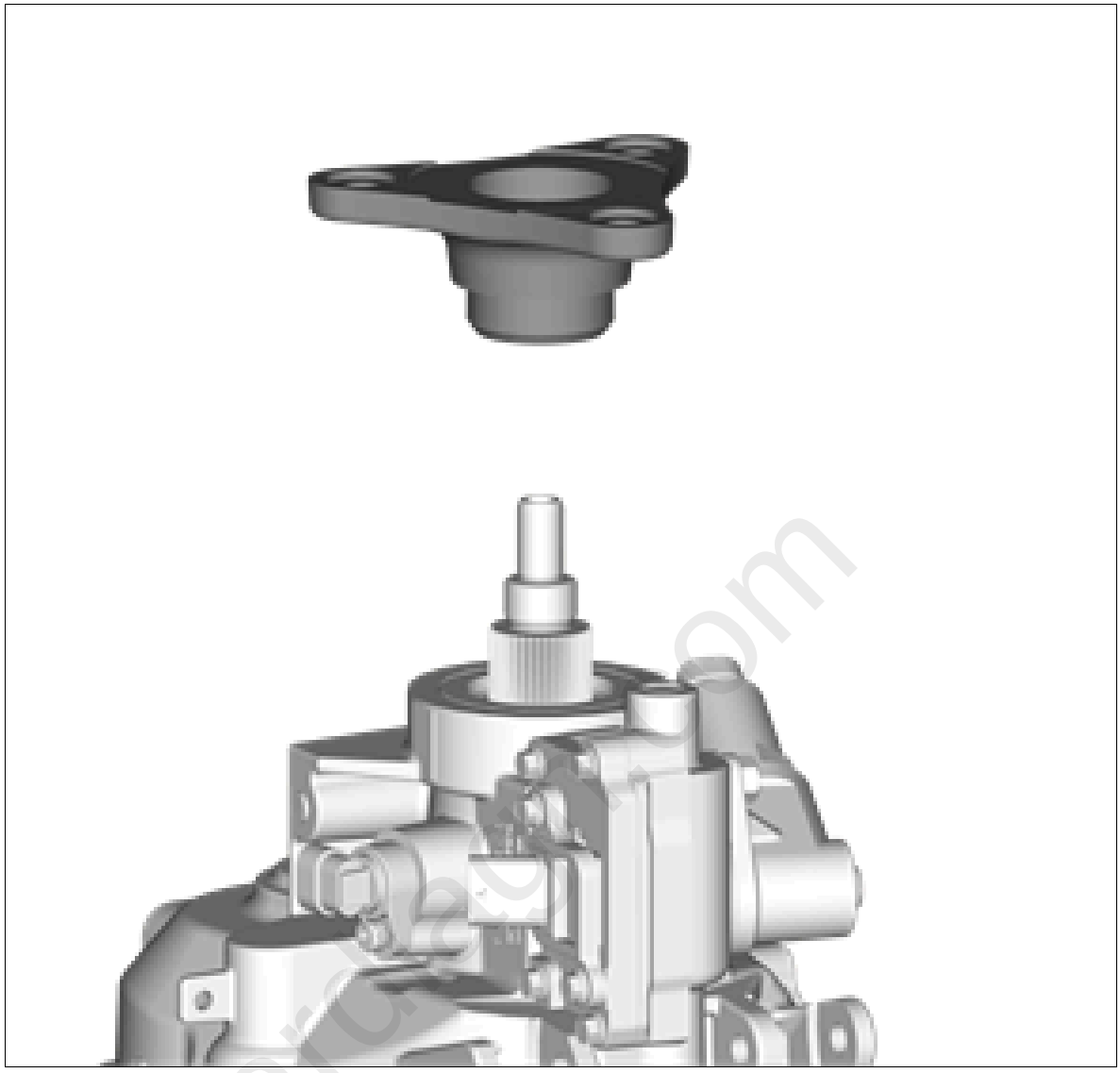


Courtesy of GENERAL MOTORS COMPANY

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5. Install the manual transmission gear position sensor gasket (3) and the manual transmission gear position sensor (2).
6. Install the manual transmission gear position sensor bolts (1). Tighten to 8 N.m (71 lb in).

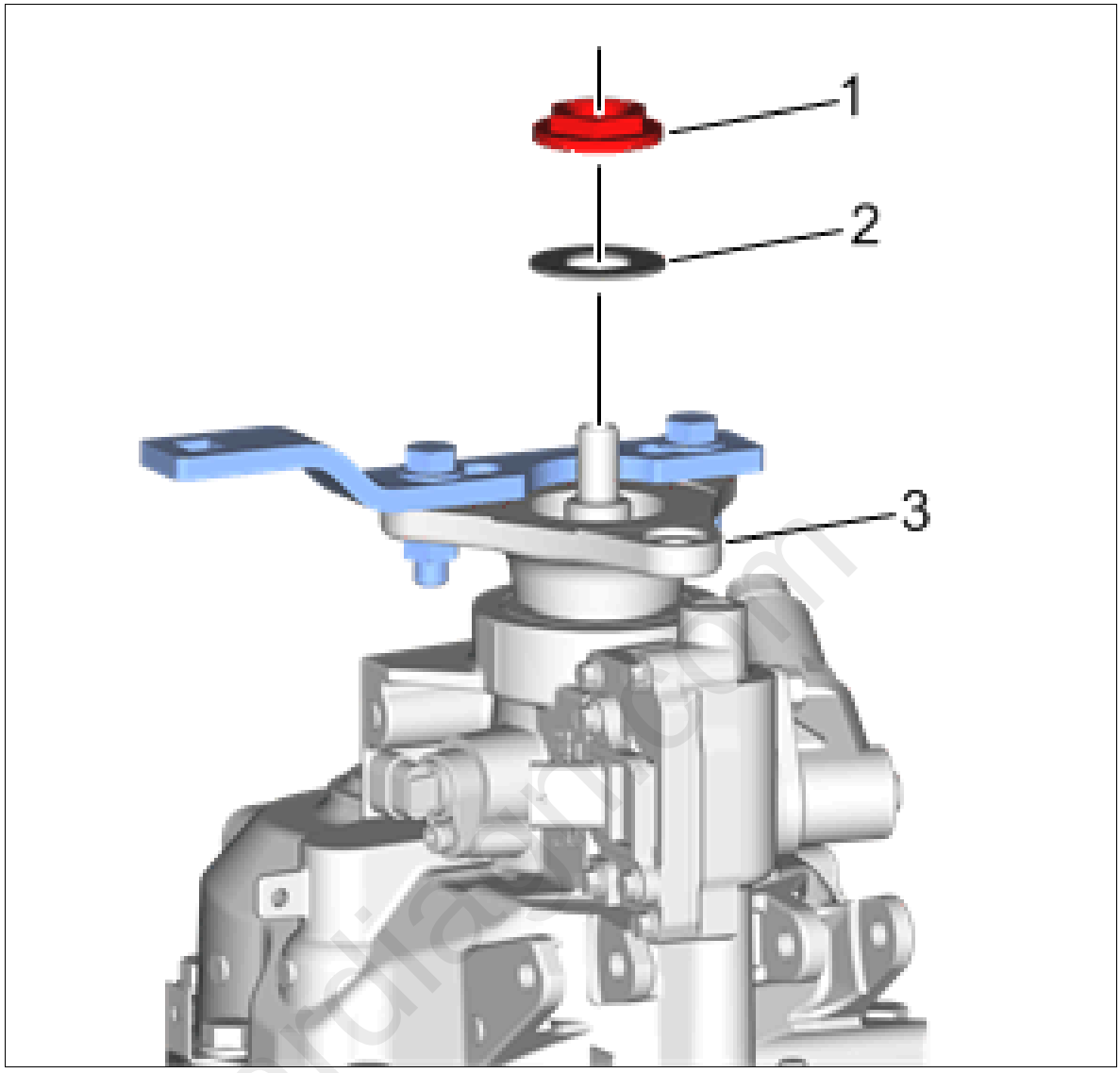
Fig 5: Propeller Shaft Transmission Yoke



Courtesy of GENERAL MOTORS COMPANY

7. Install the propeller shaft transmission yoke (1).

Fig 6: Propeller Shaft Washer

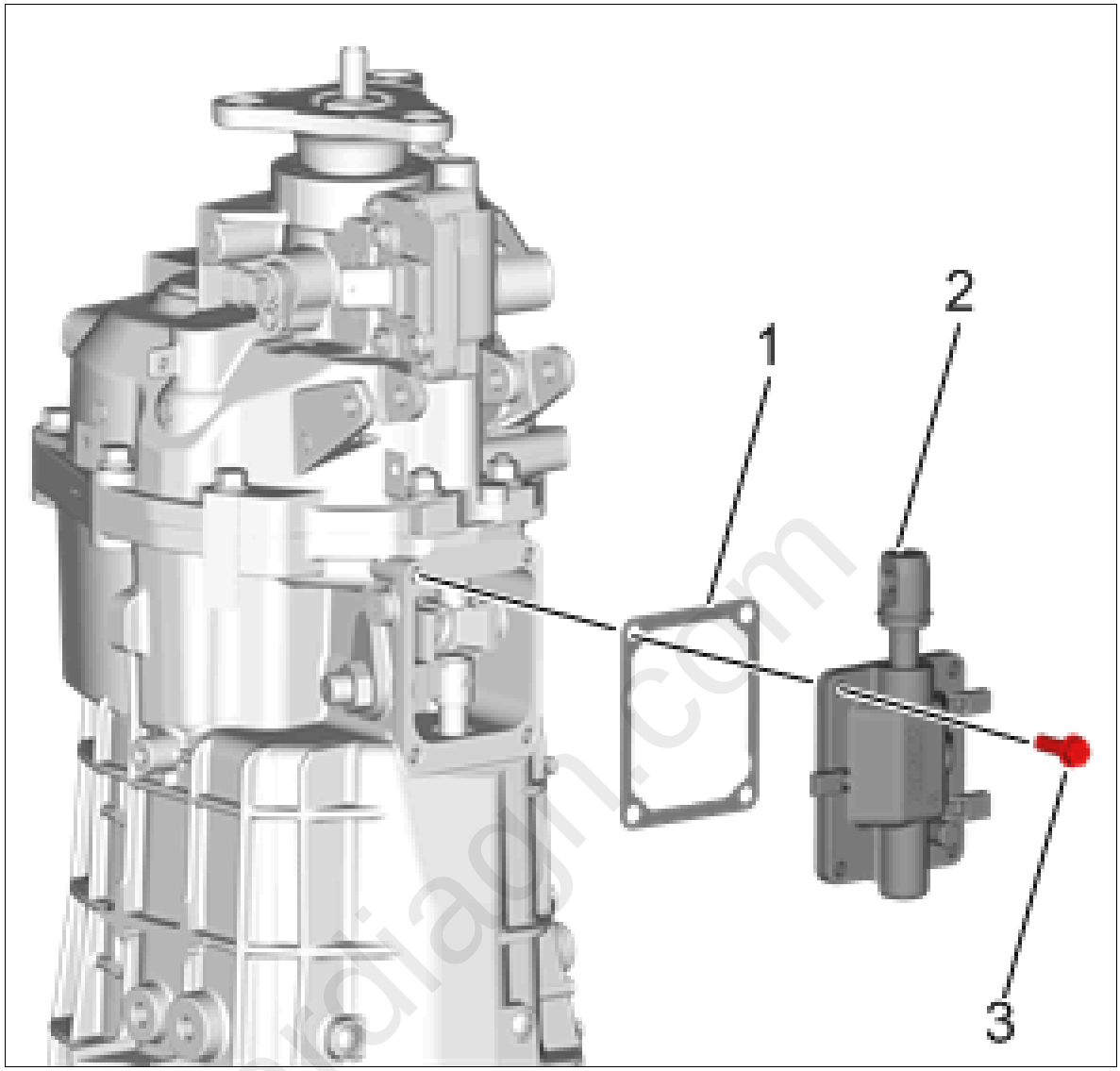


Courtesy of GENERAL MOTORS COMPANY

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8. Install the propeller shaft washer (2) and nut (1).
9. Use the **J-45012** holder (3) and tighten the nut (1) to 136 N.m (100 lb ft)

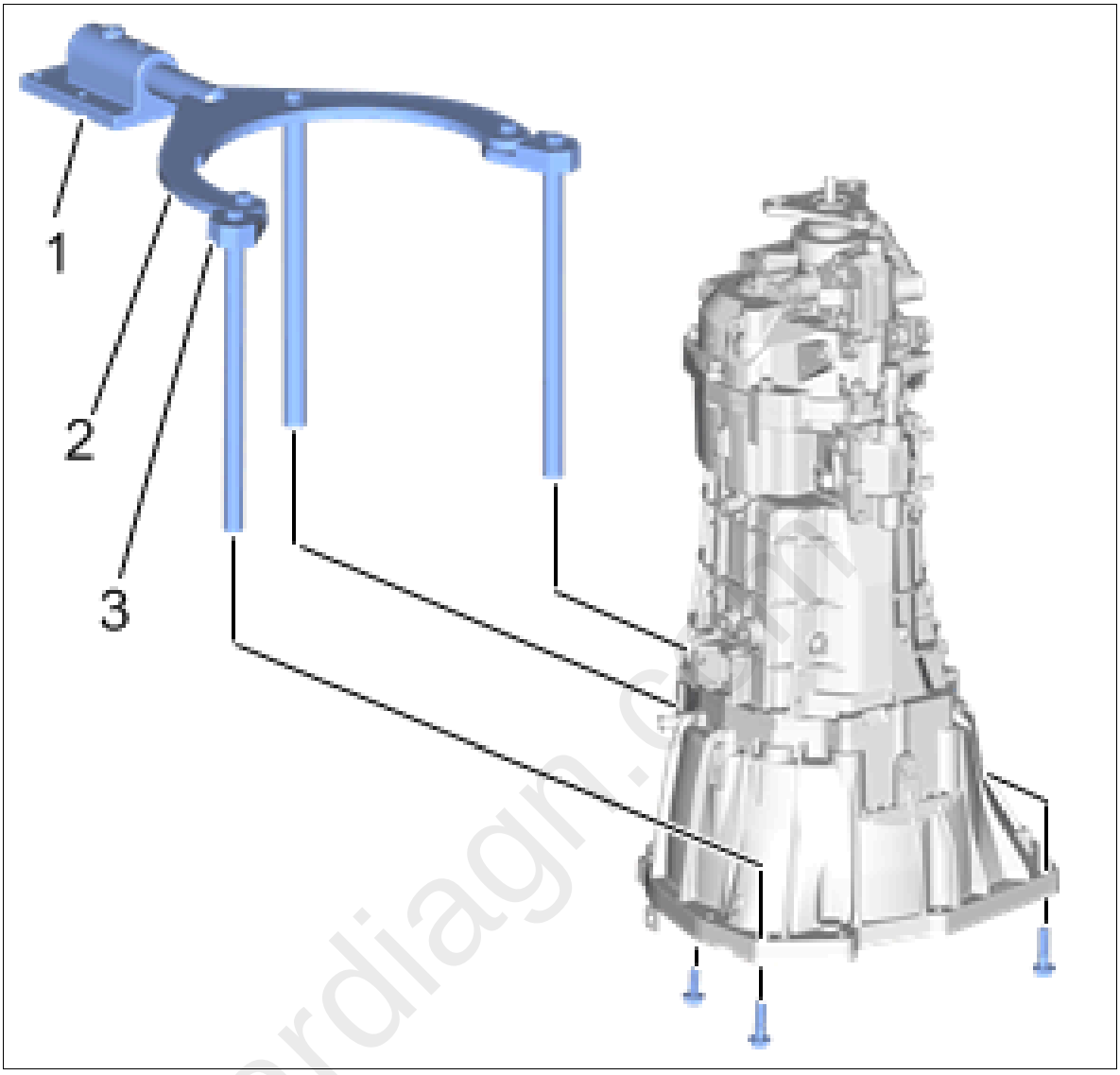
Fig 7: Shifter Cover Plate Bolts



Courtesy of GENERAL MOTORS COMPANY

10. Install the shifter cover plate (2) and gasket (1).
11. Install the shifter cover plate bolts (3) and tighten to 20 N.m (15 lb ft).

Fig 8: Holding Fixture



Courtesy of GENERAL MOTORS COMPANY

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12. Remove the **DT-47678** flange (2) and **DT-47678-10** adapter.
13. Remove the **DT-47678** flange and **DT-47678-10** adapter from **J-3289-20** fixture (1).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION ASSEMBLE (M13 - LGX W/O L4Q, LTG)

Special Tools

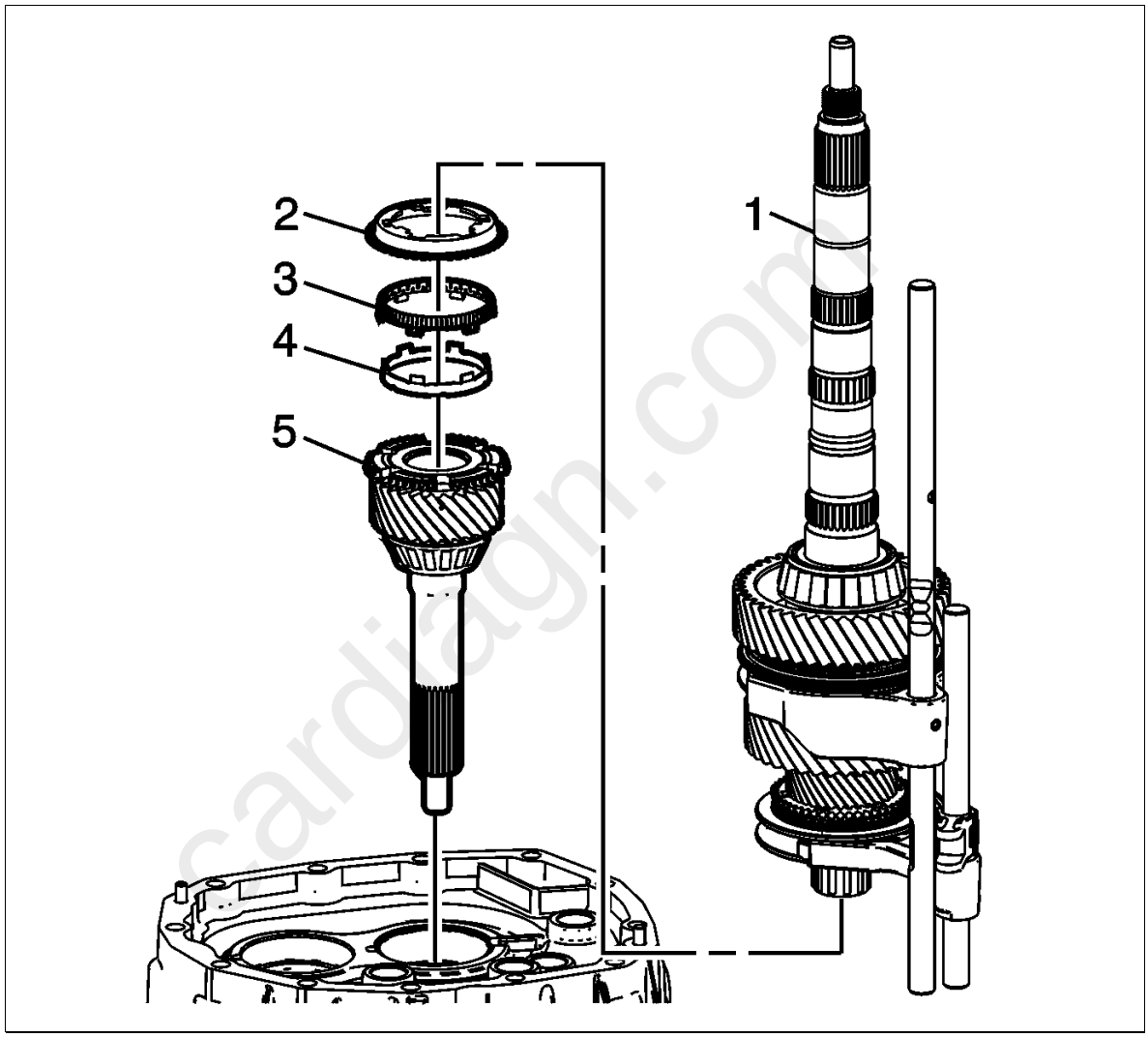
- **DT-51076** Bearing and Gear Installer
- **DT-47678** Transmission Holding Flange
- **DT-47678-10** Transmission Holding Flange Adapter

- **J-45012** Holding Fixture

Equivalent regional tools:Special Tools (M13) .

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION ASSEMBLE (M13 - LGX W/O L4Q, LTG) > SHIFT SHAFT ASSEMBLIES AND GEAR CLUSTER INSTALL

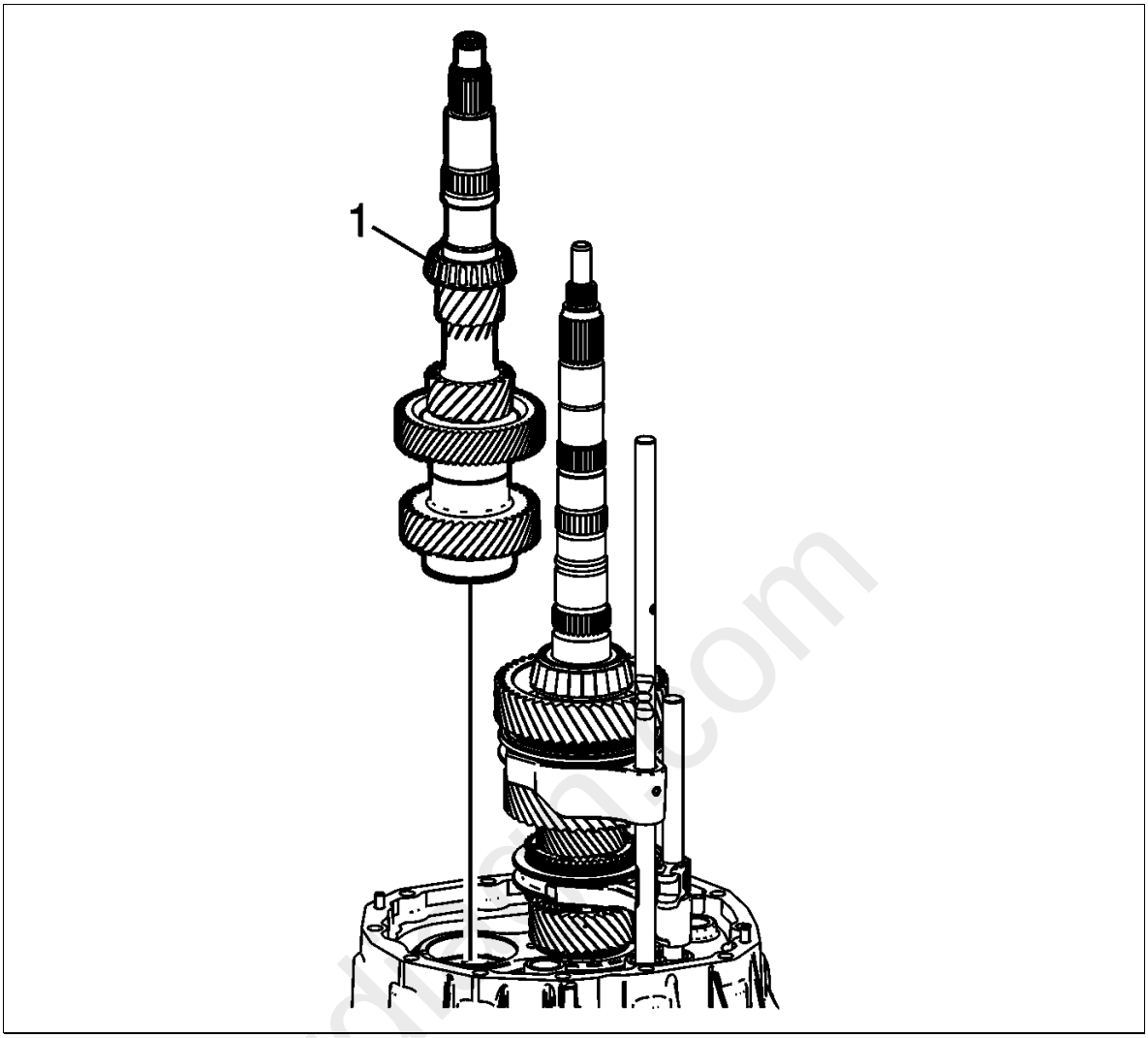
Fig 1: Input Shaft Assembly & Related Components



Courtesy of GENERAL MOTORS COMPANY

1. Install the input shaft (5).
2. Install the 5th gear blocking ring assembly (2, 3, 4).
3. Install the main shaft, shift shafts, and shift forks as an assembly (1).

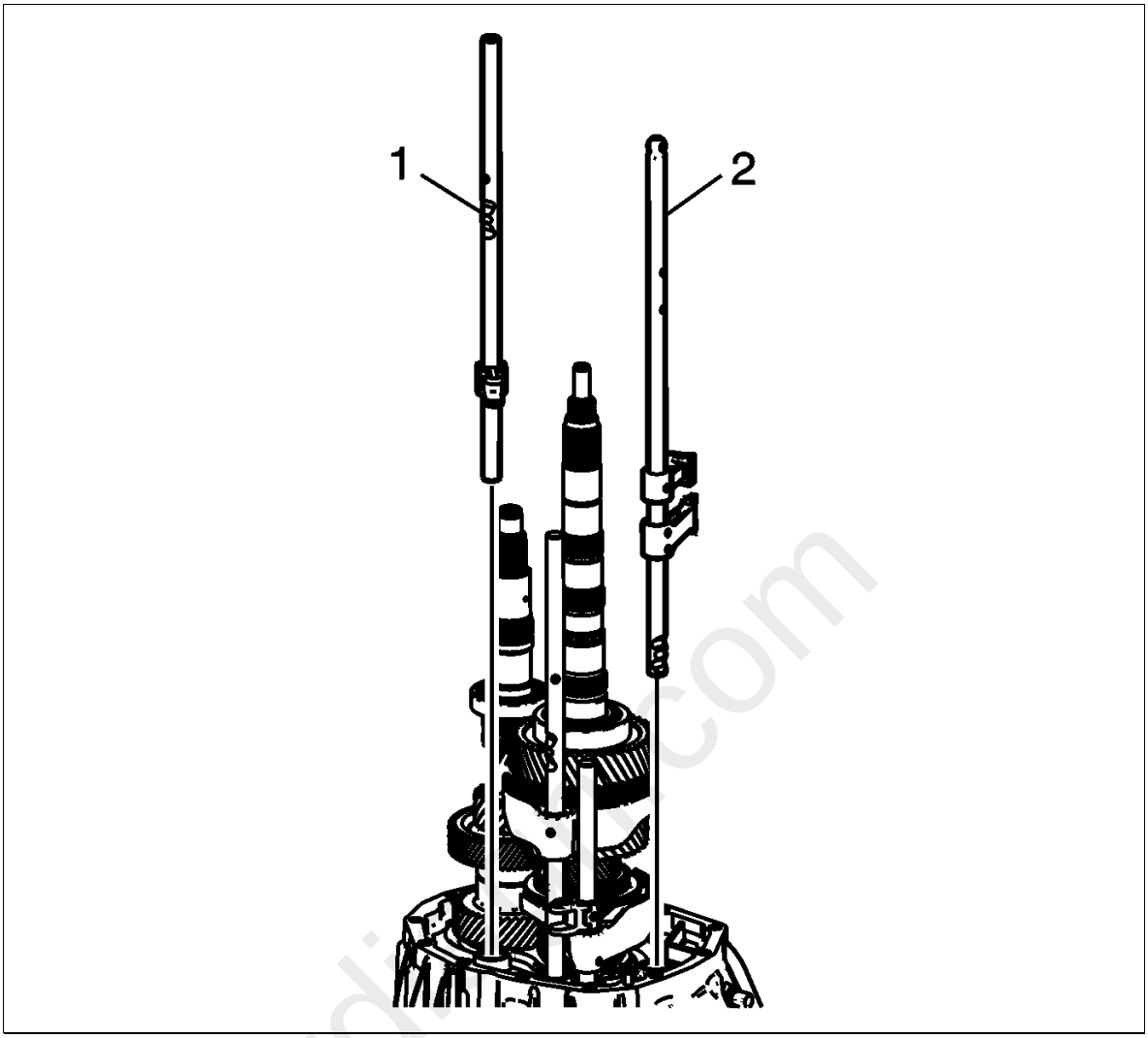
Fig 2: Counter Gear Assembly



Courtesy of GENERAL MOTORS COMPANY

4. Install the counter gear assembly (1).

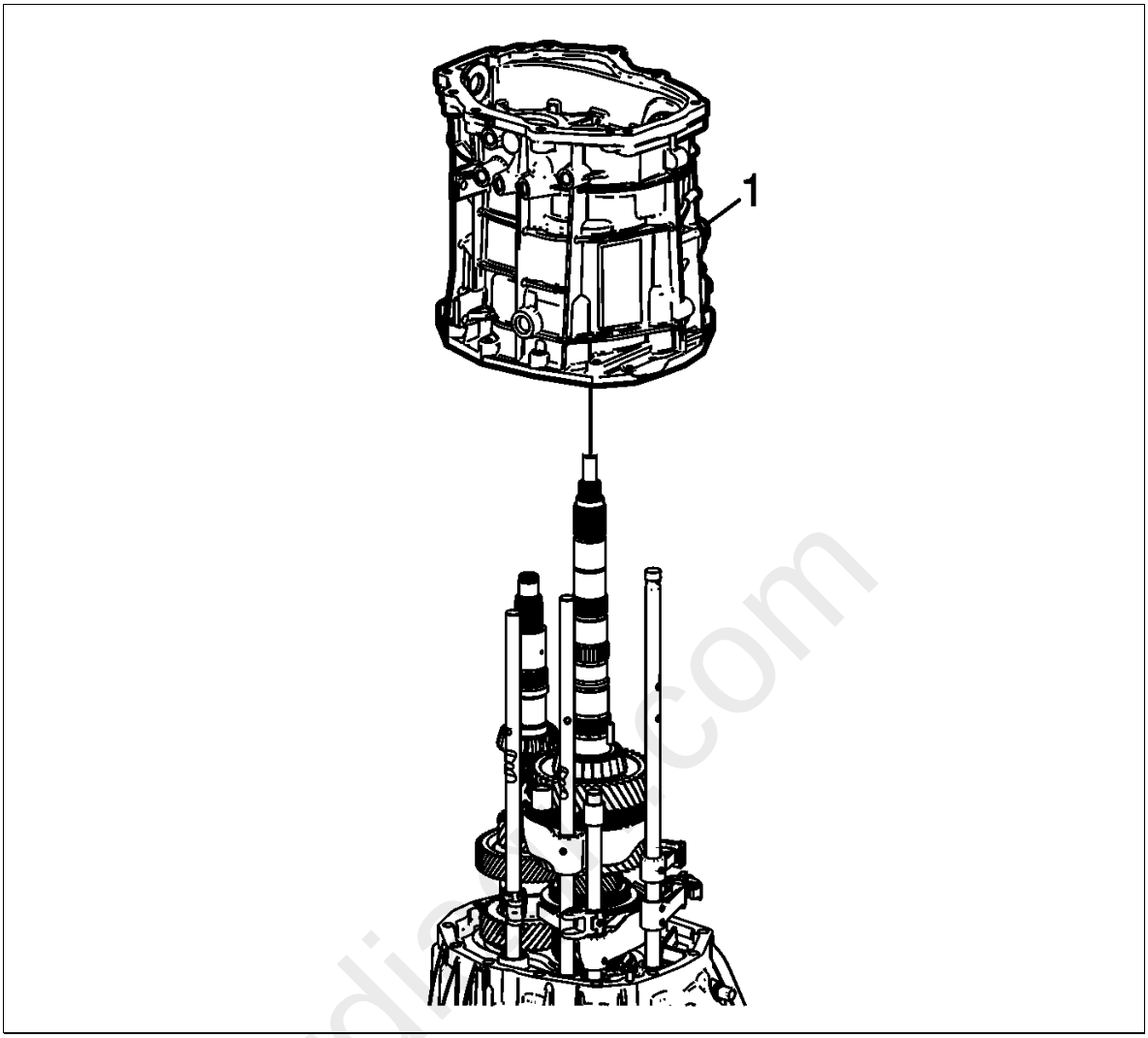
Fig 3: Shift Shaft Assemblies



Courtesy of GENERAL MOTORS COMPANY

5. Install the Shift Shaft Assemblies (1 & 2).

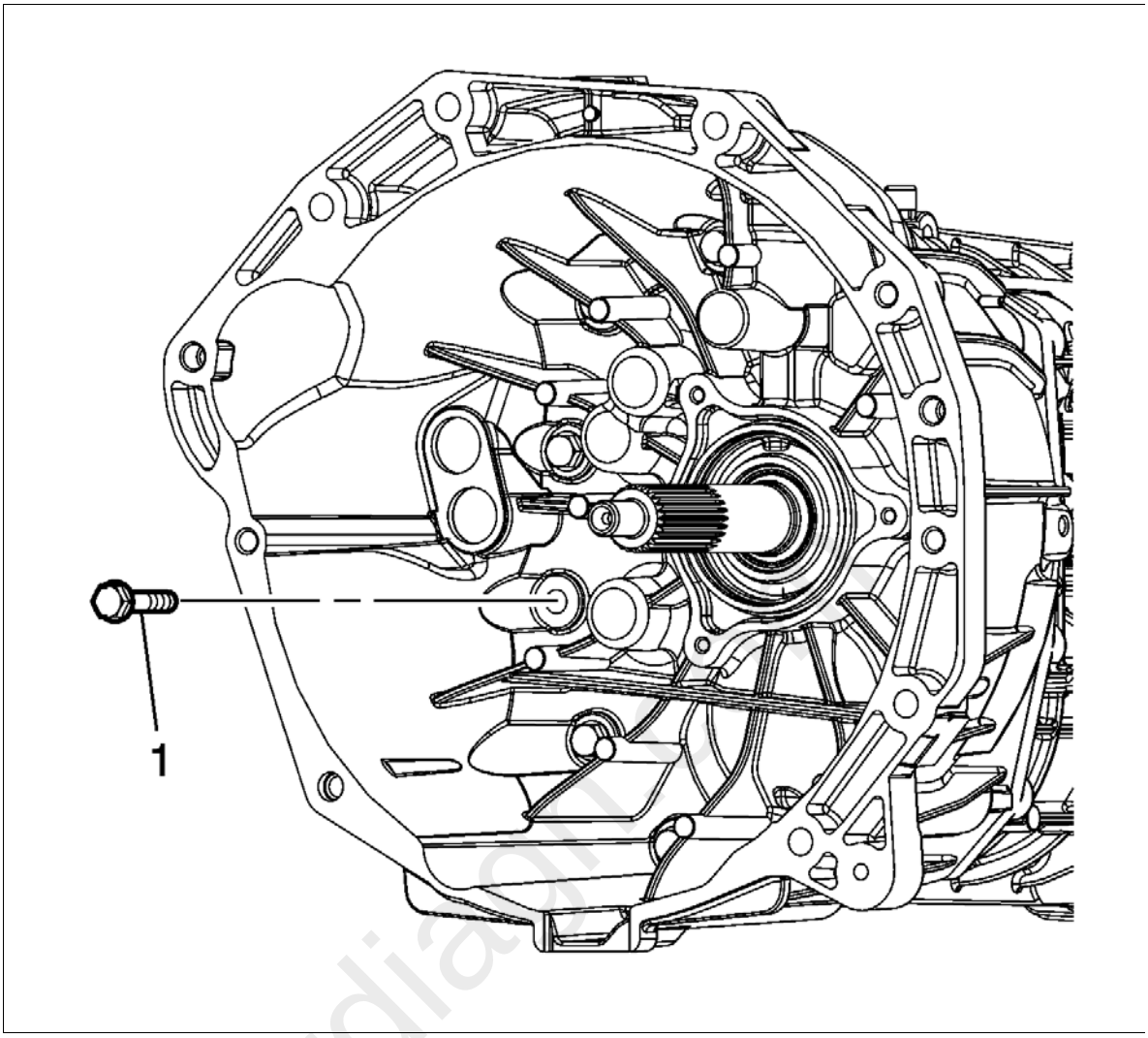
Fig 4: Transmission Case Assembly



Courtesy of GENERAL MOTORS COMPANY

6. Install the transmission case (1).

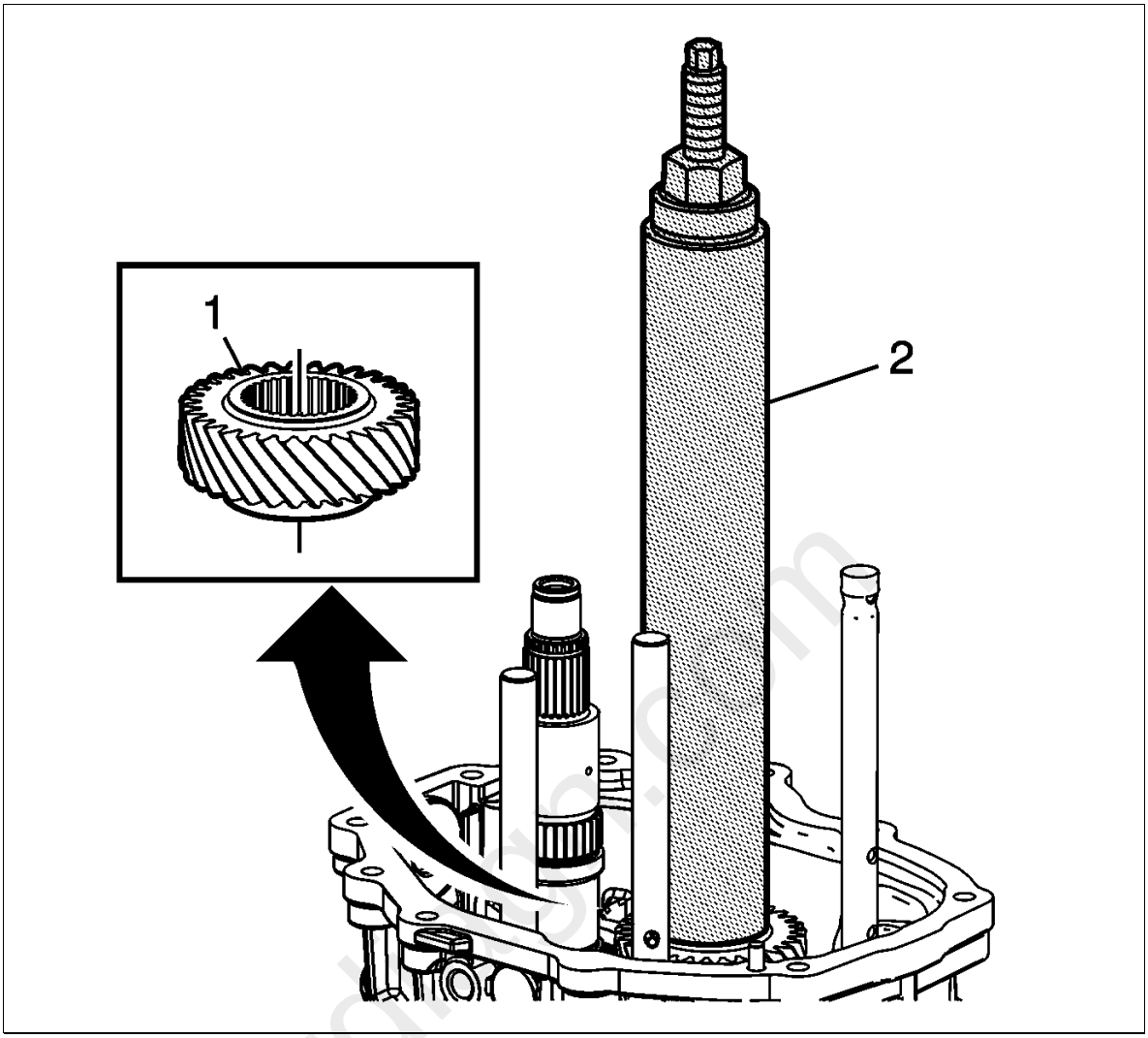
Fig 5: Clutch Housing Bolts



Courtesy of GENERAL MOTORS COMPANY

7. Install the clutch housing bolts (1) temporarily.

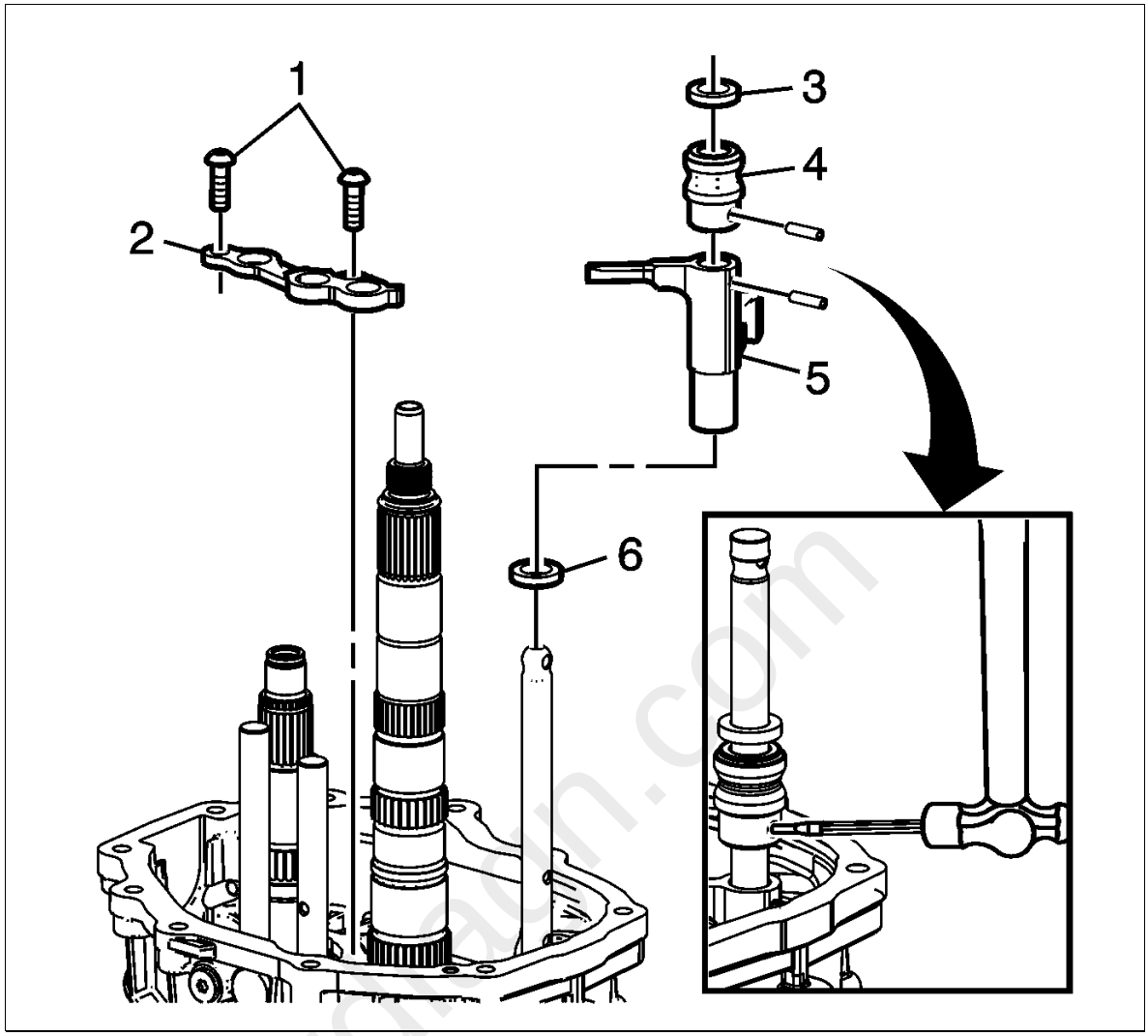
Fig 6: 4th Gear Assembly & Installer



Courtesy of GENERAL MOTORS COMPANY

8. Install the 4th gear assembly (1) using the **DT-51076** bearing and gear installer (2).

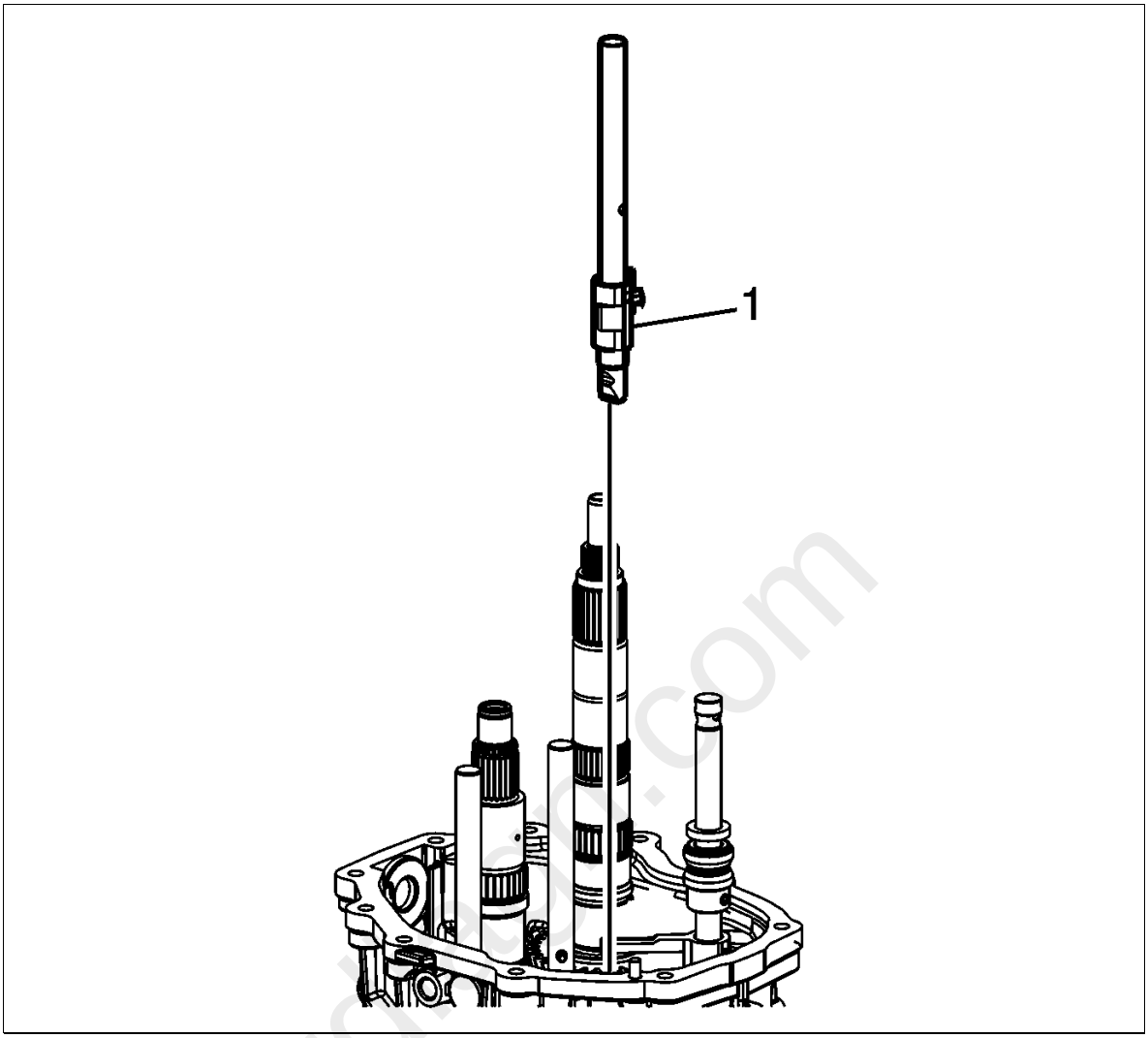
Fig 7: Shift Control Spacer



Courtesy of GENERAL MOTORS COMPANY

9. Install the shift control spacer (6)
10. Install the shift bar support (interlock) (2) and selector finger and cam (5) at the same time.
11. Install the shift interlock plate retainer bolts (1), shift control spacer (3), and neutral cam (4). Tighten the shift interlock plate retainer bolts to 31 N.m (23 lb ft).
12. Using a 3/16 in drift punch and hammer drive the coiled spring pins downward and Install.

Fig 8: Reverse Shift Shaft Assembly And Manual Transmission Reverse Selector Lever

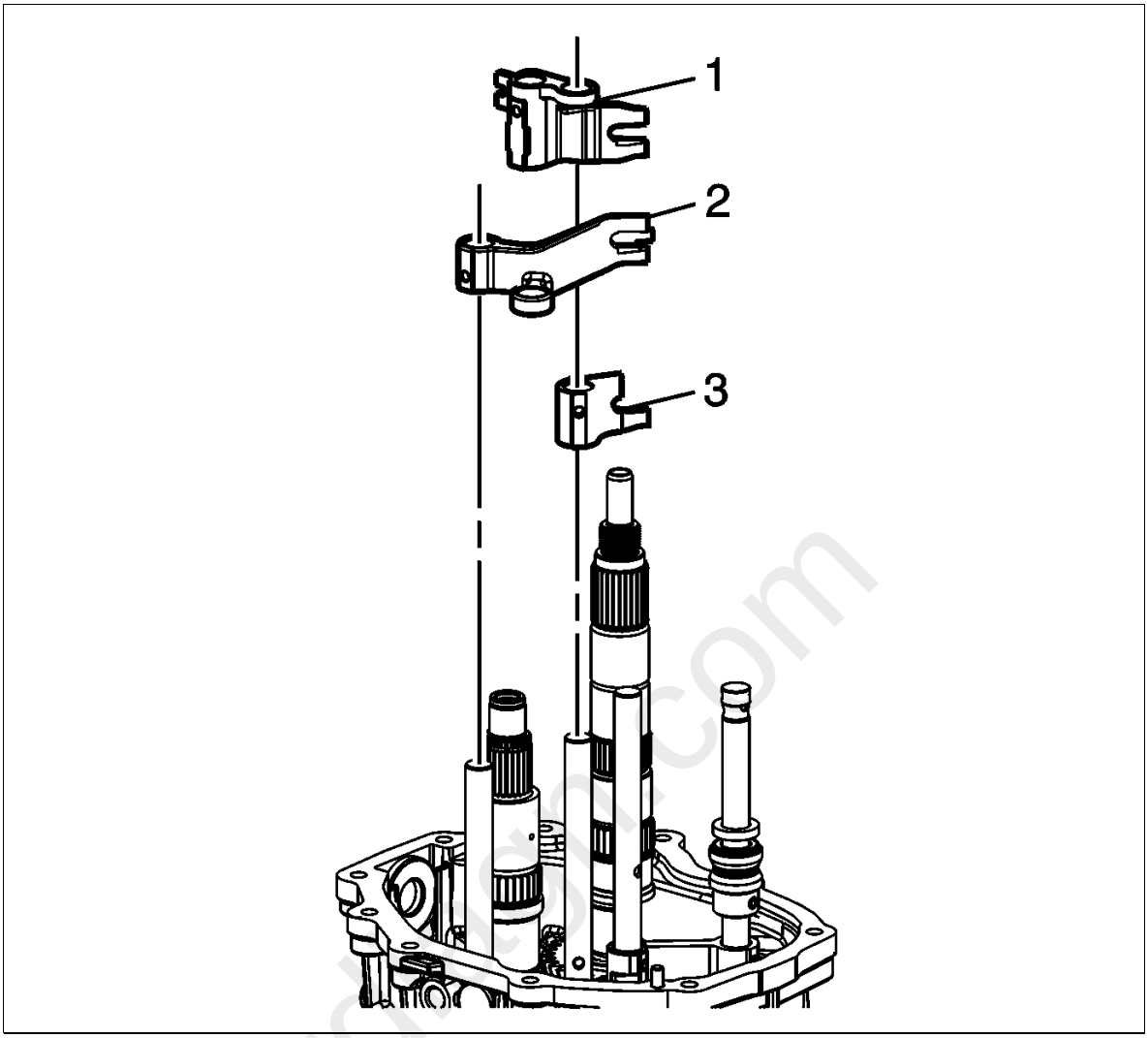


Courtesy of GENERAL MOTORS COMPANY

13.

14. Install the reverse shift shaft assembly and manual transmission reverse selector lever (1) as an assembly.

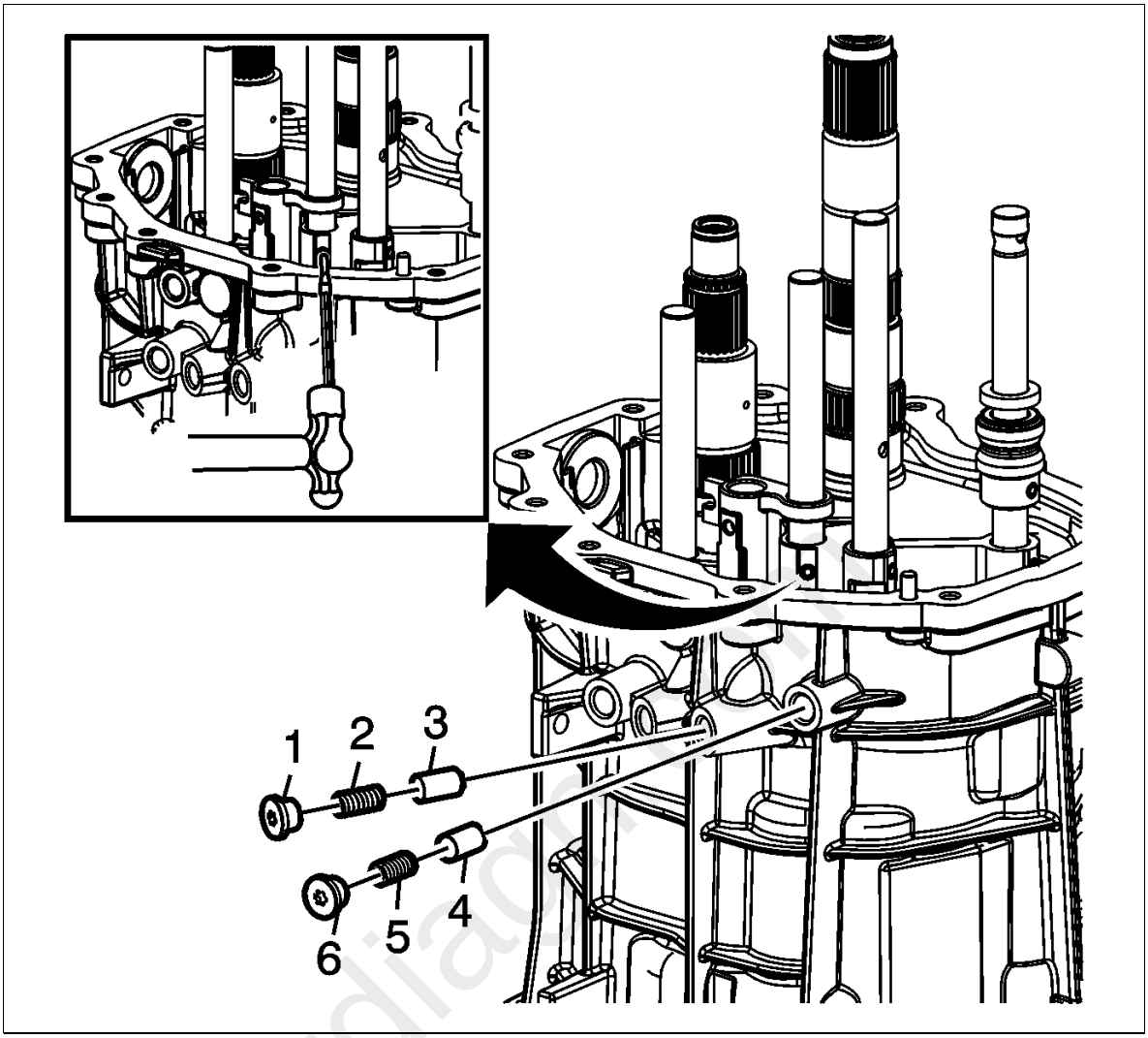
Fig 9: Selector Levers



Courtesy of GENERAL MOTORS COMPANY

15. Install the manual transmission 3rd & 4th selector lever (1), manual transmission 5th & 6th selector lever (2), and the manual transmission 1st & 2nd selector lever (3).

Fig 10: Shift Shaft, Detent And Spring

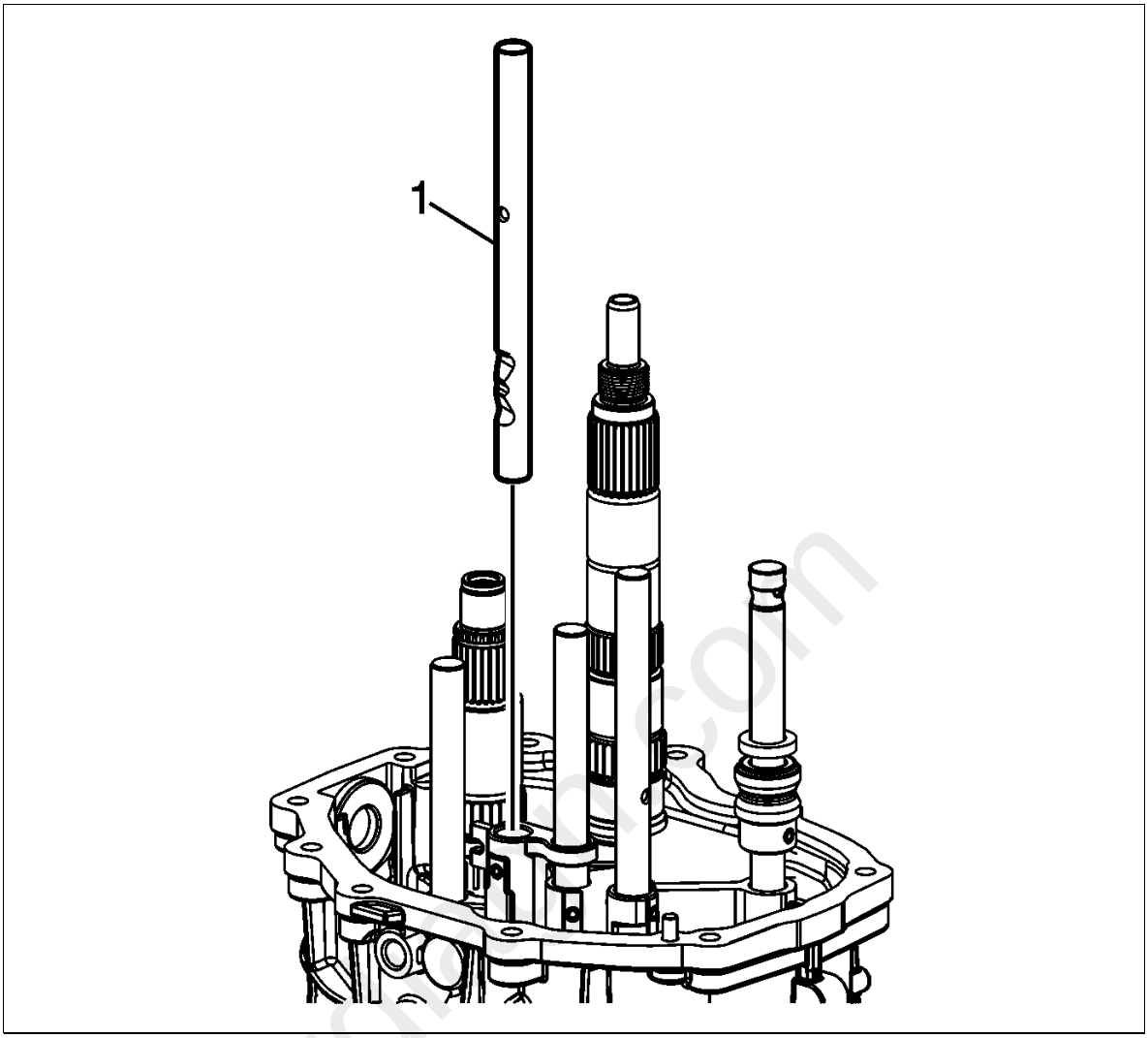


Courtesy of GENERAL MOTORS COMPANY

16. Install the shift shaft detent spring cover bolt (1 and 6), shift shaft detent springs (2 and 5) and shift shaft detents (3 and 4). Tighten plugs to 28 N.m (21 lb ft).

17. Using a 3/16 in drift punch and hammer drive the coiled spring pin downward and Install.

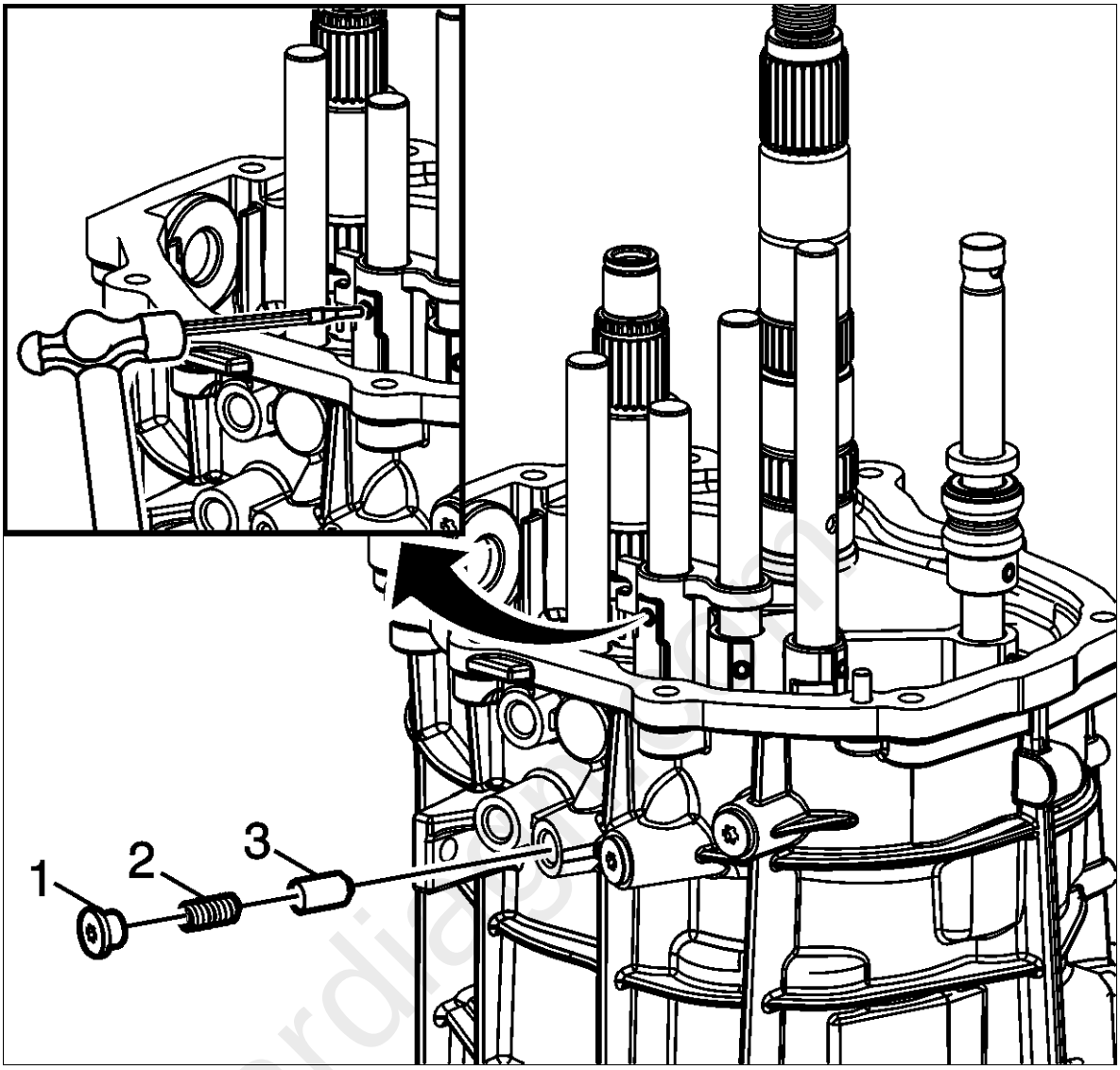
Fig 11: 3rd And 4th Shift Shaft



Courtesy of GENERAL MOTORS COMPANY

18. Install the 3rd & 4th shift shaft (1).

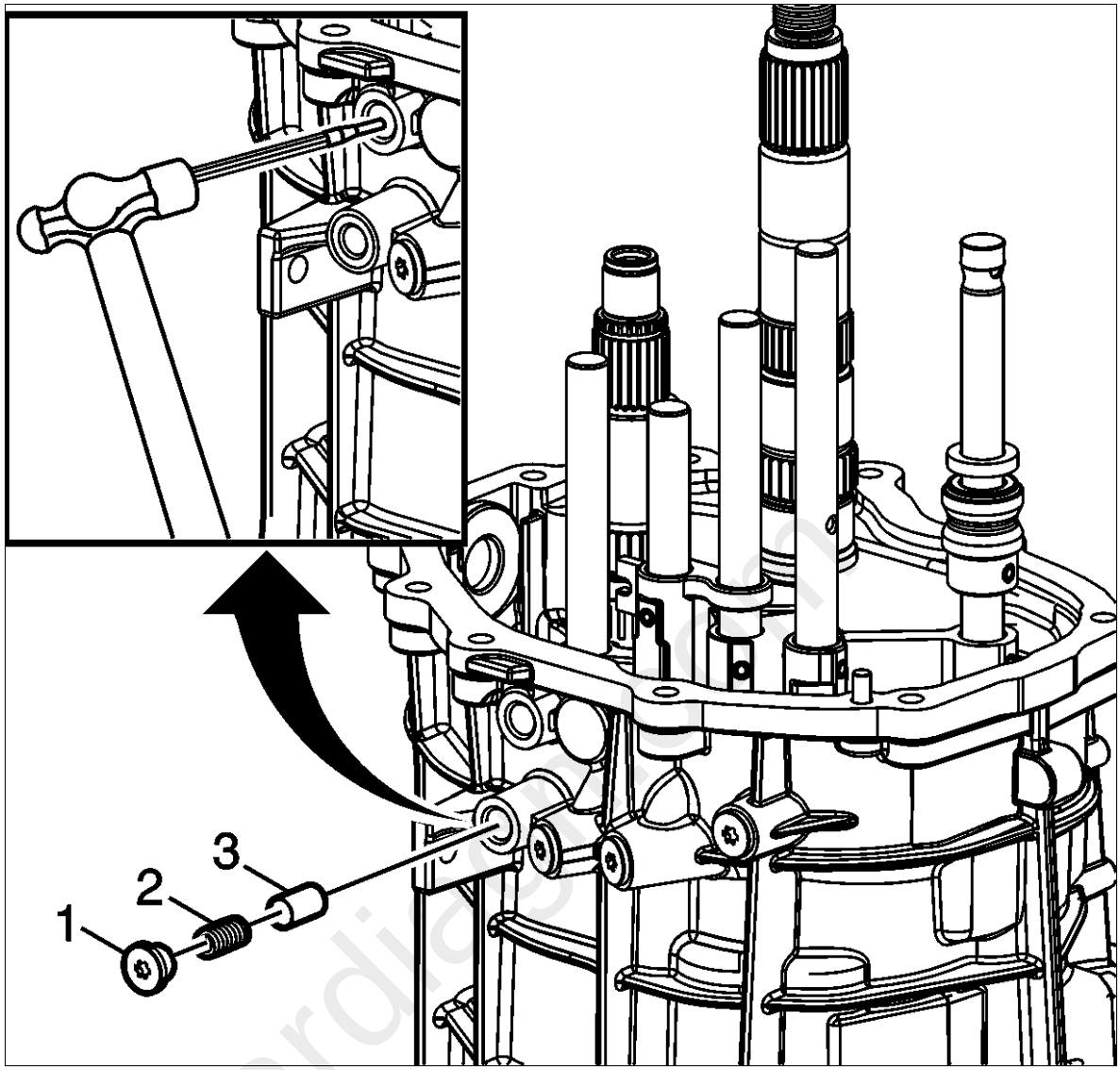
Fig 12: Coiled Spring Pin



Courtesy of GENERAL MOTORS COMPANY

19. Using a 3/16 in punch drive the coiled spring pin downward and Install.
20. Install the shift shaft detent spring cover bolt (1), shift shaft detent spring (2), and shift shaft detent (3). Tighten shift shaft detent spring cover bolt to 28 N.m (21 lb ft).

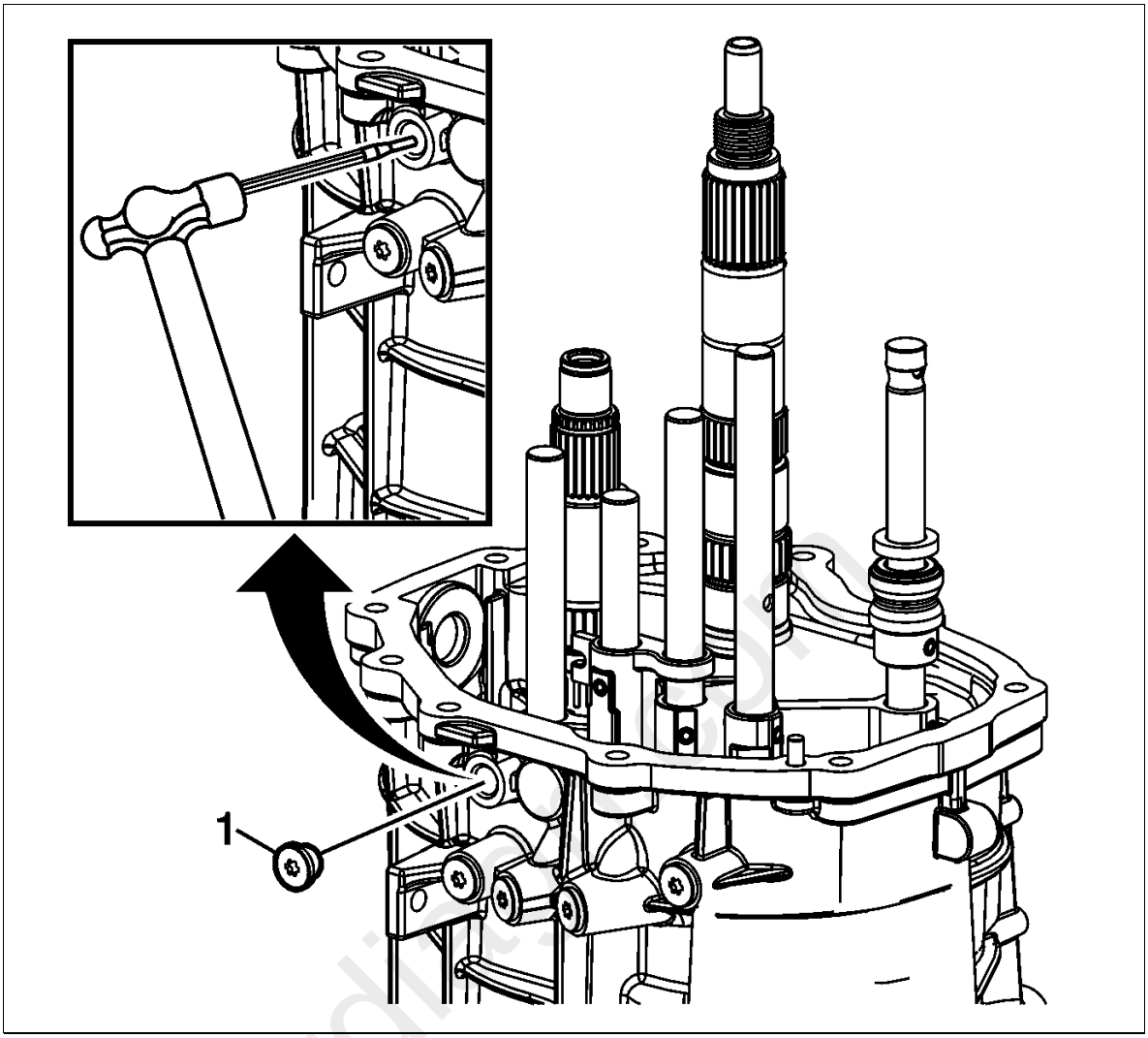
Fig 13: Shift Shaft Detent Spring And Detent



Courtesy of GENERAL MOTORS COMPANY

21. With the same drift in the shift rail, Install the shift shaft detent spring cover bolt (1), shift shaft detent spring (2), and shift shaft detent (3). Tighten shift shaft detent spring cover bolt to 28 N.m (21 lb ft).

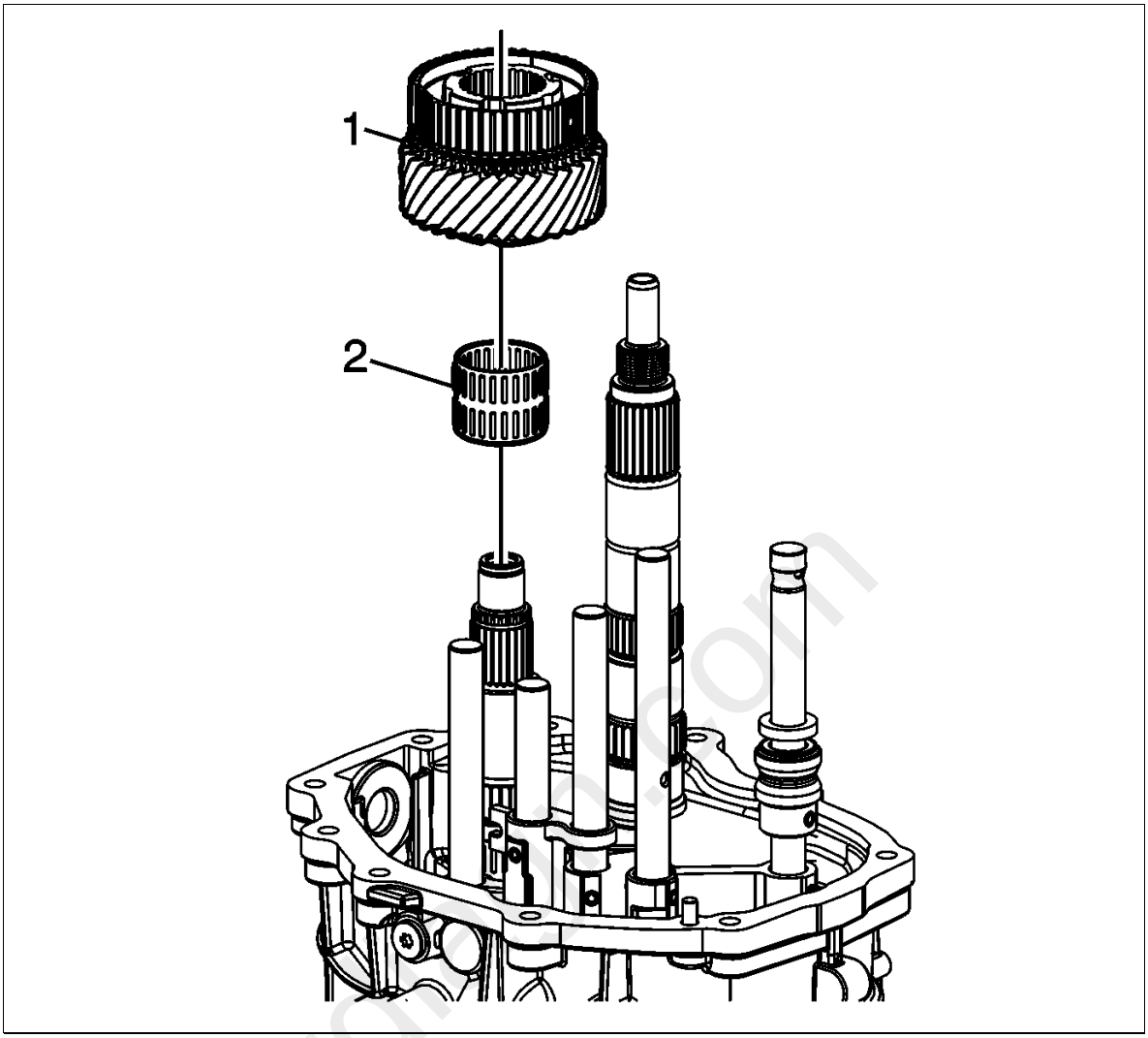
Fig 14: Shift Shaft Detent Plug



Courtesy of GENERAL MOTORS COMPANY

22. Using a 3/16 in drift punch and hammer drive the coiled spring pin downward and Install.
23. Tighten shift shaft detent spring cover bolt to 28 N.m (21 lb ft).

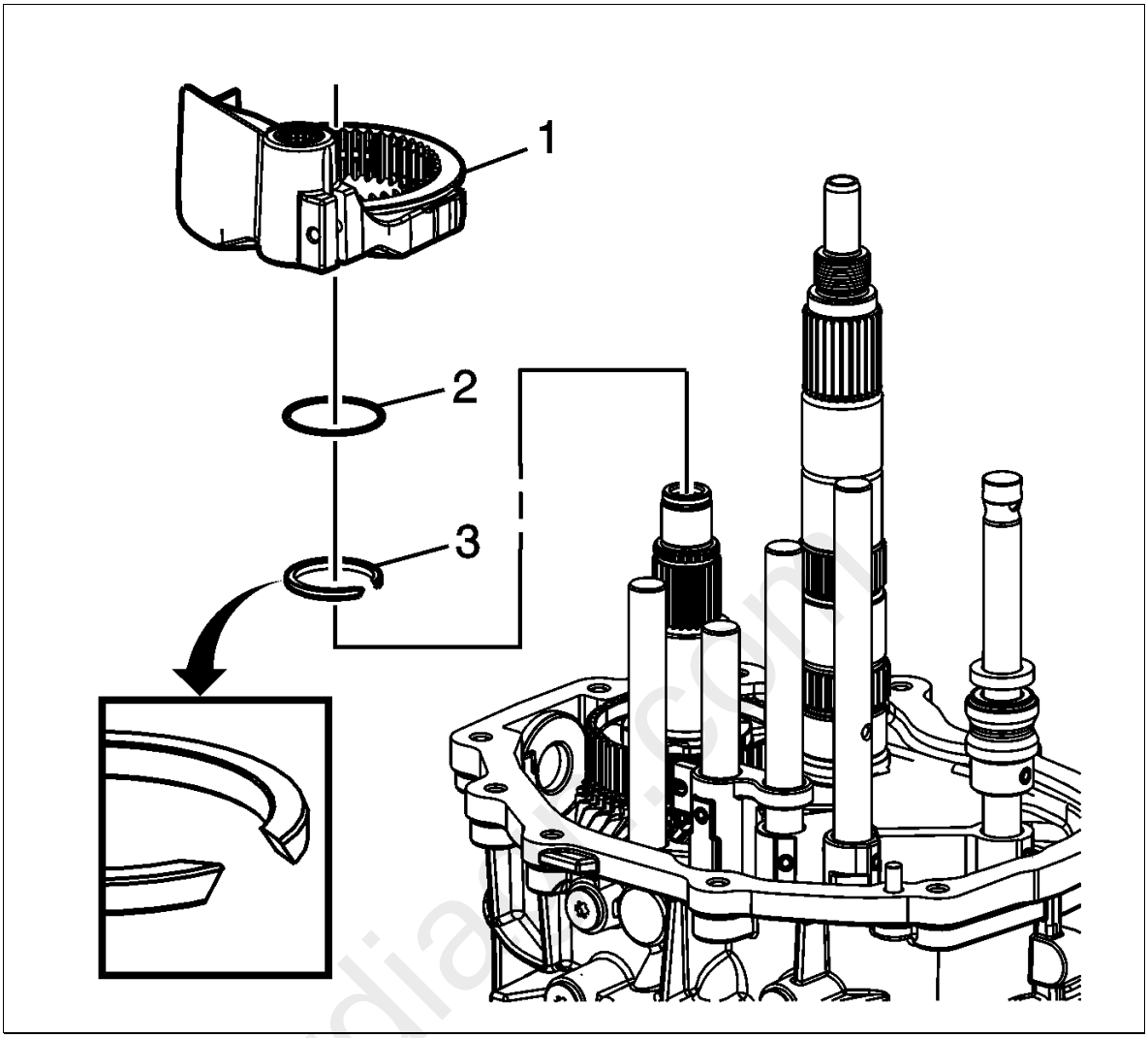
Fig 15: 3rd & 4th Hub, 4th Gear Blocking Rings, And 4th Gear Drive Gear



Courtesy of GENERAL MOTORS COMPANY

24. Install the 4th gear bearing assembly (2).
25. Install the 3rd & 4th hub, 4th gear blocking rings, and 4th gear drive gear (1) as an assembly.

Fig 16: 3rd & 4th Synchronizer Sleeve And Fork Assembly



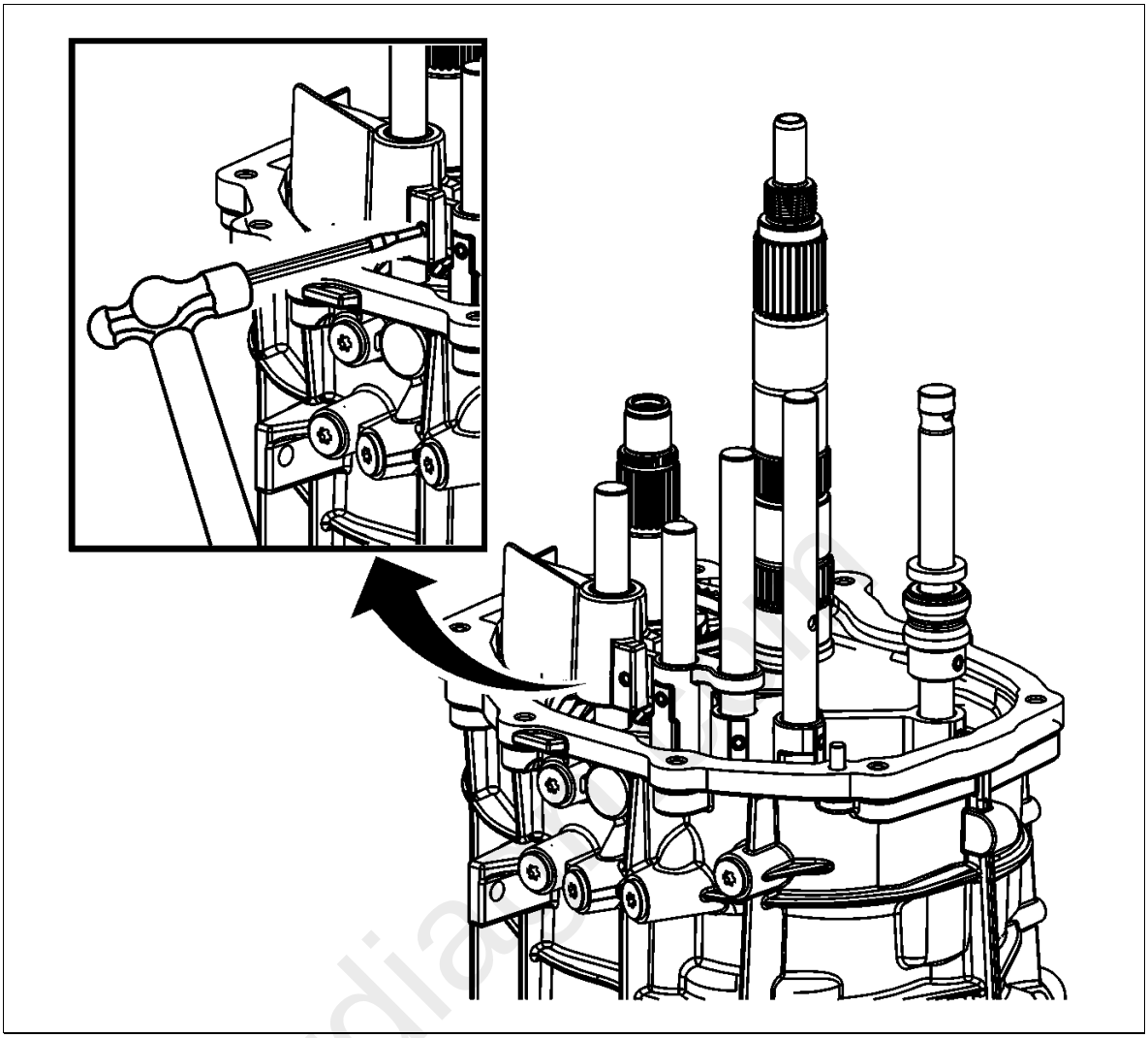
Courtesy of GENERAL MOTORS COMPANY

NOTE:

The retaining ring must be installed as shown in graphic, with the points facing up.

26. Using snap ring pliers Install the retaining ring (3). Install the 3rd gear spacer (2).
27. Install the 3rd & 4th synchronizer sleeve and fork assembly (1).

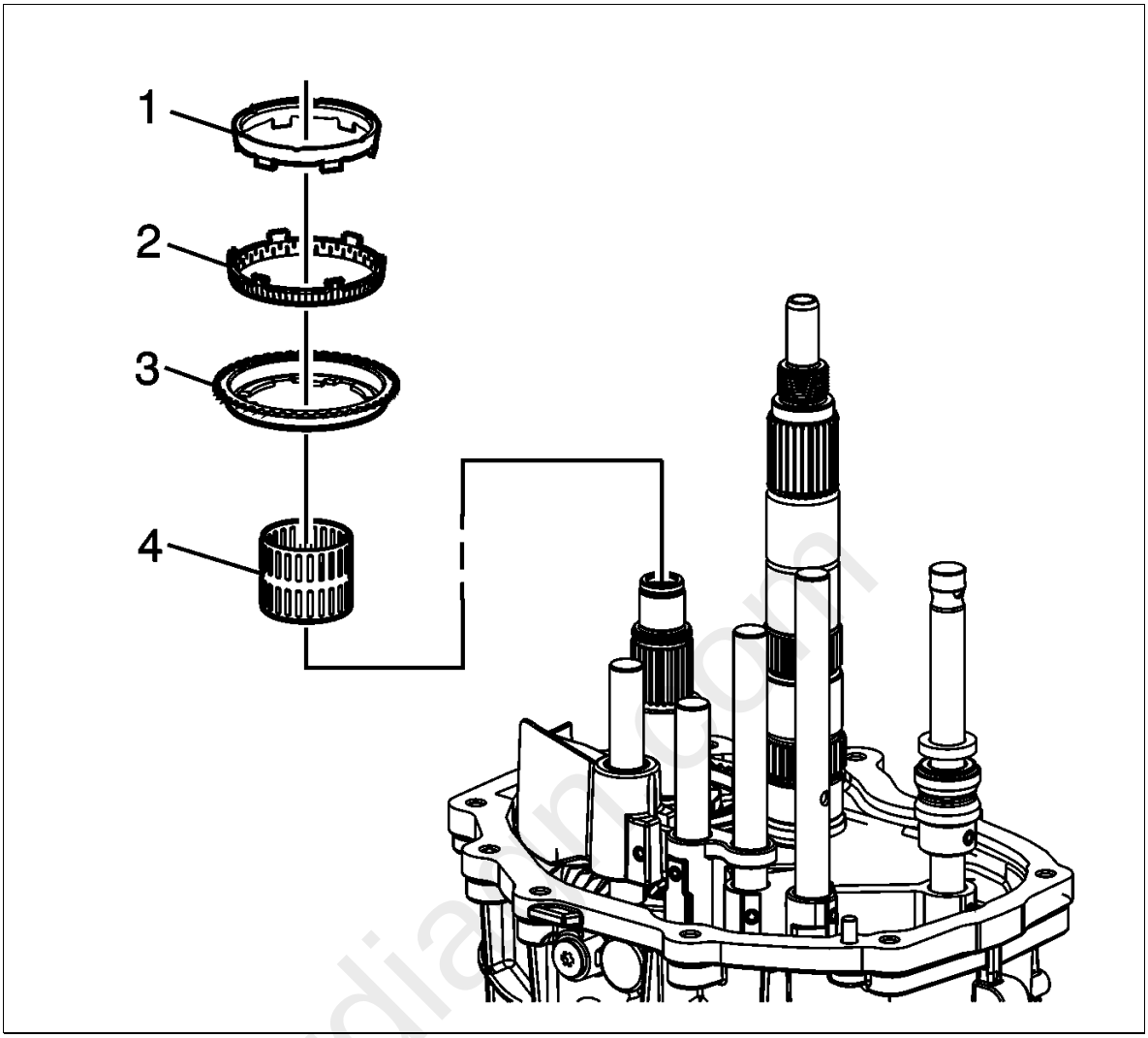
Fig 17: Coiled Spring Pin



Courtesy of GENERAL MOTORS COMPANY

28. Using a 3/16 in drift and hammer, drive the coiled spring pin downward and Install.

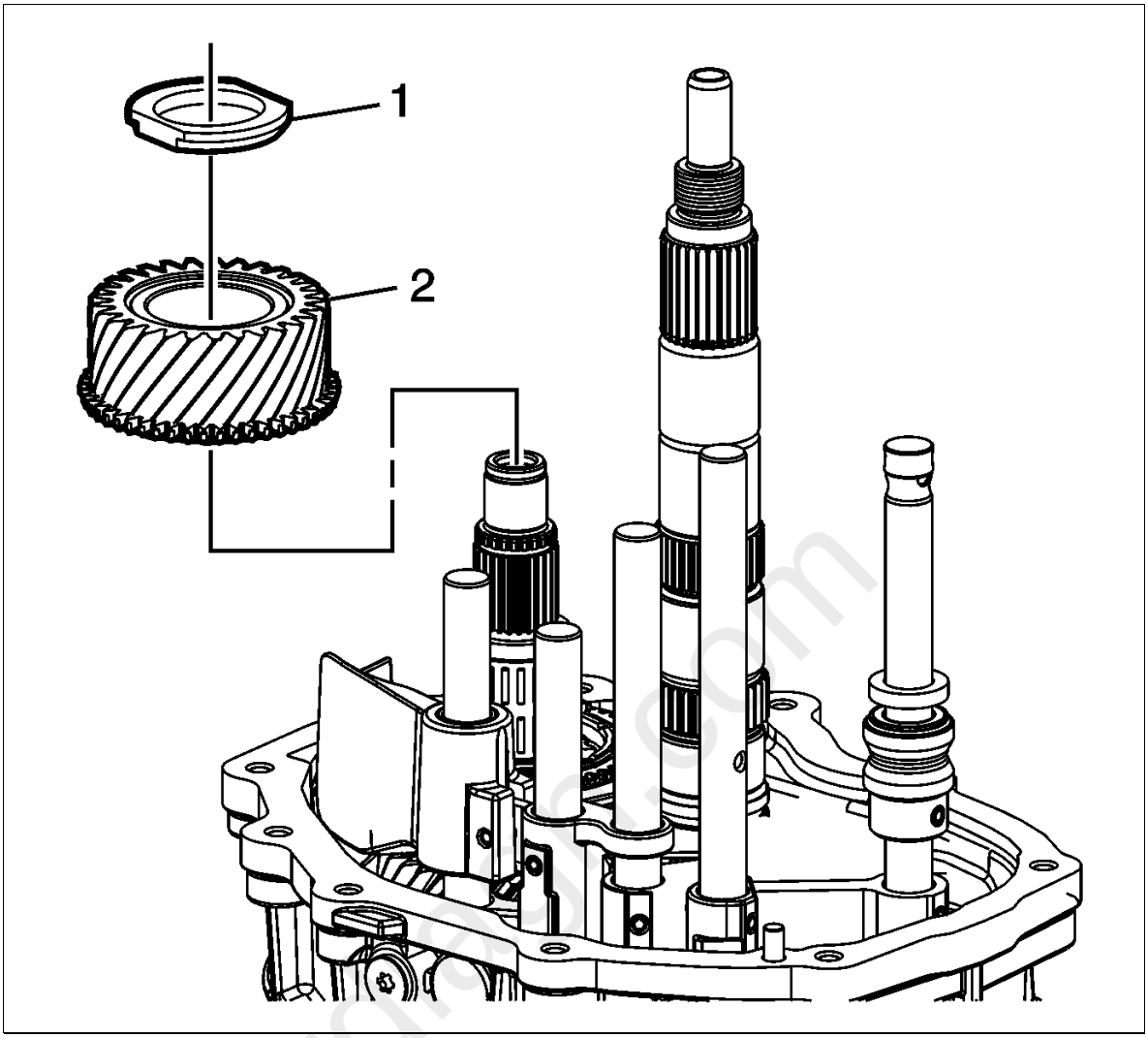
Fig 18: 3rd Gear Blocking Ring Assemblies



Courtesy of GENERAL MOTORS COMPANY

29. Install the 3rd gear bearing assembly (4).
30. Install the 3rd gear blocking ring assembly (1, 2, and 3).

Fig 19: 3rd Gear Thrust Washer And Drive Gear Assembly



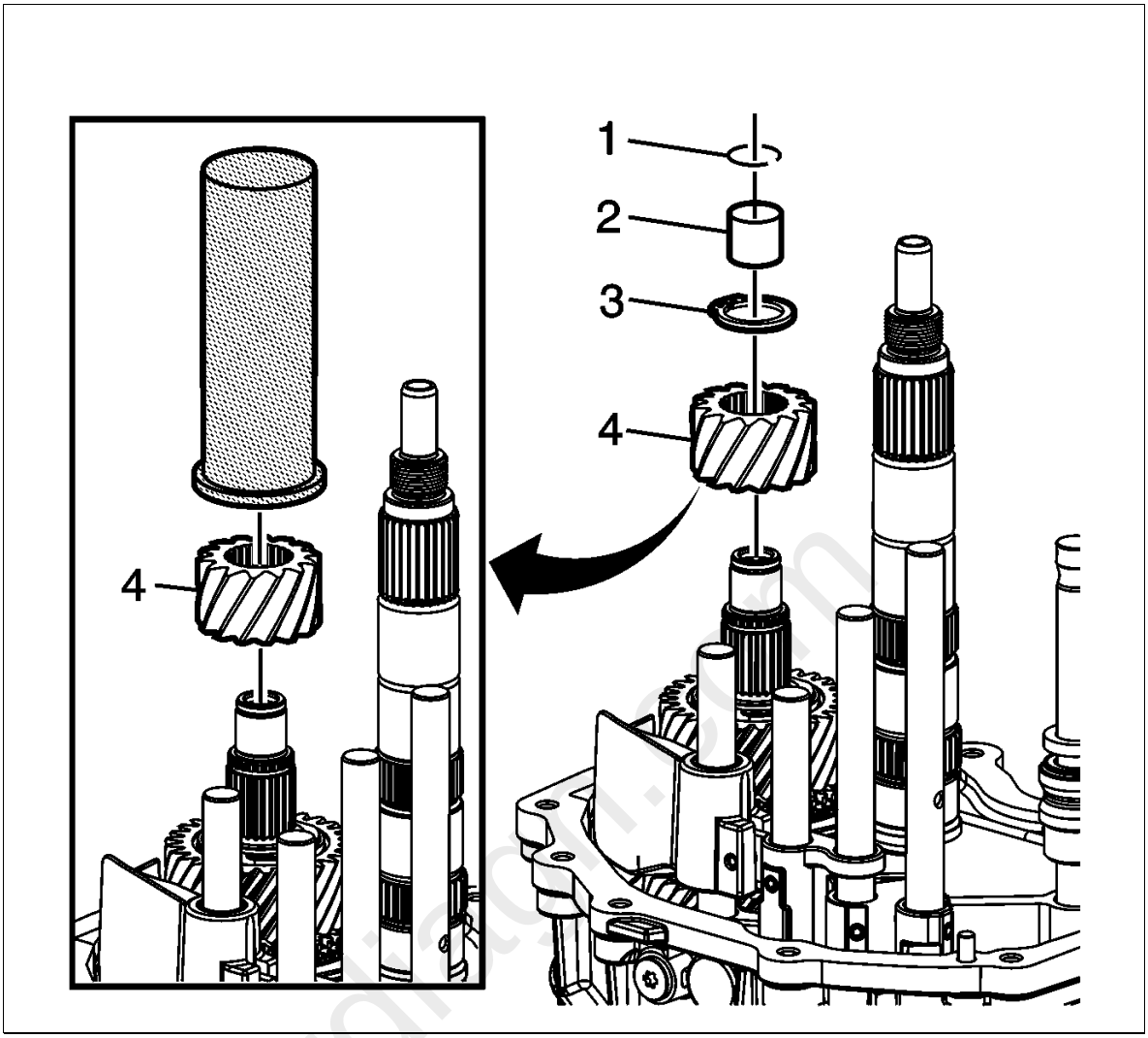
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Thrust washer (1) must be installed with lip facing upwards as shown in picture.

31. Install the 3rd gear drive gear assembly (2) and the 3rd gear thrust washer (1).

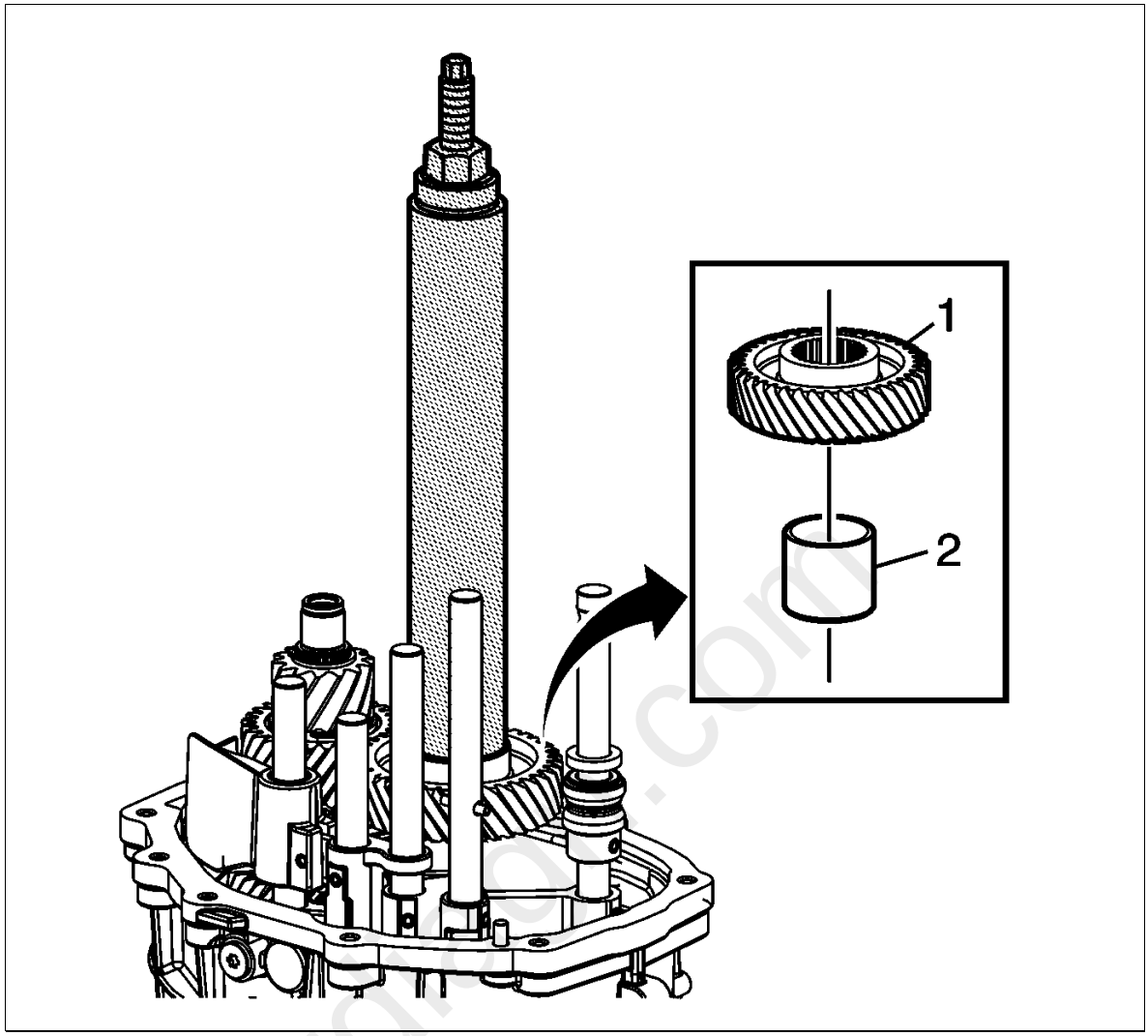
Fig 20: Reverse Drive Gear Assembly



Courtesy of GENERAL MOTORS COMPANY

32. Install the reverse drive gear assembly (4) using **DT 25234** gear and bearing installer.
33. Using snap ring pliers install the reverse drive gear assembly retainer (3).
34. Install the counter gear rear bearing race (2) and snap ring (1).

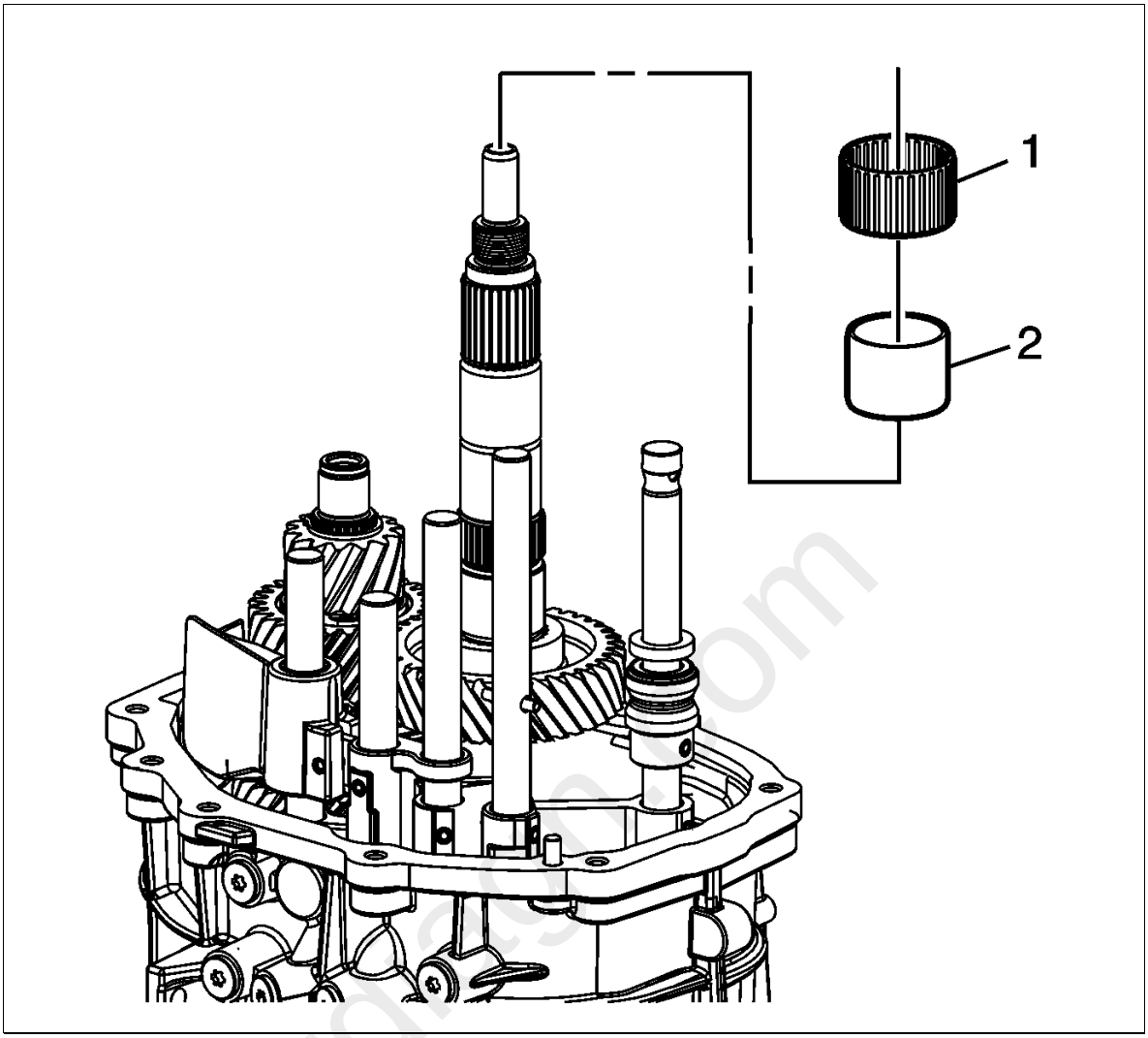
Fig 21: 3rd Gear And 3rd & 4th Gear Spacer



Courtesy of GENERAL MOTORS COMPANY

35. Install the 3rd gear assembly (1) and the 3rd & 4th gear spacer (2) using **DT-51076** bearing and gear installer.

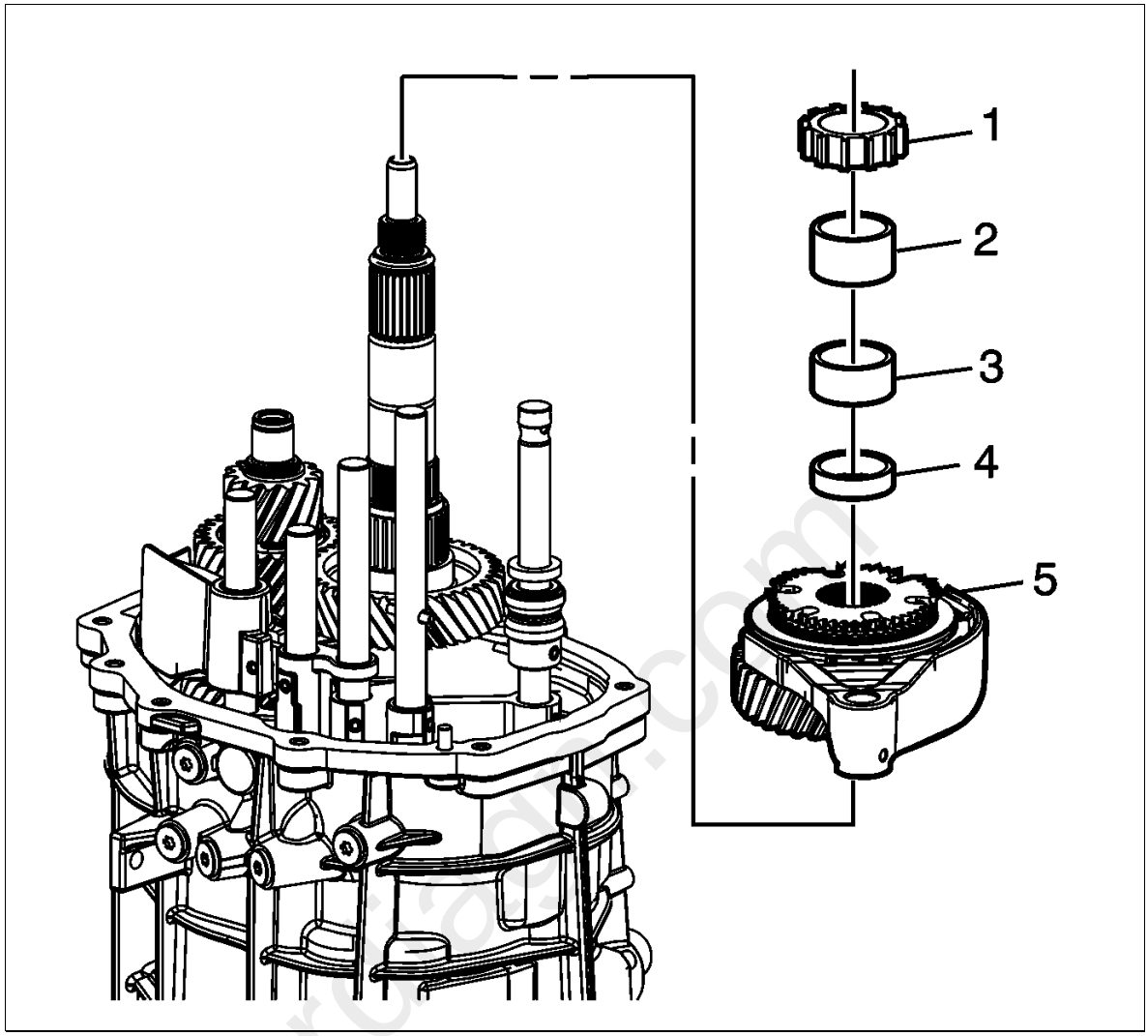
Fig 22: Reverse Gear Bearing Assembly And Bushing



Courtesy of GENERAL MOTORS COMPANY

36. Install the reverse gear bearing assembly (1) and bushing (2).

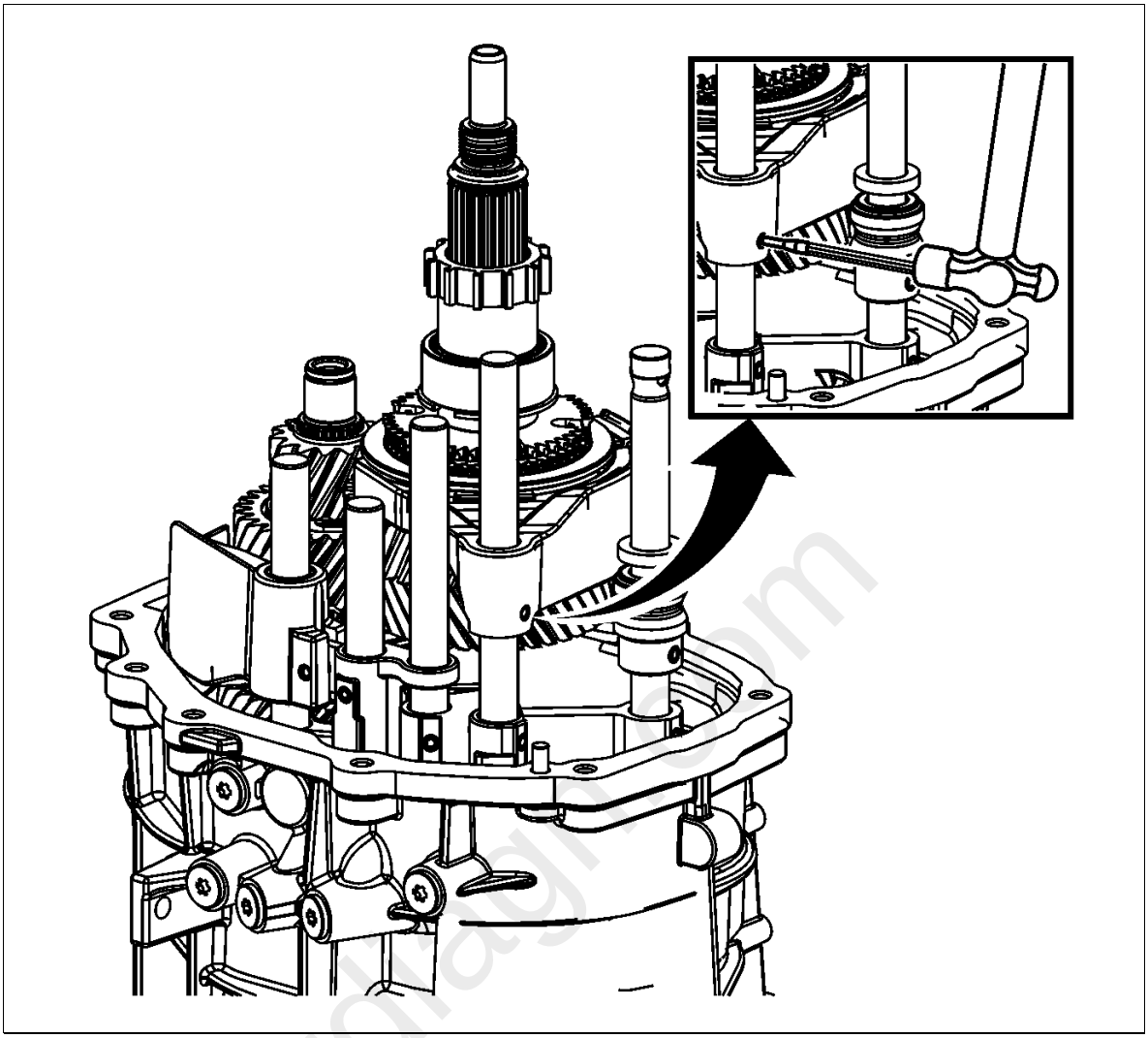
Fig 23: Vehicle Speed Sensor Reluctor Wheel, Spacer, Main Shaft Rear Bearing Race, Main Shaft Bearing Spacer And Reverse Gear And Synchronizer



Courtesy of GENERAL MOTORS COMPANY

37. Install the reverse gear and synchronizer (5) together as an assembly.
38. Install the vehicle speed sensor reluctor wheel (1), spacer (2), main shaft rear bearing race (3), and main shaft bearing spacer (4).

Fig 24: Coiled Spring Pin

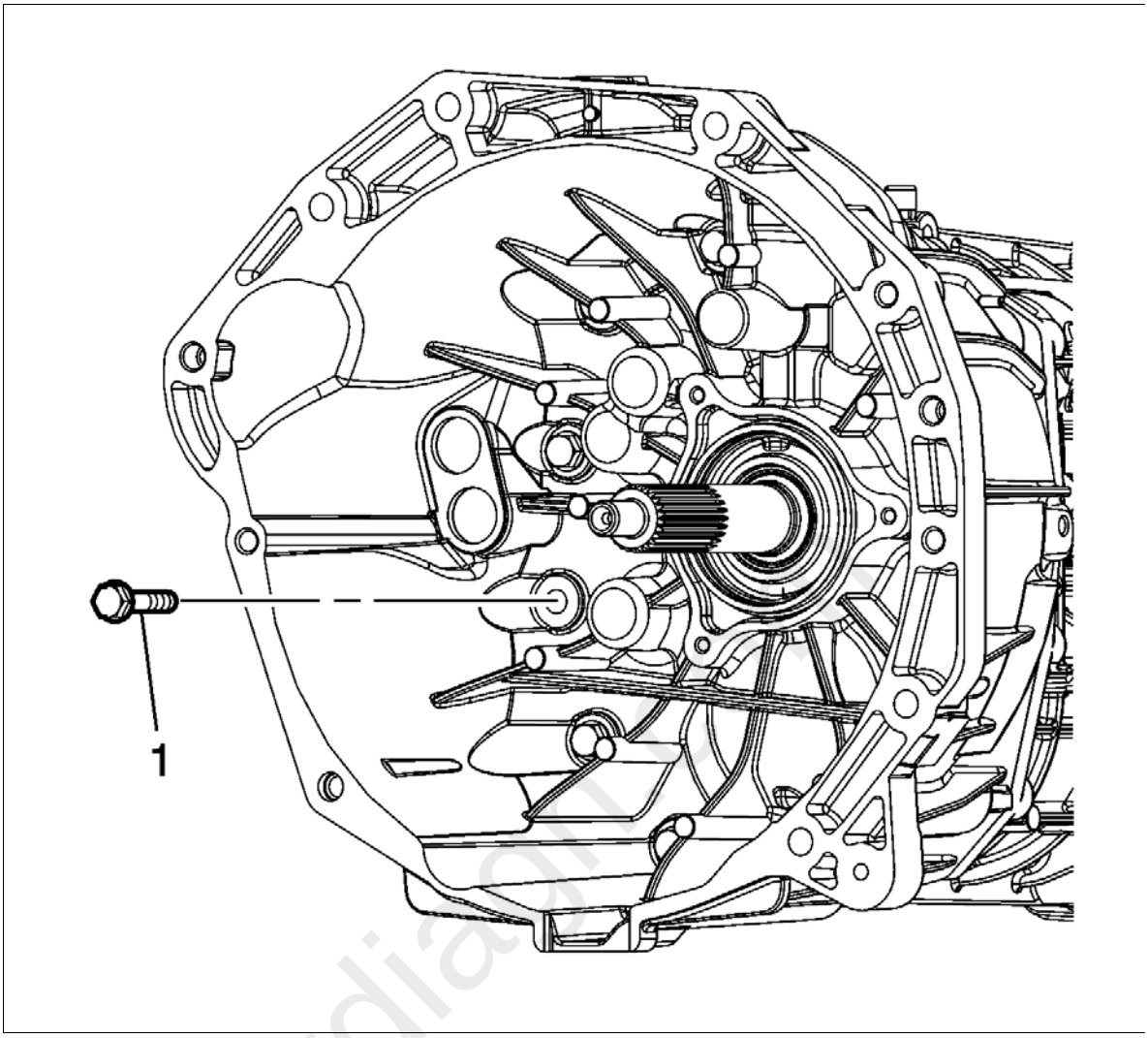


Courtesy of GENERAL MOTORS COMPANY

39. Using a 3/16 in drift punch and hammer drive the coiled spring pin downward and Install.

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION ASSEMBLE (M13 - LGX W/O L4Q, LTG) > INVERTER LEVER INSTALL

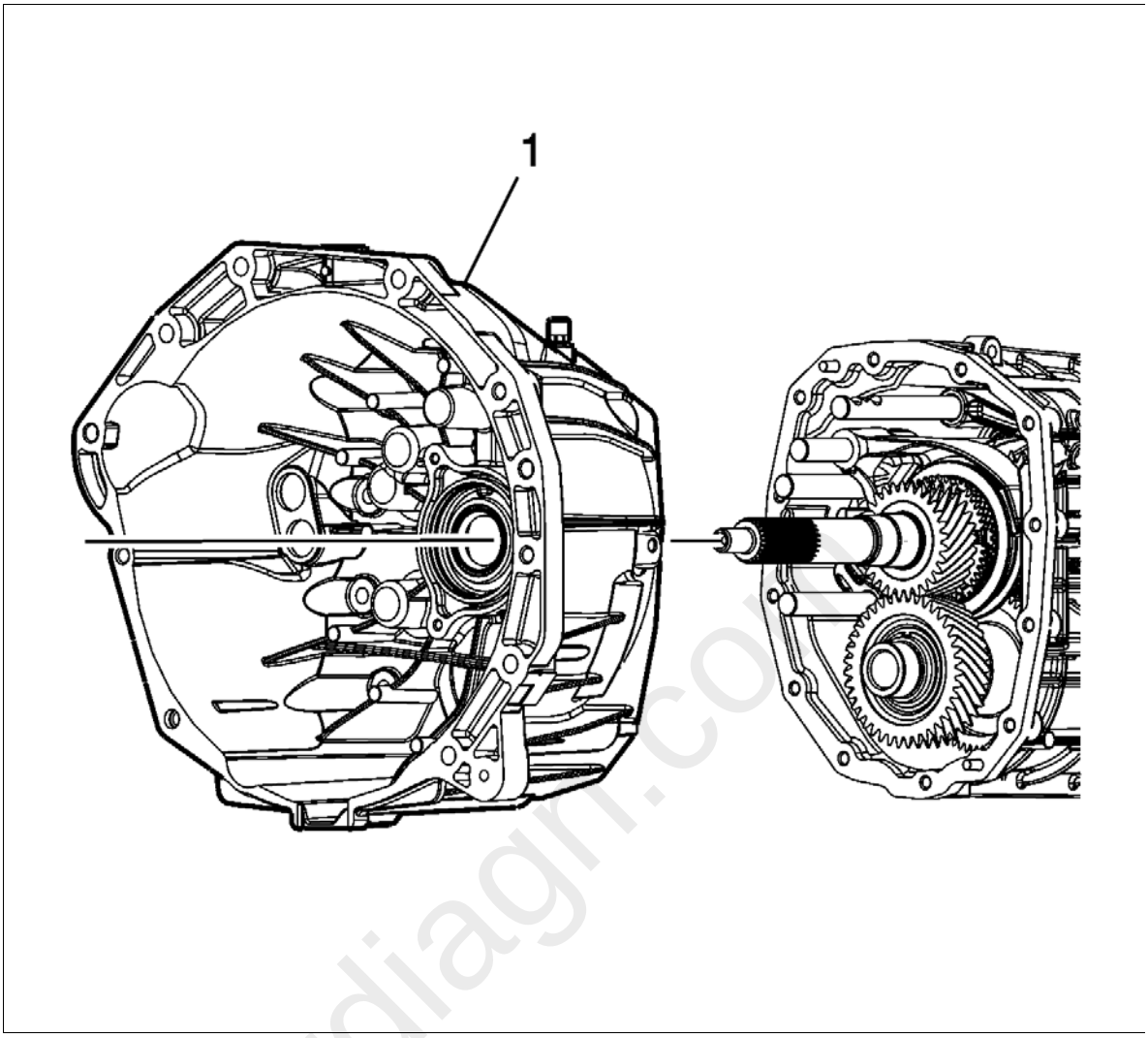
Fig 1: Clutch Housing Bolts



Courtesy of GENERAL MOTORS COMPANY

1. Temporarily remove the clutch housing bolts (1).

Fig 2: Clutch Housing Assembly

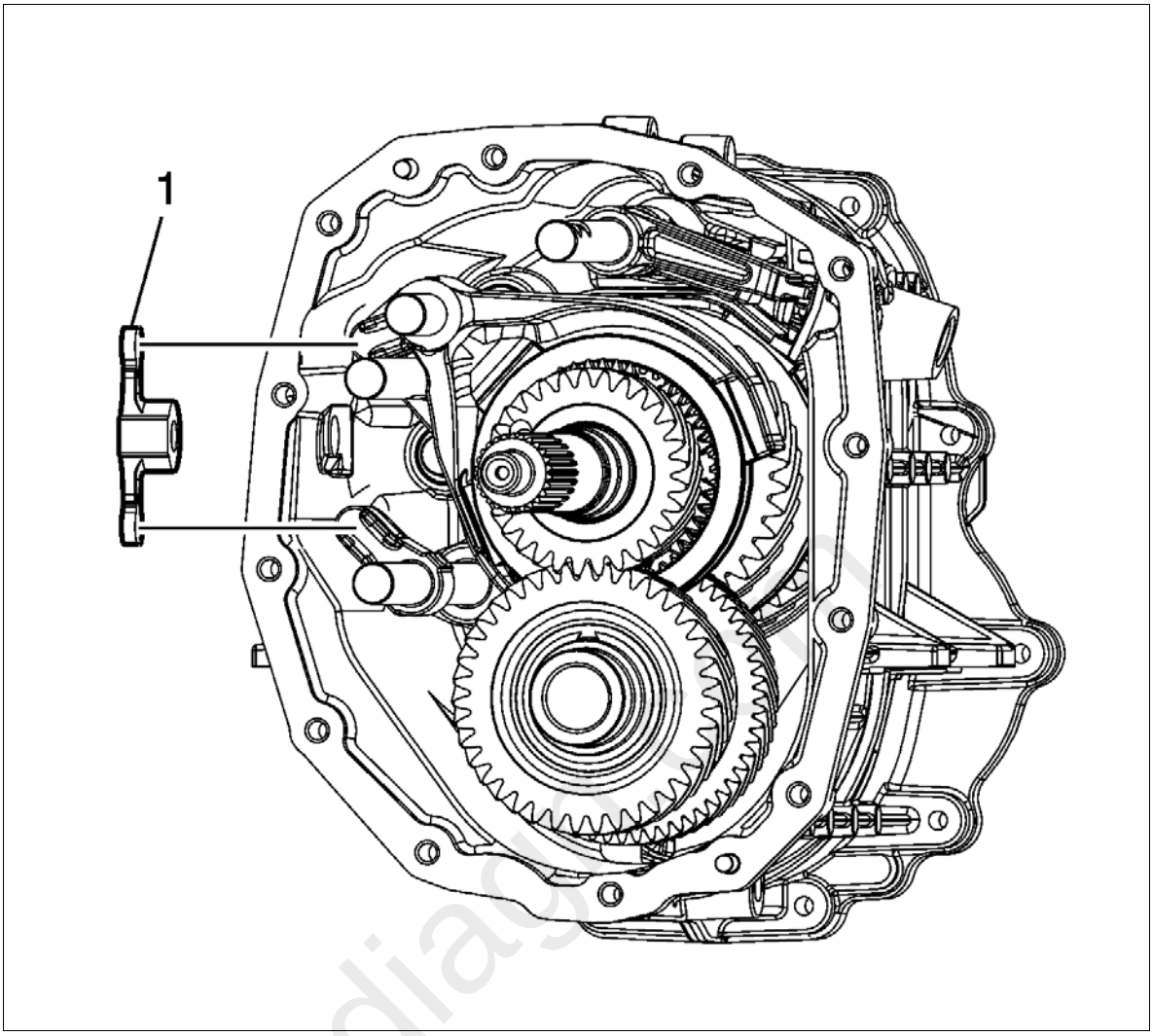


Courtesy of GENERAL MOTORS COMPANY

2. Temporarily remove the clutch housing assembly (1).

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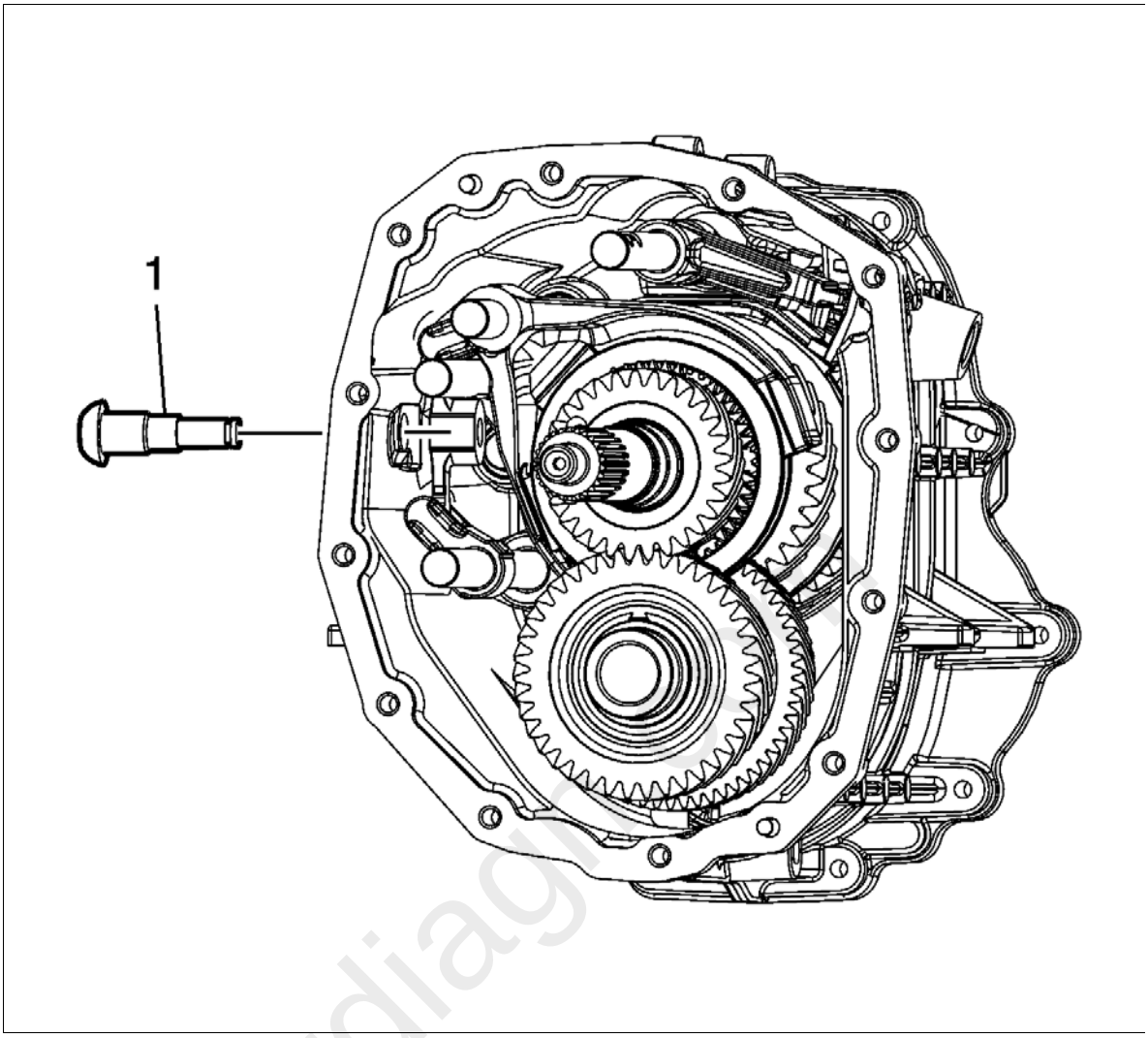
Fig 3: Manual Transmission Selector Lever



Courtesy of GENERAL MOTORS COMPANY

3. Install the manual transmission selector lever (1).

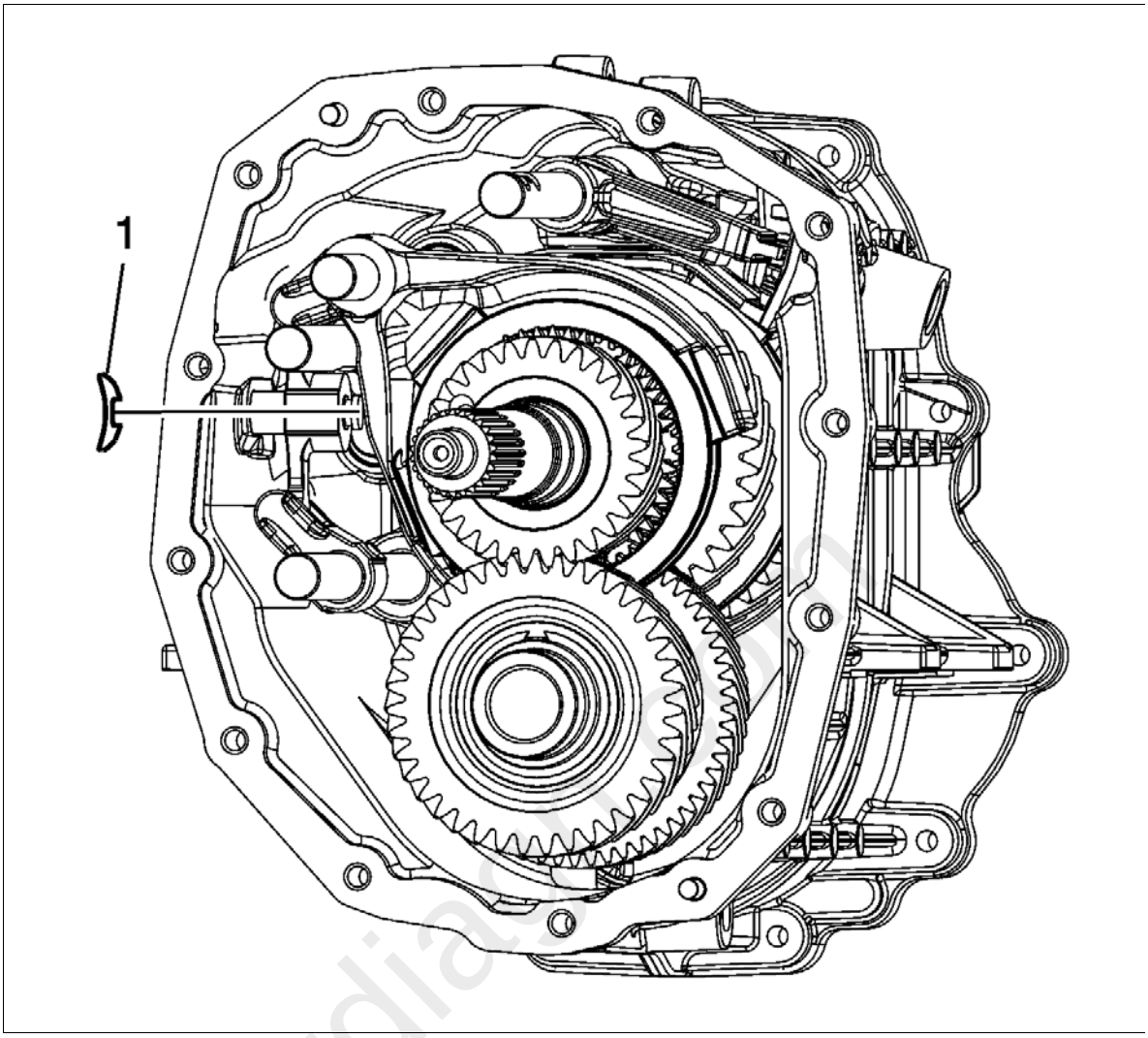
Fig 4: Manual Transmission Selector Lever Pivot Pin



Courtesy of GENERAL MOTORS COMPANY

4. Install the manual transmission selector lever pivot pin (1). Tighten to 41 N.m (30 lb ft).

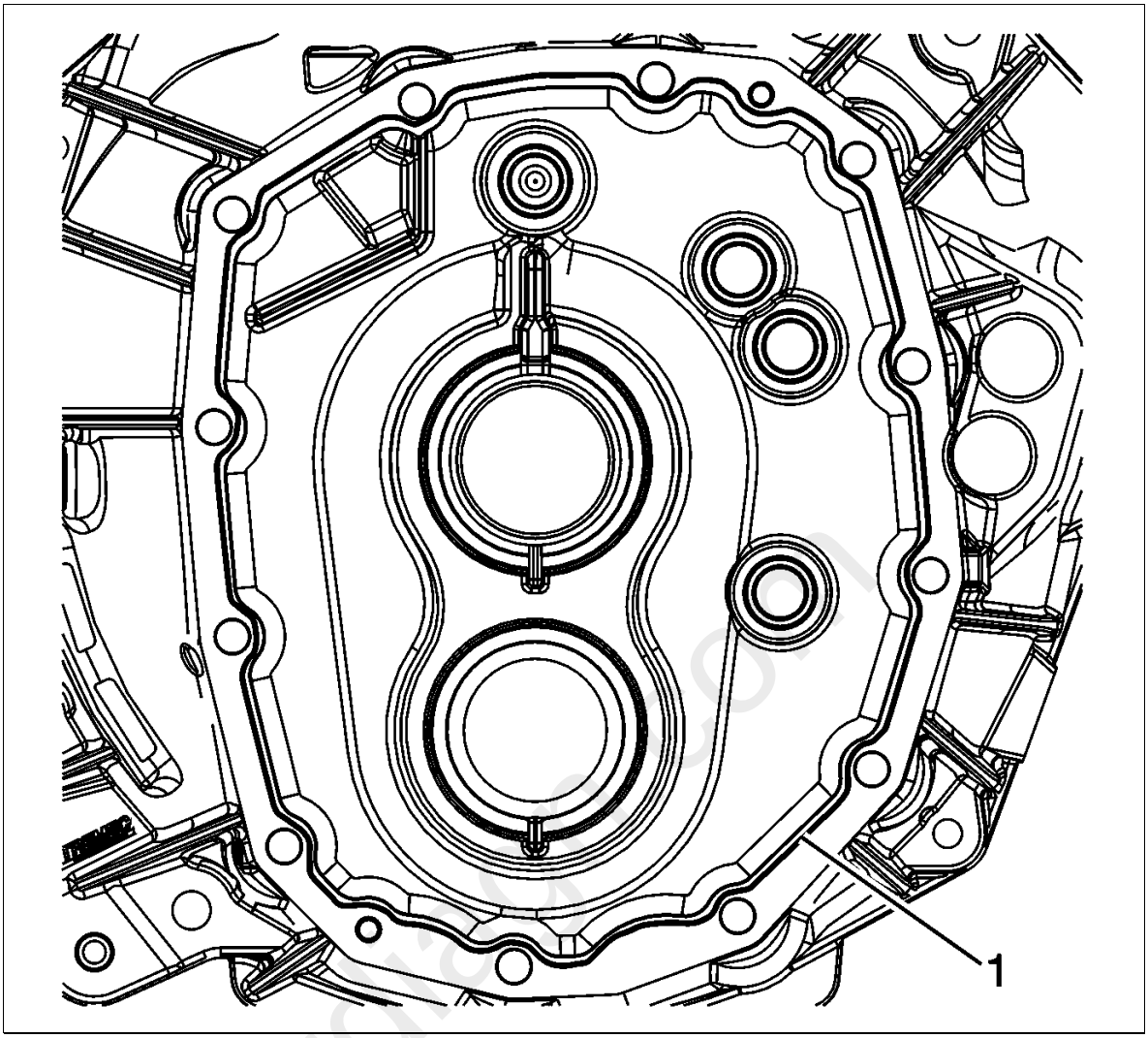
Fig 5: Manual Transmission Shift Lever Retainer



Courtesy of GENERAL MOTORS COMPANY

5. Install the manual transmission shift lever retainer (1).

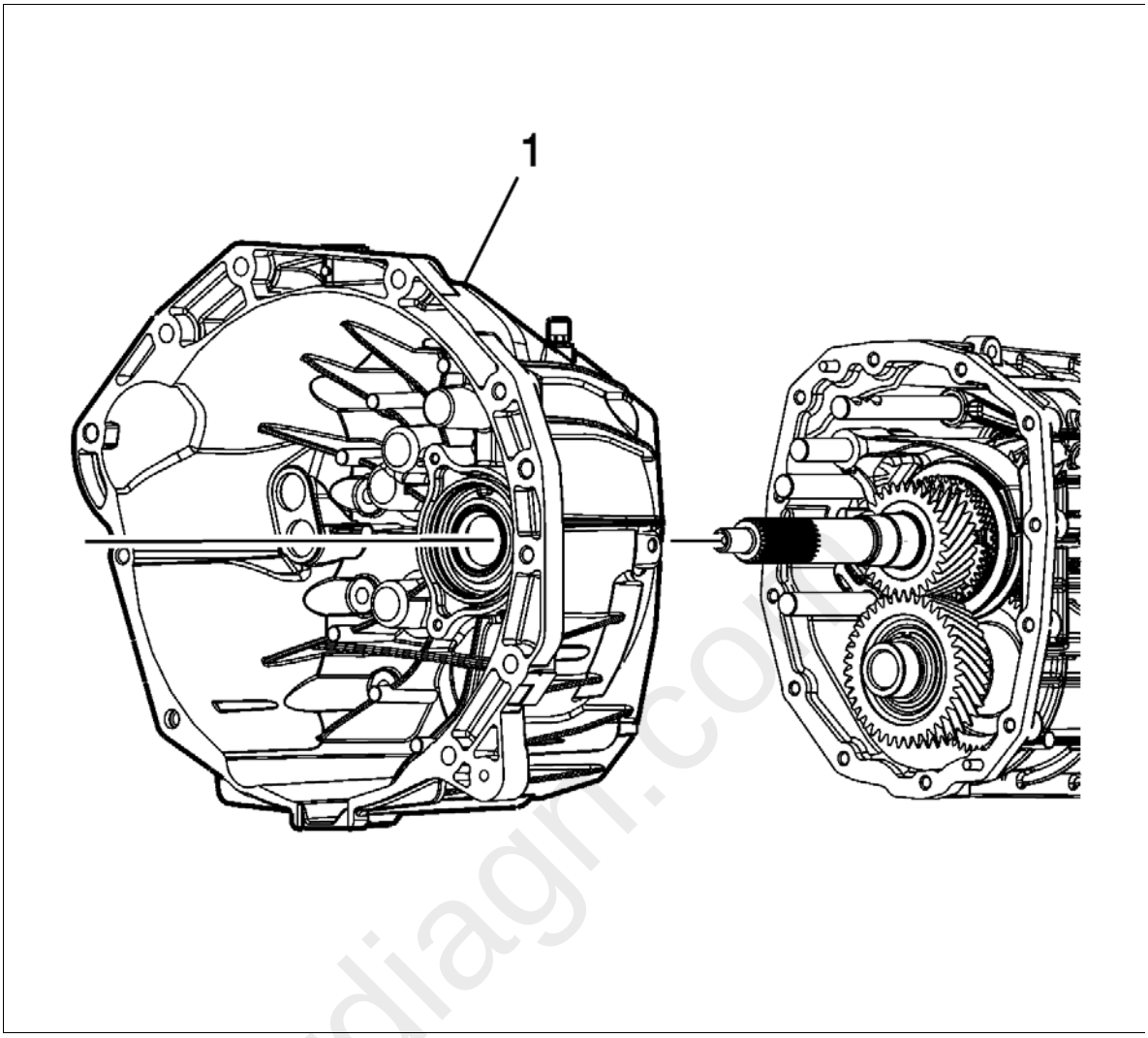
Fig 6: Clutch Housing Bead Sealant Application Area



Courtesy of GENERAL MOTORS COMPANY

6. Apply a 1.7 mm (0.07 in) bead of RTV sealant (1) to the clutch housing. Adhesives, Fluids, Lubricants, and Sealers (M13)

Fig 7: Clutch Housing Assembly

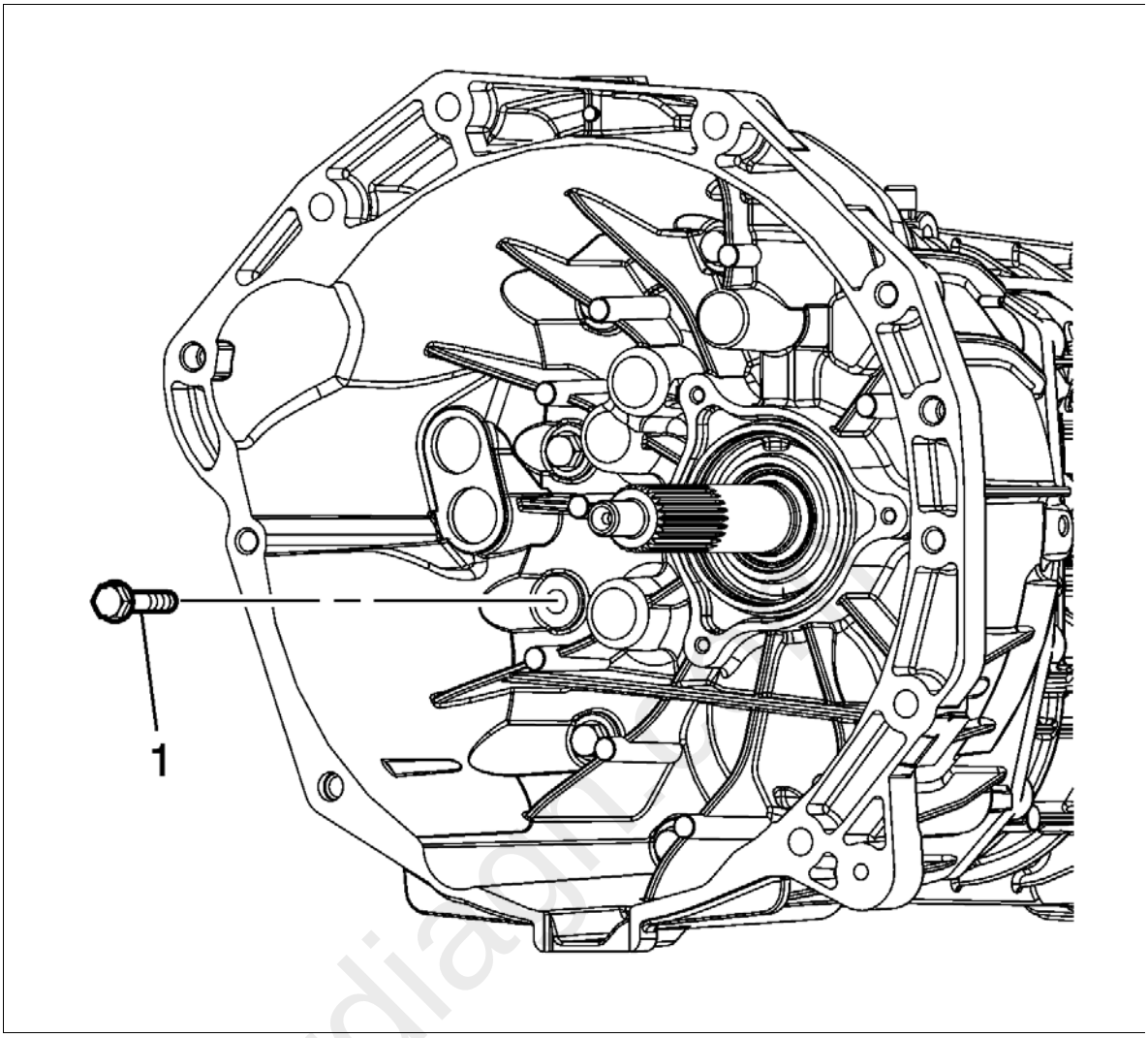


Courtesy of GENERAL MOTORS COMPANY

7. Install the clutch housing assembly (1)

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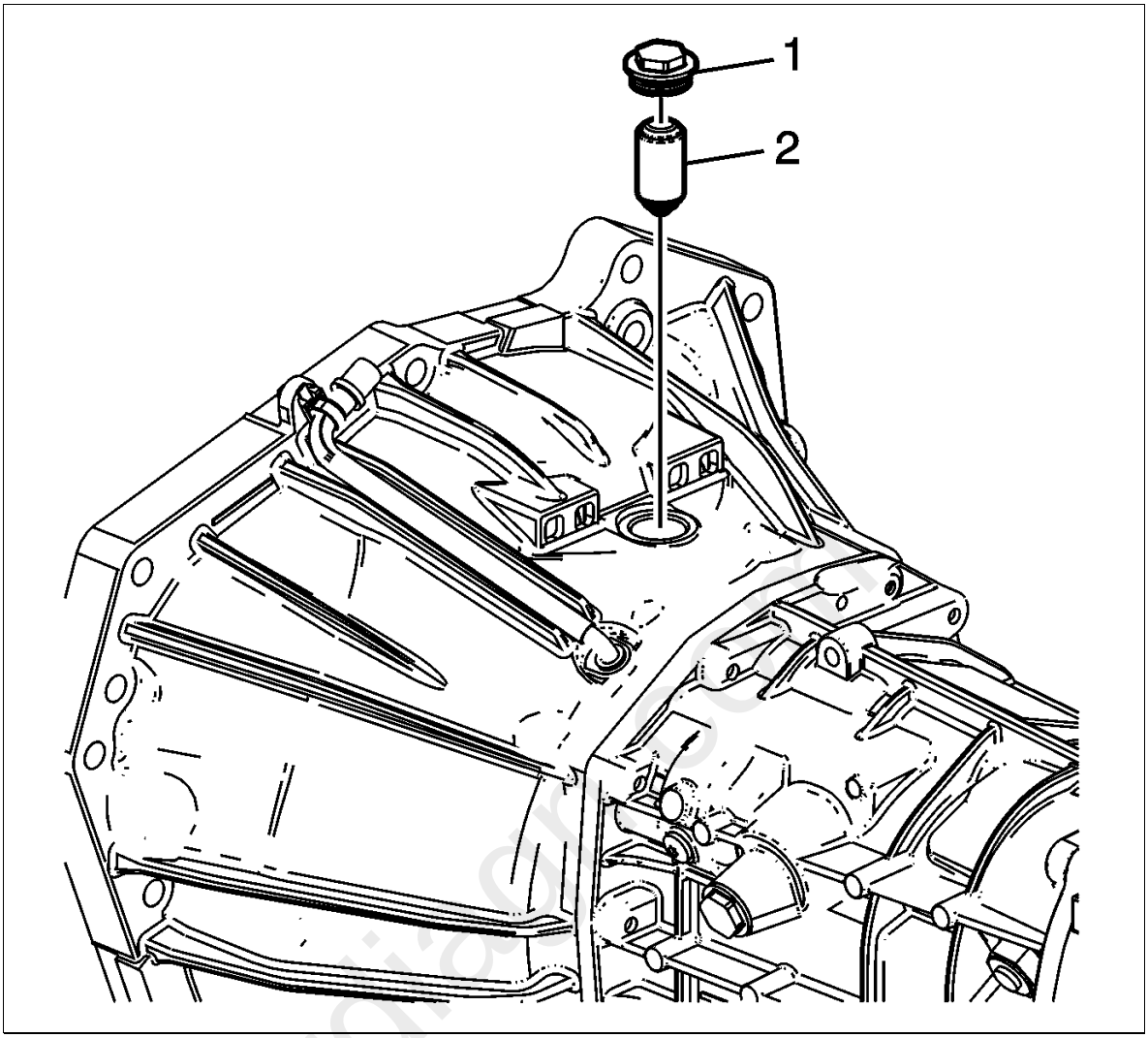
Fig 8: Clutch Housing Bolts



Courtesy of GENERAL MOTORS COMPANY

8. Install the clutch housing bolts (1). Tighten to 33 N.m (24 lb ft).

Fig 9: Shift Shaft Detent Plug And Roller Detent

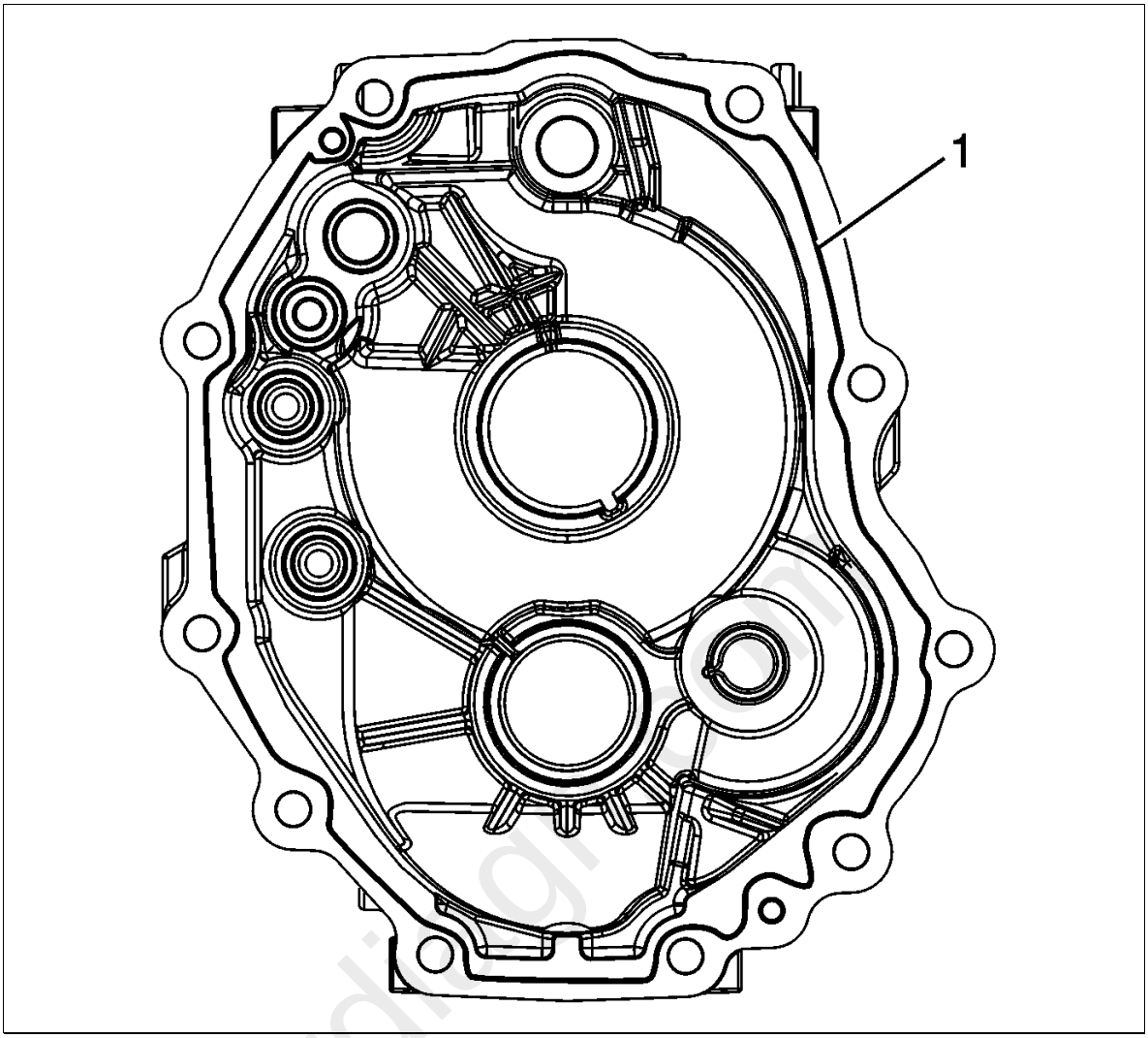


Courtesy of GENERAL MOTORS COMPANY

9. Install the shift shaft detent plug (1) and the roller detent (2). Tighten plug to 50 N.m (37 lb ft).

REPAIR INSTRUCTIONS - OFF VEHICLE > TRANSMISSION ASSEMBLE (M13 - LGX W/O L4Q, LTG) > EXTENSION HOUSING INSTALL

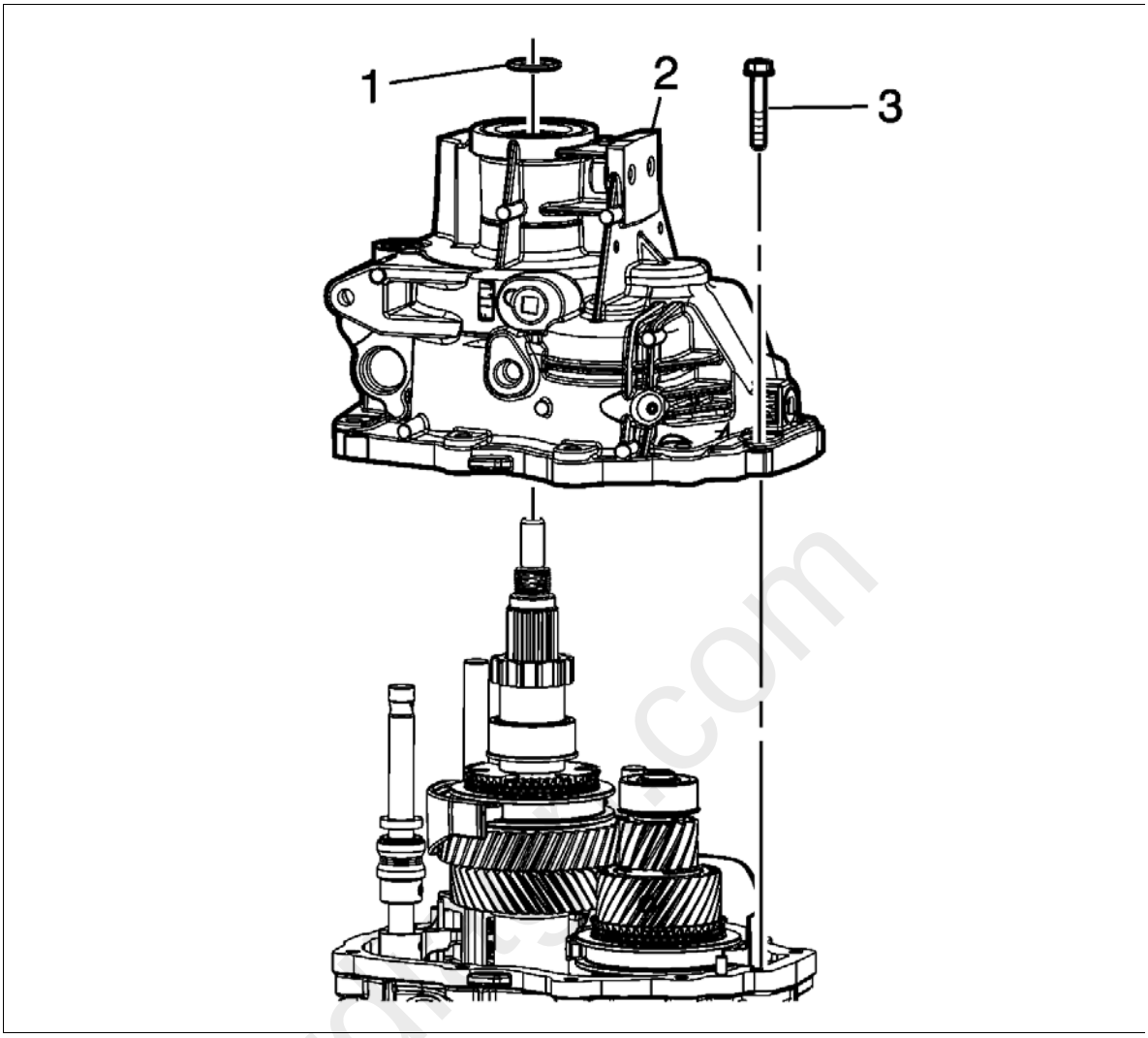
Fig 1: Extension Housing Bead Sealant Application Area



Courtesy of GENERAL MOTORS COMPANY

1. Apply a 1.7 mm (0.07 in) bead of RTV sealant (1) to the extension housing. Adhesives, Fluids, Lubricants, and Sealers (M13)

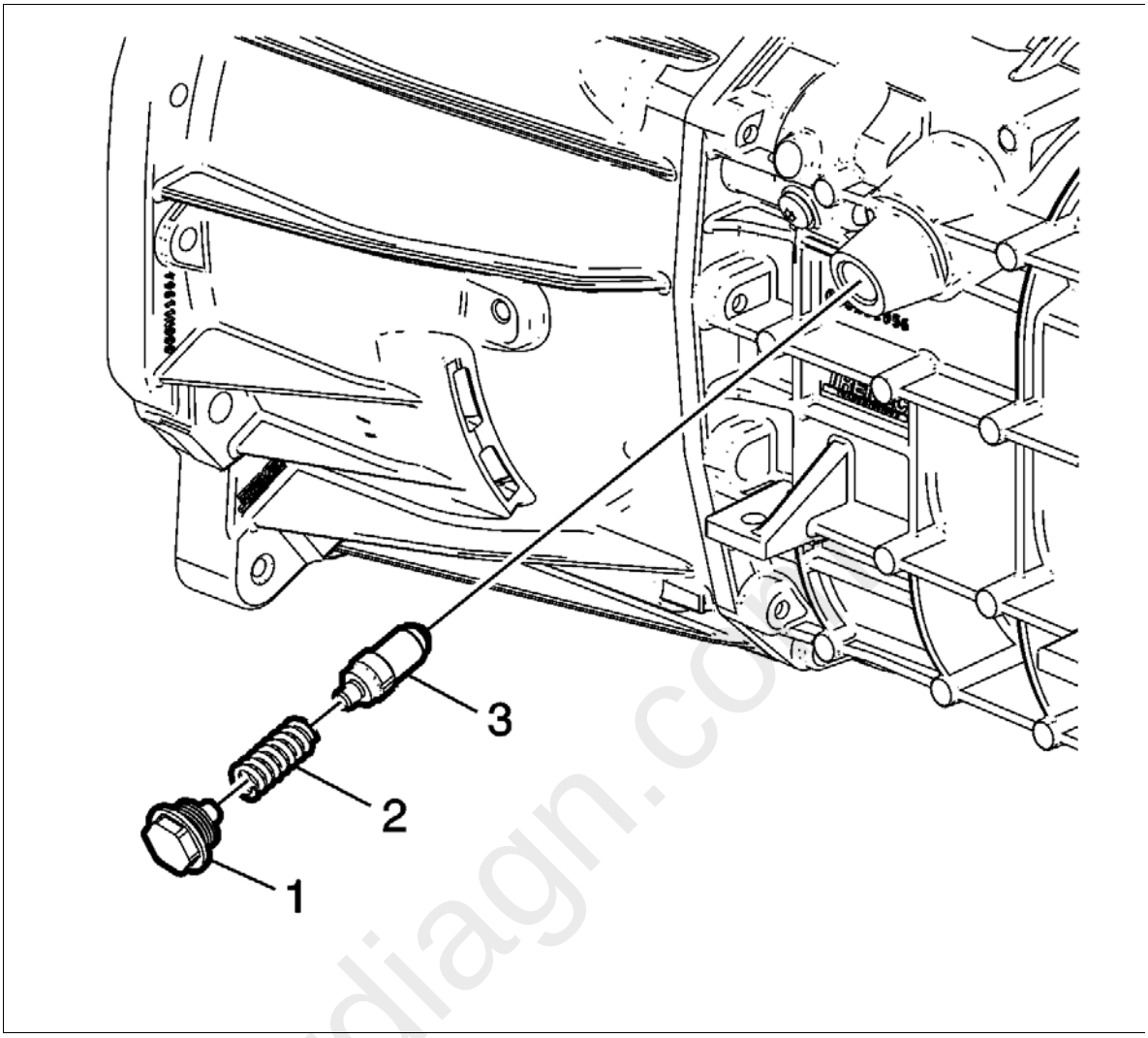
Fig 2: Extension Housing Assembly, Bolts & Propeller Shaft O-ring



Courtesy of GENERAL MOTORS COMPANY

2. Install the O-ring (1) onto the propeller shaft.
3. Install the extension housing assembly (2) and the extension housing bolts (3). Tighten the bolts to 33 N.m (24 lb ft).

Fig 3: Manual Shift Detent, Spring & Bolt

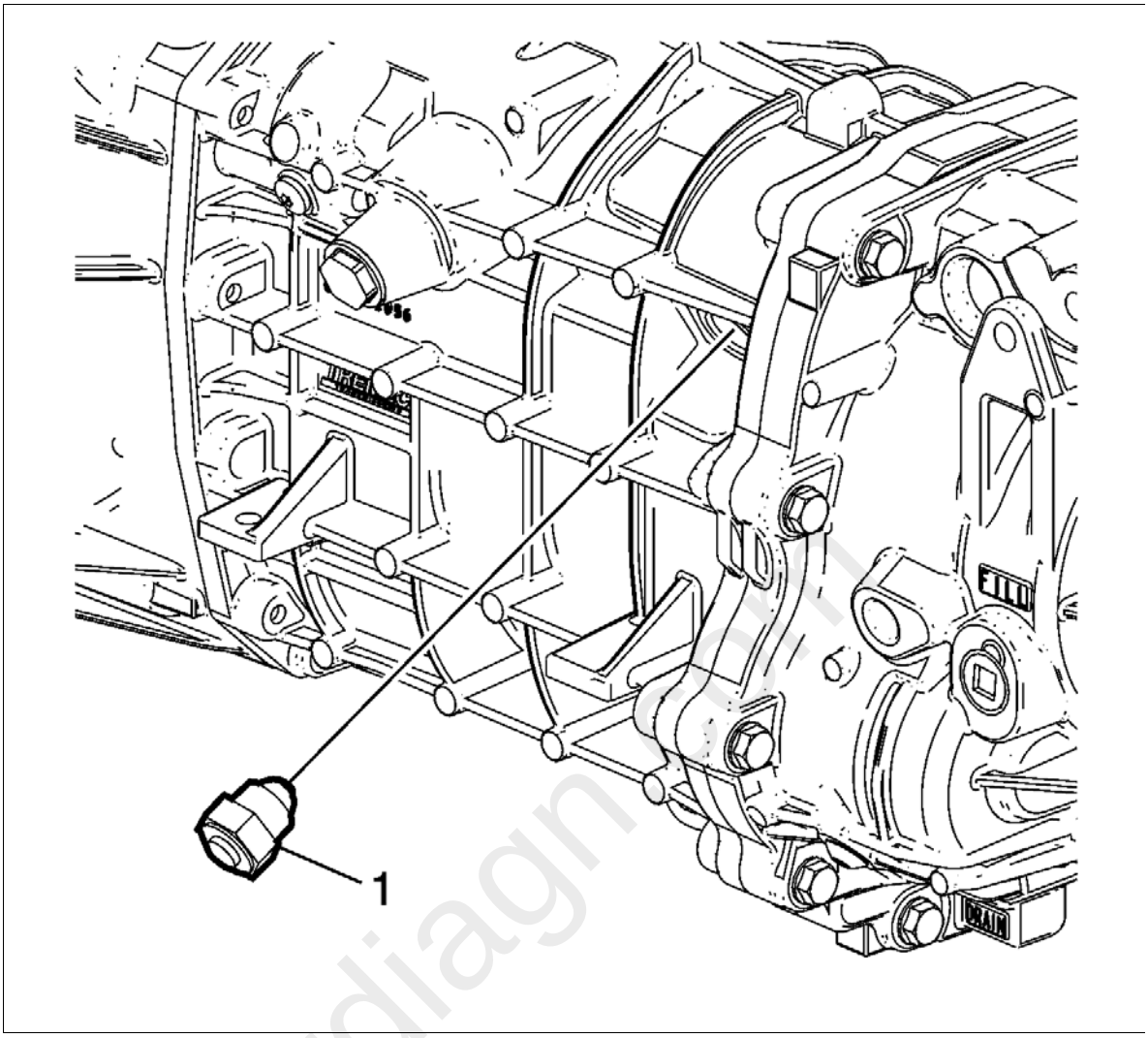


Courtesy of GENERAL MOTORS COMPANY

4. Install the manual shift detent bolt (1), detent spring (2) and the detent (3). Tighten the bolt to 28 N.m (21 lb ft).

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Fig 4: Shift Interlock Detent Assembly

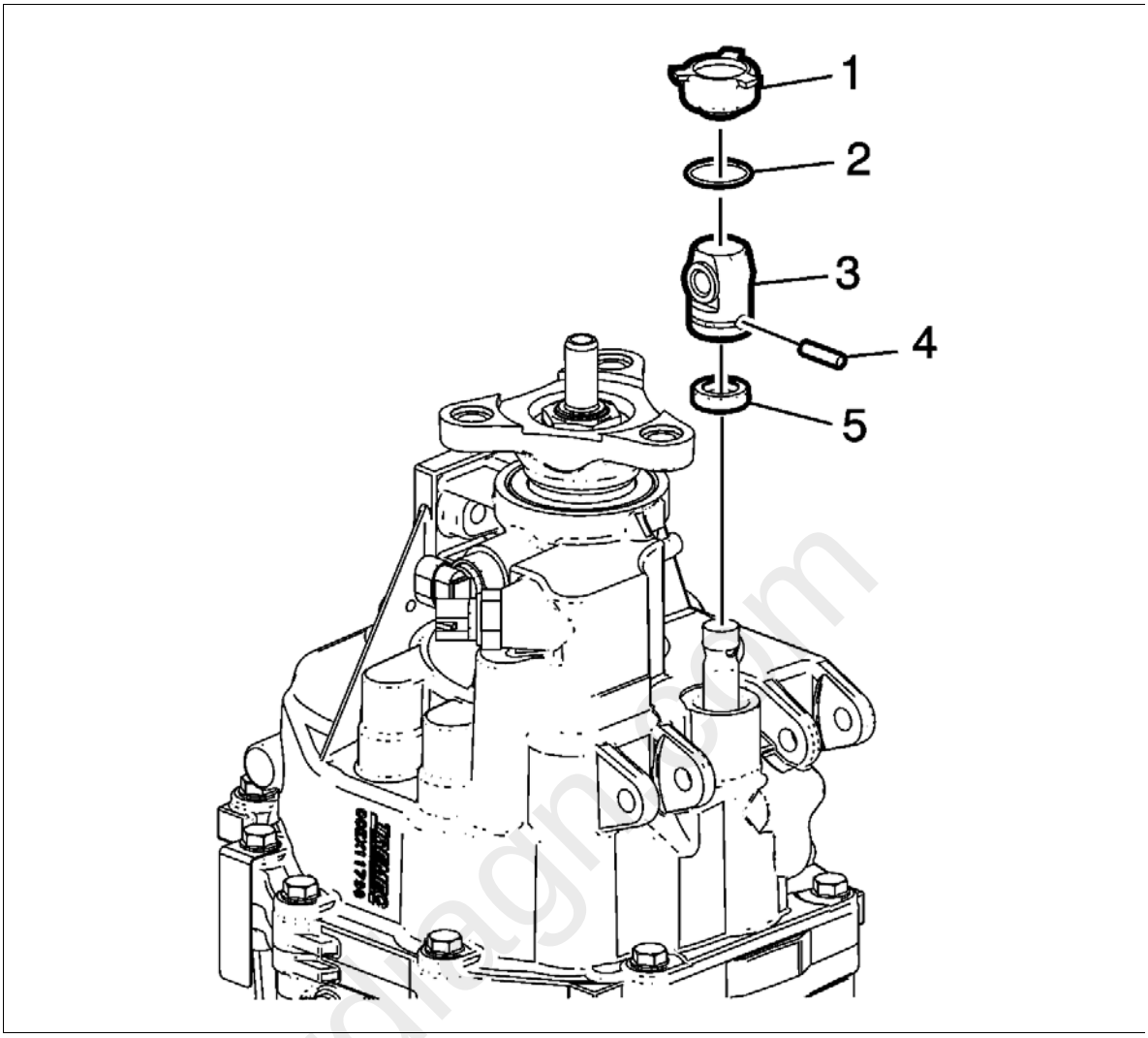


Courtesy of GENERAL MOTORS COMPANY

5. Install the shift interlock detent assembly (1). Tighten to 40 N.m (30 lb ft)

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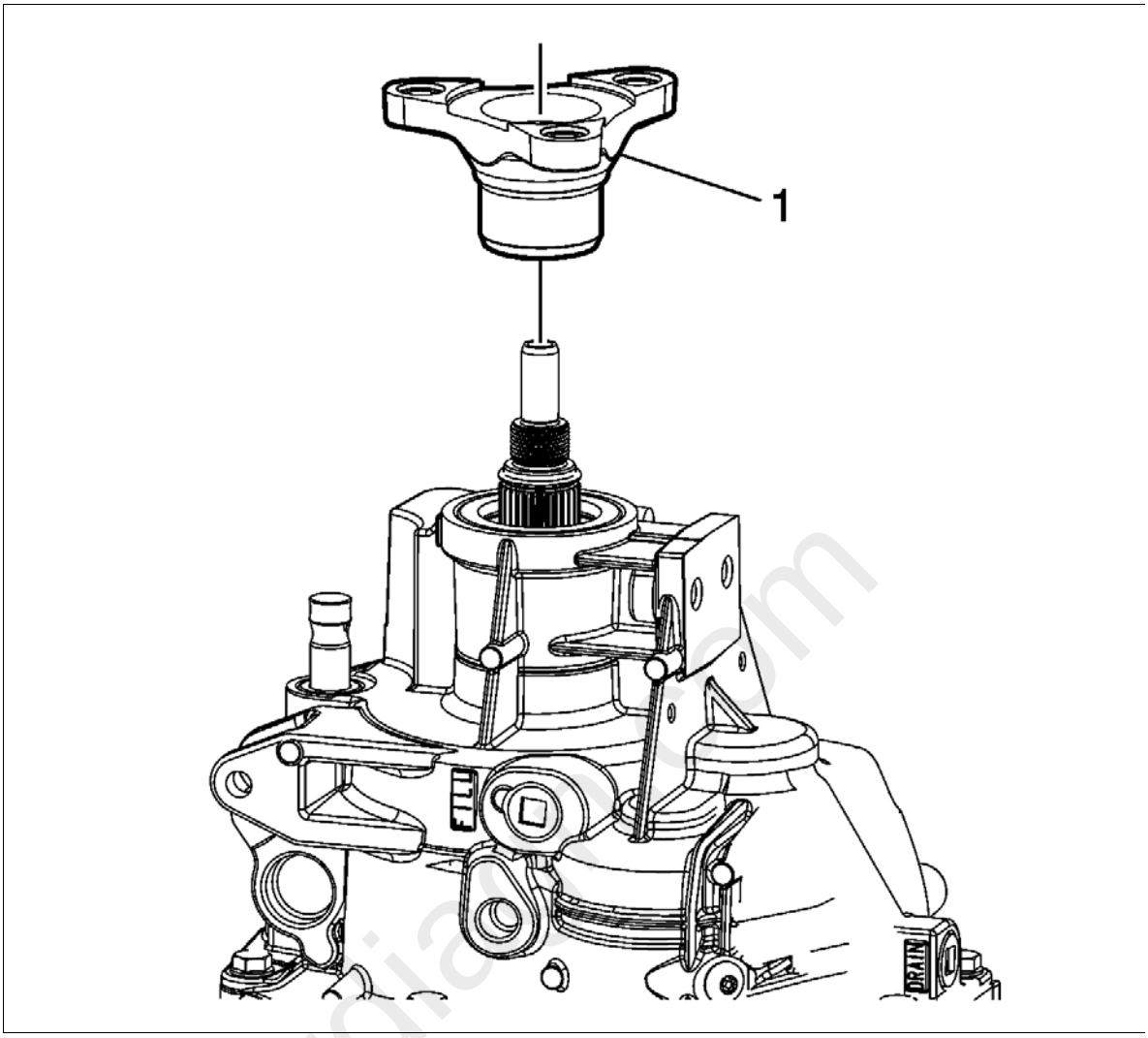
Fig 5: Manual Transmission Control Lever Components



Courtesy of GENERAL MOTORS COMPANY

6. Install the manual transmission control lever seal (5).
7. Install the manual transmission shift lever shaft joint (3) and manual transmission control lever pin (4).
8. Install the manual transmission control lever retainer (2) and manual transmission control shaft boot (1).

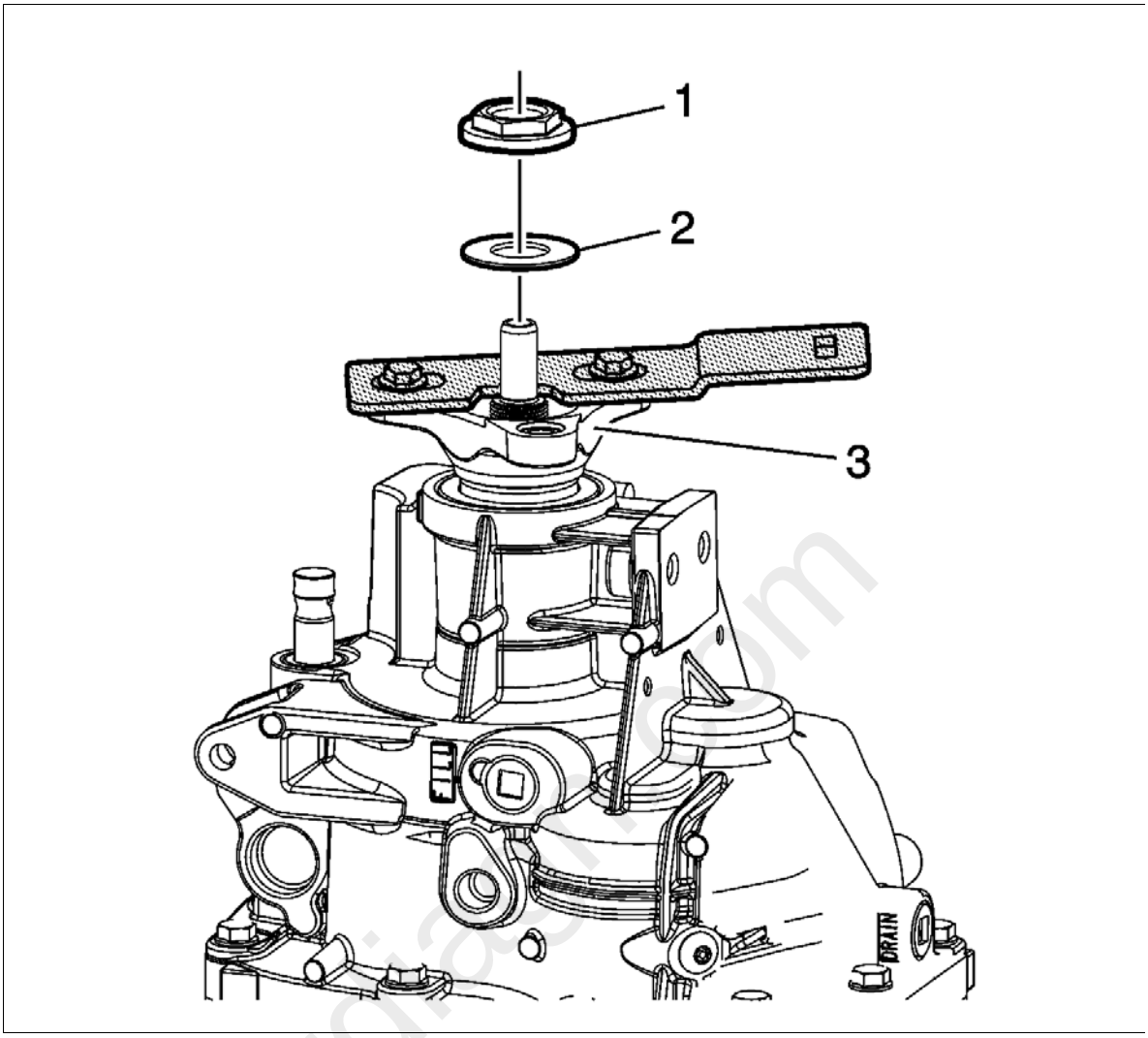
Fig 6: Propeller Shaft Transmission Yoke



Courtesy of GENERAL MOTORS COMPANY

9. Install the propeller shaft transmission yoke (1).

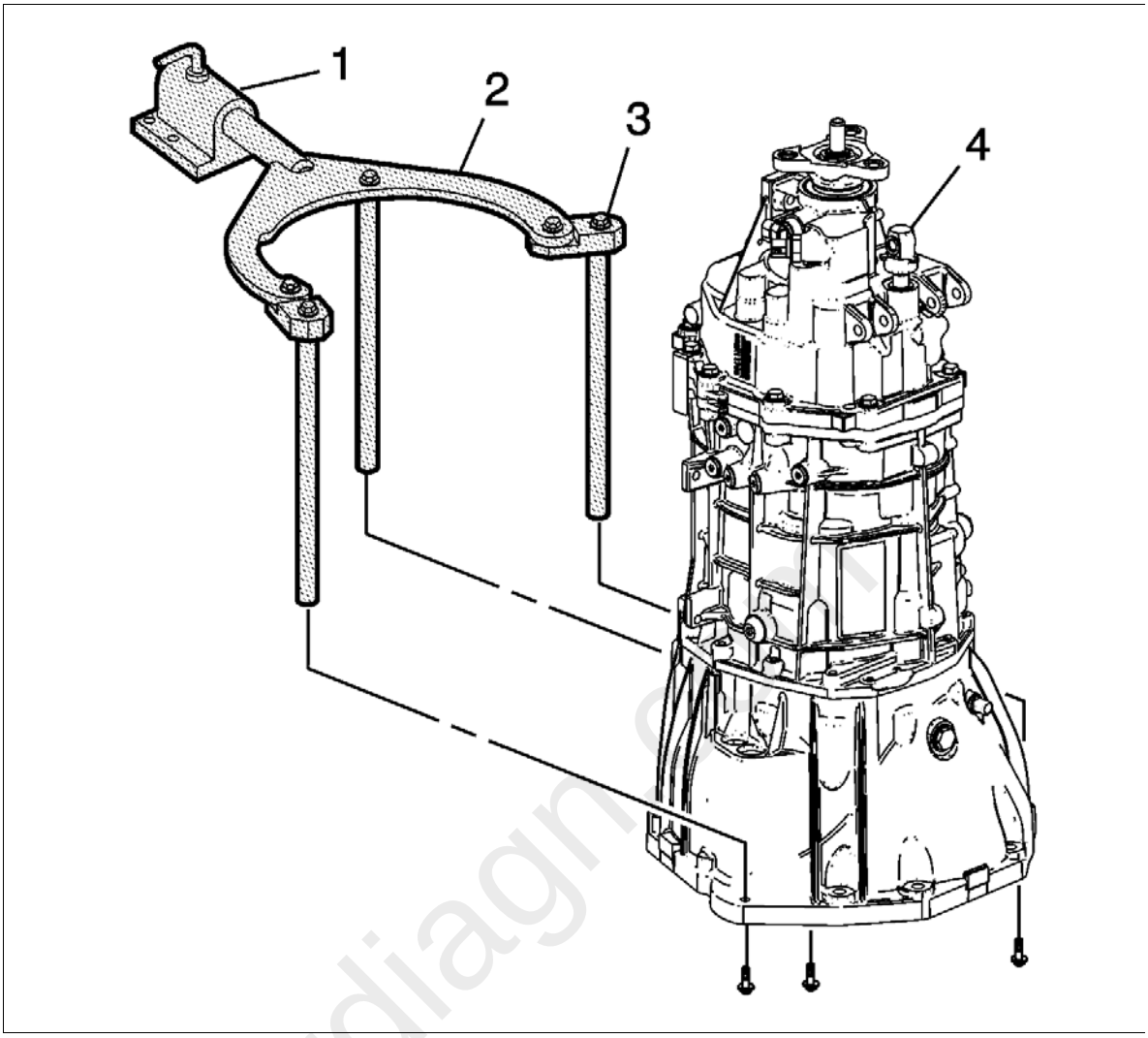
Fig 7: Propeller Shaft Transmission Yoke, Washer & Nut



Courtesy of GENERAL MOTORS COMPANY

10. Install the propeller shaft transmission yoke flange washer (2).
11. Install the **J-45012** holder with the mounting bolts to the propshaft transmission yoke (3).
12. Using a socket wrench, Install the propeller shaft transmission yoke nut (1) and tighten to 140 N.m (103 lb ft).
13. Remove the **J-45012** holder.

Fig 8: Transmission Holding Flange, Adapter & Fixture



Courtesy of GENERAL MOTORS COMPANY

14. Remove the transmission (4) from the **DT-47678** flange (2) and the **DT-47678-10** flange adapter (3).

REPAIR INSTRUCTIONS - OFF VEHICLE > SHIMMING PROCEDURES (MM6)

Special Tools

J 8001 Dial Indicator Set

For equivalent regional tools, refer to Special Tools (MM6) .

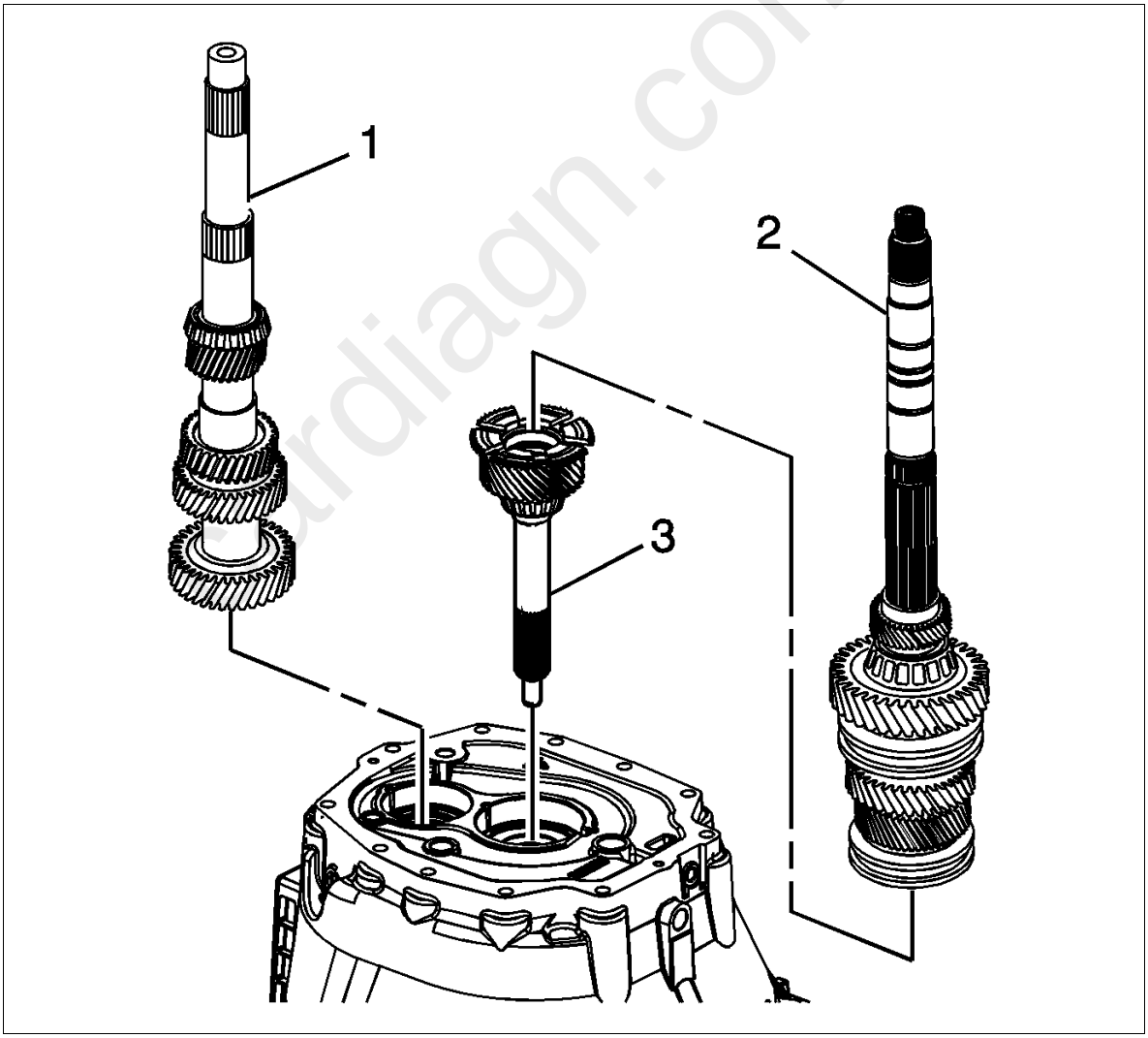
NOTE:

The shimming procedure is required to be performed during service only when the following parts are replaced:

- *The input shaft*
- *The counter shaft*
- *The main shaft*
- *The adapter plate*
- *The main housing*
- *The extension housing*

REPAIR INSTRUCTIONS - OFF VEHICLE > SHIMMING PROCEDURES (MM6) > INPUT SHAFT, MAINSHAFT, AND COUNTERSHAFT

Fig 1: Input Shaft, Mainshaft, and Countershaft



Courtesy of GENERAL MOTORS COMPANY

1. Rotate the clutch housing to the vertical position.

2. Install the following assemblies in order:

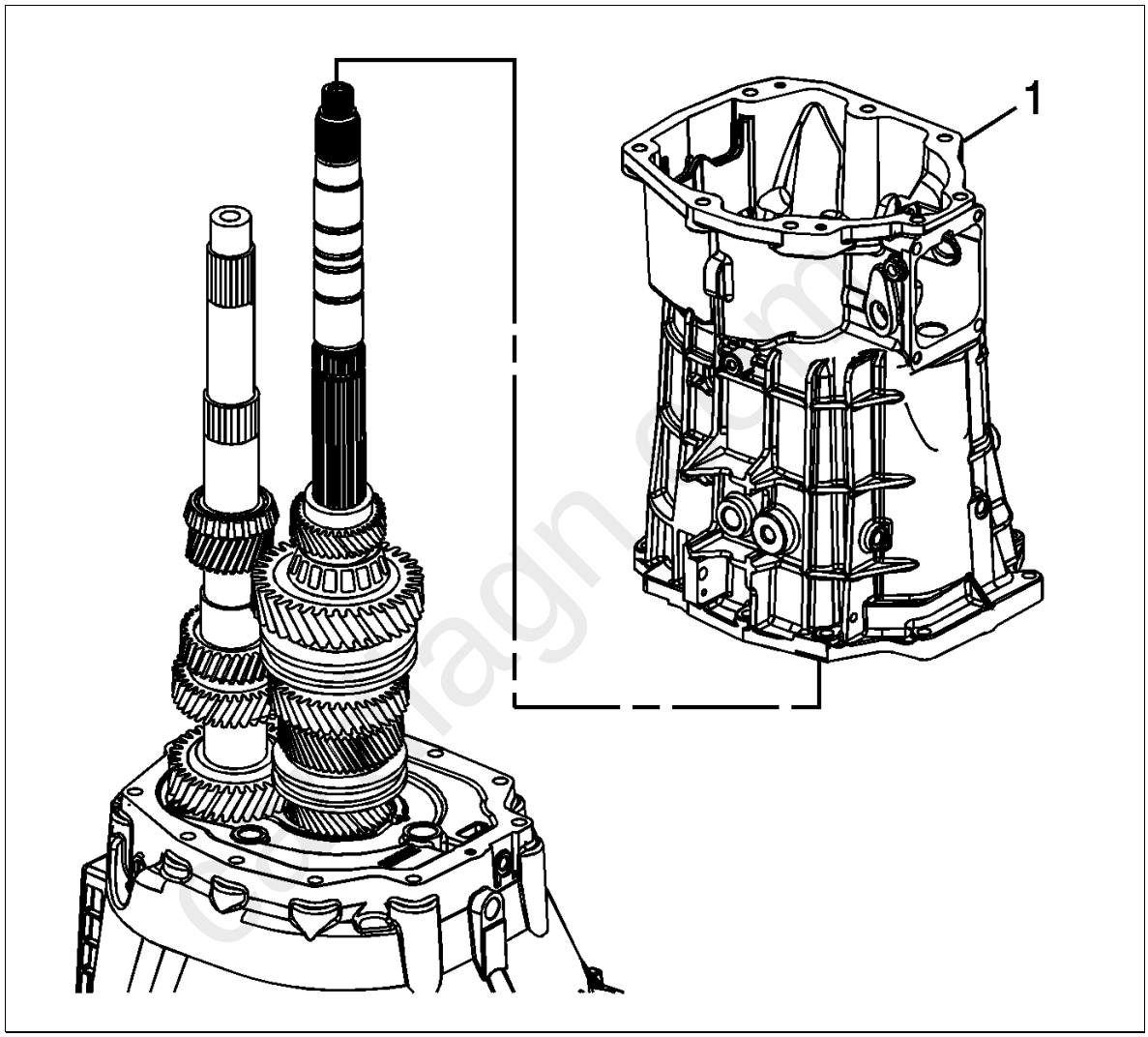
    1. The input shaft (3)

    2. Align the 4th speed gear blocking ring to the input shaft.

    3. The mainshaft assembly (2)

    4. The countershaft (1), lifting up the mainshaft enough to install the countershaft.

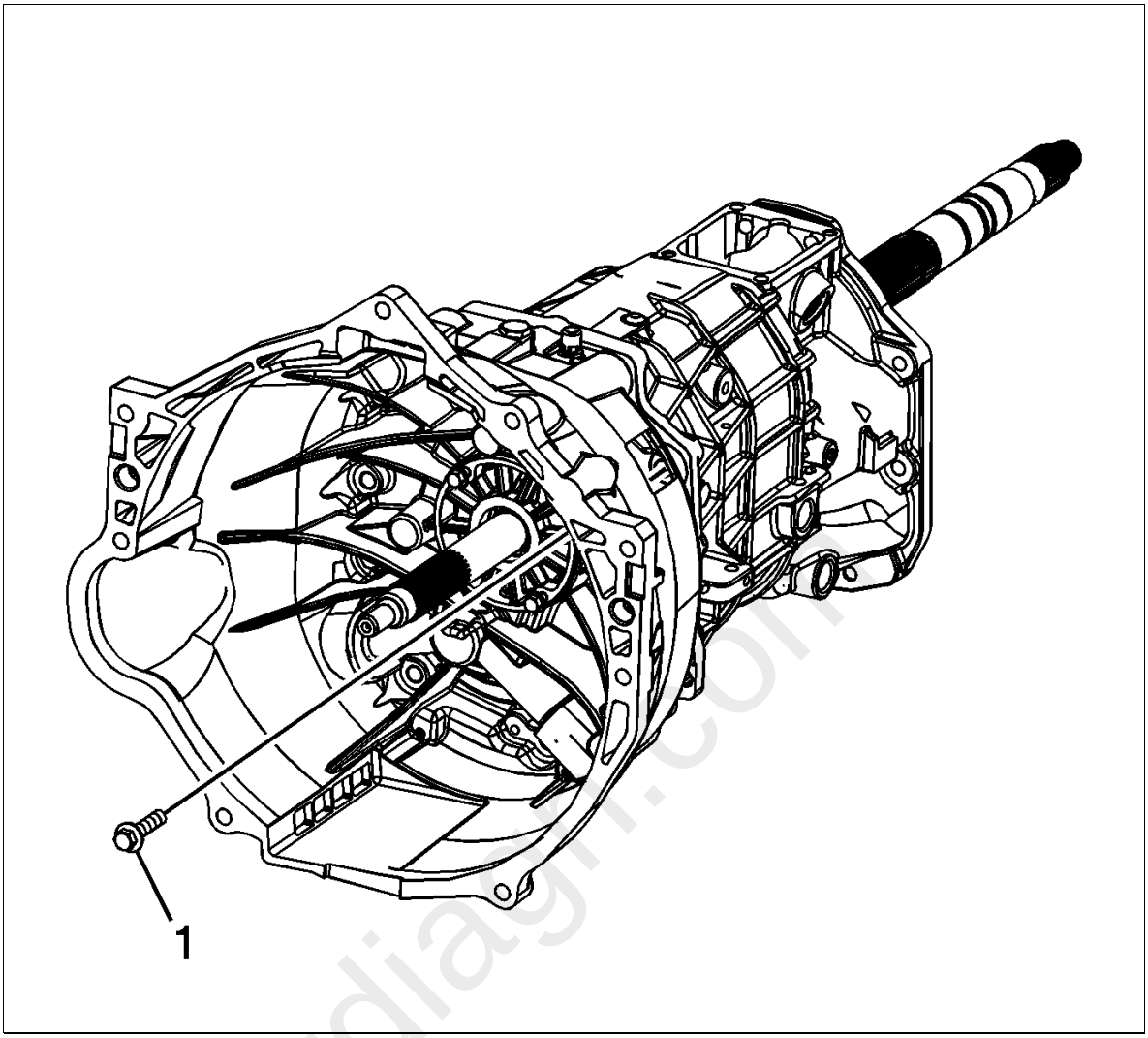
Fig 2: Transmission Case



Courtesy of GENERAL MOTORS COMPANY

3. Install the transmission case (1).

Fig 3: Clutch Housing To Transmission Case Bolts



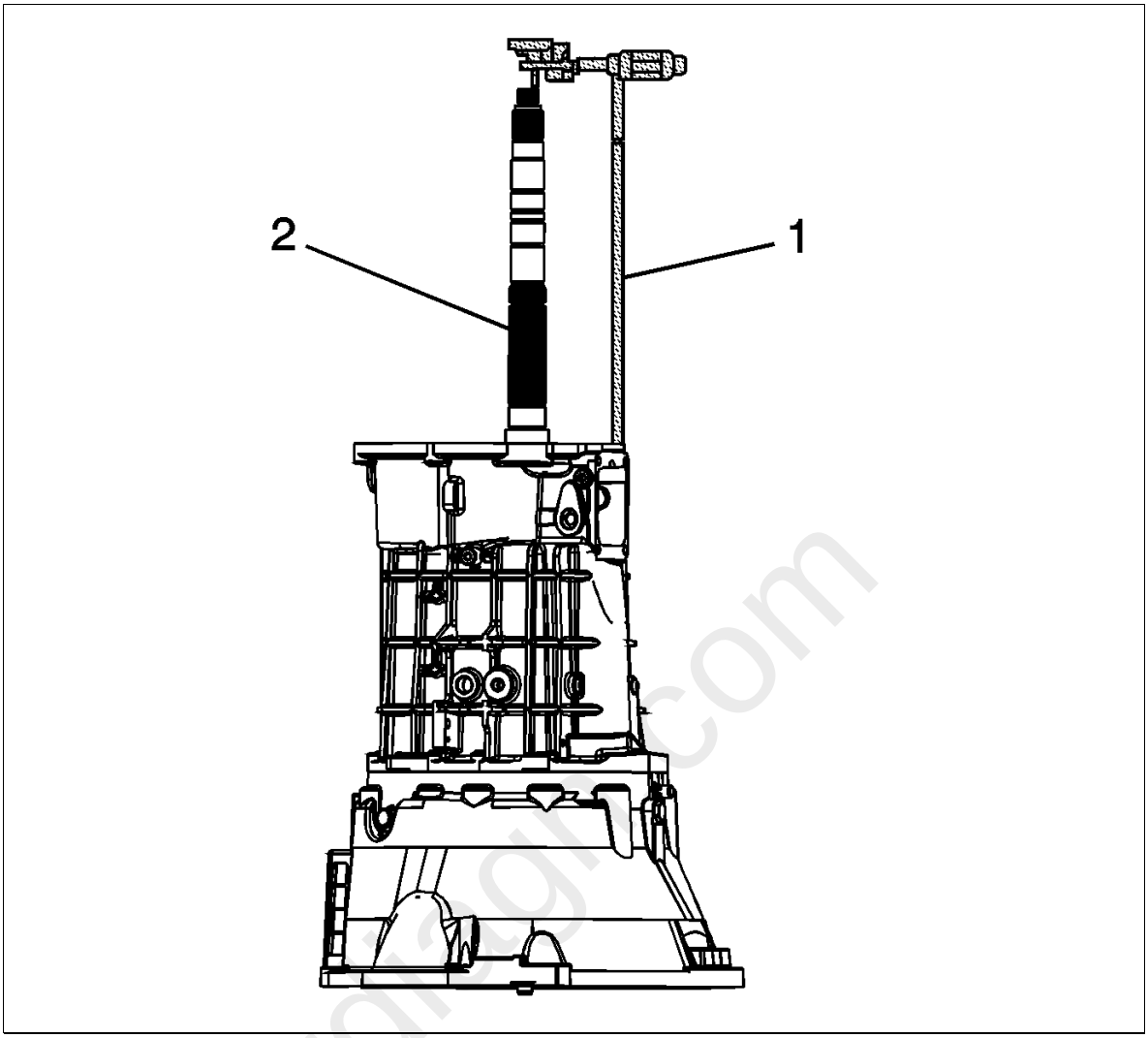
Courtesy of GENERAL MOTORS COMPANY

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> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

4. Install the clutch housing to transmission case bolts (1) and tighten to 36 N.m (27 lb ft).

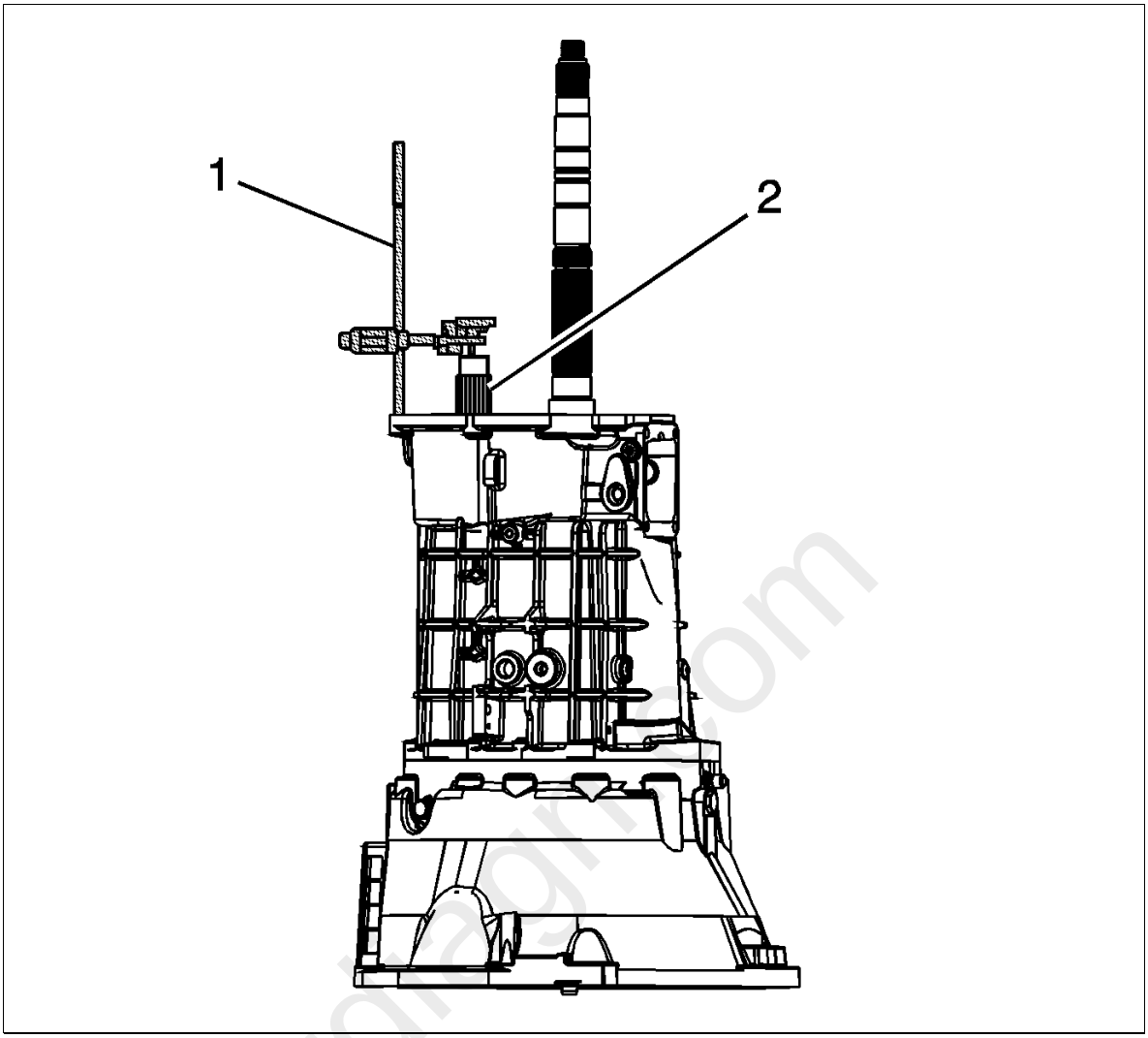
Fig 4: Input Shaft/Mainshaft End Play



Courtesy of GENERAL MOTORS COMPANY

5. Measure the input shaft/mainshaft end play using the following procedure:
    1. Place the tip of the **J 8001** indicator set (1) on the end of the mainshaft.
    2. Move the main shaft up and down.
    3. Record the measurement.
6. Select a shim to achieve 0.0127-0.0889 mm (0.00049-0.00349 in) end play.
7. Remove the **J 8001** indicator set.

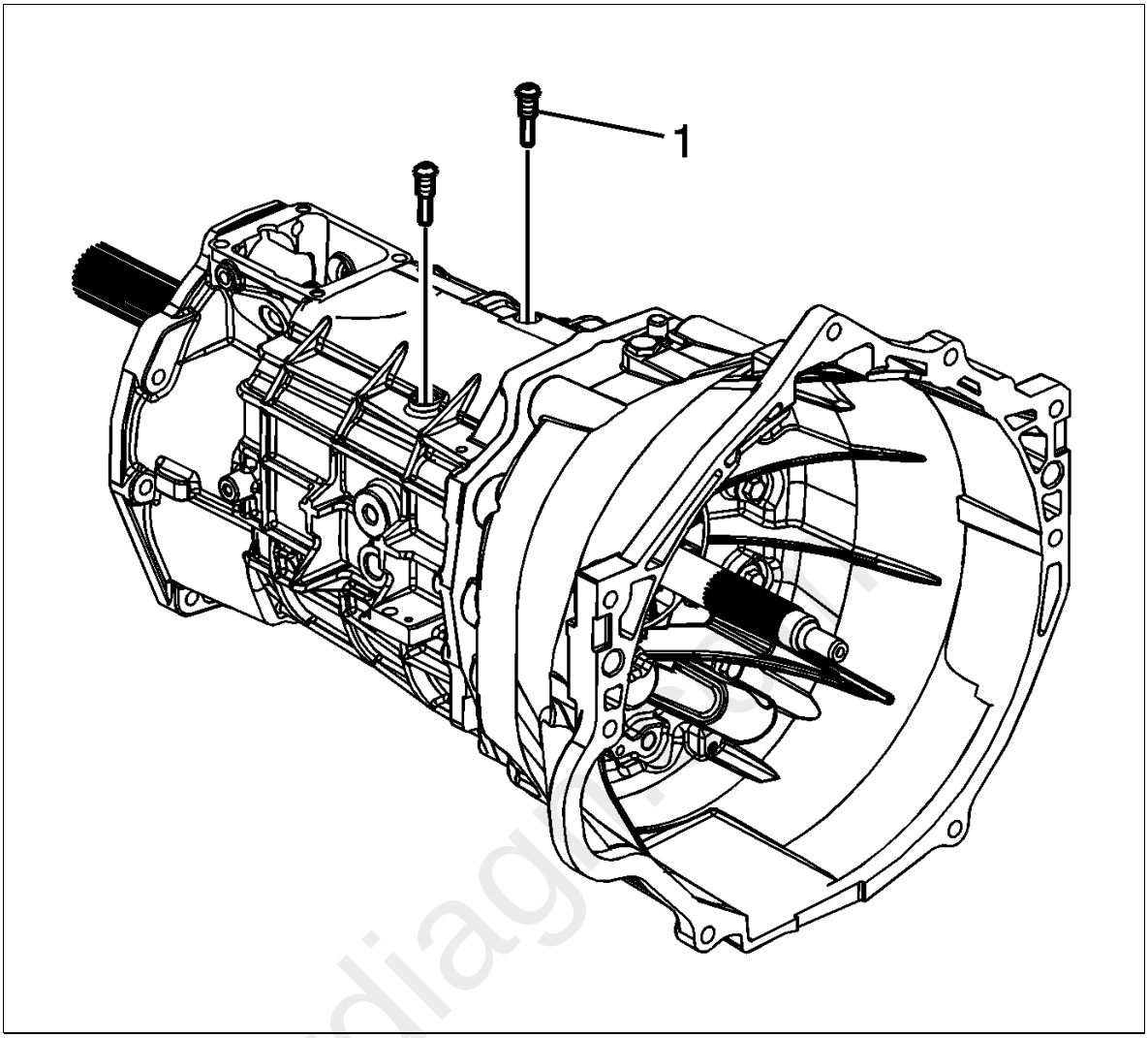
Fig 5: Countershaft End Play



Courtesy of GENERAL MOTORS COMPANY

8. Measure the countershaft end play using the following procedure:
    1. Place the tip of the **J 8001** indicator set (1) on the end of the countershaft.
    2. Move the countershaft up and down.
    3. Record the measurement.
9. Select a shim to achieve 0.0127-0.0889 mm (0.00049-0.00349 in) end play.
10. Remove the **J 8001** indicator set.

Fig 6: Shift Lever Guide Bolts

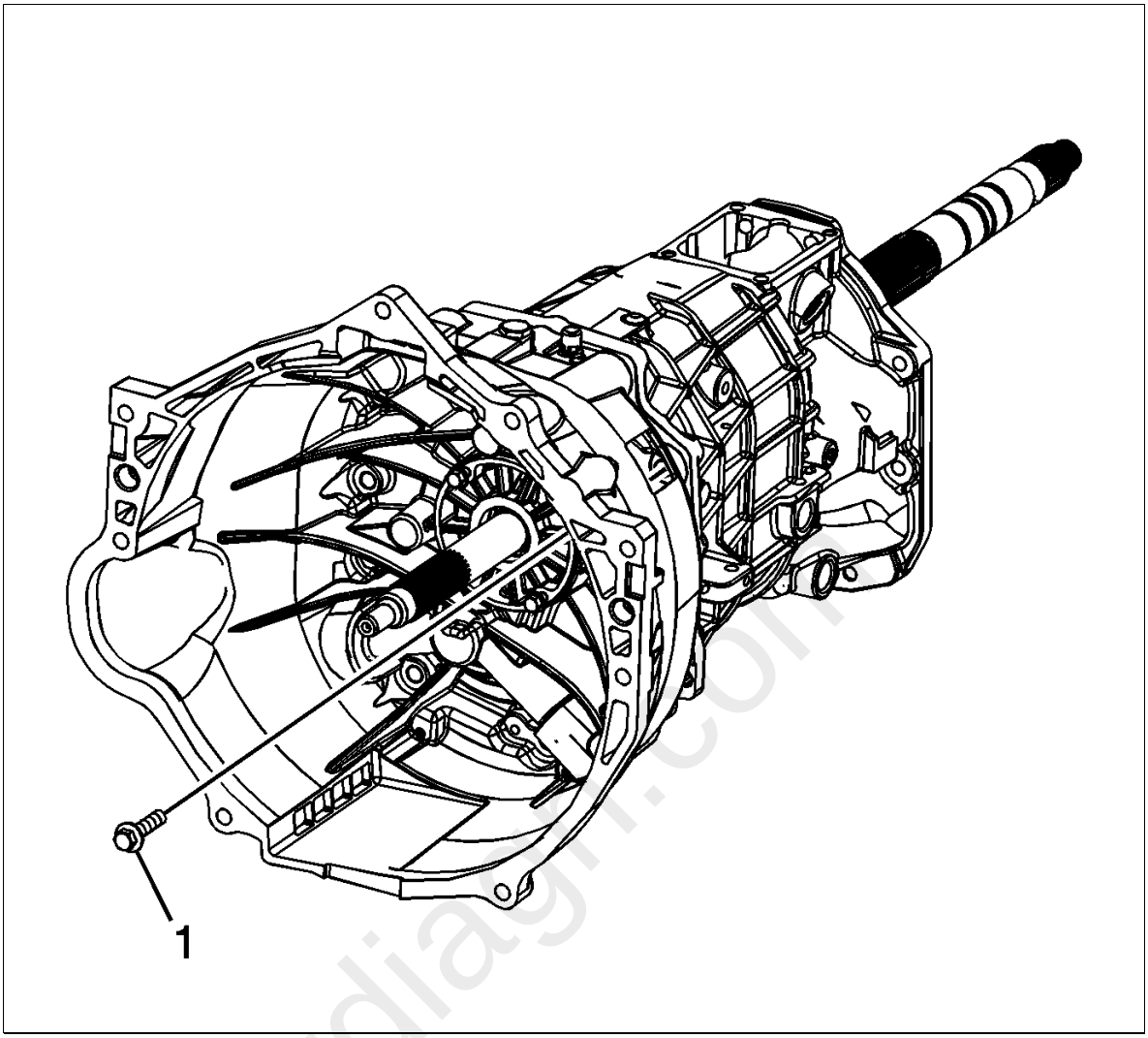


Courtesy of GENERAL MOTORS COMPANY

11. Remove the shift lever guide bolts (1).

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Fig 7: Clutch Housing To Transmission Case Bolts

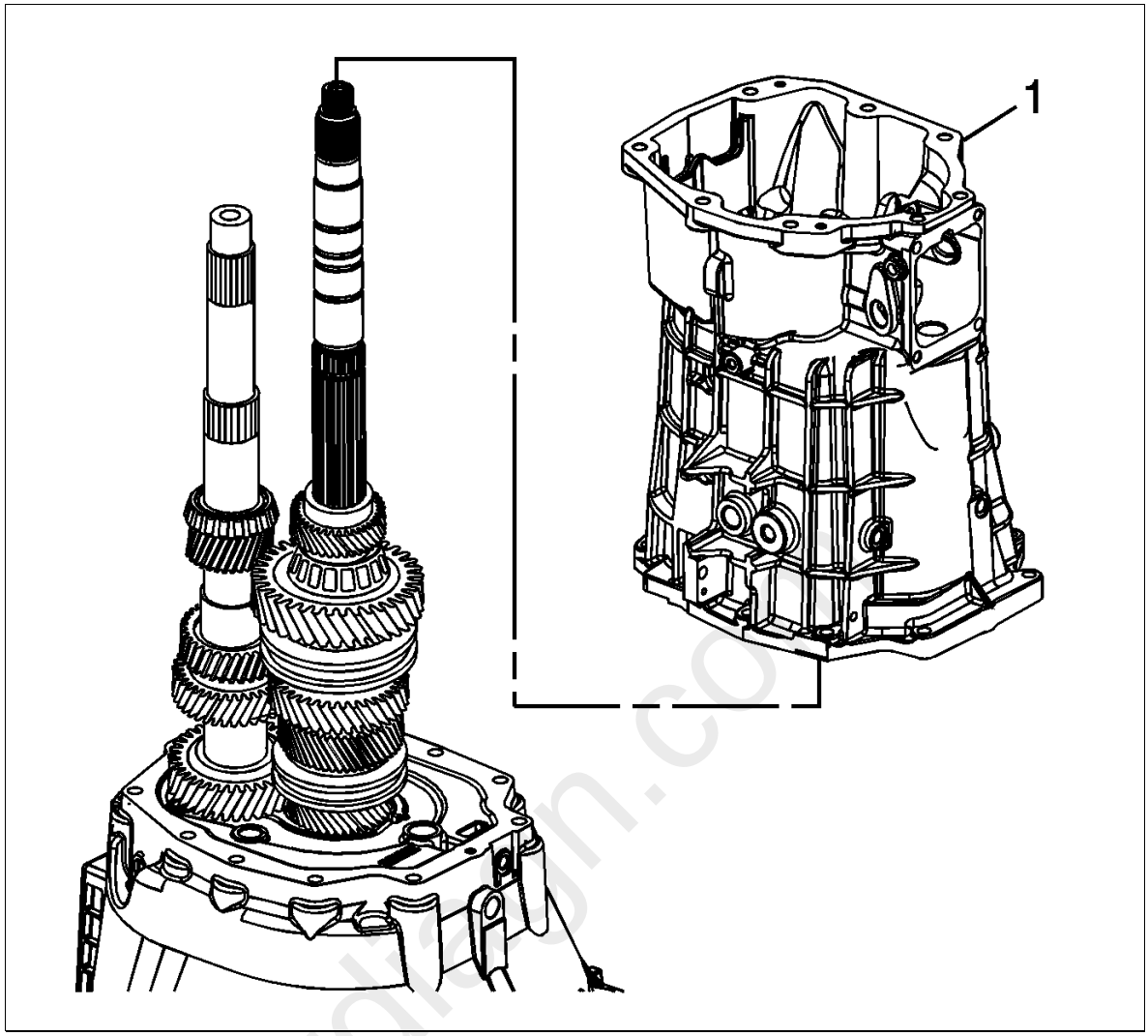


Courtesy of GENERAL MOTORS COMPANY

12. Remove the clutch housing to the transmission case bolts (1).

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Fig 8: Transmission Case

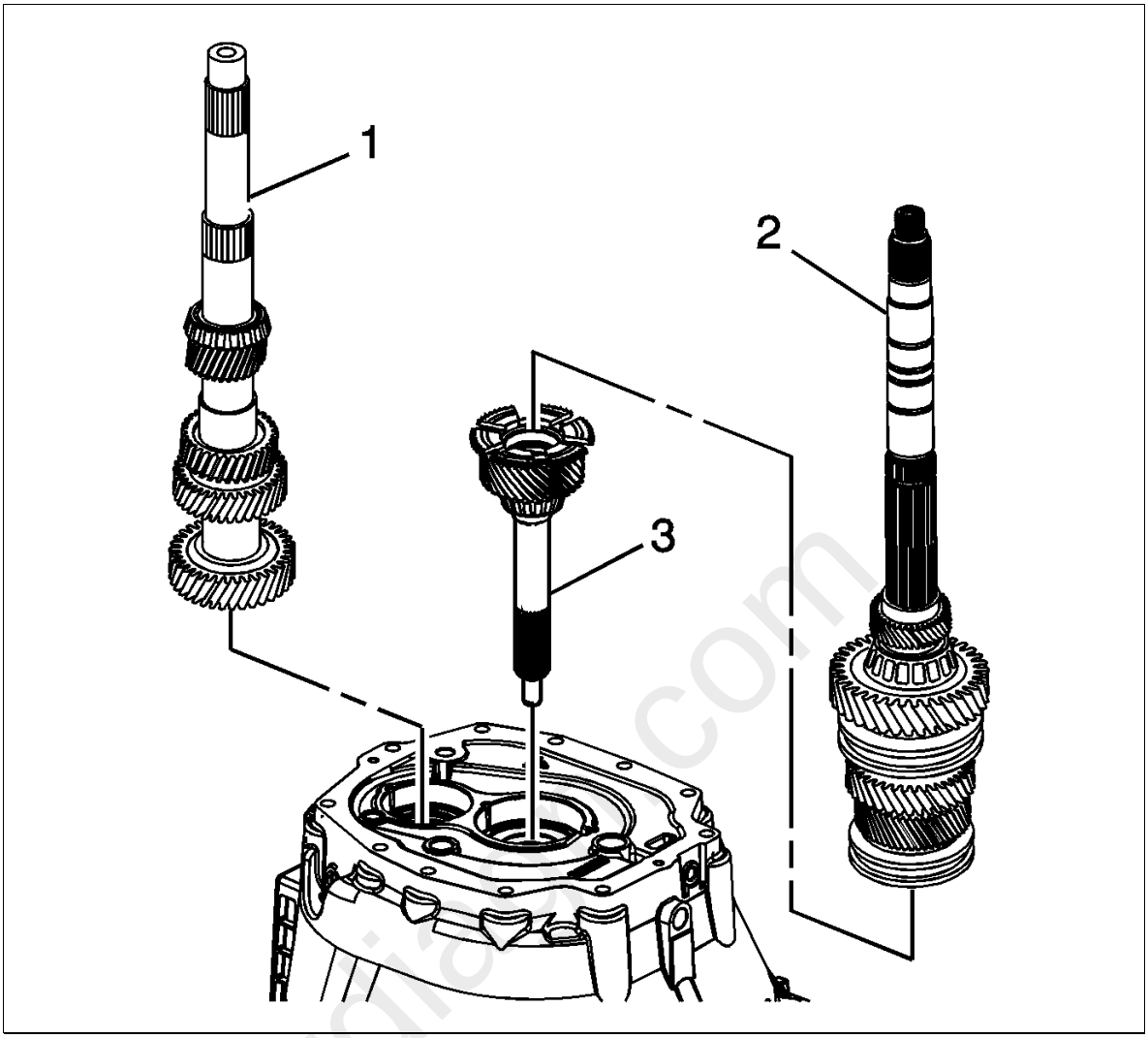


Courtesy of GENERAL MOTORS COMPANY

13. Remove the transmission case (1).

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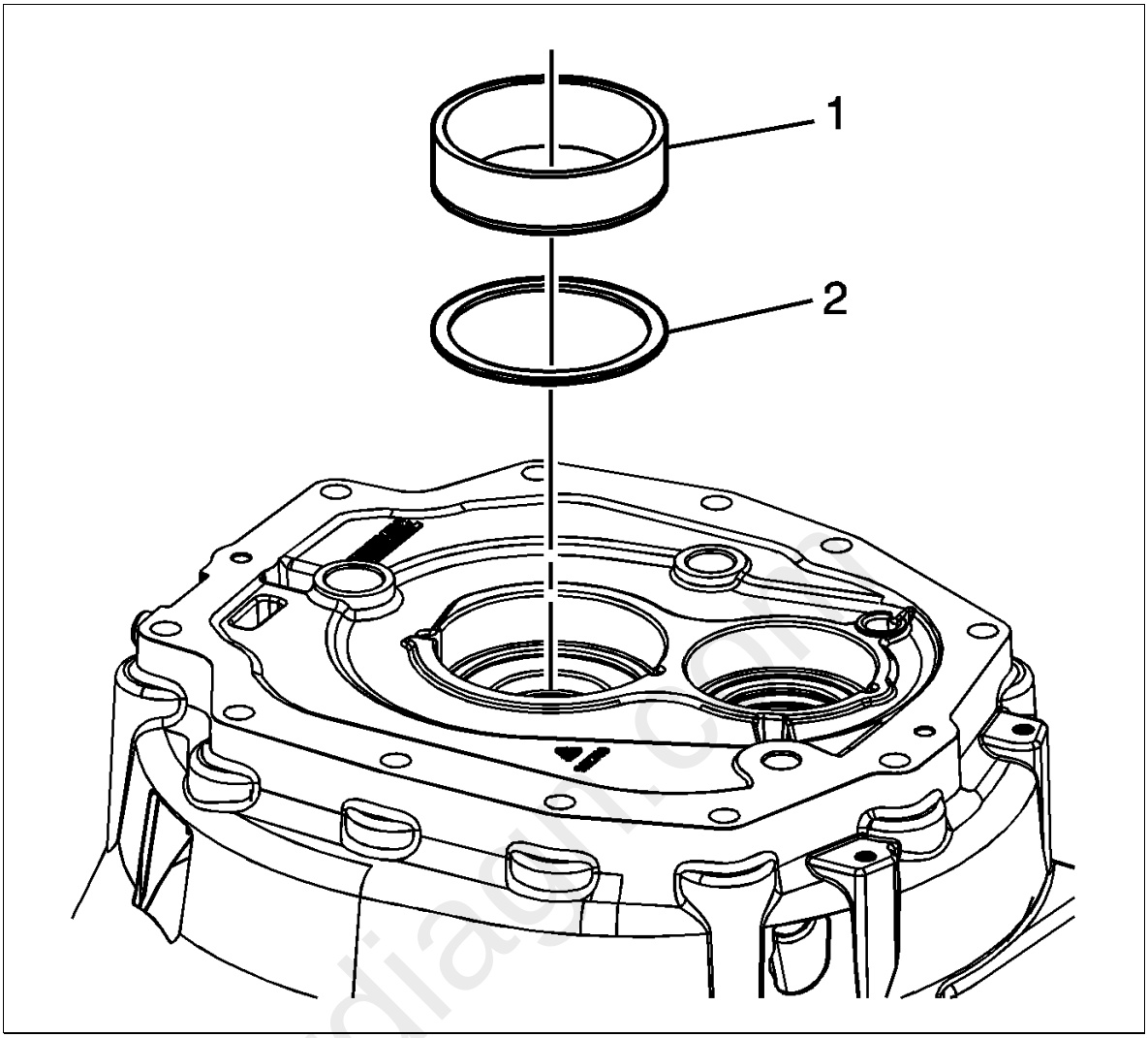
Fig 9: Input Shaft, Mainshaft, and Countershaft



Courtesy of GENERAL MOTORS COMPANY

14. Remove the following parts in order:
    1. The countershaft (1), lifting up the mainshaft (2) enough to remove the countershaft.
    2. The mainshaft assembly (2)
    3. The input shaft (3)

Fig 10: Input Shaft Bearing Race & Shim

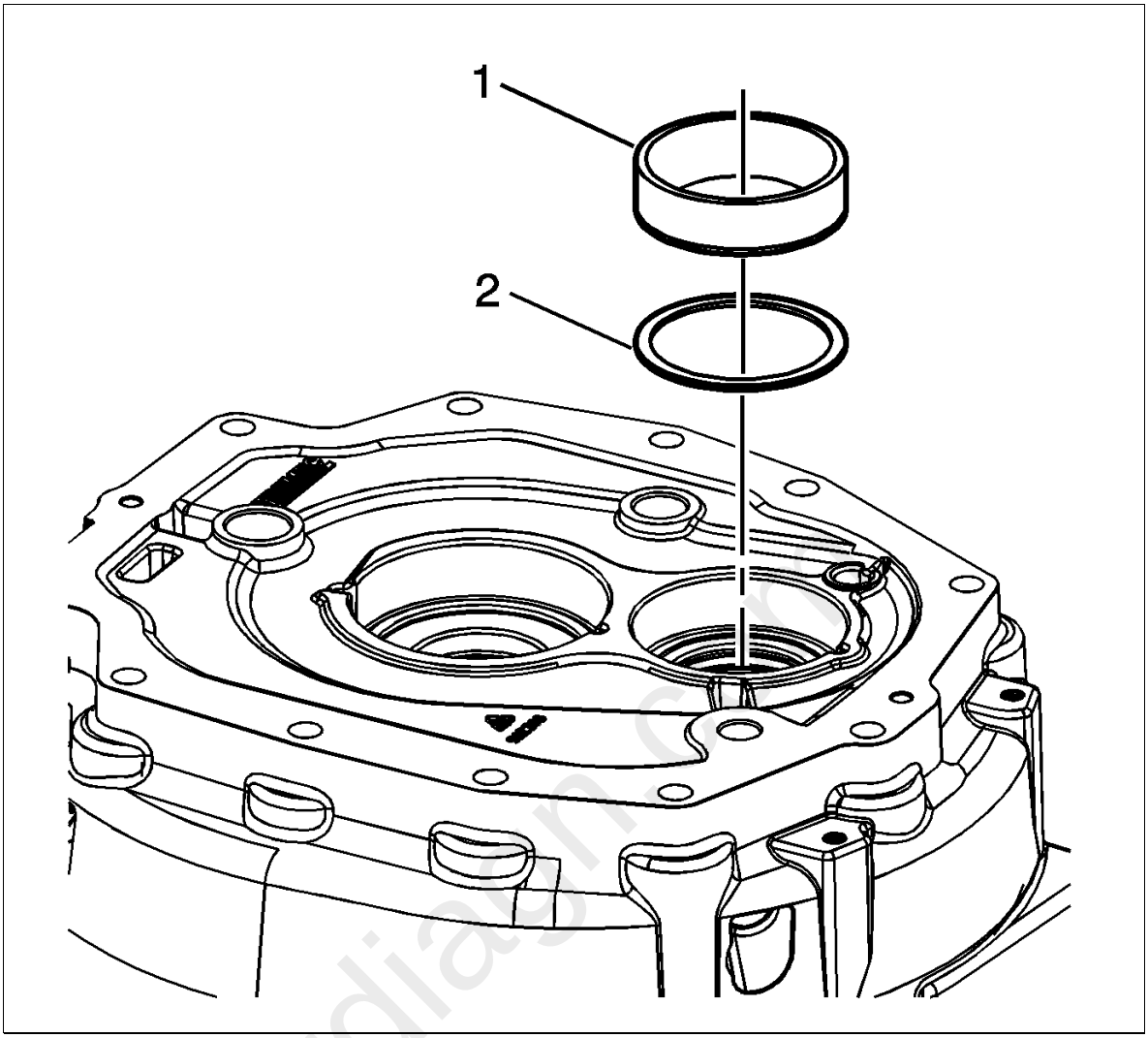


Courtesy of GENERAL MOTORS COMPANY

15. Remove the input shaft bearing race (1).
16. Remove the input shaft bearing shim (2) and discard.
17. Install the new input shaft bearing shim, and the original bearing race.

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Fig 11: Countershaft Bearing Race & Shim



Courtesy of GENERAL MOTORS COMPANY

18. Remove the countershaft bearing race (1).
19. Remove the countershaft bearing shim (2) and discard.
20. Install the new input shaft bearing shim, and the original bearing race.

REPAIR INSTRUCTIONS - OFF VEHICLE > SHIMMING PROCEDURES (M13)

Special Tools

J 8001 Dial Indicator Set

For equivalent regional tools, refer to Special Tools (M13) .

NOTE:

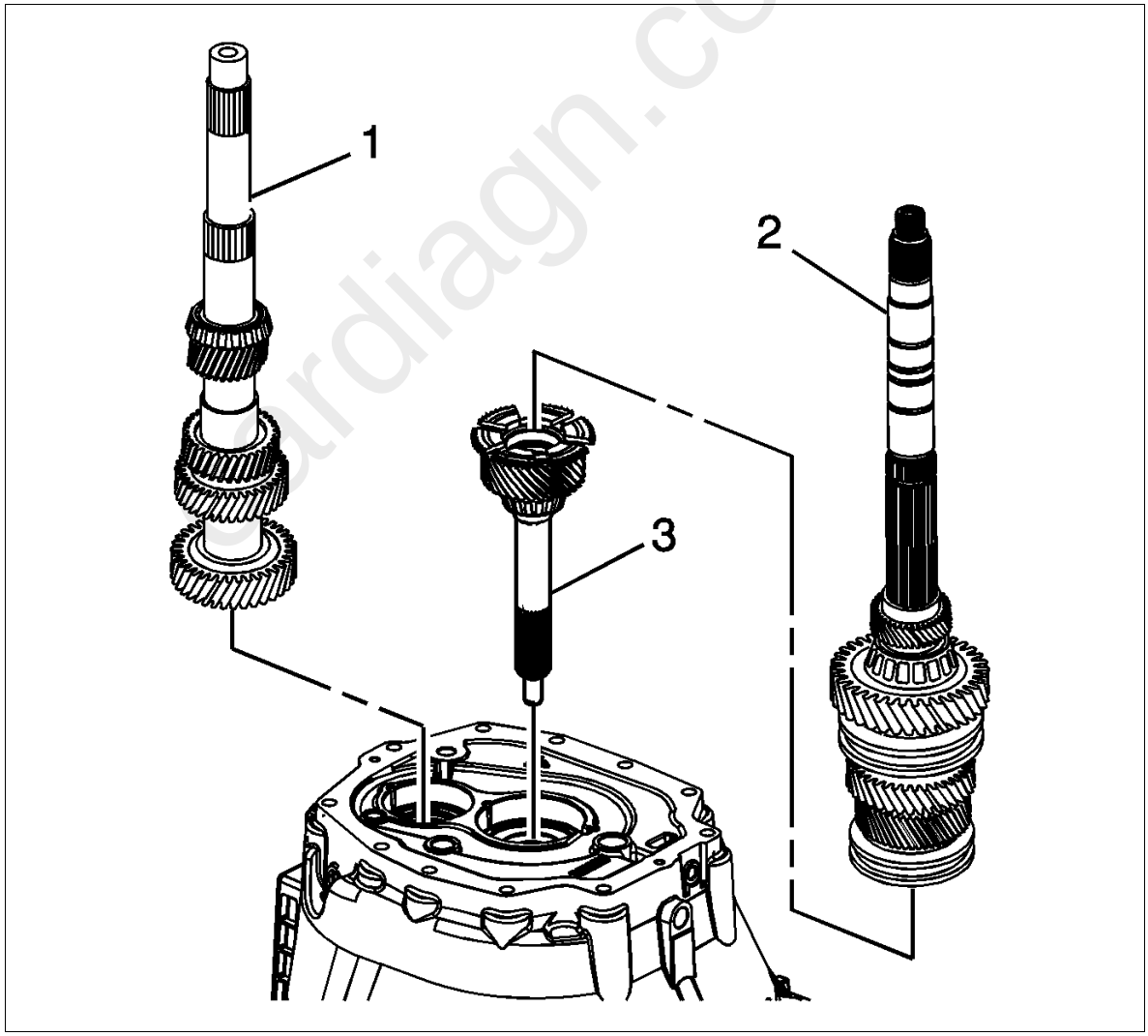
The shimming procedure is required to be performed during service only when the following

parts are replaced:

- *The input shaft*
- *The counter gear*
- *The main shaft*
- *The adapter plate*
- *The main housing*
- *The extension housing*

REPAIR INSTRUCTIONS - OFF VEHICLE > SHIMMING PROCEDURES (M13) > INPUT SHAFT, MAIN SHAFT, AND COUNTER GEAR

Fig 1: Input Shaft, Mainshaft, and Countershaft

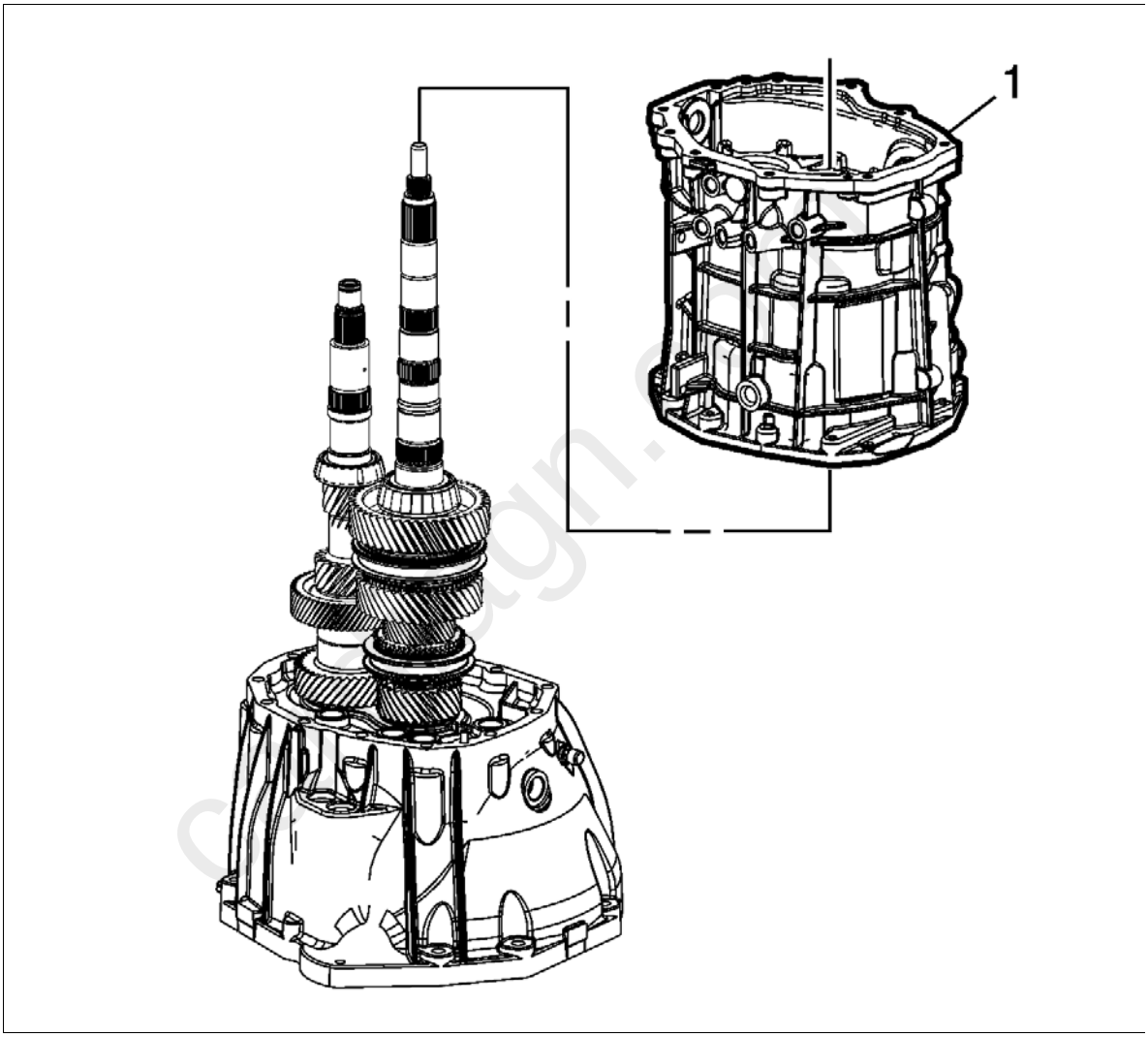


Courtesy of GENERAL MOTORS COMPANY

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1. Rotate the clutch housing to the vertical position.
2. Install the following assemblies in order:
    1. The input shaft (3)
    2. Align the 6th gear blocking ring to the input shaft.
    3. The main shaft assembly (2)
    4. The counter gear (1), lifting up the main shaft enough to install the counter gear.

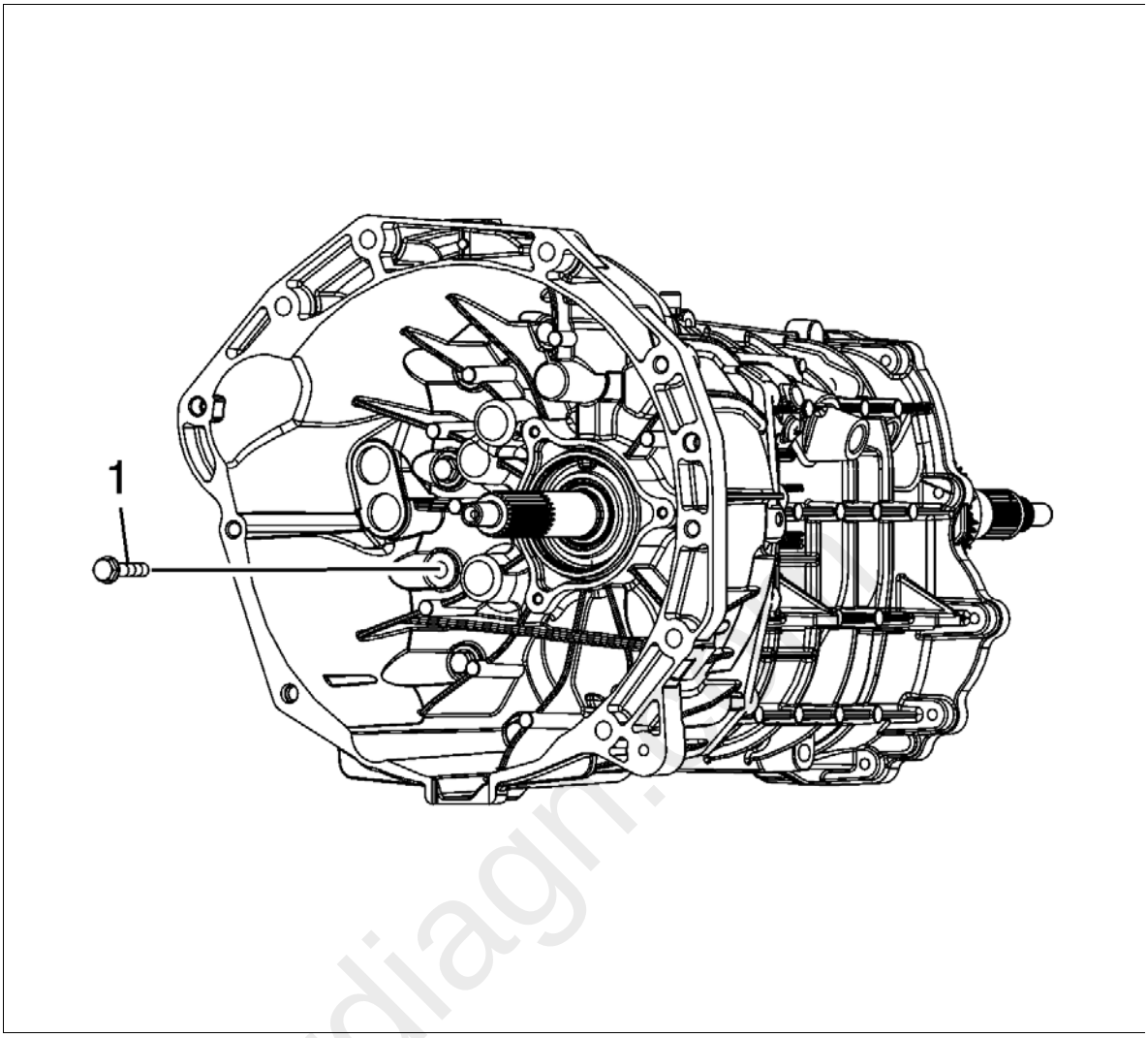
Fig 2: Transmission Case



Courtesy of GENERAL MOTORS COMPANY

3. Install the transmission case (1).

Fig 3: Clutch Housing To Transmission Case Bolts



Courtesy of GENERAL MOTORS COMPANY

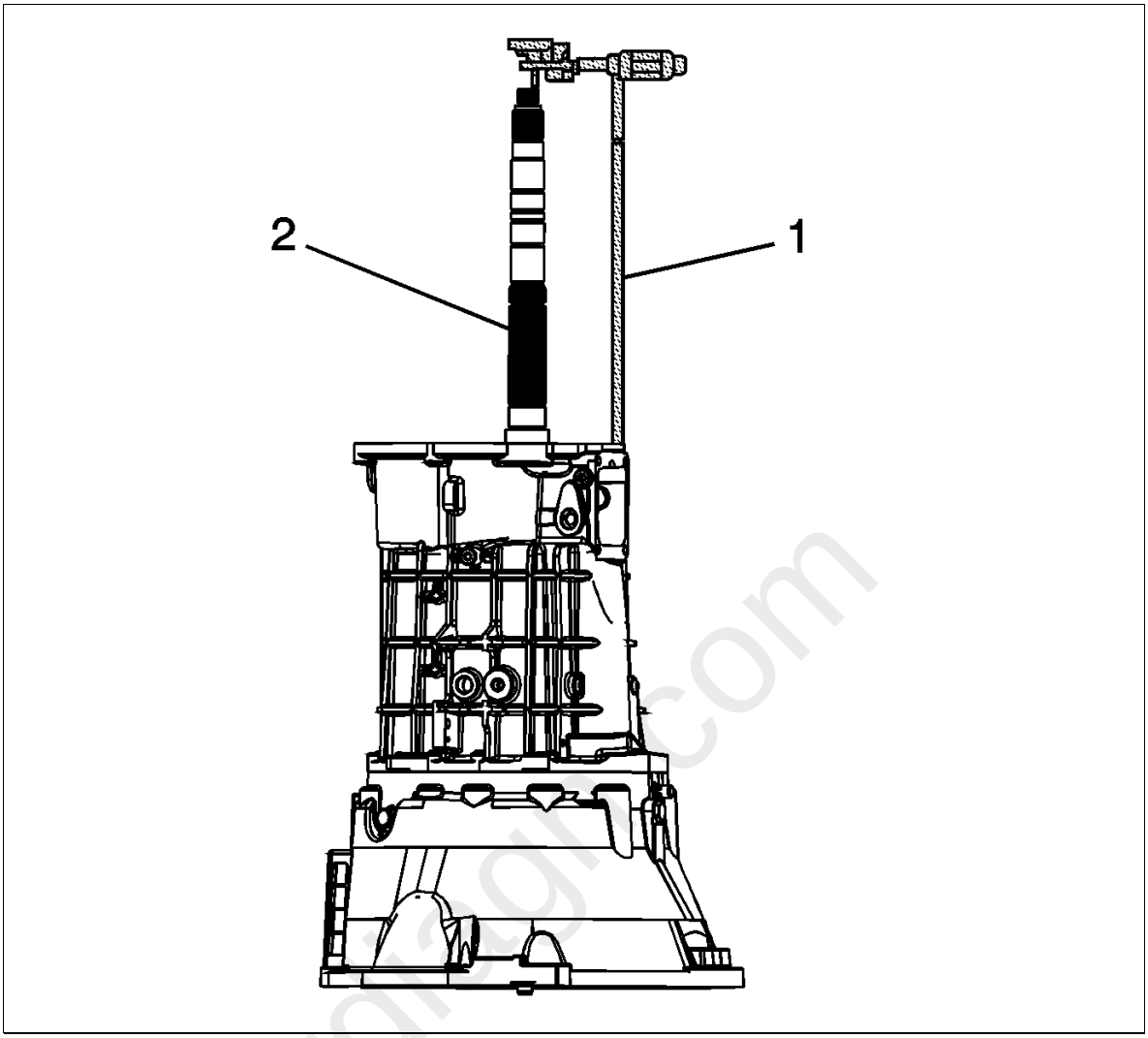
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⚠ *CAUTION:*

Refer to Fastener Caution .

4. Install the clutch housing to transmission case bolts (1) and tighten to 33 N.m (27 lb ft).

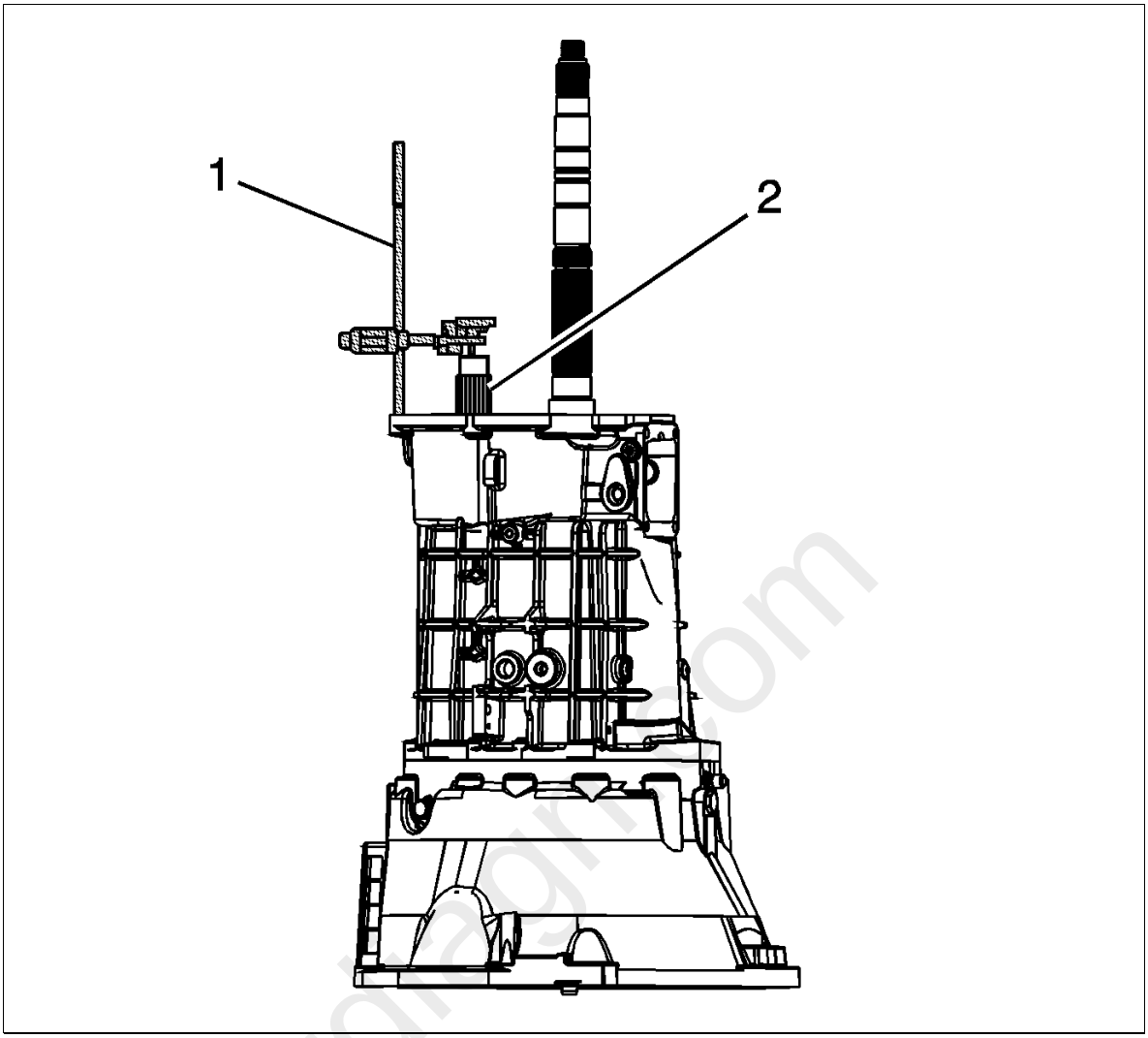
Fig 4: Input Shaft/Mainshaft End Play



Courtesy of GENERAL MOTORS COMPANY

5. Measure the input shaft/main shaft end play using the following procedure:
    1. Place the tip of the **J 8001** indicator set (1) on the end of the main shaft.
    2. Move the main shaft up and down.
    3. Record the measurement.
6. Select a shim to achieve 0.0127-0.0889 mm (0.00049-0.00349 in) end play.
7. Remove the **J 8001** indicator set.

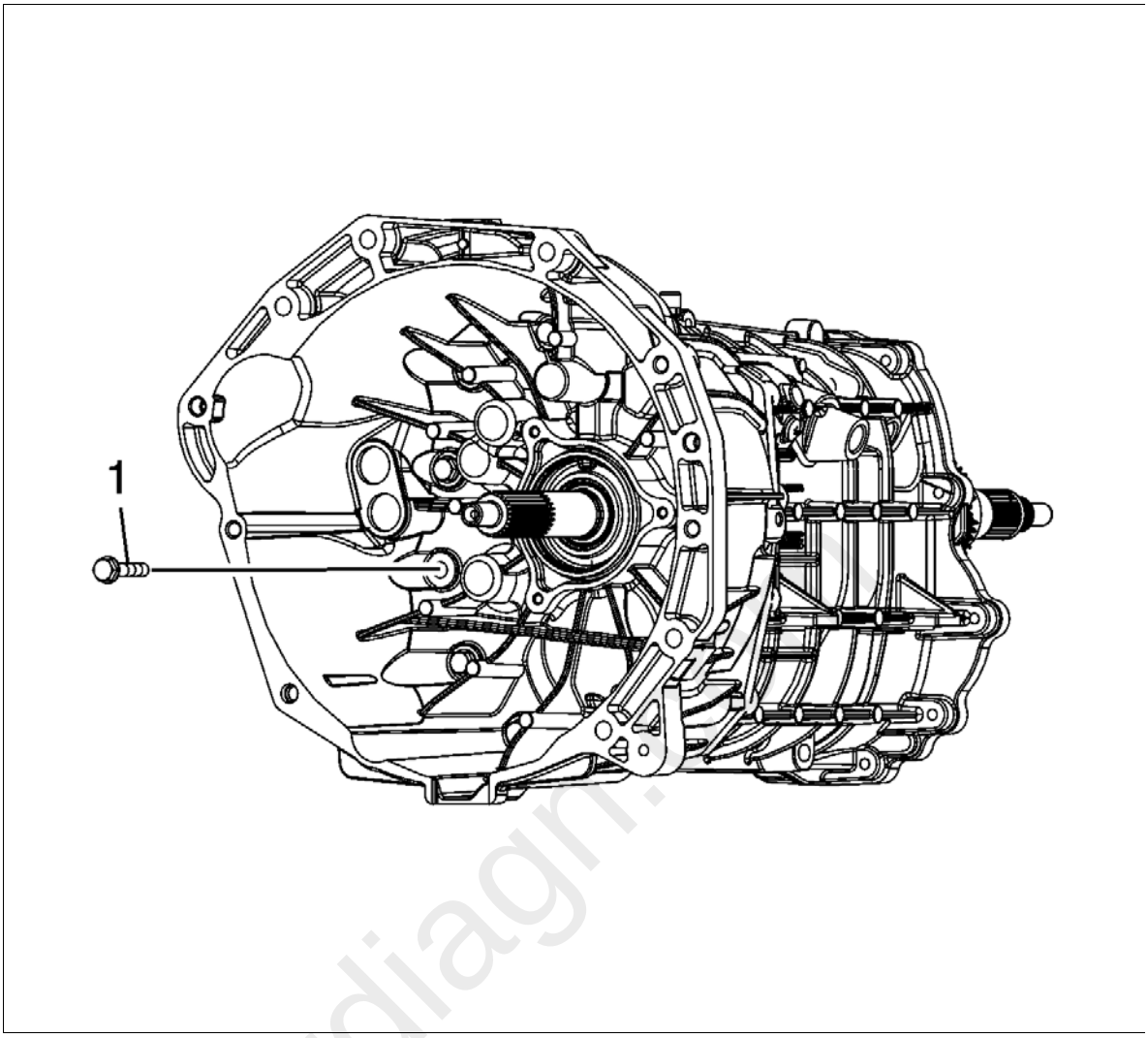
Fig 5: Countershaft End Play



Courtesy of GENERAL MOTORS COMPANY

8. Measure the counter gear end play using the following procedure:
    1. Place the tip of the **J 8001** indicator set (1) on the end of the counter gear.
    2. Move the counter gear up and down.
    3. Record the measurement.
9. Select a shim to achieve 0.0127-0.0889 mm (0.00049-0.00349 in) end play.
10. Remove the **J 8001** indicator set.

Fig 6: Clutch Housing To Transmission Case Bolts

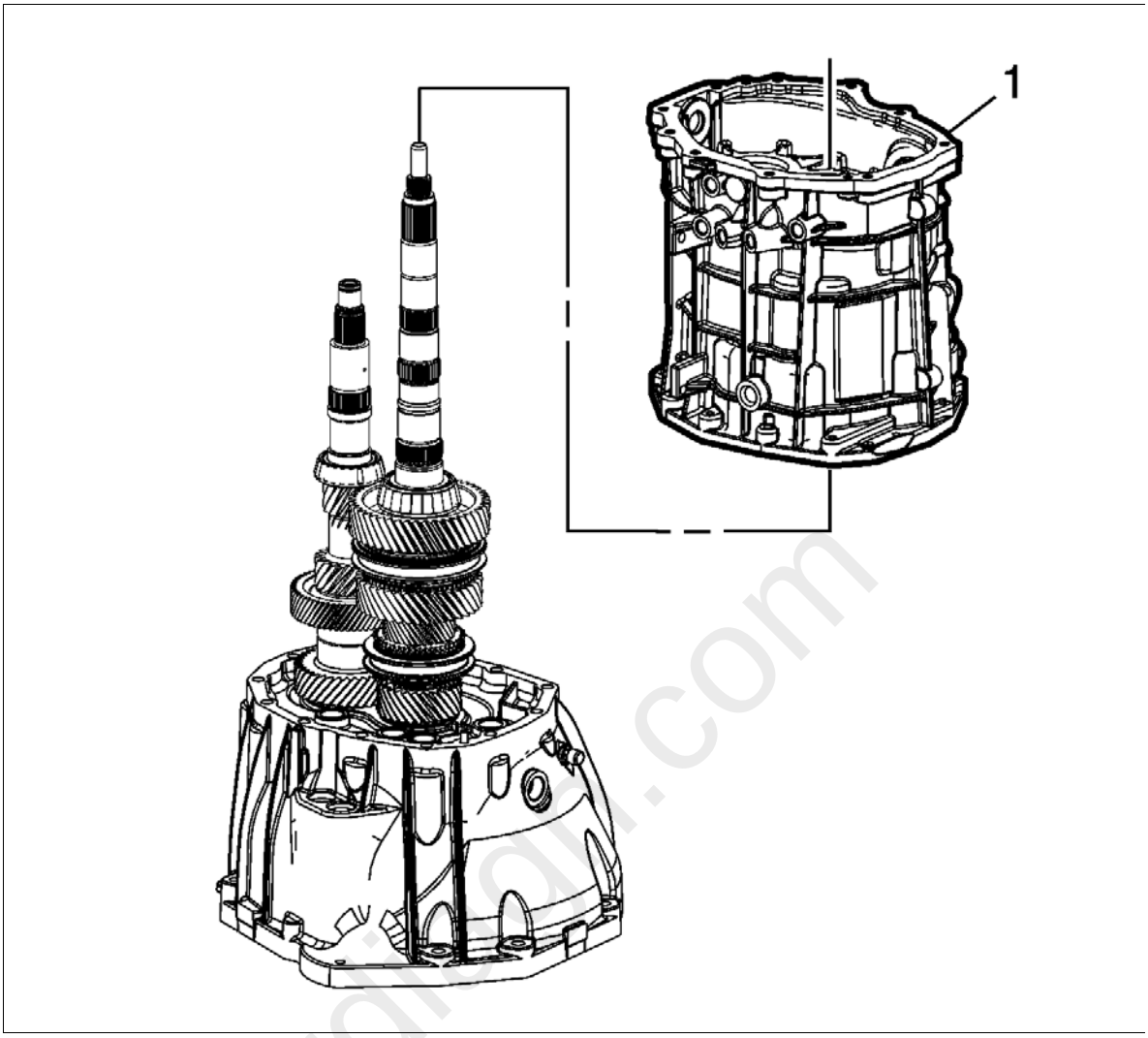


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11. Remove the clutch housing to the transmission case bolts (1).

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Fig 7: Transmission Case

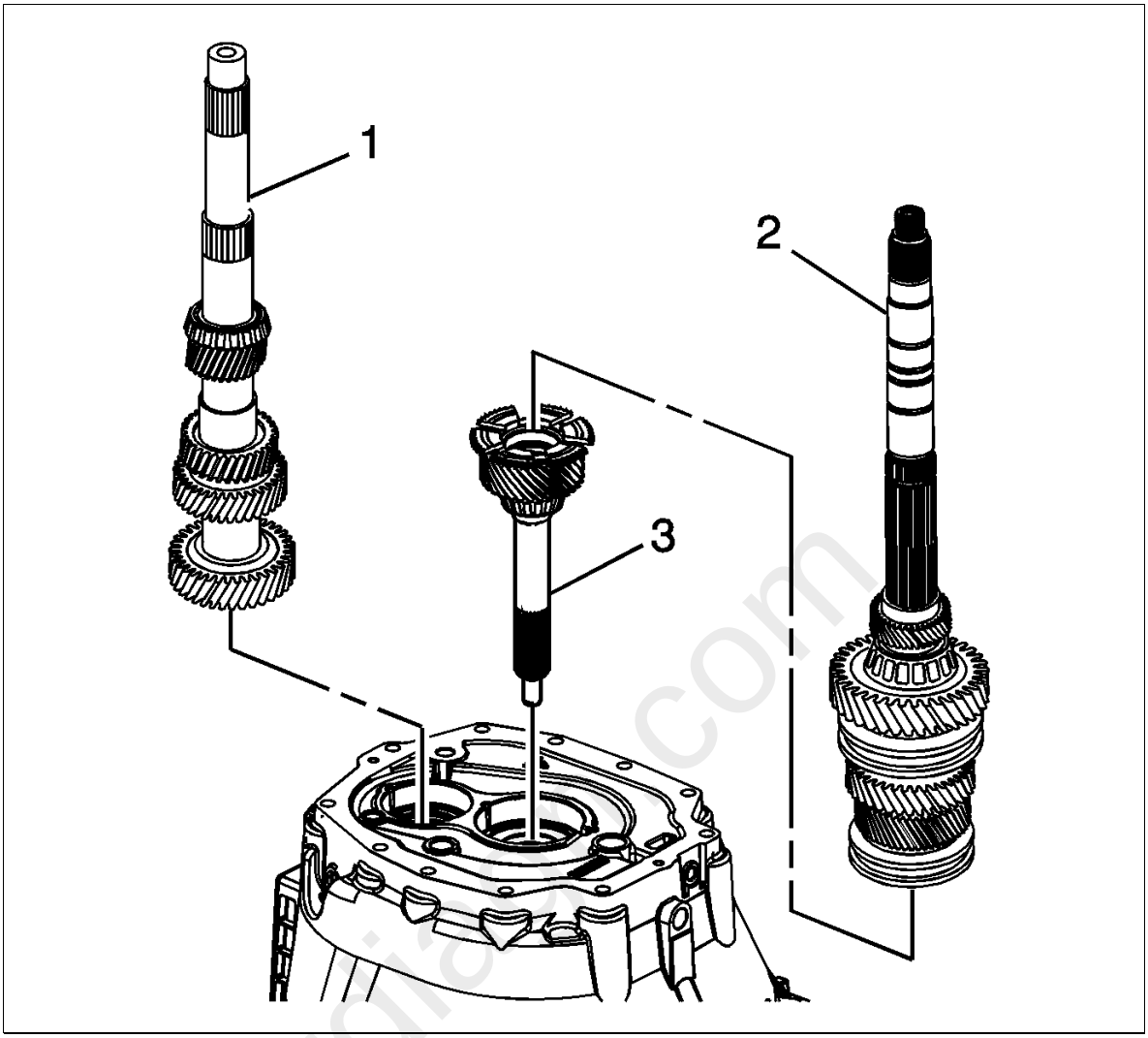


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12. Remove the transmission case (1).

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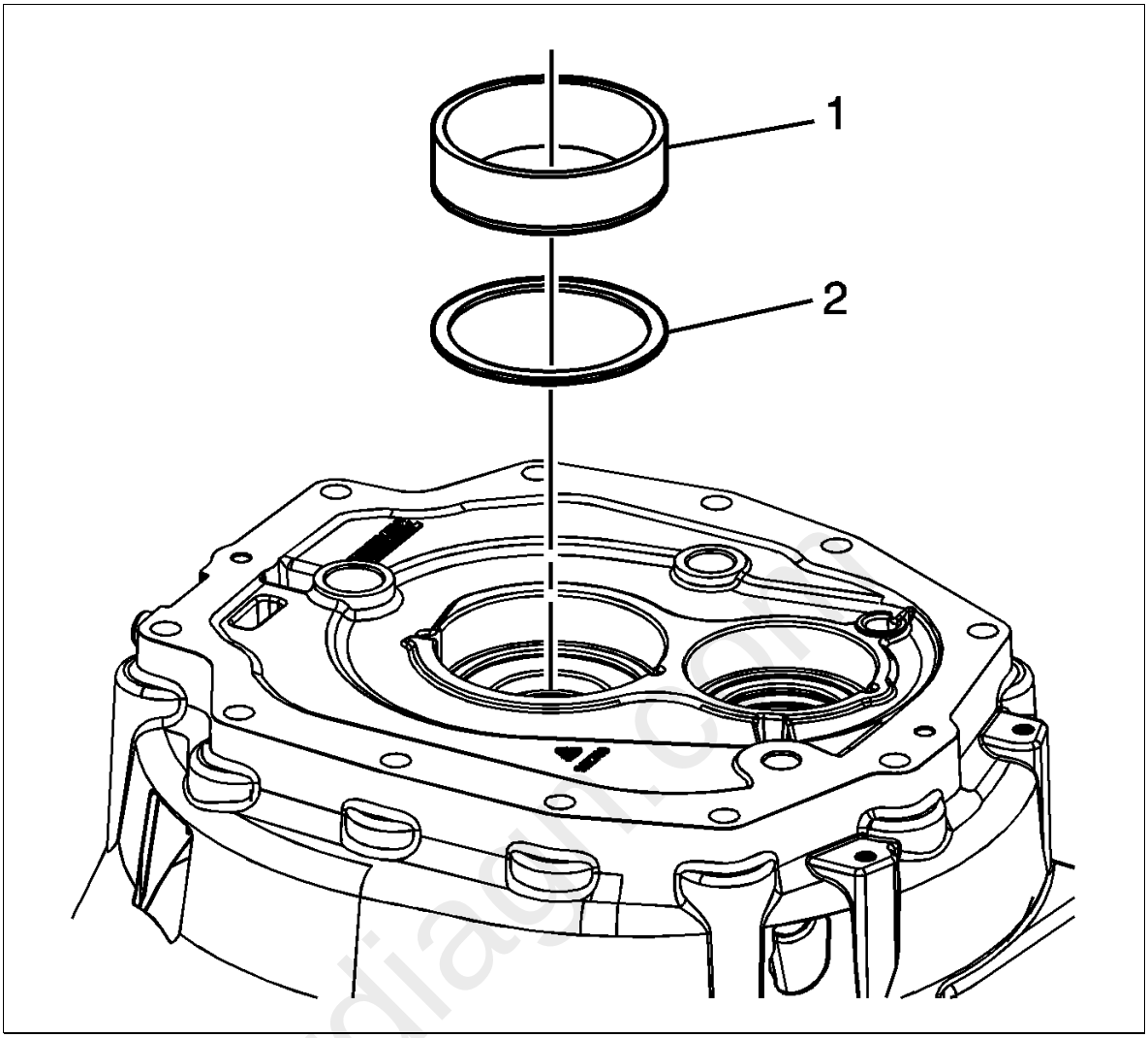
Fig 8: Input Shaft, Mainshaft, and Countershaft



Courtesy of GENERAL MOTORS COMPANY

13. Remove the following parts in order:
    1. The counter gear (1), lifting up the main shaft (2) enough to remove the counter gear.
    2. The main shaft assembly (2)
    3. The input shaft (3)

Fig 9: Input Shaft Bearing Race & Shim

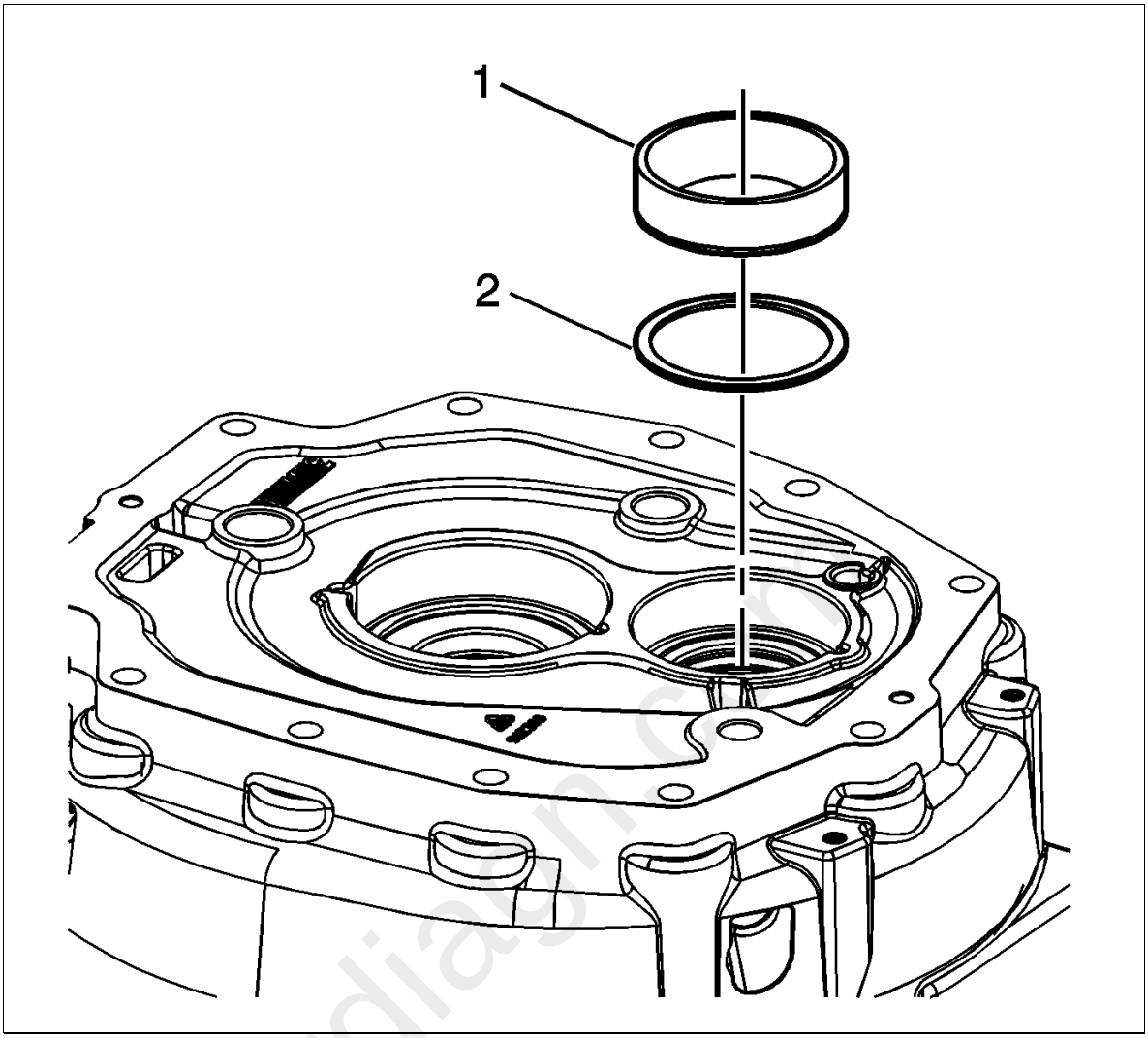


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14. Remove the input shaft bearing race (1).
15. Remove the input shaft bearing shim (2) and discard.
16. Install the NEW input shaft bearing shim, and the original bearing race.

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Fig 10: Countershaft Bearing Race & Shim

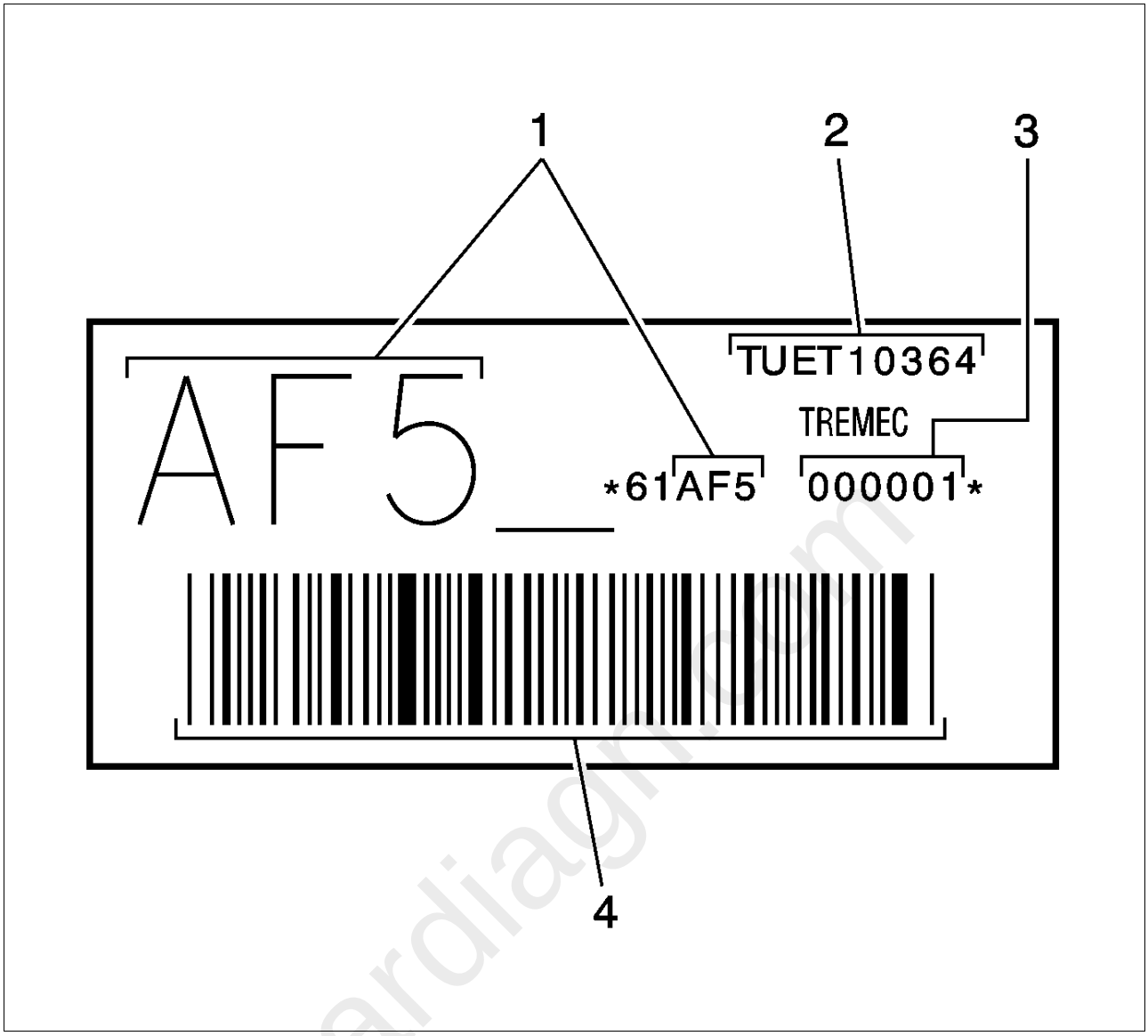


Courtesy of GENERAL MOTORS COMPANY

17. Remove the counter gear front bearing race (1).
18. Remove the counter gear front bearing shim (2) and discard.
19. Install the NEW counter gear front bearing shim, and the original bearing race.

DESCRIPTION AND OPERATION > TRANSMISSION IDENTIFICATION INFORMATION

Fig 1: Transmission Identification Plate

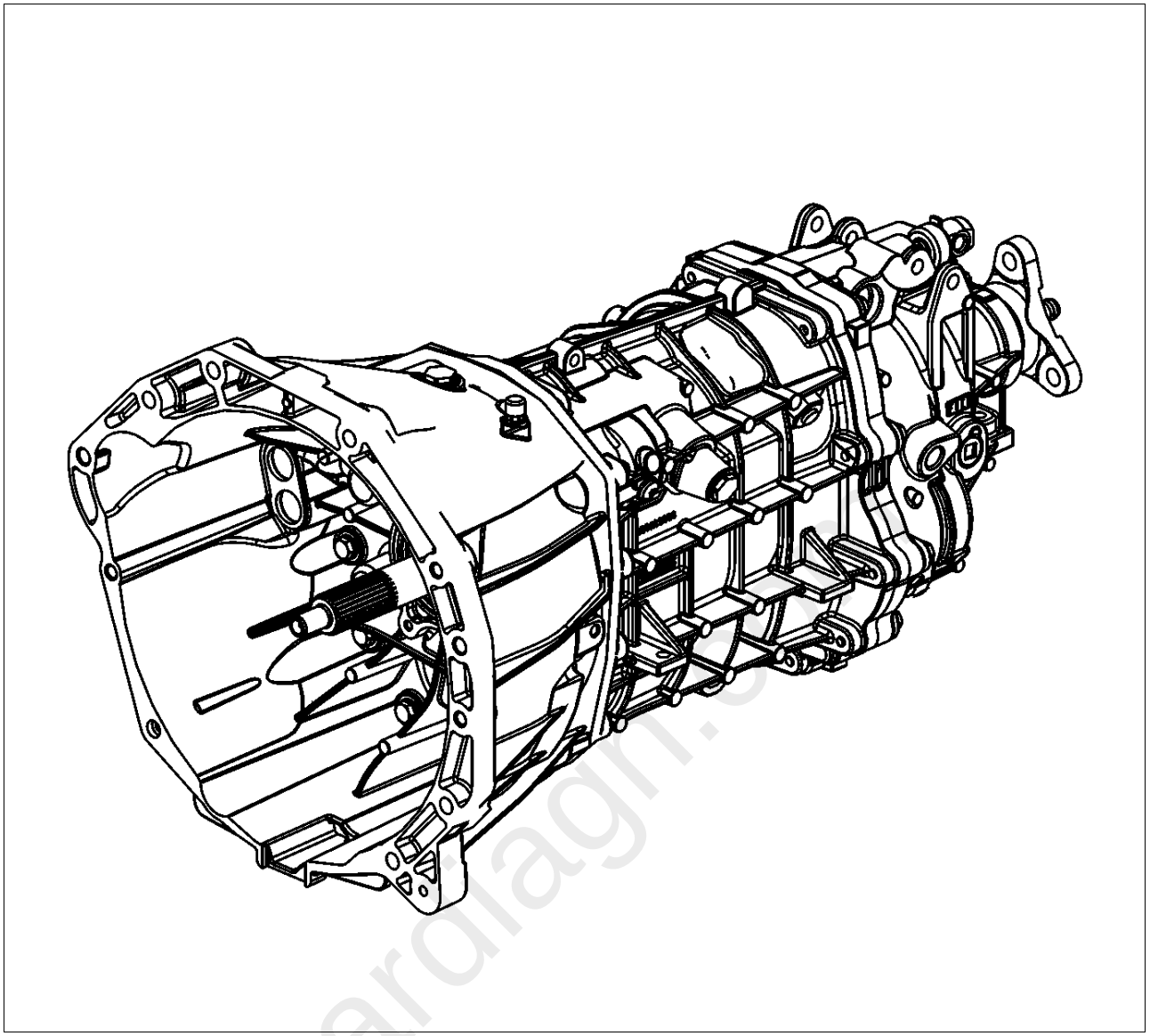


Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Broadcast Code
2	Transmission Assembly Number
3	Serial Number
4	Bar Code

DESCRIPTION AND OPERATION > MANUAL TRANSMISSION DESCRIPTION AND OPERATION (M13)

Fig 1: Manual Transmission



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Manual transmissions are identified by the number of forward gears and the measured distance between the centerline of the output shaft and the counter gear.

The 6-speed manual transmission RPO: M13 incorporates the following features:

- An aluminum case
- Fully synchronized gearing with an enhanced synchronizer cone arrangement:
    - Triple-cone: FIRST, SECOND
    - Double-cone: THIRD, FOURTH, FIFTH, SIXTH, REVERSE
- An internal shift rail mechanism
- A remote transmission shift control mounted forward of the transmission

- An external transmission shift rod enabling the rearward mount location of the transmission shift control
- Tapered roller bearings supporting the mainshaft and countershaft
- Caged roller bearings under all speed gears

These features combine to yield a rugged, reliable system capable of handling input torques of 400 N.m (295 lb ft) for RPO: M13.

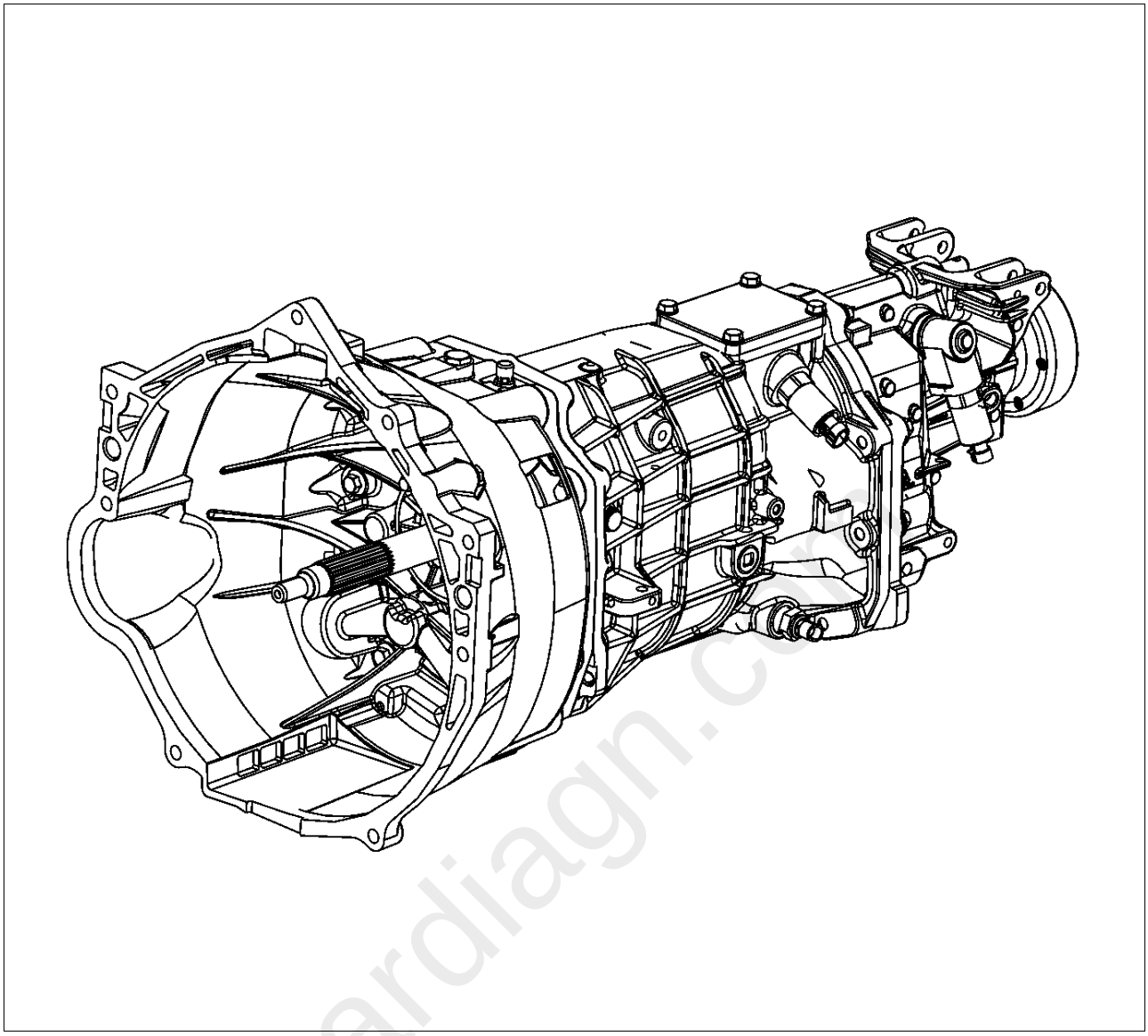
The gear ratios are as follows:

Gear	M13 Ratio (:1)
FIRST	4.40
SECOND	2.59
THIRD	1.80
FOURTH	1.34
FIFTH	1.00
SIXTH	0.75
REVERSE	3.99

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DESCRIPTION AND OPERATION > MANUAL TRANSMISSION DESCRIPTION AND OPERATION (MM6)

Fig 1: Manual Transmission



Courtesy of GENERAL MOTORS COMPANY

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Manual transmissions are identified by the number of forward gears and the measured distance between the centerline of the output shaft and the counter gear.

The 6-speed manual transmission RPO: MM6 incorporates the following features:

- An aluminum case
- Fully synchronized gearing with an enhanced synchronizer cone arrangement:
    - Triple-cone: FIRST, SECOND
    - Double-cone: THIRD, FOURTH, FIFTH, SIXTH, REVERSE
- An internal shift rail mechanism
- A remote transmission shift control mounted forward of the transmission

- An external transmission shift rod enabling the rearward mount location of the transmission shift control
- Tapered roller bearings supporting the mainshaft and countershaft
- Caged roller bearings under all speed gears
- Solenoid inhibit of SECOND and THIRD gears
- Solenoid inhibit of REVERSE gear during predefined forward motion

These features combine to yield a rugged, reliable system capable of handling input torques of 678 N.m (500 lb ft) for RPO: MM6.

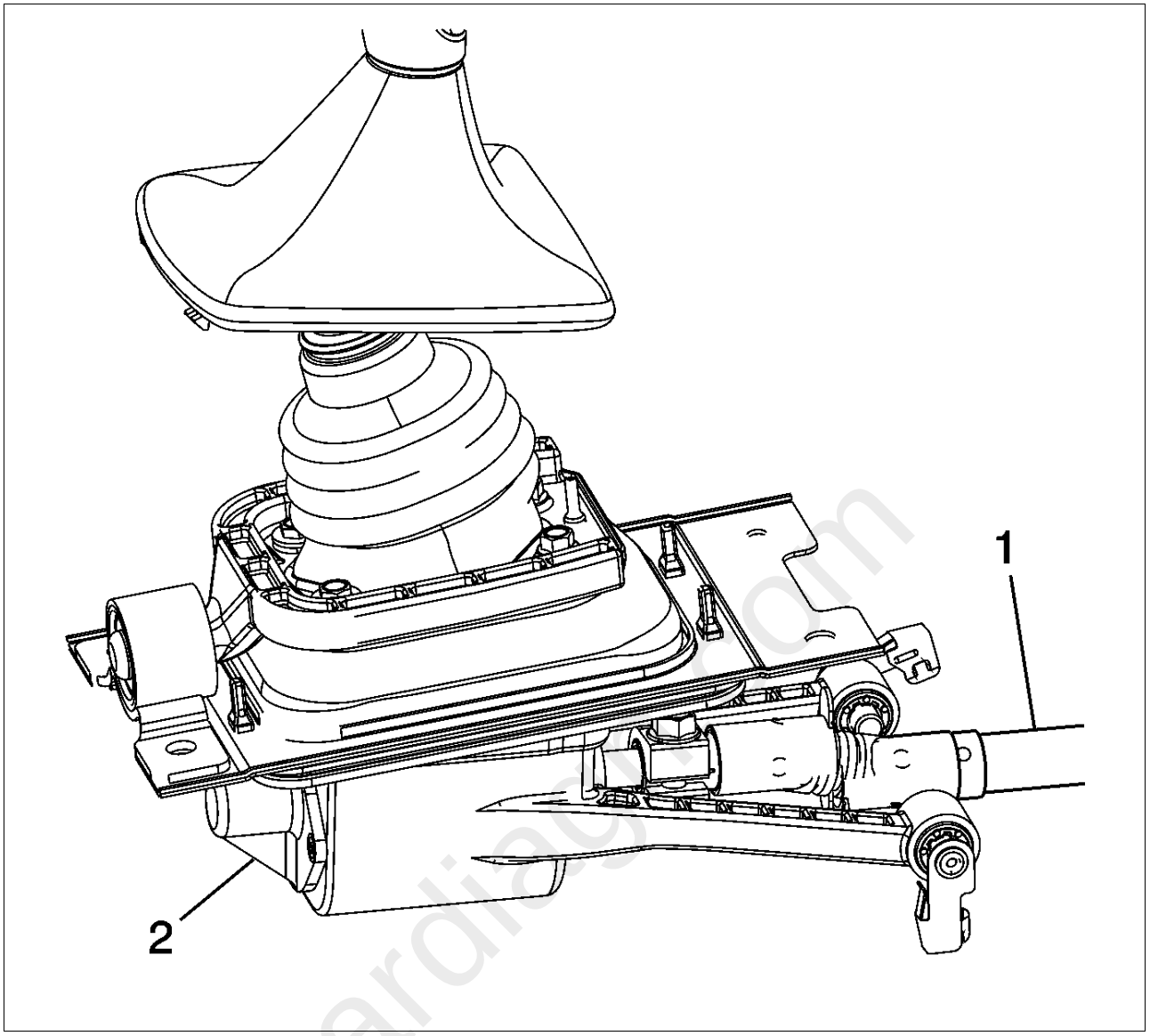
The gear ratios are as follows:

Gear	MM6 Ratio (:1)
FIRST	2.66
SECOND	1.78
THIRD	1.30
FOURTH	1.00
FIFTH	0.74
SIXTH	0.50
REVERSE	2.90

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DESCRIPTION AND OPERATION > MANUAL TRANSMISSION DESCRIPTION AND OPERATION (MM6) > SHIFT CONTROL AND SHIFT ROD

Fig 1: Shift Control & Shift Rod



Courtesy of GENERAL MOTORS COMPANY

The shift shaft is connected to a transmission shift rod (1) which contains two sealed universal-style joints, enabling the range of motion necessary in order to shift gears. The shift rod (1) is connected to the transmission shift control (2) which is a lubricated and sealed unit, mounted to the driveline support assembly. The mounting system utilized for the shift control (2) incorporates rubber insulators. The cockpit of the vehicle is isolated from the driveline through the use of a shift control closeout boot which seals off the shift control and the driveline tunnel shift control opening.

DESCRIPTION AND OPERATION > MANUAL TRANSMISSION DESCRIPTION AND OPERATION (MM6) > GEAR SELECT - SKIP SHIFT

To ensure good fuel economy and compliance with federal fuel economy standards, SECOND and THIRD gears are inhibited when shifting out of FIRST gear under the following conditions:

- Coolant temperature is above 77°C (171°F).

- Vehicle speed is 24-30 km/h (15-19 mph).
- Throttle is opened 13 percent or less.

DESCRIPTION AND OPERATION > MANUAL TRANSMISSION DESCRIPTION AND OPERATION (MM6) > REVERSE LOCKOUT

A reverse lockout system, consisting of a reverse lockout solenoid which operates a reverse lockout mechanism, is utilized to prevent shifting into REVERSE gear when the vehicle is moving forward at a speed of 5 km/h (3 mph) or more.

DESCRIPTION AND OPERATION > MANUAL TRANSMISSION DESCRIPTION AND OPERATION (MM6) > TEMPERATURE SENSOR

The temperature sensor is a safety feature that provides a warning in the event the manual transmission is operating in temperatures above 163°C (325°F).

DESCRIPTION AND OPERATION > REVERSE INHIBIT DESCRIPTION AND OPERATION

The reverse inhibit solenoid is a safety feature which prevents an inadvertent shift into reverse at speeds above 5 km/h (3 mph). The system consist of the following components:

- The powertrain control module (PCM).
- The reverse inhibit solenoid.

With the ignition ON, battery voltage is supplied directly to the reverse inhibit solenoid. At forward speeds above 5 km/h (3 mph) the PCM opens the control circuit of the reverse inhibit solenoid. This de-energizes the solenoid and mechanically blocks the shift lever from going into the REVERSE position.

DESCRIPTION AND OPERATION > SKIP SHIFT DESCRIPTION AND OPERATION (MM6)

The skip shift solenoid is a performance feature which forces the driver to shift from first gear to fourth gear during light acceleration and low engine load conditions. This feature is used to ensure good fuel economy and compliance with federal economy standards. The skip shift system consist of the following components:

- The powertrain control module (PCM).
- The skip shift solenoid.
- The skip shift lamp.

With the ignition ON, battery voltage is supplied directly to the skip shift solenoid. The powertrain control

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module (PCM) controls the solenoid by grounding the control circuit. When the skip shift system is active the PCM also grounds the control circuit of the skip shift lamp. The lamp illuminates to inform the driver that the 1-4 skip shift is engaged. The PCM determines when the skip shift system is active when the following parameters are met:

- The vehicle speed is between 24-30 km/h (15-19 mph).
- The engine coolant temperature (ECT) is greater than 77°C (171°F).
- The BARO is greater than 76 kPa.
- The accelerator pedal position (APP) is less than 13 percent.

When the conditions are met the powertrain control module (PCM) grounds the skip shift solenoid control circuit. This energizes the skip shift solenoid and mechanically blocks the gear shift lever from going into the second or third gear positions. When the drivers pulls back on the shift lever with the system enabled the transmission will go into fourth gear.

When the conditions for skip shift engagement are no longer met the powertrain control module (PCM) disables the skip shift solenoid, allowing the driver to use second and third gears.

Once the skip shift solenoid is enabled the system will not be re-enabled until the vehicle speed returns to 0 km/h (0 mph) and the conditions for enabling skip shift solenoid are met.

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DESCRIPTION AND OPERATION > MANUAL TRANSMISSION PROTECTION DESCRIPTION AND OPERATION

The engine control module (ECM) software provides protection features for the clutch and manual transmission. The ECM uses various inputs to monitor clutch use and performance and transmission temperature. ECM inputs include:

- Clutch Pedal Position
- Engine Speed
- Engine Torque
- Transmission Temperature (if equipped with transmission fluid temperature sensor)
- Vehicle Speed

These features are designed to protect the clutch and transmission from driver misuse and high thermal stresses. The ECM can provide the driver feedback through the driver information center (DIC) in an effort to protect these transmission components from premature wear and failure.

DESCRIPTION AND OPERATION > MANUAL TRANSMISSION PROTECTION DESCRIPTION AND OPERATION > CLUTCH MISUSE

Using the inputs, the ECM can detect driver clutch misuse. If the clutch pedal is partially applied for an extended period of time, while the vehicle is being driven, a message on the DIC will be displayed to alert the driver to release the clutch pedal.

DESCRIPTION AND OPERATION > MANUAL TRANSMISSION PROTECTION
DESCRIPTION AND OPERATION > CLUTCH SLIP

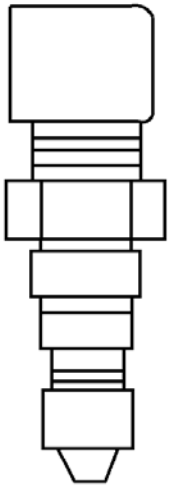
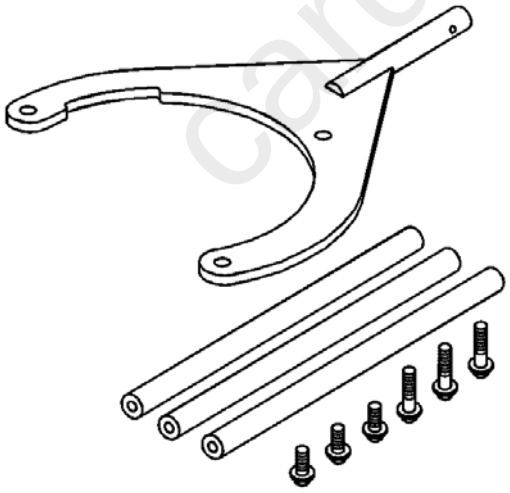
Using the inputs, the ECM can detect if the clutch is slipping under various conditions.

- After a gear shift, with the clutch pedal released, and the engine under load; if the measured gear ratio is excessively higher than the highest transmission gear ratio; the ECM will momentarily reduce engine torque in an effort to reduce clutch slippage.
- If the gear state changes, without the use of the clutch, while the engine is under load; the ECM will momentarily reduce engine torque in an effort to reduce clutch slippage.
- Driving with the clutch pedal fully released, and the engine under load; if the measured gear ratio is excessively higher than the current transmission gear ratio; the ECM will momentarily reduce engine torque in an effort to reduce clutch slippage. Additionally, if excessive clutch slip events occur, the ECM may set DTC P17A2.

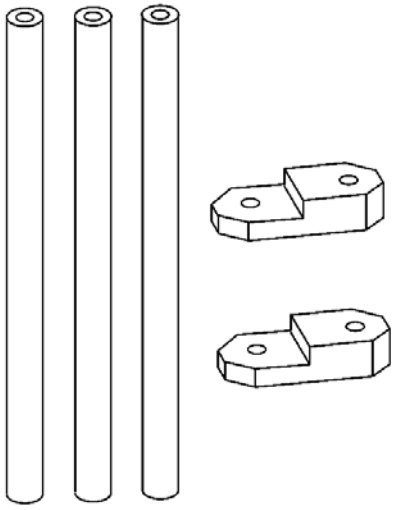
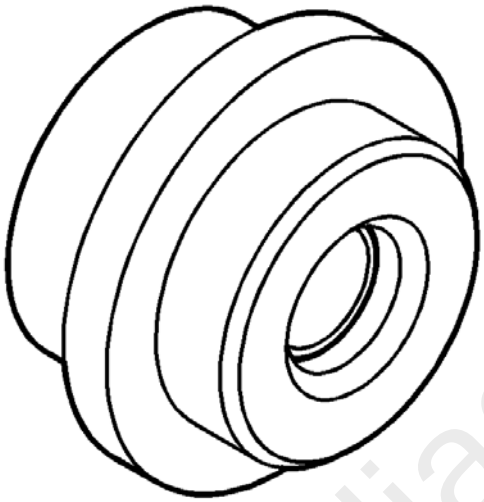
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SPECIAL TOOLS AND EQUIPMENT > SPECIAL TOOLS (MM6)

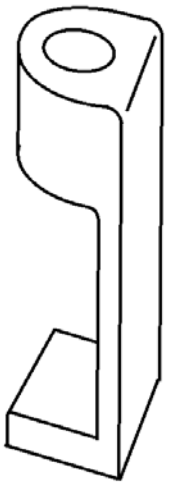
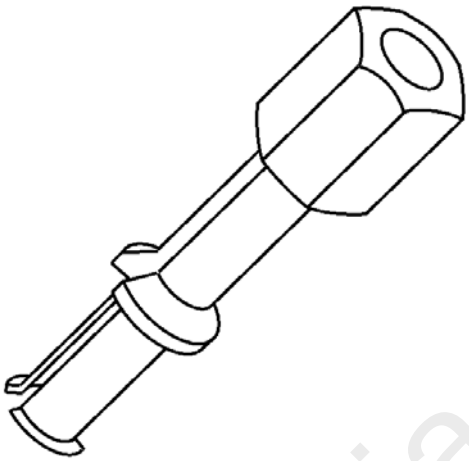
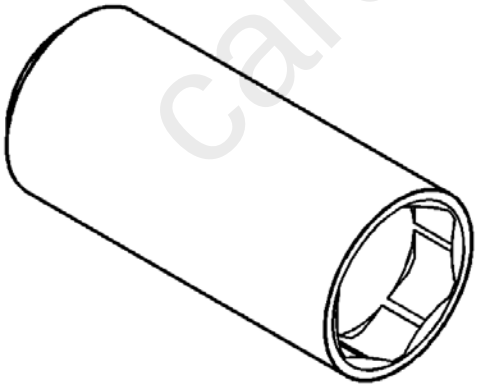
Illustration	Tool Number/ Description
	DT 35944-200A Cooler Flushing Adapter

	DT 45096 Transmission Oil Cooling System Flush and Flow Test Tool
	DT 45096-21 Cooler Flushing Adapter
	DT 47678 Transmission Holding Fixture

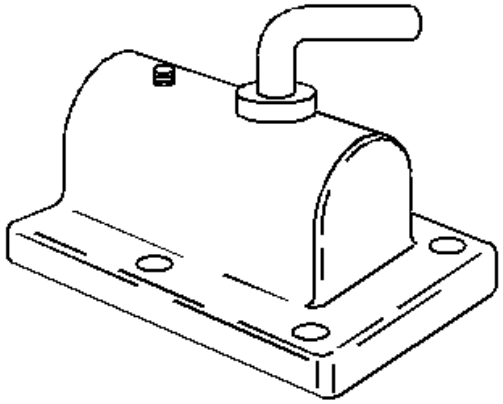
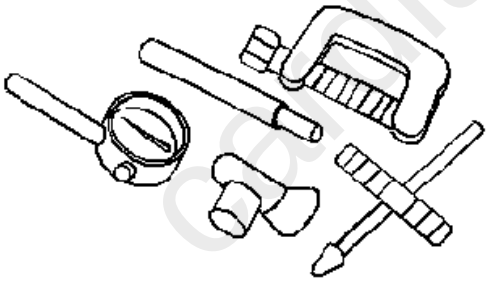
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	DT 47678-10 Transmission Holding Fixture Adapter
	DT 48074 Input and Output Shaft Seal Installer
	DT 48802 Bearing Installer

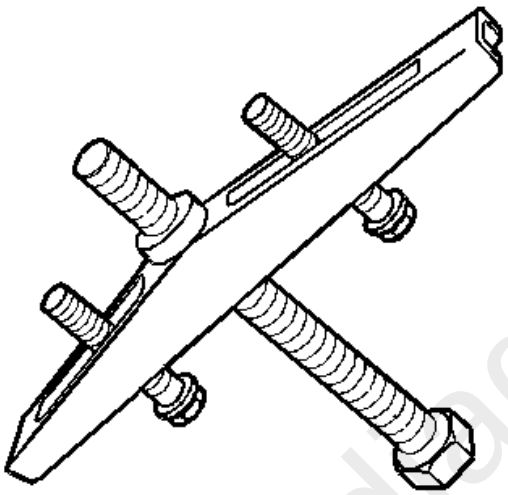
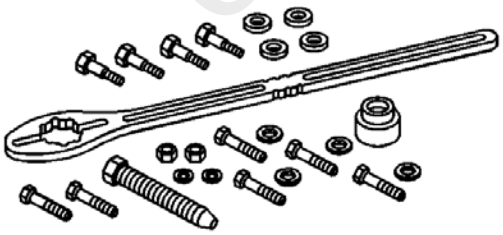
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	DT 49139 Hub Remover Tool
	DT 49216 Bushing Remover
	DT 49293 Gear Select/Skip Shift Solenoid Socket

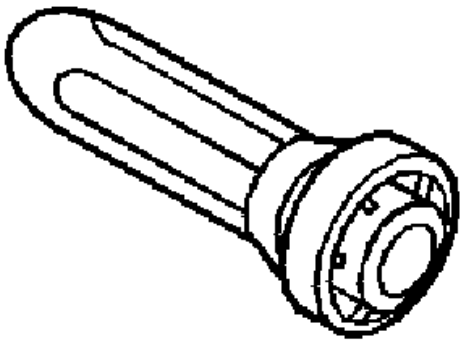
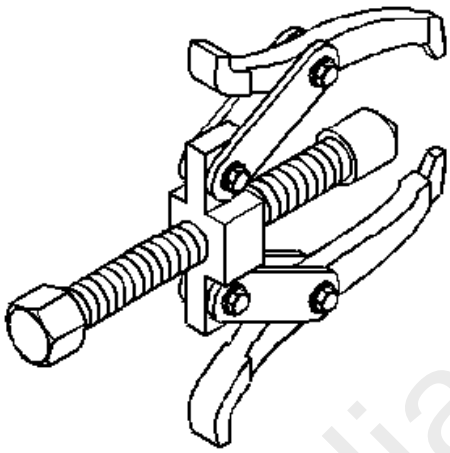
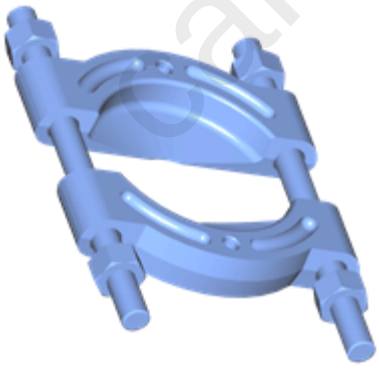
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	J 3289-20 Holding Fixture
	J 6125-1B Slide Hammer with Adapter
	J 8001 Dial Indicator Set

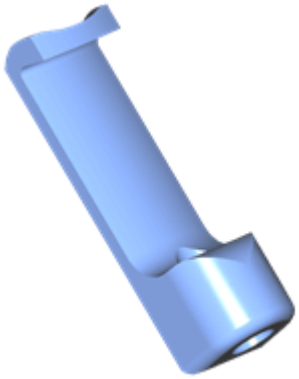
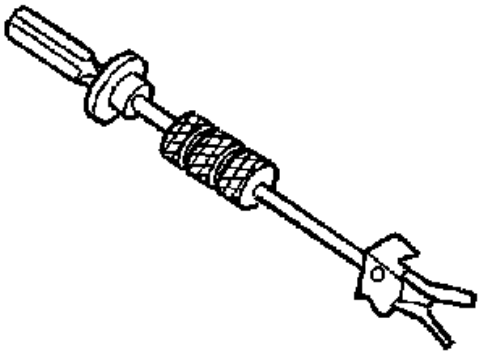
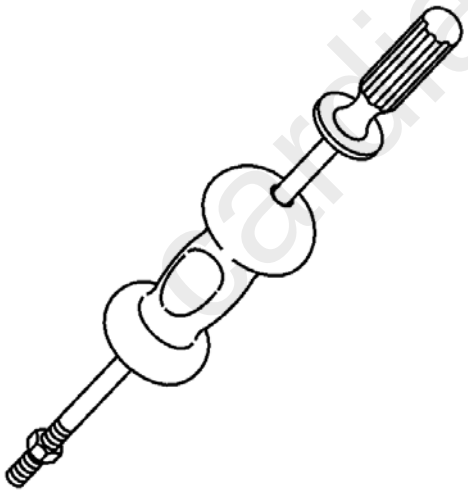
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	J 8092 Universal Driver Handle
	J 8433 Universal Bridge Puller
	J 08614-A Pinion Flange Holder and Remover

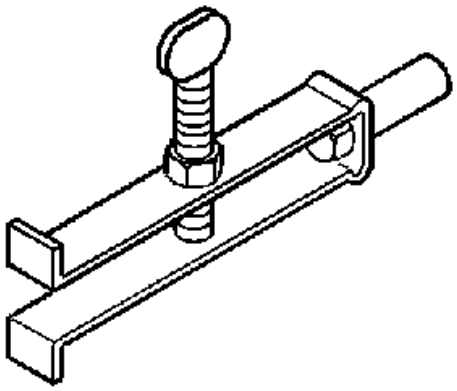
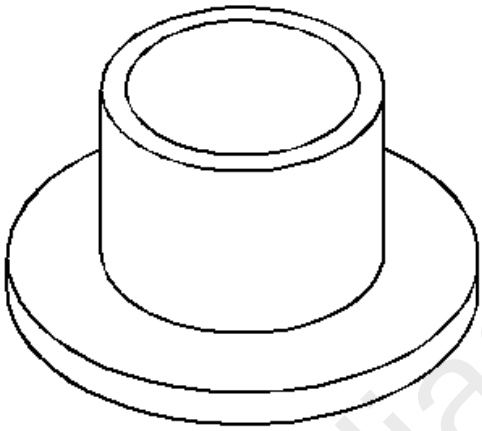
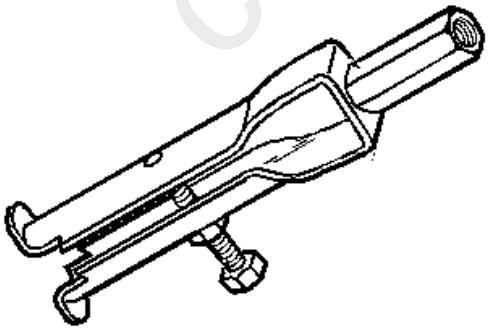
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	J 21426 Extension Housing Seal Installer
	J 22888-20A Universal Two Jaw Puller
	J 22912-B Rear Pinion and Axle Bearing Remover

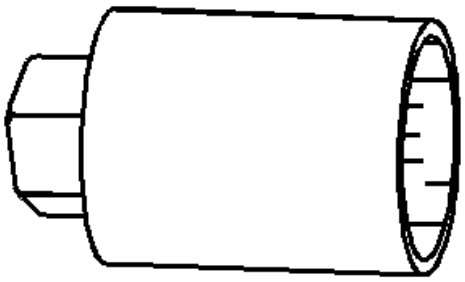
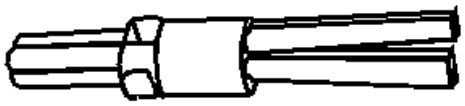
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	J 23129 Universal Seal Remover
	J 23907 Slide Hammer
	J 23907-1 Slide Hammer

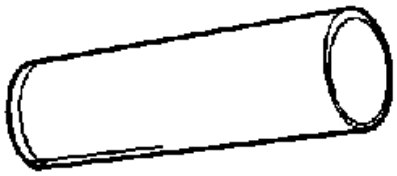
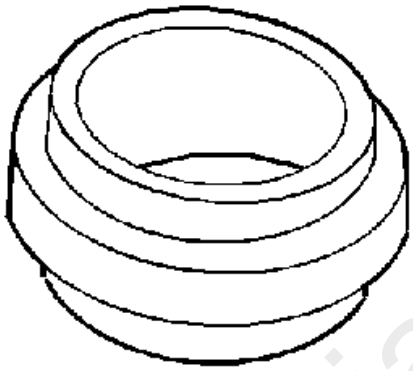
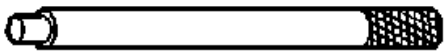
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	J 26941 Bearing Race Remover
	J 28537-17 Bearing Race Installer
	J 29369-2 Bushing and Bearing Remover - 2-3 in

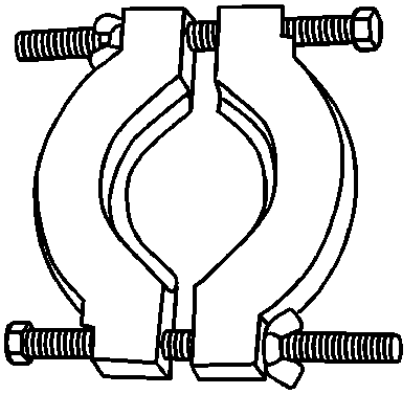
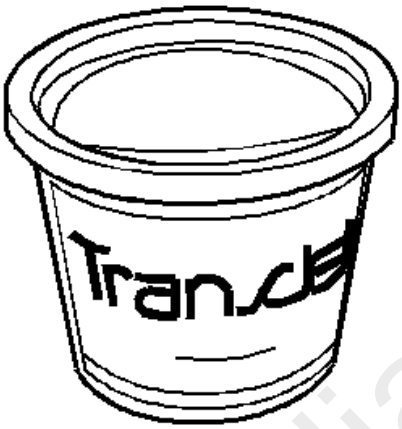
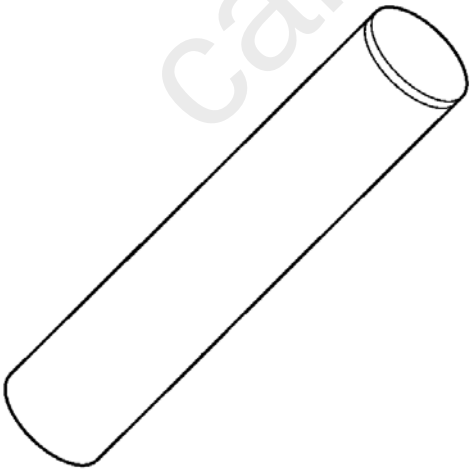
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	J 29873 Injector Nozzle Socket 30 mm
	J 35616 GM Terminal Test Kit
	J 36017 Valve Seal Remover

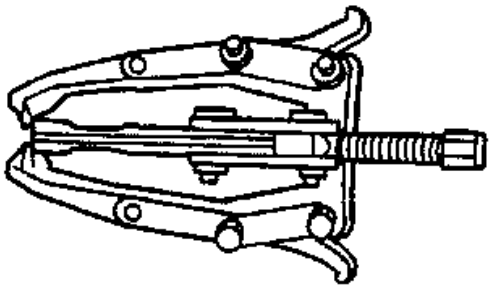
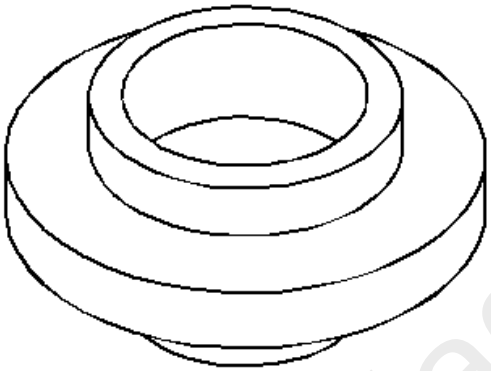
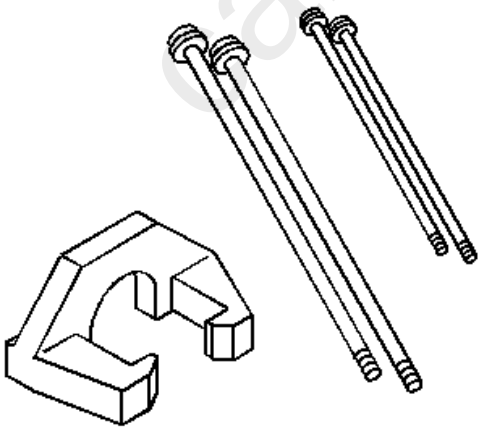
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	J 36183 Press Tube
	J 36184 Press Tube Adapter
	J 36190 Universal Driver Handle

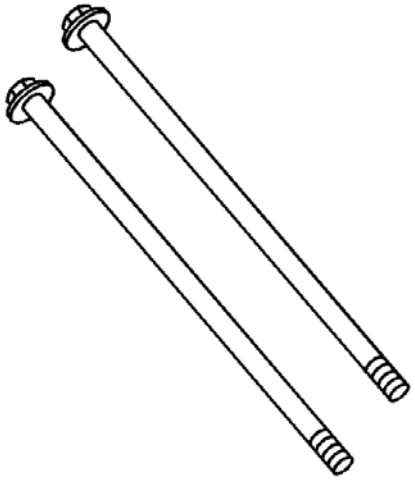
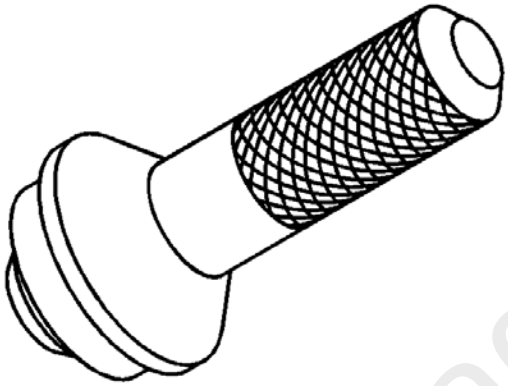
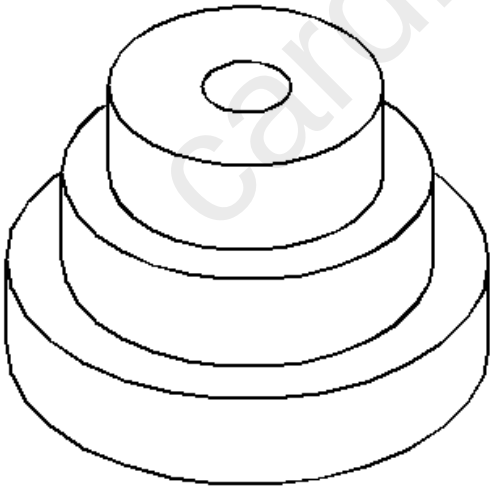
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	J 36513 Split Plate
	J 36850 Transjel® Lubricant
	J 38205-1 Press Tube

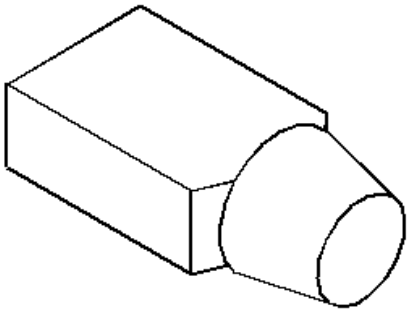
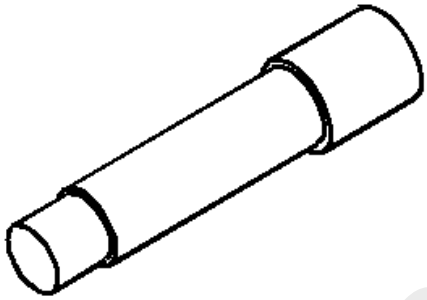
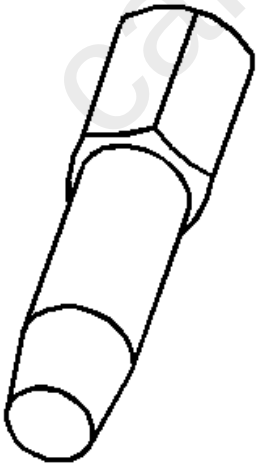
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	J 38416-B Harmonic Balancer Remover
	J 39371 1st/2nd Synchronizer Installer
	J 39431 5th/6th Driven Gear Puller

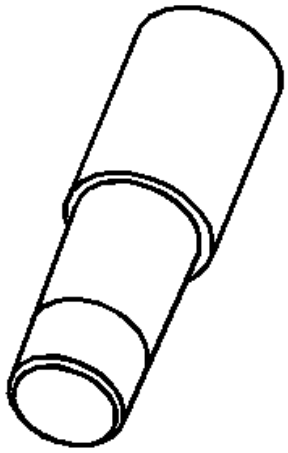
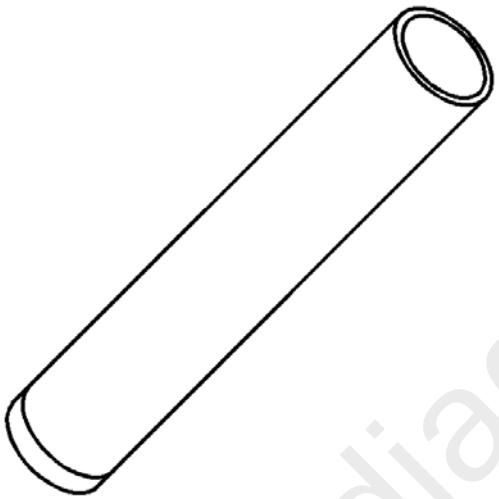
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	J 39431-3 5th Gear Puller Adapter Bolts
	J 39433 Input Shaft Seal Installer
	J 39435 Bearing Race Installer

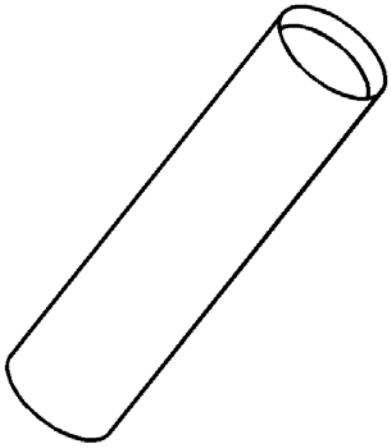
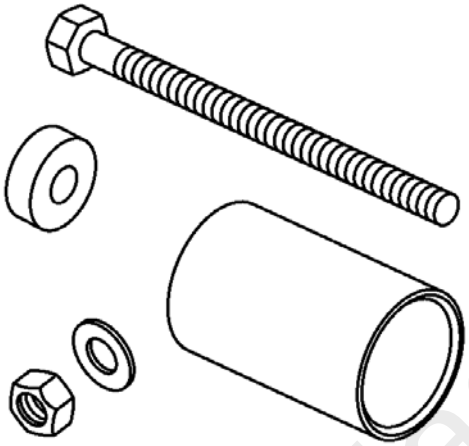
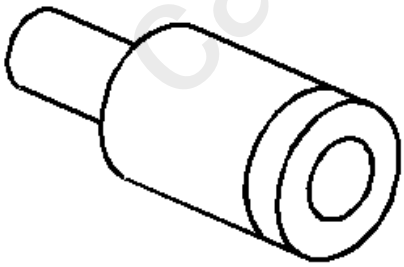
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	J 39437 Bushing Installer
	J 39439-1 Shift Rail Bushing Remover/Installer
	J 39439-2 Bushing Remover

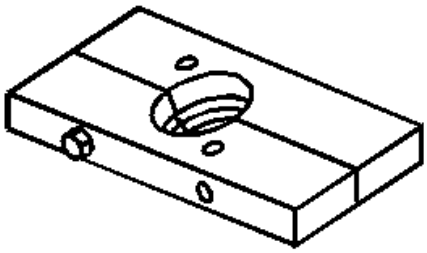
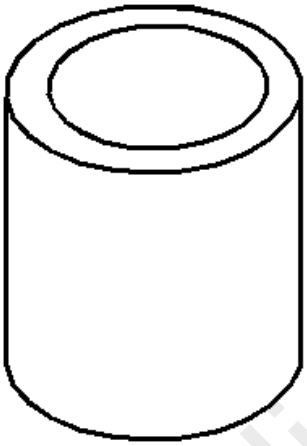
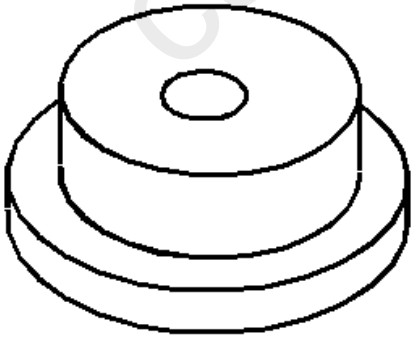
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	J 39439-3 Bushing Installer
	J 39441 5th/6th Driven Gear Installer
	J 39441-10 5th Gear Installer Adapter

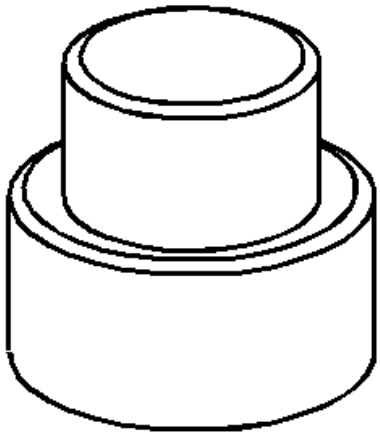
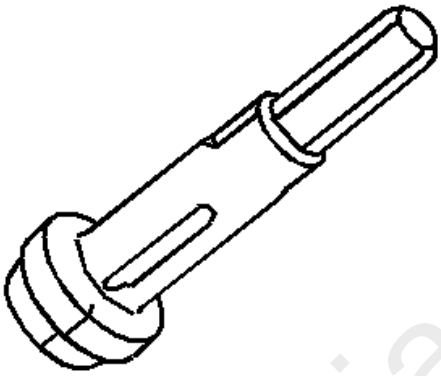
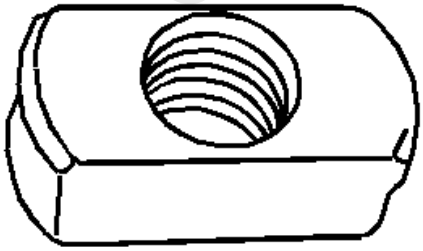
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	J 39441-20 5th Gear Installer Adapter
	J 39441-30 5th Gear Installer Adapter
	J 39442 Press Adapter

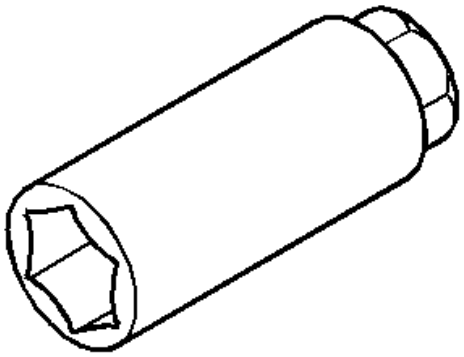
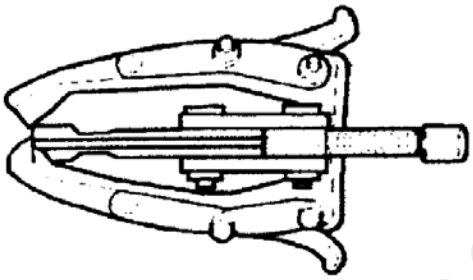
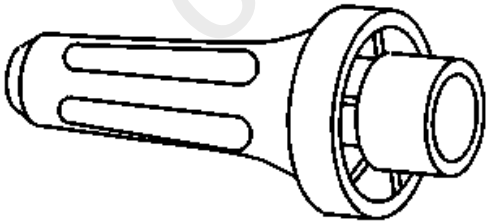
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	J 39443 Split Plate
	J 39473 Mainshaft Bearing Installer/Adapter
	J 39546 Bearing Race Installer

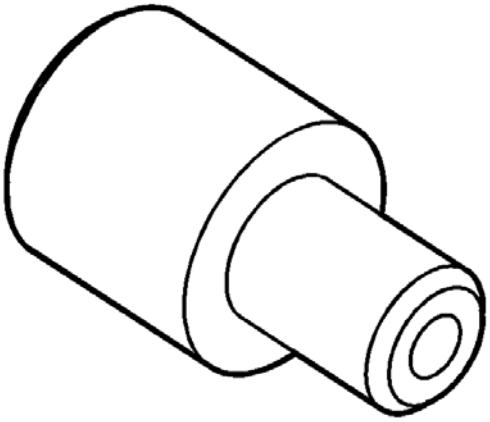
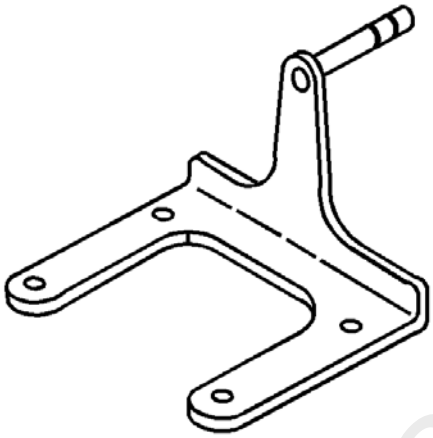
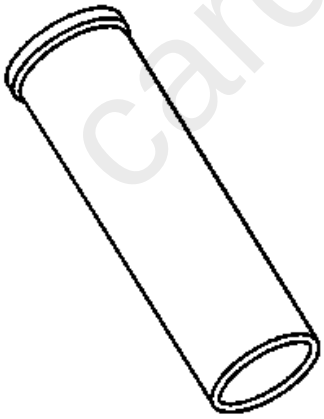
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	J 39547 Press Adapter
	J 39594 Bearing Race Remover
	J 39790 Mainshaft Bearing Race Remover

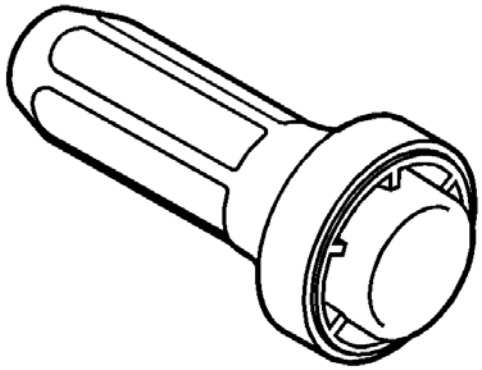
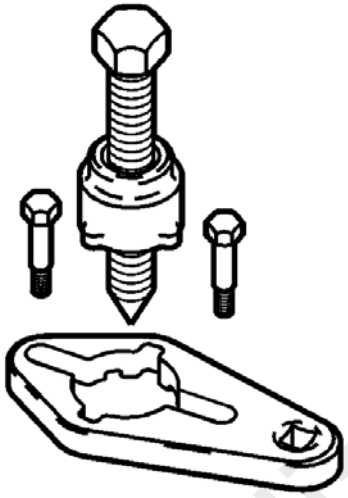
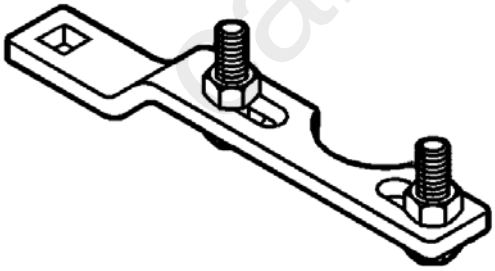
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	J 41099 Skip Shift Sensor Remover/Installer
	J 41816 Crankshaft Balancer Remover
	J 42464 Shift Shaft Seal Installer

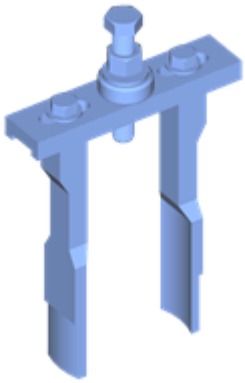
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	J 44384 Shift Fork Bearing Installer
	J 44395 Transmission Holding Fixture
	J 44735 Installation Tube

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	J 44765 Seal Installer
	J 44873 Shoulder Bolts
	J 45012 Holding Fixture

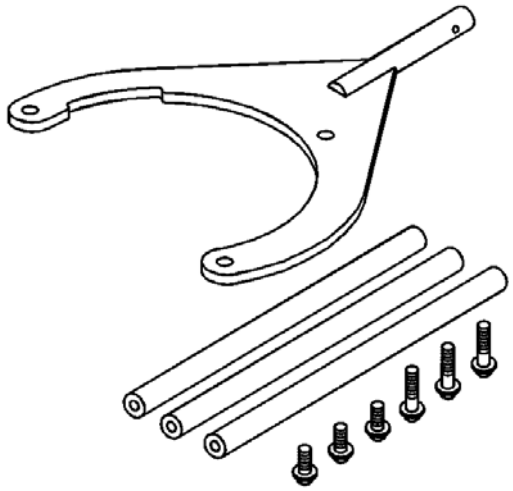
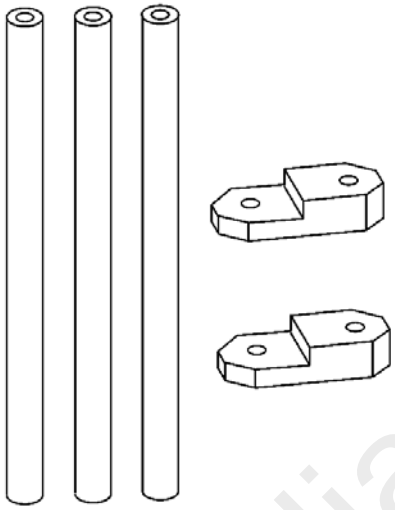
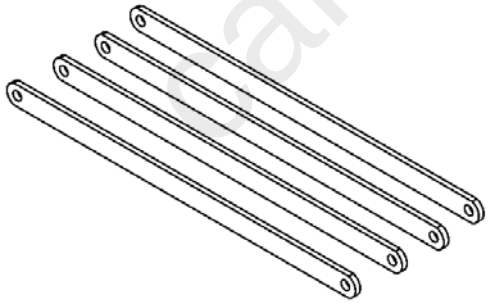
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	J 45019 Flange and Pinion Gauge Remover
	J 45124 Removal Bridge
	J 45124-9 Puller Leg

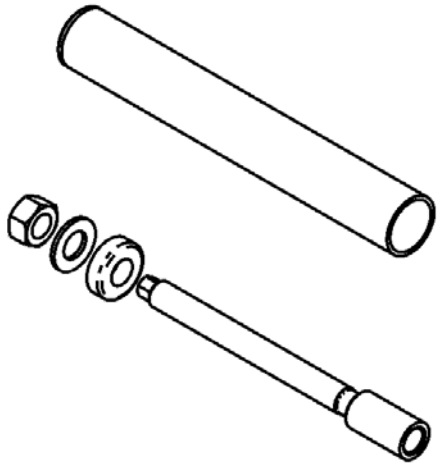
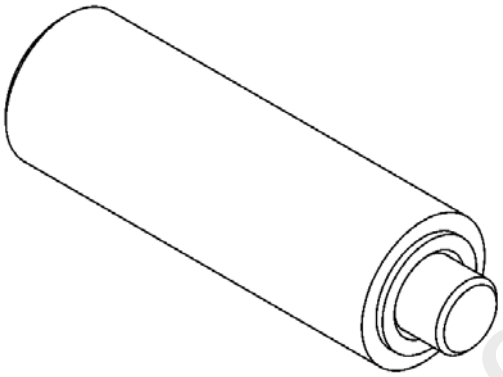
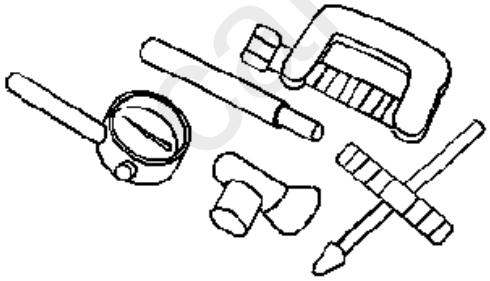
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SPECIAL TOOLS AND EQUIPMENT > SPECIAL TOOLS (M13)

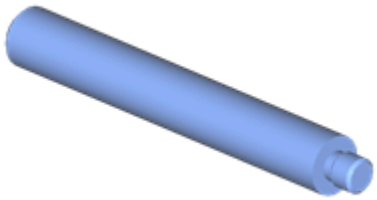
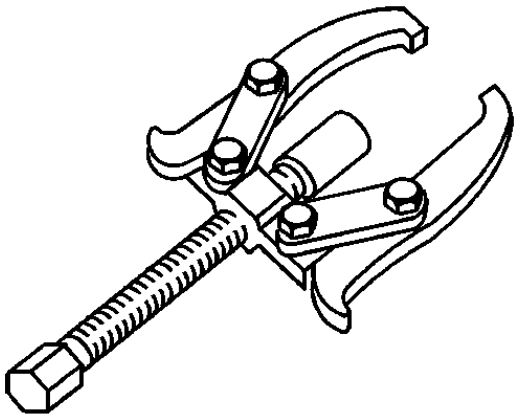
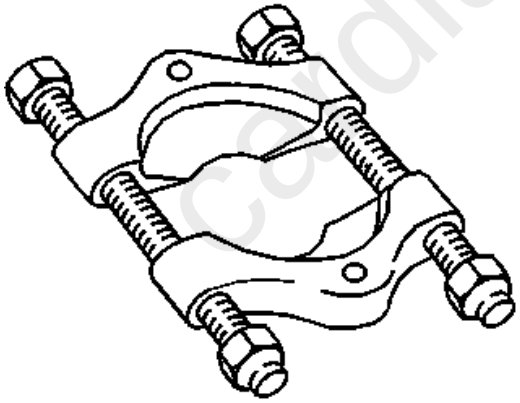
Illustration	Tool Number/ Description

	DT 47678 Transmission Holding Fixture
	DT 47678-10 Transmission Holding Fixture Adapter
	DT 51075 Puller Adapter Set

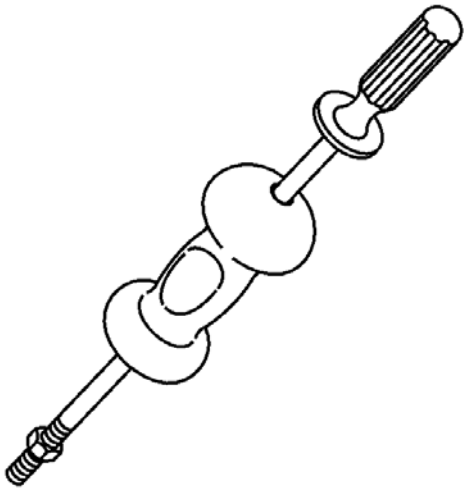
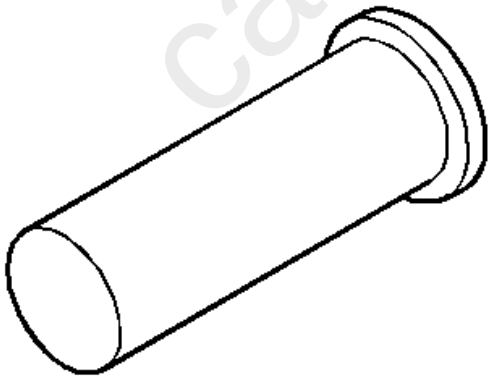
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	DT 51076 Bearing and Gear Installer
	DT 51077 Shift Shaft Seal Installer
	J 8001 Dial Indicator Set

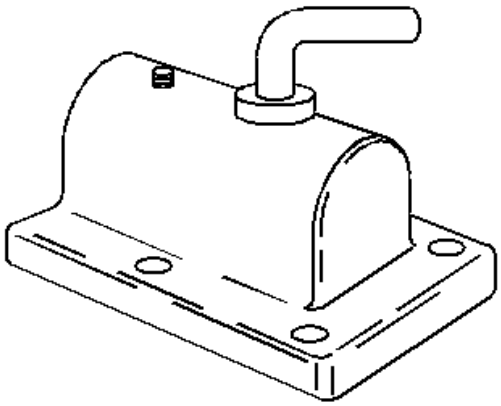
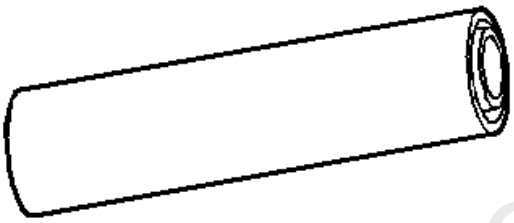
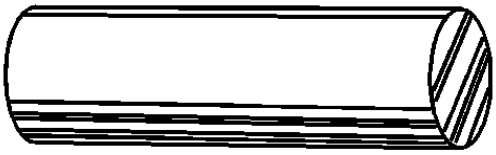
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	GE 8092 J 8092 Universal Driver Handle
	DT 22888-D J 22888-D Right Differential Side Bearing Puller
	DT-22912-B J 22912-B Split Plate Bearing Puller

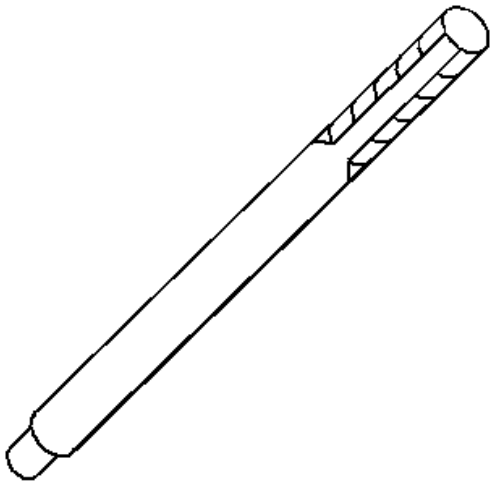
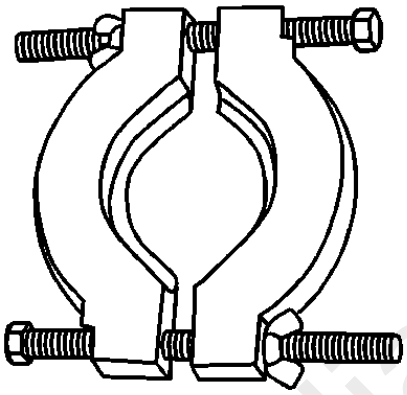
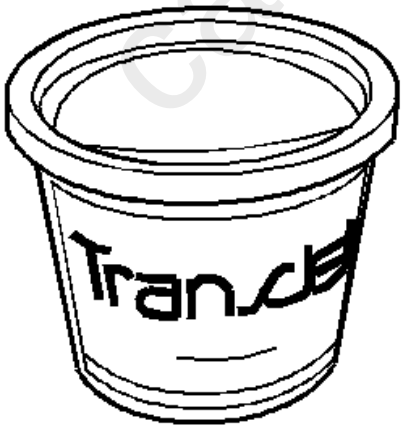
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	J 23907-1 Slide Hammer with Bearing Adapter
	J 24433 Pinion Cone and Side Bearing Installer
	DT 25234 J 25234 Gear and Bearing Installer

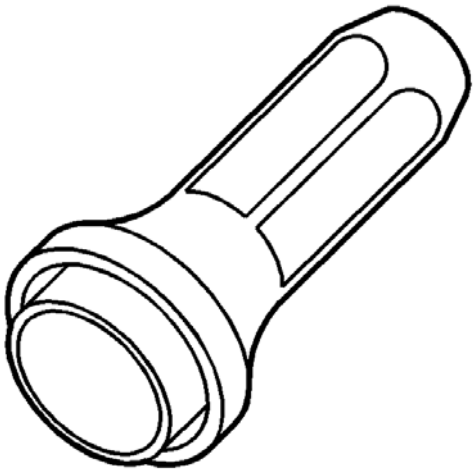
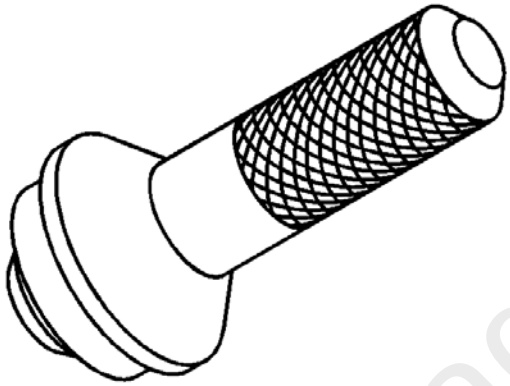
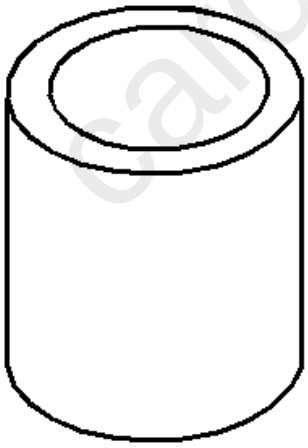
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	J 3289-20 Holding Fixture
	J 33785 Pinion Bearing Installer
	J 35664 Pinion Shaft Bearing Installer

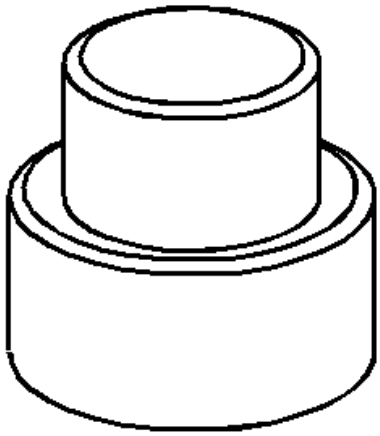
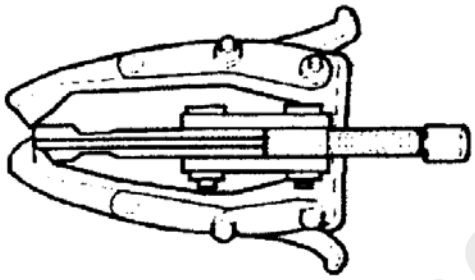
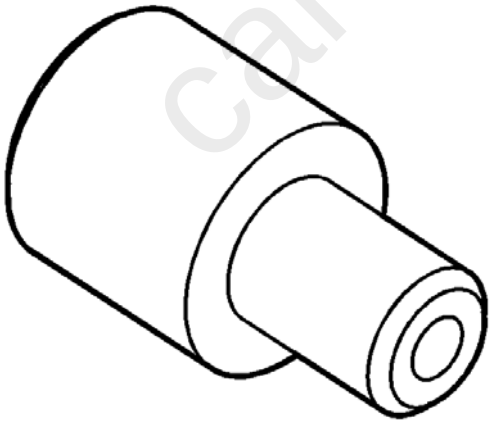
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	GE 36190 J 36190 Universal Driver Handle
	DT 36513 J 36513 Gear and Bearing Separator Plate
	J 36850 Transjel® Lubricant

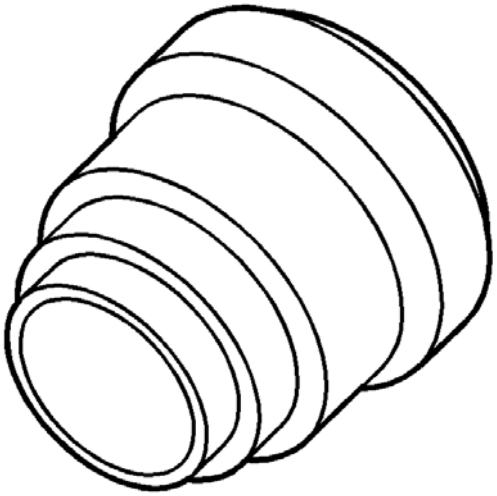
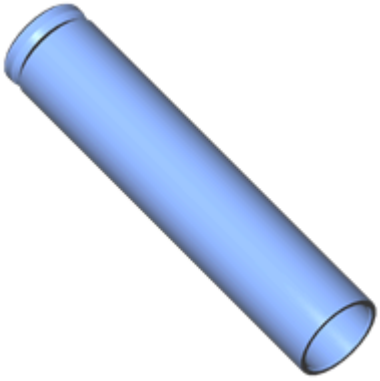
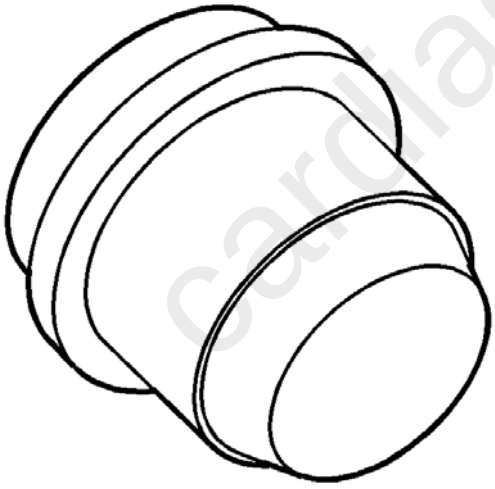
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	DT 37212 J 37212 Front Output Shaft Seal Installer
	DT-39433 J 39433 Input Shaft Seal Installer
	DT 39473 J 39473 Mainshaft Bearing Installer

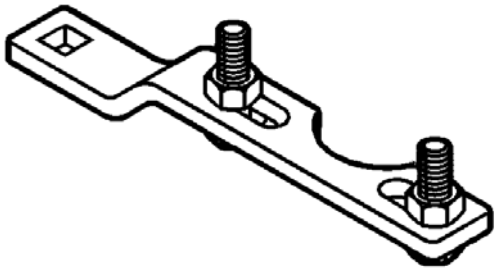
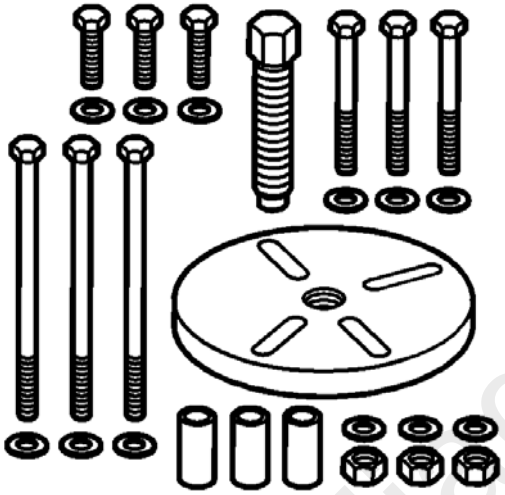
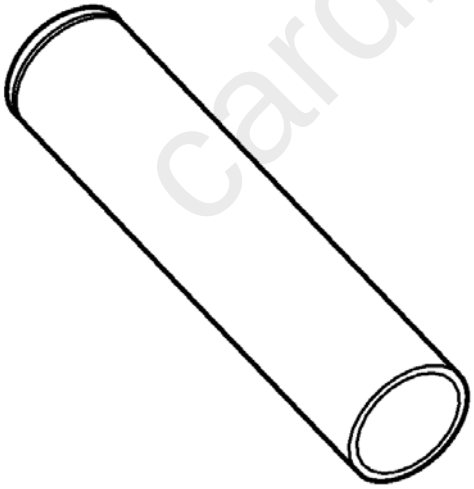
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	DT 39547 J 39547 Press Adapter
	J 41816 Crankshaft Balancer Remover
	DT 44384 J 44384 Shift Fork Bearing Installer

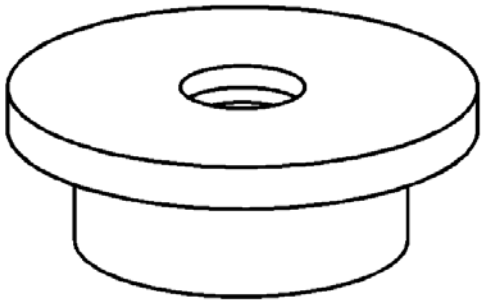
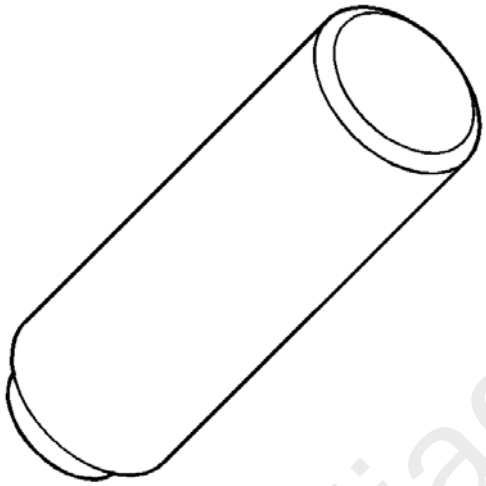
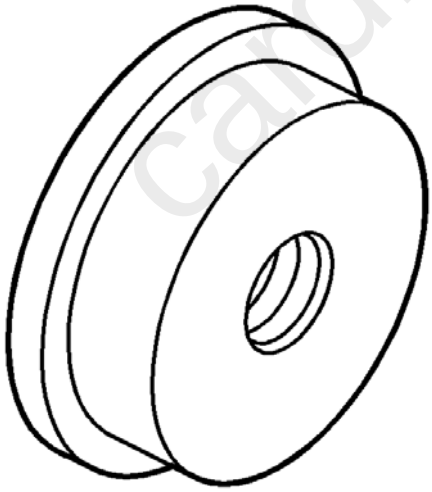
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	J 44752 Bearing, Race, and Seal Installer
	J 44907 Bearing Installer
	DT 44908 J 44908 Bearing Race Installer

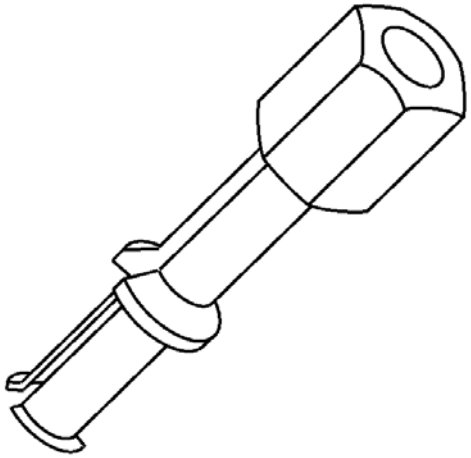
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	DT 45012 J 45012 Holding Fixture
	DT 45019 J 45019 Flange and Pinion Gauge Remover
	J 45342-1 Press Tube

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	DT 45870 J 45870 Pinion Bearing Cup Installer
	DT 46627-A J 46627-A Seal Installer
	DT 47724 Output Shaft Bearing Cup Installer

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	DT-49216 Bushing Remover

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