



2013

CC

**Quick Reference
Specification Book**

2013 Volkswagen CC

Quick Reference Specification Book

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GENERAL INFORMATION

Decimal and Metric Equivalents

Distance/Length

To calculate: mm x 0.03937 = in.

mm	in.	mm	in.	mm	in.	mm	in.
0.002	0.00008	0.01	0.0004	0.1	0.004	1	0.04
0.004	0.00016	0.02	0.0008	0.2	0.008	2	0.08
0.006	0.00024	0.03	0.0012	0.3	0.012	3	0.12
0.008	0.00031	0.04	0.0016	0.4	0.016	4	0.16
0.010	0.00039	0.05	0.0020	0.5	0.020	5	0.20
0.020	0.00079	0.06	0.0024	0.6	0.024	6	0.24
0.030	0.00118	0.07	0.0028	0.7	0.028	7	0.28
0.040	0.00157	0.08	0.0031	0.8	0.031	8	0.31
0.050	0.00197	0.09	0.0035	0.9	0.035	9	0.35
0.060	0.00236	0.10	0.0039	1.0	0.039	10	0.39
0.070	0.00276	0.20	0.0079	2.0	0.079	20	0.79
0.080	0.00315	0.30	0.0118	3.0	0.118	30	1.18
0.090	0.00354	0.40	0.0157	4.0	0.157	40	1.57
0.100	0.00394	0.50	0.0197	5.0	0.197	50	1.97
0.200	0.00787	0.60	0.0236	6.0	0.236	60	2.36
0.300	0.01181	0.70	0.0276	7.0	0.276	70	2.76
0.400	0.01575	0.80	0.0315	8.0	0.315	80	3.15
0.500	0.01969	0.90	0.0354	9.0	0.354	90	3.54
0.600	0.02362	1.00	0.0394	10.0	0.394	100	3.94
0.700	0.02756	2.00	0.0787	20.0	0.787		
0.800	0.03150	3.00	0.1181	30.0	1.181		
0.900	0.03543	4.00	0.1575	40.0	1.575		
1.000	0.03937	5.00	0.1969	50.0	1.969		
2.000	0.07874	6.00	0.2362	60.0	2.362		
3.000	0.11811	7.00	0.2756	70.0	2.756		
4.000	0.15748	8.00	0.3150	80.0	3.150		
5.000	0.19685	9.00	0.3543	90.0	3.543		
6.000	0.23622	10.00	0.3937	100.0	3.937		
7.000	0.27559	20.00	0.7874				
8.000	0.31496	30.00	1.1811				
9.000	0.35433	40.00	1.5748				
10.000	0.39370	50.00	1.9685				
20.000	0.78740	60.00	2.3622				
30.000	1.18110	70.00	2.7559				
40.000	1.57480	80.00	3.1496				
50.000	1.96850	90.00	3.5433				
60.000	2.36220	100.00	3.9370				
70.000	2.75591						
80.000	3.14961						
90.000	3.54331						
100.000	3.93701						

Tightening Torque

Nm-to-lb·ft (ft·lb)

To calculate: Nm x 0.738 = lb·ft

Nm	lb·ft (ft·lb)	Nm	lb·ft (ft·lb)	Nm	lb·ft (ft·lb)
10	7	55	41	100	74
11	8	56	41	105	77
12	9	57	42	110	81
13	10	58	43	115	85
14	10	59	44	120	89
15	11	60	44	125	92
16	12	61	45	130	96
17	13	62	46	135	100
18	13	63	46	140	103
19	14	64	47	145	107
20	15	65	48	150	111
21	15	66	49	155	114
22	16	67	49	160	118
23	17	68	50	165	122
24	18	69	51	170	125
25	18	70	52	175	129
26	19	71	52	180	133
27	20	72	53	185	136
28	21	73	54	190	140
29	21	74	55	195	144
30	22	75	55	200	148
31	23	76	56	205	151
32	24	77	57	210	155
33	24	78	58	215	159
34	25	79	58	220	162
35	26	80	59	225	166
36	27	81	60	230	170
37	27	82	60	235	173
38	28	83	61	240	177
39	29	84	62	245	181
40	30	85	63	250	184
41	30	86	63	260	192
42	31	87	64	270	199
43	32	88	65	280	207
44	32	89	66	290	214
45	33	90	66	300	221
46	34	91	67	310	229
47	35	92	68	320	236
48	35	93	69	330	243
49	36	94	69	340	251
50	37	95	70	350	258
51	38	96	71	360	266
52	38	97	72	370	273
53	39	98	72	380	280
54	40	99	73	390	288
55	41	100	74	400	295

Nm-to-lb-in (in·lb) kg·cm

To calculate: Nm x 8.85 = lb-in • Nm x 10.20 = kg·cm

Nm	lb-in (in·lb)	kg·cm	Nm	lb-in (in·lb)	kg·cm
1	9	10	26	230	265
2	18	20	27	239	275
3	27	31	28	248	286
4	35	41	29	257	296
5	44	51	30	266	306
6	53	61	31	274	316
7	62	71	32	283	326
8	71	82	33	292	337
9	80	92	34	301	347
10	89	102	35	310	357
11	97	112	36	319	367
12	106	122	37	327	377
13	115	133	38	336	387
14	124	143	39	345	398
15	133	153	40	354	408
16	142	163	41	363	418
17	150	173	42	372	428
18	159	184	43	381	438
19	168	194	44	389	449
20	177	204	45	398	459
21	186	214	46	407	469
22	195	224	47	416	479
23	204	235	48	425	489
24	212	245	49	434	500
25	221	255	50	443	510

N·cm-to-lb-in (in·lb) kg·cm

To calculate: N·cm x 0.089 = lb-in • N·cm x 0.102 = kg·cm

N·cm	lb-in (in·lb)	kg·cm	N·cm	lb-in (in·lb)	kg·cm
50	4	5	250	22	25
60	5	6	300	27	31
70	6	7	350	31	36
80	7	8	400	35	41
90	8	9	450	40	46
100	9	10	500	44	51
110	10	11	550	49	56
120	11	12	600	53	61
130	12	13	650	58	66
140	12	14	700	62	71
150	13	15	750	66	76
160	14	16	800	71	82
170	15	17	850	75	87
180	16	18	900	80	92
190	17	19	950	84	97
200	18	20	1000	89	102

kg·cm-to-lb·in (in·lb) N·cm

To calculate: $\text{kg}\cdot\text{cm} \times 0.868 = \text{lb}\cdot\text{in}$ • $\text{kg}\cdot\text{cm} \times 9.81 = \text{N}\cdot\text{cm}$

kg·cm	lb·in (in·lb)	N·cm		kg·cm	lb·in (in·lb)	N·cm
5	4	49		110	95	1079
6	5	59		120	104	1177
7	6	69		130	113	1275
8	7	78		140	122	1373
9	8	88		150	130	1471
10	9	98		160	139	1569
20	17	196		170	148	1667
30	26	294		180	156	1765
40	35	392		190	165	1863
50	43	490		200	174	1961
60	52	588		210	182	2059
70	61	686		220	191	2157
80	69	785		230	200	2256
90	78	883		240	208	2354
100	87	981		250	217	2452

Warnings and Cautions

WARNINGS

- Some repairs may be beyond your capability. If you lack the skills, tools and equipment, or a suitable workplace for any procedure described in this manual, we suggest you leave such repairs to an authorized dealer service department or other qualified shop.
- Do not reuse any fasteners that have become worn or deformed during normal use. Many fasteners are designed to be used only once and become unreliable and may fail when used a second time. This includes, but is not limited to, nuts, bolts, washers, self-locking nuts or bolts, circlips and cotter pins. Always replace these fasteners with new parts.
- Never work under a lifted car unless it is solidly supported on stands designed for the purpose. Do not support a car on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a car that is supported solely by a jack. Never work under the car while the engine is running.
- If you are going to work under a car on the ground, make sure the ground is level. Block the wheels to keep the car from rolling. Disconnect the battery negative (-) terminal (ground strap) to prevent others from starting the car while you are under it.

- Never run the engine unless the work area is well ventilated. Carbon monoxide kills.
- Remove rings, bracelets and other jewelry so they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.
- Tie back long hair. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.
- Do not attempt to work on your car if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset, or have taken medication or any other substance that may keep you from being fully alert.
- Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the car. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel, vapors or oil.
- Use a suitable container to catch draining fuel, oil, or brake fluid. Do not use food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store oily rags which can ignite and burn spontaneously.
- Always observe good workshop practices. Wear goggles when you operate machine tools or work with battery acid. Wear gloves or other protective clothing whenever the job requires working with harmful substances.
- Greases, lubricants and other automotive chemicals contain toxic substances, many of which are absorbed directly through the skin. Read the manufacturer's instructions and warnings carefully. Use hand and eye protection. Avoid direct skin contact
- Disconnect the battery negative (-) terminal (ground strap) whenever you work on the fuel or electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.
- Friction materials (such as brake pads or shoes or clutch discs) contain asbestos fibers or other friction materials. Do not create dust by grinding, sanding, or cleaning with compressed air. Avoid breathing dust. Breathing any friction material dust can lead to serious diseases and may result in death.

(WARNINGS cont'd on next page)

WARNINGS *(cont'd)*

- Batteries give off explosive hydrogen gas during charging. Keep sparks, lighted matches and open flame away from the top of the battery. If hydrogen gas escaping from the cap vents is ignited, it ignites the gas trapped in the cells and causes the battery to explode.
- Connect and disconnect battery cables, jumper cables or a battery charger only with the ignition off. Do not disconnect the battery while the engine is running.
- Do not quick-charge the battery (for boost starting) for longer than one minute. Wait at least one minute before boosting the battery a second time.
- Do not allow battery charging voltage to exceed 16.5 volts. If the battery begins producing gas or boiling violently, reduce the charging rate. Boosting a sulfated battery at a high charging rate can cause an explosion.
- The A/C system is filled with chemical refrigerant, which is hazardous. The A/C system should be serviced only by trained technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.
- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat increases system pressure and may cause the system to burst.
- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.
- Some cars are equipped with a Supplemental Restraint System (SRS) that automatically deploys airbags and pyrotechnic seat belt tensioners in the event of a frontal or side impact. These are explosive devices. Handled improperly or without adequate safeguards, they can be accidentally activated and cause serious injury.
- The ignition system produces high voltages that can be fatal. Avoid contact with exposed terminals and use extreme care when working on a car with the engine running or the ignition on.

- Place jack stands only at locations specified by manufacturer. The vehicle lifting jack supplied with the vehicle is intended for tire changes only. Use a heavy duty floor jack to lift the vehicle before installing jack stands.
- Battery acid (electrolyte) can cause severe burns. Flush contact area with water, seek medical attention.
- Aerosol cleaners and solvents may contain hazardous or deadly vapors and are highly flammable. Use only in a well ventilated area. Do not use on hot surfaces (such as engines or brakes).
- Do not remove coolant reservoir or radiator cap with the engine hot. Burns and engine damage may occur.

CAUTIONS

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized dealer or other qualified shop.
- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly and do not attempt shortcuts. Use tools appropriate to the work and use only replacement parts meeting original specifications. Makeshift tools, parts and procedures will not make good repairs.
- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque specification listed.
- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond or lake. Dispose of in accordance with Federal, State and Local laws.
- The control module for the Anti-lock Brake System (ABS) cannot withstand temperatures from a paint-drying booth or a heat lamp in excess of 95°C (203°F) and should not be subjected to temperatures exceeding 85°C (185°F) for more than two hours.
- Before doing any electrical welding on cars equipped with ABS, disconnect the battery negative (-) terminal (ground strap) and the ABS control module connector.
- Always make sure the ignition is off before disconnecting battery.

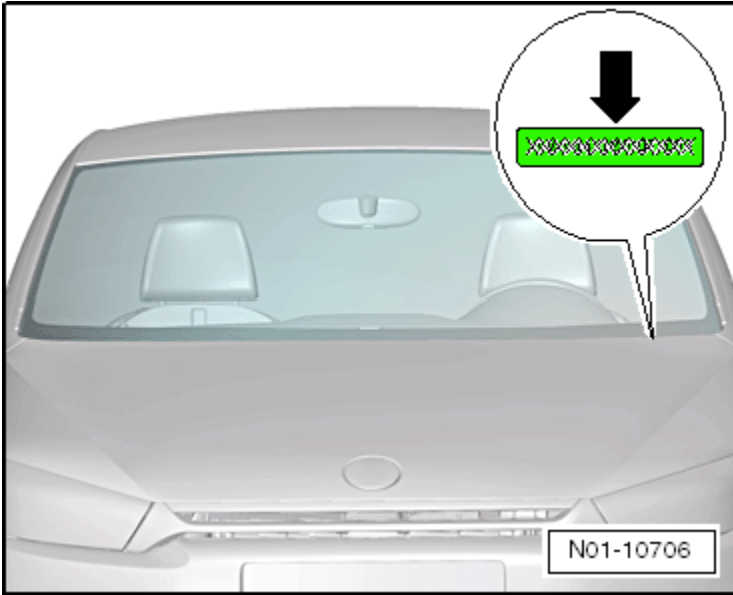
(CAUTIONS cont'd on next page)

CAUTIONS *(cont'd)*

- Label battery cables before disconnecting. On some models, battery cables are not color coded.
- Disconnecting the battery may erase fault code(s) stored in control module memory. Check for fault codes prior to disconnecting the battery cables.
- If a normal or rapid charger is used to charge the battery, disconnect the battery and remove it from the vehicle to avoid damaging paint and upholstery.
- Do not quick-charge the battery (for boost starting) for longer than one minute. Wait at least one minute before boosting the battery a second time.
- Connect and disconnect a battery charger only with the battery charger switched off.
- Sealed or “maintenance free” batteries should be slow-charged only, at an amperage rate that is approximately 10% of the battery’s ampere-hour (Ah) rating.
- Do not allow battery charging voltage to exceed 16.5 volts. If the battery begins producing gas or boiling violently, reduce the charging rate. Boosting a sulfated battery at a high charging rate can cause an explosion.

VEHICLE IDENTIFICATION

Vehicle Identification Number (VIN) Location



Vehicle
Identification

The VIN (➡) is on the left side of the vehicle in the area of the windshield wiper mount. It is visible from the outside.
(Typical illustration shown).

VIN Decoder

2013 Volkswagen VIN Decoder (except Routan)

Series:	Country of origin	Manufacturer	Vehicle Type	Series	Engine	Restraint system	Model (7&8)	Check digit	Model year	Assembly plant	Sequential production number (position 12 - 17)						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A= CC Sport w/Man Trans, Golf Zdr w/5 Spd Manual, Passat S, Tiguan w/Auto Trans B= CC Sport/Sport w/Auto Trans, Eco Komfort/Sport w/Auto Trans, Golf Zdr w/Auto Trans, Jetta SE w/5 Spd Man, Passat SE, Tiguan w/Auto Trans and 4-Motion C= Golf 4dr w/5 Spd Manual, Passat SEL, Tiguan w/Man Trans D= Golf 4dr w/Auto Trans, Jetta SE w/Auto Trans E= GTI Zdr w/Man Trans, Touareg V6 FSI/TDI /Hybrid F= Beetle w/6 Spd Auto Trans, Eco Lux/Exec w/Auto Trans, GTI Zdr w/Auto Trans G= CC V6 Exec w/Auto Trans and 4Motion, GTI 4dr w/Man Trans, Jetta SEL w/5 Spd Man Trans	W	V	V	B	P	7	A	N	8	D	E	5	0	2	0	1	3
H= CC V6 Lux w/Auto Trans, Beetle 2.5L TDI w/5 Spd Manual, GTI 4dr w/Auto Trans J= Beetle 2.5L TDI w/5 Spd Auto Trans K= Jetta SportWagen w/5 Spd Man Trans L= Jetta SEL/TDI w/Auto Trans M= Golf Zdr w/6 Spd Manual, Jetta SportWagen w/5 Spd Manual N= Golf 4dr w/6 Spd Manual P= Golf R 4dr w/Man Trans, Jetta SportWagen w/5 Spd Auto Trans R= Beetle TDI w/6 Spd Man, CC Lux w/Auto Trans, Golf R Zdr w/Man Trans V= Beetle Turbo w/6 Spd Auto Trans Z= Jetta /S w/Auto Trans 3= Jetta TDI w/6 Spd Man 4= Beetle Turbo w/6 Spd Manual, Jetta GLI w/Auto Trans 5= Jetta GLI w/6 Spd Manual 6= Jetta Hybrid w/Auto Trans	D = 2013 Sequential production number (position 12 - 17)																
** PZEV = Partial Zero Emissions Vehicle ** SULEV = Super Low Emissions Vehicle **** 7 position US model characters are alphabetic beginning with 2010 MY. ROW model characters, where different, are listed in parenthesis (), for reference only. **** Jetta and Jetta SportWagen models are identified by WMI code of 3VV, GTI and Golf models are identified by WMI code of WVV .	See block Calculate per NHTSA Code 2013 A3*** = Passat AH (1F) = Eos AJ (16)*** = Golf, Golf R, GTI, Jetta, Jetta SportWagen AN (3C) = CC AT = Beetle, Beetle Conv. AX (5N) = Tiguan BP (7P) = Touareg C = Chattanooga D = Slovakia E = Emden M = Mexico P = Mosel V = Portugal W = Wolfsburg																
A= 4 cyl 2.0L 200hp (CBFA-PZEV*) Beetle, Beetle Convertible, Jetta, Jetta GLI A= 5 cyl 2.5L 170hp (CBTA-M) Golf B= 5 cyl 2.5L 170hp (CBUAM-PZEV*) Golf D= 4 cyl 2.0L 200hp (CBFA-PZEV*) GTI D= 4 cyl 2.0L 200hp (CCTA) Eos F= 4 cyl 2.0L 256hp (CRZA) Golf R F= VR6 3.6L 280hp (CGRK) Touareg G= 6 cyl 3.0L 330hp + 34 Kw (CGFA) Touareg Hybrid H= 5 cyl 2.5L 170hp (CBTA-M) Passat K= 4 cyl 2.0L 150hp (CBFA) Jetta L= 4 cyl 2.0L TDI 140hp (CJAA) Jetta, Jetta SportWagen, Beetle, Beetle Convertible M= 4 cyl 2.0L TDI 140hp (CJAA) Golf M= VR6 3.6L 280hp (CQVR) Passat N= 4 cyl 2.0L 200hp (CCTA) CC N= 4 cyl 2.0L TDI 140hp (CKRA) Passat P= 4 cyl 2.0L 200hp (CBFA-PZEV*) CC P= 5 cyl 2.5L 170hp (CBUAM-PZEV*) Beetle, Beetle Convertible, Jetta, Jetta SportWagen, Passat P= VR6 3.0L TDI 240hp (CNRB) Touareg U= VR6 3.6L 280hp (CUNA) CC V= 4 cyl 2.0L 200hp (CCTA) GTI, Tiguan W= 4 cyl 2.0L 200hp (CBFA-SULEV) Eos X= 5 cyl 2.5L 170hp (CBTA-M) Beetle, Beetle Convertible, Jetta, Jetta SportWagen 3= 4 cyl 1.4L 150hp + 28 Kw (CNLA) Jetta Hybrid 6= 4 cyl 2.0L 200hp (CCTA) Beetle, Beetle Convertible, Jetta GLI																	

2013 Restraint System:

All = Active-DriPass - Front Air Bag - DriPass
7 = Advanced Front Air Bags + Side Impact Air Bags - Front + Side Curtain Air Bags
8 (Eos Only) = Advanced Front Air Bags + Side Impact Air Bags - Front + Knee Air Bags - Front + Side Curtain Air Bags
8 (Jetta Only) or 9 (All Others) = Advanced Front Air Bags + Side Impact Air Bags - Fr.Fr. + Side Curtain Air Bags
9 (Tiguan) = Advanced Front Air Bags + Side Impact Air Bags - Fr. Fr. + Side Curtain Air Bags
9 (Touareg) = Advanced Front Air Bags + Side Impact Air Bags - Front + Side Curtain Air Bags

M = 1991
N = 1992
P = 1993
R = 1994
S = 1995
T = 1996
V = 1997
W = 1998
X = 1999
Y = 2000
1 = 2001
2 = 2002
3 = 2003
4 = 2004
5 = 2005
6 = 2006
7 = 2007
8 = 2008
9 = 2009
A = 2010
B = 2011
C = 2012
D = 2013

2013 Volkswagen VIN Decoder (except Routan)

1	Country of origin
2	Manufacturer
3	Vehicle Type
4	Series
5	Engine
6	Restraint system
7	Model
8	(position 7 & 8)
9	Check digit
10	Model year
11	Assembly plant
12	Sequential production number (position 12 - 17)
13	
14	
15	
16	
17	

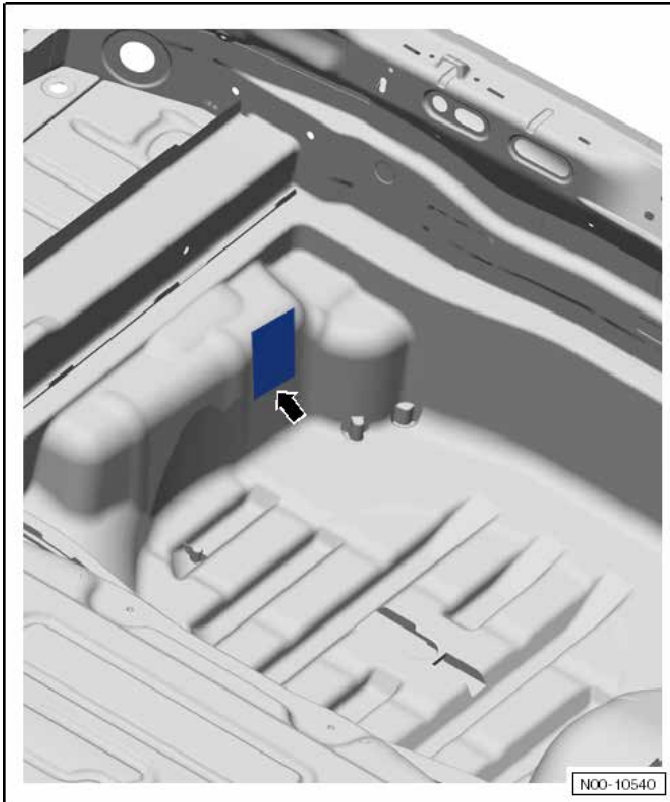
VIN on Longitudinal Member Extension



Vehicle
Identification

The Vehicle Identification Number (VIN) (➔) is located above the right wheel housing on the fender mount upper longitudinal member.

Vehicle Data Label



Vehicle data plate (➡) is secured in the right spare wheel well in the direction of travel.

SALES CODES

Engine Codes

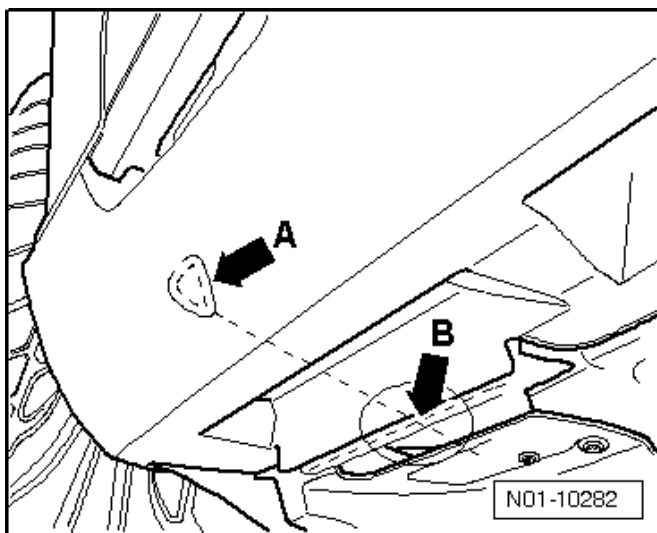
CBFA, CCTA	2.0L 4-cylinder
CNNA	3.6L 6-cylinder

Transmission Codes

02Q	6-speed manual
02E	6-speed Direct Shift Gearbox (DSG)
09M	6-speed automatic

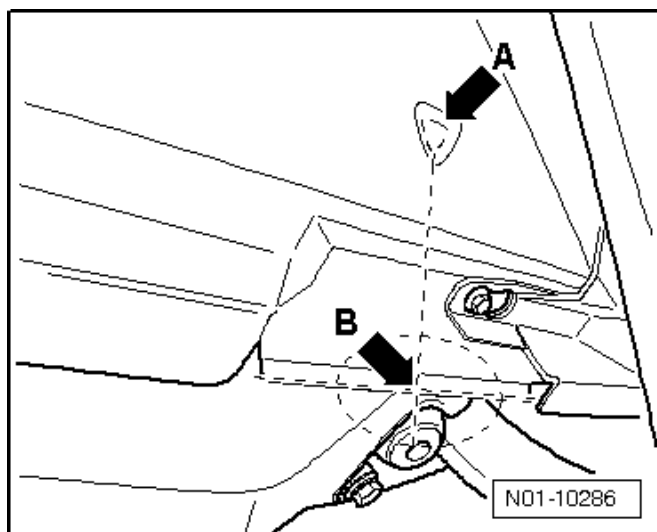
VEHICLE LIFTING

Hoist and Jack Mounting Points Front



Position the support plate in the area of the side member marking (A) on the vertical stiffener of the floor plate (B).

Rear

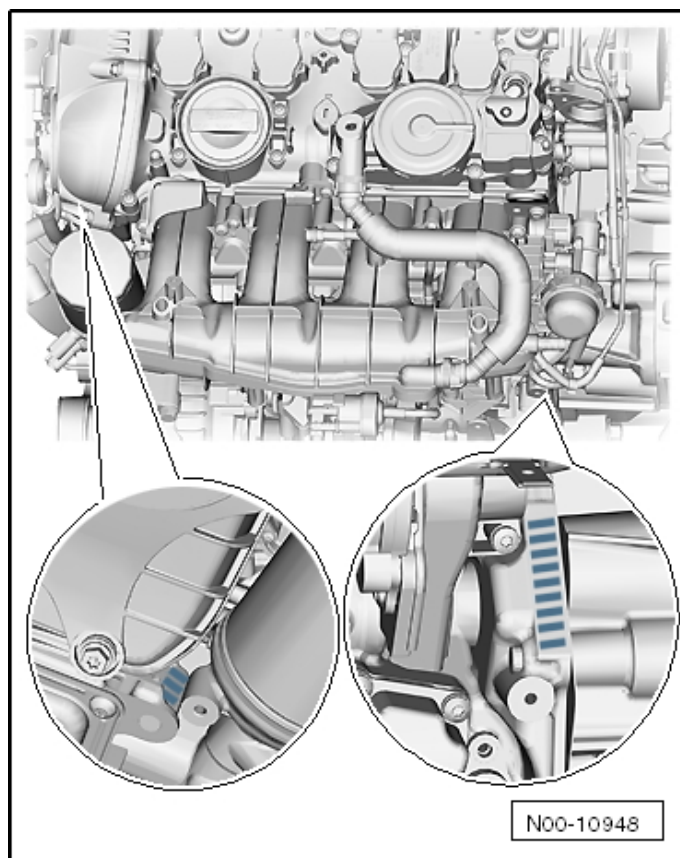


Position the support plate in the area of the side member marking (A) on the vertical stiffener of the floor plate (B).

ENGINE MECHANICAL – 2.0L CBFA, CCTA

General, Technical Data

Engine Number Location



The engine number (engine code and serial number) are located at the engine/transmission joint.

The engine code is also printed on the cylinder block behind the oil filter.

Engine Data

Code Letters		CBFA	CCTA
Manufactured		from 10.09	from 06.08
Emissions values		SULEV ¹⁾	ULEV 2 ²⁾
Displacement	liter	2.0	2.0
Output	kW at RPM	147 @ 5100	147 @ 5100
Torque	Nm at RPM	280 @ 1700	280 @ 1700
Bore	diameter mm	82.5	82.5
Stroke	mm	92.8	92.8
Compression ratio		9.6:1	9.6:1
Research Octane Number (RON)		95	95
Injection system/ignition system		FSI	FSI
Ignition sequence		1-3-4-2	1-3-4-2
Turbocharger, Supercharger		Turbocharger	Turbocharger
Variable valve timing		Yes	Yes
Secondary Air Injection (AIR)		Yes	No
Valves per cylinder		4	4
Oil pressure control		No	No

¹⁾ SULEV = Super Ultra Low Emissions Vehicle.

²⁾ ULEV = Ultra Low Emissions Vehicle.

Engine Assembly – 2.0L CBFA, CCTA

Fastener Tightening Specification

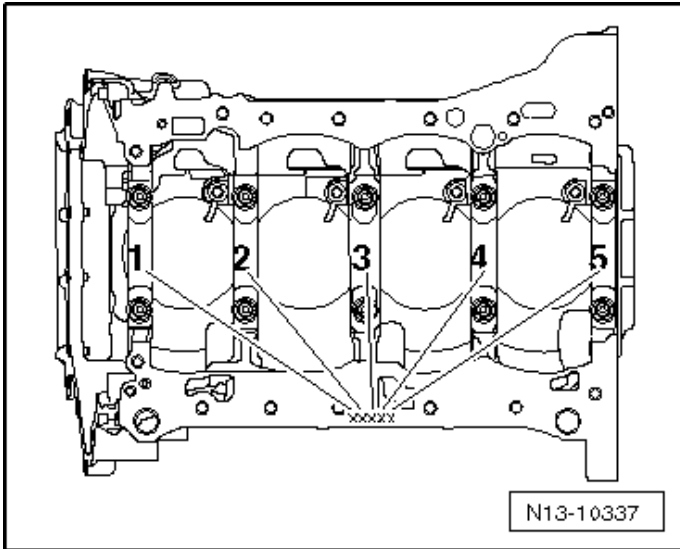
Component	Fastener size	Nm
Bolts and nuts	M6	10
	M7	15
	M8	25
	M10	40
	M12	60
Engine mount bracket-to-engine bolt ¹⁾	-	40 plus an additional 180° (½ turn)
Engine mount support bolt ¹⁾	-	20 plus an additional 90° (¼ turn)
Engine mount-to-body bolt ¹⁾	-	40 plus an additional 90° (¼ turn)
Engine mount-to-engine mount bracket bolt ¹⁾	-	60 plus an additional 90° (¼ turn)
Pendulum support-to-subframe bolt ^{1) 2)}	-	100 plus an additional 90° (¼ turn)
Support-to-body bolt ¹⁾	-	20 plus an additional 90° (¼ turn)
Transmission mount-to-body bolt ¹⁾	-	40 plus an additional 90° (¼ turn)
Transmission mount-to-transmission mount bracket bolt ¹⁾	-	60 plus an additional 90° (¼ turn)

¹⁾ Replace fastener(s).

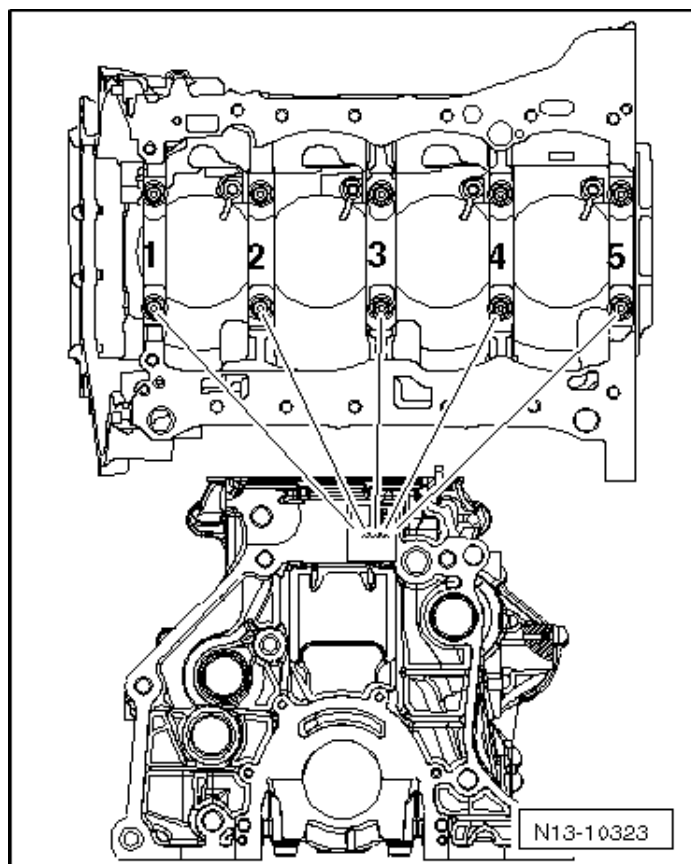
²⁾ Install the pendulum support-to-transmission bolts first, then the pendulum support-to-subframe bolt.

Crankshaft, Cylinder Block – 2.0L CBFA, CCTA

Cylinder Block Bearing Shell Identification



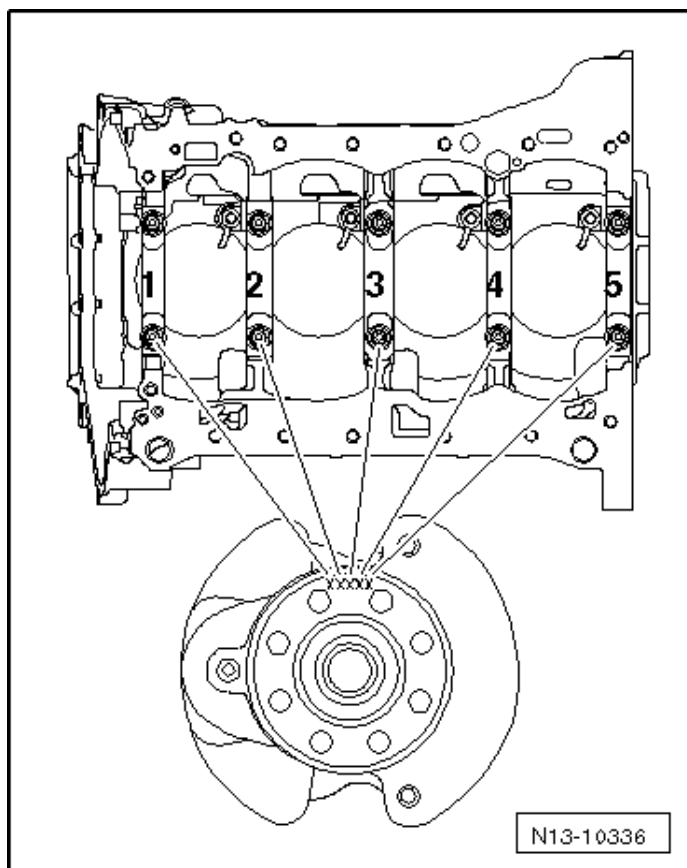
The cylinder block bearing shell identification is located either on the oil pan sealing surface or on the top (transmission side) of the cylinder block.



The identification on the cylinder block is for the upper bearing shell.
 Note the letter and match it to the color identification in the table.

Letter on cylinder block	Color of bearing
S	Black
R	Red
G	Yellow
B	Blue
W	White

Bearing Cap Bearing Shell Identification



The identification on the crankshaft is for the lower bearing shell. Note the letter and match it to the color identification in the table.

Letter on crankshaft	Color of bearing
S	Black
R	Red
G	Yellow
B	Blue
W	White

Fastener Tightening Specifications

Component	Fastener size	Nm
Air conditioning compressor-to-accessory bracket bolt	-	25
Balance shaft-to-cylinder block bolt		9
Balance shaft timing chain guide rail-to-cylinder block guide pin		20
Balance shaft timing chain tensioning rail-to-cylinder block guide pin		20
Chain tensioner-to-cylinder bolt ¹⁾		65
Connecting rod bearing cap-to-connecting rod bolt ¹⁾	-	45 plus an additional 90° (¼ turn)
Dual mass flywheel/drive plate-to-crankshaft bolt ¹⁾	-	60 plus an additional 90° (¼ turn)
Generator-to-accessory bracket bolt	-	23
Pressure relief valve	-	27
Ribbed belt tensioner-to-accessory bracket bolt	-	10
Sensor wheel-to-crankshaft screw ¹⁾	-	10 plus an additional 90° (¼ turn)
Vibration damper-to-crankshaft bolt ¹⁾	-	150 plus an additional 90° (¼ turn)

¹⁾ Replace fastener(s).

Crankshaft Dimensions

Reconditioning dimension in mm ¹⁾	Crankshaft bearing pin diameter	Connecting rod bearing pin diameter
Basic dimension	58.00	47.80

¹⁾ The preparation of worn crankshafts is not provided.

Piston Ring End Gaps

Piston ring dimensions in mm	New	Wear limit
Compression ring	0.20 to 0.40	0.8
Oil scraping ring	0.25 to 0.50	0.8

Piston Ring Clearance

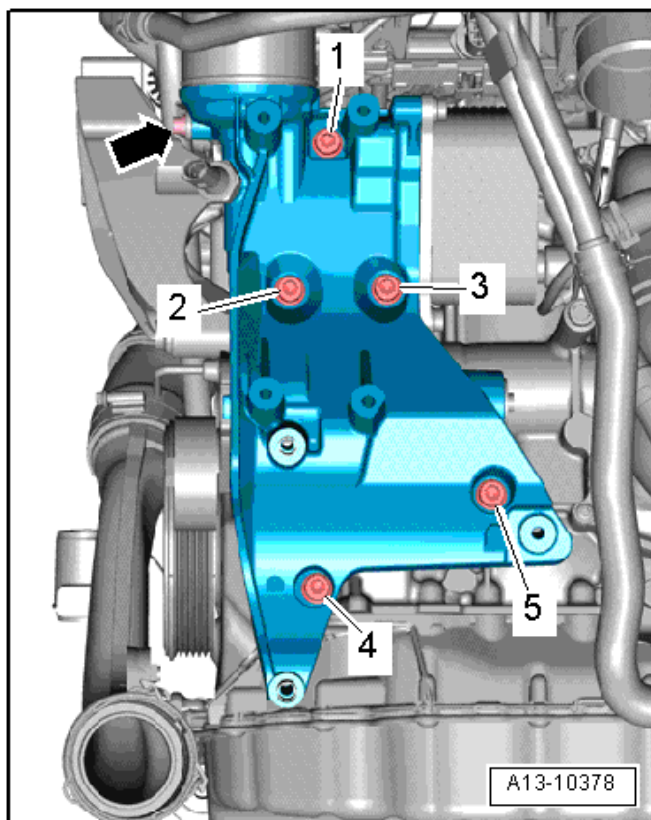
Piston ring dimensions in mm	New	Wear Limit
1 st compression ring	0.06 to 0.09	0.20
2 nd compression ring	0.03 to 0.06	0.15
Oil scraping rings	Cannot be measured	

Piston and Cylinder Dimensions

Honing dimension in mm	Piston diameter	Cylinder bore diameter
Basic dimension	82.465 ¹⁾	82.51

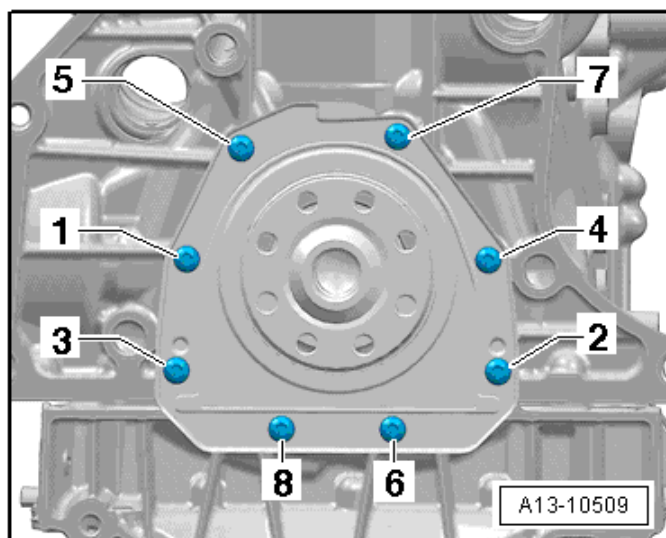
¹⁾ Measurements without graphite coating (thickness = 0.02 mm). The graphite coating wears off.

Accessory Assembly Bracket Tightening Specifications



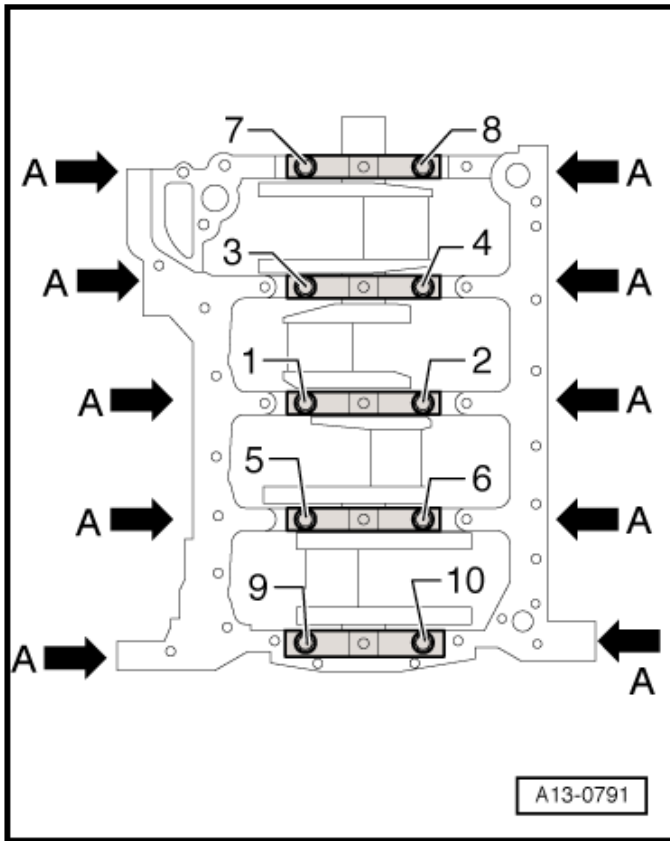
Step	Component	Nm
1	Tighten bolts 1 through 5 in sequence	Hand-tighten
2	Tighten bolts 1 through 5 in sequence	20
3	Tighten bolts 1 through 5 in sequence	an additional 90° (¼ turn)

Sealing Flange Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 8 in sequence	Hand-tighten
2	Tighten bolts 1 through 8 in sequence	9

Crankshaft Assembly Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 10 and A in sequence	Hand-tighten
2	Tighten bolts 1 through 10 in sequence	65
3	Tighten bolts 1 through 10 in sequence	an additional 90° (¼ turn)
4	Tighten bolts A	20
5	Tighten bolts A	an additional 90° (¼ turn)

Cylinder Head, Valvetrain – 2.0L CBFA, CCTA

Fastener Tightening Specifications

Component	Fastener size	Nm
Balance shaft-to-cylinder block bolt	-	9
Balance shaft timing chain guide rail-to-cylinder block guide pin	-	20
Balance shaft timing chain tensioner-to-cylinder block ²⁾	-	65
Balance shaft timing chain tensioning rail-to-cylinder block guide pin	-	20
Ball stud-to-cylinder head cover	-	5
Bearing bracket-to-cylinder head bolt	-	9
Bearing bracket-to-exhaust camshaft bolt ¹⁾	M6	8 plus an additional 90° (¼ turn)
	M8	20 plus an additional 90° (¼ turn)
Camshaft adjustment valve 1-to-upper timing chain cover bolt	-	9
Camshaft Position (CMP) sensor-to-cylinder block bolt	-	9
Camshaft timing chain tensioner-to-cylinder block bolt	-	9
Camshaft timing chain guide rail-to-cylinder block guide pin	-	20
Camshaft timing chain tensioning rail-to-cylinder block guide pin	-	20
Control valve-to-intake camshaft ⁴⁾	-	35
Cylinder head mounting plate/connecting piece bolt	-	9
Heat shield-to-bracket bolt	-	9
Heat shield-to-cylinder head bolt	-	20
Oil dipstick guide tube/camshaft adjustment valve 1-to-upper timing chain cover bolt	-	9
Oil dipstick guide tube-to-cylinder head bolt	-	9
Secondary air injection solenoid valve-to-cylinder head bolt ³⁾	-	9
Transport strap-to-cylinder head bolt	-	25
Vacuum pump-to-cylinder head bolt	-	9

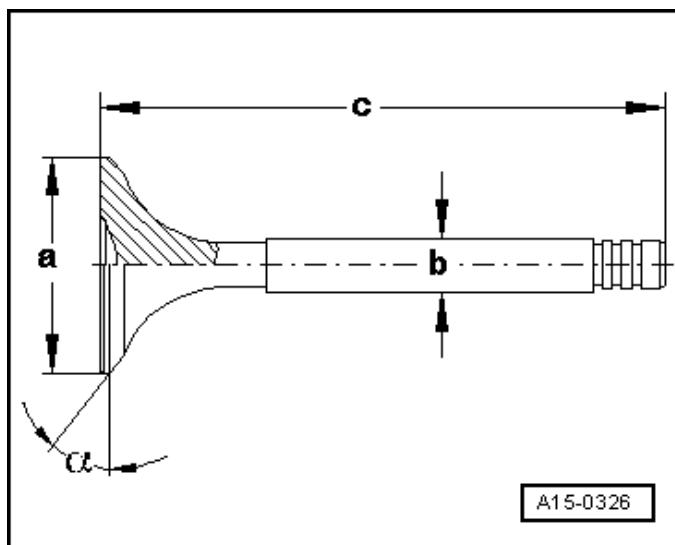
¹⁾ Replace fastener(s).

²⁾ Install with locking compound, refer to the Electronic Parts Catalog (ETKA).

³⁾ Engine code CBFA only.

⁴⁾ Left hand threads.

Valve Dimensions



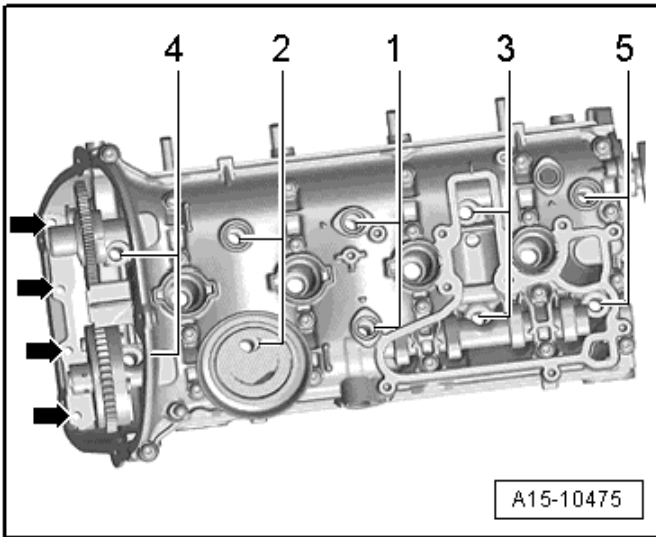
Dimension		Intake valve	Exhaust valve
Diameter a	mm	33.85 ± 0.10	28.0 ± 0.1
Diameter b	mm	5.98 ± 0.007	5.955 ± 0.007
c	mm	103.97	101.87
α	∠°	45	45

Note: Intake and exhaust valves must not be refaced by grinding. Only lapping is permitted.

Compression Pressures

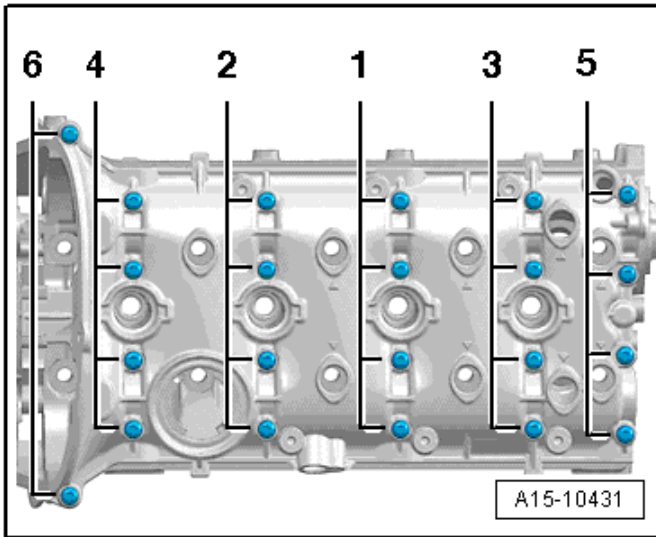
New bar positive pressure	Wear limit bar positive pressure	Difference between cylinders bar positive pressure
11.0 to 14.0	7.0	Max. 3.0

Cylinder Head Tightening Specifications



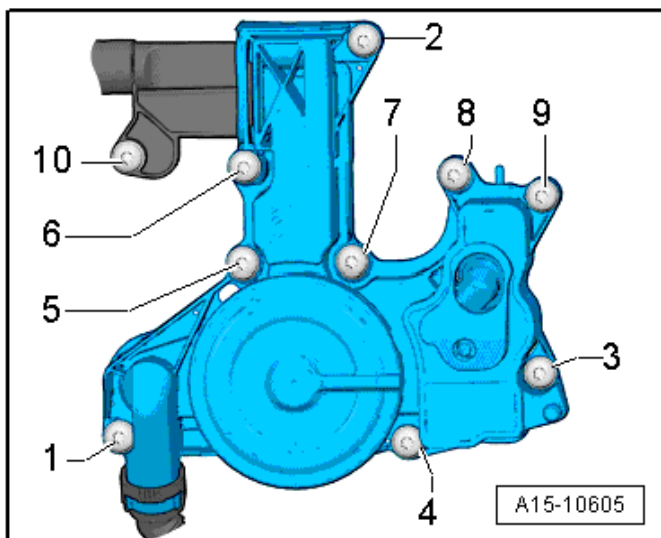
Step	Component	Nm
1	Tighten bolts 1 through 5 in sequence	40
2	Tighten bolts 1 through 5 in sequence	an additional 90° (¼ turn)
3	Tighten bolts 1 through 5 in sequence	an additional 90° (¼ turn)
4	Tighten bolts (➡)	8
5	Tighten bolts (➡)	an additional 90° (¼ turn)

Cylinder Head Cover Tightening Specifications



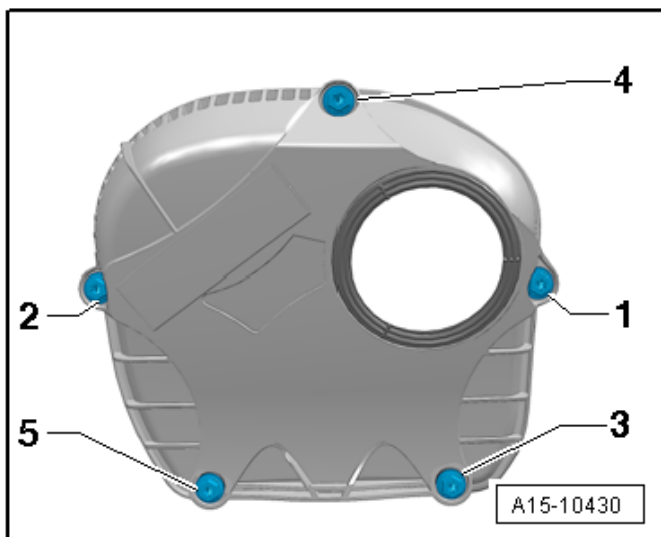
Step	Component	Nm
1	Tighten bolts 1 through 6 in sequence in several stages	Hand-tighten
2	Tighten bolts 1 through 6 in sequence	8
3	Tighten bolts 1 through 6 in sequence	an additional 90° (¼ turn)

Crankcase Ventilation Tightening Specification



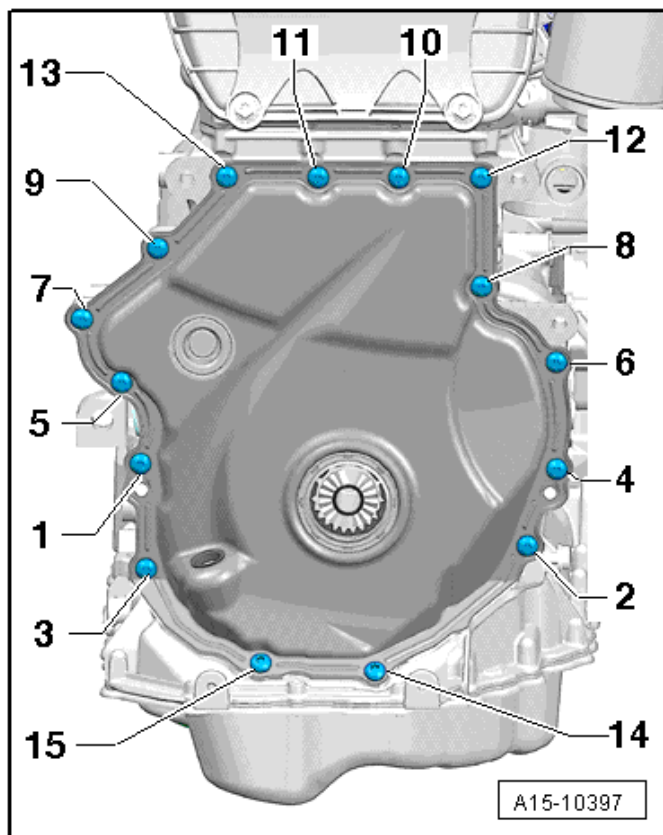
Step	Component	Nm
1	Tighten bolts 1 through 10 in sequence	11

Upper Timing Chain Cover Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 5 in sequence, in several stages	Hand-tighten
1	Tighten bolts 1 through 5 in sequence	9

Lower Timing Chain Cover with 15 Bolts Tightening Specifications



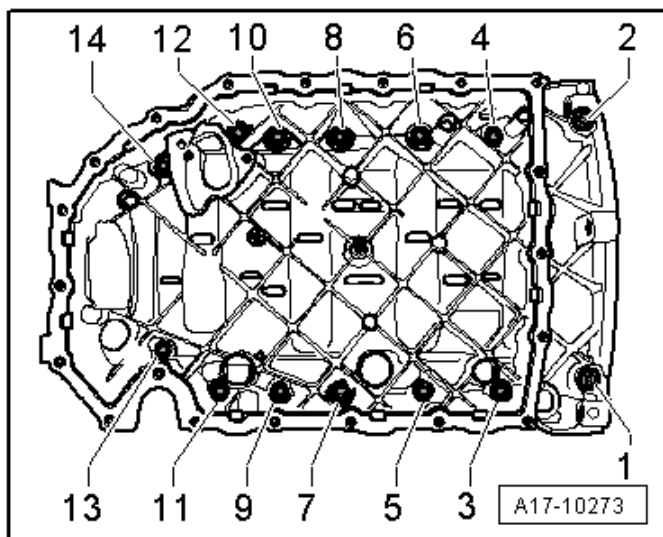
Step	Component	Nm
1	Tighten bolts 1 through 15 in sequence	8
2	Tighten bolts 1 through 15 in sequence	an additional 45° (1/8 turn)

Lubrication – 2.0L CBFA, CCTA

Fastener Tightening Specifications

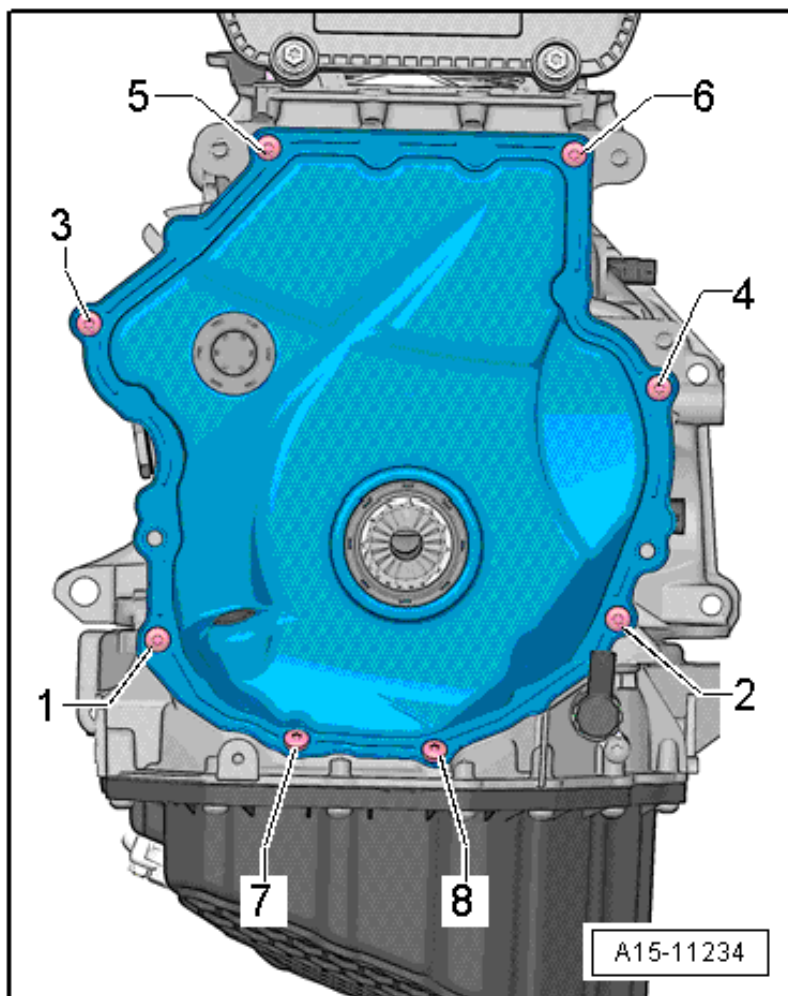
Component	Fastener size	Nm
Oil baffle-to-upper oil pan bolt	-	9
Oil cooler-to-accessory bracket bolt	-	15
Oil drain plug-to-lower oil pan	-	30
Oil filter element-to-accessory bracket	-	22
Oil intake pipe-to-oil pump bolt	-	9
Oil pressure switch-to-accessory bracket	-	20
Oil pump drive chain tensioner guide pin-to-cylinder block bolt	-	9
Oil pump-to-upper oil pan bolt	M6	9
	M8	20

Upper Oil Pan Tightening Specifications



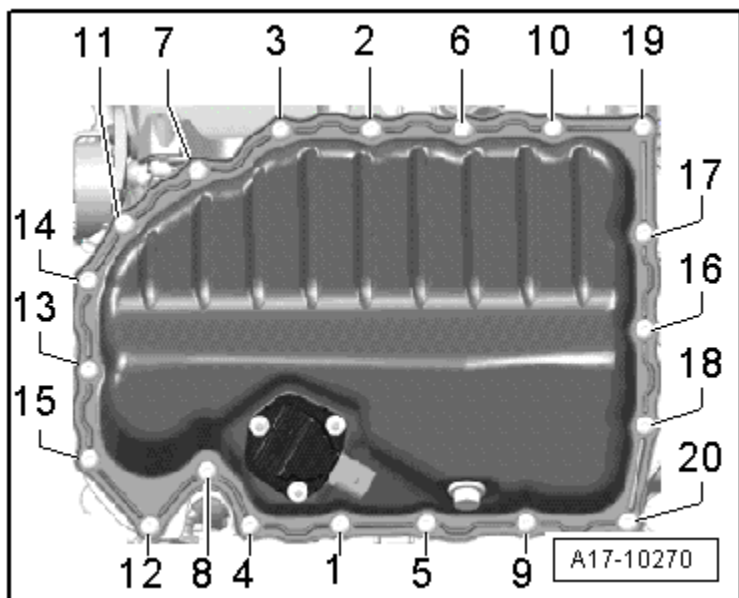
Step	Component	Nm
1	Tighten bolts 1 through 14 in sequence	Hand-tighten
2	Tighten bolts 1 through 14 in sequence	15
3	Tighten bolts 1 through 14 in sequence	an additional 90° (¼ turn)

Lower Timing Chain Cover with 15 Bolts Tightening Specifications



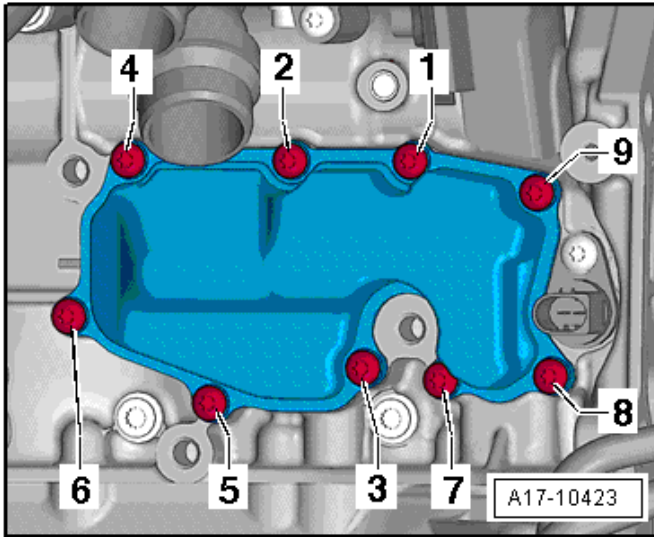
Step	Component	Nm
1	Tighten bolts 1 through 8 in sequence	4
2	Tighten bolts 1 through 8 in sequence	an additional 45° (1/8 turn)

Lower Oil Pan Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 20 in sequence	Hand-tighten
2	Tighten bolts 1 through 20 in sequence	8
3	Tighten bolts 1 through 20 in sequence	an additional 45° (1/8 turn)

Oil Separator Tightening Specification



Step	Component	Nm
1	Tighten bolts 1 through 9 in sequence	9

Cooling System – 2.0L CBFA, CCTA

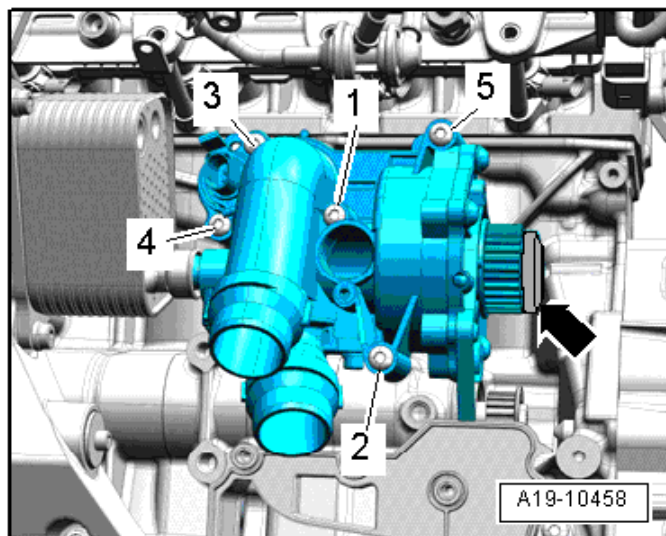
Fastener Tightening Specifications

Component	Nm
After run coolant pump bracket bolt	8
After run coolant pump bracket-to-upper oil pan bolt	40
Coolant fan-to-fan shroud nut	10
Cover for thermostat-to-coolant pump bolt	9
Engine coolant temperature sensor retaining plate to coolant pump bolt	4
Fan shroud-to-radiator bolt	5
Front coolant pipe bolt	3.5
Radiator-to-charge air pipe bolt	5
Small coolant pipe bolt	9
Toothed belt drive gear-to-balance shaft bolt ¹⁾²⁾	10 plus an additional 90° (¼ turn)
Toothed belt cover-to-coolant pump bolt	9

¹⁾ Replace fastener(s).

²⁾ Has left hand threads.

Coolant Pump Tightening Specification



Step	Component	Nm
1	Tighten bolts 1 through 5 in sequence	9

Fuel Supply – 2.0L CBFA, CCTA

Fastener Tightening Specifications

Component	Fastener size	Nm
Accelerator Pedal Position (APP) sensor with Accelerator Pedal Position 2 (APP2) sensor-to-body bolt	-	10
Evaporative Emission (EVAP) canister nut	-	10
Fuel filler door unit-to-body bolt		1.5
Fuel filler tube-to-body bolt		8 plus an additional 90° (¼ turn)
Fuel tank securing strap-to-underbody bolt ¹⁾	-	25
Fuel tank-to-underbody bolt	-	25
Locking ring-to-fuel tank		110
Tunnel brace-to-underbody		23

¹⁾ Replace fastener(s).

Turbocharger, G-Charger – 2.0L CBFA, CCTA

Fastener Tightening Specifications

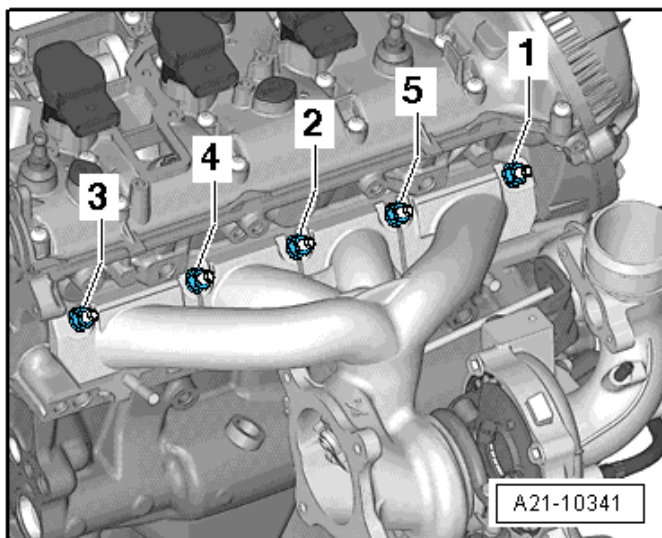
Component	Nm
Charge Air Cooler (CAC) mounting bolt	5
Charge air pipe bolt	10
Charge air pipe clamp	5.5
Charge air pressure sensor-to-charge air pipe bolt	5
Coolant return pipe-to-turbocharger banjo bolt	38
Coolant return pipe-to-turbocharger bolt	9
Coolant supply pipe-to-cylinder block banjo bolt	38
Coolant supply pipe-to-cylinder block bolt	9
Coolant supply pipe-to-turbocharger banjo bolt	38
Cylinder block bracket bolt ²⁾	30
Cylinder head fastening strip nut ^{1) 3)}	30
Cylinder head heat shield bolt	20
Drive axle heat shield bolt	20
Oil return pipe-to-cylinder block bolt	9
Oil return pipe-to-turbocharger bolt	9
Oil supply pipe-to-cylinder block bolt	9
Oil supply pipe-to-turbocharger banjo bolt	33
Oil supply pipe-to-turbocharger bolt	9
Turbocharger bracket bolt ²⁾	30
Turbocharger connection bolt	9
Turbocharger recirculation valve-to-turbocharger bolt	7
Vacuum diaphragm-to-turbocharger bolt	10
Wastegate bypass regulator valve-to-turbocharge bolt	3

¹⁾ Replace fastener(s).

²⁾ Lubricate the bolt with hot bolt paste. Refer to the Electronic Parts Catalog (ETKA).

³⁾ Lubricate the studs of the exhaust manifold with hot bolt paste. Refer to the Electronic Parts Catalog (ETKA).

Turbocharger Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 5 in sequence	5
2	Tighten bolts 1 through 5 in sequence	12
3	Tighten bolts 1 through 5 in sequence	16
4	Tighten bolts 1 through 5 in sequence	25

Exhaust System – 2.0L CBFA, CCTA

Fastener Tightening Specifications

Component	Nm
Clamping sleeve nut	
- Individual clamp	25
- Continuous clamp	35
Front exhaust pipe with catalytic converter-to-exhaust manifold/turbocharger nut ¹⁾⁴⁾	40
Oxygen Sensor (O2S)	55
Secondary Air Injection (AIR) pump motor bracket-to-underbody nut ³⁾	25
Secondary Air Injection (AIR) pump motor-to-bracket nut ³⁾	9
Secondary Air Injection (AIR) solenoid valve bolt ³⁾	9
Suspended mount bracket bolt ²⁾	20
Suspended mount-to-subframe bolt	25
Suspended mount-to-underbody bolt	25
Tunnel bridge-to-underbody bolt	25

¹⁾ Replace fastener(s).

²⁾ Tiguan.

³⁾ Engine code CBFA only.

⁴⁾ Lubricate the stud bolts on the exhaust manifold/turbocharger with hot bolt paste (G 052 112 A3).

Multiport Fuel Injection – 2.0L CBFA, CCTA

Technical Data

Engine codes	CBFA and CCTA
Idle check	
Idle speed (RPM) ¹⁾	640 to 800
Engine Speed (RPM) limitation	Approximately 6500

¹⁾ If the Engine Control Module (ECM) voltage supply drops below 12 volts, the idle speed is increased in stages up to 990 RPM. Idle speed is not adjustable.

Fastener Tightening Specifications

Component	Fastener size	Nm
Fuel pressure sensor-to-fuel rail ²⁾	-	27
Fuel pressure sensor-to-pressure sensor tester (VAS 6394/1)	-	27
Fuel rail adapter (VAS 6394/2)	-	27
Fuel supply line connection-to-fuel rail ¹⁾	-	22
Fuel supply line union nut-to-fuel rail	-	18
Fuel supply line union nut-to-high pressure pump	-	18
High pressure fuel line connection-to-high pressure pump ¹⁾		
- With inner threads	-	40
- With outer threads	-	25
High pressure pump-to-cylinder head bolt ¹⁾	M6	8 plus an additional 90° (¼ turn)
	M8	20
Intake Air Temperature (IAT) sensor-to-intake manifold bolt	-	5
Intake manifold-to-cylinder head bolt		
- First pass, tighten to	-	3
- Final pass, tighten to	-	9
Intake manifold support-to-cylinder block bolt	-	23
Intake manifold support-to-intake manifold nut	-	10
Knock Sensor (KS) bolt	-	20
Lower air filter housing-to-body bolt	-	8
Throttle valve control module-to-intake manifold bolt	-	5
Upper air filter housing-to-lower air filter housing bolt	-	1.5

¹⁾ Replace fastener(s).

²⁾ Coat the threads with clean engine oil.

Ignition – 2.0L CBFA, CCTA

Technical Data

Engine codes	CBFA and CCTA
Ignition sequence	1-3-4-2
Spark plugs	
VW/Audi	06H 905 611
Electrode gap	1.0 to 1.1 mm
Tightening specifications	25 Nm
Change intervals	Refer to Maintenance Intervals Rep. Gr. 03

¹⁾ Part numbers, refer to the Parts Catalog.

Fastener Tightening Specifications

Component	Nm
Camshaft Position (CMP) sensor bolt	10
Engine Speed (RPM) sensor bolt	10
Knock Sensor (KS) bolt	20
Spark plug	25

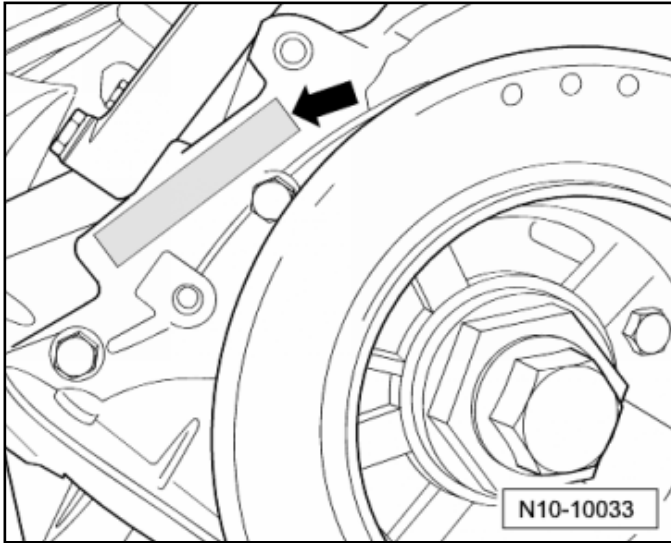
¹⁾ Replace fastener(s).

ENGINE MECHANICAL – 3.6L CNNA

General, Technical Data

Engine –
3.6L CNNA

Engine Number Location



The engine number (engine code and serial number) (➡) is located on the cylinder block next to the vibration damper.

Engine Data

Identification Code		BLV
Manufactured		from 05.11
Emission values in accordance with		ULEV 2 ¹⁾
Displacement	cm ³	3580
Output	kW at ¹ /min	206 @ 6200
Torque	Nm at ¹ /min	360 @ 2800
Bore	diameter mm	89.0
Stroke	mm	95.9
Cylinder angle		10.6°
Compression ratio		11.4
Valves per cylinder		4
Research Octane Number (RON)	minimum	98 unleaded ²⁾
Fuel injection, ignition		Motronic MED 9.1
Knock control		2 knock sensors
Oxygen Sensor (O2S) regulation		4 sensors
Catalytic converter		Yes
Leak detection system		Yes
Exhaust Gas Recirculation (EGR)		Internal

¹⁾ ULEV 2 = Ultra Low Emissions Vehicle 2.

²⁾ In exceptional circumstances a minimum 95 RON, however with reduced performance

Engine Assembly – 3.6L CNNA

Fastener Tightening Specifications

Component	Fastener size	Nm
Bolts and nuts	M6	10
	M7	15
	M8	25
	M10	40
	M12	60
Engine mount-to-body bolt ¹⁾	-	40 plus an additional 90° (¼ turn)
Engine mount bracket-to-cylinder block bolt ¹⁾	-	40 plus an additional 180° (½ turn)
Engine mount-to-engine mount bracket bolt ¹⁾	-	60 plus an additional 90° (¼ turn)
Pendulum support-to-transmission bolt ¹⁾	-	50 plus an additional 90° (¼ turn)
Pendulum support-to-transmission subframe bolt ¹⁾	-	100 plus an additional 90° (¼ turn)
Support-to-body bolt ¹⁾	-	20 plus an additional 90° (¼ turn)
Support-to-engine mount bolt ¹⁾	-	20 plus an additional 90° (¼ turn)
Transmission mount-to-body bolt ¹⁾	-	40 plus an additional 90° (¼ turn)
Transmission mount-to-transmission mount bracket bolt ¹⁾	-	80 plus an additional 90° (¼ turn)

¹⁾ Replace fastener(s).

Engine and Transmission Mount Tightening Specifications

Component	Fastener size	Nm
Engine Mount ¹⁾	-	40 plus an additional 90° (¼ turn)
	-	60 plus an additional 90° (¼ turn)
Engine mount bracket ¹⁾	-	40 plus an additional 180° (½ turn)
Pendulum support ¹⁾	-	50 plus an additional 90° (¼ turn)
	-	100 plus an additional 90° (¼ turn)
Support ¹⁾	-	20 plus an additional 90° (¼ turn)
Transmission mount ¹⁾	-	40 plus an additional 90° (¼ turn)
	-	60 plus an additional 90° (¼ turn)
Transmission mount bracket ¹⁾	-	60 plus an additional 90° (¼ turn)

¹⁾ Replace fastener(s).

Crankshaft, Cylinder Block – 3.6L CNNA

Allocation of Crankshaft Bearing Shells for Cylinder Block

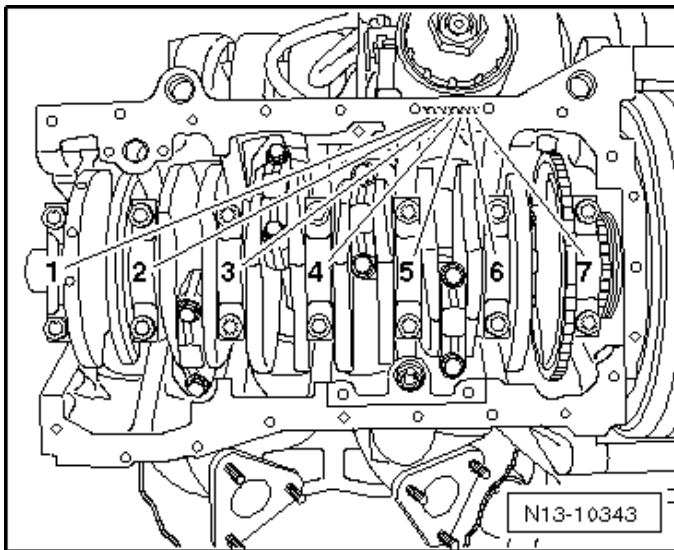
The main bearing shells are allocated to the cylinder block and crankshaft with the correct thickness by the factory. Colored dots identify the bearing thickness.

If the cylinder block or crankshaft are being replaced, the bearing shells must be allocated.

The bearing shell for the cylinder block (upper bearing shell) is always marked with a yellow dot.

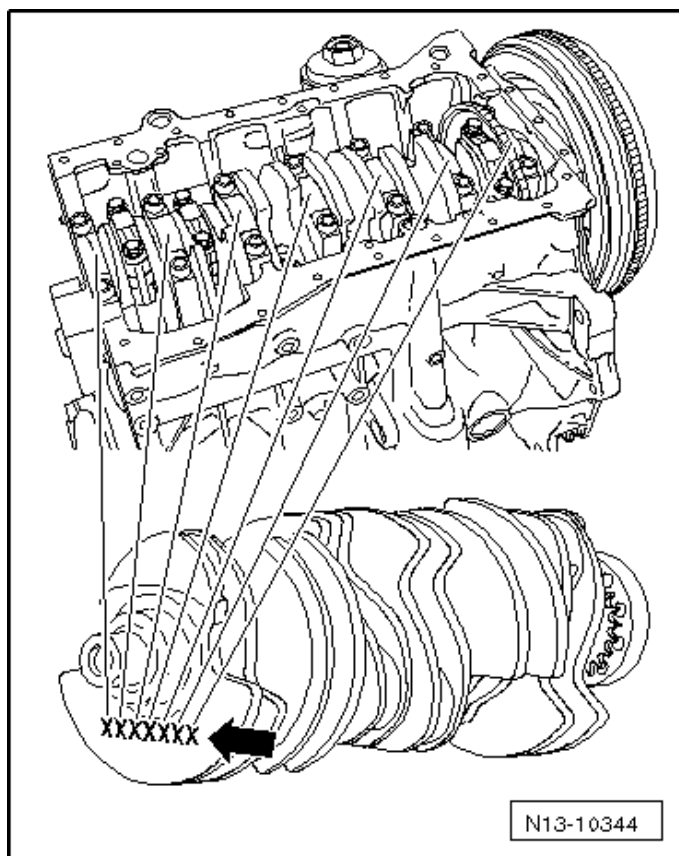
Using the letters on the cylinder block and crankshaft, determine the correct color identification for the bearing shell in the bearing cap (lower bearing shell). The first letter is for bearing cap one, the second for bearing cap two, etc.

Cylinder Block Identification



The letters are located on the oil pan sealing surface.

Crankshaft Identification



The letters are located on the outer crankshaft counterweight for cylinder 1.

Note the letters and then match it to the color identification in the table.

Letter on the cylinder block	Letter on the crankshaft counterweight	Bearing shell color identification for the bearing cap	Bearing shell color identification for the cylinder block
A, B, C, D, E	R	Red	Yellow
A, B, C, D, E	G	Red	Yellow
A, B, C, D, E	B	Yellow	Yellow
A, B, C, D, E	V	Blue	Yellow
G, H, I	R	Red	Yellow
G, H, I	G	Red	Yellow
G, H, I	B	Yellow	Yellow
G, H, I	V	Blue	Yellow
K, L, M	R	Red	Yellow
K, L, M	G	Yellow	Yellow
K, L, M	B	Blue	Yellow
K, L, M	V	Purple	Yellow

Example:

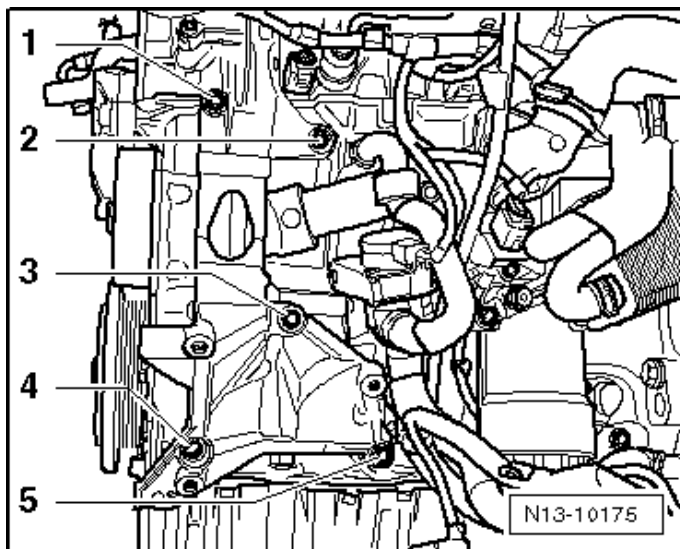
Bearing Cap	1	2	3	4	5	6	7
Letter on the cylinder block	G	H	H	H	G	E	G
Letter on the crankshaft counterweight	G	B	B	V	B	B	G
Bearing shell color identification for the bearing cap	Red	Yellow	Yellow	Blue	Yellow	Yellow	Red

Fastener Tightening Specifications

Component	Fastener Size	Nm
Accessory bracket-to-cylinder block bolt	-	25
Air conditioning compressor-to-accessory bracket bolt	M8 x 100	23
Coolant pump pulley-to-coolant pump bolt	-	20
Connecting rod bearing cap-to-connecting rod bolt ¹⁾	-	40 plus an additional 90° (¼ turn)
Coolant pump-to-cylinder block bolt	-	8
Crankshaft bearing cap-to-cylinder block bolt	-	30 plus an additional 180° (½ turn)
Generator-to-accessory bracket bolt	-	25
Idler roller-to-accessory bracket bolt	-	40
Ribbed belt tensioner-to-accessory bracket bolt	-	50
Sealing flange-to-cylinder block bolt ¹⁾	-	10
Sensor wheel-to-crankshaft screw	-	10 plus an additional 90° (¼ turn)
Vibration damper-to-crankshaft bolt ¹⁾	-	60 plus an additional 180° (½ turn)

¹⁾ Replace fastener(s).

Accessory Bracket Bolt Tightening Specifications



Engine –
3.6L CNNA

Step	Component	Nm
1	Tighten bolts 2 and 4	Hand-tighten
2	Tighten bolts 1, 3 and 5	Hand-tighten
3	Tighten bolts 1 through 5 in a diagonal sequence	25

Piston Ring End Gaps

Piston ring dimension in mm	Gap	
	New	Wear limit
Compression ring	0.30 to 0.45	1.0
Stepped compression ring	0.30 to 0.50	1.0
Oil scraping ring	0.20 to 0.90	1.2

Piston Ring Clearance

Piston ring dimension in mm	Ring to groove clearance	
	New	Wear limit
Compression ring	0.04 to 0.06	0.12
Stepped compression ring	0.03 to 0.06	0.15
Oil scraping ring	0.02 to 0.06	0.15

Piston and Cylinder Dimensions

Honing dimension in mm	Piston diameter	Cylinder bore diameter
Basic dimension	88.945	89.010

Cylinder Head, Valvetrain – 3.6L CNNA

Fastener Tightening Specifications

Component	Nm
Camshaft adjuster-to-camshaft bolt ¹⁾	60 plus an additional 90° (¼ turn)
Camshaft adjustment valve-to-cylinder head bolt	3.8
Camshaft position sensor-to-cover bolt	8
Camshaft timing chain guide rail-to-cylinder block bolt	23
Camshaft timing chain guide rail-to-cylinder block pin	10
Chain tensioner-to-cylinder block	50
Chain tensionerwith tensioning rail-to-cylinder block	10
Control housing-to-cylinder head bolt ²⁾	8 plus an additional 90° (¼ turn)
Coolant line-to-cover bolt	8
Cover-to-cylinder head bolt	10
Fuel line bracket-to-cylinder head cover bolt	10
Guide rail-to-cylinder head bolt	23
Intake manifold support-to-cylinder head bolt	23
Lifting eye-to-cylinder head bolt	23
Mechanical vacuum pump-to-cover bolt	8
Oil pump timing chain guide rail-to-cylinder block pin	10
Oil pump-to-cylinder block bolt ²⁾	8
Sprocket-to-oil pump bolt ¹⁾	60 plus an additional 90° (¼ turn)
Tensioning rail-to-cylinder block pin	10
Water connection (for heater core hose) to cylinder head bolt	10
Water connection-to-cylinder head bolt ²⁾	23

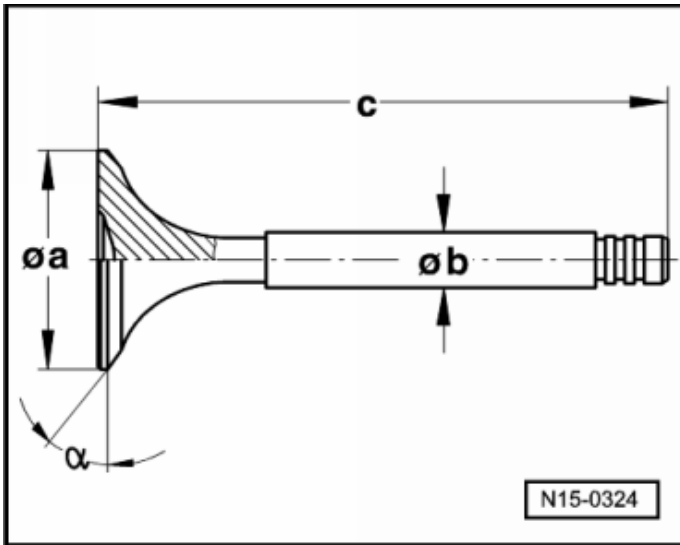
¹⁾ Replace fastener(s).

²⁾ Install the bolts using liquid locking fluid (D 000 600 A2).

Compression Pressures

New bar positive pressure	Wear limit bar positive pressure	Difference between cylinders bar positive pressure
11.0 to 13.0	8.0	Max. 3.0

Valve Dimensions



Intake valve

Dimension		Short valve	Long valve
Diameter a	mm	33.20	33.20
Diameter b	mm	5.98	5.98
c	mm	102.46	136.36
α	$^{\circ}$	44° 40'	44° 40'

Exhaust valve

Dimension		Short valve	Long valve
Diameter a	mm	30.20	30.20
Diameter b	mm	5.97	5.97
c	mm	102.20	136.20
α	$^{\circ}$	44° 40'	44° 40'

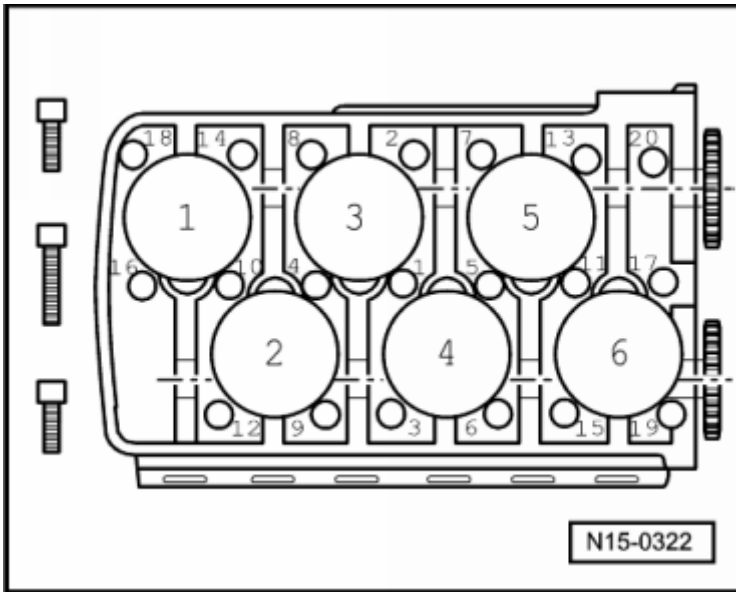
NOTE: Intake and exhaust valves must not be refaced by grinding. Only lapping is permitted.

Crankshaft Dimensions

Reworking the crankshaft is not permitted.

Crankshaft bearing journal diameter	Cylinder bore diameter
59.958 to 59.978 mm	53.958 to 53.978 mm

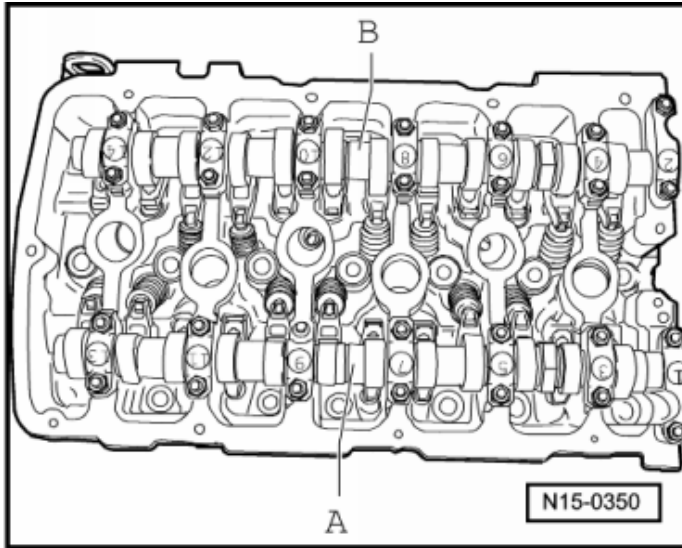
Cylinder Head Tightening Specifications



Engine –
3.6L CNNA

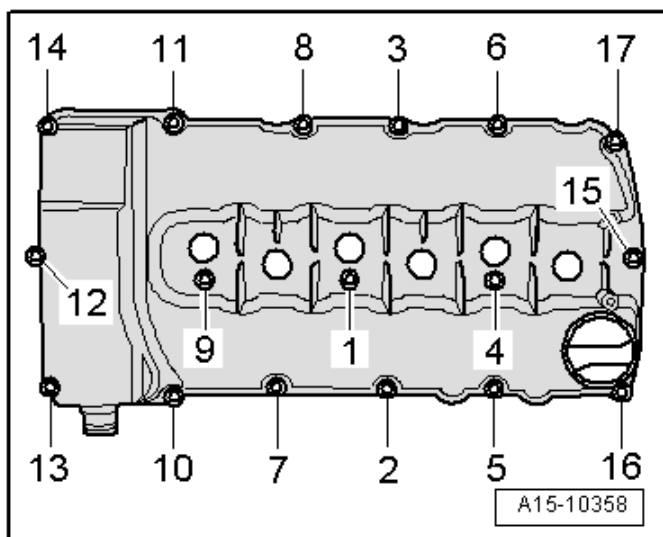
Step	Component	Nm
1	Tighten bolts 1 through 20 in sequence	15
2	Tighten bolts 1 through 20 in sequence	30
3	Tighten bolts 1 through 20 in sequence	an additional 90° (¼ turn)
4	Tighten bolts 1 through 20 in sequence	an additional 90° (¼ turn)

Camshaft Bearing Cap Tightening Specifications



Step	Component	Nm
A - Intake Camshaft		-
1	Alternately tighten bearing caps 5 and 9 and in a diagonal sequence	5 plus an additional 45° (1/8 turn)
2	Alternately tighten bearing caps 1 and 13 and in a diagonal sequence	5 plus an additional 45° (1/8 turn)
3	Tighten bearing cap 7	5 plus an additional 45° (1/8 turn)
4	Alternately tighten bearing caps 3 and 11 and in a diagonal sequence	5 plus an additional 45° (1/8 turn)
B - Exhaust Camshaft		-
1	Alternately tighten bearing caps 6 and 10 and in a diagonal sequence	5 plus an additional 45° (1/8 turn)
2	Alternately tighten bearing caps 2 and 14 and in a diagonal sequence	5 plus an additional 45° (1/8 turn)
3	Tighten bearing cap 8	5 plus an additional 45° (1/8 turn)
4	Alternately tighten bearing caps 4 and 12 and in a diagonal sequence	5 plus an additional 45° (1/8 turn)

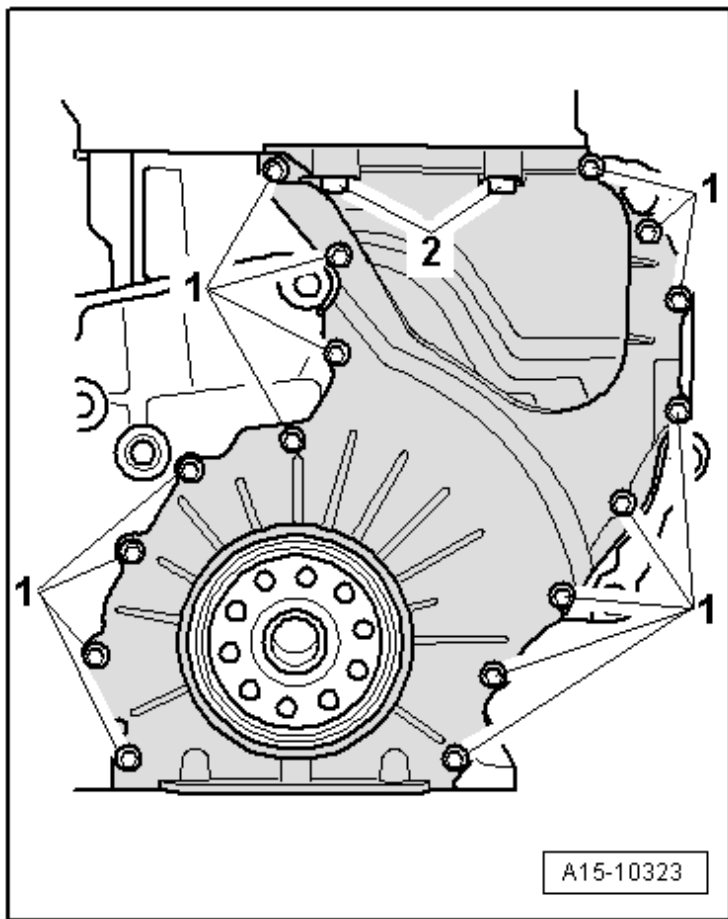
Cylinder Head Cover Tightening Specification



Engine –
3.6L CNNA

Step	Component	Nm
1	Tighten bolts 1 through 17 in sequence	10

Sealing Flange to Cylinder Block Bolt Tightening Sequence and Specifications



Step	Component	Nm
1	Tighten bolts 1	5
2	Tighten bolts 2	23
3	Tighten bolts 1	10
4	Tighten bolts 1 through 20 in sequence	an additional 90° (¼ turn)

Lubrication – 3.6L CNNA

Fastener Tightening Specifications

Component	Nm
Baffle plate-to-oil pan bolt	10
Cap-to-oil filter housing	25
Oil cooler-to-oil filter housing	8
Oil dipstick guide tube-to-intake manifold bolt	6
Oil drain plug-to-cap	10
Oil drain plug-to oil pan ¹⁾	30
Oil filter housing-to-cylinder block bolt	23
Oil level thermal sensor-to-oil pan bolt	10
Oil pan-to-cylinder block bolt	11
Oil pan-to-transmission bolt	45
Oil pipe-to-cylinder block bolt ²⁾	8
Oil pressure switch-to-oil filter housing	20
Oil pump-to-cylinder block bolt ²⁾	8
Plug-to-oil pump	35
Sprocket-to-oil pump bolt ¹⁾	60 plus an additional 90° (¼ turn)
Suction pipe-to-cylinder block bolt ²⁾	8

¹⁾ Replace fastener(s).

²⁾ Install using liquid locking fluid.

Cooling System – 3.6L CNNA

Fastener Tightening Specifications

Component	Nm
Adapter-to-flange bolt	10
Air conditioning condenser-to-radiator bolt	5
Coolant expansion tank-to-body bolt	5
Coolant pipe-to-cover bolt	10
Coolant pipe-to-cylinder head bolt	10
Coolant pipe (side, bottom)-to-cylinder block bolt	25
Coolant pipe (side, top)-to-cylinder head bolt	10
Coolant pump-to-cylinder block bolt	8
Coolant pump pulley-to-coolant pump bolt	20
Fan shroud-to-radiator bolt	5
Fan-to-fan shroud nut	10
Radiator-to-bracket bolt	5
Rear coolant pipe-to-cylinder head nut	20
Thermostat housing cover-to-thermostat housing bolt	8
Water connection-to-cylinder block bolt	10

Fuel Supply – 3.6L CNNA

Fastener Tightening Specifications

Component	Nm
Accelerator Pedal Position (APP) sensor with Accelerator Pedal Position 2 (APP2) sensor-to-body bolt	10
Evaporative Emission (EVAP) canister-to-body nut	10
Fuel filler door unit-to-body bolt	1.5
Fuel filler tube-to-body bolt	8 plus an additional 90° (¼ turn)
Fuel tank securing strap-to-underbody bolt ¹⁾	25
Fuel tank-to-underbody bolts ¹⁾	25
Fuel tank locking ring	110
Tunnel bridge-to-underbody bolt	23

¹⁾ Replace fastener(s).

Exhaust System, Emission Controls – 3.6L CNNA

Fastener Tightening Specifications

Component	Fastener size	Nm
Clamping sleeve nut	M8	25
	M10	40
Exhaust manifold-to-cylinder head nut ¹⁾	-	25
Exhaust pipewith catalytic converter-to-exhaust manifold nut ¹⁾	M8	25
	M10	40
Intake manifold front support-to-cylinder block bolt	-	20
Intake manifold front support-to-exhaust manifold heat shield bolt	-	20
Intake manifold rear support-to-cylinder head bolt	-	20
Intake manifold rear support-to-exhaust manifold heat shield bolt	-	20
Oxygen Sensor (O2S) ²⁾	-	50
Suspended mount-to-subframe bolt	-	20
Suspended mount-to-underbody bolt	-	25
Tunnel brace-to-underbody bolt	-	25

¹⁾ Replace fastener(s).

²⁾ When reusing an Oxygen Sensor (O2S) only use hot bolt paste (G 052 112 A3) on the threads. Do not let the paste get onto the slits of the oxygen sensor body.

Multiport Fuel Injection – 3.6L CNNA

Technical Data

Engine code	BLV
Idle check	
Engine idle speed RPM ¹⁾	640 to 760
Engine Control Module (ECM)	
System designation	Motronic MED 9.1
Part number	Refer to the Electronic Parts Catalog (ETKA)
Engine Speed (RPM) limitation	Approximately 6700

Fastener Tightening Specifications

Component	Nm
Air cleaner housing bracket-to-body bolt	10
Air duct-to-lock carrier bolt	5
Cap-to-lock carrier bolt	22
Connecting pipe-to-fuel rail union nut	28
Engine Control Module (ECM) bracket-to-Engine Control Module (ECM) retainer bolt (with anti-theft immobilizer)	6
Engine Control Module (ECM) bracket-to-Engine Control Module (ECM) retainer bolt (without anti-theft immobilizer)	7
Engine Control Module (ECM) retainer-to-plenum chamber nut (without anti-theft immobilizer)	6
Fuel pipe-to-fuel rail fitting	28
Fuel pressure sensor-to-fuel rail	22
Fuel pressure sensor-to-pressure sensor tester (VAS 6394)	22
Fuel rail-to-lower intake manifold bolt ^{1) 2)}	30 plus an additional 90° (¼ turn)
Fuel supply hose bracket bolt	8
Fuel supply hose clamp bolt	8
High pressure fuel pipe fitting-to-fuel rail	28
High pressure fuel pipe fitting-to-high pressure pump ³⁾	28
High pressure pump connection	
- For the high pressure fuel line	40
- For the low pressure fuel hose	28
Fuel rail plug	22
High pressure pump-to-cylinder block bolt	10
Intake manifold rear support-to-upper intake manifold bolt	20
Lower air filter housing-to-bracket nut	8

Fastener Tightening Specifications (cont'd)

Component	Nm
Lower intake manifold-to-cylinder head bolt	8
Low fuel pressure sensor-to-fuel supply hose	15
Mass Airflow (MAF) sensor-to-upper air filter housing bolt	2
Pressure sensor tester (VAS 6394)-to-fuel rail	22
Regulator flap-to-lower air filter housing screw	2
Throttle valve control module-to-upper intake manifold bolt	7
Upper air filter housing-to-lower air filter housing bolt	2
Upper intake manifold-to-intake manifold front support bolt	10
Upper intake manifold-to-lower intake manifold bolt	10
Vent hose-to-upper intake manifold bolt	3.5

- ¹⁾ Replace fastener(s).
- ²⁾ Tighten the fuel rail uniformly, starting from the inside and working toward the outside.
- ³⁾ To loosen and tighten the union nut on the high pressure pump, counter hold the connection on the pump using a wrench.

Ignition – 3.6L CNNA

Ignition Technical Data

Engine code	BLV
Ignition sequence	1-5-3-6-2-4
Spark plugs ¹⁾	
VW/Audi	101 905 622 A
Electrode gap	0.7 to 0.8 mm
Tightening specification	18 Nm
Change intervals	Refer to Maintenance Procedures Rep. Gr. 03 Maintenance Procedures

- ¹⁾ For the current spark plugs, refer to the Parts Catalog
Use the spark plug removal tool (3122B) to remove or install spark plugs.

Fastener Tightening Specifications

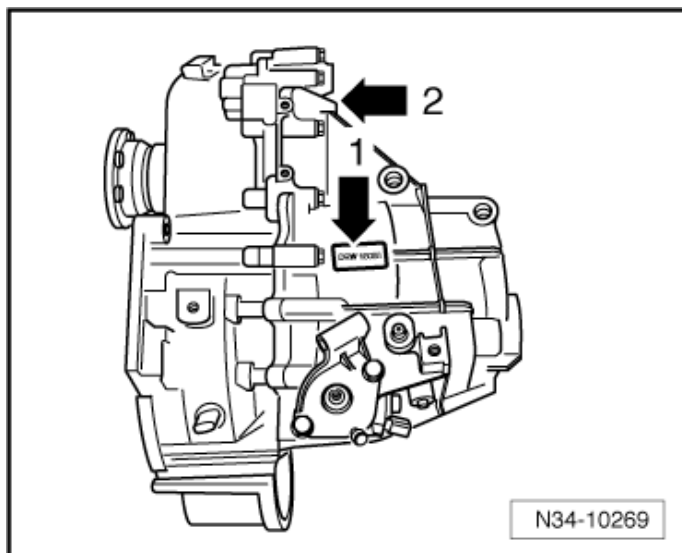
Component	Nm
Camshaft Position (CMP) sensor	10
Harness connector bracket bolt	20
Knock Sensor (KS) ¹⁾	20
Spark plug	18

- ¹⁾ Tightening specification affects the function of the Knock Sensor (KS).

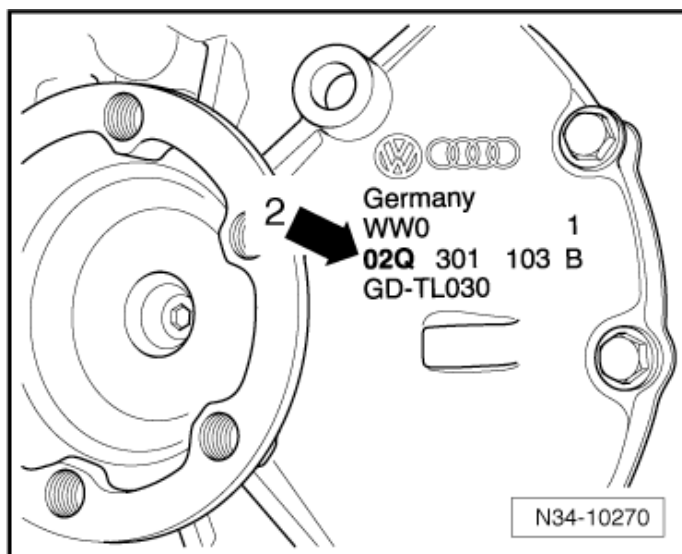
MANUAL TRANSMISSION – 02Q

General, Technical Data

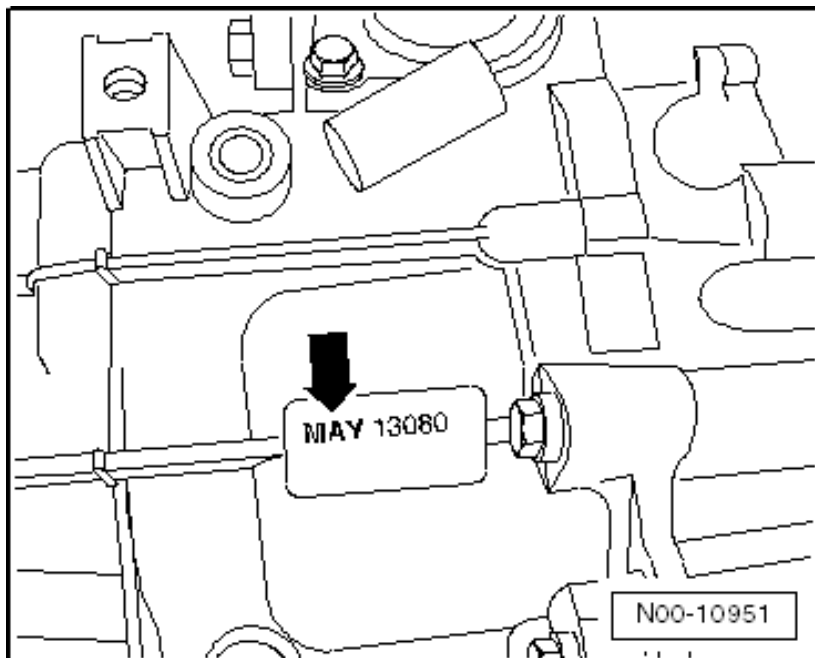
Transmission Identification



- (1) Code letters and build date.
- (2) Manual transmission 02Q.



- (2) Manual transmission 02Q.



(➡) Transmission code letters and build date.

Example:

MAY	13	08	0
Identification codes	Day	Month	Year (2010) of manufacture

Codes Letters, Transmission Allocation and Capacities

Manual transmission		6 Speed Transmission (02Q)	
Identification codes		KZS	MDL
Manufactured	from through	11.11	11.11
Allocation	Engine	2.0L - 147 kW	2.0L - 147 KW
Ratio: $Z_2 : Z_1$	Final drive I	71:18 = 3.944	70:19 = 3.684
	Final drive II	71:23 = 3.087	70:24 = 2.917
Capacities for the manual transmission		Refer to the Fluid Capacity Tables Rep. Gr. 03	
Drive axle flange diameter		107 mm	107 mm

Refer to the Electronic Parts Catalog (ETKA) for the following:

- Individual gear ratios
- Transmission fluid specifications
- Clutch disc and pressure plate allocation

Clutch – 02Q

Fastener Tightening Specifications

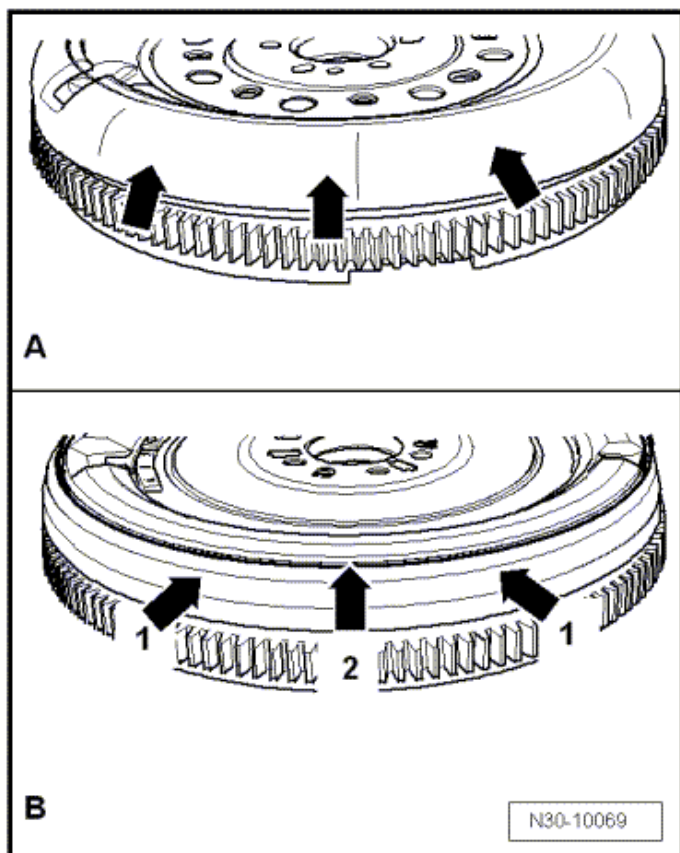
Component	Fastener size	Nm
Clutch pedal-to-mounting bracket through bolt nut ¹⁾	-	25
Impact bolster support-to-steering column bracket bolt ¹⁾	-	20
Mounting bracket-to-bulkhead nut ¹⁾	-	25
Dual mass flywheel pressure plate bolt ³⁾	M6	13
	M7	20
Slave cylinder with release bearing-to-transmission bolt ^{1) 2)}		
- Without locking fluid (for a metal slave cylinder)	-	12
- With locking fluid (for a plastic slave cylinder).	-	15

¹⁾ Replace fastener(s).

²⁾ Carefully tighten diagonally and in small stages so the slave cylinder bolt tabs do not break off.

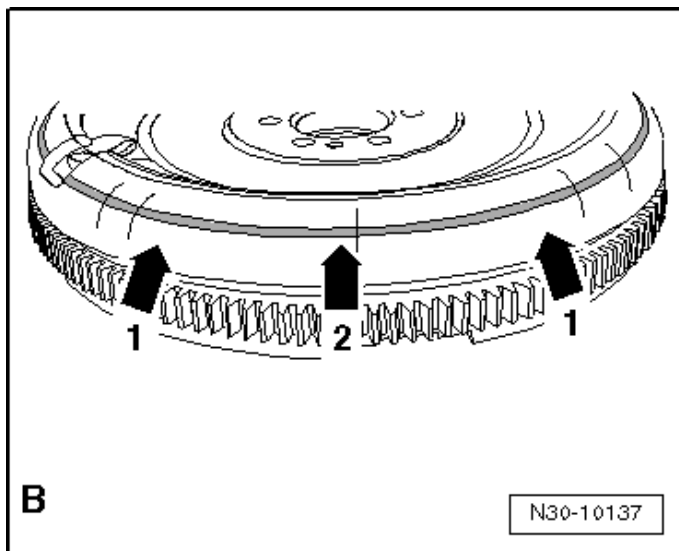
³⁾ Loosen and tighten in small steps and in a diagonal sequence.

Determining Clutch Manufacturer



A) Round outer contour (➡) indicates a clutch manufactured by Sachs.

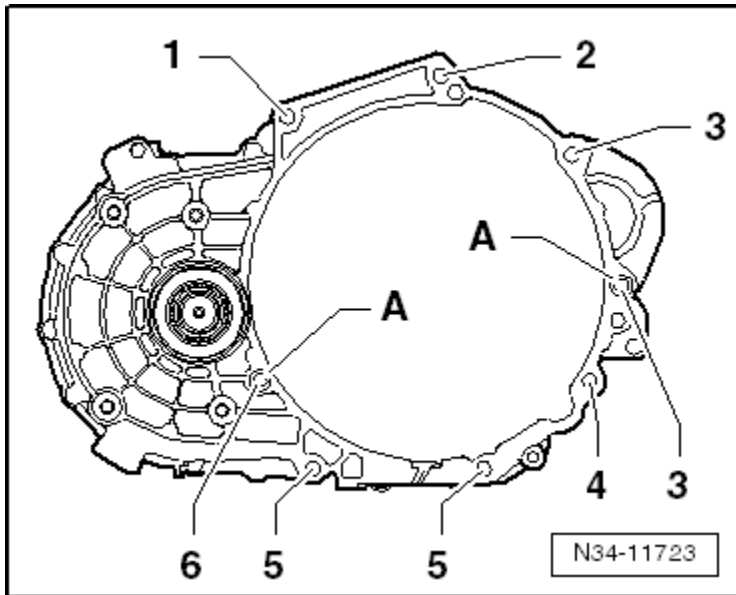
B) Squared outer contour (1) and a depression all the way around (2) indicates a clutch manufactured by LuK.



B) Round outer contour (1) and a depression all the way around (2) indicate a clutch manufactured by LuK.

Controls, Housing – 02Q

Transmission to Engine Tightening Specifications



Item	Fastener	Qty.	Nm
1	M12 x 55 with a long M8 threaded pin	1	80
2	M12 x 55 with a short M8 threaded pin Or M12 x 50 without threaded pin	1	80
3	M12 x 65 with a M8 threaded pin Also starter to transmission	2	80
4	M10 x 105	1	40
5	M10 x 50	2	40
6	M12 x 70 or M12 x 65	1	80
-	M6 x 8 small flywheel cover plate (not present on all engines)	1	10
A	Alignment sleeves for centering		

Fastener Tightening Specifications

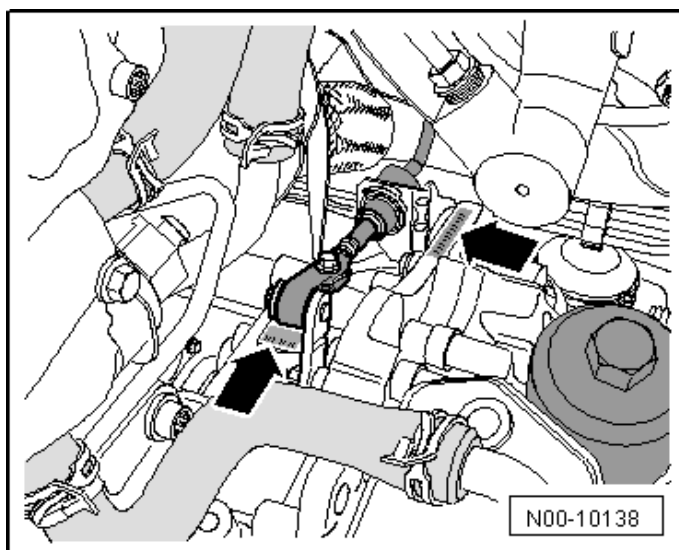
Component	Fastener size	Nm
Backup lamp switch-to-transmission housing	-	20
Cable mounting bracket-to-transmission bolt/nut	-	20
Flange shaft countersunk bolt	-	33
Gearshift unit-to-transmission housing bolt ¹⁾	-	20
Locking screw-to-transmission housing		
- Plastic	-	30
- Metal	-	45
Oil fill or drain plug		
- Multi-point socket head	-	45
- Hex socket head	-	30
Transmission housing-to-clutch housing bolt	M9 aluminum	15 plus an additional 180° (½ turn)
Transmission mount bracket-to-transmission bolt ¹⁾	-	60 plus an additional 90° (¼ turn)
Transmission mount-to-transmission mount bracket bolt ¹⁾	-	60 plus an additional 90° (¼ turn)
Shift housing-to-body nut	M6	8
	M8	25
Shift lever-to-gear shift unit nut ¹⁾	-	23

¹⁾ Replace fastener(s).

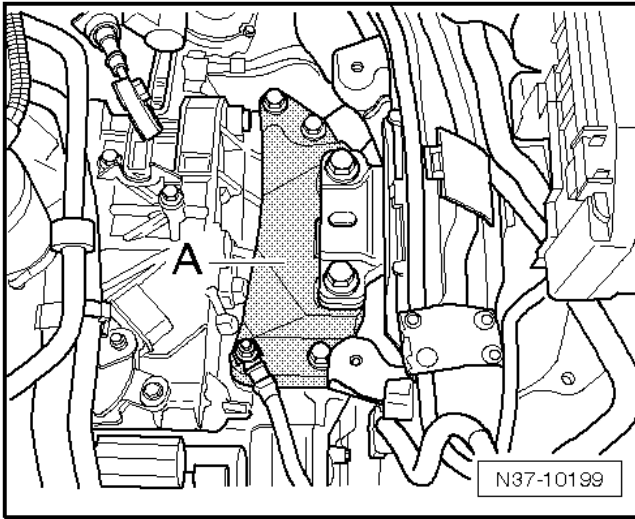
DIRECT SHIFT GEARBOX (DSG) TRANSMISSION – 02E

General, Technical Data

Identification on Transmission



The transmission code letters can be found on the transmission near the selector lever cable (➡) or under the transmission mount bracket.



To read the transmission code letters under the transmission mount bracket, support the engine and transmission and remove the transmission mount bracket (A). Refer to ElsaWeb for the transmission mount bracket removal procedure.

Transmission Allocation Codes

DSG® Transmission 02E (Front Wheel Drive [FWD])
NJM, NLQ, NNU and PBG
2.0L - 147 kW FSI-Turbo

**Direct Shift Trans.
(DSG) – 02E**

Controls, Housing (DSG) – 02E

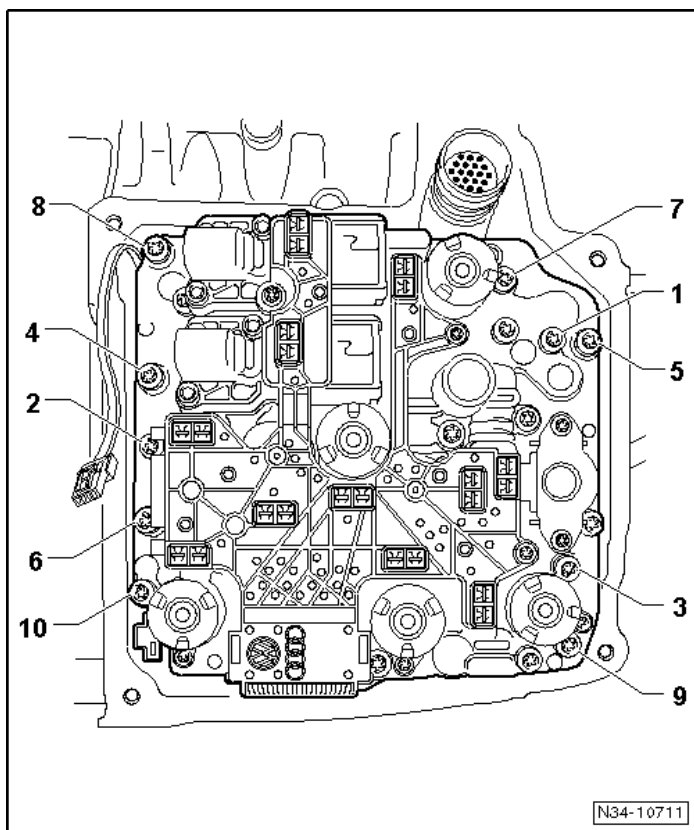
Fastener Tightening Specifications

Component	Nm
Oil filter housing	20
Oil pump cover bolt ¹⁾	8
Selector housing-to-body nut	8
Selector lever cable adjustment bolt	13
Selector mechanism with selector lever and selector lever cable-to-body bolt	8
Selector shaft lever-to-selector shaft nut	20
Transmission cover-to-transmission bolt ¹⁾	16
Transmission drain plug	45
Transmission input speed and clutch oil temperature sensor bolt	10
Transmission oil cooler-to-transmission bolt	20 plus an additional 90° (¼ turn)
Transmission overflow tube	3
Wire bracket-to-mechatronic cover nut	10

¹⁾ Tighten the bolts diagonally and in multiple stages.

²⁾ R32 models only.

Mechatronic Tightening Specifications

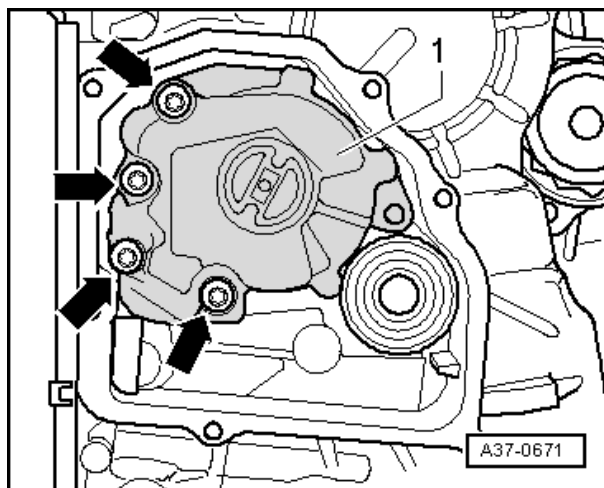


Direct Shift Trans.
(DSG) – 02E

Step	Component	Nm
1	Tighten bolts 1 through 10 in sequence ¹⁾	Hand-tighten
2	Tighten bolts 1 through 10 in sequence	5
3	Tighten bolts 1 through 10 in sequence	an additional 90° (¼ turn)

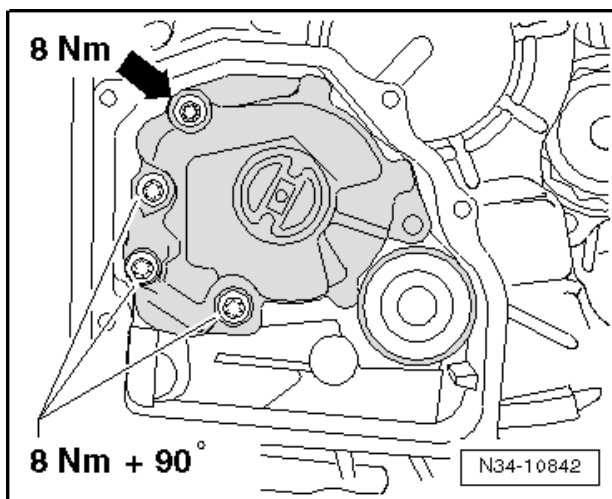
¹⁾ Replace fastener(s).

Oil Pump Tightening Specification Without Countersunk Bolt



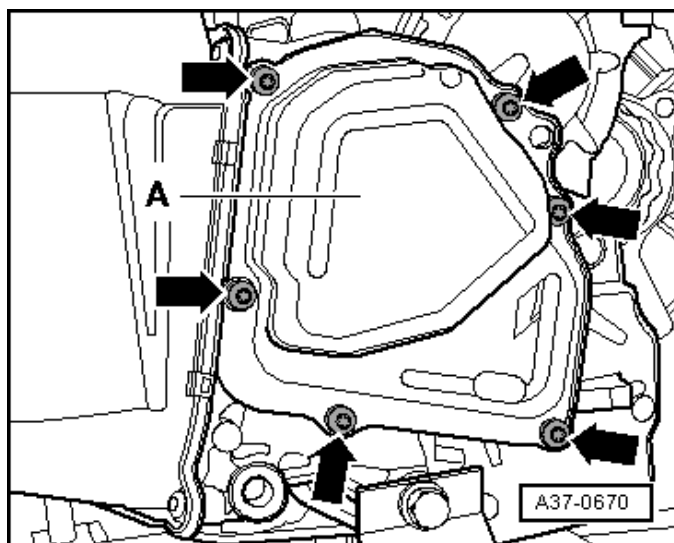
Component	Nm
Oil pump bolts (➔) with flat heads	5 plus an additional 90° (¼ turn)

With Countersunk Bolt



Component	Nm
Oil pump countersunk bolt	8
3 remaining oil pump bolts	8 plus an additional 90° (¼ turn)

Oil Pump Cover Tightening Specifications

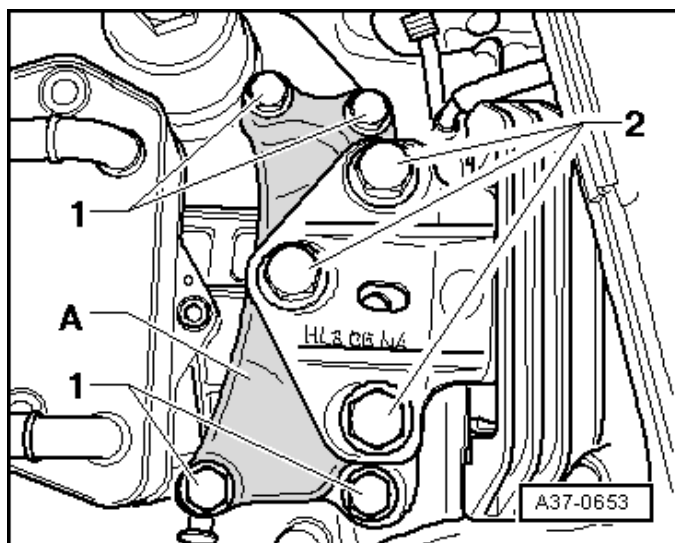


Component	Nm
Tighten bolts (➔) in several steps in a diagonal sequence ¹⁾	8

¹⁾ Replace fastener(s).

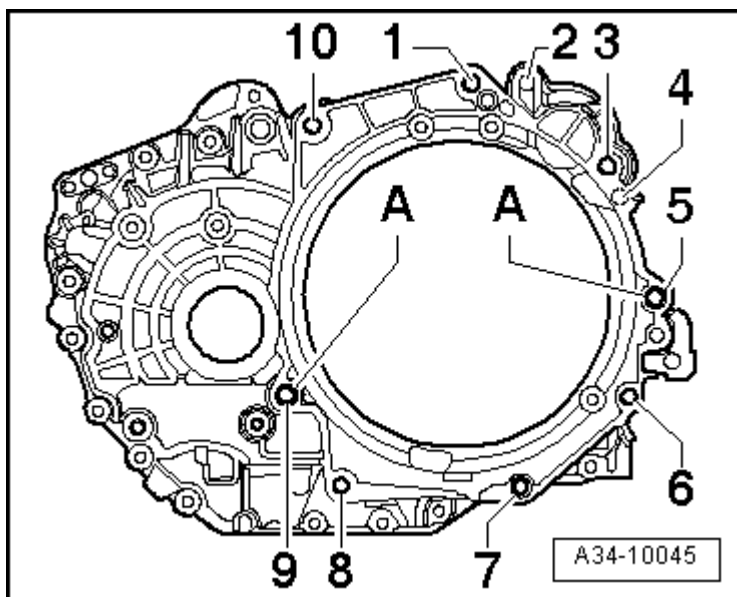
Direct Shift Trans.
(DSG) – 02E

Transmission Mount Tightening Specifications



Fastener	Component	Nm
1 and 2	Install all new bolts and tighten	Hand-tighten
1	Transmission mount-to-body	40 plus an additional 90° (¼ turn)
2	Transmission mount-to-transmission support	60 plus an additional 90° (¼ turn)

Transmission to Engine Tightening Specifications



Item	Fastener size	Nm
1	M12 x 55	80 • 65 Nm, if using the insert tool 18 mm -T10179-
2	M10 x 45 • Starter to transmission	40
3	M12 x 55 • Is accessible only through the opening for the starter	80
4	M10 x 45 or M10 x 40 • Starter to transmission	40
5	M10 x 50	80
6	M10 x 50	40
7	M10 x 50	40
8	M10 x 50	40
9	M12 x 65 or M12 x 70 or M12 x 80	80
10	M12 x 55	80 • 65 Nm, if using the insert tool 18 mm -T10179-
A	Alignment sleeves for centering	

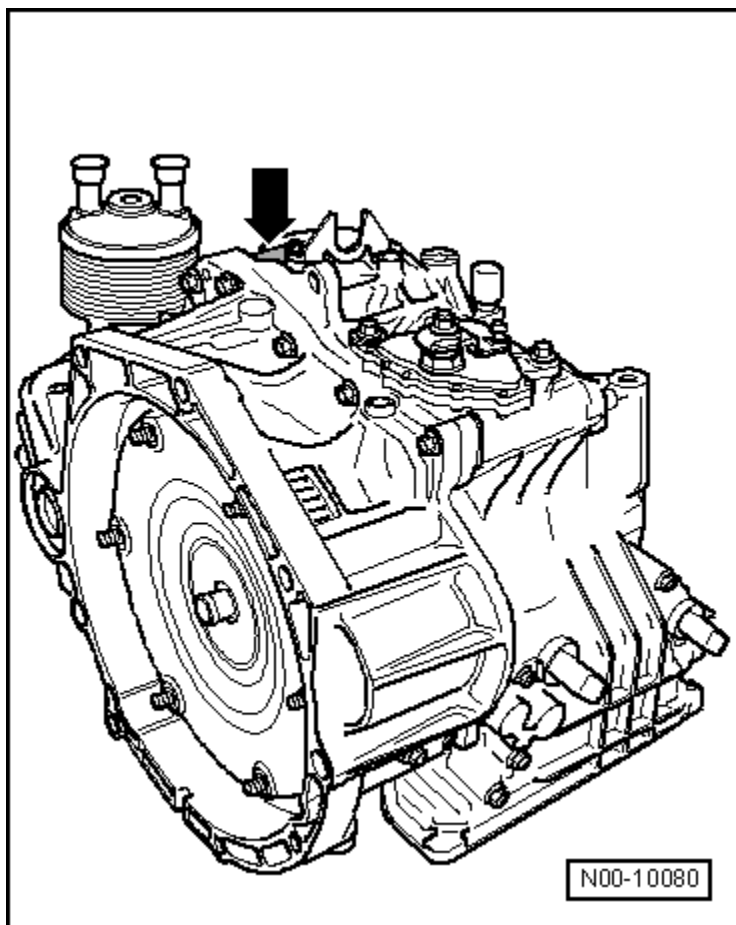
Component	Fastener size	Nm
Cable bracket-to-the transmission cover	-	10
Intermediate flange-to-right flange shaft	-	70

Direct Shift Trans.
(DSG) – 02E

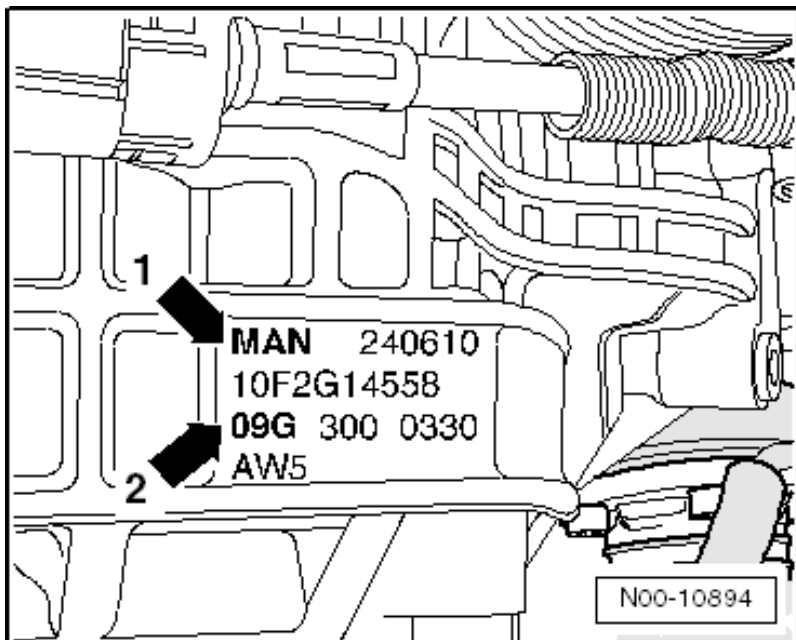
AUTOMATIC TRANSMISSION – 09M

General, Technical Data

Identification on Transmission



Code letters (➡).



- (1) Code letter indicates 6-speed automatic transmission.
 (2) 09G.

Example:

MAN	24	06	10
Identification codes	Day	Month	Year (2010) of manufacture

The transmission code letters are also listed on the vehicle data labels.

Engine and Transmission Code Allocation

6 Speed Automatic Transmission 09M - Front Wheel Drive (FWD)	
Transmission code	KFE
Engine	3.6L - 206 kW
6 Speed Automatic Transmission 09M - All Wheel Drive (AWD)	
Transmission code	KFD
Engine	3.6L - 206 kW

Automatic Trans. – 09M

Controls, Housing

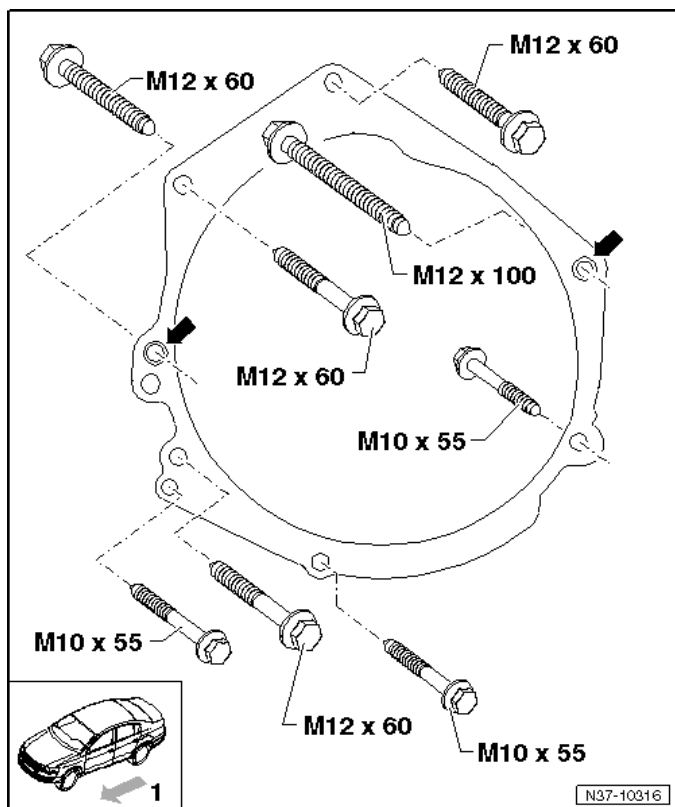
Fastener Tightening Specifications

Component	Nm
Automatic transmission fluid cooler-to-transmission bolt	36
Automatic transmission fluid pipes-to-transmission bolt	20
Bevel box-to-transmission bolt ¹⁾	40 plus an additional 90° (¼ turn)
Drive axle heat shield bolt	40
Ground cable-to-transmission mount bracket bolt	25
Multifunction transmission range switch-to-selector shaft nut	7
Multifunction transmission range switch-to-transmission bolt	6
Selector housing-to-selector mechanism/underbody nut	
- M6	8
- M8	20
Selector lever cable adjustment bolt	15
Selector lever cable bracket-to-transmission nut	8
Selector lever-to-selector shaft nut	13
Selector mechanism-to-body bolt	8
Transmission mount bracket-to-transmission bolt ¹⁾	40 plus an additional 90° (¼ turn)
Transmission mount-to-transmission mount bracket bolt ¹⁾	60 plus an additional 90° (¼ turn)

¹⁾ Replace fastener(s).

²⁾ Install with a new seal.

Transmission to Engine Tightening Specifications

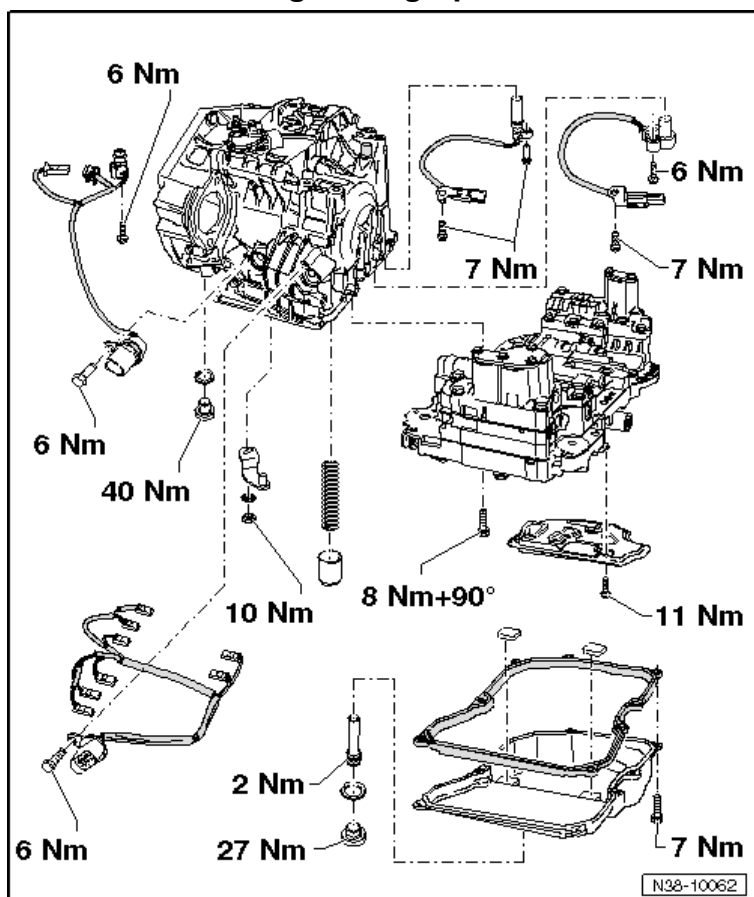


Component	Fastener size	Nm
Drive plate-to-converter	-	60
Bolts	M12	80
Bolts located in the lower flange	M10	40
➡ Alignment pins for centering		

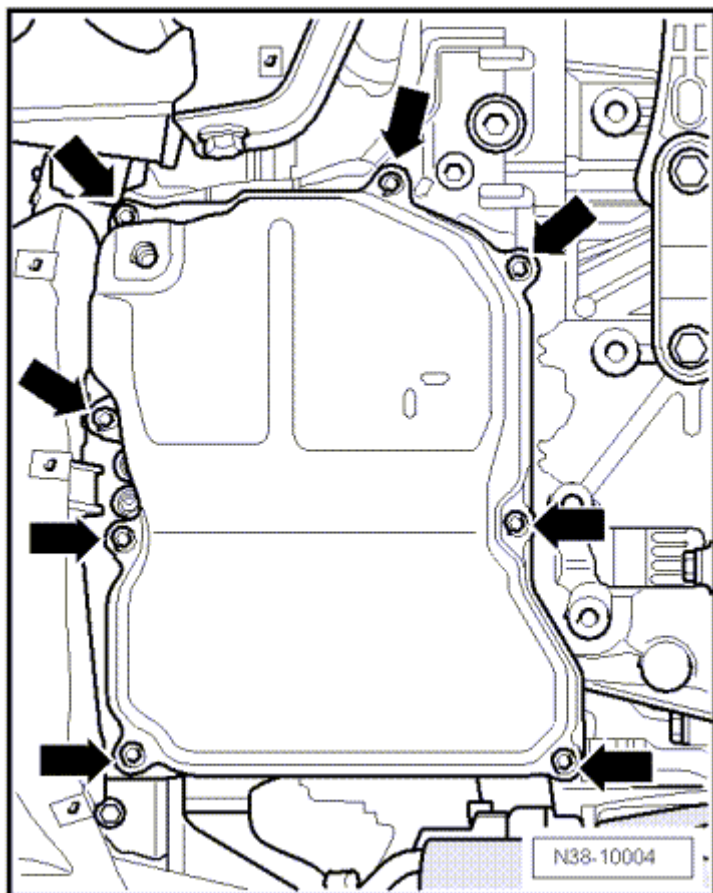
**Automatic
Trans. – 09M**

Gears, Hydraulic Controls – 09M

Fastener Tightening Specifications



Transmission Fluid Pan Tightening Specification



Component	Nm
Tighten the transmission pan bolts (➔) diagonally in several steps	7

Automatic
Trans. – 09M

Rear Final Drive, Differential – 09M

Fastener Tightening Specifications

Fastener	Fastener Size	Nm
Bevel Box Drain Plug	M6	15
	M8	60
Bevel Box Fill/Inspection Plug ¹⁾	2	15
Bevel Box to Transmission Bolt	1	30
Output Flange to Output Shaft Nut ^{1) 2)}	2	480
Pinion housing to bevel box bolt ³⁾	1	25
Right flange shaft countersunk bolt ¹⁾		30

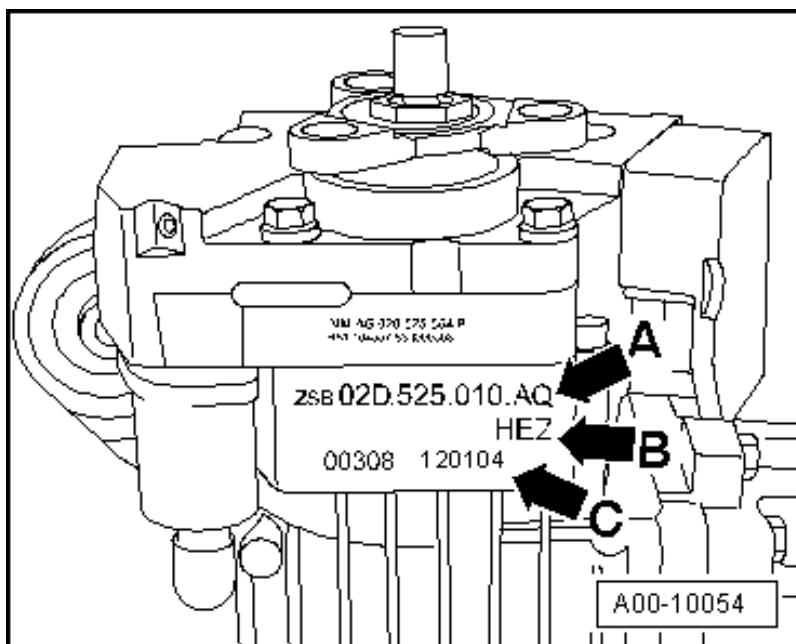
¹⁾ Replace fastener(s).

²⁾ Install using liquid locking fluid -D 000 600 A2.

³⁾ Tighten diagonally.

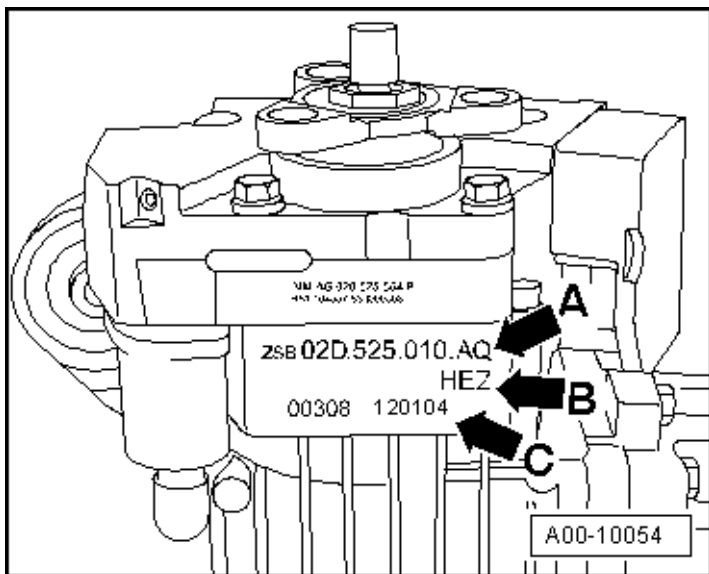
REAR FINAL DRIVE

Rear Final Drive Identification



The identification (➔) on the bottom side of the rear final drive identifies which final drive is installed.
Example identification on an 02D rear final drive

Example identification on an 02D Rear Final Drive



Rear Final Drive Code Letters

Arrow A	Final drive part number
Arrow B	Finaldrive code letters
Arrow C	Final drive build date

HEZ	12	01	04
Identification codes	Day	Month	Year (2004) of manufacture

Engine-Transmission Allocation

Rear Final Drive	0BS (Haldex clutch generation IV)
Transmission type	6 speed automative transmission 09M
Code letters	MBD
Engine	3.6L 206 kW FSI
Driveshaft flange diameter	100 mm

Capacities

Rear Final Drive	0BS (Haldex clutch generation IV)
Rear final drive capacity	Refer to the Fluid Capacity Tables, Rep. Gr. 03
Haldex clutch capacity	Refer to the Fluid Capacity Tables, Rep. Gr. 03
Replacement capacity in Haldex clutch • Change intervals, refer to Maintenance Intervals, Rep. Gr. 03	Refer to the Fluid Capacity Tables, Rep. Gr. 03

Fastener Tightening Specifications

Component	Fastener size	Nm
All Wheel Drive control module to haldex clutch housing bolt ¹⁾	-	6
Front Flexible Disc to Bevel Box Output Flange Bolt ¹⁾	-	60
Front Flexible Disc to Driveshaft Bolt ¹⁾	-	50 plus an additional 90° (¼ turn)
Haldex Clutch Drain Plug	-	30
Haldex Clutch Fill Plug	-	15
Haldex Clutch Pump to Haldex Clutch Bolt	-	6
Input Flange to Haldex Clutch Nut ²⁾	-	50
Intermediate Bearing to Underbody Bolt	-	210
Intake manifold support-to-intake manifold nut	-	25
Rear Final Drive Plug	-	15
Rear Flexible Disc to Driveshaft Bolt ¹⁾	-	50 plus an additional 90° (¼ turn)
Rear Flexible Disc to Haldex Clutch Input Flange Bolt ¹⁾	-	60

¹⁾ Replace fastener(s).

²⁾ Installing using liquid locking fluid D000 600 A2

¹⁾ Replace fastener(s).

²⁾ Installing using liquid locking fluid D000 600 A2

SUSPENSION, WHEELS, STEERING

Front Suspension

Fastener Tightening Specifications

Component	Fastener size	Nm
ABS wheel speed sensor bolt	M6 x 16	8
Ball joint-to-control arm nut ¹⁾		
- Cast steel control arm	-	60
- Steel and aluminum control arm	-	100
Ball joint-to-wheel bearing housing nut ¹⁾	M12 x 1.5	60
Constant Velocity (CV) joint boot clamp	-	25
Control arm-to-subframe bolt ^{1) 2)}	M12 x 1.5 x 110	70 plus an additional 180° (½ turn)
Coupling rod-to-stabilizer bar nut ¹⁾	-	65
Coupling rod-to-strut nut ¹⁾	-	65
Cover plate-to-wheel bearing housing bolt	M6 x 12	12
Drive axle-to-transmission flange shaft bolt ^{1) 3)}		
- With bolted Constant Velocity (CV) joint (VL100 or VL107)	M8	40
- With bolted Constant Velocity (CV) joint (VL100 or VL107)	M10	70
- With triple roller joint (AAR3300i) mounted in transmission or bolted in flange shaft	M10	70
Drive axle-to-wheel hub bolt ^{1) 6)}		
- Twelve point bolt with ribs	-	70 plus an additional 90° (¼ turn)
- Twelve point bolt without ribs	-	200 plus an additional 180° (½ turn)
Heat shield-to-subframe bolt ⁸⁾	-	6
Level control system sensor-to-lower control arm nut	-	9
Level control system sensor-to-subframe bolt	M6 x16	9

Fastener Tightening Specifications (cont'd)

Component	Fastener size	Nm
Lower control arm bracket-to-body bolt ^{1) 7)}	M12 x 1.5 x 100	70 plus an additional 180° (½ turn)
Lower control arm bracket-to-subframe bolt ¹⁾	M10 x 70	50 plus an additional 90° (¼ turn)
Pendulum support-to-subframe bolt ^{1) 7)}	M14 x 1.5 x 70	100 plus an additional 90° (¼ turn)
Pendulum support-to-transmission bolt ¹⁾	M10 x 35	50 plus an additional 90° (¼ turn)
	M10 x 75	50 plus an additional 90° (¼ turn)
	M12 x 1.5 x 85	60 plus an additional 90° (¼ turn)
Shock absorber-to-strut mount nut ¹⁾	M14 x 1.5	60
Stabilizer bar clamp-to-subframe bolt ¹⁾	M8 x 55	20 plus an additional 90° (¼ turn)
Steering gear-to-subframe bolt ¹⁾	-	50 plus an additional 90° (¼ turn)
Strut-to-body bolt ¹⁾	M8 x 26	15 plus an additional 90° (¼ turn)
Subframe-to-body bolt ¹⁾	M12 x 1.5 x 110	70 plus an additional 90° (¼ turn)
	M12 x 1.5 x 110	70 plus an additional 180° (½ turn)
	M12 x 1.5 x 90	70 plus an additional 180° (½ turn)
Tie rod end-to-wheel bearing housing nut ^{1) 4)}	M12 x 1.5	100
Universal joint-to-steering gear bolt ¹⁾	-	30

Fastener Tightening Specifications (*cont'd*)

Component	Fastener size	Nm
Wheel bearing housing pinch bolt nut ¹⁾	M12 x 1.5 x 80	70 plus an additional 90° (¼ turn)
Wheel hub-to-wheel bearing housing ¹⁾	M12 x 1.5 x 45	70 plus an additional 90° (¼ turn)

¹⁾ Replace fastener(s).

²⁾ Tighten in curb weight position.

³⁾ First pre-tighten diagonally to 10 Nm, then tighten diagonally again to specification.

⁴⁾ Tighten to 100 Nm, then loosen by 180° and tighten to 100 Nm again.

⁵⁾ Pre-tighten all nuts to 10 Nm.

⁶⁾ Vehicle must not be standing on its wheels when loosening or tightening.

⁷⁾ Only tighten when the pendulum support is bolted to the transmission

⁸⁾ For front wheel drive (FWD) only

Rear Suspension

Fastener Tightening Specifications

Component	Fastener size	Nm
ABS wheel speed sensor bolt	M6 x 16	8
Brake disk-to-wheel hub bolt	-	4
Coupling rod-to-stabilizer bar nut ¹⁾	-	45
Coupling rod-to-wheel bearing housing nut ¹⁾	-	45
Cover plate to wheel bearing housing bolt	M6 x 10	12
Cover plate to wheel bearing housing bolt		25
Drive axle-to-final drive bolt (AWD) ¹⁾³⁾	M8 x 48	40
Drive axle-to-wheel hub bolt (AWD) ¹⁾	-	
- Twelve point bolt with ribs	-	70 plus an additional 90° (¼ turn)
- Twelve point bolt without ribs	-	200 plus an additional 180° (½ turn)
Lower track control arm-to-subframe nut ¹⁾²⁾	M12 x 1.5	95

Fastener Tightening Specifications (cont'd)

Component	Fastener size	Nm
Lower track control arm-to-wheel bearing housing nut ^{1) 2)}	-	90 plus an additional 90° (¼ turn)
Rear body acceleration sensor to bracket bolt ¹⁾	-	5
Rear body acceleration sensor bracket to shock absorber mount bolt ¹⁾	M10 x 35	50 plus an additional 90° (¼ turn)
Rear final drive to subframe bolt ⁴⁾	M12 x 105	60 plus an additional 90° (¼ turn)
Shock absorber-to-body bolt ¹⁾	-	50 plus an additional 90° (¼ turn)
Shock absorber-to-shock absorber mounting nut ¹⁾	-	25
Shock absorber-to-wheel bearing housing bolt ¹⁾		
- FWD	M14 x 1.5 x 85	180
- AWD	M14 x 1.5 x 70-	180
Stabilizer bar-to-subframe bolt ¹⁾	M8 x 30	25 plus an additional 90° (¼ turn)
Stone protection plate-to-lower transverse link bolt	M6 x 12	8
Subframe-to-body bolt ¹⁾		
- FWD	M12 x 1.5 x 95	90 plus an additional 90° (¼ turn)
	M12 x 1.5 x 110	90 plus an additional 90° (¼ turn)
- AWD	M12 x 1.5 x 125	90 plus an additional 90° (¼ turn)
Tie rod-to-subframe bolt ^{1) 2)}	-	90 plus an additional 90° (¼ turn)
Tie rod-to-wheel bearing housing bolt ^{1) 2)}		
- FWD	M14 x 1.5 x 115	130 plus an additional 90° (¼ turn)

Fastener Tightening Specifications (cont'd)

Component	Fastener size	Nm
- AWD	M14 x 1.5 x 115	150 plus an additional 90° (¼ turn)
Trailing arm-to-mounting bracket bolt ¹⁾	M12 x 1.5 x 80	90 plus an additional 90° (¼ turn)
Trailing arm-to-wheel bearing housing bolt ¹⁾	-	90 plus an additional 90° (¼ turn)
Trailing arm mounting bracket-to-body bolt ¹⁾	M10 x 35	50 plus an additional 90° (¼ turn)
Upper track control arm-to-subframe nut ^{1) 2)}	M12 x 1.5	95
Upper track control arm-to-wheel bearing housing ^{1) 2)}		
- FWD	M14 x 1.5 x 115	130 plus an additional 90° (¼ turn)
- AWD	M14 x 1.5 x 115	150 plus an additional 90° (¼ turn)
Wheel hub-to-wheel bearing housing bolt ¹⁾		
- FWD	M16 x 1.5 x 70	200 plus an additional 90° (¼ turn)
- AWD	M14 x 1.5 x 45	70 plus an additional 90° (¼ turn)

¹⁾ Replace fastener(s).

²⁾ Always tighten the threaded connection in curb weight position.

³⁾ Pre-tighten to 10 Nm in a diagonal sequence, and then tighten to specification in a diagonal sequence.

⁴⁾ AWD only

Self-Leveling Suspension

Fastener Tightening Specifications

Component	Fastener size	Nm
Front body acceleration sensor-to-bracket bolt/nut ¹⁾	-	5
Front body acceleration sensor/strut to body bolt	-	15 plus an additional 90° (¼ turn)
Front level control system sensor-to-subframe bolt	M6 x 16	9
Front level control system sensor-to-control arm nut ¹⁾	-	9
Front shock absorber-to-suspension strut bearing nut ¹⁾	M14 x 1.5	60
Rear body acceleration sensor-to-bracket bolt ¹⁾	-	5
Rear level control system sensor-to-lower track control arm bolt	M5 x 20	5
Rear level control system sensor-to-subframe bolt ¹⁾	M5 x 20	5

¹⁾ Replace fastener(s).

Wheels, Tires, Wheel Alignment

Fastener Tightening Specifications

Component	Fastener size	Nm
Front subframe-to-body bolt ¹⁾	M12 x 1.5 x 110	70 plus an additional 90° (¼ turn)
	M12 x 1.5 x 100	70 plus an additional 180° (½ turn)
	M12 x 1.5 x 90	70 plus an additional 180° (½ turn)

Fastener Tightening Specifications (*cont'd*)

Component	Fastener size	Nm
Front lower control arm bracket to body bolt ¹⁾	-	70 plus an additional 180° (½ turn)
Metal valve to wheel nut	-	4
Rear lower track control arm to subframe nut ¹⁾²⁾		95
Rear upper track control arm to subframe nut ¹⁾²⁾		95
Tie rod end to tie rod nut		70
Tire pressure sensor to metal valve bolt		4

¹⁾ Replace fastener(s).

²⁾ Tighten in curb weight position.

Wheel Alignment Data

Wheel Alignment Specified Values

Front suspension	Basic suspension	Basic suspension with adaptive chassis DCC	Comfort - heavy duty suspension
Production Relevant No. (PR. No.)	G60	G61	G62
Total toe (wheels not pressed)	$10' \pm 10'$	$10' \pm 10'$	$10' \pm 10'$
Camber (wheels in straight ahead position)	$-41' \pm 30'$	$-41' \pm 30'$	$-34' \pm 30'$
Maximum permissible difference between both sides	30'	30'	30'
Toe-out angle ¹⁾ with steering wheel turned 20° to left and right	$1^{\circ}21' \pm 20'$	$1^{\circ}21' \pm 20'$	$1^{\circ}20' \pm 20'$
Caster	$7^{\circ}44' \pm 30'$	$7^{\circ}44' \pm 30'$	$7^{\circ}35' \pm 30'$
Maximum permissible difference between both sides	30'	30'	30'
Standing height (mm)	379 ± 10	379 ± 10	389 ± 10

¹⁾ Depending on the manufacturer, the toe out angle difference can also be indicated negatively in the alignment computer.

Wheel Alignment Specified Values (cont'd)

Rear suspension, front and all wheel drive	Basic suspension	Basic suspension with adaptive chassis DCC	Comfort - heavy duty suspension
Camber	-1° 20' ± 30'	-1° 20' ± 30'	-1° 20' ± 30'
Maximum permissible difference between both sides	30'	30'	30'
Total toe (at prescribed camber)	+10' ± 10'	+10' ± 10'	+10' ± 10'
Maximum permissible deviation from direction of rotation	20'	20'	20'
Standing height (mm)	382 ± 10	382 ± 10	389 ± 10

Steering

Fastener Tightening Specifications

Component	Fastener size	Nm
Bracket to steering column cross member bolt	M8 x 30, M8 x 85	20
Cross support to bracket bolt	M8 x 94-	20
Cross support to steering column to cross member bolt	M8 x 48	20
Handle to steering column bolt	M6 x 10	3
Heat shield to steering gear bolt ¹⁾	-	6
Steering column to bracket bolt ¹⁾	M8 x 30	20
Steering column u-joint to steering gear bolt ¹⁾	M8 x 35	20 plus an additional 90° (¼ turn)
Steering gear-to-subframe bolt ¹⁾	M10 x 70	50 plus an additional 90° (¼ turn)
Steering wheel-to-steering column bolt ¹⁾	-	30 plus an additional 90° (¼ turn)
Tie rod-to-steering gear	M12 x 1.5	100
Tie rod end-to-tie rod nut	-	70
Tie rod-to-wheel bearing housing nut ¹⁾²⁾	-	100

¹⁾ Replace fastener(s).

²⁾ Tighten to 100 Nm, then loosen by 180° and tighten to 100 Nm again.

BRAKE SYSTEM

General, Technical Data

Vehicle Data Sticker PR Number Allocation Front Brakes

Engine version	PR Number	Front wheel brake
2.0L - 147 kW	1ZG	FN 3 (16")
3.6L - 206 kW (FWD)		
3.6L -206 kW (AWD)	1LK	FNR-G (17")
	1LB	C60 (17")

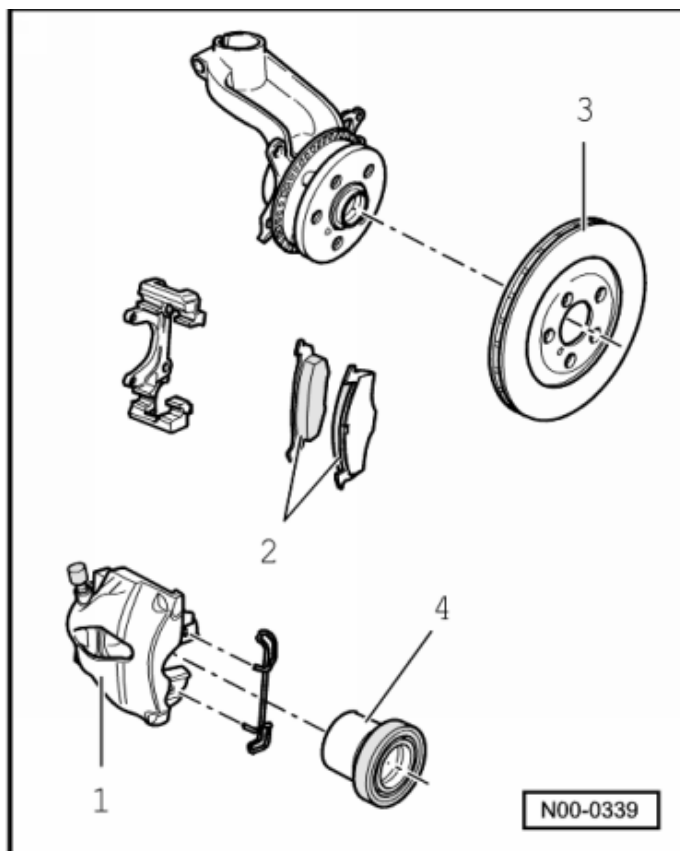
Rear Brakes

Engine version	PR Number	Rear wheel brake
2.0L - 147 kW FSI	1KU/1KW	CII 38 (16")
3.6L - 206 kW (FWD)		
3.6L -206 kW (AWD)	2EA	CII 41 (17")

Brake Master Cylinder and Brake Booster

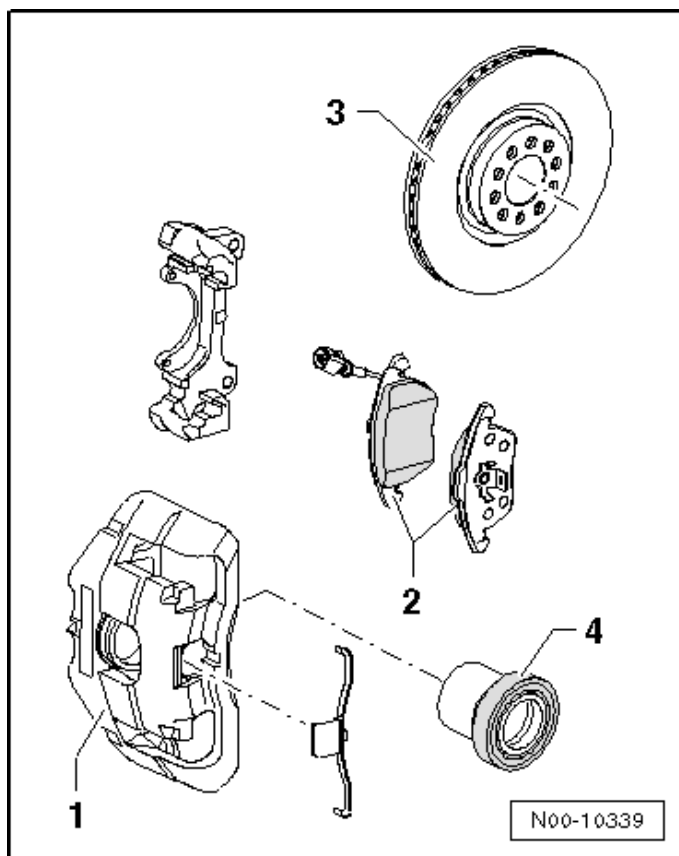
Component	Diameter in mm
Brake master cylinder (low engine)	22.22
Brake master cylinder (high engine)	23.81
Brake booster	11

Front Brakes, FN 3



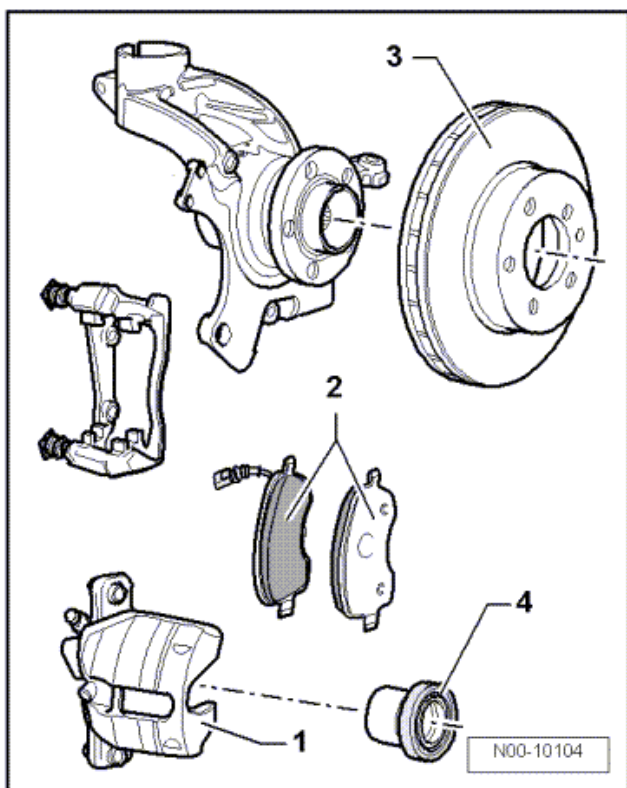
Item	PR Number		1LH/ 1ZG
1	Brake caliper		FN 3 (16")
2	Brake pad thickness	mm	14
	Brake pad wear limit without back plate	mm	2
3	Brake disc	Diameter in mm	312
	Brake disc thickness	mm	25
	Brake disc wear limit	mm	22
4	Brake caliper, piston	Diameter in mm	54

Front Brakes, FNR-G



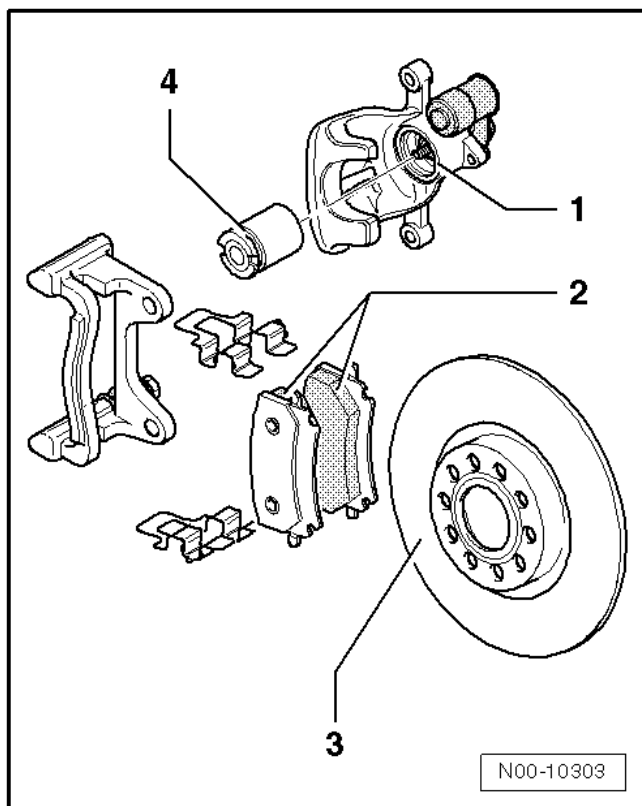
Item	PR number		1LK
1	Brake caliper		FNR-G (17")
2	Brake pad thickness	mm	14
	Brake pad wear limit without back plate	mm	2
3	Brake disc	Diameter in mm	345
	Brake disc thickness	mm	30
	Brake disc wear limit	mm	27
4	Brake caliper, piston	Diameter in mm	57

Front Brakes, C60



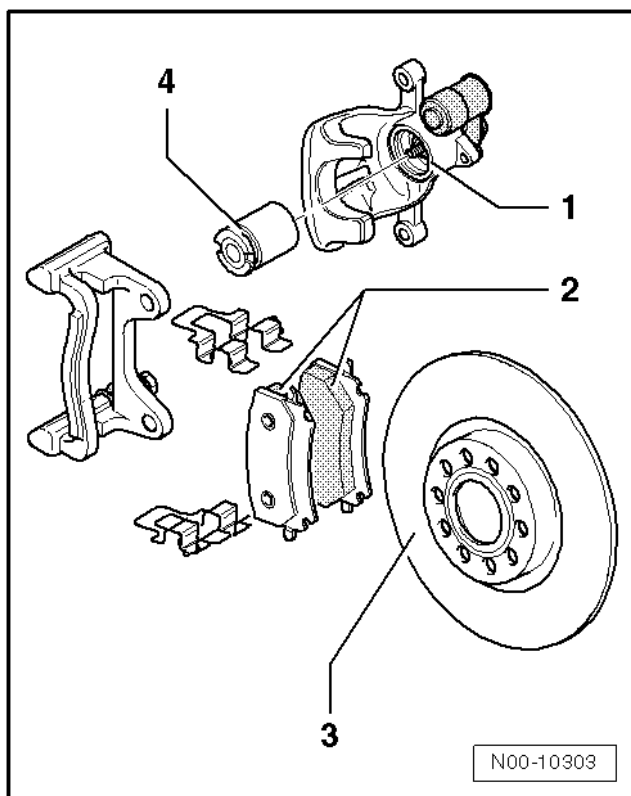
Item	PR number		1LA 1 LB
1	Brake caliper		C60 (17")
2	Brake pad thickness	mm	13
	Brake pad wear limit without back plate	mm	2
3	Brake disc	Diameter in mm	340
	Brake disc thickness	mm	30
	Brake disc wear limit	mm	27
4	Brake caliper, piston	Diameter in mm	60

Rear Brakes CII 38



Item	PR Number		1KU
1	Brake caliper		CII 38 (16")
2	Brake pad thickness	mm	11
	Brake pad wear limit without back plate	mm	2
3	Brake disc	Diameter in mm	286
	Brake disc thickness	mm	12
	Brake disc wear limit	mm	10
4	Brake caliper, piston	Diameter in mm	38

Rear Brakes CII 41



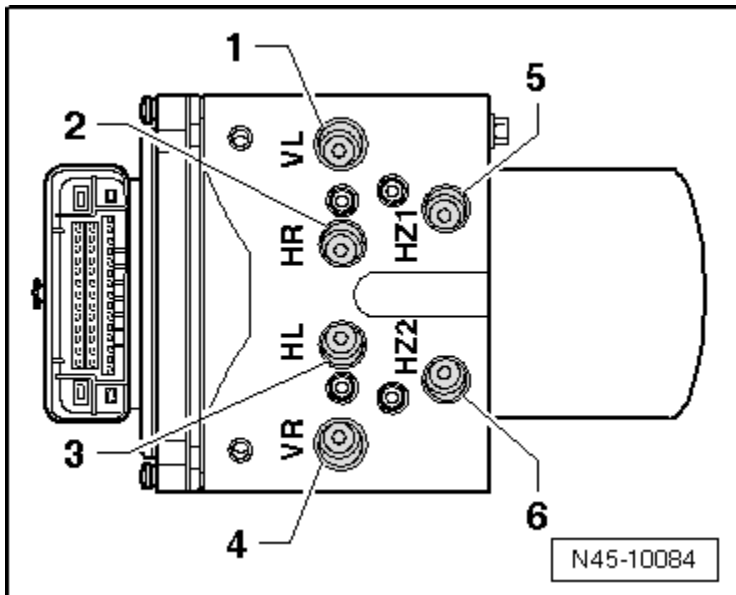
Item	PR Number		2EA
1	Brake caliper		CII 41 (17")
2	Brake pad thickness	mm	11
	Brake pad wear limit without back plate	mm	2
3	Brake disc	Diameter in mm	310
	Brake disc thickness	mm	22
	Brake disc wear limit	mm	20
4	Brake caliper, piston	Diameter in mm	41

Anti-lock Brake System (ABS)

Fastener Tightening Specifications

Component	Nm
ABS control module bracket nut	20
ABS control module heat shield	12
ABS control module-to-bracket	10
ESP sensor unit nut	9
Speed sensor bolt	8

Control Module and Hydraulic Unit Tightening Specifications



Component	Nm
Hydraulic unit bracket hex bolt	10
Brake lines with the ABS module	
Brake lines 1 through 4 (brake calipers)	14
Brake lines 5 and 6 (brake master cylinder)	
Diameter 8.5 mm	17
Diameter 6 mm	14

Mechanical Components

Fastener Tightening Specifications

Component	Nm
Brake booster-to-mounting bracket nut	25
Brake pedal nut	25
Electromechanical parking brake control module nut	9
Front brakes	
Bracket for brake hose (C-60)	8
Brake caliper (C-60)	35
Brake caliper (FNR-G)	10
Brake carrier (FN 3)	200
Brake carrier (FNR-G)	199
Brake carrier guide pin	30
Brake disc	4
Brake hose bracket (FN 3)	8
Brake hose bracket (FNR-G) ²⁾	15
	8
Brake hose-to-brake line	14
Brake line-to-brake caliper banjo bolt	35
Cover plate	12
Rear brakes	
Brake hose bracket	12
Brake caliper-to-brake carrier ¹⁾	35
Brake carrier with guide pins and protective cap	90 plus an additional 90° (¼ turn)
Brake disc	4
Brake line-to-brake hose fitting	14
Parking brake motor bolt	12
Wheel Bearing Housing with fastened brake carrier, C-60	200

¹⁾ Replace fastener(s).

²⁾ For bolt tightening clarification, refer to ElsaWeb, *Brake, FNR-G Assembly Overview*, items 16 and 20.

Hydraulic Components

Fastener Tightening Specifications

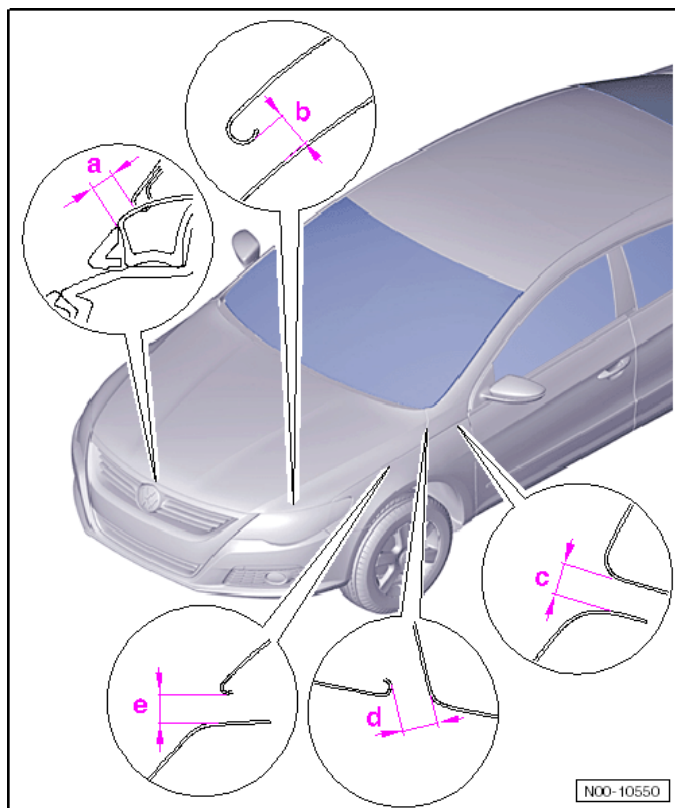
Component	Nm
Bleeder valve (C60)	13
Bleeder valve (FN 3)	10
Bleeder valve (FNR-G)	12
Brake caliper	35
Brake lamp switch-to-brake master cylinder	5
Brake line-to-brake master cylinder (6 mm diameter)	14
Brake master cylinder-to-brake booster nut ¹⁾	25
Brake pedal-to-brake booster nut ¹⁾	25
Guide pins	30
Heat shield nut	25
Parking brake motor	12
Pedal assembly nut	25
Rear brake caliper bleeder valve	10

¹⁾ Replace fastener(s).

BODY

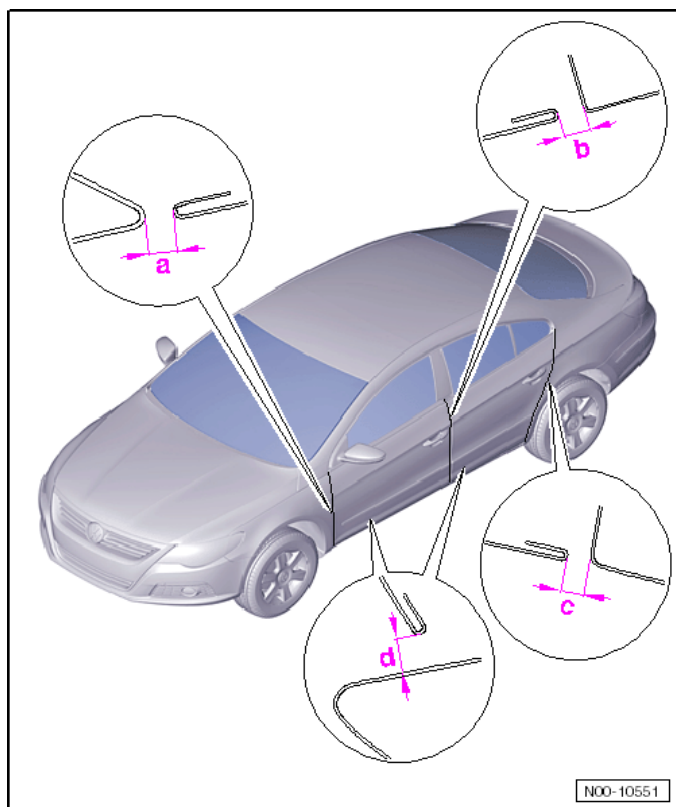
Air Gap Body Dimensions

Body, Front



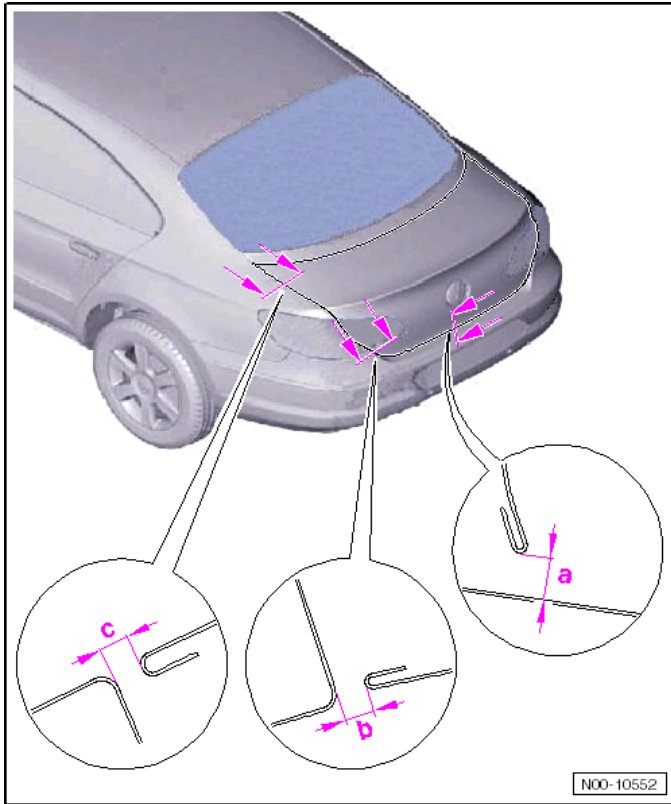
Component	mm
a	6.0 ± 1
b	6.0 ± 1
c	3.5 ± 1
d	3.5 ± 1
e	4.0 ± 1

Body, Center



Component	mm
a	3.5 ± 1
b	4.5 ± 1
c	3.5 ± 1
d	5.5 ± 1

Body, Rear



Component	mm
a	6.0 ± 1
b	3.5 ± 1
c	3.5 ± 1

Body

Body Exterior

Lock Carrier Tightening Specifications

Component	Nm
Center guide	8
Lock carrier bolts ¹⁾	8
	60

¹⁾ For bolt tightening clarification, refer to ElsaWeb, *Lock Carrier Service Position Assembly Overview*, items 2 and 3.

Front Fender Tightening Specifications

Component	Nm
Front fender bolts	7.5
Front fender brace bolts	2
Noise Insulation bolts	2

Front Bumper Tightening Specifications

Component	Nm
Front bumper carrier ¹⁾	3.5
	8.0
	60
Front bumper cover bolt	2.0
Guide trim	2.0
Lock carrier support ²⁾	3.5
	12

¹⁾ For bolt tightening clarification, refer to ElsaWeb, *Front Bumper Carrier*, items 7, 8 and 9.

²⁾ For bolt tightening clarification, refer to ElsaWeb, *Front Bumper Carrier*, items 211, 12 and 13.

Rear Bumper Tightening Specifications

Component	Nm
Guide trim screws nuts ¹⁾	3.2
Rear bumper carrier	20 ± 3.0 plus an additional 90° (¼ turn)
Rear bumper cover	2.0
	4.0
Securing strip nut ²⁾	2.2

Underbody Trim and Noise Insulation Tightening Specifications

Component	Nm
Front and rear underbody cover bolts	2
Middle underbody cover nuts	6
Noise insulation bolts	2

Bulkhead and Tunnel Bridge Tightening Specifications

Component	Nm
Bulkhead bolts	25
Front and rear tunnel bridge bolts	20

Front Hood Tightening Specifications

Component	Nm
Front hood hinge bolts	21
Hood catch bolts	10
Hood latch bolts	12
Hood release lever bracket	2

Rear Lid, Fuel Filler Door Tightening Specifications

Component	Nm
Adjusting element	1.5
Fuel filler door bolts	1.5
Rear lid catch bolts	22
Rear lid hinge bolts	22
Rear lid latch-to-body	8
Rear lid striker pin bolts	18
Release element bolts	4

Front and Rear Door Tightening Specifications

Component	Nm
Door handle with backing plate (rear)	4.5
Door handle bracket bolts	4.5
Door hinge bolts ²⁾	28
	44 ¹⁾
	50 ¹⁾
Door lock bolts	20
Door lock bracket	1.5
Door striker pin bolts	20
Door window clamping bracket bolts	8
Door window regulator bolts	
- Front	12
- Rear	14
Subframe	0.8

¹⁾ Replace fastener(s).

²⁾ For bolt tightening clarification, refer to ElsaWeb, *Hinge Assembly Overview*.

Wheel Housing Liner Tightening Specification

Component	Nm
Wheel housing liner bolts	2

Exterior Mirror and Trim Tightening Specifications

Component	Nm
Mirror base plate bolts	10
Mirror trim bolts	1
Moldings and trim bolts	2

Door Windows Tightening Specifications

Component	Nm
Clamp bracket-to-front door bolt	8
Front door window adjustment in longitudinal direction bolts	4
Rear door window adjustment in longitudinal direction bolts	9
Window regulator nut	12
Window regulator motor	3.5

Sunroof Tightening Specifications

Component	Nm
Electric drive motor bolt microencapsulated ¹⁾	3.5
Glass panel height adjustment bolts	5.5
Sun shade cover screws	2
Sun shade guide rail screws	2
Sun shade handle screws	2
Panorama sunroof glass panel drive motor	3.5

¹⁾ Replace fastener(s).

Electrical Equipment Tightening Specifications

Component	Nm
B-Pillar side trim	2
Cover	2
Mount for B-Pillar	2
Noise insulation	2
Radiator grille	2
Rear underbody cover nut	6
Sill panel cover bolt	1.5
Tunnel bridge	20
Underbody cover nut	6

Body Interior

Storage Compartments, Covers and Trim Tightening Specifications

Component	Nm
Analog clock mount-to-IP	1.5
Center console bolts	1.5
Footrest cover	1.5
Footrest mount	2.0
Footwell trim bolts	1.5
Instrument panel central tube nuts	20
Lower C-Pillar trim nut	8
Rear door trim panel ¹⁾	1.7
	4.5
Storage compartment/ashtray bolts	1.5
Sunshade bracket	20
Trim screws and bolts	1.5

¹⁾ Refer to Body Interior

Passenger Protection Fastener Tightening Specifications

Component	Nm
Adjustment switch	0.75
Airbag control module nuts	9
Bracket-to-lower seat	7.5
Driver front airbag crash sensor	4.5
Front airbag crash sensor	5.4
Front belt latch	20
Front door trim panel	4.5
Front seat backrest bolts	27
Front seat frame bolts	40
Front seat operating lever and bracket bolts	3.5
Front seat-to-floor bolts	40 +/- 4
Head curtain airbag with igniter	4.5
Operating level to lower seat	7.5
Rear center arm rest-to-bracket	8
Rear left side airbag crash sensor	9
Rear seat backrest bolts	8
Rear seat bolts	8
Rear seat clamp	8
Seat belt anchor bolts	40
Seat belt guide screws	4.5
Seat belt latch nut	40
Seat drawer mount bolts	2
Seat trim bolts	3.5

¹⁾ Refer to Body Interior

HEATING, VENTILATION AND AIR CONDITIONING

General, Technical Data

Refrigerant Oil Distribution

Component	Approximate % of total amount of oil in component
A/C compressor	50
Condenser	10
Suction hose	10
Evaporator	20
Fluid reservoir	10

Refrigerant R134a Vapor Pressure Table

Temperature in °C	Pressure in bar (positive pressure) of R134a
-45	-0.61
-40	-0.49
-35	-0.34
-30	-0.16
-25	0.06
-20	0.32
-15	0.63
-10	1.00
-5	1.43
0	1.92
5	2.49
10	3.13
15	3.90
20	4.70
25	5.63
30	6.70
35	7.83
40	9.10
45	10.54
50	12.11
55	13.83
60	15.72
65	17.79
70	20.05
75	22.52
80	25.21
85	28.14
90	31.34

Heating, Ventilation

Fastener Tightening Specifications

Component	Nm
Cable bracket bolts	4
Footwell vents	1.5
Fresh air blower bolt	1
Fresh air intake grille	2.5
Heat and fresh air controls	1.5
Heater core hose clamps	2
Heater core connection flange bolt	2
Heater unit attaching screws	9 ± 1.3
Intake air grille	2.5
Rear vent	1.5
Rear vent air duct	1.5

Air Conditioning

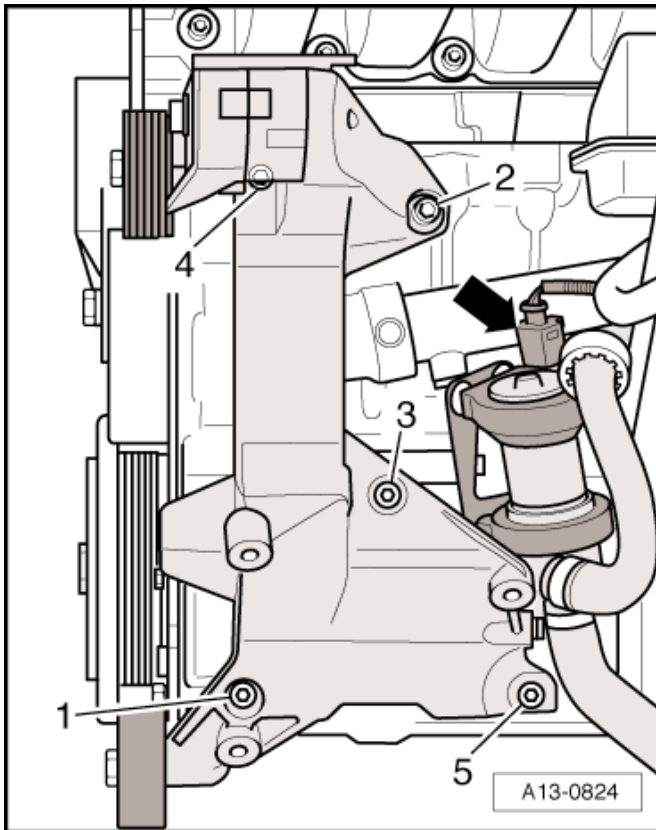
Climatic and Climatronic Components Fastener Tightening Specifications

Component	Nm
Climatic/Climatronic heating and A/C system controls	1.5
Heating and A/C unit-to-instrument panel assembly carrier	
Cable bracket bolts	4
Climatic/climatronic bracket bolts	9 ± 1.3
Door motors	
Fresh air/recirculating air/back pressure door motor	1.4
Indirect ventilation door motor	3.5
Door motors	1.5
Refrigerant line bracket to body nuts	20

Refrigerant System, Fastener Tightening Specifications

Component	Fastener size	Nm
A/C refrigerant line to A/C compressor, bolts	-	22 ± 1
2.0L Engine		
A/C compressor accessory bracket to engine, bolts	M10 x 45	40
A/C Compressor to A/C Compressor Accessory Bracket, Bolts	M8 x 100	25
3.6L Engine		
A/C Compressor Accessory Bracket to Engine, Bolts	-	25
A/C compressor to A/C compressor accessory bracket, bolts	M8 x 100	25
Ribbed Belt Pulley, Denso		
Input Shaft	-	35 ± 5
Ribbed Belt Pulley, Zexel		
Overload protection to A/C compressor, bolt	-	20
Overload protection to ribbed belt pulley, bolts	-	5
Ribbed Belt Pulley, Sanden		
Overload protection to A/C compressor, nut	-	25
Overload protection to ribbed belt pulley, bolts	-	4.5
Condenser to radiator, bolts	-	5 ± 0.5
Dryer cartridge cover, cap	-	1.2 ± 0.3
Evacuating and charging valve insert	-	2 ± 0.2
Expansion valve heat shield, bolt	-	2.5
Expansion valve heat shield, nut	-	4.5
Expansion valve to heating and a/c unit, bolts	-	5
High pressure sensor	-	8 ± 1
Refrigerant lines to expansion valve, bolts	-	10 ± 1
Refrigerant lines to condenser	-	12 ± 1

3.6L Accessory Bracket Tightening Sequence



Step	Component	Nm
1	Tighten bolts 1 through 5 in sequence hand tight	
2	Tighten bolts 1 through 5 in sequence	25

ELECTRICAL SYSTEM

Electrical Equipment

Battery, Starter, Generator and Cruise Control Tightening Specifications

Component	Fastener size	Nm
Air filter housing bolt-to-body	M6	10
B+ nut on generator	-	15
B+ nut on starter	M8	15
Battery clamping plate bolt ³⁾	M8 x 35	35
Battery clamping plate bolt ⁴⁾	M8	20
Battery terminal nut	M6	6
Bracket-to-engine bolt ⁴⁾	M10 x 45	45
Generator-to-bracket bolt ³⁾	M8 x 90	20
Generator-to-bracket bolt ⁴⁾	M8 x 110	20
Ground wire-to-transmission housing ³⁾	M8	15
Jump start point with suppressor mounting bolt	-	9
Jump start point with suppressor terminal 30 nut	-	15
Protective cap-to-generator screw ⁴⁾	M5 x 21	
Protective cap-to-generator screw ³⁾	M5	
Pyrotechnic battery isolator mounting nut	-	15
Ribbed belt tensioner-to-bracket bolt (2.0L)	M8 x 45	23
Ribbed belt pulley-to-generator		
- Without freewheel	-	65
- With freewheel	-	80
Starter mounting bolt ¹⁾	M12	75
Starter mounting bolt ²⁾	M12	80
Voltage regulator	-	2
Wiring bracket-to-starter nut	M8	23

¹⁾ 3.6L and 2.0L with manual transmission

²⁾ 2.0L with DSG transmission

³⁾ 3.6L

⁴⁾ 2.0L

Windshield Wiper/Washer Tightening Specifications

Component	Nm
Lift cylinder-to-bumper cover bolt	3
Motor crank nut on the wiper motor shaft	17
Windshield washer system and headlamp cleaning system tank bolt	5
Wiper arm-to-linkage	20
Wiper frame with linkage-to-body bolts	8
Wiper frame nut-to-body	5
Wiper motor-to-wiper frame mounting screws	12

Exterior Lights, Switches Tightening Specifications

Component	Nm
Electronic systems control module	1.5
Fog lamp	1.5
Headlamp assembly bolt	6 ¹⁾
	2 ²⁾
Headlamp range control positioning motor mounting bolt	1.5
Headlamp replacement mounting tabs	1.4
HID headlamp control module with headlamp power output stage bolt	2
Horn bracket-to-body bolt	20
Rear lid tail lamp nut	3
Rear view camera housing and pivoting motor-to-pivoting emblem bolt	2.5
Rear view camera housing-to-pivoting motor bolt	1.6
Rear view camera pivoting emblem-to-rear lid bolt	4
Steering column combination switch-to-steering column	10
Tail lamps in side panel bulb holder nut	2
Washer fluid reservoir mounting bolt	5

¹⁾ For bolt tightening clarification, refer to ElsaWeb, *Halogen headlamps see item 9.*

²⁾ For bolt tightening clarification, refer to ElsaWeb, *Halogen headlamps see item 6 or HID Headlamps with Corning Lamp and see item 7.*

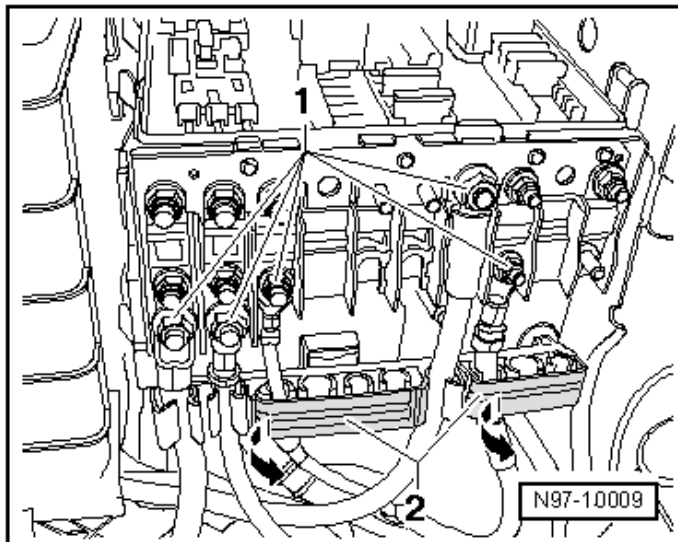
Wiring Tightening Specifications

Component	Nm
Comfort system central control module	4.5
Instrument panel fuse panel	4

Communication Tightening Specifications

Component	Nm
Rear view camera housing and pivoting motor bolts in pivoting emblem	2.5
Rear view camera housing bolts-to-pivoting motor	1.6
Pivoting emblem bolts in rear lid	4

Left Engine Compartment E-Box Tightening Specifications



Component	Fastener size	Nm
Central bolt E-box	-	9
Securing nuts (1)	M5 (8 mm)	4
	M6 (10 mm)	6

DTC CHART

Engine Codes CBFA

Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Intake Camshaft Position Slow Response Bank 1	Signal change > 8 CRK ° for > 2.9 Sec. and adjustment angle >= 2.50 CRK rev.
P0010	Intake Camshaft Position Actuator Circuit Open Bank 1	Signal voltage, > 4.7 - 5.4 V
P0011	Intake Camshaft Position Timing - Over-Advanced Bank 1	Signal change > 8 CRK ° for > 2.9 Sec. and adjustment angle < 2.50 CRK rev.
P0016	Crankshaft Position – Camshaft Position Correlation	<ul style="list-style-type: none"> • Permissible deviation < -11 CRK ° or • Permissible deviation > 11 rev
P0030	HO2S Heater Control Circuit Bank 1 Sensor 1	Heater voltage 4.70 - 5.40 V
P0031	HO2S Heater Control Circuit Low Bank 1 Sensor 1	Heater voltage < 0 to 3.26 V
P0032	HO2S Heater Control Circuit High Bank 1 Sensor 1	Signal current > 5.50 A
P0036	HO2S Heater Control Circuit Bank 1 Sensor 2	Heater voltage, 4.50 - 5.50 V
P0037	HO2S Heater Control Circuit Low Bank 1 Sensor 2	Heater voltage < 3.00 V
P0038	HO2S Heater Control Circuit High Bank 1 Sensor 2	Heater current, > 2.70 - 5.50 A
P0042	HO2S Heater Control Circuit Bank 1 Sensor 3	Heater voltage 2.34 to 3.59 V
P0043	HO2S Heater Control Circuit Low (Bank 1, Sensor 2) Short to Ground	<ul style="list-style-type: none"> • SULEV Heater voltage < 3 V • ULEV Heater voltage < 3 V
P0044	HO2S Heater Control Circuit High Bank 1 Sensor 3	Heater voltage > 3.59 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0068	MAF vs Throttle Position Correlation	Plausibility with fuel system <ul style="list-style-type: none"> • Plausibility with fuel system • Plausibility with fuel system load calculation > 50%
P0070	Ambient Air Temperature Sensor Circuit	Ambient air temperature < -50 °C
P0071	Ambient Air Temperature Sensor Range/Performance	<ul style="list-style-type: none"> • Difference in value between ECT and AAT at engine start (depending on engine off time) > 25 K • Difference in value between AAT and IAT at engine start (depending on engine off time) > 25 K
P0072	Ambient Air Temperature Sensor Circuit Low	Ambient air temperature > 77 °C
P0087	Fuel Rail/System Pressure - Too Low	<ul style="list-style-type: none"> • Fuel trim activity 0.90 - 1.15 • Pressure controller activity > 2 MPa • Difference between target and actual pressure > -16.4
P0100	Mass Air Flow Circuit Fault	MAF sensor signal 0 µs
P0101	Mass Air Flow Circuit Range/Performance	Mass air flow vs <ul style="list-style-type: none"> • Upper threshold model > 60 to 800 kg/h • Lower threshold model < 0 to 400 kg/h • Load calculation > 18% • Fuel system < -18%
P0102	Mass Air Flow Circuit Low Input	MAF sensor signal < 66 µs
P0103	Mass Air Flow Circuit High Input	MAF sensor signal > 4500 µs
P0106	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	<ul style="list-style-type: none"> • Difference of boost pressure signal vs altitude sensor signal > 230 hPa or <ul style="list-style-type: none"> • Difference of boost pressure signal vs altitude sensor signal < -130 hPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> • Difference in value IAT - ECT @ engine start (depending on engine off time) > 25 °C • Difference in value IAT - AAT @ engine start > 25 °C (depending on engine off time)
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	IAT > 141.0 °C
P0113	Intake Air Temperature Sensor 1 Circuit High Input	IAT < -46 °C
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> • No change on signal < 2 K or • Signal in range > 89 °C with no change on signal 1.5 °K
P0117	Engine Coolant Temperature Sensor 1 Circuit Low Input	ECT >140 °C
P0118	Engine Coolant Temperature Sensor 1 Circuit High Input	ECT < -40 °C
P0121	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> • TPS 1 - TPS 2 > 6.30% • Actual TPS 1 calculated value > TPS 2 calculated value • TPS 1 calc. value > 9.00%
P0122	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit Low Input	Signal voltage < 0.20 V
P0123	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit High Input	Signal voltage > 4.81 V
P0130	O2 Sensor Circuit Bank 1 Sensor 1	O2S ceramic temperature < 640°C
P0131	O2 Sensor Circuit (Bank 1, Sensor 1) Low Voltage	Virtual mass < 1.75 V
		Nernst voltage < 1.50 V
		Adjustment voltage < 0.30 V
P0132	O2 Sensor Circuit (Bank 1, Sensor 1) High Voltage	Virtual mass > 3.25 V
		Nernst voltage > 4.40 V
		Adjustment voltage > 7 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0133	O2 Circuit Slow Response (Bank 1, Sensor 1)	Signal dynamic slope check <ul style="list-style-type: none"> • O2S signal front vs. modeled O2S signal ratio < 0.35 and > 0.01 • Lower value of both counters for area ratios L to R and R to L > = 5 times Oscillation check <ul style="list-style-type: none"> • Lambda amplitude signal > 20% • Cycles > 8 • Time lambda > lambda amplitude 400 m sec. Delay check <ul style="list-style-type: none"> • Delay modeled lambda signal minus measured signal > 460 m sec. • Cycles > 12
P0135	O2 Heater Circuit (Bank 1, Sensor 1)	<ul style="list-style-type: none"> • Heater duty cycle, >100% • O2S ceramic temperature, < 715 °C • Time after O2S heater on 40 Sec.
P0136	O2 Circuit Bank 1 Sensor 2 Malfunction	<ul style="list-style-type: none"> • Delta voltage one step at heater switching > 2.00 V • Number of checks >= 4
P0137	O2 Circuit Low Voltage (Bank 1, Sensor 2)	Cold condition <ul style="list-style-type: none"> • Signal voltage, < 0.06 V for 3 Sec. Warm condition <ul style="list-style-type: none"> • Signal voltage < 0.01 V • Reaction at closed loop enrichment - no reaction
P0138	O2 Circuit High Voltage (Bank 1, Sensor 2)	Signal voltage > 1.08 V for > 5 Sec..
P0139	O2 Circuit Slow Response (Bank 1 Sensor 2)	<ul style="list-style-type: none"> • EWMA filtered transient time at fuel cutoff > 0.0 Sec. • In voltage range of 201 - 401 mV • Number of checks, >=

DTC	Error Message	Malfunction Criteria and Threshold Value
013A	O2 Sensor Slow Response Rich to Lean Bank 1 Sensor 2	<ul style="list-style-type: none"> EWMA filtered max differential transient time at fuel cutoff \geq 0.5 Sec. Number of checks \geq 3
P0140	O2 Circuit No Activity Detected Bank 1 Sensor 2	Signal voltage <ul style="list-style-type: none"> Signal voltage, 0.40 - 0.60 V for $>$ 3 Sec. Internal resistance <ul style="list-style-type: none"> $>$ 40000 ohm
P0141	O2 Heater Circuit Bank 1 Sensor 2	Heater resistance, 702 - 5250 Ohm
P0142	O2 Sensor Circuit Bank 1 Sensor 3	<ul style="list-style-type: none"> Delta voltage one step at heater $>$ 2.0 V Number of checks, 4
P0143	O2 Sensor Circuit Low Voltage Bank 1 Sensor 3	Cold/Warm condition <ul style="list-style-type: none"> Signal voltage $<$ 0.06 V for $>$ 3 Sec.
P0144	O2 Sensor Circuit High Voltage Bank 1 Sensor 3	Signal voltage $>$ 1.08 V for $>$ 5 Sec.
P0145	O2 Sensor Circuit Slow Response Bank 1 Sensor 3	<ul style="list-style-type: none"> EWMA filtered transient time at fuel cutoff $>$ 1.2 Sec. In voltage range of 201.2 - 401.4 mV Number of checks, 3
P0146	O2 Sensor Circuit No Activity Detected Bank 1 Sensor 3	<ul style="list-style-type: none"> Signal voltage 0.40 - 0.60 V for $>$ 3 Sec. Internal resistance $>$ 40000 Ohm
P0147	O2 Sensor Heater Circuit Bank 1 Sensor 3	Heater (ECM internal) resistance 792 - 4560 ohm
P0169	Incorrect Fuel Composition	<ul style="list-style-type: none"> Fuel quantity incorrect Fuel correction factor incorrect Internal check failed
P0171	System Too Lean (Bank 1)	At idle <ul style="list-style-type: none"> Adaptive value $>$ 5.02% At part-load <ul style="list-style-type: none"> Adaptive value $>$ 21%
P0172	System Too Rich (Bank 1)	At idle <ul style="list-style-type: none"> Adaptive value $<$ -5.02% At part-load <ul style="list-style-type: none"> Adaptive value $<$ -21%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0190	Fuel Rail Pressure Sensor Circuit	Signal voltage > 4.8 V
P0191	Fuel Rail Pressure Sensor Circuit Range/Performance	Actual pressure > 20.6 MPa
P0192	Fuel Rail Pressure Sensor A Circuit Low Input	Signal voltage < 0.2 V
P0201	Injector Circuit Open - Cylinder 1	<ul style="list-style-type: none"> • Low side signal current < 2.1 A • Internal logic failure
P0202	Injector Circuit Open - Cylinder 2	<ul style="list-style-type: none"> • Low side signal current < 2.1 A • Internal logic failure
P0203	Injector Circuit Open - Cylinder 3	<ul style="list-style-type: none"> • Low side signal current < 2.1 A • Internal logic failure
P0204	Injector Circuit Open - Cylinder 4	<ul style="list-style-type: none"> • Low side signal current < 2.1 A • Internal logic failure
P0221	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> • TPS 1 - TPS 2 > 6.30% • Actual TPS 2 calculated value > TPS 1 calculated value • TPS 2 – calc. value > 9.00%
P0222	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit Low Input	Signal voltage < 0.20 V
P0223	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit High Input	Signal voltage > 4.81 V
P0234	Turbocharger Overboost Condition	Difference of set value boost pressure vs altitude sensor signal > 260 - 1275 hPa
P0236	Turbocharger Boost Sensor Circuit Range/Performance	Difference of boost pressure signal vs. altitude sensor signal > 230 hPa or < -130 hPa
P0237	Turbocharger Boost Sensor Circuit Low	Signal voltage < 0.2 V
P0238	Turbocharger Boost Sensor Circuit High	Signal voltage > 4.88 V
P0243	Turbocharger Wastegate Solenoid Circuit	Signal voltage > 5.6 - 4.4 V
P0245	Turbocharger Wastegate Solenoid Low	Signal voltage < 3.25 - 2.15 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0246	Turbocharger Wastegate Solenoid High	Signal current > 2.2 to 4 A
P025A	Fuel Pump Module Control Circuit Open	Signal voltage 4.40 - 5.60 V
P025C	Fuel Pump Module Control Circuit Low	Signal voltage 2.15 - 3.25 V
P025D	Fuel Pump Module Control Circuit High	Signal current > 1.10 A
P0261	Cylinder 1 Injector Circuit Low	Signal current < 2.1 A
P0262	Cylinder 1 Injector Circuit High	Signal current > 14.70 A
P0264	Cylinder 2 Injector Circuit Low	Signal current < 2.1 A
P0265	Cylinder 2 Injector Circuit High	Signal current > 14.70 A
P0267	Cylinder 3 Injector Circuit Low	Signal current < 2.1 A
P0268	Cylinder 3 Injector Circuit High	Signal current > 14.70 A
P0270	Cylinder 4 Injector Circuit Low	Signal current < 2.1 A
P0271	Cylinder 4 Injector Circuit High	Signal current > 14.70 A
P0299	Turbocharger Underboost	Difference of set boost pressure vs actual boost pressure value > 150 hPa
P2008	Intake Manifold Runner Control Circuit Open	Signal voltage 4.70 - 5.40 V
P2009	Intake Manifold Runner Control Circuit Low	Signal voltage 0 to 3.26 V
P2010	Intake Manifold Runner Control Circuit High	Signal current > 2.20 A
P2014	Intake Manifold Runner Position Sensor Circuit	Signal voltage > 4.75 V
P2015	Intake Manifold Runner Position Sensor Circuit Range/Performance	<ul style="list-style-type: none"> • Deviation runner flap target position vs actual position > 25% • Actual position 0 to 100%
P2016	Intake Manifold Runner Position Sensor Circuit Low	Signal voltage < 0.25 V
P2088	A Camshaft Position Actuator Control Circuit Low	Signal voltage 0 - 3.25 V
P2089	A Camshaft Position Actuator Control Circuit High	Signal current > 2.2 A
P2096	Post Catalyst Fuel Trim System Too Lean	Deviation lambda control < -0.03

DTC	Error Message	Malfunction Criteria and Threshold Value
P2097	Post-Catalyst Fuel Trim System Too Rich	Integral part of lambda control > 0.03%
P3081	Engine Temperature Too Low	Difference between ECT and modeled ECT > 10° K

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random Misfire Detected	<ul style="list-style-type: none"> • Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%
P0301	Cylinder 1 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%
P0302	Cylinder 2 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR) > 5.0 - 20.0%
P0303	Cylinder 3 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%
P0304	Cylinder 4 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%
P0321	Engine Speed Input Circuit Performance	<ul style="list-style-type: none"> • Comparison of counted teeth vs. reference = incorrect • Monitoring reference gap failure
P0322	Engine Speed Input Circuit No Signal	<ul style="list-style-type: none"> • Camshaft signal > 3 • Engine speed, no signal
P0324	Knock Control System Error	<ul style="list-style-type: none"> • Signal fault counter (combustion) > 24 or • Signal fault counter (measuring window) > 2.00
P0327	Knock Sensor 1 Circuit Low	<ul style="list-style-type: none"> • Lower threshold < -0.70 V or for signal range check • Lower threshold < 0 - 1.60 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0328	Knock Sensor 1 Circuit High	<ul style="list-style-type: none"> • Upper threshold > 1.00 V or for signal range check • > 15 - 115.87 V
P0340	Camshaft Position Sensor Circuit	Cam adaption values out of range <ul style="list-style-type: none"> • > 20° KW • < -20° KW • Difference of adapted and actual values > 9° KW
P0341	Camshaft Position Sensor Circuit Performance	Signal pattern incorrect <ul style="list-style-type: none"> • Defect counter 12
P0342	Camshaft Position Sensor Circuit Low	<ul style="list-style-type: none"> • Signal voltage low • Crankshaft signals = 8
P0343	Camshaft Position Sensor Circuit High	<ul style="list-style-type: none"> • Signal voltage high • Crankshaft signals = 8
P0351	Ignition Coil A Primary Circuit	<ul style="list-style-type: none"> • Signal current < -0.25 to 2.0 mA • Internal check failed
P0352	Ignition Coil B Primary Circuit	<ul style="list-style-type: none"> • Signal current 0.25 to -2.0 mA • Internal check failed
P0353	Ignition Coil C Primary Circuit	<ul style="list-style-type: none"> • Signal current 0.25 to -2.0 mA • Internal check failed
P0354	Ignition Coil D Primary Circuit	<ul style="list-style-type: none"> • Signal current < -0.25 to 2.0 mA • Internal check failed

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0410	Secondary Air Injection System	Deviation SAI pressure sensor > 50.0 hPa
P0413	Secondary Air Injection System Switching Valve Circuit Open	Signal voltage 4.70 - 5.40 V
P0414	Secondary Air Injection System Switching Valve Circuit Low	<ul style="list-style-type: none"> • Signal voltage 0 to 3.25 V or • Signal current > 2.20 A
P0418	Secondary Air Injection System Control Circuit	Signal voltage 4.70 - 5.40 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0420	Catalyst System Efficiency Below Threshold	Front: <ul style="list-style-type: none"> • Oxygen storage capacity (OSC) vs OSC of borderline catalyst < 1.00 • Front catalyst < 1.50 • Main catalyst < 1.00 Main: <ul style="list-style-type: none"> • Oxygen storage capacity (OSC) vs OSC of borderline catalyst < 0.40 • Front catalyst < .90 • While value for front catalyst < 2.00
P0441	Evaporative Emission System Incorrect Purge Flow	Deviation < 8% lambda controller and 35% idle controller
P0442	Evaporative Emission System Leak Detected (Small Leak)	Time for pressure drop < 1.6 - 1.8 Sec.
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal voltage > 4.70 - 5.40 V
P0455	Evaporative Emission System Leak Detected (Gross Leak/ No Flow)	Time for pressure drop < 1 Sec.
P0456	Evaporative Emission System Leak Detected (Very Small Leak)	Time for pressure drop, < 4.5 - 6.0 Sec.
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage 0 - 3.26 V
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.2 A
P0491	Secondary Air System Insufficient Flow	SAI pressure sensor vs modeled pressure < 60 to 75%

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor A Range/Performance	VSS signal < 6 km/h

DTC	Error Message	Malfunction Criteria and Threshold Value
P0503	Vehicle Speed Sensor Intermittent/Erratic/High	Vehicle speed > 290 km/h
P0506	Idle Air Control System RPM Lower Than Expected	Integrated engine speed deviation > 2000 RPM OR engine speed deviation > 80 RPM
P0507	Idle Air Control System - RPM Higher Than Expected	Idle speed Deviation < -80 RPM
P050A	Cold Start Idle Air Control System Performance	Out of range low: • Engine speed deviation < -80 RPM Out of range high: • Engine speed deviation > 80 RPM
P050B	Cold Start Ignition Timing Performance	Difference between commanded spark timing vs. actual value > 20%
P052A	Cold Start Camshaft Position Timing Over-Advanced	Difference between target and actual position > 6 CRK °
P053F	Id Start Fuel Pressure Performance	• Difference between target pressure vs actual pressure: > 1.50 or • < -1.50 MPa

Control Module and Output Signals

DTC	Error Message	Malfunction Criteria and Threshold Value
P0606	ECM Processor Fault	ECM internal check failure or BARO failure (located in the ECM).
P062B	Internal Control Module Fuel Injector Control Performance	Internal logic failure
P0634	Throttle Actuator Control Range/Performance	Power stage temperature > 150 °C
P0638	Throttle Actuator Control Range/Performance	• Time to close to reference point > 0.6 Sec. and • Reference point 2.88% • TPS 1 signal 0.40 - 0.60 V • TPS 2 signal 4.20 - 4.60 V • TPS 1 and TPS 2 4.82 - 5.18 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0641	Sensor Reference Voltage A Circuit Open	Signal voltage deviation > ± 0.3 V
P0651	Sensor Reference Voltage B Circuit Open	Signal voltage deviation > ± 0.3 V
P0657	Actuator Supply Voltage A Circuit Open	Signal voltage > 4.4 - 5.6 V
P0658	Actuator Supply Voltage A Circuit Low	Signal voltage < 2.15 - 3.25 V
P0659	Actuator Supply Voltage Circuit High	Signal current > 1.1 A
P0697	Sensor Reference Voltage Circuit Open	Signal voltage deviation > ± 0.3 V
P0698	Sensor Reference Voltage C Circuit Low	Signal voltage < 4.6 - 5.0 V
P0699	Sensor Reference Voltage C Circuit High	5V supply voltage > 4.99 - 5.41 V
P1609	Crash Detected - Airbag Deployed	Airbags activated
P062B	Injection Valves Communication	Internal logic failure
U0001	High Speed CAN Communication Bus	CAN message, no feedback
U0002	High Speed CAN Communication Bus	Global Time Out failure
U0101	Lost Communication with TCM	Time Out failure. No message received by ECM
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	CAN communication with ABS Time Out - no message
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	No CAN messages received
U0302	Software Incompatibility with Transmission Control Module	AT vehicle ECM coded as MT vehicle
U0402	Invalid Data Received From Gear Shift Control Module A	Transmission Data implausible message
U0415	CAN Communication With ABS Error	<ul style="list-style-type: none"> • Speed sensor initialization failed • Speed sensor low voltage error failed • Implausible message received

DTC	Error Message	Malfunction Criteria and Threshold Value
U0422	Invalid Data Received From Body Control Module (IPC)	Ambient temperature value initialization failure.
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	Implausible CAN message received OR ambient temperature value = 00
U0447	Lost Communication With Gateway	CAN message implausible

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P1117	Bank 1 Sensor 2 Control Limit Reached	1 portion of 3rd lambda control loop > 0.030
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	<ul style="list-style-type: none"> • Pressure control activity > 0.25 MPa • Fuel trim activity < 0.80 • Difference between actual pressure vs target pressure -16.38 to 16.38 MPa
P12A2	Fuel Rail Pressure Sensor Inappropriately High	<ul style="list-style-type: none"> • Pressure control activity < -0.05 MPa • Fuel trim activity > 1.65 • Difference between target pressure and actual pressure -16.38 to 16.38 MPa
P12A4	Fuel Rail Pump Control Valve Stuck Closed	<ul style="list-style-type: none"> • Fuel trim activity .90 to 1.15 • Pressure control activity < -6 MPa • System Deviation < 16.38 MPa
P13EA	Cold Start Ignition Timing Performance Off Idle	Difference between commanded spark timing vs. actual value > 40%
P150A	Engine Off Time Performance	Difference between engine off time and ECM after run time < -12 Sec. or > 12 Sec.
P2101	Throttle Actuator Control Motor Circuit Range/ Performance	<ul style="list-style-type: none"> • Duty cycle >80% • Deviation throttle value angles vs. calculated value 4 - 50% • ECM power stage no failure
P2106	Throttle Actuator Control System - Forced Limited Power	Internal check failed

DTC	Error Message	Malfunction Criteria and Threshold Value
P2122	APP Sensor 1/APP Sensor 2 Circuit D Low Input	Signal voltage < 0.61 V
P2123	APP Sensor 1/APP Sensor 2 Circuit D High Input	Signal voltage > 4.79 V
P2127	APP Sensor 1/APP Sensor 2 Circuit E Low Input	Signal voltage < 0.27 V
P2128	APP Sensor 1/APP Sensor 2 Circuit E High Input	Signal voltage > 2.43 V
P2138	APP Sensor 1/APP Sensor 2 Circuit D/E Voltage Correlation	Signal voltage: Difference between signal APP1 and APP2 > 0.17 - 0.70 V
P2146	Fuel Injector Group A Supply Voltage Circuit Open	<ul style="list-style-type: none"> • Signal current, < 2.6 A or • Signal current > 14.90 A
P2149	Fuel Injector Group B Supply Voltage Circuit Open	<ul style="list-style-type: none"> • Signal current, < 2.6 A or • Signal current > 14.90 A
P2177	System Too Lean Off Idle	Adaptive value > 28%
P2178	System Too Rich Off Idle	Adaptive value < -21%
P2181	Cooling System Performance	Cooling system temperature too low after a sufficient mass air flow integral 74 - 84 °C
P2184	Engine Coolant Temperature Sensor 2 Circuit Low	ECT outlet > 141 °C
P2185	Engine Coolant Temperature Sensor 2 Circuit High	ECT outlet < -43 °C
P2187	System Too Lean At Idle	Adaptive value > 5.02%
P2188	System Too Rich At Idle	Adaptive value < -5.02%
P2195	O2 Sensor Signal Biased/ Stuck Lean (Bank 1, Sensor 1)	Delta lambda of 2nd lambda control loop > 0.07
P2196	O2 Sensor Signal Biased/ Stuck Rich (Bank 1, Sensor 1)	Delta lambda of 2nd lambda control loop > 0.07
P2231	O2 Sensor Signal Circuit Shorted to Heater Circuit	Delta O2S signal front > 190 uA
P2237	O2 Sensor Positive Current Control Circuit Open (Bank 1, Sensor 1)	<ul style="list-style-type: none"> • O2S signal front 1.49 - 1.51 V • Delta lambda controller > 0.10

DTC	Error Message	Malfunction Criteria and Threshold Value
P2243	O2 Sensor Reference Voltage Circuit/Open (Bank 1, Sensor 1)	<ul style="list-style-type: none"> • O2S signal front > 3.25 V and Internal resistance > 1000 Ohm • O2S signal front < 0.30 V and Internal resistance > 1000 Ohm
P2251	O2 Sensor Negative Current Control Circuit Open Bank 1 Sensor 1	<ul style="list-style-type: none"> • O2S signal front 1.47 to 1.53 V and internal resistance > 1000 Ohm
P2257	Secondary Air Injection System Control Circuit Low	Signal voltage 0 to 3.26 V
P2258	Secondary Air Injection System Control Circuit High	Signal current .60 - 2.40 A
P2270	O2 Sensor Signal Stuck Lean Bank 1 Sensor 2	<ul style="list-style-type: none"> • O2S signal rear < -2.00 mV • Enrichment after stuck lean 27.9%
P2271	O2 Sensor Signal Stuck Rich (Bank 1, Sensor 2)	<ul style="list-style-type: none"> • Sensor voltage of ≥ 0.15 V • After oxygen mass flow > 3000 mg • Number of checks ≥ 1
P2274	O2 Sensor Signal Stuck Lean Bank 1 Sensor 3	<ul style="list-style-type: none"> • O2S rear signal not oscillating at reference < 0.62 to 0.65 V • Enrichment after stuck lean 27.9%
P2275	O2 Sensor Signal Stuck Rich Bank 1 Sensor 3	<ul style="list-style-type: none"> • O2S sensor voltage ≥ 0.15 V • After oxygen mass flow (fuel cutoff) > 4500 mg • Number of checks ≥ 1
P2279	Intake Air System Leak	<ul style="list-style-type: none"> • Threshold to detect a defective system > 1.33 - 1.60
P2293	Fuel Pressure Regulator 2 Performance	<ul style="list-style-type: none"> • Difference between target pressure vs. actual pressure: > 1.50 mPa or • < -1.50 mPa
P2294	Fuel Pressure Regulator 2 Control Circuit	<ul style="list-style-type: none"> • Signal voltage 1.40 - 3.20 V or • Signal pattern incorrect
P2295	Fuel Pressure Regulator 2 Control Circuit Low	Signal voltage < 1.40 - 3.20 V
P2296	Fuel Pressure Regulator 2 Control Circuit High	Signal voltage > 3.20 V

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P2300	Ignition Coil A Primary Control Circuit Low	Signal current > 24.0 mA
P2301	Ignition Coil A Primary Control Circuit High	Signal current > 5.1 - 7.0 mA
P2303	Ignition Coil B Primary Control Circuit Low	Signal current > 24.0 mA
P2304	Ignition Coil B Primary Control Circuit High	Signal current > 5.1 - 7.0 mA
P2306	Ignition Coil C Primary Control Circuit Low	Signal current > 24.0 mA
P2307	Ignition Coil C Primary Control Circuit High	Signal voltage > 5.1 - 7.0 mA
P2309	Ignition Coil D Primary Control Circuit Low	Signal current > 24.0 mA
P2310	Ignition Coil D Primary Control Circuit High	Signal voltage > 5.1 - 7.0 mA

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/Open	Signal voltage > 4.4 - 5.6 V
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	Signal voltage < 2.15 to 3.25 V
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	Signal current > 3.0 A
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit Open	Low signal voltage > 0.5 Sec.
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	<ul style="list-style-type: none"> • High signal voltage > 12 Sec. • Number of checks = 30
P2414	O2 Sensor Exhaust Sample Error (Bank 1, Sensor 1)	Threshold 1 • Signal voltage 3.1 - 4.81 V Threshold 2 • O2S signal 2.5 - 3.2 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2431	Secondary Air Injection Sensor Performance	Difference between SAI pressure sensor and ambient pressure NOT -60.0 to 60.0 hPa
P2432	Secondary Air Injection Sensor Circuit Low	Signal voltage < 0.40 V
P2433	Secondary Air Injection Sensor Circuit High	Signal voltage > 4.65 V
P2440	Secondary Air Injection System Switching Valve Stuck Open	SAI pressure sensor vs modeled while SAI valve is closed < 71.1%
P2626	O2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	O2S signal front > 4.81 V

DTC CHART

Engine Codes CCTA

Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Intake Camshaft Position Slow Response	Signal change < 1.9 - 4.2 CRK °/ sec.
P0010	Intake Camshaft Position Actuator Circuit Open	Signal voltage, > 4.70 - 5.40 V
P0011	Intake Camshaft Position Timing - Over-Advanced	Adjustment angle > 6.8 - 8 CRK °
P0016	Crankshaft Position vs. Camshaft Position Correlation	<ul style="list-style-type: none"> • Permissible deviation < 11° rev or • Permissible deviation > 11° rev
P025A	Fuel Pump Module Control Circuit Open	Signal voltage 4.40 - 5.60 V
P025C	Fuel Pump Module Control Circuit Low	Signal voltage 2.15 - 3.25 V
P025D	Fuel Pump Module Control Circuit High	Signal current > 1.10 A
P0030	HO2S Heater Control Circuit Bank 1 Sensor 1	Heater voltage 4.70 to 5.40 V
P0031	HO2S Heater Control Circuit Low Bank 1 Sensor 1	Heater voltage 0 to 3.26 V
P0032	HO2S Heater Control Circuit High Bank 1 Sensor 1	Heater current > 5.50 A
P0036	HO2S Heater Control Circuit Bank 1 Sensor 2	Heater voltage 2.34 to 3.59 V
P0037	HO2S Heater Control Circuit Low Bank 1 Sensor 2	Heater voltage < 2.34 V
P0038	HO2S Heater Control Circuit High Bank 1 Sensor 2	Heater voltage > 3.59 V
P0068	MAF vs Throttle Position Correlation	Plausibility with fuel system <ul style="list-style-type: none"> • Load calculation < -22% Plausibility with fuel system • Load calculation > 22%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0070	Ambient Air Temperature Sensor Circuit	Ambient air temperature < -50 °C
P0071	Ambient Air Temperature Sensor Performance	<ul style="list-style-type: none"> • Difference in value between ECT and AAT at engine start (depending on engine off time) > 25 - 40 °K and <ul style="list-style-type: none"> • Difference in value between AAT and IAT at engine start (depending on engine off time) > 25 - 40 °K
P0072	Ambient Air Temperature Sensor Circuit Low	Ambient air temperature > 87 °C
P0087	Fuel Rail/System Pressure - Too Low	<ul style="list-style-type: none"> • Fuel trim activity 0.90 - 1.15 • Output value rail pressure controller > 2 MPa • Difference between target and actual pressure > -16.4
P0100	Mass Air Flow Circuit Faultt	MAF sensor signal 0 µs
P0101	Mass Air Flow Circuit Performance	Mass air flow vs. <ul style="list-style-type: none"> • Upper threshold model < 12% • Lower threshold model < 12% • Load calculation > 21% • Fuel system < -19%
P0102	Mass Air Flow Circuit Low Input	MAF sensor signal < 66 µs
P0103	Mass Air Flow Circuit High Input	MAF sensor signal > 4500 µs
P0106	Manifold Absolute Pressure/ Barometric Pressure Circuit Performance	<ul style="list-style-type: none"> • Difference of boost pressure signal vs altitude sensor signal > 230 hPa or <ul style="list-style-type: none"> • Difference of boost pressure signal vs altitude sensor signal < -130 hPa
P0111	Intake Air Temperature Sensor Circuit Performance	<ul style="list-style-type: none"> • Difference in value IAT - ECT @ engine start (depending on engine off time) > 25 - 40 °K • Difference in value IAT - AAT @ engine start < 25 - 40 °K (depending on engine off time)

DTC	Error Message	Malfunction Criteria and Threshold Value
P0112	Intake Air Temperature Sensor Circuit Low Input	IAT > 141.0 °C
P0113	Intake Air Temperature Sensor 1 Circuit High Input	IAT < -46 °C
P0116	Engine Coolant Temperature Sensor 1 Circuit Performance	<ul style="list-style-type: none"> • No change on signal < 1.5 °K or • Signal in range 88.5 - 109.5 °C with no change on signal 1.5 °K
P0117	Engine Coolant Temperature Sensor 1 Circuit Low Input	ECT >140 °C
P0118	Engine Coolant Temperature Sensor 1 Circuit High Input	ECT < -40 °C
P0121	Pedal Position Sensor A Circuit Performance	<ul style="list-style-type: none"> • TPS 1 - TPS 2 > 6.30% • Actual TPS 1 calculated value > TPS 2 calculated value • TPS 1 calc. value > 9.00%
P0122	Pedal Position Sensor A Circuit Low Input	Signal voltage < 0.20 V
P0123	Pedal Position Sensor A Circuit High Input	Signal voltage > 4.81 V
P013A	O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	EWMA filtered max differential transient time at fuel cutoff >= 0.5 Sec. for 3 function checks
P0130	O2 Sensor Circuit Bank 1 Sensor 1	O2S ceramic temperature < 640°C
P0131	O2 Sensor Circuit, Bank 1 - Sensor 1 Low Voltage	VM < 1.75 V
		UN < 1.50 V
		IA or IP > 0.30 V
P0132	O2 Sensor Circuit, Bank 1 - Sensor 1 High Voltage	VM > 3.25 V
		UN > 4.40 V
		IA or IP > 7.0 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0133	O2 Circuit Slow Response Bank 1 Sensor 1	Signal dynamic slope check <ul style="list-style-type: none"> • O2S signal front vs. modeled O2S signal ratio < 0.40 and > 0.01 • Cycles completed > 40 Oscillation check <ul style="list-style-type: none"> • Lambda amplitude signal > 20% • Cycles > 8 • Time lambda > lambda amplitude 400 m sec. Delay check <ul style="list-style-type: none"> • Delay modeled lambda signal minus measured signal > 460 m sec. • Cycles > 12
P0135	O2 Heater Circuit Bank 1 Sensor 1	<ul style="list-style-type: none"> • Heater duty cycle, >100% • O2S ceramic temperature, < 715 °C • Time after O2S heater on 40 Sec. • Difference between measured calibration resistance in ECM and set value > 45 ohm
P0136	O2 Circuit Bank 1 Sensor 2	<ul style="list-style-type: none"> • Delta voltage one step at heater switching > 2.0020 V • Number of checks 10
P0137	O2 Circuit Low Voltage Bank 1 Sensor 2	Cold condition <ul style="list-style-type: none"> • Signal voltage < 0.06 V for time > 3 Sec. Warm condition <ul style="list-style-type: none"> • Signal voltage < 0.01 V • Reaction at closed loop enrichment - no reaction
P0138	O2 Circuit High Voltage Bank 1 Sensor 2	Signal voltage 1.08 V for > 5 Sec.
P0139	O2 Circuit Slow Response Bank 1 Sensor 2	<ul style="list-style-type: none"> • EWMA filtered transient time at fuel cutoff > 0.4 Sec. • In voltage range of 201.2 - 401.4 mV • Number of checks, 3
P0140	O2 Circuit No Activity Detected Bank 1 Sensor 2	Signal voltag <ul style="list-style-type: none"> • Signal voltage 0.40 - 0.60 V Internal resistance <ul style="list-style-type: none"> • > 40000 ohm

DTC	Error Message	Malfunction Criteria and Threshold Value
P0141	O2 Heater Circuit Bank 1 Sensor 2	Heater resistance, 1404 - 13650 Ohm
P0169	Incorrect Fuel Composition	<ul style="list-style-type: none"> • Fuel quantity incorrect • Fuel correction factor incorrect • Internal check failed
P0171	System Too Lean Bank 1	At idle <ul style="list-style-type: none"> • Adaptive value > 5.02% At part-load <ul style="list-style-type: none"> • Adaptive value > 21%
P0172	System Too Rich Bank 1	At idle <ul style="list-style-type: none"> • Adaptive value < -5.02% At part-load <ul style="list-style-type: none"> • Adaptive value < -21%
P0190	Fuel Rail Pressure Sensor Circuit	Signal voltage > 4.8 V
P0191	Fuel Rail Pressure Sensor Circuit Performance	Actual pressure > 20.6 MPa
P0192	Fuel Rail Pressure Sensor Circuit Low	Signal voltage < 0.2 V
P0201	Injector Circuit Open Cylinder 1	<ul style="list-style-type: none"> • Low side signal current < 2.1 A • Internal logic failure
P0202	Injector Circuit Open Cylinder 2	<ul style="list-style-type: none"> • Low side signal current < 2.1 A • Internal logic failure
P0203	Injector Circuit Open Cylinder 3	<ul style="list-style-type: none"> • Low side signal current < 2.1 A • Internal logic failure
P0204	Injector Circuit Open Cylinder 4	<ul style="list-style-type: none"> • Low side signal current < 2.1 A • Internal logic failure
P0221	Pedal Position Sensor Circuit Performance	<ul style="list-style-type: none"> • TPS 1 - TPS 2 > 6.30% • Actual TPS 2 calculated value > TPS 1 calculated value • TPS 2 – calc. value > 9.00%
P0222	Pedal Position Sensor Circuit Low Input	Signal voltage < 0.20 V
P0223	Pedal Position Sensor Circuit High Input	Signal voltage > 4.81 V
P0234	Turbocharger Overboost Condition	Difference of set value boost pressure vs altitude sensor signal > 200 - 1275 hPa
P0236	Turbocharger Boost Sensor Circuit Performance	Difference of boost pressure signal vs altitude sensor signal > 230 or < -130 hPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P0237	Turbocharger Boost Sensor Circuit Low	Signal voltage < 0.2 V
P0238	Turbocharger Boost Sensor Circuit High	Signal voltage > 4.88 V
P0243	Turbocharger Wastegate Solenoid Circuit Performance	Signal voltage > 5.6 - 4.4 V
P0245	Turbocharger Wastegate Solenoid Low	Signal voltage < 3.25 - 2.15 V
P0246	Turbocharger Wastegate Solenoid High	Signal current > 2.2 A
P0261	Cylinder 1 Injector Circuit Low	Signal current < 2.1 A
P0262	Cylinder 1 Injector Circuit High	Signal current > 14.70 A
P0264	Cylinder 2 Injector Circuit Low	Signal current < 2.1 A
P0265	Cylinder 2 Injector Circuit High	Signal current > 14.70 A
P0267	Cylinder 3 Injector Circuit Low	Signal current < 2.1 A
P0268	Cylinder 3 Injector Circuit High	Signal current > 14.70 A
P0270	Cylinder 4 Injector Circuit Low	Low side signal current < 2.1 A
P0271	Cylinder 4 Injector Circuit High	Signal current > 14.70 A
P0299	Turbocharger Underboost	Difference of set boost pressure vs. actual boost pressure value > 150 hPa
P2008	Intake Manifold Runner Control Circuit Open	Signal voltage 4.70 - 5.40 V
P2009	Intake Manifold Runner Control Circuit Low	Signal voltage 0.0 to 3.25 V
P2010	Intake Manifold Runner Control Circuit High	Signal current > 2.20 A
P2014	Intake Manifold Runner Position Sensor Circuit	Signal voltage > 4.75 V
P2015	Intake Manifold Runner Position Sensor Circuit Performance	Deviation runner flap target position vs actual position > 25%
P2016	Intake Manifold Runner Position Sensor Circuit Low	Signal voltage < 0.25 V
P2088	A Camshaft Position Actuator Control Circuit Low	Signal voltage, < 0.0 - 3.25 V
P2089	A Camshaft Position Actuator Control Circuit High	Signal current > 2.2 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P2096	Post Catalyst Fuel Trim System Too Lean	Deviation lambda control < -0.04
P2097	Post Catalyst Fuel Trim System Too Rich	Integral part of lambda control > 0.04
P3081	Engine Temperature Too Low	Difference between ECT and modeled ECT > 9.80 °K

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random Misfire Detected	<ul style="list-style-type: none"> • Emission threshold 1st interval Misfire Rate (MR), > 3% • Catalyst damage misfire rate (MR), > 2% - 15%
P0301	Cylinder 1 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold 1st interval Misfire Rate (MR), > 3% • Catalyst damage misfire rate (MR), > 2% - 15%
P0302	Cylinder 2 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold 1st interval Misfire Rate (MR), > 3% • Catalyst damage misfire rate (MR), > 2% - 15%
P0303	Cylinder 3 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold 1st interval Misfire Rate (MR), > 3% • Catalyst damage misfire rate (MR), > 2% - 15%
P0304	Cylinder 4 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold 1st interval Misfire Rate (MR), > 3% • Catalyst damage misfire rate (MR), > 2% - 15%
P0321	Engine Speed Input Circuit Performance	<ul style="list-style-type: none"> • Comparison of counted teeth vs. reference = incorrect • Monitoring reference gap failure
P0322	Engine Speed Input Circuit No Signal	<ul style="list-style-type: none"> • Camshaft signal > 3 • Engine speed, no signal
P0324	Knock Control System Error	<ul style="list-style-type: none"> • Signal fault counter (combustion) > 24 or • Signal fault counter (measuring window) > 2.00

DTC	Error Message	Malfunction Criteria and Threshold Value
P0327	Knock Sensor 1 Circuit Low Input	<ul style="list-style-type: none"> • Lower threshold < 70 V or for signal range check • Lower threshold < 0 - 2.1582 V
P0328	Knock Sensor 1 Circuit High Input	<ul style="list-style-type: none"> • Upper threshold > 1.00 V or for signal range check • > 29.0674 - 114.9023 V
P0340	Camshaft Position Sensor Circuit	Cam adaption values out of range <ul style="list-style-type: none"> • > 20° KW • < -20° KW • Difference of adapted and actual values > 9° KW
P0341	Camshaft Position Sensor Circuit Performance	Signal pattern incorrect
P0342	Camshaft Position Sensor Circuit Low Input	<ul style="list-style-type: none"> • Signal voltage low • Crankshaft signals = 8
P0343	Camshaft Position Sensor Circuit High Input	<ul style="list-style-type: none"> • Signal voltage high • Crankshaft signals = 8
P0351	Ignition Coil A Primary/ Secondary Circuit	<ul style="list-style-type: none"> • Signal current < -0.25 to 2.0 mA • Internal check failed
P0352	Ignition Coil B Primary/ Secondary Circuit	<ul style="list-style-type: none"> • Signal current < -0.25 to 2.0 mA • Internal check failed
P0353	Ignition Coil C Primary/ Secondary Circuit	<ul style="list-style-type: none"> • Signal current < -0.25 to 2.0 mA • Internal check failed
P0354	Ignition Coil D Primary/ Secondary Circuit	<ul style="list-style-type: none"> • Signal current < -0.25 to 2.0 mA • Internal check failed

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0442	Evaporative Emission System Leak Detected (Small Leak)	Time for pressure drop < 1.55 - 1.75 Sec.
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal voltage > 4.70 - 5.40 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0455	Evaporative Emission System Leak Detected (Gross Leak/ No Flow)	Time for pressure drop < 0.95 Sec.
P0456	Evaporative Emission System Leak Detected (Very Small Leak)	Time for pressure drop, < 4.5 - 6.0 Sec.
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage 0.00 - 3.25 V
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.2 A

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor Range/ Performance	VSS signal < 4 km/h
P0503	Vehicle Speed Sensor Intermittent/Erratic/High	Vehicle speed > 290 km/h
P0506	Idle Air Control System RPM Lower Than Expected	Idle speed Deviation > 80 RPM
P0507	Idle Air Control System RPM Higher Than Expected	• Idle speed Deviation < -80 RPM
P050A	Cold Start Idle Air Control System Performance	Out of range low • Engine speed deviation < -80 RPM • Engine speed deviation > 80 RPM
P050B	Cold Start Ignition Timing Performance	Difference between commanded spark timing and actual spark timing > 20 to 50%
P052A	Cold Start Camshaft Position Timing Over-Advanced	Difference between target position vs actual position: > 6 °CRK
P053F	Cold Start Fuel Pressure Performance	Difference between target pressure vs actual pressure: > 1.50 MPa OR < -1.50 MPa

Control Module and Output Signals

DTC	Error Message	Malfunction Criteria and Threshold Value
P062B	Internal Control Module Fuel Injector Control Performance	Internal logic failure
P0606	ECM Processor Fault	ECM internal check failure
P0634	ECM Internal Temperature Too High	Power stage temperature > 150 °C
P0638	Throttle Actuator Control Performance	<ul style="list-style-type: none"> • Time to close to reference point > 0.56 Sec. and • Reference point 2.88% • Time to close below reference point, + 2.49%, > 0.56 Sec. • Duty cycle > 80% • ECM power stage no failure
P0641	Sensor Reference Voltage A Circuit	Signal voltage deviation > ± 0.3 V
P0642	Sensor Reference Voltage A Circuit Low	Signal voltage < 4.6 - 5.0 V
P0651	Sensor Reference Voltage B Circuit	Signal voltage deviation > +/- 0.3 V
P0657	Actuator Supply Voltage A Circuit Open	Signal voltage > 4.4 - 5.6 V
P0658	Actuator Supply Voltage A Circuit Low	Signal voltage < 2.15 - 3.25 V
P0659	Actuator Supply Voltage A Circuit High	Signal current > 1.1 A
P0697	Sensor Reference Voltage C Circuit Open	Signal voltage deviation > ± 0.3 V
P0698	Sensor Reference Voltage C Circuit Low	Signal voltage < 4.6 - 5.0 V
P0699	Sensor Reference Voltage C Circuit High	5V supply voltage > 4.99 - 5.41 V
P1609	Crash Fuel Shut-Off Was Deployed	Airbag activated
P169A	Transport Mode Active	Transport mode active
P062B	Injection Valves Communication	Internal logic failure

DTC	Error Message	Malfunction Criteria and Threshold Value
U0001	High Speed CAN Communication Bus	Bus Off failure
U0002	High Speed CAN Communication Bus Performance	Global Time Out failure
U0101	Lost Communication with TCM	Time Out failure. No message received by ECM
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	CAN communication with ABS Time Out.
U0146	Lost Communication With Gateway A	CAN communication with gateway Time Out
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	CAN messages not received.
U0302	Software Incompatibility with Transmission Control Module	AT vehicle. ECM coded as MT vehicle
U0402	Invalid Data Received From TCM	Transmission Data Length Code incorrect
U0415	CAN link to speed sensor	<ul style="list-style-type: none"> • Speed sensor initialization failed • Speed sensor low voltage error failed • Speed sensor error failed
U0422	Invalid Data Received From Body Control Module (Cluster)	Ambient temperature value initialization failure.
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	Implausible Ambient Air Temperature Sensor value message received from IPC
U0447	Lost Communication With Gateway	CAN message incorrect

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	<ul style="list-style-type: none"> • Pressure control activity > 2.50 MPa • Fuel trim activity < 0.80 • Difference between actual pressure vs target pressure -16.38 to 16.38 MPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P12A2	Fuel Rail Pressure Sensor Inappropriately High	<ul style="list-style-type: none"> • Pressure control activity < -0.05 MPa • Fuel trim activity > 1.65 • Difference between target pressure and actual pressure -16.38 to 16.38 MPa
P12A4	Fuel Rail Pump Control Valve Stuck Closed	<ul style="list-style-type: none"> • Fuel trim activity .90 to 1.15 • Pressure control activity < -6 MPa • System Deviation < 16.38 MPa
P2101	Throttle Actuator Control Motor Circuit Performance	<ul style="list-style-type: none"> • Duty cycle >80% • Deviation throttle value angles vs. calculated value 4 - 50% • ECM power stage no failure
P2106	Throttle Actuator Control System Forced Limited Power	Internal check failed
P2122	Pedal Position Sensor D Circuit Low Input	Signal voltage < 0.61 V
P2123	Pedal Position Sensor D Circuit High Input	Signal voltage > 4.79 V
P2127	Pedal Position Sensor E Circuit Low Input	Signal voltage < 0.27 V
P2128	Pedal Position Sensor E Circuit High Input	Signal voltage > 2.43 V
P2138	Pedal Position Sensor D / E Voltage Correlation	Signal voltage: Difference between signal APP1 and APP2 > 0.17 - 0.70 V
P2146	Fuel Injector A Supply Voltage Circuit Open	<ul style="list-style-type: none"> • Signal current, < 2.6 A or • Signal current > 14.90 A
P2149	Fuel Injector B Supply Voltage Circuit Open	<ul style="list-style-type: none"> • Signal current, < 2.6 A or • Signal current > 14.70 A
P2177	System Too Lean Off Idle	Adaptive value > 28%
P2178	System Too Rich Off Idle	Adaptive value < -21%
P2181	Cooling System Performance	Cooling system temperature too low after a sufficient mass air flow integral 74 - 84 °C
P2184	Engine Coolant Temperature Sensor 2 Circuit Low	ECT outlet > 141 °C
P2185	Engine Coolant Temperature Sensor 2 Circuit High	ECT outlet < -43 °C

DTC	Error Message	Malfunction Criteria and Threshold Value
P2187	Fuel System Too Lean At Idle	Adaptation value > 5.02%
P2188	Fuel System Too Rich At Idle	Adaptation value < -5.02%
P2195	O2 Sensor Signal Biased/ Stuck Lean Bank 1, Sensor 1	Delta lambda of 2nd lambda control loop > 0.06
P2196	O2 Sensor Signal Biased/ Stuck Rich - Bank 1, Sensor 1	Delta lambda of 2nd lambda control loop < -0.06
P2231	O2 Sensor Bank 1 Sensor 1 Signal Circuit Shorted to Heater Circuit	Delta O2S signal front > 190 uA
P2237	O2 Sensor Positive Current Control Circuit Open Bank 1, Sensor 1	<ul style="list-style-type: none"> • O2S signal front 1.493 - 1.507 V or • O2S signal front < 1.7002 V • Fuel cutoff < 3 sec. or • O2S signal front 1.50 - 1.51 V • Delta lambda controller > 0.10
P2243	O2 Sensor Reference Voltage Circuit Open Bank 1, Sensor 1	<ul style="list-style-type: none"> • O2S signal front < 0.30 V and Internal resistance > 1000 Ohm • O2S signal front > 3.25 V and Internal resistance > 1000 Ohm
P2270	O2 Sensor Signal Stuck Lean Bank 1 Sensor 2	<ul style="list-style-type: none"> • O2S signal rear < 0.63 - 0.64 V • Enrichment after stuck lean 27.90%
P2271	O2 Sensor Signal Stuck Rich Bank 1 Sensor 2	<ul style="list-style-type: none"> • O2S signal rear > 0.63 - 0.64 V • Enleanment after stuck rich 14.99%
P2279	Intake Air System Leak	Threshold to detect a defective system > 1.33 - 1.60
P2293	Fuel Pressure Regulator 2 Performance	<ul style="list-style-type: none"> • Difference between target pressure vs. actual pressure: > 1.50 mPa or • < -1.50 mPa
P2294	Fuel Pressure Regulator 2 Control Circuit	<ul style="list-style-type: none"> • Signal voltage 1.40 - 3.20 V or • Signal pattern incorrect
P2295	Fuel Pressure Regulator 2 Control Circuit Low	Signal voltage < 1.40 - 3.20 V
P2296	Fuel Pressure Regulator 2 Control Circuit High	Signal voltage > 3.20 V

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P2300	Ignition Coil A Primary Control Circuit Low	Signal current > 24.0 mA
P2301	Ignition Coil A Primary Control Circuit High	Signal current > 5.1 - 7.0 mA
P2303	Ignition Coil B Primary Control Circuit Low	Signal current > 24.0 mA
P2304	Ignition Coil B Primary Control Circuit High	Signal current > 5.1 - 7.0 mA
P2306	Ignition Coil C Primary Control Circuit Low	Signal current > 24.0 mA
P2307	Ignition Coil C Primary Control Circuit High	Signal voltage > 5.1 - 7.0 mA
P2309	Ignition Coil D Primary Control Circuit Low	Signal current > 24.0 mA
P2310	Ignition Coil D Primary Control Circuit High	Signal voltage > 5.1 - 7.0 mA

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/Open	Signal voltage > 4.7 - 5.4 V
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	Signal voltage > 2.74 - 3.26 V
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	Signal current > 1.1 A or (for 2012) signal voltage at LDP current measuring resistor > 4.00 to 1.80 V
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit/Open	Low signal voltage > 0.5 Sec.
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	• High signal voltage > 30.4 Sec.

DTC	Error Message	Malfunction Criteria and Threshold Value
P2414	O2 Sensor Exhaust Sample Error Bank 1, Sensor 1	Threshold 1 • O2S signal 2.5 - 3.2 V Threshold 2 • Signal voltage 2.5 to 3.1 V
P2450	Evaporative Emission System Switching Valve Performance/ Stuck Open	EVAP pump current difference between reference measurement to idle \leq 3 mA
P2626	O2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	O2S signal front $>$ 4.81 V

DTC CHART

Engine Codes CNNA

Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Intake Camshaft Position Slow Response Bank 1	<ul style="list-style-type: none"> • Difference between target and actual position >12 to 40 °CRK for > 3 Sec. • Adjustment angle ≥ 3 °CRK
P000B	Exhaust Camshaft Position Slow Response Bank 1	<ul style="list-style-type: none"> • Difference between target and actual position >10 to 22 °CRK for > 2 to 3 Sec • Adjustment angle ≥ 3 °CRK
P0010	Intake Camshaft Position Actuator Circuit / Open (Bank 1)	Signal voltage, > 4.7 - 5.4 V
P0011	Intake Camshaft Position Timing - Over-Advanced (Bank 1)	<ul style="list-style-type: none"> • Difference between target and actual position >12 to 40 °CRK for > 3 Sec. • Adjustment angle < 3 °CRK
P0013	Exhaust Camshaft Position - Actuator Circuit Bank 1	Signal voltage, > 4.4 - 5.6 V
P0014	Exhaust Camshaft Position - Timing Over-Advanced or System Performance Bank 1	<ul style="list-style-type: none"> • Difference between target and actual position >10 to 22 °CRK for > 2 to 3 Sec. • Adjustment angle ≥ 3 °CRK
P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1, Sensor A)	<ul style="list-style-type: none"> • Deviation in camshaft position to crankshaft position < -11.01 degrees of crank rotation or • Deviation in camshaft position to crankshaft position > 11.01 degrees of crank rotation
P0017	Crankshaft Position – Exhaust Camshaft Position Correlation Bank 1 Sensor	<ul style="list-style-type: none"> • Deviation in crankshaft position to camshaft position < -11.01 degrees of crank rotation or • Deviation in crankshaft position to camshaft position > 11.01 degrees of crank rotation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0030	HO2S Heater Control Circuit (Bank 1, Sensor 1)	Heater voltage 4.70 - 5.40 V
P0031	HO2S Heater Control Circuit Low (Bank 1, Sensor 1)	Heater voltage 0.00 to 3.26 V
P0032	HO2S Heater Control Circuit High (Bank 1, Sensor 1)	Heater voltage > 5.50 V
P0036	HO2S Heater Control Circuit (Bank 1, Sensor 2)	Heater voltage 2.34 - 3.59 V
P0037	HO2S Heater Control Circuit Low (Bank 1, Sensor 2)	Heater voltage < 2.34 V
P0038	HO2S Heater Control Circuit High (Bank 1, Sensor 2) Short to B+	Heater voltage > 3.59 V
P0040	O2 Sensor Signals Swapped Bank 1 Sensor 1/ Bank 2 Sensor 1	Lambda controllers exceed thresholds in opposite directions > 1.20 or < 0.80
P0050	O2 Sensor Heater Control Circuit Bank 2 Sensor 1	Heater voltage 4.70 - 5.40 V
P0051	O2 Sensor Heater Control Circuit Bank 2 Sensor 1 Low	Heater voltage 0.00 to 3.26 V
P0052	O2 Sensor Heater Control Circuit Bank 2 Sensor 1 High	Heater voltage > 5.50 A
P0056	O2 Sensor Heater Control Circuit Bank 2 Sensor 2	Heater voltage 2.34 - 3.59 V
P0057	O2 Sensor Heater Control Circuit Bank 2 Sensor 2 Low	Heater voltage < 2.34 V
P0058	O2 Sensor Heater Control Circuit Bank 2 Sensor 2 High	Heater voltage > 3.59 V
P0068	MAF – Throttle Position Correlation	Plausibility with fuel system <ul style="list-style-type: none"> • Load calculation < -35% • Load calculation > 35%
P0070	Ambient Air Temperature Sensor Circuit	Ambient air temperature < -50 °C
P0071	Ambient Air Temperature Sensor Range/Performance	<ul style="list-style-type: none"> • Difference in value between ECT vs IAT at engine start (depending on engine off time) > 24.8 K and • Difference in value between AAT vs ECT at engine start (depending on engine off time) > 24.8 K

DTC	Error Message	Malfunction Criteria and Threshold Value
P0072	Ambient Air Temperature Sensor Circuit Low	Ambient air temperature > 87 °C
P008A	Low Pressure Fuel System Pressure - Too Low	Actual pressure < 40 kPa
P008B	Low Pressure Fuel System Pressure - Too High	Actual pressure > 780 kPa
P0087	Fuel Rail System Pressure - Too Low	<ul style="list-style-type: none"> • Fuel trim activity > 0.80 to 1.20 • Pressure control activity > 2.20 MPa • Difference between target vs. actual pressure > 2.20 MPa
P0089	Fuel Pressure Regulator 1 Performance	<ul style="list-style-type: none"> • Difference between target vs. actual pressure < 150 kPa or > 200 kPa • Feedback control loop < -300 or > 225 kPa
P0100	Mass Air Flow Circuit	<ul style="list-style-type: none"> • MAF sensor signal 0 μs • MAF signal temp correction < 40 mSec. • MAF signal temp correction < 40 and > 65 mSec.
P0101	Mass Air Flow Circuit Range/ Performance	<ul style="list-style-type: none"> • Air mass too low < -10 kg/h • Air mass too high > 1100 kg/h • Mass air flow vs lower threshold model < 0 to 580 kg/h • Load calculation > 20% or < -20%
P0102	Mass Air Flow Circuit Low Input	MAF sensor signal < 66 μ s
P0103	Mass Air Flow Circuit High Input	MAF sensor signal > 910 μ s
P011F	Engine Coolant Temperature 2 / Ambient Air Temperature Correlation	<ul style="list-style-type: none"> • Difference in value between ECT vs IAT at engine start (depending on engine off time) > 24.8 K and • Difference in value between AAT vs ECT at engine start (depending on engine off time) > 24.8 K

DTC	Error Message	Malfunction Criteria and Threshold Value
P0111	Intake Air Temperature Circuit Range/Performance	<ul style="list-style-type: none"> • Difference in value between ECT vs IAT at engine start (depending on engine off time) < 24.8 K and • Difference in value between AAT vs ECT at engine start (depending on engine off time) > 24.8 K
P0112	Intake Air Temperature Sensor Circuit Low Input	IAT > 130 °C
P0113	Intake Air Temperature Sensor Circuit High Input	IAT < -45.0 °C
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> • No change on signal, threshold - 1.5 K or • Signal in range 80 °C with no change on signal 1.5 K
P0117	Engine Coolant Temperature Sensor 1 Circuit Low Input	ECT >137 °C
P0118	Engine Coolant Temperature Sensor 1 Circuit High Input	ECT < -44 °C
P0121	Throttle/Pedal Position Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> • TPS 1 - TPS 2 > 5.10 to 6.30% • Actual TPS 1 calculated value > TPS 2 calculated value OR TPS 2 calculated value > 9%
P0122	Throttle/Pedal Position Sensor Circuit Low Input	Signal voltage < 0.20 V
P0123	Throttle/Pedal Position Sensor Circuit High Input	Signal voltage > 4.81 V
P013A	O2 Sensor Bank 1 Sensor 2 Slow Response - Rich to Lean	<ul style="list-style-type: none"> • EWMA filtered max differential transient time at fuel cutoff >= 5 Sec. • Number of checks >= 2
P013C	O2 Sensor Bank 2 Sensor 2 Slow Response - Rich to Lean	<ul style="list-style-type: none"> • EWMA filtered max differential transient time at fuel cutoff >= 5 Sec. • Number of checks >= 2
P0130	O2 Sensor Circuit (Bank 1, Sensor 1)	O2S ceramic temperature < 640°C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0131	O2 Sensor Circuit (Bank 1, Sensor 1) Low Voltage	Virtual mass < 1.75V
		Nernst voltage < 1.50 V
		Adjustment voltage < 0.30 V
P0132	O2 Sensor Circuit (Bank 1, Sensor 1) High Voltage	Virtual mass > 3.25 V
		Nernst voltage > 4.40 V
		Adjustment voltage > 7 V
P0133	O2 Circuit Slow Response (Bank 1, Sensor 1)	<ul style="list-style-type: none"> • O2S signal front vs. modeled O2S signal ratio -0.30 to 0.30 or gradient ratio \geq 0.27 • Lower value of both area ratios < 0.15
P0135	O2 Heater Circuit (Bank 1, Sensor 1)	<ul style="list-style-type: none"> • Heater duty cycle, > 90% • O2S ceramic temperature, < 685 °C <p>or</p> <ul style="list-style-type: none"> • O2S ceramic temp < 715 °C • Time after O2S heater on 40 Sec.
P0137	O2 Circuit Low Voltage (Bank 1, Sensor 2)	<ul style="list-style-type: none"> • Signal voltage, < 40 mV for > 3 Sec. • Difference of sensor voltage with load pulse and without < 0.01 V
P0138	O2 Circuit High Voltage (Bank 1, Sensor 2)	Signal voltage > 1.08 V for > 5 Sec.
P0139	O2 Circuit Slow Response (Bank 1 Sensor 2)	<ul style="list-style-type: none"> • EWMA filtered transient time at fuel cutoff > 0.5 Sec. • In voltage range 201.20 - 401.40 mV • Number of checks \geq 1
P0140	O2 Circuit No Activity Detected (Bank 1, Sensor 2)	<p>Signal voltage</p> <ul style="list-style-type: none"> • .Signal voltage, 0.40 - 0.60 V for > 3 Sec. • Difference of sensor voltage with load pulse and without < 0.01 V <p>Internal resistance</p> <ul style="list-style-type: none"> • > 120,000 ohm • Exhaust temperature > 600 °C
P0141	O2 Heater Circuit (Bank 1, Sensor 2)	Heater resistance, 416 - 3600 Ohm

DTC	Error Message	Malfunction Criteria and Threshold Value
P0150	O2 Sensor Circuit (Bank 2 Sensor 1) Malfunction	<ul style="list-style-type: none"> • O2S ceramic temp. < 640 °C
P0151	O2 Sensor Circuit (Bank 2 Sensor 1) Low Voltage	<ul style="list-style-type: none"> • Virtual Mass < 1.75 V • Nernst voltage < 1.50 V • Adjustment voltage < 0.30 V
P0152	O2 Sensor Circuit (Bank 2 Sensor 1) High Voltage	<ul style="list-style-type: none"> • Virtual Mass > 3.25 V • Nernst voltage > 4.40 V • Adjustment voltage > 7 V
P0153	O2 Sensor Circuit (Bank 2 Sensor 1) Slow Response	<ul style="list-style-type: none"> • O2S signal front vs. modeled O2S signal ratio -0.30 to 0.30 or gradient ratio ≥ 0.27 • Lower value of both area ratios < 0.15
P0155	O2 Sensor Heater Circuit Bank 2 Sensor 1 Malfunction	<ul style="list-style-type: none"> • Heater duty cycle, > 90% • O2S ceramic temperature, < 685 °C or <ul style="list-style-type: none"> • O2S ceramic temp < 715 °C • Time after O2S heater on 40 Sec.
P0157	O2 Sensor Circuit (Bank 2 Sensor 2) Low Voltage	<ul style="list-style-type: none"> • Signal voltage, < 40 mV for > 3 Sec. • Difference of sensor voltage with load pulse and without < 0.01 V
P0158	O2 Sensor Circuit (Bank 2 Sensor 2) High Voltage	Signal voltage > 1.08 V for > 5 Sec.
P0159	O2 Sensor Circuit (Bank 2 Sensor 2) Slow Response	<ul style="list-style-type: none"> • EWMA filtered transient time at fuel cutoff > 0.5 Sec. • In voltage range 201.20 - 401.40 mV • Si
P0160	O2 Sensor Circuit Bank 2 Sensor 2 No Activity Detected	<ul style="list-style-type: none"> • Signal voltage • Signal voltage, 0.40 - 0.60 V for > 3 Sec. • Difference of sensor voltage with load pulse and without < 0.01 V • Internal resistance • > 120,000 ohm • Exhaust temperature > 600 °C
P0161	O2 Sensor Heater Circuit Bank 2 Sensor 2 Malfunction	Heater resistance, 416 - 3600 Ohm

DTC	Error Message	Malfunction Criteria and Threshold Value
P0169	Incorrect Fuel Composition	Comparison with fuel quantity = incorrect
P0171	System Too Lean (Bank 1)	At idle • Adaptive value > 5.02% At part-load • Adaptive value > 21%
P0172	System Too Rich (Bank 1)	At idle • Adaptive value < -5.02% At part-load • Adaptive value < -21%
P0190	Fuel Rail Pressure Sensor A Circuit	Signal voltage > 4.8 V
P0191	Fuel Rail Pressure Sensor Circuit Range/Performance	Actual pressure > 14.60 MPa or < 0.005 MPa
P0192	Fuel Rail Pressure Sensor Circuit Low Input	Signal voltage < 0.2 V
P0201	Injector Circuit/Open - Cylinder 1	• Low side signal current < 2.1 A • Internal logic failure
P0202	Injector Circuit/Open - Cylinder 2	• Low side signal current < 2.1 A • Internal logic failure
P0203	Injector Circuit/Open - Cylinder 3	• Low side signal current < 2.1 A • Internal logic failure
P0204	Injector Circuit/Open - Cylinder 4	• Low side signal current < 2.1 A • Internal logic failure
P0205	Injector Circuit Open - Cylinder 5	• Low side signal current < 2.1 A • Internal logic failure
P0206	Injector Circuit Open - Cylinder 6	• Low side signal current < 2.1 A • Internal logic failure
P0221	Accelerator Pedal Position Sensor Circuit Range/Performance	• TPS 1 - TPS 2 > 5.10 to 6.30% • Actual TPS 1 calculated value > TPS 2 calculated value OR TPS 2 calculated value > 9%
P0222	Accelerator Pedal Position Sensor Circuit Low Input	Signal voltage < 0.20 V
P0223	Accelerator Pedal Position Sensor Circuit High Input	Signal voltage > 4.81 V
P025A	Fuel Pump Module Control Circuit/Open	Signal voltage 4.40 - 5.60 V
P025C	Fuel Pump Module Control Circuit Low	Signal voltage 2.15 - 3.25 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P025D	Fuel Pump Module Control Circuit High	Signal current > 1.10 A
P0261	Cylinder 1 Injector Circuit Low	Low side signal current < 2.10 A
P0262	Cylinder 1 Injector Circuit High	Low side signal current > 14.70 A
P0264	Cylinder 2 Injector Circuit Low	Low side signal current < 2.10 A
P0265	Cylinder 2 Injector Circuit High	Low side signal current > 14.70 A
P0267	Cylinder 3 Injector Circuit Low	Low side signal current < 2.10 A
P0268	Cylinder 3 Injector Circuit High	Low side signal current > 14.70 A
P0270	Cylinder 4 Injector Circuit Low	Low side signal current < 2.10 A
P0271	Cylinder 4 Injector Circuit High	Low side signal current > 14.70 A
P0273	Cylinder 5- Injector Circuit Low	Low side signal current < 2.10 A
P0274	Cylinder 5- Injector Circuit High	Low side signal current > 14.70 A
P0276	Cylinder 6- Injector Circuit Low	Low side signal current < 2.10 A
P0277	Cylinder 6- Injector Circuit High	Low side signal current > 14.70 A
P2088	A Camshaft Position Actuator Control Circuit Low (Bank 1)	Signal voltage 0.0 - 3.25 V
P2089	A Camshaft Position Actuator Control Circuit High (Bank 1)	Signal current > 2.2 A
P2090	B Camshaft Position Actuator Control Circuit Low Bank 1	Signal voltage 0.0 to 3.25 V
P2091	B Camshaft Position Actuator Control Circuit High Bank 1	Signal current > 2.20 A
P2096	Post-Catalyst Fuel Trim System Too Lean (Bank 1)	1 portion of 2nd lambda control loop < -0.035
P2097	Post-Catalyst Fuel Trim System Too Rich (Bank 1)	1 portion of 2nd lambda control loop > 0.035
P2098	Post Catalyst Fuel Trim System Bank 2 Too Lean	1 portion of 2nd lambda control loop < -0.035
P2099	Post Catalyst Fuel Trim System Bank 2 Too Rich	1 portion of 2nd lambda control loop > 0.035
P3081	Engine Temperature Too Low	Difference between ECT and modeled ECT > 9.8 °K

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random Misfire Detected	<ul style="list-style-type: none"> • Emission threshold Misfire Rate (MR), > 1.9% • Catalyst damage misfire rate (MR), > 1.05% - 13.33%
P0301	Cylinder 1 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold Misfire Rate (MR), > 1.9% • Catalyst damage misfire rate (MR), > 1.05% - 13.33%
P0302	Cylinder 2 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold Misfire Rate (MR), > 1.9% • Catalyst damage misfire rate (MR), > 1.05% - 13.33%
P0303	Cylinder 3 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold Misfire Rate (MR), > 1.9% • Emission threshold Misfire Rate (MR), > 1.9%
P0304	Cylinder 4 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold Misfire Rate (MR), > 1.9% • Catalyst damage misfire rate (MR), > 1.05% - 13.33%
P0305	Cylinder 5 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold Misfire Rate (MR), > 1.9% • Catalyst damage misfire rate (MR), > 1.05% - 13.33%
P0306	Cylinder 6 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold Misfire Rate (MR), > 1.9% • Catalyst damage misfire rate (MR), > 1.05% - 13.33%
P0321	Engine Speed Input Circuit Range/Performance	<ul style="list-style-type: none"> • Comparison of counted teeth vs reference = incorrect • Missing reference gap • Camshaft signals > 8 and no engine speed signal.
P0322	Engine Speed Input Circuit No Signal	<ul style="list-style-type: none"> • Camshaft signal > 3 • Engine speed no signal
P0324	Knock Control System Error	<ul style="list-style-type: none"> • Signal fault counter (combustion) > 28 or • Signal fault counter (measuring window) > 5

DTC	Error Message	Malfunction Criteria and Threshold Value
P0325	Knock Sensor 1 Circuit Malfunction	Signal voltage < 1.80 V or > 3.20 V
P0327	Knock Sensor 1 Circuit Low Input (Bank 1)	<ul style="list-style-type: none"> • Lower threshold -0.07 V • Signal range lower threshold < 0.30 to 2.50 V
P0328	Knock Sensor 1 Circuit High Input (Bank 1)	<ul style="list-style-type: none"> • Upper threshold > 1.00 V • Signal range upper threshold < 50 to 110.15 V
P0330	Knock Sensor 2 Circuit	Signal voltage < 1.80 V or > 3.20 V
P0332	Knock Sensor 2 Circuit Low Input	<ul style="list-style-type: none"> • Lower threshold -0.07 V • Signal range lower threshold < 0.30 to 2.50 V
P0333	Knock Sensor 2 Circuit High Input	<ul style="list-style-type: none"> • Upper threshold > 1.00 V • Signal range upper threshold < 50 to 110.15 V
P0340	Camshaft Position Sensor A Circuit (Bank 1)	Cam adaption values out of range <ul style="list-style-type: none"> • > 20° KW • < -20° KW • Difference of adapted and actual values > 9° KW
P0341	Camshaft Position Sensor A Circuit Range/Performance Bank 1	<ul style="list-style-type: none"> • Signal pattern not alternating • Defect counter = 12
P0342	Camshaft Position Sensor A Circuit Low Input (Bank 1)	<ul style="list-style-type: none"> • Signal voltage low • Crankshaft signals = 8 revolutions
P0343	Camshaft Position Sensor A Circuit High Input (Bank 1)	<ul style="list-style-type: none"> • Signal voltage high • Crankshaft signals = 8 revolutions
P0351	Ignition Coil A Primary/ Secondary Circuit	<ul style="list-style-type: none"> • Signal current 0.25 to -2.0 mA or • Internal check failed
P0352	Ignition Coil B Primary/ Secondary Circuit	<ul style="list-style-type: none"> • Signal current 0.25 to -2.0 mA or • Internal check failed
P0353	Ignition Coil C Primary/ Secondary Circuit	<ul style="list-style-type: none"> • Signal current 0.25 to -2.0 mA or • Internal check failed
P0354	Ignition Coil D Primary/ Secondary Circuit	<ul style="list-style-type: none"> • Signal current 0.25 to -2.0 mA • Internal check failed

DTC	Error Message	Malfunction Criteria and Threshold Value
P0355	Ignition Coil E Primary/ Secondary Circuit	<ul style="list-style-type: none"> Signal current 0.25 to -2.0 mA or Internal check failed
P0356	Ignition Coil F Primary/ Secondary Circuit	<ul style="list-style-type: none"> Signal current 0.25 to -2.0 mA or Internal check failed
P0366	Crankshaft Position Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> Signal pattern incorrect Crankshaft signals = 8
P0367	Camshaft Position Sensor "B" Circuit (Bank 1) Low Input	<ul style="list-style-type: none"> Signal voltage low Crankshaft signals = 8 revolutions
P0368	Camshaft Position Sensor "B" Circuit (Bank 1) High Input	<ul style="list-style-type: none"> Signal voltage high Crankshaft signals = 8 revolutions
P2300	Ignition Coil A Primary Control Circuit Low	Signal current > 24.0 mA
P2301	Ignition Coil A Primary Control Circuit High	Signal current > 5.10 - 7.0 mA
P2303	Ignition Coil B Primary Control Circuit Low	Signal current > 24.0 mA
P2304	Ignition Coil B Primary Control Circuit High	Signal current > 5.10 - 7.0 mA
P2306	Ignition Coil C Primary Control Circuit Low	Signal current > 24.0 mA
P2307	Ignition Coil C Primary Control Circuit High	Signal voltage > 5.10 - 7.0 mA
P2309	Ignition Coil D Primary Control Circuit Low	Signal current > 24.0 mA
P2310	Ignition Coil D Primary Control Circuit High	Signal voltage > 5.10 - 7.0 mA
P2312	Ignition Coil "E" Primary Control Circuit Low	Signal current > 24 mA
P2313	Ignition Coil "E" Primary Control Circuit High	Signal voltage > 5.10 to 7.0 V
P2315	Ignition Coil "F" Primary Control Circuit Low	Signal current > 24 mA
P2316	Ignition Coil "F" Primary Control Circuit High	Signal voltage > 5.10 to 7.0 V

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0420/ P0430	Catalyst System Efficiency Below Threshold Bank 1 (P0420) or Bank 2 (P0430)	<ul style="list-style-type: none"> • Measured oxygen storage capacity (OSC) < 1.00 HC correlated • Measured oxygen storage capacity (OSC) catalyst system < 1.00 NOx correlated
P0441	Evaporative Emission System Incorrect Purge Flow	Deviation lambda control < 5.00 to 5.51%
P0442	Evaporative Emission System Leak Detected (Small Leak)	Time for pressure drop < 1.5 - 1.7 Sec.
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal voltage > 4.70 - 5.40 V
P0455	Evaporative Emission System Leak Detected (gross leak/no flow)	Time for pressure drop < 1.1 - 1.3 Sec.
P0456	Evaporative Emission System Leak Detected (very small leak)	Time for pressure drop, < 4.8 - 6.0 Sec.
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage 0 to 3.26 V
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.20 A

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P050A	Cold Start Idle Air Control System Performance	<ul style="list-style-type: none"> • Engine speed deviation < -200 RPM • Idle controller at max value 8% or • Engine speed deviation > 200 RPM • Idle controller at min value -4.98%
P050B	Cold Start Idle Air Control System Performance	Difference between commanded spark timing and actual value > 0.22%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor A Range/Performance	VSS signal < 4 km/h
P0506	Idle Air Control System RPM Lower Than Expected	Engine speed Deviation > 100 RPM and Idle controller at max value
P0507	Idle Air Control System RPM Higher Than Expected	Idle speed Deviation < -100 RPM and Idle controller at min value -4.98%
P052A	Cold Start "A" Camshaft Position Timing Over-Advanced Bank 1	Difference between target position vs. actual position > 12 to 40 °CRK
P053F	Cold Start Fuel Pressure Performance	<ul style="list-style-type: none"> • Difference between target pressure vs actual pressure: > 1.50 MPa or • < -1.50 MPa
P054A	Cold Start "B" Camshaft Position Timing Over-Advanced (Bank 1)	Difference between target position vs. actual position > 10 to 22 °CRK

Control Module and Output Signals

DTC	Error Message	Malfunction Criteria and Threshold Value
P0601	Internal Control Module Memory Check Sum Error	ECM internal checksum incorrect
P0604	Internal Control Module Random Access Memory (RAM) Error	Write ability check, failed
P0606	ECM Processor Fault	ECM internal check failure
P062B	Internal ECM Fuel Injector Control Performance	Internal logic failure
P0638	Throttle Actuator Control Range/Performance	<ul style="list-style-type: none"> • Time to close to reference point > 0.6 Sec. and • Reference point 2.88% • TPS 1 signal voltage 'NOT 0.40 to 0.80 V • TPS 2 signal voltage 'NOT 4.20 to 4.60 V • TPS 2 signal voltage 'NOT 4.20 to 4.60 V • ECM power stage no failure

DTC	Error Message	Malfunction Criteria and Threshold Value
P0641	Sensor Reference Voltage A Circuit/Open	Signal voltage deviation > ± 0.3 V
P0642	Sensor Reference Voltage A Circuit Low	Signal voltage < 4.6 - 5.0 V
P0643	Sensor Reference Voltage A Circuit High	5V supply voltage > 4.99 - 5.41 V
P0651	Sensor Reference Voltage B Circuit Open	Signal voltage deviation > ± 0.3 V
P0657	Actuator Supply Voltage A Circuit Open	Signal voltage > 4.4 - 5.6 V
P0685	ECM/PCM Power Relay Control Circuit/Open	• Control voltage > 0.7 V
P0686	ECM/PCM Power Relay Control Circuit Low	• Control voltage < 0.51 V
P0687	ECM/PCM Power Relay Control Circuit High	• Control voltage > 4.0 V
P0688	ECM/PCM Power Relay Sense Circuit	• Sense voltage < 3.0 V
P0697	Sensor Reference Voltage C Circuit/Open	Signal voltage deviation > ± 0.3 V
P169A	ECM In Transport Mode	Transport mode active
U0001	High Speed CAN Communication Bus	CAN message = no feedback
U0002	High Speed CAN Communication Bus Performance	Global Time Out failure. No module communication on CAN
U0101	Lost Communication with TCM	• Time Out failure. No message received by ECM from TCM > 5 Sec
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	CAN communication with ABS Time Out.
U0146	Lost Communication With Gateway A	CAN communication with gateway Time Out
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	CAN communication with IPC timed out.
U0302	Software Incompatibility with Transmission Control Module	AT vehicle, ECM coded as MT vehicle
U0402	Invalid Data Received From Gear Shift Control Module	Transmission Data Length Code incorrect or invalid information.

DTC	Error Message	Malfunction Criteria and Threshold Value
U0415	CAN Communication With ABS Error	<ul style="list-style-type: none"> • Speed sensor initialization failed • Speed sensor low voltage error failed • Speed sensor > 326 km/h
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	CAN message incorrect.
U1103	Vehicle in Production Mode	Production mode active.

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	<ul style="list-style-type: none"> • Pressure control activity > 0.13 MPa • Fuel trim activity < 0.78 • Difference between target pressure vs actual -16 to 16.38 MPa
P12A2	Fuel Rail Pressure Sensor Inappropriately High	<ul style="list-style-type: none"> • Pressure control activity < -0.13 MPa • Fuel trim activity > 1.21 • Difference between target pressure vs actual -16 to 16.38 MPa
P12A4	Fuel Rail Pump Control Valve Stuck Closed	<ul style="list-style-type: none"> • Fuel trim activity .80 to 1.20 • Pressure control activity < -4.0 MPa • Difference between target and actual pressure < -4.00 MPa
P150A	Engine Off Time Performance	<ul style="list-style-type: none"> • Difference between engine off time and ECM after run time < -8 Sec or <ul style="list-style-type: none"> • Difference between engine off time and ECM after run time > 8 Sec.
P2101	Throttle Actuator A Control Motor Circuit Range/ Performance	<ul style="list-style-type: none"> • Duty cycle >80% • ECM power stage, no failure or <ul style="list-style-type: none"> • Deviation throttle valve angles vs. calculated value 4.0 - 50.0%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2106	Throttle Actuator Control System - Forced Limited Power	<ul style="list-style-type: none"> • Duty cycle >80% • ECM power stage, no failure
P2108	Throttle Actuator Control Module Performance	Time to close under reference point > 0.60 Sec. and reference point 11.56%
P2122	Accelerator Pedal Position Sensor D Circuit Low Input	Signal voltage < 0.61 V
P2123	Accelerator Pedal Position Sensor D Circuit High Input	Signal voltage > 4.79 V
P2127	Accelerator Pedal Position Sensor E Circuit Low Input	Signal voltage < 0.27 V
P2128	Accelerator Pedal Position Sensor E Circuit High Input	Signal voltage > 2.43 V
P2138	Accelerator Pedal Position Sensor D / E Voltage Correlation	<ul style="list-style-type: none"> • Signal voltage: Difference between signal APP1 and APP2 > 0.17 to 0.70 V or • Signal voltage sensor 1 <= 0.90 V and Signal voltage sensor 2 > 0.50 V or • Signal voltage sensor 1 > 1.01 V and Signal voltage sensor 2 <= 0.45 V
P2146	Fuel Injector Group A Supply Voltage Circuit/Open	<ul style="list-style-type: none"> • High side signal current, < 2.60 A or • High side signal current > 14.90 A
P2149	Fuel Injector Group B Supply Voltage Circuit Open	<ul style="list-style-type: none"> • High side signal current, < 2.60 A or • High side signal current > 14.90 A
P2152	Fuel Injector Group "C" Supply Voltage Circuit Open	<ul style="list-style-type: none"> • High side signal current, < 2.30 A or • High side signal current > 18.60 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P2155	Fuel Injector Group "D" Supply Voltage Circuit/Open	<ul style="list-style-type: none"> • High side signal current, < 2.60 A or • High side signal current > 14.90 A
P2177	System too lean off idle, (Bank 1)	Fuel adaptive value > 30%
P2178	System too rich off idle, (Bank 1)	Fuel adaptive value < -30%
P2179	System too lean off idle, (Bank 2)	Fuel adaptive value > 30%
P2180	System too rich off idle, (Bank 2)	Fuel adaptive value < -30%
P2181	Cooling System Performance	Cooling system temperature too low after a sufficient mass air flow integral < 61 to 70 °C
P2184	Engine Coolant Temperature Sensor 2 Circuit Low	Signal voltage < 0.20 V
P2185	Engine Coolant Temperature Sensor 2 Circuit High	Signal voltage > 4.95 V
P2187	System too lean at idle, (Bank 1)	Fuel adaptive value > 6%
P2188	System too rich at idle, (Bank 1)	Fuel adaptive value < -6%
P2189	System too lean at idle, (Bank 2)	Fuel adaptive value > 6%
P2190	System too rich at idle, (Bank 2)	Fuel adaptive value < -6%
P2195	O2 Sensor Signal Biased/ Stuck Lean (Bank 1, Sensor 1)	• Delta lambda of 2nd lambda control loop > 0.059
P2196	O2 Sensor Signal Biased/ Stuck Rich (Bank 1, Sensor 1)	• Delta lambda of 2nd lambda control loop < -0.059
P2197	O2 Sensor Signal Stuck Lean (Bank 2 Sensor 1)	• Delta lambda of 2nd lambda control loop > 0.059
P2198	O2 Sensor Signal Stuck Rich Bank 2 Sensor 1	• Delta lambda of 2nd lambda control loop < -0.059
P2237	O2 Sensor Positive Current Control Circuit/Open (Bank 1, Sensor 1)	<ul style="list-style-type: none"> • O2S signal front 1.49 - 1.51 V • Delta lambda controller > 0.07

DTC	Error Message	Malfunction Criteria and Threshold Value
P2240	O2 Sensor Positive Current Control Circuit (Bank 2 Sensor 1) Open	<ul style="list-style-type: none"> • O2S signal front 1.49 - 1.51 V • Delta lambda controller > 0.07
P2243	O2 Sensor Reference Voltage Circuit/Open (Bank 1, Sensor 1)	<ul style="list-style-type: none"> • O2S signal front > 4.70 V and Internal resistance > 950 Ohms • O2S signal front < 0.20 V and Internal resistance > 950 Ohms
P2247	O2 Sensor Reference Voltage Circuit Bank 2 Sensor 1 Open	<ul style="list-style-type: none"> • O2S signal front > 4.70 V and Internal resistance > 950 Ohms • O2S signal front < 0.20 V and Internal resistance > 950 Ohms
P2251	O2 Sensor Negative Current Control Circuit Bank 1 Sensor 1 open	<ul style="list-style-type: none"> • O2S signal front 1.47 - 1.52 V • and internal resistance > 950 ohms
P2254	O2 Sensor Negative Current Control Circuit Bank 2 Sensor 1 open	<ul style="list-style-type: none"> • O2S signal front 1.47 - 1.52 V • and internal resistance > 950 ohms
P2270	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 2)	<ul style="list-style-type: none"> • O2S signal rear not oscillating at reference < 0.65 V • Enrichment after stuck lean 25%
P2271	O2 Sensor Signal Stuck Rich (Bank 1, Sensor 2)	<ul style="list-style-type: none"> • Sensor voltage of ≥ 0.15 V after oxygen mass > 1100 to 1800 mg • Number of checks ≥ 1
P2272	O2 Sensor Signal Stuck Lean (Bank 2 Sensor 2)	<ul style="list-style-type: none"> • O2S signal rear not oscillating at reference < 0.65 V • Enrichment after stuck lean 25%
P2273	O2 Sensor Signal Stuck Rich (Bank 2 Sensor 2)	<ul style="list-style-type: none"> • Sensor voltage of ≥ 0.15 V after oxygen mass > 1100 to 1800 mg • Number of checks ≥ 1

DTC	Error Message	Malfunction Criteria and Threshold Value
P2279	Intake Air System Leak	<ul style="list-style-type: none"> • Threshold to detect a defective system 2.10 and • Ratio of the tie system defective during the measurement window to the whole duration of the measurement window 0.80
P2293	Fuel Pressure Regulator 2 Performance	<ul style="list-style-type: none"> • Difference between target pressure vs. actual pressure: > 1.50 mPa or • < -1.50 mPa
P2294	Fuel Pressure Regulator 2 Control Circuit	• Signal voltage 1.40 - 3.20 V
P2295	Fuel Pressure Regulator 2 Control Circuit Low	Signal voltage < 1.40 - 3.20 V
P2296	Fuel Pressure Regulator 2 Control Circuit High	Signal voltage > 3.20 V

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/Open	Signal voltage > 4.4 - 5.6 V
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	Signal voltage < 2.15 to 3.25 V
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	Signal current > 3.0 A
P2403	Evaporative Emission System Leak Detection(3 Pump Sense Circuit/Open	Low signal voltage > 0.5 Sec.
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	<ul style="list-style-type: none"> • High signal voltage > 12 Sec. • Number of checks = 30 • Cumulative time of high signal voltage during pumping > 20 Sec.

DTC	Error Message	Malfunction Criteria and Threshold Value
P2414	O2 Sensor Exhaust Sample Error (Bank 1, Sensor 1)	Threshold 1 • Signal voltage 3.70 - 4.81 V Threshold 2 • Signal voltage 2.51 - 3.00 V
P2415	O2 Sensor Exhaust Sample Error, (Bank 2 Sensor 1)	Threshold 1 • Signal voltage 3.70 - 4.81 V Threshold 2 • Signal voltage 2.51 - 3.00 V
P2539	Low Pressure Fuel System Sensor Circuit	Signal voltage > 4.80 V
P2541	Low Pressure Fuel System Sensor Circuit Low	Signal voltage < 0.20 V
P2600	Coolant Pump Control Circuit/ Open	Signal voltage 4.5 - 5.5 V
P2602	Coolant Pump Control Circuit Low	Signal voltage < 3.0 V
P2603	Coolant Pump Control Circuit High	Signal current 0.60 - 1.20 A
P2626	O2 Sensor Pumping Current Trim Circuit/Open (Bank 1 Sensor 1)	O2S signal front > 4.81 V
P2629	O2 Sensor Pumping Current Trim Circuit/Open Bank 2, Sensor 1	• O2S signal front > 4.81 V

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