2013

Beetle/Beetle Cabrio

Quick Reference Specification Book

2013 Volkswagen Beetle/Beetle Cabrio Quick Reference Specification Book

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ENGINES

CHASSIS

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: kg·cm x 0.868 = lb·in • kg·cm x 9.81 = N·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.

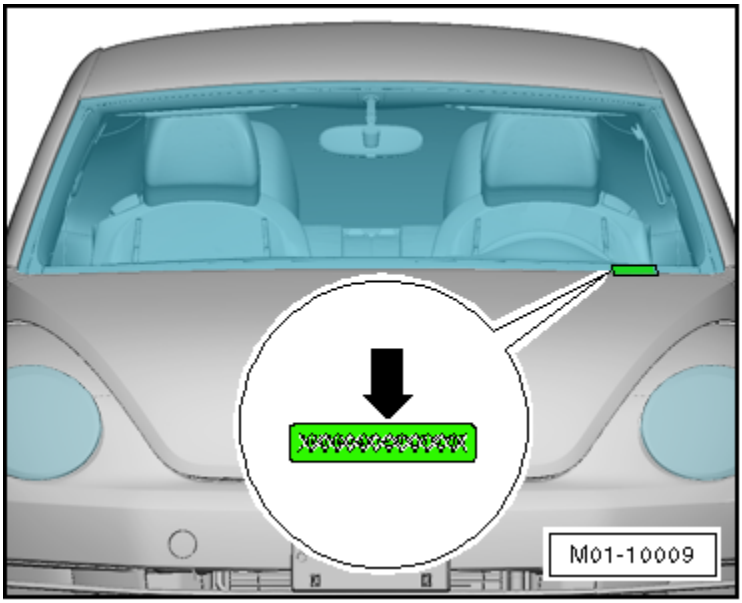
(CAUTIONS cont'd on next page)

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.

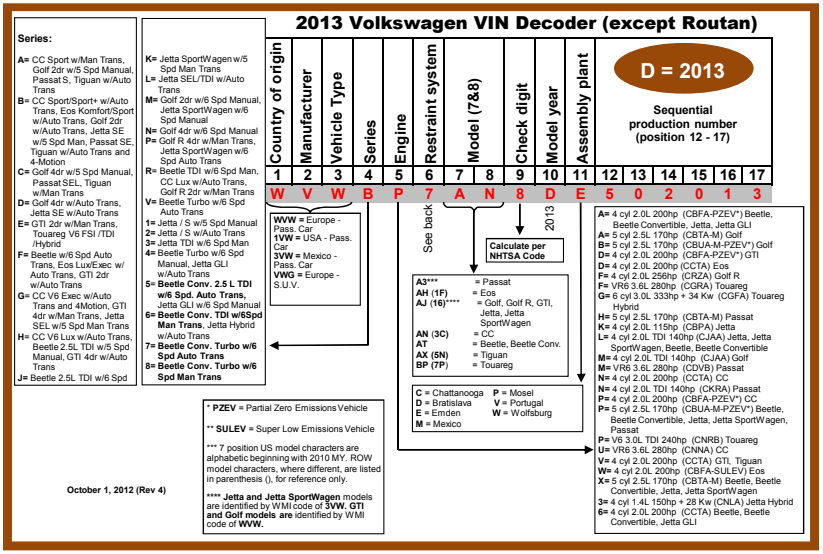
VEHICLE IDENTIFICATION

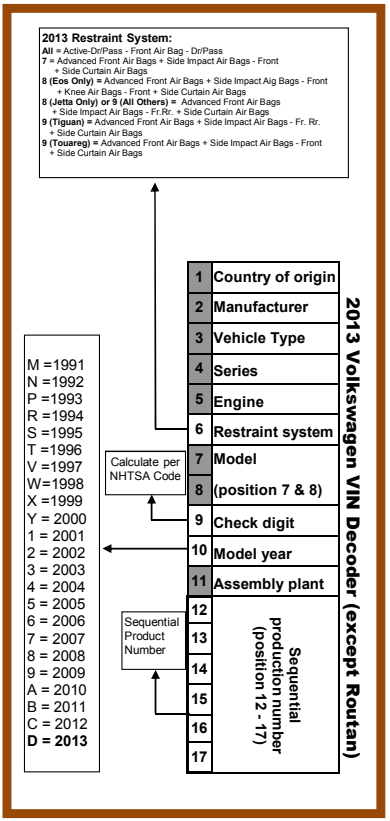
Vehicle Identification Number (VIN) Location



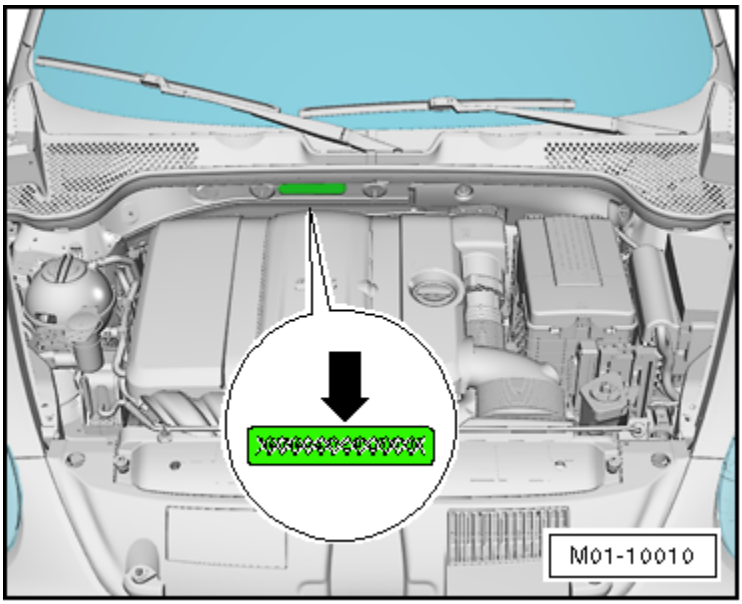
The VIN (➡) is on the left side of the vehicle in the area of the windshield wiper mount. It is visible from the outside.

VIN Decoder


2013 Volkswagen VIN Decoder (except Routan)
Series:
A= CC Sport w/Man Trans, Golf 2dr w/5 Spd Manual, Passat S, Tiguan w/Auto Trans
B= CC Sport/Sport+ w/Auto Trans, Eos Komfort/Sport w/Auto Trans, Golf 2dr 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 2dr w/Man Trans, Touareg V6 FSI /TDI /Hybrid
F= Beetle w/6 Spd Auto Trans, Eos Lux/Exec w/ Auto Trans, GTI 2dr w/Auto Trans
G= CC V6 Exec w/Auto Trans and 4Motion, GTI 4dr w/Man Trans, Jetta SEL w/5 Spd Man Trans
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/6 Spd
K= Jetta SportWagen w/5 Spd Man Trans
L= Jetta SEL/TDI w/Auto Trans
M= Golf 2dr w/6 Spd Manual, Jetta SportWagen w/6 Spd Manual
N= Golf 4dr w/6 Spd Manual
P= Golf R 4dr w/Man Trans, Jetta SportWagen w/6 Spd Auto Trans
R= Beetle TDI w/6 Spd Man, CC Lux w/Auto Trans, Golf R 2dr w/Man Trans
V= Beetle Turbo w/6 Spd Auto Trans
1= Jetta / S w/5 Spd Manual
2= 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= Beetle Conv. 2.5 L TDI w/6 Spd. Auto Trans, Jetta GLI w/6 Spd Manual
6= Beetle Conv. TDI w/6Spd Man Trans, Jetta Hybrid w/Auto Trans
7= Beetle Conv. Turbo w/6 Spd Auto Trans
8= Beetle Conv. Turbo w/6 Spd Man Trans
Country of origin
Manufacturer
Vehicle Type
Series
Engine
Restraint system
Model (7&8)
Check digit
Model year
Assembly plant
D = 2013
Sequential production number (position 12 - 17)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
W V W B P 7 A N 8 D E 5 0 2 0 1 3
WVW = Europe - Pass. Car
1VW = USA - Pass. Car
3VW = Mexico - Pass. Car
VWG = Europe - S.U.V.
See back
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 = Bratislava
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 (CBUA-M-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 (CGRA) Touareg
G= 6 cyl 3.0L 333hp + 34 Kw (CGFA) Touareg Hybrid
H= 5 cyl 2.5L 170hp (CBTA-M) Passat
K= 4 cyl 2.0L 115hp (CBPA) 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 (CDVB) 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 (CBUA-M-PZEV*) Beetle, Beetle Convertible, Jetta, Jetta SportWagen, Passat
P= V6 3.0L TDI 240hp (CNRB) Touareg
U= VR6 3.6L 280hp (CNNA) 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
October 1, 2012 (Rev 4)
* 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 3VW. GTI and Golf models are identified by WMI code of WVW.

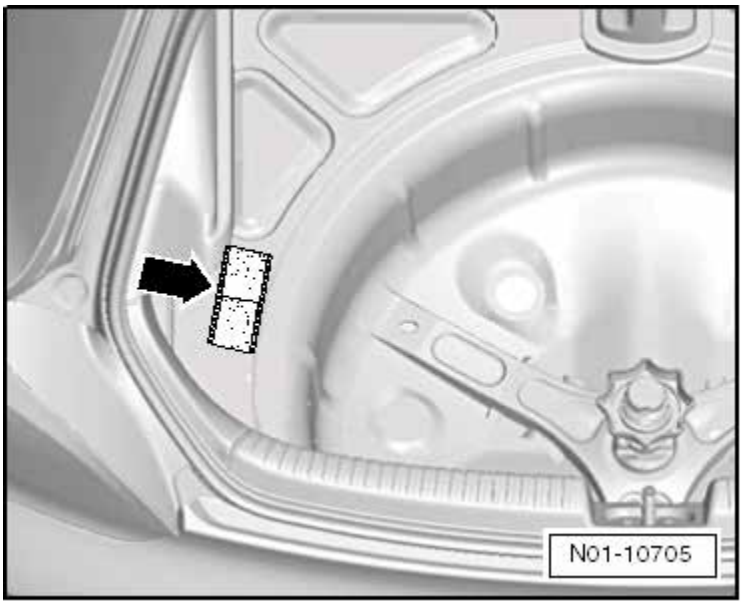

2013 Restraint System:
All = Active-Dr/Pass - Front Air Bag - Dr/Pass
7 = Advanced Front Air Bags + Side Impact Air Bags - Front + Side Curtain Air Bags
8 (Eos Only) = Advanced Front Air Bags + Side Impact Aig Bags - Front + Knee Air Bags - Front + Side Curtain Air Bags
8 (Jetta Only) or 9 (All Others) = Advanced Front Air Bags + Side Impact Air Bags - Fr.Rr. + Side Curtain Air Bags
9 (Tiguan) = Advanced Front Air Bags + Side Impact Air Bags - Fr. Rr. + 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
Calculate per NHTSA Code
Sequential Product Number
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
13
14
15
16
17
Sequential production number (position 12 - 17)
2013 Volkswagen VIN Decoder (except Routan)

VIN Inside Engine Compartment



The VIN is located in the center of the bulkhead under the plenum chamber, behind the noise insulation (➡).

Vehicle Data Label



The vehicle data label (➡) is located in the spare wheel well on the left side. The vehicle data label is also in the customer's maintenance booklet.

SALES CODES

Engine Codes

CBFA/CCTA	2.0L TFSI 4-cylinder 4V
CBTA/CBUA	2.5L 5-cylinder 4V
CJAA	2.0L TDI 4-cylinder 4V

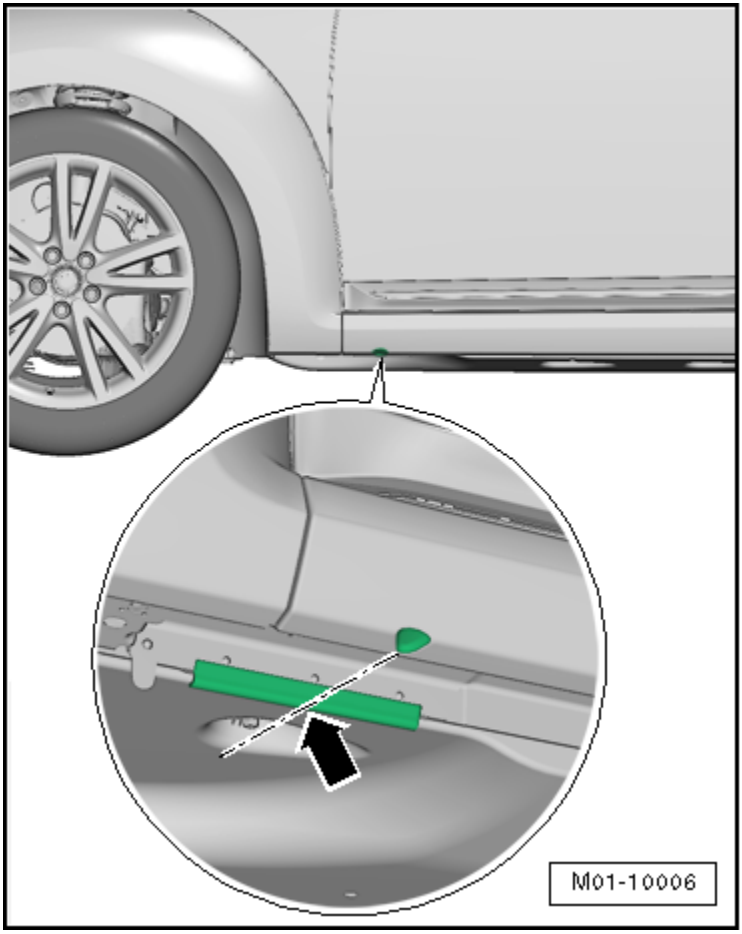
Transmission Codes

0A4	5-speed manual
02Q	6-speed manual
02E	6-speed Direct Shift Gearbox (DSG)
09G	6-speed automatic

VEHICLE LIFTING

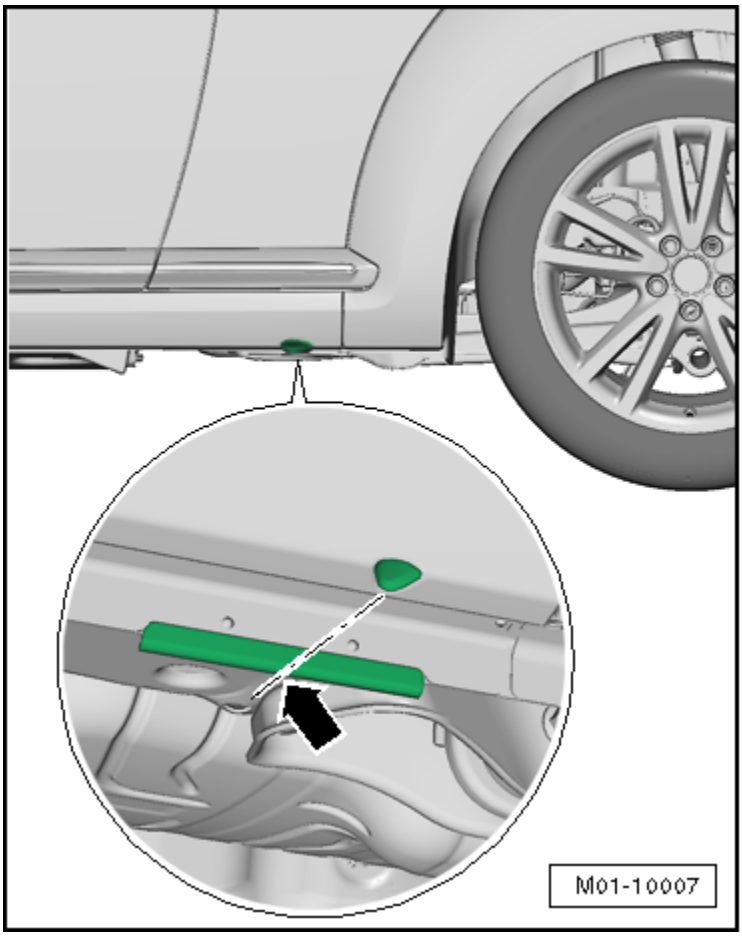
Hoist and Jack Mounting Points

Front



Position the support plate in the side member vertical reinforcement area (➡).

Rear

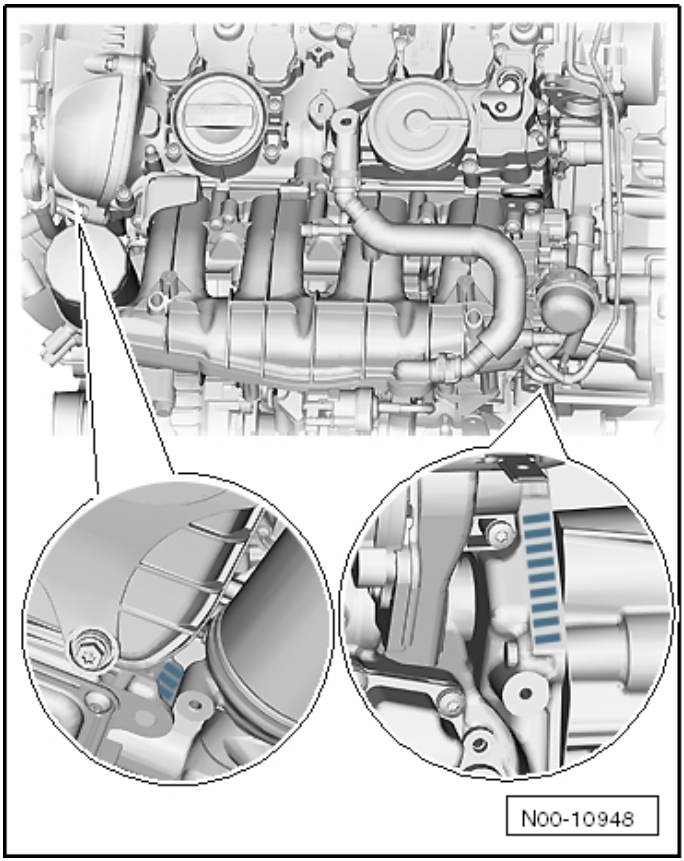


Position the support plate in the side member vertical reinforcement area (➡).

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

Engine code		CBFA	CCTA
Manufactured		from 06.2011	from 06.2011
Emissions values	Standard	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
Engine idle speed [3]	RPM	640 to 800 [1]	640 to 800 [1]
Engine speed (RPM) limitation		Approximately 6500	Approximately 6500
Bore	diameter mm	82.5	82.5
Stroke	mm	92.8	92.8
Compression ratio		9.6:1	9.6:1
Valves per cylinder		4	4
Research Octane Number (RON)		minimum 95	minimum 95
Fuel injection and ignition system		TFSI	TFSI
Ignition sequence		1-3-4-2	1-3-4-2
On Board Diagnostic (OBD)		Yes	Yes
Knock control		1 knock sensor	1 knock sensor
Catalytic converter		Yes	Yes
Oxygen Sensor (O2S) regulation		3 sensors	2 sensors
Exhaust Gas Recirculation (EGR)		No	No
Turbocharger, Supercharger		Turbocharger	Turbocharger
Variable intake manifold		Yes	Yes
Variable valve timing		Yes	Yes
Secondary Air Injection (AIR) system		Yes	No
Valves per cylinder		4	4
Oil pressure control		No	No

[1] SULEV = Super Ultra Low Emissions Vehicle.

[2] ULEV2 = Ultra Low Emissions Vehicle 2.

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

Engine Assembly – 2.0L CBFA, CCTA

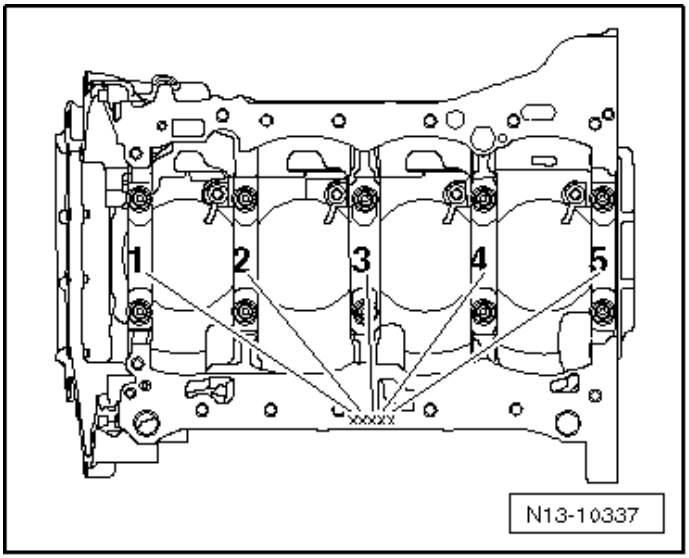
Fastener Tightening Specifications

Component	Fastener size	Nm
Bolts and nuts	M6	9
	M7	15
	M8	23
	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)
Pendulum support-to-transmission bolt [1)]	-	50 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 the transmission bolts first, and then install the pendulum support to subframe bolt.

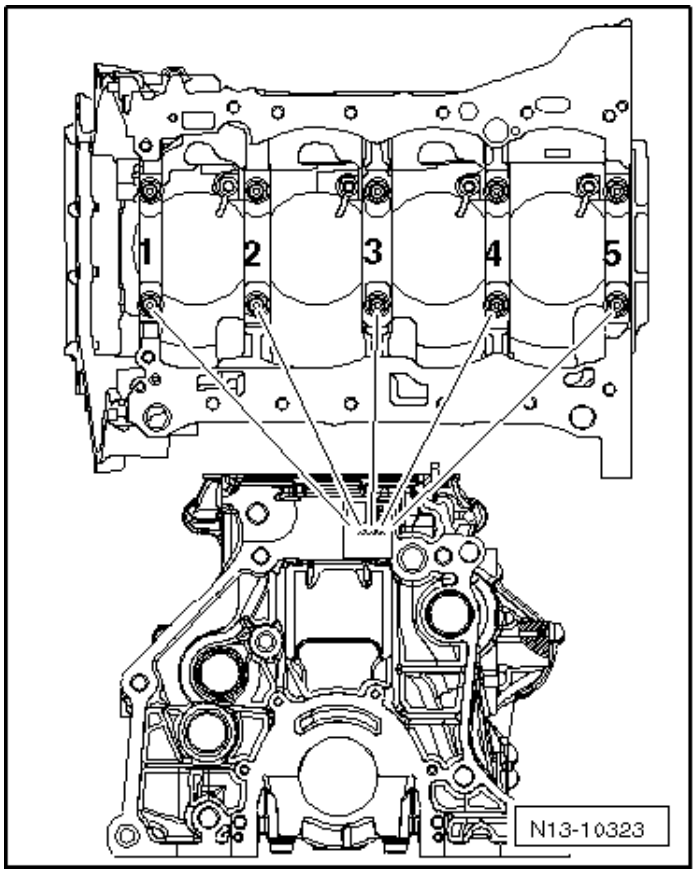
Crankshaft, Cylinder Block – 2.0L CBFA,CCTA

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.

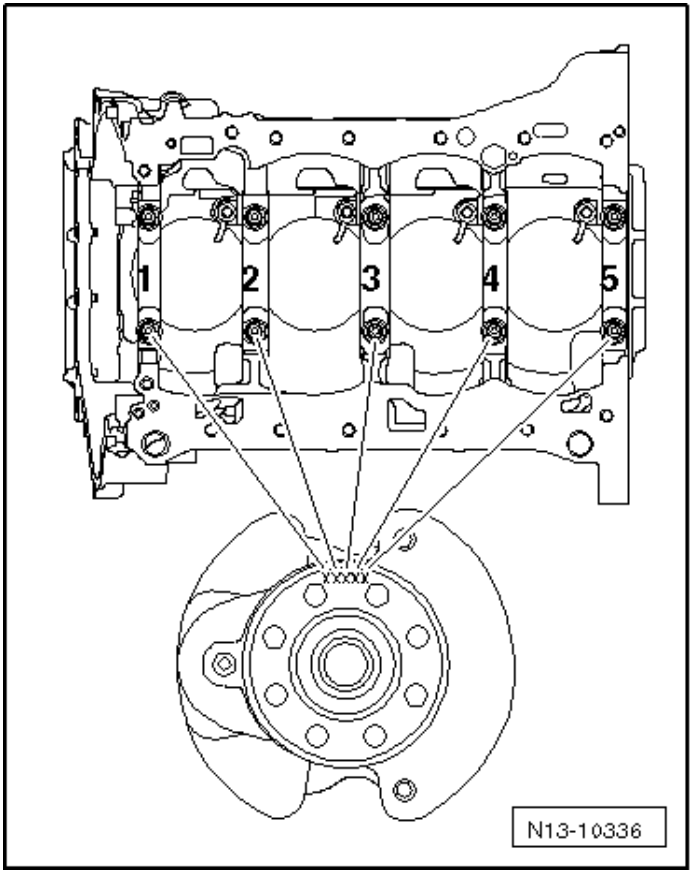
Cylinder Block Bearing Shell Identification *(cont'd)*



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	Nm
Air conditioning compressor-to-accessory bracket bolt	25
Connecting rod bearing cap to connecting rod bolt [1)]	45 plus an additional 90° (¼ turn)
Dual mass flywheel-to-crankshaft bolt [1)]	60 plus an additional 90° (¼ turn)
Generator-to-accessory bracket bolt	23
Idler roller bracket-to-accessory bracket bolt	25
Pressure relief valve-to-cylinder block	27
Ribbed belt tensioner-to-accessory bracket bolt	10
Sensor wheel-to-crankshaft screw [1)]	10 plus an additional 90° (¼ turn)
Vibration-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

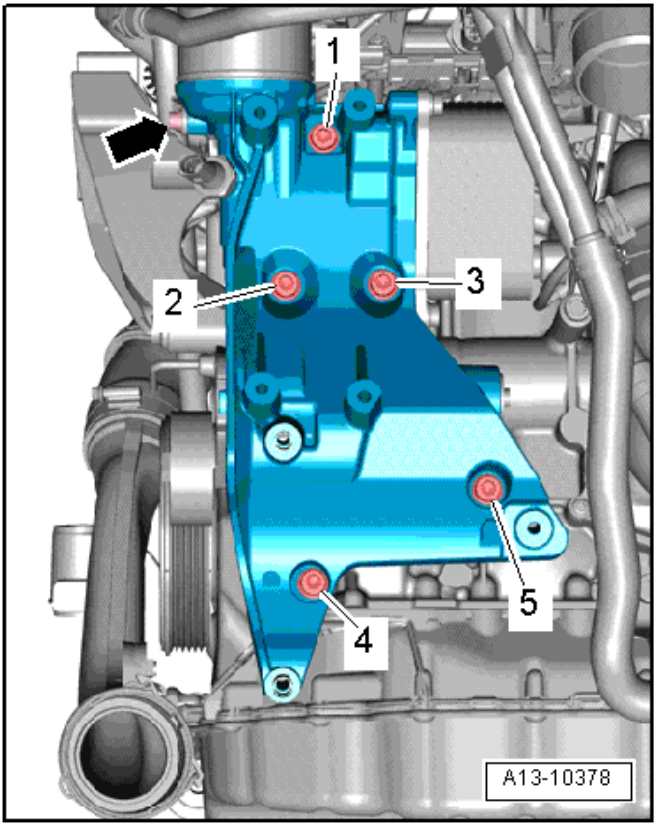
Piston ring dimensions in mm	New	Wear limit
1st compression ring	0.06 to 0.09	0.20
2nd compression ring	0.03 to 0.06	0.15
Oil scraping rings	Cannot be measured	

Piston and Cylinder Dimensions

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

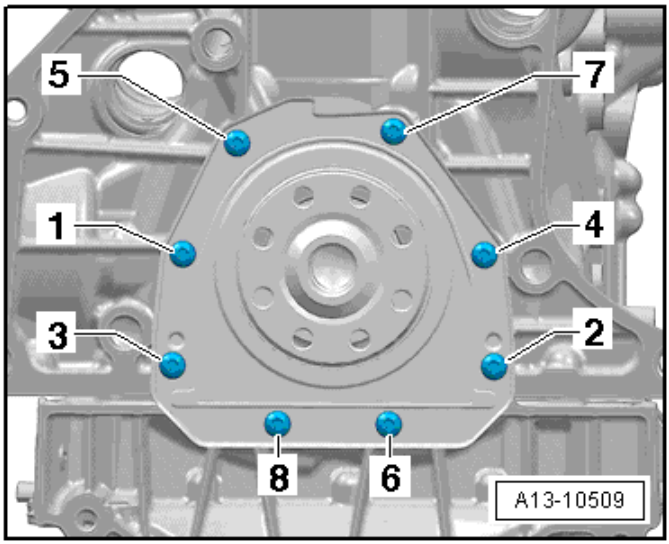
[1)] Measurement does not include the graphite coating (thickness = 0.02 mm). The graphite coating wears away.

Accessory Assembly Bracket Tightening Specifications



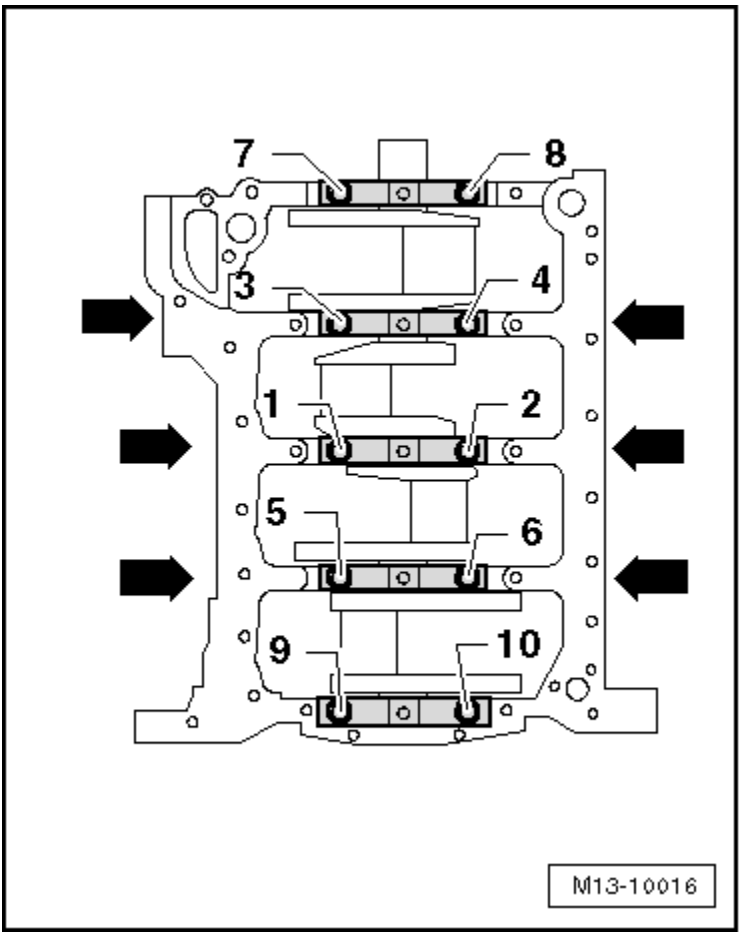
Step	Component	Nm
1	Tighten bolts 1 through 5 in sequence	Hand-tighten
2	Tighten bolts 1 through 5 in sequence	20
3	Tighten bolts 1 through 5 in sequence	an additional 90° (¼ turn)

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 Bearing Cap Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 10 and ➡ 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 ➡	20
5	Tighten bolts ➡	an additional 90° (¼ turn)

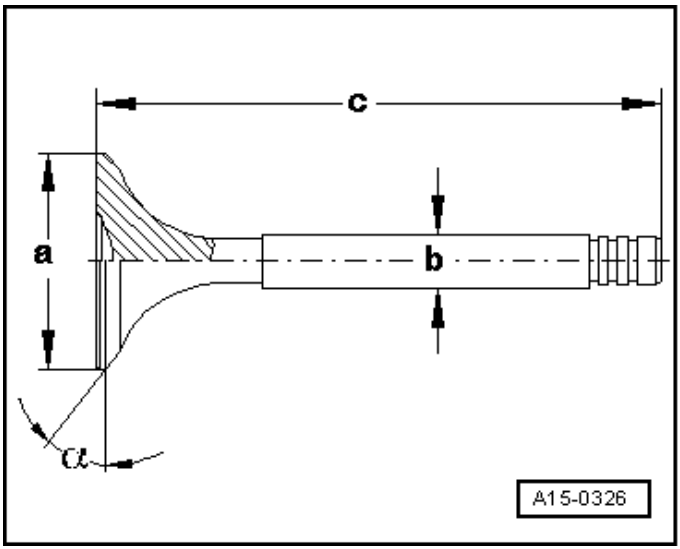
Cylinder Head, Valvetrain – 2.0L CBFA, CCTA

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, 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
Heat shield-to-bracket bolt	-	9
Heat shield-to-cylinder head bolt	-	20
Mounting plate/connecting piece-to-cylinder head bolt	-	9
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 (AIR) solenoid valve-to-cylinder head bolt [3]	-	9
Transport strap-to-cylinder head bolt	-	25
Vacuum pump-to-cylinder head bolt	M6 x 70	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



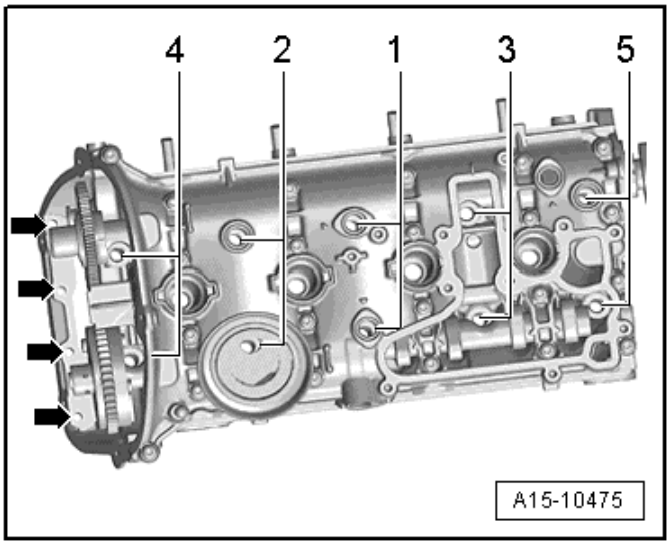
Dimension		Intake valve	Exhaust valve
Diameter a	mm	33.85 ± 0.10	28.0 ± 0.1
Diameter b	mm	5.98 ± 0.007	5.955 ± 0.007
c	mm	103.97	101.87
α	∠°	45	45

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

Compression Pressures

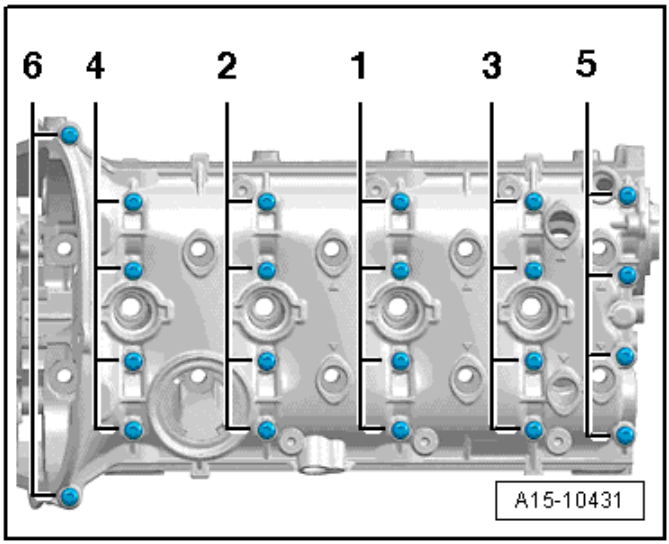
New Bar positive pressure	Wear limit Bar positive pressure	Difference between cylinders Bar positive pressure
11.0 to 14.0	7.0	Maximum 3.0

Cylinder Head Tightening Specifications



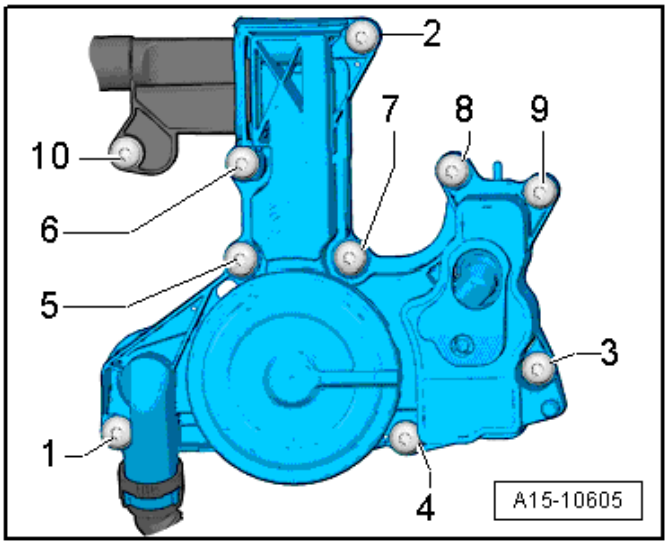
Step	Component	Nm
1	Tighten bolts 1 through 5 in sequence	40
2	Tighten bolts 1 through 5 in sequence	an additional 90° (¼ turn)
3	Tighten bolts 1 through 5 in sequence	an additional 90° (¼ turn)
4	Tighten bolts ➡	8
5	Tighten bolts ➡	an additional 90° (¼ turn)

Cylinder Head Cover Tightening Specifications



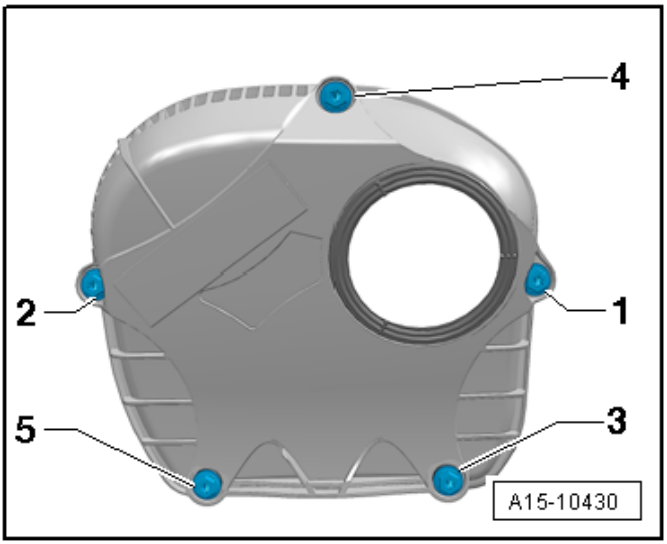
Step	Component	Nm
1	Tighten bolts 1 through 6 in sequence in several stages	Hand-tighten
2	Tighten bolts 1 through 6 in sequence	8
3	Tighten bolts 1 through 6 in sequence	an additional 90° (¼ turn)

Crankcase Ventilation Tightening Specification



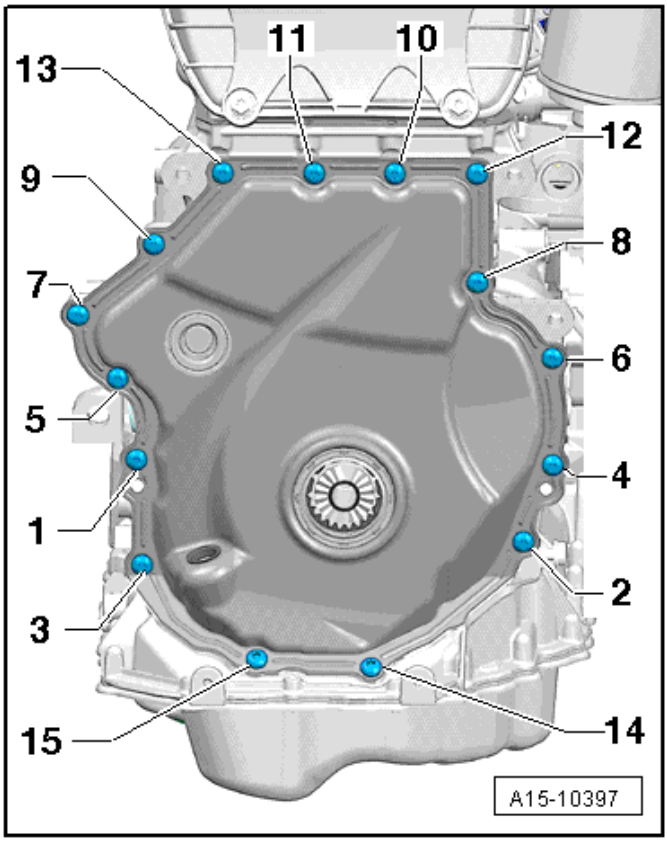
Step	Component	Nm
1	Tighten bolts 1 through 10 in sequence	11

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 Tightening Specifications



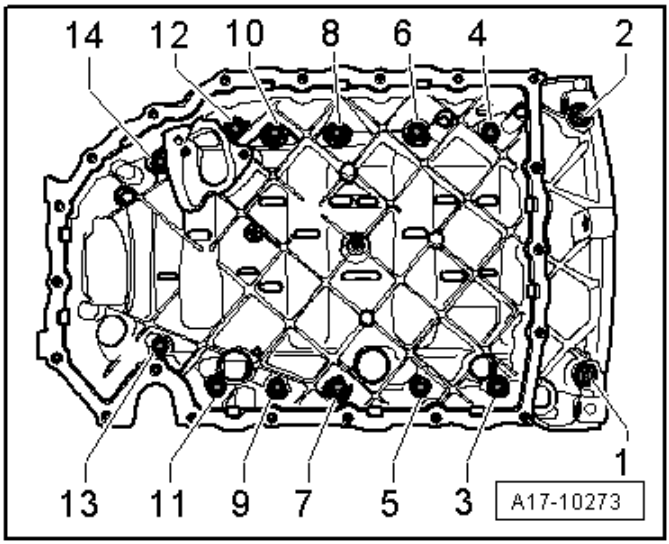
Step	Component	Nm
1	Tighten bolts 1 through 15 in sequence	8
2	Tighten bolts 1 through 15 in sequence	an additional 45° (⅛ turn)

Lubrication – 2.0L CBFA, CCTA

Fastener Tightening Specifications

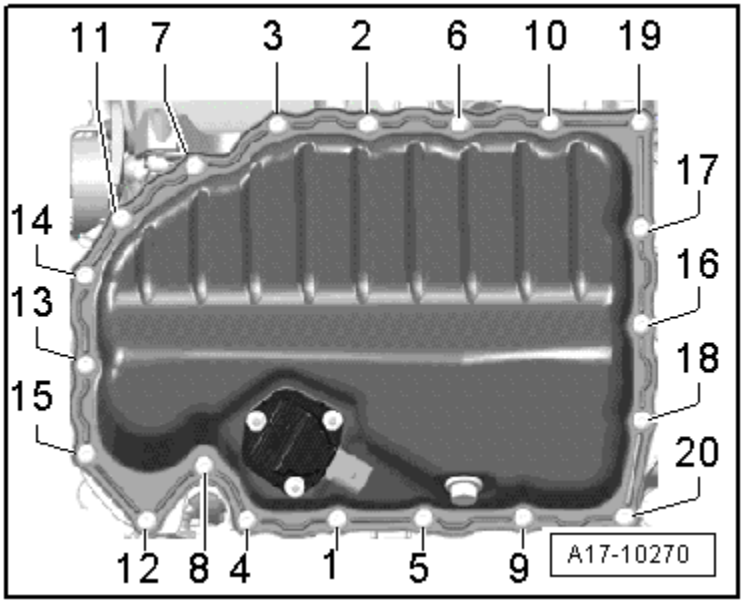
Component	Fastener size	Nm
Oil baffle-to-upper oil pan bolt	-	9
Oil cooler-to-accessory bracket bolt	-	15
Oil drain plug-to-lower oil pan	-	30
Oil filter element-to-accessory bracket	-	22
Oil intake pipe-to-oil pump bolt	-	9
Oil pressure switch-to-accessory bracket	-	20
Oil pump drive chain tensioner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

Upper Oil Pan Tightening Specifications



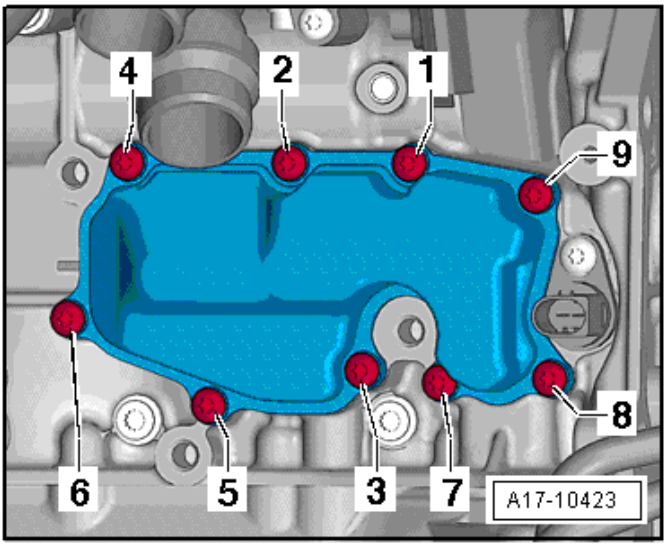
Step	Component	Nm
1	Tighten bolts 1 through 14 in sequence	Hand-tighten
2	Tighten bolts 1 through 14 in sequence	15
3	Tighten bolts 1 through 14 in sequence	an additional 90° (¼ turn)

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° (⅛ turn)

Oil Separator Tightening Specification



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

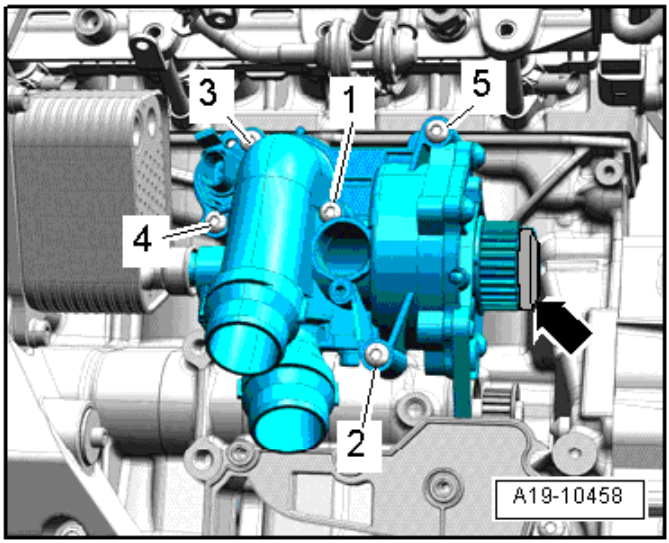
Cooling System – 2.0L CBFA, CCTA

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 shroud nut	10
Coolant pump connecting piece bolt	9
Engine Coolant Temperature (ECT) sensor retaining plate-to-coolant pump bolt	4
Front coolant pipe bolt	5
Radiator fan shroud bolt	5
Radiator-to-Charge Air Cooler (CAC) bolt	5
Small coolant pipe bolt	9
Toothed belt drive gear-to-balance shaft bolt [1) 2)]	17
Toothed belt guard-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	Nm
Accelerator pedal module-to-body bolt	10
Air filter-to-Evaporative Emission (EVAP) canister nut	1.8
Evaporative Emission (EVAP) canister-to-body nut	8
Evaporative Emission (EVAP) canister-to-body screw	1.8
Fuel filler tube-to-body bolt	11
Fuel filter bracket screw	3
Fuel tank lock ring	110
Fuel tank-to-underbody bolt [1)]	25
Heat shield-to-fuel tank nut	2.5
Leak Detection Pump (LDP)-to-Evaporative Emission (EVAP) canister screw	1.8
Tensioning strap-to-underbody bolt [1)]	25

[1)] Replace fastener(s).

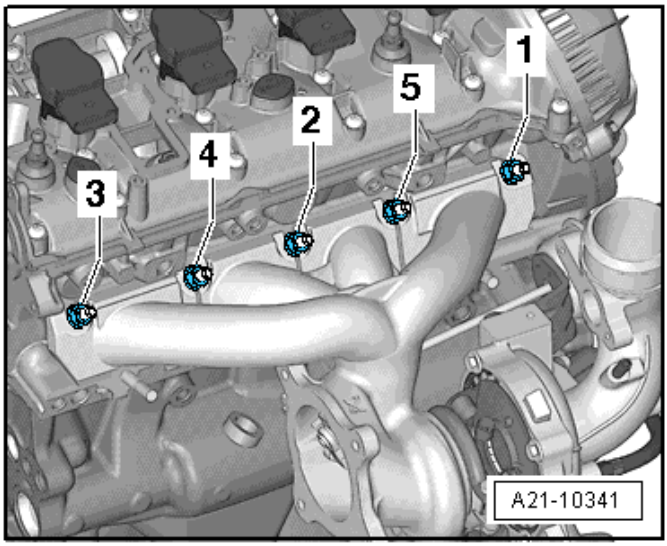
Turbocharger, G-Charger – 2.0L CBFA, CCTA

Fastener Tightening Specifications

Component	Nm
Charge Air Cooler (CAC) mount 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
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-turbocharger 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) 3)]	40
Oxygen Sensor (O2S)	55
Secondary Air Injection (AIR) pump motor bracket-to-underbody nut [2)]	25
Secondary Air Injection (AIR) pump motor-to-bracket nut [2)]	9
Secondary Air Injection (AIR) solenoid valve bolt [2)]	9
Suspended mount bracket bolt [2)]	20
Suspended mount-to-subframe bolt	25
Suspended mount-to-underbody bolt	25
Tunnel bridge-to-underbody bolt	20

1) Replace fastener(s).
2) Engine code CBFA only.
3) Lubricate the stud bolts on the exhaust manifold/turbocharger with hot bolt paste. Refer to the Electronic Parts Catalog (ETKA).

Multiport Fuel Injection – 2.0L CBFA, CCTA

Fastener Tightening Specifications

Component	Fastener size	Nm
Fuel rail adapter (VAS 6394/2)	-	27
Fuel pressure sensor-to-pressure sensor tester (VAS 6394/1)	-	27
Fuel pressure sensor-to-fuel rail [2)]	-	27
High pressure fuel line connection-to-high pressure pump [1)]	-	22
High pressure fuel line union nut-to-high pressure pump	-	18
High pressure pump-to-cylinder head bolt	M6 [1)]	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
Lower air filter housing-to-body bolt	-	8
Mass Airflow (MAF) sensor -to-upper air filter housing bolt	-	3.5
Structure-borne sound actuator-to-bracket nut	-	15
Structure-borne sound actuator bracket-to-plenum chamber bolt	-	8
Structure-borne sound control module-to-bracket bolt	-	8
Structure-borne sound control module bracket-to-plenum chamber nut	-	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[1)]	
VW/Audi	101 905 631 H
Electrode gap	1.0 to 1.1 mm
Tightening specifications	25 Nm
Change intervals	Refer to Maintenance Intervals Rep. Gr. 03

1) Remove and install using the spark plug removal tool (3122 B).

Fastener Tightening Specifications

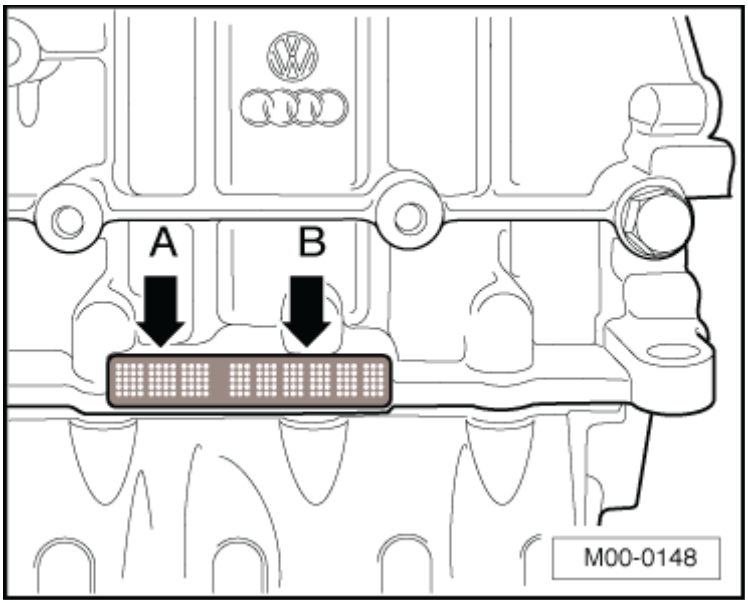
Component	Nm
Camshaft Position (CMP) sensor bolt	9
Engine Speed (RPM) sensor bolt	9
Knock Sensor (KS) bolt [1)]	20
Spark plug	25

1) The tightening specification affects the function of the Knock Sensor (KS).

ENGINE MECHANICAL – 2.5L CBTA, CBUA

General, Technical Data

Engine Number



The engine code (A) and engine number (B) (serial number) are located on the rear side of the engine, above the cylinder block/upper oil pan partition.

Engine Data

Engine codes		CBTA	CBUA
Manufactured		from 07.2007	from 07.2007
Emission values in accordance with		TIER 2/BIN5 (US coalition)	SULEV [1]
Displacement	cm^3	2480	2480
Output	kW at RPM	125 @ 5700	125 @ 5700
Torque	Nm at RPM	240 @ 4250	240 @ 4250
Engine idle speed [3]	RPM	680	680
Engine speed (RPM) limitation	RPM	approximately 6300	approximately 6300
Bore	diameter mm	82.5	82.5
Stroke	mm	92.8	92.8
Compression ratio		9.5	9.5
Valves per cylinder		4	4
Research Octane Number (RON)	minimum	95 unleaded [2]	95 unleaded [2]
Fuel injection, ignition		Motronic ME 17.5	Motronic ME 17.5
Knock control		2 sensors	2 sensors
Variable valve timing		Yes	Yes
Variable intake manifold		No	No
Oxygen Sensor (O2S) regulation		2 sensors	3 sensors
Catalytic converter		Yes	Yes
Exhaust Gas Recirculation (EGR)		No	No
Turbocharger, Supercharger		No	No
Secondary Air Injection (AIR) System		No	Yes

[1] SULEV - Super Ultra Low Emission Vehicles.

[2] Unleaded RON 91 is permitted but performance is reduced.

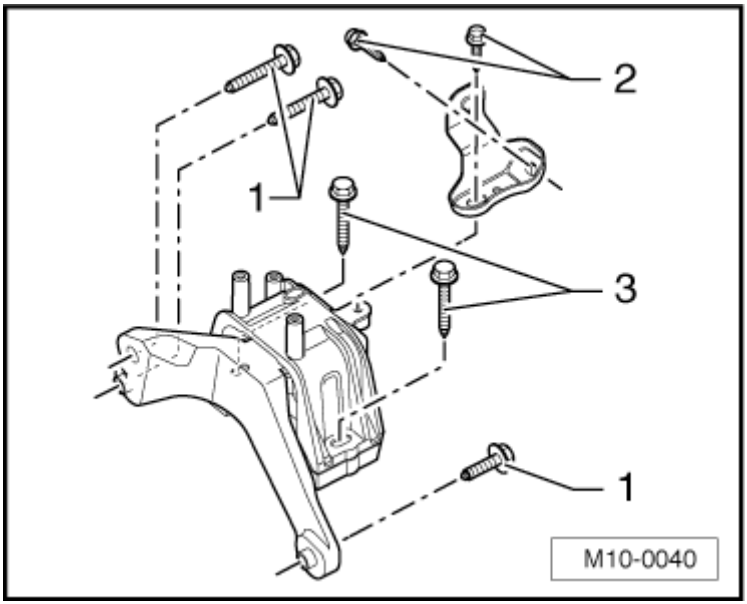
[3] If the voltage supply of the Engine Control Module (ECM) drops below 12 volts, the idle speed is raised in stages up to 780 RPM. The idle speed is not adjustable.

Engine Assembly – 2.5L CBTA, CBUA

Fastener Tightening Specifications

Component	Fastener size	Nm
Bolts and nuts	M6	10
	M7	15
	M8	25
	M10	40
	M12	60

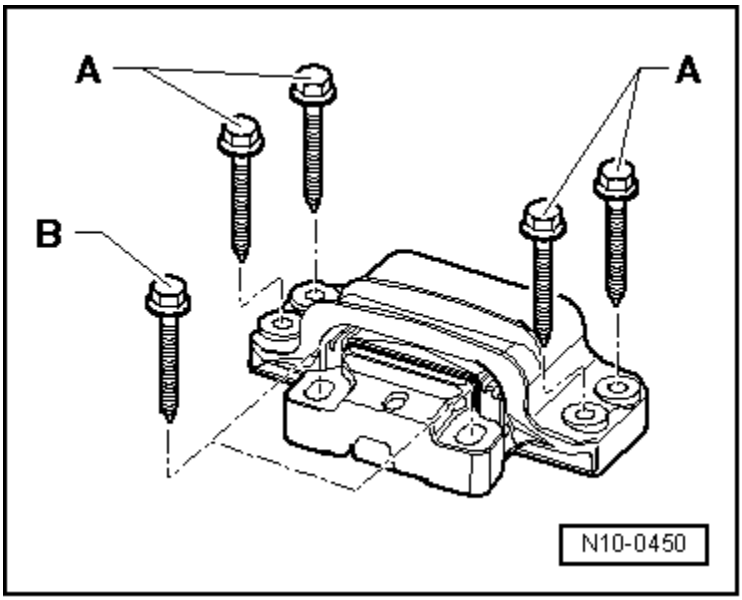
Engine Mount Tightening Specifications



Component	Nm
Bolts 1	40 plus an additional 90° (¼ turn) [1]
Bolts 2	20 plus an additional 90° (¼ turn) [1]
Bolts 3	60 plus an additional 90° (¼ turn) [1]

[1] Replace fastener(s).

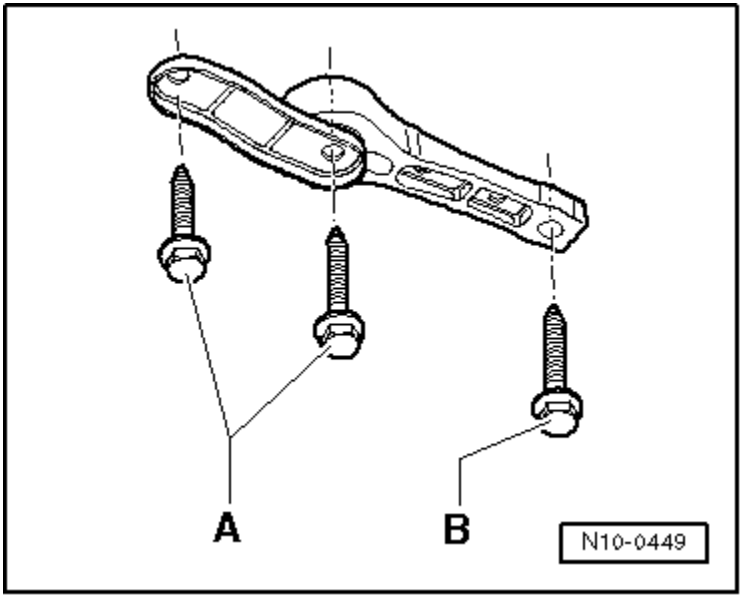
Transmission Mount Tightening Specifications



Component	Nm
Bolts A [1)]	40 plus an additional 90° (¼ turn)
Bolt B [1)]	60 plus an additional 90° (¼ turn)

[1)] Replace fastener(s).

Pendulum Support Tightening Specifications



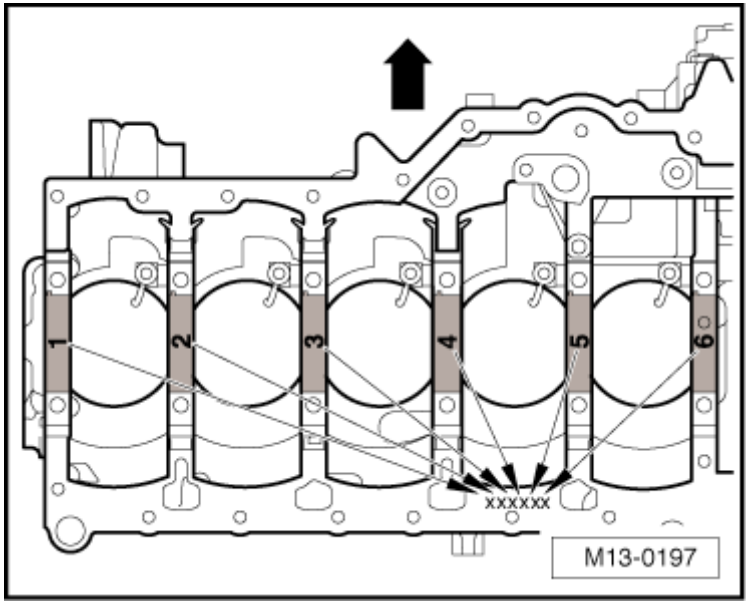
Secure the pendulum support to the transmission first and then to the subframe. To remove, first remove bolt B, then bolts A.

Component	Fastener size	Nm
Bolt A [1)]	10.9	50 plus an additional 90° (¼ turn)
Bolt B [1)]	-	100 plus an additional 90° (¼ turn)

[1)] Replace fastener(s).

Crankshaft, Cylinder Block – 2.5L CBTA, CBUA

Main Bearing Shell Allocation Crankshaft/Upper Bearing Shell Marks



The upper bearing shells are allocated to the cylinder block with the correct thickness from the factory. Colored dots identify the bearing thicknesses. The letters marked on the lower sealing surface of the cylinder block identify which bearing thickness must be installed in which location.

Letter on cylinder block	Color of bearing
G	Yellow
B	Blue
W	White

NOTE:
- The ➡ points in the direction of travel.
- If the colored dots can no longer be seen, use the bearing shell with a blue dot.
- The lower crankshaft bearing shells are always shipped as a replacement part with the yellow colored dot.

Fastener Tightening Specifications

Component	Nm
Accessory bracket-to-cylinder block bolt	25
Air conditioning compressor-to-accessory bracket bolt/ stud bolt	25
Air conditioning compressor ribbed belt tensioner-to-accessory bracket bolt	35
Connecting rod bearing cap bolt [1]	30 plus an additional 90° (¼ turn)
Control housing cover-to-cylinder block bolt	25
Crankshaft bearing cap-to-cylinder block bolt [1]	40 plus an additional 90° (¼ turn)
Cylinder block plug	30
Drive plate/flywheel-to-crankshaft bolt [1]	60 plus an additional 90° (¼ turn)
Engine mount-to-accessory bracket bolt [1]	40 plus an additional 90° (¼ turn)
Engine speed sensor-to-control housing cover bolt	5
Generator-to-accessory bracket bolt	25
Generator, power steering pump and coolant pump belt tensioner-to-accessory bracket bolt	35
Idler pulley bracket-to-accessory bracket bolt	25
Power steering pump-to-accessory bracket bolt	23
Power steering pump pulley-to-power steering pump bolt	23
Pressure relief valve	27
Sealing flange-to-cylinder block bolt	10
Vibration damper-to-crankshaft bolt [1] [2]	50 plus an additional 90° (¼ turn)

[1] Replace fastener(s).
[2] Only use a strength category 10.9 bolt.

Crankshaft Dimensions

Honing dimensions in mm	Crankshaft bearing pin diameter		Connecting rod bearing pin diameter	
Basic dimension	58.00	-0.022	47.80	-0.022
		-0.042		-0.042
1st oversize	57.75	-0.022	47.55	-0.022
		-0.042		-0.042
2nd oversize	57.50	-0.022	47.30	-0.022
		-0.042		-0.042
Stage III	57.25	-0.022	47.05	-0.022
		-0.042		-0.042

Piston and Cylinder Dimensions

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

[1)] Measurement does not include the graphite coating (thickness = 0.02 mm). The graphite coating wears away.

Piston Ring Gap

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

Piston Ring Groove Clearance

Piston ring dimensions in mm	Ring to groove clearance	
	New	Wear limit
Compression rings	0.06 to 0.09	0.20
Oil scraping ring	0.03 to 0.06	0.15

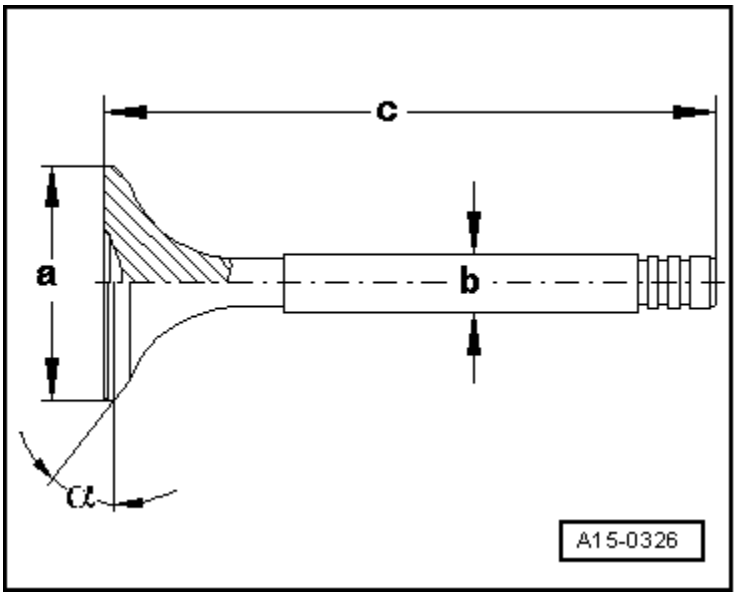
Cylinder Head, Valvetrain – 2.5L CBTA, CBUA

Fastener Tightening Specifications

Component	Nm
Camshaft adjustment valve 1-to-cylinder head bolt	2
Camshaft clamp (T40070)-to-camshaft bolt	20
Camshaft Position (CMP) sensor-to-cylinder head bolt	10
Chain compartment cover-to-cylinder head bolt	10
Coolant pipe-to-bracket bolt	10
Cylinder block mount bolt	10
Cylinder block plug	30
Double sprocket-to-cylinder block bolt [1)]	60 plus an additional 90° (¼ turn)
Exhaust camshaft sprocket-to-camshaft bolt [1)]	60 plus an additional 90° (¼ turn)
Flange-to-chain compartment cover bolt	10
Intake camshaft adjuster-to-camshaft bolt [1)]	60 plus an additional 90° (¼ turn)
Oil pump sprocket-to-oil pump bolt [1)]	20 plus an additional 90° (¼ turn)
Secondary Air Injection (AIR) connecting pipe-to-cylinder head bolt	10
Threaded pin-to-cylinder block	40
Timing chain tensioner-to-cylinder block bolt	10
Timing chain tensioner-to-cylinder head bolt	10
Transport strap-to-cylinder block bolt	25
Vacuum pump-to-control housing cover bolt	10
Wire bracket-to-chain compartment cover bolt	10

[1)] Replace fastener(s).

Valve Dimensions

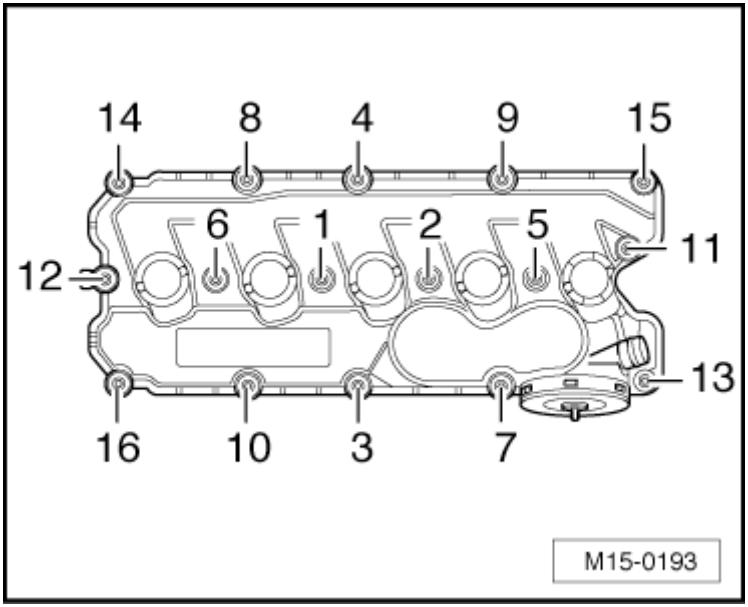


Dimension		Intake valve	Exhaust valve
Diameter a	mm	26.80 to 27.00	29.80 to 30.00
Diameter b	mm	5.95 to 5.97	5.94 to 5.95
c	mm	104.84 to105.34	103.64 to 104.14
α	∠°	45	45

Compression Pressures

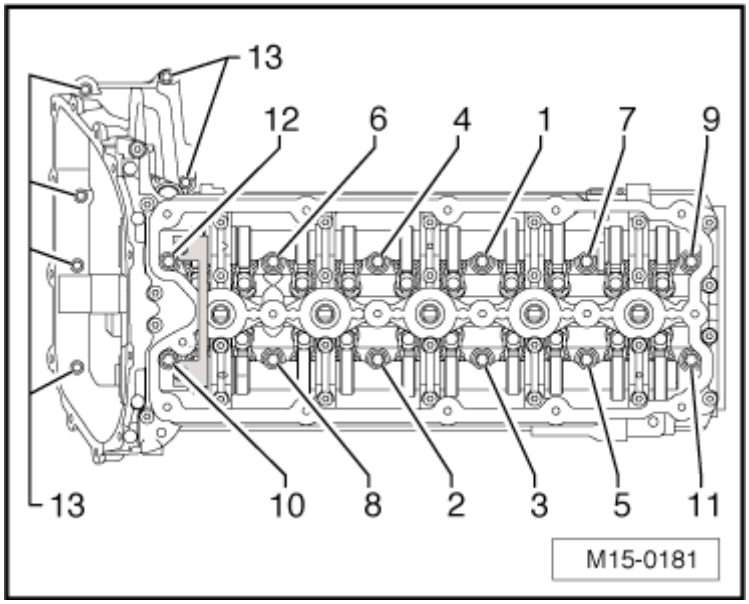
New Bar positive pressure	Wear limit Bar positive pressure	Difference between cylinders Bar positive pressure
9.0 to 13.0	8.0	Maximum 3.0

Cylinder Head Cover Tightening Specification



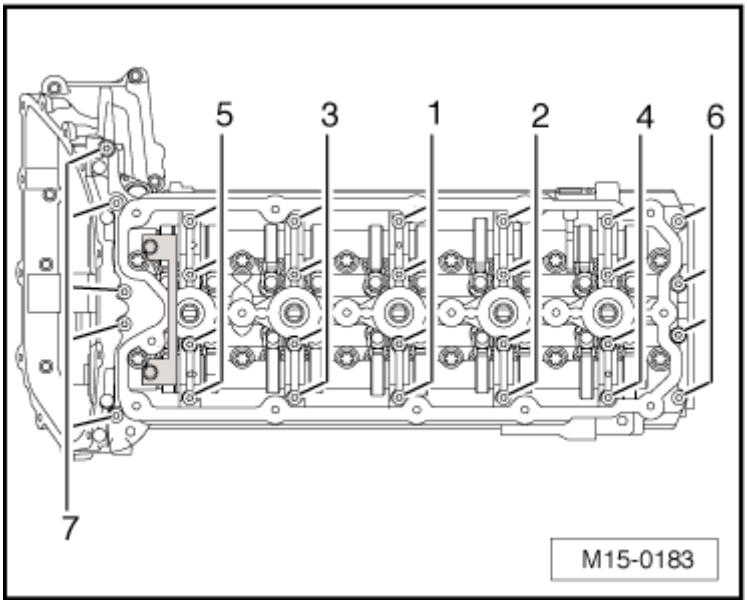
Step	Component	Nm
1	Tighten bolts 1 through 16 in sequence	10

Cylinder Head Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 12 in sequence	40
2	Tighten bolts 1 through 12 in sequence	an additional 90° (¼ turn)
3	Tighten bolts 1 through 12 in sequence	an additional 90° (¼ turn)
4	Tighten bolts 13	10

Guide Frame Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 8 in sequence [1)]	8
2	Tighten bolts 1 through 8 in sequence	an additional 90° (¼ turn)

[1)] Replace fastener(s).

Lubrication – 2.5L CBTA, CBUA

Fastener Tightening Specifications

Component	Nm
Cylinder block plug	30
Lower oil pan-to-upper oil pan bolt	10
Oil cooler-to-oil filter bracket bolt	25
Oil drain plug-to-lower oil pan	30
Oil filter bracket-to-cylinder block bolt	25
Oil filter housing-to-oil filter bracket	25
Oil intake pipe/bracket-to-oil pump bolt	10
Oil intake pipe decoupling element bolt	10
Oil intake pipe-to-upper oil pan bolt	10
Oil pressure regulation valve-to-cylinder block bolt	9
Oil pressure switch-to-cylinder block	20
Oil pump align plate (T03005)-to-crankshaft bolt	30
Oil pump-to-cylinder block bolt	25
Oil pump sprocket bolt [1)]	20 plus an additional 90° (¼ turn)
Pre-heater-to-cylinder block bolt	25
Reduced oil pressure sensor-to-cylinder block	20
Upper oil pan-to-cylinder block bolt	25

Cooling System – 2.5L CBTA, CBUA

Fastener Tightening Specifications

Component	Nm
Air conditioning condenser-to-radiator bolt	5
Coolant fan shroud nut	5
Coolant hose bracket-to-accessory bracket bolt	9
Coolant line-to-cylinder block bolt/nut	10
Coolant pump-to-cylinder block bolt	10
Coolant thermostat housing-to-cylinder block bolt	25
Cylinder head flange nut	10
Expansion tank-to-body bolt	2
Heated Oxygen Sensor (HO2S) bracket bolt	10
Oil filter bracket-to-cylinder block bolt	25
Pre-heater bracket/oil dipstick guide tube-to-cylinder block bolt	25
Radiator fan shroud bolt	5
Radiator mount-to-lock carrier bolt	7
Thermostat housing cover-to-thermostat housing bolt	5

Fuel Supply – 2.5L CBTA, CBUA

Fastener Tightening Specifications

Component	Nm
Accelerator pedal module-to-body bolt	10
Air filter-to-Evaporative Emission (EVAP) canister nut	1.8
Evaporative Emission (EVAP) canister-to-body nut	8
Evaporative Emission (EVAP) canister-to-body screw	1.8
Fuel filler tube-to-body bolt	11
Fuel filter bracket screw	3
Fuel tank-to-underbody bolt [1)]	25
Fuel tank lock ring	110
Heat shield-to-fuel tank nut	2.5
Leak Detection Pump (LDP)-to-Evaporative Emission (EVAP) canister screw	1.8
Tensioning strap-to-underbody bolt [1)]	25

1) Replace fastener(s).

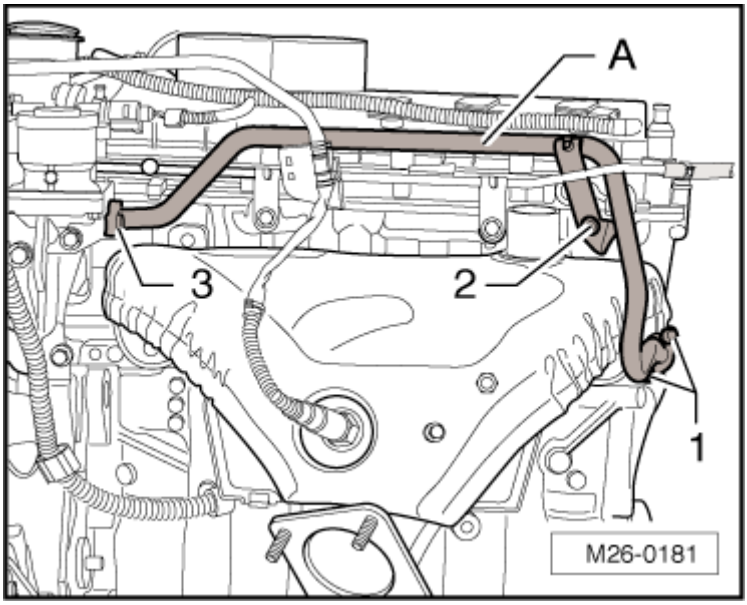
Exhaust System, Emission Controls – 2.5L CBTA, CBUA

Fastener Tightening Specifications

Component	Nm
Catalytic converter heat shield front bolt [2]	10
Catalytic converter heat shield rear bolt [2]	5
Exhaust clamp nut	23
Exhaust manifold-to-cylinder head nut [1]	25
Front exhaust pipe with catalytic converter-to-exhaust manifold nut [1]	23
Front exhaust pipe with catalytic converter suspended mount-to-subframe bolt	23
Heat shield-to-exhaust manifold bolt	10
Intake manifold support-to-cylinder block bolt	25
Muffler suspended mount-to-body bolt	23
Oxygen Sensor (O2S)	55
Oxygen Sensor (O2S) bracket-to-cylinder block bolt [3]	10
Secondary Air Injection (AIR) pump motor bushing-to-intake manifold support nut	10
Secondary Air Injection (AIR) sensor 1-to-Secondary Air Injection (AIR) pressure pipe bolt	2
Secondary Air Injection (AIR) solenoid valve-to-cylinder head bolt	10
Tunnel bridge-to-underbody nut	20
Tunnel exit suspended mount-to-body bolt	23

[1] Replace fastener(s).
[2] Engine code CBUA only.

Secondary Air Injection (AIR) Pipe Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 3 in sequence	Hand-tighten
2	Tighten bolts 1 through 3 in sequence	10

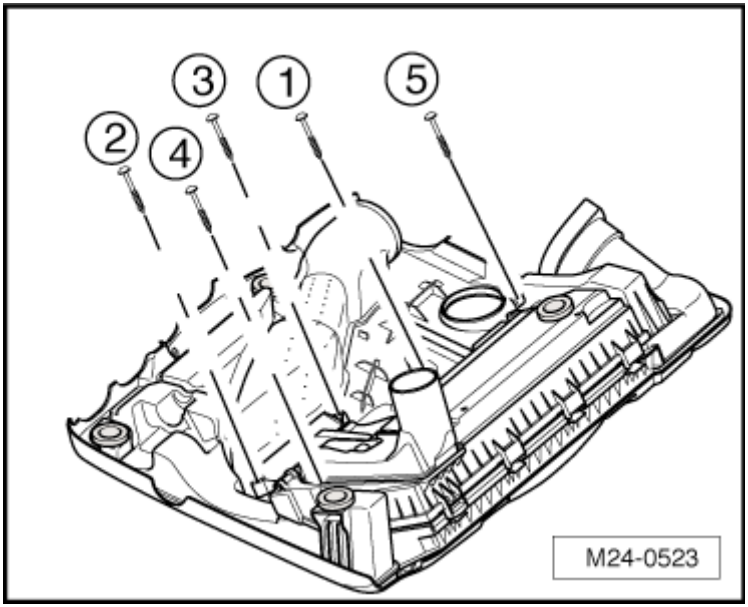
Multiport Fuel Injection – 2.5L CBTA, CBUA

Fastener Tightening Specifications

Component	Nm
Adapter to upper air filter with engine cover bolt	3
Cylinder head transport strap bolt	25
Fuel rail-to-intake manifold bolt	3.5
Intake manifold-to-cylinder head bolt	9
Intake manifold support-to-cylinder block bolt	25
Intake manifold support-to-intake manifold bolt	16
Manifold Absolute Pressure (MAP) sensor-to-intake manifold bolt	3.5
Oil dipstick guide tube-to-cylinder block bolt	25
Oxygen Sensor (O2S)	55
Power steering pump intake line and Secondary Air Injection (AIR) pump motor bracket-to-cylinder block bolt [2)]	25
Power steering pump intake line and Secondary Air Injection (AIR) pump motor bracket-to-intake manifold bolt [2)]	16
Power steering intake line bracket-to-intake manifold bolt [1)]	16
Throttle valve control module-to-intake manifold bolt	6.5

[1)] Engine code CBTA only.
[2)] Engine code CBUA only.

Lower Air Filter Housing Tightening Sequence



Step	Component	Nm
1	Tighten bolts 1 through 5 in sequence	2

Ignition – 2.5L CBTA, CBUA

Fastener Tightening Specifications

Component	Nm
Camshaft Position (CMP) sensor bolt	10
Cover plate-to-cylinder block bolt	10
Cylinder block plug	25
Knock Sensor (KS) bolt [1)]	20
Spark plug	25

[1)] Tightening specifications affect the function of the Knock Sensor (KS).

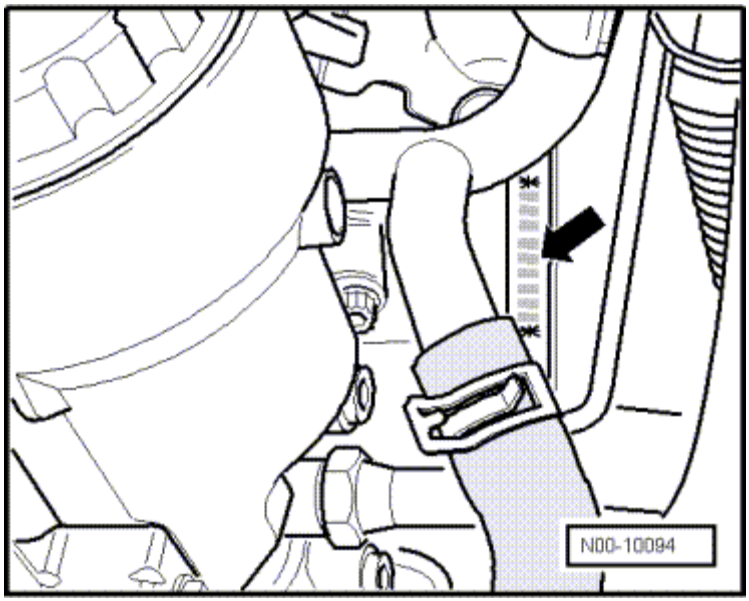
Technical Data

Engine codes	CBTA and CBUA
Ignition sequence	1-2-4-5-3
Spark plugs	Refer to the Parts Catalog
Electrode gap	1.0 to 1.1 mm
Tightening specification	25 Nm
Change intervals	Refer to Maintenance Intervals Rep. Gr. 03

ENGINE MECHANICAL – 2.0L CJAA (TDI)

General, Technical Data

Engine Number Location



The engine number (engine code and serial number) (arrow) is located at the front of the engine/transmission joint. There is also a label on the toothed belt guard that shows the engine code and serial number. Engine codes beginning with C are four digits. The first 3 digits of the engine code indicate the displacement and the mechanical structure of the engine. They are stamped in the cylinder block, including the serial number. The fourth digit describes the engine output and torque.

Engine Data

Identification code		**CJAA**
Emission values in accordance with		ULEV2 Standard
Displacement	liter	2.0
Output	kW at RPM	103 @ 4000
Torque	Nm at RPM	320 @ 1750 to 2500
Bore	diameter mm	81.0
Stroke	mm	95.5
Valves per cylinder		4
Compression ratio		16.5
Fuel		Diesel
Ignition sequence		1-3-4-2
Balance shaft module		Yes
Catalytic converter		Yes
Exhaust Gas Recirculation (EGR)		Yes
Turbocharger, Supercharger		Yes
Charge Air Cooler (CAC)		Yes
Particulate filter		Yes

Engine Assembly – 2.0L CJAA (TDI)

Fastener Tightening Specifications

Component	Fastener size	Nm
Bolts and nuts	M6	10
	M7	15
	M8	25
	M10	40
	M12 [1)]	65
Bracket to body bolt [1)]	-	40 plus an additional 90° (¼ turn)
Bracket to engine mount bolt [1)]	-	40 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)]	-	40 plus an additional 90° (¼ turn)
Engine mount bracket to engine [1)]	-	40 plus an additional 90° (¼ turn)
Pendulum support to subframe bolt [1)]	-	40 plus an additional 90° (¼ turn)
Pendulum support to transmission bolt [1)]	-	40 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 [1)]	-	40 plus an additional 90° (¼ turn)

[1)] Replace fasteners.
[2)] Tightening specification for a M12 collar bolt is 75 Nm.

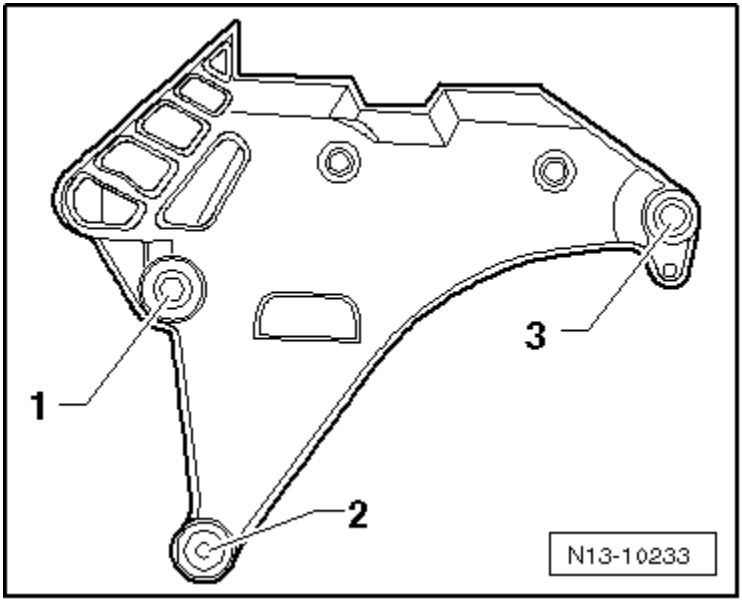
Crankshaft, Cylinder Block – 2.0L CJAA (TDI)

Fastener Tightening Specifications

Component	Nm
Air conditioning compressor-to-accessory bracket bolt	45
Connecting rod cap-to-connecting rod bolt [1) 3)]	30 plus an additional 90° (¼ turn)
Crankshaft bearing cap-to-cylinder block bolt [1)]	65 plus an additional 90° (¼ turn)
Crankshaft toothed belt gear-to-crankshaft bolt [1) 2)]	120 plus an additional 90° (¼ turn)
Dual mass flywheel-to-crankshaft bolt [1)]	60 plus an additional 90° (¼ turn)
Engine speed sensor-to-sealing flange bolt	5
Oil spray jet-to-cylinder block bolt	27
Ribbed Belt Tensioner	20 plus an additional 90° (¼ turn)
Toothed belt idler pulley-to-cylinder block bolt [1)]	50 plus an additional 90° (¼ turn)
Toothed belt idler roller-to-cylinder block nut	15

1) Replace fastener(s).

Engine Mount Bracket Tightening Specifications



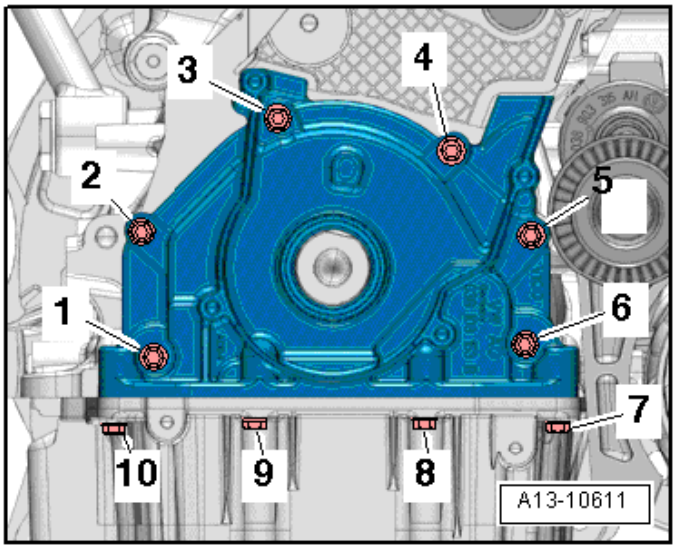
Step	Component	Nm
1	Tighten bolts 1 through 3 in sequence [1)]	7
2	Tighten bolts 1 through 3 in sequence	40
3	Tighten bolts 1 through 3 in sequence	an additional 180° (½ turn)

[1)] Replace fastener(s).

WARNING

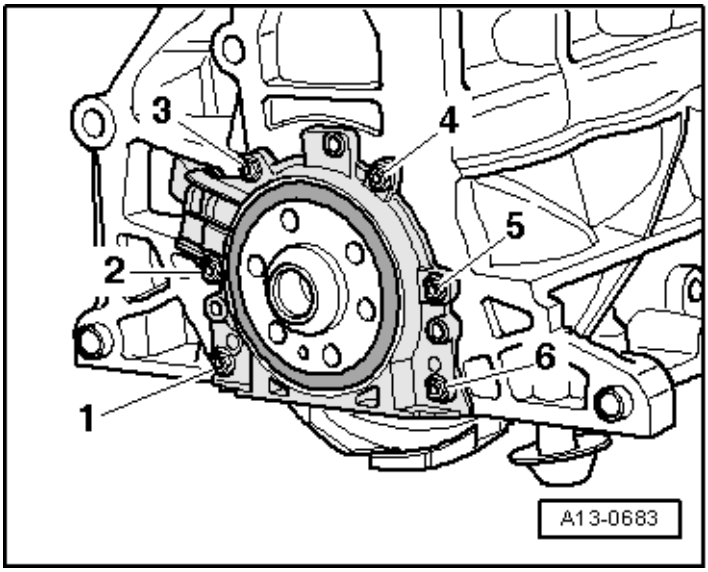
Always use the correct tightening sequence and specifications for the engine mount bracket bolts. Tension could develop in the engine mount bracket and damage to the bracket could occur.

Sealing Flange (Belt Pulley Side) Bolt Tightening Sequence and Specification



Step	**Component**	Nm
1	1 through 10	Hand-tighten
2	1 through 6	Tighten diagonally in steps to at least 15 Nm
3	7 through 10	Tighten to 15 Nm

Sealing Flange (Transmission Side) Bolt Tightening Sequence and Specification



Step	**Component**	Nm
1	1 through 6	Hand-tighten
2	1 through 6	Tighten diagonally in steps to at least 15 Nm

Crankshaft Dimensions

Honing dimension in mm	Crankshaft bearing pin diameter		Connecting rod bearing pin diameter	
Basic dimension	54.000	-0.022	50.900	-0.022
		-0.042		-0.042

Piston and Cylinder Dimensions

Honing dimension in mm	Piston diameter [1)]	Cylinder bore diameter
Basic dimension	80.96	81.01

[1)] Measurement with coating (thickness = 0.02 mm). The coating wears off.

Piston Ring End Gaps

Piston ring gap dimensions in mm	New	Wear limit
1st compression ring	0.20 to 0.40	1.0
2nd compression ring	0.20 to 0.40	1.0
Oil scraping ring	0.25 to 0.50	1.0

Piston Ring Clearance

Piston ring to groove clearance dimensions in mm	New	Wear limit
1st compression ring	0.06 to 0.09	0.25
2nd compression ring	0.05 to 0.08	0.25
Oil scraping ring	0.03 to 0.06	0.15

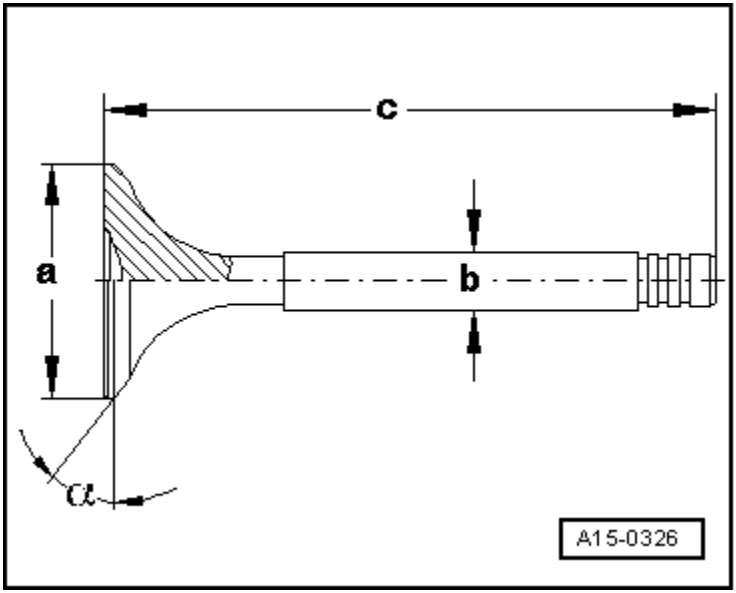
Cylinder Head, Valvetrain – 2.0L CJAA (TDI)

Fastener Tightening Specifications

Component	Nm
Camshaft Position (CMP) sensor-to-cylinder head bolt [2]	10
Camshaft sprocket-to-camshaft bolt	20 plus an additional 45° (⅛ turn)
Center toothed belt guard-to-lower toothed belt guard bolt	10
Connecting Piece-to-Cylinder Head Bolt	9
Coolant pump-to-cylinder block bolt	15
Crankshaft toothed belt gear-to-crankshaft bolt [1] [3]	120 plus an additional 90° (¼ turn)
Engine lifting eye-to-cylinder head bolt	20
Engine mount bracket-to-cylinder block bolt [1]	40 plus an additional 180° (½ turn)
Fuel rail-to-cylinder head cover bolt	22
High pressure line clamp screw	8
High pressure pump hub nut	95
High pressure pump toothed belt gear-to-hub bolt	20
Hub-to-camshaft bolt	100
Oil pressure switch-to-cylinder head	20
Rear toothed belt guard protective plate bolt	5
Rear toothed belt guard-to-cylinder head bolt [4]	10
	20 [1]
Tensioning bracket-to-cylinder head cover/cylinder head bolt [1]	8 plus an additional 180° (½ turn)
Toothed belt idler pulley-to-cylinder head bolt [1]	50 plus an additional 90° (¼ turn)
Toothed belt idler roller-to-cylinder block nut	20
Toothed belt idler roller-to-cylinder head bolt	20
Toothed belt tensioning roller-to-cylinder head nut	20 plus an additional 45° (⅛ turn)
Vacuum pump-to-cylinder head bolt	10
Vibration damper-to-crankshaft bolt [1]	10 plus an additional 90° (¼ turn)

[1] Replace fastener(s).
[2] Install using locking compound. Refer to the Electronic Parts Catalog (ETKA).
[3] Do not lubricate or grease the threads or collar.
[4] For bolt tightening clarification, refer to ElsaWeb, *Toothed Belt Drive Overview*, items 14 and 15.

Valve Dimensions



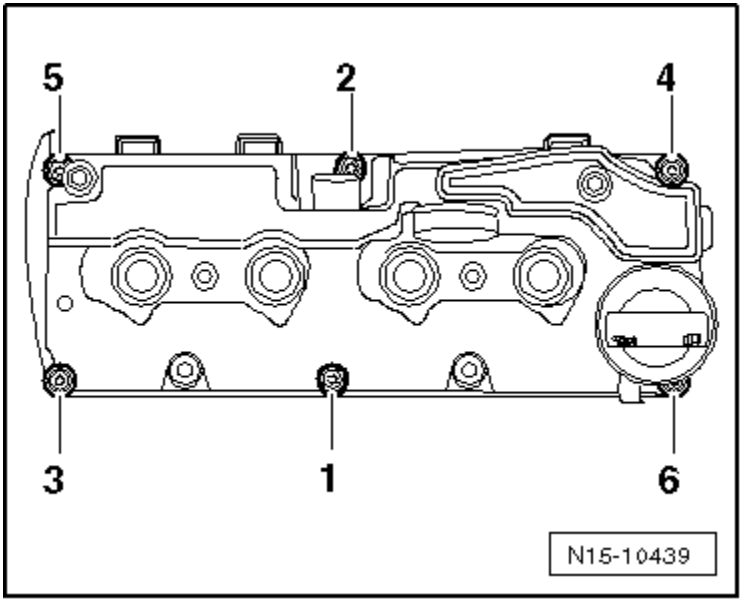
Dimension		Intake valve	Exhaust valve
Diameter a	mm	28.10	26.00
Diameter b	mm	5.975	5.965
c	mm	99.30	99.10
α	∠°	45	45

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

Compression Pressures

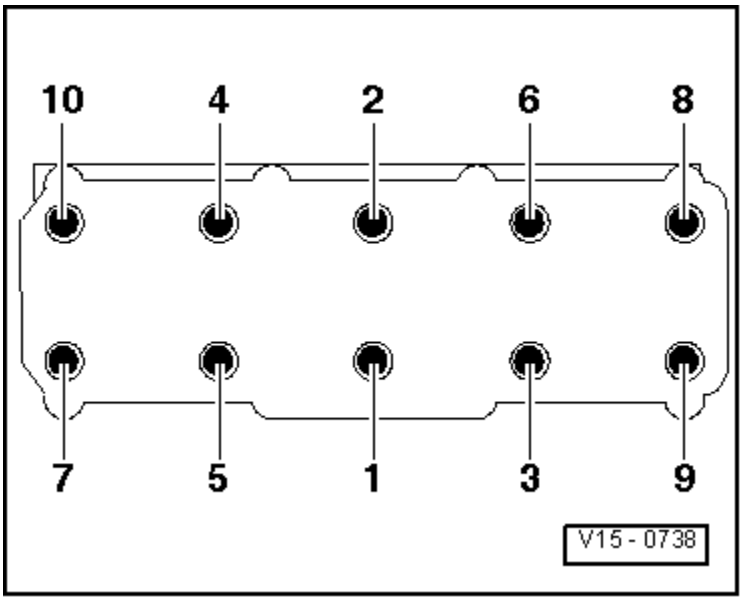
New Bar positive pressure	Wear limit Bar positive pressure	Difference between cylinders Bar positive pressure
25.0 to 31.0	19.0	Maximum 5.0

Cylinder Head Cover Tightening Specification



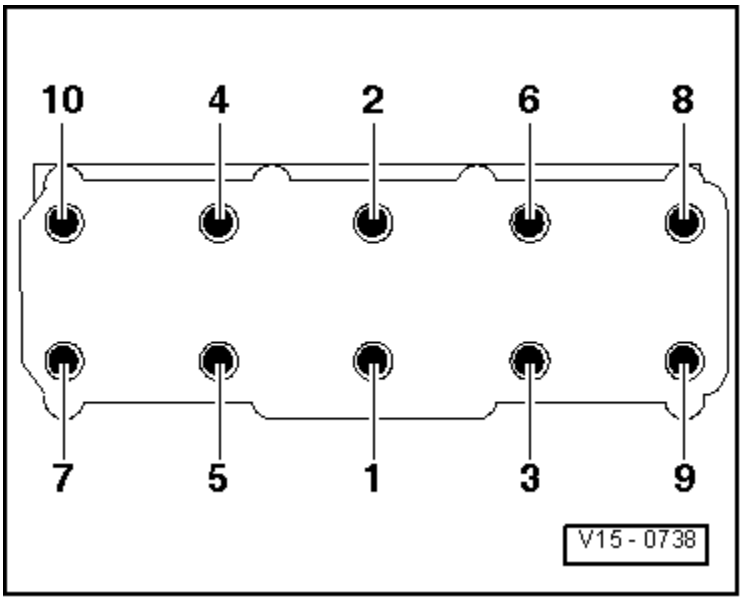
Step	Component	Nm
1	Tighten bolts 1 through 6 in sequence	9

Cylinder Head Loosening Specifications



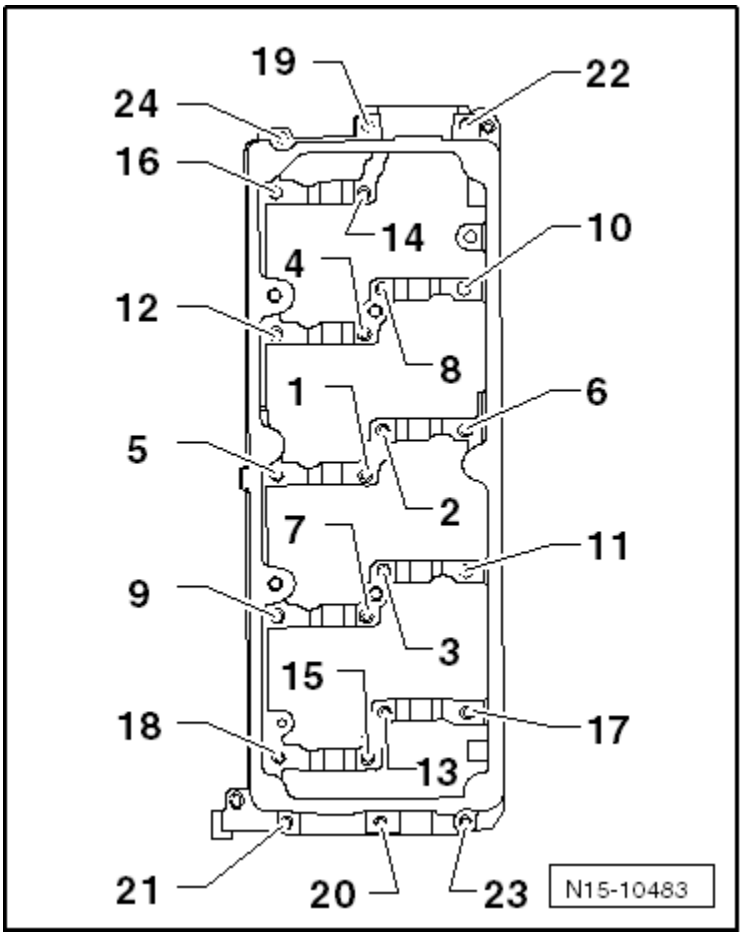
Loosen bolts 1 through 10 in sequence.

Cylinder Head Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 10 in sequence	30
2	Tighten bolts 1 through 10 in sequence	50
3	Tighten bolts 1 through 10 in sequence	an additional 90° (¼ turn)
4	Tighten bolts 1 through 10 in sequence	an additional 90° (¼ turn)

Bearing Frame Tightening Specifications



Step	Component	Nm
1	Tighten bolts and nuts 1 through 24 in sequence [1)]	Hand-tighten
2	Tighten bolts and nuts 1 through 24 in sequence	10

[1)] The guide frame must be in contact with the entire contact surface of the cylinder head.

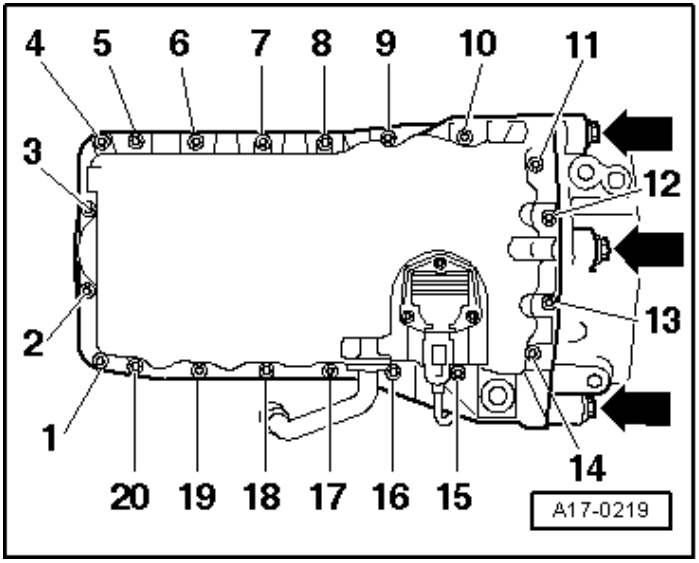
Lubrication – 2.0L CJAA (TDI)

Fastener Tightening Specifications

Component	Nm
Chain tensioner with tensioning rail to cylinder block bolt	15
Oil filter cap	25
Oil filter housing to cylinder block bolt 1, 2	15 plus an additional 90° (¼ turn)
Oil filter housing lower cover	25
Oil level thermal sensor to oil pan bolt	10
Oil pan drain plug1	30
Oil pan to transmission bolt	40
Oil pressure switch	22
Oil pump sprocket to oil pump bolt1	20 plus an additional 90° (¼ turn)
Oil pump to cylinder block	15
Oil spray jet to cylinder block bolt	27
Oil supply line to connection	22
Oil supply line connection to oil filter housing	30
Sealing flange to cylinder block bolt	15
Splash wall to cylinder block bolt	15
Suction line to oil pump bolt	15
Wiring harness bracket to oil filter housing bolt	10

1) Replace fastener(s).
2) First, fasten upper left and lower right bolts, and then tighten all 4 bolts in a diagonal sequence

Oil Pan Bolt Tightening Sequence and Specification



Note: Replace the oil pan bolts. Tighten the bolt in 3 steps:

Step	Bolts	Nm
1	-1 through 20-	Tighten to 5 Nm, in a diagonal sequence
2	-Arrows-	Tighten to 40 Nm
3	-1 through 20-	Tighten to 15 Nm, diagonally and in steps

Cooling System – 2.0L CJAA (TDI)

Fastener Tightening Specifications

Component	Fastener size	Nm
4/2 way valve with thermostat-to-cylinder block bolt	-	15
Charge air cooler bolt	-	7
Charged air cooler circuit radiator mount bolt	-	10
Charge air cooling pump-to-bracket bolt	-	1.5
Condenser on the radiator for the charged air coolant circuit	-	5
Connecting piece-to-cylinder block bolt	-	9
Coolant fan shroud nut	-	10
Coolant pump-to-cylinder block bolt	-	15
Engine pre-heater bracket to engine pre-heater coolant pipe bolt	-	10
Engine pre-heater coolant pipe to charge air pipe bolt	-	10
Front coolant pipe bolt/nut	-	8
Left coolant pipe bolt [1)]	-	9
	-	13
Radiator bolt	-	5
Radiator fan shroud bolt	-	5
Reservoir bolt	-	5
Right coolant pipe	-	9
Ventilation pipe-to-intake manifold bolt	-	10

[1)] For bolt tightening clarification, refer to ElsaWeb, *Coolant Pipes Overview* items 25, 26 and 28.

Fuel Supply – 2.0L CJAA (TDI)

Fastener Tightening Specifications

Component	-	Nm
Accelerator pedal module-to-body bolt	-	10
Auxiliary fuel pump	-	20
Differential pressure sensor	-	8
Fuel delivery unit locking ring	-	110
Fuel filler door unit	-	1.5
Fuel filler tube to body	-	10
Fuel filter upper section	-	5
Fuel filter housing	-	10
Fuel tank mounting bolt [1) 2)]	M6	8 plus an additional 90° (¼ turn)
	M8	20 plus an additional 90° (¼ turn)
Fuel tank mounting bolt [1) 3)]	-	25

1) Replace fastener(s)
2) Coupe
3) Convertible

Turbocharger – 2.0L CJAA (TDI)

Fastener Tightening Specifications

Component	Nm
Charge air pressure sensor	5
Charge air cooler mount bolt	10
Charge air pipe bolt	10
Connecting pipe to exhaust manifold nut [2]	20
Control line/heat shield to exhaust manifold stud nut	23
Control line fittings	23
Exhaust gas recirculation filter to stud bolt nut	23
Exhaust gas temperature sensor [1]	45
Intake scoop to turbocharger bolt	8
Oil return line	15
Oil supply line clamps	10
Oil supply line fittings	22
Turbocharger brace to cylinder block banjo bolt [1]	60
Turbocharger/exhaust manifold to cylinder head nut [1] [2]	23
Turbocharger to particulate filter clamp [1]	7
Turbocharger support to stud bolt	20
Warm air collector plate	8

[1] Replace fastener(s).
[2] Lubricate the studs with hot bolt paste -G 052 112 A3-

Exhaust System – 2.0L CJAA (TDI)

Fastener Tightening Specifications

Component	Fastener size	Nm
Clamping Sleeve Nut		
- Individual clamp	-	25
- Continuous clamp	-	35
Connecting pipe-to-EGR housing	-	23
Control line nut-to-housing	-	23
Control line-to-exhaust manifold nut	-	10
Control line-to-particulate filter fitting	-	45
EGR cooler-to-EGR housing	-	8
EGR filter-to-turbocharger nut	-	23
EGR housing	-	8
EGR temperature sensor	-	20
EGR valve 2	-	8
Exhaust gas recirculation filter-to-particulate filter clamp	-	3.5
Exhaust gas temperature sensors	-	45
Muffler brackets	-	25
Oxygen sensor	-	52
Particulate filter bracket-to-particulate filter/cylinder head bolt/nut	-	23
Particulate filter-to-nox reduction catalytic converter clamp [1)]	-	7
Particulate filter with nox reduction catalytic converter-to-exhaust door control unit clamp [1)]	-	7
Particulate filter shield bolt	-	10
Particulate filter suspended mount-to-subframe bolt	-	25
Particulate filter-to-turbocharger clamp [1)]	-	7

1) Replace fastener(s).

1) Tightening specification for M12 collar bolt: 75 Nm.

Ignition/Glow Plug System – 2.0L CJAA (TDI)

Fastener Tightening Specifications

Component	Nm
Glow plug	18

Diesel Fuel Injection – 2.0L CJAA (TDI)

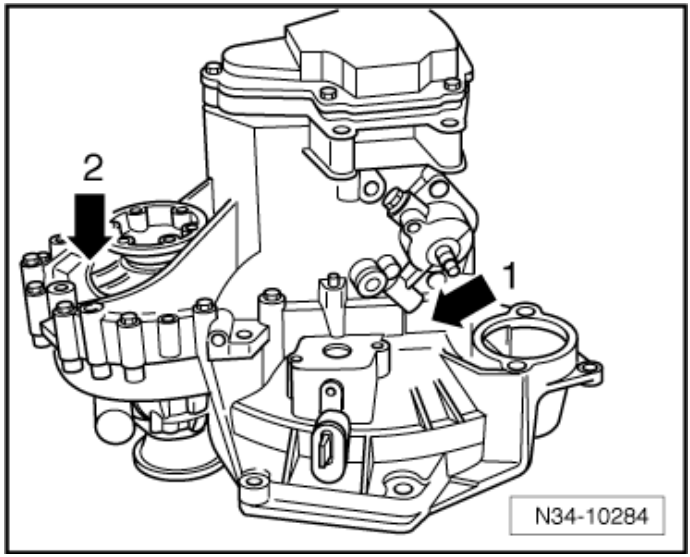
Fastener Tightening Specifications

Component	Nm
Differential pressure sensor	4
Fuel return line clamp nut	8
Fuel pressure sensor	100
Fuel rail to cylinder head cover bolt	22
Fuel injector tensioning plate to cylinder head cover nut	10
Fuel injector sealing cap to cylinder head cover bolt	5
Fuel pressure regulator valve	80
High pressure line fitting	28
High pressure fuel pump to cylinder block bolt	20
High pressure pump nut	95
Mass airflow sensor	3.5
Oxygen sensor	52
Throttle valve control module to intake manifold	10

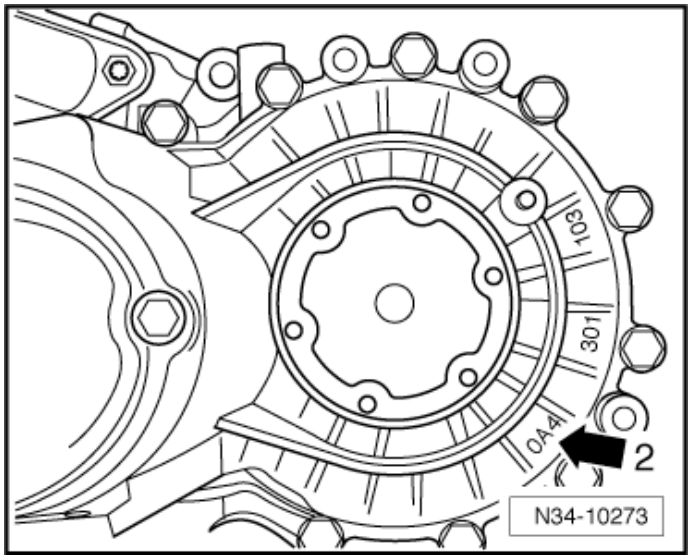
MANUAL TRANSMISSION – 0A4

General, Technical Data

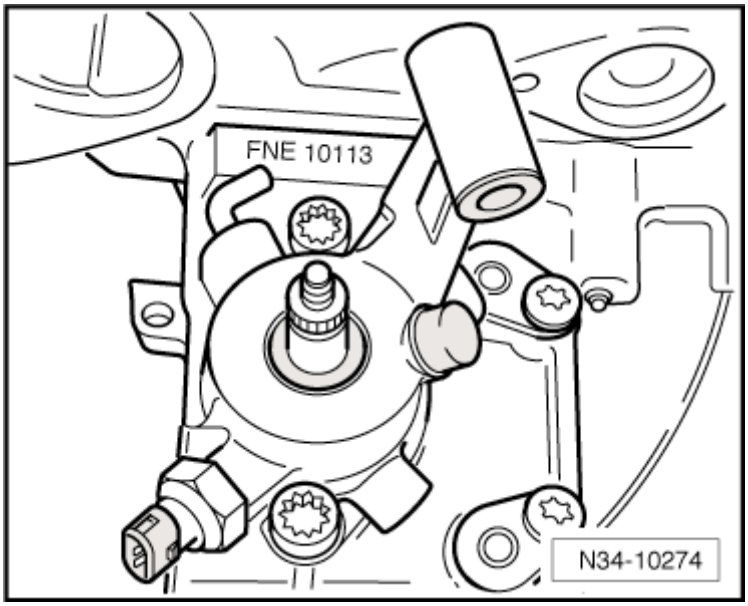
Transmission Identification



Code letters and build date (1) manual transmission 0A4 (2).



Manual transmission 0A4 (2).



Transmission code letters and build date.

Example:

FNE	10	11	3
Identification code	Day	Month	Year (2003) of manufacture

NOTE: The transmission code letters are also included on the vehicle data label.

Codes Letters, Transmission Allocation and Capacities

Manual transmission		**5 Speed Manual Transmission 0A4**
Identification codes		LPU
Manufactured	from	05.2011
	through	
Allocation	Type	Beetle from MY 2012
	Engine	2.5L - 125 kW
Manual transmission capacity (transmission completely disassembled)		Refer to Fluid Capacity Tables Rep. Gr. 03
Manual transmission capacity (transmission partly disassembled), refer to Elsaweb, Transmission Fluid, Checking and Filling		

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

- Individual gear ratios
- Final drive ratio
- Transmission fluid specifications
- Flange shaft allocation
- Clutch disc and pressure plate allocation

Clutch – 0A4

Fastener Tightening Specifications

Component	Fastener size	Nm
Ball stud-to-transmission	-	25
Clutch pedal-to-mounting bracket through bolt nut [1]	-	25
Clutch pedal bracket-to-bulkhead nut [1]	-	25
Clutch slave cylinder-to-transmission bolt	-	20
Guide sleeve-to-transmission bolt	-	20
Hose/line assembly bracket-to-transmission bolt	-	20
Impact bolster support-to-steering column bracket bolt [1]	-	20
Pressure plate-to-flywheel bolt [2]	M6	13
	M7	20
Transmission support-to-transmission bracket/transmission bolt [1]	-	20 plus an additional 90° (¼ turn)

[1] Replace fastener(s).
[2] Loosen and tighten in small steps and in a diagonal sequence.

Controls, Housing – 0A4

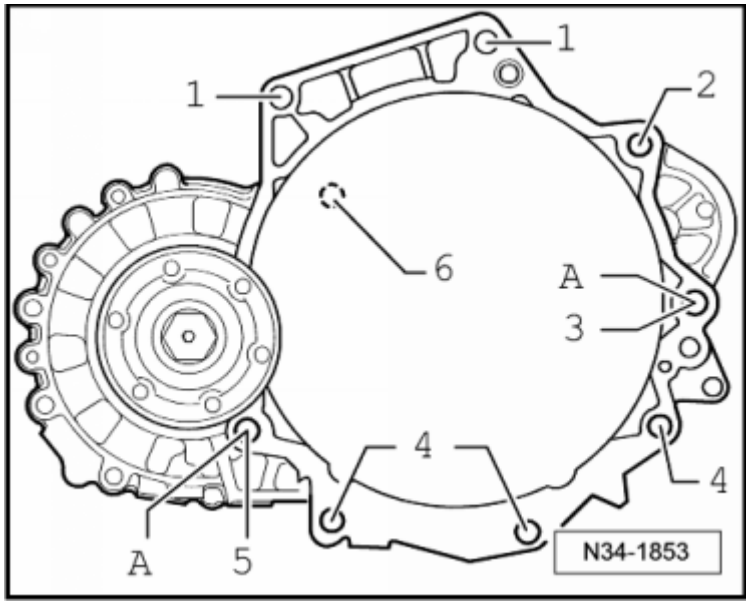
Fastener Tightening Specifications

Component	Nm
5th gear drive gear-to-output shaft bolt 1)	80 plus an additional 90° (¼ turn)
5th gear selector fork base-to-transmission housing bolt	25
5th gear shift jaw-to-selector fork with rail bolt	25
Backup lamp switch-to-shift unit	20
Cable bracket-to-transmission bolt	20
Clutch housing drain plug	35
Flange shaft bolt	25
Gearshift unit with selector cover-to-transmission housing bolt	25
Ground cable-to-upper starter stud bolt	20
Guide sleeve-to-clutch housing bolt	20
Mount-to-lower starter wires	20
Output shaft bearing support-to-clutch housing nut 1)	25 plus an additional 90° (¼ turn)
Reverse gear selector fork-to-clutch housing bolt	25
Reverse gear shaft support bolt 1)	30
Shift housing-to-body nut	8
Support pin-to-transmission housing bolt	25
Synchronizer hub with drive gear and synchronizer ring for 5th gear plate spring-to-input shaft bolt 1)	80 plus an additional 90° (¼ turn)
Transmission housing-to-clutch housing bolt 1)	25 plus an additional 90° (¼ turn)
Transmission housing cover-to-transmission housing bolt	18
Transmission housing fill plug	35
Transmission housing sealing cap bolt	25
Transmission shift lever-to-shift unit nut 1)	23
Transmission support-to-transmission bolt 1)	20 plus an additional 90° (¼ turn)
Transmission support-to-transmission mount bracket bolt 1	20 plus an additional 90° (¼ turn)
Transmission mount bracket-to-transmission bolt 1)	40 plus an additional 90° (¼ turn)

Component	Nm
Transmission mount-to-transmission mount bracket bolt [1]	60 plus an additional 90° (¼ turn)

[1] Replace fastener(s).

Transmission to Engine Tightening Specifications



Gas Engine

Item	Fastener	Qty.	Nm
1	M12 x 65	2	80
2	M12 x 170 Also starter to transmission	1	80
3	M12 x 170 Also starter to transmission	1	80
4	M10 x 65	3	40
5	M12 x 95	1	80
6	M6 x 8 Small flywheel cover plate	1	10
A	Alignment bushings for centering	-	-

Component	Nm
Lower starter plug wires mount	23

Gears, Shafts – 0A4

Component	Nm
Output Shaft Bearing Support to Clutch Housing Nut 1	25 plus an additional 90° (¼ turn)

1) Replace fastener(s).

Determining Shim Thickness

Example:

Bearing clearance measured value	Adjustment shim thickness according to the table
1.21 mm	1.175 mm

Adjustment Shim Table

Bearing play Adjusting shim Measured value (mm)	Adjustment shim thickness (mm)
0.671 to 0.699 0.700 to 0.724 0.725 to 0.749	0.650 0.675 0.700
0.750 to 0.774 0.775 to 0.799 0.800 to 0.824	0.725 0.750 0.775
0.825 to 0.849 0.850 to 0.874 0.875 to 0.899	0.800 0.825 0.850
0.825 to 0.849 0.850 to 0.874 0.875 to 0.899	0.875 0.900 0.925
0.900 to 0.924 0.925 to 0.949 0.950 to 0.974	0.950 0.975 1.000
0.975 to 0.999 1.000 to 1.024 1.025 to 1.049	1.025 1.050 1.075
1.050 to 1.074 1.075 to 1.099 1.100 to 1.124	1.100 1.125 1.150
1.125 to 1.149 1.150 to 1.174 1.175 to 1.199	1.150 1.200 1.250
1.200 to 1.224 1.225 to 1.249 1.250 to 1.274	1.175 1.200 1.225
1.275 to 1.229 1.300 to 1.324 1.325 to 1.349	1.250 1.275 1.300

Bearing play Adjusting shim Measured value (mm)	Adjustment shim thickness (mm)
1.350 to 1.374 1.375 to 1.399 1.400 to 1.424	1.325 1.350 1.375
1.425 to 1.449 1.450 to 1.474 1.475 to 1.499	1.400 1.425 1.450
1.500 to 1.524 1.525 to 1.549 1.550 to 1.574	1.475 1.500 1.525
1.575 to 1.599 1.600 to 1.624 1.625 to 1.649	1.550 1.575 1.600
1.650 to 1.674 1.675 to 1.699 1.700 to 1.724	1.625 1.650 1.675

NOTE: Refer to the Electronic Parts Catalog (ETKA) for the correct shims.

Rear Final Drive, Differential – 0A4

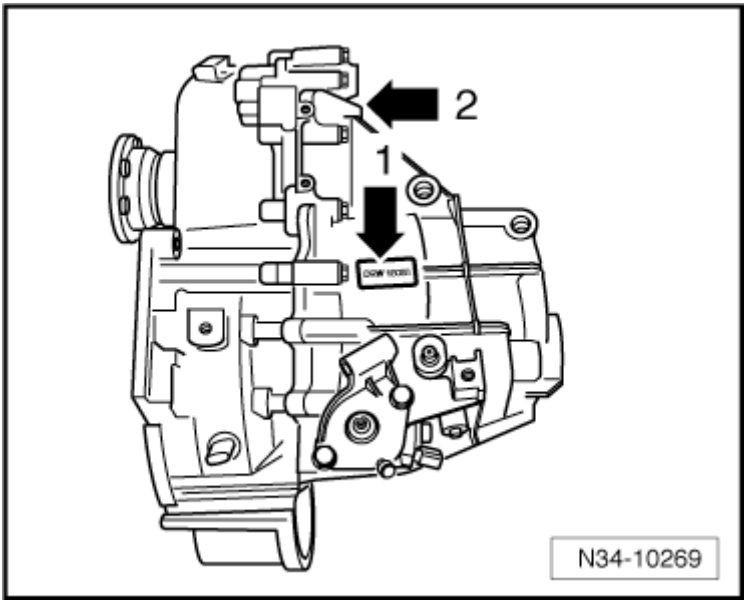
Component	Nm
Output shaft bearing support to clutch housing nut [1)]	25 plus an additional 90° (¼ turn)
Rear final drive, differential	25

[1)] Replace fastener(s).

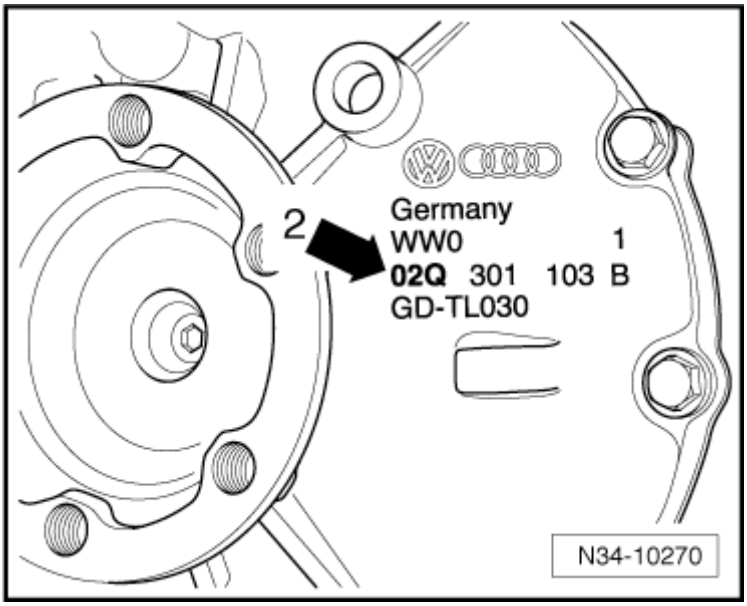
MANUAL TRANSMISSION – 02Q

General, Technical Data

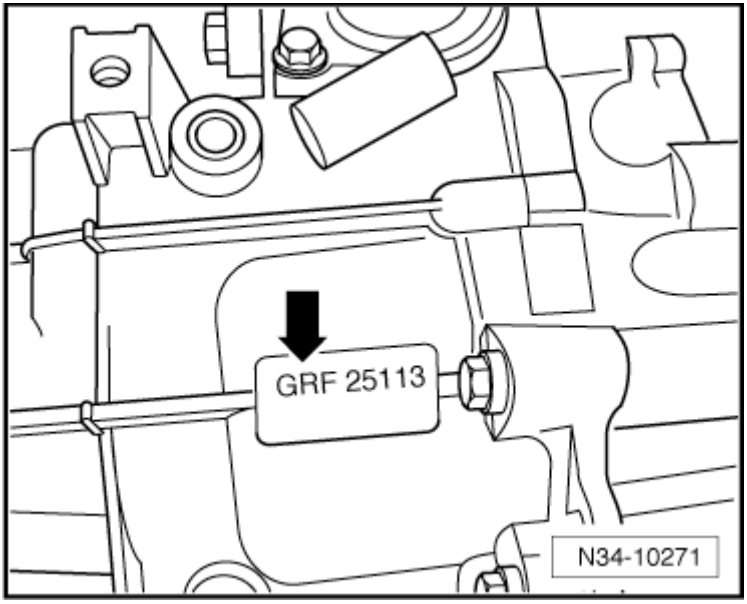
Transmission Identification



Code letters and build date (1) for the manual transmission 02Q (2).



Manual transmission 02Q (2).



Transmission code letters and build date (➡).

Transmission Identification *(cont'd)*

Example:

GRF	25	11	3
Identification codes	Day	Month	Year (2003) of manufacture

Codes Letters, Transmission Allocation and Capacities

Manual transmission		6 Speed 02Q		
Identification codes		KZS	MWS	NGB
Manufactured	from	05.2011	05.1201	05.2011
	through			
Allocation	Type	Beetle from MY 2012	Beetle from MY 2012	Beetle from MY 2012
	Engine	2.0L - 147 kW	2.0L - 147 kW	2.0L - 103 kW TDI CR
Capacity		Refer to Fluid Capacity Tables Rep. Gr. 03		

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

- Individual gear ratios
- Final drive ratio
- Flange shaft allocation
- Clutch 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
Pressure plate-to-dual mass flywheel bolt [3]	M6	13
	M7	20
Slave cylinder with release bearing-to-transmission bolt [1] [2]		
– Without locking fluid (slave cylinder with a metal housing)	-	12
– With locking fluid (slave cylinder with a plastic housing)	-	15

[1] Replace fastener(s).

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

[3] Loosen and tighten in small steps and in a diagonal sequence.

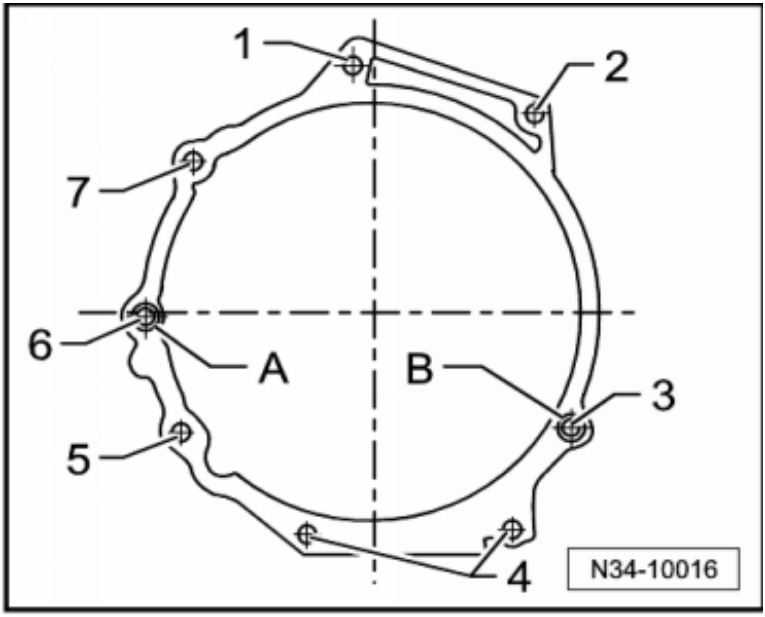
Controls, Housing – 02Q

Fastener Tightening Specifications

Component	Fastener size	Nm
Backup lamp switch-to-transmission housing	-	20
Cable bracket-to-transmission bolt/nut	-	20
Flange shaft countersunk bolt	-	33
Gearshift unit-to-transmission housing bolt [1)]	-	20
Oil fill or drain plug		
- Multipoint socket head	-	45
- Hex socket head	-	30
Shift housing-to-body nut	M6	8
	M8	25
Transmission housing-to-clutch housing bolt	M9	15 plus an additional 180° (½ turn)
Transmission housing locking screw	-	45
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)
Transmission shift lever-to-shift unit nut [1)]	-	23

[1)] Replace fastener(s).

Transmission to Engine Tightening Specifications

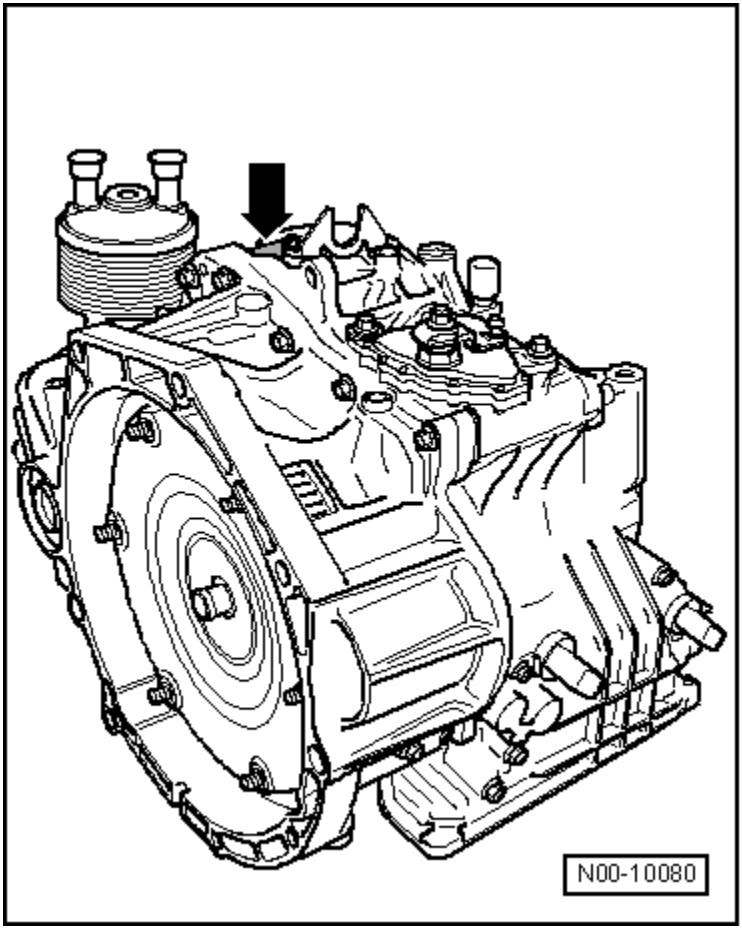


Item	Fastener	Qty.	Nm
1	M12 x 55 With a short M8 threaded pin or M12 x 50 Without threaded pin	1	80
2	M12 x 55 With a long M8 threaded pin	1	80
3	M12 x 70 or M12 x 65	1	80
4	M10 x 50	2	40
5	M10 x 105	1	40
6	M12 x 165 With a short M8 threaded pin Also starter to transmission	1	80
7	M12 x 165 With a short M8 threaded pin Also starter to transmission	1	80
-	M6 x 8 Small flywheel cover plate (not present on all engines)	1	10
A and B	Centering alignment sleeves		

AUTOMATIC TRANSMISSION – 09G

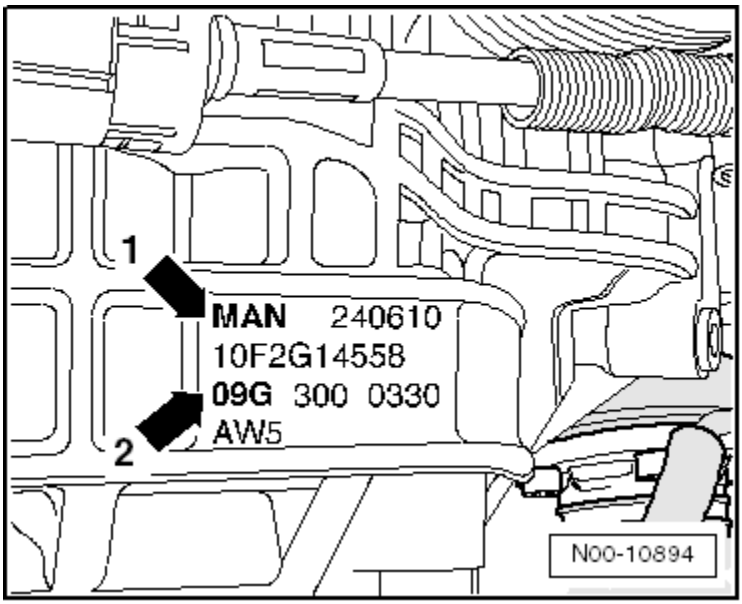
General, Technical Data

Transmission Identification



Code letters (➡).

Transmission Identification *(cont'd)*



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

Example:

MAN	24	06	10
Identification codes	Day	Month	Production year (2010)

The transmission code letters are also included on the vehicle data label.

Code Letters, Assembly Allocation and Ratios

If original replacement parts are needed for a repair, always pay attention to the transmission codes.

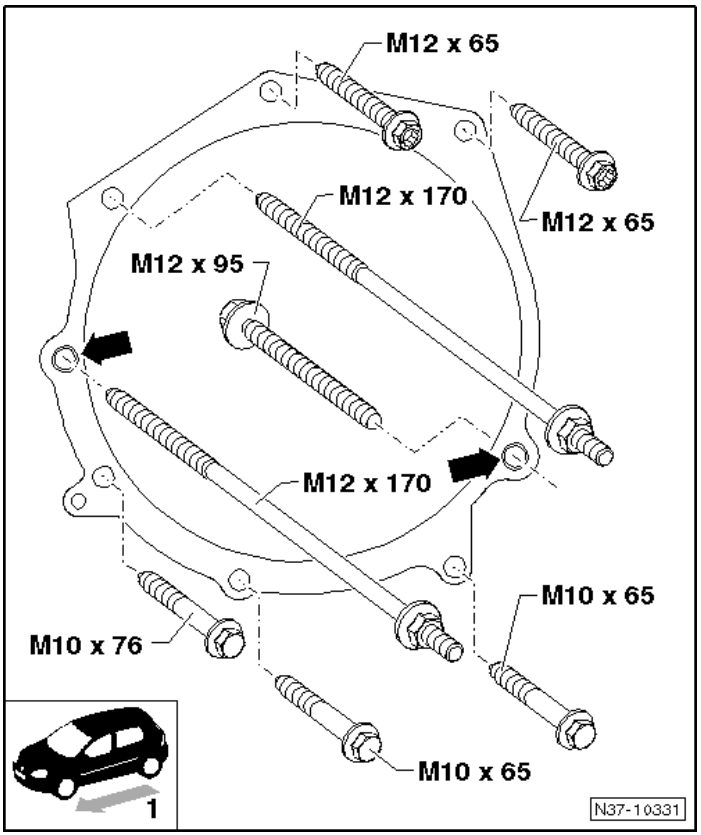
6 Speed Automatic Transmission 09G	
Identification codes	MAN
Engine	2.5L -125 kW

Controls, Housing – 09G

Fastener Tightening Specifications

Component	Nm
Multifunction transmission range switch-to-shift rod nut	7
Multifunction transmission range switch-to-transmission bolt	6
Selector housing-to-body nut	8
Selector lever cable adjustment bolt	13
Selector lever and selector mechanism with selector lever cable-to-body bolt	8
Selector lever-to-selector shaft nut	13
Transmission fluid cooler-to-transmission bolt	36
Transmission mount bracket-to-transmission bolt	40 plus an additional 90° (¼ turn)
Transmission mount-to-transmission mount bracket bolt	60 plus an additional 90° (¼ turn)
Transmission oil pan inspection plug	27

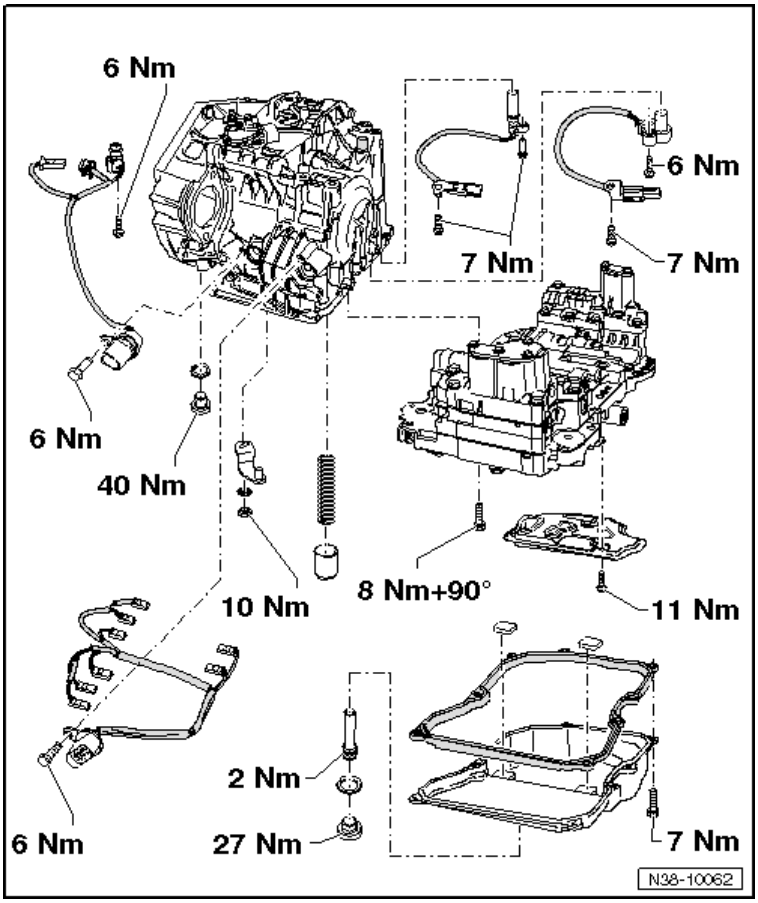
Transmission to Engine Tightening Specifications



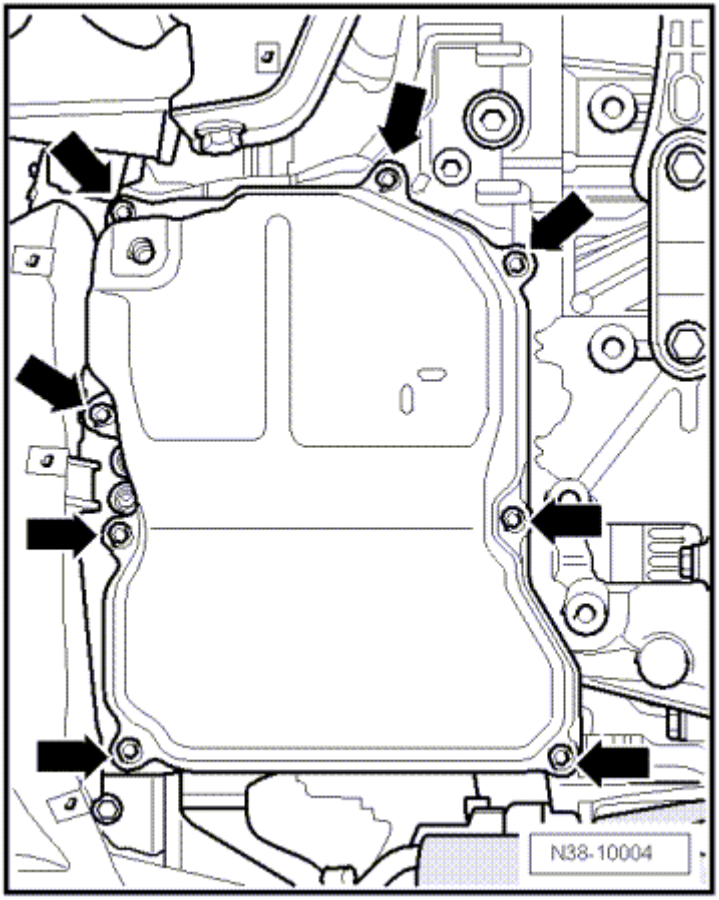
Component	Fastener size	Nm
Drive plate-to-converter	-	60
Bolts	M12	80 or 65, if using Special tool T10179
Bolts located in the lower flange	M10	40
➡ Alignment pins for centering		

Gears, Hydraulic Controls – 09G

Fastener Tightening Specifications



Transmission Fluid Pan Tightening Specification

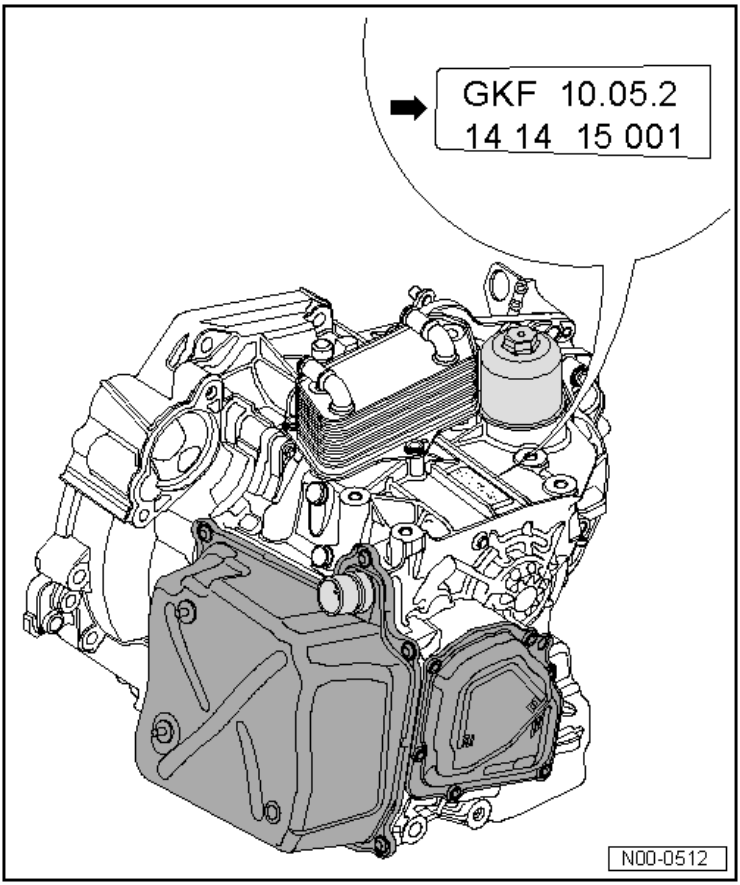


Component	Nm
Tighten the transmission fluid pan bolts (➡) diagonally in several steps	7

DIRECT SHIFT GEARBOX (DSG) TRANSMISSION – 02E

General, Technical Data

Transmission Identification

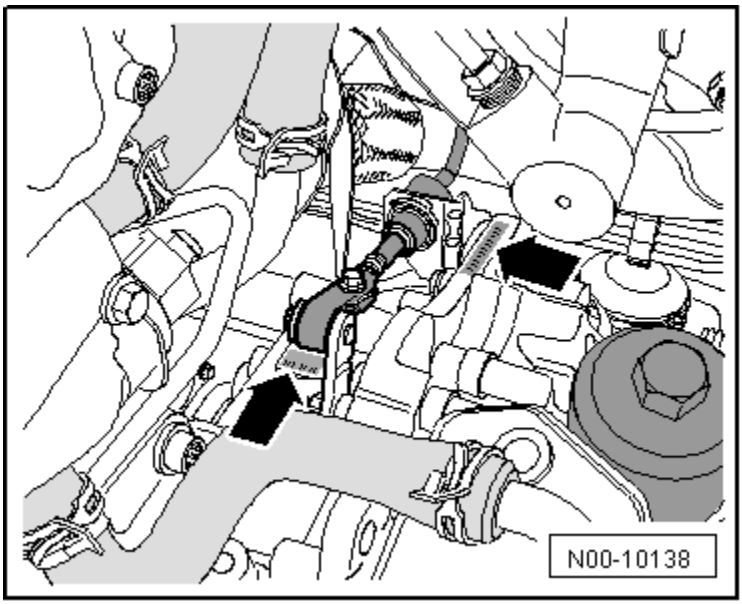


Example: arrow

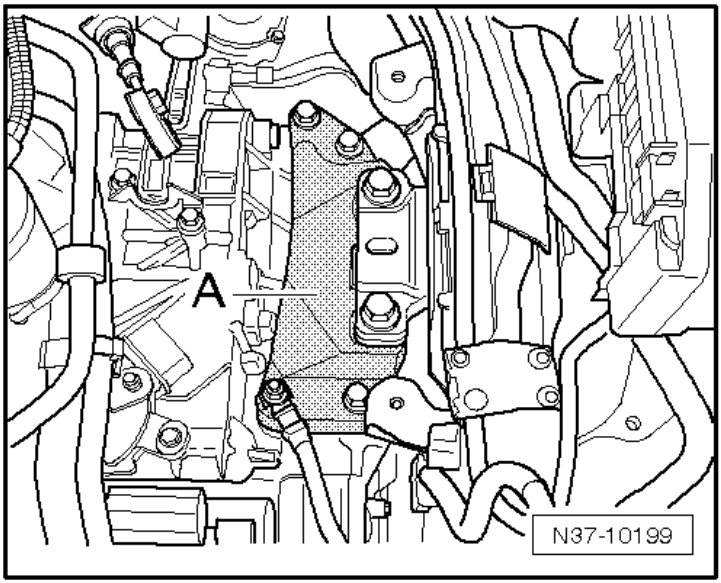
GKF	10	05	10
Identification code	Day	Month	Production year (2010)

14 - Plant code 14 15 - Time 001 - serial number

Transmission Identification *(cont'd)*



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

Direct Shift Gearbox (DSG) 02E		
Transmission identification codes	MSX, MSY and NJM	MFL, MSV and NJK
Engine	2.0L - 147 kW TFSI	2.0L - 103 kW TDI CR

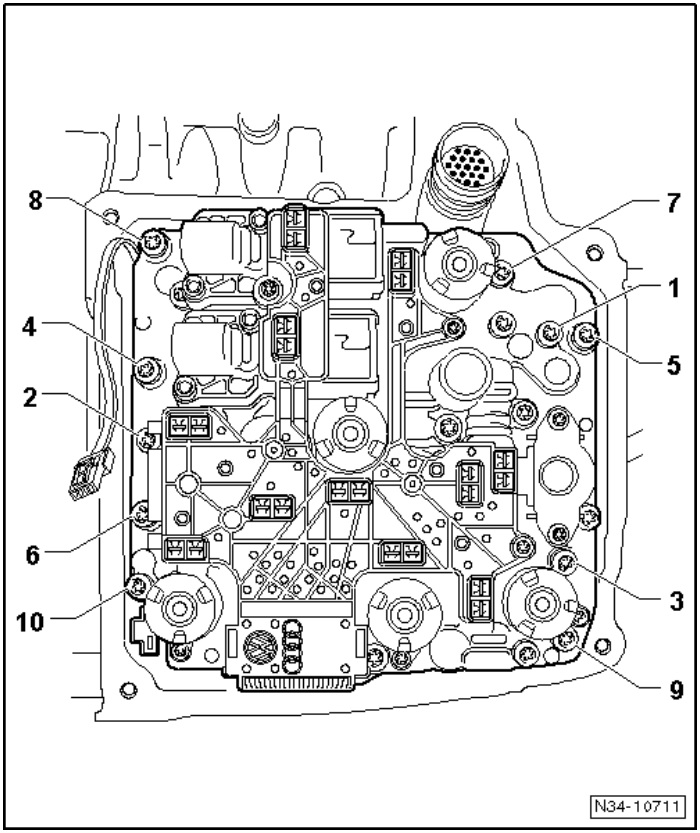
Controls, Housing (DSG) – 02E

Fastener Tightening Specifications

Component	Nm
Cable bracket-to-transmission bolt [1]	20 plus an additional 90° (¼ turn)
Oil filter housing-to-transmission	20
Oil pump cover bolt [2]	8
Overflow tube-to-transmission	3
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 bolt [2]	10
Transmission drain and inspection plug	45
Transmission oil cooler-to-transmission bolt [1]	20 plus an additional 90° (¼ turn)
Transmission input speed and clutch oil temperature sensor bolt	10
Transmission mount bracket-to-transmission bolt	40 plus an additional 90° (¼ turn)
Transmission mount-to-transmission mount bracket bolt	60 plus an additional 90° (¼ turn)
Wire bracket-to-transmission cover nut	10

[1] Replace fastener(s).
[2] Tighten the bolts diagonally and in multiple stages.

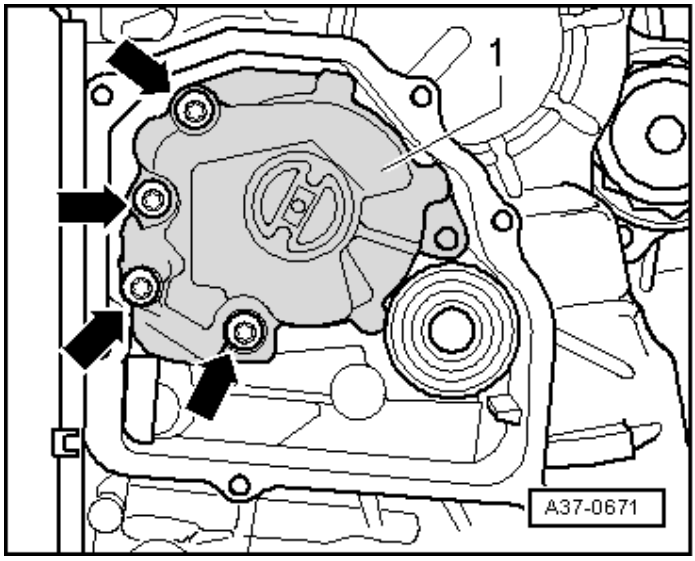
Mechatronic Unit Tightening Specifications



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)

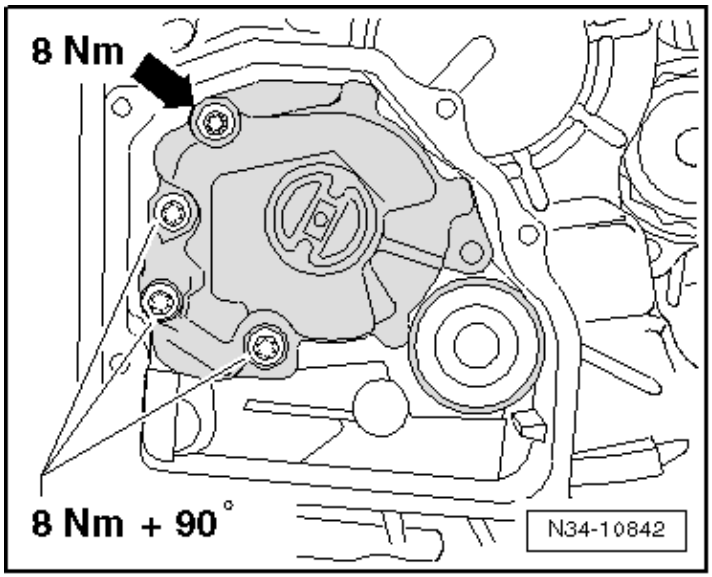
[1)] Replace fastener(s).

Oil Pump Tightening Specifications
Without Countersunk Bolt



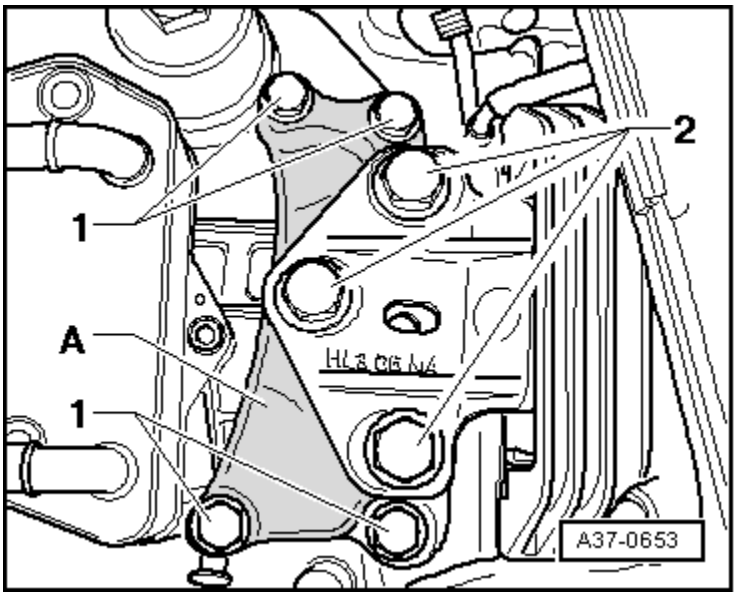
Component	Nm
Oil pump bolts (➡) with flat heads	5 plus an additional 90° (¼ turn)

With Countersunk Bolt



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

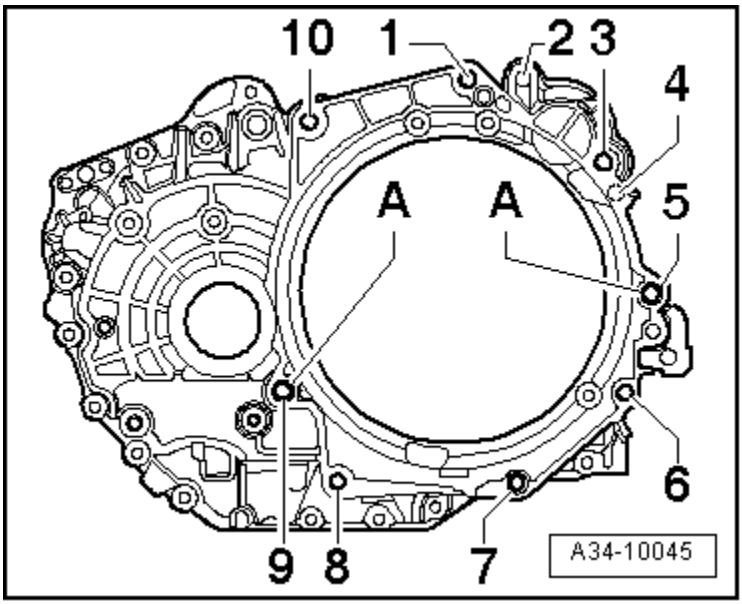
Transmission Mount Tightening Specifications



Fastener	Component	Nm
1 and 2	Tighten bolts [1]	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)

[1] Replace fastener(s).

Transmission to Engine Tightening Specifications



Item	Bolt	Nm
1	M12 x 55	80
2	M10 x 45 [1)]	40
3	M12 x 55 [2)]	80
4	M10 x 45 or M10 x 40 [1)]	40
5	M12 x 65 or M12 x 70	80
6	M10 x 50	40
7	M10 x 50	40
8	M10 x 50	40
9	M12 x 65 or M12 x 70	80
10	M12 x 55	80
A	Alignment sleeves for centering	

[1)] Starter to transmission.

[2)] Accessible only through the opening in the removed starter.

Rear Final Drive, Differential (DSG) – 02E

Fastener Tightening Specifications

Component	Nm
Rear final drive, differential [1)]	30

[1)] Replace fastener(s).

SUSPENSION, WHEELS, STEERING

Front Suspension

Fastener Tightening Specifications

Component	Fastener size	Nm
ABS wheel speed sensor-to-wheel bearing housing bolt	-	8
Ball joint-to-control arm nut	-	100
Ball joint-to-wheel bearing housing nut	-	60
Constant Velocity (CV) joint boot clamp	-	25
Control arm-to-subframe bolt [1]	M12 x 1.5 x 80	70 plus an additional 90° (¼ turn)
Coupling rod-to-stabilizer bar bolt	-	65
Coupling rod-to-suspension strut bolt	-	65
Cover plate-to-wheel bearing housing bolt	-	12
Drive axle heat shield bolt	-	25
Drive axle-to-transmission bolt [1] [3]	M8	40
	M10	70
	M10 x 52	70
	M10 x 23	70
Drive axle-to-wheel hub bolt [1]	-	200 plus an additional 90° (¼ turn)
Pendulum support-to-subframe bolt [1] [2]	M14 x 1.5 x 70	100 plus an additional 90° (¼ turn)
Pendulum support-to-transmission bolt [1]	-	50 plus an additional 90° (¼ turn)
Shock absorber-to-suspension strut bearing nut [1]	-	60
Stabilizer bar-to-subframe bolt [1]	-	20 plus an additional 90° (¼ turn)
Subframe-to-body bolt [1]	-	70 plus an additional 90° (¼ turn)
Suspension strut-to-body bolt [1]	-	15 plus an additional 90° (¼ turn)

Component	Fastener size	Nm
Suspension strut-to-wheel bearing housing nut [1)]	-	70 plus an additional 90° (¼ turn)
Wheel hub-to-wheel bearing housing bolt [1)]	-	70 plus an additional 90° (¼ turn)

1) Replace fastener(s).
2) Tighten only when the pendulum support is bolted to the transmission.
3) Pre-tighten diagonally to 10 Nm, then tighten diagonally again to the tightening specification.

Rear Suspension

Torsion Beam Suspension Tightening Specifications

Component	Nm
Axle beam-to-mounting bracket nut [1]	70 plus an additional 90° (¼ turn)
Axle beam mounting bracket-to-body bolt [1]	50 plus an additional 90° (¼ turn)
Crossbrace-to-axle beam nut [1]	70 plus an additional 90° (¼ turn)
Crossbrace-to-subframe nut [1]	70 plus an additional 90° (¼ turn)
Left rear level control system sensor bolt	5
Left rear level control system sensor heat shield bolt	2.5
Shock absorber-to-axle beam bolt [1] [3]	40 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
Stub axle and cover plate-to-axle beam bolt (disc brakes) [1]	30 plus an additional 90° (¼ turn)
Stub axle and brake carrier-to-axle beam bolt (drum brakes) [1]	30 plus an additional 90° (¼ turn)
Subframe-to-body bolt [1] [2]	90 plus an additional 90° (¼ turn)
Wheel bearing wheel hub-to-stub axle bolt [1]	180 plus an additional 90° (¼ turn)
Wheel bolts-to-wheel hub	140

[1] Replace fastener(s).

[2] Follow the tightening sequence: First tighten to 90 Nm + 90° turn, then loosen one full turn (360°), then tighten to 90 Nm + 90° turn.

[3] Tighten in the curb weight position, refer to ElsaWeb *„Wheel Bearing in Curb Weight, Rear Axle, Lifting Vehicles with Coil Spring “.*

Multi-Link Suspension Tightening Specifications

Component	Nm
ABS wheel speed sensor-to-wheel bearing housing bolt	8
Brake disc-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	12
Left rear level control system sensor bolt	5
Lower transverse link-to-subframe nut [1) 2)]	120
Lower transverse link-to-wheel bearing housing nut [1) 2)]	70 plus an additional 90° (¼ turn)
Shock absorber mounting nut [1)]	25
Shock absorber-to-body bolt [1)]	50 plus an additional 90° (¼ turn)
Shock absorber-to-wheel bearing housing bolt	180
Stabilizer bar-to-subframe bolt [1) 2) 4)]	25 plus an additional 90° (¼ turn)
Stone protection plate-to-lower transverse link bolt	8
Subframe-to-body bolt [1)]	90 plus an additional 90° (¼ turn)
Tie rod-to-subframe nut [1) 2)]	90 plus an additional 90° (¼ turn)
Tie rod-to-wheel bearing housing nut [1) 2)]	130 plus an additional 90° (¼ turn)
Trailing arm mounting bracket-to-body bolt [1)]	50 plus an additional 90° (¼ turn)
Trailing arm-to-mounting bracket bolt [1)]	90 plus an additional 90° (¼ turn)
Trailing arm-to-wheel bearing housing bolt [1) 3)]	90 plus an additional 90° (¼ turn)
Upper transverse link-to-subframe nut [1) 2)]	120

Multi-Link Suspension Tightening Specifications *(cont'd)*

Component	Nm
Upper transverse link-to-wheel bearing housing nut [1) 2)]	130 plus an additional 90° (¼ turn)
Wheel hub-to-wheel bearing housing bolt [1)]	180 plus an additional 90° (¼ turn)
Wheel bolts-to-wheel hub	140

1) Replace fastener(s).
2) Tighten bolts in curb weight position.
3) For bolt tightening clarification, refer to ElsaWeb, *Trailing Arm with Mounting Bracket.*
4) Tighten uniformly.

Self-Leveling Suspension

Fastener Tightening Specifications

Component	Nm
Heat shield to subframe bolt	2.5
Left rear level control system sensor -G76- to subframe bolt	5

Wheel Alignment Data

Wheel Alignment Specified Values with Torsion Beam Rear Suspension

Front suspension	Basic suspension	Sport suspension	Comfort suspension
Production Relevant No. (PR. No.)	2UA	2UC	2UD
Total toe (wheels not pressed)	10’ ± 10′	10’ ± 10′	10’ ± 10′
Camber (wheels in straight ahead position)	-40′ ± 30′	-40′ ± 30′	-33′ ± 30′
Maximum permissible difference between both sides	30’	30’	30’
Toe-out angle [1)] with steering wheel turned 20° to left and right	1°32′ ± 20′	1°32′ ± 20′	1°25′ ± 20′
Caster	7° 53′ ± 30′	7° 53′ ± 30′	7° 42′ ± 30′
Maximum permissible difference between both sides	30’	30’	30’
Standing height (mm)	386 ± 10	386 ± 10	396 ± 10

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

Rear suspension	Basic suspension	Sport suspension	Comfort suspension
Camber	-1° ± 30′	-1° ± 30′	-1° ± 30′
Maximum permissible difference between both sides	30’	30’	30’
Total toe (at prescribed camber)	+23′ ± 10′	+23′ ± 10′	+21′ ± 10′
Maximum permissible deviation from direction of rotation	20’	20’	20’
Standing height (mm)	396 ± 10	396 ± 10	406 ± 10

Wheel Alignment Specified Values with Multi-Link Rear Suspension

Front suspension	Basic suspension	Sport suspension	Comfort suspension
Production Relevant No. (PR. No.)	2UA	2UC	2UD
Total toe (wheels not pressed)	10’ ± 10′	10’ ± 10′	10’ ± 10′
Camber (wheels in straight ahead position)	-40′ ± 30′	-40′ ± 30′	-33′ ± 30′
Maximum permissible difference between both sides	30’	30’	30’
Toe-out angle [1)] with steering wheel turned 20° to left and right	1°32′ ± 20′	1°32′ ± 20′	1°25′ ± 20′
Caster	7° 53′ ± 30′	7° 53′ ± 30′	7° 42′ ± 30′
Maximum permissible difference between both sides	30’	30’	30’
Standing height (mm)	386 ± 10	386 ± 10	396 ± 10

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

Rear suspension	Basic suspension	Sport suspension	Comfort suspension
Camber	-1° ± 30′	-1° ± 30′	-1° ± 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)	396 ± 10	396 ± 10	406 ± 10

Steering

Fastener Tightening Specifications

Component	Fastener size	Nm
Belt pulley-to-power steering pump bolt	-	22
Power steering pump-to-bracket bolt	-	22
Power steering pump pressure line bolt	-	32
Steering column-to-assembly carrier bolt [2]	-	20
Steering column-to-steering gear bolt [1]	M8 x 35	30
Steering gear heat shield bolt	-	23
Steering gear shield bolt/nut	-	6
Steering gear-to-subframe bolt [1]	-	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	-	100
Tie rod end-to-tie rod nut	-	70
Tie rod end-to-wheel bearing housing nut [1]	M12 x 1.5	20 plus an additional 90° (¼ turn)

[1] Replace fastener(s).
[2] For bolt tightening clarification, refer to ElsaWeb, *Steering Column.*

BRAKE SYSTEM

General, Technical Data

Front Brakes

Engine version	PR Number	Front wheel brake
2.5L 125 kW	1ZP/1ZE	FN 3 (15”)
2.0L 147 kW	1ZA/1ZB/1LV	FN 3 (16”)
2.0L TDI 103 kW	1ZP/1ZE	FN 3 (15”)

Rear Brakes with Torsion Beam Rear Suspension

Engine version	PR Number	Rear wheel brake
2.5L 125 kW	1KS/1KT	Bosch
2.5L 125 kW	1KG	TB 230 X 32

Rear Brakes with Multi-Link Rear Axle

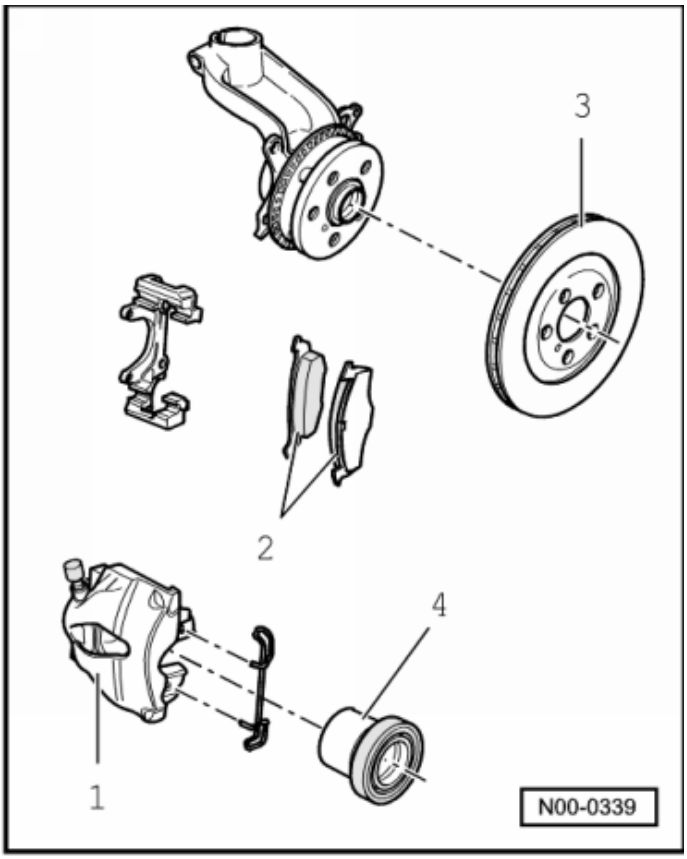
Engine version	PR Number	Rear wheel brake
2.0L 147 kW	1KS/1KT	Bosch
2.5L 125 kW		
2.0L TDI 103 kW		

Brake Master Cylinder and Brake Booster

Brake booster	Diameter in inches	10
Master brake cylinder [1)]	Diameter in mm	22.2
Master brake cylinder [1)]	Diameter in mm	23.81

[1)] For the correct allocation, refer to the Electronic Parts Catalog (ETKA).

Front Brakes, FN 3

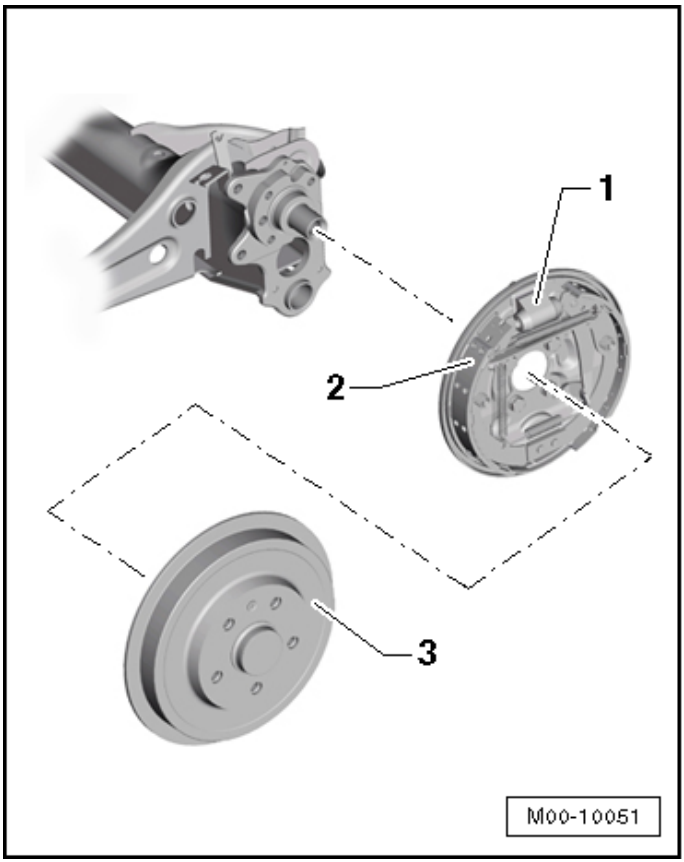


Item	PR Number		1ZE/1ZP
1	Brake caliper		FN 3 (15”)
2	Brake pad, thickness	mm	14
	Brake pad wear limit without back plate	mm	2
3	Brake disc	Diameter in mm	288
	Brake disc thickness	mm	25
	Brake disc wear limit	mm	22
4	Brake caliper piston	Diameter in mm	54

Front Brakes, FN 3 *(cont'd)*

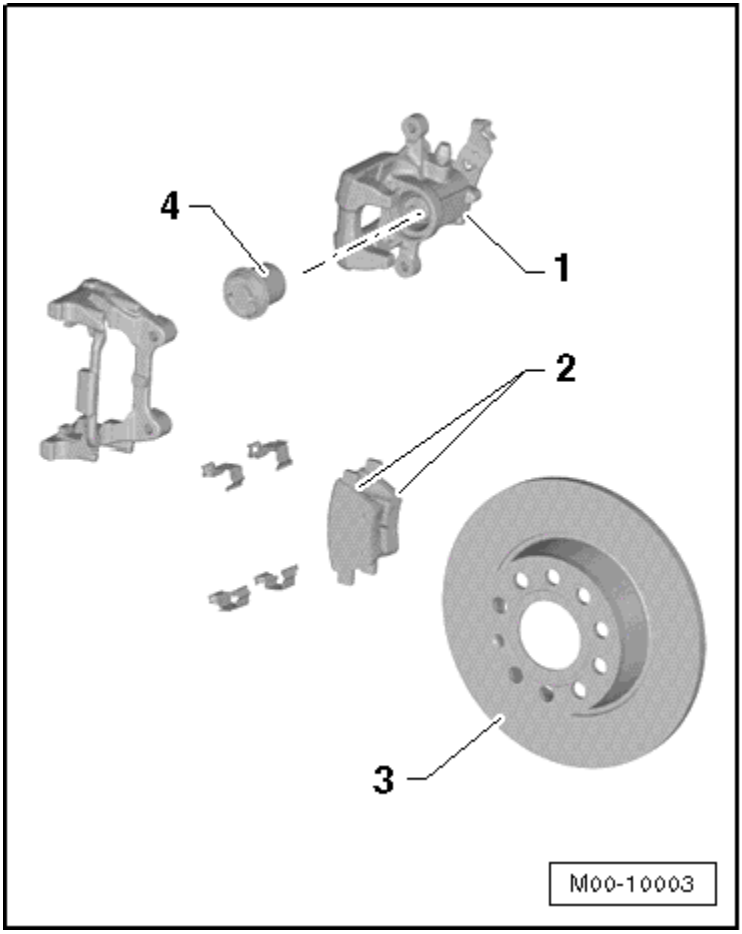
Item	PR Number		1LV/1ZA/1ZB
1	Brake caliper		FN 3 (16")
2	Brake pad thickness	mm	14
	Brake pad wear limit without back plate	mm	2
3	Brake disc	Diameter in mm	312
	Brake disc thickness	mm	25
	Brake disc wear limit	mm	22
4	Brake caliper piston	Diameter in mm	54

Rear Drum Brakes



Item	PR Number		1KG
1	Wheel brake cylinder	mm	20
2	Brake pad width	mm	32
	Brake pad thickness	mm	5
	Brake pad minimum thickness	mm	2.5
3	Brake drum	Diameter in mm	230
	Brake drum wear limit	Diameter in mm	231.5

Rear Brakes, Bosch Disc



Item	PR Number		1KS/1KT
1	Brake caliper		Bosch
2	Brake pad thickness without backing plate	mm	12
3	Brake rotor	Diameter in mm	272
	Brake disc thickness	mm	10
4	Brake caliper piston	Diameter in mm	38

Anti-lock Brake System (ABS)

Fastener Tightening Specifications

Component	Nm
ABS control module-to-ABS hydraulic unit bolt [1]	
- ABS Mark 70 (ABS/ASR)	5.5
- ABS Mark 60 EC (ABS/EDL/ASR/ESP)	2 ± 0.8
ABS hydraulic unit bracket nut/bolt	8
ABS hydraulic unit-to-bracket bolt	8
ABS wheel speed sensor bolt	8
Brake line-to-ABS hydraulic unit	14
Brake line-to-master cylinder	14
Steering angle sensor-to-steering column bolt	1.5
Steering wheel-to-steering column bolt [1]	30 plus an additional 90° (¼ turn)

[1] Replace fastener(s).

Mechanical Components

Fastener Tightening Specifications

Component	Nm
ABS wheel speed sensor bolt	8
Brake drum-to-wheel hub bolt	8
Brake hose-to-brake caliper bolt	35
Brake pedal-to-mounting bracket nut [1]	25
Brake pedal mounting bracket-to-body nut [1] [2]	25
Front brake carrier-to-wheel bearing housing bolt	200
Front brake disc-to-wheel hub bolt	4
Front caliper guide pin-to-brake carrier	30
Front cover plate-to-wheel bearing housing bolt	12
Parking brake lever nut	20
Rear brake caliper-to-brake carrier bolt [1]	35
Rear brake carrier-to-axle beam bolt (with torsion beam rear suspension) [1]	90 plus an additional 90° (¼ turn)
Rear brake cylinder bleed valve	8
Rear brake disc-to-wheel hub bolt	4
Stub axle and brake carrier-to-rear axle beam bolt [1]	30 plus an additional 90° (¼ turn)

[1] Replace fastener(s).
[2] For bolt tightening clarification, refer to ElsaWeb, *Mounting Bracket.*

Hydraulic Components

Fastener Tightening Specifications

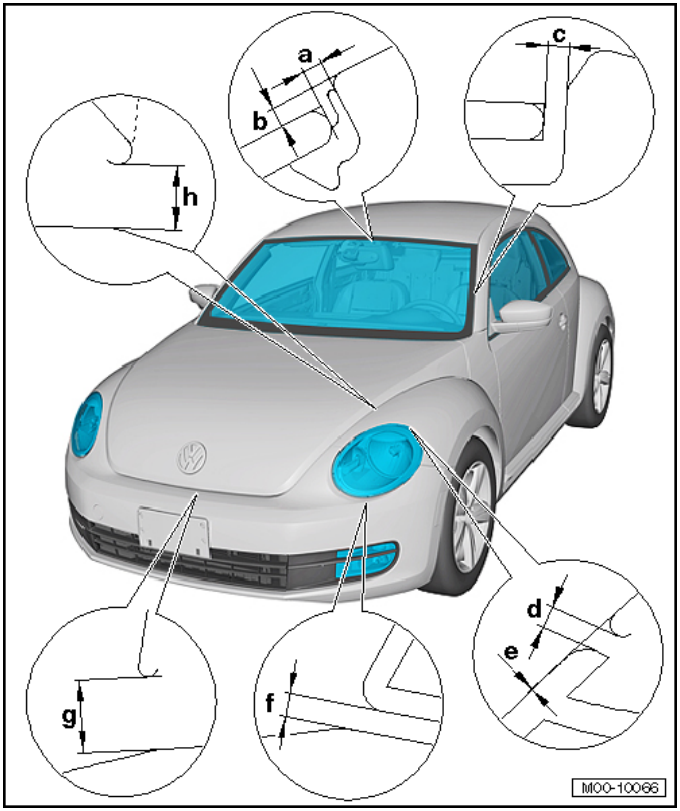
Component	Nm
Brake booster-to-pedal assembly nut [1] [2]	25
Brake caliper bleeder valve	10
Brake light switch-to-master cylinder bolt	5
Brake line-to-master cylinder	14
Brake master cylinder-to-brake booster nut [1]	25
Rear brake caliper-to-brake carrier bolt [1]	35

[1] Replace fastener(s).
[2] For bolt tightening clarification, refer to ElsaWeb, *Brake Booster.*

BODY

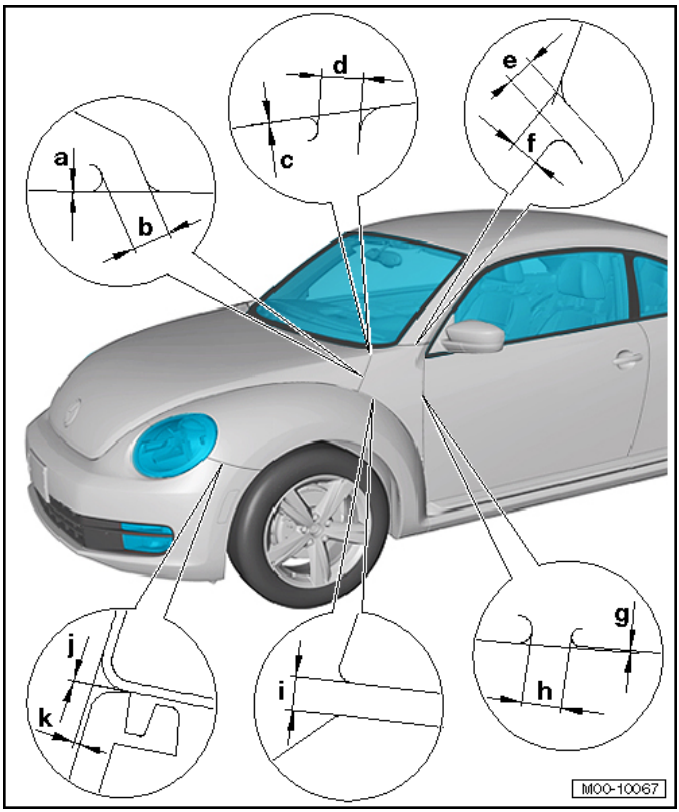
Air Gap Body Dimensions

Body, Front



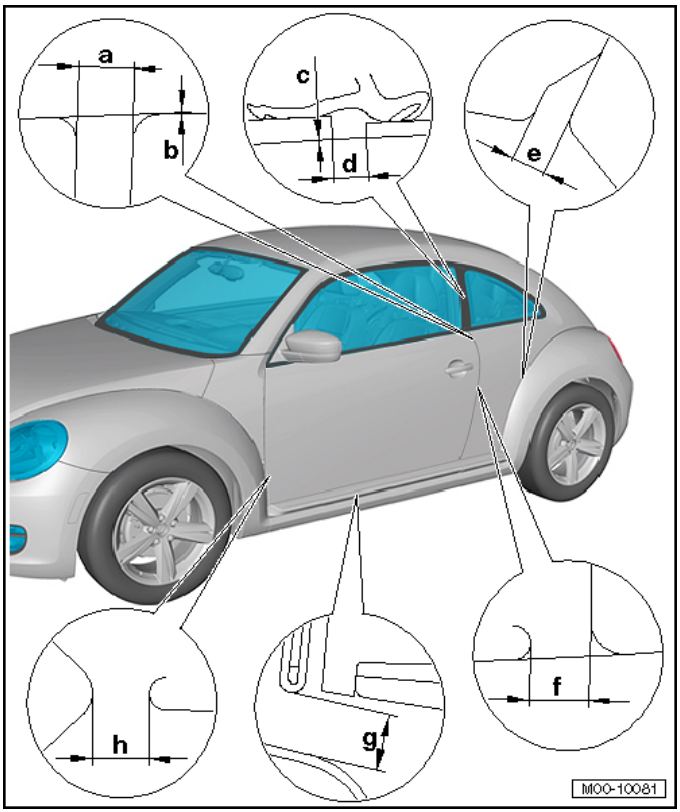
Component	Gap (mm)
a	2.5 ± 0.5
b	2.5 ± 0.5
c	2.5 ± 1.0
d	2.0 ± 0.5
e	0.0 ± 0.5
f	2.5 ± 0.5
g	8.5 ± 0.5
h	5.0 ± 0.5

Body, Center



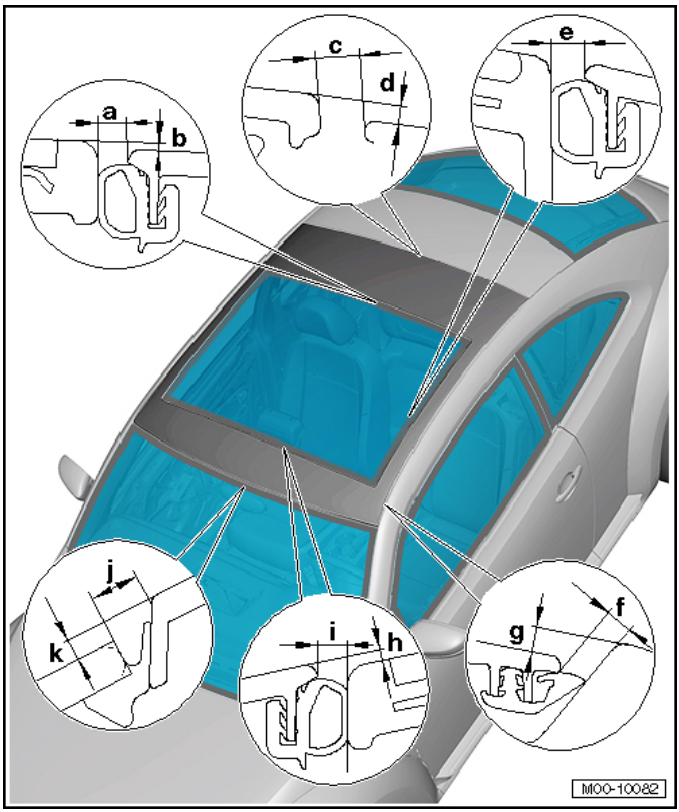
Component	Gap (mm)
a	0.0 ± 0.5
b	3.1 ± 0.5
c	0.0 ± 0.5
d	4.0 ± 0.5
e	2.0 ± 1.0
f	2.2 ± 0.5
g	0.0 ± 1.0
h	4.3 ± 0.5
i	5.0 ± 0.5
j	0.0 ± 0.5
k	0.3 ± 0.5

Body, Center *(cont'd)*



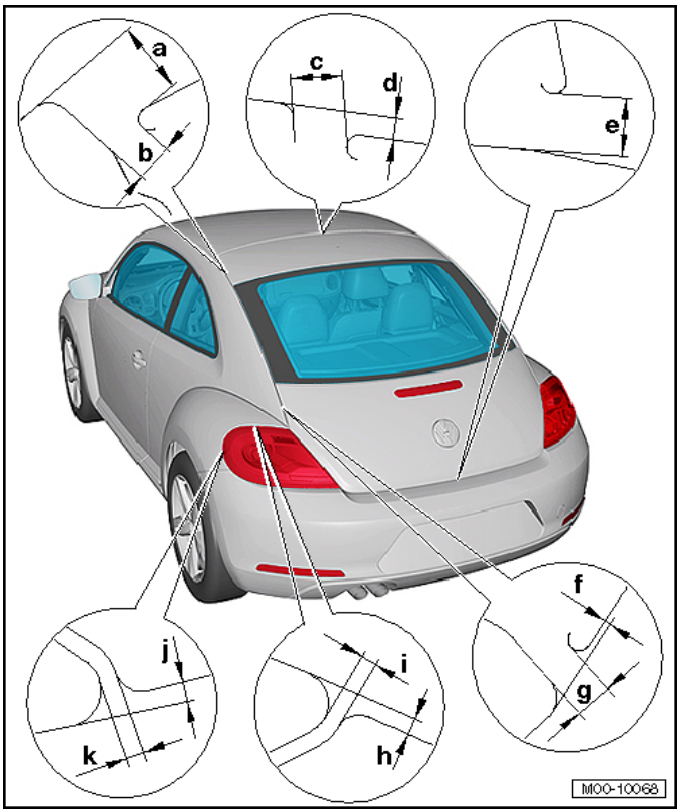
Component	Gap (mm)
a	3.5 ± 0.5
b	0.0 ± 1.0
c	0.0 ± 1.0
d	7.0 ± 1.0
e	4.0 ± 0.5
f	3.5 ± 0.5
g	4.4 ± 0.8
h	3.5 ± 0.5

Body, Center *(cont'd)*



Component	Gap (mm)
a	4.2 ± 1.5
b	1.0 ± 1.0
c	5.0 ± 0.5
d	2.0 ± 1.5
e	4.2 ± 1.3
f	4.2 ± 1.5
g	3.7 ± 1.0
h	1.7 ± 1.5
i	4.2 ± 1.5
j	5.8 ± 0.5
k	2.4 ± 0.5

Body, Rear



Component	Gap (mm)
a	7.5 ± 0.5
b	4.0 ± 0.5
c	5.0 ± 0.5
d	2.0 ± 1.5
e	5.5 ± 0.5
f	0.6 ± 0.5
g	4.0 ± 0.5
h	1.0 ± 0.5
i	1.0 ± 0.5
j	1.0 ± 0.5
k	1.0 ± 0.5

Body Exterior

Lock Carrier Tightening Specifications

Component	Nm
Air guide channel bolts	2
Angle bracket bolts	8
Bumper carrier bolts [1]	8
	60

[1] For bolt tightening clarification, refer to ElsaWeb, *Lock Carrier Assembly Overview*, items 7 and 8.

Front Fender Tightening Specifications

Component	Nm
Front fender bolts	6
Front fender nuts	6

Underbody Trim, Noise Insulation Tightening Specifications

Component	Nm
Noise insulation bolts (diesel) [1]	2
	6
Noise insulation bolts	2
Sill panel cover	2
Underbody trim panel nuts	2
Wheel housing liner bolts	2

[1] For bolt tightening clarification, refer to ElsaWeb, *Diesel Engine Noise Insulation*, items 2 and 3.

Bulkhead and Tunnel Bridge Tightening Specifications

Component	Nm
Bulkhead bolts	25
Tunnel bridge nuts	20

Convertible Top Tightening Specifications

Component	Nm
Convertible Top Latch nut	9
Convertible Top Lock nut	9
Stop buffer with fitting tabs-to-fitting grooves on linkage nut	9

Front Hood, Plenum Chamber Tightening Specifications

Component	Nm
Front hood hinge bolts	20
Hood latch bolts	12
Release cable bracket	1.5
Striker pin bolts	10

Rear Lid, Fuel Filler Door Tightening Specifications

Component	Nm
Fuel filler door unit screw	1.5
Rear lid hinge bolts	10
Rear lid hinge nuts	24
Rear lid striker pin bolts	18
Rear lid gas strut ball head pin	20 plus an additional 45° (⅛ turn)
Rear lid buffer bolt	8
Rear lid latch bolts	23

Door Tightening Specifications

Component	Nm
Door bracket bolt	1.5
Door cable bolt	1.5
Door hinge bolts [1) 2)]	9
	23
	30
	40
Door lock bolts	18
Door lock cylinder bolts	3.5
Door strap bolts [3)]	9
	30
Door striker pin bolts	20

1) Replace fastener(s).
2) For bolt tightening clarification, refer to ElsaWeb, *Front or Rear Door Hinge Assembly Overview*.
3) For bolt tightening clarification, refer to ElsaWeb, *Door Strap*.

Sunroof Tightening Specifications

Component	Nm
Cross panel screws	2.5
Glass panel drive motor screws	4
Guide rail screws	2.5
Mounting carrier screws	3
Shade cover and mount screws	2.5
Wind deflector screws	1.5

Front Bumper Tightening Specifications

Component	Nm
Bracket (left and right) nut	3
Bumper cover bolts	2
Bumper impact member and carrier bolts [1)]	8
	60
Side guide nut	3
Side guide assembly bolts	2

[1)] For bolt tightening clarification, refer to ElsaWeb, *Front Bumper Impact Member Assembly Overview*.

Rear Bumper Tightening Specifications

Component	Nm
Attachment (left and right) nut	3
Center guide nut	3
Rear bumper cover bolts	2
Rear bumper guide bolts and nuts	2
Rear impact member and carrier bolts	20
Side guide (left and right) nut	3

Mirror, Spoiler and Trim Tightening Specifications

Component	Nm
Body side molding bolts	1.5
Mirror base bolts	2
Mirror insulation bolts	12
Rear spoiler nuts	10
Sill panel cover bolts	2
Wheel housing liner bolts	2

Body Interior

Storage Compartments, Covers and Trim Tightening Specifications

Component	Nm
Center console armrest bolts	15
Center console footwell trim screws	1.5
Center console mounting bracket and support nuts	2
Center console support foot bolts	12
Center console trim screws	1.5
Eyeglass compartment screws	2
Footwell trim bracket nuts	2
Roof grab handle bracket bolts	4.5
Steering column lower trim screws	1.5
Storage compartment screws	1.5
Sun visor screws	2
Trim cover screws	1.5
Wind deflector mount	5

Instrument Panel and Crossmember Tightening Specifications

Component	Nm
Instrument panel bolts/nuts [1)]	1.5
	9
	20
Instrument panel cross member bolts [2)]	6
	9
	20

[1)] For bolt tightening clarification, refer to ElsaWeb, *Instrument Panel.*
[2)] For bolt tightening clarification, refer to ElsaWeb, *Instrument Panel Crossmember.*

Interior Trim Fastener Tightening Specifications

Component	Nm
A-pillar deformation element bolts	25
B-pillar trim bolts	2
Front door trim bolts	4.5
Inner mirror cover screws	1.5
Lock carrier cover bolts	3
Rear lid trim screws	1.5
Side trim bolts	3.5

Passenger Protection Fastener Tightening Specifications

Component	Nm
Airbag control module nuts	9
Belt anchor bolt	40
Child seat anchor screws	4
Crash sensor bolts	4.5
Front belt latch bolt	20
Front passenger airbag bolts	9
Front seat belt bracket bolt	40
Front seat belt guide bolt	4.5
Front seat belt relay bolts	4.5
Front seat belt ring guide bolt	40
Rear automatic belt retractor bolt	40
Rear belt latch bolt	40
Rear dual seat belt latch bolt	40
Side airbag bolts	9

Seat Frames Fastener Tightening Specifications

Component	Nm
Backrest bolts	35
Backrest shell screw	3
Door sill side trim bracket	8
Entry assistance handle with bracket bolt	3.5
Front seat frame bolts	40
Front seat guiding piece bolts	40
Rear seat backrest bolts	40
Seat height adjuster bolt	8
Seat trim panel bolts	8

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
Air guide channel-to-instrument panel	1.5
Air intake shroud	2.5
Auxiliary heater heating element	2
Auxiliary heater heating element ground cable nut	9
Center and side air vents intermediate piece-to-instrument panel and vents	1.5
Coolant pipes and heater core cover	2
Dash panel coolant line bracket	2
Expansion valve heat shield	10
Footwell vents	1.5
Front heat and fresh air controls	1.5
Heater and A/C housing-to-instrument panel cross-member	9
Heater core hose clamp	2
Refrigerant line bolts	10

Air Conditioning

Fastener Tightening Specifications

Component	Nm
A/C compressor bolts	25
A/C compressor drive plate	35
Condenser-to-radiator	5
Dryer cartridge bolt	2
Dryer cartridge bracket bolt	2
Evaporator housing screws	1.5
Expansion valve bolts	5
Expansion valve heat shield	10
Fresh air blower control module	2
Fresh air/recirculating air/back pressure door motor	1.5
Front A/C controls	1.5
Front air distribution door motor	1.5
Heater and A/C housing-to-instrument panel cross member	9
High pressure sensor	8
Left temperature door motor	1.5
Radiator to lock carrier bolts	5
Refrigerant lines-to-condenser	12
Refrigerant lines-to-A/C compressor	22
Refrigerant lines-to-expansion valve	10
Right temperature door motor	1.5

ELECTRICAL SYSTEM

Communication

Fastener Tightening Specifications

Component	Nm
Amplifier screws	6
Antenna module screws	2
Multimedia system control module screw	1.5
Roof antenna nut	7
Subwoofer screws	2

Electrical Equipment

Battery, Starter, Generator and Cruise Control Tightening Specifications

Component	Fastener size	Nm
Air filter housing-to-body screw	-	10
Battery terminal nuts	-	6
Battery clamping plate bolt	-	20
Battery tray bolts	-	9
Generator to Accessory Bracket Collar Bolts [2]	-	25
Generator-to-accessory bracket collar bolts	-	20
Generator B+ terminal	-	20
Generator cap screw [1]	-	4.5
Generator cap hex head nut [1]	-	15
Ribbed belt pulley (without freewheel)	-	65
Ribbed belt pulley (freewheeling)	-	80
Starter B+ wire nut	-	20
Starter bolts	M12	75
	M10	40
Starter wiring bracket nut	-	20
Voltage regulator hex bolt with washer and threaded piece	-	4
Voltage regulator screws	-	2
Wire holder nut-to-back of generator	-	3.2

[1] Applies to 2.0L Engines, Gas and Diesel.
[2] Applies to 2.5L Gasoline Engine.

Instruments Tightening Specification

Component	Nm
Additional instruments trim screw	1.5
Instrument cluster screws	1.5
Signal horn nut	10
Signal horn bolt-to-longitudinal member	20

Windshield Wiper/Washer System Tightening Specifications

Component	Nm
Windshield and headlamp washer fluid reservoir-to-body	8
Windshield wiper motor-to-wiper frame and linkage screws	8
Windshield wiper motor crank-to-windshield wiper motor shaft	18
Wiper arm mounting nuts	20
Wiper frame with linkage-to-body nut	5
Wiper frame with linkage-to-body bolts	8

Exterior Lights, Switches Tightening Specifications

Component	Nm
Fog lamp housing screw	2
Front turn signal screw	2
Halogen headlamp access cover bolt	2
Headlamp carrier plate bolt	4.5
HID headlamp cover screw	3
HID headlamp range control module screw	1.5
HID high-intensity gas discharge lamp control module	2
Steering column electronic systems control module screws	1.5
Steering column switch mount screw	3
Tail lamp bulb holder screw	2

Interior Lights, Switches Tightening Specifications

Component	Nm
Alarm horn nut	10
Front interior lamp	2

Wiring Tightening Specifications

Component	Fastener size	Nm
Driver footwell fuse panel	-	1.5
E-box bolt	-	6
E-box nuts	-	6
E-box wire nuts	-	6
Left engine compartment E-box nuts	M5	4
	M6	6

DTC CHART

Engine Code CJAA 2.0L TDI

Fuel and Air Mixture, Additional Emission Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000E	Fuel Volume Regulator Control Exceeded Learning Limit	• Number of learning points at adaptation limits ≥ 8 of 64 • Upper limit > 1.2
P00AF	Turbocharger Boost Control Module Performance	Boost pressure actuator stuck < 17% when commanded on or > 17% when commanded off.
P00C6	Fuel Rail Pressure Too Low - Engine Cranking	Fuel rail pressure < 120 to 180 bar
P00D1	O2S (Bank 1 Sensor 1) Heater Output Warm Up Time Exceeded	Sensor temperature < 720 °C
P00D2	O2S (Bank 1 Sensor 2) Heater Output Warm Up Time Exceeded	Sensor temperature < 720 °C
P00D5	O2S (Bank 1 Sensor 1) to O2S Bank 1 Sensor 2 Implausible	Offset air fuel ratio > 0.05
P0045	Turbocharger/Supercharger Boost Control Solenoid Circuit/Open	Open circuit message from output driver
P0047	Turbocharger/Supercharger Boost Control Solenoid Circuit Low	Short to ground message from output driver
P0048	Turbocharger/Supercharger Boost Control Solenoid Circuit High	Short to voltage message from output driver
P0071	Ambient Air Temperature Sensor Range/Performance	Temperature difference to at least 2 other temperature sensors at startup > 45 °Kelvin
P0072	Ambient Air Temperature Sensor Circuit Low	Error signal low sent from Cluster to ECM
P0073	Ambient Air Temperature Sensor Circuit High	Error signal high sent from Cluster to ECM

DTC	Error Message	Malfunction Criteria and Threshold Value
P0087	Fuel Rail/System Pressure - Too Low	• Control deviation > 150 - 200 Bar • Exceeding absolute rail pressure limits < 120 - 125 Bar or > 1950 Bar • Control deviation < -200 to -300 Bar
P0088	Fuel Rail/System Pressure - Too High	• Control deviation > 150 - 200 Bar • Exceeding absolute rail pressure limits < 120 - 125 Bar or > 1950 Bar • Control deviation < -200 to -300 Bar
P0090	Fuel Pressure Regulator 1 Control Circuit	Open circuit diagnostic signal from output driver
P0091	Fuel Pressure Regulator 1 Control Circuit Low	Grounded circuit diagnostic signal from output driver
P0092	Fuel Pressure Regulator 1 Control Circuit High	Over current circuit diagnostic signal from output driver
P0100	Mass or Volume Air Flow Circuit	• Battery voltage < 7.5 V or • Signal range check low, battery voltage < 7.5 V
P0101	Mass or Volume Air Flow Circuit Range/Performance	Ratio of actual mass airflow and modeled air mass > 1.80 or < 0.84
P0102	Mass or Volume Air Flow Circuit Low Input	Range check low: • Calculated PWM signal period time < 83 kg/h or • Raw value PWM signal period time > 900 kg/h
P0103	Mass or Volume Air Flow Circuit High Input	Range check high: • Calculated PWM signal period time > 666.6 µs (-57 kg/h) or • Calculated PWM signal period time > 833.35 µs (-157 kg/h)
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	Temperature difference to at least 3 other temperature sensors at startup > 30 °K

DTC	Error Message	Malfunction Criteria and Threshold Value
P0112	Intake Air Temperature Sensor 1 Bank 1 Circuit Low	Boost temperature sensor voltage < 0.04 V
P0113	Intake Air Temperature Sensor 1 Bank 1 Circuit High	Boost temperature sensor voltage > 2.88 V
P0116	Engine Coolant Temperature Circuit Range/Performance	• Time for coolant temp to reach 19.96 °C or increase by 10 °K > 300 Sec. for start temperature <10 °C >120 Sec. for start temp > 10 °C • Temperature difference to at least 3 other temperature sensors at startup > 30 °K
P0117	Engine Coolant Temperature (Sensor 1) Circuit Low	Coolant temperature sensor voltage < 0.15 V
P0118	Engine Coolant Temperature Sensor 1 Circuit High	Coolant temperature sensor voltage > 3.25 V
P0128	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)	Measured temperature lower than model temperature < 70 °C and modeled temperature > 80 °C
P013B	O2 Sensor (Bank 1 Sensor 2) Slow Response - Lean to Rich	Time delay between oxygen signals pre and post NOx trap > 0.45 Sec.
P0130	O2 Sensor Circuit (Bank 1 Sensor 1)	• Short to battery > 3 V • Nernst voltage > 4 V • Adjustment voltage > 1.5 V or • Short to ground < 2 V • Nernst voltage < 1.75 V • Adjustment voltage < 0.3 V
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	O2 sensor raw signal > 3.2 V
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	• Time to 30% of expected concentration increase > 2.8 Sec or • Time to 60% of expected concentration increase > 4.1 Sec. or • Time to 60% minus time to 30% > 1.3 Sec.

DTC	Error Message	Malfunction Criteria and Threshold Value
P0135	O2 Sensor Heater Circuit (Bank 1 Sensor 1)	• Diagnostic signal from output driver sent or • Sensor element temperature < 720 or > 840 °C
P0136	O2 Sensor Circuit (Bank 1 Sensor 2)	• LSU internal resistance > 1104 ohms • LSU raw voltage < 1.4 or > 1,6 V • Virtual ground > 3 V • Nernst voltage > 4 V • Adjustment voltage > 1.5 V or • LSU raw voltage < 0.2 or > 3 V • Short to ground < 2 V • Nernst voltage < 1.75 V • Adjustment voltage < 0.3 V
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	O2S raw signal > 3.2 V
P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	• Time to 30% of expected concentration increase > 2.8 Sec. or • Time to 60% of expected concentration increase > 4.1 Sec. or • Time to 60% minus time to 30% > 1.3 Sec.
P014D	O2 Sensor Slow Response - Lean to Rich (Bank 1 Sensor 1)	Time delay between oxygen signals pre and post NOx trap > 1.5 Sec.
P0141	O2 Sensor Heater Circuit (Bank 1 Sensor 2)	• Sensor element temp < 720 and > 840 °C • Voltage error signal from output driver.
P0181	Fuel Temperature Sensor A Circuit Range/Performance	Temperature difference to at least 2 other temperature sensors at startup > 30 °K
P0182	Fuel Temperature Sensor A Circuit Low	Fuel temperature sensor voltage < 0.05 V
P0183	Fuel Temperature Sensor A Circuit High Input	Fuel temperature sensor voltage > 4.70 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0191	Fuel Rail Pressure Sensor Circuit Range/Performance	• Sensor voltage < 428 mV or > 613 mV • Adaptation value out of limit < 83% or > 130%
P0192	Fuel Rail Pressure Sensor Circuit Low	Sensor voltage < 200 mV or > 591 mV
P0193	Fuel Rail Pressure Sensor Circuit High	Sensor voltage > 4800 mV
P020A	Cylinder 1 Injection Timing	• Control error < limit from MAP f (engine speed and desired torque) -8 °CA to -4 °CA or • Control error < limit from MAP f (engine speed and desired torque) +8 °CA to +4 °CA
P020B	Cylinder 2 Injection Timing	• Control error < limit from MAP f (engine speed and desired torque) -8 °CA to -4 °CA or • Control error < limit from MAP f (engine speed and desired torque) +8 °CA to +4 °CA
P020C	Cylinder 3 Injection Timing	• Control error < limit from MAP f (engine speed and desired torque) -8 °CA to -4 °CA or • Control error < limit from MAP f (engine speed and desired torque) +8 °CA to +4 °CA
P020D	Cylinder 4 Injection Timing	• Control error < limit from MAP f (engine speed and desired torque) -8 °CA to -4 °CA or • Control error < limit from MAP f (engine speed and desired torque) +8 °CA to +4 °CA
P0201	Injector Circuit/Open – Cylinder 1	Open circuit diagnostic signal from output driver
P0202	Injector Circuit/Open – Cylinder 2	Open circuit diagnostic signal from output driver
P0203	Injector Circuit/Open – Cylinder 3	Open circuit diagnostic signal from output driver
P0204	Injector Circuit/Open – Cylinder 4	Open circuit diagnostic signal from output driver

DTC	Error Message	Malfunction Criteria and Threshold Value
P0234	Turbo/Super Charger Overboost Condition	Control deviation > -300 - -800 hPa @ delta engine speed/ injection quantity
P0236	Turbo/Super Charger Boost Sensor “A” Circuit Range/ Performance	Difference between barometric and boost pressure signal > 150 hPa
P0237	Turbo/Super Charger Boost Sensor “A” Circuit Low	Boost Pressure Sensor < 0.68 V
P0238	Turbo/Super Charger Boost Sensor “A” Circuit High	Boost Pressure Sensor > 4.88 V
P026A	Charge Air Cooler Efficiency Too Low	Charge air intercooler efficiency < 0.4
P0263	Cylinder 1 Contribution/ Balance	Calibration value of injector energizing time > 217 µs (depending on rail pressure) or < 117 µs
P0266	Cylinder 2 Contribution/ Balance	Calibration value of injector energizing time > 217 - 426 µs (depending on rail pressure) or < 117 - 157 µs
P0269	Cylinder 3 Contribution/ Balance	Calibration value of injector energizing time > 217 - 426 µs (depending on rail pressure) or < 117 - 157 µs
P026A	Charge Air Cooler Efficiency Below Threshold	Efficiency < 0.40
P0272	Cylinder 4 Contribution/ Balance	Calibration value of injector energizing time > 217 - 426 µs (depending on rail pressure) or < 117 - 157 µs
P0299	Turbo/Super Charger Underboost	Deviation of actual and desired boost pressure > 400 - 800 hPa @ delta engine speed/injection quantity
P20D8	Exhaust After Treatment Fuel Supply Control Performance	Control deviation > limit from Map f or < limit from Map f (engine speed, torque)
P2000	NOx Absorber Efficiency Bank 1 Below Threshold	• Oxygen signals post NOx trap < 0.97 • Oxygen signals pre NOx trap < 0.045 • Mass of reductant consumption < 0.40 g

DTC	Error Message	Malfunction Criteria and Threshold Value
P2002	Particulate Trap (Bank 1) Efficiency Below Threshold	• Differential pressure signal < f (exhaust gas volume flow) or • Ratio of filtered temperature dynamic upstream and downstream of the PM trap < 1.2
P2004	Intake Manifold Runner Control (Bank 1) Stuck Open	Flap valve stuck open > 12%
P2006	Intake Manifold Runner Control (Bank 1) Stuck Closed	Flap valve stuck closed < 12%
P2008	Intake Manifold Runner (Bank 1) Control Circuit/Open	Open load diagnostic signal from output driver
P2009	Intake Manifold Runner (Bank 1) Control Circuit Low	Short to ground on output 1 or 2 signal from output driver
P2010	Intake Manifold Runner (Bank 1) Control Circuit High	Short to voltage on output 1 or 2 signal from output driver
P2015	Intake Manifold Runner Position Sensor/Switch Circuit Range/Performance	• Position sensor signal > 4.61 or < 0.39 V • Closed learning position > 4.61 or < 3.79 V • Open learning position > 1.21 or < 0.39 V
P2016	Intake Manifold Runner Position Sensor/Switch Circuit Low	Position sensor signal < 0.25 V
P2017	Intake Manifold Runner Position Sensor/Switch Circuit High	Position sensor signal > 4.75 V
P2031	Exhaust Gas Temperature (Sensor 2), Bank 1 Circuit	Sensor 2 voltage > 1.72 V
P2032	Exhaust Gas Temperature (Sensor 2), Bank 1 Circuit Low	Sensor 2 voltage < 0.45 V
P2080	Exhaust Gas Temperature Sensor Circuit (Bank 1) Range/Performance	• Comparison of upstream turbine exhaust gas temp vs modeled temperature < 85 °C or • Temperature difference to other temp sensors during cold start < 45 °K

DTC	Error Message	Malfunction Criteria and Threshold Value
P2084	Exhaust Gas Temperature Sensor 2 Circuit Range/ Performance	• Comparison of upstream turbine exhaust gas temp vs modeled temperature < 85 °C or • Temperature difference to other temp sensors during cold start < 45 °K
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/Multiple Cylinder Misfire Detected	• No rise in engine speed after fuel injection Calculated based on values from last two engine revolutions • Error threshold 82% misfire over 440 crankshaft revolutions
P0301	Cylinder 1 Misfire Detected	• No rise in engine speed after fuel injection Calculated based on values from last two engine revolutions • Error threshold 82% misfire over 440 crankshaft revolutions
P0302	Cylinder 2 Misfire Detected	• No rise in engine speed after fuel injection Calculated based on values from last two engine revolutions • Error threshold 82% misfire over 440 crankshaft revolutions
P0303	Cylinder 3 Misfire Detected	• No rise in engine speed after fuel injection Calculated based on values from last two engine revolutions • Error threshold 82% misfire over 440 crankshaft revolutions

DTC	Error Message	Malfunction Criteria and Threshold Value
P0304	Cylinder 4 Misfire Detected	• No rise in engine speed after fuel injection Calculated based on values from last two engine revolutions • Error threshold 82% misfire over 440 crankshaft revolutions
P0321	Ignition/Distributor Engine Speed Input Circuit Range/ Performance	• Consecutive not plausible signals > 15 • Cam phase signals without plausible engine speed signal > 4 cam rotations.
P0322	Ignition/Distributor Engine Speed Input Circuit No Signal	No incremental signal. Internal self test failed.
P0381	Glow Plug/Heater Indicator Circuit	Receipt bit for lamp request not equal with lamp request bit.
P0383	Glow Plug Control Module Control Circuit Low	Diagnostic error signal sent from output driver = 0 V.

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P040B	Exhaust Gas Recirculation Temperature Sensor Circuit Performance	• Sensor temperature < 55 °C or • Temperature difference to other temp sensors during cold start < 45 °K
P040C	Exhaust Gas Recirculation Temperature Sensor Circuit Low	Signal sensor voltage < 0.06 V
P040D	Exhaust Gas Recirculation Temperature Sensor Circuit High	Signal sensor voltage > 3.24 V
P0401	Exhaust Gas Recirculation Flow Insufficient Detected	Control deviation < limit from map f (engine speed, desired airflow)
P0402	Exhaust Gas Recirculation Flow Excessive Detected	Control deviation > limit from map (engine speed, desired airflow)
P0403	Exhaust Gas Recirculation Control Circuit	Valve stuck open > 17% or stuck closed < 17%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0405	EExhaust Gas Recirculation Sensor “A” Circuit Low	Position sensor signal range check low.
P0406	Exhaust Gas Recirculation Sensor “A” Circuit High	Position sensor signal range check high.
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	HC conversion rate < 0.3
P045A	Exhaust Gas Recirculation Valve 2 Control Circuit	Diagnostic signal from output driver
P045B	Exhaust Gas Recirculation Valve 2 Control Circuit Range/ Performance	Position sensor signal > 1 V or < 0.4 V
P045C	Exhaust Gas Recirculation “B” Control Circuit Low	Diagnostic signal from output driver
P045D	Exhaust Gas Recirculation Valve 2 Control Circuit High	Diagnostic signal from output driver
P045E	Exhaust Gas Recirculation Valve 2 Control Stuck Open	Comparison of actual and desired position signal • Control deviation > 12%
P045F	Exhaust Gas Recirculation Valve 2 Control Stuck Closed	Comparison of actual and desired position signal • Control deviation < -12%
P046C	Exhaust Gas Recirculation Valve 1 Circuit Performance	Position sensor signal > 1 V or < 0.4 V
P047C	Exhaust Pressure Sensor 2 Low	Pressure sensor voltage < 0.2 V
P047D	Exhaust Pressure Sensor 2 High	Pressure sensor voltage > 4.9 V
P047F	Exhaust Pressure Control Valve 1 Stuck Open	Control valve stuck open - position sensor < 10% when commanded closed
P0470	Exhaust Pressure Sensor	Sensor voltage > 4.9
P0471	Exhaust Pressure Sensor "A" Range/Performance	Differential of pressure signal < -27 or > 47 hPa
P0472	Exhaust Pressure Sensor Low	Sensor voltage < 0.2 V
P0473	Exhaust Pressure Sensor High	Sensor voltage > 4.9 V
P0474	Exhaust Pressure Sensor Circuit Intermittent	Difference between modeled and actual pressure differential across low pressure EGR > 40 hPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P0475	Exhaust Pressure Control Valve	Diagnostic signal from output driver
P0477	Exhaust Pressure Control Valve Low	Diagnostic signal from output driver.
P0478	Exhaust Pressure Control Valve High	Short to voltage on Out 1 or Out 2 signal from output driver.
P048A	Exhaust Pressure Control Valve 1 Stuck Closed	Control valve stuck closed - position sensor > 10% when commanded open
P048B	Exhaust Pressure Control Valve Position Sensor/Switch Circuit	Position sensor signal < 0.25 V
P048C	Exhaust Pressure Control Valve Pos. Sensor/Switch Circuit Range/Performance	Position sensor signal in desired range during closed position learning > 1.1 V or < 0.5 V
P048E	Exhaust Pressure Control Valve Pos. Sensor/Switch Circuit High	Position sensor signal > 4.85 V
P0486	Exhaust Gas Recirculation Sensor “B” Circuit	Position sensor signal > 4890 or < 210 mV

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor “A” Range/Performance	Vehicle speed < 6 km/h
P0502	Vehicle Speed Sensor “A” Circuit Low Input	Brake control unit error message sent
P0503	Vehicle Speed Sensor “A” Intermittent/Erratic/High	Vehicle speed > 320 km/h
P0506	Idle Control System RPM Lower than Expected	Control deviation < 10%
P0507	Idle Control System RPM Higher than Expected	Control deviation > 10%
P0534	Air Conditioner Refrigerant Charge Loss	-
P0544	Exhaust Gas Temperature Sensor Circuit (Bank 1 Sensor 1)	Signal voltage > 1.72 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0545	Exhaust Gas Temperature Sensor Circuit Low (Bank 1 Sensor 1)	Signal voltage < 0.45 V
P054E	Idle Control System Fuel Quantity Lower Than Expected	Actual fuel mass < limit from map f(engine speed , engine temperature)
P054F	Idle Control System Fuel Quantity Higher Than Expected	Actual fuel mass > limit from map f(engine speed , engine temperature)
P0562	System Voltage Low	Internal check failure of voltage supply for ECM off timer

Control Module and Output Signals

DTC	Error Message	Malfunction Criteria and Threshold Value
P06A3	Sensor Reference Voltage “D” Circuit/Open	Sensor supply voltage < 2.97 V or > 3.63 V
P06B9	Cylinder 1 Glow Plug Circuit Range/Performance	• Message from Glow Control Unit = error message • 4 - 14 Sec. after glow start = 1.2 ohm or less
P06BA	Cylinder 2 Glow Plug Circuit Range/Performance	• Message from Glow Control Unit = error message • 4 - 14 Sec. after glow start = 1.2 ohm or less
P06BB	Cylinder 3 Glow Plug Circuit Range/Performance	• Message from Glow Control Unit = error message • 4 - 14 Sec. after glow start = 1.2 ohm or less
P06BC	Cylinder 4 Glow Plug Circuit Range/Performance	• Message from Glow Control Unit = error message • 4 - 14 Sec. after glow start = 1.2 ohm or less
P06C5	Cylinder 1 Glow Plug Incorrect	Message from Glow Control Unit = error message (wrong current slope).
P06C6	Cylinder 2 Glow Plug Incorrect	Message from Glow Control Unit = error message (wrong current slope).
P06C7	Cylinder 3 Glow Plug Incorrect	Message from Glow Control Unit = error message (wrong current slope).

DTC	Error Message	Malfunction Criteria and Threshold Value
P06C8	Cylinder 4 Glow Plug Incorrect	Message from Glow Control Unit = error message (wrong current slope).
P0604	Internal Control Module Random Access Memory (RAM) Error	• Write EEPROM not possible • Checksum error in 3 or more locations
P0605	Internal Control Module Read Only Memory (ROM) Error	ECM internal ROM self test failed
P0606	ECM/PCM Processor	ECM internal self test failed
P0607	Control Module Performance	• Low/high supply voltage diagnostic signal from output driver or • Failed signal range check with barometer pressure sensor (located on ECM circuit board)
P0627	Fuel Pump “A” Control Circuit /Open	Open circuit signal from output driver
P0628	Fuel Pump “A” Control Circuit Low	Grounded circuit signal from output driver
P0629	Fuel Pump “A” Control Circuit High	Over Current signal from output driver
P0634	PCM/ECM/TCM Internal Temperature Too High	Current Over-Temperature diagnostic signal from output driver > 150 °C
P0638	Throttle Actuator Control Range/Performance Bank 1	Diagnostic signal from actuator module = defective state
P064C	Glow Plug Control Module	Wrong GCU build = error message
P0641	Sensor Reference Voltage “A” Circuit/Open	Sensor supply voltage < 4.8 V or > 5.2 V
P0651	Sensor Reference Voltage “B” Circuit/Open	Sensor supply voltage < 4.8 V or > 5.2 V
P066A	Cylinder 1 Glow Plug Control Circuit Low	Over current on circuit > 70 A
P066C	Cylinder 2 Glow Plug Control Circuit Low	Over current on circuit > 70 A
P066E	Cylinder 3 Glow Plug Control Circuit Low	Over current on circuit > 70 A
P067A	Cylinder 4 Glow Plug Control Circuit Low	Message from glow control unit = 3.44 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0670	Glow Plug Module Control Circuit	Message from glow control unit = 3.44 V
P0671	Cylinder 1 Glow Plug Circuit	Message from Glow Control Unit, (glow current < 2.2 A)
P0672	Cylinder 2 Glow Plug Circuit	Message from Glow Control Unit, (glow current < 2.2 A)
P0673	Cylinder 3 Glow Plug Circuit	Message from Glow Control Unit, (glow current < 2.2 A)
P0674	Cylinder 4 Glow Plug Circuit	Message from Glow Control Unit, (glow current < 2.2 A)
P068A	ECM/PCM Power Relay De-Energized Performance - Too Early	Relay stuck, no change in circuit voltage
P068B	ECM/PCM Power Relay De-Energized Performance - Too Late	Relay stuck, no change in circuit voltage
P0684	Glow Plug Control Module to PCM Communication Circuit Range/Performance	Message from glow relay-missing info from Glow Control Unit
P0697	Sensor Reference Voltage “C” Circuit Open	Sensor supply voltage < 3.168 V or > 3.432 V
U0001	High Speed CAN Communication Bus	CAN driver A status Bus Off.
U0002	High Speed CAN Communication Bus Performance	CAN driver A status no communication
U0101	Lost Communication with TCM	No TCM messages received.
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	No messages received from ABS module
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	No messages received from Instrument cluster
U0302	Software Incompatibility with Transmission Control Module	Wrong TCM messages received.
U0402	Invalid Data Received From Transmission Control Module	Data length code transmitted, incorrect
U0415	Invalid Data Received From Anti-Lock Brake System Control Module	Implausible ABS messages sent. Veh speed > 320 km/h or missing vehicle speed data.

DTC	Error Message	Malfunction Criteria and Threshold Value
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	Error message sent from Instrument Panel Cluster to ECU
U1024	Instrument cluster control module Read out DTC	Error message sent from instrument cluster to ECU

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P1004	Torque Difference Cylinder 1 Limiting Value Exceeded	• Control error < limit from MAP f (engine speed and desired torque) -50 to -30 Nm or • +50 to +30 Nm
P1005	Torque Difference Cylinder 2 Limiting Value Exceeded	• Control error < limit from MAP f (engine speed and desired torque) -50 to -30 Nm or • +50 to +30 Nm
P1006	Torque Difference Cylinder 3 Limiting Value Exceeded	• Control error < limit from MAP f (engine speed and desired torque) -50 to -30 Nm or • +50 to +30 Nm
P1007	Torque Difference Cylinder 4 Limiting Value Exceeded	• Control error < limit from MAP f (engine speed and desired torque) -50 to -30 Nm or • +50 to +30 Nm
P13CE	Sensor for Internal Pressure of Cylinder 1 Electrical Malfunction	Cylinder pressure sensor voltage > 3.17 V
P13CF	Sensor For Internal Pressure of Cylinder 1 Short Circuit To Ground	Cylinder pressure sensor voltage < 0.13 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P13D0	Sensor for Internal Pressure of cylinder 1 Implausible Signal	• Cylinder pressure sensor voltage < 0.33 V or > 3.09 V or • Deviation between min and max cylinder pressure # 1 < 20 bar • Offset out of range < -7 or > 7 bar or • Pressure based measured TDC position sensor out of range or • Difference of calculated cylinder pressure vs. actual measured cylinder pressure out of range < -10 or > 10 Bar
P13D1	Sensor For Internal Pressure of Cylinder 2 Electrical Error	Cylinder pressure sensor voltage > 3.17 V
P13D2	Sensor For Internal Pressure of Cylinder 2 Short Circuit To Ground	Cylinder pressure sensor voltage < 0.13 V
P13D3	Sensor For Internal Pressure of Cylinder 2 Implausible Signal	• Cylinder pressure sensor voltage < 0.33 V or > 3.09 V or • Deviation between min and max cylinder pressure # 2 < 20 bar • Offset out of range < -7 or > 7 bar or • Pressure based measured TDC position sensor out of range or • Difference of calculated cylinder pressure vs. actual measured cylinder pressure out of range < -10 or > 10 Bar
P13D4	Sensor For Internal Pressure of Cylinder 3 Electrical Error	Cylinder pressure sensor voltage > 3.17 V
P13D5	Sensor For Internal Pressure of Cylinder 3 Short Circuit To Ground	Cylinder pressure sensor voltage < 0.13 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P13D6	Sensor For Internal Pressure of Cylinder 3 Implausible Signal	• Cylinder pressure sensor voltage < 0.33 V or > 3.09 V or • Deviation between min and max cylinder pressure # 3 < 20 bar • Offset out of range < -7 or > 7 bar or • Pressure based measured TDC position sensor out of range or • Difference of calculated cylinder pressure vs. actual measured cylinder pressure out of range < -10 or > 10 Bar
P13D7	Sensor for Internal Pressure of Cylinder 4 Electrical Malfunction	Cylinder pressure sensor voltage > 3.17 V
P13D8	Sensor For Internal Pressure of Cylinder 4 Short Circuit To Ground	Cylinder pressure sensor voltage < 0.13 V
P13D9	Sensor For Internal Pressure of Cylinder 4 Implausible Signal	• Cylinder pressure sensor voltage < 0.33 V or > 3.09 V or • Deviation between min and max cylinder pressure # 4 < 20 bar • Offset out of range < -7 or > 7 bar or • Pressure based measured TDC position sensor out of range or • Difference of calculated cylinder pressure vs. actual measured cylinder pressure out of range < -10 or > 10 Bar
P13E0	Sensor For Internal Pressure of Cylinder 1 Malfunction	Pressure based measured TDC vs. crank position sensor for cyl. 1 out of range < 1.8 CA or > 1.8 CA

DTC	Error Message	Malfunction Criteria and Threshold Value
P13E1	Sensor for Internal Pressure of Cylinder 2 Malfunction	Pressure based measured TDC vs. crank position sensor for cyl. 2 out of range < 1.8 CA or > 1.8 CA
P13E2	Sensor for Internal Pressure of Cylinder 3 Malfunction	Pressure based measured TDC vs. crank position sensor for cyl. 3 out of range < 1.8 CA or > 1.8 CA
P13E3	Sensor for Internal Pressure of Cylinder 4 Malfunction	Pressure based measured TDC vs. crank position sensor for cyl. 4 out of range < 1.8 CA or > 1.8 CA
P140C	EGR (Sensor 2 Bank 1) Signal too low	Position sensor signal > 4850 mV
P140E	EGR sensor 2 bank 1 Signal too high	Position sensor signal < 150 mV
P169A	Loading mode active	Transport mode active
P2100	Throttle Actuator Control Motor Circuit/Open	Open circuit diagnostic signal sent from output driver
P2101	Throttle Actuator A Control Motor Circuit Range/ Performance	Missing diagnostic signal from actuator module
P2102	Throttle Actuator Control Motor Circuit Low	Grounded circuit diagnostic signal sent from output driver
P2103	Throttle Actuator “A” Control Motor Circuit High	Circuit short to voltage diagnostic signal sent from output driver
P2122	Throttle/Pedal Pos. Sens./ Switch D Circuit Low Input	Sensor 1 voltage < 0.61 V
P2123	Throttle/Pedal Pos. Sens./ Switch D Circuit High Input	Sensor 1 voltage > 4.79 V
P2127	Throttle/Pedal Pos. Sens./ Switch E Circuit Low Input	Sensor 2 voltage < 0.27 V
P2128	Throttle/Pedal Pos. Sens./ Switch E Circuit High Input	Sensor 2 voltage > 2.43 V
P2138	Throttle/Pedal Position Sensor/Switch D/E Voltage Correlation	Voltage drift monitoring: • Throttle Position Sensor 1 voltage and APP Sensor 2 voltage = 13 - 20%
P2146	Fuel Injector Group “A” Supply Voltage Circuit Open	Diagnostic signal from output driver = error pattern

DTC	Error Message	Malfunction Criteria and Threshold Value
P2149	Fuel Injector Group “B” Supply Voltage Circuit Open	Diagnostic signal from output driver = error pattern
P2183	Engine Coolant Temperature Sensor 2 Circuit Range/ Performance	Temperature difference to at least 2 other temperature sensors at startup > 20 °K
P2184	Engine Coolant Temperature Sensor 2 Circuit Low	ECT signal voltage < 0.15 V
P2185	Engine Coolant Temperature Sensor 2 Circuit High	Deviation to oxygen concentration > 0.046
P2195	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 1)	Deviation to oxygen concentration > 0.046
P2196	O2 Sensor Signal Stuck Rich (Bank 1 Sensor 1)	Deviation to oxygen concentration < 0.063
P2237	O2 Sensor Positive Current Control Circuit (Bank 1 Sensor 1) Open	• Measured oxygen concentration < 0.005
P2243	O2 Sensor Reference Voltage Circuit/Open (Bank 1 Sensor 1)	• O2S internal resistance > 1104Ω • Oxygen sensor raw signal > 3 V
P2251	O2 Sensor Negative Current Control Circuit/Open (Bank 1 Sensor 1)	• O2S internal resistance > 1104 Ω • Oxygen sensor raw signal < 1.4 V or > 1.6 V
P2270	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 2)	Deviation to oxygen concentration during fuel cutoff > 0.046 OR deviation between measured and modeled oxygen concentration > 4.8% vol.
P2271	O2 Sensor Signal Stuck Rich; (Bank 1 Sensor 2)	Deviation to oxygen concentration during fuel cutoff < -0.063
P2279	Intake Air System Leak	Deviation between actual airflow and modeled mass air flow < 0.7
P2294	Fuel Pressure Regulator 2 Control Circuit	Open circuit diagnostic signal from output driver
P2295	Fuel Pressure Regulator 2 Control Circuit Low	Grounded circuit diagnostic signal from output driver
P2296	Fuel Pressure Regulator 2 Control Circuit High	Over current circuit diagnostic signal from output driver

DTC	Error Message	Malfunction Criteria and Threshold Value
P320B	O2 (Bank 1 Sensor 2) Heater Performance	Sensor temperature < 720 °C
P320C	O2 (Bank 1 Sensor 1/2) Lean Correlation	Offset air fuel ratio > 0.5

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P240F	Exhaust Gas Recirculation Slow Response	Calculated characteristic value > 20 at positive or negative air mass change
P2413	Exhaust Gas Recirculation System Performance	• Number of learning points at fuel mass adaptation limit > or = to 4 • At upper limit = 6 mg/stroke • At lower limit = -6 mg/stroke
P242A	Exhaust Gas Temperature Sensor Circuit (Bank 1 Sensor 3)	Sensor signal voltage > 1.72 V
P242B	Exhaust Gas Temperature Sensor Circuit (Bank 1 Sensor 3) Range/Performance	• Comparison of upstream turbine exhaust gas temp vs modeled temperature < 250 °C or • Temperature difference to other temp sensors during cold start < 45 °K
P242C	Exhaust Gas Temperature Sensor Circuit Low (Bank 1 Sensor 3)	Sensor signal voltage < 0.45 V
P244C	Exhaust Temperature Too Low For Particulate Filter Regeneration (Bank 1)	Time to activate control loop > 45 to 60 Sec.
P2452	Diesel Particulate Filter Differential Pressure Sensor Circuit	Sensor voltage > 4.9 V
P2453	Diesel Particulate Filter Differential Pressure Sensor Circuit Range/Performance	Differential pressure signal < -83 hPa to > 80 hPa
P2454	Diesel Particulate Filter Differential Pressure Sensor Circuit Low	Sensor voltage < 0.2

DTC	Error Message	Malfunction Criteria and Threshold Value
P2456	Diesel Particulate Filter Pressure Sensor “A” Circuit Intermittent/Erratic	Inverse change of differential pressure per time > 10 hPa or < 10 hPa
P2457	Exhaust Gas Recirculation Cooler Efficiency Below Threshold	Sensor temperature above threshold 40 °K
P2458	Diesel Particulate Filter Regeneration Duration	Regeneration time > 5400 Sec.
P2459	Diesel Particulate Filter Regeneration Frequency	PM trap loading > dynamically rising threshold f(simulated engine emissions)
P246E	Exhaust Gas Temperature Sensor Circuit (Bank 1 Sensor 4)	Sensor signal voltage > 1.72 V
P246F	Exhaust Gas Temperature Sensor Circuit (Bank 1 Sensor 4) Range/Performance	• Sensor temperature < 230 °C or • Temperature difference to other temp sensors during cold start < 45 °K
P2463	Diesel Particulate Filter - Soot Accumulation	Calculated particulate matter trap loading > 40 g
P247A	Exhaust Gas Temperature Out of Range (Bank 1 Sensor 3)	Control deviation > limit from Map f or < limit from Map f (engine speed, torque)
P2470	Exhaust Gas Temperature Sensor Circuit Low (Bank 1 Sensor 4)	Sensor signal voltage < 0.45 V
P2478	Exhaust Gas Temperature Out of Range (Bank 1 Sensor 1)	Control deviation > limit from Map f or < limit from Map f (engine speed, torque)
P2563	Turbocharger Boost Control Position Sensor Circuit Range/Performance	• Position sensor signal voltage < 0.3 or > 4.5 V or • Position sensor signal > 1.72 or < 0.3 V
P2564	Turbocharger Boost Control Position Sensor Circuit Low	Position sensor signal voltage < 0.15 V
P2565	Turbocharger Boost Control Position Sensor Circuit High	Sensor signal voltage > 4.85 V
P2610	ECM/PCM Internal Engine Off Timer Performance	Quantity time over threshold < 7.52 or > 8.48 Sec.

DTC	Error Message	Malfunction Criteria and Threshold Value
P2632	Fuel Pump “B” Control Circuit Open	Open circuit diagnostic signal from output driver
P2633	Fuel Pump “B” Control Circuit Low	Grounded circuit diagnostic signal from output driver
P2634	Fuel Pump “B” Control Circuit High	Over current circuit diagnostic signal from output driver
P268A	Fuel Injector Calibration Not Learned/Programmed	Accumulated global release time of zero fuel calibration but disabled by rail pressure deviation.

DTC CHART

Engine Codes – CBFA, CCTA 2.0L

Fuel and Air Mixture, Additional Emission Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	"A" Camshaft Position Slow Response (Bank 1)	Signal change > 8 CRK ° for > 2.9 Sec. and adjustment angle ≥ 2.50 CRK rev.
P0010	Intake “A” Camshaft Position Actuator Circuit / Open Bank 1	Signal voltage > 4.70 - 5.40 V
P0011	Intake “A” Camshaft Position - Timing Over-Advanced or System Performance Bank 1	Signal change > 8 CRK ° for > 2.9 Sec. and adjustment angle < 2.50 CRK rev.
P0016	Crankshaft Position-Camshaft Position Correlation (Bank 1 Sensor A)	• Permissible deviation < -11 CRK ° or • Permissible deviation > 11° Rev
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)	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 3)	Heater voltage < 2.34 V
P0044	HO2S Heater Control Circuit High (Bank 1 Sensor 3)	Heater voltage < 2.34 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P050A	Idle Air Control System RPM Lower Or Higher Than Expected	Out of range-low • Engine speed deviation < 80 RPM and • RPM controller torque value ≥ calculated max. value Out of range-high • Engine speed deviation > 80 RPM and • RPM controller torque value ≤ calculated min. value Plausibility check • Integrated deviation of engine speed low and integrated deviation of engine speed high > 2000 RPM
P0070	Ambient Air Temperature Sensor Circuit	Ambient air temperature < -50 °C
P0071	Ambient Air Temperature Sensor Range/Performance	• Difference in value between ECT and AAT at engine start (depending on engine off time) > 25 K and • 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
P0068	MAP/MAF – Throttle Position Correlation	• Plausibility with fuel system load calculation < -50% • Plausibility with fuel system load calculation > 50%
P0087	Fuel Rail/System Pressure - Too Low	• Pressure control activity, > 5.00 mPa and • Fuel trim activity, 0.90 - 120
P0100	Mass or Volume Air Flow A Circuit	MAF sensor signal 0 µs

DTC	Error Message	Malfunction Criteria and Threshold Value
P0101	Mass or Volume Air Flow Circuit Range/Performance	• Mass air flow vs lower threshold model < 0 - 396 kg/h • Mass air flow vs upper threshold > 34 - 907 kg/h • Load calculation > 19 % and • Fuel system (mult.) < -21% • Load calculation < -19% and • Fuel system (mult.) > 21 %
P0102	Mass or Volume Air Flow Circuit Low Input	MAF sensor signal < 66 µs
P0103	Mass or Volume Air Flow Circuit High Input	MAF sensor signal > 4500 µs
P0106	Manifold Absolute Pressure/ Barometric Pressure Circuit Range/Performance	Boost pressure signal • < Altitude sensor -210 hPa • > Altitude sensor +230 hPa
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	• Difference in value: IAT-ECT @ engine start (depending on engine-off time, > 25 - 40 K and • Difference in value: IAT-AAT @ engine start (depending on engine-off time), > 25 - 40 K
P0112	Intake Air Temperature Sensor 1 Circuit Low	Intake air temperature > 141°C
P0113	Intake Air Temperature Sensor 1 Circuit High	Intake air temperature < 46°C
P0116	Engine Coolant Temperature Circuit Range/Performance	Stuck high: • Difference ECT vs. IAT at engine start > 25 - 40° C (depending on engine off time) and • Difference IAT at engine start < 25 - 40° C (depending on engine off time) and • Difference AAT vs. ECT at engine start > 25 - 40° C (depending on engine off time)

DTC	Error Message	Malfunction Criteria and Threshold Value
P0116	Engine Coolant Temperature Circuit Range/Performance only ULEV	• Signal in range 109.6 - 140.3° C and no change on signal < 1.5 K • Signal in range 50.3 - 88.4° C and no change on signal < 1.5 K • Signal in range 88.5 - 109.5° C and no change on signal < 1.5 K
P0117	Engine Coolant Temperature Circuit Low	Engine coolant temperature > 140°C
P0118	Engine Coolant Temperature Circuit High	Engine coolant temperature < -40°C
P0121	Throttle/Pedal Position Sensor/Switch “A” Circuit Range/Performance	• TPS 1 - TPS 2 > 6.30% and • Actual TPS 1 calculated value > actual TPS 2 calculated value or • TPS 1 calculated value > 9.00%
P0122	Throttle/Pedal Position Sensor/Switch “A” Circuit Low	Signal voltage < 0.20 V
P0123	Throttle/Pedal Position Sensor/Switch “A” Circuit High	Signal voltage > 4.81 V
P0130	O2 Sensor Circuit (Bank 1 Sensor 1)	O2S ceramic temperature < 640 °C
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	Virtual mass > 2.00V
		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)	Symmetric fault: • lower value of both area ratios R2L and L2R < 0.30 and • Difference of R2L area ratio vs. L2R area ratio -0.400 - 0.400 Asymmetric fault: • Lower value of both area ratios R2L and L2R < 0.30 and • Difference of R2L area ratio vs. L2R area ratio NOT (-0.400 - 0.400) General: • Lower value of both counters for area ratio R2L and L2R ≥ 5 times
P0135	O2 Sensor Heater Circuit (Bank 1 Sensor 1)	• O2S ceramic temperature < 715 °C and • Heater duty cycle 100% • O2S ceramic temperature < 715 °C and • Time after O2S heater on 40 Sec.
P0136	O2 Sensor Circuit (Bank 1 Sensor 2)	• Delta voltage one step at heater switching > 2.00 Vand number of heater coupling ≥ 6 times
P0137	O2 Sensor Circuit Low Voltage (Bank 1, Sensor 2)	• Signal voltage < 0.06 V for > 3 Sec. and • Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) < 0.01 V
P0138	O2 Sensor Circuit High Voltage (Bank 1, Sensor 2)	Signal voltage 1.26 V for > 5 Sec.

DTC	Error Message	Malfunction Criteria and Threshold Value
P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	• EWMA filtered transient time at fuel cut-off, > 0.7 Sec • In voltage range, 201....347.7 mV • Number of checks (initial phase), > 3 • Number of checks (step function), > 3
P013A	O2 Sensor Slow Response Rich to Lean (Bank 1 Sensor 2)	• EWMA filtered max differential transient time at fuel cutoff ≥ 0.5 Sec. • Number of checks ≥ 3
P0140	O2 Sensor Circuit No Activity Detected (Bank 1, Sensor 2)	• Signal voltage, 40 - 60 mV for > 3 Sec or • Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) ≥ 2.80 V
P0141	O2 Sensor Heater Circuit (Bank1 Sensor 2)	Heater resistance, 810 - 4560 Ω
P0142	O2 Sensor Circuit (Bank 1 Sensor 3)	• 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 • 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)	• EWMA filtered transient time at fuel cut-off, > 0.4 Sec • In voltage range, 401.4...201.2 mV • Number of checks (initial phase), > 3 • Number of checks (step function), > 3
P0146	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 3)	• 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

DTC	Error Message	Malfunction Criteria and Threshold Value
P0169	Incorrect Fuel Composition	Comparison with fuel quantity incorrect
P0171	System Too Lean (Bank 1)	• Lean @ idle Adaptive value > 21% • Lean @ part-load Adaptive value 26 (only B8 ULEVVII
P0172	System Too Rich (Bank 1)	• Too rich at idle Adaptive value < 5.02% (<6.0 only B8 ULEV) • Too rich at part-load Adaptive value < 21% (-26 (only B8 ULEVVII)
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 Circuit Low	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
P0221	Throttle/Pedal Position Sensor/Switch “B” Circuit Range/Performance	• TPS 1 - TPS 2 > 6.30% • Actual TPS 2 calculated value > actual TPS 1 calculated value • TPS 2 calculated value > 9.00%
P0222	Throttle/Pedal Position Sensor/Switch B Low Input	Signal voltage < 0.20 V
P0223	Throttle/Pedal Position Sensor/Switch B High Input	Signal voltage > 4.81 V
P0234	Turbo/Super Charger Overboost Condition	Difference set value boost pressure vs actual boost pressure value, > 200 - 1280 hPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P0236	Turbo/Super Charger Boost Sensor “A” Circuit Range/ Performance	• Difference boost pressure signal vs altitude sensor signal, >220 hPa • Difference boost pressure signal vs altitude sensor signal, <120 hPa
P0237	Turbo/Super Charger Boost Sensor “A” Circuit Low	Signal voltage < 0.2 V
P0238	Turbo/Super Charger Boost Sensor “A” Circuit High	Signal voltage > 4.88 V
P0243	Turbo/Super Charger Wastegate Solenoid “A”	Signal voltage, > 4.40 - 5.60 V
P0245	Turbo/Super Charger Wastegate Solenoid “A” Low	Signal voltage, < 2.15 - 3.25 V
P0246	Turbo/Super Charger Wastegate Solenoid “A” High	Signal current, > 2.20 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	Low side signal current < 2.1 A
P0271	Cylinder 4 Injector Circuit High	Signal current > 14.70 A
P0299	Turbo/Super Charger Underboost	Difference of set boost pressure vs. actual boost pressure value > 150 hPa
P2008	Intake Manifold Runner Control Circuit/Open Bank 1	Signal voltage 4.70 - 5.40 V
P2009	Intake Manifold Runner Control Circuit Low Bank 1	Signal voltage 0 - 3.26 V
P2010	Intake Manifold Runner Control Circuit High Bank 1	Signal current > 2.20 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P2014	Intake Manifold Runner Position Sensor/Switch Circuit Bank 1	Signal voltage > 4.75 V
P2015	Intake Manifold Runner Position Sensor/Switch Circuit Range/Performance Bank 1	• Deviation runner flap target position vs actual position > 25% • Actual position 0 to 100%
P2016	Intake Manifold Runner Position Sensor/Switch Circuit Low Bank 1	Signal voltage < 0.25 V
P2088	A Camshaft Position Actuator Control Circuit Low Bank 1	Signal voltage < 0 - 3.25 V
P2089	A Camshaft Position Actuator Control Circuit High Bank 1	Signal current > 2.2 A
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Deviation lambda control < -0.03
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	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/Multiple Cylinder Misfire Detected	• Emission threshold misfire rate (MR) > 1.7% • Catalyst damage misfire rate (MR) > 5.0 - 20.0%
P0301	Cylinder 1 Misfire Detected	• Emission threshold misfire rate (MR) > 1.7% • Catalyst damage misfire rate (MR) > 5.0 - 20.0%
P0302	Cylinder 2 Misfire Detected	• Emission threshold misfire rate (MR) > 1.7% • Catalyst damage misfire rate (MR) > 5.0 - 20.0%
P0303	Cylinder 3 Misfire Detected	• Emission threshold misfire rate (MR) > 1.7% • Catalyst damage misfire rate (MR) > 5.0 - 20.0%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0304	Cylinder 4 Misfire Detected	• Emission threshold misfire rate (MR) > 1.7% • Catalyst damage misfire rate (MR) > 5.0 - 20.0%
P0321	Ignition/Distributor Engine Speed Input Circuit Range/ Performance	• Counted teeth versus reference, incorrect or • Monitoring reference gap failure
P0322	Ignition/Distributor Engine Speed Input Circuit No Signal	• Camshaft signal > 3 • Engine speed no signal
P0324	Knock Control System Error	• Signal fault counter (combustion) > 24 or • Signal fault counter (measuring window) > 2.00
P0327	Knock Sensor 1 Circuit Low	Lower threshold < 70 V
P0328	Knock Sensor 1 Circuit High	• Upper threshold > 18.0 - 150.0 V
P0340	Camshaft Position Sensor “A” Circuit Bank 1 or Single Sensor	Cam adaption values out of range • > 20° KW • < -20° KW • Difference of adapted and actual values > 9° KW
P0341	Camshaft Position Sensor “A” Circuit Range/Performance Bank 1 or Single Sensor	Signal pattern, incorrect
P0342	Camshaft Position Sensor “A” Circuit Low Bank 1 or Single Sensor	Signal voltage low and crankshaft signals, 8.0
P0343	Camshaft Position Sensor “A” Circuit High Bank 1 or Single Sensor	Signal voltage high and crankshaft signals, 8.0
P0351	Ignition Coil “A” Primary/ Secondary Circuit	• Signal current < -0.25 - 2.0 mA or • Internal check failed
P0352	Ignition Coil “B” Primary/ Secondary Circuit	• Signal current < -0.25 - 2.0 mA or • Internal check failed
P0353	Ignition Coil “C” Primary/ Secondary Circuit	• Signal current < -0.25 - 2.0 mA or • Internal check failed

DTC	Error Message	Malfunction Criteria and Threshold Value
P0354	Ignition Coil “D” Primary/ Secondary Circuit	• Signal current < -0.25 - 2.0 mA or • Internal check failed

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0410	Secondary Air Injection System	Deviation SAI pressure sensor > 20.0 hPa
P0413	Secondary Air Injection System Switching Valve “A” Circuit Open	Signal voltage 9.25 - 11.25 V
P0414	Secondary Air Injection System Switching Valve “A” Circuit Shorted	• Signal voltage < 6.00 V
P0418	Secondary Air Injection System Control “A” Circuit	Signal voltage 4.50 - 5.50 V
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	• Measured OSC / OSC of borderline catalyst value for front catalyst, <0.40 or • Value for front catalyst, < 1.30 and • Value for main catalyst, < 1.20
P0441	Evaporative Emission Control System Incorrect Purge Flow	Reaction of idle controller or lambda controller Deviation less than .079% lambda controller and < 35% idle controller deviation
P0442	Evaporative Emission Control 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 > 4.40 - 5.40 V
P0455	Evaporative Emission System Leak Detected (large leak)	Time for pressure drop < 0.95 Sec.
P0456	Evaporative Emission System Leak Detected (very small leak)	< 5.0 - 6.5 Sec.

DTC	Error Message	Malfunction Criteria and Threshold Value
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage < 2.15 - 3.25 V
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.20 A
P0491	Secondary Air Injection System Insufficient Flow (Bank 1)	SAI pressure measured with SAI pressure sensor vs modeled < 0.6 (0.62) %

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
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 Idle Air Control System Performance	Difference between commanded spark timing vs. actual value > 0.25%
P0501	Vehicle Speed Sensor “A” Range/Performance	VSS signal < 4 km/h
P0503	Vehicle Speed Sensor “A” Intermittend/Erratic/High	Vehicle speed > 200 km/h
P0506	Idle Control System RPM Lower than Expected	Integrated engine speed deviation > 2000 RPM OR engine speed deviation > 80 RPM
P0507	Idle Control System RPM Higher than Expected	Idle speed Deviation < -80 RPM
P052A	Cold Start “A” Camshaft Position Timing Over-Advanced	Difference between target position vs. actual position > 12.0 °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
P0606	ECM/PCM Processor	ECM internal check failure or BARO failure (located in the ECM).
P062B	ECM Processor Fault	Internal logic failure
P0634	Internal Control Module Fuel Injector Control Performance	Power stage temperature > 150 °C
P0638	Throttle Actuator Control Range/Performance (Bank 1)	• Time to close to reference point > 0.6 Sec. and • Reference point, 2.88% • TPS 1 signal 0.40 - 0.60 V • 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
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 “A” Circuit High	Signal current > 1.1 A
P0697	Sensor Reference Voltage “C” Circuit Open	Signal voltage deviation > ± 0.3 V
U0001	High Speed CAN Communication Bus	CAN message, no feedback
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 - no message
U0146	CAN Gateway A	CAN communication with gateway Time Out - no message
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	No CAN messages received

DTC	Error Message	Malfunction Criteria and Threshold Value
U0302	Software Incompatibility with Transmission Control Module	AT vehicle ECM coded as MT vehicle
U0402	Invalid Data Received From Transmission Control Module	Transmission data implausible message
U0415	Invalid Data Received From Anti-Lock Brake System Control Module	• Speed sensor initialization failed • Speed sensor low voltage error failed • Implausible message received
U0422	Invalid Data Received From Body Control Module	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	Invalid Data Received From Gateway “A”	CAN message implausible

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P117A	(Bank 1 Sensor 2) Control Limit Reached	I portion of 3rd lambda control loop > 0.030
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	• Pressure control activity > 0.20 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	• 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	• 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%

DTC	Error Message	Malfunction Criteria and Threshold Value
P150A	Engine Off Timer Performance	Difference between engine off time and ECM after run time < -12 Sec. or > 12 Sec.
P1609	Crash Shut Down Was Deployed	Airbag was activated
P2101	Throttle Actuator A Control Motor Circuit Range/ Performance	• 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	Throttle/Pedal Position Sensor/Switch D Circuit Low Input	Signal voltage < 0.61 V
P2123	Throttle/Pedal Position Sensor/Switch D Circuit High Input	Signal voltage > 4.79 V
P2127	Throttle/Pedal Position Sensor/Switch E Circuit Low Input	Signal voltage < 0.27 V
P2128	Throttle/Pedal Position Sensor/Switch E Circuit High Input	Signal voltage > 2.43 V
P2138	Throttle/Pedal Position Sensor/Switch 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	• Signal current > 2.6 A or • Signal current < 14.90 A
P2149	Fuel Injector Group “B” Supply Voltage Circuit Open	• Signal current > 2.6 A or • Signal current < 14.90 A
P2177	System Too Lean Off Idle (Bank 1)	• Adaptive value > 28%
P2178	System Too Rich Off Idle (Bank 1)	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

DTC	Error Message	Malfunction Criteria and Threshold Value
P2185	Engine Coolant Temperature Sensor 2 Circuit High	ECT outlet < -43 °C
P2187	System too lean at idle, Bank 1	• Adaptive value > 5.02%
P2188	System too rich at idle, Bank 1	• Adaptive value < -5.02%
P2195	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 1)	Delta lambda of 2nd lambda control loop > 0.07
P2196	O2 Sensor Signal Stuck Rich (Bank 1 Sensor 1)	Delta lambda of 2nd lambda control loop < -0.07
P2231	O2 Sensor Signal Circuit Shorted to Heater Circuit (Bank 1 Sensor 1)	Delta O2S signal front > 190 uA
P2237	O2 Sensor Positive Current Control Circuit/Open (Bank 1 Sensor 1)	• O2S signal front 1.49 - 1.51 V • Delta lambda controller > 0.10
P2243	O2 Sensor Reference Voltage Circuit/Open (Bank 1, Sensor 1)	• 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)	Front O2S signal 1.47 to 1.53 V and internal resistance > 1000 ohms
P2257	Secondary Air Injection System Control “A” Circuit Low	Signal voltage 0 to 3.26 V
P2258	Secondary Air Injection System Control “A” Circuit High	Signal current .60 - 2.40 A
P2270	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 2)	• O2S signal rear < -2.00 mV • Enrichment after stuck lean 27.90%
P2271	O2 Sensor Signal Stuck Rich (Bank 1 Sensor 2)	• 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)	• O2S rear signal not oscillating at reference < 0.62 to 0.65 V • Enrichment after stuck lean 27.9%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2275	O2 Sensor Signal Stuck Rich (Bank 1 Sensor 3)	• O2S sensor voltage ≥ 0.15 V • After oxygen mass flow (fuel cutoff) > 4500 mg • Number of checks ≥ 1
P2279	Intake Air System Leak	Threshold to detect a defective system > 1.33 - 1.60
P2293	Fuel Pressure Regulator 2 Performance	• 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 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 Highh	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 - 3.25 V
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	Signal current > 3 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	• 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 • Signal voltage 2.5 V
P2431	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Range/ Performance	Difference between SAI pressure sensor and ambient pressure NOT -60.0 to 60.0 hPa
P2432	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Low	Signal voltage < 0.40 V
P2433	Secondary Air Injection System Air Flow/Pressure 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 Code – CBTA. CBUA 2.5L

Fuel and Air Mixture, Additional Emission Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	“A” Camshaft Position Slow Response (Bank 1)	• Difference between target and actual > 8° CRK for > 1.8 to 2.5 Sec. • Adjustment angle < 3° CRK rotation
P0010	“A” Camshaft Position Actuator Circuit/Open (Bank 1)	Signal voltage > 4.70 - 5.40 V
P0011	Intake “A” Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	• Difference between target and actual > 8 to 12° CRK rotation for 1.8 to 2.5 Sec. • Adjustment angle < 3° CRK rotation
P0016	Crankshaft Position – Camshaft Position Correlation (Bank 1 Sensor A)	Permissible deviation < -13.49 or >13.49 CRK deg.
P0030	O2 Sensor Heater Control Circuit (Bank 1 Sensor 1)	• O2S signal rear not oscillating at reference < 598 mV and enrichment after stuck lean 20% or • Heater voltage 4.70 to 5.40 V
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	• O2S signal rear not oscillating at reference < 598 mV and enrichment after stuck lean 20% • Heater voltage 0.0 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 or heater current 2.70 to 5.50 A

DTC	Error Message	Malfunction Criteria and Threshold Value
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 3)	Heater voltage < 2.34 V
P0044	HO2S Heater Control Circuit High (Bank 1 Sensor 3)	Heater voltage > 3.59 V
P0070	Ambient Air Temperature Sensor Circuit	Ambient air temp < -50 °C
P0071	Ambient Air Temperature Sensor Circuit Range/ Performance	Difference of ECT vs. IAT or IAT vs. AAT at start > 25 K (kelvin) or AAT vs. ECT at start < 25 K
P0072	Ambient Air Temperature Sensor Circuit Low	Ambient air temp > 87 °C
P0106	Manifold Absolute Pressure/ Barometric Pressure Circuit Range/Performance	• Difference manifold pressure - lower threshold model < 0. Model range 45 to 845 hPa • Difference manifold pressure - upper threshold model > 0. Model range 640 - 1055 • Difference altitude sensor signal vs. manifold pressure signal at engine start > 60 hPa
P0107	Manifold Absolute Pressure/ Barometric Pressure Circuit Low Input	Signal voltage < 0.20 V
P0108	Manifold Absolute Pressure/ Barometric Pressure Circuit High Input	Signal voltage > 4.86 V
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	• Difference of ECT vs. IAT or IAT vs. AAT at start > 25 K (kelvin) or AAT vs. ECT at start < 25 K
P0112	Intake Air Temperature Sensor 1 Circuit Low	IAT > 130.0 °C
P0113	Intake Air Temperature Sensor 1 Circuit High	IAT < -46 °C
P0116	Engine Coolant Temperature Circuit Range/Performance	• No change on signal 2 °K • ECT signal stuck in range 75 - 105 °C and no change in signal 2 °K
P0117	Engine Coolant Temperature (Sensor 1) Circuit Low	Engine coolant temperature > 140°C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0118	Engine Coolant Temperature Circuit High	Engine coolant temperature < -40°C
P0121	Throttle/Pedal Position Sensor/Switch “A” Circuit Range/Performance	• TPS 1 - TPS 2 > 5.10 to 6.30% • TPS 1 calc. value > 9.00%
P0122	Throttle/Pedal Position Sensor/Switch “A” Circuit Low	Signal voltage < 0.20 V
P0123	Throttle/Pedal Position Sensor/Switch “A” Circuit High	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. and number of checks ≥ 3
P0130	O2 Sensor Circuit Bank 1 Sensor 1)	O2S ceramic temperature < 640°C
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	Virtual mass < 1.75V
		Nernst voltage < 1.50 V
		Adjustment voltage < 0.30 V
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	Virtual mass > 3.25 V
		Nernst voltage > 4.40 V
		Adjustment voltage > 7 V
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	• Difference between R2L and L2R area ratio -0.40 to 0.40 • Counter cycles completed ≥ 4 times • Gradient ratio ≥ 0.25 or ≤ 0.40 and lower value of both ratios < 0.25
P0135	O2 Sensor Heater Circuit (Bank 1 Sensor 1)	• Heater duty cycle > 90% • O2S ceramic temperature, < 720 °C or • O2S ceramic temp < 715 °C • Time after O2 heater on, 35 Sec.
P0136	O2 Sensor Circuit (Bank 1 Sensor 2)	• Delta O2S rear signal > 2.00 V • Number of checks = 6
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	• Cold condition: Signal voltage < 0.06 V for > 3 Sec • Difference of sensor voltage with and without load pulse < 0.01 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	Signal voltage > 1.08 V for > 5 Sec.
P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	• EWMA filtered transient time at fuel cut off > 0.6 Sec. • O2 voltage between 201 - 401 mV • O2S rear signal > 0.16 V during fuel cut off active
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	• Signal voltage .40 to .60 V for > 3 Sec. • Voltage difference between load pulse and no load pulse ≥ 2.80 V • Internal resistance > 40 k and exhaust temp > 670 °C
P0141	O2 Sensor Heater Circuit (Bank 1, Sensor 2)	• Difference of sensor voltage with and without load pulse < 0.01 V • Internal heater resistance 1200 - 32400 Ω
P0142	O2 Sensor Circuit (Bank 1 Sensor 3)	• Delta voltage 1 step at heater switching > 2.00 V • Heater coupling ≥ 6 times
P0143	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 3)	• Signal voltage < 0.06 V for > 3 Sec. • Voltage difference between load pulse and no load pulse < 0.01V • Internal resistance > 40 k and exhaust temp > 670 °C
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)	• EWMA filtered transient time at fuel cut off > 1.5 Sec. • O2 voltage between 201 - 401 mV
P0146	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 3)	• Signal voltage .40 to .60 V for > 3 Sec. • Voltage difference between load pulse and no load pulse ≥ 2.80 V • Internal resistance > 40 k and exhaust temp > 670 °C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0147	O2 Sensor Heater Circuit (Bank 1 Sensor 3)	Internal heater resistance 1200 - 32400 Ω
P0169	Incorrect Fuel Composition	Fuel quantity out of limit or incorrect
P0201	Injector Circuit/Open – Cylinder 1	Low side signal voltage 4.50 - 5.50 V
P0202	Injector Circuit/Open – Cylinder 2	Low side signal voltage 4.50 - 5.50 V
P0203	Injector Circuit/Open – Cylinder 3	Low side signal voltage 4.50 - 5.50 V
P0204	Injector Circuit/Open – Cylinder 4	Low side signal voltage 4.50 - 5.50 V
P0205	Injector Circuit/Open – Cylinder 5	Low side signal voltage 4.50 - 5.50 V
P0221	Throttle/Pedal Position Sensor/Switch B Range/ Performance	• TPS 1 to TPS 2, > 5.10 to 6.3% • TPS 2 – calc position > 9 %
P0222	Throttle/Pedal Position Sensor/Switch “B” Circuit Low	Signal voltage < 0.20 V
P0223	Throttle/Pedal Position Sensor/Switch “B” Circuit High	Signal voltage > 4.81 V
P0261	Cylinder 1 Injector Circuit Low	Signal voltage < 3.00 V
P0262	Cylinder 1 Injector Circuit High	Signal current < 2.20 - 4.00 A
P0264	Cylinder 2 Injector Circuit Low	Signal voltage < 3.00 V
P0265	Cylinder 2 Injector Circuit High	Signal current < 2.20 - 4.00 A
P0267	Cylinder 3 Injector Circuit Low	Signal voltage < 3.00 V
P0268	Cylinder 3 Injector Circuit High	Signal current < 2.20 - 4.00 A
P0270	Cylinder 4 Injector Circuit Low	Signal voltage < 3.00 V
P0271	Cylinder 4 Injector Circuit High	Signal current < 2.20 - 4.00 A
P0273	Cylinder 5 Injector Circuit Low	Signal voltage < 3.00 V
P0274	Cylinder 5 Injector Circuit High	Signal current < 2.20 - 4.00 A
P2088	A Camshaft Position Actuator Control Circuit Low (Bank 1)	Signal voltage 0.0 to 3.25 V
P2089	A Camshaft Position Actuator Control Circuit High (Bank 1)	Signal current, > 2.2 A
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	Deviation lambda control < -0.03%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	Deviation lambda control > 0.03%
P3081	Engine temperature too low	Difference between ECT and modeled ECT > 11 K

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random/Multiple Cylinder Misfire Detected	• Emission threshold 1st interval misfire rate (200 rev Misfire Rate) > 2.5% • Emission threshold misfire rate (1000 rev Misfire Rate), > 2.5 to 24%
P0301	Cylinder 1 Misfire Detected	• Emission threshold 1st interval misfire rate (200 rev Misfire Rate) > 2.5% • Emission threshold misfire rate (1000 rev Misfire Rate), > 2.5 to 24%
P0302	Cylinder 2 Misfire Detected	• Emission threshold 1st interval misfire rate (200 rev Misfire Rate) > 2.5% • Emission threshold misfire rate (1000 rev Misfire Rate), > 2.5 to 24%
P0303	Cylinder 3 Misfire Detected	• Emission threshold 1st interval misfire rate (200 rev Misfire Rate) > 2.5% • Emission threshold misfire rate (1000 rev Misfire Rate), > 2.5 to 24%
P0304	Cylinder 4 Misfire Detected	• Emission threshold 1st interval misfire rate (200 rev Misfire Rate) > 2.5% • Emission threshold misfire rate (1000 rev Misfire Rate), > 2.5 to 24%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0305	Cylinder 5 Misfire Detected	• Emission threshold 1st interval misfire rate (200 rev Misfire Rate) > 2.5% • Emission threshold misfire rate (1000 rev Misfire Rate), > 2.5 to 24%
P0321	Ignition/Distributor Engine Speed Input Circuit Range/ Performance	• Comparison of counted teeth and number of teeth +/- 1 tooth • Loss of reference gap during normal operation • No reference gap during engine start
P0322	Ignition/Distributor Engine Speed Input Circuit No Signal	• No engine speed signal but CMP signals > 5 cam shaft revs • Engine speed = no signal
P0324	Knock Control System Error	• Signal fault counter (combustion) > 30 or Signal fault counter measuring window > 2
P0327	Knock Sensor 1 Circuit Low Input	• Lower threshold < - 0.70 V • Signal range check < 0.55 to 5.60 V
P0328	Knock Sensor 1 Circuit High Input	• Upper threshold > 1.00 V • Signal range check > 16.50 to 92 V
P0332	Knock Sensor 2 Circuit Low Input	• Lower threshold < - 0.70 V • Signal range check < 0.55 to 5.60 V
P0333	Knock Sensor 2 Circuit High Input	• Upper threshold > 1 V • Signal range check > 16.50 to 92 V
P0341	Camshaft Position Sensor “A” Circuit Range/Performance (Bank 1 or Single Sensor)	• Signal pattern incorrect • Defect counter = 8
P0342	Camshaft Position Sensor “A” Circuit Low (Bank 1 or Single Sensor)	• Signal voltage permanently low • Crankshaft signals = 8
P0343	Camshaft Position Sensor “A” Circuit High Bank 1 or Single Sensor	• Signal voltage permanently high • Crankshaft signals = 8

DTC	Error Message	Malfunction Criteria and Threshold Value
P0351	Ignition Coil A Primary/ Secondary Circuit	• Signal current < 0.25 to -2.0 mA • Internal check failed
P0352	Ignition Coil B Primary/ Secondary Circuit	• Signal current < 0.25 to -2.0 mA • Internal check failed
P0353	Ignition Coil C Primary/ Secondary Circuit	• Signal current < 0.25 to -2.0 mA • Internal check failed
P0354	Ignition Coil D Primary/ Secondary Circuit	• Signal current < -0.25 to 2.0 mA • Internal check failed
P0355	Ignition Coil E Primary/ Secondary Circuit	• 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 Malfunction	Deviation SAI pressure > 50 hPa
P0413	Secondary Air Injection System Switching Valve “A” Circuit Open	Signal voltage 4.70 to 5.40 V
P0414	Secondary Air Injection System Switching Valve “A” Circuit Shorted	• Signal voltage 0 to 3.25 V or • Signal current > 2.20 A
P0418	Secondary Air Injection System Control “A” Circuit	Signal voltage 4.70 to 5.40 V
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	Oxygen storage capacity (OSC) vs OSC value of borderline catalyst < 1.00
P043E	Evaporative Emission System Leak Detection Reference Orifice Low Flow	EVAP pump current during reference measurement > 40 mA
P043F	Evaporative Emission System Leak Detection Reference Orifice High Flow	EVAP pump current during reference measurement < 15 mA
P0441	EVAP Emission Control System Incorrect Purge Flow	Actual EVAP pump current vs. difference from last reading > 1.70

DTC	Error Message	Malfunction Criteria and Threshold Value
P0442	Evaporative Emission System Leak Detected (small leak)	Current pump pressure vs. modeled pump pressure < 9 hPa.
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal voltage 4.70 - 5.40 V
P0447	Evaporative Emission System Vent Control Circuit Open	Signal voltage > 4.70 - 5.40 V
P0448	Evaporative Emission System Vent Control Circuit Shorted	• Signal current > 2.2 to 4 A or • Signal voltage < 2.74 to 3.26 V
P0455	Evaporative Emission System Leak Detected (large leak)	Time for pressure drop < 0.95 Sec.
P0456	Evaporative Emission System Leak Detected (very small leak)	EVAP system leakage area calculated from pump current curve > 0.17 mm squared.
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, > 2.2 A
P0491	Secondary Air Injection System Insufficient Flow (Bank 1)	• SAI pressure vs. modeled SAI < 50 - 72% or • Absolute deviation of raw pressure signal from filtered signal mean value < 8.98 hPa

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor “A” Range/Performance	Vehicle speed < 4 km/h
P0503	Vehicle Speed Sensor “A” Intermittend/Erratic/High	Vehicle speed > 325 km/h
P0506	Idle Control System RPM Lower than Expected	• Engine speed deviation > 100 RPM • RPM controller torque value ≥ calculated max value.

DTC	Error Message	Malfunction Criteria and Threshold Value
P0507	Idle Control System RPM Higher than Expected	• Engine speed deviation < -100 RPM • RPM controller torque value ≤ calculated min. value.
P050A	Cold Start Idle Air Control System Performance	• Engine speed deviation > 100 RPM • RPM controller torque value ≥ calculated max. value or • Engine speed deviation < -100 RPM • RPM controller torque value ≤ calculated min. value.
P050B	Cold Start Ignition Timing Performance	Difference between commanded spark timing vs. actual value > 20%
P052A	Cold Start “A” Camshaft Position Timing Over-Advanced	Difference between actual and target position > 10° CRK rev.

Control Module and Output Signals

DTC	Error Message	Malfunction Criteria and Threshold Value
P0606	ECM/PCM Processor	• Internal hardware/voltage check - failed • Communication CPU - Sensor IC - failed • EEPROM Check failed
P0627	Fuel Pump “A” Control Circuit/ Open	• Signal voltage 4.50 to 5.50 V (open circuit) • Signal voltage < 3.00 V (grounded circuit)
P0629	Fuel Pump “A” Control Circuit High	Signal current 0.60 to 1.20 A
P0638	Throttle Actuator Control Range/Performance (Bank 1)	• Time to close to reference point > 0.6 Sec. and reference point = 2.88% or • TPS 1 signal voltage, not 0.40 - 0.80 V • TPS 2 signal voltage, not (4.20 - 4.60) 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
P0697	Sensor Reference Voltage “C” Circuit Open	Signal voltage deviation > +/- 0.3 V
U0001	High Speed CAN Communication Bus	CAN message = no feedback
U0002	High Speed CAN Communication Bus Performance	Global time out, no messages received
U0101	Lost Communication with TCM	Time out, no message received
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	No CAN messages received
U0146	Lost Communication With Gateway “A”	No CAN messages received
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	No CAN messages received
U0302	Software Incompatibility with Transmission Control Module	Manual transmission coded ECM but automatic transmission messages received from TCM
U0402	Invalid Data Received From Transmission Control Module	Implausible data message received
U0415	Invalid Data Received From Anti-Lock Brake System Control Module	• Sensor signal failure • None, or implausible information • CAN 1 VSS signal incorrect > 327.08 km/h
U0422	Invalid Data Received From Body Control Module	Ambient temperature value initialization = 00h
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	AAT sensor reading from cluster to ECM implausible or no message
U0447	Invalid Data Received From Gateway “A”	CAN message incorrect

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P117A	Bank 1, oxygen sensor correction center sensor Control limit reached	I - portion of 3rd lambda control loop > 0.03)
P150A	Engine Off Timer Performance	Comparison of engine off time from Instrument Cluster control unit with ECM engine after run timer < -12 or > 12 Sec.
P1609	Crash shut-off was triggered	Airbags activated
P2101	Throttle Actuator A Control Motor Circuit Range/ Performance	• Duty cycle >80% • Deviation throttle value angles vs calculated value 4 to 50% • ECM driver = no fault
P2106	Throttle Actuator Control System Forced Limited Power	Internal check failure
P2122	Throttle/Pedal Position Sensor/Switch D Circuit Low Input	Signal voltage < 0.61 V
P2123	Throttle/Pedal Position Sensor/Switch D Circuit High Input	Signal voltage > 4.79 V
P2127	Throttle/Pedal Position Sensor/Switch E Circuit Low Input	Signal voltage < 0.27 V
P2128	Throttle/Pedal Position Sensor/Switch E Circuit High Input	Signal voltage > 2.43 V
P2138	Throttle/Pedal Position Sensor/Switch D/E Voltage Correlation	Signal voltage sensor 1 vs. 2 > 0.17 to 0.70 V
P2177	System Too Lean Off Idle (Bank 1)	• Adaptive value > 28%
P2178	System too rich off idle, (Bank 1)	• Adaptive value < 20%
P2181	Cooling System Performance	ECT too low after sufficient mass air flow interval = 75 °C
P2184	Engine Coolant Temperature (Sensor 2) Circuit Low	ECT outlet > 140 °C
P2185	Engine Coolant Temperature (Sensor 2) Circuit High	ECT outlet < -40 °C
P2187	System too lean at idle, (Bank 1)	• Adaptive value > 5.02%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2188	System too rich at idle, (Bank 1)	• Adaptive value < -5.02%
P219A	Bank 1 Air-Fuel Ratio Imbalance	Individual cylinder fuel correction based on measured enleanment for the dedicated engine roughness < 0.19 or > 1.50
P219C	Cylinder 1 Air-Fuel Ratio Imbalance	Individual cylinder fuel correction based on measured enleanment for the dedicated engine roughness < 0.19 or > 1.50
P219D	Cylinder 2 Air-Fuel Ratio Imbalance	Individual cylinder fuel correction based on measured enleanment for the dedicated engine roughness < 0.19 or > 1.50
P219E	Cylinder 3 Air-Fuel Ratio Imbalance	Individual cylinder fuel correction based on measured enleanment for the dedicated engine roughness < 0.19 or > 1.50
P219F	Cylinder 4 Air-Fuel Ratio Imbalance	Individual cylinder fuel correction based on measured enleanment for the dedicated engine roughness < 0.19 or > 1.50
P21A0	Cylinder 5 Air-Fuel Ratio Imbalance	Individual cylinder fuel correction based on measured enleanment for the dedicated engine roughness < 0.19 or > 1.50
P2195	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 1)	Delta lambda of 2nd lambda control loop > 0.07
P2196	O2 Sensor Signal Stuck Rich (Bank 1 Sensor 1)	Delta lambda of 2nd lambda control loop < -0.07
P2237	O2 Sensor Positive Current Control Circuit/Open (Bank 1 Sensor 1)	• O2S signal front 1.49 to 1.51 V • Fuel cutoff > 3 Sec. • Delta lambda controller > 0.10
P2243	O2 Sensor Reference Voltage Circuit/Open (Bank 1 Sensor 1)	• O2S signal front > 4.70 V and Internal resistance > 950 Ω • O2S signal front < 0.20 V And Internal resistance > 950 Ω

DTC	Error Message	Malfunction Criteria and Threshold Value
P2251	O2 Sensor Negative Current Control Circuit/Open (Bank 1 Sensor 1)	O2S signal front 1.47 to 1.53 V and > 950 Ω
P2257	Secondary Air Injection System Control “A” Circuit low	Signal voltage 0 to 3.26 V
P2258	Secondary air injection System Control “A” Circuit High	Signal current .60 to 2.40 A
P2270	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 2)	O2S signal rear not oscillating at reference < 0.64 V and enrichment after stuck lean 20%
P2271	O2 Sensor Signal Stuck Rich (Bank 1 Sensor 2)	O2S signal rear not oscillating at reference > 598 mV and enrichment after stuck rich 14.99%
P2274	O2 Sensor Signal Stuck Lean; (Bank 1 Sensor 3)	O2S rear not oscillating at reference < 0.64 to 0.65 V and enrichment after stuck lean 20%
P2275	O2 Sensor Signal Stuck Rich; (Bank 1 Sensor 3)	• O2S rear not oscillating at reference > 0.64 to 0.65 V and enrichment after stuck rich 15% or • Sensor voltage of ≥ 0.15 V after oxygen mass flow (after fuel cutoff) > 3500 mg with ≥1 check
P2279	Intake Air System Leak	Offset value throttle mass flow > 13 kg/h

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

DTC	Error Message	Malfunction Criteria and Threshold Value
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
P2312	Ignition Coil E Primary Control Circuit Low	Signal current > 24.0 mA
P2313	Ignition Coil E Primary Control Circuit High	Signal voltage > 5.1 - 7.0 mA

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P240A	Evaporative Emission System Leak Detection Pump Heater Control Circuit/Open	Signal voltage > 4.7 to 5.4 V
P240B	Evaporative Emission System Leak Detection Pump Heater Control Circuit Low	Signal voltage < 2.74 to 3.26 V
P240C	Evaporative Emission System Leak Detection Pump Heater Control Circuit High	Signal current > 2.2 to 4 A
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/Open	Signal voltage > 4.70 to 5.40 V
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	Signal voltage < 2.74 to 3.26 V
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	Signal voltage > 4.00 or >1.80 V
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit/Open	Low signal voltage > .5 Sec.

DTC	Error Message	Malfunction Criteria and Threshold Value
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	• High signal voltage > 12 Sec. and • Number of checks = 30 • Cumulative time of high signal voltage during pumping > 10 Sec.
P2407	Evaporative Emission System Leak Detection Pump Sense Circuit Intermittent/Erratic	• Fluctuation of EVAP pump current during reference measurement > 1 mA • Drop of EVAP pump current during pump phase > 6 mA for ≥ 3 Sec.
P2414	02 Sensor Exhaust Sample Error, (Bank 1 Sensor 1)	• Threshold 1 - Signal voltage 3.1 to 4.77 V • Threshold 2 - Voltage 2.5 to 3.06 V
P2431	Secondary Air Injection System Air Flow/Pressure (Bank 1 Sensor) Circuit Range/Performance	Difference between SAI pressure and ambient pressure NOT -60 to 60 hPa
P2432	Secondary Air Injection System Air Flow/Pressure Bank 1 Sensor Circuit Low	Signal voltage < 0.5 V
P2433	Secondary Air Injection System Air Flow/Pressure Bank 1 Sensor Circuit High	Signal voltage > 4.5 V
P2440	Secondary Air Injection System Switching Valve Stuck Open	SAI pressure sensor measured with SAI pressure vs. modeled while SAI valve closed < 64.8%
P2450	Evaporative Emission System Switching Valve Performance or Stuck Open	EVAP pump current difference between reference measurement to idle < 3 mA
P2626	O2 Sensor Pumping Current Trim Circuit/Open (Bank 1 Sensor 1)	O2S signal front > 4.77 V (lean)

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