2013

Golf, GTI & Golf R

Quick Reference Specification Book

2013 Volkswagen Golf & GTI
Quick Reference Specification Book

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GENERAL INFORMATION

Decimal and Metric Equivalents

Distance/Length

To calculate: mm x 0.03937 = in.

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

Tightening Torque

Nm-to-lb·ft (ft·lb)

To calculate: Nm x 0.738 = lb·ft

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

Nm-to-lb·in (in·lb), kg·cm

To calculate: Nm x 8·85 = lb·in • Nm x 10.20 = kg·cm

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

N·cm-to-lb·in (in·lb), kg·cm

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

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

kg·cm-to-lb·in (in·lb), N·cm

To calculate: 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.

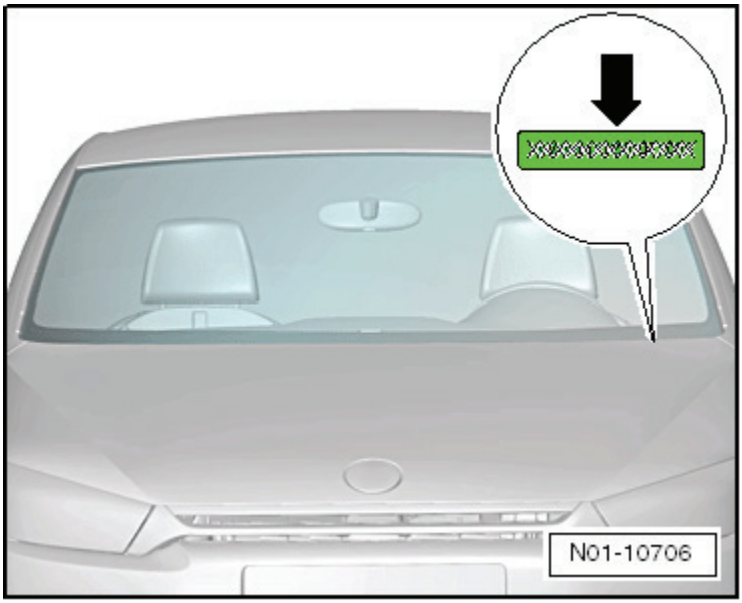
(CAUTIONS cont'd on next page)

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 Auto Trans
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= Jetta GLI w/6 Spd Manual
6= Jetta Hybrid w/Auto Trans

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Country of origin	Manufacturer	Vehicle Type	Series	Engine	Restraint system	Model (7&8)		Check digit	Model year	Assembly plant	Sequential production number (position 12 - 17)					
W	V	W	B	P	7	A	N	8	D	E	5	0	2	0	1	3

D = 2013

WVW = Europe - Pass. Car.
1VW = USA - Pass. Car
3VW = Mexico - Pass. Car
VWG = Europe - S.U.V.

See back

2013

Calculate per NHTSA Code

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

*** 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.**

August 14, 2012 (Rev 3)

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

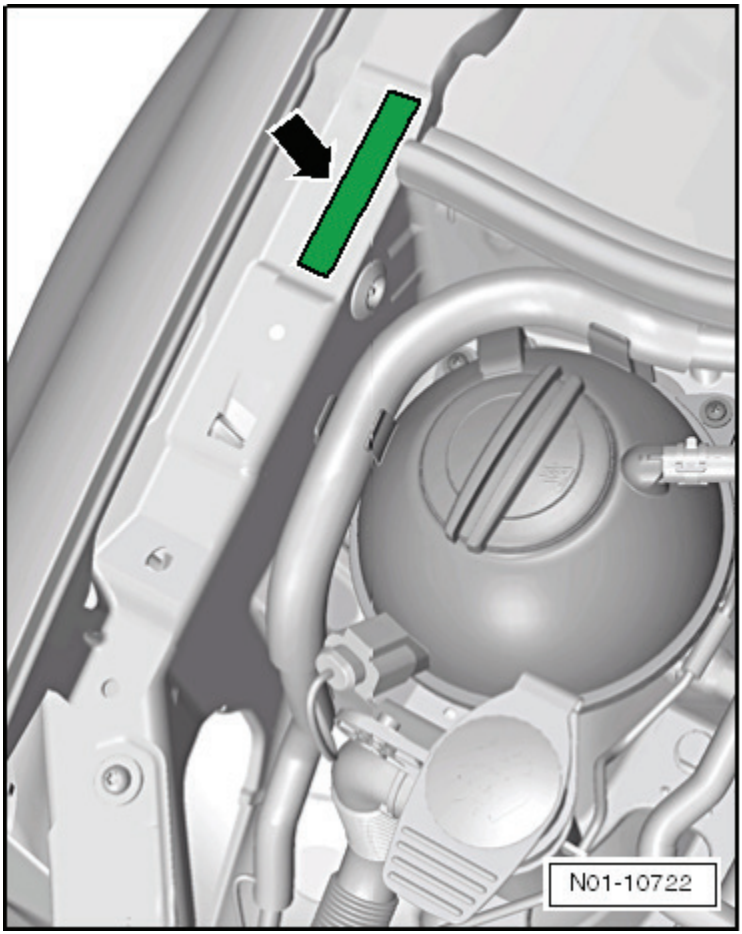
Calculate per NHTSA Code

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	Sequential production number (position 12 - 17)
13	
14	
15	
16	
17	

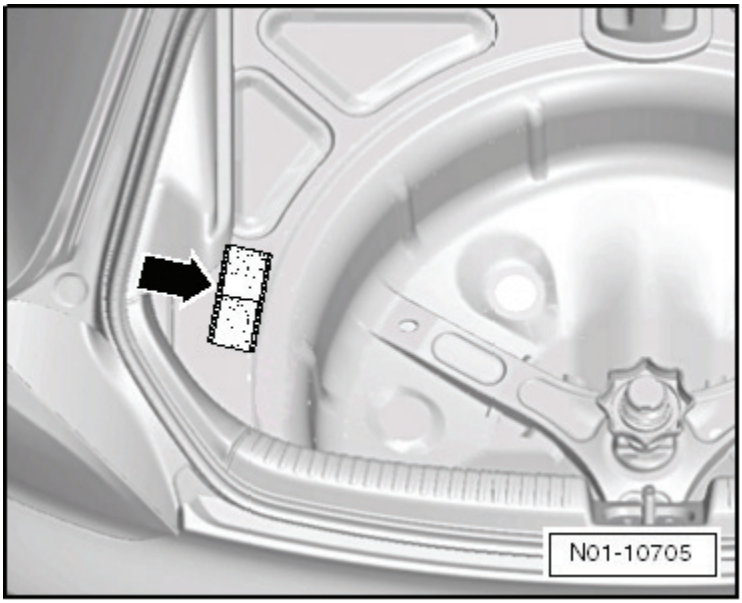
2013 Volkswagen VIN Decoder (except Routan)

VIN on Longitudinal Member Extension



The Vehicle Identification Number (VIN) is located on the longitudinal member extension (➡).

Vehicle Data Label



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

SALES CODES

Engine Codes

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

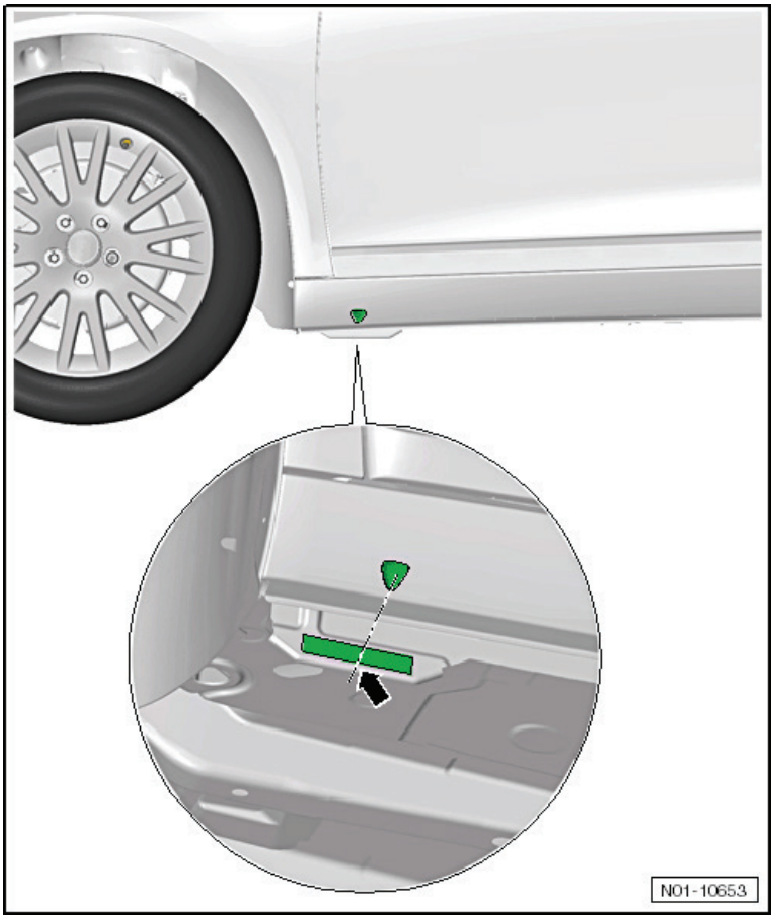
Transmission Codes

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

VEHICLE LIFTING

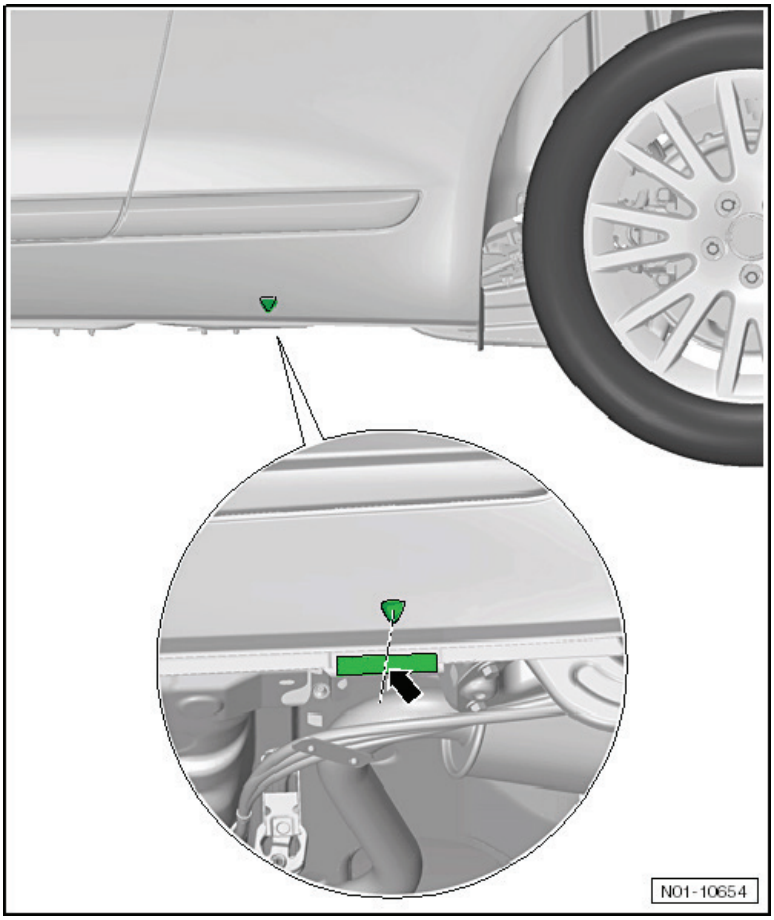
Hoist and Jack Mounting Points

Front



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

Rear

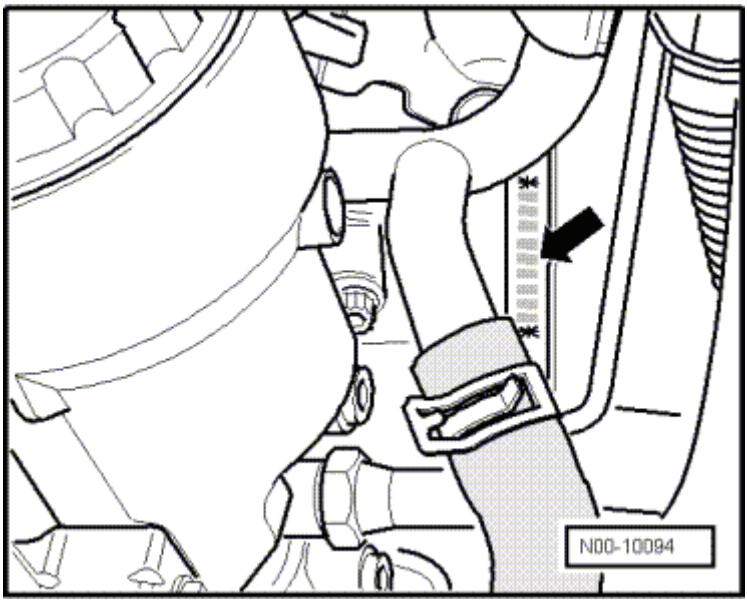


Position the support plate in the side member vertical reinforcement area (➡).

ENGINE MECHANICAL – 2.0L CJAA (TDI)

General, Technical Data

Engine Number Location



The engine number (engine code and serial number) (➡) is located at the front of the engine/transmission joint. The engine code and serial number are also located on a label found on the toothed belt guard.

Engine Data

Identification code		CJAA
Manufactured		From 09.09
Emission values in accordance with		ULEV2 [2] Standard
Displacement	liter	2.0
Output	kW at RPM	103 @ 4200
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	conforms to	ASTM D 975 Standard [1]
Ignition sequence		1-3-4-2
Balance shaft module		No
Catalytic converter		Yes
Exhaust Gas Recirculation (EGR)		Yes
Turbocharger, Supercharger		Yes
Charge Air Cooler (CAC)		Yes
Particulate filter		Yes
Selective Catalytic Reduction (SCR) system		No

[1] With a sulfur content less than 15 mg/kg of diesel fuel.
[2] SULEV = Super Ultra Low Emissions Vehicle.

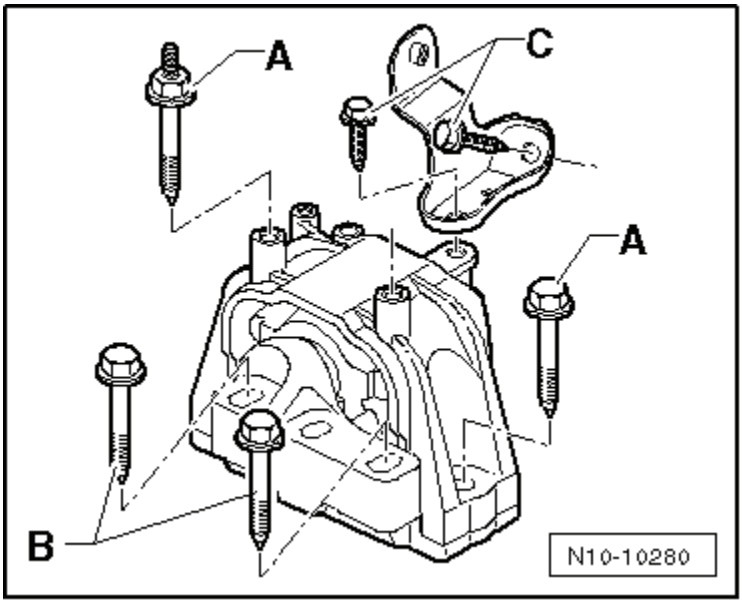
Engine Assembly - 2.0L CJAA (TDI)

Fastener Tightening Specifications

Component	Fastener size	Nm
Bolts and nuts	M6	10
	M7	15
	M8	25
	M10	40
	M12	65[1)]

1) M12 collar bolt tightening specification: 75 Nm.

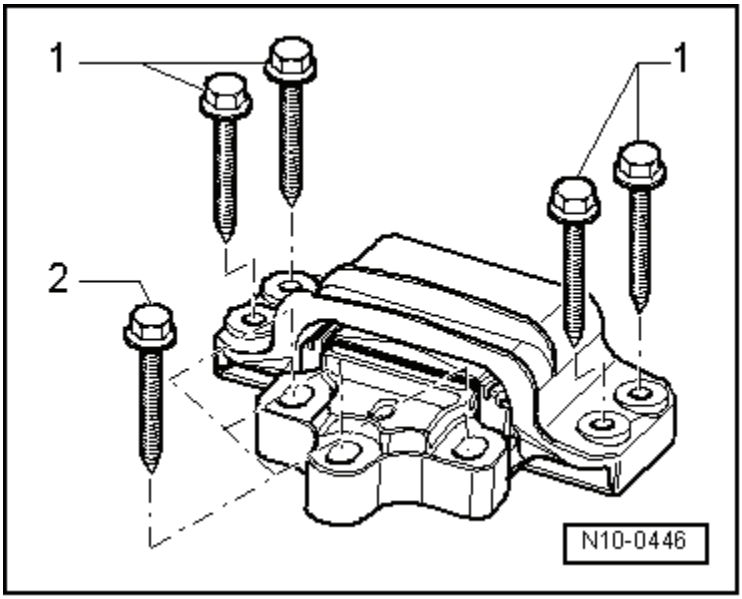
Engine Mount Tightening Specifications



Component	Nm
Bolts A	40 plus an additional 90° (¼ turn) [1)]
Bolts B	60 plus an additional 90° (¼ turn) [1)]
Bolts C	20 plus an additional 90° (¼ turn) [1)]

1) Replace fastener(s).

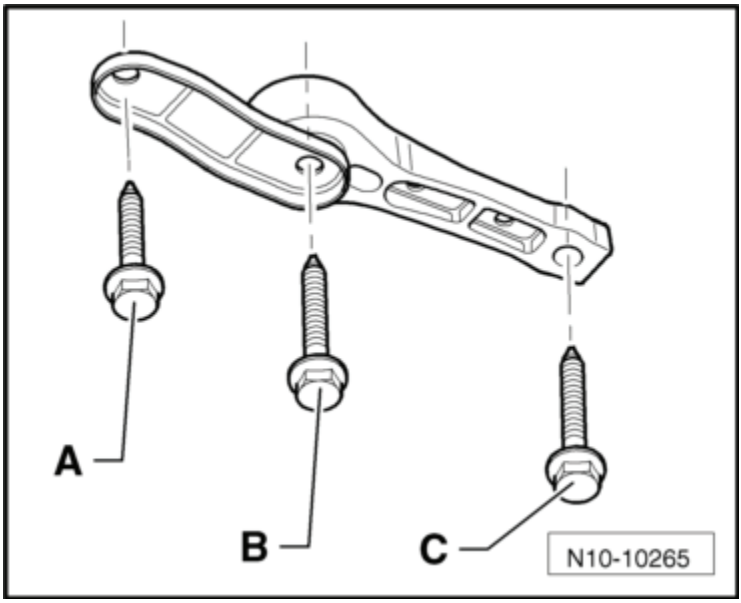
Transmission Mount Tightening Specifications



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

[1)] Replace fastener(s).

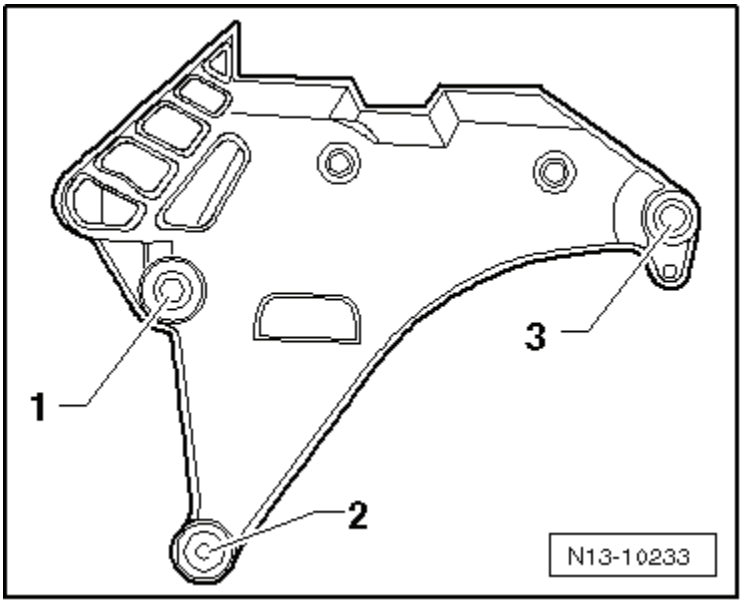
Pendulum Support Tightening Specifications



Component	Nm
Bolt A [1)]	40 plus an additional 90° (¼ turn)
Bolt B [1)]	60 plus an additional 90° (¼ turn)
Bolt C [1)]	100 plus an additional 90° (¼ turn)

[1)] Replace fastener(s).

Engine Mount Bracket Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 3 in sequence [1)]	Hand-tighten
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.

Crankshaft, Cylinder Block – 2.0L CJAA (TDI)

Fastener Tightening Specifications

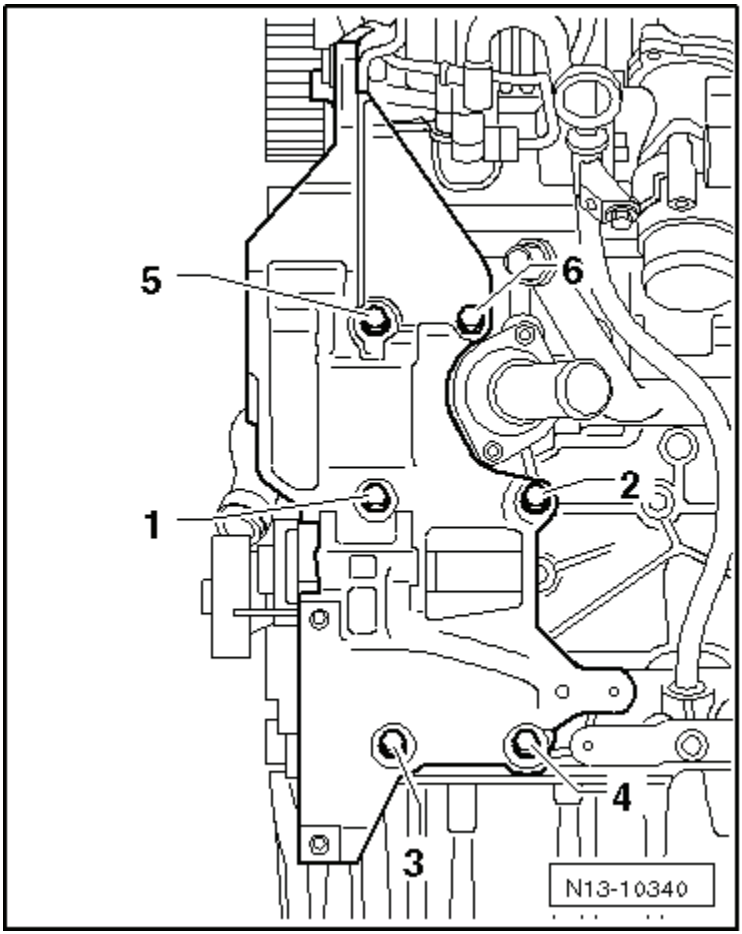
Component	Nm
Air conditioning compressor-to-accessory bracket bolt	25
Bracket-to-oil filter bracket bolt	10
Camshaft sprocket-to-camshaft bolt	20 plus an additional 45° (⅛ turn)
Center toothed belt guard-to-lower toothed belt guard bolt [1)]	10
Connecting piece-to-cylinder block bolt	15
Connecting rod cap-to-connecting rod bolt [1) 4)]	30 plus an additional 90° (¼ turn)
Coolant pump-to-cylinder block bolt	15
Crankshaft bearing cap-to-cylinder block bolt [1)]	65 plus an additional 90° (¼ turn)
Crankshaft toothed belt gear-to-crankshaft bolt [1)]	120 plus an additional 90° (¼ turn)
Engine speed sensor-to-cylinder block bolt	5
Flywheel-to-crankshaft bolt [1)]	60 plus an additional 90° (¼ turn)
Generator-to-accessory bracket bolt	25
High pressure pump-to-accessory bracket bolt	20 plus an additional 90° (¼ turn)
High pressure pump toothed belt gear-to-hub bolt [1)]	20 plus an additional 90° (¼ turn)
Hub-to-camshaft bolt	100
Hub-to-high pressure pump nut	95
Idler pulley-to-accessory bracket bolt	50 plus an additional 90° (¼ turn)
Idler roller-to-accessory bracket bolt	15
Oil filter bracket-to-cylinder block bolt [1) 3)]	15 plus an additional 90° (¼ turn)
Oil pan-to-cylinder block bolt	15
Oil spray jet-to-cylinder block bolt	25

Fastener Tightening Specifications *(cont'd)*

Component	Nm
Protective plate-to-rear toothed belt guard bolt	5
Rear toothed belt guard-to-cylinder block bolt [2]	10 [1]
	20
Ribbed belt tensioner-to-accessory bracket bolt [1]	20 plus an additional 180° (½ turn)
Sealing flange-to-cylinder block bolt	15
Toothed belt idler pulley-to-cylinder block bolt [1]	50 plus an additional 90° (¼ turn)
Toothed belt idler roller-to-cylinder block bolt/nut	20
Toothed belt tensioner-to-cylinder block nut	20 plus an additional 45° (⅛ turn)
Vibration damper-to-crankshaft bolt [1]	10 plus an additional 90° (¼ turn)

1) Replace fastener(s).
2) For bolt tightening clarification, refer to ElsaWeb, *Toothed Belt Drive Overview*, items 14 and 15.
3) Fasten the upper left and lower right bolts first and then tighten all four bolts in a diagonal sequence.
4) Lubricate the threads and contact surface.

Accessory Bracket Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 6 in sequence	Hand-tighten
2	Tighten bolts 1 through 6 in sequence	40
3	Tighten bolts 3 and 4	an additional 45° (⅛ turn)
4	Tighten bolts 1, 2, 5 and 6	an additional 90° (¼ turn)

Crankshaft Dimensions

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

Piston and Cylinder Dimensions

Honing dimension in mm	Piston diameter	Cylinder bore diameter
Basic dimension	80.960	81.010

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

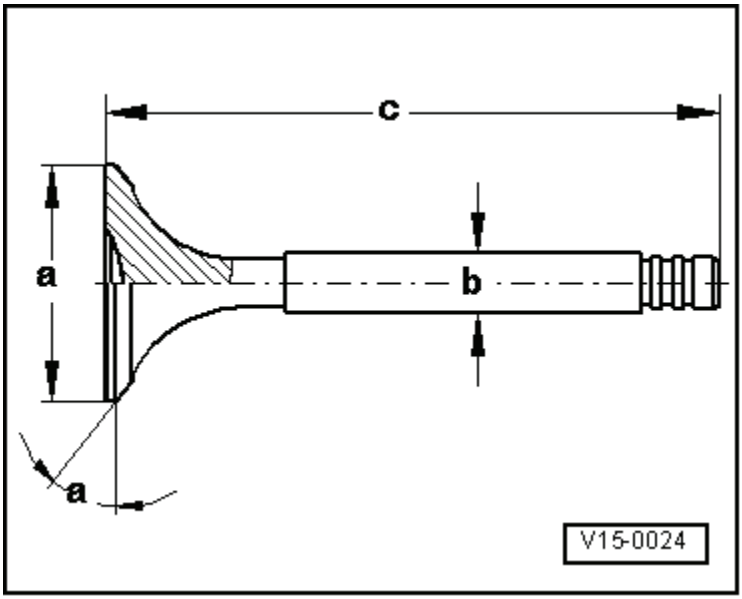
Cylinder Head, Valvetrain – 2.0L CJAA (TDI)

Fastener Tightening Specifications

Component	Nm
Adapter to cylinder head bolt	10
Camshaft Position (CMP) sensor-to-cylinder head bolt	10
Camshaft sprocket-to-camshaft bolt	20 plus an additional 90° (¼ turn)
Center toothed belt guard to lower toothed belt guard bolt [1)]	10
Coolant pump to cylinder block bolt	15
Crankshaft toothed belt gear to crankshaft bolt [1)]	120 plus an additional 90° (¼ turn)
Engine mount bracket to cylinder block bolt [1)]	40 plus an additional 180° (½ turn)
Fuel rail-to-cylinder head cover bolt	22
Heat shield-to-cylinder head cover bolt	5
High pressure pump toothed belt gear-to-hub bolt [1)]	20 plus an additional 90° (¼ turn)
Hub-to-camshaft bolt	100
Lifting eye-to-cylinder head bolt/stud bolt	25
Protective plate to rear toothed belt guard bolt	5
Rear toothed belt guard to cylinder block bolt [2)]	10 [1)]
	20
Sealing cap-to-cylinder head cover bolt	5
Tensioning plate-to-cylinder head cover nut	10
Toothed belt idler pulley to cylinder block bolt [1)]	50 plus an additional 90° (¼ turn)
Toothed belt idler roller to cylinder block bolt/nut	20
Toothed belt tensioner-to-cylinder block 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) For bolt tightening clarification, refer to ElsaWeb, *Toothed Belt Overview*, items 14 and 15.

Valve Dimensions



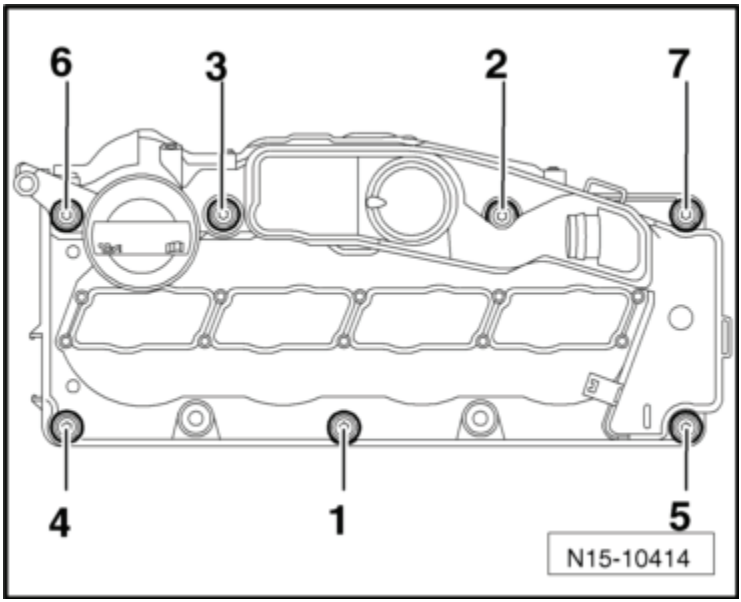
Dimension		Intake valve	Exhaust valve
Diameter a	mm	26.60	26.00
Diameter b	mm	5.940	5.940
c	mm	99.30	99.10
α	∠°	45	45

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

Compression Pressures

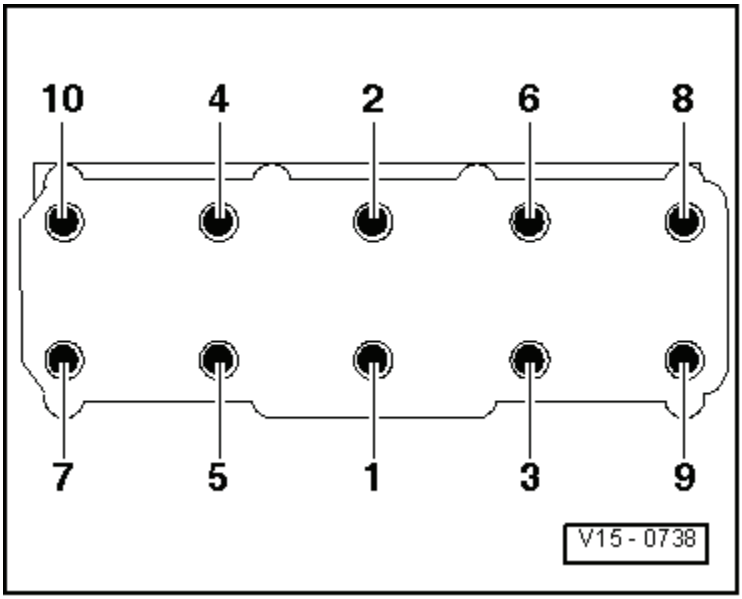
New Bar positive pressure	Wear limit Bar positive pressure	Difference between cylinders Bar positive pressure
25.0 to 31.0	19.0	Maximum 5.0

Cylinder Head Cover Tightening Specifications



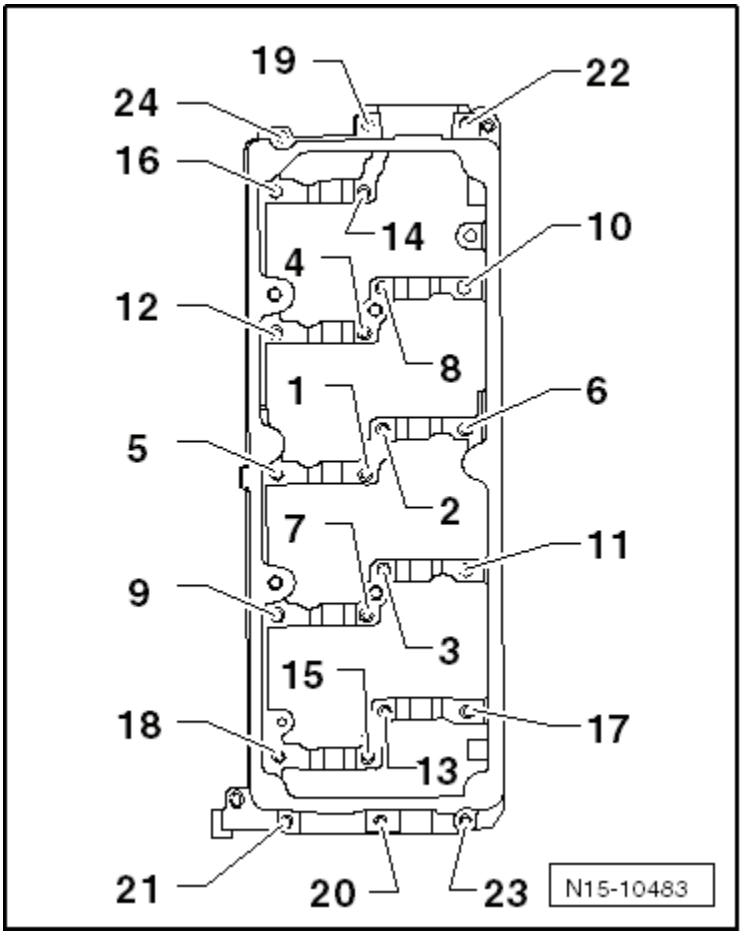
Step	Component	Nm
1	Tighten bolts 1 through 7 in sequence	Hand-tighten
2	Tighten bolts 1 through 7 in sequence	10

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

[1] The bearing 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 bracket cap	25
Oil filter bracket connection	30
Oil filter bracket cover	25
Oil filter bracket-to-cylinder block bolt [1) 2)]	15 plus an additional 90° (¼ turn)
Oil level thermal sensor-to-oil pan bolt	10
Oil pan drain plug [1)]	30
Oil pan-to-cylinder block bolt	15
Oil pan-to-transmission bolt	40
Oil pressure switch-to-oil filter bracket	22
Oil pump sprocket-to-oil pump bolt	20 plus an additional 90° (¼ turn)
Oil spray jet-to-cylinder block bolt	25
Oil supply line clamp bolt	10
Oil supply line fitting-to-connection	22
Oil supply line fitting-to-turbocharger	22
Sealing flange-to-cylinder block bolt	15
Suction pipe-to-oil pump bolt	15
Windage tray-to-cylinder block bolt	15
Wiring harness bracket-to-oil filter bracket bolt	10

1) Replace fastener(s).

2) Tighten the upper left and lower right bolts first and then tighten all four bolts in a diagonal sequence.

Cooling System – 2.0L CJAA (TDI)

Fastener Tightening Specifications

Component	Nm
4/2 way valve with thermostat-to-cylinder block bolt	15
Coolant expansion tank to body stud bolt	5
Coolant fan shroud nut	5
Coolant pump-to-cylinder block bolt	15
Coolant reservoir-to-body stud bolt	3
Cylinder block connecting piece bolt	15
Engine pre-heater coolant pipe/engine pre-heater bracket to cylinder block bolt	10
Radiator fan shroud bolt	5
Radiator bolt	5
Ventilation pipe-to-intake manifold bolt	10

Fuel Supply – 2.0L CJAA (TDI)

Fastener Tightening Specifications

Component	Nm
Accelerator pedal module-to-body bolt	10
Exhaust pressure sensor 1 bracket bolt	8
Fuel filler door unit-to-body bolt	1.5
Fuel filler tube-to-body bolt	10
Fuel filter cover-to-fuel filter housing bolt (Version A)	8
Fuel filter cover-to-fuel filter housing bolt (Version B)	5
Fuel filter housing-to-body bolt/nut	10
Fuel tank securing strap-to-body bolt [1)]	25
Fuel tank-to-body bolt [1)]	25
Fuel tank locking ring	110

[1)] Replace fastener(s).

Turbocharger – 2.0L CJAA (TDI)

Fastener Tightening Specifications

Component	Nm
Adapter-to-connecting piece bolt	8
Charge Air Cooler (CAC) mount bolt	5
Charge air pipe-to-cylinder block bolt	8
Charge air pipe-to-charge air hose clamp	5.5
Charge air pressure sensor with intake air temperature sensor-to-charge air pipe bolt	2
Connecting pipe-to-connecting piece bolt	8
Connecting pipe-to-exhaust manifold nut [2)]	20
Control line bracket-to-exhaust manifold stud nut	23
Exhaust Gas Recirculation (EGR) control line fitting	23
Cylinder block support banjo bolt [1)]	60
Damper-to-charge air hose bolt	10
Exhaust Gas Recirculation (EGR) filter to stud bolt nut	23
Exhaust gas temperature sensor 1-to-exhaust manifold [3)]	45
Exhaust manifold/turbocharger-to-cylinder head nut [1) 2)]	23
Oil return pipe-to-turbocharger bolt	15
Oil supply line bracket-to-turbocharger bolt	10
Oil supply line fitting-to-oil filter bracket connection	22
Oil supply line fitting-to-turbocharger	22
Turbocharger support stud bolt	20
Turbocharger-to-particulate filter clamp [1)]	7
Vacuum actuator with charge pressure actuator position sensor-to-turbocharger bolt [1)]	8
Warm air collector plate bolt	8
Wiring harness bracket/heat shield-to-turbocharger bolt	8

1) Replace fastener(s).
2) Coat the stud bolts with hot bolt paste G 052 112 A3.
3) Coat only the threads with hot bolt paste G 052 112 A3.

Exhaust System – 2.0L CJAA (TDI)

Fastener Tightening Specifications

Component	Nm
Bracket-to-particulate filter bolt	23
Clamping sleeve nut	
-With 2 individual clamps	25
- With a continuous clamp	35
Connecting pipe-to-Exhaust Gas Recirculation (EGR) housing	23
Control line bracket-to-exhaust manifold stud bolt nut	23

Fastener Tightening Specifications *(cont'd)*

Component	Nm
Control line bracket-to-particulate filter bolt	9
Control line-to-Exhaust Gas Recirculation (EGR) housing	23
Control line-to-particulate filter	45
Exhaust Gas Recirculation (EGR) cooler-to-Exhaust Gas Recirculation (EGR) housing bolt	8
Exhaust Gas Recirculation (EGR) filter-to-Exhaust Gas Recirculation (EGR) housing bolt	23
Exhaust Gas Recirculation (EGR) filter-to-particulate filter securing clamp	3.5
Exhaust Gas Recirculation (EGR) filter-to-turbocharger stud bolt nut	23
Exhaust Gas Recirculation (EGR) valve 2-to-Exhaust Gas Recirculation (EGR) housing bolt	8
Exhaust Gas Recirculation (EGR) temperature sensor-to-Exhaust Gas Recirculation (EGR) housing	20
Exhaust gas temperature sensor 4-to-particulate filter	45
Exhaust gas temperature sensors 2 and 3-to-particulate filter	45
Exhaust pressure sensor 2 bolt [2]	4
	8
Exhaust pressure sensor 1 bracket-to-auxiliary fuel pump bracket bolt	4
Heat shield-to-particulate filter bolt	10
Nitrogen Oxide (NOx) absorption catalytic converter-to-exhaust flap control module securing clamp [1]	7
Oxygen Sensor (O2S)	52
Particulate filter bracket-to-cylinder block nut	23
Particulate filter bracket-to-cylinder head nut	23
Particulate filter-to-bracket nut	23
Particulate filter-to-Nitrogen Oxide (NOx) absorption catalytic converter securing clamp [1]	7
Particulate filter-to-turbocharger securing clamp [1]	7
Suspended mount-to-subframe bolt	25
Suspended mount-to-underbody bolt [1]	23
Tunnel bridge-to-underbody nut	23

[1] Replace fastener(s).

[2] For bolt tightening clarification, refer to ElsaWeb, *Particulate Filter with NOx Reduction Catalytic Converter Overview*, items 3 and 4.

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

Fastener Tightening Specifications

Component	Nm
Fuel line bracket-to-intake manifold bolt	8
Glow plug	12

Diesel Fuel Injection – 2.0L CJAA (TDI)

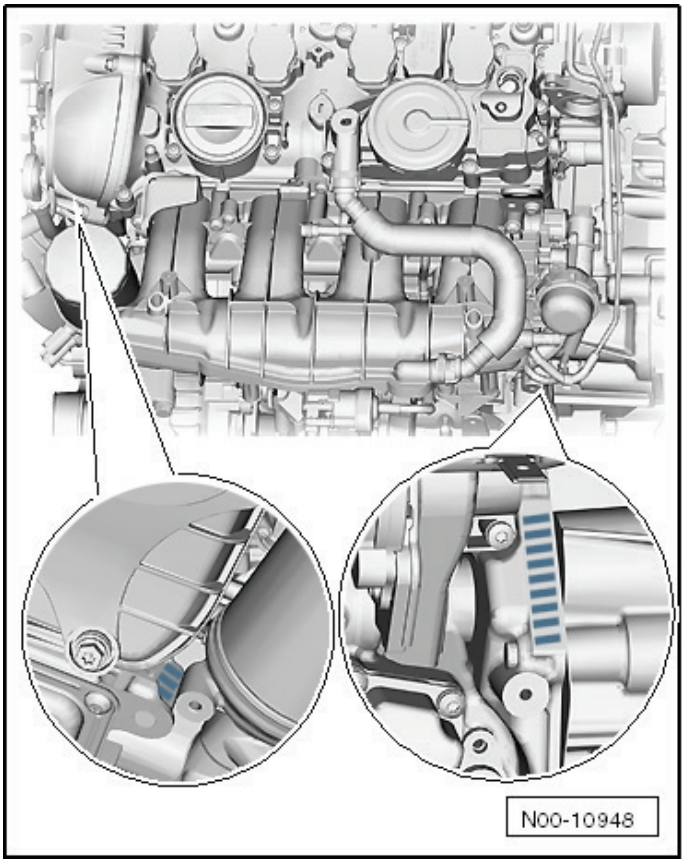
Fastener Tightening Specifications

Component	Nm
Air duct-to-lock carrier bolt	5
Connecting pipe-to-Exhaust Gas Recirculation (EGR) vacuum regulator solenoid valve with Exhaust Gas Recirculation (EGR) potentiometer bolt	20
Exhaust Gas Recirculation (EGR) vacuum regulator solenoid valve with Exhaust Gas Recirculation (EGR) potentiometer-to-intake manifold bolt	10
Fuel line clamp bolt/nut	8
Fuel pressure regulator valve-to-fuel rail	80
Fuel pressure sensor-to-fuel rail	100
Fuel rail-to-cylinder head cover bolt	22
High pressure line clamp nut	8
High pressure line-to-fuel injector fitting	28
High pressure line-to-fuel rail fitting	28
High pressure line-to-high pressure pump fitting	28
High pressure pump-to-accessory bracket bolt	20
- Tighten the long bolts an additional	180° plus an additional (½ turn)
- Tighten the short bolts an additional	45° plus an additional (⅛ turn)
Intake manifold-to-cylinder head bolt	8
Lower air filter housing-to-body bolt	8
Mass Air Flow (MAF) sensor-to-upper air filter housing	3.5
Oil dipstick guide tube-to-throttle valve control module bolt	10
Sealing cap-to-cylinder head cover bolt	5
Tensioning plate-to-cylinder head cover nut	10
Throttle valve control module-to-Exhaust Gas Recirculation (EGR) vacuum regulator solenoid valve with Exhaust Gas Recirculation (EGR) potentiometer bolt	10
Upper air filter housing-to-lower air filter housing bolt	5

ENGINE MECHANICAL – 2.0L CBFA, CCTA

General, Technical Data

Engine Number Location



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

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

Engine Data

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

[1] SULEV = Super Ultra Low Emissions Vehicle.
[2] ULEV = Ultra Low Emissions Vehicle.

Engine Assembly – 2.0L CBFA, CCTA

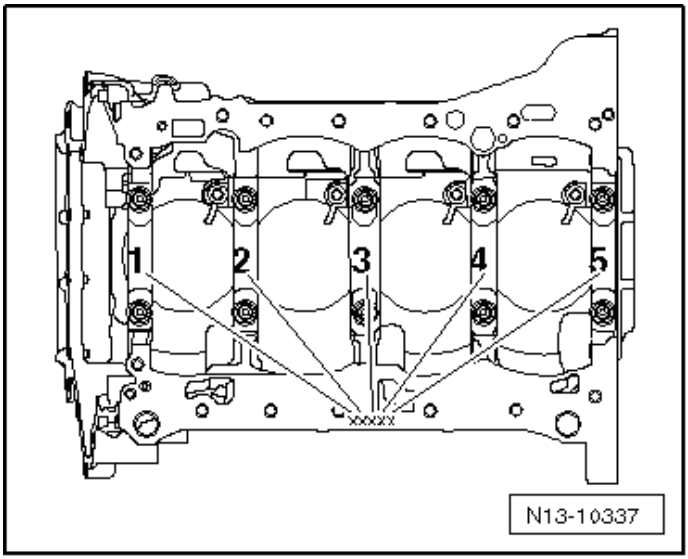
Fastener Tightening Specifications

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

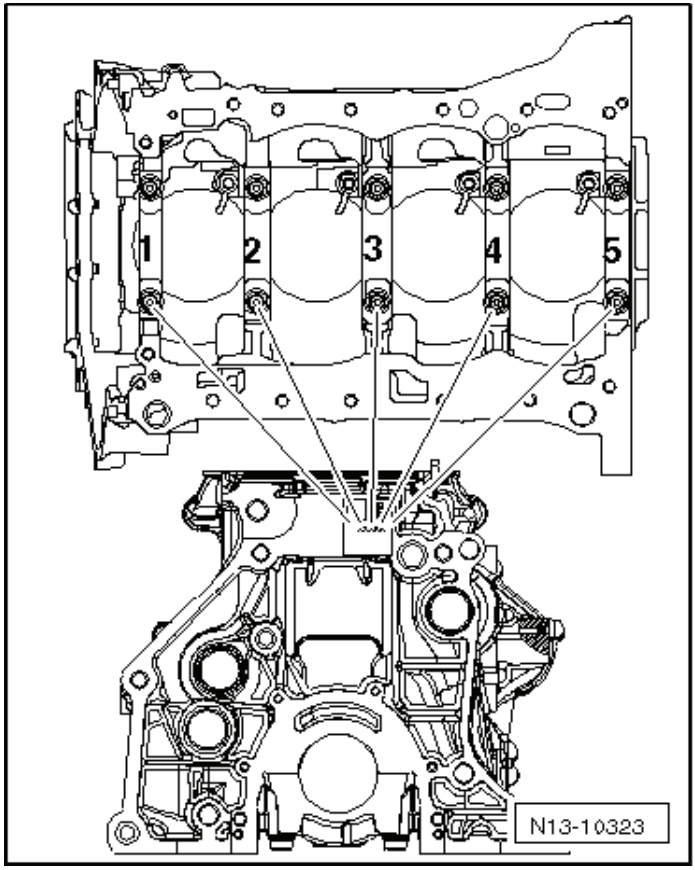
[1] Replace fastener(s).
[2] Install the pendulum support-to-transmission bolts first, then the pendulum support-to-subframe bolt.

Crankshaft, Cylinder Block – 2.0L CBFA, CCTA

Cylinder Block Bearing Shell Identification



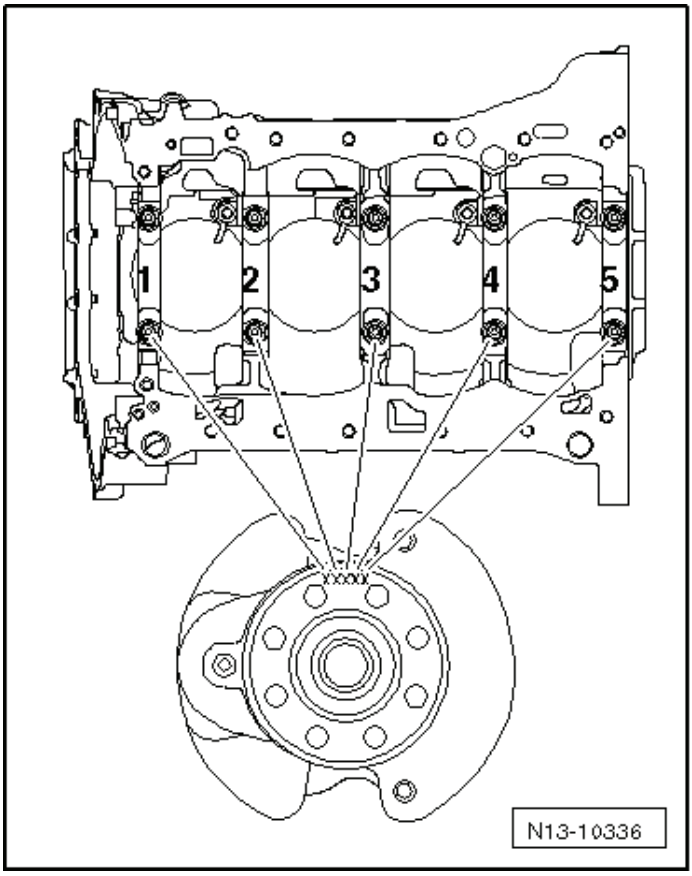
The cylinder block bearing shell identification is located on either the oil pan sealing surface or on the top (transmission side) of the cylinder block.



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

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

Bearing Cap Bearing Shell Identification



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

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

Fastener Tightening Specifications

Component	Fastener size	Nm
Air conditioning compressor-to-accessory bracket bolt	-	25
Connecting rod bearing cap-to-connecting rod bolt [1)]	M8	30 plus an additional 90° (¼ turn)
	M9	45 plus an additional 90° (¼ turn)
Dual mass flywheel/drive plate-to-crankshaft bolt [1)]	-	60 plus an additional 90° (¼ turn)
Generator-to-accessory bracket bolt	-	23
Pressure relief valve	-	27
Ribbed belt tensioner-to-accessory bracket bolt	-	10
Sensor wheel-to-crankshaft screw [1)]	-	10 plus an additional 90° (¼ turn)
Vibration damper-to-crankshaft bolt [1)]	-	150 plus an additional 90° (¼ turn)

[1)] Replace fastener(s).

Crankshaft Dimensions

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

[1] The preparation of worn crankshafts is not provided.

Piston Ring End Gaps

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

Piston Ring Clearance

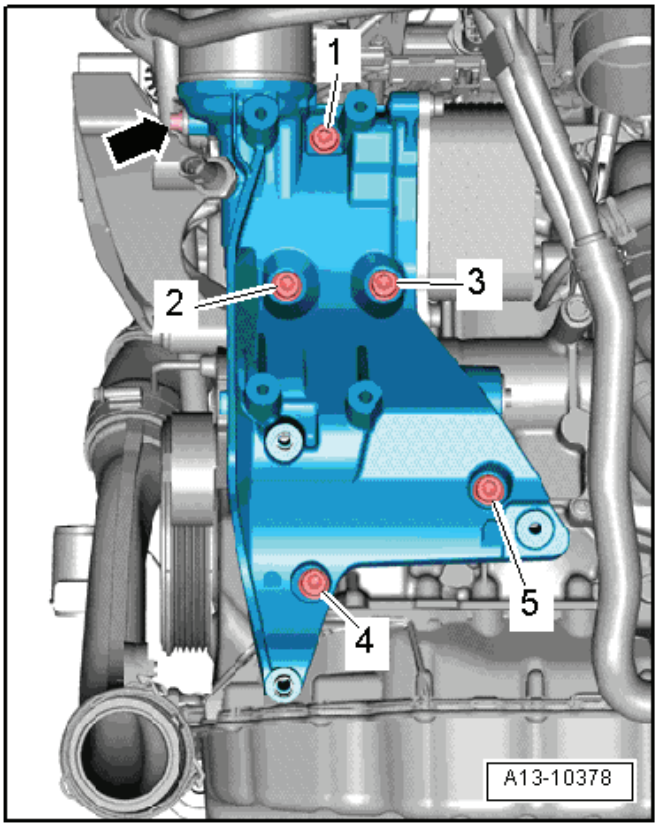
Piston ring dimensions in mm	New	Wear limit
1st compression ring	0.06 to 0.09	0.20
2nd compression ring	0.03 to 0.06	0.15
Oil scraping rings	Cannot be measured	

Piston and Cylinder Dimensions

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

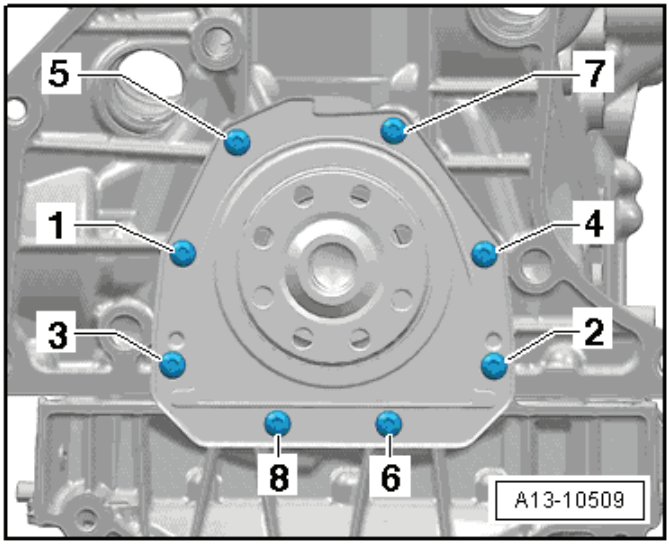
[1] Measurements without graphite coating (thickness = 0.02 mm). The graphite coating wears off.

Accessory Assembly Bracket Tightening Specifications



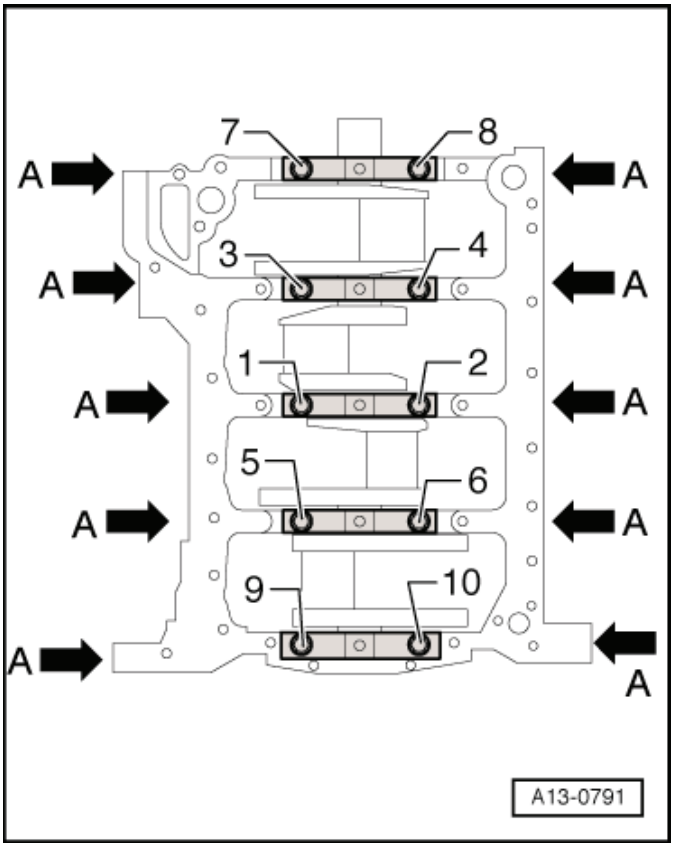
Step	Component	Nm
1	Tighten bolts 1 through 5 in sequence	Hand-tighten
2	Tighten bolts 1 through 5 in sequence	20
3	Tighten bolts 1 through 5 in sequence	an additional 90° (¼ turn)

Sealing Flange Tightening Specifications



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

Crankshaft Assembly Tightening Specifications



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

Cylinder Head, Valvetrain – 2.0L CBFA, CCTA

Fastener Tightening Specifications

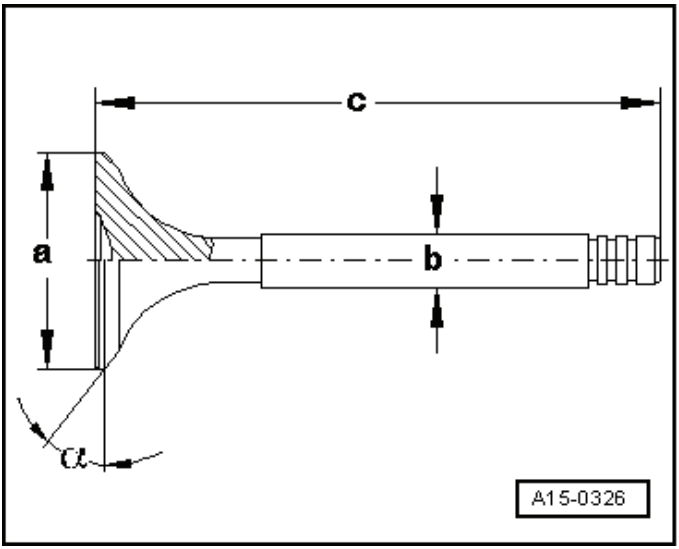
Component	Fastener size	Nm
Balance shaft-to-cylinder block bolt	-	9
Balance shaft timing chain guide rail-to-cylinder block guide pin	-	20
Balance shaft timing chain tensioner-to-cylinder block	-	85
Balance shaft timing chain tensioning rail-to-cylinder block guide pin	-	20
Ball stud-to-cylinder head cover	-	5
Bearing bracket-to-cylinder head bolt	-	9
Bearing bracket-to-exhaust camshaft bolt [1)]	M6	8 plus an additional 90° (¼ turn)
	M8	20 plus an additional 90° (¼ turn)
Camshaft adjustment valve 1-to-upper timing chain cover bolt	-	9
Camshaft Position (CMP) sensor-to-cylinder block bolt	-	9
Camshaft timing chain tensioner-to-cylinder block bolt	-	9
Camshaft timing chain guide rail-to-cylinder block guide pin	-	20
Camshaft timing chain tensioning rail-to-cylinder block guide pin	-	20
Control valve-to-intake camshaft [3)]	-	35
Cylinder head mounting plate/connecting piece bolt	-	9
Heat shield-to-bracket bolt	-	9
Heat shield-to-cylinder head bolt	-	20
Mounting plate/connection piece to cylinder head bolt		5
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 [2)]	-	9

Fastener Tightening Specifications *(cont'd)*

Component	Fastener size	Nm
Transport strap-to-cylinder head bolt	-	25
Vacuum pump-to-cylinder head bolt	-	9

1) Replace fastener(s).
2) Engine code CBFA only.
3) Left hand threads.

Valve Dimensions



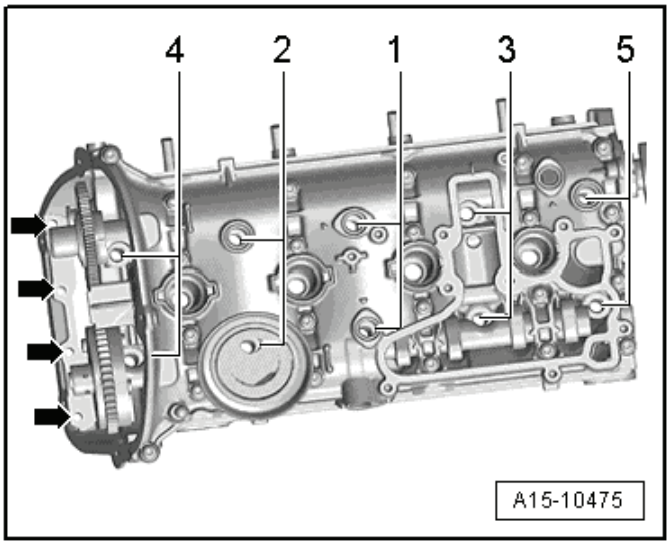
Dimension		Intake valve	Exhaust valve
Diameter a	mm	33.85 ± 0.10	28.0 ± 0.1
Diameter b	mm	5.98 ± 0.007	5.955 ± 0.007
c	mm	103.97	101.87
α	∠°	45	45

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

Compression Pressures

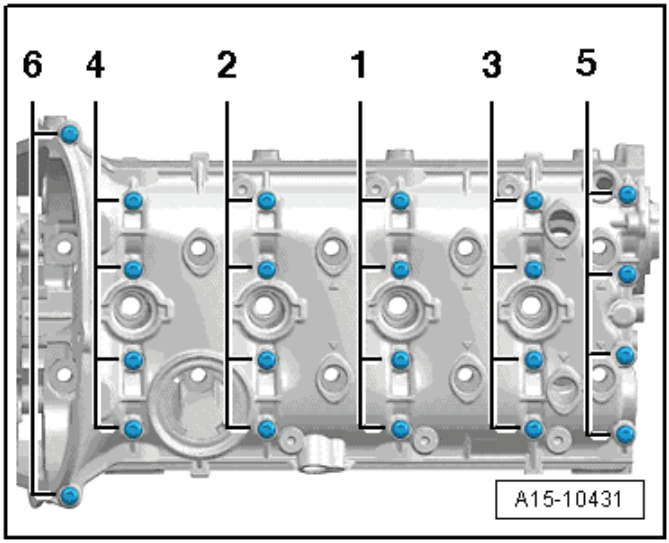
New Bar positive pressure	Wear limit Bar positive pressure	Difference between cylinders Bar positive pressure
11.0 to 14.0	7.0	Max. 3.0

Cylinder Head Tightening Specifications



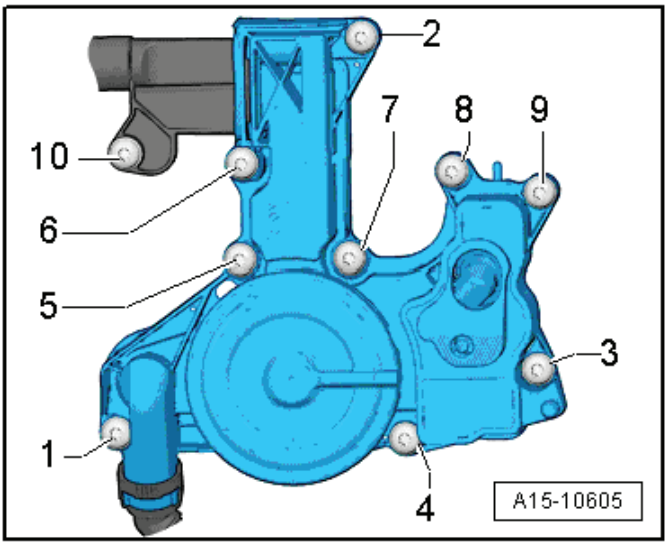
Step	Component	Nm
1	Tighten bolts 1 through 5 in sequence	40
2	Tighten bolts 1 through 5 in sequence	an additional 90° (¼ turn)
3	Tighten bolts 1 through 5 in sequence	an additional 90° (¼ turn)
4	Tighten bolts (➡)	8
5	Tighten bolts (➡)	an additional 90° (¼ turn)

Cylinder Head Cover Tightening Specifications



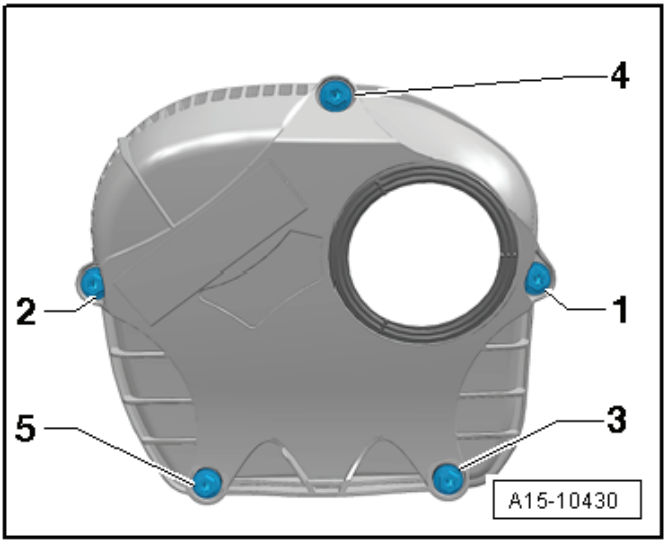
Step	Component	Nm
1	Tighten bolts 1 through 6 in sequence in several stages	Hand-tighten
2	Tighten bolts 1 through 6 in sequence	8
3	Tighten bolts 1 through 6 in sequence	an additional 90° (¼ turn)

Crankcase Ventilation Tightening Specification



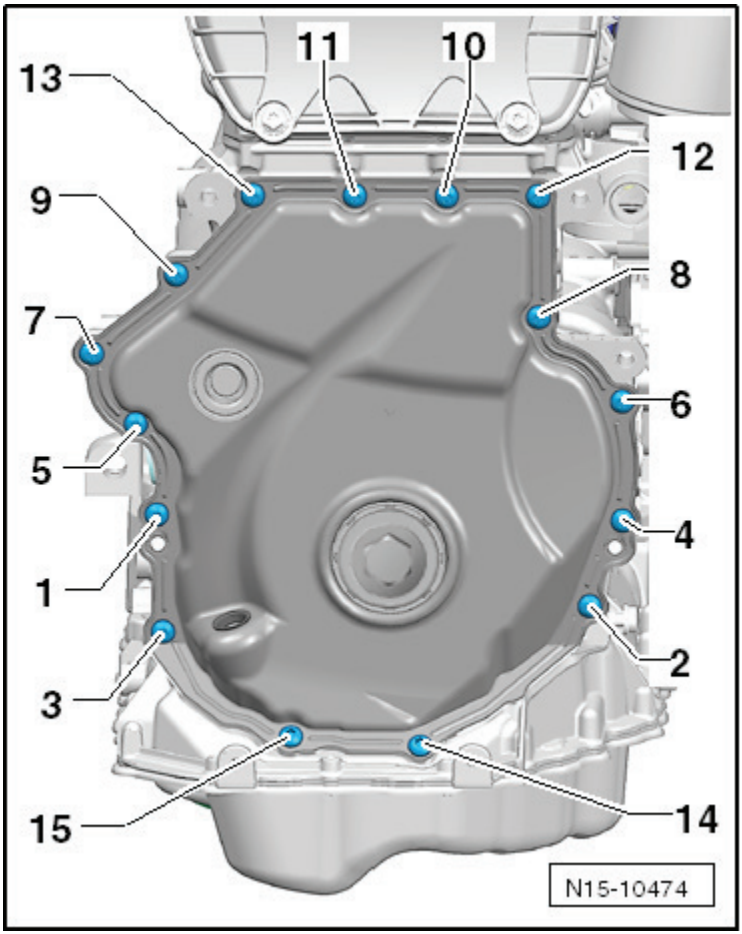
Step	Component	Nm
1	Tighten bolts 1 through 10 in sequence	11

Upper Timing Chain Cover Tightening Specifications



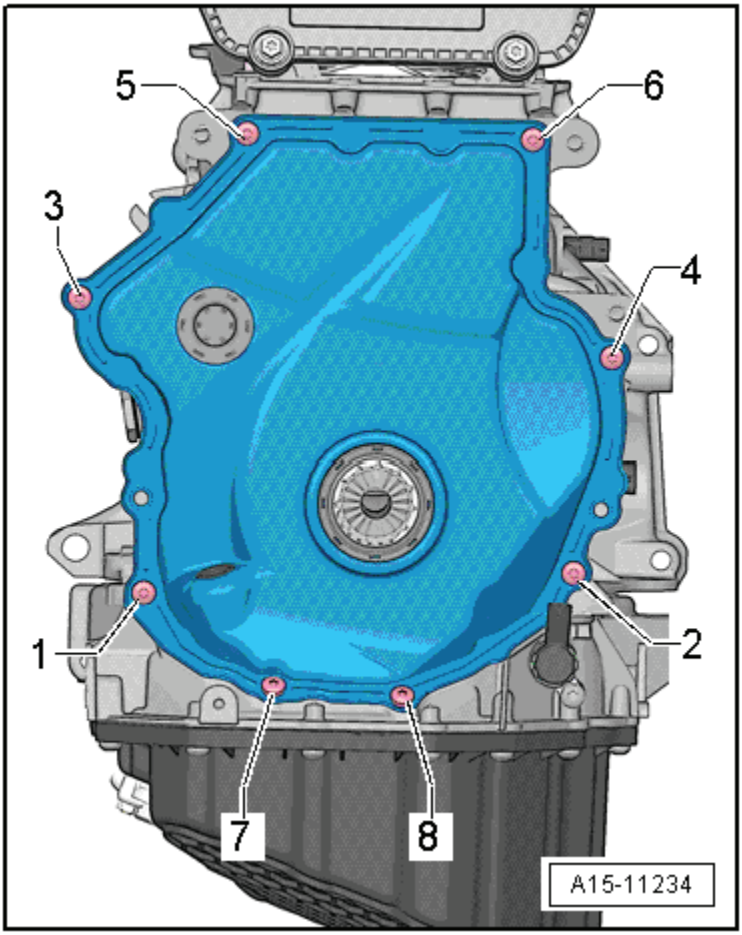
Step	Component	Nm
1	Tighten bolts 1 through 5 in sequence, in several stages	Hand-tighten
2	Tighten bolts 1 through 5 in sequence	9

Lower Timing Chain Cover Tightening Specifications with 15 Bolts



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)

Lower Timing Chain Cover Tightening Specifications with 8 Bolts



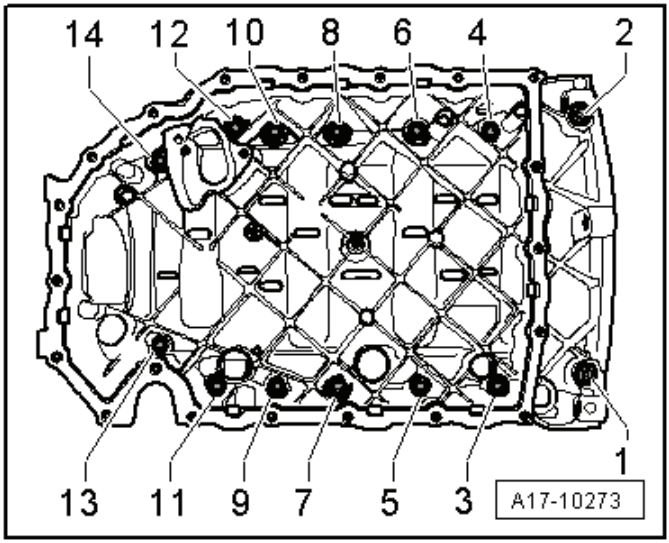
Step	Component	Nm
1	Tighten bolts 1 through 8 in sequence	4
2	Tighten bolts 1 through 8 in sequence	an additional 45° (⅛ turn)

Lubrication – 2.0L CBFA, CCTA

Fastener Tightening Specifications

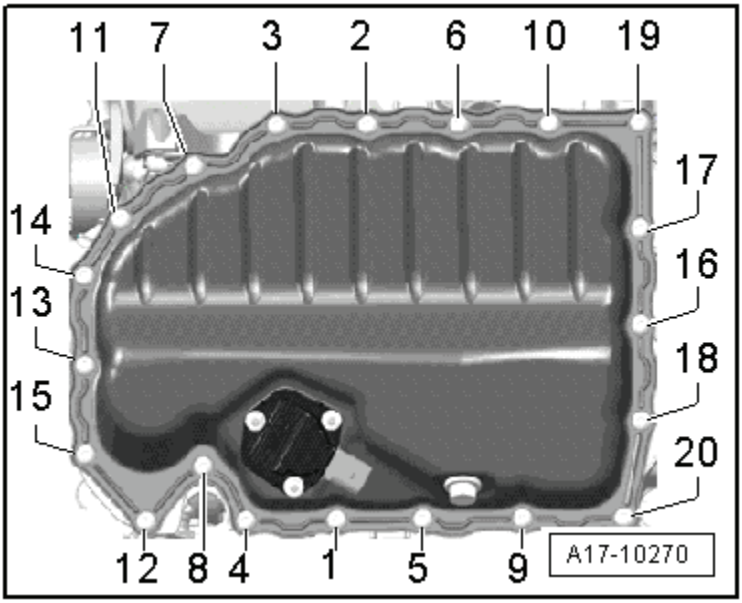
Component	Fastener size	Nm
Oil baffle-to-upper oil pan bolt	-	9
Oil cooler-to-accessory bracket bolt	-	15
Oil drain plug-to-lower oil pan	-	30
Oil filter element-to-accessory bracket	-	22
Oil intake pipe-to-oil pump bolt	-	9
Oil pressure switch-to-accessory bracket	-	20
Oil pump drive chain tensioner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

Upper Oil Pan Tightening Specifications



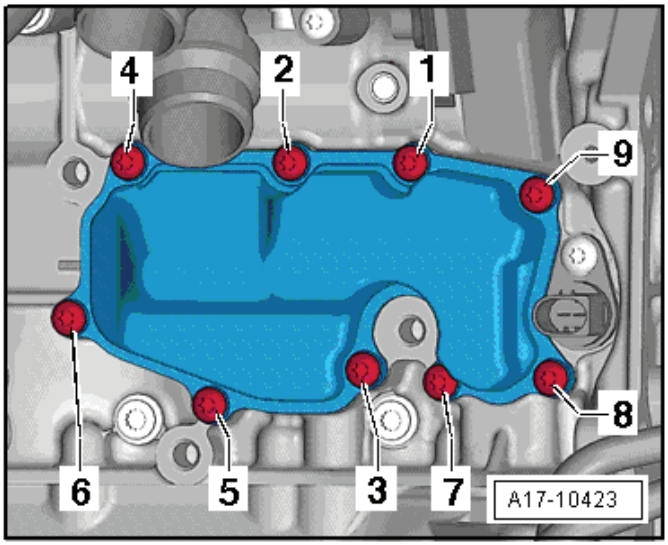
Step	Component	Nm
1	Tighten bolts 1 through 14 in sequence	Hand-tighten
2	Tighten bolts 1 through 14 in sequence	15
3	Tighten bolts 1 through 14 in sequence	an additional 90° (¼ turn)

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

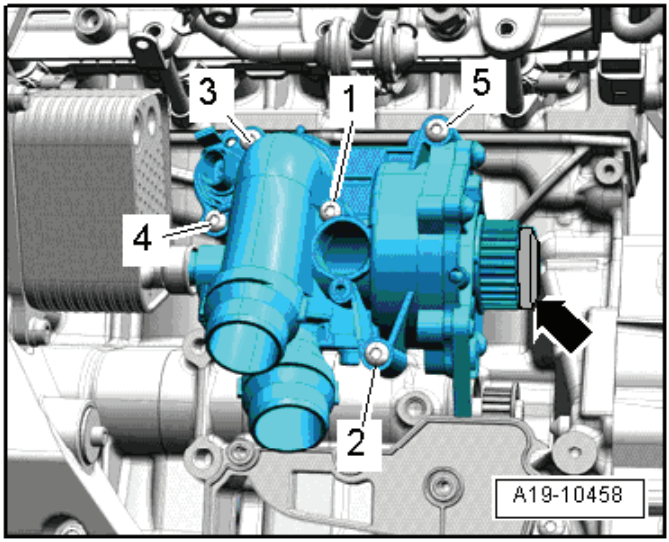
Cooling System – 2.0L CBFA, CCTA

Fastener Tightening Specifications

Component	Nm
After run coolant pump bracket bolt	8
After run coolant pump bracket-to-upper oil pan bolt	40
Coolant expansion tank bolt	5
Coolant fan shroud nut	10
Coolant pump connecting piece bolt	9
Coolant pump toothed belt guard bolt	9
Engine coolant temperature sensor retaining plate to coolant pump bolt	4
Front coolant pipe bolt	3.5
Radiator fan shroud bolt	5
Radiator-to-charge air pipe bolt [3]	5
Small coolant pipe bolt	9
Toothed belt drive gear-to-balance shaft bolt [1] [2]	10 plus an additional 90° (¼ turn)

[1] Replace fastener(s).
[2] Has left hand threads.
[3] Eos, GTI, Passat and CC only.

Coolant Pump Tightening Specification



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

Fuel Supply – 2.0L CBFA, CCTA

Fastener Tightening Specifications

Component	Fastener size	Nm
Accelerator Pedal Position (APP) sensor with Accelerator Pedal Position 2 (APP2) sensor-to-body bolt	-	10
Air filter housing-to-Leak Detection Pump (LDP) bracket bolt	-	3
Evaporative Emission (EVAP) canister bolt [3)]	-	8
Fuel filler tube-to-body bolt	-	10
Fuel tank locking ring	-	110
Fuel tank securing strap-to-underbody bolt [1)]	-	25
Leak Detection Pump (LDP)-to-Leak Detection Pump (LDP) bracket bolt	-	2
Leak Detection Pump (LDP) bracket-to-body nut	-	6

[1)] Replace fastener(s).

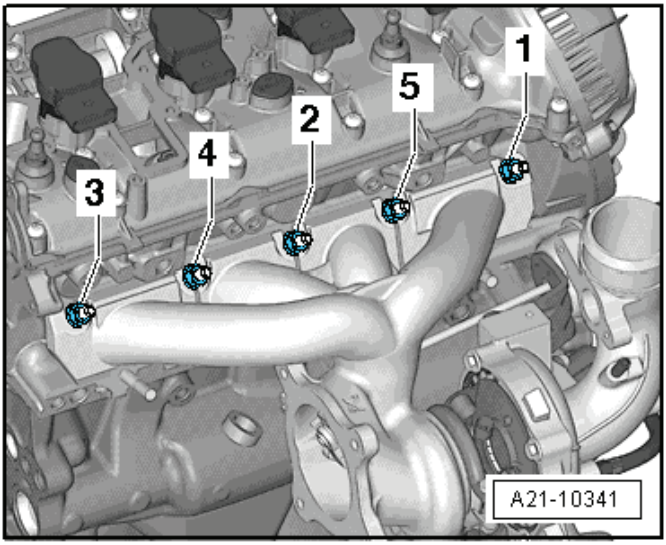
Turbocharger, G-Charger – 2.0L CBFA, CCTA

Fastener Tightening Specifications

Component	Nm
Charge Air Cooler (CAC) mounting bolt	5
Charge air pipe bolt	8
Charge air pipe clamp	5.5
Charge air pressure sensor-to-charge air pipe bolt	5
Coolant return pipe-to-turbocharger banjo bolt	38
Coolant return pipe-to-turbocharger bolt	9
Coolant supply pipe-to-cylinder block banjo bolt	38
Coolant supply pipe-to-cylinder block bolt	9
Coolant supply pipe-to-turbocharger banjo bolt	38
Cylinder block bracket bolt [2]	30
Cylinder head fastening strip nut [1] [3]	30
Cylinder head heat shield bolt	20
Drive axle heat shield bolt	20
Oil return pipe-to-cylinder block bolt	9
Oil return pipe-to-turbocharger bolt	9
Oil supply pipe-to-cylinder block bolt	9
Oil supply pipe-to-turbocharger banjo bolt	33
Oil supply pipe-to-turbocharger bolt	9
Turbocharger bracket bolt [2]	30
Turbocharger connection bolt	9
Turbocharger recirculation valve-to-turbocharger bolt	7
Vacuum diaphragm-to-turbocharger bolt	10
Wastegate bypass regulator valve-to-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 [3)]	25
Secondary Air Injection (AIR) pump motor-to-bracket nut [2)]	9
Secondary Air Injection (AIR) solenoid valve bolt [2)]	9
Suspended mount-to-subframe bolt	25
Suspended mount-to-underbody bolt	25
Tunnel bridge-to-underbody bolt	25

1) Replace fastener(s).
2) Engine code CBFA only.
3) Lubricate the stud bolts on the exhaust manifold/turbocharger with hot bolt paste (G 052 112 A3).

Multiport Fuel Injection – 2.0L CBFA, CCTA

Technical Data

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

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

Fastener Tightening Specifications

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

[1] Replace fastener(s).
[2] Coat the threads with clean engine oil.

Ignition – 2.0L CBFA, CCTA

Technical Data

Engine codes	**CBFA and CCTA**
Ignition sequence	1-3-4-2
Spark plugs	
VW/Audi	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

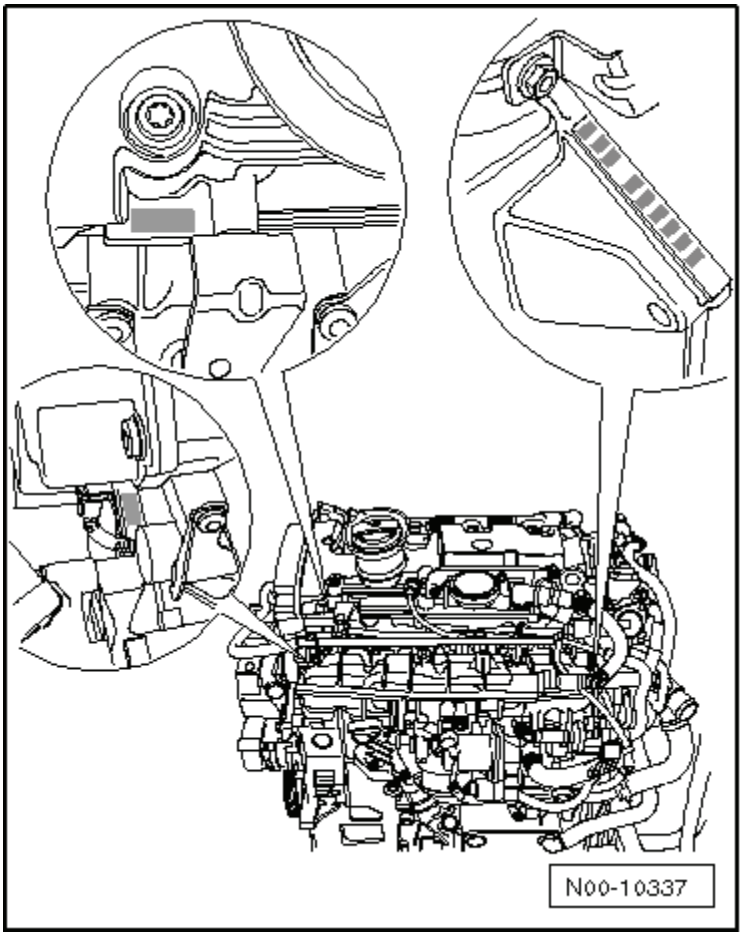
Fastener Tightening Specifications

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

ENGINE MECHANICAL – 2.0L CRZA

General, Technical Data

Engine Number Location



The engine number (engine code and serial number) is located on the left side at the engine/transmission partition.

The engine code is also stamped on the right side of the cylinder head and on the cylinder block.

Engine Data

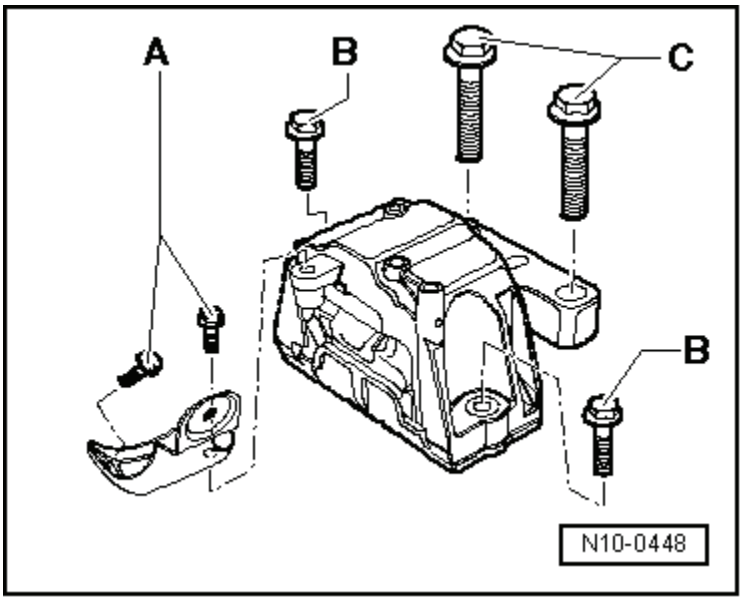
Engine code		**CRZA**
Manufactured		from 10.11
Emission values in accordance with		ULEV II
Displacement	cm^3	1984
Output	KW at RPM	188 @ 6000
Torque	Nm at RPM	330 @ 2500
Bore	diameter mm	82.5
Stroke	mm	92.8
Compression ratio		9.8
Valves per cylinder		4
Research Octane Number (RON)		98
Fuel injection, ignition		Motronic MED 9.1
Mixture generation		Uniform
Knock control		2 sensors
Oxygen Sensor (O2) regulation		2 sensors
Catalytic converter		Yes
Variable valve timing		Yes
Electronic Power Control (EPC)		Yes

Engine Assembly – 2.0L CRZA

Fastener Tightening Specifications

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

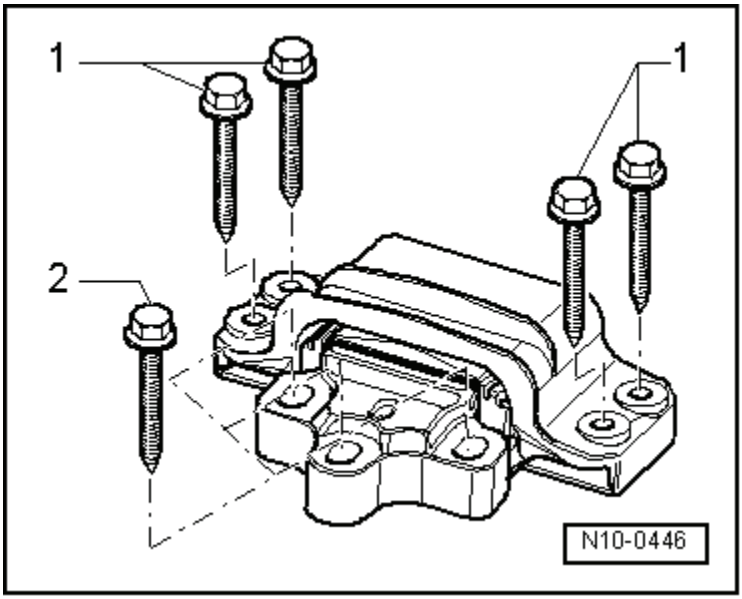
Engine Mount Tightening Specifications



Component	Nm
Bolts A [1)]	20 plus an additional 90° (¼ turn)
Bolts B [1)]	40 plus an additional 90° (¼ turn)
Bolts C [1)]	60 plus an additional 90° (¼ turn)

[1)] Replace fastener(s).

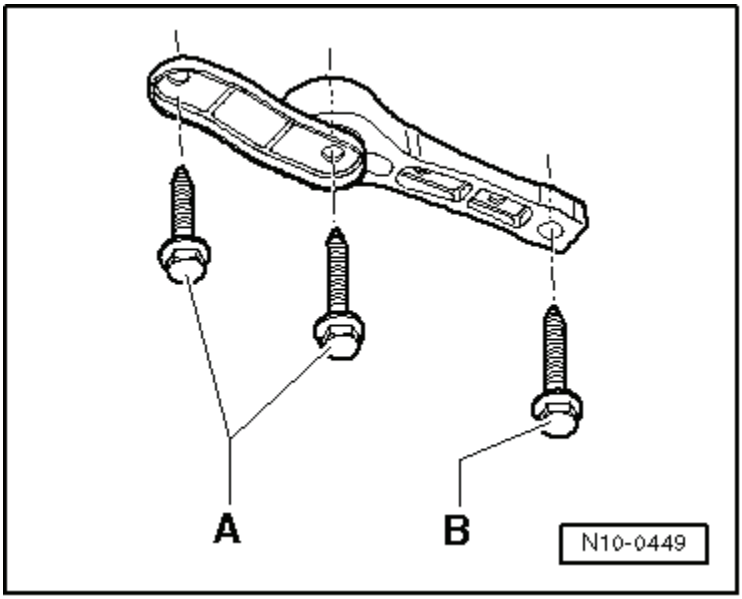
Transmission Mount Tightening Specifications



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

[1)] Replace fastener(s).

Pendulum Support Tightening Specifications

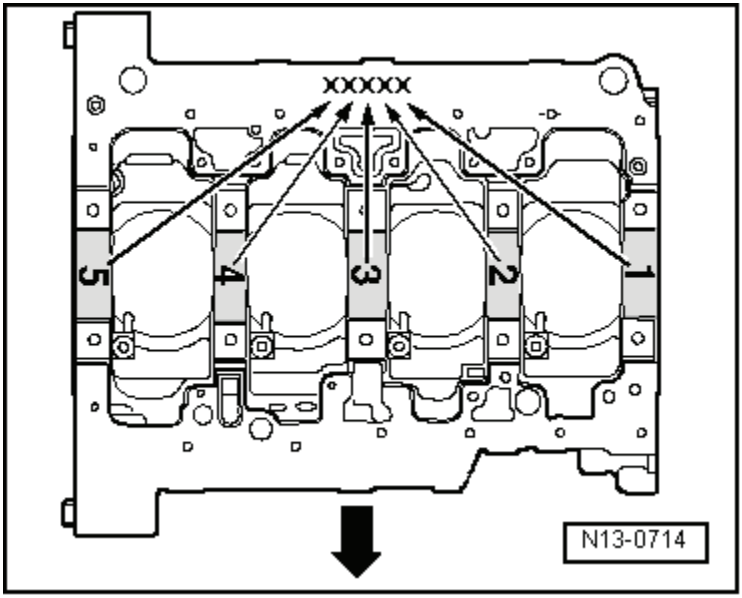


Component	Nm
Bolts A with a strength category of 8.8 [1)]	40 plus an additional 90° (¼ turn)
Bolts A with a strength category of 10.9 [1)]	50 plus an additional 90° (¼ turn)
Bolt B [1)]	100 plus an additional 90° (¼ turn)

[1)] Replace fastener(s).

Crankshaft, Cylinder Block – 2.0L CRZA

Upper Crankshaft Bearing Identification



The upper bearing shells are allocated to the cylinder block with the correct thickness by 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

Fastener Tightening Specifications

Component	Nm
Air conditioning compressor-to-accessory bracket bolt	25
Coolant pump-to-cylinder block bolt	15
Coolant thermostat housing-to-cylinder block bolt	15
Connecting rod bearing cap-to-connecting rod bolt [1]	45 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]	90 plus an additional 90° (¼ turn)
Dual mass flywheel-to-crankshaft bolt [1]	60 plus an additional 90° (¼ turn)
Engine mount bracket-to-cylinder block bolt	45
Engine Speed (RPM) sensor-to-cylinder block bolt	10
Generator-to-accessory bracket bolt/nut	23
Idler roller-to-cylinder head bolt	25
Idler roller-to-sealing flange bolt	35
Intake manifold support-to-cylinder block bolt	23
Knock Sensor (KS)-to-cylinder block bolt [3]	20
Lower toothed belt guard-to-cylinder block bolt	8
Oil filter adapter-to-cylinder block bolt [1]	15 plus an additional 90° (¼ turn)
Pressure relief valve bolt	27
Rear toothed belt guard-to-cylinder head bolt [2]	10
Ribbed belt tensioner-to-accessory bracket bolt	23
Sealing flange-to-cylinder block bolt	15
Sensor wheel-to-crankshaft screw [1]	10 plus an additional 90° (¼ turn)
Sprocket-to-camshaft bolt [1]	50 plus an additional 90° (¼ turn)
Toothed belt tensioner-to-cylinder head stud bolt nut	25
Upper toothed belt guard-to-cylinder head bolt	10
Vibration damper-to-crankshaft bolt [1]	20 plus an additional 90° (¼ turn)

[1] Replace fastener(s).
[2] Install using locking fluid.
[3] The tightening specification affects the function of the Knock Sensor (KS).

Crankshaft Dimensions

Honing dimensions in mm	Crankshaft bearing pin diameter		Connecting rod bearing pin diameter	
Basic dimension	54.00	-0.017	47.80	-0.022
		-0.037		-0.042
1st oversize	53.75	-0.017	47.55	-0.022
		-0.037		-0.042
2nd oversize	53.50	-0.017	47.30	-0.022
		-0.037		-0.042
Stage III	53.25	-0.017	47.05	-0.022
		-0.037		-0.042

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

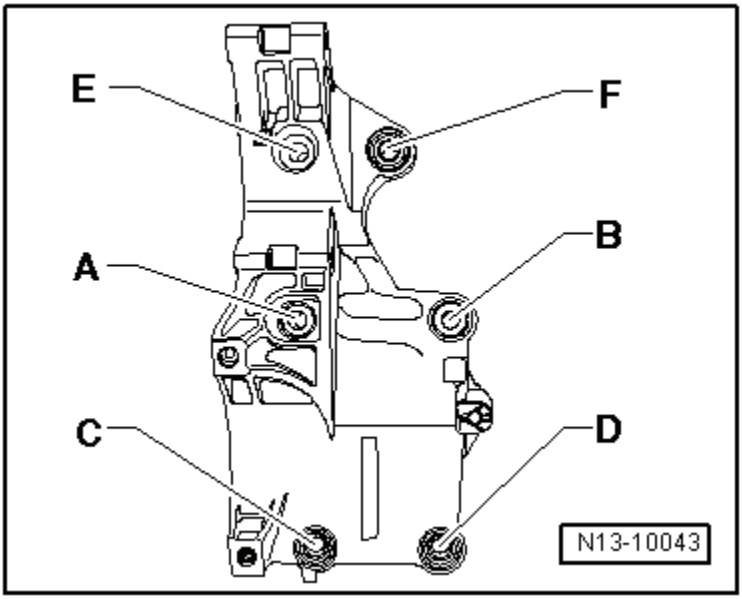
Piston ring dimensions in mm	New	Wear limit
1st compression ring	0.06 to 0.09	0.20
2nd compression ring	0.03 to 0.06	0.15
Oil scraping rings	Cannot be measured	

Piston and Cylinder Dimensions

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

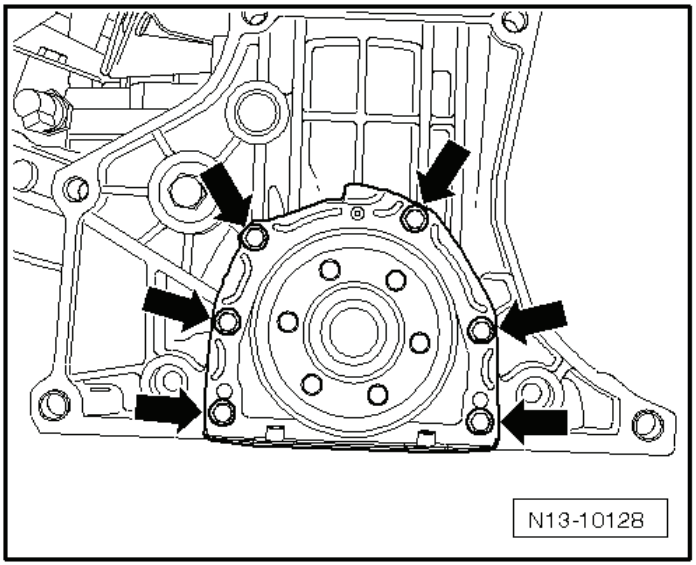
[1)] Measurements without graphite coating (thickness = 0.02 mm). The graphite coating wears off.

Accessory Assembly Bracket Tightening Specification



Step	Component	Nm
1	Tighten bolts A through F in sequence	40

Sealing Flange Tightening Specifications



Step	Component	Nm
1	Tighten bolts (➡)	Hand-tighten
2	Tighten bolts (➡)	15

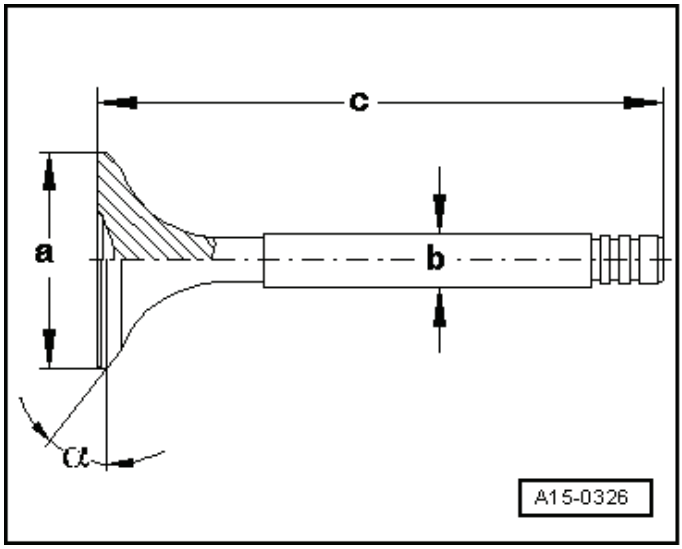
Cylinder Head, Valvetrain – 2.0L CRZA

Fastener Tightening Specifications

Component	Nm
Camshaft adjuster-to-camshaft bolt	20 plus an additional 45° (⅛ turn)
Camshaft adjustment valve 1-to-housing bolt	4
Camshaft Position (CMP) sensor-to-cylinder head bolt	10
Camshaft timing chain tensioner-to-cylinder block bolt	10
Crankcase ventilation valve-to-cylinder head cover bolt	4
Exhaust manifold stud bolt-to-cylinder head	20
Guide frame-to-cylinder head bolt [1)]	8 plus an additional 90° (¼ turn)
Housing-to-cylinder head cover bolt	10
Intake manifold stud bolt-to-cylinder head	10
Sprocket-to-camshaft bolt [1)]	50 plus an additional 180° (½ turn)
Toothed belt tensioner stud bolt-to-cylinder head	10
Transport strap-to-cylinder head bolt	25
Wire bracket-to-housing bolt	10

[1)] Replace fastener(s).

Valve Dimensions



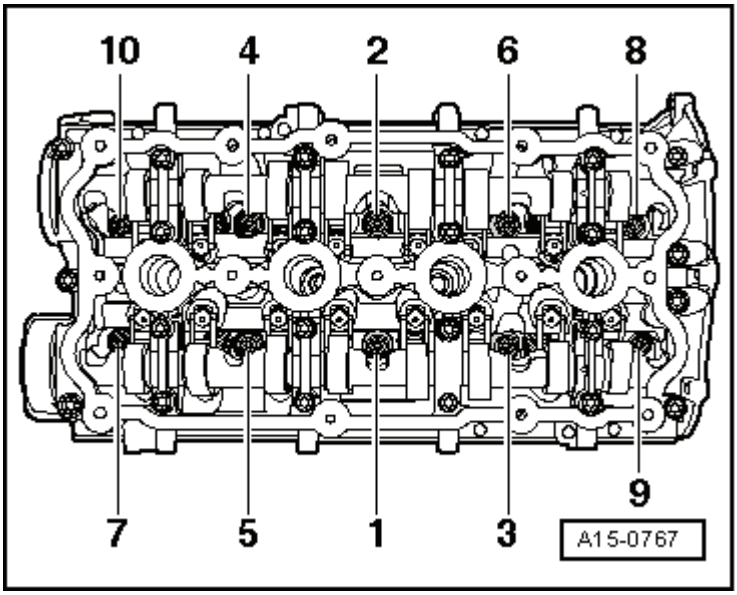
Dimension		Intake valve	Exhaust valve
Diameter a	mm	33.75 to 33.95	27.90 to 28.10
Diameter b	mm	5.98	5.95
c	mm	103.97	101.87
α	∠°	45	45

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

Compression Pressures

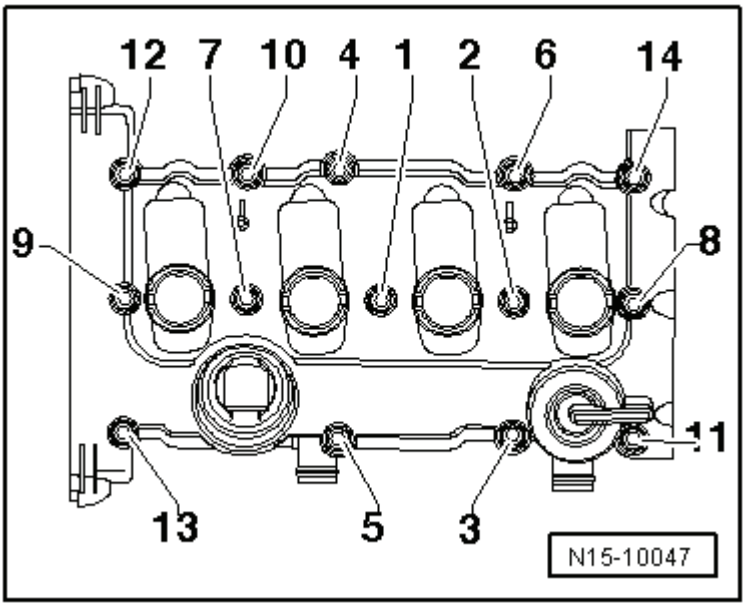
New Bar positive pressure	Wear limit Bar positive pressure	Difference between cylinders Bar positive pressure
11.0 to 14.0	7.0	Max. 3.0

Cylinder Head Tightening Specifications



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

Cylinder Head Cover Tightening Specification



Step	Component	Nm
1	Tighten bolts 1 through 14 in sequence in several stages	10

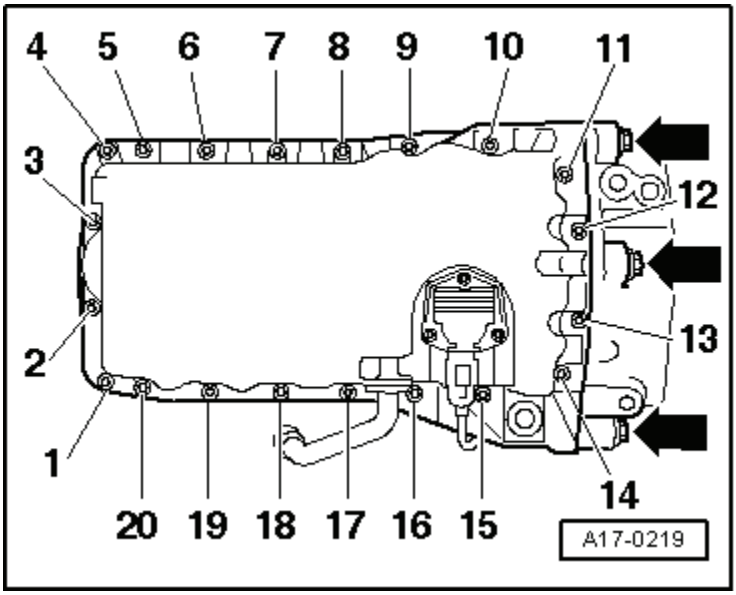
Lubrication – 2.0L CRZA

Fastener Tightening Specifications

Component	Nm
Chain tensioner with tensioning rail-to-cylinder block bolt	15
Charge air pipe-to-oil pan bolt	8
Engine oil cooler-to-oil filter adapter bolt	15
Oil drain plug-to-lower oil pan	30
Oil filter adapter-to-cylinder block bolt [1)]	15 plus an additional 90° (¼ turn)
Oil filter housing-to-oil filter adapter	25
Oil intake pipe-to-oil pump with balance shaft drive bolt	8
Oil level thermal sensor-to-oil pan bolt	10
Oil pan-to-cylinder block/sealing flange bolt	15
Oil pan-to-transmission bolt	40
Oil pressure switch ground wire-to-oil filter adapter bolt	15
Oil pressure switch-to-oil filter adapter	21
Oil pump with balance shaft drive-to-cylinder block bolt [1)]	15 plus an additional 90° (¼ turn)
Sealing flange-to-cylinder block bolt	15
Sprocket-to-oil pump bolt [1)]	20 plus an additional 90° (¼ turn)
Windage tray-to-oil pump with balance shaft drive [2)]	9
	40

1) Replace fastener(s).
2) For bolt clarification, refer to ElsaWeb, *Oil Pump and Balance Shaft Drive*, items 6 and 8.

Oil Pan Tightening Specifications



Step	Component	Nm
1	Tighten all the oil pan to cylinder block bolts in sequence	Hand-tighten
2	Tighten oil pan to transmission bolts ➡	Hand-tighten
3	Tighten all the oil pan to cylinder block bolts 1 through 20 in sequence	Hand-tighten
4	Tighten the oil pan to transmission bolts ➡	40
5	Tighten all the oil pan to cylinder block bolts in sequence	15

Cooling System – 2.0L CRZA

Fastener Tightening Specifications

Component	Nm
Coolant expansion tank-to-body stud bolt	5
Coolant fan-to-fan shroud nut	5
Coolant line bolt [1]	5
	23
	40
Coolant line-to-thermostat housing bolt	10
Coolant pump-to-cylinder block bolt	15
Coolant recirculation pump-to-bracket bolt	5
Coolant recirculation pump line nut [2]	3
	5
Radiator fan shroud bolt	5
Radiator-to-lock carrier bolt	5
Thermostat housing-to-cylinder block bolt	15
Water connection-to-cylinder head bolt	10

[1] For bolt clarification, refer to ElsaWeb, *Cooling System Components Overview, Engine Side*, items 1, 2 and 17.

[2] For bolt clarification, refer to ElsaWeb, *Coolant Recirculation Pump Overview*, items 1 and 10.

Fuel Supply – 2.0L CRZA

Fastener Tightening Specifications

Component	Nm
Accelerator Pedal Position (APP) sensor with Accelerator Pedal Position 2 (APP2) sensor-to-body bolt	10
Air filter housing-to-Leak Detection Pump (LDP) bracket bolt	3
Evaporative Emission (EVAP) canister bolt	8
Fuel filler tube-to-body bolt	10
Fuel tank locking ring	110
Fuel tank securing strap-to-underbody bolt [1]	25
Leak Detection Pump (LDP)-to-Leak Detection Pump (LDP) bracket bolt	2
Leak Detection Pump (LDP) bracket-to-body nut	6

[1] Replace fastener(s).

Turbocharger, G-Charger – 2.0L CRZA

Fastener Tightening Specifications

Component	Nm
Bracket-to-Charge Air Cooler (CAC) bolt	5
Bracket-to-cylinder head nut [1) 3)]	30
Charge air pipe bolt	10
Charge air pipe clamp	5.5
Charge air pressure sensor-to-charge air pipe bolt	5
Connection-to-turbocharger bolt	9
Coolant return pipe bracket-to-cylinder head bolt	23
Coolant return pipe-to-turbocharger banjo bolt	35
Coolant return pipe-to-turbocharger bolt	9
Coolant supply pipe-to-cylinder block banjo bolt	35
Coolant supply pipe-to-cylinder block bolt	23
Coolant supply pipe-to-turbocharger banjo bolt	35
Heat shield/vent tube-to-turbocharger bolt	9
Oil return pipe-to-cylinder block bolt	9
Oil return pipe-to-turbocharger bolt	9
Oil supply pipe-to-cylinder block banjo bolt	30
Oil supply pipe-to-cylinder block bolt	9
Oil supply pipe-to-turbocharger banjo bolt	30
Oil supply pipe-to-turbocharger bolt	9
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
Support-to-cylinder block bolt [2)]	30
Support-to-turbocharger bolt [2)]	30
Turbocharger-to-cylinder head nut [1)]	20
Turbocharger recirculation valve-to-intermediate flange bolt	7
Wastegate bypass regulator valve banjo bolt-to-turbocharger	8
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).

Exhaust System – 2.0L CRZA

Fastener Tightening Specifications

Component	Nm
Clamping sleeve nut	23
Cross member-to-underbody bolt	25
Exhaust pipe with catalytic converter-to-exhaust manifold/turbocharger nut [1) 2)]	40
Oxygen Sensor (O2S)	55
Suspended mount-to-subframe bolt	25
Suspended mount-to-underbody bolt	25

1) Replace fastener(s).
2) Lubricate the stud bolts on the exhaust manifold/turbocharger with hot bolt paste (G 052 112 A3).

Multiport Fuel Injection – 2.0L CRZA

Technical Data

Engine code		CRZA
Idle check		
Idle speed [1)]	RPM	660 to 860
Engine Control Module (ECM)		
System designation		Motronic MED 9.1
Part number:		Refer to the Parts Catalog
Engine Speed (RPM) limitation	RPM	Approximately 6800

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

Fastener Tightening Specifications

Component	Nm
Adapter (VAS 6394/2)-to-fuel rail	22
Fuel pressure sensor-to-pressure sensor tester (VAS 6394/1)	22
Fuel pressure sensor-to-fuel rail [2)]	22
Fuel rail-to-intake manifold bolt	8
Heat shield-to-engine cover/upper air filter housing bolt	7
High pressure pipe bracket bolt	3
High pressure pipe union nut-to-high pressure pump	27
High pressure pipe union nut-to-threaded connection	27
High pressure pump-to-cylinder head bolt	10
Intake air temperature sensor-to-intake manifold bolt	5
Intake flap motor with intake manifold runner position sensor-to-intake manifold bolt	7
Intake manifold-to-cylinder head bolt/nut	10
Intake manifold stud bolt-to-cylinder head	10
Intake manifold support-to-cylinder block bolt	25
Intake manifold support-to-bonded rubber bushing nut	10
Low fuel pressure sensor-to-high pressure pump	15
Low pressure pipe bolt	5
Low pressure pipe union nut-to-pressure relief valve	22
Lower air filter housing-to-engine cover/upper air filter housing screw	3
Mass Air Flow (MAF) sensor-to-engine cover/upper air filter housing bolt	3
Pressure relief valve-to-fuel rail	30
Threaded connection-to-fuel rail	30
Threaded connection-to-high pressure pump [1)]	30
Throttle valve control module-to-intake manifold bolt	7
Vent line clamp-to-intake manifold bolt	3

1) Replace fastener(s).
2) Coat the threads with clean engine oil.

Ignition – 2.0L CRZA

Technical Data

Engine code	**CRZA**
Ignition sequence	1-3-4-2
Spark plugs	
VW/Audi	101 905 631 H
Electrode gap	0.7 to 0.8 mm
Tightening specification	25 Nm
Change intervals	Refer to the Maintenance Intervals, Rep. Gr. 03

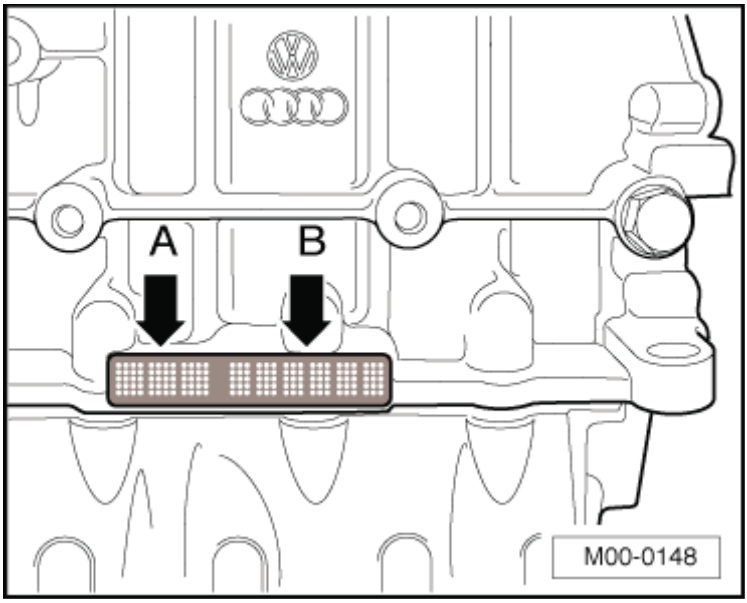
Fastener Tightening Specifications

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

ENGINE MECHANICAL – 2.5L CBTA, CBUA

General, Technical Data

Engine Number



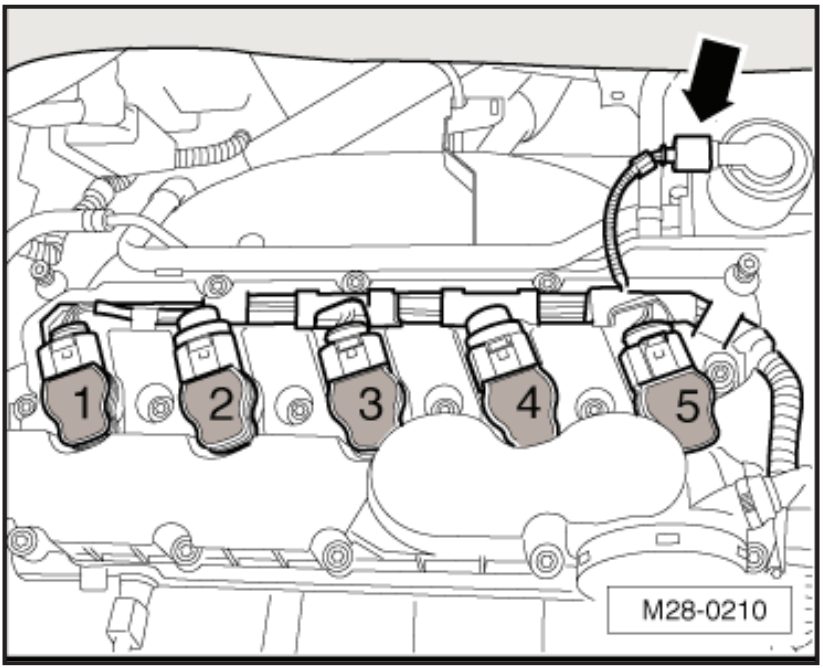
The engine code (A) and serial number (B) are located on the rear side of the engine, above the cylinder block/upper oil pan partition. In addition, a sticker with the engine code and serial number is applied to the cylinder head cover.

Engine Data

Engine code		CBTA	CBUA
Manufactured			
Rabbit from MY 2004		from 05.07	from 05.07
Golf from MY 2010		from 05.09	from 05.09
Emission values in accordance with			
Rabbit from MY 2004		ULEV 2 [1]	SULEV [2]
Golf from MY 2010		Tier2/BIN5 (US coalition)	SULEV [2]
Displacement	cm^3	2480	2480
Output	kW at RPM	125 @ 5700	125 @ 5700
Torque	Nm at RPM	240 @ 4250	240 @ 4250
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 [3]	95 unleaded [3]
Fuel injection, ignition		Motronic ME 7.1.1 [4]	Motronic ME 7.1.1 [4]
Engine idle speed		680 [5]	680 [5]
Engine speed (RPM) limitation		approximately 6300	approximately 6300
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, G-charger		No	No
Secondary Air Injection (AIR) system			
Rabbit from MY 2004		Yes	Yes
Golf from MY 2009		No	Yes

1) ULEV 2: Ultra Low Emission Vehicle 2.
2) SULEV: Super Ultra Low Emission Vehicle.
3) Unleaded RON 91 is permitted but performance is reduced.
4) From MY 2010 Motronic ME 17.5
5) Applies to manual and automatic transmissions. If the voltage supply for the Engine Control Module (ECM) drops below 12 volts, the idle speed gradually increases up to 780 RPM.

Cylinder Numbering



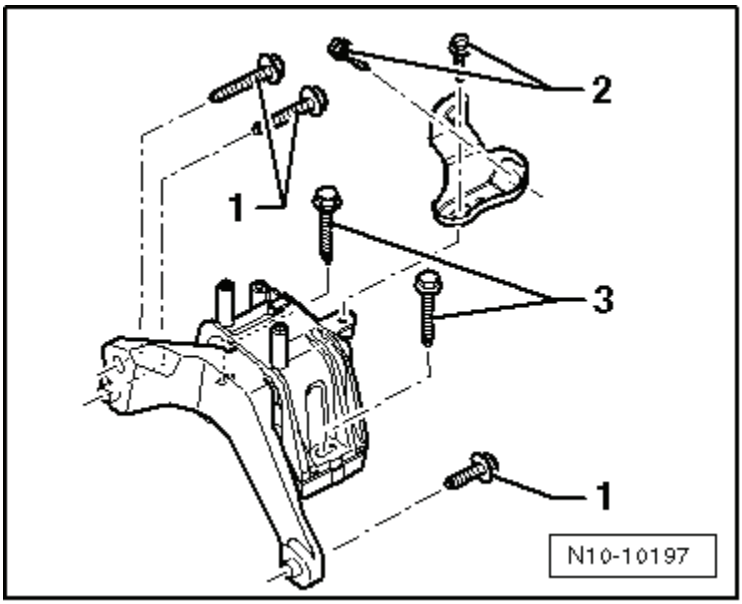
Ignition sequence	1 - 2 - 4 - 5 - 3

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

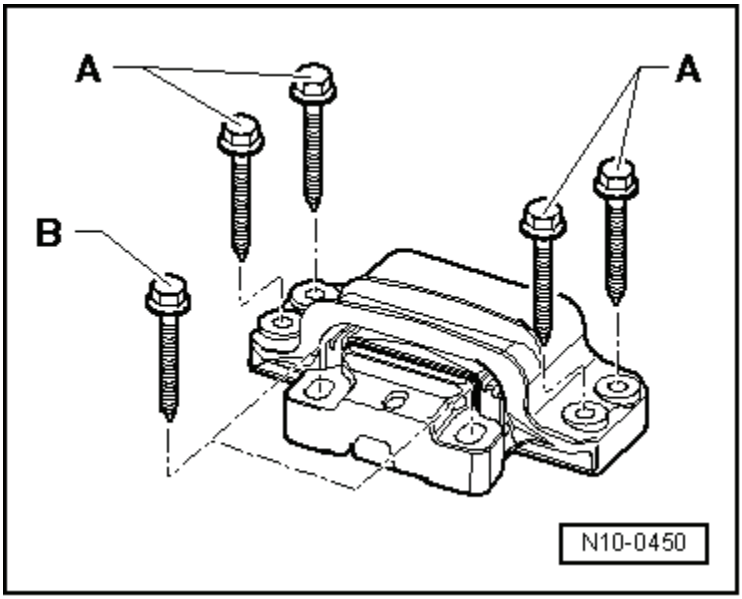
Engine Mount Tightening Specifications



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).

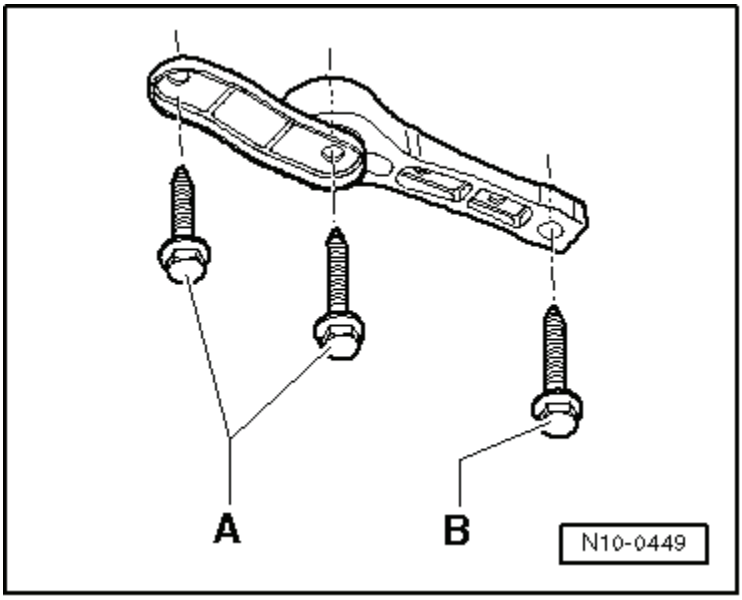
Transmission Mount Tightening Specifications



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

[1)] Replace fastener(s).

Pendulum Support Tightening Specifications



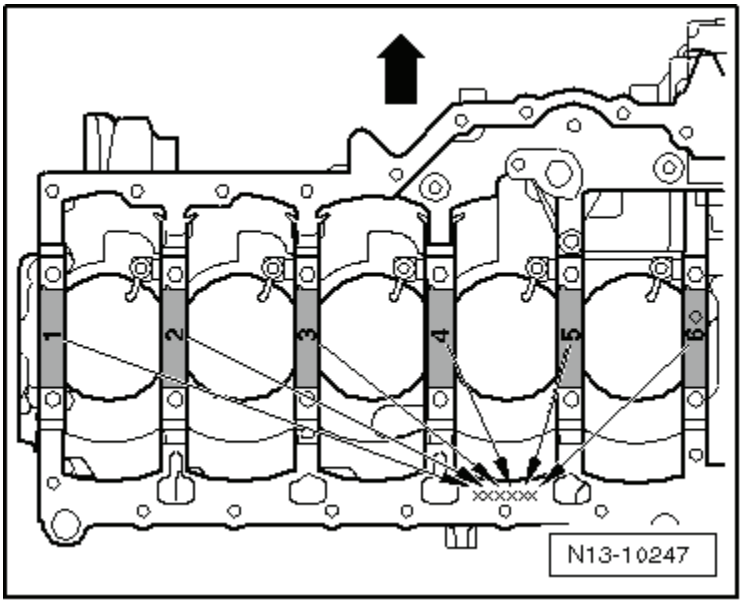
Secure the pendulum support to the transmission first and then to the subframe. To remove, first remove bolt B, then bolts A.

Component	Fastener size	Nm
Bolts A [1)]	8.8	40 plus an additional 90° (¼ turn)
	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

Crankshaft Upper Bearing Shell (for Cylinder Block) Allocation

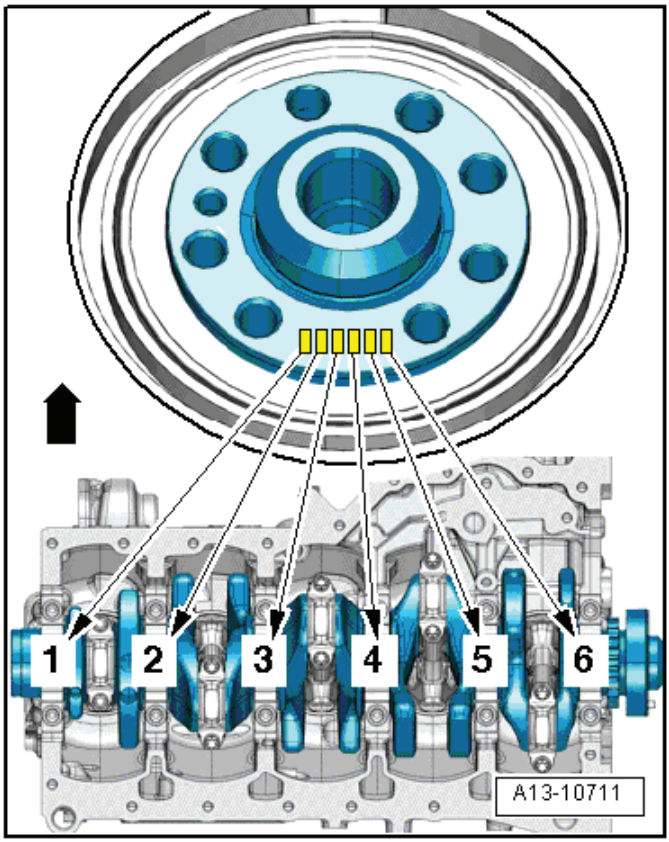


The upper bearing shells are allocated to the cylinder block with the correct thickness from the factory. Colored dots identify the bearing thicknesses. The letters marked on the lower sealing surface of the cylinder block identify which bearing thickness must be installed in which location.

Letter on cylinder block	Colored dot on bearing shell
G	Yellow
B	Blue
R	Red

NOTE: The ➡ points in direction of travel. If the colored dot is not visible, use the blue bearing shell.

Crankshaft Lower Bearing Shell (for Bearing Cap) Allocation



Bearing shells with the correct thickness are allocated to the bearing cap at the factory. Colored dots on the sides of the bearing shells identify bearing shell thickness. The allocation of the bearing shell for the bearing cap is identified by a series of letters on the crankshaft/ vibration damper pulley flange. The first letter of the row of letters represents bearing “1”, the second letter is for bearing “2”, etc.

Letter on crankshaft/vibration damper pulley flange	Colored dot on bearing shell
R	Red
G	Yellow
B	Blue
W	White

NOTE: ➡ points in direction of travel.

Fastener Tightening Specifications

Component	Nm
Accessory bracket-to-cylinder block bolt	25
Air conditioning compressor-to-accessory bracket bolt	25
Air conditioning compressor ribbed belt tensioner-to-accessory bracket bolt	35
Axial bearing disc-to-cylinder block bolt	10
Belt tensioner to accessory bracket	35
Bracket-to-cylinder block bolt	25
Brake booster vacuum pump-to-control housing cover bolt	10
Connecting rod bearing cap-to-connecting rod bolt [1) 4)]	30 plus an additional 90° (¼ turn)
Control housing cover-to-cylinder block bolt	25
Coolant pipe bolt/nut	10
Coolant pump-to-cylinder block bolt	10
Cover plate to cylinder block bolt	10
Crankshaft bearing cap-to-cylinder block bolt [1)]	40 plus an additional 90° (¼ turn)
Crankshaft/vibration damper pulley-to-crankshaft bolt [1) 2)]	50 plus an additional 90° (¼ turn)
Cylinder block locking bolt	45
Double chain sprocket (drive wheel)-to-cylinder block bolt [1)]	60 plus an additional 90° (¼ turn)
Drive plate/flywheel-to-crankshaft bolt [1)]	60 plus an additional 90° (¼ turn)
Engine mount-to-accessory bracket bolt	40 plus an additional 90° (¼ turn)
Engine Speed (RPM) sensor-to-control housing cover bolt	5
Exhaust camshaft sprocket-to-camshaft bolt [1)]	60 plus an additional 90° (¼ turn)
Generator and coolant pump ribbed belt tensioner-to-accessory bracket bolt	35
Intake camshaft adjuster-to-camshaft bolt [1)]	60 plus an additional 90° (¼ turn)
Intake manifold support/oil dipstick guide tube-to-cylinder block bolt	25

Component	Nm
Knock Sensor (KS)-to-cylinder block bolt [3]	20
Lower idler pulley with bracket-to-accessory bracket bolt	25
Oil filter bracket-to-cylinder block bolt	25
Oil pump drive chain tensioner-to-cylinder block bolt	10
Oil pump sprocket-to-oil pump bolt [1]	20 plus an additional 90° (¼ turn)
Pressure relief valve	27
Sealing flange-to-cylinder block bolt	10
Shield-to-cylinder block bolt	10
Tensioning rail pin-to-cylinder block	40
Thermostat housing-to-cylinder block bolt	10
Timing chain tensioner-to-cylinder head bolt	10
Upper idler pulley with bracket-to-accessory bracket bolt	8

1) Replace fastener(s).
2) Only use a strength category 10.9 bolt.
3) Tightening specifications affect the function of the Knock Sensor (KS).
4) Lubricate the threads and contact surface.

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	-0.02	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.

Fastener Tightening Specifications *(cont'd)*

Piston Ring End Gap

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

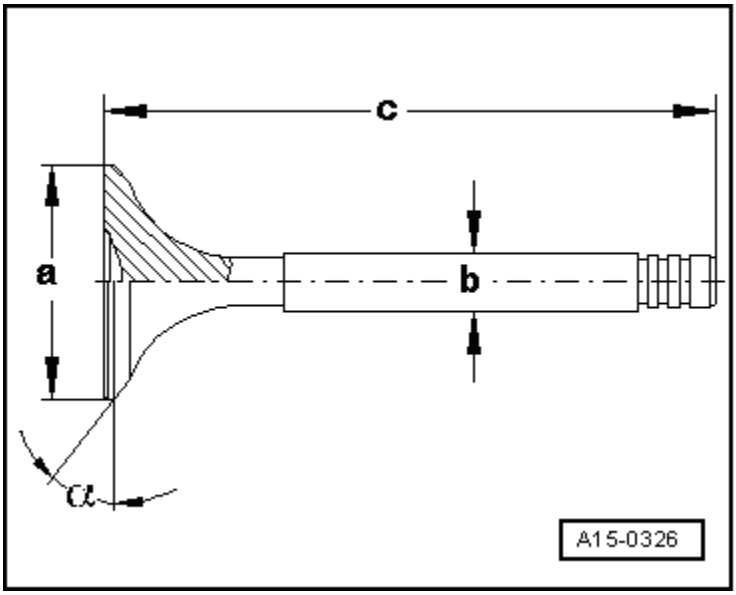
Cylinder Head, Valvetrain – 2.5L CBTA, CBUA

Fastener Tightening Specifications

Component	Nm
Axial bearing disc-to-cylinder block bolt	10
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
Camshaft timing chain tensioner-to-cylinder head bolt	10
Cap-to-cylinder head bolt	10
Chain compartment cover-to-cylinder head bolt	10
Coolant distribution housing-to-chain compartment cover bolt	10
Coolant pipe-to-bracket bolt	10
Double sprocket-to-gear shaft bolt [1)]	60 plus an additional 90° (¼ turn)
Exhaust camshaft sprocket-to-camshaft bolt [1)]	60 plus an additional 90° (¼ turn)
Guide frame-to-cylinder head bolt [1) 2)]	8 plus an additional 90° (¼ turn)
Intake camshaft adjuster-to-camshaft bolt [1)]	60 plus an additional 90° (¼ turn)
Locking bolt to cylinder block	30
Oil pump sprocket-to-oil pump bolt	20 plus an additional 90° (¼ turn)
Oil pump timing chain tensioner-to-cylinder head bolt	10
Secondary Air Injection (AIR) pipe-to-cylinder head bolt	10
Transport strap-to-cylinder head bolt	25
Wire bracket-to-chain compartment cover bolt	10
Wire bracket-to-cylinder head bolt	10

1) Replace fastener(s).
2) Tighten the bolts working from the inside toward the outside in several stages.

Valve Dimensions

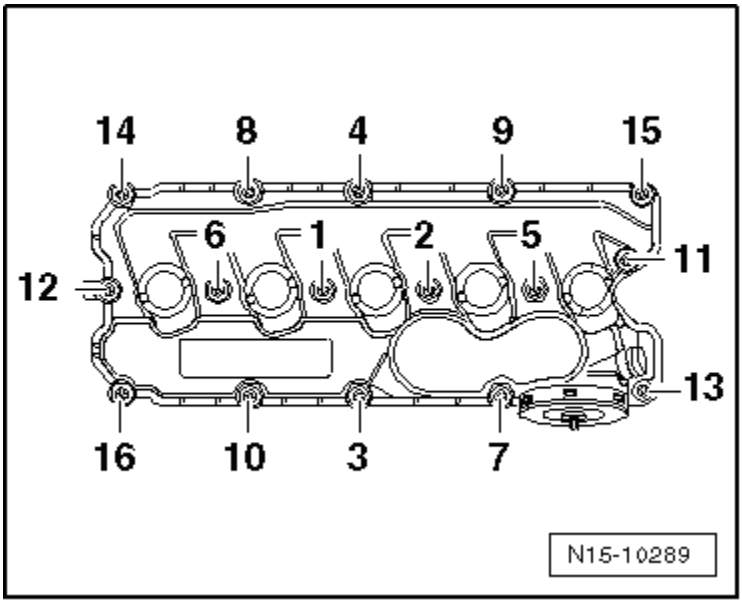


Dimension		Intake valve	Exhaust valve
Diameter a	mm	26.80 to 27.00	29.80 to 30.00
Diameter b	mm	5.95 to 5.97	5.94 to 5.95
c	mm	104.84 to 105.34	103.64 to 104.14
α	∠°	45	45

Compression Pressures

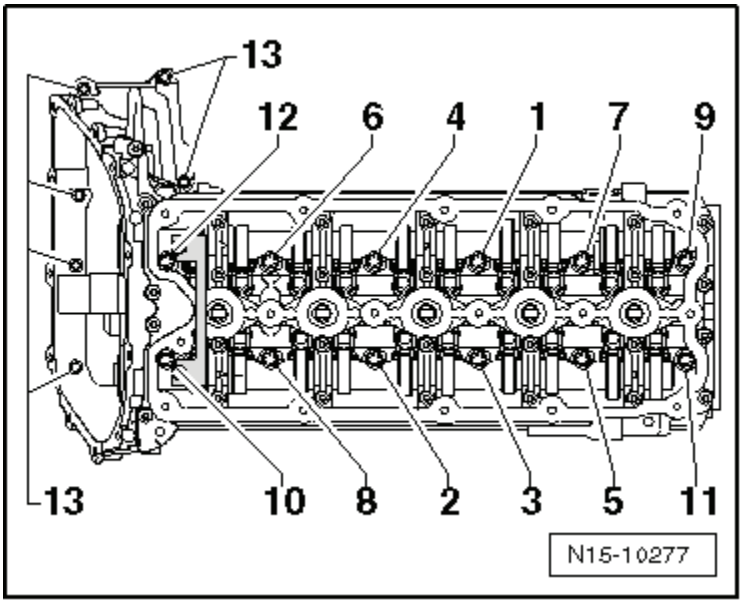
New Bar positive pressure	Wear limit Bar positive pressure	Difference between cylinders Bar positive pressure
9.0 to 13.0	8.0	Max. 3.0

Cylinder Head Cover Tightening Specification



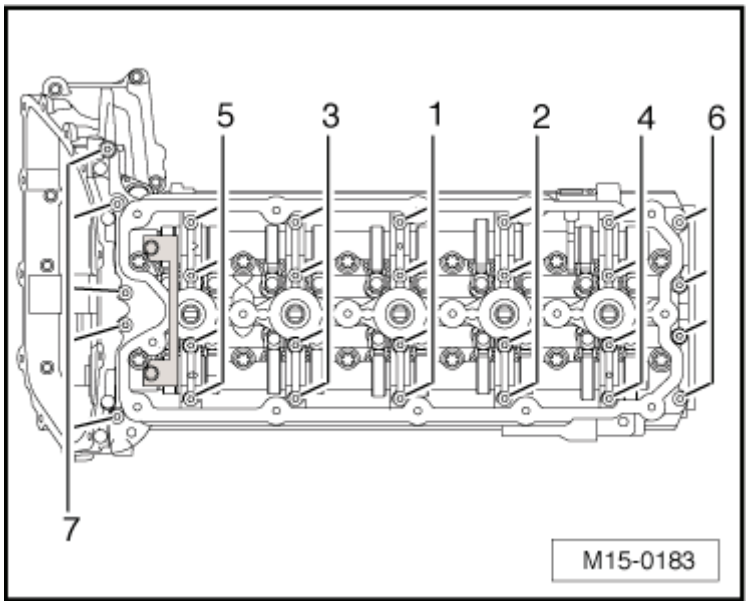
Step	Component	Nm
1	Tighten bolts 1 through 16 in sequence	10

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 7 in sequence [1)]	8
2	Tighten bolts 1 through 7 in sequence	an additional 90° (¼ turn)

[1)] Replace fastener(s).

Lubrication – 2.5L CBTA, CBUA

Fastener Tightening Specifications

Component	Nm
Cylinder block locking bolt	45
Intake manifold support/oil dipstick guide tube-to-cylinder block bolt	25
Lower oil pan-to-upper oil pan bolt	10
Oil cooler-to-oil filter bracket bolt	25
Oil filter bracket-to-cylinder block bolt	25
Oil filter housing-to-oil filter bracket	25
Oil intake pipe decoupling element-to-upper oil pan bolt	10
Oil intake pipe-to-oil pump bolt	10
Oil pan drain plug [1)]	30
Oil pressure switch-to-oil filter bracket	20
Oil pump align plate (T03005)-to-crankshaft bolt	30
Oil pump-to-cylinder block bolt	25
Oil pump sprocket-to-oil pump bolt [1)]	20 plus an additional 90° (¼ turn)
Upper oil pan-to-cylinder block bolt	25

[1)] Replace fastener(s).

Cooling System – 2.5L CBTA, CBUA

Fastener Tightening Specifications

Component	Nm
Connecting piece-to-coolant thermostat housing bolt	5
Coolant distribution housing-to-chain compartment cover nut	10
Coolant fan shroud nut	5
Coolant pipe bolt/nut	10
Coolant pipe-to-coolant distribution housing nut	10
Coolant pump-to-cylinder block bolt	10
Coolant thermostat housing-to-cylinder block bolt	25
Expansion tank-to-body bolt	3
Front coolant pipe-to-accessory bracket bolt	10
Oil filter bracket-to-cylinder block bolt	25
Radiator bracket-to-radiator bolt	5
Radiator fan shroud bolt	5
Rear coolant pipe bolt/nut	10

Fuel Supply – 2.5L CBTA, CBUA

Fastener Tightening Specifications

Component	Nm
Accelerator pedal module-to-body bolt	10
Air filter housing-to-Leak Detection Pump (LDP)/air filter housing bracket bolt	4
Evaporative emission canister-to-body bolt	8
Fuel filter bracket bolt	3
Fuel tank-to-body bolt [1)]	25
Fuel tank filler tube-to-body bolt	10
Fuel tank securing strap-to-body bolt [1)]	25
Leak Detection Pump (LDP)/air filter housing bracket-to-body nut	6
Leak Detection Pump (LDP) bracket bolt	4
Leak Detection Pump (LDP) bracket-to-Leak Detection Pump (LDP)/air filter housing bracket bolt	8
Locking ring	110

[1)] Replace fastener(s).

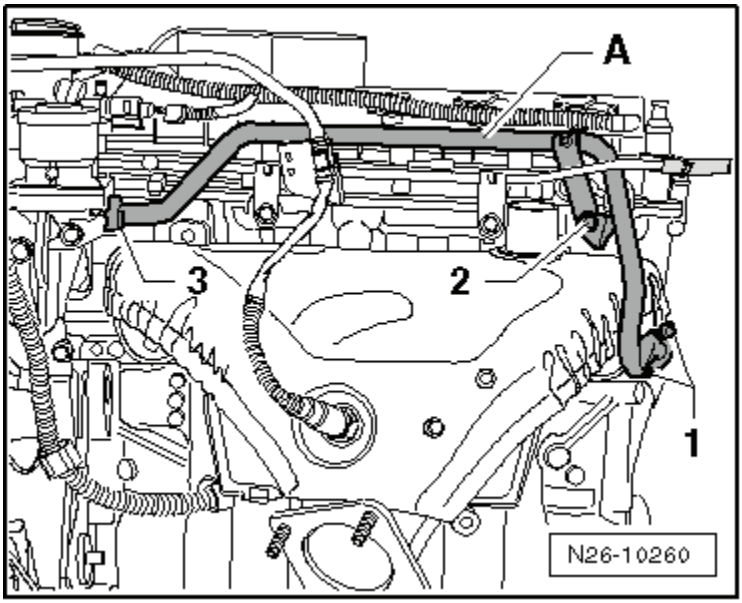
Exhaust System, Emission Controls – 2.5L CBTA, CBUA

Fastener Tightening Specifications

Component	Nm
Clamp nut	25
Exhaust manifold-to-cylinder head nut [1)]	25
Front cross member-to-underbody nut	23
Front exhaust pipe with catalytic converter-to-exhaust manifold nut [1)]	25
Heat shield-to-exhaust manifold bolt	10
Heat shield-to-front exhaust pipe with catalytic converter	
- Front bolts	10
- Rear bolts	5
Intake manifold support-to-cylinder block bolt	25
Intake manifold support-to-Secondary Air Injection (AIR) pump motor bushing nut	10
Oxygen Sensor (O2S)	55
Secondary Air Injection (AIR) sensor 1-to-pressure tube bolt	2
Secondary Air Injection (AIR) solenoid valve-to-cylinder head bolt	10
Suspended mount-to-subframe bolt	25
Suspended mount-to-underbody bolt	25

[1)] Replace fastener(s).

Secondary Air Injection Pipe Tightening Specifications



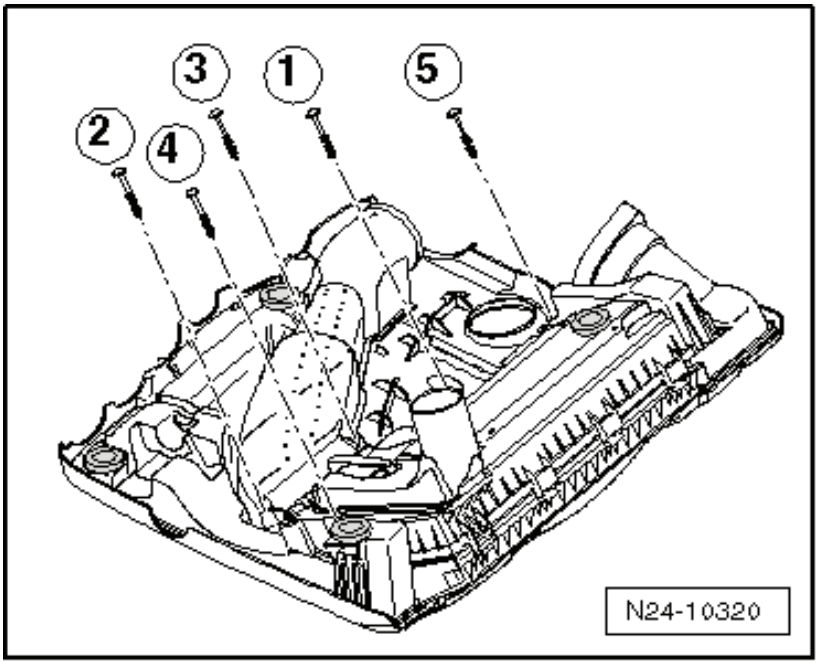
Step	Component	Nm
1	Tighten bolts 1 through 3 in sequence	Hand-tighten
2	Tighten bolts 1 through 3 in sequence	10

Multiport Fuel Injection – 2.5L CBTA, CBUA

Fastener Tightening Specifications

Component	Nm
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
Intake tube-to-lock carrier bolt	1.5
Manifold Absolute Pressure (MAP) sensor-to-intake manifold bolt	3.5
Mass Air Flow (MAF) sensor with Intake Air Temperature (IAT) sensor-to-intake tube bolt	3
Oil dipstick guide tube-to-cylinder block bolt	25
Oxygen Sensor (O2S)	55
Throttle valve control module-to-intake manifold bolt	6.5
Transport strap-to-cylinder head bolt	25

Lower Air Filter Housing Bolt Tightening Specifications



Component	Nm
Tighten bolts 1 through 5 in sequence	2

Ignition – 2.5L CBTA, CBUA

Fastener Tightening Specifications

Component	Nm
Camshaft Position (CMP) sensor bolt	10
Knock Sensor (KS) bolt [1)]	20
Spark plug	25

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

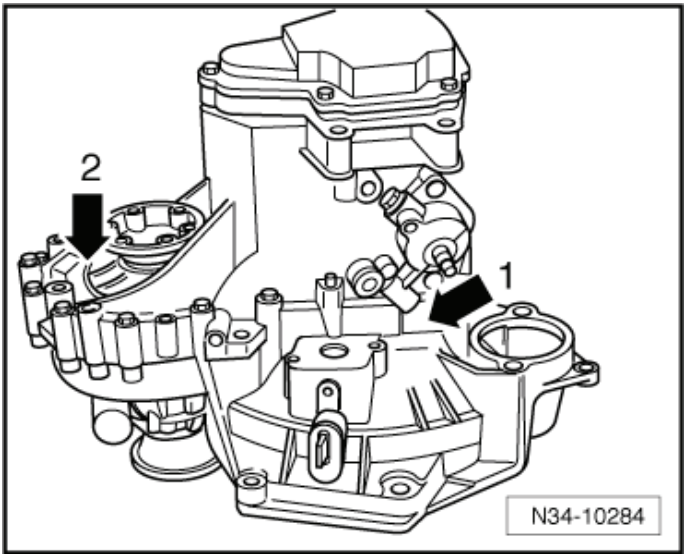
Technical Data

Engine codes	BGP, BGQ 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

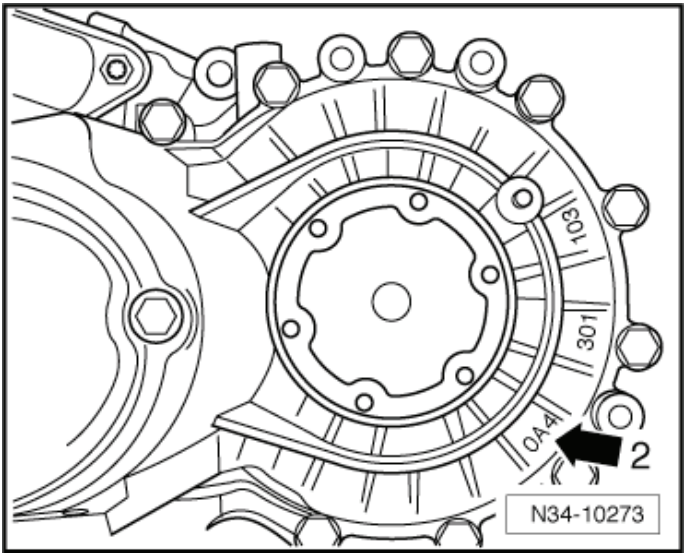
MANUAL TRANSMISSION – 0A4

General, Technical Data

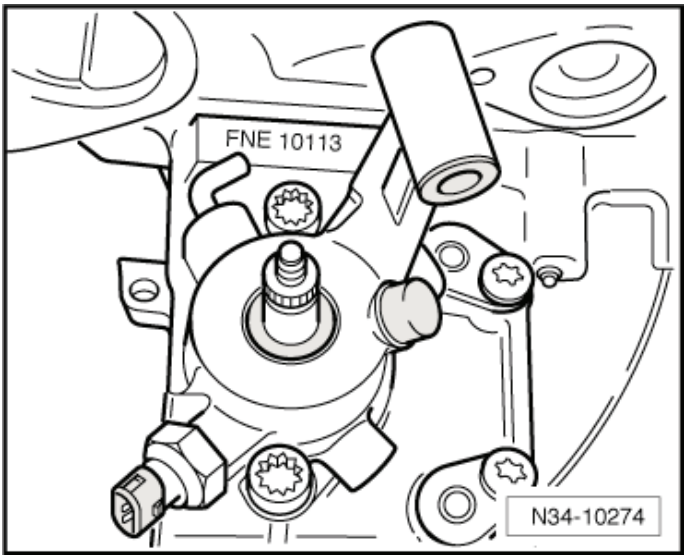
Transmission Identification



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 (0A4)**		
Identification codes		KCD	KPF	LEA
Manufactured	from through	08.09 09.09	08.09 05.10	05.10
Allocation	Engine	2.5L - 125 kW	2.5L - 125 kW	2.5L - 125 kW
Ratio Z_1:Z_2	Final drive	62:17 = 3.647	61:18 = 3.778	61:18 = 3.778
Manual transmission capacity (transmission completely disassembled)		Refer to the Fluid Capacity Tables, Rep. Gr. 03		
Manual transmission capacity (transmission partly disassembled)		Refer to the Fluid Capacity Tables, Rep. Gr. 03		
Drive axle flange diameter		100 mm	100 mm	100 mm

Refer to the Electronic Parts Catalog (ETKA) for the following:
- Individual gear ratios
- Transmission fluid specifications
- Clutch disc and pressure plate allocation

Clutch – 0A4

Fastener Tightening Specifications

Component	Fastener size	Nm
Ball stud-to-transmission	-	25
Clutch pedal 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		
- Secured with two bolts	-	10
- Secured with one bolt	-	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.

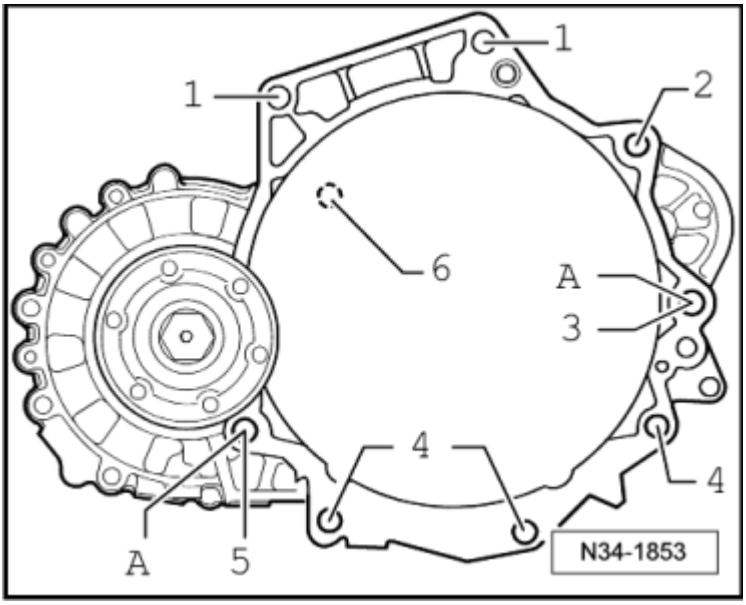
Controls, Housing – 0A4

Fastener Tightening Specifications

Component	Fastener size	Nm
5th gear drive gear-to-output shaft bolt	-	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
Flange shaft bolt	-	25
Gear shift unit with selector cover-to-transmission housing bolt	-	25
Oil drain plug-to-clutch housing	-	35
Oil fill plug-to-transmission housing	-	35
Output shaft bearing mount-to-clutch housing nut [1]	-	25 plus an additional 90° (¼ turn)
Sealing cap-to-transmission housing bolt	-	25
Reverse gear selector fork-to-clutch housing bolt	-	25
Selector bracket-to-pin bolt [2]	-	5
Shift housing-to-body nut	M6	8
	M8	25
Shift lever guide cover-to-shift housing bolt [2]	-	5
Shift lever-to-shift unit nut [1]	-	23
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

[1] Replace fastener(s).
[2] For shift levers and housings through 10.06.

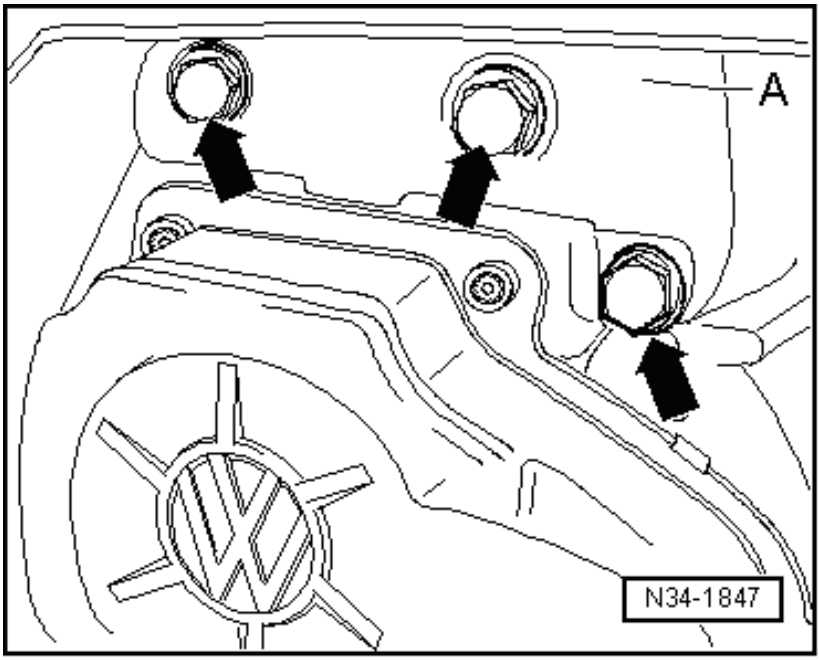
Transmission to Engine Tightening Specifications



Item	Bolt	Quantity	Nm
1	M12 x 65	2	80
2	M12 x 170 [1)]	1	80
3	M12 x 170 [1)]	1	80
4	M10 x 65	3	40
5	M12 x 95	1	80
6	M6 x 8 [2)]	1	10

[1)] Also for the starter to transmission.
[2)] Small flywheel cover plate (not present here).

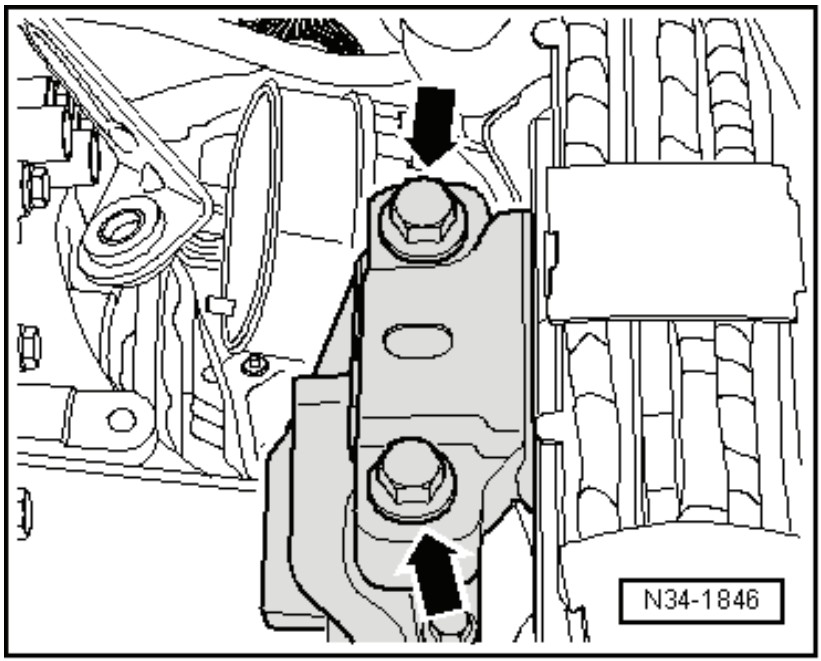
Transmission Mount Bracket to Transmission Bolt Tightening Specification



Step	Component	Nm
1	Tighten bolts [1] ➡	Hand-tighten
2	Tighten bolts ➡	40 plus an additional 90° (¼ turn)

[1] Replace fastener(s).

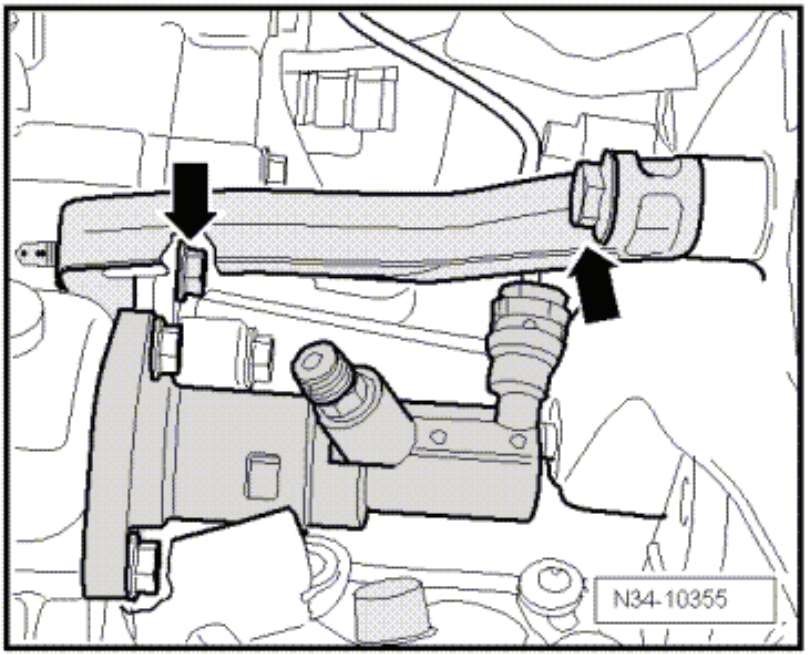
Transmission Mount to Transmission Mount Bracket Bolt Tightening Specification



Step	Component	Nm
1	Tighten bolts [1] ➡	Hand-tighten
2	Tighten bolts ➡	60 plus an additional 90° (¼ turn)

[1] Replace fastener(s).

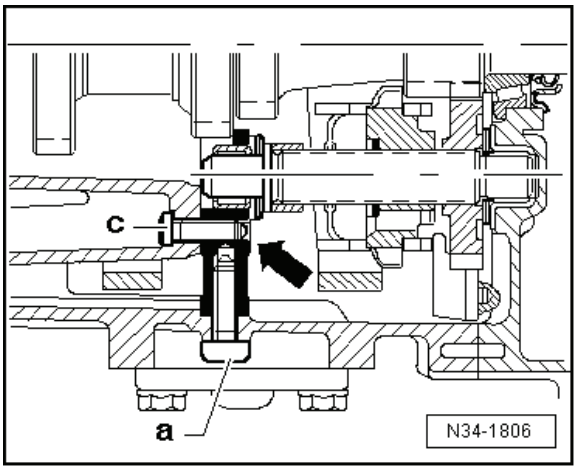
Transmission Support to Transmission Bracket and Transmission Bolt Tightening Specification



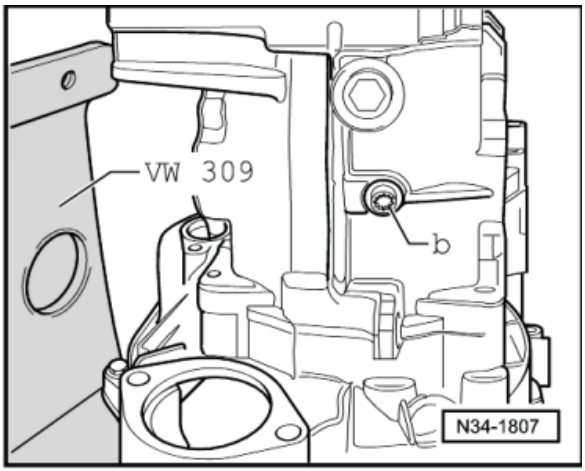
Step	Component	Nm
1	Tighten bolts [1] ➡	Hand-tighten
2	Tighten bolts ➡	20 plus an additional 90° (¼ turn)

[1] Replace fastener(s).

Reverse Shaft Support to Transmission Housing Bolt Tightening Sequence and Specification



Step	Component	Nm
1	Tighten bolt a ➡	30
2	Tighten bolt b (lower illustration	20
3	Tighten bolt c	25



Gears, Shafts – 0A4

Fastener Tightening Specification

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)	**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
0.900 to 0.924 0.925 to 0.949 0.950 to 0.974	0.875 0.900 0.925
0.975 to 0.999 1.000 to 1.024 1.025 to 1.049	0.950 0.975 1.000
1.050 to 1.074 1.075 to 1.099 1.100 to 1.124	1.025 1.050 1.075
1.125 to 1.149 1.150 to 1.174 1.175 to 1.199	1.100 1.125 1.150
1.200 to 1.224 1.225 to 1.249 1.250 to 1.274	1.175 1.200 1.225

Bearing play	Adjusting shim
Measured value (mm)	Thickness (mm)
1.275 to 1.229 1.300 to 1.324 1.325 to 1.349	1.250 1.275 1.300
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.

Using VW 447 I, remove the input shaft and the outer race/ tapered roller bearing from the transmission housing.

Install the shim with the correct thickness, thickest shim first.

If the measured shim thickness is larger than those listed in the table, then install two shims that add up to the necessary thickness.

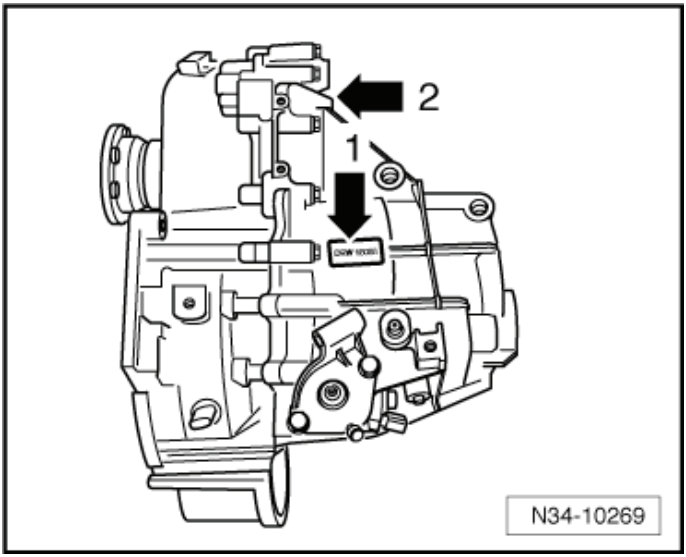
Using VW 510, press the outer race/tapered roller bearing and the selected shim (1.175 mm in the example) into the transmission housing using the.

Assemble the transmission housing and tighten the bolts to 25 Nm plus an additional 90° (¼ turn).

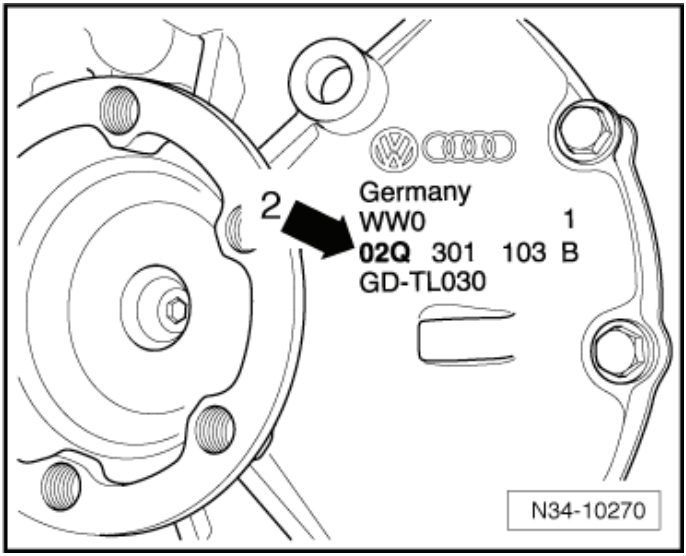
MANUAL TRANSMISSION – 02Q

General, Technical Data

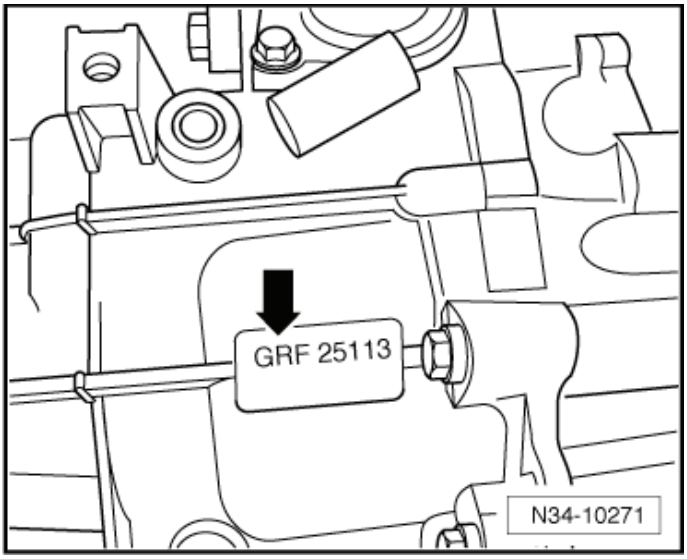
Transmission Identification



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



Manual transmission 02Q (2).



Transmission code letters and build date (➡).

Example:

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

Codes Letters, Transmission Allocation and Capacities

Manual transmission		**6 Speed Transmission (02Q)**	
Identification codes		LHD	NFP
Manufactured	from through	05.09 05.11	05.11
Allocation	Engine	2.0L - 103 kW turbo diesel	2.0L - 103 kW turbo diesel
Ratio: Z_2: Z_1	Final drive I [1)]	69:20 = 3.450	69:20 = 3.450
	Final drive II [2)]	69:25 = 2.760	69:25 = 2.760
Capacities for the manual transmission		Refer to the Fluid Capacity Tables Rep. Gr. 03	
Drive axle flange diameter		107 mm	107 mm

1) Final drive for 1st through 4th gear.
2) Final drive for 5th gear, 6th gear and reverse gear.

Refer to the Electronic Parts Catalog (ETKA) for the following:
- Individual gear ratios
- Transmission fluid specifications
- Clutch disc and pressure plate allocation

Clutch – 02Q

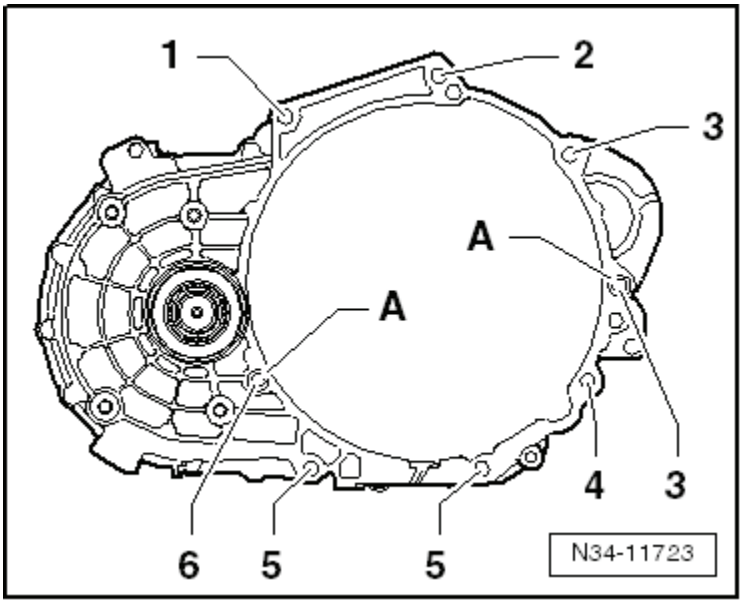
Fastener Tightening Specifications

Component	Fastener size	Nm
Clutch pedal mounting bracket-to-cross panel nut [1]	-	25
Clutch pedal-to-mounting bracket through bolt nut [1]	-	25
Impact bolster support to steering column bracket bolt [1]		
- Secured with one bolt	-	20
- Secured with two bolts	-	10
Pressure plate-to-dual mass flywheel bolt [2]	M6	13
	M7	20
Slave cylinder with release bearing-to-transmission bolt [1]		
- Slave cylinder with metal housing (without locking fluid)	-	12
- Slave cylinder with plastic housing (with locking fluid)	-	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

Transmission to Engine Tightening Specifications



Item	Bolt	Quantity	Nm
1	M12 x 55 With a long M8 threaded pin	1	80
2	M12 x 55 With a short M8 threaded pin or M12 x 50 Without threaded pin	1	80
3	M12 x 165 With an M8 threaded pin Also starter to transmission	2	80
4	M10 x 105	1	40
5	M10 x 50	2	40
6	M12 x 70 or M12 x 65	1	80
-	M6 x 8 Small flywheel cover plate (not present on all engines)	1	10

Front Wheel Drive Fastener Tightening Specifications

Component	Fastener size	Nm
Backup lamp switch-to-transmission housing	-	20

Fastener Tightening Specifications *(cont'd)*

Component	Fastener size	Nm
Cable mounting bracket-to-transmission bolt/nut	-	20
Gear shift 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		
- Round head socket bolt = "to transmission build date 6 December 2006" [1)]	M8 aluminum	8 plus an additional 90° (¼ turn)
- Round head socket bolt = "from transmission build date 7 December 2006" [1)]	M9 aluminum	15 plus an additional 180° (½ turn)
- Hex head steel bolt [1)]	-	15 plus an additional 90° (¼ turn)
Transmission mount-to-transmission mount bracket [1)]	-	60 plus an additional 90° (¼ turn)
Transmission mount bracket-to-transmission [1)]	-	60 plus an additional 90° (¼ turn)
Transmission Shift Lever to Shift Unit Nut [1)]	-	23

[1)] Replace fastener(s).

Adjustment Shim Table

Thickness in (mm)		
1.45	1.75	2.05
1.50	1.80	2.10
1.55	1.85	2.15
1.60	1.90	2.20
1.65	1.95	2.25
1.70	2.00	

Tolerance variations make it possible to find the exact shim thickness required. For the shim part number, refer to the Parts Catalog.

Rear Final Drive, Differential – 02Q

Fastener Tightening Specifications

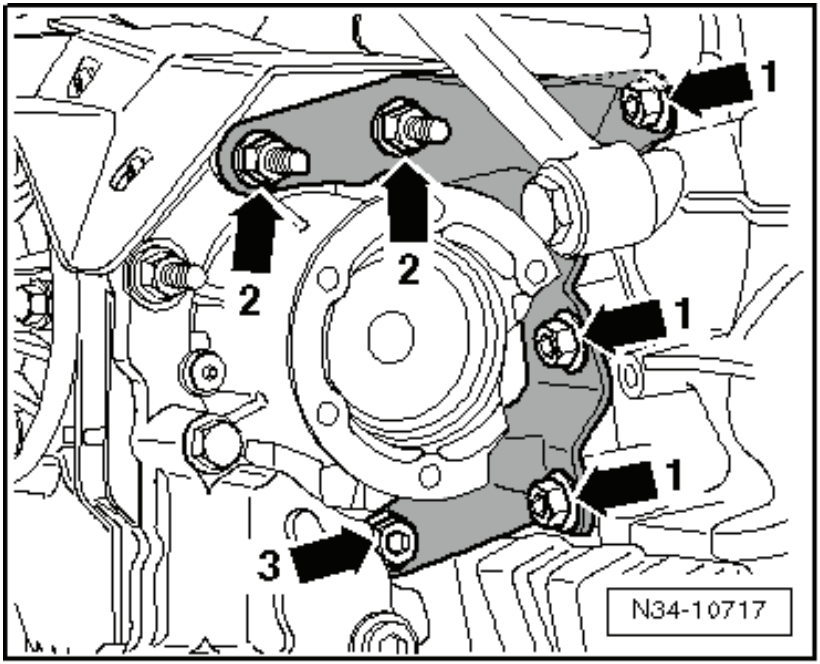
Component	Fastener Size	Nm
Flange shaft to threaded piece bolt	-	33

All Wheel Drive Fastener Tightening Specifications

Component	Fastener size	Nm
Backup lamp switch-to-transmission housing	-	20
Bevel box-to-clutch housing 1)	-	40 plus an additional 90° (¼ turn)
Bevel box-to-transmission 1)	-	40 plus an additional 45° (⅛ turn)
Cable mounting bracket-to-transmission bolt/nut	-	20
Gear shift unit-to-transmission housing bolt 1)	-	20
Heat shield/driveshaft-to-bevel box	-	25
Locking bolt to transmission housing	-	45
Oil fill or drain plug		
- Multipoint socket head	-	45
- Hex socket head	-	30
Right head shield/driveshaft to bevel gear	-	20
Shift housing to body nut	M6	8
	M8	25
Transmission fluid fill plug 1)	-	15
Transmission housing-to-clutch housing bolt 1)	-	15 plus an additional 90° (¼ turn)
Transmission shift lever-to-shift unit nut 1)	-	23

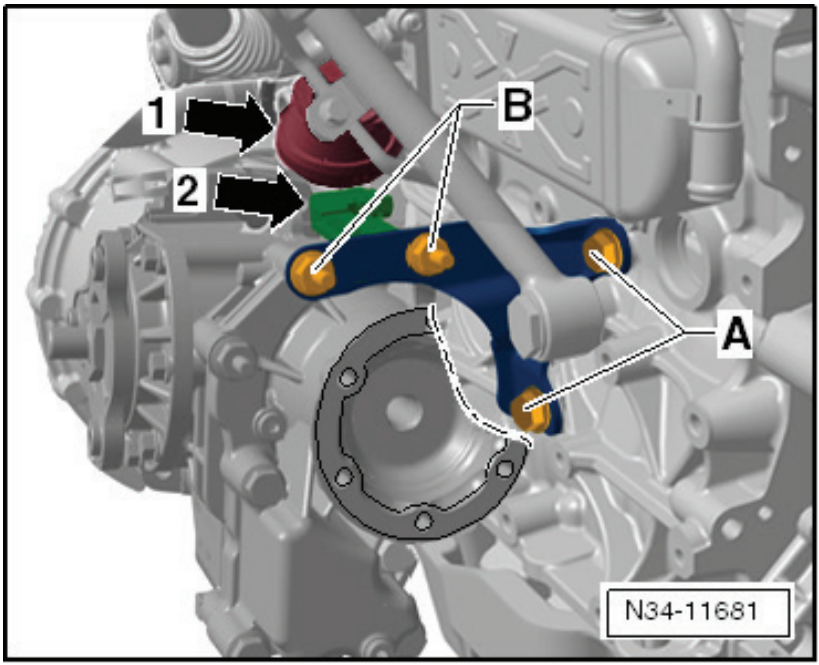
1) Replace fastener(s).

Transmission Mount



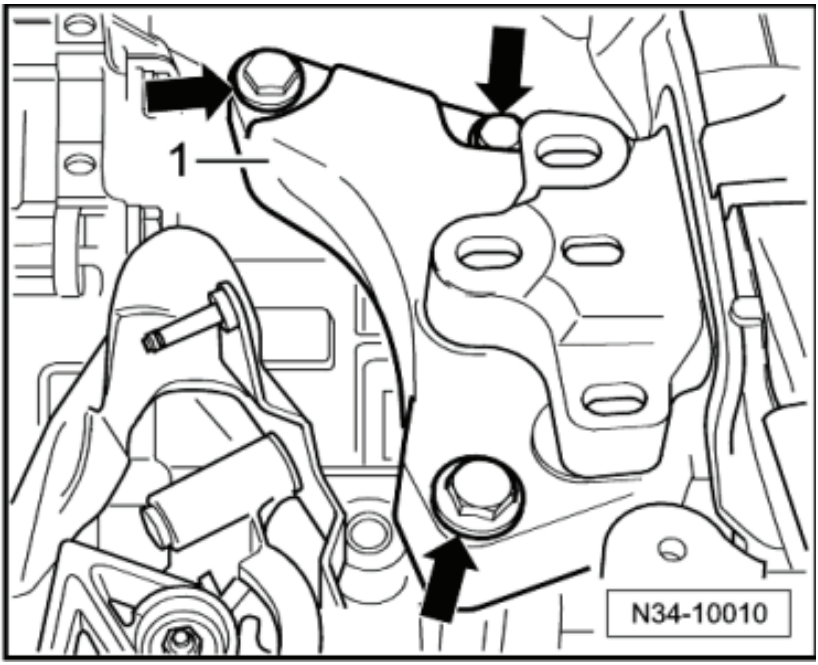
Item	Bolt	Quantity
1	M10 x 21	3
2	M10 x 45	2
3	M10 x 62	1

Brace under Diaphragm



Item	Bolt	Quantity
A	M10 x 21	2
B	M10 x 45	1
Step	**Component**	**Nm**
1	Tighten all bolts	Hand-tighten
2	Tighten bolts A	40
3	Tighten bolts B	40

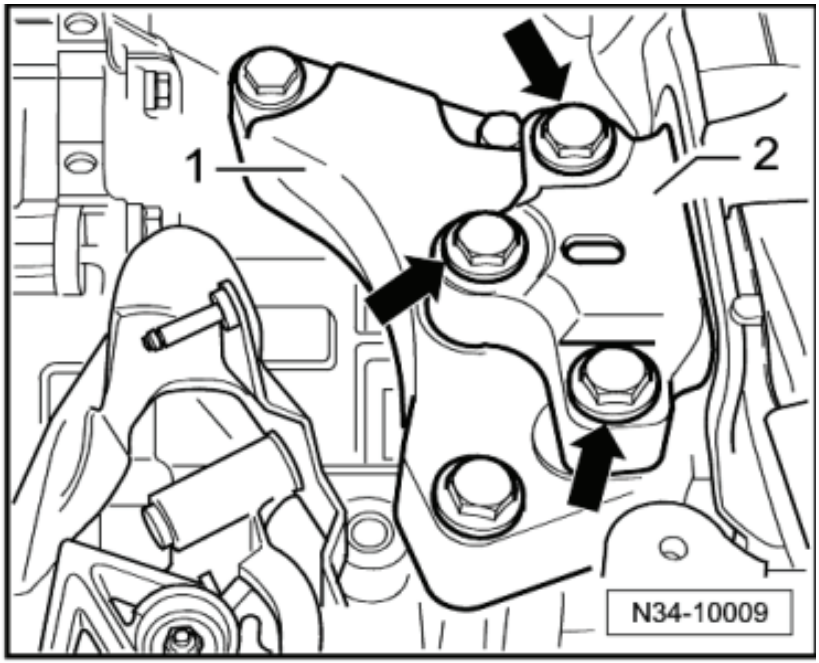
Transmission Bracket to Transmission



Tighten bolts ➡	60 plus an additional 90° (¼ turn)

1) Replace fastener(s).

Identification on Transmission



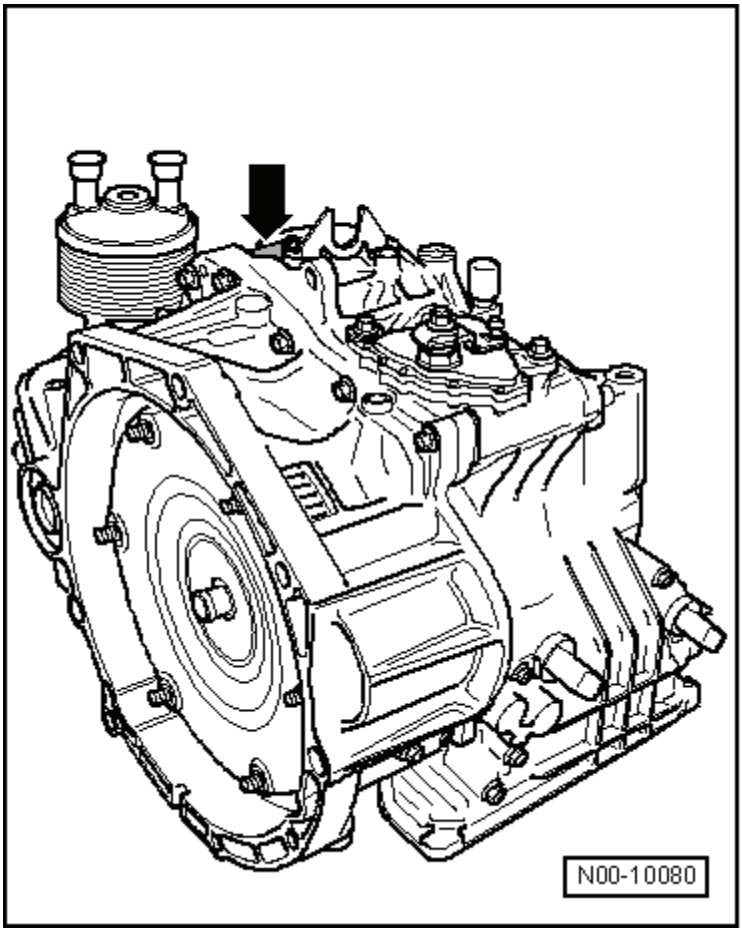
Tighten bolts ➡	60 plus an additional 90° (¼ turn)

1) Replace fastener(s).

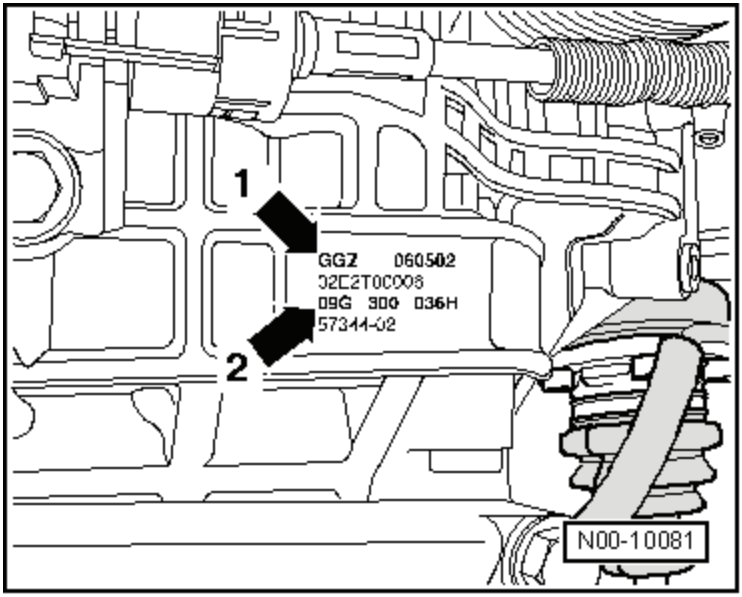
AUTOMATIC TRANSMISSION – 09G

General, Technical Data

Identification on Transmission



Code letters (➡).



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

Example:

GGZ	08	05	02
Identification codes	Day	Month	Year (2002) of manufacture

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

Code Letters, Assembly Allocation and Ratios

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

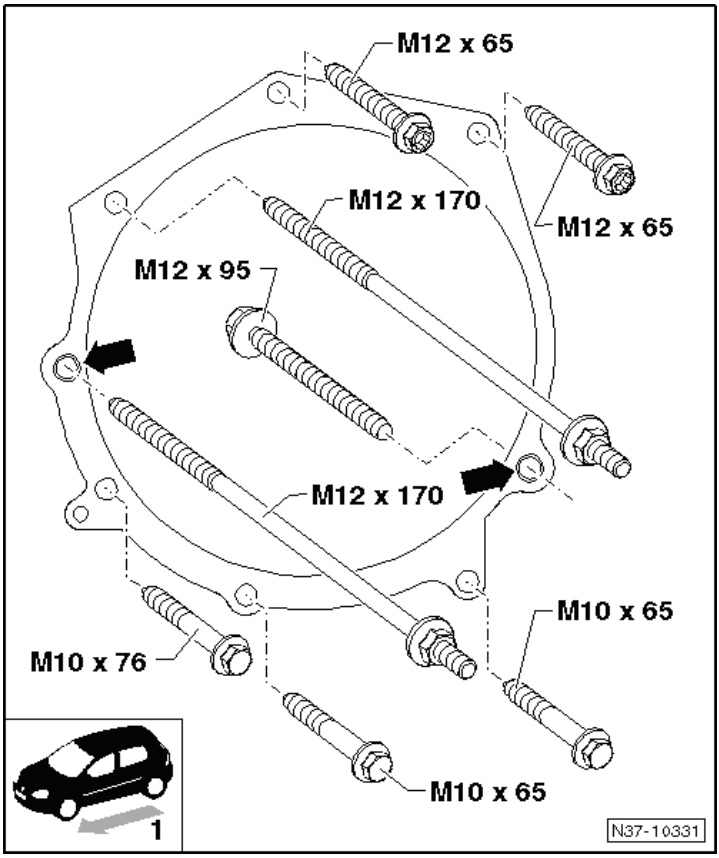
Automatic transmission 09G	
Identification codes	KGL and MAN
Engine	2.5L -125 kW

Controls, Housing

Fastener Tightening Specifications

Component	Nm
Inspection plug-to-transmission oil pan	27
Multifunction transmission range switch-to-shift rod nut	7
Multifunction transmission range switch-to-transmission bolt	6
Selector lever-to-selector shaft nut	13
Selector housing-to-body nut	8
Selector lever cable adjustment bolt	15
Selector lever and selector mechanism with selector lever cable-to-body bolt	8
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)

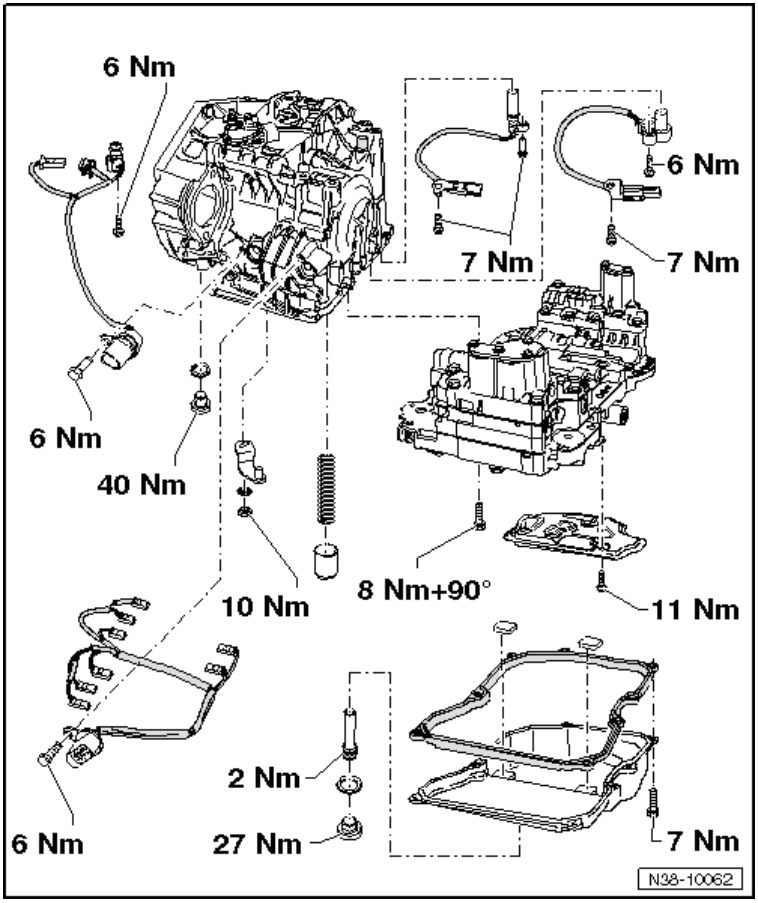
Transmission to Engine Tightening Specifications



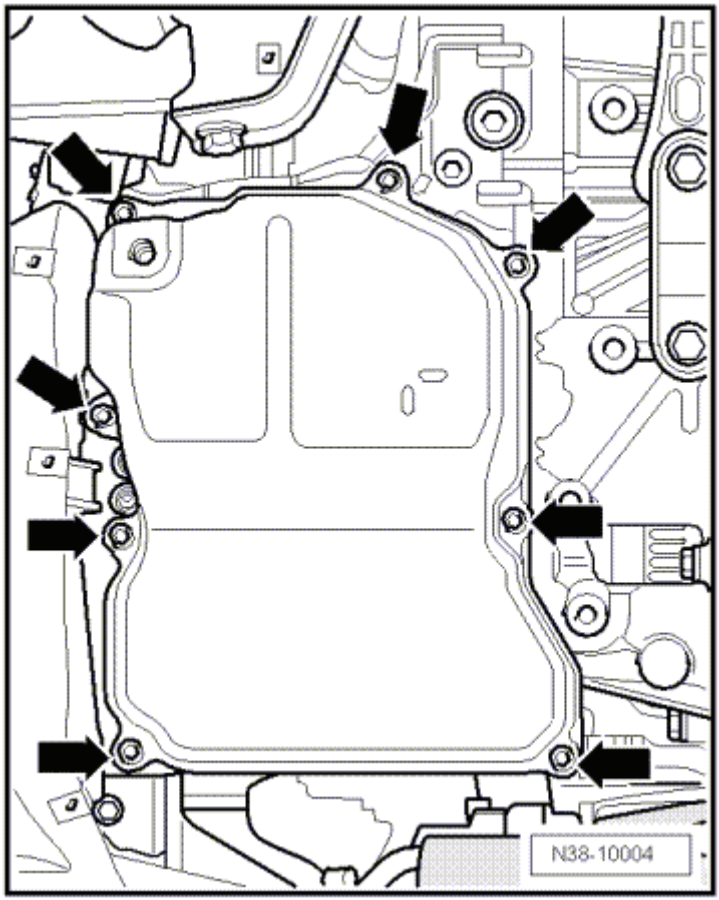
Component	Fastener size	Nm
Drive plate-to-converter	-	60
Bolts	M12	80 or 65, if using T10179
Bolts located in the lower flange	M10	40
➡ Alignment pins for centering		

Gears, Hydraulic Controls – 09G

Fastener Tightening Specifications



Transmission Fluid Pan Tightening Specification

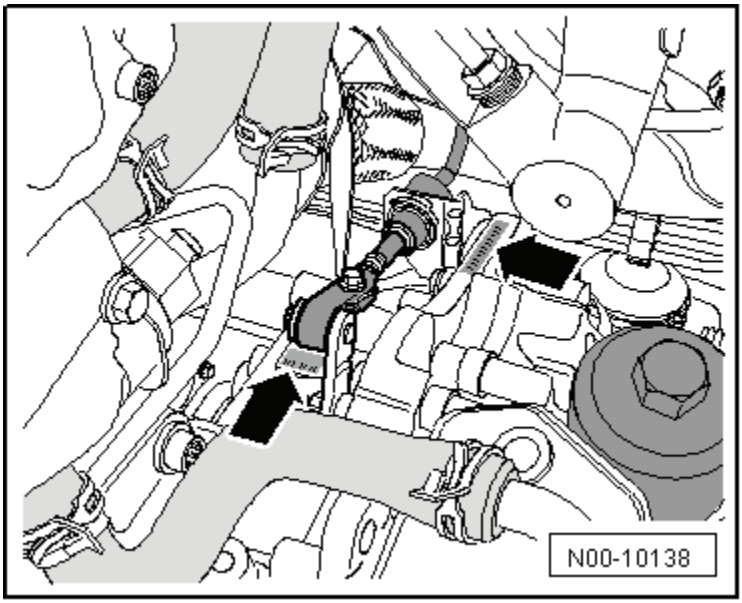


Component	Nm
Tighten the transmission pan bolts (➡) diagonally in several steps	7

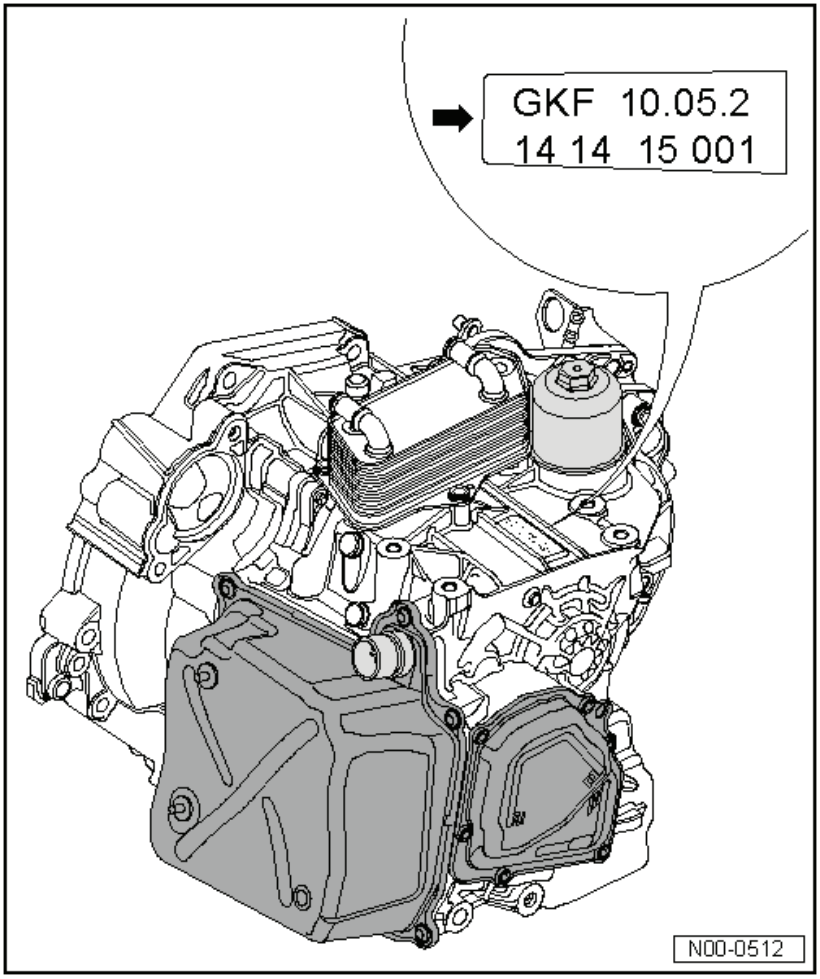
DIRECT SHIFT GEARBOX (DSG) TRANSMISSION – 02E

General, Technical Data

Identification on Transmission



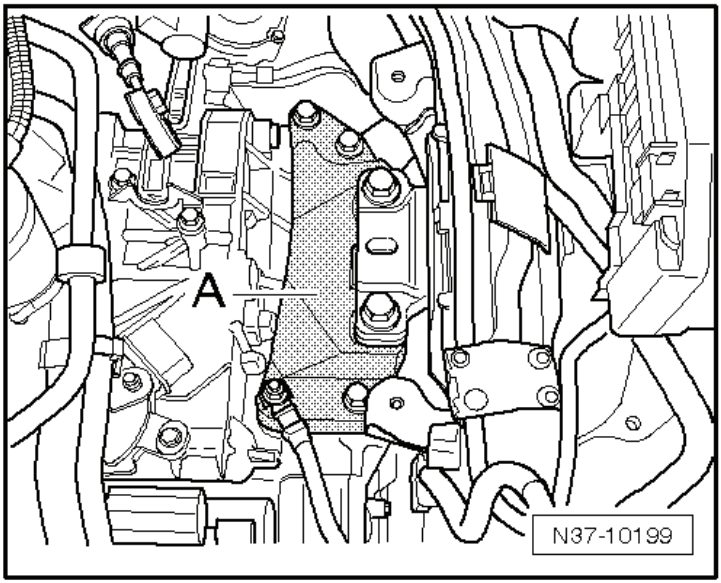
The transmission code letters can be found on the transmission near the selector lever cable (➡) or under the transmission mount bracket.



Example:

GKF	10	05	02
Identification codes	Day	Month	Year (2002) of manufacture

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



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 (A) removal procedure.

Transmission Allocation Codes

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

DSG® Transmission 02E (Front Wheel Drive [FWD])	
MSV, LQV, LTE, NJK and NLP	MSY, LQZ, LTL, NJL, NLR, and MMA
2.0L - 125 kW TDI	2.0L - 147 kW FSI-Turbo

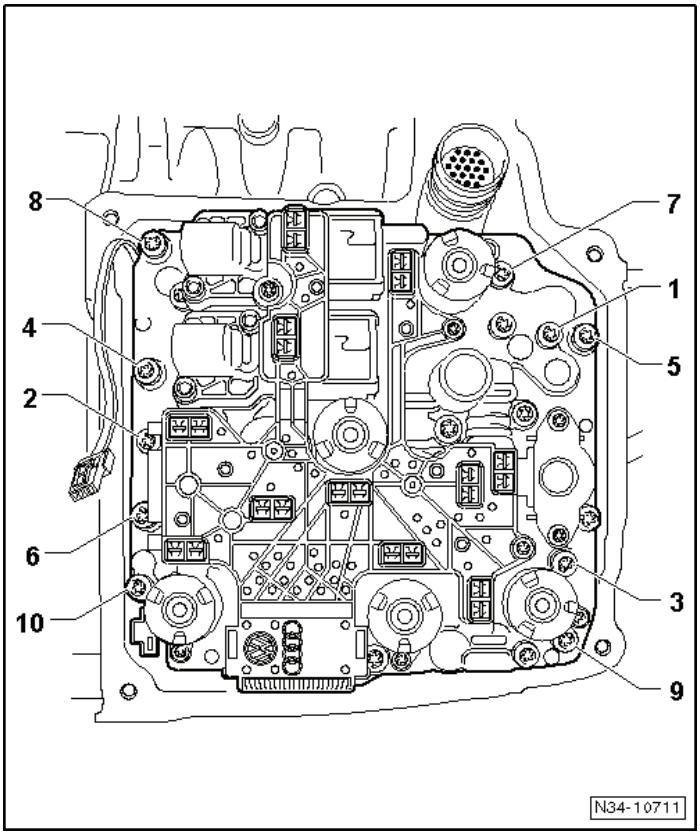
Controls, Housing (DSG) – 02E

Fastener Tightening Specifications

Component	Nm
Bevel box-to-transmission bolt [2]	40
Drive axle heat shield-to-bevel box bolt [2]	25
Mechatronic cover bolt [1]	16
Oil filter housing	20
Oil pump cover bolt [1]	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 nut	20
Transmission drain plug	45
Transmission input speed and clutch oil temperature sensor bolt	10
Transmission oil cooler-to-transmission bolt	20 plus an additional 90° (¼ turn)
Wire bracket-to-Mechatronic cover nut	10

[1] Tighten the bolts diagonally and in multiple stages.
[2] R32 models only.

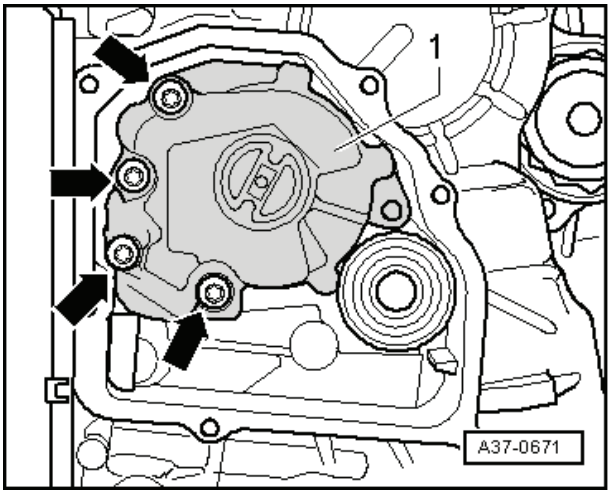
Mechatronic Tightening Specifications



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)

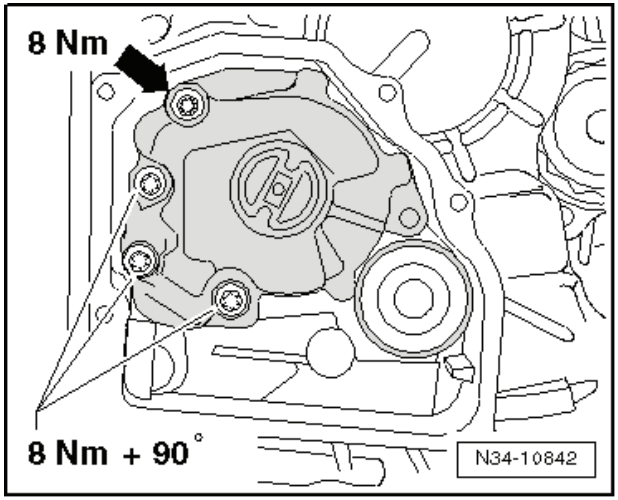
1) Replace fastener(s).

Oil Pump Tightening Specifications Without Countersunk Bolt



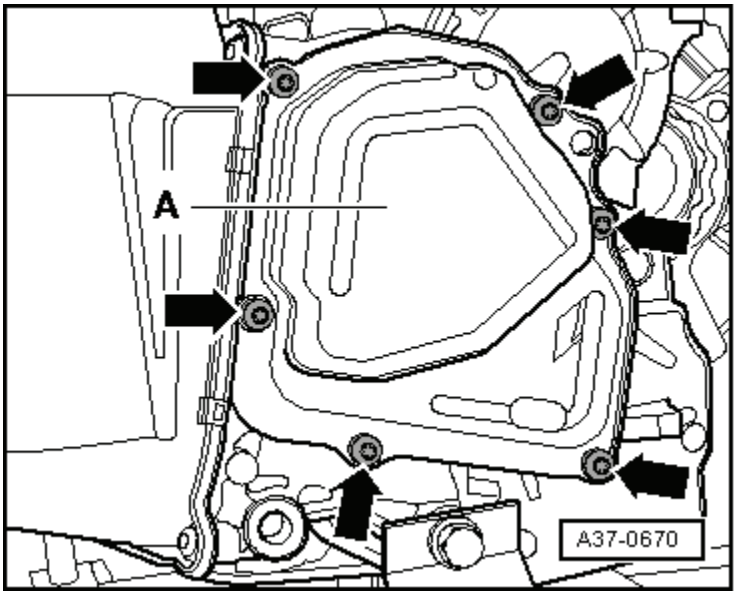
Component	Nm
Oil pump bolts (➡) with flat heads	5 plus an additional 90° (¼ turn)

With Countersunk Bolt



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

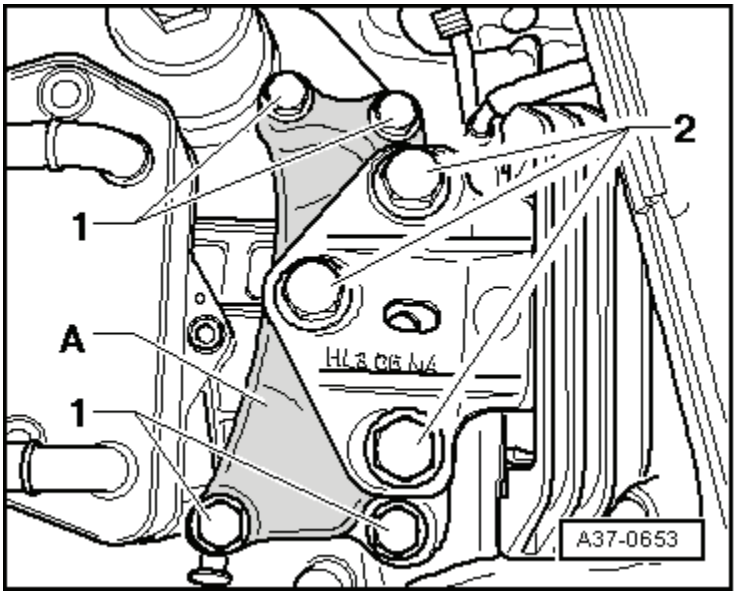
Oil Pump Cover Tightening Specifications



Component	Nm
Tighten bolts (➡) in several steps in a diagonal sequence [1)]	8

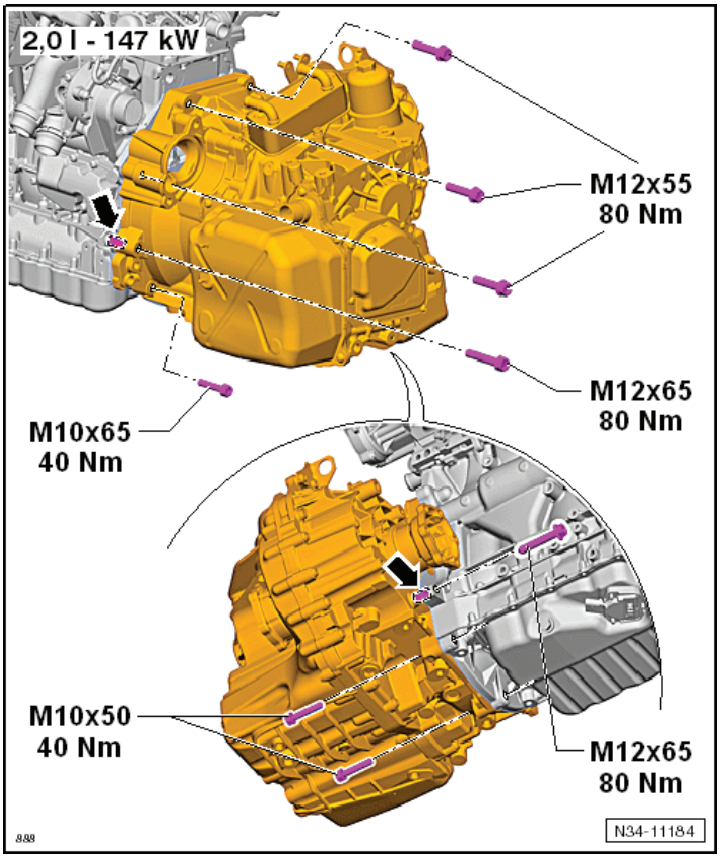
[1)] Replace fastener(s).

Transmission Mount Tightening Specifications



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

Transmission to Engine Tightening Specifications



Component	Fastener size	Nm
Bolts	M12	80 or 65 if using T10179
Bolts	M10	40
➡ Alignment pins for centering		

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 [1]		
- With cast steel control arm	-	60
- With sheet steel or aluminum control arm	-	100
Ball joint-to-wheel bearing housing nut [1]	M12 x 1.5	60
Console-to-body bolt [1]	M12 x 1.5 x 90	70 plus an additional 90° (¼ turn)
Control arm-to-console bolt [1] [2]	M12 x 1.5 x 110	70 plus an additional 90° (¼ turn)
Coupling rod-to-stabilizer bar nut [1]	-	65
Coupling rod-to-suspension strut nut [1]	-	65
Cover plate-to-wheel bearing housing bolt	-	10
Constant Velocity (CV) boot hose clamp	-	25
Drive axle heat shield		
- FWD bolt	-	25
- AWD nut [3]	-	20
Drive axle to transmission bolt [1] [4]		
- With Constant Velocity (CV) joint (VL90 and VL100)	M8 x 48	40
- With Constant Velocity (CV) joint (VL107)	M10 x 52	70
- With triple roller joint (AAR3300I)	M10 x 23	70
Drive axle-to-wheel hub bolt [1]		
- Twelve-point bolt with ribs	-	70 plus an additional 90° (¼ turn)
- Twelve-point bolt without ribs	-	200 plus an additional 180° (½ turn)
Level control system sensor-to-console bolt	-	9
Level control system sensor-to-control arm nut [1]	-	9

Fastener Tightening Specifications *(cont'd)*

Component	Fastener size	Nm
Mounting bracket-to-body bolt [1]	M12 x 1.5 x 90	70 plus an additional 90° (¼ turn)
Mounting bracket-to-console bolt [1]	-	50 plus an additional 90° (¼ turn)
Pendulum support-to-subframe bonded rubber bushing bolt	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)
Shield-to-subframe bolt (FWD)	M6	6
Steering column universal joint-to-steering gear bolt	-	30
Steering gear-to-subframe bolt [1]	-	50 plus an additional 90° (¼ turn)
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-suspension strut bearing nut [1]	M14 x 1.5	60
Suspension strut-to-suspension strut dome bolt [1]	-	15 plus an additional 90° (¼ turn)
Suspension strut-to-wheel bearing housing nut [1]	-	70 plus an additional 90° (¼ turn)
Tie rod end-to-wheel bearing housing nut [1]	-	20 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 bolts in curb weight position.
[3] Pre-tighten all nuts to 10 Nm.
[4] Pre-tighten to 10 Nm in a diagonal sequence, then tighten to tightening specification in a diagonal sequence.

Rear Suspension

Fastener Tightening Specifications

Component	Fastener size	Nm
ABS wheel speed sensor-to-wheel bearing housing bolt	-	8
Brake disc bolt	-	4
Coupling rod-to-stabilizer bar nut [1]	-	45
Coupling rod-to-trailing arm nut [1]	-	45
Cover plate-to-wheel bearing housing bolt	-	12
Constant Velocity (CV) joint boot clamp	-	25
Drive axle-to-rear final drive flange shaft bolt [1] [4]	M8 x 48	40
Drive axle-to-wheel bearing housing bolt [1]		
- Twelve-point bolt with ribs	-	70 plus an additional 90° (¼ turn)
- Twelve-point bolt without ribs	-	200 plus an additional 180° (½ turn)
Final drive-to-subframe bolt [1]	-	60 plus an additional 90° (¼ turn)
Left rear level control system sensor bolt	M5 x 20	5
Lower transverse link-to-subframe nut [1] [2]	-	95
Lower transverse link-to-wheel bearing housing nut [1] [2]	-	90 plus an additional 90° (¼ turn)
Shock absorber-to-body bolt [1]	-	50 plus an additional 90° (¼ turn)
Shock absorber-to-shock absorber mount nut [1]	-	25
Shock absorber-to-wheel bearing housing bolt	-	180
Stabilizer bar-to-subframe bolt [1] [2]	-	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)

Fastener Tightening Specifications *(cont'd)*

Component	Fastener size	Nm
Tie rod-to-subframe nut [1) 2)]	-	90 plus an additional 90° (¼ turn)
Tie rod-to-wheel bearing housing [1) 2)]		
- Nut (FWD)	-	130 plus an additional 90° (¼ turn)
- Bolt (AWD)	-	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)]	-	95
Upper transverse link-to-wheel bearing housing [1) 2)]		
- Nut (FWD)	-	130 plus an additional 90° (¼ turn)
- Bolt (AWD)	-	130 plus an additional 90° (¼ turn)
Wheel hub-to-wheel bearing housing bolt [1)]		
- FWD	-	180 plus an additional 90° (¼ turn)
- AWD	-	70 plus an additional 90° (¼ turn)

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

Self-Leveling Suspension

Fastener Tightening Specifications

Component	Fastener size	Nm
Front body acceleration sensor-to-bracket bolt	-	5
Front level control system sensor bolt	M6 x 16	9
Front level control system sensor nut [1]	-	9
Left rear level control system sensor bolt	M5 x 20	5
Rear body acceleration sensor-to-bracket mounting bolt	-	5
Shock-to-body bolt [1]	M10 x 35	50 plus an additional 90° (¼ turn)
Shock-to-wheel bearing housing bolt	-	180
Shock absorber-to-shock absorber mounting nut [1]	M10 x 1.0	25
Strut-to-body mounting bolt [1]	-	15 plus an additional 90° (¼ turn)
Strut-to-suspension strut bearing [1]	-	60

[1] Replace fastener(s).

Wheels, Tires, Wheel Alignment

Fastener Tightening Specifications

Component	Nm
Front console-to-body bolt [1]	70 plus an additional 90° (¼ turn)
Front subframe-to-body bolt [1]	70 plus an additional 90° (¼ turn)
Front tie rod end-to-tie rod nut	70
Rear lower transverse link-to-subframe nut [1] [2]	95
Rear upper transverse link-to-subframe nut [1] [2]	95
Tire pressure sensor union nut	8
Wheel hub bolts	120

[1] Replace fastener(s).

[2] Tighten bolts in curb weight position.

Wheel Alignment Data

Wheel Alignment Specified Values

Front suspension	Basic suspension	Sport suspension without 18" wheels/ GTD without 18" wheels/ GTD with adaptive chassis DCC without 18" wheels
Production Relevant No. (PR. No.)	2UA	G58, 2UC
Total toe (wheels not pressed)	10' ± 10′	10' ± 10′
Camber (wheels in straight ahead position)	-30′ ± 30′	-41′ ± 30′
Maximum permissible difference between both sides	30'	30'
Toe-out angle [1)] with steering wheel turned 20° to left and right	1°38′ ± 20′	1°40′ ± 20′
Caster	7° 34′ ± 30′	7° 47′ ± 30′
Maximum permissible difference between both sides	30'	30'
Standing height	382 ± 10 mm	367 ± 10 mm

Wheel Alignment Specified Values *(cont'd)*

Front suspension	Sport suspension with 18"/ GTI North America with 18" wheels/ GTD with 18" wheels/ GTD with 18" wheels and adaptive chassis DCC	Heavy duty suspension
Production Relevant No. (PR. No.)	G02, G05, G07,G33,G58, 2UC,	2UB
Total toe (wheels not pressed)	10' ± 10′	10' ± 10′
Camber (wheels in straight ahead position)	-41′ ± 30′	-14′ ± 30′
Maximum permissible difference between both sides	30'	30'
Toe-out angle [1)] with steering wheel turned 20° to left and right	1°40′ ± 20′	1°38′ ± 20′
Caster	7° 47′ ± 30′	7° 17′ ± 30′
Maximum permissible difference between both sides	30'	30'
Standing height	367 ± 10 mm	402 ± 10 mm

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

Front Suspension	Basic Suspension with Adaptive Chassis DCC	Basic Suspension with 18" Wheels and Adaptive Chassis DCC
Production Relevant No. (PR. No.)	G01, G03	G01, G03
Total toe (wheels not pressed)	10' ± 10′	10' ± 10′
Camber (wheels in straight ahead position)	-37′ ± 30′	-37′ ± 30′
Maximum permissible difference between both sides	maximum 30'	maximum 30'
Toe-out angle 1 with steering wheel turned 20° to left and right	1°27′ ± 20′	1°27′ ± 20′
Caster	7° 40′ ± 30′	7° 40′ ± 30′
Maximum permissible difference between both sides	maximum 30'	maximum 30'
Standing height	372 +/- 10 mm	372 +/- 10 mm

1) The toe angle difference can also be indicated negatively in alignment computer, depending on manufacturer.

Specified values valid for all engine versions.

Front Suspension	GTI without and with Adaptive Chassis DCC	Golf R
Production Relevant No. (PR. No.)	G03, G08	G09, 1JR, G45, UB9
Total toe (wheels not pressed)	10’ ± 10′	10’ ± 10′
Camber (wheels in straight ahead position)	-44′ ± 30′	-45′ ± 30′
Maximum permissible difference between both sides	maximum 30’	maximum 30’
Toe-out angle 1 with steering wheel turned 20° to left and right	1°22′ ± 20′	1°22′ ± 20′
Caster	7° 47′ ± 30′	7° 51′ ± 30′
Maximum permissible difference between both sides	maximum 30’	maximum 30’
Standing height	360 +/- 10 mm	358 +/- 10 mm

1) The toe angle difference can also be indicated negatively in alignment computer, depending on manufacturer.

Specified values valid for all engine versions.

Rear suspension	Basic suspension	Sport suspension without 18” wheels/ GTD without 18” wheels/ GTD with adaptive chassis DCC without 18” wheels
Camber	-1°20′ ± 30′	-1°20′ ± 30′
Maximum permissible difference between both sides	30’	30’
Total toe (at prescribed camber)	+10′ ± 12,5′	+10′ ± 12,5′
Maximum permissible deviation from direction of rotation	20’	20’
Standing height	380 ± 10 mm	365 ± 10 mm

Rear suspension	Sport suspension with 18”/ GTI North America with 18” wheels/ GTD with 18” wheels/ GTD with 18” wheels and adaptive chassis DCC	Heavy duty suspension
Camber	-1°45’ ± 30’	-1°20’ ± 30’
Maximum permissible difference between both sides	30’	30’
Total toe (at prescribed camber)	+10′ ± 12.5′	+10′ ± 12.5′
Maximum permissible deviation from direction of rotation	20’	20’
Standing height	365 ± 10 mm	400 ± 10 mm

Rear suspension	Basic suspension with adaptive chassis DCC	Basic suspension with 18” wheels and adaptive chassis DCC
Camber	-1°20’ ± 30’	-1°20’ ± 30’
Maximum permissible difference between both sides	30’	30’
Total toe (at prescribed camber)	+10′ ± 12.5′	+10′ ± 12.5′
Maximum permissible deviation from direction of rotation	20’	20’
Standing height	370 ± 10 mm	370 ± 10 mm

Rear suspension	GTI without and with adaptive chassis DCC	Golf R
Camber	-1°45’ ± 30’	-1°45’ ± 30’
Maximum permissible difference between both sides	30’	30’
Total toe (at prescribed camber)	+10′ ± 12.5′	+10′ ± 12.5′
Maximum permissible deviation from direction of rotation	20’	20’
Standing height	365 ± 10 mm	356 ± 10 mm

Steering

Fastener Tightening Specifications

Component	Fastener size	Nm
Brake pedal crash brace bolt [2)]	-	20
Clutch pedal crash brace bolt	-	20
Connecting link-to-stabilizer bar nut [1)]	-	65
Knee airbag mount bolt	-	9
Pendulum support-to-transmission bolt [1)]	-	50 plus an additional 90° (¼ turn)
Shield-to-steering gear bolt	-	6
Stabilizer bar-to-subframe bolt [1)]	-	20 plus an additional 90° (¼ turn)
Steering column-to-assembly carrier [2)]	-	20

Fastener Tightening Specifications *(cont'd)*

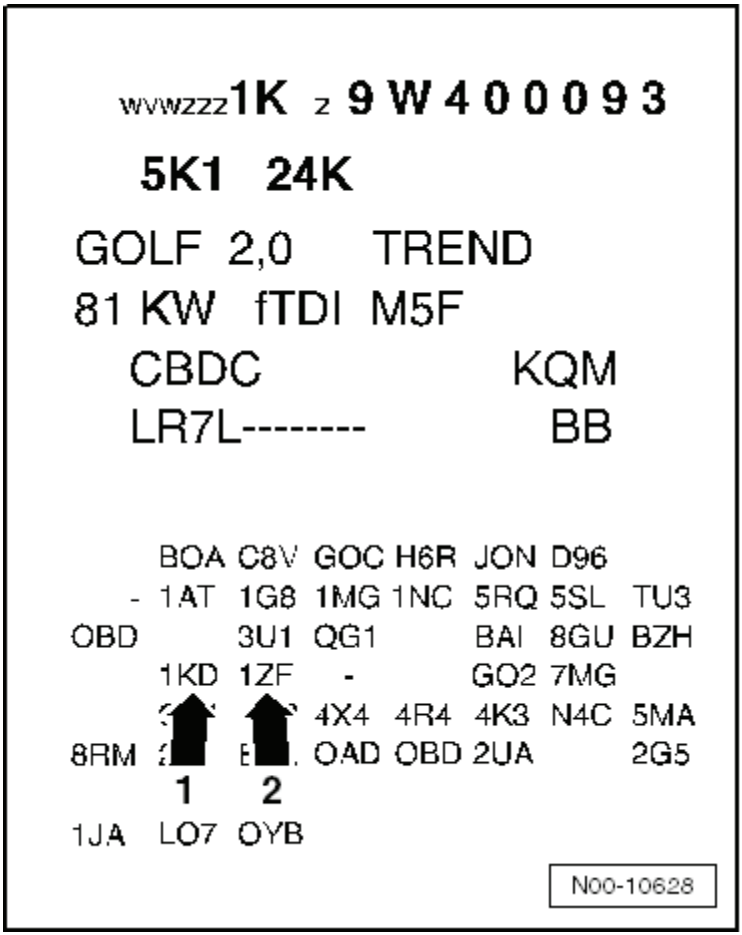
Component	Fastener size	Nm
Steering column-to-steering gear bolt [1]	M8 x 35	30
Steering gear-to-subframe bolt [1]	-	50 plus an additional 90° (¼ turn)
Steering wheel-to-steering column bolt [1]	-	30 plus an additional 90° (¼ turn)
Subframe-to-body bolt [1]	-	70 plus an additional 90° (¼ turn)
Tie rod-to-steering 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 clarification, refer to ElsaWeb, Steering Column.

BRAKE SYSTEM

General, Technical Data

Vehicle Data Sticker PR Number Allocation



The Production Relevant No. (PR. No.) on the vehicle data label describes which brake system is installed in the vehicle.

Example:

1. Rear brakes - 1KD
2. Front brakes - 1ZF

There is a vehicle data label in the spare wheel well and also one in the customer Maintenance booklet.

Front Brakes

Engine version	PR number	Front Wheel Brake
2.0L - 103 kW TDI	1ZP	FN 3 (15”)
2.5L - 125 kW		
2.0L - 147 kW T- FSI	1LL/1ZB	FN 3 (16”)

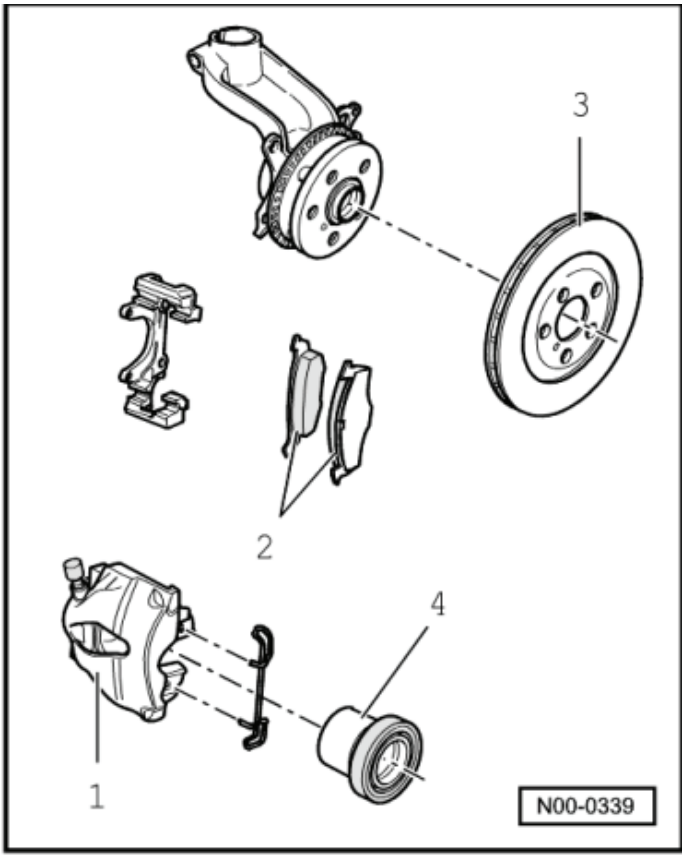
Rear Brakes

Engine version	PR number	Rear Wheel Brake
2.0L - 103 kW TDI	1KD	C 38 (15”)
2.0L - 147 kW T- FSI	1KS	Bosch
2.5L - 125 kW		

Brake Master Cylinder and Brake Booster

Brake master cylinder	Diameter in mm	23.81
Brake booster	Diameter in inches	10

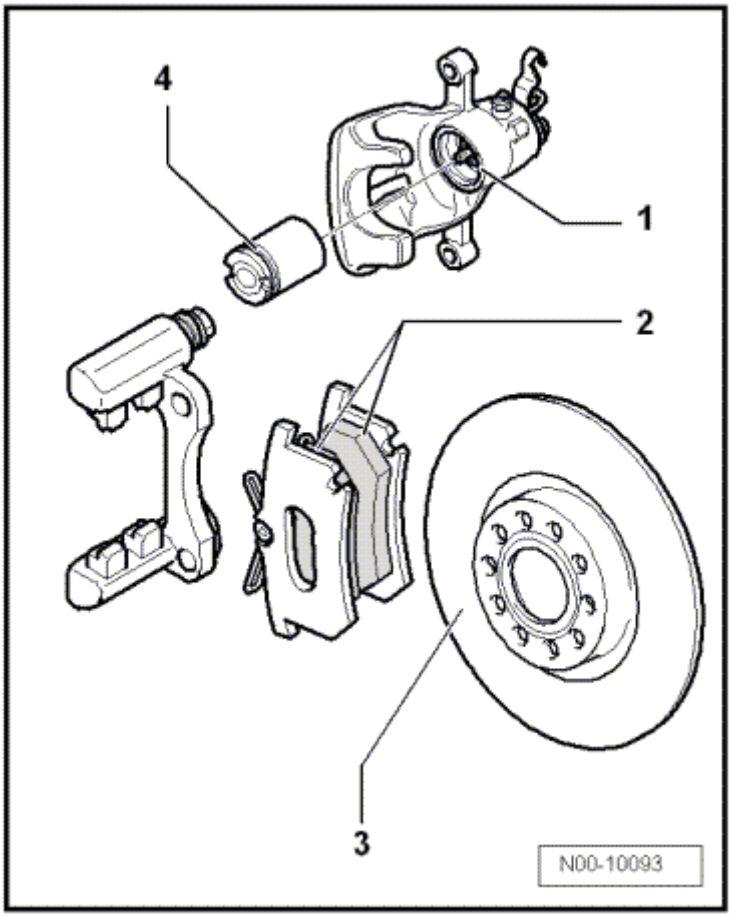
Front Brakes



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

Item	PR Number		1LJ/1ZD/1LL/ 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 Brakes C38



Item	PR Number		1KD
1	Brake caliper		C 38 (15”)
2	Brake pad thickness	mm	11
	Brake pad wear limit without back plate	mm	2
3	Brake disc	Diameter in mm	253
	Brake disc thickness	mm	10
	Brake disc wear limit		8
4	Brake caliper, piston	Diameter in mm	38

Anti-lock Brake System (ABS)

Fastener Tightening Specifications

Component	Nm
ABS control module-to-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-to-bracket bolt	8
ABS hydraulic unit bracket-to-body nut	20
ABS speed sensor-to-wheel bearing housing bolt	8
Brake lines-to-ABS unit	14
Heat shield-to-ABS hydraulic unit bracket nut, ABS Mark 60 EC (ABS/EDL/ASR/ESP)	8
Master cylinder-to-brake booster nut [1]	25

[1] Replace fastener(s).

Mechanical Components

Fastener Tightening Specifications

Component	Nm
ABS speed sensor-to-wheel bearing housing bolt	8
Brake disc-to-wheel bearing unit bolt	4
Brake line-to-rear brake caliper (C 38)	14
Brake pedal mounting bracket nut [1]	25
Brake pedal-to-mounting bracket nut [1]	25
Cover plate-to-wheel bearing housing bolt	12
Front brake caliper guide pin	30
Front brake carrier-to-wheel bearing housing bolt	190
Front brake hose-to-front brake caliper union bolt	35
Parking brake lever-to-body nut	15
Rear brake caliper-to-guide pin bolt [1]	35
Rear brake hose-to-rear brake caliper union bolt (Bosch)	35
Rear brake carrier-to-wheel bearing housing bolt [1]	90 plus an additional 90° (¼ turn)

[1] Replace fastener(s).

Hydraulic Components

Fastener Tightening Specifications

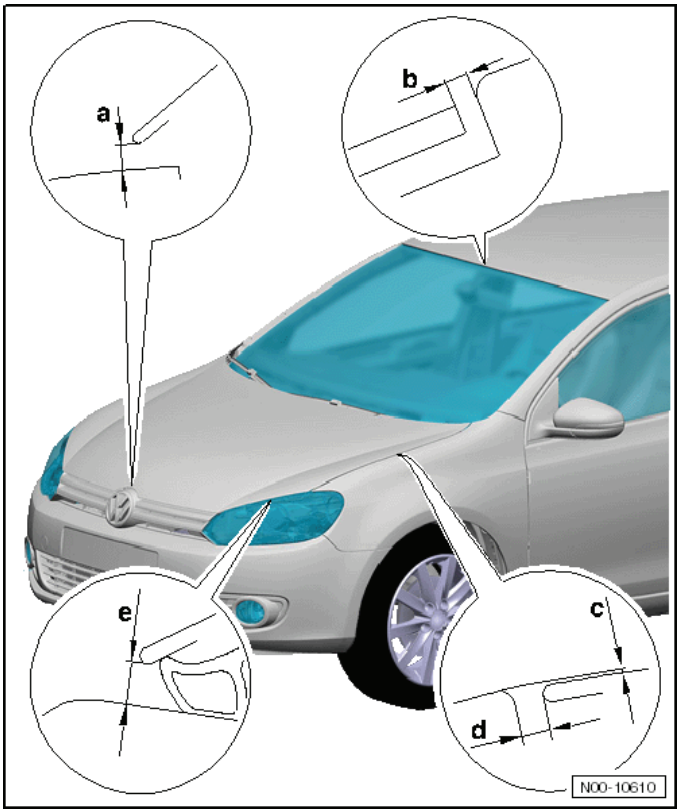
Component	Nm
Brake booster-to-pedal assembly nut [1]	25
Brake caliper bleeder valve	10
Brake line	14
Brake lamp switch-to-master cylinder bolt	5
Brake system vacuum pump-to-bracket bolt [2]	8
Brake system vacuum pump bracket-to-engine bolt [2]	25
Front brake caliper guide pins	30
Heat shield/master cylinder to brake booster nut [1]	25
Master cylinder-to-brake booster nut	25
Rear brake caliper-to-guide pin bolt [1]	35

[1] Replace fastener(s).
[2] Only on gas engines with a Direct Shift Gearbox (DSG).

BODY

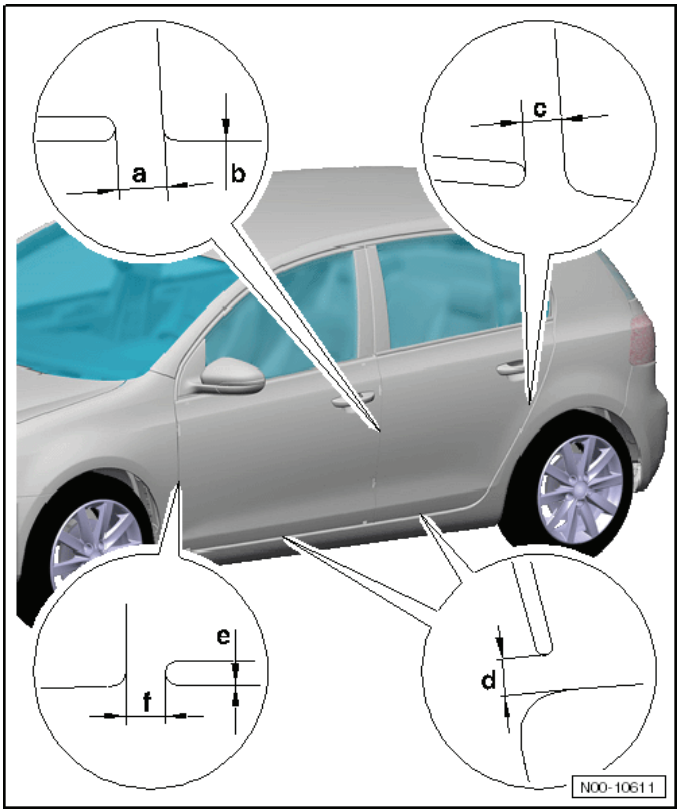
Air Gap Body Dimensions

Body, Front



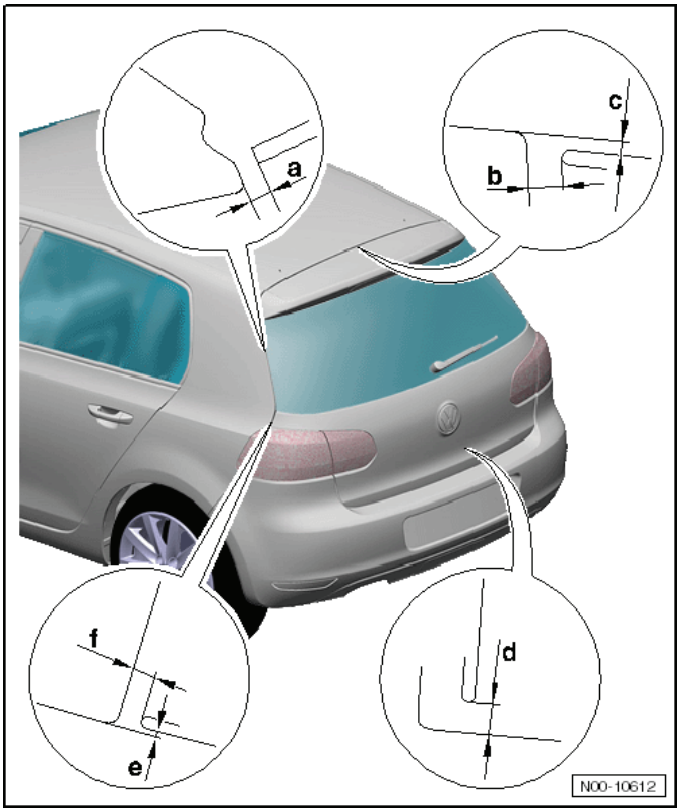
Component	mm
a	4.5 ± 0.5
b	3.5 ± 0.5
c	0.5 ± 0.5
d	3.5 ± 0.5
e	5.0 ± 0.5

Body, Center



Component	mm
a	4.5 ± 0.5
b	0.0 - 1.0
c	3.5 ± 0.5
d	4.5 ± 0.5
e	0.0 - 1.0
f	3.5 ± 0.5

Body, Rear



Component	mm
a	4.0 ± 1.0
b	5.0 ± 0.5
c	2.0 ± 1.0
d	5.0 ± 0.5
e	1.0 ± 0.5
f	4.5 ± 0.5

Body Exterior

Bulkhead, Front Fender Tightening Specifications

Component	Nm
Bulkhead bolts	25
Front fender bolts	6
Front fender brace bolts	6

Lock Carrier Tightening Specifications

Component	Nm
Air guide channel bolts	2
Angle bracket bolts	8
Cross member bolts [1]	8
	60
Guide piece bolts	5
Lock carrier support bolts	12

[1] For bolt tightening clarification, refer to ElsaWeb, *Lock Carrier Overview*, items 13 and 14.

Underbody Trim, Noise Insulation Tightening Specifications

Component	Nm
Anchor bracket bolt	20
Noise insulation bolts [1]	2
	6
Rear retaining strip bolt	70
Right side angle bracket	
- Nut	20
- Bolt	35
Underbody cover bolt	2
Underbody cover lock washer	1.5
Underbody trim panel, center nuts	1.5
Underbody trim panel, center bolts	2
Underbody impact guard [2]	2
	20

[1] For bolt tightening clarification, refer to ElsaWeb, *Noise Insulation Overview*, items 13 and 14.

[2] For bolt tightening clarification, refer to ElsaWeb, *Underbody Impact Guard Overview*.

Tunnel Bridge, Plenum Chamber Tightening Specifications

Component	Nm
Plenum chamber bulkhead bolts/nuts	8
Tunnel bridge bolts	20

Front Hood Tightening Specifications

Component	Nm
Front hood hinge bolt/nut	22
Hood latch bolts	12
Striker pin bolts	10

Rear Lid, Fuel Filler Door Tightening Specifications

Component	Nm
Angle bracket	10
Fuel filler door unit screws	1.5
Rear lid gas strut ball head pin	20 plus an additional 90° (¼ turn)
Rear lid hinge bolts	10
Rear lid hinge nuts	24
Rear lid lock bolts	23
Rear lid latch screws	12
Rear lid striker pin bolts	18

Front and Rear Door Tightening Specifications

Component	Nm
Door clamp screws	8
Door hinge bolts [1)]	10
	28
	38
	50
Door lock bolts	20
Door regulator motor bolts	3.5
Door striker pin bolts	20
Door trim screws	2
Front door mounting bracket screw	1
Rear door fixed window bolts	8
Rear door mounting bracket	4.5
Window regulator bolts	8
Window regulator motor bolts	3.5

1) For bolt tightening clarification, refer to ElsaWeb, *Front or Rear Door Hinge Assembly Overview*.

Sunroof Tightening Specifications

Component	Nm
Slotted guide rail bolts	5
Sunroof insulation unit bolts	8
Sunroof motor screws	3.5
Sunroof spring glider bolts	1.8
Sunshade motor screws	3.5

Front Bumper Tightening Specifications

Component	Nm
Bumper carrier bolts [1]	8
	60
Bumper cover bolts	1.5-2
Side guide assembly bolts	2-5

[1] For bolt tightening clarification, refer to ElsaWeb, *Front Bumper Carrier Overview*, items 2, 3, and 4.

Rear Bumper, Trailer Hitch Tightening Specifications

Component	Nm
Rear bumper carrier bolts [1]	8
	20
Rear bumper cover bolts	2
Trailer hitch bolts [2]	20
	50 plus an additional 90° (¼ turn)

[1] For bolt tightening clarification, refer to ElsaWeb, *Rear Bumper Carrier Overview*, items 2 and 5.

[2] For bolt tightening clarification, refer to ElsaWeb, *Trailer Hitch Overview*, items 3 and 4.

Mirror Tightening Specifications

Component	Nm
Adjusting motor screw	1
Mirror base bolts	10
Mirror frame	1

Exterior Equipment Tightening Specifications

Component	Nm
Sill panel extension and cover bolts	1.2-2
Wheel cover trim bolts	2
Wheel housing liner bolts	2

Body Interior

Storage Compartments, Covers and Trim Tightening Specifications

Component	Nm
Center console nuts [1]	1.5
	2.5
	8
Footwell trim bolts	1.5
Glove compartment bolts	1.5
Headliner frame bolts	2
Instrument panel crossmember nuts	20
Instrument panel trim bolts	1.5
Roof grab handle bracket bolts	2
Roof grab handle bracket bolts	2
Storage compartment /ashtray bolts	1.5
Steering column trim bolts	1.5
Sun visor bolts	2
Trim bolts/screws	1.5
Wheel housing trim bolts	1.2

[1] For bolt tightening clarification, refer to ElsaWeb, *Mounting Bracket Center Console*.

Passenger Protection Fastener Tightening Specifications

Component	Nm
Airbag crash sensor bolts	9
Door airbag crash sensor bolts	2.5
Front passenger airbag bolts	9
Knee airbag bolts	9
Knee airbag bracket nuts	1.5
Passenger airbag bolts	9
Passenger occupant detection system control module	1.5
Rear side airbag bolts	9
Seat belt bolts [1]	2
	20
	40
Side curtain airbag nuts [2]	3
	4.5
	9

[1] For bolt tightening clarification, refer to ElsaWeb, *Seat belts.*

[2] For bolt tightening clarification, refer to ElsaWeb, *Driver and Passenger Side Curtain Airbags.*

Interior Trim Fastener Tightening Specifications

Component	Nm
Airbag emblem screw	
- Screw	4
- Nut	1.5
Ashtray control module	9
Ashtray screw	1.5
Backrest adjuster screw	2.5
Bracket for front seat support and operating lever	3.5
Bracket seat pan	2.4
Drive side footwell cover screw	1.5
Drive side left trim screw	1.5
Drive side right trim screw	1.5
Front door trim panel screw	4.5
Front seat support	
Footwell trim screw	1.5
Lock carrier cover screw	1.5
Lower B-pillar trim screw	4
Luggage compartment trim screw	8
Pull support cover	1.5
Rear door trim screw	4.5
Seat backrest	34.5
Storage compartment instrument panel (center) screw	1.5
Storage unit-to-center armrest screw	9
Upper A-pillar trim screw	4
Upper B-pillar trim screw	4

[1)] For bolt tightening clarification, refer to ElsaWeb, *Interior Trim.*

Seat Frames Fastener Tightening Specifications

Component	Nm
Backrest bolts	34.5
Front seat frame bolts	40
Rear belt buckle bolt	40
Rear seat center backrest clamp bolt	9
Seat drawer mount bolts	2
Seat frame bracket bolts	3.5
Seat support bracket bolts	3.5
Side upholstery 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 (°F)	Pressure in Bar (Positive Pressure) (PSI) of R134a
-45 (-49)	-0.61 (-8.84)
-40 (-40)	-0.49 (-7.10)
-35 (-31)	-0.34 (-4.93)
-30 (-22)	-0.16 (-2.32)
-25 (-13)	0.06 (0.87)
-20 (-4)	0.32 (4.64)
-15 (5)	0.63 (9.13)
-10 (14)	1.00 (14.5)
-5 (23)	1.43 (20.74)
0 (32)	1.92 (27.84)
5 (41)	2.49 (36.11)
10 (50)	3.13 (45.39)
15 (59)	3.90 (56.56)
20 (68)	4.70 (68.16)
25 (77)	5.63 (81.65)
30 (86)	6.70 (97.17)
35 (95)	7.83 (113.56)
40 (104)	9.10 (131.98)
45 (113)	10.54 (152.86)
50 (122)	12.11 (175.64)
55 (131)	13.83 (200.58)
60 (140)	15.72 (227.99)
65 (149)	17.79 (258.02)
70 (158)	20.05 (290.80)
75 (167)	22.52 (326.62)
80 (176)	25.21 (365.64)
85 (185)	28.14 (408.13)
90	31.34 (454.54)

Heating, Ventilation

Fastener Tightening Specifications

Component	Nm
Air intake grille flange nuts	2.5 ± 0.4
Auxiliary heater heating element nut	9 ± 1
Auxiliary heater heating element bolt	1.4
Bracket [1)]	8 ± 1
Bracket [2)]	9 ± 1.3
Cable bracket	4.5 ± 0.7
Center vent screw	1.5
Footwell vent screw	1.5 ± 0.2
Fresh air blower bolt	1
Heater core connection flange bolt	2
Heater core coolant pipe clamp	2
Schrader valve insert	2.4 ± 0.2
Subframe support bolts	20 ± 3
Valve with M12x1.5 mm external threads and groove for O-ring	7 ± 1

[1)] For bolt clarification, refer to ElsaWeb, *Heater and A/C Unit* item 5.
[2)] For bolt clarification, refer to ElsaWeb, *Heater and A/C Unit* item 12.

Air Conditioning

Fastener Tightening Specifications

Component	Nm
A/C compressor	25 ± 2
A/C line bracket-to-frame nut [1]	6
A/C line retainer screw [2]	3.5
A/C line-to-dash panel bracket nut [3]	20
A/C line-to-dash panel bracket retainer screw [3]	3.5
A/C control head (Climatronic) bolt	9 ± 1.3
A/C control module J301 screws	1.5
Air distribution door motor	1.5
Air distribution housing bolts	1.4
Aluminum support to cross member bolt	9 ± 1.3
Auxiliary heating element power supply nut	9 ± 1
Bracket to heating and A/C unit bolt	9 ± 1.3
Cable bracket-to-plenum chamber bolt	4.5 ± 0.7
Condenser mounting bolts	5 ± 0.5
Cross member support bolt	20 ± 3
Evacuating and charging valve	2 ± 0.2
Expansion valve bolt	5
Fluid reservoir with dryer bolt	4.2 ± 0.7
Front A/C display control head	9 ± 1.3
Fresh air blower	1
Fresh air intake	2.5 ± 0.4
Fresh air/recirculating air/back pressure door adjuster	1.4
Heater core connection flange screw	2
Heater core coolant pipe clamps	2
Heating and A/C unit bolt [4]	8 ± 1
Heat shield in front of the expansion valve nut	6 ± 0.9
High pressure sensor	8 ± 1
Left temperature door motor	1.4
Radiator mounting bolt	7
Refrigerant lines-to-A/C compressor	22 ± 1
Refrigerant lines-to-condenser	12 ± 1.8
Refrigerant line-to-expansion valve bolt	10 ± 1
Ribbed belt pulley	35 ± 5
Right temperature door motor	1.4
Temperature regulator door motor bolts	1.4

[1] For bolt clarification, refer to, *Refrigerant Circuit Components Overview*, item 5.
[2] For bolt clarification, refer to *Refrigerant Circuit Components Overview*, item 8.
[3] For bolt clarification, refer to, *Refrigerant Circuit Components Overview*, items 13 and 15.
[4] For bolt clarification, refer to *Refrigerant Circuit Components Overview*, item 6.

ELECTRICAL SYSTEM

Electrical Equipment

Battery, Starter, Generator, Cruise Control Fastener Tightening Specifications

Component	Fastener size	Nm
A/C compressor mounting bolts [3]	M8	23
Accessory bracket-to-engine bolts [2]		25
Air filter housing-to-body bolt		10
B+ terminal of generator		15
B+ wire-to-starter mounting nut	M8	15
Battery terminal mounting nuts	M6	6
Battery clamping plate mounting bolt	M8 x 35	35
Generator-to-accessory bracket collar bolts	M8 x 90	25 [2]
	M8 x 90	20 [3]
	M8 x 110	20 [1]
Hex bolt with washer and threaded piece for voltage regulator	M4 x 20, M4 x 15	2
Lower idler pulley with bracket [2]		23
Protective cap Phillips head screw [1]	M5 x 21	4.5
Protective cap hex head nut	M8	15
Ribbed belt tensioners [2]		35
Ribbed belt pulley with freewheel		80
Ribbed belt pulley without freewheel		65
Starter bolts [2] [3]	M12	75
Starter bolts [1]	M12	80
Starter wiring bracket nut [2] [3]	M8	23
Starter wiring bracket nut [1]	M8	20
Upper idler pulley with bracket [2]	M6	8
Voltage regulator screws		2
Wire clamp nut-to-rear side of generator [2] [3]	M5	3.2

[1] Applies to 2.0L TFSI.
[2] Applies to 2.5L and Golf R.
[3] Applies to 2.0L TDI.

Windshield Wiper/Washer Tightening Specifications

Component	Nm
Front wiper arm mounting nuts	20
Rear wiper arm mounting nut	12
Telescopic cylinder for spray jets-to-front bumper cover	4.5
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 frame with linkage-to-body bolts	8

Exterior Lights, Switches Tightening Specifications

Component	Fastener size	Nm
Daytime running lamp and parking lamp LED module-to-bumper	-	2
Fog lamp screws	-	2
Headlamp housing	M6 x 20	5
Headlamp power output stage screws	-	1.4
HID headlamp ballast screws	-	1.4
Shear bolts-to-steering column lock housing	M8 x 20	15 [1]
Steering column electronic systems control module	-	1.5
Tail lamp assembly housing in rear lid nuts	-	5
Tail lamps in side panel bolt [2]	-	2.5

[1] Approximate break-off torque.
[2] Install by hand all the way in.

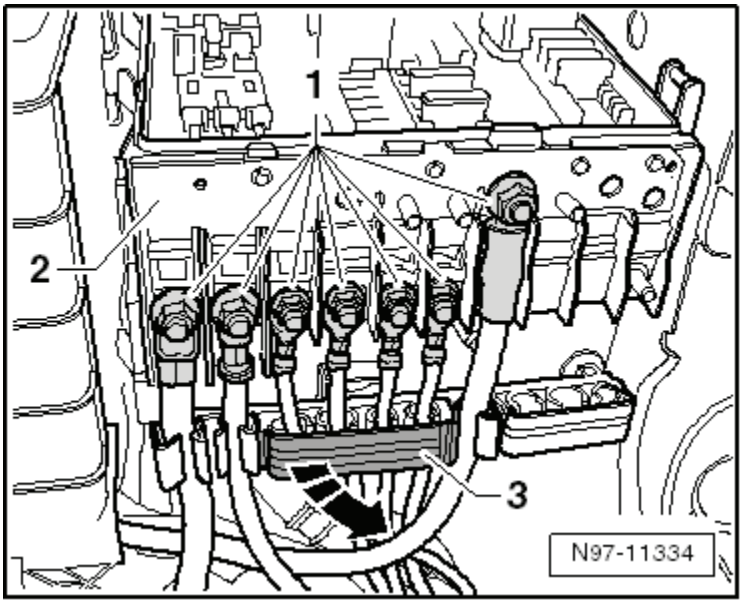
Interior Lights, Switches Tightening Specifications

Component	Nm
Horn bracket to longitudinal member	20
Left footwell lamp and diagnostic socket-to-bracket screw	1.5

Wiring Tightening Specification

Component	Nm
Instrument panel fuse panel bolts	4

Left E-box in Engine Compartment Tightening Specifications



Component	Fastener size	Nm
Central bolt E-box (2)	-	9
Nuts (1)	M5	4
Nuts (1)	M6	6

DTC CHART

Engine Codes CBFA

Fuel and Air Mixture, Additional Emission Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Intake Camshaft Position Slow Response Bank 1	Signal change > 8 CRK ° for > 2.9 Sec. and adjustment angle >= 2.50 CRK rev.
P0010	Intake Camshaft Position Actuator Circuit Open Bank 1	Signal voltage, > 4.7 - 5.4 V
P0011	Intake Camshaft Position Timing - Over-Advanced Bank 1	Signal change > 8 CRK ° for > 2.9 Sec. and adjustment angle < 2.50 CRK rev.
P0016	Crankshaft Position – Camshaft Position Correlation	• Permissible deviation < -11 CRK ° or • Permissible deviation > 11 rev
P0030	HO2S Heater Control Circuit Low Bank 1 Sensor 1	Heater voltage 4.70 - 5.40 V
P0031	HO2S Heater Control Circuit Low (Bank 1, Sensor 1)	Heater voltage < 0 to 3.26 V
P0032	HO2S Heater Control Circuit High Bank 1 Sensor 1	Signal current > 5.50 A
P0036	HO2S Heater Control Circuit Bank 1 Sensor 2	Heater voltage, 4.50 - 5.50 V
P0037	HO2S Heater Control Circuit Low Bank 1 Sensor 2	Heater voltage < 3.00 V
P0038	HO2S Heater Control Circuit High Bank 1 Sensor 2	Heater current, > 2.70 - 5.50 A
P0042	HO2S Heater Control Circuit Bank 1 Sensor 3	Heater voltage < 2.34 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
P0068	MAP/MAF – Throttle Position Correlation	• Plausibility with fuel system load calculation < -50% • Plausibility with fuel system load calculation > 50%

DTC	Error Message	Malfunction Criteria and Threshold Value
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 > 87 °C
P0087	Fuel Rail/System Pressure - Too Low	• Fuel trim activity 0.90 - 1.15 • Pressure controller activity > 2 MPa • Difference between target and actual pressure > -16.4
P0100	Mass Air Flow Circuit Fault	MAF sensor signal 0 µs
P0101	Mass Air Flow A Circuit Range/Performance	Mass air flow vs. • Upper threshold model > 60 to 800 kg/h • Lower threshold model < 0 to 400 kg/h • Load calculation > 18% • Fuel system < -18%
P0102	Mass Air Flow Circuit Low Input	MAF sensor signal < 66 µs
P0103	Mass Air Flow Circuit High Input	MAF sensor signal > 4500 µs
P0106	Manifold Absolute Pressure/ Barometric Pressure Circuit Range/Performance	• Difference of boost pressure signal vs altitude sensor signal > 230 hPa or • Difference of boost pressure signal vs altitude sensor signal < -130 hPa
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	• Difference in value IAT - ECT @ engine start (depending on engine off time) > 25 °C • Difference in value IAT - AAT @ engine start > 25 °C (depending on engine off time)

DTC	Error Message	Malfunction Criteria and Threshold Value
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	IAT > 141.0 °C
P0113	Intake Air Temperature Sensor 1 Circuit High Input	IAT < -46 °C
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/ Performance	• No change on signal < 2 K or • Signal in range > 89 °C with no change on signal 1.5 °K
P0117	Engine Coolant Temperature Sensor 1 Circuit Low Input	Engine coolant temperature > 140 °C
P0118	Engine Coolant Temperature Sensor 1 Circuit High Input	Engine coolant temperature < -40 °C
P0121	Throttle/Pedal Position Sensor A Circuit Range/Performance	• TPS 1 - TPS 2 > 6.30% • Actual TPS 1 calculated value > actual TPS 2 calculated value • TPS 1 calculated value > 9.00%
P0122	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit Low Input	Signal voltage < 0.20 V
P0123	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit High Input	Signal voltage > 4.81 V
P013A	O2 Sensor Bank 1 Sensor 2 Slow Response - Rich to Lean	• Filtered max differential transient time at fuel cut off > 0.65s or • EWMA filtered max differential transient time at fuel cut off n/a] and • Number of checks > = 1.00 -
P0130	O2 Sensor Circuit (Bank 1, Sensor 1)	O2S ceramic temperature < 640 °C
P0131	O2 Sensor Circuit (Bank 1, Sensor 1) Low Voltage	VM < 1.75 V
		UN < 1.50 V
		IA or IP > 0.30 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0132	O2 Sensor Circuit (Bank 1, Sensor 1) High Voltage	VM > 3.25 V
		UN > 4.40 V
		IA or IP > 7 V
P0133	O2 Circuit Slow Response (Bank 1, Sensor 1)	Signal dynamic slope check • O2S signal front vs. modeled O2S signal ratio < 0.35 and > 0.01 • Lower value of both counters for area ratios L to R and R to L > = 5 times Oscillation check • Lambda amplitude signal > 20% • Cycles > 8 • Time lambda > lambda amplitude 400 m sec. Delay check • Delay modeled lambda signal minus measured signal > 460 m sec. • Cycles > 12
P0135	O2 Heater Circuit (Bank 1, Sensor 1)	• Heater duty cycle, >100% • O2S ceramic temperature, < 715 °C • Time after O2S heater on 40 Sec.
P0136	O2 Circuit Bank 1 Sensor 2 Malfunction	• Delta voltage one step at heater switching > 2.00 V • Number of checks >= 4
P0137	O2 Circuit Low Voltage (Bank 1, Sensor 2)	Cold condition • Signal voltage, < 0.06 V for 3 Sec. Warm condition • Signal voltage < 0.01 V • Reaction at closed loop enrichment - no reaction
P0138	O2 Circuit High Voltage (Bank 1, Sensor 2)	Signal voltage > 1.08 V for > 5 Sec.
P0139	O2 Circuit Slow Response (Bank 1 Sensor 2)	• EWMA filtered transient time at fuel cutoff > 0.0 Sec. • In voltage range of 201 - 401 mV • Number of checks, >= 3

DTC	Error Message	Malfunction Criteria and Threshold Value
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 Circuit No Activity Detected (Bank 1, Sensor 2)	Signal voltage • Signal voltage, 0.40 - 0.60 V for > 3 Sec. Internal resistance • > 40000 ohm
P0141	O2 Heater Circuit (Bank 1, Sensor 2)	Heater resistance, 702 - 5250 Ohm
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 cutoff > 1.2 Sec. • In voltage range of 201.2 - 401.4 mV • Number of checks, 3
P0146	O2 Sensor Circuit No Activity Detected Bank 1 Sensor 3	• Signal voltage 0.40 - 0.60 V for > 3 Sec. • Internal resistance > 40000 Ohm
P0147	O2 Sensor Heater Circuit Bank 1 Sensor 3	• Heater (ECM internal) resistance 792 - 4560 ohm
P0169	Incorrect Fuel Composition	• Fuel quantity incorrect • Fuel correction factor incorrect • Internal check failed
P0171	System Too Lean (Bank 1)	At idle • Adaptive value > 5.02% At part-load • Adaptive value > 21%
P0172	System Too Rich (Bank 1)	At idle • Adaptive value < -5.02% At part-load • Adaptive value < -21%
P0190	Fuel Rail Pressure Sensor Circuit	Signal voltage > 4.8 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0191	Fuel Rail Pressure Sensor Circuit Range/Performance	Actual pressure > 20.6 MPa
P0192	Fuel Rail Pressure Sensor Circuit Low Input	Signal voltage < 0.2 V
P0201	Injector Circuit/Open - Cylinder 1	• Low side signal current < 2.1 A • Internal logic failure
P0202	Injector Circuit/Open - Cylinder 2	• Low side signal current < 2.1 A • Internal logic failure
P0203	Injector Circuit/Open - Cylinder 3	• Low side signal current < 2.1 A • Internal logic failure
P0204	Injector Circuit/Open - Cylinder 4	• Low side signal current < 2.1 A • Internal logic failure
P0221	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit Range/Performance	• TPS 1 - TPS 2 > 6.30% and • Actual TPS 2 calculated value > TPS 1 calculated value • TPS 2 calculated value > 9.00%
P0222	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit High Input	Signal voltage < 0.20 V
P0223	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit High Input	Signal voltage > 4.81 V
P0234	Turbocharger Overboost Condition	Difference of set value boost pressure vs altitude sensor signal > 260 - 1275 hPa
P0236	Turbocharger Boost Sensor Circuit Range/Performance	Difference of boost pressure signal vs. altitude sensor signal > 230 hPa or < -130 hPa
P0237	Turbocharger Boost Sensor Circuit Low	Signal voltage < 0.2 V
P0238	Turbocharger Boost Sensor Circuit High	Signal voltage > 4.88 V
P0243	Turbocharger Wastegate Solenoid Circuit	Signal voltage > 5.6 - 4.4 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0245	Turbocharger Wastegate Solenoid Low	Signal voltage < 3.25 - 2.15 V
P0246	Turbocharger Wastegate Solenoid High	Signal current > 2.2 to 4 A
P025A	Fuel Pump Module Control Circuit Open	Signal voltage 4.40 - 5.60 V
P025C	Fuel Pump Module Control Circuit Low	Signal voltage 2.15 - 3.25 V
P025D	Fuel Pump Module Control Circuit High	Signal current > 1.10 A
P0261	Cylinder 1 Injector Circuit Low	Signal current < 2.1 A
P0262	Cylinder 1 Injector Circuit High	Signal current > 14.70 A
P0264	Cylinder 2 Injector Circuit Low	Signal current < 2.1 A
P0265	Cylinder 2 Injector Circuit High	Signal current > 14.70 A
P0267	Cylinder 3 Injector Circuit Low	Signal current < 2.1 A
P0268	Cylinder 3 Injector Circuit High	Signal current > 14.70 A
P0270	Cylinder 4 Injector Circuit Low	Signal current < 2.1 A
P0271	Cylinder 4 Injector Circuit High	Signal current > 14.70 A
P0299	Turbocharger Underboost	Difference of set boost pressure vs. actual boost pressure value > 150 hPa
P2008	Intake Manifold Runner Control Circuit/Open	Signal voltage 4.70 - 5.40 V
P2009	Intake Manifold Runner Control Circuit Low	Signal voltage 0 to 3.26 V
P2010	Intake Manifold Runner Control Circuit High	Signal current > 2.20 A
P2014	Intake Manifold Runner Position Sensor Circuit	Signal voltage > 4.75 V
P2015	Intake Manifold Runner Position Sensor Circuit Range/Performance	• Deviation runner flap target position vs actual position > 25% • Actual position 0 to 100%
P2016	Intake Manifold Runner Position Sensor Circuit Low)	Signal voltage < 0.25 V
P2088	A Camshaft Position Actuator Control Circuit Low	Signal voltage 0 - 3.25 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2089	A Camshaft Position Actuator Control Circuit High	Signal current > 2.2 A
P2096	Post Catalyst Fuel Trim System Too Lean	Deviation lambda control < -0.03
P2097	Post-Catalyst Fuel Trim System Too Rich	Integral part of lambda control > 0.03%

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%
P0301	Cylinder 1 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%
P0302	Cylinder 2 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%
P0303	Cylinder 3 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%
P0304	Cylinder 4 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%
P0321	Engine Speed Input Circuit Performance	• Comparison of counted teeth vs. reference = incorrect • 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

DTC	Error Message	Malfunction Criteria and Threshold Value
P0327	Knock Sensor 1 Circuit Low	• Lower threshold < -70 V or for signal range check • Lower threshold < 0 - 1.60 V
P0328	Knock Sensor 1 Circuit High	• Upper threshold > 1.00 V or for signal range check • > 15 - 115.87 V
P0340	Camshaft Position Sensor Circuit	Cam adaption values out of range • > 20° KW • < -20° KW • Difference of adapted and actual values > 9° KW
P0341	Camshaft Position Sensor Circuit Performance	• Signal pattern incorrect • Defect counter 12
P0342	Camshaft Position Sensor A Circuit Low Input (Bank 1 or Single Sensor)	• Signal voltage low • Crankshaft signals = 8
P0343	Camshaft Position Sensor Circuit High Input	• Signal voltage high • Crankshaft signals = 8
P0351	Ignition Coil A Primary Circuit	• Signal current 0.25 to -2.0 mA • Internal check failed
P0352	Ignition Coil B Primary Circuit	• Signal current 0.25 to -2.0 mA • Internal check failed
P0353	Ignition Coil C Primary Circuit	• Signal current 0.25 to -2.0 mA • Internal check failed
P0354	Ignition Coil D Primary Circuit	• Signal current 0.25 to -2.0 mA • Internal check failed
P2300	Ignition Coil A Primary Control Circuit Low	Signal current > 24.0 mA
P2301	Ignition Coil A Primary Control Circuit High	Signal voltage > 5.1 - 7.0 V
P2303	Ignition Coil B Primary Control Circuit Low	Signal current > 24.0 mA
P2304	Ignition Coil B Primary Control Circuit High	Signal voltage > 5.1 - 7.0 V
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 V

DTC	Error Message	Malfunction Criteria and Threshold Value
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 V

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0410	Secondary Air Injection System	• Deviation SAI pressure sensor > 50.0 hPa
P0413	Secondary Air Injection System Switching Valve Circuit Open	• Signal voltage 4.70 - 5.40 V
P0414	Secondary Air Injection System Switching Valve Circuit Low	• Signal voltage 0 to 3.25 V or • Signal current > 2.20 A
P0418	Secondary Air Injection System Control Circuit	• Signal voltage 4.70 - 5.40 V
P0420	Catalyst System Efficiency Below Threshold	Front: • Oxygen storage capacity (OSC) vs OSC of borderline catalyst < 1.00 • Front catalyst < 1.50 and • Main catalyst < 1.00 Main: • Oxygen storage capacity (OSC) vs OSC of borderline catalyst < 0.40 • Front catalyst< .90 • While value for front catalyst < 2.00
P043E	Evaporative Emission System Leak Detection Reference Orifice Low Flow	Engine off • EVAP pump current during reference measurement < 0.40 mA Engine on • EVAP pump current during reference measurement > 0.40 mA

DTC	Error Message	Malfunction Criteria and Threshold Value
P043F	Evaporative Emission System Leak Detection Reference Orifice High Flow	Engine off • EVAP pump current during reference measurement < 15.0 mA Engine on • EVAP pump current during reference measurement > 15.0 mA
P0441	Evaporative Emission System Incorrect Purge Flow	Deviation < 8% lambda controller and 35% idle controller
P0442	Evaporative Emission System Leak Detected (Small Leak)	Time for pressure drop < 1.6 - 1.8 Sec.
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal voltage > 4.70 - 5.40 V
P0447	Evaporative Emission System Vent Control Circuit Open	• Open circuit signal voltage > 4.7 to 5.4 V • Short to ground, signal voltage > 27 to 3.26 V
P0448	Evaporative Emission System Vent Control Circuit Shorted	• Short to battery positive, signal current > 2.2 to 4.0 A
P0455	Evaporative Emission System Leak Detected (Gross Leak/ No Flow)	Time for pressure drop < 1 Sec.
P0456	Evaporative Emission System Leak Detected (Very Small Leak)	Time for pressure drop, < 4.5 - 6.0 Sec
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage 0 - 3.26 V
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.2 A
P0491	Secondary Air System Insufficient Flow	SAI pressure sensor vs modeled pressure < 60 to 75%

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P050A	Cold Start Idle Air Control System Performance	Out of range low: • Engine speed deviation < -80 RPM Out of range high: • Engine speed deviation > 80 RPM
P050B	Cold Start Ignition Timing Performance	Difference between commanded spark timing vs. actual value > 20%
P0501	Vehicle Speed Sensor Range Performance	VSS signal < 4 km/h
P0503	Vehicle Speed Sensor Intermittent/Erratic/High	Vehicle speed > 290 km/h
P0506	Idle Air Control System RPM Lower Than Expected	Integrated engine speed deviation > 2000 RPM OR engine speed deviation > 80 RPM
P0507	Idle Air Control System RPM Higher Than Expected	Idle speed Deviation > 80 RPM
P052A	Cold Start Camshaft Position Timing Over-Advanced	Difference between target and actual position > 6 CRK °
P053F	Cold Start Fuel Pressure Performance	• Difference between target pressure vs actual pressure: > 1.50 MPa or • < -1.50 MPa

Control Module and Output Signals

DTC	Error Message	Malfunction Criteria and Threshold Value
P0606	ECM Processor Fault	ECM internal check failure or BARO failure (located in the ECM).
P062B	Internal Control Module Fuel Injector Control Performance	Internal logic failure

DTC	Error Message	Malfunction Criteria and Threshold Value
P0638	Throttle Actuator Control Range/Performance	• Time to close to reference point > 6 Sec. and • Reference point 2.88% • TPS 1 signal 0.40 - 0.60 V • TPS 2 signal 4.20 - 4.60 V • TPS 1 and TPS 2 4.82 - 5.18 V
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 Circuit Open	Signal voltage > 4.4 - 5.6 V
P0658	Actuator Supply Voltage A Circuit Low	Signal voltage < 2.15 - 3.25 V
P0659	Actuator Supply Voltage Circuit High	Signal current > 1.1 A
P0697	Sensor Reference Voltage Circuit/Open	Signal voltage deviation > ± 0.3 V
P1609	Crash shut-off was triggered	Airbag(s) activated
P169A	Loading mode active	Transport mode active
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	Lost Communication With Gateway A	CAN communication with gateway Time Out - no message
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	No CAN messages received
U0302	Software Incompatibility with Transmission Control Module	AT vehicle ECM coded as MT vehicle
U0402	Invalid Data Received From Gear Shift Control Module A	Transmission Data Length Code incorrect

DTC	Error Message	Malfunction Criteria and Threshold Value
U0415	CAN Communication With ABS Error	• Speed sensor initialization failed • Speed sensor low voltage error failed • Implausible message received
U0422	Invalid Data Received From Body Control Module (IPC)	Ambient temperature value initialization failure.
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	Implausible CAN message received OR ambient temperature value = 00
U0447	Lost Communication With Gateway	CAN message implausible
U102E	Fan identification sensor Implausible signal	LIN message incorrect
U102F	Fan identification sensor No Communication	LIN communication time out
U1030	Local data bus Electrical malfunction	LIN communication not active

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 > 0.25 MPa • Fuel trim activity < 0.80 • Difference between actual pressure vs target pressure -16.38 to 16.38 MPa
P12A2	Fuel Rail Pressure Sensor Inappropriately High	• 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

DTC	Error Message	Malfunction Criteria and Threshold Value
P13EA	Cold Start Ignition Timing Performance Off Idle	Difference between commanded spark timing vs. actual value > 40%
P150A	Engine Off Time Performance	Difference between engine off time and ECM after run time < -12 Sec. or > 12 Sec.
P2101	Throttle Actuator Control Motor Circuit Range Performance	• 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	APP Sensor 1/APP Sensor 2 Circuit D Low Input	Signal voltage < 0.61 V
P2123	APP Sensor 1/APP Sensor 2 Circuit D High Input	Signal voltage > 4.79 V
P2127	APP Sensor 1/APP Sensor 2 Circuit E Low Input	Signal voltage < 0.27 V
P2128	APP Sensor 1/APP Sensor 2 Circuit E High Input	Signal voltage > 2.43 V
P2138	APP Sensor 1/APP Sensor 2 Circuit D/E Voltage Correlation	• Signal voltage: Difference between signal APP1 and APP2 > 0.17 - 0.70 V
P2146	Fuel Injector Group A Supply Voltage Circuit Open	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	Adaptive value > 28%
P2178	System Too Rich Off Idle	Adaptive value < -21%
P2181	Cooling System Performance	Cooling system temperature too low after a sufficient mass air flow integral 74 - 84 °C
P2184	Engine Coolant Temperature Sensor 2 Circuit Low	ECT outlet > 141 °C
P2185	Engine Coolant Temperature Sensor 2 Circuit High	ECT outlet < -43 °C
P2187	System Too Lean At Idle	Adaptive value > 5.02%
P2188	System Too Rich At Idle	Adaptive value < -5.02%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2195	Sensor Signal Biased/Stuck Lean Bank 1 Sensor 1	Delta lambda of 2nd lambda control loop > 0.07
P2196	O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 1	Delta lambda of 2nd lambda control loop < -0.07
P2231	O2 Sensor Bank 1 Sensor 1 Signal Circuit Shorted to Heater Circuit	Delta O2S signal front > 190 uA
P2237	O2 Sensor Positive Current Control Circuit Open Bank 1 Sensor 1	• 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	O2S signal front 1.47 to 1.53 V and internal resistance > 1000 Ohm
P2257	Secondary Air Injection System Control Circuit Low	Signal voltage 0 to 3.26 V
P2258	Secondary Air Injection System Control Circuit High	Signal current .60 - 2.40 A
P2270	O2 Sensor Signal Stuck Lean Bank 1 Sensor 2	• O2S signal rear < -2.00 mV • Enrichment after stuck lean 27.9%
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%
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

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/Open	Signal voltage > 4.4 - 5.6 V
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	Signal voltage < 2.15 to 3.25 V
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	Signal current > 3 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 Range/Performance	• High signal voltage > 12 Sec. • Number of checks = 30
P2407	Evaporative Emission System Leak Detection Pump Sense Circuit Intermittent/Erratic	Engine off • Fluctuation of EVAP pump current during reference measurement > 2.0 mA or • Drop of EVAP pump current > 6.0 mA during pump phase for time > = 3.0s Engine on • Fluctuation of EVAP pump current during reference measurement > 2.0 mA or • Drop of EVAP pump current > 6.0 mA during pump phase for time > = 3.0s
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 4.0 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P2414	O2 Sensor Exhaust Sample Error Bank 1, Sensor 1	Threshold 1 • Signal voltage 3.1 - 4.81 V Threshold 2 • O2S signal 2.5 - 3.2 V
P2431	Secondary Air Injection Sensor Performance	• Difference between SAI pressure sensor and ambient pressure NOT -60.0 to 60.0 hPa
P2432	Secondary Air Injection Sensor Circuit Low	• Signal voltage < 0.40 V
P2433	Secondary Air Injection Sensor Circuit High	• Signal voltage > 4.65 V
P2440	Secondary Air Injection System Switching Valve Stuck Open	• SAI pressure sensor vs modeled while SAI valve is closed < 71.1%
P2450	Evaporative Emission System Switching Valve Performance/ Stuck Open	Engine off • EVAP pump current difference between reference measurement to idle < = 3.0mA Engine on • EVAP pump current difference between reference measurement to idle < = 3.0mA
P2568	Direct Ozone Reduction Catalyst Temperature Sensor Circuit Range/Performance	• ID check failure • Temperature sensor functional check failure
P2569	Direct Ozone Reduction Catalyst Temperature Sensor Circuit Low	• Electrical error via LIN failure (grounded)
P2570	Direct Ozone Reduction Catalyst Temperature Sensor Circuit High	• Electrical error via LIN failure (short to battery, open circuit)
P2626	O2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	• O2S signal front > 4.81 V
P3081	Engine Temperature Too Low	Difference between ECT and modeled ECT > 10 °K

DTC CHART

Engine Codes CCTA

Fuel and Air Mixture, Additional Emission Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Intake (A) Camshaft Position Slow Response Bank 1	Signal change < 1.9 - 4.2°CRK/s
P0010	Intake (A) Camshaft Position Actuator Circuit/Open (Bank 1)	Signal voltage > 4.4 - 5.6 V
P0011	Intake (A) Camshaft Position Timing - Over-Advanced (Bank 1)	Target error (stuck position) > 6.8 - 8°CRK
P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1, Sensor A)	• Permissible deviation < 11° Rev or • Permissible deviation > 11° Rev
P025A	Fuel Pump Open Circuit	Signal voltage > 4.4 - 5.6 V
P025C	Fuel Pump Short to Ground	Signal voltage < 2.15 - 3.25 V
P025D	Fuel Pump Short to B+	Signal current > 1.1 A
P0030	HO2S Heater Control Circuit (Bank 1, Sensor 1) Open Circuit	Heater voltage 2.34 - 3.59 V
P0031	HO2S Heater Control Circuit Low (Bank 1, Sensor 1)	Heater voltage < 2.34 V
P0032	HO2S Heater Control Circuit High (Bank 1, Sensor 1)	Heater voltage > 3.59 V
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

DTC	Error Message	Malfunction Criteria and Threshold Value
P0068	MAP/MAF – Throttle Position Correlation	• Plausibility with fuel system load calculation < -50% • Plausibility with fuel system load calculation > 50%
P0070	Ambient Air Temperature Sensor Circuit	Ambient air temperature < -45 °C
P0071	Ambient Air Temperature Sensor Range/Performance	• Difference in value between ECT and AAT at engine start (depending on engine off time) > 25 - 40 °K and • Difference in value between AAT and IAT at engine start (depending on engine off time) > 25 - 40 °K
P0072	Ambient Air Temperature Sensor Circuit Low	Ambient air temperature > 87 °C
P0087	Fuel Rail/System Pressure - Too Low	• Fuel trim activity 1.3 - 0.16 • Output value rail pressure controller > 4 MPa • Difference between target and actual pressure > -16.4
P0100	Mass or Volume Air Flow A Circuit	MAF sensor signal 0 µs
P0101	Mass Air Flow A Circuit Range/Performance	Mass air flow vs. • Upper threshold model < 12% • Lower threshold model < 12% • Load calculation > 21% • Fuel system < -19%
P0102	Mass or Volume Air Flow A Circuit Low Input	MAF sensor signal < 66 µs
P0103	Mass or Volume Air Flow A Circuit High Input	MAF sensor signal > 4500 µs
P0106	Manifold Absolute Pressure/ Barometric Pressure Circuit Range/Performance	• Difference of boost pressure signal vs altitude sensor signal > 230 hPa or • Difference of boost pressure signal vs altitude sensor signal < -130 hPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	• Difference in value IAT - ECT @ engine start (depending on engine off time) > 25 - 40 °K • Difference in value IAT - AAT @ engine start < 25 - 40 °K (depending on engine off time)
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	Intake air temperature > 141 °C
P0113	Intake Air Temperature Sensor 1 Circuit High Input	Intake air temperature < 45.8 °C
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/ Performance	• No change on signal < 1.5 °K or • Signal in range 88.5 - 109.5 °C with no change on signal 1.5 °K
P0117	Engine Coolant Temperature Sensor 1 Circuit Low Input	Engine coolant temperature > 140.30 °C
P0118	Engine Coolant Temperature Sensor 1 Circuit High Input	Engine coolant temperature < -39.80 °C
P0121	Throttle/Pedal Position Sensor A Circuit Range/Performance	• TPS 1 - TPS 2 > 6.30% • Actual TPS 1 calculated value > actual TPS 2 calculated value • TPS 1 calculated value > 9.00%
P0122	Throttle/Pedal Position Sensor A Circuit Low Input	Signal voltage < 0.20 V
P0123	Throttle/Pedal Position Sensor A Circuit High Input	Signal voltage > 4.81 V
P013A	O2 Sensor Bank 1 Sensor 2 Slow Response - Rich to Lean	• Arithmetric filtered max differential transient time at fuel cut off > = 0.50s or • EWMA filtered max differential transient time at fuel cut off n.a. and • Number of checks > = 1.00 -
P0130	O2 Sensor Circuit (Bank 1, Sensor 1)	O2S ceramic temperature < 640 °C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0131	O2 Sensor Circuit (Bank 1, Sensor 1) Low Voltage	VM < 2.0 V
		UN < 1.75 V
		IA or IP > 0.30 V
P0132	O2 Sensor Circuit (Bank 1, Sensor 1) High Voltage	VM > 3 V
		UN > 4 V
		IA or IP > 1.5 V
P0138	O2 Circuit High Voltage (Bank 1, Sensor 2)	Signal voltage > 1.26 V
P0139	O2 Circuit Slow Response (Bank 1 Sensor 2)	• EWMA filtered transient time at fuel cut off > 0.4 Sec. • In voltage range 201.2 - 401.4 mV • Number of checks > 3
P0140	O2 Circuit No Activity Detected (Bank 1, Sensor 2)	Signal voltage • Signal voltage 401.4 - 499 mV Internal resistance • > 40000 ohm
P0141	O2 Heater Circuit (Bank 1, Sensor 2) Out of Range	Heater resistance, 1404 - 13650 Ohm
P0169	Incorrect Fuel Composition	• Fuel quantity incorrect • Fuel correction factor incorrect • Internal check failed
P0171	System Too Lean (Bank 1)	At idle • Adaptive value > 5.02% At part-load • Adaptive value 21%
P0172	System Too Rich (Bank 1)	At idle • Adaptive value < 5.02% (< 6.0% only B8 ULEV) At part-load • Adaptive value < 21%
P0190	Fuel Rail Pressure Sensor A Circuit	Signal voltage > 4.8 V
P0191	Fuel Rail Control Valve, High Pressure Side	Actual pressure > 20.6 MPa
P0192	Fuel Rail Pressure Sensor A Circuit Low Input	Signal voltage < 0.2 V
P0201	Injector Circuit/Open - Cylinder 1	• Low side signal current < 2.1 A • Internal logic failure

DTC	Error Message	Malfunction Criteria and Threshold Value
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 Circuit Range/ Performance	• TPS 1 - TPS 2 > 6.30% and • Actual TPS 2 calculated value > TPS 1 calculated value • TPS 2 calculated value > 9.00%
P0222	Throttle/Pedal Position Sensor/Switch B Circuit Low Input	Signal voltage < 0.20 V
P0223	Throttle/Pedal Position Sensor/Switch Circuit High Input	Signal voltage > 4.81 V
P0234	Turbocharger/Supercharger Overboost Condition	Difference of set value boost pressure vs altitude sensor signal > 200 - 1275 hPa
P0236	Turbocharger Boost Sensor A Plausibility Check	Difference in boost pressure signal vs. altitude sensor signal > 220 hPa or < 120 hPa
P0237	Turbocharger/Supercharger Boost Sensor A Circuit Low	Signal voltage < 0.2 V
P0238	Turbocharger/Supercharger Boost Sensor A Circuit High	Signal voltage > 4.88 V
P0243	Turbocharger/Supercharger Wastegate Solenoid A	Signal voltage > 5.6 - 4.4 V
P0245	Turbocharger/Supercharger Wastegate Solenoid A Low	Signal voltage < 3.25 - 2.15 V
P0246	Turbocharger/Supercharger Wastegate Solenoid A High	Signal current > 2.2 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

DTC	Error Message	Malfunction Criteria and Threshold Value
P0261	Cylinder 1 Injector Circuit Low	Signal current < 2.1 A
P0262	Cylinder 1 Injector Circuit High	Signal current > 14.70 A
P0264	Cylinder 2 Injector Circuit Low	Signal current < 2.1 A
P0265	Cylinder 2 Injector Circuit High	Signal current > 14.70 A
P0267	Cylinder 3 Injector Circuit Low	Signal current < 2.1 A
P0268	Cylinder 3 Injector Circuit High	Signal current > 14.70 A
P0270	Cylinder 4 Injector Circuit Low	Low side signal current < 2.1 A
P0271	Cylinder 4 Injector Circuit High	Signal current > 14.70 A
P0299	Turbocharger/Supercharger Underboost	Difference of set boost pressure vs. actual boost pressure value > 150 hPa
P2004	Intake Manifold Runner Control Stuck Open Bank 1	• Normal closed position, unable to reach signal voltage < 2.62 or > 4.65 V or • Normal open position, unable to reach signal voltage < 0.35 or > 2.38 V
P2008	Intake Manifold Runner Control Circuit/Open	Signal voltage 4.40 - 5.50 V
P2009	Intake Manifold Runner Control Circuit Low	Signal voltage 3.25 - 2.15 V
P2010	Intake Manifold Runner Control Circuit High	Signal current > 2.20 A
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%
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 < 2.15 - 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%

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.1% • Catalyst damage misfire rate (MR), > 2.9% - 20%
P0301	Cylinder 1 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.1% • Catalyst damage misfire rate (MR), > 2.9% - 20%
P0302	Cylinder 2 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.1% • Catalyst damage misfire rate (MR), > 2.9% - 20%
P0303	Cylinder 3 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.1% • Catalyst damage misfire rate (MR), > 2.9% - 20%
P0304	Cylinder 4 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.1% • Catalyst damage misfire rate (MR), > 2.9% - 20%
P0321	Ignition/Distributor Engine Speed Input Circuit Range/ Performance	• Comparison of counted teeth vs. reference = incorrect • 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 Input (Bank 1)	• Lower threshold < -70 V or for signal range check • Lower threshold < 0 - 2.1582 V
P0328	Knock Sensor 1 Circuit High Input (Bank 1)	• Upper threshold > 1.00 V or for signal range check • > 29.0674 - 114.9023 V

DTC	Error Message	Malfunction Criteria and Threshold Value
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 Input (Bank 1 or Single Sensor)	• Signal voltage low • Crankshaft signals = 8
P0343	Camshaft Position Sensor A Circuit High Input (Bank 1 or Single Sensor)	• Signal voltage high • Crankshaft signals = 8
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
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

DTC	Error Message	Malfunction Criteria and Threshold Value
P2310	Ignition Coil D Primary Control Circuit High	Signal voltage > 5.1 - 7.0 mA

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	Front: • Oxygen Storage Capacity (OSC) vs. OSC of borderline catalyst < 0.40 or • Front catalyst < 1.30 and • Main catalyst < 1.20 Main: • Oxygen storage capacity (OSC) vs OSC of borderline catalyst < 0.40 • Front catalyst< .90 • While value for front catalyst < 2.00
P0441	Evaporative Emission System Incorrect Purge Flow	Deviation < 0.079% lambda controller and 35% idle controller
P0442	Evaporative Emission System Leak Detected (Small Leak)	Time for pressure drop < 1.55 - 1.75 Sec.
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal voltage > 4.40 - 5.40 V
P0455	Evaporative Emission System Leak Detected (Gross Leak/ No Flow)	Time for pressure drop < 0.95 Sec.
P0456	Evaporative Emission System Leak Detected (Very Small Leak)	Time for pressure drop, < 4.5 - 6.0 Sec.
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage < 2.15 - 3.25 V
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.2 A

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P050A	Cold Start Idle Air Control System Performance	Out of range low: • Engine speed deviation < -80 RPM Out of range high: • Engine speed deviation > 80 RPM
P050B	Cold Start Ignition Timing Performance	• Difference between commanded spark timing vs. actual value > 20.00 to 50.00%
P0501	Vehicle Speed Sensor A Range/Performance	VSS signal < 4 km/h
P0503	Vehicle Speed Sensor Intermittent/Erratic/High	Vehicle speed > 290 km/h
P0506	Idle Air Control System - RPM Lower Than Expected	Idle speed Deviation < -80 RPM
P0507	Idle Air Control System RPM Higher Than Expected	Idle speed Deviation > 80 RPM
P053F	Cold Start Fuel Pressure Performance	• Difference between target pressure vs. actual pressure < -1.50 MPa • Difference between target pressure vs. actual pressure > 1.50 MPa
P150A	Engine Off Timer Performance	• Difference between engine-off-time and ECM after-run time < -12.0 s • Difference between engine-off-time and ECM after-run time > 12.0 s

Control Module and Output Signals

DTC	Error Message	Malfunction Criteria and Threshold Value
P0606	ECM Processor Fault	ECM internal check failure
P062B	Internal Control Module Fuel Injector Control Performance	Internal logic failure

DTC	Error Message	Malfunction Criteria and Threshold Value
P0638	Throttle Actuator Control Range/Performance - Bank 1	• Time to close to reference point > 0.56 Sec. and • reference point 2.88% • Time to close below reference point, + 2.49%, > 0.56 Sec. • Duty cycle > 80% • ECM power stage no failure
P0641	Sensor Reference Voltage A Circuit/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
P1609	Crash shut-off was triggered	Airbag(s) activated
P169A	Loading mode active	Transport mode active
U0001	High Speed CAN Communication Bus	Bus Off failure
U0002	High Speed CAN Communication Bus Performance	Global Time Out failure
U0100	Lost Communication with TCM	• Time Out failure. No message received by ECM
U0101	Lost Communication with TCM	CAN communication with TCM, time out. No message received by ECM
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	CAN communication with ABS Time Out.
U0146	Lost Communication With Gateway A	CAN communication with gateway Time Out
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	Received CAN message no message

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 Gear Shift Control Module A	Transmission Data Length Code incorrect
U0415	CAN Communication With ABS Error	• Speed sensor initialization failed • Speed sensor low voltage • Speed sensor error failed
U0422	Invalid Data Received From Body Control Module (Cluster)	Ambient temperature value initialization failure.
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	• Received data implausible message • Ambient temperature value (initialization) 00h(-)
U0427	Lost Communication With Gateway	CAN message incorrect

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	• Pressure control activity > 0.25 MPa • Fuel trim activity < 0.80 • Difference between actual pressure vs target pressure -16.38 to 16.38 MPa
P12A2	Fuel Rail Pressure Sensor Inappropriately High	• Pressure control activity < -0.05 MPa • Fuel trim activity > 1.30 • 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
P150A	Engine Off Time Performance	Difference between engine off time and ECM after run time < -12 s or > 12 s

DTC	Error Message	Malfunction Criteria and Threshold Value
P2101	Throttle Actuator 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 < 0.606 V
P2123	Throttle/Pedal Position Sensor/Switch D Circuit High Input	Signal voltage > 4.794 V
P2127	Throttle/Pedal Position Sensor/Switch E Circuit Low Input	Signal voltage < 0.268 V
P2128	Throttle/Pedal Position Sensor/Switch E Circuit High Input	Signal voltage > 2.431 V
P2138	Throttle/Pedal Position Sensor/Switch D/E Voltage Correlation	• Signal voltage: Difference between signal APP1 and APP2 > 0.167 - 0.703 V
P2146	Fuel Injector Group A Supply Voltage Circuit / Open	Signal current, < 2.6 A or • Signal current > 14.70 A
P2149	Fuel Injector Group B Supply Voltage Circuit/Open	• Signal current, < 2.6 A or • Signal current > 14.70 A
P2177	System too lean off idle, Bank 1	System to lean @ part load adaptive value > 28.00%
P2178	System too rich off idle, Bank 1	System to rich @ part load adaptive value < -21.00%
P2181	Cooling System Performance	Cooling system temperature too low after a sufficient mass air flow integral 74 - 84 °C
P2187	System too lean at idle, Bank 1	System to lean @ idle adaptive value > 5.02%
P2188	System too rich at idle, Bank 1	System to rich @ idle adaptive value < -5.02%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2195	O2 Sensor Signal Biased/ Stuck Lean (Bank 1, Sensor 1)	Delta lambda of 2nd lambda control loop > 0.07
P2196	O2 Sensor Signal Biased/ Stuck Rich (Bank 1, Sensor 1)	Delta lambda of 2nd lambda control loop < 0.07
P2231	O2 Sensor Bank 1 Sensor 1 Signal Circuit Shorted to Heater Circuit	Delta O2S signal front > 190 uA
P2237	O2 Sensor Positive Current Control Circuit/Open (Bank 1, Sensor 1)	• O2S signal front 1.493 - 1.507 V or • O2S signal front < 1.7002 V • Fuel cutoff < 3 sec. or • O2S signal front 1.50 - 1.51 V • Delta lambda controller > 0.10
P2243	O2 Sensor Reference Voltage Circuit/Open (Bank 1, Sensor 1)	• O2S signal front < 0.30 V and Internal resistance > 1000 Ohms • O2S signal front > 4.70 V and Internal resistance > 1000 Ohm
P2251	O2 Sensor Negative Current Control Circuit Bank 1 Sensor 1 open	Open circuit virtual mass (VM) • O2S voltage signal front 1.47 to 1.53 V •and • Internal resistance > 1000.00 Ohm
P2270	O2 Sensor Signal Stuck Lean (Bank 1, Sensor 2)	O2S signal rear < 0.557 — 5.30
P2271	O2 Sensor Signal Stuck Rich (Bank 1, Sensor 2)	• Measurement range from fuel cutoff to voltage threshold < = 152.3 mV • 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

DTC	Error Message	Malfunction Criteria and Threshold Value
P2294	Fuel Pressure Regulator 2 Control Circuit	• Signal voltage 2.3 - 2.7 V or • Signal pattern incorrect
P2295	Fuel Pressure Regulator 2 Control Circuit Low	Signal voltage 1.8 - 2.2 V
P2296	Fuel Pressure Regulator 2 Control Circuit High	Signal voltage > 3.9 V

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/Open	Signal voltage > 4.4 - 5.6 V
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	Signal voltage < 2.15 to 3.25 V
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	Signal current > 1.1 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 Range/Performance	• High signal voltage > 30.4 Sec
P2414	O2 Sensor Exhaust Sample Error (Bank 1, Sensor 1)	Threshold 1 • Signal voltage 3.1 - 4.81 V • O2S signal 2.5 - 3.2 V Threshold 2 • Signal voltage 2.5 V • O2S signal 2.5 - 3.1 V
P2626	O2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	• O2S signal front > 4.81 V
P3081	Engine Temperature Too Low	Difference between ECT and modeled ECT > 9.80 °K

DTC CHART

Engine Codes CJAA

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 “A” Module Performance	Boost pressure actuator stuck < 17% when commanded on or > 17% when commanded off.
P00C6	Fuel Rail Pressure Too Low - Engine Cranking	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 Boost Control Solenoid “A” Circuit Open	Open circuit message from output driver
P0047	Turbocharger Boost Control Solenoid “A” Circuit Low	Short to ground message from output driver
P0048	Turbocharger Boost Control Solenoid “A” Circuit High	Short to voltage message from output driver
P0071	Ambient Air Temperature Sensor Circuit Range/ Performance	Temperature difference to at least 2 other temperature sensors at startup > 45 °K
P0072	Ambient Air Temperature Sensor Circuit Low	Error signal low sent from Cluster to ECU
P0073	Ambient Air Temperature Sensor Circuit High	Error signal high sent from Cluster to ECU

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 Air Flow Circuit	• Battery voltage < 7.5 V or • Signal range check low, battery voltage < 7.5 V
P0101	Mass Air Flow Circuit Performance	Ratio of actual mass airflow and modeled air mass > 1.80 or < 0.84
P0102	Mass 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 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 Circuit 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 Circuit Low Input	Boost temperature sensor voltage < 0.04 V
P0113	Intake Air Temperature Sensor Circuit High Input	Boost temperature sensor voltage > 2.88 V
P0116	Engine Coolant Temperature Sensor 1 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 Temperature below control range	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) Malfunction	• 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 (Bank 1, Sensor 1)	• VM > 3.25 V • UN > 4.40 V • IA or IP > 7.0 V
P0133	O2 Sensor Circuit Bank 1 Sensor 1 Slow Response	• 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 Malfunction	Diagnostic signal from output driver sent OR Sensor element temperature < 720 or > 840 °C
P0136	O2 Sensor Circuit Bank 1 Sensor 2 Malfunction	• 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 • 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 (Bank 1 Sensor 2) Slow Response	O2S raw signal > 3.2 V
P0139	O2 Sensor Circuit (Bank 1 Sensor 2) Slow Response	• 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.
P0140	O2 Sensor Bank 1 Sensor 1 Slow Response Lean to Rich	Time delay between oxygen signals pre and post NOx trap > 1.5 Sec.
P0141	O2 Sensor Heater Circuit Bank 1 Sensor 2 Malfunction	• 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	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 Input	Sensor voltage < 200 mV or > 591 mV
P0193	Fuel Rail Pressure Sensor Circuit High Input	• 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	Cylinder 1 Injector Circuit	Open circuit diagnostic signal from output driver
P0202	Cylinder 2 Injector Circuit	Open circuit diagnostic signal from output driver
P0203	Cylinder 3 Injector Circuit	Open circuit diagnostic signal from output driver

DTC	Error Message	Malfunction Criteria and Threshold Value
P0204	Cylinder 4 Injector Circuit	Open circuit diagnostic signal from output driver
P0234	Turbo Charger Overboost Condition limit exceeded	Control deviation > -300 - -800 hPa @ delta engine speed/ injection quantity
P0236	Turbocharger Boost Sensor (A) Circuit Performance	Difference between barometric and boost pressure signal > 150 hPa
P0237	Turbocharger Boost Sensor (A) Circuit Low Input	Boost Pressure Sensor < 0.68 V
P0238	Turbocharger Boost Sensor (A) Circuit High Input	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 Charger Underboost	Deviation of actual and desired boost pressure > 400 - 800 hPa @ delta engine speed/injection quantity
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

DTC	Error Message	Malfunction Criteria and Threshold Value
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
P13CF	Sensor for internal pressure of cylinder 1 Implausible signal	Cylinder pressure sensor voltage < 0.13 V
P13DO	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 malfunction	Cylinder pressure sensor voltage > 3.17 V
P13D3	Sensor for internal pressure of cylinder 2 Implausible signal	Offset out of range < -7 bar or > 7 bar
P13D4	Sensor for internal pressure of cylinder 3 Electrical malfunction	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	Low Pressure EGR Sensor Position circuit high	Position sensor signal > 4850 mV
P014D	O2 Sensor Bank1-Sensor1 Slow Response - Lean to Rich	• 1.5 s (sensor 1 later than sensor 2) • 0.45 to 0.72 s = f (exhaust gas mass flow) (sensor 2 later than sensor 1)
P140E	Low Pressure EGR Sensor Position circuit Low	Position sensor signal < 150 mV
P169A	Loading mode active	Transport mode = active
P20D8	Exhaust After Treatment Fuel Supply Control Performance	Control deviation > limit from Map f or < limit from Map f (engine speed, torque)
P2000	NOx Adsorber 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 gf
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%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2008	Intake Manifold Runner Bank 1 Control Circuit Low	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 Control Circuit High, Bank 1	Short to voltage on output 1 or 2 signal from output driver
P2015	Intake Manifold Runner Position Sensor 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
P2016	Intake Manifold Runner Position Sensor Circuit Low	Position sensor signal < 0.25 V
P2017	Intake Manifold Runner Position Sensor Circuit High	Position sensor signal > 4.75 V
P2031	Exhaust Gas Temperature Sensor 2 Circuit	Sensor 2 voltage > 1.72 V
P2032	Exhaust Gas Temperature Sensor 2 Circuit Low	Sensor 2 voltage < 0.45 V
P2080	Exhaust Gas Temperature Sensor 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
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
P2122	Throttle/Pedal Position Sensor D Circuit Low Input	Sensor 1 voltage < 0.61 V
P2123	Throttle/Pedal Position Sensor D Circuit High Input	Sensor 1 voltage > 4.79 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2127	Throttle/Pedal Position Sensor E Circuit Low Input	Sensor 2 voltage < 0.27 V
P2128	Throttle/Pedal Position Sensor D/E Circuit Voltage Correlation	Sensor 2 voltage > 2.43 V
P2138	Throttle/Pedal Position Sensor D/E Circuit Voltage Correlation	Voltage drift monitoring: • Throttle Position Sensor 1 voltage and APP Sensor 2 voltage = 13 - 20%
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	ECT signal voltage > 3.25 V
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 Bank 1 Sensor 1 Open	• O2S internal resistance > 1104Ω • Oxygen sensor raw signal > 3 V
P2251	O2 Sensor Negative Current Control Circuit Bank 1 Sensor 1 open	• 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

DTC	Error Message	Malfunction Criteria and Threshold Value
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

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P2100	Throttle Actuator Control Motor Circuit/Open	Open circuit diagnostic signal sent from output driver
P2101	Throttle Actuator Control Motor Circuit Range/ performance	Missing diagnostic signal from actuator module
P2102	Throttle Actuator Control Motor Circuit Low	Circuit short to ground diagnostic signal sent from output driver
P2103	Throttle Actuator "A" Control Motor Circuit High	Circuit short to voltage diagnostic signal sent from output driver
P2146	Fuel Injector Group “A” Supply Voltage Circuit Open	Diagnostic signal from output driver = characteristic error pattern
P2149	Fuel Injector Group “B” Supply Voltage Circuit Open	Diagnostic signal from output driver = characteristic error pattern
P2279	Intake Air System Leak	• Threshold to detect a defective system > 1.33 - 1.60
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 Short to Ground	Signal voltage < 1.40 - 3.20 V
P2296	Fuel Pressure Regulator 2 Control Circuit High	Signal voltage > 3.20 V
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

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
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	Engine Speed Input Circuit Range/Performance	• Consecutive not plausible signals > 15 • Cam phase signals without plausible signal > 4 cam rotations.

DTC	Error Message	Malfunction Criteria and Threshold Value
P0322	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.
P2300	Ignition Coil A Primary Control Circuit Low	Signal current > 24.0 mA
P2301	Ignition Coil A Primary Control Circuit High	Signal current > 5.1 - 7.0 mA
P2303	Ignition Coil B Primary Control Circuit Low	Signal current > 24.0 mA
P2304	Ignition Coil B Primary Control Circuit High	Signal current > 5.1 - 7.0 mA
P2306	Ignition Coil C Primary Control Circuit Low	Signal current > 24.0 mA
P2307	Ignition Coil C Primary Control Circuit High	Signal voltage > 5.1 - 7.0 mA
P2309	Ignition Coil D Primary Control Circuit Low	Signal current > 24.0 mA
P2310	Ignition Coil D Primary Control Circuit High	Signal voltage > 5.1 - 7.0 mA

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P040B	Exhaust Gas Recirculation Temperature Sensor Circuit Range/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 Insufficient Flow Detected	Control deviation < limit from map f (engine speed, desired airflow)

DTC	Error Message	Malfunction Criteria and Threshold Value
P0402	Exhaust Gas Recirculation Excessive Flow Detected	Control deviation > limit from map (engine speed, desired airflow)
P0403	Exhaust Gas Recirculation Circuit	Valve stuck open > 17% or stuck closed < 17%
P0405	Exhaust Gas Recirculation Sensor Circuit Low	Position sensor signal range check low.
P0406	Exhaust Gas Recirculation Sensor Circuit High	Position sensor signal range check high.
P0420	Catalyst System Bank 1 Efficiency Below Threshold	HC conversion rate < 0.3
P045A	Exhaust Gas Recirculation “B” Control Circuit	Diagnostic signal from output driver
P045B	Exhaust Gas Recirculation “B” 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 “B” Control Circuit High	Diagnostic signal from output driver
P045E	Exhaust Gas Recirculation “B” Control Stuck Open	Comparison of actual and desired position signal • Control deviation > 12%
P045F	Exhaust Gas Recirculation “B” Control Stuck Closed	Comparison of actual and desired position signal • Control deviation < -12%
P046C	Exhaust Gas Recirculation Sensor “A” Circuit Range/ Performance	Position sensor signal > 1 V or < 0.4 V
P047C	Exhaust Pressure Sensor “B” Low	Pressure sensor voltage < 0.2 V
P047D	Exhaust Pressure Sensor “B” High	Pressure sensor voltage > 4.9 V
P047F	Exhaust Pressure Control Valve “A” Stuck Open	Control valve stuck open - position sensor < 10% when commanded closed
P0470	Exhaust Pressure Sensor “A”	Sensor voltage > 4.9
P0471	Exhaust Pressure Sensor “A” Range/Performance	Sensor voltage > 4.9
P0472	Exhaust Pressure Sensor A Low	Sensor voltage < 0.2 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0473	Exhaust Pressure Sensor A High	Sensor voltage >4.9 V
P0474	Exhaust Pressure Sensor “A” Circuit Intermittent/Erratic	Difference between modeled and measured differential pressure across low pressure EGR > 40hPa
P0475	Exhaust Pressure Control Valve “A”	Diagnostic signal from output driver
P0477	Exhaust Pressure Control Valve “A” Low	Diagnostic signal from output driver.
P0478	Exhaust Pressure Control Valve “A” High	Short to voltage on Out 1 or Out 2 signal from output driver.
P048A	Exhaust Pressure Control Valve “A” Stuck Closed	Control valve stuck closed - position sensor > 10% when commanded open
P048B	Exhaust Pressure Control Valve Position Sensor Circuit Low	Position sensor signal < 0.25 V
P048C	Exhaust Pressure Control Valve Position Sensor 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 Position Sensor Circuit High	Position sensor signal > 4.85 V
P0486	Exhaust Gas Recirculation Sensor “B” Circuit	Position sensor signal > 4890 or < 210 mV
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

DTC	Error Message	Malfunction Criteria and Threshold Value
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
P2456	Diesel Particulate Filter Pressure Sensor “A” Circuit Intermittent/Erratic	• Inverse change of differential pressure per time > 10 hPa/s • Inverse change of differential pressure per time < -10 hPa/s
P2457	Exhaust Gas Recirculation Cooling System Performance	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

DTC	Error Message	Malfunction Criteria and Threshold Value
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)

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor Performance	Vehicle speed < 6 km/h
P0502	Vehicle Speed Sensor Circuit Low Input	Brake control unit error message sent
P0503	Vehicle Speed Sensor Intermittent High Signal	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	Vehicle Speed Sensor “A” Intermittent/Erratic/High	
P054E	Idle Control System Fuel Quantity Lower Than Expected	Actual fuel mass < limit from map f (engine temperature)
P054F	Idle Control System Fuel Quantity Higher Than Expected	Actual fuel mass > limit from map f (engine temperature)
P0544	Exhaust Gas Temperature Sensor Circuit - Bank 1	Signal voltage > 1.72 V
P0545	Exhaust Gas Temperature Sensor Circuit - Bank 1 Low	Signal voltage < 0.45 V
P0562	System Voltage Low Voltage	Internal check failure of voltage supply for ECM off timer

DTC	Error Message	Malfunction Criteria and Threshold Value
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

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).
P06C8	Cylinder 4 Glow Plug Incorrect	Message from Glow Control Unit = error message (wrong current slope).

DTC	Error Message	Malfunction Criteria and Threshold Value
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	Internal Control Module Memory Check Sum Error	• 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	ECM Internal Temperature Too High	Current Over-Temperature diagnostic signal from output driver > 150 °C
P0638	Throttle Actuator Control (Bank 1) Range/Performance	Diagnostic signal from actuator module = defective state
P064C	Glow Control Unit Module Error	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	Over current on circuit > 70 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P0670	Glow Plug Module 1 Control Circuit electrical malfunction electrical circuit	Message from glow control unit = 3.44 V
P0671	Cylinder 1 Glow Plug Circuit Q10 Electrical Fault	Message from Glow Control Unit, (glow current < 2.2 A)
P0672	Cylinder 2 Glow Plug Circuit Q11 Electrical Fault	Message from Glow Control Unit, (glow current < 2.2 A)
P0673	Cylinder 3 Glow Plug Circuit Q12 Electrical Fault	Message from Glow Control Unit, (glow current < 2.2 A)
P0674	Cylinder 4 Glow Plug Circuit Q13 Electrical Fault	Message from Glow Control Unit, (glow current < 2.2 A)
P068A	ECM Power Relay Performance - De-Energized Too Early	Relay stuck, no change in circuit voltage
P068B	ECM Power Relay Performance - De-Energized 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
P2610	ECM/PCM Internal Engine Off Timer Performance	Quantity time over threshold < 7.52 or > 8.48 Sec.
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 > 35s
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.

DTC	Error Message	Malfunction Criteria and Threshold Value
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	No messages received from ABS module
U0146	Lost Communication With Gateway “A”	Fault message from gateway = true
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 Gear Shift Control Module A	Wrong TCM messages received.
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.
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	Error message sent from Instrument Panel Cluster to ECU
U1024	Communications Bus Fault, IPC to ECU	Error message sent from instrument cluster to ECU

DTC CHART

Engine Codes CRZA

Fuel and Air Mixture, Additional Emission Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Camshaft Position Slow Response	Difference between target and actual position > 8 °CRK for > 1.3 to 2.9 Sec. and adjustment angle >= 2.50 °CRK
P0010	Camshaft Position Actuator Circuit Open	Signal voltage, > 4.70 - 5.40 V
P0011	Camshaft Position Timing - Over-Advanced	• Difference between target and actual position > 8 CRK ° • Adjustment angle < 2.50 CRK °
P0016	Crankshaft Position vs. Camshaft Position Correlation	• Permissible deviation < 11° Rev or • Permissible deviation > 11° Rev
P0036	HO2S Heater Control Circuit (Bank 1, Sensor 2) Open	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
P008A	Low Pressure Fuel System Pressure Too Low	Actual pressure < 0.08 MPa
P008B	Low Pressure Fuel System Pressure Too High	Actual pressure > 0.8 MPa
P0087	Fuel Rail/System Pressure - Too Low	• Fuel trim activity 0.90 - 1.15 • Output value rail pressure controller > 2 MPa • Difference between target and actual pressure > -16.38
P0089	Fuel Pressure Regulator Performance	• Difference between target and actual pressure > 0.15 and < -0.2 MPa • Total pressure controller response < -0.25 and > 0.35 MPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P0100	Mass Air Flow Circuit Fault	MAF sensor signal 0 µs
P0101	Mass Air Flow Circuit Performance	Mass air flow vs. • Upper threshold model < 12% • Lower threshold model < 0.400 kg/h • Load calculation > 21% • Fuel system < -19%
P0102	Mass Air Flow Circuit Low Input	MAF sensor signal < 66 µs
P0103	Mass Air Flow Circuit High Input	MAF sensor signal > 4500 µs
P0106	Manifold Absolute Pressure/ Barometric Pressure Circuit Performance	• Difference of boost pressure signal vs altitude sensor signal > 230 hPa or • Difference of boost pressure signal vs altitude sensor signal < -130 hPa
P0111	Intake Air Temperature Sensor Circuit Performance	• Difference in value IAT - ECT @ engine start (depending on engine off time) > 24.8 °K • Difference in value IAT - AAT @ engine start < 24.8 °K (depending on engine off time)
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	Intake air temperature > 141°C
P0113	Intake Air Temperature Sensor Circuit High Input	Intake air temperature < 46°C
P0116	Engine Coolant Temperature Sensor 1 Circuit Performance	•No change on signal < 1.5 °K or • Signal in range 88.5 - 109.5 °C with no change on signal < 1.5 °K
P0117	Engine Coolant Temperature Sensor 1 Circuit Low Input	Engine coolant temperature > 140°C
P0118	Engine Coolant Temperature Sensor 1 Circuit High Input	Engine coolant temperature < -40°C
P0121	Pedal Position Sensor A Circuit Performance	• TPS 1 - TPS 2 > 6.30% • Actual TPS 1 calculated value > TPS 2 calculated value • TPS 1 calc. value > 9.00%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0122	Pedal Position Sensor A Circuit Low Input	Signal voltage < 0.20 V
P0123	Pedal Position Sensor A Circuit High Input	Signal voltage > 4.81 V
P013A	O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	EWMA filtered max differential transient time at fuel cutoff >= 0.5 Sec. for 3 function checks
P0130	O2 Sensor Circuit (Bank 1, Sensor 1)	O2S ceramic temperature < 640 °C
P0131	O2 Sensor Circuit (Bank 1, Sensor 1) Low Voltage	• VM < 1.75 V • UN < 1.50 V • IA or IP > 0.30 V
P0132	O2 Sensor Circuit (Bank 1, Sensor 1)	• VM > 3.25 V • UN > 4.40 V • IA or IP > 7.0 V
P0133	O2 Circuit Slow Response (Bank 1, Sensor 1)	Signal dynamic slope check • O2S signal front vs. modeled O2S signal ratio < 0.40 and > 0.01 • Cycles completed > 400 Oscillation check • Lambda amplitude signal > 20% • Cycles > 8 • Time lambda > lambda amplitude 400 m sec. Delay check • Delay modeled lambda signal minus measured signal > 460 m sec. • Cycles > 12
P0135	O2 Heater Circuit (Bank 1, Sensor 1)	• Heater duty cycle > 90% • O2S ceramic temperature < 720 °C • Time after O2S heater on 40 Sec.
P0136	O2 Circuit (Bank 1, Sensor 2)	• Delta voltage one step at heater switching > 2.0020 V • Number of checks 10

DTC	Error Message	Malfunction Criteria and Threshold Value
P0137	O2 Circuit Low Voltage (Bank 1, Sensor 2)	• Signal voltage < 0.06 V for > 3 Sec. • Difference with/without load pulse < 0.01 V
P0138	O2 Circuit High Voltage (Bank 1, Sensor 2)	Signal voltage 1.08 V for > 5 Sec.
P0139	O2 Circuit Slow Response (Bank 1 Sensor 2)	• EWMA filtered transient time at fuel cutoff > 0.4 Sec. • In voltage range of 201.2 - 401.4 mV • Number of checks, 3
P0140	O2 Circuit No Activity Detected (Bank 1, Sensor 2)	Signal voltage • Signal voltage 0.40 - 0.60 V for > 3 Sec. Internal resistance • > 40000 ohm • Exhaust temperature > 600 °C
P0141	O2 Heater Circuit (Bank 1, Sensor 2)	Heater resistance > 792 to 4560 Ohm
P0171	System Too Lean (Bank 1)	At idle • Adaptive value > 5.02 At part-load • Adaptive value > 21%
P0172	System Too Rich (Bank 1)	At idle • Adaptive value < -5.02% At part-load • Adaptive value < -21%
P0190	Fuel Rail Pressure Sensor Circuit	Signal voltage > 4.8 V
P0191	Fuel Rail Pressure Sensor Circuit Performance	Actual pressure > 20.6 MPa
P0192	Fuel Rail Pressure Sensor Circuit Low	Signal voltage < 0.2 V
P0201	Injector Circuit Open - Cylinder 1	• 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

DTC	Error Message	Malfunction Criteria and Threshold Value
P0221	Pedal Position Sensor Circuit Performance	• TPS 1 - TPS 2 > 6.30% • Actual TPS 2 calculated value > TPS 1 calculated value • TPS 2 – calc. value > 9.00%
P0222	Pedal Position Sensor Circuit Low Input	Signal voltage < 0.20 V
P0223	Pedal Position Sensor Circuit High Input	Signal voltage > 4.81 V
P0234	Turbocharger Overboost Condition	Difference of set value boost pressure vs altitude sensor signal > 260 - 1275 hPa
P0237	Turbocharger Boost Sensor Circuit Low	Signal voltage < 0.2 V
P0238	Turbocharger Boost Sensor Circuit High	Signal voltage > 4.88 V
P0243	Turbocharger Wastegate Solenoid Circuit Performance	Signal voltage > 5.6 - 4.4 V
P0245	Turbocharger Wastegate Solenoid Low	Signal voltage < 3.25 - 2.15 V
P0246	Turbocharger Wastegate Solenoid High	Signal current > 2.2 to 4 A
P025A	Fuel Pump Module Control Circuit Open	Signal voltage 4.80 - 5.30 V
P025C	Fuel Pump Module Control Circuit Low	Signal voltage 2.70 - 3.25 V
P025D	Fuel Pump Module Control Circuit Low	Signal voltage 2.70 - 3.25 V
P0261	Cylinder 1 Injector Circuit Low	Signal current < 2.1 A
P0262	Cylinder 1 Injector Circuit High	Signal current > 14.70 A
P0264	Cylinder 2 Injector Circuit Low	Signal current < 2.1 A
P0265	Cylinder 2 Injector Circuit High	Signal current > 14.70 A
P0267	Cylinder 3 Injector Circuit Low	Signal current < 2.1 A
P0268	Cylinder 3 Injector Circuit High	Signal current > 14.70 A
P0270	Cylinder 4 Injector Circuit Low	Low side signal current < 2.1 A
P0271	Cylinder 4 Injector Circuit High	Signal current > 14.70 A
P0299	Turbocharger Underboost	Difference of set boost pressure vs. actual boost pressure value > 150 hPa

DTC	Error Message	Malfunction Criteria and Threshold Value
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
P2004	Intake Manifold Runner Control Stuck Open	• Signal voltage < 2.62 or > 4.65 V • Unable to reach normal closed position
P2008	Intake Manifold Runner Control Circuit Open	• Signal duty cycle > 80% • ECM power stage failure
P2014	Intake Manifold Runner Position Sensor Circuit	Signal voltage > 4.75 V
P2015	Intake Manifold Runner Position Sensor Circuit Performance	Deviation runner flap target position vs actual position > 25% and actual position within 0 to 100%
P2088	A Camshaft Position Actuator Control Circuit Low	Signal voltage, < 0.0 - 3.25 V
P2089	A Camshaft Position Actuator Control Circuit High	Signal current > 2.2 A
P2096	Post Catalyst Fuel Trim System Too Lean	Deviation lambda control < -0.04
P2097	Post Catalyst Fuel Trim System Too Rich	Integral part of lambda control > 0.04

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 3% • Catalyst damage misfire rate (MR), > 2% - 15%
P0301	Cylinder 1 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 3% • Catalyst damage misfire rate (MR), > 2% - 15%
P0302	Cylinder 2 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 3% • Catalyst damage misfire rate (MR), > 2% - 15%
P0303	Cylinder 3 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 3% • Catalyst damage misfire rate (MR), > 2% - 15%
P0304	Cylinder 4 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 3% • Catalyst damage misfire rate (MR), > 2% - 15%
P0321	Engine Speed Input Circuit Performance	• Comparison of counted teeth vs reference = incorrect • Monitoring reference gap failure
P0322	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 Input	• Lower threshold < -70 V or for signal range check • Lower threshold < 0.60 - 1.60 V
P0328	Knock Sensor 1 Circuit High Input	• Upper threshold > 1.00 V or for signal range check • > 21.75 - 115.87 V
P0332	Knock Sensor 2 Circuit Low Input	Signal range check lower threshold 0.5 to 0.8

DTC	Error Message	Malfunction Criteria and Threshold Value
P0333	Knock Sensor 2 Circuit High Input	Signal range check upper threshold 4.5 to 30
P0341	Camshaft Position Sensor Circuit Performance	• Signal pattern incorrect • Defect counter 12
P0342	Camshaft Position Sensor Circuit Low Input	• Signal voltage low • Crankshaft signals = 8
P0343	Camshaft Position Sensor Circuit High Input	• Signal voltage high • Crankshaft signals = 8
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
P2300	Ignition Coil A Primary Control Circuit Low	Signal current > 24.0 mA
P2301	Ignition Coil A Primary Control Circuit High	Signal current > 5.1 - 7.0 mA
P2303	Ignition Coil B Primary Control Circuit Low	Signal current > 24.0 mA
P2304	Ignition Coil B Primary Control Circuit High	Signal current > 5.1 - 7.0 mA
P2306	Ignition Coil C Primary Control Circuit Low	Signal current > 24.0 mA
P2307	Ignition Coil C Primary Control Circuit High	Signal voltage > 5.1 - 7.0 mA
P2309	Ignition Coil D Primary Control Circuit Low	Signal current > 24.0 mA
P2310	Ignition Coil D Primary Control Circuit High	Signal voltage > 5.1 - 7.0 mA

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0420	Catalyst System Efficiency Below Threshold	Front: • Oxygen storage capacity (OSC) vs OSC of borderline catalyst < 0.40 • Front catalyst < 1.30 • Main catalyst < 1.20 Main: • Oxygen storage capacity (OSC) vs OSC of borderline catalyst < 0.40 • Front catalyst< .90 • While value for front catalyst < 2.00
P0441	Evaporative Emission System Incorrect Purge Flow	Actual evap pump current difference between reference measurement to idle divided by pump current difference from the last leak detection phase during engine off > 1.40 mA
P0442	Evaporative Emission System Leak Detected (Small Leak)	Modeled pressure from pump current < 9 hPa
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal voltage > 4.40 - 5.40 V
P0456	Evaporative Emission System Leak Detected (Very Small Leak)	EVAP leakage area calculated from pump current curve > 0.17 mm 2
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage 0.00 - 3.25 V
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.2 A

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
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
P0501	Vehicle Speed Sensor Range/ Performance	VSS signal < 4 km/h
P0506	Idle Air Control System RPM Lower Than Expected	Idle speed Deviation > 80 RPM
P0507	Idle Air Control System - RPM Higher Than Expected	Idle speed Deviation < -80 RPM
P052A	Cold Start Camshaft Position Timing Over-Advanced	• Difference between target position vs actual position: > 6 °CRK

Control Module and Output Signals

DTC	Error Message	Malfunction Criteria and Threshold Value
P0601	Internal Control Module Memory Check Sum Error	Internal check sum, incorrect
P0604	Internal Control Module Random Access Memory (RAM) Error	Write ability check, failed
P0605	Internal Control Module Read Only Memory (ROM) Error	ROM check failed
P0606	ECM Processor Fault	ECM internal check failure
P0638	Throttle Actuator Control Performance	• Time to close to reference point > 0.6 Sec. and • Reference point 2.88% • Time to close below reference point, + 2.49%, > 0.56 Sec. • Duty cycle > 80% • ECM power stage no failure
P0641	Sensor Reference Voltage A Circuit	Signal voltage deviation > ± 0.3 V
P0642	Sensor Reference Voltage A Circuit Low	Signal voltage < 4.6 to 5 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0643	Sensor Reference Voltage A Circuit High	Signal voltage > 5 to 5.4 V
P0651	Sensor Reference Voltage B Circuit	Signal voltage deviation > +/- 0.3 V
P0652	Sensor Reference Voltage B Circuit Low	Signal voltage < 4.6 - 5.0 V
P0653	Sensor Reference Voltage B Circuit High	Signal voltage > 5 to 5.4 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
P0685	ECM Power Relay Control Circuit Open	Control voltage 2.6 to 3.7 V and Sense circuit voltage < 6 V
P0686	ECM Power Relay Control Circuit Low	Control voltage 2.6 to 3.7 V and Sense circuit voltage > 6 V
P0687	ECM Power Relay Control Circuit High	Signal current > 1.4 to 0.7 A and Sense circuit voltage < 6 V
P0688	ECM Power Relay Sense Circuit Open	• Sense voltage > 3 V with main relay commanded on • Sense voltage < 3 V with main relay commanded off
P0697	Sensor Reference Voltage C Circuit Open	Signal voltage deviation > ± 0.3 V
P0698	Sensor Reference Voltage C Circuit Low	Signal voltage < 4.6 - 5.0 V
P0699	Sensor Reference Voltage C Circuit High	Signal voltage > 5 to 5.4 V
U0001	High Speed CAN Communication Bus	Bus Off failure
U0002	High Speed CAN Communication Bus Performance	Global Time Out failure
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	CAN communication with ABS, time out
U0146	Lost Communication With Gateway A	CAN communication with gateway, time out

DTC	Error Message	Malfunction Criteria and Threshold Value
U0155	CAN Instrument Cluster	CAN messages not received
U0415	CAN Communication With ABS Error	• Speed sensor initialization failed • Speed sensor low voltage error failed • Speed > 326 km/h
U0422	Invalid Data Received From Body Control Module (Cluster)	Ambient temperature value initialization failure.
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	Implausible Ambient Air Temperature Sensor value message received from IPC

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	• Pressure control activity > 0.25 MPa and • Fuel trim activity < 0.85
P12A2	Fuel Rail Pressure Sensor Inappropriately High	• Pressure control activity > 0.25 MPa and • Fuel trim activity < 0.85
P12A4	Fuel Rail Pump Control Valve Stuck Closed	• Fuel trim activity 0.85 to 1.15 and • Pressure control activity < 6.0 mPa
P2004	Intake Manifold Runner Control Stuck Open	• Signal voltage < 2.62 or > 4.65 V • Unable to reach normal closed position
P2008	Intake Manifold Runner Control Circuit Open	• Signal duty cycle > 80% • ECM power stage failure
P2014	Intake Manifold Runner Position Sensor Circuit	• Signal voltage > 4.75 V
P2015	Intake Manifold Runner Position Sensor Circuit Performance	• Deviation runner flap target position vs actual position > 25% and actual position within 0 to 100%
P2088	A Camshaft Position Actuator Control Circuit Low	Signal voltage, < 0.0 - 3.25 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2089	A Camshaft Position Actuator Control Circuit High	Signal current > 2.2 A
P2096	Post Catalyst Fuel Trim System Too Lean	Deviation lambda control < -0.04
P2097	Post Catalyst Fuel Trim System Too Rich	Integral part of lambda control > 0.04
P2101	Throttle Actuator Control Motor Circuit 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	Pedal Position Sensor D Circuit High Input	Signal voltage < 0.61 V
P2123	Pedal Position Sensor D Circuit High Input	Signal voltage > 4.79 V
P2127	Pedal Position Sensor E Circuit Low Input	Signal voltage < 0.27 V
P2128	Pedal Position Sensor E Circuit High Input	Signal voltage > 2.43 V
P2138	Pedal Position Sensor D / E Voltage Correlation	Signal voltage: Difference between signal APP1 and APP2 > 0.17 - 0.70 V
P2146	Fuel Injector A Supply Voltage Circuit Open	• Signal current, < 2.6 A or • Signal current > 14.90 A
P2149	Fuel Injector B Supply Voltage Circuit Open	• Signal current, < 2.6 A or • Signal current > 14.70 A
P2181	Cooling System Performance	Cooling system temperature too low after a sufficient mass air flow integral 74 - 84 °C
P2195	O2 Sensor Signal Biased/ Stuck Lean Bank 1, Sensor 1	Delta lambda of 2nd lambda control loop > 0.06
P2196	O2 Sensor Signal Biased/ Stuck Rich (Bank 1, Sensor 1)	Delta lambda of 2nd lambda control loop < 0.08
P2231	O2 Sensor Signal Circuit Shorted to Heater Circuit	Delta O2S signal front > 190 uA
P2237	O2 Sensor Positive Current Control Circuit Open (Bank 1, Sensor 1)	O2S signal front 1.493 - 1.507 V and delta lambda controller > 0.10

DTC	Error Message	Malfunction Criteria and Threshold Value
P2243	O2 Sensor Reference Voltage Circuit Open (Bank 1, Sensor 1)	• O2S signal front < 0.30 V and Internal resistance > 1000 Ohms • O2S signal front > 3.25 V and Internal resistance > 1000 Ohms
P2270	O2 Sensor Signal Stuck Lean (Bank 1, Sensor 2)	• O2S signal rear < 0.63 - 0.64 V • Enrichment after stuck lean 27.90%
P2271	O2 Sensor Signal Stuck Rich (Bank 1, Sensor 2)	• O2S signal rear > 0.63 - 0.64 V • Enrichment after stuck rich 14.99%
P2279	Intake Air System Leak	• Threshold to detect a defective system > 1.33 - 1.60
P2293	Fuel Pressure Regulator 2 Performance	• 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 Short to Ground	Signal voltage < 1.40 - 3.20 V
P2296	Fuel Pressure Regulator 2 Control Circuit High	Signal voltage > 3.20 V

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P2400	Evaporative Emission System Leak Detection Pump Control Circuit Open	Signal voltage > 4.7 - 5.4 V
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	Signal voltage > 2.74 - 3.26 V
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	Signal voltage at LDP current measuring resistor > 4.00 to 1.80 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit/Open	Low signal voltage > 0.5 Sec.
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	• High signal voltage > 30.4 Sec.
P2414	O2 Sensor Exhaust Sample Error (Bank 1, Sensor 1)	Threshold 1 • Signal voltage 3.1 - 4.81 V • O2S signal 2.5 - 3.2 V Threshold 2 • Signal voltage 2.5 V • O2S signal 2.5 - 3.1 V
P2539	Low Pressure Fuel System Circuit	Signal voltage > 4.9 V
P2541	Low Pressure Fuel Sensor Circuit Low Input	Signal voltage < 0.2 V
P2626	O2 Sensor Pumping Current Trim Circuit Open (Bank 1 Sensor 1)	O2S signal front > 4.81 V
P3081	Engine Temperature Too Low	Difference between ECT and modeled ECT > 9.80 °K

DTC CHART

Engine Codes CBTA, CBUA

Fuel and Air Mixture, Additional Emission Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Intake 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	Intake Camshaft Position Actuator Circuit Open Bank 1	Signal voltage > 4.70 - 5.40 V
P0011	Intake Camshaft Position Timing - Over-Advanced Bank 1	• Difference between target and actual > 8° CRK rotation • Adjustment angle < 3° CRK rotation
P0016	Camshaft Position Sensor Angular Offset Check	Permissible deviation < -13.49 or >13.49 CRK deg.
P0030	HO2S 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% or • Heater voltage 0 to 3.26 V
P0032	HO2S Heater Control Circuit High Bank 1 Sensor 1	Heater current > 5.50 A
P0036	HO2S Heater Control Circuit Bank 1 Sensor 2	Heater voltage 2.34 to 3.59 V
P0037	HO2S Heater Control Circuit Low (Bank 1, Sensor 2)	Heater voltage < 2.34 V
P0038	HO2S Heater Control Circuit High (Bank 1, Sensor 2)	Heater voltage > 3.59 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P0042	O2 Sensor Heater Control Circuit Bank 1 Sensor 3 (CBUA ONLY)	Heater voltage 2.34 to 3.59 V
P0043	O2 Sensor Heater Control Circuit Bank 1 Sensor 3 Low (CBUA ONLY)	Heater voltage < 2.34 V
P0044	O2 Sensor Heater Control Circuit Bank 1 Sensor 3 High (CBUA ONLY)	Heater voltage > 3.59 V
P0070	Ambient Air Temperature	• Ambient air temp < -50 °C
P0071	Ambient Air Temperature Sensor 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 to 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 Circuit High Input	Signal voltage > 4.86 V
P0108	Manifold Absolute Pressure Circuit High Input	Signal voltage > 4.86 V
P0111	Intake Air Temperature 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 Circuit Low Input	• IAT > 130.0 °C
P0113	Intake Air Temperature Sensor Circuit High Input	• IAT < -46 °C
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/ Performance	• No change on signal 2 °K • ECT signal stuck in range 75 - 105 °C and no change in signal 2 °K

DTC	Error Message	Malfunction Criteria and Threshold Value
P0117	Engine Coolant Temperature Sensor 1 Circuit Low Input	• ECT >140 °C
P0118	Engine Coolant Temperature Sensor 1 Circuit High Input	ECT < -40 °C
P0121	Accelerator Pedal Position Sensor A Circuit Range/ Performance	• TPS 1 - TPS 2 > 5.10 to 6.30% • TPS 1 calc. value > 9.00%
P0122	Accelerator Pedal Position Sensor A Circuit Low Input	Signal voltage < 0.20 V
P0123	Accelerator Pedal Position Sensor A Circuit High Input	Signal voltage > 4.81 V
P013A	O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	EWMA filtered max differential transient time at fuel cutoff >= 0.5 Sec. and number of checks >= 3
P0130	O2 Sensor Circuit (Bank 1, Sensor 1)	• O2S ceramic temp. < 640 ° C
P0131	O2 Sensor Circuit, (Bank 1 Sensor 1) Low Voltage	• Virtual mass < 1.75 V • UN, < 1.50 V • IA, 0.3 V
P0132	O2 Sensor Circuit, (Bank 1 Sensor 1) High Voltage	• Virtual mass, > 3.25 V • UN, > 4.40 V • IA, > 7.0 V
P0133	O2 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

DTC	Error Message	Malfunction Criteria and Threshold Value
P0137	O2 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
P0138	O2 Circuit High Voltage (Bank 1, Sensor 2)	Signal voltage > 1.08 V for > 5 Sec.
P0139	O2 Circuit Slow Response (Bank 1, Sensor 2)	• 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 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 .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
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

DTC	Error Message	Malfunction Criteria and Threshold Value
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
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	• Injector Circuit Open Cylinder 3
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	Accelerator Pedal Position Sensor B Circuit Range/ Performance	• TPS 1 to TPS 2, > 5.10 to 6.3% • TPS 2 – calc position > 9 %
P0222	Accelerator Pedal Position Sensor B Circuit Low Input	• Signal voltage < 0.20 V
P0223	Accelerator Pedal Position Sensor B Circuit High Input	• Signal voltage, > 4.81 V
P0261	Cylinder 1 Injector Circuit High	Signal current < 2.20 - 4.00 A
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

DTC	Error Message	Malfunction Criteria and Threshold Value
P2088	"A" Camshaft Position Actuator Control Circuit Low - Bank 1	Short to ground, signal voltage 0.0 to 3.25 V
P2089	"A" Camshaft Position Actuator Control Circuit High - Bank 1	Short to battery plus, signal current > 2.20 A
P2096	Post Catalyst Fuel Trim System Bank 1 Too Lean	Out of range, I-portion of 2nd lambda control loop < 0.030
P2097	Post Catalyst Fuel Trim System Bank 1 Too Rich	Out of range, I-portion of 2nd lambda control loop > 0.030
P2122	Accelerator Pedal Position Sensor D Circuit Low Input	• Signal voltage < 0.61 V
P2123	Accelerator Pedal Position Sensor D Circuit High Input	• Signal voltage > 4.79 V
P2127	Accelerator Pedal Position Sensor E Circuit Low Input	• Signal voltage < 0.27 V
P2128	Accelerator Pedal Position Sensor E Circuit High Input	• Signal voltage > 2.43 V
P2138	Accelerator Pedal Position Sensor D / E Voltage Correlation	• Signal voltage sensor 1 vs. 2 > 0.17 to 0.70 V
P2177	System Too Lean Off Idle	• Adaptive value > 28%
P2178	System Too Rich Off Idle	• 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%
P2188	System Too Rich at Idle (Bank 1)	• Adaptive value < -5.02%
P2195	Biased/Stuck Lean (Bank 1, Sensor 1	• Delta lambda of 2nd lambda control loop
P2196	O2 Sensor Signal Biased/ 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

DTC	Error Message	Malfunction Criteria and Threshold Value
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
P2251	O2 Sensor Negative Current Control Circuit Open	• O2S signal front 1.47 to 1.53 V and > 950 Ω
P2257	Secondary Air Injection System Control Circuit Low	• Signal voltage 0 to 3.26 V
P2258	Secondary Air Injection System Control Circuit High	•Signal current .60 to 2.40 A
P2270	O2 Sensor Signal Stuck Lean Bank 1 Sensor 2	• O2S signal rear not oscillating at reference < 598 mV 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 15%
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
P2300	Ignition Coil A Primary Control Circuit Low	• Signal current > 24 mA
P2301	Ignition Coil A Primary Control Circuit High	• Signal voltage > 5.1 - 7.0 mA
P2303	Ignition Coil B Primary Control Circuit Low	• Signal current > 24 mA
P2304	Ignition Coil B Primary Control Circuit High	• Signal voltage > 5.1 - 7.0 mA
P2306	Ignition Coil C Primary Control Circuit Low	• Signal current > 24 mA

DTC	Error Message	Malfunction Criteria and Threshold Value
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 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 mA
P2313	Ignition Coil “E” Primary Control Circuit High	• Signal voltage > 5.1 - 7.0 mA
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.
P2404	Evaporative Emission System Leak Detection Pump Sense 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.

DTC	Error Message	Malfunction Criteria and Threshold Value
P2414	O2 Sensor Exhaust Sample Error Bank 1, Sensor 1	• Threshold 1 • Signal voltage 3.1 to 4.77 V • Threshold 2 • Signal Voltage 2.5 to 3.06 V
P2431	Secondary Air Injection System Air Flow Pressure Sensor Circuit Range/ Performance	• Difference between SAI pressure and ambient pressure NOT -60 to 60 hPa
P2432	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Low	•Signal voltage < 0.5 V
P2433	Secondary Air Injection System Air Flow/Pressure 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/ 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)
P3081	Engine Temperature Too Low	• Difference between ECT and modeled ECT > 10.5 K

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random 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%s
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%

DTC	Error Message	Malfunction Criteria and Threshold Value
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%
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	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	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 V • Signal range check > 16.50 to 92 V

DTC	Error Message	Malfunction Criteria and Threshold Value
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	• Signal pattern incorrect • Defect counter = 8
P0342	Camshaft Position Sensor A Circuit Low Input	• Signal voltage permanently low • Crankshaft signal = 8
P0343	Camshaft Position Sensor A Circuit High Input	• Signal voltage permanently high • Crankshaft signal = 8
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
P0381	Glow Plug/Heater Indicator Circuit	Measured engine coolant temp. below reference model, diff, reference model temperature vs. ECT > 10.5

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0410	Secondary Air Injection System	• Deviation SAI pressure > 50 hPa
P0413	Secondary Air Injection System Switching Valve Circuit Open	• Signal voltage 4.70 to 5.40 V
P0414	Secondary Air Injection System Switching Valve Circuit Shorted	• Signal voltage 0 to 3.25 V or • Signal current > 2.20 A
P0418	Secondary Air Injection System Control Circuit	• Signal voltage 4.70 to 5.40 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0420	Catalyst System Efficiency Below Threshold	• 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	Evaporative Emission System Incorrect Purge Flow	• Actual EVAP pump current vs. difference from last reading > 1.70
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 (gross 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 System Insufficient Flow. Flow Check During Catalyst Heating. (PZEV)	• 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 Range/ Performance	• Vehicle speed < 4 km/h
P0503	Vehicle Speed Sensor Intermittent High Signal	• Vehicle speed > 325 km/h
P0506	Idle Air Control System RPM Lower Than Expected	• Engine speed deviation > 100 RPM • RPM controller torque value >= calculated max value.
P0507	Idle Control System RPM Higher than Expected	• Engine speed deviation < -100 RPM • RPM controller torque value <= calculated min. value.
P050A	Idle Air Control System Out of Range	• 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 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	ECM internal self test failed
P0627	Fuel Pump Control Circuit Open/Shorted to ground	• Signal voltage 4.50 to 5.50 V (open circuit) • Signal voltage < 3.00 V (grounded circuit)
P0629	Fuel Pump Control Circuit High	• Signal current 0.60 to 1.20 A

DTC	Error Message	Malfunction Criteria and Threshold Value
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
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
P150A	Engine Off Timer Comparison	• Difference between engine-off-time and ECM after-run time < 12.0s • Difference between engine-off-time and ECM after-run time > 12.0s
P0674	Cylinder 4 Glow Plug Circuit Q13 Electrical Fault	Message from Glow Control Unit, (glow current < 2.2 A)
P068A	ECM Power Relay Performance - De-Energized Too Early	Relay stuck, no change in circuit voltage
P068B	ECM Power Relay Performance - De-Energized 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
P1609	Crash shut-off was triggered	Airbag(s) activated
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

DTC	Error Message	Malfunction Criteria and Threshold Value
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 • No
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 Module	• CAN message incorrect

Fuel and Ratio Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P2101	Throttle Actuator 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
P2279	Intake Air System Leak	• Offset value throttle mass flow > 13 kg/h

Printed in the United States of America

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