2013

A8/A8L /S8

Quick Reference Specification Book

Audi
Truth in Engineering

2013 Audi A8/A8L/S8
Quick Reference Specification Book

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ENGINES

CHASSIS

GENERAL INFORMATION

Decimal and Metric Equivalents

Distance/Length

To calculate: mm x 0.03937 = in.

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

Tightening Torque

Nm-to-lb·ft (ft·lb)

To calculate: Nm x 0.738 = lb·ft

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

Nm-to-lb·in (in·lb), kg·cm

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

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

N·cm-to-lb·in (in·lb), kg·cm

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

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

kg·cm-to-lb·in (in·lb), N·cm

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

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

Warnings and Cautions

WARNINGS

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

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

(WARNINGS cont'd on next page)

WARNINGS *(cont'd)*

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

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

CAUTIONS

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

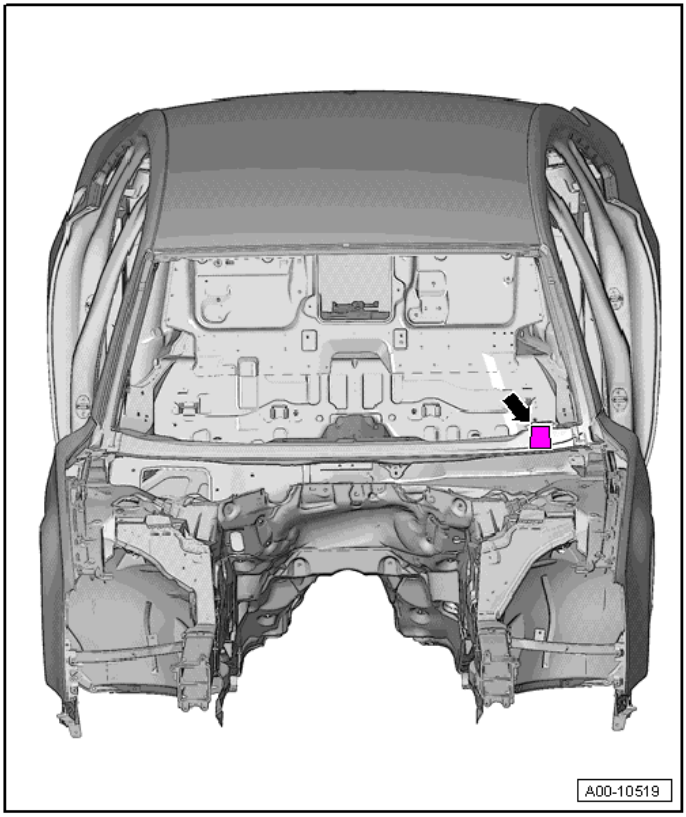
(CAUTIONS cont'd on next page)

CAUTIONS *(cont'd)*

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

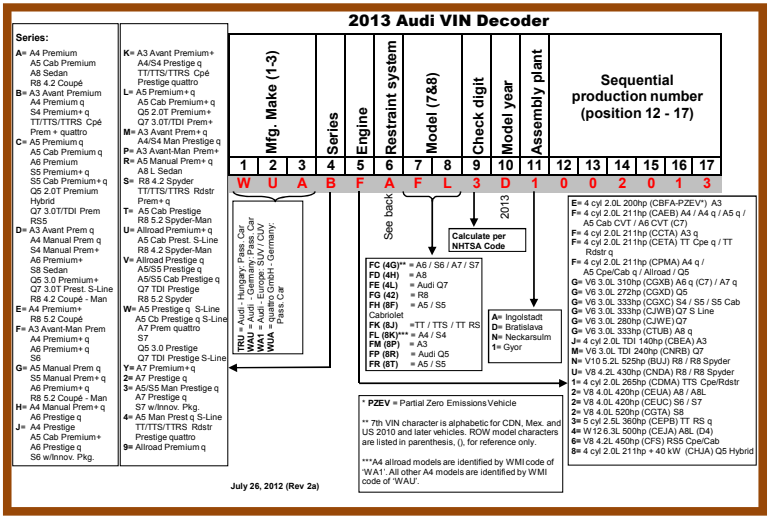
VEHICLE IDENTIFICATION

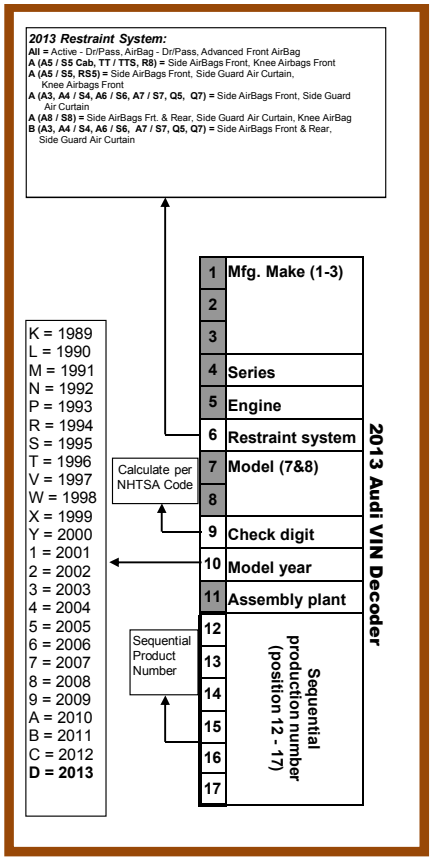
Vehicle Identification Number (VIN) Location



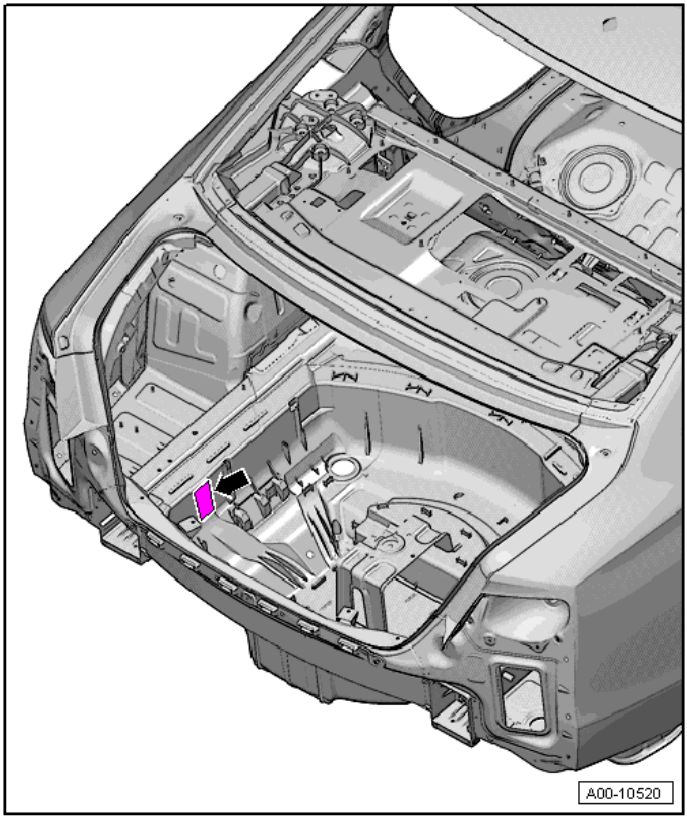
The VIN (➡) is on the left side of the vehicle in the area of the windshield wiper mount. It is visible from the outside.

VIN Decoder


2013 Audi VIN Decoder
Series:
A= A4 Premium
A5 Cab Premium
A8 Sedan
R8 4.2 Coupé
B= A3 Avant Premium
A4 Premium q
S4 Premium+ q
TT/TTS/TTRS Cpé
Prem + quattro
C= A5 Premium q
A5 Cab Premium q
A6 Premium
S5 Premium+ q
S5 Cab Premium + q
Q5 2.0T Premium
Hybrid
Q7 3.0T/TDI Prem
RS5
D= A3 Avant Prem q
A4 Manual Prem q
S4 Manual Prem+
A6 Premium+
S8 Sedan
Q5 3.0 Premium+
Q7 3.0T Prest. S-Line
R8 4.2 Coupé - Man
E= A4 Premium+
R8 5.2 Coupé
F= A3 Avant-Man Prem
A4 Premium+ q
A6 Premium+ q
S6
G= A5 Manual Prem q
S5 Manual Prem+ q
A6 Premium+ q
R8 5.2 Coupé - Man
H= A4 Manual Prem+ q
A6 Prestige q
J= A4 Prestige
A5 Cab Premium+
A6 Prestige q
S6 w/Innov. Pkg.
K= A3 Avant Premium+
A4/S4 Prestige q
TT/TTS/TTRS Cpé
Prestige quattro
L= A5 Premium+ q
A5 Cab Premium+ q
Q5 2.0T Premium+
Q7 3.0T/TDI Prem+
M= A3 Avant Prem+ q
A4/S4 Man Prestige q
P= A3 Avant-Man Prem+
R= A5 Manual Prem+ q
A8 L Sedan
S= R8 4.2 Spyder
TT/TTS/TTRS Rdstr
Prem+ q
T= A5 Cab Prestige
R8 5.2 Spyder-Man
U= Allroad Premium+ q
A5 Cab Prest. S-Line
R8 4.2 Spyder-Man
V= Allroad Prestige q
A5/S5 Prestige q
A5/S5 Cab Prestige q
Q7 TDI Prestige
R8 5.2 Spyder
W= A5 Prestige q S-Line
A5 Cb Prestige q S-Line
A7 Prem quattro
S7
Q5 3.0 Prestige
Q7 TDI Prestige S-Line
Y= A7 Premium+ q
2= A7 Prestige q
3= A5/S5 Man Prestige q
A7 Prestige q
S7 w/Innov. Pkg.
4= A5 Man Prest q S-Line
TT/TTS/TTRS Rdstr
Prestige quattro
9= Allroad Premium q
Mfg. Make (1-3)
Series
Engine
Restraint system
Model (7&8)
Check digit
Model year
Assembly plant
Sequential production number (position 12 - 17)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
W U A B F A F L 3 D 1 0 0 2 0 1 3
See back
2013
Calculate per NHTSA Code
TRU = Audi - Hungary: Pass. Car
VSS = Audi - Germany: Pass. Car
WAU = Audi - Europe: SUV / CUV
WUA = quattro GmbH - Germany: Pass. Car
FC (4G)** = A6 / S6 / A7 / S7
FD (4H) = A8
FE (4L) = Audi Q7
FG (42) = R8
FH (8F) = A5 / S5 Cabriolet
FK (8J) = TT / TTS / TT RS
FL (8K)*** = A4 / S4
FM (8P) = A3
FP (8R) = Audi Q5
FR (8T) = A5 / S5
A= Ingolstadt
D= Bratislava
N= Neckarsulm
1= Gyor
* PZEV = Partial Zero Emissions Vehicle
** 7th VIN character is alphabetic for CDN, Mex. and US 2010 and later vehicles. ROW model characters are listed in parenthesis, (), for reference only.
***A4 allroad models are identified by WMI code of 'WA1'. All other A4 models are identified by WMI code of 'WAU'.
E= 4 cyl 2.0L 200hp (CBFA-P2EV*) A3
F= 4 cyl 2.0L 211hp (CAEB) A4 / A4 q / A5 q / A5 Cab CVT / A6 CVT (C7)
F= 4 cyl 2.0L 211hp (CCTA) A5 q
F= 4 cyl 2.0L 211hp (CETA) TT Cpe q / TT Rdstr q
F= 4 cyl 2.0L 211hp (CPMA) A4 q / A5 Cpe/Cab q / Allroad / Q5
G= V6 3.0L 310hp (CGXB) A6 q (C7) / A7 q
G= V6 3.0L 272hp (CGXD) Q5
G= V6 3.0L 333hp (CGXC) S4 / S5 / S5 Cab
G= V6 3.0L 333hp (CJWB) Q7 S Line
G= V6 3.0L 280hp (CJWE) Q7
G= V6 3.0L 333hp (CTUB) A8 q
J= 4 cyl 2.0L TDI 140hp (CBEA) A3
M= V6 3.0L TDI 240hp (CNRB) Q7
N= V10 5.2L 525hp (BUJ) R8 / R8 Spyder
U= V8 4.2L 430hp (CNDA) R8 / R8 Spyder
1= 4 cyl 2.0L 265hp (CDMA) TTS Cpe/Rdstr
2= V8 4.0L 420hp (CEUA) A8 / A8L
2= V8 4.0L 420hp (CEUC) S6 / S7
2= V8 4.0L 520hp (CGTA) S8
3= 5 cyl 2.5L 360hp (CEPB) TT RS q
4= W 12 6.3L 500hp (CEJA) A8L (D4)
6= V8 4.2L 450hp (CFS) RS5 Cpe/Cab
8= 4 cyl 2.0L 211hp + 40 kW (CHJA) Q5 Hybrid
July 26, 2012 (Rev 2a)


2013 Restraint System:
All = Active - Dr/Pass, AirBag - Dr/Pass, Advanced Front AirBag
A (A5 / S5 Cab, TT / TTS, R8) = Side AirBags Front, Knee Airbags Front
A (A5 / S5, RS5) = Side AirBags Front, Side Guard Air Curtain, Knee Airbags Front
A (A3, A4 / S4, A6 / S6, A7 / S7, Q5, Q7) = Side AirBags Front, Side Guard Air Curtain
A (A8 / S8) = Side AirBags Frt. & Rear, Side Guard Air Curtain, Knee AirBag
B (A3, A4 / S4, A6 / S6, A7 / S7, Q5, Q7) = Side AirBags Front & Rear, Side Guard Air Curtain
K = 1989
L = 1990
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 Mfg. Make (1-3)
2
3
4 Series
5 Engine
6 Restraint system
7 Model (7&8)
8
9 Check digit
10 Model year
11 Assembly plant
12
13
14
15
16
17
Sequential production number (position 12 - 17)
2013 Audi VIN Decoder

Vehicle Data Label



The vehicle data label (➡) is located in the back of the spare wheel well on the left side.

SALES CODES

Engine Codes

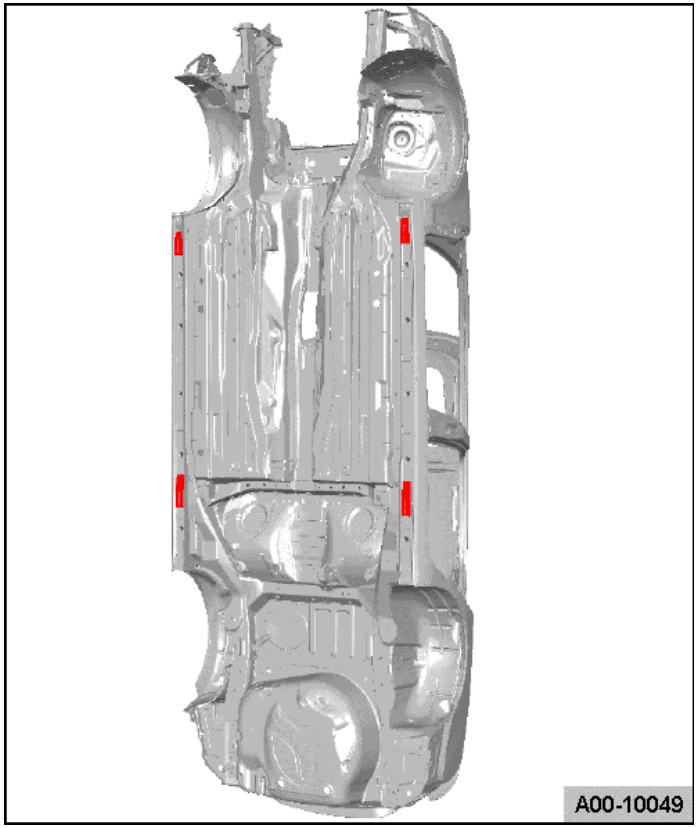
CPNA	3.0L 6-cylinder (TDI)
CGXC, CTUB	3.0L 6-cylinder
CEUA, CGTA	4.0L 8-cylinder
CEJA	6.3L 12-cylinder

Transmission Code

0BK	8-speed automatic transmission

VEHICLE LIFTING

Hoist and Floor Jack Lifting Points

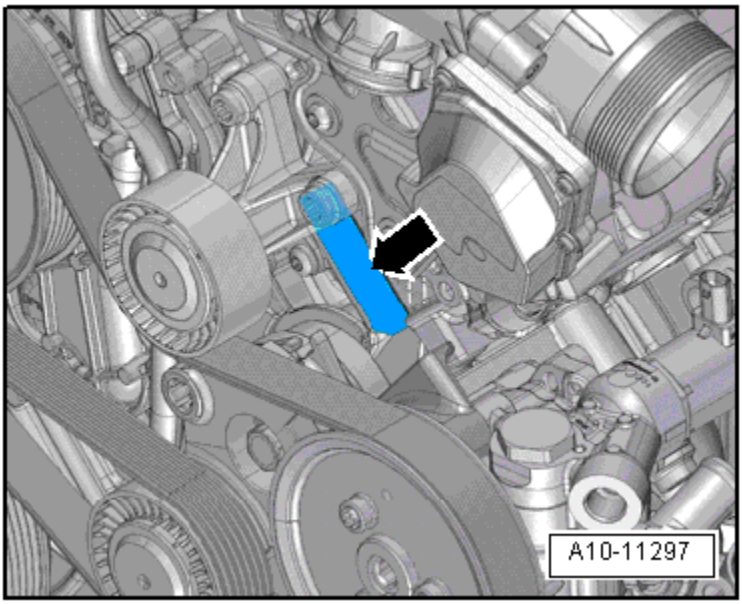


Front and Rear: At the plastic recesses on the vehicle underbody marked in red.

ENGINE MECHANICAL – 3.0L CPNA (TDI)

General, Technical Data

Engine Number Location



The engine number (➡) (engine code and serial number) is located on the left side in the front under the high pressure pump toothed belt.

Engine Data

Code letters		CPNA
Displacement	liter	2.967
Output	kW at RPM	176 @ 4000
Torque	Nm at RPM	550 @ 2200
Bore	diameter mm	83.0
Stroke	mm	91.4
Compression ratio		16.8
RON	at least	51
Fuel injection and ignition system		Bosch Motronic
Ignition sequence		1-4-3-6-2-5
Exhaust Gas Recirculation (EGR)		Yes
Turbocharger, Supercharger		Turbocharger
Charge air cooler		Yes
Oxygen Sensor (O2S) regulation		Heated oxygen sensor (HO2S) 1
Particulate Filter		Yes
Selective Catalytic Reduction (SCR) - catalytic converter		Yes
Valve per cylinder		4

Engine Assembly – 3.0L CPNA (TDI)

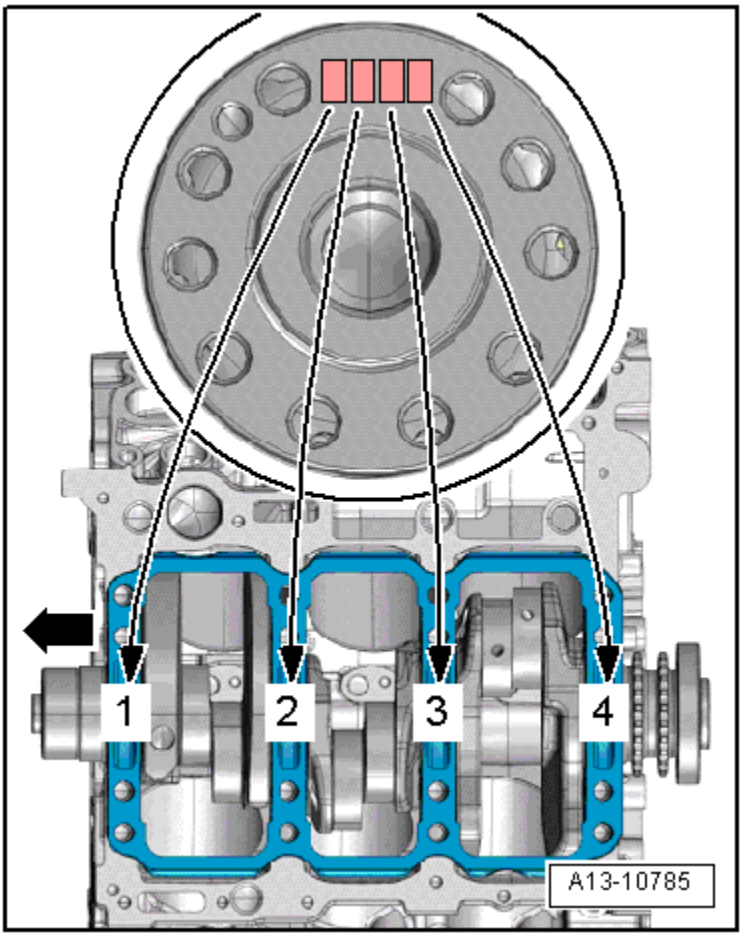
Fastener Tightening Specifications

Component	Fastener size	Nm
Bolts and nuts	M6	9
	M7	15
	M8	20
	M10	40
	M12	65
Engine mount [1)]	-	90 plus an additional 90° (¼ turn)
Engine support	-	40
Heat shield	-	10
Hydraulic hose mount nut		9
etaining plate for the engine mount bolt	-	20
Subframe bolt-to-retaining plate	-	55

[1)] Replace fastener(s).

Crankshaft, Cylinder Block – 3.0L CPNA

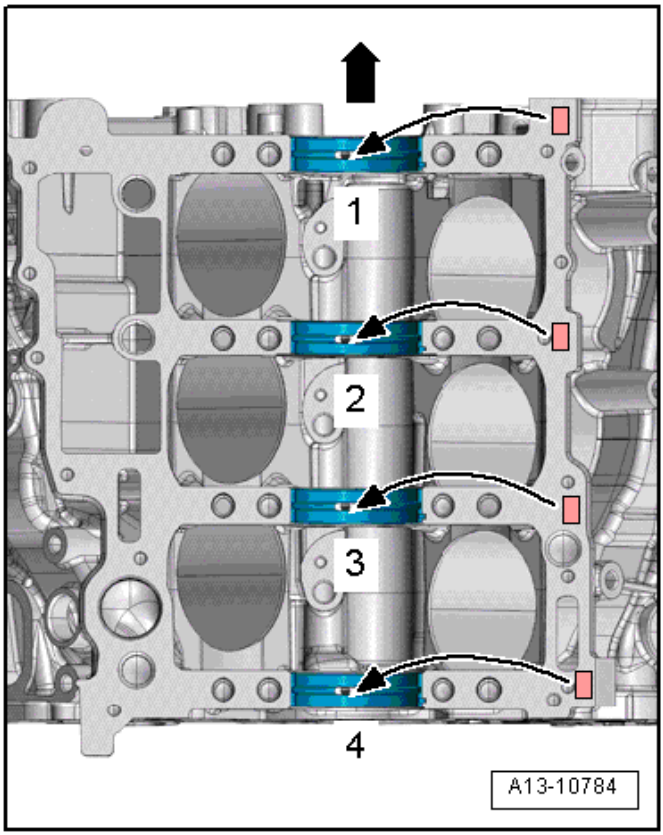
Allocation of Crankshaft Bearing Shells for Guide Frame



Bearing shells with the correct thickness are allocated to the guide frame in the factory. Colored dots on sides of bearing shells serve for identifying bearing shell thickness. Allocation of bearing shells to guide frame is marked on flywheel flange of crankshaft by a row of letters. The first letter of the row of letters represents bearing 1 the second letter is for bearing 2 etc.

Letter on cylinder block	Color of bearing
R	Red
G	Yellow
B	Blue

Allocation of Crankshaft Bearing Shells for Cylinder Block



Bearing shells with the correct thickness are allocated to the cylinder block in the factory. Colored dots on bearing shells serve for identifying bearing shell thickness. Arrow: belt pulley side. Allocation of bearing shells to cylinder block is identified with a letter by each bearing.

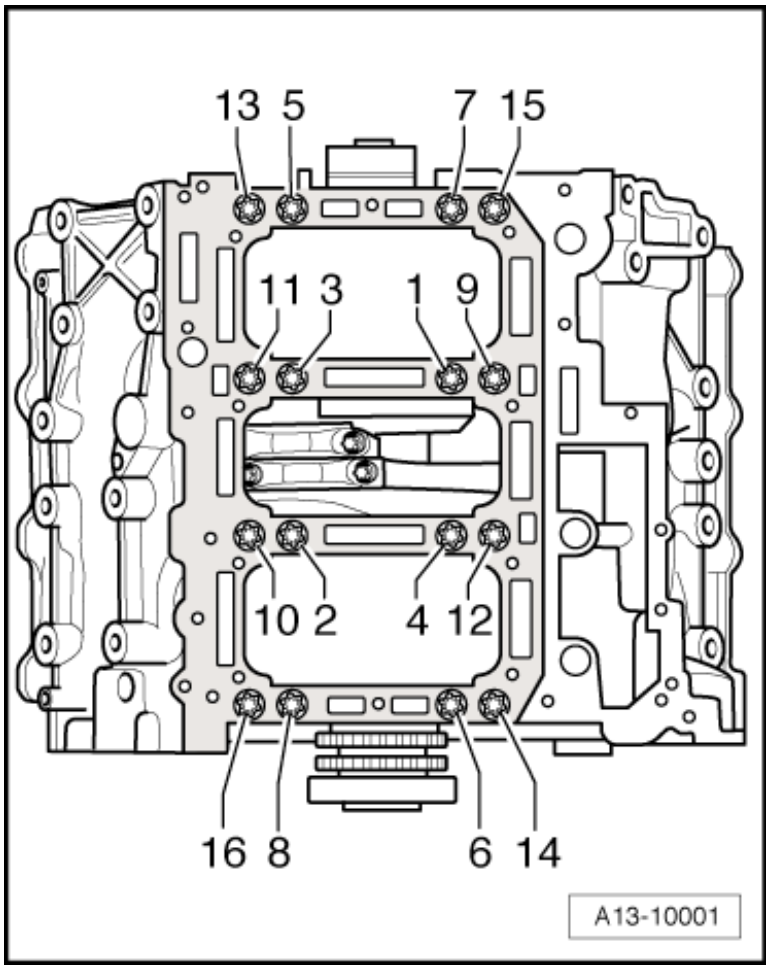
Letter on cylinder block	Color of bearing
R	Red
S	Black
G	Yellow
U	Green
B	Blue

Fastener Tightening Specifications

Component	Nm
Bracket for assemblies	
Tighten in 2 steps: 5 Nm diagonally 40 Nm diagonally	-
Bracket for the generator	
Tighten in 2 steps: 5 Nm diagonally 40 Nm diagonally	-
Bracket for idler roller	23
Connecting rod bearing cap bolts [1) 2)]	35 plus an additional 90° (¼ turn)
Cover to sealing flange bolt	9
Connecting rod bearing cap [1)]	60 plus an additional 90° (¼ turn)
Idler Roller For the ribbed belt	23
Oil dipstick guide tube	9
Piston cooling oil spray jet	9
Tensioner for the ribbed belt [1]	50 plus an additional 90° (¼ turn)
Vibration damper to crankshaft [1)]	20 plus an additional 90° (¼ turn)

1) Replace fastener(s).
2) Lubricate the thread and contact surface.

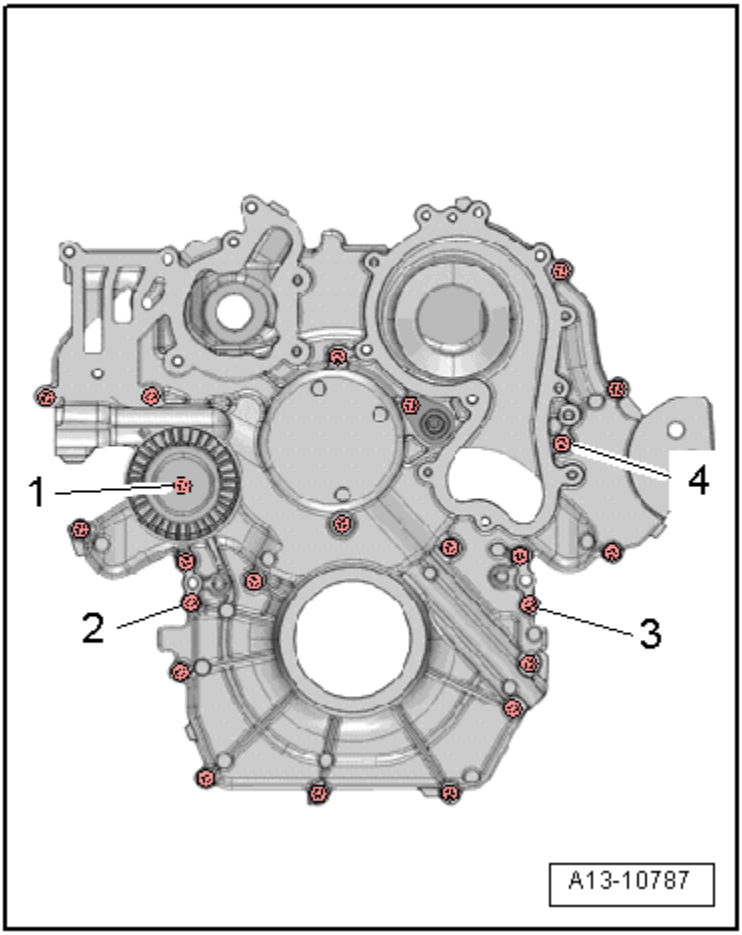
Guide Frame Tightening Specifications



Replace any bolts that were tightened with an additional turn.

Step	Component	Nm
1	Tighten bolts 1 through 16 in sequence	30
2	Tighten bolts 1 through 16 in sequence	50
3	Tighten bolts 1 through 16 in sequence	an additional 180° (½ turn)

Ribbed Belt Pulley Side Sealing Flange Tightening Specifications

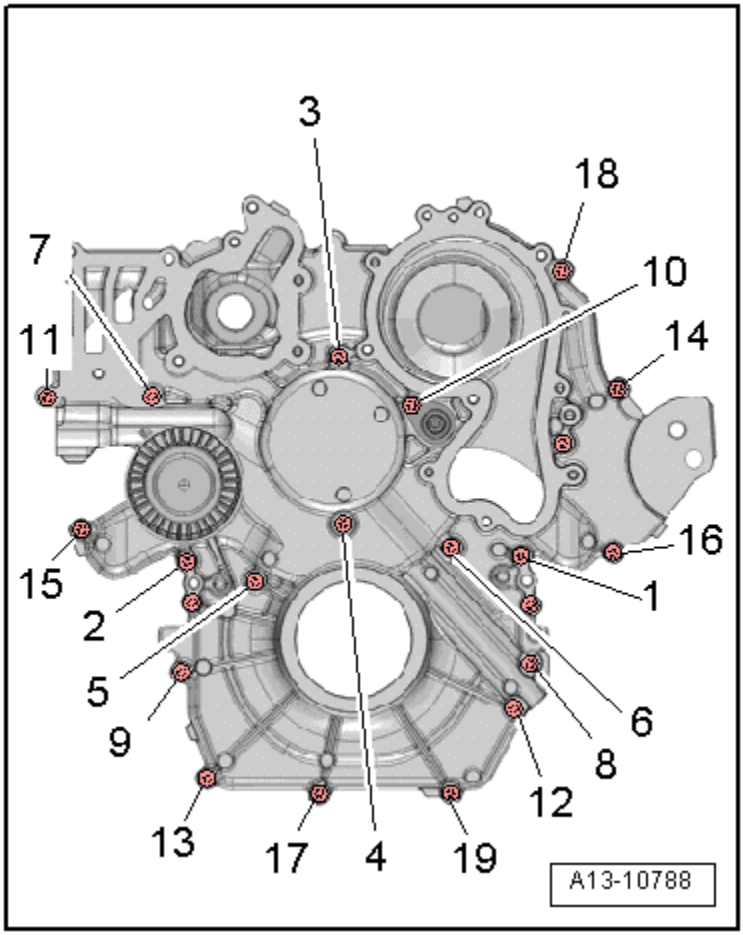


Replace any bolts that were tightened with an additional turn.
Tighten the bolts in 11 steps in the sequence shown.

Steps 1 to 3:

Step	Component	Nm
1	Attach the sealing flange with the seal to the cylinder block	
2	Tighten bolt 1	23
3	Tighten bolts 2 through 4 in sequence	Tighten M6x20 to 9 Nm

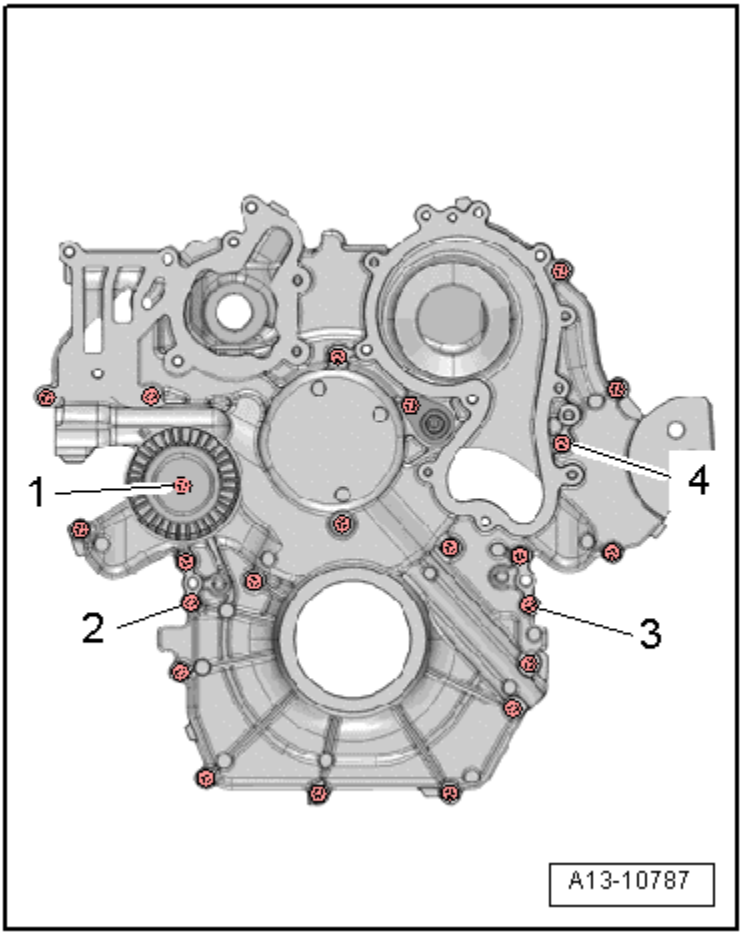
Ribbed Belt Pulley Side Sealing Flange Tightening Specifications *(cont'd)*



Steps 4 to 8:

Step	Component	Nm
4	Insert a temperature regulator for the engine oil cooler with the cover	
5	Tighten bolt 10	Hand-tighten
6	Tighten bolts 1 through 19 in sequence	3
7	Tighten bolts 1 through 19 in sequence	3
8	Tighten bolts 1 through 19 in sequence	90 plus an additional 90° (¼ turn)

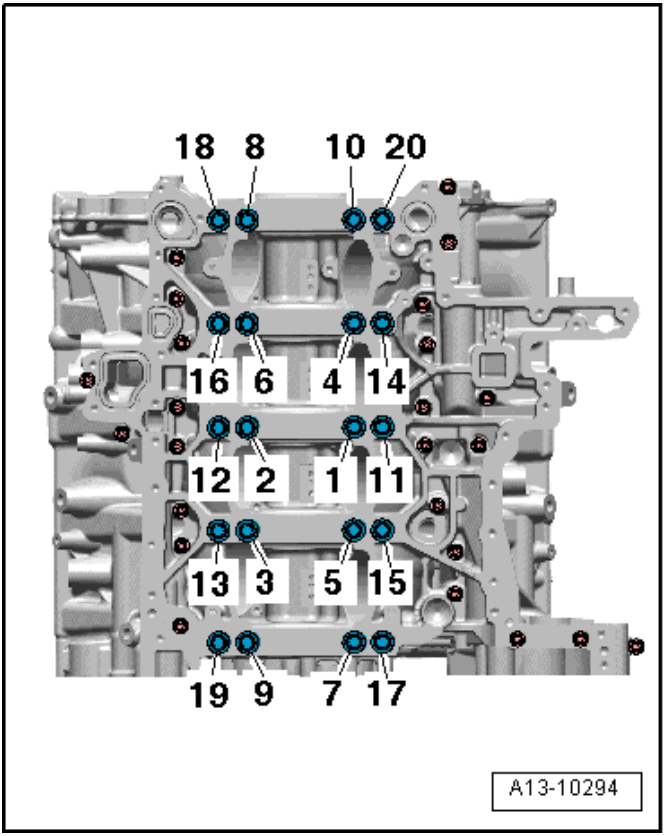
Ribbed Belt Pulley Side Sealing Flange Tightening Specifications *(cont'd)*



Steps 9 to 11:

Step	Component	Nm
1	Tighten bolts 2 through 4 in sequence	Remove the steel bolts M6x20
10	Tighten bolts 2 through 4 in sequence	Insert the aluminum bolts and tighten to 3 Nm
11	Tighten bolts 2 through 4 in sequence	Turn the aluminum bolts 90 plus an additional 90° (¼ turn)

Guide Frame Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 10 in sequence [1)]	30
2	Tighten bolts 11 through 20 in sequence [1)]	30
3	Tighten bolts 1 through 10 in sequence	50
4	Tighten bolts 1 through 10 in sequence	an additional 90° (¼ turn)
4	Tighten bolts 11 through 20 in sequence	50
5	Tighten bolts 1 through 10 in sequence	an additional 90° (¼ turn)
6	Tighten guide frame to cylinder block sealing surface bolts (not numbered) in a diagonal sequence	9

[1)] Replace fastener(s).

Crankshaft Dimensions

Honing dimension in mm	Crankshaft bearing journal diameter		Connecting rod journal diameter	
Basic dimension	65.000	– 0.022	54.000	– 0.022
		– 0.042		– 0.042

Piston Ring End Gaps

Piston ring end gaps dimensions in mm	New	Wear limit
1st compression ring	0.25 to 0.40	0.60
2nd compression ring	0.70 to 0.90	1.20
Oil scraping ring	0.25 to 0.50	0.70

Piston Ring Clearance

Piston ring dimensions in mm	New	Wear limit
1st compression ring	0.009 to 0.130	0.160
2nd compression ring	0.05 to 0.09	0.11
Oil scraping ring	0.03 to 0.07	0.10

Piston and Cylinder Dimensions

	Cylinder bore diameter in mm	Piston diameter in mm
Nominal dimension	83.006 to 83.014 [1)]	82.924 to 82.936 [2)]
Repair stage	83.046 to 83.054 [1)]	82.964 to 82.976 [2)]

[1)] Measure 50 mm inside the cylinder bore..

[2)] Measurement with graphite coating (thickness 0.02 mm). The graphite coating wears away.

Cylinder Head, Valvetrain – 3.0L CPNA

Fastener Tightening Specifications

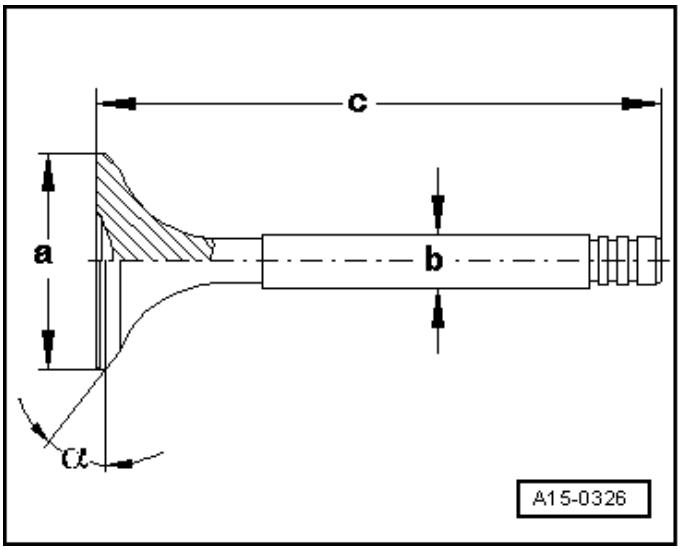
Component	Nm
Camshaft adjuster [1)]	80 plus an additional 90° (¼ turn)
Camshaft adjustment valve 2	2.4
Chain tensioner [1)]	5 plus an additional 90° (¼ turn)
Chain tensioner (with glide track) [1)]	5 plus an additional 90° (¼ turn)
Cylinder head plug	45
Drive sprocket bracket	9
Engine lifting eye (with wiring harness bracket)	22
Engine temperature control temperature sensor	8
Guide rail [1)]	17 plus an additional 90° (¼ turn)
Idler sprocket mounting pin	42
Left camshaft control chain drive sprocket [1)]	22
Right camshaft timing chain drive sprocket mounting pin	42

[1)] Replace fastener(s).

Compression Checking Specifications

Compression pressure	Bar pressure
New	10.0 to 14.0
Wear limit	9.0
Maximum difference between cylinders	3.0

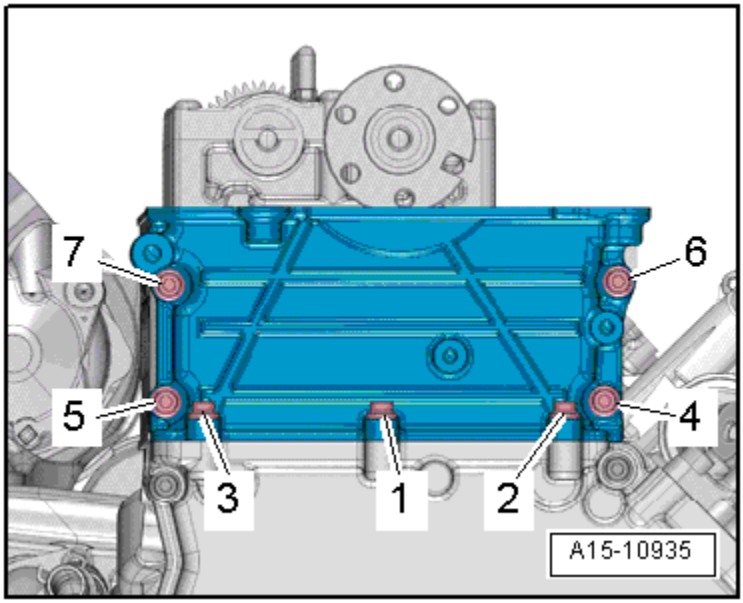
Valve Dimensions



Dimension		Intake valve	Exhaust valve
Diameter a	mm	33.85 ± 0.10	28.0 ± 0.1
Diameter b	mm	5.98 ± 0.01	5.96 ± 0.01
c	mm	103.97 ± 0.20	101.9 ± 0.2
α	∠°	45	45

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

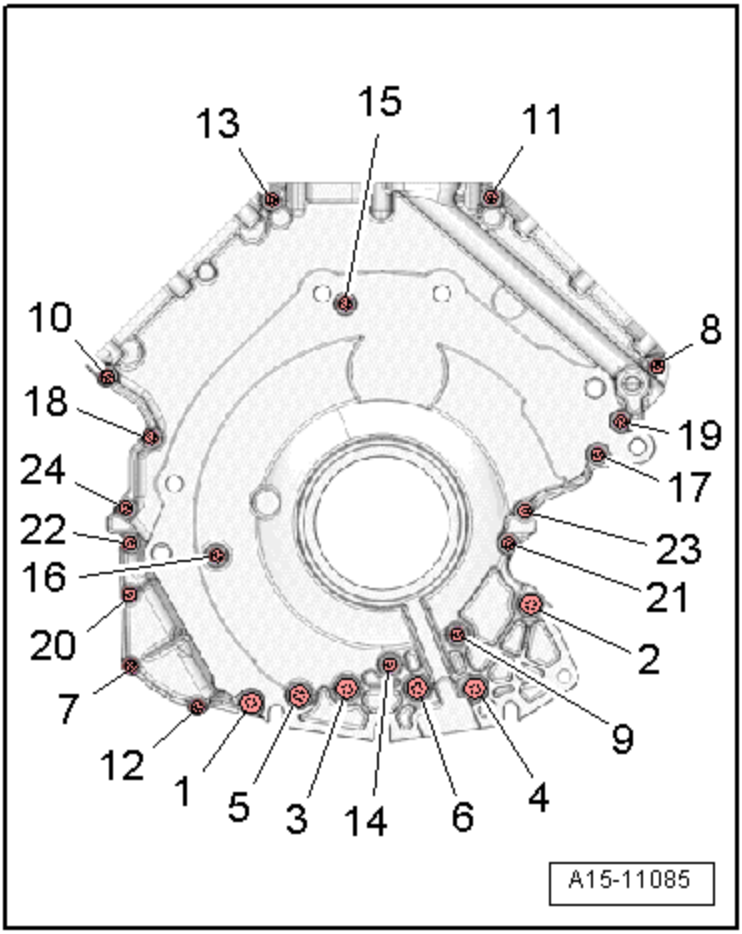
Upper Timing Chain Cover Tightening Specification



Replace any bolts that were tightened with an additional turn.

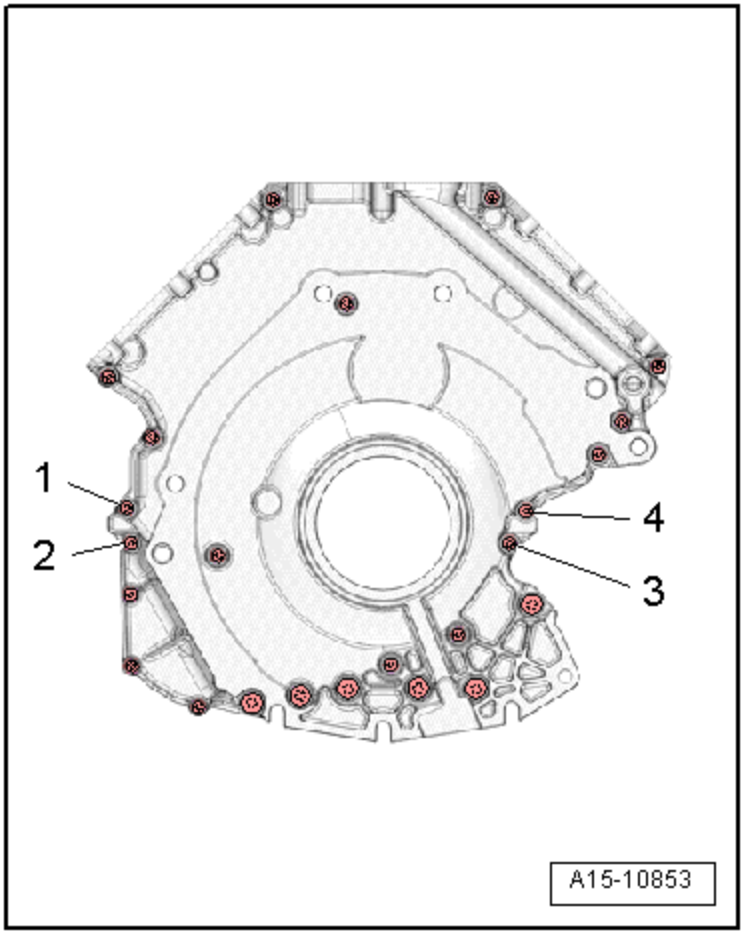
Steps	Component	Nm
1	Tighten bolts 1 through 3 in sequence	Hand-tighten
2	Tighten bolts 4 through 7 in sequence	Hand-tighten
3	Tighten bolts 1 through 7 in sequence	8
4	Tighten bolts 1 through 7 in sequence	8
5	Tighten bolts 1 through 7 in sequence	an additional 90° (¼ turn)

Lower Timing Chain Cover Removing Sequence



Remove the bolts in the following sequence 24 to 1.

Lower Timing Chain Cover Tightening Specification

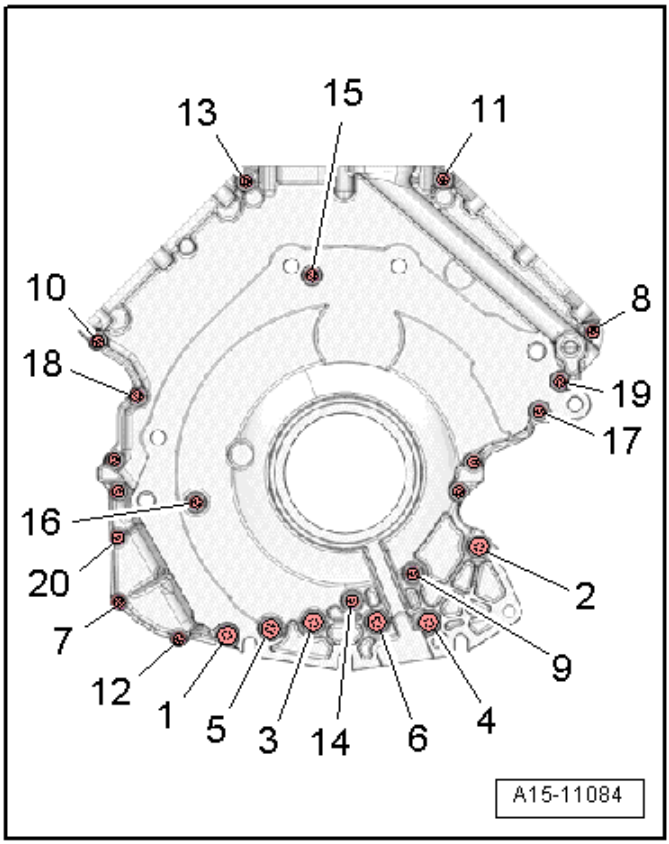


Replace any bolts that were tightened with an additional turn.

Steps 1 and 2

Steps	Component	Nm
1	Attaching the timing chain guard lower section with the sealant and the sealing pieces to the cylinder block	
2	Tighten bolts 1 through 4 in sequence	9

Lower Timing Chain Cover
Tightening Specification *(cont'd)*

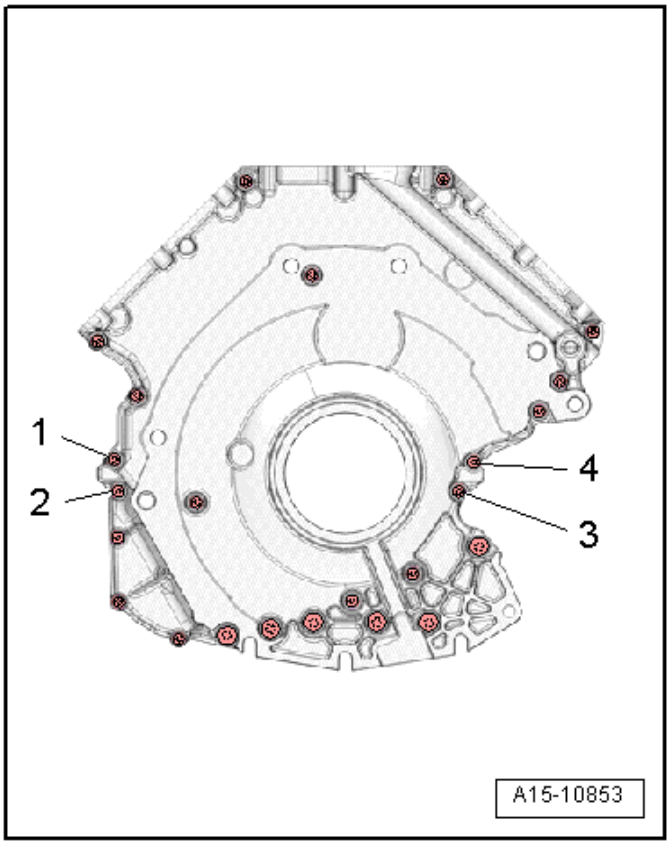


Replace any bolts that were tightened with an additional turn.

Steps 3 to 6

Steps	Component	Nm
3	Tighten bolts 1 through 20 in sequence	3
4	Tighten bolts 1 through 20 in sequence	3
5	Tighten bolts 1 through 20 in sequence	8
6	Tighten bolts 1 through 20 in sequence	an additional 90° (¼ turn)

Lower Timing Chain Cover
Tightening Specification *(cont'd)*

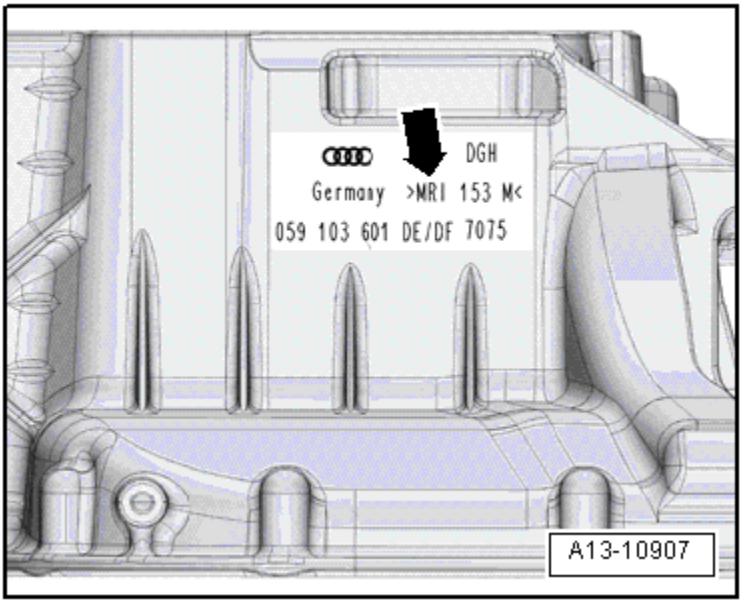


Replace any bolts that were tightened with an additional turn.

Steps 7 to 9

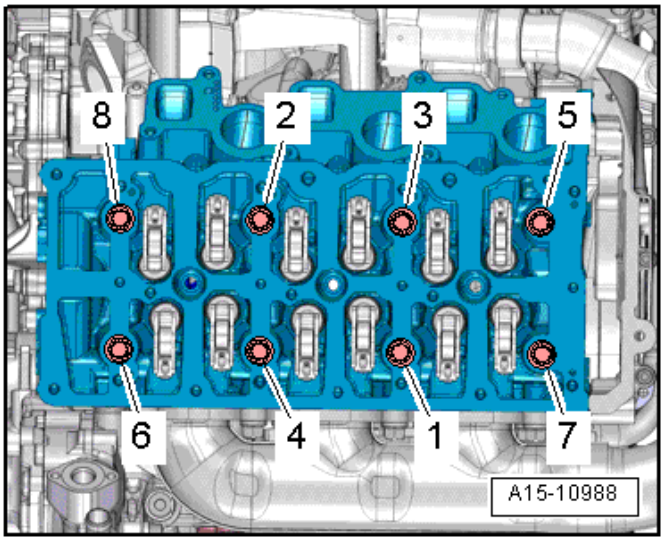
Steps	Component	Nm
7	Tighten bolts 1 through 4 in sequence	Remove the steel bolts M6x20
8	Tighten bolts 1 through 4 in sequence	3
9	Tighten bolts 1 through 4 in sequence	an additional 90° (¼ turn)

Vehicles with Magnesium Upper Oil Pan



The steel bolts must be replaced with aluminum bolts (steps 6 - 8) after all bolts have been tightened on vehicles with magnesium oil pan upper sections (identifying feature: letter combination MRI (➡) on the oil pan upper section).

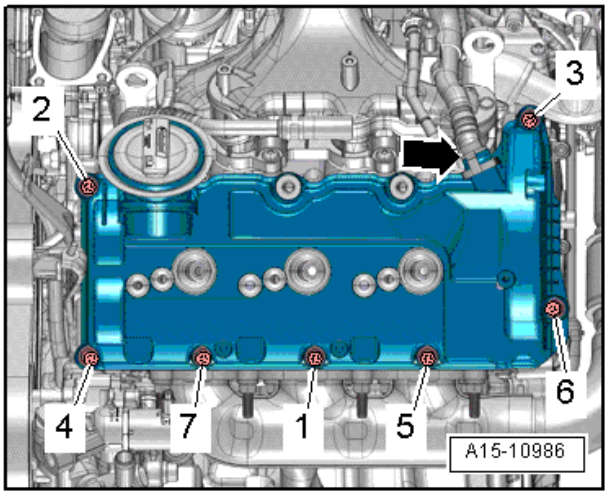
Cylinder Head Tightening Specifications



Replace any bolts that were tightened with an additional turn.

Step	Component	Nm
1	Tighten bolts 1 through 8 in sequence	Hand-tighten
2	Tighten bolts 1 through 8 in sequence	35
3	Tighten bolts 1 through 8 in sequence	70
4	Tighten bolts 1 through 8 in sequence	an additional 90° (¼ turn)
5	Tighten bolts 1 through 8 in sequence	an additional 90° (¼ turn)

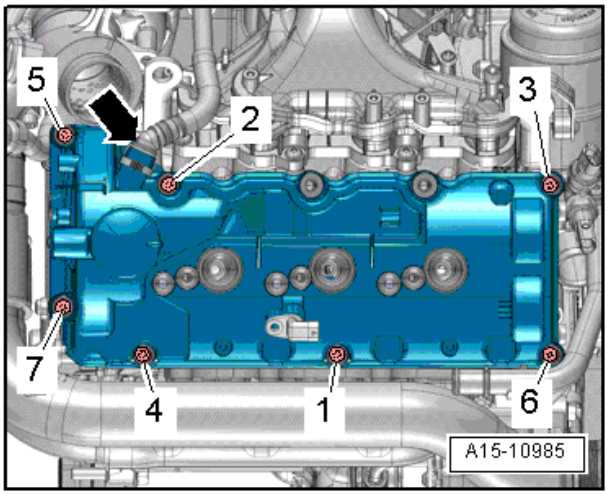
Left Cylinder Head Cover Tightening Specification



Replace any bolts that were tightened with an additional turn.

Step	Component	Nm
1	Tighten bolts 1 through 7 in sequence	Hand-tighten
2	Tighten bolts 1 through 7 in sequence	8
3	Tighten bolts 1 through 7 in sequence	an additional 90° (¼ turn)

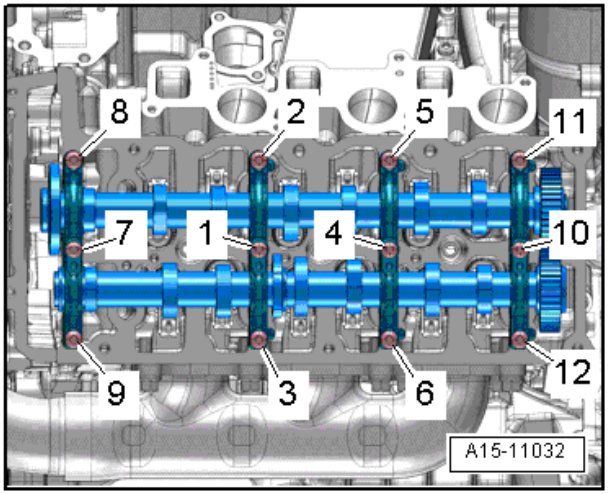
Right Cylinder Head Cover Tightening Specification



Replace any bolts that were tightened with an additional turn.

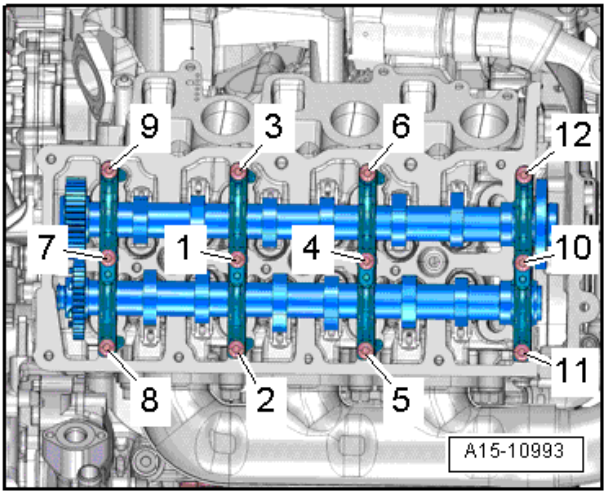
Step	Component	Nm
1	Tighten bolts 1 through 7 in sequence	Hand-tighten
2	Tighten bolts 1 through 7 in sequence	8
3	Tighten bolts 1 through 7 in sequence	an additional 90° (¼ turn)

Cylinder Bank 1 (Right) Bearing Cap Tightening Specification



Step	Component	Nm
1	Tighten bolts 1 through 12 in sequence	Hand-tighten
2	Tighten bolts 1 through 12 in sequence	9

Cylinder Bank 2 (Left) Bearing Cap Tightening Specification



Step	Component	Nm
1	Tighten bolts 1 through 12 in sequence	Hand-tighten
2	Tighten bolts 1 through 12 in sequence	9

Lubrication – 3.0L CPNA

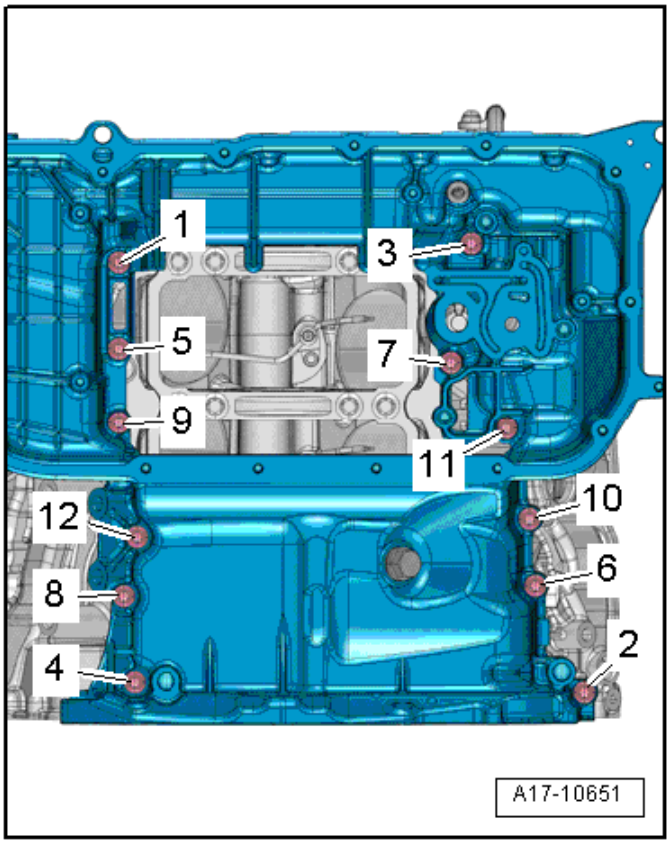
Fastener Tightening Specifications

Component	Nm
Cap with oil filter by-pass valve	35
Chain sprocket for the oil pump bolt [1]	30 plus an additional 45° (⅛ turn)
Engine oil cooler	9
Engine oil cooler thermostat cap [1]	3 plus an additional 90° (¼ turn)
Guide tube for the oil dipstick	9
Mounting plate for the engine oil cooler	9
Oil baffle bolt [1]	3 plus an additional 90° (¼ turn)
Oil drain plug	30
Oil filter housing bolt	9
Oil level thermal sensor-to-oil pan	9
Oil pressure regulation valve	9
Oil pressure switch	20
Oil return pipe-to-oil pump	9
Reduced oil pressure switch	20
Upper oil pan drain plug	25
Vacuum line from the vacuum pump [2]	
- Bolt [1]	3 plus an additional 45° (⅛ turn)
- Bolt	9

[1] Replace fastener(s).

[2] For bolt tightening clarification, refer to ElsaWeb, *Upper Oil Pan Overview,* items 19 and 21.

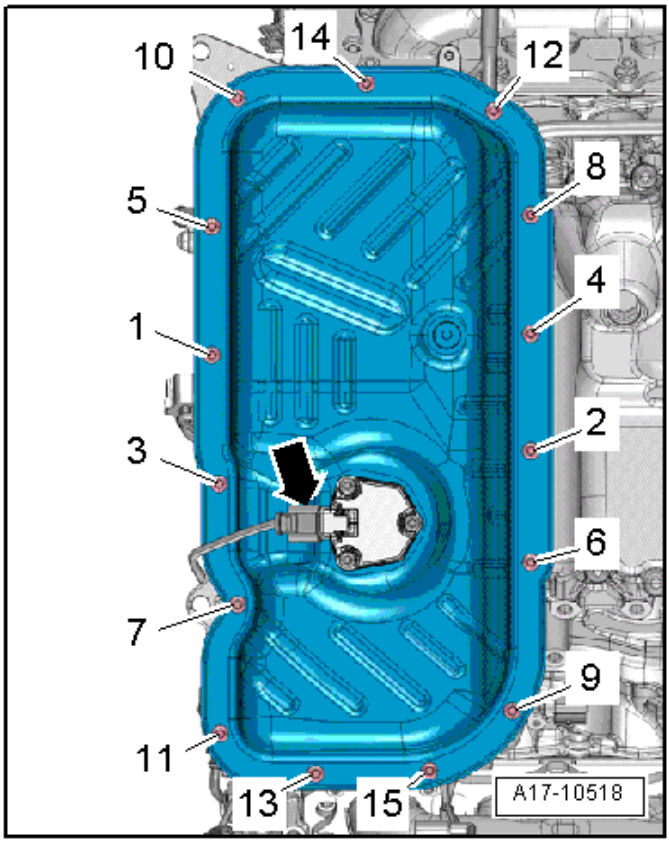
Upper Oil Pan Tightening Specifications



Replace any bolts that were tightened with an additional turn.

Step	Component	Nm
1	Tighten bolts 1 through 12 in sequence	2
2	Tighten bolts 1 through 12 in sequence	5
3	Tighten bolts 1 through 12 in sequence	an additional 90° (¼ turn)

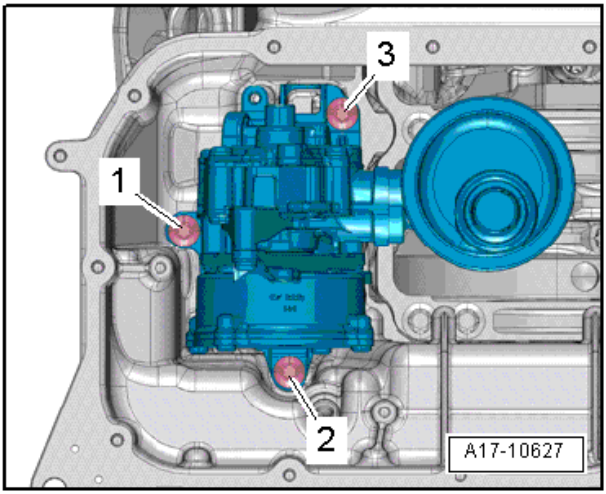
Oil Pan Tightening Specifications



Replace any bolts that were tightened with an additional turn.

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

Oil Pump with Vacuum Pump
Tightening Specification



Replace any bolts that were tightened with an additional turn.

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

Cooling System – 3.0L CPNA

Fastener Tightening Specifications

Component	Nm
Check valve bolts	9
Coolant connection bolts	9
Coolant fan bolts	3.5
Coolant lines	
- Banjo bolt	12
- Bolt	9
Coolant pump to engine bolts	9
Coolant pump ribbed belt pulley bolts [1)]	23
Coolant shut-off valve	9
Engine Coolant Temperature (ECT) sensor	9
Fan wheel bolts	5
Front coolant pipe bolts	9
Left coolant pipe bolts	9
Left lower coolant pipe bolts	9
Rubber buffer bolt	3.5
Transmission coolant valve bolts	9
Upper left coolant pipe nut/bolt	9

[1)] Tighten diagonally in steps.

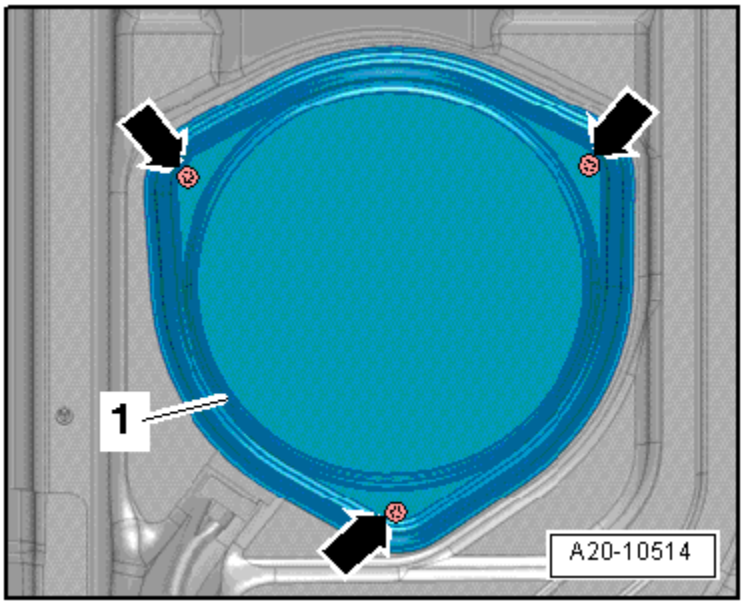
Fuel Supply – 3.0L CPNA

Fastener Tightening Specifications

Component	Nm
Accelerator pedal module	8
Air filter housing	23
Bracket for fuel filter [1]	
- Bolt	2.1
- Bolt	5.5
Carrier plate bolt	23
Fuel cooler bolts	1.5
Fuel filler neck	
- Bolt	23
- Nut	2.5
Fuel pump control module to bracket nut	1.6
Fuel tank heat shield to fuel tank bolt	23
Locking flange cover bolt	1.5
Locking ring	120
Mounting strap bolts	23

[1] For bolt tightening clarification, refer to ElsaWeb, *Fuel Filter Overview,* items 2 and 16.

Locking Flange Cover Tightening Specification



Step	Component	Nm
1	Tighten bolts (➡) in a diagonal sequence	1.5

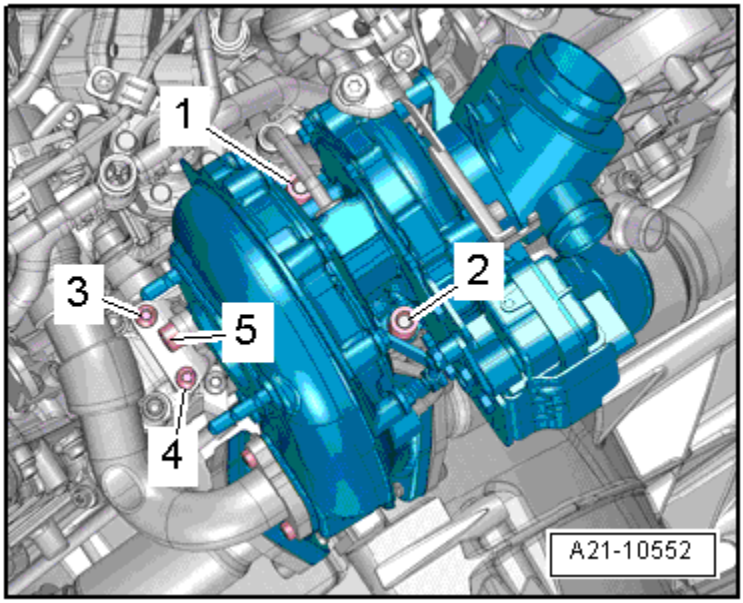
Turbocharger, Supercharger – 3.0L CPNA

Fastener Tightening Specifications

Component	Nm
Air guide pipe	9
Air guide pipe bracket bolts	8
Bracket for charge air cooler	9
Bracket for connector and engine cover	9
Charge air cooler bolts	3.5
Charge air cooler bolts (Hot Climate version)	9
Charge air pressure sensor/intake air temperature sensor	3.5
Charge air pressure sensor/intake air temperature sensor (Hot Climate version)	9
Connection for air guide hose	9
Coolant supply line bolts [1)]	9
Coolant supply line bolts [2)]	8
Coolant supply line connections	25
Exhaust manifold bolts [3) 4)]	30 plus an additional 90° (¼ turn)
Particulate filter nut [3) 4)]	23
Rear air guide bolt	1.7
Screw-type clamps	
- 9 mm wide	3.4
- 13 mm wide	5.5

1) For bolt tightening clarification, refer to ElsaWeb, *Turbocharger Overview,* item 32.
2) For bolt tightening clarification, refer to ElsaWeb, *Turbocharger Overview,* item 8.
3) Replace fasteners.
4) Coat the thread with hot bolt paste..

Turbocharger Tightening Specification



Replace the stud bolts and the nuts.

Step	Component	Nm
1	Stud bolts for the nuts 1 and 2	10
2	Tighten bolts and nuts 1 and 2	Hand-tighten
3	Tighten bolts and nuts 1 and 2	9
4	Tighten bolts and nuts 1 and 2	an additional 90° (¼ turn)
5	Tighten bolts 3 to 5 in sequence	Hand-tighten
6	Tighten bolts 3 and 4 in sequence	9
7	Tighten bolt 5	23

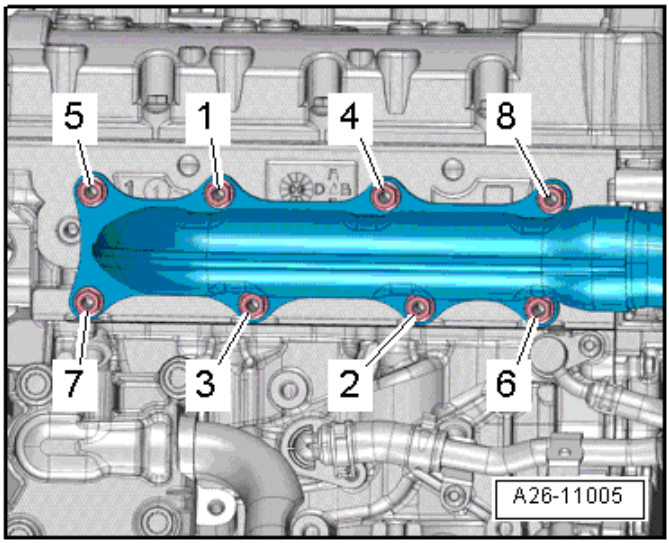
Exhaust System, Emission Controls – 3.0L CPNA

Fastener Tightening Specifications

Component	Nm
Catalytic converter nut [1)]	20
Center muffler brace nut	25
Connection flange	9
Front clamping sleeve nut	23
Rear clamping sleeve nut	23
Secondary Air Injection (AIR) hose bracket	9
Secondary Air Injection (AIR) pump motor bracket nut/ bolt	9
Securing strip nut [1)]	25
Suspended mount	23

1) Replace fastener(s).

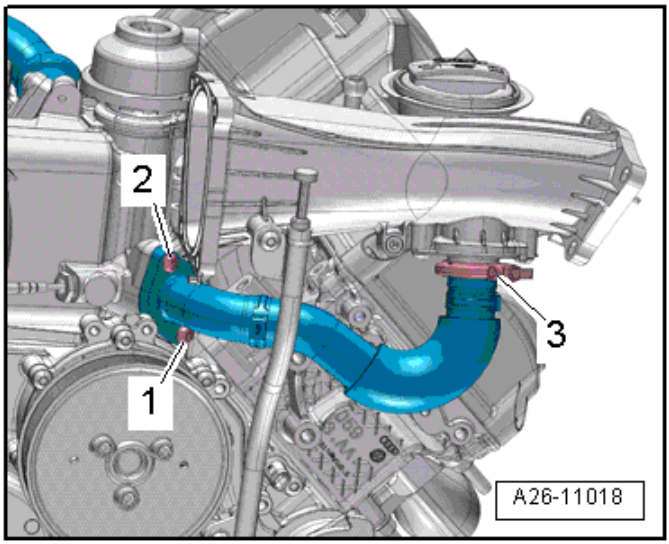
Exhaust Manifold Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 9 in sequence [1) 2)]	Hand-tighten
2	Tighten bolts 1 through 9 in sequence	15
3	Tighten bolts 1 through 9 in sequence	25

1) Replace fastener(s).
2) Coat the thread on the nut with hot bolt paste. For the correct hot bolt paste, refer to the Electronic Parts Catalog (ETKA).

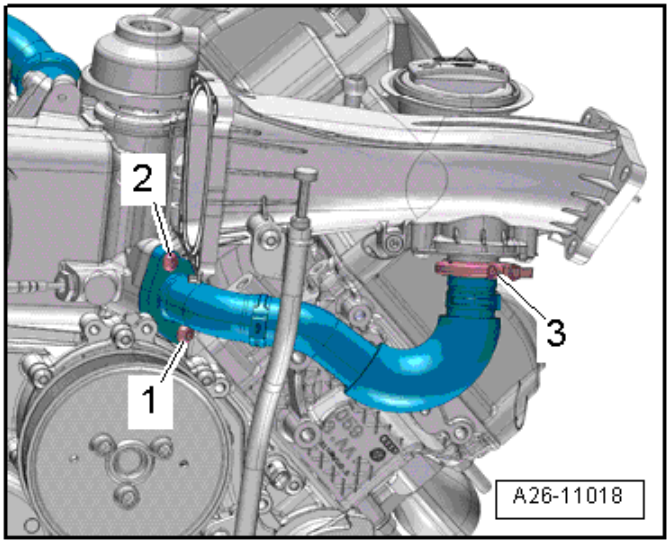
EGR Pipe at the Intake Manifold Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 and 2 in sequence [1)]	Hand-tighten
2	Tighten bolt 3	2.5
3	Tighten bolts 1 and 2 in sequence	30

[1)] Coat the thread on the nut with hot bolt paste. For the correct hot bolt paste, refer to the Electronic Parts Catalog (ETKA).

EGR Pipe at the Turbocharger Tightening Specifications



Step	Component	Nm
1	Tighten bolts 2and 3 in sequence [1)]	Hand-tighten
2	Tighten bolt [1)]	2.5
3	Tighten bolts 2and 3 in sequence	30
4	Tighten bolts 2and 3 in sequence	an additional 90° (¼ turn)

[1)] Coat the thread on the nut with hot bolt paste. For the correct hot bolt paste, refer to the Electronic Parts Catalog (ETKA).

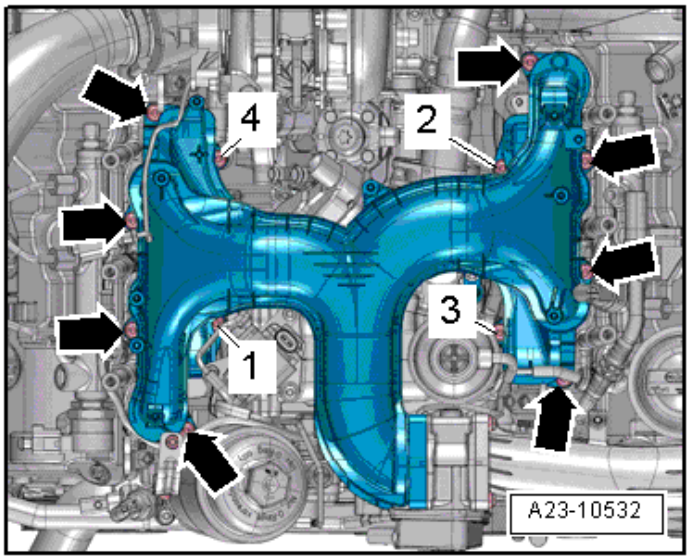
Multiport Fuel Injection – 3.0L CPNA

Fastener Tightening Specifications

Component	Nm
Air filter mount bolt	3.5
Air filter housing bracket bolt	8
Air guide bolt	2.5
Air guide pipe bolt	9
Bracket for air guide pipe bolt	9
Bracket for connector bolt	4
Bracket for tension clamp	
- on camshaft bearing	2
- on cylinder head	9
Clamp for the high pressure line bolt	9
Differential pressure sensor	45
Differential pressure sensor bolt	4.5
Engine support adapter nut	70
Exhaust gas temperature sensor 3	45
Fuel rail bolt	22
Fuel temperature sensor	2
Heated oxygen sensor	55
High pressure line [1]	25
High pressure pump bolt	22
Intake flap motor bolt	25
Lower air filter housing bolt	9
Mass air flow sensor bolt	3.5
Mass air flow sensor housing bolt	3.5
Mounting pins for engine cover	5
Particle sensor [3]	60
Pipe for the exhaust gas recirculation bolt	9
NOx sensor with NOx sensor control module	8
NOx sensor control module 2 with NOx sensor 2	50
NOx sensor control module 2 with NOx sensor 2 bolt	6
Tension clamp bolt [2]	
- First tighten	8
- Second tighten	an additional 90° (¼ turn)
Upper air filter housing bolt	2.5
Wiring guide bolt	4

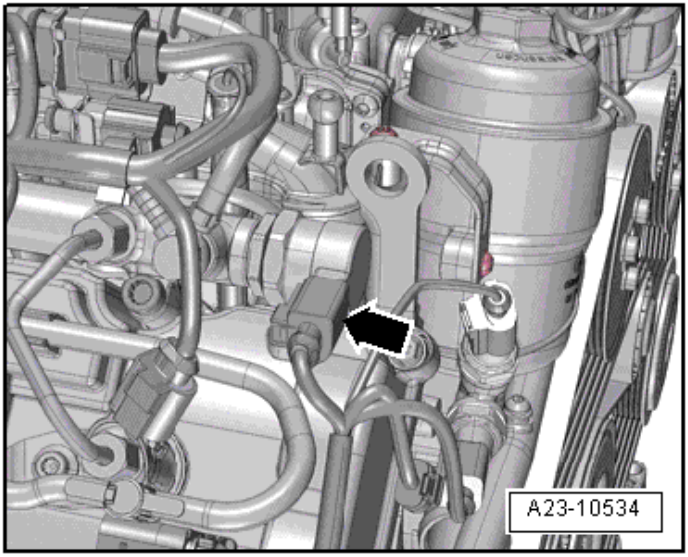
[1] Coat the threads on the union nut with clean engine oil.
[2] Replace fastener
[3] Coat with hot bolt paste.

Intake Manifold Tightening Specifications



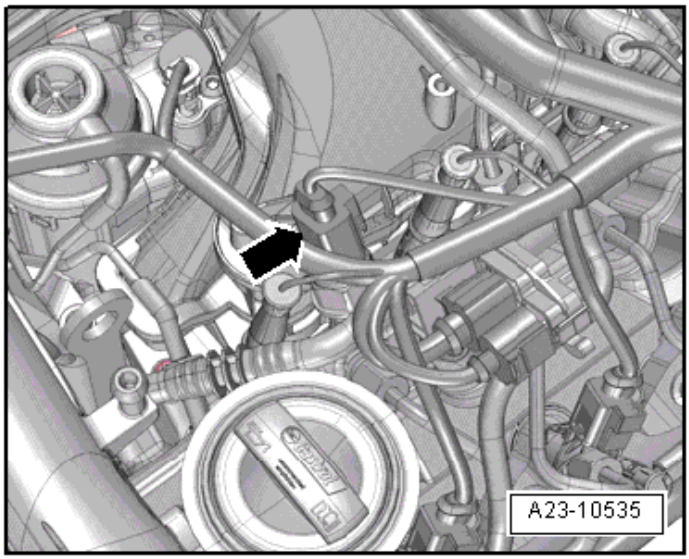
Step	Component	Nm
1	Tighten bolts 1 through 4 and (➡) in sequence	Hand-tighten
2	Tighten bolts 1 through 4 in sequence	5
3	Tighten bolts 1 through 4 and (➡) any sequence	9

Fuel Pressure Regulator Valve Tightening Specification



Step	Component	Nm
1	Tighten bolt (➡)	Hand-tighten
2	Tighten bolt (➡)	60
3	Tighten bolt (➡)	Turn back 90°
4	Tighten bolt (➡)	85

Fuel Pressure Sensor Tightening Specification



Step	Component	Nm
1	Tighten bolt (➡)	Hand-tighten
2	Tighten bolt (➡)	60
3	Tighten bolt (➡)	Turn back 180°
4	Tighten bolt (➡)	85

Ignition System – 3.0L CPNA

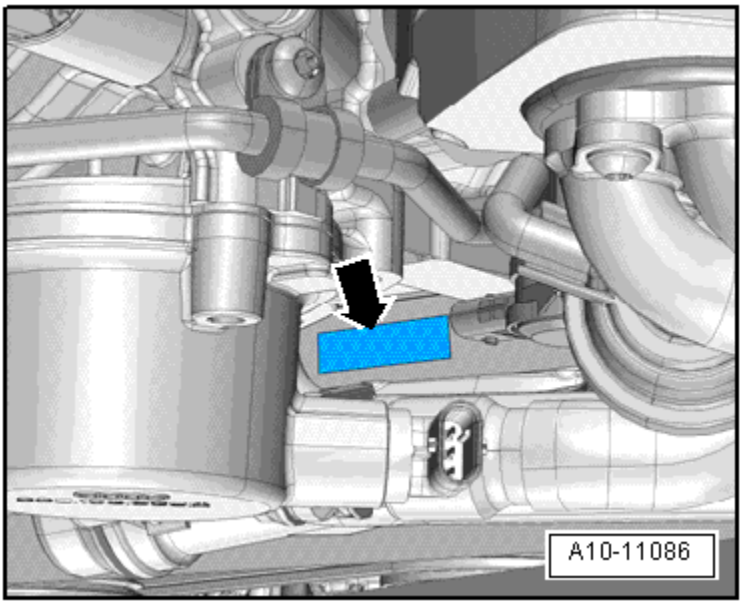
Ignition Tightening Specifications

Component	Nm
Camshaft Position (CMP) sensor	10
Engine Speed (RPM) sensor	9
Knock Sensors (KS)	20
Spark plug	30
Wiring for ignition coils at cylinder head cover	5

ENGINE MECHANICAL – 3.0L CGXC, CTUB

General, Technical Data

Engine Number Location



The engine number (➡) (engine code and serial number) is located at the front of the engine on top of the cylinder block.

Engine Data

Code letters		CGXC	CTUB
Displacement	liter	2.995	2.995
Output	kW at RPM	245@5300-7000	245@5300-7000
Torque	Nm at RPM	440@2900-5300	440@2900-5300
Bore	diameter mm	84.5	84.5
Stroke	mm	89.0	89.0
Compression ratio		10.5	10.5
RON	at least	98 [1)]	98 [1)]
Fuel injection and ignition system		Simos	Simos
Ignition sequence		1-4-3-6-2-5	1-4-3-6-2-5
Exhaust Gas Recirculation (EGR)		No	No
Supercharger		Supercharger	Supercharger
Knock Sensors (KS)		2 sensors	2 sensors
Charge air cooler		Yes	Yes
Oxygen Sensor (O2S) regulation		2 sensors before catalytic converter 2 sensors after catalytic converter	2 sensors before catalytic converter 2 sensors after catalytic converter
Variable valve timing		Intake	Intake
Variable intake manifold		No	No
Secondary Air Injection (AIR) system		Yes	Yes
Valve per cylinder		4	4

[1)] Unleaded RON 95 is also permitted but performance is reduced.

Engine Assembly – 3.0L CGXC, CTUB

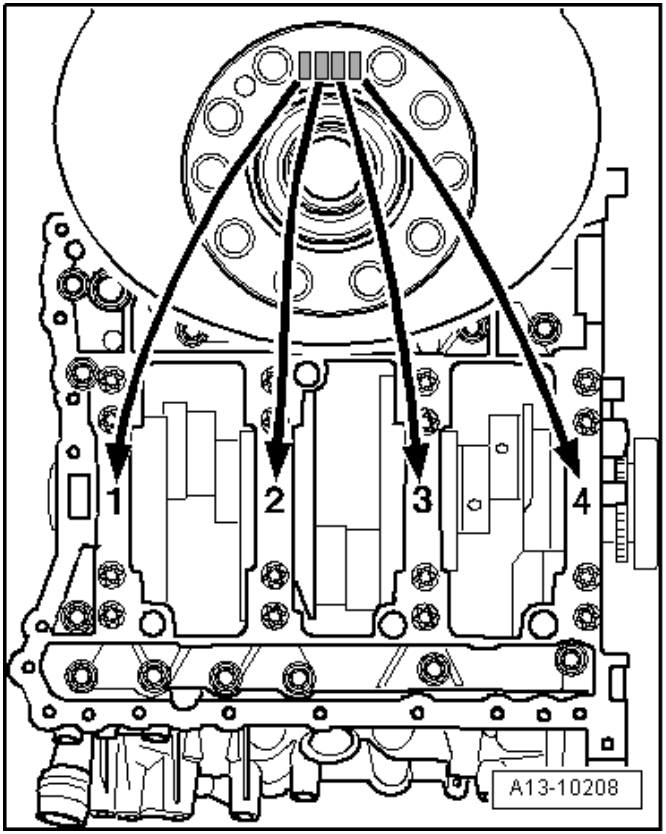
Fastener Tightening Specifications

Component	Fastener size	Nm
Bolts and nuts	M6	9
	M7	15
	M8	20
	M10	40
	M12	60
Engine bracket	-	20
Engine mount [1)]	-	90 plus an additional 90° (¼ turn)
Engine support	-	40
Heat shield	-	10
Hydraulic hose mount	-	9
Subframe	-	55
Exception: Ground pins to the strut tower	-	9

[1)] Replace fastener(s).

Crankshaft, Cylinder Block – 3.0L CGXC, CTUB

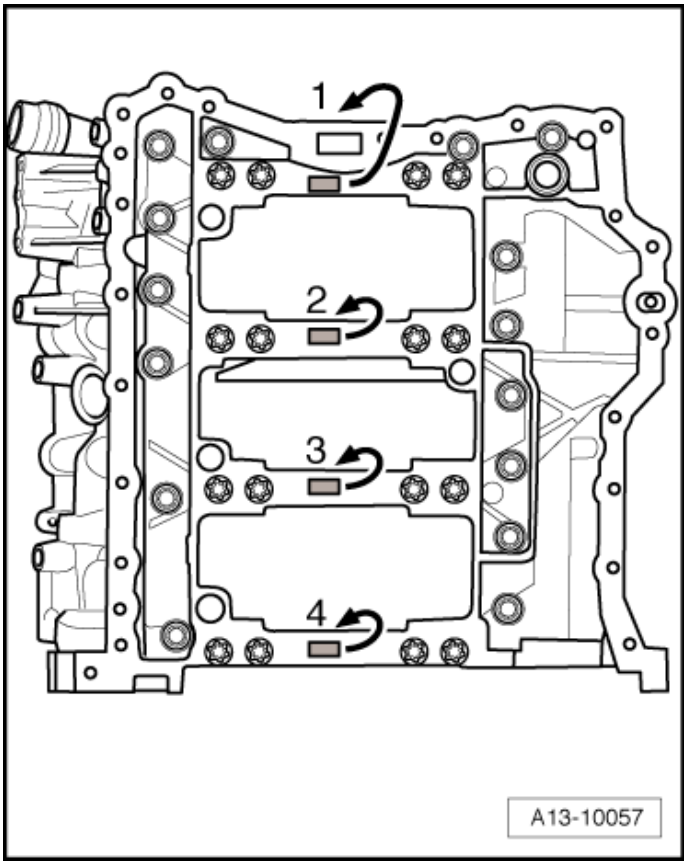
Allocation of Crankshaft Bearing Shells for Guide Frame



Bearing shells with the correct thickness are allocated to the guide frame in the factory. Colored dots on the sides of the bearing shells serve for identifying bearing shell thickness. Allocation of bearing shells to guide frame is marked on the transmission flange of crankshaft by a row of letters. The first letter of the row of letters represents bearing “1“, the second letter is for bearing “2“, etc.

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

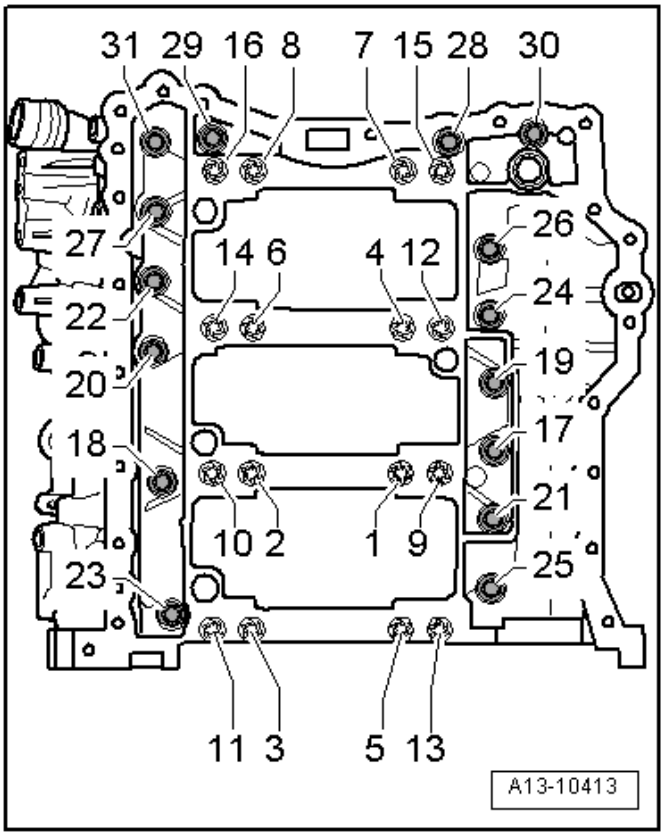
Allocation of Crankshaft Bearing Shells for Cylinder Block



Bearing shells with the correct thickness are allocated to the cylinder block in the factory. Colored dots on the sides of the bearing shells identify the bearing shell thickness. The allocation of the bearing shells to the cylinder block is marked by one letter each on the respective bearing on guide frame.

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

Guide Frame Tightening Specifications



Replace any bolts that were tightened with an additional turn.

Step	Bolts	Nm
1	Bolts 1 through 16 in sequence	50
2	Bolts 1 through 16 in sequence	an additional 90° (¼ turn)
3	Bolts 17 through 31 in sequence	Blue

Fastener Tightening Specifications

Component	Nm
Bearing flange drive plate [1]	60 plus an additional 90° (¼ turn)
Connecting rod bearing cap [1]	50 plus an additional 90° (¼ turn)
Coolant pump-to-engine	9
Generator bracket [3]	22
	46
Oil dipstick guide tube	9
Oil Pressure Regulation Valve	9
Oil spray jet [4]	9
Piston cooling oil spray jet	9
Ribbed belt idler roller	22
Ribbed belt pulley side sealing flange	9
Ribbed belt tensioning element [2]	22
	55
TDC marking locking bolt	14
Tensioner for the ribbed belt-to-engine	40
Vibration damper to engine [1]	20 plus an additional 90° (¼ turn)

[1] Replace fastener(s).
[2] For bolt tightening clarification, refer to ElsaWeb, *Ribbed Belt Drive Overview*, items 1 and 2.
[3] For bolt tightening clarification, refer to ElsaWeb, *Ribbed Belt Drive Overview*, items 7 and 8.
[4] Insert bolt with locking compound.
[5] In a diagonal sequence in stages.

Crankshaft Dimensions

Honing dimension in mm	Crankshaft bearing journal diameter		Connecting rod journal diameter	
Basic dimension	65.000	– 0.022	54.000	– 0.022
		– 0.042		– 0.042

Piston Ring End Gaps

Piston ring end gaps dimensions in mm	New	Wear limit
1st compression ring	0.20 to 0.30	0.80
2nd compression ring	0.50 to 0.70	0.80
Oil scraping ring	0.25 to 0.50	1)

1) Not determined yet.

Piston Ring Clearance

Piston ring dimensions in mm	New	Wear limit
1st compression ring	0.04 to 0.08	0.20
2nd compression ring	0.03 to 0.07	0.15
Oil scraping ring	0.02 to 0.06	0.15

Piston and Cylinder Dimensions

Cylinder bore diameter in mm	Piston diameter in mm
84.51	84.49 1)

1) Measurement with graphite coating (thickness 0.02 mm). The graphite coating wears off.

Cylinder Head, Valvetrain – 3.0L CGXC, CTUB

Fastener Tightening Specifications

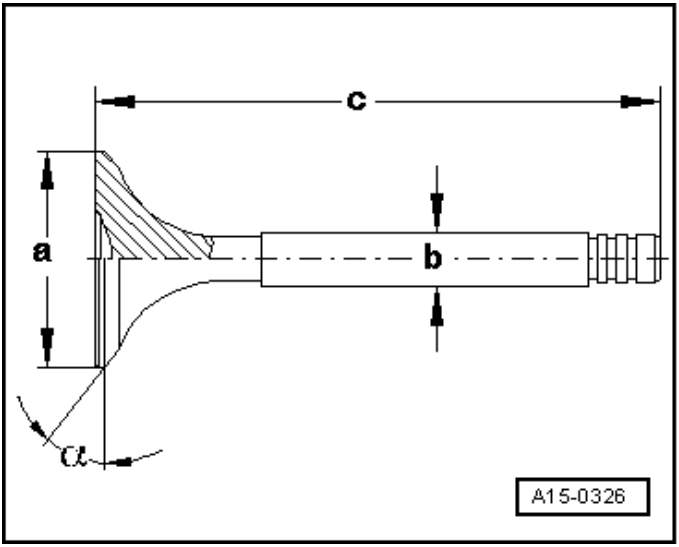
Component	Nm
Bearing plate for drive sprocket to cylinder head [1]	8 plus an additional 45° (⅛ turn)
Balance weight transmission side to balance shaft	60
Camshaft adjuster for the exhaust camshaft [1]	80 plus an additional 90° (¼ turn)
Camshaft adjuster for the intake camshaft [1]	80 plus an additional 90° (¼ turn)
Camshaft adjustment solenoid valve to cylinder head	5
Camshaft Chain Sprocket For the exhaust camshaft to camshaft [1]	80 plus an additional 90° (¼ turn)
Chain tensioner to engine	9
Chain tensioner with glide track to engine [1]	10 plus an additional 45° (⅛ turn)
Drive sprocket for Left camshaft timing chain drive sprocket to bearing plate [1]	30 plus an additional 90° (¼ turn)
Drive sprocket for oil pump to engine [1]	30 plus an additional 90° (¼ turn)
Drive sprocket for right camshaft timing chain [1]	15 plus an additional 90° (¼ turn)
Gear carrier to engine	13
Glide track to engine [1]	10 plus an additional 45° (⅛ turn)
Mounting pin for left camshaft timing chain drive sprocket to bearing plate [1]	5 plus an additional 60° turn
Mounting pin for right camshaft timing chain drive sprocket [1]	30 plus an additional 90° (¼ turn)
Oil dipstick guide tube to engine	9

[1] Replace fastener(s).

Compression Checking Specifications

Compression pressure	Bar pressure
New	10.0 to 14.0
Wear limit	9.0
Maximum difference between cylinders	3.0

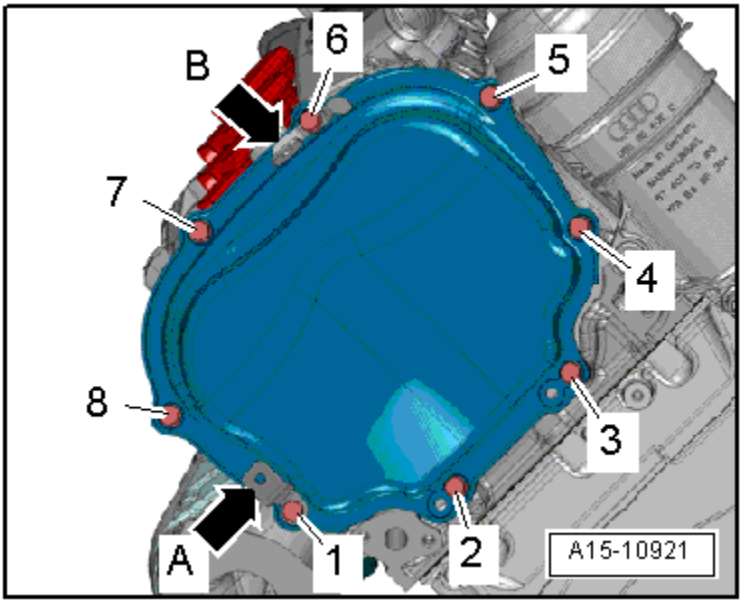
Valve Dimensions



Dimension		Intake valve	Exhaust valve
Diameter a	mm	33.85 ± 0.10	28.0 ± 0.1
Diameter b	mm	5.98 ± 0.01	5.96 ± 0.01
c	mm	104.00 ± 0.20	101.9 ± 0.2
α	∠°	45	45

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

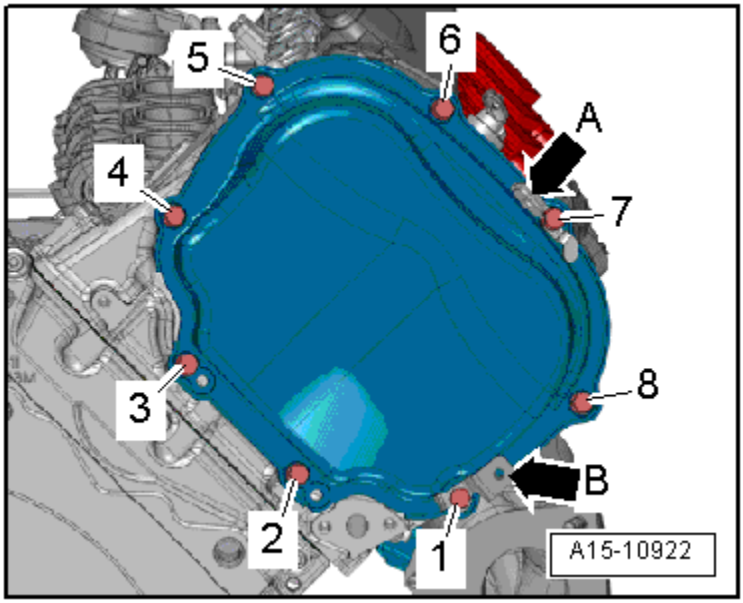
Left Timing Chain Cover Tightening Specification



Replace any bolts that were tightened with an additional turn. The brackets -arrows A, B- are connected with the left timing chain cover.

Step	Component	Nm
1	1 through 8 in sequence	5
2	1 through 8 in sequence	an additional 90° (¼ turn)

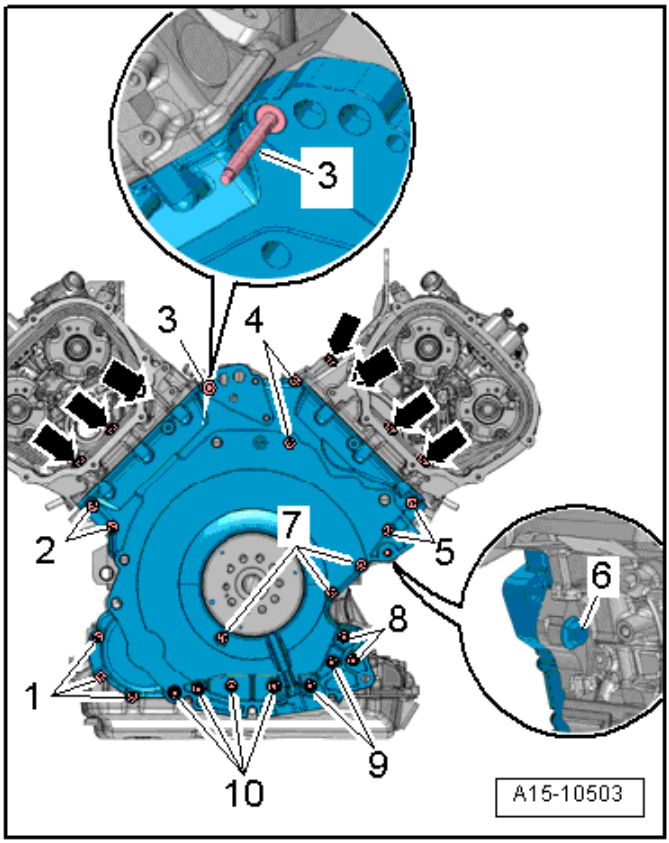
Right Timing Chain Cover Tightening Specification



Replace any bolts that were tightened with an additional turn. The brackets -arrows A, B- are connected with the left timing chain cover.

Step	Component	Nm
1	1 through 8 in sequence	5
2	1 through 8 in sequence	an additional 90° (¼ turn)

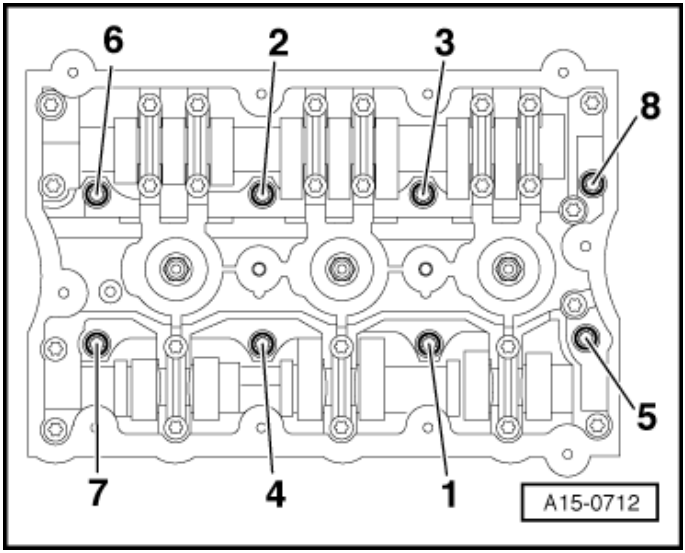
Lower Timing Chain Cover Tightening Specifications



Replace any bolts that were tightened with an additional turn.

Step	Component	Nm
1	Tighten bolts (➡)	3
2	Tighten bolts 1 through 10 in a diagonal sequence	3
3	Tighten bolts 1, 2, 4,5, 7 and (➡)	an additional 90° (¼ turn)
4	Tighten bolts 8, 9 and 10 in sequence	8
5	Tighten bolts 8, 9 and 10 in sequence	an additional 90° (¼ turn)
6	Tighten bolt 3	16
7	Tighten bolt 6	20
8	Tighten bolt 6	an additional 180° (½ turn)

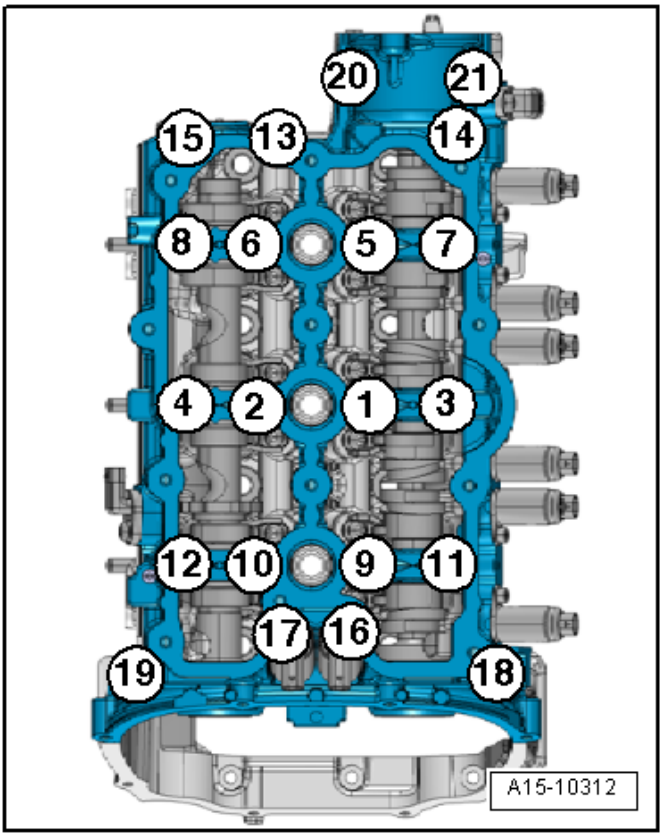
Cylinder Head Tightening Specifications



Replace any bolts that were tightened with an additional turn.

Step	Component	Nm
1	Tighten bolts 1 through 8 in sequence	Hand-tighten
2	Tighten bolts 1 through 8 in sequence	40
3	Tighten bolts 1 through 8 in sequence	an additional 90° (¼ turn)

Camshaft Guide Frame Tightening Specifications

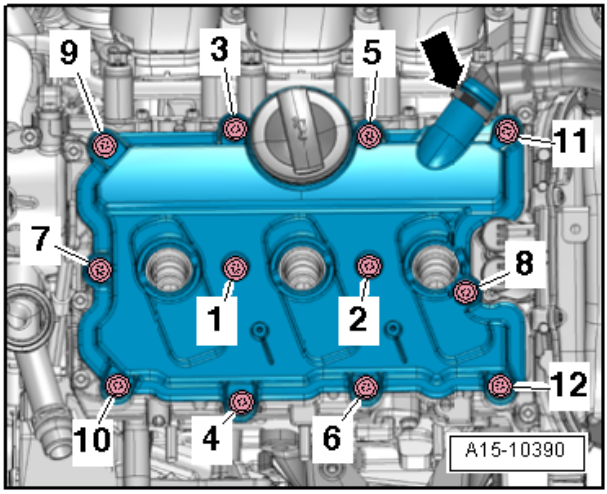


The guide frame for the left cylinder head camshaft is shown in the illustration. The right cylinder head is identical.

Step	Component	Nm
1	Tighten bolts 1 through 21 in sequence [1]	Hand-tighten [2]
2	Tighten bolts 1 through 21 in sequence	8
3	Tighten bolts 1 through 21 in sequence	an additional 90° (¼ turn)

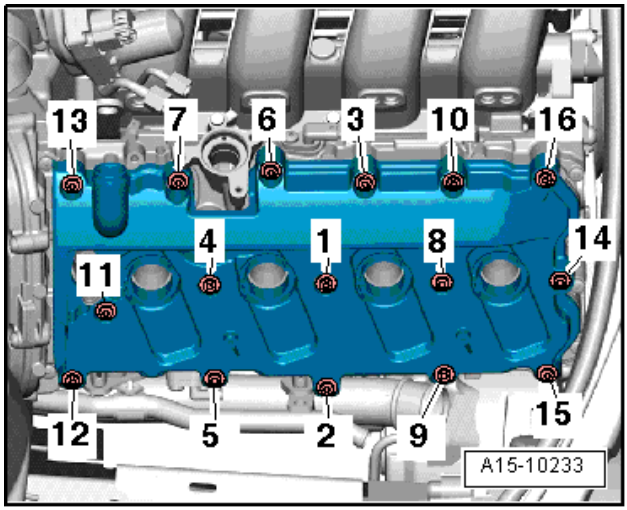
[1] Replace fastener(s).
[2] The guide frame must be in contact with the entire contact surface of the cylinder head.

Left Cylinder Head Cover Tightening Specification



Step	Component	Nm
1	Tighten bolts 1 through 12 in sequence	9

Right Cylinder Head Cover Tightening Specification



Step	Component	Nm
1	Tighten bolts 1 through 12 in sequence	9

Lubrication – 3.0L CGXC, CTUB

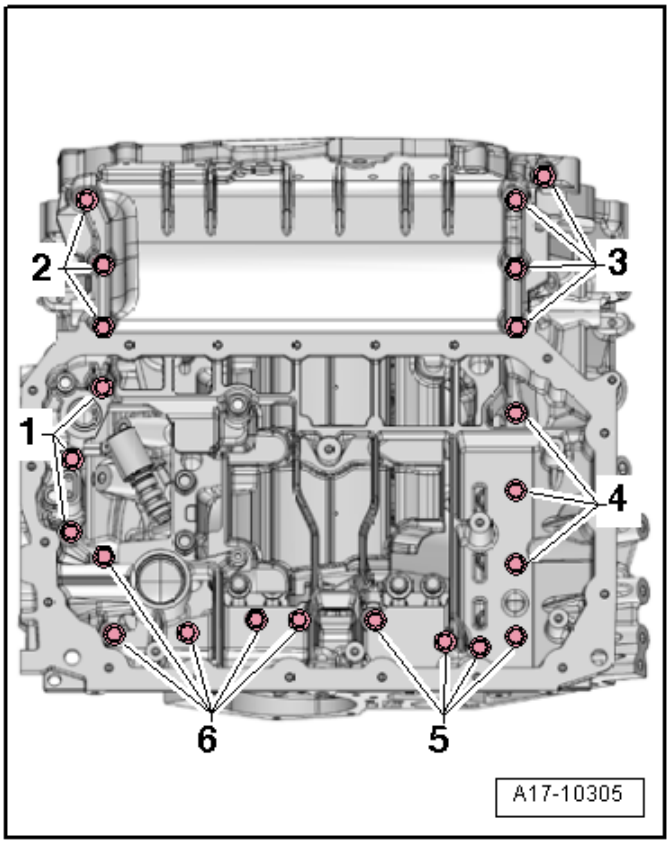
Fastener Tightening Specifications

Component	Nm
Bracket chain sprocket for oil pump to upper oil pan	9
Cap to oil filter housing	25
Cover with oil separator to engine	9
Engine oil cooler to upper oil pan [1) 2)]	3 plus an additional 90° (¼ turn)
	9
Lower oil baffle to upper oil pan [1)]	3 plus an additional 90° (¼ turn)
Oil check valve to engine	9
Oil drain plug to lower oil pan	20
Oil filter housing to engine	30
Oil filter housing union nut to threaded pin	13
Oil level thermal sensor to lower oil pan nut	13
Oil pressure switch to oil filter housing	9
Oil pump to upper oil pan	20
Oil pump to upper oil pan	20
Oil pump chain sprocket to oil pump input shaft	30 plus an additional 90° (¼ turn)
Upper oil baffle to upper oil pan [1)]	3 plus an additional 90° (¼ turn)

1) Replace fastener(s).
2) For bolt tightening clarification, refer to ElsaWeb, *Upper and Lower Oil Pans, Oil Pump and Oil Cooler Overview,* items 15 and 17.

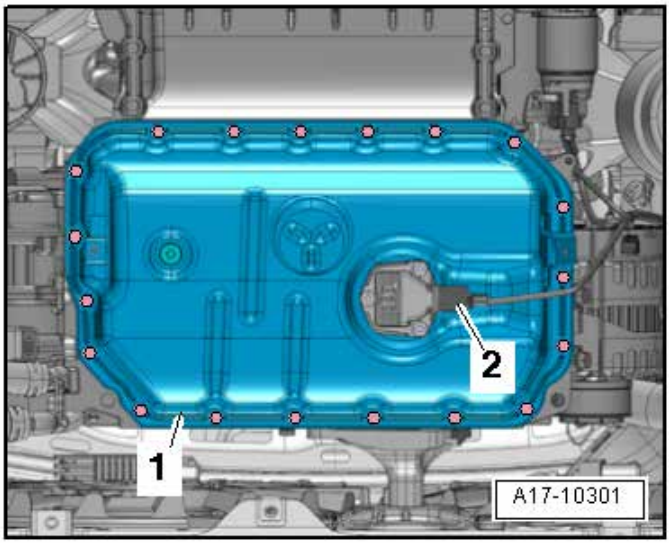
.

Upper Oil Pan Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 6 in a diagonal sequence	8
2	Tighten bolts 1 through 6 in a diagonal sequence	an additional 90° (¼ turn)

Oil Pan Tightening Specifications



Step	Component	Nm
1	Tighten bolts in a diagonal sequence	3
2	Tighten bolts in a diagonal sequence	an additional 90° (¼ turn)

Cooling System – 3.0L CGXC, CTUB

Fastener Tightening Specifications

Component	Nm
Bracket for front left coolant pipes-to-engines	22
Bracket for left cooler for charge air cooling circuit-to-left charge air cooling circuit radiator	9
Charge air cooling pump-to-engine	9
Connection for coolant hose-to-engine	9
Coolant pump-to-engine	9
Coolant thermostat-to-engine	9
Engine temperature control sensor-to-engine	3
Fan shroud-to-radiator	3.5
Fan wheel-to-fan shroud	3.5
Front left coolant pipes-to-engine	9
Front coolant pipe-to-engine	9
Idler roller for the ribbed belt-to-engine	42
Left coolant pipes-to-engine	9
Lower coolant pipe on the compressor-to-engine	9
Lower left coolant pipe-to-transmission	9
Ribbed belt pulley-to-coolant pump	20
Right coolant pipe on the right side of the transmission-to-transmission	9
Rubber buffer-to-radiator	3.5
Upper coolant pipe-to-engine	9
Upper coolant pipe on the compressor-to-engine	9

Fuel Supply – 3.0L CGXC, CTUB

Fastener Tightening Specifications

Component	Nm
Accelerator pedal module to pedal bracket	8
Air filter housing to bracket	4
Bracket for fuel tank pressure sensor	4
Bracket to the fuel tank	23
Carrier plate	23
Evaporative Emission (EVAP) canister	20
Fuel filler neck bolt	23
Fuel filler neck nut	2.5
Fuel pump control module nut	1.6
Fuel tank	23
Fuel tank leak detection control module nut	1.6
Heat shield for fuel tank	23
Locking flange cover to floor	1.5
Locking ring to fuel tank	120
Securing strap	23

Turbocharger, G-Charger – 3.0L CGXC, CTUB

Fastener Tightening Specifications

Component	Nm
Bleeder screw for the left charge air cooler	1.5 to 3.0
Bracket for change-over valves-to-supercharger	9
Charge air cooler-to-supercharger housing [1)]	10
Charge air pressure sensor-to-supercharger [1)]	10
Drive head-to-supercharger housing [1)]	25
Engine lifting eye-to-supercharger	27
Insulation plate-to-supercharger	5
Nut-to-threaded pin	20
Threaded pin-to-engine	17

[1)] Replace fastener(s).

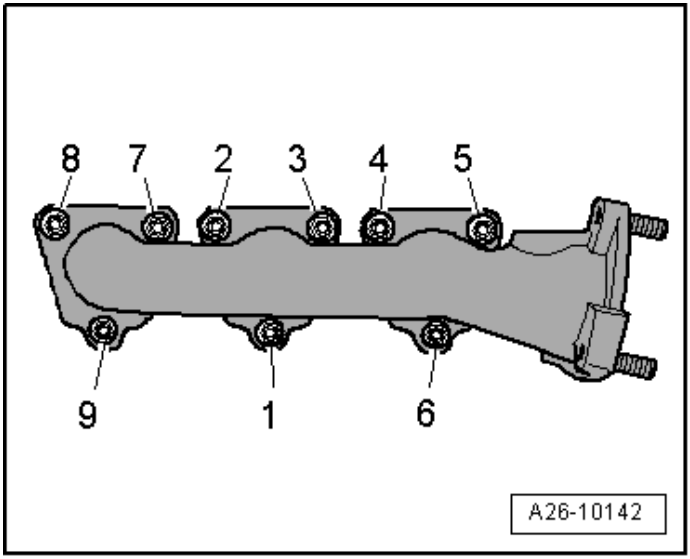
Exhaust System, Emission Controls – 3.0L CGXC, CTUB

Fastener Tightening Specifications

Component	Nm
Bonded rubber bushing bracket for secondary air injection pump motor nut	9
Bracket for secondary air injection pump motor-to-body	9
Catalytic converter-to-manifold nut 1, 2	20
Front clamping sleeve nut	23
Front muffler-to-catalytic converter nut 1, 2	20
Hose from the secondary air injection pump motor-to-right secondary air injection combination valve	9
Right secondary air injection combination valve-to-engine	9
Secondary air combination valve heat shield	9
Suspended mount-to-center muffler	23
Suspended mount-to-front muffle	23
Left secondary air injection combination valve-to-engine	9

1) Replace fastener(s).
2) Coat the thread with hot bolt paste.

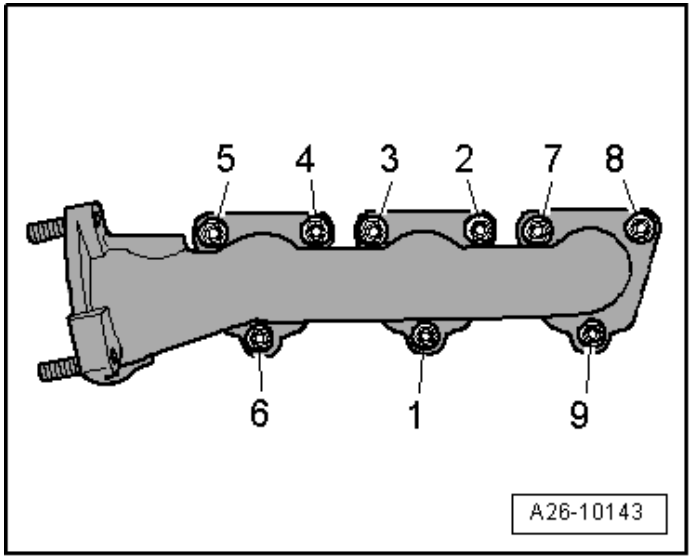
Left Exhaust Manifold Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 9 in sequence [1) 2)]	Hand-tighten
2	Tighten bolts 1 through 9 in sequence	15
3	Tighten bolts 1 through 9 in sequence	25

1) Replace fastener(s).
2) Coat the thread on the nut with hot bolt paste. For the correct hot bolt paste, refer to the Electronic Parts Catalog (ETKA).

Right Exhaust Manifold Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 9 in sequence [1) 2)]	Hand-tighten
2	Tighten bolts 1 through 9 in sequence	15
3	Tighten bolts 1 through 9 in sequence	25

1) Replace fastener(s).
2) Coat the thread on the nut with hot bolt paste. For the correct hot bolt paste, refer to the Electronic Parts Catalog (ETKA).

Multiport Fuel Injection – 3.0L CGXC, CTUB

Technical Data

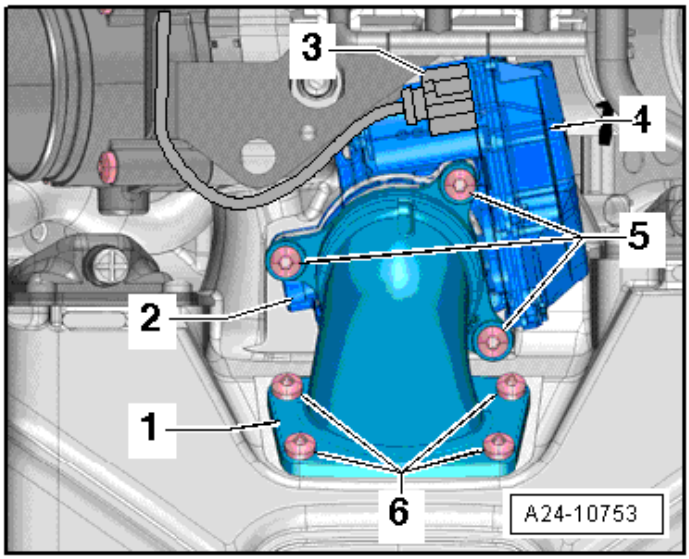
Engine data	4.2L/4V/273 kW-Motor
Idle speed	Cannot be adjusted, it is regulated by idle stabilization
Fuel pressure before high pressure pump	3 to 6 bar pressure
Fuel pressure after high pressure pump	30 to 125 bar pressure

Fastener Tightening Specifications

Component	Nm
Adapter-to-air filter housing upper section	1.5
Air guide-to-air filter housing	1.5
Air filter housing upper section-to-lower section	2.5
Bracket for high pressure line-to-cylinder head	9
Camshaft position sensor-to-housing	9
Fuel line union nut	25
Fuel pressure sensor	22
High pressure line threaded connection-to-fuel rail	40
High pressure line-to-bracket	9
High pressure line-to-high pressure pump	25
Housing-to-protective plate	
- Threaded pin	9
- Nut	9
Intake manifold lower section [1)]	9
Intake manifold runner position sensor 2-to-vacuum actuator	2.5
Low fuel pressure sensor-to-high pressure pump	15
Oxygen sensor	55
Throttle valve control module [1)]	10

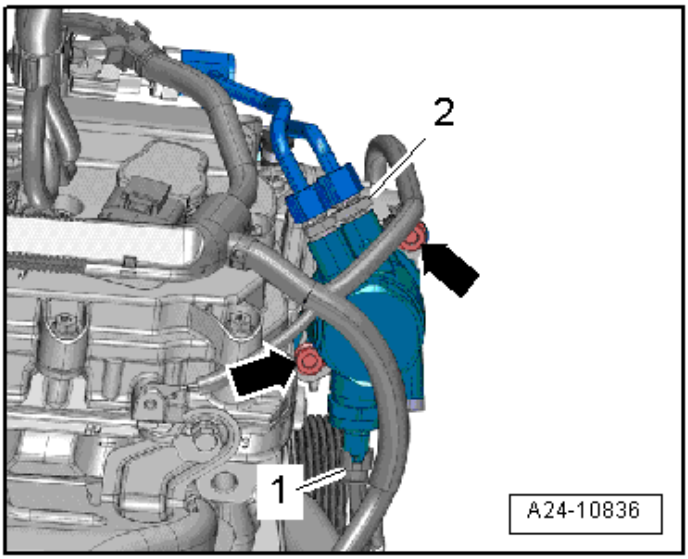
[1)] Tighten bolts in a diagonal sequence.

Control Valve Control Module
Tightening Specification



Step	Component	Nm
1	Tighten bolts 5 and 6	Hand-tighten
2	Tighten bolt 6	10
3	Tighten bolt 5	10

High Pressure Pump Tightening Specifications



Step	Component	Nm
1	Tighten bolts (➡)	Hand-tighten
2	Tighten bolts (➡)	11

Ignition System – 3.0L CGXC, CTUB

Ignition Tightening Specifications

Component	Nm
Camshaft Position (CMP) sensor	9
Knock Sensors (KS)	25
Wiring for ignition coils at cylinder head cover	5

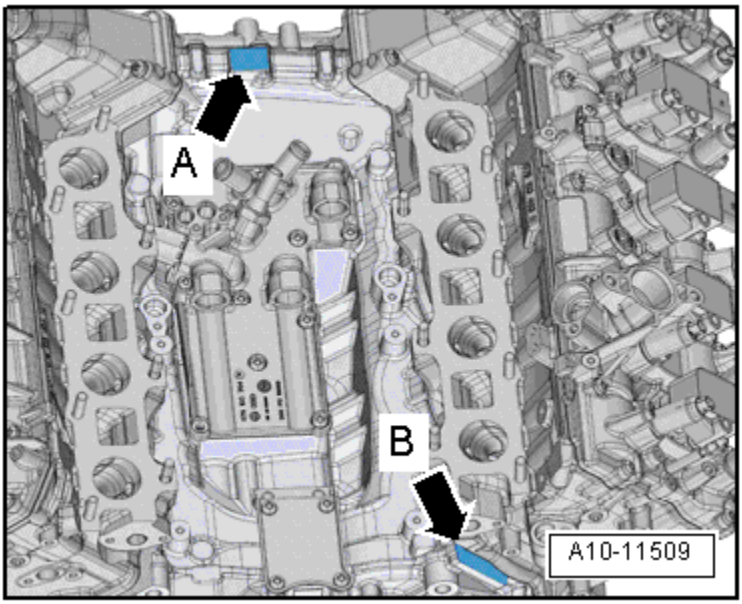
Technical Data

Test data		3.0L TFSI Engine
Engine idle speed		Cannot be adjusted, it is regulated by idle stabilization
Ignition timing		Not adjustable; regulated by the Engine Control Module (ECM).
Ignition/glow plug system		Single coil ignition system with 8 ignition coils (output stages integrated) that are connected directly to the spark plugs via the ignition cables.
Spark plugs	Names	Refer to Electronic Parts Catalog (ETKA).
	Removing and installing	Maintenance Procedures Rep. Gr.03
Ignition sequence		1-4-3-6-2-5

ENGINE MECHANICAL – 4.0L CEUA, CGTA

General, Technical Data

Engine Number Location



The engine number -arrow B- is visible, if the housing for the charge air cooler is removed. The first 3 digits of the engine code -arrow A- are visible, when the engine cover is removed. The 4-digit engine code is on the type plate, vehicle data label and ECM.

Engine Data

Code letters		CEUA	CGTA
Displacement	liter	3.999	3.999
Output	kW at RPM	309 @ 6000	381 @ 6000
Torque	Nm at RPM	600 @ 1500 to 4500	650 @ 1500 to 4500
Bore	diameter mm	84.5	84.5
Stroke	mm	89.0	89.0
Compression ratio		10.1	10.1
RON	at least	98 [1)]	98 [1)]
Fuel injection and ignition system		Bosch Motronic	Bosch Motronic
Ignition sequence		1-5-4-8-6-3-7-2	1-5-4-8-6-3-7-2
Turbocharger		No	No
Oxygen Sensor (O2S) regulation			4 Heated Oxygen Sensors (HO2S)
Variable valve timing			Yes
Variable intake manifold			Yes
Secondary Air Injection (AIR) system			Yes
Valve per cylinder			4

1) Unleaded RON 95 is also permitted but performance is reduced.

Engine Assembly – 4.0L CEUA, CGTA

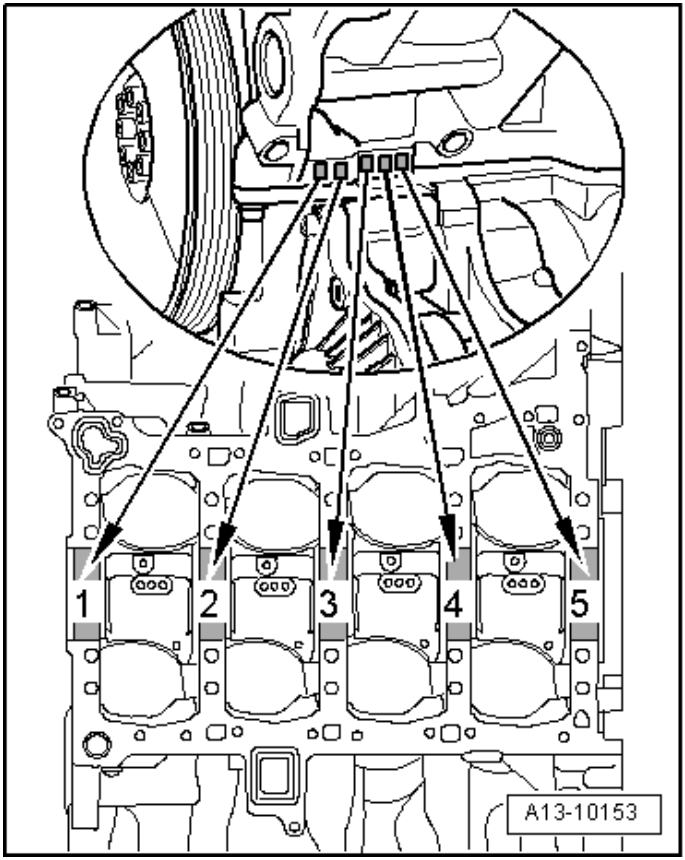
Fastener Tightening Specifications

Component	Fastener size	Nm
Bolts and nuts	M6	9
	M7	15
	M8	20
	M10	40
	M12	65
Engine bracket	-	20
Engine mount-to-engine support [1)]	-	90 plus an additional 90° (¼ turn)
Engine support	-	40
Heat shield	-	10
Subframe	-	55
Wheel housing bracket bolt		9

1) Replace fastener(s).

Crankshaft, Cylinder Block – 4.0L CEUA, CGTA

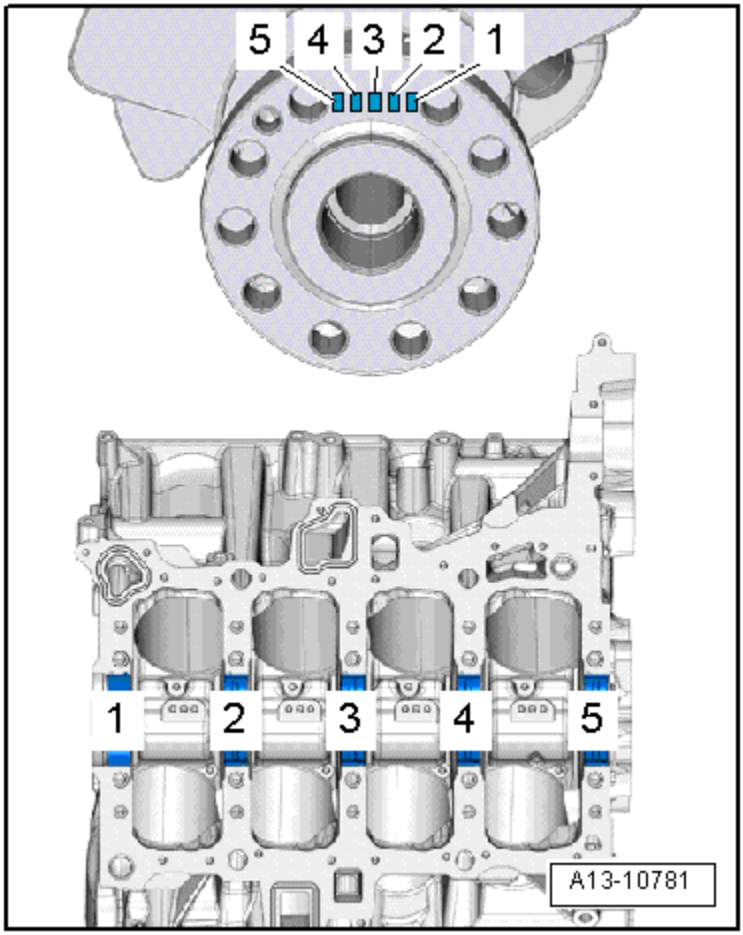
Allocation of Crankshaft Bearing Shells for Cylinder Block – New Crankshaft



Bearing shells with the correct thickness are allocated to the cylinder block in the factory. Colored dots on the sides of the bearing shells identify the bearing shell thickness. The allocation of the bearing shells to the cylinder block is marked by one letter each at the front left on cylinder block as shown in the illustration.

Letter on cylinder block	Color of bearing
R	Red
S	Black
G	Yellow
U	Green
B	Blue

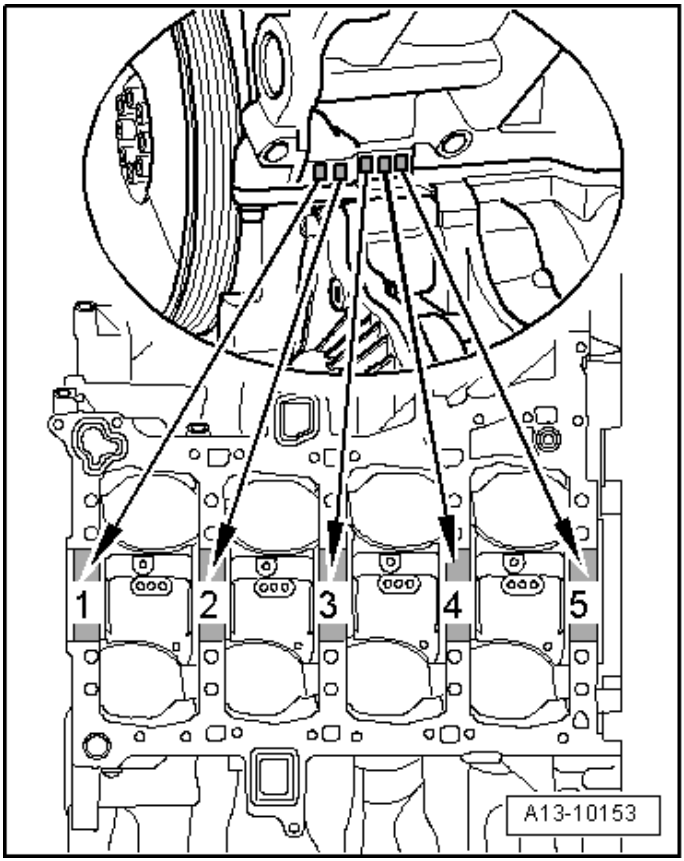
Allocation of Crankshaft Bearing Shells for Guide Frame



Bearing shells with the correct thickness are allocated to the guide frame in the factory. Colored dots on the sides of the bearing shells identify the bearing shell thickness. The allocation of bearing shells to the guide frame is identified by a letter on the front crankshaft flange as shown in the illustration.

Letter on cylinder block	Color of bearing
R	Red
S	Black
G	Yellow
U	Green
B	Blue

Allocation of Crankshaft Bearing Shells for Guide Frame – Used and Reworked Crankshafts



Bearing shells are allocated to cylinder block corresponding to the color markings stamped into the cylinder block. With used and reworked crankshafts, measure the crankshaft pivot pins to allocate the appropriate bearing shells. Thicker oversized bearing shells are available for a reworked crankshaft. These have the same color markings as the original size bearing shells.

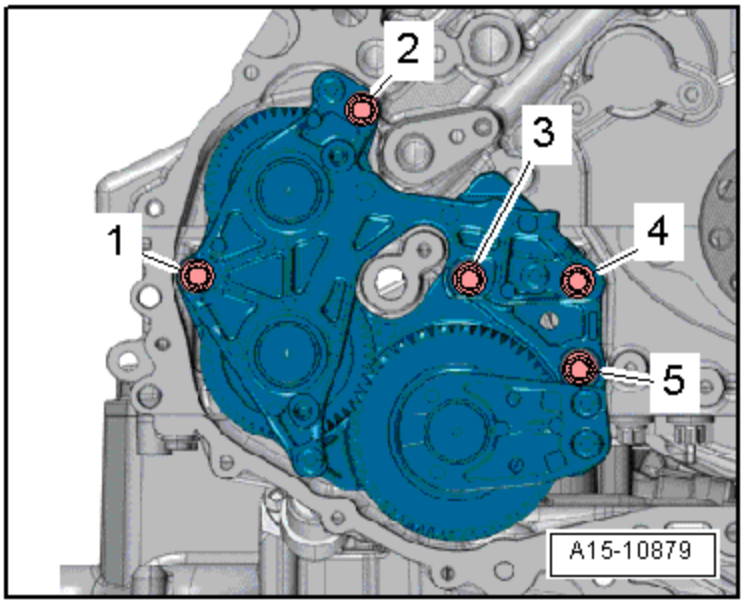
Letter on cylinder block	Color of bearing
R	Red
S	Black
G	Yellow
U	Green
B	Blue

Fastener Tightening Specifications

Component	Nm
Drive plate-to-crankshaft [1]	60 plus an additional 90° (¼ turn)
Connecting rod bearing cap-to-connecting rod [1]	50 plus an additional 90° (¼ turn)
Idler roller for the ribbed belt	22
Oil spray jet for piston cooling [3]	9
Ribbed belt tensioning element [2]	22
	55

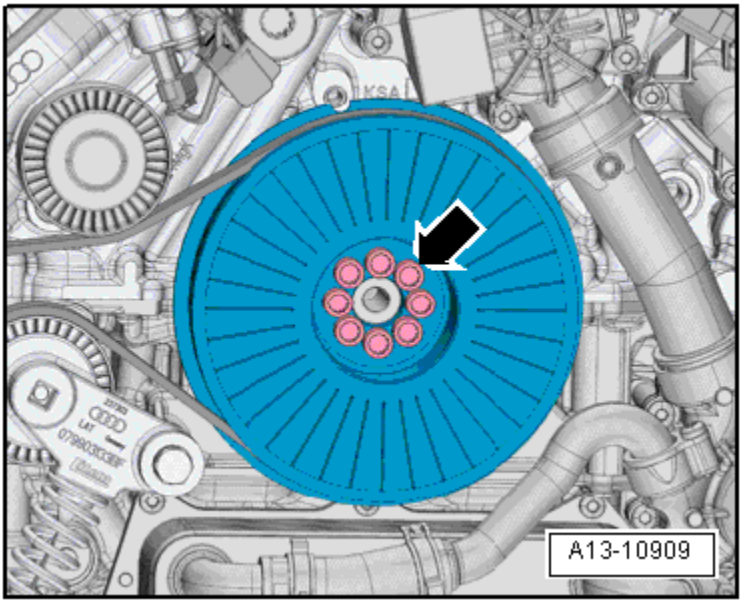
[1] Replace fastener(s).
[2] For bolt tightening clarification, refer to ElsaWeb, *Ribbed Belt Drive Overview*, items 1 and 2.
[3] Insert bolts with locking compound

Spur Gear Unit Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 to 5 in a diagonal sequence	22

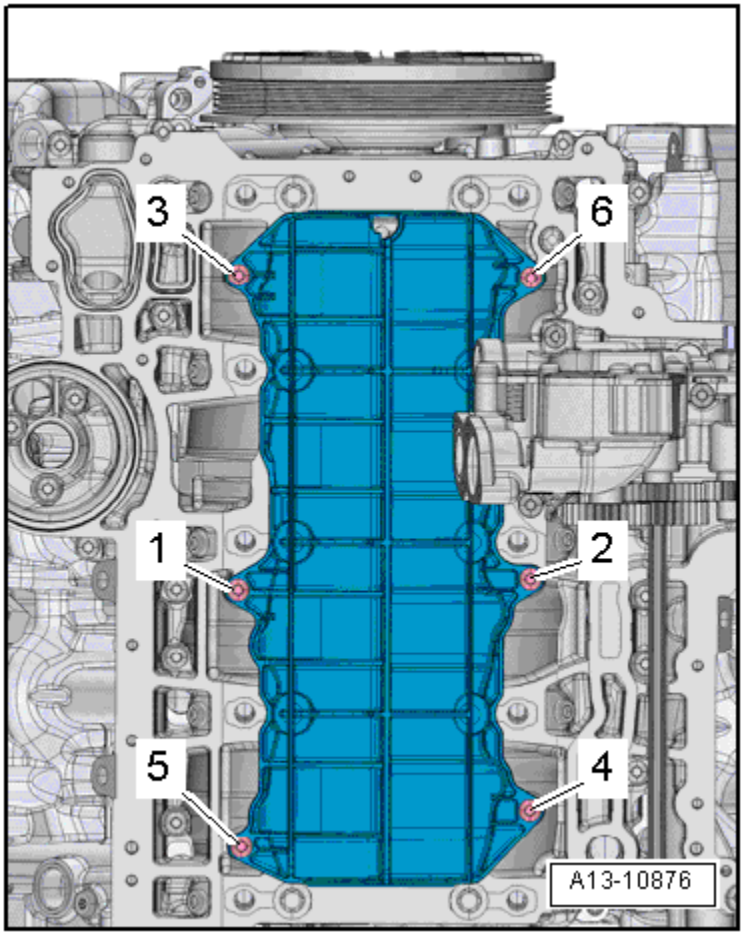
Vibration Damper Tightening Specifications



Step	Component	Nm
1	Tighten bolts (➡) in a diagonal sequence [1) 2)]	15
2	Tighten bolts (➡) in a diagonal sequence	22
3	Tighten bolts (➡) in a diagonal sequence	an additional 90° (¼ turn)

1) Replace fastener(s).
2) Install the bolts with a locking compound. Refer to the Electronic Parts Catalog (ETKA).

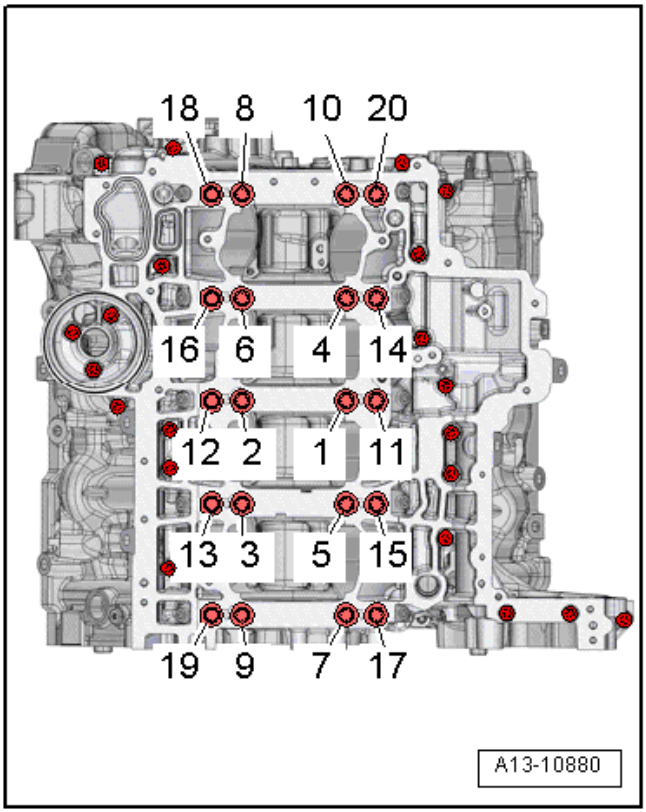
Baffle Plate Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 6 in sequence [1)]	5
2	Tighten bolts 1 through 6 in sequence	an additional 90° (¼ turn)

[1)] Replace fastener(s).

Guide Frame Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 10 in sequence [1)]	30
2	Tighten bolts 11 through 20 in sequence [1)]	30
3	Tighten bolts 1 through 10 in sequence	50
4	Tighten bolts 1 through 10 in sequence	an additional 90° (¼ turn)
4	Tighten bolts 11 through 20 in sequence	50
5	Tighten bolts 1 through 20 in sequence	an additional 90° (¼ turn)
6	Tighten guide frame to cylinder block sealing surface bolts (not numbered) in a diagonal sequence	9

[1)] Replace fastener(s).

Crankshaft Dimensions (Engine Code CEUA)

Honing dimension in mm	Crankshaft bearing journal diameter		Connecting rod journal diameter	
Basic dimension	65.000	– 0.022	54.000	– 0.022
		– 0.042		– 0.042
Repair stage	64.750	– 0.022	53.750	– 0.022
		– 0.042		– 0.042

Crankshaft Dimensions (Engine Code CGTA)

Honing dimension in mm	Crankshaft bearing journal diameter		Connecting rod journal diameter	
Basic dimension	67.000	– 0.010	54.000	– 0.022
		– 0.029		– 0.042
Repair stage	66.750	– 0.010	53.750	– 0.022
		– 0.029		– 0.042

Piston Ring End Gaps

Piston ring end gaps dimensions in mm	New	Wear limit
1st compression ring	0.20 to 0.35	0.80
2nd compression ring	0.20 to 0.40	0.80
Oil scraping ring	0.20 to 0.40	0.80

Piston Ring Clearance (Engine Code CEUA)

Piston ring dimensions in mm	New	Wear limit
1st compression ring	0.020 to 0.070	0.200
2nd compression ring	0.005 to 0.045	0.150
Oil scraping ring	0.020 to 0.055	0.200

Piston Ring Clearance (Engine Code CGTA)

Piston ring dimensions in mm	New	Wear limit
1st compression ring	0.026 to 0.058	not fixed
2nd compression ring	0.020 to 0.045	not fixed
Oil scraping ring	0.011 to 0.028	not fixed

Piston and Cylinder Dimensions

Cylinder bore diameter in mm	Piston diameter in mm
84.510 ± 0.005	84.490 [1)]
84.610 ± 0.005	84.590 [1)]

[1)] Measurement with graphite coating (thickness 0.01 mm). The graphite coating wears away.

Cylinder Head, Valvetrain – 4.0L CEUA, CGTA

Fastener Tightening Specifications

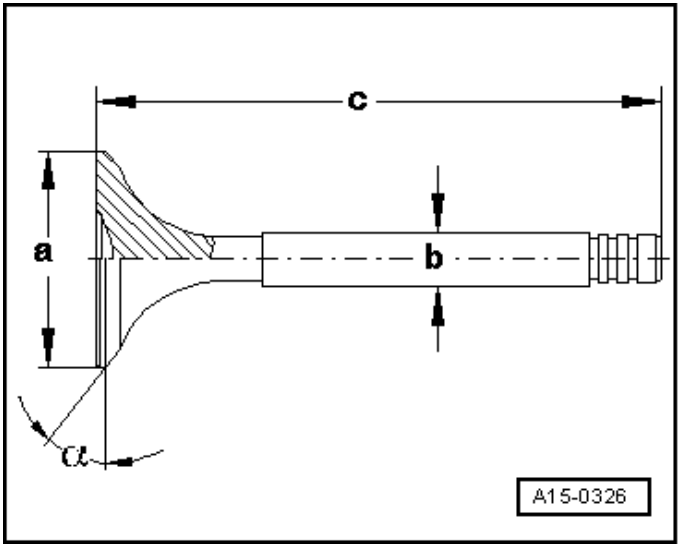
Component	Nm
Bearing plate for drive sprocket	9
Bracket for idler sprocket [1]	5 plus an additional 90° (¼ turn)
Camshaft adjustment valve 2 to camshaft housing	5
Camshaft adjuster for the exhaust camshaft [1]	80 plus an additional 90° (¼ turn)
Camshaft adjuster for the intake camshaft [1]	80 plus an additional 90° (¼ turn)
Chain tensioner for the left camshaft control chain [1]	5 plus an additional 90° (¼ turn)
Chain Tensioner for the right camshaft timing chain [1]	5 plus an additional 90° (¼ turn)
Chain tensioner to engine [1]	5 plus an additional 90° (¼ turn)
Chain tensioner with glide track to engine [1]	5 plus an additional 90° (¼ turn)
Drive sprocket for the right camshaft timing chain [1]	20 plus an additional 45° (⅛ turn)
Glide Track [1]	17 plus an additional 90° (¼ turn)
Gliding piece to engine [1]	5 plus an additional 90° (¼ turn)
Engine lifting eye to cylinder head	22
Exhaust camshaft adjustment valve 2 to camshaft housing	5
Idler sprocket for the power take-off drive chain to engine	42
Intake/exhaust camshaft to cylinder head	5
Mounting pin to bearing plate [1]	5 plus an additional 90° (¼ turn)

[1] Replace fastener(s).

Compression Checking Specifications

Compression pressure	Bar pressure Engine Code CEUA	Bar pressure Engine Code CGTA
New	10.0 to 15.0	10.0 to 14.0
Wear limit	9.0	8.0
Maximum difference between cylinders	3.0	3.0

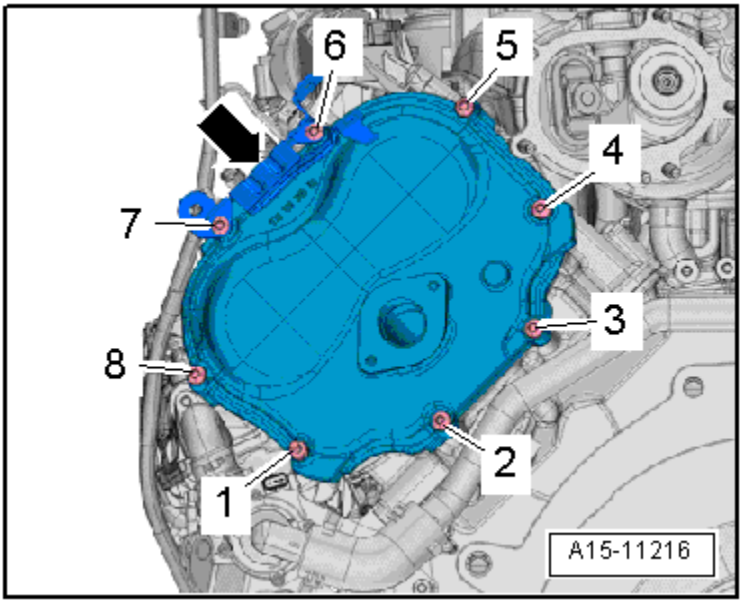
Valve Dimensions



Dimension		Intake valve	Exhaust valve
Diameter a	mm	33.85 ± 0.10	28.0 ± 0.1
Diameter b	mm	5.98 ± 0.01	5.96 ± 0.01
c	mm	103.97 ± 0.20	101.9 ± 0.2
α	∠°	45	45

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

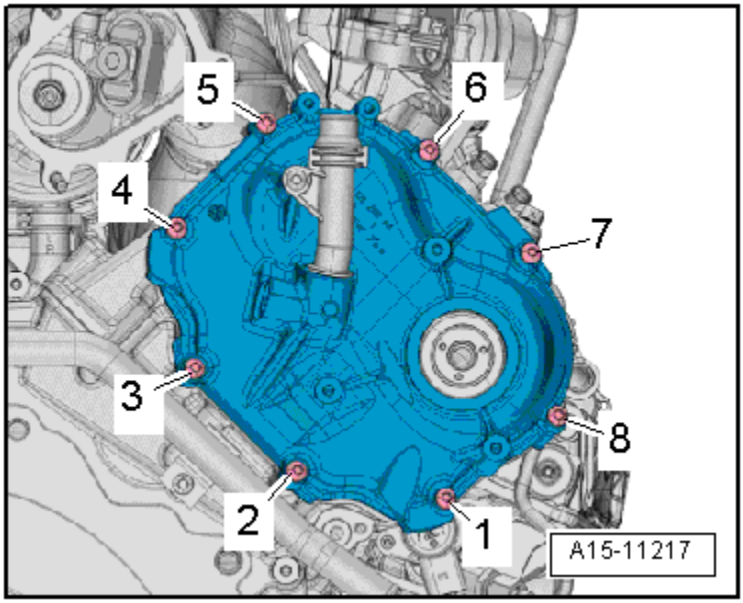
Left Timing Chain Cover Tightening Specification



Replace any bolts that were tightened with an additional turn.

Step	Component	Nm
1	Tighten bolts 1 through 8 in sequence	9
2	Tighten bolts 1 through 8 in sequence	an additional 90° (¼ turn)

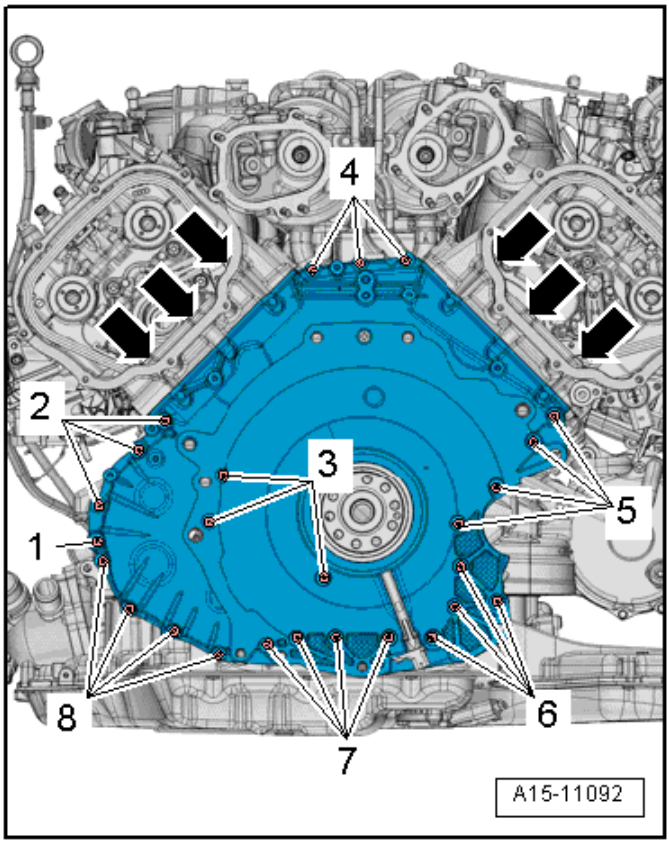
Right Timing Chain Cover Tightening Specification



Replace any bolts that were tightened with an additional turn.

Step	Component	Nm
1	Tighten bolts 1 through 8 in sequence	9
2	Tighten bolts 1 through 8 in sequence	an additional 90° (¼ turn)

Lower Timing Chain Cover Tightening Specifications

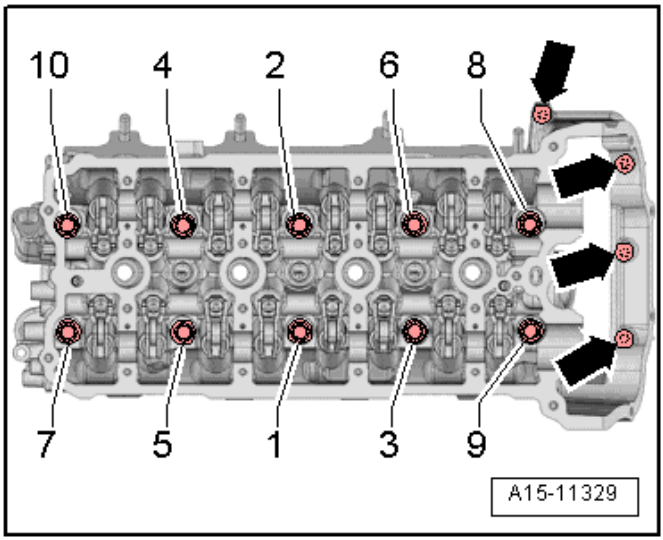


Replace any bolts that were tightened with an additional turn.

Step	Component	Nm
1	Tighten bolts (➡)	5
2	Tighten bolts 2 through 8 in a diagonal sequence[1)]	8
3	Tighten bolts (➡)	8
4	Tighten bolts 2 through 8 in a diagonal sequence	an additional 90° (¼ turn)
5	Tighten bolts (➡)	an additional 90° (¼ turn)
6	Tighten bolt [1)]	Tighten for power steering pump

1) For bolt tightening clarification, refer to ElsaWeb, *Suspension, Wheels, Steering; Rep. Gr.48; Specifications*

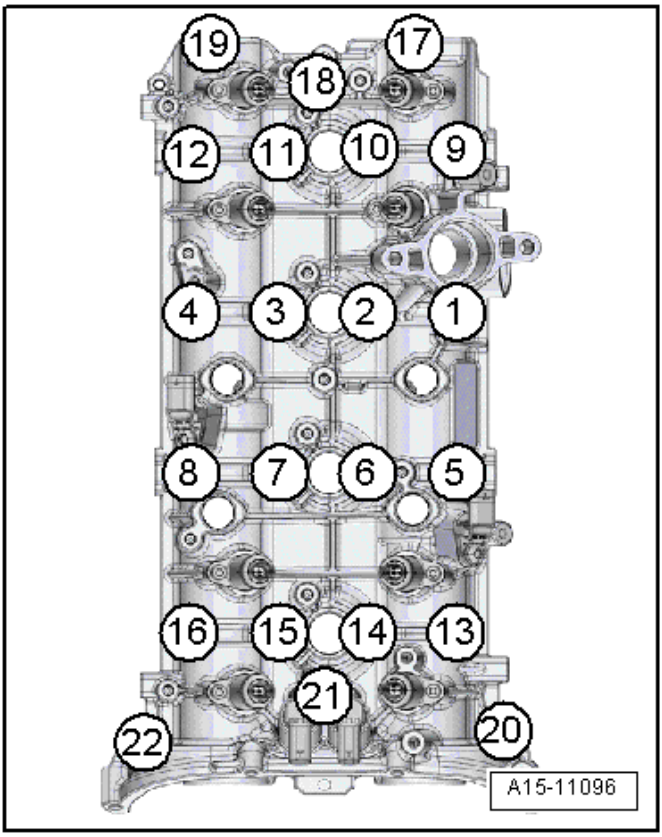
Cylinder Head Tightening Specifications



Replace any bolts that were tightened with an additional turn.

Step	Component	Nm
1	Tighten bolts 1 through 10 in sequence [1)]	Hand-tighten
2	Tighten bolts 1 through 10 in sequence	30
3	Tighten bolts 1 through 10 in sequence	60
4	Tighten bolts 1 through 10 in sequence	an additional 90° (¼ turn)
5	Tighten bolts 1 through 10 in sequence	an additional 90° (¼ turn)
6	Tighten bolts (➡)	10
7	Tighten bolts (➡)	an additional 90° (¼ turn)

Camshaft Housing Tightening Specifications



Replace any bolts that were tightened with an additional turn.

Step	Component	Nm
1	Tighten bolts 1 through 22 in sequence [1)]	Hand-tighten [2)]
2	Tighten bolts 1 through 22 in sequence	8
3	Tighten bolts 1 through 22 in sequence	an additional 90° (¼ turn)

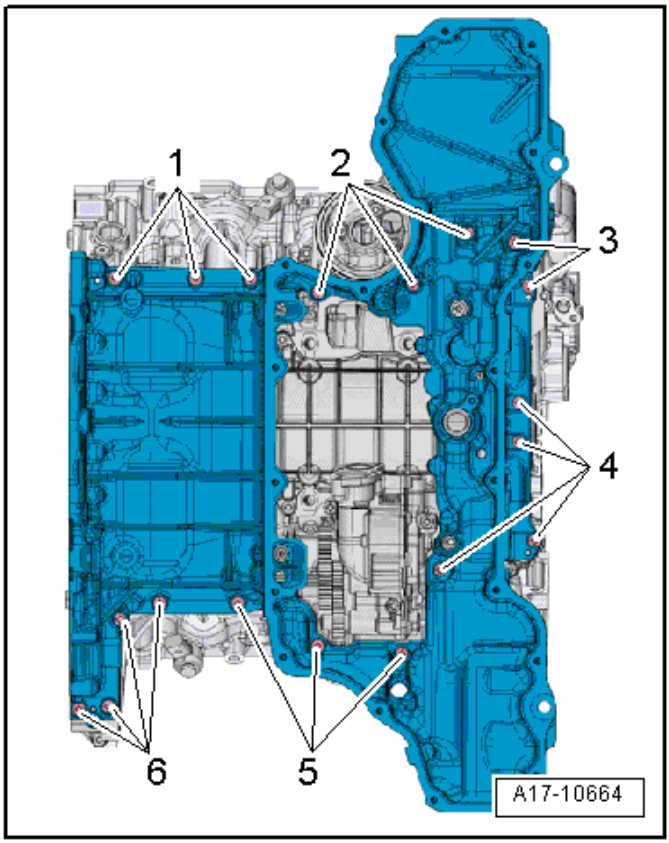
Lubrication – 4.0L CEUA, CGTA

Fastener Tightening Specifications

Component	Nm
Cover in the inner V-to-engine [1]	5 plus an additional 90° (¼ turn)
Cover-to-upper oil pan	8
Drain plug-to-engine	30
Guide tube-to-upper oil pan	9
Intake tube for oil pump	9
Oil drain plug-to-lower oil pan	20
Oil drain plug-to-oil filter cap	4
Oil filter cap	25
Oil level thermal sensor-to-lower oil pan	9
Oil pipe to oil pump [1]	8 plus an additional 90° (¼ turn)
Oil pipes-to-upper oil pan (for vehicles with engine code CGTA)	9
Oil pressure regulation valve-to-engine	9
Oil pressure switch	20
Oil pressure switch, level 3	20
Oil return line-to-right engine oil cooler	9
Oil separator	3.2
Oil supply line-to-right engine oil cooler	9
Oil temperature sensor-to-engine 2 double bolt	9
Pipe for the crankcase ventilation	3.2
Rear air guide-to-right engine oil cooler	9
Reduced oil pressure switch	20
Right engine oil cooler (Engine Code CGTA)	9

[1] Replace fastener(s).

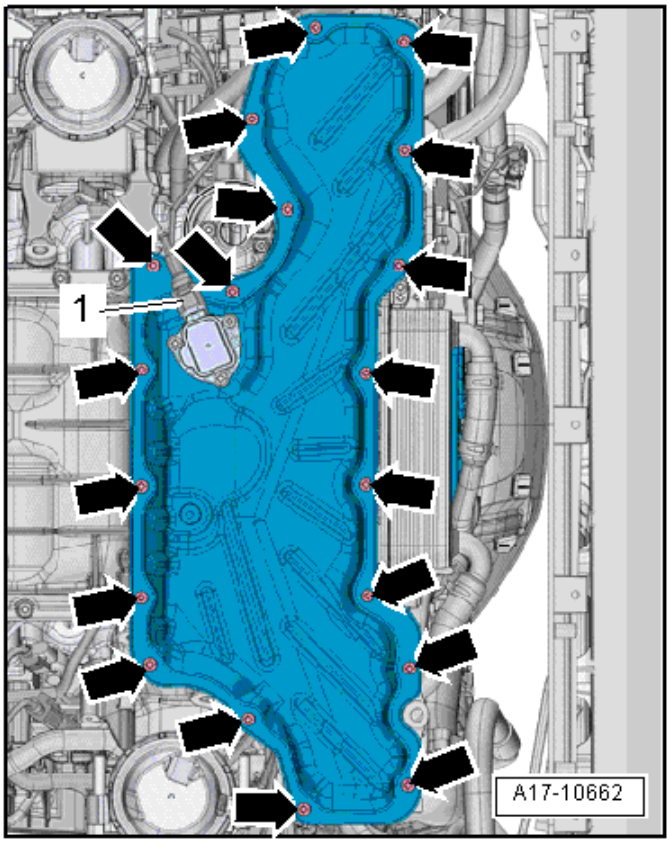
Upper Oil Pan Tightening Specifications



Replace any bolts that were tightened with an additional turn.

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

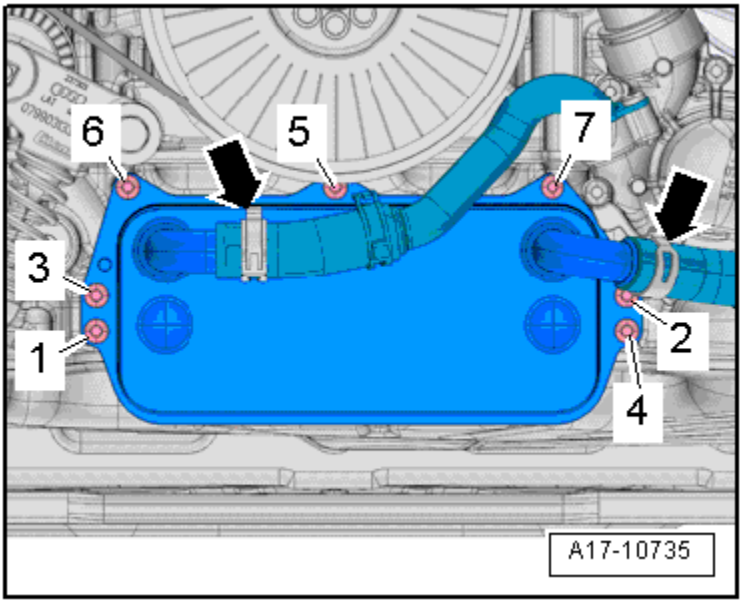
Oil Pan Tightening Specifications



Replace any bolts that were tightened with an additional turn.

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

Front Engine Oil Cooler Tightening Specification



Step	Component	Nm
1	Tighten bolts 1 through 7 in sequence	3
2	Tighten bolts 1 through 7 in sequence	9

Cooling System – 4.0L CEUA, CGTA

Fastener Tightening Specifications

Component	Nm
Bracket for after-run coolant pump [2]	
- Bolt	1.5
- Bolt	9
- Nut	9
Bracket for charge air cooling pump-to-bracket for after-run coolant pump	9
Bracket for engine coolant circulation pump 2-to-engine coolant circulation pump 2	1.5
Bracket for engine coolant circulation pump 2-to-engine	9
Bracket for left cooler for charge air cooling circuit	9
Coolant connection-to-housing for the coolant pump	9
Coolant switch-off valve [1]	5 plus an additional 90° (¼ turn)
Engine coolant temperature sensor-to-engine	9
Engine temperature control sensor-to-engine	9
Fan shroud-to-fan	3.5
Fan wheel-to-fan shroud	5
Front charge air cooling circuit radiator-to-radiator	5
Housing for the coolant pump-to-coolant pump [1]	8 plus an additional 90° (¼ turn)
Hydraulic oil cooler-to-condenser	5
Lower left coolant pipe	9
Map controlled engine cooling thermostat-to-housing for the coolant pump	9
Right coolant pipe on the right side of the transmission-to-engine	9
Transmission coolant valve bracket for engine coolant circulation pump 2 to engine (vehicles with engine codes CEUA)	9
Transmission fluid cooling valve-to-abracket for after-run coolant pump	9
Upper left coolant pipe-to-aengine nut	9
Upper rear coolant pipe-to-aengine	9

[1] Replace fastener(s).

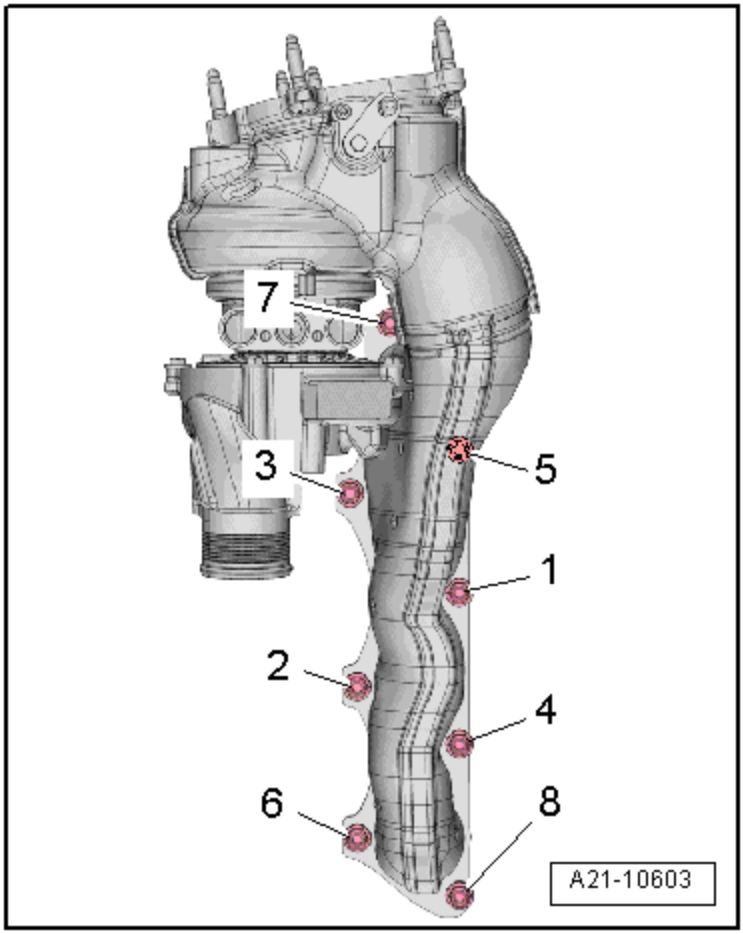
[2] For bolt tightening clarification, refer to ElsaWeb, *After-Run Coolant Pump -V51-, Charge Air Cooling Pump -V188-, Transmission Coolant Valve -N488- Overview"* items 2, 5, 6 and 9

Turbocharger, G-Charger– 4.0L CEUA, CGTA

Fastener Tightening Specifications

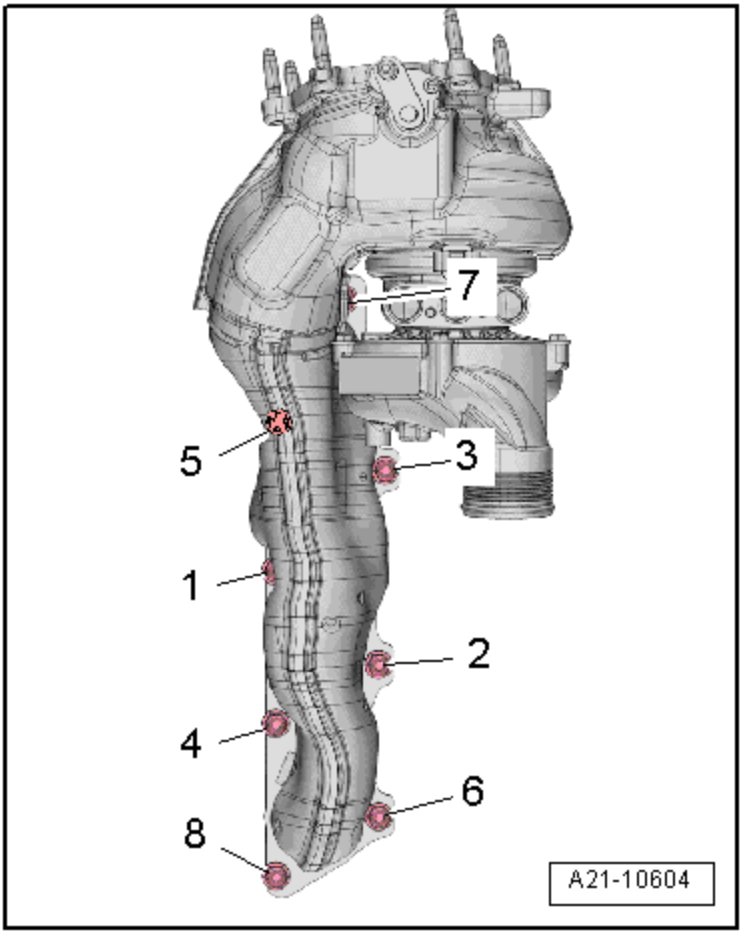
Component	Nm
Air guide-to-throttle valve control module	9
Air guide pipe-to-turbocharger	9
Charge air cooler-to-charge air cooler housing	3.2
Charge air cooler housing-to-body	9
Charge air pressure sensor-to-air guide	9
Connection for oil return hose-to-turbocharger	9
Coolant supply pipe-to-turbocharger	9
Engine cover temperature sensor	9
Oil supply line-to-turbocharger	9
Retaining plate for coolant and oil lines-to-turbocharger	9
Turbocharger recirculation valve-to-air guide	9
Vacuum actuator for the turbocharger	
- Ball pin	2.5
- Bolt	9

Left Turbocharger Tightening Specification



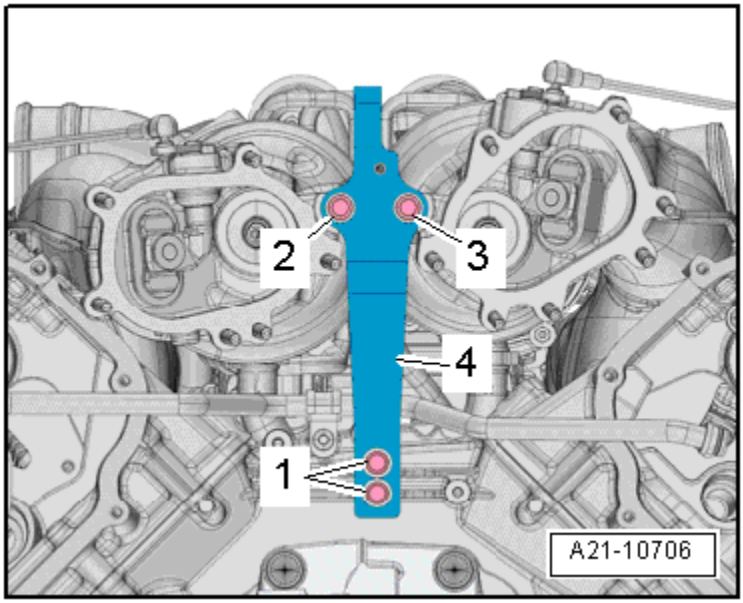
Step	Component	Nm
1	Tighten bolts 1 through 8 in sequence	16
2	Tighten bolts 1 through 8 in sequence	25

Right Turbocharger Tightening Specification



Step	Component	Nm
1	Tighten bolts 1 through 8 in sequence	16
2	Tighten bolts 1 through 8 in sequence	25

Turbocharger Support Tightening Specification



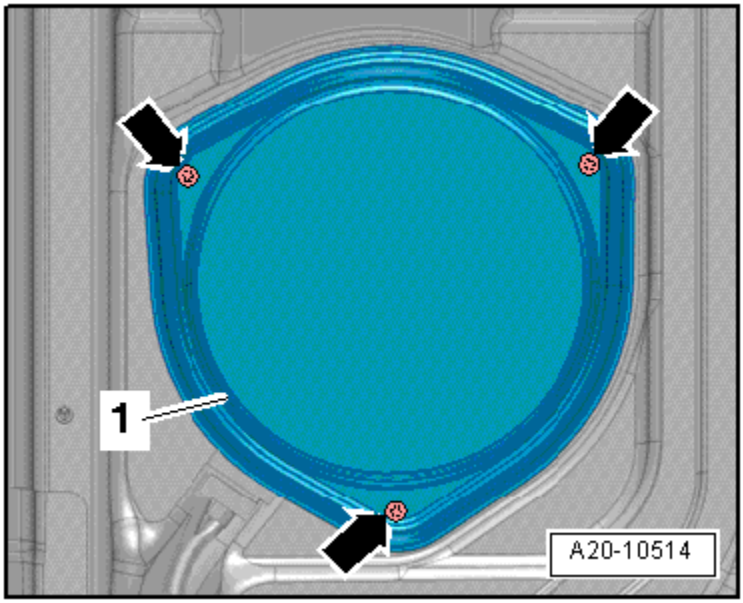
Step	Component	Nm
1	Tighten bolts 1 to 3 in sequence	5
2	Tighten bolts 1 to 3 in sequence	25

Fuel Supply – 4.0L CEUA, CGTA

Fastener Tightening Specifications

Component	Nm
Accelerator pedal module to pedal bracket	8
Air filter housing to bracket	4
Bracket for fuel tank pressure sensor	4
Bracket to the fuel tank	23
Carrier plate	23
EVAP canister	20
Fuel filler neck nut	2.5
Fuel filler neck bolt	23
Fuel tank	23
Fuel tank leak detection control module, nut	1.6
Fuel pump control module to bracket nut	1.6
Heat shield for fuel tank	23
Locking flange cover to floor	1.5
Locking ring to fuel tank	120
Securing strap	23

Locking Flange Cover Tightening Specification



Step	Component	Nm
1	Tighten bolts (➡) in a diagonal sequence	1.5

Exhaust System, Emission Controls – 4.0L CEUA, CGTA

Fastener Tightening Specifications

Component	Nm
Catalytic converter-to-manifold nut [1) 2)]	23
Clamping sleeve	23
Front muffler-to-catalytic converter nut [1) 2)]	23
Secondary Air Injection (AIR) pump motor bracket-to-air pump motor [3)]	
- Bolt	5
- Bolt	8
- Nut	9
Suspended mount-to-body	23

1) Replace fastener(s).
2) Coat the threads with hot bolt paste.
3) For bolt tightening clarification, refer to ElsaWeb,*Secondary Air Injection System Overview* items 1, 3 and 31.

Multiport Fuel Injection – 4.0L CEUA, CGTA

Technical Data

Engine data	4.0L TFSI Engine
Idle speed	Cannot be adjusted, it is regulated by idle stabilization
Fuel pressure after high pressure pump	25 to 140 bar pressure
Fuel pressure before high pressure pump	4.0 to 7.0 bar pressure

1) Depending on Engine Control Module (ECM) requirements.

Fastener Tightening Specifications

Component	Nm
Air guide 1)	2.5
Air guide 2)	3.5
Air guide with turbocharger recirculation valve -N249- to throttle valve control module	9
Bracket for the fuel rail	3
Charge air cooler temperature sensor to throttle valve control module	9
High pressure line	
- Union nuts	25
- Connections	40
Fuel pressure sensor 2 to fuel rail 3)	25
High pressure pump to camshaft housing 5)	22
Intake manifold runner position sensor 2	2.5
Intake manifold to Bracket for the fuel rail 4)	9
Intake air temperature sensor to Intake manifold	2.5
Low fuel pressure sensor to high pressure pump	15
Manifold absolute pressure sensor to charge air cooler housing	3
Threaded connection between high pressure line and fuel rail	40
Throttle valve control module to charge air cooler housing	5
Upper air filter housing to lower air filter housing	2.5

1) For bolt tightening clarification, refer to ElsaWeb, *Air Filter Overview*, items 1,2, 4 and 5.
2) For bolt tightening clarification, refer to ElsaWeb, *Air Filter Overview*, items 9 and 11.
3) Coat the threads with clean engine oil.
4) Fasten in diagonal sequence in steps
5 Replace

Ignition System – 4.0L CEUA, CGTA

Ignition Tightening Specifications

Component	Nm
Camshaft Position (CMP) sensor-to-engine	9
Engine Speed (RPM) sensor-to-engine	9
Knock Sensors (KS)-to-engine	9
Spark plug-to-engine	25
Wiring router-to-engine	5

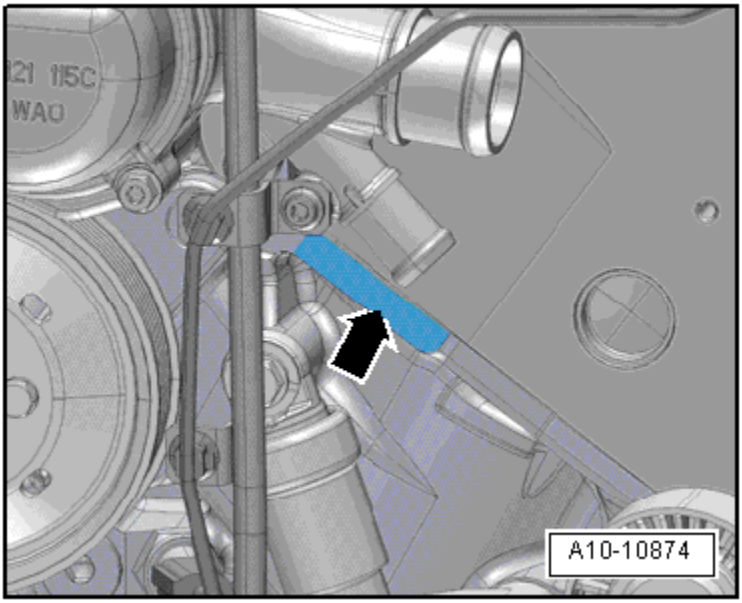
Technical Data

Test data		4.0L TFSI Engine
Idle speed		Cannot be adjusted, it is regulated by idle stabilization
Ignition timing		Not adjustable; regulated by the Engine Control Module (ECM).
Ignition System		Single coil ignition system with 8 ignition coils (output stages integrated) that are connected directly to spark plugs via the ignition cables.
Spark plugs	Names	Refer to the Parts Catalog
	Removing and installing	Refer to the Maintenance Procedures Rep. Gr. 03
Ignition sequence		1-5-4-8-6-3-7-2

ENGINE MECHANICAL – 6.3L CEJA

General, Technical Data

Engine Number Location



The engine number (➡) (engine code and serial number) is located at the front of the engine on the left side.

Engine Data

Identification codes		CEJA
Displacement	liter	6.299
Output	kW at RPM	368 @ 6400
Torque	Nm at RPM	550 @ 3250
Bore	diameter mm	86.0
Stroke	mm	90.368
Compression ratio		11.4
RON	at least	98 [1)]
Fuel injection and ignition system		Bosch Motronic
Ignition sequence		1-7-5-11-3-9-6-12-2-8-4-10
Turbocharger		No
Knock control		4 sensors
Oxygen Sensor (O2S) regulation		4 sensors before catalytic converter 4 sensors after catalytic converter
Variable valve timing		Intake Exhaust
Variable intake manifold		No
Secondary Air Injection (AIR) system		Yes
Valve per cylinder		4

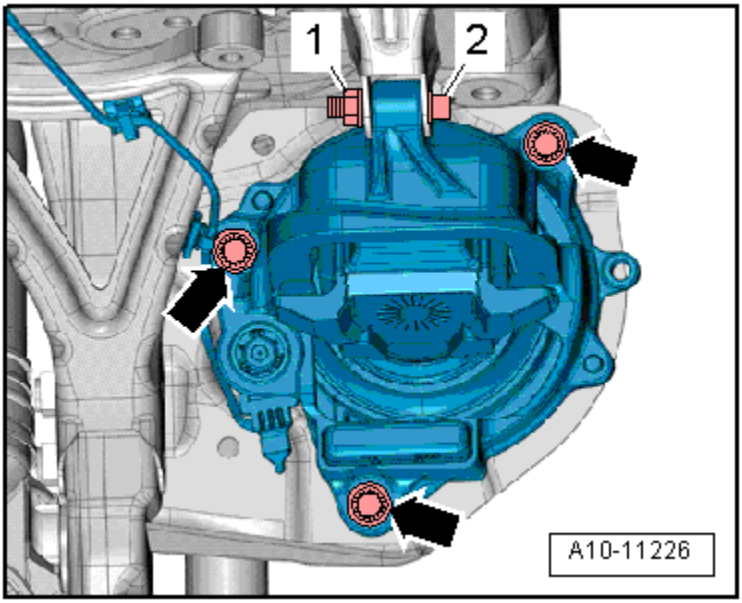
[1)] Unleaded RON 95 is also permitted but performance is reduced.

Engine Assembly – 6.3L CEJA

Fastener Tightening Specifications

Component	Fastener size	Nm
Bolts and nuts	M6	9
	M7	15
	M8	20
	M10	40
	M12	65
Engine support	-	40
Subframe nut	-	20

Locking Flange Cover Tightening Specification



Step	Component	Nm
1	Tighten bolts (➡) and 2	Hand-tighten
2	Tighten bolts (➡) and 2	20

Crankshaft, Cylinder Block – 6.3L CEJA

Fastener Tightening Specifications

Component	Nm
Drive plate	60 plus an additional 90° (¼ turn)
Power steering pump bracket	40
Ribbed belt idler roller	32
Tensioning element with relay lever [1)]	32 plus an additional 90° (¼ turn)
Tensioning roller tension spring	23
Vibration damper [1)]	40 plus an additional 90° (¼ turn)

[1)] Replace fastener(s).

Cylinder Head, Valvetrain – 6.3L CEJA

Fastener Tightening Specifications

Component	Nm
Camshaft adjustment valve in the exhaust	2.4
Camshaft drive chain sprocket [1)]	90 plus an additional 135°
Chain tensioner with tensioning rail for the drive chain	9
Camshaft adjustment control housing [1)]	4 plus an additional 90° (¼ turn)
Engine lifting eye	23
Guide rail mounting pin	15
Cylinder bank 1 (right)	
Camshaft adjuser [1)]	60 plus an additional 90° (¼ turn)
Camshaft timing chain guide rail	8 plus an additional 90° (¼ turn)
Camshaft timing chain tensioner [1)]	4 plus an additional 90° (¼ turn)
Guide rail mounting pin	20
Tensioning element mounting pin	42

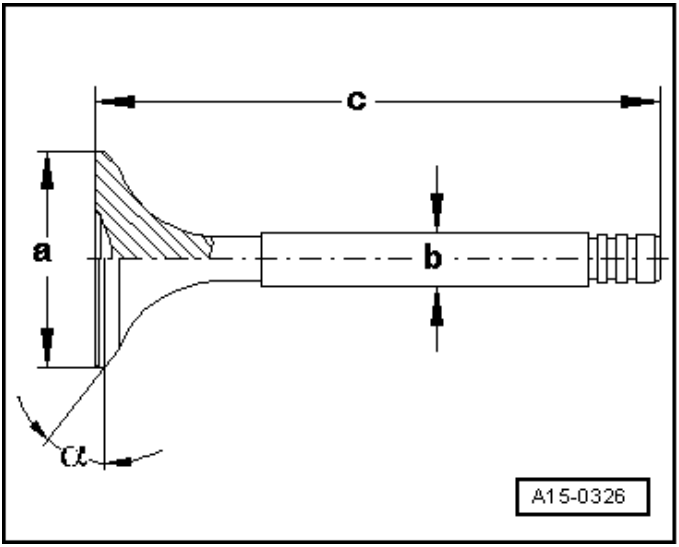
Component	Nm
Timing chain tensioning element	8
Cylinder bank 2 (left)	
Camshaft adjuster [1)]	60 plus an additional 90° (¼ turn)
Camshaft timing chain tensioner [3)]	4 plus an additional 90° (¼ turn)
	8 plus an additional 90° (¼ turn)
Tensioning element mounting pin	42
Timing chain tensioning element [2)]	8

1) Replace fastener(s).
2) Install the bolts with a locking compound. Refer to the Electronic Parts Catalog (ETKA).
3) For bolt tightening clarification, refer to ElsaWeb, *Camshaft Timing Chains Overview, Cylinder Bank 2 (left)*, items 1 and 7.

Compression Checking Specifications

Compression pressure	Bar pressure
New	11.0 to 13.0
Wear limit	10.0
Maximum difference between cylinders	3.0

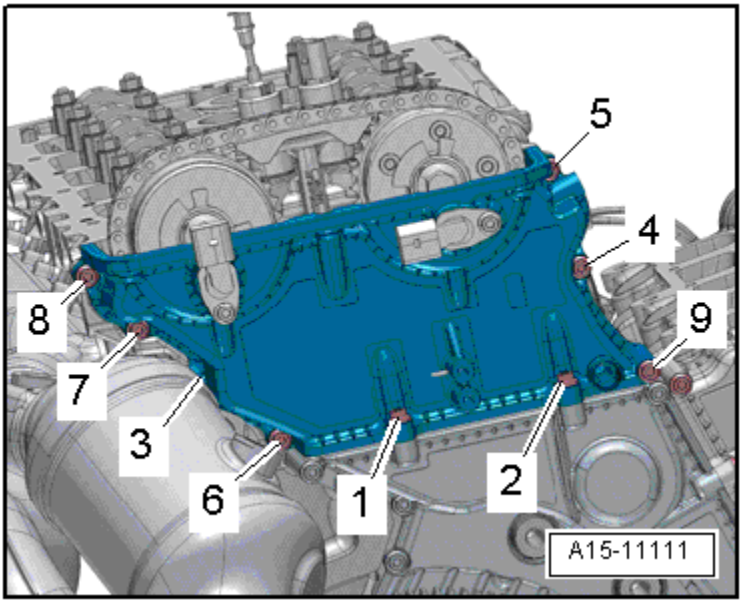
Valve Dimensions



Dimension		Short intake valve	Long intake valve	Short exhaust valve	Long exhaust valve
Diameter a	mm	33.2	33.2	30.2	30.2
Diameter b	mm	5.96	5.96	5.94	5.94
c	mm	102.2	136.4	102.2	136.1
α	∠°	45	45	45	45

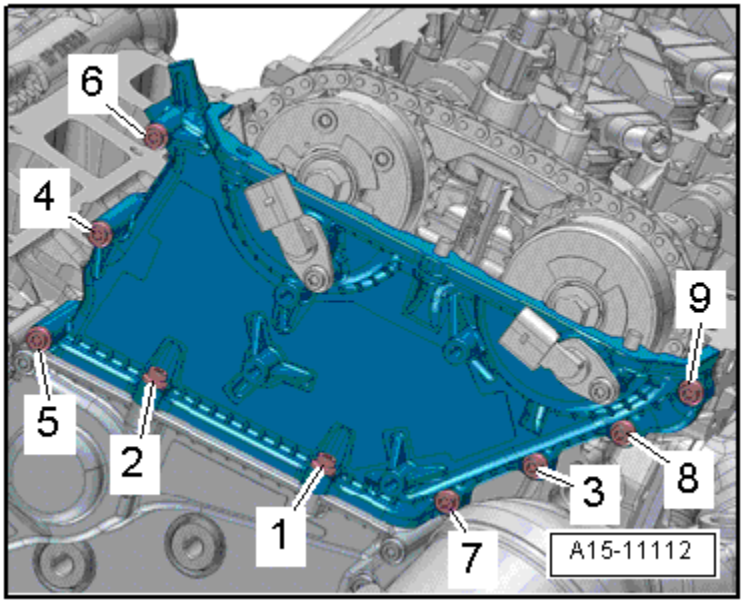
NOTE: Intake and exhaust valves must not be refaced by grinding. Only lapping is permitted.

Left Timing Chain Cover Tightening Specifications



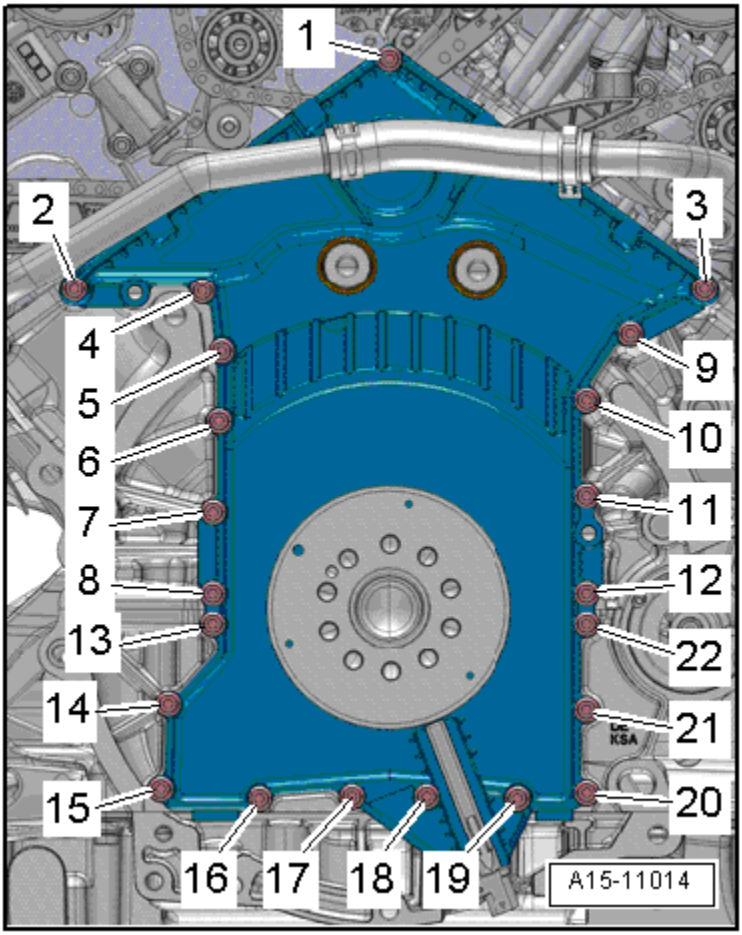
Step	Component	Nm
1	Tighten bolts 1 through 9 in sequence	4
2	Tighten bolts 1 through 8 in sequence	an additional 45° (⅛ turn)
3	Tighten bolt 9	an additional 180° (½ turn)

Right Timing Chain Cover Tightening Specifications



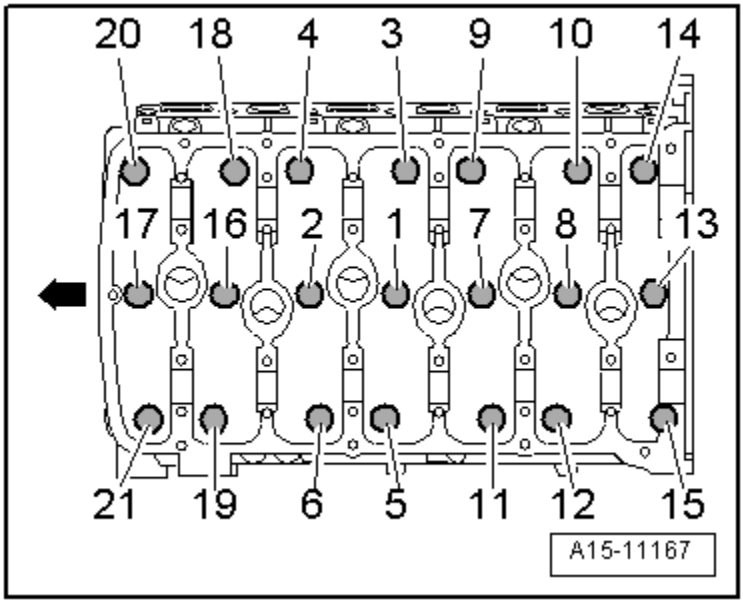
Step	Component	Nm
1	Tighten bolts 1 through 9 in sequence	4
2	Tighten bolts 1 through 3 and 7 through 9 in sequence	an additional 45° (⅛ turn)
3	Tighten bolts 4 through 6	an additional 180° (½ turn)

Lower Timing Chain Cover Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 22	4
2	Tighten bolts 1 through 3	an additional 180° (½ turn)
3	Tighten bolts 4 through 22	an additional 45° (⅛ turn)

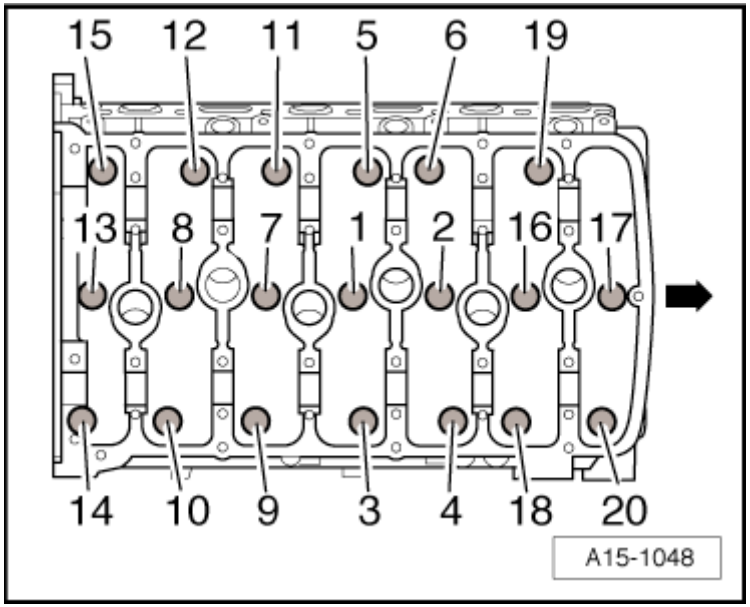
Left Cylinder Head Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 21 in sequence [1]	23
2	Tighten bolts 1 through 21 in sequence	37
3	Tighten bolts 1 through 21 in sequence	an additional 90° (¼ turn)
4	Tighten bolts 1 through 21 in sequence	an additional 90° (¼ turn)

[1] Replace fastener(s).

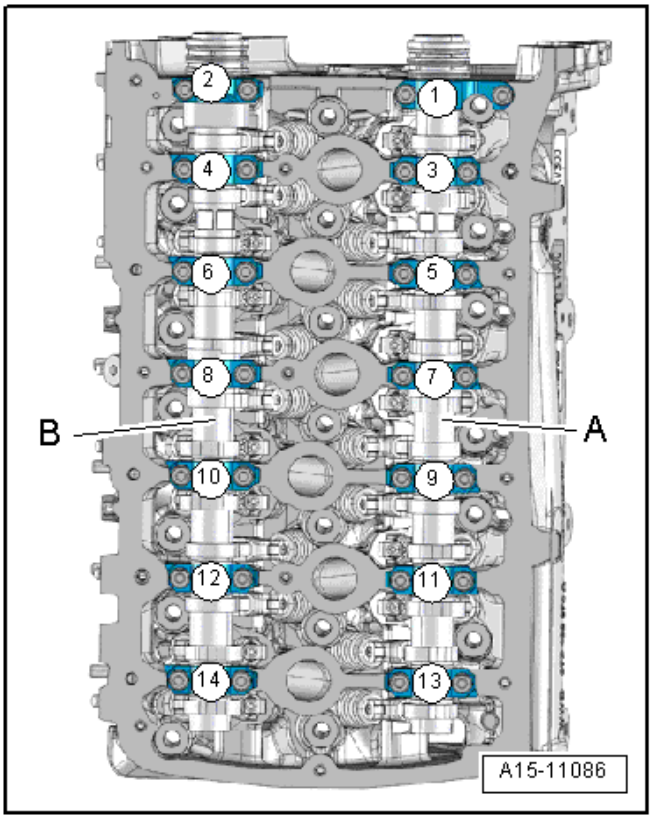
Right Cylinder Head Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 20 in sequence [1)]	23
2	Tighten bolts 1 through 20 in sequence	37
3	Tighten bolts 1 through 20 in sequence	an additional 90° (¼ turn)
4	Tighten bolts 1 through 20 in sequence	an additional 90° (¼ turn)

[1)] Replace fastener(s).

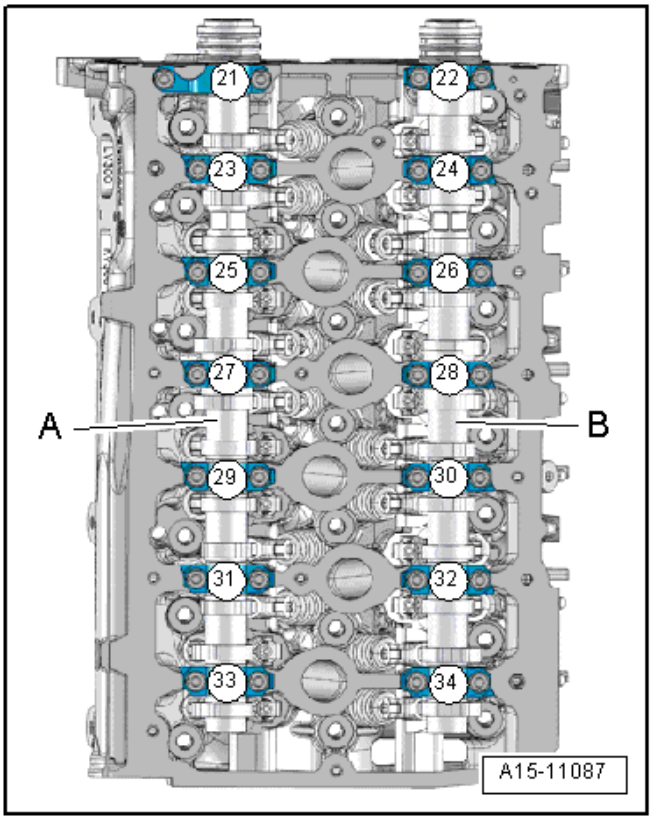
Cylinder Bank 1 (Right) Bearing Cap Tightening Specifications



Step	Component	Nm
Intake camshaft A		
1	Tighten bolts 3 and 11	Hand-tighten
2	Tighten bolts 3 and 11	5 plus an additional 45° (⅛ turn)
3	Tighten bolt 7	5 plus an additional 45° (⅛ turn)
4	Tighten bolts 5 and 9	5 plus an additional 45° (⅛ turn)
5	Tighten bolts 1 and 13	5 plus an additional 45° (⅛ turn)

Step	Component	Nm
Intake camshaft B		
1	Tighten bolts 4 and 12	Hand-tighten
2	Tighten bolts 4 and 12	5 plus an additional 45° (⅛ turn)
3	Tighten bolt 8	5 plus an additional 45° (⅛ turn)
4	Tighten bolts 6 and 10	5 plus an additional 45° (⅛ turn)
5	Tighten bolts 2 and 14	5 plus an additional 45° (⅛ turn)

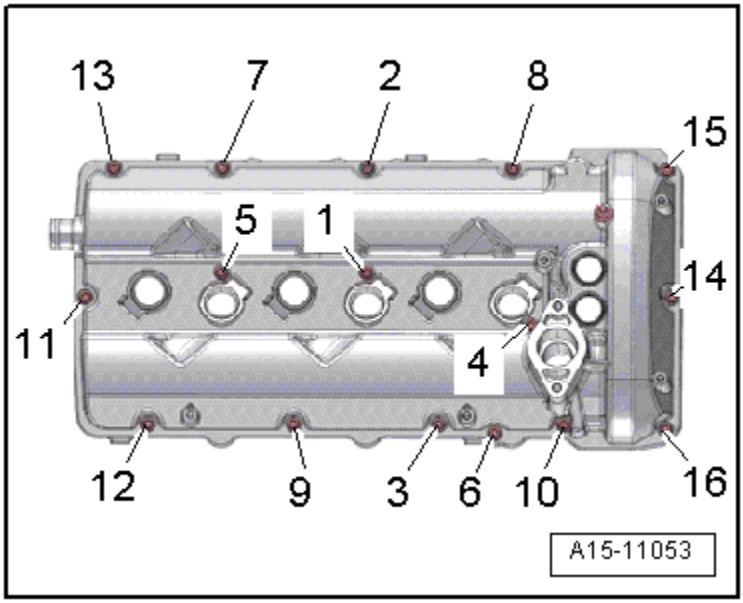
Cylinder Bank 2 (Left) Bearing Cap Tightening Specifications



Step	Component	Nm
Intake camshaft A		
1	Tighten bolts 23 and 31	Hand-tighten
2	Tighten bolts 23 and 31	5 plus an additional 45° (⅛ turn)
3	Tighten bolt 27	5 plus an additional 45° (⅛ turn)
4	Tighten bolts 25 and 29	5 plus an additional 45° (⅛ turn)
5	Tighten bolts 21 and 33	5 plus an additional 45° (⅛ turn)

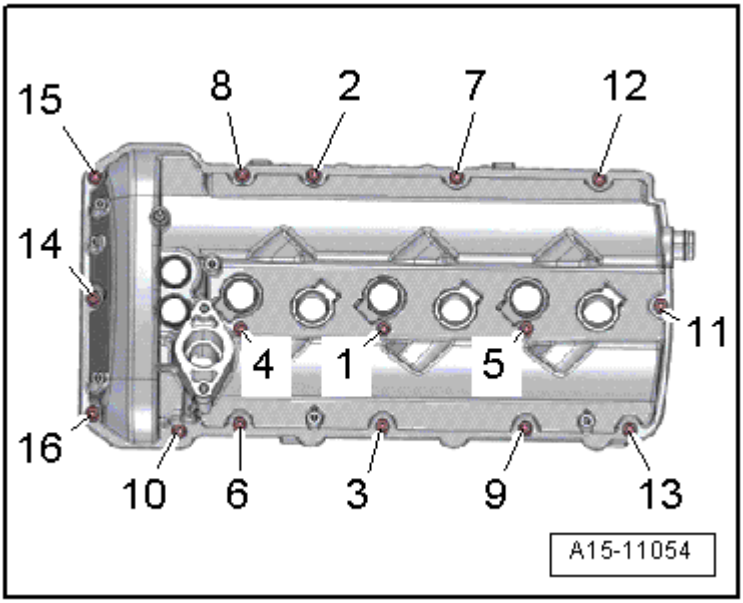
Step	Component	Nm
Intake camshaft B		
1	Tighten bolts 24 and 32	Hand-tighten
2	Tighten bolts 24 and 32	5 plus an additional 45° (⅛ turn)
3	Tighten bolt 28	5 plus an additional 45° (⅛ turn)
4	Tighten bolts 26 and 30	5 plus an additional 45° (⅛ turn)
5	Tighten bolts 22 and 34	5 plus an additional 45° (⅛ turn)

Left Cylinder Head Cover Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 13 in sequence	8
2	Tighten bolts 14 through 16 in sequence	4
3	Tighten bolts 14 through 16 in sequence	an additional 90° (¼ turn)

Right Cylinder Head Cover Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 13 in sequence	8
2	Tighten bolts 14 through 16 in sequence	4
3	Tighten bolts 14 through 16 in sequence	an additional 90° (¼ turn)

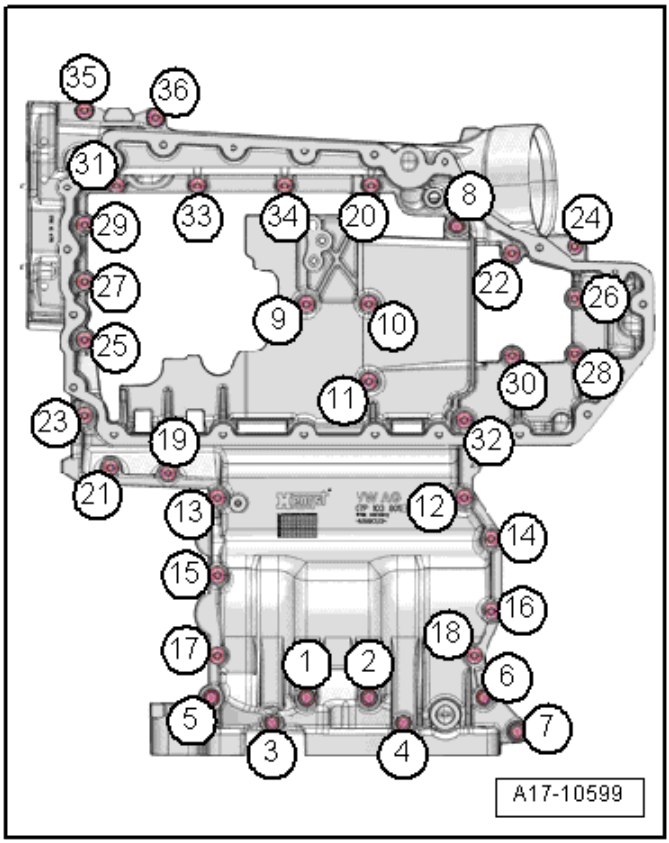
Lubrication – 6.3L CEJA

Fastener Tightening Specifications

Component	Fastener size	Nm
Chain tensioner	M6	8
	M8	20
Crankcase ventilation hose	-	8
Engine cover ball pin	-	8
Engine oil cooler	-	9
Oil dipstick guide tube [1)]	-	4 plus an additional 45° (⅛ turn)
Oil drain plug	-	30
Oil filler tube and crankcase ventilation pressure control valve housing	-	8
Oil filter element cap	-	25
Oil level thermal sensor	-	8
Oil pipe banjo bolt	-	20
Oil pressure switch	-	20
Oil pump	-	20
Oil pump intake tube	-	8
Reduced oil pressure switch	-	20

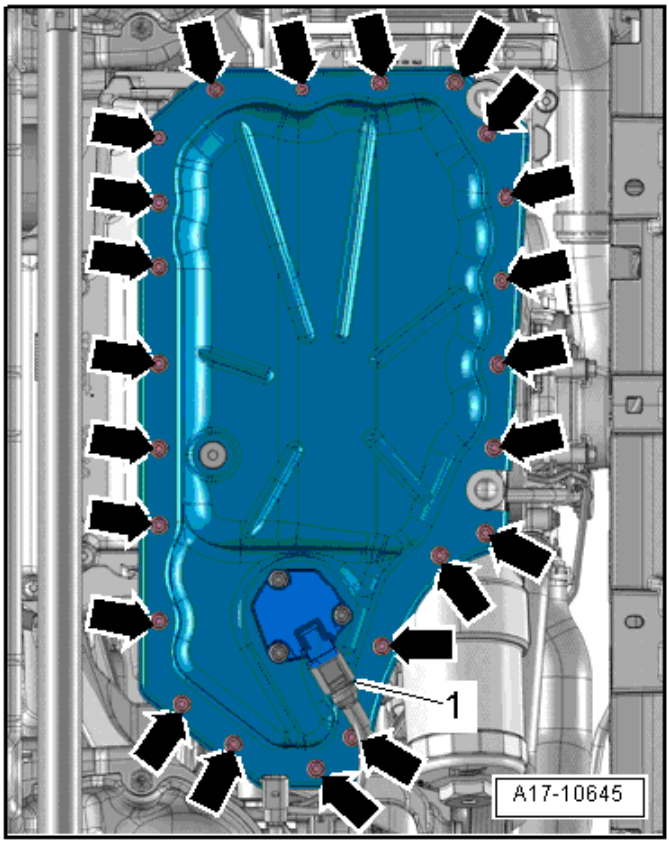
[1)] Replace fastener(s).

Upper Oil Pan Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 36 in sequence	Hand-tighten
2	Tighten bolts 1 through 36 in sequence	8
3	Tighten bolts 1 through 8 in sequence	20

Oil Pan Tightening Specifications



Step	Component	Nm
1	Tighten bolts (➡) in a diagonal sequence	Hand-tighten
2	Tighten bolts (➡) in a diagonal sequence	4
3	Tighten bolts (➡) in a diagonal sequence	an additional 45° (⅛ turn)

Cooling System – 6.3L CEJA

Fastener Tightening Specifications

Component	Nm
After-run coolant pump	9
Coolant auxiliary cooler bracket	9
Coolant pump	10
Coolant temperature sensor [1)]	4 plus an additional 45° (⅛ turn)
Engine cover mounting pins	4.5
Fan rib	3.5
Fan wheel	5
Left rear coolant pipe	9
Lower left coolant pipe	9
Radiator	3.5
Ribbed belt pulley	8
Right coolant pipes [2)]	9
	20
Right front coolant pipe	9
Right rear coolant pipe	9
Thermostat housing[1)]	20
Thermostat housing cover	9
Upper left coolant pipe	9

[1)] Replace fastener(s).

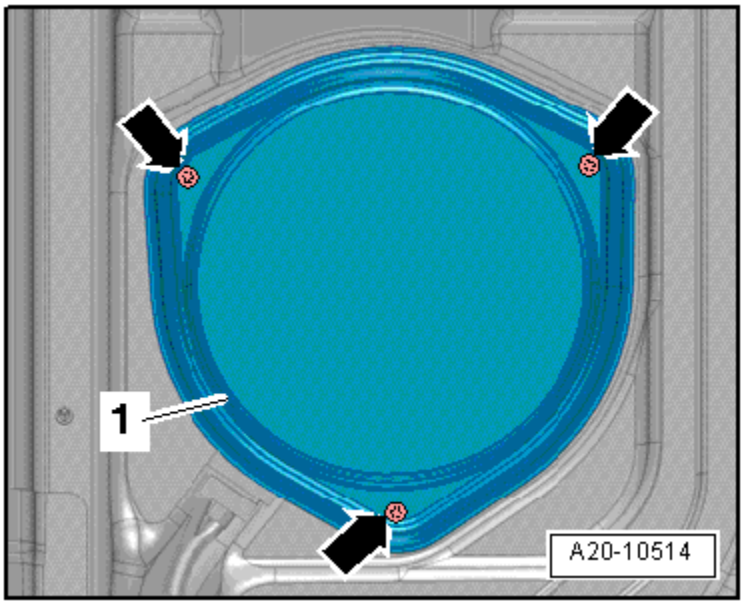
[2)] For bolt tightening clarification, refer to ElsaWeb, *Coolant Pipes Overview*, items 8 through 11.

Fuel Supply – 6.3L CEJA

Fastener Tightening Specifications

Component	Nm
Accelerator pedal module	8
Air filter housing	4
Carrier plate	23
Evaporative Emission (EVAP) canister	20
Fuel filler neck nut	2.5
Fuel filler neck bolt	23
Fuel pump control module nut	1.6
Fuel tank	23
Fuel tank bracket	23
Fuel tank heat shield	23
Fuel tank leak detection control module nut	1.6
Fuel tank pressure sensor bracket	4
Locking ring	120
Securing strap	23

Locking Flange Cover Tightening Specification



Step	Component	Nm
1	Tighten bolts (➡) in a diagonal sequence	1.5

Exhaust System, Emission Controls – 6.3L CEJA

Fastener Tightening Specifications

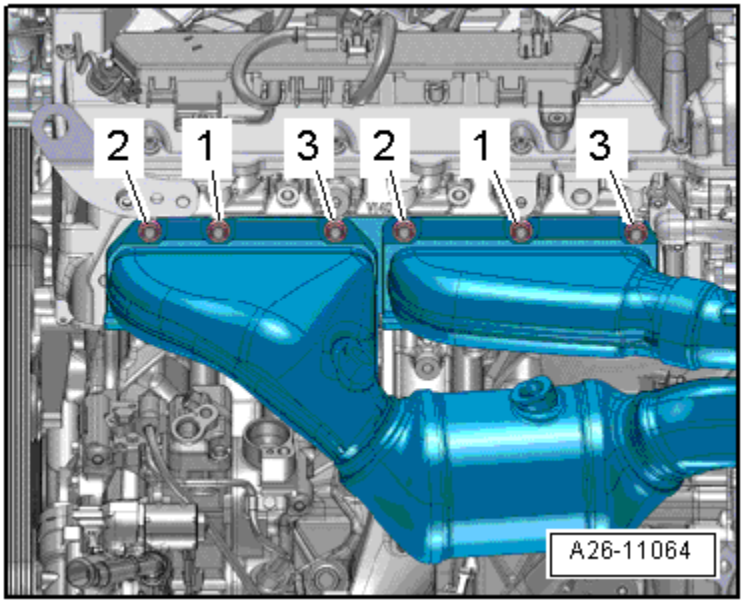
Component	Nm
Air filter bracket	9
Air filter housing bracket	9
Bonded rubber bushing nut	9
Front clamping sleeve nut	23
Front muffler nut [1]	20
Heat shield	9
Rear clamping sleeve nut	23
Secondary Air Injection (AIR) pump motor bracket	20
Secondary Air Injection (AIR) system air filter housing	9
Secondary air pipe	8
Secondary air pipe [3]	4 plus an additional 45° (⅛ turn)
	8
Securing strip nut [1] [2]	23
Suspended mount	23

[1] Replace fastener(s).

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

[3] For bolt tightening clarification, refer to ElsaWeb, *Secondary Air Injection System Overview,* items 1, 3, 5, 19, 21 and 23.

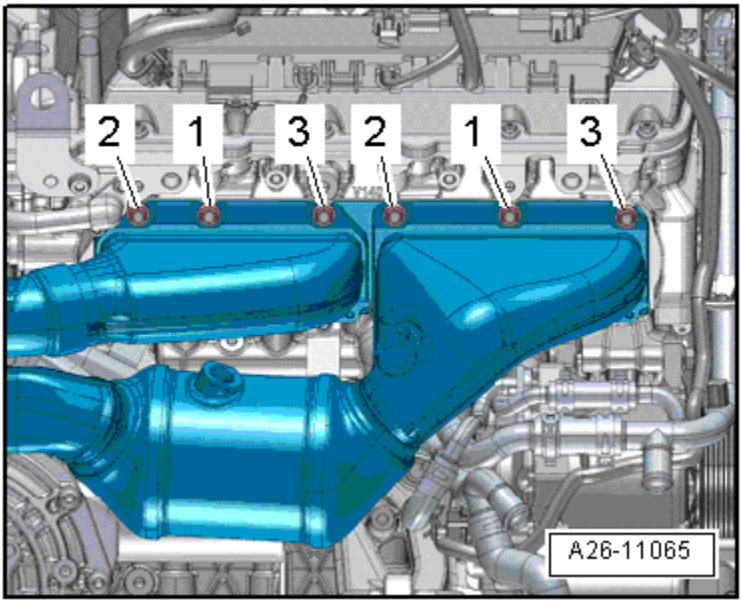
Left Exhaust Manifold Tightening Specifications



Step	Component	Nm
1	Tighten nuts 1 through 3 in sequence [1) 2)]	Hand-tighten
2	Tighten nuts 1 through 3 in sequence	15
3	Tighten nuts 1 through 3 in sequence	23

1) Replace fastener(s).
2) Lubricate the threads with hot bolt paste. For the correct hot bolt paste, refer to the Electronic Parts Catalog (ETKA).

Right Exhaust Manifold Tightening Specifications



Step	Component	Nm
1	Tighten nuts 1 through 3 in sequence [1) 2)]	Hand-tighten
2	Tighten nuts 1 through 3 in sequence	15
3	Tighten nuts 1 through 3 in sequence	23

1) Replace fastener(s).
2) Lubricate the threads with hot bolt paste. For the correct hot bolt paste, refer to the Electronic Parts Catalog (ETKA).

Multiport Fuel Injection – 6.3L CEJA

Technical Data

6.3L FSI engine	
Engine idle speed	Cannot be adjusted, it is regulated by idle stabilization.
Fuel pressure before high pressure pump	6.0 to 7.0 bar pressure
Fuel pressure after high pressure pump	15 to 135 bar pressure

Fastener Tightening Specifications

Component	**Nm**
Air filter upper section	2.5
Air guide	1.5
Air guide pipe	2.5
Clamp nut	9
Connecting piece	40
Fuel pressure sensor	27
Fuel rail [1)]	30 plus an additional 90° (¼ turn)
High pressure pipe	27
High pressure pump	20
Housing	1.5
Intake manifold	9
Low fuel pressure sensor	15
Mass Air Flow (MAF)/Intake Air Temperature (IAT) sensor	1.5
Throttle valve control module [1)]	7
Union nut-to-high pressure pump [2)]	22
	27

1) Replace fastener(s).
2) For bolt tightening clarification, refer to ElsaWeb, *High Pressure Pump Overview,* items 1 and 3.

Ignition System Tightening Specifications

Component	Nm
Camshaft Position (CMP) sensor	9
Electrical harness connector	5
Engine Speed (RPM) sensor [1)]	4 plus an additional 45° (⅛ turn)
Knock Sensor (KS)	20

1) Replace fastener(s).

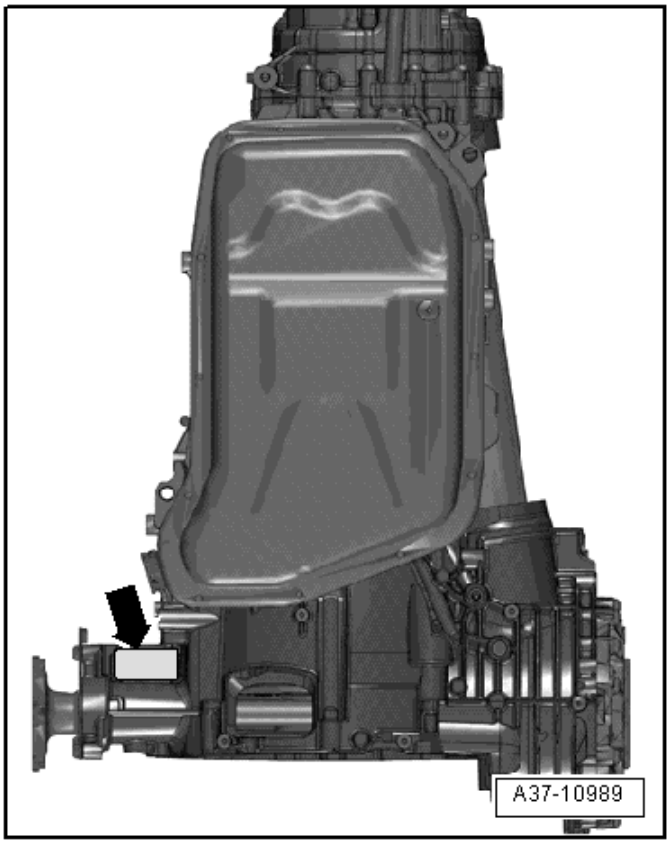
Technical Data

Test data		6.3L/4V engine
Engine idle speed		Cannot be adjusted, it is regulated by idle stabilization.
Ignition timing		Not adjustable; regulated by the Engine Control Module (ECM).
Ignition system		Single coil ignition system with 12 ignition coils (output stages integrated) that are connected directly to spark plugs via the ignition cables.
Spark plugs	Names	Refer to the Electronic Parts Catalog
	Tightening specifications	Maintenance Procedures Rep. Gr. 03
Ignition sequence		1-12-5-8-3-10-6-7-2-11-4-9

AUTOMATIC TRANSMISSION – 0BK

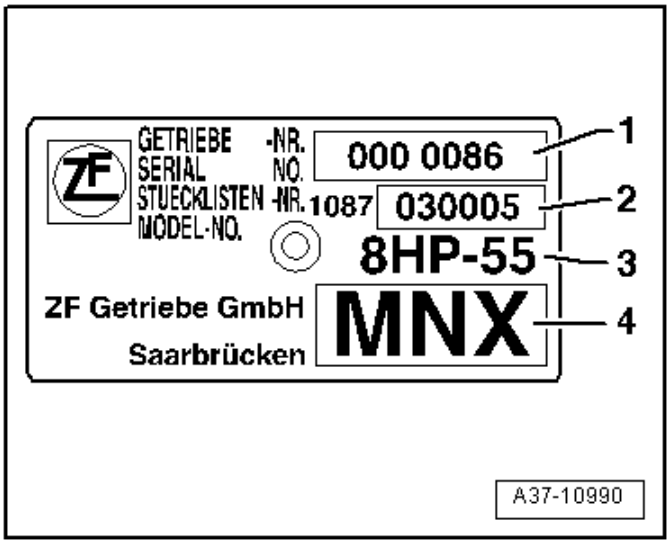
General, Technical Data

Transmission Identification



The transmission code letters are located on the type plate under the transmission. The (➡) indicates the location of the type plate.

Transmission Type Plate



1 - Transmission serial number
2 - Parts list number
3 - Manufacturer transmission identification: 8HP-55
4 - Example of a transmission code: MNX

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

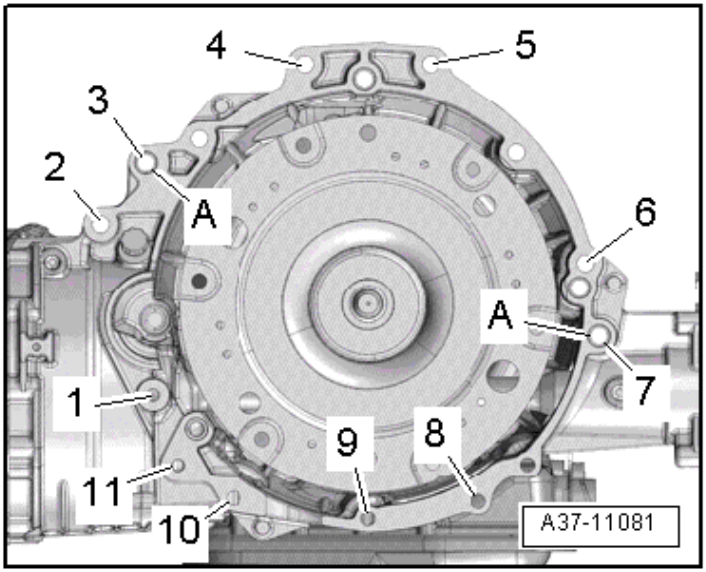
Code Letters, Transmission Allocations, Ratios and Equipment

Automatic transmission		0BK AWD	
Transmission	Identification codes	MEE	MXS
Torque converter	Identification codes	N140	T138
Allocation	Type	Audi A8 from MY 2010	Audi A8 from MY 2010
	Engine	4.0L TFSI - 309 kW	6.3L FSI - 368 kW
Primary drive		32:33 = 0.970	27:29 = 0.931
Gear wheel (front axle)		31:29 = 1.069	31:29 = 1.069
Front axle bevel gear		34:11 = 3.091	34:11 = 3.091
Complete front axle ratio = primary drive x drive wheel x bevel gear		3.204	3.076
Rear axle bevel gear		43:13 = 3.308	43:13 = 3.308
Complete rear axle ratio = rear axle bevel gear x primary drive		3.207	3.080
Oil system, front final drive/transfer case		Shared	Shared
Start/Stop System		Yes	No

Automatic transmission		0BK AWD	
Transmission	Identification codes	MXT	NCK
Torque converter	Identification codes	Y137	T138
Allocation	Type	Audi A8 from MY 2010	Audi A8 from MY 2010
	Engine	3.0L FSI - 273 kW	6.3L FSI - 368 kW
Primary drive		32:33 = 0.970	27:29 = 0.931
Gear wheel (front axle)		31:29 = 1.069	31:29 = 1.069
Front axle bevel gear		34:11 = 3.091	34:11 = 3.091
Complete front axle ratio = primary drive x drive wheel x bevel gear		3.203	3.076
Rear axle bevel gear		43:13 = 3.308	43:13 = 3.308
Complete rear axle ratio = rear axle bevel gear x primary drive		3.207	3.080
Oil system, front final drive/transfer case		Separated	Shared
Start/Stop System		No	Yes

Automatic transmission		0BK AWD
Transmission	Identification codes	NPQ
Torque converter	Identification codes	P140
Allocation	Type	Audi A8 from MY 2010
	Engine	3.0L TDI - 184 kW and 176 kW
Primary drive		27:34 = 0.794
Gear wheel (front axle)		31:29 = 1.069
Front axle bevel gear		34:11 = 3.091
Complete front axle ratio = primary drive x drive wheel x bevel gear		2.624
Rear axle bevel gear		43:13 = 3.308
Complete rear axle ratio = rear axle bevel gear x primary drive		2.627
Oil system, front final drive/transfer case		Separated
Start/Stop System		Yes

Securing Transmission to 3.0L TDI Engine

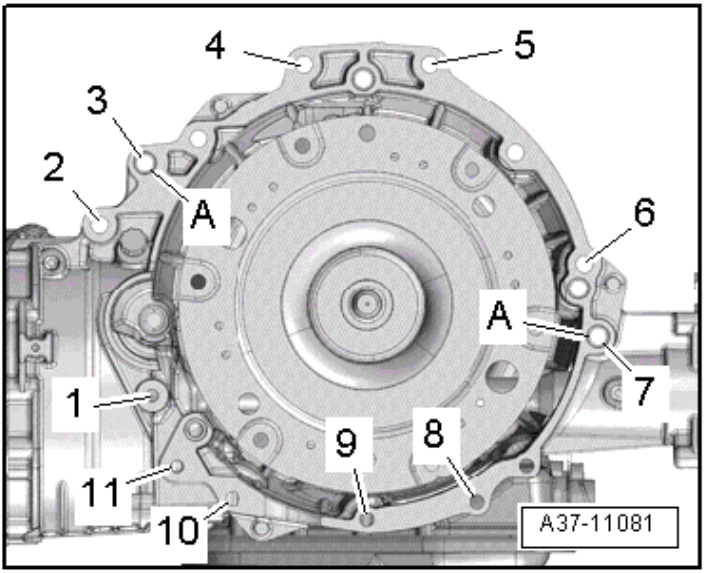


Item	Fastener	Nm
1	M10 x 50 [1)]	65
2 to 6	M12 x 100 [2)]	30 plus an additional 90° (¼ turn)
7	M12 x 125	30 plus an additional 90° (¼ turn)
8, 11	M10 x 60 [2)]	15 plus an additional 90° (¼ turn)
9	M10 x 75 [2)]	15 plus an additional 90° (¼ turn)
10	M10 x 95 [2)]	15 plus an additional 90° (¼ turn)
A	Alignment sleeves for centering	

[1)] Attaches the starter to the transmission. Bolt strength rating 10.9. There is no limit to the number of times the steel bolt can be used again.

[2)] Aluminum bolts can only be used twice. Mark the bolts by making two notches (X) with a chisel after they have been used the first time. To prevent damaging the bolts when marking them, do not clamp them in a vise. Insert the bolts in a ½" drive 14 mm socket clamped into a vise. Do not use bolts that have been marked with an X.

Securing Transmission to 3.0L TFSI Engine

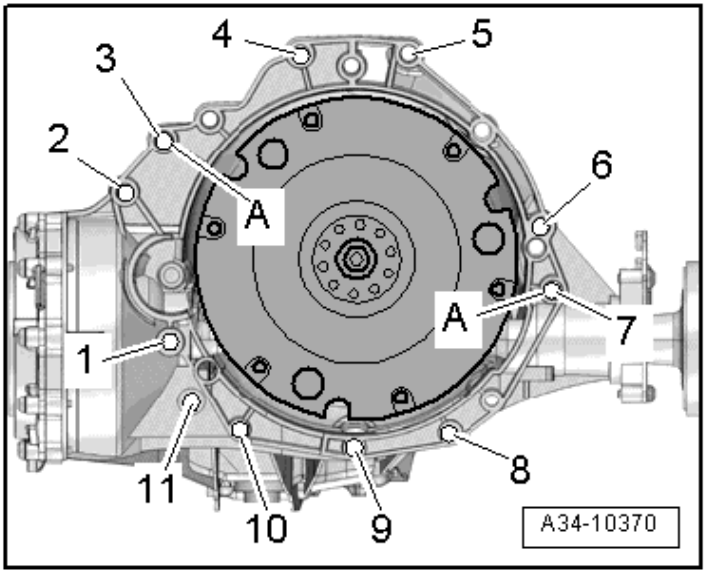


Item	Fastener	Nm
1	M10 x 50 [1)]	65
2 to 6	M12 x 100 [2)]	30 plus an additional 90° (¼ turn)
7	M12 x 125[1)]	30 plus an additional 90° (¼ turn)
8, 11	M10 x 60 [2)]	15 plus an additional 90° (¼ turn)
9	M10 x 75 [2)]	15 plus an additional 90° (¼ turn)
10	M10 x 95 [2)]	15 plus an additional 90° (¼ turn)
A	Alignment sleeves for centering	

[1)] Bolt strength rating 10.9. There is no limit to the number of times steel bolts may be used.

[2)] Aluminum bolts can only be used twice. Mark the bolts by making two notches (X) with a chisel after they have been used the first time. To prevent damaging the bolts when marking them, do not clamp them in a vise. Insert the bolts in a ½" drive 14 mm socket clamped into a vise. Do not use bolts that have been marked with an X.

Securing Transmission to 4.0L Engine



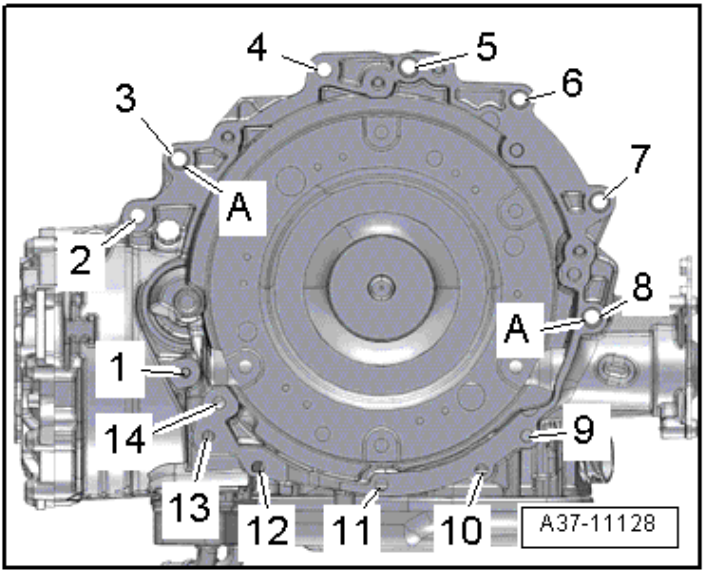
Item	Fastener	Nm
1	M10 x 50 [1)]	65
2 to 6	M12 x 100 [2)]	30 plus an additional 90° (¼ turn)
7	M12 x 175 [3)]	30 plus an additional 90° (¼ turn)
8, 11	M10 x 60 [2)]	15 plus an additional 90° (¼ turn)
9	M10 x 75 [2)]	15 plus an additional 90° (¼ turn)
10	M10 x 95 [2)]	15 plus an additional 90° (¼ turn)
A	Alignment sleeves for centering	

[1)] Bolt strength rating 10.9. There is no limit to the number of times steel bolts may be used.

[2)] Aluminum bolts can only be used twice. Mark the bolts by making two notches (X) with a chisel after they have been used the first time. To prevent damaging the bolts when marking them, do not clamp them in a vise. Insert the bolts in a ½" drive 14 mm socket clamped into a vise. Do not use bolts that have been marked with an X.

[3)] Also attaches the power steering pump. Replace the bolt each time it is removed.

Securing Transmission to 6.3L Engine



Item	Fastener	Nm
1	M10 x 50 [1)]	65
2, 8	M12 x 100 [2)]	30 plus an additional 90° (¼ turn)
3, 4, 5, 6, 7, 14	M12 x 75 [2)]	30 plus an additional 90° (¼ turn)
9, 12, 13	M10 x 75 [2)]	15 plus an additional 90° (¼ turn)
10	M10 x 40 [2)]	15 plus an additional 90° (¼ turn)
11	M10 x 60 [2)]	15 plus an additional 90° (¼ turn)
A	Alignment sleeves for centering	

[1)] Bolt strength rating 10.9. There is no limit to the number of times steel bolts may be used.

[2)] Aluminum bolts can only be used twice. Mark the bolts by making two notches (X) with a chisel after they have been used the first time. To prevent damaging the bolts when marking them, do not clamp them in a vise. Insert the bolts in a ½" drive 14 mm socket clamped into a vise. Do not use bolts that have been marked with an X.

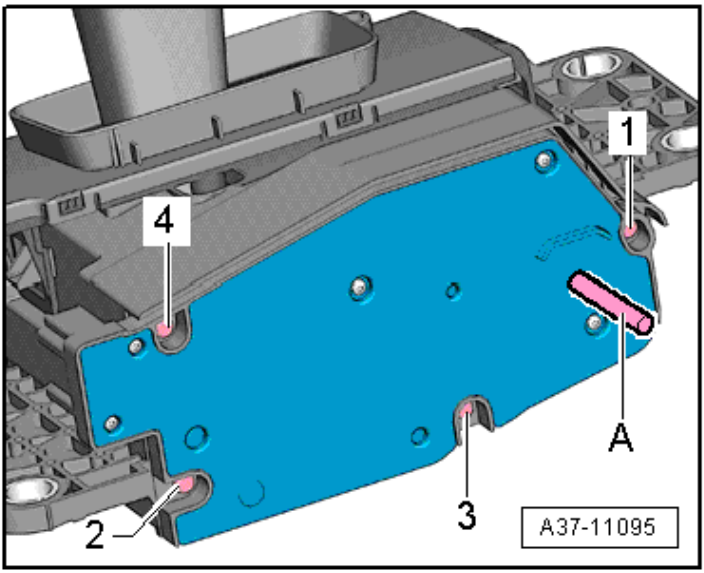
Fastener Tightening Specifications

Component	Fastener size	Nm
Automatic Transmission Fluid (ATF) cooler	-	8
Automatic Transmission Fluid (ATF) pipes [3]	-	8
	-	20
Bolts and nuts	M6	9
	M7	15
	M8	20
	M10	40
	M12	65
Drain plug for the hole for checking and filling, for the transmission fluid inside the transfer case [1]	-	27
Drive Axle Heat Shields	-	23
Emergency release lever nut	-	2.5
Front emergency release cable	-	9
Heat shield	-	10
Left transmission mount	-	20
Left transmission mount brace	-	20
Left transmission support [2]	-	20
	-	40
Oil drain plug for the ATF in the transmission	-	12
Oil drain plug for the ATF in the transmission for the transmission fluid inside the transfer case [1]	-	12
Rear transmission mount lower stop [1]	-	20 plus an additional 90° (¼ turn)
Rear transmission support bolt	-	40
Rear transmission support nut	-	20
Right transmission mount	-	20
Right transmission mount brace	-	20
Right transmission support	-	20
Selector lever handle lower section	-	7
Selector lever release button (E681) and selector lever transmission range position display unit (Y26)	-	0.25
Selector mechanism function unit		8

Component	Fastener size	Nm
Tunnel cross member	M10 x 55 8.8	40
	M10 x 40 10.9	70
Tunnel cross member nut	-	20

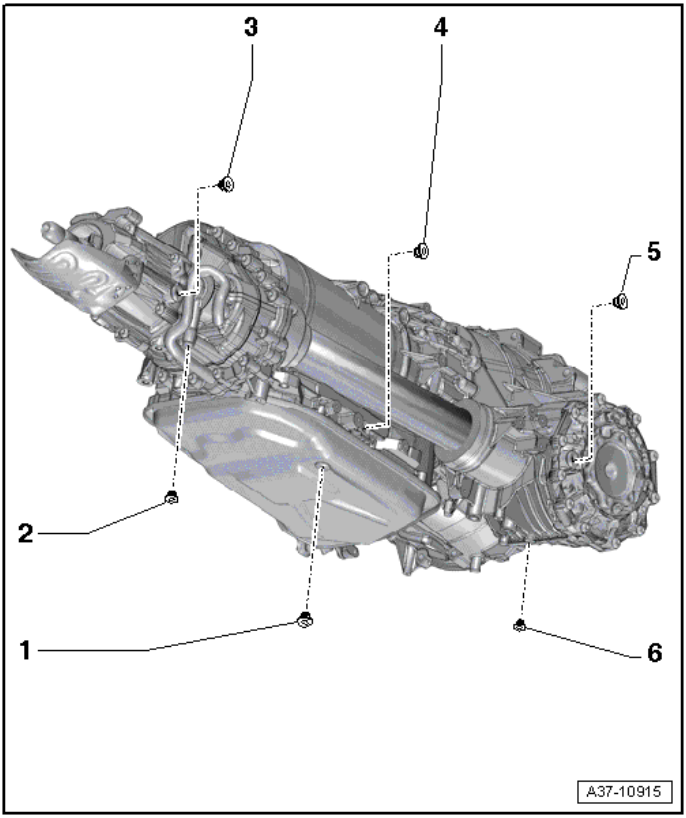
1) Replace fastener(s).
2) For bolt tightening clarification, refer to ElsaWeb, *Tunnel Crossmember, Transmission Mount and Transmission Supports Overview*, items 20 and 28.
3) For bolt tightening clarification, refer to ElsaWeb, *ATF Cooler and ATF Pipes Overview*, items 7, 8 and 11.

Selector Lever Sensor System Control Module Tightening Specifications



Step	Bolts	Nm
1	Tighten bolts 1 to 4 in sequence	1.1

Drain and Fill Plugs Tightening Specifications



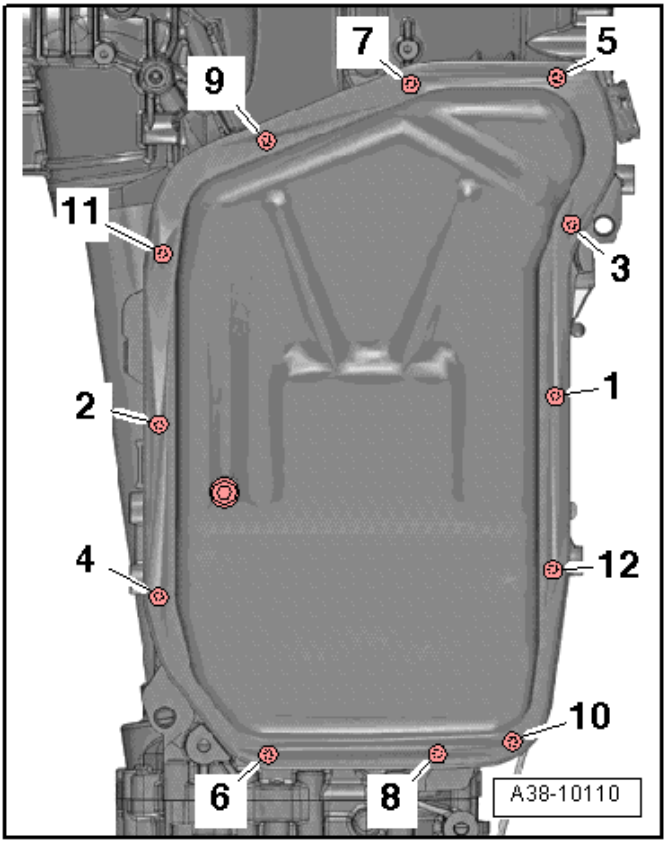
Item	Fastener	Nm
1	Automatic Transmission Fluid (ATF) drain plug [1)]	12
2	Transmission fluid oil drain plug (inside the transfer case) [1)]	12
3	Transmission fluid drain plug (inside the transfer case) [1)]	27
4	Automatic Transmission Fluid (ATF) check and fill hole drain plug [1)]	30
5	Transmission fluid drain plug (inside the front final drive)	27
6	Transmission fluid oil drain plug (inside the front final drive)	10

[1)] Replace fastener(s).

Fastener Tightening Specification

Component	Nm
Connector housing	5.5
Oil drain plug	12

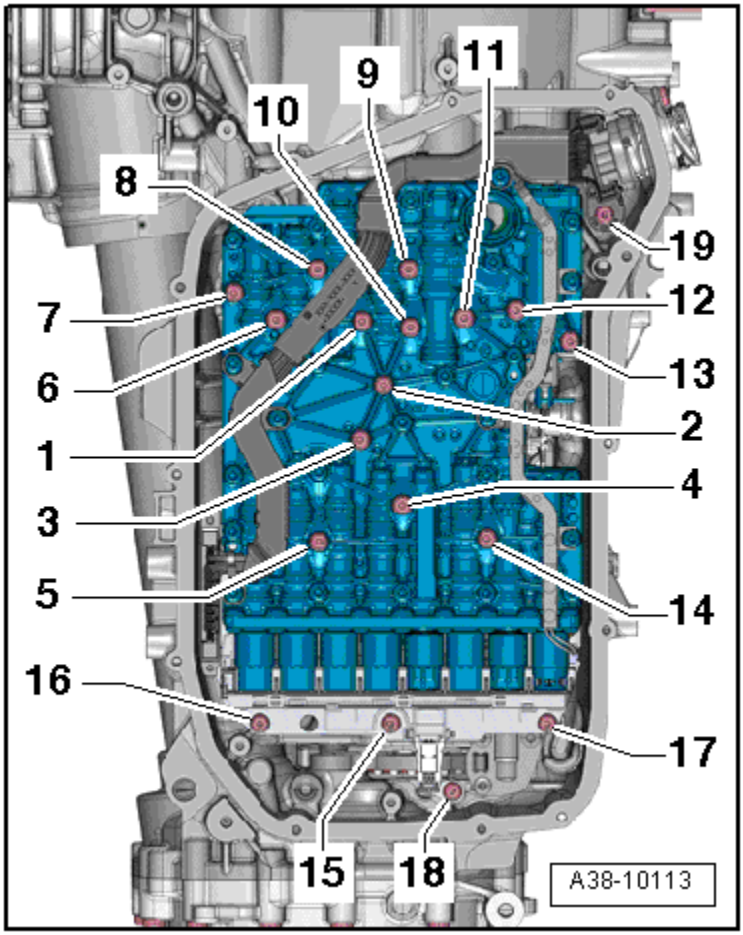
Oil Pan Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 12 in sequence [1]	Hand-tighten
2	Tighten bolts 1 through 12 in sequence	4
3	Tighten bolts 1 through 12 in sequence	an additional 45° (⅛ turn)

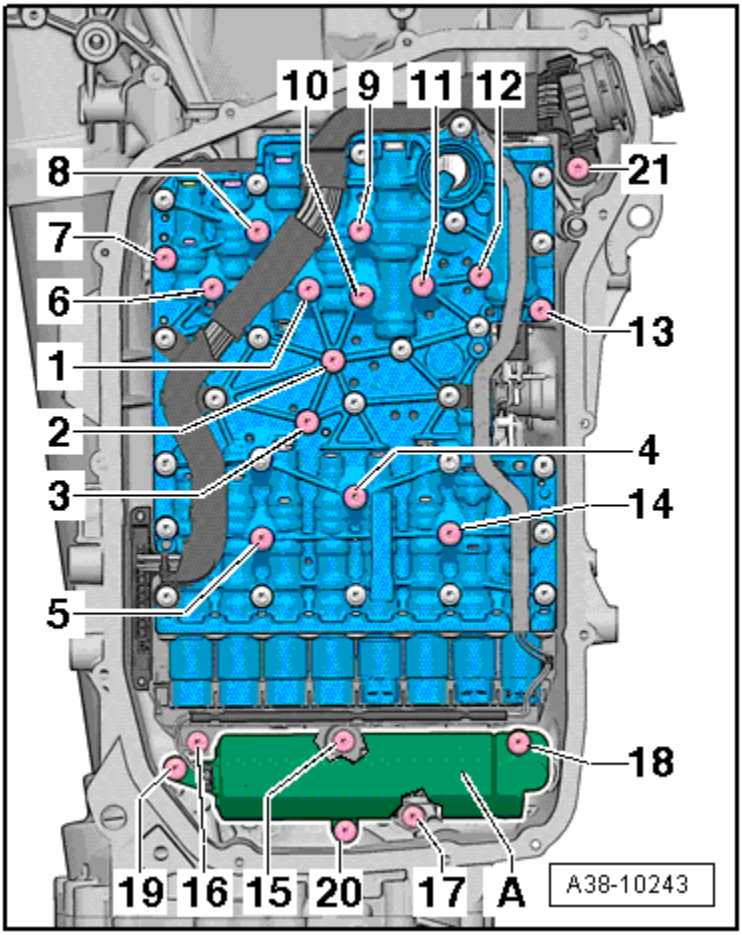
[1] Replace fastener(s).

Mechatronic Tightening Specification without Hydraulic Pulse Memory



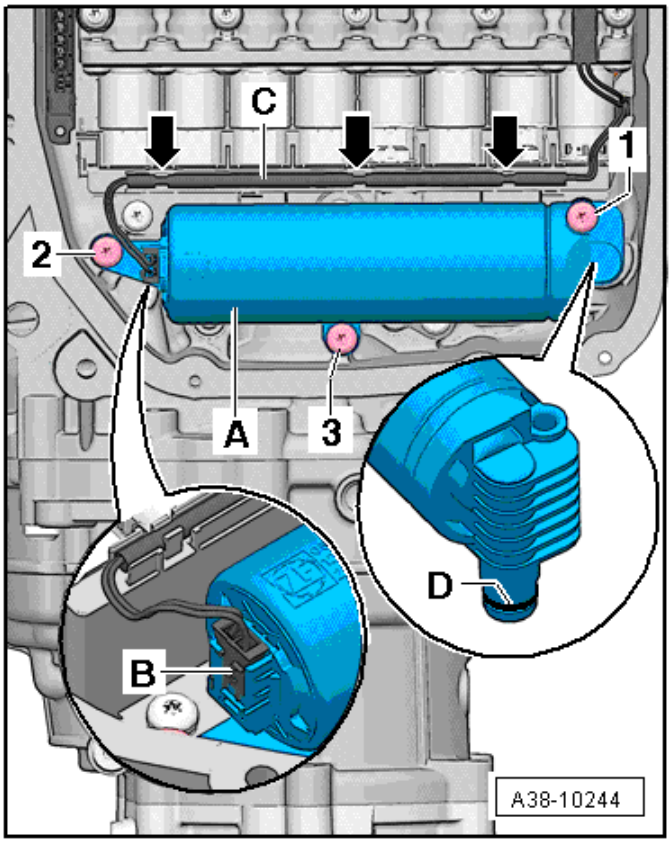
Component	Nm
Tighten bolts 1 through 19 in sequence	10

Mechatronic Tightening Specifications with Hydraulic Pulse Memory



Component	Nm
Tighten bolts 1 through 17 in sequence	10
Tighten bolts 18 through 21 in sequence	10

Hydraulic Pulse Memory Tightening Specifications



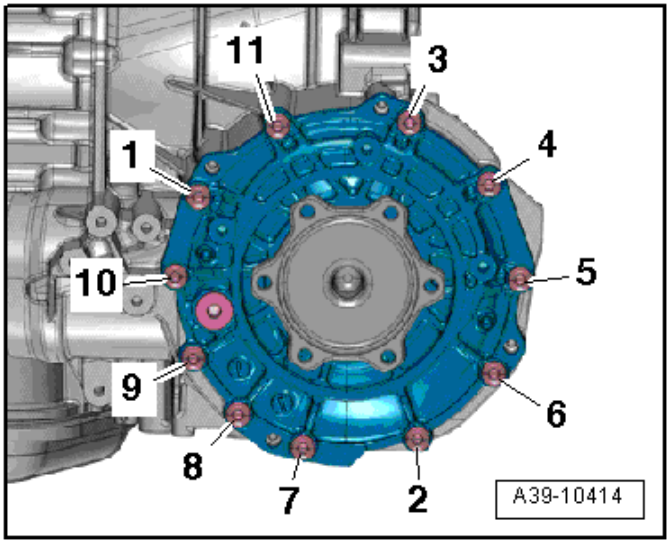
Step	Component	Nm
1	Tighten bolts 1 to 3 in sequence	10

Rear Final Drive, Differential – 0BK

Fastener Tightening Specifications

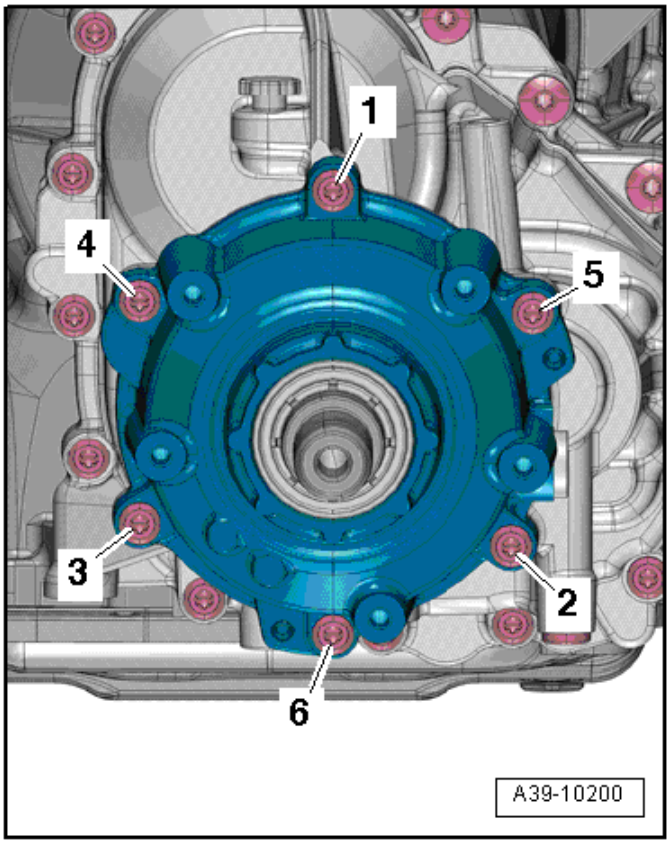
Component	Nm
Automatic Transmission Fluid (ATF) drain plug (in the transmission)	30
Automatic Transmission Fluid (ATF) oil drain plug (in the transmission)	12
Gear carrier	9 plus an additional 60° (⅙ turn)
Transmission fluid drain plug (inside the front final drive)	27
Transmission fluid drain plug (inside the transfer case)	27
Transmission fluid oil drain plug (inside the front final drive)	10
Transmission fluid oil drain plug (inside the transfer case)	12

Front Final Drive Cover Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 and 6	3
2	Tighten bolts 1 through 11 in sequence	27

Center Differential Housing Tightening Specifications



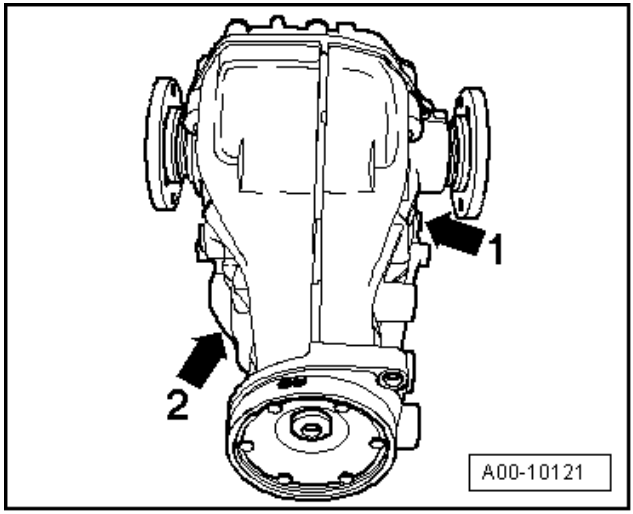
Step	Component	Nm
1	Tighten bolts 1 and 6 [1)]	3
2	Tighten bolts 1 through 6 in sequence [1)]	10
3	Tighten bolts 1 through 6 in sequence	an additional 90° (¼ turn)

[1)] Replace fastener(s).

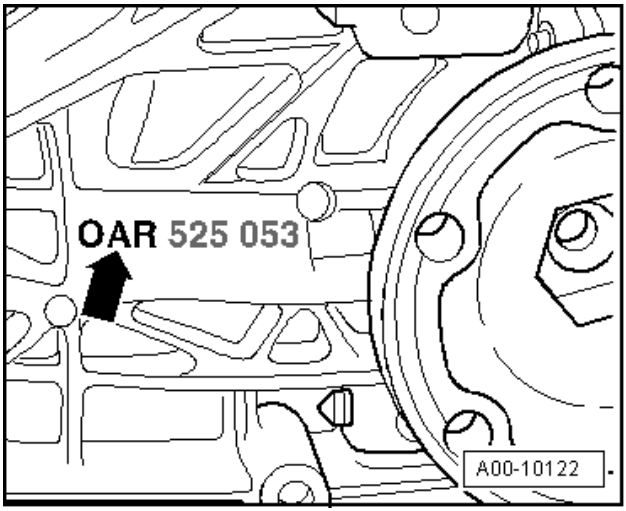
REAR FINAL DRIVE – 0BC

General, Technical Data

Rear Final Drive Identification



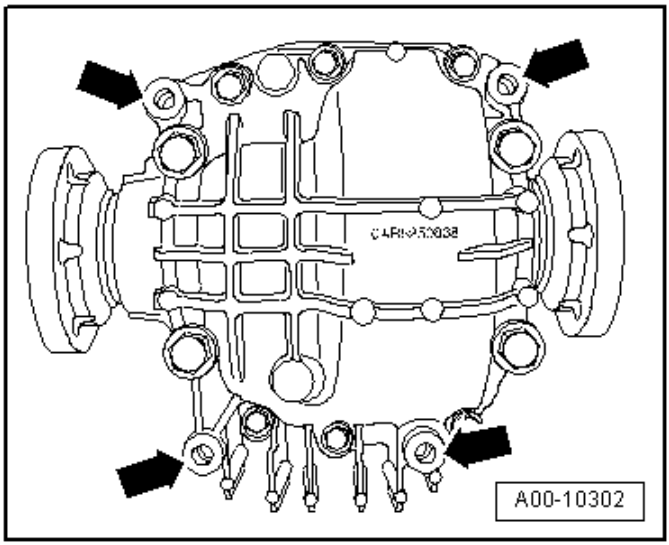
0BC final drive and 0AR (1).
Code and build date (2).



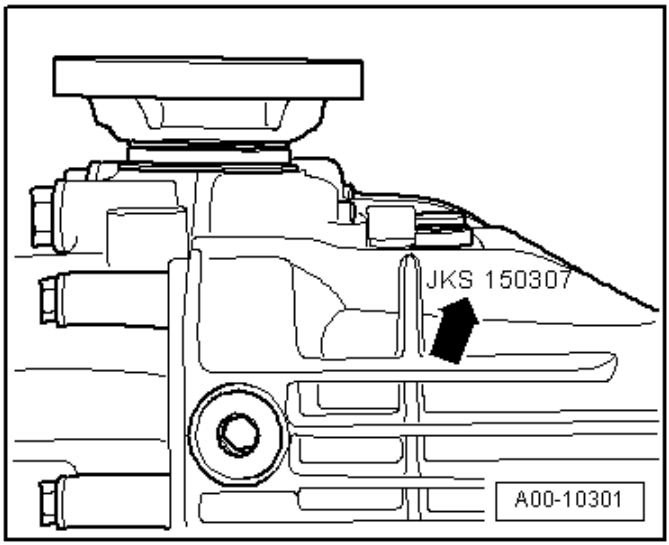
Final drive 0BC and 0AR (➡). 0AR shown.

Note: 0AR is always on the rear final drive housing. The changes to the housing are what differentiate the 0BC final drive from the 0AR final drive.

Rear Final Drive Identification *(cont'd)*



The 0BC final drive housing has four threaded holes (➡) used for attaching the cross member. An additional threaded hole under the flange/driveshaft attaches the final drive to the subframe.



Example:	JKS	15	03	07
	Code letters	Day	Month	Year of manufacture -2007

Rear Final Drive Transmission Allocations, Ratios, Capacities

Rear final drive		**0BC**
Code letters		KCC
Ratio	Final drive $Z_2 : Z_1$	43:13 = 3.308
Driveshaft flange diameter		75.5 mm
Gear oil capacity		0.9 liters

The following information can be found in the Electronic Parts Catalog (ETKA):

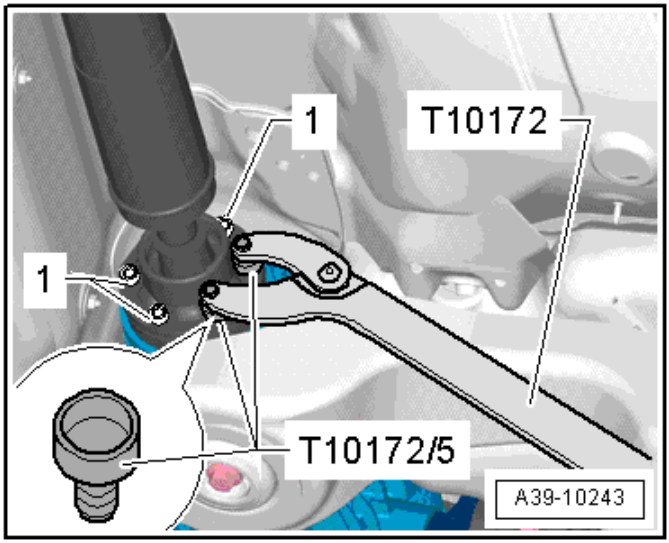
- Date of manufacture
- Gear oil specification
- Engine, manual transmission and automatic transmission allocation using code letters and PR numbers.

Fastener Tightening Specifications

Component	**Nm**
Backing plate-to-driveshaft [1)]	30 plus an additional 90° (¼ turn)
Balance weight to rear final drive	22
Check plug for rear final drive	30
Crossmember to rear final drive	55
Driveshaft heat shield	24
Heat Shield to crossmember	20
Intermediate bearing bracket	20
Subframe-to-frame	55
Subframe-to-rear final drive	95

[1)] Replace fastener(s).

Driveshaft to Rear Final Drive
Tightening Specification



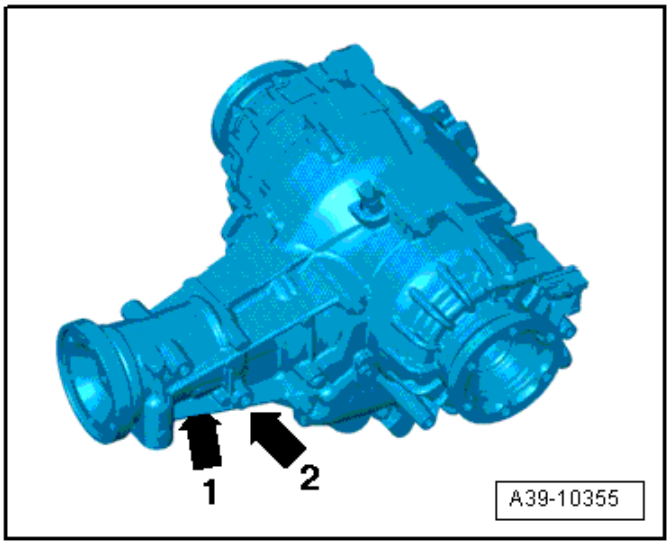
Step	Component	Nm
1	Tighten bolts 1	Next to the color dot 30 [1]
2	Tighten bolts 1	30
3	Tighten bolts 1	an additional 90° (¼ turn)

[1] By doing this, the CV joint is pushed slightly to the opposite side and imbalance is avoided.

REAR FINAL DRIVE – 0BE, 0BF

General, Technical Data

Rear Final Drive Identification

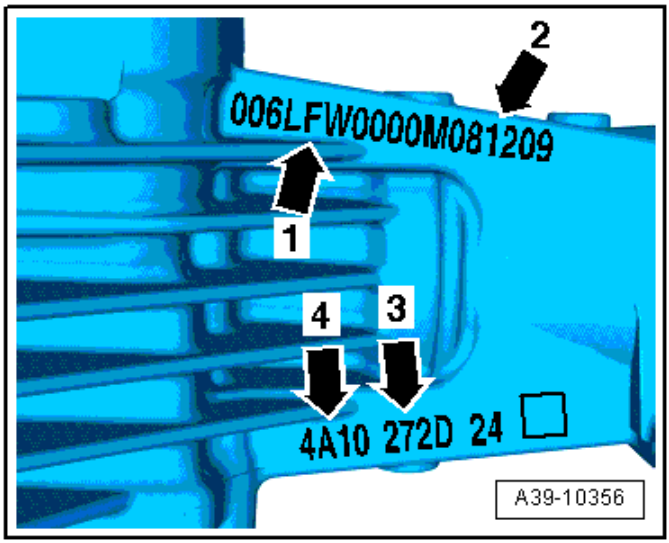


Clutch classification (1).

Code and build date (2).

Note: The rear final drive 0BE and 0BF have a hydraulic control unit with the side chambers.

Rear Final Drive Identification *(cont'd)*



1-Code letters LFW (example: 0BD 500 043A)
2-Rear final drive date of manufacture (example below)
3-Right clutch classification (classification of the clutch friction values) Example: 272D
4-Left clutch classification (classification of the clutch friction values) Example: 4A10

Example:	**08**	**12**	**09**
	Year of manufacture 2008	Month	Day

NOTE: When replacing a rear final drive, pay close attention to the final drive code, the PR number and the engine code. Refer to the Electronic Parts Catalog (ETKA). This is the only way to make sure the allocation is correct.

Rear Final Drive Allocations, Ratios, Capacities

Rear final drive		0BF
Code letters		MKV
Allocation	Engine	4.2L - 273 kW FSI 6.3L - 368 kW FSI
Ratio	Final drive $Z_2 : Z_1$	43:13 = 3.308
Driveshaft flange diameter		75.5 mm
Gear oil capacity For the final drive (differential and pinion) No change interval		Refer to the Fluid Capacity Tables Rep. Gr. 03
Gear oil specification		Refer to the Electronic Parts Catalog
Automatic Transmission Fluid (ATF) capacity for the hydraulic control unit and chambers No change interval		Refer to the Fluid Capacity Tables Rep. Gr. 03
Automatic Transmission Fluid (ATF) specification		Refer to the Electronic Parts Catalog

Rear Final Drive, Differential – 0BE, 0BF

Fastener Tightening Specifications

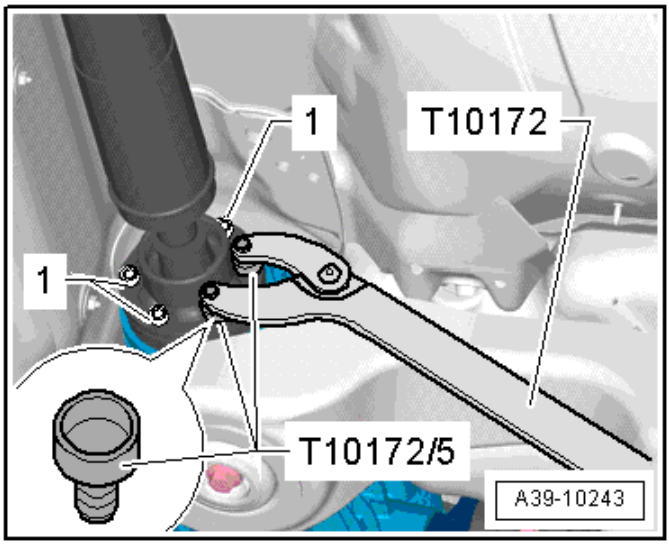
Component	Nm
All Wheel Drive (AWD) clutch valve-to-hydraulic control unit housing bolt	2.5
All Wheel Drive (AWD) pump-to-hydraulic control unit housing bolt	5
Automatic Transmission Fluid (ATF) drain plug-to-final drive housing	15
Automatic Transmission Fluid (ATF) inspection plug-to-left chamber	15
Center bearing	20
Drive axle heat shield-to-rear final drive bolt	20
Driveshaft center bearing-to-body bolt	20
Driveshaft heat shield	24
Driveshaft-to-rear final drive flange bolt [1)]	30 plus an additional 90° (¼ turn)
Driveshaft-to-transmission flange bolt [1)]	30 plus an additional 90° (¼ turn)

Fastener Tightening Specifications *(cont'd)*

Component	Nm	
Flange shaft-to-rear final drive bolt [1]	50 plus an additional 180° (½ turn)	
Gear oil inspection plug-to-final drive housing	15	
Hydraulic control module-to-final drive housing bolt	M8 [2]	20
	M8 [3]	20
	M8 [4]	30
Left pipe installed between the hydraulic control unit and the left chamber nuts	30	
Left/right chamber-to-final drive housing bolt	24	
Oil pressure/temperature sensor-to-hydraulic control unit housing	10	
Right pipe installed between the hydraulic control unit and the right chamber nuts	30	
Shuttle valve-to-hydraulic control unit housing	8	
Subframe-to-rear final drive lower bolt	55	
Subframe-to-rear final drive rear bolt	95	
Wiring harness bracket	9	
Wiring harness bracket-to-right chamber bolt	5	
Wiring harness bracket-to-rear final drive	9	

[1] Replace fastener(s).
[2] 50 mm long.
[3] 50 mm long with a permanent seal under the bolt head.
[4] 30 mm long.

Driveshaft to Rear Final Drive Tightening Specification



Step	Component	Nm
1	Tighten bolts 1	Next to the color dot 30 [1]
2	Tighten bolts 1	30
3	Tighten bolts 1	an additional 90° (¼ turn)

[1] By doing this, the CV joint is pushed slightly to the opposite side and imbalance is avoided.

SUSPENSION, WHEELS, STEERING

General, Technical Data

Chassis

Front axle	Five-link front axle, transverse stabilizer, air spring damper with variable levels and damping characteristics, guide links with hydraulic damping mounts
Rear axle	Track-controlled axle, upper and lower transverse link, transverse stabilizer, independent suspension, air spring damper with variable levels and damping characteristics

FWD/AWD		**Standard suspension (1BK) [1]**	**Sport suspension (2MA/2MB) [2]**	**Heavy duty suspension (1BY) [3]**
Wheelbase	mm	2992	2994	2991
Front track	mm	1644	1632	1643
Rear track	mm	1635	1623	1634
Maximum steering angle at inner wheel	Degree	39.8	39.8	39.8

[1] Suspension in the “Comfort” level.
[2] Suspension in the “Sport” level.
[3] Suspension in the “heavy duty suspension” level.

NOTE: The specified values apply to all engine versions.
Tracks change with use of wheels with different offset.

Steering

Steering gear	Maintenance-free rack and pinion steering with speed-dependent servo assist
Turning diameter	Approximately 12.30 meters

Front Suspension

Fastener Tightening Specifications

Component	Fastener size	Nm
Adapter-to-subframe bolt	-	20
Air spring shock absorber-to-shock absorber fork bolt [1]	-	40 plus an additional 180° (½ turn)
Air spring shock absorber-to-suspension strut dome nut [1] [5]	-	30
Ball joint-to-track control arm nut [1]	-	120
Ball joint-to-wheel bearing housing bolt [1]	-	40
Air line connecting piece with the residual pressure retaining valve	-	3
Constant Velocity (CV) joint boot clamp	-	20
Control arm-to-wheel bearing housing nut [1]		120
Coupling rod-to-shock absorber fork bolt [1] [3]	-	40 plus an additional 90° (¼ turn)
Coupling rod-to-stabilizer bar bolt [1] [3]	-	40 plus an additional 90° (¼ turn)
Drive axle-to-transmission bolt [1]	M10	70
	M12	90 plus an additional 90° (¼ turn)
Drive axle-to-wheel hub bolt [1]	-	200 plus an additional 180° (½ turn)
Guide link-to-subframe nut [1] [3]	-	70 plus an additional 180° (½ turn)
Guide link-to-wheel bearing housing nut [1]	-	120
Heat shield-to-subframe bolt	-	9
Level control system sensor bolt	-	9
Outer Constant Velocity (CV) joint	-	200 plus an additional 180° (½ turn)
Power steering hose-to-subframe bolt	-	9
Protection bracket-to-subframe bolt	-	23
Shock absorber fork-to-track control arm nut [1] [3]	-	90 plus an additional 90° (¼ turn)
Stabilizer bar-to-subframe nut [1] [4]	-	35

Fastener Tightening Specifications *(cont'd)*

Component	Fastener size	Nm
Subframe crossbrace-to-subframe bolt [1]	-	90 plus an additional 180° (½ turn)
Subframe-to-body bolt [1] [2]	-	115 plus an additional 90° (¼ turn)
Tie rod end-to-wheel bearing housing nut [1]	-	130
Tower brace mounting bolt [6]	-	10
	-	25
	-	50
Track control arm-to-subframe nut [1] [3]	-	70 plus an additional 180° (½ turn)
Upper control arm-to-suspension strut dome bolt [1] [3]	-	50 plus an additional 90° (¼ turn)
Upper control arm-to-wheel bearing housing nut [1]	-	40
Wheel bearing-to-wheel bearing housing bolt [1]	-	80 plus an additional 90° (¼ turn)

[1] Replace fastener(s).
[2] Remove and tighten diagonally and in steps.
[3] For bolt tightening clarification, refer to ElsaWeb, *Wheel Bearing, Raising to Control Position to Tighten Bolts*.
[4] Remove and install the nuts alternating from side to side.
[5] Tighten in the curb weight position.
[6] For bolt tightening clarification, refer to ElsaWeb, *Air Spring Damper, Shock Absorber Fork, Upper Control Arm and Tower Brace Overview,* items 3, 4 and 6.

Rear Suspension

Fastener Tightening Specifications

Component	Fastener size	Nm
Air spring damper boot clamp	-	8
Air spring damper-to-body nut [1) 4)]	-	30
Air spring shock absorber-to-wheel bearing housing bolt [1)]	-	100 plus an additional 180° (½ turn)
Brace-to-subframe bolt	-	17
Brake disc cover plate-to-wheel bearing housing bolt	-	10
Brake disc-to-wheel hub bolt	-	5
Constant Velocity (CV) joint boot clamp	-	20
Coupling rod-to-lower transverse link bolt [1) 2)]	-	40 plus an additional 90° (¼ turn)
Coupling rod-to-stabilizer bar bolt [1) 2)]	-	40 plus an additional 90° (¼ turn)
Drive axle-to-rear final drive bolt	M10	70
Drive axle-to-wheel hub collar bolt [1)]	-	200 plus an additional 180° (½ turn)
Level control system sensor bolt	-	9
Lower transverse link-to-subframe bolt [1) 2)]	-	70 plus an additional 180° (½ turn)
Lower transverse link-to-wheel bearing housing bolt [1) 2)]	-	120 plus an additional 360° (1 full turn)
Stabilizer bar-to-subframe bolt [1) 3)]	-	25 plus an additional 90° (¼ turn)
Subframe-to-body bolt [1)]	-	115 plus an additional 90° (¼ turn)
Tie rod-to-subframe nut [1) 2)]	-	95
Tie rod-to-wheel bearing housing bolt [1) 2)]	-	90 plus an additional 90° (¼ turn)
Upper transverse link-to-subframe bolt [1) 2)]	-	70 plus an additional 180° (½ turn)

Fastener Tightening Specifications *(cont'd)*

Component	Fastener size	Nm
Upper transverse link-to-wheel bearing housing nut [1) 2)]	-	95
Wheel bearing-to-wheel bearing housing bolt [1)]	-	80 plus an additional 90° (¼ turn)

1) Replace fastener(s).
2) Tighten in the curb weight position.
3) Tighten evenly.
3) Tighten diagonally.

Self-Leveling Suspension

Fastener Tightening Specifications

Component	Fastener size	Nm
Air spring damper connecting piece	-	3
Air supply unit connecting piece	-	3
Air supply unit-to-bracket threaded sleeve	-	7.5
Air supply unit-to-retainer bolt	-	9
Muffler nut	-	5
Pressure reservoir bolt	-	9
Pressure reservoir connecting piece	-	5
Solenoid valve block-to-bracket bolt	-	3.5
Solenoid valve connecting piece	10 mm	2
	12 mm	3
Spare wheel well bracket nut	-	9
Spare wheel well cover nut	-	2.5
Stone chip protective molding nut	-	9
Wiring connector connecting piece	-	5

Wheels, Tires

Fastener Tightening Specifications

Component	Fastener size	Nm
Active steering control module bracket nut	-	2.5
Active steering control module to bracket bolt	-	8
Distance regulation control module bracket bolt	-	2.5
Night vision camera-to-retaining plate bolt	-	5
Night vision camera retaining plate-to-bumper bolt	-	6

Wheel Alignment Data

Wheel Alignment Specified Values

The specified values are for all vehicles except those equipped with an 8-cylinder TDI or 12-cylinder FSI engine

Front Axle	Standard suspension (1BK)	Sport suspension (2MA/2MB)	Heavy duty suspension (1BY)
Camber	- 56′± 23′	- 1°7′± 23′	- 48′± 23′
Maximum permissible difference between both sides	30′	30′	30′
Toe per wheel (adjustment value)	+ 10′ ± 5′	+ 10′ ± 5′	+ 10′ ± 5′
Toe per wheel (control value)	+ 10′ ± 6′	+ 10′ ± 6′	+ 10′ ± 6′
Toe differential angle at 20° [1)]	1° 49′ ± 30′	1° 49′ ± 30′	1° 49′ ± 30′
Outer wheel steering angle at maximum steering angle	33° 24′ $^{+\,1°\,30'}_{-\,2°}$	33° 24′ $^{+\,1°\,30'}_{-\,2°}$	33° 24′ $^{+\,1°\,30'}_{-\,2°}$
Inner wheel steering angle at maximum steering angle	39° 48′ $^{+\,1°\,30'}_{-\,2°}$	39° 48′ $^{+\,1°\,30'}_{-\,2°}$	39° 48′ $^{+\,1°\,30'}_{-\,2°}$

[1)] The wheel stop on the outer wheel is reduced by this amount. Depending on the computer manufacturer, the toe-out angle difference can be indicated negatively in the alignment computer.

Wheel Alignment Specified Values *(cont'd)*

Rear Axle	Standard suspension (1BK)	Sport suspension (2MA/2MB)	Heavy duty suspension (1BY)
Camber	- 1°15′ ± 25′	- 1°20′ ± 25′	- 1°15′ ± 25′
Maximum permissible difference between both sides	30′	30′	30′
Toe for each wheel	+ 12′ ± 5′	+ 12′ ± 5′	+ 12′ ± 5′
Total toe	+ 24′ ± 10′	+ 24′ ± 10′	+ 24′ ± 10′
Maximum permissible deviation in direction of travel relative to vehicle longitudinal axis	10′	10′	10′

The specified values are for vehicles equipped with a 12-cylinder FSI engine.

Front Axle	Standard suspension (1BK)	Sport suspension (2MA/2MB)	Heavy duty suspension (1BY)
Camber	- 56′± 23′	- 1°7′± 23′	- 48′± 23′
Maximum permissible difference between both sides	30′	30′	30′
Toe per wheel (adjustment value)	+ 12′ ± 5′	+ 12′ ± 5′	+ 12′ ± 5′
Toe per wheel (control value)	+ 12′ ± 6′	+ 12′ ± 6′	+ 12′ ± 6′
Toe differential angle at 20° [1)]	1° 49′ ± 30′	1° 49′ ± 30′	1° 49′ ± 30′
Outer wheel steering angle at maximum steering angle	33° 24′ $^{+ 1° 30'}_{- 2°}$	33° 24′ $^{+ 1° 30'}_{- 2°}$	33° 24′ $^{+ 1° 30'}_{- 2°}$
Inner wheel steering angle at maximum steering angle	39° 48′ $^{+ 1° 30'}_{- 2°}$	39° 48′ $^{+ 1° 30'}_{- 2°}$	39° 48′ $^{+ 1° 30'}_{- 2°}$

1) The wheel stop on the outer wheel is reduced by this amount. Depending on the computer manufacturer, the toe-out angle difference can be indicated negatively in the alignment computer.

Rear Axle	Standard suspension (1BK)	Sport suspension (2MA/2MB)	Heavy duty suspension (1BY)
Camber	- 1°15′ ± 25′	- 1°20′ ± 25′	- 1°15′ ± 25′
Maximum permissible difference between both sides	30′	30′	30′
Toe for each wheel	+ 12′ ± 5′	+ 12′ ± 5′	+ 12′ ± 5′
Total toe	+ 24′ ± 10′	+ 24′ ± 10′	+ 24′ ± 10′
Maximum permissible deviation in direction of travel relative to vehicle longitudinal axis	10′	10′	10′

Steering

Fastener Tightening Specifications

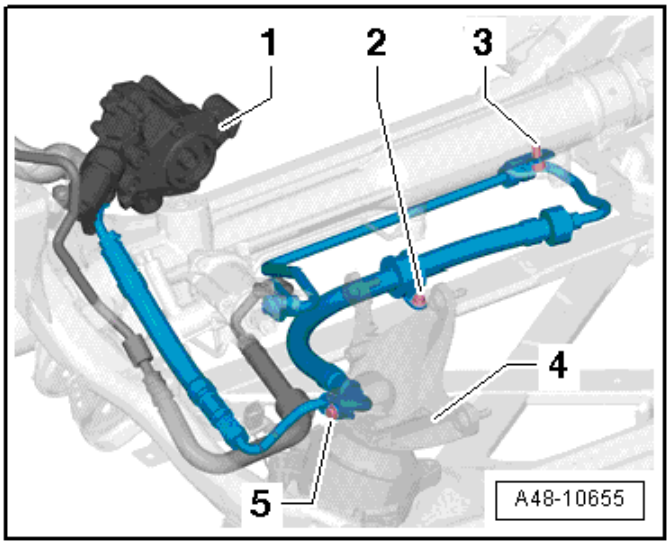
Component	Nm
Belt Pulley to Power Steering Pump Bolt (6-Cylinder)	22
Belt pulley-to-power steering pump bolt (12-cylinder)	23
Electro-Mechanical Steering Gear with Tie Rods [1)]	
- Bolt to subrame	80 plus an additional 180° (½ turn)
- Nut to wheel bearing housing	100
Electronic steering column lock control module-to-steering column bolt	5
Hose and line-to-body mounting bolt	9
Hydraulic fluid cooler bolt	4.5
	5
Lower reservoir-to-body bolt	9
Power adjustable steering column control module-to-steering column bolt	5
Power assisted steering gear with tie rods-to-wheel bearing housing nut [1)]	130
Power steering pressure line-to-pump bolt (without dynamic steering)	
- 8-cylinder	20
-12-cylinder	9

Fastener Tightening Specifications *(cont'd)*

Component	Nm
Power steering pressure line-to-pump union nut (with dynamic steering)	40
Power steering pressure line-to-steering gear bolt	20
Power steering pressure line bracket-to-steering gear bolt	20
Power steering pressure line union bolt	40
Power steering pump bracket-to-engine bolt (12-cylinder)	23
Power steering pump-to-bracket bolt (12-cylinder)	23
Power steering pump-to-engine bolt (8-cylinder)	25
Pressurized line union nut (8-cylinder)	40
Protective boot bolt	4
Upper reservoir-to-body bolt	4.5
	9
Servotronic solenoid valve	3
Steering column-to-central tube bolt	20
Steering gear-to-subframe bolt [1)]	80 plus an additional 180° (½ turn)
Steering intermediate shaft-to-steering column bolt [1)]	30
Steering intermediate shaft-to-steering gear bolt [1)]	30
Steering wheel-to-steering column bolt [1)]	30 plus an additional 90° (¼ turn)
Tie rod-to-steering gear	105
Tie rod end-to-tie rod nut	60
Tie Rod End to Steering Gear ((Electro-Mechanical Steering Gear)	100
Tie Rod End to Tie Rod Nut (Electro-Mechanical Steering Gear)	80
Tie rod end-to-wheel bearing housing nut [1)]	130

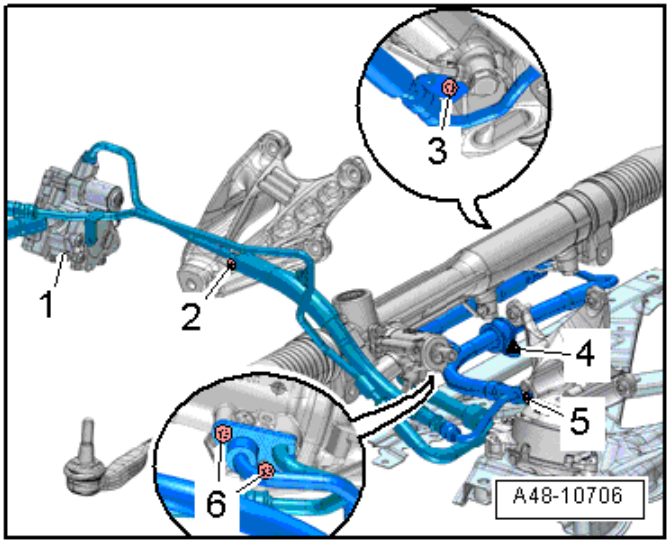
[1)] Replace fastener(s).

Pressure Line from the Power Steering Pump to the Power Steering Gear (8-Cylinder)



Step	Component	Nm
1	Tighten bolts 3 and 5 in sequence	9
2	Tighten nut 2	9

Pressure Line from the Power Steering Pump to the Power Steering Gear (12-Cylinder)

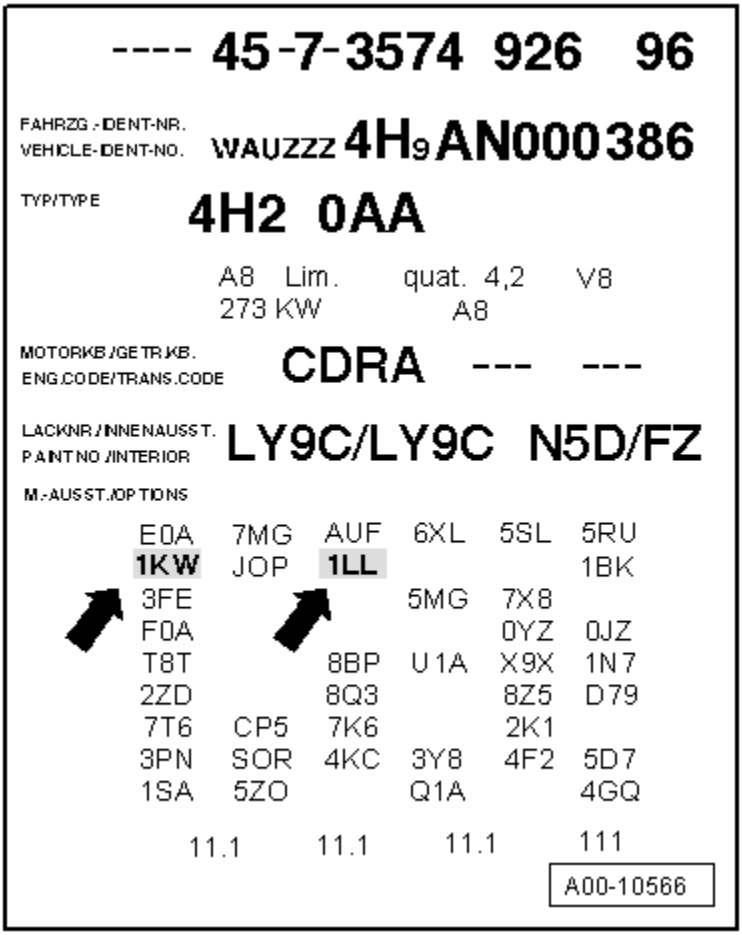


Step	Component	Nm
1	Tighten bolts 2 and 5 in sequence	9
2	Tighten bolts 3 and 6 in sequence	20
3	Tighten nut 4	9

BRAKE SYSTEM

General, Technical Data

Vehicle Data Label



The brake system installed in a vehicle is indicated (➡) on the vehicle data label by the Production Relevant No. (PR No.).

Technical Data

Brake system
Dual-circuit brake system with diagonal distribution and ABS, EBV, EDL, ASR, ESP, ECD and electromechanical parking brake

Front wheel brake				
Brake		**(17")**	**(18")**	**(19")**
Production Relevant No. (PR. No.)		1LL/ 1LM	1LJ/ 1LK	1LW/ F4S
Brake disc ventilated	Dia. mm	356	380	400
Brake disc thickness	mm	34	36	38
Brake disc wear limit	mm	32	34	36
Brake pad thickness with backing plate and dampening sheet	mm	20.2	20.2	20.2
Brake pad wear limit with backing plate and dampening sheet	mm	9	9	9

Rear wheel brake				
Brake		**(17")**	**(18")**	**(19")**
Production Relevant No. (PR. No.)		1KW	1KY/1KZ	F4S
Brake disc ventilated	Dia. mm	330	356	380
Brake disc thickness	mm	22	22	30
Brake disc wear limit	mm	20	20	28
Brake pad thickness with backing plate and dampening sheet	mm	17.45	17.45	17.45
Brake pad wear limit with backing plate and dampening sheet	mm	8	8	8

Ceramic Front Brakes		
Production Relevant No. (PR. No.)		F4S
Brake disc ventilated	Dia. mm	400
Brake disc thickness	mm	38
Brake disc wear limit		The minimum dimension for the brake rotor thickness is stamped on the brake rotor cup. Use this when checking for wear.
Brake caliper, 6 piston monoblock	Dia. mm	2 x 32/ 36/ 38

Anti-lock Brake System (ABS)

Fastener Tightening Specifications

Component	Nm
ABS control module-to-ABS hydraulic unit bolt [1)]	4.5
ABS wheel speed sensor-to-wheel bearing housing bolt	9
Brake line-to-hydraulic unit	
- 5 mm brake lines	12
- 8 mm brake lines	20
Sensor electronics control module nut	9

[1)] Replace fastener(s).

Mechanical Components

Fastener Tightening Specifications

Component	Nm
Brake disc cover plate-to-wheel bearing housing bolt (PR-1LN and 1LP)	10
Brake disc-to-wheel hub bolt	
- Front, PR-1LL and 1LM	9
- Front, PR-1LN and 1LP	5
- Rear	5
Brake pedal mounting pin bolt	8
Electromechanical parking brake control module nut	10
Electromechanical parking brake motor-to-rear caliper bolt	12
Front brake line	
- To brake hose	12
- To brake caliper	19
Front brake caliper guide pin (PR-1LL and 1LM)	55
Front brake caliper-to-wheel bearing housing bolt (PR-1LN and 1LP)	196
Front brake carrier bolt (PR-1LL and 1LM) [1)]	196
Gas pedal module-to-mounting bracket bolt	8
Mounting bracket nut	8
Mounting bracket-to-steering bolt	20
Rear brake caliper-to-guide pin bolt [1)]	35
Rear brake carrier bolt [1)]	100 plus an additional 90° (¼ turn)
Rear brake hose	
- To brake pipe	12
- To brake caliper	19
Rear brake hose bracket bolt	10

Fastener Tightening Specifications *(cont'd)*

Component	Nm
Trim and balance spring-to-front brake caliper bolt (PR-1LL and 1LM)	22

1) Replace fastener(s).

Hydraulic Components

Hydraulic Tightening Specifications

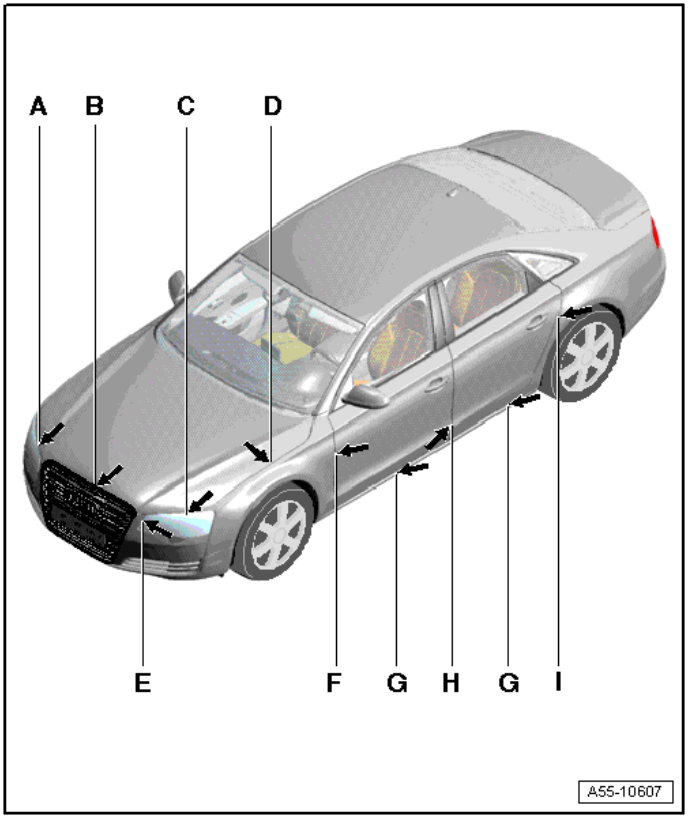
Component	Nm
Ball head-to-brake booster	30
Brake booster-to-mounting bracket bolt	23
Brake line	
- To brake master cylinder	24
- To hydraulic unit (Ø 5 mm brake lines)	12
- To hydraulic unit (Ø 8 mm brake lines)	20
- To the brake hose	12
- To the brake caliper	19
Brake master cylinder-to-booster nut	49
Brake system vacuum pump bracket nut	9
Mounting bracket-to-steering bolt	20
Rear brake caliper-to-guide pin bolt [1]	35

1) Replace fastener(s).

BODY

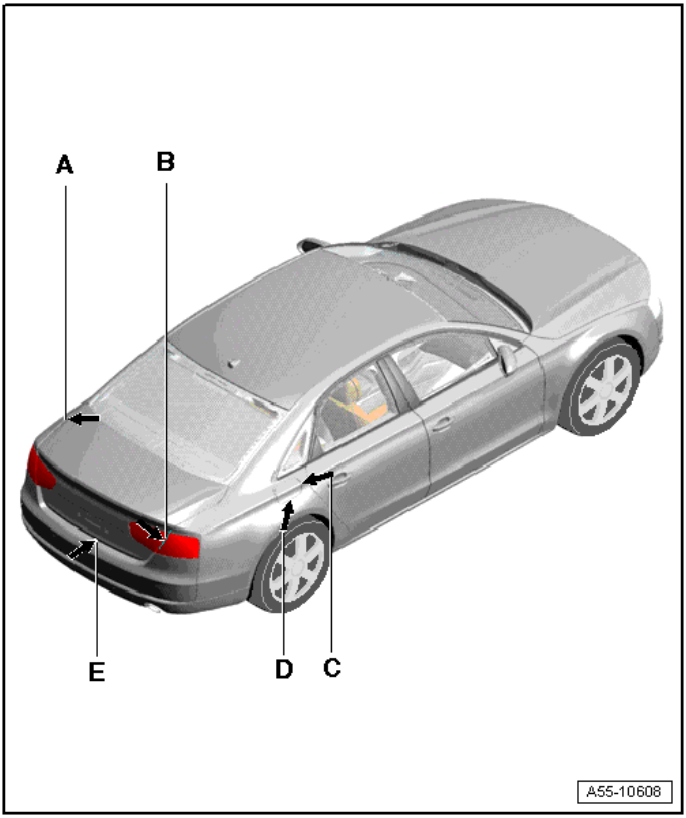
Air Gap Body Dimensions – Coupe

Front Gap Dimensions



Component	mm
A	5.5
B	4.5
C	4.5
D	3.0
E	2.5
F	3.5
G	5.0
H	4.5
I	3.5

Rear Gap Dimensions



Component	mm
A	3.5
B	3.5
C	2.5
D	2.5
E	5.0

Lock Carrier and Plenum Chamber Tightening Specifications

Component	Nm
Lock carrier bolts [1)]	9
	23
	24
Plenum chamber bolts	10

[1)] For bolt tightening clarification, refer to ElsaWeb, *Lock Carrier with Attachments Assembly Overview*.

Tower Brace Tightening Specifications

Component	Nm
Tower brace bolts [1)]	10
	25
	50

[1)] For bolt tightening clarification, refer to ElsaWeb, *Tower Brace Assembly Overview*.

Front Fender Tightening Specifications

Component	Nm
Front fender bolts	12
Front fender mount bolts	24
Front fender brace bolts[1)]	9
	23

[1)] For bolt tightening clarification, refer to ElsaWeb, *Front Fender Assembly Overview, removing the fender bracket,* items 2 and 7.

Front Hood Tightening Specifications

Component	Nm
Catch	11
Front hood hinge nuts	32
Front hood gas filled strut ball stud bolts	32
Front hood hinge bolts	21
Hood catch	11

Rear Lid, Fuel Filler Door Tightening Specifications

Component	Nm
Fuel filler door bolts	2
Fuel tank lid unlock motor (V155) cover nut	1.5
Rear lid front adjusting buffer bolts	14
Rear lid handle bracket nuts	6
Rear lid hinge bolts/nuts	34
Rear lid latch nuts	23
Rear lid lock cover bolt	8
Rear lid motor 1 (V444) nuts	20
Rear lid motor 1 (V444) bolts	23

Front Door Tightening Specifications

Component	Nm
Front door handle bolts	2.5
Front door hinge and arrester bolts [1)]	8
	25
	30
	32
	45
Front door lock bolts	19
Front door striker pin bolts	25

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

Rear Door Tightening Specifications

Component	Nm
Rear door handle bolts	2.5
Rear door hinge and arrester bolts [1)]	8
	30
	32
	45
Rear door lock bolts	19
Rear door striker pin bolts	25
Rear door window regulator bolts	6
Rear door window regulator motor (V26) bolts	3.5

[1)] For bolt tightening clarification, refer to ElsaWeb, *Rear Door Assembly Overview*.

Front Bumper and Impact Member Tightening Specifications

Component	Nm
Front bumper cover bolts [1]	1.5
	3
	4
Impact member bolts [2]	7
	9
	23
	30

[1] For bolt tightening clarification, refer to ElsaWeb, *Bumper Cover Assembly Overview.*

[2] For bolt tightening clarification, refer to ElsaWeb, *Impact Member Assembly Overview.*

Rear Bumper and Impact Member Tightening Specifications

Component	Nm
Impact member bolts [1]	36
	40
Rear bumper cover bolts [2]	1.5
	2
	2.5
	4

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

[2] For bolt tightening clarification, refer to ElsaWeb, *Rear Bumper Cover Assembly Overview.*

Sunroof Tightening Specifications

Component	Nm
Panorama sunroof lifter bolts	1
Panorama sunroof shade frame bolts	3
Panorama sunroof slotted guide rail bolts	1
Sliding headliner bolts	1.5
Wind deflector motor bolts	1.5

Front Wheel Spoiler Tightening Specification

Component	Nm
Front wheel spoiler bolts	2.5

Radiator Grille, Front Wheel Housing Liner Tightening Specifications

Component	Nm
Radiator grille bolts	6
Wheel housing liner nuts and bolts	2.5

Rear View Mirror Tightening Specifications

Component	Nm
Mirror adjusting unit bolts	1
Mirror adjusting unit mount bolts	10

Trim Tightening Specifications

Component	Nm
B-pillar trims bolts	2.5
Sill panel cover bolts	8
Sill panel trim molding bracket bolts	1.5

Heat Shield and Tunnel Brace Tightening Specifications

Component	Nm
Heat shield nuts	2.5
Tunnel brace bolts	24

Wheel Housing Liners Tightening Specifications

Component	Nm
Wheel housing liner bolts	2.5

Body Interior

Storage Compartment, Center Console Tightening Specifications

Component	Nm
Center console bolts [1]	1.2
	1.6
	2.5
	4.3
	4.5
Front center armrest bolts	4.5
Glove compartment bolts	3
Glove compartment cover bolts	1.6
Rear center armrest bolts	4.5
Side cover bolts	3
Steering column trim bolts	1.5

[1] For bolt tightening clarification, refer to ElsaWeb, *Front or Rear Center Console Assembly Overview.*

Instrument Panel and Central Tube Tightening Specifications

Component	Nm
Central tube bolts [1]	3
	9
	20
Instrument panel cover bolts	3

[1] For bolt tightening clarification, refer to ElsaWeb, *Instrument Panel Central Tube Assembly Overview*.

Passenger Protection Tightening Specifications

Component	Nm
Airbag control module (J234) nuts	9
Airbag crash sensor bolts [2]	6
	9
	10
Automatic belt retractor bolts [1]	35
Battery interrupt igniter (N253) nuts	15
Belt guide ring bolts [1]	45
Belt height adjustment bolts [1]	23
Driver side knee airbag nuts [1]	8
Front belt anchor bolts	33
Front seat belt guide nuts [1]	2
Front seat belt latch with driver seat belt switch bolt	33

Passenger Protection Tightening Specifications *(cont'd)*

Component	Nm
Front side airbag bolts [1]	8
Passenger airbag screws [1]	9
Passenger side knee airbag bolts [1]	9
Passenger side knee airbag nuts [1]	8
Rear automatic belt retractor bolts [1]	35
Rear belt anchor bolts [1]	45
Rear belt guide ring nuts [1]	30
Rear belt latch bolts [1]	34.5
Rear belt latch nuts [1]	45
Rear center 3-point seat belt latch hex nut [1]	35
Rear outer belt anchor bolts [1]	35
Rear side airbag bolts [1]	8
Rear threaded pins	6
Seat occupied recognition control module (J706) bolts	3.5

[1] Replace fastener(s).

[2] For bolt tightening clarification, refer to ElsaWeb, *Airbag Crash Sensors Overview*.

Interior Trim Tightening Specifications

Component	Nm
B-pillar trim nuts	4.5
Central tube bolt/nut	20
D-pillar trim bolts	3
Front and rear door trim bolts	1.2 – 2.8
Front sill panel trim bolts	4.5
Instrument panel bolts	3
Instrument panel vent bolt	1.5
Luggage compartment trim bolts	1.5
Rear roof grab handle bolts	4.5
Rear shelf bolts	2
Rear window shade bolts	3
Roof grab handle	4.5
Sun visor bolts	3.5
Tie-down eye bolt	4.5
Upper A-pillar trim bolts	4.5

Seat Frames Tightening Specifications

Component	Nm
Adjusting spindle bolt	20
Backrest adjustment motor bolts	3.7

Component	Nm
Backrest adjustment motor nuts	6
Backrest bracket and frame bolts	6.5
Backrest-to-seat pan bolts	33
Belt guide bolts	10
Center seat cushion hook nuts [1]	8
Footrest bolts	2.5
Front backrest self-locking screws [1]	33
Front seat frame bolts [1]	50
Front seat mount bolts	25
Headrest height adjustment motor bolts/nuts	10
Lumbar support pressure distribution plate bolts	2.5
Passenger footrest adjustment motor bolts	5
Power headrest bolts	5
Safety ground lock bolts	28
Rear bench seat bolts	45
Rear seat backrest retaining bracket nuts	20
Rear seat cover bolts	8
Rear seat forward/back adjustment motor bolts	8
Retaining plated-to-lower seat pan frame	28
Seat angle adjustment motor bolt	20
Seat angle adjustment motor screws	10
Seat height adjuster screws	8
Seat height adjustment motor [1] [2]	10
	20
	22 [3]
Seat side piece trim bolts	3.5
Seat tunnel side trim bolts	6.5
Upper seat pan frame bolts [1]	22

[1] Replace fastener(s).

[2] For bolt tightening clarification, refer to ElsaWeb, *Seat Height Adjustment Motor Overview*.

[3] Left hand thread.

HEATING, VENTILATION & AIR CONDITIONING

General, Technical Data

Refrigerant Oil Distribution

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

Refrigerant R134a Vapor Pressure Table

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

Temperature in °C	Pressure in bar (positive pressure) of R134a
80	25.21
85	28.14
90	31.34

Air Conditioning

Fastener Tightening Specifications

Component	Fastener size	Nm
A/C pressure/temperature sensor	-	5
Bracket for (V50) and (N82/N279)	-	8
Compressor driveshaft	-	60
Compressor drive plate	-	30
Compressor drive plate socket head bolt	-	10
Compressor mounting bolts	-	25
Compressor pulley drive plate bolt	-	20
Compressor refrigerant lines	M6	9
	M8	25
Condenser refrigerant lines	M6	10
	M8	20
Condenser refrigerant line bracket	-	5
Denso oil drain plug	-	30
Denso pressure relief valve	-	10
Dryer cartridge retaining bolt	-	2
Evaporator line connector	-	5
Front expansion valve retaining plate bolts	-	10
Rear expansion valve retaining plate bolts	M6	10
Rear refrigerant line bracket-to-center tunnel	M8	10
Refrigerant line connection points	M6	10
	M8	20
Refrigerant lines-to-front expansion valve	-	10
Refrigerant lines-to-rear expansion valve	M6	10
	M8	20
Windshield defogger control module	-	6

ELECTRICAL SYSTEM

Communication Equipment

Communication Tightening Specifications

Component	Nm
Antenna amplifier-to-D-pillar screw	2
Center speaker-to-instrument panel screw	1.5
Digital sound system control module bracket nut [2]	4
Digital sound system control module bracket-to-rear panel nut [1]	4
Digital sound system control module bracket-to-rear panel screw [1]	3
Digital sound system control module bracket-to-rear panel screw [2]	4
Digital sound system control module 2 bracket-to-rear panel nut [2]	4
Display mount-to-instrument panel screw	3
DVD changer bracket screw	4
Effects speaker-to-rear panel screw [1]	2.5
Effects speaker-to-rear panel screw [2]	3
Front bass speaker-to-front door screw	3
Front information display control head-to-display mount screw	1.3
Front mid-range speaker-to-front door screw	3
Front treble speaker-to-instrument panel screw	1.5
Multifunction button-to-steering wheel screw	1.2
Multimedia display unit-to-bracket screw	4
Radio bracket-to-rear panel nut	4
Rear bass speaker-to-rear door screw [2]	3
Rear mid-bass speaker-to-rear door screw [1]	3
Rear mid-range speaker-to-rear door screw [2]	3
Rearview camera-to-handle button nut	8
Roof antenna-to-roof screw	6
Subwoofer-to-rear panel screw [1]	2.5
Subwoofer-to-rear panel screw [2]	3
Telephone baseplate-to-center armrest storage compartment screw	1
Tiptronic downshift button-to-steering wheel screw	1.2

[1] BOSE® system only
[2] Bang & Olufsen® system only

Electrical Equipment

Battery, Starter, Generator, Cruise Control Tightening Specifications

Component	Nm
Battery jump start terminal mount	4
Battery positive cable-to-jump start terminal nut	8
Battery positive cable from battery-to-jump start terminal nut	20
Battery terminal clamp nut	6
Generator coolant pipes retaining plate	9
Generator mounting bolt	23
Wiring harness mount[1)]	10
Terminal 30/B+ generator nut	16
Terminal 30/B+ starter nut	18
Tool kit cover retainer bolts	18
Voltage stabilizer nut	3

[1)] For bolt tightening clarification, refer to ElsaWeb, *Battery Jump Start Terminal and Positive Terminal Overview,* items 1, 2, 3 and 18.

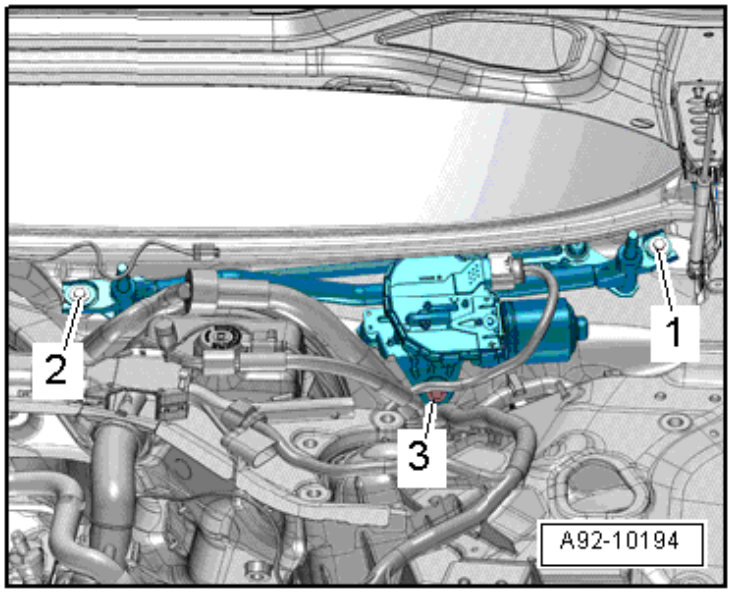
Instruments Tightening Specifications

Component	Nm
Converter with socket (12V, 110V) screws	1.2
Instrument cluster-to-instrument panel	3
Luggage compartment 12 V outlet trim panel nut	2
Signal horn bracket-to-body	11
Signal horns-to-bracket	11

Windshield Wiper/Washer Tightening Specifications

Component	Nm
Washer fluid hose-to-left spray nozzle and night vision camera	4
Washer fluid reservoir-to-body	7
Wiper arm-to-wiper axle nut	21

Windshield Wiper Motor Tightening Sequence



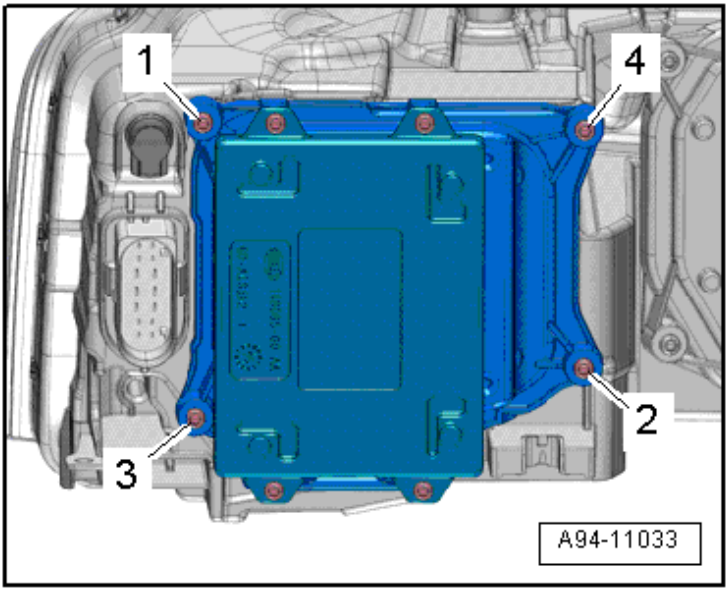
Step	Component	Nm
1	Tighten bolts 1 through 3 in sequence	Hand-tighten
2	Tighten bolts 1 through 3 in sequence	8

Exterior Lights, Switches Tightening Specifications

Component	Nm
Access/start authorization switch mount	3
Adjusting element for adjusting the headlamp housing-to-the bumper contour screw	4
Headlamp housing adjusting element-to-bumper contour screw	4.5
Exterior rear view mirror turn signal bulb screw	0.9
Back-up light lamp socket screw	2
Headlamp housing bracket	4.5
Headlamp housing bracket screw	4.5
Headlamp housing cover	1.2
HID headlamp control module	1.2
HID headlamp power output stages screw	1.4
Inner tail lamp nut	6
LED power output stages screw	1.5
LED retaining frame	1.5
License plate light screw	1
Outer tail lamp	3.5

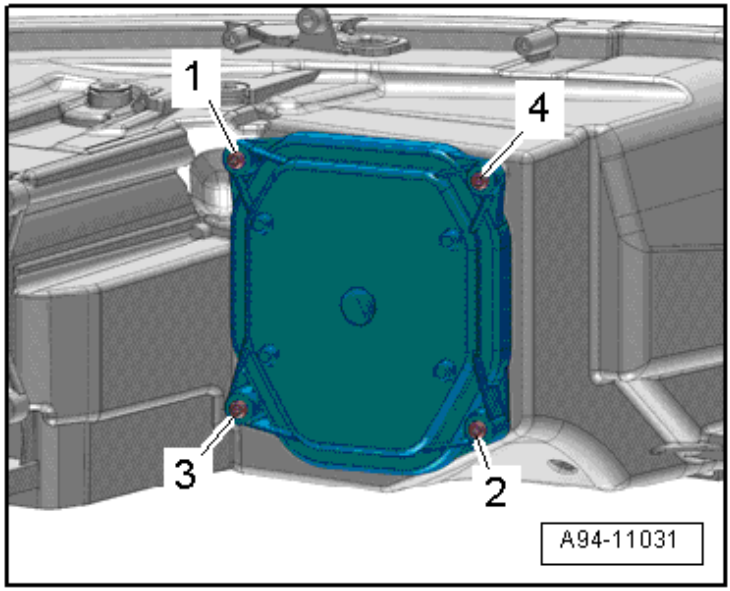
Component	Nm
Steering column clamping ring screw	4
Steering column electronic systems control module screw	0.5

Housing Cover With Power Output Stage 1 for Led Headlamps Tightening Sequence



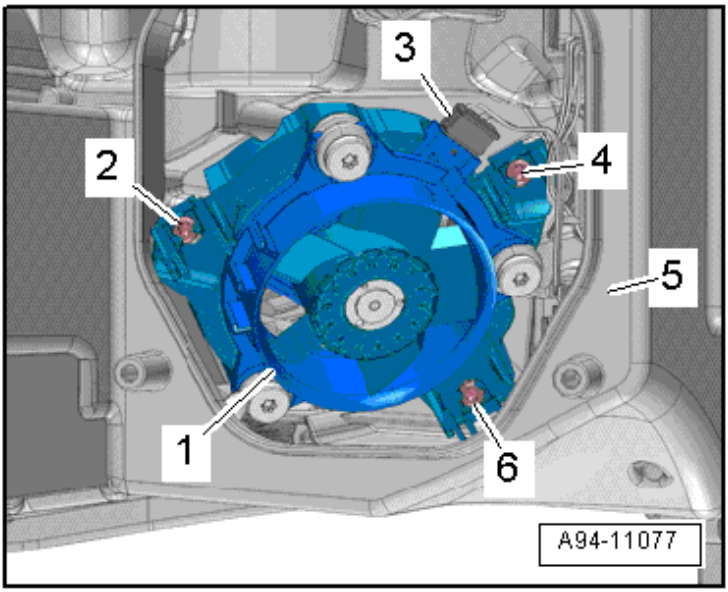
Step	Component	Nm
1	Tighten bolts 1 through 4 in sequence	1.5

Housing Cover Tightening Sequence



Step	Component	Nm
1	Tighten bolts 1 through 4 in sequence	1

Headlamp Fan - Tightening Tightening Sequence



Step	Component	Nm
1	Tighten bolts 2, 4 and 6 in sequence	1

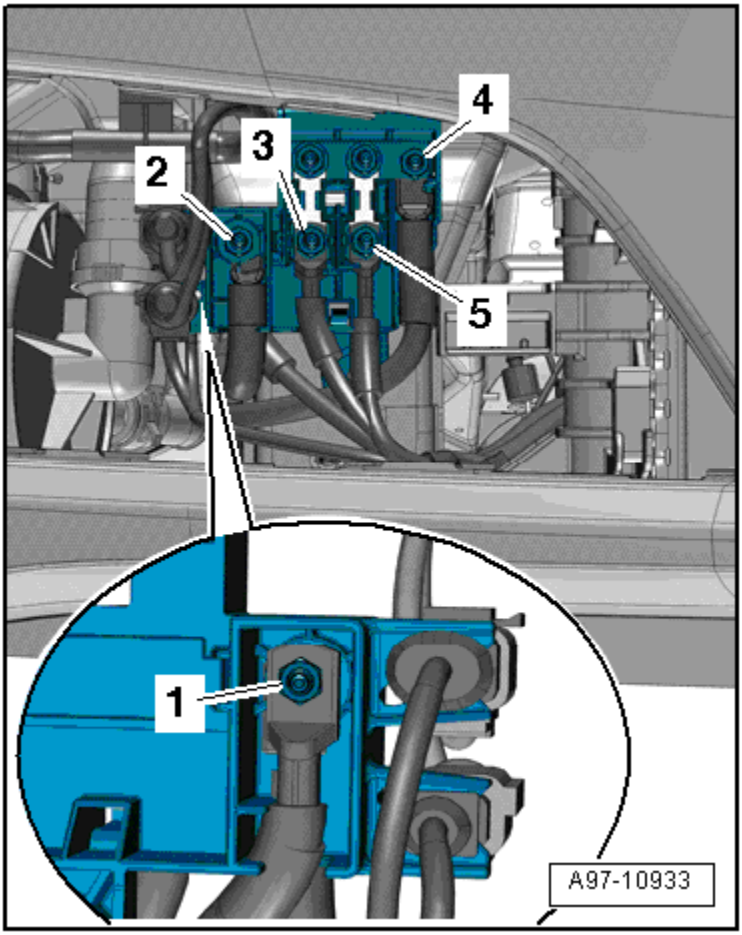
Interior Lights, Switches Tightening Specifications

Component	Nm
Alarm horn nut	7
Driver memory seat control head	2
Roof electronics control module	0.8
Electromechanical parking brake button -AUTO HOLD- button	2.5
Front interior lamps/reading lamps	4.5
Interior access/start authorization antenna 2 nut	2
Lane change assistance control module screw	3.5
Lane change assistance control module 2 screw	3.5
Left access/start authorization antenna screw	1
Luggage compartment access/start authorization antenna nut	2
Rear seat adjustment control head assembly	2
Steering column adjustment switch/steering wheel heating button	1
Sunroof button	0.8

Wiring Tightening Specifications

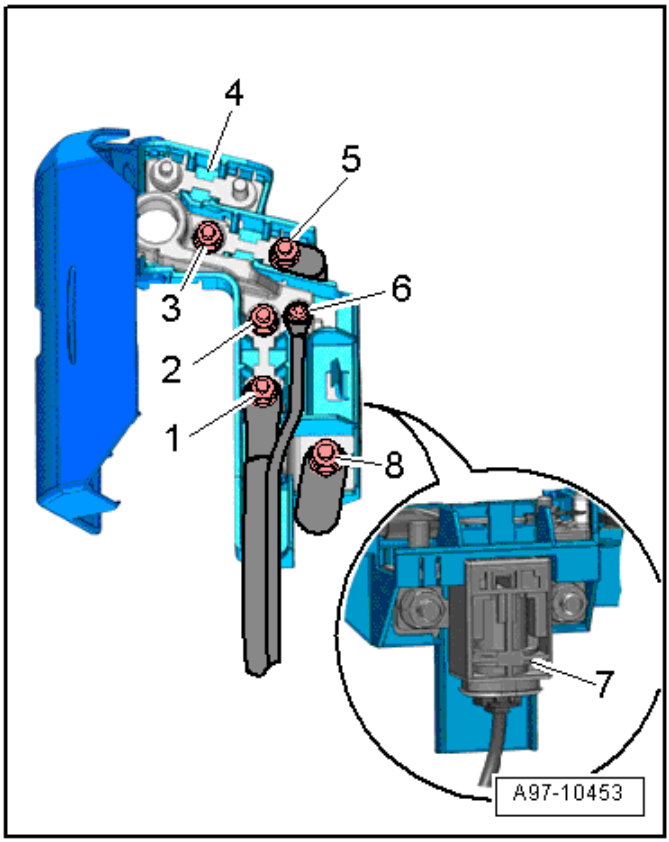
Component	Nm
2-pin relay/fuse panel, right A-pillar screw	4
Battery jump start pin for negative terminal clamp	20
Control modules retaining frame nut	4
Data bus OBD interface nut	4
E-Box cover screw (in plenum chamber, right side)	3.5
E-Box nut (in plenum chamber, right side)	3
Fuse panel F nut	4
Fuse panel screw	3
Vehicle electrical system control module mount nut	3

Fuse Panel Tightening Specifications



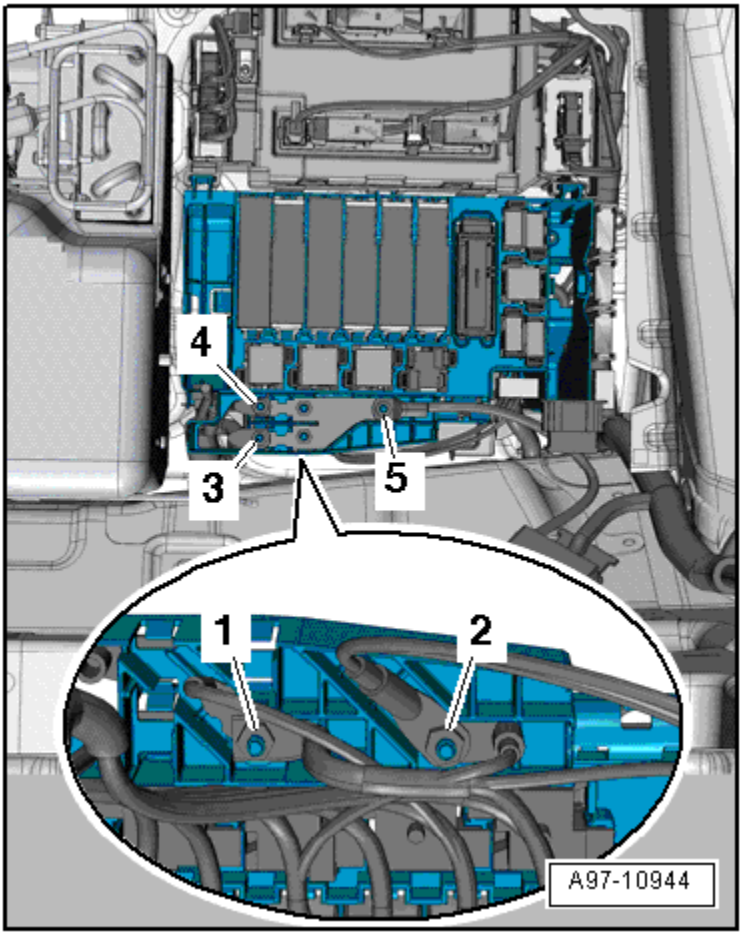
Item	Component	Nm
1	Ground wires	7.5
2	Ground connection for the ground wire on the longitudinal member	9
3	Coolant fan fuse (S42)	7.5
4	Terminal 30 wire Junction 2 (TV22)	7.5
5	Coolant fan second speed fuse (S104)	7.5

Fuse Panel D Tightening Specifications



Item	Component	Nm
1	Electrical wire	7.5
2	Nut	9
3	Nut	9
4	Fuse panel D (SD) inside the luggage compartment	-
5	Positive wire-to-engine	7.5
6	Bolt	2.5
7	Battery interrupt igniter (N253)	15
8	Electrical wire	18

Fuse Panel F Tightening Specifications



Item	Component	Nm
1	Positive cable to fuse panel 5 (ST5), fuse panel 6 (ST6)	7.5
2	Positive cable to fuse panel 3 (ST3), fuse panel 4 (ST4), terminal 15 power supply relay (J329), sockets relay (J807), auxiliary fuses	7.5
3	Positive cable from the wiring harness on the right side of the vehicle	7.5
4	Positive cable from the wiring harness on the left side of the vehicle	7.5
5	Electrical wire	7.5

DTC CHART

Engine Codes - 3.0L CGXC, CTUB

Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Intake “A” Camshaft Position Slow Response (Bank 1)	• Adjustment angle difference < 5° CA • Number of checks 10 times
P000B	Exhaust “B” Camshaft Position Slow Response (Bank 1)	• Difference between target and actual position > 10° - 22° CRK for 2 - 3 s • Adjustment angle ≥ 3° CRK
P000C	Intake “A” Camshaft Position Slow Response (Bank 2)	• Adjustment angle difference < 5° CA • Number of checks 10 times
P000D	Exhaust “B” Camshaft Position Slow Response (Bank 2)	• Difference between target and actual position > 10° - 22° CRK for 2 - 3 s • Adjustment angle ≥ 3° CRK
P0010	Intake “A” Camshaft Position Actuator Circuit / Open (Bank 1)	Signal current > 0.8 mA
P0011	Intake “A” Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	• Adjustment angle difference > 10° CA • Number of checks 3 times
P0013	Exhaust “B” Camshaft Position - Actuator Circuit / Open (Bank 1)	Signal current < 0.8 mA
P0014	Exhaust “B” Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	• Difference between target and actual position > 10° - 22° CRK for 2 - 3 s • Adjustment angle >= 3° CRK
P0016	Crankshaft Position – Camshaft Position Correlation (Bank 1 Sensor A)	Aptive value > 139° CRK
P0017	Crankshaft Position – Camshaft Position Correlation (Bank 1 Sensor B)	Camshaft/crankshaft • Adaptive value > 70°CA

DTC	Error Message	Malfunction Criteria and Threshold Value
P0018	Crankshaft Position – Camshaft Position Correlation (Bank 2 Sensor A)	Actual value < 75° CA
P0019	Crankshaft Position – Camshaft Position Correlation (Bank 2 Sensor B)	Misalignment • Adaptive value < 142° CA
P0020	Intake “A” Camshaft Position Actuator Circuit / Open (Bank 2)	Signal current < 0.8 mA
P0021	Intake “A” Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	• Adjustment angle difference > 10° CA • Number of checks 3 times
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	Heater current (hardware values) < 40 mA
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	Heater voltage (hardware values) < 2.22 V
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	Heater current (hardware values) > 8 A
P0036	HO2S Heater Control Circuit (Bank 1 Sensor 2)	Heater current (hardware values) < 40 mA
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	Heater voltage < 2.22 V
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	Heater current (hardware values) > 3 A
P0042	HO2S Heater Control Circuit (Bank 1 Sensor 3)	Heater voltage 4.50 - 5.50 V
P0043	HO2S Heater Control Circuit Low (Bank 1 Sensor 3)	• SULEV Heater voltage < 3 V • ULEV Heater voltage < 3 V
P0044	HO2S Heater Control Circuit High (Bank 1 Sensor 3)	Heater current, > 2.70 - 5.50 A
P0050	HO2S Heater Control Circuit (Bank 2 Sensor 1)	Heater current (hardware values) < 40 mA
P0051	HO2S Heater Control Circuit Low (Bank 2 Sensor 1)	Heater voltage (hardware values) < 2.22 V
P0052	HO2S Heater Control Circuit High (Bank 2 Sensor 1)	Heater current (hardware values) > 8 A
P0056	HO2S Heater Control Circuit (Bank 2 Sensor 2)	Heater current (hardware values) < 40 mA
P0057	HO2S Heater Control Circuit Low (Bank 2 Sensor 2)	Heater voltage < 2.22 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0058	HO2S Heater Control Circuit High (Bank 2 Sensor 2)	Heater current (hardware values) > 3 A
P0068	MAP/MAF – Throttle Position Correlation	• Deviation throttle controller < 43 or > 43% • Difference actual pressure downstream throttle to set-point value >30 kPa
P0071	Ambient Air Temperature Sensor Circuit Range/ Performance	• Difference ECT vs. CHDT vs. IAT at engine start < 26.5 °C (depending on engine off time) map (1) • Difference AAT vs. IAT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference AAT vs. ECT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference AAT vs. CHDT at engine start > 26.5 °C (depending on engine off time) map (1)
P0072	Ambient Air Temperature Sensor Circuit Low	Failure ambient air temp > 87.0° C
P0073	Ambient Air Temperature Sensor Circuit High	Failure ambient air temp > 87.0° C
P007C	Charge Air Cooler Temperature Sensor Circuit Low (Bank 1)	Intake Air Temperature > 129 °C
P007D	Charge Air Cooler Temperature Sensor Circuit High (Bank 1)	Intake Air Temperature < -40 °C
P0087	Fuel Rail/System Pressure - Too Low	• Deviation fuel rail pressure control > 0.105 g/Rev and • Deviation HO2S control -15 - 15% • Actual pressure 3.5 MPa • Target pressure-actual pressure >2 MP and • Deviation HO2S control -15 - 15%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0088	Fuel Rail/System Pressure - Too High	Fuel rail pressure > 13.9 MPa
P0089	Fuel Pressure Regulator 1 Performance	• Deviation fuel press control (LP) < -28% or > 35% • Target press minus actual press > 0.17 MPa • Target press minus actual press < 0.17 MPa
P008A	Low Pressure Fuel System Pressure - Too Low	Actual pressure < 0.08 MPa
P008B	Low Pressure Fuel System Pressure - Too High	Actual pressure >1.1 MPa
P0090	Fuel Pressure Regulator 1 Control Circuit	Open circuit signal current < 8.0 mA
P0091	Fuel Pressure Regulator 1 Control Circuit Low	Short to ground signal voltage < 2.0 V
P0092	Fuel Pressure Regulator 1 Control Circuit High	Short to battery plus signal current > 11 A
P0096	Intake Air Temperature Sensor 2 Circuit Range/Performance	• Difference AAT vs. ECT vs. CHDT at engine start < 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. CHDT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. AAT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. ECT at engine start > 26.5 °C (depending on engine off time) map (1)
P00A2	Charge Air Cooler Temperature Sensor Circuit Low (Bank 2)	
P00A3	Charge Air Cooler Temperature Sensor Circuit High (Bank 2)	IAT > 3.20 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P00A6	Intake Air Temperature Sensor 2 Circuit (Bank 2) Range/ Performance	• Difference AAT vs. ECT vs. CHDT at engine start < 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. CHDT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. AAT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. ECT at engine start > 26.5 °C (depending on engine off time) map (1)
P0111	Intake “A” Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	• Difference AAT vs. ECT vs. CHDT at engine start < 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. CHDT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. AAT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. ECT at engine start > 26.5 °C (depending on engine off time) map (1)
P0112	Intake “A” Camshaft Position - Timing Over-Retarded (Bank 1)	Intake air temperature > 129 °C
P0113	Exhaust “B” Camshaft Position - Actuator Circuit / Open (Bank 1)	Intake air temperature < -40 °C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0116	Crankshaft Position – Camshaft Position Correlation (Bank 1 Sensor A)	• Difference AAT vs. ECT vs. CHDT at engine start < 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. CHDT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. AAT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. ECT at engine start > 26.5 °C (depending on engine off time) map (1)
P0117	Crankshaft Position – Camshaft Position Correlation (Bank 1 Sensor B)	Engine coolant temperature < - 45.8 °C
P0118	Crankshaft Position – Camshaft Position Correlation (Bank 2 Sensor A)	Engine coolant temperature > 141 °C
P0121	Throttle/Pedal Position Sensor/Switch “A” Circuit Range/Performance	• TPS 1 - TPS 2 > 5.79% and • Relative mass air integral > 100 at 0.45 s
P0122	Throttle/Pedal Position Sensor/Switch “A” Circuit Low	Signal voltage < 0.117 V
P0123	Throttle/Pedal Position Sensor/Switch “A” Circuit High	Signal voltage < 0.117 V
P012B	Turbocharger/Supercharger Inlet Pressure Sensor Circuit Range/Performance	• Pressure difference in cross check between boost pressure sensor 1/2; inlet charger pressure and ambient pressure sensor > 7 kPa • Pressure difference in cross check between boost pressure sensor 1/2 and inlet charger pressure (1) > 12 - 27 kPa • Depending on engine speed
P012C	Turbocharger/Supercharger Inlet Pressure Sensor Circuit Low	Signal voltage < 0.2 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P012D	Turbocharger/Supercharger Inlet Pressure Sensor Circuit High	Signal voltage > 4.8 V
P0130	O2 Sensor Circuit (Bank 1, Sensor 1)	O2S ceramic temperature < 640 °C
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	Signal voltage < 0.13 V
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	Signal voltage > 5.5 V
P0133	O2 Circuit Slow Response (Bank 1, Sensor 1)	Response check- HO2S value vs modeled HO2S value > 0.9004
P0135	O2 Sensor Heater Circuit (Bank 1 Sensor 1)	UEGO ceramic temperature < 680 or > 965 °C
P0136	O2 Sensor Circuit (Bank 1 Sensor 2)	Oscillation check • O2S signal rear not oscillating at reference +/- 10 mV Signal range check • Signal voltage > 0.15 V
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	• Signal voltage < 20 mV and • Internal resistance < 10 Ohm
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	Signal voltage > 1.2 V
P0139	O2 Circuit Slow Response (Bank 1 Sensor 2)	O2S signal rear- signal too slow- 1
P013A	O2 Sensor (Bank 1 Sensor 2) Slow Response - Rich to Lean	• Arithmetic filtered max differential transient time at rich to lean transition ≤ 800 mV/s • Number of checks ≥ 3
P013B	O2 Sensor (Bank 1 Sensor 2) Slow Response - Lean to Rich	• Arithmetic filtered max differential transient time at rich to lean transition ≤ 800 mV/s • Number of checks ≥ 3
P013C	O2 Sensor (Bank 2 Sensor 2) Slow Response - Rich to Lean	• Arithmetic filtered max differential transient time at rich to lean transition ≤ 800 mV/s • Number of checks ≥ 3

DTC	Error Message	Malfunction Criteria and Threshold Value
P013D	O2 Sensor (Bank 2 Sensor 2) Slow Response - Lean to Rich	• Arithmetic filtered max differential transient time at rich to lean transition ≤ 800 mV/s • Number of checks ≥ 3
P013E	O2 Sensor (Bank 1 Sensor 2) Delayed Response - Lean to Rich	• Arithmetic filtered max differential transient time at rich to lean transition ≤ 800 mV/s • Number of checks ≥ 3
P013F	O2 Sensor (Bank 1 Sensor 2) Delayed Response - Lean to Rich	• Arithmetic filtered max differential transient time at rich to lean transition ≤ 800 mV/s • Number of checks ≥ 3
P0140	O2 Circuit No Activity Detected (Bank 1, Sensor 2)	• Signal voltage, 0.376 - 0.474 V • O2S rear internal resistance > 60 KΩ
P0141	O2 Sensor Heater Circuit (Bank 1 Sensor 2)	Heater resistance > 10K Ω
P014A	O2 Sensor (Bank 2 Sensor 2) Delayed Response - Rich to Lean	• Arithmetic filtered max differential transient time at rich to lean transition ≤ 800 mV/s • Number of checks ≥ 3
P014B	O2 Sensor (Bank 1 Sensor 2) Delayed Response - Lean to Rich	• Arithmetic filtered max differential transient time at rich to lean transition ≤ 800 mV/s • Number of checks ≥ 3
P0151	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1)	Signal voltage < 0.13 V
P0152	O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)	Signal voltage > 5.5 V
P0153	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)	Response check- HO2S value vs modeled HO2S value > 0.7998
P0155	O2 Sensor Heater Circuit (Bank 2 Sensor 1)	UEGO ceramic temperature < 680 or > 965 °C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0156	O2 Sensor Circuit (Bank 2 Sensor 2)	Oscillation check • O2S signal rear not oscillating at reference +/- 10 mV Signal range check • Signal voltage > 0.2 V
P0157	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 2)	• Signal voltage < 20 mV and • Internal resistance < 10 Ohm
P0158	O2 Sensor Circuit High Voltage (Bank 2 Sensor 2)	Signal voltage > 1.2 V
P0159	O2 Circuit Slow Response (Bank 1, Sensor 2)	O2S signal rear- signal too slow- 1
P0160	O2 Circuit No Activity Detected (Bank 1, Sensor 2)	• Signal voltage, 0.376 - 0.474 V • O2S rear internal resistance > 60 KΩ
P0161	O2 Sensor Heater Circuit (Bank 2 Sensor 2)	Heater resistance > 10K Ω
P0169	Incorrect Fuel Composition	Plausibility check failed
P0171	System Too Lean (Bank 1)	Lean @ idle Adaptive value > 0.0063 g/Rev
P0172	System Too Rich (Bank 1)	Too rich at idle Adaptive value < 25%
P0174	System Too Lean (Bank 2)	Lean @ idle Adaptive value > 0.0063 g/Rev
P0175	System Too Rich (Bank 2)	Too rich at idle Adaptive value >25%

DTC	Error Message	Malfunction Criteria and Threshold Value
P017B	Engine Temperature Control Sensor Circuit Rationality Check	• Measured cylinder head temperature below modeled temperature • Difference ETC vs AAT vs IAT at engine start < 26.5 °C (depending on engine off time) map (1) • Difference CHDT vs ECT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference CHDT vs IAT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference CHDT vs AAT at engine start > 26.5 °C (depending on engine off time) map (1)
P017C	Engine Temperature Control Sensor Circuit Short to Ground	Cylinder head temperature > 215 °C
P017D	Engine Temperature Control Sensor Circuit Short to Battery Voltage or Open	Cylinder head temperature < -60 °C
P0190	Fuel Rail Pressure Sensor Circuit	Signal voltage > 4.6 V
P0191	Fuel Rail Pressure Sensor Circuit Range/Performance	Actual pressure > 16.85 MPa
P0192	Fuel Rail Pressure Sensor Circuit Low	Signal voltage < 0.2 V
P0201	Injector Circuit/Open - Cylinder 1	• Signal current < 10 A and • Signal voltage > 3.5 V
P0202	Injector Circuit/Open - Cylinder 2	• Signal current < 10 A and • Signal voltage > 3.5 V
P0203	Injector Circuit/Open - Cylinder 3	• Signal current < 10 A and • Signal voltage > 3.5 V
P0204	Injector Circuit/Open - Cylinder 4	• Signal current < 10 A and • Signal voltage > 3.5 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0205	Injector Circuit/Open - Cylinder 5	• Signal current < 10 A and • Signal voltage > 3.5 V
P0206	Injector Circuit/Open - Cylinder 6	• Signal current < 10 A and • Signal voltage > 3.5 V
P0221	Throttle/Pedal Position Sensor/Switch “B” Circuit Range/Performance	• TPS 1 - TPS 2 > 5.79% and • Relative mass air integral > 100 at 0.45 s
P0222	Throttle/Pedal Position Sensor/Switch “B” Circuit Low	Signal voltage < 0.117 V
P0223	Throttle/Pedal Position Sensor/Switch “B” Circuit High	Signal voltage > 4.6 V
P0234	Turbo/Super Charger Overboost Condition	Difference set value boost pressure vs actual boost pressure value, 200 - 1275 hPa
P0235	Turbo/Super Charger Boost Sensor “A” Circuit	Boost pressure sensor signal vs target value > 0.25 - 35 kPa, depending on altitude
P0236	Turbo/Super Charger Boost Sensor “A” Circuit Range/ Performance	• Pressure difference in cross check between boost pressure sensor 1/2; inlet charger pressure and ambient pressure sensor > 7 kPa • Pressure difference in cross check between boost pressure sensor 1/2 and inlet charger pressure (1) > 12 -27 kPa • Pressure difference in cross check between boost pressure sensor 1 and 2 > 12.5 kPa • Fuel trim activity (bank with deviation is considered to be defective) > 15%
P0237	Turbo/Super Charger Boost Sensor “A” Circuit Low	Signal voltage < 0.2 V
P0238	Turbo/Super Charger Boost Sensor “A” Circuit High	Signal voltage > 4.8 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0240	Turbo/Super Charger Boost Sensor “B” Circuit Range/ Performance	• Pressure difference in cross check between boost pressure sensor 1/2; inlet charger pressure and ambient pressure sensor > 7 kPa • Pressure difference in cross check between boost pressure sensor 1/2 and inlet charger pressure (1) > 12 -27 kPa • Pressure difference in cross check between boost pressure sensor 1 and 2 > 12.5 kPa • Fuel trim activity (bank with deviation is considered to be defective) > 15%
P0241	Turbo/Super Charger Boost Sensor “B” Circuit Low	Signal voltage < 0.2 V
P0242	Turbo/Super Charger Boost Sensor “B” Circuit High	Signal voltage > 4.8 V
P025A	Fuel Pump Module Control Circuit/Open	Signal current < 0.8 mA
P025C	Fuel Pump Module Control Circuit Low	Signal voltage < 2.0 V
P025D	Fuel Pump Module Control Circuit High	Signal current > 1.0 A
P0261	Cylinder 1 Injector Circuit Low	• Signal current < 10 A and • Signal voltage > 3.5 V
P0262	Cylinder 1 Injector Circuit High	Signal current > 16 A
P0264	Cylinder 2 Injector Circuit Low	• Signal current < 10 A and • Signal voltage > 3.5 V
P0265	Cylinder 2 Injector Circuit High	Signal current > 16 A
P0267	Cylinder 3 Injector Circuit Low	• Signal current < 10 A and • Signal voltage > 3.5 V
P0268	Cylinder 3 Injector Circuit High	Signal current > 16 A
P0270	Cylinder 4 Injector Circuit Low	• Signal current < 10 A and • Signal voltage > 3.5 V
P0271	Cylinder 4 Injector Circuit High	Signal current > 16 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P0273	Cylinder 5 Injector Circuit Low	• Signal current < 10 A and • Signal voltage > 3.5 V
P0274	Cylinder 5 Injector Circuit High	Signal current > 16 A
P0276	Cylinder 6 Injector Circuit Low	• Signal current < 10 A and • Signal voltage > 3.5 V
P0277	Cylinder 6 Injector Circuit High	Signal current > 16 A
P0299	Turbo/Super Charger Underboost	Difference set value boost pressure vs actual boost pressure value, >150 hPa
P2004	Intake Manifold Runner Control Stuck Open (Bank 1)	Signal voltage > 2.5V
P2005	Intake Manifold Runner Control Stuck Open (Bank 2)	Signal voltage < 2.9 V
P2006	Intake Manifold Runner Control Stuck Closed (Bank 1)	Signal voltage < 2.9 V
P2007	Intake Manifold Runner Control Stuck Closed (Bank 2)	Signal voltage > 2.5 V
P2008	Intake Manifold Runner Control Circuit/Open (Bank 1)	Signal current < 0.8 mA
P2009	Intake Manifold Runner Control Circuit Low (Bank 1)	Signal voltage >2.0 V
P2010	Intake Manifold Runner Control Circuit High (Bank 1)	Signal current > 2 A
P2014	Intake Manifold Runner Position Sensor/Switch Circuit (Bank 1)	Signal voltage < 0.2 V
P2017	Intake Manifold Runner Position Sensor/Switch Circuit High (Bank 1)	Signal voltage > 4.8 V
P2019	Intake Manifold Runner Position Sensor/Switch Circuit (Bank 2)	Signal voltage < 0.2 V
P2022	Intake Manifold Runner Position Sensor/Switch Circuit High (Bank 2)	Signal voltage > 4.8 V
P2024	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Circuit	Signal current < 0.8 mA

DTC	Error Message	Malfunction Criteria and Threshold Value
P2025	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Performance	• Response time > 1000 ms and number of checks > 3.00 • Security bit incorrect and number of checks > 3.00 • Resetcounter > 3.00 • Time difference between ECU and EVAP Fuel Tank Temp Sensor > 3.0 s Case 1: • EVAP Fuel Tank Temp Sensor > 119 °C • EVAP Fuel Tank Temp Sensor < -39 °C • Difference between EVAP Fuel Tank Temp Sensor and ECT ≥ 20.3 K and Difference between EVAP Fuel Tank Temp Sensor and IAT ≥ 20.3 K gradient EVAP Fuel Tank Temp Sensor > 20 [K/10min]
P2026	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Circuit Low Voltage	Signal voltage < 2 V
P2027	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Circuit High Voltage	Signal current > 1 A
P2088	A Camshaft Position Actuator Control Circuit Low (Bank 1)	Signal voltage < 2 V
P2089	A Camshaft Position Actuator Control Circuit High (Bank 1)	Signal current > 3 A
P2092	A Camshaft Position Actuator Control Circuit Low (Bank 2)	Signal voltage < 2 V
P2093	A Camshaft Position Actuator Control Circuit High (Bank 2)	Signal current > 3 A
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	Integral part of trim control post cat. > 10%
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	Integral part of trim control post cat. < -10%
P2098	Post Catalyst Fuel Trim System Too Lean (Bank 2)	Integral part of trim control post cat. > 10%
P2099	Post Catalyst Fuel Trim System Too Rich (Bank 2)	Integral part of trim control post cat. < 10%

DTC	Error Message	Malfunction Criteria and Threshold Value
P3081	Engine temperature too low	Step 1 • Modeled ECT > 30° C and • ECT < 30° C

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random/Multiple Cylinder Misfire Detected	• Emission threshold misifre rate (MR) 1st interval > 1.5% • Emission threshold misfire rate (MR) > 1.5% • Catalyst demage,misfire rate (MR) > 1.5 - 15%
P0301	Cylinder 1 Misfire Detected	• Emission threshold misifre rate (MR) 1st interval > 1.5%
P0302	Cylinder 2 Misfire Detected	• Emission threshold misfire rate (MR) > 1.5%
P0303	Cylinder 3 Misfire Detected	• Catalyst demage,misfire rate (MR) > 1.5 - 15%
P0304	Cylinder 4 Misfire Detected	• Emission threshold misifre rate (MR) 1st interval > 1.5% • Emission threshold misfire rate (MR) > 1.5% • Catalyst demage,misfire rate (MR) > 1.5 - 15%
P0305	Cylinder 5 Misfire Detected	• Emission threshold misifre rate (MR) 1st interval > 1.5% • Emission threshold misfire rate (MR) > 1.5% • Catalyst demage,misfire rate (MR) > 1.5 - 15%
P0306	Cylinder 6 Misfire Detected	• Emission threshold misifre rate (MR) 1st interval > 1.5% • Emission threshold misfire rate (MR) > 1.5% • Catalyst demage,misfire rate (MR) > 1.5 - 15%
P0326	Knock Sensor 1 Circuit Range/Performance	• Lower threshold < 0.029 V • Upper threshold > 1.992 V
P0327	Knock Sensor 1 Circuit Low	• Lower threshold < 0.18 V
P0328	Knock Sensor 1 Circuit High	• Upper threshold > 14.8 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0331	Knock Sensor 2 Circuit Range/Performance	• Lower threshold < 0.029 V • Upper threshold > 1.992 V
P0332	Knock Sensor 2 Circuit Low	• Lower threshold < 0.18 V
P0335	Crankshaft Position Sensor “A” Circuit	• Open circuit > 1 V • Short to grnd < 1.5 V • Short to Battery voltage > 3.5 V • Signal check no signal
P0336	Crankshaft Position Sensor “A” Circuit Range/ Performance	• RPM Signal comparison with phase sensor not synchronous • Counted versus reference teeth > 1 • Actual time value vs modeled time value > 1.375
P0340	Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor)	Signal activity check • Signal voltage no altering @ 4 Rev
P0341	Camshaft Position Sensor “A” Circuit Range/Performance (Bank 1 or Single Sensor)	• Actual time value vs. min. time value < 1 • Adaptive value vs. target value > 12.4 °CA • Actual time value vs. modeled time value > 3.5
P0345	Camshaft Position Sensor “A” Circuit (Bank 2)	Signal activity check • Signal voltage no altering @ 4 Rev
P0346	Camshaft Position Sensor “A” Circuit Range/Performance (Bank 2)	• Actual time value vs. min. time value < 1 • Adaptive value vs. target value > 12.4 °CA • Actual time value vs. modeled time value > 3.5
P0351	Ignition Coil “A” Primary/ Secondary Circuit	Open circuit • Signal current < -0.05 - 0.2 mA • Hardware value from final stage > 0.04 - 0.2 mA
P0352	Ignition Coil “B” Primary/ Secondary Circuit	Short to ground • Signal current < -0.05 - 0.2 mA • Hardware value from final stage > 0.04 - 0.2 mA

DTC	Error Message	Malfunction Criteria and Threshold Value
P0353	Ignition Coil “C” Primary/ Secondary Circuit	Short to battery • Signal current < -0.05 - 0.2 mA • Hardware value from final stage > 0.04 - 0.2 mA
P0354	Ignition Coil “D” Primary/ Secondary Circuit	• Signal current < -0.05 - 0.2 mA • Hardware value from final stage > 0.04 - 0.2 mA
P0355	Ignition Coil E Primary/ Secondary Circuit	• Signal current < -0.05 - 0.2 mA • Hardware value from final stage > 0.04 - 0.2 mA
P0356	Ignition Coil F Primary/ Secondary Circuit	• Signal current < -0.05 - 0.2 mA • Hardware value from final stage > 0.04 - 0.2 mA
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 current > 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 current > 5.1 - 7.0 mA

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0413	Secondary Air Injection System Switching Valve “A” Circuit Open	Signal voltage < 0.8 mA

DTC	Error Message	Malfunction Criteria and Threshold Value
P0414	Secondary Air Injection System Switching Valve “A” Circuit Shorted	Signal voltage < 2 V
P0416	Secondary Air Injection System Switching Valve “B” Circuit Open	Signal voltage < 0.8 mA
P0417	Secondary Air Injection System Switching Valve “B” Circuit Shorted	Signal voltage < 2 V
P0418	Secondary Air Injection System Control “A” Circuit	Signal current < 8 mA
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	Amplitude ratio O2S > 1.5
P0430	Catalyst System Efficiency Below Threshold (Bank 2)	Amplitude ratio O2S > 1.5
P0441	Evaporative Emission System Incorrect Purge Flow	Deviation HO2S control < 4% • Purge valve quality < 0,05 [-]
P0442	Evaporative Emission System Leak Detected (Small Leak)	Time for pressure drop < 1.06 - 1.3 Sec.
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal current < 0.8mA
P0445	Evaporative Emission System Purge Control Valve Circuit Shorted	Signal voltage < 2.0 V or Signal current > 5 A
P0450	Evaporative Emission System Pressure Sensor/Switch	Signal voltage 0.39 - 0.55 V
P0451	Evaporative Emission System Pressure Sensor/Switch Range/Performance	VLD Pressure Sensor / Switch = Closed
P0452	Evaporative Emission System Pressure Sensor/Switch Low	Signal voltage > 3.0 V
P0453	Evaporative Emission System Pressure Sensor/Switch High	Signal voltage < 0.24 V
P0455	Evaporative Emission System Leak Detected (large leak)	Time for pressure drop < 0.65 - 0.7 s.
P0456	Evaporative Emission System Leak Detected (very small leak)	NVLD switch position open

DTC	Error Message	Malfunction Criteria and Threshold Value
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage < 2.15 - 3.25 V
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.2 A
P0491	Secondary Air Injection System Insufficient Flow (Bank 1)	• Blockage: relative SAIR pressure (phase 1) - no flow < 0.102 • Leakage: relative SAIR pressure (phase 1) - no flow < 0.102 • Blockage: relative SAIR pressure (phase 1) < 0.5 - 0.648 [-] • Leakage: relative SAIR pressure (phase 1 < 0.602 • Blockage: relative SAIR pressure (phase 21) < 0.5 - 0.648 • Leakage: relative SAIR pressure (phase 21) < 0.727 • Relative SAIR pressure (phase 2) < 0.75 • Average pressure difference between absolute value and filtered value (phase 21) < 2.422 - 4.84 hPa • Relative SAIR pressure (phase 2) <0.75

DTC	Error Message	Malfunction Criteria and Threshold Value
P0492	Secondary Air Injection System Insufficient Flow (Bank 2)	• Blockage: relative SAIR pressure (phase 1) - no flow < 0.102 • Leakage: relative SAIR pressure (phase 1) - no flow < 0.102 • Blockage: relative SAIR pressure (phase 1) < 0.5 - 0.648 [-] • Leakage: relative SAIR pressure (phase 1 < 0.602 • Blockage: relative SAIR pressure (phase 21) < 0.5 - 0.648 • Leakage: relative SAIR pressure (phase 21) < 0.727 • Relative SAIR pressure (phase 2) < 0.75 • Average pressure difference between absolute value and filtered value (phase 21) < 2.422 - 4.84 hPa • Relative SAIR pressure (phase 2) <0.75

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor “A” Range/Performance	Vehicle speed signal < 4 km/h
P0503	Vehicle Speed Sensor “A” Intermittent/Erratic/High	Vehicle speed signal > 200 km/h
P0506	Idle Air Control System RPM Lower Than Expected	• Engine speed deviation < -80 to -250 rpm
P0507	Idle Air Control System RPM Higher Than Expected	• Engine speed deviation > 80 to 250 rpm
P050A	Cold Start Idle Air Control System Performance	• Out of range low • Engine speed deviation < 80 - 250 rpm • Out of range high • Engine speed deviation > 80 - 250 rpm

DTC	Error Message	Malfunction Criteria and Threshold Value
P050B	Cold Start Ignition Timing Performance	Idle Difference between commanded spark timing vs. actual value > 20%
P052A	Cold Start “A” Camshaft Position Timing Over-Advanced	• Adjustment angle difference > 10° CA • Number of checks 2
P052C	Cold Start “A” Camshaft Position Timing Over-Advanced	• Adjustment angle difference > 10° CA • Number of checks 2
P053F	Cold Start Fuel Pressure Performance	Target pressure-actual pressure > 1.5 MPa

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
P0603	Internal Control Module Keep Alive Memory (KAM) Error	SPI Communication lost
P0604	Internal Control Module Random Access Memory (RAM) Error	Write ability check, failed
P0605	Internal Control Module Read Only Memory (ROM) Error	Checksum Incorrect
P0606	ECM/PCM Processor	EEPROM check failed
P0627	Fuel Pump “A” Control Circuit /Open	• Internal error fuel pump control unit • Feedback from fuel pump control unit pump blocked short circuit to battery +, ground or open circuit

DTC	Error Message	Malfunction Criteria and Threshold Value
P0638	Throttle Actuator Control Range/Performance (Bank 1)	Functional check: close movement • Open to 15° > 1.275 s • Then close to ref. point > 1.28 s • Gradient < 7° per second Functional check open movement • Close to 1.99° > 1.275 s • Then open to ref. point > 1.28 s • Gradient < 7° per second Signal range check @ mechanical stop low • TPS 1 signal voltage out-off range 0.208 - 0.852 V or • TPS 2 signal voltage out off range 4.158 - 4.802 V
P0641	Sensor Reference Voltage “A” Circuit/Open	Signal voltage, deviation +/- 0.3 V
P0642	Sensor Reference Voltage “A” Circuit Low	Signal voltage < 4.62 V
P0643	Sensor Reference Voltage “A” Circuit High	5 V supply voltage > 5.44 V
P0651	Sensor Reference Voltage “B” Circuit/Open	Signal voltage, deviation +/- 0.3 V
P0652	Sensor Reference Voltage “B” Circuit Low	Signal voltage < 4.62 V
P0653	Sensor Reference Voltage “B” Circuit High	5 V supply voltage > 5.44 V
P0657	Actuator Supply Voltage “A” Circuit/Open	Signal current < 0.8 mA
P0658	Actuator Supply Voltage “A” Circuit Low	Signal voltage, > 2.0 V
P0659	Actuator Supply Voltage “A” Circuit High	Signal current > 1.0 A
P0685	ECM/PCM Power Relay Control Circuit /Open	• Signal voltage, 2.6 - 3.7 V • Sense circuit voltage, > 6 V
P0686	ECM/PCM Power Relay Control Circuit Low	Sense circuit voltage > 6.0 V
P0687	ECM/PCM Power Relay Control Circuit High	Sense circuit voltage < 5.0 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0688	ECM/PCM Power Relay Sense Circuit /Open	• Sense voltage, < 3.0 V • Difference sense circuit voltage with camshaft actuator commanded off and on > 2.5 V • Battery voltage > 3 V
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 V
P0699	Sensor Reference Voltage “C” Circuit High	5 V supply voltage > 4.99 - 5.41 V
U0001	High Speed CAN Communication Bus	CAN message, no feedback
U0002	High Speed CAN Communication Bus Performance	Global time out...receiving no messages
U0100	Lost Communication With ECM/PCM “A”	• Failure of all CAN engine messages, Time out more than 490 mSec • Failure of all CAN engine messages but not all CAN messages, Time out more than 1010 mSec
U0101	Lost Communication with TCM	No message received from TCM
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	No CAN communication with TCU, time-out
U0140	Lost Communication With Body Control Module	CAN message no message
U0146	Lost Communication With Gateway “A”	CAN communication with gateway, implausible message
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	No CAN communication with ICL, time-out
U0302	Software Incompatibility with Transmission Control Module	MT vehicle ECM coded as AT vehicle
U0322	Software Incompatibility with Body Control Module	Ambient temperature value (moduel not encoded for ambient temperature sensor) FDh

DTC	Error Message	Malfunction Criteria and Threshold Value
U0323	Software Incompatibility with Instrument Panel Control Module	Ambient temp value module not encoded for ambient temp sensor, 00h
U0402	Invalid Data Received From Transmission Control Module	Invalid data received from TCM • Implausible message
U0404	Invalid Data Received From Gear Shift Control Module	• If the value of message counter is permanent, constant, or change exceeds a threshold, increment an event counter • Maximum change of message counter > 5
U0415	Invalid Data Received From Anti-Lock Brake System Control Module	• Out of range: receiving fault value 203.5 mph • Out of range: receiving fault value > 202.81 mph • Out of range: receiving fault value < 1.24 mph
U0422	Invalid Data Received From Body Control Module	Ambient temp. value (initialization), Audi, 01h
U0423	Invalid Data Received From Instrument Panel Control Module	Received CAN message, implausible message
U0447	Invalid Data Received From Gateway “A”	Received data from Gateway implausible message
U1103	(Bank 1 Sensor 1) Heater Circuit Performance Too Low	Proiduction mode active

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P0705	Transmission Range Sensor “A” Circuit Malfunction (PRNDL Input)	-
P0706	Transmission Range Sensor “A” Circuit Range/ Performance	4 bit position code, incorrect
P0707	Transmission Range Sensor “A” Circuit Range/ Performance	-
P0708	Transmission Range Sensor “A” Circuit High	-

DTC	Error Message	Malfunction Criteria and Threshold Value
P0710	Transmission Fluid Temperature Sensor “A” Circuit	Sensor short circuit: • U_sensor (+), and U_sensor (-) diagnosis by ASIC
P0711	Transmission Fluid Temperature Sensor “A” Circuit Range/Performance	Discontinual temperature: • ATF temperature delta T between 2 measurements, > 20 °C Sensor stuck: • Comparision ATF vs. chip temperature, ATF temp. must follow chip temp. in certain ranges, 25-40 °C
P0712	Transmission Fluid Temperature Sensor “A” Circuit Low	Circuit low: • U_sensor (+), and U_sensor (-) diagnosis by ASIC
P0713	Transmission Fluid Temperature Sensor “A” Circuit High	Circuit high: • U_sensor (+), and U_sensor (-) diagnosis by ASIC
P0714	Transmission Fluid Temperature Sensor “A” Circuit Intermittent	Circuit high: • U_sensor (+), and U_sensor (-) diagnosis by ASIC
P0716	Input/Turbine Speed Sensor “A” Circuit Range/ Performance	Signal higher or lower than threshold • Higher, > + 8000 RPM • Lower, < 20 RPM
P0717	Input/Turbine Speed Sensor “A” Circuit No Signal	Hardware detection
P0721	Output Speed Sensor Circuit Range/Performance	• Signal > threshold, > 10000 RPM • Difference between last and actual value > threshold, -1000 RPM • Difference to wheel speeds, > 500 RPM and input speed, > 200 RPM
P0722	Output Speed Sensor Circuit No Signal	Hardware detection
P0727	Engine Speed Input Circuit No Signal	CAN message signal error flag, =1
P0741	Torque Converter Clutch Circuit Performance or Stuck Off	Rate of (setting of nominal value) - actual value, > 50 RPM

DTC	Error Message	Malfunction Criteria and Threshold Value
P0746	Pressure Control Solenoid “A” Performance or Stuck Off	PWM hardware detection, 0 or 100%
P0747	Pressure Control Solenoid “A” Stuck On	PWM hardware detection, 0 or 100%
P0748	Pressure Control Solenoid “A” Electrical	• Current higher or lower than threshold, > 220 mA • EDS output voltage at short to ground or open circuit ~ 0.5 V smaller than EDS supply voltage • Static leakage current flow
P0751	Shift Solenoid “A” Performance or Stuck Off	• If PWM = 0%, diagnosis by ASIC • If 0% ≤ PWM , 7.6% voltage return lead (low), < 0.75 V • If 7.6% ≤ PWM , 92.4% voltage return lead (high), < 0.75 V • If 7.6% ≤ PWM , 92.4% voltage return lead (low), < 0.75 V
P0752	Shift Solenoid “A” Stuck On	• If PWM = 100%, diagnosis by ASIC • If 7.6% ≤ PWM ≤ 100% voltage return lead (high), > 0.3 V
P0754	Shift Solenoid “A” Intermittent	• If PWM = 0%, diagnosis by ASIC • If 0% ≤ PWM , 7.6% voltage return lead (low), < 0.75 V • If 7.6% ≤ PWM , 92.4% voltage return lead (high), < 0.75 V • If 7.6% ≤ PWM , 92.4% voltage return lead (low), < 0.75 V
P0776	Pressure Control Solenoid “B” Performance or Stuck off	PWM hardware detection, 0 or 100%
P0777	Pressure Control Solenoid “B” Stuck On	PWM hardware detection, 0 or 100%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0778	Pressure Control Solenoid “B” Electrical	• Current higher or lower than threshold, < 730 mA • EDS output voltage at short to ground or open circuit ~ 0.5 V smaller than EDS supply voltage • Static leakage current flow
P0796	Pressure Control Solenoid “C” Performance or Stuck off	PWM hardware detection, 0 or 100%
P0797	Pressure Control Solenoid “C” Stuck On	PWM hardware detection, 0 or 100%
P0798	Pressure Control Solenoid “C” Electrical	• Current higher or lower than threshold, > 220 mA • EDS output voltage at short to ground or open circuit ~ 0.5 V smaller than EDS supply voltage • Static leakage current flow
P0889	TCM Power Relay Sense Circuit Range/Performance	FET drive, not possible
P0890	TCM Power Relay Sense Circuit Low	• Solenoid power supply voltage, < 1.4 V • Drop voltage over high side FET, > 1 V
P0891	TCM Power Relay Sense Circuit High	Hardware detection
P0892	TCM Power Relay Sense Circuit Intermittent	Hardware detection
P2637	Torque Management Feedback Signal “A”	CAN message signal error flag, = 1
P2714	Pressure Control Solenoid “D” Performance or Stuck Off	PWM hardware detection, 0 or 100%
P2715	Pressure Control Solenoid “D” Stuck On	PWM hardware detection, 0 or 100%
P2716	Pressure Control Solenoid “D” Electrical	• Current higher or lower than threshold, <730 mA • EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage • Static leakage current flow
P2723	Pressure Control Solenoid “E” Performance or Stuck Off	PWM hardware detection, 0 or 100%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2725	Pressure Control Solenoid “E” Electrical	• Current higher or lower than threshold, < 730 mA • EDS output voltage at short to ground or open circuit ~ 0.5 V smaller than EDS supply voltage • Static leakage current flow
P2732	Pressure Control Solenoid “F” Performance or Stuck Off	PWM hardware detection, 0 or 100%
P2733	Pressure Control Solenoid “F” Stuck On	PWM hardware detection, 0 or 100%
P2734	Pressure Control Solenoid “F” Electrical	• EDS output voltage at short to ground or open circuit ~ 0.5 V smaller than EDS supply voltage • Static leakage current flow
P2735	Pressure Control Solenoid “F” Intermittent	PWM hardware detection, 0 or 100%

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P10A0	Actuation Regulating Flap for Intake Air Electrical Malfunction	• Duty cycle > 95% • Duty cycle < 95% • Duty cycle > 0.3 s at > 98 %
P10A4	Regulating Flap for Intake Air Mechanical Malfunction	Absolute value of maximum deviation between predicted and real value: > 8%
P10A5	Potentiometer Regulating Flap for Intake Air Signal Too High	Signal voltage > 4.9 V
P10A6	Potentiometer Regulating Flap for Intake Air Signal Too Low	Signal voltage < 0.1 V
P10A7	Adaptation Regulating Flap for Intake Air Soiled	Difference actual signal voltage to learned signal voltage > 0.05 V
P10A8	Adaptation Regulating Flap for Intake Air Lower Limit Not Reached	RFP Signal Voltage in closed position ≤ 0.35 - ≥ 0.65 V
P1114	Internal resistance too large (Bank 1, sensor 2)	Heater resistance, (128-648)*(8-40)1.02-25.9 k Ω (dep. on mod. exhaust temp. and heater power)

DTC	Error Message	Malfunction Criteria and Threshold Value
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	• Deviation fuel rail pressure control > 0.060 g/Rev and • Deviation HO2S control < -22.5%
P12A2	Fuel Rail Pressure Sensor Inappropriately High	• Deviation fuel rail pressure control < 0.051 g/Rev • Deviation HO2S control > 30%
P12A4	Fuel Rail Pump Control Valve Stuck Closed	• Deviation fuel rail pressure control < -0.120 g/rev • Lambda controller output (no map, just bottom and top limit) -15 - 15 % • Actual pressure - target pressure >3.5 MPa • Lambda controller output (no map, just bottom and top limit) -15 - 15 %
P13EA	Cold Start Ignition Timing Performance @ Part Load	Part Load Difference between commanded spark timing vs. actual value > 15%
P150A	Engine Off Timer Performance	• Difference between engine-off-time < -12.0 Sec. and • ECM after run-time > 12.0 Sec.
P2101	Throttle Actuator Control Motor Circuit Range/ Performance	• Duty cycle > 0.4 s at > 98% and • Actual TPS - ref. point > 1.5° or • Actual TPS - calc. value > 0.4 s at > 8°
P2106	Throttle Actuator Control System - Forced Limited Power	ECM power stage failure
P2122	Throttle/Pedal Position Sensor/Switch “D” Circuit Low Input	Signal voltage < 0.4 V
P2123	Throttle/Pedal Position Sensor/Switch “D” Circuit High Input	Signal voltage > 4.82 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2127	Throttle/Pedal Position Sensor/Switch “E” Circuit Low Input	Signal voltage < 0.2 V
P2128	Throttle/Pedal Position Sensor/Switch “E” Circuit High Input	Signal voltage > 2.8 V
P2138	Throttle/Pedal Position Sensor/Switch “D” / “E” Voltage Correlation	Signal voltage sensor 1 vs 2, > 0.24 V
P2147	Fuel Injector Group “A” Supply Voltage Circuit Low	Signal current > 12 A
P2148	Fuel Injector Group “A” Supply Voltage Circuit High	Signal current > 33 A
P2150	Fuel Injector Group “B” Supply Voltage Circuit Low	Signal current > 12 A
P2151	Fuel Injector Group “B” Supply Voltage Circuit High	Signal current > 33 A
P2153	Fuel Injector Group “C” Supply Voltage Circuit Low	Signal current > 12 A
P2154	Fuel Injector Group “C” Supply Voltage Circuit High	Signal current > 33 A
P2181	Cooling System Performance	• ECT < 75 °C • Mass air integral 3.5 - 26.0 kg
P2195	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 1)	HO2S value > 1.1 V
P2196	O2 Sensor Signal Stuck Rich (Bank 1 Sensor 1)	HO2S value < 0.9 V
P2197	O2 Sensor Signal Stuck Lean (Bank 2 Sensor 1)	HO2S value > 1.1 V
P2198	O2 Sensor Signal Stuck Rich (Bank 2 Sensor 1)	HO2S value < 0.9 V
P219C	Cylinder 1 Air-Fuel Ratio Imbalance	• Adaptive value < -10% or • > 10%
P219D	Cylinder 2 Air-Fuel Ratio Imbalance	• Adaptive value < -10% or • > 10%
P219E	Cylinder 3 Air-Fuel Ratio Imbalance	• Adaptive value < -10% or • > 10%

DTC	Error Message	Malfunction Criteria and Threshold Value
P219F	Cylinder 4 Air-Fuel Ratio Imbalance	• Adaptive value < -10% or • > 10%
P21A0	Cylinder 5 Air-Fuel Ratio Imbalance	• Adaptive value < -10% or • > 10%
P21A1	Cylinder 6 Air-Fuel Ratio Imbalance	• Adaptive value < -10% or • > 10%
P2227	Barometric Pressure Circuit Range/Performance	Pressure difference in cross check between boost pressure sensor 1/2; inlet charger pressure and ambient pressure sensor > 7 kPa
P2237	O2 Sensor Positive Current Control Circuit/Open (Bank 1 Sensor 1)	• Signal activity check-failed • Open Circuit pump Current (IP)
P2240	O2 Sensor Positive Current Control Circuit/Open (Bank 2 Sensor 1)	• Signal activity check-failed • Open Circuit pump Current (IP)
P2243	O2 Sensor Reference Voltage Circuit/Open (Bank 1 Sensor 1)	• Signal activity check-failed • Open Circuit Nernst Voltage (UN)
P2247	O2 Sensor Reference Voltage Circuit/Open (Bank 2 Sensor 1)	• Signal activity check-failed • Open Circuit Nernst Voltage (UN)
P2251	O2 Sensor Negative Current Control Circuit/Open (Bank 1 Sensor 1)	• Signal activity check-failed • Open Circuit Virtual Mass (VM)
P2254	O2 Sensor Negative Current Control Circuit/Open (Bank 2 Sensor 1)	• Signal activity check-failed • Open Circuit Virtual Mass (VM)
P2257	Secondary Air Injection System Control “A” Circuit Low	Signal voltage < 2.00 V
P2258	Secondary Air Injection System Control “A” Circuit High	Signal current > 5 A
P2270	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 2)	Signal voltage < 0.800 V and number of checks ≥ 3
P2271	O2 Sensor Signal Stuck Rich Bank 1 Sensor 2	Signal voltage > 0.2 V and number of checks ≥ 3

DTC	Error Message	Malfunction Criteria and Threshold Value
P2272	O2 Sensor Signal Stuck Lean (Bank 2 Sensor 2)	Signal voltage < 0.800 V and number of checks ≥ 3
P2273	O2 Sensor Signal Stuck Rich (Bank 2 Sensor 2)	Signal voltage > 0.2 V and number of checks ≥ 3
P2293	Fuel Pressure Regulator 2 Performance	• Difference between target pressure vs. actual pressure, > 1.50mPa • Difference between target pressure vs. actual pressure, < -1.50 mPa
P2294	Fuel Pressure Regulator 2 Control Circuit	Signal current < 0.8 mA
P2295	Fuel Pressure Regulator 2 Control Circuit Low	< 2.0 V
P2296	Fuel Pressure Regulator 2 Control Circuit High	Signal current > 8 A

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/Open	Signal current < 0.8 mA
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	Signal voltage < 2 V
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	Signal current > 2.0 A
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit/Open	Low signal voltage > 0.5 s time > 1 s
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	• High signal voltage and • Time > 0.36 s
P2414	O2 Sensor Exhaust Sample Error (Bank 1 Sensor 1)	O2S signal front > 3.1 V
P2415	O2 Sensor Exhaust Sample Error (Bank 2 Sensor 1)	O2S signal front > 3.1 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2440	Secondary Air Injection System Switching Valve Stuck Open	Deviation of lambda controller > 15.00%
P2442	Secondary Air Injection System Switching Valve Stuck Open (Bank 2)	Deviation of lambda controller > 15.00%
P2539	Low Pressure Fuel System Sensor Circuit	Signal voltage > 4.8 V
P2541	Low Pressure Fuel System Sensor Circuit Low	Signal voltage < 0.2 V
P2626	O2 Sensor Pumping Current Trim Circuit/Open (Bank 1 Sensor 1)	• O2S signal front > 4.7 V • Open Circuit Adjustment Voltage (IA)
P2629	O2 Sensor Pumping Current Trim Circuit/Open Bank 2 Sensor 1)	• O2S signal front > 4.7 V • Open Circuit Adjustment Voltage (IA)

DTC CHART

Engine Codes - 4.0L CEUA, CGTA

Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Intake “A” Camshaft Position Slow Response (Bank 1)	• Difference between target position vs. actual position > 8.00 - 63.75 °CRK for time > 1.5 - 3.0 s and • Adjustment angle ≥ 3.00 °CRK
P000B	Exhaust “B” Camshaft Position Slow Response (Bank 1)	• Difference between target position vs. actual position > 8.00 - 63.75 °CRK for time > 1.5 - 3.0 s and • Adjustment angle ≥ 3.00 °CRK
P000C	Intake “A” Camshaft Position Slow Response (Bank 2)	• Difference between target position vs. actual position > 8.00 - 63.75 °CRK for time > 1.5 - 3.0 s and • Adjustment angle ≥ 3.00 °CRK
P000D	Exhaust “B” Camshaft Position Slow Response (Bank 2)	• Difference between target position vs. actual position > 8.00 - 63.75 °CRK for time > 1.5 - 3.0 s and • Adjustment angle ≥ 3.00 °CRK
P0010	Intake “A” Camshaft Position Actuator Circuit / Open (Bank 1)	Signal voltage 4.70 - 5.40 V
P0011	Intake “A” Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	• Difference between target position vs. actual position > 8.00 - 63.75 °CRK for time > 1.5 - 3.0 s and • Adjustment angle < 3.00 °CRK
P0013	Exhaust “B” Camshaft Position - Actuator Circuit / Open (Bank 1)	Signal voltage 4.70 - 5.40 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0014	Exhaust “B” Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	• Difference between target position vs. actual position > 8.00 - 63.75 °CRK for time > 1.5 - 3.0 s and • Adjustment angle < 3.00 °CRK
P0016	Crankshaft Position – Camshaft Position Correlation (Bank 1 Sensor A)	• Permissible deviation < -11.01° CRK and • Engine speed no signal
P0017	Crankshaft Position – Camshaft Position Correlation (Bank 1 Sensor B)	• Permissible deviation < -11.01° CRK or • Permissible deviation > 11.01° CRK
P0018	Crankshaft Position – Camshaft Position Correlation (Bank 2 Sensor A)	• Permissible deviation < -11.01° CRK and • Engine speed no signal
P0019	Crankshaft Position – Camshaft Position Correlation (Bank 2 Sensor B)	• Permissible deviation < -11.01° CRK or • Permissible deviation > 11.01° CRK
P0020	Intake “A” Camshaft Position Actuator Circuit / Open (Bank 2)	Signal voltage 4.70 - 5.40 V
P0021	Intake “A” Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	• Difference between target position vs. actual position > 8.00 - 63.75 °CRK for time > 1.5 - 3.0 s and • Adjustment angle <3.00 °CRK
P0023	Exhaust “B” Camshaft Position - Actuator Circuit / Open (Bank 2)	Signal voltage 4.70 - 5.40 V
P0024	Exhaust “B” Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	• Difference between target position vs. actual position > 8.00 - 63.75 °CRK for time > 1.5 - 3.0 s and • Adjustment angle <3.00 °CRK
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	Signal voltage > 4.70 - 5.40 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	Signal voltage < 0.0 - 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)	Signal voltage 2.34 - 3.59 V
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	Signal voltage < 2.34 V
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2	Signal current > 3.59 A
P0040	O2 Sensor Signals Swapped (Bank 1 Sensor 1/ Bank 2 Sensor 1)	Lambda controllers exceed thresholds in opposite directions • Case 1: lambda control value bank 1 < 0.80 and • Lambda control value bank 2 > 1.20 • Case 2: lambda control value bank 1 > 1.20 and • Lambda control value bank 2 < 0.80
P0043	HO2S Heater Control Circuit Low (Bank 1 Sensor 3)	• SULEV Heater voltage < 3 V • ULEV Heater voltage < 3 V
P0044	HO2S Heater Control Circuit High (Bank 1 Sensor 3)	Heater current > 2.70 - 5.50 A
P0050	HO2S Heater Control Circuit (Bank 2 Sensor 1)	Signal voltage > 4.70 - 5.40 V
P0051	HO2S Heater Control Circuit Low (Bank 2 Sensor 1)	Signal voltage 0.0 - 3.26 V
P0052	HO2S Heater Control Circuit High (Bank 2 Sensor 1)	Heater current > 5.50 A
P0056	HO2S Heater Control Circuit (Bank 2 Sensor 2)	Signal voltage 2.34 - 3.59 V
P0057	HO2S Heater Control Circuit Low (Bank 2 Sensor 2)	Heater voltage < 2.34 V
P0058	HO2S Heater Control Circuit High (Bank 2 Sensor 2)	Signal current > 3.59 A
P0068	MAP/MAF – Throttle Position Correlation	Deviation throttle controller < 43 or > 43%
P0070	Ambient Air Temperature Sensor Circuit	Ambient air temp <50.0 °C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0071	Ambient Air Temperature Sensor Range/Performance	• Difference ECT vs. IAT at engine start < 24.8 - 39.8 K and • Difference IAT vs. AAT at engine start > 24.8 - 39.8 K and • Difference AAT vs. ECT at engine start > 24.8 - 39.8 K (depending on engine off time)
P0072	Ambient Air Temperature Sensor Circuit Low	Ambient air temp >87.0 °C
P007C	Charge Air Cooler Temperature Sensor Circuit Low (Bank 1)	Intake air temperature < 0.099 V
P007D	Charge Air Cooler Temperature Sensor Circuit High (Bank 1)	Intake air temperature > 3.20 V
P0087	Fuel Rail/System Pressure - Fuel Rail/System Pressure - Too Low	• Pressure control activity > 1.0 mPa and • Fuel trim activity 0.90 - 20 and • Difference between target pressure vs. actual pressure > 0.40 mPa
P0088	Fuel Rail/System Pressure - Too High	Fuel rail pressure > 13.9 MPa
P0089	Fuel Pressure Regulator 1 Performance	• Difference between actual pressure - target pressure > 200 kPa • Pressure control activity < -350 kPa or > 350 kPa
P008A	Low Pressure Fuel System Pressure - Too Low	< 80.0 kPa
P008B	Low Pressure Fuel System Pressure - Too High	Actual press > 850 MPa
P0096	Intake Air Temperature Sensor 2 Circuit Range/Performance	Difference charge air cooler temp. sensor 1 vs. median between (ECT, IAT, Charge air cooler temp. sensor 1, Charge air cooler temp. sensor 2) > 9.8 K

DTC	Error Message	Malfunction Criteria and Threshold Value
P0097	Intake Air Temperature Sensor 2 Circuit Low	Signal voltage < 0.10 V
P0098	Intake Air Temperature Sensor 2 Circuit High	Signal voltage > 4.62 V
P00A6	Intake Air Temperature Sensor 2 Circuit Bank 2 Range/ Performance	Difference charge air cooler temp. sensor 2 vs. median between (ECT, IAT, Charge air cooler temp. sensor 2 , Charge air cooler temp. sensor 1) > 9.8 K
P00A7	Charge Air Cooler Temperature Sensor 2 Short to Ground	Signal Voltage < 0.10 V
P00A8	Charge Air Cooler Temperature Sensor 2 Short to Battery Voltage / Open Circuit	Signal Voltage > 4.62 V
P0100	Mass or Volume Air Flow A Circuit	MAF sensor signal 0 µs
P0101	Mass or Volume Air Flow Circuit Range/Performance	• Mass air flow vs. lower threshold model < 11 - 192% • Mass air flow vs upper threshold > 120 - 168% • Load calculation >20%. and • Fuel system (mult) < 15% • Mass air flow vs. calculated mass air flow < 20%
P0102	Mass or Volume Air Flow Circuit Low Input	MAF sensor signal, < 0.2 V
P0103	Mass or Volume Air Flow Circuit High Input	MAF sensor signal > 4.8 V
P0106	Manifold Absolute Pressure/ Barometric Pressure Circuit Range/Performance	Boost pressure signal • Manifold pressure signal: variation between state 1 and 2 < 50.00 [hPa]
P0107	Manifold Absolute Pressure/ Barometric Pressure Circuit Low Input	• Signal voltage < 0.20 V Range check: • Manifold pressure signal < 80.00 hPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P0108	Manifold Absolute Pressure/ Barometric Pressure Circuit High Input	• Signal voltage > 4.80 V Range check: • Manifold pressure signal > 1170.00 hPa
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	• Difference IAT vs. ECT at engine start > 24.8 - 39.8 K • (Depending on engine off time) and difference IAT vs. AAT at engine start > 24.8 - 39.8 K
P0112	Intake Air Temperature Sensor 1 Circuit Low	Signal voltage < 0.15 V
P0113	Intake Air Temperature Sensor 1 Circuit High	Signal voltage > 4.50 V
P0116	Engine Coolant Temperature Circuit Range/Performance	•Difference ECT vs. IAT at engine start > 24.8 - 39.8 K and • Difference IAT vs. AAT at engine start < 24.8 - 39.8 K and • Difference AAT vs. ECT at engine start < 24.8 - 39.8 K (depending on engine off time)
P0117	Engine Coolant Temperature Circuit Low	Engine coolant temperature > 140°C
P0118	Engine Coolant Temperature Circuit High	Engine coolant temperature < 40°C
P0121	Throttle/Pedal Position Sensor/Switch “A” Circuit Range/Performance	• TPS 1 - TPS 2 > 6.30% and • TPS 1 calculated value > 9.00%
P0122	Throttle/Pedal Position Sensor/Switch “A” Circuit Low	Signal voltage < 0.18 V
P0123	Throttle/Pedal Position Sensor/Switch “A” Circuit High	Signal voltage > 4.63 V
P012B	Turbocharger/Supercharger Inlet Pressure Sensor Circuit Range/Performance	• Pressure difference in cross check between boost pressure sensor 1/2; IM pressure, ambient pressure sensor • Pressure difference in cross check between boost pressure sensor 1/2; IM pressure

DTC	Error Message	Malfunction Criteria and Threshold Value
P012C	Turbocharger/Supercharger Inlet Pressure Sensor Circuit Low	Signal voltage < 0.2 V
P012D	Turbocharger/Supercharger Inlet Pressure Sensor Circuit High	Signal voltage > 4.8 V
P0130	O2 Sensor Circuit (Bank 1, Sensor 1)	Sensor element temperature < 690° C
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	Virtual mass < 1.75 V
		Nernst voltage < 1.50 V
		Adjustment voltage < 3.0 V
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	Virtual mass > 3.25 V
		Nernst voltage > 4.40 V
		Adjustment voltage > 7 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0133	O2 Circuit Slow Response (Bank 1, Sensor 1)	Symmetric fault: • Difference of R2L area ratio vs. L2R area ratio -0.50 - 1.00 • Lower value of both counters for area ratio R2L and L2R ≥ 5 times Delay Time: • Gradient ratio ≥ 0.30 • Lower value of both area ratios R2L and L2R < 0.30 Transient Time: • Gradient ratio ≥ 0.30 • Gradient ratio ≤ 0.60 • Lower value of both area ratios R2L and L2R < 0.30 or • Lower value of both gradient ratios R2L and L2R < 0.30 Asymmetric fault: • Difference of R2L area ratio vs. L2R area ratio NOT (-0.50 - 1.00) • Values of both counters for area ratio R2L and L2R ≥ 5 times Delay Time: • Gradient ratio ≥ 0.30 • Lower value of both area ratios R2L and L2R < 0.30 Transient Time: • Gradient ratio ≥ 0.30) • Gradient ratio ≤ 0.60 • Lower value of both area ratios R2L and L2R < 0.30 or • Lower value of both gradient ratios R2L and L2R < 0.30

DTC	Error Message	Malfunction Criteria and Threshold Value
P0135	O2 Sensor Heater Circuit (Bank 1, Sensor 1)	Out of range high • O2S ceramic temperature < 725°C and • Heater duty cycle 90.00% Rationality check (sensor heating up) • O2S ceramic temperature < 725°C and • Time after O2S heater on 40 Sec.
P0136	O2 Sensor Circuit (Bank 1, Sensor 2)	Delta O2S signal rear > 2 V
P0137	O2 Sensor Circuit Low Voltage (Bank 1, Sensor 2)	• Signal voltage < 0.06 V for time > 3 Sec. and • Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) < 0.01 V
P0138	O2 Sensor Circuit High Voltage (Bank 1, Sensor 2)	Signal voltage > 1.08 V for > 5 Sec.
P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	O2S rear signal 640 - 645 mV
P013A	Oxygen Sensors Rear (binary LSF)	• EWMA filtered max differential transient time at fuel cut off ≥ 0.5 Sec and • Number of checks ≥ 3.00 (initial phase and step function)
P013C	Oxygen Sensors Rear (binary LSF)	• EWMA filtered max differential transient time at fuel cut off ≥ 0.5 Sec and • Number of checks ≥ 3.00 (initial phase and step function)

DTC	Error Message	Malfunction Criteria and Threshold Value
P0140	O2 Circuit No Activity Detected (Bank 1, Sensor 2)	• Signal voltage .40 - .60 mV for > 3 Sec and • Difference in sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) ≥ 2.80 V
P0141	O2 Sensor Heater Circuit Bank 1 Sensor 2	Heater resistance 500 - 10000 Ω
P0145	O2 Sensor Circuit Slow Response (Bank 1 Sensor 3)	• EWMA filtered transient time at fuel cut off > 0.4 Sec. • In voltage range 401.4 - 201.2 mV • Number of checks (initial phase) > 3 • Number of checks (step function) > 3
P0150	O2 Sensor Circuit (Bank 2, Sensor 1)	Sensor element temperature < 690° C
P0151	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1)	Virtual mass < 1.75 V
		Nernst voltage < 1.50 V
		Adjustment voltage < 3.0 V
P0152	O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)	Virtual mass > 3.25 V
		Nernst voltage > 4.40 V
		Adjustment voltage > 7 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0153	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)	Symmetric fault: • Difference of R2L area ratio vs. L2R area ratio -0.50 - 1.00 • Lower value of both counters for area ratio R2L and L2R ≥ 5 times Delay Time: • Gradient ratio ≥ 0.30 • Lower value of both area ratios R2L and L2R < 0.30 Transient Time: • Gradient ratio ≥ 0.30 • Gradient ratio ≤ 0.60 • Lower value of both area ratios R2L and L2R < 0.30 or • Lower value of both gradient ratios R2L and L2R < 0.30 Asymmetric fault: • Difference of R2L area ratio vs. L2R area ratio NOT (-0.50 - 1.00) • Values of both counters for area ratio R2L and L2R ≥ 5 times Delay Time: • Gradient ratio ≥ 0.30 • Lower value of both area ratios R2L and L2R < 0.30 Transient Time: • Gradient ratio ≥ 0.30) • Gradient ratio ≤ 0.60 • Lower value of both area ratios R2L and L2R < 0.30 or • Lower value of both gradient ratios R2L and L2R < 0.30

DTC	Error Message	Malfunction Criteria and Threshold Value
P0155	O2 Sensor Heater Circuit (Bank 2 Sensor 1)	Out of range high • O2S ceramic temperature < 725 °C and • Heater duty cycle > 90.00% Rationality check (sensor heating up) • O2S ceramic temperature < 725 °C and • Time after O2S heater on 40.0 Sec
P0156	O2 Sensor Circuit (Bank 2 Sensor 2)	Delta O2S signal rear > 2 V
P0157	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 2)	• Signal voltage < 0.06 V for time > 3.0 Sec and • Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) < 0.01 V
P0158	O2 Sensor Circuit High Voltage (Bank 2 Sensor 2)	Signal voltage > 1.08 V for time > 5.0 Sec
P0159	O2 Sensor Circuit Slow Response (Bank 2 Sensor 2)	O2S rear signal 640 - 645 mV
P0160	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 2)	• Signal voltage 0.40 - 0.60 V for time > 3.0 Sec and • Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) ≥ 2.80 V
P0161	O2 Sensor Heater Circuit (Bank 2 Sensor 2)	Heater resistance > 500 - 10000 Ω
P0169	Incorrect Fuel Composition	Comparison with fuel quantity incorrect
P0171	System Too Lean (Bank 1)	• Adaptive value > 5.30% • Too rich at idle Adaptive value > 25%
P0172	System Too Rich (Bank 1)	• Adaptive value < -5.30% • Adaptive value < -20%
P0174	System Too Lean (Bank 2)	• System too lean adaptive value > 20 • Signal Adaptive value > 5.30%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0175	System Too Rich (Bank 2)	• Too rich at idle Adaptive value < 20% • Adaptive value < -5.30%
P017B	Cylinder Head Temperature Sensor	• Difference between modelled and measured cylinder head temperature > 9.8 K • Difference CHDT (Cylinder Head Temperature) vs. ECT at engine start ≥ 24.8 - 39.8 K or • Difference CHDT (Cylinder Head Temperature) vs. IAT at engine start ≥ 24.8 - 39.8 K • Difference CHDT (Cylinder Head Temperature) vs. ECT at engine start ≤ -(24.8 - 39.8) K or • Difference CHDT (Cylinder Head Temperature) vs. IAT at engine start ≤ -(24.8 - 39.8) K
P017C	Cylinder Head Temperature Sensor	Signal voltage < 0.11 V
P017D	Cylinder Head Temperature Sensor	Signal voltage > 3.10 V
P0190	Fuel Rail Pressure Sensor Circuit	Signal voltage > 4.80 V
P0191	Fuel Rail Pressure Sensor Circuit Range/Performance	Actual pressure > 10 MPa
P0192	Fuel Rail Pressure Sensor Circuit Low	Signal voltage < 0.2 V
P0201	Injector Circuit/Open - Cylinder 1	Signal current < 2.1 A
P0202	Injector Circuit/Open - Cylinder 2	Signal current < 2.1 A
P0203	Injector Circuit/Open - Cylinder 3	Signal current < 2.1 A
P0204	Injector Circuit/Open - Cylinder 4	Signal current < 2.1 A
P0205	Injector Circuit/Open - Cylinder 5	Signal current < 2.1 A
P0206	Injector Circuit/Open - Cylinder 6	Signal current < 2.1 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P0207	Injector Circuit/Open - Cylinder 7	Signal current < 2.1 A
P0208	Injector Circuit/Open - Cylinder 8	Signal current < 2.1 A
P0221	Throttle/Pedal Position Sensor/Switch “B” Circuit Range/Performance	• TPS 1 - TPS 2 > 6.30% or • TPS 2 calculated value > 9.00%
P0222	Throttle/Pedal Position Sensor/Switch “B” Circuit Low	Signal voltage < 0.16 V
P0223	Throttle/Pedal Position Sensor/Switch “B” Circuit High	Signal voltage > 4.88 V
P0234	Turbo/Super Charger Overboost Condition	Difference of set value boost pressure vs. actual boost pressure value > 200 - 1275 hPa
P0235	Turbo/Super Charger Boost Sensor “A” Circuit	Boost pressure sensor signal vs target value • > 27 - 50 kPa, depending on altitude
P0236	Turbo/Super Charger Boost Sensor “A” Circuit Range/ Performance	• Pressure difference in cross check between boost pressure sensor 1/2; IM pressurel > 7 kPa • Pressure difference in cross check between . boost pressure sensor 1/2 and IM > 12 - 27 kPa
P0237	Turbo/Super Charger Boost Sensor “A” Circuit Low	Signal voltage < 0.2 V
P0238	Turbo/Super Charger Boost Sensor “A” Circuit High	Signal voltage > 4.8 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0240	Turbo/Super Charger Boost Sensor “B” Circuit Range/ Performance	• Pressure difference in cross check between boost pressure sensor 1/2; IM pressure, ambient pressure > 7 kPa • Pressure difference in cross check between boost pressure sensor 1/2; IM pressure > 12 - 27 kPa • Pressure difference in cross check between pressure sensor 1 and 2 > 12.51 kPa and fuel trim activity (bank with deviation is considered to be defective > 151%
P0241	Turbo/Super Charger Boost Sensor “B” Circuit Low	Signal voltage < 0.2 V
P0242	Turbo/Super Charger Boost Sensor “B” Circuit High	Signal voltage > 4.8 V
P0243	Turbo/Super Charger Wastegate Solenoid “A”	Signal voltage > 4.4 - 5.6 V
P0245	Turbo/Super Charger Wastegate Solenoid “A” Low	Signal voltage < 2.15 - 3.25 V
P0246	Turbo/Super Charger Wastegate Solenoid "A" High	Signal current > 2.2 A
P025A	Fuel Pump Module Control Circuit/Open	Signal current < 0.8 mA
P025C	Fuel Pump Module Control Circuit Low	Signal voltage< 2.0 V
P025D	Fuel Pump Module Control Circuit High	Signal current > 1.0 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
P0273	Cylinder 5 Injector Circuit Low	Signal current < 2.1 A
P0274	Cylinder 5 Injector Circuit High	Signal current > 14.70 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P0276	Cylinder 6 Injector Circuit Low	Signal current < 2.1 A
P0277	Cylinder 6 Injector Circuit High	Signal current > 14.70 A
P0279	Cylinder 7 Injector Circuit Low	Signal current < 2.1 A
P0280	Cylinder 7 Injector Circuit High	Signal current > 14.70 A
P0282	Cylinder 8 Injector Circuit Low	Signal current < 2.1 A
P0283	Cylinder 8 Injector Circuit High	Signal current > 14.70 A
P0299	Turbo/Super Charger Underboost	Difference set value boost pressure vs actual boost pressure value, >150 hPa
P200A	Intake Manifold Runner Control Out of Range	Signal voltage < 0.7 V
P200B	Intake Manifold Runner Control Overtravel	Signal voltage < 0.7 V
P2004	Intake Manifold Runner Control Stuck Open (Bank 1)	Difference between target position vs. actual position > 30%
P2005	Intake Manifold Runner Control Stuck Open (Bank 2)	Difference between target position vs. actual position > 30%
P2006	Intake Manifold Runner Control Stuck Closed (Bank 1)	Difference between target position vs. actual position > 30%
P2007	Intake Manifold Runner Control Stuck Closed (Bank 2)	Deviation runner flaps position > 30 vs. calculated position > 30%
P2008	Intake Manifold Runner Control Circuit/Open (Bank 1)	Signal voltage 4.70 - 5.40 V
P2009	Intake Manifold Runner Control Circuit Low (Bank 1)	Signal voltage 0.0 - 3.26 V
P2010	Intake Manifold Runner Control Circuit High (Bank 1)	Signal current > 2.20 A
P2014	Intake Manifold Runner Position Sensor/Switch Circuit (Bank 1)	Signal voltage, < 0.20 V
P2015	Intake Manifold Runner Position Sensor/Switch Circuit Range/Performance (Bank 1)	Deviation runner flap position vs. actual position > 25%
P2016	Intake Manifold Runner Position Sensor/Switch Circuit Low (Bank 1)	Signal voltage < 0.25 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2017	Intake Manifold Runner Position Sensor/Switch Circuit High (Bank 1)	Signal voltage, > 4.80 V
P2019	Intake Manifold Runner Position Sensor/Switch Circuit (Bank 2)	Signal voltage, < 0.20 V
P2022	Intake Manifold Runner Position Sensor/Switch Circuit High (Bank 2)	Signal voltage, > 4.80 V
P2024	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Circuit	Signal voltage 4.70 - 5.40 V
P2025	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Performance	• Response time > 1000 ms • Number of checks > 3.00 • Security bit incorrect • Number of checks > 3.00 [-] • Time difference between ECM and Smart Module > 3.0 s • Smart Module Temp High > 119 °C • Smart Module Temp Low < -39 °C
P2026	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Circuit Low Voltage	Signal voltage 0.0 - 3.25 V
P2027	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Circuit High Voltage	Signal current > 2.20 A
P2088	A Camshaft Position Actuator Control Circuit Low (Bank 1)	Signal voltage 0.0 - 3.25
P2089	A Camshaft Position Actuator Control Circuit High (Bank 1)	Signal current > 2.2 A
P2090	B Camshaft Position Actuator Control Circuit Low (Bank 1)	Signal voltage 0.0 - 3.25 V
P2091	B Camshaft Position Actuator Control Circuit High (Bank 1)	Short to battery plus signal current > 2.20 A
P2092	A Camshaft Position Actuator Control Circuit Low (Bank 2)	Signal voltage 0.0 - 3.25
P2093	A Camshaft Position Actuator Control Circuit High Bank 2	Signal current, > 2.20 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P2094	B Camshaft Position Actuator Control Circuit Low (Bank 2)	Signal voltage 0.0 - 3.25 V
P2095	B Camshaft Position Actuator Control Circuit High (Bank 2)	Short to battery plus signal current > 2.20 A
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	Out of range I-portion of 2nd lambda control loop < -0.030
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	I-portion of 2nd lambda control loop > 0.030
P2098	Post Catalyst Fuel Trim System Too Lean (Bank 2)	Out of range I-portion of 2nd lambda control loop < -0.030
P2099	Post Catalyst Fuel Trim System Too Rich (Bank 2)	I-portion of 2nd lambda control loop > 0.030
P3081	Engine Temperature Too Low	Reference model temperature - measured engine coolant temperature > 9.8 K
P31A2	Variable Valve Lift (VVL) Actuator, Inlet Open, Cyl. 2, Short to Ground	Signal voltage < 2.8 - 3.2 V
P31A3	Variable Valve Lift (VVL) Actuator, Inlet Open, Cyl. 3, Short to Ground	Signal voltage < 2.8 - 3.2 V
P31A5	Variable Valve Lift (VVL) Actuator, Inlet Open, Cyl. 5, Short to Ground	Signal voltage < 2.8 - 3.2 V
P31A8	Variable Valve Lift (VVL) Actuator, Inlet Open for Cylinder 8 Short to Ground	Signal voltage < 2.8 - 3.2 V
P31AA	Variable Valve Lift (VVL) Actuator, Inlet Open for Cylinder 2 Short to Ground	Signal voltage < 2.8 - 3.2 V
P31AB	Variable Valve Lift (VVL) Actuator, Inlet Open for Cylinder 5 Short to Ground	Signal voltage < 2.8 - 3.2 V
P31AD	Variable Valve Lift (VVL) Actuator, Inlet Open for Cylinder 3 Short to Ground	Signal voltage < 2.8 - 3.2 V
P31B0	Variable Valve Lift (VVL) Actuator, Outlet Open for Cylinder 8 Short to Ground	Signal voltage < 2.8 - 3.2 V
P31B2	Variable Valve Lift (VVL) Actuator, Outlet Open for Cylinder 8 Short to Ground	Signal voltage < 2.8 - 3.2 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P31B3	Variable Valve Lift (VVL) Actuator, Outlet Open for Cylinder 8 Short to Ground	Signal voltage < 2.8 - 3.2 V
P31B5	Variable Valve Lift (VVL) Actuator, Outlet Open for Cylinder 8 Short to Ground	Signal voltage < 2.8 - 3.2 V
P31B8	Variable Valve Lift (VVL) Actuator, Inlet Closed, Cyl. 8, Short to Ground	Signal voltage < 2.8 - 3.2 V
P31BA	Variable Valve Lift (VVL) Actuator, Outlet close, Cyl. 2, Short to Ground	Signal voltage < 2.8 - 3.2 V
P31BB	Variable Valve Lift (VVL) Actuator, Outlet close, Cyl. 3, Short to Ground	Signal voltage < 2.8 - 3.2 V
P31BD	Variable Valve Lift (VVL) Actuator, Outlet close, Cyl. 5, Short to Ground	Signal voltage < 2.8 - 3.2 V
P31C0	Variable Valve Lift (VVL) Actuator, Outlet close, Cyl. 8, Short to Ground	Signal voltage < 2.8 - 3.2 V

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random/Multiple Cylinder Misfire Detected	• Emission threshold misfire rate (MR) > 2.5% • Catalyst damage misfire rate (MR) > 2.5 - 24%
P0301	Cylinder 1 Misfire Detected	• Emission threshold misfire rate (MR) > 2.5% • Catalyst damage misfire rate (MR) > 2.5 - 24%
P0302	Cylinder 2 Misfire Detected	• Emission threshold misfire rate (MR) > 2.5% • Catalyst damage misfire rate (MR) > 2.5 - 24%
P0303	Cylinder 3 Misfire Detected	• Emission threshold misfire rate (MR) > 2.5% • Catalyst damage misfire rate (MR) > 2.5 - 24%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0304	Cylinder 4 Misfire Detected	• Emission threshold misfire rate (MR) > 2.5% • Catalyst damage misfire rate (MR) > 2.5 - 24%
P0305	Cylinder 5 Misfire Detected	• Emission threshold misfire rate (MR) > 2.5% • Catalyst damage misfire rate (MR) > 2.5 - 24%
P0306	Cylinder 6 Misfire Detected	• Emission threshold misfire rate (MR) > 2.5% • Catalyst damage misfire rate (MR) > 2.5 - 24%
P0307	Cylinder 7 Misfire Detected	• Emission threshold misfire rate (MR) > 2.5% • Catalyst damage misfire rate (MR) > 2.5 - 24%
P0308	Cylinder 8 Misfire Detected	• Emission threshold misfire rate (MR) > 2.5% • Catalyst damage misfire rate (MR) > 2.5 - 24%
P0321	Ignition/Distributor Engine Speed Input Circuit Range/ Performance	• Counted teeth vs. reference incorrect or • Monitoring reference gap failure
P0322	Ignition/Distributor Engine Speed Input Circuit No Signal	• Camshaft signal > 3 and • Engine speed no signal
P0324	Knock Control System Error	• Signal fault counter (combustion) > 24 or • Signal fault counter (measuring window) > 2.00 • Communication errors • SPI communication > 25
P0326	Knock Sensor 1 Circuit Range/Performance	• Lower threshold < 0.029 V • Upper threshold > 1.992 V
P0327	Knock Sensor 1 Circuit Low	Lower threshold 0.18 V
P0328	Knock Sensor 1 Circuit High	Upper threshold > 1.00 V
P0331	Knock Sensor 2 Circuit Range/Performance	• Lower threshold < 0.029 V • Upper threshold > 1.992 V
P0332	Knock Sensor 2 Circuit Low	Lower threshold 0.18 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0333	Knock Sensor 2 Circuit High	Upper threshold > 1.00 V
P0335	Crankshaft Position Sensor “A” Circuit	• Open circuit > 1 V • Short to grnd < 1.5 V • Short to B+ > 3.5 V • Signal check no signal
P0336	Crankshaft Position Sensor “A” Circuit Range/ Performance	• RPM signal comparison with phase sensor not synchronous • Counted versus reference teeth > 1 • Actual time value vs modeled time value > 1.375
P0340	Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor)	Signal activity check • Signal voltage no altering @ 4 Rev
P0341	Camshaft Position Sensor “A” Circuit Range/Performance (Bank 1 or Single Sensor)	• Signal pattern incorrect • Defect counter 6.00
P0342	Camshaft Position Sensor A Circuit Low Input (Bank 1 or Single Sensor)	• Signal voltage permanently low and • Crankshaft signals 4.00
P0343	Camshaft Position Sensor “A” Circuit High (Bank 1 or Single Sensor)	• Signal voltage permanently high • Crankshaft signals 4
P0345	Camshaft Position Sensor “A” Circuit (Bank 2)	Signal activity check • Signal voltage no altering @ 4 Rev
P0346	Camshaft Position Sensor “A” Circuit Range/Performance (Bank 2)	• Signal pattern incorrect • Defect counter 6.00
P0347	Camshaft Position Sensor “A” Circuit Low (Bank 2)	• Signal voltage permanently low and • Crankshaft signals 4.00
P0348	Camshaft Position Sensor “A” Circuit High (Bank 2)	• Signal voltage permanently high and • Crankshaft signals 4
P0351	Ignition Coil “A” Primary/ Secondary Circuit	Open circuit • Signal current < 0.25 to 2.0 mA or • Internal check failed

DTC	Error Message	Malfunction Criteria and Threshold Value
P0352	Ignition Coil “B” Primary/ Secondary Circuit	Open circuit • Signal current < 0.25 to 2.0 mA or • Internal check failed
P0353	Ignition Coil “C” Primary/ Secondary Circuit	Open circuit • Signal current < 0.25 to 2.0 mA or • Internal check failed
P0354	Ignition Coil “D” Primary/ Secondary Circuit	Open circuit • Signal current < 0.25 to 2.0 mA or • Internal check failed
P0355	Ignition Coil “E” Primary/ Secondary Circuit	Open circuit • Signal current < 0.25 to 2.0 mA or • Internal check failed
P0356	Ignition Coil “F” Primary/ Secondary Circuit	Open circuit • Signal current < 0.25 to 2.0 mA or • Internal check failed
P0357	Ignition Coil “G” Primary/ Secondary Circuit	Open circuit • Signal current < 0.25 to 2.0 mA or • Internal check failed
P0358	Ignition Coil “H” Primary/ Secondary Circuit	Open circuit • Signal current < 0.25 to 2.0 mA or • Internal check failed
P0366	Camshaft Position Sensor A Circuit Range/Performance (Bank 1 or Single Sensor)	• Signal pattern incorrect • Defect counter 6
P0367	Camshaft Position Sensor “B” Circuit Low (Bank 1)	• Signal voltage permanently low and • Crankshaft signals 4.00

DTC	Error Message	Malfunction Criteria and Threshold Value
P0368	Camshaft Position Sensor “B” Circuit High (Bank 1)	• Signal voltage permanently high and • Crankshaft signals 4.00
P0391	Camshaft Position Sensor “B” Circuit Range/Performance (Bank 2)	• Signal pattern incorrect • Defect counter 6
P0392	Camshaft Position Sensor “B” Circuit Low (Bank 2)	• Signal voltage permanently low and • Crankshaft signals 4.00
P0393	Camshaft Position Sensor “B” Circuit High (Bank 2)	• Signal voltage permanently high and • Crankshaft signals 4.00

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0410	Secondary Air Injection System	Difference ambient pressure vs. AIR pressure measured with AIR pressure sensor > 3.00 kPa
P0413	Secondary Air Injection System Switching Valve “A” Circuit Open	Signal voltage 4.70 - 5.40 V
P0414	Secondary Air Injection System Switching Valve “A” Circuit Shorted	Signal voltage 0.0 - 3.25 V Signal current > 2.20 A
P0415	Secondary Air Injection System Switching Valve “B” Circuit	Signal current 2.20 - 4.20 A
P0416	Secondary Air Injection System Switching Valve “B” Circuit Open	Signal voltage 4.70 - 5.40 V
P0417	Secondary Air Injection System Switching Valve “B” Circuit Shorted	Signal voltage 0.0 - 3.25 V Signal current > 2.20 A
P0418	Secondary Air Injection System Control “A” Circuit	Signal voltage 4.70 - 5.40 V
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	Measured OSC / OSC of borderline catalyst. EWMA filter value for catalyst , < 1.0

DTC	Error Message	Malfunction Criteria and Threshold Value
P0421	Warm Up Catalyst Efficiency Below Threshold (Bank 1)	EWMA filter value for catalyst < 0.2
P0430	Catalyst System Efficiency Below Threshold (Bank 2)	Amplitude ratio O2S > 1.5
P0431	Warm Up Catalyst Efficiency Below Threshold (Bank 2)	EWMA filter value for catalyst < 0.2
P0441	Evaporative Emission System Incorrect Purge Flow	Deviation lambda control < 2.50% and deviation idle control < 20%
P0442	Evaporative Emission System Leak Detected (small leak)	Time for pressure drop < 1.7 - 2.2 Sec.
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal voltage > 4.70 - 5.40 V
P0445	Evaporative Emission System Purge Control Valve Circuit Shorted	• Signal voltage < 2.0 V • Signal current >1.0 A
P0450	Evaporative Emission System Pressure Sensor/Switch	Open circuit signal voltage 0.39 - 0.55 V
P0451	Evaporative Emission System Pressure Sensor/Switch Range/Performance	Natural vacuum leak detection (NVLD) switch position stuck closed
P0452	Evaporative Emission System Pressure Sensor/Switch Low	Short to ground signal voltage < 0.24 V
P0453	Evaporative Emission System Pressure Sensor/Switch High	Short to battery voltage signal voltage > 3.0 V
P0455	Evaporative Emission System Leak Detected (large leak)	Time for pressure drop < 0.95 - 1.1 Sec.
P0456	Evaporative Emission System Leak Detected (very small leak)	• Natural vacuum leak detection (NVLD) switch position • Switch Open
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage, < 0.0 - 3.26 V
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.2 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P0491	Secondary Air Injection System Insufficient Flow (Bank 1)	• Blockage: relative AIR pressure measured with AIR pressure sensor vs. modeled < 0.10 [-] • Leakage: relative AIR pressure measured with AIR pressure sensor vs. modeled < 0.10 [-] and • Relative AIR pressure measured ≤ 3.00 kPa or • Blockage: relative AIR pressure measured with AIR pressure sensor vs. modeled < 0.45 [-] • Leakage: relative AIR pressure measured with AIR pressure sensor vs. modeled < 0.45 [-] and • Relative AIR pressure measured ≤ 3.00 kPa or • Blockage: relative AIR pressure measured with AIR pressure sensor vs. modeled while valve bank 2 commanded closed < 0.70[-] • Leakage: relative AIR pressure measured with AIR pressure sensor vs. modeled while valve bank 2 commanded closed < 0.70 [-] and • Relative AIR pressure measured ≤ 3.00 kPa or • Average pressure difference between absolute value and filtered value while valve bank 2 commanded closed < 0.14 - 1.22 kPa and • Relative AIR pressure measured ≤ 3.00 kPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P0492	Secondary Air System Insufficient Flow (Bank 2)	• Blockage: relative AIR pressure measured with AIR pressure sensor vs. modeled < 0.10 [-] • Leakage: relative AIR pressure measured with AIR pressure sensor vs. modeled < 0.10 [-] and • Relative AIR pressure measured ≤ 3.00 kPa or • Blockage: relative AIR pressure measured with AIR pressure sensor vs. modeled < 0.45 [-] • Leakage: relative AIR pressure measured with AIR pressure sensor vs. modeled < 0.45 [-] and • Relative AIR pressure measured ≤ 3.00 kPa or • Blockage: relative AIR pressure measured with AIR pressure sensor vs. modeled while valve bank 2 commanded closed < 0.70[-] • Leakage: relative AIR pressure measured with AIR pressure sensor vs. modeled while valve bank 2 commanded closed < 0.70 [-] and • Relative AIR pressure measured ≤ 3.00 kPa or • Average pressure difference between absolute value and filtered value while valve bank 2 commanded closed < 0.14 - 1.22 kPa and • Relative AIR pressure measured ≤ 3.00 kPa

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor “A” Range/Performance	Speed sensor signal: plausibility error failure
P0502	Vehicle Speed Sensor “A” Circuit Low Input	Speed sensor signal: electrical error failure
P0503	Vehicle Speed Sensor “A” Intermittent/Erratic/High	Vehicle speed > 200 km/h
P0506	Idle Air Control System RPM Lower Than Expected	• Engine speed deviation < -80 RPM and • RPM controller torque value ≥ calculated max value
P0507	Idle Air Control System RPM Higher Than Expected	• Engine speed deviation > -80 RPM and • RPM controller torque value ≤ calculated max. value
P0597	Thermostat Heater Control Circuit/Open	Signal voltage 4.70 - 5.40 V
P0598	Thermostat Heater Control Circuit Low	Signal voltage 0.0 - 3.25 V
P0599	Thermostat Heater Control Circuit High	Signal current > 2.20 A
P050A	Cold Start Idle Air Control System Performance	RPM lower: • Engine speed deviation > 200 RPM and • RPM controller torque value ≥ calculated max. value RPM Higher: • Engine speed deviation < -200 RPM and • RPM controller torque value ≤ calculated min. value
P050B	Cold Start Ignition Timing Performance	Difference between commanded spark timing vs. actual value> 18.00%
P052A	Cold Start “A” Camshaft Position Timing Over-Advanced	Difference between target position and actual position > 8°CA

DTC	Error Message	Malfunction Criteria and Threshold Value
P052C	Cold Start “A” Camshaft Position Timing Over-Advanced	Difference between target position and actual position > 8°CA
P053F	Cold Start Fuel Pressure Performance	• Target pressure-actual pressure >1.30 MPa • Difference between target pressure vs. actual pressure < -3.00 mPa
P054A	Cold Start “B” Camshaft Position Timing Over-Advanced	Difference between target position vs. actual position > 8°CA
P054C	Cold Start “B” Camshaft Position Timing Over-Advanced	Difference between target position vs. actual position > 8°CA

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
P0603	Internal Control Module Keep Alive Memory (KAM) Error	SPI communication lost
P0604	Internal Control Module Random Access Memory (RAM) Error	Write ability check, failed
P0605	Internal Control Module Read Only Memory (ROM) Error	Checksum incorrect
P0606	ECM/PCM Processor	• Drive by wire module check check failed • EEPROM-check check failed
P0627	Fuel Pump “A” Control Circuit /Open	• Internal error fuel pump control unit • Feedback from fuel pump control unit pump blocked short circuit to battery +, ground or open circuit
P0634	PCM/ECM/TCM Internal Temperature Too High	Signal range check over temperature > 150° C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0638	Throttle Actuator Control Range/Performance (Bank 1)	• Time to open over reference point > 0.6 Sec and • Reference point -1.5% • Time to close below reference point > 0.3 Sec and • Reference point 1.0%
P0641	Sensor Reference Voltage “A” Circuit/Open	Signal voltage deviation > ± 0.3 V
P0642	Sensor Reference Voltage “A” Circuit Low	Signal voltage < 4.606 - 4.998 V
P0643	Sensor Reference Voltage “A” Circuit High	5 V supply voltage: > supply voltage > 4.998 - 5.406 V
P0651	Sensor Reference Voltage “B” Circuit/Open	Signal voltage deviation > ± 0.3 V
P0652	Sensor Reference Voltage “B” Circuit Low	Signal voltage < 4.606 - 4.998 V
P0653	Sensor Reference Voltage “B” Circuit High	> 5 V supply voltage: supply voltage > 4.998 - 5.406 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/PCM Power Relay Control Circuit /Open	• Signal voltage 2.6 - 3.7 V • Sense circuit voltage > 6 V
P0686	ECM/PCM Power Relay Control Circuit Low	• Signal voltage 2.6 - 3.7 V • Sense circuit voltage > 6 V
P0687	ECM/PCM Power Relay Control Circuit High	• Signal current > 0.7 - 1.4 A • Sense circuit voltage < 5.0 V
P0688	ECM/PCM Power Relay Sense Circuit /Open	Sense voltage < 4.0 V
P0697	Sensor Reference Voltage “C” Circuit/Open	Signal voltage deviation > ± 0.3 V
P0698	Sensor Reference Voltage “C” Circuit Low	Signal voltage < 4.606 - 4.998 V
P0699	Sensor Reference Voltage “C” Circuit High	5V supply voltage > 4.998 - 5.406 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P062B	Communication Check	SPI communications check identifier failure
U0001	High Speed CAN Communication Bus	CAN message, no feedback
U0002	High Speed CAN Communication Bus Performance	Global time out, receiving no messages
U0100	Lost Communication with ECM/PCM A	• Failure of all CAN engine messages, time out > 490 mSec. • Failure of all CAN engine messages, but not all CAN messages, time out > 1010 mSec.
U0101	Lost Communication with TCM	No CAN message received from TCM
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	Received CAN message no message
U0140	Lost Communication With Body Control Module	Time out no message
U0146	Lost Communication With Gateway “A”	Received CAN message no message
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	Received CAN message no message
U0302	Software Incompatibility with Transmission Control Module	MT vehicle ECM coded as AT vehicle
U0323	Software Incompatibility with Instrument Panel Control Module	Ambient temperature value module not encoded for ambient temperature sensor, 00h
U0402	Invalid Data Received From Transmission Control Module	Invalid data received from TCM • Implausible message
U0404	Invalid Data Received From Gear Shift Control Module	• If the value of message counter is permanent, constant, or change exceeds a threshold, increment an event counter • Maximum change of message counter > 5
U0415	Invalid Data Received From Anti-Lock Brake System Control Module	Received data implausible message

DTC	Error Message	Malfunction Criteria and Threshold Value
U0422	Invalid Data Received From Body Control Module	Ambient temperature value initialization, 01 h
U0423	Invalid Data Received From Instrument Panel Control Module	Received data implausible message
U0447	Invalid Data Received From Gateway “A”	Received data from Gateway implausible message

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P10A0	Actuation Regulating Flap for Intake Air Electrical Malfunction	Signal range check • ECM power stage failure or • Duty cycle < 95% or • Duty cycle < 95%
P10A4	Regulating Flap for Intake Air Mechanical Malfunction	Absolute value of maximum deviation between predicted and real value: > 8%
P10A5	Potentiometer Regulating Flap For Intake Air Signal Too High	Signal voltage > 4.9 V
P10A6	Potentiometer regulating flap for intake air Signal too low	Signal voltage < 0.1 V
P100F	Functional Check Stuck Open	• Rail pressure controller value > 60.00 - 327.67 mm³ • Misfire failure
P1114	Internal Resistance Too Large (Bank 1, Sensor 2)	Heater resistance, (128-648)*(8-40) 1.02-25.9 k Ω (dep. on mod. exhaust temp. and heater power)
P11A5	Cam Shift Actuator “A” Cylinder 2 Circuit/Open	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 3 - 6 A
P11A6	Cam Shift Actuator “A” Cylinder 2 Range/ Performance	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail

DTC	Error Message	Malfunction Criteria and Threshold Value
P11A7	Cam Shift Actuator “B” Cylinder 2 Circuit/Open	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 3 - 6 A
P11A8	Cam Shift Actuator “B” Cylinder 2 Range/ Performance	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail
P11A9	Cam Shift Actuator “A” Cylinder 3 Circuit/Open	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 3 - 6 A
P11AA	Cam Shift Actuator “A” Cylinder 3 Range/ Performance	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail
P11AB	Cam Shift Actuator “B” Cylinder 3 Circuit/Open	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 3.74 - 6.8 A
P11AC	Cam Shift Actuator “B” Cylinder 3 Range/ Performance	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail
P11B1	Cam Shift Actuator “A” Cylinder 5 Circuit/Open	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 3 - 6 A
P11B2	Cam Shift Actuator “A” Cylinder 5 Range/ Performance	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail
P11B3	Cam Shift Actuator “B” Cylinder 5 Circuit/Open	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 3.74 - 6.8 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P11B4	Cam Shift Actuator "B" Cylinder 5 Range/ Performance	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail
P11BD	Variable Valve Lift (VVL) Actuator, Inlet Closed, Cyl. 8, Open or Short to Battery Voltage	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 5.5 - 10.0 A
P11BE	Variable Valve Lift (VVL) Actuator, Inlet Open, Cyl. 8, Open or Short to Battery Voltage	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 3.74 - 6.8 A
P11C1	Variable Valve Lift (VVL) Actuator, Outlet Close, Cyl. 2, Open or Short to Battery Voltage	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 3.74 - 6.8 A
P11C2	Variable Valve Lift (VVL) Actuator, Outlet Open, Cyl. 2, Open or Short to Battery Voltage	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 3.74 - 6.8 A
P11C3	ariable Valve Lift (VVL) Actuator, Outlet Close, Cyl. 3, Open or Short to Battery Voltage	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 3.74 - 6.8 A
P11C4	Variable Valve Lift (VVL) Actuator, Outlet Open, Cyl. 3, Open or Short to Battery Voltage	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 3.74 - 6.8 A
P11C7	Variable Valve Lift (VVL) Actuator, Outlet Close, Cyl. 5, Open or Short to Battery Voltage	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 3.74 - 6.8 A
P11C8	Variable Valve Lift (VVL) Actuator, Outlet Open, Cyl. 5, Open or Short to Battery Voltage	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 3.74 - 6.8 A
P11CD	Variable Valve Lift (VVL) Actuator, Outlet Close, Cyl. 8, Open or Short to Battery Voltage	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 5.5 - 10.0 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P11CE	Variable Valve Lift (VVL) Actuator, Outlet Open, Cyl. 8, Open or Short to Battery Voltage	• Signal Voltage = 4.8 - 5.3 V or • Signal Current = 5.5 - 10.0 A
P11D1	Variable Valve Lift (VVL) Actuator, Inlet Closed, Cyl. 8, Rationality Check	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail
P11D2	Variable Valve Lift (VVL) Actuator, Inlet Open, Cyl. 8, Rationality Check	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail
P11D5	Variable Valve Lift (VVL) Actuator, Outlet Close, Cyl. 2, Rationality Check	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail
P11D6	Variable Valve Lift (VVL) Actuator, Outlet Open, Cyl. 2, Rationality Check	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail
P11D7	Variable Valve Lift (VVL) Actuator, Outlet Close, Cyl. 3, Rationality Check	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail

DTC	Error Message	Malfunction Criteria and Threshold Value
P11D8	Variable Valve Lift (VVL) Actuator, Outlet Open, Cyl. 3, Rationality Check	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail
P11DB	Variable Valve Lift (VVL) Actuator, Outlet Open, Cyl. 5, Rationality Check	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail
P11DC	Variable Valve Lift (VVL) Actuator, Outlet Open, Cyl. 5, Rationality Check	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail
P11E1	Variable Valve Lift (VVL) Actuator, Outlet Close, Cyl. 8, Open or Short to Battery Voltage	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail
P11E2	Variable Valve Lift (VVL) Actuator, Outlet Open, Cyl. 8, Rationality Check	• Difference of feedback signal vs. battery voltage < 1.00 [V] and • Correction switch (self-contained switching in opposite lift) = successful or fail
P12A1	Fuel Rail Pressure Sensor Inappropriately High	• Rail pressure bank 1 @ engine start < 0.10 mPa • Fuel system too lean @ part load ≤ -15.00% • Fuel system too lean @ idle ≤ 3.00% • Rail pressure bank 2 @ engine start ≥ 0.50 mPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P12A2	Fuel Rail Pressure Sensor Inappropriately High	• Rail pressure bank 1 @ engine start > 1.50 mPa • Fuel system too lean @ part load ≥ -15.00% • Fuel system too lean @ idle ≥ 3.% • Rail pressure bank 2 @ engine start ≤ 1.00 mPa
P12A4	Fuel Rail Pump Control Valve Stuck Closed	• Pressure control activity < -3.0 • Fuel trim activity 0.90 - 1.30 mPa and • Difference between target pressure vs. actual pressure < -8.00 mPa
P129B	Fuel Rail Pressure Control Valve	• Open circuit signal voltage 1.40 - 3.20 V • Rationality check signal pattern incorrect
P129C	Fuel Rail Pressure Control Valve	Signal voltage 1.40 - 3.20 V
P129D	Fuel Rail Pressure Control Valve	Short to battery plus signal voltage > 3.20 V
P13EA	Ignition Timing Monitor	Difference between commanded spark timing and actual value > 0.60%
P150A	Engine Off Time Performance	• Difference between engine off time and ECM after run time < -12.0 Sec. • Difference between engine off time and ECM after run time > 12.0 Sec.
P2101	Throttle Actuator Control Motor Circuit Range/ Performance	Signal range check • Duty cycle > 80% and • ECM power stage, no failure Rationality check • Deviation throttle valve angles vs. calculated value 4.0 - 50.0%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2106	Throttle Actuator Control System - Forced Limited Power	Short to battery plus/ short to ground • Internal check failed Open circuit • Internal check failed Temperature / current monitoring • Internal check failed Functional check • Internal check failed
P2119	Throttle Actuator Control Throttle Body Range/ Performance	• TPS 1 signal voltage NOT (0.21 - 0.87) V or • TPS 2 signal voltage NOT (4.14 - 4.84) V
P2122	Throttle/Pedal Position Sensor/Switch “D” Circuit Low Input	Signal voltage < 0.65 V
P2123	Throttle/Pedal Position Sensor/Switch “D” Circuit High Input	Signal voltage > 4.79 V
P2127	Throttle/Pedal Position Sensor/Switch “E” Circuit Low Input	Signal voltage < 0.28 V
P2128	Throttle/Pedal Position Sensor/Switch “E” Circuit High Input	Signal voltage > 2.43 V
P2138	Throttle/Pedal Position Sensor/Switch “D” / “E” Voltage Correlation	Signal voltage sensor 1 vs. 2 > 0.14 - 0.70 V
P2146	Fuel Injector Group “A” Supply Voltage Circuit/Open	Short to ground (high side) • Signal current > 14.90 A Short to battery plus (high side) • Signal current < 2.60 A
P2147	Fuel Injector Group “A” Supply Voltage Circuit Low	Signal current > 12 A
P2148	Fuel Injector Group “A” Supply Voltage Circuit High	Signal current > 33 A
P2149	Fuel Injector Group “B” Supply Voltage Circuit/Open	Short to ground (high side) • Signal current > 14.90 A Short to battery plus (high side) • Signal current < 2.60 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P2150	Fuel Injector Group “B” Supply Voltage Circuit Low	Signal current > 12 A
P2151	Fuel Injector Group “B” Supply Voltage Circuit High	Signal current > 33 A
P2152	Fuel Injector Group “C” Supply Voltage Circuit/Open	Short to ground (high side) • Signal current, > 14.90 A Short to battery plus (high side) • Signal current < 2.60 A
P2153	Fuel Injector Group “C” Supply Voltage Circuit Low	Signal current > 12 A
P2154	Fuel Injector Group “C” Supply Voltage Circuit High	Signal current > 33 A
P2155	Fuel Injector Group “D” Supply Voltage Circuit/Open	Short to ground (high side) • Signal current, > 14.90 A Short to battery plus (high side) • Signal current < 2.60 A
P2181	Cooling System Performance	Cooling system temperature to low after a sufficient air mass flow interval < 60 - 75 °C
P2195	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 1)	Delta lambda of 2nd lambda control loop > 0.070
P2196	O2 Sensor Signal Stuck Rich (Bank 1 Sensor 1)	Delta lambda of 2nd lambda control loop < 0.070
P2197	O2 Sensor Signal Stuck Lean (Bank 2 Sensor 1)	Delta lambda of 2nd lambda control loop > 0.070
P2198	O2 Sensor Signal Stuck Rich (Bank 2 Sensor 1)	Delta lambda of 2nd lambda control loop < 0.070
P2227	Barometric Pressure Circuit Range/Performance	Pressure difference in cross check between boost pressure sensor 1/2; IM pressure, ambient pressure >7 kPa
P2231	O2 Sensor Signal Circuit Shorted to Heater Circuit (Bank 1 Sensor 1)	• Delta O2S signal front > 0.2 - 0.498 V • Elapsed time since last O2S < 0.05 Sec
P2234	O2 Sensor Signal Circuit Shorted to Heater Circuit (Bank 2 Sensor 1)	• Delta O2S signal front > 0.2 - 0.498 V • Elapsed time since last O2S < 0.05 Sec

DTC	Error Message	Malfunction Criteria and Threshold Value
P2237	O2 Sensor Positive Current Control Circuit/Open (Bank 1 Sensor 1)	• O2S signal front 1.46 - 1.52 V and • Delta lambda controller > | 0.10 |
P2240	O2 Sensor Positive Current Control Circuit/Open (Bank 2 Sensor 1)	• O2S signal front 1.46 - 1.52 V and • 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 > 950Ω • O2S signal front < 0.20 V and • Internal resistance > 950Ω
P2247	O2 Sensor Reference Voltage Circuit/Open (Bank 2 Sensor 1)	• O2S signal front > 3.25 V and • Internal resistance > 950Ω • O2S signal front < 0.20 V and • Internal resistance > 950Ω
P2251	O2 Sensor Negative Current Control Circuit/Open (Bank 1 Sensor 1)	• O2S signal front 1.44 - 1.53 V and • Internal resistance > 950 Ω
P2254	O2 Sensor Negative Current Control Circuit/Open (Bank 2 Sensor 1)	• O2S signal front 1.44 - 1.53 V and • Internal resistance > 950 Ω
P2257	Secondary Air Injection System Control “A” Circuit Low	Signal voltage 0.00 - 3.26 V
P2258	Secondary Air Injection System Control “A” Circuit High	Signal current 0.60 - 2.40 A
P2270	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 2)	• O2S signal rear not oscillating at reference < 0.62 - 0.68 V and • Enrichment after stuck lean 25.00%
P2271	O2 Sensor Signal Stuck Rich (Bank 1 Sensor 2)	• Sensor voltage of ≥ 0.18 V • After oxygen mass > 3300 - 400 mg • (after fuel cut off) and number of checks ≥1.0

DTC	Error Message	Malfunction Criteria and Threshold Value
P2272	O2 Sensor Signal Stuck Lean (Bank 2 Sensor 2)	• O2S signal rear not oscillating at reference < 0.62 - 0.68 V and • Enrichment after stuck lean 25.00%
P2273	O2 Sensor Signal Stuck Rich (Bank 2 Sensor 2)	• Sensor voltage of ≥ 0.18 V • After oxygen mass > 3300 - 400 mg • (after fuel cut off) and number of checks ≥1.0
P2279	Intake Air System Leak	• Offset value throttle mass flow > 17.00 kg/h and • Correction factor > 0.97
P2293	Fuel Pressure Regulator 2 Performance	• Difference between target pressure - actual pressure > 1.30 mPa
P2294	Fuel Pressure Regulator 2 Control Circuit	Open circuit • Signal voltage 1.40 - 3.20 V Rationality check • Signal pattern incorrect
P2295	Fuel Pressure Regulator 2 Control Circuit Low	Signal voltage < 1.40 - 3.20 V
P2296	Fuel Pressure Regulator 2 Control Circuit High	Short to battery plus signal voltage > 3.20 V

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P2300	Ignition Coil “A” Primary Control Circuit Low	Short to ground signal current > 24.0 mA
P2301	Ignition Coil “A” Primary Control Circuit High	Short to battery plus signal voltage > 5.1 - 7.0 V
P2303	Ignition Coil “B” Primary Control Circuit Low	Short to ground signal current > 24.0 mA
P2304	Ignition Coil “B” Primary Control Circuit High	Short to battery plus signal voltage > 5.1 - 7.0 V
P2306	Ignition Coil “C” Primary Control Circuit Low	Short to ground signal current > 24.0 mA
P2307	Ignition Coil “C” Primary Control Circuit High	Short to battery plus signal voltage > 5.1 - 7.0 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2309	Ignition Coil “D” Primary Control Circuit Low	Short to ground signal current > 24.0 mA
P2310	Ignition Coil “D” Primary Control Circuit High	Short to battery plus signal voltage > 5.1 - 7.0 V
P2312	Ignition Coil “E” Primary Control Circuit Low	Short to ground signal current > 24.0 mA
P2313	Ignition Coil “E” Primary Control Circuit High	Short to battery plus signal voltage > 5.1 - 7.0 V
P2315	Ignition Coil “F” Primary Control Circuit Low	Short to ground signal current > 24.0 mA
P2316	Ignition Coil “F” Primary Control Circuit High	Short to battery plus signal voltage > 5.1 - 7.0 V
P2318	Ignition Coil “G” Primary Control Circuit Low	Short to ground signal current > 24.0 mA
P2319	Ignition Coil “G” Primary Control Circuit High	Short to battery plus signal voltage > 5.1 - 7.0 V
P2321	Ignition Coil “H” Primary Control Circuit Low	Short to ground signal current > 24.0 mA
P2322	Ignition Coil “H” Primary Control Circuit High	Short to battery plus signal voltage > 5.1 - 7.0 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 - 5.5 V
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	Signal voltage < 3V
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	Signal current 2.7 - 5.5 A
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit/Open	Low signal voltage > 10.4 Sec.
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	High signal voltage > 10.4 Sec.

DTC	Error Message	Malfunction Criteria and Threshold Value
P2414	O2 Sensor Exhaust Sample Error (Bank 1 Sensor 1)	• Threshold 1 - Signal voltage 2.71 - 6.00 V • Threshold 2 - Depending on gain factor, that actual is used for sensor characteristic, the threshold is signal voltage 2.05 - 3.06 V
P2415	O2 Sensor Exhaust Sample Error (Bank 2 Sensor 1)	• Threshold 1 - Signal voltage 2.71 - 6.00 V • Threshold 2 - Depending on gain factor, that actual is used for sensor characteristic, the threshold is signal voltage 2.05 - 3.06 V
P2431	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Range/ Performance	Difference between AIR pressure, AMP, and MAP -6.0 - 6.00 kPa
P2432	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Low	Signal voltage < 0.40 V
P2433	Secondary Air Injection System Air Flow/Pressure Sensor Circuit High	Signal voltage > 4.60 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2440	Secondary Air Injection System Switching Valve Stuck Open	• Relative AIR pressure measured ≤ 3.00 kPa • Relative AIR pressure (measured with AIR pressure sensor vs. modeled) vs. relative AIR pressure (measured with AIR pressure sensor vs. modeled while both AIR valves closed) >1.50 [-] • Relative AIR pressure (measured with AIR pressure sensor vs. modeled while valve bank 2 commanded closed) vs. relative AIR pressure (measured with AIR pressure sensor vs. modeled while valve bank 1 commanded closed) >1.50 [-] • Difference of average pressure between absolute value and filtered value while both valves commanded closed ≥ 0.30 - 1.00 kPa
P2442	Secondary Air Injection System Switching Valve Stuck Open (Bank 2)	• Relative AIR pressure measured ≤ 3.00 kPa • Relative AIR pressure (measured with AIR pressure sensor vs. modeled) vs. relative AIR pressure (measured with AIR pressure sensor vs. modeled while both AIR valves closed) >1.50 [-] • Relative AIR pressure (measured with AIR pressure sensor vs. modeled while valve bank 2 commanded closed) vs. relative AIR pressure (measured with AIR pressure sensor vs. modeled while valve bank 1 commanded closed) >1.50 [-] • Difference of average pressure between absolute value and filtered value while both valves commanded closed ≥ 0.30 - 1.00 kPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P2539	Low Pressure Fuel System Sensor Circuit	Signal voltage > 4.80 V
P2540	Low Pressure Fuel System Sensor Circuit Range/ Performance	Actual pressure deviation < 800 kPa < 80 kPa
P2541	Low Pressure Fuel System Sensor Circuit Low	Signal voltage < 0.20 V
P2626	O2 Sensor Pumping Current Trim Circuit/Open (Bank 1 Sensor 1)	O2S signal front > 4.8 V
P2629	O2 Sensor Pumping Current Trim Circuit/Open (Bank 2 Sensor 1)	O2S signal front > 4.8 V

DTC CHART

Engine Codes - 6.3L CEJA

Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Intake “A” Camshaft Position Slow Response (Bank 1)	• Difference between target position vs. actual position > 6.00 - 50.00 °CRK • for time > 1.3 - 5.0 Sec and • Adjustment angle ≥ 3.00 °CRK
P000B	Exhaust “B” Camshaft Position Slow Response (Bank 1)	• Difference between target position vs. actual position > 6.00 - 20.0 °CRK • for time > 1.3 - 7.5 Sec and • Adjustment angle ≥ 3.00 °CRK
P000C	Intake “A” Camshaft Position Slow Response (Bank 2)	• Difference between target position vs. actual position > 6.00 - 50.00 °CRK • for time > 1.3 - 5.0 Sec and • Adjustment angle ≥ 3.00 °CRK
P000D	Exhaust “B” Camshaft Position Slow Response (Bank 2)	• Difference between target position vs. actual position > 6.00 - 20.0 °CRK • for time > 1.3 - 7.5 Sec and • Adjustment angle ≥ 3.00 °CRK
P00AB	Intake Air Temperature Sensor 1 Circuit Rationality Check	• Difference ECT vs. IAT at engine start > 24.8 K • (depending on engine off time) and diff. IAT vs. AAT at engine start > 24.8 K • (depending on engine off time) and diff. AAT vs. ECT at engine start < 24.8 K] (depending on engine off time)
P00AC	Intake Air Temperature Sensor 1 Circuit Low	IAT > 138.0 °C
P00AD	Intake Air Temperature Sensor 1 Circuit Low	IAT > 138.0 °C

DTC	Error Message	Malfunction Criteria and Threshold Value
P008A	Fuel System Pressure Sensor Low Pressure System	Actual pressure, < 40.0 kPa
P008B	Fuel System Pressure Sensor Low Pressure System	Actual pressure, > 900 kPa
P0010	Intake “A” Camshaft Position Actuator Circuit / Open (Bank 1)	Signal voltage 4.70 - 5.40 V
P0011	Intake “A” Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	• Difference between target position vs. actual position > 6.00 - 50.00 °CRK • for time > 1.3 - 5.0 Sec • Adjustment angle < 3.00 °CRK
P0013	Exhaust “B” Camshaft Position - Actuator Circuit / Open (Bank 1)	Signal voltage 4.70 - 5.40 V
P0014	Exhaust “B” Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	• Difference between target position vs. actual position > 8.00 - 63.75 °CRK for time > 1.5 - 3.0 s and • Adjustment angle < 3.00 °CRK
P0016	Crankshaft Position – Camshaft Position Correlation (Bank 1 Sensor A)	• Permissible deviation < -12.00 °CRK or • Permissible deviation > 12.00 °CRK
P0017	Crankshaft Position – Camshaft Position Correlation (Bank 1 Sensor B)	• Permissible deviation < -12.00 °CRK or • Permissible deviation > 12.00 °CRK
P0018	Crankshaft Position – Camshaft Position Correlation (Bank 2 Sensor A)	• Permissible deviation < -12.00 °CRK or • Permissible deviation > 12.00 °CRK
P0019	Crankshaft Position – Camshaft Position Correlation (Bank 2 Sensor B)	• Permissible deviation < -12.00 °CRK or • Permissible deviation > 12.00 °CRK

DTC	Error Message	Malfunction Criteria and Threshold Value
P0020	Intake “A” Camshaft Position Actuator Circuit / Open (Bank 2)	Signal voltage, signal voltage 4.70 - 5.40 V
P0021	Intake “A” Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	Frequency (normal operation) 3 times
P0023	Exhaust “B” Camshaft Position - Actuator Circuit / Open (Bank 2)	Signal voltage 4.70 - 5.40 V
P00EC	“B” Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	• Difference between target position vs. actual position > 6.00 - 20.0 °CRK • for time > 1.3 - 7.5 Sec and • Adjustment angle < 3.00 °CRK
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	Signal voltage > 4.70 - 5.40 V
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	Signal voltage < 0.0 - 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 2.34 - 3.59 V
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	Heater voltage < 2.34 V
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	Heater current > 3.59 A
P0050	HO2S Heater Control Circuit (Bank 2 Sensor 1)	Signal voltage > 4.70 - 5.40 V
P0051	HO2S Heater Control Circuit Low (Bank 2 Sensor 1)	Signal voltage 0.0 - 3.26 V
P0052	HO2S Heater Control Circuit High (Bank 2 Sensor 1)	Signal current > 5.50 A
P0056	HO2S Heater Control Circuit (Bank 2 Sensor 2)	Heater voltage 2.34 - 3.59 V
P0057	HO2S Heater Control Circuit Low (Bank 2 Sensor 2)	Heater voltage < 2.34 V
P0058	HO2S Heater Control Circuit High (Bank 2 Sensor 2)	Heater voltage > 3.59 A
P0068	MAP/MAF – Throttle Position Correlation	Plausibility with fuel system • Load calculation < -35%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0070	Ambient Air Temperature Sensor Circuit	Ambient temperature < 50.0 °C
P0071	Ambient Air Temperature Sensor Range/Performance	• Difference ECT vs. IAT at engine start < 24.8 - 39.8 K • (Depending on engine off time) and diff. IAT vs. AAT at engine start > 24.8 K • (Depending on engine off time) and diff. AAT vs. ECT at engine start > 24.8 K] (depending on engine off time)
P0072	Ambient Air Temperature Sensor Circuit Low	Ambient temperature > 87.0 °C
P0087	Fuel Rail/System Pressure - Too Low	• Pressure control activity, > 2.20 MPa and • Fuel trim activity, 0.90 - 16 • Difference between actual pressure - Target pressure > 2.20 MPa
P0089	Fuel Pressure Regulator 1 Performance	• Difference between actual pressure vs. target pressure > 200.00 kPa • Difference between actual pressure - Target pressure >150.kPa • Pressure control activity > 280kPa • Pressure control activity < -300.00 kPa
P0100	Mass or Volume Air Flow Circuit	MAF sensor signal 0 µs
P0101	Mass or Volume Air Flow Circuit Range/Performance	• Air mass too low < -10.00 kg/h • Air mass too high > 1100.00 kg/h • Mass air flow vs. lower threshold model < 0 - 500 kg/h • Mass air flow vs. upper threshold model > 25 - 1100 kg/h • Load calculation > 25% • and fuel system (mult.) < -16% • Load calculation < -20% • and fuel system (mult.) > 25%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0102	Mass or Volume Air Flow A Circuit Low Input	MAF sensor signal < 66 uSec
P0103	Mass or Volume Air Flow A Circuit High Input	MAF sensor signal > 4.8 V
P010A	2 MAF Sensors MAF 1 MAF 2	MAF sensor signal 0 µs
P010B	(MAF 2)	• MaSS air flow HFM2 vs. lower threshold map HFM2 < 0 - 450 kg/h • Mass air flow HFM2 vs. upper threshold map > 55 - 1082
P010C	2 MAF Sensors MAF 1 MAF 2	MAF Sensor signal temp.-correction > 65
P010D	2 MAF Sensors MAF 1 MAF 2	• Signal voltage < 4.80 V Range check: • Manifold pressure signal > 1170.00 hPa
P010E	MAF Sensors MAF 1 MAF 2	PWM time length 0 uSec
P018A	Fuel Rail Pressure Sensor	Signal voltage > 4.8 V
P018B	Fuel Rail Pressure Sensor	Rail pressure > 13.5 mPa
P018C	Fuel Rail Pressure Sensor	Signal voltage < 0.20 V
P025A	Fuel Pump Module Control Circuit/Open	Signal voltage > 4.8 - 5.3 V
P025C	Fuel Pump Module Control Circuit Low	Signal voltage < 2.7 - 3.25 V
P025D	Fuel Pump Module Control Circuit High	Signal current > 0.6 A
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	• Difference ECT vs. IAT at engine start > 24.8 K • (Depending on engine off time) and diff. IAT vs. AAT at engine start > 24.8 K • (Depending on engine off time) and diff. AAT vs. ECT at engine start < 24.8 K] (depending on engine off time)
P0112	Intake Air Temperature Sensor 1 Circuit Low	IAT >138.0° C
P0113	Intake Air Temperature Sensor 1 Circuit High	IAT < -45° C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/ Performance	• No change on signal < 0.0...1.5 K and • Signal in range 140° C
P0117	Engine Coolant Temperature Circuit Low	Short to ground-ECT > 140° C
P0118	Engine Coolant Temperature Circuit High	Short to battery positive or open circuit-ECT < - 41 °C
P0121	Throttle/Pedal Position Sensor/Switch “A” Circuit Range/Performance	• TPS 1 - TPS 2 > 6.3% and • Actual TPS 1 - calc. value > actual TPS 2 - calc. value 1 % or • TPS 1 - calc. value > 9%
P0122	Throttle/Pedal Position Sensor/Switch “A” Circuit Low	Signal voltage < 0.20 V
P0123	Throttle/Pedal Position Sensor/Switch “A” Circuit High	Signal voltage > 4.81 V
P0130	O2 Sensor Circuit (Bank 1, Sensor 1)	O2S ceramic temperature < 690°C
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	Short to battery
		Virtual mass > 3.25 V
		Nernst voltage > 4.40 V
		Adjustment voltage > 7 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	Symmetric fault: • Difference of R2L area ratio vs. L2R area ratio -0.40 - 0.40 • Lower value of both counters for area ratio R2L and L2R ≥ 5 times Delay Time: • Gradient ratio ≥ 0.50 • Lower value of both area ratios R2L and L2R < 0.30 Transient Time: • Gradient ratio ≥ 0.50 • Gradient ratio ≤ 0.55 • Lower value of both area ratios R2L and L2R < 0.30 or • Lower value of both gradient ratios R2L and L2R < 0.50 Asymmetric fault: • Difference of R2L area ratio vs. L2R area ratio NOT (-0.40 - 0.40) • Values of both counters for area ratio R2L and L2R ≥ 5 times Delay Time: • Gradient ratio ≥ 0.50 • Lower value of both area ratios R2L and L2R < 0.30 Transient Time: • Gradient ratio ≥ 0.50) • Gradient ratio ≤ 0.55 • Lower value of both area ratios R2L and L2R < 0.30 or • Lower value of both gradient ratios R2L and L2R < 0.50
P0135	O2 Sensor Heater Circuit (Bank 1 Sensor 1)	• O2S ceramic temperature < 725°C and • Heater duty cycle 90.00%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0136	O2 Sensor Circuit (Bank 1, Sensor 2)	• Delta O2S signal rear > 2 V • Number of heater coupling faults > 4
P0137	O2 Sensor Circuit Low Voltage (Bank 1, Sensor 2)	• Signal voltage < 0.06 V for time > 3 Sec. and • Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) < 0.01 V
P0138	O2 Sensor Circuit High Voltage (Bank 1, Sensor 2)	Signal voltage > 1.08 V for > 5 Sec.
P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	• O2S rear signal not oscillating at reference 635 - 659 mV • 2S signal rear during fuel cut off > 200 mV
P013A	Oxygen Sensors Rear (binary LSF)	• EWMA filtered max differential transient time at fuel cut off ≥ 0.5 Sec and • Number of checks ≥ 3.00 (initial phase and step function)
P013C	Oxygen Sensors Rear (binary LSF)	• EWMA filtered max differential transient time at fuel cut off ≥ 0.5 Sec and • Number of checks ≥ 3.00 (initial phase and step function)
P0140	O2 Circuit No Activity Detected (Bank 1, Sensor 2)	• Signal voltage .40 - .60 mV for > 3 Sec and • Difference in sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) ≥ 2.80 V
P0140	O2S Signal Check - Circuit Continuity (sensor ground line open circuit)	• Internal resistance > 80,000Ω and • Exhaust temperature > 700° C
P0141	O2 Sensor Heater Circuit (Bank 1 Sensor 2)	Heater resistance 500 - 10000 Ω
P0150	O2 Sensor Circuit (Bank 1, Sensor 1)	O2S ceramic temperature < 690° C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0151	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1)	Short to ground
		Virtual mass < 1.75 V
		Nernst voltage < 1.50 V
		Adjustment voltage < 3.0 V
P0152	O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)	Short to battery
		Virtual mass > 3.25 V
		Nernst voltage > 4.40 V
		Adjustment voltage > 7 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0153	O2 Sensor Circuit Slow Response (Sensor 1, Bank 2)	Symmetric fault: • Difference of R2L area ratio vs. L2R area ratio -0.40 - 0.40 • Lower value of both counters for area ratio R2L and L2R ≥ 5 times Delay Time: • Gradient ratio ≥ 0.50 • Lower value of both area ratios R2L and L2R < 0.30 Transient Time: • Gradient ratio ≥ 0.50 • Gradient ratio ≤ 0.55 • Lower value of both area ratios R2L and L2R < 0.30 or • Lower value of both gradient ratios R2L and L2R < 0.50 Asymmetric fault: • Difference of R2L area ratio vs. L2R area ratio NOT (-0.40 - 0.40) • Values of both counters for area ratio R2L and L2R ≥ 5 times Delay Time: • Gradient ratio ≥ 0.50 • Lower value of both area ratios R2L and L2R < 0.30 Transient Time: • Gradient ratio ≥ 0.50) • Gradient ratio ≤ 0.55 • Lower value of both area ratios R2L and L2R < 0.30 or • Lower value of both gradient ratios R2L and L2R < 0.50
P0155	O2 Sensor Heater Circuit (Bank 1, Sensor 1)	• O2S ceramic temperature < 725 °C and • Heater duty cycle > 90.00%
P0156	O2 Sensor Circuit (Bank 1, Sensor 2)	• Delta O2S signal rear > 2 V • Number of heater coupling faults > 4

DTC	Error Message	Malfunction Criteria and Threshold Value
P0157	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 2)	• Signal voltage < 0.06 V for time > 3.0 Sec and • Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) < 0.01 V
P0158	O2 Sensor Circuit High Voltage (Bank 1, Sensor 2)	Signal voltage > 1.08 V for time > 5.0 Sec
P0159	O2 Sensor Circuit Slow Response (Bank 1, Sensor 2)	• O2S rear signal not oscillating at reference 635 - 659 mV • O2S signal rear during fuel cut off > 200 mV
P0160	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 2)	• Signal voltage 0.40 - 0.60 V for time > 3.0 Sec and • Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) ≥ 2.80 V
P0161	O2 Sensor Heater Circuit Bank 2 Sensor 2	Heater resistance > 500 - 10000Ω
P0169	Incorrect Fuel Composition	Comparison with fuel quantity incorrect
P0171	System Too Lean (Bank 1)	Adaptive value > 5%
P0172	System Too Rich (Bank 1)	Adaptive value < 5%
P0174	System Too Lean (Bank 2)	Adaptive value > 5%
P0175	System Too Rich (Bank 2)	Adaptive value < -5%
P0190	Fuel Rail Pressure Sensor Circuit	Signal voltage > 4.8 V
P0191	Fuel Rail Pressure Sensor Circuit Range/Performance	Rail pressure > 13.5 mPa
P0192	Fuel Rail Pressure Sensor Circuit Low	Signal voltage < 0.20 V
P0201	Injector Circuit/Open - Cylinder 1	Internal logic failure
P0202	Injector Circuit/Open - Cylinder 2	Internal logic failure
P0203	Injector Circuit/Open - Cylinder 3	Internal logic failure

DTC	Error Message	Malfunction Criteria and Threshold Value
P0204	Injector Circuit/Open - Cylinder 4	• Internal logic failure
P0205	Injector Circuit/Open - Cylinder 5	• Internal logic failure
P0206	Injector Circuit/Open - Cylinder 6	• Internal logic failure
P0207	Injector Circuit/Open - Cylinder 7	• Internal logic failure
P0208	Injector Circuit/Open - Cylinder 8	• Internal logic failure
P0209	Injector Circuit/Open - Cylinder 9	Internal logic failure
P0210	Injector Circuit/Open - Cylinder 10	Internal logic failure
P0211	Injector Circuit/Open - Cylinder 11	Internal logic failure
P0212	Injector Circuit/Open - Cylinder 12	Internal logic failure
P0221	Throttle/Pedal Position Sensor/Switch “B” Circuit Range/Performance	• TPS 1 - TPS 2 > 6.30% • Actual TPS 2 - calc. value > actual TPS 1 - calc. value • Actual TPS 2 - calc. value > 9%
P0222	Throttle/Pedal Position Sensor/Switch “B” Circuit Low	Signal voltage < 0.215 V
P0223	Throttle/Pedal Position Sensor/Switch “B” Circuit High	Signal voltage > 4.78 V
P0261	Cylinder 1 Injector Circuit Low	Signal current < 2.1 A
P0262	Cylinder 1 Injector Circuit High	Short to battery plus (low side) • Signal current > 14.70 A
P0264	Cylinder 2 Injector Circuit Low	Signal current < 2.1 A
P0265	Cylinder 2 Injector Circuit High	Short to battery plus (low side) • Signal current > 14.70 A
P0267	Cylinder 3 Injector Circuit Low	Signal current < 2.1 A
P0268	Cylinder 3 Injector Circuit High	Short to battery plus (low side) • Signal current > 14.70 A
P0270	Cylinder 4 Injector Circuit Low	Signal current < 2.1 A
P0271	Cylinder 4 Injector Circuit High	Short to battery plus (low side) • Signal current > 14.70 A
P0273	Cylinder 5 Injector Circuit Low	Signal current < 2.1 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P0274	Cylinder 5 Injector Circuit High	Short to battery plus (low side) • Signal current > 14.70 A
P0276	Cylinder 6 Injector Circuit Low	Signal current < 2.1 A
P0277	Cylinder 6 Injector Circuit High	Short to battery plus (low side) • Signal current > 14.70 A
P0279	Cylinder 7 Injector Circuit Low	Signal current < 2.1 A
P0280	Cylinder 7 Injector Circuit High	Short to battery plus (low side) • Signal current > 14.70 A
P0282	Cylinder 8 Injector Circuit Low	Signal current < 2.1 A
P0283	Cylinder 8 Injector Circuit High	Short to battery plus (low side) • Signal current > 14.70 A
P0285	Cylinder 9 Injector Circuit Low	Signal current < 2.1 A
P0286	Cylinder 9 Injector Circuit High	Short to battery plus (low side) • Signal current > 14.70 A
P0288	Cylinder 10 Injector Circuit Low	Signal current < 2.1 A
P0289	Cylinder 10 Injector Circuit High	Short to battery plus (low side) • Signal current > 14.70 A
P0291	Cylinder 11 Injector Circuit Low	Signal current < 2.1 A
P0292	Cylinder 11 Injector Circuit High	Short to battery plus (low side) • Signal current > 14.70 A
P0294	Cylinder 12 Injector Circuit Low	Signal current < 2.1 A
P0295	Cylinder 12 Injector Circuit High	Short to battery plus (low side) • Signal current > 14.70 A
P0299	Turbocharger/Supercharger Underboost Rationality Check Low	Difference set value boost pressure vs actual boost pressure value, >150 hPa
P2004	Intake Manifold Runner Control Stuck Open (Bank 1)	Deviation runner flaps position vs. calculated position > 30%
P2005	Intake Manifold Runner Control Stuck Open (Bank 2)	Deviation runner flaps position vs. calculated position > 30%
P2006	Intake Manifold Runner Control Stuck Closed (Bank 1)	Deviation runner flaps position vs. calculated position > 30%
P2007	Intake Manifold Runner Control Stuck Closed (Bank 2)	Deviation runner flaps position vs. calculated position > 30%
P2008	Intake Manifold Runner Control Circuit/Open (Bank 1)	Signal voltage 4.40 - 5.60 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2009	Intake Manifold Runner Control Circuit Low (Bank 1)	Signal voltage 2.15 - 3.25 V
P2010	Intake Manifold Runner Control Circuit High (Bank 1)	Signal current > 2.20 A
P2014	Intake Manifold Runner Position Sensor/Switch Circuit (Bank 1)	Signal voltage, < 0.20 V
P2015	Intake Manifold Runner Position Sensor/Switch Circuit Range/Performance (Bank 1)	Deviation runner flap position vs. actual position > 20%
P2016	Intake Manifold Runner Position Sensor/Switch Circuit Low (Bank 1)	Signal voltage < 0.25 V
P2017	Intake Manifold Runner Position Sensor/Switch Circuit High (Bank 1)	Signal voltage, > 4.80 V
P2019	Intake Manifold Runner Position Sensor/Switch Circuit (Bank 2)	Signal voltage, < 0.20 V
P2020	Intake Manifold Runner Position Sensor/Switch Circuit Range/Performance (Bank 2)	Deviation runner flaps position vs. calculated position, > 20%
P2022	Intake Manifold Runner Position Sensor/Switch Circuit High (Bank 2)	Signal voltage, > 4.80 V
P2024	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Circuit	Signal voltage 4.70 - 5.40 V
P2025	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Performance	• Response time > 1000 ms and • Number of checks > 3.00 • Security bit incorrect or • Security bit incorrect and • Number of checks > 3.00
P2026	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Circuit Low Voltage	Signal voltage 0.0 - 3.25 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2027	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Circuit High Voltage	Signal current > 2.20 A
P2088	A Camshaft Position Actuator Control Circuit Low (Bank 1)	Signal voltage 0.0 - 3.25
P2089	A Camshaft Position Actuator Control Circuit High (Bank 1)	Signal current > 2.2 A
P2090	B Camshaft Position Actuator Control Circuit Low (Bank 1)	Signal voltage 0.0 - 3.25 V
P2091	B Camshaft Position Actuator Control Circuit High (Bank 1)	Short to battery plus signal current > 2.20 A
P2092	A Camshaft Position Actuator Control Circuit Low (Bank 2)	Signal voltage 0.0 - 3.25
P2093	A Camshaft Position Actuator Control Circuit High (Bank 2)	Signal current, > 2.20 A
P2094	B Camshaft Position Actuator Control Circuit Low (Bank 2)	Signal voltage 0.0 - 3.25 V
P2095	B Camshaft Position Actuator Control Circuit High (Bank 2)	Signal current > 2.20 A
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	I-portion of 2nd lambda control loop < -0.045
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	I-portion of 2nd lambda control loop > -0.045
P2098	Post Catalyst Fuel Trim System Too Lean (Bank 2)	I-portion of 2nd lambda control loop < -0.045
P2099	Post Catalyst Fuel Trim System Too Rich (Bank 2)	I-portion of 2nd lambda control loop > -0.045
P3025	Angle Sensor 1 (on throttle drive 2 power accelerator actuation)	• TPS 1-TPS 2, > 6.3% • TPS 2 - calc value > TPS 1 calc. value or • TPS 2 calc. value, > 9%
P3026	Angle Sensor 1 (on throttle drive 2 power accelerator actuation)	Signal voltage < 0.20 V
P3027	Angle Sensor 1 (on throttle drive 2 power accelerator actuation)	Signal voltage, > 4.81V

DTC	Error Message	Malfunction Criteria and Threshold Value
P3028	Angle Sensor 2 (on throttle drive 2 power accelerator actuation)	• TPS 1-TPS 2, > 6.3% • TPS 2 - calc value > TPS 1 calc. value or • TPS 2 calc. value, > 9%
P3029	Angle Sensor 2 (on throttle drive 2 power accelerator actuation)	Signal voltage, < 0.20 V
P3030	Angle Sensor 2 (on throttle drive 2 power accelerator actuation)	Signal voltage, > 4.81 V
P3031	Throttle Drive 2 (power accelerator actuation) Electrical Malfunction in Circuit	ECM power stage Failure
P3032	Throttle Actuator Basic Setting (Bank 1 Bank 2)	• TPS 1 signal voltage < 0.21 or > 0.87 V • TPS 2 signal voltage < 4.14 or > 4.84 V
P3035	Throttle Valve Control Module 2 Mechanical malfunction	• Time to open over reference point + 12%, > 0.14 Sec. • Time to close below reference point, + 3%, > 0.56 Sec. • Time to close below reference point + 3% > 0.56 Sec.
P3081	Engine Temperature Too Low	• Modeled ECT, Minus ECT > 9.8 K or • Measured engine coolant temp. - reference model temperature > 191.3 [K]
P3144	Oxygen Sensors Front	Delta lambda of 2nd lambda control loop > 0.070
P3145	Oxygen Sensors Front	Delta lambda of 2nd lambda control loop < 0.070
P3146	Oxygen Sensors Front	Delta lambda of 2nd lambda control loop > 0.070
P3147	Oxygen Sensors Front	Delta lambda of 2nd lambda control loop < 0.070
P3148	Oxygen Sensors Heater front	• O2S ceramic temp. < 725 °C and • Heater duty cycle > 90.00%

DTC	Error Message	Malfunction Criteria and Threshold Value
P3150	Oxygen Sensors Heater Front	• O2S ceramic temp. < 725 °C and • Heater duty cycle > 90.00%
P3152	Oxygen Sensors Heater Front	• O2S ceramic temp. < 725 °C and • Time after O2S heater on 55.0 Sec
P3153	Oxygen Sensors Heater Front	• O2S ceramic temp. < 725 °C and • Time after O2S heater on 55.0 Sec
P3200	HO2S Heater Control Circuit Low (Bank 2 Sensor 1)	• Signal voltage 0.0 - 3.26 V
P3201	HO2S Heater Control Circuit High (Bank 2 Sensor 1)	Signal current > 5.50 A
P3202	HO2S Heater Control Circuit (Bank 1, Sensor 1)	Signal voltage > 4.70 - 5.40 V
P3205	Oxygen Sensors Front	Short to ground • Virtual mass (VM) voltage < 1.75 V • Nernst voltage (UN) < 1.50 V • Adjustment voltage (IP) < 0.30 V
P3206	Oxygen Sensors Front	Short to battery • Virtual mass (VM) voltage > 3.25 V • Nernst voltage (UN) > 4.40 V • Adjustment voltage (IP) > 7.00 V
P3207	Oxygen Sensors Front	O2S ceramic temp. < 690 °C

DTC	Error Message	Malfunction Criteria and Threshold Value
P3209	Oxygen Sensors Front	SYMMETRIC FAULT: • Difference of R2L area ratio vs. L2R area ratio -0.40 - 0.40 • Lower value of both counters for area ratio R2L and L2R ≥ 5 times Delay Time: • Gradient ratio ≥ 0.50 • Lower value of both area ratios R2L and L2R < 0.30 Transient Time: • Gradient ratio ≥ 0.50 • Gradient ratio ≤ 0.55 • Lower value of both area ratios R2L and L2R < 0.30 • or lower value of both gradient ratios R2L and L2R < 0.50 ASYMMETRIC FAULT: • Difference of R2L area ratio vs. L2R area ratio NOT (-0.40 - 0.40) • Values of both counters for area ratio R2L and L2R ≥ 5 Delay Time: • Gradient ratio ≥ 0.50 • Lower value of both area ratios R2L and L2R < 0.30 Transient Time: • Gradient ratio ≥0.50 • Gradient ratio ≤ 0.55 • Lower value of both area ratios R2L and L2R < 0.30 • or lower value of both gradient ratios R2L and L2R < 0.50
P3215	HO2S Heater Control Circuit (Bank 2 Sensor 2)	Heater voltage, < 2.34 V
P3216	Oxygen Sensors Heater rear 2-Point-LSF	Heater voltage > 3.59 V
P3217	HO2S Heater Control Circuit (Bank 2 Sensor 2)	Heater voltage, 2.34 - 3.59 V
P3218	Oxygen Sensors Heater Rear 2-Point-LSF	Heater resistance > 500 - 10000Ω

DTC	Error Message	Malfunction Criteria and Threshold Value
P3220	Oxygen Sensors Rear 2-Point-LSF	• Signal voltage < 0.06 V for time > 3.0 Sec and • Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) < 0.01 V
P3221	Oxygen Sensors Rear 2-Point-LSF	• Signal voltage > 1.08 V • for time > 5.0 Sec
P3223	Oxygen Sensors Rear (binary LSF)	• Signal voltage 0.40 - 0.60 V for time > 3.0 Sec and • Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) ≥ 2.80 V
P3224	Oxygen Sensors Rear (binary LSF)	• EWMA filtered max differential transient time at fuel cut off ≥ 0.5 Sec and • Number of checks ≥ 3.00 (initial phase and step function)
P3230	HO2S Heater Control Circuit Low (Bank 2 Sensor 1)	Signal voltage 0.0 - 3.26 V
P3231	HO2S Heater Control Circuit High (Bank 2 Sensor 1)	Signal current > 5.50 A
P3232	HO2S Heater Control Circuit (Bank 1, Sensor 1)	Signal voltage > 4.70 - 5.40 V
P3235	Oxygen Sensors Front	Short to ground • Virtual mass (VM) voltage < 1.75 V • Nernst voltage (UN) < 1.50 V • Adjustment voltage (IP) < 0.30 V
P3236	Oxygen Sensors Front	Short to battery • Virtual mass (VM) voltage > 3.25 V • Nernst voltage (UN) > 4.40 V • Adjustment voltage (IP) > 7.00 V
P3237	Oxygen Sensors Front	O2S ceramic temp. < 690 °C

DTC	Error Message	Malfunction Criteria and Threshold Value
P3239	Oxygen Sensors Front	SYMMETRIC FAULT: • Difference of R2L area ratio vs. L2R area ratio -0.40 - 0.40 • Lower value of both counters for area ratio R2L and L2R ≥ 5 times Delay Time: • Gradient ratio ≥ 0.50 • Lower value of both area ratios R2L and L2R < 0.30 Transient Time: • Gradient ratio ≥ 0.50 • Gradient ratio ≤ 0.55 • Lower value of both area ratios R2L and L2R < 0.30 • or lower value of both gradient ratios R2L and L2R < 0.50 ASYMMETRIC FAULT: • Difference of R2L area ratio vs. L2R area ratio NOT (-0.40 - 0.40) • Values of both counters for area ratio R2L and L2R ≥ 5 Delay Time: • Gradient ratio ≥ 0.50 • Lower value of both area ratios R2L and L2R < 0.30 Transient Time: • Gradient ratio ≥0.50 • Gradient ratio ≤ 0.55 • Lower value of both area ratios R2L and L2R < 0.30 • or lower value of both gradient ratios R2L and L2R < 0.50
P3245	HO2S Heater Control Circuit (Bank 2 Sensor 2)	Heater voltage, < 2.34 V
P3246	Oxygen Sensors Heater Rear 2-Point-LSF	Heater voltage > 3.59 V
P3248	Oxygen Sensors Heater Rear 2-Point-LSF	Heater resistance > 500 - 10000Ω

DTC	Error Message	Malfunction Criteria and Threshold Value
P3250	Oxygen Sensors Rear 2-Point-LSF	• Signal voltage < 0.06 V for time > 3.0 Sec and • Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) < 0.01 V
P3251	Oxygen Sensors Rear 2-Point-LSF	• Signal voltage > 1.08 V for time > 5.0 Sec
P3253	Oxygen Sensors Rear 2-Point-LSF	• Signal voltage 0.40... 0.60 V for time > 3.0 Sec and • Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) ≥ 2.80 V
P3254	Oxygen Sensors Rear (binary LSF)	• EWMA filtered max differential transient time at fuel cut off ≥ 0.5 Sec and • Number of checks ≥ 3.00 (initial phase and step function)
P3278	Oxygen Sensors Front	• 2S signal front 1.46 - 1.54 V • Delta lambda controller > .10
P3281	Oxygen Sensors Front	• O2S signal front < 0.20 V • Internal resistance > 950Ω
P3285	Oxygen Sensors front	• O2S signal front 1.44 - 1.53 V and • Internal resistance > 950 Ω
P3288	Oxygen Sensors Front	• O2S signal front 1.46 - 1.54 V • Delta lambda controller > .10
P3291	Oxygen Sensors Front	• O2S signal front 1.46 - 1.54 V • Delta lambda controller > .10
P3295	Oxygen Sensors Front	• O2S signal front 1.44 - 1.53 V and • Internal resistance > 950 Ω
P3298	Warm Up Catalyst Efficiency Below Threshold (Bank 3)	<1.0 -
P3299	Warm Up Catalyst Efficiency Below Threshold (Bank 4)	<1.0 -

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random/Multiple Cylinder Misfire Detected	• Catalyst damage misfire rate (MR), > 0.75% - 6.25%
P0301	Cylinder 1 Misfire Detected	• Emission threshold misfire rate (MR) > 2.75%
P0302	Cylinder 2 Misfire Detected	• Emission threshold misfire rate (MR) > 2.75%
P0303	Cylinder 3 Misfire Detected	• Emission threshold misfire rate (MR) > 2.75%
P0304	Cylinder 4 Misfire Detected	• Emission threshold misfire rate (MR) > 2.75%
P0305	Cylinder 5 Misfire Detected	• Emission threshold misfire rate (MR) > 2.75%
P0306	Cylinder 6 Misfire Detected	• Emission threshold misfire rate (MR) > 2.75%
P0307	Cylinder 7 Misfire Detected	• Emission threshold misfire rate (MR) > 2.75%
P0308	Cylinder 8 Misfire Detected	• Emission threshold misfire rate (MR) > 2.75%
P0309	Cylinder 9 Misfire Detected	• Emission threshold misfire rate (MR) > 2.75%
P0310	Cylinder 10 Misfire Detected	• Emission threshold misfire rate (MR) > 2.75%
P0311	Cylinder 11 Misfire Detected	• Emission threshold misfire rate (MR) > 2.75%
P0312	Cylinder 12 Misfire Detected	• Emission threshold misfire rate (MR) > 2.75%
P0321	Ignition/Distributor Engine Speed Input Circuit Range/ Performance	• Counted versus referenced teeth, incorrect • Monitoring reference gap failure
P0322	Ignition/Distributor Engine Speed Input Circuit No Signal	• Camshaft signal > 3 and • Engine speed no signal
P0324	Knock Control System Error	• Signal fault counter (combustion) > 28.00 or • Signal fault counter (measuring window) > 5.00

DTC	Error Message	Malfunction Criteria and Threshold Value
P0327	Knock Sensor 1 Circuit Low	Short to ground Port B lower threshold < -0.70 V • Short to ground Port A lower threshold < -0.70 V • Signal range check lower threshold < 0.7 - 3.0 V
P0328	Knock Sensor 1 Circuit High	Short to ground Port B upper threshold > 1.00 V • Short to ground Port A lower threshold > 1.00 V • Signal range check upper threshold > 44 - 116 V
P0332	Knock Sensor 2 Circuit Low	l short to ground Port B ower threshold < -0.70 V • short to ground Port A lower threshold < -0.70 V • Signal
P0333	Knock Sensor 2 Circuit High	Upper threshold > 1.00 V • Signal • Signal range check lower threshold < 0.7 - 3.0 V
P0341	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 1 or Single Sensor)	• Signal pattern incorrect • Defect counter 6.00
P0342	Camshaft Position Sensor “A” Circuit Low (Bank 1 or Single Sensor)	• Signal voltage permanently low and • Crankshaft signals 8
P0343	Camshaft Position Sensor “A” Circuit High (Bank 1 or Single Sensor)	• Signal voltage permanently high • Crankshaft signals 8
P0346	Camshaft Position Sensor “A” Circuit Range/Performance (Bank 2)	• Signal pattern incorrect • Defect counter 12.00
P0347	Camshaft Position Sensor “A” Circuit Low (Bank 2)	• Signal voltage permanently low and • Crankshaft signals 8
P0348	Camshaft Position Sensor “A” Circuit High (Bank 2)	• Signal voltage permanently high and • Crankshaft signals 8

DTC	Error Message	Malfunction Criteria and Threshold Value
P0351	Ignition Coil “A” Primary/ Secondary Circuit	• Signal current < 0.25 to 2.0 mA or • Internal check failed
P0352	Ignition Coil “B” Primary/ Secondary Circuit	• Signal current < 0.25 to 2.0 mA or • Internal check failed
P0353	Ignition Coil “C” Primary/ Secondary Circuit	• Signal current < 0.25 to 2.0 mA or • Internal check failed
P0354	Ignition Coil “D” Primary/ Secondary Circuit	• Signal current < 0.25 to 2.0 mA or • Internal check failed
P0355	Ignition Coil “E” Primary/ Secondary Circuit	• Signal current < 0.25 to 2.0 mA or • Internal check failed
P0356	Ignition Coil “F” Primary/ Secondary Circuit	• Signal current < 0.25 to 2.0 mA or • Internal check failed
P0357	Ignition Coil “G” Primary/ Secondary Circuit	• Signal current < 0.25 to 2.0 mA or • Internal check failed
P0358	Ignition Coil “H” Primary/ Secondary Circuit	• Signal current < 0.25 to 2.0 mA or • Internal check failed
P0359	Ignition Coil “I” Primary/ Secondary Circuit	• Signal current < 0.25 to 2.0 mA or • Internal check failed
P0360	Ignition Coil “J” Primary/ Secondary Circuit	• Signal current < 0.25 to 2.0 mA or • Internal check failed

DTC	Error Message	Malfunction Criteria and Threshold Value
P0361	Ignition Coil “K” Primary/ Secondary Circuit	• Signal current < 0.25 to 2.0 mA or • Internal check failed
P0362	Ignition Coil “L” Primary/ Secondary Circuit	• Signal current < 0.25 to 2.0 mA or • Internal check failed
P0366	Camshaft Position Sensor “B” Circuit Range/Performance (Bank 1)	• Signal pattern incorrect • Defect counter 12
P0367	Camshaft Position Sensor “B” Circuit Low (Bank 1)	• Signal voltage permanently low • Crankshaft signals 8.00
P0368	Camshaft Position Sensor “B” Circuit High (Bank 1)	• Signal voltage permanently high • Crankshaft signals 8.00
P0391	Camshaft Position Sensor “B” Circuit Range/Performance (Bank 2)	• Signal pattern incorrect • Defect counter 12
P0392	Camshaft Position Sensor “B” Circuit Low (Bank 2)	• Signal voltage permanently low and • Crankshaft signals 8.00
P0393	Camshaft Position Sensor “B” Circuit High (Bank 2)	• Signal voltage permanently high and • Crankshaft signals 8.00

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0410	Secondary Air Injection System	Difference ambient pressure vs. AIR pressure measured with AIR pressure sensor > 50.00 hPa
P0413	Secondary Air Injection System Switching Valve “A” Circuit Open	Signal voltage > 5.6 - 4.4 V
P0414	Secondary Air Injection System Switching Valve “A” Circuit Shorted	Signal current > 2.20 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P0418	Secondary Air Injection System Control "A" Circuit	Signal voltage 4.70 - 5.40 V
P0419	Secondary Air Injection System Control "B" Circuit	Signal voltage 4.70 - 5.40 V
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	< 1.0
P0421	Warm Up Catalyst Efficiency Below Threshold (Bank 1)	EWMA filter value for catalyst < 0.2
P0430	Catalyst System Efficiency Below Threshold (Bank 2)	< 1.0
P0431	Warm Up Catalyst Efficiency Below Threshold (Bank 2)	EWMA filter value for catalyst < 0.2
P0441	Evaporative Emission System Incorrect Purge Flow	Deviation lambda control < 3.7 - 4.9% and deviation idle control < 30%
P0442	Evaporative Emission System Leak Detected (small leak)	Time for pressure drop < 1.7 - 2.2 Sec.
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal voltage > 4.70 - 5.40 V
P0449	Evaporative Emission System Vent Valve/Solenoid Circuit	Signal voltage > 4.4 - 5.5 V
P0450	Evaporative Emission System Pressure Sensor/Switch	Open circuit signal voltage 0.39 - 0.55 V
P0451	Evaporative Emission System Pressure Sensor/Switch Range/Performance	Natural vacuum leak detection (NVLD) switch position stuck closed
P0452	Evaporative Emission System Pressure Sensor/Switch Low	Signal voltage < 0.24 V
P0453	Evaporative Emission System Pressure Sensor/Switch High	Signal voltage > 3.0 V
P0455	Evaporative Emission System Leak Detected (large leak)	Time for pressure drop < 0.95 - 1.1 Sec.
P0456	Evaporative Emission System Leak Detected (very small leak)	• Natural vacuum leak detection (NVLD) switch position
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage, < 0.0 - 3.25 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.2 A
P0491	Secondary Air Injection System Insufficient Flow (Bank 1)	• AIR pressure measured with AIR pressure sensor vs. modeled < 74 - 75% or • Absolute deviation of raw pressure signal from filtered signal: mean value < 1.21 hPa
P0492	Secondary Air Injection System Insufficient Flow (Bank 2)	• AIR pressure measured with AIR pressure sensor vs. modeled < 74 - 75 % or • Absolute deviation of raw pressure signal from filtered signal: mean value < 1.21 hPa
P0498	Evaporative Emission System Vent Valve Control Circuit Low	Signal Voltage, < 3.01 V
P0499	Evaporative Emission System Vent Valve Control Circuit High	Signal current, 2.7 - 5.5 A

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor “A” Range/Performance	Speed sensor signal: plausibility error failure
P0502	Vehicle Speed Sensor “A” Circuit Low Input	Speed sensor signal: electrical error failure
P0506	Idle Air Control System - RPM Lower Than Expected	• Engine speed deviation, > 100 RPM and • RPM controller torque value ≥ calculated max value

DTC	Error Message	Malfunction Criteria and Threshold Value
P0507	Idle Air Control System RPM Higher Than Expected	• Engine speed deviation< 100 RPM and • RPM controller torque value ≤ calculated min. value or • Integrated number of fuel cut off transitions ≥ n.a.
P050A	Cold Start Idle Air Control System Performance	Out of range low • Engine speed deviation > 150 RPM and • RPM controller torque value ≥ calculated max. value Out of range high • Engine speed deviation < 150 RPM and • RPM controller torque value ≤ calculated min. value or • Integrated number of fuel cut off transitions ≥ n.a.
P050B	Cold Start Ignition Timing Performance	Difference between commanded spark timing vs. actual value> 18.00%
P052A	Cold Start “A” Camshaft Position Timing Over-Advanced	Difference between target position vs. actual position > 10.00 - 40.00°CA
P052C	Cold Start “A” Camshaft Position Timing Over-Advanced	Difference between target position vs. actual position > 10.00 - 40.00°CA
P053A	Crankcase Heater	Open circuit-signal voltage failure
P053B	Crankcase Heater	Short to ground-signal voltage failure
P053C	Crankcase Heater	Short to battery plus-signal current failure
P053F	Cold Start Fuel Pressure Performance	• Difference between target pressure vs. actual pressure < -1.50 • Difference between target pressure vs. actual pressure > 1.50

DTC	Error Message	Malfunction Criteria and Threshold Value
P054A	Cold Start “B” Camshaft Position Timing Over-Advanced	Difference between target position vs. actual position > 10.00 - 22.00° CA
P054C	Cold Start “B” Camshaft Position Timing Over-Advanced	Difference between target position vs. actual position > 10.00 - 22.00° CA

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
P0602	Control Module Programming Error	Reprogramming not completed
P0604	Internal Control Module Random Access Memory (RAM) Error	Write ability check, failed
P0605	Internal Control Module Read Only Memory (ROM) Error	Check failed
P0606	ECM/PCM Processor	• Internal check failure • SPI communications check Identifier failure
P06D1	CM/PCM Processor	• Internal check failure • SPI communications check Identifier failure
P0613	TCM Processor	Check-calculation of 1st CPU failed, Single reset does not cover problem
P0614	ECM / TCM Incompatible	Detection of error signal
P062B	Injector Valves Communication CPU	SPI communications check Identifier not active / correct
P0638	Throttle Actuator Control Range/Performance (Bank 1)	• Time to close reference point > 0.6 Sec. and • Reference point 2.88%.
P0639	Throttle Actuator Control Range/Performance Bank 2	• Duty cycle > 80% and • ECM power stage No Failure • Deviation throttle valve angles vs. calculated values > 4-50%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0641	Sensor Reference Voltage “A” Circuit/Open	Internal Fault • Signal voltage deviation > ± 0.3 V
P0642	Sensor Reference Voltage “A” Circuit Low	Signal voltage < 4.606 - 4.998 V
P0643	Sensor Reference Voltage “A” Circuit High	5 V supply voltage: > supply voltage > 4.998 - 5.406 V
P0651	Sensor Reference Voltage “B” Circuit/Open	Internal Fault • Signal voltage deviation > ± 0.3 V
P0652	Sensor Reference Voltage “B” Circuit Low	Signal voltage < 4.606 - 4.998 V
P0653	Sensor Reference Voltage “B” Circuit High	Signal voltage > 4.998 - 5.406 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/PCM Power Relay Control Circuit /Open	• Signal voltage 2.6 - 3.7 V • Sense circuit voltage < 6 V
P0686	ECM/PCM Power Relay Control Circuit Low	• Signal voltage 2.6 - 3.7 V • Sense circuit voltage < 6 V
P0687	ECM/PCM Power Relay Control Circuit High	• Signal current > 0.7 - 1.4 A • Sense circuit voltage < 6 V
P0688	ECM/PCM Power Relay Sense Circuit /Open	Sense voltage < 4.0 V
P0697	Sensor Reference Voltage C Circuit/Open	Internal Fault • Signal voltage deviation > +/- 0.3 V
P0698	Sensor Reference Voltage “C” Circuit Low	Signal voltage < 4.606 - 4.998 V
P0699	Sensor Reference Voltage “C” Circuit High	5V supply voltage > 4.998 - 5.406 V
U0001	High Speed CAN Communication Bus	CAN message, no feedback
U0002	High Speed CAN Communication Bus Performance	Global timeout receiving no message

DTC	Error Message	Malfunction Criteria and Threshold Value
U0037	Vehicle Communication Bus B	Internal CAN failure
U0100	Lost Communication With ECM/PCM “A”	No time triggered CAN message received from Master. no feedback
U0101	Lost Communication with TCM	No CAN message received from TCM no feedback
U0115	Lost Communication With ECM/PCM “B”	No time triggered CAN message received from Slave; no feedback
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	CAN communication with brake unit, time-out
U0140	Lost Communication With Body Control Module	Time out no message
U0146	Lost Communication With Gateway “A”	Received CAN message no message
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	Received CAN message no message
U0301	Software Incompatibility with ECM/PCM	Software Incompatibility With ECM/PCM implausible message
U0302	Software Incompatibility with Transmission Control Module	OBD relevant Gear-ECU wrong coded
U0322	Software Incompatibility with Body Control Module	Temperature received from CAN ≤ -50
U0323	CAN: Instrument cluster only	Ambient temperature value module not encoded for ambient temperature sensor, 00h
U0401	Invalid Data Received From ECM/PCM	Communication on private CAN failed
U0402	Invalid Data Received From Transmission Control Module	Invalid data received from TCM
U0415	Invalid Data Received From Anti-Lock Brake System Control Module	Received data implausible message
U0422	Invalid Data Received From Body Control Module	Ambient temperature value initialization, 01 h

DTC	Error Message	Malfunction Criteria and Threshold Value
U0423	Invalid Data Received From Instrument Panel Control Module	Received data implausible message
U0447	Invalid Data Received From Gateway “A”	Received data from Gateway implausible message

Transmission

DTC	Error Message	Malfunction Criteria and Threshold Value
P0705	Transmission Range Sensor “A” Circuit Malfunction (PRNDL Input)	-
P0706	Transmission Range Sensor “A” Circuit Range/ Performance	4 bit position code, incorrect
P0707	Transmission Range Sensor “A” Circuit Low	-
P0708	Transmission Range Sensor “A” Circuit High	-
P0710	Transmission Fluid Temperature Sensor “A” Circuit	Sensor short circuit: • U_sensor (+), and U_sensor (-) diagnosis by ASIC
P0711	Transmission Fluid Temperature Sensor “A” Circuit Range/Performance	Discontinual temperature: • ATF temperature delta T between 2 measurements, >20 °C Sensor stuck: • Comparision ATF vs. chip temperature, ATF temp. must follow chip temp. in certain ranges, 25 - 40 °C
P0712	Transmission Fluid Temperature Sensor “A” Circuit Low	Circuit low: • U_sensor (+), and U_sensor (-) diagnosis by ASIC
P0713	Transmission Fluid Temperature Sensor “A” Circuit High	Circuit high: • U_sensor (+), and U_sensor (-) diagnosis by ASIC
P0714	Transmission Fluid Temperature Sensor “A” Circuit Intermittent	Circuit high: • U_sensor (+), and U_sensor (-) diagnosis by ASIC

DTC	Error Message	Malfunction Criteria and Threshold Value
P0716	Input/Turbine Speed Sensor “A” Circuit Range/ Performance	Signal higher or lower than threshold • Higher, > + 8000 RPM • Lower, < 20 RPM
P0717	Input/Turbine Speed Sensor “A” Circuit No Signal	Hardware detection
P0721	Output Speed Sensor Circuit Range/Performance	• Signal> threshold, > 10000 RPM • Difference between last and actual value >threshold, -1000 RPM • Difference to wheel speeds, > 500 RPM and input speed, > 200 RPM
P0722	Output Speed Sensor Circuit No Signal	Hardware detection
P0727	Engine Speed Input Circuit No Signal	CAN message signal error flag, =1
P0741	Torque Converter Clutch Circuit Performance or Stuck Off	Rate of (setting of nominal value) - actual value, > 50 RPM
P0746	Pressure Control Solenoid “A” Performance or Stuck Off	PWM hardware detection, 0 or 100%
P0747	Pressure Control Solenoid “A” Stuck On	PWM hardware detection, 0 or 100%
P0748	Pressure Control Solenoid “A” Electrical	• Current higher or lower than threshold, > 220 mA • EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage • Static leakage current flow
P0751	Shift Solenoid “A” Performance or Stuck Off	• If PWM = 0%, diagnosis by ASIC • If 0% < = PWM , 7.6% voltage return lead (low), < 0.75 V • If 7.6% < = PWM , 92.4% voltage return lead (high), < 0.75 V • If 7.6% < = PWM , 92.4% voltage return lead (low), < 0.75 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0752	Shift Solenoid “A” Stuck On	• If PWM = 100%, diagnosis by ASIC • If 7.6% ≤ PWM ≤ 100% voltage return lead (high), >0.3 V
P0754	Shift Solenoid “A” Intermittent	• If PWM = 0%, diagnosis by ASIC • If 0% ≤ PWM , 7.6% voltage return lead (low), < 0.75 V • If 7.6% ≤ PWM , 92.4% voltage return lead (high), < 0.75 V • If 7.6% ≤ PWM , 92.4% voltage return lead (low), < 0.75 V
P0776	Pressure Control Solenoid “B” Performance or Stuck off	PWM hardware detection, 0 or 100%
P0777	Pressure Control Solenoid “B” Stuck On	PWM hardware detection, 0 or 100%
P0778	Pressure Control Solenoid “B” Electrical	• Current higher or lower than threshold, < 730 mA • EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage • Static leakage current flow
P0796	Pressure Control Solenoid “C” Performance or Stuck off	PWM hardware detection, 0 or 100%
P0797	Pressure Control Solenoid “C” Stuck On	PWM hardware detection, 0 or 100%
P0798	Pressure Control Solenoid “C” Electrical	• Current higher or lower than threshold, >220 mA • DS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage • Static leakage current flow
P0889	TCM Power Relay Sense Circuit Range/Performance	FET drive, not possible
P0890	TCM Power Relay Sense Circuit Low	• Solenoid power supply voltage, < 1.4 V • Drop voltage over high side FET, > 1 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0891	TCM Power Relay Sense Circuit High	Hardware detection
P0892	TCM Power Relay Sense Circuit Intermittent	Hardware detection
P1702	Impossible Combination of Substitute Functions or Not Allowed Actuating of Valves	SW functions: actuating solenoid valves colliding with 2 substitute functions with same priority as driven solenoid valves that have short circuit to supply or interruption
P2637	Torque Management Feedback Signal “A”	CAN message signal error flag, = 1
P2714	Pressure Control Solenoid “D” Performance or Stuck Off	PWM hardware detection, 0 or 100%
P2715	Pressure Control Solenoid “D” Stuck On	PWM hardware detection, 0 or 100%
P2716	Pressure Control Solenoid “D” Electrical	• Current higher or lower than threshold, <730 mA • EDS output voltage at short to ground or open circuit ~ 0.5 V • Static leakage current flow
P2723	Pressure Control Solenoid “E” Performance or Stuck Off	PWM hardware detection, 0 or 100%
P2725	Pressure Control Solenoid “E” Electrical	• Current higher or lower than threshold, <730 mA • EDS output voltage at short to ground or open circuit ~ 0.5 V smaller than EDS supply voltage • Static leakage current flow
P2732	Pressure Control Solenoid “F” Performance or Stuck Off	PWM hardware detection, 0 or 100%
P2733	Pressure Control Solenoid “F” Stuck On	PWM hardware detection, 0 or 100%
P2734	Pressure Control Solenoid “F” Electrical	• EDS output voltage at short to ground or open circuit ~ 0.5 V smaller than EDS supply voltage • Static leakage current flow
P2735	Pressure Control Solenoid “F” Intermittent	PWM hardware detection, 0 or 100%

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P100F	Fuel Rail Injection Valves	• Volume part of rail pressure controller > 20 mm • Misfire failure
P1009	Air Mass Meter 1/2 Implausible Signal From Load Detection (Via throttle position and engine speed map)	• Mass air flow HFM2 vs. lower threshold map HFM2 < 0 .. 450 kg/h • Mass air flow HFM2 vs. upper threshold map > 55 - 1082
P106A	Intake Air System	Plausibility with fuel system • Load calculation < -35%
P1073	2 MAF Sensors MAF 1 MAF 2	MAF sensor signal < 66 uSec
P1074	2 MAF Sensors MAF 1 MAF 2	MAF sensor signal > 110 uSec
P1081	System Too Lean @ Idle	Adaptive value > 6.00 %]
P1082	System Too Lean @ Part Load	Adaptive value > 30%
P1083	System Too Rich @ Idle	Adaptive value < -6.00%
P1084	System Too Rich @ Part Load	Adaptive value < -30%
P1085	System Too Lean @ Idle	Adaptive value > 6.00 %
P1086	System Too Lean @ Part Load	Adaptive value > 30%
P1087	System Too Lean @ Part Load	Adaptive value < -6.00%]
P1088	System Too Rich @ Idle	Adaptive value < -30%
P1094	System Too Rich @ Part Load	Comparison with fuel quantity incorrect
P1167	Incorrect Fuel Composition	• Air mass too low < -10.00 kg/h • Air mass too high > 1100.00 kg/h • Rail • Mass air flow vs. lower threshold model < 0...500 kg/h • Mass air flow vs. upper threshold model > 25...1100 kg/h • Load calculation > 25% and • Fuel system (mult.) < -16% • Load calculation < -20% and • Fuel system (mult.) > 25%

DTC	Error Message	Malfunction Criteria and Threshold Value
P117C	Post Catalyst Fuel Trim System Too Lean (Bank 3)	I-portion of 2nd lambda control loop < -0.045
P117D	Post Catalyst Fuel Trim System Too Rich (Bank 3)	I-portion of 2nd lambda control loop > -0.045
P117E	Post Catalyst Fuel Trim System Too Lean (Bank 4)	I-portion of 2nd lambda control loop < -0.045
P117F	Post Catalyst Fuel Trim System Too Rich (Bank 4)	I-portion of 2nd lambda control loop > -0.045
P118A	Oxygen Sensors Front	• Threshold 1: signal voltage 2.71 - 6.00 V • Threshold 2: signal voltage 2.05 - 3.06 V
P118B	Oxygen Sensors Front	• Threshold 1: signal voltage 2.71 - 6.00 V • Threshold 2: signal voltage 2.05 - 3.06 V
P118C	Oxygen Sensors Rear 2-Point-LSF	• O2S signal rear not oscillating at reference < 0.64 V and • Enrichment after stuck lean 28%
P118D	Oxygen Sensors Rear 2-Point-LSF	• O2S signal rear not oscillating at reference > 0.64 V and • Enrichment after stuck rich 15%
P118E	Oxygen Sensors Rear 2-Point-LSF	• O2S signal rear not oscillating at reference < 0.64 V and • Enrichment after stuck lean 28%
P118F	Xygen Sensors Rear 2-Point-LSF	• O2S signal rear not oscillating at reference > 0.64 V and • Enrichment after stuck lean 15%
P12A1	Fuel Rail Pressure Sensor High Pressure System	• Pressure control activity > 0.02 mPa • Fuel trim activity < 0.60 • Difference between target pressure - actual pressure -16.38 - 16.38 MPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P12A2	Fuel Rail Pressure Sensor High Pressure System	• Pressure control activity < -0.06 MPa • Fuel trim activity > 1.33 • Difference between target pressure - actual pressure -16.38 - 16.38 MPa
P12A4	Fuel Rail Pump Control Valve Stuck Closed	• Pressure control activity < -3.0 • Fuel trim activity 0.90 - 1.30 mPa and • Difference between target pressure vs. actual pressure < -8.00 mPa
P12A5	Fuel Rail Pressure Sensor High Pressure System	• Pressure control activity > 0.02 mPa • Fuel trim activity < 0.60 • Difference between target pressure - actual pressure -16.38 - 16.38 MPa
P12A6	Fuel Rail Pressure Sensor High Pressure System	• Pressure control activity < -0.06 MPa • Fuel trim activity > 1.33 • Difference between target pressure - actual pressure -16.38 - 16.38 MPa
P12A7	Fuel Rail Pressure Control Valve	• Pressure control activity <- 4.0 MPa • Fuel trim activity 0.75 - 1.25 • Difference between target pressure - actual pressure < -4.0 mPa
P129B	Fuel Pressure Regulator 2 Control Circuit	Signal voltage 1.40 - 3.20 V
P129C	Fuel Pressure Regulator 2 Control Circuit Low	Signal voltage < 1.40 - 3.20 V
P129D	Fuel Pressure Regulator 2 Control Circuit High	Signal voltage > 3.20 V
P13EA	Ignition Timing Monitor	Difference between commanded spark timing and actual value > 10%

DTC	Error Message	Malfunction Criteria and Threshold Value
P1321	Knock Control System Error	Short to ground Port B lower threshold < -0.70 V • Short to ground Port A lower threshold < -0.70 V • Signal range check lower threshold < 0.7 - 3.0 V
P1322	Knock Control System Error	Short to battery plus Port B upper threshold > 1.00 V • Short to battery plus Port A upper threshold > 1.00 V •Signal range check upper threshold > 44 - 116 V
P1323	Knock Control System Error	Short to ground Port B lower threshold < -0.70 V • Short to ground Port A lower threshold < -0.70 V • Signal range check lower threshold < 0.7 - 3.0 V
P1324	Knock Control System Error	Short to battery plus Port B upper threshold > 1.00 V • Short to battery plus Port A upper threshold > 1.00 V • Signal range check upper threshold > 44 - 116 V
P1489	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.2 A
P1491	Evaporative Emission System Purge Control Valve CircuitOpen	Signal voltage > 4.4- 5.6 V
P1490	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage, 3.25 - 2.15 V
P1494	Evaporative Emission System Incorrect Purge Flow	• Deviation lambda control < 6% • Deviation idle control < 20%
P1497	Secondary Air Injection System Insufficient Flow (Bank 3)	• Relative secondary air mass flow < 0.047 • Relative secondary air mass flow, < 0.05
P1498	Secondary Air Injection System Insufficient Flow (Bank 4)	• Relative secondary air mass flow < 0.047 • Relative secondary air mass flow, < 0.05

DTC	Error Message	Malfunction Criteria and Threshold Value
P150A	Engine Off Time Performance	• Difference between engine off time and ECM after run time < -12.0 Sec. • Difference between engine off time and ECM after run time > 12.0 Sec.
P1647	Checking Coding/Versions of Control Modules in Can-Bus	-
P210B	Throttle Actuator Control Motor Circuit Range/ Performance	• Duty cycle > 80 % and • ECM power stage no failure • Deviation throttle value angles vs. calculated value > 4.00 - 50.00%
P2101	Throttle Actuator A Control Motor Circuit Range/ Performance	Signal range check • Duty cycle > 80% and • ECM power stage, no failure Rationality check • Deviation throttle valve angles vs. calculated value 4.0 - 50.0%
P2106	Throttle Actuator Control System - Forced Limited Power	ECM power stage Failure
P2108	Throttle Actuator Control Module Performance	• TPS 1 signal voltage NOT (0.40 - 0.80) V or • TPS 2 signal voltage NOT (4.20 - 4.60) V
P2122	Throttle/Pedal Position Sensor/Switch “D” Circuit Low Input	Signal voltage < 0.65 V
P2123	Throttle/Pedal Position Sensor/Switch “D” Circuit High Input	Signal voltage > 4.79 V
P2127	Throttle/Pedal Position Sensor/Switch “E” Circuit Low Input	Signal voltage < 0.28 V
P2128	Throttle/Pedal Position Sensor/Switch “E” Circuit High Input	Signal voltage > 2.43 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2138	Throttle/Pedal Position Sensor/Switch “D” / “E” Voltage Correlation	Signal voltage sensor 1 vs. sensor 2 > 0.14 - 0.70 V
P2146	Fuel Injector Group “A” Supply Voltage Circuit/Open	Short to ground (high side) • Signal current > 14.90 A • Short to battery plus (high side) signal current < 2.60 A • Core connection (high side - low side) signal current < 2.60 A
P2149	Fuel Injector Group “B” Supply Voltage Circuit/Open	Short to ground (high side) • Signal current > 14.90 A • Short to battery plus (high side) signal current < 2.60 A • Core connection (high side - low side) signal current < 2.60 A
P2152	Fuel Injector Group “C” Supply Voltage Circuit/Open	Short to ground (high side) • Signal current, > 14.90 A Short to battery plus (high side) • Signal current < 2.60 A
P2155	Fuel Injector Group “D” Supply Voltage Circuit/Open	Short to ground (high side) • Signal current > 14.90 A • Short to battery plus (high side) signal current < 2.60 A • Core connection (high side - low side) signal current < 2.60 A
P216A	Fuel Injector Group “E” Supply Voltage Circuit/Open	Short to ground (high side) • Signal current > 14.90 A • Short to battery plus (high side) signal current < 2.60 A • Core connection (high side - low side) signal current < 2.60 A
P216D	Fuel Injector Group “F” Supply Voltage Circuit/Open	Short to ground (high side) • Signal current > 14.90 A • Short to battery plus (high side) signal current < 2.60 A • Core connection (high side - low side) signal current < 2.60 A
P2177	System Too Lean Off Idle (Bank 1)	Adaptive value > 30%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2178	System Too Rich Off Idle (Bank 1)	Adaptive value < -30%
P2179	System Too Lean Off Idle (Bank 2)	Adaptive value > 30%
P217A	Fuel Injector Group “C” Supply Voltage Circuit/Open	Short to ground (high side) • Signal current > 14.90 A • Short to battery plus (high side) signal current < 2.60 A • Core connection (high side - low side) signal current < 2.60 A
P217D	Fuel Injector Group “D” Supply Voltage Circuit/Open	Short to ground (high side) • Signal current > 14.90 A • Short to battery plus (high side) signal current < 2.60 A • Core connection (high side - low side) signal current < 2.60 A
P2180	System Too Rich Off Idle (Bank 2)	Adaptive value < -30%
P2181	Cooling System Performance	• ECT < 75° C • Mass air integral 4 - 12 Kg
P2187	System Too Lean at Idle	Adaptive value > 6.00%
P2188	System Too Rich at Idle	Adaptive value < -6.00%
P2189	System Too Lean at Idle (Bank 2)	Adaptive value > 6.00 %
P2190	System Too Rich at Idle (Bank 2)	Adaptive value < -6.00%
P2195	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 1)	Trim control post catalyst > 0.070
P2196	O2 Sensor Signal Stuck Rich (Bank 1 Sensor 1)	Delta lambda of 2nd lambda control loop < -0.070
P2197	O2 Sensor Signal Stuck Lean (Bank 2 Sensor 1)	Trim control post catalyst > 0.070
P2198	O2 Sensor Signal Stuck Rich (Bank 2 Sensor 1)	Delta lambda of 2nd lambda control loop < -0.070
P2231	O2 Sensor Signal Circuit Shorted to Heater Circuit (Bank 1 Sensor 1)	• Delta O2S signal front > 0.2 - 0.498 V • Elapsed time since last O2S < 0.05 Sec • Heater switch on

DTC	Error Message	Malfunction Criteria and Threshold Value
P2234	O2 Sensor Signal Circuit Shorted to Heater Circuit (Bank 2 Sensor 1)	• Delta O2S signal front > 0.2 - 0.498 V • Elapsed time since last O2S < 0.05 Sec • Heater switch on
P2237	O2 Sensor Positive Current Control Circuit/Open (Bank 1 Sensor 1)	• O2S signal front 1.46 - 1.54 V and • Delta lambda controller > 0.10
P2240	O2 Sensor Positive Current Control Circuit/Open (Bank 2 Sensor 1)	• O2S signal front 1.46 - 1.54 V and • Delta lambda controller > 0.10
P2243	O2 Sensor Reference Voltage Circuit/Open (Bank 1 Sensor 1)	• O2S signal front < 0.20 V • Internal resistance > 950Ω
P2247	O2 Sensor Reference Voltage Circuit/Open (Bank 2 Sensor 1)	• O2S signal front > 4.70 and • Internal resistance > 950 Ω
P2251	O2 Sensor Negative Current Control Circuit/Open (Bank 1 Sensor 1)	• O2S signal front 1.44 - 1.53 V and • Internal resistance > 950 Ω
P2254	O2 Sensor Negative Current Control Circuit/Open (Bank 2 Sensor 1)	• O2S signal front 1.44 - 1.53 V and • Internal resistance > 950 Ω
P2257	Secondary Air Injection System Control “A” Circuit Low	Signal voltage 0.00 - 3.26 V
P2258	Secondary Air Injection System Control “A” Circuit High	Signal current 0.60 - 2.40 A
P2259	Secondary Air Injection System Control “B” Circuit Low	Signal voltage 0.0 - 3.26 V
P2260	Secondary Air Injection System Control “B” Circuit High	Signal current 0.60 - 2.40 A
P2270	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 2)	• O2S signal rear not oscillating at reference < 0.64 V and • Enrichment after stuck lean 28%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2271	O2 Sensor Signal Stuck Rich (Bank 1 Sensor 2)	• O2S signal rear not oscillating at reference > 0.64 V and • Enrichment after stuck rich 15%
P2272	O2 Sensor Signal Stuck Lean (Bank 2 Sensor 2)	• O2S signal rear not oscillating at reference < 0.64 V and • Enrichment after stuck lean 28%
P2273	O2 Sensor Signal Stuck Rich (Bank 2 Sensor 2)	• O2S signal rear not oscillating at reference > 0.64 V and • Enrichment after stuck rich 15%
P2279	Intake Air System Leak	• Threshold to detect a defective system > 1.70 and • Ratio of the tie “System defective” during the measurem. window to the whole duration of the measurem. window > 0.80
P2293	Fuel Pressure Regulator 2 Performance	Difference between actual pressure - Target pressure <1.50 & > 1.50 MPa
P2294	Fuel Pressure Regulator 2 Control Circuit	• Signal voltage 1.40 - 3.20 V
P2295	Fuel Pressure Regulator 2 Control Circuit Low	Signal voltage < 1.40 - 3.40 V
P2296	Fuel Pressure Regulator 2 Control Circuit High	Signal voltage > 3.20 V

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P2300	Ignition Coil “A” Primary Control Circuit Low	Signal current > 24.0 mA
P2301	Ignition Coil “A” Primary Control Circuit High	Signal voltage > 5.1 - 7.0 V
P2303	Ignition Coil “B” Primary Control Circuit Low	Signal current > 24.0 mA

DTC	Error Message	Malfunction Criteria and Threshold Value
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
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
P2312	Ignition Coil “E” Primary Control Circuit Low	Signal current > 24.0 mA
P2313	Ignition Coil “E” Primary Control Circuit High	Signal voltage > 5.1 - 7.0 V
P2315	Ignition Coil “F” Primary Control Circuit Low	Signal current > 24.0 mA
P2316	Ignition Coil “F” Primary Control Circuit High	Signal voltage > 5.1 - 7.0 V
P2318	Ignition Coil “G” Primary Control Circuit Low	Signal current > 24.0 mA
P2319	Ignition Coil “G” Primary Control Circuit High	Signal voltage > 5.1 - 7.0 V
P2321	Ignition Coil “H” Primary Control Circuit Low	Signal current > 24.0 mA
P2322	Ignition Coil “H” Primary Control Circuit High	Signal voltage > 5.1 - 7.0 V
P2324	Ignition Coil “I” Primary Control Circuit Low	Signal current > 24.0 mA
P2325	Ignition Coil “I” Primary Control Circuit High	Signal voltage > 5.1 - 7.0 V
P2327	Ignition Coil “J” Primary Control Circuit Low	Signal current > 24.0 mA
P2328	Ignition Coil “J” Primary Control Circuit High	Signal voltage > 5.1 - 7.0 V
P2330	Ignition Coil “K” Primary Control Circuit Low	Signal current > 24.0 mA
P2331	Ignition Coil “K” Primary Control Circuit High	Signal voltage > 5.1 - 7.0 V
P2333	Ignition Coil “L” Primary Control Circuit Low	Signal current > 24.0 mA

DTC	Error Message	Malfunction Criteria and Threshold Value
P2334	Ignition Coil “L” Primary Control Circuit High	Signal voltage > 5.1 - 7.0 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 - 5.5 V
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	Signal voltage < 3V
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	Signal current 2.7 - 5.5 A
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit/Open	Low signal voltage > 10.4 Sec.
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	High signal voltage > 10.4 Sec.
P2414	O2 Sensor Exhaust Sample Error (Bank 1 Sensor 1)	• Threshold 1 - Signal voltage 2.71 - 6.00 V • Threshold 2 - Signal voltage 2.05 - 3.06 V
P2415	O2 Sensor Exhaust Sample Error (Bank 2 Sensor 1)	• Threshold 1 - Signal voltage 2.71 - 6.00 V • Threshold 2 - Signal voltage 2.05 - 3.06 V
P2422	Evaporative Emission System Vent Valve Stuck Closed=	Time for pressure drop during 2nd leak check < 1.45 Sec.
P2431	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Range/ Performance	Difference between SAI pressure and ambient pressure NOT(-60 - 60 hPa)
P2432	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Low	Signal voltage < 0.50 V
P2433	Secondary Air Injection System Air Flow/Pressure Sensor Circuit High	Signal voltage > 4.50 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2436	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Range/ Performance (Bank 2)	Difference between SAI pressure and ambient pressure NOT(-60 - 60 hPa)
P2437	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Low (Bank 2)	Signal voltage < 0.50 V
P2438	Secondary Air Injection System Air Flow/Pressure Sensor Circuit High (Bank 2)	Signal voltage > 4.50 V
P2440	Secondary Air Injection System Switching Valve Stuck Open	Deviation of raw pressure signal from filter signal: • Maximum value > 3.8 hPa • Minimum value < -25 hPa • Mean value > 1.5 hPa
P2442	Secondary Air Injection System Switching Valve Stuck Open (Bank 2)	Deviation of raw pressure signal from filter signal: • Maximum value > 3.8 hPa • Minimum value < -25 hPa • Mean value > 1.5 hPa
P2539	Low Pressure Fuel System Sensor Circuit	Signal voltage > 4.90 V
P2541	Low Pressure Fuel System Sensor Circuit Low	Signal voltage < 0.10 V
P2626	O2 Sensor Pumping Current Trim Circuit/Open (Bank 1 Sensor 1)	O2S signal front > 4.81 V
P2629	O2 Sensor Pumping Current Trim Circuit/Open (Bank 2 Sensor 1)	O2S signal front > 4.8 V

DTC CHART

Engine Codes - 3.0L TDI CPNA

Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P00AF	Turbocharger/Supercharger Boost Control "A" Module Performance	Functional check: stuck open • Control deviation > 8.00% or • Control deviation < -8.00% • Actual position ≤ 30.00% Functional check: stuck close • Control deviation > 8.00% or • Control deviation < -8.00% • Actual position > 30.00%
P00C6	Fuel Rail Pressure Too Low - Engine Cranking	Rail pressure < 12000.00 - 23000.00 kPa
P0045	Turbocharger/Supercharger Boost Control Solenoid "A" Circuit/Open	Signal voltage > 0.8; < 2.0 V
P0047	Turbocharger/Supercharger Boost Control Solenoid "A" Circuit Low	Signal current > 8 - 18 A
P0048	Turbocharger/Supercharger Boost Control Solenoid "A" Circuit High	Signal current > 8 - 18 A
P0071	Ambient Air Temperature Sensor Circuit Range/ Performance	• Number of detected faults ≥ 6.00 Cross checks for fault detection: • AAT vs. ECT @ cylinder head > 40 K • AAT vs. IAT > 35 K • AAT vs. FTS > 35 K • AAT vs. ECT @ radiator outlet > 35 K • AAT vs. ECT @ cylinder block > 35 K • AAT vs. EOT > 35 K • AAT vs. TEGR n.a
P0072	Ambient Air Temperature Sensor Circuit Low	Ambient air temperature signal: short to ground failure

DTC	Error Message	Malfunction Criteria and Threshold Value
P0073	Ambient Air Temperature Sensor Circuit High	Ambient air temperature signal: short to battery / open circuit failure
P0087	Fuel Rail/System Pressure - Too Low	• Positive control deviation step 1 > 17000.00 - 50000.00 kPa • Positive control deviation step 2 > 15000.00 kPa • Minimum rail pressure < 0.00 - 12500.00 kPa
P0088	Fuel Rail/System Pressure - Too High	• Negative control deviation < -25000.00 kPa • Maximum rail pressure > 215000.00 kPa • Negative control deviation < -30000.00 - -20000.00 kPa
P0090	Fuel Pressure Regulator 1 Control Circuit	Signal voltage < 4.7 V
P0091	Fuel Pressure Regulator 1 Control Circuit Low	• Signal voltage < 2.97 V • Signal voltage < 0.428 V • Signal voltage > 0.613 V
P0092	Fuel Pressure Regulator 1 Control Circuit High	Signal curent > 3.0 A
P01BA	Engine Oil Temperature Sensor "B" Range/ Performance	• Number of detected faults ≥ 6.00 Cross checks for fault detection: • EOT vs. ECT @ cylinder head > 35 K • EOT vs. IAT > 35 K • AAT vs. FTS > 35 K • EOT vs. FTS > 35 K • EOT vs. ECT @ radiator outlet > 35 K • EOT vs. ECT @ cylinder block > 35 K • EOT vs. TEGR n.a
P01BB	Engine Oil Temperature Sensor "B" Circuit Low	Signal voltage > 4.85 V for time ≥ 5.00
P01BC	Engine Oil Temperature Sensor "B" Circuit High	Signal voltage < 0.20 V for time ≥ 5.00

DTC	Error Message	Malfunction Criteria and Threshold Value
P01BD	Engine Oil Temperature Sensor "B" Circuit Intermittent/ Erratic	• Oil temperature increase < 3.0 K • Oil temperature < 66 °C • Evaluation timer > 59 - 1490 s
P01E3	Engine Coolant Temperature Sensor 3 Circuit	Signal voltage > 4.92 V
P01E4	Engine Coolant Temperature Sensor 3 Circuit Range/ Performance	• Number of detected faults ≥ 6.00 Cross checks for fault detection: • ECT @ radiator outlet vs. ECT @ cylinder head > 35 K • ECT @ radiator outlet vs. IAT > 35 K • ECT @ radiator outlet vs. FTS > 35 K • ECT @ radiator outlet vs. AAT > 35 K • ECT @ radiator outlet vs. ECT @ cylinder block > 35 K • ECT @ radiator outlet vs. EOT > 35 K • ECT @ radiator outlet vs. TEGR n.a.
P01E5	Engine Coolant Temperature Sensor 3 Circuit Low	Signal voltage < 0.22 V
P0101	Mass or Volume Air Flow Circuit Range/Performance	• Mass air flow ratio calculated from: mass air flow measured vs. mass air flow modeled < 0.85 • Mass air flow ratio calculated from: mass air flow measured vs. mass air flow modeled > 1.15
P0102	Mass or Volume Air Flow Circuit Low Input	MAF sensor signal < 83 µs
P0103	Mass or Volume Air Flow Circuit High Input	MAF sensor signal > 4500 µs
P0104	Mass or Volume Air Flow Circuit Intermittent	MAF sensor signal period failed
P0106	Manifold Absolute Pressure/ BARO Sensor Range/ Performance	Boost pressure signal • Altitude sensor < -210 hPa • Altitude sensor > 230 hPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P0111	Intake Air Temperature (Sensor 1 Bank 1) Circuit Range/Performance	• Number of detected faults ≥ 6.00 Cross checks for fault detection: • IAT vs. ECT @ cylinder head > 35 K • IAT vs. FTS > 35 K • IAT vs. AAT > 35 K • IAT vs. ECT @ radiator outlet > 35 K • IAT vs. ECT @ cylinder block > 35 K • IAT vs. EOT > 35 K • IAT vs. TEGR n.a
P0112	Intake Air Temperature (Sensor 1 Bank 1) Circuit Low	Signal voltage < 0.10 V
P0113	Intake Air Temperature (Sensor 1 Bank 1) Circuit High	Signal voltage > 4.83 V
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/ Performance	• ECT increase < 2 °C • ECT < 66 °C • Evaluation timer > 80 - 1200 s • Number of detected faults ≥ 6.00 Cross checks for fault detection: • ECT @ cylinder head vs. IAT > 35 K • ECT @ cylinder head vs. FTS > 35 K • ECT @ cylinder head vs. AAT > 40 K • ECT @ cylinder head vs. ECT @ radiator outlet > 35 K • ECT @ cylinder head vs. ECT @ cylinder block > 35 K • ECT @ cylinder head vs. EOT > 35 K • ECT @ cylinder head vs. TEGR n.a.
P0117	Engine Coolant Temperature Sensor 1 Circuit Lowt	Signal voltage < 0.22 V
P0118	Engine Coolant Temperature Sensor 1 Circuit High	Signal voltage > 4.92 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0121	Throttle/Pedal Pos.Sensor A Circuit Range/Performance	• Position sensor signal 0.15 - 0.30 V • Position sensor signal > 1.00
P0122	Throttle/Pedal Pos.Sensor A Circuit Low Input	Position sensor signal < 0.15 V
P0123	Throttle/Pedal Pos.Sensor A Circuit High Input	Position sensor signal ≥ 4.85 V
P0128	Coolant Termostat (Coolant Temperature Below Thermostat Regulating Temperature)	ECT @ cylinder head < 66 °C
P0130	O2 Sensor Circuit (Bank 1 Sensor 1) Malfunction	Short to battery plus • Virtual mass (VM) > 3.0 V or • Nernst voltage (UN) > 4.0 V or • Adjustment voltage (IA/IP) > 1.5 V Short to ground • Virtual mass (VM) < 2.0 V or • Nernst voltage (UN) < 1.75 V or • Adjustment voltage (IA/IP) < 0.3 V
P0132	O2 Sensor Circuit (Bank 1, Sensor 1) High Voltage	Signal voltage > 3.20 V
P0133	O2 Circuit (Bank 1, Sensor 1) Slow Response	Time to reach 0% to 60% Oxygen > 4.0 s
P0134	O2 Sensor Circuit (Bank 1 Sensor 1) No Activity Detected	• Integrated oxygen sensor temperature > 339990.2 - 1114045.9 K • Oxygen sensor heating not active
P0135	O2 Sensor Heater Circuit (Bank 1 Sensor 1) Malfunction	• Signal current > 2.2 A • Signal voltage < 2.15 V (short to ground) • Signal voltage < 4.4 V (open circuit) • O2S ceramic temperature > 840 °C • O2S ceramic temperature < 720 °C

DTC	Error Message	Malfunction Criteria and Threshold Value
P016A	Excessive Time To Enter Closed Loop Air/Fuel Ratio Control	Control intervention 0%
P0171	Fuel Trim (Bank 1) System too Lean	Fuel mass correction value < -0.01 [g/rev]
P0172	Fuel Trim (Bank 1) System too Rich	Fuel mass correction value > 0.01 [g/rev]
P0181	Fuel Temperature Sensor A Circuit Range/Performance	• Number of detected faults ≥ 6.00 Cross checks for fault detection: • FTS vs. ECT @ cylinder head > 35 K • FTS vs. IAT @ cylinder head > 35 K • FTS vs. AAT @ cylinder head > 35 K • FTS vs. ECT @ radiator outlet > 35 K • FTS vs. ECT @ cylinder block > 35 K • FTS vs. EOT > 35 K • FTS vs. TEGR n.a.
P0182	Fuel Temperature Sensor A Circuit Low Input	Signal voltage < 0.10 V
P0183	Fuel Temperature Sensor A Circuit High Input	Signal voltage > 4.90 V
P0191	Fuel Rail Pressure Sensor "A" Circuit Range/Performance	• Adaptation factor of fuel rail pressure regulator valve > 125.31% • Adaptation factor of fuel rail pressure regulator valve < 83.20%
P0192	Fuel Rail Pressure Sensor "A" Circuit Low Input	Signal voltage < 200 mV
P0193	Fuel Rail Pressure Sensor "A" Circuit High Input	Signal voltage > 4800 mV

DTC	Error Message	Malfunction Criteria and Threshold Value
P0201	Cylinder 1- Injector Circuit	• Signal voltage > 60 V (open circuit) • Signal voltage failed (short to battery plus (low side)) • Signal voltage > 30 V (short circuit over load) • Deviation between set and actual signal voltage after charging > 30% (short circuit (low side)) • Deviation between set and actual signal voltage before charging > 45% (short circuit (low side))
P0202	Cylinder 2- Injector Circuit	• Signal voltage > 60 V (open circuit) • Signal voltage failed (short to battery plus (low side)) • Signal voltage > 30 V (short circuit over load) • Deviation between set and actual signal voltage after charging > 30% (short circuit (low side)) • Deviation between set and actual signal voltage before charging > 45% (short circuit (low side))
P0203	Cylinder 3- Injector Circuit	• Signal voltage > 60 V (open circuit) • Signal voltage failed (short to battery plus (low side)) • Signal voltage > 30 V (short circuit over load) • Deviation between set and actual signal voltage after charging > 30% (short circuit (low side)) • Deviation between set and actual signal voltage before charging > 45% (short circuit (low side))

DTC	Error Message	Malfunction Criteria and Threshold Value
P0204	Cylinder 4- Injector Circuit	• Signal voltage > 60 V (open circuit) • Signal voltage failed (short to battery plus (low side)) • Signal voltage > 30 V (short circuit over load) • Deviation between set and actual signal voltage after charging > 30% (short circuit (low side)) • Deviation between set and actual signal voltage before charging > 45% (short circuit (low side))
P0205	Cylinder 5- Injector Circuit	• Signal voltage > 60 V (open circuit) • Signal voltage failed (short to battery plus (low side)) • Signal voltage > 30 V (short circuit over load) • Deviation between set and actual signal voltage after charging > 30% (short circuit (low side)) • Deviation between set and actual signal voltage before charging > 45% (short circuit (low side))
P0206	Cylinder 6- Injector Circuit	• Signal voltage > 60 V (open circuit) • Signal voltage failed (short to battery plus (low side)) • Signal voltage > 30 V (short circuit over load) • Deviation between set and actual signal voltage after charging > 30% (short circuit (low side)) • Deviation between set and actual signal voltage before charging > 45% (short circuit (low side))

DTC	Error Message	Malfunction Criteria and Threshold Value
P0234	Turbo/Super Charger Overboost Condition	• Difference set value boost pressure vs. actual boost pressure value < -22.00 kPa • Boost pressure > 160.00 - 300.00 kPa
P0236	Turbocharger Boost Sensor (A) Circ. Range/Performance	Difference in boost pressure signal vs. altitude sensor signal > 220 hPa or < 120 hPa
P0237	Turbocharger Boost Sensor (A) Circuit Low Input	Sensor voltage < 0.40 V
P0238	Turbocharger Boost Sensor (A) Circuit High Input	Sensor voltage > 4.90 V
P026A	Charge Air Cooler Efficiency Below Threshold	Filtered charge air cooler efficiency < 0.70
P0263	Cylinder 1 Contribution/ Balance	• Injection balancing amount per cylinder > 0.0005 - 0.006 [g/rev] • Calibration value of injector energizing time > 224 - 412 µs (adaptive value limit high) • Calibration value of injector energizing time < 109.2 - 167.2 µs (adaptive value limit low) • Diagnostic signal from power stage failed
P0266	Cylinder 2 Contribution/ Balance	• Injection balancing amount per cylinder > 0.0005 - 0.006 [g/rev] • Calibration value of injector energizing time > 224 - 412 µs (adaptive value limit high) • Calibration value of injector energizing time < 109.2 - 167.2 µs (adaptive value limit low) • Diagnostic signal from power stage failed

DTC	Error Message	Malfunction Criteria and Threshold Value
P0269	Cylinder 3 Contribution/ Balance	• Injection balancing amount per cylinder > 0.0005 - 0.006 [g/rev] • Calibration value of injector energizing time > 224 - 412 µs (adaptive value limit high) • Calibration value of injector energizing time < 109.2 - 167.2 µs (adaptive value limit low) • Diagnostic signal from power stage failed
P0272	Cylinder 4 Contribution/ Balance	• Injection balancing amount per cylinder > 0.0005 - 0.006 [g/rev] • Calibration value of injector energizing time > 224 - 412 µs (adaptive value limit high) • Calibration value of injector energizing time < 109.2 - 167.2 µs (adaptive value limit low) • Diagnostic signal from power stage failed
P0275	Cylinder 5 Contribution/ Balance	• Injection balancing amount per cylinder > 0.0005 - 0.006 [g/rev] • Calibration value of injector energizing time > 224 - 412 µs (adaptive value limit high) • Calibration value of injector energizing time < 109.2 - 167.2 µs (adaptive value limit low) • Diagnostic signal from power stage failed

DTC	Error Message	Malfunction Criteria and Threshold Value
P0278	Cylinder 6 Contribution/ Balance	• Injection balancing amount per cylinder > 0.0005 - 0.006 [g/rev] • Calibration value of injector energizing time > 224 - 412 µs (adaptive value limit high) • Calibration value of injector energizing time < 109.2 - 167.2 µs (adaptive value limit low) • Diagnostic signal from power stage failed
P0299	Turbocharger/Supercharger Underboost	• Difference set value boost pressure vs. actual boost pressure value: depending on ECT > 30.00 - 99.90 kPa • Difference set value boost pressure vs. actual boost pressure value: depending on engine speed and fuel > 35.00 - 100.00 kPa • Boost pressure < 0.00 - 85.00 kPa
P2002	Particulate Trap Bank 1 Efficiency Below Threshold	Case 1: • PM Sensor signal current > 12 µA Case 2: • PM Sensor signal current < 3 µA • Pressure difference between measured and modeled value < 0.00 - 163.27 kPa
P20B9	Reductant Heater "A" Control Circuit/Open	• Power stage current > 1 A or • Internal detection via pull up resistor
P20BB	Reductant Heater "A" Control Circuit Low	High side current > 14 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P20BC	Reductant Heater "A" Control Circuit High	Current: • High side current < 1; > 14 A or • Low side current > 30 A or Resistor: • Internal detection via pull up resistor
P20BD	Reductant Heater "B" Control Circuit/Open	• Power stage current < 1 A or • Internal detection via pull up resistor
P20BF	Reductant Heater "B" Control Circuit Low	high side current > 14 A
P20C0	Reductant Heater "B" Control Circuit High	Current: • High side current < 1; > 14 A or • Low side current > 30 A or Resistor: • Internal detection via pull up resistor
P20E8	Reductant Pressure Too Low	• Actual pressure SCR delivery system < 300.00 kPa • Actual pressure SCR delivery system < 350.00 kPa • Actual pressure SCR delivery system < 450.00 kPa number of checks > 21.00
P20E9	Reductant Pressure Too High	• Actual pressure SCR delivery system > 790.00 kPa • Actual pressure SCR delivery system > 650.00 kPa • Pressure @ dosing end > 50.00 kPa
P20EE	SCR NOx Catalyst Efficiency Below Threshold Bank 1	Average efficiency < 0.40
P20F4	Reductant Consumption Too Low	SCR adaption value > 2.50
P20F5	Reductant Consumption Too High	SCR adaption value < 0.51

DTC	Error Message	Malfunction Criteria and Threshold Value
P20FE	Reductant Metering Unit Performance	• Difference of average SCR pressure pump speed (bewteen reductant dosing and no dosing) > 50 rpm • Difference of average SCR pressure pump speed (bewteen reductant dosing and no dosing) < 25 rpm
P20FF	Reductant Control Module Performance	• CAN Controler RAM fault detection 3 times or • Control Module ROM fault detection 3 times or • Control Module EEPROM fault detection 3 times or • Control Module watchdog fault detection 3 times or • Control Module AD-converter fault detection 3 times or • Voltage of sensor ground > 0.2 V
P202A	Reductant Tank Heater Control Circuit/Open	Conductance during heating ≤ 0.10 [1/Ohm]
P202B	Reductant Tank Heater Control Circuit Low	Conductance @ start heating < 0.20 [1/Ohm]
P202C	Reductant Tank Heater Control Circuit High	Conductance @ start heating > 1.00 [1/Ohm]
P2004	Intake Manifold Runner Control (Bank 1) Stuck Open	• Control deviation > 10.00% or • Control deviation < -10.00% • Actual position > 12.00%
P2006	Intake Manifold Runner Control (Bank 1) Stuck Closed	• Control deviation > 10.00% or • Control deviation < -10.00% • Actual position > 12.00%
P2008	Intake Manifold Runner (Bank 1) Control Circuit/Open	Signal voltage > 0.8; < 2.0 V
P2009	Intake Manifold Runner (Bank 1) Control Circuit Low	Signal current > 8 - 18 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P2010	Intake Manifold Runner (Bank 1) Control Circuit High	Signal current > 8 - 18 A
P2016	Intake Manifold Runner Position Sensor/Switch Circuit Low	Position sensor signal < 0.15 V
P2017	Intake Manifold Runner Position Sensor/Switch Circuit High	Position sensor signal ≥ 4.85 V
P2031	Exhaust Gas Temperature (Sensor 2, Bank 1) Circuit	Signal voltage > 2.61 V
P2032	Exhaust Gas Temperature (Sensor 2, Bank 1) Circuit Low	Signal voltage < 0.68 V
P203B	Reductant Level Sensor Circuit Range/Performance	Signal voltage within fault range: • Fault range 1: 0.6 - 0.9 V • Fault range 2: 1.03 - 1.365 V • Fault range 3: 1.525 - 1.9 V • Fault range 4: 2.04 - 2.4 V • Fault range 5: 2.6 - 3.105 V • Fault range 6: 3.205 - 3.7 V
P203C	Reductant Level Sensor Circuit Low	Signal voltage < 0.1 V
P203D	Reductant Level Sensor Circuit High	Signal voltage > 4.8 V
P204A	Reductant Pressure Sensor Circuit	Signal voltage < 0.1 V
P204B	Reductant Pressure Sensor Circuit Range/Performance	• Actual pressure SCR delivery system < -50.00 kPa (before pressure build up) • Actual pressure SCR delivery system > 50.00 kPa (before pressure build up)
P204D	Reductant Pressure Sensor Circuit High	Signal voltage > 4.8 V
P2047	Reductant Injection Valve Circuit/Open (Bank 1 Unit 1)	Signal voltage < 4.7 V
P2048	Reductant Injection Valve Circuit Low (Bank 1 Unit 1)	• Signal voltage < 2.97 V • Signal current > 1.6 A
P2049	Reductant Injection Valve Circuit High (Bank 1 Unit 1)	• Signal current > 1.8 A • Signal current < 0.2 A
P205A	Reductant Tank Temperature Sensor Circuit	Signal voltage > 4.63 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P205B	Reductant Tank Temperature Sensor Circuit Range/ Performance	• Difference between AAT vs. reductant temperature < -30.0 K Case 1: • ATT > 25 °C Case 2: • ATT < 25 °C • Reductant temperature increase while heating SCR tank < 1.5 K for time < 1500.0 s • Difference between AAT vs. reductant temperature > 30.0 K Case 1: • ATT > -20 °C Case 2: • ATT < -20 °C • Reductant temperature increase while heating SCR tank < 1.5 K for time < 1500.0 s
P205C	Reductant Tank Temperature Sensor Circuit Low	Signal voltage < 0.18 V
P207F	Reductant Quality Performance	SCR adaption value after reductant refill event > 2.50
P208A	Reductant Pump "A" Control Circuit/Open	Current: • Total current of SCR pump electric phases 1,2,3 < 0.9 A or Voltage: • Voltage on electric phases 2, 3 < 0 V
P208B	Reductant Pump "A" Control Range/Performance	Rotation speed < 400 rpm for time > 5 s
P208C	Reductant Pump "A" Control Circuit Low	Current: • Total current of SCR pump electric phases 1,2,3 > 30 A or Voltage: • voltage on single activated phase < 0 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P208D	Reductant Pump "A" Control Circuit Low	Current: • Total current of SCR pump electric phases 1,2,3 > 20 A or Voltage: • Voltage on electric phases 2, 3 < 0 V
P208E	Reductant Injection Valve Stuck Closed (Bank 1 Unit 1)	Number of missing signal peaks > 200.00
P2080	Exhaust Gas Temperature Sensor Circuit Bank1 Range/ Performance	Measured sensor temperature - mean value of modelled temperature > 250.0; < -200.0 K • Number of detected faults ≥ 4.00 Cross checks for fault detection: • EGT upstream Turbocharger vs. EGT upstream Catalyst > 40 K • EGT upstream Turbocharger vs. EGT downstream Catalyst > 40 K • EGT upstream Turbocharger vs. EGT downstream DPF > 40 K • EGT upstream Turbocharger vs. TEGR > 40 K
P2084	Exhaust Gas Temperature Sensor 2 Circuit Range/ Performance	Measured sensor temperature - mean value of modelled temperature < -100.0 K • Number of detected faults ≥ 4.00 Cross checks for fault detection: • EGT upstream Turbocharger vs. EGT upstream Catalyst > 40 K • EGT upstream Turbocharger vs. EGT downstream Catalyst > 40 K • EGT upstream Turbocharger vs. EGT downstream DPF > 40 K • EGT upstream Turbocharger vs. TEGR > 40 K

DTC	Error Message	Malfunction Criteria and Threshold Value
P3081	Engine Temperature Too Low	Difference between ECT and modeled ECT > 10° K
P3348	Activation turbocharger control module 1 -J724 Electrical error in circuit	Signal current > 8 - 18 A

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random/Multiple Cylinder Misfire Detected	• Counted misfire per cylinder > 180.00 • Number of combustion cycles tested ≥ 220.00 • Number of cylinders with detected misfire > 1.00
P0301	Cylinder 1 Misfire Detected	• Counted misfire per cylinder > 180.00 • Number of combustion cycles tested ≥ 220.00
P0302	Cylinder 2 Misfire Detected	• Counted misfire per cylinder > 180.00 • Number of combustion cycles tested ≥ 220.00
P0303	Cylinder 3 Misfire Detected	• Counted misfire per cylinder > 180.00 • Number of combustion cycles tested ≥ 220.00
P0304	Cylinder 4 Misfire Detected	• Counted misfire per cylinder > 180.00 • Number of combustion cycles tested ≥ 220.00
P0305	Cylinder 5 Misfire Detected	• Counted misfire per cylinder > 180.00 • Number of combustion cycles tested ≥ 220.00
P0306	Cylinder 6 Misfire Detected	• Counted misfire per cylinder > 180.00 • Number of combustion cycles tested ≥ 220.00

DTC	Error Message	Malfunction Criteria and Threshold Value
P0321	Ignition/Distributor Engine Speed Input Circuit Range/ Performance	• Counted teeth vs. reference > 200.00 or • Monitoring reference gap failure
P0322	Ignition/Distributor Engine Speed Input Circuit No Signal	• Camshaft signal > 3. 00 and • Crankshaft signals no signal
P0381	Glow Plug/Heater Indicator Circuit	Glow plug indicator control (sent message) vs. glow plug indicator (recieved message) status not equal

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P040B	Exhaust Gas Recirculation Temperature Sensor "A" Circuit Range/Performance	Measured sensor temperature - mean value of modelled temperature < -90.0 - -40.0 K • Number of detected faults ≥ 4.00 Cross checks for fault detection: • TEGR vs. EGT upstream Catalyst > 40 K • TEGR vs. EGT downstream Catalyst > 40 K • TEGR vs. EGT downstream DPF > 40 K • TEGR vs. EGT upstream Turbocharger > 40 K
P040C	Exhaust Gas Recirculation Temperature Sensor "A" Circuit Low	Signal voltage < 0.68 V
P040D	Exhaust Gas Recirculation Temperature Sensor "A" Circuit High	Signal voltage > 2.61 V
P0401	Exhaust Gas Recircullation Flow Insufficient Detected	Control deviation EGR -45… -200 [g/rev]
P0402	Exhaust Gas Recirc.Flow Excessive Detected	Mass air flow ratio calculated from: mass air flow measured vs. mass air flow modeled > 1.29

DTC	Error Message	Malfunction Criteria and Threshold Value
P0403	Exhaust Gas Recirculation Circuit	Functional check: stuck close • Control deviation > 10.00% or • Control deviation < -10.00% • Actual position ≤ 17.00% Functional check: stuck open • Control deviation > 10.00% or • Control deviation < -10.00% • Actual position > 17.00% • Signal voltage > 0.8; < 2.0 V (open circuit) • Signal current > 8 - 18 A (short to ground) • Signal current > 8 - 18 A (short to battery plus) • Signal current > 8 - 18 A (electrical error)
P0405	Exhaust Gas Recirculat. Sensor A Circuit Low	Position sensor signal < 0.25 V
P0406	Exhaust Gas Recirculat. Sensor A Circuit High	Position sensor signal ≥ 4.75 V
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	Ratio of measured and modeled heat quantity < 0.30
P046C	Exhaust Gas Recirculation Sensor "A" Circuit Range/ Performance	• Position sensor signal > 1.05 V • Position sensor signal 0.25 - 0.35 V

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor "A" Range/Performance	Speed sensor signal: plausibility error failure
P0502	Vehicle Speed Sensor "A" Circuit Low Input	Speed sensor signal: electrical error failure
P0506	Idle Air Control System - RPM Lower Than Expected	Difference between target and measured idle engine speed < 10.00%
P0507	Idle Air Control System - RPM Higher Than Expected	Difference between target and measured idle engine speed > 10.00%

DTC	Error Message	Malfunction Criteria and Threshold Value
P050E	Cold Start Engine Exhaust Temperature Too Low	• Calculated SCR-temperature < 150 °C • Modeled heat quantity ≥ 120 kJ
P052F	Glow Plug Control Module System Voltage	Voltage supply via LIN message 0 V
P054E	Idle Control System Fuel Quantity Lower Than Expected	Expected fuel quantity - actual fuel quantity < 0.004 [g/rev]
P054F	Idle Control System Fuel Quantity Higher Than Expected	Expected fuel quantity - actual fuel quantity > 0.018 - 0.033 [g/rev]
P0544	Exhaust Gas Temperatur Sensor Circuit - Bank 1	Signal voltage > 2.61 V
P0545	Exhaust Gas Temperatur Sensor Circuit - Bank 1 Low	Signal voltage < 0.68 V

Control Module and Output Signals

DTC	Error Message	Malfunction Criteria and Threshold Value
P0604	Internal Control Module Random Access Memory (RAM) Error	Write ability check, failed
P0605	Internal Control Module Read Only Memory (ROM) Error	Checksum incorrect

DTC	Error Message	Malfunction Criteria and Threshold Value
P0606	ECM/PCM Processor	• Number of camshaft revolutions with irregular Pol 1 shut offs > 10.00 • Number of camshaft revolutions with irregular Pol 2 shut offs > 10.00 • Diagnostic signal from power stage failed • Signal voltage < 3.4 V • Comparison voltage sensor 1 with sensor 2 implausible • Comparison voltage sensor1 with sensor 2 implausible • Calculated vehicle acceleration while no injection demanded implausible • Fuel injection (without driver demand) active • Engine speed > 1500 rpm • Communication between monitoring module and function controller failed
P0607	Control Module Performance	• Supply voltage for IC • Oxygen sensor adaption value > 0.20 V • Oxygen sensor adaption value < -0.20 V • Sensor voltage < 0.94 V (short to ground) • Sensor voltage > 4.76 V (short to battery / open circuit) • Internal check failed
P06B0	Sensor Power Supply "A" Circuit/Open	Sensor supply voltage < 0.2; > 5.3 V
P06CA	Cylinder 6 Glow Plug Incorrect	Internal resistance < 0.11; > 1.15 Ohm
P06C5	Cylinder 1 Glow Plug Incorrect	Internal resistance < 0.11; > 1.15 Ohm
P06C6	Cylinder 2 Glow Plug Incorrect	Internal resistance < 0.11; > 1.15 Ohm
P06C7	Cylinder 3 Glow Plug Incorrect	Internal resistance < 0.11; > 1.15 Ohm

DTC	Error Message	Malfunction Criteria and Threshold Value
P06C8	Cylinder 4 Glow Plug Incorrect	Internal resistance < 0.11; > 1.15 Ohm
P06C9	Cylinder 5 Glow Plug Incorrect	Internal resistance < 0.11; > 1.15 Ohm
P0607	Control Module Performance	Short to ground • Sensor voltage < 0.94 V Short to battery / open circuit • Sensor voltage > 4.76 V
P0634	PCM/ECM/TCM Internal Temperature Too High	• Power stage temperature > 150 °C • Power stage temperature > 170 °C • Power stage temperature > 175 °C
P064C	Sensor Reference Voltage "A" Circuit Open	Message from glow plug contol module incorrect
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
P0658	Actuator Supply Voltage A Circuit Low	Signal voltage < 2.15 - 3.25 V
P06E5	Glow Plug Control Module 1 Performance	• Ground offset ≤ -1.76 V • Ground offset ≥ 1.76 V
P066A	Cylinder 1 Glow Plug Control Circuit Low	• Glow current ≥ 70 A • Message from glow plug contol module incorrect • Glow current ≥ 37.10 A
P066B	Cylinder 1 Glow Plug Control Circuit High	Message from glow plug contol module incorrect
P066C	Cylinder 2 Glow Plug Control Circuit Low	• Glow current ≥ 70 A • Message from glow plug contol module incorrect • Glow current ≥ 37.10 A
P066D	Cylinder 2 Glow Plug Control Circuit High	Message from glow plug contol module incorrect
P066E	Cylinder 3 Glow Plug Control Circuit Low	• Glow current ≥ 70 A • Message from glow plug contol module incorrect • Glow current ≥ 37.10 A
P066F	Cylinder 3 Glow Plug Control Circuit High	Message from glow plug contol module incorrect

DTC	Error Message	Malfunction Criteria and Threshold Value
P067A	Cylinder 4 Glow Plug Control Circuit Low	• Glow current ≥ 70 A • Message from glow plug contol module incorrect • Glow current ≥ 37.10 A
P067B	Cylinder 4 Glow Plug Control Circuit High	Message from glow plug contol module incorrect
P067C	Cylinder 5 Glow Plug Control Circuit Low	• Glow current ≥ 70 A • Message from glow plug contol module incorrect • Glow current ≥ 37.10 A
P067D	Cylinder 5 Glow Plug Control Circuit High	Message from glow plug contol module incorrect
P067E	Cylinder 6 Glow Plug Control Circuit Low	• Glow current ≥ 70 A • Message from glow plug contol module incorrect • Glow current ≥ 37.10 A
P067F	Cylinder 6 Glow Plug Control Circuit High	Message from glow plug contol module incorrect
P0671	Cylinder 1 Glow Plug Circuit	Glow current ≤ 2.19 A
P0672	Cylinder 2 Glow Plug Circuit	Glow current ≤ 2.19 A
P0673	Cylinder 3 Glow Plug Circuit	Glow current ≤ 2.19 A
P0674	Cylinder 4 Glow Plug Circuit	Glow current ≤ 2.19 A
P0675	Cylinder 5 Glow Plug Circuit	Glow current ≤ 2.19 A
P0676	Cylinder 6 Glow Plug Circuit	Glow current ≤ 2.19 A
P0683	Glow Plug Control Module 1 to PCM Communication Circuit	LIN message no feedback
P0697	Sensor Reference Voltage "C" Circuit Open	Signal voltage deviation > ± 0.3 V
U0002	High Speed CAN Communication Bus Performance	Global time out receiving no message
U0028	Vehicle Communication Bus A	CAN message no feedback
U0029	Vehicle Communication Bus A Performance	Global time out receiving no message
U0037	Vehicle Communication Bus B	CAN message no feedback
U0038	Vehicle Communication Bus B Performance	Global time out receiving no message

DTC	Error Message	Malfunction Criteria and Threshold Value
U010E	Lost Communication With Reductant Control Module	• Received CAN message no message or • Received data ímplausible message
U0100	Lost Communication with ECM/PCM A	• Failure of all CAN engine messages, time out > 490 mSec. • Failure of all CAN engine messages, but not all CAN messages, time out > 1010 mSec.
U0101	Lost Communication with TCM	Received CAN message no message
U0106	Lost Communication With Glow Plug Control Module	LIN message no message
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	Received CAN message no message
U0140	CAN communication with Body Control Module	Time out, no message
U0146	Lost Communication With Gateway "A"	Received CAN message - no message
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	Received CAN message - no message
U02A3	Lost Communication With PM Sensor	Received CAN message - no message
U0302	Software Incompatibility with Transmission Control Module	Recieved AT vehicle data, TCM signal
U0307	Software Incompatibility With Glow Plug Control Module	Software check via LIN message incorrect
U0323	CAN: Instrument cluster Audi only	Ambient temperature value module not encoded for ambient temp sensor, 00h

DTC	Error Message	Malfunction Criteria and Threshold Value
U04A4	Invalid Data Received From PM Sensor	• signal sensitivity factor 0.75 - 1.25 or • Invalid sensitivity signal ≥ 2.0 s • Received data implausible message • Communication PM sensor control unit failed > 600 ms
U0402	Invalid Data Received From Transmission Control Module	Received data implausible message
U040F	Invalid Data Received From Reductant Control Module	• Dataset is not adequate for hardware version or download of dataset was aborted time after ignition on startup of SCR control module • Dataset of SCR control module does not belong to car type it is used with time after ignition on startup of SCR control module
U0407	Invalid Data Received From Glow Plug Control Module	LIN message implausible message
U0415	Invalid Data Received From Anti-Lock Brake System Control Module	• Speed sensor signal: initialisation error 407.296mph • Speed sensor signal: low voltage error 407.290 mph • Speed sensor signal: sensor error 407.303 mph • Received data implausible message
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	• Ambient temperature value (initialization) FEh • Received data implausible message
U0447	Invalid Data Received From Gateway "A"	Received data implausible message
U1006	NOX Sensor 1 Bank 1 No communication	Received CAN message no message
U10C1	NOX Sensor 2 Bank 1 Implausible signal	Received data implausible message

DTC	Error Message	Malfunction Criteria and Threshold Value
U10C2	NOX Sensor 2 Bank 1 No Communication	Received CAN message no message
U102A	Internal (Master/Slave) CAN 2 Faulty	CAN message no feedback
U102B	Internal (Master/Slave) CAN 2 No communication	Global time out receiving no message
U1024	Instrument cluster control module Read out DTC	Ambient temperature value (initialization) FDh
U1026	Transmission control module Read out DTC	Clutch signal error message
U1034	NOX Sensor 1 Bank 1 Implausible signal	Received data ímplausible message
U1103	Production Mode Active	Production mode active
U140C	Reductant Control Module Supply Voltage Too Low	Supply voltage > 8.5 V for time ≥ 90 s
U140D	Reductant Control Module Supply Voltage Too High	Supply voltage > 16.5 V for time ≥ 90 s
U140E	Reductant Control Module Function restriction due to insufficient voltage	Supply voltage < 9 V for time ≥ 3 s
U140F	Reductant Control Module Function Restriction Due to Excessive Voltage	• Supply voltage > 16 V for time ≥ 3 s • Dataset is not adequate for hardware version or download of dataset was aborted

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P150A	Engine Off Time Performance	Difference between ECM time and IPC time > 12.0 a
P2100	Throttle Actuator Control Motor Circuit/Open	Signal voltage > 0.8; < 2.0 V
P2101	Throttle Actuator Control Motor Circuit Range/ performance	Signal current > 8 - 18 A
P2102	Throttle Actuator Control Motor Circuit Low	Signal current > 8 - 18 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P2103	Throttle Actuator Control Motor Circuit High	Signal current > 8 - 18 A
P2111	Throttle Actuator Control System - Stuck Open	• Control deviation > 10.00% or • Control deviation < -10.00% • Actual position ≤ 30.00
P2112	Throttle Actuator Control System - Stuck closed	• Control deviation > 10.00% or • Control deviation < -10.00% • Actual position > 30.00
P21C7	Reductant Control Module Power Relay/Relays Control Circuit/Open	Supply voltage during relais activation too low < 1 V
P21C9	Reductant Control Module Power Relay/Relays Control Circuit High	Supply voltage before relais activation already high > 7 V
P21CA	Reductant Control Module Supply Voltage Circuit	Voltage @ closed main relais < 1 V for time ≥ 300 ms
P21CC	Reductant Control Module Supply Voltage High	Voltage @ opened main relais > 7 V for time ≥ 300 ms
P2122	Throttle/Pedal Pos. Sens./ Switch D Circuit Low Input	Signal voltage < 0.65 V
P2123	Throttle/Pedal Pos. Sens./ Switch D Circuit High Input	Signal voltage > 4.79 V
P2127	Throttle/Pedal Pos. Sens./ Switch E Circuit Low Input	Signal voltage < 0.28 V
P2128	Throttle/Pedal Pos. Sens./ Switch E Circuit High Input	Signal voltage > 2.43 V
P2138	Throttle/Pedal Position Sensor/Switch D/E Voltage Correlation	Signal voltage: Difference between signal sensor 1 and 2 > 0.14 - 0.26 V
P214E	Reductant Pump "A" Current Too High	Powerstage temperature > 140 °C for time > 300 ms
P2146	Fuel Injector Group A Supply Voltage Circuit/Open	Diagnostic signal in power stage failed
P2149	Fuel Injector Group B Supply Voltage Circuit/Open	Diagnostic signal in power stage failed
P2181	Cooling System Performance	Deviation between target and measured ECT value < -7.5 K

DTC	Error Message	Malfunction Criteria and Threshold Value
P2183	Engine Coolant Temperature Sensor 2 Circuit Range/ Performance	• Number of detected faults ≥ 6.00 Cross checks for fault detection: • ECT @ radiator outlet vs. ECT @ cylinder head > 35 K • ECT @ radiator outlet vs. IAT > 35 K • ECT @ radiator outlet vs. FTS > 35 K • ECT @ radiator outlet vs. AAT > 35 K • ECT @ radiator outlet vs. ECT @ cylinder block > 35 K • ECT @ radiator outlet vs. EOT > 35 K • ECT @ radiator outlet vs. TEGR n.a.
P2184	Engine Coolant Temperature Sensor 2 Circuit Low	Signal voltage < 0.22 V
P2185	Engine Coolant Temperature Sensor 2 Circuit High	Signal voltage > 4.92 V
P2195	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 1)	• Measured oxygen concentration @ fuel cut off > 25.60; < 14.70% • Measured oxygen concentration compared with calculated oxygen concentration deviation @ part load > 11.00; < 32.77%
P2196	2 Sensor Signal Stuck Rich (Bank 1 Sensor 1)	Measured oxygen concentration @ fuel cut off > 25.60; < 14.70%
P220A	NOx Sensor Supply Voltage (Bank 1 Sensor 1) Circuit	Difference between battery voltage and sensor supply voltage > 1.50 V
P220B	NOx Sensor Supply Voltage (Bank 1 Sensor 2) Circuit	Difference between battery voltage and sensor supply voltage > 1.50
P2200	NOx Sensor Bank 1 Sensor 1 Circuit	• Message from NOx-Sensor failure • NOx sensor signal ratio of validity ≥ 0.50

DTC	Error Message	Malfunction Criteria and Threshold Value
P2201	NOx Sensor Circuit Range/ Performance Bank 1 Sensor 1	• (Measured NOx value - calculated NOx value) / calculated NOx value > -0.60 • NOx value < -35.00 ppm • Time to decrease 100% to 60% NOx > 5.0 s • Average NOx Offset value > 50.00 ppm number of checks 2 • Average NOx Offset value < -30.00 ppm number of checks 2
P2202	NOx Sensor Bank 1 Sensor 1 Circuit Low	NOx value < -105.00 ppm
P2203	NOx Sensor Bank 1 Sensor 1 Circuit High	NOx value > 1655.00 ppm
P2209	NOx Sensor Heater Sense Bank 1 Sensor 1 Circuit Range/Performance	NOx control active time since dew point exceeded > 180.0 s
P2237	O2 Sensor Positive Current Control Circuit (Bank 1 Sensor 1) Open	Measured oxygen concentration (absolute value) < 0.01
P2243	O2 Sensor Reference Voltage Circuit (Bank 1 Sensor 1) Open	• Internal resistance voltage > 3.00 V • O2S signal front < -1.30 V or • O2S signal front > 1.50 V
P2251	O2 Sensor Negative Current Control Circuit (Bank 1 Sensor 1) Open	• Internal resistance voltage > 3.00 V • O2S signal front -0.20 - 0.20 V
P226C	Turbocharger Boost Control "A" Slow Response	Accumulated and factor weighted negative boost control difference between target and measured boost < - 6976 J

DTC	Error Message	Malfunction Criteria and Threshold Value
P2279	Intake Air System Leak	Ratio of measured and modeled air mass flow 0.45 - 0.80
P2294	Fuel Pressure Regulator 2 Control Circuit	Signal voltage < 4.7 V
P2295	Fuel Pressure Regulator 2 Control Circuit Low	Signal voltage < 2.97 V
P2296	Fuel Pressure Regulator 2 Control Circuit High	Signal current > 3.0 A
P229E	NOx Sensor (Bank 1 Sensor 2) Circuit	• Message from NOx-Sensor failure • NOx sensor signal ratio of validity ≥ 0.50
P229F	NOx Sensor Circuit Range/ Performance (Bank 1 Sensor 2)	• Message from NOx-Sensor failure • NOx Sensor characteristic line: average self diagnosis value > 60.00; < 140.00% • Counted self diagnosis aborts > 4.00 • Average NOx Offset value > 50.00 ppm number of checks 2 • Average NOx Offset value < -30.00 ppm number of checks 2 • Measured oxygen concentration compared with calculated oxygen concentration deviation @ part load > 11.00% • NOx value < -35.00 ppm • Time to reach 0% to 59% Oxygen > 4.5 s
P22A0	NOx Sensor Bank 1 Sensor 2 Circuit Low	• NOx sensor lambda signal < -0.20 • NOx value > 1655.00 ppm
P22A1	NOx Sensor Bank 1 Sensor 2 Circuit High	• NOx sensor lambda signal > 1.54 • NOx value < -105.00 ppm
P22A7	NOx Sensor Heater Sense (Bank 1 Sensor 2) Circuit Range/Performance	NOx control active time since dew point exceeded > 180.0 s

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P24AE	Particulate Matter Sensor Circuit	• Signal voltage negative connection (IDE) > 4.7 V (short to battery) • Signal voltage negative connection (IDE) < 0.3 V (short to ground • Current (IDE) @ measurement 1 < 2 µA • Difference between current (IDE) measurement 1 and 2 < 0.15 µA
P24AF	Particulate Matter Sensor Circuit Range/Performance	Accumulated change in heater voltage ≤ 0.20 V
P24B0	Particulate Matter Sensor Circuit Low	Signal current (IDE) > 5 µA
P24B1	Particulate Matter Sensor Circuit High	• Signal voltage negative connection (IDE) > 4.1 V (short to battery) • Signal voltage negative connection (IDE) = 0 V (short to ground)
P24B3	Particulate Matter Sensor Heater Control Circuit/Open	• Heating coil resistance < 1.06 - 2.31 Ohm or • Heating coil resistance < 2.94 - 5.13 Ohm
P24B5	Particulate Matter Sensor Heater Control Circuit Low	• Heater current < 1.0 A or • Heater current > 15.0 A
P24B6	Particulate Matter Sensor Heater Control Circuit High	• Heater current ≥ 0.2 A
P24C6	Particulate Matter Sensor Temperature Circuit	• Short to ground > 0.3 V • Short to battery / open circuit > 3 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P24C7	Particulate Matter Sensor Temperature Circuit Range/ performance	PM temperature sensor vs. mean value of: • EGT upstream Catalyst > 40.0 K • EGT downstream Catalyst > 40.0 K • EGT downstream DPF > 40.0 K • Measured sensor temperature - mean value of modelled temperature < -100.0 K
P24D0	Reductant Tank Cap Switch Circuit Low	Signal range check low Difference between measured PM Sensor supply wire voltage and battery voltage (ECM): • Value > 1.90 V or • Value > 2.60 V or • Value > 3.00 V Signal range check high Difference between measured battery voltage (ECM) and PM Sensor supply wire voltage: • Value > 3.00 V or • Value > 2.10 V or • Value > 1.10 V
P240F	Exhaust Gas Recirculation Slow Response	• Calculated characteristcal value: negative gradient of target air mass flow ≥ 35.00 • Calculated characteristcal value: positve gradient of target air mass flow ≥ 30.00
P242A	Exhaust Gas Temperature Sensor Circuit (Bank 1 Sensor 3)	Signal voltage > 2.61 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P242B	Exhaust Gas Temperature Sensor Circuit (Bank 1 Sensor 3) Range/Performance	Measured sensor temperature - mean value of modelled temperature < -100.0 K • Number of detected faults ≥ 4.00 Cross checks for fault detection: • EGT upstream Turbocharger vs. EGT upstream Catalyst > 40 K • EGT upstream Turbocharger vs. EGT downstream Catalyst > 40 K • EGT upstream Turbocharger vs. EGT downstream DPF > 40 K • EGT upstream Turbocharger vs. TEGR > 40 K
P242C	Exhaust Gas Temperature Sensor Circuit Low (Bank 1 Sensor 3)	Signal voltage < 0.68 V
P2425	Exhaust Gas Recirculation Cooling Valve Control Circuit Open	Signal voltage < 4.7 V
P2426	Exhaust Gas Recirculation Cooling Valve Control Circuit Low	Signal voltage < 2.97 V
P2427	Exhaust Gas Recirculation Cooling Valve Control Circuit High	Signal current > 2.2 A
P244C	Exhaust Temperature Too Low For Particulate Filter Regeneration (Bank 1)	• EGT downstream Catalyst < 350 °C • EGT sensor response time > 260.0 s
P245B	Exhaust Gas Recirculation Cooler Bypass Control Circuit Range/Performance	
P2440	System Check After SAI (PZEV)	SAI pressure measured with SAI pressure sensor vs. modeled while SAI valve closed < 0.55%

DTC	Error Message	Malfunction Criteria and Threshold Value
P245B	Exhaust Gas Recirculation Cooler Bypass Control Circuit Range/Performance	• Positive difference between measured and target temperature too high 10.0 - 70.0 K • Negative difference between measured and target temperature too low -10.0 K
P2452	Diesel Particulate Filter Differential Pressure Sensor Circuit	Sensor voltage > 4.90 V
P2453	Diesel Particulate Filter Differential Pressure Sensor Circuit Range/Performance	• Pressure difference between absolute value and filtered value -3.00 - 3.00 kPa • DPF difference pressure < -3.00 kPa
P2454	Diesel Particulate Filter Differential Pressure Sensor Circuit Low	Sensor voltage < 0.20 V
P2458	Diesel Particulate Filter Regeneration Duration	Accumulated timer of regeneration duration > 93.35 min.
P2459	Difference soot mass- upper threshold model	Difference soot mass- upper threshold model > 0 g
P246E	Exhaust Gas Temperature Sensor Circuit (Bank 1 Sensor 4)	Signal voltage > 2.61 V
P246F	Exhaust Gas Temperature Sensor Circuit (Bank 1 Sensor 4) Range/Performance	Measured sensor temperature - mean value of modelled temperature < -100.0 K • Number of detected faults ≥ 4.00 Cross checks for fault detection: • EGT upstream Turbocharger vs. EGT upstream Catalyst > 40 K • EGT upstream Turbocharger vs. EGT downstream Catalyst > 40 K • EGT upstream Turbocharger vs. EGT downstream DPF > 40 K • EGT upstream Turbocharger vs. TEGR > 40 K

DTC	Error Message	Malfunction Criteria and Threshold Value
P2463	Diesel Particulate Filter - Soot Accumulation	• Calculated DPF loading > 38.0 g • Soot mass exceeds maximum value > 42.0 g
P247A	Exhaust Gas Temperature Out of Range Bank 1 Sensor 3	• Difference between target and measured exhaust gas temperature < -100.0 K • Difference between target and measured exhaust gas temperature > 180.0 K
P2470	Exhaust Gas Temperature Sensor Circuit Low (Bank 1 Sensor 4)	Signal voltage < 0.68 V
P2564	Turbocharger Boost Control Position Sensor Circuit Low	Position sensor signal < 0.15 V
P2565	Turbocharger Boost Control Position Sensor Circuit High	Position sensor signal ≥ 4.85 V
P2626	O2 Sensor Pumping Current Trim Circuit/Open (Bank 1 Sensor 1)	O2S signal front > 4.81 V
P268A	Fuel Injector Calibration Not Learned/Programmed	• Deviation to target rail pressure > 1500.00 - 2000.00 kPa • Accumulated time > 40.0 s

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