

2013

# Q7

Quick Reference  
Specification Book





# 2013 Audi Q7

## Quick Reference Specification Book

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# GENERAL INFORMATION

## *Decimal and Metric Equivalents*

### Distance/Length

To calculate: mm x 0.03937 = in.

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

# Tightening Torque

## Nm-to-lb·ft (ft·lb)

To calculate: Nm x 0.738 = lb·ft

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

## Nm-to-lb-in (in·lb), kg·cm

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

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

## N·cm-to-lb-in (in·lb), kg·cm

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

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

## kg·cm-to-lb·in (in·lb), N·cm

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

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

## Warnings and Cautions

### WARNINGS

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

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

*(WARNINGS cont'd on next page)*

## **WARNINGS** *(cont'd)*

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



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

## CAUTIONS

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

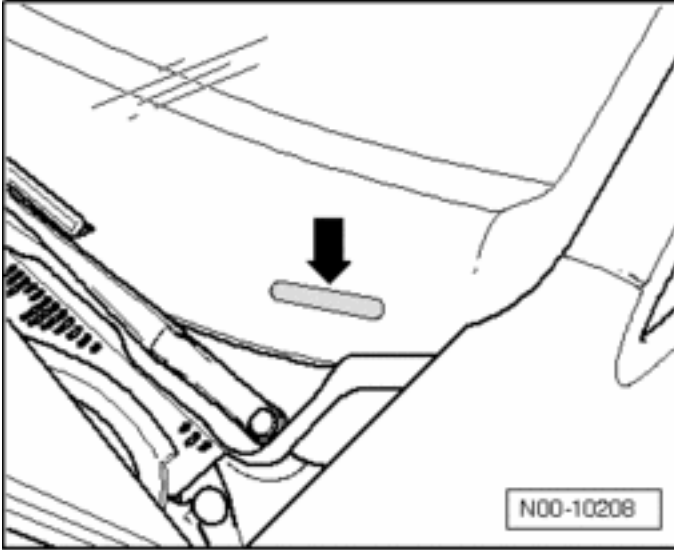
*(CAUTIONS cont'd on next page)*

## **CAUTIONS** *(cont'd)*

- Always make sure the ignition is off before disconnecting battery
- 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 Vehicle Identification Number (VIN) (➡) is on the left side of the vehicle and is visible from the outside.

Vehicle  
Identification

# VIN Decoder

### 2013 Audi VIN Decoder

Series:	Mfg. Make (1-3)	Series	Engine	Restraint system	Model (7&8)	Check digit	Model year	Assembly plant	Sequential production number (position 12 - 17)
<b>A=</b> A4 Premium A5 Cab Premium A3 Sedan R8 4.2 Coupé <b>B=</b> A3 Avant Premium A4 Premium q S4 Premium q TT/TTTS/TTRS Cpe Prem+ quattro <b>C=</b> A5 Premium q A5 Cab Premium q A8 Premium S5 Premium+ q S5 Cab Premium+ q Q5 2.0T Premium Hybrid Q7 3.0TTDI Prem RS5 <b>D=</b> 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 SS <b>E=</b> A4 Premium+ R8 5.2 Coupé <b>F=</b> A3 Avant-Man Prem A4 Premium q A6 Premium+ q S5 <b>G=</b> A5 Manual Prem q S5 Manual Prem+ q A6 Premium+ q A7 Prestige q <b>H=</b> A4 Manual Prem+ q A5 Prestige q <b>J=</b> A4 Prestige A5 Cab Premium+ A5 Prestige q S6 w/Innov. Pkg.	<b>K=</b> A3 Avant Premium+ A4/S4 Prestige q TT/TTTS/TTRS Cpe Prestige quattro <b>L=</b> A5 Premium+ q A5 Cab Premium+ q Q5 2.0T Premium+ Q7 3.0TTDI Prem+ <b>M=</b> A3 Avant Prem+ q A4/S4 Man Prestige q <b>P=</b> A3 Avant-Man Prem+ <b>R=</b> A5 Manual Prem+ q A8 L Sedan <b>S=</b> R8 4.2 Spyder TT/TTTS/TTRS Rdstr Prem+ q <b>T=</b> A5 Cab Prestige R9 5.2 Spyder-Man <b>U=</b> Allroad Premium+ q A5 Cab Prest. S-Line R9 4.2 Spyder-Man <b>V=</b> Allroad Prestige q A5/S5 Prestige q A5/S5 Cab Prestige q Q7 TDI Prestige R9 5.2 Spyder <b>W=</b> A5 Prestige q S-Line A5 Cab Prestige S-Line A7 Prem quattro S7 Q5 3.0 Prestige <b>X=</b> A5 Manual Prestige q <b>Y=</b> A7 Premium+ q A7 Prestige q <b>Z=</b> A7 Prestige q <b>3=</b> A5/S5 Man Prestige q <b>4=</b> A5 Man Prest q S-Line A7 Prestige q S7 w/Innov. Pkg. <b>5=</b> Allroad Premium q TT/TTTS/TTRS Rdstr Prestige quattro S6 w/Innov. Pkg.	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 Calculate per NHTSA Code FG (4G)** = A6 / S6 / A7 / S7 FD (4H) = A8 FE (4L) = Audi Q7 FG (4S) = R8 FH (8F) = A5 / S5 Cabriolet FK (8A) = TT / TTS / TT RS FL (8K)** = A4 / S4 FM (8P) = A3 FF (8R) = Audi Q5 FR (8T) = A5 / S5 A= Ingolstadt D= Bratislava N= Neckarsulm 1= Gyr	2013 A= Ingolstadt D= Bratislava N= Neckarsulm 1= Gyr	E= 4 cyl 2.0L 200hp (CBFA-PZEV)* A3 F= 4 cyl 2.0L 211hp (CAEB) A4 / A4 q / A5 q / A5 Cab CVT / A6 CVT (C7) G= 4 cyl 2.0L 211hp (CCTA) A3 q H= 4 cyl 2.0L 211hp (CETA) TT Cpe q / TT Rdstr q I= 4 cyl 2.0L 211hp (CPMA) A4 q / A6 Cpe/Cab q / Allroad / Q5 J= V6 3.0L 310hp (CGXK) A6 q (C7) / A7 q K= V6 3.0L 272hp (CGXD) Q5 L= V6 3.0L 333hp (CGXC) S4 / S5 / S5 Cab M= V6 3.0L 333hp (CJWB) Q7 S-Line N= V6 3.0L 280hp (CJWE) Q7 O= V6 3.0L 333hp (CTUB) A8 q P= 4 cyl 2.0L TDI 140hp (CBEA) A3 Q= V6 3.0L TDI 240hp (CNRB) Q7 R= V6 3.0L 333hp (CNDM) TT S Cpe/Rdstr S= 4 cyl 2.0L 211hp (CCTA) TT S Cpe/Rdstr T= V8 4.0L 420hp (CEUA) A8 / A8L U= V8 4.0L 420hp (CEUC) S6 / S7 V= V8 4.0L 520hp (CGTA) S8 W= 5 cyl 2.5L 360hp (CEFB) TT RS q X= W12 3.6L 500hp (CEJA) A8L (D4) Y= V8 4.2L 450hp (CFS) RS5 Cpe/Cab Z= 4 cyl 2.0L 211hp + 40 kW (CHJA) Q5 Hybrid			

July 26, 2012 (Rev 2a)

### 2013 Restraint System:

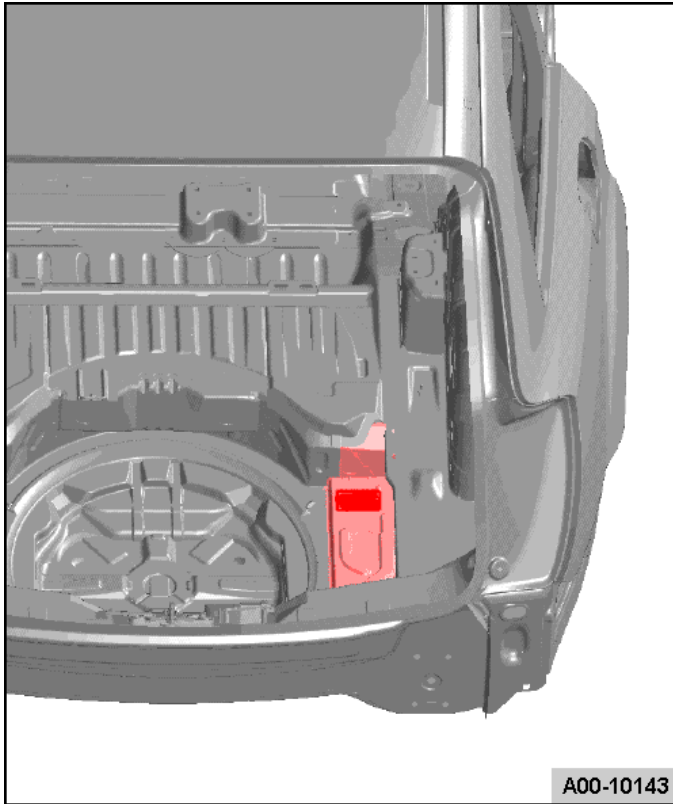
All = Active - Dri/Pass, AirBag - Dri/Pass, Advanced Front AirBag  
**A (A5 / S5, R5S)** = Side AirBags Front, Knee AirBags Front  
**A (A5 / S5, R5S)** = Side AirBags Front, Side Guard Air Curtain, Knee AirBags Front  
**A (A3, A4 / S4, A6 / S6, A7 / S7, Q5, Q7)** = Side AirBags Front, Side Guard Air 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**

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

2013 Audi VIN Decoder

## Vehicle Data Label Location



The vehicle data label is in the rear right longitudinal member on the floor panel.

Vehicle  
Identification

# SALES CODES

## Engine Codes

<b>CNRB</b>	3.0L 6-cylinder TDI
<b>CTWA, CTWB</b>	3.0L 6-cylinder

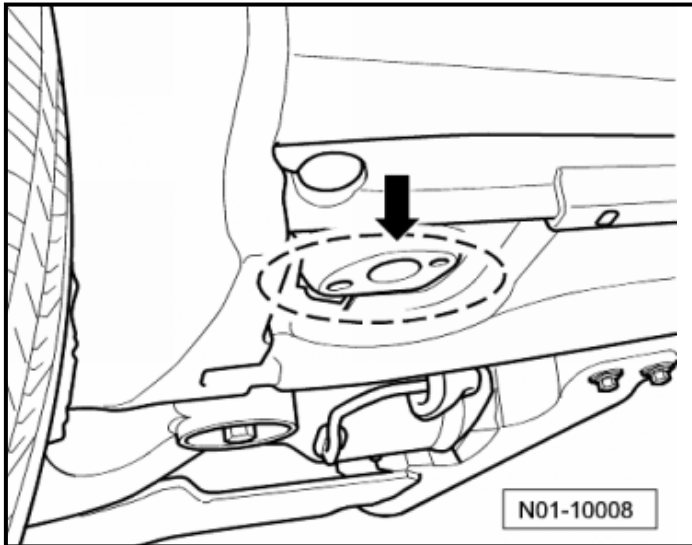
## Transmission Codes

<b>0C8</b>	8-speed automatic transmission
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# VEHICLE LIFTING

## *Hoist and Jack Mounting Points*

Front



Front: Position the mounting plate on the floor panel reinforcement (➔).



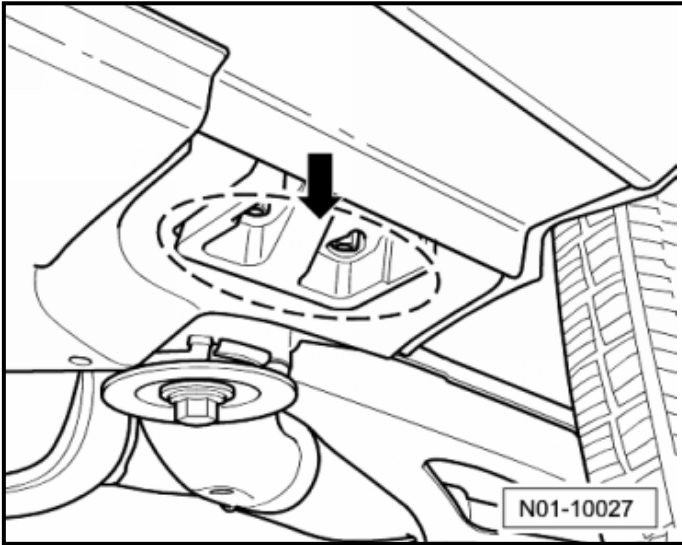
### **WARNING**

Never raise the front of the vehicle by the side member vertical stiffener.

Sales  
Codes

Vehicle  
Lifting

## Rear



Rear: Position the mounting plate on the floor plate reinforcement near the rear axle mount (➡).



### **WARNING**

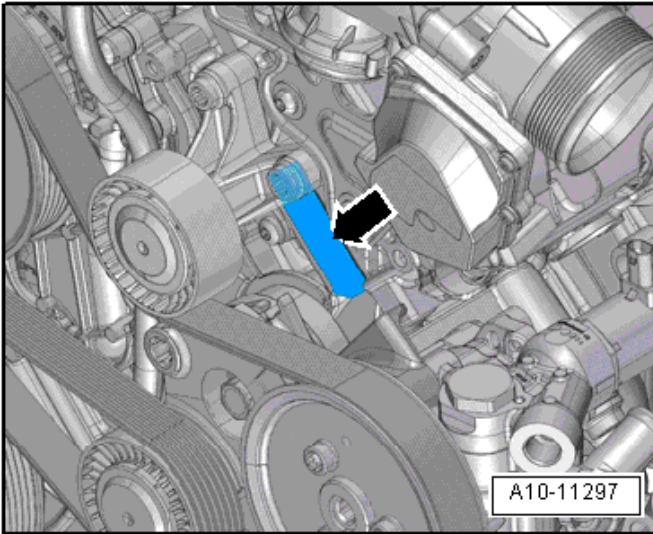
Make sure the lifting platform support plate is centrally positioned on the reinforcement.



# ENGINE MECHANICAL – 3.0L CNRB (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 (➡). The first 3 digits of the engine code stand for displacement and the mechanical structure of the engine. They are stamped in the cylinder block, including the serial number.

## Engine Data

Engine code		CNRB
Manufactured		from 05.12
Emission values in accordance with		BIN5/ULEV2
Displacement	liter	2.967
Output	kW at RPM	176 @ 4000-4500
Torque	Nm at RPM	550 @ 1500-3000
Bore	diameter mm	83.0
Stroke	mm	91.4
Compression ratio		16.8
CZ	at least	51
Ignition sequence		1-4-3-6-2-5
Exhaust Gas Recirculation (EGR)		Yes
Turbocharger, Supercharger		Turbocharger
Catalytic converter		Yes
Particulate filter		Yes
Charge Air Cooler (CAC)		Yes
Oxygen Sensor (O2S) regulation		Yes
Valves per cylinder		4
Selective Catalytic Reduction (SCR) system		No

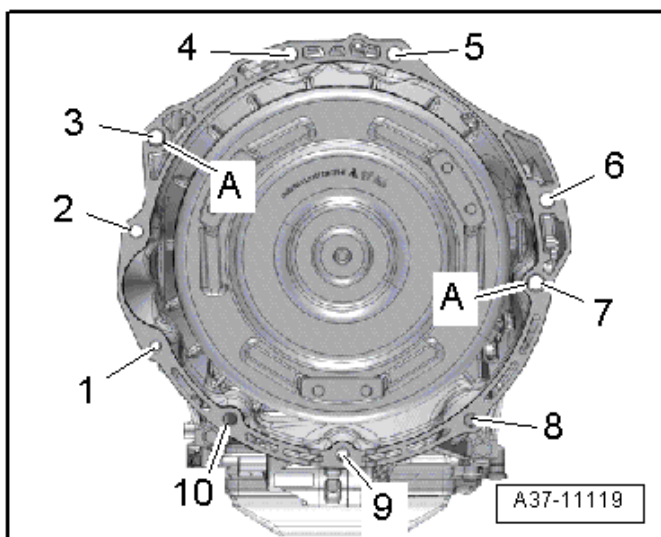
# Engine Assembly – 3.0L CNRB (TDI)

## Fastener Tightening Specifications

Component	Fastener size	Nm
Bolts and nuts	M6	10
	M7	15
	M8	25
	M10	40
	M12	60
Bracket for vacuum reservoir-to-engine support	-	9
Bracket-to-vacuum reservoir	-	2.5
Electrohydraulic engine mount solenoid valve-to-bracket for vacuum reservoir	-	5
Engine support-to-subframe <sup>1)</sup>	-	120 plus an additional 180° (½ turn)
Ground wire-to-right engine support	-	15
Left engine support-to-left engine mount nut	-	75
Left engine support-to-left engine mount nut	-	60
Left engine support-to-subframe	-	50 plus an additional 90° (¼ turn)
<b>Right engine support</b>		
- Bolt	-	50 plus an additional 90° (¼ turn)
- Nuty	-	75

<sup>1)</sup> Replace

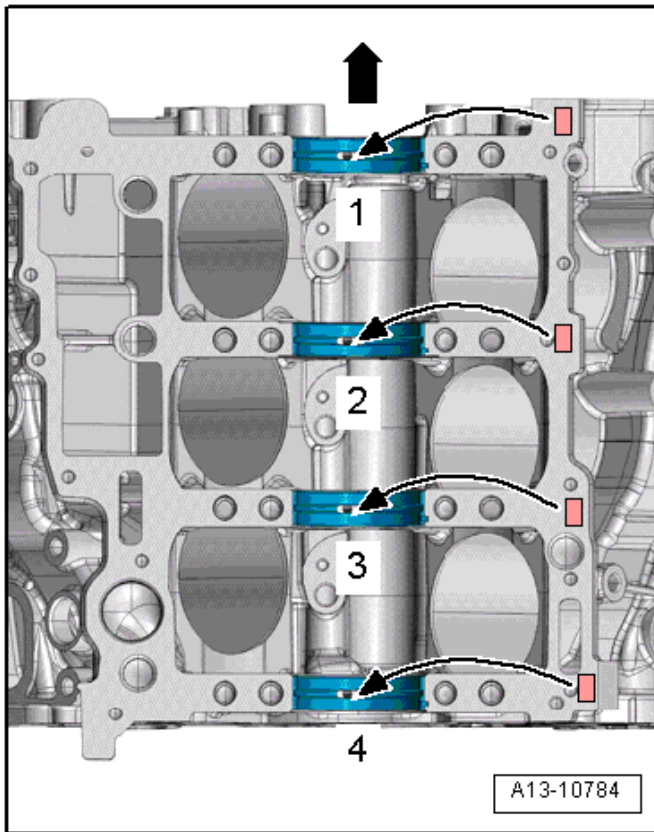
## Engine to Automatic Transmission



Item	Bolts	Nm
1	M10x70 <sup>1)</sup>	65
2	M10x70 <sup>1)</sup>	65
3, 4, 5, 7	M12x80	80
6	M12x80	80
8, 9, 10	M10x70	45
A	Alignment sleeves for centering	
<sup>1)</sup> Also secures the starter		

# Crankshaft, Cylinder Block – 3.0L CNRB (TDI)

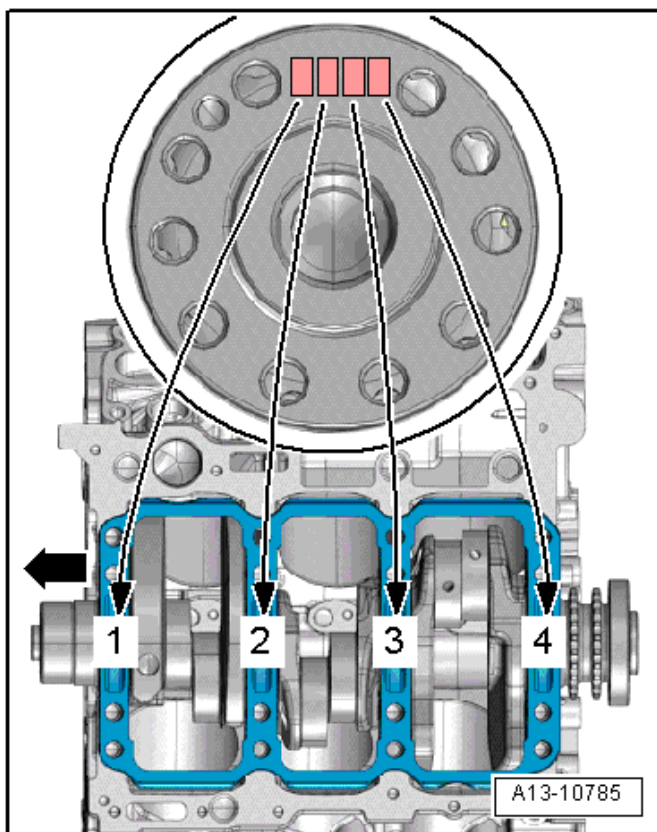
## Allocation of Crankshaft Bearing Shells for Cylinder Block



Bearing shells with the correct thickness are allocated to the cylinder block in the factory. Colored dots on the bearing shells identify bearing shell thickness. The ➔ points to the belt pulley side. The allocation of the bearing shells to the cylinder block is identified with a letter by each bearing.

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

## Allocation of Crankshaft Bearing Shells for Guide Frame



Bearing shells with the correct thickness are allocated to the bearing cap at 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 crankshaft	Color of bearing
R	Red
G	Yellow
B	Blue

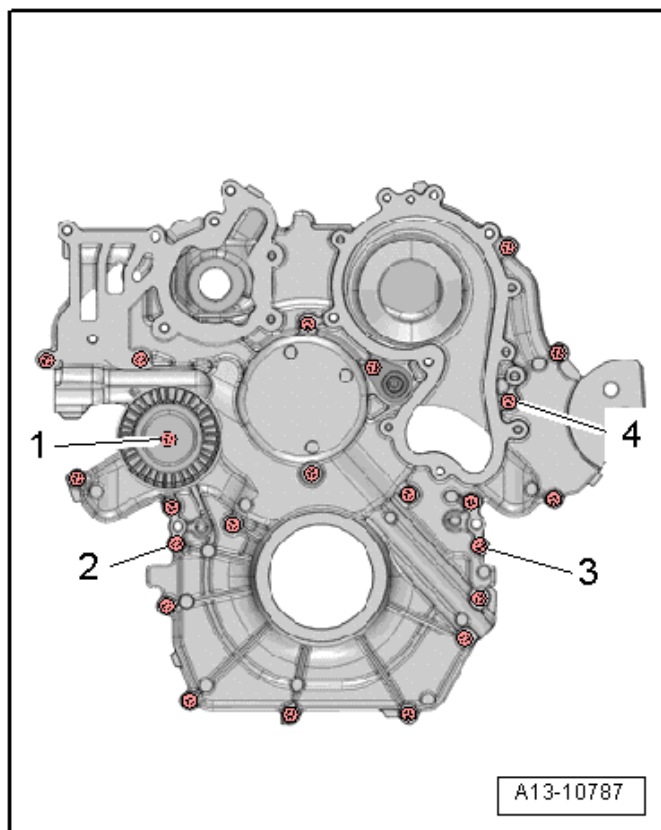
## Fastener Tightening Specifications

Component	Fastener Size	Nm
<b>Bracket for the assemblies</b>		
Tighten in 2 stages: • 5 Nm in a diagonal sequence • 40 Nm in a diagonal sequence	-	
Connecting rod bearing cap-to-connecting rod <sup>1)</sup> <sup>2)</sup>	-	35 plus an additional 90° (¼ turn)
Cover for the belt pulley side sealing flange	-	9
Drive plate-to-crankshaft <sup>1)</sup>	-	60 plus an additional 90° (¼ turn)
<b>Generator bracket-to-engine</b>		
Tighten in 2 stages: • 5 Nm in a diagonal sequence • 40 Nm in a diagonal sequence	-	
Idler roller for the ribbed belt		23
Idler roller-to-engine		23
Oil spray jet for piston cooling	-	9
Oil temperature sensor 2-to-sealing flange	-	9
Ribbed belt tensioner-to-engine <sup>1)</sup>	-	50 plus an additional 90° (¼ turn)
Vibration damper-to-crankshaft <sup>1)</sup>	-	20 plus an additional 90° (¼ turn)

<sup>1)</sup> Replace fastener(s).

<sup>2)</sup> Lubricate the thread and contact surface

## Ribbed Belt Pulley Side Sealing Flange Tightening Specification

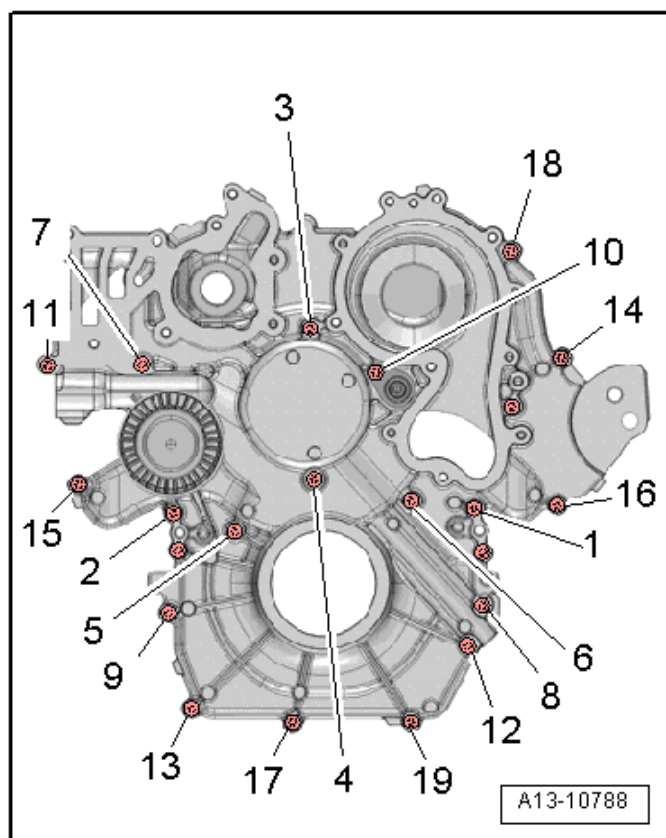


Replace the bolts that have been tightened to additional torque. There is a risk of damaging the aluminum bolts when installing the sealing flange. Aluminum bolts must not be used to tighten the sealing flange to the cylinder block. Therefore prepare 3 M6x20 steel bolts to tighten the sealing flange as instructed as follows. Tighten the bolts in 11 steps in the sequence shown.

Step	Bolts	Nm
1	Tighten bolts in a diagonal sequence	Attach the sealing flange with the seal to the cylinder block
2	1	23
3	2, 3, 4	M6 x 20 to 9 Nm

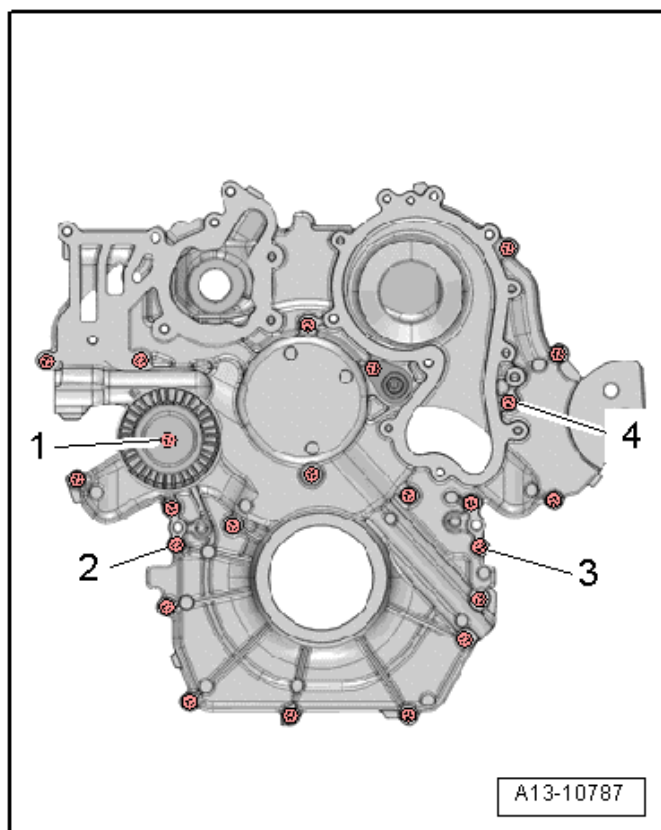


## Ribbed Belt Pulley Side Sealing Flange Tightening Specification (cont'd)



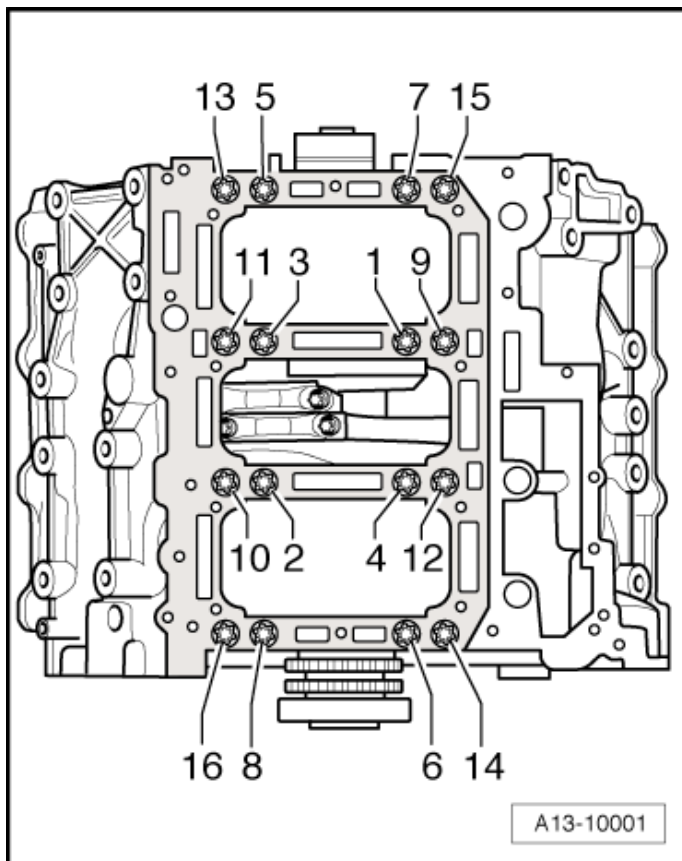
Step	Bolts	Nm
4		Insert a temperature regulator for the engine oil cooler with the cover
5	10	Install all the way in by hand.
6	1 through 19	3
7	1 through 19	3 Nm - this measurement accounts for the seal shrinkage
8	1 through 19	Tighten an additional turn 90°

## Ribbed Belt Pulley Side Sealing Flange Tightening Specification (cont'd)



Step	Bolts	Nm
9	2, 3, 4	Remove the steel bolts M6 x 20
10	2, 3, 4	Insert the aluminum bolts and tighten to 3 Nm
11	2, 3, 4	Turn the aluminum bolts 90° further

## Guide Frame Tightening Specifications



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

<sup>1)</sup> Replace fastener(s).

## Crankshaft Dimensions

Honing dimension in mm	Crankshaft bearing pin diameter		Crankshaft connecting rod journal diameter	
Basic dimension	65.00	-0.022	60.00	-0.022
		-0.042		-0.042

## Piston and Cylinder Dimensions

Honing dimensions in mm	Piston diameter	Cylinder bore diameter
Basic dimension	82.924 to 82.936 <sup>1)</sup>	83.006 to 83.014 <sup>2)</sup>
Repair stage	82.964 to 82.976 <sup>1)</sup>	83.046 to 83.054 <sup>2)</sup>

<sup>1)</sup> Measurements without graphite coating (thickness = 0.02 mm). The graphite coating wears off.

<sup>2)</sup> Measure 50 mm inside the cylinder bore.

## Piston Ring End Gaps

Piston ring dimensions in mm	New	Wear limit
1 <sup>st</sup> compression ring	0.25 to 0.40	0.60
2 <sup>nd</sup> 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
1 <sup>st</sup> compression ring	0.009 to 0.130	0.160
2 <sup>nd</sup> compression ring	0.05 to 0.09	0.11
Oil scraping ring	0.03 to 0.09	0.10

# Cylinder Head, Valvetrain – 3.0L CNRB (TDI)

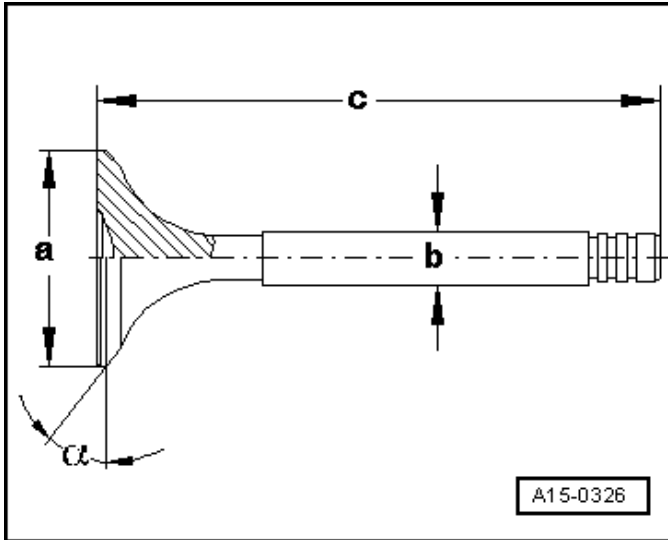
## Fastener Tightening Specifications

Component	Nm
Balance weight belt pulley side bolt	60
Balance weight transmission side	30 plus an additional 90° (¼ turn)
Bracket-to-cylinder head bolt	23
Camshaft chain sprocket-to-camshaft bolt	23
Chain tensioner for camshaft timing chain <sup>1)</sup>	5 plus an additional 90° (¼ turn)
Chain tensioner with glide track-to-engine <sup>1)</sup>	5 plus an additional 90° (¼ turn)
Guide rail guide bolt <sup>1)</sup>	5 plus an additional 90° (¼ turn)
Drive sprocket for the balance shaft	23
Drive sprocket-to-oil pump <sup>1)</sup>	30 plus an additional 45° (⅛ turn)
Engine lifting eye-to-cylinder head	23
Gear carrier <sup>2)</sup>	9
Heat shield-to-cylinder head cover	9
Jump protector-to-crankshaft	9

<sup>1)</sup> Replace fastener(s).

<sup>2)</sup> Insert with locking compound.

## Valve Dimensions



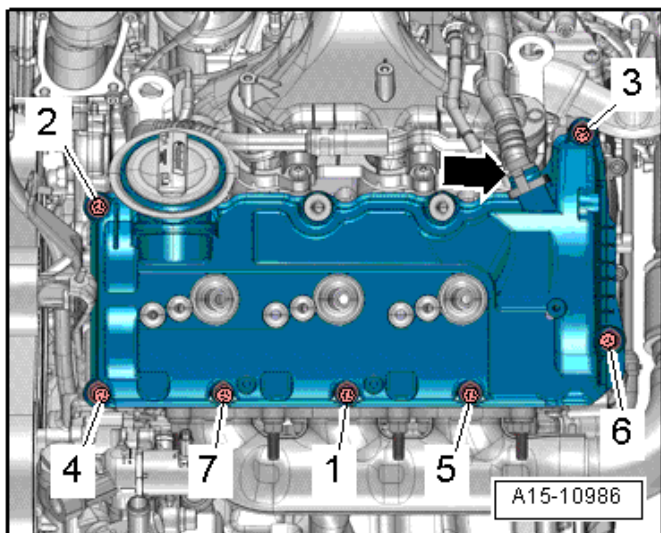
Dimension		Intake valve	Exhaust valve
Diameter a	mm	28.5 to 28.7	25.9 to 26.1
Diameter b	mm	5.968 to 5.982	5.958 to 5.972
c	mm	97.2 to 97.4	99.0 to 99.2
$\alpha$	$^{\circ}$	45° 10'	45° 10'

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

## Compression Pressures

Compression pressure	Bar pressure
New	28 to 33
Wear limit	21
Maximum difference between cylinders	5

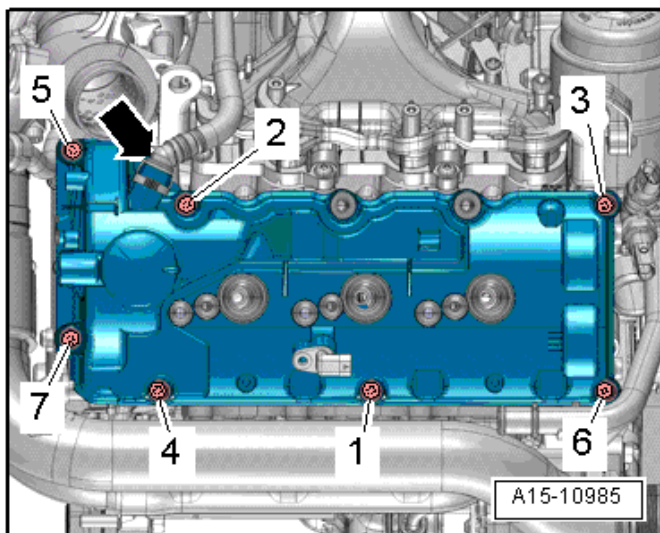
## Left Cylinder Head Cover Tightening Specifications



Replace the bolts that have been tightened to additional torque.

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 Specifications

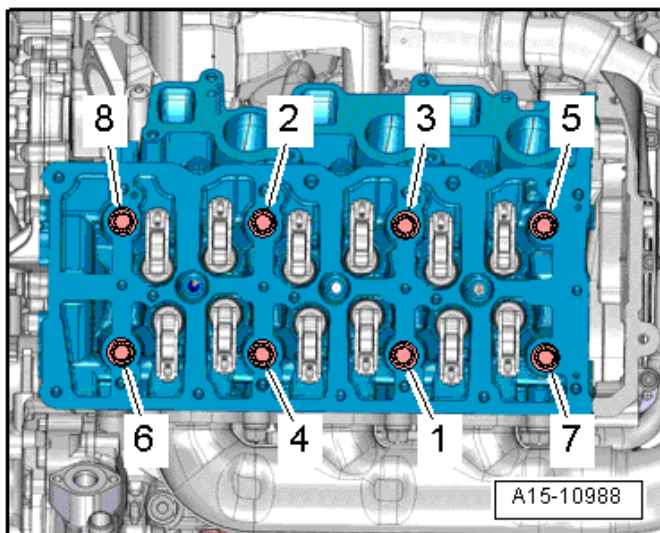


Replace the bolts that have been tightened to additional torque.

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)



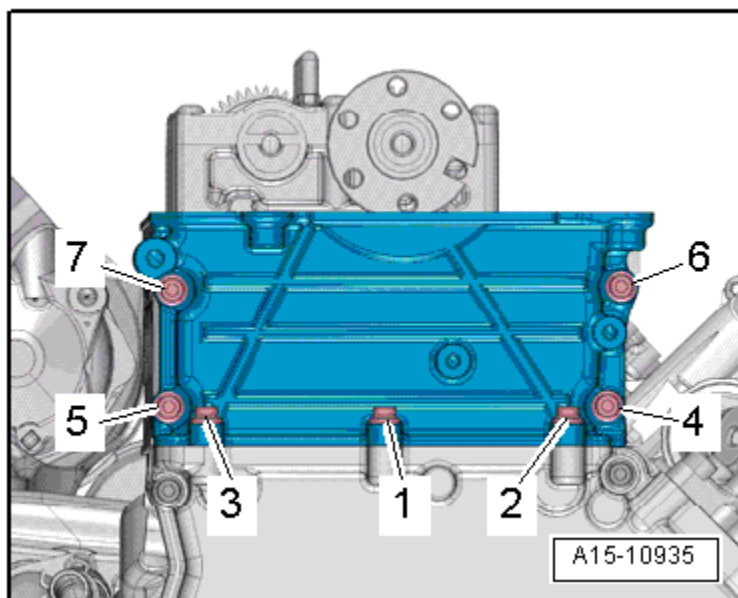
## Cylinder Head Tightening Specifications



Replace the bolts that have been tightened to additional torque.

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)

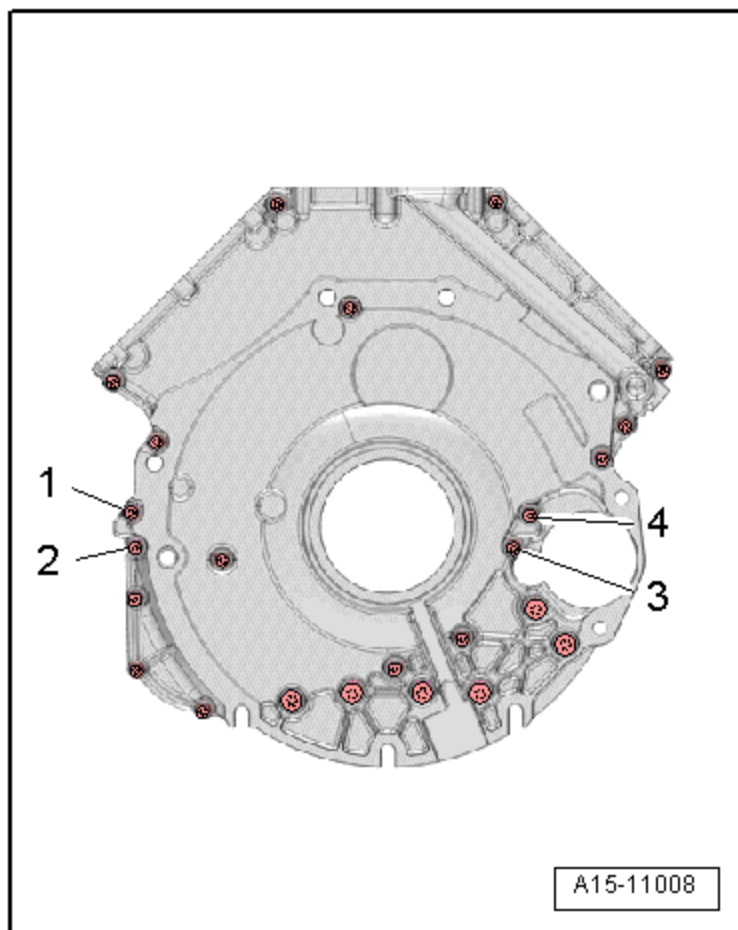
## Upper Timing Chain Cover Tightening Specifications



Replace the bolts that have been tightened to additional torque

Step	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 Nm - this measurement takes into account the timing chain guard shrinkage.
5	Tighten bolts 1 through 7 in sequence	an additional 90° (¼ turn)

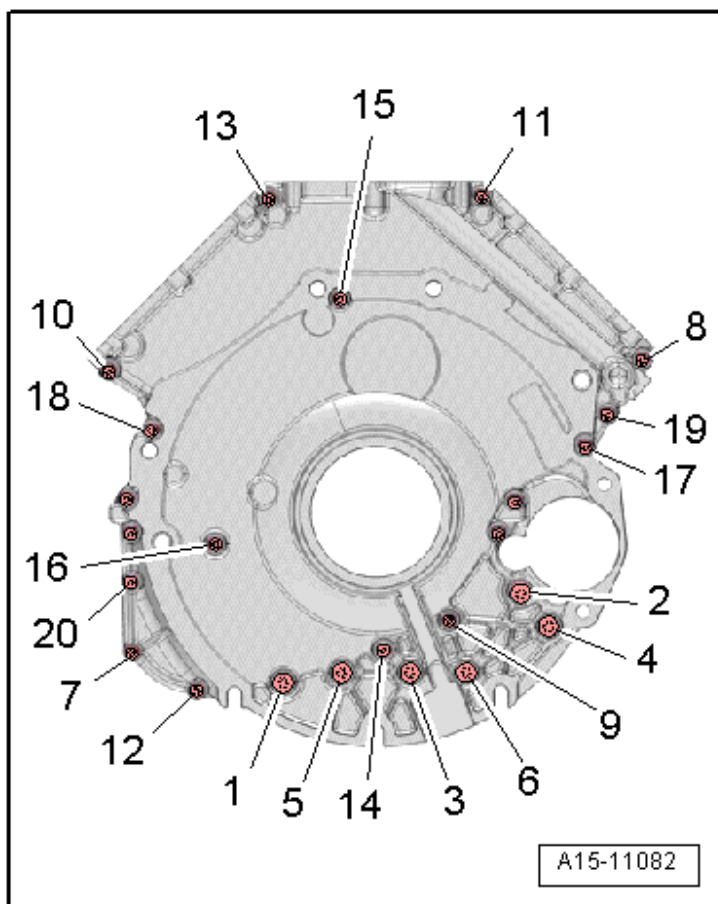
## Lower Timing Chain Cover Tightening Specifications



Replace the bolts that have been tightened to additional torque.

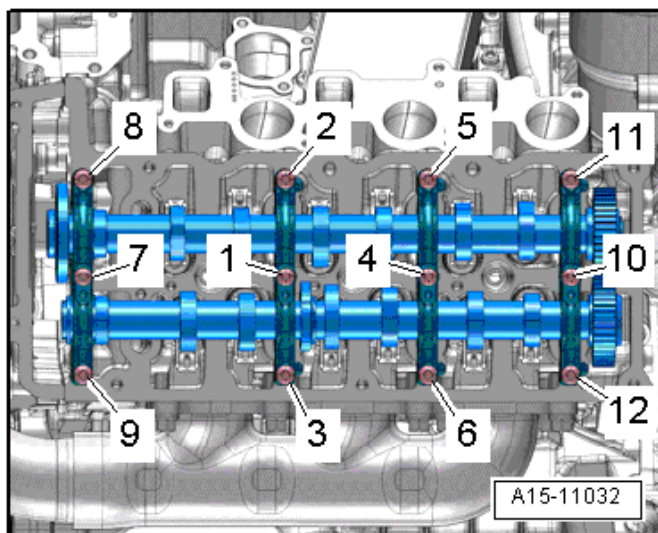
Step	Component	Fastener Size	Nm
1		-	Attaching the timing chain guard lower section with the sealant and the sealing pieces to the cylinder block
2	Tighten bolts 1 - 4 in sequence	M26x20	9

## Lower Timing Chain Cover Tightening Specifications (cont'd)



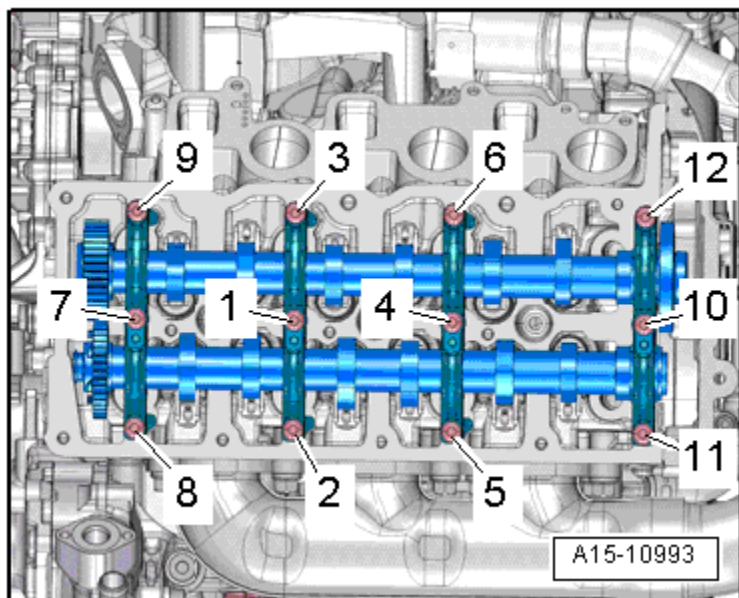
Step	Component	Nm
3	Tighten bolts 1 through 20 in sequence	3
4	Tighten bolts 1 through 20 in sequence	3 Nm - this measurement takes into account the timing chain guard lower section shrinkage
5	Tighten bolts 1 through 6 in sequence	8
6	Tighten bolts 1 through 20 in sequence	an additional 90° (¼ turn)

## Cylinder Bank 1 (Right) Bearing Cap Tightening Specifications



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 Specifications



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

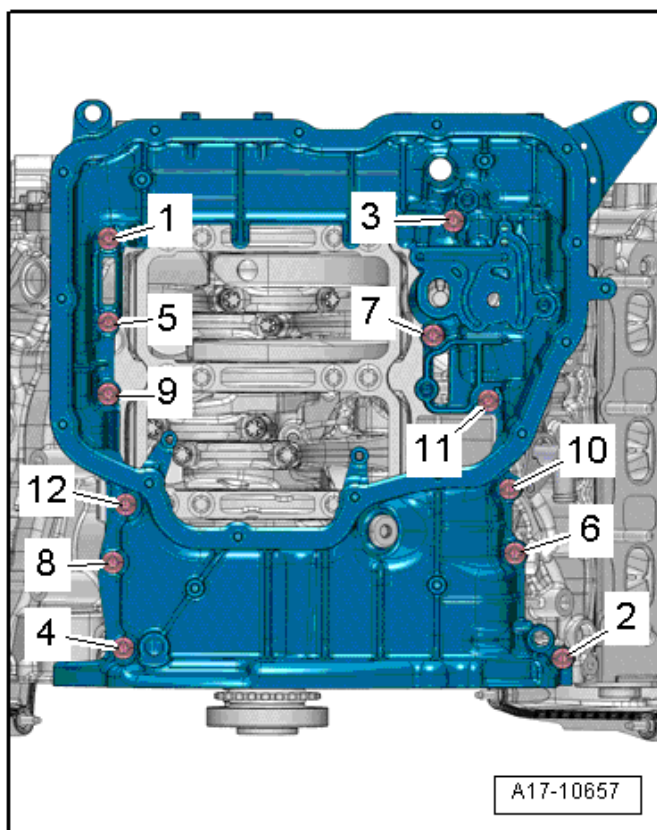
# Lubrication – 3.0L CNRB (TDI)

## Fastener Tightening Specifications

Component	Nm
Cap-to-oil filter housing	35
Chain sprocket-to-support <sup>1)</sup>	30 plus an additional 45° ( $\frac{1}{8}$ turn)
Cover for the temperature regulator for the engine oil cooler-to-engine <sup>1)</sup>	3 plus an additional 90° ( $\frac{1}{4}$ turn)
Coolant switch-off valve-to-mounting plate bolt	9
Drain plug	25
Engine oil cooler-to-mounting plate	9
Guide tube-to-engine	9
Mounting plate-to-engine oil cooler	9
Oil baffle bolt <sup>1)</sup>	3 plus an additional 90° ( $\frac{1}{4}$ turn)
Oil drain plug	30
Oil level thermal sensor-to-lower oil pan nut	9
Oil pressure regulation valve-to-upper oil pan	9
Oil pressure switch-to-oil filter housing	9
Oil pressure switch-to-oil filter housing	20
Oil return pipe-to-oil pump	9
Reduced oil pressure switch-to-oil filter housing	20
Suction pipe to oil pump	9
Vacuum line bolt	9
Vacuum line-to-upper oil pan bolt <sup>1)</sup>	3 plus an additional 45° ( $\frac{1}{8}$ turn)

<sup>1)</sup> Replace fastener(s).

## Upper Oil Pan Tightening Specifications

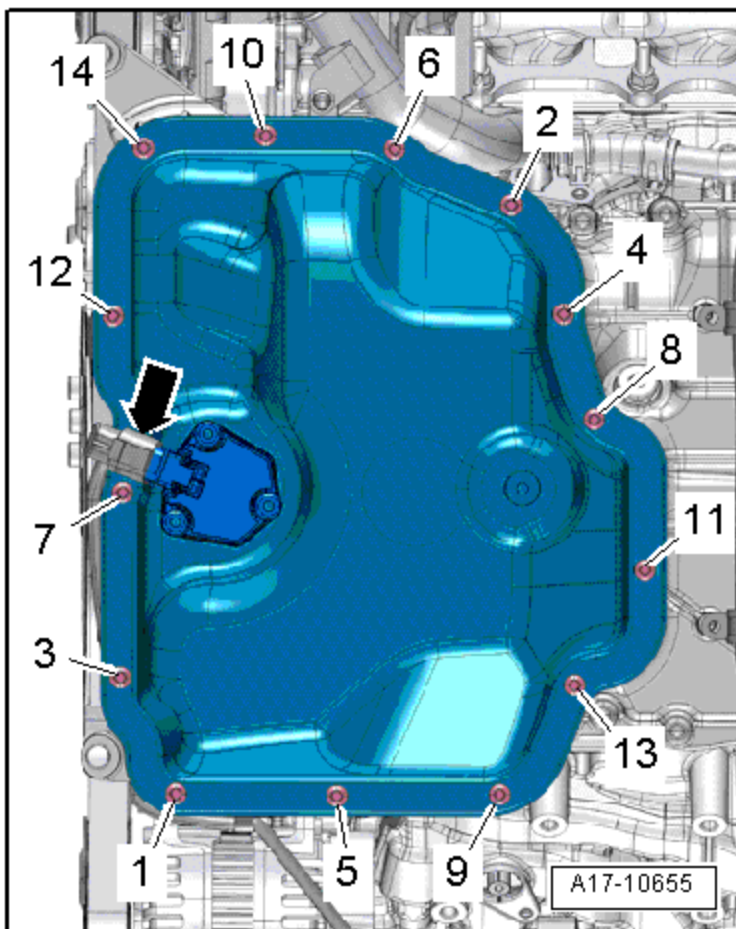


Replace the bolts that have been tightened to additional torque.

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



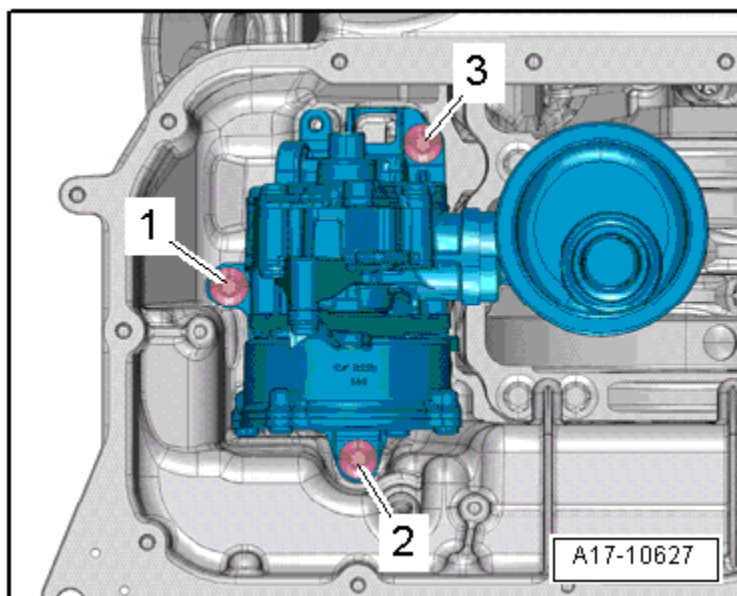
## Lower Oil Pan Tightening Specifications



Replace the bolts that have been tightened to additional torque.

Step	Component	Nm
1	Tighten bolts 1 through 14 in a diagonal sequence	2
2	Tighten bolts 1 through 14 in a diagonal sequence	3
3	Tighten bolts 1 through 14 in a diagonal sequence	an additional 90° (¼ turn)

## Oil Pan Tightening Specifications



Replace the bolts that have been tightened to additional torque.

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

# Cooling System – 3.0L CNRB (TDI)

## Fastener Tightening Specifications

Component	Nm
Bracket for transmission coolant valve-to-transmission <sup>3)</sup>	
- Bolt	9
- Bolt	23
Check valve-to-cylinder	9
Coolant connection-to-engine	9
Coolant pipe on the left side of the transmission-to-transmission	9
Coolant pipes-to-cylinder head bank 2 (left)	
- Banjo bolt	12
- Bolt	9
Coolant pump ribbed belt pulley-to-coolant pump	23
Coolant pump-to-engine <sup>1) 2)</sup>	3 plus an additional 90° (¼ turn)
Coolant switch-off valve-to-mounting plate	9
Engine coolant temperature sensor-to-engine	9
Engine temperature control sensor-to-engine	9
Fan shroud-to-coolant fan	10
Fan shroud-to-coolant fan 2 <sup>4)</sup>	
- Bolt	5
- Bolt	10
Front coolant pipe-to-engine	9
Grommet-to-radiator	5.5
Left coolant pipe-to-engine	9
Left upper coolant pipe on the transmission-to-transmission	9
Lower left coolant pipe-to-engine	9
Transmission coolant valve-to-bracket	9
Upper coolant pipe-to-engine	9

<sup>1)</sup> Replace fastener(s).

<sup>2)</sup> Fasten in diagonal sequence in steps

<sup>3)</sup> For bolt tightening clarification, refer to ElsaWeb, *Coolant Pipe on Transmission Overview*, items 14 and 16.

<sup>4)</sup> For bolt tightening clarification, refer to ElsaWeb, *Fan Shroud and Coolant Fan Overview*, items 2 and 3.

# Fuel Supply – 3.0L CNRB (TDI)

## Fastener Tightening Specifications

Component	Nm
Accelerator Pedal Position (APP) module bolt	10
Bracket for auxiliary fuel pump, nut	9
Bracket for fuel filter, nut	9
Carrier plate bolt	33
<b>Filter housing cover</b>	
- Bleeder screw	5
- Bolt	8
Fuel filter housing, bolt/nut	8
Fuel cooler-to-bracket, bolt/nut	8
Fuel Pump Control Module -J538- for vehicles with a Horizontal Fuel Filter	3.5
<b>Fuel tank <sup>1)</sup></b>	
- Bolt	5
- Bolt	9
Locking Flange Cover	9
Locking ring	110
Protective plate for fuel filler tube, nut	9
Securing strap bolt	33

<sup>1)</sup> For bolt tightening clarification, refer to ElsaWeb, *Fuel Tank with Attachments with Reducing Agent Metering System Overview*, items 12 and 14.

# Turbocharger, G-Charger – 3.0L CNRB (TDI)

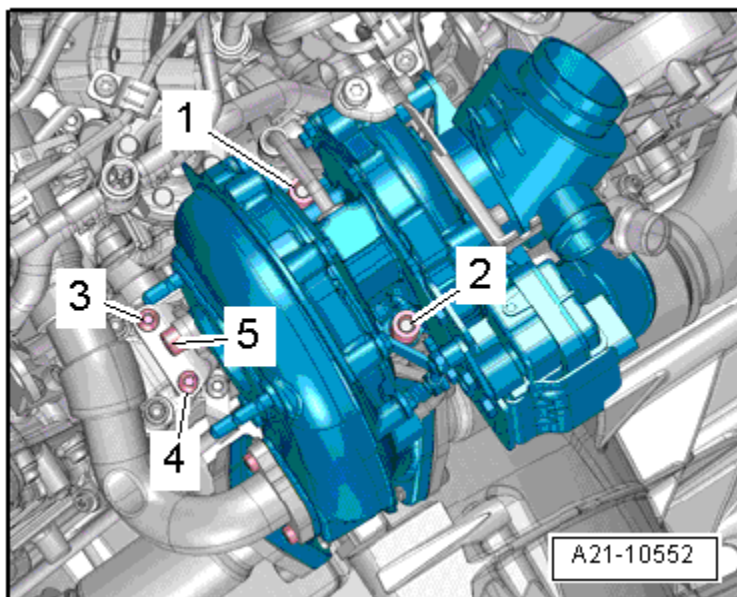
## Fastener Tightening Specifications

Component	Nm
Bracket for electric connector and engine cover-to-turbocharger	9
<b>Bracket for turbocharger</b>	
- Stud bolt <sup>2)</sup>	10
- Bolt <sup>1)</sup>	23
Charge air pressure sensor/intake air temperature sensor-to-connection	9
Clamp 9 mm wide	3
Clamp 13 mm wide	5.5
Connection for air guide hose-to-turbocharger	9
Connection-to-charge air cooler	9
Right air duct pipe	9
Sleeve-to-air duct pipe in the center	5.5
Sleeve-to-lower air duct pipe	9

<sup>1)</sup> Tighten lastly in diagonal sequence and in stages

<sup>2)</sup> Replace nuts after each time they are loosened

## Turbocharger Tightening Specifications



Replace stud bolts and nuts

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

# Exhaust System – 3.0L CNRB (TDI)

## Fastener Tightening Specifications

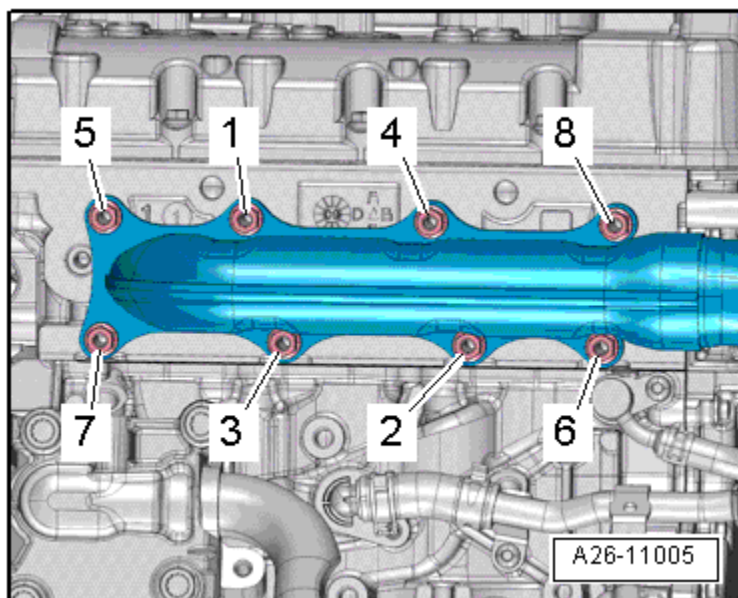
Component	Nm
Active tank to body	9
Bleeder screw	8
Bracket for the preliminary catalytic converter-to-body	23
Bracket for the preliminary catalytic converter-to-particulate filter nut <sup>1)</sup>	23
Bracket for reducing agent metering system control module nut-to-body	2
Clamp-to-SCR - catalytic converter	5
Exhaust gas recirculation cooler-to-engine	9
Exhaust gas recirculation motor-to-connection	9
Exhaust gas temperature sensor <sup>1)</sup>	45
Exhaust manifold-to-engine nut <sup>1)</sup>	25
Exhaust manifold-to-primary catalytic converter <sup>1)2)</sup>	30 + 90°
Exhaust pressure sensor	23
Engine temperature control sensor-to-connection	9
<b>Mounting straps-to-body <sup>3)</sup></b>	
	35
	60
Particle sensor <sup>1)</sup>	50
Primary catalytic converter to bracket for the preliminary catalytic converter	23
Reducing agent metering system control module nut-to-bracket	2
Reducing agent metering system pressure sensor -G686- version 1	8
Reducing agent metering system pressure sensor -G686- version 2	1.5
Reducing agent pump to active tank	1.8
Reducing agent tank cap switch	0.6
Reducing agent transfer pump-to-passive tank	1.8
Suspended mount-to-body	23
Tail pipe-to-rear muffler	60
Underbody protection lock washer-to-passive tank	1.5

<sup>1)</sup> Coat the thread with hot bolt paste

<sup>2)</sup> Replace fastener(s).

<sup>3)</sup> For bolt tightening clarification, refer to ElsaWeb, *Reducing Agent Tank Overview*, items 3, 5 and 14.

## Exhaust Manifold Tightening Specifications

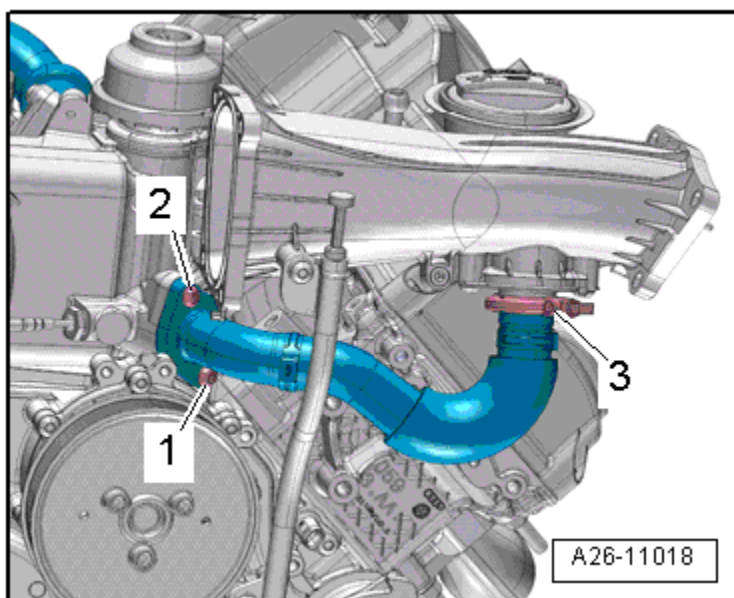


Replace nuts. Coat the nut thread with hot bolt paste. Refer to the Parts Catalog.

Step	Component	Nm
1	Tighten nuts 1 through 9 in sequence	Hand-tighten
2	Tighten nuts 1 through 9 in sequence	15
3	Tighten nuts 1 through 9 in sequence	25



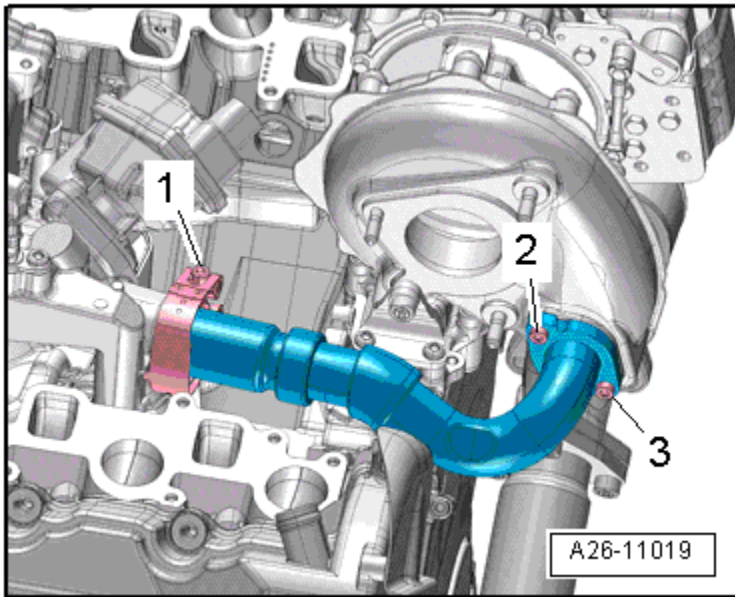
## EGR Pipe at the Intake Manifold Tightening Specifications



Coat the screw thread with hot bolt past. Refer to the Parts Catalog.

Step	Bolts/screw-type clamps	Nm
1	1, 2	Hand-tighten
2	3	2.5
3	1, 2	9

## EGR Pipe at the Turbocharger Tightening Specifications



Coat the screw thread with hot bolt past. Refer to the Parts Catalog.

Step	Bolts/screw-type clamps	Nm
1	2, 3	Hand-tighten
2	1	6
3	2, 3	5
4	2, 3	an additional 90° (¼ turn)

# Diesel Fuel Injection – 3.0L CNRB (TDI)

## Fastener Tightening Specifications

Component	Nm
Bracket for the air guide pipe-to-air guide pipe bolt	9
Bracket for the electrical connector to Intake Manifold bolt	4
Charge air pressure sensor / intake air temperature sensor bolt	5
Clamp for high pressure line	9
Differential pressure sensor nut	3.5
Exhaust gas temperature sensor <sup>2)</sup>	45
Engine support adapter to high pressure pump nut	70
Fuel rail bolt	22
Fuel temperature sensor	2
<b>Guide pin</b>	
- On camshaft bearing	2.5
- On cylinder head	9
High pressure line union nut <sup>1)</sup>	25
High pressure pump bolt	22
Hose connection ring-to-fuel rail banjo bolt	25
Intake flap motor-to-bracket exhaust gas recirculation cooler switch-over valve bolt	9
Lower Air Filter Housing bolt	10
Mass airflow sensor-to-upper air filter housing bolt	1.5
Mounting pins for engine cover	1.5
NOx sensor nut	2.5
Particulate sensor <sup>2)</sup>	50
Particulate sensor-to-CR - catalytic converter nut	3.5
Pipe for Exhaust Gas Recirculation (EGR) system-to-air guide pipe bolt	9
Pressure line to particulate filter	45
Oxygen sensor	50
Tensioning clamp bolt	14
Wiring guide-to-intake manifold bolt	4

<sup>1)</sup> Coat the union nut threads with clean engine oil

<sup>2)</sup> Coat with hot bolt paste.

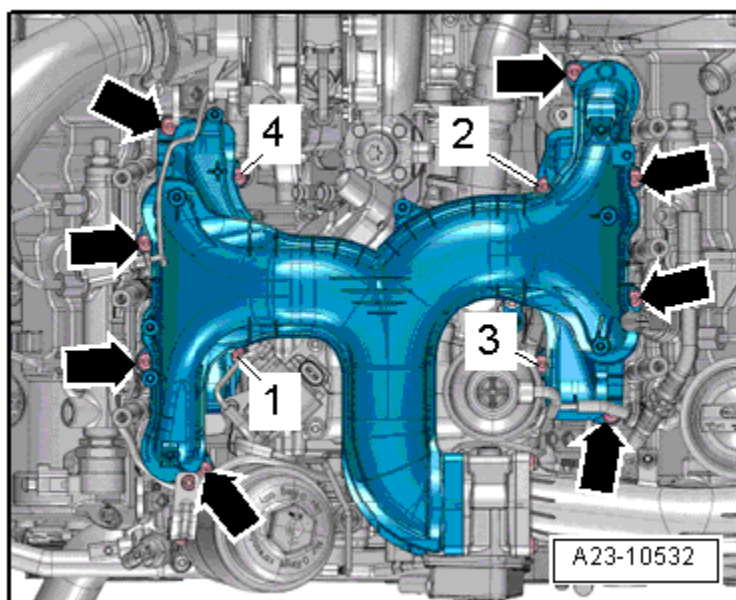
## Fuel Pressure Regulator Valve Tightening Specifications

Step	Nm
1	Hand-tighten
2	60
3	Turn back 180°
4	85

## Fuel Pressure Sensor Tightening Specifications

Step	Nm
1	Hand-tighten
2	60
3	Turn back 180°
4	85

## Intake Manifold Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 4 in sequence and arrows	Hand-tighten
2	Tighten bolts 1 through 4 in sequence	9
3	Tighten arrows in any sequence	9

# **Ignition/Glow Plug System – 3.0L CNRB (TDI)**

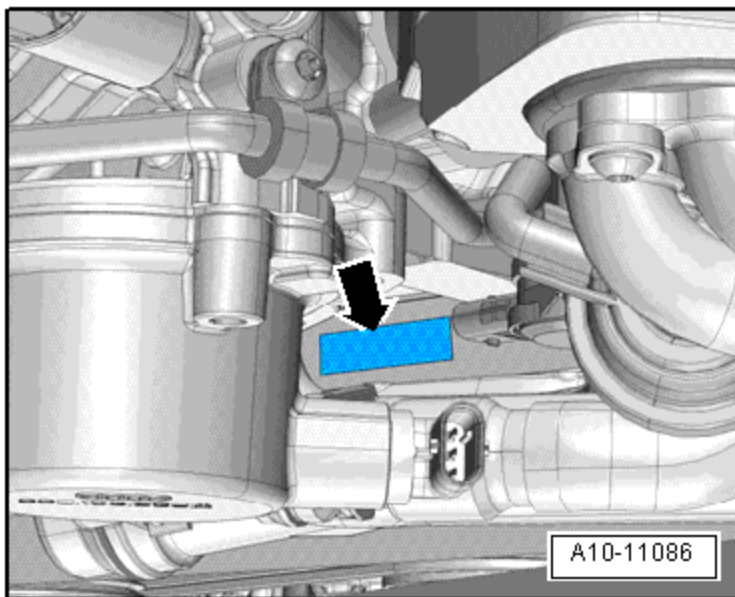
## **Fastener Tightening Specifications**

<b>Component</b>	<b>Nm</b>
Camshaft position sensor bolt	9
Engine speed sensor bolt	9
Glow plug	12

# ENGINE MECHANICAL – 3.0L CTWA, CTWB

## *General, Technical Data*

### Engine Number Location



The engine number (engine code and serial number) is located on the top front of the cylinder block, below the right cylinder head (➡). Engine codes beginning with C are four-digit. The first 3 digits of the engine code indicate the displacement and the mechanical structure of the engine. The fourth digit describes the engine output and torque.

## Engine Data

**Engine – 3.0L  
CTWA, CTWB**

Engine code		CTWB	CTWA
Displacement	liter	2.995	2.995
Output	kW at RPM	206 @ 4900-6500	245 @ 5500-6500
Torque	Nm at RPM	400 @ 1500-4900	440 @ 2900-5300
Bore	dia. mm	84.5	84.5
Stroke	mm	89.0	89.0
Compression ratio		10.5	10.5
Research Octane Number (RON)	minimum	98 <sup>1)</sup>	98 <sup>1)</sup>
Fuel injection system 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
Turbocharger, Supercharger		Supercharger	Supercharger
Knock Sensor (KS)		2 sensors	2 sensors
Charge Air Cooler (CAC)		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

<sup>1)</sup> Unleaded RON 95 is permitted but performance is reduced.

# Engine Assembly – 3.0L CTWA, CTWB

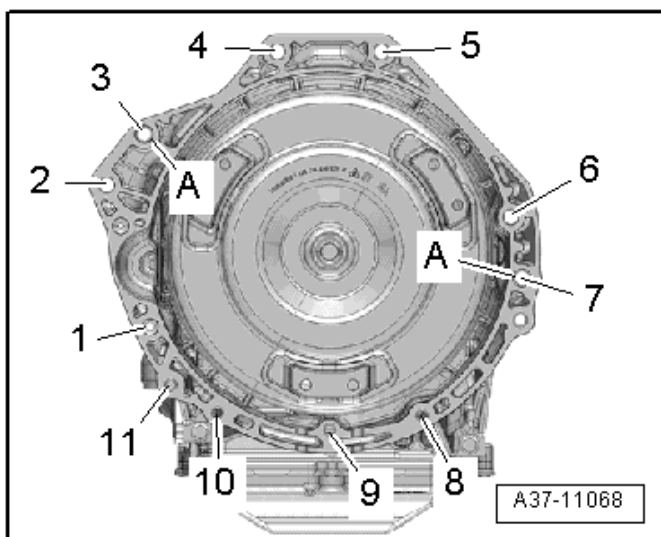
## Fastener Tightening Specifications

Component	Fastener size	Nm
Bolts and nuts	M6	9
	M7	15
	M8	20
	M10	40
	M12	65
Engine carrier-to-body bolt <sup>1)</sup>	-	120 plus an additional 180° (½ turn)
Engine mount, left	-	60
Engine mount, right	-	50
Ground connection on the right longitudinal member	-	15
<b>Left engine support</b>		
- Bolt	-	50
- Nut	-	75
<b>Right engine support</b>		
- Bolt	-	40
- Nut	-	75

<sup>1)</sup> Replace fastener(s).



## Engine to Automatic Transmission

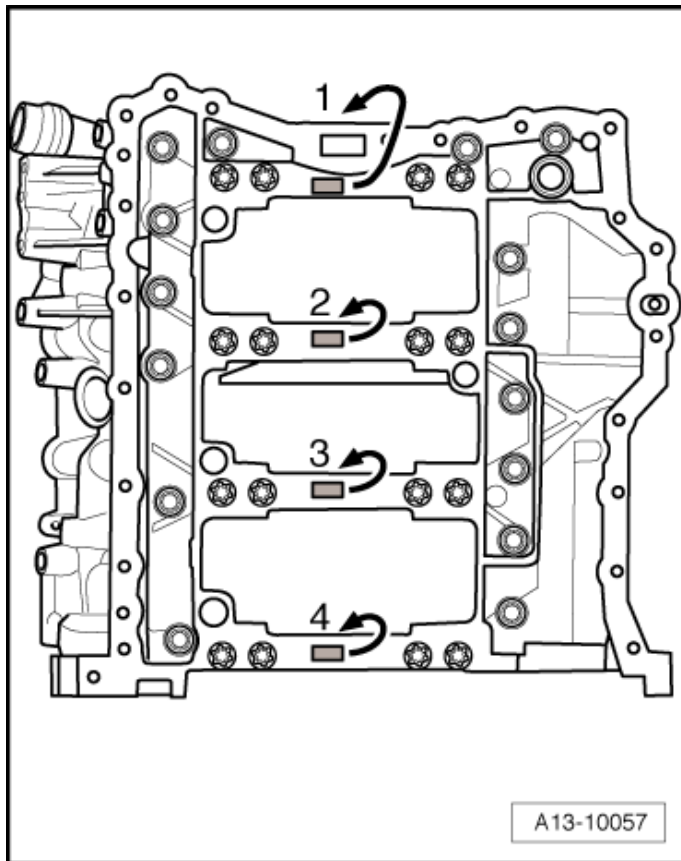


Engine – 3.0L  
CTWA, CTWB

Item	Bolts <sup>1)</sup>	Nm
1	M10x95	15 plus an additional 90° (¼ turn)
2-5	M12x75	30 plus an additional 90° (¼ turn)
6, 7	M12x140	30 plus an additional 90° (¼ turn)
8, 9, 10	M10x60	15 plus an additional 90° (¼ turn)
11	M10x45	15 plus an additional 90° (¼ turn)
A	Alignment sleeves for centering	
<sup>1)</sup> Aluminum bolts may be used two times		

# Crankshaft, Cylinder Block – 3.0L CTWA, CTWB

## Allocation of Crankshaft Bearing Shells for Cylinder Block

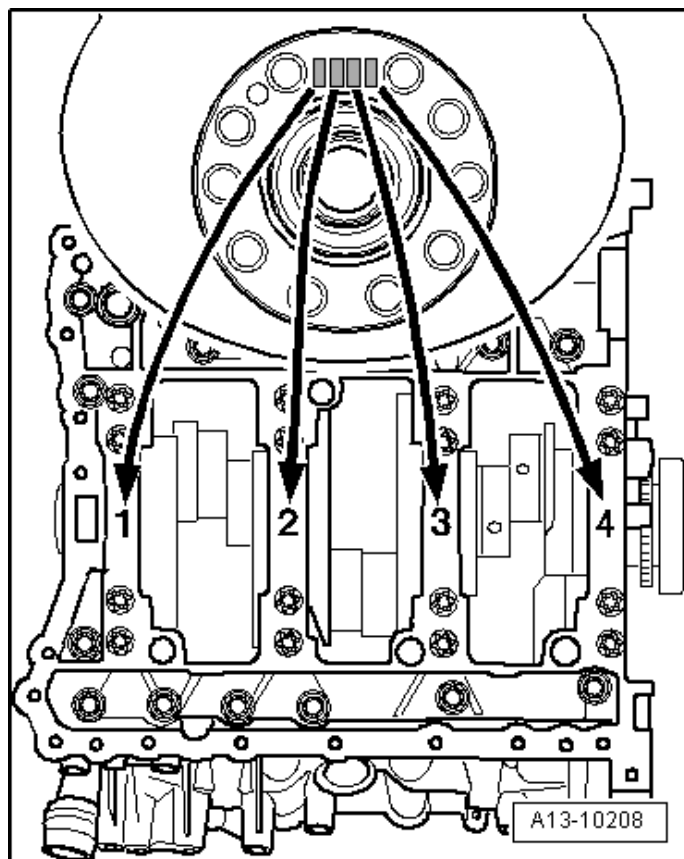


Bearing shells with the correct thickness are allocated to the cylinder block in the factory. Colored dots on the bearing shells identify bearing shell thickness. The ➔ points to the belt pulley side. The allocation of the bearing shells to the cylinder block is identified with a letter by each bearing.

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

## Allocation of Crankshaft Bearing Shells for Guide Frame

Engine – 3.0L  
CTWA, CTWB



Bearing shells with the correct thickness are allocated to the bearing cap at 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 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 crankshaft	Color of bearing
R	Red
G	Yellow
B	Blue
S	Black

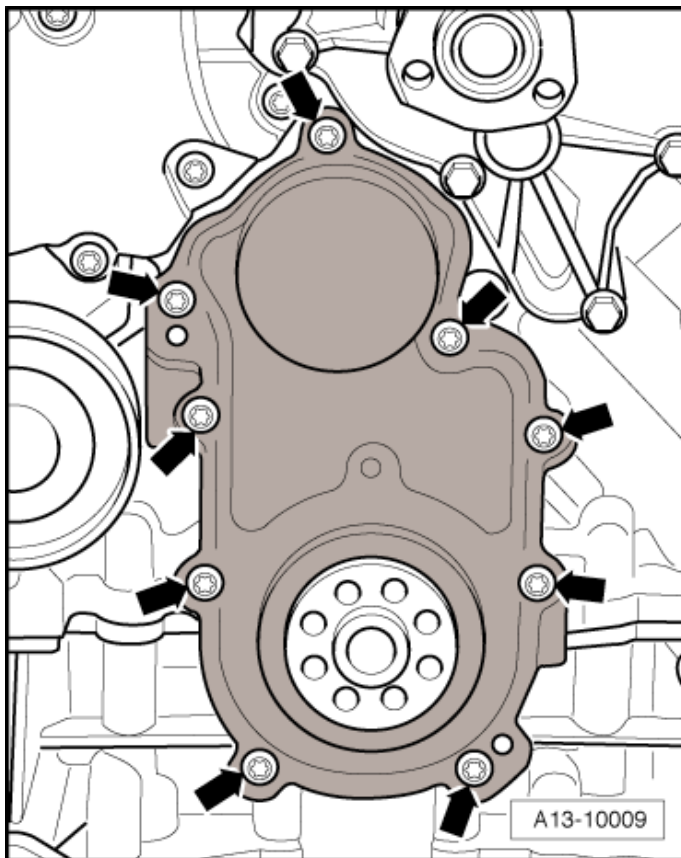
## Fastener Tightening Specifications

Component	Nm
Bracket for generator	20
Connecting rod bearing cap bolt <sup>1)</sup>	50 plus an additional 90° (¼ turn)
Drive plate bolt <sup>1)</sup>	60 plus an additional 90° (¼ turn)
Idler roller for ribbed belt bolt	40
Idler roller for ribbed belt (supercharger) bolt	42
Oil spray jet for piston cooling	9
Tensioning element for ribbed belt bolt	40
Top Dead Center (TDC) marking locking bolt	14
Vibration damper-to-crankshaft bolt <sup>1)</sup>	20 plus an additional 90° (¼ turn)

<sup>1)</sup> Replace fastener(s).

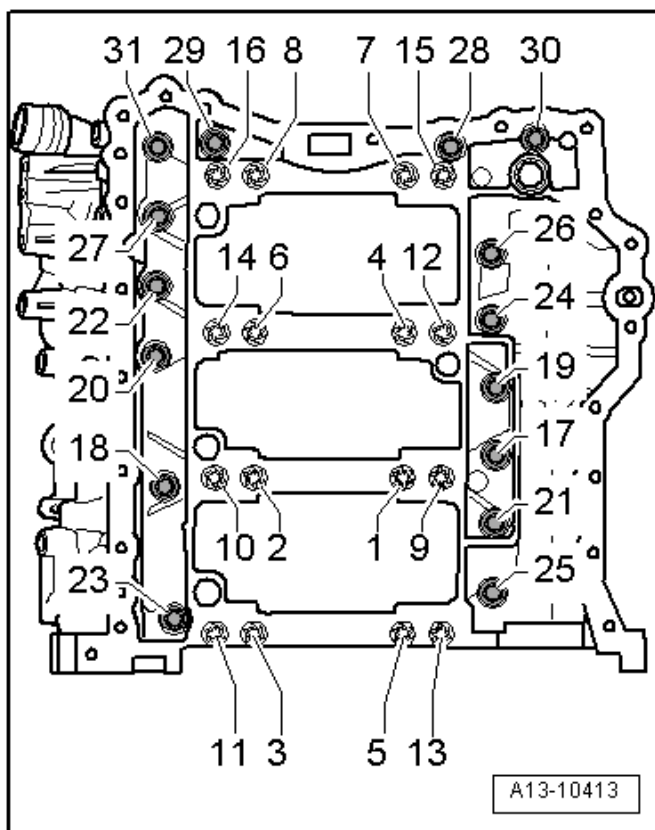
## Ribbed Belt Sealing Flange Tightening Specification

Engine – 3.0L  
CTWA, CTWB



Step	Component	Nm
1	Tighten the bolts (➡) in a diagonal sequence	9

## Guide Frame Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 16 in sequence <sup>1)</sup>	50
2	Tighten bolts 1 through 16 in sequence	an additional 90° (¼ turn)
3	Tighten bolts 17 through 31 in sequence (for guide frame sealing surfaces on cylinder block)	23

<sup>1)</sup> Replace fastener(s).

## Crankshaft Dimensions

Honing dimension in mm	Crankshaft bearing pin diameter		Crankshaft connecting rod journal diameter	
Basic dimension	65.000	-0.022	56.000	-0.022
		-0.042		-0.042

## Piston Ring End Gaps

Piston ring dimensions in mm	New	Wear limit
1 <sup>st</sup> compression ring	0.20 to 0.30	0.80
2 <sup>nd</sup> compression ring	0.50 to 0.70	0.80
Oil scraping ring	0.25 to 0.50	– <sup>1)</sup>

<sup>1)</sup> Not determined yet.

## Piston Ring Clearance

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

## Piston and Cylinder Dimensions

Honing dimension in mm	Piston diameter	Cylinder bore diameter
Basic dimension	84.49 <sup>1)</sup>	84.51

<sup>1)</sup> Dimension without graphite coating (thickness 0.02 mm). The graphite coating wears away.

# Cylinder Head, Valvetrain – 3.0L CTWA, CTWB

## Fastener Tightening Specifications

Component	Nm
Balance Shaft	60
Balance Shaft Chain Sprocket <sup>1)</sup>	15 plus an additional 90° (¼ turn)
Balance shaft bearing end bracket-to-cylinder block bolt	13
Bearing Plate for Drive Sprocket <sup>1)</sup>	8 plus an additional 45° (⅛ turn)
Bracket for Electrical Wires	9
Bearing Plate for the Right Camshaft Timing Chain Drive Sprocket <sup>1)</sup>	8 plus an additional 45° (⅛ turn)
Camshaft Adjuster for Intake Camshaft <sup>1)</sup>	80 plus an additional 90° (¼ turn)
Camshaft Adjustment Solenoid Valve	5
Camshaft Chain Sprocket for Exhaust Camshaft <sup>1)</sup>	80 plus an additional 90° (¼ turn)
Chain Tensioner	9
Chain Tensioner with Glide Track <sup>1)</sup>	10 plus an additional 45° (⅛ turn)
Drive Chain for Timing Mechanism <sup>1)</sup>	10 plus an additional 90° (¼ turn)
Drive Sprocket for Oil Pump <sup>1)</sup>	30 plus an additional 90° (¼ turn)
Guide Rail <sup>1) 4)</sup>	10 plus an additional 90° (¼ turn)
Guide Rail <sup>1) 5)</sup>	8 plus an additional 45° (⅛ turn)
Mounting Pin for Drive Sprocket <sup>1) 2)</sup>	5 plus an additional 60° (⅙ turn)
Mounting Pin for Drive Sprocket <sup>1) 3)</sup>	30 plus an additional 90° (¼ turn)
Oil dipstick guide tube	9

<sup>1)</sup> Replace fastener(s).

<sup>2)</sup> For bolt tightening clarification, refer to ElsaWeb, *Timing Mechanism Drive Chain Overview*, items 3 and 4.

<sup>3)</sup> For bolt tightening clarification, refer to ElsaWeb, *Timing Mechanism Drive Chain Overview*, items 14 and 15.

<sup>4)</sup> For bolt tightening clarification, refer to ElsaWeb, *Timing Mechanism Drive Chain Overview*, items 1 and 2.

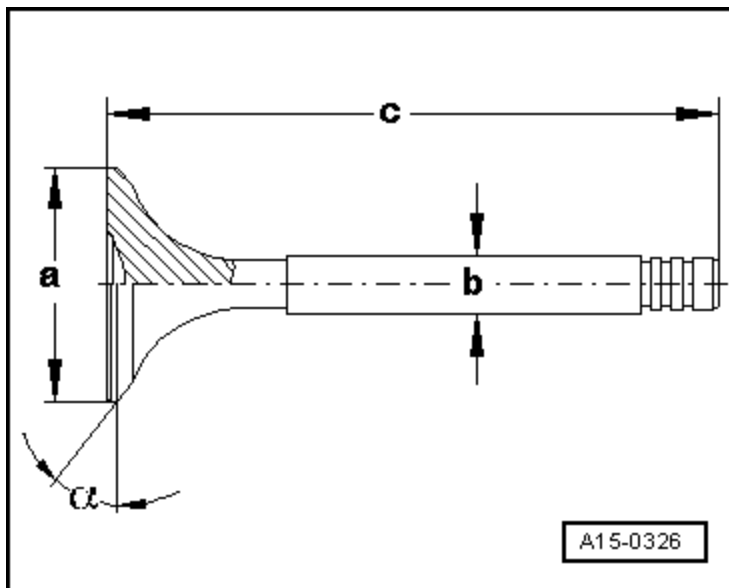
<sup>5)</sup> For bolt tightening clarification, refer to ElsaWeb, *Timing Mechanism Drive Chain Overview*, items 9 and 10.



## Compression Checking Specifications

Compression pressure	Bar pressure
New	11.0 to 14.0
Wear limit	10.0
Maximum difference between cylinders	3.0

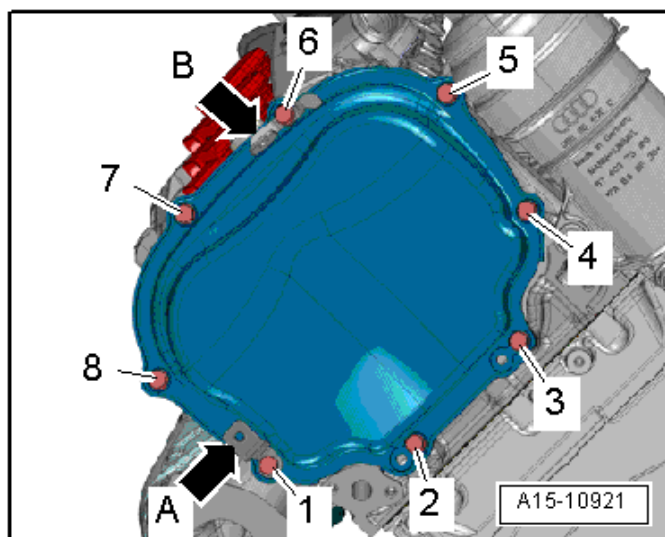
### Valve Dimensions



Dimension		Intake valve	Exhaust valve
Diameter a	mm	$33.85 \pm 0.10$	$28.0 \pm 0.1$
Diameter b	mm	$5.98 \pm 0.01$	$5.96 \pm 0.01$
c	mm	$104.0 \pm 0.2$	$101.9 \pm 0.2$
$\alpha$	$\angle^\circ$	45	45

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

## Left Timing Chain Cover Tightening Specifications

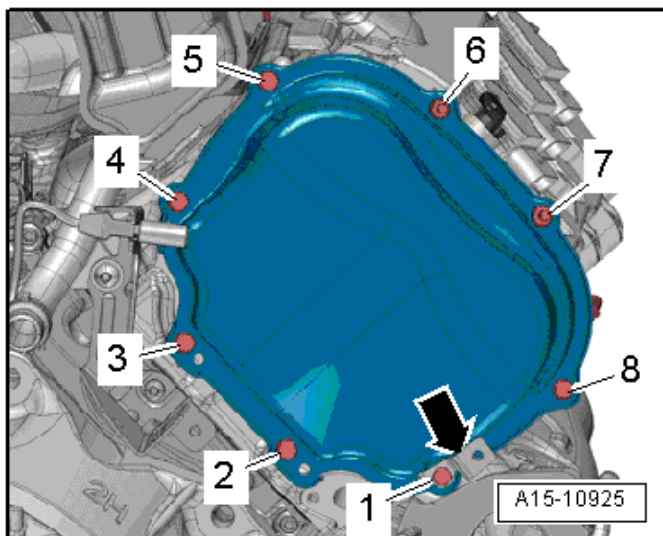


Step	Component	Nm
1	Tighten bolts 1 through 8 in sequence (replace bolts)	5
2	Tighten bolts 1 through 8 in sequence	an additional 90° (¼ turn)

The brackets (A and B) are connected with the left timing chain cover.

## Right Timing Chain Cover Tightening Specifications

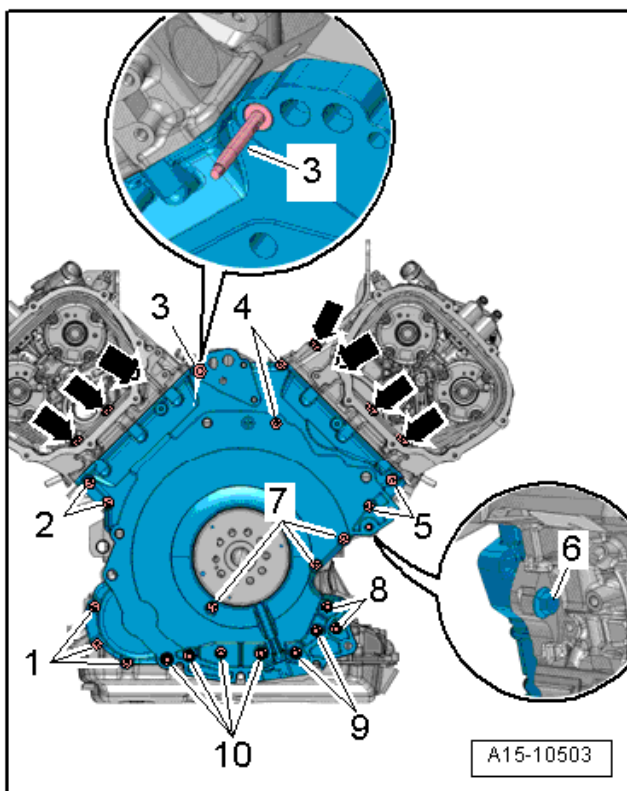
Engine – 3.0L  
CTWA, CTWB



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

The bracket (➡) is connected with the right timing chain cover.

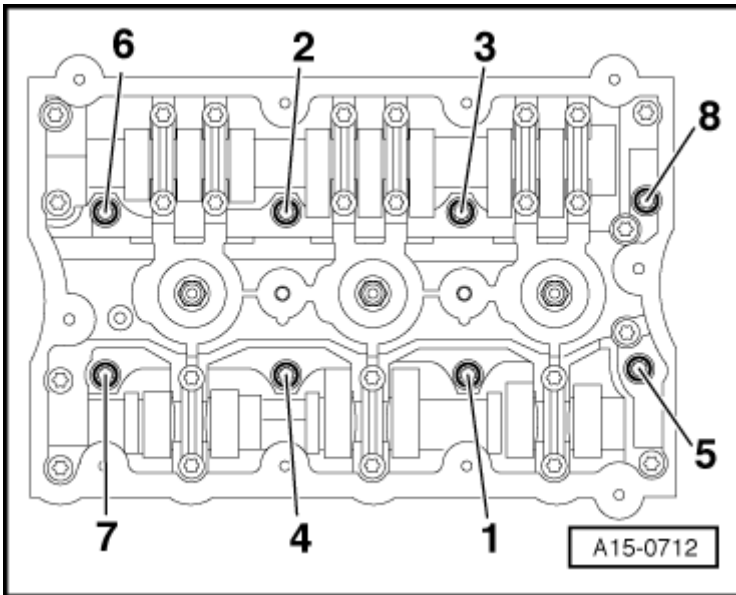
## Lower Timing Chain Cover Tightening Specifications



Replace bolts that are tightened to the specification.

Step	Component	Nm
1	Tighten the 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	8
5	Tighten bolts 8, 9 and 10	an additional 90° (¼ turn)
6	Tighten bolt 3	16
7	Tighten bolt 6	20
8	Tighten bolt 6	an additional 90° (¼ turn)

## Cylinder Head Tightening Specifications

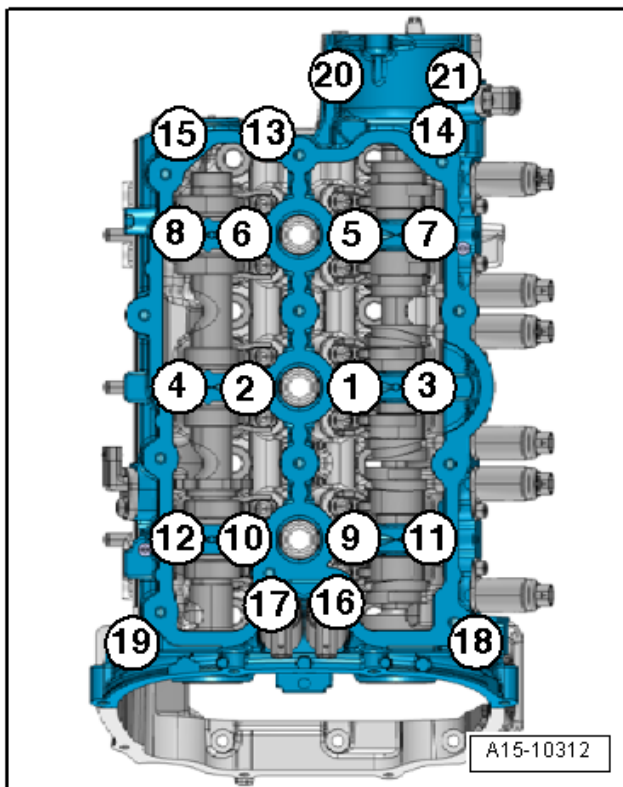


Engine – 3.0L  
CTWA, CTWB

NOTE: The left cylinder head is shown. The right cylinder head is identical.

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

## Camshaft Guide Frame Tightening Specifications



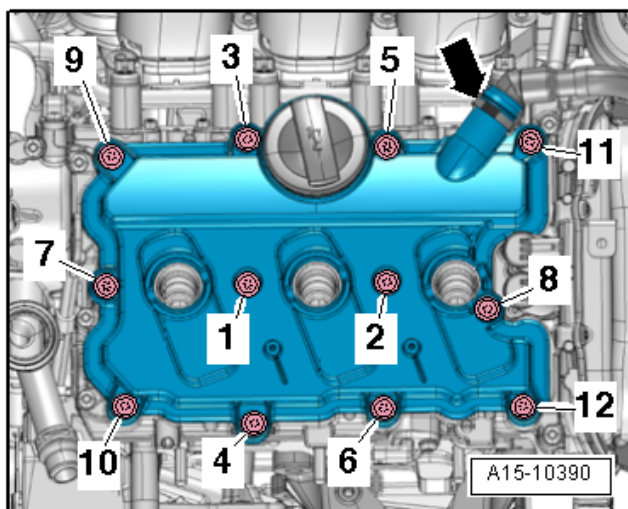
NOTE: The left cylinder head camshaft guide frame is shown.  
The right cylinder head camshaft guide frame is identical.

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

<sup>1)</sup> Replace fastener(s).

<sup>2)</sup> The guide frame must be in contact with the entire contact surface of the cylinder head.

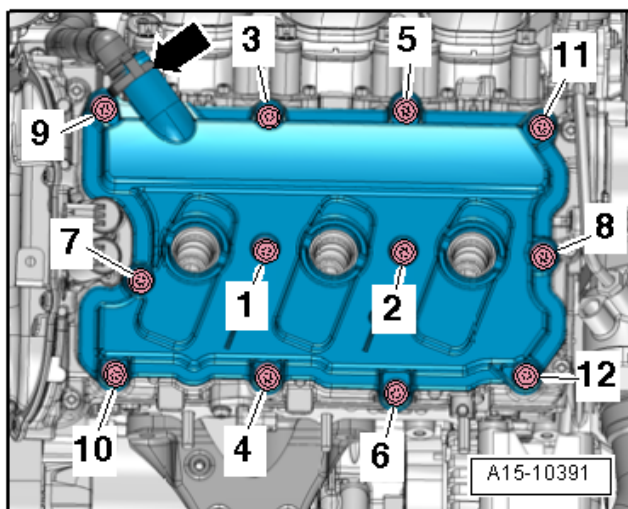
## Left Cylinder Head Cover Tightening Specification



Engine – 3.0L  
CTWA, CTWB

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

# Engine Lubrication – 3.0L CTWA, CTWB

## Fastener Tightening Specifications

Component	Nm
Bracket	9
Crankcase ventilation hose-to-oil separator cover bolt	3
Cover with oil separator	9
Engine oil cooler <sup>1)2)</sup>	3 plus an additional 90° (¼ turn)
	9
Lower oil baffle-to-upper oil pan bolt <sup>1)</sup>	3 plus an additional 90° (¼ turn)
Oil check valve	20
Oil drain plug	30
<b>Oil filter housing <sup>3)</sup></b>	
- Bolt	9
- Bolt	13
- Union nut	13
- Threaded pin	16
Oil filter housing cap	25
Oil level thermal sensor, nut	9
Oil pressure regulation valve	9
Oil pressure switch	20
Oil pump chain sprocket <sup>1)</sup>	30 plus an additional 90° (¼ turn)
Oil pump	20
Reduced oil pressure switch	20
Upper oil baffle-to-upper oil pan bolt <sup>4)</sup>	9

<sup>1)</sup> Replace fastener(s).

<sup>2)</sup> For bolt tightening clarification, refer to ElsaWeb, *Upper and Lower Oil Pan Sections, Oil Pump and Oil Cooler Overview*, items 15 and 17.

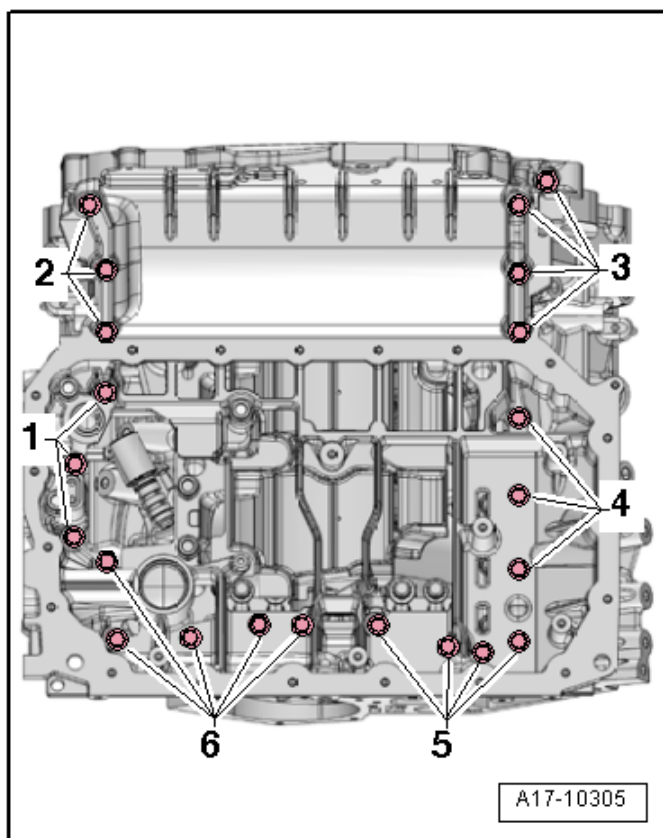
<sup>3)</sup> For bolt tightening clarification, refer to ElsaWeb, *Oil Filter Housing Overview*, items 1, 4, 5 and 13.

<sup>4)</sup> Insert with locking compound.



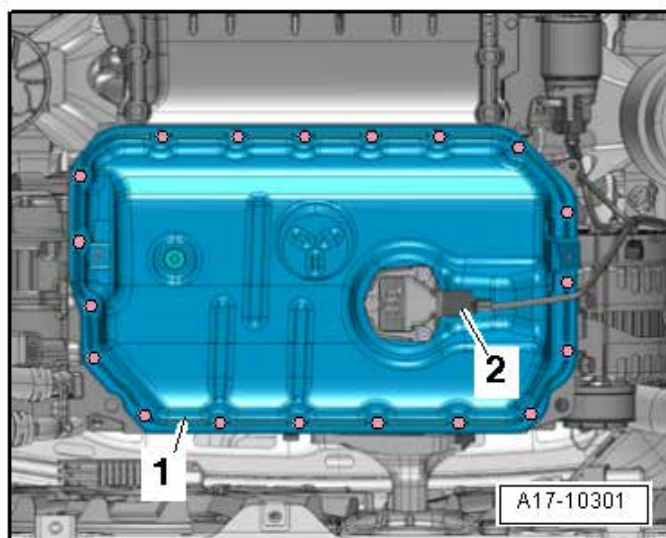
## Upper Oil Pan Tightening Specifications

Engine – 3.0L  
CTWA, CTWB



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 CTWA, CTWB

## Fastener Tightening Specifications

Component	Fastener size	Nm
After-Run coolant pump	-	4
Bracket for after-run coolant pump	-	9
Bracket for left front coolant pipes	-	22
Charge air cooling circuit cooler	-	9
Coolant pump	-	9
Coolant pump ribbed belt pulley	-	20
Coolant thermostat	-	9
Connecting piece for coolant hose	-	9
Fan shroud <sup>2)</sup>	-	5
	-	10
Front coolant pipe	-	9
Left coolant pipes	-	9
Left front coolant pipes	-	9
Left rear coolant pipes on the transmission	-	9
Lower coolant pipe on the supercharger	-	9
Radiator <sup>1)</sup>	-	5.5
	-	8
Right coolant pipe on the right side of the transmission	-	9
Upper coolant pipe	-	9
Upper coolant pipe on the supercharger	-	9

<sup>1)</sup> For bolt tightening clarification, refer to ElsaWeb, *Radiator Overview*, items 8, 15 and 19.

<sup>2)</sup> For bolt tightening clarification, refer to ElsaWeb, *Fan Shroud and Coolant Fan Overview*, items 1, 2 and 3.

# Fuel Supply – 3.0L CTWA, CTWB

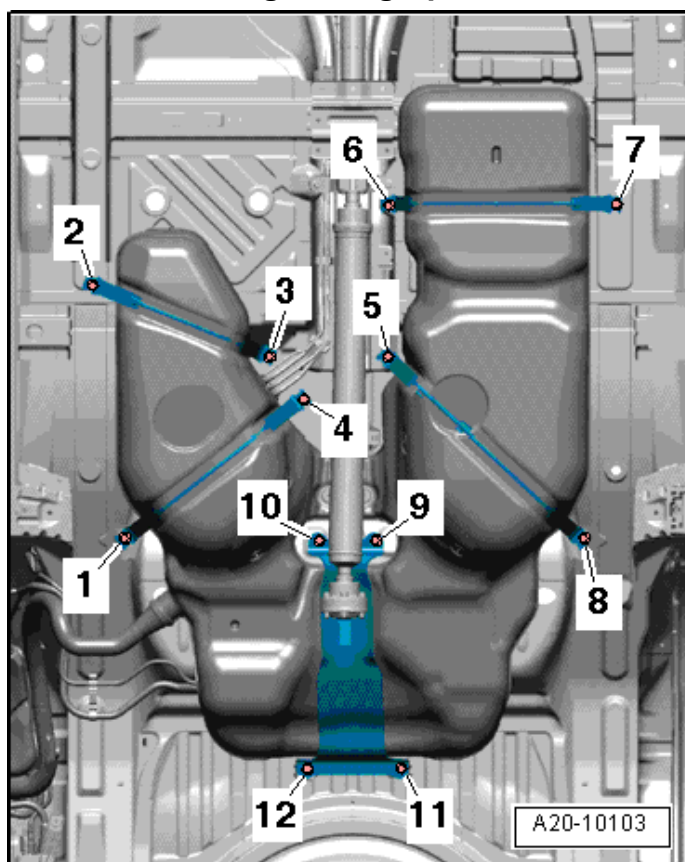
## Fastener Tightening Specifications

Component	Nm
Accelerator pedal module	10
EVAP canister <sup>2)</sup>	1.2
	9
Filter housing cap	10
Fuel pump control module	3.5
Fuel tank <sup>1)</sup>	9
	5
Locking flange cover	9
Locking ring	110
Protective plate for fuel delivery connection, nut	9

<sup>1)</sup> For bolt tightening clarification, refer to ElsaWeb, *Radiator Overview*, items 8, 15 and 19.

<sup>2)</sup> For bolt tightening clarification, refer to ElsaWeb, *Fan Shroud and Coolant Fan Overview*, items 1, 2 and 3.

## Fuel Tank Tightening Specifications



Engine – 3.0L  
CTWA, CTWB

Step	Bolts	Nm
1	Tighten bolts 9, 10, 11, 12 in sequence	33
2	Tighten bolts 1, 4, 5, 8 in sequence	33
3	Tighten bolts 2, 3, 6, 7 in sequence	33

# Turbocharger, G-Charger - 3.0L CTWA, CTWB

## Fastener Tightening Specifications

Component	Nm
Bleeder screw	1.5 to 3.0
Bracket for change-over valves	9
Charge air pressure sensor <sup>1)</sup>	10
Drive head <sup>1)</sup>	27
Engine lifting eye	27
Insulation plate	5
Left charge air cooler <sup>1)</sup>	10
Right charge air cooler <sup>1)</sup>	10
Threaded pin	17
Threaded pin, nut	20

<sup>1)</sup> Replace fastener(s).

# Exhaust System, Emission Controls – 3.0L CTWA, CTWB

## Fastener Tightening Specifications

Component	Nm
Bracket for secondary air injection pump motor	9
Catalytic converter, nut <sup>1) 3)</sup>	23
Clamp for the tail pipe	23
Front clamping sleeve	23
Heat shield	10
Hose from secondary air injection combination valve	9
Left secondary air injection combination valve	9
Rear clamping sleeve, nut	23
Right secondary air injection combination valve	9
Secondary air combination valve heat shield	9
Suspended mount <sup>4)</sup>	23
Suspended mount <sup>2)</sup>	60

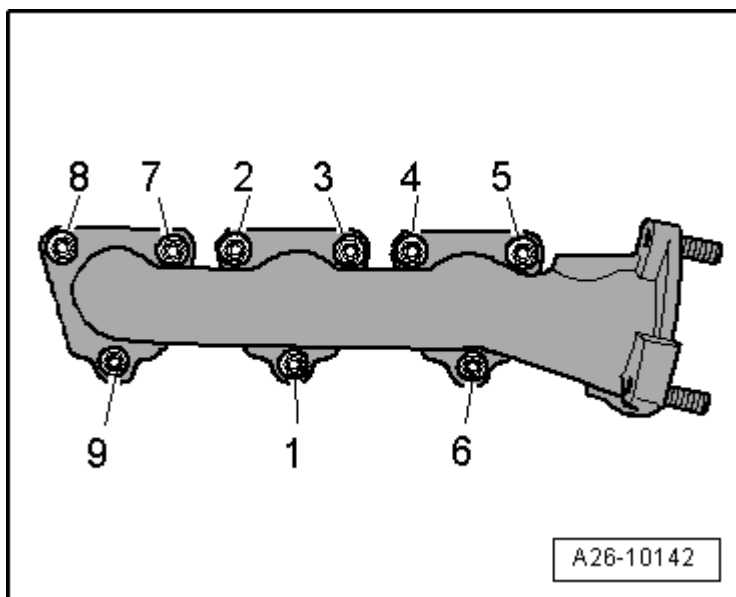
<sup>1)</sup> Replace fastener(s).

<sup>2)</sup> For bolt tightening clarification, refer to ElsaWeb, *Muffler and Catalytic Converter Overview*, Front Muffler item 3.

<sup>3)</sup> Coat the thread with hot bolt paste

<sup>4)</sup> For bolt tightening clarification, refer to ElsaWeb, *Muffler and Catalytic Converter Overview*, Catalytic Converter items 7, 9 and 13.

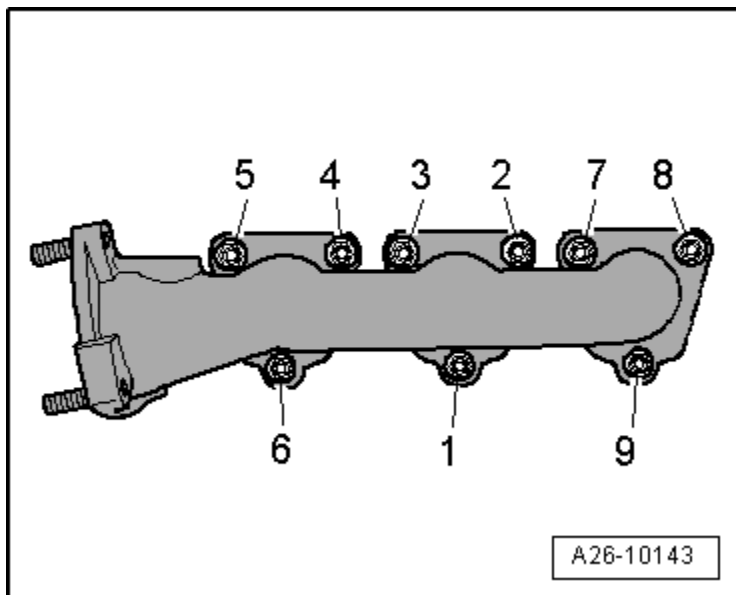
## Left Exhaust Manifold Tightening Specifications



Engine – 3.0L  
CTWA, CTWB

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

## Right Exhaust Manifold Tightening Specifications



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



# ***Multiport Fuel Injection – 3.0L CTWA, CTWB***

**Engine – 3.0L  
CTWA, CTWB**

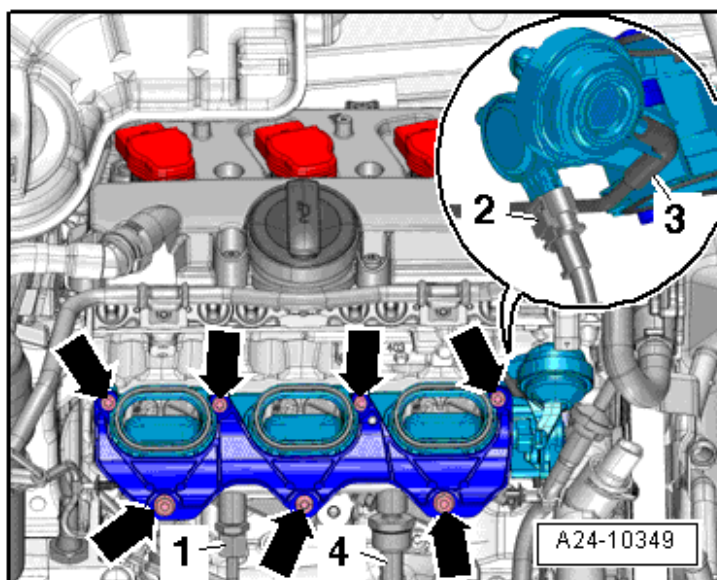
## **Fastener Tightening Specifications**

<b>Component</b>	<b>Nm</b>
Bracket for fuel rail	2.5
Bracket for high-pressure line	9
Camshaft position sensor	9
Connecting piece to high pressure pump	27
Fuel pressure sensor <sup>1)</sup>	22
Fuel rail threaded connection	40
Fuel supply line	25
High-pressure line	25
Housing threaded pin	9
Intake Air Temperature (IAT) Sensor/Manifold Absolute Pressure (MAP) Sensor	10
Intake manifold runner position sensor 2	2.5
Low fuel pressure sensor	15
Lower air filter housing	9
Oxygen sensors	55
Protective plate for high pressure line, nut	9
Threaded connection for high-pressure line	40
Throttle valve control module <sup>2)</sup>	10

<sup>1)</sup> Oil the threads.

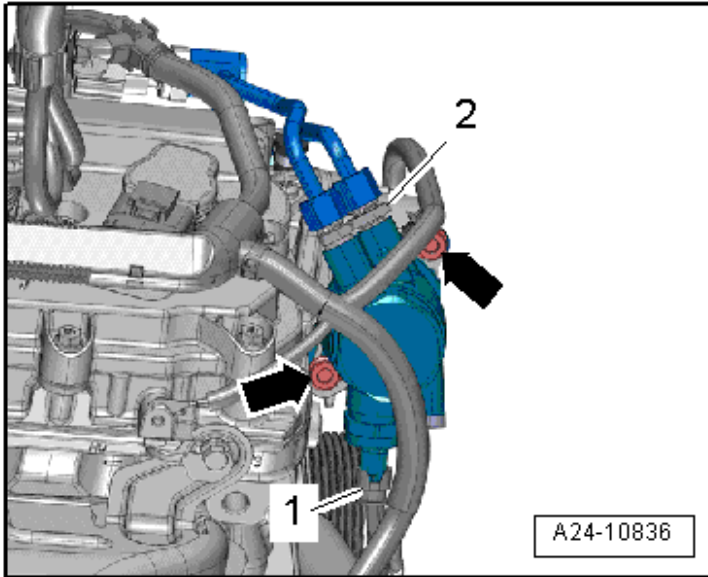
<sup>2)</sup> Diagonal sequence.

## Lower Intake Manifold Tightening Specification



Step	Component	Nm
1	Tighten bolt and nuts (↗) diagonally in stages	9

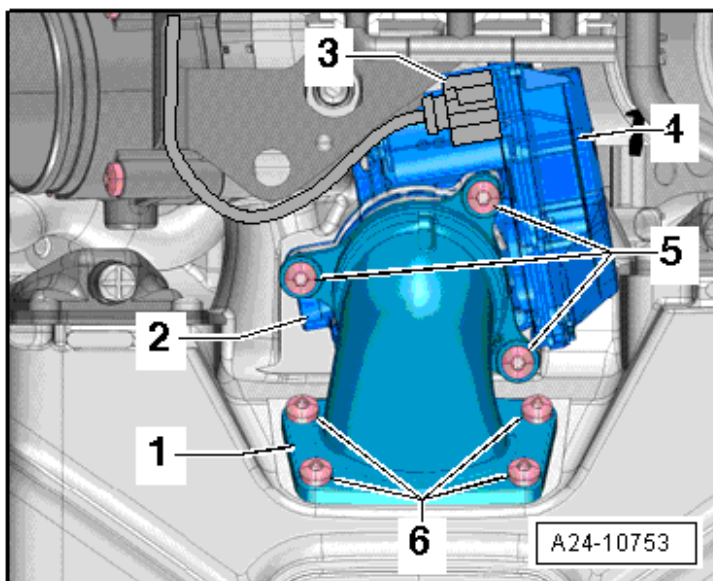
## High Pressure Pump Tightening Specification



Engine – 3.0L  
CTWA, CTWB

Step	Component	Nm
1	Tighten bolts (➔)	Hand-tighten
2	Tighten bolts (➔)	In steps to 20 Nm

## Control Valve Control Unit Tightening Specification



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

## Ignition/Glow Plug System – 3.0L CTWA, CTWB

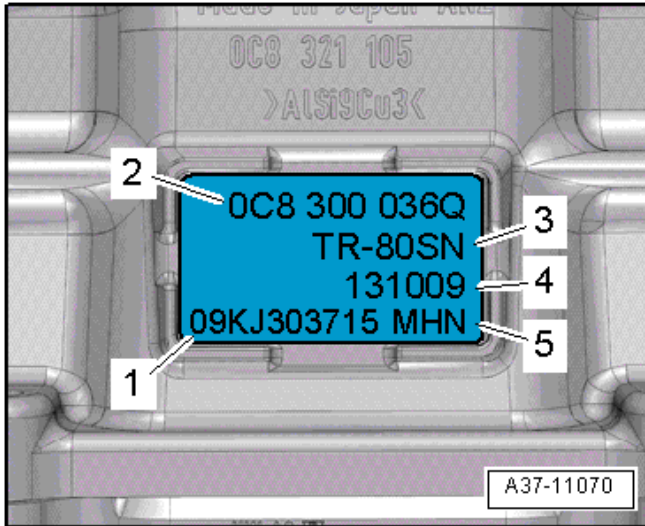
### Fastener Tightening Specifications

Component	Nm
Camshaft Position Sensor Bolt	9
Engine Speed Sensor Bolt	9
Knock Sensor Bolt	25
Ignition Coil Wire Harness Clamp Bolt	5
Spark Plug	30

# AUTOMATIC TRANSMISSION – 0C8

## General, Technical Data – 0C8

### Transmission Identification



Automatic Trans. –  
0C8

Transmission code letters are located on the type plate on the bottom left side of the transmission.

#### Example:

- 1 - Code Letters
- 2 - Part number
- 3 - Manufacturer type number
- 4 - Production date
- 5 - Transmission code

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

## Code Letters and Transmission Allocations Vehicles with a Gas Engine

Engine	Transmission code
3.L - 200 kW and 245 kW	MHN
1st Gear	4.845
2nd Gear	2.840
3rd Gear	1.864
4th Gear	1.437
5th Gear	1.217
6th Gear	1.000
7th Gear	0.816
8th Gear	0.672
Reverse gear	3.825

## Vehicles with a Diesel Engine

Engine	Transmission code
3.0L - 165 kW V6	MHC, MHP, NAB, NAC
1st Gear	4.970
2nd Gear	2.840
3rd Gear	1.864
4th Gear	1.437
5th Gear	1.210
6th Gear	1.000
7th Gear	0.825
8th Gear	0.686
Reverse gear	4.066

## *Torque Converter*

### Fastener Tightening Specifications

Component	Nm
Flange for the starter bolt	9
Torque converter drive plate bolt <sup>1)</sup>	85

<sup>1)</sup> Replace fasteners

# Controls, Housing – 0C8

## Fastener Tightening Specifications

Component	Fastener size	Nm
ATF Check Plug to the Pan	-	16
Bolt for Adjusting the Selector Lever Cable	-	13
Bolts/Nuts	M6	9
	M8	20
	M10	40
	M12	65
Cable Mounting Bracket for Selector Lever Cable	M6	9
	M8	22
Centering Bracket to the Lower Section of the Selector Mechanism Function Unit	-	6.5
Lower Section of the Selector Mechanism Function Unit to the Body <sup>4)</sup>	-	6.4
	-	10
Selector Lever Cable Heat Shield	-	9
<b>Mounting ATF pipes to the ATF cooler</b>		
- Bolts	-	10
- Union Nuts	-	20
Overflow Tube in the Opening for the Plug	-	1
Selector Lever Sensor System Control Module with Tiptronic Switch	-	1
<b>6-Cylinder Vehicles 3.0L TFSI</b>		
ATF Pipes <sup>1)</sup>	M6	8
	M8	20
	-	10
Thermostat	-	8
<b>6-Cylinder Vehicles 3.0L TDI Engine</b>		
ATF Pre-Heater to ATF Pipes	-	20
ATF Pipes <sup>2)</sup>	-	8
ATF Pipes <sup>3)</sup>	-	8
	-	25
ATF Auxiliary Cooler	-	20
Thermostat	-	8

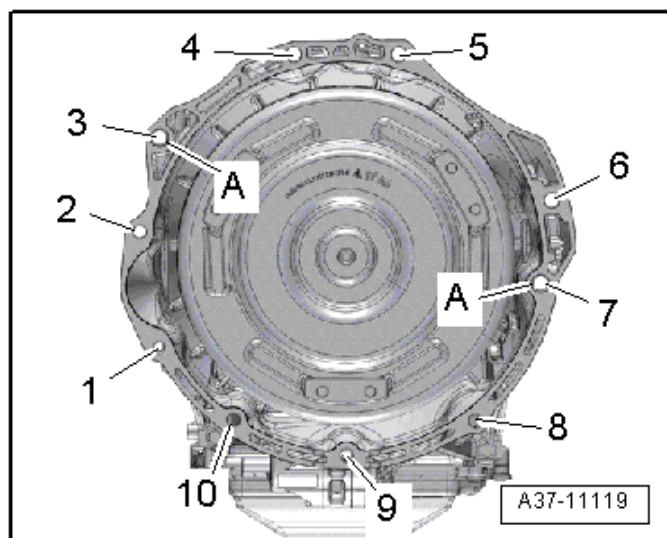
<sup>1)</sup> For bolt tightening clarification, refer to ElsaWeb, *ATF Pipe and ATF Cooler Overview*, items 1, 13, 15 and 16.

<sup>2)</sup> For bolt tightening clarification, refer to ElsaWeb, *ATF Pipes, ATF Cooler and ATF Pre-Heater Overview*, item 2.

<sup>3)</sup> For bolt tightening clarification, refer to ElsaWeb, *ATF Pipes, ATF Cooler and ATF Pre-Heater Overview*, items 20, 21 and 22.

<sup>4)</sup> For bolt tightening clarification, refer to ElsaWeb, *Selector Mechanism Overview*, items 14 and 15.

## Securing Transmission to a 3.0L TDI Engine

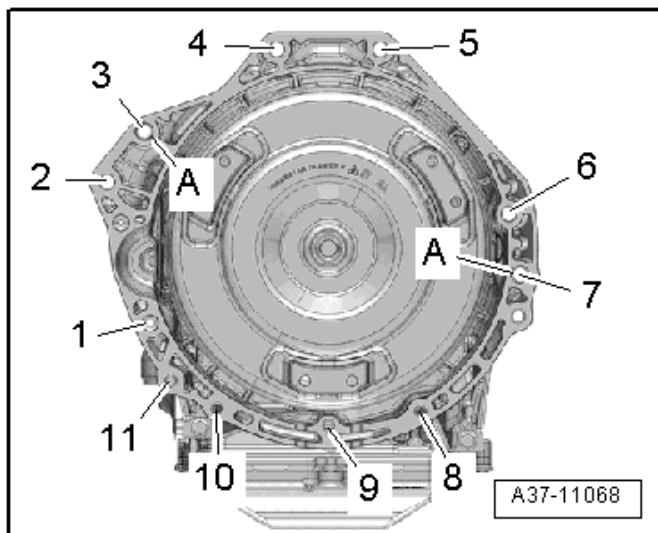


Item	Bolt	Nm
1	M10 x 70 <sup>1)</sup>	65
2	M10 x 90 <sup>1)</sup>	65
3, 4, 5 and 7	M12 x 80	80
6	M12 x 70	80
8, 9 and 10	M10 x 70	45
A	Alignment sleeves	

<sup>1)</sup> Also secures the starter.



## Securing Transmission to a 3.0L Engine

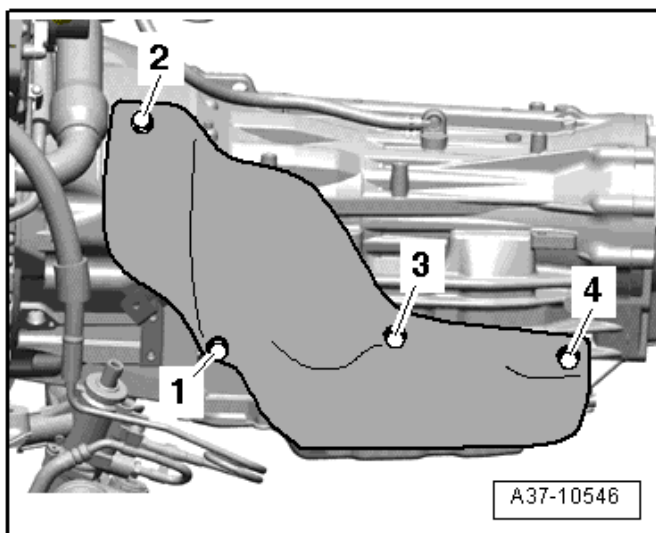


Automatic Trans. –  
0C8

Item	Bolt <sup>1)</sup>	Nm
1	M10 x 95	80
2 through 5	M12 x 75	80
6 and 7	M12 x 140	45
8, 9 and 10	M10 x 60	80
11	M10 x 45	80
A	Alignment sleeves	

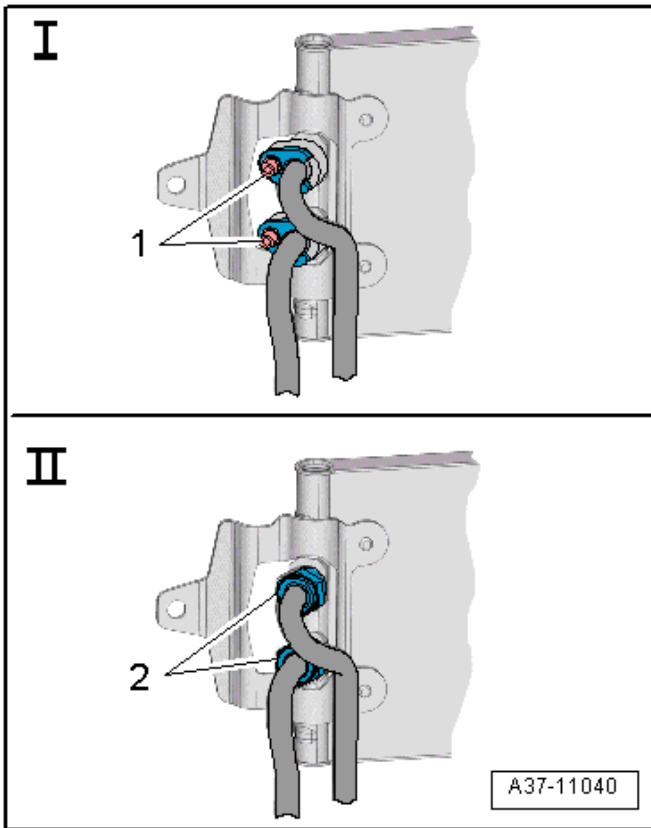
<sup>1)</sup> Aluminum bolts may be used two times.

## Selector Lever Cable Heat Shield Tightening Specification



Step	Bolt	Nm
1	Tighten bolts 1 through 4 in sequence	9

## Mounting ATF Pipes to the ATF Cooler



### I - Mounting with Clamping Joint:

Tighten the bolts -1- to 10 Nm.

### II - Mounting with Threaded Connection:

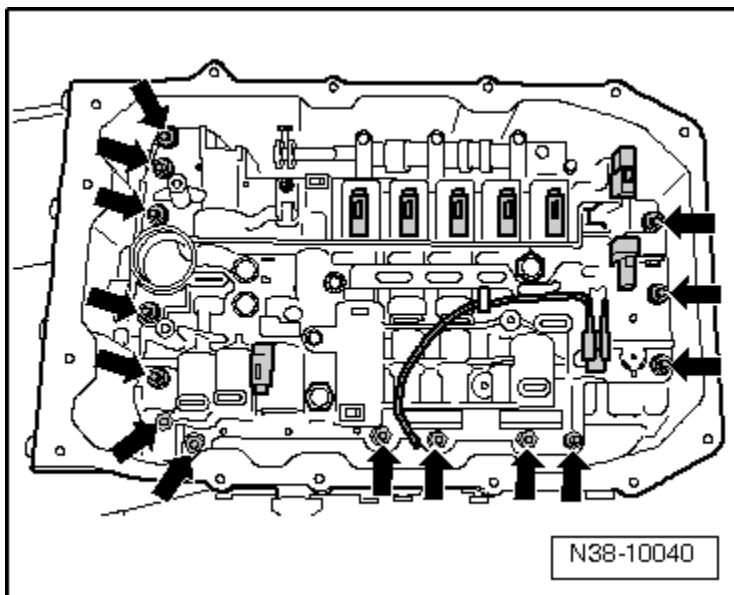
Tighten the bolts -2- to 20 Nm.

# Gears, Hydraulic Controls – 0C8

## Fastener Tightening Specifications

Component	Nm
Cover for multifunction transmission range switch	12
Gearshift lever, nut	12
<b>Multifunction transmission range switch</b>	
- Bolt	6
- Nut	7
Oil pan to transmission	8
Oil screen to transmission	10
Transmission fluid temperature sensor	10

## Valve Body Tightening Specifications



Automatic Trans. –  
0C8

Step	Bolts <sup>1)</sup>	Nm
1	Tighten bolts (➡) diagonally	Hand-tighten
2	Tighten bolts (➡) diagonally	8
3	Tighten bolts (➡) diagonally	an additional 90° (¼ turn)

<sup>1)</sup> Replace bolts that are tightened to the specification.

# TRANSFER CASE, FRONT FINAL DRIVE, REAR FINAL DRIVE

## *General, Technical Data – 0BU*

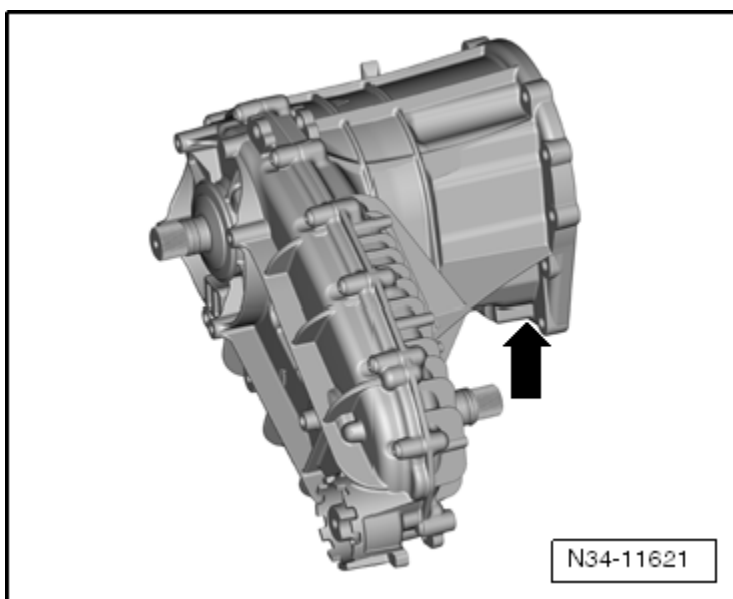
### Fastener Tightening Specifications

Component	Nm
<b>Front final drive</b>	
Front subframe, nut/bolts <sup>1)</sup>	90 plus an additional 90° (¼ turn)
Lock plate bolts <sup>1)</sup>	30 plus an additional 90° (¼ turn)
Transmission fluid filler plug to the front final drive	35
<b>Rear final drive</b>	
Driveshaft center bearing	20
Rear subframe, nut <sup>1)</sup>	90 plus an additional 90° (¼ turn)
Transmission fluid filler plug to the rear final drive bolt	35
Tunnel brace bolt	60

<sup>1)</sup> Replace fastener(s).

## General, Technical Data – 0BU

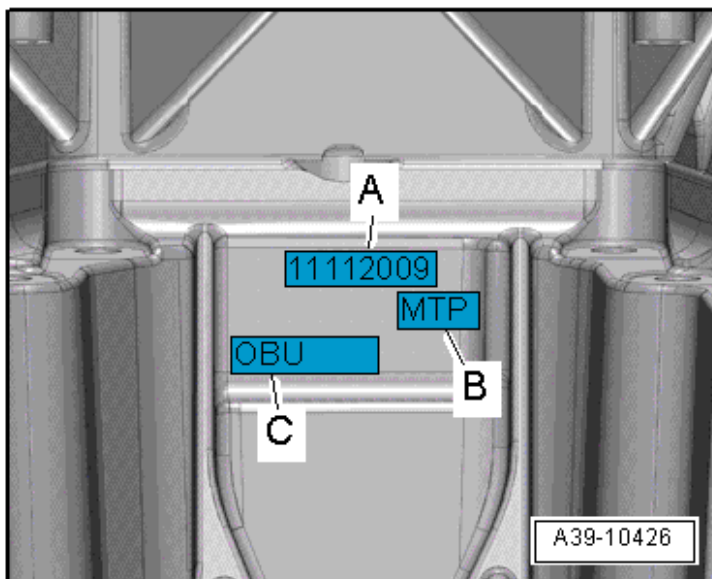
### Transfer Case Identification Location



Transfer case 0BU, code letters and dates of manufacture (➡).

Transfer Case, Front  
& Rear Final Drive

## Transfer Case Identification



A: Transfer case production date

B: Code letters MTP

C: Transfer case OBU with part number

### Example:

<b>MPT</b>	<b>11</b>	<b>11</b>	<b>2009</b>
Code letters	Day	Month	Year (2009) of manufacture

## Transfer Case Code Letter, Allocation and Capacities

Transfer case		OBU	
Code letters		MTP/LXW	MGF/MTR
Allocation	Type	Audi Q7 from 2007	Audi Q7 from 2007
Engine		3.0l - 165 kW, 176 kW TDI	3.0l - 200 kW, 245 kW TFSI
Capacity		Refer to Fluid Capacity Tables Rep. Gr. 03	

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

- Allocation for the proper vehicle via the code letters on the automatic transmission and PR number.
- Transmission fluid specification.



## Fastener Tightening Specifications

Component	Fastener size	Nm
Balance weight-to-transfer case bolt <sup>1) 2)</sup>	-	32
Transfer case drain/fill plug <sup>1) 3)</sup>	-	50
Bracket to transfer case <sup>4)</sup>	-	20
	-	50 plus an additional 90° (¼ turn)
Transfer case-to-transmission bolt <sup>1)</sup>	-	20 plus an additional 90° (¼ turn)
Transfer case carrier-to-underbody bolt <sup>1)</sup>	-	50 plus an additional 90° (¼ turn)
Transmission fluid filler plug on the transfer case <sup>5)</sup>	-	20

<sup>1)</sup> Replace fastener(s).

<sup>2)</sup> For bolt tightening clarification, refer to ElsaWeb, *Transfer Case Overview*, item 10.

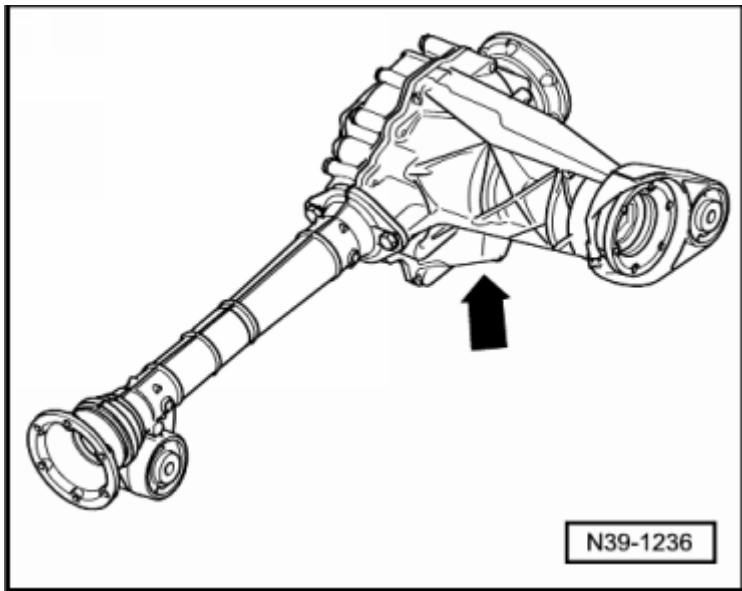
<sup>3)</sup> For bolt tightening clarification, refer to ElsaWeb, *Transfer Case Overview*, item 11.

<sup>4)</sup> For bolt tightening clarification, refer to ElsaWeb, *Transmission Support and Bracket Overview*, items 4, 5 and 6.

<sup>5)</sup> Insert the transmission fluid filler plug using locking fluid -AMV 185 101 A1-.

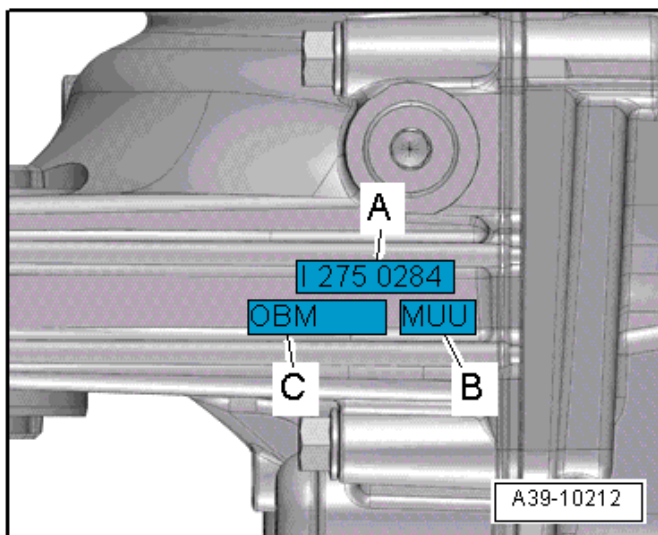
## ***Front Final Drive – 0BM, 0C1***

### **Front Final Drive Identification Location**



Front final drive 0BM, 0C1, code letters  
and dates of manufacture (➡).

## Front Final Drive Identification



A: Dates of Manufacture for the front final drive

B: Code letters MUU

C: Front final drive OBM and part number

### Example:

I	275	0284
Year of manufacture: 2009 I = 2009 K = 2010 L = 2011 M = 2012	Day of manufacture: 275th calendar day (always stated as three digits)	Serial number for the day of production

## Front Final Drive Code Letters, Allocation, Ratios and Capacities

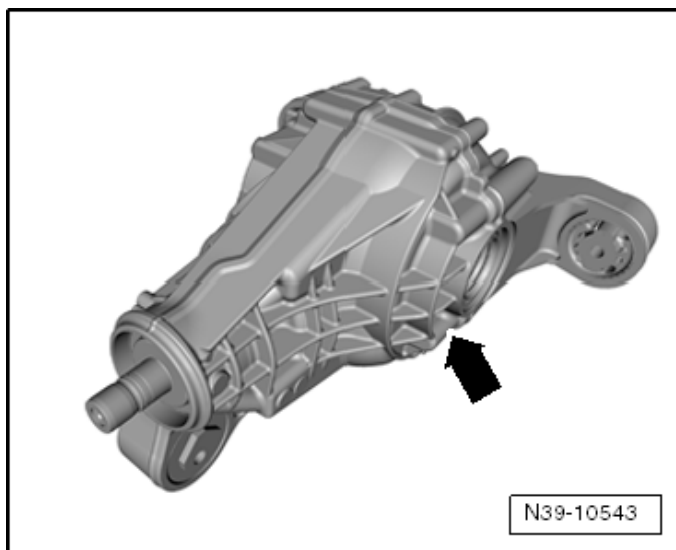
Front final drive		OBM	
Identification codes		MUN	MUU
Allocation	Type	Audi Q7 from 2007	Audi Q7 from 2007
	Engine	3.0I - 165 kW, 176 kW TDI	3.0I - 200 kW, 245 kW TFSI
Ratio: $Z_1: Z_2$	Final drive	36:11 = 3.272	37:10 = 3.700
Capacity		Refer to the Fluid Capacity Tables Rep. Gr. 03	

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

- Allocation of the flange shafts.
- Using the VIN and PR numbers for allocating to the proper vehicle.
- Transmission fluid specification.

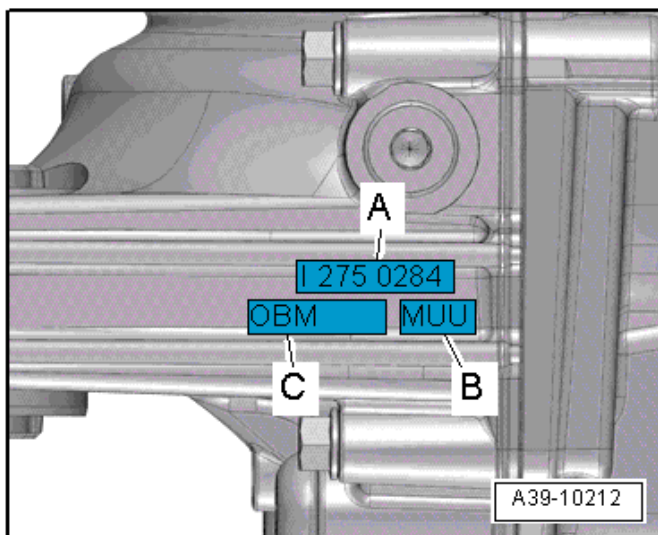
## Rear Final Drive – 0BN, 0BP

### Rear Final Drive Identification Location



Rear final drive 0BN, 0BP code letters and dates of manufacture (➡).

## Rear Final Drive Identification



A: Rear final drive 0BP and part number

B: Code letters MEY

C: Dates of Manufacture for the rear final drive

### Example:

I	275	0284
Year of manufacture: 2009 I = 2009 K = 2010 L = 2011 M = 2012	Day of manufacture: 275th calendar day (always stated as three digits)	Serial number for the day of production

## Rear Final Drive Code Letters, Allocation, Ratios and Capacities

Rear final drive		0BP	
Identification codes		MEX	MEY
Allocation	Type	Audi Q7 from 2007	Audi Q7 from 2007
	Engine	3.0l - 165 kW, 76 kW TDI	3.0l - 200 kW, 245 kW TFSI
Ratio: $Z_2 : Z_1$	Final drive	36:11 = 3.272	37:10 = 3.700
Capacity		Refer to Fluid Capacity Table Rep. Gr. 03	

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

- Allocation of the flange shafts.
- Using the VIN and PR numbers for allocating to the proper vehicle.
- Transmission fluid specification.

# SUSPENSION, WHEELS, STEERING

## General Information

### Chassis

<b>Front Suspension</b>	Double wishbone axle with subframe, stabilizer bar and twin gas-filled struts. Steel suspension or option air suspension with variable damping characteristics.
<b>Rear Suspension</b>	Double wishbone axle with loose upper steering levels, subframe, stabilizer bar and twin gas-filled struts. Steel suspension or option air suspension with variable damping characteristics.

### Steering

<b>Steering gear</b>	Rack-and-pinion steering with speed-dependent servo assist and variable steering ratio.
<b>Turning diameter</b>	Approximately 12.00 meters.

## Front Suspension

### Fastener Tightening Specifications

Component	Fastener Size	Nm
Air line	-	5
Bracket-to-wheel bearing housing	-	9
Coupling rod-to-stabilizer bar nut <sup>1)</sup>	-	110
Coupling rod-to-suspension strut nut <sup>1)</sup>	-	110
Cover plate-to-wheel bearing housing	-	20
CV joint boot clamp	-	25
Drive axle-to-final drive bolt <sup>1)</sup>	M10	50 plus an additional 90° (¼ turn)
	M12	90 plus an additional 90° (¼ turn)
Drive axle-to-wheel hub nut <sup>1)</sup>	-	500
Final drive-to-subframe bolt <sup>1)</sup>	-	90 plus an additional 90° (¼ turn)
Level control system sensor bolt	-	5

Component	Fastener Size	Nm
Level control system sensor-to-upper control arm nut	-	7
Looking plate-to-drive axle nut <sup>1)</sup>	M10	50 plus an additional 90° (¼ turn)
	M12	90 plus an additional 90° (¼ turn)
Lower control arm-to-subframe nut <sup>1)</sup>	-	180
Lower control arm-to-wheel bearing housing nut <sup>1)</sup>	-	105
Mounting bracket-to-body bolt <sup>1)</sup>	-	50 plus an additional 90° (¼ turn)
Residual pressure retaining valve-to-air spring	-	8
Shock absorber-to-air spring nut <sup>1)</sup>	-	60
Shock absorber-to-shock absorber mount nut, coil spring suspension <sup>1)</sup>	-	60
Stabilizer bar-to-coupling rod nut	-	110
Stabilizer bar-to-subframe bolt	-	60
Subframe-to-body bolt <sup>1)</sup>	-	120 plus an additional 180° (½ turn)
Suspension strut-to-lower control arm nut <sup>1)</sup>	-	150 plus an additional 90° (¼ turn)
Suspension strut-to-mounting bracket nut <sup>1)</sup>	-	30
Tie rod end to wheel bearing housing nut <sup>1)</sup>	-	90
<b>Upper control arm-to-mounting bracket <sup>1)</sup></b>		
- Coil spring suspension, nut	-	50 plus an additional 90° (¼ turn)
- Air spring suspension, bolt	-	50 plus an additional 90° (¼ turn)
Upper control arm-to-wheel bearing housing nut <sup>1)</sup>	-	85
Vibration damper-to-stabilizer bar bolt, tdi	-	60

<sup>1)</sup> Replace fastener(s).

# Rear Suspension

## Fastener Tightening Specifications

Component	Nm
ABS wheel speed sensor bolt	8
Air/coil spring suspension strut-to-crossmember bolt	60
Air/coil spring suspension strut and coupling rod-to-wheel bearing housing bolt <sup>1)</sup>	90 plus an additional 90° (¼ turn)
Coupling rod-to-stabilizer bar nut <sup>1)</sup>	100
Cover plate-to-wheel bearing housing bolt	20
	8
Crossmember-to-body bolt <sup>1)</sup>	90 plus an additional 120° (½ turn)
Drive axle-to-final drive bolt <sup>1)</sup>	50 plus an additional 90° (¼ turn)
Lower control arm-to-subframe <sup>1)</sup>	
- Front bolt	150 plus an additional 90° (¼ turn)
- Rear nut	180
Lower control arm-to-wheel bearing housing bolt <sup>1)</sup>	150 plus an additional 90° (¼ turn)
Mounting bracket-to-air spring bolt	30
Mounting bracket-to-coil spring strut nut	30
Protective cap-to-air spring shock absorber nut	7
Residual pressure retaining valve-to-air spring	8
Shock absorber-to-air spring nut <sup>1)</sup>	60
Shock absorber-to-coil spring rubber mount nut <sup>1)</sup>	60
Stabilizer bar-to-right connecting link	100
Stabilizer bar-to-subframe bolt	50
Stone protection plate-to-subframe bolt <sup>3)</sup>	1
Stone protection plate-to-subframe bolt <sup>1) 2)</sup>	120 plus an additional 180° (½ turn)
Suspension strut (air suspension)-to-crossmember	60
Subframe-to-body bolt <sup>1)</sup>	120 plus an additional 180° (½ turn)
Tie rod-to-subframe nut <sup>1)</sup>	180



Component	Nm
Tie rod-to-wheel bearing housing bolt <sup>1)</sup>	150 plus an additional 90° (¼ turn)
Upper front control arm-to-ubframe nut <sup>1)</sup>	90 plus an additional 90° (¼ turn)
Upper front control arm-to-wheel bearing housing bolt <sup>1)</sup>	150 plus an additional 90° (¼ turn)
Upper rear control arm-to-subframe nut <sup>1)</sup>	90 plus an additional 90° (¼ turn)
Upper rear control arm-to-wheel bearing housing bolt <sup>1)</sup>	150 plus an additional 90° (¼ turn)

<sup>1)</sup> Replace fastener(s).

<sup>2)</sup> Tighten in sequence. Refer to ElsaWeb, *Subframe, Stabilizer Bar, Coupling Rod and Stone Deflector*, item 21.

<sup>3)</sup> Tighten in sequence. Refer to ElsaWeb, *Steel Spring Shock Absorber or Air Spring Damper*, items 11 and 24.

## Self-Leveling Suspension

### Fastener Tightening Specifications

Component	Nm
Air supply unit bracket bolt	20
Air supply unit upper-to-lower part bolt	5
Body acceleration sensor bolt	8
Compressor unit and solenoid valve block bracket <sup>1)</sup>	
- Bolt	9
- Bolt	20
- Nut	9
Connector piece in solenoid valve block	3
Connector piece in residual pressure retaining valve	5
Connector piece in pressure reservoir	5
Connector piece in line connector (pressure reservoir t-piece)	3
Solenoid valve block bracket bolt	9
Solenoid valve block-to-bracket bolt	4

<sup>1)</sup> Tighten in sequence. Refer to ElsaWeb, *Air Supply Unit and Solenoid Value Block Overview*, items 19, 20, 21, 22 and 24.

# Wheels, Tires

## Fastener Tightening Specifications

Component	Nm
Adaptive cruise control sensor bracket bolt	8
Metal valve-to-wheel nut	4
Tire pressure monitoring control module-to-body bolt	2
Tire pressure sensor-to-metal valve bolt	4
Wheel bolt	160

## Wheel Alignment Data

### Wheel Alignment Specified Values

Specifications valid for all engine versions

Front sus- sension	Standard sus- sension (1BA)	Air sus- sension (1KB)	Sport sus- sension S-Line (1BV)	Comfort sus- sension (1BW)	Air spring sus- sension S-Line (2MB)
Caster angle	8° 10' +10'-30'	8° 35' +10'-30'	8° 10' +10'-30'	8° 10' +10'-30'	8° 35' +10'-30'
Maximum permissible difference between both sides	30'	30'	20'	30'	20'
Camber	-10' ± 15'	-10' ± 15'	-10' ± 15'	-10' ± 15'	-10' ± 15'
Maximum permissible difference between both sides	10'	10'	10'	10'	10'
Toe for each wheel	+7' ± 5'	+7' ± 5'	+7' ± 5'	+7' ± 5'	+7' ± 5'
Maximum permissible difference between both sides	5'	5'	5'	5'	5'
Toe angle difference at 20 degrees <sup>1)</sup>	1° 20' ± 30'	1° 30' ± 30'	1° 20' ± 30'	1° 20' ± 30'	1° 30' ± 30'

<sup>1)</sup> Wheel stop on outer wheel is reduced by this amount. It can also be indicated negatively in alignment computer, depending on manufacturer.

Rear suspension	Standard suspension (1BA)	Air suspension (1KB)	Sport suspension S-Line (1BV)	Comfort suspension (1BW)	Air spring suspension S-Line (2MB)
Camber	$-1^{\circ} 20' \pm 20'$	$-1^{\circ} 20' \pm 20'$	$-1^{\circ} 20' \pm 20'$	$-1^{\circ} 20' \pm 20'$	$-1^{\circ} 20' \pm 20'$
Maximum permissible difference between both sides	20'	20'	20'	20'	20'
Toe for each wheel	$+12' \pm 5'$	$+12' \pm 5'$	$+12' \pm 5'$	$+12' \pm 5'$	$+12' \pm 5'$
Maximum permissible difference between both sides	5'	5'	5'	5'	5'
Maximum permissible deviation in direction of travel relative to vehicle longitudinal axis	4'	4'	4'	4'	4'

# Steering

## Fastener Tightening Specifications

Component	Nm
<b>Belt pulley to power steering pump bolt</b>	
- V6 TDI	23
- V6 TFSI	25
Bracket for hydraulic oil cooler on condenser	9
Control line-to-steering gear bolt	12
Control line-to-steering gear banjo bolt	40
Handle-to-steering column bolt	4.5
Heat shield-to-steering gear bolt	10
Power steering line bracket bolt	9
Power steering pressure/return line-to-steering gear mounting bolt	9
Power steering pressure/return line-to-steering gear union nut	32
Power steering pressure/return line union nut	32
<b>Power steering pump to bracket bolt</b>	
- V6 TDI	23
- V6 TFSI	25
<b>Pressure line to power steering pump</b>	
- Banjo bolt	35
- Bolt, v6 tdi engine, generation i with scr and on a v6 tdi engine, generation ii	9
Protective boot nut <sup>1)</sup>	4
Reservoir to bracket bolt	8
Servotronic solenoid valve-to-steering gear bolt <sup>3)</sup>	3
Steering column-to-lateral control arm bolt/nut <sup>2)</sup>	20
Steering column-to-steering gear bolt <sup>1)</sup>	35 plus an additional 90° (¼ turn)
Steering gear-to-subframe nut <sup>1)</sup>	90 plus an additional 90° (¼ turn)
Steering wheel-to-steering column bolt <sup>1)</sup>	50
Tie rod-to-steering gear	100
Tie rod end-to-tie rod nut	70
Tie rod end-to-wheel bearing housing nut <sup>1)</sup>	90

<sup>1)</sup> Always replace after removal..

<sup>2)</sup> Follow tightening sequence.

<sup>3)</sup> Follow tightening sequence. Refer to ElsaWeb, *Servotronic Solenoid Valve N119*.

# BRAKE SYSTEM

## General Information

### Vehicle Data Label

TYP / TYPE	4LB 0FL
A — Q7 quat.	TDI3.0 V6171 KW DPF A6
MOTOR. / GETR. KB.	---
ENG. CODE / TRANS. CODE	---
LACKNR. / INNENAUSST.	LY7E
PAINT NO. / INTERIOR	CH
M.-AUSST. / OPTIONS	
X9X BOA CJ3 GOR HS9 JOZ D1D -	
B — - 1G1 2ZM 5RU 5SL T41	
OBB 3S2 OG7 8YQ 8GV	
C — 1KF 1LF - 7GG	
OY1 4UE 4X3 4K4 NSA STA	
8RY EOA OAB OBB	
OJZ OYZ 1BK	
	A00-10141

The following brakes are installed in this example:

- A - Model
- B - Front brakes - 1LF
- C - Rear brakes - 1KF

The vehicle data label can be found in the spare wheel well and the Maintenance booklet.

## Brakes

<b>Brembo 18 Inch Front Brakes</b>		
<b>Production Relevant No. (PR. No.)</b>		<b>1LF</b>
Brake caliper		Brembo 18"
Brake pad, thickness, without backing plate	mm	9
Brake pad, wear limit without backing plate	mm	2
Brake disc	Dia. in mm	350
Brake disc thickness	mm	34
Brake disc wear limit	mm	32
Brake caliper, 6 pistons	Dia. in mm	Each 2x 30/ 34/ 38 mm

<b>Rear Brakes (Disc Brakes 17" and 18")</b>			
<b>Production Relevant No. (PR. No.)</b>		<b>1KF</b>	<b>2EA</b>
Brake caliper		Brembo 17"	Brembo 18"
Brake pad, thickness	mm	11	1
Brake pad, wear limit without backing plate	mm	2	2
Brake disc	Dia. in mm	330	358
Brake disc thickness	mm	28	28
Brake disc wear limit	mm	26	26
Brake caliper, 4 pistons	Dia. in mm	Each 2 x 28/ 30 mm	Each 30

<b>Rear Wheel Brake, 18" Plus Disc Brake</b>		
<b>Production Relevant No. (PR. No.)</b>		<b>1KD</b>
Brake caliper		Brembo 18"
Brake pad, thickness	mm	11
Brake pad, wear limit without backing plate	mm	2
Brake disc	Dia. in mm	358
Brake disc thickness	mm	28
Brake disc wear limit	mm	26
Brake caliper, 4 pistons	Dia. in mm	Each 30

<b>Parking Brake, Drum Brake</b>		
Brake drum	Dia. in mm	210
Brake drum, wear limit	Dia. in mm	211
Brake pad, thickness	mm	30
Brake pad, remaining thickness	mm	5.5

# Anti-lock Brake System (ABS)

## Fastener Tightening Specifications

Component	Nm
ABS wheel speed sensor bolt	8
Brake lines at abs aggregate	14
ESP sensor unit nut	8
Hydraulic unit bracket bolt	5
Hydraulic unit-to-bracket bolt	8
Master cylinder-to-brake booster nut <sup>1)</sup>	49

<sup>1)</sup> Always replace after removal.

## Mechanical Components

### Fastener Tightening Specifications

Component	Nm
Brake disc cover plate bolt	20
<b>Brake line</b>	
- Brembo 18 inch front caliper, rear Brembo 17" and 18"	14
- Front ceramic brakes C/SIC	19
Brake line bracket-to-wheel bearing housing bolt, Brembo 18 inch front caliper	9
Brake line bracket-to-pivot bearing bolt, front ceramic brakes C/SIC	20
Brake line bracket-to-brake caliper bolt, rear Brembo 17" and 18"	8
Brake pedal mounting bracket bolt	8
Brake pedal-to-mounting bracket nut <sup>1)</sup>	20
Combination bracket-to-rear brake caliper bolt, ceramic brakes	8
Contact switch for parking brake bolt	2
Front brake caliper bolt <sup>1)</sup>	270
<b>Front brake disc to wheel hub bolt</b>	
- Exc. ceramic brakes C/SIC	15

## Fastener Tightening Specifications (cont'd)

Component	Nm
- Ceramic brakes C/SIC	10
Parking brake adjustment screw plug	14
Pedal parking brake lever-to-bracket bolt	23
Pedal parking brake transfer module bolt	23
<b>Rear brake caliper bolt <sup>1)</sup></b>	
- Exc. ceramic brakes	180
- Ceramic brakes	150 plus an additional 90° (¼ turn)
Rear brake disc-to-wheel hub bolt	14
Rear brake pad wear display cable bracket bolt, 18" plus	8
Tension strut bolt, Brembo 18 inch front caliper	30

<sup>1)</sup> Replace fastener(s).

## Hydraulic Components

### Fastener Tightening Specifications

Component	Nm
Brake booster-to-pedal support bolt <sup>2)</sup>	25
Brake caliper bleeder valve	12
Brake caliper connecting pipe <sup>1)</sup>	17
Brake line-to-master cylinder	14
Master cylinder-to-brake booster nut <sup>2)</sup>	49
Vacuum hose-to-vacuum pump bolt, diesel	5
Vacuum pump-to-engine bolt, diesel	9

<sup>1)</sup> Not installed on all models.

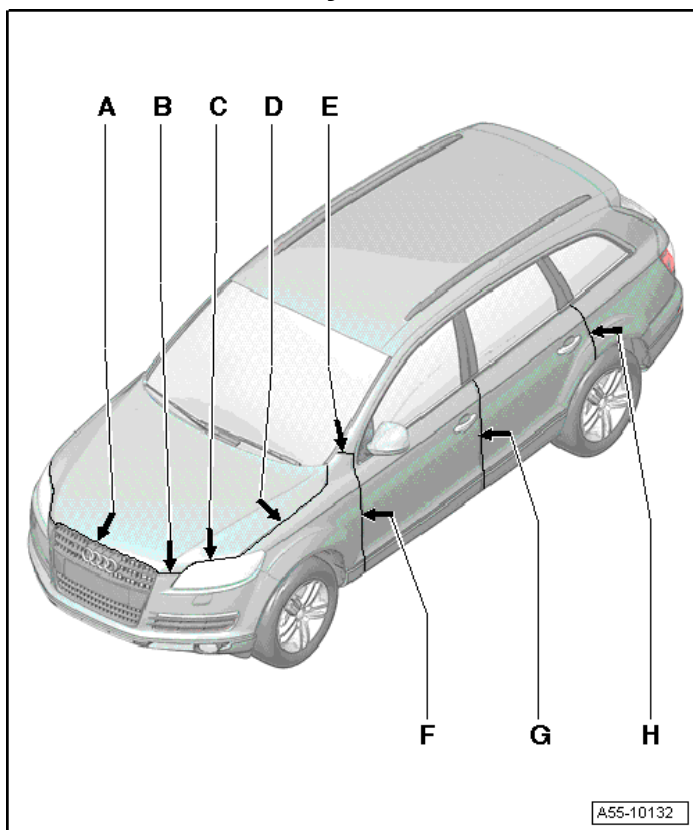
<sup>2)</sup> Always replace after removal.



# BODY

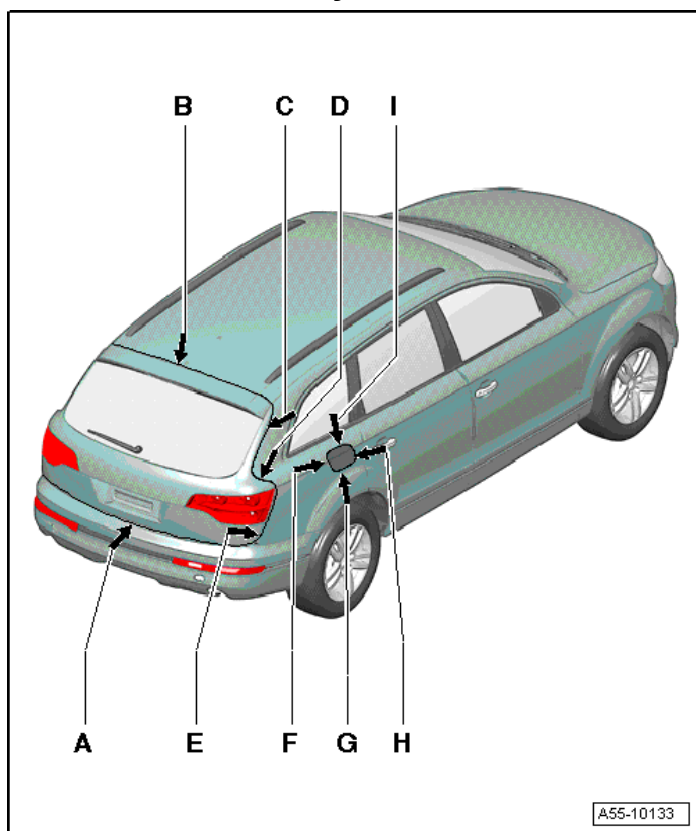
## Air Gap Body Dimensions

### Body, Front



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

## Body, Rear



Component	mm
A	5.0
B	4.5
C	4.5
D	5.5
E	4.5
F	2.0
G	2.0
H	2.0
I	2.0

## Body Exterior

### Lock Carrier, Plenum Chamber Fastener Tightening Specifications

Component	Nm
Bulkhead	8
Lock carrier bolt	25
Lock carrier screw	3
Bumper impact member bolt <sup>1)</sup>	22
	60

<sup>1)</sup> For bolt tightening clarification, refer to ElsaWeb, *Lock Carrier with Attachments*.

### Front Fender and Noise Insulation Fastener Tightening Specifications

Component	Nm
Front fender bolt	15
Front fender flange bolt	8
Front fender brace bolt	10
Front fender end plate screw	1.5
Front fender angle bolt	15
Muffler heat shield	4.5
<b>Noise insulation front and rear bolts</b>	
- Metal screw	2
- Bolts	8
Underbody trim panel	2

### Front Hood Fastener Tightening Specifications

Component	Nm
Front hood catch cap nut	11
Front hood gas strut ball head pin	14
Front hood lower part of lock from carrier bolt	11
Front hood hinge bolt/nut	21
Front wheel spoiler	2

## Rear Lid Fastener Tightening Specifications

Component	Nm
Rear lid hinge bolt	21
Rear lid gas strut ball head pin	20
Rear lid adjusting buffer combination screw	8
Rear lid striker pin nut	20
Rear lid bracket combination screw	8
Rear lid latch nut	21
Rear lid handle nut	8
Rear lid spoiler bolt	4
Rear wheel spoiler	2

## Front and Rear Door Fastener Tightening Specifications

Component	Nm
Upper door hinge securing nut	25
Lower door hinge combination screw	32
Side impact members screws	32
Door lock screw	20
Door lock bracket screw	2.5
Door lock screw	20
Door handle bolt	2.5
Window regulator motor screw	3.5

## Sunroof Fastener Tightening Specifications

Component	Nm
Panel motor screw	3.5
Front and rear glass panel bolt	4.5
Sunroof frame	8
Tilting mechanism bolt	2

## Front Bumper Fastener Tightening Specifications

Component	Nm
Bumper cover screw	6
Bumper cover bolt	6

## Rear Bumper Fastener Tightening Specifications

Component	Nm
Bumper bracket bolts	2
Bumper guide piece bolt	3
Side impact bar bolt	60
Side impact bar nuts	4.5

## Front and Rear Door Window Fastener Tightening Specifications

Component	Nm
Window regulator bolt	2.5
Window regulator nuts	6

## Mirror and Roof Rail Tightening Specifications

Component	Nm
Adjusting motor screw	1
Mirror base bolt	15

## ***Body Interior***

### Storage Compartment and Armrest Fastener Tightening Specifications

Component	Nm
Media control head bolt	0.85
Center console mounting bracket bolt	2
Center console lower part of support foot bolt	4 - 7.5
Storage compartment /ashtray unit bolt	2
Center armrest bolt	0.9 - 7.5
Glove compartment	1.4
Knee bar	10
Knee bar brace	3
Multi-box bolt	1 - 2

<sup>1)</sup> For bolt tightening clarification, refer to ElsaWeb, *Front Center Armrest with Foldable or Fixed Padding Overview*.

## Instrument Panel and Central Tube Fastener Tightening Specifications

<b>Component</b>	<b>Nm</b>
Instrument panel cover bolt	1.4
Driver central tube bolt	10
Driver knee bar brace bolt	3
Multibox bolt	6
Passenger central tube bolt	10
Passenger knee bar brace bolt	3
Glove compartment bolt	1.4

## Passenger Protection Fastener Tightening Specifications

<b>Component</b>	<b>Nm</b>
Belt anchor bolt	55
Front seat belt relay bolt	55
Front belt guide bolt	5
Belt height adjustment bolt	21
Front rollter/belt tensioner seat belt bolt	55
Front seat belt height adjuster relay bolt	55
Front seat belt height adjuster bolt	21
Belt relay bolt	55
Automated belt retractor bolt	55
Center second row 3-point seatbelt belt bolt/nut	55
Third row seat belt roller bolt	55
Driver and front head curtain bolt	5
Driver and front head curtain cap nut	9
Front passenger airbag bracket nut	7
Airbag control module J234 nuts	9
Crash sensor on front end bolt	9
Crash sensor to body bolt	9
Side head curtain airbag cap nuts	9
Battery interrupt igniter-to-positive wires bolt	20
Driver airbag unit on the steering wheel nut	7
Side airbag-to-backrest frame <sup>1)</sup>	10
Rear side airbag-to-backrest frame <sup>1)</sup>	10
Belt latch-to-seat	34.5
Belt guide-to-body	5
Seat occupied recognition control module (J706)	2.5

<sup>1)</sup> Replace fastern(s).

## Interior Trim Fastener Tightening Specifications

Component	Nm
Footrest trim bolt	3
Foot door trim mount bolt	2.5
Front door pocket bolt	2
Front door switch mount bolt	2.5
Front door trim bolt	2.5
Rear door trim mount bolt	2.5
Rear door pocket bolt	2
Rear door switch mount bolt	2.5
Rear door trim bolt	2.5
Rear door shunshade bolt	1.2
Headliner bolt	2-4
A-pillar trim bolt	2-3
Rear cross panel trim bolt	3.5
Rear lid trim bolt	1.5
Sill panel trim bolt	2.5
Sun visor bolt	3
Luggage compartment cover side storage compartment bolt	2
Molded headliner bolt	2

## Seat Frames Fastener Tightening Specifications

Component	Nm
Front seat frame bolt	45
Front seat bracket self-locking screw	45
2nd row console and mounting piece screw	50
Upper seat pan frame bolt	20
Upper seat pan frame self locking screw	28
Lumbar support adjustment switch bolt	0.5
Memory seat/steering column adjustment control module bolt	3.5
Seat trim bolt	2
Seat angle adjustment motor bolt	20

# HEATING AND AIR CONDITIONING

## *General, Technical Data*

### Refrigerant Oil Distribution

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

### Refrigerant R134a Vapor Pressure Table

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



# Air Conditioning

## Fastener Tightening Specifications

Component	Fastener size	Nm
Auxiliary heater ground connection	-	9
Compressor belt pulley drive plate (diesel)	-	35
Compressor bolt	-	25
Compressor driveshaft	-	60
Compressor drive plate hex socket head bolt	-	10
Compressor drive plate	-	30
Drive plate retaining screw (V6 gasoline)	-	20
Fluid reservoir	-	10
Front expansion valve	-	10
High pressure relief valve	-	10
High pressure sensor	-	5
Oil drain plug	-	30
Rear expansion valve	-	10
Rear fresh air blower control moduel	-	10
Rear refrigerant lines-to-retaining plate	-	10
Rear refrigerant line retaining plate-to-body	-	10
Refrigerant lines-to-compressor	-	20
Refrigerant lines-to-condenser	-	20
Refrigerant lines-to-front expansion valve	-	10
Refrigerant line connection points	M6	10
	M8	20
Refrigerant temperature sensor	-	8

# ELECTRICAL SYSTEM

## Communication

### Communication Fastener Tightening Specifications

<b>Component</b>	<b>Nm</b>
Antenna amplifiers	2
Digital sound system control module	5
Digital sound system control module 2 screw	3.5
Digital sound system control module 2 bracket screw	3
Front camera	2
Front information display control head	2
Navigation system with cd drive control module screw	2
Navigation system with cd drive control module nut	4
Radio	2
Rear DVD changer bracket nut	8
Rear DVD changer to bracket screw	2
<b>Rear view camera system</b>	
- Control module retainer to body nut	4
- Control module retainer to body nut	2
- Rear view camera	4
Roof antenna	6
Speakers, bass screw	4
Speakers, treble and midrange, screw	2
Telephone baseplate in center armrest	2
Tiptronic switch	3

# Electrical Equipment

## Battery, Starter, Generator, Cruise Control Tightening Specifications

Component	Nm
After run coolant pump bracket-to-longitudinal member (3.0L TDI)	22
Automatic Transmission Fluid (ATF) line-to-upper part of oil pan (3.0L TDI)	9
Automatic Transmission Fluid (ATF) line-to-transmission (3.0L TDI)	9
B+ wire-to-starter (3.0L TDI)	16
B+ wire-to-starter (3.0L TFSI)	15
Battery terminal-to-battery post	6
Battery jump start terminal-to-bracket	8
Energy management control module-to-chassis	20
Floor vent-to-battery cover	2
<b>Generator-to-engine</b>	
- 3.0L TFSI	23
- 3.0L TDI	22
Ground (GND) wire-to-energy management control module	20
Ground (GND) wire-to-ground point	20
<b>Starter-to-transmission</b>	
- 3.0L TDI upper bolt, without 16 mm open end wrench (T10388)	65
- 3.0L TDI upper bolt, with T10388 and torque wrench (VAG 1332)	53
- 3.0L TDI upper bolt, with T10388 and torque wrench (VAS 5820)	50
- 3.0L TDI lower bolt	45
- 3.0L starter-to-transmission lower bolt (Generation II)	65
Terminal 30/B+ to generator	16
Terminal 50-to-starter	8
Threaded pins with battery bracket-to-battery mount	20
Upper battery bracket-to-battery mount	9
Voltage stabilizer screws	4.5
Battery jump start terminal wires	15

## Instrument Fastener Tightening Specifications

Component	Nm
12V socket 5 nut	2
Data bus On Board Diagnostic (OBD) interface-to-chassis	3.5
Instrument cluster lining-to-instrument panel	1.4
Radio frequency controlled clock receiver at bumper cover	3.5
Signal horn/dual tone horn-to-bracket	10

## Windshield Wiper/Washer Fastener Tightening Specifications

Component	Nm
Headlamp washer nozzle-to-bumper cover	2.5
Rear window wiper motor-to-rear lid nut	8
Rear window wiper arm-to-wiper axle nut	12
Washer fluid reservoir-to-body	8
Windshield wiper arm-to-wiper axle nut	35
Windshield wiper motor-to-wiper frame bolt	11
Windshield wiper frame bolt	8
Windshield wiper fluid reservoir filler tube-to-coolant reservoir	8

## Exterior Lights, Switches Tightening Specifications

Component	Nm
Access/start authorization switch-to-mount	1.4
Center instrument panel relay and fuse panel-to-central tube	3
Cruise control switch-to-steering column electronic systems control module	0.65
Exterior mirror housing-to-mirror mount	0.9
Fog lamp housing-to-bumper cover	2
Mechanical steering column adjustment handle trim	4.5
Headlamp housing mount-to-lock carrier bolt	4.5
HID headlamp range contro module screw	1.4
HID headlamp control module-to-headlamp	1.4
HID headlamp ballast	1.4
HID headlamp power output stages	1.4
Lower trim-to-steering column	3
Mirror mount-to-cover	0.9
Mount with access/start authorization switch-to-instrument panel	1.4
Rear lid tail lamp nut	3.5
Rear lid closed sensor-to-rear lid end panel trim panel	0.9
Side marker lamp and turn signal housing-to-bumper cover	2.5
Steering column switch module	3
Steering column switch module-to-steering column electronic systems control module	0.65
Tail lamp cap nut	3.5
Tail lamp in rear bumper screw	2.5
Trim for steering column switch	0.6
Turn signal switch retainer bolt	3
Turn signal inside the exterior mirror to the cover	0.9
Turn signal LED in exterior mirror-to-cover	0.9
Windshield wiper/washer switch-to-steering column electronic systems control module	0.65

## Interior Lights, Switches Tightening Specifications

Component	Nm
Access/start authorization button-to-switch panel	0.8
Access/start authorization button-to-multimedial control head	0.8
Vehicle interior access/start authorization antenna 1-to-center console	3.5
Luggage compartment access/start authorization antenna-to-body	2
Air guide-to-air guide channel	1.4
Alarm horn-to-body	23
Ashtray housing-to-front center console frame	1.4
Bracket-to-alarm horn	8
Cover-to-E-box plenum chamber	2.5
Driver access/start authorization antenna-to-door trim	2
Front passenger access/start authorization antenna-to-door trim	2
Garage door opener control module-to-bumper cover	2.5
Inside door release mechanism-to-door trim	2.5
Interior/reading light-to-roof trim	2.6
Lane change assistance control modules screws	3.5
Lower trim-to-steering column	3.5
Steering column adjust switch-to-bottom trim	2.5
Sunroof regulator-to-interior/reading light	1.5
Steering column switch trim	0.6

## Wiring Tightening Specifications

Component	Nm
Antenna ground wire	9
Basemount with fuse pane-to-central tube for instrument panel	3
Cover-to-E-box plenum chamber	2.5
Electrical wires-to-main fuse panel	4.5
Floor vent-to-battery cover	2
Main fuse panel-to-body	6
Positive wires-to-main fuse panel	15
Relay and fuse panel-to-body	3
Side curtain airbag screws	4
E-box plenum chamber uper part-to-lower parts	1.2
Vehicle eletrical system control module-to-instrument panel central tube	4.5
Vehicle eletrical system control module 2 mount-to-seat console	2

# DTC CHART

## Engine Code - CNRB

### Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P00AF	Turbocharger Boost Pressure Actuator Control functional Check	Stuck open • Control deviation > 8.00 [%] or • Control deviation < -8.00 [%] • Actual position ≤ 30.00 [%]
P00C6	Fuel Rail Pressure System	Fuel rail, high pressure value < 12000 - 23000 kPa
P0045	Turbocharger Boost Control Solenoid Circuit Open	Diagnostic signal from power stage > 0.8 V (Out 1) and < 2 V (Out 2)
P0047	Turbocharger Boost Control Solenoid Circuit Grounded	Diagnostic signal from power stage = 8 - 18 A
P0048	Turbocharger Boost Control Solenoid Circuit High	Diagnostic signal from power stage = 8 - 18 A
P0071	Ambient Air Temperature Sensor Circuit Range/ Performance	• Temperature difference to ECT, ECT 2 > 40 °K • Temperature difference to T2, and FTS > 45 °K • Error bit = set
P0072	Ambient Air Temperature Sensor Circuit Low	AAT < -40 °C
P0087	Fuel Rail/System Pressure - Too Low	• Positive control deviation step 1 > 17000 - 50000 kPa • Positive control deviation step 2 > 15000 kPa • Minimum Fuel Rail Pressure < 0.00 - 12500 kPa
P0088	Fuel Rail/System Pressure - Too High	• Negative control deviation < -20000 kPa • Maximum rail pressure > 215000 kPa
P0090	Fuel Pressure Regulator Control Circuit Open	Signal Voltage < 4.7 V
P0091	Fuel Pressure Regulator Control Circuit Grounded	Signal Voltage < 2.97 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0092	Fuel Pressure Regulator Control Circuit Shorted to Battery Voltage	Signal Current > 3.0 A
P0101	Mass Air Flow Circuit Range/ Performance	Ratio of modeled and measured air mass flow > 1.15 or < 0.85
P0102	Mass Air Flow Circuit Low Input	MAF sensor signal (< 0.083 mSec.) > 900 kg/hr
P0103	Mass Air Flow Circuit High Input	MAF sensor signal (> 4.5 mSec.) ≤ 0 kg/hr
P0104	Mass Air Flow Circuit Intermittent	MAF sensor signal period = not measurable
P0111	Intake Air Temperature Circuit Performance	<ul style="list-style-type: none"> <li>• Temperature difference to ECT, ECT 2 &gt; 35 °K</li> <li>• Temperature difference to FTS &gt; 40 °K</li> <li>• Temperature difference to T1 &gt; 45 °K</li> </ul>
P0112	Intake Air Temperature Sensor Circuit Low Input	Signal voltage < 162 mV
P0113	Intake Air Temperature Sensor Circuit High Input	Signal voltage > 3255 mV
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/ Performance	<ul style="list-style-type: none"> <li>• ECT increase &lt; f(ECT @ start) °K and</li> <li>• Engine running time &gt; f(ECT @ start) Sec</li> </ul> or <ul style="list-style-type: none"> <li>• Temperature difference to ECT 2 &gt; 30 °K</li> <li>• Temperature difference to T2, FTS &gt; 35 °K</li> <li>• Temperature difference to T1 &gt; 40 °K</li> </ul>
P0117	Engine Coolant Temperature Sensor 1 Circuit Low	Signal voltage < 162 mV
P0118	Engine Coolant Temperature Sensor 1 Circuit High	Signal voltage > 3255 mV
P0128	Engine Coolant Temperature Sensor Rationality Check	ECT @ cylinder head < 66 [°C]



DTC	Error Message	Malfunction Criteria and Threshold Value
P0130	O2 Sensor Circuit (Bank 1, Sensor 1) Malfunction	Short to Battery Voltage: <ul style="list-style-type: none"> <li>• Virtual mass &gt; 3.0 V</li> <li>• Nernst voltage &gt; 4.0 V</li> <li>• Adjustment voltage &gt; 6 V</li> </ul> Shorted to Ground: <ul style="list-style-type: none"> <li>• Virtual mass &lt; 2 V</li> <li>• Nernst voltage &lt; 1.75 V</li> <li>• Adjustment voltage &lt; 0.9 V</li> </ul>
P0132	O2 Sensor Circuit (Bank 1 Sensor 1) High Voltage	O2 signal > 3.2 V
P0133	O2 Circuit (Bank 1, Sensor 1) Slow Response	<ul style="list-style-type: none"> <li>• Oxygen 30 - 70% time &gt; 5 Sec</li> <li>• Time to reach 60% oxygen &gt; 5 Sec.</li> </ul>
P0134	O2 Sensor Circuit Bank 1 Sensor 1 No Activity Detected / Feedback Check	<ul style="list-style-type: none"> <li>• Integrated oxygen sensor temperature &gt; 280000 - 917476 Kelvin</li> <li>• Oxygen sensor heating not active</li> </ul>
P0135	O2 Sensor Heater Circuit (Bank 1 Sensor 1) Malfunction	<ul style="list-style-type: none"> <li>• Sensor element temperature &lt; 720 or &gt; 840 °C</li> <li>• Power stage active and signal current = -100 to 10000 uA</li> <li>• Power stage not active and signal current = -1000 to -350 uA</li> <li>• Power stage not active and signal current = -100 to 100 uA</li> </ul>
P016A	Fuel Trim, Feedback Check	Control intervention 0%
P0171	Fuel Trim, System Lean	Fuel mass correction value ≤ -0.03 [g/rev]
P0172	Fuel Trim, System too Rich	Fuel mass correction value ≥ 0.03 [g/rev]
P0181	Fuel Temperature Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Number of Dected Faults ≥ 6.00[-]</li> </ul> Cross checks for fault detection: <ul style="list-style-type: none"> <li>• FTS vs. ECT @ cylinder head &gt; 35 K</li> <li>• FTS vs. IAT &gt; 40 K</li> <li>• FTS vs. EOT &gt; 35 K</li> <li>• FTS vs. AAT &gt; 45 K</li> <li>• FTS vs. ECT @ radiator outlet &gt; 35 K</li> <li>• FTS vs. ECT @ cylinder block &gt; 35 K</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0182	Fuel Temperature Sensor Circuit Grounded	Signal voltage < 0.10 V
P0183	Fuel Temperature Sensor Circuit Shorted to Battery Voltage / Open	Signal Voltage > 4.9 V
P0191	Fuel Rail Pressure Sensor Circuit Range/Performance	Signal voltage < 0.428 V or > 0.613 V
P0192	Fuel Rail Pressure Sensor A Circuit Low Input	Signal voltage < 0.2 V
P0193	Fuel Rail Pressure Sensor Circuit High Input	Signal voltage > 4.8 V
P01BA	Engine Oil Temperature Sensor 2 Performance	<ul style="list-style-type: none"> <li>• EOT cross checks for fault detection: <math>\geq 6</math> detected faults</li> <li>• EOT vs. ECT 3, IAT, FTS, AAT or ECT 2 &gt; 30 Kelvin</li> </ul>
P01BB	Engine Oil Temperature Sensor 2 Circuit Low	Signal voltage < 0.20 V for $\geq 5$ s
P01BC	Engine Oil Temperature Sensor 2 Circuit High	Signal voltage > 4.85 V for $\geq 5$ Sec.
P01BD	Engine Oil Temperature Sensor 2 Circuit Intermittent / Erratic	<ul style="list-style-type: none"> <li>• Oil temperature increase &lt; 3.0 K</li> <li>• Oil temperature &lt; 66 °C</li> <li>• Evaluation timer &gt; 59 - 251 s</li> </ul>
P01E3	Engine Temperature Control Sensor Circuit Shorted to Battery Voltage	Signal voltage > 4.92 V
P01E4	Engine Temperature Control Sensor Circuit Range/ Performance	ETC vs IAT or AAT or FTS at start up > 35 Kelvin
P01E5	Engine Temperature Control Sensor Circuit Grounded	Signal voltage < 0.22 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0201	Cylinder 1 Injector Circuit Malfunction	<ul style="list-style-type: none"> <li>• Open circuit signal voltage &gt; 60 V</li> <li>• Short to battery voltage (low side) signal voltage = failure</li> <li>• Short circuit over load signal Voltage &gt; 30 V</li> </ul> Short circuit low side: <ul style="list-style-type: none"> <li>• Deviation between set and actual signal voltage after charging, Injector voltage &gt; 30% of nominal voltage</li> <li>• Deviation between set and actual signal voltage before charging, Injector voltage &gt; 45% of nominal voltage</li> </ul>
P0202	Cylinder 2 Injector Circuit Malfunction	<ul style="list-style-type: none"> <li>• Open circuit signal voltage &gt; 60 V</li> <li>• Short to battery voltage (low side) signal voltage = failure</li> <li>• Short circuit over load signal Voltage &gt; 30 V</li> </ul> Short circuit low side: <ul style="list-style-type: none"> <li>• Deviation between set and actual signal voltage after charging, Injector voltage &gt; 30% of nominal voltage</li> <li>• Deviation between set and actual signal voltage before charging, Injector voltage &gt; 45% of nominal voltage</li> </ul>
P0203	Cylinder 3 Injector Circuit Malfunction	<ul style="list-style-type: none"> <li>• Open circuit signal voltage &gt; 60 V</li> <li>• Short to battery voltage (low side) signal voltage = failure</li> <li>• Short circuit over load signal Voltage &gt; 30 V</li> </ul> Short circuit low side: <ul style="list-style-type: none"> <li>• Deviation between set and actual signal voltage after charging, Injector voltage &gt; 30% of nominal voltage</li> <li>• Deviation between set and actual signal voltage before charging, Injector voltage &gt; 45% of nominal voltage</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P0204	Cylinder 4 Injector Circuit Malfunction	<ul style="list-style-type: none"> <li>• Open circuit signal voltage &gt; 60 V</li> <li>• Short to battery voltage (low side) signal voltage = failure</li> <li>• Short circuit over load signal Voltage &gt; 30 V</li> </ul> Short circuit low side: <ul style="list-style-type: none"> <li>• Deviation between set and actual signal voltage after charging, Injector voltage &gt; 30% of nominal voltage</li> <li>• Deviation between set and actual signal voltage before charging, Injector voltage &gt; 45% of nominal voltage</li> </ul>
P0205	Cylinder 5 Injector Circuit Malfunction	<ul style="list-style-type: none"> <li>• Open circuit signal voltage &gt; 60 V</li> <li>• Short to battery voltage (low side) signal voltage = failure</li> <li>• Short circuit over load signal Voltage &gt; 30 V</li> </ul> Short circuit low side: <ul style="list-style-type: none"> <li>• Deviation between set and actual signal voltage after charging, Injector voltage &gt; 30% of nominal voltage</li> <li>• Deviation between set and actual signal voltage before charging, Injector voltage &gt; 45% of nominal voltage</li> </ul>
P0206	Cylinder 6 Injector Circuit Malfunction	<ul style="list-style-type: none"> <li>• Open circuit signal voltage &gt; 60 V</li> <li>• Short to battery voltage (low side) signal voltage = failure</li> <li>• Short circuit over load signal Voltage &gt; 30 V</li> </ul> Short circuit low side: <ul style="list-style-type: none"> <li>• Deviation between set and actual signal voltage after charging, Injector voltage &gt; 30% of nominal voltage</li> <li>• Deviation between set and actual signal voltage before charging, Injector voltage &gt; 45% of nominal voltage</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P0234	Turbo Charger Overboost Condition Limit Exceeded	Control deviation < -22 kPa
P0236	Turbocharger Boost Sensor A Circuit Range/Performance	Absolute value of pressure difference > 14 kPa
P0237	Turbocharger Boost Sensor A Circuit Low Input	Sensor voltage < 0.40 V
P0238	Turbocharger Boost Sensor A Circuit High Input	Signal voltage > 4.90 V
P026A	Charge Air Cooler Below Efficiency	Filtered charge air cooler efficiency < 7
P0263	Cylinder 1 Contribution/Balance Internal Check	Diagnostic signal from power stage = Failure
P0266	Cylinder 2 Contribution/Balance Internal Check	<ul style="list-style-type: none"> <li>• Diagnostic signal from power stage = Failure</li> <li>• Adaptive Value Limit High &gt; 213 - 412 [μs]</li> <li>• Adaptive Value Limit Low &lt; 213 - 412 [μs]</li> </ul>
P0269	Cylinder 3 Contribution/Balance Internal Check	<ul style="list-style-type: none"> <li>• Diagnostic signal from power stage = Failure</li> <li>• Adaptive Value Limit High &gt; 213 - 412 [μs]</li> <li>• Adaptive Value Limit Low &lt; 213 - 412 [μs]</li> </ul>
P0272	Cylinder 4 Contribution/Balance Internal Check	<ul style="list-style-type: none"> <li>• Diagnostic signal from power stage = Failure</li> <li>• Adaptive Value Limit High &gt; 213 - 412 [μs]</li> <li>• Adaptive Value Limit Low &lt; 213 - 412 [μs]</li> </ul>
P0275	Cylinder 5 Contribution/Balance Internal Check	<ul style="list-style-type: none"> <li>• Diagnostic signal from power stage = Failure</li> <li>• Adaptive Value Limit High &gt; 213 - 412 [μs]</li> <li>• Adaptive Value Limit Low &lt; 213 - 412 [μs]</li> </ul>
P0278	Cylinder 6 Contribution/Balance Internal Check	<ul style="list-style-type: none"> <li>• Diagnostic signal from power stage = Failure</li> <li>• Adaptive Value Limit High &gt; 213 - 412 [μs]</li> <li>• Adaptive Value Limit Low &lt; 213 - 412 [μs]</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0299	Turbo Charger Underboost	Control deviation > 30 - 100 kPa with f (engine coolant temp)
P2002	Particulate Trap Bank 1 Efficiency Below Threshold	<ul style="list-style-type: none"> <li>• Differential pressure &lt; f (volumetric flow rate, soot load)</li> <li>or</li> <li>• Differential pressure &lt; f (volumetric flow rate)</li> </ul>
P2004	Intake Manifold Runner Control (Bank 1) Stuck Open	<ul style="list-style-type: none"> <li>• Control deviation &gt; 10%</li> <li>• Actual position ≤ 40%V</li> </ul>
P2005	Intake Manifold Runner Control (Bank 2) Stuck Open	<ul style="list-style-type: none"> <li>• Control deviation &gt; 10%</li> <li>• Actual position ≤ 40%V</li> </ul>
P2006	Intake Manifold Runner Control (Bank 1) Stuck Closed	<ul style="list-style-type: none"> <li>• Control deviation &gt; 10%</li> <li>• Actual position &gt; 40%V</li> </ul>
P2007	Intake Manifold Runner Control (Bank 2) Stuck Closed	<ul style="list-style-type: none"> <li>• Control deviation &gt; 10%</li> <li>• Actual position &gt; 40%V</li> </ul>
P2008	Intake Manifold Runner (Bank 1) Control Circuit/Open	<ul style="list-style-type: none"> <li>• Diagnostic signal from power stage &gt; 0.8 V (output 1) and &lt; 2 V (output 2)</li> <li>or</li> <li>• Diagnostic signal from power stage = 8 to 18 A</li> <li>or</li> <li>• Diagnostic signal from power stage &gt; 5 V or &lt; 3.4 V</li> </ul>
P2009	Intake Manifold Runner (Bank 1) Control Circuit Low	Diagnostic signal from power stage 8 to 18 A
P2010	Intake Manifold Runner Control Circuit High (Bank 1)	Diagnostic signal from power stage = 8 to 18 A
P2011	Intake Manifold Runner (Bank 2) Control Circuit Stuck Open	<ul style="list-style-type: none"> <li>• Diagnostic signal from power stage &gt; 0.8 V (output 1) and &lt; 2 V (output 2)</li> <li>or</li> <li>• Diagnostic signal from power stage = 8 to 18 A</li> <li>or</li> <li>• Diagnostic signal from power stage &gt; 5 V or &lt; 3.4 V</li> </ul>
P2012	Intake Manifold Runner Bank 2 Control Circuit Low	Diagnostic signal from power stage 8 to 18 A
P2013	Intake Manifold Runner Bank 2 Control Circuit High	Diagnostic signal from power stage = 8 to 18 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P2015	Intake Manifold Runner Position Sensor/Switch Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Position sensor signal &lt; 3550 mV</li> <li>• Position sensor signal &gt; 1450 mV</li> </ul> or <ul style="list-style-type: none"> <li>• Position sensor signal &gt; 550 mV and &lt; 250 mV</li> </ul> or <ul style="list-style-type: none"> <li>• Position sensor signal &gt; 4450 mV and &lt; 4750 mV</li> </ul>
P2016	Intake Manifold Runner Position Sensor Circuit Low	Position sensor signal $\leq$ 250 mV
P2017	Intake Manifold Runner Position Sensor Circuit High	Position sensor signal $\geq$ 4750 mV
P202A	Reducing Agent Tank Heater Control Circuit/Open	Conductance @ start of heating $\leq$ 0.10 1/Ohm
P202B	Reducing Agent Tank Heater Control Circuit Low	Conductance @ start of heating < 0.30 1/Ohm
P202C	Reducing Agent Tank Heater Control Circuit High	Conductance @ start of heating > 1.50 1/Ohm
P2020	Intake Manifold Runner Position Sensor Circuit (Bank 2) Range/Performance	<ul style="list-style-type: none"> <li>• Position sensor signal &lt; 3550 mV</li> <li>• Position sensor signal 1450 mV</li> </ul> or <ul style="list-style-type: none"> <li>• Position sensor signal &gt; 550 mV and &lt; 250 mV</li> </ul> or <ul style="list-style-type: none"> <li>• Position sensor signal &gt; 4450 mV and &lt; 4750 mV</li> </ul>
P2021	Intake Manifold Runner Position Sensor Circuit (Bank 2) Low	Position sensor signal $\leq$ 250 mV
P2022	Intake Manifold Runner Position Sensor Circuit (Bank 2) High	Position sensor signal $\geq$ 4750 mV

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P203B	Reducing Agent Level Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Signal Voltage not equal Full Level &lt; 1.76 V or &gt; 2.02 V</li> <li>or</li> <li>• Signal Voltage not Equal Half Full Level , 2.03 V or &gt; 2.31 V</li> <li>or</li> <li>• Signal Voltage not Equal Empty Level &lt; 1.32 V or &gt; 1.53 V</li> <li>or</li> <li>• Signal Voltage not Equal SCR Values &lt; 0.25 V &gt; 2.35 V</li> </ul>
P203C	Reducing Agent Level Sensor Circuit Open or Grounded	Signal Voltage < 0.25 V
P203D	Reducing Agent Level Sensor Circuit Short to Battery Voltage	Signal Voltage > 2.35 V
P2031	Exhaust Gas Temperature Sensor 2 Circuit	Signal voltage > 1652 mV
P2032	Exhaust Gas Temperature (Sensor 2) Circuit Low	Signal voltage < 330 mV
P204A	Reducing Agent Pressure Sensor Circuit Open / Short Ground	Signal voltage < 0.8 V
P204B	Reducing Agent Pressure Sensor Circuit Range/ Performance	Actual pressure Reduction Agent delivery system > 50.00 kPa
P204D	Reducing Agent Pressure Sensor Circuit High	Signal voltage > 4.90 V
P2047	Reducing Agent Injection Valve Circuit Open	Signal Voltage < 4.7 V
P2048	Reducing Agent Injection Valve Circuit Grounded	<ul style="list-style-type: none"> <li>• Signal Voltage &lt; 2.97 V</li> <li>or</li> <li>• Signal Current &gt; 1.6 A</li> </ul>
P2049	Reducing Agent Injection Valve Circuit Short to Battery Voltage	<ul style="list-style-type: none"> <li>• Signal Current &gt; 1.8 A</li> <li>or</li> <li>• Analog measure &lt; 200 mA</li> </ul>
P205A	Reducing Agent Tank Temperature Sensor Circuit Short to Battery Voltage or Open	Signal voltage > 4.30 V



DTC	Error Message	Malfunction Criteria and Threshold Value
P205B	Reducing Agent Tank Temperature Sensor Circuit Range/Performance	Case 1: <ul style="list-style-type: none"> <li>AAT &gt; 25 °C</li> <li>Difference between Reducing agent (AdBlue®) to ECT &lt; -30 °K</li> </ul> Case 2: <ul style="list-style-type: none"> <li>AAT &lt; 25 °C</li> <li>Difference between reducing agent (AdBlue®) to ECT &lt; -30 °K</li> <li>Reducing agent temperature increase while heating tank &lt; 1.5 K</li> <li>For time &lt; 1500.0 s</li> </ul>
P205C	Reducing Agent Tank Temperature Sensor Circuit Grounded	Signal voltage < 0.04 V
P207F	Reducing Agent Quality Performance	Average efficiency < 0.50 [-]
P208A	Reducing Agent Pump Control Circuit/Open	Signal voltage > 4.7 V
P208C	Reducing Agent Pump Control Circuit Grounded	Signal voltage < 2.74 V
P208D	Reducing Agent Pump Control Circuit High	Signal current > 4.0 A
P208E	Reducing Agent Injection Valve Stuck Closed (Bank 1 Unit 1)	Missing number of signal peaks > 50
P2080	Exhaust Gas Temperature Sensor Circuit Bank 1 Range/Performance	<ul style="list-style-type: none"> <li>Temperature difference to temp EGR T3, T4, T5, T6 &gt; 60 °K</li> </ul> or <ul style="list-style-type: none"> <li>Mean value of modeled to measured T4 &gt; 100 °K</li> </ul>
P2084	Exhaust Gas Temperature Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> <li>Temperature difference to temp EGR T3, T4, T5, T6 &gt; 60 °K</li> </ul> or <ul style="list-style-type: none"> <li>Mean value of modeled to measured T3 &gt; 100 °K</li> </ul>
P20BB	Reducing Agent Tank Heater Control Circuit Shorted to Ground	Diagnostic signal from power stage < 2.97 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P20BC	Reducing Agent Tank Heater Control Circuit Shorted to Battery Voltage	Diagnostic signal from power stage > 2.2 A
P20BD	Reducing Agent Heater 2 Control Circuit/Open	Diagnostic signal from power stage > 4.7 V
P20BF	Reducing Agent Heater 2 Control Circuit/Low	Diagnostic signal from power stage < 2.97 V
P20B5	Reducing Agent Metering Unit Heater Control Circuit/Open	Conductance during heating $\leq 0.10$ 1/Ohm
P20B7	Reducing Agent Metering Unit Heater Control Circuit Low	Conductance @ start heating < 0.30 1/Ohm
P20B8	Reducing Agent Metering Unit Heater Control Circuit High	Conductance @ start heating > 1.00 1/Ohm
P20B9	Reducing Agent Tank Heater Control Circuit Open	Diagnostic signal from power stage < 4.7 V
P20C0	Reducing Agent Heater 2 Control Circuit High	Diagnostic signal from power stage > 2.2 A
P20EE	SCR NOx Catalyst Efficiency Below Threshold	Difference between calculated and measured efficiency < 0.2[-]
P20E8	Reducing Agent Pressure Too Low / Functional Check	<ul style="list-style-type: none"> <li>• Actual pressure &lt; 300.00 kPa for 55 s</li> <li>or</li> <li>• Actual pressure &lt; 400.00 kPa for 60 s</li> <li>or</li> <li>• Pressure built up for 21.00[-] Attempts &gt; 350 kPa</li> </ul>
P20E9	Reducing Agent Pressure Too High	<ul style="list-style-type: none"> <li>• Actual pressure &gt; 790.00 kPa for 0.0 s</li> <li>or</li> <li>• Actual pressure &gt; 650.00 kPa for 10 s</li> <li>or</li> <li>• Pressure @ Dosing end &gt; 50 kPa</li> </ul>
P20F4	Reducing Agent Consumption Too High	SCR adaptive value $\geq 1.79$
P20F5	Reducing Agent Consumption Too Low	SCR adaptive value $\leq 0.51$

## Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random/Multiple Cylinder. Misfire Detected	<ul style="list-style-type: none"> <li>• Rise in engine speed after fuel injection Calculated based on values from last two engine revolutions</li> <li>• Error threshold 82% misfire over 440 crankshaft revolutions</li> </ul>
P0301	Cylinder 1 Misfire Detected	<ul style="list-style-type: none"> <li>• Rise in engine speed after fuel injection Calculated based on values from last two engine revolutions</li> <li>• Error threshold 82% misfire over 440 crankshaft revolutions</li> </ul>
P0302	Cylinder 2 Misfire Detected	<ul style="list-style-type: none"> <li>• Rise in engine speed after fuel injection Calculated based on values from last two engine revolutions</li> <li>• Error threshold 82% misfire over 440 crankshaft revolutions</li> </ul>
P0303	Cylinder 3 Misfire Detected	<ul style="list-style-type: none"> <li>• Rise in engine speed after fuel injection Calculated based on values from last two engine revolutions</li> <li>• Error threshold 82% misfire over 440 crankshaft revolutions</li> </ul>
P0304	Cylinder 4 Misfire Detected	<ul style="list-style-type: none"> <li>• Rise in engine speed after fuel injection Calculated based on values from last two engine revolutions</li> <li>• Error threshold 82% misfire over 440 crankshaft revolutions</li> </ul>
P0305	Cylinder 5 Misfire Detected	<ul style="list-style-type: none"> <li>• Rise in engine speed after fuel injection Calculated based on values from last two engine revolutions</li> <li>• Error threshold 82% misfire over 440 crankshaft revolutions</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0306	Cylinder 6 Misfire Detected	<ul style="list-style-type: none"> <li>• Rise in engine speed after fuel injection Calculated based on values from last two engine revolutions</li> <li>• Error threshold 82% misfire over 440 crankshaft revolutions</li> </ul>
P0321	Ignition/Distributor Engine Speed Input Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Counted teeth vs. reference &gt; 200</li> <li>• Monitoring reference gap failure</li> </ul>
P0322	Ignition/Distributor Engine Speed Input Circuit No Signal	<ul style="list-style-type: none"> <li>• Camshaft signals &gt; 10</li> <li>• Engine speed = no signal</li> </ul>

### **Additional Exhaust Regulation**

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P04DD	Cold Start EGR Insufficient Flow Detected	Control deviation < f(engine speed, injection quantity, target air mass flow)
P04DE	Cold Start EGR Excessive Flow Detected	Ratio of modeled and measured air mass flow > f(turbo charger position)
P040B	Exhaust Gas Recirculation Temperature Sensor Circuit Range/Performance	Thank you for the feedback the repair manual has been updated.
P040C	Exhaust Gas Recirculation Temperature Sensor Circuit Low	Signal voltage < 0.68 V
P040D	Exhaust Gas Recirculation Temperature Sensor Circuit High	Signal voltage > 2.61 V
P0401	Exhaust Gas Recirculation Insufficient Flow Detected	Control deviation < f (engine speed, injection quantity, target air mass flow)
P0402	Exhaust Gas Recirculation Excessive Flow Detected	Ratio of modeled and measured air mass flow > 1.3

DTC	Error Message	Malfunction Criteria and Threshold Value
P0403	Exhaust Gas Recirculation Actuator Circuit Functional Check	<ul style="list-style-type: none"> <li>• Control deviation &gt; 10%</li> <li>or</li> <li>• Control deviation &lt; -10.00 [%]</li> <li>or</li> <li>• Actual position ≤ 17.00 [%]</li> <li>• Control deviation &gt; 10.00 [%]</li> <li>or</li> <li>• Control deviation &lt; -10.00 [%]</li> <li>• Actual position &gt; 17.00 [%]</li> </ul> Open circuit: <ul style="list-style-type: none"> <li>• Signal voltage &gt; 0.8; &lt; 2.0 [V]</li> </ul> Short to ground: <ul style="list-style-type: none"> <li>• Signal current &gt; 8 - 18 [A]</li> </ul> Short to battery voltage: <ul style="list-style-type: none"> <li>• Signal current &gt; 8 - 18 [A]</li> </ul>
P0404	Exhaust Gas Recirculation Control Circuit Range/ Performance	<ul style="list-style-type: none"> <li>• Control deviation &gt; 10%</li> <li>• Actual position &gt; 17%</li> </ul>
P0405	Exhaust Gas Recirculation Sensor Circuit Low	Position sensor signal < 0.25 V
P0406	Exhaust Gas Recirculation Sensor Circuit High	Position sensor signal ≥ 4.75 V
P0420	Catalyst System (Bank 1) Efficiency Below Threshold	Ratio of measured and modeled heat < 0.3
P046C	Exhaust Gas Recirculation Sensor Circuit Range/ Performance	Position sensor signal > 1.025 V

## Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P050A	Cold Start Idle Air Control System Performance	Idle speed control deviation more than 10% under or 10% above desired idle speed
P050E	SCR Catalyst, Temperature, Plausibility Check	Exhaust gas temperature < 150 °C
P0501	Vehicle Speed Sensor A Range/Performance	Vehicle speed < 4 km/h
P0502	Vehicle Speed Sensor Circuit Low	Sensor signal failure
P0506	Idle Air Control System - RPM Lower Than Expected	Control deviation < 10%

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0507	Idle Air Control System - RPM Higher Than Expected	Control deviation > 10%
P052F	Glow Plug Control Module System Voltage	Error message from Glow Control Unit.
P0544	Exhaust Gas Temperature Sensor Circuit Short to Battery Voltage or Open	Signal voltage > 2.61 V
P0545	Exhaust Gas Temperature Sensor Circuit Low	Signal voltage < 0.68 V

### **Control Module and Output Signals**

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P06BA	Cylinder 2 Glow Plug Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Glow plug resistance (between 4 - 9 Sec.) &lt; 0.3 ohm</li> <li>• Glow plug resistance (between 9 - 14 Sec.) &lt; 0.4 ohm</li> <li>• Glow plug resistance (after 14 Sec.) &lt; 0.5 ohm</li> <li>• Glow plug resistance anytime &gt; 1.2 ohm</li> </ul>
P06BB	Cylinder 3 Glow Plug Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Glow plug resistance (between 4 - 9 Sec.) &lt; 0.3 ohm</li> <li>• Glow plug resistance (between 9 - 14 Sec.) &lt; 0.4 ohm</li> <li>• Glow plug resistance (after 14 Sec.) &lt; 0.5 ohm</li> <li>• Glow plug resistance anytime &gt; 1.2 ohm</li> </ul>
P06BC	Cylinder 4 Glow Plug Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Glow plug resistance (between 4 - 9 Sec.) &lt; 0.3 ohm</li> <li>• Glow plug resistance (between 9 - 14 Sec.) &lt; 0.4 ohm</li> <li>• Glow plug resistance (after 14 Sec.) &lt; 0.5 ohm</li> <li>• Glow plug resistance anytime &gt; 1.2 ohm</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P06BD	Cylinder 5 Glow Plug Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Glow plug resistance (between 4 - 9 Sec.) &lt; 0.3 ohm</li> <li>• Glow plug resistance (between 9 - 14 Sec.) &lt; 0.4 ohm</li> <li>• Glow plug resistance (after 14 Sec.) &lt; 0.5 ohm</li> <li>• Glow plug resistance anytime &gt; 1.2 ohm</li> </ul>
P06BE	Cylinder 6 Glow Plug Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Glow plug resistance (between 4 - 9 Sec.) &lt; 0.3 ohm</li> <li>• Glow plug resistance (between 9 - 14 Sec.) &lt; 0.4 ohm</li> <li>• Glow plug resistance (after 14 Sec.) &lt; 0.5 ohm</li> <li>• Glow plug resistance anytime &gt; 1.2 ohm</li> </ul>
P06B9	Cylinder 1 Glow Plug Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Glow plug resistance (between 4 - 9 Sec.) &lt; 0.3 ohm</li> <li>• Glow plug resistance (between 9 - 14 Sec.) &lt; 0.4 ohm</li> <li>• Glow plug resistance (after 14 Sec.) &lt; 0.5 ohm</li> <li>• Glow plug resistance anytime &gt; 1.2 ohm</li> </ul>
P06E5	Glow Plug Control Module Performance	Calculated ground offset $\geq 1.75$ V or $\leq -1.75$
P06FE	Cold Start Diesel Intake Air Flow Control Performance	Signal low
P0604	Internal Control Module Random Access Memory (RAM) Error	Read/write error bit set
P0605	Internal Control Module Read Only Memory (ROM) Error	Internal self test failed
P0606	Internal Control Module Memory Check Sum Error	<ul style="list-style-type: none"> <li>• ECM internal self test failed</li> <li>• RAM error in memory</li> </ul>
P0607	Control Module Performance	<ul style="list-style-type: none"> <li>• Oxygen sensor adaptation &gt; 0.2 V or &lt; -0.2 V</li> <li>• Internal communication failed</li> <li>• Supply voltage for IC &lt; 9 V</li> </ul> or <ul style="list-style-type: none"> <li>• Sensor voltage &lt; 0.265 V or &gt; 3.9 V</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0634	ECM Internal Temperature Too High	Current Over-Temperature diagnostic signal from output driver • Power stage temperature > 170 °C
P0638	Throttle Actuator Control (Bank 1) Range/Performance	Diagnostic signal = low state
P064C	Glow Plug Control Module	Received incorrect number of cylinders or glow plug type is unequal to ECU application = error bit
P0641	Sensor Reference Voltage A Circuit/Open	Voltage supply < 4.7 V or > 5.3 V
P0651	Sensor Reference Voltage B Circuit/Open	Voltage supply < 4.7 V or > 5.3 V
P066A	Cylinder 1 Glow Plug Control Circuit Low	Glow current $\geq$ 70 A
P066C	Cylinder 2 Glow Plug Control Circuit Low	Glow current $\geq$ 70 A
P066E	Cylinder 3 Glow Plug Control Circuit Low	Glow current $\geq$ 70 A
P067A	Cylinder 4 Glow Plug Control Circuit Low	Glow current $\geq$ 70 A
P067B	Cylinder 4 Glow Plug Control Circuit High	Error message from Glow Control Unit
P067C	Cylinder 5 Glow Plug Control Circuit Low	Glow current $\geq$ 70 A
P067D	Cylinder 5 Glow Plug Control Circuit High	Error message from Glow Control Unit
P067E	Cylinder 6 Glow Plug Control Circuit Low	Glow current $\geq$ 70 A
P067F	Cylinder 6 Glow Plug Control Circuit High	Error message from Glow Control Unit
P0671	Cylinder 1 Glow Plug Circuit	Glow current $\leq$ 2.20 A
P0672	Cylinder 2 Glow Plug Circuit	Glow current $\leq$ 2.20 A
P0673	Cylinder 3 Glow Plug Circuit	Glow current $\leq$ 2.20 A
P0674	Cylinder 4 Glow Plug Circuit	Glow current $\leq$ 2.20 A
P0675	Cylinder 5 Glow Plug Circuit	Glow current $\leq$ 2.20 A
P0676	Cylinder 6 Glow Plug Circuit	Glow current $\leq$ 2.20 A



DTC	Error Message	Malfunction Criteria and Threshold Value
P0683	Glow Plug Control Module to PCM Communication Circuit	LIN message no feedback
P0697	Sensor Reference Voltage C Circuit/Open	Voltage supply < 4.7 V or > 5.3 V
U0001	High Speed CAN Communication Bus	CAN message, no feedback
U0002	High Speed CAN Communication Bus Performance	Global time out. Receiving no messages.
U0028	Vehicle Communication Bus A	CAN message = no feedback
U0029	Vehicle Communication Bus A Performance	Global time out. Receiving no messages.
U0101	Lost Communication with TCM	No TCM messages received.
U0106	Lost Communication with Glow Plug Control Module	No message received
U0121	Lost Communication with Anti-Lock Brake System (ABS) Control Module	No CAN messages received from ABS module
U0140	Lost Communication with Body Control Module	No CAN messages from BCM
U0146	Lost Communication with Gateway "A"	CAN messages from Gateway = no message.
U0155	Lost Communication with Instrument Panel Cluster (IPC) Control Module	No CAN messages received from Instrument cluster
U02A3	Lost Communication with PM Sensor	No CAN message received
U0302	Software Incompatibility with Transmission Control Module	Auto trans messages received from ECM
U0307	Software Incompatibility with Glow Plug Control Module	Error bit = set
U0402	Invalid Data Received From Transmission Control Module	Wrong TCM messages received.
U0407	Invalid Data Received From Glow Plug Control Module	Implausible messages received
U0415	Invalid Data Received From Anti-Lock Brake System Control Module	<ul style="list-style-type: none"> <li>• Error bit = set</li> <li>• Implausible data from ABS</li> <li>or</li> <li>• Speed sensor signal = 655.35 km/h</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	Error message sent from instrument cluster = invalid data
U0447	Invalid Data Received From Gateway "A"	Implausible message from gateway
U04A4	NOx Sensor Communication Check / Signal Range Check	Communication error
U1006	NOx Sensor 1 (Front) No communication	No messages from NOx sensor 1 module
U1024	Communications Bus Fault	Error bit set
U1034	NOx Sensor 1 (Front) Implausible Signal	Data from NOx sensor 1 module implausible
U10C1	NOx Sensor 1 (Rear) Implausible Signal	Data from NOx sensor 2 module implausible
U10C2	NOx Sensor 1 (Rear) No Communication	No messages from NOx sensor 2 module
P1103	ECM: Production Mode	Production mode = Active

### **Fuel and Air Ratios Control Module**

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P1419	Exhaust Gas Recirculation Cooler Switch-Over Valve 2 Short Circuit to Voltage	Diagnostic signal from power stage > 1.5 A
P146D	Reducing Agent Tank Heater Short Circuit to Voltage	Signal voltage > 3.27 V
P146F	Heater 2 for Reducing Agent Short Circuit to Voltage	Signal voltage > 4.70 V
P148F	Exhaust Gas Recirculation Cooler Switch-Over Valve 2 Electrical Malfunction	Diagnostic signal from power stage < 2.97 V
P1499	Exhaust Gas Recirculation Cooler Switch-Over Valve 2 Open Circuit/Short Circuit to Ground	Diagnostic signal from power stage > 4.5 V
P149D	Reducing Agent Transfer Pump Circuit Open	Signal voltage < 4.70 V
P149E	Reducing Agent Transfer Pump Circuit Grounded	Signal voltage < 2.97 V

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P149F	Reducing Agent Transfer Pump Circuit Short to Battery Voltage	Signal Current > 3.0 A
P150A	Engine Off Time Performance	ECM time - IPC time > 12 Sec.
P2100	Throttle Actuator Control Motor Circuit/Open	Signal from power stage > 3.26 V and < 5.40 V
P2101	Throttle Actuator Control Motor Circuit Range/Performance	Signal = no change
P2102	Throttle Actuator Control Motor Circuit Low	Signal from power stage ≤ 3.26 V
P2103	Throttle Actuator Control Motor Circuit High	Signal from power stage > 1.50 V and > 50 mA
P2122	Throttle/Pedal Position Sensor/Switch D Circuit Low Input	Signal voltage < 0.646 V
P2123	Throttle/Pedal Position Sensor/Switch D Circuit High Input	Signal voltage > 4.889 V
P2127	Throttle/Pedal Position Sensor/Switch E Circuit Low Input	Signal voltage < 0.276 V
P2128	Throttle/Pedal Position Sensor/Switch E Circuit High Input	Signal voltage > 2.644 V
P2138	Throttle/Pedal Position Sensor/Switch D/E Voltage Correlation	Signal voltage sensor 1 vs. sensor 2 > 143 - 260 mV
P2146	Fuel Injector Group "A" Supply Voltage Circuit Open	Diagnostic signal from power stage = internal signal
P2149/ P2152	Fuel Injector Group C Supply Voltage Circuit/Open	Diagnostic signal from power stage = internal signal
P2181	Engine Coolant Temperature Sensor On Radiator Outlet Circuit Rationality Check	Deviation between target and measured ECT < -7.5 Kelvin
P2183	Engine Coolant Temperature Sensor On Radiator Outlet Circuit Cross Check	ECT 2 at radiator outlet vs IAT or AAT or FTS at start up > 35 Kelvin
P2184	Engine Coolant Temperature Sensor On Radiator Outlet Circuit Grounded	Signal voltage < 162 mV

DTC	Error Message	Malfunction Criteria and Threshold Value
P2185	Engine Coolant Temperature Sensor On Radiator Outlet Circuit Short to Battery Voltage	Signal voltage > 3255 mV
P2195	O2 Sensor Signal Stuck Lean (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>• Measured oxygen concentration @ fuel cutoff &gt; 25.6%</li> <li>or</li> <li>• Measured oxygen concentration @ part load &gt; (calculated) 6.5%</li> </ul>
P2196	O2 Sensor Signal Stuck Rich (Bank 1, Sensor 1)	Measured oxygen concentration @ fuel cutoff > 14.7%
P220A	NOx Sensor Front Circuit Supply Voltage	Sensor supply voltage > 1.5 or < 12 V
P220B	NOx Sensor Rear Supply Voltage Circuit	Sensor supply voltage > 1.5
P2200	NOx Sensor Front Circuit Failure	NOx sensor signal ratio of validity > = 0.50 [-]
P2201	NOx Sensor Circuit Range/ Performance	<ul style="list-style-type: none"> <li>• NOx 40 - 70%, time &gt; 5 Sec. or 40% value not reached within 7 Sec.</li> <li>• Ratio &gt; 3 or &lt; -0.75</li> <li>• Average NOx Offset value &gt; 50 or &lt; -30 ppm</li> </ul>
P2202	NOx Sensor Front Circuit Low	NOx value < -105 ppm
P2203	NOx Sensor Front Circuit High	NOx value > 1655 ppm
P2209	NOx Sensor Front Rationality Check	NOx control active time since dew point exceeded
P2237	O2 Sensor Positive Current Control Circuit (Bank 1 Sensor 1) Open	Measured oxygen concentration < 0.005
P2243	O2 Sensor Reference Voltage Circuit (Bank 1 Sensor 1) Open	<ul style="list-style-type: none"> <li>• O2S internal resistance &gt; 3 V</li> <li>• Oxygen signal &lt; -1.3 V or &gt; 1.5 V</li> </ul>
P2251	O2 Sensor Negative Current Control Circuit (Bank 1 Sensor 1) Open	<ul style="list-style-type: none"> <li>• O2S internal resistance voltage &gt; 3 V</li> <li>• Oxygen signal &lt; -1.3 V or &gt; 1.5 V</li> </ul>
P2263	Turbocharger Boost System Performance	Control deviation > 8%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2279	Turbocharger Boost Pressure Intake Air System Leak	Ratio of measured and modeled mass air flow = 0.45 - 0.80[-]
P229E	NOx Sensor Rear Circuit Short or Open	<ul style="list-style-type: none"> <li>• Message From NOx Sensor = Failure</li> </ul> or <ul style="list-style-type: none"> <li>• NOx sensor status ratio of validity <math>\geq 0.5[-]</math></li> </ul>
P229F	NOx Sensor Rear Circuit Range /Performance	<ul style="list-style-type: none"> <li>• Average NOx offset value &gt; 50 ppm</li> <li>• Number of checks = 2</li> </ul> or <ul style="list-style-type: none"> <li>• Average NOx offset value &gt; 50 or &lt; -30 ppm</li> <li>• Number of checks = 2[-]</li> </ul> or <ul style="list-style-type: none"> <li>• Measured oxygen concentration compared with calculated oxygen concentration deviation @ part load &gt; 5.3%</li> </ul>
P2294	Fuel Pressure Metering Valve Control Circuit Open	Signal Voltage < 4.7 V
P2295	Fuel Pressure Metering Valve Control Circuit Grounded	Signal Voltage < 2.97 V
P2296	Fuel Pressure Metering Valve Control Circuit Short to Battery Voltage	Signal Current > 3.0 A
P22A0	NOx Sensor Rear Circuit Low	NOx value < -105 ppm
P22A1	NOx Sensor Rear Circuit High	NOx value > 1655 ppm
P22A7	NOx Sensor Rear Rationality Check	NOx control active time since dew point exceeded >180 s

### Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P240F	Exhaust Gas Recirculation Slow Response	<ul style="list-style-type: none"> <li>• Calculated characteristic value (for positive gradients of desired air flow) &gt; 70</li> </ul> or <ul style="list-style-type: none"> <li>• Calculated characteristic value (for negative gradients of desired air flow) &gt; 50</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P242A	Exhaust Gas Temperature Sensor Circuit (Bank 1 Sensor 3)	Signal voltage > 1652 mV
P242B	Exhaust Gas Temperature Sensor Circuit (Bank 1 Sensor 3) Range/Performance	<ul style="list-style-type: none"> <li>• Temperature difference to EGR temp, T3, T4, T5, T6 &gt; 60 °K</li> <li>or</li> <li>• Mean value of modeled - measured T5 &gt; 100 °K</li> </ul>
P242C	Exhaust Gas Temperature Sensor Circuit Low (Bank 1 Sensor 3)	Signal voltage < 330 mV
P2425	Exhaust Gas Recirculation Cooling Valve Control Circuit Open	Diagnostic signal from power stage > 4.5 V
P2426	Exhaust Gas Recirculation Cooling Valve Control Circuit Low	Diagnostic signal from power stage < 2.97 V
P2427	Exhaust Gas Recirculation Cooling Valve Control Circuit Shorted Battery Voltage	Diagnostic signal from power stage > 2.2 A
P244C	Exhaust Temperature Too Low For Particulate Filter Regeneration (Bank 1)	Time to closed loop 120 - 300 Sec.
P245B	Exhaust Gas Recirculation Cooler Bypass Control Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Positive difference between measured and target temperature too high = 10.0 - 70.0 [K]</li> <li>or</li> <li>• Negative difference between measured and target temperature too low = -12.0 -7.0 [K]</li> </ul>
P2452	Diesel Particulate Filter Differential Pressure Sensor Circuit	Sensor voltage > 4.9 V
P2453	Diesel Particulate Filter Differential Pressure Sensor Circuit Range/Performance	Pressure drop > 3 kPa or < -3 kPa
P2454	Diesel Particulate Filter Differential Pressure Sensor Circuit Low	Sensor voltage < 0.2 V
P2458	Diesel Particulate Filter Regeneration Duration	Time of regen duration > 3600 Sec

DTC	Error Message	Malfunction Criteria and Threshold Value
P2459	Diesel Particulate Filter Regeneration Frequency	Measured soot mass > f(volumetric flow rate) grams
P246E	Exhaust Gas Temperature Sensor Circuit (Bank 1 Sensor 4)	Signal voltage > 1652 mV
P246F	Exhaust Gas Temperature Sensor Circuit (Bank 1 Sensor 4) Range/Performance	<ul style="list-style-type: none"> <li>• Temperature difference to EGR temp, T3, T4, T5, T6 &gt; 60 °K</li> <li>or</li> <li>• Mean value of modeled - measured T5 &gt; 100 °K</li> </ul>
P2463	Diesel Particulate Filter - Soot Accumulation	Calculated particulate matter trap loading > 40 g
P247A	Exhaust Gas Temperature Out of Range (Bank 1 Sensor 3)	Control deviation (T5) > 200 K or < -100 K
P2470	Exhaust Gas Temperature Sensor Circuit Low (Bank 1 Sensor 4)	Signal voltage < 330 mV
P24AE	PM Sensor Functional Check / Shorted or Open	<ul style="list-style-type: none"> <li>• Current (IDE) @ measurement 1 &lt; 2 µA</li> <li>• Difference between current (IDE) measurement 1 and 2</li> <li>or</li> <li>• Signal voltage positive connection (IDE) &gt; 4.7 [V]</li> <li>• Signal voltage positive connection (IDE) &lt; 0.3 [V]</li> </ul>
P24AF	PM Sensor Monitoring, Rationality Check	<ul style="list-style-type: none"> <li>• Signal current (IDE) &gt; 5 µA</li> <li>or</li> <li>• Accumulated change in heater voltage ≤ 0.40 V</li> </ul>
P24B1	PM Sensor Circuit Shorted or Open	<ul style="list-style-type: none"> <li>• Signal voltage negative connection (IDE) &gt; 4.1 [V]</li> <li>• Signal voltage negative connection (IDE) = 0.0 [V]</li> </ul>
P24B3	PM Sensor Heater functional Check	<ul style="list-style-type: none"> <li>• Heater Coil resistance &gt; 1.06 - 2.31 Ω</li> <li>• Heater Coil resistance &lt; 2.94 - 5.13 Ω</li> </ul>
P24B5	PM Sensor Heater Short to Ground	<ul style="list-style-type: none"> <li>• Heater Current &lt; 1.0 A</li> <li>or</li> <li>• Heater Current &gt; 15.0 A</li> </ul>
P24B6	PM Sensor Heater Short to Battery Voltage	Heater current ≥ 0.2 A

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P24C7	PM Sensor Plausibility Check	Measured sensor temperature vs. mean value of modeled temperature < -100 Kelvin
P24CC	Reducing Agent Tank Cap Switch Functional Check	Dosed + Offset amount of Reducing Agent Mass $\geq$ 27.2 kg
P24CD	Reducing Agent Tank Cap Switch Circuit Short to Ground	Signal Voltage < 0.65 V
P24CE	Reducing Agent Tank Cap Switch Circuit Short Battery Voltage	Signal Voltage > 1.2 V
P24D0	PM Sensor Monitoring, Range / Performance Check	Signal range check low: difference between measured PM Sensor supply wire voltage and battery voltage (ECM): <ul style="list-style-type: none"> <li>• Value &gt; 1.90 [V]</li> <li>or</li> <li>• Value &gt; 2.60 [V]</li> <li>or</li> <li>• Value &gt; 3.00 [V]</li> </ul> Signal Range Check High: difference between measured battery voltage (ECM) and Sensor supply wire voltage: <ul style="list-style-type: none"> <li>• Value &gt; 3.00 [V]</li> <li>or</li> <li>• Value &gt; 2.10 [V]</li> <li>or</li> <li>• Value &gt; 1.10 [V]</li> </ul>
P2564	Turbocharger Boost Control Position Sensor Circuit Low	Sensor signal voltage < 0.15 V
P2565	Turbocharger Boost Control Position Sensor Circuit High	Sensor signal voltage > 4.85 V
P261A	Coolant Pump "B" Control Circuit/Open	<ul style="list-style-type: none"> <li>• Open circuit signal voltage &lt; 5 V</li> <li>• Functional voltage = 3.2 - 3.5 V</li> </ul>
P261C	Coolant Pump "B" Control Circuit Low	Signal voltage < 3 V
P261D	Coolant Pump "B" Control Circuit High	Signal voltage > 1.8 V



DTC	Error Message	Malfunction Criteria and Threshold Value
P268A	Fuel Injector Calibration Not Learned/Programmed	Accumulated global release time of zero fuel calibration but disabled by rail pressure deviation.
P310E	Exhaust Gas Recirculation Cooler Bypass Valve 2 Implausible Signal	Measured temperature < 0.8
P3348	Turbocharger Control Module Circuit Malfunction	<ul style="list-style-type: none"> <li>• Diagnostic signal from power stage = 8 - 18 A</li> <li>or</li> <li>• Diagnostic signal from power stage &gt; 5 V or &lt; 3.4 V</li> </ul>

# DTC CHART

## Engine Code - CTWA, CTWB

### Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Intake (A) Camshaft Position Slow Response (Bank 1 or Bank 2)	<ul style="list-style-type: none"> <li>• Adjustment angle difference &lt; 5° CA</li> <li>• Number of checks 10 times</li> </ul>
P000B	Exhaust (B) Camshaft Position - Slow Response (Bank 1)	<ul style="list-style-type: none"> <li>• Difference between target and actual position &gt; 10° - 22° CRK for 2 - 3 s</li> <li>• Number of checks 10 times</li> </ul>
P000C	Intake (A) Camshaft Position Response check (Bank 1 or Bank 2)	<ul style="list-style-type: none"> <li>• Adjustment angle difference &lt; 5° CRK</li> <li>• Number of checks 10 times</li> </ul>
P000D	Exhaust (B) Camshaft Position - Slow Response (Bank 2)	<ul style="list-style-type: none"> <li>• Difference between target and actual position &gt; 10° - 22° CRK for 2 - 3 s</li> <li>• Adjustment angle <math>\geq 3^\circ</math> CRK</li> </ul>
P00A2	Intake Air Temperature Sensor after Intercooler 2 Short to Ground	Intake air temperature < 0.099 V
P00A3	Intake Air Temperature Sensor after Intercooler 2 Open Circuit	Intake Air Temperature > 3.20 V
P00A6	Intake Air Temperature Sensor after Intercooler 2 Open Circuit S4 only	<ul style="list-style-type: none"> <li>• Difference value: IAT-ECT @ engine start (depending on engine-off time, &gt; 26.5° C and</li> <li>• Difference value: IAT- AAT @ engine start (depending on engine-off time), &gt; 26.5° C and</li> <li>• Difference AAT vs. ECT at engine start &lt; 26.5° C (depending on engine off time)</li> </ul>
P007C	Intake Air Temperature Sensor after Intercooler 1	IAT < 0.099 V
P007D	Intake Air Temperature Sensor after Intercooler 1	IAT > 3.20 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P008A	Low Pressure Fuel System Pressure - Too Low	Actual pressure • < 0.08 MPa
P008B	High Pressure Fuel System Pressure - Too High	Actual pressure for Q7 • Actual press > 146 psi Actual pressure for A6 • > 116 psi
P0010	Intake (A) Camshaft Position Actuator Circuit/Open (Bank 1)	Signal voltage > 4.4 - 5.6 V
P0011	Intake (A) Camshaft Position Timing - Over-Advanced (Bank 1)	• Adjustment angle difference >8° - 10° CA • Number of checks 3 times
P0013	Camshaft Position Actuator Circuit / Open (Bank 1)	Signal current < 0.8 mA
P0014	Exhaust (B) Camshaft Position - Timing Over - Advanced (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, Bank 2)	Adaptive value > 139° CRK
P0017	Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A) Exhaust	Camshaft/crankshaft • Adaptive value > 70°CA
P0018	Crankshaft Position - Camshaft Position Correlation (Bank 1 Bank 2)	Adaptive value < 75° CRK
P0019	Crankshaft Position - Camshaft Position Correlation (Bank 2 Sensor A) Exhaust	Misalignment • Adaptive value < 142° CA
P0020	Intake (A) Camshaft Position Actuator Circuit / Open (Bank 1)	Signal current < 0.8 mA
P0021	Intake (A) Camshaft Position Timing - Over-Advanced (Bank 1)	• Adjustment angle difference > 10° CRK • Number of checks 3 times
P0023	Camshaft Position Actuator Circuit / Open (Bank 2)	Signal current < 0.8 mA
P0024	Exhaust (B) Camshaft Position - Timing Over - Advanced (Bank 2)	• Difference between target and actual position > 10° - 22° CRK for 2 - 3 s • Adjustment angle ≥ 3° CRK

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P025A	Fuel Pump Open Circuit	Signal current < 0.8 mA
P025C	Fuel Pump Short to Ground	Signal voltage < 2.0 V
P025D	Fuel Pump Short to Battery Voltage	Signal current > 1.0 A
P0030	HO2S Heater Control Circuit (Bank 1, Sensor 1) Open Circuit	Heater current < 8 - 40 mA
P0031	HO2S Heater Control Circuit Low (Bank 1, Sensor 1) Short to Ground	Heater voltage < 1.9 - 2.22 V
P0032	HO2S Heater Control Circuit High (Bank 1, Sensor 1) Short to Battery Voltage	Heater current > 8 - 11 A
P0036	HO2S Heater Control Circuit (Bank 1, Sensor 2) Open Circuit	Heater current < 8 - 40 mA
P0037	HO2S Heater Control Circuit Low (Bank 1, Sensor 2) Short to Ground	Heater voltage < 1.9 - 2.22 V
P0038	HO2S Heater Control Circuit High (Bank 1, Sensor 2) Short to Battery Voltage	Heater current bank 1, > 3 - 5 A
P0042	HO2S Heater Circuit (Bank 1, Sensor 3) Open Circuit SULEV	Heater voltage 4.50...5.50 V
P0043	HO2S Heater Control Circuit Low (Bank 1, Sensor 2) Short to Ground	<ul style="list-style-type: none"> <li>• SULEV Heater voltage &lt; 3 V</li> <li>• ULEV Heater voltage &lt; 3 V</li> </ul>
P0044	HO2S Heater Control Circuit High (Bank 1, Sensor 2) Short to Battery Voltage	Heater current > 2.70 - 5.50 A
P0050	HO2S Heater Control Circuit (Bank 1 Sensor 1) Open Circuit	Heater current < 8 - 40 mA
P050A	Idle Air Control System RPM Lower or Higher Than Expected	Out of range-low <ul style="list-style-type: none"> <li>• Engine speed deviation &lt; 80 RPM</li> </ul> Out of range-high <ul style="list-style-type: none"> <li>• Engine speed deviation &gt; 80 RPM</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P0051	HO2S Heater Control Circuit Low (Bank 1, Sensor 1) Short to Ground	Heater voltage < 1.9 - 2.22 V
P0052	HO2S Heater Control Circuit High (Bank 1, Sensor 1) Short to Battery Voltage	Heater current > 8 - 11 A
P0056	HO2S Heater Control Circuit (Bank 1, Sensor 2) Open Circuit	Heater current < 8 - 40 mA
P0057	HO2S Heater Control Circuit Low (Bank 1, Sensor 2) Short to Ground	Heater voltage < 1.9 - 2.22 V
P0058	HO2S Heater Control Circuit High (Bank 1, Sensor 2) Short to Battery Voltage	Heater current bank 2, > 3 - 5 A
P0068	MAP/MAF – Throttle Position Correlation	Deviation throttle controller < 43 or > 43%
P0070	Ambient Air Temperature Sensor Short to Battery Voltage	Ambient air temp < 50.0 °C
P0071	Rationality Check	Difference value AAT - IAT engine start (depending on engine-off time) > 26.5° C
P0072	Ambient Air Temperature Sensor Short to Ground	Ambient air temp > 87.0 °C
P0073	Ambient Air Temp Sensor Open Circuit	Ambient air temp < 50.0° C
P0087	Fuel Rail/System Pressure - Too Low	<ul style="list-style-type: none"> <li>• Deviation fuel rail pressure control &gt; 0.105 g/Rev and</li> <li>• Deviation HO2S control -15 - 15%</li> <li>• Actual pressure 3.5 MPa</li> <li>• Target pressure-actual pressure &gt; 2 MP and</li> <li>• Deviation HO2S control -15 ... 15 %</li> </ul>
P0088	Fuel Rail/System Pressure - Too High	Fuel rail pressure > 13.9 MPa

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0089	Fuel Pressure Regulator 1 Performance	Actual pressure Deviation <ul style="list-style-type: none"> <li>• Deviation fuel press control &lt; -28% &gt; 35%</li> <li>• Target press minus actual press &gt; 0.17 MPa</li> <li>• Target press minus actual press &lt; 0.17 MPa</li> </ul>
P008A	Low Pressure Fuel System Pressure - Too Low	Delta fuel press low < 0.80 BAR
P008B	Low Pressure Fuel System Pressure - Too High	Delta fuel press low > 8.5 BAR
P0090	Fuel Rail Pressure Control Valve	Open circuit signal current < 8.0 mA
P0091	Fuel Rail Pressure Control Valve	Short to ground signal voltage < 2.0 V
P0092	Fuel Rail Pressure Control Valve	Short to battery plus signal current > 11 A
P0100	Mass or Volume Air Flow A Circuit	MAF sensor signal, out of range low. <ul style="list-style-type: none"> <li>• &gt; 25 RPM</li> <li>• &lt; 40 ms</li> </ul>
P0101	Mass or Volume Air Flow A Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Mass air flow vs lower threshold model &lt; 12%</li> <li>• Load calculation &gt; 21% and</li> <li>• Fuel system (mult) &lt; -19%. -23 ULEV only</li> <li>• Load calculation &lt; 21%. -23 for ULEV only</li> </ul>
P0102	Mass or Volume Air Flow A Circuit Low Input	MAF sensor signal, Volume Air Flow Low for < 66 $\mu$ s
P0103	Mass or Volume Air Flow A Circuit High Input	MAF sensor signal, > 4500 u s
P0106	Manifold Absolute Pressure/ BARO Sensor Range/ Performance	Boost pressure signal <ul style="list-style-type: none"> <li>• &lt; Altitude sensor -210 hPa</li> <li>• &gt; Altitude sensor +230 hPa</li> </ul>
P0107	Manifold Absolute Pressure/ BARO Sensor Range/ Performance Short to Ground- Open Circuit	Signal voltage < 0.2 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0108	Manifold Absolute Pressure/ BARO Sensor Range/ Performance Short to Battery Voltage	Signal voltage > 4.8 V
P0111	Intake Air Temperature (Sensor 1) Rationality Check S4 Only	<ul style="list-style-type: none"> <li>• Difference value: IAT-ECT @ engine start (depending on engine-off time, &gt; 26.5° C and</li> <li>• Difference value: IAT-AAT @ engine start (depending on engine-off time), &gt; 26.5° C and</li> <li>• Difference AAT vs. ECT at engine start &lt; 26.5° C (depending on engine off time)</li> </ul>
P0112	Intake Air Temperature Sensor (Sensor 1) Circuit Low Input	Intake air temperature < 0.099 V
P0113	Intake Air Temperature Sensor (Sensor 1) Circuit High Input	Intake air temperature > 3.2 V
P0116	Engine Coolant Temperature (Sensor 1) Circuit Range/ Performance. (Stuck)	<ul style="list-style-type: none"> <li>• Difference value: IAT-ECT @ engine start (depending on engine-off time, &gt; 26.5° C and</li> <li>• Difference value: IAT-AAT @ engine start (depending on engine-off time), &gt; 26.5° C and</li> <li>• Difference AAT vs. ECT at engine start &lt; 26.5° C (depending on engine off time)</li> </ul>
P0117	Engine Coolant Temperature (Sensor 1) Circuit Low	Engine coolant temperature < 0.25 V
P0118	Engine Coolant Temperature (Sensor 1) Circuit Open	Engine coolant temperature > 3.20 V
P0121	Throttle/Pedal Position Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>• TPS 1-TPS 2, &gt; 5.79° and</li> <li>• Relative mass air integral &gt; 100... at 0.45 s</li> </ul>
P0122	Throttle/Pedal Position Sensor A Circuit Low Input	Signal voltage < 0.117 V
P0123	Throttle/Pedal Position Sensor A Circuit High Input	Signal voltage > 4.6 V

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P012B	Charger Inlet Pressure Rationality Check	<ul style="list-style-type: none"> <li>• Pressure difference in cross check between boost press. sensor 1/2; IM press., ambient press sensor &gt; 7 kPa</li> <li>• Pressure difference in cross check between boost press. sensor 1/2; IM press. &gt; 12.27 kPa</li> </ul>
P012C	Charger Inlet Pressure Short to Ground	Signal voltage < 0.2 V
P012D	Charger Inlet Pressure Short to Battery Voltage	Signal voltage > 4.8 V
P0130	O2 Sensor Circuit (Bank 1, Sensor 1)	O2S ceramic temperature < 640 °C
P0131	O2 Sensor Circuit (Bank 1, Bank 2) Low Voltage	Signal voltage < 0.13 V
P0132	O2 Sensor Circuit (Bank 1, Sensor 1) High Voltage	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 Heater Circuit (Bank 1, Sensor 1)	UEGO ceramic temperature < 680 or > 965° C
P0136	O2 Sensor Circuit (Bank 1, Sensor 2)	Oscillation check <ul style="list-style-type: none"> <li>• O2S signal rear not oscillating at reference +/- 10 mV</li> </ul> Signal range check <ul style="list-style-type: none"> <li>• Signal voltage &gt; 0.02 V</li> </ul>
P0137	O2 Circuit Low Voltage (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>• Signal voltage, &lt; 20mV. and</li> <li>• Internal resistance &lt; 10Ω</li> </ul>
P0138	O2 Circuit Circuit (Bank 1, Sensor 2) High Voltage	Signal voltage > 1.2 V
P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	O2S signal rear- signal too slow - 1



DTC	Error Message	Malfunction Criteria and Threshold Value
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	<ul style="list-style-type: none"> <li>Signal voltage, 0.376 - 0.474 V</li> <li>O2S rear internal resistance &gt;60 K<math>\Omega</math></li> </ul>
P0141	O2 Sensor Heater Circuit (Bank 1, Sensor 2) Out of Range	Heater resistance, > 10K $\Omega$
P0142	O2 Circuit (Bank 1 Sensor 3) Heater Check	<ul style="list-style-type: none"> <li>Delta voltage one step at heater switching, &gt; 2.0 V</li> <li>Number of checks, 10</li> </ul>
P0143	O2 circuit (Bank 1 Sensor 3) Short to Ground	<ul style="list-style-type: none"> <li>Cold condition, signal voltage, &lt; 59.6 mV</li> <li>Warm condition, signal voltage &lt; 59.6 mV</li> <li>Short to battery voltage, voltage &gt; 1.26 V</li> </ul>
P0144	O2 circuit Bank 1 Sensor 3 Short to Battery +	Signal voltage > 1.26 V
P0145	O2 Circuit Slow Response (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>EWMA filtered transient time at fuel cut-off, &gt; 0.4 s</li> <li>In voltage range, 401.4 - 201.2 mV</li> <li>Number of checks (initial phase), &gt; 3</li> <li>Number of checks (step function), &gt; 3</li> </ul>
P0146	O2 Circuit Bank 1 Sensor 3 Open Circuit	<ul style="list-style-type: none"> <li>Signal voltage, 401.4 - 499 mV</li> <li>Internal resistance, 40 K<math>\Omega</math></li> </ul>
P0147	O2 Circuit Bank 1 Sensor 3 Heater Check SULEV	Heater resistance 1056 - 11656 $\Omega$
P0150	O2 Circuit No Activity Detected (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>Signal voltage, 0.376 - 0.474 V</li> <li>O2S rear internal resistance &gt; 7 K<math>\Omega</math></li> </ul>
P0151	O2 Sensor Circuit (Bank 1 Bank 2) Low Voltage	Signal voltage < 0.13 V
P0152	O2 Sensor Circuit (Bank 1 Bank 2) High Voltage	Signal voltage > 5.5 V
P0153	O2 Circuit Slow Response (Bank 2, Bank 2)	Response check- HO2S value vs modeled HO2S value > 0.7998
P0155	O2 Heater Circuit Fault (Bank 1 Sensor 1)	UEGO ceramic temperature < 680 or > 965° C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0156	O2 Sensor Circuit Fault (Bank 1 Sensor 2)	Oscillation check <ul style="list-style-type: none"> <li>• O2S signal rear not oscillating at reference +/- 10 mV</li> </ul> Signal range check <ul style="list-style-type: none"> <li>• Signal voltage &gt; 0.2 V</li> </ul>
P0157	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<ul style="list-style-type: none"> <li>• Signal voltage, &lt; 20mV and</li> <li>• Internal resistance &lt; 10Ω</li> </ul>
P0158	O2 Circuit High Voltage (Bank 1, 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 Sensor Circuit No Activity Detected (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>• Signal voltage, 0.376 - 0.474 V</li> <li>• O2S rear internal resistance &gt; 60 KΩ</li> </ul>
P0161	O2 Heater Circuit (Bank 1, Sensor 2) Out of Range	Heater resistance, > 10K Ω
P0169	Incorrect Fuel Composition	Plausability check - failed
P0171	Fuel System Too Lean, Additive (Bank 1, Bank 2)	Lean @ idle adaptive value > 0.0063 g/Rev
P0172	Fuel System Too Rich-Multiplicative (Bank 1, Bank 2)	Too rich at idle adaptive value < 25%
P0174	Fuel System Too Lean, Additive (Bank 1, Bank 2)	Lean @ idle adaptive value > 0.0063 g/Rev
P0175	System Too Rich-Additive (Bank 1, Bank 2)	Too rich at idle adaptive value > 25%
P0190	Fuel Rail Pressure Sensor A Circuit	Signal voltage > 4.6 V
P0191	Fuel Rail Control Valve, High Pressure Side	Actual pressure > 16.85 mPa
P0192	Fuel Rail Pressure Sensor A Circuit Low Input	Signal voltage < 0.2 V
P0201	Injector Circuit/Open - Cylinder 1	<ul style="list-style-type: none"> <li>• Signal current &lt; 10 A and</li> <li>• Signal voltage &gt; 3.5 V</li> </ul>
P0202	Injector Circuit/Open - Cylinder 2	<ul style="list-style-type: none"> <li>• Signal current &lt; 10 A and</li> <li>• Signal voltage &gt; 3.5 V</li> </ul>
P0203	Injector Circuit/Open - Cylinder 3	<ul style="list-style-type: none"> <li>• Signal current &lt; 10 A and</li> <li>• Signal voltage &gt; 3.5 V</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P0204	Injector Circuit/Open - Cylinder 4	<ul style="list-style-type: none"> <li>• Signal current &lt; 10 A and</li> <li>• Signal voltage &gt; 3.5 V</li> </ul>
P0205	Injector Circuit/Open - Cylinder 5	<ul style="list-style-type: none"> <li>• Signal current &lt; 10 A and</li> <li>• Signal voltage &gt; 3.5 V</li> </ul>
P0206	Injector Circuit/Open - Cylinder 6	<ul style="list-style-type: none"> <li>• Signal current &lt; 10 A and</li> <li>• Signal voltage &gt; 3.5 V</li> </ul>
P0221	Throttle Pedal Position Sensor Switch B Circuit Range Performance	<ul style="list-style-type: none"> <li>• TPS 1-TPS 2, &gt; 5.79° and</li> <li>• Relative mass air integral &gt; 100... at 0.45 s</li> </ul>
P0222	Accelerator Pedal Position Sensor B Circuit Low Input	Signal voltage, < 0.117 V
P0223	Throttle Pedal Position Sensor Switch B Circuit High Input	Signal voltage, > 4.6 V
P0234	Turbocharger/Supercharger Overboost Condition Rationality Check High	Difference set value boost pressure vs actual boost pressure value, > 200 - 1275 hPa
P0235	Boost Pressure Control	Boost pressure sensor signal vs target value <ul style="list-style-type: none"> <li>• &gt; 0.25 - 35 kPa, depending on altitude</li> </ul>
P0236	Turbocharger/Supercharger Boost Sensor A Plausibility Check.	<ul style="list-style-type: none"> <li>• Pressure difference in cross check between boost pressure sensor 1/2; IM pressure &gt; 7 kPa</li> <li>• Pressure difference in cross check between . boost pressure sensor 1/2 and IM &gt; 12 - 27 kPa</li> <li>• Pressure difference in cross check between pressure sensor 1 and 2 &gt; 12.5 kPa and</li> <li>• Fuel trim activity (bank with deviation is considered to be defective) &gt; 15%</li> </ul>
P0237	Turbocharger/Supercharger Boost Sensor A Circuit Low	Signal voltage < 0.2 V

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0238	Turbocharger/Supercharger Boost Sensor A Circuit High	Signal voltage, > 4.8 V
P0240	Turbocharger/Supercharger Boost Sensor Rationality Check	<ul style="list-style-type: none"> <li>• Pressure difference in cross check between boost pressure sensor 1/2; IM pressure, ambient pressure &gt; 7 kPa</li> <li>• Pressure difference in cross check between boost pressure sensor 1/2; IM pressure &gt; 12 - 27 kPa</li> <li>• Pressure difference in cross check between pressure sensor 1 and 2 &gt; 12.51 kPa and fuel trim activity (bank with deviation is considered to be defective &gt; 151%</li> </ul>
P0241	Turbocharger/Supercharger Boost Sensor Short to Ground	Signal voltage < 0.2 V
P0242	Turbocharger/Supercharger Boost Sensor Short to Battery Voltage	Signal voltage > 4.8 V
P0243	Turbocharger/Supercharger Wastegate Solenoid A	Signal voltage, > 4.40...5.60 V
P0245	Turbocharger/Supercharger Wastegate Solenoid A Low	Signal voltage, < 2.15 - 3.25 V
P0246	Turbocharger/Supercharger Wastegate Solenoid A High	Signal current, >2.20 A
P025A	Fuel Pump Module -Open Control Circuit	Signal voltage, > 4.4 V - 5.6 V
P025C	Fuel Pump Module -Short to Ground (GND)	Signal voltage, < 2.15 V- 3.25 V
P025D	Fuel Pump Module -Short to Battery Voltage	Signal current, > 1.1 A
P0261	Cylinder 1 Injector Circuit Short to Ground	<ul style="list-style-type: none"> <li>• Signal current &lt; 10 A and</li> <li>• Signal voltage &lt; 3.5 V</li> </ul>
P0262	Cylinder 1 Injector Circuit Short to Battery Voltage	Signal current > 16 A
P0264	Cylinder 2 Injector Circuit Short to Ground	<ul style="list-style-type: none"> <li>• Signal current &lt; 10 A and</li> <li>• Signal voltage &lt; 3.5 V</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0265	Cylinder 2 Injector Circuit Short to Battery Voltage	Signal current > 16 A
P0267	Cylinder 3 Injector Circuit Short to Ground	<ul style="list-style-type: none"> <li>• Signal current &lt; 10 A</li> <li>and</li> <li>• Signal voltage &lt; 3.5 V</li> </ul>
P0268	Cylinder 3 Injector Circuit Short to Battery Voltage	Signal current > 16 A
P0270	Cylinder 4 Injector Circuit Short to Ground	<ul style="list-style-type: none"> <li>• Signal current &lt; 10 A</li> <li>and</li> <li>• Signal voltage &lt; 3.5 V</li> </ul>
P0271	Cylinder 4 Injector Circuit Short to Battery Voltage	Signal current > 16 A
P0273	Cylinder 5 Injector Circuit Short to Ground	<ul style="list-style-type: none"> <li>• Signal current &lt; 10 A</li> <li>and</li> <li>• Signal voltage &lt; 3.5 V</li> </ul>
P0274	Cylinder 5 Injector Circuit Short to Battery Voltage	Signal current > 16 A
P0276	Cylinder 6 Injector Circuit Short to Ground	<ul style="list-style-type: none"> <li>• Signal current &lt; 10 A</li> <li>and</li> <li>• Signal voltage &lt; 3.5 V</li> </ul>
P0277	Cylinder 6 Injector Circuit Short to Battery Voltage	Signal current > 16 A
P0299	Turbocharger/Supercharger Underboost Rationality Check Low	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 over travel	Signal voltage < 0.7 V
P2004	Intake Manifold Runner Control Stuck Closed (Bank 1)	Difference between target and actual position > 40%
P2005	Intake Manifold Runner Control Stuck Closed (Bank 1)	Signal voltage, < 2.9 V
P2006	Intake Manifold Runner Control Stuck Open (Bank 1)	Signal voltage, > 2.5 V
P2007	Intake Manifold Runner Control Stuck Open (Bank 1)	Signal voltage, > 2.5 V

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P2008	Intake Manifold Runner Control (Bank 1) Circuit/Open	Signal current < 0.8 mA
P2009	Intake Manifold Runner Control Circuit Shorted (Bank 1)	Signal voltage > 2.0 V
P2010	Intake Manifold Runner Control Circuit Shorted to Battery Voltage (Bank 1)	Signal current > 2 A
P2014	Intake Manifold Runner Position Sensor Circuit Short to Ground (Bank 1)	Signal voltage, < 0.2 V
P2015	Intake Manifold Runner Position Sensor Circuit Range / Performance (Bank 1)	Deviation runner flap position vs actual position > 25 %
P2016	Intake Manifold Runner Position Sensor Circuit Low Bank 1	Signal voltage, <0.25 V
P2017	Intake Manifold Runner Position Sensor/Switch Circuit Short to Battery voltage (Bank 1)	Signal voltage, > 4.8 V
P2019	Intake Manifold Runner Position Sensor Circuit Open Circuit (Bank 1)	Signal voltage, < 0.2 V
P2022	Intake Manifold Runner Position Sensor Circuit Short to Battery voltage (Bank 1)	Signal voltage > 4.8 V
P2088	A Camshaft Position Actuator Control Circuit Low Short to Ground (Bank 1)	Signal current, > 3 A
P2089	A Camshaft Position Actuator Control Circuit High Short to Battery Voltage (Bank 1)	Signal current, > 3 A
P2092	A Camshaft Position Actuator Control Circuit Low Short to Ground (Bank 1)	Signal voltage, < 2 V
P2093	A Camshaft Position Actuator Control Circuit High Short to Battery voltage (Bank 1)	Signal current, > 3 A
P2096	Post Catalyst Fuel Trim System Out of Range High (Bank 1 Bank 2)	Integral part of trim control, post cat > 10%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2097	Post Catalyst Fuel Trim System Out of Range Low (Bank 1 Bank 2)	Integral part of trim control, post cat < 10%
P2098	Post Catalyst Fuel Trim System Out of Range High (Bank 1 Bank 2)	Integral part of trim control, post cat > 10%
P2099	Post Catalyst Fuel Trim System Out of Range Low (Bank 1 Bank 2)	Integral part of trim control, post cat < 10%
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 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold misfire rate (MR) 1st interval &gt; 1.5%</li> <li>• Emission threshold misfire rate (MR) &gt; 1.5%</li> <li>• Catalyst damage, misfire rate (MR) &gt; 1.5 - 15%</li> </ul>
P0301	Cylinder 1 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold misfire rate (MR) 1st interval &gt; 1.5%</li> <li>• Emission threshold misfire rate (MR) &gt; 1.5%</li> <li>• Catalyst damage, misfire rate (MR) &gt; 1.5 - 15%</li> </ul>
P0302	Cylinder 2 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold misfire rate (MR) 1st interval &gt; 1.5%</li> <li>• Emission threshold misfire rate (MR) &gt; 1.5%</li> <li>• Catalyst damage, misfire rate (MR) &gt; 1.5 - 15%</li> </ul>
P0303	Cylinder 3 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold misfire rate (MR) 1st interval &gt; 1.5%</li> <li>• Emission threshold misfire rate (MR) &gt; 1.5%</li> <li>• Catalyst damage, misfire rate (MR) &gt; 1.5 - 15%</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0304	Cylinder 4 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold misfire rate (MR) 1st interval &gt; 1.5%</li> <li>• Emission threshold misfire rate (MR) &gt; 1.5%</li> <li>• Catalyst damage, misfire rate (MR) &gt; 1.5 - 15%</li> </ul>
P0305	Cylinder 5 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold misfire rate (MR) 1st interval &gt; 1.5%</li> <li>• Emission threshold misfire rate (MR) &gt; 1.5%</li> <li>• Catalyst damage, misfire rate (MR) &gt; 1.5 - 15%</li> </ul>
P0306	Cylinder 6 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold misfire rate (MR) 1st interval &gt; 1.5%</li> <li>• Emission threshold misfire rate (MR) &gt; 1.5%</li> <li>• Catalyst damage, misfire rate (MR) &gt; 1.5 - 15%</li> </ul>
P0321	Ignition/Distributor Engine Speed Input Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Counted teeth vs. reference incorrect</li> </ul> or <ul style="list-style-type: none"> <li>• Monitoring reference gap failure</li> </ul>
P0322	Ignition/Distributor Engine Speed Input Circuit No Signal	<ul style="list-style-type: none"> <li>• Camshaft signal &gt; 3</li> <li>• Engine speed no signal</li> </ul>
P0324	Knock Control System Error	<ul style="list-style-type: none"> <li>• Signal fault counter (combustion) &gt; 24.0</li> </ul> or <ul style="list-style-type: none"> <li>• Signal fault counter (measuring window) &gt; 2.00</li> <li>• Communication errors</li> <li>• SPI communication &gt; 25</li> </ul>
P0326	Knock Control System	<ul style="list-style-type: none"> <li>• Lower threshold &lt; 0.029 V</li> <li>• Upper threshold &gt; 1.992 V</li> </ul>
P0327	Knock Sensor 1 Circuit Low Input (Bank 1) Short to Ground	Lower threshold, < 0.18 V
P0328	Knock Sensor 1 Circuit Short to Battery Voltage	Upper threshold > 4.8 V
P0331	Knock Control System	<ul style="list-style-type: none"> <li>• Lower threshold &lt; 0.029 V</li> <li>• Upper threshold &gt; 1.992 V</li> </ul>
P0332	Knock Sensor 1 Circuit Low Input (Bank 1) Short to Ground	Lower threshold, < 0.18 V



DTC	Error Message	Malfunction Criteria and Threshold Value
P0333	Knock Sensor 1 Circuit Short to Battery Voltage	Upper threshold > 1.00 V
P0335	Engine Speed Sensor	<ul style="list-style-type: none"> <li>• Open circuit &gt; 1 V</li> <li>• Short to grnd &lt; 1.5 V</li> <li>• Short to Battery voltage &gt; 3.5 V</li> <li>• Signal check no signal</li> </ul>
P0336	Engine Speed Sensor	<ul style="list-style-type: none"> <li>• RPM signal comparison with phase sensor not synchronous</li> <li>• Counted versus reference teeth &gt; 1</li> <li>• Actual time value vs modeled time value &gt; 1.375</li> </ul>
P0340	Camshaft Position Sensor A Circuit (Bank 1 or Single Sensor)	Signal activity check <ul style="list-style-type: none"> <li>• Signal voltage no altering @ 4 Rev</li> </ul>
P0341	Camshaft Position Sensor A Circuit Range/Performance (Bank 1 or Single Sensor)	<ul style="list-style-type: none"> <li>• Actual time value vs min. time value &lt; 1</li> <li>• Adaptive value vs target value &gt; 12.4° CA</li> <li>• Actual time value vs modeled time value &gt; 3.5</li> </ul>
P0342	Camshaft Position Sensor A Circuit Low Input (Bank 1 or Single Sensor)	Signal voltage low and crankshaft signals, 8.0
P0343	Camshaft Position Sensor A Circuit High Input (Bank 1 or Single Sensor)	Signal voltage low and crankshaft signals, 8.0
P0345	Camshaft Position Sensor A Circuit (Bank 1 or Single Sensor)	Signal activity check <ul style="list-style-type: none"> <li>• Signal voltage no altering @ 4 Rev</li> </ul>
P0346	Camshaft Position Sensor A Circuit Range/Performance (Bank 1 or Single Sensor)	<ul style="list-style-type: none"> <li>• Actual time value vs min. time value &lt; 1</li> <li>• Adaptive value vs target value &gt; 12.4° CA</li> <li>• Actual time value vs modeled time value &gt; 3.5</li> </ul>
P0347	Camshaft Position Sensor A Circuit Low Input (Bank 1 or Single Sensor)	Signal activity check <ul style="list-style-type: none"> <li>• Signal voltage low @ 10 Rev</li> </ul>
P0348	Camshaft Position Sensor A Circuit High Input (Bank 1 or Single Sensor)	Signal activity check <ul style="list-style-type: none"> <li>• Signal voltage low @ 10 Rev</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0351	Ignition Coil A Primary/ Secondary Circuit	Open circuit • Signal current, < -0.05 - 0.2mA • Hardware value from final stage > 0.04 - 0.2 mA
P0352	Ignition Coil B Primary/ Secondary Circuit	Short to ground • Signal current, < -0.05 - 0.2mA • Hardware value from final stage > 0.04 - 0.2 mA
P0353	Ignition Coil C Primary/ Secondary Circuit	Short to Battery voltage • Signal current, < -0.05 - 0.2mA • Hardware value from final stage > 0.04 - 0.2 mA
P0354	Ignition Coil D Primary/ Secondary Circuit	• Signal current, < -0.05 - 0.2mA • Hardware value from final stage > 0.04 - 0.2 mA
P0355	Ignition Coil E Primary/ Secondary Circuit	• Signal current, < -0.05 - 0.2mA • Hardware value from final stage > 0.04 - 0.2 mA
P0356	Ignition Coil F Primary/ Secondary Circuit	• Signal current, < -0.05 - 0.2mA • Hardware value from final stage > 0.04 - 0.2 mA

### **Additional Exhaust Regulation**

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0410	Rationality Check	Difference of SAIR pressure during phase 3 to SAIR pressure before SAIR injection > 30 hPa
P0413	Secondary Air Injection Switching Valve A Circuit Open	Signal voltage < 8 mA
P0414	Air Valve Short To Ground	Signal voltage < 2.00 V
P0415	Short to Battery Voltage	Signal current > 5.0 A
P0416	Open Circuit	Signal voltage < 8 mA
P0417	Air Valve Short to Ground	Signal voltage < 2.00 V
P0418	Air Pump Relay. Open Circuit	Signal voltage < 8mA
P0420	Catalyst System Bank 1	Amplitude ratio O2S > 1.5
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	Amplitude ratio O2S > 1.5
P0430	Catalyst System Bank 2	Amplitude ratio O2S > 1.5

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0441	Evaporative Emission System Incorrect Purge Flow	Deviation HO2S control < 4% or <ul style="list-style-type: none"> <li>• Deviation throttle controller &lt; 8.0%</li> <li>• Deviation press. control &lt; 4 kpa</li> </ul>
P0442	Evaporative Emission System Leak Detected (Small Leak)	Time for pressure drop < 1.06 - 1.3 s.
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal current < 0.8mA
P0445	Evaporative Emission System Purge Control Valve Short to Ground	Signal voltage < 2.0 V
P0445	Evaporative Emission System Purge Control Valve Short to Battery Plus	Signal current >5.0 A
P0455	Evaporative Emission System Leak Detected (gross leak/no flow)	Time for pressure drop < 0.65 - 0.7 s.
P0456	Evaporative Emission System Leak Detected (very small leak)	Time for press drop < 5.0-6.5 s.
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage, < 2.15 - 3.25 V
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.20 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P0491	Secondary Air System Insufficient Flow. (Bank 1)	<ul style="list-style-type: none"> <li>• Blockage: relative SAIR pressure (phase 1) - no flow &lt; 0.102</li> <li>• Leakage: relative SAIR pressure (phase 1) - no flow &lt; 0.102</li> <li>• Blockage: relative SAIR pressure (phase 1) &lt; 0.5 - 0.648 [-]</li> <li>• Leakage: relative SAIR pressure (phase 1) &lt; 0.602</li> <li>• Blockage: relative SAIR pressure (phase 21) &lt; 0.5 - 0.648</li> <li>• Leakage: relative SAIR pressure (phase 21) &lt; 0.727</li> <li>• Relative SAIR pressure (phase 2) &lt; 0.75</li> <li>• Average pressure difference between absolute value and filtered value (phase 21) &lt; 2.422 - 4.84 hPa</li> <li>• Relative SAIR pressure (phase 2) &lt; 0.75</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P0492	Secondary Air System Insufficient Flow. (Bank 2)	<ul style="list-style-type: none"> <li>• Blockage: relative SAIR pressure (phase 1) - no flow &lt; 0.102</li> <li>• Leakage: relative SAIR pressure (phase 1) - no flow &lt; 0.102</li> <li>• Blockage: relative SAIR pressure (phase 1) &lt; 0.5 - 0.648 [-]</li> <li>• Leakage: relative SAIR pressure (phase 1) &lt; 0.602</li> <li>• Blockage: relative SAIR pressure (phase 21) &lt; 0.5 - 0.648</li> <li>• Leakage: relative SAIR pressure (phase 21) &lt; 0.727</li> <li>• Relative SAIR pressure (phase 2) &lt; 0.75</li> <li>• Average pressure difference between absolute value and filtered value (phase 21) &lt; 2.422 - 4.84 hPa</li> <li>• Relative SAIR pressure (phase 2) &lt; 0.75</li> </ul>

### Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P050A	Idle Air Control System RPM Higher or Lower Than Expected	<ul style="list-style-type: none"> <li>• Out of range low</li> <li>• Engine speed deviation &lt; 80...250 RPM</li> <li>• Out of range high</li> <li>• Engine speed deviation &gt;80...250 RPM</li> </ul>
P0501	Vehicle Speed Sensor A Range/Performance	VSS signal < 4 km/h
P0503	Vehicle Speed Sensor A Out of Range High	Vehicle speed >200 km/h
P0506	Idle Air Control System RPM Lower Than Expected	Engine speed deviation < -80 RPM
P0507	Idle Air Control System - RPM Higher Than Expected	Engine speed deviation > 80 RPM

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P052A	Intake (A) Camshaft Position Actuator Circuit / (Bank 1)	<ul style="list-style-type: none"> <li>• Adjustment angle difference &gt; 10° CA</li> <li>• Number of checks 2</li> </ul>
P052C	Intake (A) Camshaft Position Actuator Circuit / (Bank 1)	<ul style="list-style-type: none"> <li>• Adjustment angle difference &gt; 10° CA</li> <li>• Number of checks 2</li> </ul>
P053F	Fuel Rail Pressure Control Valve	Target pressure-actual pressure > 1.5 MPa

### **Control Module and Output Signals**

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0601	Internal Control Module Memory Check Sum Error	Internal check sum, incorrect
P0603	Internal Hardware Check	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	EEPROM check..failed
P0606	ECM fault	Internal check failed
P062B	Internal Control Module Fuel Injector Control Performance	SPI communication check identifier failure
P0627	Fuel Pump "A" Control Circuit /Open	<ul style="list-style-type: none"> <li>• Internal error fuel pump control unit</li> <li>• Feedback from fuel pump control unit Pump blocked short circuit to battery +, ground or open circuit</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P0638	Throttle Actuator Control Range/Performance (Bank 1)	Functional check: close movement <ul style="list-style-type: none"> <li>• Open to 15° &gt; 1.275 s</li> <li>• then close to ref. point &gt; 1.28 s</li> <li>• Gradient &lt; 7° per second</li> </ul> Functional check open movement <ul style="list-style-type: none"> <li>• Close to 1.99° &gt; 1.275 s</li> <li>• Then open to ref. point &gt; 1.28 s</li> <li>• Gradient &lt; 7° per second</li> </ul> Signal range check @ mechanical stop low <ul style="list-style-type: none"> <li>• TPS 1 signal voltage out-off range 0.208 - 0.852 V</li> </ul> or <ul style="list-style-type: none"> <li>• TPS 2 signal voltage out off range 4.158 - 4.802 V</li> </ul>
P0641	Sensor Reference Voltage A Circuit/Open	Signal voltage deviation $\pm 0.3$ 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 $\pm 0.3$ 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	<ul style="list-style-type: none"> <li>• Signal voltage, 2.6-3.7 V</li> <li>• Sense circuit voltage, &gt; 6 V</li> </ul>
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

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0688	ECM / PCM Power Relay Sense Circuit	<ul style="list-style-type: none"> <li>• Sense voltage, &lt; 3.0 V</li> <li>• Difference sense circuit voltage with camshaft actuator commanded off and on &gt; 2.5 V</li> <li>• Battery voltage &gt; 3 V</li> </ul>
P0697	Sensor Reference Voltage C Circuit/Open	Signal voltage deviation $\pm 0.3$ 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	Global time out, receiving no messages
U0100	Lost Communication with ECM/PCM A	<ul style="list-style-type: none"> <li>• Failure of all CAN engine messages, time out &gt; 490 mSec.</li> <li>• Failure of all CAN engine messages, but not all CAN messages, time out &gt; 1010 mSec.</li> </ul>
U0101	Lost Communication with TCM	No message received from TCM
U0121	CAN ABS Brake Unit	No CAN communication with TCU, time-out
U0140 (only S4)	CAN communication with BCM 1	CAN message no message
U0146 (only S4)	Lost Communication with Gateway "A"	CAN communication with gateway, implausible message
U0155	Communication with ICL	No CAN communication with IPC, time-out
U0302	Software Incompatibility with Transmission Control Module	Manual transmission vehicle, ECM coded as AT vehicle.
U0323	CAN: Instrument cluster Audi Only	Ambient temp value module not encoded for ambient temp sensor, 00h
U0402	CAN communication with TCM	Invalid data received from TCM <ul style="list-style-type: none"> <li>• Implausible message</li> </ul>



DTC	Error Message	Malfunction Criteria and Threshold Value
U0404	Invalid Data Received from Gear Shift Control Module	<ul style="list-style-type: none"> <li>• If the value of message counter is permanent, constant, or change exceeds a threshold, increment an event counter</li> <li>• Maximum change of message counter &gt; 5</li> </ul>
U0415	CAN Link to Speed Sensor Only A6	<ul style="list-style-type: none"> <li>• Out of range: receiving fault value 203.5 mph</li> <li>• Out of range: receiving fault value &gt; 202.81 mph</li> <li>• Out of range: receiving fault value &lt; 1.24 mph</li> </ul>
U0415	CAN Link to Speed Sensor Only S4	<ul style="list-style-type: none"> <li>• Out of range: receiving fault value 407.22 mph</li> <li>• Out of range: receiving fault value &gt; 202.81 mph</li> <li>• Out of range: receiving fault value &lt; 1.24 mph</li> </ul>
U0422	CAN: Instrument Cluster	Ambient temp. value (initialization), Audi, 01h
U0423	Communication with ICL	Invalid data received from ICL implausible message
U0447	CAN Gateway	Received data from Gateway implausible message

## Transmission

DTC	Error Message	Malfunction Criteria and Threshold Value
P0705	Transmission Range Sensor Circuit Malfunction (PRNDL Input)	---
P0706	Transmission Range Sensor "A" Circuit Range/Performance	4 bit position code, incorrect
P0707	Transmission Range Sensor Circuit Low	---
P0708	Transmission Range Sensor Circuit High	---
P0710	Transmission Fluid Temperature Sensor "A" Circuit	Sensor short circuit: <ul style="list-style-type: none"> <li>• U_sensor (+), and U_sensor (-) diagnosis by ASIC</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0711	Transmission Fluid Temperature Sensor "A" Circuit Range/Performance	Discontinual temperature: <ul style="list-style-type: none"> <li>• ATF temperature delta T between 2 measurements, &gt;20° C</li> </ul> Sensor stuck: <ul style="list-style-type: none"> <li>• Comparison ATF vs. chip temperature, ATF temp. must follow chip temp. in certain ranges, 25-40° C</li> </ul>
P0712	Transmission Fluid Temperature Sensor "A" Circuit Low	Circuit low: <ul style="list-style-type: none"> <li>• U_sensor (+), and U_sensor (-) diagnosis by ASIC</li> </ul>
P0713	Transmission Fluid Temperature Sensor "A" Circuit High	Circuit high: <ul style="list-style-type: none"> <li>• U_sensor (+), and U_sensor (-) diagnosis by ASIC</li> </ul>
P0714	Transmission Fluid Temperature Sensor "A" Circuit Intermittent	Circuit high: <ul style="list-style-type: none"> <li>• U_sensor (+), and U_sensor (-) diagnosis by ASIC</li> </ul>
P0716	Input/Turbine Speed Sensor "A" Circuit Range/Performance	Signal higher or lower than threshold <ul style="list-style-type: none"> <li>• Higher, &gt; + 8000 RPM</li> <li>• Lower, &lt; 20 RPM</li> </ul>
P0717	Input/Turbine Speed Sensor "A" Circuit No Signal	Hardware detection
P0721	Output Speed Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Signal &gt; threshold, &gt; 10000 RPM</li> <li>• Difference between last and actual value &gt; threshold, -1000 RPM</li> <li>• Difference to wheel speeds, &gt; 500 RPM and input speed, &gt; 200 RPM</li> </ul>
P0722	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%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0748	Pressure Control Solenoid "A" Electrical	<ul style="list-style-type: none"> <li>• Current higher or lower than threshold, &gt; 220 mA</li> <li>• EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage</li> <li>• Static leakage current flow</li> </ul>
P0751	Shift Solenoid "A" Performance or Stuck Off	<ul style="list-style-type: none"> <li>• If PWM = 0%, diagnosis by ASIC</li> <li>• If <math>0\% \leq \text{PWM}</math>, 7.6% voltage return lead (low), &lt; 0.75 V</li> <li>• If <math>7.6\% \leq \text{PWM}</math>, 92.4% voltage return lead (high), &lt; 0.75 V</li> <li>• If <math>7.6\% \leq \text{PWM}</math>, 92.4% voltage return lead (low), &lt; 0.75 V</li> </ul>
P0752	Shift Solenoid "A" Stuck On	<ul style="list-style-type: none"> <li>• If PWM = 100%, diagnosis by ASIC</li> <li>• If <math>7.6\% \leq \text{PWM} \leq 100\%</math> voltage return lead (high), &gt;0.3 V</li> </ul>
P0754	Shift Solenoid "A" Intermittent	<ul style="list-style-type: none"> <li>• If PWM = 0%, diagnosis by ASIC</li> <li>• If <math>0\% \leq \text{PWM}</math>, 7.6% voltage return lead (low), &lt; 0.75 V</li> <li>• If <math>7.6\% \leq \text{PWM}</math>, 92.4% voltage return lead (high), &lt; 0.75 V</li> <li>• If <math>7.6\% \leq \text{PWM}</math>, 92.4% voltage return lead (low), 0.75 V</li> </ul>
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	<ul style="list-style-type: none"> <li>• Current higher or lower than threshold, &lt; 730 mA</li> <li>• EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS</li> <li>• Static leakage current flow</li> </ul>
P0796	Pressure Control Solenoid "C" Performance or Stuck Off	PWM hardware detection, 0 or 100%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0797	Pressure Control Solenoid "C" Stuck On	PWM hardware detection, 0 or 100%
P0798	Pressure Control Solenoid "C" Electrical	<ul style="list-style-type: none"> <li>• Current higher or lower than threshold, &gt;220 mA</li> <li>• EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage</li> <li>• Static leakage current flow</li> </ul>
P0889	TCM Power Relay Circuit Range / Performance	FET drive, not possible
P0890	TCM Power Relay Circuit Low	<ul style="list-style-type: none"> <li>• Solenoid power supply voltage, &lt;1.4 V</li> <li>• Drop voltage over high side FET, &gt; 1 V</li> </ul>
P0891	TCM Power Relay Circuit High	Hardware detection
P0892	TCM Power Relay 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	<ul style="list-style-type: none"> <li>• Current higher or lower than threshold, &lt;730 mA</li> <li>• EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage</li> <li>• Static leakage current flow</li> </ul>
P2723	Pressure Control Solenoid "E" Performance or Stuck Off	PWM hardware detection, 0 or 100%
P2725	Pressure Control Solenoid "E" Electrical	<ul style="list-style-type: none"> <li>• Current higher or lower than threshold, &lt;730 mA</li> <li>• EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage</li> <li>• Static leakage current flow</li> </ul>
P2732	Pressure Control Solenoid "F" Performance or Stuck Off	PWM hardware detection, 0 or 100%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2733	Pressure Control Solenoid "F" Stuck On	PWM hardware detection, 0 or 100%
P2734	Pressure Control Solenoid "F" Electrical	<ul style="list-style-type: none"> <li>• Current higher or lower than threshold, &lt;730 mA</li> <li>• EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage</li> <li>• Static leakage current flow</li> </ul>
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	Supercharger Control Flap Signal Range Check	Signal range check <ul style="list-style-type: none"> <li>• ECM power stage failure</li> <li>• or duty cycle &gt; 95%</li> <li>• or duty cycle &lt; 95%</li> </ul>
P10A4	RFP Actuator, functional check	Absolute value of maximum deviation between predicted and real value: > 8%
P10A5	RFP Sensor, Short to B +e	Signal voltage > 4.9 V
P10A6	RFP Sensor, Short to Ground / Open Circuit	Signal voltage < 0.1 V
P10A7	RFP Sensor, Signal Range Check @ Mechanical Stop High	Difference actual signal voltage to learned signal voltage > 0.05 V
P10A8	RFP Sensor, Signal Range Check @ Mechanical Stop Low	RFP signal voltage in closed position $\leq 0.35 - \geq 0.65$ V
P1114	Internal Resistance Too Large (Bank 1, Sensor 2)	Heater resistance, (128-648)*(8-40)1.02-25.9 k $\Omega$ (dep. on mod. exhaust temp. and heater power)
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	<ul style="list-style-type: none"> <li>• Deviation fuel rail pressure control &gt; 0.060 g/Rev and</li> <li>• Deviation HO2S control &lt; 22.5%</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P12A2	Fuel Rail Pressure Sensor Inappropriately High	<ul style="list-style-type: none"> <li>• Deviation fuel rail pressure control &lt; 0.051 g/Rev</li> <li>and</li> <li>• Deviation HO2S control &gt; 30%</li> </ul>
P12A4	Fuel Rail Pump Control Valve Stuck Closed	<ul style="list-style-type: none"> <li>• Deviation fuel rail pressure control &lt; 0.120 g/Rev</li> <li>and</li> <li>• Actual press. above target press. -15 - 15%</li> </ul>
P150A	Comparing Engine Off Time From Instrument Cluster Control Unit With Engine after Run Time	<ul style="list-style-type: none"> <li>• Difference between engine-off-time &lt; - 12 s</li> <li>and</li> <li>• ECM after run-time &gt; 12 s</li> </ul>
P2101	Throttle Actuator A Control Motor Circuit Range/ Performance	<ul style="list-style-type: none"> <li>• Duty cycle &gt; 0.4 s at &gt; 98%</li> <li>and</li> <li>• Actual TPS reference point &gt; 1.5°</li> <li>• Actual TPS calc value &gt; 0.4 s at &gt; 8°</li> </ul>
P2106	Throttle Actuator Control System - Short to Battery Voltage or Ground	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
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
P2146	Fuel Injector Group A Supply Voltage Circuit / Short to Ground	Signal current, > 14.90 A
P2147	Injector Circuit Short to Ground	Signal current > 12 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P2148	Injector Circuit Short to Battery Voltage	Signal current > 33 A
P2149	Fuel Injector Group B Supply Voltage Circuit/Open	Signal current, > 14.90 A or < 2.60 V
P2150	Injector Circuit short to ground	signal current > 12 A
P2151	Injector Circuit Short to Battery Voltage	Signal current > 33 A
P2153	Injector Circuit Short to Ground	Signal current > 12 A
P2154	Injector Circuit Short to Battery Voltage	Signal current > 33 A
P2181	Cooling System Performance	<ul style="list-style-type: none"> <li>• ECT &lt; 75 °C</li> <li>• Mass air integral 3.5 - 26.0 kg</li> </ul>
P2195	O2 Sensor Rationality Check High (Bank 1, Bank 2)	HO2S value > 1.1 V
P2196	O2 Sensor Rationality Check Low (Bank 1, Bank 2)	HO2S value < 0.9 V
P2197	O2 Sensor Rationality Check High (Bank 1, Bank 2)	HO2S value > 1.1 V
P2198	O2 Sensor rationality Check Low (Bank 1, Bank 2)	HO2S value < 0.9 V
P219C	Cylinder Imbalance	<ul style="list-style-type: none"> <li>• Adaptive value &lt; -10 %</li> <li>or</li> <li>• &gt; 10 %</li> </ul>
P219D	Cylinder Imbalance	<ul style="list-style-type: none"> <li>• Adaptive value &lt; -10 %</li> <li>or</li> <li>• &gt; 10 %</li> </ul>
P219E	Cylinder Imbalance	<ul style="list-style-type: none"> <li>• Adaptive value &lt; -10 %</li> <li>or</li> <li>• &gt; 10 %</li> </ul>
P219F	Cylinder Imbalance	<ul style="list-style-type: none"> <li>• Adaptive value &lt; -10 %</li> <li>or</li> <li>• &gt; 10 %</li> </ul>
P21A0	Cylinder Imbalance	<ul style="list-style-type: none"> <li>• Adaptive value &lt; -10 %</li> <li>or</li> <li>• &gt; 10 %</li> </ul>
P21A1	Cylinder Imbalance	<ul style="list-style-type: none"> <li>• Adaptive value &lt; -10 %</li> <li>or</li> <li>• &gt; 10 %</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P2227	Turbocharger/Supercharger Boost Sensor A Plausibility Check.	Pressure difference in cross-check between boost press. sensor 1/2; IM pressusre, ambient pressure >7 kPa
P2231	O2 Sensor Signal Circuit Shorted to Heater Circuit	Delta O2S signal front, > 190uA
P2237	O2 Sensor Positive Current Control Circuit / Open (Bank 1, Bank 2)	Signal activity check-failed
P2240	O2 Sensor Positive Current Control Circuit Open (Bank 2 Sensor 1)	Signal activity check-failed
P2243	O2 Sensor Reference Voltage Circuit/Open (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>• Functional check heater failed and</li> <li>• Internal resistance &gt; 950 ohm</li> </ul>
P2247	O2 Sensor Nernst Voltage Open (Bank 1, Bank 2)	<ul style="list-style-type: none"> <li>• Functional check heater failed and</li> <li>• Intrusive check temperature measurement failed</li> </ul>
P2251	O2 Sensor Negative Current Control Circuit Open (Bank 1 Sensor 1)	<ul style="list-style-type: none"> <li>• Functional check heater failed and</li> <li>• Signal activity check failed</li> </ul>
P2254	O2 Sensor Signal open circuit (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>• Functional check heater failed and</li> <li>• Signal activity check failed</li> </ul>
P2257	Air pump relay. short to ground.	Signal voltage < 2.00 V
P2258	Air pump relay. sort to Battery voltage.	Signal current > 5 A
P2270	O2 Circuit Slow Response (Bank 1, Sensor 2) SULEV	Rationality check, O2S signal rear, < 0.557 - 0.630 mV
P2271	O2 Circuit (Bank 1, Sensor 2) SULEV	Rationality check, O2S signal rear, < 0.557 - 0.630 mV
P2279	Intake Air System Leak	<ul style="list-style-type: none"> <li>• Threshold to detect a defective system &gt; 1.33 - 1.6 and</li> <li>• Ratio of the tie system defective during the measurement window to the whole duration of the measurement window &gt; 0.60000</li> </ul>



DTC	Error Message	Malfunction Criteria and Threshold Value
P2293	Fuel Pressure Regulator 2 Performance	<ul style="list-style-type: none"> <li>• Difference between target pressure vs. actual pressure: &gt; 1.50 mPa</li> <li>• Difference between target pressure vs. actual pressure, &lt; -1.50 MPa</li> </ul>
P2294	Fuel Pressure Regulator 2 Control Circuit	Signal current < 0.8 mA
P2295	Fuel Pressure Regulator 2 Control Circuit Low Short to Ground	< 2.0 V
P2296	Fuel Pressure Regulator 2 Control Circuit High	Signal current > 8 A

### Ignition System

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

## Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/Open	Signal current < 0.8 mA
DTC	Error Message	Malfunction Criteria and Threshold Value
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 Range/Performance	• High signal voltage and • Time > 0.36 s
P2414	O2 Sensor Signal Range Check (Bank 1, Bank 2)	O2S signal front > 3.1 V
P2415	O2 Sensor Signal Range Check (Bank 1, Bank 2)	O2S signal front > 3.1 V
P2431	Rationality check	difference between SAIR pressure, AMP, and MAP > 6 kPa
P2432	Signal Range Check	Signal voltage < 0.3 V
P2433	Signal Range Check	Signal voltage > 4.7 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2440	Secondary Air System Valve (Bank 1) Stuck Open	<ul style="list-style-type: none"> <li>• Quotient of relative SAI pressure @ phase 1 and relative SAI pressure @ phase 2 &gt; 1.2</li> <li>• and quotient of relative SAI pressure @ phase 21 &gt; 1.23 and relative SAI pressure @ phase 22</li> <li>• quotient of relative SAI pressure @ phase 22 &gt; 1.23 and relative SAI pressure @ phase 21</li> <li>• or quotient of relative SAI pressure @ phase 1 and relative SAI pressure @ phase 2 &gt; 1.2</li> <li>• and quotient of relative SAI pressure @ phase 21 ≤ 1.23 and relative SAI pressure @ phase 22</li> <li>• "Quotient of relative SAI pressure @ phase 22" ≤ 1.23 and relative SAI pressure @ phase 21</li> <li>• and average pressure difference between absolute value and filtered while both valves commanded closed (1) &gt; 0.3 kPa</li> <li>• or quotient of relative SAI pressure @ phase 1 and relative SAI pressure @ phase 2 ≤ 1.2</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P2440 Cont'd	Secondary Air System Valve (Bank 1) Stuck Open	<ul style="list-style-type: none"> <li>• and quotient of relative SAI pressure @ phase 21 &gt; 1.23 and relative SAI pressure @ phase 22</li> <li>• "Quotient of relative SAI pressure @ phase 22" &gt; 1.23 and relative SAI pressure @ phase 21</li> <li>• and average pressure difference between absolute value and filtered while both valves commanded closed (1) &gt; 3 hPa</li> <li>• or quotient of relative SAI pressure @ phase 1 and relative SAI pressure @ phase 2 <math>\leq 1.2</math></li> <li>• and quotient of relative SAI pressure @ phase 21 <math>\leq 1.23</math> and relative SAI pressure @ phase 22</li> <li>• "Quotient of relative SAI pressure @ phase 22" <math>\leq 1.23</math> and relative SAI pressure @ phase 21</li> <li>• and average pressure difference between absolute value and filtered while both valves commanded closed (1) &gt; 3 hPa</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P2442	Secondary Air System Valve (Bank 2) Stuck Open	<ul style="list-style-type: none"> <li>• Quotient of relative SAI pressure @ phase 1 and relative SAI pressure @ phase 2 &gt; 1.2</li> <li>• and quotient of relative SAI pressure @ phase 21 &gt; 1.23 and relative SAI pressure @ phase 22</li> <li>• Quotient of relative SAI pressure @ phase 22 &gt; 1.23 and relative SAI pressure @ phase 21</li> <li>• or quotient of relative SAI pressure @ phase 1 and relative SAI pressure @ phase 2 &gt; 1.2</li> <li>• and quotient of relative SAI pressure @ phase 21 ≤ 1.23 and relative SAI pressure @ phase 22</li> <li>• "Quotient of relative SAI pressure @ phase 22" ≤ 1.23 and relative SAI pressure @ phase 21</li> <li>• and average pressure difference between absolute value and filtered while both valves commanded closed (1) &gt; 0.3 kPa</li> </ul>
P2539	Low Pressure Fuel System Sensor Circuit Short to B +	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 < 0.2 V
P2626	O2 Sensor Pumping Current Trim Circuit/Open (Bank 1 Sensor 1)	O2S signal front > 4.7 V
P2629	O2 Sensor Pumping Current Trim Circuit/Open (Bank 1 Sensor 1)	O2S signal front > 4.7 V



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