

2014

Q5/SQ5

Quick Reference
Specification Book

2014 Audi Q5

Quick Reference Specification Book

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GENERAL INFORMATION

Decimal and Metric Equivalents

Distance/Length

To calculate: mm x 0.03937 = in.

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

Tightening Torque

Nm-to-lb·ft (ft·lb)

To calculate: Nm x 0.738 = lb·ft

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

Nm-to-lb-in (in·lb), kg·cm

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

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

N·cm-to-lb-in (in·lb), kg·cm

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

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

kg·cm-to-lb·in (in·lb), N·cm

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

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

Warnings and Cautions

WARNINGS

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

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

(WARNINGS cont'd on next page)

WARNINGS *(cont'd)*

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

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

CAUTIONS

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

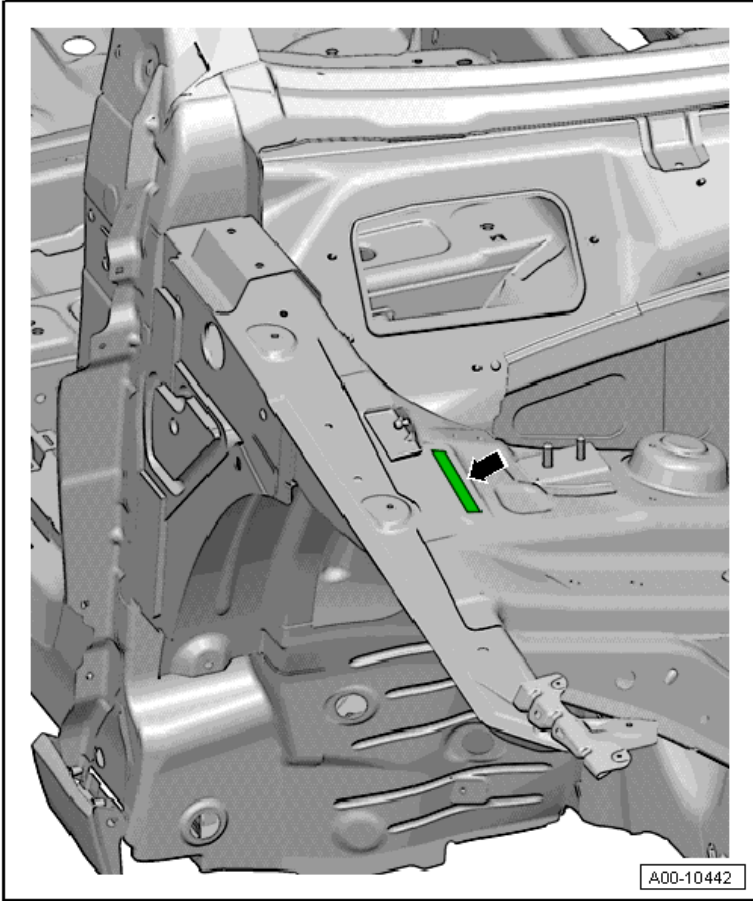
(CAUTIONS cont'd on next page)

CAUTIONS *(cont'd)*

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

VEHICLE IDENTIFICATION

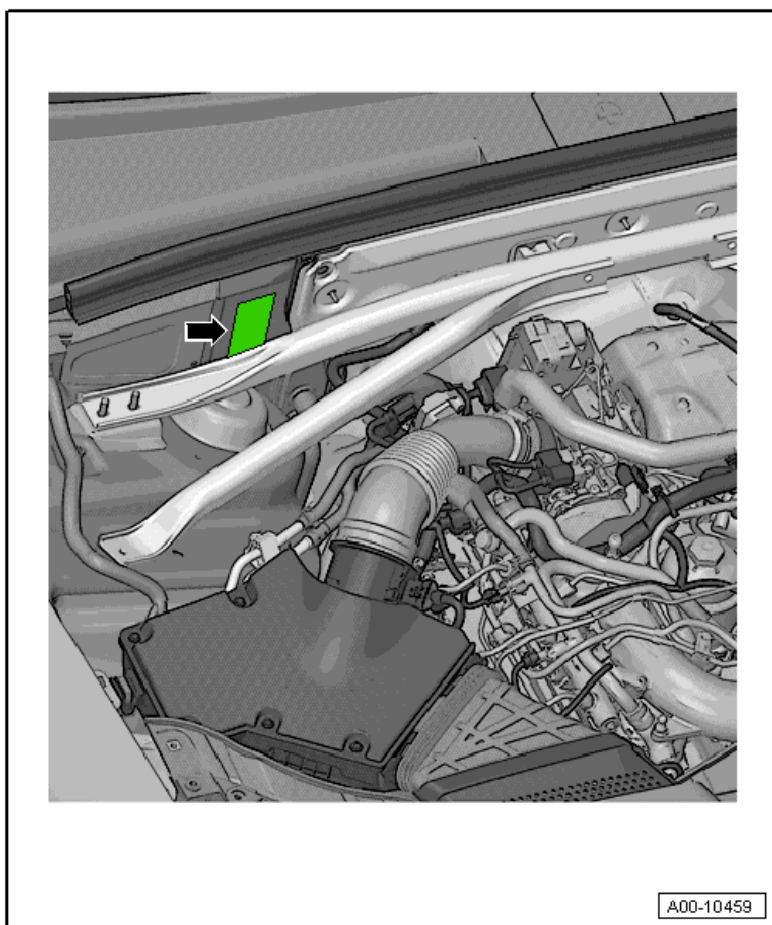
Vehicle Identification Number (VIN) Location



Vehicle
Identification

The Vehicle Identification Number (VIN) is located on the right suspension strut.

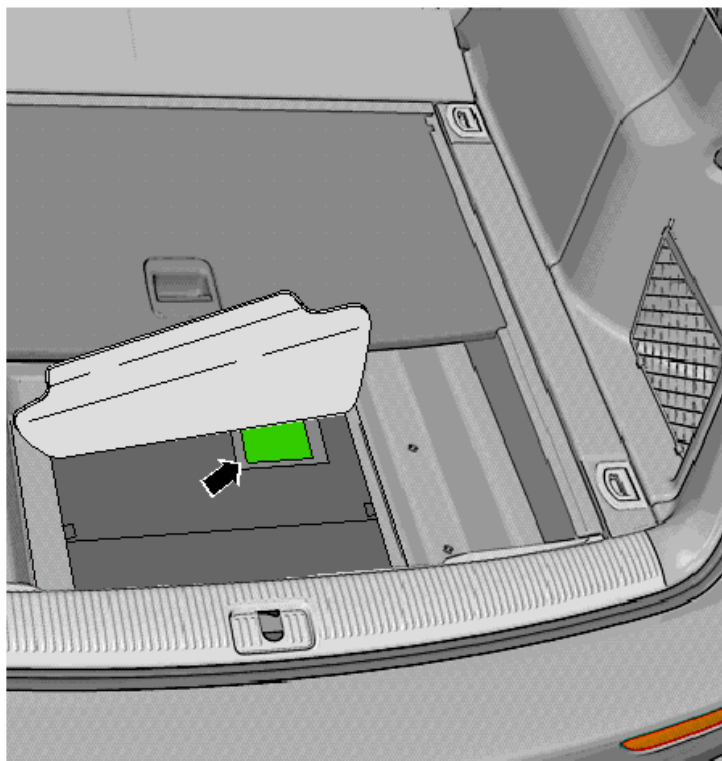
Vehicle Identification Number Decoder Type Plate Location



The type plate is located on the right side of the engine compartment near the suspension strut.

Vehicle
Identification

Vehicle Data Label Location



The vehicle data label is located inside the luggage compartment on the spare wheel well cover.

SALES CODES

Engine Codes

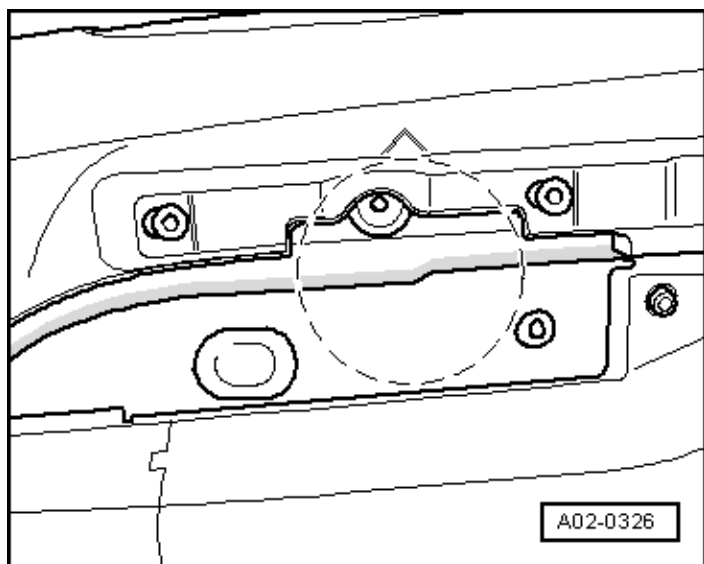
CPMB	2.0L 4-cylinder
CHJA	2.0L 4-cylinder
CTUC, CTUB	3.0L 6-cylinder
CPNB	3.0L 6-cylinder (TDI)

Transmission Codes

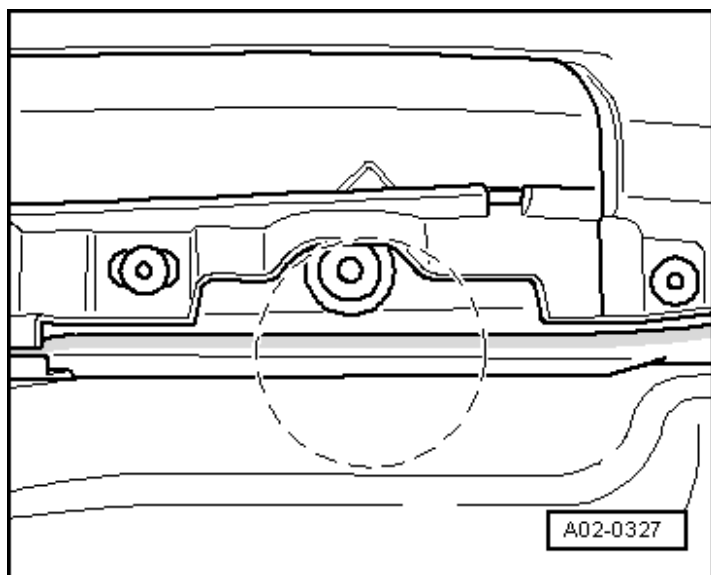
0BW	8-speed automatic
0BK	8-speed automatic

VEHICLE LIFTING

Lifting Points for Lifting Platform and Trolley Jack



Front: At the side member of the vertical reinforcement area.
The marking is for the onboard vehicle jack.

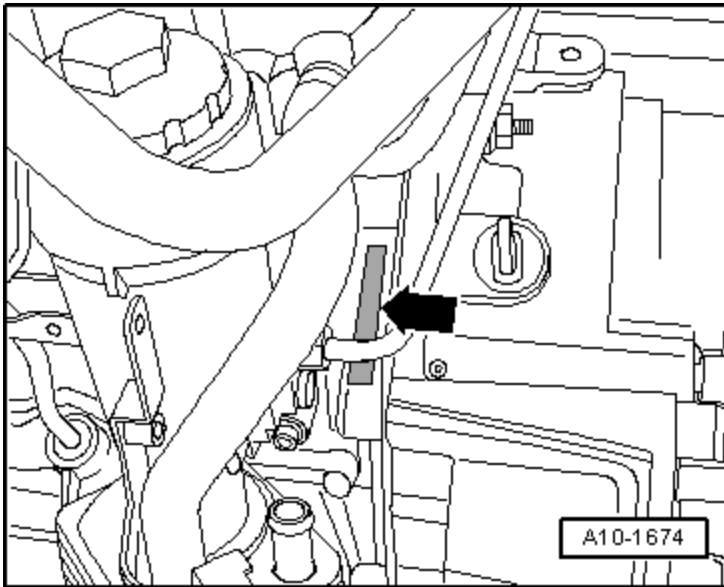


Rear: At the side member vertical reinforcement area.
The marking is for the onboard vehicle jack.

ENGINE MECHANICAL – 2.0L CPMA, CHJA

General, Technical Data – 2.0L CPMB, CHJA

Engine Number Location



The engine number (engine code and serial number) ➔ is located on the left side of the vehicle where the engine/transmission are joined.

Vehicle
Lifting

Engine –
2.0L CPMA, CHJA

Engine Data

Code Letters		CPMA	CHJA
Displacement	liter	1.984	1.984
Output	kW at RPM	155/6000	155/5800
Torque	Nm at RPM	350/1500	350/1500
Bore	Diameter in mm	82.5	82.5
Stroke	mm	92.8	92.8
Compression ratio		9.6	9.6
RON		95 ¹⁾	95 ¹⁾
Injection system/ignition system		FSI	FSI
Ignition sequence		1-3-4-2	1-3-4-2
Knock control		Yes	Yes
Turbocharger, Supercharger		Yes	Yes
Exhaust Gas Recirculation (EGR)		No	No
Variable intake manifold		No	No
Variable valve timing		Yes	Yes
Secondary Air Injection (AIR)		No	No

¹⁾ Unleaded RON 91 is also permitted but performance is reduced.

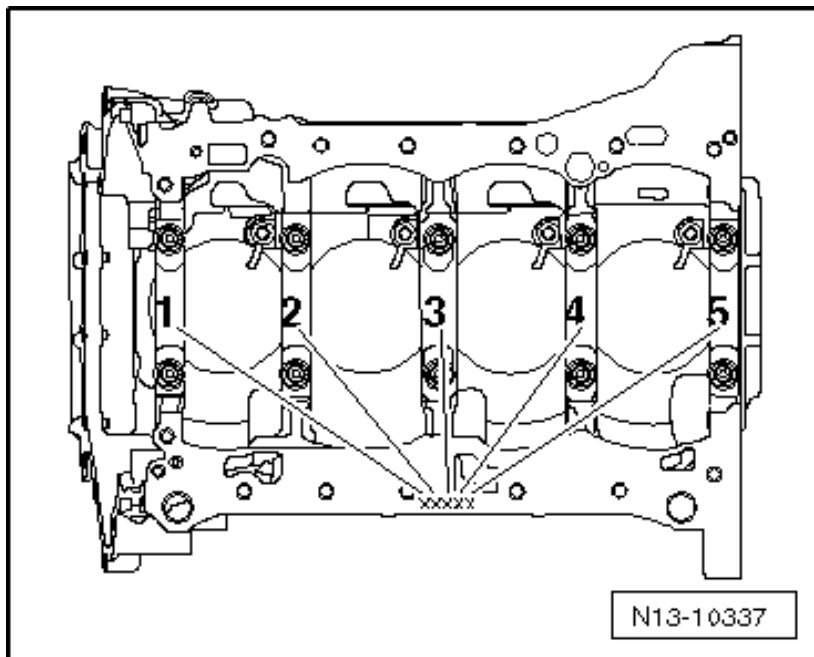
Engine Assembly – 2.0L CPMB, CHJA

Fastener Tightening Specifications

Component	Fastener size	Nm
Bolts and nuts	M6	9
	M7	15
	M8	20
	M10	40
	M12	65
Exceptions:		
Crossmember-to-subframe		20
Ground (GND) cable nut		9
Hydraulic line bracket nut		9
Engine mount		90 plus an additional 90° (¼ turn)
Engine support		40
Heat shield		10
Retaining plate		20
Subframe		55
Torque bracket-to-engine		50

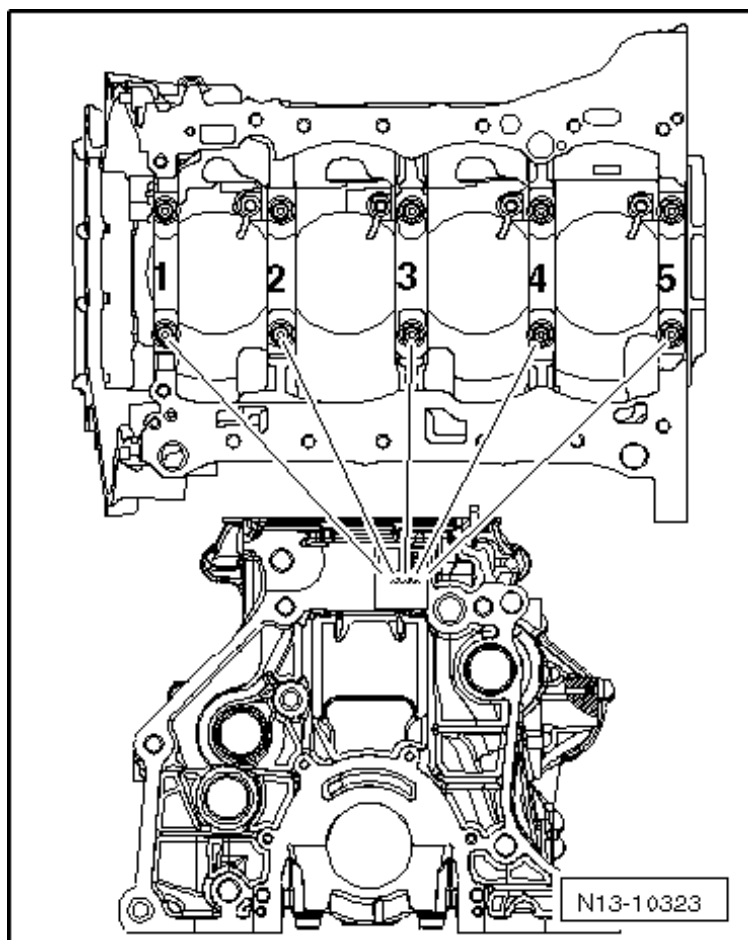
Crankshaft, Cylinder Block – 2.0L CPMB, CHJA

Cylinder Block Bearing Shell Identification



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

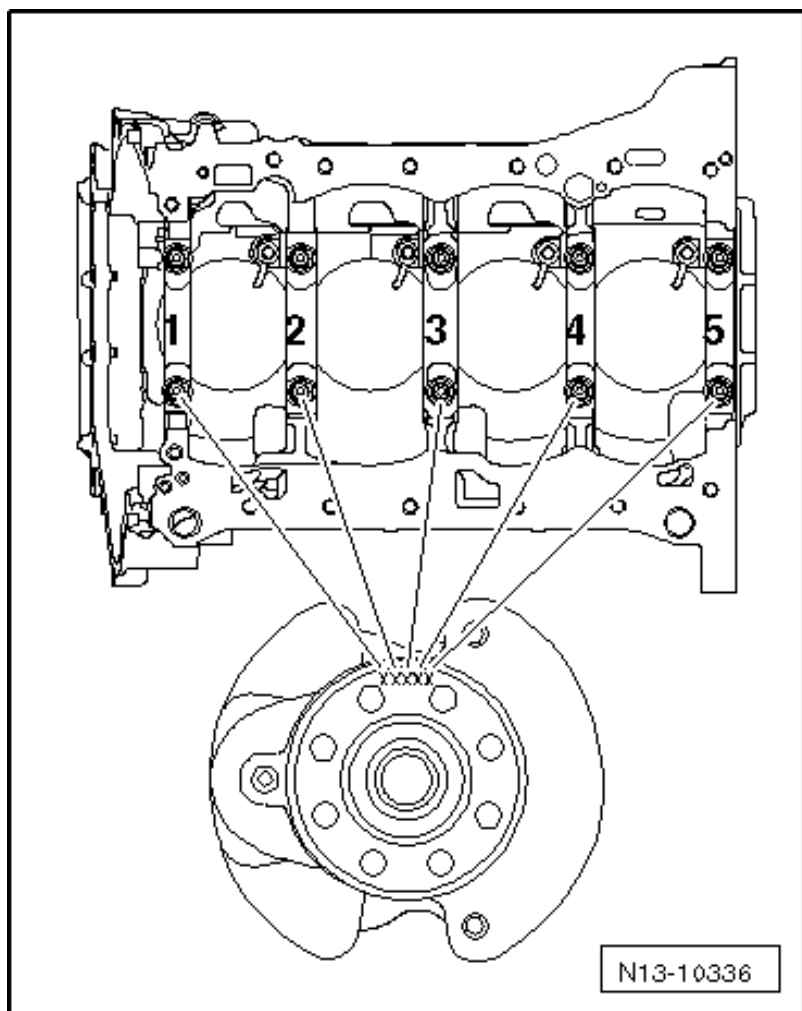
Cylinder Block Bearing Shell Identification



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

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

Bearing Cap Bearing Shell Identification



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

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

Fastener Tightening Specifications

Component	Nm
Balance shaft bolt ¹⁾	9
Connecting rod bearing cap (replace fasteners)	45 plus an additional 90° (¼ turn)
Drive plate (replace fasteners)	60 plus an additional 90° (¼ turn)
Idler roller	20
Pressure relief valve	27
Pressure relief valve-to-oil spray jet	27
Ribbed belt tensioning damper to auxiliary components bracket bolt	40
Sensor wheel ¹⁾	10 plus an additional 90° (¼ turn)
Vibration damper ¹⁾	150 plus an additional 90° (¼ turn)

¹⁾ Replace

Crankshaft Dimensions

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

¹⁾ The preparation of worn crankshafts is not provided.

Piston Ring End Gaps

Piston ring dimensions in mm	New	Wear limit
Compression ring	0.20 to 0.40	0.80
Oil scraping ring	0.25 to 0.50	0.80

Piston Ring Clearance

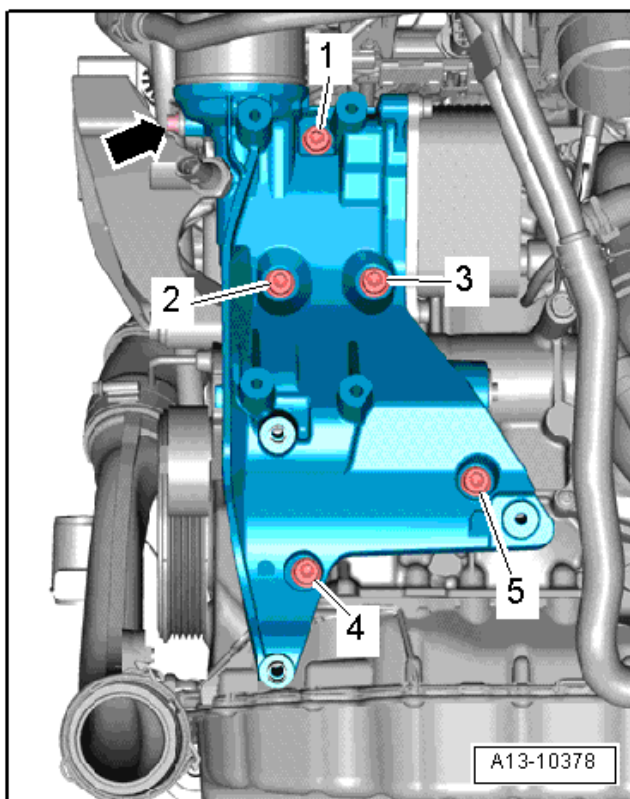
Piston ring dimensions in mm	New	Wear limit
1 st compression ring	0.06 to 0.09	0.20
2 nd compression ring	0.03 to 0.06	0.15
Oil scraping rings	Cannot be measured	

Piston and Cylinder Dimensions

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

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

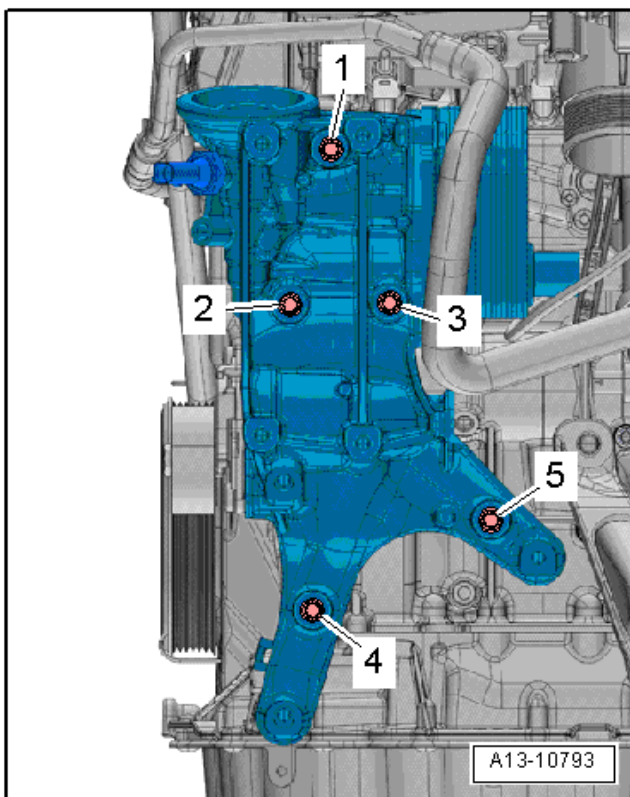
Accessory Assembly Bracket for Engine Code CMPB Tightening Specifications



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

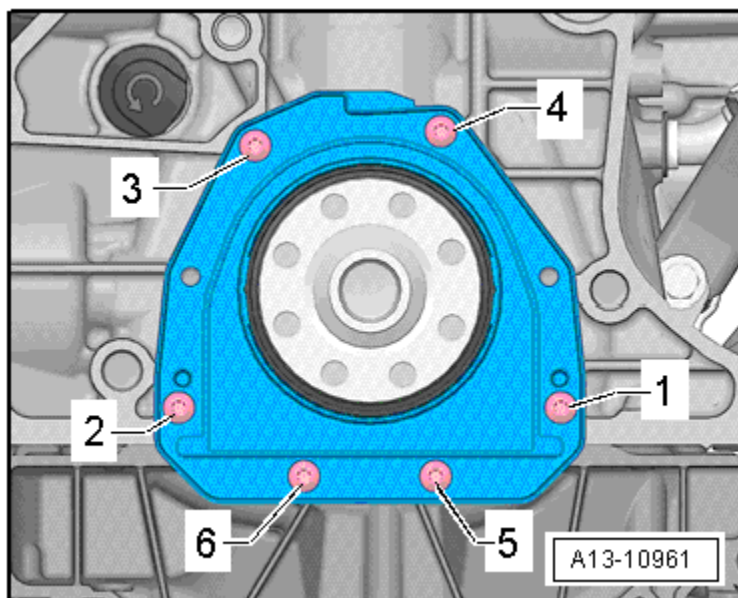
Engine –
2.0L CPMB, CHJA

Accessory Assembly Bracket for Engine Code CHJA Tightening Specifications



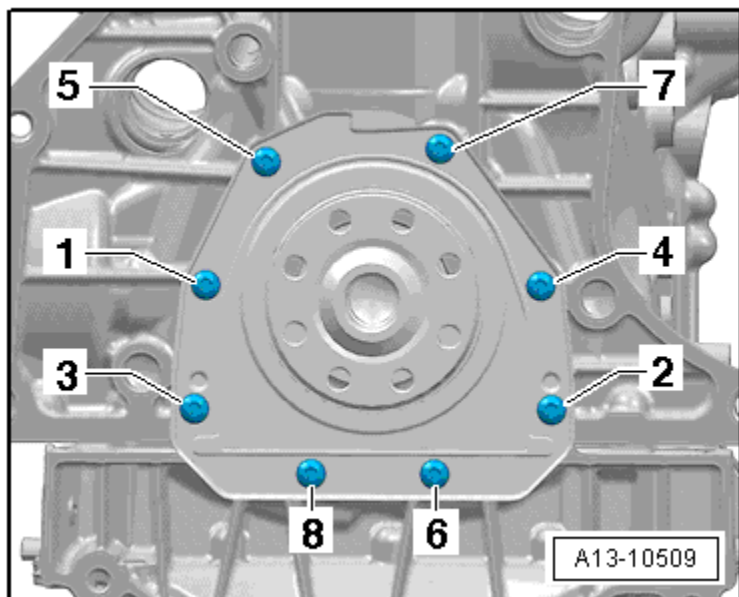
Step	Component	Nm
1	Tighten bolts 1 through 5 in sequence	Hand-tighten
2	Tighten bolts 1 through 5 in sequence	20
3	Tighten bolts 1 through 5 in sequence	an additional 90° (¼ turn)

Sealing Flange with 6 Bolts Tightening Specifications



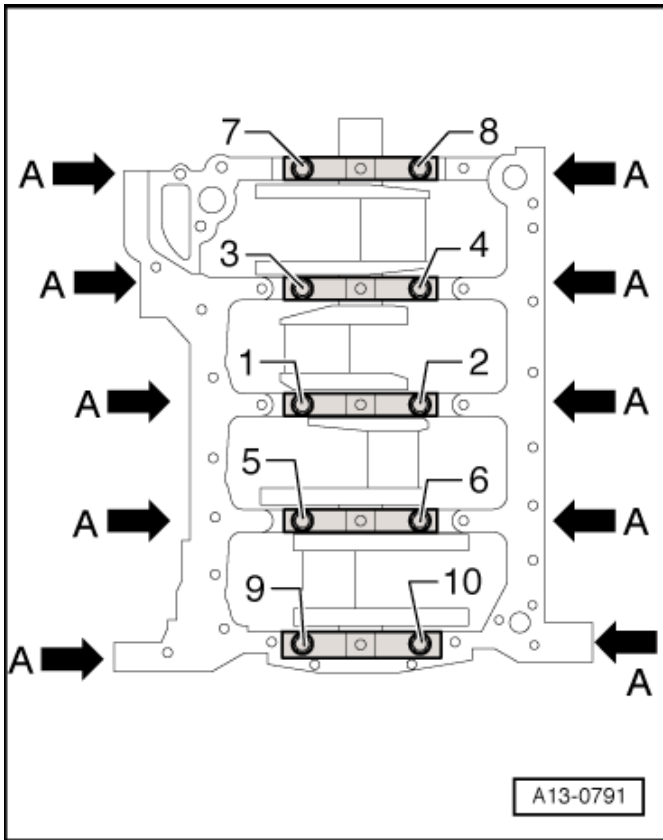
Step	Component	Nm
1	Tighten bolts 1 through 6 in sequence	Hand-tighten
2	Tighten bolts 1 through 6 in sequence	9
3	Tighten bolts 1 through 6 in sequence	an additional 45° (1/8 turn)

Sealing Flange with 8 Bolts Tightening Specifications



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

Crankshaft Tightening Specifications



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

Cylinder Head, Valvetrain – 2.0L CPMB, CHJA

Fastener Tightening Specifications

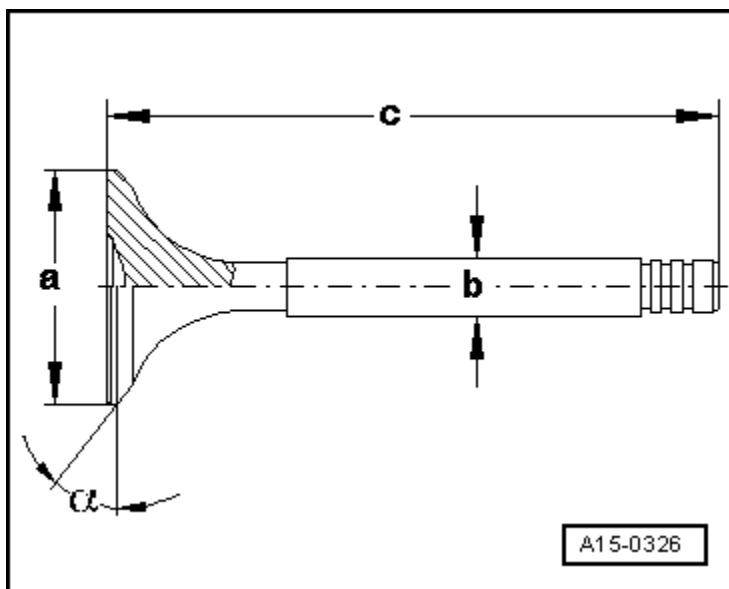
Component	Nm
Bearing bracket to camshaft housing bolt ^{2) 3)}	9
	20 plus an additional 90° (¼ turn) (replace fasteners)
Cam adjustment actuator to cylinder head bolt	5
Camshaft timing chain guide rail guide pin	20
Chain tensioner for timing chain tensioning rail bolt	9
Chain tensioner to engine	85
Control valve to camshaft housing bolt ¹⁾	35
Guide rail guide pin	20
Heat shield to cylinder head bolt	20
Oil dipstick tube to engine bolt	9
Plug with ball head for the engine cover	5
Retaining plate to connection	9
Timing chain tensioning rail guide pin	20
Tensioning rail guide pin	20
Transport strap	25

¹⁾ Left hand thread.

²⁾ Replace

³⁾ For bolt tightening clarification, refer to ElsaWeb, Camshaft Timing Chain Overview, and items 5 and 7.

Valve Dimensions



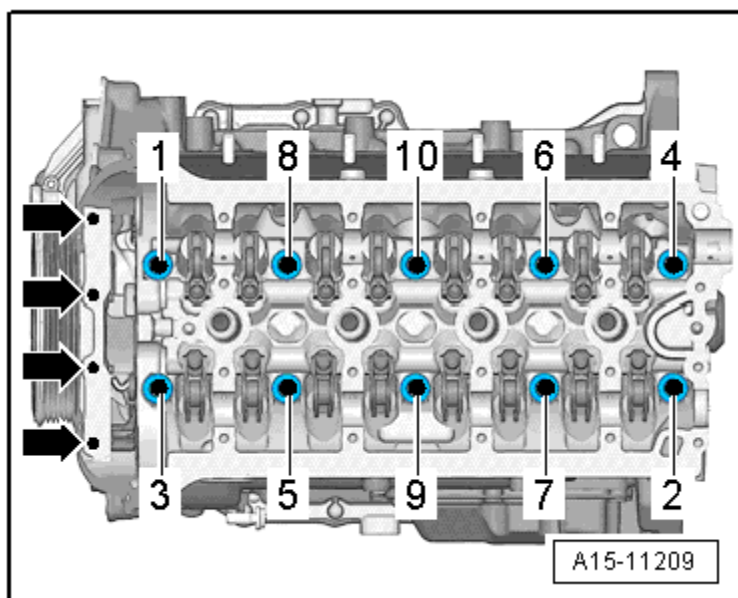
Dimension		Intake valve	Exhaust valve
Diameter a	mm	33.85 ± 0.10	28.0 ± 0.1
Diameter b	mm	5.98 ± 0.01	5.96 ± 0.01
c	mm	104.0 ± 0.2	101.9 ± 0.2
α	∠°	45	45

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

Compression Pressures

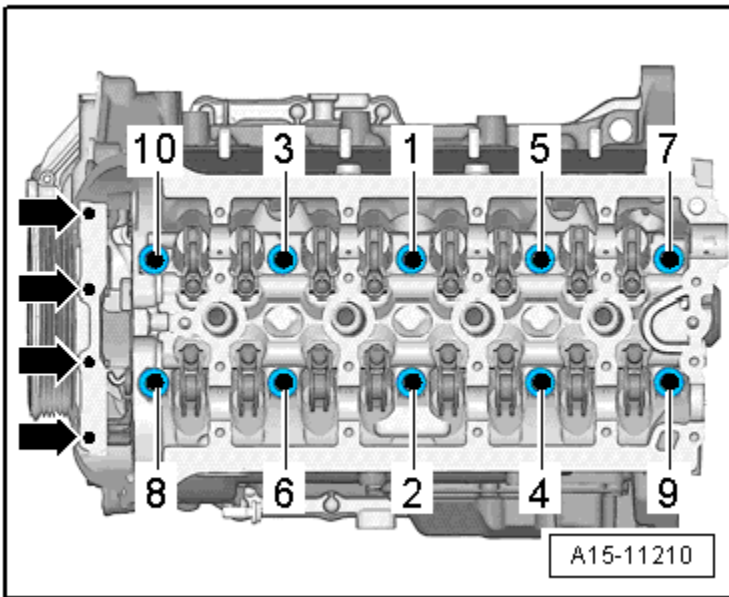
New bar positive pressure	Wear limit bar positive pressure	Difference between cylinders bar positive pressure
11.0 to 14.0	7.0	Max. 3.0

Cylinder Head Removal Specifications



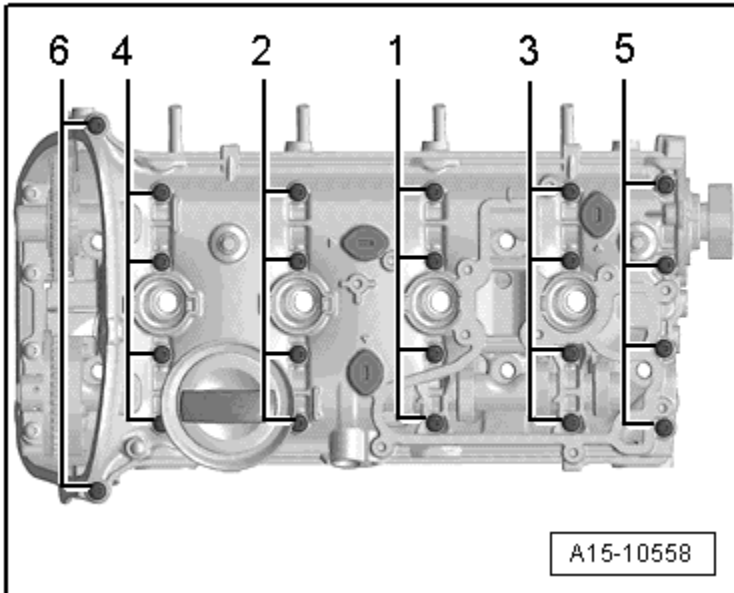
Remove cylinder head bolts 1 to 10 in sequence.

Cylinder Head Tightening Specifications



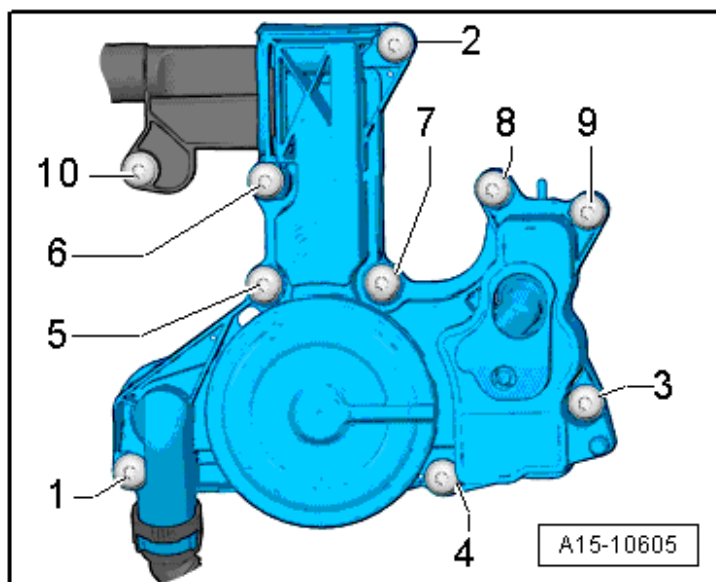
Step	Component	Nm
1	Tighten bolts 1 through 10 in sequence	40
2	Tighten bolts 1 through 10 in sequence	an additional 90° (¼ turn)
3	Tighten bolts 1 through 10 in sequence	an additional 90° (¼ turn)
4	Tighten bolts arrows	8
5	Tighten bolts arrows	an additional 90° (¼ turn)

Cylinder Head Cover Tightening Specifications



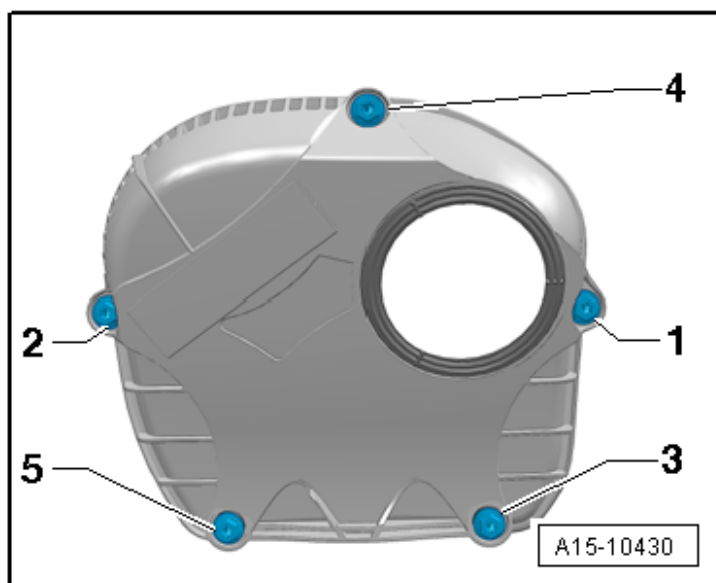
Step	Component	Nm
1	Tighten bolts 1 through 6 in sequence in several stages	Hand-tighten
2	Tighten bolts 1 through 6 in sequence	8
3	Tighten bolts 1 through 6 in sequence	an additional 90° (¼ turn)

Crankcase Ventilation Tightening Specifications



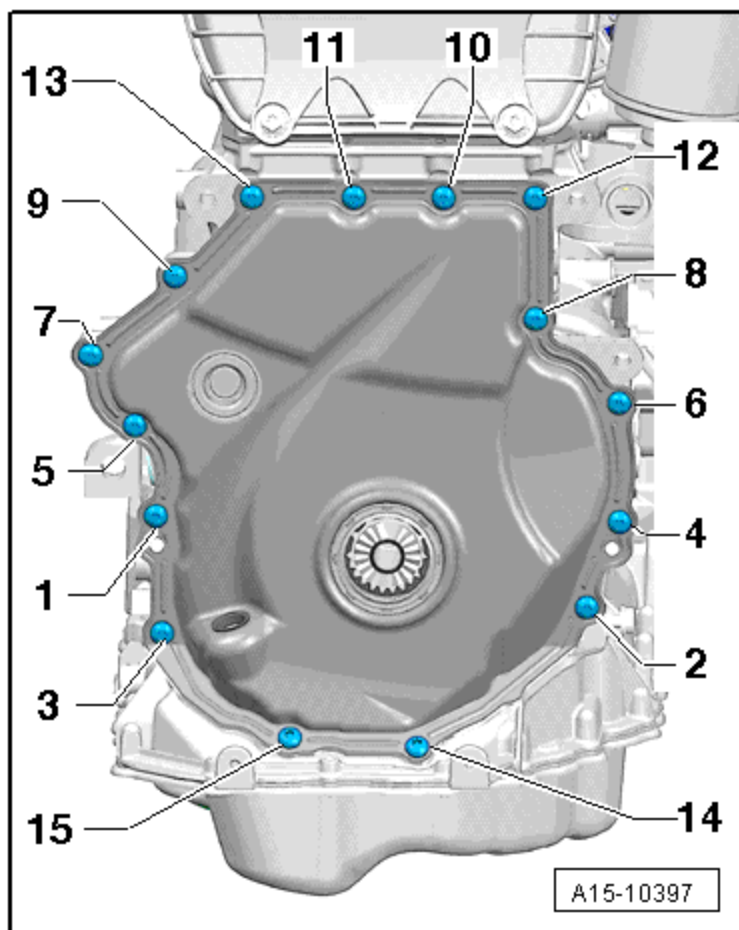
Step	Component	Nm
1	Tighten bolts 1 through 10 in sequence	11

Upper Timing Chain Cover Tightening Specifications



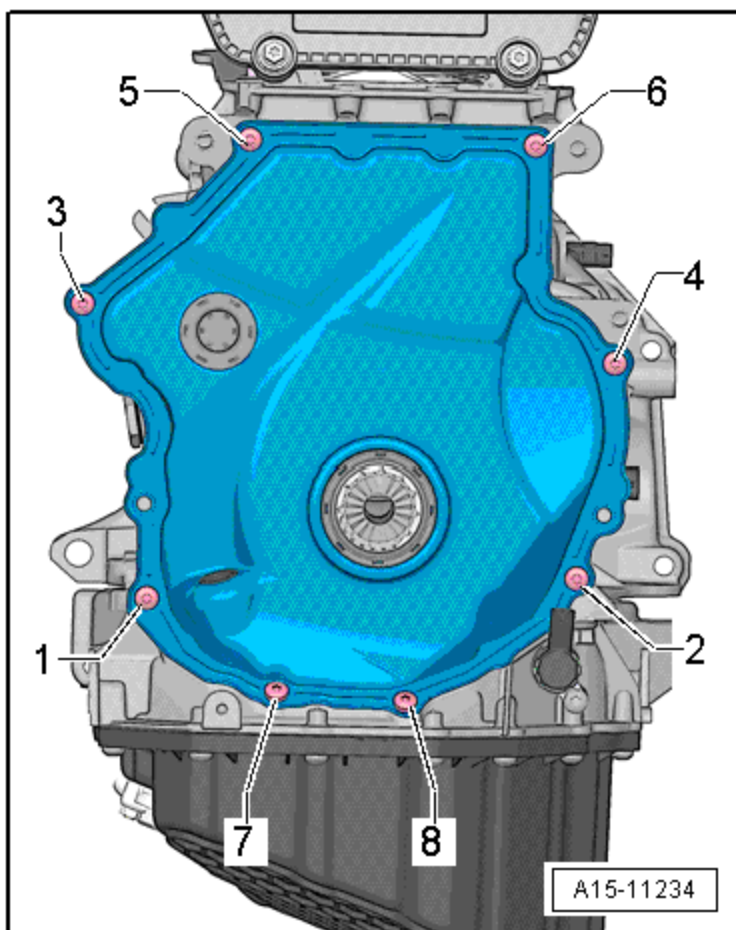
Step	Component	Nm
1	Tighten bolts 1 through 5 in sequence	9

Lower Timing Chain Cover with 15 Bolts Tightening Specifications



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

Lower Timing Chain Cover with 8 Bolts Tightening Specifications



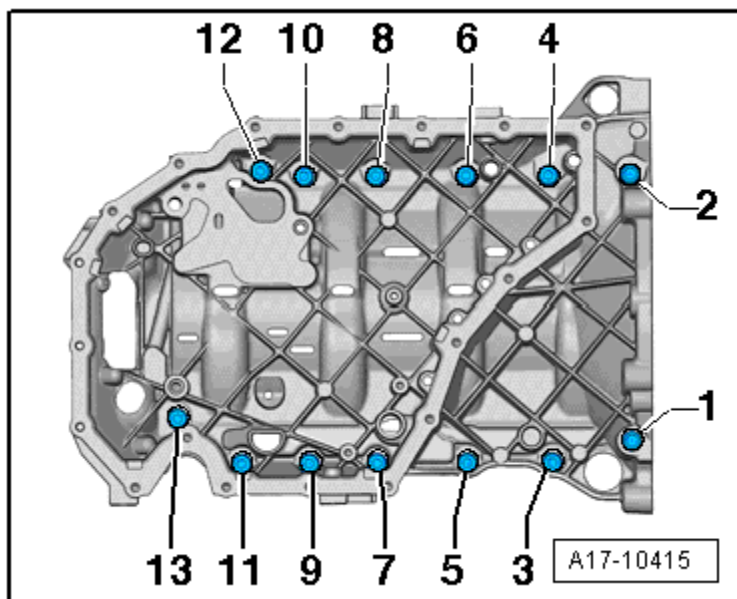
Step	Component	Nm
1	Tighten bolts 1 through 8 in sequence	4
2	Tighten bolts 1 through 8 in sequence	an additional 45° (1/8 turn)

Lubrication – 2.0L CPMB, CHJA

Fastener Tightening Specifications

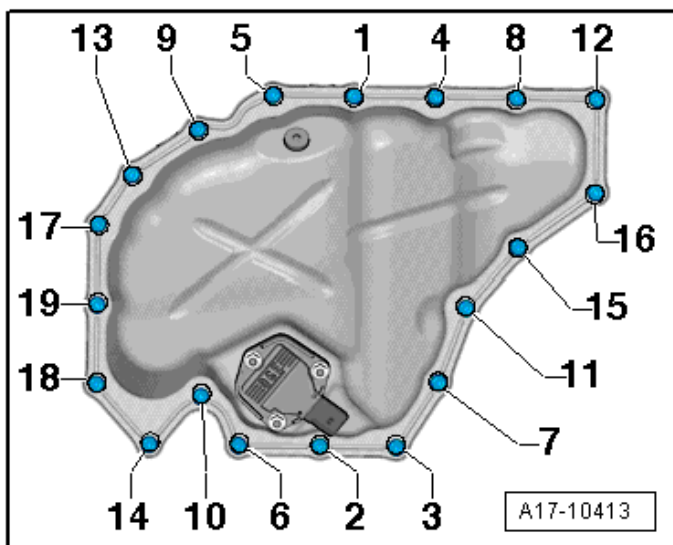
Component	Nm
Chain tensioner bolts	9
Engine oil cooler bolts	23
Oil baffle bolts	9
Oil drain plug (replace)	30
Oil level thermal sensor nut	9
Oil pump bolts	20
Oil pressure regulation valve bolts	9
Oil pressure switch bolt	20
Reduced oil pressure switch bolt	20
Suction line bolts	9

Upper Oil Pan Tightening Specifications



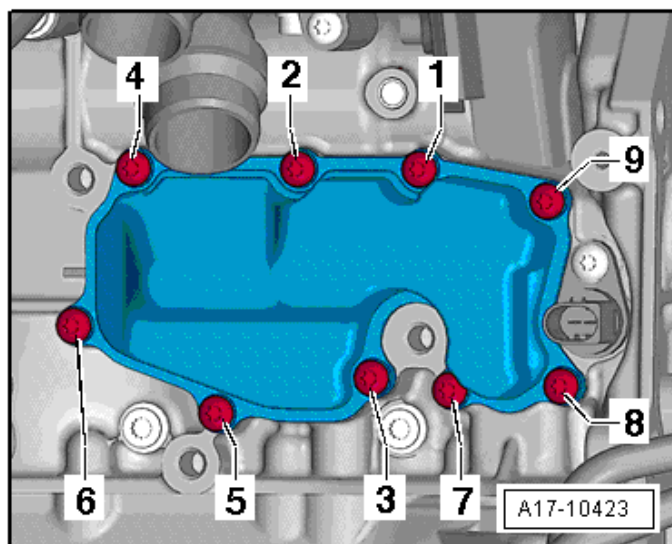
Step	Component	Nm
1	Tighten bolts 1 through 13 in sequence	15
2	Tighten bolts 1 through 13 in sequence	an additional 90° (¼ turn)

Oil Pan Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 19 in sequence	8
2	Tighten bolts 1 through 19 in sequence	an additional 45° (1/8 turn)

Oil Separator Tightening Specifications



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

Engine Cooling – 2.0L CPMA, CHJA

Fastener Tightening Specifications

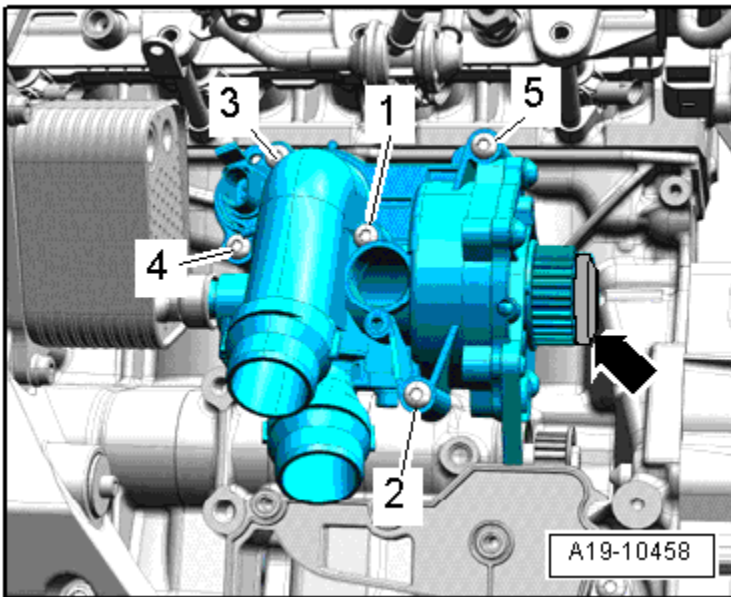
Component	Nm
After-run coolant pump bracket bolt (Hybrid)	23
Bleeder screw	5
Bracket for low temperature circuit coolant pump nut (Hybrid)	20
Bracket for pump unit bolt (Hybrid)	23
Bracket for transmission coolant valve bolt	23
Bracket only hot climate version bolt ³⁾	4
	9
Bracket to after-run coolant pump bolt (Hybrid)	2.7
Bracket to coolant recirculation pump bolt (Hybrid)	2.7
Connection to coolant pump bolt	9
Coolant circuit solenoid valve to bracket nut (Hybrid)	9
Coolant circuit solenoid valve to coolant shut-off valve bolt (Hybrid)	9
Coolant connection bolt	9
Coolant fan control module to fan shroud bolt	2.5
Coolant pipe for electric drive power and control electronics bolt (Hybrid)	9
Fan shroud to coolant fan bolt	5
Front coolant pipe bolt	6
Lower coolant pipe on lock carrier to condenser bolt	4.5
Low temperature circuit coolant pump bolt	9
Low temperature circuit coolant pump nut (Hybrid)	20
Low temperature coolant circuit radiator frame to condenser bolt	8
Mounting plate to coolant recirculation pump bolt	2.7
Radiator bracket bolt	5.5
Radiator bracket to radiator bolt	4.5
Retaining plate (Only with the threaded version)	4
Small coolant pipe bolt	9
Toothed belt cover to coolant pump bolt	9
Toothed belt drive gear to balance shaft bolt ^{1) 2)}	10 an additional 90° (¼ turn)
Transmission coolant valve to bracket nut	9

¹⁾ Replace

²⁾ Left thread

³⁾ For bolt tightening clarification, refer to ElsaWeb, *Coolant Pipes Overview*, items 21 and 23.

Coolant Pump Tightening Specifications



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

Fuel Supply – 2.0L CPMA, CHJA

Fastener Tightening Specifications

Component	Nm
Accelerator pedal module	8
Bracket to air filter bolt (Hybrid)	5
EVAP canister to bracket	16
EVAP canister to bracket for the honeycomb filter (Hybrid) bolt	1.5
	2.8
Fuel pump control module	2.5
Fuel tank nut/bolt	20
Fuel pump control module bolt	2.5
Fuel tank heat shield bolt	4
Fuel tank leak detection control module nut (Hybrid)	1.6
Fuel tank pressure sensor to bracket bolt 1 (Hybrid) bolt	1.5
	5
Leak detection pump air filter nut	5
Leak Detection Pump (LDP)-to-EVAP canister bolt	4

Fastener Tightening Specifications (cont'd)

Component	Nm
Locking flange cover bolt	1.5
Locking ring	110
Mounting strap to fuel tank bolt	20
Securing fuel filler tube and the ground connection bolt	20

¹⁾ For bolt tightening clarification, refer to ElsaWeb, *EVAP Canister and Leak Detection System Overview*, items 19 and 20.

¹⁾ For bolt tightening clarification, refer to ElsaWeb, *EVAP Canister and Leak Detection System Overview*, items 4 and 23.

Turbocharger – 2.0L CPMA, CHJA

Fastener Tightening Specifications

Component	Nm
Bracket	30
Charge Air Cooler (CAC)	7
Charge air pressure sensor to air guide pipe bolt	5
Clamping strip-to-engine, nut ⁵⁾ ⁶⁾	30
Connection to turbocharger bolt	9
Coolant return line ³⁾	9
	35
Coolant supply line ²⁾	9
	35
Crankcase ventilation pipe	9
Hose clamp	5.5
Oil return pipe	9
Oil supply line-to-turbocharger ¹⁾	9
	30
Support to bracket bolt	30
Turbocharger recirculation valve to turbocharger bolt	7
Turbocharger-to-support ⁴⁾	30
Wastegate bypass regulator valve	3

¹⁾ For bolt tightening clarification, refer to ElsaWeb, Turbocharger Overview Part II, items 6, 8 and 9.

²⁾ For bolt tightening clarification, refer to ElsaWeb, Turbocharger Overview Part II, items 12, 13 and 14.

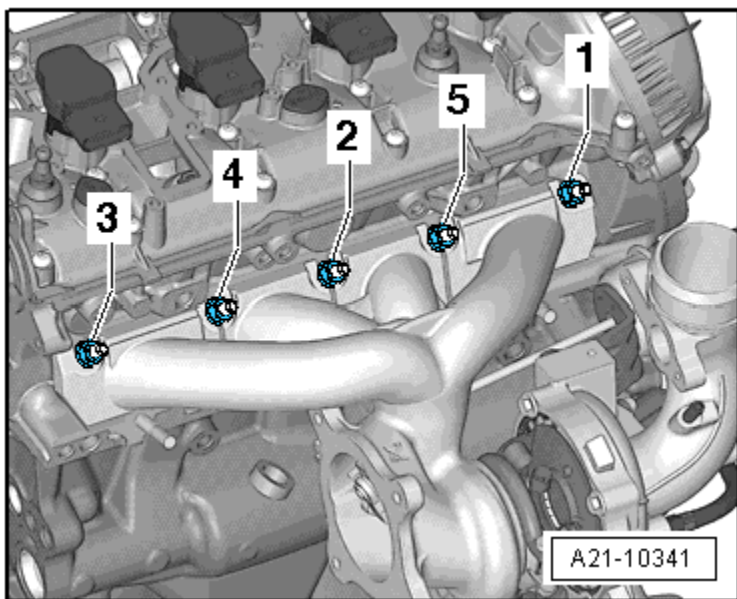
³⁾ For bolt tightening clarification, refer to ElsaWeb, Turbocharger Overview Part III, items 3 and 6.

⁴⁾ Coat the bolt with hot bolt paste; hot bolt paste, refer to the Parts Catalog.

⁵⁾ Replace

⁶⁾ Coat the exhaust manifold stud bolts with hot bolt past; hot bolt paste, refer to the Parts Catalog

Turbocharger Tightening Specifications



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

Exhaust System – 2.0L CPMB, CHJA

Fastener Tightening Specifications

Component	Nm
Bracket for rear muffler	23
Bracket for the secondary air injection pump motor nut	9
Catalytic converter nuts ²⁾³⁾	25
	40
Clamping sleeve nut	25
Connection bolt	4
Front clamping sleeve nut	23
Heat shield-to-pipe for secondary air	9
Pipe for secondary air bolt ⁴⁾	9
	20
Rear clamping sleeve nut	23
Secondary air injection solenoid valve bolt	9
Suspended mount bolt ¹⁾	23

¹⁾ Replace if damaged

²⁾ For bolt tightening clarification, refer to ElsaWeb, *Emissions Control Overview*, items 1 and 6.

³⁾ Replace

⁴⁾ For bolt tightening clarification, refer to ElsaWeb, *Secondary Air Injection System Overview*, items 4 and 25.

Fuel Injection and Ignition – 2.0L CPMB, CHJA

Fastener Tightening Specifications

Component	Nm
Bracket for the connectors	4
Bracket to intake manifold bolt	4
Clamp for high pressure line	5
Connection for fuel return line	40
Fuel line with bracket for cold start injector bolt	9
Fuel rail bolt	5
Fuel rail bolt (engine code CPMB)	9
Fuel return pipe union nut	27
High pressure line union nut	27
Intake Air Temperature (IAT) sensor to intake manifold bolt	5
Intake manifold bolt/nut	
- Pre-tightening specification	3
- Final tightening specification	10
Intake manifold runner position sensor to intake manifold bolt	0.8
Intake manifold support bolt	
- Nut	10
- Bolt	20
Low fuel pressure sensor	27
Oxygen sensor 1	55
Throttle valve control module to intake manifold bolt	7
Vacuum hose bolt	4

¹⁾ Coat the threads on the new heated oxygen sensors with assembly paste.

Ignition/Glow Plug System– 2.0L CPMB, CHJA

Technical Data

Engine data	2.0L Turbo FSI engine
Idle speed Idle speed cannot be adjusted, it is regulated by idle stabilization	640 to 800 RPM
RPM limited by switching off fuel injectors and closing throttle valve	Approximately 6500 RPM
Ignition timing is regulated by control module. It is not possible to adjust the ignition timing.	
Ignition System	Single coil ignition system with 4 ignition coils (output stages integrated) that are connected directly to spark plugs via the ignition cables.
Ignition sequence	1-3-4-2
Spark plugs	Refer to the Parts Catalog

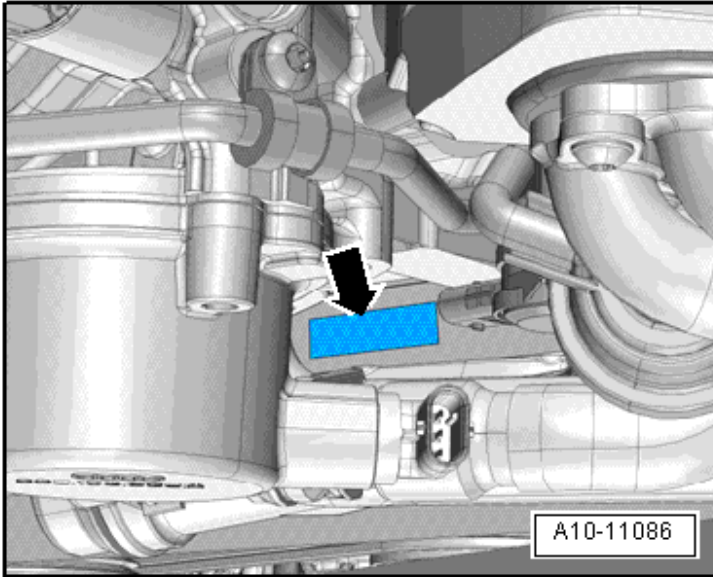
Fastener Tightening Specifications

Component	Nm
Camshaft position sensor bolt	9
Engine speed sensor bolt	4.5
Knock sensor bolt	20

ENGINE MECHANICAL – 3.0L CTUC, CTUD

General, Technical Data – 3.0L CTUC, CTUD

Engine Number Location



The engine number (engine code and serial number) is located at front on cylinder block, below the right cylinder head (1➡).

Engine codes beginning with “C” are four-digit.

The first 3 digits of the engine code are for displacement and mechanical structure of the engine and are stamped on the cylinder block. The fourth digit describes the engine output and torque.

Engine Data

Identification codes		CTUC	CTUD
Displacement	liter	2.995	2.995
Output	kW at RPM	200/4800 to 6500	260/6000 to 6500
Torque	Nm at RPM	400/2250 to 4250	470/4000 to 4500
Bore	diameter mm	84.5	84.5
Stroke	mm	89.0	89.0
Compression ratio		10.5	10.5
RON	at least	95 ¹⁾	98 ²⁾
Fuel injection and ignition system		Simos	Simos
Ignition sequence		1-4-3-6-2-5	1-4-3-6-2-5
Turbocharger		No	No
Knock control		2 sensors	2 sensors
Oxygen Sensor (O2S) regulation		2 sensors before catalytic converter 2 sensors after catalytic converter	2 sensors before catalytic converter 2 sensors after catalytic converter
Variable valve timing		Intake	Intake
Variable intake manifold		No	No
Secondary Air Injection (AIR) system		Yes	Yes
Valve per cylinder		4	4

¹⁾ Unleaded RON 91 is permitted but performance is reduced.

²⁾ Unleaded RON 95 is permitted but performance is reduced.

Engine Assembly – 3.0L CTUC, CTUD

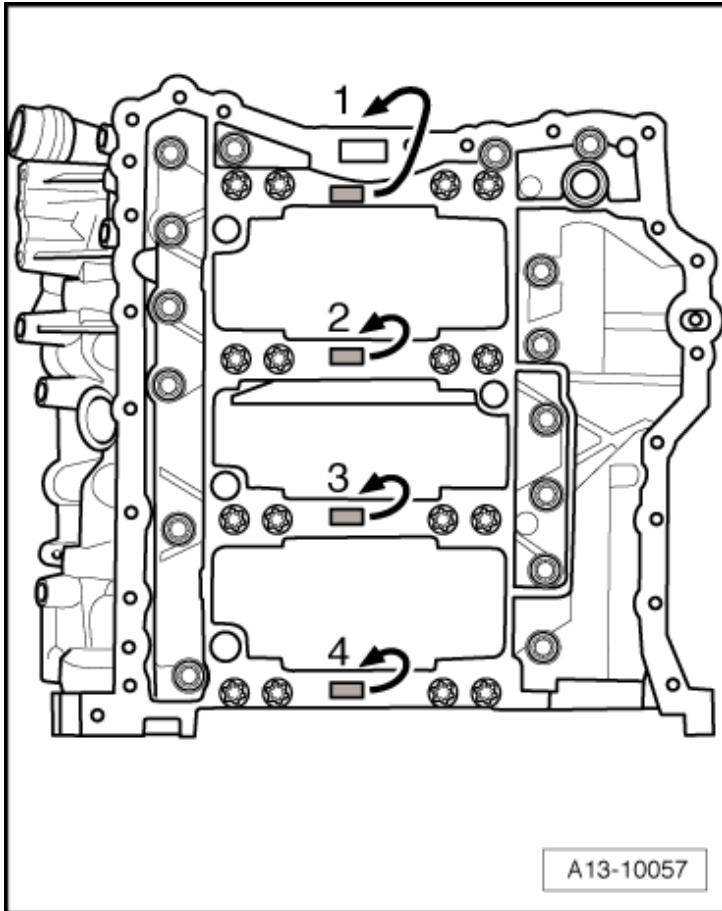
Fastener Tightening Specifications

Component	Fastener size	Nm
Bolts and nuts	M6	9
	M7	15
	M8	20
	M10	40
	M12	65
Engine mount (replace fastener)	-	90 plus an additional 90° (¼ turn)
Engine mount retaining plate	-	20
Engine support	-	40
Heat shield	-	10
Subframe to retaining plate	-	55

Crankshaft, Cylinder Block – 3.0L CTUC, CTUD

Engine –
3.0L CTUC, CTUD

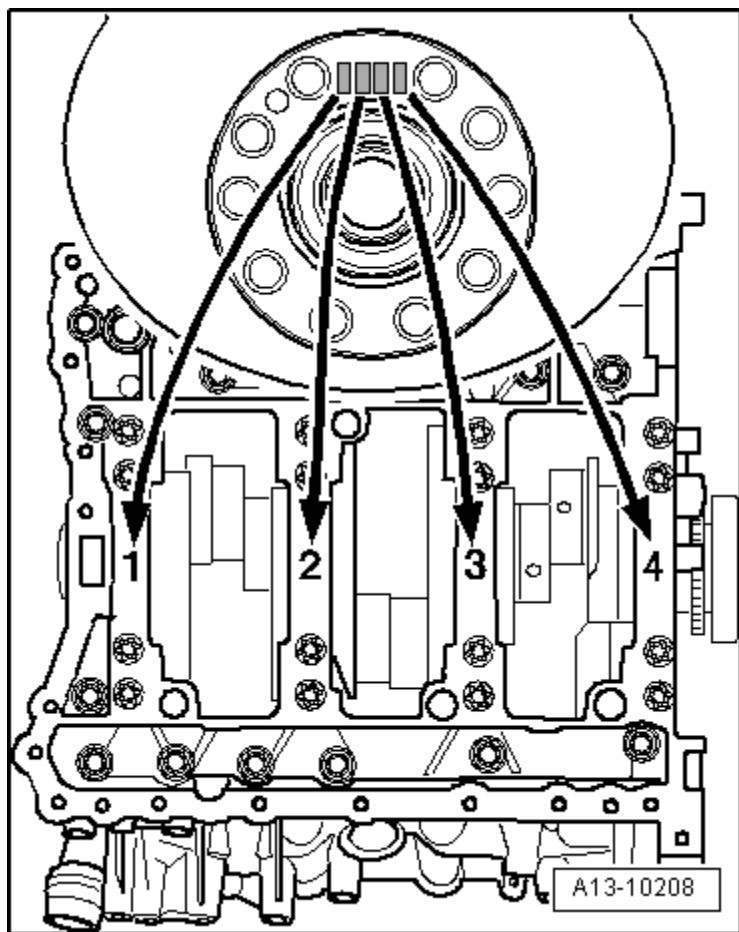
Allocation of Crankshaft Bearing Shells for Cylinder Block



The bearing shells are allocated to the cylinder block with the correct thickness from the factory. Colored dots on the sides of the bearing shells identify the bearing shell thickness. Allocation of the bearing shells to the cylinder block is marked by a letter on the respective bearing on the guide frame.

Letter on guide frame	Color of bearing
R	Red
G	Yellow
B	Blue
S	Black

Allocation of Crankshaft Bearing Shells for Guide Frame



The bearing shells are allocated to the guide frame with the correct thickness from the factory. Colored dots on the sides of the bearing shells identify the bearing shell thickness.

Allocation of the bearing shells to the guide frame is marked on the flywheel flange of the crankshaft by a row of letters. The first letter represents bearing 1, the second letter is for bearing 2, etc.

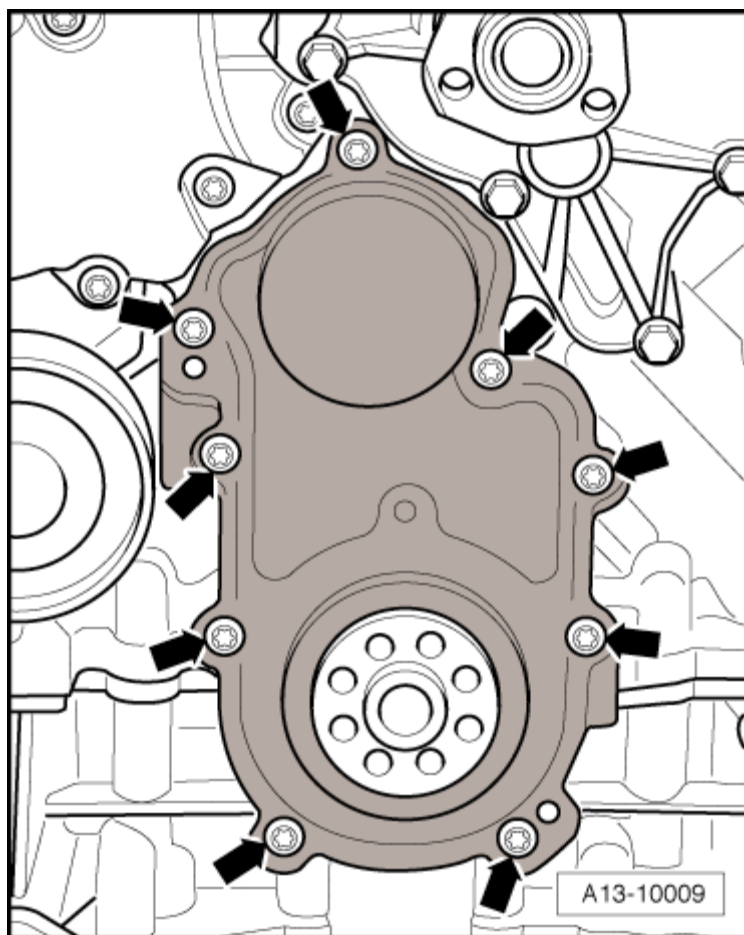
Letter on crankshaft	Color of bearing
R	Red
G	Yellow
B	Blue
S	Black

Fastener Tightening Specifications

Component	Nm
Connecting rod bearing cap-to-connecting rod bolt (replace fastener)	50 plus an additional 90° (¼ turn)
Coolant pump-to-engine bolt	9
Drive plate (replace fastener)	60 plus an additional 90° (¼ turn)
Idler roller-to-coolant pump bolt	40
Idler roller-to-supercharger bolt	40
Marking locking bolt	14
Oil pressure regulation valve-to-engine bolt	9
Oil spray jet bolt	9
Tensioner for the ribbed belt-to-engine bolt	40
Vibration damper-to-engine bolt (replace fastener)	20 plus an additional 90° (¼ turn)

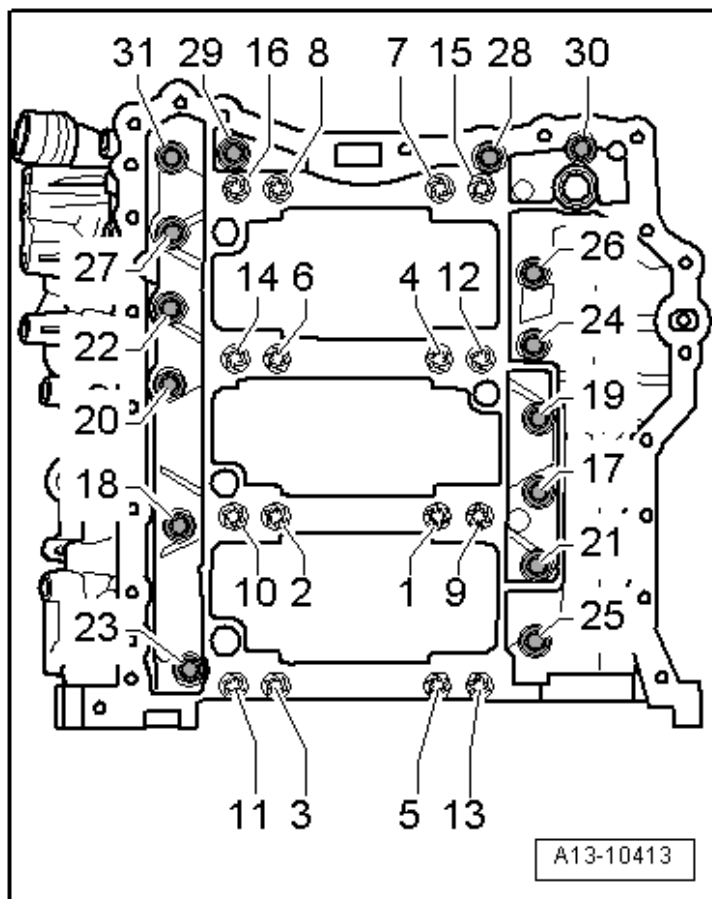
¹⁾ Insert bolt with locking compound.

Ribbed Belt Sealing Flange Tightening Specification



Component	Nm
Tighten the bolts ➔ in a diagonal sequence	9

Guide Frame Tightening Specifications



Replace the guide frame bolts and insert the long bolts in the inner rows of the guide frame.

Step	Component	Nm
1	Tighten bolts 1 through 16 in sequence	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

Crankshaft Dimensions

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

Piston Ring End Gaps

Piston ring Dimensions in mm	New gap	Wear limit
1 st compression ring	0.20 to 0.30	0.80
2 nd compression rings	0.50 to 0.70	0.80
Oil scraping ring	0.25 to 0.50	Not determined yet

Piston Ring Clearance

Piston ring Dimensions in mm	New	Wear limit
1 st compression ring	0.04 to 0.08	0.20
2 nd compression rings	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 ¹⁾	84.51

¹⁾ Dimension without graphite coating (thickness 0.02 mm). The graphite coating wears away.

Compression Checking Specifications

Compression pressure	Bar pressure
New	10.0 to 14.0
Wear limit	9.0
Maximum difference between cylinders	30

Cylinder Head, Valvetrain – 3.0L CTUC, CTUD

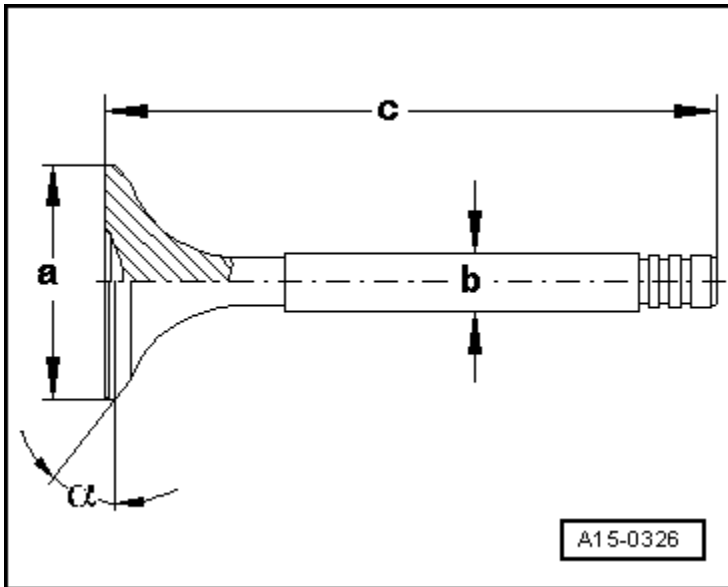
Fastener Tightening Specifications

Component	Nm
Balance shaft belt pulley side-to-balance shaft bolt	60
Balance shaft chain sprocket ²⁾	15 plus an additional 90° (¼ turn)
Balance shaft transmission side-to-balance shaft bolt	60
Bearing plate for the right camshaft timing chain drive sprocket bolt ²⁾	8 plus an additional 45° (⅙ turn)
Camshaft adjustment solenoid valve-to-cylinder head	5
Camshaft chain sprocket bolt ²⁾	80 plus an additional 90° (¼ turn)
Chain tensioner for the left camshaft control chain-to-engine bolt	9
Chain tensioner for the right camshaft timing chain-to-engine bolt	9
Chain tensioner for timing mechanism drive chain-to-engine bolt	9
Chain tensioner with glide track-to-engine bolt	10 plus an additional 45° (⅙ turn)
Drive chain sprocket for the oil pump-to-engine bolt	30 plus an additional 90° (¼ turn)
Gear carrier bolt	13
Glide track-to-engine bolt ²⁾	10 plus an additional 90° (¼ turn)
Mounting pin for the drive chain sprocket bolt-to-engine bolt ^{1) 2)}	5 plus an additional 60° (⅙ turn)
Mounting pin for the drive chain sprocket bolt-to-engine bolt ^{1) 2)}	30 plus an additional 90° (¼ turn)
Oil dipstick guide tube-to-engine bolt	9

¹⁾ For bolt tightening clarification, refer to ElsaWeb, Timing Mechanism Drive Chain Overview, items 4 and 14.

²⁾ Replace fastener

Valve Dimensions



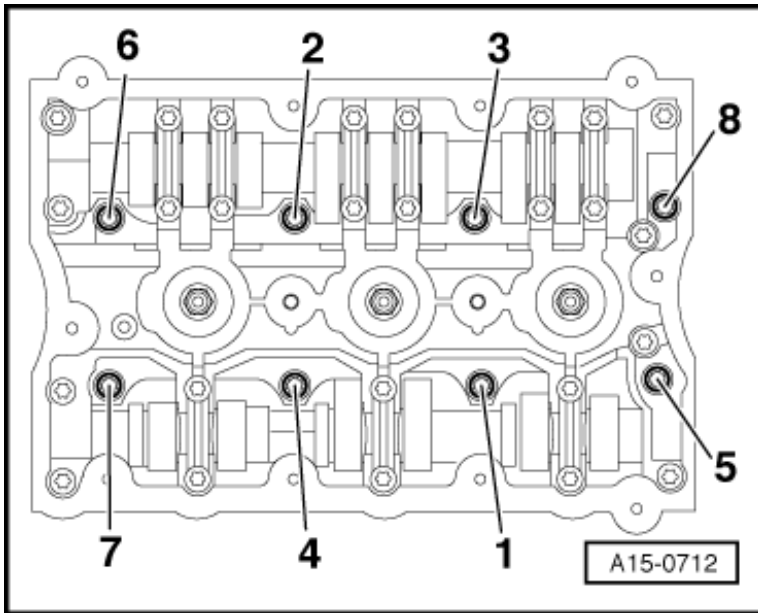
Dimension		Intake valve	Exhaust valve
Diameter a	mm	33.85 ± 0.10	28.0 ± 0.1
Diameter b	mm	5.98 ± 0.01	5.96 ± 0.01
c	mm	104.0 ± 0.2	101.9 ± 0.2
α	$^{\circ}$	45	45



WARNING

- Risk of injury if exhaust valves with sodium filling are disposed of improperly.
- Cut exhaust valve with sodium filling into 2 parts using a metal saw between the shaft center and valve plate. While doing this, do not come into contact with water.
- Throw, at the most, 10 such sawed exhaust valves in a bucket filled with water and step back immediately.
- When there is contact with water, a sudden chemical reaction occurs which burns the sodium filling.
- The treated parts may then be discarded through conventional disposal channels.

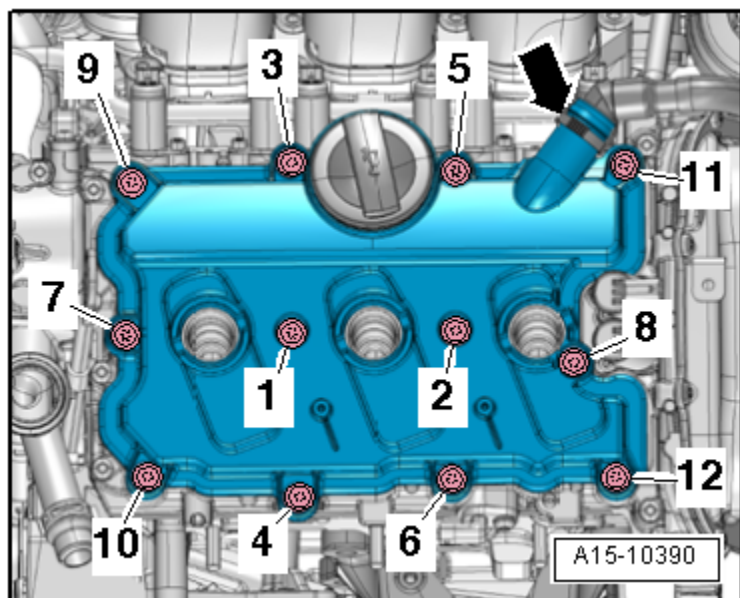
Cylinder Head Tightening Specifications



Replace any bolts that were tightened with an additional turn.

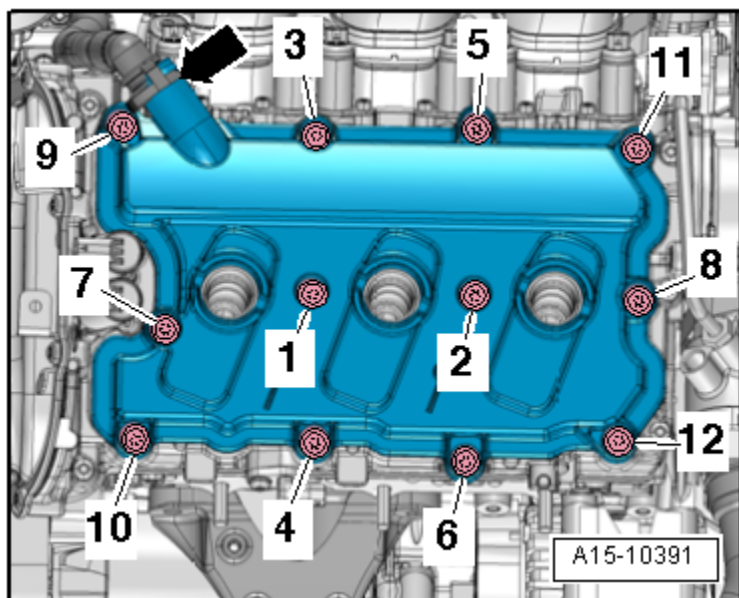
Step	Component	Nm
1	Insert and tighten bolts 1 through 8 in sequence	Hand-tighten
2	Tighten bolts 1 through 8 in sequence	40
3	Tighten bolts 1 through 8 in sequence	an additional 90° (¼ turn)
4	Tighten bolts 1 through 8 in sequence	an additional 90° (¼ turn)

Left Cylinder Head Cover Tightening Specification



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

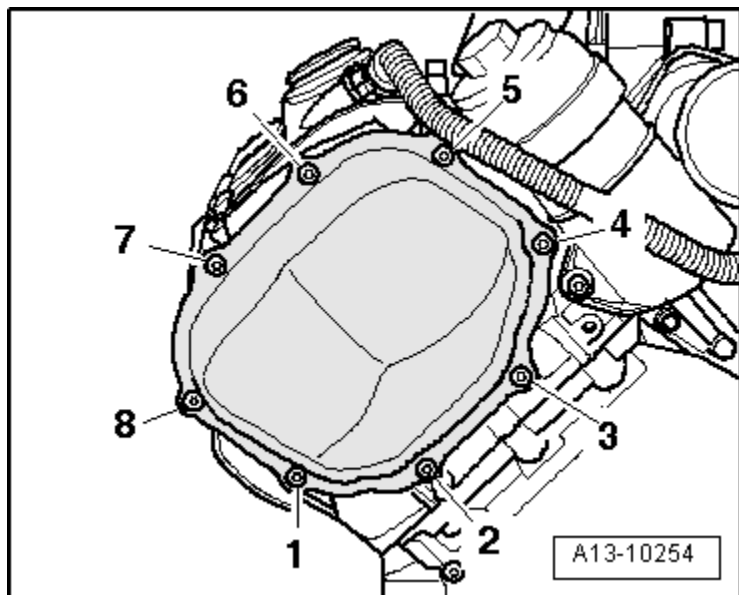
Right Cylinder Head Cover Tightening Specification



Engine –
3.0L CTUC, CTUD

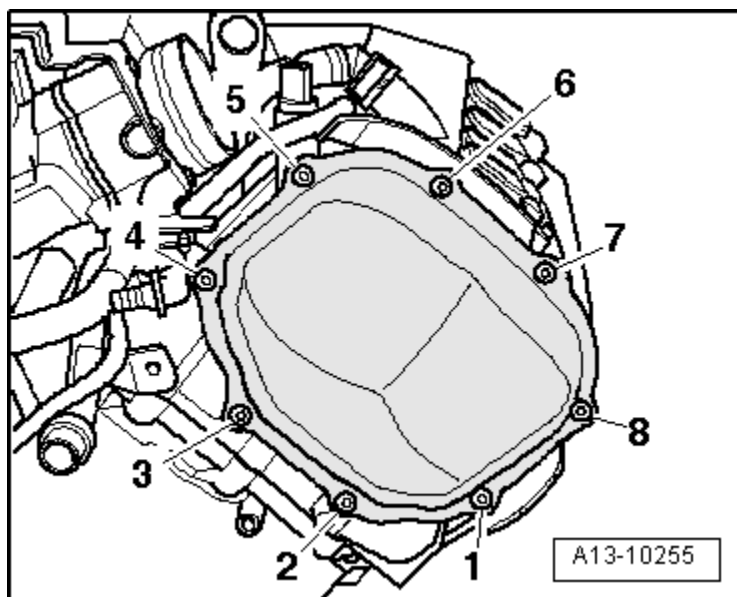
Step	Component	Nm
1	Tighten bolts 1 through 12 in sequence	9

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)

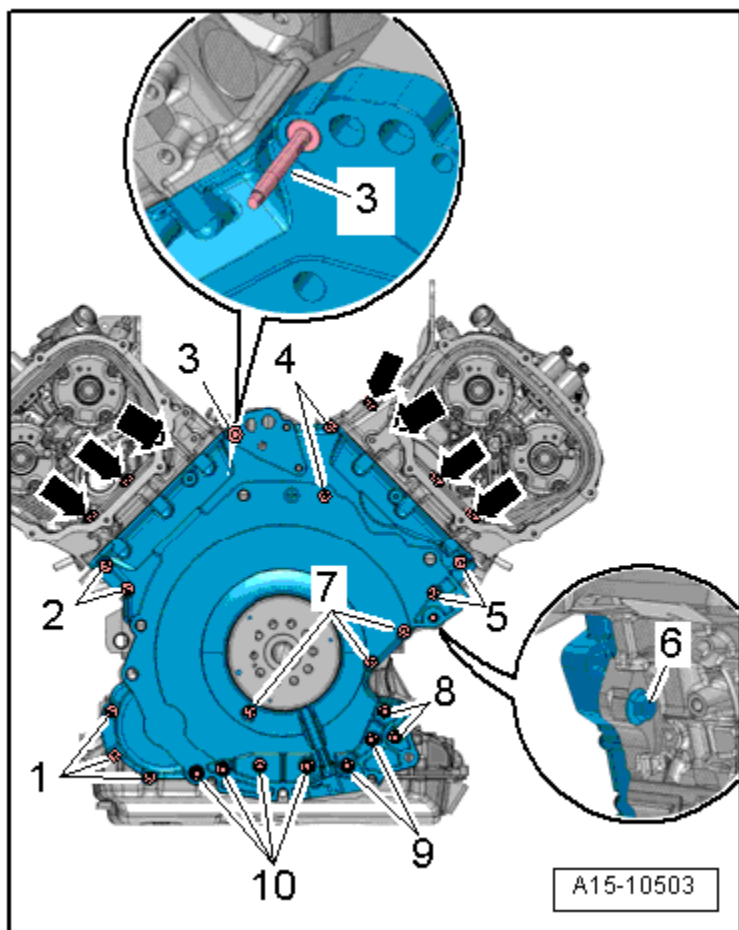
Right Timing Chain Cover Tightening Specifications



Engine –
3.0L CTUC, CTUD

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)

Lower Timing Chain Cover Tightening Specifications

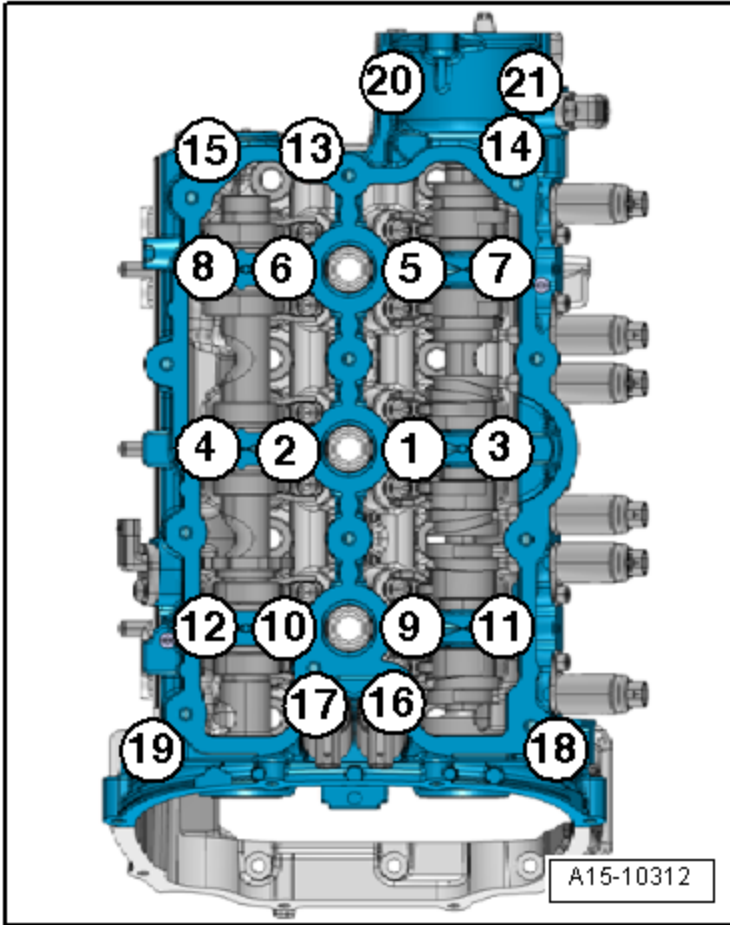


Replace any bolts that were tightened with an additional turn.

Step	Component	Nm
1	Insert the bolts (➔) and tighten	3
2	Tighten bolts 1 through 10 in sequence diagonally	3
3	Tighten bolts 1, 2, 4, 5, 7	an additional 90° turn
4	Tighten bolts 8, 9 and 10	9
5	Tighten bolt 3	8
6	Tighten bolt 6	an additional 90° turn
7	Tighten bolt 3	16
8	Tighten bolt 6	20

Step	Component	Nm
9	Tighten bolt 6	an additional 180° turn

Camshaft Guide Frame Tightening Specifications



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

Engine Lubrication – 3.0L CTUC, CTUD

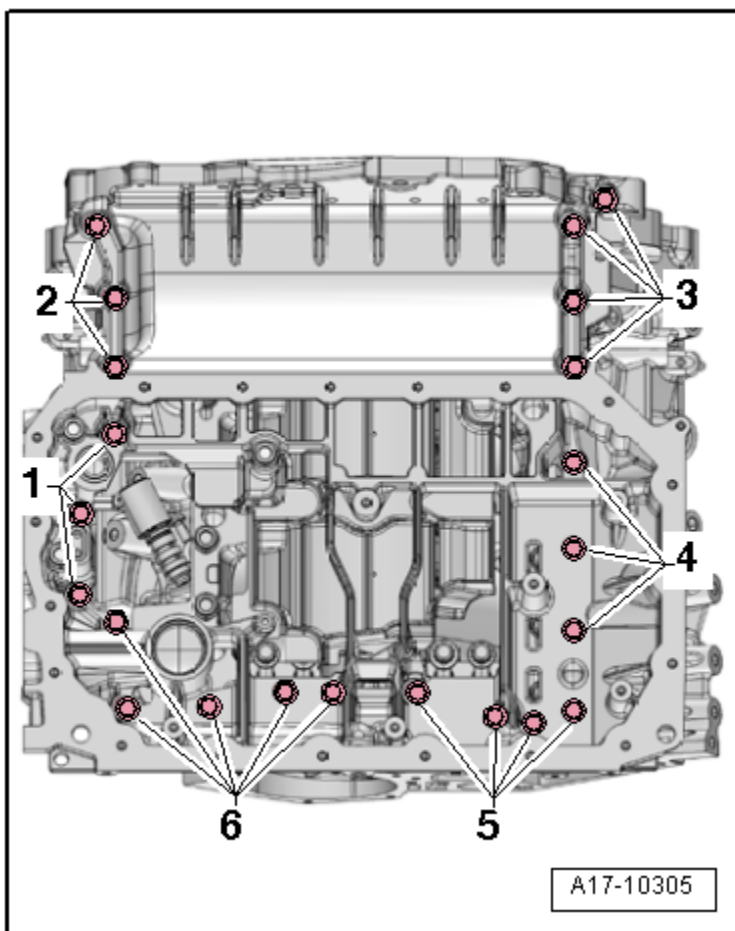
Fastener Tightening Specifications

Component	Nm
Bracket-to-upper oil pan bolt	9
Chain sprocket for the oil pump bolt (replace fastener)	30 plus an additional 90° (¼ turn)
Chain sprocket for the oil pump bolt	2.5
	9
Chain sprocket for the oil pump bolt	9
Drain plug-to-engine	20
Engine oil cooler bolt (replace fastener)	3 plus an additional 90° (¼ turn)
	9
Lower oil baffle-to-upper oil pan bolt	9
Oil drain plug	30
Oil filter housing cap	25
Oil filter housing	
- Bolt	13
- Collar Nut	13
- Bolt	9
Oil level thermal sensor-to-lower oil pan nut	9
Oil pressure switch	20
Oil pump-to-upper oil pan	20
Upper oil baffle to upper oil pan bolt (replace fastener)	30 plus an additional 90° (¼ turn)

¹⁾ For bolt tightening clarification, refer to ElsaWeb, *Oil Filter Housing and Oil Pressure Switch Overview*, items 1, 4 and 5.

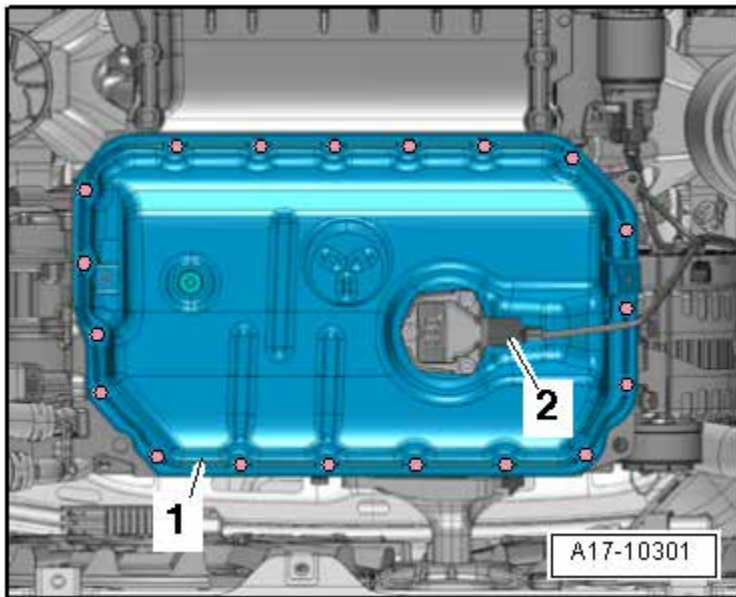
²⁾ For bolt tightening clarification, refer to ElsaWeb, *Oil Separator, Crankcase Ventilation Overview*, items 4 and 8.

Upper Oil Pan Tightening Specifications



Step	Component	Nm
1	Tighten bolts 1 through 6 in a diagonal sequence in stages	20

Lower Oil Pan Tightening Specifications



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

Cooling System – 3.0L CTUC, CTUD

Fastener Tightening Specifications

Component	Nm
Bracket for left front coolant pipes	22
Bracket for left cooler for charge air cooling circuit ³⁾	
- Bolt	6
- Nuts	9
- Bolt	23
Connection for coolant hose to engine	9
Coolant pump to engine	9
Coolant thermostat-to-engine	9
Engine temperature control temperature sensor	3
Fan shroud-to-radiator	3.5
Fan wheel-to-coolant fan	5
Front charge air cooling circuit radiator	4.5
Front coolant pipe bolts ¹⁾	2.5
	9
Idler roller for the ribbed belt	40
Left coolant pipes ²⁾	3 plus an additional 90° (¼ turn)
Left front coolant pipes-to-engine	9
Lower coolant pipe on the supercharger	5
Radiator bracket	5
Ribbed belt pulley-to-coolant pump	20
Rubber buffer	4.5
Upper coolant pipe on the supercharger	5
Upper coolant pipe-to-engine	5

¹⁾ For bolt tightening clarification, refer to ElsaWeb, *Coolant Pipes Overview*, item 6, 7 and 27.

²⁾ Replace fasteners.

³⁾ For bolt tightening clarification, refer to ElsaWeb, *Left Charge Air Cooling Circuit Radiator, Charge Air Cooling Pump Overview*, items 1, 9 and 10.

Turbocharger, Supercharger – 3.0L CTUC, CTUD

Fastener Tightening Specifications

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

¹⁾ Replace fasteners.

Exhaust System, Emission Controls – 3.0L CTUC, CTUD

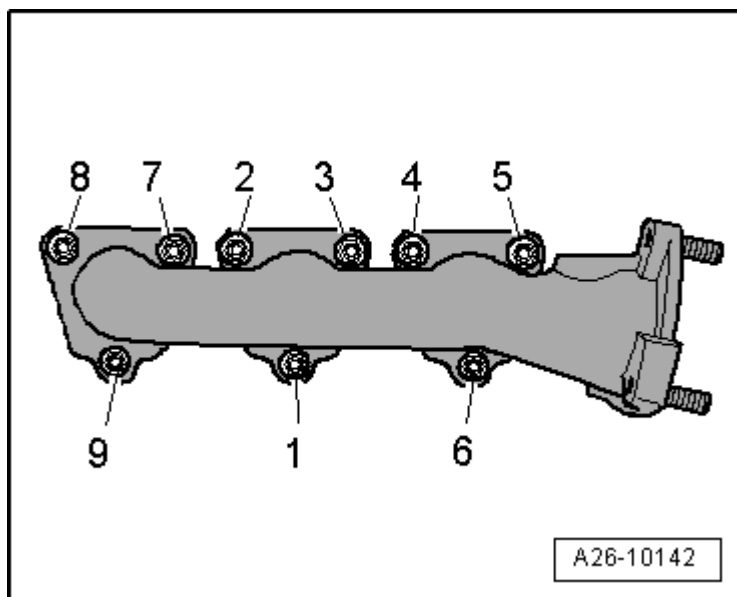
Fastener Tightening Specifications

Component	Nm
Bracket for Secondary Air Injection (AIR) hose	9
Bracket for Secondary Air Injection (AIR pump motor)	9
Bonded rubber bushing to bracket nut	9
Catalytic converter to exhaust manifold nut ¹⁾²⁾	23
Catalytic converter to front muffler nut	23
Center muffler nut ¹⁾	20
Exhaust door control unit to muffler nut	3
Heat shield	9
Left Secondary Air Injection (AIR combination valve)	9
Right Secondary Air Injection (AIR combination valve)	9
Secondary air combination valve heat shield	9
Secondary air hose bolt	9
Suspended mount bolt	23

¹⁾ Replace fasteners.

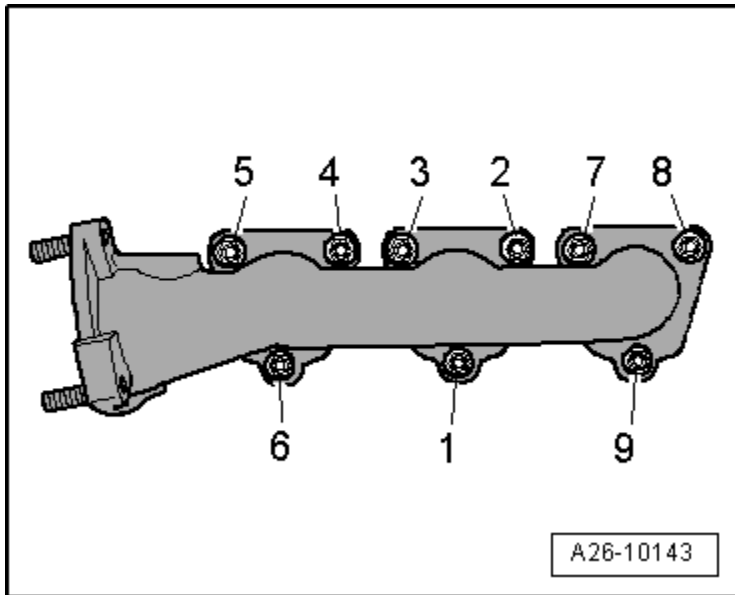
²⁾ Coat the thread with hot bolt paste.

Left 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

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

Fuel Supply – 3.0L CTUC, CTUD

Fastener Tightening Specifications

Component	Nm
Accelerator pedal module-to-pedal bracket bolt	8
Bracket (Hybrid) bolts/nuts	20
Bracket to air filter bolt (Hybrid)	5
EVAP canister-to-bracket bolt	16
EVAP canister to bracket for the honeycomb filter bolt 2 (Hybrid)	1.5
	2.8
Fuel tank nut/bolt	20
Fuel pump control module bolt	2.5
Fuel tank heat shield bolt	4
Fuel tank leak detection control module nut (Hybrid)	1.6
Fuel tank pressure sensor to bracket bolt 1 (Hybrid)	1.5
	5
Leak detection pump air filter nut	5
Leak detection pump to EVAP canister bolt	4
Locking flange cover bolt	1.5
Locking ring bolt	110
Mounting strap to fuel tank bolt	20
Securing fuel filler tube and the ground connection bolt	20

Fuel Injection and Ignition – 3.0L CTUC, CTUD

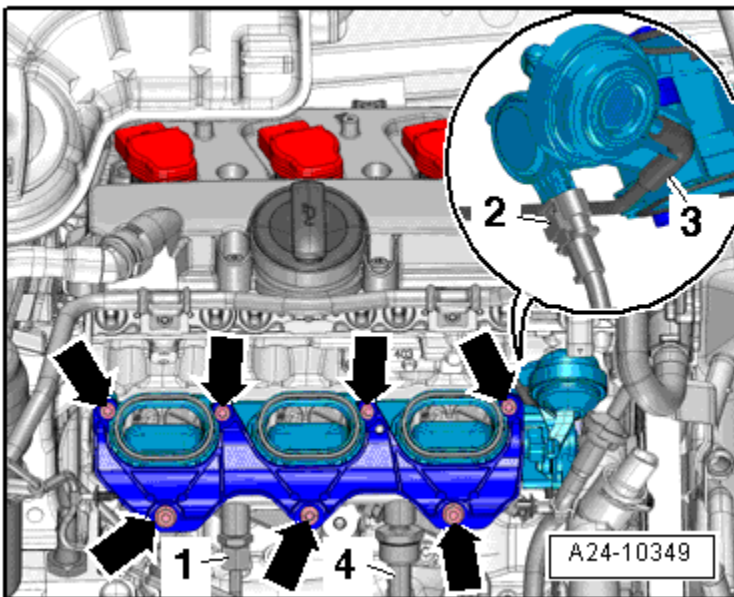
Ignition Technical Data

Engine data	3.0L TFSI
Idle speed	Cannot be adjusted, it is regulated by idle stabilization
Ignition timing	Not adjustable, regulated by Engine Control Module (ECM)
Ignition/glow plug system	Single coil ignition system with 6 ignition coils (output stages integrated) connected directly to the spark plugs via the ignition cables.
Ignition sequence	1-5-3-6-2-4

Fastener Tightening Specifications

Component	Nm
Air Filter Housing Upper Section Bolt	1.5
Air Guide to Lock Carrier Bolt	2
Camshaft Position Sensor Bolt	9
Engine Speed Sensor Bolt	9
Fuel Line Bracket Bolt	9
Fuel Line to Fuel Rail Threaded Connection	40
Fuel Pressure Sensor	22
Fuel Rail Bracket Bolt	2.5
Fuel Supply Hose to High Pressure Pump Threaded Connection	27
Heat Shield Double Stud to High Pressure Pump	9
High Pressure Line	25
Ignition Coil Harness Retainer Bolt	5
Intake Air Temperature Sensor/Manifold Absolute Pressure Sensor	10
Intake Manifold Runner Position Sensor Bolts	2.5
Knock Sensor Bolt	25
Low Fuel Pressure Sensor	15
Oxygen Sensor	55
Throttle Valve Control Module (diagonal sequence)	10

Lower Intake Manifold Tightening Specifications



Engine –
3.0L CTUC, CTUD

Component	Nm
Lower intake manifold-to-cylinder head (➔) (tighten diagonally)	9

Ignition/Glow Plug System – 3.0L CTUC, CTUD

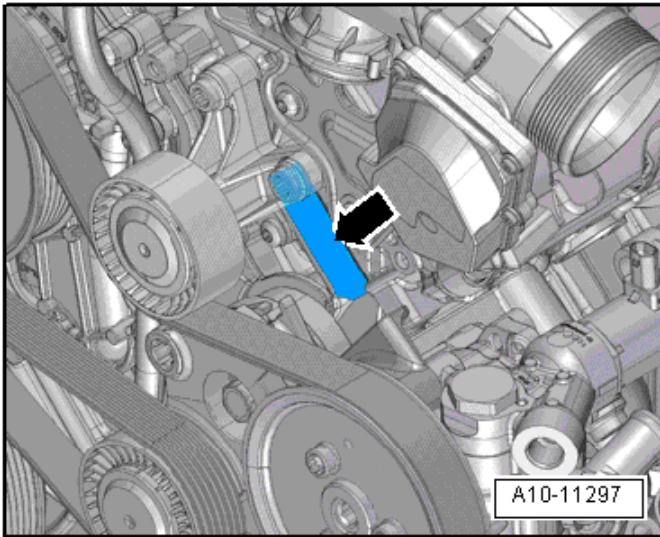
Fastener Tightening Specifications

Component	Nm
Camshaft position sensor bolt	9
Engine speed sensor bolt	9
Ignition coil harness retainer bolt	5
Knock sensor bolt	25

ENGINE MECHANICAL – 3.0L CPNB (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 (➡). In addition, a sticker with “engine code” and “serial number” is affixed to the intake manifold. 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. The four digit engine code is on the type plate, vehicle data label and engine control module.

Engine Data

Code letters		CPNB
Displacement	liter	2.967
Output	kW at RPM	176 @ 4000 to 4500
Torque	Nm at RPM	580 @ 1700 to 2750
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		1 Turbocharger
Charge air cooler		Yes
Oxygen Sensor (O2S) regulation		Heated Oxygen Sensor (HO2S) 1
Particulate Filter		Yes
Selective Catalytic Reduction (SCR) - catalytic converter		Yes
Valve per cylinder		4

**Engine –
3.0L CPNB (TDI)**

Engine Assembly – 3.0L CPNB (TDI)

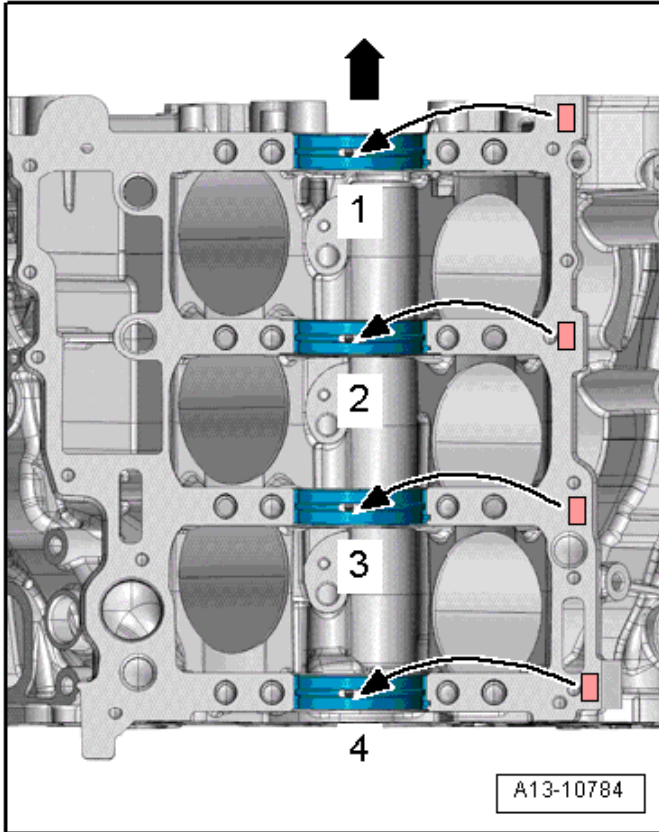
Fastener Tightening Specifications

Component	Fastener size	Nm
Bolts and nuts	M6	9
	M7	15
	M8	20
	M10	40
	M12	65
Engine mount to engine support bolt ¹⁾	-	90 plus an additional 90° (¼ turn)
Engine support bolt	-	40
Heat shield to engine support bolt	-	10
Retaining plate bolt	-	20
Subframe to retaining plate bolt	-	55
Transverse beam to lock carrier nut	-	40
Stop for torque bracket to transverse beam bolt	-	30
Torque bracket bolt ¹⁾	-	20 plus an additional 90° (¼ turn)

¹⁾ Replace fastener(s).

Crankshaft, Cylinder Block – 3.0L CPNB (TDI)

Allocation of Crankshaft Bearing Shells for Cylinder Block

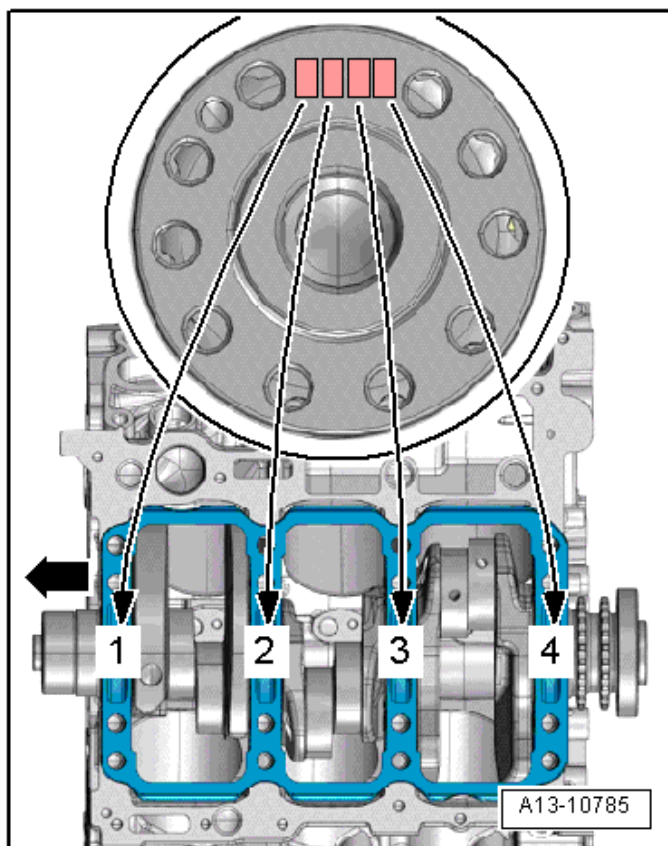


**Engine –
3.0L CPNB (TDI)**

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

Letter on guide frame	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 guide frame at the factory. Colored dots on the sides of the bearing shells identify the bearing shell thickness. Allocation of the bearing shells to the guide frame is marked on the flywheel flange of the crankshaft by a row of letters. The first letter represents bearing 1, the second letter is for bearing 2, etc.

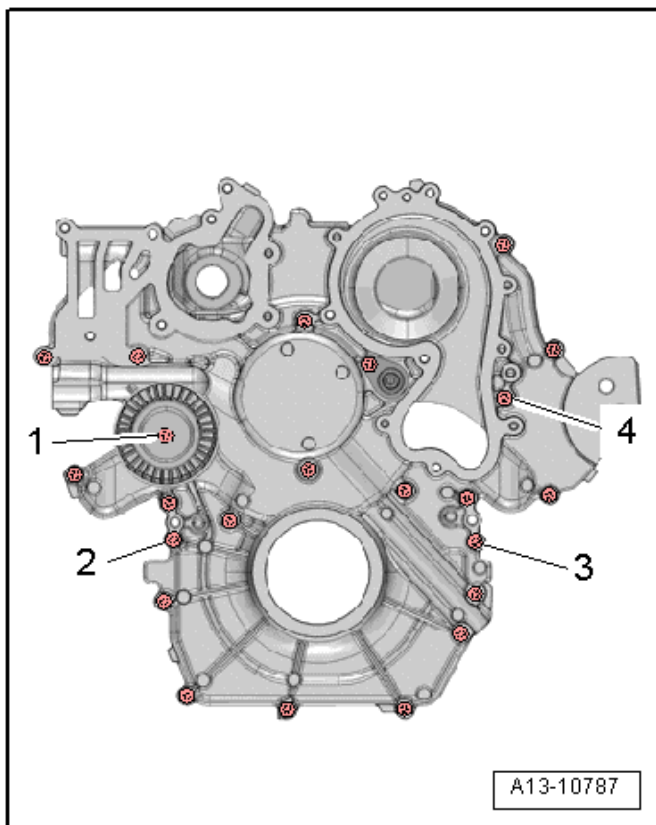
Letter on guide frame	Color of bearing
R	Red
G	Yellow
B	Blue

Fastener Tightening Specifications

Component	Nm
Bracket for A/C compressor tighten in 2 steps:	
- Diagonally	5
- Diagonally	40
Bracket for generator tighten in 2 steps:	
- Diagonally	5
- Diagonally	40
Connecting rod bearing cap to connecting rod bolt ¹⁾	35 plus an additional 90° (¼ turn)
Cover for the belt pulley side sealing flange bolt	9
Drive plate to crankshaft bolt 1	60 plus an additional 90° (¼ turn)
Idler roller for the ribbed belt to engine bolt	23
Oil temperature sensor 2 bolt	9
Tensioner for the ribbed belt bolt ¹⁾	50 plus an additional 90° (¼ turn)
Washer to vibration damper bolt ¹⁾	20 plus an additional 90° (¼ turn)

¹⁾ Replace fastener(s).

Ribbed Belt Sealing Flange Tightening Specification

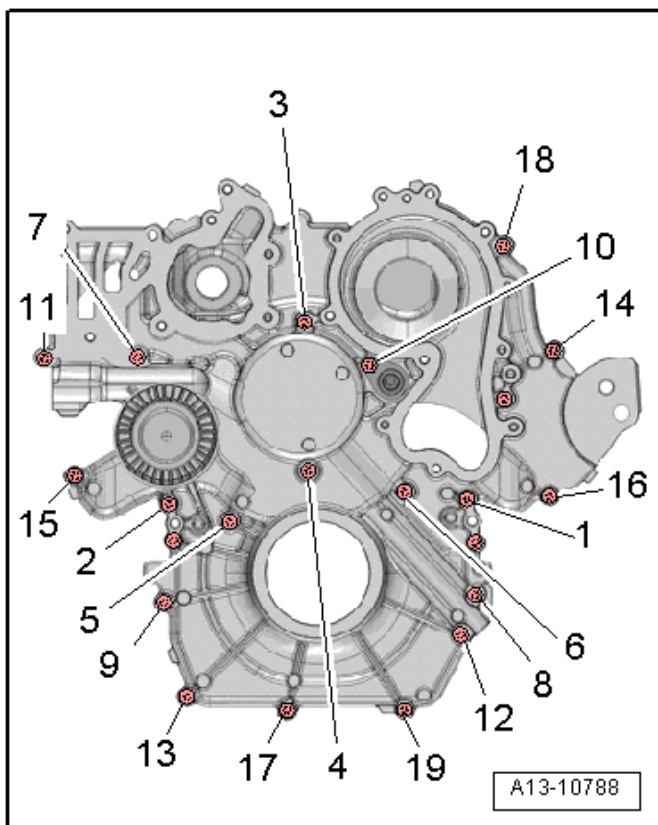


Tighten the bolts in 11 steps in the sequence shown.

Steps 1 ... 3:

Steps	Bolts	Tightening Specification
1		Attach the sealing flange with the seal to the cylinder block
2	1	Tighten for the idler roller 23 Nm
3	2, 3, 4	Tighten the M6x20 to 9 Nm

Ribbed Belt Sealing Flange Tightening Specification Continued

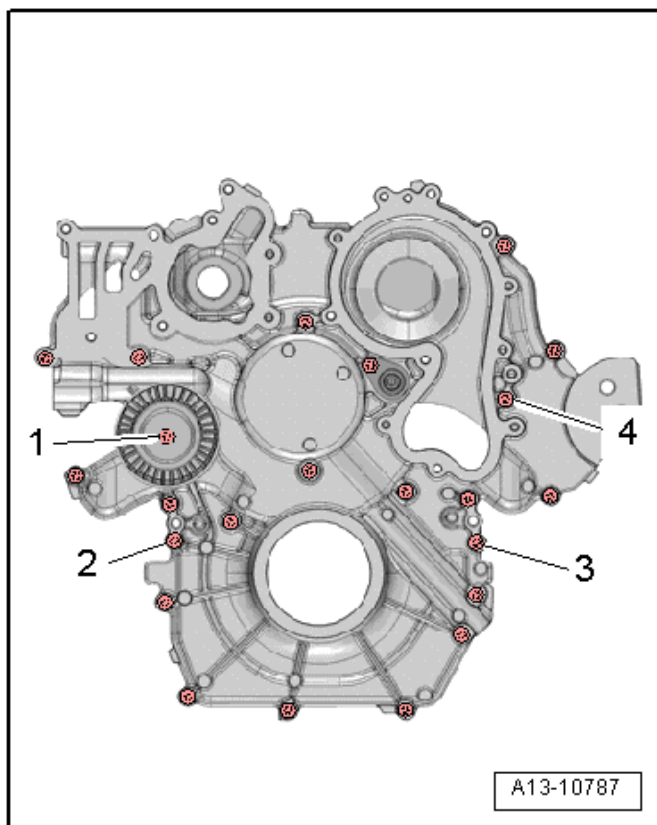


Engine –
3.0L CPNB (TDI)

Steps 4 ... 8:

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

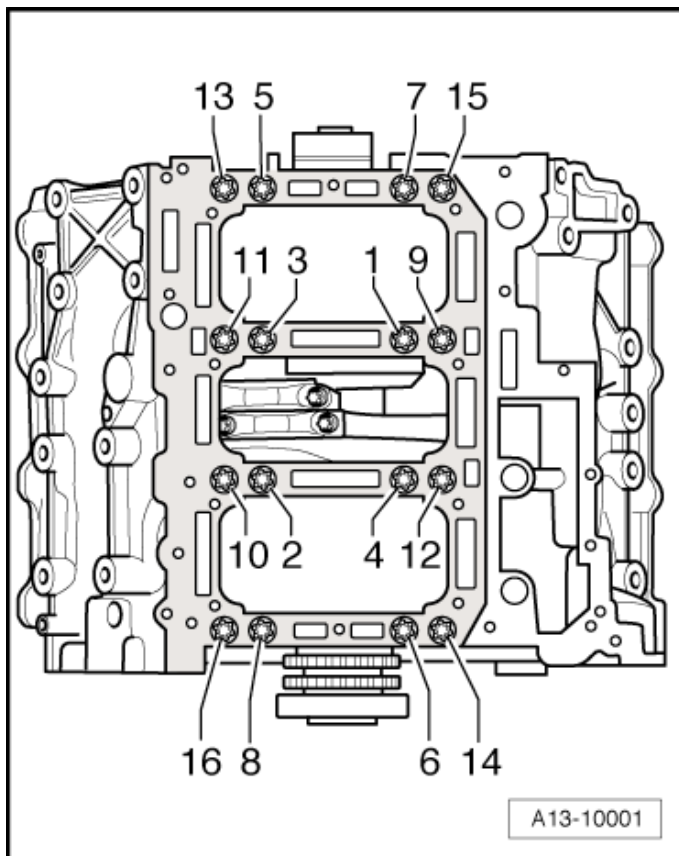
Ribbed Belt Sealing Flange Tightening Specification Continued



Steps 9 ... 11:

Steps	Bolts	Tightening Specification
9	2, 3, 4	Remove the steel bolts M6x20
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



Engine –
3.0L CPNB (TDI)

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

¹⁾ Replace fastener(s).

Crankshaft Dimensions

Honing dimension in mm	Crankshaft bearing pin diameter		Crankshaft connecting rod journal diameter	
Basic dimension	65.000	- 0.022	60.000	- 0.022
		- 0.042		- 0.042

Piston Ring End Gaps

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

¹⁾ Not determined.

Piston Ring Clearance

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

Piston and Cylinder Dimensions

Honing dimension in mm	Piston diameter	Cylinder bore diameter
Nominal dimension	82.924 and 82.936 ¹⁾	83.006 and 83.014 ¹⁾
Repair stage	82.964 and 82.976 ¹⁾	83.046 and 83.054 ¹⁾

¹⁾ Dimension without graphite coating (thickness 0.02 mm). The graphite coating wears away.

Piston Projection, Measuring at “TDC”

Piston Projection above the Upper Edge of the Cylinder Block	Identification Holes
0.82 to 0.92 mm	1
0.92 to 0.97 mm	2
0.97 to 1.08 mm	3

Cylinder Head, Valvetrain – 3.0L CPNB (TDI)

Fastener Tightening Specifications

Component	Nm
Balance weight belt pulley side to balance shaft bolt	60
Balance weight transmission side to balance shaft nut ²⁾	30 plus an additional 90° (¼ turn)
Bracket to cylinder head bolt	23
Camshaft chain sprocket bolt	23
Chain tensioner for the camshaft timing chain bolt ¹⁾	5 plus an additional 90° (¼ turn)
Chain tensioner with glide track bolt ¹⁾	5 plus an additional 90° (¼ turn)
Coolant pipes banjo bolt	12
Drive chain sprocket for the oil pump bolt ¹⁾	30 plus an additional 45° (½ turn)
Drive chain sprocket to balance weight bolt	23
Engine lifting eye bolt	23
Gear carrier bolt	9
Guide rail guide pin ¹⁾	5 plus an additional 90° (¼ turn)
Jump protector bolt	9

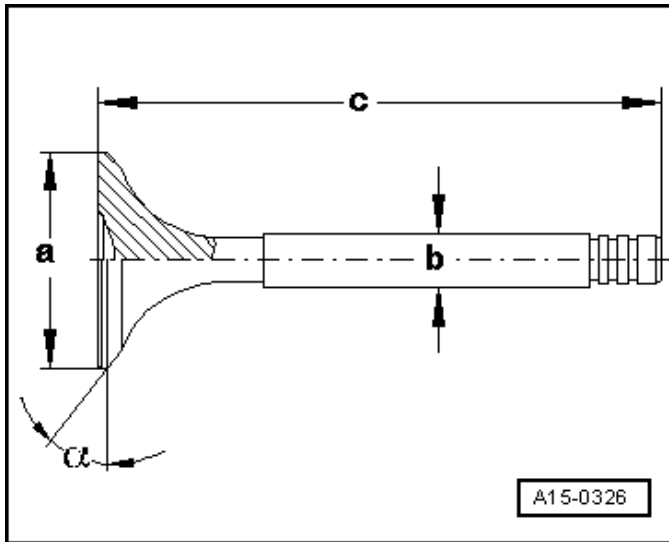
¹⁾ Replace fastener(s).

²⁾ After loosening the nut, the balance shaft must be replaced

Compression Checking Specifications

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

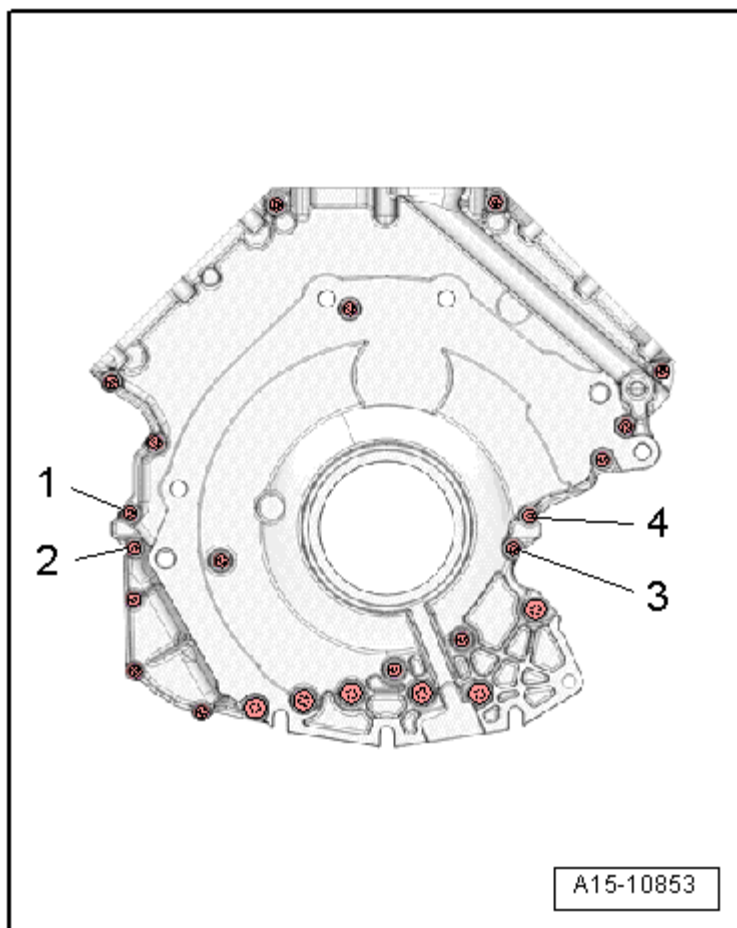
Valve Dimensions



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
α	\angle°	45° 10'	45° 10'

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

Lower Timing Chain Cover Tightening Specifications



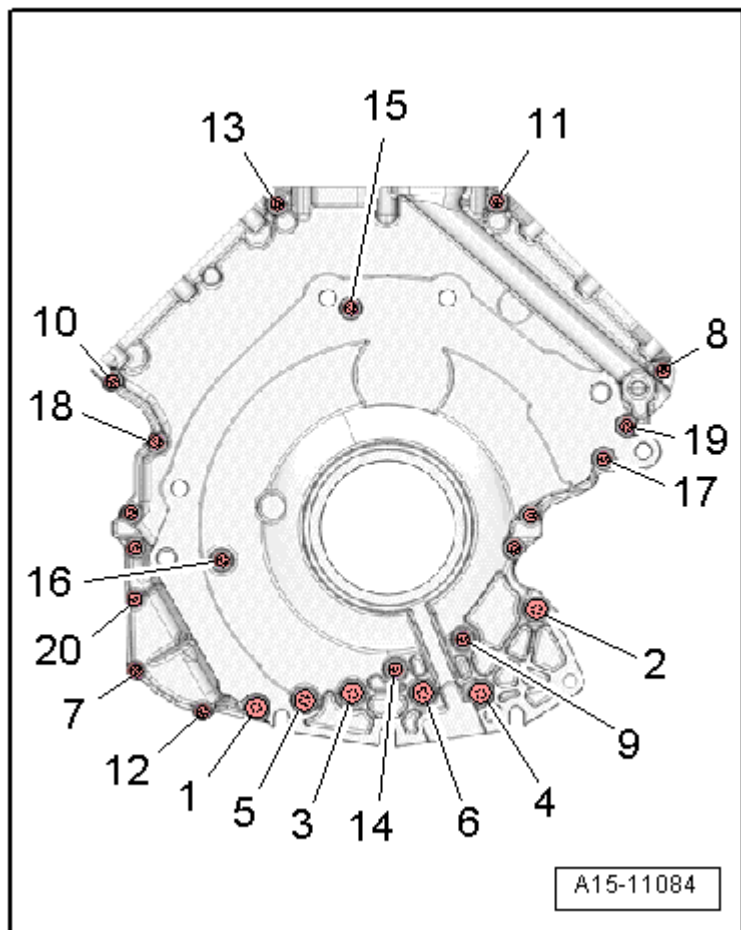
Engine –
3.0L CPNB (TDI)

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

Steps 1 and 2:

Step	Bolts	Tightening Specification/Additional Turn
1		Attaching the timing chain guard lower section with the sealant and the sealing pieces to the cylinder block
2	1, 2, 3, and 4	Tighten the M6x20 to 9 Nm

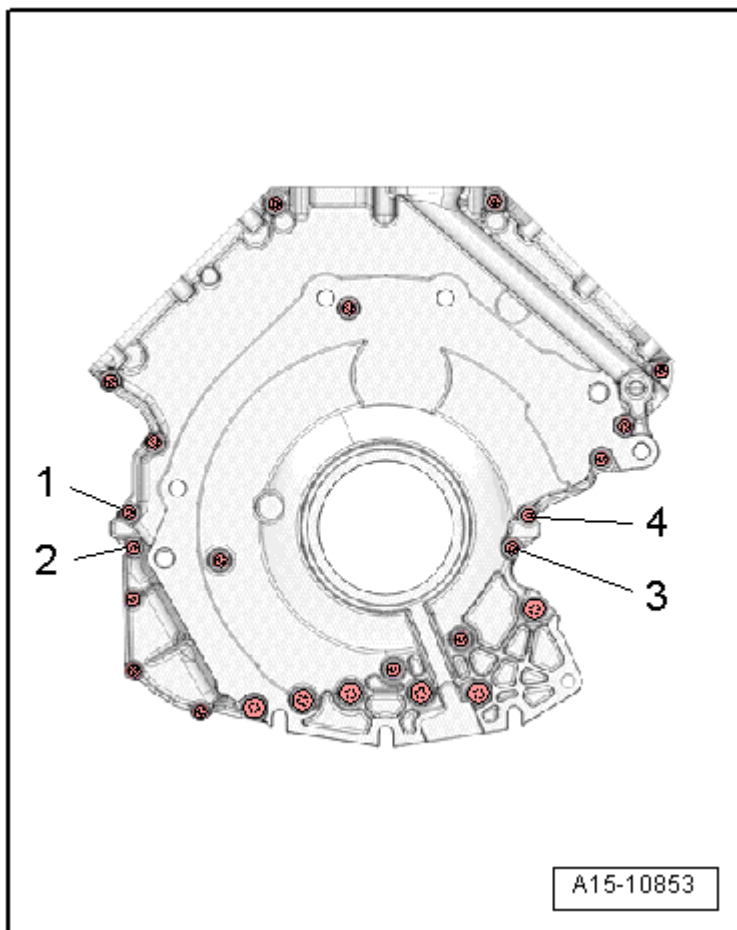
Lower Timing Chain Cover Tightening Specifications Continued



Steps 3 to 6:

Step	Bolts	Tightening Specification/Additional Turn
3	1 to 20	3 Nm
4	1 to 20	3 Nm - this measurement takes into account the lower timing chain cover shrinkage.
5	1 to 6	8 Nm
6	1 to 20	Tighten 90° additional turn

Lower Timing Chain Cover Tightening Specifications Continued

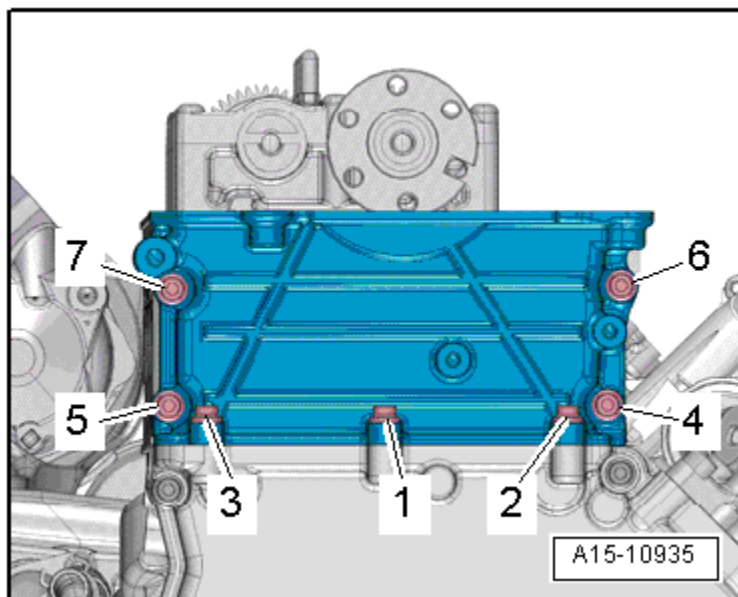


Engine –
3.0L CPNB (TDI)

Steps 7 to 9:

Step	Bolts	Tightening Specification/Additional Turn
7	1, 2, 3, and 4	Remove the steel bolts M6x20
8	1, 2, 3, and 4	Insert the aluminum bolts and tighten to 3 Nm
9	1, 2, 3, and 4	Turn the aluminum bolts 90° further

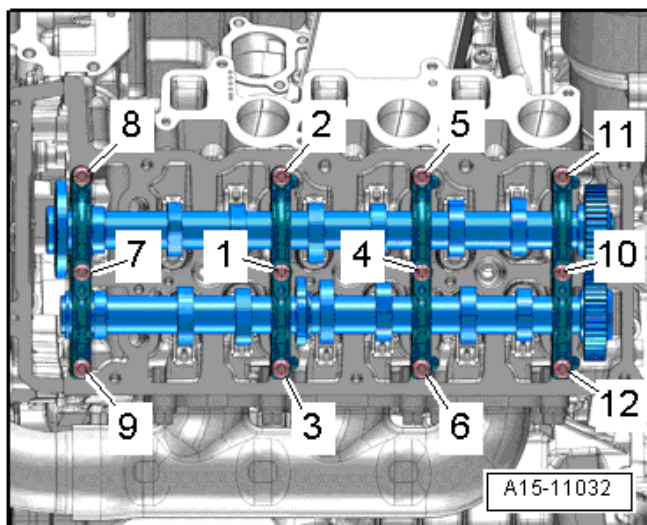
Upper Timing Chain Cover Tightening Specifications



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

Step	Bolts	Tightening Specification/Additional Turn
1	1, 2, and 3	Install all the way in by hand.
2	4 to 7	Install all the way in by hand.
3	1 to 7	8 Nm
4	1 to 7	8 Nm - this measurement takes into account the timing chain guard shrinkage.
5	1 to 7	Tighten 90° additional turn

Cylinder Bank 1 (right) Bearing Cap - Tightening Specification and Sequence

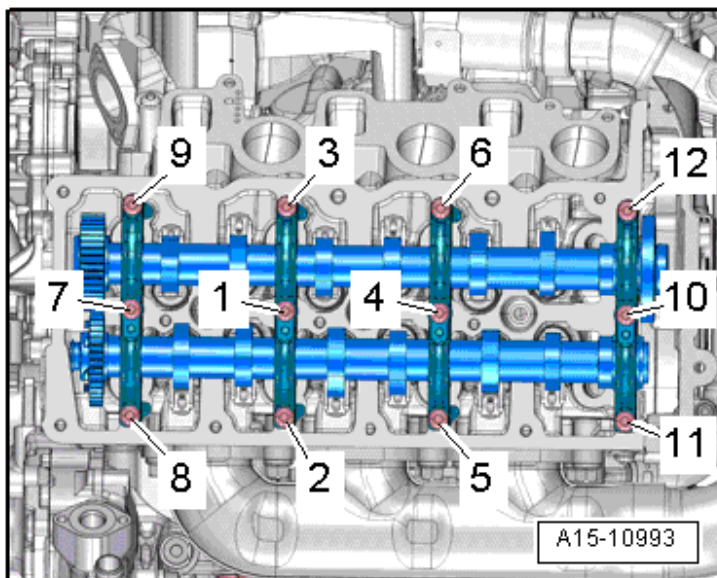


Engine –
3.0L CPNB (TDI)

Step	Bolts	Tightening Specification/Additional Turn
1	1 to 12	Install all the way in by hand.
2	1 to 12	9 Nm

¹⁾ Replace fastener(s) except bolt 3.

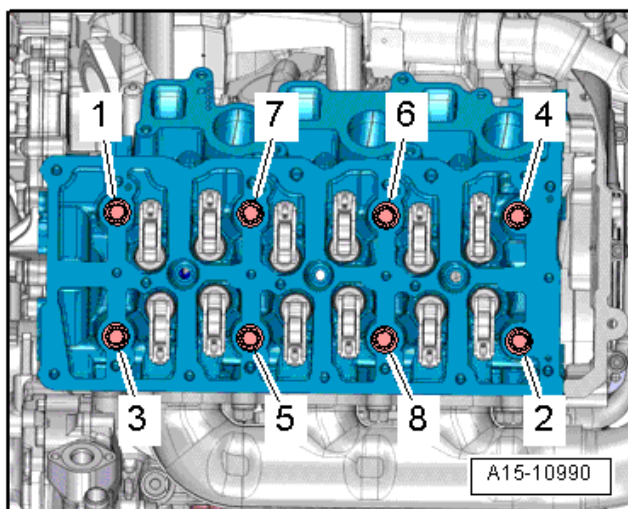
Cylinder Bank 2 (left) Bearing Cap - Tightening Specification and Sequence



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

Step	Bolts	Tightening Specification/Additional Turn
1	1 to 12	Install all the way in by hand.
2	1 to 12	9 Nm

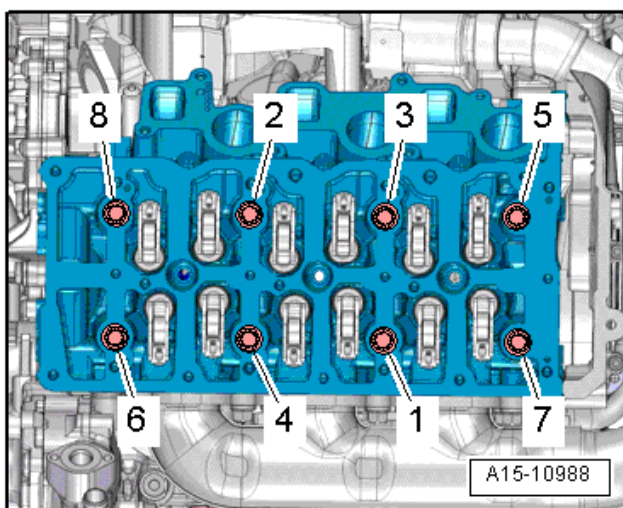
Cylinder Head, Loosening Bolts



Loosen the cylinder head bolts in the sequence -1 to 8

Engine –
3.0L CPNB (TDI)

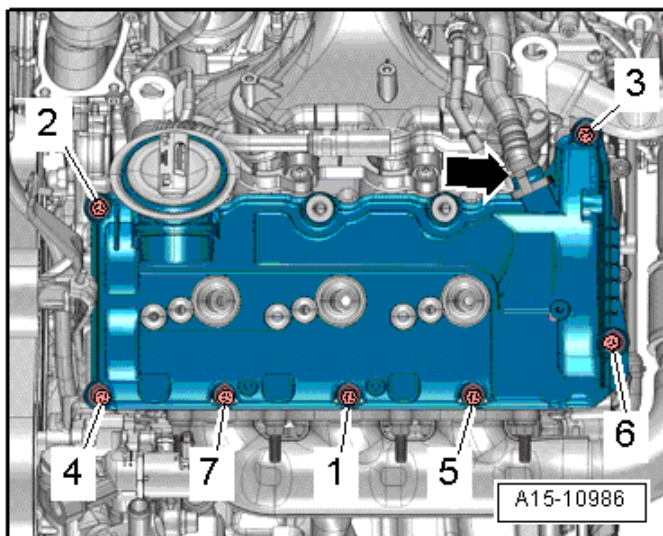
Cylinder Head - Tightening Specification and Sequence



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

Step	Bolts	Tightening Specification/Additional Turn
1	1 to 8	Install all the way in by hand.
2	1 to 8	35 Nm
3	1 to 8	70 Nm
4	1 to 8	an additional 90° (¼ turn)
5	1 to 8	an additional 90° (¼ turn)

Left Cylinder Head Cover Tightening Specification

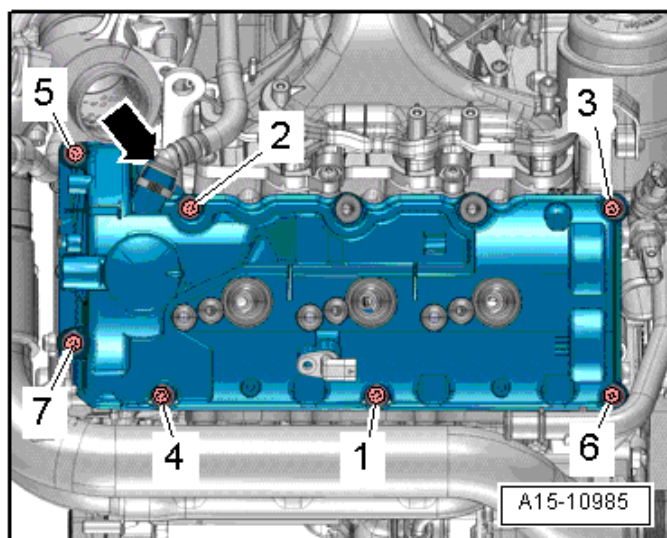


Engine –
3.0L CPNB (TDI)

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

Step	Bolts	Tightening Specification/Additional Turn
1	1 to 7	Install all the way in by hand.
2	1 to 7	8 Nm
3	1 to 7	Tighten 90° additional turn

Right Cylinder Head Cover Tightening Specification



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

Step	Bolts	Tightening Specification/Additional Turn
1	1 to 7	Install all the way in by hand.
2	1 to 7	8 Nm
3	1 to 7	Tighten 90° additional turn

Lubrication – 3.0L CPNB (TDI)

Fastener Tightening Specifications

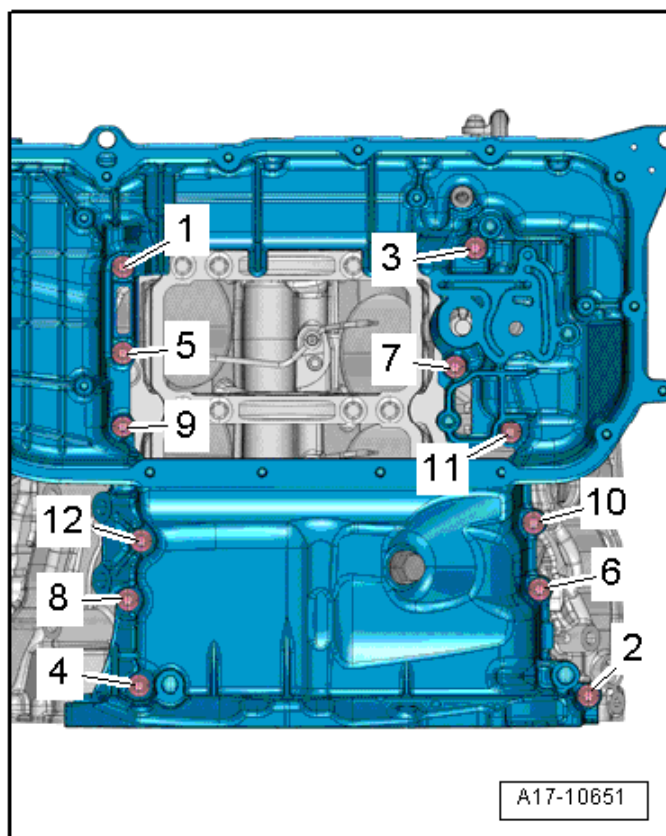
Component	Nm
Chain sprocket for the oil pump to input shaft bolt ¹⁾	30 plus an additional 45° (1/8 turn)
Coolant shut-off valve to mounting plate bolt	9
Cover to oil filter housing	35
Engine oil cooler to mounting plate	9
Guide tube for the oil dipstick to engine bolt	9
Intake line to oil pump bolt	9
Mounting plate for the engine oil cooler bolt	9
Oil baffle bolt ¹⁾	3 plus an additional 90° (1/4 turn)
Oil drain plug	30
Oil filter housing bolt	9
Oil pan upper section drain plug ²⁾	25
Oil pressure regulation valve to oil pan upper section bolt	9
Oil pressure switch	20
Oil pump to oil return pipe bolt	9
Oil return pipe to oil pump bolt	9
Reduced oil pressure switch	20
Vacuum line from the vacuum pump	
- Bolt	9
- Bolt ¹⁾	3 plus an additional 45° (1/8 turn)

¹⁾ Replace fastener(s).

²⁾ For Top Dead Center (TDC) marking

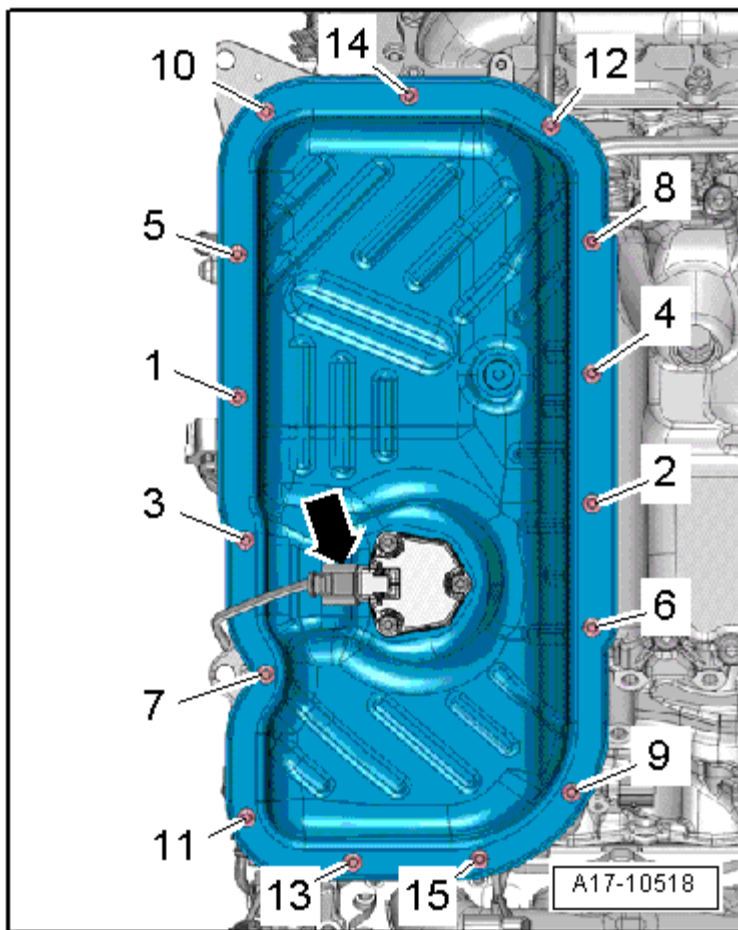
³⁾ For bolt tightening clarification, refer to ElsaWeb, *Oil Pan Upper Section Overview* and see items -19 and 21.

Upper Oil Pan Section Tightening Specifications



Step	Bolts	Tightening specification/additional turn
1	1 to 12	2 Nm
2	1 to 12	5 Nm
3	1 to 12	Tighten 90° additional turn

Lower Oil Pan Tightening Specifications

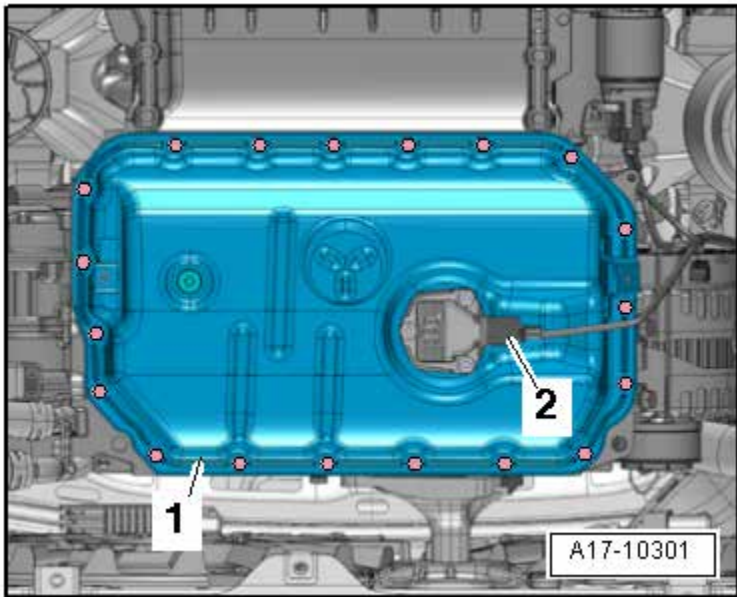


Engine –
3.0L CPNB (TDI)

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

Step	Bolts	Tightening specification/additional turn
1	1 to 15	2 Nm
2	1 to 15	5 Nm
3	1 to 15	Tighten 90° additional turn

Oil Pump with Vacuum Pump - Tightening Specification and Sequence



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

Step	Bolts	Tightening specification/additional turn
1	1 to 3	Install all the way in by hand.
2	1 to 3	8 Nm
3	1 to 3	Tighten 90° additional turn

Cooling System – 3.0L CPNB (TDI)

Fastener Tightening Specifications

Component	Nm
Bracket for coolant auxiliary cooler bolt	
- Bolt	20
- Nut	8
Bracket to coolant auxiliary cooler bolt	3.5
Check valve bolt	9
Coolant connection bolt	9
Coolant fan control module to fan shroud bolt	2.5
Coolant pipes ²⁾	
- Bolt	9
- Banjo Bolt	12
Coolant pump to engine bolt ¹⁾	3 plus an additional 90° (¼ turn)
Coolant pump ribbed belt pulley to coolant pump bolt	23
Coolant shut-off valve to mounting plate bolt	9
Engine coolant temperature sensor bolt	9
Engine temperature control sensor bolt	9
Fan shroud to coolant fan bolt	5
Front coolant pipe bolt	9
Left rear coolant pipe bolt ³⁾	
- Bolt	9
- Bolt	20
Radiator bracket ⁴⁾	
- Bolt	4.5
- Bolt	5
Upper coolant pipe bolt	9

¹⁾ Tighten diagonally in steps

²⁾ For bolt tightening clarification, refer to ElsaWeb, *Coolant Pipes Overview*, items 13, 15 and 16.

³⁾ For bolt tightening clarification, refer to ElsaWeb, *Coolant Pipes Overview*, items 22 and 24.

⁴⁾ For bolt tightening clarification, refer to ElsaWeb, *Radiator Overview* items 18 and 20.

Fuel Supply – 3.0L CPNB (TDI)

Fastener Tightening Specifications

Component	Nm
Accelerator pedal module to bracket bolt	8
Fuel filter bracket nut	2.1
Fuel filler neck to fender bolt	20
Fuel pump control module bolt	1.6
Heat shield to fuel tank bolt	2
Locking flange cover screw	1.5
Locking ring	110
Mounting strap to body bolt	20
Reducing agent filler tube bolt	2.5

Turbocharger, G-Charger – 3.0L CPNB (TDI)

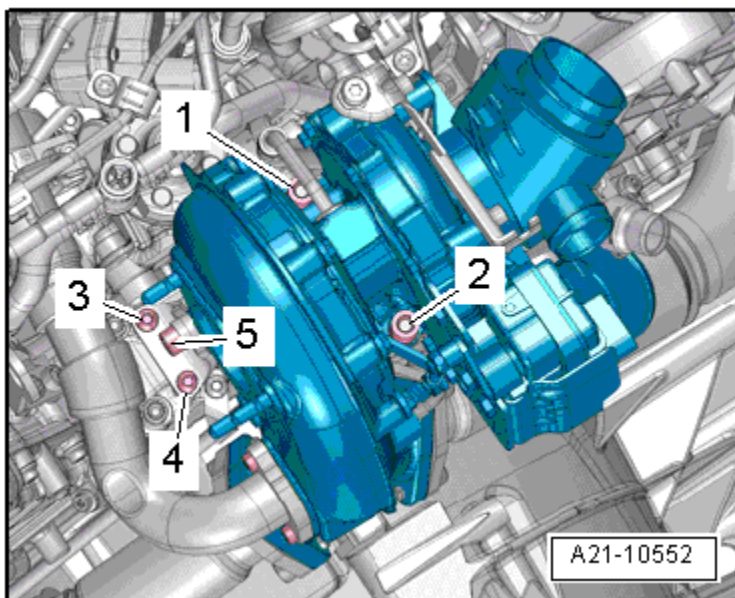
Fastener Tightening Specifications

Component	Nm
Bracket for connector and engine cover to turbocharger	9
Bracket for turbocharger bolt ¹⁾	23
Bracket for turbocharger stud bolt ²⁾	10
Charge air cooler	7
Charge air pressure sensor/intake air temperature sensor bolt	5
Clamp 13 mm wide	5.5
Clamp 9 mm wide	3.4
Connection to turbocharger bolt	9
Right air guide pipe bolt	9

¹⁾ Tighten last to 23 Nm diagonally and in steps.

²⁾ Replace nuts after each time they are loosened.

Turbocharger - Tightening Specification and Sequence



Engine –
3.0L CPNB (TDI)

Tighten the bolts and nuts in seven steps in the sequence shown.
Replace the stud bolts and nuts.

Step	Bolts	Tightening specification/additional turn
1	Stud bolts for the nuts -1, and 2-	10 Nm
2	1 and 2	Install all the way in by hand.
3	1 and 2	9 Nm
4	1 and 2	Tighten 90° additional turn
5	3, 4 and 5	Install all the way in by hand.
6	3 and 4	9 Nm
7	56	23 Nm

Exhaust System, Emission Controls – 3.0L CPNB (TDI)

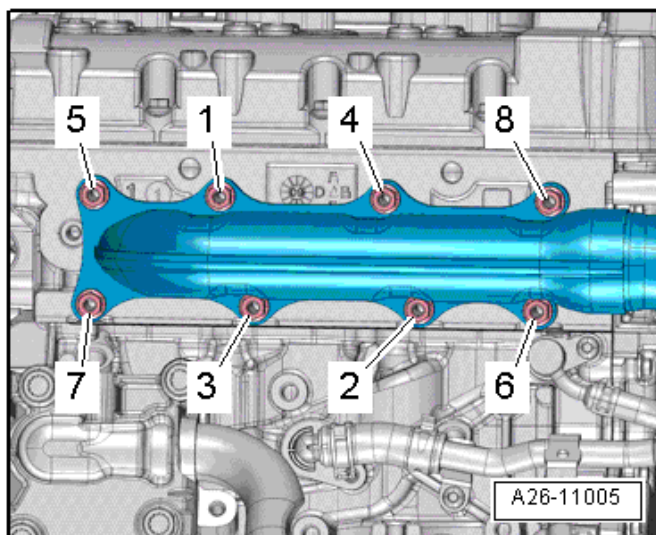
Fastener Tightening Specifications

Component	Nm
Clamp for front exhaust pipe to reducing agent injector bolt	5
Clamping sleeve nut	23
Connection to EGR cooler bolt	23
Coolant connection bolt	9
Cover for the reducing agent tank to tank	2
EGR cooler bolt	9
EGR motor to connection bolt	9
EGR temperature sensor	
- Aluminum exhaust gas recirculation radiator bolt	35
- Steel exhaust gas recirculation radiator bolt	45
Engine coolant temperature sensor bolt	9
Exhaust manifold bolt ^{1) 2)}	30 plus an additional 90° (¼ turn)
NOx sensor control module 2 with NOx sensor 2	
- Bolt	50
- Nut	2
Particulate filter with catalytic converter nut ^{1) 2)}	23
Particulate sensor	
- Bolt	45
- Nut	2
Pressure line for the differential pressure sensor	45
Pressure pipe for differential pressure sensor	45
Reducing agent metering system control module to base plate bolt	4.5
Suspended mount bolt	23
Selective Catalytic Reduction (SCR) - catalytic converter to front exhaust pipe nut	23
Tank For the reducing agent bolt	20

¹⁾ Replace fastener(s).

²⁾ Coat the thread with hot bolt paste.

Exhaust Manifold - Tightening Specification and Sequence

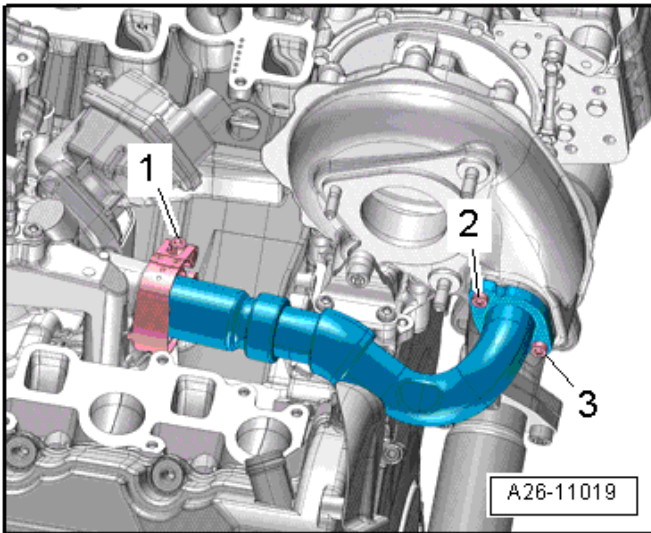


Engine –
3.0L CPNB (TDI)

Replace the nuts. Coat the thread on the nut with hot bolt paste. Refer to the Parts Catalog. Tighten the nuts in 3 steps according to the tightening sequence:

Step	Bolts	Tightening specification
1	Stud bolts for the nuts -1, and 2-	Install all the way in by hand.
2	1 and 2	15 Nm
3	1 and 2	25 Nm

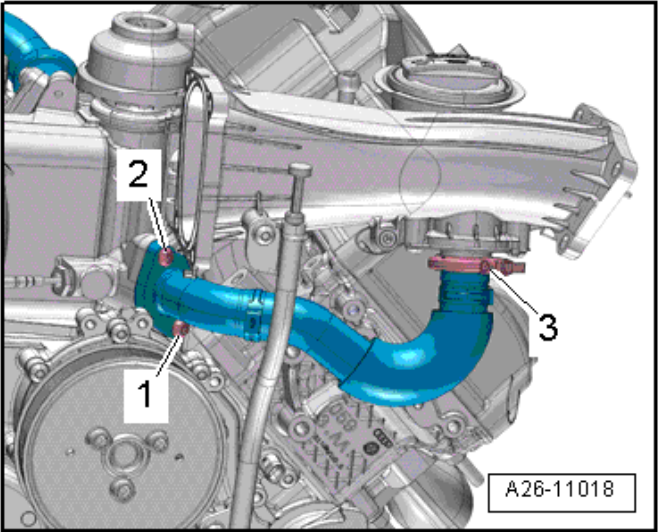
EGR Pipe at the Turbocharger - Tightening Specification and Sequence



Replace the nuts. Coat the thread on the nut with hot bolt paste. Refer to the Parts Catalog. Tighten the nuts in 3 steps according to the tightening sequence:

Step	Bolts	Tightening specification
1	2 and 3	Turn them by hand until the bolt heads are touching
2	1	Position using the tab on the EGR pipe tightening specification. <ul style="list-style-type: none"> • Part number 059 131 548 C: 5 Nm • Part number 059 131 548 D: 3.5 Nm
3	2 and 3	5 Nm
4	2 and 3	Tighten 90° additional turn

Exhaust Gas Recirculation (EGR) Pipe at the Intake Manifold - Tightening Specification and Sequence



**Engine –
3.0L CPNB (TDI)**

The flange at the EGR pipe must not be wavy or bent. Attach the EGR pipe with the seals and the screw-type clamps. Coat the thread on the bolts with hot bolt paste; for the correct hot bolt paste refer to the Parts Catalog.

Step	Bolts	Tightening specification
1	1 and 2	Turn them by hand until the bolt heads are touching
2	3	Position them as shown in the illustration 2.5 Nm
3	1 and 2	9 Nm

Multiport Fuel Injection – 3.0L CPNB (TDI)

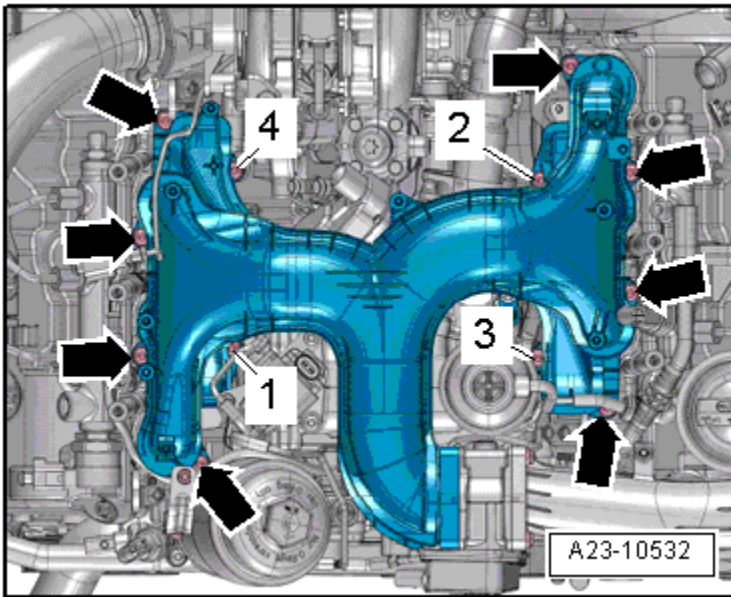
Fastener Tightening Specifications

Component	Nm
Adapter to high pressure pump bolt	70
Air guide bolt	1.5
Air guide pipe to intake flap motor bolt	9
Bracket for the air guide pipe bolt	9
Bracket for the connector to intake manifold bolt	4
Clamp the high pressure line bolt	9
Counter pin	
- On camshaft bearing	2.5
- On cylinder head	9
Differential pressure sensor	4.5
Fuel rail bolt	22
Fuel return hose to fuel rail banjo bolt	25
Fuel temperature sensor	2
High pressure line	25
High pressure pump bolt	22
Intake flap motor to intake manifold bolt	9
Intake manifold mounting pins to cover bolt	5
Mass airflow sensor bolt	3.5
NOx sensor control module with NOx sensor nut	2
Oxygen sensor ²⁾	55
Particle sensor nut	2
Pipe for the exhaust gas recirculation to air guide pipe bolt	9
Pressure line for exhaust pressure sensor ¹⁾	45
Tensioning Claw ¹⁾	
- First tightening	6
- Second tightening	Tighten 90° additional turn
Wiring guide to intake manifold bolt	4

¹⁾ Replace

²⁾ Coat threads with hot bolt paste

Intake Manifold - Tightening Specification and Sequence

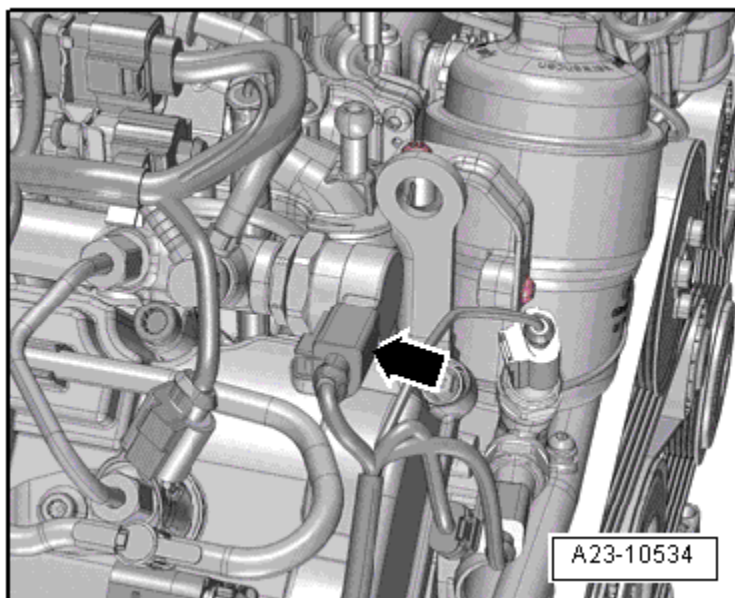


Engine –
3.0L CPNB (TDI)

Tighten the bolts in 3 steps as follows:

Step	Bolts	Tightening specification
1	1 through 4, arrows	Install all the way in by hand.
2	1 through 4	5 Nm in sequence shown
3	1 through 4 and arrows	9 Nm in any sequence

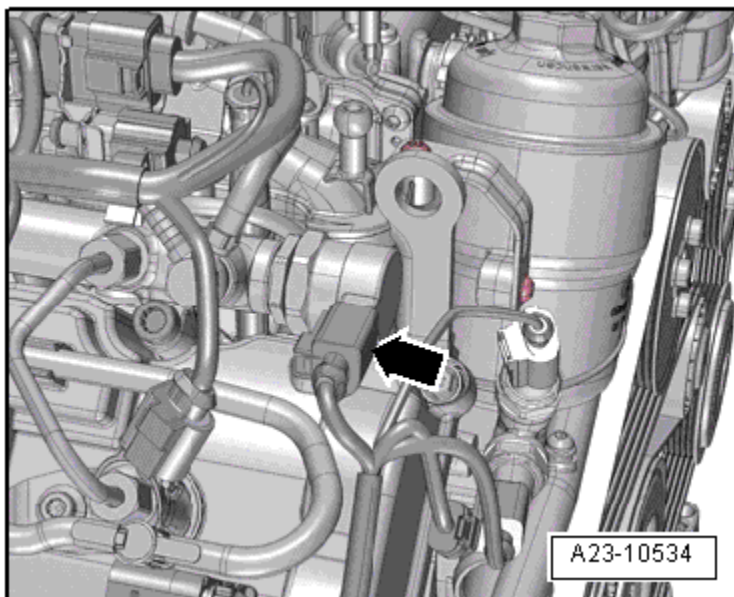
Fuel Pressure Regulator Valve -N276- - Tightening Specification



Align the Fuel Pressure Regulator Valve -N276- such that connecting the harness connector -arrow- does not cause the electrical wiring to be placed under tension. Counterhold the housing hex bolt to tighten union nut on regulator valve in four stages as follows:

Step	Tightening specification
1	Install all the way in by hand.
2	60 Nm
3	Turn back 90°
4	85 Nm

Fuel Pressure Sensor -G247- Tightening Specifications



Engine –
3.0L CPNB (TDI)

Tighten the Fuel Pressure Sensor -G247- in four steps:

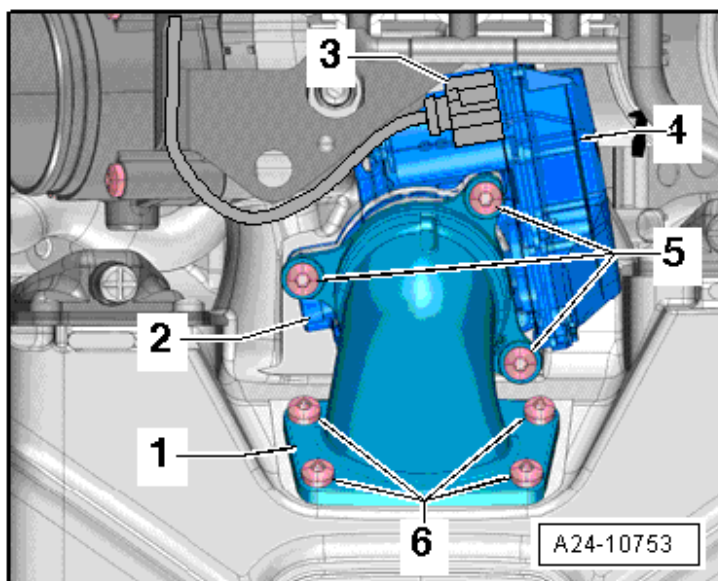
Step	Tightening specification
1	Install all the way in by hand.
2	60 Nm
3	Turn back 180°
4	85 Nm

Ignition – 3.0L CPNB (TDI)

Fastener Tightening Specifications

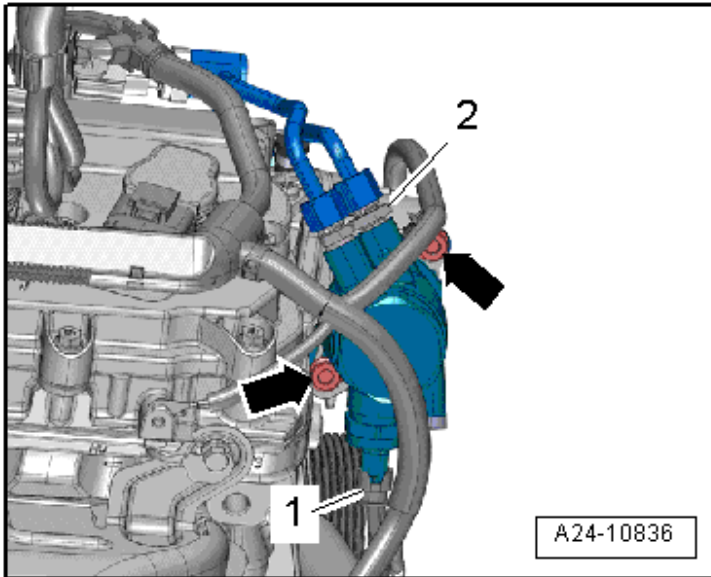
Component	Nm
Camshaft Position (CMP) sensor	9
Engine Speed (RPM) sensor	9
Glow Plug	12

Control Valve Control Module Tightening Specification



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

High Pressure Pump Tightening Specification



Engine –
3.0L CPNB (TDI)

Step	Component	Nm
1	Tighten (➡)	Hand-tighten
2	Tighten (➡) in steps	9

Ignition/Glow Plug System – 3.0L CPNB (TDI)

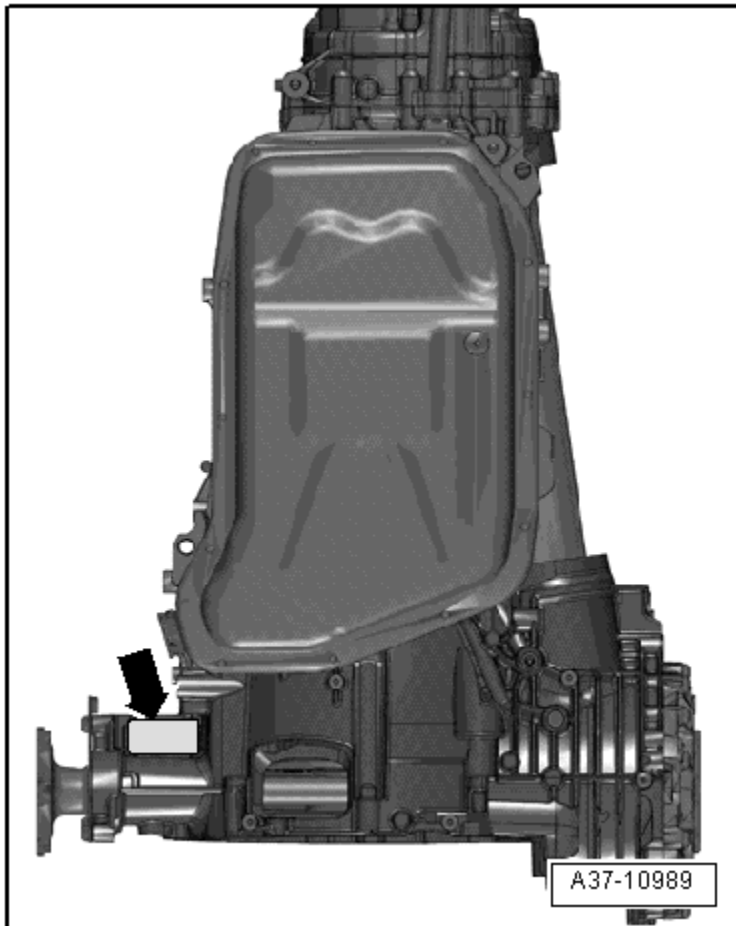
Fastener Tightening Specifications

Component	Nm
Camshaft position sensor bolt	9
Engine speed sensor bolt	9
Particulate filter	12

AUTOMATIC TRANSMISSION – 0BK

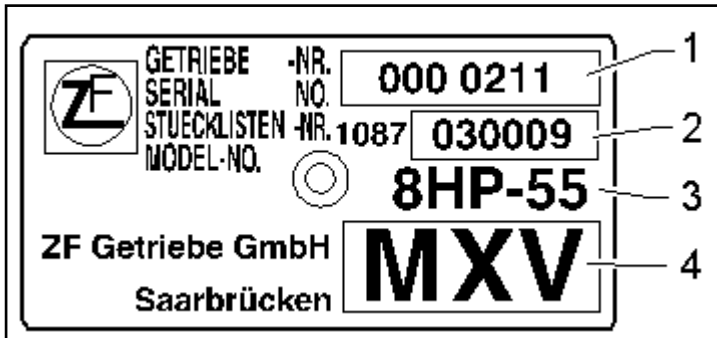
General, Technical Data – 0BK

Transmission Identification



Transmission code letters are located on the data plate under the transmission. Type plate installed location ➔.

Transmission Code and Transmission Serial Number



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

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

Code Letters, Transmission Allocations, Ratios and Equipment

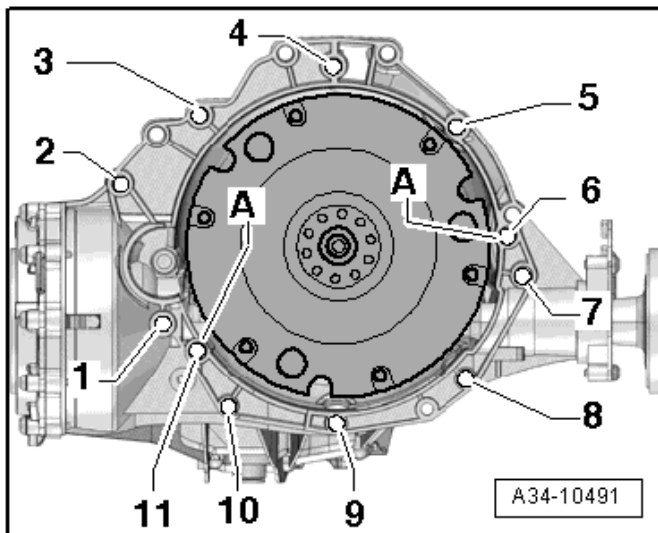
Automatic Transmission		0BK AWD	
Transmission	Identification codes	PRW	MXV, NEV, NTB, NXX
Torque converter	Identification codes	A138	A138
Allocation	Type	Audi Q5 from MY 08	Audi Q5 from MY 08
	Engine	2.0L TFSI-162kW	2.0L TFSI- 55 kW
Primary drive		33:29 = 1.138	33:29 = 1.138
Gear wheel front axle		31:29 = 1.069	31:29 = 1.069
Front axle bevel gear		34:11 = 3.091	34:11 = 3.091
Complete front axle ratio = primary drive x drive wheel x bevel gear		3.760	3.760
Rear axle bevel gear		43:13 = 3.308	43:13 = 3.308
Complete rear axle ratio = rear axle bevel gear x primary drive		3.764	3.764
Oil system, front final drive/ transfer case		Separated	Separated

Automatic Trans. - 0BK

Automatic Transmission		0BK AWD	
Trans- mission	Identification codes	MQY	NWX
Torque converter	Identification codes	Y137	F164
Allocation	Type	Audi Q5 from MY 08	Audi Q5 from MY 08
	Engine	3.0L TFSI-200 kW	3.0L TFS-260 kW
Primary drive		32:33 = 0.970	32:33 = 0.970
Gear wheel front axle		31:29 = 1.069	31:29 = 1.069
Front axle bevel gear		34:11 = 3.091	34:11 = 3.091
Complete front axle ratio = primary drive x drive wheel x bevel gear		3.204	3.204
Rear axle bevel gear		43:13 = 3.308	43:13 = 3.308
Complete rear axle ratio = rear axle bevel gear x primary drive		3.207	3.207
Oil system, front final drive/ transfer case		Separated	Separated

Controls, Housing – 0BK

Securing Transmission to 4-Cylinder Engine



Item	Bolt	Nm
1 ¹⁾	M10 x 50 ²⁾	65
2 ¹⁾ , 7	M12 x 100 ³⁾	30 plus an additional 90° (¼ turn)
3 ⁴⁾ , 6	M12 x 75 ³⁾	30 plus an additional 90° (¼ turn)
4, 5 ⁴⁾	M12 x 120 ³⁾	15 plus an additional 90° (¼ turn)
8, 10	M10 x 75 ³⁾	15 plus an additional 90° (¼ turn)
9	M10 x 60 ³⁾	15 plus an additional 90° (¼ turn)
11 ⁵⁾	M12 x 50 ³⁾	30 plus an additional 90° (¼ turn)
A	Alignment sleeves for centering	

¹⁾ Also secures the starter.

²⁾ Bolt strength rating 10.9, there is no limit to the number of times steel bolts can be used.

³⁾ The aluminum bolts can be used twice.

⁴⁾ With a bracket for the wires.

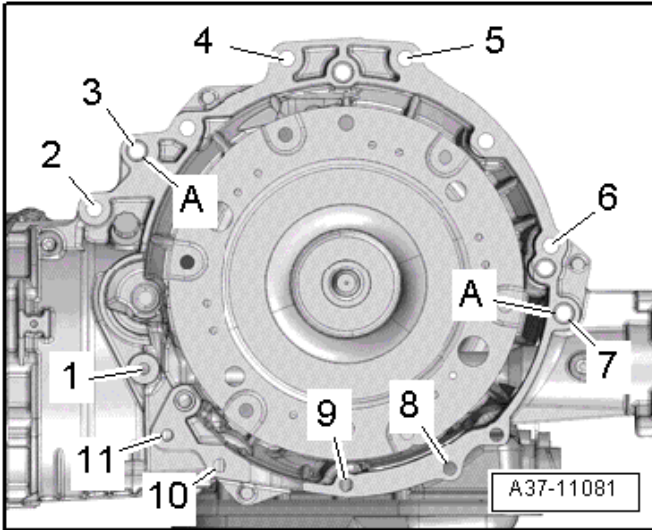
⁵⁾ Installed from the engine side.

Aluminum bolts 2 through 11 can only be used twice. After using the bolts once, use a chisel and mark the bolts with two notches (X).

To prevent damaging the bolts when marking them, do not clamp them in a vise. Use a ½" drive 14 mm socket and extension clamped into a vice. Do not use bolts that have been marked with an X.

Automatic Trans. –
0BK

Securing Transmission to 6-Cylinder Engine



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

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

²⁾ The aluminum bolts can be used twice.

Fastener Tightening Specifications

Component	Fastener size	Nm
ATF drain plug (replace fastener)	-	12
ATF plug for the hole for checking and filling (replace fastener)	-	30
Bolts and nuts	M6	9
	M7	15
	M8	20
	M10	40
	M12	65
Drain plug for the transmission fluid inside the transfer case 1	-	12
Drain plug for the transmission fluid inside the front final drive 1	-	27
Driveshaft heat shield	-	23
Lower stop to transmission support bolt 1	-	20 plus an additional 90° (¼ turn)
Oil drain plug for the transmission fluid inside the front final drive 1	-	10
Oil drain plug for the transmission fluid inside the transfer case 1	-	27
Seal to selector mechanism function unit nut	-	10
Selector lever cable bolt	-	13
Selector lever cable bracket to transmission bolt	-	8
Selector Lever Cable Heat Shield		
- Upper bolts	-	9
- Lower bolts	-	20
Transmission support to transmission bolt	-	40
Transmission support to transmission mount nut	-	20
Tunnel crossmember		
- Bolt	-	70
- Nut	-	20
2.0L TFSI Engine		
Attaching the ATF pipe to the engine bolt	-	9
ATF pipe, supply bolt	-	5
ATF pipe, return 2		
- Bolt	-	9
- Bolt	-	20

Fastener Tightening Specifications (*cont'd*)

Component	Fastener size	Nm
3.0L TFSI Engine		
ATF pipe, return Bolt	-	20
ATF pipe, return Nuts on lines	-	29
ATF pipe, supply bolt	-	5
ATF pipe, supply Nuts on line	-	29
Bracket to ATF pipe, return bolt	-	8

¹⁾ Replace

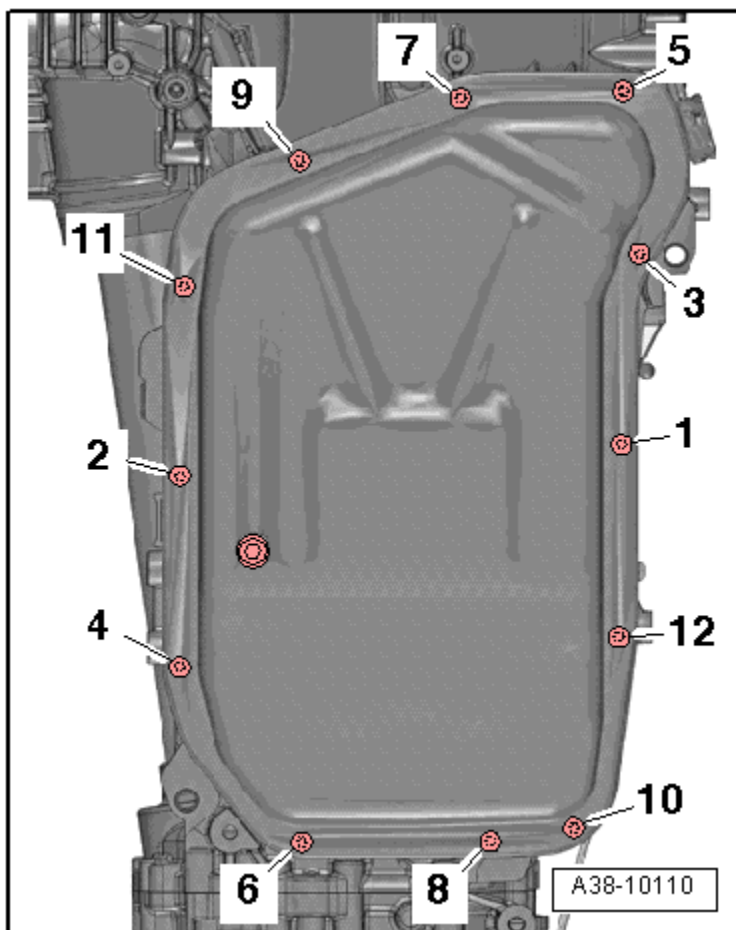
²⁾ For bolt tightening clarification, refer to *ElsaWeb, ATF Cooler and ATF Pipes Overview* and see items 13 and 14.

Gears, Hydraulic Controls – 0BK

Fastener Tightening Specifications

Component	Nm
Connector housing	5.5
Mechatronic connector-to-transmission housing	10
Transmission output speed sensor-to-transmission housing	10

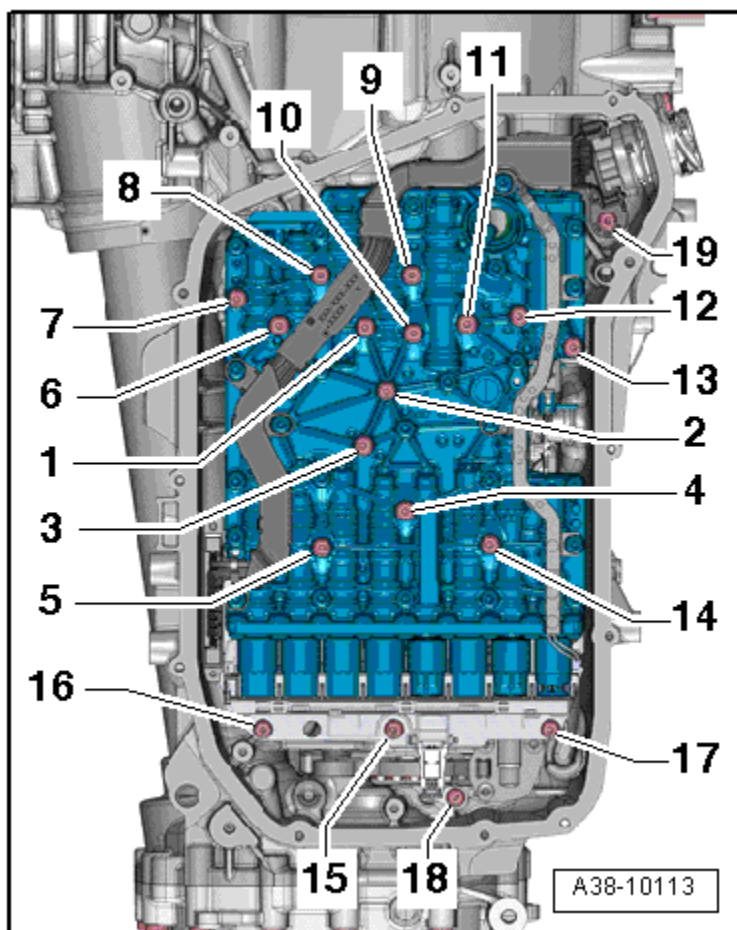
ATF Oil Pan Tightening Specifications and Sequence



Automatic Trans. –
0BK

Step	Component	Nm
1	Replace and tighten bolts 1 through 12 in sequence	Hand-tighten
2	Tighten bolts 1 through 12 in sequence	4
3	Tighten bolts 1 through 12 in sequence	an additional 45° (1/8 turn)

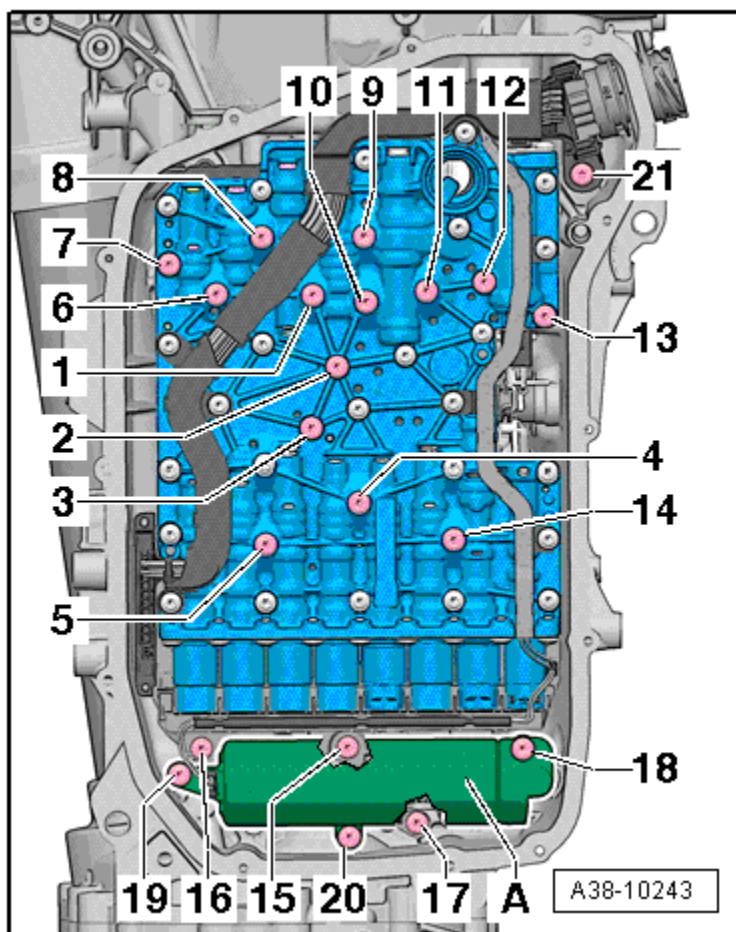
Tightening Specification and Sequence for Mechatronic Without a Hydraulic Pulse Memory



Bolts -18- and -19- are shorter. Bolt -18- attaches the transmission output speed sensor -G195- to the transmission housing. Bolt -19- attaches the Mechatronic connector to the transmission housing.

Component	Nm
Tighten bolts 1 through 19 in sequence	10

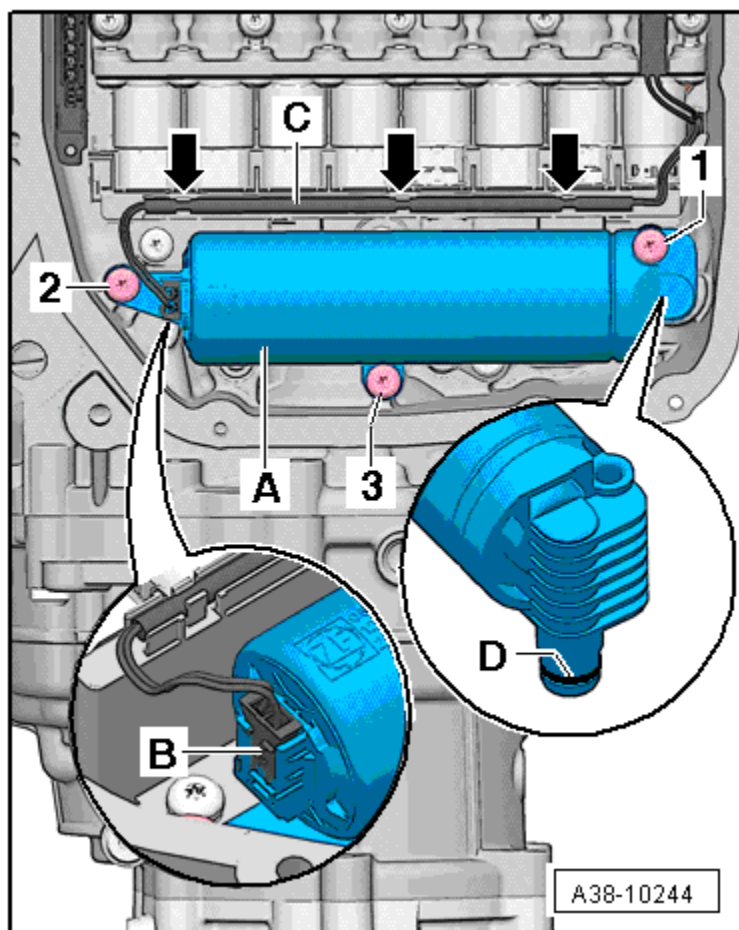
Tightening Specification and Sequence for Mechatronic With a Hydraulic Pulse Memory



Automatic Trans. -
0BK

Tighten the bolts to 10 Nm in the following sequence -1 through 17-.
Tighten the bolts to 10 Nm in the following sequence: -18 to 21-.
The bolts -18, 19 and 20- secure the hydraulic pulse memory.

Hydraulic Pulse Memory Tightening Specification and Sequence



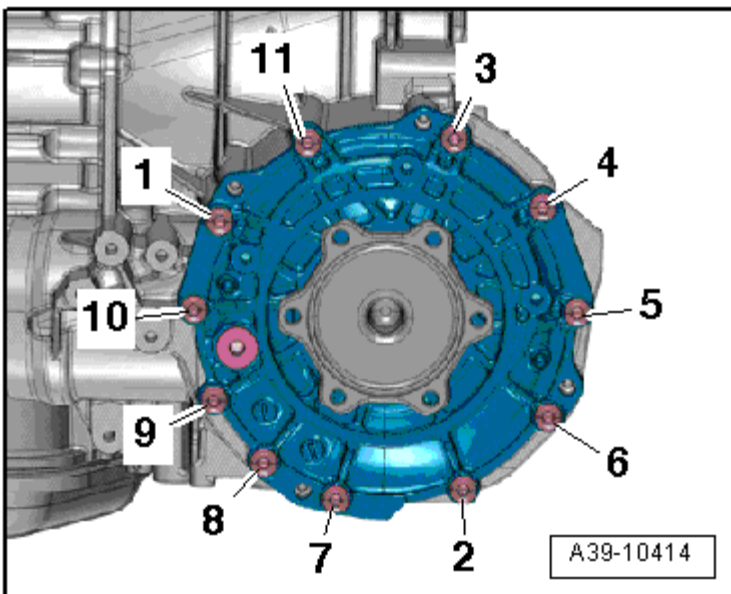
Tighten the bolts to 10 Nm in the following sequence: -1 to 3-.

Rear Final Drive, Differential – 0BK

Fastener Tightening Specifications

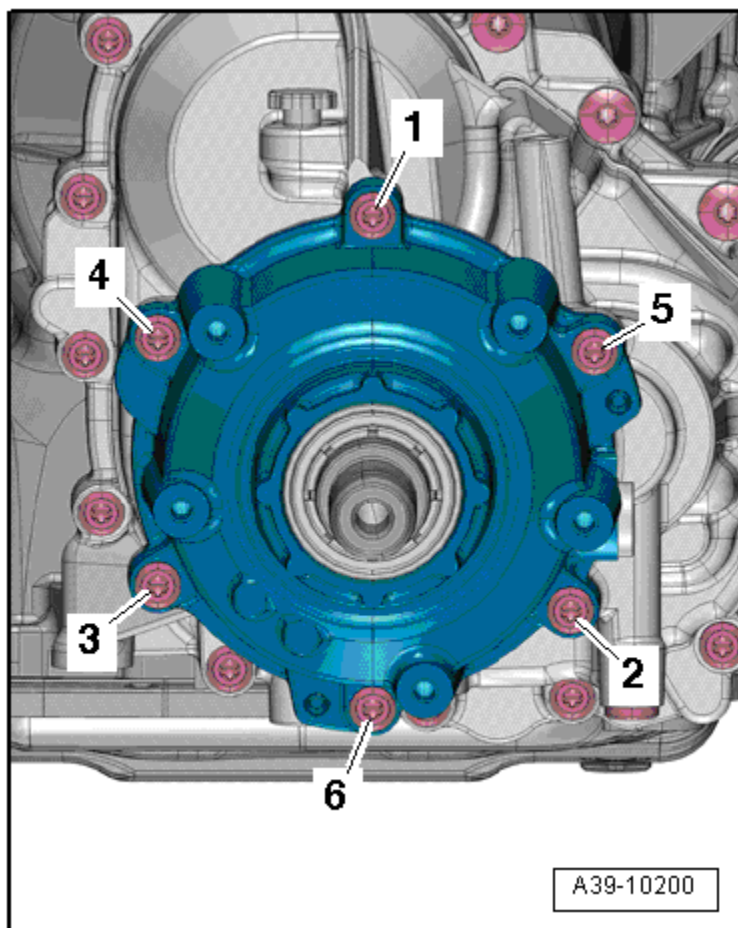
Component	Nm
Camshaft position sensor bolt	20 plus an additional 90° (¼ turn)
Drain Plug For the transmission fluid inside the front final drive 1	27
Drain Plug For the transmission fluid inside the transfer case 1	27
Gear Carrier to transmission bolt 1	9 plus an additional 60° turn
Oil Drain Plug For the transmission fluid inside the front final drive 1	10
Oil Drain Plug For the transmission fluid inside the transfer case 1	12

Front Final Drive Cover Tightening Specifications



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

Center Differential Housing Tightening Specifications



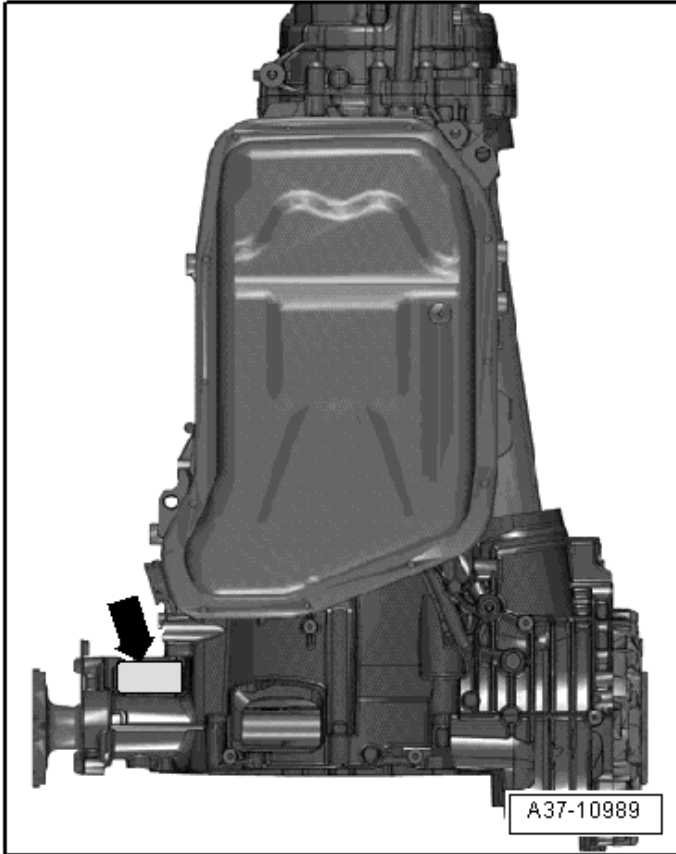
Replace the center differential housing bolts.

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

AUTOMATIC TRANSMISSION – 0BW

General, Technical Data – 0BW

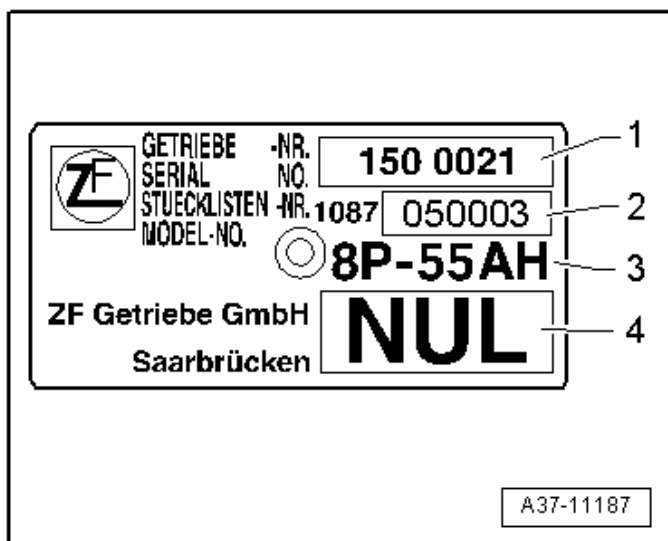
Transmission Identification



Transmission code letters are located on the data plate under the transmission. The data plate is installed at ➔

Automatic Trans. –
0BW

Transmission Code Letters and Serial Numbers



Example:	
1	Transmission serial number
2	Parts list number
3	Manufacturer transmission identification: 8P55AH
4	Transmission code letters, for example: KRL

Note: The transmission code is also listed on the vehicle data plate.

Specifications – Engine Codes, Allocation, Ratios and Capacities

Automatic Transmission			8 Speed Automatic 0BW Hybrid AWD
Transmission	Identification code		NUL, NWS, PFU
	Month of production	from to	06.2011
Allocation	Model		Audi Q5 from MY 08
	Engine		2.0L TFSI - 155 kW
Primary drive			33:29 = 1.138
Front axle helical gear			31:29 = 1.069
Front axle bevel gear			34:11 = 3.091
Complete front axle ratio = primary drive x helical gear drive x bevel gear drive			3.760
Rear axle bevel gear			43:13 = 3.308
Complete rear axle ratio = Rear axle bevel gear x primary drive			3.760
Oil system, front final drive/transfer case			Separated

Automatic Trans. –
0BW

Controls, Housing – 0BW

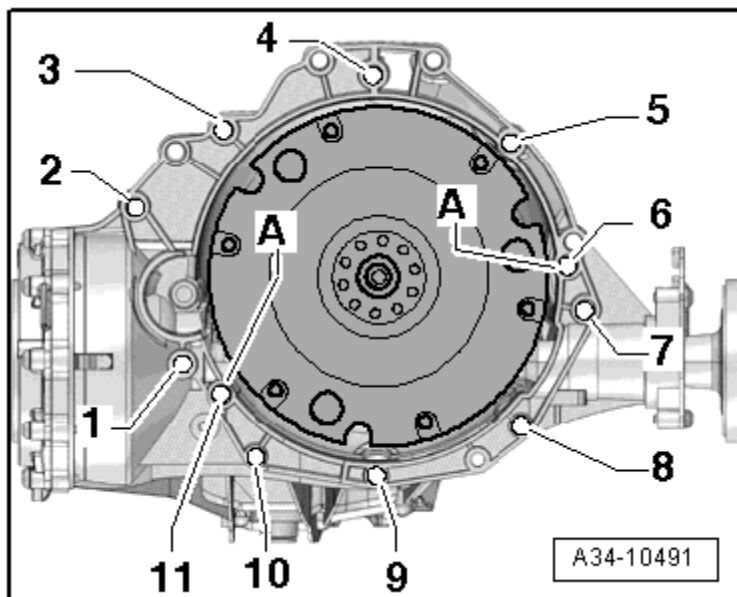
Fastener Tightening Specifications

Component	Fastener size	Nm
ATF Drain Plug ²⁾	-	12
ATF Pipe, Nut	-	29
ATF Pipe, Return ¹⁾	-	9
	-	20
ATF Pipe, Supply for Attaching the ATF Pipe to the Engine	-	9
ATF Pipe, Supply from the Transmission to the ATF Cooler	-	9
ATF Plug for the Hole for Checking and Filling for the ATF in the Transmission ²⁾	-	30
Bolts and nuts	M6	9
	M7	15
	M8	20
	M10	40
	M12	65
Drain Plug for the Hole for Checking and Filling for the Transmission Fluid Inside the Transfer Case ²⁾	-	27
Drain Plug for the Hole for Checking and Filling for the Transmission Fluid Inside the Front Final Drive ²⁾	-	27
Lower Stop for the Transmission Mount ²⁾	-	20 plus an additional 90° (¼ turn)
Oil Drain Plug for the Transmission Fluid Inside the Front Final Drive ²⁾	-	8
Oil Drain Plug for the Transmission Fluid Inside the Transfer Case ²⁾	-	12
Selector Lever Cable, Nut	-	13
Selector Lever Cable Adjustment Secured on the Shift Mechanism Function Unit	-	13
Selector Lever Cable Bracket	-	8
Selector Mechanism Function Unit, Nut	-	10
Tunnel Crossmember	-	70
Transmission Mount	-	20
Transmission Support BOLT	-	40
Transmission Support nut	-	20

¹⁾ For bolt tightening clarification, refer to ElsaWeb, *ATF Cooler and ATF Pipes Overview* items 10, 12 and 13.

²⁾ Replace

Transmission to Engine Tightening Specifications



Item	Bolt	Nm
1 ¹⁾	M10 x 50 ²⁾	65
2 ¹⁾ , 7	M12 x 100 ³⁾	30 plus an additional 90° (¼ turn)
3 ⁴⁾ , 6	M12 x 75 ³⁾	30 plus an additional 90° (¼ turn)
4, 5 ⁴⁾	M12 x 120 ³⁾	15 plus an additional 90° (¼ turn)
8, 10	M10 x 75 ³⁾	15 plus an additional 90° (¼ turn)
9	M10 x 60 ³⁾	15 plus an additional 90° (¼ turn)
11 ⁵⁾	M12 x 50 ³⁾	30 plus an additional 90° (¼ turn)
A	Alignment pins for centering	

¹⁾ Also secures the starter.

²⁾ Bolt strength rating 10.9, there is no limit to the number of times steel bolts can be used.

³⁾ The aluminum bolts can be used 2 times

⁴⁾ With a bracket for the wires.

⁵⁾ Installed from the engine side

Gears, Hydraulic Controls – 0BW

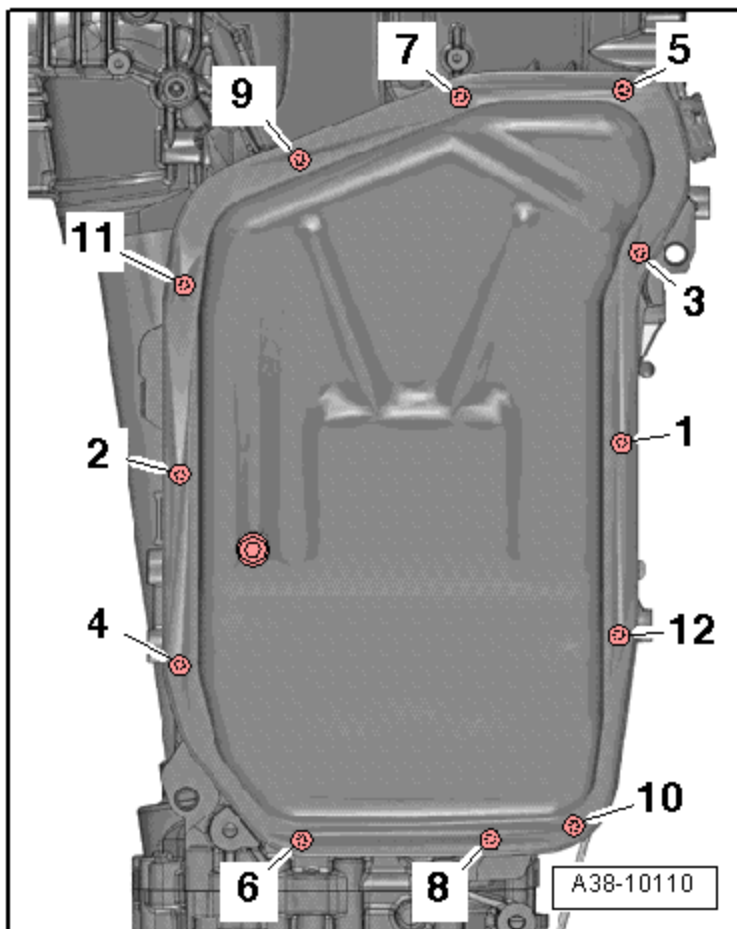
Fastener Tightening Specifications

Component	Fastener size	Nm
ATF Drain Plug	-	10
ATF Pipe, Nut	-	5.5
Electro-Drive Drive Motor ²⁾	-	10
	-	10 plus an additional 75°
	-	60 ¹⁾
Electro-Drive Drive Motor coolant line connections	-	20
High Voltage Connection Box Housing	-	20
Oil Drain Plug for the ATF in the Transmission	-	12
Transmission Fluid Auxiliary Hydraulic Pump 1	-	10

¹⁾ Replace

²⁾ For bolt tightening clarification, refer to ElsaWeb, *Electro-Drive Drive Motor -V141-Overview* items 10, 11 and 12

ATF Oil Pan Tightening Specifications

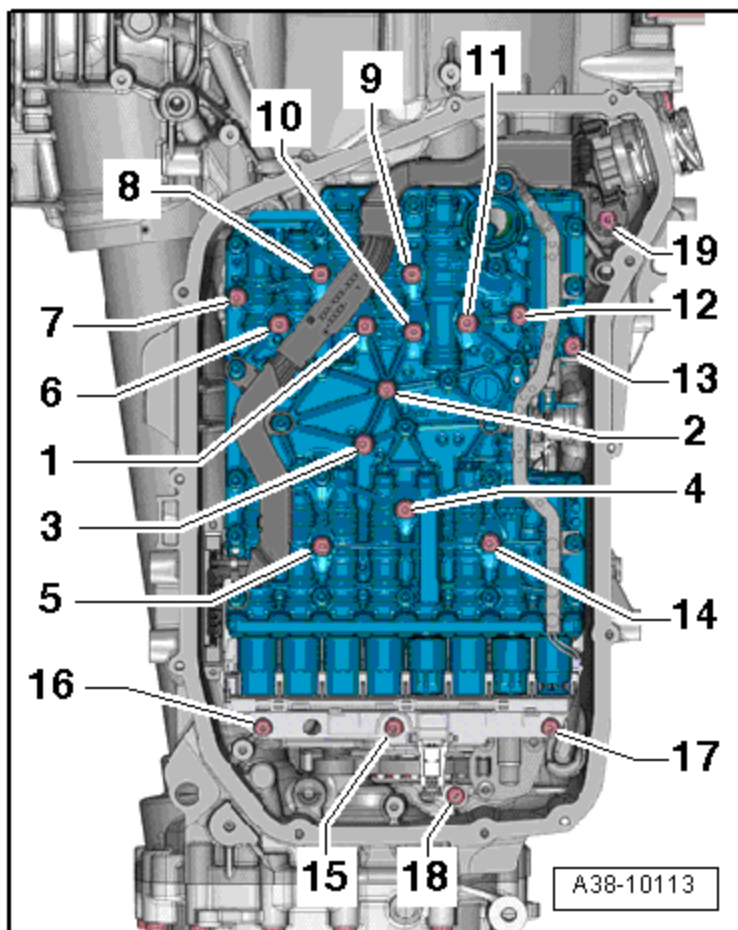


Replace the oil pan bolts.

Step	Bolts	Tightening Specification/Additional Turn
1	1 through 12	Hand-tighten
2	1 through 12	4 Nm
3	1 through 12	Plus an additional 45° (1/8 turn)

Automatic Trans. –
0BW

Mechatronic Tightening Specifications



Bolts -18- and -19- are shorter. Bolt -18- attaches the transmission output speed sensor -G195- to the transmission housing. Bolt -19- attaches the Mechatronic connector to the transmission housing.

Component	Nm
Tighten bolts 1 through 19 in sequence	10

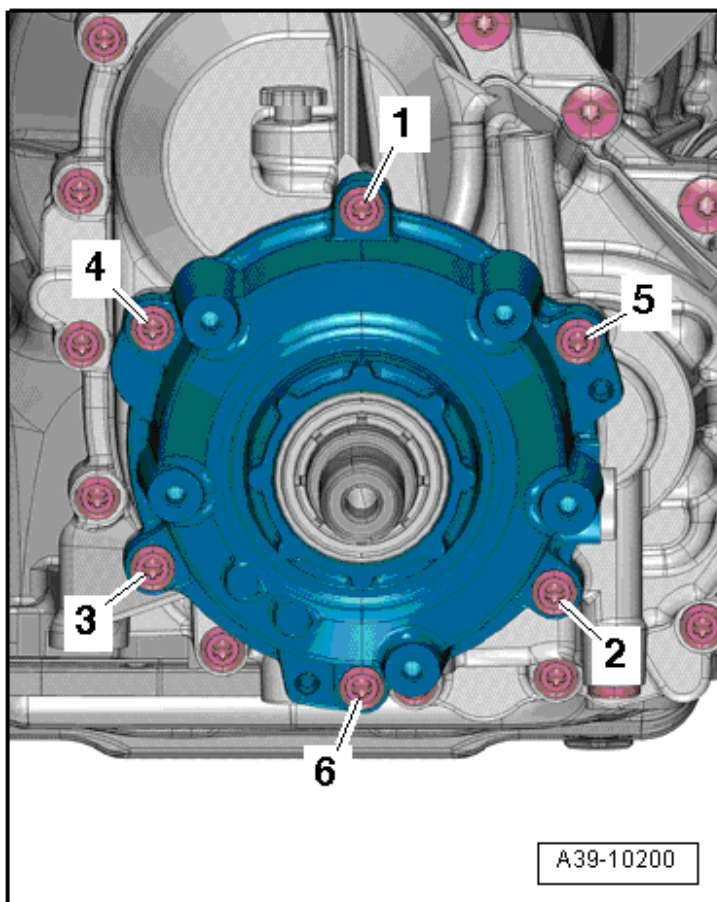
Rear Final Drive, Differential – 0BW

Fastener Tightening Specifications

Component	Fastener size	Nm
Balance Weight ¹⁾	-	20 plus an additional 90° (¼ turn)
Drain Plug for the Transmission Fluid Inside the Front Final Drive ¹⁾	-	27
Drain Plug for the Transmission Fluid Inside the Transfer Case ¹⁾	-	27
Left Flange Shaft Mounting Bracket ¹⁾	-	9 plus an additional 60°
Oil Drain Plug for the Transmission Fluid inside the Front Final Drive ¹⁾	-	8
Oil Drain Plug for the Transmission Fluid Inside the Transfer Case ¹⁾	-	12

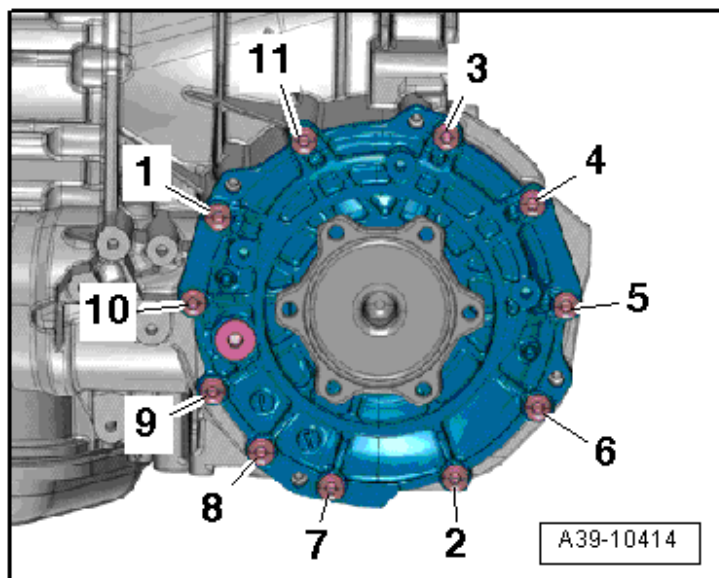
¹⁾ Replace

Center Differential Housing Tightening Specifications



Step	Bolts	Tightening Specification/Additional Turn
1	1 through 6	3 Nm
2	1 through 6	4 Nm
3	1 through 6	Plus an additional 90° (¼ turn)

Front Final Drive Cover Tightening Specifications

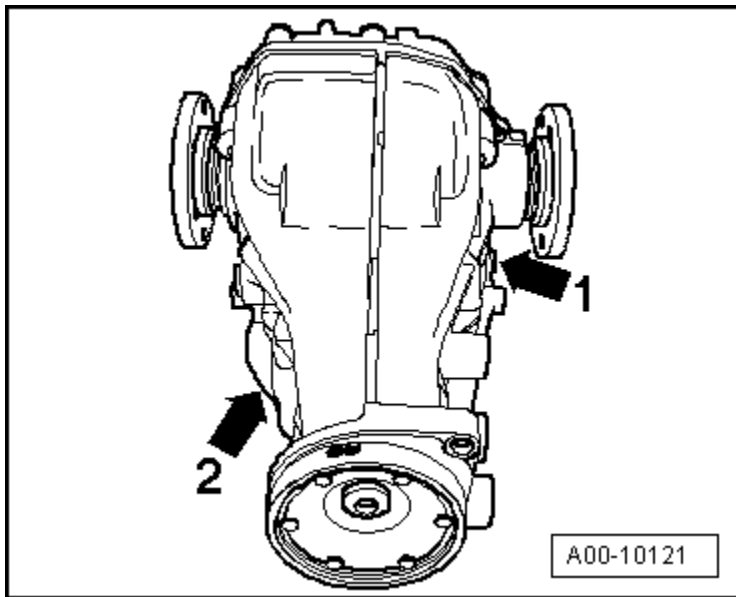


Step	Bolts	Tightening Specification/Additional Turn
1	1 and 6	3 Nm
2	1 through 11	27 Nm

REAR FINAL DRIVE – 0BC, 0BD, 0BE, 0BF

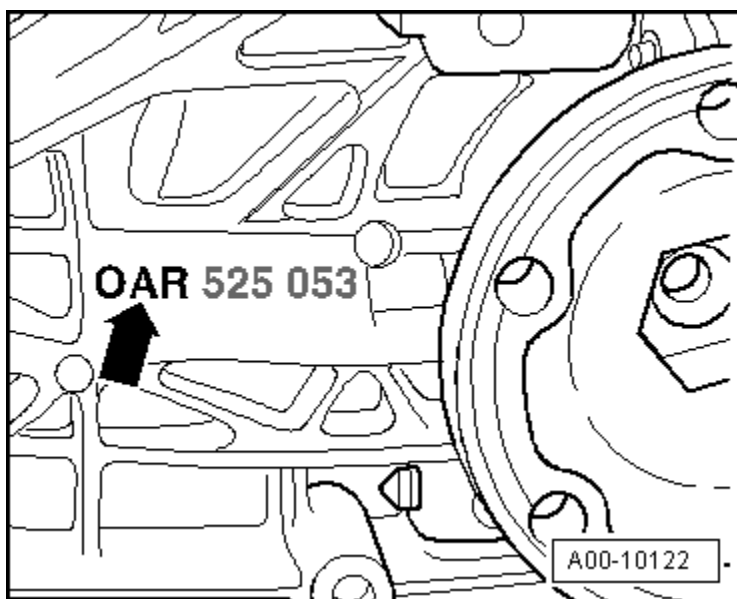
General, Technical Data – 0BC

Rear Final Drive Identification



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

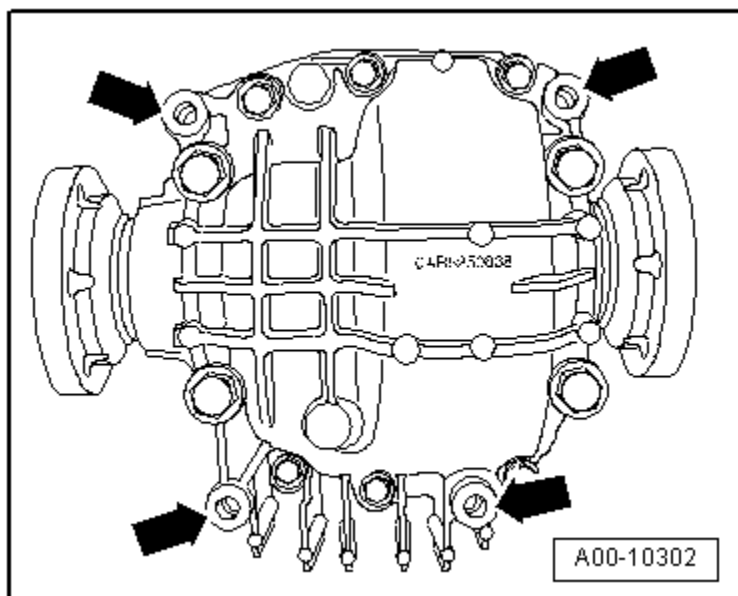
Final Drive Identification



Final Drive OBC (➡) and OAR

Note: OAR is always on the rear final drive housing.
The changes to the housing are what differentiate
the OBC final drive from the OAR final drive.

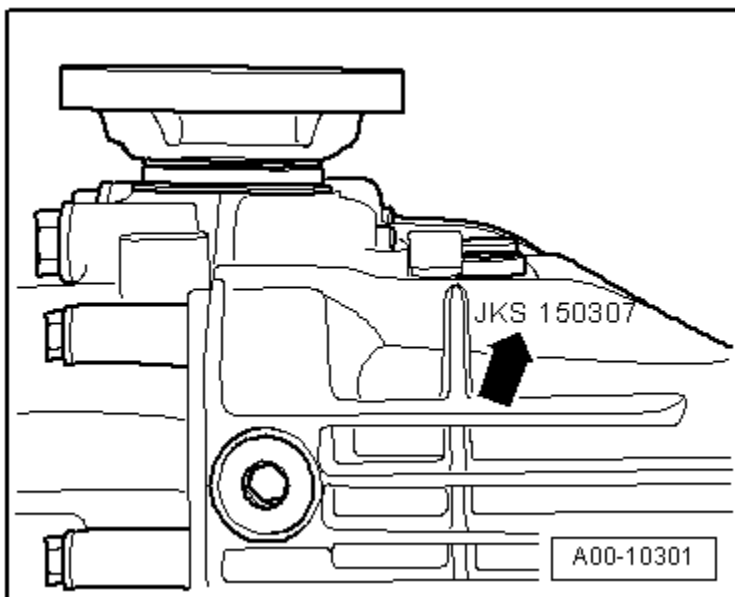
Final Drive Identification (cont'd)



The locations of the threaded holes (➡) for attaching the cross member to the rear final drive are also different.

The OBC final drive has 4 threaded holes (➡) in its housing, used for attaching the cross member. In addition to this, there is an additional threaded hole under the flange/driveshaft used for attaching the final drive to the subframe.

Rear Final Drive Code and Date of Manufacture

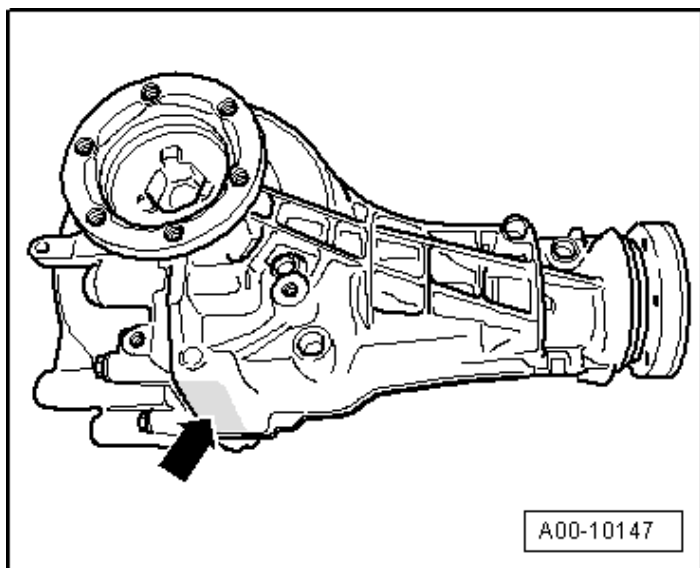


Example:	JKS	15	03	07
	Code letters	Day	Month	Year of manufacture 2007

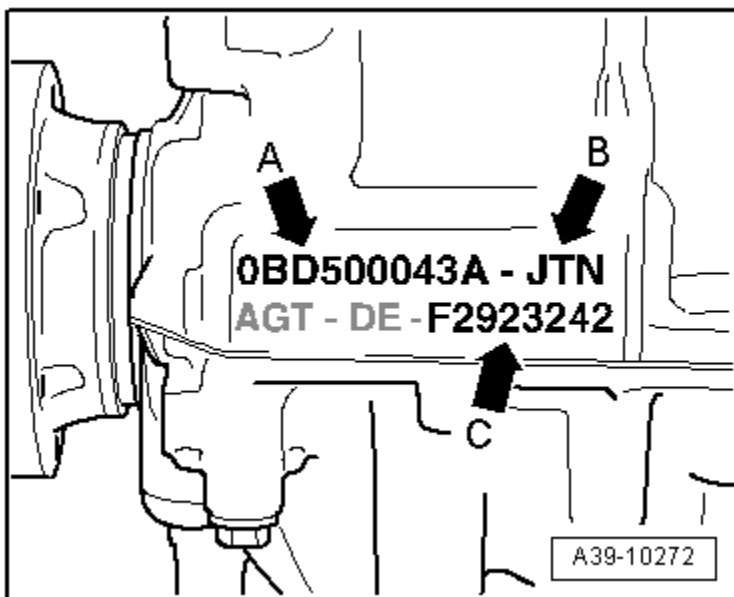
When installing a new rear final drive unit, the final drive code, the PR number and the vehicle engine code must be verified in the Parts Catalog. This is the only to assure the correct allocation.

General, Technical Data – 0BD

Rear Final Drive Identification



Final drive OBD, code letters and manufacture date (➡).



A ➔ front final drive OBD with replacement part number (example: 0BD 500 043A)

B ➔ code letters JTN

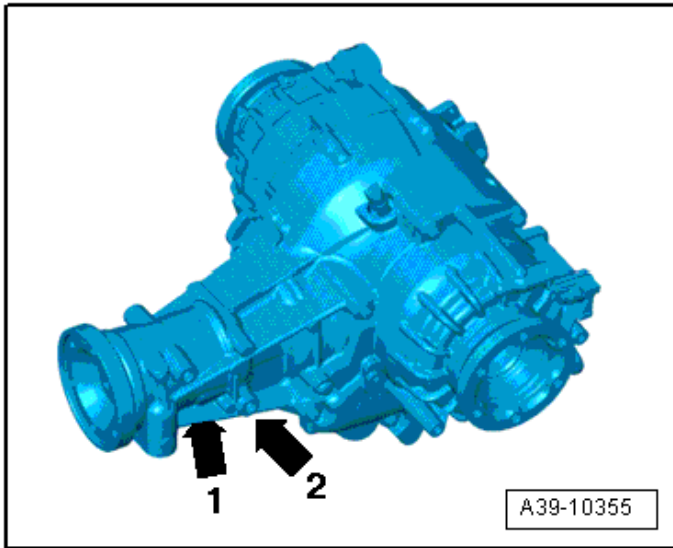
C ➔ Rear final drive manufacture date

Example

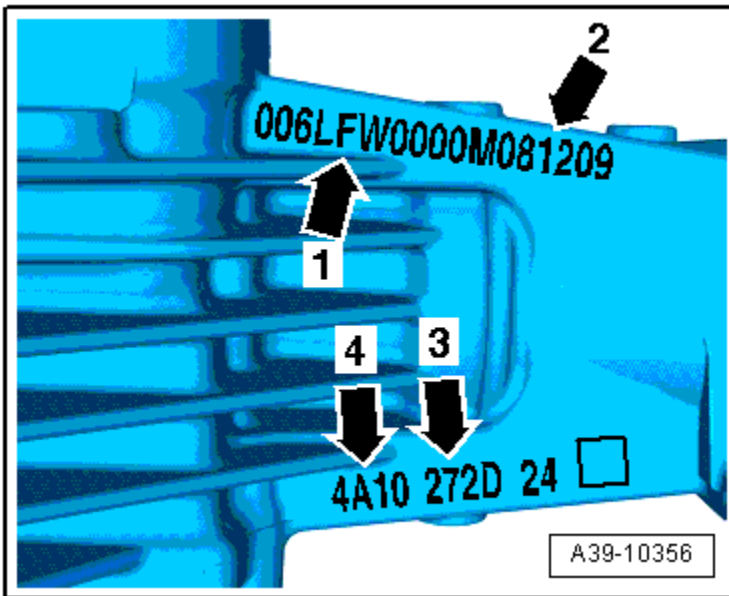
F	292	3242
Production year 2006 F = 2006, G = 2007, H = 2008, etc.	Production date 292 nd calendar day (always given in three-digit format)	Day of manufacture serial number

General, Technical Data – 0BE, 0BF

Rear Final Drive Identification



Clutch class -arrow 1-. Engine code and build date-arrow 2-. The way to recognize the rear final drive “0BF and 0BE” is the hydraulic control unit with the side chambers.



1 ➔ Code LFW

2 ➔ Rear final drive build dates

3 ➔ Classification (classification of the clutch wear values) for the right clutch. Example: -272D-

4 ➔ Classification (classification of the clutch wear values) for the left clutch. Example: -4A10-

Example

08	12	09
Production year 2008	Month	Day

Rear Final Drive Transmission Allocations, Ratios, Capacities

Rear Final Drive		0BC		
Code letters		KCC	KLL	KLM
Ratio	Final drive $Z_2:Z_1$	43:13 = 3.308	35:8 = 4.375	35:8 = 4.375
Driveshaft flange diameter		75.5 mm	70.7 mm	75.5 mm
Gear oil capacity		See the Fluid Capacity Tables; Rep. Gr.03;		

Rear Final Drive		0BC		
Code letters		LAW	NPR	
Ratio	Final drive $Z_2:Z_1$	42:9 = 4.666	43:13 = 3.308	
Driveshaft flange diameter		75.5 mm	70.7 mm	
Gear oil capacity		See the Fluid Capacity Tables; Rep. Gr.03;		

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

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

Rear Final Drive 0BC in the Audi Q5 Hybrid Transmission Allocations, Ratios, Capacities

Rear Final Drive		0BC	
Code letters		KCC	NPR
Ratio	Final drive $Z_2:Z_1$	43:13 = 3.308	43:13 = 3.308
Driveshaft flange diameter		75.5 mm	70.7 mm
Gear oil capacity		See the Fluid Capacity Tables; Rep. Gr.03;	

Rear Final Drive 0BD in the Audi Q5 Transmission Allocations, Ratios, Capacities

Rear Final Drive		0BD	
Code letters		KBB	KHR
Ratio	Final drive $Z_2:Z_1$	35:8 = 4.375	43:13 = 4.625
Driveshaft flange diameter		75.5 mm	75.5 mm
Gear oil capacity		See the Fluid Capacity Tables; Rep. Gr.03;	

Rear Final Drive		0BD	
Code letters		KQF	LLU
Ratio	Final drive $Z_2:Z_1$	37:8 = 4.625	42:9 = 4.667
Driveshaft flange diameter		75.5 mm	75.5 mm
Gear oil capacity		See the Fluid Capacity Tables; Rep. Gr.03;	

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

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

Fastener Tightening Specifications

Component	-Fastener Size	Nm
Driveshaft heat shield	-	24
Intermediate bearing bracket	-	20
Lock plate to driveshaft ¹⁾	-	30 plus an additional 90° (¼ turn)
Final Drive 0BC, 0BD		
Balance weight to rear final drive bolt ³⁾	-	22
Balance weight to rear final drive bolt ⁴⁾	-	55
Crossmember to rear final drive bolt	-	55
Heat shield to crossmember bolt	-	20
Subframe ²⁾		
- Bolt	-	55
- Bolt	-	95
Gear Oil Drain and Inspection Plugs 0BE, 0BF		
Drain plug for gear oil ¹⁾	-	15
Inspection plug for gear oil ¹⁾	-	15
Final Drive 0BE, 0BF		
All Wheel Drive Clutch Valve 2 -N446- to hydraulic control unit housing bolt	-	2.5
All Wheel Drive Pump -V415- to hydraulic control unit housing bolt	-	5
ATF check plug ¹⁾	-	15
ATF drain plug ¹⁾	-	15
Bracket for wiring harness to rear final drive bolt	-	9
Gear oil drain plug ¹⁾	-	15
Gear oil inspection plug ¹⁾	-	15
Gear oil checking plug 0BC	-	30

Rear Final Drive –
0BC, 0BD, 0BE, 0BF

Fastener Tightening Specifications (*cont'd*)

Component	-Fastener Size	Nm
Gear oil checking plug 0BD		45
Hydraulic control unit ⁶⁾		
- Bolt ⁵⁾	M8 x 50	20
- Bolt	M8 x 30	see tightening sequence → Hydraulic Control Module, 0BE, 0BF
Left line to Hydraulic Control Unit Housing nut		30
Oil Pressure/Temperature Sensor		10
Right Flange Shaft to Final Drive bolt ¹⁾		50 + 90°
Right line to Hydraulic Control Unit Housing nut		30
Shuttle valve		8
Gear Oil Drain and Inspection Plugs, 0BE, 0BF		
ATF drain plug ¹⁾		15
ATF inspection plug ¹⁾		15

¹⁾ Replace

²⁾ For bolt tightening clarification, refer to ElsaWeb, *Final Drive 0BC, 0BD Overview* items 2 and 3

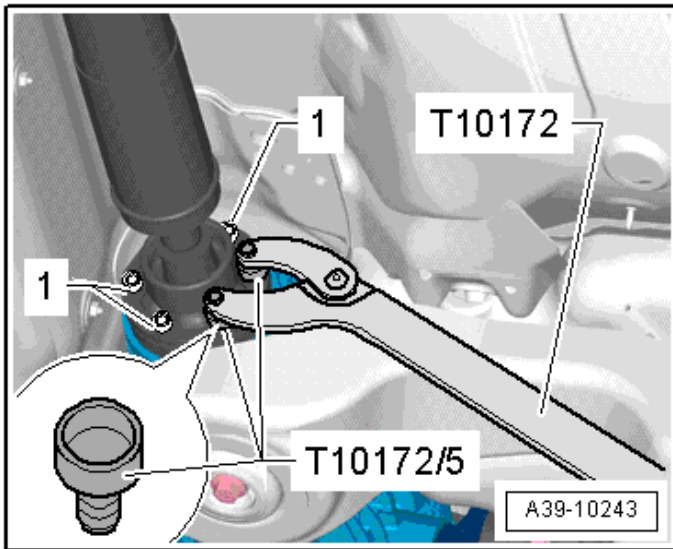
³⁾ For bolt tightening clarification, refer to ElsaWeb, *Final Drive 0BC, 0BD Overview* item 1

⁴⁾ For bolt tightening clarification, refer to ElsaWeb, *Final Drive 0BC, 0BD Overview* item 9

⁵⁾ Coat the thread with Sealing Compound -D 176 501 A1-

⁶⁾ For bolt tightening clarification, refer to ElsaWeb, *Final Drive 0BE, 0BF Overview* items 7, 8 and 9

Driveshaft to Rear Final Drive Tightening Specification



Always replace the driveshaft bolts 1.

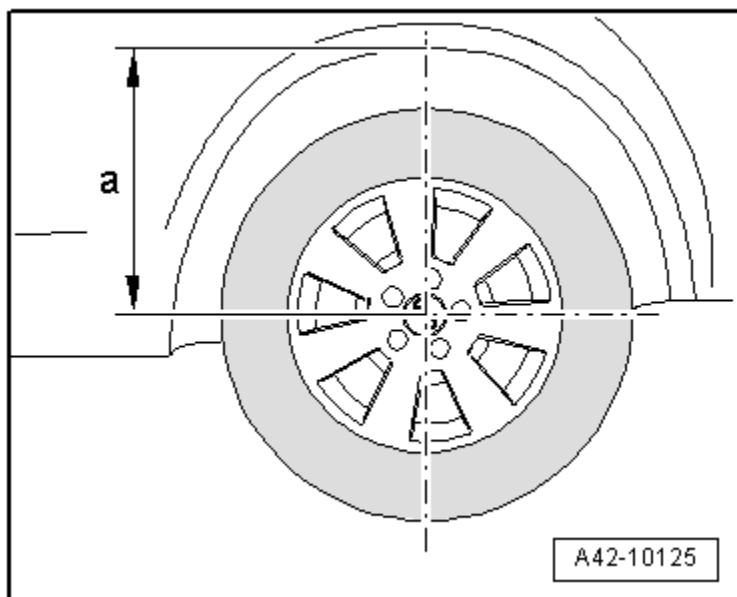
Step	Bolts	Tightening Specification/Additional Turn
1	1	Next to the color dot 30 Nm ¹⁾
2	1	30 Nm
3	1	Plus an additional 90° (¼ turn)

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

SUSPENSION, WHEELS, STEERING

Front Suspension

Front Axle – Curb Weight Data



Before starting work, use a tape measure to measure dimension (a) from the wheel center to the lower edge of wheel housing. Take this measurement in the curb weight position (unloaded condition).

Front Axle	Five-link - front axle, upper and lower transverse link, transverse stabilizer, twin gas-filled strut
Rear Axle	Track controlled axle, upper and lower transverse links, transverse stabilizer, individual wheel suspension, twin gas-filled struts with coil spring

AWD				
		Standard Suspension (1BA)	Sport Suspension (1BV)	Suspension with Electronic Damping (1BL)
Wheelbase	mm	Approximately 2807	Approximately 2807	Approximately 2807
Front track; refer to Note	mm	Approximately 1617	Approximately 1617	Approximately 1617
Rear track; refer to Note	mm	Approximately 1613	Approximately 1613	Approximately 1613
Maximum steering angle at curved inner wheel	Degree	39° 54'	39° 54'	39° 54'

Note:

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

Change in track width:

- ET 27 “+ 22 mm“
- ET 33 “+ 12 mm“
- ET 37 “+ 4 mm“

Front Suspension Tightening Specifications

Component	Nm
Ball joint-to-wheel bearing housing bolt (replace fastener)	40
Brake shield-to-wheel bearing housing bolt	10
Coupling rod-to-stabilizer bar bolt ¹⁾ (replace fastener)	40 plus an additional 90° (¼ turn)
Coupling rod-to-shock absorber fork bolt ¹⁾²⁾	40 plus an additional 90° (¼ turn)
Constant Velocity (CV) joint boot clamp	20
Drive axle-to-transmission bolt ¹⁾	70
Drive axle-to-wheel hub bolt ¹⁾	200 plus an additional 180° (½ turn)
Guide link-to-subframe nut ¹⁾²⁾	70 plus an additional 180° (½ turn)
Guide link-to-wheel bearing housing nut ¹⁾	
- Hex collar nut M12 special wrench 21 mm	145
- Hex combination nut M12 special wrench 18 mm	110
- Hex combination nut M12 special wrench 21 mm	120
- Hex combination nut M12 special wrench 21 mm	140
Level control system sensor bolt	20
Level control system sensor nut	9
Shock absorber-to-shock absorber fork bolt ¹⁾	40 plus an additional 180° (½ turn)
Shock absorber mounting bracket-to-body bolt ³⁾ (replace fastener)	40 plus an additional 90° (¼ turn)
Stabilizer bar-to-subframe nut ¹⁾ (replace fastener)	25
Subframe-to-body bolt (replace fastener)	115 plus an additional 90° (¼ turn)
Subframe crossbrace-to-subframe bolt (replace fastener)	90 plus an additional 90° (¼ turn)
Subframe shield-to-subframe bolt	9
	20
Tie rod end-to-wheel bearing housing nut	
- Hex collar nut	20 plus an additional 90° (¼ turn)
- 12-point combi-nut	100

Component	Nm
- Hex combi-nut	110
Tower brace-to-body nut	2
	20
Tower brace reinforcement bolt	20
Track control arm-to-ball joint nut (replace fastener)	
- Hex collar nut M12 special wrench 21 mm	145
- Hex combination nut M12 special wrench 18 mm	110
- Hex combination nut M12 special wrench 21 mm	120
- Hex combination nut M12 special wrench 21 mm	140
Track control arm-to-shock absorber fork bolt ¹⁾ (replace fastener)	90 plus an additional 90° (¼ turn)
Track control arm-to-wheel bearing housing nut ¹⁾ (replace fastener)	70 plus an additional 180° (½ turn)
Upper control arm-to-mounting bracket nut ^{1) 2)} (replace fastener)	50 plus an additional 90° (¼ turn)
Upper control arm-to-wheel bearing housing nut (replace fastener)	40
Wheel bearing-to-wheel bearing housing bolt (replace fastener)	80 plus an additional 90° (¼ turn)
Wheel speed sensor-to-wheel bearing housing bolt	9

¹⁾ Must be tightened in the curb weight position. Refer to ElsaWeb, Wheel Bearing, Lifting to Curb Weight Position.

²⁾ Push toward the inside of the vehicle when tightening the control arm.

³⁾ Follow tightening sequence. Refer to ElsaWeb, Suspension Strut with Mounting Bracket.

Rear Suspension Tightening Specifications

Component	Fastener size	Nm
ABS wheel speed sensor-to-wheel bearing housing bolt	-	9
Brake disc-to-wheel hub bolt	-	5
Brake shield-to-wheel bearing housing bolt	-	10
Coupling rod-to-stabilizer bar bolt ¹⁾ (replace fastener)	-	40 plus an additional 90° (¼ turn)
Drive axle-to-rear final drive bolt (replace fastener) ³⁾		
- with 89 mm diameter outer Constant Velocity (CV) joint and 100 mm diameter inner Constant Velocity (CV) joint	M8	20 plus an additional 90° (¼ turn)
- with 94 mm diameter outer Constant Velocity (CV) joint and 107 mm diameter inner Constant Velocity (CV) joint	M10	70
Drive axle-to-wheel hub bolt (replace fastener)	-	200 plus an additional 180° (½ turn)
Level control system sensor bolt	-	5
	-	9
Lower transverse link-to-subframe bolt ¹⁾ (replace fastener)	-	70 plus an additional 180° (½ turn)
Lower transverse link-to-wheel bearing housing bolt ¹⁾ (replace fastener)	-	120 plus an additional 360° (full turn)
Shock absorber-to-shock absorber mount nut (replace fastener)	-	35
Shock absorber-to-wheel bearing housing bolt ¹⁾ (replace fastener)	-	150 plus an additional 180° (½ turn)
Shock absorber mount-to-body bolt (replace fastener)	-	50 plus an additional 45° (⅙ turn)
Stabilizer bar-to-subframe bolt ²⁾ (replace fastener)	-	25 plus an additional 90° (¼ turn)
Subframe-to-body bolt (replace fastener)	-	115 plus an additional 90° (¼ turn)
Tie rod-to-subframe nut ¹⁾ (replace fastener)	-	95
Tie rod-to-wheel bearing housing bolt ¹⁾ (replace fastener)	-	90 plus an additional 90° (¼ turn)

Component	Fastener size	Nm
Upper transverse link-to-subframe bolt ¹⁾ (replace fastener)	-	70 plus an additional 180° (½ turn)
Upper transverse link-to-wheel bearing housing nut ¹⁾ (replace fastener)	-	95
Wheel bearing-to-wheel bearing housing bolt	-	80 plus an additional 90° (¼ turn)

¹⁾ Must be tightened in the curb weight position. Refer to ElsaWeb, Wheel Bearing, with Coil Spring, Lifting to Curb Weight Position.

²⁾ Tighten evenly.

Wheels, Tires

Fastener Tightening Specifications

Component	Nm
Adaptive cruise control sensor bracket bolt	8
Level control system control module bracket nut	6
Level control system control module to bracket bolt	8
Tire pressure monitoring control module nut	2
Tire pressure monitoring sensor to rim union nut	8
Wheel bolts (tighten the wheel bolts in a diagonal sequence to the following specified torque)	140

Wheel Alignment Data

Wheel Alignment Specified Values – AWD

Specifications valid for all engine versions

Front Suspension	Standard suspension (1BA)	Sport suspension (1BV)	Suspension with electronic damping (1BL)
Camber through MY 12 ¹⁾	- 25' ± 23'	- 25' ± 23'	- 25' ± 23'
Camber through MY 13 ¹⁾	- 24' ± 23'	- 24' ± 23'	- 24' ± 23'
Maximum permissible difference between both sides	30'	30'	30'
Toe per wheel (adjustment value)	+ 10' ± 5'	+ 10' ± 5'	+ 10' ± 5'
Toe per wheel (control value)	+ 10' ± 7'	+ 10' ± 7'	+ 10' ± 7'
Toe-out angle at 20 degrees ²⁾	1° 49' ± 30'	1° 49' ± 30'	1° 49' ± 30'
Outer wheel steering angle at maximum steering angle	33° 30' + 1° 30' - 2°	33° 30' + 1° 30' - 2°	33° 30' + 1° 30' - 2°
Inner wheel steering angle at maximum steering angle	39° 54' + 1° 30' - 2°	39° 54' + 1° 30' - 2°	39° 54' + 1° 30' - 2°

Front Suspension	Sport suspension (1BD)	Sport suspension (2MT)	
Camber ¹⁾	- 55' ± 23'	- 24' ± 23'	
Maximum permissible difference between both sides	30'	30'	
Toe per wheel (adjustment value)	+ 10' ± 5'	+ 10' ± 5'	
Toe per wheel (control value)	+ 10' ± 7'	+ 10' ± 7'	
Toe-out angle at 20 degrees ²⁾	1° 49' ± 30'	1° 49' ± 30'	
Outer wheel steering angle at maximum steering angle	33° 30' + 1° 30' - 2°	33° 30' + 1° 30' - 2°	
Inner wheel steering angle at maximum steering angle	39° 54' + 1° 30' - 2°	39° 54' + 1° 30' - 2°	

¹⁾ A camber value of -20' applies to the front axle for the Australian market.

²⁾ Depending on the computer manufacturer, the toe-out angle difference can be indicated negatively in the alignment computer.

Rear Suspension	Standard suspension (1BA)	Sport suspension (1BV)	Suspension with electronic damping (1BL)
Camber	- 1°20' ± 25'	- 1°20' ± 25'	- 1°20' ± 25'
Maximum permissible difference between both sides	30'	30'	30'
Toe per wheel (adjustment value)	+ 10' ± 5'	+ 10' ± 5'	+ 10' ± 5'
Toe per wheel (control value)	+ 10' ± 5'	+ 10' ± 5'	+ 10' ± 5'
Maximum permissible deviation in direction of travel relative to vehicle longitudinal axis	10'	10'	10'

Rear Suspension	Sport suspension (1BD)	Sport suspension (2MT)	
Camber	- 1°20' ± 25'	- 1°20' ± 25'	
Maximum permissible difference between both sides	30'	30'	
Toe per wheel (adjustment value)	+ 10' ± 5'	+ 10' ± 5'	
Toe per wheel (control value)	+ 10' ± 5'	+ 10' ± 5'	
Maximum permissible deviation in direction of travel relative to vehicle longitudinal axis	10'	10'	

Wheel Alignment Specified Values – FWD

Specifications valid for all engine versions

Front Suspension	Standard suspension (2MF)	Sport suspension (1BV)
Camber	- 49 ± 23'	- 49 ± 23'
Maximum permissible difference between both sides	30'	30'
Toe per wheel (adjustment value)	+ 10' ± 5'	+ 10' ± 5'
Toe per wheel (control value)	+ 10' ± 7'	+ 10' ± 7'
Toe-out angle at 20 degrees ¹⁾	1° 49' ± 30'	1° 49' ± 30'
Outer wheel steering angle at maximum steering angle	33° 30' + 1° 30' - 2°	33° 30' + 1° 30' - 2°
Inner wheel steering angle at maximum steering angle	39° 54' + 1° 30' - 2°	39° 54' + 1° 30' - 2°

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

Rear Suspension	Standard suspension (2MF)	Sport suspension (1BV)
Camber	- 1°20' ± 25'	- 1°20' ± 25'
Maximum permissible difference between both sides	30'	30'
Toe per wheel (adjustment value)	+ 10' ± 5'	+ 10' ± 5'
Toe per wheel (control value)	+ 10' ± 5'	+ 10' ± 5'
Maximum permissible deviation in direction of travel relative to vehicle longitudinal axis	10'	10'

Wheel Alignment Specified Values – Hybrid

Front Suspension	Standard suspension (1BA) ¹⁾	Sport suspension (2MF) ²⁾
Camber	- 27 ± 23'	- 49 ± 23'
Maximum permissible difference between both sides	30'	30'
Toe per wheel (adjustment value)	+ 10' ± 5'	+ 10' ± 5'
Toe per wheel (control value)	+ 10' ± 7'	+ 10' ± 7'
Toe-out angle at 20 degrees ³⁾	1° 49' ± 30'	1° 49' ± 30'
Outer wheel steering angle at maximum steering angle	33° 30' + 1° 30' - 2°	33° 30' + 1° 30' - 2°
Inner wheel steering angle at maximum steering angle	39° 54' + 1° 30' - 2°	39° 54' + 1° 30' - 2°

¹⁾ NAR, China and Russia

²⁾ ECE without Russia

³⁾ Angle of outer wheel is less by this amount. It can also be indicated negatively in alignment computer, depending on manufacturer.

Rear Suspension	Standard suspension (1BA)	Sport suspension (2MF)
Camber	- 1°20' ± 25'	- 1°20' ± 25'
Maximum permissible difference between both sides	30'	30'
Toe per wheel (adjustment value)	+ 10' ± 5'	+ 10' ± 5'
Toe per wheel (control value)	+ 10' ± 5'	+ 10' ± 5'
Maximum permissible deviation in direction of travel relative to vehicle longitudinal axis	10'	10'

Steering

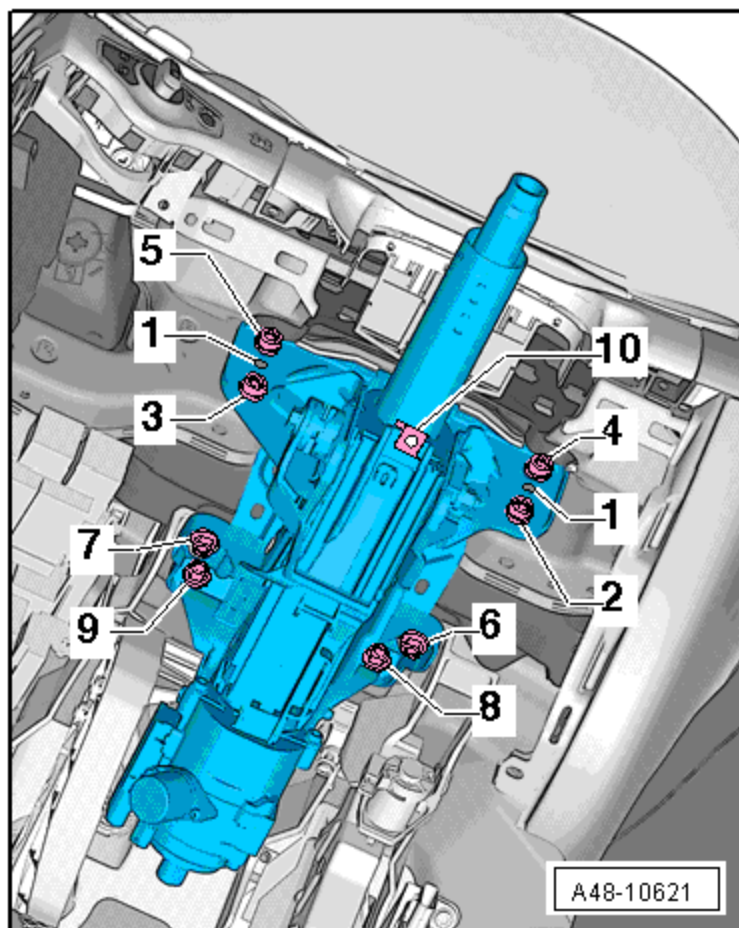
Fastener Tightening Specifications

Component	Nm
Airbag-to-steering wheel bolt	7
Belt pulley-to-power steering pump bolt	
- 4-cylinder	20
- 6-cylinder	22
Electronic steering column lock control module-to-steering column bolt	5
Handle-to-steering column bolt	3
Power steering pump bolt	20
Pressure line-to-steering gear bolt	20
Pressure line rubber bushing-to-steering gear	6
Pressure line-to-rubber bushing nut	6
Pressure line union nut	40
Pressure line to power steering pump	
- Union nut, with dynamic steering	38
- Bolt, without dynamic steering	9
Reservoir-to-bracket bolt	9
Reservoir bracket-to-body bolt	9
Return line-to-body bolt	9
Servotronic solenoid valve-to-steering gear bolt ²⁾	3
Steering column-to mounting bracket and central tube bolt ¹⁾	20
Steering gear-to-subframe bolt (replace fastener)	80 plus an additional 180° (½ turn)
Steering intermediate shaft-to-steering column bolt (replace fastener)	30 plus an additional 90° (¼ turn)
Steering intermediate shaft-to-steering gear bolt (replace fastener)	30 plus an additional 90° (¼ turn)
Steering wheel-to-steering column bolt (replace fastener)	30 plus an additional 90° (¼ turn)
Tie rod-to-steering gear	
- Electromechanical steering	100
- Hydraulic steering	90
Tie rod end-to-tie rod nut	
- Electromechanical steering	80
- Hydraulic steering	60

Component	Nm
Tie rod end-to-wheel bearing housing nut (electromechanical steering gear) (replace fastener)	100
Tie rod end-to-wheel bearing housing nut (hydraulic steering gear) (replace fastener)	
- Hex collar nut	20 plus an additional 90° (¼ turn)
- 12-point combi-nut	100
- Hex combi-nut	110

- ¹⁾ Always follow bolt tightening sequence. Refer to ElsaWeb, Steering Column Tightening Specifications.
- ²⁾ Always follow bolt tightening sequence. Refer to ElsaWeb, *Servotronic Solenoid Valve*.

Steering Column Tightening Specifications



Step	Component	Nm
1	Position the steering column with the positioning pins (1) in the central tube positioning holes	
2	Loosely install all bolts	
3	Tighten bolts 2 through 5 in sequence	20
4	If equipped, install the right driver side knee bar	
5	Tighten bolts 6 through 9 in sequence	20
6	Replace the spring nut (10) if the steering column was replaced	

BRAKE SYSTEM

General Information

Brake System – Technical Data

---- 21-7-0928 926 96					
WAUZZZ 8R ₁ 8A101698					
8RB 0HY			S0R		
Q5 quat. 176 KW		TDI 3.0 A7S		V6	
CCWA --- ---					
LX7W/LX7W N3Q/CA					
EOA 701 4UE 6XC 5SL 6TS					
A —	1KE	J0Z	1LJ	1AT	1BA
	3FU		5MA	7X	
B —	F0A	8GR	0G7	0YD	0JJ
	T41	5KA	8BP	U2A	X9X
	1XX		803	904	8Z5
	7T6	C2T	7K0	4X3	2K1
	3L3		4KC	3Y0	4K4
			7MG	01A	4GF
88.8		8.8		88.8 888	
A00-10419					

Brake System

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

Front Wheel Brakes – Technical Data

Front Brakes			
Production Relevant No. (PR. No.)		1LA	1LJ
Brake caliper		FBC- 60 - 16"	FBC- 60 - 17"
Brake disc ventilated	Diameter mm	320	345
Brake disc, thickness	mm	30	30
Brake disc, wear limit	mm	28	28
Brake caliper, piston	Diameter mm	60	60
Pad thickness with backing plate and dampening sheet	mm	20.3	20.3
Brake pad wear limit with backing plate and dampening sheet	mm	10	10

Front Brakes			
Production Relevant No. (PR. No.)		1LB, 1LC	1LE, 1LP
Brake caliper		FBC- 60 - 16"	FBC- 60 - 17"
Brake disc ventilated	Diameter mm	320	345
Brake disc, thickness	mm	30	30
Brake disc, wear limit	mm	28	28
Brake caliper, piston	Diameter mm	60	60
Pad thickness with backing plate and dampening sheet	mm	20.3	20.3
Brake pad wear limit with backing plate and dampening sheet	mm	10	10

Rear Wheel Brakes – Technical Data

Rear Brakes			
Production Relevant No. (PR. No.)		1KW	1KE
Brake caliper		CII-43 EPB - 16"	CII-43 EPB - 17"
Brake disc	Diameter mm	300	330
Internally vented brake disc thickness	MM	12	22
Brake disc, wear limit	mm	10	20
Brake caliper, piston	Diameter mm	43	43
Pad thickness with backing plate and dampening sheet	mm	17.5	17.5
Brake pad wear limit with backing plate and dampening sheet	mm	7	7

Antilock Brake System (ABS)

Fastener Tightening Specifications

Component	Nm
Front ABS wheel speed sensor to wheel bearing housing bolt	9
Rear ABS wheel speed sensor to wheel bearing housing bolt	8
All brake lines at hydraulic unit	14
ESP sensor unit to floor	9

Mechanical Components

Brake Pedal Tightening Specifications

Component	Nm
Front Brakes	
Brake caliper-to-brake carrier bolt	30
Brake carrier-to-wheel bearing housing bolt ¹⁾	196
Brake line-to-brake caliper	20
Brake rotor-to-wheel bearing housing	5
Rear Brakes	
Brake carrier-to-wheel bearing housing bolt -1-	100 plus an additional 90° (¼ turn)
Brake caliper-to-brake carrier bolt -1-	35
Brake hose-to-brake caliper bolt	20
Brake rotor-to-wheel bearing bolt	5
Brake shield-to-wheel bearing housing bolt	10
Electromechanical parking brake actuator-to-brake caliper bolt	12
Brake booster-to-mounting bracket for pedal assembly nut	8
Gas pedal module-to-mounting bracket for pedal assembly bolt	8
Mounting pin bolt	8
Pedal support-to-bracket bolt	20
Wheel bolts	140

¹⁾ Always replace if removed

Hydraulic Components

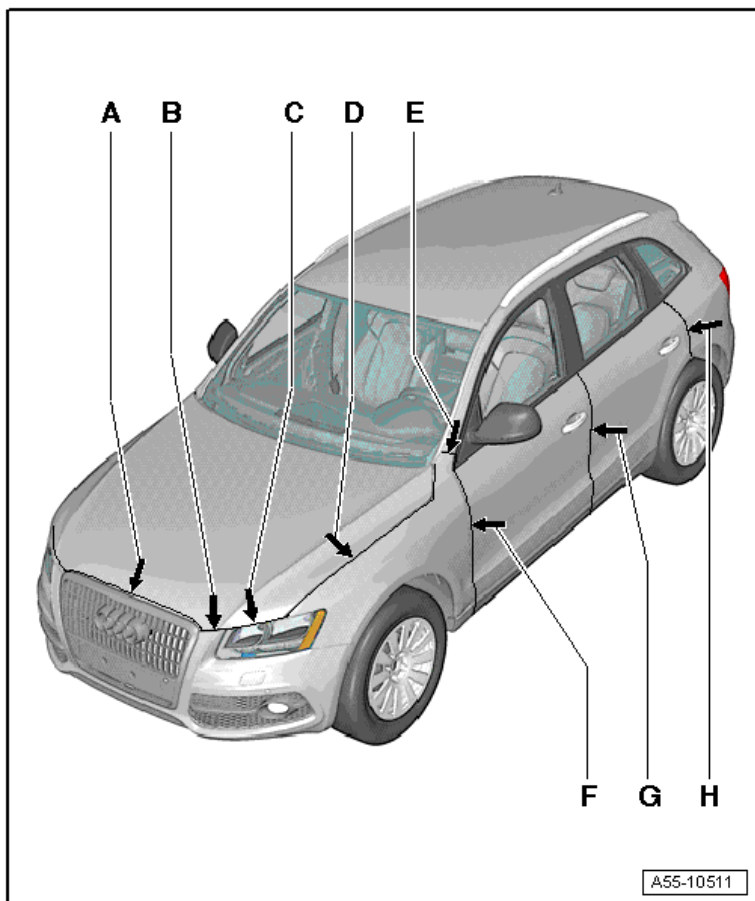
Hydraulic Tightening Specifications

Component	Nm
Front Brakes	
Bleeder valve	15
Brake caliper housing bolts	30
Brake caliper to brake carrier bolt	30
Brake carrier to wheel bearing housing bolt ¹⁾	196
Brake line to brake caliper	20
Brake rotor to wheel bearing housing	5
Electronic Parking Brake Rear Caliper	
Bleeder valve	10
Brake caliper housing with actuator to brake caliper ¹⁾	35
Brake carrier to wheel bearing housing ¹⁾	100 plus an additional 90° (¼ turn)
Brake system vacuum pump bracket to body bolt	9
Brake system vacuum pump bracket to body nut	8
Brake system vacuum pump to bracket nut	9
Brake booster to mounting bracket bolt	25
Brake fluid reservoir to brake master cylinder bolt	5
Brake line to brake master cylinder	14
Brake master cylinder to hydraulic unit nut	49
Brake system vacuum pump bracket bolts	9
Brake system vacuum pump bracket nut	8
Brake system vacuum pump buffer nut-to-bracket	9
Electronic parking brake rear caliper ¹⁾	35
Pedal support to bracket bolt	20
Vacuum pump hose-to-pump	5
Vacuum pump to engine bolt (Torx® 30)	9
Wheel bolts	140

¹⁾ Always replace if removed

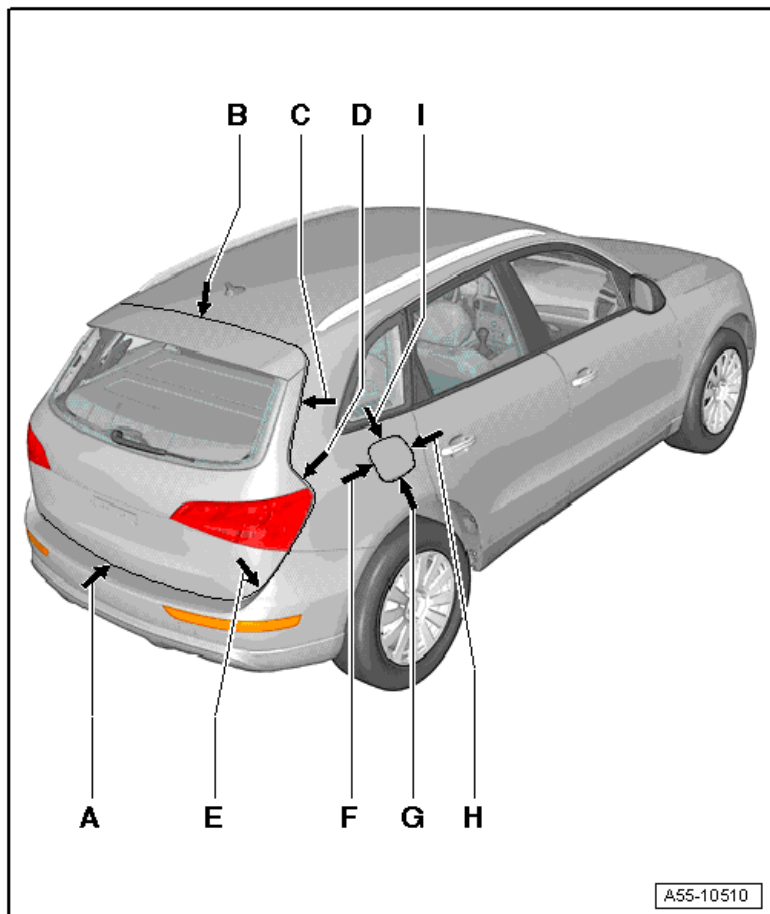
BODY

Air Gap Body Dimensions



Body

Component	mm
A	4.5 ± 1.0
B	4.5 ± 1.0
C	4.5 ± 1.0
D	3.0 ± 0.5
E	2.0 ± 0.5
F	3.5 ± 0.5
G	4.5 ± 0.5
H	3.5 ± 0.5



Component	mm
A	5.0 ± 1.0
B	4.5 ± 0.5
C	4.5 ± 0.5
D	4.5 ± 0.5
E	4.5 ± 0.5
F	$2.0 + 0.5$
G	2.5 ± 0.5
H	$2.0 + 0.5$
I	$2.0 + 0.5$

Body Exterior

Lock Carrier, Plenum Chamber Tightening Specifications

Component	Nm
Impact member to lock carrier bolt	55
Left and right lock carrier brace	
- Bolts	5
- Nut	23
Left and right reinforcement bolt	30
Lock carrier bolts, upper	5
Lock carrier bolts, lower	1.5
	55
Side impact bar	55
Underbody cover hex nuts	2
Rear underbody bolts	2
Plenum chamber nut	4
Plenum chamber bolt	7
Rear lid bolts	21
Rear lid gas filled strut ball studs	21
Rear lid hinge hex head nut	21
Rear lid latch bracket bolts	21
Rear lid lock bolts	21
Tower Brace	
- Nut	2.5
- Nut	30

¹⁾ For bolt tightening clarification. Refer to ElsaWeb, *Lock Carrier with Attachments Assembly Overview, items 1 and 7.*

²⁾ For bolt tightening clarification. Refer to ElsaWeb, *Additional Reinforcement Assembly Overview items 2, 6, 8 and 9.*

Front Fender Tightening Specifications

Component	Nm
Front fender bolts	8
Front fender mount nut	4
Front fender brace bolts	10
Front fender brace nuts	4
Front fender end plate screws	1.5

Front Hood Tightening Specifications

Component	Nm
Front hood hex nut	21
Front hood gas filled strut ball studs	21
Front hood hinge bolts	21

Front Hood Tightening Specifications (cont'd)

Component	Nm
Front hood catch bolts	8
Hood release lever bracket	2

Rear Lid Tightening Specifications

Component	Nm
Adjusting buffer bolt	8
Bracket to rear lid drive motor bolt	8
Lid hinge to rear lid drive motor bolt	11
Rear lid bolts	21
Rear lid drive motor nut	6
Rear lid gas filled strut ball studs	21
Rear lid hinge hex head nut	21
Rear lid latch bracket bolts ¹⁾	8
	21
Rear lid lock bolts	21
Rear lid latch nut	21
Rear lid catch nut	8
Stop bolt	8

¹⁾ For bolt tightening clarification. Refer to ElsaWeb, *Rear Lid Motor Assembly Overview items 3 and 5*.

Front and Rear Door Tightening Specifications

Component	Nm
Cover for the door lock bolt	3.5
Door arrester bolt	25
Door upper hinge stud bolt	30
Door upper hinge bolt	32
Door Lower hinge bolt	32
Door Lower hinge fitting bolt	45
Door lock to inner door part bolt	20
Front backing-to-door	2.5
Side impact protection bolts	20
Side impact protection nuts	20
Door arrester bolts	8
Door striker pin bolts	25
Door lock bolts	19
Rear lid catch bolt	25
Upper door hinge stud bolt	30
Window regulator motor-to-door bolts	3.5

Sunroof Tightening Specifications

Component	Nm
Assembly frame bolt	8
Front and rear glass panel bolts	4.5
Sunroof motor bolts	2
Sunshade bolts	3.5

Front and Rear Door Window Tightening Specifications

Component	Nm
Window regulator bolts	6
Window regulator nuts	6
Speaker bolts	1.5

Front Bumper Tightening Specifications

Component	Nm
Bumper cover bolts	5
Connecting strip bolt	2.5
Distance regulation control module bolt	8
Front spoiler bolt	2.5
Impact member nut	20
Impact member bracket bolt	55
Vent grille bolt	2.5
Noise insulation bolts	2.5
Cover mount nuts	4
Radiator grille bolt	1.5
Rear bumper cover end plate bolt	5
Reinforcement brace bolt	1.5
Side impact bar-to-body bolts	1.5
Side impact bar-to-bracket-to-lock carrier bolts	4
Spoiler (special equipment)	1.5
Locating bolt	5

Rear Bumper Tightening Specifications

Component	Nm
Rear bumper cover bolts	1.5
Rear bumper guide piece	1.5
Side impact bar bolts	8
Side impact bar nuts	4
Spoiler (if equipped) bolt	1.5
Trailer hitch bolts	20
Trailer hitch hand actuator bracket bolts	8

Front Wheel Housing Liner Tightening Specification

Component	Nm
Aerodynamic trim panel nuts	2
Front noise insulation bolt	2.5
Rear noise insulation bolt	2.5
Roof spoiler bolt/nut	2.5
Wheel housing liner bolts	1.5

Rear View Mirror Tightening Specifications

Component	Nm
Mirror adjusting unit mount	10
Mirror adjusting unit bolts	1.5

Strips and Trim Tightening Specifications

Component	Nm
Sill panel extension bolts	2
Retaining strip-to-sill panel bolts	2

Body Interior

Storage Compartment and Armrest Tightening Specifications

Component	Nm
Bracket for center console-to-center console	
- Nut	8
- Bolt	3
Center console mounting bracket bolts	8
Cupholder-to-center console	1.4
Driver side instrument panel cover bolt	3
Front ashtray-to-center console	2.5
Front center console bolts	2
Glove compartment bolt	3
Handle bolt	3
Heated cupholder-to-center console	1.4
Screen separator wall bolt	9
Storage compartment/ashtray unit bolts	1.4
Steering column trim bolts	2
Trim panel for center console	1.4

Instrument Panel and Central Tube Tightening Specifications

Component	Nm
Front sill panel trim (Driver side only) bolt	2.5
Instrument panel vent bolts	3
Top center defrost vent	1.5
Panel trim bolts	3
Speaker trim bolts	1.5
Central tube mounting bracket bolts	20
Driver's side trim bolts	3
Threaded pin	20
Instrument panel cover bracket bolt	9
Glove compartment bracket bolts	9
Glove compartment right retainer bolts	9
Glove compartment left retainer bolts	9
Left shock absorber bolts	9
Support base nuts	20
Support base bolts center armrest	1.4

Passenger Protection Tightening Specifications

Component	Nm
Airbag control module J234 nuts	9
Automatic belt retractor nut ¹⁾	45
Battery Interrupt Igniter-to-fuse panel A nuts	15
Belt end fitting bolt ²⁾	45
Belt latch to seat bolt ¹⁾	34
Belt guide ring bolt ¹⁾	45
Belt anchor bolt ¹⁾	45
Driver side airbag crash sensor bolt	5
Driver side rear side airbag crash sensor nut	9
Front door crash sensor bolts	2.5
Front passenger airbag nut ²⁾	8
Front seat belt B-pillar bolt ¹⁾	45
Front seat belt height adjuster bolt	23
Front seat belt-to-window anchor rail bolt ¹⁾	45
Front side airbag	10
Head curtain airbag	
- Bolt	3.5
- Nut	9
Latch child seat anchorage bolt ^{2) 3)}	8
Passenger airbag nut	8
Passenger front airbag crash sensor	9
Passenger side airbag crash sensor bolts	5

Passenger Protection Tightening Specifications (cont'd)

Component	Nm
Passenger occupant detection system control module bolt	1.5
Rear center 3-point seat belt latch hex nut	45
Rear center lap belt bolt ¹⁾	45
Rear double belt latch bolt ¹⁾	45
Rear outer belt anchor bolt ¹⁾	45
Rear side airbag	4.5
Rear sill panel trim	4.5
Rear wheel housing crash sensor bolts	9
Reinforcement (on power seats) nut/bolt	18
Retaining plate (passenger seat only) bolt ^{2) 3)}	8
Right rear side airbag crash sensor nut	9
Seat belt height adjuster	27
Seat position sensor bolt	1.3
Side airbag bolts	9
Side curtain airbag cap nuts	9

¹⁾ If it was removed because of an accident, replace the bolt

²⁾ Replace

³⁾ Install the new bolt with locking compound fluid -D 000 600 A2- (for customer service only)

Interior Trim Tightening Specifications

Component	Nm
Air intake chamber bracket bolt	9
Armrest bolt (front door) bolt	1.2
Armrest bolt (rear door) bolt	2.5
Bracket to Central tube bolt	20
Central tube ¹⁾	
- Bolt	3.6
- Bolt	20
- Nut	20
- Threaded pin	20
Door trim bolt	2.5
D-pillar protector 2x bolt	1.6
Glove compartment bracket bolt	9
Glove compartment left/right retainer bolt	9
Front sill panel trim bolt	2.5
Front bracket	20
Hinge 3x bolt	1.6
Inside door release mechanism	1.2

Component	Nm
Instrument panel cover bracket bolt	9
Interior door mechanism bolt	2.5
Left/right shock absorber bolt	9
Large mount 2x bolt	1.6
Lower Rear Lid Trim Panel	2
Luggage compartment side trim bolt	3
Pull handle bolt	1.2
Pull handle clipbolt	2.5
radio/navigation system Installation frame bolt	3
Rail for storage net 2x	1.6
Retaining tracks bolt	7
Speaker Trim bolt	1
Storage net mounts bolt	1.6
Sun shade mount bolt	1.2
Sun shade bolt	1.2
Tie-down eye	6
Upper center defroster vent bolt	1.5

¹⁾ For bolt tightening clarification. Refer to ElsaWeb, *Lock Carrier with Attachments Assembly Overview, items 3, 4, 12, 15,18 and 19.*

Seat Frames Tightening Specifications

Component	Nm
Actuator bracket nut	3
Backrest to seat pan bolt	33
Backrest adjustment motor bolt	8
Backrest release actuator bolt	1.5
Center armrest bolt ²⁾	18
Drawer mount bolt	8
Front seat frame bolts	50
Lever for seat height adjustment handle.	19.5
Lower seat frame bolt ²⁾	22
Lumbar support adjustment switch bolt	1.3
Pass-through door lock bolt	22
Pass-through door release bolt	3.8
Rear center armrest bolt	9
Rear seat bolt	50
Rear seat backrest cover bolt	3.8
Rear center belt latch bolt	36
Release lever bolt ³⁾	18
Seat adjustment control head bolt	1.3
Seat angle adjustment	
- Bolt ²⁾	6.5
- Shoulder pin ²⁾	6

Seat Frames Tightening Specifications (cont'd)

Component	Nm
Seat cushion fan cover grille bolt	1.5
Seat depth adjuster trim bolt ²⁾	4
Seat height adjuster	6
Seat side sill panel trim bolt	8
Seat height adjustment motor bolt ²⁾	8
Seat pan forward/backward adjustment lower seat frame bolt ²⁾	26
Shaft nut ¹⁾	8
Sill-Side Trim-to-seat bolt	8
Spindle nut nut ²⁾	18
Storage compartment bolt	8
Upper seat frame bolt ²⁾	22

¹⁾ Apply Locking Compound Fluid -D 000 600 A2- to the threaded section of the shaft before installing the nut

²⁾ Always replace if removed

³⁾ Install with locking compound; locking compound. Refer to the Parts Catalog.

HEATING, VENTILATION & AIR CONDITIONING

General, Technical Data

Refrigerant Oil Distribution

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

Refrigerant R134a Vapor Pressure Table

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

Air Conditioning

Fastener Tightening Specifications

Component	Fastener size	Nm
A/C pressure/temperature sensor		5
Electric compressor refrigerant lines	M6	9
	M8	25
Compressor Bolts 4-cylinder and 8-cylinder	-	25
Compressor Oil Drain Plug (Denso)	-	30
Compressor Driveshaft	-	60
Expansion Valve, Front	-	10
Expansion Valve, Rear (Hybrid)	-	10
Hybrid Battery Refrigerant Shut-Off Valve 1 Union	-	16.5
Pressure Relief Valve (Denso)	-	10
Refrigerant Line With Inner Heat Exchanger	-	10

ELECTRICAL SYSTEM

Communication Equipment

Communication Tightening Specifications

Component	Nm
Front information display control head screw	2
Radio screw	3
Roof antenna nut	6
Antenna systems	
Antenna amplifier (R24)/Antenna Amplifier 4 (R113) screw	6
Antenna amplifier 3 (R112) screw	2
Left antenna module (R108) screw	2
Roof antenna (R216) nut	6
Rearview camera system	
Rearview camera (R189) nut	6
Multifunction steering wheel	
Multifunction buttons screw	3
Sound system	
Center mid/high range loudspeaker (R158)	1
Digital sound system control module (J525) nut	3.5
Left front treble speaker (R20)/left front mid-range speaker (R103)/right front treble speaker (R22)/right front mid-range speaker (R104) screw	1
Left front treble speaker (R20)/right front treble speaker (R22) screw	2
Left front mid-bass speaker (R101)/right effects speaker (R21)/right front mid-bass speaker (R102)/right front bass speaker (R23) screw	3
Left rear mid-range speaker (R105)/right rear mid-range speaker (R106) nut	3
Left rear mid/low range loudspeaker (R159)/right rear mid/low range loudspeaker (R160) screw	3
Rear shelf subwoofer (R157) screw	2
TV system	
Bracket with radio (R) nut	3
TV tuner (R78) nut	3

Electrical Equipment

Battery, Starter, Generator, Cruise Control Tightening Specifications

Component	Nm
Auxiliary battery bracket screws	9
Battery retaining bracket screw	18
Fuse panel a nut	5
Generator screws/bolts	23
Ground wire with battery monitoring control module nut	5
Ground wire with battery monitoring control module to screw for battery terminal nut	5
Ground wire with battery monitoring control module 2 nut	18
Negative pole to auxiliary battery screw	4.5
Terminal 30/b+ to generator nut	16
Terminal 30/b+ to starter nut	15

Instruments Tightening Specifications

Component	Nm
12V socket 3 right luggage compartment side trim nut	2
Data bus onboard diagnostic interface screw	3
Instrument cluster screw	2.5
Low and high tone horn-to-impact member nuts	9
Radio frequency controlled clock receiver screw	2.5

Windshield Wiper/Washer System Tightening Specifications

Component	Nm
Fuel filler tube nut	7
Fluid Filler Tube to Washer Fluid Reservoir Nut	7
Rear wiper arm-to-rear window wiper motor nut	12
Rear Window Wiper Motor Nut	8
Washer Fluid Reservoir to Vehicle Tighten in sequence	7 ¹⁾
Windshield wiper arm-to-windshield wiper motor nut	17
Windshield Wiper Motor to Vehicle	8

¹⁾ Tighten bolt 3 then 4.

Exterior Lights, Switches Tightening Specifications

Component	Nm
Bolt on the Access/Start Authorization Switch	3
Nuts for tail lamp	3.5
Nuts to Parking Aid Control Module	3
Retaining Strap on the Headlamp Housing	6
Screw for Bi-Xenon Headlamp Retaining Plate	1.4
Screw for Clamping Ring to Steering Column	4
Screw for Daytime Running Lamp and Parking Lamp LED Module	1.4
Screw for Exterior Rearview Mirror Turn Signal Bulb	0.9
Screw for Fog Lamps	4.5
Screws for Headlamp Housing	4.5
Screws for Headlamp Housing Bracket	8
Screws for Headlamp Housing Bracket (Bi-Xenon Headlamps)	4.5
Screws for Headlamp Mount	4.5
Screw for Headlamp Range Control Positioning Motor Housing Cover	2
Screws for High Mounted Brake Light	2.5
Screw for Steering Column Electronic Systems Control Module	0.5

¹⁾ Tighten bolts 1, 2 and 3 in sequence.

Interior Lights, Switches Tightening Specifications

Component	Nm
Front interior lamps/reading lamps bolt	1.6
Interior access/start authorization antenna 1 mount bolt	2
Left and Right Access/Start Authorization Antenna Bolts	2
Luggage Compartment Access/Start Authorization Antenna Bolts	2
Sunroof regulator bolt	1
Alarm horn bracket nuts	7
	8.5
Headlamp assistant screw	2.4
Lane change assistance control module screws	2.5
Lane change assistance control module 2 screws	2.5

Wiring Tightening Specifications

Component	Nm
4-pin relay/fuse panel electrical wire	9
Engine compartment E-Box cover bolt	3.5
Engine compartment E-Box cover nut	9
Electrical wire on back of fuse panel B	9
Engine compartment E-Box screws	4.5
Fuse panel A bolt	3.5
Fuse panel A nut	9
Fuse panel A electrical wire	7.5
Fuse panel A positive wire-to-engine	18
Positive wire-to-fuse panel B	9
Relay/fuse panel mount nut	3
Terminal 30 nut	7.5
Terminal 30 battery wire	18
Terminal 30 battery jump start terminal	20
Terminal 30 E-Box positive wire	7.5
Terminal 30 fan wire	7.5
Terminal 30 PTC line	7.5
Terminal 30 starter wire	18

DTC CHART

Engines - CPMB

Fuel and Air Mixture, Additional Emission Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	"A" Camshaft Position Slow Response Bank 1	<ul style="list-style-type: none">• Difference between target position vs. actual position > 8.00° CRK• For time > 1.3 to 2.9 s and• Signal change < 1.9 - 4.2 °CRK/s
P0010	"A" Camshaft Position - Timing Over-Advanced or System Performance Bank 1	Signal voltage > 4.70 - 5.40 V
P0011	"A" Camshaft Position - Timing Over-Advanced or System Performance Bank 1	<ul style="list-style-type: none">• Difference between target position vs. actual position > 8.00° CRK• For time > 1.3 to 2.9 s and• Adjustment angle < 2.50 °CRK
P0016	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A	<ul style="list-style-type: none">• Permissible deviation < 11.01° Revor• Permissible deviation > 11.01° Rev
P0030	HO2S Heater Control Circuit Low Bank 1 Sensor 1	Heater voltage 4.70 to 5.40 V
P0031	O2S Heater Control Circuit High Bank 1 Sensor 1	Heater voltage 0.0 to 2.26 V
P0032	HO2S Heater Control Circuit High Bank 1 Sensor 1	Heater voltage > 5.50 V
P0036	HO2S Heater Control Circuit Bank 1 Sensor 2	Heater voltage, 2.34 - 3.59 V
P0037	HO2S Heater Control Circuit Low Bank 1 Sensor 2	Heater voltage < 2.34 V
P0038	HO2S Heater Control Circuit High Bank 1 Sensor 2	Heater voltage > 3.59 V
P0043	HO2S Heater Control Circuit Low Bank 1 Sensor 3	<ul style="list-style-type: none">• SULEV Heater voltage < 3 V• ULEV Heater voltage < 3 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0044	HO2S Heater Control Circuit High Bank 1 Sensor 3	Heater current > 2.70 - 5.50 A
P0068	MAP/MAF – Throttle Position Correlation	<ul style="list-style-type: none"> • Plausibility with fuel system load calculation < -50% or • Plausibility with fuel system load calculation > 50%
P0070	Ambient Air Temperature Sensor Circuit "A"	AAT signal: short to battery / open circuit = failure
P0071	Ambient Air Temperature Sensor Circuit "A" Range/ Performance	<ul style="list-style-type: none"> • Diff. ECT vs. IAT at engine start < 24.8 K (depending on engine off time) • Diff. IAT vs. AAT at engine start > 24.8 K (depending on engine off time) • Diff. AAT vs. ECT at engine start > 24.8 K (depending on engine off time)
P0072	Ambient Air Temperature Sensor Circuit "A" Low	AAT signal: short to ground = failure
P0087	Fuel Rail/System Pressure - Too Low Bank 1	<ul style="list-style-type: none"> • Pressure control activity > 10.00 mPa and • Fuel trim activity 0.90 - 120 and • Difference between target pressure vs. actual pressure > -16.38 MPa
P0088	Fuel Rail/System Pressure - Too High	Fuel rail pressure > 13.9 MPa
P0089	Fuel Pressure Regulator 1 Performance	<ul style="list-style-type: none"> • Difference between actual pressure vs. target pressure > 250.00 kPa • Difference between target pressure vs. actual pressure > 200.00 kPa
P008A	Low Pressure Fuel System Pressure - Too Low	Actual pressure < 40.00 kPa
P008B	Low Pressure Fuel System Pressure - Too High	Actual pressure > 950.00 kPa
P0100	Mass or Volume Air Flow Sensor "A" Circuit	MAF sensor signal 0 μ s

DTC	Error Message	Malfunction Criteria and Threshold Value
P0101	Mass or Volume Air Flow A Circuit Range/Performance	<ul style="list-style-type: none"> • Mass air flow vs lower threshold model < 0.0 to 417.0 kg/h • Mass air flow vs upper threshold > 39.0 to 873.0 kg/h • Load calculation > 23.0% • Fuel system (mult.) < -23.0% • Load calculation < -23.0% • Fuel system (mult.) > 23.0 %
P0102	Mass or Volume Air Flow Sensor "A" Circuit Low	MAF sensor signal < 66 μ s
P0103	Mass or Volume Air Flow Sensor "A" Circuit High	MAF sensor signal > 4500 μ s
P0106	Manifold Absolute Pressure/Barometric Pressure Sensor Circuit Range/Performance	Boost pressure signal <ul style="list-style-type: none"> • Altitude sensor < -210 hPa • Altitude sensor > +230 hPa
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance Bank 1	<ul style="list-style-type: none"> • Difference ECT vs. IAT @ manifold at engine start > 24.8 K (depending on engine off time) • Difference IAT @ manifold vs. AAT at engine start > 24.8 K (depending on engine off time) • Difference AAT vs. ECT at engine start < 24.8 K (depending on engine off time)
P0112	Intake Air Temperature Sensor 1 Circuit Low Bank 1	Signal voltage < 0.16 V
P0113	Intake Air Temperature Sensor 1 Circuit High Bank 1	Signal voltage > 4.48 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> • Diff. max ECT vs. min ECT < 1.5 K Stuck in Range • No change on signal < 1.5 K • Signal in range (lower threshold) > 89 °C • Signal in range (upper threshold) < 110 °C Cross Check • Diff. ECT vs. IAT at engine start > 24.8 K (depending on engine off time) and • Diff. IAT @ manifold vs. AAT at engine start > 24.8 K (depending on engine off time) and • Diff. AAT vs. ECT at engine start > 24.8 K (depending on engine off time)
P0117	Engine Coolant Temperature Sensor 1 Circuit Low	Engine coolant temperature > 140°C
P0118	Engine Coolant Temperature Sensor 1 Circuit High	Engine coolant temperature < -40°C
P0121	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	<ul style="list-style-type: none"> • TPS 1-TPS 2, > 5.10 to 6.30% and • Actual TPS 1 -calc. value, > actual TPS 2 calc. value or • TPS 1 calculated value > 9.00%
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low	Signal voltage < 0.20 V
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High	Signal voltage > 4.81 V
P0130	O2 Sensor Circuit Bank 1 Sensor 1	O2S ceramic temperature < 640°C
P0131	O2 Sensor Circuit Low Voltage Bank 1 Sensor 1	Virtual mass (VM) < 1.75 V
		Nernst voltage (UN) < 1.50 V
		Adjustment voltage (IA) < 0.30 V
		Adjustment voltage (IP) < 0.30 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0132	O2 Sensor Circuit High Voltage Bank 1 Sensor 1	Virtual mass (VM) > 3.25 V
		Nernst voltage (UN) > 4.40 V
		Adjustment voltage (IA) > 7.00 V
		Adjustment voltage (IP) > 7.00 V
P0133	O2 Sensor Circuit Slow Response Bank 1 Sensor 1	<p>Symmetric fault:</p> <ul style="list-style-type: none"> • Difference of R2L area ratio vs. L2R area ratio -0.40 - 0.40 • Max value of both counters for area ratio R2L and L2R > = 4 times <p>Delay Time:</p> <ul style="list-style-type: none"> • Gradient ratio ≥ 0.00 • Lower value of both area ratios R2L and L2R < 0.30 <p>Transient Time:</p> <ul style="list-style-type: none"> • Gradient ratio ≥ 0.00 • Gradient ratio ≤ 0.45 • Lower value of both area ratios R2L and L2R < 0.30 - or lower value of both gradient ratios R2L and L2R < 0.00 <p>Asymmetric fault:</p> <ul style="list-style-type: none"> • Difference of R2L area ratio vs. L2R area ratio < -0.40; > 0.40 • Values of both counters for area ratio R2L and L2R ≥ 4 times <p>Delay Time:</p> <ul style="list-style-type: none"> • Gradient ratio ≥ 0.00 • Lower value of both area ratios R2L and L2R < 0.30 <p>Transient Time:</p> <ul style="list-style-type: none"> • Gradient ratio ≥ 0.00 • Gradient ratio ≤ 0.45 • Lower value of both area ratios R2L and L2R < 0.30 • Lower value of both gradient ratios R2L and L2R < 0.00

DTC	Error Message	Malfunction Criteria and Threshold Value
P0135	O2 Sensor Heater Circuit Bank 1 Sensor 1	Out of Range: <ul style="list-style-type: none"> • O2S ceramic temp. < 715° C • Heater duty cycle > 90% Rationality Check: (Sensor Heating Up): <ul style="list-style-type: none"> • O2S ceramic temp. < 715° C • Time after O2S heater On 40.0 s
P0136	O2 Sensor Circuit Bank 1 Sensor 2	<ul style="list-style-type: none"> • Delta voltage one step at heater switching > 2.00 V and number of heater coupling \geq 6 times
P0137	O2 Sensor Circuit Low Voltage Bank 1 Sensor 2	<ul style="list-style-type: none"> • Signal voltage < 0.06 V for time > 3 Sec. and <ul style="list-style-type: none"> • Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) < 0.01 V
P0138	2 Sensor Circuit High Voltage Bank 1 Sensor 2	Signal voltage > 1.26 V for > 5 Sec.
P013A	O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	<ul style="list-style-type: none"> • Arithmetic filtered max differential transient time at fuel cut off n.a. or <ul style="list-style-type: none"> • EWMA filtered max differential transient time at fuel cut off \geq 0.70 s and <ul style="list-style-type: none"> • Number of checks \geq 3.0
P013B	O2 Sensor Slow Response - Lean to Rich Bank 1 Sensor 2	<ul style="list-style-type: none"> • EWMA filtered transient time at fuel cut-off, \geq 1.2 s • Number of checks (initial phase) and (step function), > 3.00 -
P013E	O2 Sensor Delayed Response - Rich to Lean Bank 1 Sensor 2	<ul style="list-style-type: none"> • Arithmetic filtered max differential delay time at rich to lean transition > n.a. or <ul style="list-style-type: none"> • WMA filtered max differential delay time at rich to lean transition > 1.0 s and <ul style="list-style-type: none"> • Number of checks \geq 3.0

DTC	Error Message	Malfunction Criteria and Threshold Value
P013F	O2 Sensor Delayed Response - Lean to Rich Bank 1 Sensor 2	<ul style="list-style-type: none"> EWMA filtered max differential delay time at lean to rich transition ≥ 2.4 to 4.4 s Number of checks ≥ 3.00 - (initial phase and step function)
P0140	O2 Sensor Circuit No Activity Detected Bank 1 Sensor 2	<ul style="list-style-type: none"> Signal voltage $.40 - .60$ mV for > 3 Sec or Difference in sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) ≥ 2.80 V Internal resistance > 40000.00 Ω and Exhaust temperature $> 600.0^{\circ}$ C
P0141	O2 Sensor Heater Circuit Bank 1 Sensor 2	Heater resistance $810 - 4560$ Ω
P0145	O2 Sensor Circuit Slow Response Bank 1 Sensor 3	<ul style="list-style-type: none"> EWMA filtered transient time at fuel cut off > 0.4 Sec. In voltage range $401.4 - 201.2$ mV Number of checks (initial phase) > 3 Number of checks (step function) > 3
P0169	Incorrect Fuel Composition	Comparison with fuel quantity incorrect
P0171	System Too Lean Bank 1	<ul style="list-style-type: none"> Lean @ idle Adaptive value $> 21\%$ Lean @ part-load Adaptive value 26 (only B8 ULEV VII)
P0172	System Too Rich Bank 1	<ul style="list-style-type: none"> Too rich at idle Adaptive value $< 5.02\%$ (< 6.0 only B8 ULEV) Too rich at part-load Adaptive value $< 21\%$ (-26 (only B8 ULEV VII))
P0177	Fuel Composition Sensor Circuit Range/Performance	<ul style="list-style-type: none"> Signal fault Possibly in fuel change window after refueling event
P0178	Fuel Composition Sensor Circuit Low	Signal Voltage < 1.0 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0179	Fuel Composition Sensor Circuit High	Signal Voltage > 2.2 V
P0190	Fuel Pressure Regulator 1 Control Circuit/Open	Signal voltage > 4.90 V
P0191	Fuel Rail Pressure Sensor Circuit Range/Performance Bank 1	Actual pressure > 21.30 MPa
P0192	Fuel Rail Pressure Sensor Circuit Low Bank 1	Signal voltage < 0.20 V
P0201	Cylinder 1 Injector "A" Circuit	<ul style="list-style-type: none"> • Low side signal current < 2.10 A • Internal logic failure
P0202	Cylinder 2 Injector "A" Circuit	<ul style="list-style-type: none"> • Low side signal current < 2.10 A • Internal logic failure
P0203	Cylinder 3 Injector "A" Circuit	<ul style="list-style-type: none"> • Low side signal current < 2.10 A • Internal logic failure
P0204	Cylinder 4 Injector "A" Circuit	<ul style="list-style-type: none"> • Low side signal current < 2.10 A • Internal logic failure
P0221	Throttle/Pedal Position Sensor/Switch "B" Circuit Range/Performance	<ul style="list-style-type: none"> • TPS 1-TPS 2, > 5.10 to 6.30 % and • Actual TPS 2-calc. value, > actual TPS 1calc. value or • PS 2-calc value > 9.00%
P0222	Throttle/Pedal Position Sensor/Switch "B" Circuit Low	Signal voltage < 0.20 V
P0223	Throttle/Pedal Position Sensor/Switch "B" Circuit High	Signal voltage > 4.81 V
P0234	Turbocharger/Supercharger "A" Overboost Condition	Difference set value boost pressure vs actual boost pressure value, > 20.00 to 128.00 kPa
P0236	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance	<ul style="list-style-type: none"> • Difference boost pressure signal vs altitude sensor signal, > 24.20 kPa • Difference boost pressure signal vs altitude sensor signal, < 14.20 kPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P0237	urbocharger/Supercharger Boost Sensor "A" Circuit Low	Signal voltage < 0.20 V
P0238	Turbocharger/Supercharger Boost Sensor "A" Circuit High	Signal voltage > 4.88 V
P0243	Turbocharger/Supercharger Wastegate Solenoid "A"	Signal voltage, > 4.40 to 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 to 4.0 A
P025A	Fuel Pump Module "A" Control Circuit/Open	Signal voltage 4.8 to 5.3 V
P025C	Fuel Pump Module "A" Control Circuit Low	Signal voltage < 2.7 - 3.25 V
P025D	Fuel Pump Module "A" Control Circuit High	Signal current > 0.6 mA
P0261	Cylinder 1 Injector "A" Circuit Low	Signal current < 2.10 A
P0262	Cylinder 1 Injector "A" Circuit High	Signal current > 14.70 A
P0264	Cylinder 2 Injector "A" Circuit Low	Signal current < 2.10 A
P0265	Cylinder 2 Injector "A" Circuit High	Signal current > 14.70 A
P0267	Cylinder 3 Injector "A" Circuit Low	Signal current < 2.10 A
P0268	Cylinder 3 Injector "A" Circuit High	Signal current > 14.70 A
P0270	Cylinder 4 Injector "A" Circuit Low	Signal current < 2.10 A
P0271	Cylinder 4 Injector "A" Circuit High	Signal current > 14.70 A
P0299	Turbocharger/Supercharger "A" Underboost Condition	Difference of set boost pressure vs. actual boost pressure value > 150 hPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P2004	Intake Manifold Runner Control Stuck Open Bank 1	<ul style="list-style-type: none"> • Normal closed position, unable to reach • Signal voltage < 2.62 or > 4.65 V or <ul style="list-style-type: none"> • Normal open position, unable to reach • Signal voltage < 0.35 or > 2.38 V
P2008	Intake Manifold Runner Control Circuit/Open Bank 1	Signal voltage 4.70 - 5.50 V
P2009	Intake Manifold Runner Control Circuit Low Bank 1	Signal voltage 0.00 to 3.26 V
P2010	Intake Manifold Runner Control Circuit High Bank 1	Signal current > 2.20 A
P2014	Intake Manifold Runner Position Sensor/Switch Circuit Bank 1	Signal voltage > 4.75 V
P2015	Intake Manifold Runner Position Sensor/Switch Circuit Range/Performance Bank 1	<ul style="list-style-type: none"> • Difference between target position vs. actual position >25% and <ul style="list-style-type: none"> • Actual position <0.0 to > 100.0 %
P2016	Intake Manifold Runner Position Sensor/Switch Circuit Low Bank 1	Signal voltage < 0.25 V
P2024	EVAP Fuel Vapor Temperature Sensor Circuit	Signal voltage 4.70 to 5.40 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2025	EVAP Fuel Vapor Temperature Sensor Performance	Functional Check: <ul style="list-style-type: none"> • Reset counter > 3.0 Out of Range Low: <ul style="list-style-type: none"> • Smart module temperature < -39 °C Cross Check: <ul style="list-style-type: none"> • Difference between smart temperature and ECT ≥ 25.5 K and • Difference between smart temperature and IAT@ manifold ≥ 25.5 Functional Check: <ul style="list-style-type: none"> • Time difference between ECU and smart module > 3.0 s Communication with Smart Temperature Sensor: <ul style="list-style-type: none"> • Response time > 1000 ms and • Number of checks 3.0 or <ul style="list-style-type: none"> • Security bit incorrect and • Number of checks 3.0 Signal Dynamic Check: <p>Case 1:</p> <ul style="list-style-type: none"> • Smart module temperature > 119° C <p>Case 2:</p> <ul style="list-style-type: none"> • Smart module temperature > 119° C
P2026	EVAP Fuel Vapor Temperature Sensor Circuit Low Voltage	Signal voltage, < 0.00 - 3.25 V
P2027	EVAP Fuel Vapor Temperature Sensor Circuit High Voltage	Signal current > 2.20 A
P2067	Fuel Level Sensor "B" Circuit Low	<ul style="list-style-type: none"> • Instrument cluster module signal: short to ground, failure or <ul style="list-style-type: none"> • Instrument cluster module signal: signal range check, failure
P2068	Fuel Level Sensor "B" Circuit High	Instrument cluster module signal: short to battery / open circuit, failure

DTC	Error Message	Malfunction Criteria and Threshold Value
P2088	"A" Camshaft Position Actuator Control Circuit Low Bank 1	Signal voltage, < 0.00 to 3.25 V
P2089	"A" Camshaft Position Actuator Control Circuit High Bank 1	Signal current > 2.2 A
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	l-portion of 2nd lambda control loop < -0.045
P2097	ost Catalyst Fuel Trim System Too Rich Bank 1	l-portion of 2nd lambda control loop > 0.045
P303F	Cold Start Injector Circuit Short to Ground	Signal voltage < 3.0 V
P3081	Engine Coolant Temperature measured engine coolant temp. below reference model	Diff. reference model temperature vs. ECT > 9.8 K

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random/Multiple Cylinder Misfire Detected	<ul style="list-style-type: none"> Emission threshold misfire rate (MR) > 2.1% Catalyst damage misfire rate (MR) > 2.9 - 20.0%
P0301	Cylinder 1 Misfire Detected	<ul style="list-style-type: none"> Emission threshold misfire rate (MR) > 2.1% Catalyst damage misfire rate (MR) > 2.9 - 20.0%
P0302	Cylinder 2 Misfire Detected	<ul style="list-style-type: none"> Emission threshold misfire rate (MR) > 2.1% Catalyst damage misfire rate (MR) > 2.9 - 20.0%
P0303	Cylinder 3 Misfire Detected	<ul style="list-style-type: none"> Emission threshold misfire rate (MR) > 2.1% Catalyst damage misfire rate (MR) > 2.9 - 20.0%
P0304	Cylinder 4 Misfire Detected	<ul style="list-style-type: none"> Emission threshold misfire rate (MR) > 2.1% Catalyst damage misfire rate (MR) > 2.9 - 20.0%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0321	Ignition/Distributor Engine Speed Input Circuit Range/Performance	<ul style="list-style-type: none"> Counted teeth versus reference = incorrect or Monitoring reference gap = failure
P0322	Ignition/Distributor Engine Speed Input Circuit No Signal	<ul style="list-style-type: none"> Camshaft signal > 3 Engine speed = no signal
P0324	Knock Control System Error	<ul style="list-style-type: none"> Signal fault counter (combustion) > 24 or Signal fault counter (measuring window) > 2.00
P0327	Knock/Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor	<ul style="list-style-type: none"> Lower threshold, < -0.70 V or Lower threshold < 0.58 - 1.60 V
P0328	Knock/Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor	<ul style="list-style-type: none"> Upper threshold > 1.00 V or Upper threshold > 18.00 - 150.00 V
P0340	Camshaft Position Sensor "A" Circuit Bank 1 or Single Sensor	<ul style="list-style-type: none"> Cam adaption values out of range > 20° KW < -20° KW Difference of adapted and actual values > 9° KW
P0341	Camshaft Position Sensor "A" Circuit Range/Performance Bank 1 or Single Sensor	<ul style="list-style-type: none"> Signal pattern incorrect Defect counter 12.00
P0342	Camshaft Position Sensor "A" Circuit Low Bank 1 or Single Sensor	<ul style="list-style-type: none"> Signal voltage permanently low and Crankshaft signals 8.0
P0343	Camshaft Position Sensor "A" Circuit High Bank 1 or Single Sensor	<ul style="list-style-type: none"> Signal voltage permanently high Crankshaft signals 8.0
P0351	Ignition Coil "A" Primary Control Circuit/Open	<ul style="list-style-type: none"> Signal current, 0.25 to 2.00 mA Internal check failed
P0352	Ignition Coil "B" Primary Control Circuit/Open	<ul style="list-style-type: none"> Signal current, 0.25 to 2.00 mA Internal check failed
P0353	Ignition Coil "C" Primary Control Circuit/Open	<ul style="list-style-type: none"> Signal current, 0.25 to 2.00 mA Internal check failed
P0354	Ignition Coil "D" Primary Control Circuit/Open	<ul style="list-style-type: none"> Signal current, 0.25 to 2.00 mA Internal check failed

Additional Exhaust Regulation

DTC	Error Message	Malfuction Criteria and Threshold Value
P0410	AIR System	Deviation SAI pressure > 20.0 hPa
P0413	AIR System Switching Valve "A" Circuit Open	Signal voltage 9.25 - 11.25 V
P0414	AIR System Switching Valve "A" Circuit Shorted	Signal voltage < 6.00 V
P0415	AIR System Switching Valve "B" Circuit	Signal current 2.20 - 4.20 A
P0418	AIR System Control "A" Circuit	Signal voltage 4.50 - 5.50 V
P0420	Catalyst System Efficiency Below Threshold Bank 1	Measured OSC / OSC of borderline catalyst value for front catalyst, < 1.00
P0441	EVAP System Incorrect Purge Flow	<ul style="list-style-type: none"> • Deviation lambda control < 7.00% and • Deviation idle control < 30.00 %
P0442	EVAP System Leak Detected Small Leak	Time for pressure drop < 1.55 - 1.75 Sec.
P0444	EVAP System Purge Control Valve "A" Circuit Open	Signal voltage > 4.40 - 5.40 V
P0450	EVAP System Pressure Sensor/Switch Circuit	Signal voltage > 0.39 to 0.55 V
P0451	EVAP System Pressure Sensor/Switch Circuit Range/ Performance	Natural vacuum leak detection (NVLD) switch position closed
P0452	EVAP System Pressure Sensor/Switch Circuit Low	Signal voltage < 0.24 V
P0453	EVAP System Pressure Sensor/Switch Circuit High	Signal voltage > 3.0 V
P0455	EVAP System Leak Detected (large leak)	Time for pressure drop < 0.95 Sec.
P0456	EVAP System Leak Detected (very small leak)	< 5.0 - 6.5 Sec.
P0458	EVAP System Purge Control Valve "A" Circuit Low	Signal voltage, 0.0 to 3.26 V
P0459	EVAP System Purge Control Valve "A" Circuit High	Signal current > 2.20 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P0461	Fuel Level Sensor "A" Circuit Range/Performance	Difference between fuel consumption and fuel level changes < -12.00 to 12.00
P0462	Fuel Level Sensor "A" Circuit Low	<ul style="list-style-type: none"> • Instrument cluster module signal: short to ground, failure or • Instrument cluster module signal: signal range check, failure
P0463	Fuel Level Sensor "A" Circuit High	Instrument cluster module signal: short to battery / open circuit, failure
P0491	AIR System Insufficient Flow Bank 1	SAI pressure measured with SAI pressure sensor vs modeled < 0.6 (0.62) %

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor "A" Circuit Range/Performance	Vehicle speed < 2 MPH
P0503	Vehicle Speed Sensor "A" Circuit Intermittent/Erratic/High	Vehicle speed > 200 km/h
P0506	Idle Control System RPM - Lower Than Expected	Out of Range Low: <ul style="list-style-type: none"> • Engine speed deviation > 80.0 RPM and • RPM controller torque value ≥ calculated max. value • Engine speed deviation <-80.0 RPM • RPM controller torque value ≥ calculated max. value • Integrated deviation of engine speed low and integrated deviation of engine speed high > 2000.0 RPM

DTC	Error Message	Malfunction Criteria and Threshold Value
P0507	Idle Control System RPM - Higher Than Expected	<ul style="list-style-type: none"> • Engine speed deviation < -80.0 RPM and • RPM controller torque value \leq calculated min. value or • Integrated number of fuel cut off transitions = n.a.
P050A	Cold Start Idle Control System Performance	<ul style="list-style-type: none"> • Integrated deviation of engine speed low and integrated deviation of engine speed high > 2000 RPM • Engine speed deviation > 80.0 RPM and • RPM controller torque value \geq calculated max. value • Engine speed deviation < -80.0 RPM and • RPM controller torque value \leq calculated min. value or • Integrated number of fuel cut off transitions = n.a.
P050B	Cold Start Idle Air Control System Performance	Difference between commanded spark timing vs. actual value > 20.00 - 35.00 %
P052A	Cold Start "A" Camshaft Position Timing Over-Advanced Bank 1	Difference between target position vs. actual position > 12.0 °CRK
P053F	Cold Start Fuel Pressure Performance	<ul style="list-style-type: none"> • Difference between target pressure vs. actual pressure, > 2.00 MPa or • Difference between target pressure vs. actual pressure, < -2.00 MPa

Control Module and Output Signals

DTC	Error Message	Malfunction Criteria and Threshold Value
P0601	Internal Control Module Memory Check Sum Error	Internal check sum, incorrect

DTC	Error Message	Malfunction Criteria and Threshold Value
P0604	Internal Control Module Random Access Memory (RAM) Error	Write ability check, failed
P0605	Internal Control Module Read Only Memory (ROM) Error	Checksum incorrect
P0606	Control Module Processor	Internal control module processor failure
P0627	Fuel Pump "A" Control Circuit /Open	<ul style="list-style-type: none"> • Internal error fuel pump control unit • Feedback from fuel pump control unit pump blocked short circuit to battery +, ground or open circuit
P062B	Internal Control Module Fuel Injector Control Performance	SPI communications check Identifier failure
P0634	Control Module Internal Temperature "A" Too High	Power stage temperature > 150 °C
P0638	Throttle Actuator Control Range/Performance Bank 1	<ul style="list-style-type: none"> • Time to open over reference point > 0.6 s and • Reference point -1.5% • Time to close below reference point > 0.30 s and • Reference point 1.0% • Time to close to reference point > 0.6 s and reference point 2.88 % • TPS 1 signal voltage < 0.40 also > 0.80 V or TPS 2 signal voltage < 4.20 also > 4.60 V
P0641	Sensor Reference Voltage "A" Circuit/Open	Signal voltage deviation > ± 0.3 V
P0642	Sensor Reference Voltage "A" Circuit Low	Signal voltage < 4.6 - 5.0 V
P0643	Sensor Reference Voltage "A" Circuit High	5V supply voltage > 4.99 - 5.41 V
P0651	Sensor Reference Voltage "B" Circuit/Open	Signal voltage deviation > ± 0.3 V
P0652	Sensor Reference Voltage "B" Circuit Low	Signal voltage < 4.6 - 5.0 V
P0653	Sensor Reference Voltage "B" Circuit High	5V supply voltage > 4.99 - 5.41 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0657	Actuator Supply Voltage "A" Circuit/Open	Signal voltage > 4.40 - 5.60 V
P0658	Actuator Supply Voltage "A" Circuit Low	Signal voltage < 2.15 - 3.25 V
P0659	Actuator Supply Voltage "A" Circuit High	Signal current > 1.10 A
P0685	ECM/PCM Power Relay Control Circuit/Open	<ul style="list-style-type: none"> Signal voltage 2.6 - 3.7 V Sense circuit voltage > 6 V
P0686	ECM/PCM Power Relay Control Circuit Low	<ul style="list-style-type: none"> Signal voltage 2.6 - 3.7 V Sense circuit voltage > 6 V
P0687	ECM/PCM Power Relay Control Circuit High	<ul style="list-style-type: none"> Signal current > 1.4 - 0.7 A Sense circuit voltage < 6 V
P0688	ECM/PCM Power Relay Sense Circuit	<ul style="list-style-type: none"> Sense voltage < 3.0 V Difference sense circuit voltage with camshaft actuator commanded off and on > 2.5 V Battery voltage > 3 V
P0697	Sensor Reference Voltage "C" Circuit/Open	Signal voltage deviation > ± 0.3 V
P0698	Sensor Reference Voltage "C" Circuit Low	Signal voltage < 4.6 - 5.0 V
P0699	Sensor Reference Voltage "C" Circuit High	5V supply voltage > 4.99 - 5.41 V
U0001	High Speed CAN Communication Bus	CAN message, no feedback
U0002	High Speed CAN Communication Bus Performance	Global time out, receiving no message
U0100	Lost Communication With ECM/PCM "A"	<ul style="list-style-type: none"> Failure of all CAN engine messages, time out > 490 mSec. Failure of all CAN engine messages, but not all CAN messages, time out > 1010 mSec.
U0101	Lost Communication with TCM	Received CAN message, no message
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	Received CAN message, no message
U0140	Lost Communication With Body Control Module	Time out, no message

DTC	Error Message	Malfunction Criteria and Threshold Value
U0146	Lost Communication With Gateway "A"	Received CAN message, no message
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	Received CAN message - no message
U0302	Software Incompatibility with Transmission Control Module	Received AT vehicle data TCM signal
U0323	Software Incompatibility With Instrument Panel Control Module	AAT value (module not encoded for ambient temp sensor) FDh
U0402	Invalid Data Received From TCM	Received CAN message implausible message
U0404	Invalid Data Received From Gear Shift Control Module "A"	<ul style="list-style-type: none"> • If the value of message counter is permanent, constant, or change exceeds a threshold, increment an event counter • Maximum change of message counter > 5
U0415	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module	<p>Out of Range High:</p> <ul style="list-style-type: none"> • Vehicle speed > 202 MPH <p>CAN Communication with BSCM:</p> <ul style="list-style-type: none"> • Received data, implausible message <p>CAN Communication with Vehicle Speed Sensor:</p> <ul style="list-style-type: none"> • Speed sensor signal: initialization error, 407.296 MPH • Speed sensor signal: low voltage error 407.290 MPH • Speed sensor signal: sensor error 407.303 MPH
U0422	Invalid Data Received From Body Control Module	AAT value (initialization), Audi, FEh
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	Received CAN message, implausible message
U0447	Invalid Data Received From Gateway "A"	Received data, implausible message
U1103	ECM: Production Mode	Production mode = Active

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P11A1	Cylinder 1 Exhaust Cam Low Lift Electrical Fault	
P11A2	Cylinder 1 Functional Test, Fault Switching to Low Exhaust Cam Lift	0.00147 s
P11A3	Cylinder 2 Exhaust Cam Low Lift Electrical Fault	
P11A4	Cylinder 2 Functional Test, Fault Switching to Low Exhaust Cam Lift	0.00147 s
DTC	Error Message	Malfunction Criteria and Threshold Value
P11A5	Cylinder 3 Exhaust Cam Low Lift Electrical Fault	
P11A6	Cylinder 3 Functional Test, Fault Switching to Low Exhaust Cam Lift	0.00147 s
P11A7	Cylinder 4 Exhaust Cam Low Lift Electrical Fault	
P11A8	Cylinder 4 Functional Test, Fault Switching to Low Exhaust Cam Lift	0.00147 s
P1114	O2 Sensor Heater Circuit Bank 1 Sensor 2	Heater resistance, (128-648)*(8-40)1.02-25.9 k Ω (dep. on mod. exhaust temp. and heater power)
P12A1	Fuel Pressure Sensor Rationality Check Inappropriately Low	<ul style="list-style-type: none"> • Pressure control activity > 0.25 MPa and • Fuel trim activity < 0.85 and • Difference between target pressure vs. actual pressure -16.38 - 16.38 MPa
P12A2	Fuel Pressure Sensor Rationality Check Inappropriately High	<ul style="list-style-type: none"> • Pressure control activity, > 0.25 MPa and • Fuel trim activity, < 1.64 and • Difference between target pressure vs. actual pressure -16.38 - 16.38 MPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P12A4	Fuel Volume Metering Valve Functional Check Valve Stuck Closed	<ul style="list-style-type: none"> • Pressure control activity, < -10.00 MPa and • Fuel trim activity, 0.85 to 1.15 - and • Difference between target pressure vs. actual pressure < 16.38 MPa
P13EA	Cold Start Monitoring Part Load: Ignition timing monitor	Difference between commanded spark timing vs. actual value > 20.0 45.0%
P150A	Engine Off Time	<ul style="list-style-type: none"> • Difference between engine-off-time and ECM after-run time < -12.0 s • Difference between engine-off-time and ECM after-run time > 12.0 s
P169A	ECM: Transport Mode	Transport mode = active
P2101	Throttle Actuator "A" Control Motor Circuit Range/ Performance	<ul style="list-style-type: none"> • Duty cycle > 80% and • ECM power stage, no failure • Deviation throttle valve angles vs throttle value setpoint > 4.00 to 50.00%
P2106	Throttle Actuator Control System - Short to B+ or Ground	Short to Battery Voltage or Short to Ground: <ul style="list-style-type: none"> • Internal check, failed Open Circuit: <ul style="list-style-type: none"> • Internal check, failed Current Monitoring: <ul style="list-style-type: none"> • Internal check, failed Functional Check: <ul style="list-style-type: none"> • Internal check, failed
P2110	Throttle Drive Actuator Forced Limited RPM	Engine load out of range
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low	Signal voltage < 0.65 V
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High	Signal voltage >4.79 V
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low	Signal voltage < 0.28 V
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High	Signal voltage > 2.43 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2138	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation	Signal voltage sensor 1 vs 2, > 0.14 - 0.70 VV
P2146	Fuel Injector Group "A" Supply Voltage Circuit/Open	Short to ground (high side) • Signal current > 14.90 A Short to battery voltage (high side): or Core Connection (high side - low side): • Signal current < 2.60 A
P2149	Fuel Injector Group "B" Supply Voltage Circuit/Open	Short to ground (high side) • Signal current > 14.90 A Short to battery voltage (high side): or Core Connection (high side - low side): • Signal current < 2.60 A
P2177	System Too Lean Off Idle Bank 1	• Adaptive value > 26%
P2178	System Too Rich Off Idle Bank 1	• Adaptive value < 26%
P2181	Cooling System Performance	Cooling system temp too low after a sufficient air mass flow interval 55 - 80° C
P2187	System Too Lean at Idle Bank 1	• Adaptive value > 5.02%
P2188	System Too Rich at Idle Bank 1	• Adaptive value < - 6.0%
P2195	O2 Sensor Signal Biased/ Stuck Lean Bank 1, Sensor 1	Delta lambda of 2nd lambda control loop > 0.070
P2196	O2 Sensor Signal Biased/ Stuck Rich Bank 1, Sensor 1	Delta lambda of 2nd lambda control loop, < - 0.070
P2231	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 1	Delta O2S signal front > 190 uA

DTC	Error Message	Malfunction Criteria and Threshold Value
P2237	O2 Sensor Positive Current Control Circuit/Open Bank 1, Sensor 1	<ul style="list-style-type: none"> • O2S signal front 1.49 to 1.51 and • Difference between maximum and minimum value of O2S voltage signal front < 32.00 V and • Delta lambda controller > 0.10 or • Lambda control at min or max limit • O2S signal front 1.49 to 1.51 V and • Difference between maximum and minimum value of O2S voltage signal front < 32.00 V and • No reaction on commanded stepwise change of lambda-setpoint <= 1
P2243	O2 Sensor Reference Voltage Circuit/Open Bank 1, Sensor 1	<ul style="list-style-type: none"> • O2S signal front < 0.3 to > 3.25 V and • Internal resistance > 1000Ω
P2251	O2 Sensor Negative Current Control Circuit/Open Bank 1 Sensor 1	<ul style="list-style-type: none"> • O2S voltage signal front 1.45 to 1.53 V and • Internal resistance > 1000Ω
P2257	AIR System Control "A" Circuit Low	Signal voltage < 3.00 V
P2258	AIR System Control "A" Circuit High	Signal current 0.60 - 1.20 A
P2270	O2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 2	Sensor voltage < 0.76 V
P2271	O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 2	Sensor voltage > 0.15 V
P2279	MAP/MAF - Throttle Position Correlation	<ul style="list-style-type: none"> • Threshold to detect a defective system > 1.45 and • Ratio of the tie system defective during the measurement window to the whole duration of the measurement window > 0.60

DTC	Error Message	Malfunction Criteria and Threshold Value
P2293	Fuel Pressure Regulator 2 Performance	<ul style="list-style-type: none"> • Difference between target pressure vs. actual pressure, > 2.00 MPa • Difference between target pressure vs. actual pressure, < -2.00 MPa
P2294	Fuel Pressure Regulator 2 Control Circuit Open	• Signal voltage 1.40 - 3.20 V
P2295	Fuel Pressure Regulator 2 Control Circuit Low	Signal voltage < 1.40 - 3.20 V
P2296	Fuel Pressure Regulator 2 Control Circuit High	Signal voltage > 3.20 V

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
P2414	O2 Sensor Exhaust Sample Error Bank 1, Sensor 1	<ul style="list-style-type: none"> • Threshold 1 - Signal voltage 3.10 - 4.81 V • Threshold 2 - Signal Voltage (Depending on gain factor, that actual is used for sensor characteristic, the threshold is switched) 2.5 - 3.10 V
P2431	AIR System Air Flow/Pressure Sensor Circuit Range/ Performance Bank 1	Difference between SAI pressure and ambient pressure, NOT -25.0 to 25.00 hPa
P2432	AIR System Air Flow/Pressure Sensor Circuit Low Bank 1	Signal voltage < 0.40 V
P2433	AIR System Air Flow/Pressure Sensor Circuit High Bank 1	Signal voltage > 4.65 V
P2440	AIR System Switching Valve Stuck Open Bank 1	SAI pressure measured with SAI pressure sensor vs modeled while SAI valve closed. <0.55%
P2539	Low Pressure Fuel System Sensor Circuit	Signal voltage > 4.79 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 < 0.21 V
P2626	O2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	O2S signal front > 4.81 V

Transmission

DTC	Error Message	Malfunction Criteria and Threshold Value
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%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2716	Pressure Control Solenoid "D" Electrical	<ul style="list-style-type: none"> • Current higher or lower than threshold, < 730 mA • EDS output voltage at short to ground or open circuit ~ 0.5 V smaller than EDS supply voltage • Static leakage current flow
P2723	Pressure Control Solenoid "E" Performance or Stuck off	PWM hardware detection, 0 or 100%
P2725	Pressure Control Solenoid "E" Electrical	<ul style="list-style-type: none"> • Current higher or lower than threshold, < 730 mA • EDS output voltage at short to ground or open circuit ~ 0.5 V smaller than EDS supply voltage • Static leakage current flow
P2732	Pressure Control Solenoid "F" Performance or Stuck off	PWM hardware detection, 0 or 100%
P2733	Pressure Control Solenoid "F" Stuck On	PWM hardware detection, 0 or 100%
P2734	Pressure Control Solenoid "F" Electrical	<ul style="list-style-type: none"> • EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage • Static leakage current flow
P2735	Pressure Control Solenoid "F" Intermittent	PWM hardware detection, 0 or 100%

DTC CHART

Engine Code CHJA

Fuel and Air Mixture, Additional Emission Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	"A" Camshaft Position Slow Response	<ul style="list-style-type: none">• Difference between target position vs. actual position > 8.00° CRK• For time > 1.3 - 2.9 Sec• Adjustment angle \geq 2.50° CRK
P0010	"A" Camshaft Position Actuator Circuit/Open	Signal voltage > 4.70 - 5.40 V
P0011	"A" Camshaft Position - Timing Over-Advanced or System Performance	<ul style="list-style-type: none">• Difference between target position vs. actual position > 8.00° CRK• For time > 1.3 - 2.9 Sec• Adjustment angle \geq 2.50° CRK
P0016	Crankshaft Position - Camshaft Position Correlation	<ul style="list-style-type: none">• Permissible deviation < 11.01 Revor• Permissible deviation > 11.01 Rev
P0030	HO2S Heater Control Circuit Bank 1 Sensor 1	Heater voltage 4.70 - 5.40 V
P0031	HO2S Heater Control Circuit Low Bank 1 Sensor 1	Heater voltage 0.0 - 3.26 V
P0032	HO2S Heater Control Circuit High Bank 1 Sensor 1	Heater voltage > 5.50 V
P0036	HO2S Heater Control Circuit Bank 1 Sensor 2	Heater voltage 2.34 - 3.59 V
P0037	HO2S Heater Control Circuit Low Bank 1 Sensor 2	Heater voltage < 2.34 V
P0038	HO2S Heater Control Circuit High Bank 1 Sensor 2	Heater current 3.59 A
P0068	MAP/MAF – Throttle Position Correlation	<ul style="list-style-type: none">• Plausibility with fuel system load calculation < -50%• Plausibility with fuel system load calculation > 50%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0070	Ambient Air Temperature Sensor Circuit	<ul style="list-style-type: none"> Ambient air temp < 50.0° C AAT signal: short to battery / open circuit failure
P0071	Ambient Air Temperature Sensor	<ul style="list-style-type: none"> Difference value: IAT-ECT @ engine start (depending on engine-off time, < 24.8 K and Difference value: IAT-AAT @ engine start (depending on engine-off time), > 24.8 K and Difference AAT vs. ECT at engine start > 24.8 (depending on engine off time) K
P0072	Ambient Air Temperature Sensor Circuit Low	<ul style="list-style-type: none"> Ambient air temp > 87.0° C AAT signal: short to ground failure
P0087	Fuel Rail/System Pressure - Too Low	<ul style="list-style-type: none"> Pressure control activity > 5.00 mPa and Fuel trim activity 0.90 - 120 and Difference between target pressure vs. actual pressure > -16.38 mPa
P0088	Fuel Rail/System Pressure - Too High	Fuel rail pressure > 13.9 MPa
P0089	Fuel Pressure Regulator 1 Performance	Actual pressure deviation <ul style="list-style-type: none"> < 100 kPa > 100 kPa
P0100	Mass or Volume Air Flow "A" Circuit	MAF sensor signal 0 µs
P0101	Mass or Volume Air Flow A Circuit Range/Performance	<ul style="list-style-type: none"> Mass air flow vs. lower threshold model < 0 - 417 kg/h Mass air flow vs. upper threshold > 34 - 873 kg/h Load calculation > 23% Fuel system (mult.) < -23% Load calculation < -23% Fuel system (mult.) > 23%
P0102	Mass or Volume Air Flow A Circuit Low Input	MAF sensor signal < 66 µs
P0103	Mass or Volume Air Flow A Circuit High Input	MAF sensor signal > 4500 µs

DTC	Error Message	Malfunction Criteria and Threshold Value
P0106	Manifold Absolute Pressure/ BARO Sensor Range/ Performance	Boost pressure signal • Altitude sensor < -210 hPa • Altitude sensor > 230 hPa
P0111	Intake Air Temperature Sensor 1 Rationality Check	• Difference in value between IAT vs. ECT at engine start (depending on engine off time) > 24.8 K and • Difference in value between IAT vs. AAT at engine start (depending on engine off time) > 24.8 K and • Difference in value between AAT vs. ECT at engine start (depending on engine off time) < 24.8 K
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	Signal voltage < 0.16 V
P0113	Intake Air Temperature Sensor 1 Circuit High Input	Signal voltage > 4.48 V
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/ Performance	• Difference value: IAT-ECT @ engine start (depending on engine-off time, >24.8 K • Difference value: IAT-AAT @ engine start (depending on engine-off time), < 24.8 K • Difference AAT vs. ECT at engine start > 24.8 (depending on engine off time) K Stuck high / low - no change on signal • Difference max ECT vs. min ECT < 1.5 [K]
P0117	Engine Coolant Temperature Sensor 1 Circuit Low	Engine coolant temperature > 140°C
P0118	Engine Coolant Temperature Sensor 1 Circuit Open	Engine coolant temperature < -40°C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0121	Throttle/Pedal Position Sensor "A" Circuit Range/Performance	<ul style="list-style-type: none"> • TPS 1 - TPS 2 > 5.1 - 6.3% and • Actual TPS 1 calculated value > actual TPS 2 calculated value or <ul style="list-style-type: none"> • TPS 1 calculated value > 9.00%
P0122	Throttle/Pedal Position Sensor A Circuit Low Input	Signal voltage < 0.20 V
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High	Signal voltage > 4.81 V
P0130	O2 Sensor Circuit Bank 1, Sensor 1	O2S ceramic temperature < 690° C
P0131	HO2 Sensor Circuit Low Bank 1 Sensor 1	Short to ground Virtual mass (VM) < 1.75 [V]
		Nernst voltage (UN) < 1.50 [V]
		Adjustment voltage (IA) < n.a. [V]
		Adjustment voltage (IP) < 0.30 [V]
P0132	HO2 Sensor Circuit High Voltage Bank 1 Sensor 1	Short to battery Virtual mass (VM) > 3.25 [V]
		Nernst voltage (UN) > 4.40 [V]
		Adjustment voltage (IA) > n.a. [V]
		Adjustment voltage (IP) > 7.00 [V]

DTC	Error Message	Malfunction Criteria and Threshold Value
P0133	O2 Circuit Slow Response Bank 1 Sensor 1	<p>Symmetric Fault:</p> <ul style="list-style-type: none"> • Difference of R2L area ratio vs. L2R area ratio -0.40 - 0.40 • Lower value of both counters for area ratio R2L and L2R ≥ 4 times <p>Delay Time:</p> <ul style="list-style-type: none"> • Gradient ratio ≥ 0.00 • Lower value of both area ratios R2L and L2R < 0.30 <p>Transient Time:</p> <ul style="list-style-type: none"> • Gradient ratio ≥ 0.00 • Gradient ratio ≤ 0.45 • Lower value of both area ratios R2L and L2R < 0.30 • or lower value of both gradient ratios R2L and L2R < 0.00 <p>Asymmetric Fault:</p> <ul style="list-style-type: none"> • Difference of R2L area ratio vs. L2R area ratio NOT -0.40...0.40 • Lower value of both counters for area ratio R2L and L2R ≥ 4 times <p>Delay Time:</p> <ul style="list-style-type: none"> • Gradient ratio ≥ 0.00 • Lower value of both area ratios R2L and L2R < 0.30 <p>Transient Time:</p> <ul style="list-style-type: none"> • Gradient ratio ≥ 0.00 • Gradient ratio ≤ 0.45 • Lower value of both area ratios R2L and L2R < 0.30 • or lower value of both gradient ratios R2L and L2R < 0.00
P0135	O2 Heater Circuit Bank 1 Sensor 1	<ul style="list-style-type: none"> • HO2S ceramic temperature $< 725^{\circ}\text{C}$ • Heater duty cycle $> 90\%$ • Time after O2S heater on 40 Sec.
P0136	HO2 Heater Circuit Bank 1 Sensor 2	Delta voltage one step at heater switching $> 2.00\text{ V}$ and number of heater coupling ≥ 6 times

DTC	Error Message	Malfunction Criteria and Threshold Value
P0137	HO2 Circuit Low Voltage Bank 1 Sensor 2	<ul style="list-style-type: none"> Signal voltage < 0.06 V for time > 3 Sec. and <ul style="list-style-type: none"> Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) < 0.01 V
P0138	HO2 Circuit High Voltage Bank 1 Sensor 2	Signal voltage > 1.26 V for > 5 Sec.
P0139	HO2 Circuit Slow Response Bank 1 Sensor 2	<ul style="list-style-type: none"> EWMA filtered transient time at fuel cut off > 0.7 Sec. In voltage range 201 - 347.7 mV Number of checks (initial phase) > 3 Number of checks (step function) > 3
P013A	HO2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	<ul style="list-style-type: none"> Arithmetic filtered max differential transient time at fuel cut off n.a. EWMA filtered max differential transient time at fuel cut off > 0.7 Sec. Number of checks ≥ 3.00 (initial phase and step function)
P013B	HO2 Sensor Slow Response - Lean to Rich Bank 1 Sensor 2	<ul style="list-style-type: none"> Arithmetic filtered max differential transient time at fuel feed restart = n.a or <ul style="list-style-type: none"> EWMA filtered max differential transient time at fuel feed restart ≥ 0.7 Number of checks ≥ 3.00 (initial phase and step function)
P013E	HO2 Sensor Delayed Response - Rich to Lean Bank 1 Sensor 2	<ul style="list-style-type: none"> Arithmetic filtered max differential delay time at lean to rich transition = n.a. EWMA filtered max differential delay time at lean to rich transition > 1.0 [s] and number of checks ≥ 3.00 [-]

DTC	Error Message	Malfunction Criteria and Threshold Value
P013F	HO2 Sensor Delayed Response - Lean to Rich Bank 1 Sensor 2	<ul style="list-style-type: none"> • Arithmetic filtered max differential delay time at lean to rich transition = n.a. • EWMA filtered max differential delay time at lean to rich transition > 1.5 [s] and number of checks \geq 3.00 [-]
P0140	HO2 Circuit No Activity Detected Bank 1 Sensor 2	<ul style="list-style-type: none"> • Signal voltage .40 - .60 mV for > 3 Sec and • Difference in sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) \geq 2.80 V • Internal resistance > 40000 Ω • Exhaust temperature > 600° C
P0141	HO2 Heater Circuit Bank 1 Sensor 2	Heater resistance 810 - 4560 Ω
P0169	ECM: Electronic Throttle Control Module	<ul style="list-style-type: none"> • Corrections of fuel mass on single cylinders incorrect • Injection cut off incorrect • Internal check failed • Corrections of fuel mass on single cylinders = incorrect • Fuel quantity incorrect • ABS difference between predicted and real air mass > 11.30%
P0171	System Too Lean	<ul style="list-style-type: none"> • Low pass filtered lambda controller output > 23.00% • For time > 25.0 [s]
P0172	System Too Rich	<ul style="list-style-type: none"> • Low pass filtered lambda controller output > -23.00% • For time > 25.0 [s]
P0190	Fuel Pressure Regulator 2 Control Circuit/Open	Signal voltage > 4.90 V
P0191	Fuel Rail Pressure Sensor "A" Circuit Range/Performance	Actual pressure > 21.3 MPa
P0192	Fuel Rail Pressure Sensor "A" Circuit Low	Signal voltage < 0.20 V
P0201	Injector Circuit/Open - Cylinder 1	<ul style="list-style-type: none"> • Low side signal current < 2.1 A • Internal logic failure

DTC	Error Message	Malfunction Criteria and Threshold Value
P0202	Injector Circuit/Open - Cylinder 2	<ul style="list-style-type: none"> • Low side signal current < 2.1 A • Internal logic failure
P0203	Injector Circuit/Open - Cylinder 3	<ul style="list-style-type: none"> • Low side signal current < 2.1 A • Internal logic failure
P0204	Injector Circuit/Open - Cylinder 4	<ul style="list-style-type: none"> • Low side signal current < 2.1 A • Internal logic failure
P0221	Throttle/Pedal Position Sensor/Switch "B" Circuit Range/Performance	<ul style="list-style-type: none"> • TPS 1 - TPS 2 > 5.1 - 6.30% and • Actual TPS 2 calculated value > actual TPS 1 calculated value or <ul style="list-style-type: none"> • TPS 2 calculated value > 9.00%
P0222	Throttle/Pedal Position Sensor/Switch "B" Circuit Low	Signal voltage < 0.20 V
P0223	Throttle/Pedal Position Sensor/Switch "B" Circuit High	Signal voltage > 4.81 V
P0234	Turbocharger/Supercharger "A" Overboost Condition	Difference set value boost pressure vs. actual boost pressure value > 20.00 to 128.00 [kPa]
P0236	Turbocharger Boost Sensor A Plausability Check	<ul style="list-style-type: none"> • Difference boost pressure signal vs altitude sensor signal, > 242.03 hPa • Difference boost pressure signal vs altitude sensor signal, < 142.03 hPa
P0237	Turbocharger/Supercharger Boost Sensor "A" Circuit Low	Signal voltage < 0.20 V
P0238	Turbocharger/Supercharger Boost Sensor "A" Circuit High	Signal voltage > 4.88 V
P0243	urbocharger/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 - 4.0 A
P025A	Fuel Pump Module Control Circuit/Open	Signal voltage > 4.80 - 5.30 V
P025C	Fuel Pump Module Control Circuit Low	Signal voltage < 2.7 - 3.25 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P025D	Fuel Pump Module Control Circuit High	Signal current > 0.6 mA
P0261	Cylinder 1 Injector Circuit Low	Signal current < 2.10 A
P0262	Cylinder 1 Injector Circuit High	Signal current > 14.70 A
P0264	Cylinder 2 Injector Circuit Low	Signal current < 2.10 A
P0265	Cylinder 2 Injector Circuit High	Signal current > 14.70 A
P0267	Cylinder 3 Injector Circuit Low	Signal current < 2.10 A
P0268	Cylinder 3 Injector Circuit High	Signal current > 14.70 A
P0270	Cylinder 4 Injector Circuit Low	Low side signal current < 2.10 A
P0271	Cylinder 4 Injector Circuit High	Signal current > 14.70 A
P0299	Turbocharger/Supercharger "A" Underboost Condition	Difference of set boost pressure vs. actual boost pressure value (filtered) > 15.00 [kPa]
P2004	Intake Manifold Runner Control Stuck Open Bank 1	<ul style="list-style-type: none"> • Normal closed position, unable to reach signal voltage < 2.62 or > 4.65 V or • Normal open position, unable to reach signal voltage < 0.35 or > 2.38 V
P2008	Intake Manifold Runner Control Circuit/Open	Signal voltage 4.75 - 5.40 V
P2009	Intake Manifold Runner Control Circuit Shorted Bank 1	Signal voltage 0.0 - 3.26 V
P2010	Intake Manifold Runner Control Circuit Shorted to B+ Bank 1	Signal current > 2.20 A
P2014	Intake Manifold Runner Position Sensor/Switch Circuit	Signal voltage > 4.75 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2015	Intake Manifold Runner Position Sensor/Switch Circuit Range/Performance	Rationality check <ul style="list-style-type: none"> • Difference between target position vs. actual position > 25.00% • Actual position < 0 - 100% Rationality check high <ul style="list-style-type: none"> • Difference between target position vs. actual position > 25.00% • Actual position 0 - 100% Rationality check low <ul style="list-style-type: none"> • Difference between target position vs. actual position > 25.00% • Actual position 0 - 100%
P2016	Intake Manifold Runner Position Sensor/Switch Circuit Low	Signal voltage < 0.25 V
P2024	Evaporative Emissions (EVAP) Fuel Vapor Temperature / Pressure Sensor Circuit Open	Signal voltage 4.70 - 5.40 V

DTC Chart

DTC	Error Message	Malfunction Criteria and Threshold Value
P2025	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Performance	Out of Range High Case 1: <ul style="list-style-type: none"> • Smart Module Temp High > 119° C Case 2: <ul style="list-style-type: none"> • Smart Module Temp High > 119° C Out of Range Low <ul style="list-style-type: none"> • Smart module temperature < -39 [° C] Cross Check: <ul style="list-style-type: none"> • Difference between smart temperature and ECT ≥ 25.5 [K] • Difference between smart temperature and IAT@ manifold ≥ 25.5 [K] Signal Dynamic Check <ul style="list-style-type: none"> • Gradient smart temperature > 20 [K/10min] Communication Check <ul style="list-style-type: none"> • Response time > 1000 [ms] • Number of checks >3.00 [-] • Security bit incorrect Functional Check <ul style="list-style-type: none"> • Reset-counter > 3.00 [-] • Time difference between ECU and smart module > 3.0 [s]
P2026	Evaporative Emissions (EVAP) Fuel Vapor Temperature / Pressure Sensor Short to Ground	Signal voltage 0.0 - 3.25 V
P2027	Evaporative Emissions (EVAP) Fuel Vapor Temperature / Pressure Sensor Short to Battery Voltage	Signal current > 2.20 A
P2067	Fuel Level Sensor "B" Circuit Low	CAN communication with Instrument Cluster Module <ul style="list-style-type: none"> • Instrument cluster module signal: short to ground failure • Instrument cluster module signal: signal range check failure

DTC	Error Message	Malfunction Criteria and Threshold Value
P2068	Fuel Level Sensor "B" Circuit Low	CAN communication with Instrument Cluster Module <ul style="list-style-type: none"> Instrument cluster module signal: short to battery / open circuit failure
P2088	"A" Camshaft Position Actuator Control Circuit Low	Signal voltage, < 0.0 - 3.25 V
P2089	"A" Camshaft Position Actuator Control Circuit High	Signal current > 2.2 A
P2096	Post-Catalyst Fuel Trim System Too Lean	I-portion of 2nd lambda control loop < 0.045
P2097	Post-Catalyst Fuel Trim System Too Rich	I-portion of 2nd lambda control loop > 0.045
P3081	Engine Temperature Too Low	Difference reference model temperature vs. ECT > 9.8 K
P30A2	Brake Pedal Position Sensor	<ul style="list-style-type: none"> Brake light switch not active Brake pedal position > 47.50% Brake light switch active Brake pedal position < 10.00%

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Crankshaft Speed Fluctuation (Single or Multiple)	<ul style="list-style-type: none"> Emission threshold misfire rate (MR) > 1.7% Catalyst damage misfire rate (MR) > 5.0 - 20.0%
P0301	Cylinder 1 Misfire Detected	<ul style="list-style-type: none"> Emission threshold misfire rate (MR) > 1.7% Catalyst damage misfire rate (MR) > 5.0 - 20.0%
P0302	Cylinder 2 Misfire Detected	<ul style="list-style-type: none"> Emission threshold misfire rate (MR) > 1.7% Catalyst damage misfire rate (MR) > 5.0 - 20.0%
P0303	Cylinder 3 Misfire Detected	<ul style="list-style-type: none"> Emission threshold misfire rate (MR) > 1.7% Catalyst damage misfire rate (MR) > 5.0 - 20.0%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0304	Cylinder 4 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold misfire rate (MR) > 1.7% • Catalyst damage misfire rate (MR) > 5.0 - 20.0%
P0321	Ignition/Distributor Engine Speed Input Circuit Range/Performance	<ul style="list-style-type: none"> • Counted teeth vs. reference incorrect or <ul style="list-style-type: none"> • Monitoring reference gap failure
P0322	Ignition/Distributor Engine Speed Input Circuit No Signal	<ul style="list-style-type: none"> • Camshaft signal > 3 • Engine speed no signal
P0324	Knock Control System Error	<ul style="list-style-type: none"> • Signal fault counter (combustion) > 24 or <ul style="list-style-type: none"> • Signal fault counter (measuring window) > 2.00
P0327	Knock Sensor 1 Circuit Low	<ul style="list-style-type: none"> • Lower threshold, < 0.70 V • Lower threshold, < 0.58 - 1.60 V
P0328	Knock Sensor 1 Circuit High	<ul style="list-style-type: none"> • Upper threshold > 1.0 V • Upper threshold > 18.0 - 150.0 V
P0340	Camshaft Position Sensor A Circuit (Bank 1 or Single Sensor)	Cam adaption values out of range <ul style="list-style-type: none"> • > 20° KW • < -20° KW • Difference of adapted and actual values > 9° KW
P0341	Camshaft Position Sensor A Circuit Range/Performance (Bank 1 or Single Sensor)	<ul style="list-style-type: none"> • Signal pattern, incorrect • Defect counter 12.00
P0342	Camshaft Position Sensor A Circuit Low Input (Bank 1 or Single Sensor)	<ul style="list-style-type: none"> • Signal pattern, incorrect • Defect counter 12.00 [-]
P0343	Camshaft Position Sensor A Circuit High Input (Bank 1 or Single Sensor)	<ul style="list-style-type: none"> • Signal voltage permanently high • Crankshaft signals = 8 [-]
P0351	Ignition Coil A Primary/Secondary Circuit	<ul style="list-style-type: none"> • Signal current < -0.25 to 2.0 mA • Internal check failed
P0352	Ignition Coil B Primary/Secondary Circuit	<ul style="list-style-type: none"> • Signal current < -0.25 to 2.0 mA • Internal check failed

DTC	Error Message	Malfunction Criteria and Threshold Value
P0353	Ignition Coil C Primary/ Secondary Circuit	<ul style="list-style-type: none"> Signal current < -0.25 to 2.0 mA Internal check failed
P0354	Ignition Coil D Primary/ Secondary Circuit	<ul style="list-style-type: none"> Signal current < -0.25 to 2.0 mA Internal check failed

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0410	Secondary Air Injection System Fault	Diff. of measured AIR pressure before AIR injection vs. AIR pressure after AIR injection > 2.00 [kPa]
P0413	Secondary Air Injection System Switching Valve "A" Circuit Open	Signal voltage 4.70- 5.40 V
P0414	Secondary Air Injection System Switching Valve "A" Circuit Shorted	<ul style="list-style-type: none"> Signal voltage 0.00 - 3.25 V Short to battery plus signal current > 2.20 A
P0418	Air Pump Relay Open Circuit	Signal voltage 4.7 - 5.4 V
P0420	Catalyst System Efficiency Below Threshold Bank 1	<ul style="list-style-type: none"> Measured OSC / OSC of borderline catalyst measured OSC (HC and Nox-correlated) EWMA filter value for catalyst < 1.00
P0441	Evaporative Emission System Incorrect Purge Flow	<p>Case 1: high canister load</p> <ul style="list-style-type: none"> Deviation lambda control < 14.40 - 19.20 [%] Deviation EVAP pressure sensor < 1.50 [kPa] Deviation lambda control < 14.40 - 19.20 [%] Deviation EVAP pressure sensor < 1.50 [kPa] and for number of checks ≥ 3.00 [-] <p>Case 2: low canister load</p> <ul style="list-style-type: none"> Deviation EVAP pressure sensor < 1.50 [kPa] For number of checks ≥ 3.00 [-]

DTC	Error Message	Malfunction Criteria and Threshold Value
P0442	Evaporative Emission System Leak Detected (Small Leak)	Time for pressure drop < 1.55 - 1.75 Sec.
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal voltage > 4.70 - 5.40 V
P0450	Evaporative Emission System Pressure Sensor/Switch	Signal voltage 0.39 - 0.55 V
P0451	Evaporative Emission System Pressure Sensor/Switch Range/Performance	Natural vacuum leak detection (NVLD) switch position = closed
P0452	Evaporative Emission System Pressure Sensor/Switch Low	Signal voltage < 0.24 [V]
P0453	Evaporative Emission System Pressure Sensor/Switch High	Signal voltage > 3.0 [V]
P0455	Evaporative Emission System Leak Detected (Gross Leak/ No Flow)	Time for pressure drop < 0.95 Sec.
P0456	Evaporative Emission System Leak Detected (Very Small Leak)	Natural vacuum leak detection (NVLD) switch position open
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage < 0.00 - 3.26 V
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.20 A
P0461	Fuel Level Sensor "A" Circuit Range/Performance	Difference between fuel consumption and fuel level changes < -12.00 and/or > 12.00 [l]
P0462	Fuel Level Sensor "A" Circuit Low	CAN communication with Instrument Cluster Module <ul style="list-style-type: none"> • Instrument cluster module signal: short to ground failure • Instrument cluster module signal: signal range check failure
P0463	Fuel Level Sensor "A" Circuit Low	CAN communication with Instrument Cluster Module <ul style="list-style-type: none"> • Instrument cluster module signal: short to battery / open circuit failure

DTC	Error Message	Malfunction Criteria and Threshold Value
P0491	Secondary Air System Insufficient Flow. Flow Check During Catalyst Heating.	<ul style="list-style-type: none"> • Difference of measured AIR pressure before AIR injection vs. AIR pressure after AIR injection ≤ 2.00 [kPa] Case 1: <ul style="list-style-type: none"> • Blockage: relative AIR pressure measured with AIR pressure sensor vs. modeled < 0.10 [-] • Leakage: relative AIR pressure measured with AIR pressure sensor vs. modeled < 0.10 [-] Case 2: <ul style="list-style-type: none"> • Blockage: relative AIR pressure measured with AIR pressure sensor vs. modeled < 0.60 [-] • Leakage: relative AIR pressure measured with AIR pressure sensor vs. modeled < 0.62 Case 3: <ul style="list-style-type: none"> • Average pressure difference between absolute value and filtered < 0.00 [kPa]

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor A Range/Performance	Speed sensor signal: plausibility error failure
P0502	Vehicle Speed Sensor A Electrical Check	Speed sensor signal: electrical error failure
P0503	Vehicle Speed Sensor A Out of Range/High	Vehicle speed > 200 km/h
P0506	Idle Air Control System - RPM Lower Than Expected	<ul style="list-style-type: none"> • Engine speed deviation < 80 RPM • RPM controller torque value \geq calculated max value • Integrated deviation of engine speed low and integrated deviation of engine speed high > 2000 RPM

DTC	Error Message	Malfunction Criteria and Threshold Value
P0507	Idle Air Control System - RPM Higher Than Expected	<ul style="list-style-type: none"> • Engine speed deviation > 80 RPM and • RPM controller torque value \leq calculated min. value
P050A	Cold Start Idle Air Control System Performance	Out of range-low <ul style="list-style-type: none"> • Engine speed deviation < 80 RPM • RPM controller torque value \geq calculated max. value Out of range-high <ul style="list-style-type: none"> • Engine speed deviation > 80 RPM • RPM controller torque value \leq calculated min. value
P050B	Cold Start Ignition Timing Performance	Difference between commanded spark timing vs. actual value > 20.0 - 40.0%
P052A	Cold Start "A" Camshaft Position Timing Over-Advanced	Difference between target position and actual position > 12.0°CRK
P053F	Cold Start Fuel Pressure Performance	<ul style="list-style-type: none"> • Difference between target pressure vs. actual pressure < -1.50 MPa • Difference between target pressure vs. actual pressure > 1.50 MPa
P0555	Brake Booster Pressure Sensor Circuit	Sensor voltage > 4.88 V
P0556	Brake Booster Electrical Vacuum Pump Performance	<ul style="list-style-type: none"> • Difference brake booster pressure vs. barometric pressure > 10.00 [kPa] • Gradient brake booster pressure > 4.3 [kPa/s] • Brake booster pressure < 0.5 - 3.5 [kPa] • For time = 0.5 [s]
P0557	Brake Booster Pressure Sensor Circuit Low	Sensor voltage < 0.2 V
P0571	Brake Switch "A" Circuit	<ul style="list-style-type: none"> • Brake light switch not active • "Driver brakes" via CAN from BSCM active

DTC	Error Message	Malfunction Criteria and Threshold Value
P057B	Brake Pedal Position Sensor	<ul style="list-style-type: none"> • Plausibility check for the two PWM brake sensor raw values duty cycle > 125.00% • Synchronization check for the two PWM brake sensor raw values duty cycle > 8.00% • Check of duty cycle (channel 1) duty cycle > 95.00% • Check of duty cycle (channel 2) duty cycle > 95.00% • Check of duty cycle (channel 1) duty cycle < 5.00% • Check of duty cycle (channel 2) duty cycle < 5.00 • Check of period of time (channel 1) period of time > 6 mSec • Check of period of time (channel 2) period of time > 6 mSec • Check of period of time (channel 1) period of time < 6 mSec • Check of period of time (channel 2) period of time < 6 mSec • Signal activity check (channel 1) position sensor signal no signal • Signal activity check (channel 2) position sensor signal no signal • Rationality check high offset adaption value > 45.00% • Rationality check low offset adaption value < 12.00%

Control Module and Output Signals

DTC	Error Message	Malfunction Criteria and Threshold Value
P0601	Internal Control Module Memory Check Sum Error	Internal check sum, incorrect
P0604	Internal Control Module Random Access Memory (RAM) Error	Write ability check, failed

DTC	Error Message	Malfunction Criteria and Threshold Value
P0605	Internal Control Module Read Only Memory (ROM) Error	Checksum incorrect
P0606	ECM Processor ECM: EEPROM	<ul style="list-style-type: none"> • SPI communications check Identifier failure • Communication check; internal check failure • Internal hardware check under / over voltage detection
P0627	Fuel Pump "A" Control Circuit/ Open	Signal voltage 4.8 - 5.3 V
P062B	Internal Control Module Fuel Injector Control Performance	<ul style="list-style-type: none"> • SPI communications check Identifier = failure • Internal logic = failure
P0634	ECM: Over - Temperature Power Stage	Power stage temperature > 150 [°C]
P0638	Throttle Actuator Control Range/Performance	Rationality check: <ul style="list-style-type: none"> • Time to open to reference point > 0.6 Sec. and • Time to close to reference point < 1.5 Sec. • Time to close below reference point > 0.3 Sec. and • Reference point, 1% • Time to close to reference point > 0.6 Sec. and • Reference point, 2.88% • TPS 1 signal voltage not 0.40 - 0.80 V or • TPS 2 signal voltage not 4.20 - 4.60 V
P0641	Sensor Reference Voltage A Circuit/Open	Signal voltage deviation > ± 0.3 V
P0642	Sensor Reference Voltage A Circuit Low	Signal voltage < 4.6 - 5.0 V
P0643	Sensor Reference Voltage A Circuit High	5V supply voltage > 4.99 - 5.41 V
P0651	Sensor Reference Voltage B Circuit/Open	Signal voltage deviation > ± 0.3 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0652	Sensor Reference Voltage B Circuit Low	Signal voltage < 4.6 - 5.0 V
P0653	Sensor Reference Voltage B Circuit High	5V supply voltage > 4.99 - 5.41 V
P0657	Actuator Supply Voltage A Circuit/Open	Signal voltage > 4.40 - 5.60 V
P0658	Actuator Supply Voltage A Circuit Low	Signal voltage < 2.15 - 3.25 V
P0659	Actuator Supply Voltage A Circuit High	Signal current > 1.10 A
P0685	ECM/PCM Power Relay Control Circuit/Open	<ul style="list-style-type: none"> • Signal voltage 2.6 - 3.7 V • Sense circuit voltage > 6 V
P0686	ECM/PCM Power Relay Control Circuit Low	<ul style="list-style-type: none"> • Signal voltage 2.6 - 3.7 V • Sense circuit voltage > 6 V
P0687	ECM/PCM Power Relay Control Circuit High	<ul style="list-style-type: none"> • Signal current > 1.4 - 0.7 A • Sense circuit voltage < 6 V
P0688	ECM/PCM Power Relay Sense Circuit	<ul style="list-style-type: none"> • Sense voltage < 3.0 V • Difference sense circuit voltage with camshaft actuator commanded off and on > 2.5 V • Battery voltage > 3 V
P0697	Sensor Reference Voltage C Circuit/Open	Signal voltage deviation > ± 0.3 V
P0698	Sensor Reference Voltage C Circuit Low	Signal voltage < 4.6 - 5.0 V
P0699	Sensor Reference Voltage C Circuit High	5V supply voltage > 4.99 - 5.41 V
P0703	Brake Switch "B" Circuit	Sensed voltage > 2430 [mV]
P0A1B	Drive Motor "A" Control Module	Deviation between set and actual value (the actual operation mode is different to the one required) incorrect
P0A7D	High Voltage Battery Pack	Charge state < 25.00%
P0A1F	High Voltage Battery Pack	Deviation between set and actual value (the actual operation mode is different to the one required) incorrect
P0AB9	Hybrid/EV System Performance	Internal check = failed
U0001	High Speed CAN Communication Bus	CAN message, no feedback

DTC	Error Message	Malfunction Criteria and Threshold Value
U0002	High Speed CAN Communication Bus	Global time out
U0028	CAN: Sensor- or Hybrid-CAN	CAN message no feedback
U0029	CAN: Sensor- or Hybrid-CAN	Global time out receiving no message
U0037	Internal CAN Bus (master / slave) no communication, No Feedback Message	No Feedback
U0038	Internal CAN Bus (master / slave) no communication, Communication Check	Global time out = receiving no message
U0100	Lost Communication with ECM/PCM A	<ul style="list-style-type: none"> • Failure of all CAN engine messages, time out > 490 mSec. • Failure of all CAN engine messages, but not all CAN messages, time out > 1010 mSec.
U0101	Lost Communication with TCM	CAN communication with TCM • Time out check No message received by ECM
U0110	CAN: DMCM (Drive Motor Control Module)	Received CAN message no message
U0112	CAN: BECM (Battery Energy Control Module)	Received CAN message no message
U0121	CAN ABS Brake Unit	Received CAN message- no message
U0140	CAN communication with Body Control Module	Received CAN message - no message
U0146	CAN Gateway A	CAN communication with gateway, time out
U0155	CAN Instrument Cluster	Received CAN message - no message
U0164	CAN: Climate Control Unit	Received CAN message no message
U0302	Software Incompatibility with Transmission Control Module	AT vehicle ECM coded as MT vehicle
U0322	CAN Communication with BCM	Ambient temperature value (module not encoded for ambient temperature sensor) = FDh [-]

DTC	Error Message	Malfunction Criteria and Threshold Value
U0323	CAN: Instrument cluster Audi only	Ambient temperature value module not encoded for ambient temp sensor, 00h
U0402	CAN Communication with TCM	Received data implausible message
U0404	Invalid Data Received From Gear Shift Control Module	<ul style="list-style-type: none"> • If the value of message counter is permanent, constant, or change exceeds a threshold, increment an event counter • Maximum change of message counter > 5
U0411	CAN: DMCM (Drive Motor Control Module)	Received CAN message no message
U0413	CAN: BECM (Battery Energy Control Module)	Received data implausible message
U0415	CAN: Vehicle Speed Sensor	Received data implausible message
U0422	CAN: Instrument Cluster	Ambient temperature value initialization, Audi 01 h
U0423	CAN: Instrument Cluster	Received CAN message, implausible message
U0424	CAN: Climate Control Unit	Received data implausible message
U0447	CAN Gateway	CAN message incorrect
U102A	Internal CAN Bus (master / slave) no communication, No Feedback Message	No Feedback
U102B	Internal CAN Bus (master / slave) no communication, Communication Check	Global time out = receiving no message
U10EB	CAN: DMCM (Drive Motor Control Module)	Received data implausible message
U10E5	CAN: TCM Hybrid	Received CAN message: no message
U10E6	CAN: TCM Hybrid	Received data: implausible message
U1103	ECM: Production Mode	Production mode active
U1106	ECM: HEV Service Mode	Vehicle in service mode; HEV service mode

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	<ul style="list-style-type: none"> • Pressure control activity > 0.25 MPa and • Fuel trim activity < 0.85 and • Difference between target pressure vs. actual pressure -16.38 - 16.38 MPa
P12A2	Fuel Rail Pressure Sensor Inappropriately High	<ul style="list-style-type: none"> • Pressure control activity > 0.25 MPa and • Fuel trim activity > 1.64 and • Difference between target pressure vs. actual pressure -16.38 - 16.38 MPa
P12A4	Fuel Rail Pump Control Valve Stuck Closed	<ul style="list-style-type: none"> • Pressure control activity < 6.0 mPa and • Fuel trim activity 0.85 to 1.15 and • Difference between target pressure vs. actual pressure < 16.38 MPa
P13EA	Cold Start Ignition Timing Performance Off Idle	Difference between commanded spark timing and actual value > 20.0 - 40.0%
P1427	Vacuum Pump, Brakes - Short to Positive	Short to battery plus; signal current > 2.2 A
P1428	Vacuum Pump, Brakes - Short to Ground	Short to ground; signal voltage < 2.15 V
P1429	Vacuum Pump, Brakes - Open Circuit	Open circuit signal voltage 4.4 - 5.6 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P150A	Engine Off Time	Comparison of engine off time from instrument cluster control unit with engine after run time. <ul style="list-style-type: none"> • Difference between engine off time and ECM after run time < -12.0 Sec. Comparison of engine off time from instrument cluster control unit with engine after run time <ul style="list-style-type: none"> • Difference between engine off time and ECM after run time > 12.0 Sec.
P169A	ECM: Transport Mode	Transport mode active
P1912	Brake Servo Pressure Sensor - Open Circuit/Short to Positive	Sensor voltage > 4.88 V
P1913	Brake Servo Pressure Sensor - Short To Ground	Brake booster pressure sensor signal: electrical error -failure
P2101	Throttle Actuator "A" Control Motor Circuit Range/ Performance	<ul style="list-style-type: none"> • Duty cycle > 80% and • ECM power stage, no failure • Deviation throttle valve angles vs. calculated value 4.0 - 50.0%
P2106	Throttle Actuator Control System - Forced Limited Power	Internal check failed
P2110	Throttle Actuator Control System - Forced Limited RPM	Engine load out of range
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low	Signal voltage < 0.55 V
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	Signal voltage > 4.79 V
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low	Signal voltage < 0.28 V
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High	Signal voltage > 2.43 V
P2138	Throttle/Pedal Position Sensor/Switch D/E Voltage Correlation	Signal voltage sensor 1 vs 2, > 0.143 to 0.70 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2146	Fuel Injector Group "A" Supply Voltage Circuit/Open	Short to ground (high side) • Signal current > 14.90 A Short to battery plus (high side) • Signal current < 2.60 A Core connection (high side - low side) • Signal current < 2.60 A
P2149	Fuel Injector Group "B" Supply Voltage Circuit/Open	Short to ground (high side) • Signal current > 14.90 A Short to battery plus (high side) • Signal current < 2.60 A Core connection (high side - low side) • Signal current < 2.60 A
P2177	System Too Lean Off Idle	• Adaptive value > 26%
P2178	System too Rich off Idle	System too rich @ part load • Adaptive value < 26%
P2181	Cooling System Performance	Cooling system temp too low after a sufficient air mass flow integral < 55 - 80° C for time ≥ 1.0 [s]
P2187	System Too Lean at Idle	• Adaptive value > 5.02%
P2188	System Too Rich at Idle	• Adaptive value < 6.0%
P2195	HO2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 1	Delta lambda of 2nd lambda control loop > 0.070
P2196	HO2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 1	Delta lambda of 2nd lambda control loop < 0.07
P2231	HO2 Sensor Signal Circuit Shorted to Heater Circuit	Delta O2S signal front > 190 uA

DTC	Error Message	Malfunction Criteria and Threshold Value
P2237	HO2 Sensor Positive Current Control Circuit/Open Bank 1 Sensor 1	<ul style="list-style-type: none"> • O2S signal front 1.46 - 1.54 • Difference between maximum and minimum value of O2S voltage signal front < 0.01 [V] • Delta lambda controller > 0.10 [-] or <ul style="list-style-type: none"> • Lambda control at min or max limit • O2S voltage signal front 1.46 - 1.54 [V] • Difference between maximum and minimum value of O2S voltage signal front < 0.01 [V] • No reaction on commanded stepwise change of lambda - setpoint <> 1
P2243	HO2 Sensor Reference Voltage Circuit/Open Bank 1 Sensor 1	Open circuit nernst voltage (UN) <ul style="list-style-type: none"> • O2S signal front > 4.70 V and Internal resistance > 950 Ω • O2S signal front < 0.30 V and internal resistance > 950 Ω
P2251	HO2 Sensor Negative Current Control Circuit/Open Bank 1 Sensor 1	Open circuit virtual mass (VM) <ul style="list-style-type: none"> • O2S voltage signal front 1.42 - 1.50 [V] • Internal resistance > 950 [Ohm]
P2257	Secondary Air Injection System Control "A" Circuit Low	Signal voltage 0.0 - 3.25 V
P2258	Secondary Air Injection System Control "A" Circuit High	Signal current 0.60 - 2.40 A
P2270	HO2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 2	Sensor voltage < 0.76 V
P2271	HO2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 2	• Sensor voltage of > 0.15 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2279	Intake Air System Leak	<ul style="list-style-type: none"> • Threshold to detect a defective system > 1.45 and • Ratio of the tie system defective during the measurement window to the whole duration of the measurement window > 0.60
P2293	Fuel Pressure Regulator 2 Performance	<ul style="list-style-type: none"> • Difference between target pressure vs. actual pressure: > 1.50 mPa • Difference between target pressure vs. actual pressure, < -1.50 mPa
P2294	Fuel Pressure Regulator 2 Control Circuit Open	Signal voltage 1.40 - 3.20 V
P2295	Fuel Pressure Regulator 2 Control Circuit Low	Signal voltage > 1.40 [V]
P2296	Fuel Pressure Regulator 2 Control Circuit High	Signal voltage > 3.20 V

Ignition System

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

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/Open	Signal voltage > 4.40 - 5.60 V
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	Signal voltage < 2.15 to 3.25 V
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	Signal current > 3.0 A
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit/Open	Low signal voltage > 0.5 Sec.
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	<ul style="list-style-type: none"> • High signal voltage > 12 Sec. and • Number of checks 30 and • Cumulative time of high signal voltage during pumping > 50 Sec.
P2414	HO2 Sensor Exhaust Sample Error Bank 1 Sensor 1	Threshold 1 • Signal voltage 2.71 - 6.00 V Threshold 2 • Signal voltage 2.05 to 3.06 V
P2431	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Range/Performance	Difference between AIR pressure and barometric pressure < -2.50 and/or > 2.50 [kPa]
P2432	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Low	Signal voltage < 0.40 V
P2433	Secondary Air Injection System Air Flow/Pressure Sensor Circuit High	Signal voltage > 4.65 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2440	Secondary Air Injection System Switching Valve Stuck Open	<ul style="list-style-type: none"> • Difference of measured AIR pressure before AIR injection vs. AIR pressure after AIR injection ≤ 2.00 [kPa] • Blockage: relative AIR pressure measured with AIR pressure sensor vs. modeled ≥ 0.60 [-] • Leakage: relative AIR pressure measured with AIR pressure sensor vs. modeled ≥ 0.62 [-] Case 1: <ul style="list-style-type: none"> • Relative AIR pressure (measured with AIR pressure sensor vs. modeled) vs. relative AIR pressure (measured with AIR pressure sensor vs. modeled while AIR valve closed) > 1.41 [-] Case 2: <ul style="list-style-type: none"> • Average pressure difference between absolute value and filtered value while AIR valve closed > 256.00 [kPa]
P24D5	EVAP System Pressure Sensor/Switch "B" Circuit	> 4.88 V
P24D6	EVAP System Pressure Sensor/Switch "B" Circuit Range/Performance	<ul style="list-style-type: none"> • Pressure > 149.00 [kPa] or • Pressure < 11.00 [kPa]
P24D7	EVAP System Pressure Sensor/Switch "B" Circuit Low	< 0.20 V
P2539	Low Pressure Fuel System Sensor Circuit	Signal voltage > 4.9 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	HO2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	O2S signal front > 4.81 V
P2681	Engine Coolant Bypass Valve Control Circuit/Open	Open circuit signal voltage $4.8 - 5.3$ V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2682	Engine Coolant Bypass Valve Control Circuit Low	Short to ground signal voltage < 2.8 - 3.2 V
P2683	Engine Coolant Bypass Valve Control Circuit High	Short to battery plus signal current > 2.2 - 4.0 A
P2705	ECM: Electronic Throttle Control Module	De-coupler status incorrect

Battery Regulation Control Module - J840-

DTC	Error Message	Malfunction Criteria and Threshold Value
P062F	ECU EEPROM check	EEPROM failure
P0A1F	Battery Energy Control Module	<ul style="list-style-type: none"> • Monitor signal for contactor power circuit is High • Monitor signal for contactor power latch circuit is Low • Monitor signal for power sustain circuit in (input signal to CPU from H/W) is High (input signal to CPU from H/W) • Watch Dog counter > 50 count (increment 10 ms cycle during malfunction detection)
P0A80	Battery Energy Control Module	Internal resistance > 4.45 to 1.29 Ω
P0A95	High Voltage Fuse "A"	Status information from V Sensor indicates fuse malfunction
P0A9D	Hybrid/EV Battery Temperature Sensor "A" Circuit Low	Temperature sensor x > 94° C
P0A9E	Hybrid/EV Battery Temperature Sensor "A" Circuit Low	Temperature sensor x > 94° C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0AA1	Hybrid/EV Battery Positive Contactor Circuit Stuck Closed	<ul style="list-style-type: none"> • State 1: all contactors off inconsistency • State 2: control negative contactor to close inconsistency • State 3: control precharge contactor to close inconsistency • State 4: control positive contactor to close inconsistency • State 5: control precharge contactor to open in case of malfunction of state 1 to 5 to pin-point: inconsistency • State 6: control negative contactor to open inconsistency • $(HVP - CVP) * 100 / HVP \leq 20 \%$ <p>or</p> <ul style="list-style-type: none"> • $(HVN - CVN) * 100 / HVN \leq 20 \%$
P0AA2	Hybrid/EV Battery Positive Contactor Circuit Stuck Open	<ul style="list-style-type: none"> • State 1: all contactors off inconsistency • State 2: control negative contactor to close inconsistency • State 3: control precharge contactor to close inconsistency • State 4: control positive contactor to close inconsistency • State 5: control precharge contactor to open in case of malfunction of state 1 to 5 to pin-point: inconsistency • State 6: control negative contactor to open inconsistency • BECM requests to closed • Battery current < 0,2 A • $(TV-High - CVP) * 100 / \text{Pack voltage} > 20\%$ • $(TV-Low - CVN) * 100 / \text{Pack voltage} > 20\%$

DTC	Error Message	Malfunction Criteria and Threshold Value
P0AA4	Hybrid/EV Battery Negative Contactor Circuit Stuck Closed	<ul style="list-style-type: none"> • State 1: all contactors off inconsistency • State 2: control negative contactor to close inconsistency • State 3: control precharge contactor to close inconsistency • State 4: control positive contactor to close inconsistency • State 5: control precharge contactor to open in case of malfunction of state 1 to 5 to pin-point: inconsistency • State 6: control negative contactor to open inconsistency • $(HVP - CVP) * 100 / HVP \leq 20\%$ or • $(HVN - CVN) * 100 / HVN \leq 20\%$
P0AA5	Hybrid/EV Battery Negative Contactor Circuit Stuck Open	<ul style="list-style-type: none"> • State 1: all contactors off inconsistency • State 2: control negative contactor to close inconsistency • State 3: control precharge contactor to close inconsistency • State 4: control positive contactor to close inconsistency • State 5: control precharge contactor to open in case of malfunction of state 1 to 5 to pin-point: inconsistency • State 6: control negative contactor to open inconsistency • BECM requests to closed • Battery current < 0,2 A • $(TV-High - CVP) * 100 / Pack \text{ voltage} > 20\%$ • $(TV-Low - CVN) * 100 / Pack \text{ voltage} > 20\%$

DTC	Error Message	Malfunction Criteria and Threshold Value
P0AAD	Hybrid/EV Battery Pack Air Temperature Sensor "A" Circuit Range/Performance	<ul style="list-style-type: none"> • Average of battery temperature - inlet/outlet thermistor • Inlet thermistor temperature - outlet thermistor temperature > 10° C • Engine off time > 360 min
P0AAE	Hybrid/EV Battery Pack Air Temperature Sensor "A" Circuit Low	Thermistor temperature < -45.0° C
P0AAF	Hybrid/EV Battery Pack Air Temperature Sensor "A" Circuit High	Thermistor temperature > 95.0° C
P0AB2	Hybrid/EV Battery Pack Air Temperature Sensor "B" Circuit Range/Performance	<ul style="list-style-type: none"> • Average of battery temperature - inlet/outlet thermistor temperature > 10° C • Inlet thermistor temperature - outlet thermistor temperature > 10° C • Engine off time > 360 min
P0AB3	Hybrid/EV Battery Pack Air Temperature Sensor "B" Circuit Low	Thermistor temperature < -45.0° C
P0AB4	Hybrid/EV Battery Pack Air Temperature Sensor "B" Circuit High	Thermistor temperature > 95.0° C
P0ABA	Hybrid/EV Battery Pack Voltage Sense "A" Circuit	Cell controller communication is missing at least one cell controller
P0ABB	Hybrid/EV Battery Pack Voltage Sense "A" Circuit Range/Performance	<ul style="list-style-type: none"> • Negative contactor voltage > 1.15 V negative total cell voltage or • Negative contactor voltage < 0.85 V negative total cell voltage or • Positive contactor voltage > 1.15 V positive total cell voltage or • Positive contactor voltage < 0.85 V positive total cell voltage V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0ABC	Hybrid/EV Battery Pack Voltage Sense "A" Circuit Low	<ul style="list-style-type: none"> • Negative contactor voltage > 258 V or • Negative contactor voltage < -258 V or • Positive contactor voltage > 258 V or • Positive contactor voltage < -258 V
P0AC0	Hybrid/EV Battery Pack Current Sensor "A" Circuit Range/Performance	<ul style="list-style-type: none"> • Battery current > 130 A • Battery current < -190 A • compare P-GND voltage polarization with Current polarization inconsistency • current offset > 1 A • current offset < -2 A • State 1: all contactors off inconsistency • State 2: control negative contactor to close inconsistency • State 3: control precharge contactor to close inconsistency • State 4: control positive contactor to close inconsistency • State 5: control precharge contactor to open in case of malfunction of state 1 to 5 to pin-point: inconsistency • State 6: control negative contactor to open inconsistency
P0AC1	Hybrid/EV Battery Pack Current Sensor "A" Circuit Low	Battery current < -240 A
P0AC2	Hybrid/EV Battery Pack Current Sensor "A" Circuit High	Battery current > 240 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P0AC6	Hybrid/EV Battery Temperature Sensor "B" Circuit Range/Performance	<ul style="list-style-type: none"> • Difference of two temperature sensors < -20° C or • Difference of two temperature sensors > 20° C • Number of checks with a single sensor exceeds threshold value ≥ 5
P0AC7	Hybrid/EV Battery Temperature Sensor "A" Circuit Low	Temperature sensor x > 94° C
P0AC8	Hybrid/EV Battery Temperature Sensor "A" Circuit Low	Temperature sensor x > 94° C
P0ACB	Hybrid/EV Battery Temperature Sensor "C" Circuit Range/Performance	<ul style="list-style-type: none"> • Difference of two temperature sensors < -20° C or • Difference of two temperature sensors > 20° C • Number of checks with a single sensor exceeds threshold value ≥ 5
P0ACC	Hybrid/EV Battery Temperature Sensor "A" Circuit Low	Temperature sensor x > 94° C
P0ACD	Hybrid/EV Battery Temperature Sensor "A" Circuit Low	<ul style="list-style-type: none"> • Negative contactor voltage > 258 V or • Negative contactor voltage < -258 V or • Positive contactor voltage > 258 V or • Positive contactor voltage < -258 V
P0A9C	Hybrid/EV Battery Temperature Sensor "A" Circuit Range/Performance	Temperature sensor x > 94° C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0AE2	Hybrid/EV Battery Temperature Sensor "A" Circuit Range/Performance	<ul style="list-style-type: none"> • Difference of two temperature sensors < -20° C or • Difference of two temperature sensors > 20° C • Number of checks with a single sensor exceeds threshold value ≥ 5
P0AE3	Hybrid/EV Battery Precharge Contactor Circuit Stuck Open	<ul style="list-style-type: none"> • State 1: all contactors off inconsistency • State 2: control negative contactor to close inconsistency • State 3: control precharge contactor to close inconsistency • State 4: control positive contactor to close inconsistency • State 5: control precharge contactor to open in case of malfunction of state 1 to 5 to pin-point: inconsistency • State 6: control negative contactor to open inconsistency
P0AE9	Hybrid/EV Battery Temperature Sensor "D" Circuit Range/Performance	<ul style="list-style-type: none"> • Difference of two temperature sensors < -20° C or • Difference of two temperature sensors > 20° C • Number of checks with a single sensor exceeds threshold value ≥ 5
P0AEA	Hybrid/EV Battery Temperature Sensor "A" Circuit Low	Temperature sensor x > 94° C
P0AEB	Hybrid/EV Battery Temperature Sensor "A" Circuit Low	Temperature sensor x > 94° C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0AF8	Hybrid/EV Battery System Voltage	<ul style="list-style-type: none"> • Battery current ≥ 20 A or • Positive Pack Voltage - Negative Pack Voltage < 48 V • Positive Backup Pack Voltage - Negative Backup Pack Voltage < 48 V
P0B15	Hybrid Battery Pack Voltage Sense "B" Circuit Range/Performance	<ul style="list-style-type: none"> • State 1: all contactors off inconsistency • State 2: control negative contactor to close inconsistency • State 3: control precharge contactor to close inconsistency • State 4: control positive contactor to close inconsistency • State 5: control precharge contactor to open in case of malfunction of state 1 to 5 to pin-point: inconsistency • State 6: control negative contactor to open inconsistency
P0B15	Hybrid/EV Battery Pack Voltage Sense "B" Circuit Range/Performance	<ul style="list-style-type: none"> • Negative contactor voltage > 1.15 V negative total cell voltage or • Negative contactor voltage < 0.85 V negative total cell voltage or • Positive contactor voltage > 1.15 V positive total cell voltage or • Positive contactor voltage < 0.85 V positive total cell voltage V
P0B16	Hybrid/EV Battery Pack Voltage Sense "B" Circuit Low	<ul style="list-style-type: none"> • $(HVP - CVP) * 100 / HVP \leq 20$ % or • $(HVN - CVN) * 100 / HVN \leq 20$ %

DTC	Error Message	Malfunction Criteria and Threshold Value
P0B17	Hybrid/EV Battery Pack Voltage Sense "B" Circuit High	<ul style="list-style-type: none"> • Negative contactor voltage > 258 V or • Negative contactor voltage < -258 V or • Positive contactor voltage > 258 V or • Positive contactor voltage < 0.85 V positive total cell voltage V
P0B3C	Hybrid Battery Voltage Sense "A" Circuit Range/ Performance	<ul style="list-style-type: none"> • TV-High > 240 V • TV-High < 24 V • TV-High - HVP > 48 V • TV-High - CVP > 48 V • HVP - CVP < 48 V • Average Block voltage – Minimum Block voltage (8 cell) > 1.2 V or • Minimum Block voltage (8 cell) – Minimum Block voltage (16 cell) > 0.6 V
P0B41	Hybrid/EV Battery Voltage Sense "B" Circuit Range/ Performance	<ul style="list-style-type: none"> • Block Voltage (TMV01) < 20.8 V • Block Voltage (TMV01) > 208 V • Average Block voltage – Minimum Block voltage (8 cell) > 1.2 V or • Minimum Block voltage (8 cell) – Minimum Block voltage (16 cell) > 0.6 V
P0B42	Hybrid/EV Battery Voltage Sense "B" Circuit Low	Block Voltage (TMV01) < -226 V
P0B43	Hybrid/EV Battery Voltage Sense "B" Circuit High	Block Voltage (TMV01) > 226 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0B46	Hybrid/EV Battery Voltage Sense "C" Circuit Range/ Performance	<ul style="list-style-type: none"> • Block Voltage (TMV02) < 17.6 V • Block Voltage (TMV02) > 176 V • Average Block voltage – Minimum Block voltage (8 cell) > 1.2 V or <ul style="list-style-type: none"> • Minimum Block voltage (8 cell) – Minimum Block voltage (16 cell) > 0.6 V
P0B47	Hybrid/EV Battery Voltage Sense "C" Circuit Low	Block Voltage (TMV02) < -189 V
P0B48	Hybrid/EV Battery Voltage Sense "C" Circuit High	Block Voltage (TMV02) > 189 V
P0B4B	Hybrid/EV Battery Voltage Sense "D" Circuit Range/ Performance	<ul style="list-style-type: none"> • Block Voltage (TMV03) < 14.4 V • Block Voltage (TMV03) > 144 V • Average Block voltage – Minimum Block voltage (8 cell) > 1.2 V or <ul style="list-style-type: none"> • Minimum Block voltage (8 cell) – Minimum Block voltage (16 cell) > 0.6 V
P0B4C	Hybrid/EV Battery Voltage Sense "D" Circuit Low	Block Voltage (TMV03) < -171 V
P0B4D	Hybrid/EV Battery Voltage Sense "D" Circuit High	Block Voltage (TMV03) > 171 V
P0B50	Hybrid/EV Battery Voltage Sense "E" Circuit Range/ Performance	<ul style="list-style-type: none"> • Block Voltage (TMV04) < 11.2 V • Block Voltage (TMV04) > 112 V • Average Block voltage – Minimum Block voltage (8 cell) > 1.2 V or <ul style="list-style-type: none"> • Minimum Block voltage (8 cell) – Minimum Block voltage (16 cell) > 0.6 V
P0B51	Hybrid/EV Battery Voltage Sense "E" Circuit Low	Block Voltage (TMV04) < -171 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0B52	Hybrid/EV Battery Voltage Sense "E" Circuit High	Block Voltage (TMV04) > 171 V
P0B55	Hybrid/EV Battery Voltage Sense "F" Circuit Range/ Performance	<ul style="list-style-type: none"> • Block Voltage (TMV05) < 8 V • Block Voltage (TMV05) > 80 V • Average Block voltage – Minimum Block voltage (8 cell) > 1.2 V or <ul style="list-style-type: none"> • Minimum Block voltage (8 cell) – Minimum Block voltage (16 cell) > 0.6 V
P0B56	Hybrid/EV Battery Voltage Sense "F" Circuit Low	Block Voltage (TMV05) < -189 V
P0B57	Hybrid/EV Battery Voltage Sense "F" Circuit High	Block Voltage (TMV05) > 189 V
P0B5A	Hybrid/EV Battery Voltage Sense "G" Circuit Range/ Performance	<ul style="list-style-type: none"> • Block Voltage (TMV06) < 4.8 V • Block Voltage (TMV06) > 48 V • Average Block voltage – Minimum Block voltage (8 cell) > 1.2 V or <ul style="list-style-type: none"> • Minimum Block voltage (8 cell) – Minimum Block voltage (16 cell) > 0.6 V
P0B5B	Hybrid/EV Battery Voltage Sense "G" Circuit Low	Block Voltage (TMV06) < -192 V
P0B5C	Hybrid/EV Battery Voltage Sense "G" Circuit High	Block Voltage (TMV06) > 192 V
P0B5F	Hybrid/EV Battery Voltage Sense "H" Circuit Range/ Performance	<ul style="list-style-type: none"> • Block Voltage (TMV07) < 1.6 V • Block Voltage (TMV07) > 16 V • Average Block voltage – Minimum Block voltage (8 cell) > 1.2 V or <ul style="list-style-type: none"> • Minimum Block voltage (8 cell) – Minimum Block voltage (16 cell) > 0.6 V
P0B60	Hybrid/EV Battery Voltage Sense "H" Circuit Low	Block Voltage (TMV07) < -192 V
P0B61	Hybrid/EV Battery Voltage Sense "H" Circuit High	Block Voltage (TMV07) > 192 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0BC3	Hybrid/EV Battery Temperature Sensor "E" Circuit Range/Performance	<ul style="list-style-type: none"> • Hybrid/EV Battery Temperature Sensor "E" Circuit Range/Performance or <ul style="list-style-type: none"> • Difference of two temperature sensors > 20° C • Number of checks with a single sensor exceeds threshold value ≥ 5
P0BC4	Hybrid/EV Battery Temperature Sensor "A" Circuit Low	Temperature sensor x > 94° C
P0BC5	Hybrid/EV Battery Temperature Sensor "A" Circuit Low	Temperature sensor x > 94° C
P0BC8	Hybrid/EV Battery Pack Cooling Fan 1 Sense Range/Performance	Fan feedback voltage > 1.37 to 3.43 V (depending on fan duty)
P0BC9	Hybrid/EV Battery Pack Cooling Fan 1 Sense Circuit Low	Fan feedback voltage < 0.1 V
P0BCA	Hybrid/EV Battery Pack Cooling Fan 1 Sense Circuit High	Fan feedback voltage > 3.45 V
P0C34	Hybrid/EV Battery Temperature Sensor "F" Circuit Range/Performance	<ul style="list-style-type: none"> • Difference of two temperature sensors < -20° C or <ul style="list-style-type: none"> • Difference of two temperature sensors > 20° C • Number of checks with a single sensor exceeds threshold value ≥ 5
P0C35	Hybrid/EV Battery Temperature Sensor "A" Circuit Low	Temperature sensor x > 94° C
P0C36	Hybrid/EV Battery Temperature Sensor "A" Circuit Low	Temperature sensor x > 94° C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0DAC	Hybrid/EV Battery Cell Balancing Circuit "A"	<ul style="list-style-type: none"> • Cell voltage direction different count \geq 9 counts or • Cell voltage $>$ 4 mV or • Cell voltage $<$ 4 mV or • Cell voltage - 1.85 V $>$ 0.8 V
P0DB0	Hybrid/EV Battery Cell Balancing Circuit "B"	<ul style="list-style-type: none"> • Cell voltage direction different count \geq 9 counts or • Cell voltage $>$ 4 mV or • Cell voltage $<$ 4 mV or • Cell voltage - 1.85 V $>$ 0.8 V
P0DB4	Hybrid/EV Battery Cell Balancing Circuit "C"	<ul style="list-style-type: none"> • Cell voltage direction different count \geq 9 counts or • Cell voltage $>$ 4 mV or • Cell voltage $<$ 4 mV or • Cell voltage - 1.85 V $>$ 0.8 V
P0DB8	Hybrid/EV Battery Cell Balancing Circuit "D"	<ul style="list-style-type: none"> • Cell voltage direction different count \geq 9 counts or • Cell voltage $>$ 4 mV or • Cell voltage $<$ 4 mV or • Cell voltage - 1.85 V $>$ 0.8 V
P0DBC	Hybrid/EV Battery Cell Balancing Circuit "E"	<ul style="list-style-type: none"> • Cell voltage direction different count \geq 9 counts or • Cell voltage $>$ 4 mV or • Cell voltage $<$ 4 mV or • Cell voltage - 1.85 V $>$ 0.8 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0DC0	Hybrid/EV Battery Cell Balancing Circuit "F"	<ul style="list-style-type: none"> • Cell voltage direction different count \geq 9 counts or • Cell voltage $>$ 4 mV or • Cell voltage $<$ 4 mV or • Cell voltage - 1.85 V $>$ 0.8 V
P0DC4	Hybrid/EV Battery Cell Balancing Circuit "G"	<ul style="list-style-type: none"> • Cell voltage direction different count \geq 9 counts or • Cell voltage $>$ 4 mV or • Cell voltage $<$ 4 mV or • Cell voltage - 1.85 V $>$ 0.8 V
P0DC8	Hybrid/EV Battery Cell Balancing Circuit "H"	<ul style="list-style-type: none"> • Cell voltage direction different count \geq 9 counts or • Cell voltage $>$ 4 mV or • Cell voltage $<$ 4 mV or • Cell voltage - 1.85 V $>$ 0.8 V

Electrical Drive Control Module -J841-

DTC	Error Message	Malfunction Criteria and Threshold Value
P0604	Internal Control Module Random Access Memory (RAM) Error	CAN-transceiver RAM failure
P064F	Unauthorized Software/ Calibration Detected	Internal eprom value is not plausible
P06B1	Sensor Power Supply "A" Circuit Low	Power supply voltage \equiv ground
P06B2	Sensor Power Supply "A" Circuit High	Power supply voltage \equiv battery voltage
P06B4	Sensor Power Supply "B" Circuit Low	Power supply voltage too low
P06B5	Sensor Power Supply "B" Circuit High	Power supply voltage too high
P06B0	Sensor Power Supply "A" Circuit/Open	VDD5 supply voltage too high internal hardware check

DTC	Error Message	Malfunction Criteria and Threshold Value
P06B5	Sensor Power Supply "B" Circuit High	Gate driver internal hardware check \equiv battery voltage
P0A1B	Drive Motor "A" Control Module	DC link circuit resistance $< 0,19$ [Ohm] (= DC link voltage / DC link current)
P0A2B	Drive Motor "A" Temperature Sensor Circuit Range/ Performance	> 38 K and / or > 37 K
P0A2C	Drive Motor "A" Temperature Sensor Circuit Low	Stator Temp. $> 221^{\circ}$ C
P0A2D	Drive Motor "A" Temperature Sensor Circuit High	Stator Temp. $< - 53^{\circ}$ C
P0A40	Drive Motor "A" Position Sensor Circuit Range/ Performance	Signal pattern change too fast < 100 μ s
P0AEE	Drive Motor Inverter Temperature Sensor "A" Circuit Range/Performance	Phase U IGBT temperature too low > 5 K
P0AEF	Drive Motor Inverter Temperature Sensor "A" Circuit Low	Phase U IGBT temperature too low $< - 55^{\circ}$ C
P0AF0	Drive Motor Inverter Temperature Sensor "A" Circuit High	Phase U IGBT temperature too high > 161 [$^{\circ}$ C]
P0AF3	Drive Motor Inverter Temperature Sensor "B" Circuit Range/Performance	Phase V IGBT temperature - Phase U IGBT temperature > 5 K
P0AF4	Drive Motor Inverter Temperature Sensor "B" Circuit Low	Phase V IGBT temperature too low $< - 57^{\circ}$ C
P0AF5	Drive Motor Inverter Temperature Sensor "B" Circuit High	Phase V IGBT temperature too high $> + 161^{\circ}$ C
P0BD2	Drive Motor Inverter Temperature Sensor "C" Circuit Range/Performance	Phase W IGBT temperature - Phase W IGBT temperature > 5 K
P0BD3	Drive Motor Inverter Temperature Sensor "C" Circuit Low	Phase W IGBT temperature too low $< - 57^{\circ}$ C
P0BD4	Drive Motor Inverter Temperature Sensor "C" Circuit High	Phase W IGBT temperature too high $> + 161^{\circ}$ C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0BE6	Drive Motor "A" Phase U Current Sensor Circuit Range/Performance	Phase U current offset > 20 A
P0BE7	Drive Motor "A" Phase U Current Sensor Circuit Low	Phase U current negative value too high < - 928 A
P0BEA	Drive Motor "A" Phase V Current Sensor Circuit Range/Performance	Phase V current offset > 23 A
P0BEB	Drive Motor "A" Phase V Current Sensor Circuit Low	Phase V current negative value too high < -921 A
P0BEC	Drive Motor "A" Phase V Current Sensor Circuit High	Phase V current positive value too high > 921 A
P0BE8	Drive Motor "A" Phase U Current Sensor Circuit High	Phase U current positive value too high > 921 A
P0BEE	Drive Motor "A" Phase W Current Sensor Circuit Range/Performance	Phase W current offset > 23 A
P0BEF	Drive Motor "A" Phase W Current Sensor Circuit Low	Phase W current negative value too high < -921 A
P0BF0	Drive Motor "A" Phase W Current Sensor Circuit High	Phase W current positive value too high > 921 A
P0BFD	Drive Motor "A" Phase U-V-W Current Sensor Correlation	Phase U + Phase V + Phase W > 40 A]
P0BFF	Drive Motor "A" Current	Calculated drive motor voltage - drive motor model voltage > 100 V
P0C01	Drive Motor "A" Current High	Phase U,V,W signal range check > 745 A
P0C17	Drive Motor "A" Position Sensor Not Learned	<ul style="list-style-type: none"> • Offset angle estimation < - 200 [1/min] • Offset angle deviation > 60°
P0C4E	Drive Motor "A" Position Exceeded Learning Limit	<ul style="list-style-type: none"> • Incorrect order of signal change from position sensor = wrong order • Time for acceleration to long > 2,5 [s] • Drive motor speed while acceleration > 1750 [1/min] • Phase current > 0 A • Time to calculate offset angle > 0,5 [s]

DTC	Error Message	Malfunction Criteria and Threshold Value
P0C51	Drive Motor "A" Position Sensor Circuit "A" Range/ Performance	Position sensor signal out of range low or high
P0C52	Drive Motor "A" Position Sensor Circuit "A" Low	Position sensor signal < 0.064 V
P0C53	Drive Motor "A" Position Sensor Circuit "A" High	Position sensor signal > 4.889 V
P0C5B	Drive Motor "A" Position Sensor Circuit "B" Range/ Performance	Position sensor signal out of range low or high
P0C5C	Drive Motor "A" Position Sensor Circuit "B" Low	Position sensor signal = 0 (continuously)
P0C5D	Drive Motor "A" Position Sensor Circuit "B" High	Position sensor signal = 1 (continuously)
P0C79	Drive Motor "A" Inverter Voltage Too High	DC link voltage > 420 V
P0D2E	Drive Motor "A" Inverter Voltage Sensor Circuit Range/ Performance	DC link voltage (BECM) - DC link voltage (DMCM) > 9 to 24 V
P0D30	Drive Motor "A" Inverter Voltage Sensor Circuit High	DC link voltage too high > 440 V
P33CA	Power electronics control module wrong software version	Internal failure detection
P33D4	Drive motor "A" magnetic flow calibration implausible	Deviation of measured magnetic flux from nominal magnetic flux > 25 %
P33D7	Control module for power electronic, output module 1 Internal malfunction	IGBT module hardware check - Internal failure detection
P33D8	Control module for power electronic, output module 2 Internal malfunction	IGBT module hardware check - Internal failure detection
P33D9	Control module for power electronic, HV input current Implausible	DC link current (BECM) + (DC link current (DMCM) + 20A > 50 A
P33DA	Control module for power electronic software or hardware version, implausible	Internal failure detection

DTC CHART

Engine Code CTUC, CTUD

Fuel and Air Mixture, Additional Emission Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	A Camshaft Position Slow Response Bank 1	<ul style="list-style-type: none"> • Adjustment angle difference < 5° CA • Number of checks 10 times
P000B		
P000C	Intake (A) Camshaft Position Response check (Bank 1 or Bank 2)	<ul style="list-style-type: none"> • Adjustment angle difference < 5° CRK • Number of checks 10 times
P0010	A Camshaft Position Actuator Circuit / Open Bank 1	Signal current > 0.8 mA
P0011	A Camshaft Position - Timing Over-Advanced or System Performance Bank 1	<ul style="list-style-type: none"> • Adjustment angle difference > 10° CA • Number of checks 3 times
P0016	Crankshaft Position – Camshaft Position Correlation Bank 1 Sensor A	Adaptive value > 146° CRK
P0018	Crankshaft Position – Camshaft Position Correlation Bank 2 Sensor A	Adaptive value < 84° CRK
P0020	A Camshaft Position Actuator Circuit / Open Bank 2	Signal current < 0.8 mA
P0021	A Camshaft Position - Timing Over-Advanced or System Performance Bank 2	<ul style="list-style-type: none"> • Adjustment angle difference > 10° CRK • Number of checks 3 times
P0030	HO2S Heater Control Circuit Bank 1 Sensor 1	Heater current (hardware values) < 8 to 40 mA
P0031	HO2S Heater Control Circuit Low Bank 1 Sensor 1	Heater voltage (hardware values) < 1.9 to 2.22 V
P0032	HO2S Heater Control Circuit High Bank 1, Sensor 1	Heater current (hardware values) > 8 to 11 A
P0036	HO2S Heater Control Circuit Bank 1 Sensor 2	Heater current (hardware values) < 8 to 40 mA
P0037	HO2S Heater Control Circuit Low Bank 1 Sensor 2	Heater voltage < 1.9 - 2.22 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0038	HO2S Heater Control Circuit High Bank 1 Sensor 2	Heater current (hardware values) > 3 to 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"> • SULEV Heater voltage < 3 V • ULEV Heater voltage < 3 V
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	Heater current (hardware values) < 8 to 40 mA
P0051	HO2S Heater Control Circuit Low Bank 1 Sensor 1	Heater voltage (hardware values) < 1.9 to 2.22 V
P0052	HO2S Heater Control Circuit High Bank 1, Sensor 1	Heater current (hardware values) > 8 to 11A
P0056	HO2S Heater Control Circuit Bank 2, Sensor 2	Heater current (hardware values) < 8 to 40 mA
P0057	HO2S Heater Control Circuit Low Bank 1 Sensor 2	Heater voltage < 1.9 - 2.22 V
P0058	HO2S Heater Control Circuit High Bank 1 Sensor 2	Heater current (hardware values) > 3 to 5 A
P0068	MAP/MAF – Throttle Position Correlation	<ul style="list-style-type: none"> • Ddeviation throttle controller < 43 or > 43% • Difference actual pressure downstream throttle to set-point value > 30 kPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P0071	Ambient Air Temperature Sensor Range/Performance	<ul style="list-style-type: none"> • Difference ECT vs. CHDT vs. IAT at engine start < 26.5° C (depending on engine off time) map (1) • Difference AAT vs. IAT at engine start > 26.5° C (depending on engine off time) map (1) • Difference AAT vs. ECT at engine start > 26.5° C (depending on engine off time) map (1) • Difference AAT vs. CHDT at engine start > 26.5° C (depending on engine off time) map (1)
P0072	Ambient Air Temperature Sensor Circuit Low	Failure
P0073	Ambient Air Temperature Sensor Circuit High	Failure
P007C	Charge Air Cooler Temperature Sensor Circuit Low Bank 1	<ul style="list-style-type: none"> • Check the Charge Air Pressure Sensor -G31- Integrated with Intake Manifold Temperature Sensor -G72- • Refer to Charge Air Pressure Sensor / Intake Manifold Temperature Sensor, Checking in Elsa
P007D	Charge Air Cooler Temperature Sensor Circuit High Bank 1	<ul style="list-style-type: none"> • Check the Charge Air Pressure Sensor -G31- Integrated with Intake Manifold Temperature Sensor -G72- • Refer to Charge Air Pressure Sensor / Intake Manifold Temperature Sensor, Checking in Elsa

DTC	Error Message	Malfunction Criteria and Threshold Value
P0087	Fuel Rail/System Pressure Too Low	<ul style="list-style-type: none"> • Deviation fuel rail pressure control > 0.105 g/Rev and • Deviation HO2S control -15 - 15% • Actual pressure 3.5 MPa • Target pressure-actual pressure > 2 MP and • Deviation HO2S control -15 - 15%
P0088	Fuel Rail/System Pressure - Too High	Fuel rail pressure > 13.9 MPa
P0089	Fuel Pressure Regulator 1 Performance	Actual pressure deviation <ul style="list-style-type: none"> • Deviation fuel press control (LP) < -28% > 35% • Target press minus actual press > 0.17 MPa • Target press minus actual press < 0.17 MPa
P008A	Low Pressure Fuel System Pressure Too Low	Actual pressure < 0.08 MPa
P008B	Low Pressure Fuel System Pressure Too High	Actual pressure >1.1 MPa
P0090	Fuel Pressure Regulator 1 Control Circuit/Open	Signal voltage < 2.9 - 3.2 [V]
P0091	Fuel Pressure Regulator 1 Control Circuit Low	Signal voltage 1.95 - 2.2 [V]
P0092	Fuel Pressure Regulator 1 Control Circuit High	Short to battery plus signal current > 8 to 11 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P0096	Intake Air Temperature Sensor 2 Circuit Range/Performance Bank 1	<ul style="list-style-type: none"> • Difference AAT vs. ECT vs. CHDT at engine start < 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. CHDT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. AAT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. ECT at engine start > 26.5 °C (depending on engine off time) map (1)
P00A2	Charge Air Cooler Temperature Sensor Circuit Low Bank 2	IAT > 129 [° C]
P00A3	Charge Air Cooler Temperature Sensor Circuit High Bank 2	IAT < -40 [° C]
P00A6	Intake Air Temperature Sensor 2 Circuit Range/Performance Bank 2	<ul style="list-style-type: none"> • Difference AAT vs. ECT vs. CHDT at engine start < 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. CHDT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. AAT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. ECT at engine start > 26.5 °C (depending on engine off time) map (1)

DTC	Error Message	Malfunction Criteria and Threshold Value
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance Bank 1	<ul style="list-style-type: none"> • Difference AAT vs. ECT vs. CHDT at engine start < 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. CHDT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. AAT at engine start > 26.5 °C (depending on engine off time) map (1) • Difference IAT vs. ECT at engine start > 26.5 °C (depending on engine off time) map (1)
P0112	Intake Air Temperature Sensor 1 Circuit Low Bank 1	Intake air temperature > 129° C
P0113	Intake Air Temperature Sensor 1 Circuit High Bank 1	Intake air temperature < - 40° C
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> • Difference AT vs. ECT vs. IAT at engine start < 26.5° C (depending on engine off time) map (1) • Difference IAT vs. CHDT at engine start > 26.5° C (depending on engine off time) map (1) • Difference IAT vs. AAT at engine start > 26.5° C (depending on engine off time) map (1) • Difference IAT vs. ECT at engine start > 26.5° C (depending on engine off time) map (1)
P0117	Engine Coolant Temperature Sensor 1 Circuit Low Input	Engine coolant temperature < - 45.8° C
P0118	Engine Coolant Temperature Sensor 1 Circuit High	Engine coolant temperature > 141° C
P0121	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	<ul style="list-style-type: none"> • TPS 1 - TPS 2 > 5.79° and • Relative mass air integral > 100... at 0.45 s

DTC	Error Message	Malfunction Criteria and Threshold Value
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low	Signal voltage < 0.117 V
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High	Signal voltage > 4.6 [V]
P012B	Turbocharger/Supercharger Inlet Pressure Sensor Circuit Range/Performance Downstream of throttle valve	<ul style="list-style-type: none"> • Pressure difference in cross check between boost pressure sensor 1/2; inlet charger pressure and ambient pressure sensor > 7 kPa • Pressure difference in cross check between boost pressure sensor 1/2 and inlet charger pressure (1) > 12..27 kPa • Depending on engine speed
P012C	Turbocharger/Supercharger Inlet Pressure Sensor Circuit Low Downstream of Throttle Valve	Signal voltage < 0.2 V
P012D	Turbocharger/Supercharger Inlet Pressure Sensor Circuit High Downstream of Throttle Valve	Signal voltage > 4.8 V
P0130	HO2 Sensor Circuit Bank 1 Sensor 1	O2S ceramic temperature < 640° C
P0131	HO2 Sensor Circuit Low Voltage Bank 1 Sensor 1	Signal voltage < 0.13 V
P0132	HO2 Sensor Circuit High Voltage Bank 1 Sensor 1	Signal voltage > 5.5 V
P0133	HO2 Sensor Circuit Slow Response Bank 1 Sensor 1	Response check- HO2S value vs modeled HO2S value > 0.9004
P0135	HO2 Sensor Heater Circuit Bank 1, Sensor 1	UEGO ceramic temperature < 680 and/or > 965° C
P0136	HO2 Sensor Circuit Bank 1 Sensor 2	Oscillation check <ul style="list-style-type: none"> • O2S signal rear not oscillating at reference +/- 10 mV Signal range check <ul style="list-style-type: none"> • Signal voltage > 0.2 V
P0137	HO2 Sensor Circuit Low Voltage Bank 1 Sensor 2	<ul style="list-style-type: none"> • Signal voltage < 20 mV and • Internal resistance < 10 Ω
P0138	HO2 Sensor Circuit High Voltage Bank 1 Sensor 2	Signal voltage > 1.2 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0139	HO2 Sensor Circuit Slow Response Bank 1 Sensor 2	O2S signal rear- signal too slow- 1
P013A	HO2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	<ul style="list-style-type: none"> • Arithmetic filtered max differential transient time at rich to lean transition ≤ 800 mV/s • Number of checks ≥ 2
P013B	HO2 Sensor Slow Response - Lean to Rich Bank 1, Sensor 2	<ul style="list-style-type: none"> • Arithmetic filtered max differential transient time at rich to lean transition ≤ 800 mV/s • Number of checks ≥ 2
P013C	HO2 Sensor Slow Response - Rich to Lean Bank 2 Sensor 2	<ul style="list-style-type: none"> • Arithmetic filtered max differential transient time at rich to lean transition ≤ 800 mV/s • Number of checks ≥ 2
P013D	Oxygen Sensors Slow Response - Lean to Rich Bank 2, Sensor 2	<ul style="list-style-type: none"> • Arithmetic filtered max differential transient time at rich to lean transition ≤ 800 mV/s • Number of checks ≥ 2
		<ul style="list-style-type: none"> • Arithmetic filtered max differential transient time at rich to lean transition ≥ 0.800 mV/s • Number of checks ≥ 3
P013F	HO2 Sensor Delayed Response - Lean to Rich Bank 1, Sensor 2	<ul style="list-style-type: none"> • Arithmetic filtered max differential transient time at rich to lean transition ≥ 0.800 mV/s • Number of checks ≥ 3
P0140	HO2 Sensor Circuit No Activity Detected Bank 1 Sensor 2	<ul style="list-style-type: none"> • Signal voltage .0376 - 0.474 V • O2S rear internal resistance > 60 KΩ
P0141	HO2 Sensor Heater Circuit Bank 1 Sensor 2	Heater resistance > 10 K Ω
P014A	HO2 Sensor Circuit Delayed Response - Lean to Rich Bank 2, Sensor 2	<ul style="list-style-type: none"> • Arithmetic filtered max differential transient time at rich to lean transition ≥ 0.800 mV/s • Number of checks ≥ 3

DTC	Error Message	Malfunction Criteria and Threshold Value
P014B	HO2 Sensor Circuit Delayed Response - Lean to Rich Bank 2 Sensor 2	<ul style="list-style-type: none"> Arithmetic filtered max differential transient time at rich to lean transition ≥ 0.800 mV/s Number of checks ≥ 3
P0151	HO2 Sensor Circuit Low Voltage Bank 2 Sensor 1	Signal voltage < 0.13 V
P0152	HO2 Sensor Circuit High Voltage Bank 2 Sensor 1	Signal voltage > 5.5 V
P0153	HO2 Sensor Circuit Slow Response Bank 2 Sensor 1	Response check- HO2S value vs modeled HO2S value > 0.7998
P0155	HO2 Sensor Heater Circuit Bank 2, Sensor 1	UEGO ceramic temperature < 680 or $> 965^\circ$ C
P0156	HO2 Sensor Circuit Bank 2 Sensor 2	Oscillation check <ul style="list-style-type: none"> O2S signal rear not oscillating at reference ± 10 mV Signal range check <ul style="list-style-type: none"> Signal voltage > 0.15 V
P0157	HO2 Sensor Circuit Low Voltage Bank 2 Sensor 2	<ul style="list-style-type: none"> Signal voltage, < 20 mV and Internal resistance $< 10\Omega$
P0158	HO2 Sensor Circuit High Voltage Bank 2 Sensor 2	Signal voltage > 1.2 V
P0159	HO2 Sensor Circuit Slow Response Bank 2 Sensor 2	<ul style="list-style-type: none"> O2S signal rear- signal too slow- 1[-] Maximum allowed rich to lean switching time
P0160	HO2 Sensor Circuit No Activity Detected Bank 2 Sensor 2	<ul style="list-style-type: none"> Signal voltage, $0.376 - 0.474$ V O2S rear internal resistance > 60 KΩ
P0161	HO2 Sensor Heater Circuit Bank 1, Sensor 2	Heater resistance, $> 10K \Omega$
P0169	Incorrect Fuel Composition	Plausability check - failed
P0171	System Too Lean Bank 1	System too lean adaptive value > 0.0075 [g/rev]
P0172	System Too Rich Bank 1	System too rich adaptive value < -0.0075 [g/rev]
P0174	System Too Lean Bank 2	System too lean adaptive value > 0.0075 [g/rev]
P0175	System Too Rich Bank 2	System too rich adaptive value < -0.0075 [g/rev]

DTC	Error Message	Malfunction Criteria and Threshold Value
P017B	Cylinder Head Temperature Sensor Circuit Range/Performance	<ul style="list-style-type: none"> • Measured cylinder head temperature below modeled temperature • Difference ETC vs AAT vs IAT at engine start < 26.5° C (depending on engine off time) map (1) • Difference CHDT vs ECT at engine start > 26.5° C (depending on engine off time) map (1) • Difference CHDT vs IAT at engine start > 26.5° C (depending on engine off time) map (1) • Difference CHDT vs AAT at engine start > 26.5° C (depending on engine off time) map (1)
P017C	Cylinder Head Temperature Sensor Circuit Low	Cylinder head temperature > 215° C
P017D	Cylinder Head Temperature Sensor Circuit High	Cylinder head temperature < - 60° C
P0190	Fuel Rail Pressure Sensor "A" Circuit	Signal voltage > 4.6 V
P0191	Fuel Rail Pressure Sensor "A" Circuit Range/Performance	Actual pressure > 16.85 mPa
P0192	Fuel Rail Pressure Sensor "A" Circuit Low	Signal voltage < 0.2 V
P0201	Injector Circuit/Open - Cylinder 1	<ul style="list-style-type: none"> • Signal current < 10 A and • Signal voltage > 3.5 V
P0202	Injector Circuit/Open - Cylinder 2	<ul style="list-style-type: none"> • Signal current < 10 A and • Signal voltage > 3.5 V
P0203	Injector Circuit/Open - Cylinder 3	<ul style="list-style-type: none"> • Signal current < 10 A and • Signal voltage > 3.5 V
P0204	Injector Circuit/Open - Cylinder 4	<ul style="list-style-type: none"> • Signal current < 10 A and • Signal voltage > 3.5 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0205	Injector Circuit/Open - Cylinder 5	<ul style="list-style-type: none"> • Signal current < 10 A and • Signal voltage > 3.5 V
P0206	Injector Circuit/Open - Cylinder 6	<ul style="list-style-type: none"> • Signal current < 10 A and • Signal voltage > 3.5 V
P0221	Throttle/Pedal Position Sensor/Switch "B" Circuit Range/Performance	<ul style="list-style-type: none"> • TPS 1 - TPS 2 > 5.79° and • Relative mass air integral > 100... at 0.45 s
P0222	Throttle/Pedal Position Sensor/Switch "B" Circuit Low	Signal voltage < 0.117 V
P0223	Throttle/Pedal Position Sensor/Switch "B" Circuit High	Signal voltage > 4.6 V
P0234	Turbocharger/Supercharger Overboost Condition Rationality Check High	Difference of set value boost pressure vs. actual boost pressure value > 200 - 1275 hPa
P0235	Turbocharger/Supercharger Boost Sensor "A" Circuit	Difference between actual measured charge pressure quotient and target charge pressure quotient (1) > 0.25 - 35 [-] depending on altitude
P0236	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance	<ul style="list-style-type: none"> • Pressure difference in cross check between boost pressure sensor 1/2; inlet charger pressure and ambient pressure sensor > 7 kPa • Pressure difference in cross check between boost pressure sensor 1/2 and inlet charger pressure (1) > 12 - 27 kPa • Pressure difference in cross check between pressure sensor 1 and 2 > 12.5 kPa • Fuel trim activity (bank with deviation is considered to be defective) > 15%
P0237	Turbocharger/Supercharger Boost Sensor "A" Circuit Low	Signal voltage < 0.2 V
P0238	Turbocharger/Supercharger Boost Sensor "A" Circuit High	Signal voltage > 4.8 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0240	Turbocharger/Supercharger Boost Sensor "B" Circuit Range/Performance	<ul style="list-style-type: none"> • Pressure difference in cross check between boost pressure sensor 1/2; inlet charger pressure and ambient pressure sensor > 7 kPa • Pressure difference in cross check between boost pressure sensor 1/2 and inlet charger pressure (1) > 12 - 27 kPa • Pressure difference in cross check between pressure sensor 1 and 2 > 12.5 kPa • Fuel trim activity (bank with deviation is considered to be defective) > 15%
P0241	Turbocharger/Supercharger Boost Sensor "B" Circuit Low	Signal voltage < 0.2 V
P0242	Turbocharger/Supercharger Boost Sensor "B" Circuit High	Signal voltage > 4.8 V
P025A	Fuel Pump Module Control Circuit/Open	Signal voltage < 2.9 to 3.2 [V]
P025C	Fuel Pump Module Control Circuit Low	Signal voltage < 1.95 to 2.2 V
P025D	Fuel Pump Module Control Circuit High	Signal current > 1 to 2 A
P0261	Cylinder 1 Injector Circuit Low	<ul style="list-style-type: none"> • Signal current < 10 A and • Signal voltage < 3.5 V
P0262	Cylinder 1 Injector Circuit High	Signal current > 16 A
P0264	Cylinder 2 Injector Circuit Low	<ul style="list-style-type: none"> • Signal current < 10 A and • Signal voltage < 3.5 V
P0265	Cylinder 2 Injector Circuit High	Signal current > 16 A
P0267	Cylinder 3 Injector Circuit Low	<ul style="list-style-type: none"> • Signal current < 10 A and • Signal voltage < 3.5 V
P0268	Cylinder 3 Injector Circuit High	Signal current > 16 A
P0270	Cylinder 4 Injector Circuit Low	<ul style="list-style-type: none"> • Signal current < 10 A and • Signal voltage < 3.5 V
P0271	Cylinder 4 Injector Circuit High	Signal current > 16 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P0273	Cylinder 5 Injector Circuit Low	<ul style="list-style-type: none"> • Signal current < 10 A and • Signal voltage < 3.5 V
P0274	Cylinder 5 Injector Circuit High	Signal current > 16 A
P0276	Cylinder 6 Injector Circuit Low	<ul style="list-style-type: none"> • Signal current < 10 A and • Signal voltage < 3.5 V
P0277	Cylinder 6 Injector Circuit High	Signal current > 16 A
P0299	Turbocharger/Supercharger Underboost Rationality Check Low	Difference of set boost pressure vs. actual boost pressure value > 150 hPa
P2004	Intake Manifold Runner Control Stuck Open Bank 1	Signal voltage, < 2.5 V
P2005	Intake Manifold Runner Control Stuck Open Bank 2	Signal voltage, > 2.5 V
P2006	Intake Manifold Runner Control Stuck Closed Bank 1	Signal voltage, < 2.9 V
P2007	Intake Manifold Runner Control Stuck Closed Bank 2	Signal voltage > 2.9 V
P2008	Intake Manifold Runner Control Circuit/Open	Signal voltage 2.9 to 3.2 V
P2009	Intake Manifold Runner Control Circuit Low	Signal voltage < 1.95 to 2.2 V
P2010	Intake Manifold Runner Control Circuit High	Signal current 1.2 A
P2014	Intake Manifold Runner Position Sensor/Switch Circuit Bank 1	Signal voltage, < 0.2 V
P2017	Intake Manifold Runner Position Sensor/Switch Circuit High Bank 1	Signal voltage, > 4.8 V
P2019	Intake Manifold Runner Position Sensor/Switch Circuit Bank 2	Signal voltage, < 0.2 V
P2022	Intake Manifold Runner Position Sensor/Switch Circuit High Bank 2	Signal voltage, > 4.8 V
P2024	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Circuit	Signal Current < 0.8 mA

DTC	Error Message	Malfunction Criteria and Threshold Value
P2025	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Performance	<ul style="list-style-type: none"> • Response time > 1000 ms and number of checks > 3.00 • Ssecurity bit incorrect and number of checks > 3.00 • Resetcounter > 3.00 • Time difference between ECU and EVAP Fuel Tank Temp Sensor > 3.0 s • EVAP Fuel Tank Temp Sensor > 119 °C • EVAP Fuel Tank Temp Sensor < -39 °C • Difference between EVAP Fuel Tank Temp Sensor and ECT ≥ 20.3 K and Difference between EVAP Fuel Tank Temp Sensor and IAT ≥ 20.3 K gradient EVAP Fuel Tank Temp Sensor > 20 [K/10min]
P2026	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Circuit Low Voltage	Signal Voltage < 2.0 V
P2027	Evaporative Emissions (EVAP) Fuel Vapor Temperature Sensor Circuit High Voltage	Signal Current > 1.0 A
P2088	A Camshaft Position Actuator Control Circuit Low Bank 1	Signal voltage, < 1.95 to 2.20 V
P2089	A Camshaft Position Actuator Control Circuit High Bank 1	Signal current, > 3 to 5 A
P2092	A Camshaft Position Actuator Control Circuit Low Bank 2	Signal voltage, < 1.95 to 2.20 V
P2093	A Camshaft Position Actuator Control Circuit High Bank 2	Signal current, > 3 to 5 A
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Integral part of trim control, post cat > 10%
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	Integral part of trim control, post cat < 10%
P2098	Post Catalyst Fuel Trim System Too Lean Bank 2	Integral part of trim control, post cat > 10%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2099	Post Catalyst Fuel Trim System Too Rich Bank 2	Integral part of trim control, post cat < 10%
P3081	Engine Temperature Too Low	Step 1 <ul style="list-style-type: none"> • Modeled ECT > 30° C and • ECT < 30° C

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random/Multiple Cylinder Misfire Detected	<ul style="list-style-type: none"> • Emission threshold misfire rate (MR) 1st internal > 1.5% • Emission threshold misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR) > 1.5 - 15%
P0301	Cylinder 1 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold misfire rate (MR) 1st internal > 1.5% • Emission threshold misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR) > 1.5 - 15%
P0302	Cylinder 2 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold misfire rate (MR) 1st internal > 1.5% • Emission threshold misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR) > 1.5 - 15%
P0303	Cylinder 3 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold misfire rate (MR) 1st internal > 1.5% • Emission threshold misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR) > 1.5 - 15%
P0304	Cylinder 4 Misfire Detected	<ul style="list-style-type: none"> • Emission threshold misfire rate (MR) 1st internal > 1.5% • Emission threshold misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR) > 1.5 - 15%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0305	Cylinder 5 Misfire Detected	<ul style="list-style-type: none"> Emission threshold misfire rate (MR) 1st internal > 1.5% Emission threshold misfire rate (MR) > 1.5% Catalyst damage misfire rate (MR) > 1.5 - 15%
P0306	Cylinder 6 Misfire Detected	<ul style="list-style-type: none"> Emission threshold misfire rate (MR) 1st internal > 1.5% Emission threshold misfire rate (MR) > 1.5% Catalyst damage misfire rate (MR) > 1.5 - 15%
P0321	Ignition/Distributor Engine Speed Input Circuit Range/Performance	<ul style="list-style-type: none"> Counted teeth vs. reference incorrect or <ul style="list-style-type: none"> Monitoring reference gap failure
P0326	Knock Sensor 1 Circuit Range/Performance Bank 1 or Single Sensor	<ul style="list-style-type: none"> Lower threshold < 0.029 V Upper threshold > 1.992 V
P0327	Knock Sensor 1 Circuit Low Bank 1 or Single Sensor	Lower threshold, < 0.18 V
P0328	Knock Sensor 1 Circuit High Bank 1 or Single Sensor	Upper threshold > 4.8 V
P0331	Knock Sensor 2 Circuit Range/Performance Bank 2	<ul style="list-style-type: none"> Lower threshold < 0.029 V Upper threshold > 1.992 V
P0332	Knock Sensor 2 Circuit Low Bank 2	Lower threshold, < 0.18 V
P0333	Knock Sensor 1 Circuit Short to Battery Voltage	Upper threshold > 1.00 V
P0335	Engine Speed Sensor	<ul style="list-style-type: none"> Open circuit > 1 V Short to grd < 1.5 V Short to Battery voltage > 3.5 V Signal check no signal
P0336	Crankshaft Position Sensor "A" Circuit Range/Performance	<ul style="list-style-type: none"> RPM signal comparison with phase sensor not synchronous Counted versus reference teeth > 1 Actual time value vs modeled time value > 1.375

DTC	Error Message	Malfunction Criteria and Threshold Value
P0340	Camshaft Position Sensor "A" Circuit Bank 1 or Single Sensor	Signal activity check <ul style="list-style-type: none"> • Signal voltage no altering at 4 Rev
P0341	Camshaft Position Sensor "A" Circuit Range/Performance Bank 1 or Single Sensor	<ul style="list-style-type: none"> • Actual time value vs min. time value < 1 • Adaptive value vs target value > 12.4° CA • Actual time value vs modeled time value > 3.5
P0345	Camshaft Position Sensor "A" Circuit Bank 2	Signal activity check <ul style="list-style-type: none"> • Signal voltage no altering at 4 Rev
P0346	Camshaft Position Sensor "A" Circuit Range/Performance Bank 2	<ul style="list-style-type: none"> • Actual time value vs min. time value < 1 • Adaptive value vs target value > 12.4° CA • Actual time value vs modeled time value > 3.5
P0351	Ignition Coil "A" Primary/ Secondary Circuit	Open circuit <ul style="list-style-type: none"> • Signal current < -0.05 - 0.2 mA • Hardware value from final stage > 0.04 - 0.2 mA
P0352	Ignition Coil "B" Primary/ Secondary Circuit	Short to ground <ul style="list-style-type: none"> • Signal current < -0.05 - 0.2 mA • Hardware value from final stage > 0.04 - 0.2 mA
P0353	Ignition Coil "C" Primary/ Secondary Circuit	Short to Battery voltage <ul style="list-style-type: none"> • Signal current < -0.05 - 0.2 mA • Hardware value from final stage > 0.04 - 0.2 mA
P0354	Ignition Coil "D" Primary/ Secondary Circuit	<ul style="list-style-type: none"> • Signal current < -0.05 - 0.2 mA • Hardware value from final stage > 0.04 - 0.2 mA
P0355	Ignition Coil "E" Primary/ Secondary Circuit	<ul style="list-style-type: none"> • Signal current < -0.05 - 0.2 mA • Hardware value from final stage > 0.04 - 0.2 mA

DTC	Error Message	Malfunction Criteria and Threshold Value
P0356	Ignition Coil "F" Primary/ Secondary Circuit	<ul style="list-style-type: none"> • Signal current < -0.05 - 0.2 mA • Hardware value from final stage > 0.04 - 0.2 mA

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0413	Secondary Air Injection System Switching Valve "A" Circuit Open	<ul style="list-style-type: none"> • Signal Current 8 to 40 mA • Signal Voltage 2.9 to 3.2 V
P0414	Secondary Air Injection System Switching Valve "A" Circuit Shorted	Short to Battery Voltage: <ul style="list-style-type: none"> • Signal Current 3 to 5 A
P0416	Secondary Air Solenoid Valve 2 Circuit Open Circuit	Signal voltage < 8 mA
P0417	Secondary Air Solenoid Valve 2 Circuit Short to Ground or Battery Voltage	Signal voltage < 2.00 V
P0418	Secondary Air Injection System Control "A" Circuit	<ul style="list-style-type: none"> • Signal current < 1 [mA] • Signal Voltage 2.9 to 3.2 [V]
P0420	Catalyst System Efficiency Below Threshold Bank 1	Amplitude ratio O2S > 1.5
P0430	Catalyst System Efficiency Below Threshold Bank 2	Amplitude ratio O2S > 1.5
P0441	Evaporative Emission System Incorrect Purge Flow	<ul style="list-style-type: none"> • Deviation HO2S control < 4% • Purge valve quality < 0.05 [-]
P0442	EVAP System Leak Detected LDP (Small Leak)	Time for pressure drop < 1.06 - 1.3 Sec.
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal current < 0.8mA
P0445	Evaporative Emission System Purge Control Valve Short to Ground	<ul style="list-style-type: none"> • Signal voltage < 2.0 V or • Signal current > 5.0 A
P0450	Evaporative Emission System Pressure Sensor/Switch	<ul style="list-style-type: none"> • Signal Voltage 2.9 to 3.2 V or • Signal Current 0.8 to 4 mA
P0451	Evaporative Emission System Pressure Sensor/Switch Range/Performance	NVLD Pressure Sensor / Switch = Closed

DTC	Error Message	Malfunction Criteria and Threshold Value
P0452	Fuel Tank Leak Detection System (NVLD) Short to Battery Voltage	Signal Voltage > 3.0 V
P0453	Evaporative Emission System Pressure Sensor/Switch	<ul style="list-style-type: none"> • Signal Current 1 to 2 A or • Signal Voltage 2 V
P0455	EVAP System Leak Detected LDP (Large Leak Detected)	Time for pressure drop < 0.65 - 0.7 s.
P0456	EVAP System Leak Detected NVLD (very small leak)	NVLD switch position open
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage < 2.15 - 3.25 V
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.20 A
P0491	Secondary Air Injection System Insufficient Flow Bank 1	Diference between reference AIR mass flow and calculated AIR mass flow > 18 to 21 [kg/h]
P0492	Secondary Air Injection System Insufficient Flow Bank 2	Diference between reference AIR mass flow and calculated AIR mass flow > 18 to 21 [kg/h]

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor "A" Range/Performance	Communication check • Sensor signal failure
P0502	Vehicle Speed Sensor "A" Circuit Low	Communication check • Sensor signal failure
P0503	Vehicle Speed Sensor Range/Performance	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

DTC	Error Message	Malfunction Criteria and Threshold Value
P050A	Cold Start Idle Air Control System Performance	<ul style="list-style-type: none"> • Out of range low • Engine speed deviation < 80 - 250 RPM • Out of range high • Engine speed deviation > 80 - 250 RPM
P050B	Cold Start Ignition Timing Performance	Idle difference between commanded spark timing vs. actual value > 20%
P052A	Cold Start "A" Camshaft Position Timing Over-Advanced Bank 1	<ul style="list-style-type: none"> • Adjustment angle difference > 10° CA • Number of checks 2
P052C	Cold Start "A" Camshaft Position Timing Over-Advanced Bank 2	<ul style="list-style-type: none"> • Adjustment angle difference > 10° CA • Number of checks 2
P053F	Cold Start Fuel Pressure Performance	Target pressure-actual pressure > 1.5 MPa

Control Module and Output Signals

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

DTC	Error Message	Malfunction Criteria and Threshold Value
P0638	Throttle Actuator Control Range/Performance Bank 1	Functional check:close movement <ul style="list-style-type: none"> • Open to 15° > 1.275 s • Then close to ref. point > 1.28 s • Gradient < 7° per second Functional check open movement <ul style="list-style-type: none"> • Close to 1.99° > 1.275 s • Then open to ref. point > 1.28 s • Gradient < 7° per second Signal range check at mechanical stop low <ul style="list-style-type: none"> • TPS 1 signal voltage out-off range 0.208 - 0.852 V or <ul style="list-style-type: none"> • TPS 2 signal voltage out off range 4.158 - 4.802 V
P0641	Sensor Reference Voltage A Circuit/Open	Signal voltage deviation > ± 0.3 V
P0642	Sensor Reference Voltage A Circuit Low	Signal voltage < 4.62 V
P0643	Sensor Reference Voltage A Circuit High	5V supply voltage > 5.44 V
P0651	Sensor Reference Voltage B Circuit/Open	Signal voltage deviation > ± 0.3 V
P0652	Sensor Reference Voltage B Circuit Low	Signal voltage < 4.62 V
P0653	Sensor Reference Voltage B Circuit High	5V supply voltage > 5.44 V
P0657	Actuator Supply Voltage A Circuit/Open	Signal voltage, < 2.9 to 3.2 V
P0658	Actuator Supply Voltage A Circuit Low	Signal voltage, < 1.95 to 2.2 V
P0659	Actuator Supply Voltage "A" Circuit High	Signal current > 1.2 A
P0685	ECM/PCM Power Relay Control Circuit/Open	<ul style="list-style-type: none"> • Signal voltage 2.6 - 3.7 V • Sense circuit voltage > 6 V
P0686	ECM/PCM Power Relay Control Circuit Low	Sense circuit voltage, > 6.0 V
P0687	ECM/PCM Power Relay Control Circuit High	Sense circuit voltage, < 5.0 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0688	ECM/PCM Power Relay Sense Circuit	<ul style="list-style-type: none"> • Sense voltage < 3.0 V • Difference sense circuit voltage with camshaft actuator commanded off and on > 2.5 V • Battery voltage > 3 V
P0697	Sensor Reference Voltage C Circuit/Open	Signal voltage deviation > \pm 0.3 V
P0698	Sensor Reference Voltage C Circuit Low	Signal voltage < 4.6 - 5.0 V
P0699	Sensor Reference Voltage C Circuit High	5V supply voltage > 4.99 - 5.41 V
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"> • Failure of all CAN engine messages, time out > 490 mSec. • Failure of all CAN engine messages, but not all CAN messages, time out > 1010 mSec.
U0101	Lost Communication with TCM	No message received from TCM
U0121	CAN ABS Brake Unit	No CAN communication with TCU, time-out
U0140	CAN communication with BCM 1	CAN message no message
U0146	CAN Gateway A	CAN communication with gateway, implausible message
U0155	Communication with ICL	No CAN communication with ICL, time-out
U0302	Software Incompatibility with Transmission Control Module	MT vehicle ECM coded as AT vehicle
U0322	Communication with Body Control Module	Ambient temperature value (moduel not encoded for ambient temperature sensor) FDh -
U0323	CAN: Instrument cluster Audi only	Ambient temperature 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"> • Implausible message

DTC	Error Message	Malfunction Criteria and Threshold Value
U0404	Invalid Data Received From Gear Shift Control Module	<ul style="list-style-type: none"> • If the value of message counter is permanent, constant, or change exceeds a threshold, increment an event counter • Maximum change of message counter > 5
U0415	CAN Link to Speed Sensor Only S4	<ul style="list-style-type: none"> • Out of range: receiving fault value 203.5 mph • Out of range: receiving fault value > 202.81 mph • Out of range: receiving fault value < 1.24 mph
U0415	CAN: Vehicle Speed Sensor	<ul style="list-style-type: none"> • Out of range: receiving fault value 407.22 mph • Out of range: receiving fault value > 202.81 mph • Out of range: receiving fault value < 1.24 mph
U0422	CAN: Instrument Cluster	Ambient temperature value initialization, Audi 01 h
U0423	Communication with ICL	Invalid data received from ICL implausible message
U0447	Lost Communication With Gateway "B"	Received data from Gateway implausible message
U1103	Vehicle in Production Mode	Production mode = active

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	

DTC	Error Message	Malfunction Criteria and Threshold Value
P0710	Transmission Fluid Temperature Sensor "A" Circuit	Sensor short circuit: <ul style="list-style-type: none"> U_sensor (+), and U_sensor (-) diagnosis by ASIC
P0711	Transmission Fluid Temperature Sensor "A" Circuit Range/Performance	Discontinual temperature: <ul style="list-style-type: none"> ATF temperature delta T between 2 measurements, > 20° C Sensor stuck: <ul style="list-style-type: none"> Comparison ATF vs. chip temperature, ATF temp. must follow chip temp. in certain ranges, 25-40° C
P0712	Transmission Fluid Temperature Sensor "A" Circuit Low	Circuit low: <ul style="list-style-type: none"> U_sensor (+), and U_sensor (-) diagnosis by ASIC
P0713	Transmission Fluid Temperature Sensor "A" Circuit High	Circuit high: <ul style="list-style-type: none"> U_sensor (+), and U_sensor (-) diagnosis by ASIC
P0714	Transmission Fluid Temperature Sensor "A" Circuit Intermittent	Circuit high: <ul style="list-style-type: none"> U_sensor (+), and U_sensor (-) diagnosis by ASIC
P0716	Input/Turbine Speed Sensor "A" Circuit Range/Performance	Signal higher or lower than threshold <ul style="list-style-type: none"> Higher, > + 8000 RPM Lower, < 20 RPM
P0717	Output Speed Sensor Circuit Range/Performance	Hardware detection
P0721	Output Speed Sensor Circuit Range/Performance	<ul style="list-style-type: none"> Signal > threshold, > 10000 RPM Difference between last and actual value > threshold, -1000 RPM Difference to wheel speeds, > 500 RPM and input speed, > 200 RPM
P0722	Output Speed Sensor Circuit No Signal	Hardware detection
P0727	Engine Speed Input Circuit No Signal	CAN message signal error flag, =1
P0741	Torque Converter Clutch Circuit Performance or Stuck Off	Rate of (setting of nominal value) - actual value, > 50 RPM

DTC	Error Message	Malfunction Criteria and Threshold Value
P0746	Pressure Control Solenoid "A" Performance or Stuck Off	PWM hardware detection, 0 or 100%
P0747	Pressure Control Solenoid "A" Stuck On	PWM hardware detection, 0 or 100%
P0748	Pressure Control Solenoid "A" Electrical	<ul style="list-style-type: none"> • Current higher or lower than threshold, > 220 mA • EDS output voltage at short to ground or open circuit ~ 0.5 V smaller than EDS supply voltage • Static leakage current flow
P0751	Shift Solenoid "A" Performance or Stuck Off	<ul style="list-style-type: none"> • If PWM = 0%, diagnosis by ASIC • If $0\% \leq \text{PWM}$, 7.6% voltage return lead (low), < 0.75 V • If $7.6\% \leq \text{PWM}$, 92.4% voltage return lead (high), < 0.75 V • If $7.6\% \leq \text{PWM}$, 92.4% voltage return lead (low), < 0.75 V
P0752	Shift Solenoid "A" Stuck On	<ul style="list-style-type: none"> • If PWM = 100%, diagnosis by ASIC • If $7.6\% \leq \text{PWM} \leq 100\%$ voltage return lead (high), >0.3 V
P0754	Shift Solenoid "A" Intermittent	<ul style="list-style-type: none"> • If PWM = 0%, diagnosis by ASIC • If $0\% \leq \text{PWM}$, 7.6% voltage return lead (low), < 0.75 V • If $7.6\% \leq \text{PWM}$, 92.4% voltage return lead (high), < 0.75 V • If $7.6\% \leq \text{PWM}$, 92.4% voltage return lead (low), < 0.75 V
P0776	Pressure Control Solenoid "B" Performance or Stuck Off	PWM hardware detection, 0 or 100%
P0777	Pressure Control Solenoid "B" Stuck On	PWM hardware detection, 0 or 100%
P0778	Pressure Control Solenoid "B" Electrical	<ul style="list-style-type: none"> • Current higher or lower than threshold, < 730 mA • EDS output voltage at short to ground or open circuit ~ 0.5 V smaller than EDS • Static leakage current flow

DTC	Error Message	Malfunction Criteria and Threshold Value
P0796	Pressure Control Solenoid "C" Performance or Stuck Off	PWM hardware detection, 0 or 100%
P0797	Pressure Control Solenoid "C" Stuck On	PWM hardware detection, 0 or 100%
P0798	Pressure Control Solenoid "C" Electrical	<ul style="list-style-type: none"> • Current higher or lower than threshold, >220 mA • EDS output voltage at short to ground or open circuit ~ 0.5 V smaller than EDS supply voltage • Static leakage current flow
P0889	TCM Power Relay Circuit Range / Performance	FET drive, not possible
P0890	TCM Power Relay Circuit Low	<ul style="list-style-type: none"> • Solenoid power supply voltage, < 1.4 V • Drop voltage over high side FET, > 1 V
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"> • Current higher or lower than threshold, < 730 mA • EDS output voltage at short to ground or open circuit ~ 0.5 V smaller than EDS supply voltage • Static leakage current flow
P2723	Pressure Control Solenoid "E" Performance or Stuck off	PWM hardware detection, 0 or 100%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2725	Pressure Control Solenoid "E" Electrical	<ul style="list-style-type: none"> • Current higher or lower than threshold, < 730 mA • EDS output voltage at short to ground or open circuit ~ 0.5 V smaller than EDS supply voltage • Static leakage current flow
P2732	Pressure Control Solenoid "F" Performance or Stuck Off	PWM hardware detection, 0 or 100%
P2733	Pressure Control Solenoid "F" Stuck On	PWM hardware detection, 0 or 100%
P2734	Pressure Control Solenoid "F" Electrical	<ul style="list-style-type: none"> • EDS output voltage at short to ground or open circuit ~ 0.5 V smaller than EDS supply voltage • Static leakage current flow
P2735	Pressure Control Solenoid "F" Intermittent	PWM hardware detection, 0 or 100%

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P10A0	Actuation Regulating Flap for Intake Air Electrical Error	<ul style="list-style-type: none"> • Duty cycle > 95 [%] and/or duty cycle < -95 [%] • Duty cycle > 0.3 s at > 98%
P10A4	Regulating Flap for Intake Air Mechanical Malfunction	<ul style="list-style-type: none"> • Difference Adapted value vs. actual value > 6.5 [%] • Absolute value of maximum deviation between predicted and real value: > 8% • Adaptive value < 60 [%] and/or adaptive value > 88 [%]
P10A5	Potentiometer Regulating Flap for Intake Air Signal Too High	Signal voltage > 4.9 V
P10A6	Potentiometer Regulating Flap for Intake Air Signal Too Low	Signal voltage < 0.1 V
P10A7	Adaptation Regulating Flap for Intake Air Soiled	Difference actual signal voltage to learned signal voltage > 0.05 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P10A8	Adaptation Regulating Flap for Intake Air Lower Limit Not Reached	RFP Signal Voltage in closed position $\leq 0.35 \text{ V} \geq 0.65 \text{ V}$
P1114	Internal Resistance Too Large (Bank 1, Sensor 2)	Heater resistance, (128-648)*(8-40)1.02-25.9 k Ω (dep. on mod. exhaust temp. and heater power)
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	<ul style="list-style-type: none"> • Deviation fuel rail pressure control $> 0.060 \text{ g/Rev}$ and • Deviation HO2S control $< 22.5\%$
P12A2	Fuel Rail Pressure Sensor Inappropriately High	<ul style="list-style-type: none"> • Deviation fuel rail pressure control $< 0.051 \text{ g/Rev}$ and • Deviation HO2S control $> 30\%$
P12A4	Fuel Rail Pressure Metering Valve Function Check Valve Stuck Closed	<ul style="list-style-type: none"> • Deviation fuel rail pressure control $< - 0.120 \text{ g/rev}$ • Lambda controller output (no map, just bottom and top limit) $-15 - 15 \%$ • Actual pressure - target pressure $>3.5 \text{ MPa}$ • Lambda controller output (no map, just bottom and top limit) $-15 - 15 \%$
P13EA	Cold Start Ignition Timing Performance Off Idle	Part Load Difference between commanded spark timing vs. actual value $> 15\%$
P150A	Engine Off Timer Performance	<ul style="list-style-type: none"> • Difference between engine-off-time $< -12 \text{ s.}$ and • ECM after run-time $> 12 \text{ s}$
P169A	Loading Mode Active	Transport mode active
P2101	Throttle Actuator "A" Control Motor Circuit Range/ Performance	<ul style="list-style-type: none"> • Duty cycle $> 0.4 \text{ s}$ at $> 98\%$ • Actual TPS reference point $> 1.5^\circ$ • Actual TPS calc value $> 0.4 \text{ s}$ at $> 8^\circ$
P2106	Throttle Actuator Control System - Forced Limited Power	ECM power stage = failure

DTC	Error Message	Malfunction Criteria and Threshold Value
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low	Signal voltage < 0.4 V
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High	Signal voltage > 4.82 V
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low	Signal voltage < 0.2 V
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High	Signal voltage > 2.8 V
P2138	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation	Signal voltage sensor 1 vs 2, > 0.24 V
P2147	Fuel Injector Group "A" Supply Voltage Circuit Low	Signal current > 12 A
P2148	Fuel Injector Group "A" Supply Voltage Circuit High	Signal current > 33 A
P2150	Fuel Injector Group "B" Supply Voltage Circuit Low	Signal current > 12 A
P2151	Fuel Injector Group "B" Supply Voltage Circuit High	Signal current > 33 A
P2153	Fuel Injector Group "C" Supply Voltage Circuit Low	Signal current > 12 A
P2154	Fuel Injector Group "C" Supply Voltage Circuit High	Signal current > 33 A
P2181	Cooling System Performance	<ul style="list-style-type: none"> • ECT < 75° C • Mass air integral 3.5 - 26.0 kg
P2195	HO2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 1	HO2S value > 1.1 [-]
P2196	HO2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 1	HO2S value < 0.9 [-]
P2197	HO2 Sensor Signal Biased/ Stuck Lean Bank 2 Sensor 1	HO2S value > 1.1 [-]
P2198	HO2 Sensor Signal Biased/ Stuck Rich Bank 2 Sensor 1	HO2S value < 0.9 [-]
P219C	Cylinder 1 Air-Fuel Ratio Imbalance	<ul style="list-style-type: none"> • Adaptive value < -10% or • > 10%
P219D	Cylinder 2 Air-Fuel Ratio Imbalance	<ul style="list-style-type: none"> • Adaptive value < -10% or • > 10%

DTC	Error Message	Malfunction Criteria and Threshold Value
P219E	Cylinder 3 Air-Fuel Ratio Imbalance	<ul style="list-style-type: none"> • Adaptive value < -10% or • > 10%
P219F	Cylinder 4 Air-Fuel Ratio Imbalance	<ul style="list-style-type: none"> • Adaptive value < -10% or • > 10%
P21A0	Cylinder 5 Air-Fuel Ratio Imbalance	<ul style="list-style-type: none"> • Adaptive value < -10% or • > 10%
P21A1	Cylinder 6 Air-Fuel Ratio Imbalance	<ul style="list-style-type: none"> • Adaptive value < -10% or • > 10%
P2227	Turbocharger/Supercharger Boost Sensor A Plausibility check.	Pressure difference in cross-check between boost press. sensor 1/2; IM pressure ambient pressure >7 kPa
P2237	HO2 Sensor Positive Current Control Circuit Open Bank 1, Sensor 1	<ul style="list-style-type: none"> • Signal activity check-failed • Open Circuit pump Current (IP)
P2240	HO2 Sensor Positive Current Control Circuit Open Bank 2, Sensor 1	<ul style="list-style-type: none"> • Signal activity check-failed • Open Circuit pump Current (IP)
P2243	HO2 Sensor Reference Voltage Circuit/Open Bank 1 Sensor 1	<ul style="list-style-type: none"> • Signal activity check-failed • Open Circuit Nernst Voltage (UN)
P2247	HO2 Sensor Reference Voltage Circuit/Open Bank 2 Sensor 1	<ul style="list-style-type: none"> • Signal activity check-failed • Open Circuit Nernst Voltage (UN)
P2251	HO2 Sensor Negative Current Control Circuit Open Bank 1, Sensor 1	<ul style="list-style-type: none"> • Signal activity check-failed • Open Circuit Virtual Mass (VM)
P2254	HO2 Sensor Negative Current Control Circuit Open Bank 2, Sensor 1	<ul style="list-style-type: none"> • Signal activity check-failed • Open Circuit Virtual Mass (VM)
P2257	Secondary Air Injection System Control "A" Circuit Low	Signal voltage < 2.00 V
P2258	Secondary Air Injection System Control "A" Circuit High	Signal current > 3 A
P2270	HO2 Sensor Signal Biased/Stuck Lean Bank 1 Sensor 2	<ul style="list-style-type: none"> • Signal voltage < 0.750 V • Number of checks ≥ 2

DTC	Error Message	Malfunction Criteria and Threshold Value
P2271	HO2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 2	<ul style="list-style-type: none"> • Signal voltage > 0.15 V • Number of checks ≥ 2
P2272	HO2 Sensor Signal Biased/ Stuck Lean Bank 2 Sensor 2	<ul style="list-style-type: none"> • Signal voltage < 0.750 V • Number of checks ≥ 2
P2273	HO2 Sensor Signal Biased/ Stuck Rich Bank 2 Sensor 2	<ul style="list-style-type: none"> • Signal voltage > 0.15 V • Number of checks ≥ 2
P2293	Fuel Pressure Regulator 2 Performance	<ul style="list-style-type: none"> • Difference between target pressure vs. actual pressure: > 1.50 mPa • Difference between target pressure vs. actual pressure, < -1.50 mPa
P2294	Fuel Pressure Regulator 2 Control Circuit Open 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
P2414	HO2 Sensor Exhaust Sample Error Bank 1, Sensor 1	O2S signal front > 3.1 V
P2415	HO2 Sensor Exhaust Sample Error Bank 2, Sensor 1	O2S signal front > 3.1 V
P2440	Secondary Air Injection System Switching Valve Stuck Open Bank 1	Deviation of lambda controller > 15.00%
P2442	Secondary Air Injection System Switching Valve Stuck Open Bank 2	Deviation of lambda controller > 15.00%
P2539	Low Pressure Fuel System Sensor Circuit	Signal voltage > 4.8 V
P2541	Low Pressure Fuel System Sensor Circuit Low	Signal voltage < 0.2 V
P2626	HO2 Sensor Pumping Current Trim Circuit Open Bank 1 Sensor 1	<ul style="list-style-type: none"> • O2S signal front > 4.7 V • Open Circuit Adjustment Voltage (IA)
P2629	HO2 Sensor Pumping Current Trim Circuit Open Bank 2 Sensor 1	<ul style="list-style-type: none"> • O2S signal front > 4.7 V • Open Circuit Adjustment Voltage (IA)

DTC CHART

Engine Code CPNB

Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
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	<ul style="list-style-type: none"> Diagnostic signal from power stage > 8 - 18 A
P0048	Turbocharger Boost Control Solenoid Circuit High	<ul style="list-style-type: none"> Turbocharger boost control solenoid circuit high
P0071	Ambient Air Temperature Sensor Circuit Range/Performance	<ul style="list-style-type: none"> Temperature difference to ECT, ECT > 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	<ul style="list-style-type: none"> 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	Max 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
P0092	Turbocharger Boost Pressure Actuator Control Functional Check	Signal current > 3.0 A
P00AF	Crankshaft Position - Camshaft Position Correlation Intake (Bank 1 Bank 2)	Stuck open <ul style="list-style-type: none"> Control deviation > 8.00 [%] or Control deviation < -8.00 [%] Actual position ≤ 30.00 [%]

DTC	Error Message	Malfunction Criteria and Threshold Value
P00C6	Fuel Rail Pressure System	Fuel rail, high pressure value < 12000 - 23000 kPa
P0101	Mass Air Flow Circuit Range/ Performance	Ratio of modeled and measured air mass flow > 1.15 or < 0.85
P0102	HO2S Heater Control Circuit Low (Bank 1, Sensor 1) Short to Ground	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"> • Temperature difference to ECT, ECT 2 > 35 °K • Temperature difference to FTS > 40 °K • Temperature difference to T1 > 45 °K
P0112	Intake Air Temperature Circuit Low Input	Signal voltage < 162 mV
P0113	Intake Air Temperature Circuit High Input	Signal voltage > 3255 mV
P0116	Engine Coolant Temperature Sensor @1 Circuit Range/ Performance	<ul style="list-style-type: none"> • ECT increase < f(ECT @ start) °K and • Engine running time > f(ECT @ start) Sec. or <ul style="list-style-type: none"> • Temperature difference to ECT 2 > 30 °K • Temperature difference to T2, FTS > 35 °K • Temperature difference to T1 > 40 °K
P0117	Engine Coolant Temperature Sensor 1 Circuit low	Signal voltage < 162 mV
P0118	Engine Coolant Temperature Sensor 1 Circuit High	Signal voltage > 3255 mV
P0121	Throttle Position Sensor Circuit Performance	Position sensor signal > 1 V or 0.15 to 0.30 V
P0122	Throttle Position Sensor Circuit Low Input	Position sensor signal < 0.15 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0123	Throttle Position Sensor Circuit High Input	Position sensor signal < 0.15 V
P0128	Engine Coolant Temperature Sensor Rationality Check	ECT @ cylinder head < 66 [°C]
P0130	O2 Sensor Circuit Bank 1 Sensor 1 Malfunction	Short to Battery Voltage: <ul style="list-style-type: none"> • Virtual Mass (VM) > 3.0 V • Nernst voltage (UN) > 4.0 V • Adjustment Voltage IA/IP > 1.5 V Shorted to Ground: <ul style="list-style-type: none"> • Virtual Mass (VM) < 2.0 V • Nernst voltage (UN) < 1.75 V • Adjustment IA/IP < 0.3 V
P0132	O2 Sensor Circuit Bank 1 Sensor 1 High Voltage	O2 signal > 3.2 V
P0133	O2 Sensor Circuit Bank 1 Sensor 1 Slow Response	Time to reach 60% oxygen > 4 Sec.
P0134	O2 Sensor Heated Circuit, Bank 1, Sensor 1 No Activity Detected / Feedback Check	<ul style="list-style-type: none"> • Integrated oxygen sensor temperature > 330000 - 1117476 K • Oxygen sensor heating = not active
P0135	O2 Sensor Heater Circuit Bank 1 Sensor 1 Malfunction	<ul style="list-style-type: none"> • Sensor element temperature < 720 or > 840 °C • Power stage active and signal current = -100 to 10000 uA • Power stage not active and signal current = -1000 to -350 uA • Power stage not active and signal current = -100 to 100 uA
P016A	Fuel Trim, Feedback Check	Control Intervention = 0 %
P0171	Fuel Trim, System Lean	Fuel Mass Correction Value = < -0.01 [g/rev]
P0172	Fuel Trim, System Rich	Fuel Mass Correction Value = > 0.01 [g/rev]

DTC	Error Message	Malfunction Criteria and Threshold Value
P0181	Fuel Temperature Sensor Circuit Range/Performance	<ul style="list-style-type: none"> • Number of Dected Faults $\geq 6.00[-]$ Cross checks for fault detection: <ul style="list-style-type: none"> • FTS vs. ECT @ cylinder head $> 35\text{ K}$ • FTS vs. IAT $> 35\text{K}$ • FTS vs. EOT $> 35\text{ K}$ • FTS vs. AAT $> 35\text{K}$ • FTS vs. ECT @ radiator outlet $> 35\text{ K}$ • FTS vs. ECT @ cylinder block $> 35\text{ K}$ • FTS vs. TEGR $> 35\text{ K}$
P0182	Fuel Temperature Sensor Circuit Grounded	Signal Voltage $< 0.10\text{ V}$
P0183	Fuel Temperature Sensor Circuit Shorted to Battery Voltage / Open	Signal Voltage $> 4.9\text{ V}$
P0191	Fuel Rail Pressure Sensor Circuit Range/Performance	Signal voltage $< 0.428\text{ V}$ or $> 0.613\text{ V}$
P0192	Fuel Rail Pressure Sensor Circuit Low Input	Signal voltage $< 0.2\text{ V}$
P0193	Fuel Rail Pressure Sensor Circuit High Input	Signal voltage $> 4.8\text{ V}$
P01BA	Engine Oil Temperature Sensor 2 Performance	<ul style="list-style-type: none"> • EOT cross checks for fault detection: ≥ 6 detected faults • EOT vs. ECT 3, IAT, FTS, AAT or ECT 2 $> 30\text{ Kelvin}$
P01BB	Engine Oil Temperature Sensor 2 Circuit Low	Signal voltage $< 0.20\text{ V}$ for $\geq 5\text{ Sec.}$
P01BC	Engine Oil Temperature Sensor 2 Circuit Intermittent/ Erratic	Signal voltage $> 4.85\text{ V}$ for $\geq 5\text{ Sec.}$
P01BD	Engine Oil Temperature Sensor 2 Circuit Intermittent/ Erratic	<ul style="list-style-type: none"> • Oil temperature increase $< 3.0\text{ K}$ • Oil temperature $< 66\text{ }^\circ\text{C}$ • Evaluation timer $> 59 - 251\text{ s}$
P01E3	Engine Temperature Control Sensor Circuit Shorted to Battery Voltage	Signal voltage $> 4.92\text{ V}$
P01E4	Engine Temperature Control Sensor Circuit Range/ Performance	ETC vs IAT or AAT or FTS at start up $> 35\text{ K}$

DTC	Error Message	Malfunction Criteria and Threshold Value
P01E5	Engine Temperature Control Sensor Circuit Grounded	Signal voltage < 0.22 V
P0201	Cylinder 1 Injector Circuit Malfunction	<ul style="list-style-type: none"> • Open circuit signal voltage > 60 V • Short to battery voltage (low side) signal voltage = failure • Short circuit over load signal voltage > 30 v Short circuit low side: <ul style="list-style-type: none"> • Deviation between set and actual signal voltage after charging, Injector voltage > 30% of nominal voltage • Deviation between set and actual signal voltage before charging, Injector voltage > 45% of nominal voltage
P0202	Cylinder 2 Injector Circuit Malfunction	<ul style="list-style-type: none"> • Open circuit signal voltage > 60 V • Short to battery voltage (low side) signal voltage = failure • Short circuit over load signal voltage > 30 V Short circuit low side: <ul style="list-style-type: none"> • Deviation between set and actual signal voltage after charging, Injector voltage > 30% of nominal voltage • Deviation between set and actual signal voltage before charging, Injector voltage > 45% of nominal voltage

DTC	Error Message	Malfunction Criteria and Threshold Value
P0203	Cylinder 3 Injector Circuit Malfunction	<ul style="list-style-type: none"> • Open circuit signal voltage > 60 V • Short to battery voltage (low side) signal voltage = failure • Short circuit over load signal voltage > 30 V Short circuit low side: <ul style="list-style-type: none"> • Deviation between set and actual signal voltage after charging, Injector voltage > 30% of nominal voltage • Deviation between set and actual signal voltage before charging, Injector voltage > 45% of nominal voltage
P0204	Cylinder 4 Injector Circuit	<ul style="list-style-type: none"> • Open circuit signal voltage > 60 V • Short to battery voltage (low side) signal voltage = failure • Short circuit over load signal voltage > 30 V Short circuit low side: <ul style="list-style-type: none"> • Deviation between set and actual signal voltage after charging, Injector voltage > 30% of nominal voltage • Deviation between set and actual signal voltage before charging, Injector voltage > 45% of nominal voltage
P0205	Cylinder 5 Injector Circuit	<ul style="list-style-type: none"> • Open circuit signal voltage > 60 V • Short to battery voltage (low side) signal voltage = failure • Short circuit over load signal voltage > 30 V Short circuit low side: <ul style="list-style-type: none"> • Deviation between set and actual signal voltage after charging, Injector voltage > 30% of nominal voltage • Deviation between set and actual signal voltage before charging, Injector voltage > 45% of nominal voltage

DTC	Error Message	Malfunction Criteria and Threshold Value
P0206	Cylinder 6 Injector Circuit	<ul style="list-style-type: none"> • Open circuit signal voltage > 60 V • Short to battery voltage (low side) signal voltage = failure • Short circuit over load signal voltage > 30 V Short circuit low side: <ul style="list-style-type: none"> • Deviation between set and actual signal voltage after charging, Injector voltage > 30% of nominal voltage • Deviation between set and actual signal voltage before charging, Injector voltage > 45% of nominal voltage
P0234	Turbo Charger Overboost Condition Limit Exceeded	Control deviation < -22 kPa
P0236	Turbocharger Boost Pressure Sensor Circuit Performance	Absolute value of pressure difference > 14 kPa
P0237	Turbocharger Boost Pressure Sensor Circuit Low Input	Sensor voltage < 0.40 V
P0238	Turbocharger Boost Pressure Sensor Circuit High Input	Sensor voltage > 4.90 V
P026A	Charge Air Cooler Below Efficiency	Filtered chare 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"> • Diagnostic signal from power stage = Failure • Adaptive Value Limit High > 213 - 412 [µs] • Adaptive Value Limit Low < 213 - 412 [µs]
P0269	Cylinder 3 Contribution / Balance Internal Check	<ul style="list-style-type: none"> • Diagnostic signal from power stage = Failure • Adaptive Value Limit High > 213 - 412 [µs] • Adaptive Value Limit Low < 213 - 412 [µs]

DTC	Error Message	Malfunction Criteria and Threshold Value
P0272	Cylinder 4 Contribution / Balance Internal Check	<ul style="list-style-type: none"> • Diagnostic signal from power stage = Failure • Adaptive Value Limit High > 213 - 412 [μs] • Adaptive Value Limit Low < 213 - 412 [μs]
P0275	Cylinder 5 Contribution / Balance Internal Check	<ul style="list-style-type: none"> • Diagnostic signal from power stage = Failure • Adaptive Value Limit High > 213 - 412 [μs] • Adaptive Value Limit Low < 213 - 412 [μs]
P0278	Cylinder 6 Contribution / Balance Internal Check	<ul style="list-style-type: none"> • Diagnostic signal from power stage = Failure • Adaptive Value Limit High > 213 - 412 [μs] • Adaptive Value Limit Low < 213 - 412 [μs]
P0299	Turbo Boost Pressure Control rationality check High	<ul style="list-style-type: none"> • Differential set value boost pressure vs. actual boost pressure value: depending on ECT > 30 - 100 [kPa] • Differential set value boost pressure vs. actual boost pressure value: depending on engine speed and fuel quantity > 35 - 100 [kPa] • Boost pressure < 0 - 85 [kPa]
P2002	Particulate Trap Efficiency Below Threshold	<ul style="list-style-type: none"> • Differential pressure < f (volumetric flow rate, soot load) <p>or</p> <ul style="list-style-type: none"> • Differential pressure < f (volumetric flow rate)
P2004	Intake Manifold Runner Control (Bank 1) Stuck Open	<ul style="list-style-type: none"> • Control deviation > 10% • Actual position \leq 40%
P2005	Intake Manifold Runner Control (Bank 2) Stuck Open	<ul style="list-style-type: none"> • Control deviation > 10% • Actual position \leq 40%
P2006	Intake Manifold Runner Control (Bank 1) Stuck Closed	<ul style="list-style-type: none"> • Control deviation > 10% • Actual position \leq 40%
P2007	Intake Manifold Runner Control (Bank 2) Stuck Closed	<ul style="list-style-type: none"> • Control deviation > 10% • Actual position \leq 40%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2008	Intake Manifold Runner Control (Bank 1) Stuck Open	<ul style="list-style-type: none"> • Diagnostic signal from power stage > 0.8 V (output 1) and < 2 V (output 2) or • Diagnostic signal from power stage = 8 to 18 A or • Diagnostic signal from power stage > 5 V or < 3.4 V
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"> • Diagnostic signal from power stage > 0.8 V (output 1) and < 2 V (output 2) or • Diagnostic signal from power stage = 8 to 18 A or • Diagnostic signal from power stage > 5 V or < 3.4 V
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
P2015	Intake Manifold Runner Position Sensor Circuit Range/Performance	<ul style="list-style-type: none"> • Position sensor signal < 3550 mV • Position sensor signal > 1450 mV or • Position sensor signal > 550 mV and < 250 mV or • Position sensor signal > 4450 mV and < 4750 mV
P2016	Intake Manifold Runner Position Sensor Circuit Low	Position sensor signal ≤ 250 mV
P2017	Intake Manifold Runner Position Sensor Circuit High	Position sensor signal ≥ 4750 mV
P202A	Reducing Agent Tank Heater Control Circuit/Open	Conductance @ start of heating ≤ 0.10 1/Ohm

DTC	Error Message	Malfunction Criteria and Threshold Value
P202B	Reducing Agent Tank Heater Control Circuit Low	Conductance @ start of heating < 0.20 Ohm
P202C	Reducing Agent Tank Heater Control Circuit High	Conductance @ start of heating > 1 Ohm
P2020	Intake Manifold Runner Position Sensor Circuit (Bank 2) Range/Performance	<ul style="list-style-type: none"> • Position sensor signal < 3550 mV • Position sensor signal > 1450 mV or <ul style="list-style-type: none"> • Position sensor signal > 550 mV and < 250 mV or <ul style="list-style-type: none"> • Position sensor signal > 4450 mV and < 4750 mV
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
P203B	Reducing Agent Level Sensor Circuit Range / Performance	<ul style="list-style-type: none"> • Signal voltage not equal full level < 1.76 V or > 2.02 V or <ul style="list-style-type: none"> • Signal voltage not equal half full level, 2.03 V or > 2.31 V or <ul style="list-style-type: none"> • Signal voltage not equal empty level < 1.32 V or > 1.53 V or <ul style="list-style-type: none"> • Signal voltage not equal SCR values < 0.25 V > 2.35 V
P203C	Reducing Agent Level Sensor Circuit Open or Grounded	Signal Voltage < 0.1 V
P203D	Reducing Agent Level Sensor Circuit Short to Battery Voltage	Signal Voltage > 4.8 V
P2031	Exhaust Gas Temperature Sensor 2 Circuit	Signal voltage > 2.61 V
P2032	Exhaust Gas Temperature Sensor 2 Circuit Low	Signal voltage < 0.68 V
P204A	Reducing Agent Pressure Sensor Circuit Open / Short Ground	Signal voltage < 0.1 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P204B	Reducing Agent Pressure Sensor Circuit Range / Performance	Actual pressure reduction agent delivery system > 50.00 kPa or < 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"> • Signal Voltage < 2.97 V or • Signal Current > 1.6 A
P2049	Reducing Agent Injection Valve Circuit Short to Battery Voltage	<ul style="list-style-type: none"> • Signal Current > 1.8 A or • Analog measure < 200 mA
P205A	Reducing Agent Tank Temperature Sensor Circuit Short to Battery Voltage or Open	Signal voltage > 4.63 V
P205B	Reducing Agent Tank Temperature Sensor Circuit Range/Performance	<p>Case 1:</p> <ul style="list-style-type: none"> • AAT > 25 °C • Difference between reducing agent (AdBlue®) to ECT < -30 °K <p>Case 2:</p> <ul style="list-style-type: none"> • AAT < 25 °C • Difference between reducing agent (AdBlue®) to ECT < -30 °K • Reducing agent temperature increase while heating tank < 1.5 K • For time < 1500.0 s
P205C	Reducing Agent Tank Temperature Sensor Circuit Grounded	Signal voltage < 0.18 V
P207F	Reducing Agent Quality Performance	Average efficiency > 2.50 [-]
P208A	Reducing Agent Pump Control Circuit Open	Signal Voltage > 4.7 V
P208B	Reducing Agent Pump Does Not Rotate At Expected Speeds	<ul style="list-style-type: none"> • Rotation < 400 RPM • > 5 Seconds
P208C	Reducing Agent Pump Control Circuit Grounded	Signal Voltage < 2.74 V

DTC	Error Message	Malfunction Criteria and Threshold Value
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 > 200
P2080	Exhaust Gas Temperature Sensor Circuit Range/Performance	<ul style="list-style-type: none"> • Temperature difference to temp EGR T3, T4, T5, T6 > 40 °K or • Mean value of modeled to measured T4 > 100 °K
P2084	Exhaust Gas Temperature Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> • Temperature difference to temp EGR T3, T4, T5, T6 > 40 °K or • Mean value of modeled to measured T3 > 100 °K
P20BB	Reducing Agent Tank Heater Control Circuit Shorted to Ground	Diagnostic signal from power stage > 14A
P20BC	Reducing Agent Tank Heater Control Circuit Shorted to Battery Voltage	Diagnostic signal from power stage > 1 A
P20BD	Reducing Agent Heater 2 Control Circuit/Open	Diagnostic signal from power stage < 1 A
P20BF	Reducing Agent Heater 2 Control Circuit/Low	Diagnostic signal from power stage < 14 A
P20B5	Reducing Agent Metering Unit Heater Control Circuit/Open	Conductance during heating ≤ 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 < 1A
P20C0	Reducing Agent Heater 2 Control Circuit High	Diagnostic signal from power stage < 1 A
P20EE	SCR NOx Catalyst Efficiency Below Threshold	Difference between calculated and measured efficiency < 0.4[-]

DTC	Error Message	Malfunction Criteria and Threshold Value
P20E8	Reducing Agent Pressure Too Low / Functional check	<ul style="list-style-type: none"> • Actual pressure < 300.00 kPa for 55 s or • Actual pressure < 350.00 kPa for 60 s or • Pressure built up for 21.00[-] Attempts > 450 kPa
P20FE	Reducing Agent Quality Performance	Average Efficiency > 2.50 [-]
P20E9	Reducing Agent Pressure Too High	<ul style="list-style-type: none"> • Actual pressure > 790.00 kPa for 0.0 s or • Actual pressure > 650.00 kPa for 10 s or • Pressure @ Dosing end > 50 kPa
P20FF	Reducing Agent Metering System Control Module -J880- Detects Internal Hardware Defects	Internal fault
P20F4	Reducing Agent Consumption Too High	SCR adaptive value \geq 2.50
P20F5	Reducing Agent Consumption Too Low	SCR adaptive value \leq 0.51
P21CA	Reducing Agent Metering System Control Module -J880- Detects Short Circuit of Heater Supply Voltage to B+	Sensor supply voltage < 1 V
P21CC	Reducing Agent Metering System Control Module -J880- Detects Short Circuit Of Heater Supply Voltage to Ground	Sensor supply voltage > 7 V
P21C7	Reducing Agent Metering System Control Module -J880- Detects Short Circuit to Ground on Main Relay	Supply voltage during activation > 7 V
P21C9	Reducing Agent Metering System Control Module -J880- Detects Short Circuit to B+ on Main Relay	Supply voltage during activation < 1 V

DTC	Error Message	Malfunction Criteria and Threshold Value
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	Pedal Position Sensor D Circuit Low Input	Signal voltage < 0.646 V
P2123	Pedal Position Sensor D Circuit High Input	Signal voltage > 4.889 V
P2127	Pedal Position Sensor E Circuit Low Input	Signal voltage < 0.276 V
P2128	Pedal Position Sensor E Circuit High Input	Signal voltage > 2.644 V
P2138	Pedal Position Sensor D/E Circuit Voltage Correlation	Signal voltage sensor 1 vs. sensor 2 > 143 - 260 mV
P214E	Reducing Agent Metering System Control Module -J880- Internal Temperature Too High	Current Over-Temperature diagnostic signal from output driver • Power stage temperature > 140 °C
P214F	Reducing Agent Metering System Control Module -J880- Internal Pump Temperature Too High	Current Over-Temperature diagnostic signal from output driver • Power stage temperature > 140 °C
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 [K]
P2183	Engine Coolant Temperature Sensor on Radiator Outlet Circuit Cross Check	ECT on radiator outlet vs IAT or AAT or FTS at start up > 35 K
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"> • Measured oxygen concentration @ fuel cutoff > 25.6% or • Measured oxygen concentration @ part load > (calculated) 11%
P2196	2 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	Ox 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 Front Circuit Range / Performance	<ul style="list-style-type: none"> • NOx 40 - 70%, time > 5 Sec. or 40% value not reached within 7 Sec. • Ratio > 3 or < -0.75 • Average NOx Offset value > 50 or < -30 ppm
P2202	NOx Sensor Front Circuit Low	NOx Sensor Front Circuit Low
P2203	NOx Sensor Front Circuit High	NOx value > 1655 ppm
P2209	NOx Sensor Front Rationality Check	NOx control active time since dew point exceeded > 180
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"> • O2S internal resistance > 3 V • Oxygen signal < -1.3 V or > 1.5 V
P2251	O2 Sensor Negative Current Control Circuit Bank 1 Sensor 1 Open	O2S internal resistance voltage > 3 V
P226C	Turbocharger Boost Control "A" Slow Response	Boost difference between target and measured < -6976[J]
P2279	Turbocharger Boost Pressure Intake Air System Leak	Ratio of measured and modeled mass air flow = 0.45 - 0.80[-]

DTC	Error Message	Malfunction Criteria and Threshold Value
P229E	Ox Sensor Rear Circuit Short or Open	<ul style="list-style-type: none"> • Message From NOx Sensor = Failure or • NOx sensor status ratio of validity $\geq 0.5[-]$
P229F	NOx Sensor Rear Circuit Range /Performance	<ul style="list-style-type: none"> • Average NOx Offset Value > 50 ppm • Number of checks = 2[-] or • Average NOx Offset Value < - 30 ppm • Number of checks = 2[-] or • Measured oxygen concentration compared with calculated oxygen concentration deviation @ part load > 5.3%
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	Ox Sensor Rear Rationality Check	NOx control active time since dew point exceeded >180 s

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random Misfire Detected	<ul style="list-style-type: none"> • Rise in engine speed after fuel injection calculated based on values from last two engine revolutions • Error threshold 82% misfire over 440 crankshaft revolutions

DTC	Error Message	Malfunction Criteria and Threshold Value
P0301	Cylinder 1 Misfire Detected	<ul style="list-style-type: none"> • Rise in engine speed after fuel injection calculated based on values from last two engine revolutions • Error threshold 82% misfire over 440 crankshaft revolutions
P0302	Cylinder 2 Misfire Detected	<ul style="list-style-type: none"> • Rise in engine speed after fuel injection calculated based on values from last two engine revolutions • Error threshold 82% misfire over 440 crankshaft revolutions
P0303	Cylinder 3 Misfire Detected	<ul style="list-style-type: none"> • Rise in engine speed after fuel injection calculated based on values from last two engine revolutions • Error threshold 82% misfire over 440 crankshaft revolutions
P0304	Cylinder 4 Misfire Detected	<ul style="list-style-type: none"> • Rise in engine speed after fuel injection calculated based on values from last two engine revolutions • Error threshold 82% misfire over 440 crankshaft revolutions
P0305	Cylinder 5 Misfire Detected	<ul style="list-style-type: none"> • Rise in engine speed after fuel injection calculated based on values from last two engine revolutions • Error threshold 82% misfire over 440 crankshaft revolutions
P0306	Cylinder 6 Misfire Detected	<ul style="list-style-type: none"> • Rise in engine speed after fuel injection calculated based on values from last two engine revolutions • Error threshold 82% misfire over 440 crankshaft revolutions

DTC	Error Message	Malfunction Criteria and Threshold Value
P0321	Engine Speed Input Circuit Range/Performance	<ul style="list-style-type: none"> Counted teeth vs. reference > 200 Monitoring reference gap failure
P0322	Engine Speed Input Circuit No Signal	<ul style="list-style-type: none"> Camshaft signal > 10 Engine speed = no signal

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
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	Measured sensor temperature - mean value of modelled temperature
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"> • Control deviation > 10.00 [%] or • Control deviation < -10.00 [%] or • Actual position ≤17.00 [%] • Control deviation > 10.00 [%] or • Control deviation < -10.00 [%] • Actual position > 17.00 [%] Open circuit: <ul style="list-style-type: none"> • Control deviation < -10.00 [%] Short to ground: <ul style="list-style-type: none"> • Signal current > 8 - 18 [A] Short to battery voltage <ul style="list-style-type: none"> • Signal current > 8 - 18 [A]
P0404	Exhaust Gas Recirculation Control Circuit Range/ Performance	<ul style="list-style-type: none"> • Control deviation > 10% • Actual position > 17%
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 > 1.05 V
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

DTC	Error Message	Malfunction Criteria and Threshold Value
P240F	EGR Slow Response	<ul style="list-style-type: none"> • Calculated characteristically value: Negative gradients of target air mass flow > 35 [-] or <ul style="list-style-type: none"> • Calculated characteristically value: Positive gradients of Target air mass flow \geq 30 [-]
P242A	Exhaust Gas Temperature Sensor Circuit Bank 1 Sensor 3	Signal voltage > 2.61 V
P242B	Exhaust Gas Temperature Sensor Circuit Bank 1 Sensor 3 Range/Performance	<ul style="list-style-type: none"> • Temperature difference to EGR temp, T3, T4, T5, T6 > 40 °K or <ul style="list-style-type: none"> • Mean value of modeled - measured T5 > 100 °K
P242C	Exhaust Gas Temperature Sensor Circuit Low Bank 1 Sensor 3	Signal voltage < 0.68 V
P2425	Exhaust Gas Recirculation Cooling Valve Control Circuit Open	Diagnostic signal from power stage < 2.97 V
P2426	Exhaust Gas Recirculation Cooling Valve Control Circuit Grounded	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"> • Positive difference between measured and target temperature too high = 10.0 - 70.0 [K] or <ul style="list-style-type: none"> • Negative difference between measured and target temperature too low = -12.0 -7.0 [K]
P2452	Diesel Particulate Filter Differential Pressure Sensor Circuit	Sensor voltage > 4.9 V

DTC	Error Message	Malfunction Criteria and Threshold Value
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.
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"> • Temperature difference to EGR temp, T3, T4, T5, T6 > 40 °K or • Mean value of modeled - measured T5 > 100 °K
P2463	Diesel Particulate Filter - Soot Accumulation	Calculated particulate matter trap loading > 40 g
P247A	Exhaust Gas Temperature Out of Range Bank 1 Sensor 3	Control deviation (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"> • Current (IDE) @ measurement 1 < 2 µA • Difference between current (IDE) measurement 1 and 2 or • Signal voltage positive connection (IDE) > 4.7 [V] • Signal voltage positive connection (IDE) < 0.3 [V]
P24AF	PM Sensor Monitoring, Rationality Check	<ul style="list-style-type: none"> • Signal current (IDE) > 5 µA or • Accumulated change in heater voltage < = 0.40 V
P24B1	PM Sensor Circuit Shorted or open	<ul style="list-style-type: none"> • Signal voltage negative connection (IDE) > 4.1 [V] • Signal voltage negative connection (IDE) = 0.0 [V]

DTC	Error Message	Malfunction Criteria and Threshold Value
P24B3	PM Sensor Heater functional check	<ul style="list-style-type: none"> • Heater Coil resistance > 1.06 - 2.31 Ω • Heater Coil resistance < 2.94 - 5.13 Ω
P24B5	PM Sensor Heater Short to Ground	<ul style="list-style-type: none"> • Heating Current < 1.0 A or • Heating Current > 15.0 A
P24B6	PM Sensor Heater Short to Battery Voltage	Heating Current \geq 0.2 A
P24C7	PM Sensor Plausibility Check	Measured sensor temperature - mean value of modelled temperature < - 100 °K
P24D0	PM Sensor Monitoring, Range / Performance Check	<p>Signal range check low: difference between measured PM Sensor supply wire voltage and battery voltage (ECM):</p> <ul style="list-style-type: none"> • Value > 1.90 [V] or • Value > 2.60 [V] or • Value > 3.00 [V] <p>Signal Range Check High: difference between measured battery voltage (ECM) and Sensor supply wire voltage:</p> <ul style="list-style-type: none"> • Value > 3.00 [V] or • Value > 2.10 [V] or • Value > 1.10 [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 Performance	Vehicle speed < 4 km/h
P0502	Vehicle Speed Sensor Circuit Low	Sensor signal failure

DTC	Error Message	Malfunction Criteria and Threshold Value
P0506	Idle Control System RPM Lower than Expected	Control deviation < 10%
P0507	Idle 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

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

DTC	Error Message	Malfunction Criteria and Threshold Value
P06BC	Cylinder 4 Glow Plug Circuit Range/Performance	<ul style="list-style-type: none"> • Glow plug resistance (between 4 - 9 Sec.) < 0.3 ohm • Glow plug resistance (between 9 - 14 Sec.) < 0.4 ohm • Glow plug resistance (after 14 Sec.) < 0.5 ohm • Glow plug resistance anytime > 1.2 ohm
P06BD	Cylinder 5 Glow Plug Circuit Range/Performance	<ul style="list-style-type: none"> • Glow plug resistance (between 4 - 9 Sec.) < 0.3 ohm • Glow plug resistance (between 9 - 14 Sec.) < 0.4 ohm • Glow plug resistance (after 14 Sec.) < 0.5 ohm • Glow plug resistance anytime > 1.2 ohm
P06BE	Cylinder 6 Glow Plug Circuit Range/Performance	<ul style="list-style-type: none"> • Glow plug resistance (between 4 - 9 Sec.) < 0.3 ohm • Glow plug resistance (between 9 - 14 Sec.) < 0.4 ohm • Glow plug resistance (after 14 Sec.) < 0.5 ohm • Glow plug resistance anytime > 1.2 ohm
P06B0	Reducing Agent Metering System Control Module -J880- detects short circuit of supply voltage	Sensor supply voltage < 0.2 >... 5.3 V
P06B9	Cylinder 1 Glow Plug Circuit Range/Performance	<ul style="list-style-type: none"> • Glow plug resistance (between 4 - 9 Sec.) < 0.3 ohm • Glow plug resistance (between 9 - 14 Sec.) < 0.4 ohm • Glow plug resistance (after 14 Sec.) < 0.5 ohm • Glow plug resistance anytime > 1.2 ohm

DTC	Error Message	Malfunction Criteria and Threshold Value
P06E5	Glow Plug Control Module Performance	Calculated ground offset ≥ 1.75 V or ≤ -1.75 V
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"> • ECM internal self test failed • RAM error in memory
P0607	Control Module Performance	<ul style="list-style-type: none"> • Oxygen sensor adaptation > 0.2 V or < -0.2 V • Internal communication failed • Supply voltage for IC < 9 V or • Sensor voltage < 0.265 V or > 3.9 V
P0634	ECM Internal Temperature Too High	<ul style="list-style-type: none"> • Current over-temperature diagnostic signal from output driver • Power stage temperature > 150 °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 ≥ 70 A
P066C	Cylinder 2 Glow Plug Control Circuit Low	Glow current ≥ 70 A
P066E	Cylinder 3 Glow Plug Control Circuit Low	Glow current ≥ 70 A
P067A	Cylinder 4 Glow Plug Control Circuit Low	Glow current ≥ 70 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P067B	Cylinder 4 Glow Plug Control Circuit High	Error message from glow control unit
P067C	Cylinder 5 Glow Plug Control Circuit Low	Glow current ≥ 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 ≥ 70 A
P067F	Cylinder 6 Glow Plug Control Circuit High	Error message from glow control unit
P0671	Cylinder 1 Glow Plug Circuit	Glow current ≤ 2.20 A
P0672	Cylinder 2 Glow Plug Circuit	Glow current ≤ 2.20 A
P0673	Cylinder 3 Glow Plug Circuit	Glow current ≤ 2.20 A
P0674	Cylinder 4 Glow Plug Circuit	Glow current ≤ 2.20 A
P0675	Cylinder 5 Glow Plug Circuit	Glow current ≤ 2.20 A
P0676	Cylinder 6 Glow Plug Circuit	Glow current ≤ 2.20 A
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.
U010E	CAN Communication Error	No Reducing Agent Metering System Control Module -J880-messages received.
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

DTC	Error Message	Malfunction Criteria and Threshold Value
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
U0302	Software Incompatibility with Transmission Control Module	Auto trans messages received from ECM.
U0307	CAN: Instrument cluster only	Error bit = set
U040F	Invalid Data Received From Reducing Agent 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"> • Error bit = set • Implausible data from ABS or • Speed sensor signal = 655.35 km/h
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	Ox 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 2 (Rear) Implausible Signal	Data from NOx sensor 2 module implausible
U10C2	NOx Sensor 2 (Rear) No Communication	No messages from NOx sensor 2 module
U140C	Reducing Agent Control Module Supply Voltage Too Low	Supply voltage < 8.5 V

DTC	Error Message	Malfunction Criteria and Threshold Value
U140D	Reducing Agent Control Module Supply Voltage Too High	Supply voltage > 16.5 V
U140E	Reducing Agent Control Module Function Restriction Due to Insufficient Voltage	Supply voltage < 9 V
U140F	Reducing Agent Control Module Function restriction due to excessive voltage	Supply voltage > 16 V

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P1103	ECM: Production Mode	production mode = Active
P150A	Engine Off Timer Performance	ECM time - IPC time > 12 Sec.

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
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"> • Open circuit Signal voltage < 5 V • Functional voltage = 3.2 - 3.5 V
P261C	Coolant Pump "B" Control Circuit Low	Signal voltage < 3 V
P261D	Coolant Pump "B" Control Circuit High	Signal voltage > 1.8 V
P268A	Fuel Injector Calibration Not Accumulated / 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

DTC	Error Message	Malfunction Criteria and Threshold Value
P3348	Turbocharger Control Module Circuit Malfunction	<ul style="list-style-type: none"> • Diagnostic signal from power stage > 8 - 18 A or • Diagnostic signal from power stage > 5 V or < 3.4 V

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