

A close-up photograph of a car's headlight with a silver 'FSI' badge mounted on the front edge.

FSI or TSI?

The differences explained.

A close-up photograph of a car's grille with a silver 'TSI' badge mounted on it.

best viewed in Acrobat® Reader®

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Proper service and repair procedures are vital to the safe, reliable operation of all engine vehicles as well as the personal safety of those performing the repairs. Standard safety procedures and precautions (including use of safety goggles and proper tools and equipment) should be followed at all times to eliminate the possibility of personal injury or improper service which could damage the vehicle or compromise its safety.

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First things first. FSI stands for “Fuel Stratified Injection,” TSI for “Turbo Stratified Injection.” Both of these initialisms apply to engines with Volkswagen Audi Group’s direct fuel injection technology. These engines feature highly pressurized fuel in a common rail that injects directly into each cylinder’s combustion chamber. Compared to port injection, direct injection allows for a higher compression ratio, improved driveability, greater fuel economy, and more power. Direct injection also presents unique issues.

All variations in terminology; Turbo FSI, TSI, TFSI, etc. are the result of marketing decisions. Don’t get confused by the names, all of these engines share similar technological and mechanical features. However, there are nuances among engines, some fairly inconsequential and others quite evolutionary. Stemming from these nuances is an important question;

what differentiates the **FSI** engine from the **TSI** engine?

This guide applies to all four-cylinder turbocharged 2005.5+ Audi and 2006+ VW models and addresses this question through:

- a quick-look visual guide to determine which engine your car has ([page 3](#))
- comparison chart of terms, applications, production dates, and features ([page 4](#))
- the High Pressure Fuel Pump, how it works, and what differences exist ([pages 5-6](#))
- detailed descriptions of each of the engines and their applications ([pages 7-12](#))

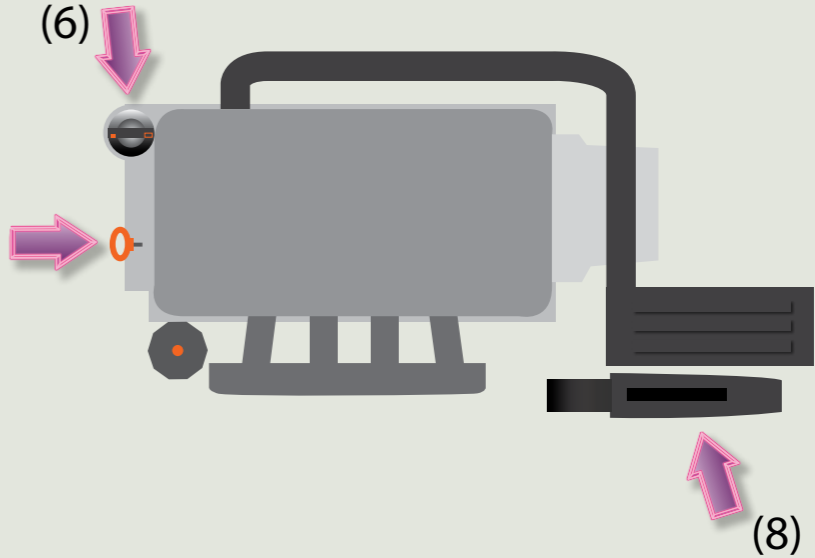
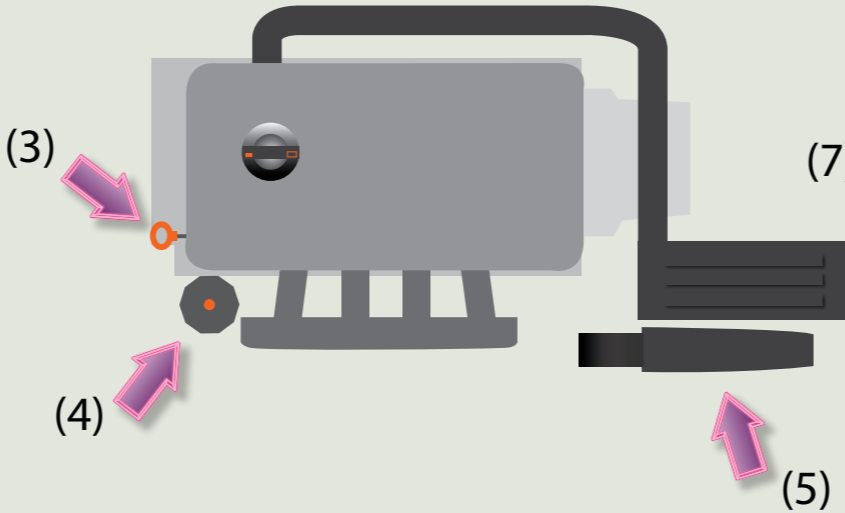
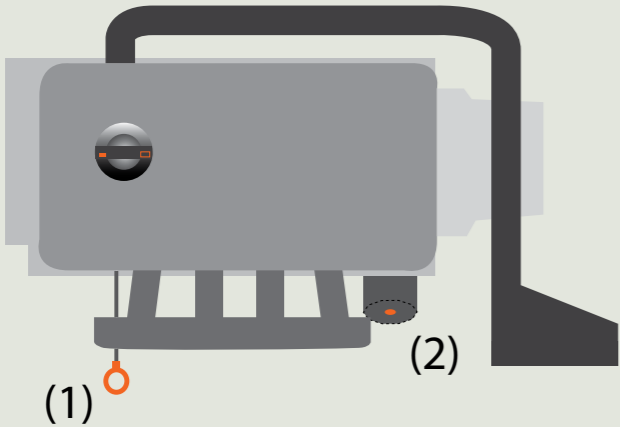
Engine Quick-Look Guide
(engine covers removed)

FSI

TSI

TSI

2013.5+



- (1) oil dipstick located aside intake manifold
- (2) oil filter housing located on bottom of engine

- (3) relocated oil dipstick
- (4) relocated oil filter housing
- (5) redesigned airbox

- (6) relocated oil filler cap
- (7) relocated oil dipstick
- (8) redesigned airbox

The next page contains a chart detailing more differences.

FSI vs. TSI explained



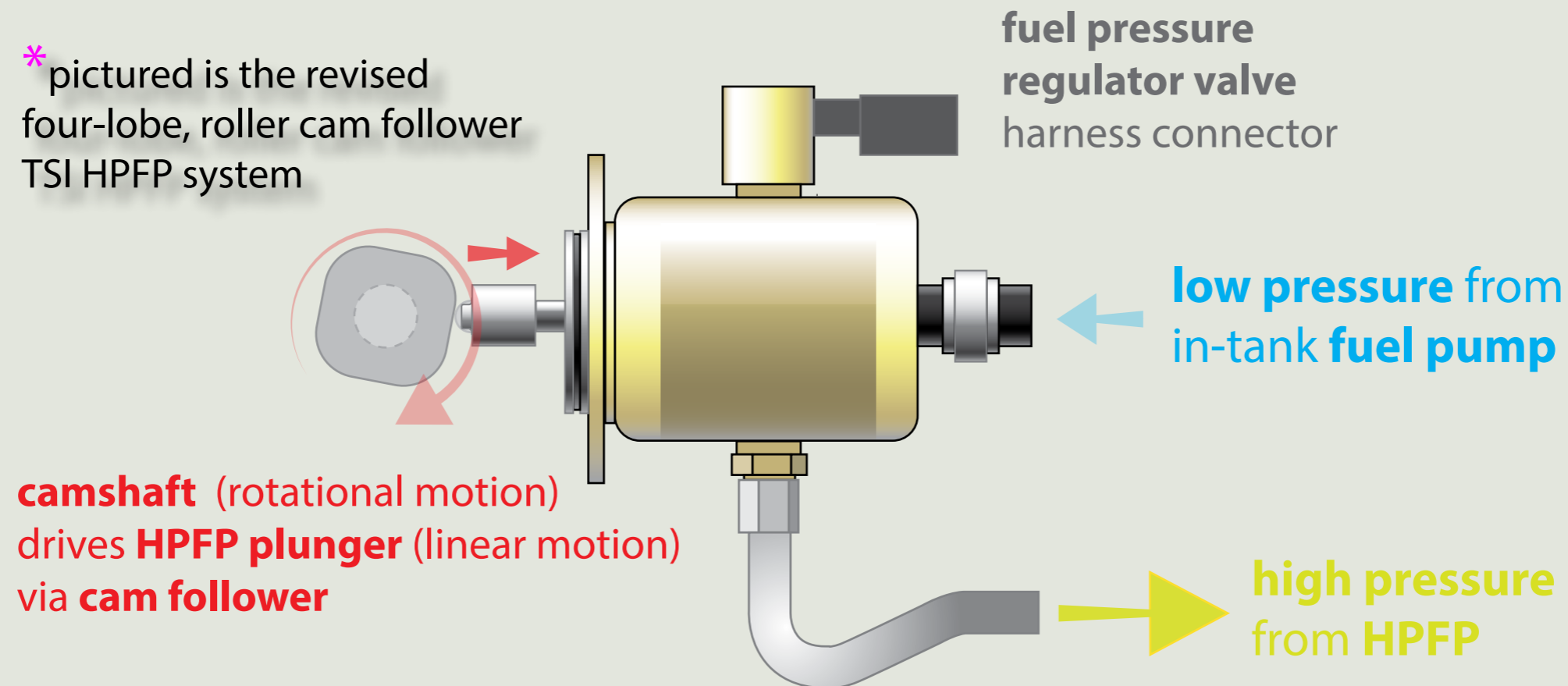
Vernacular Name	2.0 Turbo FSI	2.0 TSI	2.0 TSI	2.0 TFSI	2.0 TFSI	2.0 TSI	2.0 TSI
Engine Base	EA113	EA888	EA888	EA888	EA113	EA113	EA888
Engine Code(s)	BPY	CCTA	CBFA	CAEA/CAEB/CDNC	CDL	CRZA	CPLA/CPPA
Production	2005.5-2008.5	2008.5-2013.5	2008.5-2013.5	2008.5+	2008.5+	2011.5+	2013.5+
Applications	VW, Audi	VW, Audi A3	VW, Audi A3	Audi (not A3)	Audi TTS	VW Golf R	VW GLI, Beetle
Rated Power (hp/trq)	200/207	200/207	200/207	211/258	267/258	256/243	210/207
HPFP	✓	✓	✓	✓	✓	✓	✓
Flat Tappet Cam Follower	✓				✓	✓	
Roller Cam Follower		✓	✓	✓			✓
Single Intake Cam Lobe for HPFP	✓				✓	✓	
Four-sided Exhaust Cam Lobe for HPFP		✓	✓	✓			✓
Upgraded Camshafts and Cylinder Head					✓	✓	
Timing Belt	✓				✓	✓	
Timing Chain		✓	✓	✓			✓
Valvelift				✓			
Secondary Air Pump			✓				
3 Oxygen Sensors		✓	✓	✓			✓
4 Oxygen Sensors					✓	✓	
K04 Turbocharger					✓	✓	
Larger Intercooler and Radiator Cores			✓		✓	✓	
Integral Exhaust Manifold							✓
Electric Wastegate							✓

Pages 7-12 contain thorough descriptions of each engine type.

The heart of the matter..

The High Pressure Fuel Pump (henceforth known as HPFP) is arguably the most crucial and occasionally problematic mechanical component of the FSI and TSI engines. The HPFP pressurizes a low-pressure fuel feed from the in-tank fuel pump via a plunger. The plunger is actuated by a cam follower that rides on a camshaft lobe.

* pictured is the revised four-lobe, roller cam follower TSI HPFP system



What causes the excessive FSI HPFP wear issues?

A combination of factors...

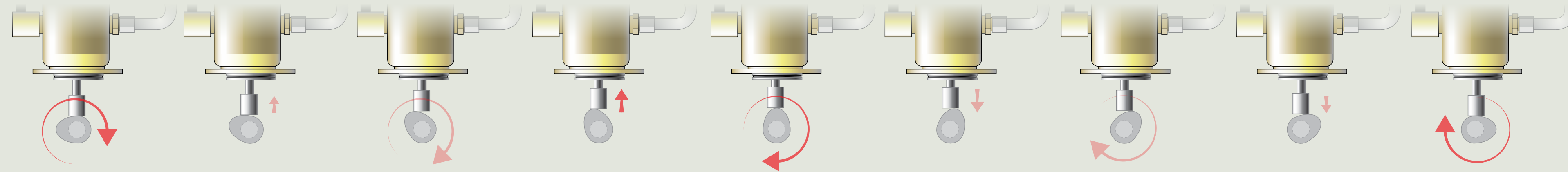
- federally-mandated low-ZDDP engine oil does not provide the lubricity necessary for sliding metal-on-metal contact of lobe and follower
- improperly specified HPFP seals allow fuel dilution of engine oil, further reducing lubrication
- insufficient hardening of the cam follower friction surface leads to accelerated wear

How the FSI /TSI cam-follower based HPFP operates:

FSI
HPFP



FSI flat tappet cam follower

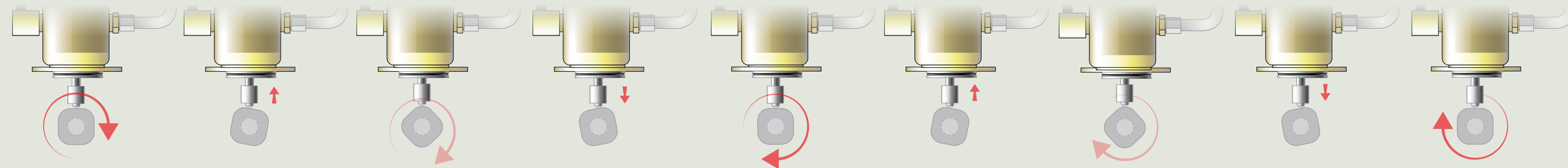


180* of camshaft rotation = 1 pressurization.
Therefore, for every four combustion cycles,
two large volume pressurizations occur.

TSI
HPFP



TSI roller cam follower



180* of camshaft rotation = 2 pressurizations.
Therefore, for every four combustion cycles,
four small volume pressurizations occur.

FSI engine

First released in the 2005.5 Audi A4 and later in 2006+ Volkswagen MKV Jetta, GLI, GTI, Tiguan, Passat, and CC models as well as Audi A3, A5, Q5, and TT, this 1984cc turbocharged and intercooled engine was revolutionary in its use of direct injection in gasoline passenger vehicles.

Key Features

EA113 2.0 Turbo FSI (code BPY) engines feature the following:

- High Pressure Fuel Pump (HPFP) actuated by special lobe on intake camshaft
- flat tappet cam follower
- variable intake camshaft timing
- timing belt driven camshafts
- 'noise pipe', demarkated in photo (GTI/GLI only)

Common Issues

- excessive wear on HPFP, camshaft, and cam follower (outlined in TSB 2013147/8) and covered under VIN-qualifying 120,000 mile/10 year extended warranty
- carbon accumulation in cylinder head and intake tract (symptom of direct injection as well as PCV issues)
- PCV system oil blow-by issues



TSI engine

Not to be confused with the Euro-market 1.4 TSI 'twincharged' engine, the 2.0 TSI is an evolution of the 2.0 Turbo FSI. First appearing in late-production 2008.5 VW and Audi models, the TSI engine addresses the issues of its FSI predecessor. At a glance, the changes are subtle. But underneath the plastic cladding lie a number of markedly important revisions.

Key Features and Revisions

The EA888 2.0 TSI (codes CCTA or CBFA) engine features the following changes over the FSI:

- timing chain (gear, not roller chains)
- HPFP actuated by special 4-sided camshaft lobe, now on exhaust camshaft
- roller cam follower
- lowered compression ratio (9.6:1 vs. 10.5:1 on FSI)
- difference downpipe
- 3 oxygen sensors (as opposed to 2 on FSI)
- improved PCV system
- relocated oil filter and oil dipstick
- redesigned air box and engine cover

Common Issues

- weak early-production valve springs may cause misfires when modified (due to higher exhaust backpressure)
- carbon accumulation similar to FSI engine



CCTA or CBFA?

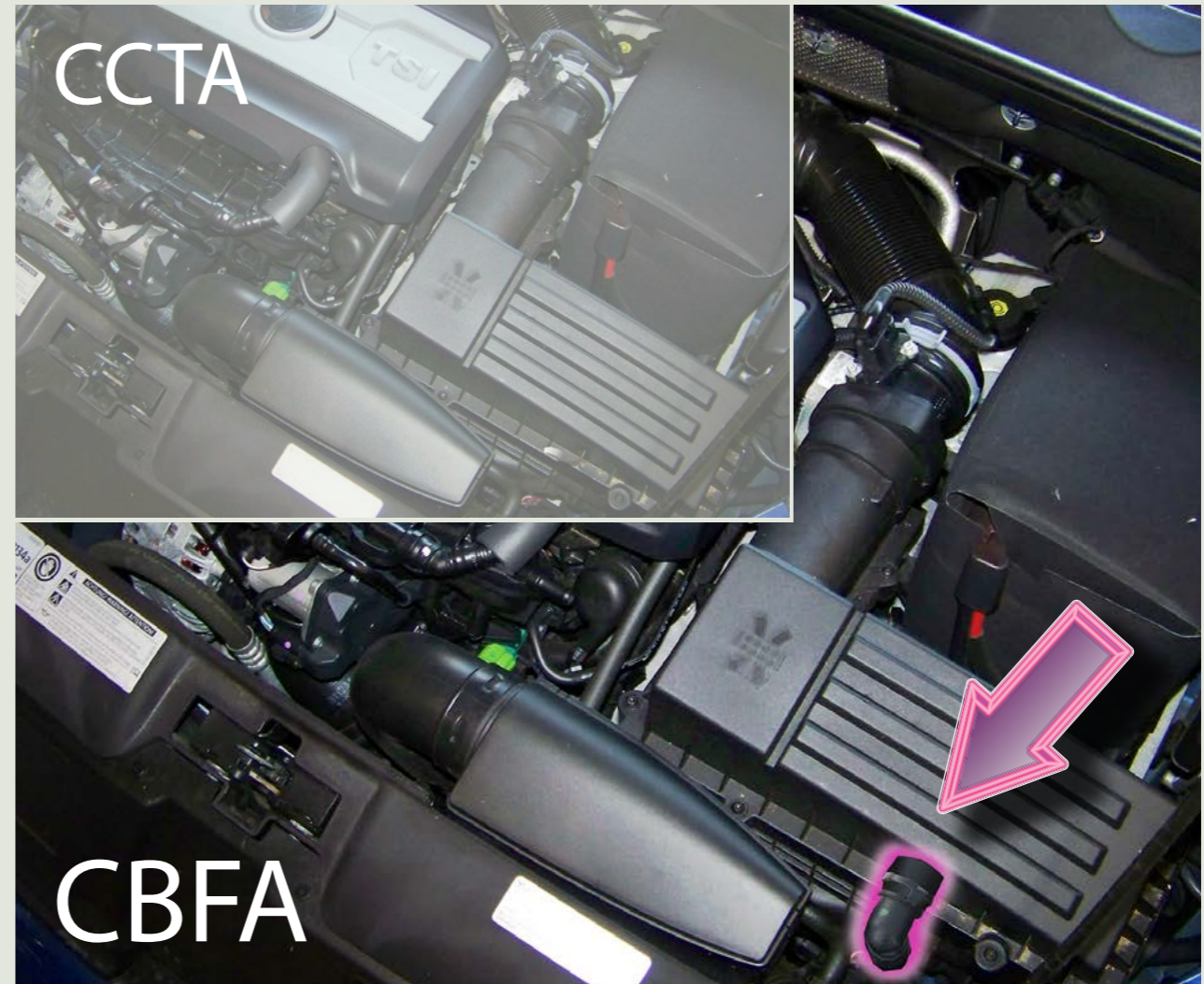
There are two variants of the 2008.5-2013.5 2.0 TSI engine. Engine code CCTA applies to 49-state emissions vehicles. CBFA engines feature a few changes to meet California's more stringent emissions standards.

Mechanical Differences

- secondary air injection pump for startup emissions
- third oxygen sensor relocated to turbocharger turbine outlet (as opposed to downpipe on CCTA)
- slightly larger radiator and intercooler cores for a cooler, denser, cleaner burning intake charge

Visual Differences

- as pictured on the right, CBFA engines feature an **additional hose** on the airbox (for the secondary air pump)



TSI revision

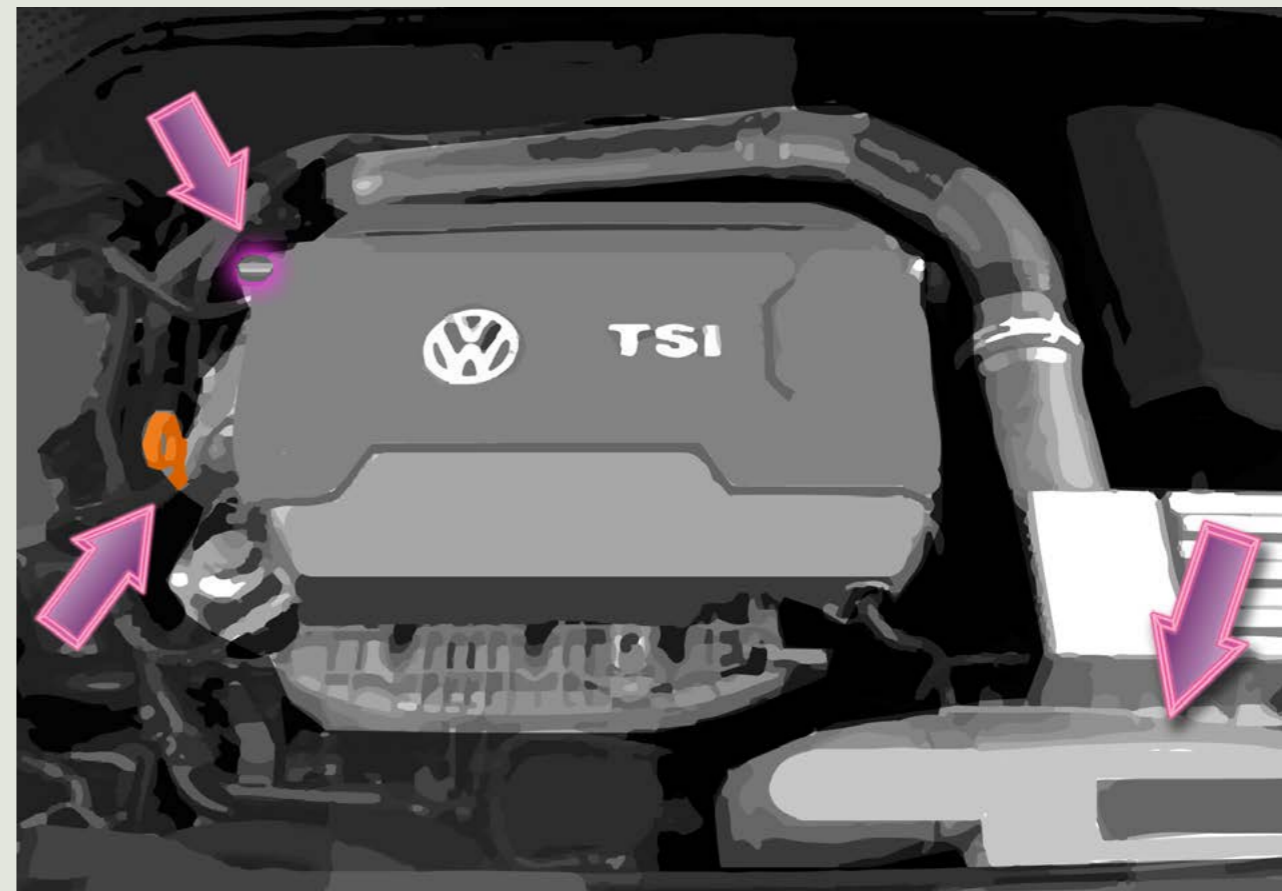
Starting in 2013.5+ Jetta GLI and Beetle Turbo models, EA888 2.0 TSI engines (codes CPPA/CPLA) have a number of revisions that rectify previous issues and increase power, improve fuel economy, and reduce emissions.

Key Features and Revisions

- exhaust manifold eliminated; exhaust gases now collect in integrated runners cast into the cylinder head
- electric turbocharger wastegate
- lighter turbine housing, lighter block casting, aluminum screws, and plastic lower oil pan
- smaller main bearings, reduced oil pressure, and reduced belt tensioner forces improve fuel economy
- revised PCV system, ECU tune, and intake manifold
- rated for 210 horsepower, 207 ft-lbs of torque

Visual Differences (noted on left)

- relocated engine oil cap and oil dipstick
- redesigned engine cover
- revised airbox



What about Audis?

Late production 2008 Audi-specific EA888 2.0 TFSI engines (codes CAEA/CAEB/CDNC) feature two-stage variable valve lift technology. Based on rpm, load, engine coolant temperature, and air intake temperature, solenoids actuate metal pins that slot into helical grooves on the exhaust camshaft. The engagement of the pins in the helical grooves causes the camshaft to slide fore and aft relative to the valve rockers, thereby causing the valve rockers to interface with one of two different camshaft lobes. One of the lobes features longer duration and higher lift for more airflow and power, whereas the lesser lobe improves cruising and part-throttle efficiency.

Notable Differences

- Audi valvelift system on exhaust cam
- longitudinal mounting (except TT)
- rated for 211 horsepower, 258 ft-lbs of torque

Applications

- 2008+ Audi 2.0 TFSI-equipped models, such as A4, A5, Q5, TT, and the new Q3.



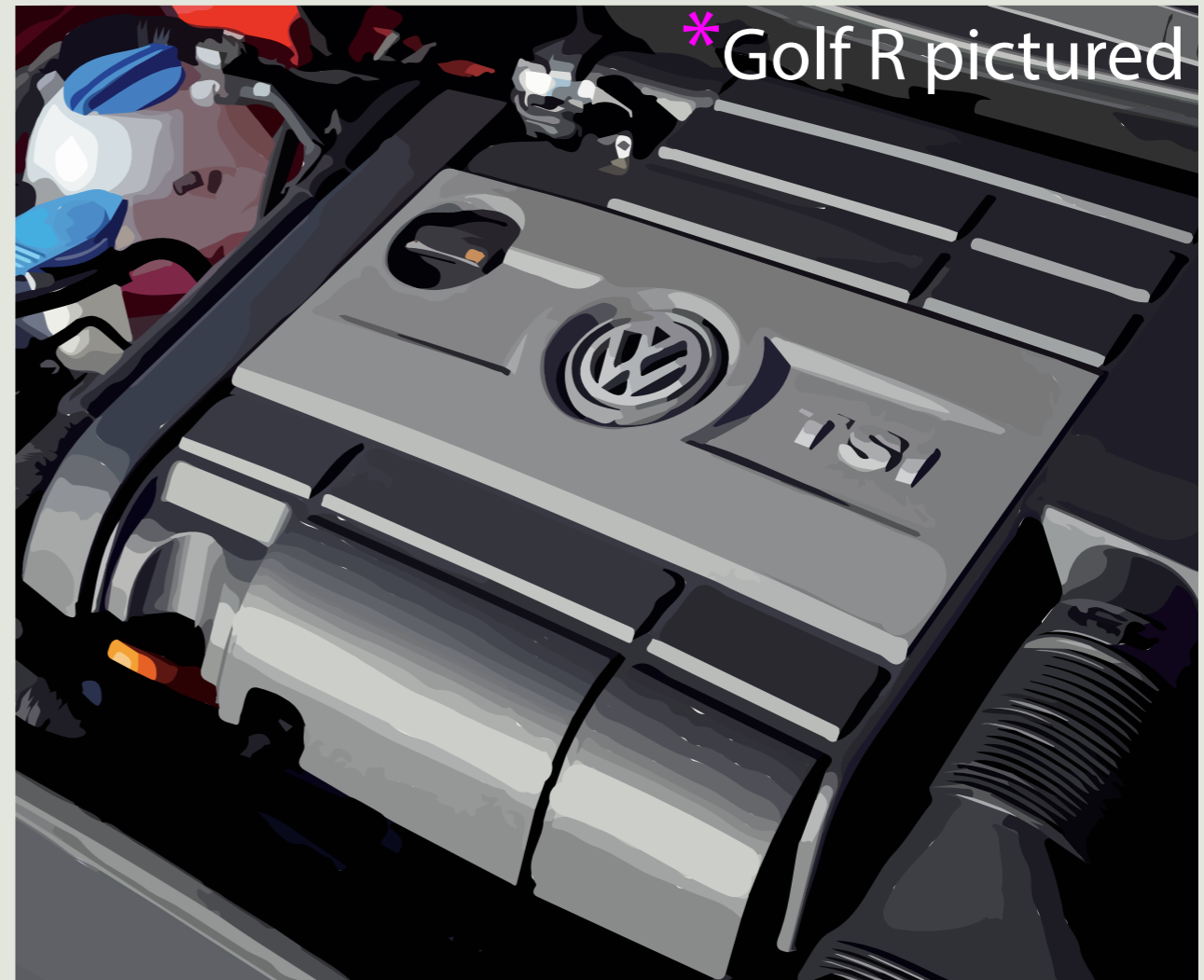
High-output variants (VW Golf R and Audi TTS)

Released after the introduction of the EA888 2.0 TSI engines, these factory tuned EA113-based FSI engines power the 2012+ Golf R (engine code CRZA) and the 2009+ Audi TTS (engine code CDL). Featuring upgraded engine internals and turbocharging components, these engines are more powerful and better accept aftermarket performance upgrades than other 2.0T offerings. Different ECU parameters explain the TTS's additional horsepower and torque.

Factory Tuned FSI

- lower compression ratio forged pistons (9.8:1 vs 10.5:1)
- stronger connecting rods, wrist pins, piston rings, engine block, and main bearings
- larger K04 turbocharger producing more boost pressure (1.2 bar vs .7 bar in 2.0 Turbo FSI)
- long-duration camshafts and high-flow cylinder head
- larger intercooler core and oil cooler
- higher-flow fuel injectors
- relocated diverter valve
- upgraded PCV system
- 4 oxygen sensors
- rated for 256 horsepower, 243 ft-lbs of torque (Golf R)
267 horsepower, 258 ft-lbs of torque (TTS)

*These engines do not feature variable valve lift technology. Valvelift is found exclusively on Audi-specific EA888 engines.





Thanks for reading!

We appreciate your business,
and hope this guide has been
helpful and informative.