6.0l Ford Diesel Engine Reliability Issues, Detection and Preventive Measures

Diesel engined pickup trucks started being produced in the 80's but didn't really get exciting till the growing pains in the 80's were over and the venerable 7.3l by Ford (in '87) and the 5.9l by Dodge (in '89) rose to prominence. As the pain to both, manufacturers and early adopters lessened, the quantity and quality of diesel engine trucks became a staple for hauling truck campers but the learning process has never really ended. Many generations of trucks have been developed with notable differences in engines, transmissions, axles, and suspension. Most brands have developed mixed reputations. ALL having at least one significant problematic system. Government didn't do anyone favors either, increasing fuel economy and emissions requirements that required manufacturers to develop new engine designs almost as soon as they got the bugs worked out of the current one.

It has become a matter of picking the truck with the least perceived shortcomings. Serious owners have spent time seeking, knowledge, people and businesses that will help improve the reliability and reduce the cost of operation. My 2004 F350 SRW, 4x4, crew cab (bought in 2015), wasn't purchased specifically to haul a truck camper but that was always a possibility. After a lot of research on the faults and features, it seemed the best truck for my needs. The 6.0l engine had been produced from 2003-1/2 though 2007 in trucks and 2010 in vans. It developed a reputation as suffering from a number of 'pattern failures' that Ford and several aftermarket manufacturers had developed numerous improvements to correct. If you want to understand those pattern failures, how to detect them, prevent them or mitigate their damage, this article should be a good starting place.

Ford 's evolution from the 14 year run of the 7.3l, driven by emissions regulation, led to the 6.0l which debuted or mainstreamed a large number of innovative changes in diesel engine design such that significant problems were inevitable.

Most notable (and problematic) were;

- Emission laws required use of an Exhaust Gas Recirculation (EGR) system that routes exhaust through a coolant heat exchanger and into the intake to reduce combustion temperatures.
- Hydraulic-Electronic Unit Injection (HEUI) fuel injectors using high pressure engine oil to power electronically metered fuel injection
- Variable Geometry Turbocharger (VGT) allowed efficient changes to boost pressure by using movable inlet guide vanes to regulate exhaust flow into the turbine.
- A common 'fin-plate' style heat exchanger (HX) was used cool engine oil, inside the engine.

They also chose design options that turned out to be (in retrospect) poor choices;

- Dash gauges convey little information and are virtually worthless for problem detection.
- Insufficiently robust fuel injection power supply.
- Too few and use of 'torque to yield' head bolts

They also chose not to do things that they (in retrospect) should have;

- No sensing of primary fuel pressure
- No exhaust gas temperature sensing

While we will get into details about these shortcomings, is important to say that, when shortcomings are understood and dealt with proactively or monitored, the 6.0l engine becomes a great performing, reliable engine.

A failure pattern describes how a failure is produced from a fault, identifies the components which are involved in the failure, the specific causes which allowed the failure to occur, and the effect of the failure on the system. In some cases, the initiating failure causes a 'cascade' of failures. By the time drivability is affected, serious damage to several components has likely occurred. This is why it is imperative to understand how ‘failure chains’ initiate and symptoms they may present.

The intent is of this article is to offer a simple method to understand common failures so owners so can recognize their susceptibility to a failure that could occur or is occurring and be proactive in avoiding or mitigating it. Forewarned is forearmed. There are numerous online resources describing these pattern failures in detail but that is tedious. This article offers a graphic portrayal of the failure patterns to identify where/how (especially minor) symptoms can be detected and the path of problem development if not corrected.

As always, identifying the single ‘root cause’ of a problem is necessary for both prevention and correction. The flow charts use the following definitions;

- SYMPTOM is the experienced lack of expectation or prior performance
- ROOT CAUSE is the source of the problem, detectable by the symptom or test condition. If not corrected, the vehicle will continue to operate with the fault condition, possibly precipitation other problems or failures.
- PRECIPITATED PROBLEM is a secondary problem, created by the root cause. If mitigated, the symptom may disappear temporarily but the root cause will again produce the same precipitated problem and re-produce the same symptom.
- PRECIPITATED FAILURE is a (permanent) fault that a cause or problem has created. Precipitated failures are not fatal but often result in problematic operation.
- TERMINAL FAILURE is permanent fault that will result in an inoperative engine or severe drivability problems.

A necessary tool in detecting symptoms is the ability to measure. Connecting to the OBD II port with a device able to 'see' what is happening is almost required.

This 10" Android tablet runs the 'Torque Pro' app to constantly read out data coming from an OBD II to a Bluetooth transceiver. It displays several screens of data of which this is the main one.

Samsung 10" Android tablet running 'Torque Pro' custom dashboard connected to OBD II Bluetooth interface.

Knowing what to look for is obviously necessary. Alarm conditions for each reading can be set. The readings above are compared to norms below to determine what is abnormal;

Measured Characteristic	**Code**	**Normal**	**Severe**	**Alarm**
Transmission Temp (F)	TFT	150-190	195-200	>220
Coolant Temp (F)	ECT	180-210	210-230	>235
Turbo Boost (psi)	BST	<26	28-30	>30
Engine Oil Temp (F)	EOT	ECT+10	ECT+15	>250
Engine Coolant Temp(F)	ECT	190-200	200-215	>235
Injection Control Voltage (V)	ICV	>.82V-4.7		
Injection Control Pressure (psi)	ICP	>500-4000		<500, >4000
Injection Pressure Regulator (V)	IPR	>15%, <75%		>80%
High pressure oil pump (psi)	HPOP	500-4000		
FICM Main Power (Voltage)	FMP	47.5-48.5		45V
FICM Logic Power (Voltage)	FLP	~battery voltage		
FICM Sync (Crank & Cam Pos)	SYC	1		0
VGT duty cycle (%)	VGT	15-85% (40-60%)		
EGR position (larger is open)(%)	EVM	Varies		
Fan Speed Sensor	FSS	varies	>220F ECT~ 2x engine	
Exhaust Back Pressure	EBP	Boost +2-10psi		34psi
EGT (Pre-turbo) (F)	N/A	650-850	800-1050	>1250
Primary Fuel Pressure	N/A	50-65psi	45-50	<40, >75
Coolant Pressure	N/A	8-12	12-14	16

Coolant Related Failures

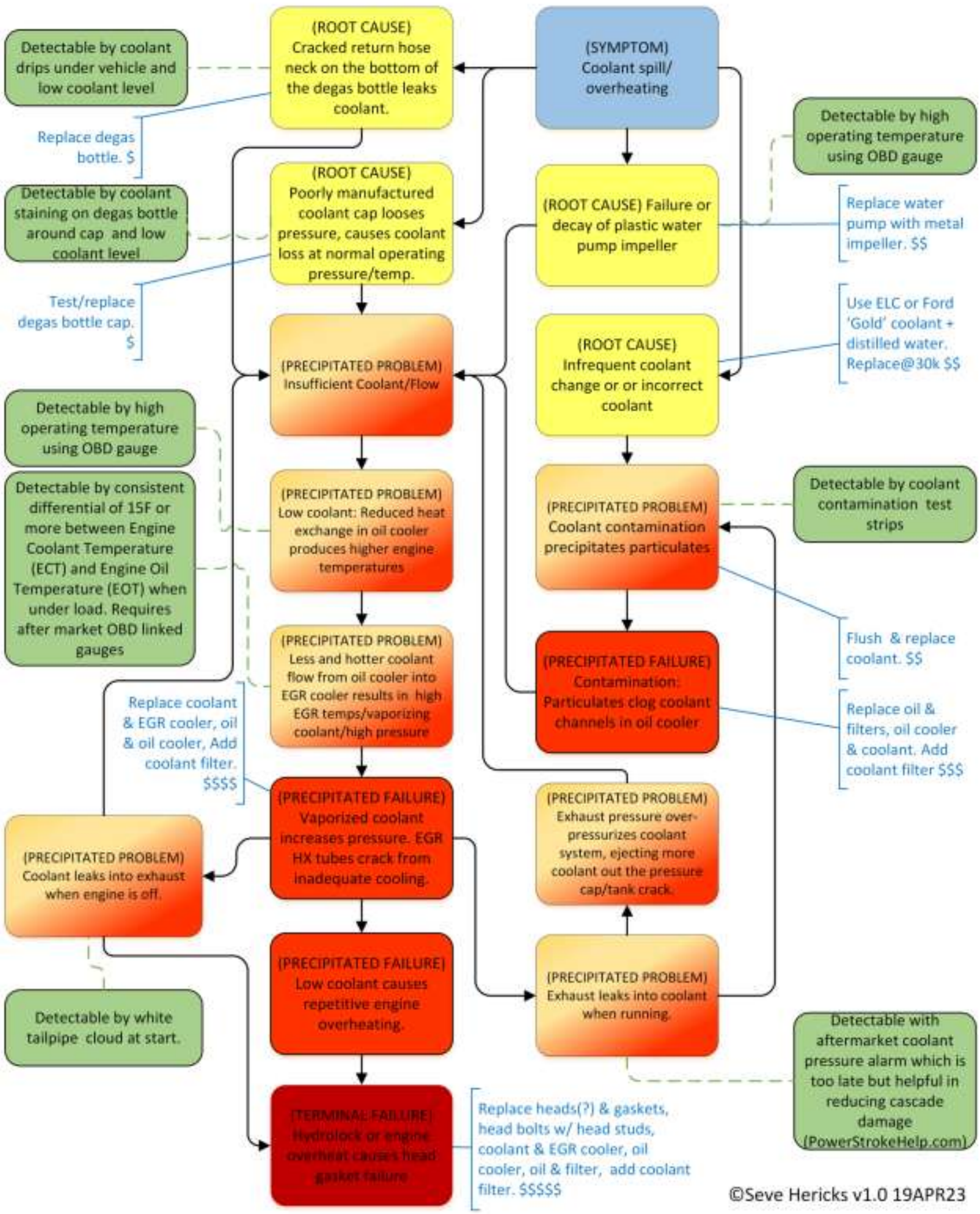
The instrument cluster has temperature gauge for coolant temperature that is COMPTELELY INCAPABLE of displaying any temperature short of a catastrophic overheating. It will almost always read mid range. Using better tools will show the real temperatures and is invaluable in helping to detect or avoid overheating problems.

The most common cause of coolant failures results from coolant loss. Being on the lookout for spilled coolant and checking coolant levels frequently will provide early detection of most problems. Having present and clean coolant is more important in the 6.0l than probably any other engine. This may be the first vehcle you have owned where coolant changes are frequent and necessary.

Coolant degas bottle often suffers from broken drain neck and leaking cap

By-pass coolant filter cleans a portion of the coolant continuously

Ford 6.0L Coolant Related Failure Chain



Oil Related Failures

As with coolant, clean and adequate oil, designed for diesel engines is necessary. Due to the use of engine lubricating oil to perform a hydraulic function in the Hydraulic-Electric Unit Injection (HEUI) fuel injections system, there are many more potential oil related issues.

The oil filter system is unique being on the top of the engine. To facilitate filter changes, it has a drain-back valve that allows oil in surrounding the filter to return to the oil pan if the filter housing is opened. This may be a blessing or a curse. Ford patented features on their oil filter that engage this drain valve to make the system work. As such, legitimate after market filter manufacturers must use features that avoid Fords patent and may not be completely successful in controlling the drain back valve. Some early filters allowed some or all of the oil to return through the drain back valve and by-pass the filter. As exorbitant as OEM parts have become, it is advisable to use them, and to insure they are genuine before installing.

In addition to regular oil changes, it is prudent to use an oil additive specifically made for HEUI injectors. Archoil 9100 is probably the most common and should be considered 'insurance' against future problems.

ROUND STYLE HPOP
FITS 2003-2004
Credit: Bulletproof Diesel

SQUARE STYLE HPOP
FITS 2005 -2010

STC connector: New style (L), Old style -(R)
Credit: Bulletproof Diesel

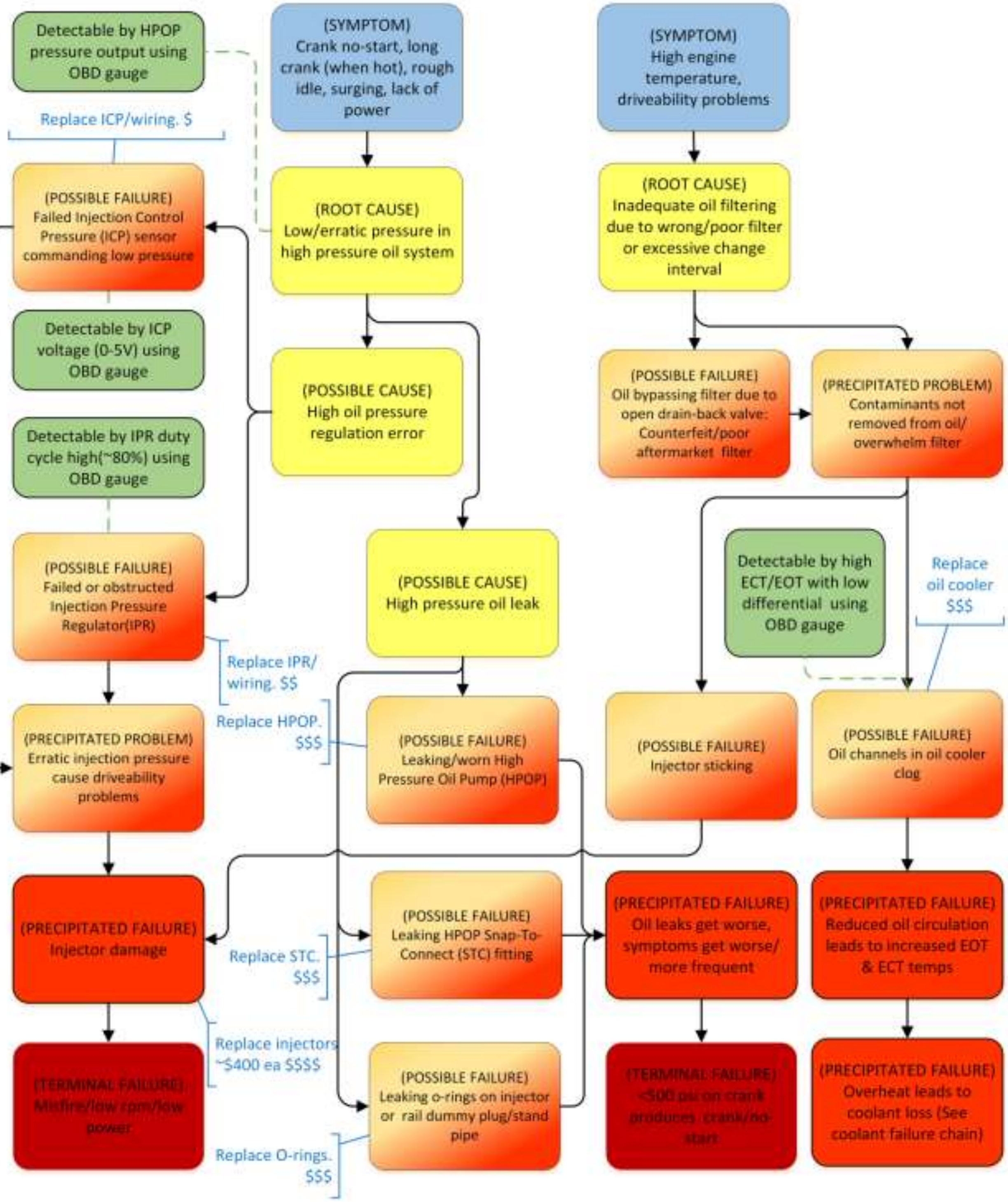
EARLY ICP

LATE ICP

IPR VALVE

Credit: Bulletproof Diesel

Ford 6.0L Oil Related Failure Chain



https://bulletproofdiesel.com/blogs/diesel-tips-info/high-pressure-oil-system-diagnostic-procedure-ford-6-0l

Fuel Related Failures

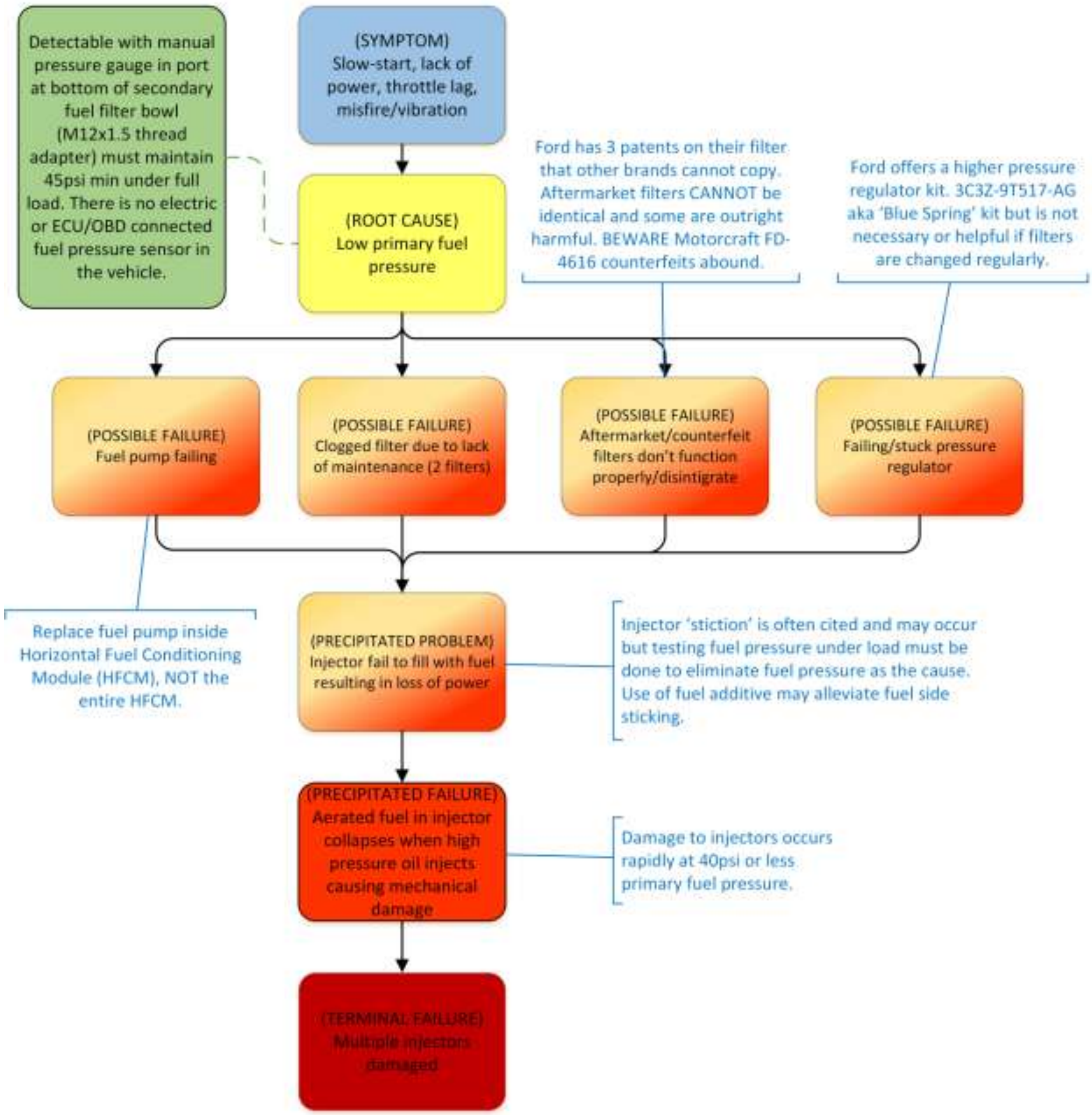
The nearly singular cause of fuel related failures is low fuel pressure. For example, problems such as poor fuel quality lead to clogged filters which lead to low fuel pressure. Problems lead to failures if permitted to remain. There are no symptoms of low fuel pressure until damage to the system is well under way. While there is a lot of concern about failure of fuel injectors because of their cost, many if not most of those failures are precipitated by other detectable causes. If you want to safeguard your injectors, invest in preventing things that cause their failure. Be rigorous in conducting maintenance with good materials.

Keeping a continuous eye on primary fuel pressure can mitigate the vast majority of potential problems. The below photo shows the location of the fuel pressure test port. Attaching a gauge to it and permanently mounting it in the dash is inexpensive (~$50 in material) and can provide critical information about fuel pump and fuel filter performance.


M12x1.5 Fuel Pressure port Adapter Credit: Bulletproof Diesel

Mechanical primary fuel pressure gauge in dash connected to pressure test port in bottom of engine fuel filter bowl

Ford 6.0L Fuel Related Failure Chain



Turbocharger Related Failures

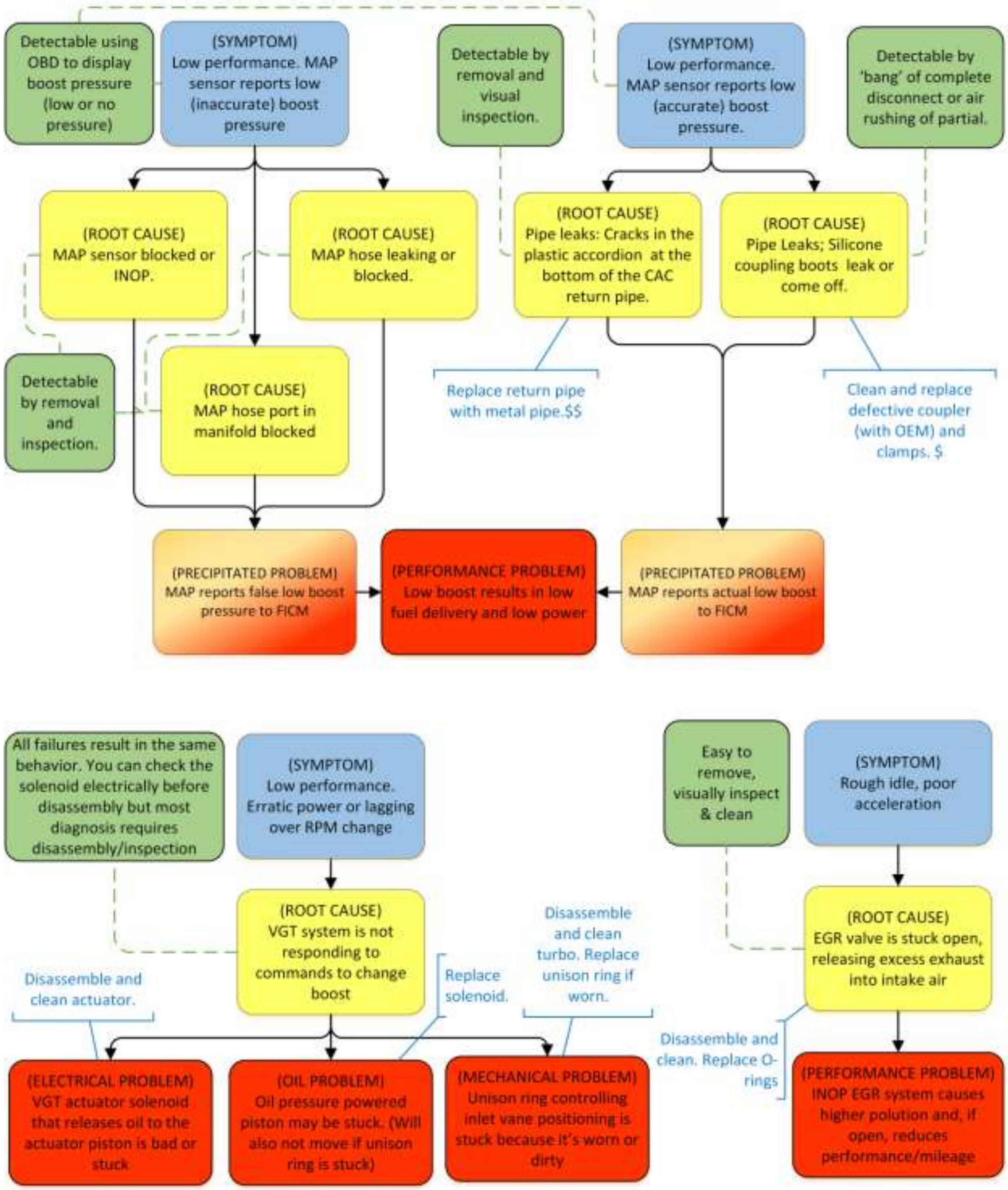
The many innovations debuted on the 'Variable Geometry Turbocharger' have become widespread but their birth was not without problems. Fortunately, most of the problematic parts are within both the reach and expertise of the average owner to correct.

Adding an Exhaust Gas Temperature (EGT) sensor is not something most users need but if your hauling a lot of weight, you should.

Periodically (annually?) cleaning the EGR valve is something that has become a necessity. Its right on the top front of the engine and easy to remove. If cleaned regularly, no parts are needed but periodically, a new set of o-rings (3) are needed.

EGR cooler can suffer coolant starvation, overheat and crack
Credit: PowerStorke.org

Ford 6.0l Turbo Related Failure Chain



Miscellaneous Issues

1) Large engines take lots of torque to start. Two batteries provide a lot of power but they don't provide equally resulting in the passenger battery failing before the driver side. The driver battery is grounded to the chassis while the passenger is grounded to the engine, resulting in the passenger side battery providing a lot more power during a start than the driver side. To correct this, add a 1/0 cable from the driver battery ground to the engine block.

2) Refrain from replacing the air filter with an aftermarket one that is 'cool looking' but is also a poorer performer. You have the best one already.