[redacted] filter

[redacted] FORD Diesel Application

Follow-up of the indices

Indice	Comments	Justification
0	Creation	- According to the last DVP revision signed by Ford - Change nominal system pressure from 4 bar to 4,5 bar - Specification of [redacted] V with nominal flow rate or no specified voltage with [redacted] on different tests
1	Correction of the pump nominal pressure	- Change nominal system pressure from 4,5 bar to 4 bar - [redacted] Apply only on DFCM ➔ correction of the test repartition list (Add fuel staying in the filter element to fuel drained) ➔ idem FC 5-7 - FC6-1: integration of Bosch pump special cleanliness → class 1 acc. to [redacted] and [redacted] Apply only on DFCM + FF ➔ correction of the test repartition list

Customer: [redacted]

Engine: - V8 4.4L (Lion)
- V8 6.7L

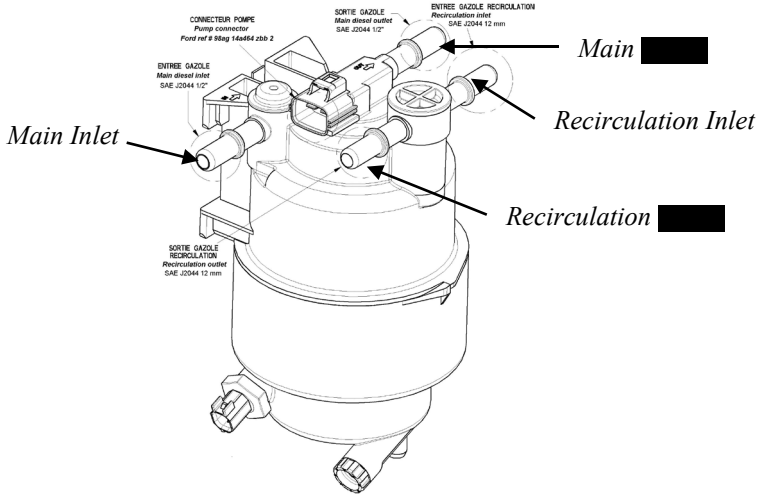
⇨ 2 Fine filters versions one by engine

Vehicle: -
- [redacted]
- P415
- U22x
- VN127

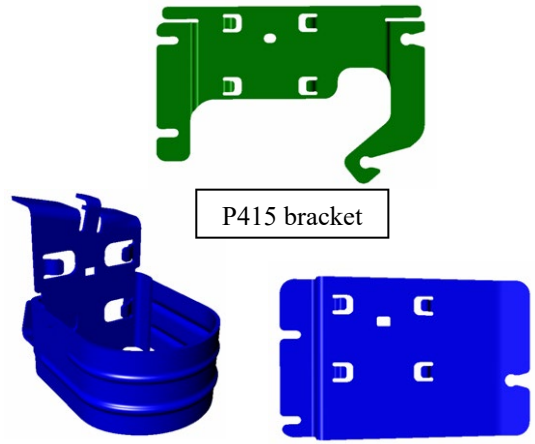
⇨ Only one DFCM version for [redacted]
4 different brackets for each vehicle

Product life time: 250,000 miles and 15 years which is equivalent to 10,000 hours

Filter element life: 22,500 miles (36,210 km) (every other third oil change). At this point, end of life flow should be ≥ 225 [redacted]



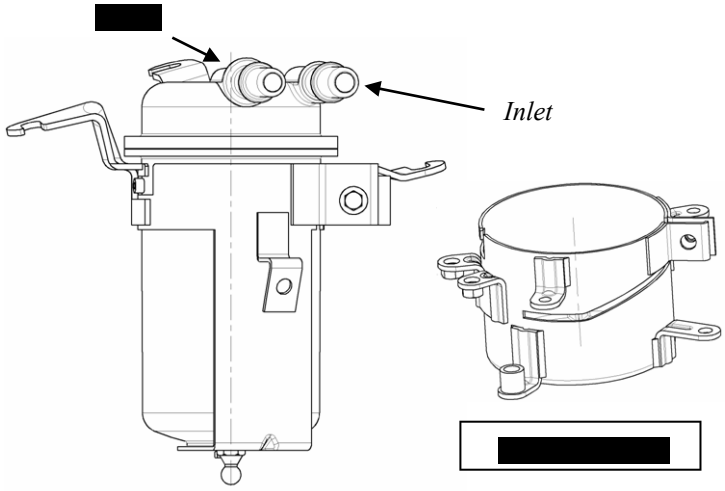
[redacted] version [redacted]



P415 bracket

[redacted] bracket

U22x bracket



XFC144: Fine filter 4.4L version [redacted]

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters 1+2: [redacted] (in vehicle configuration)

[redacted] N° FCt	FORD N° FCt	TEST N°	FILTER 1	FILTER 2	[redacted]	TEST REALISED	DESIGNATION	[redacted]	FORD N°	TEST	FILTER			TEST REALISED BY	DESIGNATION
[redacted]							Initial efficiency ISO [redacted]								Resist to thermal cycle durability
[redacted] **1-1-b**	- -	**S2**	X			[redacted]	Initial efficiency ISO 19438	**FC 1-2**	- -	**S10**	[redacted]			[redacted]	Resist to ageing test
[redacted] **1-1-c**		[redacted]		X		[redacted]	Initial efficiency ISO [redacted]		[redacted]					[redacted]	Resist to pulsation pressure
[redacted] **1-1-d**	3.1.4	**4**			X	SWRI	Initial efficiency SAE J905	**FC 1-3-2**	- -	**S11**		X		[redacted]	Resist to pressure cycling
[redacted]	- -	[redacted]			X	[redacted]	Life time	**FC** [redacted]						[redacted]	Resist to corrosion
[redacted] **1-2-b**	- -	**S5**	X			[redacted]	Life time	[redacted]							
[redacted]							Life time	[redacted]							Resist to automotive fluids
[redacted] **1-5**	- -	[redacted]					Pressure drop	**FC 1-6-1**	[redacted]						Resist to Impact test
[redacted] **2-1-a**	3.1.5	**5**			X	SWRI	Water separation SAE J1839	**FC 1-6-2**	- -	**S14**	X			[redacted]	Resistance to Impact of the WIF Sensor
[redacted] **2-1-b**	3.1.6	**6**			X	[redacted]	Water separation ISO 16332	[redacted]							Drop test
[redacted] **2-1-c**	3.1.7	**7**			X	[redacted]	Water separation (dynamics)	**FC 1-8-1**	3.6.3	**29**	[redacted]			[redacted]	Vibration durability
[redacted] **2-2**	3.1.9	**9**	X			[redacted]	Water reservoir	**FC 1-8-2**	3.2.2	**18**	[redacted]			[redacted] / [redacted]	Resist to vibration
[redacted]							Water and fuel drain	**FC** [redacted]							Long term durability
[redacted] **2-4-1**	3.1.10	**10**	X			[redacted]	Water detection (static)	**FC 1-11-1**	- -	[redacted]					Resist to differential pressure
[redacted]							Water detection (dynamic)	**FC 1-11-2**	- -	[redacted]					Filter element tightness
[redacted] **3-1**	- -	[redacted]	X			[redacted]	Degazing air	**FC** [redacted]							Contamination durability
[redacted] **4-1**	3.1.8	**8**	X			[redacted]	Fuel recirculation	**FC 1-13**	3.6.7				X	[redacted]	Operational durability
[redacted] **5-1-1**	- -	**45**			X	FORD	Priming capability (complete system)	**FC** [redacted]							Additional fluid durability
[redacted]							Priming capability (filter only)	**FC 1-15**	3.6.6	**32**	X			[redacted]	Dry running durability
[redacted]							Air purge capability	**FC** [redacted]							Resist to fuel + water
[redacted] **12-1**	3.1.1	**1**	X			[redacted] / [redacted]	Performances of fuel pump	**FC 3-1**	[redacted]						Vacuum decay
[redacted]	- -	[redacted]					Pump green vacuum	**FC** [redacted]							Pressure decay
								FC 3-3	3.8.9	**41**	[redacted]			[redacted]	Hydrostatic burst to failure
								FC [redacted]							Recirculation durability test
								FC [redacted]							Module electrical connector [redacted] retention test
								FC 5-2	3.8.3	**36**	X			[redacted] / ZERTAN	Module electrical connector [redacted] retention test

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters [redacted] (in vehicle configuration)

[redacted] N° FCt	FORD N° FCt	TEST N°	FILTER 1	FILTER 2	TEST REALISED [redacted]	DESIGNATION	[redacted]	FORD N°	TEST	FILTER	TEST REALISED BY	DESIGNATION
[redacted] 5-3	3.8.4	37	X		[redacted] / [redacted]	Electrical terminal retention pull test	[redacted] 21-1	- -	S23	[redacted]		Ensure no draining inlet fuel line during maintenance
[redacted] 5-4	3.8.5	38	X		[redacted] / [redacted]	Electrical terminal push test	[redacted]	[redacted]				Ensure clean maintenance
[redacted] 5-5	3.8.7	39	[redacted]			Module port axial pull retention test	[redacted]	[redacted]				Ensure no draining outlet fuel during maintenance
[redacted]	[redacted]					port [redacted] retention	[redacted]	[redacted]				Ensure no fuel flow if filter element is not present
[redacted]	[redacted]					Drain robustness	[redacted]	[redacted]				Pressure rise time
[redacted] 5-8	3.1.15	15	[redacted]			Drain strength	[redacted] 26-1	3.5.2*	48	X	[redacted]	Locked rotor test
[redacted]	[redacted]					Cleanliness	[redacted]	[redacted]				Pressure relief valve reseat
[redacted] 7-1	- -	- -	[redacted]			To be integrated in the environment	[redacted] 27-2	3.6.8*	50	X	[redacted]	Relief valve durability
[redacted]	[redacted]					To allow connection inlet connector	[redacted]	[redacted]				Performance during cold start
[redacted] 7-3	- -	- -	[redacted]			To allow connection inlet connector	[redacted] 29-1	- -	52		[redacted]	Real world test
[redacted] 7-7-1	- -	- -	[redacted]			To allow electric connection of WIF						
[redacted] 7-7-2	- -	- -	[redacted]			To allow electric connection of pump						
[redacted] 8-1	- -	- -	[redacted]			Respect legislation and recyclability						
[redacted] 9-1	- -	S20	[redacted]			To allow ESD dissipation						
[redacted]	[redacted]					To be identifiable and traceability						
[redacted] 11-1-1	3.4.3	23	[redacted]			Resist to storage @ high T°C						
[redacted] 11-1-2	[redacted]	[redacted]				Resist to storage @ low T°C						
[redacted] 13-1-1	[redacted]	[redacted]			[redacted]	Magnet cold knockdown						
[redacted]	[redacted]					High voltage durability						
[redacted] 14-1	3.1.16	16	[redacted]			Allow maintenance						
[redacted]	- -	[redacted]				Resist to radial force on the sleeve during change						
[redacted]						Dead head pressure						
[redacted] 18-1	3.4.1	21	X		[redacted]	Performance with high T°C						
[redacted]						Performance with cold T°C						
[redacted]	[redacted]					Module draining contamination robustness	* Tests 48 to 50 are coming from [redacted] / Others test are coming from ES7C34-9G2826-AA and M1DVP discussion between [redacted] and FORD					
[redacted]						Compatibility electro magnetic						

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters [redacted] (in vehicle configuration)

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FP 1-1-a Initial efficiency [redacted] + *Fine Filter*	[redacted]			X	[redacted]	[redacted] FORD specification translated into ISO [redacted]	Initial efficiency: [redacted] [redacted] ISO Medium (MTD): concentration 50 [redacted] *Run without the pump*	Particles class / Efficiency > 5.1 µmc 98.9 % > 6.4 µmc 99.6 % > 9.8 µmc 99.9 % > 13.6 µmc 99.9 % > 17.5 µmc 100 % > 24.9 µmc 100 %
							Report efficiency based on ISO/TS13353:1994	3-4 µm 98 %
FP [redacted] Initial efficiency [redacted]	**S2**	X			[redacted]	[redacted] FORD specification translated into ISO [redacted]	Initial efficiency: [redacted] [redacted] ISO Medium (MTD): concentration 50 [redacted] *Run without the pump*	To be reviewed upon completion of tests
FP 1-1-c Initial efficiency *Fine Filter*	[redacted]		X		[redacted]	[redacted] FORD specification translated into ISO [redacted]	Initial efficiency: [redacted] [redacted] ISO UltraFine (UFTD): 6.2 [redacted]	To be reviewed upon completion of tests
FP 1-1-d Initial efficiency [redacted] + *Fine filter*	**4**			X	[redacted]	FORD ES7C34-9G282-AA §3.1.4 SAE J 905 [redacted]	Use test set-up in Figure 1 Q: nominal (new pump) or 245 l/h (end of life pump) - Pressure = ~~14.5 psi~~ 4 bar - Voltage = [redacted] V Test fuel: Q (ULSD)	> 95% at 10 [redacted]
FP 1-2-a Life time [redacted] + *Fine Filter*	[redacted]			X	[redacted]	[redacted] ISO [redacted]	*Run without the pump of the filter* Q: nominal (new pump) [redacted] l/h [redacted] ISO Medium (MTD): 50 [redacted] Final ΔP: initial ΔP + 10.15 PSI (70kPa)	Time ≥ 128 min (or 30 g)
FP 1-2-b Life time [redacted]	[redacted]	X			[redacted]	[redacted] ISO [redacted] modified	*Run without the pump of the filter* Q: nominal (new pump) [redacted] l/h [redacted] ISO Medium (MTD): 50 [redacted] Final ΔP: initial ΔP + 10.15 PSI (70kPa)	Time ≥ 128 min (or 30 g)
FP 1-2-c Life time *Fine Filter*	**S6**		X		[redacted]	[redacted] ISO [redacted] modified	Q: nominal (new pump) [redacted] l/h [redacted] ISO ultra fine FTD 6.2 [redacted] Final ΔP: initial ΔP + 10.15 PSI (70kPa)	Time ≥ 128 min (or [redacted] g)

Filter 1: XFC104 [redacted]
Filter 2: XFC144 Fine filter
Filters 1+2: XFC104 + XFC144 (in vehicle configuration)

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FP 1-5 Pressure drop	**S7**	X	X		[redacted]	ISO [redacted]	Pressure drop: new filter without connectors: Flow rate: 0 to 320 [redacted] For filter 1, remove electrical pump. Test temperature: 23°C Test fuel: U	DFCM: no acceptance criteria, note the value FF: ΔP ≤ [redacted]
FP 2-1-a Water separation J1839	**5**			X	SWRI	FORD ES7C34-9G282-AA §3.1.5 SAE J1839 [redacted]	<u>Large Droplet Water Separation Test</u> - Q: nominal (new pump) [redacted] - Pressure = 14.5 psi (100 kPa) - Test fuel: U (IFT ≈ 13 ± 3 [redacted]) *Run without the pump of the filter*	Efficiency: 95% mini
FP 2-1-b Water separation ISO 16332 (09/2006)	**6**			X	[redacted]	FORD ES7C34-9G282-AA §3.1.6 ISO16332:09/2006 [redacted]	<u>Emulsified Water/Fuel Separation Test</u> - Q: nominal (new pump) [redacted] - Pressure = 14.5 psi (100 kPa) - Test fuel: U (IFT ≈ 13 ± 3 [redacted]) - Water droplet size: 60 µm / Water percent: 0.25 % *Run without the pump of the filter*	Efficiency: 95% mini
FP 2-1-c Water separation: Module Sensitivity to Dynamic *DFCM + FF*	**7**			X	[redacted]	FORD ES7C34-9G282-AA §3.17 modified [redacted] ISO 16332	Use test set-up in Figure 4 (Sogefi Spec.) Module in-vehicle position and under dynamic driving conditions. - Test fuel U (IFT ≈ 13 ± 3 [redacted]) - Flow rate = Green Pump [redacted] - Pressure = Psys *Run without the pump of the filter* 1) Initial fuel/water separation efficiency test according to the ISO 16332 standard during the time necessary to fill the bowl ➔ To know the initial performances of the filter. ➔ To have a filter with the media full of water. ➔ Keep the bowl full of water. 2) Vibration test using the P473 [redacted] from Ford. 3) Final fuel/water separation efficiency test 3.1.) To know the quantity of water which has go through the media during the vibration test: Before injection of water, to put a fuel flow rate through the filter during a few minutes and to collect the water in the final water separator. 3.2.) Fuel/water separation efficiency test	Dynamic/Static: Amount of water separated must be > 90% at water capacity rating or the reservoir under all conditions. Static: Filter water saturation point must be >20% water capacity rating of the reservoir under all conditions.

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters [redacted] (in vehicle configuration)

N° FCt	N° Test PVP [redacted]	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FP 2-2 Water Reservoir	**9**	**X**			[redacted]	[redacted] §3.1.9 [redacted]	Use test set-up in [redacted]. Module needs to be in vehicle position. Use transparent filter. - Flow rate = 225 [redacted] - Pressure = Psys ~~- Voltage = 13.2 V~~ - Test fuel: Q Static Test: Place module in Vehicle position without using 3-[redacted]. Note what the (X, Y, Z) coordinates being used for vehicle position are. 1. Add water to the drain screw of the module until the maximum water capacity of the reservoir is reached without water touching the filter paper. 2. Run the fuel module at maximum water capacity for 8 hours. If fuel in return line is emulsified, return to step 1 and determine the actual water capacity. Actual water capacity is that of a static test without emulsified at steady state. 3. Drain the water from the reservoir. 4. Measure and note the amount of water drained. Note Actual Water Capacity vs. Predicted Water Capacity. 5. Repeat test with the stand at a [redacted] % grade representing the vehicle parked on a hill overnight. Leave module like this nose up and nose down positions for 8 hours.	Water reservoir capacity: 200 cm^3 1. Note Actual Water Capacity 3. Report total water contents vs. reservoir contents.
FP 2-3 Water and fuel drain	[redacted]	**X**			[redacted]	[redacted] §3.1.[redacted] [redacted]	Module must be in vehicle position [redacted] and outlet pipes blocked. Note: Test performed at RT (ambient and fluid) Fill a recipient ([redacted]) with 2 liters of fuel Place [redacted] pipe into [redacted] Run the pump to fill the filter; make sure there is no more air Unplug the filter and block all the ports Empty the pipes and write down the volume of fuel in the recipient [redacted] and drain screw (see annex 1 for procedure) To precise total amount of fuel staying in the filter, measure the weight of filter element before and after the test	Drain screw must be serviceable without tools and easily accessible by the customer Record: - Time to drain - Rate of drain (Amount of water drained + Amount of fuel drained) / (Amount of water input + Amount of fuel input) (add fluid staying in the filter element to amount of fuel drained) 90% contents of module must drain in less than 1 minute / 100 ml.

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters [redacted] (in vehicle configuration)

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
[redacted] Water detection (static)	**10**	**X**			SOGEFI	FORD [redacted] §3.1.10 SOGEFI	Use test set-up in [redacted]. Module needs to be in vehicle position - Flow rate > 225 l/h - Pressure = Psys - Voltage = 13.2 V - Test fuel: Q 1. Prime system until outlet fuel is solid and clear 2. Turn module off 3. Put increments of 10% of total water capacity into the supply tank and allow settling. 4. Re-energize module 5. Move supply hose around the bottom of the tank to pick up as much free water as possible 6. Increase amounts of water until WIF pins sense a change in conductivity due to exposure to water. 7. Record the volume of water needed to trigger the sensor as a volume metric and as a percentage of total capacity. 8. Drain entirely the filter and compare the volume of water to the complete volume drained. (water + diesel fuel) 9. Follow the driving dynamic simulation test 3.1.11 ([redacted] 2-4-2). Report if at any point if fuel that is returning to tank is emulsified.	1. The WIF Sensor must consistently sense a delta in conductivity when the reservoir is exposed to water of the rated total capacity. This includes any sloshing and movement of reservoir contents. 2. The WIF Sensor pins must instantaneously sense a change in conductivity through various movements of module

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters [redacted] (in vehicle configuration)

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
[redacted] Water detection (dynamic)	11	X			FORD	FORD [redacted] §[redacted]	Use test set-up in [redacted]. Module needs to be in vehicle position - Flow rate = 225 l/h - Pressure = Psys - Test fuel: Q 1. Prime system until outlet fuel is solid and clear 2. Turn module off 3. Put increments of 25% of total water capacity into the supply tank and allow settling. 4. Re-energize module 5. Move supply hose around the bottom of the tank to pick up as much free water as possible 6. Increase amounts of water until WIF pins sense a change in conductivity due to exposure to water. 7. Record the volume of water needed to trigger the sensor as a volume metric and as a percentage of total capacity. 8. Drain entire contents of module and record total volume of Module. Record water reservoir as a percentage of total module. 9. Follow the driving dynamic simulation matrix (see page 20 of [redacted]) Report if at any point water that is returning to tank emulsified. Run the first portion of test with 15 minute intervals. Then proceed to cycle back and forth for 30 minutes with the module filled with water to reservoir capacity. 10. Turn module off and allow to stand for 15 minutes 11. Drain entire module and measure free water. Report total water contents vs. reservoir contents 12. Replace filter with new one	1. The WIF Sensor must consistently sense a delta in conductivity when the reservoir is exposed to water. This includes any sloshing and movement of reservoir contents. 2. The WIF Sensor pins must instantaneously sense a change in conductivity through various movements of module (i.e. vehicle). 3. Test results should be presented as traces of conductivity vs. time.

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters [redacted] (in vehicle configuration)

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FP 3-1 Degazing air	[redacted]	X			[redacted]	[redacted]	Use test set-up in [redacted]. Module needs to be in vehicle position. Use transparent filter - Flow rate > [redacted] - Pressure = Psys - Voltage = 12.5 V - Test fuel: Q Insert in filter 100 cc air. Check pump performance before air is injected and after air is injected	Note the degazing at outlet pipe Visual Evacuation of air present? **FP 12-1**: Qmin -3s > [redacted]
FP 4-1 Fuel recirculation	**8**	X			[redacted]	FORD ES7C34-9G282-AA §3.1.8 [redacted]	Use test set-up in Figure 5 Set-up module with 4 flow meters. Supply fuel temperature = [redacted] and 30°C. Test fuel: [redacted] Flow rate = 100 [redacted] and [redacted] Outlet pressure = Psys ΔP return [redacted] tank outlet: 1 [redacted] kPa) Measure percent of recirculation to engine and fuel tank at each temperature	Acceptable recirculation levels: Max 90% Min 50% Acceptance criteria have been reviewed, Agreement is to run test and evaluate leak rate based on engineering judgement. No criteria for recirculation level in hot condition
FP [redacted] Priming capability (Complete system)	[redacted]			X	FORD	SDS FY-0028	Per SDS FY-0028 Test Parameters: Test fuel: Q and U Qmin: [redacted] lph Voltage: 12.5 V Test temperature: 23°C and -30°C Complete breadboard circuit simulating tank, High pressure pump etc Test Method: Ensure filter/pump is empty Ensure [redacted] between DFCM and simulated tank is empty [redacted]	Acceptance criteria to be reviewed upon completion of test and evaluated using engineering judgment

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
[redacted] **(in vehicle configuration)**

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FP 5-1-2 Priming capability (Filter only)	**S9**	**X**			[redacted]	New procedure	Use priming test set-up (see annex 2) Ensure complete line / filter / air tank is empty Test fuel: [redacted] Voltage: [redacted] Test temperature: [redacted]°C et -30°C Energize Pump and measure how much time it is necessary to completely prime the system. Check air remaining in the system by using transparent fuel line	Maximum time to be determined. Note the time needed to clear air from line
[redacted] Air purge capability (Complete system)	[redacted]	[redacted]					Per SDS FY-0028 Test Parameters: Test fuel: Q and U Qmin: 225 l/h Voltage: [redacted] Complete breadboard circuit simulating tank, air management module etc Test Method: Ensure line between simulated AMM and recirculation valve is empty Energize Pump Apply a known quantity (pressure/flow rate) of air to inlet of recirc valve, measure quantity (pressure/flow rate) at exit of recirc valve.	Acceptance criteria to be reviewed upon completion of test and evaluated using engineering judgment

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters [redacted] (in vehicle configuration)

N° FCt	N° Test PVP [redacted]	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
[redacted]-1 [redacted] ces of fuel pump	1	X			SOGEFI	[redacted] §3.1.1 SOGEFI	Pump Test while installed in [redacted] Test fuel : Q (ULSD) Filter element Removed Minimum flow rate = value define by supplier for respect [redacted] after test **FC 1-14** - Outlet pressure: 65 [redacted] (400 kPa) - Inlet vacuum pressure : -4.35 [redacted] (-30 kPa)* - T°C : 23°C (fuel and ambient) - Voltage = [redacted] V Test Procedure: Run module at test parameters for one minute then record flow and current draw	[redacted] > [redacted] Current draw < 12A
					[redacted]	[redacted] §3.1.1 SOGEFI	Pump Test Only, removed from module Same test	[redacted] > [redacted] Current draw < 12A
[redacted] Pump green vacuum	[redacted]	[redacted]					Use test set-up in Figure 1 with vacuum gauge on [redacted] side of pump (see annex) Energize Module (do NOT energize for more than [redacted] seconds) - Test fuel: Q - Voltage = [redacted] V - [redacted] rate: 0 [redacted]	Average Vmin - 3s > -48 kPa (6.9 [redacted]

Filter 1: XFC104 [redacted]
Filter 2: XFC144 Fine filter
[redacted] (in vehicle configuration)

N° FCt	N° Test PVP [redacted]	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
[redacted] 1-1 Resist to thermal cycle durability	30	X	X		[redacted]	[redacted] §3.6.4 [redacted]	No test fluid is used during thermal soak. Fuel module is not energized during thermal soak. Thermal Cycle: 2 hrs at 90°C then 2 hrs at [redacted]°C Duration = 10 cycles Rate of change of temperature 4 °C/min on heat cycles and 2-5°C/min on cooling cycles (±1° C/min)	[redacted] / [redacted]: Vacuum and pressure decay (@ 23°C) [redacted]: Resist to ageing test [redacted] / [redacted]: Vacuum and pressure decay (@-29°[redacted]°) [redacted]: Performances of pump (@ 25 and 90°C) (DFCM) [redacted]: Resist to vibration [redacted] / [redacted]: Vacuum and pressure decay [redacted]: Performances of pump (@ 25 and 90°C) (DFCM) [redacted]: Resist to vibration [redacted]: To resist to pressure cycling (FF only) [redacted]: Pressure decay
[redacted] Resist to ageing test	[redacted]	[redacted]					**After [redacted] 1-1**: Test fluid Q is used during thermal soak (filter filled) Fuel module is not energized during thermal soak. Duration of test: 1000 h @ 80°C	[redacted] / [redacted]: Vacuum and pressure decay (@-29°[redacted]°) [redacted]: Performances of pump (@ 25 and 90°C) (DFCM) [redacted]: Resist to vibration
[redacted] Resist to pulsation pressure	17	X			BOSCH	[redacted] §3.2.1	Test Set-up: Use test set-up in Figure 3. - Flow rate = 225 [redacted] - Pressure = Psys - Test fuel: Q Measure RMS pressure pulsations. Record Voltage	Sample rate should be at least 44 kHz. X+3s < 7 kPa RMS
[redacted] Resist to pressure cycling	[redacted]		[redacted]				Test Parameters: Test fuel: Q and U Pressure: 0-7 bar Test Procedure: Apply pressure according to the following intervals: 5 sec, Pressure = 0 bar 5 sec, Pressure = 7 bar Continue for 50,000 cycles	[redacted]: Pressure decay

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
[redacted] **(in vehicle configuration)**

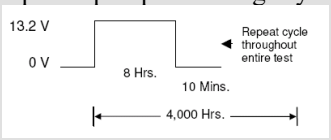
N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 1-4 Resist to corrosion	**28**	**X**	**X**		SOGEFI	FORD [redacted] §3.6.2 SOGEFI	Use test fuels: [redacted] [redacted] if necessary) - Operate module for 5 minutes. - Use sufficient amount of fuel to submerge fuel modules. - Soak modules for 30 days at [redacted]°C in a non-vented container, to allow natural pressure build-up. - Operate the modules for 1 hour every 168 soak hours (~1/week) Change the fluid with fresh fluid at each 168 hour interval Perform test using fuels W and Z, if, upon completion of test additional questions exist, Fuels Q and U to be performed to be used as a base-line Post-test pump analysis to be completed by pump supplier	Statistical requirements do not apply. All must pass **FP 12-1**: Performances of pump **FC 17-1**: To protect the pump of over pressure – Pump only **FC 3-1**: Vacuum decay (DFCM only) **FC 3-2**: Pressure decay After test--conduct a documented (pictures) teardown analysis
FC 1-4-2 Resist to corrosion (brackets)	**S12**	**X**	**X**		SOGEFI	WSS-M2P177-B2	Test brackets according to WSS-M2P177-B2	Must meet corrosion targets per WSS-M2P177-B2 (color: Black)
FC 1-5 Resist to automotive fluids	**S13**	**X**	**X**		SOGEFI	New procedure	Test Parameters; Test Fluid: common automotive fluids Test Method: Cap/Seal all ends/orifices of module (DFCM and FF) Submerge Filter ASSY specified duration Duration: 10 days Petroleum Gas: ELF SP95 Ethanol: Purity -- 99% CaCl: Purity -- 98%, dissolved in water (5% by weight) Methanol: Purity -- 99.8% Coolant: NFR 15-601 Urea: Purity -- 98%, dissolved in water (10% by weight) WWS: Ford Ref: 1388435 Brake Fluid: DOT4 SAE J1703 - ISO 4925	No cracks Results and Acceptance Criteria to be reviewed and agreed by Ford/Sogefi/Material Supplier upon completion of test **FC 3-2** Pressure decay @ ambient if necessary based on tests results

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 1-6-1 Resist to impact test	**34**	**X**	**X**		SOGEFI	FORD ES7C34-9G282-AA §3.8.1 SAEJ400	The DFCM must be soaked at –40°C ± 2°C for 8 hours prior to the test. Use of gravelometer to be included to simulate impact. During the test the DFCM must be held in position by the fittings on the side or sides opposite the side of collision. Ford recommends SAEJ400, using 3 pints of gravel Test filters with counter connectors and brackets	At the conclusion of the test perform visual inspection for any structural damage. Utilizing system flow and pressure energize module for 30 minutes and check for leaks. **FC 3-1**: Vacuum decay (DFCM only) **FC 3-2**: Pressure decay **FP 12-1**: Performances of pump
FC 1-6-2 Resistance to Impact of the WIF Sensor	**S14**	**X**			SOGEFI		Module needs to be in-vehicle position and under various service positions. 1. Apply increasing force in 3 directions, 120 Degrees from each other (1 direction per sample) onto WIF body ('hex' surface) until the WIF body is destroyed. 2. Record force or impact that was required	Report force to failure in all directions and types that were required.
FC 1-7 Drop test	**42**	**X**	**X**		SOGEFI	FORD ES7C34-9G282-AA §3.8.10	Drop the DFCM from a height of 3 ft (.9 M) onto a concrete floor. The DFCM should be visualized as a cube and the test repeated on all six sides (a different DFCM is to be used for each drop)	Structurally either the modules must withstand the drop with no structural damage or have such damage that the part cannot be assembled. If there no structural damages : **FC 3-1**: Vacuum decay (DFCM only) **FP 12-1** : Performances of pump **FC 3-3**: Hydrostatic burst to failure Subject to Engineering review upon completion of tests; Test is for information only, control plan to require dropped parts not be used

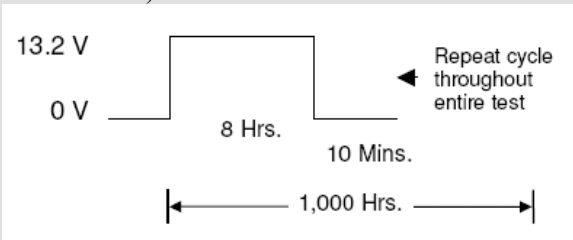
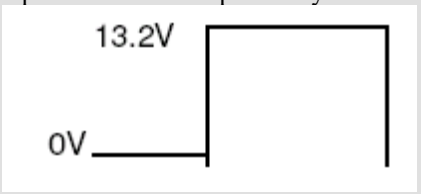
Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters [redacted] (in vehicle configuration)

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 1-8-1 Vibration Durability	**29**	**X**	**X**		SOGEFI SOGEFI	FORD ES7C34-9G282-AA §3.6.3	Filter filled of fuel and assembly on a specific bracket: 3 of P473 / 3 of P415 / 3 of U22X and 3 of 4.4L engine / 3 of 6.7L engine Test to be carried out on aged part (see FC 1-1) Fuel module is not energized during vibration. Fixture fuel module in vehicle position, then run DFCM: use vibration profile for P473 *(File name : P473-DFCM-PSD-RL0357.Xls)* FF: PSD to be determined	**FC 3-1**: Vacuum decay (DFCM only) **FC 3-2**: Pressure decay **FP 12-1**: Performances of pump (@ [redacted] and 90°C) (DFCM) **FC** [redacted]: Resist to vibration [redacted]: To resist to pressure cycling (FF only)
FC [redacted] Module vibration	[redacted]	**X**	**X**		SOGEFI BOSCH	FORD ES7C34-9G282-AA §3.2.2	Use test set-up in Figure 3. - Pressure = P sys - Voltage = [redacted] V - Test fuel: Q Measure axial and radial RMS vibration levels from 50 Hz to 10 kHz in 1/12 octave bands. Reference quantity: 1 g_{rms} = ØdB. IP tests may use alternative direction or voltage and pressure levels with Ford SME approval.	Maximum RMS vibration levels within the specified ranges are shown in the following chart. Vibration Level -dB Direction / 50 - 500 / 500 - 1k / 1k - 10k Axial / -5 / -5 / 5 Radial / -5 / -5 / -5
FC 1-10 Long term durability	**S15**				BOSCH	SOGEFI	Simulation of pump service life: - Pressure = Psys - Voltage = [redacted] V - Test fuel : Q, U (change fuel every 168 h) - Perform test using Fuel Q for 1st 2500 hrs, change to U for 2nd 2500 hrs, 3rd interval = Fuel Q, 4th interval = Fuel U; Change fuel at end of cycle or next scheduled fuel change, whichever is 1st. - T: RT Run module for 10,000 hrs	EOL Flow rate: 225 l/h min
FC 1-11-1 Resist to differential pressure	**S16**	**X**	**X**		SOGEFI	SOGEFI IN-1-006	Test per ISO 4020 The filter element must resist to a differential pressure of 200 kPa with : Temperature oil 50 ±5 °C during 2 min After 2 min, increase pressure until loss of pressure	No outlet pressure change during the test Note the maximal pressure reached before loss of pressure

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters [redacted] (in vehicle configuration)

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 1-11-2 Filter Element Tightness	[redacted]	X	X		SOGEFI	SOGEFI IN-1-007	Seal Filter end caps in test rig and apply air pressure to ID of filter. Raise level of test fluid until filter is submerged. Increase pressure input until visible leak is present. Record pressure input at time leak is present.	No bubble present at or below XXXX psi/bar Standard criteria 100 mm H_2O (approx 10 mbar)
FC 1-12 Contamination durability	**27**	X			BOSCH	FORD ES7C34-9G282-AA §3.6.1 CETP 10.01-E-300	Use test set-up in figure 4 Test procedure: see CETP 10.01-E-300 (fuel module contamination key life test) - Flow rate = 225 l/h - Pressure = Psys - Voltage = 12.5 V - Test fuel: Q Filter to be used in test setup to be XXXXX Drop pressure	**FP 12-1:** Performances of pump (all pass) **FC 17-1**: to protect system of over pressure (all pass)
FC 1-13 Operational durability	**33**			X	SOGEFI	FORD ES7C34-9G282-AA §3.6.7 SOGEFI	Use test set-up in Figure 1 with pressure regulator option. Temperature Range Allowed = 90°C to 6°C under CFPP point (use highest CFPP for both fuels) **instead of -40°C** - Test fuel : Q and U / Tank Volume: 20 L Every 168 hrs: change fuel and run pumps out of fuel for 1 min Change filter element when flow drops below rated flow and record fuel filter pressure drop Operate pumps to voltage cycle as below:  Pressure = Psys Repeat the cycle below 5 times to acquire 4,000 hours. Fuel System Temperature / Hours / Cycle Schedule (hours)* 25°C (77°F) 500 100 50°C (122°F) 250 50 90°C (194°F) 375 75 50°C (122°F) 250 50 25°C (77°F) 500 100 0°C (32°F) 250 50 -40°C (-40°F) 250 50 90°C (194°F) 375 75 -40°C (-40°F) 250 50 50°C (122°F) 250 50 -40°C (-40°F) 250 50 25°C (77°F) 500 100	Every 1000 hrs: **FP 12-1**: Performances of pump (all pass) After 4000 hrs, proceed to **FC 1-14**: Additional fluid durability **FP 2-1**: Performances of pump (all pass) After test--conduct a documented (pictures) teardown analysis

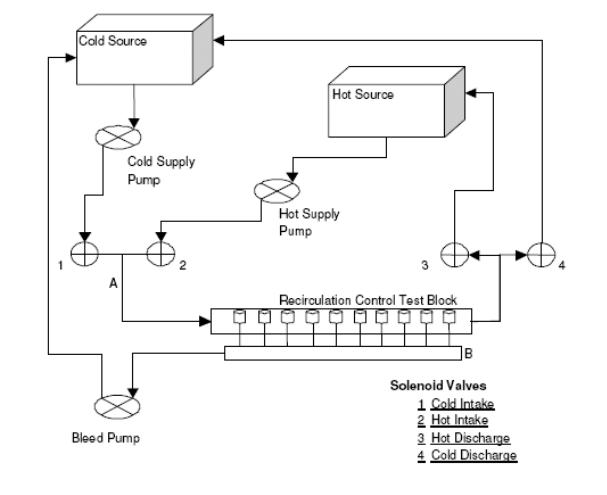
Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters [redacted] (in vehicle configuration)

N° FCt	N° Test PVP [redacted]	Filter 1	Filter 2	Filter 1+2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 1-14 Additional fluid durability	**33**			**X**	SOGEFI	[redacted] §3.6.7.1 SOGEFI	After **FC 1-13**, continue the test during 1000 hrs (same cycle than **FC 1-13**)  Test Parameters: -T = Room Temp (25 C) -Fuels = W, Z Maintain fluid circulation for 500 hrs for each fluid *Note: Intention is to run 12 samples in fuel Q for 4000 hrs, then in Fuel W and Z for 500 hrs apiece, and to run 12 samples in Fuel U for 4000 hrs, then in Fuel W and Z for 500 hrs apiece*	**FP 12-1**: Performances of pump (all pass) ~~**FC 18-1**: Performance with high T°C~~
[redacted] Dry running durability	[redacted]	**X**			[redacted]	[redacted] §[redacted]	Fuel module should be primed in test fluid Type Q prior to test. No test fluid is used during dry running test. Operate the module per the cycle shown above.  10 min. Duration = 1 Cycle	**FP 12-1:** Performances of pump (all pass) **FC** [redacted]: Resist to pulsation pressure [redacted]: Resist to vibration
[redacted] Resist to fuel + water	**S18**	**X**			ZERTAN	SOGEFI	- Test water: tap water with approx. 100 mg/l Ca2+ ions - Test fuel : Q - Temperature: 50°C Cycle: 10 hours in water/2 hours in diesel Repeat cycle 5 times to reach 50 hours in water. Change water after each cycle. Electrical Circuit to be provided by Ford Engineering	The WIF sensor must detect water after the 5 cycles without defect. Differential voltage between = 'water present' and 'water not present' must be > 1 V

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters 1+2: XFC104 + XFC144 (in vehicle configuration)

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 3-1 Vacuum decay	**2**	**X**			SOGEFI	FORD [redacted] §3.1.2 SOGEFI	Note: No Fuel present in filter Test Preparation: Determine average pump suction performance - Temperature must remain constant throughout the test: -29 ± 0.5ºC and 80 ± 0.5°C Seal pressure side inlet and outlet ports. Apply vacuum to inlet: -30 [redacted] For cold T°C: Measure (after stabilisation) the vacuum over a 30 minute period For high T°C: Measure the initial and final vacuum	Leakage: 1 cc/ min @ all T°C For cold T°C: Final Vacuum: 58.8 [redacted] mini Final Vacuum : Initial vacuum level - 2% TBC
FC 3-2 Pressure decay	**3**	**X**	**X**		SOGEFI	FORD [redacted] §3.1.3 SOGEFI	Pressure test is conducted with Fuel (filter filled of Q fuel) Pressurize module utilizing correlated value. Apply pressure to inlet : P: 30 psi (200 [redacted] T°C : 20 °C Measure pressure decay for a 30 minute period Apply pressure to inlet : P: 43.5 psi (300 [redacted] T°C : -40°C Measure Pressure decay for a 30 minute period Apply pressure to inlet : P: 137.8 PSI (950 [redacted] T°C : 100 °C	3 cc/min max @ T = 20 C and P = 30 PSI (200 [redacted] 5 cc/min max @ T = -40 C and P = 43.5 PSI (300 [redacted] For T = 100° C and P = 137.8 PSI (950 [redacted] , report leak rate--FOR INFORMATION ONLY
FC 3-3 Hydrostatic burst to failure	**41**	**X**	**X**		SOGEFI	FORD [redacted] §3.8.9 SOGEFI	Test is to be conducted at room temperature (RT) with oil or fuel Apply increasing pressure to the inlet port until cracks or deformities are observed (FF only) Apply increasing pressure to the main inlet on 1 filter and to the outlet ports on another one until cracks or deformities are observed (DFCM only)	Minimum burst pressure: 1350 [redacted] (Minimum burst pressure shall be three times the maximum pressure that can be encountered in the system in which the tubing will be used. Additionally, the burst pressure shall not be less than the level shown in Table 2; SAE J2260) Minimum burst pressure for outlet test: 1350 [redacted]

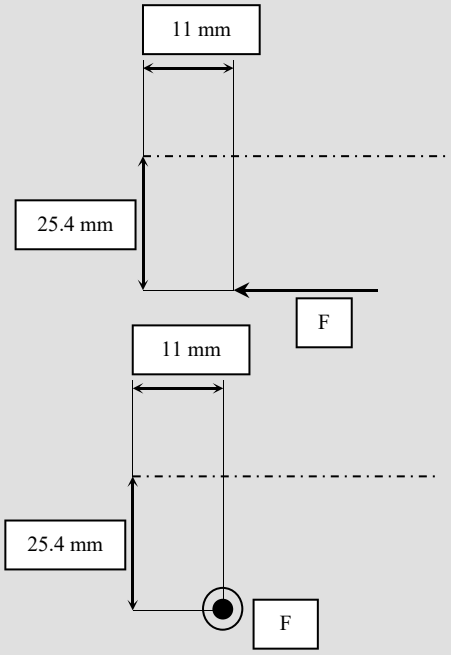
Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters 1+2: XFC104 + XFC144 (in vehicle configuration)

N° FCt	N° Test PVP [redacted]	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 4-1 Recirculation durability test	**43**	**X**			[redacted]	[redacted] §3.9.1 SOGEFI	Number of test blocks: 10. There are made of clear acrylic so the discs can be directly observed. - Test fuel: Q - Cold Source T°C: System specified temp – 10°F (-23°C) Hot Source T°C: System specified temp + 10°F (+23°C) - Flow rate: 100 [redacted] - Pressures: Point B Vacuum: 7"± 2"Hg (16.9 kPa ?) - Cycles: 15,000. The stand using liquid at higher and lower temperature than any of the tipping temperatures as measured in FP 4-1. Observing twice daily after 5,000 cycles have been completed if discs have any damage. Each one needs to be confirmed to be still operating. 	**FP 4-1**: Fuel recirculation on 3 parts in the specific test rig On the others wax elements: with F = 80N max : L_2 = 16.2 + 0.3 / - 0.9 mm à +21°C (increasing temperature), L_3 = 20.4 + 0.45 / -1.05 mm

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters [redacted] (in vehicle configuration)

N° FCt	N° Test PVP [redacted]	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 5-1 Module electrical connector axial pull retention test	**35**	**X**			Electrical pump: SOGEFI Electrical sensor: ZERTAN	[redacted] [redacted] §3.8.2	Secure module in assembled position. Test to be conducted at ambient temperature [redacted] Apply load at a point axial to the connector. Set up a load cell in line with the axial pull. Pull the fitting until it breaks away from the module or the WIF body	Connection should be capable of withstanding a minimum 157.5 N pull off load with no structural damage *Note: Design is directed by Ford EESE--Test results to be reviewed with Ford Chassis Fuel and Electrical Core EESE and evaluated with Engineering Judgment*
FC 5-2 Module electrical connector sheer retention test	**36**	**X**			Electrical pump: SOGEFI Electrical sensor: ZERTAN	[redacted] [redacted] §3.8.3	2 modules will be required for this test. Secure module in assembled position. Ambient T°C (25 °C). Apply load on the connection assembled. The Load should be applied parallel to the axial centreline of the connection (moment arm is in the X axis) and at a pt "d" perpendicular from the axial centreline of the connection. The distance "d" should be a minimum of 25.4 mm (1 inch) · With a load cell in the line of force, pull until the connector breaks away from the module. · Repeat the previous steps on a new module but with the moment arm in the Y axis.	Record the breaking force. Calculate the peak torque by multiplying the peak force by the distance "d" from the connection centreline Connection shall be capable of withstanding a minimum 4.5Nm pull-off torque with no structural damage. *Note: Design is directed by Ford EESE--Test results to be reviewed with Ford Chassis Fuel and Electrical Core EESE and evaluated with Engineering Judgment*
FC 5-3 Electrical terminal retention pull test	**37**	**X**			Electrical pump: SOGEFI Electrical sensor: ZERTAN	[redacted] [redacted] §3.8.4	Secure module/connector in assembled position. Test to be conducted at ambient temperature [redacted] . Apply load at a point axial to the connector terminal With a load cell in the line of force attempt to pull the pins out of the connector in 2.2N increments up to 22N	Pins should remain intact with no change in displacement/position. *Note: Design is directed by Ford EESE--Test results to be reviewed with Ford Chassis Fuel and Electrical Core EESE and evaluated with Engineering Judgment*
FC 5-4 Electrical terminal push test	[redacted]	[redacted]			Electrical pump: SOGEFI Electrical sensor: ZERTAN	[redacted] [redacted] §[redacted]	Secure module/connector in assembled position. Test to be conducted at ambient temperature (25°C). Apply load at a point [redacted] from axial to the connector terminal. With a load cell in the line of force apply a push force to the pins out of the connector in 2.2N increments up to 22 N.	Pins should remain intact with a displacement/change of position less 4° (note that the maximum permissible displacement must permit connection with the mating connector). *Note: Design is directed by Ford EESE--Test results to be reviewed with Ford Chassis Fuel and Electrical Core EESE and evaluated with Engineering Judgment*

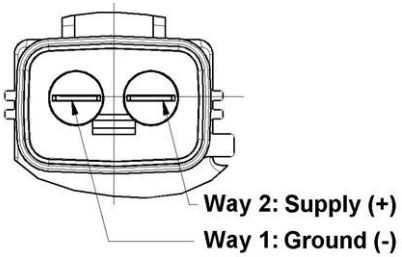
Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters 1+2: XFC104 + XFC144 (in vehicle configuration)

N° FCt	N° Test PVP [redacted]	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
[redacted] Module port axial pull retention test	39		[redacted]		[redacted]	[redacted] § [redacted]	Note1: All ports Note2: Module ports must meet the requirements of the SDS requirement [redacted] (Requirements for liquid fuel line push connect fittings). Secure module in assembled position. Test to be conducted at ambient temperature (25°C) Apply load at a point axial to the port Pull the fitting until it breaks away from the module	Connection should be capable of withstanding a minimum [redacted] N pull off load with no structural damage
[redacted] Module port [redacted] retention	40		[redacted]		[redacted]	[redacted] § [redacted]	Note1: All ports Note2: module ports must meet the requirements of the SDS requirement [redacted] (Requirements for liquid fuel line push connect fittings). Two modules will be required for this test. Secure module in assembled position. T = 25°C Apply load on the assembly. The Load should be applied parallel to the axial centerline of the port (moment arm is in the X axis) and at a point "d" perpendicular from the axial centerline of the connection. The distance "d" should be a minimum of 25.4 mm (1 inch) With a load cell in the line of force, pull until the port breaks away from the module. Record the breaking force Calculate the peak torque by multiplying the peak force by the distance "d" from the connection centerline. Repeat the previous steps on a new module but with the moment arm in the Y axis	[redacted] shall be capable of withstanding a minimum 5 Nm pull-off torque with no structural damage 

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
[redacted] (in vehicle configuration)

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 5-7 Drain robustness	[redacted]	X			SOGEFI	FORD ES7C34-9G282-AA §3.1.[redacted] SOGEFI	Module needs to be in-vehicle position and under various service positions. - Test fuel: Q - Temperature = RT; -30 °F (-34°C); & 104 °F (40°C) 1. At room temperature and with the module at equilibrium, 70°F (21°C) 2. Open and close Valve 100 cycles all at once (in one setting). 3. Raise fuel temperature at a rate of 2 °C/min to 104° F and allow equilibrium to be reached 4. Open and close Valve 100 cycles all at once (in one setting) 5. Lower fuel temperature at a rate of 2 °C/min to -30°F (-30°C) and allow equilibrium to be reached 6. Open and close Valve 100 cycles all at once (in one setting). To precise total amount of fuel staying in the filter, measure the weight of filter element before and after the test	1. The fluid drained must be 95% by volume of total volume of module (with fluid staying in the filter element added) with no degradation to drain time as seen in Test **FP 2-3** Water and fuel drain 2. The valve must fully open and close for duration of test. The valve must completely unscrew and screw at 3 N.m to complete one cycle.
FC 5-8 Drain strength	**15**	X			SOGEFI	FORD ES7C34-9G282-AA §3.1.15	Module needs to be in-vehicle position and under various service positions. 1. Apply increasing force in 3 directions, 120 Degrees from each other (1 direction per sample) onto to drain body (gripping surface of drain screw) until the drain body is destroyed. 2. Record force or impact that was required	Report force to failure in all directions and types that were required.
FC 6-1 Cleanliness		X	X		SOGEFI	SOGEFI QNO-04-55 QIN-10-01 §3.3.5	DFCM: class 0 according to standard DFCM element + pump sleeve: class 1 according to standard: Fine Filter: class 2 according to standard	Design review No Particle > 300 µm on DFCM filter element & sleeve
	S19		X		SOGEFI	SOGEFI FORD	Seal Filter end caps in test rig Apply Test Fluid (heptane) at a flow of 100 l/h Total flow 200 ml Particle collection: 1.2 µm white membrane Leica Microscope + Optical image analyzer	Max amount allowed particles: For particles between 50 - 100 µm Max. 150 particles present For particles between 100 - 200 µm Max. 50 particles present For particles between 200 - 400 µm Max. 10 particles present For particles > 400 µm Zero particle present
FC 7-1 To be integrated in the environment		X	X		SOGEFI	SOGEFI	Respect overall dimension available	Design review

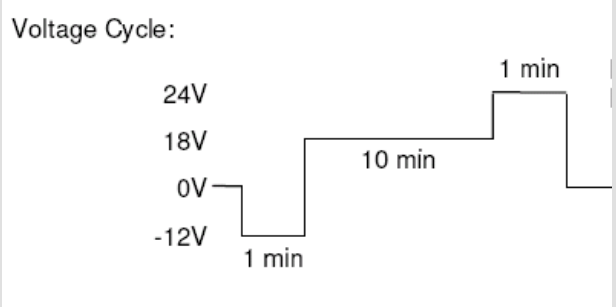
Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
[redacted] **(in vehicle configuration)**

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 7-2 To allow connection of [redacted] connectors		X	X		SOGEFI	FORD	DFCM: " ½ inch " according to standard SAE J2044 for main [redacted] "12 mm " according to standard SAE J2044 for recirculation Fine Filter: " ½ inch " according to standard SAE J2044 for [redacted]	Design review
FC 7-3 To allow connection of outlet connectors		X	X		SOGEFI	FORD	DFCM: " ½ inch " according to standard SAE J2044 for main outlet "12 mm " according to standard SAE J2044 for recirculation Fine Filter: "12 mm" according to standard SAE J2044 for outlet	Design review
FC 7-7-1 To allow electric connection of WIF		X			SOGEFI	FORD	According to standard 150-S-002-1-Z01 option A Way 1 : Sign RTN (-) Way 2 : E out (+)	Design review
FC 7-7-2 To allow electric connection of pump		X			SOGEFI	FORD	According to standard 98AG-14A464-ZBB-2 with the optional construction (windows on the connector)  	Design review
FC 8-1 Respect legislation and recyclability		X	X		SOGEFI	FORD WSS-M99P9999-A1	See note: Prepared By: GMF&S Dept/MET&S/VEV / VR E. Rezendes Revised 2-8-2006 2006-03-06 RSMS Substance Prohibition Update- Final Respect of FORD standard WSS-M99P9999-A1	Declaration in IMDS system data Design review

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters [redacted] (in vehicle configuration)

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 9-1 To allow ESD dissipation	[redacted]	X	X		[redacted]	[redacted] [redacted] J1645	DFCM: Remove Bowl (leave filter element assembled to DFCM header) Apply a Voltage of 500 V between lower end cap of filter element and negative terminal of DFCM Pump connector and measure the resistance Fine Filter: Section Filter so top end cap is able to be accessed Apply a Voltage of 500 V between upper end cap of filter element and bowl of filter and measure the resistance	Surface resistivity must be less than 1x10^6 Ohms/square surface area < 100 MOhm < 100 MOhm ~~1 m A ?????~~
FC 10-1 To be identifiable and traceability	**S21**	X	X		[redacted]	[redacted]	Engraving arrows on alls pipes IN and OUT Dating of product according to standard QNO-08-09	Design review
FC 11-1-1 Resist to storage @ high T°C	**23**	X			[redacted]	FORD ES7C34-9G282-AA §3.4.3 [redacted]	Filter empty. Prepare module for shipping (cap, bag, etc.) as it is (will be) done in production. Store @ 60ºC for 500 hours, then remove modules and allow modules to return to room temperature.	**FP 12-1:** Performances of pump
					BOSCH		Prepare pump for shipping (cap, bag, etc.) as it is (will be) done in production. Store @ 60ºC for 500 hours, then remove pump and allow pump to return to room temperature	**FP 12-1:** Performances of pump (all pass) **FC 17-1**: To protect system of over pressure
FC 11-1-2 Resist to storage @ low T°C	**24**	X			[redacted]	FORD ES7C34-9G282-AA §3.4.4 [redacted]	Filter empty. Prepare module for shipping (cap, bag, etc.) as it is (will be) done in production. Store @ -30ºC for 500 hours, then remove modules and allow modules to return to room temperature.	**FP 12-1:** Performances of pump
					BOSCH		Prepare pump for shipping (cap, bag, etc.) as it is (will be) done in production. Store @ -30ºC for 500 hours, then remove pump and allow pump to return to room temperature.	**FP 12-1:** Performances of pump (all pass) **FC 17-1**: To protect system of over pressure

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters [redacted] (in vehicle configuration)

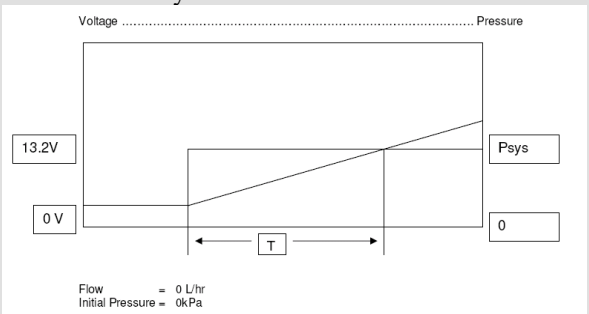
N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 13-1-1 Magnet cold knockdown	**25**	**X**			[redacted]	FORD ES7C34-9G282-AA §3.4.5	Use test set-up in Figure 6 with pressure regulator option. - Test fuel : R and T - Voltage = 18.0V - Temperature = -40°C - Pressure = Psys Set regulated pressure to Psys, de-energize, and soak modules for two hours at test parameter temperature. After stabilization, energize module twice for 5 seconds at test parameter voltage, allowing module to come to complete stop between cycles.	[redacted] Performances of pump (all pass) [redacted]: To protect system of over pressure
FC 13-1-2 High voltage durability [redacted]	[redacted]	**X**			[redacted] [redacted]	FORD ES7C34-9G282-AA §3.6.5	Use test set-up in Figure 1 with pressure regulator option. - Test fuel : R and T (or another winter diesel) - Pressure = Psys - Cycles: 6 	[redacted] Performances of pump (all pass) [redacted]: To protect system of over pressure – [redacted] [redacted]: Pressure rise time – [redacted] [redacted]: Resist to pulsation pressure – [redacted]
FC 14-1 Allow maintenance	**16**	**X**	**X**		[redacted]	FORD ES7C34-9G282-AA §3.1.16 [redacted]	Allow maintenance with standards tools tightening torque adapted tightening and loosening manual or with tools Filter element change: see design procedure in annex 1	Design review For water drain report tightening torque and loosening torque Design review
FC 14-2 Resist to radial force on the sleeve during change	**S22**	**X**			[redacted]	[redacted]	Disassembly the bowl and the filter element of the DFCM. Apply a force perpendicularly to the main axis of the filter on the bottom of the sleeve (between the cylinder and the cone)	Measure the force needed to disassembly the sleeve or to have a broken clip on the header.

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters [redacted] (in vehicle configuration)

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 17-1 To protect system of over pressure (dead head pressure)	**19**	**X**			BOSCH	FORD ES7C34-9G282-AA §3.3.1	Use test set-up in Figure 1. Energize Module (do NOT energize for more than 12 seconds) - Test fuel : Q - Voltage = [redacted] V - Flow rate: 0 LPH	AVG Pmax + 3s < 950 kPa (137 PSI), AVG Pmax - 3s > Psys + 100 kPa (14.5 PSI)
FC 18-1 Performance with high temperature	**21**	**X**			BOSCH	FORD ES7C34-9G282-AA §3.4.1	Use test setup in figure 5 Fill test tank with 20 liters of fuel Q Test Parameters: Temperature = 20 to 90°C Voltage = [redacted] V Pressure = Psys Record parameters throughout the heating cycle at the voltage & pressure settings below. Test Parameters: Fuel Heating: 20°C to 90°C at [redacted]°C/minute + .2°C/minute	Q min = lowest flow over temperature range Q min -3s > 225 l/h
FC [redacted] Performance with cold temperature	**22**	**X**			BOSCH	FORD ES7C34-9G282-AA §3.4.2	Use test fuel T, Q and U Use test setup in figure 6 Test Parameters: Temperature = 6°C below the test fuel cold filter plug point (note: CFPP for Arctic / Jet Fuel is -35 deg. C) Voltage = [redacted] V Pressure = Psys (Ambient) Soak modules at test parameter temperature for 2 hours. Run module for no more than 10 minutes at the test parameter (pressure and voltage). Repeat test as required by additional test parameters and /or fuel type.	Qmin = lowest flow over temperature range Qmin -3s > 225 l/h

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 19-1 Module draining contamination robustness	**14**	**X**			SOGEFI	FORD ES7C34-9G282-AA §3.1.14 SOGEFI	Module needs to be in-vehicle position and under various service positions. - Test fuel Q - Flow rate = 225 l/h - Pressure = Psys - Voltage = 12.5 V 1. Mix a slurry of 30g ISO MTD + water volume equal to bowl volume 2. Run pump for 10 minutes with slurry at inlet 3. Unscrew bowl 1 full turn 4. Re-tighten bowl 5. Repeat unscrew and retighten bowl 10 times 6. Perform service cycle (remove bowl, replace filter) 7. Run pump for 10 minutes with slurry at inlet 8. At room temperature and with the module at equilibrium, 21°C (70°F) Open and close Valve (screw) 30 cycles all at once (in one setting). 9. Slowly Raise fuel temperature to 40°C (104°F) and allow equilibrium to be reached 10. Open and close Valve 30 cycles all at once (in one setting)	Valve must open and close 100% for entire duration of test. FC 3-2: Pressure Decay (all pass)
FC 20-1 Compatibility electro magnetic	**26**	**X**			SOGEFI	FORD ES7C34-9G282-AA §3.5	Test to Ford ARL 09-0466 (only sections applying to small motors).	Acceptance can be approved based on passing ARL 09-0466 at the -9H307- end item assembly level.
FC 21-1 To ensure no draining inlet fuel during maintenance	**S23**	**X**			SOGEFI	SOGEFI	(Ensure no draining inlet fuel line during maintenance) Use test set-up in Figure 1 but with the tank at 10 cm above the filter Run the pump until the filter is full of diesel Use the draining procedure and put out the filter element Check how many volume of diesel is drained	Note the volume drained and check what is the leak at the no flow valve without the filter element

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
[redacted] **(in vehicle configuration)**

N° FCt	N° Test PVP FORD	Filter 1	Filter 2	Filter 1 + 2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 22-1 Ensure clean maintenance	**S24**	**X**	[redacted]				Modules must have a clean maintenance. For draining modules, no disconnection of connectors and no air drain on top of modules are authorized. All fuel and water must be drained by the drain screw before disassembly of module	Acceptance by FORD
FC 23-1 [redacted] Antisiphon	**S25**	[redacted]					During maintenance, the outlet pipe must be closed Test Parameters: Test Fuel: Q or U -Ensure the filter is filled with test fuel -Assemble a clear hose/tube to outlet [redacted] -Fill hose/tube with test fuel until the fill level is 25 cm above the outlet [redacted] -Remove filter / cartridge -After 2 minutes record amount of fluid lost from hose/tube	Loss of liquid must be < 1 cc/min
FC [redacted] Ensure no fuel flow if filter element is not present	**44**	**X**			SOGEFI	FORD [redacted] §[redacted]	Use test set-up in Figure 1 with pressure regulator option. - Test fuel Q - Voltage = 12.5 V With the module's filter element removed, run module at test parameters for one minute then record flow and current draw	Fuel flow should be less than or equal to 3cc/min
FC 25-1 Pressure rise time	**20**	**X**			BOSCH	FORD [redacted] §3.3.2	Use test set-up in Figure 2. Energize the Module with 12.5 VDC and run the Module for sufficient time to purge all the air from the system. Once air has been purged turn off voltage. Apply a 12.5 volt step input to the Module until final pressure is attained. Measure the time to reach Psys. 	Determine best fit distribution of rise times. 99% of best fit distribution must be less than 120 ms. Use Chi-squared or [redacted] goodness of fit test to demonstrate acceptability of distribution model. (Use a significance level of %)

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters 1+2: XFC104 + XFC144 (in vehicle configuration)

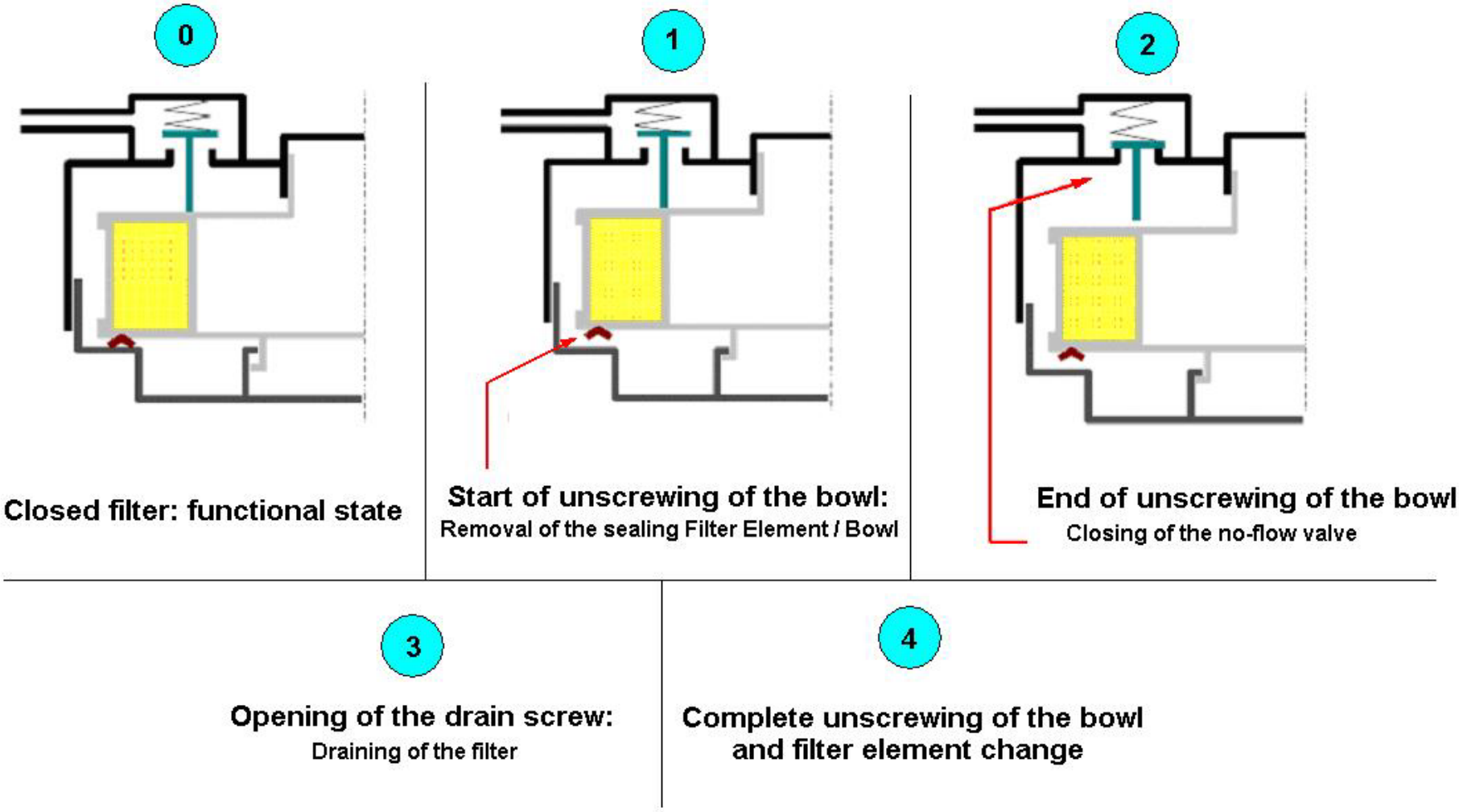
N° FCt	N° Test PVP [redacted]	Filter 1	Filter 2	Filter 1+2	Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
FC 26-1 Locked rotor test	**48**	[redacted]			(pump only test)	[redacted] ES-9U5A-9350-AA §3.5.2	Perform **FP 12-1** Pump Performance, record results Apply physical lock to pump (method [redacted] Perform the following cycle: [redacted] for 30 seconds V = 0 for 30 seconds Repeat for 6 Cycles Remove physical lock to pump Perform **FP 12-1** (Pump Performance, record results	**FP 12-1** Pump performance
FC 27-1 Pressure Relief Valve Reseat	[redacted]	**X**			[redacted] (pump only test)	[redacted] ES-9U5A-9350-AA §3.3.5	Fuel: Q and U Energize pump to 13.2V while deadheaded for 60 seconds. Without de-energizing the pump, open regulator until pump starts flowing. Continue opening regulator until pressure reaches Psys. Psys should be reached within 5 seconds. Within 5 seconds after reaching Psys, measure flow leakage out of the relief valve for 60 seconds	Leakage (X bar + 3s) at Psys < 30 ml/min Exception: A higher leakage is allowable provided no objectionable noise (3.2) can be heard at rated flow, and the pump meets rated flow (225 lph EOL)
FC 27-2 Relief Valve Durability	**50**	[redacted]			(pump only test)	[redacted] ES-9U5A-9350-AA §3.6.8	Fuel: Q and U Perform the following sequence of power on/off cycling using 13.2V supply: - 1 second "on" + 10 seconds "off" with fuel pump deadheaded @ 60°C for 24 hours. - 1 second "on" + 10 seconds "off" with fuel pump deadheaded @ -30°C for 24 hours. - 1 second "on" + 10 seconds "off" with fuel pump deadheaded @ 23°C for 120 hours.	**FC 17-1** To protect system of over pressure (Dead head pressure) **FC 27-1** Pressure Relief Valve Reseat
FC 28-1 Performance during cold start	[redacted]	[redacted]			(pump only test)	[redacted]	Use test set-up in Figure 6 with variable orifice closed and pump deadheaded. Use Test fuel R Voltage = [redacted] Temperature = -30°C Soak pumps at test parameter temperature for 2 hours. Run pump for no more than 12 seconds at the test parameters below and record maximum dead head pressure of system	AVG Pmax - 3s > 650 kPa

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters 1+2: XFC104 + XFC144 (in vehicle configuration)

N° FCt	N° Test PVP FORD	Filter			Test realised by	STANDARD	CONDITION OF TESTS	ACCEPTANCES
		1	2	1 + 2				
FC 29-1 Real World Capacity Simulation Test	**52**			**X**	SOGEFI	FORD ES7C34-9G282-AA §3.5.2	Procedure (See RealWorld CapTest annex) Procure 3000 gallons of diesel fuel Assemble system as shown below Perform Lifetime Capacity Simulation test per parameters below V = 12.5 T = RT Flow rate = Green pump Recirculation rate = Green pump – 100% WOT consumption rate Perform test until 3000 gallons of diesel has been transferred from 'Fuel Supply Tank' to 'Engine Consumption' tank Record ΔP of DFCM, FF, and System (continuous monitoring) After 3000 hours, produce chart showing ΔP v. Fuel Volume	Engineering review of results to determine ability to meet capacity requirement of 22,500 miles

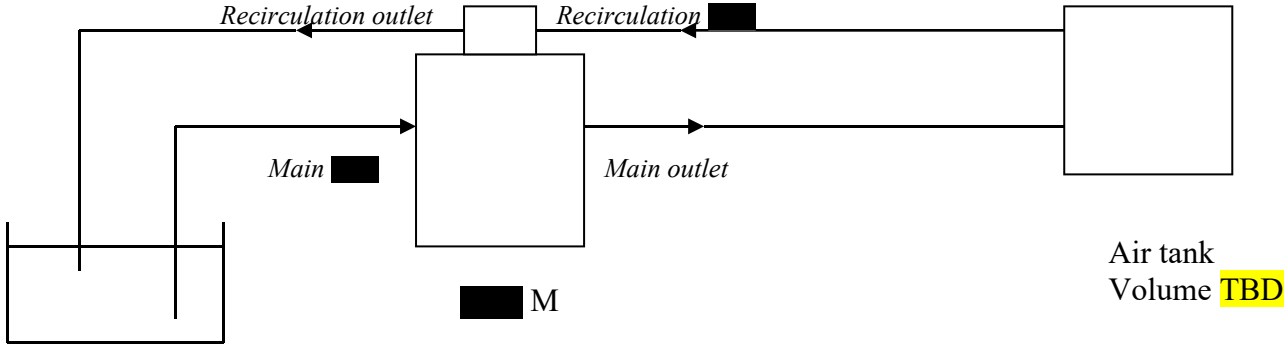
Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters 1+2: XFC104 + XFC144 (in vehicle configuration)

1-DFCM drain procedure



Number of turn needed to drain the filter (step 1+2): **3**

2-Priming test set-up



3-Real World Lifetime Capacity test

Procedure

Procure 3000 gallons of diesel fuel

Assemble system as shown below

Perform Lifetime Capacity Simulation test per parameters below

V = 12.5

T = RT

Flow rate = Green pump

Recirculation rate = Green pump – 100% WOT consumption rate

Perform test until 3000 gallons of diesel has been transferred from 'Fuel Supply Tank' to 'Engine Consumption' tank

Record ΔP of [redacted] and System (continuous monitoring)

After 3000 hours, produce chart showing ΔP v. Fuel Volume

Acceptance Criteria: Engineering review of results to determine ability to meet capacity requirement of 22,500 miles

Assumptions:

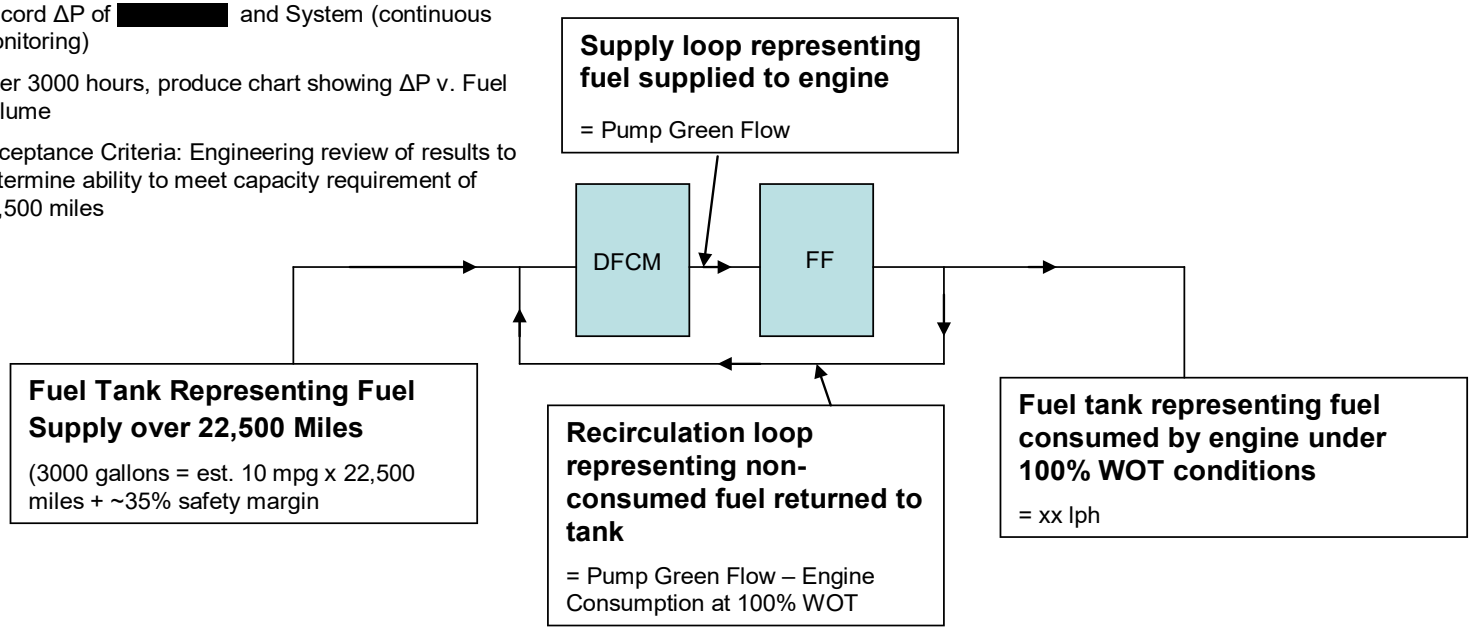
Test to be performed at a source in USA (SWRI, IBR, Perkin Helmer)

Fuel source directed by Ford Engineering – 'worst case' fuel source, likely to be a source in Texas (dirtiest fuel available)

Assumed Pump Green Flow rate: approx. 280 l/h

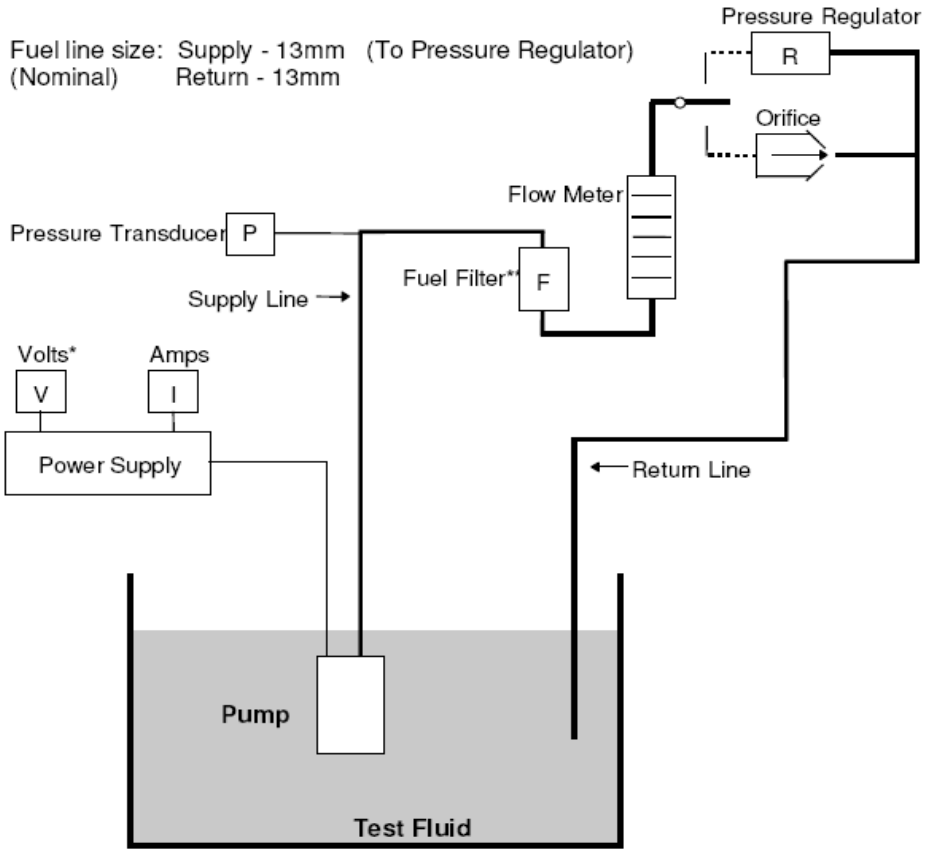
Assumed Engine Consumption rate at 100% Wide-Open-Throttle = 90 l/h

Assumed Recirculation Rate = 280 – 90 l/h = 190 l/h



4-Other tests set-up

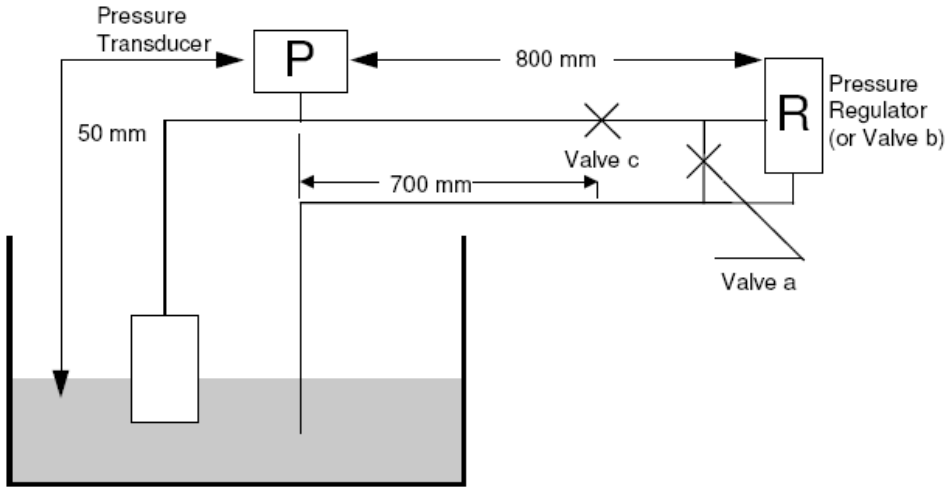
Fuel Pump Performance Test Set-Up



* At Pump Terminals
** OEM fuel filter required for Test 3.6.7

FIGURE 1

Pressure Rise Time / Decay Test Set-Up

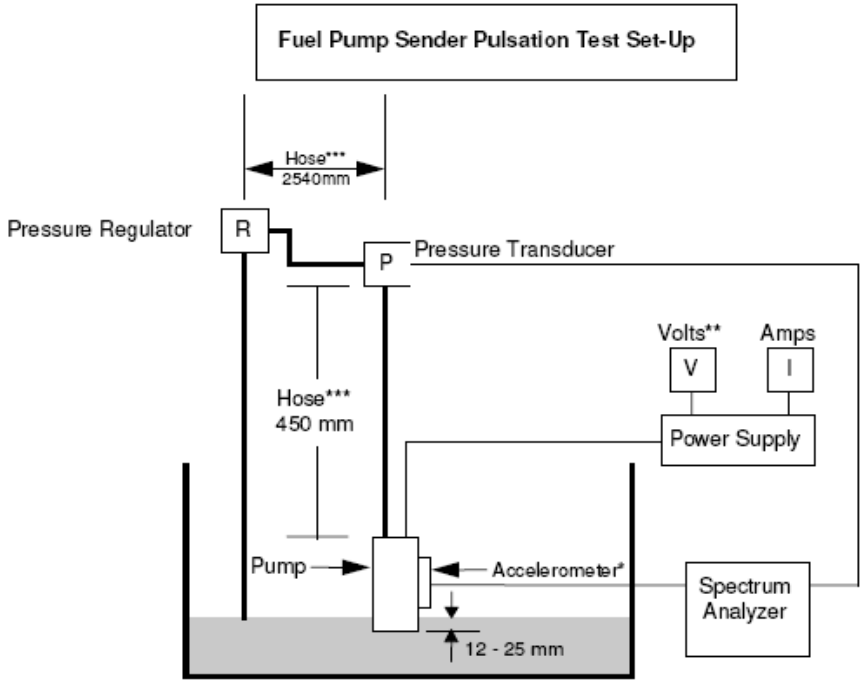


Use 13mm metal lines
A hose may be used between the pump and transducer

* If a pressure regulator is used, a regulator that does not pass fuel until set pressure is reached must be used. Response time and resolution of pressure transducer and recording device shall be less than 5 ms.

FIGURE 2

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters 1+2: XFC104 + XFC144 (in vehicle configuration)



* Attach Accelerometer to an aluminum block (see sketch below) via a stud. Attach aluminum block to the side of the pump with a thin layer of epoxy. Another type of adhesive may be used if the entire measuring system's natural frequency is greater than 30 kHz. The aluminum block should be attached to the fuel pump midway between top and bottom of pump body, 180 º from outlet tube. When measuring axial vibration attach the accelerometer at the top of the aluminum block.

** At pump terminals

*** Use 1/2" Motorcraft KFL-1A reinforced rubber hose.

Accelerometer Specifications

- Shear Type
- Useable frequency range to 10% limit at least 50 Hz -10 kHz
- Mounted resonant frequency (to block) > 50 kHz
  (Ref: Unmounted resonant frequency typically 50% to 60% of mounted resonant frequency)
- Total mass of accelerometer(s) and mounting block < 10 grams

Aluminum Block

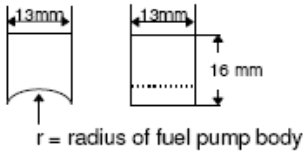
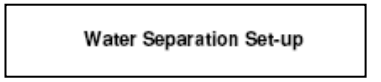
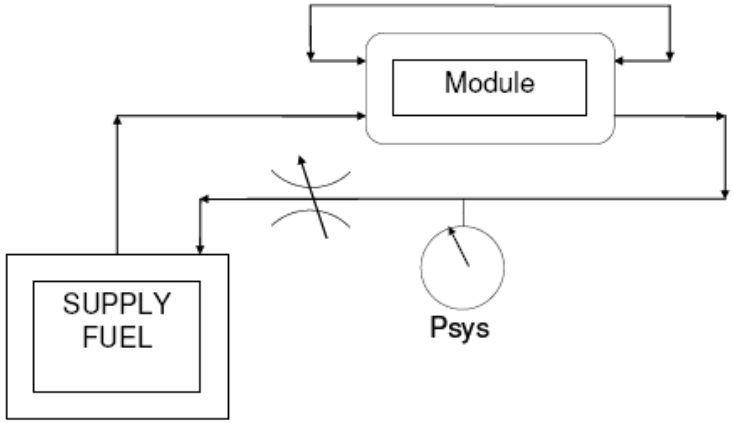


FIGURE 3





Dynamics

In order to accurately simulate the dynamics of the vehicle, the module should be set-up in the following manner:

- Mount module in vehicle position and note what grade vehicle position equates to in test report.
- Test is to be conducted on a three axis test stand.
- 30% grade represents a San Francisco Hill
- 7% grade represents Davis Dam which is 11 miles long.

FIGURE 4

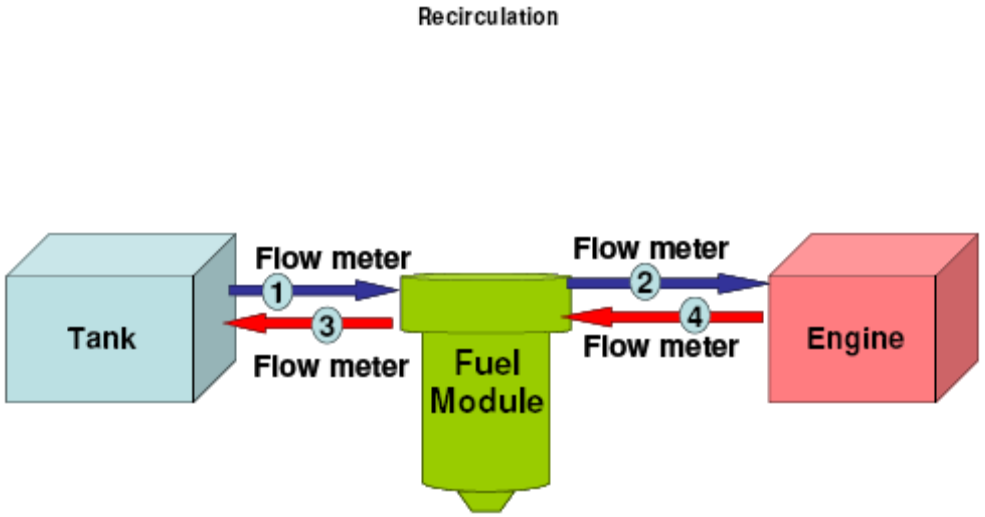


FIGURE 5

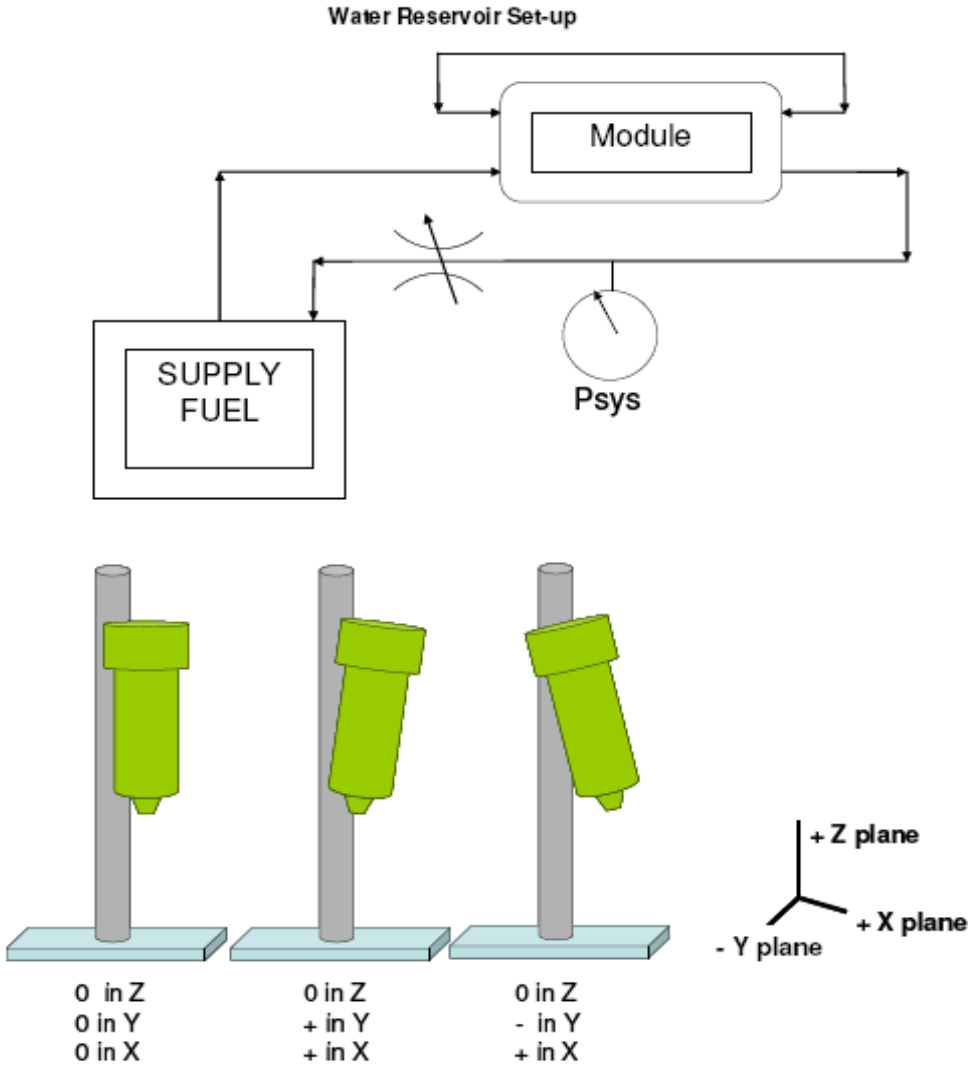


FIGURE 6

Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters 1+2: XFC104 + XFC144 (in vehicle configuration)

5-Compilation of reference documents

1. QS9000 Quality System Standard, Ford Motor Company, Latest Release

2. Advanced Product Quality Planning and Control Plan, Ford Motor Company/General Motors/ Chrysler (AIAG#810-358-3003)

3. PEP 3-145, sec. VII, Guidelines for Part Number Identification on Parts

4.

Fuel Type	Specification	Fuel Name
I	XE-M4CX601-602-85A	M85 - Mileage Accumulation
L	XE-M4CX609-85A	E85 Summer Grade
Q	ASTM D975 XE-M4CX726-A	Ultra-low sulfur (now known as Diesel #2)
R	XE-M4CX727-A	Diesel #1, Cold Weather
S	Corrosive Fuel	Corrosive Fuel, Aggressive Diesel *
T	XE-M4CX703-B	Artic / Jet Fuel
U	ASTM D6751 XE-M4CX715-A	20% Bio Diesel
V	Aged Bio-diesel	Aged-diesel

5. Electrical Design Specification ARL 09-0466

6. Fuel System Design Specifications:
   SDS FY-0006
   SDS FY-0009

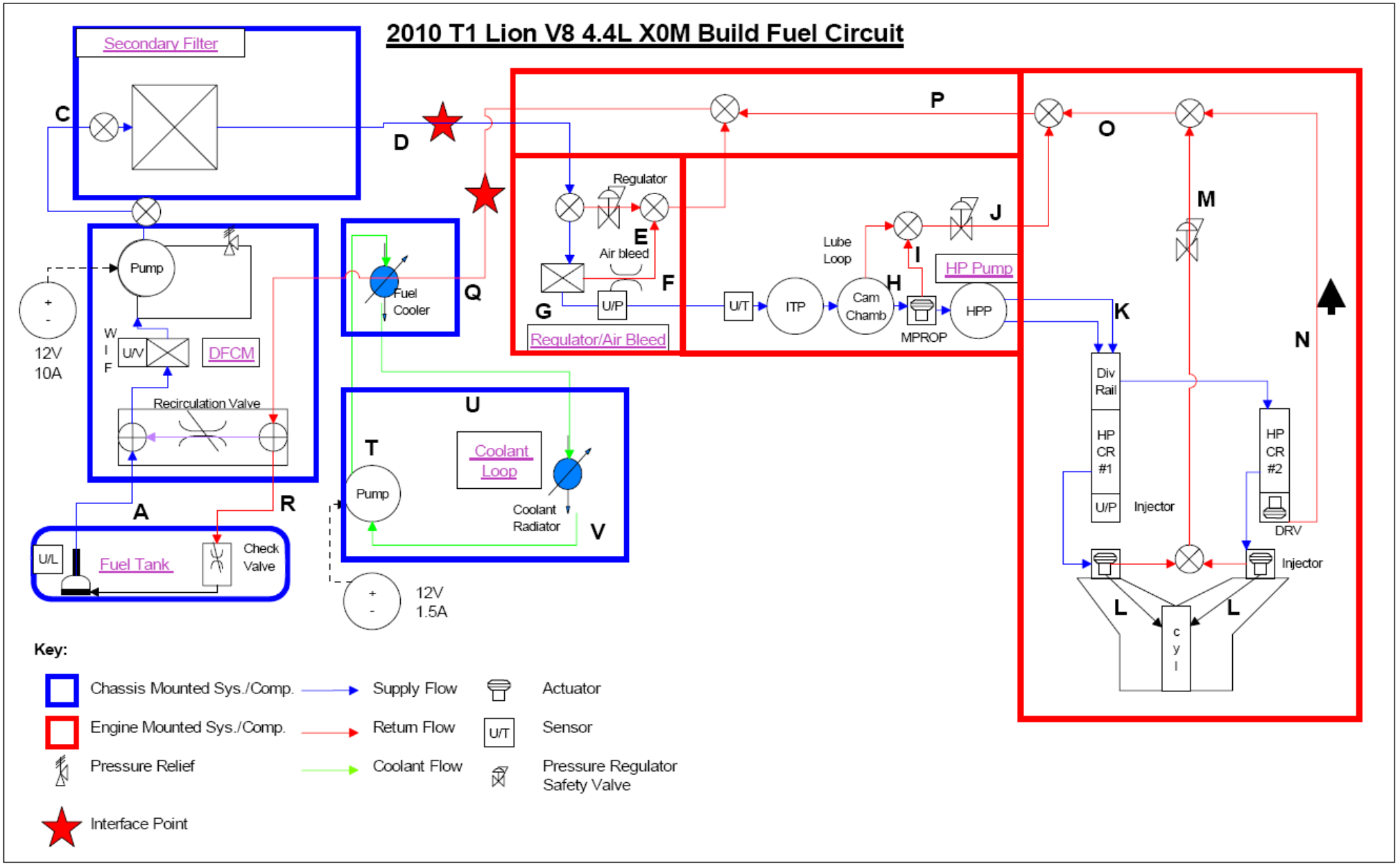
Testing Fuels

I - XE-M4CX601-602-85A	M85 - Mileage Accumulation
L - XE-M4CX609-85A	E85 Summer Grade, General Purpose
Q - ASTM D215S XE-M4CX726-A	Ultra-low sulfur (now known as Diesel #2)
R - XE-M4CX727-A	Diesel #1, Cold Weather
S - Corrosive Fuel -	Acidic Corrosive Fuel, Aggressive Diesel *
T - XE-M4CX703-B	Artic / Jet Fuel
U - ASTM D6751 XE-M4CX715-A	20% Bio Diesel (20% soy oil and 80% ultra-low sulfur –fuel Q) SME Bio Diesel
V - Aged Bio-diesel	Aged Bio-diesel** SME Bio Diesel
W – Corrosive Fuel - Basic	Basic Aggressive Diesel***
X – Free Sulfur Aggressive Biodiesel "B20AS"	B20A [fuel 4] 15 ppm powdered sulfur
Y– Base Biodiesel Fuel "B20"	#2 Diesel 75% volume Soy-based FAME 20% volume DI water 5% volume
Z= Aggressive Bio-Diesel Fuel -	#2 Diesel 75% volume Soy-based FAME 20% volume Acid Water, 5% volume [600 ppm acetic acid/1L DI water]

* Fuel S blend = XE-M4CX726-A with 2% by volume of corrosive water
Corrosive water = 990 ml distilled water and 600 ppm of acetic acid.

** Obtain required amount of fuel in a proper container (store at room temperature).
Precondition fuel for 4 days before use in tests as follows:
Apply barrel warmer to container to heat fuel to 100 deg F (simulate a hot summer day).
Place a tube in the fuel with one end in fuel and the other venting to the atmosphere to incorporate air into the fuel.

*** Fuel W blend = XE-M4CX726-A with 0.5% by volume of basic corrosive water.
Corrosive water = 0.165 g/l NaCl, 0.148 g/l Na_2SO_4, 0.138 g/l $NaHCO_3$, and 1 Liter of Distilled H_2O
NOTE: Test fluids may be substituted with prior Ford Program or SME approval



Filter 1: XFC104 DFCM
Filter 2: XFC144 Fine filter
Filters [redacted] (in vehicle configuration)