



*Bror Tingvall/2017-11-30V2*

## **Pressure drop in fuel system on Ikarus C42B, SE-VMV with Rotax 912 ULS**

The mechanical pump mounted in the Ikarus C42B, SE-VMV, is a BCD Corona Type 893115 membrane pump.

After 5 years of service where some components are to be replaced, also the changing of the mechanical fuel pump occurred. Immediately after the change, pressure drops were noted in the fuel system. The pressure drop most often occurs when the electric pump is switched off during full-power increase, but has also occurred after the transition to plan-escape with slightly reduced power. On a few occasions, the plane became distressed after engine failure occurred when the electric pump was switched off.

We thought that the customer was wrong with the delivered pump and ordered another new pump. After assembly and test flight, the same error occurred, ie pressure drop when the electric pump is switched off. In addition, it took quite some time to return to normal fuel pressure again.

Now a modification was carried out according to Ikarus Service Bulletin SB-42-019-2015, Extra pump sealing, new check valve on the fuel return. At engine tests, pressure still drops in the fuel system when the electric pump was switched off.

The next step was to contact the manufacturer of the aircraft, Ikarus. We received a tested fuel pump from Comco-Ikarus that was assembled and tested. The result was the same as before, pressure drop when the electric pump was switched off. We did not perform test flights because the fault was already on the ground.

The mechanical pump design is a standard diaphragm pump with two check valves, one for the suction side and one for the pressure side.

The fuel system is designed with the electrical and mechanical pump connected in series, ie when the electric pump is switched on, the fuel is fed through the full pressure mechanical pump. Both reversing valves in the mechanical pump are in the maximum open position.

When the electrical pump is switched off, the mechanical pump appears to be disturbed, probably due to the high pressure on the suction side. As a result, it takes too long for the mechanical pump to start functioning optimally and to achieve the correct fuel pressure again.



Mechanical fuel pump BCD type 893115

## Comments

It appears that the new mechanical fuel pumps are unable to operate in series by an electric fuel pump. It is likely that mechanical pump interference will take too long to return to optimal operation.

Rebuilding of the fuel system into a parallel-connected system appears to work fully. No abnormal pressure drop occurs when the electric pump is switched off. At low engine speeds, the fuel pressure is higher than at higher engine speeds. The pressure difference with the electric pump to alternatively from is quite small. It is quite logical that the fuel pressure is slightly higher at lower engine speeds.

A further test is complete without the additional sealing included in the Ikarus modification according to Service Bulletin SB-42-019-2015. The gasket increased the capacity of the pump slightly. We wanted to test the difference without this extra sealing. It turned out that the fuel droplet decreased slightly, which is sufficient enough. You do not need to have this extra gasket to the fuel pump. On the other hand, we kept the steering valve for the 0.7 mm return line as stated in the service bulletin.

The UL aircraft Evector EV97 has the same parallel fuel pump system as we tried in the Ikarus C42B.

We suggest that you choose to mount the pumps in parallel for a safer function and the elimination of pressure drop in the fuel system if we are to use the existing mechanical pump.

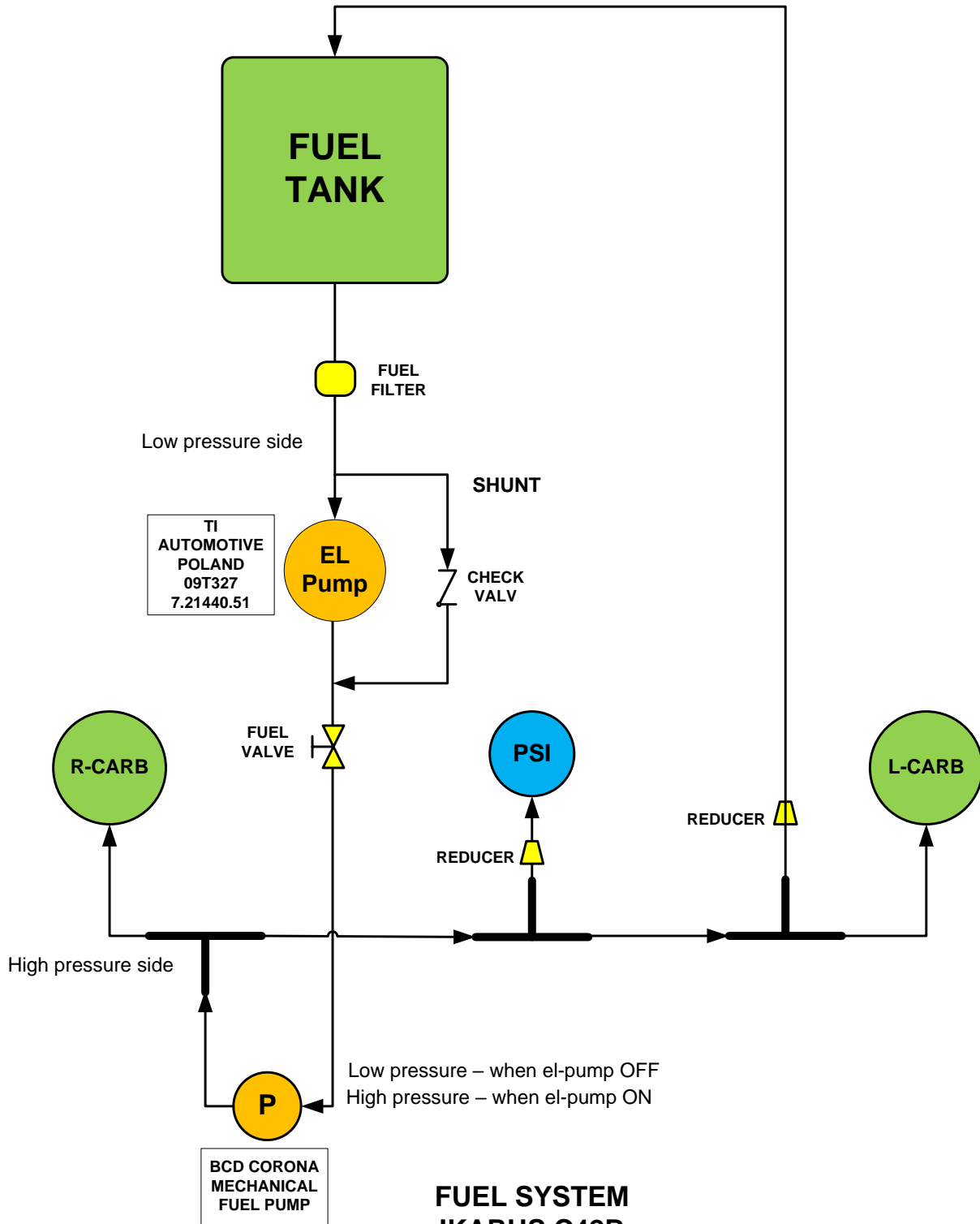
## Different tests performed - test results below

Ikarus C4B - SE-VMV, Luleå-Boden Flygklubb					
Test flying after modification of fuel system: Extra pump sealing, new check valv on the fuel return					
Sign.: B. Tingvall/0705587912		Test 1	2017-09-30	Luleå-Kallax airport, ESPA Sweden	
		Test 2	2017-10-06	Luleå-Kallax airport, ESPA Sweden	
<b>Serial pump system</b>			<b>Electric pump</b>	<b>Electric pump</b>	
			<b>Shut OFF</b>	<b>ON</b>	
<b>Operation</b>	<b>Position</b>	<b>Speed</b>	<b>Fuel pressure</b>	<b>Fuel pressure</b>	<b>Notes</b>
		<b>km/h</b>	<b>PSI</b>	<b>PSI</b>	
Idle, 1800 rpm	On ground	0	4,7	5,5	Idle
3800 rpm	On ground	0	5,0	6,0	Reduced trottle
3000 rpm	On ground	0	5,0	5,5	Reduced trottle
Max. climbing angle	Flying	100	2,5	4,8	Max. trottle
Max. climbing angle	Flying	100	2,5	4,2	Max. trottle
Climbing, red angle	Flying	140	3,5	4,8	Max. trottle
Climbing, red angle	Flying	150	3,6	4,8	Max. trottle
Cruise, 4300 rpm	Flying	165	4,7	5,2	Reduced trottle
<b>Test procedure: in air</b>					
From start and climbing upp to about 1000 ft both mechanical and Electric fuel pump was ON					
After climbing up to about 1000 ft the el.pump was shut off and pressure drop was noted					
The fuel amount was about 40 liters in the tank at the tests					
<b>Notations:</b>					
The greater the climbing angle, the more the fuel pressure drops when the electric pump is switched off. In max. climbing op. The fuel pressure will increase slowly to normal about 5-10 sec (from 2,5 up to about 4 psi)					
<b>The first school flight after modification:</b> 2017-10-06					
The electric fuel pump was switched on from start					
After start and climbing to 1000 ft the power was reduced					
The Electric fuel pump was switched off					
The fuel pressure dropped close to zero and increased very slowly					
After 5-6 seconds the pressure was still low, about 1 psi					
The electric pump was switched on and we returned for landing.					

<b>Ikarus C42B - SE-VMV, Luleå-Boden Flygklubb</b>					
Test flying after modification of fuel system: Extra pump sealing, new check valv on the fuel return according to Service Bulletin SB-42-019-2015 (Comco Ikarus)					
and a new mechanical pump (Ikarus tested)					
Sign.: B. Tingvall/0705587912					
<b>Test 2017-11-01</b> Luleå-Kallax airport, ESPA Sweden					
<b>Serial pump system</b>			<b>Electric pump</b>	<b>Electric pump</b>	
			<b>Shut OFF</b>	<b>ON</b>	
<b>Operation - rpm</b>	<b>Position</b>	<b>Speed</b>	<b>Fuel pressure</b>	<b>Fuel pressure</b>	<b>Notes</b>
		<b>km/h</b>	<b>PSI</b>	<b>PSI</b>	
1800	On ground	0	4,4	5,5	
2000	On ground	0	5,3	5,5	
2000	On ground	0	5,0	5,4	
2000	On ground	0	4,7	5,2	
2000	On ground	0	3,0	5,4	
2000	On ground	0	2,3	5,3	
2000	On ground	0	2,5	5,5	13 sek delay up to 3 psi
3000	On ground	0	3,9	5,2	
3000	On ground	0	3,8	5,2	
3000	On ground	0	3,8	5,2	
3000	On ground	0	2,3	4,0	15 seconds delay
3000	On ground	0		4,5	20 seconds delay
3000	On ground	0		5,0	30 seconds delay
<b>Test 2017-11-29</b> Luleå-Kallax airport, ESPA Sweden					
<b>Parallell pump system</b>			<b>Electric pump</b>	<b>Electric pump</b>	
			<b>Shut OFF</b>	<b>ON</b>	
<b>Operation - rpm</b>	<b>Position</b>	<b>Speed</b>	<b>Fuel pressure</b>	<b>Fuel pressure</b>	<b>Notes</b>
		<b>km/h</b>	<b>PSI</b>	<b>PSI</b>	
2000	On ground	0	5,8	6,0	
2000	On ground	0	5,6	5,8	
2000	On ground	0	5,8	6,0	
3600	On ground	0	4,8	5,0	
4000	On ground	0	4,7	4,8	

<b>Ikarus C42B - SE-VMV, Luleå-Boden Flygklubb</b>					
Test flying after modification of fuel system: Extra pump sealing, new check valv on the fuel return according to Service Bulletin SB-42-019-2015 (Comco Ikarus)					
and a new mechanical pump (Ikarus tested)					
Notes: No extra sealing on the mech. Pump					
Check valve fuel return: 0,7 mm					
Sign.: B. Tingvall/0705587912					
<b>Test 2017-11-30</b>		Luleå-Kallax airport, ESPA Sweden			
<b>Parallell pump system</b>			<b>Electric pump</b>	<b>Electric pump</b>	
<b>Without extra sealing on the pump!</b>			<b>Shut OFF</b>	<b>ON</b>	
<b>Operation - rpm</b>	<b>Position</b>	<b>Speed</b>	<b>Fuel pressure</b>	<b>Fuel pressure</b>	<b>Notes</b>
		<b>km/h</b>	<b>PSI</b>	<b>PSI</b>	
2000	On ground	0	5,2	5,2	
2000	On ground	0	5,1	5,4	
2000	On ground	0	5,2	5,4	
2000	On ground	0	5,2	5,4	
2000	On ground	0	5,2	5,4	
3000	On ground	0	4,7	5,1	
3000	On ground	0	4,7	5,1	
3000	On ground	0	4,7	5,1	
3000	On ground	0	4,7	5,1	
3600	On ground	0	4,6	4,9	
3600	On ground	0	4,6	4,9	
4000	On ground	0	4,8	4,9	
4000	On ground	0	4,7	4,8	

# Drawings on series- and parallel mounted fuel systems

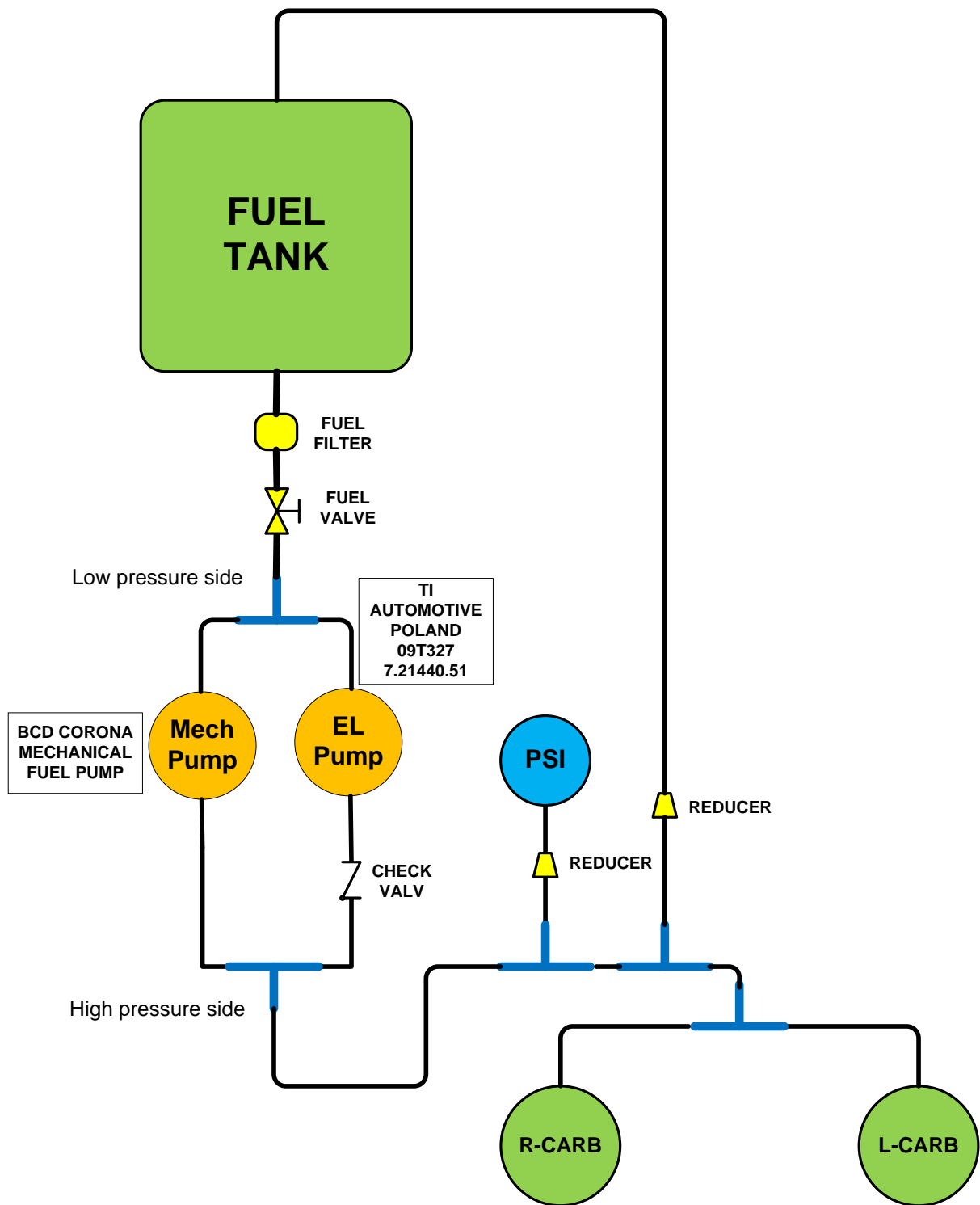


## FUEL SYSTEM IKARUS C42B SE-VMV

(Original fuel system after  
modifications according to  
Ikarus service message)

Date: 2017-11-01

B. Tingvall



**MODIFICATION OF THE FUEL SYSTEM  
IKARUS C42B, ROTAX 100Hp, YEAR: 2010  
REG.: SE-VMV  
BT/20171121**