The check valve on the 914 turbocharger

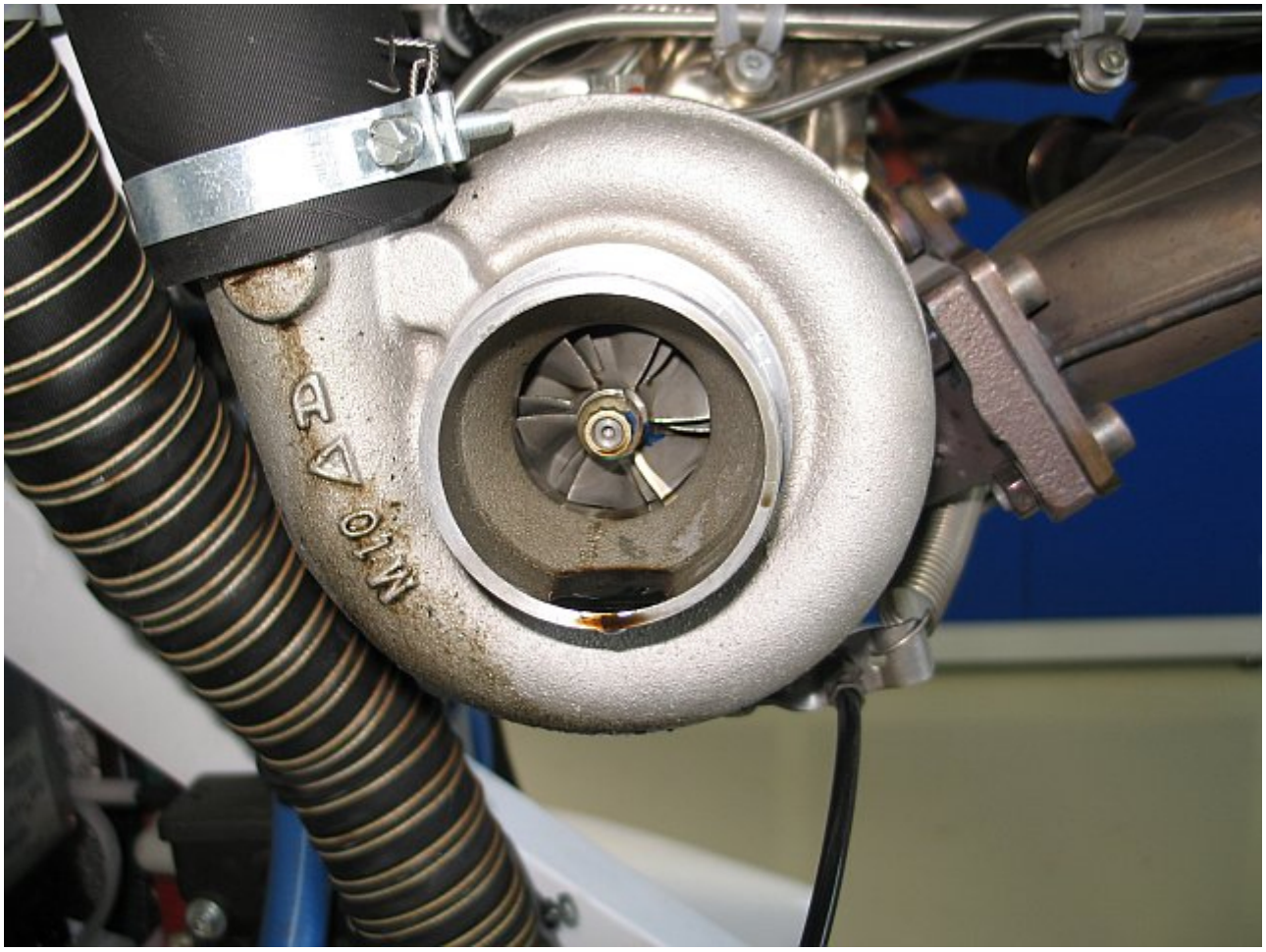
…. or why there is a pool of oil under the 914

The appearance

…. Recently, it has become noticeable, or it is pointed out, that after the first start of the day, a decent plume of smoke comes out of the exhaust.
If the problem worsens, you will sometimes have an oil stain under the plane in the morning.
Not regularly at first, but more often and larger the longer the plane is parked.

A visual inspection of the engine is initially unsuccessful - the engine is dry as dust.
…. but stop: there is a drop of oil on the hose between the air filter and turbocharger.

Now the hose is removed from the turbine housing and **you can see the following picture:**



A pool of oil that shouldn't be there is smiling at you in the turbocharger.

The cause ...

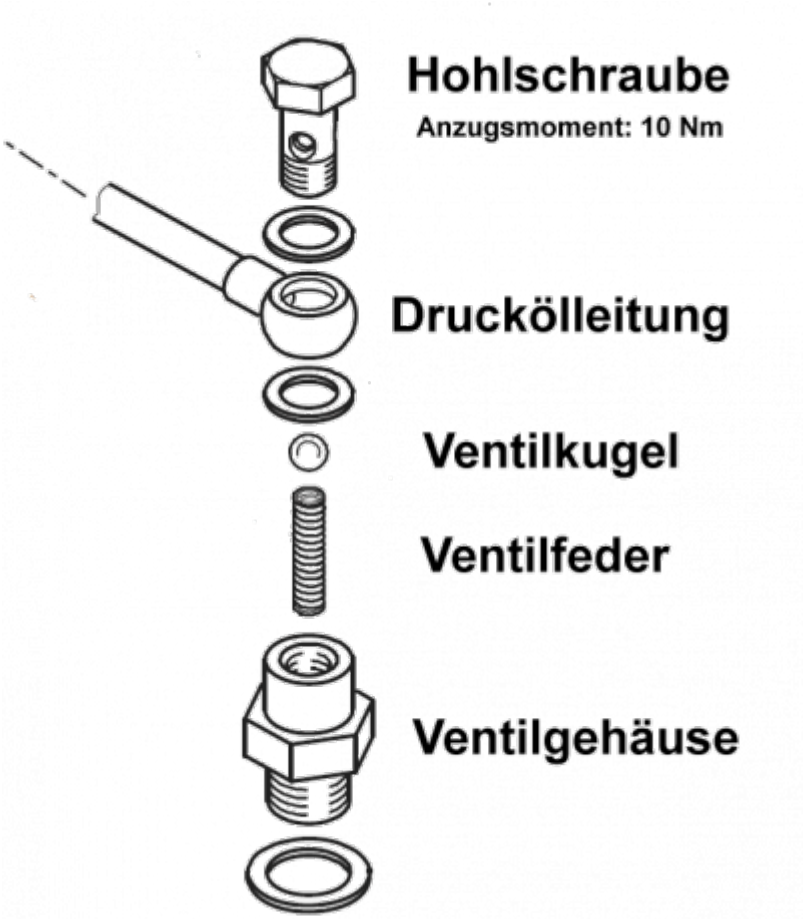
… is due to the design of the turbocharger's lubrication system:
An illustrative picture and a brief explanation can be found here
The plain bearings of the turbocharger shaft must be supplied with pressure oil and this is done via the pressure oil line.
Coming from the oil pump housing, this is screwed into the valve housing with a banjo bolt on the top of the turbocharger center section.

The oil that drips off after lubricating the shaft bearings is normally collected in the oil sump and pumped from the oil pump into the oil tank via the suction line. The amount of oil in the oil sump is relatively small, but perfectly sufficient for operation. In addition, the return flow rate from the oil sump to the oil tank is considerably greater than the amount of oil that lubricates the bearings.

If the non-return valve in the valve housing is not tight, the oil sump will fill up and then the turbine and compressor housing will also fill up.
If this is also full, the oil continues to run into the exhaust and into the compressor housing inlet. Here you can see the oil loss when oil drips from the intake hose.

The standstill ...

… and how the oil floods the turbocharger:
You will have already stumbled across the term „valve housing“.
The valve is intended to ensure that no oil can run in from the direction of the oil pump.
To do this, the ball is pressed against the banjo bolt. During operation, the ball is lifted from the valve seat by the oil pressure and the oil can lubricate the turbocharger unhindered.
See the following graphic:



Let's start at the bottom.

- The valve housing is mounted on top of the turbocharger.
- There is a compression spring in the valve housing
- which presses the ball above it
- against the banjo bolt.

… and this is the crux of the matter
The banjo bolt is fitted with a cone, which is designed as a valve seat.
Unfortunately, the valve seat is not always designed precisely enough to be considered a valve seat, as the following image illustrates.

The image shows the conical valve seat in the banjo bolt. You can imagine that a leak is pre-programmed here.
However, I must point out that the picture is from an older version. The banjo bolts are now made of stainless steel and generally look better.

The remedy

There are 3 options here:

1. During the warranty period, get on your contractual partner's nerves until they have rectified the problem
2. Fit a new banjo bolt (or have one fitted)
3. rework the valve seat

1. is probably the most time-consuming and annoying method, as you have to reconcile deadlines
2. very successful with a „good“ banjo bolt
3. **nothing for beginners**.

Reworking the banjo bolt

… I clearly only recommend this to a mechanic **with sufficient experience**

Place the banjo bolt with the bolt head on a stable surface (anvil, vice) and place the ball on the valve

seat.
Then place a cloth over it to keep the ball in place.
Now hit the ball with a 200g hammer with a targeted and balanced blow.

Now you should see a nice, smooth valve seat in the banjo bolt under the microscope and have permanent peace of mind after assembly.

…. but be careful:
If the ball jumps away, it is usually gone too.
If the impact is too strong, the banjo bolt or the ball will be damaged.
If the blow is too weak, the valve is still leaking.