Conducting a compressor air purity test by filling a test cylinder to 200bars
IMPORTANT NOTE: -   Air Sample Test cylinder - Filling Instructions

My mathematics reveals that it is critically important that when the pillar valve is refitted to the test sample cylinder, that the cylinder is thoroughly purged beforehand with ANHYDROUS gas (Dry air, dry Nitrogen, etc)

If the pillar valve is fitted to the test cylinder without purging the cylinder with anhydrous gas, then any humidity measurement carried out on air filled into the cylinder _will have huge errors_.

Here is the math
Test Cylinder WP =207bars
Test cylinder WC =12 Liters
Location of valve refitting = Thailand
Ambient temperature during valve refitting = 35 degrees C
Ambient humidity during valve refitting = 100% (dive shop on the beach, mid-day conditions)
Humidity content of ambient air = 40g/m^3   (See attached standard chart to read off the correct value)

Prior to filling with the test sample for a newly revalved cylinder:-
The humidity content of the 1 bar ambient air is 0.012m^3 x 40g/m^3 = 0.480g/m^3 = 480mg/m^3

Let's say we filled this newly valved cylinder with completely dry air with no humidity at all...
The after filling, the total air in the cylinder would be 207 x 12 = 2,484 Liters = 2.484m^3
Thus the humidity content of the air now inside the cylinder would be 480mg/2.484 = **193mg/m^3** (OUCH!!!) - The humidity content of dry air is supposed to be zero.

Now then, **EN12021** air is required to have a maximum humidity content of **25mg/m^3** measured at the compressor outlet (This is your clients requirements for the fire service scba air)
EN12021 air is allowed to have **35mg/m^3** measured in an air bank cylinder.
We can thus observe that by simply refitting the pillar valve onto the cylinder without previously purging the cylinder with anhydrous (dry) air, which we have totally messed up the humidity measurement of the air sample.

Solution
Prior to filling the cylinder with air test sample we must remove the valve from the cylinder and purge Thailand's humid ambient air out of the cylinder using a full 200bar cylinder air cylinder with 1st stage and long hose connected.
Insert the long hose all the way down into the cylinder and purge the cylinder quickly taking about 1 minute to use 100bar of air. Purging at this speed will also dry off any residual moisture droplets inside the tank that would mess up any moisture measurement.
After purging with 100bar of scuba air quickly remove the hose and _immediately_ refit the pillar valve ('that very second' before any wet ambient air has had a chance to get in...)

In this instance, even if the cylinder used to purge/dry the test cylinder was filled from a compressor working at 45degrees 'C', 100% humidity, and with a bad filter, the fact that the cylinder being used to purge the gas is already at 200bar will have dropped the cylinder air humidity to 480mg/m^3 - (A vast improvement on the local ambient air sitting at 40,000mg/m^3)

In this case with a dried, purged cylinder and refitted valve, there will only be 0.012 x 480mg/m^3 = 5pm of water in the cylinder prior to filling with the test sample, giving a humidity of 5/2.484 = mug/m^3 of humidity reading if filled from a dry air source to 207 bars.

Conclusion

Please ensure that the cylinders used to supply the test sample have had their valves removed and purged with dry scuba air immediately prior to filling with the test gas sample, or the humidity measurement will be in error.

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