Water Cooling System

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The electronic FEBs need to be cooled during operation. The cooling process will be done by circuilating water in cooling pipes shown in Figure 1.Left attached to the cooling plate shown in Figure 1.Middle. The FEBs are sitting on bottom of the cooling plates. The cooling plate is attached to the cooling pipe by a L shape connector, shown in Figure 1.Right. Figure 2 shows the FEBs mounted on the chamber with the cooling components (Pipes, Plate, L bars).

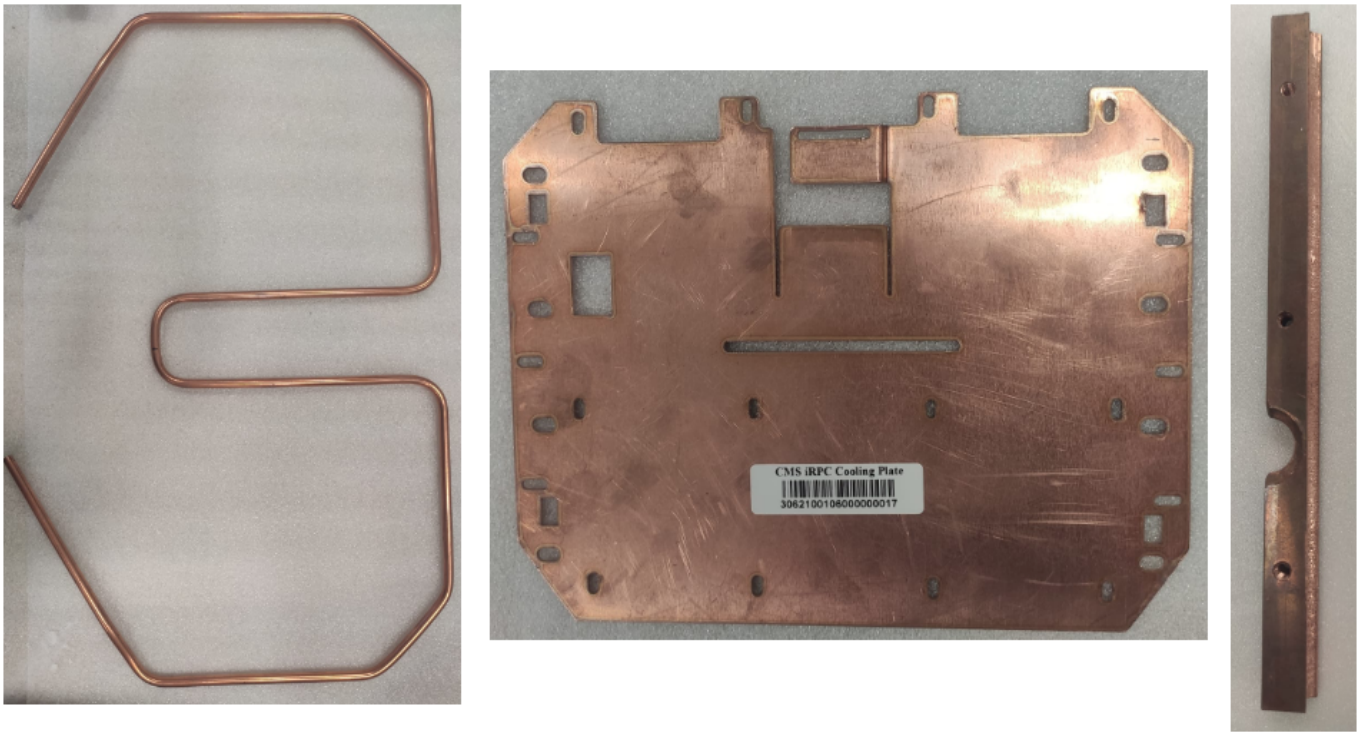

Figure 1

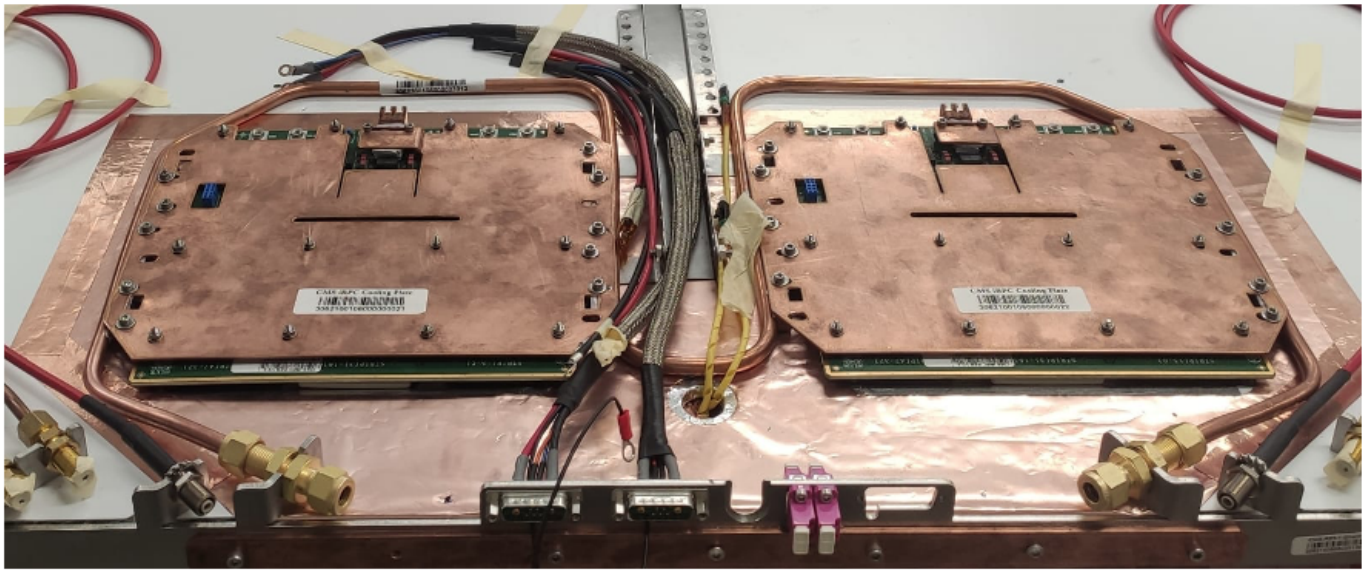

Figure 2

For cooling purpose we circulate water. But in case we need to disconnect pipes and change the chamber under test as example, we need to use air to purge the water from the pipes and safely disconnect the pipes.

Let’s first describe the cooling system components then you can find the procedure to use the cooling system.
The cooling system has different components:

1. The chiller

This unit is responsible of cooling the water, shown in Figure 3.Left.

- To switch on/off the chiller, there is 1/0 button (shown by number 1 in top right of figure 3), then you need to press the power button (shown by number 2 in top right figure 3) for 1 sec to switch on the chiller.
- Check the set point of the temperature by pressing on SET button shown by number 3 in top right figure 3 (You need to keep pressing on the set button to see the temperature in the display)
- You can adjust the set point of the water with 2 arrows up/down (shown by numbered 4 in top right figure 3), when you adjusting the set point by up/down arrows you need to keep pressing on the SET button. Normally we set the temperature at 17oC
- You can check the water level in the water tank inside the chiller from the glass window shown in Figure 3 right bottom.
- Important: You must check the water level before switch on the chiller and should be between and ???

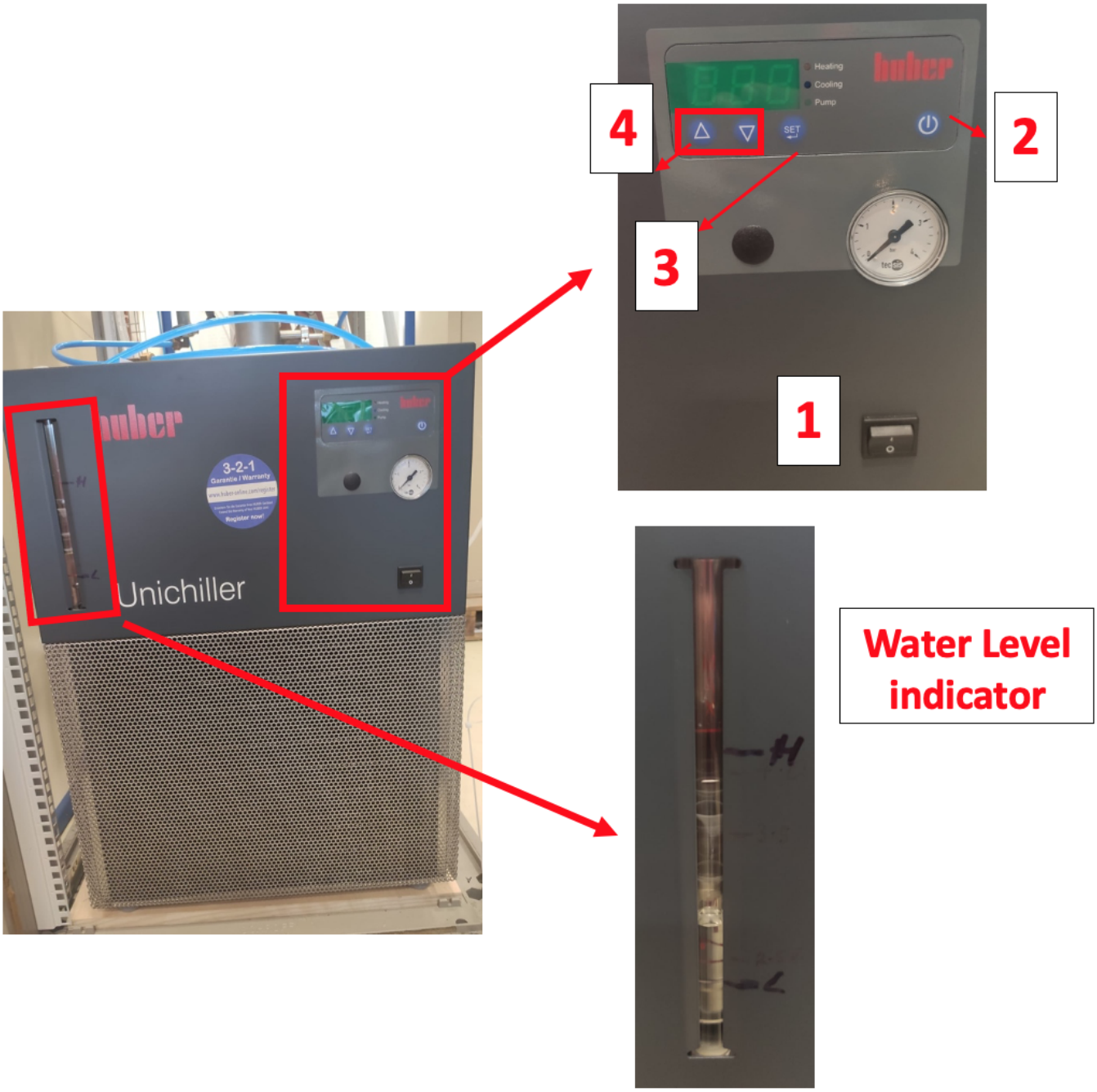

Figure 3

2. The distribution panel
   This unit is responsible for distributing the water in 4 supply channels to the chambers and collect the return water through 4 return channels to the chiller again, shown in Figure 4.

- Four channels allows the water circulation in 4 chambers at the same time.
- We have 4 supply (S1, S2, S3, S4) and 4 return (R1, R2, R3, R4) lines as shown in Figure 4. As an example; pipe from line 1 supply (S1) is connected to the chamber and the return line (R1) is connected to return line 1. This is repeated for other 3 channels.
- You can find the channel name for supply and return lines on figure 4.

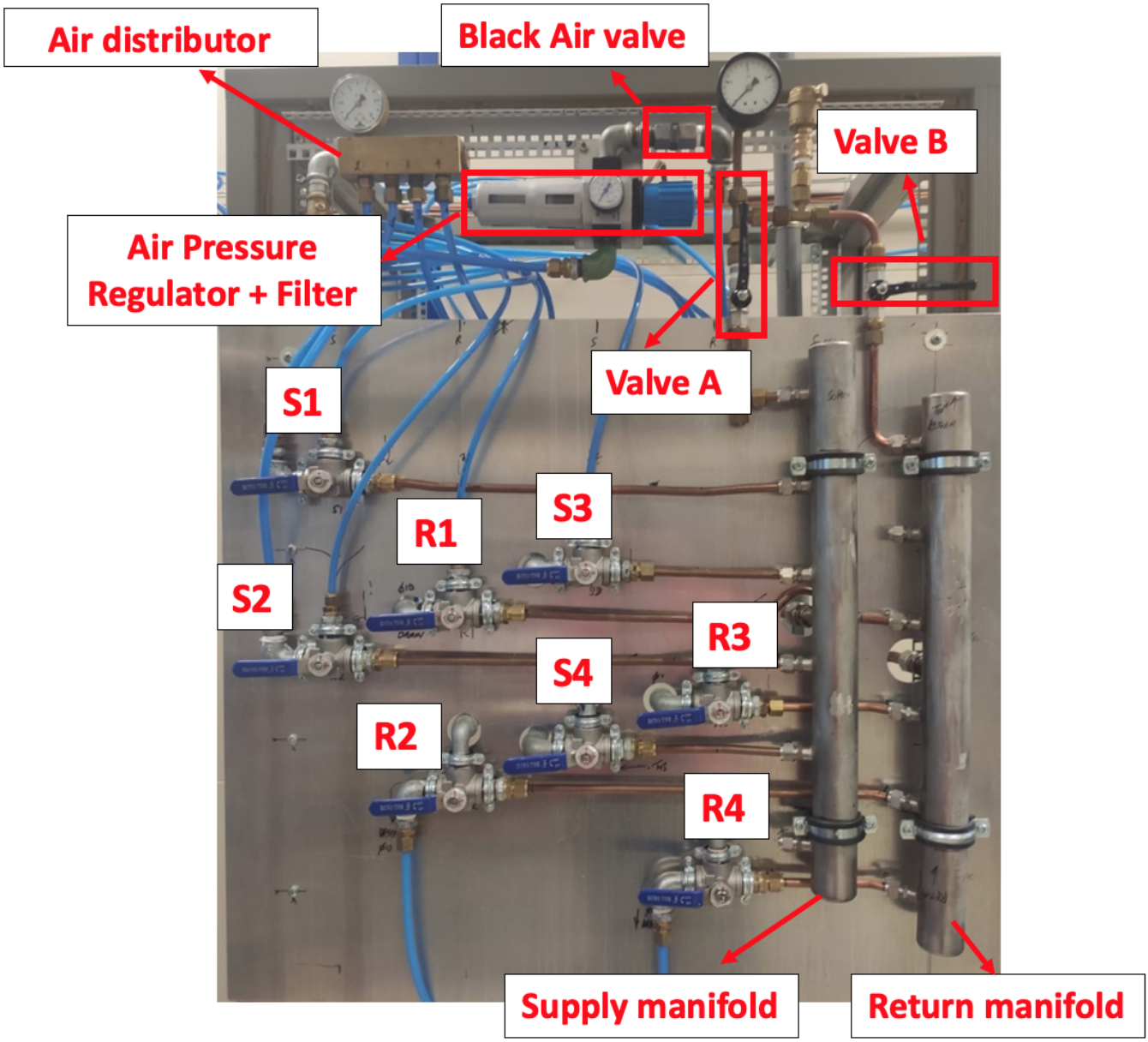

Figure 4

VIP: It is important to connect the same line of supply and return to the same chamber (S1 and R1 to same chamber and etc.)

- Valve A should be always in vertical position, we will not change this position in all the steps.

3. The Rotameter
   You can see the water starting to flow with bubbles (2 phase mixture “Water+Air”) when you switch on the chiller, shown in Figure 5.Left. We will have an indication of the total flow from the Hall effect flowmeter???.

4. The Rotary Flow Indictor (RFI)
   The RFIs are rotating when water pass through. The fans are connected to return lines to indicate the circulation of water in the chamber returning to return lines, shown in Figure 5.Right

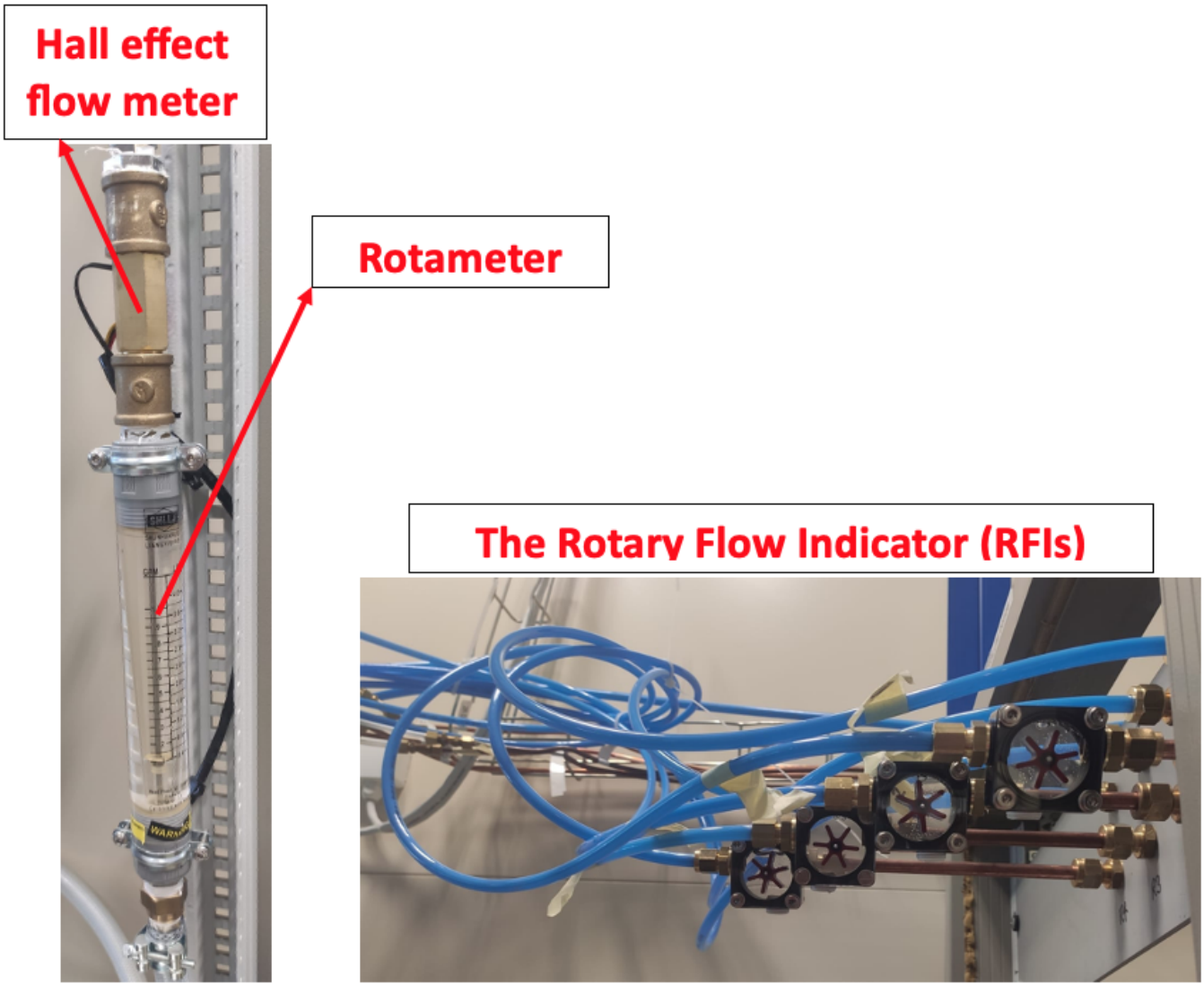

Figure 5

Procedure to connect chambers and start cooling

In order to circualte water in the chambers do the following steps:

1. Connect the four chambers with the blue pipes using Swagelok unions shown in Figure 6. When you are tighting the union use keys number 16 and 18 and tight gentily (Don't tight so much). Please Ask Ian Crotty, Ivan how much you can tight the union.

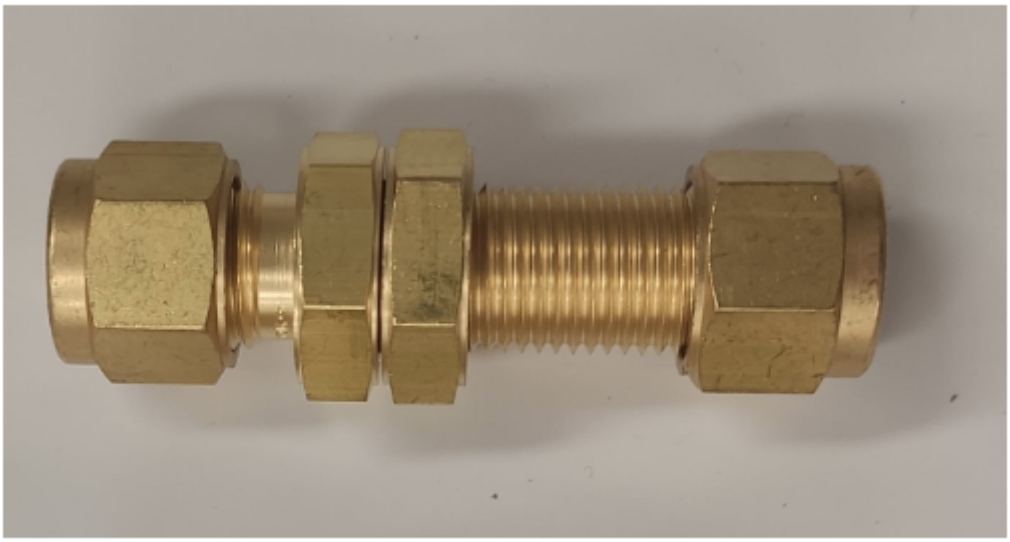

Figure 6

2. As example: first supply (S1) goes to the first chamber and the return goes to return line 1 (R1) and the same for the other 3 chambers.
3. Make sure all the pipes connections have been made (otherwise there will be water leak in the chamber with HV connectors and the electronic FEBs).
4. Make sure from the water level in the water tank in the chiller is between ??? and ???
5. All the valves in the distbution panel should be in the horizontal position as shown in Figure 7 , this insures that the water will flow in the chambers.

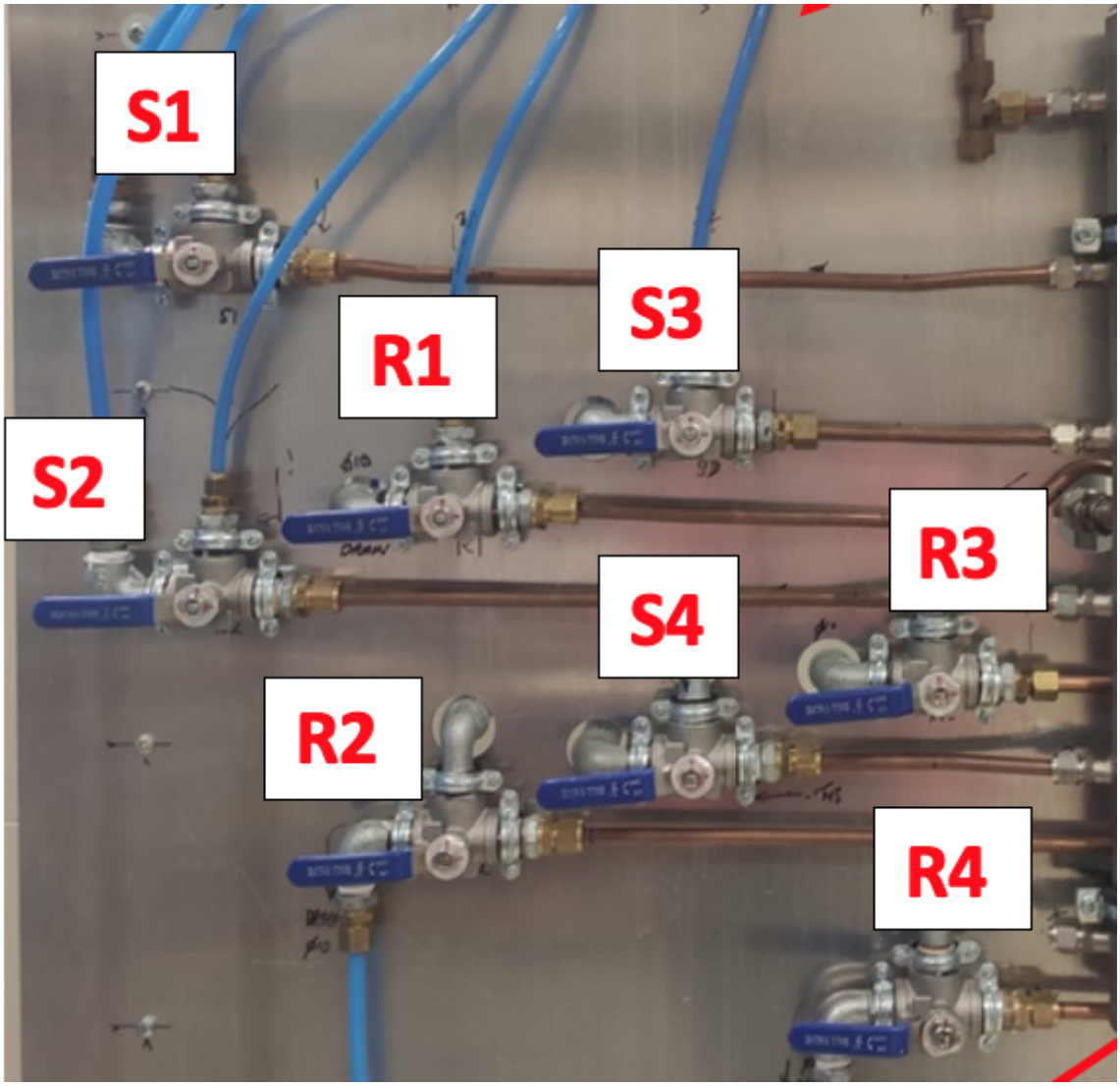

Figure 7

IF the valves are NOT in horizontal position, put them in the horizontal position BUT one chamber by one (this mean to rotate the supply and return line of the same line same chamber simultaneously)

Note: you can hear the water flowing in the pipes.

6. Make sure that the black valve (Air Valve) in vertical position as shown in Figure 8, ensuring no air is going into the circuits.

Figure 8

7. Switch on the chiller from on/off bottom as show in Figure 9, you need to wait till the value in the display is stable (once you switch on the chiller you can see 8.88 in the display then it will be changed to the right stable value).
8. Press ON button (blue one) for 1-2 seconds as shown in Figure 9 .

Figure 9

8. Look at the unions and make sure no water leake in the chamber side, if there is leake switch off the chiller and tighten the unions.

9. You will see the water is flowing in the rotameter and the four RFIs connected to the return lines are rotating (this illustates that the water is circulating now in cooling pipes on the chambers)

10. To purge the system from Air, valve B should be opened in vertical position (rotate anti-clockwise) for 3-5 minutes.

11. Close valve B by rotating to horizontal position

12. Check the set point on the chiller by pressing on SET button. It should be at 17 oC and if not, you can adjust by pressing on SET button and in same time increase/decrease the temperature from the arrows shown in Figure 2 to reach 17 oC

Procedure To disconnect the chambers

VIP: Disconnect ONE chamber at a time.

In order to disconnect the chambers we need to follow this procedure carefully.

As mentioned earlier, we can purge the water in the circuits using compressed air before we disconnect the pipes from the chambers, otherwise there could be a water leak in HV connectors and FEBs.

The compressed air line is connected to the system from the black valve (Air Valve) shown in Figure 3.

IMPORTANT: The Chiller should be **OFF**

In order to circuilate air make the following steps.

1. Put the black valve (Air Valve) to the horizontal position (rotate anti-clockwise) as shown in Figure 10.

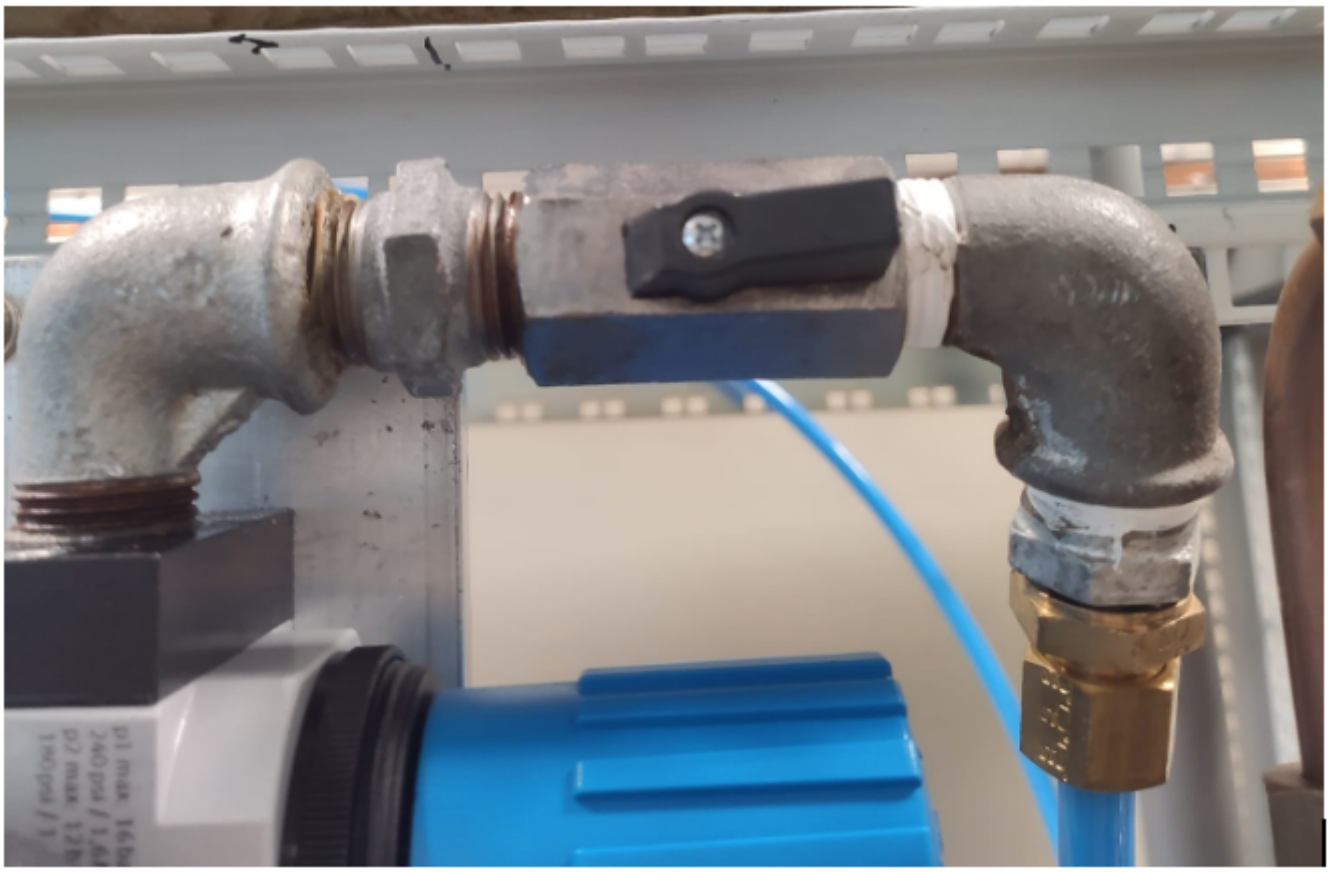

Figure 10

2. You can notice the air flow in the manometer.

3. Check the presurre in the air distributor to be around 0.7 bar as shown in Figure 8.

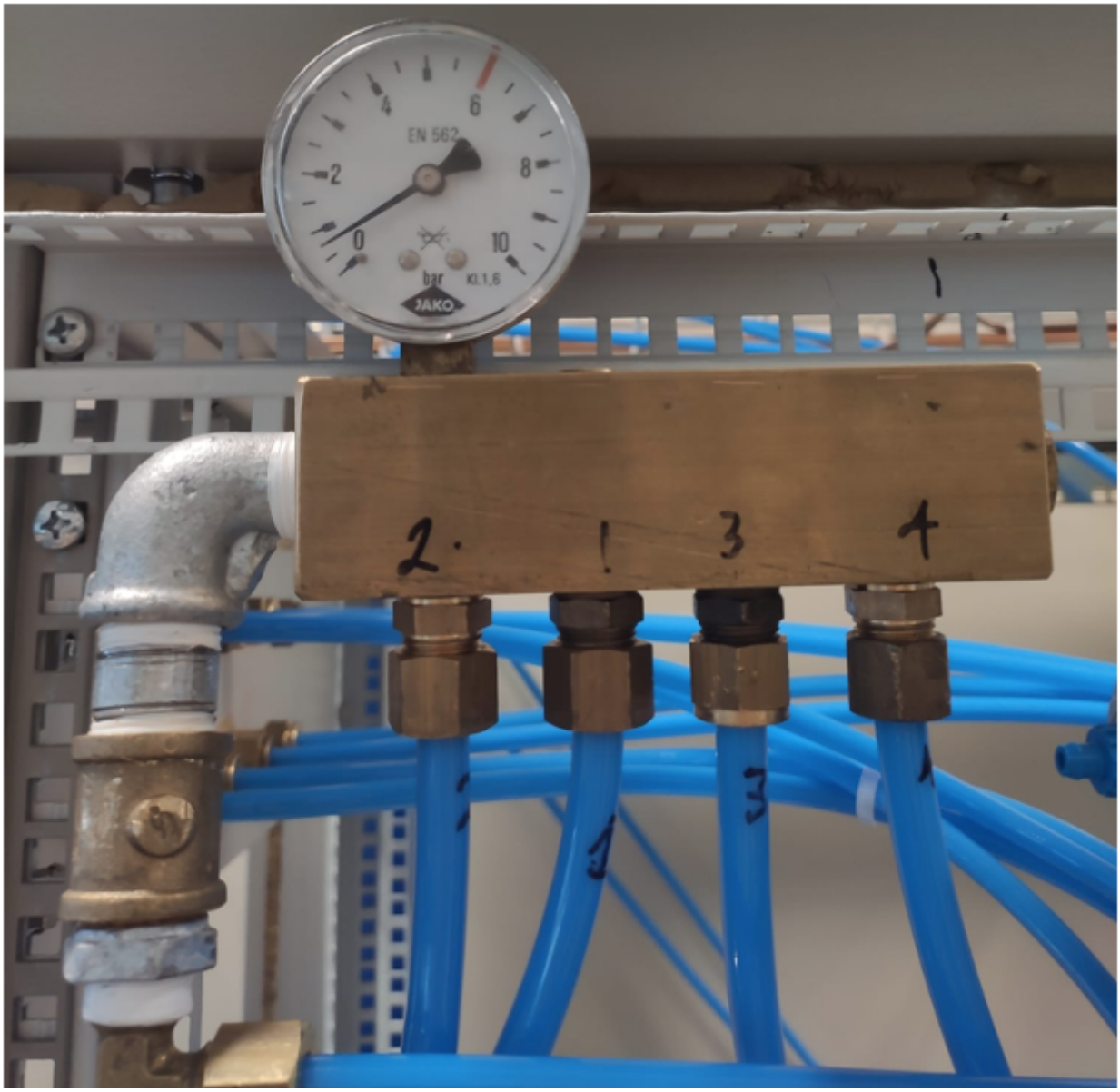

Figure 11

2. Move the two valves corresponding to the chamber to be purged (supply line and return line of the chamber) at the same time to the vertical position to allow air flow as shown in Figure ???. It is important to move the two valves together simultaneously.

Figure 12 ???

3. The air will flow in the pipes and push water back to the water tank inside the chiller and the air will flow out to the exhaust.
4. You can see the RFIs are running with the air flow.
5. Wait 2 minutes.
6. Turn the black air valve to the vertical position.
7. Now you can disconnect the chamber.
8. In order to connect a new chamber go back to the procedure to connect the chamber discussed earlier.