

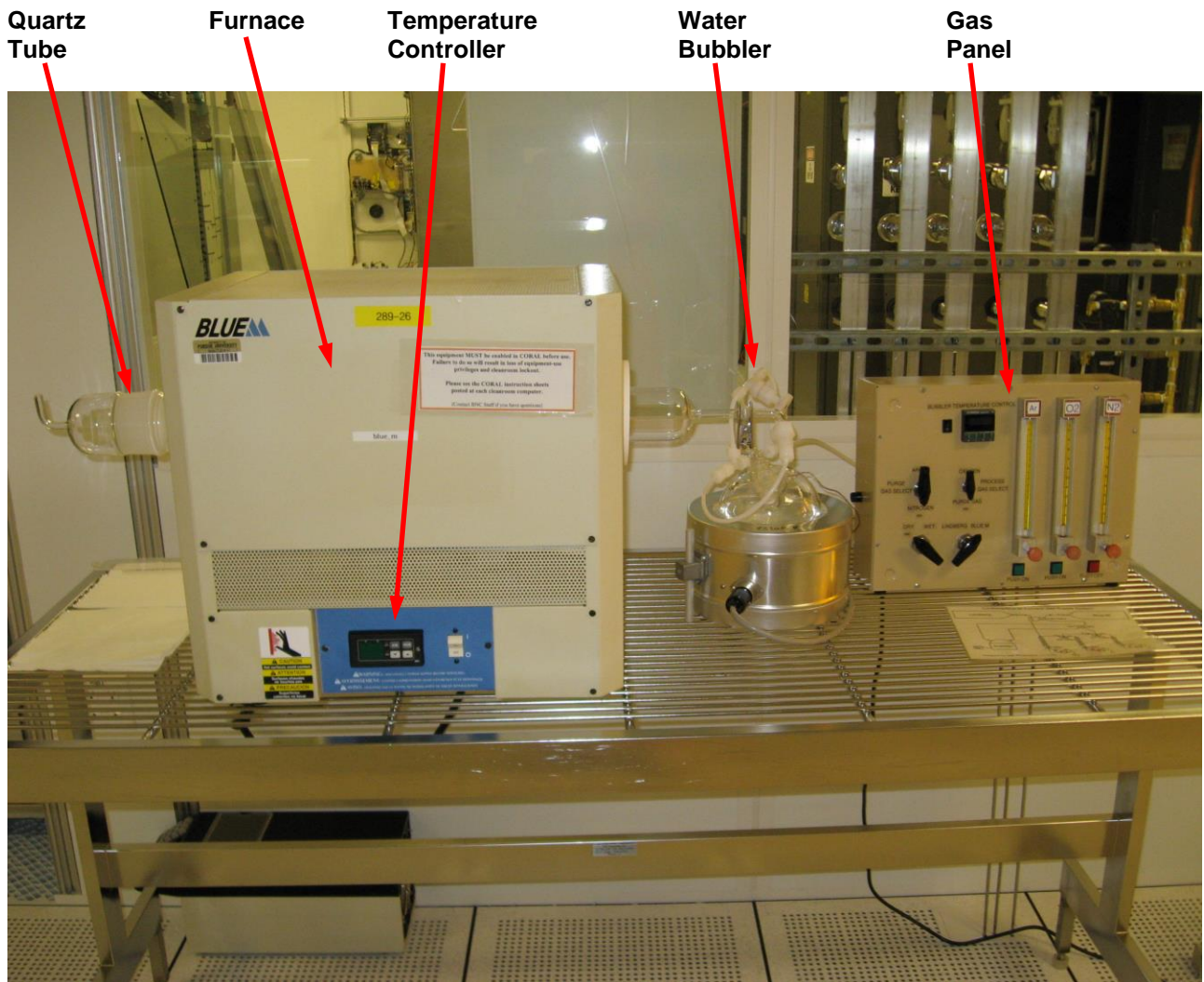
This instruction covers the set-up and use of the bench-top Blue M Oven for annealing and oxidizing samples within the cleanroom.

1. SAFETY REQUIREMENTS

- 1.1 Safety glasses must be worn whenever in the cleanroom, except when using a microscope or when wearing protective goggles.
- 1.2 Information regarding the hazardous materials used in the cleanroom can be found through MSDS documentation located in the gowning room.
- 1.3 When handling hazardous liquids and chemicals, Personal Protective Equipment must be worn.
- 1.4 Do not attempt to load or unload samples that are above 150°C.

2. EQUIPMENT

- 2.1 Blue M Oven Furnace
- 2.2 Bubbler
- 2.3 Gas Panel
- 2.4 Quartz push rod – 24 inches long
- 2.5 Quartz sample tray
- 2.6 Quartz tube – 3 inch bore



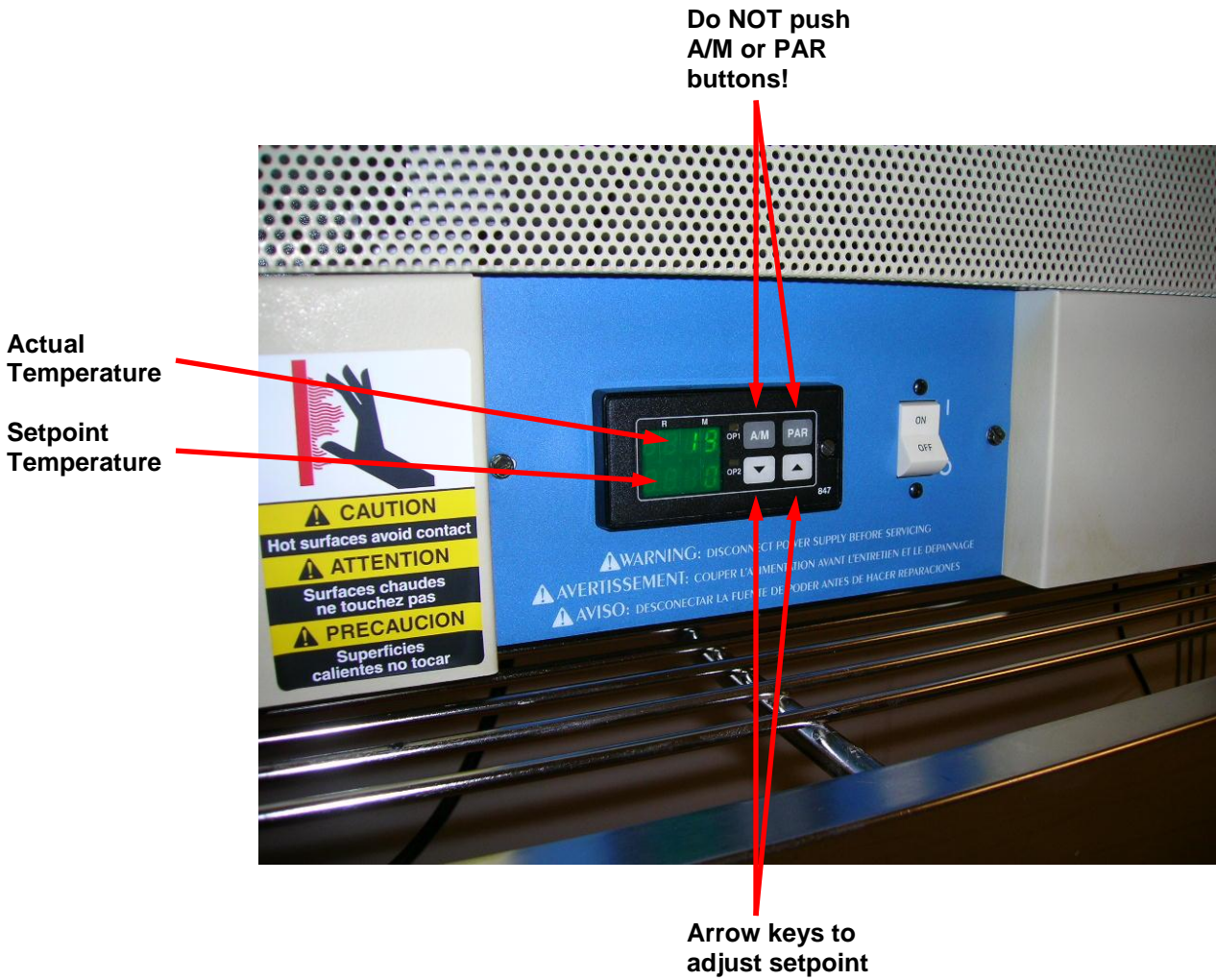
3. MATERIALS

- 3.1 Nitrogen - 20 psi, 1/4" UHP SS Tubing – House supplied
- 3.2 Oxygen - 20 psi, 1/4" UHP SS Tubing – House supplied
- 3.3 Argon - 20 psi, 1/4" UHP SS Tubing – House supplied
- 3.4 DI Water to fill the bubbler

4. CYCLE OF OPERATIONS

- 4.1 Prior to beginning, please enable the Blue M Oven through the I-Lab portal to ensure proper billing.
- 4.2 Turn on the temperature controller power on the front of the machine.
Two numbers will now be visible on the temperature controller.

Note: The TOP number is the actual temperature of the furnace tube.
The BOTTOM number is the temperature setpoint the furnace is driving towards.



- 4.3 Using the gray arrow keys, push the down arrow to set the temperature setpoint to 0°C. Setting the temperature to 0°C ensure the tube will stay cool enough during the load sequence. Make sure the temperature of the tube is cool enough to safely load your sample.

Note: Please use only the gray arrow keys. If you happen to push the other two buttons (the A/M or the PAR buttons), you will get into “automatic program mode”, and it is not easy to exit out of this mode.

- 4.4 Load your sample in the furnace tube
- Take off the quartz end cap from the left side of the quartz tube.
 - Pull out the sample tray to the lip of the quartz tube.
 - Load your sample onto the tray.
 - Carefully and slowly, push the sample tray to the center area of the furnace.
 - Replace the quartz end cap onto the end of the tube. Please **do not** put it on tightly.

- 4.5 Adjust the gases as required at the gas panel.
 Turning on a gas requires two motions – pushing a button **AND** turning a knob.
 Select your flowrate from Table #1 found at the end of this document.

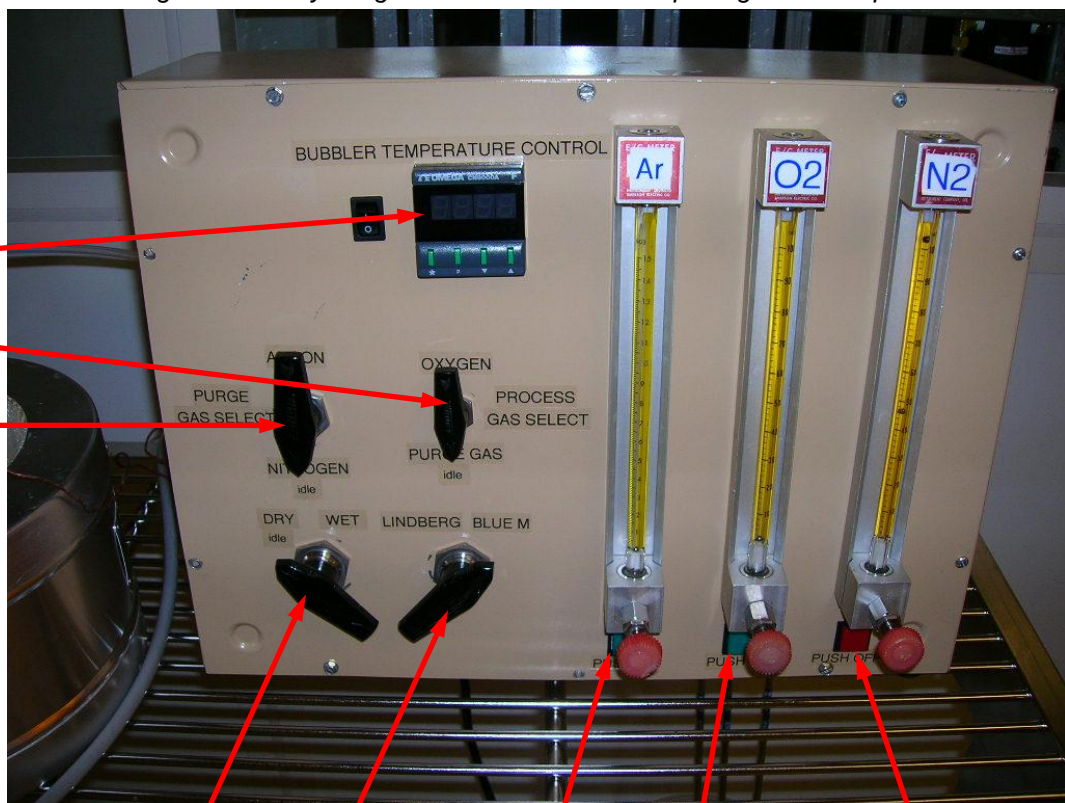
- If you are performing an anneal, you will use Nitrogen or Argon (dictated by your process)
 - If you are performing an oxidation, you will use Oxygen.
 - If oxidizing, you have the option of either dry or wet (bypass or through the bubbler).
- To turn on Oxygen
 - Turn the “Process Gas Select” knob to oxygen
 - Push in the green button below the oxygen flowmeter
 - Adjust the oxygen flowmeter to the desired setting.
 - To turn on Nitrogen
 - Turn the “Process Gas Select” knob to “Purge Gas”
 - Turn the “Purge Gas Select” knob to nitrogen
 - Do not push in the red button below the nitrogen flowmeter (keep it out)
 - Adjust the nitrogen flowmeter to the desired setting.
 - To turn on Argon
 - Turn the “Process Gas Select” knob to “Purge Gas”
 - Turn the “Purge Gas Select” knob to argon
 - Push in the green button below the argon flowmeter
 - Adjust the argon flowmeter to the desired setting.

Note: The sequence of turning valves off and on does not matter to turn on an individual gas. The only thing that does matter is completing all the steps.

Bubbler Temp Control

Process Gas Selector

Purge Gas Selector



Not Used

Not Used

Argon Valve
(push for ON)

Oxygen Valve
(push for ON)

Nitrogen Valve
(push for OFF)

- 4.6. Wait 20 minutes for the quartz tube to fully purge with your selected gas. By waiting 20 minutes, the chamber is properly purged with approximately 10 volumetric exchanges at mid-flow range.
- 4.7. If you plan to use the DI Water Bubbler, follow this additional sequence of events:
- Turn on the Bubbler temperature controller. You will have to wait for it to warm up to around 95°C over the course of approximately 90 minutes.
 - Turn on Oxygen to your desired flow level.
 - Close the bypass valve to the bubbler.
 - Verify Oxygen is bubbling through the bubbler. If it is not, increase your oxygen flow.



- 4.8. Adjust the temperature setpoint up to your desired process temperature. Please only use the gray arrow keys. (see 4.2 and 4.3 for further information)
- 4.9. Once your process is finished, adjust the temperature setpoint down to 0°C. This will allow your sample to cool down. Please wait for the furnace to reach 150°C before you remove your sample.
- 4.10. Remove your sample from the furnace tube
- Take off the quartz end cap from the left side of the quartz tube.
 - Pull out the sample tray to the lip of the quartz tube.
 - Remove your sample from the tray.
 - Carefully and slowly, push the sample tray to the center area of the furnace.
 - Replace the quartz end cap onto the end of the tube. Please **do not** put it on tightly.
- 4.11. Turn on a low flow of Nitrogen to prepare the furnace to go to an idle state. See 4.5 for information on how to do this.

Note: *The setpoint of Nitrogen flow for an idle state should be between 20 and 30 on the flowmeter.*

- 4.12. Keep the power ON to the temperature controller.

- 4.13 Before you walk away, check to make sure the furnace is in the following state:
- ✓ Nitrogen is flowing at 20% on the flowmeter
 - ✓ If you used the bubbler, open the bypass valve.
 - ✓ The quartz endcap has been replaced onto the tube.
 - ✓ The temperature setpoint is at 0°

Table 1

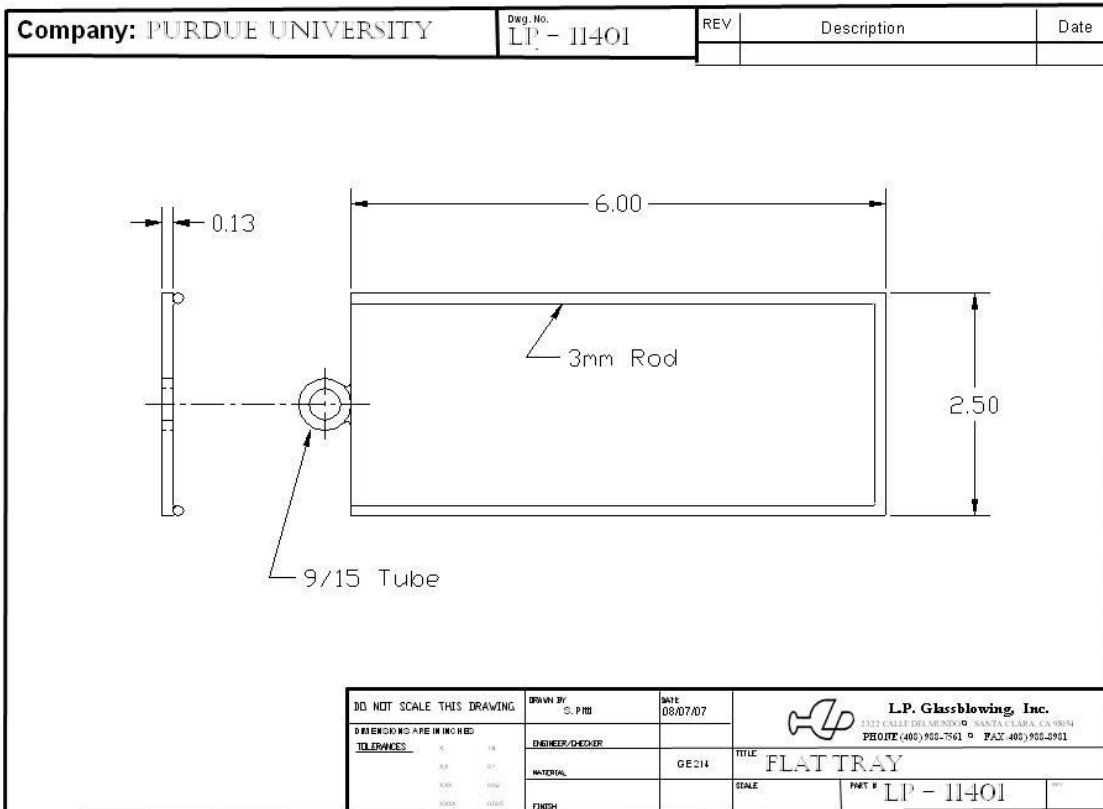
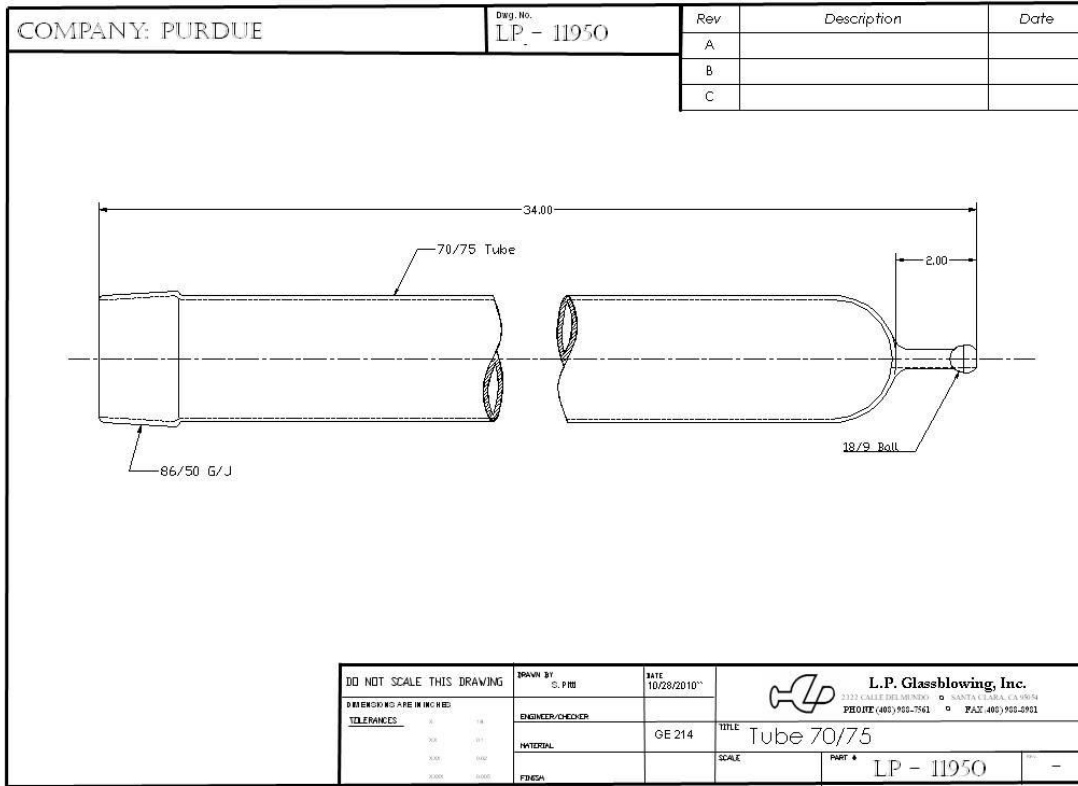
Blue M Oven Gas Flows

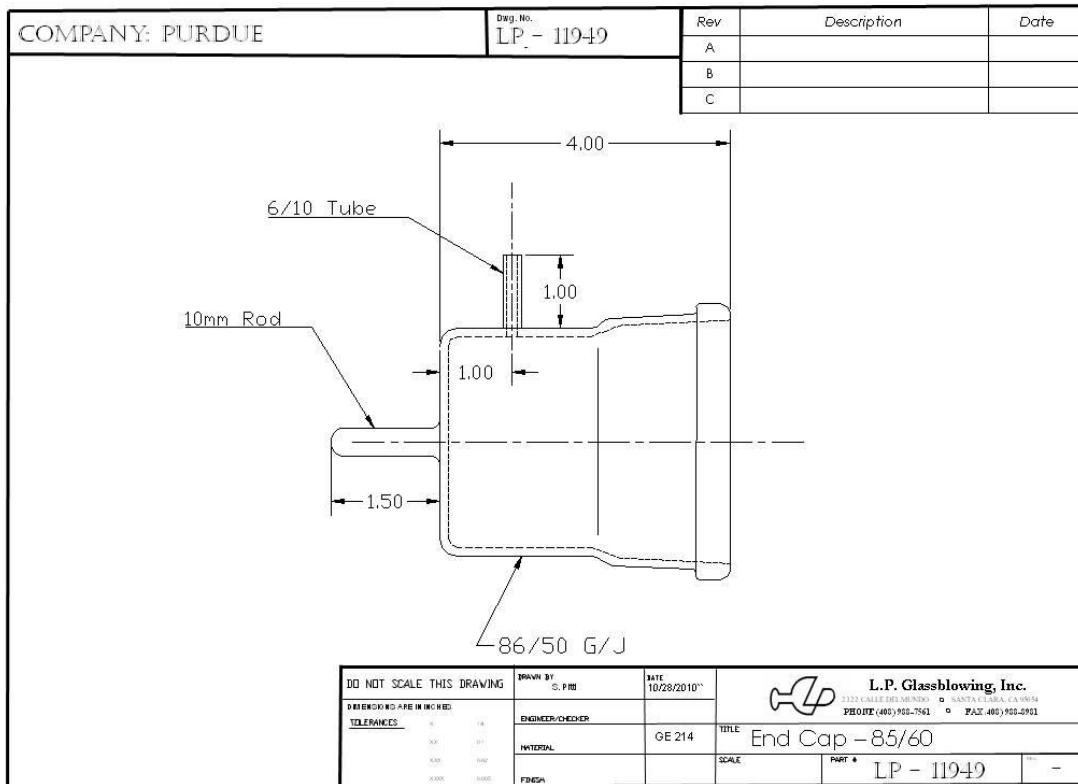
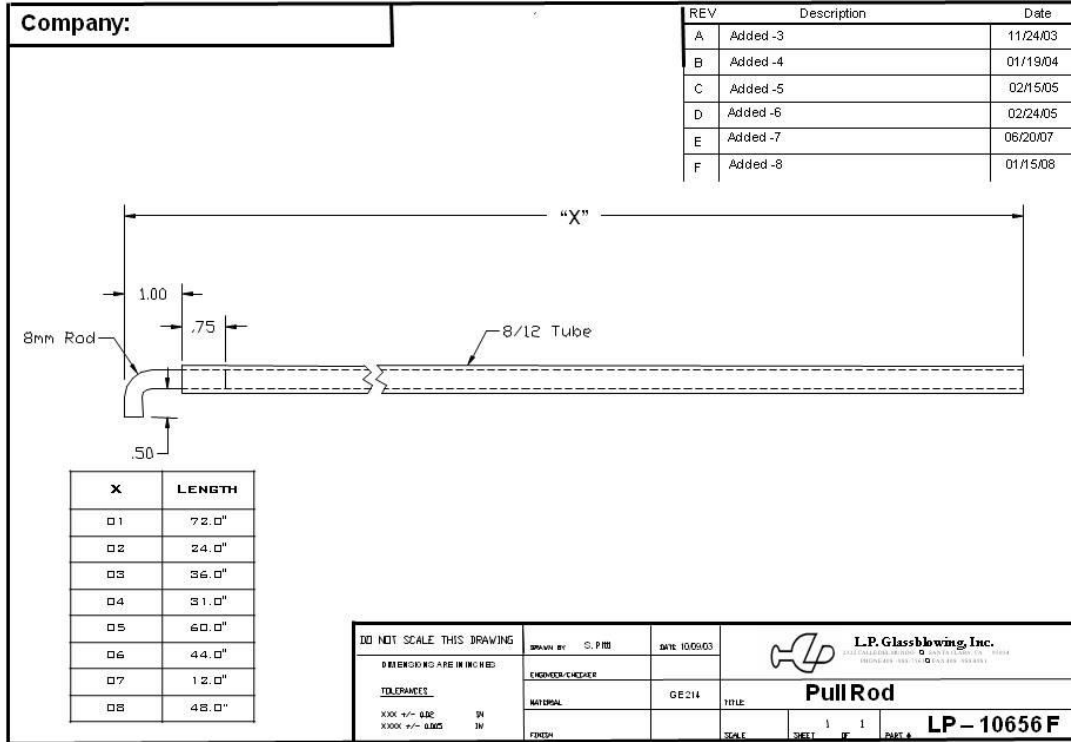
Scale Reading	Argon (slpm)
0	0.00
1	0.25
2	0.50
3	0.75
4	0.99
5	1.24
6	1.49
7	1.74
8	1.99
9	2.24
10	2.49
11	2.74
12	2.98
13	3.23
14	3.48
15	3.73

Scale Reading	Oxygen (slpm)
0	0.00
5	0.21
10	0.42
15	0.62
20	0.83
25	1.04
30	1.25
35	1.46
40	1.66
45	1.87
50	2.08
55	2.29
60	2.50
65	2.70
70	2.91
75	3.12
80	3.33
85	3.54
90	3.74
95	3.95
100	4.16

Scale Reading	Nitrogen (slpm)
0	0.00
5	0.22
10	0.44
15	0.66
20	0.88
25	1.10
30	1.32
35	1.54
40	1.76
45	1.98
50	2.20
55	2.42
60	2.64
65	2.86
70	3.08
75	3.30
80	3.52
85	3.74
90	3.96
95	4.18
100	4.40

5. QUARTZWARE





5. REVISION RECORD

Reason for Revision	Date of Revision	Person Responsible
Initial Release	November 4, 2008	Dan Hosler
Add quartz drawings	October 29, 2010	Dan Hosler
Remove Coral and replace with I-Labs	October 20, 2016	Dan Hosler