Process Flow chart

The complete heat treatment process is divided in to five stages. The process stage sequence should not be changed while programming. The sequence of the process stages are as follows.

Stage 1: Evacuation

Stage 2: Pre-heating

Stage 3: Heat Treatment process-1

Stage 4: Heat Treatment process-2

Stage 5: Gas Quenching process

There should be a provision to select the process operation mode, either manual or auto mode. In this process following are the variable parameters. In manual mode all the variable parameters will be decided by user, while in auto mode several parameters should be adjusted automatically as per the other related parameter. (Interlocking shall be ensured)

Variable Parameters:

1. Pumping speed of piston pump.
2. Pumping speed of Roots pump.
3. Opening of conductance valve.
4. Flow rate of hydrogen gas.
5. Flow rate of Acetylene gas.
6. Flow rate of Nitrogen gas.
7. Gas mixing ratio of hydrogen gas.
8. Gas mixing ratio of Acetylene gas.
9. Gas mixing ratio of Nitrogen gas.
10. Total Pressure.
11. Power of each heating zone.
12. Temperature of each heating zone.
13. Time duration for achieving set temperature (Rate of heating).
14. Soaking time duration.
15. Speed of blower fan motor.
16. Time duration to achieve the lowest temperature. (Rate of cooling).
17. Water Cooling temperature.
18. Quenching gas pressure.

Important: Here entire hot zone should be divided in more than two heating zone, power to each heating zone should be independently controllable. Independent temperature measurement of each zone also must be provided.

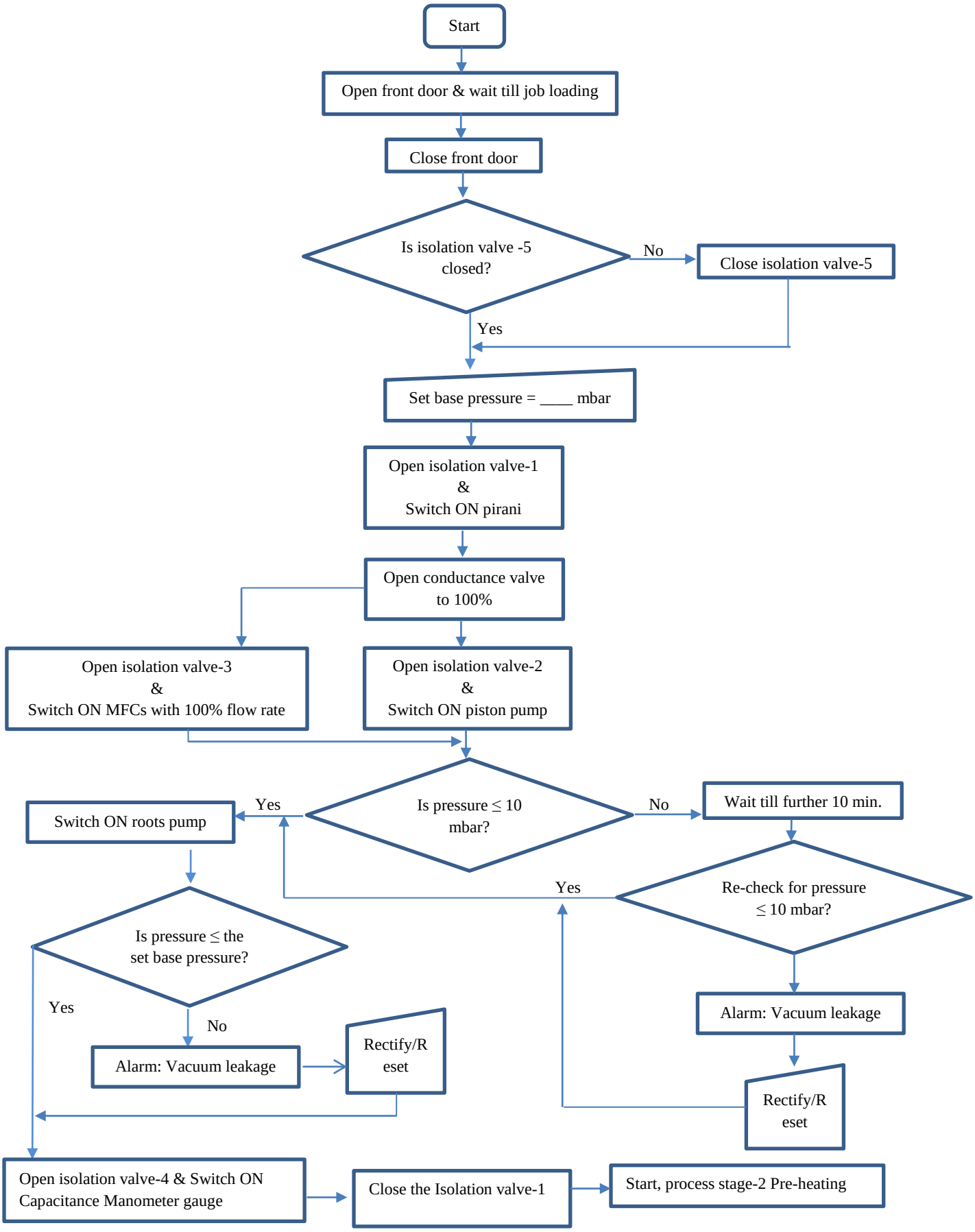
Auto adjusted parameter (only in auto mode):

In auto mode, following parameters should be adjusted automatically to achieve user defined value of particular parameter. Other parameter will be decided by user at the time of process.

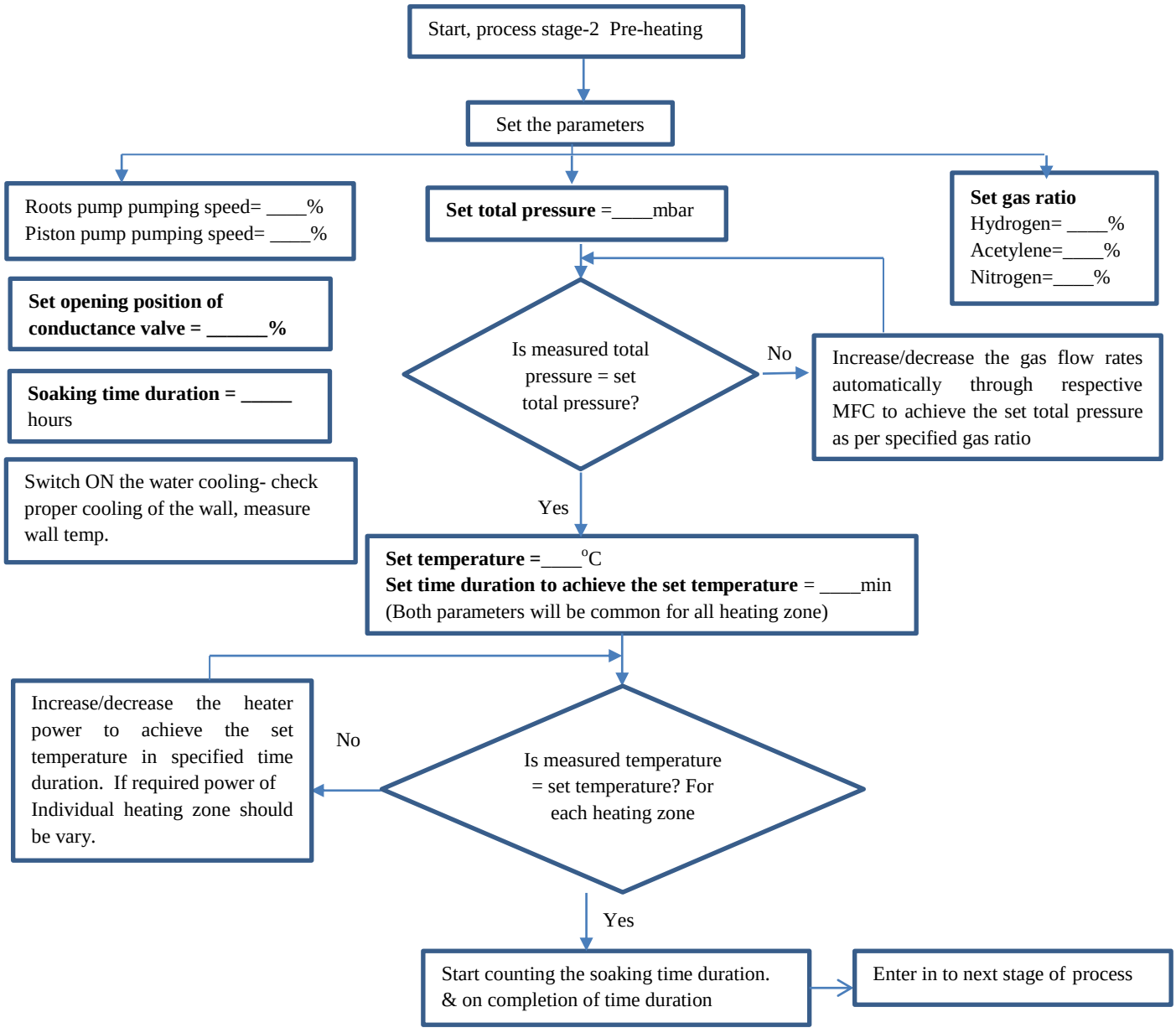
A) Gas flow rates (variable parameter Point no.4, 5 & 6).
   Should vary automatically as per the defined gas mixing ratio (point no. 7, 8 & 9) to achieve the set total pressure (Point. 10).
B) Power of each heating zone (Point no. 11).
   Should vary automatically for each heating zone to achieve defined temperature (point no. 12) in time duration specified (point no. 13).
C) Speed of blower fan.
   Should be vary automatically to achieve the lowest temperature (point no. 17) in specified time duration (point no. 16).
D) Quenching gas pressure.
   Should be achieved by filling a gas from nitrogen chamber by opening an isolation valve.

The stage wise flow chart of the processes is given below. Bidder can suggest necessary changes in flow chart and recipe as per their design for better control of the process. Bidder has to get the approval from the purchaser before implementing any changes. Bidder has to also provide the safety interlocks, which are essential for safe operation of the system as well as safety to the user/operator.

Stage 1: Evacuation



Stage 2: Pre-heating



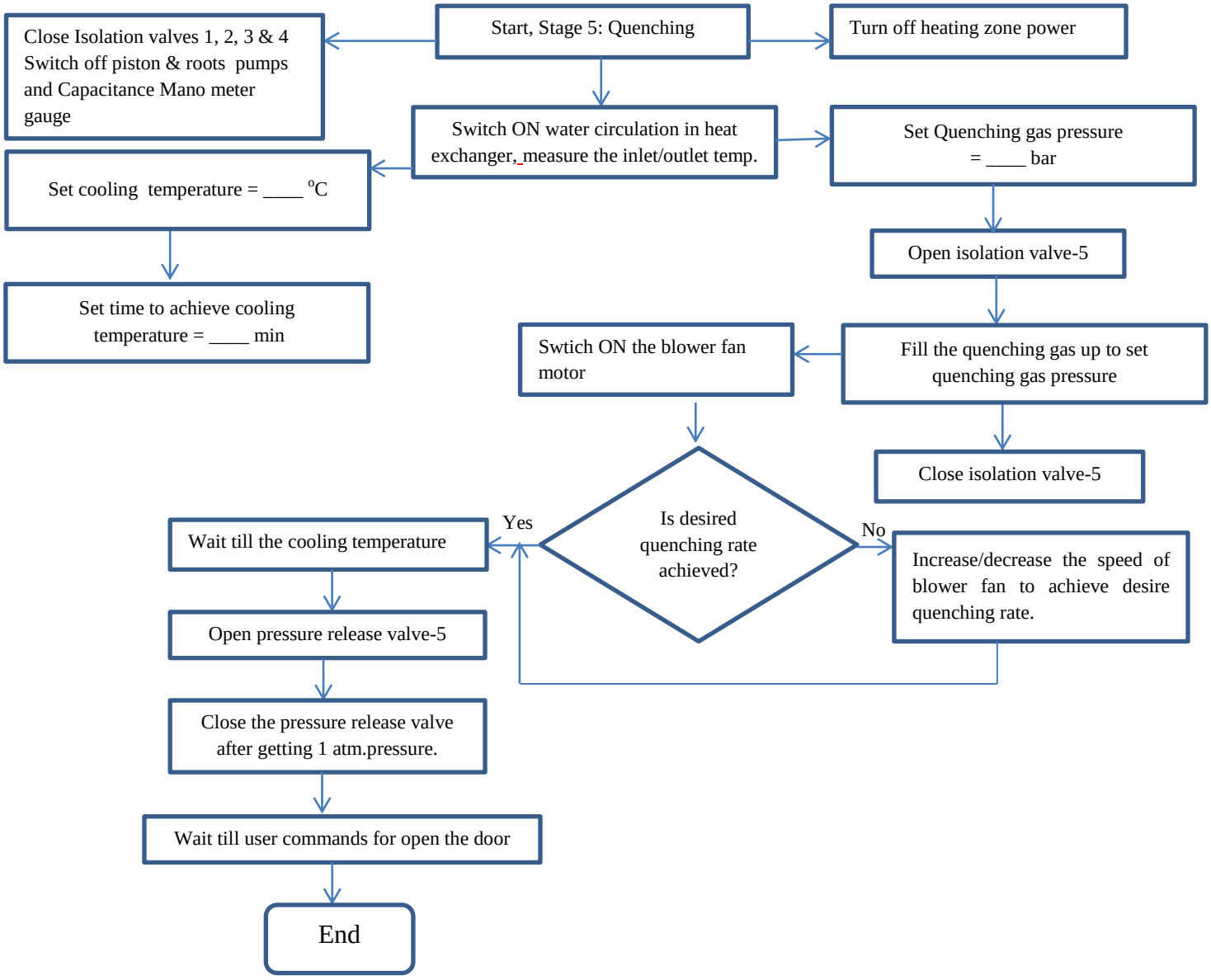
Stage 3: Heat Treatment process-1

Flow chart will be similar to stage 2: Pre-heating

Stage 4: Heat Treatment process-2

Flow chart will be similar to stage 3: Heat treatment process-1

Stage 5: Quenching

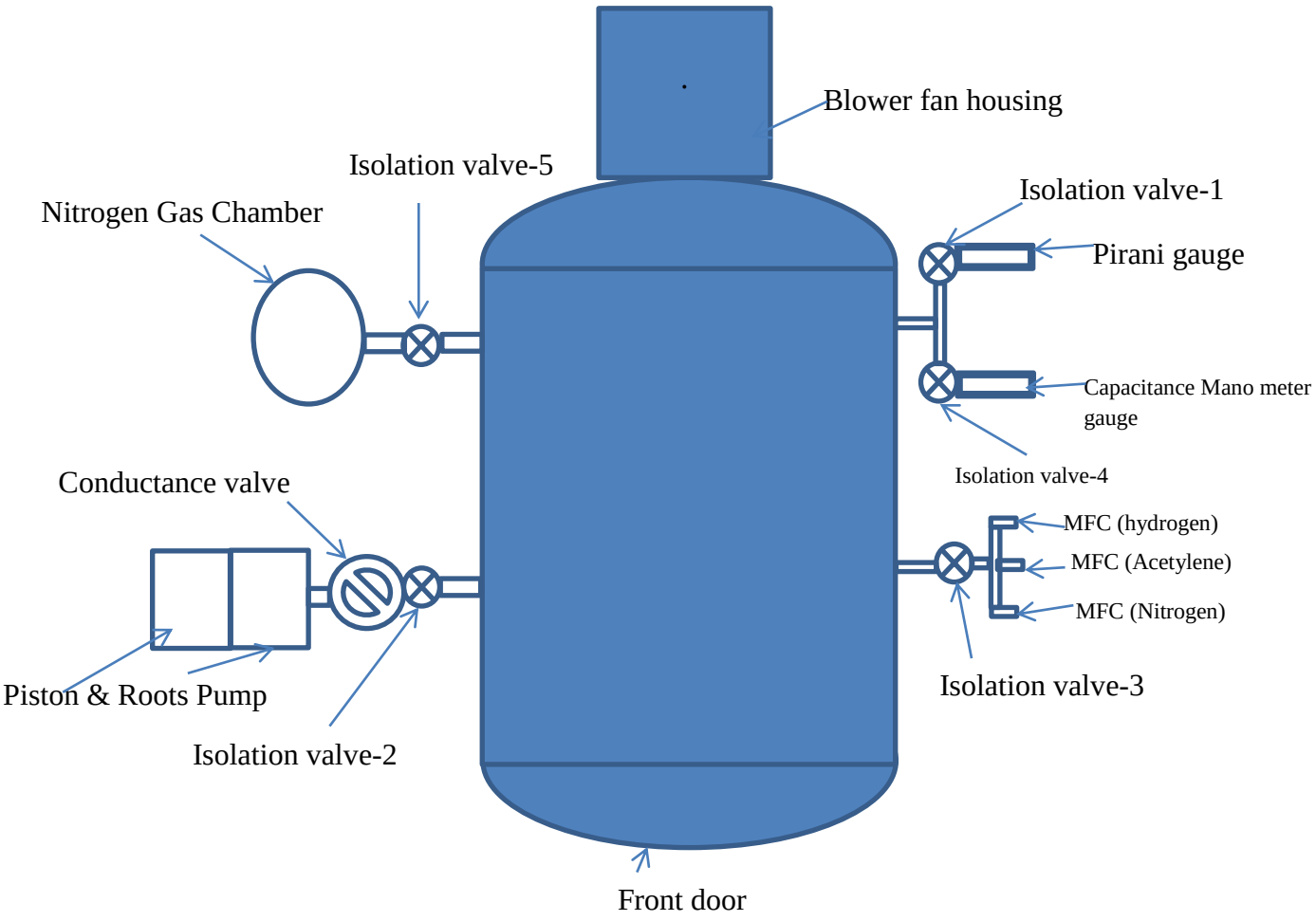


Important Notes:

a. Entire recipe should be controllable through remote control access (within LAN and outside LAN network as well through SCADA.
b. Provision must be made in SCADA for monitoring and control of all individual stages of process during maintenance.
c. The provision should be made to save entire process, operated in manual mode as a new recipe for future application.
d. Interlocks.
   I. Front door should not open while process is going on.
   II. In the beginning, cooling of the vacuum chamber and heat exchanger should be checked and if it fails heater power must not turned ON.
   III. If cooling fails during process heater power should be turned OFF. Necessary audio/video signals shall be activated.

IV. In the case of mains power failure, data acquisition system and cooling system must be switched on to emergency UPS system (powered by UPS) immediately.

V. In the beginning of the quenching process, closed condition for isolation valves-1, 2, 3 and 4 must be ensured, if it fails quenching gas should not be filled in the vacuum chamber.

VI. Provision should be made to bypass the interlock whenever required.

Schematic drawing for the process flow chart: