

# pfRICH Gas System Requirements

## Fundamental Requirements for the Gas System:

1. Control the moisture in the chamber by selecting a nitrogen source with the required moisture level.
2. Ensure the pfRICH chamber is reasonably gas-tight and maintained at a slight overpressure to prevent ambient air from leaking into the chamber. Details follow.

1. **Nitrogen Gas Purity:** Use high-purity nitrogen ( $H_2O < 3$  ppm) from cryogenic liquids or house nitrogen, based on availability.
2. **Moisture Control:** Install inline moisture traps after the source with service ports for maintenance.
3. **Overpressure Maintenance:** Maintain a small overpressure ( $\sim 4$  mBar) above atmospheric pressure to prevent air leaks into the pfRICH chamber.
4. **Pressure Regulation:** Ensure the overpressure inside the chamber adjusts with atmospheric pressure changes.
5. **Overpressure Protection:** Safeguard the pfRICH chamber from accidental overpressure.
6. **Gas Tightness:** Ensure the pfRICH chamber is reasonably gas-tight.
7. **Even Gas Distribution:** Distribute nitrogen evenly in the pfRICH chamber to avoid localized air pockets.
8. **Flushing Capability:** Enable the ability to flush the pfRICH chamber within a few hours for test beam studies, achieving one volume exchange per hour.
9. **Standby Gas Source:** Provide a standby nitrogen source in case the primary source fails or during cylinder exchanges.
10. **Flow Indicator:** Install a flow indicator (bubbler) before venting gas to the atmosphere to confirm gas flow through the chamber.
11. **System Flushing:** Design the gas system to allow flushing of piping and components by bypassing the chamber (to avoid contaminating the chamber).
12. **Particle Filtering:** Use a  $0.5 \mu m$  particle filter after the gas source to remove dust particles introduced during gas source exchanges.
13. **Pressure Testing:** Pressure test the gas system to at least 1.5 times the operating pressure.
14. **Pressure Relief Valve:** Set a pressure relief valve next to the nitrogen source at 1.5 times the maximum operating pressure.
15. **Nitrogen Source Pressure Regulation:** Implement digital pressure outlet control to regulate pressure from the nitrogen source, ensuring smooth operation under various weather conditions and for low-pressure regulator operations.
16. **Mass Flow Controller:** Use a non-pressure-limiting digital mass flow controller for nitrogen flow.
17. **Monitoring and Troubleshooting:** Equip the system with pressure gauges and pressure transmitters for monitoring and troubleshooting. Archive critical readings such as chamber pressure and flow.

# Cost Estimate

Prashanth

	Item	Qty	Spare	Unit Price	Total
	1 Pressure Gauages	4	0		2000
	2 Pressure Trasnmitters	4	0		2400
	3 Pressure Regulators	1	0	1200	1200
	4 Moisture trap	1	1	550	1100
	5 Filter (0.5um)	1	1	200	400
	6 Pressure relief valve (certified)	1	0	1000	1000
	7 Check Valves	2	1	200	600
	8 Tank Blenketing Pressure Regulaor	1	1	2200	4400
	9 Bubblers	2	2	200	800
	10 Cu tubes (ø0.5)	300 m			800
	11 Cu tubes (ø0.25)	100 m			125
	12 Digital pressure output controller	1	0	4420	4420
	13 Digital nitrogen mass flow meter	1	0	2805	2805
	14 Fittings				2500
					<b>24550</b>

001/000

2 pcs

7.10.029



IN-FLOW Select F-201CI-10K Mass Flow Controller

Model key	:	F-201CI-10K-AGD-55-A
Product series	:	IN-FLOW Select
Ingress protection	:	IP-65
Material	:	Stainless steel 316
Multi Fluid Multi Range	:	Disabled
Control function	:	Flow control
Fluid	:	N2 (Nitrogen)
Flow range	:	0.068285...15 l/min
Accuracy	:	±0.5% Rd plus ±0.1% FS (At calibration conditions)
Calibration certificate	:	3-point calibration (0%, 50%, 100%)
Inlet pressure (P1)	:	30 psi (g)
Outlet pressure (P2)	:	20 psi (g)
Valve function	:	Normally Closed
Orifice	:	1.30 mm
Temperature	:	30 °C
Seals	:	Viton 514178 FDA/USP Class VI
Plunger	:	Viton 514178 FDA/USP Class VI
Inlet connection	:	1/2" OD compression
Outlet connection	:	1/2" OD compression
Output signal	:	RS-232 0...100 % (4...20 mA sourcing)
Setpoint	:	RS-232 0...100 % (4...20 mA sinking)
Power supply	:	+15...24 Vdc
Price	:	US\$ 2,805.00

002/000 1 pc 7.10.191



IN-PRESS P-502CI-6K0R Pressure Meter

Model key : P-502CI-6K0R-AGD-55-A  
 Product series : IN-PRESS  
 Ingress protection : IP-65  
 Material : Stainless steel 316  
 Control function : Pressure outlet control  
 Fluid : N2 (Nitrogen)  
 Flow range : max. 15 l/min  
 Controlled volume : 0.7 m3  
 Sensor position : Outlet side (forward pressure)  
 Accuracy : ±0.5% FS  
 (At calibration conditions)  
 Calibration certificate : 3-point calibration (0%, 50%, 100%)  
 Inlet pressure (P1) : 1...20 psi (g)  
 Pressure controlled (P2) : 1...20 psi (g) (calibrated for 20 psi (g))  
 Valve function : Normally Closed  
 Temperature : 30 °C  
 Seals : Viton 514178 FDA/USP Class VI  
 Inlet connection : 1/2" OD compression  
 Outlet connection : 1/2" OD compression  
 Output signal : RS-232 0...100 % (4...20 mA sourcing)  
 Setpoint : RS-232 0...100 % (4...20 mA sinking)  
 Power supply : +15...24 Vdc

Electrically and mechanically connected.

**Total price : US\$ 4,420.00**

003/000 1 pc 2.04.111

Swagelok portconnector 1/2"OD

**Total price : US\$ 0.00**

004/000 1 pc 7.10.003



F-001AI Control valve

Model key : F-001AI-IIU-55-A  
 Ingress protection : IP-65  
 Fluid : N2 (Nitrogen)  
 Flow range : 0.3...15 l/min  
 Inlet pressure (P1) : 30...50 psi (g)  
 Outlet pressure (P2) : 1...20 psi (g)  
 Valve function : Normally Closed  
 Orifice : 1.30 mm  
 Temperature : 30 °C  
 Seals : Viton 514178 FDA/USP Class VI  
 Plunger : Viton 514178 FDA/USP Class VI  
 Inlet connection : 1/2" OD compression  
 Outlet connection : 1/2" OD compression

**Total price : US\$ 0.00**