

BAB V

PENUTUP

V.1 Kesimpulan

Pengendalian tekanan dalam *antechamber glove box* dirancang menggunakan PID untuk menjaga kestabilan tekanan sesuai *setpoint*. Dari hasil penelitian, diperoleh kesimpulan sebagai berikut:

1. Sistem dapat membaca dan mengatur tekanan *antechamber* menggunakan sensor Autonics PSS-C01V dengan akurasi MAPE sebesar 2,9%, serta *proportional valve* yang bekerja efektif pada 5,2–10 VDC yang mendukung implementasi PID dalam mengatur besar laju aliran tekanan vakum.
2. Kendali PID berpengaruh signifikan terhadap kestabilan tekanan, di mana tuning ZN-1 menghasilkan respon lebih stabil dengan *overshoot* 6%, sedangkan metode kedua lebih agresif dengan *overshoot* sebesar 45%. Kemudian, setelah dilakukan *tuner* PID melalui MATLAB-Simulink, sistem mampu menurunkan *overshoot* rata-rata menjadi 3% dan *steady state error* sebesar 1 mbar, sehingga menghasilkan respon sistem yang lebih stabil dan akurat.
3. Perbedaan antara hasil simulasi MATLAB Simulink dan eksperimen nyata disebabkan oleh karakteristik aliran udara satu arah sesuai prinsip dekontaminasi. Simulasi menunjukkan respon yang cepat, dan agresif dengan waktu jatuh singkat, *overshoot* tinggi namun cepat diredam, serta mampu mencapai *settling time* dan *steady state error* yang kecil. Sebaliknya, respon sistem nyata lebih lambat, dengan *overshoot* bervariasi dan tekanan yang tidak stabil dalam rentang toleransi, sehingga *settling time* tidak tercapai. Hal ini menunjukkan bahwa performa ideal di simulasi perlu divalidasi dan disesuaikan kembali saat diterapkan pada sistem nyata.

V.2 Saran

Mengingat keterbatasan alat pada modul PID yang tidak mendukung integrasi data *float*, disarankan penelitian selanjutnya mempertimbangkan pengolahan data *floating point* agar implementasi parameter PID lebih presisi. Penelitian selanjutnya juga dapat mengoptimasi parameter PID dalam mengurangi *overshoot* dan *steady state error* atau dapat menerapkan metode kendali lain seperti *fuzzy logic*.

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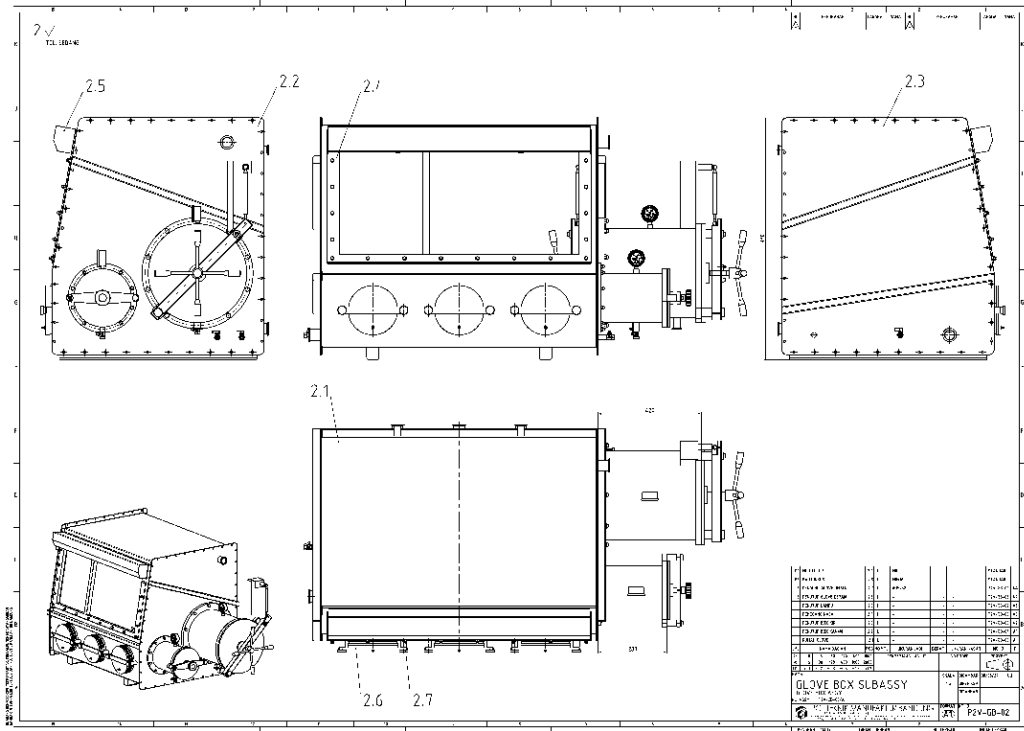
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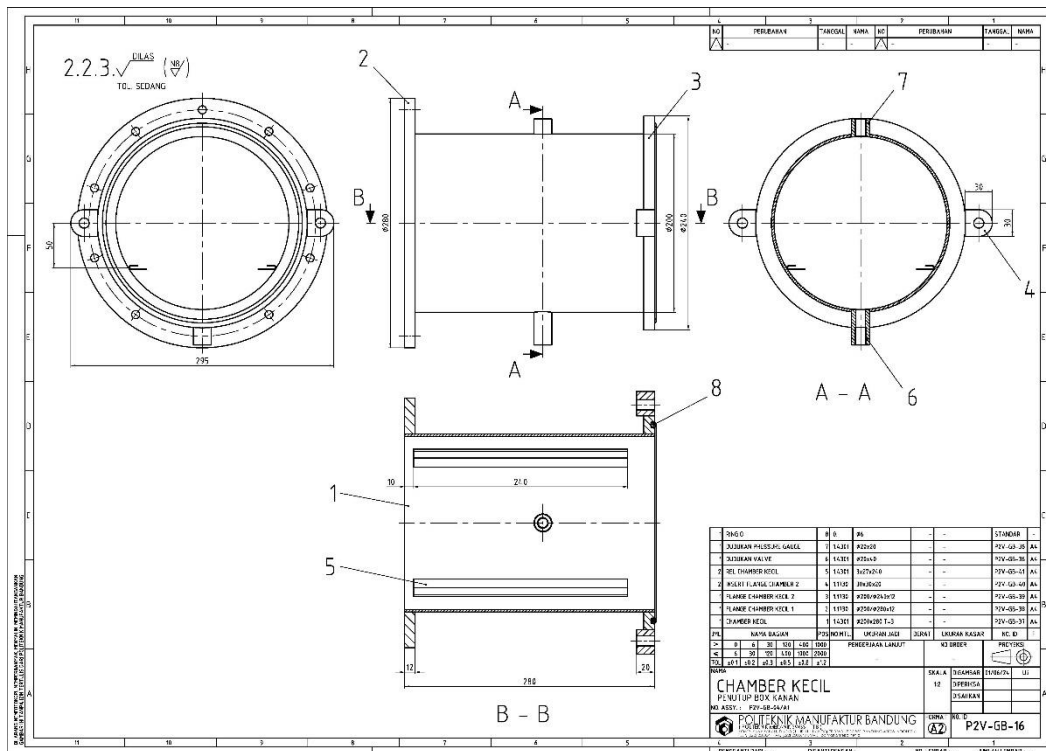
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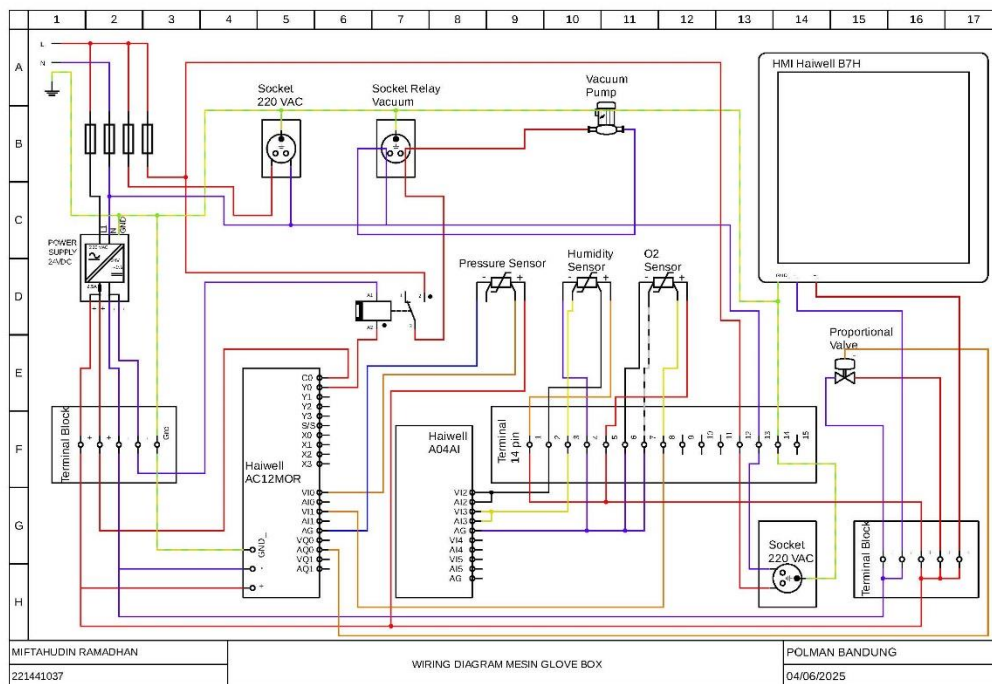
Lampiran 1 Desain Mesin *Glove Box*



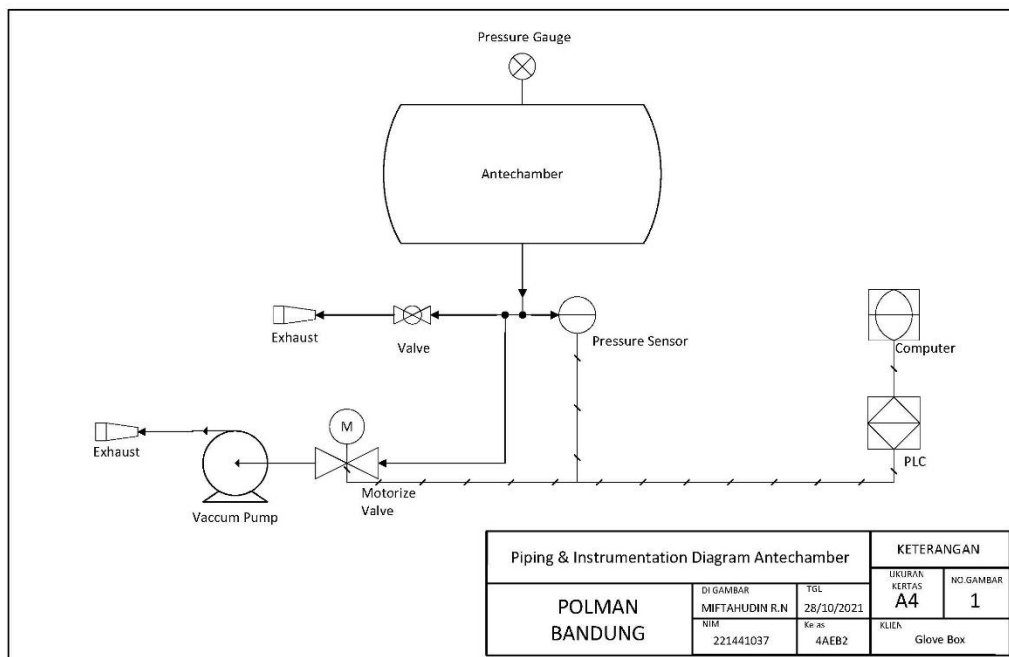
Lampiran 2 Antechamber *Glove Box*



Lampiran 3 Wiring Diagram Mesin Glove Box



Lampiran 4 Piping and Instrumentation Diagram



Lampiran 5 Configuration Hardware PLC

Hardware configuration						
Index	Module type	X Component	Y Component	AI Component	AQ Component	Other
0	AC12M0R	X0 - X3	Y0 - Y3	AI0 - AI1	AQ0 - AQ1	COM1-2
1	A04AI			AI2 - AI5		

Index	Description
0	CPU module 4*DI 4*DO relay 2*AI analog input 2*AO analog output DC24V power LAN + RS485
1	Analog input module 4*AI analog input

File	Hardware configuration	Project name	Small Antechamber		
Designer	Mifdhan	User name	Little-Einstein		
Date	01/05/2025 14:47:23	Company	Polman Bandung	Page	1 OF 1

Lampiran 6 Program PLC

