

TUGAS AKHIR

**RANCANG BANGUN SISTEM *HEATING*,
VENTILATION, *AIR CONDITIONING* (HVAC) UNTUK
RUANG *NEONATAL INTENSIVE CARE UNIT* (NICU)
PADA RUMAH SAKIT UNIVERSITAS ANDALAS**

OLEH:

MUHAMMAD TAUFIQ

NIM. 2210911012



DOSEN PEMBIMBING:

HAZNAM PUTRA, S.T, M.T

NIP. 196305071990022001

Dr. Eng. Ir. DENDI ADI SAPUTRA M, S.T., M.T.

NIP. 198712012012121004

DEPARTEMEN TEKNIK MESIN

FAKULTAS TEKNIK

UNIVERSITAS ANDALAS

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ABSTRACT

Indonesia, as a tropical country, has high temperatures and relative humidity, increasing the risk of condensation and microorganism growth in treatment rooms. This condition was identified at Andalas University Hospital, where room humidity was not optimally controlled. This research developed a Heating, Ventilation, and Air Conditioning (HVAC) system for the NICU room of Andalas University Hospital, designed in accordance with Indonesian Minister of Health Regulation No. 40 of 2022 and ASHRAE-170 standards. Cooling load calculations were performed using the Cooling Load Temperature Difference (CLTD) method, considering external factors such as wall, roof, and glass conduction and solar radiation, as well as internal factors from occupants and medical equipment, yielding a total required cooling capacity of 3.2575 PK for a 10 × 6 × 3 m room. The HVAC system was integrated with a UV box control to sterilize the air from microorganisms and prevent biofilm growth on the cooling coil. System testing was conducted over two days (March 3 and 4, 2026) at 5-minute intervals. Results showed that the system successfully maintained indoor temperature at an average of 25.95°C on day one and 24.97°C on day two, and relative humidity at 52.18% and 51.45% respectively, both consistently within the 22–26°C and 40–60% RH standards. The performance of the cooling system was evaluated using the Coefficient of Performance (COP), which yielded an overall average value of 4.5814. This result indicates that the HVAC system is capable of delivering effective cooling performance with appropriate energy utilization under the tested operating conditions..

Keywords: HVAC, NICU, cooling load, humidity, cooling system performance

ABSTRAK

Indonesia sebagai negara beriklim tropis memiliki temperatur tinggi dan kelembapan relatif tinggi, sehingga memperbesar risiko kondensasi serta pertumbuhan mikroorganisme di ruang rawat. Kondisi ini teridentifikasi di Rumah Sakit Universitas Andalas, dimana kelembapan ruangan belum terkontrol secara optimal. Penelitian ini mengembangkan sistem *Heating, Ventilation, and Air Conditioning* (HVAC) untuk ruang NICU Rumah Sakit Universitas Andalas, yang dirancang sesuai standar Permenkes RI No. 40 Tahun 2022 dan ASHRAE-170. Perhitungan beban pendinginan dilakukan menggunakan metode *Cooling Load Temperature Difference* (CLTD) dengan memperhitungkan faktor eksternal berupa konduksi dinding, atap, dan kaca serta radiasi matahari, maupun faktor internal dari penghuni dan peralatan medis, sehingga diperoleh total kapasitas pendinginan yang dibutuhkan sebesar 3,2575 PK untuk ruang berukuran $10 \times 6 \times 3$ m. Sistem HVAC diintegrasikan dengan UV box control untuk mensterilkan udara dari mikroorganisme dan mencegah pertumbuhan *biofilm* pada koil pendingin. Pengujian sistem dilakukan selama dua hari (3 dan 4 Maret 2026) dengan interval 5 menit. Hasil pengujian menunjukkan sistem berhasil mempertahankan temperatur *indoor* rata-rata $25,95^{\circ}\text{C}$ pada hari pertama dan $24,97^{\circ}\text{C}$ pada hari kedua, serta kelembapan relatif rata-rata 52,18% dan 51,45%, keduanya konsisten berada dalam rentang standar $22\text{--}26^{\circ}\text{C}$ dan 40–60% RH. Evaluasi kinerja sistem pendingin menggunakan *Coefficient of Performance* (COP) menghasilkan nilai rata-rata sebesar 4,5814, yang menunjukkan bahwa sistem HVAC mampu menghasilkan efek pendinginan yang baik dengan pemanfaatan energi yang efektif serta bekerja secara layak dalam kondisi operasi yang diuji.

Kata kunci: HVAC, NICU, beban pendinginan, kelembapan, kinerja sistem pendingin