**DAFTAR ISI**

|  |  |
| --- | --- |
| **LEMBAR PENGESAHAN .....................................................** | **i** |
| **LEMBAR PERNYATAAN .....................................................** | **ii** |
| **UCAPAN TERIMA KASIH ...................................................** | **iii** |
| **ABSTRAK ................................................................................** | **v** |
| **DAFTAR ISI ............................................................................** | **vii**  |
| **DAFTAR TABEL ....................................................................** | **x** |
| **DAFTAR GAMBAR ................................................................** | **xi** |
| **DAFTAR LAMPIRAN ............................................................** | **70** |
| **BAB I PENDAHULUAN .........................................................** | 1 |
| * 1. Latar Belakang ...................................................................
 | 1 |
| * 1. Rumusan Masalah Penelitian .............................................
 | 2 |
| * 1. Batasan Masalah ................................................................
 | 2 |
| * 1. Tujuan Penelitian ...............................................................
 | 2 |
| * 1. Manfaat Penelitian .............................................................
 | 2 |
| * 1. Sistematika Penulisan ........................................................
 | 2 |
| **BAB II KAJIAN PUSTAKA ...................................................** | 4 |
| * 1. Generator Sinkron .............................................................
 | 4 |
| * 1. Prinsip GGL Induksi .........................................................
 | 4 |
| * 1. Reaksi Jangkar Generator Sinkron ....................................
 | 5 |
| * + 1. Untuk Beban Resistif ............................................
 | 5 |
| * + 1. Untuk Beban Induktif Murni .................................
 | 5 |
| * + 1. Untuk Beban Kapasitif Murni ................................
 | 6 |
| * 1. Konstruksi Generator Sinkron ............................................
 | 6 |
| * + 1. Stator ......................................................................
 | 6 |
| * + - 1. Belitan Stator Satu Lapis.........................
 | 6 |
| * + - 1. Belitan Stator Berlapis Ganda ................
 | 7 |
| * + 1. Rotor .......................................................................
 | 8 |
| * + - 1. Rotor Kutub Sepatu atau Menonjol ........
 | 9 |
| * + - 1. Rotor Kutub Silindris ..............................
 | 10 |
| * 1. Prinsip Kerja Generator Sinkron ........................................
 | 10 |
| * 1. Sistem Eksitasi pada Generator ..........................................
 | 11 |
| * + 1. Sistem Eksitasi Menggunakan Sikat (*Brush Excitation*) ………………………………………..
 | 11 |
| * + 1. Sistem Eksitasi Tanpa Sikat (*Brushless Excitation*) ..............................................................
 | 11 |
| * 1. Rangkaian Ekivalen Generator Sinkron .............................
 | 12 |
| * 1. Menentukan Parameter Alternator ......................................
 | 13 |
| * + 1. Pengujian Beban Nol (Tanpa Beban) .....................
 | 14 |
| * + 1. Pengujian Hubung Singkat .....................................
 | 15 |
| * + 1. Pengujian Sumber DC ...........................................
 | 16 |
| * 1. Fluks Magnet .....................................................................
 | 16 |
| * 1. Kebocoran Induktansi .........................................................
 | 17 |
| * 1. Metode Elemen Hingga (*Finite Element Method*) ..............
 | 18 |
| * 1. Penelitian Terkait ................................................................
 | 19 |
| **BAB III METODE PENELITIAN ..........................................** | 22 |
| * 1. Data Desain Generator Sinkron ...........................................
 | 22 |
| * + 1. *Technical Data* .........................................................
 | 22 |
| * 1. Data Lapangan .....................................................................
 | 25 |
| * + 1. Desain Pengawatan pada Stator ...............................
 | 25 |
| * + 1. Jumlah Lilitan (*Turn*) ...............................................
 | 26 |
| * + 1. *Test Report* ...............................................................
 | 29 |
| * + - 1. Tanpa *A.C. Exciter* ....................................
 | 29 |
| * + - 1. Dengan *A.C. Exciter* .................................
 | 31 |
| * 1. Sumber Data dan Perangkat Penunjang Penelitian ..............
 | 33 |
| * 1. Prosedur Penelitian ..............................................................
 | 33 |
| **BAB IV PEMBAHASAN .........................................................** | 37 |
| 1. Temuan Hasil Penelitian .....................................................
 | 37 |
| 1. Desain Generator Sinkron ...................................................
 | 38 |
| 1. Desain Stator dan Rotor Generator .......................
 | 38 |
| 1. Parameter Meterial Stator dan Rotor .....................
 | 39 |
| 1. Wiring Stator dan Rotor ........................................
 | 40 |
| 1. *Inner Air Gap* dan *Outer Air Gap* ..........................
 | 43 |
| 1. Motion Rotor .........................................................
 | 44 |
| 1. *Boundary Condition* ..............................................
 | 46 |
| 1. *New Circuit Windows* ............................................
 | 47 |
| 1. *Running Test (Solving)* ..........................................
 | 47 |
| 1. Hasil Simulasi MAGNET 7.5 .............................................
 | 48 |
| 1. Kebocoran Induktansi .........................................................
 | 52 |
| 1. Kondisi Kebocoran Induktansi ...........................................
 | 63 |
| 1. Pembahasan ........................................................................
 | 64 |
| **BAB V SIMPULAN IMPLIKASI DAN REKOMENDASI ..** | 66 |
| * 1. Kesimpulan .........................................................................
 | 66 |
| * 1. Implikasi .............................................................................
 | 66 |
| * 1. Rekomendasi ......................................................................
 | 67 |
| **DAFTAR PUSTAKA ................................................................** | 68 |

**DAFTAR TABEL**

|  |  |
| --- | --- |
| **Tabel 3.1.** Generator ................................................................... | 22 |
| **Tabel 3.2.** Stator ......................................................................... | 23 |
| **Tabel 3.3.** Rotor .......................................................................... | 23 |
| **Tabel 3.4.** Sistem Eksitasi .......................................................... | 23 |
| **Tabel 3.5.** Rata-rata Resistansi oleh *Double Bridge* .................. | 27 |
| **Tabel 3.6.** Kalkulasi Efisiensi pada Power Faktor 80% ............. | 28 |
| **Tabel 3.7.** Kalkulasi Efisiensi pada Power Faktor 100% ........... | 29 |
| **Tabel 3.8.** Karakteristik Tes Tanpa Beban ................................. | 29 |
| **Tabel 3.9.** Karakteristik Tes Hubung Singkat ............................ | 30 |
| **Tabel 3.10.** Krakteristik Tes Tanpa Beban ................................. | 31 |
| **Tabel 3.11.** Karakteristik Tes Hubung Singkat ........................... | 32 |
| **Tabel 4.1.** *Flux Linkage* Stator .................................................... | 52 |
| **Tabel 4.2.** *Stored Magnetic Energy* ............................................. | 55 |
| **Tabel 4.3.** Induktansi Bersama .................................................... | 55 |
| **Tabel 4.4.** Induktansi Diri ........................................................... | 56 |
| **Tabel 4.5.** Induktansi Bersama Rotor – Phasa ............................ | 56 |
| **Tabel 4.6.** Kebocoran Induktansi ................................................ | 60 |

**DAFTAR GAMBAR**

|  |  |  |
| --- | --- | --- |
| **Gambar 2.1** | Prinsip GGL Induksi ........................................ | 4 |
| **Gambar 2.2** | Stator Generator ............................................... | 6 |
| **Gambar 2.3** | Belitan Satu Lapis Generator Sinkron Tiga Phasa …………………………………………. | 7 |
| **Gambar 2.4** | Belitan Berlapis Ganda Generator Sinkron Tiga Phasa ……………………………………......... | 8 |
| **Gambar 2.5** | Rotor Generator ................................................. | 9 |
| **Gambar 2.6** | Tipe Rotor a. *Salient Poles* b. *Non Salient Poles.* | 9 |
| **Gambar 2.7** | Sistem Eksitasi *Brush Excitation* ...................... | 11 |
| **Gambar 2.8** | Sistem Exsitasi *Brushless Excitation* ................ | 12 |
| **Gambar 2.9** | Rangkaian Ekivalen Generator Sinkron ............ | 12 |
| **Gambar 2.10** | Rangkaian Ekivalen Belitan Stator Tiga Phasa Generator Sinkron a. Hubungan (Y) dan b. Hubungan ($∆$) ………………………….……... | 13 |
| **Gambar 2.11** | Rangkaian Pengujian Beban Nol pada Alternator …………………………………….. | 14 |
| **Gambar 2.12** | Kurva Karakteristik Alternator Tanpa Beban dan Hubung Singkat .......................................... | 15 |
| **Gambar 2.13** | Rangkaian Pengujian Hubung Singkat .............. | 15 |
| **Gambar 2.14** | Rangkaian Pengujian Sumber DC ..................... | 16 |
| **Gambar 3.1** | Wiring Stator Koil ............................................. | 24 |
| **Gambar 3.2** | Desain Wiring Stator Koil ................................. | 25 |
| **Gambar 3.3** | Desain Pengawatan pada Stator ......................... | 26 |
| **Gambar 3.4** | Wiring Stator Generator pada Saat OVERHAUL …………………………………. | 27 |
| **Gambar 3.5** | Kurva Karakteristik Generator .......................... | 32 |
| **Gambar 3.6** | Flowchart Prosedur Penelitian .......................... | 34 |
| **Gambar 3.7** | Flowchart Desain menggunakan FEM .............. | 36 |
| **Gambar 4.1** | Stator Generator Sinkron .................................... | 37 |
| **Gambar 4.2** | Rotor Generator Sinkron ................................... | 37 |
| **Gambar 4.3** | Menunjukkan Tampilan Awal MAGNET 7.5 ... | 38 |
| **Gambar 4.4** | Desain Stator dan Rotor Generator Sikron pada Software Magnet 7.5 .......................................... | 39 |
| **Gambar 4.5** | Desain Stator dan Rotor ..................................... | 40 |
| **Gambar 4.6** | *Coil Rotor Directions* ......................................... | 41 |
| **Gambar 4.7** | Parameter Input *Coil Phasa R* ........................... | 41 |
| **Gambar 4.8** | *Coil Phasa R Directions* .................................... | 43 |
| **Gambar 4.9** | *Inner Air Gap* (warna hijau) dan *Outer Air Gap* (warna abu) ....................................................... | 44 |
| **Gambar 4.10** | *Motion Component* ............................................ | 45 |
| **Gambar 4.11** | *Motion Component Parameters* ........................ | 46 |
| **Gambar 4.12** | *Boundary Condition* .......................................... | 46 |
| **Gambar 4.13** | Sirkuit Koil Rotor (Kiri) dan Stator (Kanan) ..... | 47 |
| **Gambar 4.14** | *Running Test Magnet Transient 2D Motion Solver Progress* ................................................. | 5148 |
| **Gambar 4.15** | Tegangan Output Tiap Phasa dalam Kondisi Tanpa Beban ...................................................... | 49 |
| **Gambar 4.16** | Arus pada Phasa R ............................................. | 49 |
| **Gambar 4.17** | Grafik Putaran Rotor .......................................... | 50 |
| **Gambar 4.18** | *Flux Linkage* ...................................................... | 50 |
| **Gambar 4.19** | Kurva Karakteristik Desain ................................ | 51 |
| **Gambar 4.20** | Induktansi Bersama (Rotor – Phasa) ................. | 59 |
| **Gambar 4.21** | Kebocoran Induktansi pada Tiap-tiap Phasa ...... | 63 |