**Tabel 1** Dimensi utama mesin poles metalografi

|  |  |
| --- | --- |
| **Item** | **Unit (mm)** |
| Panjang | 800 |
| Lebar | 600 |
| Tinggi | 800 |
| profil | 35x35x1 |

**Tabel 2** Spesifikasi material *galvanized steel*

|  |  |  |
| --- | --- | --- |
| **No** | **Steel, Galvanized** | |
| 1 | Mass Density | 7,85 g/cm3 |
| 2 | Yield Strength | 207 MPa |
| 3 | Ultimate Tensile Strenght | 345 MPa |
| 4 | Youngs Modulus | 200 GPa |
| 5 | Poissons Ratio | 0,3 ul |
| 6 | Shear Modulus | 76,9231 GPa |

**Tabel 3** Worksheet analysis

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | ***name of assambly*** |
| ***part I.D. No.*** | ***number of time the operation is carried out consecutively*** | ***two-digit manual handling code*** | ***manual handling time per part*** | ***two-digit manual insertion code*** | ***manual insertion time per part*** | ***operation time, seccond (2)x[(4)+(6)]*** | ***operation cost, Rp. 1,04 x (7)*** | ***figure for estimation of theoritical minimum part*** |  |
|  |  |  |  |  |  |  |  |  |  |
| Total | | | | | | |  |  |  |

**Tabel 4.** Morfologi Mesin Poles Metalografi

|  |  |  |  |
| --- | --- | --- | --- |
|  | Option Topic | 1 | 2 |
| A | Model rangka | Konsep desain mesin poles model berdiri | Konsep desain mesin poles model duduk |
| B | Pemilihan material rangka | Besi Hollow Galvanis 35mm x 35mm | Besi Hollow Aluminium 3mm x 3mm |
| C | Motor | Motor Ac 1 phase | Motor DC |
| D | Mekanisme transmisi | Double belt | Single belt |

**Tabel 5** Beban part pada rangka

|  |  |  |  |
| --- | --- | --- | --- |
| Keterangan | | Beban | |
| Poros 1 | Poros | 1,45kg | Total  4,7 Kg |
| Pulley 1 | 1,20Kg |
| 2 Bearing | 1,40Kg |
| Mur dan baut | 0,40Kg |
| Piringan | 0,25Kg |
| Poros 2 | Poros | 1,45kg | Total  4,4 Kg |
| Pulley 2 | 0,90Kg |
| 2 Bearing | 1,40Kg |
| Mur dan baut | 0,40Kg |
| Piringan | 0,25Kg |
| Total | | | 9,1 Kg |

**Tabel 6** Hasil data simulasi pada rangka mesin poles

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Name** | **Nilai Maksimum** | | | **Nilai Minimum** | | | **Safety Factor** |
| **Von Misses Stress (MPa)** | **Displacement (mm)** | **Strain** | **Von Misses Stress (MPa)** | **Displacement (mm)** | **Strain** |
| **Rangka mesin poles metalografi** | 7,82986 | 0,0587477 | 0,0000352366 | 0,000117923 | 0 | 0,000000000511336 | 26,43 |

**Tabel 7** Result summary desain rangka mesin poles

|  |  |  |
| --- | --- | --- |
| **Name** | **Minimum** | **Maximum** |
| **Volume** | 3017390 mm^3 | |
| **Mass** | 23,6865 kg | |
| **Von Mises Stress** | 0,000117923 MPa | 7,82986 MPa |
| **1st Principal Stress** | -1,29474 MPa | 7,52143 MPa |
| **3rd Principal Stress** | -8,25488 MPa | 1,3916 MPa |
| **Displacement** | 0 mm | 0,0587477 mm |
| **Safety Factor** | 15 ul | 15 ul |
| **Stress XX** | -3,94493 MPa | 4,4251 MPa |
| **Stress XY** | -3,9483 MPa | 2,61082 MPa |
| **Stress XZ** | -1,46716 MPa | 1,49841 MPa |
| **Stress YY** | -6,80022 MPa | 7,0659 MPa |
| **Stress YZ** | -1,4651 MPa | 1,42215 MPa |
| **Stress ZZ** | -3,491 MPa | 4,11554 MPa |
| **X Displacement** | -0,0030955 mm | 0,0031463 mm |
| **Y Displacement** | -0,0587447 mm | 0,00000401616 mm |
| **Z Displacement** | -0,00403797 mm | 0,000836727 mm |
| **Equivalent Strain** | 0,000000000511336 ul | 0,0000352366 ul |
| **1st Principal Strain** | -0,00000147141 ul | 0,000032656 ul |
| **3rd Principal Strain** | -0,0000385288 ul | 0,00000177876 ul |
| **Strain XX** | -0,0000153242 ul | 0,0000178941 ul |
| **Strain XY** | -0,0000256639 ul | 0,0000169703 ul |
| **Strain XZ** | -0,00000953654 ul | 0,00000973968 ul |
| **Strain YY** | -0,0000290152 ul | 0,000029695 ul |
| **Strain YZ** | -0,00000952312 ul | 0,00000924399 ul |
| **Strain ZZ** | -0,0000137178 ul | 0,0000172266 ul |
| **Contact Pressure** | 0 MPa | 12,2814 MPa |
| **Contact Pressure X** | -8,27534 MPa | 8,26292 MPa |
| **Contact Pressure Y** | -8,71347 MPa | 4,75192 MPa |
| **Contact Pressure Z** | -6,51425 MPa | 8,65424 MPa |

**Tabel 8** Analisa assembly

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | ***name of assambly*** |
| ***part I.D. No.*** | ***Number of item*** | ***Handling Code*** | ***Handling Time*** | ***Insertion Code*** | ***Insertion time*** | ***Total time (s) (2)x[(4)+(6)]*** | ***operation cost (Rp.) 1,04 x (7)*** | ***figure for estimation of theoritical minimum part*** | ***PHOLISING MACHINE*** |
| Sub Assembly 1 | | | | | | | | | |
| S3A1 : Rakitan motor | | | | | | | | | |
| 1 | 1 | 30 | 1.95 | 00 | 1.5 | 3.45 | 3.588 | 1 | Motor |
| 2 | 4 | 09 | 2.98 | 06 | 5.5 | 33.92 | 35.2768 | 0 | ring baut pengunci motor |
| 3 | 4 | 10 | 1.5 | 38 | 6 | 30 | 31.2 | 1 | baut pengunci motor |
|  |  |  |  |  |  | 0 | 0 | - | membalikkan posisi motor |
| 4 | 8 | 10 | 1.5 | 38 | 6 | 60 | 62.4 | 1 | mur pengunci motor A |
|  |  |  |  |  |  | 0 | 0 | - | memutar 90° posisi motor |
| 5 | 1 | 11 | 1.8 | 06 | 5.5 | 7.3 | 7.592 | 1 | pulley ganda |
| 6 | 1 | 10 | 1.5 | 38 | 6 | 7.5 | 7.8 | 1 | baut penahan pulley |
| Sub Assembly 2 | | | | | | | | | |
| S3A2 : Gabungan cover dengan dimmer | | | | | | | | | |
| 7 | 1 | 30 | 1.95 | 00 | 1.5 | 3.45 | 3.588 | 1 | cover atas |
|  |  |  |  |  |  | 0 | 0 | - | membalikkan posisi cover |
| 8 | 1 | 30 | 1.95 | 06 | 5.5 | 7.45 | 7.748 | 1 | dimmer |
| 9 | 1 | 30 | 1.95 | 00 | 1.5 | 3.45 | 3.588 | 1 | saklar on/off |
|  |  |  |  |  |  | 0 | 0 | - | putar cover ke posisi awal |
| 10 | 1 | 30 | 1.95 | 00 | 1.5 | 3.45 | 3.588 | 0 | handle dimmer |
| Assembly Akhir | | | | | | | | | |
| Rakitan Akhir : Gabungan Rangka dengan sub Assembly 1 dan 2 | | | | | | | | | |
| 11 | 1 | 30 | 1.95 | 00 | 1.5 | 3.45 | 3.588 | 1 | rangka |
| 12 | 2 | 33 | 2.51 | 00 | 1.5 | 8.02 | 8.3408 | 1 | bearing |
| 13 | 4 | 09 | 2.98 | 06 | 5.5 | 33.92 | 35.2768 | 0 | ring baut pengunci bearing |
| 14 | 4 | 10 | 1.5 | 38 | 6 | 30 | 31.2 | 1 | baut pengunci bearing |
| 15 | 4 | 09 | 2.98 | 06 | 5.5 | 33.92 | 35.2768 | 0 | ring mur pengunci bearing |
| 16 | 4 | 10 | 1.5 | 38 | 6 | 30 | 31.2 | 1 | mur pengunci bearing |
| 17 | 2 | 11 | 1.8 | 06 | 5.5 | 14.6 | 15.184 | 1 | poros A |
| 18 | 1 | 10 | 1.5 | 06 | 5.5 | 7 | 7.28 | 1 | pulley A |
| 19 | 1 | 80 | 4.1 | 32 | 4 | 8.1 | 8.424 | 1 | V belt A |
| 20 | 2 | 11 | 1.8 | 06 | 5.5 | 14.6 | 15.184 | 1 | poros B |
| 21 | 1 | 10 | 1.5 | 06 | 5.5 | 7 | 7.28 | 1 | pulley B |
| 22 | 1 | 80 | 4.1 | 32 | 4 | 8.1 | 8.424 | 1 | V belt B |
| S3A2 | 1 | 80 | 4.1 | 38 | 6 | 10.1 | 10.504 | - | menggabungkan sub assembly 2 ke rakitan akhir |
| 23 | 12 | 10 | 1.5 | 38 | 6 | 90 | 93.6 | 1 | baut pengunci cover |
| 24 | 2 | 00 | 1.13 | 06 | 5.5 | 13.26 | 13.7904 | 0 | piringan |
| 25 | 8 | 11 | 1.8 | 38 | 6 | 62.4 | 64.896 | 1 | skrup pengunci piringan |
| S3A1 | 1 | 85 | 5 | 38 | 6 | 11 | 11.44 | - | menggabungkan sub assembly 1 ke rakitan akhir |
| 19 | 1 | 80 | 4.1 | 32 | 4 | 8.1 | 8.424 | - | V belt A |
| 22 | 1 | 80 | 4.1 | 32 | 4 | 8.1 | 8.424 | - | V belt B |
| 26 | 2 | 10 | 1.5 | 38 | 6 | 15 | 15.6 | 1 | mur pengunci motor |
|  | 1 | - |  | 98 | 9 | 9 | 9.36 | - | Ajusting Belt Pulley A |
|  | 1 | - |  | 98 | 9 | 9 | 9.36 | - | Ajusting Belt Pulley B |
| Total | | | | | | 594.64 | 618.4256 | 21 | Design Efficiency =  = 0.1059 |
|  |  |  |  |  |  | TM | CM | NM |

**Tabel 9** Hasil estimasi perakitan

|  |  |
| --- | --- |
| **Kriteria** | **Nilai** |
| Jumlah part per produk | 26 |
| Total waktu perakitan (TM) per produk | 594.64 s |
| Selisih jumlah part aktual dengan jumlah part minimum teoritis (NM) | 21 |
| Total biaya perakitan (CM) per produk | 618.4256 |
| Design Efficiency | 0.1059 (10,59%) |
| Jumlah part produk yang dapat dirakit | 76 |
| Banyaknya langkah perakitan berdasarkan assembly chart | 26 |