

DAFTAR PUSTAKA

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LAMPIRAN 1
(TABEL DATA MATERIAL, *CUTTING SPEED*, DAN SPESIFIKASI
VARIASI KECEPATAN *SPINDLE* MESIN FRAIS)

LAMPIRAN 1

TABEL DATA MATERIAL, *CUTTING SPEED*, DAN SPESIFIKASI KECEPATAN PUTARAN *SPINDLE* MESIN *FRAIS*.

Tabel 1 Kecepatan potong untuk proses *frais* untuk pasangan benda kerja dan pisau HSS (Widarto, 2008)

| MATERIAL | CUTTING SPEED (sfpm) _{1, 2} | | | |
|-------------------------------------|--------------------------------------|--------------|---------------------|--------------|
| | PLAIN MILLING CUTTERS | | END MILLING CUTTERS | |
| | Roughing | Finishing | Roughing | Finishing |
| Aluminum..... | 400 to 1,000 | 400 to 1,000 | 400 to 1,000 | 400 to 1,000 |
| Brass, composition..... | 125 to 200 | 90 to 200 | 90 to 150 | 90 to 150 |
| Brass, yellow..... | 150 to 200 | 100 to 250 | 100 to 200 | 100 to 200 |
| Bronze, phosphor and manganese..... | 30 to 80 | 25 to 100 | 30 to 80 | 30 to 80 |
| Cast iron (hard)..... | 25 to 40 | 10 to 30 | 25 to 40 | 20 to 45 |
| Cast iron (soft and medium)..... | 40 to 75 | 25 to 80 | 35 to 65 | 30 to 80 |
| Monel metal..... | 50 to 75 | 50 to 75 | 40 to 60 | 40 to 60 |
| Steel, hard..... | 25 to 50 | 25 to 70 | 25 to 50 | 25 to 70 |
| Steel, soft..... | 60 to 120 | 45 to 110 | 50 to 85 | 45 to 100 |

Tabel 2 Tebal beram per gigi untuk beberapa tipe pisau *frais* dan benda kerja yang dikerjakan (satuan dalam inchi) (Widarto, 2008)

| TYPE OF CUTTER | ALUMINUM | | BRONZE | | CAST IRON | | FREE MACHINING STEEL | | ALLOY STEEL | |
|-----------------------|----------|----------|---------|----------|-----------|----------|----------------------|----------|-------------|----------|
| | HSS | CAR BIDE | HSS | CAR BIDE | HSS | CAR BIDE | HSS | CAR BIDE | HSS | CAR BIDE |
| FACE MILLS | .007 | .007 | .005 | .004 | .004 | .006 | .003 | .004 | .002 | .003 |
| | to .022 | to .020 | to .014 | to .012 | to .016 | to .020 | to .012 | to .016 | to .008 | to .014 |
| HELICAL MILLS | .006 | .006 | .003 | .004 | .004 | .002 | .002 | .003 | .002 | .003 |
| | to .018 | to .016 | to .011 | to .010 | to .018 | to .018 | to .010 | to .013 | to .007 | to .012 |
| SIDE CUTTING MILLS | .004 | .004 | .003 | .003 | .002 | .003 | .002 | .003 | .001 | .002 |
| | to .013 | to .012 | to .008 | to .007 | to .009 | to .012 | to .007 | to .009 | to .005 | to .008 |
| END MILLS | .003 | .003 | .003 | .002 | .002 | .003 | .001 | .002 | .001 | .002 |
| | to .011 | to .010 | to .007 | to .006 | to .008 | to .010 | to .006 | to .008 | to .004 | to .007 |
| FORM RELIEVED CUTTERS | .002 | .002 | .001 | .001 | .002 | .002 | .001 | .002 | .001 | .001 |
| | to .007 | to .006 | to .004 | to .004 | to .005 | to .006 | to .004 | to .005 | to .003 | to .004 |
| CIRCULAR SAWS | .002 | .002 | .001 | .001 | .001 | .002 | .001 | .001 | .005 | .001 |
| | to .005 | to .005 | to .003 | to .003 | to .004 | to .006 | to .003 | to .004 | to .002 | to .004 |

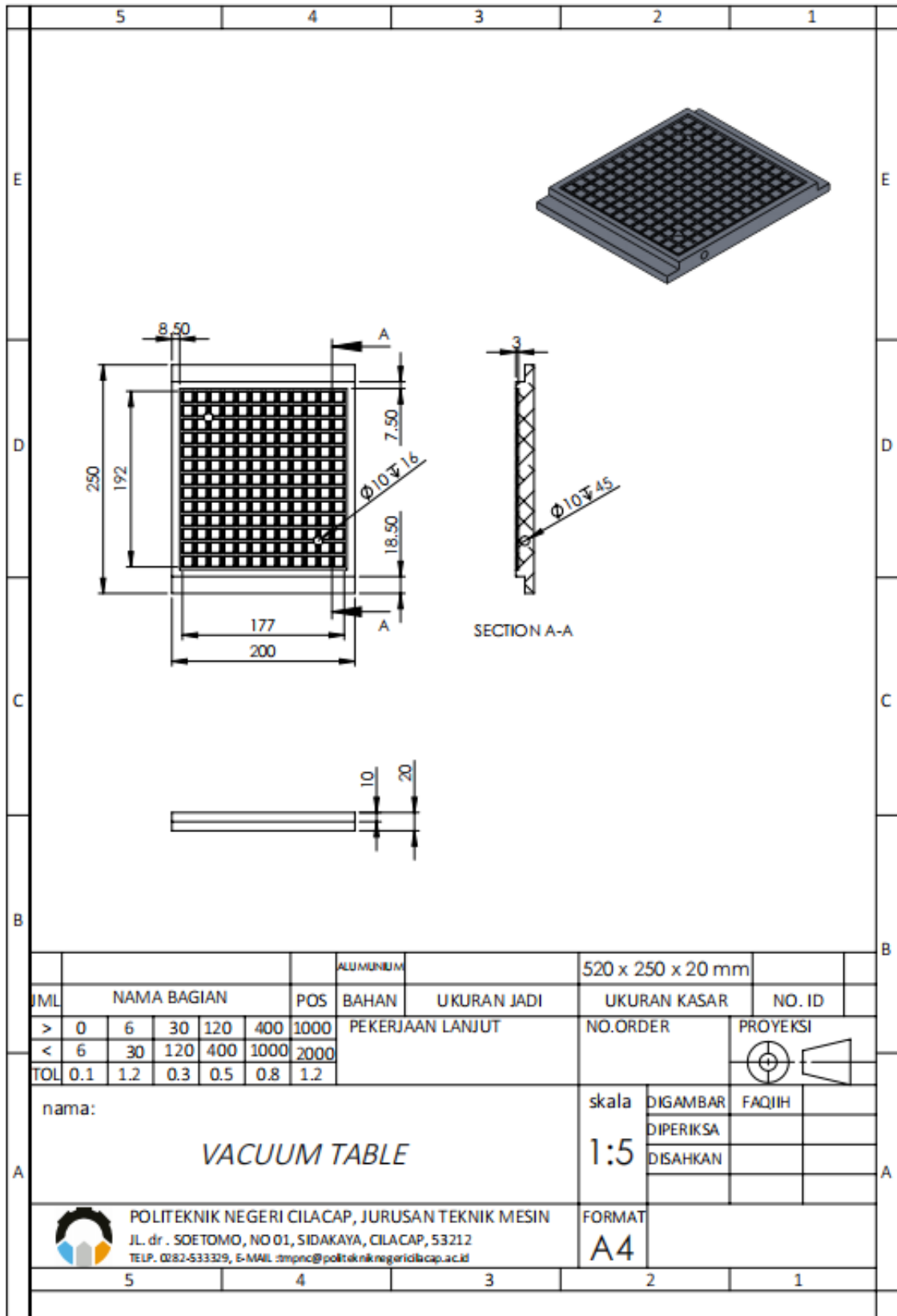
| HORIZONTAL SPINDLE R.P.M. | | | |
|---------------------------|-----|-----|------|
| 60% 50% POLE 4 | A | B | C |
| HIGH 60% _s | 360 | 610 | 1470 |
| HIGH 50% _s | 300 | 512 | 1225 |
| LOW 60% _s | 108 | 180 | 430 |
| LOW 50% _s | 90 | 151 | 358 |

Gambar 1 Kecepatan *spindle* mesin *frais*

| Material | Teg. Tarik (kg/mm ²) | CS (m/mnt) | Material | Teg. Tarik (kg/mm ²) | CS (m/mnt) |
|--------------------------------|----------------------------------|------------|---------------------------------|----------------------------------|------------|
| Main carbon steel | | | Spring Steel (JIS Grade) | | |
| ST37 / MS | 37 | 32 | SUP4, 6, 7, 9, 10, 11 | 125 | 13 |
| 1030 / S30C | 48 | 32 | SUS 302, 304, 316 WPA | 170 | 5 |
| 1035 / S35C | 52 | 25 | SUS 302, 304, WPB | 210 | 5 |
| 1040 / S40C | 55 | 25 | SUS 631J1 WPC | 200 | 5 |
| 1045 / S45C / EMS45 / 1730 | 58 | 25 | Stainless Steel | | |
| 1050 / S50C / ST60 | 62 | 25 | 304, 304L, 316, 316L | 70 | 18 |
| 1055 / S55C | 66 | 25 | 410, 416 | 77 | 18 |
| Alloy Steel (JIS Grade) | | | 420, 420F | 84 | 18 |
| SNC2, 3, 21 | 95 | 18 | 440C, 440F | 91 | 18 |
| SNC22 | 100 | 13 | Copper | | |
| SNCM1, 2, 22 | 90 | 18 | | | 70 |
| SNCM7, 8, 23, 25 | 100 | 13 | Lead Bronze | | |
| SCr3, 4, 21, 22 | 90 | 18 | | | 50-70 |
| SCr5 | 100 | 13 | Phosphor Bronze | | |
| SCM2, 3, 21, 22 | 90 | 18 | | | 40-50 |
| SCM4, 5, 23 | 100 | 13 | Pure Aluminum | | |
| Tool Steel (AISI Grade) | | | | | 200-300 |
| W Series | 70 | 18 | Aluminum Alloy | | |
| O Series | 135 | 5 | | | 70-120 |
| D Series | 140 | 5 | Cast Iron | | |
| A Series | 140 | 5 | | | |
| H Series | 140 | 5 | GG20 | | 25 |
| L Series | 100 | 13 | GG25 | | 18 |
| P Series | 100 | 13 | GG30, 35, 40 | | 18 |
| S Series | 130 | 5 | GG45, 50 | | 13 |
| HSS T Series | 150 | 5 | GG55, 60 | | 5 |
| HSS M Series | 140 | 5 | | | |

Gambar 2 Tabel data material dan *cutting speed* (Widarto, 2008)

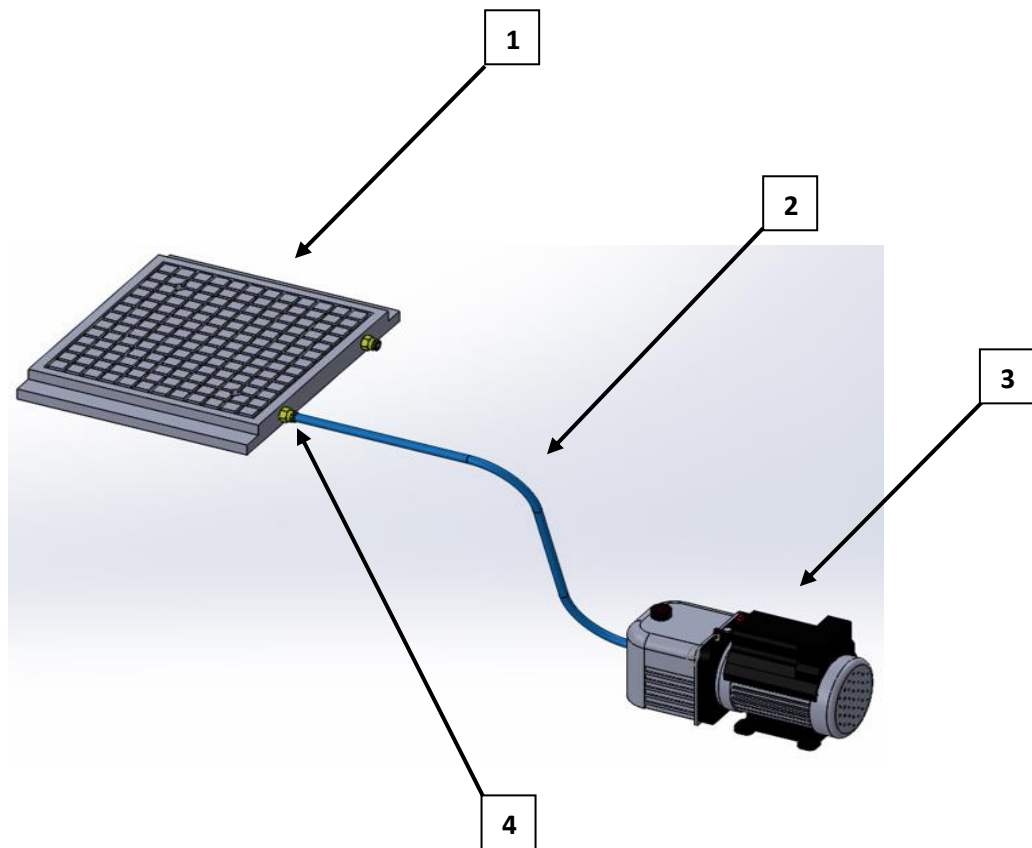
LAMPIRAN 2
(DESAIN *VACUUM TABLE*)



| | | | | | | | | | | |
|---|-------------|-----------|-----|-------------------|------|------|------------------|-------------|--------------|----------|
| | | ALUMINIUM | | 520 x 250 x 20 mm | | | | | | |
| JML | NAMA BAGIAN | | | | | POS | BAHAN | UKURAN JADI | UKURAN KASAR | NO. ID |
| > | 0 | 6 | 30 | 120 | 400 | 1000 | PEKERJAAN LANJUT | | NO.ORDER | PROYEKSI |
| < | 6 | 30 | 120 | 400 | 1000 | 2000 | | | | |
| TOL | 0.1 | 1.2 | 0.3 | 0.5 | 0.8 | 1.2 | | | | |
| nama: | | | | | | | | skala | DIGAMBAR | FAQIHH |
| VACUUM TABLE | | | | | | | | 1:5 | DIPERIKSA | |
| | | | | | | | | | DISAHKAN | |
| | | | | | | | | | | |
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| | | | | | | | | A4 | | |

LAMPIRAN 3
(DESAIN WUJUD *VACUUM CLAMPING*)

LAMPIRAN 3
DESAIN WUJUD *VACUUM CLAMPING*



Gambar 1 Desain alat *vacuum clamping*.

Tabel 1 Keterangan komponen alat *vacuum clamping*.

| No | Bahan | Spesifikasi | Fungsi |
|----|-----------|-------------------|---|
| 1. | Alumunium | 300 × 250 × 30 mm | Digunakan untuk bahan <i>clamping dedvice</i> atau <i>jig vacuum clamping</i> . |

Tabel 1 Keterangan komponen alat *vacuum clamping* (lanjutan).

| No | Bahan | Spesifikasi | Fungsi |
|-----------|------------------|---|---|
| 2. | Selang Pneumatik | Diameter output : 6 mm Diameter Inner : 4 mm | Untuk mengalirkan udara bertekanan dari pompa vakum. |
| 3. | Pompa Vakum | Flow rate : 9.0 CFM Voltage : 230V Power : $\frac{3}{4}$ HP | Digunakan sebagai sistem penghisap atau pencekam. |
| 4. | Nepel Pneumatik | Diameter <i>inner</i> : 6 mm Diameter ulir : 9,7 mm | Penghubung selang dengan <i>jig clamping</i> dan selang dengan pompa vakum. |

LAMPIRAN 4
(BIODATA PENULIS)

LAMPIRAN 4
BIODATA PENULIS



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LAMPIRAN 5
(DOKUMENTASI PENGUJIAN)

LAMPIRAN 5
DOKUMENTASI PENGUJIAN

