

BAB 6

KESIMPULAN DAN SARAN

6.1. Kesimpulan

Berdasarkan hasil penelitian di PT. Kreasindo Jayatama Sukses Bekasi maka dapat ditarik beberapa kesimpulan:

- a. Tabel 6.1 di bawah ini menunjukkan strategi *toolpath* pembuatan *prototype Seat Grip dan Footrest Grip* dengan software PowerMill 9.0 yang telah optimal dan waktu aktualnya.
- b. Waktu proses permesinan pembuatan *part Universal Chair* secara simulasi mencapai 13:53:43. Sedangkan waktu aktual pada proses mesin CNC mencapai 32:48:00.
- c. Hasil analisis Vericut menunjukkan jumlah *Gouges* pada *Footrest Grip dan Seat Grip* dalam toleransi 0,01 mencapai 45.207 titik dan *Excess* mencapai 7.219 titik.

Tabel 6.1. Waktu proses simulasi optimal dan waktu proses aktual

| Nama Proses | Nama Toolpath | Simulation Time | Actual Time |
|-------------------------------|--------------------------------|------------------------|--------------------|
| <i>Facing pertama</i> | <i>Raster AreaClear Model</i> | <i>0:20:16</i> | <i>0:19:00</i> |
| <i>Facing kedua</i> | <i>Raster AreaClear Model</i> | <i>0:20:16</i> | <i>0:18:00</i> |
| <i>Roughing</i> | <i>Offset AreaClear Model</i> | <i>1:26:38</i> | <i>4:44:00</i> |
| <i>Semi Finishing pertama</i> | <i>Interleaved Constant Z</i> | <i>0:50:48</i> | <i>1:24:00</i> |
| <i>Semi Finishing kedua</i> | <i>Interleaved Constant Z</i> | <i>0:42:52</i> | <i>3:13:00</i> |
| <i>Finishing</i> | <i>Interleaved Constant Z</i> | <i>2:04:57</i> | <i>8:18:00</i> |
| <i>Cornering pertama</i> | <i>Corner Pencil Finishing</i> | <i>0:00:33</i> | <i>0:05:00</i> |
| <i>Cornering kedua</i> | <i>Corner Pencil Finishing</i> | <i>0:07:18</i> | <i>0:14:00</i> |
| <i>Stopper Top</i> | <i>Offset AreaClear Model</i> | <i>0:09:36</i> | <i>0:15:00</i> |
| <i>Stopper Bottom</i> | <i>Offset AreaClear Model</i> | <i>0:10:25</i> | <i>0:15:00</i> |
| <i>Roughing</i> | <i>Offset AreaClear Model</i> | <i>2:05:18</i> | <i>2:10:00</i> |
| <i>Semi Finishing pertama</i> | <i>Interleaved Constant Z</i> | <i>0:43:28</i> | <i>1:19:00</i> |
| <i>Semi Finishing kedua</i> | <i>Interleaved Constant Z</i> | <i>0:37:10</i> | <i>2:00:00</i> |
| <i>Finishing pertama</i> | <i>Interleaved Constant Z</i> | <i>1:53:04</i> | <i>1:20:00</i> |
| <i>Finishing kedua</i> | <i>Interleaved Constant Z</i> | <i>1:53:08</i> | <i>5:43:00</i> |
| <i>Cornering</i> | <i>Corner Pencil Finishing</i> | <i>0:00:44</i> | <i>0:01:00</i> |
| <i>Cutting</i> | <i>Interleaved Constant Z</i> | <i>0:27:12</i> | <i>1:10:00</i> |

- d. *Prototype* hasil mesin CNC menggunakan *toolpath* strategi yang optimal dari *software* PowerMill 9.0.



Gambar 6.1. *Prototype* bagian *front* hasil permesinan CNC



Gambar 6.2. *Prototype* bagian *back* hasil permesinan CNC

6.2. Saran

Keterbatasan dalam penelitian ini adalah perbedaan waktu antara hasil simulasi dengan hasil permesinan

pada mesin YHM-600A yang memiliki *controller* jenis Fanuc seri 6 (yang telah *old version*).

Penulis mengusulkan agar penelitian berikutnya akan membahas mengenai:

- a. Analisis optimalisasi *toolpath strategy* yang terbatas terhadap *transfer rate* dari CPU ke *memory* mesin.
- b. Optimalisasi *toolpath strategy* menggunakan *software* Vericut.
- c. Aplikasi *software* PowerMill dalam pengerjaan mesin *milling five-axis*.
- d. Pengaruh-parameter lain dalam simulasi permesinan seperti *spindle speed*, *feed rate*, *depth of cut*, *material tools* atau *material* produk.
- e. Aplikasi *software* PowerMill dalam pengerjaan mesin dengan *high speed machining*.
- f. Pengaruh *temperature material cutter / product* terhadap kekerasan saat permesinan.
- g. Analisis optimalisasi *toolpath strategy* dengan menggunakan *Computerise Measurement Machine* (CMM).
- h. Optimalisasi *toolpath strategy* dengan membandingkan verifikasi hasil vericut dengan *Computerise Measurement Machine* (CMM).

DAFTAR PUSTAKA

Amalia, A., 2005, *Analisis Pembuatan Mold Botol AQUA 600 ml Menggunakan Software Mastercam Version 9.1. Studi Kasus di Asia Protendo Graha Boyolali*, Fakultas Teknologi Industri Program Studi Teknik Industri, Universitas Atma Jaya Yogyakarta, Yogyakarta.

Chang, T.C., Wysk, R.A., Wang H.P., 1998, *Computer-Aided Manufacturing 2nd Edition*, Prentice-Hall, Inc., Simon and Schuster/A Viacom Company, Upper Saddle River, New Jersey.

DEL CAM, PLC., 2005, *What's New in PowerMILL 6.0*, Delcam, Plc., England.

DEL CAM, PLC., 2007, *What's New in PowerMILL 8.0*, Delcam, Plc., England.

DEL CAM, PLC., 2008, *What's New in PowerMILL 9.0*, Delcam, Plc., England.

Sari, F.E., 2010, *Analisis Pemilihan Strategi Permesinan Untuk Proses Pengerjaan Lower Die Draw 52185 (Studi Kasus di PT. Mekar Armada Jaya)*, Fakultas Teknologi Industri Program Studi Teknik Industri, Universitas Atma Jaya Yogyakarta, Yogyakarta.

Groover, M.P., 1996, *Fundamental of Modern Manufacturing : Material, Processes, and System*, Prentice-Hall, Inc., A Simon and Schuster Company, Upper Saddle River, New Jersey.

Kibbe, R.R., 1999, *Machine Tool Practices 6th Edition*, Prentice Hall, Upper Saddle River, New Jersey.

Maharanto, F., 2007, *Penentuan Strategi Machining dan Prototyping Core Cavity Bra Menggunakan Software PowerMILL Versi 7.0*, Fakultas Teknologi Industri Program Studi Teknik Industri, Universitas Atma Jaya Yogyakarta, Yogyakarta.

<http://andryanto86.files.wordpress.com>

<http://cdn1.grizzly.com>

<http://upload.wikimedia.org>

<http://www.ctia.com.cn>

<http://www.ferret.com.au>

<http://www.soghoyan.com>

SURAT KETERANGAN **001/Ext/ Dir/ VII/11**

Dengan ini, kami menyatakan bahwa :

Nama : Jimmy Hendro Christanto
Universitas : Atmajaya Yogyakarta
Fakultas : Teknologi Industri
Program Studi : Teknik Industri
NIM : 06 06 05144/ TI

Yang tersebut diatas benar telah melaksanakan Penelitian Tugas Akhir di PT. Kreasindo Jayatama Sukses dari tgl 02 Mei 2011 S.d 29 Juli 2011.

Demikian surat ini kami buat untuk dapat dipergunakan sebagaimana mestinya.

Bekasi, 29 Juli 2011

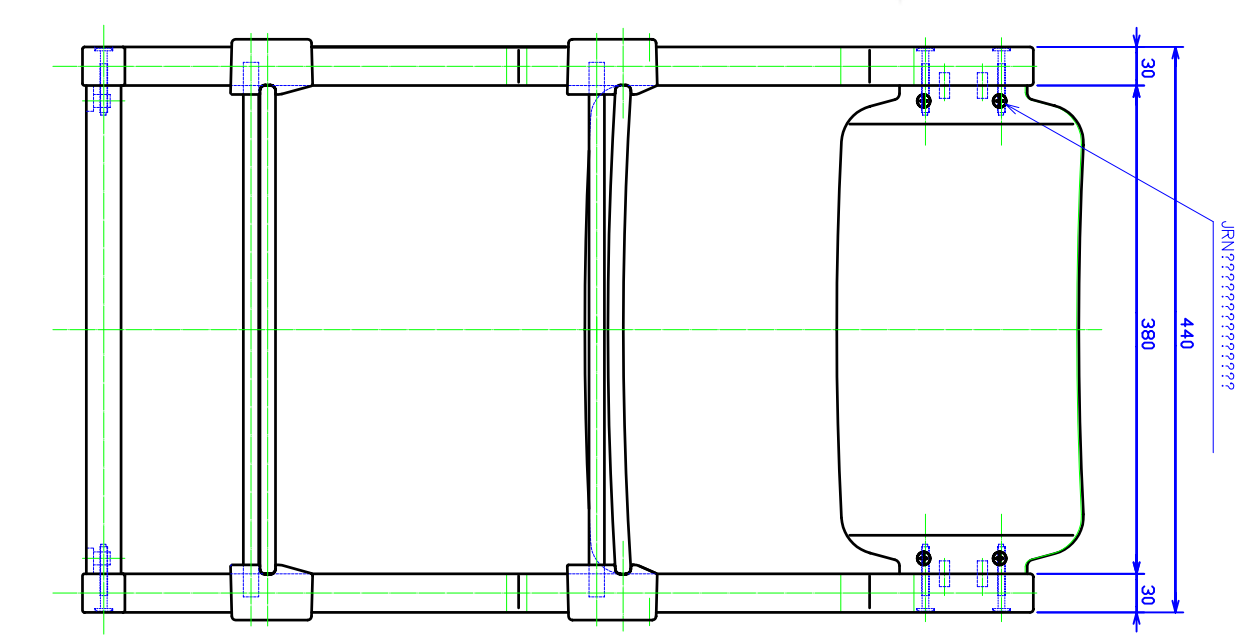
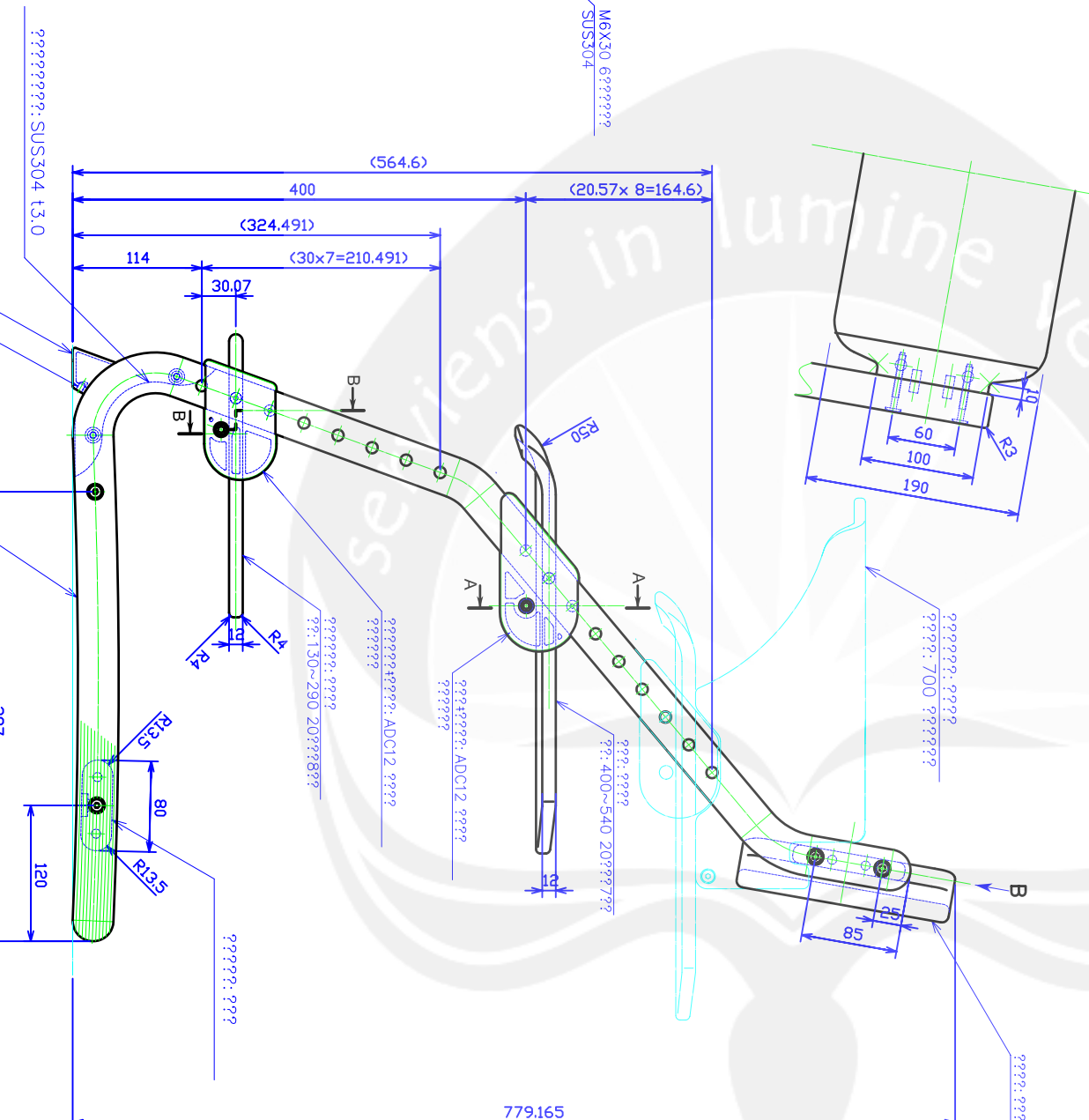
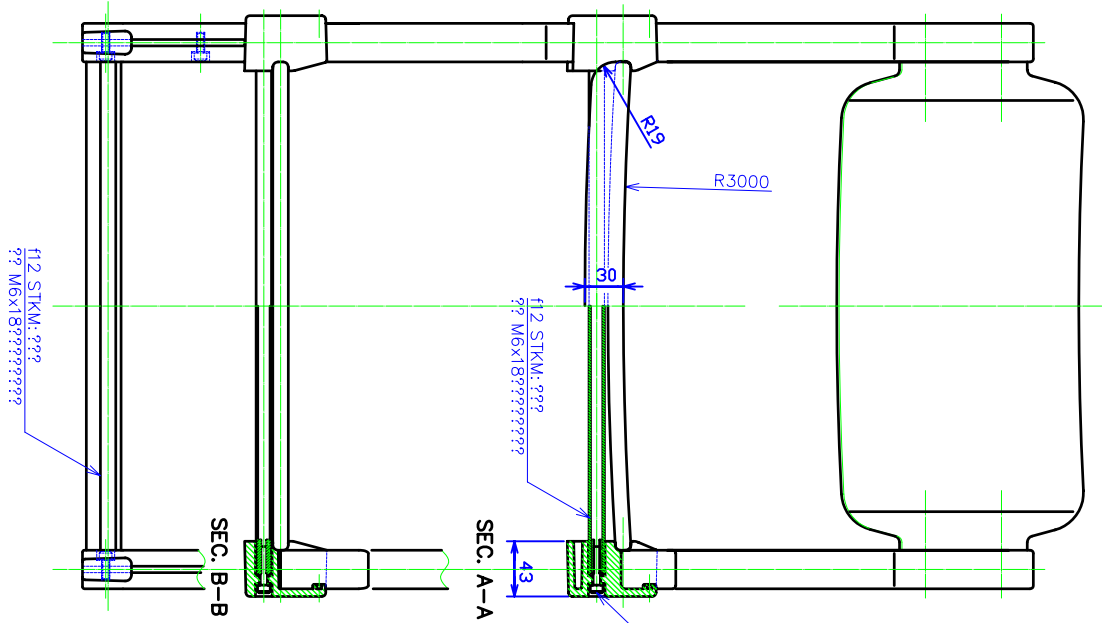
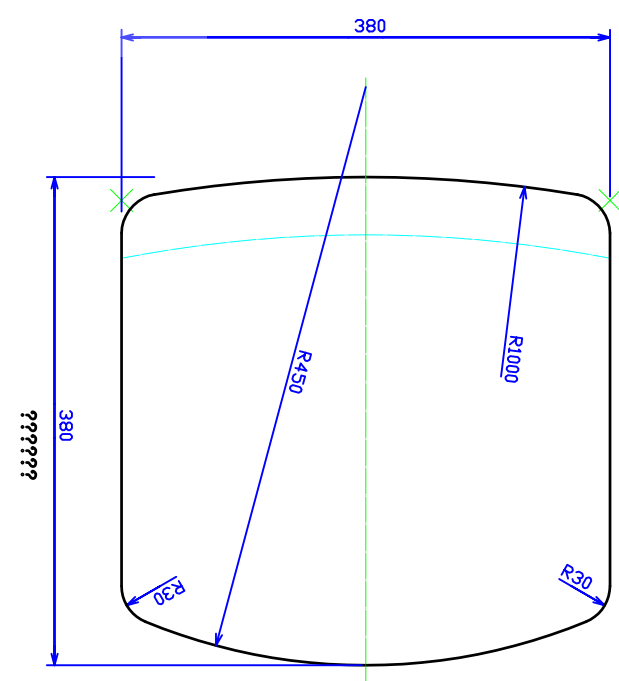
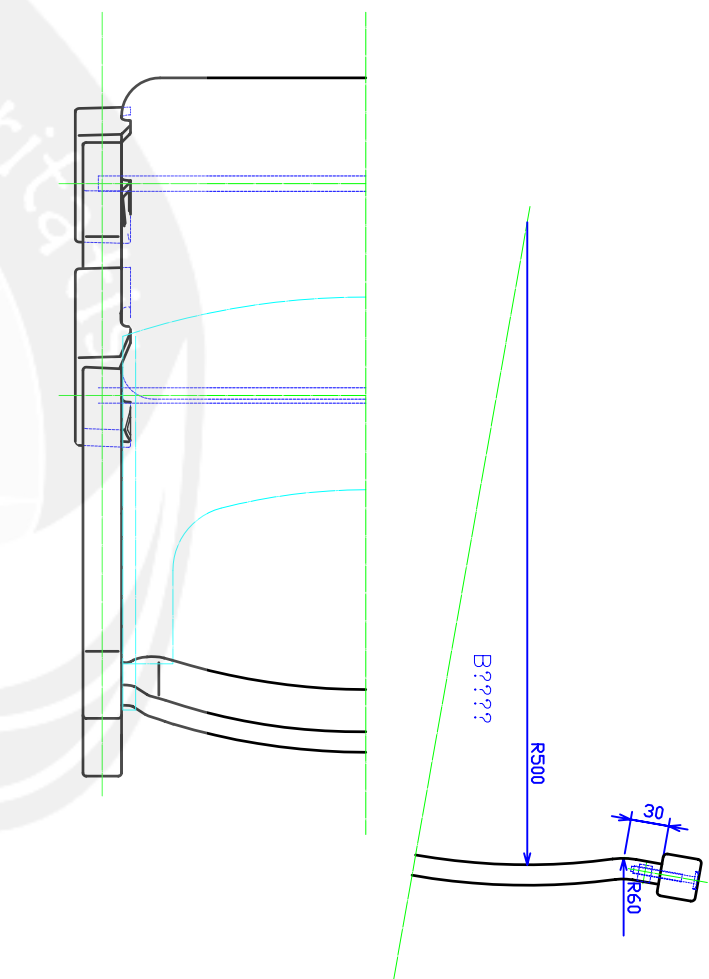
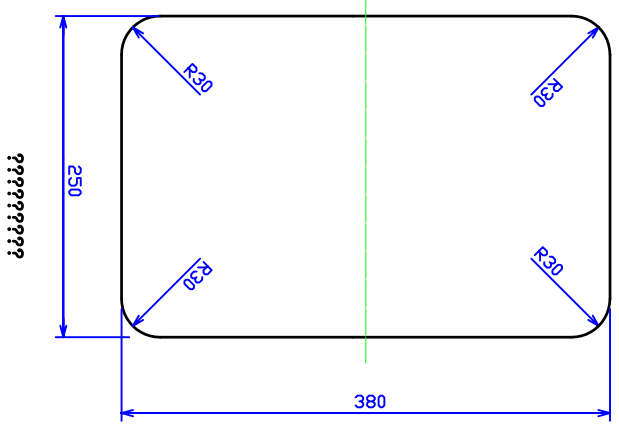
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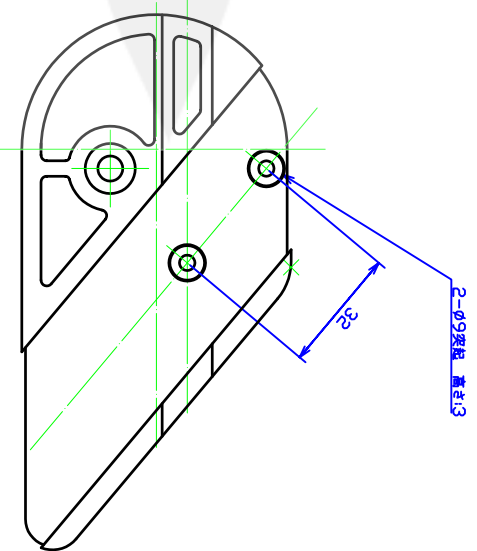
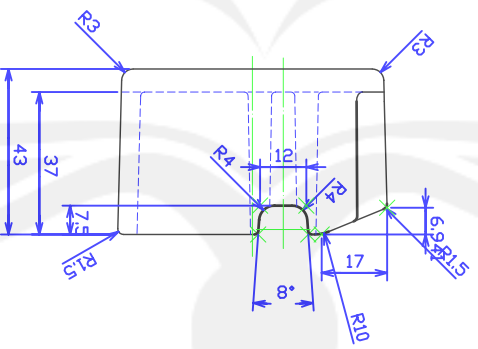
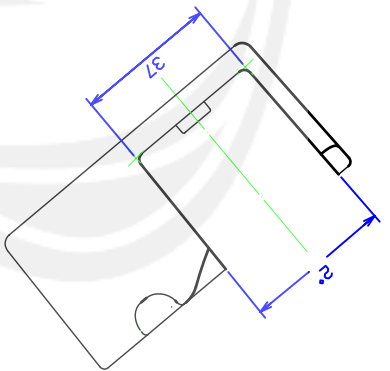
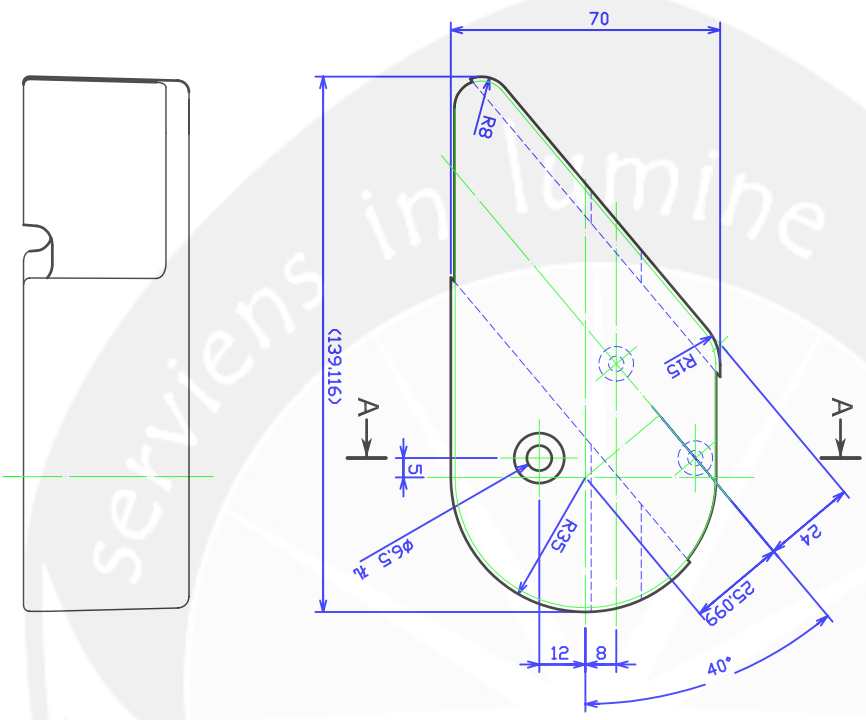
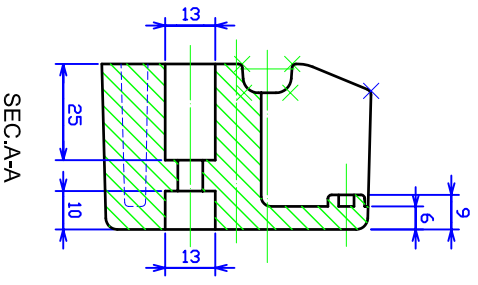
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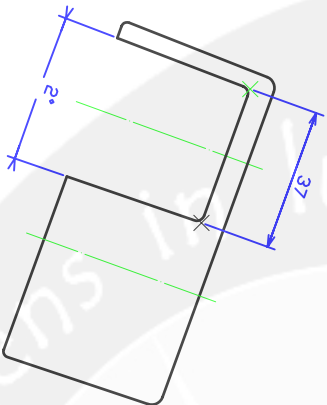
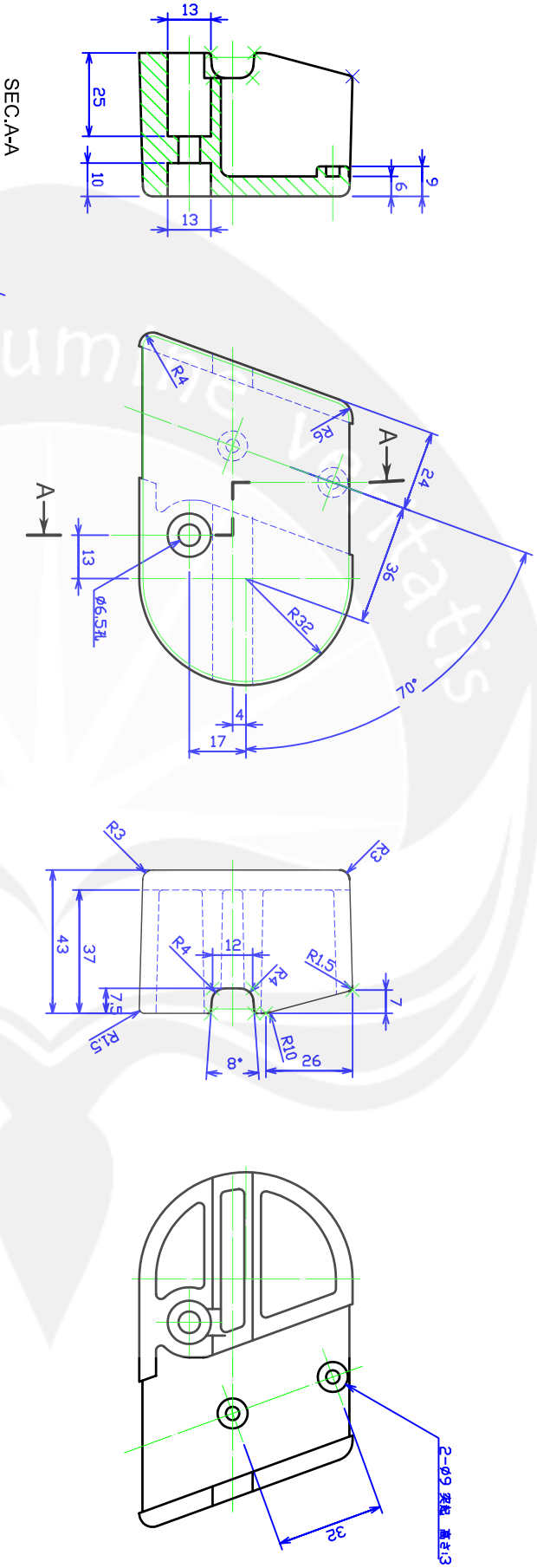
PT. KREASINDO JAYATAMA SUKSES



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| DESIGN | Y.NAKAGUCHI | SIGNATURE | | DATE | 2011/6/1 |
| CHKD | Y.NAKAGUCHI | | | FILE NAME | |
| APPV | Y.KITAGAWA | | | REVISION | B-2 |
| | | | | | SHEET 1/1 |



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| DESIGN | Y.Nokkomi | NAME | | SIGNATURE | |
| DRAWING | Y.Nokkomi | MATERIAL | PA66 77777 | DATE | 2011/5/31 |
| CHKD | | WEIGHT | | | |
| APPVD | Y.Kitagawa | | | | FILE NAME |
| | | | | | 2011/5/31 |
| | | | | | PARTS NO. |
| REVISION | 8 | | | | SHEET |



SEC.A-A

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| APPROV: Y.Kitogawa | | DATE: 2011/5/31 | | SIGNATURE: | | REVISION: 8 | |
| ROZUMI | | SHEET | | REVISION: 8 | | SHEET | |



YHM-600A

CAM Programmer

JIMMY HENDRO
Checked by BETTY DIANA

Power MILL Setup Sheet

| Project | NC Program | Part | Side | Date |
|--------------|-----------------|------|-------|------------|
| 061511 - 019 | UNIVERSAL CHAIR | - | Front | 22-07-2011 |

Material and Toolpath Limits

| Material | Block | Tool Datum Setting |
|--------------|---------------------|--------------------|
| NYLON 6-GF30 | (360 x 250 x 50) mm | tip |

| | X | Y | Z |
|-------------|------|------|-----|
| Start Point | 0 | 0 | 5 |
| Maximum | 180 | 125 | 0 |
| Minimum | -180 | -125 | -49 |

Toolpaths

| TAP File | Feed Rates | | | | Tool | |
|--|---------------|------|---------|------|------------|--------------|
| Material_1.tap Z0 = 70.5 mm from bed BALIK | R | 8000 | P | 1000 | Type | End Mill |
| | F | 1000 | S | 4000 | Diameter | 12 |
| | Thickness | | 0.0 | | Tip radius | - |
| | Toolpath Time | | 0:20:16 | | Overhang | 35 |
| | Actual Time | | 0:19:00 | | Flute | 2 |
| TAP File | Feed Rates | | | | Tool | |
| Material_2.tap Z0 = 70 mm from bed | R | 8000 | P | 1000 | Type | End Mill |
| | F | 1000 | S | 4000 | Diameter | 12 |
| | Thickness | | 0.0 | | Tip radius | - |
| | Toolpath Time | | 0:20:16 | | Overhang | 35 |
| | Actual Time | | 0:18:00 | | Flute | 2 |
| TAP File | Feed Rates | | | | Tool | |
| 1.tap | R | 8000 | P | 100 | Type | JW-End Mill |
| | F | 1000 | S | 5000 | Diameter | 12-xlong |
| | Thickness | | 1.0 | | Tip radius | - |
| | Toolpath Time | | 1:26:38 | | Overhang | 55 |
| | Actual Time | | 4:44:00 | | Flute | 4 |
| TAP File | Feed Rates | | | | Tool | |
| 2.tap | R | 8000 | P | 170 | Type | JW-TipRadius |
| | F | 1700 | S | 5000 | Diameter | 10-long |
| | Thickness | | 0.5 | | Tip radius | 2 |
| | Toolpath Time | | 0:50:48 | | Overhang | 55 |
| | Actual Time | | 1:24:00 | | Flute | 2 |

| TAP File | | Feed Rates | | | | Tool | |
|---|---------------|------------|---------|------|------------|-------------|--|
| 3.tap | R | 8000 | P | 400 | Type | Tip Radius | |
| | F | 4000 | S | 5000 | Diameter | 8-long | |
| | Thickness | | 0.2 | | Tip radius | 1 | |
| | Toolpath Time | | 0:42:52 | | Overhang | 55 | |
| | Actual Time | | 3:13:00 | | Flute | 2 | |
| TAP File | | Feed Rates | | | | Tool | |
| 4.tap | R | 8000 | P | 450 | Type | Tip Radius | |
| | F | 4500 | S | 5000 | Diameter | 6-long | |
| | Thickness | | 0.0 | | Tip radius | 0.5 | |
| | Toolpath Time | | 2:04:57 | | Overhang | 55 | |
| | Actual Time | | 8:18:00 | | Flute | 2 | |
| TAP File | | Feed Rates | | | | Tool | |
| 5.tap | R | 8000 | P | 50 | Type | End Mill | |
| | F | 500 | S | 5000 | Diameter | 6-long | |
| | Thickness | | 0.0 | | Tip radius | - | |
| | Toolpath Time | | 0:00:33 | | Overhang | 55 | |
| | Actual Time | | 0:05:00 | | Flute | 2 | |
| TAP File | | Feed Rates | | | | Tool | |
| 6.tap | R | 8000 | P | 100 | Type | JW-End Mill | |
| | F | 1000 | S | 5000 | Diameter | 4 | |
| | Thickness | | 0.0 | | Tip radius | - | |
| | Toolpath Time | | 0:07:18 | | Overhang | 25 | |
| | Actual Time | | 0:14:00 | | Flute | 4 | |
| TAP File | | Feed Rates | | | | Tool | |
| Stopper_top.tap | R | | P | | Type | | |
| | F | | S | | Diameter | | |
| | Thickness | | | | Tip radius | | |
| | Toolpath Time | | | | Overhang | | |
| | Actual Time | | | | Flute | | |
| TAP File | | Feed Rates | | | | Tool | |
| Stopper_bottom.tap Z0= 10 mm from bed +material max (150x100x10)mm on centre | R | 8000 | P | 100 | Type | End Mill | |
| | F | 1000 | S | 4000 | Diameter | 12 | |
| | Thickness | | 0.0 | | Tip radius | - | |
| | Toolpath Time | | 0:10:25 | | Overhang | 35 | |
| | Actual Time | | 0:15:00 | | Flute | 2 | |
| TAP File | | Feed Rates | | | | Tool | |
| | R | | P | | Type | | |
| | F | | S | | Diameter | | |
| | Thickness | | | | Tip radius | | |
| | Toolpath Time | | | | Overhang | | |
| | Actual Time | | | | Flute | | |
| TAP File | | Feed Rates | | | | Tool | |
| | R | | P | | Type | | |
| | F | | S | | Diameter | | |
| | Thickness | | | | Tip radius | | |
| | Toolpath Time | | | | Overhang | | |
| | Actual Time | | | | Flute | | |



YHM-600A

CAM Programmer

JIMMY HENDRO
Checked by BETTY DIANA

Power MILL Setup Sheet

| Project | NC Program | Part | Side | Date |
|--------------|-----------------|------|------|------------|
| 061511 - 019 | UNIVERSAL CHAIR | - | Back | 22-07-2011 |

Material and Toolpath Limits

| Material | Block | Tool Datum Setting |
|--------------|---------------------|--------------------|
| NYLON 6-GF30 | (360 x 250 x 50) mm | tip |

| | X | Y | Z |
|-------------|------|------|-----|
| Start Point | 0 | 0 | 5 |
| Maximum | 180 | 125 | 0 |
| Minimum | -180 | -125 | -49 |

Toolpaths

| TAP File | Feed Rates | | | | Tool | |
|----------|---------------|------|---------|------|------------|--------------|
| 1.tap | R | 8000 | P | 100 | Type | JW-End Mill |
| | F | 1000 | S | 3000 | Diameter | 12-xlong |
| | Thickness | | 1.0 | | Tip radius | - |
| | Toolpath Time | | 2:05:18 | | Overhang | 55 |
| | Actual Time | | 2:10:00 | | Flute | 4 |
| TAP File | Feed Rates | | | | Tool | |
| 2.tap | R | 8000 | P | 170 | Type | JW-TipRadius |
| | F | 1700 | S | 4000 | Diameter | 10-long |
| | Thickness | | 0.5 | | Tip radius | 2 |
| | Toolpath Time | | 0:43:28 | | Overhang | 55 |
| | Actual Time | | 1:19:00 | | Flute | 2 |
| TAP File | Feed Rates | | | | Tool | |
| 3.tap | R | 8000 | P | 400 | Type | Tip Radius |
| | F | 4000 | S | 5000 | Diameter | 8-long |
| | Thickness | | 0.2 | | Tip radius | 1 |
| | Toolpath Time | | 0:37:10 | | Overhang | 55 |
| | Actual Time | | 2:00:00 | | Flute | 2 |
| TAP File | Feed Rates | | | | Tool | |
| 4.tap | R | 8000 | P | 450 | Type | Tip Radius |
| | F | 4500 | S | 5000 | Diameter | 6-long |
| | Thickness | | 0.0 | | Tip radius | 0.5 |
| | Toolpath Time | | 1:53:04 | | Overhang | 55 |
| | Actual Time | | 1:20:00 | | Flute | 2 |

| TAP File | | Feed Rates | | | | Tool | |
|----------|---------------|------------|---------|------|------------|--------------|--|
| 5.tap | R | 8000 | P | 150 | Type | JW-TipRadius | |
| | F | 1500 | S | 5000 | Diameter | 4-long | |
| | Thickness | | 0.0 | | Tip radius | 0.3 | |
| | Toolpath Time | | 1:53:08 | | Overhang | 35 | |
| | Actual Time | | 5:43:00 | | Flute | 4 | |
| TAP File | | Feed Rates | | | | Tool | |
| 6.tap | R | 8000 | P | 50 | Type | JW-End Mill | |
| | F | 500 | S | 5000 | Diameter | 4-long | |
| | Thickness | | 0.0 | | Tip radius | - | |
| | Toolpath Time | | 0:00:44 | | Overhang | 35 | |
| | Actual Time | | 0:01:00 | | Flute | 4 | |
| TAP File | | Feed Rates | | | | Tool | |
| 7.tap | R | 8000 | P | 250 | Type | JW-TipRadius | |
| | F | 2500 | S | 5000 | Diameter | 10-long | |
| | Thickness | | 0.0 | | Tip radius | 2 | |
| | Toolpath Time | | 0:27:12 | | Overhang | 55 | |
| | Actual Time | | 1:10:00 | | Flute | 2 | |