Macromodular Computer Design, Part 2, Volume 12, Frame Section and Base Pedestal

Computer Systems Laboratory, Washington University

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Computer Systems Laboratory
Washington University
St. Louis, Missouri
Complete manufacturing documents regarding electrical and mechanical components and assembly procedures for the macromodular frame block and base-pedestal are contained in this report.
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MACROMODULAR SYSTEMS PROJECT

401-1
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<td>4</td>
<td>—</td>
<td>8-32 x 3/4 LONG CADMIUM PLATED STEEL CUP POINT SOCKET SET SCREW</td>
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<td>10</td>
<td>—</td>
<td>3/32 D x 5/16 LONG CADMIUM PLATED STEEL ROLL PIN (POST PIN)</td>
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<td>3/32 D x 9/16 LONG CADMIUM PLATED STEEL ROLL PIN (RAIL PIN)</td>
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<td>3/32 D x 5/16 LONG CADMIUM PLATED STEEL ROLL PIN (FPB STOP PIN)</td>
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<td>16</td>
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<td>4-40 x 7/16 STAINLESS STEEL SOCKET HEAD CAP SCREW</td>
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MACROMODULAR SYSTEMS PROJECT

401-2
Assembly Procedure and Descriptive Notes

This document contains manufacturing information for production of the macromodular frame section sub assembly. On the following pages will be found a complete set of mechanical drawings fully describing components and assembly of the frame section. In addition, an inspection drawing is included as a guide for assertion of the quality control of production methods employed in manufacture.

Frame Section Description

The frame section is a sub assembly used to construct a larger assembly known as the frame block. The frame section is made up of four components - the front post, rear posts, rails and section plate. Front and rear post, in addition to acting as load bearing members serve as keys to permit vertical stacking of sections. The rails, mounted on the section plate; guide and hold electronic packages inserted into the frame block assembly.

Manufacturing Notes

Provision has been made for hold down points on the section plate to be employed for machining operations (see dwg. 401-6). Should the manufacturer desire hole sizes or locations different from those indicated approval must be granted for such changes by the Computer Systems Lab.

It will be noted that tolerance specification on rail spacing is to be closely maintained. This is due to the fact that series tolerance accumulation may result from the use to which the frame sections are put (A maximum tolerance magnification of sixteen could be possible). Therefore, care must be exercised in final assembly of these rails. It is highly recommended that an assembly jig be used for this purpose.

Tolerance specifications and material finishes are listed on the mechanical drawings. For further information pertaining to finish specifications the manufacturer is referred to CSL document 010-General Standards.

All tolerances and specifications relating to the frame section must be adhered to in order to produce acceptable assemblies. The manufacturer must assure himself that these requirements can be met by analyzing component and assembly documentation, his tooling, and characteristics his production process.
Assembly Procedure

1. The rails are assembled to the section plate by pressing in the rail pins and installing the 4-40 screws. The rail pins shall be centered in the plate.

2. The plate, front post and rear post are then secured in an assembly jig.

3. Drill the spotted holes in the posts using a No. 41 drill bit, and insert the post pins with the slots randomly oriented. The pins shall be .031 below the surface on both sides. (Deburr holes)

4. Insert the FPB stop pins in the rails. Sink the pins with all slots facing the rear post. This pin is to be positively stopped upon insertion by the bottom of a hole into which it is pressed. This may be accomplished by letting the pin bottom on the section plate and grinding to length or by drilling to appropriate depth a hole through the rail and into the section plate at assembly.
DO NOT SCALE

NOTE A: OPTIONAL 2500 HOLES FOR JIG OR CLAMP FIXTURE (95 HOLES)

NOTE B: ALTERNATIVE OPTIONAL 2500 EXTRA HOLES FOR JIG OR CLAMP FIXTURE, FLAT WITHIN 0.007 OVERALL

MATERIAL: .160 ALUM 2024-T351
DIM: ±0.005 UGN
FORM: C5L SPEC M51
CHAMFER INSIDE EDGE .030 USING 82° CSINK

VIEW A-A

ENgrave S/Nd Block Style Digit Characters As Shown. Height .156, Line Width .030

MATERIAL: .375 x .750 ALUM 6061-T6
DIM: ±.005 U.O.N.
FINISH: C/S/I SPEC MF1
BLACK FILL ENGRAVING

DO NOT SCALE

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MACROMODULAR PROJECT

FRONT POST

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WAC 401-7

Project: Prod 6-27-70

Orders No.

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NOTES:

1. CENTERED ±.0005
2. BREAK BOTH ENDS .030 x 45°
3. SPOT WITH .54 CTR DRILL 5 PLCS
4. 3 SPACES @ 2.520 ±.005
   NON CUMULATIVE = 7.560
5. DRILL NO. 30 C'ORE .187
   X.125 DEEP
6. TAP 8-32 4 PLCS
7. TAP 4-40
8. 2.354 ±.010
9. Q.185 Q.189
   Q.375 Q.380
10. CHAM .015 X .45°
11. CHAM .050 X .45°
DRILL NO. 30 C BORE .187 TO BOTTOM OF SLOT

3 EQUAL SPACES
2.520 ± .005 NON-CUMULATIVE = 7.560

TAP 4-40

BREAK .030 X 45°

SPOT 64 CTR DRILL 5 HOLES

BREAK .030 X 45°

CHAMFER INSIDE EDGE .030 USING 82° C'SINK

CHAMFER .030 4 EDGES

VIEW A-A

PRESS 3/32 X 5/16

ROLL PIN CENTERED ± .010 4 PLACES

.127
.129

CENTERS .005

.375 STOCK

MATERIAL: .375 X 1.000 ALUM 6061-T6
DIMENSIONS: ± .005 U.O.N.
FINISH: CSL SPEC MF-1
CHAMFER .050 × 45° BOTH ENDS

BREAK 2 EDGES

DRILL NO. 30 & C'BORE .187 ×.125 DEEP 2 PLCS

TAP 4-40 2 HOLES

DRILL NO. 41 2 HOLES

MAT'L: .250 ±.001 SQUARE EXTRUDED ALUM
2024-T4

DEBURR ALL HOLES
FINISH: CSL SPEC MF1
DIM: .005 UON.

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MACROMODULAR PROJECT

RAIL

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DESCRIPTION

COMMENTS

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**MACROMODULAR SYSTEMS PROJECT**

402-1
Lateral Channel Sub Assembly

This document contains manufacturing information for production of metal components and printed circuit boards used in the macromodular lateral channel sub assembly. Documentation in the form of verbal descriptions, mechanical drawings and illustration will be found on the pages following.

Lateral Channel Description

Mechanically, the lateral channel, together with its cover, serves as a primary structural element in the frame block assembly and as a protective housing for printed circuit boards and ducting. Printed circuit boards provide electrical pathways within the channel while ducting conveys convective cooling air to macromodular electronics packages being serviced by the lateral channel sub assembly.
Manufacturing Notes

In addition to the functions listed above the lateral channel sub assembly is a controlling factor in the lateral spacing of frame sections making up the frame block. In order that tolerance accumulation problems be kept to a minimum strict tolerance control must be maintained in the location of frame slots (see 402-5) The same is true of the ten 2-56 tapped holes in the cut out side of the channel. These holes determine connector location and, therefore, the ability or disability of connectors to mate. Tolerance specifications and material finishes are listed on each mechanical drawing. For further information concerning specifications and workmanship relating to metal parts and circuit boards the manufacturer is referred to CSL document 010 - General standards.

Notes to Manufacturer

This document deals exclusively with the components of the lateral channel sub assembly. Should the manufacturer have need, complete assembly instructions for lateral channel circuit boards are found in document 403 while the lateral channel assembly is treated in document 404.

All tolerances and specifications relating to the lateral channel components must lie adhered to in order to produce acceptable units. The manufacturer must assure himself that these requirements can be met by analyzing component documentation his tooling, and characteristics of his production processes.
Refer to 402-4 for overall dimensioning.
Tolerance: ±0.065 in.
Deburr holes.

Drill #43 and countersink 80° x .177 face diam 8 holes.

Break 0.15 min.
BREAK ALL EDGES

MATERIAL: 2024-T4 ALUM
250 ± 0.01 SQUARE EXTRUSION

FINISH: ESL SPEC No 1
MATL: 6061-T6 ALUM
DIM: ± .005 U.O.N.
FINISH: CSL SPEC MF1
NOTE.  
SEE MACROMODULAR SYSTEMS PROJECT  
DOCUMENT NO. 010 UNDER PC-1 PAGES 010-12  
THRU 010-16 FOR GENERAL SPECIFICATIONS.  

EXCEPTIONS ARE AS FOLLOWS 
1. LAMINATE THICKNESS IS 1/16 IN. 
2. G2 PLATED THROUGH HOLES TYPE "B"  
IN MARKED LOCATIONS. DO NOT DRILL  
OTHER PADS. 
3. 6 HOLES, NOT PLATED THROUGH SHOULD  
BE DRILLED ACCORDING TO DWG. 402-11.

ARTWORK SUPPLIED AS 2:1 CRONAFLEX PRINT

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MACROMODULAR PROJECT
# LATERAL CHANNEL BOARD ASSEMBLY PROCEDURE

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# LATERAL CHANNEL BOARD
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<td>FEMALE CONNECTORS A-MP 4-202 844-1</td>
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<td>64</td>
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<td>JUMPER 22 GA. TINNED COPPER WIRE (\frac{1}{2}) INCH LONG</td>
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**NOTE:** POWER BOARD PTC0115-1 IS BONDED TO GROUND SIDE OF SIGNAL BOARD PTC0116-1

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403-2
PTC 0115-1 BOARD IS BONDED TO PTC 0116-1 BOARD GROUND SIDE

LATERAL CHANNEL BOARD

GROUND SIDE

SIGNAL SIDE

JUMPERS

END CONNECTORS

FEMALE CONNECTORS

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LATERAL CHANNEL BOARD ASSEMBLY
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1. Loosen front and rear clamp screws and remove carrier from frame. With carrier removed push five female connectors A-MP 202844-1 onto the five male connectors which are permanently fixed to carrier. (set aside until called for.)

2. Place end connector on board by passing the solder tabs through the holes in the circuit board from the signal side. (There is only one way in which this connector can be placed in the predrilled hole configuration of the board.)

3. The end connectors are alligned, and held in place with the four shoulder screws assembled through the connector mounting holes from the signal side of the circuit board.
4. Place spline onto back of lateral channel board with long leg of spline on signal side of board.

5. Make sure that front and rear clamp screws are in retracted position in preparation for loading board into frame.

6. Place assembly (board, end connector and spline) in frame with signal side down. Align board notches with keys of frame (top of frame is up during this operation, there is only one way in which the board will fit into the frame).
7. Lock spline and board in frame by tightening rear clamp screws. These screws fit mating holes in the rear of spline.

8. Solder the end connector tabs to circuit board at both ends.

9. Clip off excess tab when soldering is completed.

10. Remove shoulder screws that have temporarily held end connectors.

11. Place previously loaded carrier into frame. Guide pins on carrier engage front set of notches in end bracket. Carefully lower carrier into frame taking care that solder tabs on connector do not strike channel board.
12. Front clamp screws on frame are now very carefully screwed into engagement with carrier. As screws are tightened, solder tabs on connector will be pushed into engagement with circuit board in frame.

13. Rotate jig and place plastic splint against solder tabs and firmly push solder tabs toward connector. This step assures that the connector pins are fully extended before soldering in place.

14. Solder connector tabs to the board making sure that tab is laying against board fingers. A 600°F iron tip is recommended.

15. Repeat steps 13 & 14, then go to Step 16.

16. Insert jumpers from top side of jig at every through hole location on PTC0115–1 board. The jumper is a piece of 22 ga. wire approximately \( \frac{1}{2} \) long with a right angle bend forming a short leg approximately 1\( \frac{1}{8} \) long. The long leg is inserted through the hole while the short leg is aligned perpendicular to the PC line.

17. Solder short leg of jumper to PC board.
18. Rotate jig, bend over long jumper leg parallel to and away from the PC line and clip excess wire leaving a short right angle leg similar to that on the previous side (this will prevent pins from falling back through hole while soldering).

19. Solder all jumpers to this side of board then clip excess wire.

20. Rotate jig, clip excess wire from jumpers.

21. Loosen front and rear clamp screws and lift carrier from the frame.

22. Remove board from carrier, remove spline from board, board is ready for cleaning and inspection.
# Lateral Channel Assembly

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**NOTES**

MACROMODULAR SYSTEMS PROJECT

*Issue:* 5/5/71  RJA
1. Place channel duct into lateral channel with flat side of duct in up position.

2. Assemble 4 board brackets onto the two end connectors of the previously assembled lateral channel board using 2-56 x 3/16 filister head machine screws.

3. Place spline on lateral board with long leg of spline on signal side and load assembly into lateral channel.
4. Carefully place lateral channel board in lateral channel, signal side down.

5. Screw board bracket to face of channel using 2-56 x 1/8 flat head machine screws.

6. Fasten the five channel board connectors to the channel face. Assembly is made with 2-56 x 3/16 fillister head machine screws at each connector mounting hole.

7. Lock spline in place with 2-56 x 3/16 socket head set screws from rear of channel at 6 locations.
8. Place channel signal board insulation strip on top of board with long notch of insulation strip placed toward front of channel. Be careful to clear end brackets.

9. Complete assembly by placing cover on lateral channel making sure that the chamfers on the ends of the cover are facing up.
## Frame Block Assembly

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MACROMODULAR SYSTEMS PROJECT

405-2
FRAME ASS'Y AIDE MAT'L ALUMINUM OR PLEXIGLAS
2 REQUIRED

TOLERANCE U.O.N.

XXX=1.005

XXX=1.010

X = ±1/64

FRAME BLOCK ASSEMBLY AIDE
1. Place the six frame sections in the assembly aide. Make sure the front posts of the frame sections are in alignment with one another.

2. Carefully slip one completed lateral channel Assembly through a channel cut out in the frame section.

3. Make sure the lateral channel assembly slots on the lateral channel face engage the machined step on the frame section.
4. Slowly tighten the socket head set screws adjacent to the channel in the front posts at each frame location to lock the lateral channel assembly in place.

5. Repeat steps 2, 3, & 4 until the four lateral channel Assemblies have been loaded into and secured to the six frame sections.

6. The frame block is complete and may be lifted from the Assembly aide.

7. It is now necessary to remove the four roll pins located in the rails on the outboard side of the two end frame sections. This final step is required in order that the lateral channel coupler may slide into place.
# Base Pedestal

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MACROMODULAR SYSTEMS PROJECT
BASE PEDESTAL - MANUFACTURE
AND SPECIFICATION OF MECHANICAL COMPONENTS

The intent of this document (421.) is to set forth manufacturing specifications for mechanical parts relating to the Macromodular base-pedestal. On the following pages of this document drawings will be found fully describing materials, tolerances, and finishes relating to each component. Quantities indicated herein are for the production of a single unit. A partial assembly drawing of the base pedestal is included for the manufacturer to illustrate the relationship between various assembled components. Complete assembly procedures may be found in document (425).

All tolerances and specifications relating to the base pedestal components must be adhered to in order to produce acceptable assemblies. The manufacturer must assure himself that these requirements can be met by analyzing component and assembly documentation, his tooling, and characteristics of his production processes.
ANGLE FRAME SPACER
(421-43)

UPPER FRAME ANGLE
(421-46)

FRAME ADAPTER
(421-19)

SIDE PANEL
(421-20)

TYPICAL SECTION THRU SIDEWALL
AT FRAME ADAPTER

.688

.020 BETWEEN PEDESTALS

1/2 x 1/2 x .062
TRIM ANGLE

26.650 INSIDE TO INSIDE

LEFT SIDE WALL (.375)
(421-8)

FRONT PANEL

TYPICAL SECTION THRU FRONT WALL
+ PANEL

FRONT WALL
(421-11)

SCREW GUIDE
(421-54)

FRAME ADAPTER
(421-19)

Panel Mount
(421-50)

NUT
(421-51)
PLUG IN SUPPLY
POWER SUPPLY COVER
(421-13)

TENSION SPRING

SPRING PURCHASE
(421-56)

PIANO HINGE

HINGE SPACER (421-49)

COTTER PIN

RAIL SUPPORT BAR
TYPE 1
(421-44)
DRILL 6 CSINX 180 DEEP X 82 9 HOLES

DRILL 2 HOLES

MATERIAL: 100 ALUM 2003-H18
FINISH: CEB SPEC MFT
TOLERANCE U.0.1
X.X 0.002
X.Y 0.010
Y.Z + 0.08
1 REGD
DRILL "F" C’HORE 1/2 x 200 DEEP 12 PLC’S

5 SPACES @ .250 NON CUMULATIVE = 25.250

DRILL "F" C’HORE 1/32 x .255 DEEP (2 HOLES)

TAP 6-32 6 PLC’S

TAP 6-40 X 1/2 DEEP C’SINK 8 x 1/10 DEEP 10 HOLES

100 TYP

375 TYP

1.375

1.550

1.412

6.25

1.688

3.38

2.43

4.375

5.500

1.25

0.75

0.25

0.125

1.00

1.00

1.00

1.00

FINISH: LIGHT SHOT PEEN & ALUMINUM

1. REOIL.

MATERIAL: 2024-T3 ALUM

TOLERANCE U.O.N.

XXX ± .005

XX ± .010

X ± .015

FINISH: LIGHT SHOT PEEN & ALUMINUM

1. REOIL.

COMPUTER SYSTEMS LABORATORY

MACROMODULAR PROJECT

BASE PEDESTAL REAR WALL

PROJECT SHEET: 16900

CH 14-10 02-26-11

0 16-9800 00025 02-10

A 16-9800 00025 02-10
CHAMFER .050 x 45° BOTH ENDS

DRILL NO. 30 & C'BORE .187 x .125 DEEP 2 PLCS
TAP 4-40 2 HOLES
DRILL NO. 41 2 HOLES

BREAK 2 EDGES

MAT'L: .250 ±.001 SQUARE EXTRUDED ALUM
2024-T4 12 REQ'D.

DEBURR ALL HOLES
FINISH: CSL SPEC MF1
DIM: ±.005 U.GN.

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT
BASE PEDESTAL RAIL

ISSUE 1-10-72 E.C.0.0228 R/JA

DATE DESCRIPTION

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT
BASE PEDESTAL RAIL
DRILL & CSINK FOR 4-40 FLATHEAD SCREW 4 PLC'S

BREAK CORNERS

1/32 R

MATERIAL: .050 ALUM 3003-H14
FINISH: ALODINE
TOLERANCE U.O.N.

XXX ± .005
XX ± .010
X ± L
X ± 64

1 REQ'D.
DRILL & C'SINK FOR 4 - 40
FLATHEAD SCREW
4 PLC'S

TOLERANCE U.O.N.

XXX ± 0.005
XX ± 0.01
X ± 0.064

MAT'L: .050 ALUM 3003-H14
FINISH: ALODINE
4 REQ'D
MAT'L: 2024-T3 ALUM

FINISH: LIGHT SHOT PEEN & ALODINE

TOLERANCE: U.O.N
XXX 1.005
.XX 5.010
X ++ L
X = 64

1 REQ'D.
TAP 6-32 Holes

3 Spacings @ 5.250
Non-Cumulative = 15.750
23.312
23.56

Drill \( \frac{9}{32} \)
C'Bore \( \frac{13}{64} \) x .26 Deep
6 Places

Section AA

Material: Alum 2024-T3

Finish: Light Shot Peen & Aloxine

Tolerance:

\[
\begin{align*}
XXX & \pm 0.005 \\
XX & \pm 0.010 \\
\frac{X + 1}{64} & \text{1 Req'd.}
\end{align*}
\]
TOLERANCE U.O.N.

0.005

0.010

X + 1

X 64

MAT'L: 2024-T3 ALUM
FINISH: CSL SPEC MF 1
6 REQ'D.
MAT'L: .040 ALUM 3003-H114
DIAMOND PATTERN
FINISH: CSL SPEC MF-1
TOLERANCE ±.010
2 REQ'D.
TAP 4-40x DEEP 4 HOLES

DRILL 1.00

CHAM. 1/16 x 45°

SECTION AA

MATERIAL: ALUM 2024-T3
FINISH: CSL SPEC MF-1

1 REQ'D
CHAM .030 x 45°

DRILL #30 C'BORE .187 x .125 DEEP

DRILL #30 C'SINK FOR 4-40
FLATHEAD SCREW
THIS SIDE ONLY 2 PLC'S.

TOLERANCE U.O.N.

XXX ± .005
XX ± .010
X ± .02

MAT'L: 6061-T6 ALUM 6 REQ'D.
FINISH: CSL SPEC MF1
6 REQ'D.

CHAM .030 x 45°
CHAM .050 x 45°

CHAM INSIDE EDGE
.030 USING 82° C'SINK

VIEW AA
CHAM .030 x 45°

.370
.374

.1450 .750 .512

.320 .562 .736 .746

.30 C'BORE .187 x .125 DEEP

ENGRAVE STND BLOCK STYLE DIGIT CHARACTER
HEIGHT .156, LINE WIDTH .030

DRILL #30, C'SINK FOR 4-40 FLATHEAD SCREW THIS SIDE
ONLY. 2 PLCS

CHAM .015 x 45°

.127 .129

CHAM INSIDE EDGE .030 USING 82°
C'SINK

15° ± .30

.736 .746

VIEW AA

TOLERANCE U.O.N.
.005
.XX .100
.XX .01
.X .01
.X .64

FRONT POST ADAPTER
MATL: 6061-T6 ALUM 6 REQ'D.
FINISH: CSL SPEC MF1
6 REQ'D.

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT
TITLE
BASE PEDESTAL
FRONT POST ADAPTER

DRAWING NO. 421-23
DRAWN BY R.JA
DATE 8-18-71

APPROVED BY
R.JA
DATE
P.L
DATE
MAT'L: STEEL 1 x 1 x 2/16
FINISH: SHOT PEEN TO REMOVE SCALE
ZINC PLATE & BLUE BRIGHT
1 REQ'D

TOLERANCE U.G.N:
XXX ± .005
XX ± .010
X ± .005
X ± 1/64

DRILL 1/8 2 HOLES
TAP 1/4-20 6 HOLES

TAP 1/4-20 2 HOLES
TAP 6-32 4 HOLES
TAP 2-56 2 HOLES

8.00
13.88
2.88

.625
.62
8.00

.31
.187
.295
.62

5 SPACES @ .250
NON CUMULATIVE = 26.250

26.640
MATL: STEEL 1 X 1 X 3/16

FINISH SHOT PEEN TO REMOVE SCALE
ZINC PLATE & BLUE BRIGHT

TOLERANCE U.O.N.
.
.XXX ± .005
.XX ± .010
.X ± .01

1 REQ'D.
TAP 1/4-20 8 PLC'S

TAP 10-32 4 PLC'S

.625

.620

.195

5 SPACES @ 5.25
NON CUMULATIVE = 26.250

200
18.775
11.338
-200
3.901
-1.182

23.494
16.057
8.620

26.640

1.50

DRILL 9/32 6 PLC'S

DRILL 11/32

.50

MAT'L: STEEL L 1 x 1 x 3/16

FINISH: SHOT PEEN TO REMOVE SCALE
ZINC PLATE & BLUE BRIGHT

TOLERANCE UON
.XXX ±.005
.XX ±.010
.X ±.015
.X ±.020

1 REQ'D.
TOLERANCE U.O.N.

XXX ±0.005
XX ±0.01
X ±1/64

DRILL #7
5 PLC'S

MAT' L: STEEL 1.500" x .125"
FINISH: ZINC PLATE & BLUE BRIGHT
2 REQ'D
MAT'L: STEEL .375 x .375 STOCK
FINISH: ZINC PLATE & BLUE BRIGHT
2 REQ'D
MAT'L: STEEL .375 x .375 STOCK
FINISH: ZINC PLATE & BLUE BRIGHT
2 REQ'D
**TOLERANCE U.O.N.**

- **XXX ±0.05**
- **XX ±0.01**
- **X ±1/64**

**MAT'L:** Extruded Alum 1³/₄ x 3₁/₂ x 1/₈

**FINISH:** Alodine

2 REQ'D
TOLERANCE U.O.N.
.XXX ±.005
.X ±.01
.X ± .01
.X ± .01

MAT' L: STEEL
FINISH: ZINC PLATE & BLUE BRIGHT

4 REQ'D
MAT'L: STEEL L 1" X 1 X 1/4
6 REQ'D

FINISH: SHOT PEEN TO REMOVE SCALE
ZINC PLATE & BLUE BRIGHT

DRILL 9/32 2 HOLES

TAP 1/4 20 2 PLC'S

TOLERANCE U.O.N.
.XXX ±.005
.XX ±.010
.X ± 1/64

ISSUE 1-10-72 E.O. 0228 RJA

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

BASE PEDESTAL RAIL SUPPORT CLIP ANGLE

RJA PROD 1-10-72 DRAWN BY PLL
RJA 421-36
GM 8-19-71
TOLERANCE U.O.N.

\[ \text{X} \pm 0.005 \]

\[ \text{XX} \pm 0.010 \]

\[ \frac{X}{X} \pm \frac{1}{64} \]

**Base Pedestal Connector, Adapter**

**Material:** Steel L 2x2x3/16

3 req'd

**Finish:** Shot peen to remove scale
Zinc plate & blue bright

**Computer Systems Laboratory**

Washington University
St. Louis, Missouri

**Macromodular Project**

**Drawing Details**

**Date:** 4-25-72

**ECO:** ECO. 0261

**RJA**

**Issue:** 10-72

**ECO:** ECO. 0228

**RJA**

**Change No.** 421-37

**Approved:** RJA

**Drawn By:** RJA

**Checked:** GM

**Date:** 8-20-71
DRILL \#30 C'SINK FOR 4-40 FLATHEAD SCREW
2 PLC'S

CHAM CORNER .030 x 45°

MAT'L: EXTRUDED ALUM ANGLE \( \frac{1}{2} \times \frac{1}{2} \times 0.062 \)
FINISH: CSL SPEC MF 1
1 L.H. & 1 R.H. REQ'D

TOLERANCE U.O.N.

\[
\begin{align*}
XXX & \pm 0.005 \\
XX & \pm 0.01 \\
\frac{X}{X} & = \frac{1}{64}
\end{align*}
\]
DRILL #30 C'SINK FOR 4-40 FLATHEAD SCREW 2 PLC'S

CHAM. CORNER .030 X 45°

TOLERANCE U.O.N.
.XXX ± .005
.XX ± .01
.X ± 1/64

MAT' L: EXTRUDED ALUM ANGLE \( \frac{1}{2} \times \frac{1}{2} \times .062 \)
FINISH: CSL SPEC SPEC MF 1
2 REQ'D
DRILL #30 C'SINK FOR 4-40 FLATHEAD SCREW 2 PLC'S

TOLERANCE U.O.N.

| .XXX | .005 |
| .XX  | .01  |
| X    | +.1  |
| X    | ±.64 |

MAT'L: EXTRUDED ALUM ANGLE 1/2 x 1/2 x .062
FINISH: CSL SPEC MF 1

2 REQ'D

CHAM. CORNER .030 x 45°
DRILL H30 C'SINK FOR 4-40
FLATHEAD SCREW
6 PLC'S

CHAM, CORNER .030 x 45°

.295

.750 — 5 SPACES @ 5.750 NON-CUMULATIVE = 28.750

29.81

TOLERANCE U.O.N.

.XXX ±.005
.XX ±.01
.X ±.0164

MATERIAL: EXTRUDED ALUM ANGLE \( \frac{1}{2} \times \frac{1}{2} \times .062 \)
FINISH: CSL SPEC MF 1
1 L.H. & 1 R.H. REQ'D

MACROMODULAR PROJECT

BASE PEDESTAL
TRIM ANGLE TYPE 4

ISSUE 1-10-72 E.O.0228 RJA
CHANGE NO. DATE DESCRIPTION

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE BASE PEDESTAL
TRIM ANGLE TYPE 4

APPROVED ENGINEER DRAWING NO.
RJA PROD 1-10-72 421-41
SEQ. FOR DATE DRAWN BY
RJA 1-10-72 DHO
CHECKED DATE
JH 8-24-71
DRILL #30 C'SINK FOR 4-40 FLATHEAD SCREW 2 PLC'S

CHAM CORNER .030 x 45°

TOLERANCE U.O.N.

XXX ± .005
XX ± .01
X ± 1/64

MAT'L: EXTRUDED ALUM ANGLE 1/2 x 1/2 x .062
FINISH: CSL SPEC MF 1
1 L.H. & 1 R.H. REQ'D

MACROMODULAR PROJECT

TITLE BASE PEDESTAL TRIM ANGLE TYPE 5

ISSUE 1-10-72 E.C.O.0228 RJA

CHANGE NO. DATE DESCRIPTION

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

ENG. RJA
DRAWING NO. 421-42

RJA PROD 1-10-72
DRAWN BY DHO
CHECKED GM
DATE 8-24-71
### TOLERANCE U.O.N.

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<td>± .005</td>
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<tr>
<td>.XX</td>
<td>± .01</td>
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<tr>
<td>X / X</td>
<td>± 1 / 64</td>
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**MATERIAL**: ALUM 1.000 x .500 STOCK 2024-T3

**FINISH**: LIGHT SHOT PEEN & ALODINE

1 REQ'D

---

**MACROMODULAR PROJECT**

**TITLE**: BASE PEDESTAL

**RAIL SUPPORT BAR TYPE 1**

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<td>421-44</td>
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**DRAWING NO.**: 421-44
TOLERANCE U.O.N.

XXX ± .005
XX ± .01
X X ± \frac{1}{64}

MAT'L: ALUM 1.000 x .500 STOCK 2024-T3
FINISH: LIGHT SHOT PEEN & ALODINE
2 REQ'D
DRILL $\frac{9}{32}$ 2 PLC'S

TAP 10-32 4 PLC'S

1.500 TYP

DRILL #7 3 PLC'S

-1.312

-3.740

-13.614

-23.488

-25.916

-27.228

.000

TOLERANCE U.O.N.

.XXX ±.005

.X ±.01

.X ±.64

MAT'L: EXTRUDED ALUM ANGLE 1x1x.188

FINISH: CSL SPEC MF-1

REQ'D: 1

 ISSUE 1/10/72 E.CO. 0228 RJA

CHANGE NO. DATE DESCRIPTION

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE BASE PEDESTAL
UPPER FRAME ANGLE

APPROVED RJA PROD 1/10/72 DRAWN BY

RJ A PARTY DATE

421-46

CHECKED DATE

GM 9/1-71
TOLERANCE  U.O.N.

XXX  ±.005
XX   ±.01
X    ±.1
X    ±.64

MAT'L: EXTRUDED ALUM ANGLE 1 x 1 x .188
FINISH: CSL SPEC. MF-1
REQ'D  1
**Computer Systems Laboratory**

**Washington University**

**St. Louis, Missouri**

---

**Title:** BASE PEDESTAL

**Side Frame Angles**

---

**Issue:** 7-10-71

**E.C.O. 0228**

**R.J.A.**

---

**MATERIAL:** EXTRUDED ALUM ANGLE 1 x 1 x .188

**Finish:** CSL SPEC MF-1

**Req'd:** L.H. & R.H.

---

**Drill:** 

\[
\frac{9}{32} \quad 2 \text{ PLC'S}
\]

---

**Tolerance U.O.N.:**

\[
\begin{align*}
XXX & \pm .005 \\
XX & \pm .01 \\
X & + \frac{1}{64} \\
X & - \frac{1}{64}
\end{align*}
\]

---

**Comparison Sheet**

**Issue No.:** 7-10-71

**E.C.O. 0228**

**R.J.A.**

---

**Approved by:**

**For:**

**Date:** 7-10-71

**Drawn by:**

**Checked by:**

**Date:** 9-1-71

**Drawing No.:** 421-48
TOLERANCE U.O.N.

\[
\begin{align*}
XXX & \pm 0.005 \\
.XX & \pm 0.01 \\
.X & \pm \frac{1}{64}
\end{align*}
\]

MAT'L: 2024-T3 ALUM \( \frac{1}{2} \times \frac{1}{4} \).

FINISH: ALODINE

REQ'D: 2

- DRILL \#25
- 2 PLC'S

---

ISSUE 1/10/72 E.C.O. 0228 R.J.A
CHANGE NO. DATE DESCRIPTION

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE BASE PEDESTAL HINGE SPACER

APPROVED BY ENG. DRAWING NO.
R.J.A 421-49
R.J.A PROD 1/10/72 DHO
R.J.A CHECKED 9-20-71
DRILL #7 C’SINK 82° x .120 DEEP 2 HOLES

TAP 1/4-20

MAT'L: 5/16 STEEL 4 REQ'D

TOLERANCE U.O.N.

XXX ± .005

XX ± .010

X

X ± 1/64
TAP $\frac{5}{8} - 18$

TAP $\frac{1}{4} - 20$

4 PLC'S

1.000

1.500

2.18

1.500

.250

.44

1.00

1.37

TOLERANCE U.O.N.

$XXX \pm .005$

$XX \pm .01$

$\frac{X}{X} + \frac{1}{64}$

MAT L: CRS

FINISH: ZINC PLATE & BLUE BRIGHT

4 REQ'D

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
BASE PEDESTAL NUT

ISSUE: 1/10/72 E.C.O. 0228 RJA

CHANGE NO. DATE DESCRIPTION

APPROVED ENG
RJA 421-51

DRAWN BY
RJA PROD. 1/10/72

CHECKED GM 8-23-71

DATE
MAT'L: \( \frac{1}{2} \times 1 \times .094 \) EXTRUDED ALUM ANGLE

TOLERANCE

\[
\begin{align*}
XXX & \pm .005 \\
XX & \pm .010 \\
\frac{X}{X} & \pm \frac{1}{64}
\end{align*}
\]

3 REQ'D
TAP $\frac{1}{4}$-20 4 PLC'S ON VERT. SURFACE

1.250

.500

500

1.250

MAT'L: STEEL L 1$\frac{1}{2}$ x 1$\frac{1}{2}$ x $\frac{1}{4}$ 6 REQ'D.

FINISH: SHOT PEEEN TO REMOVE SCALE ZINC PLATE & BLUE BRIGHT

TOLERANCE U.O.N.

$.XXX \pm .005$

$.XX \pm .010$

$\frac{X + 1}{X - 64}$
NYLON BRG. .625 I.D. x .750 O.D. x 1.000 LG. PRESS FIT INTO SCREW GUIDE & SLIP FIT SCREW

TAP 1/4 -20
2 PLC'S

TOLERANCE U.O.N.

<p>| | |</p>
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<tbody>
<tr>
<td>XXX</td>
<td>+.005</td>
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<tr>
<td>XX</td>
<td>+.01</td>
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<tr>
<td>X</td>
<td>+.01</td>
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MAT'L: STEEL U.O.N.

FINISH: ZINC PLATE & BLUE BRIGHT

4 REQ'D

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

BASE PEDESTAL SCREW GUIDE

ISSUE 1-10-72
E.C.O. 0228 RJA

CHANGE NO. DATE DESCRIPTION

APPROVED ENO DRAWING NO.
RJA PROD 1-10-72 421-54
DRAWN BY DHO
CHECKED GM
DATE 8-20-71
MAT'L: STEEL
6 REQ'D
FINISH: ZINC PLATE & BLUE BRIGHT

TOLERANCE UON
.XXX ±.005
.XX ±.010
\[ \frac{X}{X} \pm \frac{1}{64} \]

CHAM .062 x 45°
TOLERANCE U.O.N.

XXX ± .005
XX ± .01
X + 1/64

MAT'L: 3/16 ALUM ROD 2024-T3
FINISH: ALODINE
REQ'D: 2

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
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MACROMODULAR PROJECT
TITLE BASE PEDESTAL SPRING PURCHASE
DRAWING NO. 421-56
ISSUE 1-10-72 E.C.O.0228 RJA
CHANGE NO. DATE DESCRIPTION
RJA PROD 1-10-72 DHO
CHECKED GY DATE 9-24-71
DIA ALUM ROD

CHAM .010 MIN

TURN \( \frac{3}{32} \) SHOULDER AND RIVET IN PLACE

PUNCH \( \frac{5}{32} \)

PUNCH \( \frac{3}{32} \) 2 PLCS

TOLERANCE U.O.N.

\[ \begin{align*}
XXX & \pm 0.005 \\
XX & \pm 0.01 \\
X & \pm \frac{1}{64}
\end{align*} \]

MAT'L: .020 SPRING STOCK

FINISH: STOCK

REQ'D: 1
MAT' L: STAINLESS SHEET STEEL 304 .020 STK
FINISH: MILL
REQ'D: 2
TOLERANCE U.O.N.

\[ \begin{align*}
\text{XXX} & \pm .005 \\
\text{XX} & \pm .01 \\
\text{X} & \pm \frac{1}{64}
\end{align*} \]

MAT' L: STAINLESS SHEET STEEL 304 .020 STK
FINISH: MILL
REQ'D: 2

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: BASE PEDESTAL CAPACITOR STRAP TYPE 2

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TOLERANCE U.O.N.

XXX ±.005
XX ±.01
X ±.1/64

MAT'L: ALUM 2024-T3
FINISH: ALODINE
REQ'D: 2
CHAMFER INSIDE EDGE 0.020 X 45 BOTH ENDS

16 ± 1/8

2.50 MIN.

5/16 x 24 THDS.

MAT'L: SEAMLESS ALUM. TUBING 5/16 DIA.

0.058 THK. WALL 6061-T6

FINISH: ALODINE

REQ'D: 1

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

BASE PEDESTAL
CABLE CONDUIT

E.C.O. 0228 RJA

421-66

GM 9-7-71

RJA PROD 1-10-72

DHO DRAFTED

TJC APPROVED
TOLERANCE U.O.N.

\[
\begin{align*}
\text{XXX} & \pm .005 \\
\text{XX} & \pm .01 \\
\frac{X}{X} & \pm \frac{1}{64}
\end{align*}
\]

MAT'L: STEEL ROD \(\frac{1}{8} \times 8\frac{3}{8}\)

FINISH: AS FABRICATED

REQ'D 1
TOLERANCE U.O.N.

XXX ±.005
XX ±.01
X ±1/64

MAT'L: EXTRUDED ALUM CHANNEL 1\frac{1}{4} \times \frac{3}{4} \times .125
FINISH: CSL SPEC. MF-1
REQ'D: 1
TAP 6-32 on 2 PLC's

MAT'L: 2024-T3 ALUM ROD \( \frac{3}{8} \) D STOCK
FINISH: ALODINE
REQ'D: 1
TOLERANCE: ±0.01
TAP 6-32

DRILL 5/32

3 PLC'S

TOLERANCE U.O.N.

. XXX ± .005
. XX ± .01
. X ± 1/64

MAT' L: ALUM 2024-T3
FINISH: ALODINE
REQ'D: 1
DRILL $\frac{5}{32}$

2 PLC'S

.75

.375

.31

.31

.31

.50

.25

.25

.19

.50

TOLERANCE U.O.N.

$.XXX \pm 0.005$

$.XX \pm 0.01$

$.X \pm \frac{1}{64}$

TAP 6-32

2 PLC'S

MAT'L: EXTRUDED ALUM CHANNEL 1 x 1 x .125

FINISH: ALODINE

REQ'D 3

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
BASE PEDESTAL
WIRE BUNDLE SUPPORT CLIP

ISSUE 1-10-72 E.C.O. 0228 RJA

CHANGE DATE DESCRIPTION
NO.  

APPROVED FOR DATE DRAWN BY CHECKED DATE

ENG. TJC RJA PROD 1-10-72 DHO 421-71

DRAWING NO. 9-1-71
TAP 4-40
THDS. \( \frac{3}{8} \) DEEP

TOLERANCE U.O.N.

\[
\begin{align*}
.XXX & \pm .005 \\
.XX & \pm .01 \\
X & \pm \frac{1}{64}
\end{align*}
\]

MAT'L: NYLON ROD \( \frac{5}{8} \) STOCK
FINISH: AS MACHINED
REQ'D: 1

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

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<td>GM</td>
<td>9-3-71</td>
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</table>
MATL: 1/16 ALUM STK 6061-T6

FINISH: ALODINE

DIMENSIONS UGN:

.0001 ± 0.005

X = ± 0.010

X = ± 0.001

1 REQ'D.
TOLERANCE: ± 1/2"
MAT'L: PLASTIC
LIGHT DIFFUSER

TYPICAL CELL
FRAME SECTION AND BASE PEDESTAL

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
   Final Report 4/1/65 through 12/31/73

5. AUTHOR(S) (First name, middle initial, last name)
   Robert J. Arnzen, Editor

13. ABSTRACT
   Complete manufacturing documents regarding electrical and mechanical components and assembly procedures for the macromodular frame block and base-pedestal are contained in this report.
<table>
<thead>
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<th>KEY WORDS</th>
<th>LINK A</th>
<th>LINK B</th>
<th>LINK C</th>
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<tr>
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<td>Macromodule Base-Pedestal</td>
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<td>Macromodule Cooling Duct</td>
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