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

Computer Systems Laboratory, Washington University
MACROMODULAR
COMPUTER DESIGN
PART 2
MANUFACTURING DESCRIPTION

VOLUME XII
FRAME SECTION AND BASE PEDESTAL

Technical Report No. 41

FINAL REPORT - FEBRUARY, 1974
CONTRACT SD-302 (ARPA)
COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI
This work has been supported by the Advanced Research Projects Agency of the Department of Defense under Contract SD-302 and by the Division of Research Facilities and Resources of the National Institutes of Health under Grant RR-00396. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the Advanced Research Projects Agency or the U.S. Government.

Computer Systems Laboratory
Washington University
St. Louis, Missouri
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.
INDEX

FRAME SECTION SUBASSEMBLY
   PAGES 401-1 thru 401-10

LATERAL CHANNEL PARTS AND PRINTED CIRCUIT BOARDS
   PAGES 402-1 thru 402-14

LATERAL CHANNEL BOARD ASSEMBLY PROCEDURE
   PAGES 403-1 thru 403-9

LATERAL CHANNEL ASSEMBLY
   PAGES 404-1 thru 404-6

FRAME BLOCK ASSEMBLY
   PAGES 405-1 thru 405-6

BASE PEDESTAL
   PAGES 421-1 thru 421-74
FRAME SECTION SUB ASSEMBLY

<table>
<thead>
<tr>
<th>PAGE</th>
<th>TITLE</th>
<th>CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>401-1</td>
<td>TITLE PAGE</td>
<td>A</td>
</tr>
<tr>
<td>401-2</td>
<td>PARTS LIST</td>
<td>A</td>
</tr>
<tr>
<td>401-3</td>
<td>DESCRIPTIVE NOTES AND ASSEMBLY PROCEDURES</td>
<td>A</td>
</tr>
<tr>
<td>401-4</td>
<td>FRAME SECTION ASSEMBLY</td>
<td></td>
</tr>
<tr>
<td>401-5</td>
<td>PLATE</td>
<td></td>
</tr>
<tr>
<td>401-6</td>
<td>FRONT POST</td>
<td></td>
</tr>
<tr>
<td>401-7</td>
<td>REAR POST/LADDER</td>
<td></td>
</tr>
<tr>
<td>401-8</td>
<td>RAIL</td>
<td></td>
</tr>
<tr>
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<td>INSPECTION DIMENSIONS</td>
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MACROMODULAR SYSTEMS PROJECT
## Frame Section
### Parts List

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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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<tr>
<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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<tr>
<td>4</td>
<td>—</td>
<td>3/32 D x 9/16 LONG CADMIUM PLATED STEEL ROLL PIN (RAIL PIN)</td>
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<td>8</td>
<td>—</td>
<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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**Revision History:**

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<th>E.C.O.</th>
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**MACROMODULAR SYSTEMS PROJECT**
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 Systmes 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.

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401-3
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.
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°

CHAMFER INSIDE EDGE .030 USING 82° CSINK

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

BREAK .030 X 45°

CHAMFER .030
4 EDGES

VIEW A-A

PRESS .185 .189 .375 .380
ROLL PIN CENTERED ± .005
4 PLACES

MATERIAL: .375 X 1.000 ALUM 6061-T6
DIMENSIONS: ± .005 U.O.N.
FINISH: CSL SPEC MF-1

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MACROMODULAR PROJECT

REAR POST/LADDER

DRAWING NO.

WAC 401-8

DATE 10-21-70
CHAMFER .050 x 45° BOTH ENDS

BREAK 2 EDGES

DRILL NO. 30 & C'BORE .187 x .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: .5005 UDN.

MACROMODULAR PROJECT

TITLE

RAIL

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

ISSUE 4-26-71 ECO 0173 R J A

CHANGE

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DESCRIPTION

CHANGE

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EXTRACTION

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SIGNATURE

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401-9

5-27-70
## Lateral Channel Parts and Printed Circuit Boards

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<thead>
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<th>PAGE</th>
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<tr>
<td>402-4</td>
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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.
BREAK 0.05 MIN TIP

STOCK

STOCK

STOCK

STOCK

BREAK 0.05 MIN TIP

DRILL #43 AND COUNTERBORE 80° X 0.017 FACE DIAM 8 HOLES

BREAK 0.05 MIN

REVIEW TO 402-4 FOR OVERALL DIMENSIONING

TOLERANCE: 2-0.005 UNM

DEBUR HOLE
MATL: 2024-T4 ALUM 
.250 ± .001 SQUARE EXTRUSION

FINISH: C51 SPEC N1
MATL: 6061-T6 ALUM
DIM: ± .005 U.O.N.
FINISH: CSL SPEC MF1

Drill & Tap 2-56 3 Holes

BEVEL .040 X 45°
JOINTS TO BE MADE WITH PLEXIMENT ACRYLIC CEMENT

CHANNEL DUCT MATERIAL TO ACRYLIC (BLACK)

TOLERANCE U.D.N.

XXX ± 0.005
XX ± 0.010
X ± .04
DIMENSIONS: ±0.010
MATERIAL: MYLAR .005 THICK
DRILL 0.093 ± 0.0003
2 HOLES FOR REGISTRATION
NOTE
1. SEE MACROMODULAR SYSTEM PROJECT
   DOCUMENT FOR SIZE AND SPLICEUSTER.
   EXCEPTION: ELATE/LIZATION

2. MATERIAL IS LAMINATE.

REGISTRATION HOLE

3. REGISTRATION HOLES TO BE DRILLED
   AS SHOWN ON DRAWING AND ON THIS
   SHEET.

4. HOLE LEAD THROUGH HOLES ON THIS
   SIDE.

ARTWORK SUPPLIED AS
2X CROMA FLEX PRINT

REGISTRATION HOLE
NOTE.
SEE MACROMODULAR SYSTEMS PROJECT
DOCUMENT 010 UNDER PC-1 PAGES 010-12
THRU 010-16 FOR GENERAL SPECIFICATIONS.

EXCEPTIONS ARE AS FOLLOWS
1. LAMINATE THICKNESS IS 1/16
2. 62 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
# Lateral Channel Board Assembly Procedure

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<td>Title Page</td>
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Macromodular Systems Project
## LATERAL CHANNEL BOARD
### ASSEMBLY PROCEDURE
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<td>END CONNECTORS A-MP 202844-5</td>
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<td>FEMALE CONNECTORS A-MP 4-202844-1</td>
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<td>64</td>
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<td>JUMPER 22 GA. TINNED COPPER WIRE ½ INCH LONG</td>
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**NOTE:** POWER BOARD PTC0115-1 IS BONDED TO GROUND SIDE OF SIGNAL BOARD PTC0116-1

### ISSUE

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<th>DATE</th>
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<td>3-24-71</td>
<td>RJA</td>
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MACROMODULAR SYSTEMS PROJECT
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

### LATERAL CHANNEL BOARD ASSEMBLY
#### PARTS IDENTIFICATION

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MACROMODULAR PROJECT

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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 ½ long with a right angle bend forming a short leg approximately 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

<table>
<thead>
<tr>
<th>PAGE</th>
<th>TITLE</th>
<th>CHANGE</th>
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<tbody>
<tr>
<td>404-1</td>
<td>TITLE PAGE</td>
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<td>PARTS LIST</td>
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</tr>
<tr>
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<th>Date</th>
<th>Approver</th>
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<td>ISSUE</td>
<td></td>
<td>5-5-71</td>
<td>RJA</td>
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MACROMODULAR SYSTEMS PROJECT

404-1
## LATERAL CHANNEL ASSEMBLY

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<td>Channel signal board insulation strip</td>
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<tr>
<td>8</td>
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<td>2-56 x 1/8 flathead machine screw</td>
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<tr>
<td>14</td>
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<tr>
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<tr>
<td>6</td>
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<td>2-56 x 3/16 Socket head set screws</td>
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**Issue Date:** 5/5/71  
**Approver:** 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

<table>
<thead>
<tr>
<th>PAGE</th>
<th>TITLE</th>
<th>CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>405-1</td>
<td>TITLE PAGE</td>
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</tr>
<tr>
<td>405-2</td>
<td>PARTS LIST</td>
<td></td>
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<tr>
<td>405-3</td>
<td>FRAME BLOCK ASSEMBLY AIDE</td>
<td></td>
</tr>
<tr>
<td>405-4</td>
<td>PARTS IDENTIFICATION</td>
<td></td>
</tr>
<tr>
<td>405-5</td>
<td>ASSEMBLY PROCEDURES</td>
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---|---|---|---|---|---|---|---|---|---|---|---|
ISSUE | -  | 5-3-71 | RJA | | | | | | | | |

MACROMODULAR SYSTEMS PROJECT
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MACROMODULAR SYSTEMS PROJECT
FRAME ASS'Y AIDE MAT'L ALUMINUM OR PLEXIGLAS
2 REQUIRED

TOLERANCE U.O.N.
XXX = 0.005
XXX = 0.010
\[
\frac{X}{X} = 5\frac{1}{64}
\]
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

<table>
<thead>
<tr>
<th>PAGE</th>
<th>TITLE</th>
<th>CHANGE</th>
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<tbody>
<tr>
<td>421-1 &amp; 2</td>
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<td>421-3</td>
<td>MANUFACTURE AND SPECIFICATION OF MECHANICAL COMPONENTS</td>
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**Change Log**

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MACROMODULAR SYSTEMS PROJECT

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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.
TOP VIEW WITH COVER, FRAME ADAPTERS, COVER SUPPORT ANGLES, ANGLE FRAME SPACER AND UPPER FRAME ANGLE REMOVED FOR CLARITY.
ANGLE FRAME SPACER
(421-43)

UPPER FRAME ANGLE
(421-46)

FRAME ADAPTER
(421-19)

PANEL MOUNT
(421-50)

SCREW GUIDE
(421-54)

FRONT PANEL

FRONT WALL
(421-11)

SIDE PANEL
(421-20)

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

NUT
(421-51)

TYPICAL SECTION THRU SIDEWALL
AT FRAME ADAPTER

.020 BETWEEN PEDESTALS

.688

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

26.650 INSIDE TO INSIDE

TYPICAL SECTION THRU FRONT WALL
+ PANEL

ISSUE NO: ECO.0520 RJA

CHANGES:

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
BASE PEDESTAL
TYPICAL SECTIONS

FILE

APPROVED EXP.
RJA PFD 4-20-71 RJA PFD 4-20-71

CHECKS
C K 6-23-71
MAPL: 2024-T3 ALUM
TOLERANCE U.D.N.

XXX = 0.005
XX = 0.010
X = 0.03

1 REQD.
FINISH: LIGHT SHOT PEEN & ALODINE
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.O.N.

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT
BASE PEDESTAL RAIL

WAC 421-14
PLL

GM 10-19-71
MATERIAL: .050 ALUM 3003-H14
FINISH: ALODINE
TOLERANCE: U.O.N.
.3XX ± .005
.2X ± .010
.1X ± .064
1 REQ'D.
DRILL C'SINK FOR 4-40 FLATHEAD SCREW 4 PLCS

TOLERANCE U.O.N.

<table>
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<th>XXX</th>
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<td>XX</td>
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<tr>
<td>X</td>
<td>±0.005</td>
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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 1.010
X 64
1 REQ'D.
TAP 6-32 Holes

3 SPACE @ 5.250
NON CUMULATIVE = 15.750
23.312

23.56

DRILL \( \frac{9}{32} \)
C'BORE \( \frac{17}{32} \) X .26 DEEP
6 PLACES

1.000 STK

MAT'L: ALUM 2024-T3
FINISH: LIGHT SHOT PEEN & ALODINE

TOLERANCE UON.

\[
\begin{align*}
XXX & \pm 0.005 \\
XX & \pm 0.010 \\
\frac{X}{X} & \pm \frac{1}{64}
\end{align*}
\]

1 REQ'D.
MAT'L: .040 ALUM 3003-H114
DIAMOND PATTERN

FINISH: CSL SPEC MF.1
TOLERANCE ±.010
2 REQ'D.
TAP 4-40 x \( \frac{1}{4} \) DEEP 4 HOLES

DRILL 1.00

CHAM. \( \frac{1}{16} \times 45^\circ \)

BREAK SHARP CORNERS

TAP \( \frac{1}{4} \) - 20 x \( \frac{5}{16} \) DEEP 2 HOLES

SECTION AA

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

1 REQ'D

TOLERANCE U.D.O.N.

\( .XXX \) ± .005
\( .XX \) ± .01
\( .X \) ± .064

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: BASE PEDESTAL FAN MODULE
CONNECTOR ADAPTER

DRAWING NO. 421-21

AUG 8-19-71
CHAM .030 x 45°

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

FLATHEAD SCREW
THIS SIDE ONLY 2 PLC'S.

TOLERANCE U.O.N.
XXX ±.005
XX ± .010
X ± .001
X ± .0005

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

CHAM .030 x 45°

CHAM .050 x 45°

VIEW AA
ENgrave STND BLOCK STYLE DIGIT CHARACTER
HEIGHT .156, LINE WIDTH .030

DRILL #30, C'BORE .187 X .125 DEEP

TOLERANCE U.O.N.
.XXX .1005
.XX .1010
.X .1
.X .064

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

CHAM .015 X 45°
CHAM .050 X 45°

CHAM INSIDE EDGE .030 USING 82°
C'SINK

CHAM .030 X 45°
MATL: STEEL L 1 X 1 X \( \frac{3}{16} \)

FINISH SHOT PEELED TO REMOVE SCALE
ZINC PLATE & BLUE BRIGHT

TOLERANCE U.O.N.
\.XXX ± .005
\.XX ± .010
\.X ± .02
\.X ± .04

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

XXX ± .005
XX ± .01
X ± .02

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

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

1 REQ'D
TAP 1/4 - 20

TAP 10-32 4 PLC'S

.625

.620

23.494

16.057

8.620

1.182

.620

5 SPACES @ 5.250
NON CUMULATIVE 26.250

TAP 1/4 - 20 6 PLC'S

.625

.195

MAT'L: STEEL L 1X1 X 3/16
FINISH: SHOT PEEN TO REMOVE SCALE
ZINC PLATE & BLUE BRIGHT

TOLERANCE U.O.N.
.XXX ± .005
.X ± .010
.X ± .016

1 REQ'D.
MATL: STEEL L 1\times 1\times 3/16

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

TOLERANCE UON
.XXX 1.005
.XXX 1.010
.X 4
X 64

1 REQ'D.
DRILL H7
S PLCS

MAT'L: STEEL 1"x.125"
FINISH: ZINC PLATE & BLUE BRIGHT
REQ'D: 2

TOLERANCE U.O.N.
XXX ±.005
XX ±.01
X ±.064

BASE PEDESTAL
END SLIDE PLATE

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

421-30
8-20-71
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

TOLERANCE U.O.N.
XXX ± .005
X ± .01
\( \frac{X}{X} \) ± \( \frac{1}{64} \)

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

BASE PEDESTAL
GUIDE RAIL

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

APPROVED ENG.
R.J.A 421-32
R.J.A PROD 1-10-72 DRAWN BY
DHO CHECKED
G.M 8-27-71
MAT'L: STEEL .375 x .375 STOCK
FINISH: ZINC PLATE & BLUE BRIGHT
2 REQ'D
TOLERANCE U.O.N.

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

MAT'L: EXTRUDED ALUM \( \frac{3}{4} \times \frac{3}{4} \times \frac{1}{8} \)

FINISH: ALODINE

2 REQ'D
TOLERANCE U.O.N.

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

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

4 REQ'D
TOLERANCE U.O.N.
.XXX ±0.005
.XX ±0.010
.X ± 1/64

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

COMPUTER SYSTEMS LABORATORY
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MACROMODULAR PROJECT

BASE PEDESTAL RAIL SUPPORT CLIP ANGLE

RJA 421-36

RJA PROD 1-10-72
DRAWN BY PLL

APPROVED RJA
CHECKED GM
DATE 8-19-71
TOLERANCE U.O.N.
XXX ±.005
XX ±.010
\[ X = \frac{1}{64} \]

MAT'L: STEEL L 2x2x\(\frac{3}{16}\)
3 REQ'D

FINISH: SHOT PEEN TO REMOVE SCALE
ZINC PLATE & BLUE BRIGHT
Drill H30 C'sink for 4-40 flathead screw
2 PLC's

Cham corner .030 x 45°

Tolerance U.O.N.

XXX ±.005
XX ±.01
X X ± 1/64

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

Title: Base Pedestal
Trim Angle Type 1

Computer Systems Laboratory
Washington University
St. Louis, Missouri
DRILL #30 C'SINK FOR 4-40 FLATHEAD SCREW
2 PLC'S

CHAM. CORNER .030 x 45°

.295

.438

8.250

9.125

TOLERANCE U.O.N.

XXX ± .005
XX ± .01
X X ± 1/64

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

MACROMODULAR PROJECT

BASE PEDESTAL
TRIM ANGLE TYPE 2

APPROVED
RJA
RJA PROD.
DHO

DRAWN NO. 421-39
CHECKED
GM 8-23-71

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

ISSUE 1-10-72 ECO. 0228 RJA

CHANGE NO. DATE DESCRIPTION
DRILL #30 C'SINK FOR 4-40 FLATHEAD SCREW
2 PLC'S

TOLERANCE U.O.N.

.300 ± .005
.295 ± .01

X

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 & PLC'S

CHAM. CORNER .030 x 45°

.295

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

29.81

TOLERANCE U.O.N.

.XXX ±.005

.XX ±.01

.X ±.01

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

BASE PEDESTAL

TRIM ANGLE TYPE 4

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

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

MACROMODULAR PROJECT

BASE PEDESTAL
TRIM ANGLE TYPE 5

<table>
<thead>
<tr>
<th>ISSUE</th>
<th>E.C.O. 0228</th>
<th>RJA</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE</td>
<td>1-10-72</td>
<td></td>
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</tr>
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<tbody>
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<td></td>
</tr>
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</tr>
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<tbody>
<tr>
<td>GM</td>
<td>8-24-71</td>
</tr>
</tbody>
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TOLERANCE U.O.N.  MAT'L:  EXTRUDED ALUM CHANNEL 1\times 1\times 1.25
XXX  \pm .00  FINISH:  CSL SPEC MF 1
XX  \pm .01
X  \pm \frac{1}{64}
1  REQ'D

DRILL $\frac{3}{4}$
2 PLC'S

TAP 10-32
6 PLC'S

.75

.75

.562

1.022

13.325

25.628

26.650

26.645

ISSUE 1/10/72 ECO 0228 RJA

CHANGE NO. DATE DESCRIPTION

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE BASE PEDESTAL ANGLE FRAME SPACER

APPROVED RJA PROD 1/10/72 DRAWN BY DHO
CHECKED GM 9-1-71

DRAWING NO. 421-43
DRILL \( \frac{9}{32} \) 6 PLC'S

DRILL \( \frac{1}{8} \) 2 PLC'S

DRILL \( \frac{11}{32} \)

TAP \( \frac{1}{4} \) - 20 x \( \frac{1}{2} \) DEEP 2 PLC'S

.200 → 5 SPACES @ 5.250 NON CUMULATIVE = 26.250

26.650

26.645

TOLERANCE U.O.N.

.333 \( \pm \) .005

.332 \( \pm \) .01

\( \frac{X}{X} \) \( \pm \frac{1}{64} \)

MAT'L: ALUM 1.000 x .500 STOCK 2024-T3

FINISH: LIGHT SHOT PEEN & ALODINE

1 REQ'D
DRILL \( \frac{9}{32} \)
6 PLC'S

DRILL \( \frac{11}{32} \)

1.50

5 SPACES \( @ 5.250 \) NON CUMULATIVE = 26.250

\( \frac{26.650}{26.645} \)

TAP \( \frac{1}{4} \) - 20 x \( \frac{1}{2} \) DEEP 2 PLC'S

\( \frac{250}{1.000 \ STK} \)

\( \frac{500}{\} \)

TOLERANCE U.O.N.

.\( XXX \) \( \pm .005 \)

.\( XX \) \( \pm .01 \)

\( \frac{X}{X} \) \( \pm \frac{1}{64} \)

MAT' L: ALUM 1.000 x .500 STOCK 2024-T3

FINISH: LIGHT SHOT PEEN & ALODINE

2 REQ'D

MACROMODULAR PROJECT

BASE PEDESTAL
RAIL SUPPORT BAR TYPE 2

COMPUTER SYSTEMS LABORATORY
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ST. LOUIS, MISSOURI

D 1-9-73 E.C.O. 0282 RJA
ISSUE 1-10-72 E.C.O. 0228 RJA

CHANGE
NO.

DATE

DESCRIPTION

MACROMODULAR PROJECT

BASE PEDESTAL
RAIL SUPPORT BAR TYPE 2

APPROVED

RJA

DRAWN BY

DHO

CHECKED

GM

DRAWING NO.

421-45

DATE

8-30-71
MAT'L: EXTRUDED ALUM ANGLE 1 x 1 x .188
FINISH: CSL SPEC MF-1
REQ'D: L.H. & R.H.
TOLERANCE U.O.N.

XXX ±.005
XX ±.01
X ± 1/64

MAT'L: 2024-T3 ALUM \( \frac{1}{2} \times \frac{1}{4} \)
FINISH: ALODINE
REQ'D: 2

DRILL #25
2 PLC'S
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 PLCS

\[ \begin{align*}
1.000 \quad & \rightarrow \\
1.500 \quad & \rightarrow \\
2.18 \quad & \rightarrow \\
1.500 \quad & \rightarrow \\
.250 \quad & \rightarrow \\
.44 \quad & \rightarrow \\
1.37 \quad & \rightarrow \\
\end{align*} \]

TOLERANCE U.O.N.

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

MAT L: CRS

FINISH: ZINC PLATE & BLUE BRIGHT

4 REQ'D

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

BASE PEDESTAL
NUT

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<thead>
<tr>
<th>ISSUE</th>
<th>E.C.O. 0228</th>
<th>RJA</th>
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<tr>
<td>DATE</td>
<td>1-10-72</td>
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CHANGE NO. | DATE | DESCRIPTION
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MACRONUMBER | RJA | PROD. | 1-10-72 | DRAWN BY | 421-51
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CHECKED | G/M |
---------|-----|
DATE | 8-23-71 |

MAT'L: \( \frac{1}{2} \times 1 \times 0.094 \) EXTRUDED ALUM ANGLE

TOLERANCE

\[
\begin{align*}
XXX & \pm 0.005 \\
XX & \pm 0.010 \\
\frac{X}{X} & \pm \frac{1}{64}
\end{align*}
\]

DRILL \#16 2 HOLES

---

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

BASE PEDESTAL COVER SUPPORT ANGLE

<table>
<thead>
<tr>
<th>ISSUE</th>
<th>E.C.O. 0228</th>
<th>RJA</th>
</tr>
</thead>
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</table>
MAT'L: STEEL 1 \( \frac{1}{2} \times 1 \frac{1}{2} \times \frac{1}{4} \) G Req'd.
FINISH: SHOT PEEN TO REMOVE SCALE
ZINC PLATE & BLUE BRIGHT

TOLERANCE U.O.N.
\( .XXX \pm .005 \)
\( .XX \pm .010 \)
\( \frac{X + 1}{X} \leq 64 \)

TAP 1/4-20
4 PLC'S ON VERT. SURFACE

TAP 8-32
4 PLC'S ON HORIZONTAL SURFACE

BASE PEDESTAL CLIP ANGLE

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

<table>
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<td>1-10-72</td>
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<td>GM</td>
<td>8-19-71</td>
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</table>
NYLON BRG. .625 I.D. x .750 O.D. x 1.000 LG. PRESS FIT INTO SCREW GUIDE & SLIP FIT SCREW

TOLERANCE U.O.N.
XXX ±.005
XX ±.01
X +.01
X - .64

MAT'L: STEEL U.O.N.
FINISH: ZINC PLATE & BLUE BRIGHT

4 REQ'D

MACROMODULAR PROJECT
TITLE
BASE PEDESTAL SCREW GUIDE

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

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

CHANGE NO. DATE DESCRIPTION
MAT'L: STEEL
6 REQ'D
FINISH: ZINC PLATE & BLUE BRIGHT

TOLERANCE UON
.XXX ±0.005
.XX ±0.010
X ± 1/64

CHAM .062 x 45°
TOLERANCE U.O.N.

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

MAT'L: \( \frac{3}{16} \) ALUM ROD 2024-T3
FINISH: ALODINE
REQ'D: 2
DIA ALUM ROD

CHAM .010 MIN

TURN 3/32 SHOULDER AND RIVET IN PLACE

PUNCH 5/32

TOLERANCE U.O.N.

.XXX ± .005

.X ± .01

X ± 1/64

MAT'L: .020 SPRING STOCK

FINISH: STOCK

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

XXX ± .005
XX ± .01
X + .1
X - .64

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

XXX \( \pm 0.005 \)

XX \( \pm 0.01 \)

X \( \pm 0.016 \)

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

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MACROMODULAR PROJECT

BASE PEDESTAL
CAPACITOR STRAP TYPE 2

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

CHANGE NO DATE DESCRIPTION

MACROMODULAR PROJECT

BASE PEDESTAL
CAPACITOR STRAP TYPE 2

APPROVED

END

DRAWN BY

DRAWING NO.

CHECKED

DATE

J. DO

GM 10-8-71

421-64

TJC

4/10-72

RJA

PROD
TOLERANCE U.O.N.

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

MAT' L: ALUM 2024-T3
FINISH: ALODINE
REQ'D: 2

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

STOCK

TAP 6-32
3 PLC'S

.65

.65

.68

.960

.12

4.960

8.960

9.920

10.16

MACROMODULAR PROJECT

BASE PEDESTAL
PAN SUPPORT BAR

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

ISSUE 1/10/72 E.C.O. 0228 R.Y.A

CHANGE NO. DATE DESCRIPTION

R.J.A PROD 1/10/72 DRAWN BY D.H.O

CHECKED G.M. DATE 9-8-71

APPROVED 4-25-72 E.C.O. 0261 R.Y.A

ENG. T.J.C. DRAWING NO. 421-65
CHAMFER INSIDE EDGE
.020 X 45 BOTH ENDS

MAT'L: SEAMLESS ALUM. TUBING 5/16 DIA.
0.058 THK. WALL 6061-T6
FINISH: ALODINE
REQ'D: 1

5/16 x 24 THDS.
TOLERANCE U.O.N.

. . XXX \pm .005
. . XX \pm .01
. \( \frac{X}{X} \pm \frac{1}{64} \)

MAT'L: STEEL ROD \( \frac{1}{8} \times 8\frac{3}{8} \)
FINISH: AS FABRICATED
REQ'D 1

INNER DIA. \( \frac{5}{32} \)
4-40 THDS.

FINISH: AS FABRICATED

BASE PEDESTAL CIRCUIT BREAKER ROD
TAP 8-32
2 PLC'S

1.000
1.875
5 SPACES @ 2.375 NON CUMULATIVE = 11.875
14.750
16.50

DRILL 17/64
6 PLC'S

BREAK EDGE

MAT'L: EXTRUDED ALUM CHANNEL 1\frac{1}{4} \times \frac{3}{4} \times .125
FINISH: CSL SPEC. MF-1
REQ'D: 1

TOLERANCE U.O.N.
XXX ± .005
XX ± .01
X ± \frac{1}{64}

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MACROMODULAR PROJECT

TITLE
BASE PEDESTAL INDICATOR WIRE CHASE CHANNEL

ISSUE 1-10-72 ECO. 0228 RJA

CHANGE NO. DATE DESCRIPTION

COMMENTS

TJC
421-68

RJA PROD 1-10-72 DHO

PROD 9-3-71

GM

DRAWING NO.

421-68

RJA PROD 1-10-72 DHO

DATE

CHANGED

9-3-71

CHECKED

G/M
TAP 6-32
2 PLC'S

MAT'L: 2024-T3 ALUM ROD 3/8 D STOCK
FINISH: ALODINE
REQ'D: 1
TOLERANCE: ± .01

MACROMODULAR PROJECT

BASE PEDESTAL
BRACKET HANDLE

COMPUTER SYSTEMS LABORATORY
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ISSUE: 1-10-72  E.C.O. 0228  RJA

CHANGE NO.  DATE  DESCRIPTION

MACRO MODULAR PROJECT  TITLE  BASE PEDESTAL  BRACKET HANDLE

ENGINEER  TJC  DRAWING NO.  421-69

DRAWN BY  DHO  DATE  9-7-71

CHECKED  GM  DATE  9-7-71

RJA  PROD  1-10-72
TAP 6-32

DRILL 5/32

3 PLC'S

TOLERANCE U.O.N.

.38  2.37

1.38  .21

2.95

MAT'L: ALUM 2024-T3

FINISH: ALODINE

REQ'D: 1

MACROMODULAR PROJECT

TITLE BASE PEDESTAL

DEC BLOCK BAR

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

<table>
<thead>
<tr>
<th>ISSUE</th>
<th>E.C.O. 0228</th>
<th>RJA</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE</td>
<td>1-10-72</td>
<td></td>
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CHANGE NO. | DATE | DESCRIPTION
-----------|------|---------------

APPROVED BY | FOR | DATE | ENQ | DRAWN BY | CHECKED | DRAWING NO.
-------------|-----|------|-----|----------|---------|-------------
TJC          |     |      |     |          |         | 421-70      
RJA          | PROD| 1-10-72|     |          |         |             
DHO          |     |      |     |          |         |             
GM           |     |      |     |          |         | 9-7-71      

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

CHANGE NO. | DATE | DESCRIPTION
-----------|------|---------------

1: 1.38  .21  .50

XXX ± .005

XX ± .01

X ± 1

64
DRILL $\frac{5}{32}$

TOLERANCE U.O.N.

$.XXX \pm .005$

$.XX \pm .01$

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

TAP 6-32

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

FINISH: ALODINE

REQ'D 3

MACROMODULAR PROJECT

TITLE BASE PEDESTAL

WIRE BUNDLE SUPPORT CLIP

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

ISSUE 1-10-72

CHANGE NO. DATE DESCRIPTION

E.C.O. 0228 RJA

APPROVED ENG.

BY FOR DATE

RJA PROD 1-10-72

DRAWN BY

DHO

CHECKED GM

DATE 9-1-71

DRAWING NO. 421-71
TOLERANCE U.O.N.

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

MAT'L: NYLON ROD \( \frac{5}{8} \) STOCK

FINISH: AS MACHINED

REQ'D: 1

---

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

<table>
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<tr>
<th>TITLE</th>
<th>BASE PEDESTAL CIRCUIT BREAKER KNOB</th>
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</table>

<table>
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<tr>
<th>ISSUE</th>
<th>1-10-72</th>
<th>E.C.O. 0228</th>
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</thead>
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<td>TJC</td>
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</tr>
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<tr>
<th>BY</th>
<th>FOR</th>
<th>DATE</th>
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<tr>
<td>RJA</td>
<td>PROD</td>
<td>1-10-72</td>
</tr>
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<th>DATE</th>
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</thead>
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<tr>
<td>GM</td>
<td>9-3-71</td>
</tr>
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MATL: 1/16 ALUM STK 6061-T6

FINISH: ALODINE

DIMENSIONS UGON:
XXX ± .005
XX ± .010
X ± .005
X ± .010

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

TYPICAL CELL
**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>
<tr>
<th>KEY WORDS</th>
<th>LINK A</th>
<th>LINK B</th>
<th>LINK C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macromodule Frame Block</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Macromodule Base-Pedestal</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Macromodule Lateral Channel</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Macromodule Frame Section</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macromodule Lateral Extension</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macromodule Cooling Duct</td>
<td></td>
<td></td>
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