CALS TEST NETWORK

CTN Test Report
89-014

UCID 21772

Engineering Drawing Transfer Test Between Tracor and NAVSEACOMBATSYSENGSTA: MIL-D-28000 Class II (IGES)

October 10, 1989

Prepared for
Air Force Logistics Command
AITI Project

Lawrence Livermore National Laboratory

Work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

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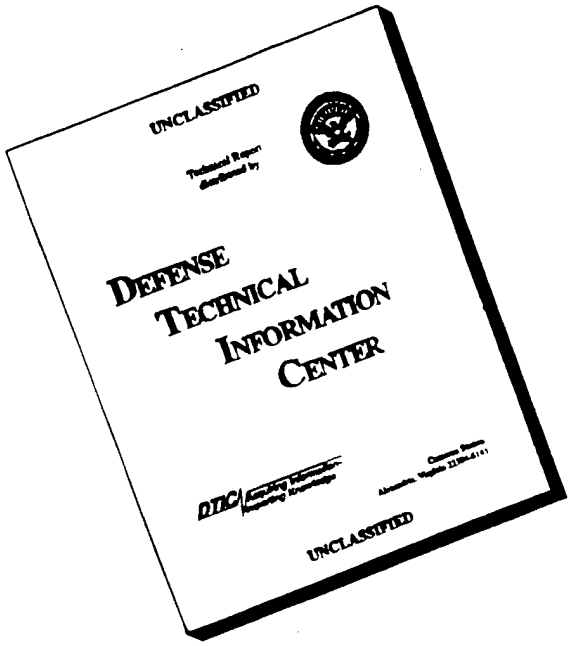

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Contents

Preface

The following people are acknowledged for their contribution to this test and test report: Glenn Wright, David Sadler, Michael Firnstahl, Christopher Platt, and Edmond Haddad of the Naval Sea Combat System Engineering Station; Fred Cleveland and Tony Colozzi of Manufacturing and Consulting Services, Inc.; Stephen Metzger and Albert Bordeleau of Tracor Applied Sciences, Inc.; and Kevin Dillon, Christopher Conrad, Bob Elman, and Gary Adams of Autodesk, Inc.

This report does not endorse any product, process, or company.

Executive Summary

The DoD Computer-aided Acquisition and Logistic Support (CALS) Test Network (CTN) is conducting tests of the military standard for the Automated Interchange of Technical Information, MIL-STD-1840A (1840A), and its companion suite of military specifications. This test was an end-to-end test between Tracor Applied Sciences, Inc. (Tracor) of Groton, CT, and the Naval Sea Combat System Engineering Station (NAVSEACOMBATSYS-ENGSTA - here on referred to as the Engineering Station) of Norfolk, VA. Tracor transferred Initial Graphics Exchange Specification (IGES) engineering data to the Engineering Station in accordance with the CALS Standards 1840A and MIL-D-28000 (28000). The test's objective was to study the engineering drawing subset of IGES entities defined in 28000 and to introduce the participants to the concept of IGES/28000 testing.

The results were informative. Tracor's AutoCAD Computer Aided Design (CAD) system was able to transfer actual engineering drawings to the Engineering Station's Anvil 5000 CAD system using IGES. The data transferred well except for some enlarged text and a few misplaced graphics. In addition to these results, the test also pinpointed several CAD system deficiencies in meeting 28000. Finally, the test highlighted the need to correct some ambiguities in the standards and to broaden 1840A's transfer media requirements (Tracor delivered on floppy disks, not 9-track tapes). On the basis of this test it is recommended that:

1. CTN technical staff suggest modifications to the Office of the Secretary of Defense (OSD) CALS Policy Office on 1840A in the areas of multiple engineering sheet identification and transfer media requirements.

2. The OSD CALS Policy Office look into a new subset or application protocol to allow microcomputer-based CAD systems to become more easily CALS compliant.

3. The CAD vendors involved in the test continue to improve their IGES processors to 1840A and 28000 levels.

Summary of MIL-STD-1840A Testing - Tracor to the Engineering Station

Tracor's Creation and Delivery

Ability to Write Transmission Envelope	
ANSI Level 3 Tape	Part
MIL-STD-1840A Format	Part
Declaration Files	Pass
Header Records	Pass
Ability to Pre-process IGES	
Process IGES	Part
Process 28000 Class II Compliant Entities	Part

The Engineering Station's Acceptance and Use

Ability to Read Transmission Envelope	
ANSI Level 3 Tape	N/A
MIL-STD-1840A Format	Pass
Declaration Files	Pass
Header Records	Pass
Ability to Post-process IGES	
Process IGES	Part
Process Entire 28000 Class II Subset	Part
Produce a Good Image	Part

Pass = Compliant in all respects
Part = Noncompliant, still usable
Fail = Noncompliant, unusable
N/A = Not applicable, because Tracor delivered on floppy disk rather than ANSI tape

1 Introduction

The DoD Computer-aided Acquisition and Logistic Support (CALS) Test Network (CTN) is conducting tests of the military standard for the Automated Interchange of Technical Information, MIL-STD- 1840A (1840A) [OSDA88] and its companion suite of military specifications. The CTN is a DoD sponsored confederation of voluntary participants from industry and government, managed jointly by the technical staff at Air Force Logistics Command (AFLC) and Lawrence Livermore National Laboratory (LLNL). The objective of the CTN tests is to demonstrate and evaluate the interchange and functional use of digital technical information between industry and government using the CALS Standards. This test studied, in particular, the Engineering Drawing Subset (Class II) of Initial Graphics Exchange Specification (IGES) [NBS88] entities defined in the military specification for the Digital Representation for Communication of Product Data: IGES Application Subsets, MIL-D- 28000 Amendment 1 (28000) [OSDD88].

The CTN conducted this end-to-end test between Tracor Applied Sciences, Inc. (Tracor) of Groton, Connecticut, and the Naval Sea Combat System Engineering Station (NAVSEACOMBATSYS-ENGSTA - here on referred to as the Engineering Station) of Norfolk, Virginia, on May 8-12, 1989 [CTN89]. The test was conducted to demonstrate and test the transfer of IGES data using the CALS Standards 1840A and 28000.

The staff at the Engineering Station asked to participate in this CTN test because they wanted to: (1) gain knowledge of 1840A and IGES/28000 testing enough to develop in-house tests, (2) gain knowledge to use these in-house tests on the bidding of future contracts, and (3) gain information on the IGES/28000 processing ability of their own Computer Aided Design (CAD) system.

2 Test Conditions and Procedures

2.1 Test Data

The CTN technical staff utilized two sets of data for the test between Tracor and the Engineering Station. The first set, the CTN MIL-D-28000 Class II Reference Drawings, "N-entity" and "L-bracket", were used to test each individual CAD system's abilities and to lay the groundwork for understanding when and why problems occurred. These reference drawings are found in "The CALS Test Network MIL-D-28000 Class II Reference Drawing Packet" [FARR89]. They contain every entity identified by 28000 Class II and are displayed in Appendix A of this report.

The second and most important set of data consisted of four sheets, saved as separate parts therefore separate IGES files, of an actual engineering drawing drafted by Tracor. The four sheets were Installation Control Drawings for the AN/SQQ-89(V) Surface Ship Anti-Submarine Warfare Combat System, an integrated system consisting of sonar and fire control systems. Plots of the drawings are displayed in the results s ection of this report.

2.2 Test Platforms

All testing at Tracor was undertaken on an Autodesk Inc. AutoCAD Release 10 CAD system operating on a Leading Edge 286 personal computer.

The Engineering Station's system was its Manufacturing and Consulting Services (MCS), Inc. Anvil 5000 Revision 1.2.5 CAD system operating on a VAX 8530 computer with a Tektronix 4111 terminal.

The CTN analysis was conducted using the IGES Data Analysis Parser/Verify Software, the Glatz Associates IGES Model Testing System, Rosetta Technologies PreVIEW Package, and visual inspection.

2.3 Test Procedures

The specific test procedures for the transfer test between Tracor and the Engineering Station, and the Engineering Station's study of it's own CAD package's IGES translators are as follows:

For the end-to-end test using the actual engineering drawing:

1. Tracor chose four sheets, stored as separate AutoCAD drawing files, of an actual engineering drawing. These four sheets were then plotted, pre-processed to separate IGES files, and written to floppy disks following 1840A procedures where ever possible.

2. Tracor delivered the floppy disks to the CTN for evaluation and to the Engineering Station for acceptance.

3. The Engineering Station post-processed into Anvil, displayed, and plotted the four actual engineering sheets and then examined the CAD databases for missing graphics.

4. The Engineering Station delivered the plots to the CTN for analysis.

For the preparatory testing to pre-evaluate each system's performance using the CTN Reference Drawings:

1. Tracor followed the generation scripts to create the "N- entity" and "L-bracket" drawings on AutoCAD, plotted the graphics, pre-processed the IGES files, and wrote the files to 1840A-like floppy disks.

2. Tracor delivered the floppy disks to the CTN for evaluation and to the Engineering Station for acceptance.

3. The Engineering Station post-processed the IGES files into Anvil, plotted the graphics, and answered the questions listed in the evaluation scripts about the "N-entity" and "L-bracket" drawings.

4. The Engineering Station delivered all evaluation scripts and plots to the CTN for analysis.

5. The Engineering Station created the "N-entity" and "L-bracket" drawings on Anvil, plotted the graphics, pre- processed the IGES files, and sent all data to the CTN for analysis.

6. The Engineering Station received the "N-entity" and "L-bracket" reference IGES files on 1840A tape from the CALS Test Network, post-processed them into Anvil, answered the evaluation scripts, plotted the graphics, and delivered all data to the CTN for analysis.

3 Test Results

3.1 Transmission Envelope

In general, Tracor was able to write the 1840A transmission information and the Engineering Station was able to read it, but one major deficiency existed in the 1840A transfer, the media on which the data was delivered. 1840A calls out that the data be delivered primarily on 9-track tape, but in the case of Tracor and other subcontractors who use only microcomputer-based CAD systems, this requirement is difficult to meet. In this test, for example, Tracor delivered the data on floppy disks. Other organizations wishing to deliver CALS data through telecommunications or other media are facing a similar problem. The CTN technical staff feels this media restriction is unnecessary and recommends that 1840A's discussion of computer media be removed from the document and placed in one or more separate specifications referenced by 1840A. These new specifications should call out and control more types of transfer media than just 9-track tape.

3.1.1 1840A Declaration Files and Header Fields

Because of the makeup of one set of data, one engineering drawing comprised of four sheets saved as different IGES files, Tracor was unsure how to complete the source system and destination system document identifiers found both in the declaration files and header fields. The problem is that 1840A does not clearly specify what is required in these identifier fields, the computer file names or the actual document/drawing names, and this ambiguity should be removed. Furthermore, Tracor was confused because 1840A did not make it clear how to identify that the engineering drawing was made up of four related drawing sheets. The solutions to these problems will be looked into as CTN testing continues and as other tests bring up similar problems. The direction seems to be toward modifying 1840A to require both the computer file names and the actual document/drawing names, both allowing a sheet number.

3.1.2 28000 Class II Start Section

28000 requires that the sending organization enter certain information into the Start Section of the IGES files, for example information to identify the drawing, its date of translation, the performing organization, and more. However, because AutoCAD does not allow the user to enter his/her own Start Section information, Tracor was unable to meet this requirement. This leads to the recommendation that all CAD systems be capable of allowing the user to create his/her own Start Sections.

3.2 Processing of IGES/28000 Class II Data

3.2.1 End-to-End Transfer Using the Actual Engineering Drawing

Table 1 summarizes the results of the end-to-end test using the four sheets of the actual Installation Control Drawing. The table is divided into two main sections: the translation from Tracor's AutoCAD drawing format to the IGES file and from the IGES file to the Engineering Station's Anvil display. The pre-processed IGES files from AutoCAD were evaluated in three areas: AutoCAD's ability to write files that conformed to 28000 Class II, had correct IGES syntax, and represented the correct graphics. The post-processing and display of the IGES file was evaluated in only one area, the correct display of the IGES file's graphics on the Anvil system. The table's "Y"s and "N"s answer the general questions yes or no, and the "X"s denote that the drawing sheet had that particular problem and that the problem was attributed to that particular item.

Plots of Tracor's actual engineering drawing (Sheets 1, 2, 3, and 4) follow the table; keep in mind that they are test drawings and not officially released. The plots are displayed in numerical order and, furthermore, in order of translation. The first plot of each set is Tracor's original drawing (no translation). The second is the graphics that were contained in the IGES file pre-processed by

Tracor's AutoCAD system (one translation). The third is the Engineering Station's Anvil display of the IGES file (two translations). Overall, the graphics transferred well and the Engineering Station could have utilized the CAD drawings with only minor clean up if this had been a production transfer.

Table I

Results from the End-to-end Transfer of the Actual Engineering Drawing Sheets

Engineering Drawing Sheet Number			1	2	3	4
From AutoCAD Format to IGES Format						
Conform to Class II?	Yes/No?		N	N	N	N
	Conformance Errors	Drawing Entity missing	X	X	X	X
		Drawing Properties missing	X	X	X	X
		Illegal text font present	X	X	X	X
		Illegal Composite Curve Entity	X	X	X	X
	If problem, where attributed	IGES Specification				
		28000 Specification				
		AutoCAD pre-processor	X	X	X	X
		Tracor computer operator				
Correct IGES syntax?	Yes/No?		N	N	N	N
	Syntax errors	Line Font DE Fields incorrectly set	X	X	X	X
	If problem, where attributed	IGES Specification				
		28000 Specification				
		AutoCAD pre-processor	X	X	X	X
		Tracor computer operator				
Correct graphics?	Yes/No?		N	N	N	N
	Graphical Problems	Title block text oversized	X	X	X	X
		Shading not correctly filled			X	X
		Small arrowheads not filled	X	X	X	X
		Special characters incorrectly written	X	X		
		IGES Specification				
		28000 Specification				
		AutoCAD pre-processor	X	X	X	X
		Tracor computer operator				

Table I Continued

Engineering Drawing Sheet Number			1	2	3	4
From IGES Format to Anvil Format (End-to-End)						
Correct Graphics?	Yes/No?		N	N	N	N
	Graphical Problems	Title block text oversized	X	X	X	X
		Shading not correctly filled			X	X
		Special characters incorrectly written	X	X		
		Circles around textural notes missing	X	X		
		Large filled arrows missing	X			
		Small arrowheads missing	X	X	X	X
		Various other details saved as subfigures missing			X	X
	If problem, where attributed	IGES Specification				
		28000 Specification				
		AutoCAD pre-processor	X	X	X	X
		Anvil post processor	X	X	X	X
		Tracor computer operator	*	*	*	*
		Engineering Station computer operator				
Overall usable data?			Y	Y	Y	Y

* Graphical appearance of transfer could be improved if operator exploded all entities.

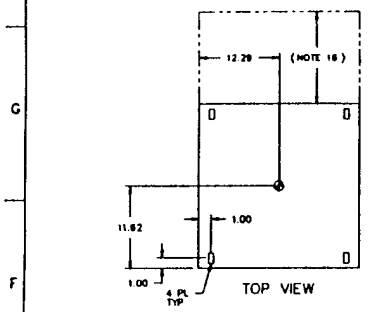
Sheet 1

The following three plots are:

1. Installation Control Drawing Sheet 1 as originally drawn by Tracor on AutoCAD.

2. Sheet 1 graphics as stored in the IGES file pre-processed by Tracor's AutoCAD.

3. Sheet 1 as displayed by the Engineering Station's Anvil system after post-processing the IGES file.



14. SLIDING RACKS CAN BE EXTENDED TOGETHER OR INDIVIDUALLY
15. A SERVICE LOOP IN SHIPS CABLING MUST BE PROVIDED TO ALLOW THE INTERFACE UNIT (A7) TO BE EXTENDED FOR SERVICING.
16. MAINTENANCE ACCESS CLEARANCE REQUIRED AT REAR OF RACK IS 18 INCHES. (C1)
17. TO DETACH THE STABILIZER, REMOVE FOUR .375-16 X 1.250 SCREWS AND FOUR LOCK WASHERS AT REAR OF RACK. TO RE-INSTALL STABILIZER, ALIGN HOLES IN STABILIZER WITH HOLES IN RACK INSURING THAT THE RUBBER SNUBBER IS POSITIONED AS SHOWN ON SHEET 2, ZONE C-2. INSTALL HARDWARE AND TORQUE TO 150 INCH-LBS.

    TO DETACH THE BASE MOUNT, THE HARDWARE HOLDING THE BASE MOUNT TO THE RACK IS LOCATED AT TWELVE PLACES ON THE INSIDE BOTTOM OF THE RACK. BEFORE REMOVAL OF THESE .375-16 X .875 SCREWS AND LOCK WASHERS, SUPPORT THE RACK IN SUCH A WAY THAT IT WILL NOT BE DAMAGED WHEN THE BASE MOUNT IS DETACHED. TORQUE SCREWS TO 150 INCH-LBS.

18. MOUNTING SURFACE SHALL BE FLAT WITHIN ±.09. MATCH DRILL MOUNTING BOLT HOLES IN FOUNDATION.

(NOTES CONTINUED ON SHEET 3)

11. THE MAXIMUM TOTAL EXCURSION OF ANY POINT ON THE CABINET UNDER SHOCK IS ±2.00 VERTICALLY AND ±1.50 HORIZONTALLY
12. TO PERMIT PASSAGE THROUGH 30 X 30 HATCH PER MIL-E-16400, THE REAR STABILIZERS MUST BE REMOVED
13. MOUNTING HARDWARE

BASE MOUNT: EIGHT .500-13 UNC SCREWS MS90725-4
EIGHT .500-13 UNC NUTS MS17828-8C **
EIGHT .500 FLAT WASHERS MS27183-18

STABILIZERS: EIGHT .375-16 UNC-2A SCREWS MS90725-4
EIGHT .375 FLAT WASHERS MS27183-14
EIGHT .375-16 UNC-3B NUTS MS17828-6C **

GROUND: TWO .375-16 X .625 UNC-2A SCREWS MS90728-57
TWO LOCK WASHERS MS35338-48
ONE GROUND PLATE 03538-7249653P1

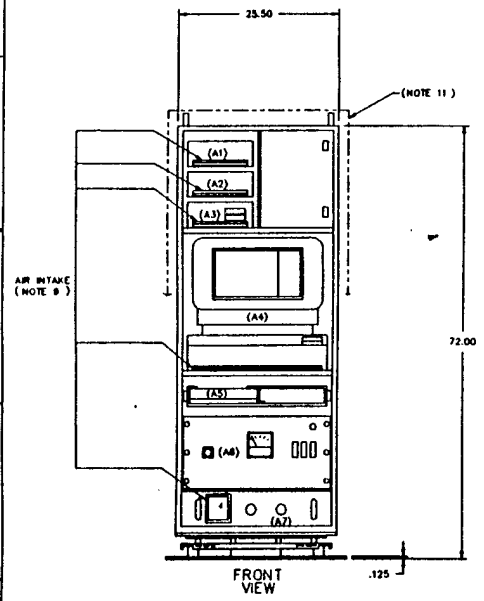
NOTES:

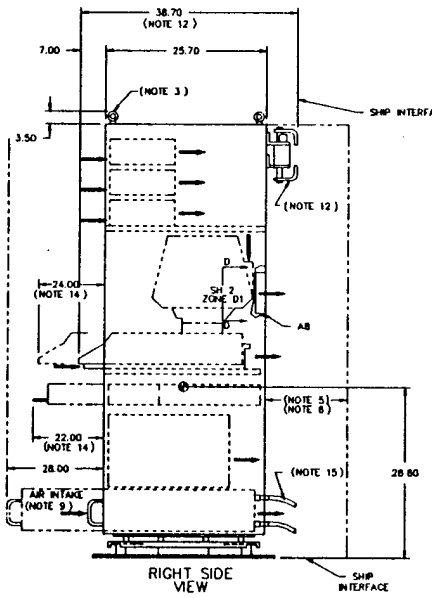
1. THIS UNIT IS DESIGNED TO WITHSTAND GRADE B, CLASS 2, SHOCK IN ACCORDANCE WITH MIL-S-901 AND VIBRATION IN ACCORDANCE WITH MIL-STD-167-1, TYPE 1
2. THIS EQUIPMENT IS NOT DESIGNED TO MEET THE DRIP-PROOF REQUIREMENTS OF MIL-STD-108 AND SHALL NOT BE MOUNTED EXPOSED TO THE WEATHER.
3. FOR LIFTING, USE FOUR EYEBOLTS AT TOP OF CABINET WITH SPREADER BARS AT ALL TIMES.
4. THIS EQUIPMENT IS RESILIENTLY MOUNTED. THE RESILIENT MOUNTING SYSTEM CONSISTS OF A BASE MOUNT 81060-25193 AND REAR STABILIZERS 81860-21263. A STRUCTURE FOR MOUNTING THE STABILIZERS TO THE OVERHEAD OR BULKHEAD MUST BE PROVIDED BY THE INSTALLING ACTIVITY. THE SUPPORT MUST BE DESIGNED SUCH THAT IT WILL TRANSFER THE RIGIDITY OF THE OVERHEAD OR BULKHEAD TO THE POINT OF ATTACHMENT OF THE TWO STABILIZERS. PROPER INSTALLATION OF THE REAR STABILIZERS IS AS SHOWN ON SHEET 2. FOR PROPER OPERATION OF THE STABILIZERS THE SHIP SUPPORT STRUCTURE MUST NOT INHIBIT THE VERTICAL MOTION OF THE CABINET.
5. ALL MULTICONDUCTOR CABLE CONNECTORS WHICH ATTACH AT THE CONNECTOR PANELS OF THE I/O (A7) ARE SUPPLIED WITH STRAIGHT BACKSHELLS. CLEARANCE REQUIRED FOR CABLE ROUTING IS 18.00.
6. ⊕ DENOTES CENTER OF GRAVITY.
7. MOUNTING SURFACE MATERIAL OF BASE MOUNT AND STABILIZER IS STEEL, FINISHED PER MIL-E-15090, LIGHT GRAY ENAMEL.
8. BONDING AND GROUNDING SHALL BE IN ACCORDANCE WITH MIL-STD-1310. GROUNDING SURFACE IS ALUMINUM. ONE GROUND STRAP IS REQUIRED. SEE VIEW A SHEET 2.
9. DIRECTION OF AIR FLOW THROUGH ASSEMBLIES IS INDICATED BY ARROWS (⟶). SPECIFIC DATA FOR EACH ASSEMBLY IS AS FOLLOWS:

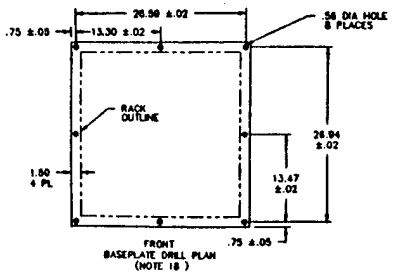
ASSY REF	CLEARANCE REQUIRED FOR AIR CIRCULATION		AIR FLOW (SCFM)	SIZE (IN SQUARE INCHES)		TEMP RISE °F
	INTAKE	EXHAUST		INTAKE	EXHAUST	
A1	1.00	3.00	INA	17.53	7.07	2
A2	1.00	3.00	INA	17.53	7.07	1
A3	1.00	3.00	INA	12.75	7.07	1
A4	1.00	3.00	INA	40.12	102.48	2
A6	1.00	2.00	INA	76.50	17.72	3
A7	1.00	4.00	85	17.72	3.98	5

(C4)

*10. ASSEMBLIES A1 THROUGH A7 SHALL BE ASSEMBLED ONLY AFTER INSTALLATION OF EQUIPMENT RACK. SEE SHEET 3 FOR ASSEMBLY INSTRUCTIONS AND SHEET 4 FOR INTERNAL CABINET CABLES HOOK-UP.







WEIGHT BREAKDOWN

2	RS 232 CONNECTOR PANEL (A8) (C2)
225	BASE MOUNT W/2 STABILIZERS
409	EQUIPMENT RACK
7	2225A THINK JET PRINTER (A5)
125	9020A COMPUTER (A4)
18	9144A STREAMING TAPE DRIVE (A3)
21	7945A 55 MB DISK DRIVE (A1)
18	9134D 18/20 MB DISK DRIVE (A2)
50	INTERFACE UNIT (A7)
183	POWER CONDITIONER (A8)
10	MOUNTING HARDWARE AND CABLES
1070 LBS	TOTAL

TABULATION OF DATA (C3)

WEIGHT		1070 LBS
WET WEIGHT		N/A
POWER REQUIREMENTS: TYPE I PER DOD-STD-1399, SECTION 300		
AC	115V ±5%, 1 PHASE, 60 HZ ±5%, 25 AMP, .97 POWER FACTOR, LAGGING	
DC	NONE	
MAXIMUM OPERATING POWER		1164.9 WATTS
HEAT DISSIPATION TO AIR		3977 BTU/HR (1164.9 WATTS)
HEAT DISSIPATION TO WATER		NONE
RELATIVE HUMIDITY		20% TO 80%
BASE PLATE LOADING		103 LBS/SQ. FT.
OPERATING TEMPERATURE		10° TO 40° CELSIUS
NONOPERATING TEMPERATURE	A1 THRU A7	-20° TO 80° CELSIUS
	MEDIA	-40° TO 45° CELSIUS

LEGEND:
INA - INFORMATION NOT AVAILABLE
N/A - NOT APPLICABLE
* - LENGTHS TO BE DETERMINED BY INSTALLING ACTIVITY
** - NUTS SHALL BE SELF LOCKING AND SHALL BE IN ACCORDANCE WITH MIL-N-25027

REFERENCES: (C5)
1. DRAWING LIST - SEE DRAWING 807-5035668

D	D	D	D	REV	DOCUMENT REVISION STATUS
4	3	2	1	SHEET	

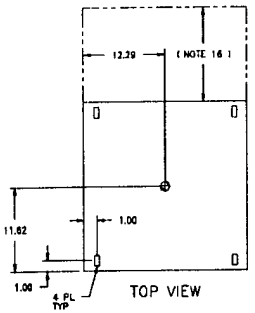
UNIT 1
INSTALLATION CONTROL DRAWING

NAVAL SEA SYSTEMS COMMAND
WASHINGTON, D.C. 20362
DATA PROCESSING SYSTEM
EQUIPMENT RACK
AM/UYQ-25A(V)2
OUTLINE AND INSTALLATION DRAWING

SIZE	CAGE CODE	DRAWING NO.	REV
E	53711	807-5035672	D

SHEET 1 OF 4

7329063



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17. TO DETACH THE STABILIZER, REMOVE FOUR .375-16 X 1.250 SCREWS AND FOUR LOCK WASHERS AT REAR OF RACK. TO RE-INSTALL STABILIZER, ALIGN HOLES IN STABILIZER WITH HOLES IN RACK INSURING THAT THE RUBBER SNUBBER IS POSITIONED AS SHOWN ON SHEET 2, ZONE C-2. INSTALL HARDWARE AND TORQUE TO 150 INCH-LBS.

    TO DETACH THE BASE MOUNT, THE HARDWARE HOLDING THE BASE MOUNT TO THE RACK IS LOCATED AT TWELVE PLACES ON THE INSIDE BOTTOM OF THE RACK. BEFORE REMOVAL OF THESE .375-16 X .875 SCREWS AND LOCK WASHERS, SUPPORT THE RACK IN SUCH A WAY THAT IT WILL NOT BE DAMAGED WHEN THE BASE MOUNT IS DETACHED. TORQUE SCREWS TO 150 INCH-LBS.
18. MOUNTING SURFACE SHALL BE FLAT WITHIN XXp.09. MATCH DRILL MOUNTING BOLT HOLES IN FOUNDATION.

(NOTES CONTINUED ON SHEET 3)

11. THE MAXIMUM TOTAL EXCURSION OF ANY POINT ON THE CABINET UNDER SHOCK IS XXp2.00 VERTICALLY AND XXp1.50 HORIZONTALLY.
12. TO PERMIT PASSAGE THROUGH 30 X 30 HATCH PER MIL-E-16400, THE REAR STABILIZERS MUST BE REMOVED.
13. MOUNTING HARDWARE:

    BASE MOUNT: EIGHT .500-13 UNC SCREWS MS90725-*
    EIGHT .500-13 UNC NUTS MS17828-8C **
    EIGHT .500 FLAT WASHERS MS27183-16

    STABILIZERS: EIGHT .375-16 UNC-2A SCREWS MS90725-*
    EIGHT .375 FLAT WASHERS MS27183-14
    EIGHT .375-16 UNC-3B NUTS MS17828-6C **

    GROUND: TWO .375-16 X .825 UNC-2A SCREWS MS90728-57
    TWO LOCK WASHERS MS35338-46
    ONE GROUND PLATE 03538-7249653P1

NOTES:

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4. THIS EQUIPMENT IS RESILIENTLY MOUNTED. THE RESILIENT MOUNTING SYSTEM CONSISTS OF A BASE MOUNT 81860-25193 AND REAR STABILIZERS 81860-21263. A STRUCTURE FOR MOUNTING THE STABILIZERS TO THE OVERHEAD OR BULKHEAD MUST BE PROVIDED BY THE INSTALLING ACTIVITY. THE SUPPORT MUST BE DESIGNED SUCH THAT IT WILL TRANSFER THE RIGIDITY OF THE OVERHEAD OR BULKHEAD TO THE POINT OF ATTACHMENT OF THE TWO STABILIZERS. PROPER INSTALLATION OF THE REAR STABILIZERS IS AS SHOWN ON SHEET 2. FOR PROPER OPERATION OF THE STABILIZERS THE SHIP SUPPORT STRUCTURE MUST NOT INHIBIT THE VERTICAL MOTION OF THE CABINET.
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6. ⊕ DENOTES CENTER OF GRAVITY.
7. MOUNTING SURFACE MATERIAL OF BASE MOUNT AND STABILIZER IS STEEL, FINISHED PER MIL-E-15090, LIGHT GRAY ENAMEL.
8. BONDING AND GROUNDING SHALL BE IN ACCORDANCE WITH MIL-STD-1310. GROUNDING SURFACE IS ALUMINUM. ONE GROUND STRAP IS REQUIRED. SEE VIEW A SHEET 2.
9. DIRECTION OF AIR FLOW THROUGH ASSEMBLIES IS INDICATED BY ARROWS (⟶). SPECIFIC DATA FOR EACH ASSEMBLY IS AS FOLLOWS:

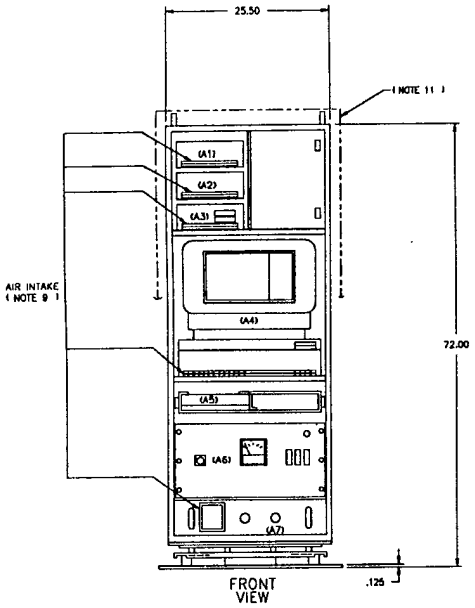
ASSY REF	CLEARANCE REQUIRED FOR AIR CIRCULATION INTAKE	EXHAUST	AIR FLOW (SCFM)	SIZE (IN SQUARE INCHES) INTAKE	EXHAUST	TEMP RISE °C/F
A1	1.00	3.00	INA	17.53	7.07	2
A2	1.00	3.00	INA	17.53	7.07	1
A3	1.00	3.00	INA	12.75	7.07	1
A4	1.00	3.00	INA	40.12	102.48	2
A6	1.00	2.00	INA	76.50	17.72	3
A7	1.00	4.00	85	17.72	3.98	5

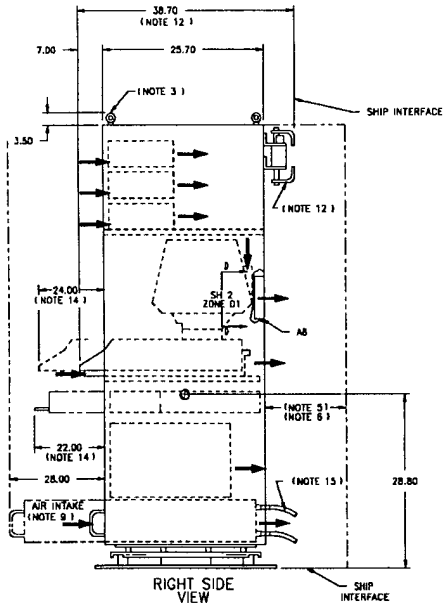
(C4)

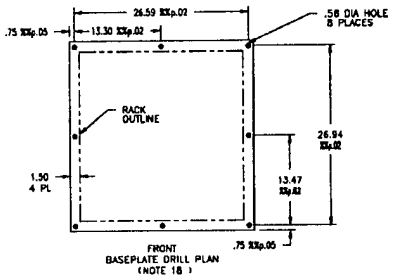
10. ASSEMBLIES A1 THROUGH A7 SHALL BE ASSEMBLED ONLY AFTER INSTALLATION OF EQUIPMENT RACK. SEE SHEET 3 FOR ASSEMBLY INSTRUCTIONS AND SHEET 4 FOR INTERNAL CABINET CABLES HOOK-UP.

DRAWING REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	DRAWING RELEASED BY RWM/RJA	1/15/87	
A	B	1-REVISED TO SHOW VERTICAL DISTANCE FROM GRAY TO STABILIZER MOUNTING BOLT HOLES ON SHT 1.	2/27/87	BLB
	C	1-CLEARANCE WAS 24 INCHES 2-REVISED TO SHOW PROPER DATA 3-ADDED TITLE 4-ADDED DRAWING NUMBER 5-ADDED SHT 3 LOCATION 6-ADDED CABLE PLUG LOCATION 7-REVISED CABLE PLUG LOCATION 8-RENAMED DESKTOP COMPUTER & IPC NOMENCLATURE 9-ADDED NOTE 18 10-REVISED AS CABLE ROCKER 11-ADDED CABLE PLUG LOCATIONS	10/21/87	AS
	D	REVISIONS IN CONCRETE: REVISED NOTES 1, 12 & 17, WEIGHT BREAKDOWN TABLE, LEGEND, NOT ITEM NO., ADDED, POSITION BAR, FOR LIFTING EYES, PG 1, REVISED, ZONE CHART DATA FOR A6A1, F & G, ADDED, WITH CALLOUT TO NOTE C IN 2, ADDED IN PARENTHESES AROUND NOTES CONFIRMED BY A, REVISED, NOTE 21 AND B-2011 CALLOUT TO REAR VIEW, ADDED, END STRAP PAN TO NOTE 22, IN 4,		







WEIGHT BREAKDOWN (C2)

2	RS 232 CONNECTOR PANEL (A8)
225	BASE MOUNT W/2 STABILIZERS
409	EQUIPMENT RACK
7	2225A THINK JET PRINTER (A5)
125	9020A COMPUTER (A4)
19	9144A STREAMING TAPE DRIVE (A3)
21	7945A 55 MB DISK DRIVE (A1)
19	9134D 16/20 MB DISK DRIVE (A2)
50	INTERFACE UNIT (A7)
183	POWER CONDITIONER (A6)
10	MOUNTING HARDWARE AND CABLES
1070 LBS	TOTAL

TABULATION OF DATA (C3)

WEIGHT		1070 LBS
WET WEIGHT		N/A
POWER REQUIREMENTS: TYPE I PER DOD-STD-1399, SECTION 300		
AC	115V XXp5%, 1 PHASE, 60 HZ XXp5%, 25 AMP, .97 POWER FACTOR, LAGGING	
DC	NONE	
MAXIMUM OPERATING POWER		1184.9 WATTS
HEAT DISSIPATION TO AIR		3977 BTU/HR (1184.9 WATTS)
HEAT DISSIPATION TO WATER		NONE
RELATIVE HUMIDITY		20% TO 80%
BASE PLATE LOADING		193 LBS/SQ. FT.
OPERATING TEMPERATURE		10XX4 TO 40XX4 CELSIUS
NONOPERATING TEMPERATURE	A1 THRU A7	-20XX4 TO 80XX4 CELSIUS
	MEDIA	-40XX4 TO 45XX4 CELSIUS

LEGEND:
INA – INFORMATION NOT AVAILABLE
N/A – NOT APPLICABLE
* – LENGTHS TO BE DETERMINED BY INSTALLING ACTIVITY
** – NUTS SHALL BE SELF LOCKING AND SHALL BE IN ACCORDANCE WITH MIL-N-25027

REFERENCES: (C5)
1. DRAWING LIST – SEE DRAWING 807- 5035668

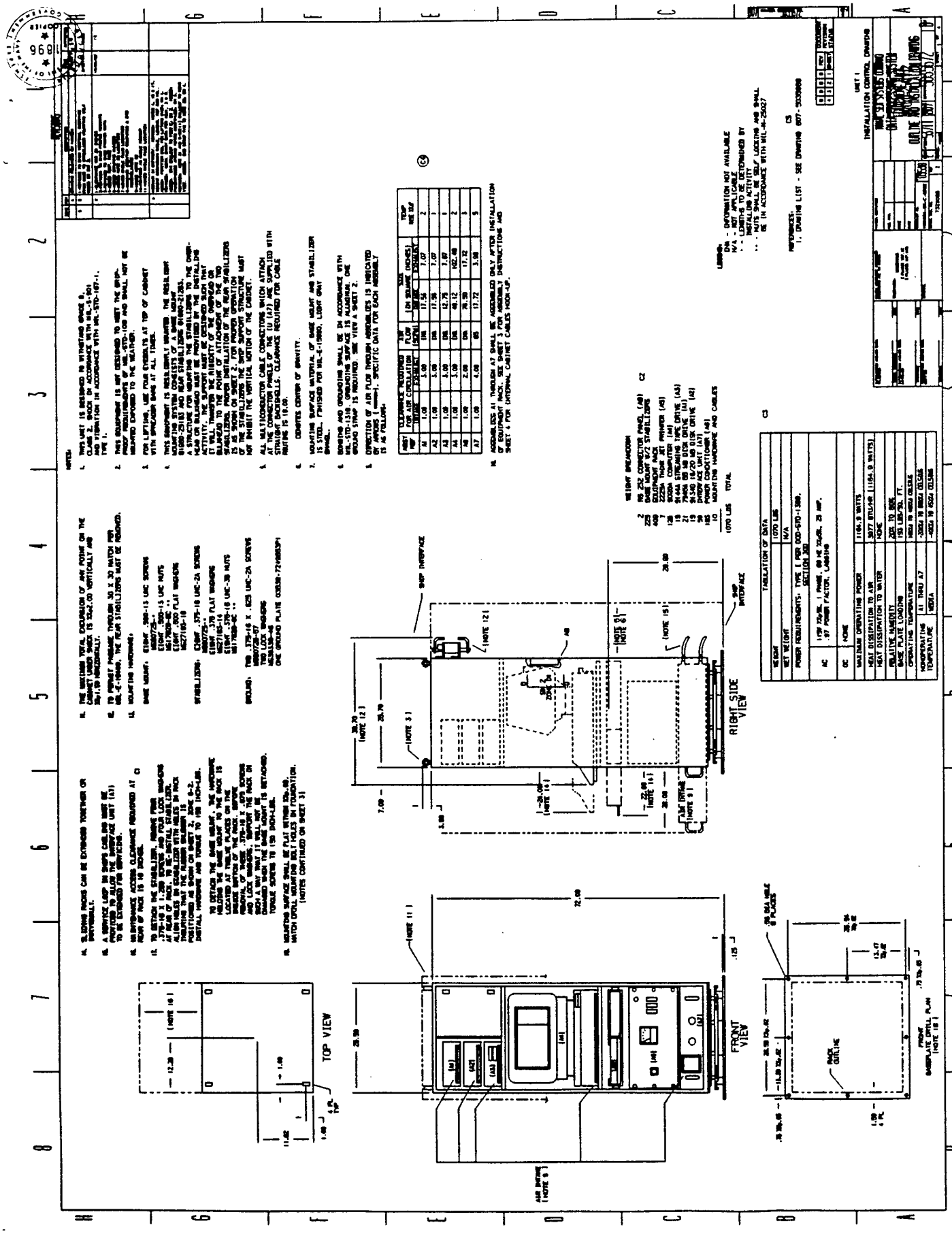
0	0	0	0	REV	DOCUMENT REVISION STATUS
4	3	3	1	SHEET	

UNIT 1
INSTALLATION CONTROL DRAWING

NAVAL SEA SYSTEMS COMMAND
DATA PROCESSING SYSTEM
AN/UYK-43(V)
OUTLINE AND INSTALLATION DRAWING

CAGE CODE	SIZE	DRAWING NO.	REV
13711	D	5035672	B

SCALE: NONE SHEET 1 OF 4



Engineering Station's Display of IGES File

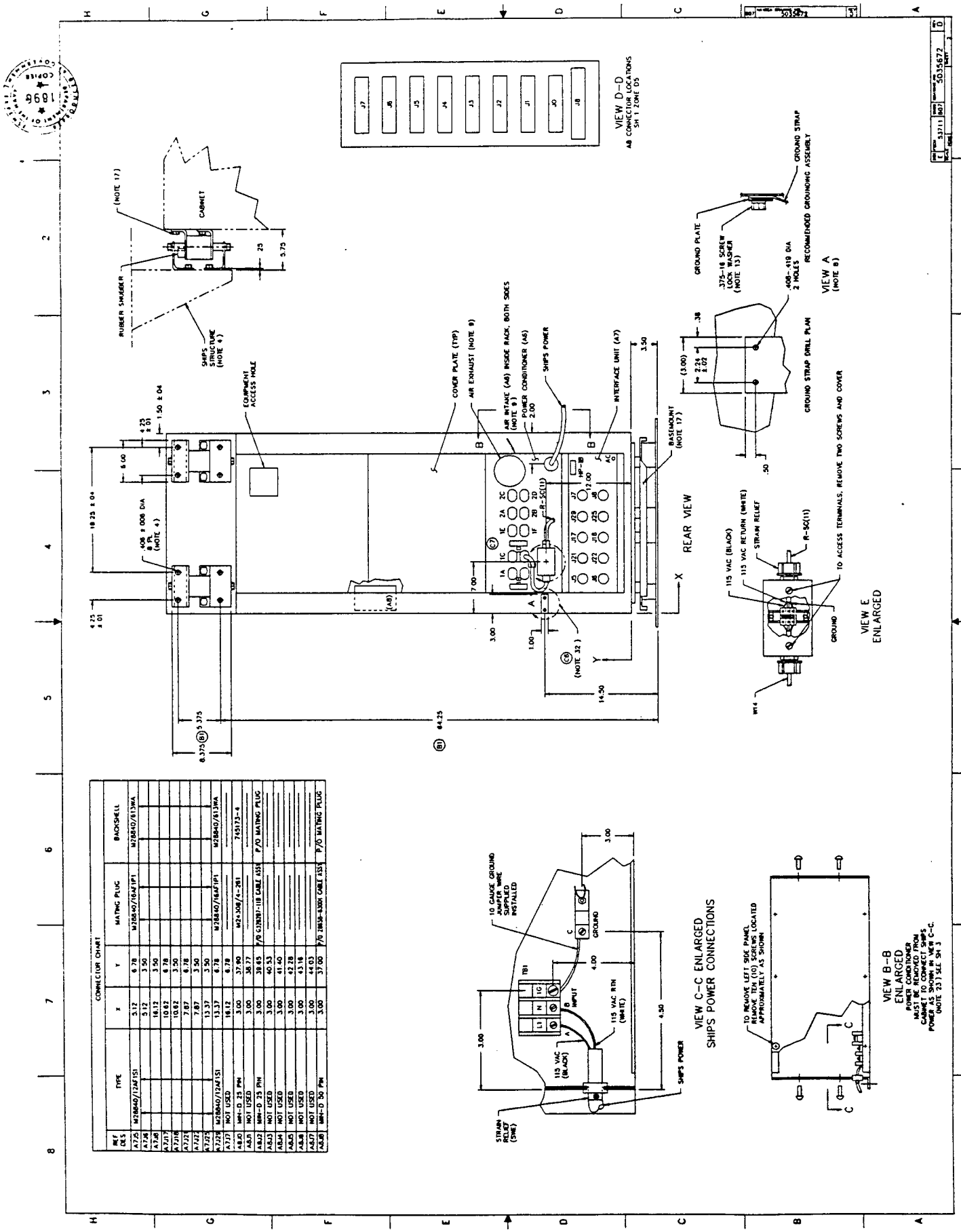
Sheet 2

The following three plots are:

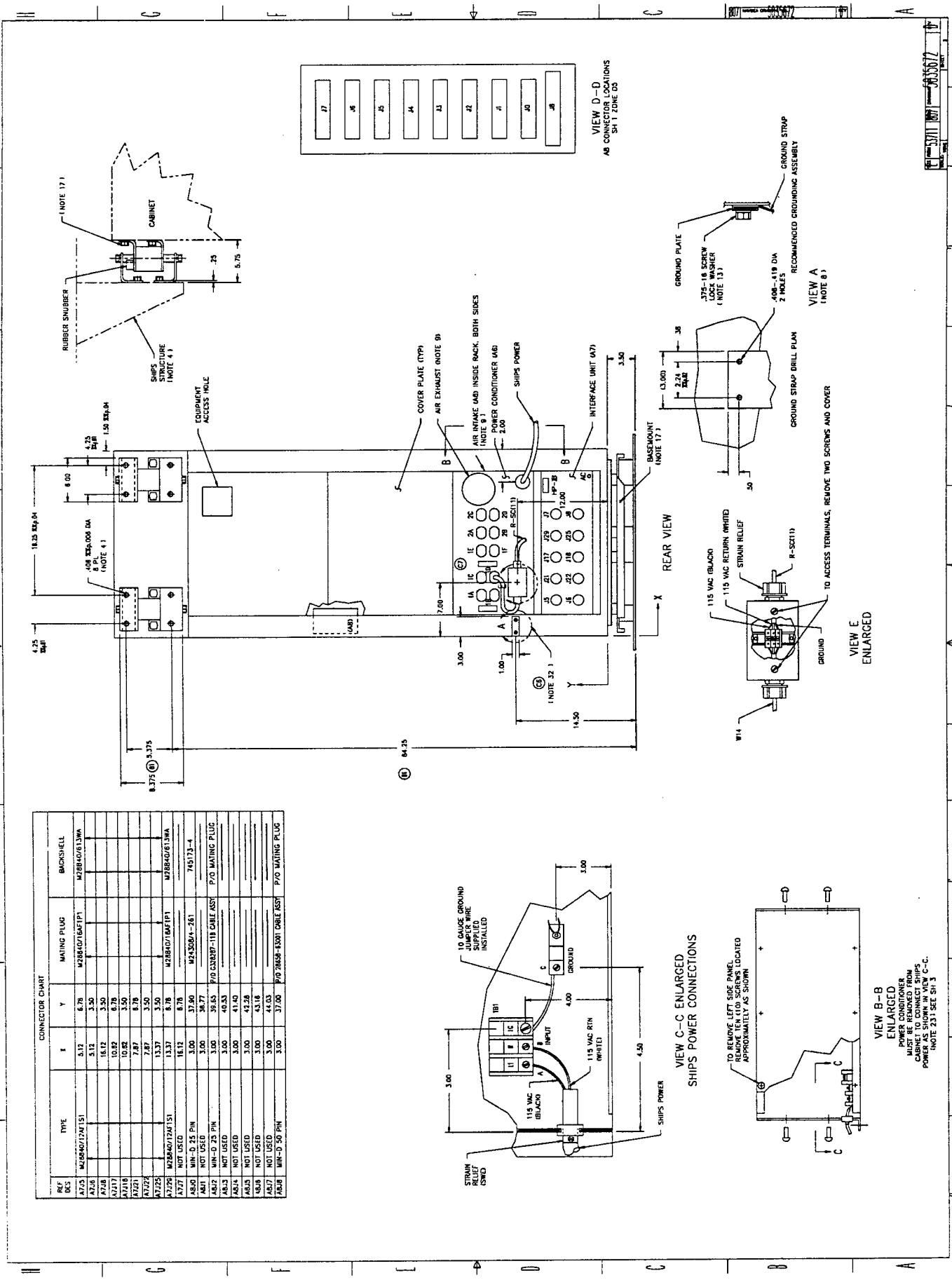
1. Installation Control Drawing Sheet 2 as originally drawn by Tracor on AutoCAD.

2. Sheet 2 graphics as stored in the IGES file pre-processed by Tracor's AutoCAD.

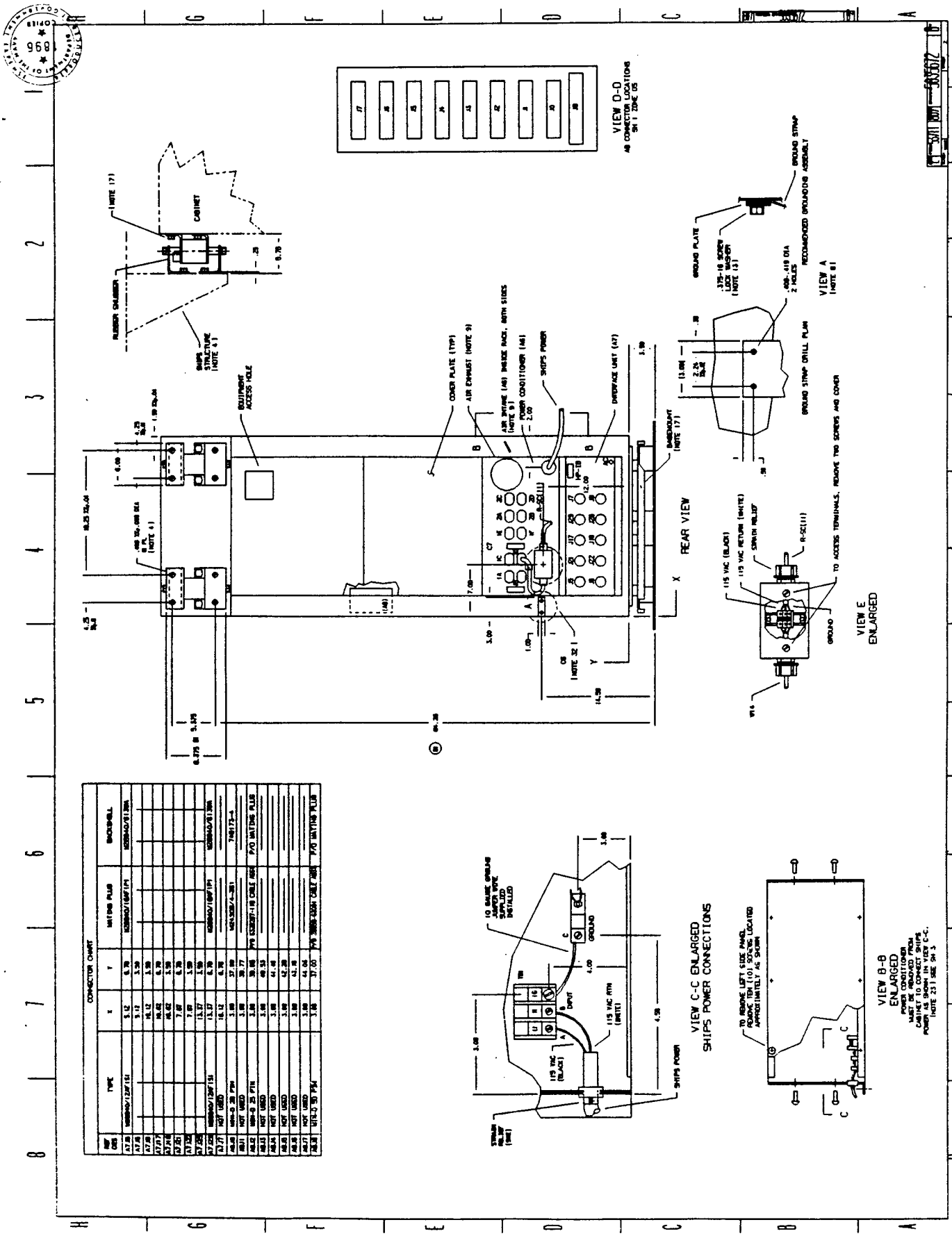
3. Sheet 2 as displayed by the Engineering Station's Anvil system after post-processing the IGES file.



Tracor's Original Drawing



REF DES	TYPE	X	Y	MATING PLUG	BACKSHELL
A7J5	M28840/12A1S1	5.12	6.76	M28840/16AF1P1	M28840/613WA
A7J6		5.12	3.50		
A7J8		16.12	3.50		
A7J17		10.82	6.76		
A7J16		10.82	3.50		
A7J21		7.87	6.76		
A7J22		7.87	3.50		
A7J25		13.37	3.50		
A7J26	M28840/12A1S1	13.37	6.76	M28840/16AF1P1	M28840/613WA
A7J27	NOT USED	16.12	6.76		
A8J0	MIN-D 25 PIN	3.00	37.90	M24308/4-261	745173-4
A8J1	NOT USED	3.00	36.77		
A8J2	MIN-D 25 PIN	3.00	39.63	P/O C32697-113 CABLE ASSY	P/O MATING PLUG
A8J3	NOT USED	3.00	40.53		
A8J4	NOT USED	3.00	41.40		
A8J5	NOT USED	3.00	42.26		
A8J6	NOT USED	3.00	43.16		
A8J7	NOT USED	3.00	44.03	P/O 28858-13001 CABLE ASSY	P/O MATING PLUG
A8J8	MIN-D 50 PIN	3.00	37.00		



Engineering Station's Display of IGES File

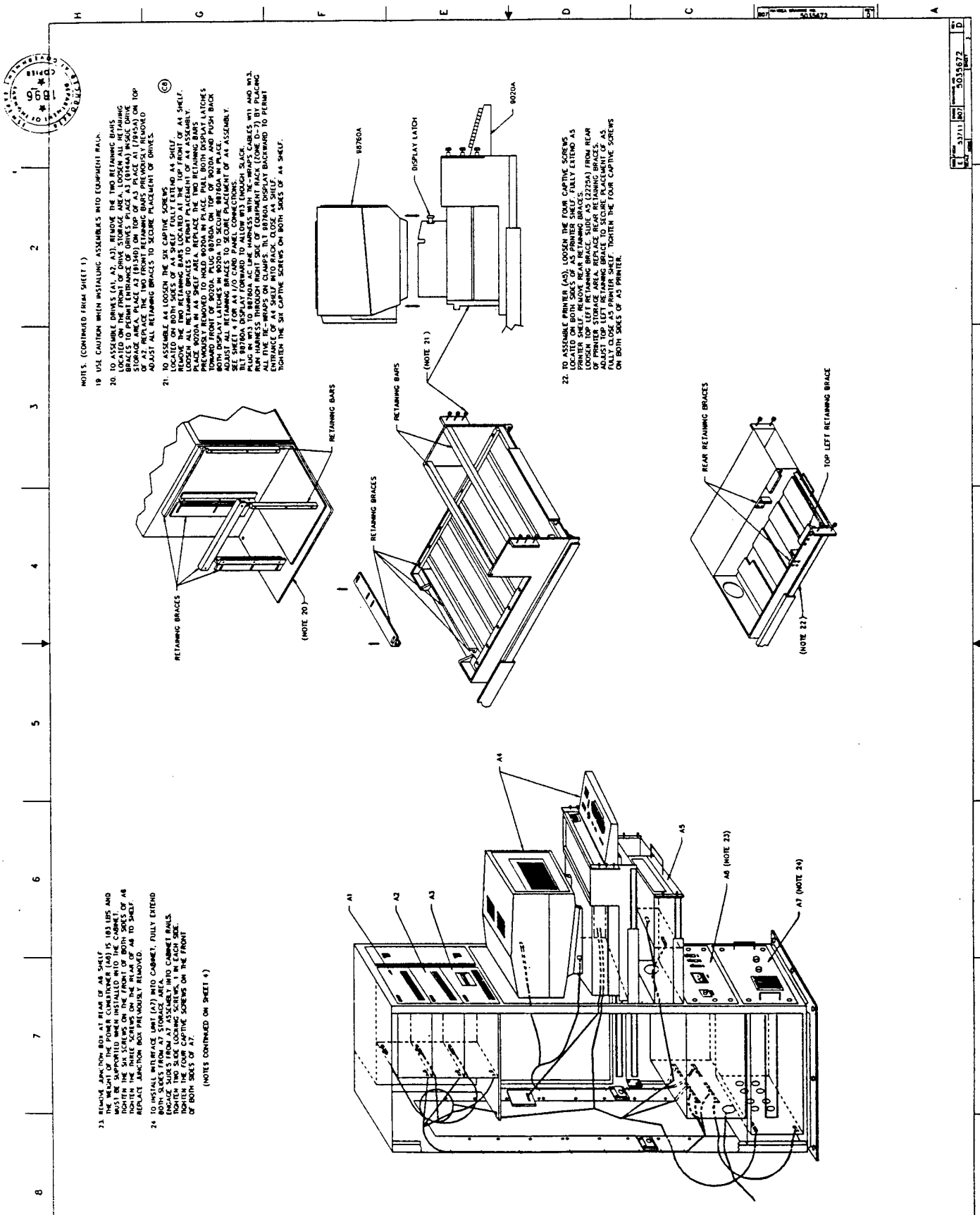
Sheet 3

The following three plots are:

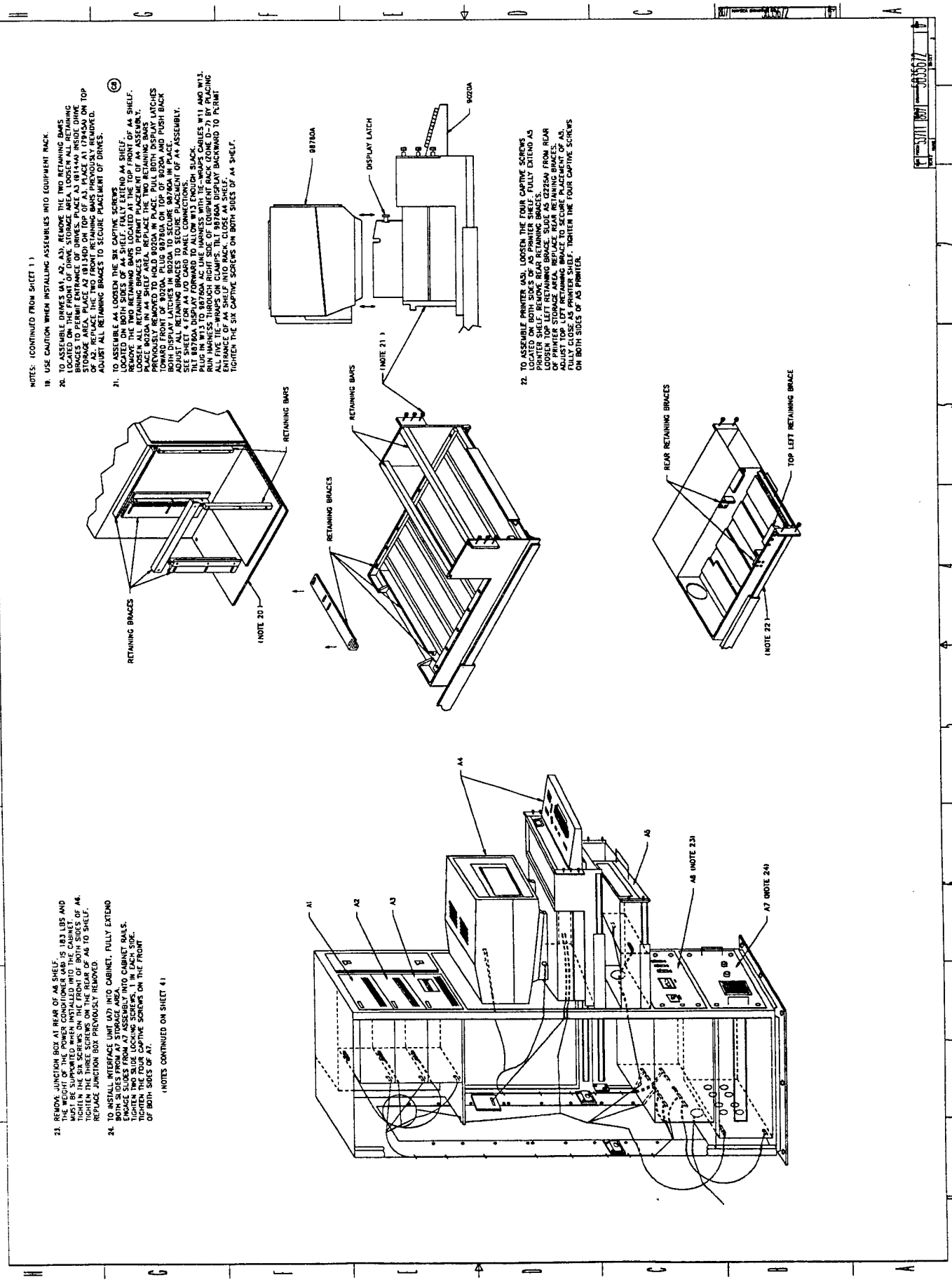
1. Installation Control Drawing Sheet 3 as originally drawn by Tracor on AutoCAD.

2. Sheet 3 graphics as stored in the IGES file pre-processed by Tracor's AutoCAD.

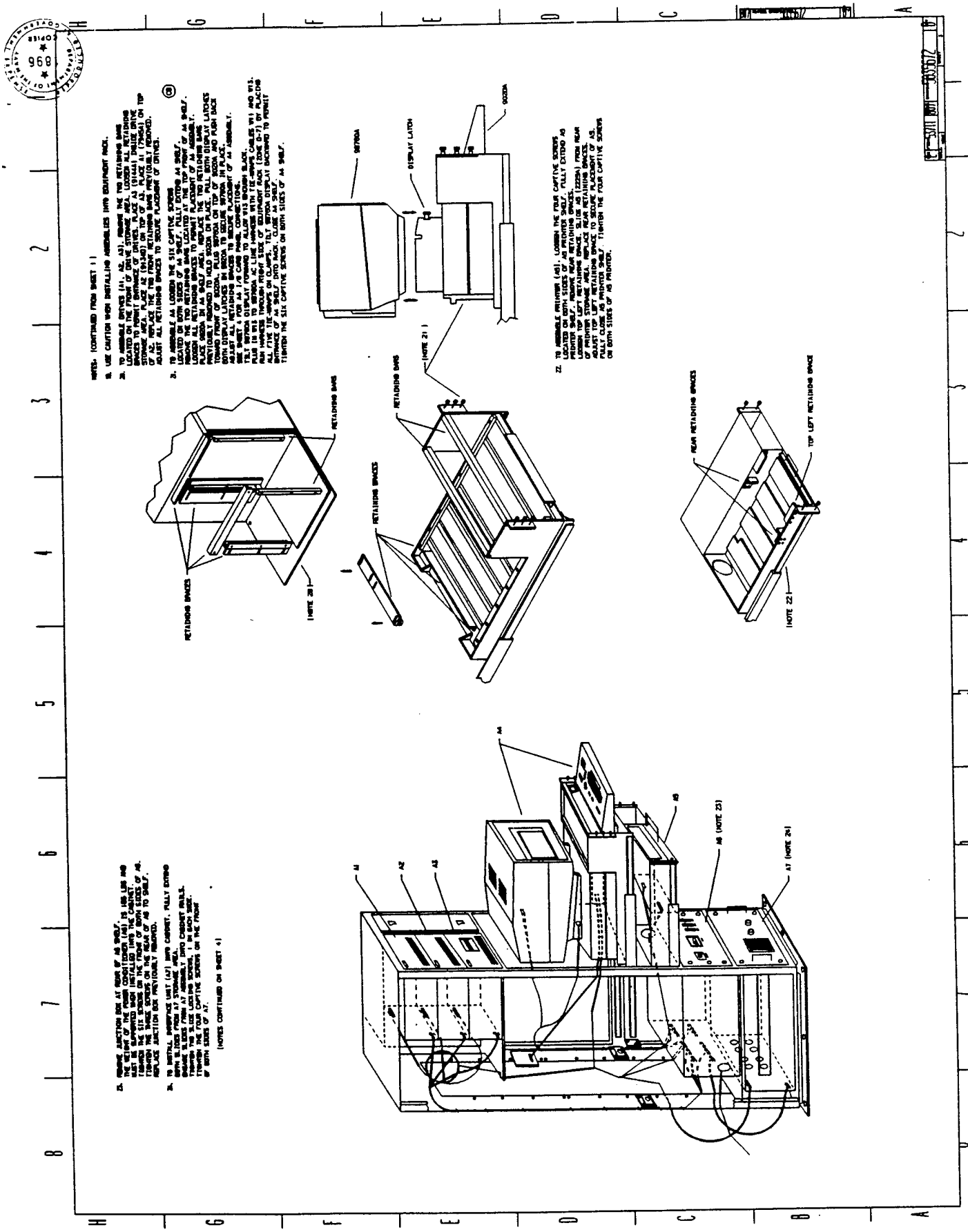
3. Sheet 3 as displayed by the Engineering Station's Anvil system after post-processing the IGES file.



Tracor's Original Drawing



Tracor's IGES File Representation



Engineering Station's Display of IGES File

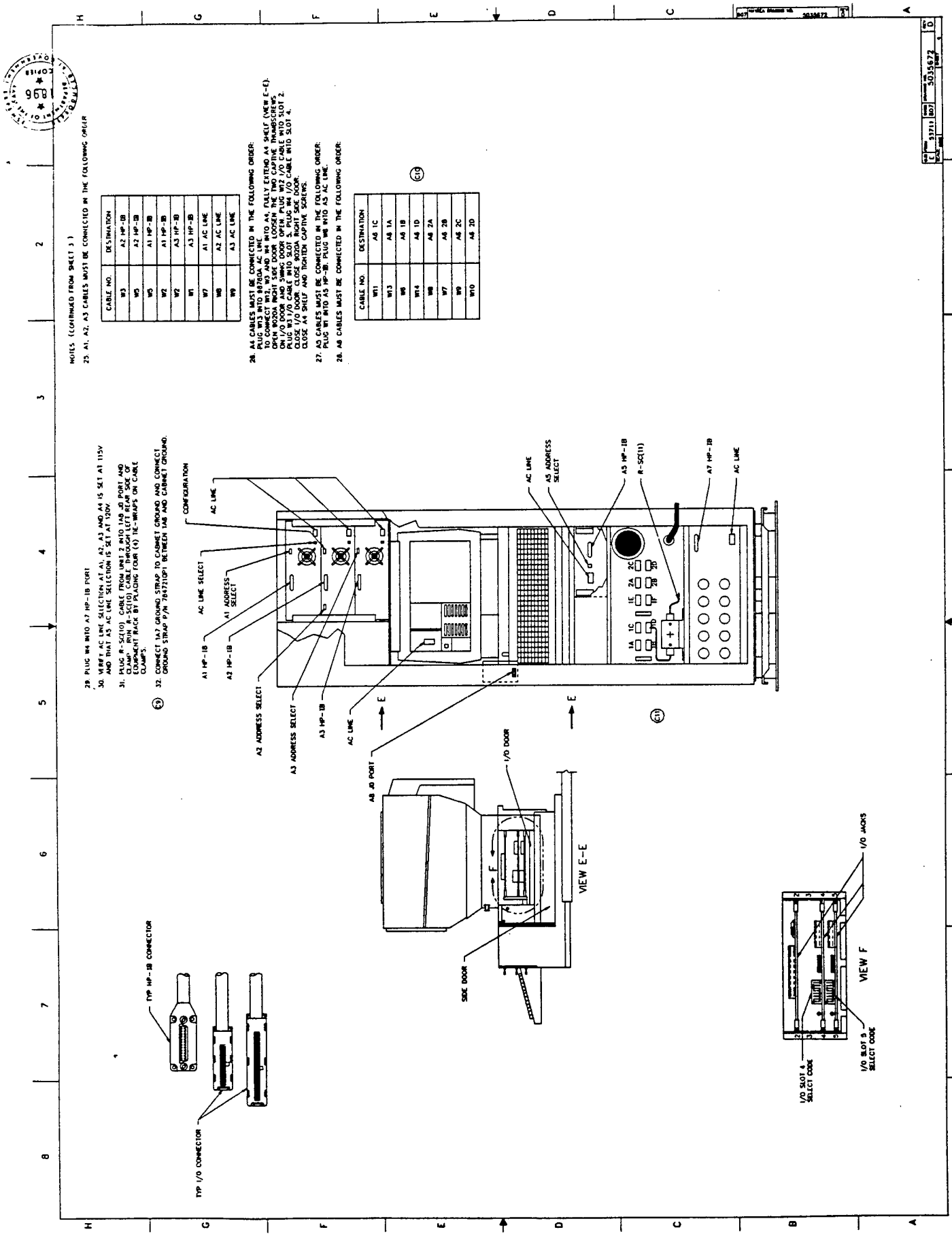
Sheet 4

The following three plots are:

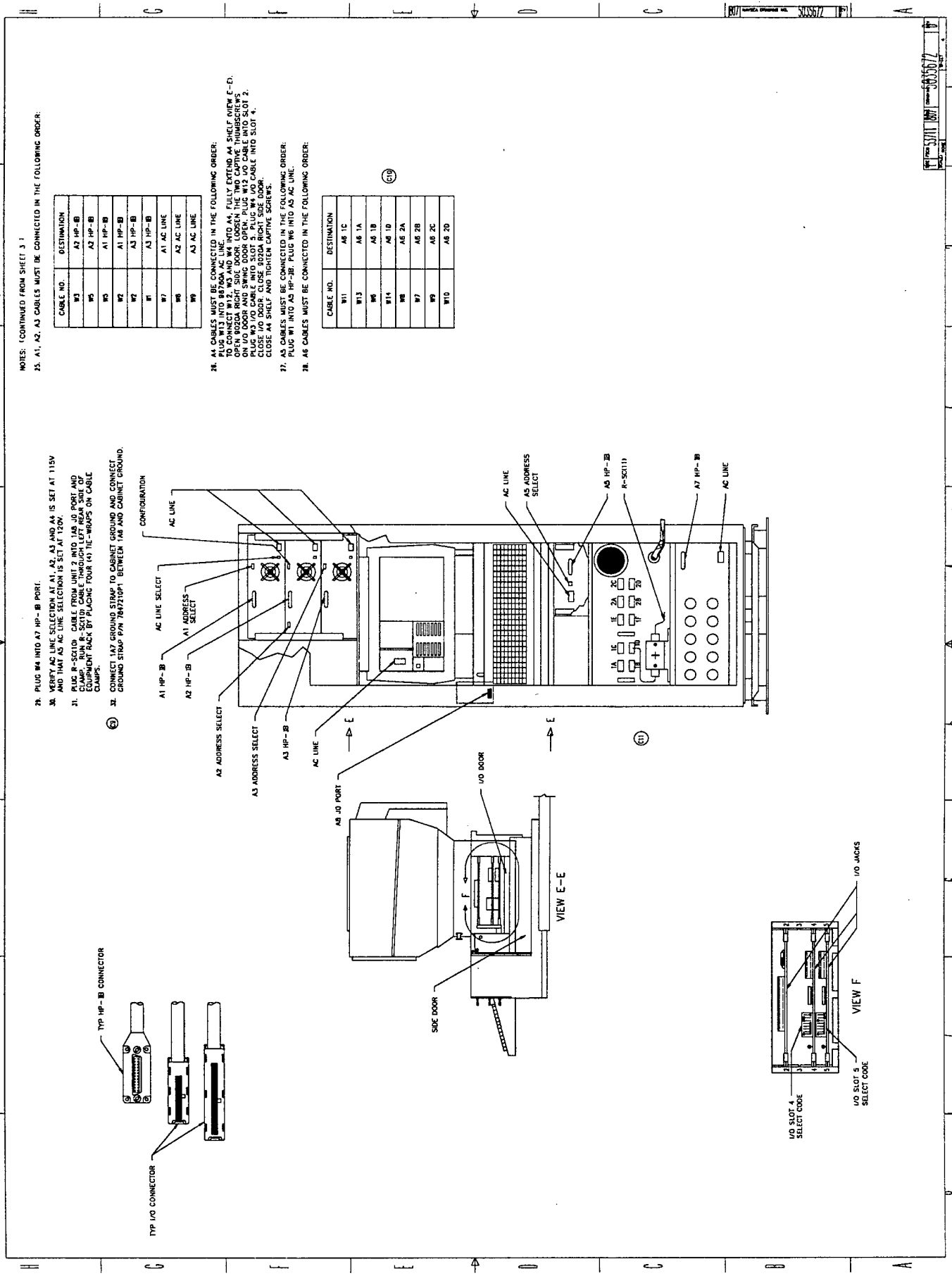
1. Installation Control Drawing Sheet 4 as originally drawn by Tracor on AutoCAD.

2. Sheet 4 graphics as stored in the IGES file pre-processed by Tracor's AutoCAD.

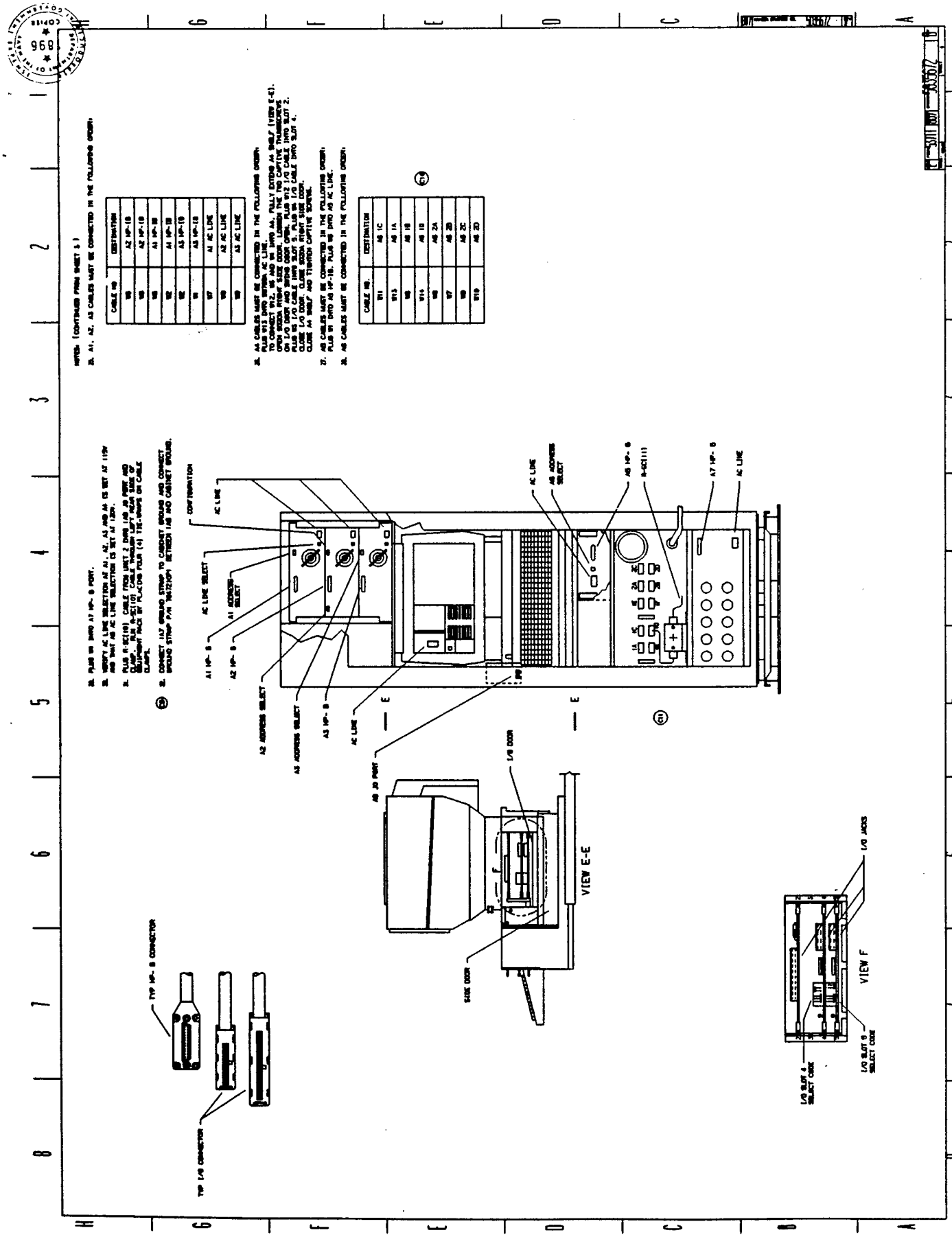
3. Sheet 4 as displayed by the Engineering Station's Anvil system after post-processing the IGES file.



Tracor's Original Drawing



Tracor's IGES File Representation



Engineering Station's Display of IGES File

3.2.1.1 28000 Conformance of AutoCAD's IGES

First, the table shows that the IGES files AutoCAD created did not conform to 28000 because they were missing the required Drawing and Drawing Property Entities. Furthermore, the files contained text of a non-allowed text font and Composite Curve Entities made up of only one curve. All problems were attributed to AutoCAD's IGES pre-processor.

The missing Drawing and Drawing Property Entities bring up an interesting point. 28000 requires these entities, yet AutoCAD, like many microcomputer-based CAD systems, does not inherently have the "Drawing" concept in its drafting package. CALS faces a sizable decision regarding CAD packages with less inherent sophistication than the specification allows. Should the Office of the Secretary of Defense (OSD) CALS Policy Office ask microcomputer-based systems to bring their CAD packages up to 28000 levels (possibly an impossible task), or create another subset for less capable systems?

3.2.1.2 Correct Syntax of AutoCAD's IGES

Next, the table shows that AutoCAD incorrectly set the Line Font Field of the Directory Entry Section to zero for certain entities. This is an AutoCAD pre-processor syntax error.

3.2.1.3 Correct Graphics of AutoCAD's IGES

Finally, AutoCAD's IGES files did not correctly contain representations of all of the original graphics drafted by Tracor. Problems included large title block text, incorrectly written special characters (for example, the degree or plus and minus symbols), and improperly filled arrowheads and shaded areas. The plots display these graphical problems. The large title block text was caused by Tracor's use of a special shape font which AutoCAD's processor did not properly translate into IGES. The special characters were incorrectly generated because AutoCAD does not make use of the

special character font that IGES and 28000 allows. The inaccurate and missing fill is an AutoCAD software bug.

3.2.1.4 Correct Display of Graphics by Anvil

The last section of Table I lists the graphical problems uncovered after the complete end-to-end transfer of the engineering drawing sheets and their display on the Engineering Station's Anvil system. The AutoCAD problems still existed, but in addition, Anvil produced several more graphical errors while post-processing the IGES file. Those problems included missing circles on the revision notes, missing large filled arrows, missing arrowheads from the small arrows, and various missing details (those saved as subfigures or blocks). All were attributed to Anvil's non-processing of three entities: the Copious Data Simple Closed Area, the Subfigure Instance, and the Subfigure Definition Entities. MCS Inc. claims it has added the support of both these entities to its new version (Release 2.0) of Anvil 5000.

To make present use of the data, the Engineering Station and Tracor discussed a work around that would eliminate most of these problems. It involved exploding all closed area and subfigure data at Tracor before pre-processing the file. This would eliminate these entities from the IGES file, therefore Anvil could properly generate the graphics, but on the down side, this procedure would also create a larger file.

3.2.2 Preparatory CTN Reference Drawing Testing

As preparatory work to the end-to-end test using the actual engineering drawing, Tracor and the Engineering Station transferred the CTN Reference Drawings. This transfer involved following the pre-processor scripts on AutoCAD to develop the reference drawings, pre-processing them to IGES, and post-processing them into Anvil to answer the questions in the evaluation scripts. A second test involved purely a single-ended test with Anvil and the CTN platform. This was done to determine the capabilities of Anvil.

Results of the end-to-end and the single-ended reference drawing tests are shown in Appendix B and C respectively. Results include a table describing by entity number, which 28000 entities of the "N-entity" and "L-bracket" drawings were processed by each processor, and if not, where the problem was attributed. Plots also accompany the tables to graphically display the entities that were pre- and post-processed. To explain the pre-processed "N-entity" drawings, the entities occupy a square only if the translator pre-processed them into the IGES file. If an entity was not used by the drafting package or IGES translator or mapped to a different entity instead, the square was left blank. Thus, in the case of AutoCAD which pre-processes only a few IGES entities the drawing appears empty, but as demonstrated in the actual engineering drawing testing the system is able to transfer most of the graphical information necessary for a typical drawing. The plots show that Anvil translated a fair number of the 28000 entities well.

4 Conclusions and Recommendations

Overall, the results of the end-to-end test were good and the preparatory testing useful. Tracor and the Engineering Station were pleased to learn about work arounds for the present problems and to receive commitments from the vendors for better and more 28000 support in the future. Autodesk Inc. issued a verbal corporate statement that it intends to support CALS to the extent possible given its microcomputer-based technology. In the meantime, Autodesk hopes that this microcomputer technology will improve and/or that the standards making committees will recognize the importance microcomputers have in today's industry and revise the standards to reflect this. Furthermore, MCS, Inc. corporately announced in writing its intent to support CALS, including the creation of 28000-subset-compliant processors to help the users directly meet the CALS requirements. As a result of the testing, the CTN technical staff recommends that:

1. 1840A be modified to clarify what is required within document identifiers and to address identifiers for multiple sheeted engineering drawings. Possible solutions may come from the upcoming CTN large volume transfer tests.

2. The words concerning the transfer media requirements be removed from 1840A and placed in new CALS specifications governing an expanded list of transfer media.

3. The OSD CALS Policy Office begin to study an approach for allowing limited microcomputer-based CAD systems to become more easily CALS compliant, possibly looking into a new subset or application protocol.

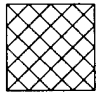
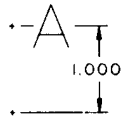
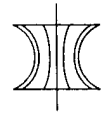
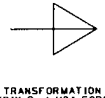
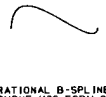
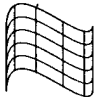
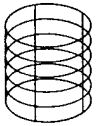
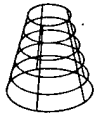
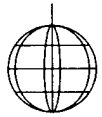
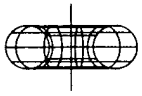
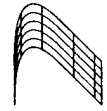
4. Autodesk, Inc. continue to improve its AutoCAD IGES processors and to allow for user-created Start Sections.

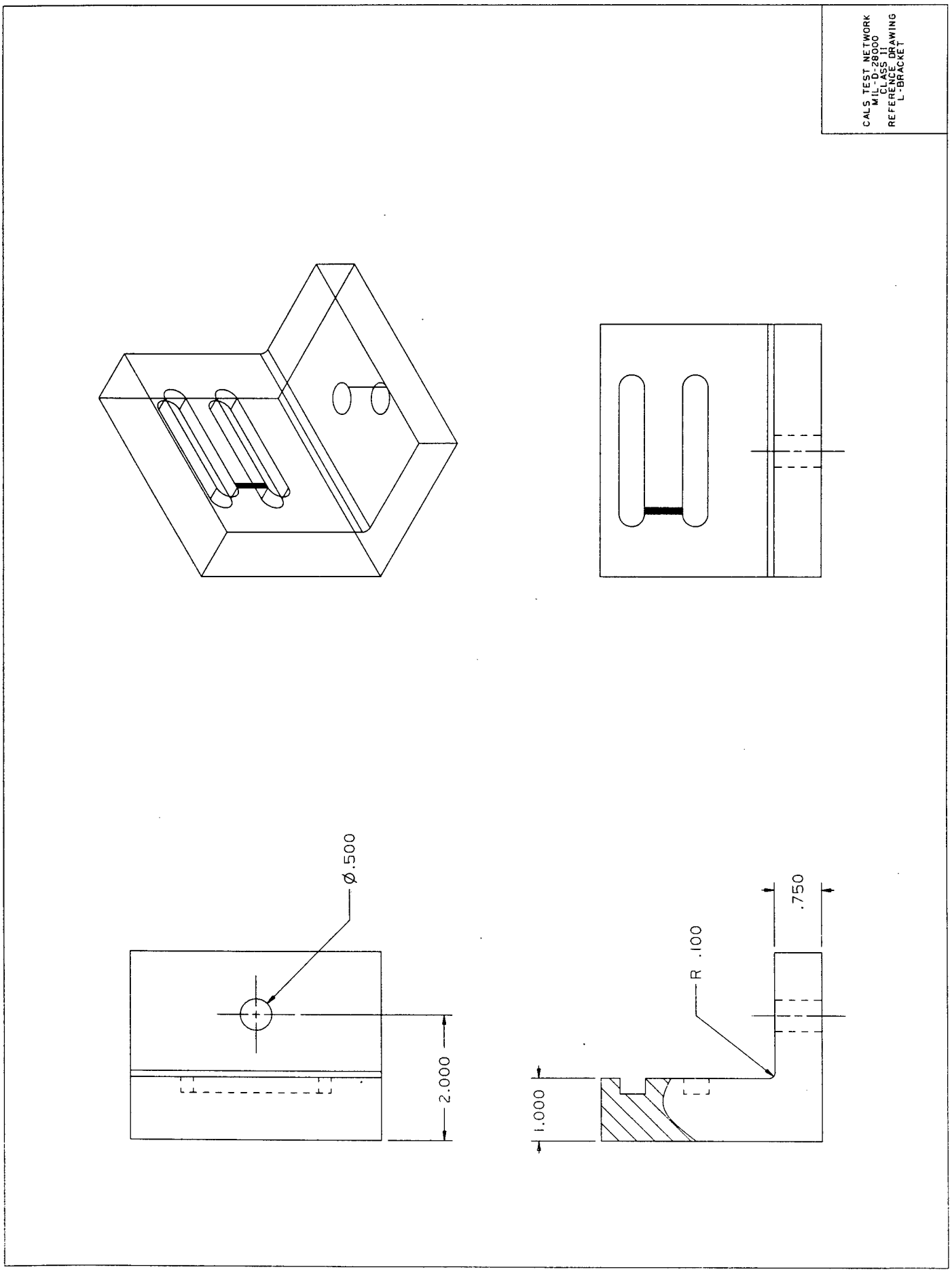
5. MCS, Inc. continue to improve its Anvil IGES processors to support more 28000 entities.

Appendix A

Plots of the standard CALS Test Network MIL-D-28000 Class II Reference Drawings "N-entity" and "L-bracket"

CTN N-Entity Reference Drawing

 CIRCULAR ARC (100)	 COMPOSITE CURVE (102)	 CONIC ARC - GENERAL (104 FORM 0)	 CONIC ARC - ELLIPSE (104 FORM 1)	CONIC ARC - HYPERBOLA (104 FORM 2)	 CONIC ARC - PARABOLA (104 FORM 3)	 LINEAR PLANAR CURVE (106 FORM 11)	 COORDINATE TRIPLES (106 FORM 12)	CENTERLINE THRU POINTS (106 FORM 20)	 CENTERLINE THRU CENTERS (106 FORM 21)
 SECTION 31 (106 FORM 31)	 SECTION 32 (106 FORM 32)	 SECTION 33 (106 FORM 33)	 SECTION 34 (106 FORM 34)	 SECTION 35 (106 FORM 35)	 SECTION 36 (106 FORM 36)	 SECTION 37 (106 FORM 37)	 SECTION 38 (106 FORM 38)	 WITNESS LINE (106 FORM 40)	 SIMPLE CLOSED AREA (106 FORM 63)
 UNBOUNDED PLANE (108 FORM 0)	 BOUNDED PLANE (108 FORM 1)	LINE (110)	 PARAMETRIC SPLINE CURVE (112)	 PARAMETRIC SPLINE SURFACE (114)	POINT (116)	 RULED SURFACE - ARC LENGTH (118 FORM 0)	 RULED SURFACE - PARAMETRIC (118 FORM 1)	 SURFACE OF REVOLUTION (120)	 TABULATED CYLINDER (122)
 TRANSFORMATION MATRIX D=1 (124 FORM 0)	 TRANSFORMATION MATRIX D=-1 (124 FORM 1)	 RATIONAL B-SPLINE CURVE (126 FORM 0)	 RATIONAL B-SPLINE SURFACE (128 FORM 0)	 RBS RIGHT CIRC CYLINDER (128 FORM 2)	 RBS CONE (128 FORM 3)	 RBS SPHERE (128 FORM 4)	 RBS TORUS (128 FORM 5)	 RBS GENERAL QUADRATIC (128 FORM 9)	 OFFSET CURVE (130)
OFFSET SURFACE (140)	CURVE ON PARAMETRIC SURFACE (142)	TRIMMED PARAMETRIC SURFACE (144)	ANGULAR DIMENSION (202)	DIAMETER DIMENSION (206)	GENERAL LABEL (210)	GENERAL NOTE - SIMPLE (212 FORM 0)	NOTE - DUAL STACK (212 FORM 1)	NOTE - IMBEDDED FONT CHANGE (212 FORM 2)	NOTE - SUPERSCRIPT (212 FORM 3)
NOTE - SUBSCRIPT (212 FORM 4)	NOTE - SUPER/SUB SCRIPT (212 FORM 5)	NOTE - MULTI STACK LEFT JUST (212 FORM 6)	NOTE - MULTI STACK CENT JUST (212 FORM 7)	NOTE - MULTI STACK RIGHT JUST (212 FORM 8)	NOTE - SIMPLE FRACTION (212 FORM 100)	NOTE - DUAL STACK FRACTION (212 FORM 101)	NOTE - FONT/DOUBLE FRACTION (212 FORM 102)	NOTE - SUPER/SUB FRACTION (212 FORM 105)	LEADER - WEDGE (214 FORM 1)
LEADER - TRIANGLE (214 FORM 2)	LEADER - FILLED TRIANGLE (214 FORM 3)	LEADER - NO ARROW (214 FORM 4)	LEADER - CIRCLE (214 FORM 5)	LEADER - FILLED CIRCLE (212 FORM 6)	LEADER - RECTANGLE (214 FORM 7)	LEADER - FILLED RECTANGLE (214 FORM 8)	LEADER - SLASH (214 FORM 9)	LEADER - INTEGRAL SIGN (214 FORM 10)	LEADER - OPEN TRIANGLE (214 FORM 11)
LINEAR DIMENSION (216)	ORDINATE DIMENSION (218)	POINT DIMENSION (220)	RADIUS DIMENSION (222)	SYMBOL - GENERAL (228 FORM 0)	SYMBOL - DATUM FEATURE (228 FORM 1)	SYMBOL - DATUM TARGET (228 FORM 2)	SYMBOL - FEATURE CONTROL (228 FORM 3)	SECTIONED AREA (230)	CALS TEST NETWORK MIL-D-28000 CLASS II REFERENCE DRAWING N-ENTITY



CTN L-bracket Reference Drawing

Appendix B

Results of the preparatory end-to-end test between Tracor and the Engineering Station using the reference drawings

Table:

Table B-I describes by entity name and number which 28000 entities of the "N-entity" and "L-bracket" drawings were processed during the end-to-end transfer between Tracor and the Engineering Station.

Plots:

Tracor's Original N-entity Drawing = displays the "N-entity" drawing as drafted on AutoCAD.

Tracor's N-entity IGES Representation = displays the graphics represented in the IGES file pre-processed by AutoCAD.

Engineering Station's Display of N-entity IGES File = shows what entities present in the IGES file were displayed on the Engineering Station's Anvil system.

Tracor's Original L-bracket Drawing = displays the "L-bracket" drawing as drafted on AutoCAD.

Tracor's L-bracket IGES Representation = displays the graphics represented in the IGES file pre-processed by AutoCAD.

Engineering Station's Display of L-bracket IGES File = shows what entities present in the IGES file were displayed on the Engineering Station's Anvil system.

Table B-I
End-to-end Processing of MIL-D-28000 Class II Entities Between Tracor and the Engineering Station

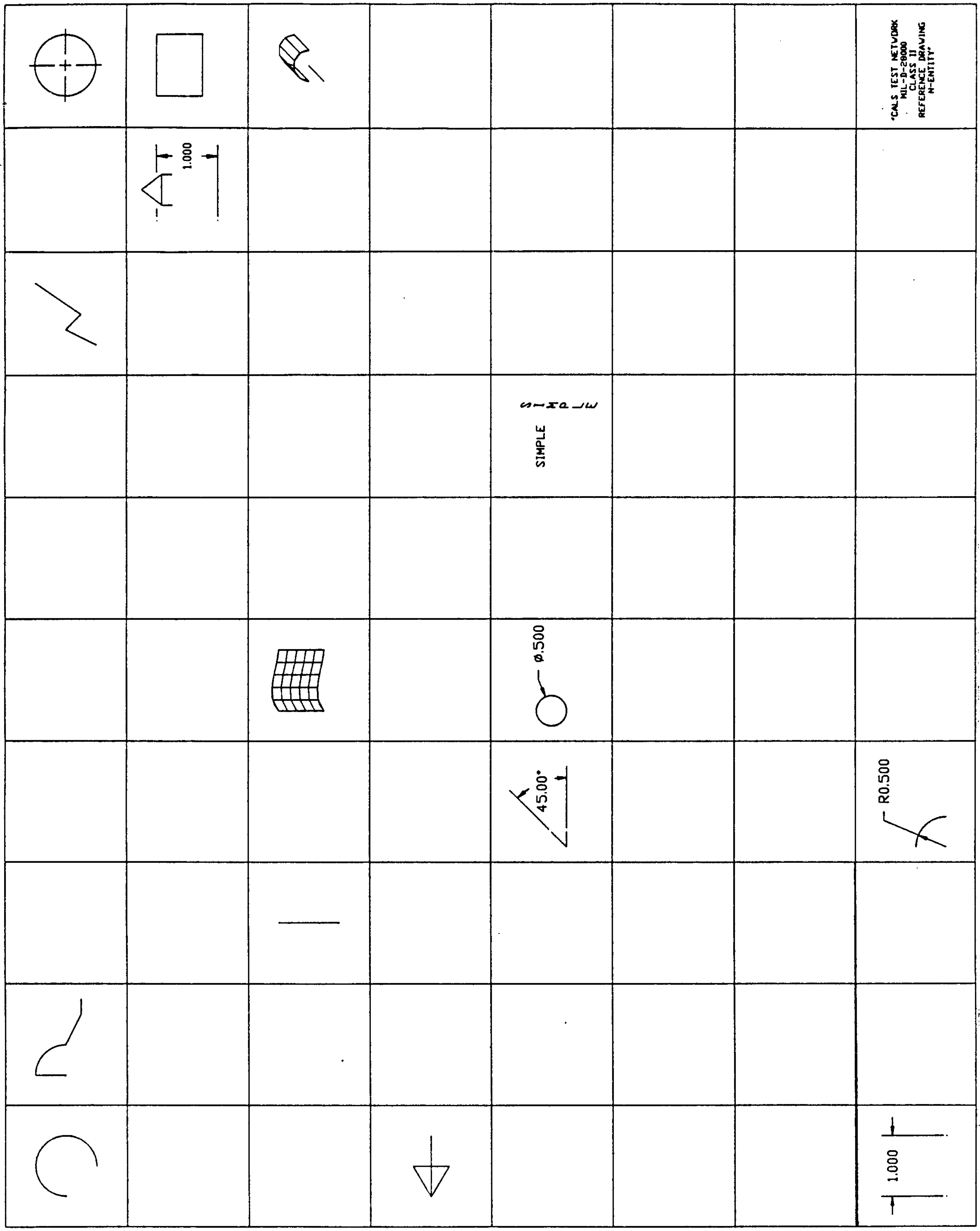
Entity Number	Form Number	Entity Name	Pre-processed from AutoCAD	If no, where attributed	If pre-processed, then post-processed into Anvil	If no, where attrib.
100		Circular Arc	yes	-	yes	-
102		Composite Curve	part	AD	yes	-
104	0	Conic Arc-General	no	AD	-	-
104	1	Conic Arc-Ellipse	no	AP	-	-
104	2	Conic Arc-Hyperbola	no	AD	-	-
104	3	Conic Arc-Parabola	no	AD	-	-
106	11	Linear Planar Curve	no	AP	-	-
106	12	Coordinate Triples	yes	-	yes	-
106	20	Centerline Thru Point	no	AP	-	-
106	21	Centerline Thru Centr	yes	-	yes	-
106	31	Section Form 31	no	AP	-	-
106	32	Section Form 32	no	AP	-	-
106	33	Section Form 33	no	AP	-	-
106	34	Section Form 34	no	AP	-	-
106	35	Section Form 35	no	AP	-	-
106	36	Section Form 36	no	AP	-	-
106	37	Section Form 37	no	AP	-	-
106	38	Section Form 38	no	AP	-	-
106	40	Witness Line	part	AD	yes	-
106	63	Simple Closed Area	yes	-	no	NP
108	0	Unbounded Plane	no	AD	-	-
108	1	Bounded Plane	no	AP	-	-
110		Line	yes	-	yes	-
112		Param Spline Curve	no	AP	-	-
114		Param Spline Surface	yes	-	yes	-
116		Point	yes	-	yes	-
118	0	Ruled Surf-Arc Lngth	no	AP	-	-
118	1	Ruled Surf-Param	no	AP	-	-
120		Surface of Revolution	no	AP	-	-
122		Tabulated Cylinder	yes	-	yes	-
124	0	Transf Matrix D = 1	yes	-	yes	-
124	1	Transf Matrix D = -1	no	AP	-	-
126	0	Rat B-Spline Curve	no	AP	-	-

Entity Number	Form Number	Entity Name	Pre-processed from AutoCAD	If no, where attributed	If pre-processed, then post-processed into Anvil	If no, where attrib.
128	0	Rat B-Spline Surface	no	AP	-	-
128	2	RBS Rt Circ Cylinder	no	AP	-	-
128	3	RBS Cone	no	AP	-	-
128	4	RBS Sphere	no	AP	-	-
128	5	RBS Torus	no	AP	-	-
128	9	RBS General Quadratic	no	AP	-	-
130		Offset Curve	no	AP	-	-
140		Offset Surface	no	AD	-	-
142		Curve on Param Surf	no	AD	-	-
144		Trimmed Param Surf	no	AD	-	-
202		Angular Dimension	part	AP	yes	-
206		Diameter Dimension	part	AP	part	NP
210		General Label	no	AP	-	-
212	0	General Note-Simple	part	AP	part	NP
212	1	Note-Dual Stack	no	AP	-	-
212	2	Note-Imbed Font Chnge	no	AP	-	-
212	3	Note-Superscript	no	AD	-	-
212	4	Note-Subscript	no	AD	-	-
212	5	Note-Super/Subscript	no	AD	-	-
212	6	Note-Mu Stack Lf Just	no	AP	-	-
212	7	Note-Mu Stack Ct Just	no	AP	-	-
212	8	Note-Mu Stack Rt Just	no	AP	-	-
212	100	Note-Simple Fraction	no	AD	-	-
212	101	Note-Dual Stack Fract	no	AD	-	-
212	102	Note-Font/Dble Fract	no	AD	-	-
212	105	Note-Super/Sub Fract	no	AD	-	-
214	1	Leader-Wedge	no	AD	-	-
214	2	Leader-Triangle	no	AD	-	-
214	3	Leader-Fill Triangle	no	T	-	-
214	4	Leader-No Arrow	no	T	-	-
214	5	Leader-Circle	no	AD	-	-
214	6	Leader-Filled Circle	no	T	-	-
214	7	Leader-Rectangle	no	AD	-	-
214	8	Leader-Fill Rectangle	no	AD	-	-
214	9	Leader-Slash	no	T	-	-
214	10	Leader-Integral Sign	no	AD	-	-
214	11	Leader-Open Triangle	no	AP	-	-
216		Linear Dimension	yes	-	part	NP
218		Ordinate Dimension	no	AD	-	-
220		Point Dimension	no	AD	-	-

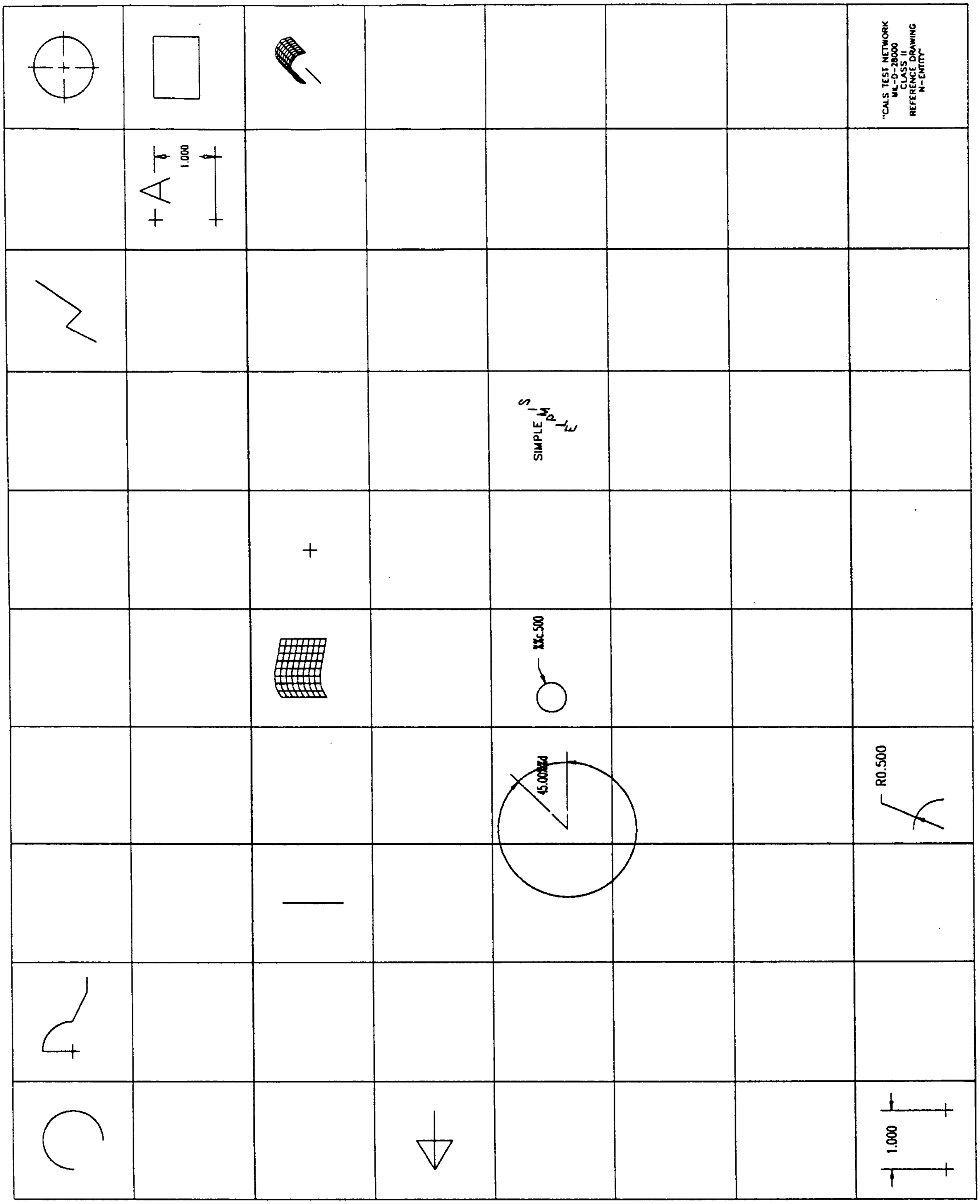
Entity Number	Form Number	Entity Name	Pre-processed from AutoCAD	If no, where attributed	If pre-processed, then post-processed into Anvil	If no, where attrib.
222		Radius Dimension	yes	-	yes	-
228	0	Symbol-General	no	AD	-	-
228	1	Symbol-Datum Feature	no	AD	-	-
228	2	Symbol-Datum Target	no	AD	-	-
228	3	Symbol-Feature Contrl	no	AD	-	-
230		Sectioned Area	no	AP	-	-
304	1	Line Font-Rept Subfig	no	AP	-	-
304	2	Line Font-Rept Vs/bnk	yes	-	yes	-
308		Subfigure Definition	yes	-	no	NP
314		Color Definition	no	AP	-	-
402	3	Views Visible	no	AD	-	-
402	4	View Vble/Color/Line	no	AD	-	-
402	15	Ordr Group wo B Point	no	AD	-	-
404		Drawing	no	AD	-	-
406	1	Definition Levels	no	AD	-	-
406	3	Level Function	no	AP	-	-
406	5	Line Widening	no	AP	-	-
406	15	Name	no	AD	-	-
406	16	Drawing Size	no	AD	-	-
406	17	Drawing Units	no	AD	-	-
408		Subfigure Instance	yes	-	no	NP
410		View	no	AD	-	-

KEY

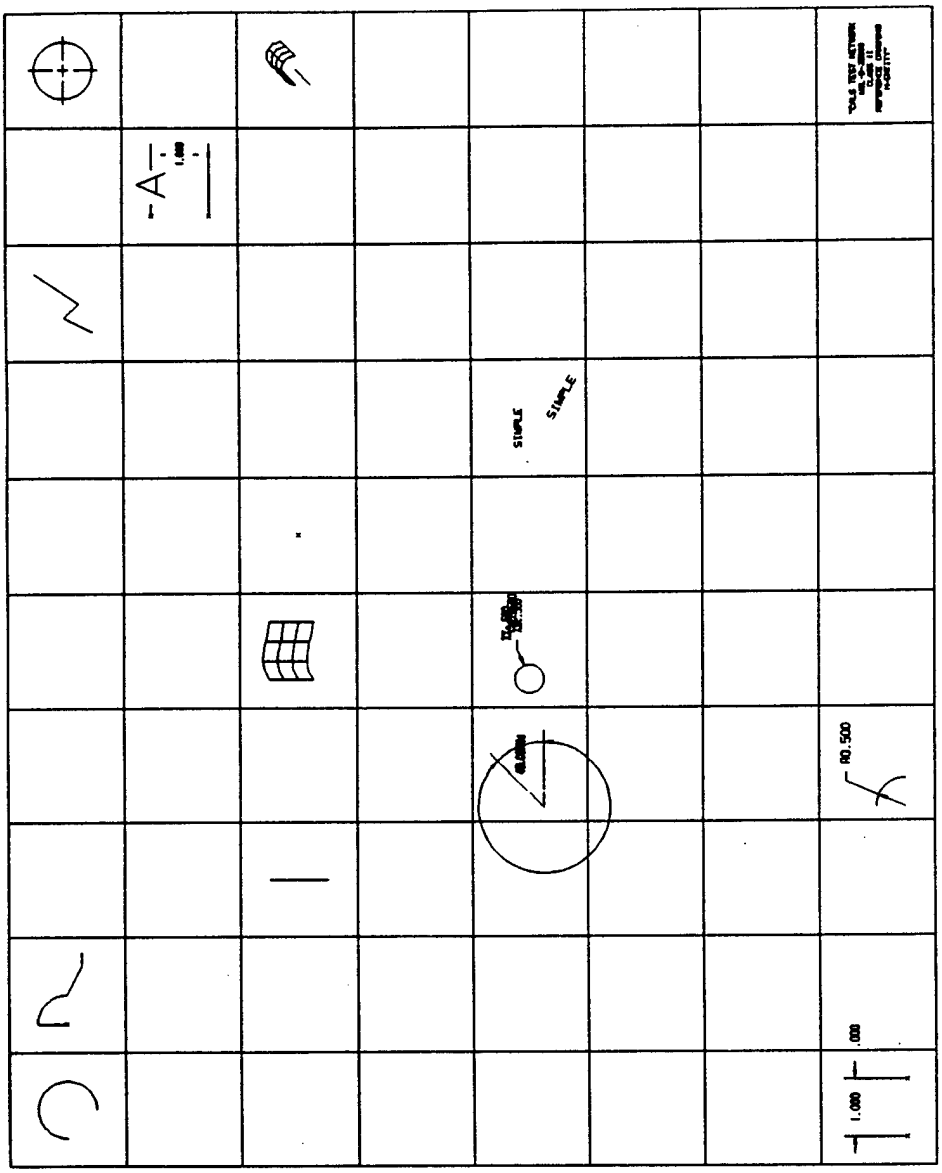
yes = entity maintained its intent and functionality upon pre- or post-processing
part = entity maintained partial intent or functionality and/or was able to transfer part of the information
no = entity was not translated
AD = entity could not be created by AutoCAD's drafting package, therefore not translated
AP = entity incorrectly or not translated by AutoCAD's IGES pre-processor
T = entity could not be created by AutoCAD's drafting package as described in the test case generation script, therefore entity not tested
ND = entity could not be created by Anvil's drafting package, therefore not translated
NP = entity incorrectly or not translated by Anvil's IGES post-processor
- = not applicable



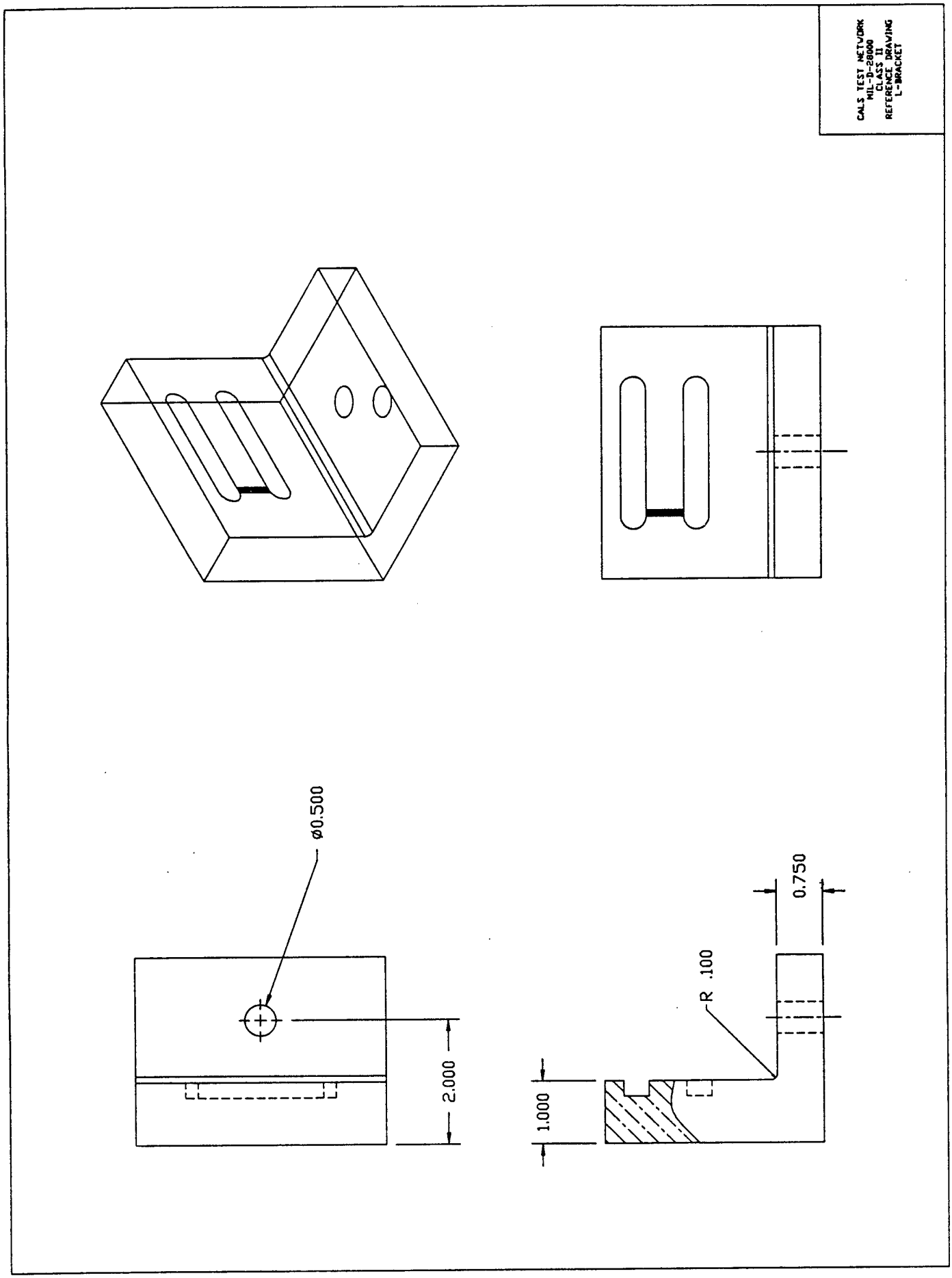
Tracor's Original N-Entity Drawing



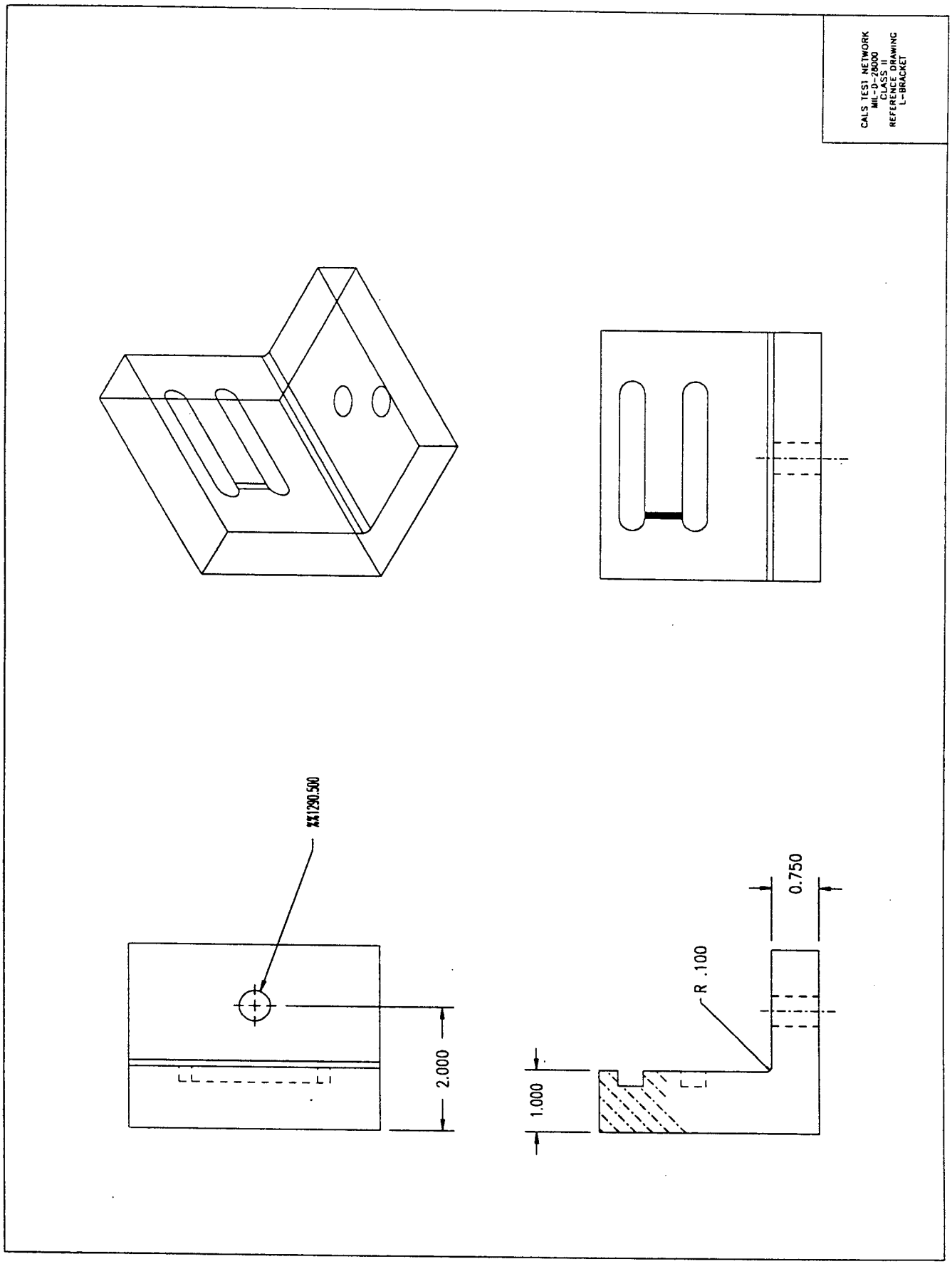
Tracor's N-entity IGES Representation



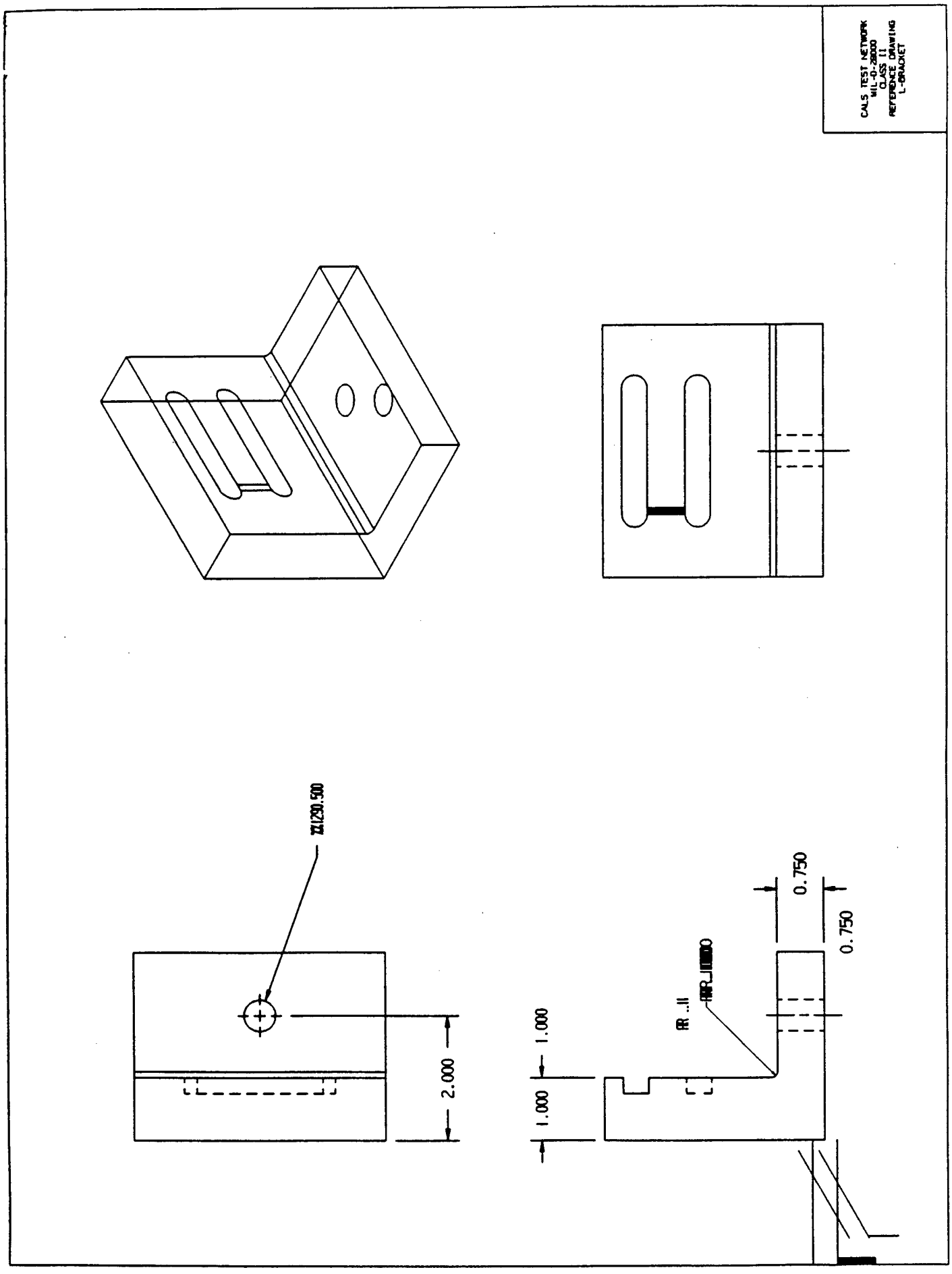
Engineering Station's Display N-entity IGES File



Tracor's Original L-bracket Drawing



Tracor's L-bracket IGES Representation



Engineering Station's Display of L-bracket IGES File

Appendix C

Results of the preparatory single-ended test with the Engineering Station's Anvil system using the reference drawings

Table:

Table C-I describes by entity name and number which 28000 entities of the "N-entity" and "L-bracket" drawings were processed by the Engineering Station's Anvil system.

Plots:

Anvil N-entity Before Pre-processing = displays the 28000 "N–entity" entities Anvil created to pre-processes into IGES.

Anvil N-entity IGES Representation = displays the graphics represented in Anvil's pre-processed IGES file.

Anvil L-bracket Before Pre-processing = displays the "L-bracket" drawing Anvil created to pre-processes into IGES.

Anvil L-bracket IGES Representation = displays the graphics represented in Anvil's pre-processed IGES file.

Anvil N-entity After Post-processing = displays the "N-entity" entities post-processed by Anvil.

Anvil L-bracket After Post-processing = displays the "L-bracket" drawing after post-processing by Anvil.

Table C-I
The Ability of Anvil 5000 to Pre- and Post-process the MIL-D-28000 Class II Entities

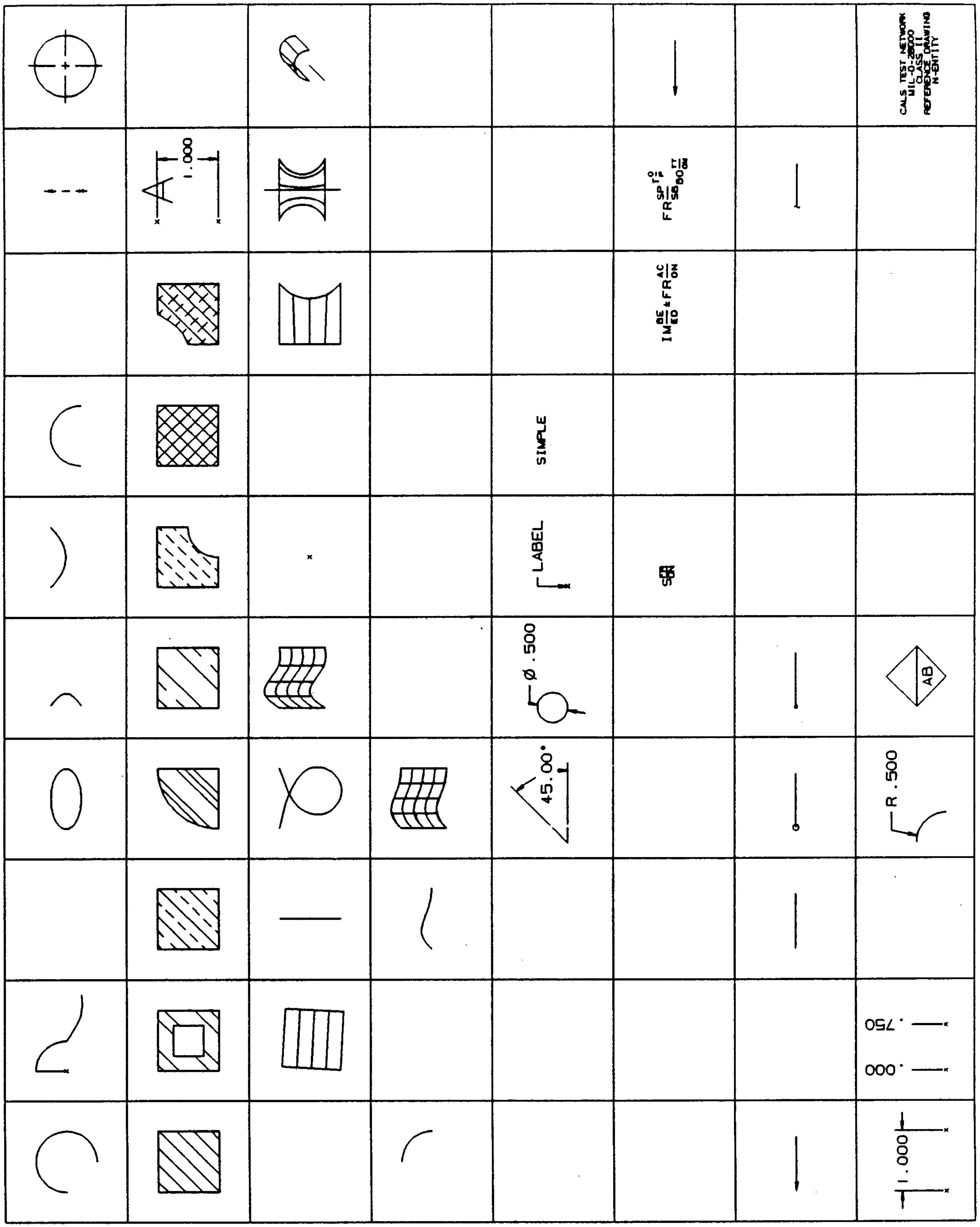
Entity Number	Form Number	Entity Name	Pre-process from Anvil	If no, where attributed	Post-process into Anvil	If no, where attributed
100		Circular Arc	yes	-	yes	-
102		Composite Curve	part	DP	part	P
104	0	Conic Arc-General	no	P	yes	-
104	1	Conic Arc-Ellipse	yes	-	yes	-
104	2	Conic Arc-Hyperbola	yes	-	yes	-
104	3	Conic Arc-Parabola	yes	-	yes	-
106	11	Linear Planar Curve	yes	-	yes	-
106	12	Coordinate Triples	no	P	yes	-
106	20	Centerline Thru Point	yes	-	yes	-
106	21	Centerline Thru Centr	yes	-	yes	-
106	31	Section Form 31	yes	-	part	P
106	32	Section Form 32	part	P	part	P
106	33	Section Form 33	part	P	part	P
106	34	Section Form 34	part	P	map	D
106	35	Section Form 35	part	P	part	P
106	36	Section Form 36	part	P	yes	-
106	37	Section Form 37	yes	-	yes	-
106	38	Section Form 38	part	P	yes	-
106	40	Witness Line	part	D	part	P
106	63	Simple Closed Area	no	D	no	P
108	0	Unbounded Plane	part	D	yes	-
108	1	Bounded Plane	part	P	part	P
110		Line	yes	-	yes	-
112		Param Spline Curve	yes	-	yes	-
114		Param Spline Surface	yes	-	yes	-
116		Point	yes	-	yes	-
118	0	Ruled Surf-Arc Lngth	no	D	yes	-
118	1	Ruled Surf-Param	part	P	yes	-
120		Surface of Revolution	yes	-	yes	-
122		Tabulated Cylinder	yes	-	yes	-
124	0	Transf Matrix D = 1	yes	-	part	P

Entity Number	Form Number	Entity Name	Pre-process from Anvil	If no, where attributed	Post-process into Anvil	If no, where attributed
124	1	Transf Matrix D = -1	no	P	part	P
126	0	Rat B-Spline Curve	yes	-	part	S
128	0	Rat B-Spline Surface	yes	-	part	S
128	2	RBS Rt Circ Cylinder	no	P	part	S
128	3	RBS Cone	no	P	part	S
128	4	RBS Sphere	no	P	yes	-
128	5	RBS Torus	no	P	yes	-
128	9	RBS General Quadratic	no	P	part	S
130		Offset Curve	no	P	no	D
140		Offset Surface	no	P	no	P
142		Curve on Param Surf	no	P	yes	-
144		Trimmed Param Surf	no	P	part	P
202		Angular Dimension	yes	-	yes	-
206		Diameter Dimension	yes	-	part	P
210		General Label	yes	-	yes	-
212	0	General Note-Simple	part	D	part	P
212	1	Note-Dual Stack	no	P	yes	-
212	2	Note-Imbed Font Chnge	no	P	part	D
212	3	Note-Superscript	no	P	yes	-
212	4	Note-Subscript	no	P	yes	-
212	5	Note-Super/Subscript	no	P	yes	-
212	6	Note-Mu Stack Lf Just	no	P	yes	-
212	7	Note-Mu Stack Ct Just	no	D	yes	-
212	8	Note-Mu Stack Rt Just	no	D	yes	-
212	100	Note-Simple Fraction	yes	-	yes	-
212	101	Note-Dual Stack Fract	no	P	yes	-
212	102	Note-Font/Dble Fract	yes	-	part	D
212	105	Note-Super/Sub Fract	yes	-	yes	-
214	1	Leader-Wedge	yes	-	yes	-
214	2	Leader-Triangle	yes	-	yes	-
214	3	Leader-Fill Triangle	no	D	map	D
214	4	Leader-No Arrow	yes	-	yes	-
214	5	Leader-Circle	yes	-	part	P
214	6	Leader-Filled Circle	yes	-	yes	-
214	7	Leader-Rectangle	no	D	map	D
214	8	Leader-Fill Rectangle	no	D	map	D
214	9	Leader-Slash	no	D	map	D
214	10	Leader-Integral Sign	yes	-	yes	-

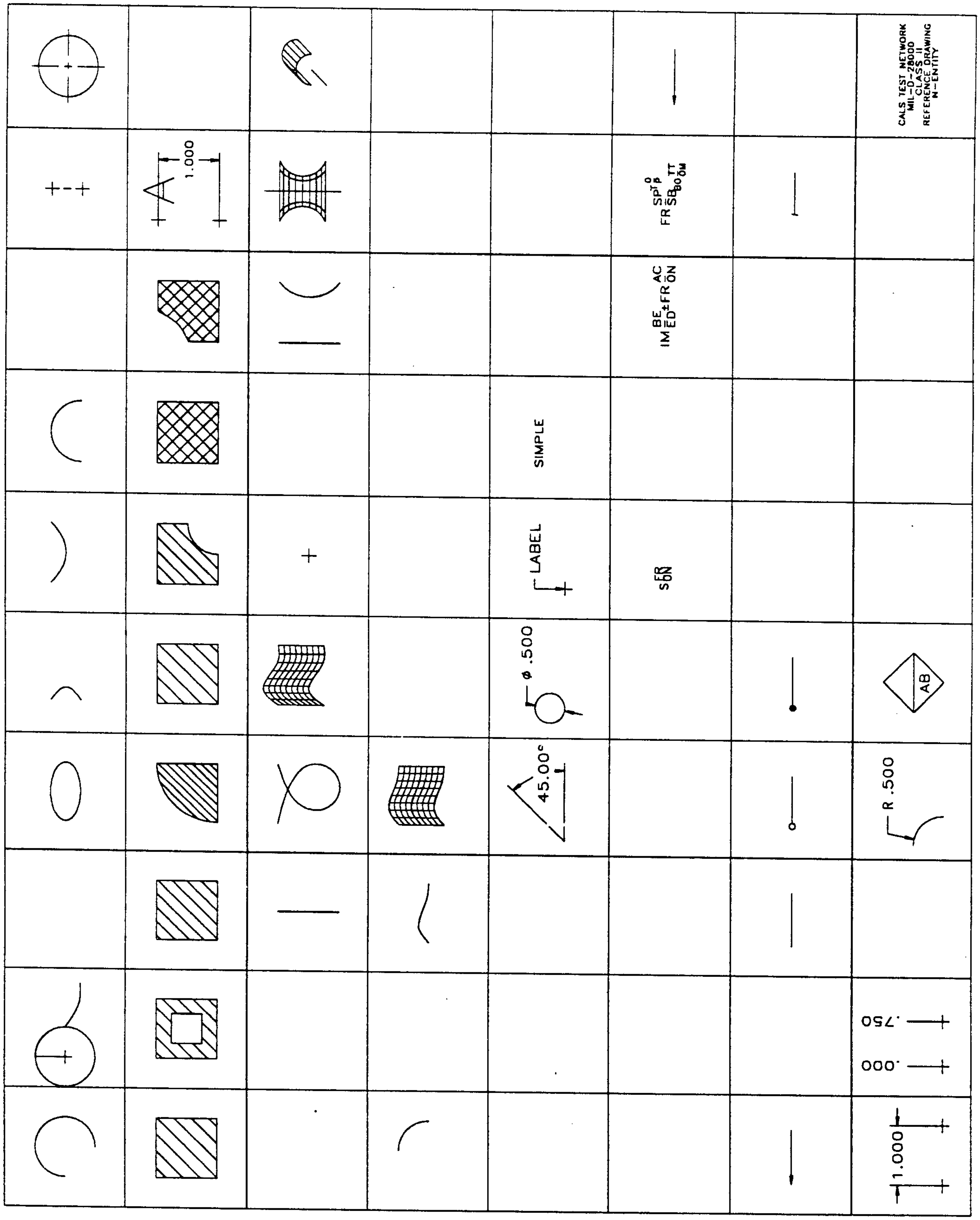
Entity Number	Form Number	Entity Name	Pre-process from Anvil	If no, where attributed	Post-process into Anvil	If no, where attributed
214	11	Leader-Open Triangle	no	D	map	D
216		Linear Dimension	yes	-	yes	-
218		Ordinate Dimension	yes	-	yes	-
220		Point Dimension	no	D	no	D
222		Radius Dimension	yes	-	yes	-
228	0	Symbol-General	yes	-	part	P
228	1	Symbol-Datum Feature	no	D	part	P
228	2	Symbol-Datum Target	no	D	part	P
228	3	Symbol-Feature Contrl	no	D	part	P
230		Sectioned Area	no	P	no	P
304	1	Line Font-Rept Subfig	no	P	?	-
304	2	Line Font-Rept Vs/bnk	yes	-	?	-
308		Subfigure Definition	no	P	no	P
314		Color Definition	no	P	no	P
402	3	Views Visible	no	P	?	-
402	4	View Vble/Color/Line	no	P	no	P
402	15	Ordr Group wo B Point	no	P	no	P
404		Drawing	part	P	part	P
406	1	Definition Levels	no	D	no	D
406	3	Level Function	no	P	no	P
406	5	Line Widening	no	P	no	P
406	15	Name	yes	-	yes	-
406	16	Drawing Size	yes	-	yes	-
406	17	Drawing Units	yes	-	yes	-
408		Subfigure Instance	no	P	no	P
410		View	yes	-	yes	-

KEY

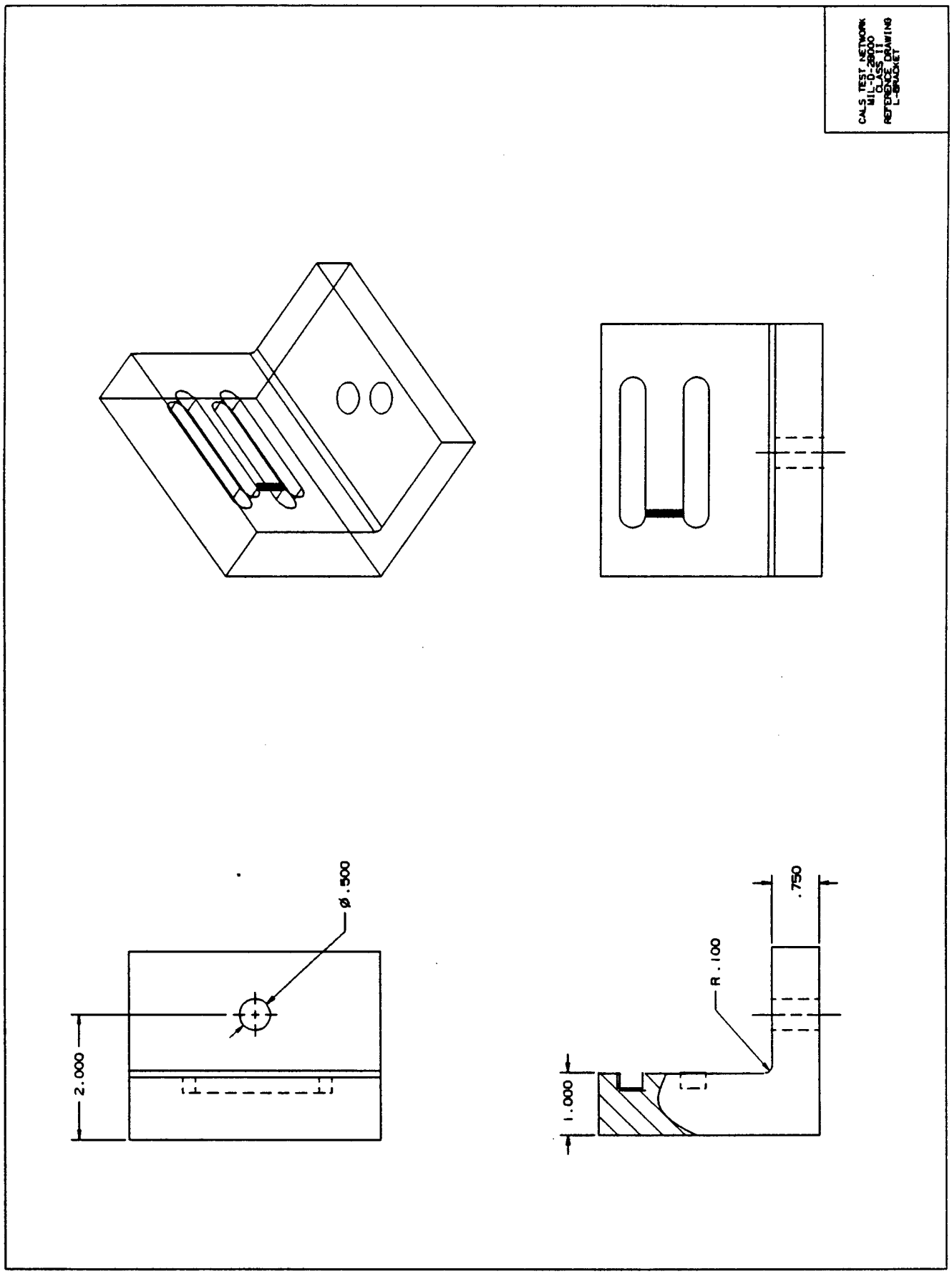
yes = entity maintained its intent and functionality upon pre- or post-processing
part = entity maintained partial intent or functionality and/or was able to transfer part of the information
map = intended information was transferred into or by not specified entity, but a similar entity
no = entity was not translated
D = entity could not be created by Anvil's drafting package, therefore not translated
P = entity was not or incorrectly translated by Anvil's IGES pre-processor
S = data was transferred, but not properly displayed by Anvil's display code
- = not applicable
? = could not be determined due to incomplete post-processing of "L-bracket" drawing



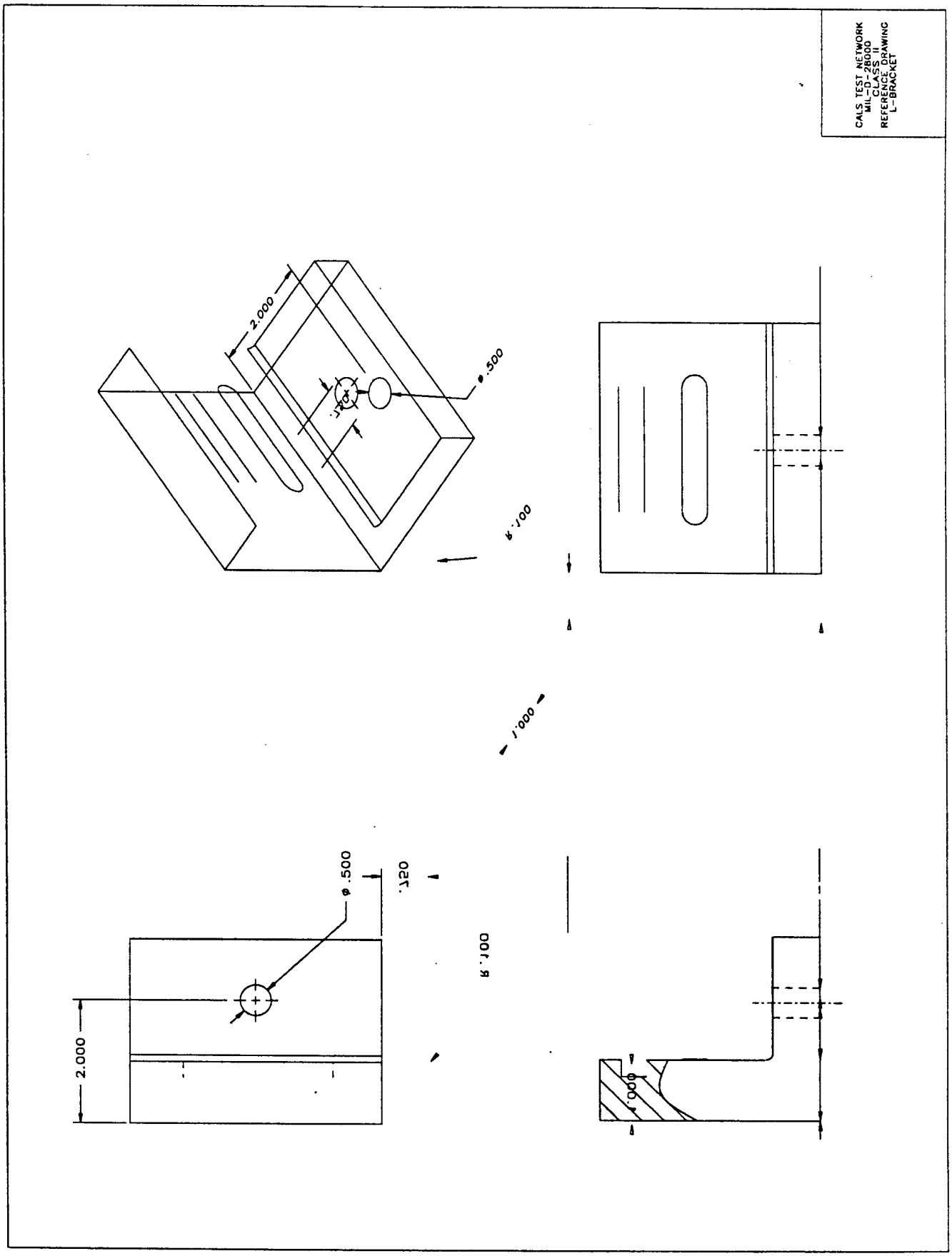
Anvil N-entity Before Pre-Processing



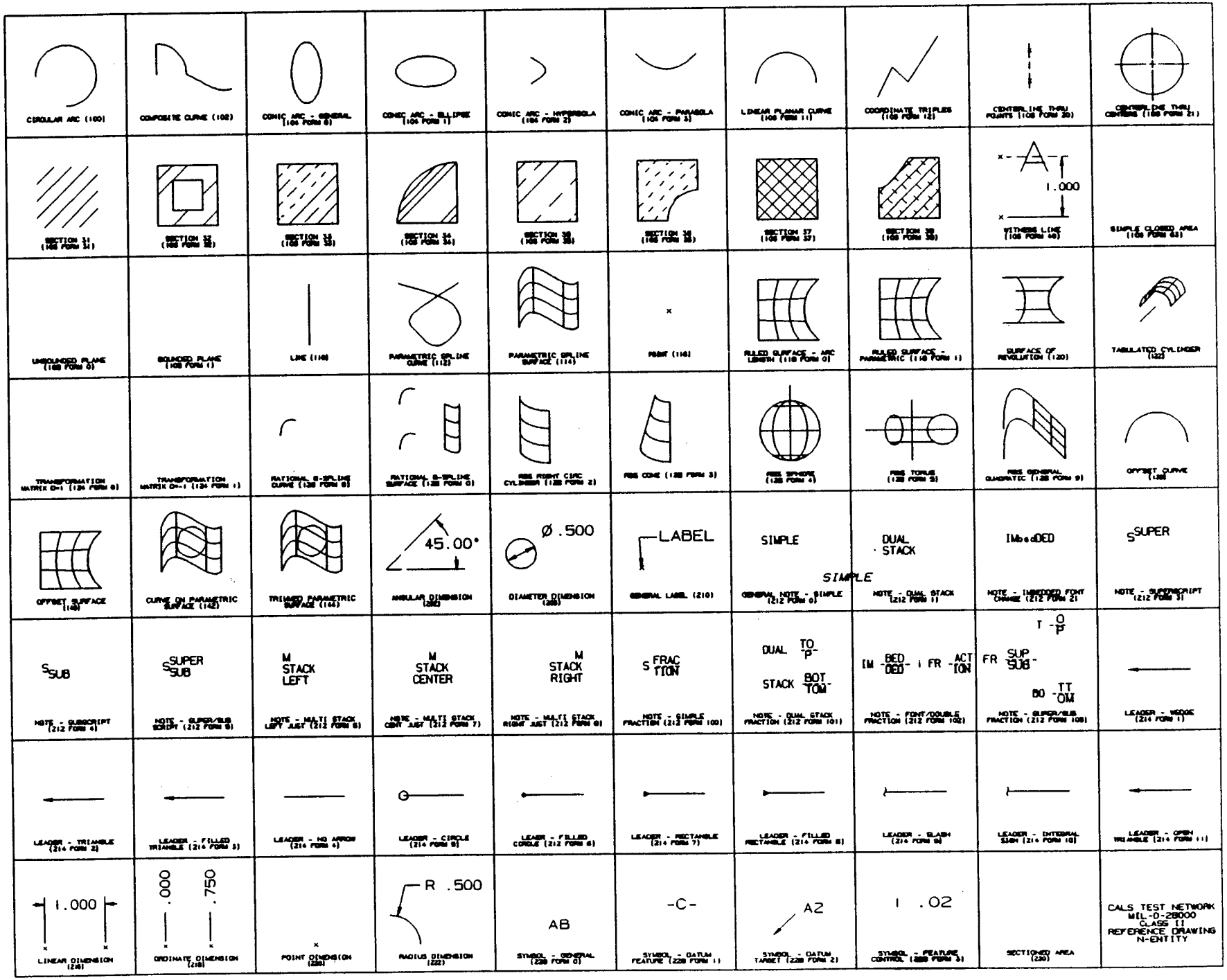
Anvil N-entity IGES Representation



Anvil L-bracket Before Pre-processing



Anvil L-bracket IGES Representation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COMPOSITE CURVE (102)
CONIC ARC - GENERAL (104 FORM 0)
CONIC ARC - ELLIPSE (104 FORM 1)
CONIC ARC - HYPERBOLA (104 FORM 2)
CONIC ARC - PARABOLA (104 FORM 3)
LINEAR PLANAR CURVE (106 FORM 11)
COORDINATE TRIPLES (106 FORM 12)
CENTERLINE THRU POINTS (106 FORM 20)
CENTERLINE THRU CENTERS (106 FORM 21)
SECTION 31 (106 FORM 31)
SECTION 32 (106 FORM 32)
SECTION 33 (106 FORM 33)
SECTION 34 (106 FORM 34)
SECTION 35 (106 FORM 35)
SECTION 36 (106 FORM 36)
SECTION 37 (106 FORM 37)
SECTION 38 (106 FORM 38)
1.000
WITNESS LINE (106 FORM 40)
SIMPLE CLOSED AREA (106 FORM 63)
UNBOUNDED PLANE (108 FORM 0)
BOUNDED PLANE (108 FORM 1)
LINE (110)
PARAMETRIC SPLINE CURVE (112)
PARAMETRIC SPLINE SURFACE (114)
POINT (116)
RULED SURFACE - ARC LENGTH (118 FORM 0)
RULED SURFACE - PARAMETRIC (118 FORM 1)
SURFACE OF REVOLUTION (120)
TABULATED CYLINDER (122)
TRANSFORMATION MATRIX D=1 (124 FORM 0)
TRANSFORMATION MATRIX D=1 (124 FORM 1)
RATIONAL B-SPLINE CURVE (126 FORM 0)
RATIONAL B-SPLINE SURFACE (128 FORM 0)
RBS POINT CIRC CYLINDER (128 FORM 2)
RBS CONE (128 FORM 3)
RBS SPHERE (128 FORM 4)
RBS TORUS (128 FORM 5)
RBS GENERAL QUADRATIC (128 FORM 9)
OFFSET CURVE (130)
OFFSET SURFACE (140)
CURVE ON PARAMETRIC SURFACE (142)
TRIMMED PARAMETRIC SURFACE (144)
45.00°
ANGULAR DIMENSION (202)
Ø .500
DIAMETER DIMENSION (206)
LABEL
GENERAL LABEL (210)
SIMPLE
SIMPLE
GENERAL NOTE - SIMPLE (212 FORM 0)
DUAL STACK
NOTE - DUAL STACK (212 FORM 1)
IMbedDED
NOTE - IMBEDDED FONT CHANGE (212 FORM 2)
SSUPER
NOTE - SUPERSCRIPT (212 FORM 3)
SSUB
NOTE - SUBSCRIPT (212 FORM 4)
SSUPER SUB
NOTE - SUPER/SUB SCRIPT (212 FORM 5)
M STACK LEFT
NOTE - MULTI STACK LEFT JUST (212 FORM 6)
M STACK CENTER
NOTE - MULTI STACK CENT JUST (212 FORM 7)
M STACK RIGHT
NOTE - MULTI STACK RIGHT JUST (212 FORM 8)
S FRAC TION
NOTE - SIMPLE FRACTION (212 FORM 100)
DUAL TO P-
STACK BOT TOM-
NOTE - DUAL STACK FRACTION (212 FORM 101)
IM -BED -DED- I FR -ACT -TION
NOTE - FONT/DOUBLE FRACTION (212 FORM 102)
T O P
FR SUP SUB-
BO TT OM
NOTE - SUPER/SUB FRACTION (212 FORM 108)
LEADER - WEDGE (214 FORM 1)
LEADER - TRIANGLE (214 FORM 2)
LEADER - FILLED TRIANGLE (214 FORM 3)
LEADER - NO ARROW (214 FORM 4)
LEADER - CIRCLE (214 FORM 5)
LEADER - FILLED CIRCLE (214 FORM 6)
LEADER - RECTANGLE (214 FORM 7)
LEADER - FILLED RECTANGLE (214 FORM 8)
LEADER - SLASH (214 FORM 9)
LEADER - INTEGRAL SLASH (214 FORM 10)
LEADER - OPEN TRIANGLE (214 FORM 11)
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LINEAR DIMENSION (218)
.000
.750
ORDINATE DIMENSION (218)
POINT DIMENSION (220)
R .500
RADIUS DIMENSION (222)
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SYMBOL - GENERAL (228 FORM 0)
-C-
SYMBOL - DATUM FEATURE (228 FORM 1)
A2
SYMBOL - DATUM TARGET (228 FORM 2)
I .02
SYMBOL - FEATURE CONTROL (228 FORM 3)
SECTIONED AREA (230)
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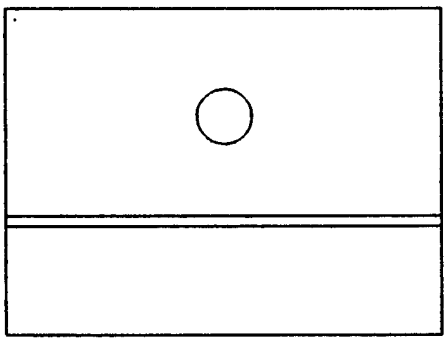
MIL-D-28000
CLASS II
REFERENCE DRAWING
N-ENTITY



Anvil L-bracket After Post-processing

Appendix D

References

[CTN89] CALS Test Network Test Plans, Report 89-003, Lawrence Livermore National Laboratory, CALS Test Network.

[FARR89] Farrell, J., The CALS Test Network MIL-D-28000 Class II Reference Drawing Packet, UCID 21622, Report 89-001, Lawrence Livermore National Laboratory, CALS Test Network, 1989.

[NBS88] Initial Graphics Exchange Specification (IGES), Version 4.0, NBSIR 88-3813, U.S. National Bureau of Standards, 1988.

[OSDA88] Automated Interchange of Technical Information, Military Standard MIL-STD-1840A Notice 1, OSD CALS Policy Office, 1988.

[OSDD88] Digital Representation for Communication of Product Data: IGES Application Subsets, Military Specification MIL-D-28000 Amendment 1, OSD CALS Policy Office, 1988.

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