Micro-based CAD: A Production Tool for Manufacturing Engineering

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1. Introduction

This paper presents two case studies to illustrate how low cost, microcomputer-based CAD can be a viable production tool for engineering and manufacturing disciplines. The first case study concerns an engineering/manufacturing company before and after the introduction of CAD. The second study documents how micro-based CAD performs sixty to seventy percent of the 2D drafting needs formerly addressed by more costly minibased systems, with no sacrifice in performance.

In the fast growing CAD industry, a new micro-based CAD system is introduced each week. Evaluating these many systems, especially the software, can be a source of frustration and confusion. For example, after watching a CAD demonstration, it is often difficult to determine if you have seen most of the system's capability or only a very small portion of the overall software. Since not all micro-based CAD systems can produce the successful results given in the two case studies and since they exhibit a wide range of performance levels, from "full-featured" to electronic toys, hardware and software considerations are also presented to show how common pitfalls of evaluating system performance can be avoided.

2. A Case Study of Electro Controls

Electro Controls, located in Salt Lake City, Utah, is a privately owned company founded in 1947. It makes automatic lighting control systems for television studios and theatres. More recently, the company has begun selling its control systems to owners of major hotels and office buildings who need lights in certain areas to turn on/off or to dim on schedule.

Each control system is assembled from standard components to match a specific lighting plan for a particular building. Each job requires a custom set of installation drawings so that the electricians installing the equipment know how to hang

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North-Holland Computer Graphics Forum 4 (1985) 287-300 the cabinets and how to connect the wires. A set of roughly 100 standard drawings that contain modular components are referenced to produce a design customized to each client's requirements. After the engineering stage is complete, the designs are turned over to manufacturing engineers.

2.1. Engineering the Old Way

Prior to installing a micro-based CAD system, Electro Controls employed an engineering staff that consisted of six systems designers and six draftsmen. The design proceeded according to the following steps.

- 1. A previous drawing which most closely resembled the current design requirements was selected from the standard drawing file.
- 2. A blue print of this drawing was made and then red-lined (or edited) by the systems engineer.
- 3. The edited drawing was given to a draftsman to produce an ink on mylar sheet.
- 4. A blueprint of this drawing was made for checking purposes. The drafting was checked as well as the actual design.
- 5. The systems designers sent any changes back to draftsmen to update the ink on mylar sheet.
- 6. Another blueprint of the revised drawing was made and sent to the customer to review and correct.
- 7. Minor changes were issued by the systems designers who, in turn, submitted the corrected drawing again to the draftsmen.
- 8. Another blueprint was made which was checked again by the systems designers. Final changes were performed by the draftsman and the drawings were then issued as a final to the customer.
- 9. Manufacturing received the design drawings and used them as the basis for generating punch details for the control panel.
- 10. A silk screen was developed to label the operations on the front of the control panel.

2.2. Engineering the New Way

Over two years ago, Electro Controls installed a networked, six station, micro-based CAD system. The system hardware/software cost for all six stations totaled about \$150,000 (or \$25,000 per networked workstation at 1984 prices). Each workstation contained the following: 68000dedicated graphics processor, NEC 7220 graphics generator, another host processor for I/O, stylus and tablet (with menu), joystick for dynamic pan and zoom, one Megabyte of high-speed memory where the drawing remains resident during the work session, a dot-matrix printer for a fast plot, dual raster screens - one for menu display. separate high resolution (1024×796), multiple intensity (colour option), and a shared 20 Megabyte (expandable to 80 Megabyte) fixed disk where drawings are initially retrieved and stored.

Without the aid of draftsmen, the six systems designers used CAD workstations where they complete the same job that previously took six to eight weeks in about half the time. An average of 300 to 400 drawings are produced each month. According to Dale Gilchrist, Vice President of Engineering, the productivity gain of 4:1 (reduction in staff by one-half and increase in productivity by a factor of roughly two) has had a major impact on marketing. The quick turnaround time in combination with higher quality drawings, has allowed the company to accept jobs from client: requiring as little as three days completion time.

The 100 standard drawings now reside on floppy disk masters along with 30 libraries which contain over 1,000 symbols or details. The standardized engineering and manufacturing production sequence is given below.

- 1. The floppy disk which contains the drawings that most closely represent the new design is copied into the CAD system.
- 2. The systems designers make the necessary modifications to the drawings by interactively editing their drawings at their graphics workstations. The drawings are concurrently checked by the designers while they are being viewed on the graphics screen, thereby eliminating the need for blueprints.
- 3. The drawings are plotted ink on mylar and checked. Drafting conventions require little attention since all lettering, notes, and dimensions are consistently rendered.

- 4. The drawings are numbered and sent to the customer for review. Any changes or client corrections are returned to the systems designers for minor design changes which are performed at the CAD workstation. The final drawing is electronically plotted using ink on mylar.
- 5. In manufacturing, punch details are applied to the drawing. They are placed on a separate level so that they can be turned off later for clients.
- 6. A legend is prepared on still another level which is also plotted ink on mylar. This drawing is used to shoot a silk screen which is transferred to the control panel.

According to Tim Hansen, Systems Designer of Electro Controls, dimensioning the drawing had previously presented the biggest problem for draftsmen. Designers with little drafting experience can dimension components with the consistency and precision of skilled draftsmen through use of the ANSI dimensioning capability of the micro CAD system.

The transition from the drafting board to the CAD system was an easy one because of the workstation's ability to

- 1. instantly zoom in and out at the push of a button, and
- 2. move around (or pan) to different locations on the drawing through use of the joystick.

A low-cost, off-line plotter station could be used to generate the final plots without consuming valuable workstation time.

On the low end of the productivity scale, creating a schematic from scratch requires about the same drafting time using CAD as it did manually. (Of course, the CAD drawing has a more appealing consistency.) At the high end of the scale, entire proposal drawings can be quickly generated by filling in the blanks of the title block of standard drawings and adding production or function notes.

3. A Second Case Study: Mini vs. Micro CAD Systems

Due to increases in overall performance of microcomputer systems, the principle distinction between mini- and micro-based systems is price. Progressive management at Lawrence Livermore National Laboratory (L.L.N.L.) under the guidance of Fred Norton, CAD consultant, have realized that the role for the mini-based workstations in the \$100,000 and higher range is 3D applications, complex, high-precision design functions, and other speciality applications. It was interesting to note their confirmation of Dataquest statistics which report CAD systems are utilized sixty to seventy percent of the time for 2D applications only thirty to forty percent of the time for 3D and other applications.¹

The mechanical engineering divisions of many companies found that creating 2D drawings on mini-based systems (typically costing \$120,000 per workstation) was not cost effective. In many cases drafters and designers using such costly CAD workstations reported that even after one year of experience, they had achieved only the same productivity levels as previously attained using manual drafting techniques. The low productivity was attributed to the fact that the minibased systems required mastery of a complex instruction set - more suitable to 3D modelling and design. Input of the same 2D drawings on micro CAD workstation at L.L.N.L. realized better than 1:1 productivity ratios after only a two month trial period and has contained to rise.

After gaining additional expertise in operating the CAD system, designers and drafters often recognize areas of drafting which are repetitive and which could be automated. The use of highlevel language and micro-based system allows the programming of not only various graphic constructions, but also designing software to determine flange ratings, compute tube wall thickness, and solve other engineering problems. A program was written to construct a torsional test specimen based on the input of the minimum specimen diameter. This construction now requires only fifteen minutes instead of four hours that CAD operators previously took prior to the implementation of the program.²

4. Micro-based CAD Hardware Technology

The advent of the 68000 microprocessor is largely responsible for the technology breakthrough. Migration of software from BASIC and FOR-TRAN to Pascal (and other higher-level languages) accounts for the easier maintenance, transportability, and greater capability afforded by modern micro-based systems.³

The bar chart in figure 1 shows benchmarks of various processors against the VAX 11/780 running Pascal. It is interesting to note that a dedicated graphics processor based on 68000 architecture operating at 12.5 Megahertz yields a system whose performance far exceeds that of the existing VAX and is approximately equal to improved VAX systems of the future. It also shows performance of the 68000, 8086, and IAPX 432 ar various clock rates and wait states.⁴

5. Software Evaluation: A Means to Distinguish One Micro-Based CAD System from Another

On the surface, it may be difficult to distinguish the superiority of one micro-based CAD system over another. To the experienced user, all CAD systems allow the creation of graphic primitives such as lines, arcs, circles, ellipses, text, and combination of these called groups or symbols. Furthermore, all CAD systems provide the capability to move, copy, delete, and edit objects on the drawing. So the question might rightly be asked, "What actually does distinguish one CAD system

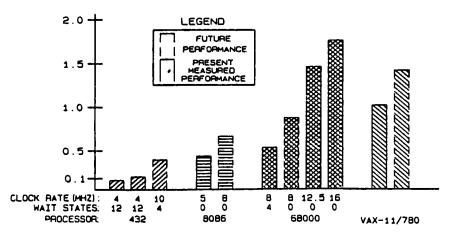


Figure 1. Performance Comparison of Processors

from another when highest productivity is the measure of effectiveness?"

To answer this question one may reason that the fewer CAD functions offered by the software, the faster the learning curve. It is true that operation of some micro-based CAD systems can be mastered in a matter of a few days. The CAD operator quickly recognizes, however, the severe limitations of such systems. Many elementary, time consuming graphic operations are found necessary to perform some of the simplest constructions. To illustrate this, consider the construction of a chamfered corner for example. Without the option to construct a chamfer directly, it may be necessary to perform a manual calculation, create additional lines, and finally edit the line segments. Ask yourself what steps would be required to convert the square corner shown in figure 2 to the chamfered corner shown in figure 3. Ideally, the operator would simply enter the 1/4" (or 2.5") and 30-degree parameters and pick the two lines.

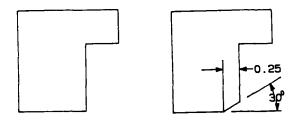


Figure 2. Original Object Figure 3. Object with Chamfer

As another example, consider the placement of multiple lines of notes on the drawing. Does the system require that the operator individually place each string of text in a paragraph, or can the spacing between lines be specified so that all the operator need do is indicate the location of the first text line with subsequent text strings automatically located at the desired spacing. Better still, can a file of text which has been previously entered and edited via a word processor be referenced and converted to text on the drawing? Suppose further, it is desired to centre three lines of text inside a rectangle. Does the system software require that the operator manually move the text strings to their centred position, or does the software support the automatic centering of a specified number of text lines inside a given object boundary?

As a final example, consider the external walls shown as double-lines in figure 4. Can the

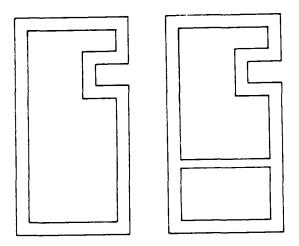


Figure 4. Exterior Walls Figure 5. Added interior Walls

interior wall shown in figure 5 be added simply by picking the two endpoints? Can the interior wall be automatically gapped? Furthermore, can doors and windows of specified widths be inserted automatically into these walls at their desired locations?

From these few examples we see that the subtle nuances of CAD software contribute to great productivity gains of one system over another. CAD vendors have long recognized that the more options available to the user, the greater the productivity gains in the long run — despite the fact that the initial learning curve and the mastery of extensive software options may take longer than those systems offering only basic create and edit options.

Today, micro-based CAD systems, priced under \$30,000, rival many of the larger \$130,000 mini-based systems in terms of both number of software options and speed performance. Table 1 provides a check list of micro-based CAD software functions. These functions represent a concensus of experienced CAD operators generating thousands of mechanical, architectural, electrical, electronic and process drawings in a service bureau environment using mini-based workstations over a period of several years. Currently, state-of-art micro CAD systems respond in seconds to any operator selected function.

6. Conclusion

A properly selected micro-based CAD system can be an effective production tool for engineering disciplines. In comparison to manual techniques, CAD offers a reduction in the manufacturing cycle TABLE 1. CHECK LIST OF CAD SOFTWARE FUNCTIONS

TABLE I. CHECK LIST OF	CAD SOFTWARE FUNCTIONS
I. COORDINATE INPUT	4.14 ZOOM IN TO A DESIRED LOCATION
1.1 KEY IN ABSOLUTE COORDINATES OF	4.15 DISPLAY & FULL VIEW OF THE
THE FORM (X,Y), WHERE X AND Y ARE EXPRESSED AS DECIMAL	DRAWING.
NUMBERS.	4.16 REDRAW CURRENTLY DISPLAYED WINDOW.
I.2 KEY IN ABSOLUTE COORDINATES OF THE FORM (5'3-5/16', 2'2-3/8') WHERE THE COORDINATES ARE	
WHERE THE COORDINATES ARE	5. DRAWING PRARMETERS
EXPRESSED IN FEET, INCHES, AND	5.1 ACTIVATE BY NAME
FRACTINAL INCHES.	5.2 ACTIVATE BY NUMBER.
- THE FORM DISTANCE, ANGLE	5.3 SPECIFY DRAWING UNITS. 5.3.1 MM (MILLIMETERS)
THE FORM DISTANCE ANGLE WHERE ANGLE IS EXPRESSED AS A DECIMAL NUMBER OF DEGREES.	5.3.2 CM (CENTIMETERS)
I.4 KEY IN POLAR COORDINATES OF	
THE FORM	- 5.3.5 IN (INCHES)
DISTANCE, XXDYYMZZS, WHERE THE ANGLE IS EXPRESSED IN	- 5.3.6 FT (FEET)
DEGREES, MINUTES, AND SE CONDS.	
I.S KEY IN RELATIVE COORDINATES OF THE FORM [X,Y], WHERE X AND Y	5.4 SPECIFY DRAWING SCALE.
THE FORM [X,Y], WHERE X AND Y ARE EXPRESSED AS DECIMAL	5.4.1 FULL SCALE 5.4.2 KEY IN DESIRED DRAWING
NUM BERS.	SCALE.
1.6 KEY IN RELATIVE COORDINATES OF THE FORM [5'3-5/16',2'2-3/8']	5.5 SPECIFY DRAWING SIZE. 5.5.1 A-SIZE (11 X 8.5 INCHES)
WHERE THE COORDINATES ARE	
EXPRESSED IN FEET, INCHES, AND FRACTIONAL INCHES.	5.5.4 C-SIZE (22 X 17 INCHES)
I.7 ALLOW KEYED IN COORDINATES TO BE TERMINATED WITH A RETURN	- 5.5.5 E-SIZE (44 X 34 INCHES)
BE TERMINATED WITH A RETURN INSTEAD OF KEYING IN THE	5.5.6 SPECIFY OTHER IMPERIAL
INSTEAD OF KEYING IN THE CLOSING, LOR KEYING IN THE I.B THE SPECIFICATION OF X OR Y	
I.B THE SPECIFICATION OF X OR Y	- 5.5.7 A4-512E (29,7 X 21 CM) - 5.5.8 A3-512E (42 X 29.7 CM) 5.5.9 A2-512E (59,4 X 42 CM) - 5.5.10 A1-512E (54,1 X 59,4 CM)
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I.10 COORDINATE INPUT FROM STYLUS ON A DIGITIZER.	5.7 - ORIGIN OF DRAWING IN LOWER
	- LEFT CORNER OF DRAWING.
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2.1 GRID PICK. 2.2 - FREE PICK.	6.1 TRANSFER SINGLE DRAWINGS TO
2.1 GRID PICK. 2.2 FREE PICK. 2.3 OBJECT SNAP.	6.2 FLOPPY DISK. 6.2 TRANSFER SINGLE DRAWINGS TO
2.3.I INTERSECTION OF TWO	- FIXED DISK.
- ARCS (OR CIRCLES) 2.3.2 INTERSECTION OF ARC	6.3 TRANSFER MULTIPLE DRAWINGS SIMULTANEOUSLY TO FIXED DISK.
(OR CIRCLE) AND LINE.	16.4 TRANSFER MULTIPLE DRAWINGS TO
2.3.3 INTERSECTION OF TWO LINES.	6.5 DELETE DRAWING.
2.3.4 ENDPOINT OF ARC.	6.6 — DELETELIBRARY.
2.3.5 ENDPOINT OF CIRCLE. 2.3.6 CLOSEST POINT ON LINE.	6.7 — COPY DRAWING. 6.8 — COPY LIBRARY.
2.3.7 QUADRANT POINT OF	6.9 - RENAME DRAWING.
23.8 CLOSEST POINT ON ARC	6.10 TRENAME LIBRARY.
- 2.3.8 CLOSEST POINT ON ARC ORCIRCLE.	6.11 — CHANGE DRAWING TYPE FROM WORKING TO STANDARD.
2.3.9 FREE PICK IF NO OBJECT	6.12 CHANGE LIBRARY TYPE FROM
AXIS LOCK.	
2.4 AXIS LOCK. 2.5 - NON-AXIS LOCK.	6.14 OPTION TO SAVE CURRENTLY
3. OBJECT ATTRIBUTES	ACTIVE DRAWING UNDER A SPECIFIED FILE NAME
3.1 LEVEL (0-255). 3.2 PEN NO. (0-15) FOR COLOR OR PEN	7. TEXT OPERATIONS
— THICKNESS OF PLOTTED OBJECTS.	7.1 SPECIFY CHARACTER HEIGHT. 7.2 SPECIFY CHARACTER WIDTH.
3.3 INTENSITY (0-3) OR COLOR (0-7).	7.3 — SPECIFY CHARACTER WIDTH.
4. BUILT-IN FUNCTIONS	CHARACTERS.
4.1 TOGGLE GRIDS ON/OFF ANY TIME.	7.4 SPECIFY TEXT ANGLE. 7.5 - SPECIFY TEXT SIZE (SETS BOTH
4.2 CHANGE GRID SPACING ANY TIME.	7.5 — SPECIFY TEXT SIZE (SETS BOTH HEIGHT AND WIDTH THE SAME).
4.3 CHANGE OBJECTLEVEL ANY TIME.	
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1.13 - 214.3 - 0.05 CREES 1.15 - 1770 MITTER COPTION WTH 1.16 - 0.07 POINT OF ARCE COPTION II2.3 1.17 - 0.07 POINT OF ARCE COPTION II2.3 1.18 - 0.07 POINT OF ARCE COPTION II2.3 1.20 - 0.07 POINT OF ARCE COPTION II2.3 1.20 - 0.07 POINT OF ARCE COPTION II2.3 1.20 - 0.07 POINT OF ARCE COPTION II2.3 1.21 - 0.08 POINT OF ARCE COPTION II2.3 1.22 - 0.08 POINT OF ARCE COPTION II2.3 1.21 - 0.08 POINT OF ARCE COPTION II2.3 1.22 - 0.08 POINT OF ARCE COPTION II2.3 1.23 - 0.08 POINT OF ARCE COPTION II2.3 1.24 - 0.08 POINT OF ARCE COPTIONT - 0.07 POINT OF ARCE COPTION ARCE POINT 1.25 - 0.08 POINT OF ARCE COPTIONT - 0.07 POINT OF COPTIONT ARCE POINT 1.25 - 0.08 POINT OF ARCE COPTIONT - 0.07 POINT OF COPTIONT ARCE POIN	7.13,5 0.3750 INCH	
7.13	- 7.14.1 0-DEGREES	DISTANCE RELATIVE TO IST LINE.
7.16 OFFONTO REPEAT CURRENT LINE 7.17 OFFONTO REPEAT CURRENT LINES. 7.18 DEFAULT CLAMPER AT A SPECIFED 7.19 DEFAULT CLAMPERT TATLINES. 7.10 DEFAULT CLAMPERT TATLINES. 7.11 DEFAULT CLAMPERT TO SALP 7.12 CHAPTER LINES TO ACTOR SPECIFICATION. 7.12 SECIFY MARCIN FOR MAXIMUM 7.12 SECIFY MARCIN FOR MAXIMUM 7.12 CHAPTER LINES 7.13 DEFAULT OF MARCIN FOR MAXIMUM 7.14 DEFAULT OF MARCIN FOR MAXIMUM 7.15 DEFAULT OF MARCIN FOR MAXIMUM 7.16 DEFAULT OF MARCIN FOR MAXIMUM 7.17 CHAPTER TO SECIFY ARROW AT 7.18 DEFAULT OF MARCIN FOR MAXIMUM 8.1 SALIDE OF MARCIN FOR MAXIMUM 8.1 SALID LINES. 8.1 SALID LINES. 8.1 FAANTOM LINES. 8.1	7.15 TYPEWRITER OPTION WITH	12.2 CHAMFER GIVEN TWO DISTANCES
7.17 A SPECIFIED NUMBER OF TWES. 13. FLOWLINES 7.18 STACING BETWEEN TEXTLINES. 13. FLOWLINES 7.20 CENTER TORMANNUM 13. FLOWLINES 7.21 CENTER TORMANNUM 13. A CONGTRE LINES 7.22 CENTER TORMACTERS FER LINES 7.23 SECIFY MARGIN FOR MAXMUM 7.24 CENTER TORMACTERS FER LINES 7.25 CENTER TORMACTERS FER LINES 8.1 NUMBER OF CHARACTERS FER LINES 8.2 SOLD LINES. 8.3 SOLD DINTS. 8.4 SOLD DINTS. 8.5 CENTER TORMACTINES. 8.6 FENCE LINES. 8.1 CAPILLARY LINES. 8.1 SOLD DINTS. 8.2 CONG DASHED LINES. 8.3 CENTER TO CENTER OF LINES. 8.4 CAPILLARY LINES. 8.5 CAPILARY LINES. 8.10 CARIROAD. 8.118 MUTH-SEGMENT SOLEDINES. 8.13 GEMENT. 8.14 MUTH-SEGMENT SOLEDINES. 8.13 GEMENT. 8.14 MUTH-SEGMENT SOLEDINES.	7.16 OPTION TO REPEAT CURRENT LINE	12.3 DEFAULT CHAMFER ANGLE OF
1.13 → DUMBER OF ROWS. 7.13 → DARGING BUTWER LINES. 7.14 → DARGING DEVICATION. 7.21 CENTER JUSTIFICATION. 7.22 → SPECIFY MARGIN FOR MAXIMUM 8.1 → SOLD LINES. 1.1 → SOLD LINES. 1.1 → SOLD LINES. 1.2 → ARMYE ALINES. 1.3 → SPECIFY DI LINES. 1.4 → ORD LINES. 1.5 → OF ARROW. 1.4 → ORD LINES. 1.5 → OF ARROW. 1.4 → ORD NOR OR ORD ARROW. 1.5 → OF ARROW. 1.6 → ORD NOR OR ORD ARROW. 1.7 → RECHTER LINES. 1.8 → ORD NOR OR ORD ARROW. 1.3 → ORD NOR OR ORD ARROW. 1.4 → ORD NOR OR ORD ARROW. 1.5 → ORD NOR OR ORD ARAROW. 1.6		
7.13 EIGHT IUSTIFICATION. 7.21 CENTER USTIFICATION. 7.22 SPECIFY MARGIN FOR MAXMUN 7.23 SPECIFY MARGIN FOR MAXMUN 7.24 CENTER USTIFICATION. 7.25 CENTER USTIFICATION. 7.22 SPECIFY MARGIN FOR MAXMUN 7.22 CENTER USTIFICATION. 8.11ME OPERATIONS 13.1 8.11ME OPERATIONS 13.2 8.11ME OPERATIONS 13.3 8.2 SPECIFY ARROW AT 8.2 SPECIFY OF LINES. 8.3 SPECIFY ARROW AT 8.4 CENTER USTIFICATION. 8.5 OPERATIONS 8.6 FERCELINES. 8.1 OPERATIONS 8.1 OPERATIONS 8.1 OPERATIONS 8.1 CENTER OF LINES. 8.1 SPECIFY OF CINCHTON TO CHANGE ARROW 8.1 MULTI-SECOMENTS OLID LINES. 8.1 MULTI-SECOMENTS OLID LINES. 8.1 MULTI-SECOMENTS OLED LINES. 8.1 MULTI-SECOMENTS OLED LINES. 8.1 MULTI-SECOMENTS OLED LINES. 8.1	NUMBER OF ROWS. SPACING BETWEEN TEXTLINES	
1.21CENTER JUSTIFICATIONMAXIMUM7.22CENTER JUSTIFICATIONMAXIMUM7.23CENTER JUSTIFICATIONMAXIMUM7.24INSIDE ANY OBJECT.13.1ABILITY TO SPECIFY ARROW AT8.1SIDE ANY OBJECT.13.2ABILITY TO SPECIFY ARROW AT8.1SOLD LINES.13.3ABILITY TO SPECIFY ARROW AT8.1SOLD LINES.13.4ABILITY TO SPECIFY ARROW AT8.2SOLD LINES.13.4ABILITY TO SPECIFY ARROW AT8.3FANTOM LINES.13.4ABILITY TO SPECIFY ARROW AT8.4SOLD LINES.13.4ABILITY TO SPECIFY ARROW AT8.5FANTOM LINES.13.5OPTION FOR OPEN ARROW.8.6FENCE LINES.13.6OPTION TO CHANGE PEN NUMBER8.7FRUEATICLINES.13.6OPTION TO CHANGE ARROW.8.10RAIROAD LINES.13.6OPTION TO CHANGE ARROW.8.11MULTI-SECMENT SOCIAL LINES.13.0OPTION TO CHANGE ARROW.8.13DIALTY TO CHARGE DASH AND GARVERTEX TO CENTER OF LINES.13.108.14MULTI-SECMENT LINES.14.1LINE TO TANCENT ARC. GIVEN ARC.8.13DIALTY TO CHARGE DASH AND GARVERTEX TO CONTROL LINES.14.18.14ARROW LINES.13.10CONSTRUCTION LINE ARC.8.15FRANTON LINES CONTROL CONTROL ARC.14.2LINE TO TANCENT ARC. GIVEN ARC.8.14MULTI-SECMENT SOLOTANCAWITHTANGENT ARC.8.14MULTI-SECMENT SOLOTANCAWITHTANGENT ARC.8.14HERCTANGLE	7.19 - RIGHT JUSTIFICATION	THESE ARE LINES THAT CONTAIN
- NUMBER OF CHARACTERS PERLIME 13.1 - ARIELTAD DURST CONTRACTORS PERLIME 2.22 CENTER TO RAMORE LINES 13.2 - ARIELTY TO SPECIFY ARROW AT 3.1 SHILTY TO SPECIFY ARROW AT A - CENTER OF LINES 3.1 SHILTY TO SPECIFY ARROW AT A 3.2 SHILTY TO SPECIFY ARROW AT A 3.3 SHILTY TO SPECIFY ARROW AT A 3.4 SOLID LINES 3.5 SOLID LINES 3.4 SHORT DASHED LINES 3.5 STORE OF ARROW 3.4 SHORT DASHED LINES 3.5 STORE OF ARROW 3.6 STORE OF ARROW 3.7 STORE OF ARROW 3.8 OFTION FOR SOLID ARROW 3.9 STORE OF ARROW 3.10 STORE OF ARROW 3.11 MUTHSEGMENTS DID LINES 3.12 SHAP VERTEX TO CENTER OF LINE 3.13 STORE OF ARROW 3.14 STORE OF ARROW 3.15 STORE OF ARROW 3.16 STORE OF ARROW 3.17 ARROW VERTEX TO CENTER OF LINES 3.13 STORE OF ARROW 3.14 STOR	7.21 CENTER JUSTIFICATION.	ALONG THE LINE.
2.22 CENTER / OR MORE LINES OF TEXT 1.12 CENTER OF LINE 8.11NE OPERATIONS 8.1 SOLID LINES 8.1 SOLID LINES 8.1 SOLID LINES 8.1 SOLID LINES 8.1 CENTER OF LINES 8.3 CHORD DAMED LINES 8.4 CENTER OF LINES 8.5 FRACELINES 8.4 CENTER OF LINES 8.5 FRACELINES 8.4 CENTER OF LINES 8.5 FRACELINES 8.6 CAPILLARY LINES 8.13 CAPILLARY LINES 8.14 SIAP VERTEX TO CENTER OF LINE 8.13 SIAP VERTEX TO CENTER OF LINES 8.14 SIAP VERTEX TO CENTER OF LINE 8.15 SIAP VERTEX TO CENTER OF LINE 8.16 MULTI-SEGMENT PECIAL LINES 8.17 ARROME LINES WITH 8.18 RECTANGLE 8.19 SAROPE ELINES WITH 8.10 CONSTRUCTION LINES 8.11 SECOMENT 8.12 CAPILLARY LINES 8.13 SAROPERATIONS <td></td> <td></td>		
a. LINE OPERATIONS a.1 SOLID LINES. a.2 LONG DASHED LINES. a.3 SHORD DASHED LINES. a.3 SHORD DASHED LINES. a.3 SHORD DASHED LINES. a.3 CENTER LINES. b.3 FERGE LINES. c.3 CENTER LINES. c.4 PERCELINES. c.5 FERCE LINES. c.6 MUTH-SEGMENT SOLID LINES. c.12 MUTH-SEGMENT SPECIAL LINES. c.13 SNAP VERTEX TO CENTER OF LINES. c.14 CINCL VERTEX TO CENTER OF LINES. c.15 SNAP VERTEX TO CENTER OF LINES. c.16 MUTH-SEGMENT SECOLID LINES. c.17 LINES COMENT SPECIAL LINES. c.18 CIRCL VERTEX TO CENTER OF LINES. c.19 RECTANGLE WITH TWO a.14 CINCL VERTEX TO CENTER OF LINES. c.15 SNAP VERTEX TO MIDIO LINES. c.16 MUTH-SEGMENT SECOLID LINES. c.16	7.22 CENTER I OR MORE LINES OF TEXT	IS.2 ABILITY TO SPECIFY ARROW AT
1.1 SOLID LINES. 2.2 LONG DASHED LINES. 2.3 LONG DASHED LINES. 2.4 SCHTER LINES. 2.5 PHANTOM LINES. 2.6 PENTER LINES. 2.7 CONG DASHED LINES. 2.8 PHANTOM LINES. 2.9 PANTOM LINES. 2.1 PHOLMATTIC LINES. 2.3 PANTOM LINES. 2.4 SCHLER LINES. 2.5 PANTOM LINES. 2.6 PERCELIPEOL COCATON OFEN ARROW. 2.7 PANTOM LINES. 2.8 PANTOM LINES. 2.9 PANTOM LINES. 2.10 PANTOM LINES. 2.11 MUTT-SEGMENT SOLID LINES. 2.13 CICLE. 2.14 SNAP. VERTEX TO CENTER OF LINE 2.15 CICLE. WITT TO CATAGE ARROW. 3.16 ARCOTEL. 3.17 ABULT TO CAMARGE DASHADO LINES. 3.18 LERGETMS	-	CENTER OF LINE.
10 NG D'ASHÉD LINES. 13 S MORT D'ASHED LINES. 14 C PHATTOM LINES. 15 F PHATTOM LINES. 15 F PHATTOM LINES. 15 C PHATTOM LINES. 15 C PHATTOM LINES. 16 F PHATTOM LINES. 17 ALROAD LINES. 18 F PHEURLARY LINES. 18 F PHEURLARY LINES. 18 F PHEURLARY LINES. 19 F PHEURLARY LINES. 10 C AFILCARY LINES. 11 G LINES C MENTS DE CLAL LINES. 11 G LINES C MENTS DE CLAL LINES. 11 G LINES C MENTS LINES. 11 G LINES C MENTS LINES. 11 G LINES C CHARGE D'S AND CARCOW. 12 G LINE ST COMENTS LINES WITH 13 G S MAD VERTEX TO CENTER OF LINES 14 G CIACLE RTEX TO MOPOINT OF ARC 14 J S DIAGONALLY OPODATE CONTERS. 14 J S DOLED ARCS. 2 ARC OPERATIONS 3 J ARC GIVEN START/CENTER/END. 3 J ARC GIVEN START/CENTER/END. 3 J ARC GIVEN START/CENTER/CHOPEN. 3 J ARC GIVEN START/CENTER/CHOPEN.		SPECIFIED LOCATION ON LINE.
B.3 SHO &T D ASHED LINES. B.3 — FEARCE DIMESS. B.3 — FEARCE DIMESS. B.3 — FEARCE DIMESS. B.3 — PEARCE DIMESS. B.3 — MULTASCENTSSE CLAIL LINES. B.12 — MULTASCENTSSE CLAIL LINES. B.13 — SNAP VERTEX TO CENTER OF LINE B.14 — MULTASCENTS SPECIAL LINES. B.13 — SNAP VERTEX TO CENTER OF LINE B.14 — MULTASCENENT SPECIAL LINES. B.14 — MULTASCENENT SO CONTER OF LINE B.15 — STACLE PTEX TO MULTOST GAPSE. B.16 — MULTASCENENT SO CANTER OF LINE B.17 — BURCHARL, WITH TWO CHANGE DASH AND GAP B.18 — CONTRUCTION LINES B.19 — RECTANGLES ALLGNED TO - A B.19 — RECTANGLES ALLGNED TO - A B.19 — RECTANGLES ALLGNED TO - A S.2 — DASHED ARCS. S.3 — CENTER ARCS. S.4 — FHANTOM ARCS. <td< td=""><td>8.1 SOLID LINES. 8.2 UNG DASHED LINES.</td><td>— DIMENSION ARROWS.</td></td<>	8.1 SOLID LINES. 8.2 UNG DASHED LINES.	— DIMENSION ARROWS.
1.5.3 — PHANTOM LINES. 1.5.4 — PREUCE LINES. 1.5.5 — CAPILLARY LINES. 1.5.1 — OPTION TO CHANGE ARROW 1.5.2 — CAPILLARY LINES. 1.5.1 — OPTION TO CHANGE ARROW 1.5.2 — CAPILLARY LINES. 1.5.1 — OPTION TO CHANGE ARROW 1.5.1 — CONTRUCTION LINES. 1.5.2 — MULTI-SEGMENT SOLIDLINES. 1.5.3 — SCHAPER, TEX TO CENTER OF LINE 1.6 — MULTI-SEGMENT SOLIDLINES. 1.6 — MULTI-SEGMENT SOLIDLINES. 1.7 — DENTER TO CONTRUCTION LINES. 1.8 — CONTRUCTION LINES. 1.1.7 — DENTER TO CONTRUCTION LINES. 1.1.8 — RECTANGLE 1.1.9 — DIAGONALLY OPOSTE CONTRUCTION LINES. 1.10 — SPECIFIED ANGLE 1.11 — DATONCHARCS. 3.12 — SPECIFIED ANGLE 3.13 — SOLID ARCS. 3.14 — DATONCHARCS. 3.15 — SARC OPERATON 3.16 — MARCYCENTRATCENTER/ENDINGLIDED 3.17 — DENTER ARCS. 3.28 <td< td=""><td>8.3 SHORT DASHED LINES.</td><td>13.6 OPTION FOR OPEN ARROW.</td></td<>	8.3 SHORT DASHED LINES.	13.6 OPTION FOR OPEN ARROW.
1.3.7 — INPURATICE LINES. 1.3.8 — OPTION. TO CHANGE ARROW 1.3.9 — OPTION. TO CHANGE ARROW 1.3.10 — ARLEQAD LINES. 1.3.11 — MULTI-SEGMENT SOLD LINES. 1.3.11 — MULTI-SEGMENT SOLD LINES. 1.3.13 — MOLTI-SEGMENT SOLD LINES. 1.3.14 — OPTION. FOR DASHED LINE WITH 1.3.15 — MOLTI-SEGMENT SOLD LINES. 1.3.16 — ARROW. 1.3.17 — ARROW FOR DASHED LINE SCHWITS (GAPSITH) 1.3.17 — ARGENT ARC. 1.3.18 — OPTION TO COMPLEMENT OF 1.3.17 — ABLITY TO CHANGE DASH AND GAP 1.3.18 — OPTION CO ANGENT ARC. 1.3.17 — ABLITY TO CHANGE DASH AND GAP 1.3.18 — DIAGONALLY OPTOSTE CONFRES. 3.19 — RECTANGLE WITH 1.19 — RECTANGLE WITH 3.19 — OPTION ARCS. — CONSTRUCTION LINE AT ARC GIVEN 3.19 — SPECIFIED ANGLE. — ARC (OR CIRCLES). 3.10 — ARC OPERATIONS — ARC (OR CIRCLES). 3.10 — ARC GIVEN START/CENTER/ENDINCUTOD. — CONSTRUCTION LINE AT ANGLE <	8.5 — PHANTOM LINES.	— OF ARROW.
23 — CAPILIZARY LINES. 8.10 — RALROAD LINES. 8.11 — MULTI-SEGMENT SPECIAL LINES. 8.13 — SNAP VERTEX TO CENTER OF LINE 8.14 — SIGMENT SPECIAL LINES. 8.14 — SIGMENT SPECIAL LINES. 8.15 — SNAP VERTEX TO CENTER OF LINE 8.14 — SIGMENT LINES WITH 14.1 — LINE TO TANGENT ARC GIVEN ARC 8.15 — SNAP VERTEX TO CENTER OF LINE 8.16 — MULTI-SEGMENT LINES WITH 14.1 — LINE TO TANGENT ARC GIVEN ARC ARC ARC ARC ARC GIVEN ARC GIVEN ARC	8.7 PNEUMATICLINES.	13.8 OPTION TO CHANGE ARROW
111	8.9 CAPILLARYLINES.	13.9 OPTION TO CHANGE ARROW
AL2 MULTI-SEGMENT SPECIAL LINES. 8.13 SNAP VERTEX TO CENTER OF LINES. 8.14 SNAP VERTEX TO CENTER OF LINES. 8.16 MULTI-SEGMENT. 8.16 MULTI-SEGMENT. 8.17 ABLITY TO CHANGE DASH AND GARS. 8.18 RECTANGLE WITH 8.19 RECTANGLE 9.10 DIAGONALL'O OPOSTE CONVERS. 1.9 RECTANGLE 9.1 SOLID ARCS. 9.2 CANTEVCTION LINE AT ANGLE 9.1 SOLID ARCS. 9.2 CANTEVCTION LINE AT ANGLE 9.1 SOLID ARCS. 9.2 CANTEVCTION LINE AT ANGLE 9.3 CANTEVCTION LINE AT ANGLE 9.4 CONSTRUCTION LINE AT ANGLE 9.5 ARC GIVEN START/CENTER/END. 9.6 ARC GIVEN START/CENTER/END. 9.7 ARC GIVEN START/CENTER/END. 9.8 ARC GIVEN START/CENTER/CHORAL 9.10 START/CENTER/CHORAD. 9.11 </td <td>8.11 MULTI-SEGMENT SOLID LINES.</td> <td>13.10 OPTION FOR DASHED LINE WITH</td>	8.11 MULTI-SEGMENT SOLID LINES.	13.10 OPTION FOR DASHED LINE WITH
B.14 SEGMENT. B.14 SRAP VERTEX TO CENTER OF B.14 CINCLE. B.15 CINCLE. B.16 MUNTISEGEMENT LINES B.17 ABLITY TO CHANGE DASH AND GASY B.18 RECTANGLE B.17 ABLITY TO CHANGE DASH AND GASY B.18 RECTANGLE B.19 RECTANGLE P. ARC OPERATIONS 9.1 SOLID ARCS. 9.1 SOLID ARCS. 9.2 DASHED ARCS. 9.3 CENTER ARCS. 9.4 PHANTON ARCS. 9.4 PHANTON ARCS. 9.5 SOLID ARCS. 9.4 CHARE ARCS. 9.5 TARC GIVEN START/CENTER/END. 9.6 ARC GIVEN START/CENTER/CHORENCE 9.7 ARC GIVEN START/CENTER/CHORENCE 9.9 ARC GIVEN START/CENTER/CHORENCE 9.11 START/CENTER/CHORENCE 9.12 MARC ME CENTER AND AND 9.13 START/CENTER/CHORENCE 9.14 START/CENTER/CHORENCE 9.15 START/CENTER/CHORENCE 9.14	8.12 🚞 MULTI-SEGMENT SPECIAL LINES.	
CIRCLE CIRCLE CIRCLE End primition area of the ar	E SEGMENT.	14. CONSTRUCTION LINES
8.16 → MUTTUSECGAPTI MULTURE OF MUTTUSEL LINE SEGMENTS OF MUTTUSECGAPTI ARC. 8.17 → ABILITY TO CHANGE DASH AND GAP 8.18 RECTANGLE WITH 9.1 → SIDE LINE SEGMENTS 9.1 → SIDE LINE SEGMENTS 9.1 → SPECIFIED ANGLE 9.1 → SPECIFIED ANGLE 9.1 → SOLID ARS. 9.1 → SOLID ARS. 9.1 → SOLID ARS. 9.2 → CANTRUCTION LINE TANGENT TO 9.3 → CENTER ARCS. 9.4 → CONSTRUCTION LINE AT ANGLE 9.3 → CENTER ARCS. 9.4 → CONSTRUCTION LINE AT ANGLE 9.3 → CENTER ARCS. 9.4 → CONSTRUCTION LINE AT ANGLE 9.3 → CENTER ARCS. 9.4 → ARC GIVEN START/END/RADIUS. 9.3 → CENTER ARCS. 9.4 → ARC GIVEN START/END/RADIUS. 9.5 → ARC GIVEN START/END/RADIUS. 9.11 → SPECIFIED ARC 9.9 → ARC GIVEN START/END/RADIUS. 9.10 → ARC GIVEN START/END/RADIUS. 9.11 → SPECIFIED ARC 9.12	- CIRCLE,	14.1 LINE TO TANGENT ARC GIVEN ARC
8.17 ARC TO TANGENT ARC. 8.18 RECTANGLE WITH TWO 8.19 RECTANGLE WITH TWO 9.10 OLAGONALLY OPPOSITE CORNERS ARC TO TANGENT ARC. 9.11 SPECIFIED ANGLE ALIGNED ARC TO TANGENT ARC. 9.1 SOLID ARCS. 14.5 CONSTRUCTION LINE TANGENT TO 9.1 SOLID ARCS. 14.7 CONSTRUCTION LINE AT SPECIFIED 9.1 SOLID ARCS. 14.7 CONSTRUCTION LINE AT SPECIFIED 9.1 SOLID ARCS. 14.8 CONSTRUCTION LINE AT ANGLE 9.1 SOLID ARCS. 14.9 HORECONTAL CONSTRUCTION LINE AT ANGLE 9.1 SOLID ARCS. 14.9 HORECONTAL CONSTRUCTION LINE AT ANGLE 9.1 SOLID ARCS. 14.9 HORECONTAL CONSTRUCTION LINE AT ANGLE 9.1 SOLID ARCS. 14.9 HORECONTAL CONSTRUCTION LINE AT ANGLE 9.1 SOLID ARCS. 14.10 CONSTRUCTION LINES 14.10 9.1 SOLID ARCS. 14.11 CONSTRUCTION LINES 14.12 9.10 ARC GIVEN START/CENTER/CHORD. 14.13	8.16 - MULTI-SEGMENT LINES WITH	14.2 LINE TO COMPLEMENT OF
8.18LENGTHS. MECTANGLEWITH UTH UTH 	8.17 ABILITY TO CHANGE DASH AND GAP	14.3 ARC TO TANGENT ARC.
 DIAGONALLY OPPOSITE CORNERS. a.19 — RECTANGLES ALIGNED TO ARCS. SPECIFIE DANGLE SPECIFIE DANGLE SOLID ARCS. SOLID ARCS. SOLID ARCS. CONTRUCTION LINE AT SPECIFIED DASHED ARCS. CONTRUCTION LINE AT ANGLE CONSTRUCTION LINE AT ANGLE CONSTRUCTION LINE AT ANGLE START/CENTER/INCLUDED ANGLE. START/CENTER/INCLUDES ATART/CENTER/INCLUDES AND ANC. START/CENTER/INCLUDES AND ANC. START/CENTER/INCLUDES AND AND AND AND AND AND AND AND AND AND	LENGTHS. 8.18 RECTANGLE WITH TWO	RADIUS/ENDPOINT.
9. ARC OPERATIONS 14.8 — CONSTRUCTION LINE TANGENT TO ARC (OR CIRCLE). 9.1 SOLID ARCS. 14.7 — ARC (OR CIRCLE). 9.2 DASHED ARCS. 14.7 — CONSTRUCTION LINE AT SPECIFIED ANGLE. 9.3 CENTER ARCS. 14.8 — PERPENDICULAR TO SPECIFIED ANGLE. 9.4 PHANTON ARCS. 14.8 — CONSTRUCTION LINE AT ANGLE 9.5 — ARC GIVEN START/CENTER/END. 14.19 — HORIZONTAL CONSTRUCTION LINES. 9.6 — ARC GIVEN START/CENTER/CHORD. ANGLE. 14.10 — CONSTRUCTION LINES. 9.9 — ARC GIVEN START/CENTER/CHORD. ANGLE. 14.10 — CONSTRUCTION LINES. 9.10 — ARC GIVEN START/CENTER/CHORD. ANGLE. 14.13 — CONSTRUCTION LINES. 9.11 — SFART/CENTER/INCLUDED ANGLE. 14.13 — CONSTRUCTION LINES. 9.11 — SPECIFY ARC DIRECTION AS COUNTER-CLOCK WISE 14.14 — TURN OFF DISPLAY OF ALL CONSTRUCTION LINES. 9.12 MARK THE CENTER OF THE ARC. 14.14 — TURN ON DISPLAY OF ALL CONSTRUCTION LINES. 9.13 — PLACE ORTHOGONAL CENTER CONSTRUCTION LINES. 14.16 10. CIRCLE GIVEN CENTER AND RADIUS. 14.18 SOLID CONSTRUCTION LINES.	DIAGONALLY OPPOSITE CORNERS, 8.19 RECTANGLES ALIGNED TO A	14.5 CONSTRUCTION LINE TANGENT TO TWO ARCS (OR CIRCLES).
9.1SOLID ARCS.9.2DASHED ARCS.9.3CENTER ARCS.9.4PHANTOM ARCS.9.4PHANTOM ARCS.9.53-POINT ARCS.9.6ARC GIVEN START/CENTER/END.9.7ARC GIVEN START/END/RADIUS.9.8ARC GIVEN START/END/RADIUS.9.9ARC GIVEN START/CENTER/CHORD.9.10ARC GIVEN START/CENTER/CHORD.9.11START/CENTER/INCLUDED ANGLE9.12MARKE9.13PLACE ORTHOGONAL9.14START/CENTER/INCLUDED ANGLE.9.15ARC GIVEN START/CENTER/INCLUDED ANGLE.9.16ARC GIVEN START/CENTER/INCLUDED ANGLE.9.17MARK THE CENTER OF THE ARC.9.18PLACE ORTHOGONAL9.19COUNTE R-CLOCK WISE.9.11CONSTRUCTION LINES.9.12MARK THE CENTER OF THE ARC.9.13PLACE ORTHOGONAL9.14CINCLE OFERATIONS10.1CIRCLE GIVEN CENTER AND RADIUS.10.2CIRCLE GIVEN CENTER AND RADIUS.10.3CONCENTRIC CIRCLES.10.4MARK CENTER OF CIRCLE.10.5PLACE10.6CINCLE GIVEN CENTER AND RADIUS.11.1FILLET BETWEEN TWO LINES.11.1FILLET BETWEEN TWO LINES.11.1.2TRIM UNE ENDPOINTS.11.1.3TRIM UNE ENDPOINTS.11.1.4TRIM UNE ENDPOINTS.11.1.5TRIM UNE ENDPOINTS.11.1.7TRIM UNE ENDPOINTS.11.1.8TRIM UNE ENDPOINTS.11.1.9TRIM UNE ENDPOINTS.<	SPECIFIED ANGLE	14.6 CONSTRUCTION LINE TANGENT TO ARC (OR CIRCLE).
9.1 SOLID ARCS. 9.2 DASHED ARGS. 9.4 PHANTOM ARCS. 9.4 PHANTOM ARCS. 9.5 S-FOINT ARCS. 9.6 ARC GIVEN START/CENTER/END. 9.7 ARC GIVEN START/END/RADIUS. 9.8 ARC GIVEN START/END/RADIUS. 9.9 ARC GIVEN START/END/INCLUDED 9.10 ARC 9.11 SPECIFIC ARC DIRECTION ANDLE 9.12 MARK THE CENTER/CHORD. 9.13 SPECIFY ARC DIRECTION AS 9.14 SPECIFIC ARC DIRECTION AS 9.15 COUNTRECLOCK WISE 9.16 ARC GIVEN START/CENTER/INCLUDED ANGLE 9.17 MARK THE CENTER OF THE ARC. 9.18 PLACE ORTHOGONAL CENTER 9.19 PLACE ORTHOGONAL CENTER 9.12 MARK THE CENTER AND RADIUS. 10.1 CIRCLE GIVEN CENTER AND RADIUS. 10.2 CIRCLE GIVEN CENTER AND RADIUS. 10.3 CONCENTRIC CIRCLES. 10.4 MARK CENTER OF CIRCLE. 10.5 PLACE ORTHOGONAL CENTER 10.4 MARK CENTER OF CIRCLE. 10.5 <t< th=""><th>9. ARC OPERATIONS</th><th>14.7 CONSTRUCTION LINE AT SPECIFIED</th></t<>	9. ARC OPERATIONS	14.7 CONSTRUCTION LINE AT SPECIFIED
9.3 — CENTER ARCS. 9.4 PHANTOM ARCS. 9.5 — S-POINT ARCS. 9.6 — ARC GIVEN START/CENTER/END. 9.7 — ARC GIVEN START/END/RADIUS. 9.8 — ARC GIVEN START/END/INCLUDED 9.9 — ARC GIVEN START/CENTER/CHORD. 9.10 — ARC GIVEN START/CENTER/CHORD. 9.10 — ARC GIVEN START/CENTER/CHORD. 9.11 — START/CENTER/INCLUDED ANGLE. 9.12 — ARC DIRECTION ANGLE. 9.13 — PLACE ORTHOGONAL CENTER 9.14 — SPECIFY ARC DIRECTION ASI 14.15 — TURN OFF DISPLAY OF ALL 9.12 MARK THE CENTER ARC. 9.13 — PLACE ORTHOGONAL CENTER 10.1 CIRCLE GIVEN CENTER AND RADIUS. 10.2 — CIRCLE GIVEN CENTER AND RADIUS. 10.3 CONCENTRIC CIRCLES. 10.4 — MARK CENTER OF CIRCLE. 10.5 — PLACE ORTHOGONAL CENTER 10.4 — GURCLE GIVEN CENTER AND RADIUS. 14.18 SOLID CONSTRUCT NON LINES. 10.2 — CIRCLE GIVEN CENTER AND RADIUS. 10.4 — MARK CENTER OF CIRCLE. <td< th=""><th>9.1 SOLID ARCS.</th><th>14.8 CONSTRUCTION LINE AT ANGLE</th></td<>	9.1 SOLID ARCS.	14.8 CONSTRUCTION LINE AT ANGLE
9.5 → POINT ARCS. 9.6 → ARC GIVEN START/CENTER/END. 9.7 → ARC GIVEN START/END/RADIUS. 9.8 → ARC GIVEN START/END/RADIUS. 9.9 → ARC GIVEN START/END/INCLUDED 9.9 → ARC GIVEN START/CENTER/CHORD. 9.10 → ARC GIVEN START/CENTER/CHORD. 9.11 → START/CENTER/INCLUDED ANGLE. 9.11 → SPECIFY ARC DIRECTION AS 9.12 → MARK THE CENTER OF THE ARC. 9.13 → PLACE ORT HOGONAL CENTER 9.14 → PLACE ORT HOGONAL CENTER 10.1 CIRCLE GIVEN CENTER AND RADIUS. 10.2 CIRCLE GIVEN CENTER AND RADIUS. 10.3 CONCENTRIC CIRCLES. 10.4 → MARK CENTER OF CIRCLE. 10.4 → MARK CENTER OF CIRCLE. 10.4 → MARK CENTER OF CIRCLES. 10.4 → MARK CENTER OF CIRCLE. 10.4 → MARK CENTER OF CIRCLE. 11.1 FILLETS 11.1 FILLETS 11.1 FILLET BETWEEN TWO LINES. 11.1.12 TRIM 11.1.2 TRIM 11.1.13 TRIM	9.3 — CENTER ARCS.	ANGLE.
9.8 □ ARC GIVEN START/CENTER/INCLUDED 14.12 TWO GIVEN POINTS. 9.9 ARC GIVEN START/CENTER/CHORD. GIVEN 9.10 — ARC GIVEN START/CENTER/CHORD. 9.11 — SPECIFY ARC DIRECTION AS GIVEN 9.12 — MARK CENTER/INCLUDED ANGLE. 14.13 — CONSTRUCTION LINES SPANNING 9.13 — PLACE DIRECTION AS 14.14 — TURN OFF DISPLAY OF ALL 9.12 MARK THE CENTER OF THE ARC. ON STRUCTION LINES. 9.13 — PLACE ORTHOGONAL CENTER. 14.16 — CONSTRUCTION LINES. 9.13 — PLACE ORTHOGONAL CENTER. 14.16 — DELETE ALL CONSTRUCTION LINES. 9.13 — PLACE ORTHOGONAL CENTER. 14.16 — DELETE ALL CONSTRUCTION LINES. 10.1 CIRCLE GIVEN CENTER. AND RADIUS. 14.18 SOLID CONSTRUCTION LINES. 10.2 — CIRCLE GIVEN CENTER AND RADIUS. 14.18 SOLID CONSTRUCTION LINES. 10.3 CONCENTRIC CIRCLES. 14.19 — DASHED CONSTRUCTION LINES. 10.4 — MARK CENTER OF CIRCLE. CONSTRUCTION LINES. A SPECIFIED OFFSET FROM ANOTHER 111 FILMES ON CIRCLE CENTER. INES INES ON CIRCLE CENTER. INES<	9.5 - 3-POINT ARCS.	I — LINES.
9.8 □ ARC GIVEN START/CENTER/INCLUDED 14.12 TWO GIVEN POINTS. 9.9 ARC GIVEN START/CENTER/CHORD. GIVEN 9.10 — ARC GIVEN START/CENTER/CHORD. 9.11 — SPECIFY ARC DIRECTION AS GIVEN 9.12 — MARK CENTER/INCLUDED ANGLE. 14.13 — CONSTRUCTION LINES SPANNING 9.13 — PLACE DIRECTION AS 14.14 — TURN OFF DISPLAY OF ALL 9.12 MARK THE CENTER OF THE ARC. ON STRUCTION LINES. 9.13 — PLACE ORTHOGONAL CENTER. 14.16 — CONSTRUCTION LINES. 9.13 — PLACE ORTHOGONAL CENTER. 14.16 — DELETE ALL CONSTRUCTION LINES. 9.13 — PLACE ORTHOGONAL CENTER. 14.16 — DELETE ALL CONSTRUCTION LINES. 10.1 CIRCLE GIVEN CENTER. AND RADIUS. 14.18 SOLID CONSTRUCTION LINES. 10.2 — CIRCLE GIVEN CENTER AND RADIUS. 14.18 SOLID CONSTRUCTION LINES. 10.3 CONCENTRIC CIRCLES. 14.19 — DASHED CONSTRUCTION LINES. 10.4 — MARK CENTER OF CIRCLE. CONSTRUCTION LINES. A SPECIFIED OFFSET FROM ANOTHER 111 FILMES ON CIRCLE CENTER. INES INES ON CIRCLE CENTER. INES<	9.6 ARC GIVEN START/CENTER/END. 9.7 ARC GIVEN START/END/RADIUS.	14.10 VERTICAL CONSTRUCTION LINES.
9.9 ARC GIVEN START/CENTER/CHORD. 9.10 ARC GIVEN START/CENTER/CHORD. 9.11 SPECIFY ARC DIRECTION AS CONSTRUCTION LINES SPANNING 9.12 MARK THE CENTER OF THE ARC. 9.13 PLACE ORTHOGONAL CENTER 14.14 TURN OF DISPLAY OF ALL CONSTRUCTION LINES. 9.15 MARK THE CENTER OF THE ARC. 9.16 CIRCLE OF RATIONS 10.1 CIRCLE OF RATIONS 10.1 CIRCLE GIVEN CENTER AND RADIUS. 10.2 CIRCLE GIVEN CENTER AND RADIUS. 10.4 MARK CENTER OF CIRCLE. 10.4 MARK CENTER OF CIRCLE. 11.1 FILLETS 11.1 FILLETS 11.1 FILLET BETWEEN TWO LINES. 11.2 FILLET BETWEEN TWO ARCS (OR 11.2 FILLET BETWEEN TWO ARCS (OR 11.2 CIRCLES. 11.2 FILLET BETWEEN TWO ARCS (OR 11.2 FILLET BETWEEN TWO ARCS (OR 11.2 CIRCLES. 11.2 FILLET BETWEEN TWO ARCS (OR 11.2 FILLET BETWEEN TWO ARCS (OR 11.2 FILLET BETWEEN TWO ARCS (OR 11.2 CIRCLES. 11.2 FILLET BETWEEN TWO ARCS (OR 11.2 FILLET BETWEEN TWO ARCS (OR 11.2 CIRCLES. 11.2 FILLET BETWEEN TWO ARCS (OR 11.2 FILLET BETWEEN TWO ARCS (OR 11.2 CIRCLES. 11.2 FILLET BETWEEN TWO ARCS (OR 11.2 CIRCLES. 11.2 FILLET BETWEEN TWO ARCS (OR 11.2 FILLET BETWEEN TWO ARCS (OR 11.2 EVALUATE Y-VALUES ON CURVE	9.8 ARC GIVEN START/END/INCLUDED	TWO GIVEN POINTS.
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COUNTER-CLOCK WISE. 9.12 MARK THE CENTER OF THE ARC. 9.13 PLACE ORTHOGONAL CENTER 14.15 CONSTRUCTION LINES. 14.16 DELETE ALL CONSTRUCTION LINES 14.16 DELETE ALL CONSTRUCTION LINES 14.17 CONSTRUCTION LINES FROM AN 14.18 SOLID CONSTRUCTION LINES. 14.19 DASHED CONSTRUCTION LINES. 14.20 PHANTOM CONSTRUCTION LINES. 14.21 CONSTRUCTION LINES. 14.22 CONSTRUCTION LINES REPEATED 14.22 CONSTRUCTION LINES REPEATED 14.22 CONSTRUCTION LINES REPEATED 14.22 CONSTRUCTION LINES REPEATED 14.22 CONSTRUCTION LINES REPEATED 14.23 SPECIFIED OFFSET FROM ANOTHER 14.24 CONSTRUCTION LINES REPEATED 14.25 ON CIRCLE CENTER. 14.25 ON CIRCLE CENTER. 14.26 PHENDOFFSET FROM ANOTHER 14.27 CONSTRUCTION LINES REPEATED 15.1 SELECT SPECIFIED RESOLUTION. 15.2 RETERVED ATA FROM FILE 15.3 SPECIFY X-OFFSET TO BE 15.3.1 SPECIFY X-OFFSET TO BE 15.3.2 SPECIFY Y-OFFSET TO BE 15.3.3 SPECIFY Y-OFFSET TO BE 15.3.4 PHILED TO DATA. 15.4 PHILED TO DATA. 15.4 PHILED TO DATA.	START/CENTER/INCLUDED ANGLE	THE ENTIRE DRAWING.
COUNTER-CLOCK WISE. 9.12 MARK THE CENTER OF THE ARC. 9.13 PLACE ORTHOGONAL CENTER 14.15 CONSTRUCTION LINES. 14.16 DELETE ALL CONSTRUCTION LINES 14.16 DELETE ALL CONSTRUCTION LINES 14.17 CONSTRUCTION LINES FROM AN 14.18 SOLID CONSTRUCTION LINES. 14.19 DASHED CONSTRUCTION LINES. 14.20 PHANTOM CONSTRUCTION LINES. 14.21 CONSTRUCTION LINES. 14.22 CONSTRUCTION LINES REPEATED 14.22 CONSTRUCTION LINES REPEATED 14.22 CONSTRUCTION LINES REPEATED 14.22 CONSTRUCTION LINES REPEATED 14.22 CONSTRUCTION LINES REPEATED 14.23 SPECIFIED OFFSET FROM ANOTHER 14.24 CONSTRUCTION LINES REPEATED 14.25 ON CIRCLE CENTER. 14.25 ON CIRCLE CENTER. 14.26 PHENDOFFSET FROM ANOTHER 14.27 CONSTRUCTION LINES REPEATED 15.1 SELECT SPECIFIED RESOLUTION. 15.2 RETERVED ATA FROM FILE 15.3 SPECIFY X-OFFSET TO BE 15.3.1 SPECIFY X-OFFSET TO BE 15.3.2 SPECIFY Y-OFFSET TO BE 15.3.3 SPECIFY Y-OFFSET TO BE 15.3.4 PHILED TO DATA. 15.4 PHILED TO DATA. 15.4 PHILED TO DATA.	9.11 SPECIFY ARC DIRECTION AS	CONSTRUCTION LINES.
9.13	COUNTER-CLOCKWISE. 9.12 MARK THE CENTER OF THE ARC	CONSTRUCTION LINES.
10. CIRCLE OPERATIONS 10. I CIRCLE GIVEN CENTER AND RADIUS. 10.1 CIRCLE GIVEN CENTER AND RADIUS. 10.2 CIRCLE GIVEN CENTER AND RADIUS. 10.3 CONCENTRIC CIRCLES. 10.4 MARK CENTER OF CIRCLES. 10.5 LINES ON CIRCLE CENTER. 10.6 PLACE ORTHOGONAL CENTER 11.6 FILLETS 11.1 FILLET BETWEEN TWO LINES. 11.1.1 NO 11.1.2 TRIM LINE ENDPOINTS 11.1.3 TRIM LINE ENDPOINTS 11.2 FILLET BETWEEN TWO LINES. 11.2 FILLET BETWEEN TWO LINES. 11.2 FILLET BETWEEN TWO LINES. 11.2 TRIM LINE ENDPOINTS 11.2 FILLET BETWEEN TWO LINES. 11.2 FILLET BETWEEN TWO ARCS (OR	9.13 PLACE ORTHOGONAL CENTER	14.16 DELETE ALL CONSTRUCTION LINES
14.18SOLID CONSTRUCTION LINES.10.1CIRCLE GIVEN CENTER AND RADIUS.14.18— DASHED CONSTRUCTION LINES.10.2CIRCLE GIVEN CENTER AND RADIUS.14.20— PHANTOM CONSTRUCTION LINES.10.3CONCENTRIC CIRCLES10.4MARK CENTER OF CIRCLE10.5PLACE ORTHOGONAL CENTER10.6MARK CENTER OF CIRCLE10.7PLACE ORTHOGONAL CENTER11.8FILLETS11.1INTERSECTION11.1.2TRIM LINE ENDPOINTS11.2FILLET BETWEEN TWO LINES11.1.3TRIM LINE ENDPOINTS11.2FILLET BETWEEN TWO ARCS (OR11.2FILLET BETWEEN TWO ARCS (OR11.3SPECIFY SCALE TO BE		14.17 CONSTRUCTION LINES FROM AN
10.2 CIRCLE OFFICE OFFICER AND AND TARTOM CONSTRUCTION LINES. 10.3 DIAMETER. 10.4 MARK CENTER OF CIRCLES. 10.4 MARK CENTER OF CIRCLES. 10.5 PLACE ORTHOGONAL 10.6 MARK CENTER OF CIRCLES. 10.7 PLACE ORTHOGONAL 10.8 CONSTRUCTION LINES AT A 10.4 MARK CENTER OF CIRCLE. 10.5 PLACE ORTHOGONAL 10.6 CONSTRUCTION LINES AFFICIENTIAL CENTER 11.7 FILLETS 11.1 FILLET BETWEEN TWOLINES. 11.1.1 NO 11.1.2 TRIM 11.1.2 TRIM 11.1.2 TRIM 11.1.3 TRIM 11.2 FILLET BETWEEN TWO LINES. 11.1.2 TRIM 11.1.3 TRIM 11.2 FILLET BETWEEN TWO ARCS (OR		14.18 SOLID CONSTRUCTION LINES.
10.3 CONCENTRIC CIRCLES. 10.4 MARK CENTER OF CIRCLE. 10.5 PLACE ORTHOGONAL CENTER 11.5 LINES ON CIRCLE CENTER. 11.1 FILLETS 11.1 FILLET BETWEEN TWO LINES. 11.1.1 NO 11.1.2 TRIM 11.1.2 TRIM 11.1.3 TRIM 11.1.3 TRIM 11.2 FILLET. 12.3 SPECIFY SCALE 13.3 SPECIFY SCALE 14.22 CINCES. 15.3 SPECIFY SCALE 15.3 SPLIED TO DATA.		
10.5 PLACE ORTHOGONAL CENTER 14.22 CONSIGUTION UNBER OF TIMES. 11. FILLETS 11. FILLET BETWEEN TWO LINES. 15.1 SELECT SPECIFIED NUMBER OF TIMES. 11.1 FILLET BETWEEN TWO LINES. 15.1 SELECT SPECIFIED RESOLUTION. 11.1.2 TRIM OF 15.2 ENTER DESIRED RESOLUTION. 11.1.2 TRIM OF 15.3 RETRIEVE DATA FROM FILE. 11.1.3 TRIM ENDPOINTS 15.3.1 SPECIFY X-OFFSET TO BE 11.2 FILLET BEFORE FILLET. 15.3.2 SPECIFY X-OFFSET TO BE 11.2 FILLET BEFORE FILLET. 15.3.3 SPECIFY X-OFFSET TO BE 11.2 FILLET BEFORE FILLET. APPLIED TO DATA. 11.2 FILLET BETWEEN TWO ARCS (OR 15.3.3 SPECIFY SCALE APPLIED TO DATA. 11.2 FILLET BETWEEN TWO ARCS (OR 15.4 EVALUATE Y-VALUES ON CURVE	DIAMETER.	14.21 - CONSTRUCTION LINES AT A SPECIFIED OFFSET FROM ANOTHER
LINES ON CIRCLE CENTER. A SPECIFIED NUMBER OF TIMES. 11.1 FILLETS 11.1 FILLET BETWEEN TWO LINES. 11.1 INTERSECTION. 11.1.2 TRIM LINE ENDPOINTS 11.1.3 TRIM LINE ENDPOINTS 11.2 FILLET. 11.2 FILLET. 11.2 FILLET. 11.2 TRIM LINE ENDPOINTS 11.2 FILLET. 12.3 SPECIFY SCALE TO BE 13.3 SPECIFY SCALE TO BE 15.4 EVALUATE Y-VALUES ON CURVE	10.4 - MARK CENTER OF CIRCLE.	
11.1 FILLET BETWEEN TWO LINES. 11.1 11.1.1 NO TRIM OF 15.1 SELECT SPECIFIED RESOLUTION. 11.1.1 11.1.2 11.1.2 ITILIZ INTER SECTION. 15.1 SELECT SPECIFIED RESOLUTION. 15.2 ENTER DESIRED RESOLUTION. 15.3.1 SELECT SPECIFIED RESOLUTION. 15.3.1 SECORE FILLET. APPLIED TO DATA. SPECIFY SCALE TO BE APPLIED TO DATA. CIRLCES). 15.3.3 SPECIFY SCALE TO	LINES ON CIRCLE CENTER.	
II.LI NO TRIM OF 15.2 ENTER DESIRED RESOLUTION. INTERSECTION. 15.3 RETRIEVE DATA FROM FILE. II.1.2 TRIM ENDPOINTS 15.3.1 SPECIFY X-OFFSET TO BE II.1.3 TRIM ENDPOINTS 15.3.2 SPECIFY Y-OFFSET TO BE II.1.3 TRIM ENDPOINTS 15.3.2 SPECIFY Y-OFFSET TO BE BEFORE FILLET. 15.3.3 SPECIFY Y-OFFSET TO BE BEFORE FILLET. 15.3.3 SPECIFY SCALE TO BATA. 11.2 FILLET BETWEEN TWO ARCS (OR 15.3.3 SPECIFY SCALE TO BE CIRLCES). 15.4 EVALUATE Y-VALUES ON CURVE	I I. FILLETS	15. CURVE OPERATIONS
II.1.1 NO TRIM OF 13.2 - ENTER EVED ATA FROM FILE INTERSECTION. II.1.2 TRIM LINE ENDPOINTS II.1.3 TRIM LINE ENDPOINTS FILLET BEFOREFILLET. II.2 FILLET BETWEEN TWO ARCS (OR CIRLCES). II.1.4 ENDPOINTS II.2 FILLET BETWEEN TWO ARCS (OR II.2 CIRLCES). II.2 ENTERSECTION. II.2 CIRLCES ON CURVE	II.I FILLET BETWEEN TWO LINES.	
- 11.1.2 TRIM LINE ENDPOINTS - 15.3.1 SPECIFY X-OFFSET TO BE BEYOND FILLET 15.3.2 SPECIFY Y-OFFSET TO BE II.2 FILLET BEFORE FILLET 15.3.3 SPECIFY Y-OFFSET TO BE CIRLCES 15.3.3 SPECIFY Y-OFFSET TO BE APPLIED TO DATA. - 15.3.3 SPECIFY Y-OFFSET TO BE APPLIED TO DATA. - 15.3.4 SPECIFY Y-OFFSET TO BE APPLIED TO DATA. - 15.3.3 SPECIFY Y-OFFSET TO BE APPLIED TO DATA. - 15.3.4 SPECIFY Y-OFFSET TO BE - 15.3.4 SPECIFY SECONDATA - 15.3.4 SPECIFY SECOND		
- II.I.3 TRIM LINE ENDPOINTS - IS.3.2 SPECIFY Y-OFFSET TO BE APPLIED TO DATA 11.2 FILLET BETWEEN TWO ARCS (OR - IS.3.3 SPECIFY SCALE TO BE CIRLCES). APPLIED TO DATA. 15.4 EVALUATE Y-VALUES ON CURVE	JI.I.Z JKIM LINE ENDPOINTS	15.3.1 SPECIFY X-OFFSET TO BE
11.2 FILLET BETWEEN TWO ARCS (OR 15.3.3 SPECIFY SCALE TO BE APPLIED TO DATA. IS.4 EVALUATE Y-VALUES ON CURVE	I.I.3 TRIM LINE ENDPOINTS	I IS.3.2 SPECIFY Y-OFFSET TO BE
CIRCES).	11.2 FILLET BETWEEN TWO ARCS (OR	I IS.3.3 SPECIFY SCALE TO BE
GIVEN SPECIFIED X-VALUES.	- CIRLCES).	15.4 EVALUATE Y-VALUES ON CURVE
		GIVEN SPECIFIED X-VALUES.

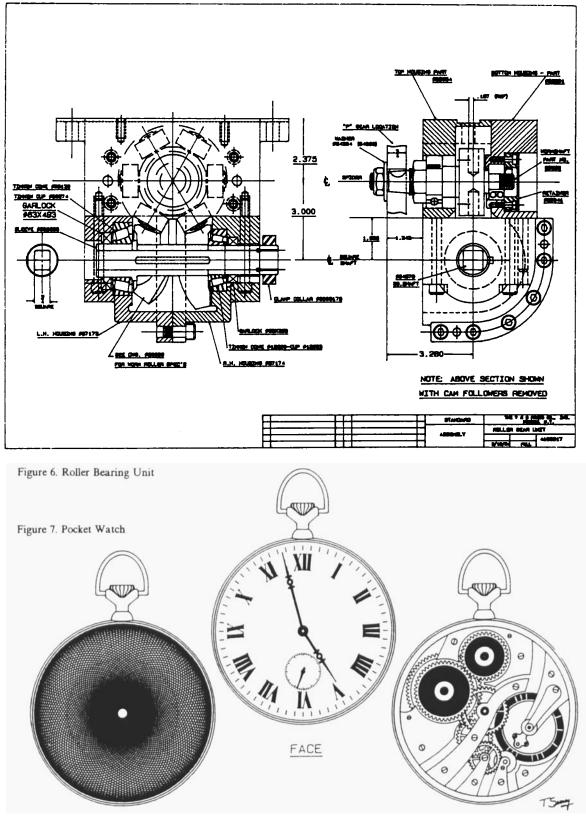
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15.5	PRINT VERTEX FOINTS	IS. ANSI	DIMENSIONING AND TOLERANCES
15.6	PRINT PARAMETERS LISED IN	19.1	CONSTRUCT FEATURE CONTROL
15.7 —	EVALUATING Y-VALUES ON CURVE, MOVE VERTEX POINT OF CURVE, DELETE VERTEX POINT OF CURVE,		SYMBOLS ACCORDING TO ANSI STANDARDS.
is.9 _	INSERT VERTEX POINT INTO CURVE.		19.1.1 DIAMETER. - 19.1.2 SYMMETRY. - 19.1.3 FLATNESS.
16. GENE	RAL EDIT OPERATIONS	-	- 19.1.3 FLATNESS. - 19.1.4 Parallelum. - 19.1.5 Straightness.
16.1	MOVE INDIVIDUAL OBJECT BY Dragging.	_	- 19.1.6 PROFILE LINE. - 19.1.7 PROFILE SURFACE.
16.2	MOVE INDIVIDUAL OBJECT BY A SPECIFIED INCREMENT.		T ISILE MMC (MAXIMUM
16.3	MOVE OBJECTS WITHIN A		MATERIAL CONDITION). 19.1.9 CONCENTRICTY. 19.1.10 ROUNDNESS.
16.4	RECTANGLE. COPY INDIVIDUAL OBJECT AND DRAGTODESIREDLOCATION.	-	- I9.1.11 POSITION. - 19.1.12 PROJECTED TOLERANCE,
16.5	COPY INDIVIDUAL OBJECT TO A SPECIFIED INCREMENTAL	=	- 19.1.13 RUNOUT. - 19.1.14 PERPENDICULARITY.
16.6	LOCATION. COPY OBJECTS WITHIN A		- 19.1.16 CYLINDRICITY.
16.7	RECTANGLE COPY OBJECTS WITHIN A RECTANGLE A SPECIFIED NUMBER	-	- 19.1.17 REGARDLESS OF FEATURE SIZE. 19.1.18 PLUS/MINUS SIGN.
16.8	OF TIMES. DELETE INDIVIDUAL OBJECTS.	19.2 -	19.1.18 PLUS/MINUS SIGN. - 19.1.19 SLASH. - SPECIFY BOX SIZE.
i 6.9 <u> </u>	DELETE OBJECTS WITHIN A	19.3 = 19.4 =	- KEY IN DESIRED TEXT STRINGS. - OBTAIN DOUBLE HIGH SYMBOLS.
—	16.9.1 DELETE ONLY POINTS 16.9.2 DELETE ONLY LINES	19.5 =	- CONTINUE SYMBOLS ON THE NEXT - LINE.
=	16.9.3 DELETE ONLY ARCS 16.9.4 DELETE ONLY TEXT	20. DET	AIL CALL-OUTS
=	16.9.5 DELETE ONLY CIRCLES	c	RELES/ELLIPSES CONTAINING
	ALIGN OBJECTS HORIZONTALLY. ALIGN OBJECTS VERTICALLY. ALIGN OBJECTS VERTICALLY. RIGHT JUSTIFY TEXT TO A	LEADER	R LINES THAT POINT TO DESIGNATED
16.12	SPECIFIED LOCATION.	OBJECT	
16.13	LEFT JUSTIFY TEXT TO A SPECIFIED LOCATION. CENTER JUSTIFY TEXT A	20.1 20.2 - 20.3 -	SPECIFY TEXT SIZE. — CONSTRUCT CIRCLE. — CONSTRUCT ELLIPSE.
16.15	SPECIFIED LOCATION. ROTATE OBJECT TO A SPECIFIED	20.4 _	- OPTION FOR LEADER LINE.
16.16	ANGLE. ROTATE OBJECT A SPECIFIED	20.5	 20.4.1 I-VERTEX LEADER LINE. 20.4.2 2-VERTEX LEADER LINE. SPECIFY STARTING VALUE.
16.17	NUMBER OF DEGREES.	20.6	SPECIFY AUTOMATIC INCREMENTAL VALUE
	NUMBER OF TIMES, ROTATING	20.7	
	FACH COPY BY THE SPECIFIED	-	DEFAULT SYMBOL SIZE TO CONTAIN CENTERED TEXT.
16.17	EACH COPY BY THE SPECIFIED Angle. Scale object in both X and	20.8	- CONTAIN CENTERED TEXT. SPECIFY ARROW LENGTH.
16.17 16.18	EACH COPY BY THE SPECIFIED Angle. Scale object in both X and Y-directions. Scale object in the	20.8 21. F AS	- CONTÂIN CENTERED TEXT. SPECIFY ARROW LENGTH. <u>TENERS</u>
· · · —	EACH COPY BY THE SPECIFIED ANGLE. SCALE OBJECT IN BOTH X AND Y-DIRECTIONS. SCALE OBJECT IN THE X-DIRECTION ONLY. SCALE OBJECT IN THE	20.8	- CONTAIN CENTERED TEXT. SPECIFY ARROW LENGTH. <u>TENERS</u> SPECIFY FASTENER TY PE - 21.1.1 SQUARE BOLT HEAD. - 21.1.2 HEXELAT FACE ROLT.
16.18	EACH COPY BY THE SPECIFIED ANGLE. SCALE OBJECT IN BOTH X AND Y-DIRECTIONS. SCALE OBJECT IN THE X-DIRECTION ONLY. SCALE OBJECT IN THE Y-DIRECTION ONLY. MIRROR OBJECT ABOUT THE	20.8 21. F AS	- CONTAIN CENTERED TEXT. SPECIFY ARROW LENGTH. <u>TENERS</u> SPECIFY FASTENER TYPE - 21.1.1 SQUARE BOLT HEAD. - 21.1.2 HEX FLATFACE BOLT. - 21.1.3 HEX FLATFACE BOLT. - 21.1.4 FLAT COUNTERSINK HEAD.
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16.18	EACH COPY BY THE SPECIFIED ANGLE. SCALE OBJECT IN BOTH X AND Y-DIRECTIONS. SCALE OBJECT IN THE X-DIRECTION ONLY. SCALE OBJECT IN THE Y-DIRECTION ONLY. INTROR OBJECT ABOUT THE X-AXS. IG.21 MIRROR OBJECT ABOUT THE X-AXS. IG.21 MIRROR OBJECT ABOUT THE Y-AXS. IG.22 MOVE ORIGIN OF OBJECT. DIT OPERATIONS CHANGE DIRECTION. CHANGE DIRECTION. CHANGE ARCCENTER POINT. CHANGE ARC CENTER POINT. CHANGE ARC CONTER POINT. CONTE ARC A SPECIFIED ANGLE. COMPLEMENT ARC. EDIT OPERATIONS MOVE VERTEX. INSERT VERTEX. IN	20.8 <u>21. FAS</u> <u>21.1</u> 	CONTAIN CENTERED TEXT. SPECIFY ARROWLENGTH. TENERS SPECIFY FASTENER TYPE 21.1.1 SQUARE BOLT HEAD. 21.1.3 HEX FLANGE BOLT. 21.1.3 HEX FLANGE BOLT. 21.1.4 FLAT COUNTERSINK HEAD. 21.1.5 HEX CAP BOLT. 21.1.6 HEX SOCKET CAP. 21.1.8 BUTTON HEAD CAP. 21.1.8 BUTTON HEAD CAP. 21.1.8 BUTTON HEAD CAP. 21.1.10 ROUND HEAD CAP. 21.1.11 ROUND MACHINE HEAD. 21.1.12 FLAT COUNTERSINK MACHINE HEAD. 21.1.13 OVAL COUNTERSINK 21.1.14 FAN HEAD MACHINE. 21.1.15 TRUSS HEAD. 21.1.16 TRUSS HEAD. 21.1.16 TRUSS HEAD. 21.1.16 TRUSS HEAD. 21.1.15 TRUSS HEAD. 21.1.16 TRUSS HEAD. 21.1.25 HEXAGONAL DOUBLE 21.2.1 STANDARD SQUARE NUT. 21.2.2 HEXAGONAL JAM NUT. 21.2.3 HEXAGONAL FLAT FACE NUT. 21.2.5 HEXAGONAL FLAT FACE MACHINE NUT. 21.2.6 DOUBLE CHAMFER MACHINE NUT. 21.2.7 HEAVY HEX JAM NUT. 21.2.8 HEX FLANGE NUT. 21.2.8 HEX FLANGE NUT. 21.3.1 FLAT POINT SOCKET SET SCREW.
16.18	EACH COPY BY THE SPECIFIED ANGLE. SCALE OBJECT IN BOTH X AND Y-DIRECTIONS. SCALE OBJECT IN THE X-DIRECTION ONLY. SCALE OBJECT IN THE Y-DIRECTION ONLY. INTROR OBJECT ABOUT THE X-AXES. IG.21 MIRROR OBJECT ABOUT THE X-AXES. IG.21 MIRROR OBJECT ABOUT THE Y-AXES. IG.21 MIRROR OBJECT ABOUT THE Y-AXES. IG.22 MOVE ORIGIN OF OBJECT. DIT OPERATIONS CHANGE INCLUDED ANGLE. GAP ARC. REFLECT ARC. CHANGE ARC CENTER POINT. CHANGE ARC CENTER POINT. CHANGE ARC CENTER POINT. CHANGE ARC CENTER POINT. CHANGE ARC CONTER POINT. CHANGE ARC A SPECIFIED ANGLE. COMPLEMENT ARC. EDIT OPERATIONS MOVE VERTEX. REMOVE VERTEX. INSERT VERTEX. EXTEND LINE. EXTEND LINE. EXTEND LINE. EXTEND LINE. EXTEND LINE. EXTEND LINE TO THE POINT AT WHICH THE LINE INTERSECTS ANOTHER GIVEN OBJECT. MOVE VERTEX OF A NON-ORTHOGONAL LINE SO THAT THE LINE BECOMES OR NENTED ALONG THE XOR YAXES.	20.8 <u>21. FAS</u> <u>21.1</u> 	CONTAIN CENTERED TEXT. SPECIFY ARROWLENGTH. TENERS SPECIFY FASTENER TYPE 21.1.1 SQUARE BOLT HEAD. 21.1.2 HEX FLAT FACE BOLT. 21.1.3 HEX FLANGE BOLT. 21.1.4 FLAT COUNTERSINK HEAD. 21.1.5 HEX CAP BOLT. 21.1.6 HEX SOCKET CAP. 21.1.8 BUTTON HEAD CAP. 21.1.8 BUTTON HEAD CAP. 21.1.9 ROUND HEAD CAP. 21.1.10 ROUND MACHINE HEAD. 21.1.11 ROUND MACHINE HEAD. 21.1.12 FLAT COUNTERSINK MACHINE HEAD. 21.1.14 PAN HEAD MACHINE. 21.1.15 FILLSTER HEAD. 21.1.16 TRUSS HEAD. 21.1.16 TRUSS HEAD. 21.1.16 TRUSS HEAD. 21.1.17 STUDS HEAD. 21.1.18 FILLSTER HEAD. 21.1.14 PAN HEAD MACHINE. 21.1.27 HEXAGONAL JAM NUT. 21.2.3 HEXAGONAL FLAT FACE NUT. 21.2.6 DOUBLE CHAMFER. 21.2.7 HEAY HEX JAM NUT. 21.2.7 HEAY HEX JAM NUT. 21.2.8 HEX FLANGE NUT. 21.2.8 HEX FLANGE NUT. 21.2.9 HEX AGONAL FLAT FACE MACHINE NUT. 21.2.8 HEX FLANGE NUT. 21.2.1 STANDARD SOCKET SET SCREW. 21.3.1 CAL POINT SOCKET SET SCREW.
16.18	EACH COPY BY THE SPECIFIED ANGLE. SCALE OBJECT IN BOTH X AND Y-DIRECTIONS. SCALE OBJECT IN THE X-DIRECTION ONLY. SCALE OBJECT IN THE Y-DIRECTION ONLY. INTROR OBJECT ABOUT THE X-AX5. IG.21 MIRROR OBJECT ABOUT THE X-AX5. IG.21 MIRROR OBJECT ABOUT THE Y-AX5. IG.21 MIRROR OBJECT ABOUT THE Y-AX5. IG.22 MOVE ORIGIN OF OBJECT. DIT OPERATIONS CHANGE RADIUS. CHANGE ARCONDOLO CHANGE ARCO	20.8 <u>21. FAS</u> <u>21.1</u> 	CONTAIN CENTERED TEXT. SPECIFY ARROWLENGTH. TENERS SPECIFY FASTENER TYPE 21.1.1 SQUARE BOLT HEAD. 21.1.3 HEX FLANGE BOLT. 21.1.3 HEX FLANGE BOLT. 21.1.4 FLAT COUNTERSINK HEAD. 21.1.5 HEX CAP BOLT. 21.1.6 HEX SOCKET CAP. 21.1.8 BUTTON HEAD CAP. 21.1.8 BUTTON HEAD CAP. 21.1.9 ROUND HEAD CAP. 21.1.10 ROUND HEAD CAP. 21.1.11 ROUND MACHINE HEAD. 21.1.12 FLAT COUNTERSINK MACHINE HEAD. 21.1.13 WAL 21.1.14 PAN HEAD MACHINE. 21.1.15 TRUSS HEAD. 21.1.16 TRUSS HEAD. 21.1.16 TRUSS HEAD. 21.1.13 GVAL 21.1.14 PAN HEAD MACHINE. 21.1.15 TRUSS HEAD. 21.1.16 TRUSS HEAD. 21.1.16 TRUSS HEAD. 21.1.27 HEXAGONAL DOUBLE CHAMFER. 21.2.3 HEXAGONAL FLAT FACE NUT. 21.2.4 HEXAGONAL FLAT FACE NUT. 21.2.5 HEXAGONAL FLAT FACE MACHINE NUT. 21.2.6 DOUBLE CHAMFER MACHINE NUT. 21.2.8 HEX FLANGE NUT. 21.2.8 HEX FLANGE NUT. 21.2.1 FLAT FOINT SOCKET SET SCREW. 21.3.3 CONE POINT SOCKET SET SCREW. 21.3.3 CONE POINT SOCKET SET SCREW.
16.18	EACH COPY BY THE SPECIFIED ANGLE. SCALE OBJECT IN BOTH X AND Y-DIRECTIONS. SCALE OBJECT IN THE X-DIRECTION ONLY. IN THE Y-DIRECTION ONLY. IN THE Y-DIRECTION ONLY. IN THE X-AX5. IS 20 MOVE ORIGIN OF OBJECT ABOUT THE Y-AX5. IS 22 MOVE ORIGIN OF OBJECT. IS 21 MIRROR OBJECT ABOUT THE Y-AX5. IS 22 MOVE ORIGIN OF OBJECT. IS 21 MIRROR OBJECT ABOUT THE Y-AX5. IS 22 MOVE ORIGIN OF OBJECT. IS 21 MOVE ORIGIN OF OBJECT. CHANGE INCLUDED ANGLE. GAP ARC. REFLECT ARC. CHANGE ARC CENTER POINT. CHANGE ARC CENTER POINT. CHANGE ARC APECIFIED ANGLE. COMPLEMENT ARC. EDIT TOPERATIONS MOVE VERTEX. REMOVE VERTEX. EXTEND LINE TO THE POINT AT WHICH THE LINE INTERSECTS ANOTHER GIVEN OBJECT. MOVE VERTEX. EXTEND LINE TO THE POINT AT WHICH THE LINE INTERSECTS ANOTHER GIVEN OBJECT. MOVE VERTEX. EXTEND LINE TO THE POINT AT WHICH THE LINE INTERSECTS ANOTHER GIVEN OBJECT. MOVE VERTEX. EXTEND LINE TO THE POINT AT WHICH THE LINE INTERSECTS ANOTHER GIVEN OBJECT. MOVE VERTEX. EXTEND LINE TO THE POINT AT WHICH THE LINE SO THAT THE LINE BECOMES ORIENTED ALONG THE X OR Y AXES. MOVE LINE SEGMENT.	20.8 <u>21. FAS</u> <u>21.1</u> 	CONTAIN CENTERED TEXT. SPECIFY ARROW LENGTH. TENERS SPECIFY FASTENER TYPE 21.1.1 SQUARE BOLT HEAD. 21.1.3 HEX FLANGE BOLT. 21.1.3 HEX FLANGE BOLT. 21.1.4 FLAT COUNTERSINK HEAD. 21.1.5 HEX CAP BOLT. 21.1.6 HEX SOCKET CAP. 21.1.7 LOW HEAD CAP. 21.1.9 ROUND HEAD CAP. 21.1.10 ROUND HEAD CAP. 21.1.10 ROUND HEAD CAP. 21.1.11 ROUND MACHINE HEAD. 21.1.12 FLAT COUNTERSINK MACHINE HEAD. 21.1.13 OVAL COUNTERSINK MACHINE HEAD. 21.1.14 FAN HEAD MACHINE. 21.1.15 FILLSTER HEAD. 21.1.16 TRUSS HEAD. 21.1.16 TRUSS HEAD. 21.1.16 TRUSS HEAD. 21.2.1 STANDARD SQUARE NUT. 21.2.2 HEXAGONAL JAM NUT. 21.2.3 HEXAGONAL FLAT FACE NUT. 21.2.4 SQUARE MACHINE NUT. 21.2.4 SQUARE MACHINE NUT. 21.2.4 SQUARE MACHINE NUT. 21.2.4 SQUARE MACHINE NUT. 21.2.6 DOUBLE CHAMFER MACHINE NUT. 21.2.7 HEAY HEX JAM NUT. 21.2.8 HEXAGONAL FLAT FACE NUT. 21.2.8 HEXAGONAL FLAT FACE NUT. 21.2.9 HEXAGONAL SIAN NUT. 21.2.9 HEXAGONAL SIAN SOCKET SET SCREW. 21.3.1 FLAT POINT SOCKET SET 3.2.2 OVAL POINT SOCKET SET 3.2.2 OVAL POINT SOCKET SET 3.2.2 OVAL POINT SOCKET SET 3.2.2 OVAL POINT SOCKET SET

21.5SPECIFY THREADS PER INCH (OR PITCH FOR METRIC FASTENERS), 21.6 SPECIFY FASTENER LENGTH, 21.7SPECIFY THREAD LENGTH,	24.9 DELETE GROUPS FROM DRAWING OR MASTER LIBRARIES.
21.6 SPECIFY FASTENER LENGTH.	24.10 PACK MASTER LIBRARIES. 24.11 - INSERT GROUP INTO LINE
21.7 SPECIFY THREAD LENGTH. 21.8 SPECIFY ANGLE OR ORIENTATION	24.11 - INSERT GROUP INTO LINE. 24.11.1 MIRROR GROUP ABOUT
	INSERTED LINE.
21.9 OPTION TO OBTAIN CENTER LINES — THROUGH FASTENER. 21.10 OPTION FOR SCHEMATIC THREADS. 21.11 — OPTION FOR TRUE THREADS.	24.11.2 MIRROR GROUP ABOUT
21.10 OPTION FOR SCHEMATIC THREADS. 21.11 OPTION FOR TRUE THREADS.	PERPENDICULAR TO
	INSERTED LINE.
21.13 OPTION FOR IMPERIAL INPUT. 21.14 OPTION FOR SIDE VIEW.	24.13 - RETRIEVE GROUP BY NUM BER. 24.14 - RETRIEVE GROUP BY NAME.
21.15 OPTION FOR END VIEW.	
21.16 SELECTION OF STANDARD	25. GROUP EDIT OPERATIONS
- 21.16.1 NATIONAL FINE. 21.16.2 NATIONAL COARSE.	25.1 MOVE GROUP ORIGIN. 25.2 UN-NEST TOP LEVEL GROUP ONLY.
21.17 OPTIONAL WASHER ON FASTENER.	25.3 UN-NEST ALL LEVELS IN GROUP.
21.17.1 TYPE A PLAIN WASHERS: NARROW AND WIDE.	26. MENU SET-UP OPERATIONS
21.17.2 ITPE B PLAIN WASHERS:	26.1 SET UP COMMAND MENU.
WIDE,	26.2 TAKE DOWN COMMAND MENU.
21.17.3 HELICAL SPRING LOCK WASHERS: NAR., REG.	26.3 — SET UP GROUP MENU. 26.4 — TAKE DOWN GROUP MENU.
WIDE.	· · · · · · · · · · · · · · · · · · ·
21.18 ABILITY TO CHANGE OR ADD FASTENER TYPES.	27. CROSSHATCH OPERATIONS
22 POLYGON OPERATIONS	27.1 MANUALLY PICK BOUNDARY TO
	27.2 AUTOMATICALLY TRACE BOUNDARY TO BE CROS SHATCHED.
22.1 FULL ELLIPSE. 22.2 HALF ELLIPSE.	27.3 BOUNDARY TO BE CROSSHATCHED.
22.3 OUARTER ELLIPSE.	BOUNDARIES TO ACCOMMODATE
22.4 GAP ELLIPSE. 22.5 SPECIFY RESOLUTION	HOLES. 27.4 SPECIFY SPACING BETWEEN
22.6 — INSCRIBED POLYGON. 22.7 — CIRCUMSCRIBED POLYGON.	- SUCCESSIVE LINES.
22.8 SPECIFY NUMBER OF SIDES	POSITION.
22.9 COMPRISING POLYGON. MARK CENTER OF ELLIPSE OR	27.6 SPECIFY ANGLE. 27.7 SPECIFY PATTERN TYPE.
- POLYGON.	
22.11 GAP ELLIPSE OR POLYGON	28. AREA/PERIMETER CALCULATIONS
- BOUNDARY	28.1 MANUALLY PICK POLYGON. 28.2 AUTOMATICALLY TRACE
23. ANSI WELD SYM BOLS	- BOUNDARY.
23.I SQUARE GROOVE.	283 ACCUMULATE AREAS OF
23.2 - V-GROOVE. 23.3 - BEVEL GROOVE.	28.4 SUBTRACT AREAS OF HOLES OR
23.4 U-GROOVE.	28.5 PRINT OUT GEOMETRY DATA OF
23.5 - J-GROOVE 23.6 - FLARE V-GROOVE	SELECTED OBJECTS.
23.7 FLARE BEVEL WELD.	29. ACCESS GEOMETRY DATA
23.9 PLUG WELD.	29.1 RETURN OBJECT TYPE
23.10 SPOT WELD. 23.11 SEAM WELD.	29.1 RETURN OBJECT TYPE. 29.2 RETURN LINE PARAMETERS.
23.12 STAGGERED FILLET.	29.2.1 LINE SEGMENT NUMBER. 29.2.2 START POINT
23.13 BACKING. 23.14 MELT THROUGH.	29.2.3 END POINT COOR DINATES.
23.15 SURFACING. 23.16 FLANGEEDGE.	27.2.4 CENGIN
23.17 FLANGE CORNER.	29.2.5 ANGLE RELATIVE TO THE
23.18 FLUSH CONTOUR. 23.19 CONVEX CONTOUR.	29.3 RETURN ARC PARAMETERS.
23.20 CONCAVE CONTOUR.	29.3.2 END POINT.
23.21 FINISH SYMBOL. 23.22 SPECIFY ARROW TYPE	29.3.3 CENTER POINT. 29.3.4 RADIUS.
23.22 SPECIFY ARROW TYPE 23.23 SPECIFY TEXT SIZE. 23.24 SPECIFY WELD NOTES.	29.3.5 INCLUDED ANGLE
	29.4 RETURN POINT PARAMETERS.
24. SYMBOL OR GROUP OPERATIONS	
24.1 CREATE GROUP BY PICKING	
INDIVIDUAL PRIMITIVE OBJECTS OR OTHER GROUPS.	30. DRAWING DEFAULT OPERATIONS
24.2 CREATE GROUP BY SELECTING	30.1 CHANGE SPACING OF MAJOR
ALL OBJECTS WITHIN A SPECIFIED	GRIDS. 30.2 CHANGE SPACING OF MINOR GRIDS.
24.3 ALLOW A MAXIMUM OF 255 GROUP	30.3 SPECIFY INCREMENT FOR MAIOR
MEMBERS ON FACH I FVEL . ALLOW	
MEMBERS ON EACH LEVEL; ALLOW	304 CHANGE SENSITIVITY OF STYLUS
MEMBERS ON EACH LEVEL; ALLOW UP TO IO LEVELS OF GROUP NESTING, OULS UNTO DOWNLO	30.4 CHANGE SENSITIVITY OF STYLUS
MEMBERS ON EACH LEVEL; ALLOW UP TO IO LEVELS OF GROUP NESTING, OULS NITO DOWNLO	30.4 CHANGE SENSITIVITY OF STYLUS PICK BY ENLARGING OR DECREASING THE SIZE OF THE HIT WINDOW.
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MEM BERS ON EACH LEVEL; ALLOW UP TO 10 LEVELS OF GROUP NESTING. 24.4 FILE GROUPS INTO DRAWING LIBRARY. 24.5 RETRIVE GROUPS FROM DRAWING LIBRARY. 24.6 FILE GROUPS INTO MASTER LIBRARY WHERE THEY CAN BE ACCESSED BY ALL DRAWINGS.	 30.4 CHANGE SENSITIVITY OF STYLUS PICK BY ENLARGING OR DECREASING THE SIZE OF THE HIT WINDOW. 30.5 SET ALL LEVELS OF. 30.6 SET ALL LEVELS OF. 30.7 SET A SPECIFIED LEVEL ON. 30.8 SET A SPECIFIED LEVEL OF. 30.9 SET A RANGE OF LEVELS ON.
MEM BERS ON EACH LEVEL; ALLOW UP TO IO LEVELS OF GROUP NESTING. 24.4 FILE GROUPS INTO DRAWING LIBRARY. 24.5 RETRIVE GROUPS FROM DRAWING LIBRARY. 24.6 FILE GROUPS INTO MASTER LIBRARY WHERE THEY CAN BE ACCESSED BY ALL DRAWINGS. 24.7 RETRIEVE GROUPS FROM MASTER	 30.4 CHANGE SENSITIVITY OF STYLUS PICK BY ENLARGING OR DECREASING THE SIZE OF THE HIT WINDOW. 30.5 SET ALL LEVELS ON. 30.6 SET ALL LEVELS OFF. 30.7 SET A SPECIFIED LEVEL ON. 30.8 SET A SPECIFIED LEVEL OFF. 30.9 SET A RANGE OF LEVELS OF. 30.10 SET A RANGE OF LEVELS OFF.
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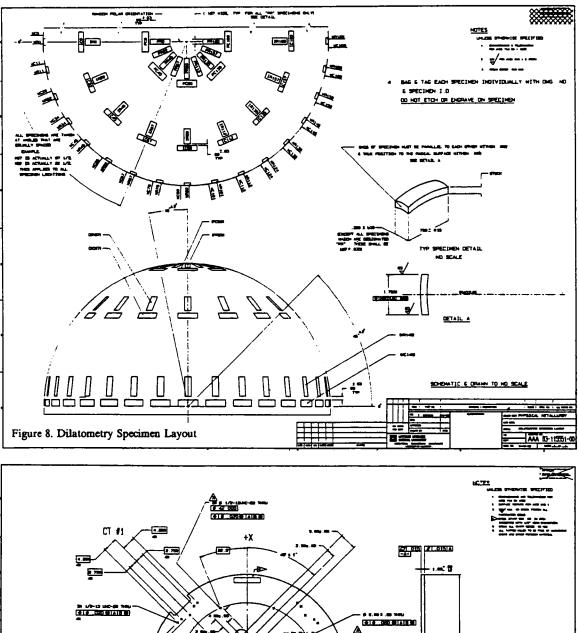
30.14 INSPECT DRAWING UNITS.	33.11	REMOVE A PROPERTY FROM A
30.15 INSPECT DRAWING ORIGIN	33.12	SPECIFIED OBJECT. DISPLAY OBJECTS WITH
30.16 INSPECT DRAWING MEMORY		UNASSIGNED PROFERTIES.
- UTILIZATION (AS A PERCENTAGE OF FULL CAPACITY).	13713 -	PRINT ALL PROPERTIES IN THE
30.17 INSPECT CURRENTLY ACTIVE	33.14	PRINT A PROPERTY REPORT OF
- LEVEL		ALL GRAPHIC OBJECTS ON
30.18 INSPECT CURRENTLY ACTIVE PEN NUMBER.	33.15	DRAWING. SPECIFY THE NAME OF THE
30.19 INSPECT CURRENTLY ACTIVE	-	PROPERTY FILE.
30.20 INSPECT CURRENTLY ACTIVE	33.16	SPECIFY WHICH FIELD IS TO BE Sorted.
SYLUS INPUT MODE (FREE PICK	33.17	AUTOMATICALLY ACCUMULATE
GRID PICK, OR OBJECT SNAP).		QUANTITIES OF IDENTICAL ITEMS.
30.21 INSPECT CURRENTLY ACTIVE AXIS LOCK OR NON-AXIS LOCK STATUS,	34 MECH	ANICAL DIMENSIONS
31. TEXTEDIT OPERATIONS	341	SPECIFY TEXT SIZE FOR LABELING DIMENSION VALUE.
31.1 SPECIFY TEXT TO BE EDITED.	34.2	CHOOSE STANDARD TEXT SIZES
31.2 - SPECIFY JUSTIFICATION FOR		34.2.1 0.08 INCH TEXT. 34.2.2 0.10 INCH TEXT.
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31.3 - SPECIFY EXISTING CHARACTER OR	34.4 -	ANGULAR DIMENSIONS. RADIAL DIMENSIONS.
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31.4 SPECIFY OPTION TO TRUNCATE TO	(–	TEXT WHICH IS TOO LARGE TO BE CONTAINED WITHIN THE
31.4 SPECIFY OPTION TO TRUNCATE TO THE END OF THE TEXT STRING.	[DIMENSIONED DISTANCE
31.5 PROVIDE OPTION FOR	34.7	OPTION TO HANDLE TOLERANCES.
DUPLICATING EDIT ON OTHER TEXT STRINGS.	····	LIMITS.
31.6 ALLOW TEXT STRING TO BE	34.9	OPTION TO KEY IN NOTE.
- RETYPED.	34.10 =	OPTION TO OFFSET THE DIMENSION
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32.1 RETRIEVE PEN NUMBER.	34.12	TEXT BASED ON A PICKED POINT. VERTICAL DIMENSION ANGLE.
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32.3 RETRIEVE LINE STYLE 32.4 RETRIEVE KIND ATTRIBUTE (USED	34.14 =	NON-ORTHOGONAL DIMENSION
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328.1 POINTS.	34.18	NUMBERS. OPTION TO EXPRESS DIMENSION
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33.1 DEFINE PROPERTY FORMAT.	34.25	OPTION TO CHANGE THE TYPE OR
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CHARACTERS PROPERTY, 33.3 — SPECIFY NUMBER OF FIELDS OR REPORT COLUMNS, 33.4 — SPECIFY REPORT TITLES. 33.5 — SPECIFY REPORT DATE OR REVISION NUMBER. 33.6 — INDICATE WHETHER FIELDS ARE NUMERIC OR ALPHANUMERIC. 33.7 EXAMINE PROPERTY OF A	35.1 35.2 35.3 35.4	WIDEN OPERATIONS WIDEN FROM CENTER LINE. WIDEN TO GIVEN SIDE OF LINE. OPTION TO DELETE OR SAVE REFERENCE LINE TO BE WIDENED. SPECIFY WIDTM.
CHARACTERS PROPERTY, 33.3 — SPECIFY NUMBER OF FIELDS OR REPORT COLUMNS, 33.4 — SPECIFY REPORT TITLES, 33.5 — SPECIFY REPORT DATE OR REVISION NUMBER, 33.6 — INDICATE WHETHER FIELDS ARE NUMERIC OR ALPHANUMERIC, 33.7 — EXAMINE PROPERTY OF A SPECIFIED OBJECT. 33.8 — ASSIGN PROPERTY TO A SPECIFIED	35.1 35.2 35.3 — 35.4 35.5 —	WIDEN OPERATIONS WIDEN FROM CENTER LINE. WIDEN TO GIVEN SIDE OF LINE. OPTION TO DELETE OR SAVE REFERENCE LINE TO BE WIDENED. SPECIFY WIDTM. HANDLE BOUNDARIES CONSISTING OF LINES AND/OR ARCS.
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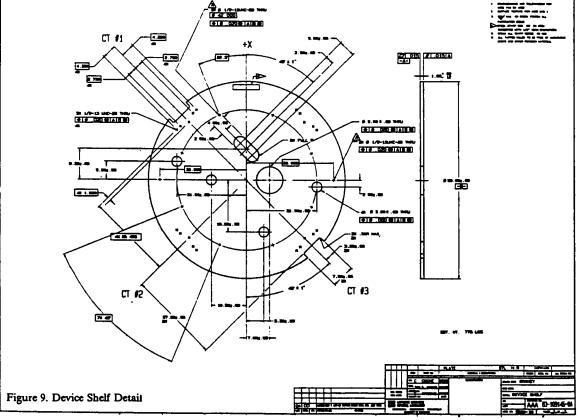
36.9 SPECIFY CHANFTER DEPTH.	44. LAND SCAPE ARCHITECTURE
36.9 SPECIFY CHANFTER DEPTH. 36.10 SPECIFY SIDE AND/OR END VIEW. 36.11 SPECIFY PERIMETER VIEW.	44.1 FREE-HAND SKETCH. 44.2 SKETCH USING BRUSH PATTERN.
36.12 SPECIFY ORIENTATION. 36.13 SPECIFY METRIC OR IMPERIAL	44.2.1 SOLID CIRCULAR BRUSH
36.14 THREADS. 36.14 SPECIFY TRUE OR SCHEMATIC THREAD REPRESENTATION.	
37. SPRING OPERATIONS	BRUSH OF SPECIFIED HEIGHTAND WIDTH. 44.2,3 PICK DESIRED BRUSH
37.1 COMPRESSION SPRING.	- PATTERN.
37.2 - EXTENSION SPRING. 37.3 - SECTION VIEW.	45. WALL CONSTRUCTION
37.4 - SCHEMATIC VIEW. 37.5 - SIMPLIFIED VIEW.	45.1 CONSTRUCT DOULBE LINE WALLS.
37.6 — SPECIFY LENGTH. 37.7 — SPECIFY INSIDE DIAMETER. 37.8 — SPECIFY OUTSIDE DIAMETER.	45.1.1 WIDEN WALL TO THE LEFT. 45.1.2 WIDEN WALL FROM THE
37.8 — SPECIFY OUTSIDE DIAMETER. 37.9 — SPECIFY WIRE DIAMETER.	45.1.3 WIDEN WALL TO THE
37.10 SPECIFY NUMBER OF COLLS.	45.2 AUTOMATIC CORNER AND
37.11 - AUTOMATICALLY COMPUTER NUMBER OF COLLS FOR EXTENSION	45.3 PICK STARTING REFERENCE POINT.
SP RINGS. 37.12 SPECIFY ORIENTATION. 37.13 — OPTION TO SHOW CENTER LINE.	46. DOOR/WINDOW CONSTRUCTION
3& CUT & PASTE OPERATIONS	46.1 SPECIFY WIDTH OF DOOR/WINDOW. 46.2 OPTION FOR DOUBLE DOOR.
3&I CUT ALL OBJECTS THAT	46.3 OPTION FOR SLIDING
- INTERSECT A GIVEN RECTANGLE AND GROUP THE OBJECTS FOR	46.4 PICK STARTING REFERENCE POINT.
SUBSEQUENT ENLARGÉMENT FOR DETAILS.	
38.1 OPTION TO SAVE ORIGINAL OBJECTS INSIDE RECTANGLE.	47. FACILITIES PLANNING
39. CUSTOM-TAILORED TASKS	47.1 SPECIFY SCALE OF SYMBOL. 47.2 SPECIFY ANGLE OF SYMBOL
39.1 A MEANS FOR ADDING CUSTON TASKS TO THE MENU.	- ROTATION.
39.2 A HIGH-LEVEL PROGRAMMING AID	- SYMBOL. 47.3.1 CLUB CHAIR.
WHICH MAKES GEOMETRY ACCESS AND RETRIEVAL TRANSPARENT TO THE USER.	
39.3 _ A PROGRAMMER'S GUIDE WHICH	- 47.3.5 SMALL SOFA
DETAILS HOW TO WRITE CUSTON TASKS.	- 47.3.6 END TABLE. - 47.3.7 FOOTSTOOL.
40. PLOT OPERATIONS	- 47.3.8 TV CONSOLE. - 47.3.9 PORTABLE TV.
40.1 SET PEN TABLE. 40.2 SPECIFY PLOT SCALE	- 47.3.10 CHINA CABINET. 47.3.11 FIREPLACE
40.2 - SPECIFY PLOT SCALE. 40.3 - OPTION TO PICK WINDOW.	- 47.3.12 COFFEETABLE. - 47.3.13 SMALL DESK.
40.4 — OPTION TO FRAME WINDOW. 40.5 — OPTION TO CLIP WINDOW.	47.3.14 LARGE DESK.
40.6 — OPTION TO ADJUST WINDOW. 40.7 — SELECT DESIRED PLOTTER.	47.3.16 TWIN BED.
41. FAST PLOT OPERATIONS	
41.1 SELECT DESIRED MATRIX PRINTER.	47.3.20 WARDROBE CLOSET.
41.2 SELECT DRAWING WINDOW TO BE PLOTTED.	47.3.22 DRESSING TABLE.
42. DRAWING PACK	I 47.3.24 TRIPPLE DRESSER.
42.1 OPTION TO RECOVER STORAGE	47.3.25 DOUBLE DRESSER. 47.3.26 CHAIR. 47.3.27 VANITY.
DELETED OBJECTS.	47.3.27 VANITY. 47.3.28 BENCH. 47.3.29 BATHTUB.
43. SYMBOLLIBRARIES	- 47.3.30 WATER CLOSET. - 47.3.31 LAVATORY.
43.I ARCHITECTURAL.	- 47.3.32 SHO WER. - 47.3.33 FREEZER.
43.2 — LANDSCAPE. 43.3 — FACILITIES PLANNING.	47.3.34 REFRIGERATOR. 47.3.35 REFRIG./FREEZER.
43.4 PIPING & INSTRUMENTATION.	- 47.3.36 SINK. - 47.3.37 OVEN
436 - ELECTRICAL	47.3.38 WASHER.
438 - MINING & METALLURGY	- 47.3.39 DRYER. - 47.3.40 STOVE.
43.9 - ABILITY TO ADD CUSTOM SYMBO (OR GROUP) LIBRARIES.	



COVER

MECHANISM





and a reduction in the manufacturing cycle and a reduction of costly field errors due to consistency. Through use of a common data base of standards, micro-based CAD allows the cost effective creation of production drawings which can be rapidly

A full-featured CAD system should be upgradable, networkable, and expandable through use of a high-level graphics programming language. State-of-the-art micro CAD systems perform most graphic manipulations (even on complex objects) in less than three seconds are more cost effective for the input of 2D drawings than the higher priced mini-based systems. Furthermore, since each workstation in the networked micro system incorporates distributed processing, degradation is not as apparent as mini workstations that are networked to a single central processing unit (CPU).

changed or edited in a consistent format.

In CAD Environments, benchmarks can be misleading since computer graphics involves a human-machine interface. Even if identical drawings are used for benchmarks, a control test is difficult to achieve due to differences in an operator's

- (a) learning curve,
- (b) ability to effectively use available commands,
- (c) prior CAD experience,
- (d) exposure to the specific type of drawing,
- (c) familiarity with the drawing symbols,
- (f) initial preparation of symbol libraries,
- (h) skill in establishing production techniques prior to generating the drawing,

as well as other factors. More important, however, is an evaluation of the CAD software, the ease of use, documentation, support and maintenance. Usually, the more comprehensive the CAD software, the greater the productivity potential regardless of the claimed "horsepower".

If the CAD system is to be used in a specific application area such as mechanical design, determine whether or not programs are available for ANSI dimensioning, geometric tolerancing, the construction of weld symbols, fasteners, springs, etc.⁵ For architectural applications, the ability to draw free-hand for landscapes and renderings is useful⁶ Also programs to construct double-line walls and insert doors and windows of various widths provide CAD productivity gains that exceed manual techniques. Examples of various engineering drawings produced on micro CAD workstations discussed in this paper are shown in Figures 6 through 10.

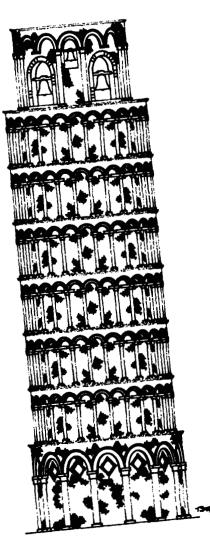


Figure 10. Leaning Tower of Pisa

References

- Beth W. Tucker, "CAD Market Review and Forecast," pp. 12-14 in copyright 1983 by Dataquest, Inc., CAD/CAM Industry Service Conference (September 26-28 1983).
- 2. Dr. Gary S. Goldman, "PGL: Pascal Graphics Library, Programmer's Guide," in copyright 1983 by Cascade Graphics Development, (1983).

- 3. Dr. Gary S. Goldman, "A New Era in Computer Aided Drafting," in copyright 1982 by Cascade Graphics Development, (1982).
- 4. Computer Architecture News, A performance Evaluation of the Intel iAPX 432. June 1982.
- 5. Dr. Gary S. Goldman, "MDAS: Mechanical Design Application Software," in copyright 1981 by Cascade Graphics Development, (1981).
- 6. Dr. Gary S. Goldman, "ASAP: Architectural Software Application Package," in copyright 1984 by Cascade Graphics Development, (1984).

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