

## STANDING INSTRUCTIONS

FOR USE OF G-E EMPLOYEES ONLY

SI

S-10025

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4 1 4

5 1 K

REVISIONS

PREPARED BY *AKG 12/1977*

F.E. TAYLOR

ISSUED BY *200131/1984**AKG 12/1977*

APPROVALS

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## TOLERANCING, DIMENSIONING AND ALTERNATE MATERIAL INDEX

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C JUNE 1, 1976 REVISED  
 J.E. Jaylor INDEX  
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PRINTS  
TO

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## 1.0 BASIC RULES

Dimensioning shall conform to the following:

- 1.1 Dimensioning of geometric features of parts must convey sufficient information to define clearly the engineering intent.
- 1.2 Each dimension on production drawings must have a tolerance, either applied directly, indicated by a general note, a true position symbol or shown by the tolerance block in the upper right hand corner of the drawing.
- 1.3 Dimensions for size, form, and location of features must be complete so that the intended size and shape can be produced without any assumptions.
- 1.4 Each dimension must be expressed clearly so that it will be interpreted in only one way.
- 1.5 No surface line or point may be located by more than one toleranced dimension in any one direction.
- 1.6 Dimensions shall be selected and arranged to avoid accumulation of tolerances.
- 1.7 All linear dimensions will be expressed as decimal values.
- 1.8 No dimension shall be expressed with less than two decimal places; however, dimensions shall be specified to three or more decimal places when dictated by requirements.
- 1.9 When practicable, dimensions shall be expressed as even increments of one-fiftieth of an inch, i.e., .02, .24, .32, .76, 1.00, 5.08, etc.
- 1.10 All linear dimensions shall be expressed in inches to 120, dimensions will then be expressed in feet and inches.
- 1.11 Dimensions of features produced by commercial tools and/or which lend themselves to inspection by commercial gages shall reflect the dimensional identity of the tool or gage in the basic dimension.

Examples:

Holes - .25, .375, .625, etc.Threads - #8-32, .3125-18, .50-13, etc.Counterbores - CB .25, CB 1.375, etc.Spotfaces - SF .25, SF .6875, etc.

Limit to four place decimal - (although rounded off to four places dimension designates commercially available tools.

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J.E. Dayley FEB 11, 1957

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1.12 Commercial materials ie., bars, sheets, strips, tubing, etc., shall be dimensioned with the decimal equivalent of the commercial stock sizes, written as two, three, or four place decimals, thus: .25 dia. (stk.), .625 hex. (stk.), .125 thk. (stk.).

1.13 The finished part should normally be defined without specifying manufacturing methods. For example, only the diameter of a hole is given, without indication as to whether it is to be drilled, reamed or punched. Exceptions may exist where only one manufacturing method is suitable. This may then be indicated on the drawing.

1.14 Bolts and studs should be dimensioned in standard length increments to allow a minimum of two (2) threads to extend through their attached nut.

## 2.0 GENERAL TOLERANCES

Tolerances given in this section are to be used as a guide for decimal dimensioned drawings and to cover dimensions on fractional and decimal dimensioned drawings, for which no tolerance is specified on the drawing.

2.1 With regard to the order of authority, the following is always true in the order listed.

### 2.1.1 (First

Tolerances appearing on the drawing take precedence over all other instructions, and shall normally be expressed in the same form as their dimension. The tolerance of a decimal dimension must be expressed by a decimal to at least the same number of places.

Where possible the pre-printed tolerance block should be used to designate general tolerances and reference this Standing Instruction. (See Fig. 1)

#### APPLIED PRACTICES

SI-10025 Sec. 2

#### TOLERANCES ON MACHINED DIMENSIONS

Up to 1"

± .02

OVER 1" to 20"

± .04

OVER 20"

± .06

2.1.2 (Second Priority) FIG. 1  
Engineering Specification on drawing.

2.1.3 (Third Priority)  
Standard practices SI-10025 Sec. 2 which cover certain standard or repetitive dimensions such as radii, chamfer, location of holes etc. & any other tolerances or instructions defined in any Section of SI-10025.

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NOV 13 1978  
DETROIT  
5 FEB 11 1978  
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JAN. 7, 1956

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- 2.2 Dimensions for machined or assembled parts which a tolerance is not specified on the drawing or on the subsequent pages of SI-10025 use the following, with the exception noted in Paragraph 2.6.

DIMENSION	FRACTIONAL OR DECIMAL TOLERANCE
UP to 1"	± .02
OVER 1" to 20"	± .04
OVER 20"	± .06

- 2.3 Out of roundness dimensions for machined diameters can be averaged to determine the representative dimension providing the minimum and maximum dimensions measured are included. The maximum out of roundness allowed will be no more than 200 percent of the specified diameter tolerance.
- 2.4 Surface finishes specified on drawings are the roughest acceptable finish.
- 2.5 Angles for which a tolerance is not specified on the drawing or on subsequent pages of SI-10025 use the following:
- Angles locating features subject to true position require no tolerance.
  - Angles locating keyways, slots, or defining pulley grooves  $\pm 1/2^\circ$  (.009 mils/inch).
  - All other angles  $\pm 1^\circ$  (.018 mils/inch).
- 2.6 Dimensions locating features subject to true position tolerances, are expressed as a basic value, and no tolerance may be assumed. (See Paragraph 14.0).
- 2.7 Casting drawings or cast dimensions will require additional tolerancing based on material. (See Paragraph 12.0 & 13.0)
- 2.8 Tolerance on fabricated parts will be in accordance with "process capabilities of welded components". (See Paragraph 11.0).
- 2.9 In the event complete tolerancing cannot be achieved by application of Paragraph 2.1, then a bilateral tolerance may be added to individual dimensions as required.
- 3.0 TAPPED HOLES
- 3.1 The thread fit will be indicated on the drawing, and unless otherwise specified will conform to a 2A or 2B fit as described in ASA B1.1-1960 Standards & be right hand.
- 3.2 Tap drill sizes will be in accordance with paragraph 5.0 and need not be called for on the drawing, except in the case of pipe taps which must have tap drill specified in order to maintain full threads.

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3.3 Countersinks on tapped or drilled holes will be in accordance with Paragraph 5.0 and need not be called for on the drawing.

3.4 When the depth of tap & depth of tap hole are given, the depth of tap on the drawing is a minimum dimension for full threads & the depth of tap hole on the drawing is a maximum dimension, exclusive of the cone from the drill point.

## 4.0 DRILLED HOLES

4.1 The size tolerance of drilled holes may vary according to the functional requirement as follows: Clearance holes for bolts, studs & drain holes may vary in accordance with the column "Ordinary Work". Holes for pole bolts should be treated as close work. Closer tolerance may be produced by a combination of drilling and reaming. Holes for tap drills require separate tolerances for coarse and fine threads.

## 4.1.1

DIAMETER OF HOLE		CLOSE WORK		ORDINARY WORK	REAMED TOLERANCE ON DIAMETER	TAP DRILL	
OVER	A. INCL.	METAL *	NON-METAL **			FINE THREADS	COURSE THREADS
	.040	+.002 -.001	+.001 -.003	+.010 -.001	+.0008 -.0010	+.002 -.001	+.002 -.001
.040	.07	+.003 -.001	+.001 -.003			+.004 -.001	+.004 -.001
.070	.128	+.004 -.001	+.001 -.004			+.004 -.001	+.004 -.001
.128	.228	+.005 -.002	+.002 -.005	+.015 -.002	+.0010 -.0015	+.004 -.003	+.003 -.002
.228	.500	+.006 -.002	+.003 -.007			+.005 -.001	+.006 -.003
.500	.750	+.008 -.002	+.003 -.008			+.004 -.010	+.010 -.003
.750	1.00	+.010 -.003	+.005 -.010	+.025 -.005	+.0015 -.0020	+.002 -.010	+.013 -.003
1.00	3.00	+.015 -.003	+.005 -.015			+.006 -.003	+.012 -.006
3.00	Over	+.020 -.005				---	---

NOTES: \* This includes all metals, & mycalex or similar non-shrinking materials.

\*\* This includes all non-metallic materials having shrinkable characteristics.

Unless otherwise specified 1000/ is required for drilled holes.

## 4.2 LOCATION OF DRILLED &amp; TAPPED HOLES

True position on drilled & tapped holes unless otherwise specified will be as follows:

Bolting surface & joint tapped holes .018  
 Bolting surface & joint through holes .012  
 Puller & jack out tapped holes .030  
 All other holes .060

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 R. K. Kozlowski

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## 5.0 DRILL, TAP, COUNTERBORE &amp; SPOTFACE INFORMATION (REF. 41C633023)

PREFERRED SIZES OF DRILLS FOR USE IN BUILDING 2. SIZES NOT LISTED ARE SPECIAL.

DRILL SIZE	PRIMARY DRILL FUNCTION	SECONDARY OR ADDITIONAL FUNCTIONS FOR SAME DRILL
3/32 (.1040)	5-40 TAP DRILL	NAME PLATE DRILLING
7/64 (.1094)		.015 BORE STOCK FOR 1/8 DOWEL
9/64 (.1111)	6-32 TAP DRILL	
5/32 (.1562)	10-24 TAP DRILL	
3/16 (.1875)		.018 CLEARANCE FOR 6-32 & 6-40 THD.
1/8 (.125)	10-32 TAP DRILL	
11/64 (.1719)		.015 BORE STOCK FOR 3/16 DOWEL
3/16 (.1875)	1/4-20 TAP DRILL	
7/32 (.2188)	1/4-28 TAP DRILL	1/32 CLEARANCE FOR 10-24 & 10-32 THD.
15/64 (.2344)		.015 BORE STOCK FOR 1/4 DOWEL
1/4 (.250)	5/16-18 TAP DRILL	
9/32 (.2812)		1/32 CLEARANCE FOR 1/4-20 & 1/4-28 THD.
5/16 (.3125)	3/8-16 TAP DRILL	
3/8 (.375)	3/8-24 TAP DRILL	
11/32 (.3438)	1/8 TAPER PIPE TAP	
23/64 (.3594)		.015 BORE STOCK FOR 3/8 DOWEL
13/32 (.4062)		1/32 CLEARANCE FOR 3/8-16 & 3/8-24 THD.
27/64 (.4219)	1/2-13 TAP DRILL	
7/16 (.4375)	1/4 TAPER PIPE TAP	
29/64 (.4531)	1/2-20 TAP DRILL	
31/64 (.4844)		.015 BORE STOCK FOR 1/2 DOWEL
17/32 (.5312)	5/8-11 TAP DRILL	ALSO 1/32 CLEARANCE FOR 1/2 THD.
9/16 (.5625)		1/16 CLEARANCE FOR 1/2 THD.
37/64 (.5781)	5/8-18 TAP DRILL & 3/8 TAPER PIPE TAP	
39/64 (.6094)		.015 BORE STOCK FOR 5/8 DOWEL
21/32 (.6562)	3/4-10 TAP DRILL	ALSO 1/32 CLEARANCE FOR 5/8-11 & 5/8-18 THREAD
11/16 (.6875)	3/4-16 TAP DRILL	
45/64 (.7031)	1/2 TAPER PIPE TAP	
49/64 (.7656)	7/8-9 TAP DRILL	
25/32 (.7812)		1/32 CLEARANCE FOR 3/4 THD.
13/16 (.8125)	7/8-14 TAP DRILL	ALSO 1/16 CLEARANCE FOR 3/4 THD.
7/8 (.875)	1"-8 TAP DRILL	
29/32 (.9062)		1/32 CLEARANCE FOR 7/8 THD.
59/64 (.9219)		.048 CLEARANCE FOR 7/8 THD.
15/16 (.9375)	1-14 TAP DRILL & 3/4 TAPER PIPE TAP	ALSO 1/16 CLEARANCE FOR 7/8-9 & 7/8-14 THREAD
1 3/64 (1.0469)		.048 CLEARANCE FOR 1" THD.
1 1/16 (1.0625)		1/16 CLEARANCE FOR 1-8 & 1-14 THD.
1 7/64 (1.1094)	1 1/4-7 TAP DRILL	
1 5/32 (1.1562)	1 TAPER PIPE TAP	
1 11/64 (1.1719)	1 1/4-12 TAP DRILL	
1 5/16 (1.3125)		1/16 CLEARANCE FOR 1 1/4-7 & 1 1/4-12 THREAD
1 11/32 (1.3438)	1 1/2-6 TAP DRILL	
1 27/64 (1.4219)	1 1/2-12 TAP DRILL	
1 1/2 (1.50)	1 1/4 TAPER PIPE TAP	
1 9/16 (1.5625)		1/16 CLEARANCE FOR 1 1/2-6 & 1 1/2-12 THREAD
1 47/64 (1.7344)	1 1/2 TAPER PIPE TAP	

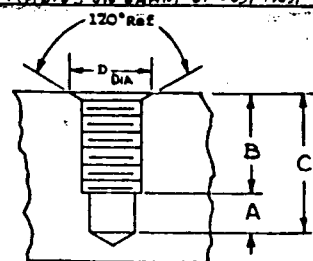
## COUNTERBORE, SPOTFACE TAP DEPTH &amp; TAP DRILL DEPTH INFORMATION

COUNTERBORE OR SPOTFACE MUST COMPLY WITH THE FOLLOWING:

- FREE FROM PAINT, PLATING, RUST & SCALE AT ASSEMBLY.
- PERPENDICULAR TO AXIS WITHIN .005/IN OF C'BORE DIA.
- FLAT WITHIN .005/IN OF C'BORE DIA.
- SURFACE FINISH 250

NOTE: C'BORES &amp; SPOTFACE DIA'S FOR \*\* PREFERRED SIZES MUST INCLUDE .031 &amp; .031-0

THREAD SIZE		COUNTERBORE & SPOTFACE DIA'S				60 HEAD BOLTS	
FRACTIONAL	DECIMAL	A	B	C	D	IMPACT WRENCH HEX HEAD BOLTS	
1/4-20	.25-20	.32	.50	.82	.28-.32	1.00 * #	.6875
5/16-18	.3125-18	.32	.62	.94	.34-.41	1.00 * #	.6875
3/8-16	.375-16	.38	.76	1.14	.41-.50	1.00 * #	.6875
7/16-14	.4375-14	.44	.88	1.32	.42-.56	1.125 * #	.75
1/2-13	.50-13	.50	1.00	1.50	.51-.62	1.25 * #	.875
9/16-12	.5625-12	.50	1.12	1.62	.59-.68	1.375 * #	1.00
5/8-11	.625-11	.56	1.26	1.82	.65-.74	1.50 * #	1.0325
3/4-10	.75-10	.62	1.50	2.12	.78-.88	1.875 * #	1.25
7/8-9	.875-9	.70	1.76	2.46	.90-1.00	2.25 * #	1.4375
1-8	1.00-8	.76	2.00	2.76	1.03-1.12	2.50 * #	1.625
1 1/8-7	1.125-7	.88	2.26	3.14	1.15-1.27	2.75 * #	1.9375
1 1/4-7	1.125-7	.88	2.50	3.38	1.28-1.40	2.875 * #	2.125
1 3/8-6	1.375-6	1.00	2.76	3.76	1.40-1.52	3.125 * #	2.25
1 1/2-6	1.50-6	1.00	3.00	4.00	1.53-1.68	3.375 * #	2.50
1 3/4-5	1.75-5	1.20	3.50	4.70	1.78-1.93	3.875 * #	3.00
2-4 1/2	2.00-4.50	1.26	4.00	5.26	2.03-2.18	4.375 * #	3.25



ALTHOUGH ROUNDED OFF TO FOUR PLACES, DECIMAL DIMENSIONS FOR DRILL &amp; TAP SIZES DESIGNATE COMMERCIALLY AVAILABLE TOOLS

FOR ADDITIONAL TAP DRILL SIZES SEE M-9946126

PREFERRED SIZES OF DRILLS FOR USE IN BLDG. 5. SIZES NOT LISTED ARE SPECIAL. DRILLS UP TO .125 - IN INCREMENTS OF .0156. .125 TO 1.00 - IN INCREMENTS OF .0112. 1.00 TO 2.00 - IN INCREMENTS OF .0625.

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FOR USE OF G-E EMPLOYEES ONLY

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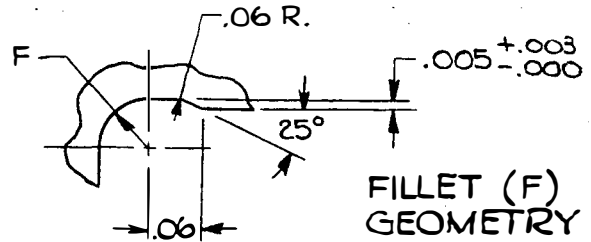
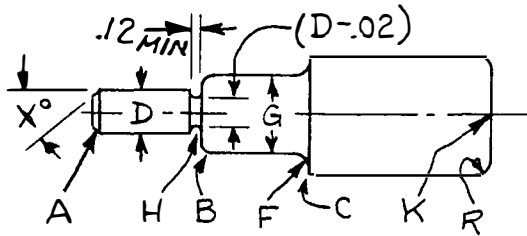
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## 6.0 CHAMFERS, FILLETS, RADII



FILLET (F) GEOMETRY

ITEM

DRAFTING AND MANUFACTURING PRACTICE

(A)  
CHAMFER

UNLESS OTHERWISE SPECIFIED  
CHAMFER TOLERANCES TO  
BE  $\pm 5^\circ$

CHAMFER	FRACTIONAL	DECIMAL
UP TO 1/32	+ .010 - .000	+ .010 - .000
1/32 & UP	+ 1/32 - 1/64	+ .04 - .02

FRACTIONAL	DECIMAL	
	CHAMFER OR RADIUS	
UP TO 1"	.005 to 1/64	.005 to .02
OVER 1" to 2"	.005 to 1/32	.005 to .04
OVER 2"	.005 to 1/16	.005 to .06

CHAMFER OR RADIUS	
FRACTIONAL	DECIMAL
UP TO 1"	.005 to 1/64
OVER 1" to 2"	.005 to 1/32
OVER 2"	.005 to 1/16

(B)  
BREAK  
CORNER OR  
BURR

UNLESS OTHERWISE STATED,  
SHOP WILL REMOVE ALL BURRS  
BY CHAMFER OR RADIUS

DIAMETER	CHAMFER OR RADIUS
UP TO 1"	.005 to 1/64
OVER 1" to 2"	.005 to 1/32
OVER 2"	.005 to 1/16

CHAMFER OR RADIUS	
FRACTIONAL	DECIMAL
UP TO 1"	.005 to 1/64
OVER 1" to 2"	.005 to 1/32
OVER 2"	.005 to 1/16

CHAMFER OR RADIUS	
FRACTIONAL	DECIMAL
UP TO 1"	.005 to 1/64
OVER 1" to 2"	.005 to 1/32
OVER 2"	.005 to 1/16

(C)  
SHARP  
CORNER

MUST BE STATED ON DRAWING AS "SHARP CORNER" AND HAVE A  
MAXIMUM RADIUS OF .005

(R)  
RADIUS  
CORNER

SPECIFY ON DRAWING ONLY WHEN A CHAMFER IS NOT ACCEPTABLE.  
UNLESS OTHERWISE SPECIFIED RADII OF CORNERS TO BE:  
NO RADII SPECIFIED---SEE TABLE UNDER "B"  
FRACTIONAL RADII +1/32, -1/64  
DECIMAL RADII +.04, -.02 (SPECIFY ON DRAWING)

(F)  
FILLET

UNLESS OTHERWISE SPECIFIED FILLET TOLERANCES TO BE:  
NO RADII SPECIFIED---SEE TABLE UNDER "B"  
1/32 through 1/8 radius tol =  $\pm 1/64$   
.03 through .12 radius tol =  $\pm .015$   
Over 1/8 through 1/2 radius tol =  $\pm 1/32$   
Over .12 through .50 radius tol =  $\pm .03$   
Greater than 1/2 radius tol =  $\pm 1/16$   
Greater than .50 radius tol =  $\pm .06$

(H)  
UNDERCUT

WHERE DIAMETER "D" IS TO BE GROUND TO SIZE AND IS  
ADJACENT TO A SHOULDER, A DIMENSIONED GROOVE IS TO BE  
SHOWN TO PROVIDE CUTTING WHEEL CLEARANCE. USE ONLY IF  
MANUFACTURING REQUIRES.

(K)  
PART OFF  
THREAD  
UNDERCUT

END PROJECTIONS ON PART-OFF CUTS MUST BE REMOVED UNLESS  
OTHERWISE SPECIFIED.  
UNDERCUT DIAMETER MUST BE SHOWN WHEN THREAD IS CARRIED  
UP TO HEAD.

REVISIONS

-5

OCT 21 1991  
J. E. Taylor

MAY 25 1976  
JUNE 1 1976  
REVISED  
J. E. Taylor

4

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PREPARED BY

MARCH 22, 1956

APPROVALS

J. E. Taylor  
6/1/78

ISSUED BY

J. E. Taylor - June 1, 1978

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LOCATION

SECTION

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PROP. EQUIP. PROD. ENGRG

SECTION

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SH NO.

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CODE IDENT NO.

## STANDING INSTRUCTIONS

**FOR USE OF G-E EMPLOYEES ONLY**

SI S-10025

SECTION \_\_\_\_\_ 2

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## 7.0 BEARING HOUSINGS, FRAME HEADS, BEARING CAPS & FRAMES

- 7.1 Bearing seat faces and frame faces of bearing housings and frame heads should be parallel to each other within .0002 T.I.R./inch of largest diameter

EX. 10" Diameter x .0002 = .0020 T.I.R.

$$16'' \text{ Diameter} \times .0002 = .0032 \text{ T.I.R.}$$

- 7.2 Bearing bores must be perpendicular to the bearing seat face within .0004/inch of bore length measured on the diameter with a bore gage.

- 7.3 Frame faces should be of frame within .0002 inch of frame face diameter.

- 7.4 Bearing bore to be concentric with frame head diameter within .004 T.I.R.

- 7.5 Bearing bore to be concentric with labyrinth grooves and shaft clearance bore within .006 T.I.R.

- 7.6 Bearing cap and end cover fits to be concentric with shaft seal diameter and/or labyrinth grooves within .006 T.I.R.

- 7.7 The averaging of a bore diameter is permissible in accordance with Para. 2.3 except as noted in Para. 7.8.

- 7.8 The maximum deviation (excursion) between any two points in the bearing bore of a frame head, bearing housing, or bearing housing fit in a frame may not be greater than the tolerance for the bore.

- 7.9 The taper allowed on all other bores\* should not exceed .001 per inch of bore length and all readings are to be within drawing tolerances

\*(i.e. comm. shells, collars, sleeves, flingers, etc.)

Excludes frame pole bore & frame head fit in frame.

## 8.0 COMMUTATOR CAPS AND SHELLS

- 8.1 The 30° angle should not vary more than 5 minutes and may be measured with a gage similar to tool number 389D423.

PREPARED BY

MAR 2, 1956

### APPROVALS

NR 2/11/74

**TSD**

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ISSUED BY

J E Daylor MAY 25, 1976

JOHN

ERIE

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## SECTION

CONT ON SHEET 4

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FEB 11. 1974

# STANDING INSTRUCTIONS No. S-10025

MOTOR ENGINEERING  
LOCO & CAR EQUIP DEPT

## Section 2

## ORGANIZATION

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**Continued on Pg.**

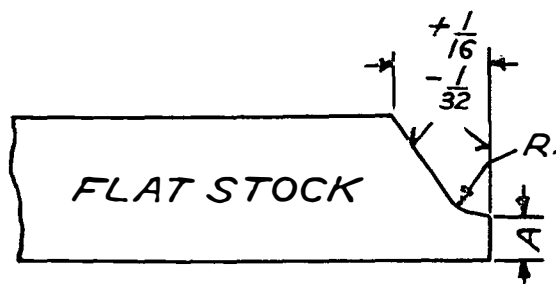
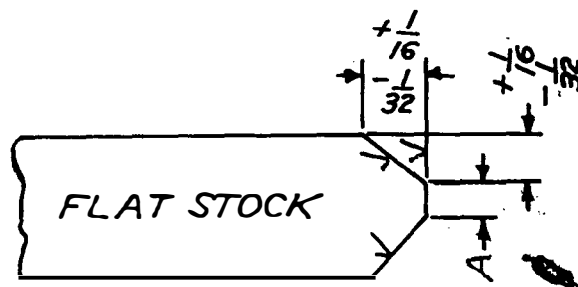
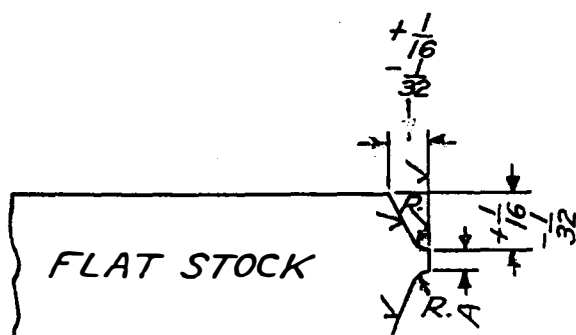
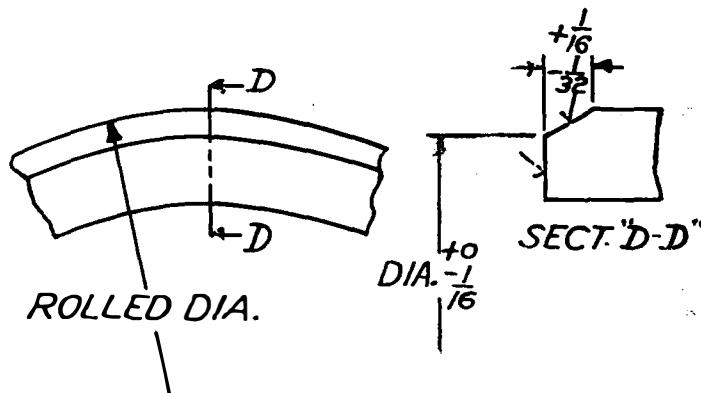
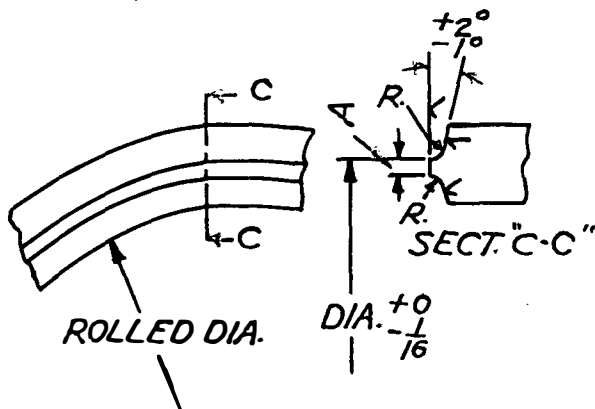
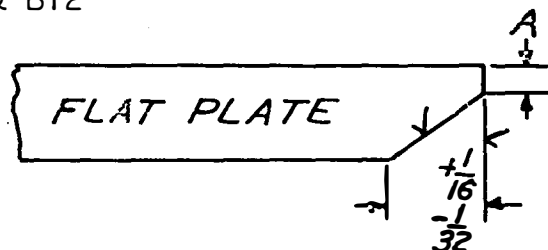
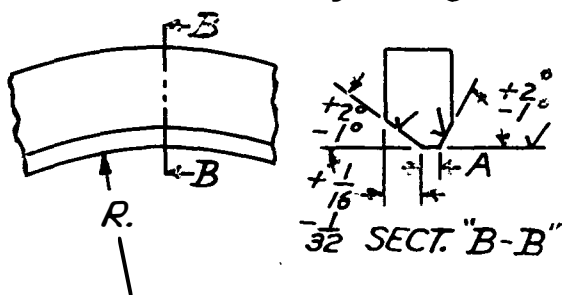
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**Date** Nov. 26, 1958

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## 9.0 MACHINING TOLERANCES FOR WELDING PREPARATION (FRACTIONAL DIMENSIONS)

FOR DIMENSIONING OF PREPARATION REFER TO WELDING DESIGN  
HANDBOOK DF58LC423 SECTION B11 & B12



"A" TOL.

$\frac{1}{16}$ TO $\frac{3}{16}$	$\begin{array}{r} + 0 \\ - \frac{1}{16} \end{array}$
$\frac{3}{16}$ UP	$\begin{array}{r} + \frac{1}{32} \\ - \frac{1}{16} \end{array}$

**NOSE**

✓ = 1000 FINISH

# STANDING INSTRUCTIONS

FOR USE OF G-E EMPLOYEES ONLY

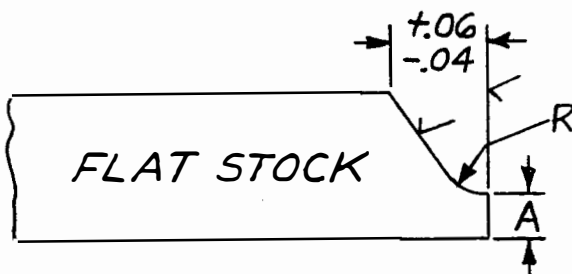
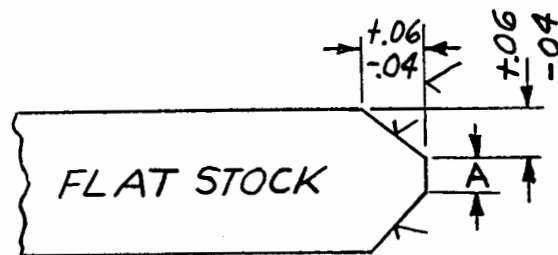
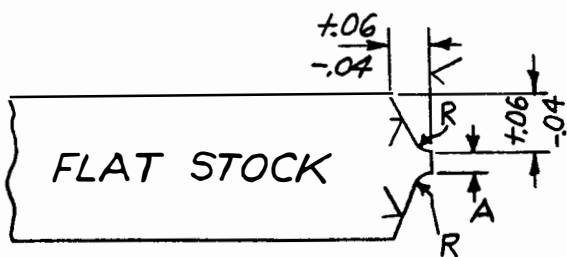
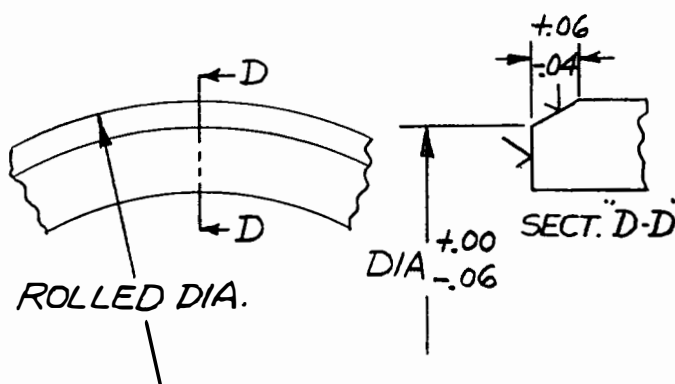
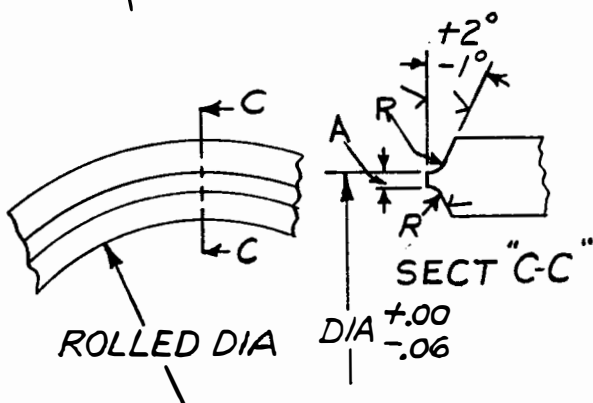
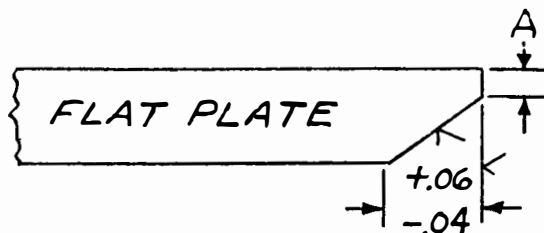
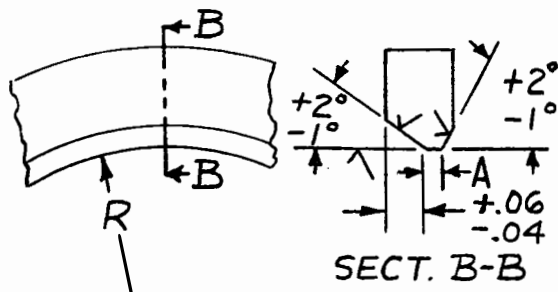
SI S-10025

SECTION 2

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## 9.0 (Cont'd.) MACHINING TOLERANCES FOR WELDING PREPARATION (DECIMAL DIMENSIONS)

For dimensioning of preparation refer to welding design handbook DF58LC423 Section B11 & B12



"A" TOL.

.06 TO .18	+ .00 - .06
.18 & UP	+ .04 - .06

NOSE

√ = 1000 FINISH

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PREPARED BY  
J.E. Daylor July 14, 1967  
ISSUED BY  
J.E. Daylor July 14, 1967

APPROVALS  
[Signature] 2/1/77

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CODE IDENT NO.

# STANDING INSTRUCTIONS

FOR USE OF G-E EMPLOYEES ONLY

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## 10.0 DEBURRING

The following general rules are provided by engineering to guide planning, methods, and inspection in deciding to what extent sharp edges, burrs, weld spatter, welding flux and shot are to be removed. These are general rules and thus will leave specific decisions to the discretion of manufacturing. They are in no way to detract from established "good machine shop practice". If specific questions come up where there is no precedent, the planner may wish to ask the production engineer for advice.

10.1 There must be no weld spatter, shot, flux or burrs that can become loose:

- A. Inside any cavity that is to contain moving or insulated parts.
- B. Near any opening where it could fall into such cavities.
- C. Where it could interfere or get between mating surfaces.
- D. Where it causes the surface to not meet the finish requirements.

10.2 All tapped holes must be free of chips, weld spatter, shot and countersunk before tapping per 41C633023 (See Para. 5.0). Where tapped hole breaks through a finished surface, burr should be removed where break through occurs.

10.3 Sharp corners and burrs must be removed from areas where other manufacturing or customer's service personnel may be injured.

10.4 Edges around cable bushing holes and bolt holes should be burred at

10.5 Register fits must be free of burrs, sharp corners, and high metal from nicks, and no more than 5% of the fit area should be lost by deburring.

10.6 All sharp edges around coil seats or other insulated parts should be rounded.

Where a specific chamfer or radius is required on a part, it will be delineated on the drawing. Otherwise, the rules shown above will suffice as Engineering's Specifications.

10.7 Internal & external splines & other mating surfaces must have the sharp corners broken so as not to cause any interference of mating parts.

REVISIONS

5	FEB 11, 1974	RETYPE	AN 60402
4	AUG 31, 1973	AN 69918	6 MAY 25, 1976 AN-61951

PREPARED BY  
C. LAPPLE AUG. 21, 1959

ISSUED BY  
J.E. Daylan FEB 11, 1974

APPROVALS

MR 2/11/74

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## STANDING INSTRUCTIONS

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60402

REVISIONS

## 11.0 PROCESS CAPABILITIES OF WELDED COMPONENTS

These tolerances reflect the most economical methods of production. If lesser dimensional variations are required, special methods, tools, & operational planning can be devised to produce parts to a closer tolerance. This of course will increase the total production costs.

## 11.1 FLAME CUTTING

## LENGTH OF PIECE

THICKNESS	0-12.00	12.00-24.00	24.00-36.00	OVER 36.00
.060-.112	±.035	±.035	±.035	±.035
.120-.180	±.045	±.045	±.045	±.045
.250-1.00	±.062	±.062	±.093	±.093
1.00-2.00	±.062	±.125	±.125	±.187
2.00-4.00	±.093	±.125	±.125	±.187
Over 4.00.	±.125	±.125	±.187	±.187

Angularity of cut included. These dimensions apply to diameters also.

## 11.2 SAW CUT - BAR, ANGLE, PIPE

## LENGTH OF PIECE

A. Automatic Feed	0-12.00	12.00-24.00	24.00-51.00
	±.061	±.093	±.125
B. Band Feed & Measure	Up to 72.00	Over 72.00	
	±.031	±.062	

Angularity of cut included.

## 11.3 SHEAR

## LENGTH OF PIECE

THICKNESS	0-12.00	12.00-24.00	OVER 24.00
0 - .250	±.031	±.031	±.062
Over .250	±.031	±.062	±.093

Includes angularity of sheared edge and out of squareness of adjacent edges.

## 11.4 ROLL - TOLERANCE APPLIES TO DIMENSIONED DIAMETER AFTER WELDING, INCLUDING WELDING JOINT DISTORTION BUT NOT THE WELD ITSELF

## A. Before Pressing Round

## LENGTH OF PIECE

THICKNESS	10.00-20.00	20.00-30.00	30.00-40.00
0-1.00	±.125	±.125	±.187
1.00-2.00	±.187	±.250	±.250
2.00-4.00	±.250	±.312	±.312

## B. After Pressing Round

## LENGTH OF PIECE

THICKNESS	10.00-20.00	20.00-30.00	30.00-40.00
0-1.00	±.093	±.093	±.125
1.00-4.00	±.125	±.125	±.125

Out of roundness is included.

PREPARED BY  
F.E. Taylor Feb. 11, 1974

APPROVALS

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ISSUED BY  
JAN 6, 1982  
R.E. Taylor

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## STANDING INSTRUCTIONS

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60402

REVISIONS

## 11.0 PROCESS CAPABILITIES OF WELDED COMPONENTS (CONTINUED)

## 11.5 HOLES

- A. Location-1 hole to another-or maximum variation in a group of holes. Center line to center line of any two holes.

Stack Drill	± .093
Transfer L/O and Drill or Punch	± .093
Punch (fixed stops)	± .031
Drill Jig	± .015
Automatic Pantograph Punch	± .020"

This includes a two Sigma limit of ± .010" variation in template.

These include holes in large sheet metal parts and angles.

- B. SIZE - DIAMETER OF HOLES - .250" TO 1.500" DIAMETER.

Punched	+ .008"	- .016"
Stack Drilled	+ .020"	- .005"
Single Drilled	+ .015"	- .005"

## 11.6 EXPANDER PROCESS (Frame barrel)

- A. Use only with the approval of Bldg.5 Planning section
- B. Reduce normal calculated developed length by .7 of 1% for expanding.
- C. Normal tolerance will be ±.06 or .120 total applied to inside diameter. MIN.ID = 18" MAX THK = 2.375" MAX LENGTH = 29.75"

## 11.7 FABRICATION CAPABILITY

- A. Stack assemblies of two or more pieces with flame cut edges, steel plate and/or castings. ± .187
- B. Stack assembly of premachined parts, in addition to machining variations. ± .032
- C. Locating parts in location (other than stacked) when proper fixturing and tack available. Fixturing and drawing dimensioning must be from the same point or area. Parts and assembly must be designed so that important points, surfaces or areas are not restricted as to location - no gaps in welds - use lap joints. ± .062
- D. Fabrication of angles, plate and sheet steel. ± 1/8"

JULY 13, 1977 CHECK 11.5 B  
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PRINTS TO	PREPARED BY <i>JE Taylor</i> FEB 11, 1974	APPROVALS <i>RE 2/11/74</i>	TSD	DIV OR DEPT	SI	S-10025
	ISSUED BY <i>JE Taylor</i> FEB 11, 1974		ERIE	LOCATION	SECTION	2
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## STANDING INSTRUCTIONS

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60402

REVISIONS

## 11.0 PROCESS CAPABILITIES OF WELDED COMPONENTS

## 11.8 CAPABILITIES OF FLAME CUTTING (GENERAL PARTS)

## 11.8.1 LINEAR DIMENSION LIMITS

See SI S-10025, Section 2, Sheet 6, Item 11.1

## 11.8.2 DRAG LIMITS \*\*

Material ThicknessApprox. Length of Drag in Inches \*

1/2" or below

3/32

Above 1/2" to and including 1"

13/64

Above 1" to &amp; including 2"

7/32

Above 2"

1/4

\*- The drag limits are based upon the assumption that the final edge of the work material is exactly perpendicular to the line of torch traverse.

## 11.8.3 FLAME CUT SURFACE GOUGE OR DENT LIMITS \*\*

Base Material Thickness	Maximum Total Defect Length in 3"	Max. Defect Width	Max. Defect Depth
1/4" or Below	1/8	1/16	1/16
Above 1/4" to & including 1/2"	1/4	1/16	1/16
Above 1/2" to & including 1"	3/8	1/16	1/16
Above 1" to & including 6"	3/4	3/16	1/8

## 11.8.4 CHAMFERED EDGE SURFACE

Base Material Thickness	% Allowable Harsh Drag Line	Maximum Harsh Drag Line Dimensions
1/4" to 6"	33%	1/16 Width x 1/16 Depth

\*\* Defects need not be repaired if they are removed by subsequent machine operations. This is generally indicated by a surface finish specification on the drawing (250)

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## STANDING INSTRUCTIONS

FOR USE OF G-E EMPLOYEES ONLY

SI S-10025

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60402

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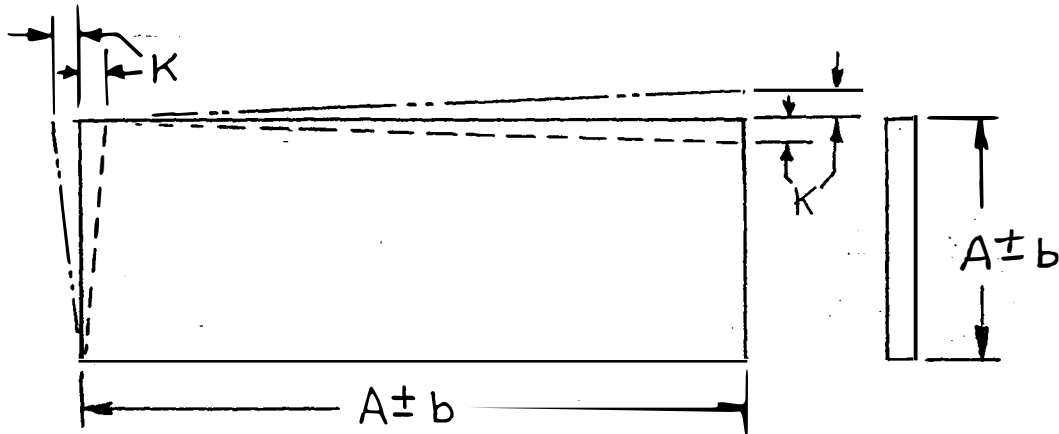
## 11.9 CAPABILITIES OF FLAME CUTTING (BARREL BLANKS)

## 11.9.1 LINEAR DIMENSION LIMITS

See SI S-10025, Section 2, Sheet 6, Item 11.1

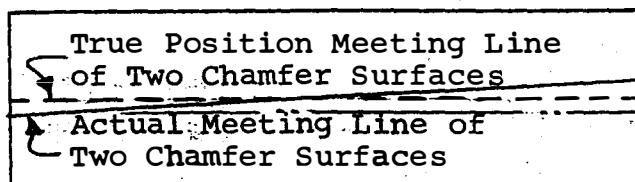
## 11.9.2 Angularity Limits

Angularity tolerance "K" as shown in pictorial not to exceed linear tolerance "b" as specified in Paragraph 11.9.1.



## 11.9.3 CHAMFER LIMITS

## A. Chamfer Position Limits

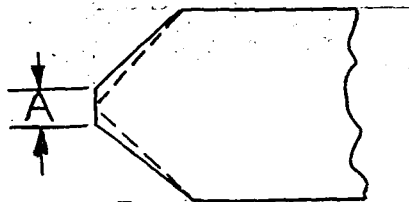


Maximum "T" = 1/16"

Maximum "R" = 1/8"

CHAMFERED EDGE ANGLE =  $\pm 2^\circ$ 

## B. Chamfer Flatness



Maximum A = 1/32 In.

PREPARED BY  
J.E. Taylor JULY 13, 1977  
ISSUED BY  
J.E. Taylor JULY 13, 1977

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FOR USE OF G-E EMPLOYEES ONLY

SI S-10025

SECTION 2

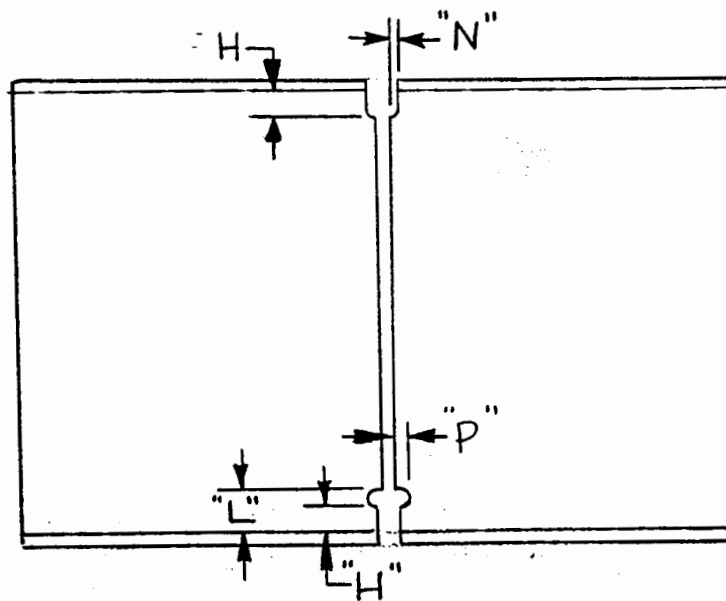
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## 11.9.3 CHAMFER LIMITS

## C. Chamfer Finish Limits

- Surface finish = 2000 micro inches maximum
- Must be free of mill scale, flame cutting slag, etc
- Maximum allowable gouges = 1/16" deep x 1/16" wide with a maximum of three (3) gouges per linear inch.

## 11.9.4 BARREL SLITTING LIMITS



"N" Max. = 1/8 in.

"H" Max. = 3/4 in.

"P" Max. = 3/16 in.

"L" Max. = 1 1/2 in.

Max. surface finish = 2000 micro inches

## 11.10 CAPABILITIES OF FLAME CUTTING (RINGS)

## 11.10.1 LINEAR DIMENSION LIMITS

See SI S-10025, Section 2, Sheet 6, Item 11.1

PREPARED BY  
J.E. Taylor July 13, 1977  
ISSUED BY  
J.E. Taylor July 13, 1977

APPROVALS

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## STANDING INSTRUCTIONS

FOR USE OF G-E EMPLOYEES ONLY

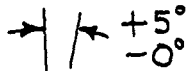
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SECTION 2  
CONT ON SHEET 8 SH NO. 7D

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REVISIONS

## 11.10.2 CHAMFER LIMITS



## A. Chamfer Angle Limits

Angle tolerance must be within -0° to +5°

## B. Chamfer Finish Limits

- Surface finish = 2000 micro inches maximum
- Must be free of mill scale, flame cutting slag, etc
- Maximum allowable gouges = 1/16" deep x 1/16" wide with a maximum of three (3) gouges per linear inch.

↑ INSIDE DIA.

PREPARED BY  
*J.E. Taylor* JULY 13, 1977  
ISSUED BY  
*J.E. Taylor* JULY 13, 1977

APPROVALS

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CODE IDENT NO.

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# STANDING INSTRUCTIONS

FOR USE OF G-E EMPLOYEES ONLY

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CONT ON SHEET 8A SH NO. 8

## 11.11 BRAKE FORMING TOLERANCES

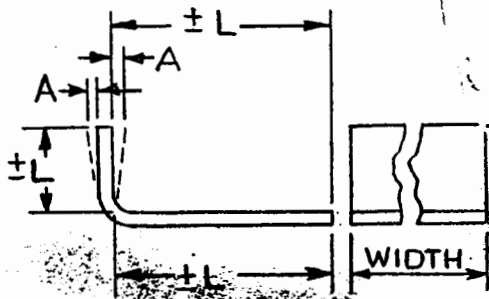


FIG. 1

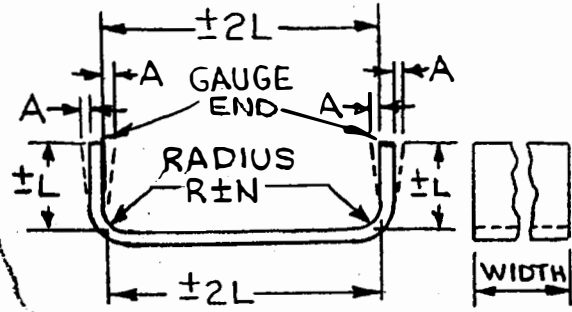


FIG. 2

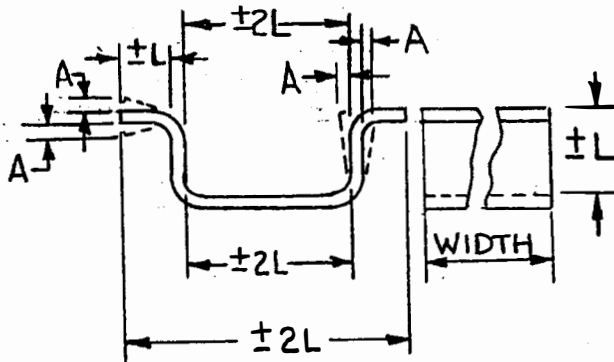


FIG. 3

"A" = Angular tolerance =  $\pm 0.010$  per inch of length.  $1/8"$  Max.

"L" = Length tolerance

Length tolerance (L, 2L) includes angularity tolerance.

"N" = Radius tolerance

MAT'L THICKNESS	LINEAR TOLERANCE "L"
UP TO $1/8"$	$\pm 1/32$ (.031)
$1/8"$ TO $1/4"$	$\pm 1/16$ (.062)
$1/4"$ TO $1/2"$	$\pm 1/8$ (.125)
OVER $1/2"$	$\pm 3/16$ (.188)

RADIUS TOLERANCE "N"		
MAT'L THICKNESS	"N"	WHEN "R" IS GREATER THAN 2x MAT'L THICKNESS, TOL. IS SHOWN ON DRAWING.
UP TO $1/8"$	$\pm 0 - 1/32$	
$1/8"$ TO $1/4"$	$\pm 0 - 1/16$	
OVER $1/4"$	$\pm 0 - 1/8$	

Minimum radius to be called for = Material thickness

Minimum length of leg "L" to be 5x Mat'l thickness or mach. req'd.

Die opening should be 8x material thickness.

PREPARED BY  
J. E. Doyle FEB 11, 1974  
ISSUED BY  
J. E. Doyle FEB 11, 1974

APPROVALS  
J. E. Doyle 2/11/74  
J. E. Doyle

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G 08/21/1984  
B 07/13/1977  
JULY 13, 1977 CHICAGO  
J. E. Doyle FEB 11, 1974

## STANDING INSTRUCTIONS

FOR USE OF G-E EMPLOYEES ONLY

SI

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REVISIONS

## 11.12 Defect criteria for frame barrel weld seams

11.12.1 PLANAR DEFECTS

Planar defects are not permissible in any of the welds. These types of defects include cracks in the weld and tears, lack of fusion and lack of root penetration of the weld.

11.12.2 CAVITIES

Cavities include isolated pores, pores in a group, linear porosity, wormholes and crater pipes. Linear porosity is not acceptable in any welded part.

Localized porosity is acceptable as long as it does not exceed 5% of the weld surface area in the worst 1 square inch of weld surface.

Note that the 5% estimate is based on the surface after machining. Isolated porosity is acceptable as long as any pore is not greater than 1/4 of the weld thickness or .250", which ever is the smaller number.

Wormholes, as long as they are isolated, are acceptable up to a .250" length & a width no greater than .0625".

Aligned wormholes are generally indicative of lack of root fusion and root penetration and are not acceptable.

11.12.3 SOLID, INCLUSIONS

Solid inclusions, due to slag, up to 1.00" in length are acceptable provided the depth does not exceed .125".

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## STANDING INSTRUCTIONS

FOR USE OF G-E EMPLOYEES ONLY

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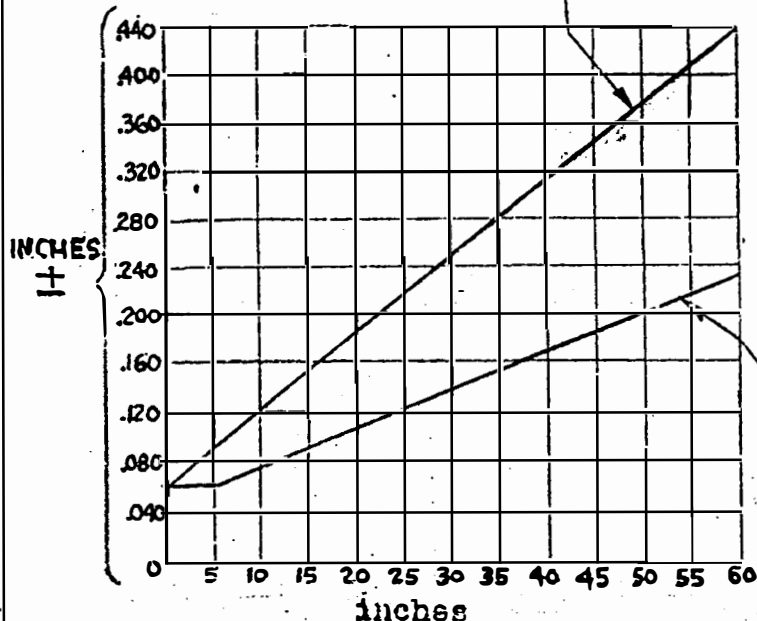
CONT ON SHEET

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SH NO. 9

60482  
REVISIONS12.0 Sand Casting Tolerances

LINEAR TOLERANCE "A"

LINEAR TOLERANCE

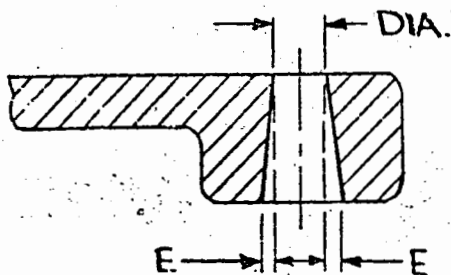
Linear tolerance "A" is for steel. Linear tolerance "B" is for cast iron, malleable iron, aluminum, brass, bronze or magnesium.

(Tolerances will not show on drawings except where chart dimensions are exceeded)

LINEAR TOLERANCE "B"

CHART I

NOTE: Above tolerances also apply between a machined and unmachined surface.

DRAFT ON UNFINISHED CAST HOLES

Diameter specified on drawing is to be checked at small diameter.

Draft "E" will be such that part will be within dimensional tolerances.

Material	Avg. Peak to Valley	Surface Finish
Steel	7000 micro inches	2000/
Cast & Malleable	3500 micro inches	1000/
Copper Base and Aluminum & Magnesium	1750 micro inches	500/

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## STANDING INSTRUCTIONS

FOR USE OF G-E EMPLOYEES ONLY

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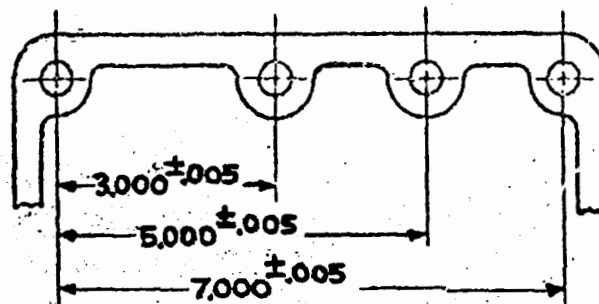
CONT ON SHEET 11 SH NO. 10

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12.0 Send Casting Tolerances (cont'd)

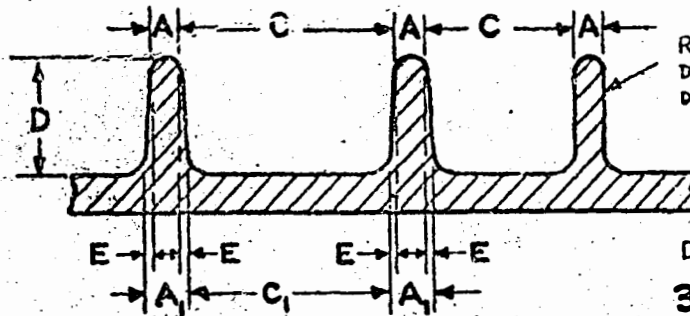
## SUPERIMPOSED DIMENSIONS

WHEN CASTING AND MACHINING DIMENSIONS ARE SUPERIMPOSED, ONLY THE MACHINING DIMENSIONS WILL BE SHOWN ON THE DRAWING. THE CASTING DIMENSIONS WILL BE THE NOMINAL MACHINING DIMENSION PLUS OR MINUS (AS APPLIES) THE TOLERANCES OF CHART I (SHEET 9).



## LINEAR DIMENSION TOLERANCES

THE LINEAR TOLERANCE ON DIMENSIONS "A", "C", AND "D" WILL BE AS PER CHART I, SHEET 9.



DRAFT "E" = .052" / INCH  
OF "D"  
3 DEG. MAX.

DRAFT "E" WILL BE ADDED TO "A" TO GIVE "A<sub>1</sub>", AND SUBTRACTED FROM "C" TO GIVE "C<sub>1</sub>". IN NO CASE WILL DRAFT "E" DECREASE WALL SECTION "A" BELOW TOLERANCE FOR SIZE.

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ISSUED BY  
*J. E. Doyle* FEB 11, 1974

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# STANDING INSTRUCTIONS

FOR USE OF G-E EMPLOYEES ONLY

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CONT ON SHEET

12

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REVISIONS

## 13.0 DIE AND PRESSURE CASTING TOLERANCES

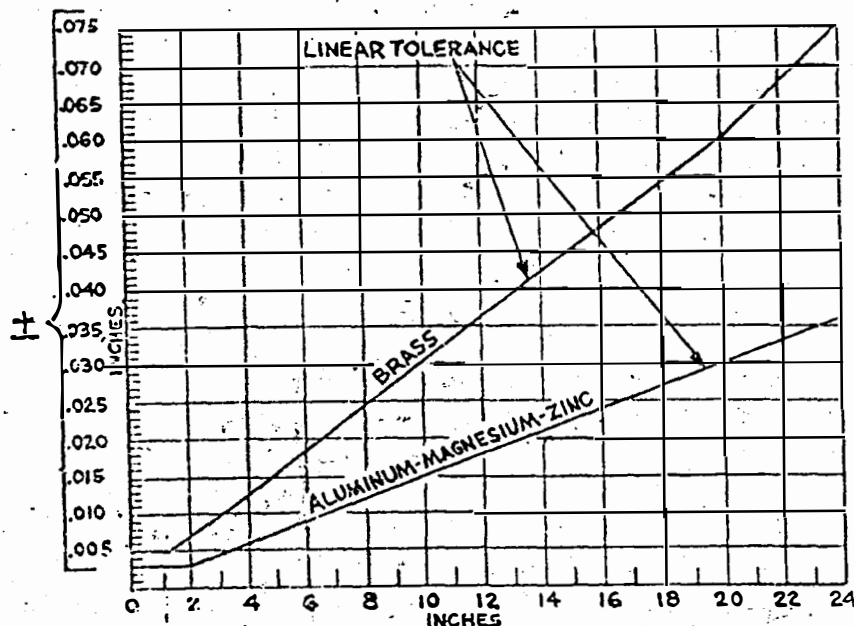
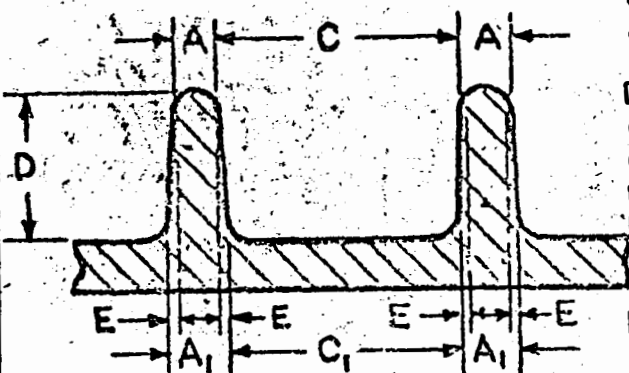


CHART II

### LINEAR DIMENSION TOLERANCE

- THE LINEAR TOLERANCE ON DIMENSIONS "A", "C", AND "D" WILL BE AS SHOWN ON CHART II ABOVE.



DRAFT "E" WILL BE ADDED TO "A" TO GIVE "A1" AND SUBTRACTED FROM "C" TO GIVE "C1". IN NO CASE WILL DRAFT "E" DECREASE WALL SECTION "A" BELOW TOLERANCE FOR SIZE.

DRAFT "E" - SEE CHARTS III AND IV SHEET 13.

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ISSUED BY

J E Daylon FEB 11, 1974

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## STANDING INSTRUCTIONS

FOR USE OF G-E EMPLOYEES ONLY

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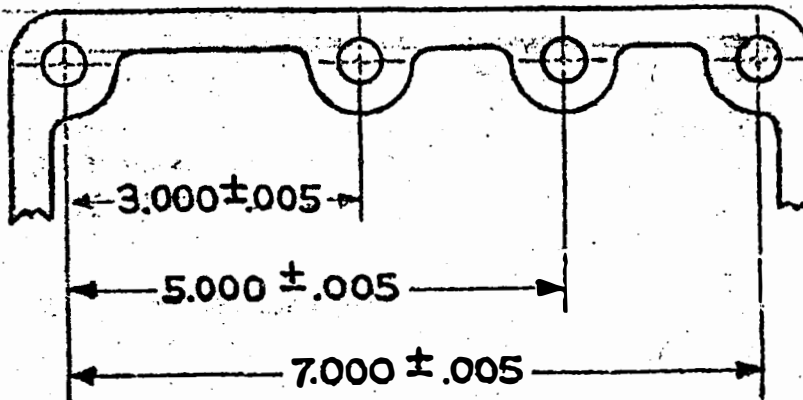
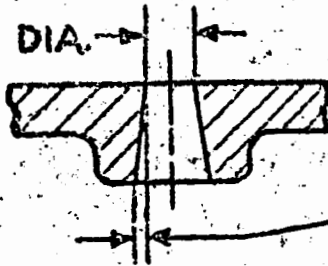
CONT ON SHEET 13 SH NO. 12

60407  
REVISIONS

## 13.0 DIE AND PRESSURE CASTING TOLERANCES (CONT'D.)

SUPERIMPOSED DIMENSIONS

WHEN CASTING AND MACHINING DIMENSIONS ARE SUPERIMPOSED ONLY THE MACHINING DIMENSIONS WILL BE SHOWN ON THE DRAWING. THE CASTING DIMENSIONS WILL BE THE NOMINAL MACHINING DIMENSION PLUS OR MINUS (AS APPLIES) THE TOLERANCES OF CHART II,

DIE CAST HOLES

HOLES WITHOUT FINISH ARE TO BE MEASURED AT SMALL DIAMETER.

MAXIMUM ALLOWABLE DRAFT  
SEE CHARTS III & IV

MATERIAL	AVG. PEAK TO VALLEY	SURFACE FINISH
ANY DIE CASTING	500 MICRO INCHES	CASTINGS MUST BE SMOOTH AND FREE FROM FLASH WITH SURFACES AS SHOWN ON TABLE TO LEFT.
		NO TOLERANCES ON THIS SHEET SHOWN ON DRAWINGS.

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J.E. Taylor FEB 11, 1974

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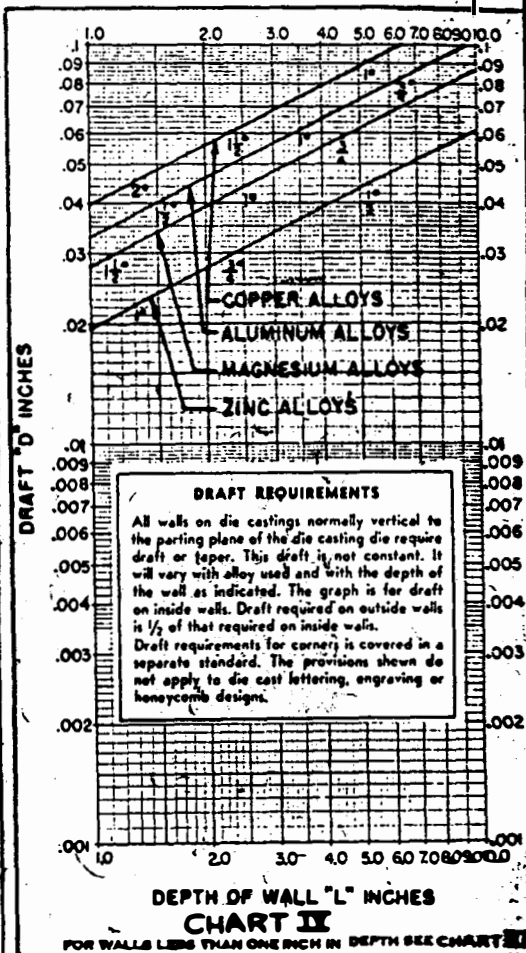
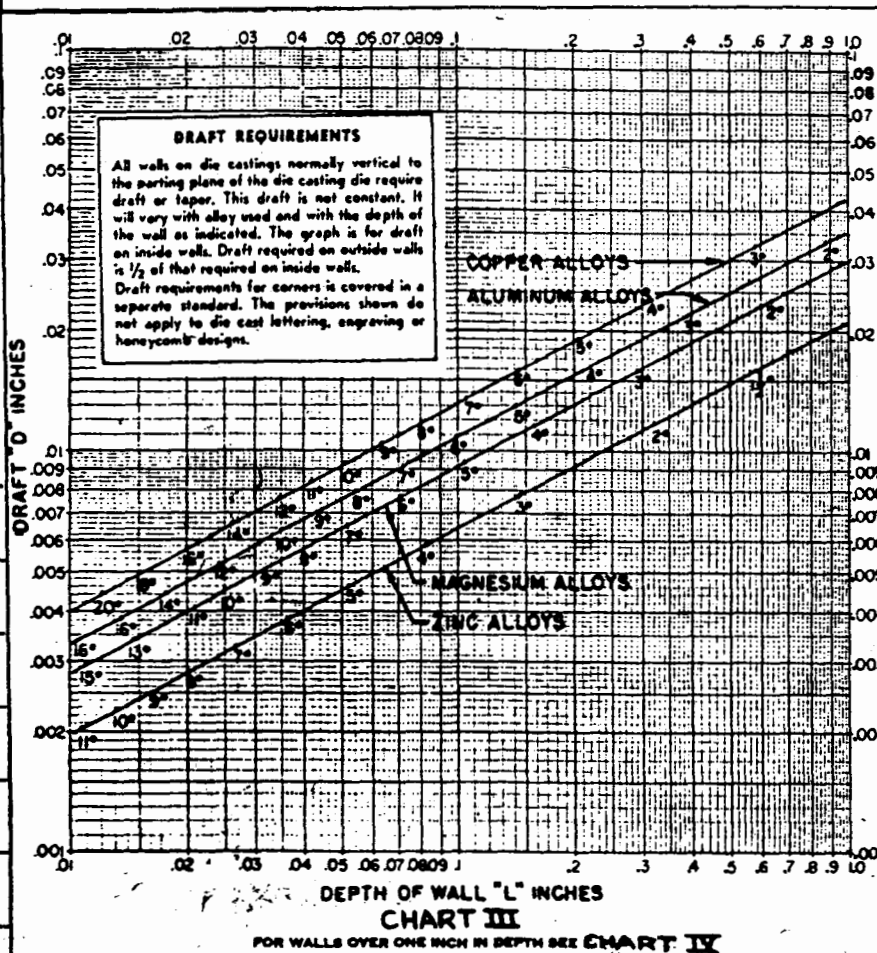
SECTION 2

CONT ON SHEET 14 SH NO. 13

## 13.0 DIE AND PRESSURE CASTING TOLERANCES (CONT'D.)

**NOTE**—The values shown herein represent normal production practice at the most economic level. Greater accuracy involving extra close work or care in production should be specified only when and where necessary since additional cost may be involved.

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# STANDING INSTRUCTIONS

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SECTION 2

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## 14.0 TRUE POSITION DEFINITION AND APPLICATION

For additional information see Drafting Manual Section K6.4

A. True position denotes the basic or theoretical exact position for a feature. The basic location is given by untoleranced dimensions and a positional tolerance is added to the note or symbol that normally is provided for specifying the number and size of features. The positional tolerance is the tolerance assigned to a dimension that locates one or more features in relation to another feature. Unless otherwise noted, true position tolerance will be applied at MMC (Maximum material condition)

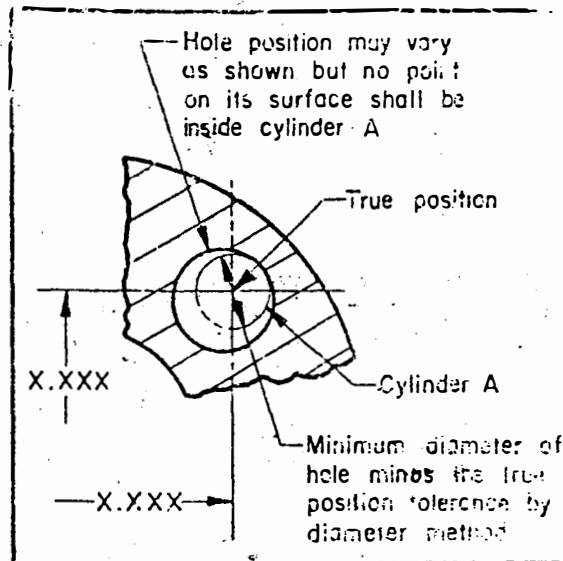


FIGURE 2

located at true position, having a diameter equal to that shown in Cylinder A of Figure 2.

B. Maximum material condition by itself means that a feature of a finished product contains the maximum amount of material permitted by the toleranced size dimensions shown for that feature. Thus, for holes, slots, and other internal features, maximum material is the condition where these features are at their minimum allowable sizes; for shafts, as well as for bosses, lugs, tabs, and other external features, maximum material is the condition where these are at their maximum allowable sizes.

### 2. In Terms of the Surfaces of Non Circular Features

The side surface feature shall not violate a zone that has a width equal to the MMC limit of the feature, and is further modified by the positional tolerance. Figure 3 shows these requirements as applied to a slot.

C. Where a true position tolerance applies at MMC, the interpretation is as follows:

### 1. In Terms of the Cylindrical Surface of a Hole

A true position tolerance at MMC requires that, while maintaining the specified diameter limits of the hole, no element of the hole surface shall be inside an imaginary cylinder

### 3. True Position Features are Indicated by the Following Symbols

.XXX -.XXX Dia. 4 holes

preferred  $\oplus .XXX R$

optional  $\oplus .XXX Dia.$

4 slots eq. spaced

$\oplus .XXX Total$

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FOR USE OF G-E EMPLOYEES ONLY

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SECTION 2

CONT ON SHEET 16 SH NO. 15

## 14.0 TRUE POSITION DEFINITION AND APPLICATION (CONT'D.)

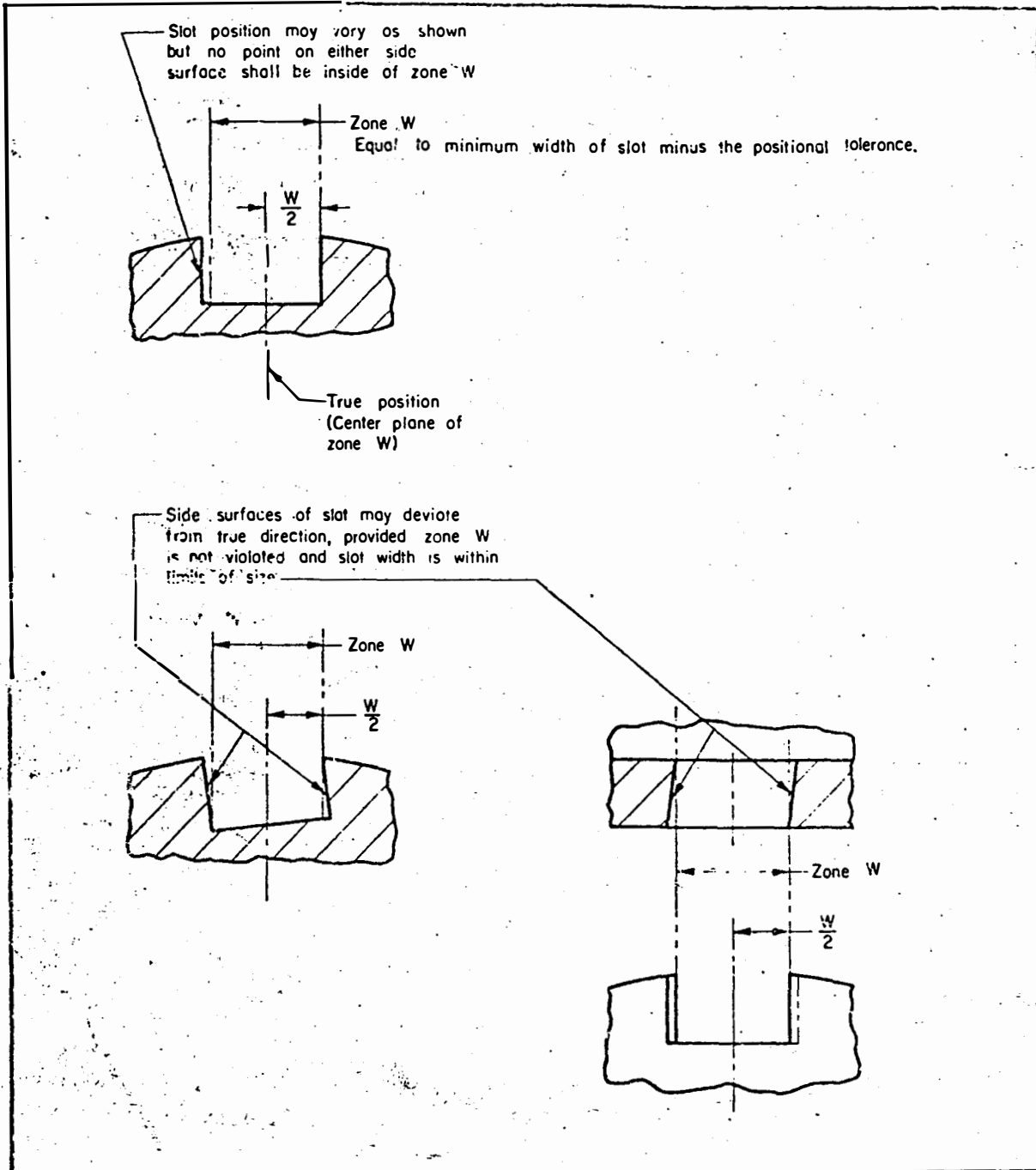


FIGURE 3

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	Trans. Equip. Prod. Engg.		CONT ON SHEET	16	SH NO. 15
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## 14.0 TRUE POSITION DEFINITION AND APPLICATION (CONT'D.)

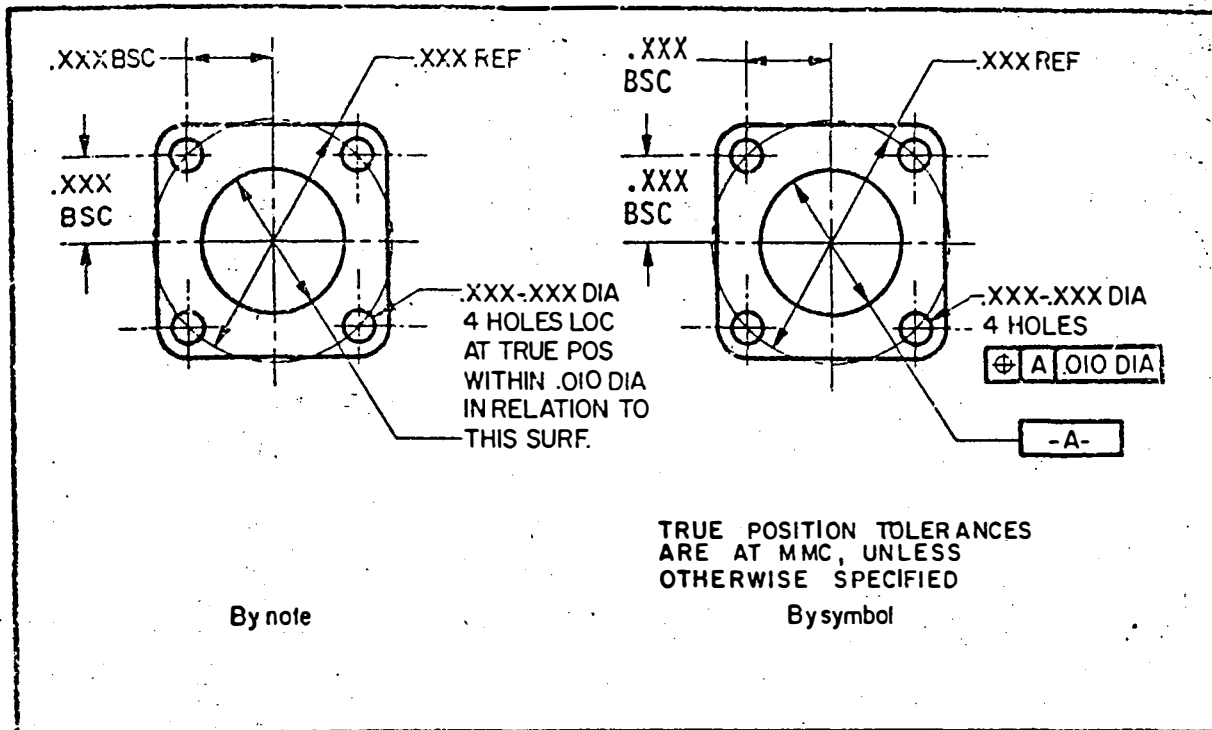


FIGURE 4

TRUE POSITION DATUMS

A. Datums should always be identified on drawings wherever failure to do so could result in a wrong selection of the datum. For instance, in Figure 5, if Surface A datum reference had been omitted, it would not have been clear whether the inside diameter (Surface A) or the outside diameter was the intended datum. Because some degree of eccentricity between these two diameters is unavoidable, the selection of the outside diameter as a datum (in the absence of any datum designation on the drawing) might have resulted in non-usable parts. Acceptable methods for indicating datums are as follows:

1. By including in the true position note or symbol a reference to the datum(s). See Figures 4 and 5.
2. By implying as in Figures 6, 7, and 8 the implied datums (by use of pattern-locating dimensions referred directly from datum surfaces).
3. By specifying a minimum edge distance (especially suitable for cast or forged parts).

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	Feb 11, 1974				SH NO.	16
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FOR USE OF G-E EMPLOYEES ONLY

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## 14.0 TRUE POSITION DEFINITION AND APPLICATION (CONT'D.)

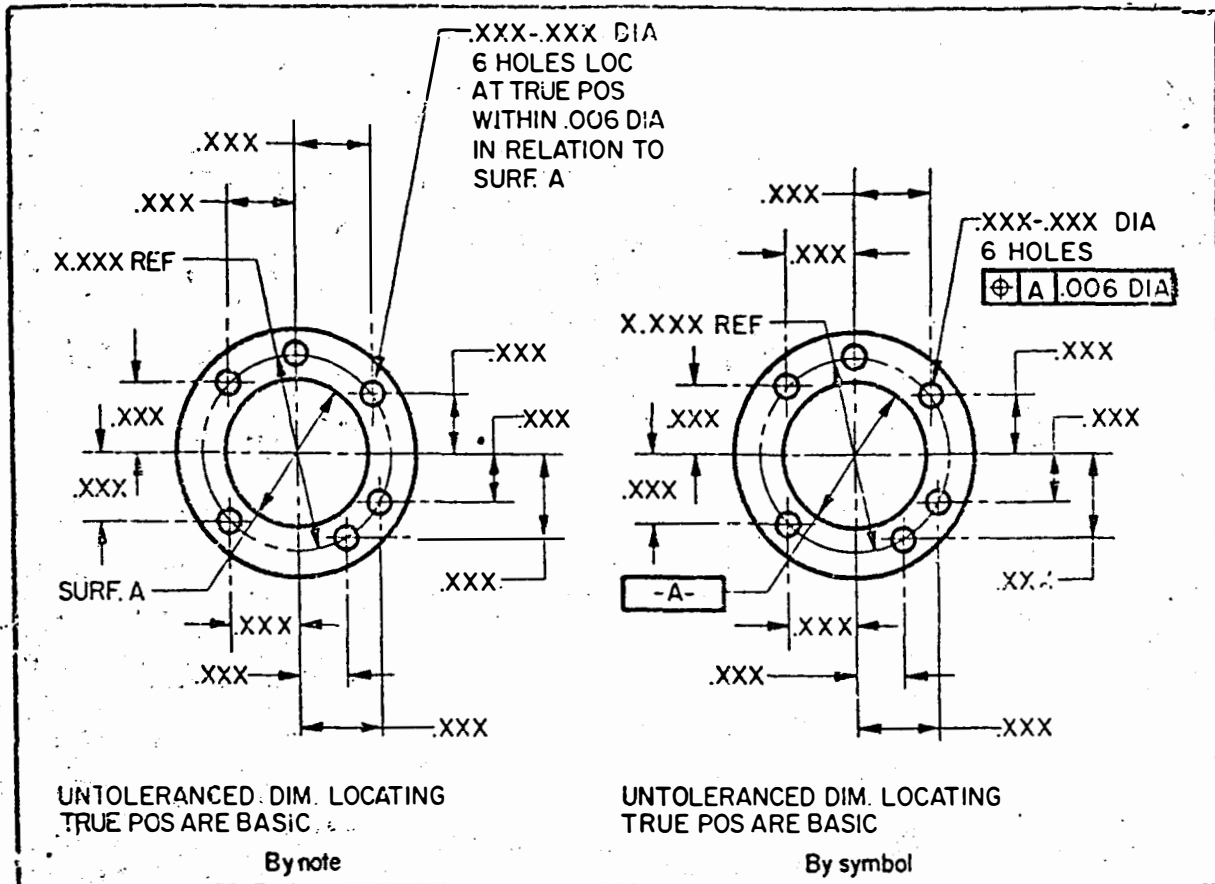


FIGURE 5

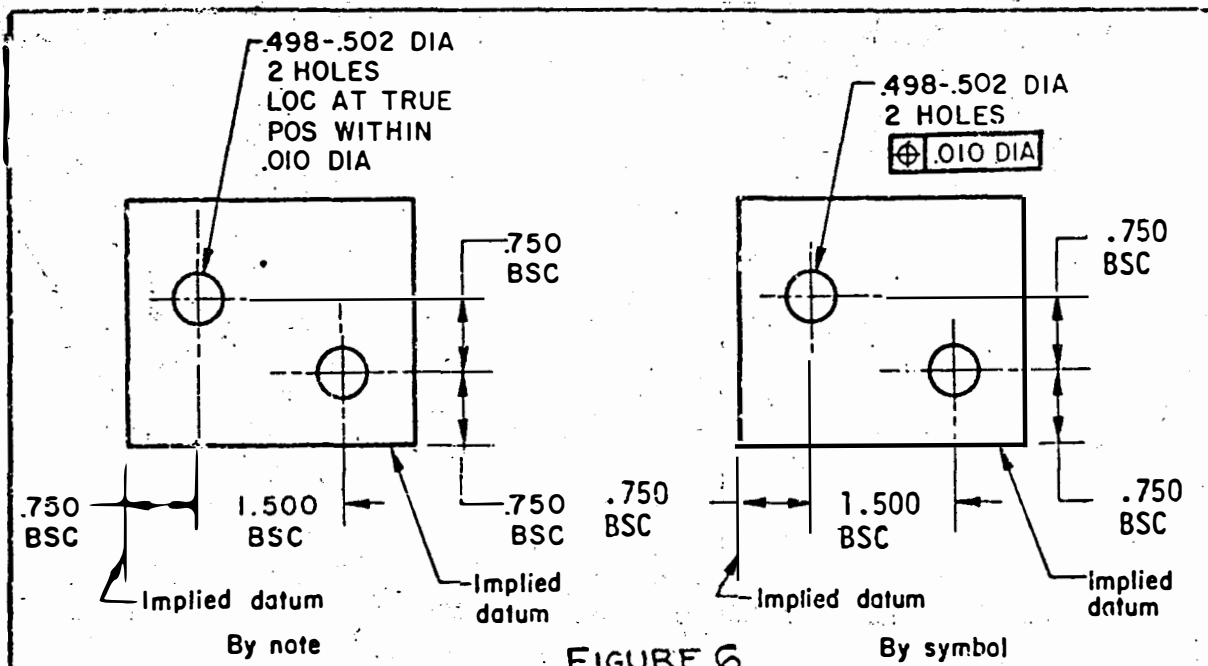


FIGURE 6

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## 14.0 TRUE POSITION DEFINITION AND APPLICATION (CONT'D.)

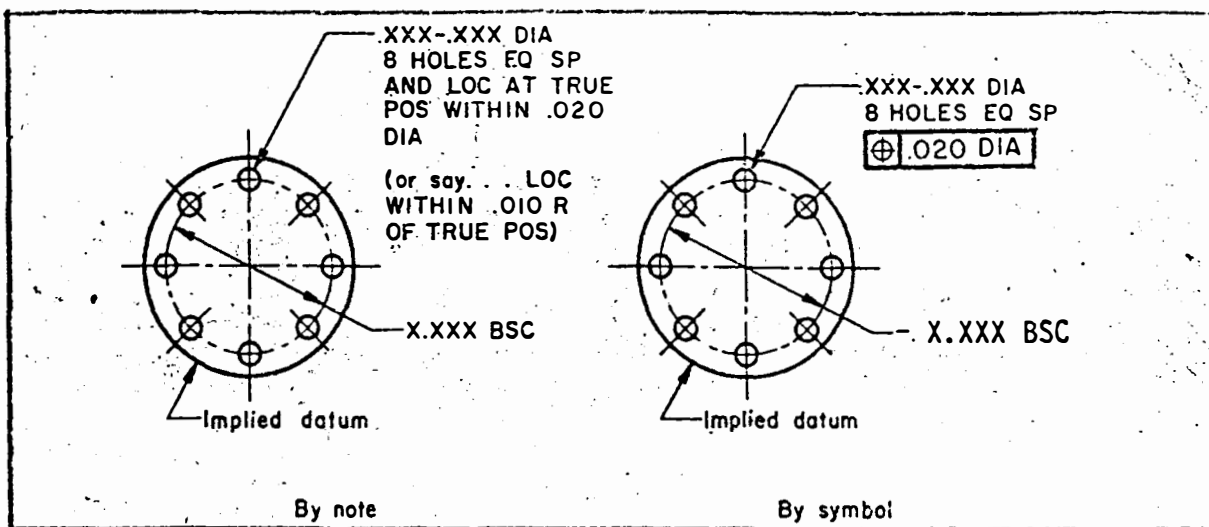


FIGURE 7

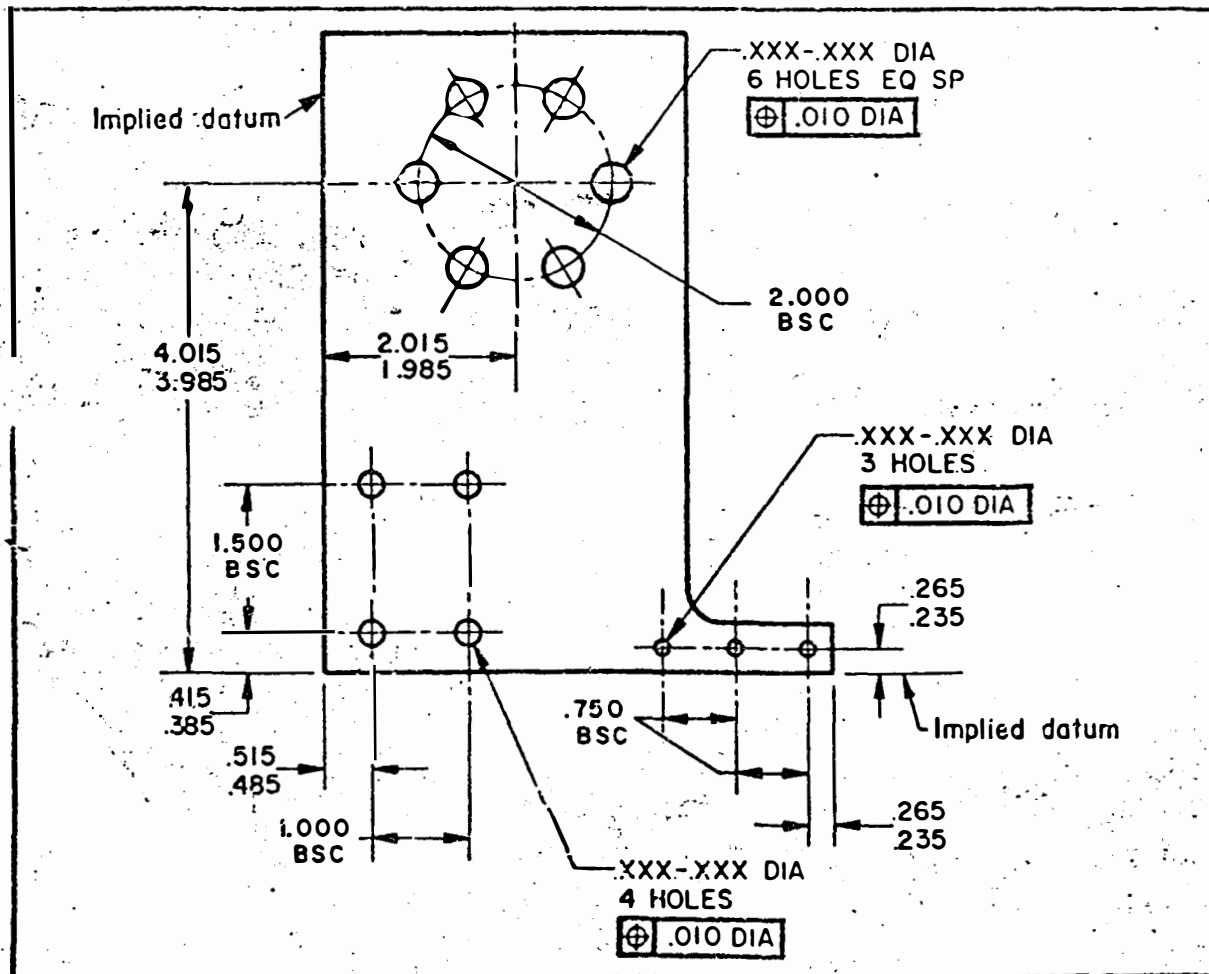


FIGURE 8

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## STANDING INSTRUCTIONS

FOR USE OF G-E EMPLOYEES ONLY

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## 14.0 TRUE POSITION DEFINITION AND APPLICATION (CONT'D.)

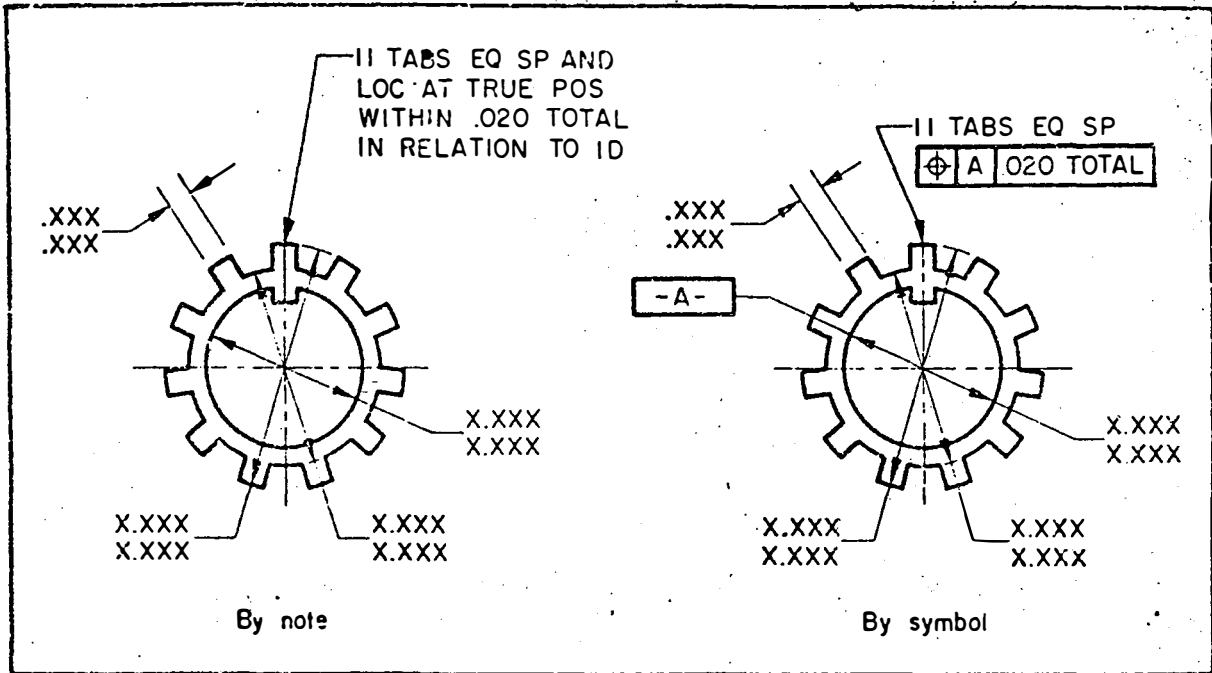


FIGURE 9

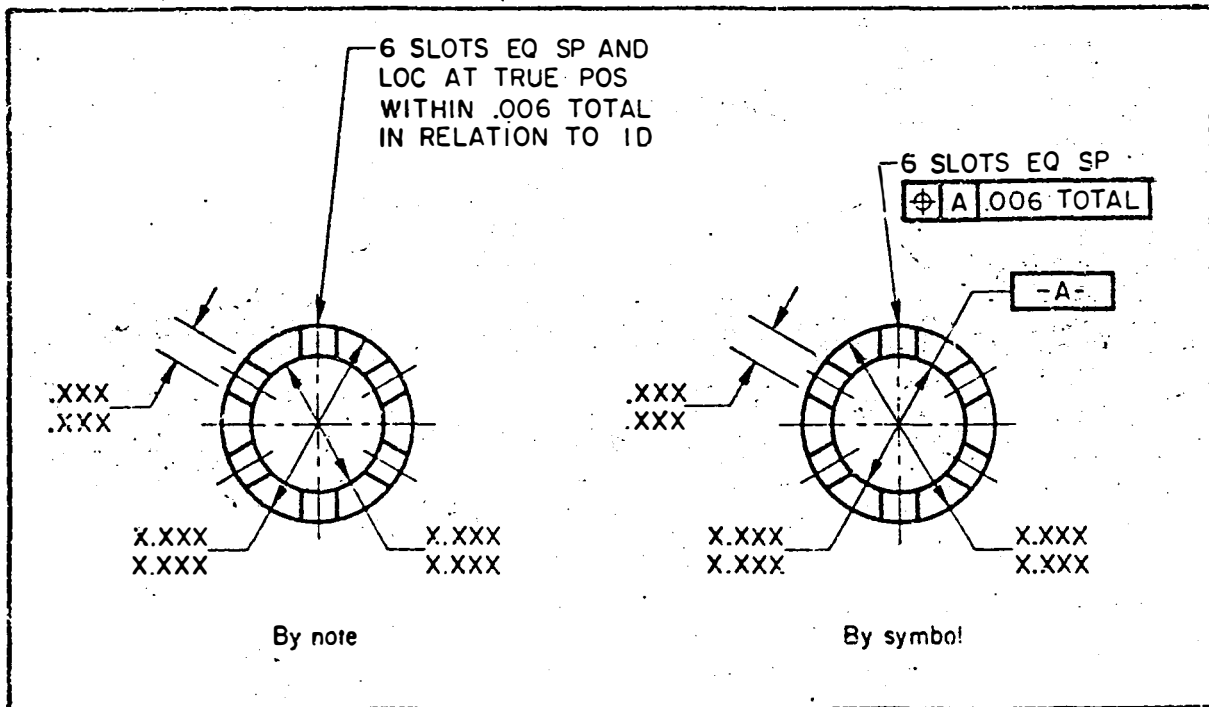


FIGURE 10

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			Trans. Equip. Prod. Eng.	CONT ON SHEET	20	SH NO. 19
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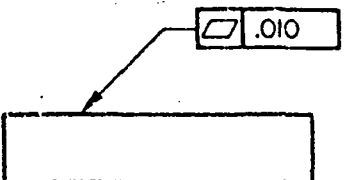
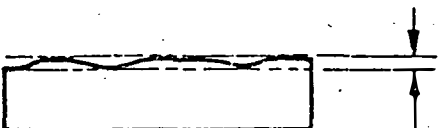
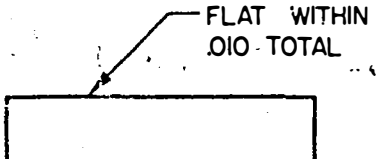
SI S-10025

SECTION 2

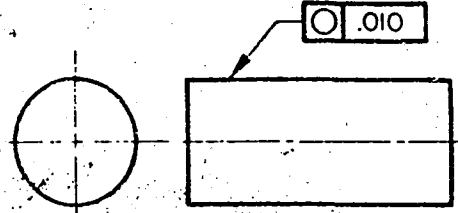
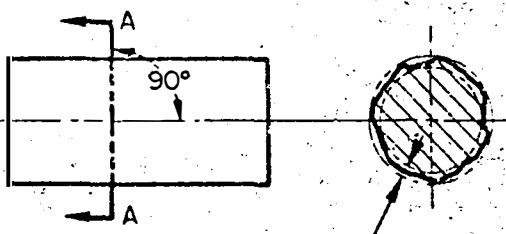
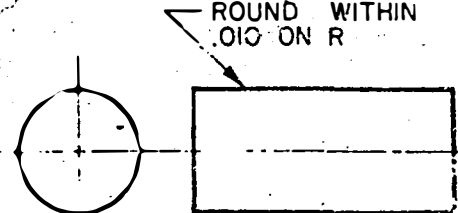
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## 15.0 GEOMETRIC CHARACTERISTICS SYMBOLS AND INTERPRETATIONS

### 15.1 FLATNESS

DRAWING CALLOUT	INTERPRETATION
 <p>By Symbol</p>	 <p>.010 wide tolerance zone</p>
 <p>By Note</p>	<p>The surface must be within the specified tolerance of size and must lie between two parallel planes (.010 apart).</p>

### 15.2 OUT OF ROUND

DRAWING CALLOUT	INTERPRETATION
 <p>By Symbol</p>	 <p>.010 wide tolerance zone</p> <p>Section A-A</p>
 <p>By Note</p>	<p>The periphery at any cross section perpendicular to the axis must be within the specified tolerance of size and must lie between two concentric circles (one having a radius .010 larger than the other).</p>

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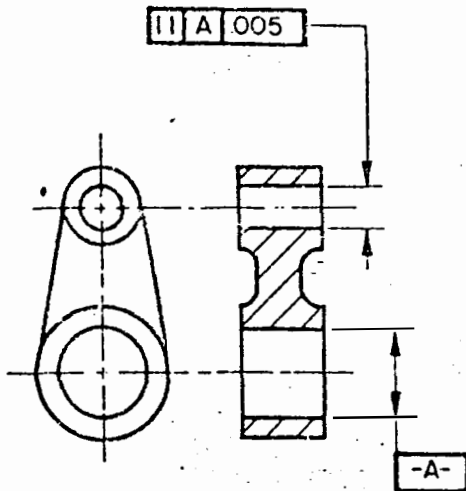
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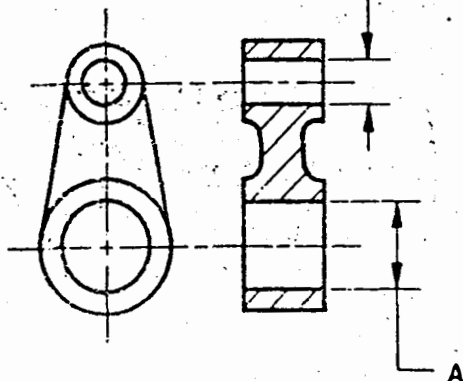
## 15.6 GEOMETRIC CHARACTERISTICS SYMBOLS &amp; INTERPRETATIONS (CONT'D.)

## 15.3 PARALLELISM

## DRAWING CALLOUT

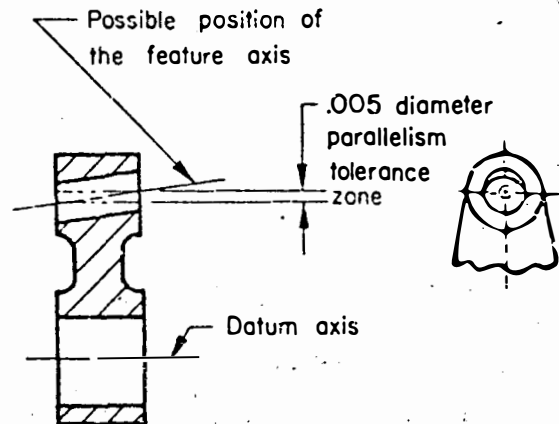


By Symbol

PAR. TO DIA A  
WITHIN .005 TOTAL

By Note

## INTERPRETATION



The feature axis must be within the specified tolerance of location. Regardless of the actual size of the feature, its axis must lie within a cylindrical zone (.005 diameter) which is parallel to the datum axis.

NOTE - This feature could also have been analyzed by True Position concept.

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 TO  
 ISSUED BY

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 J.E. Taylor FEB 11, 1974

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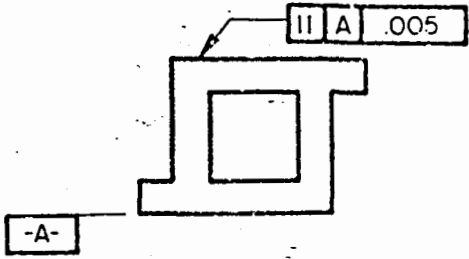
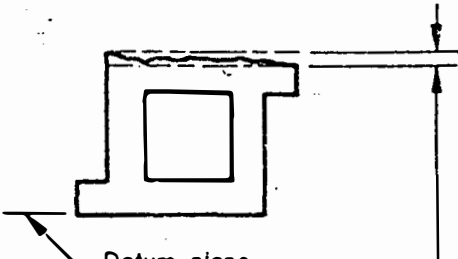
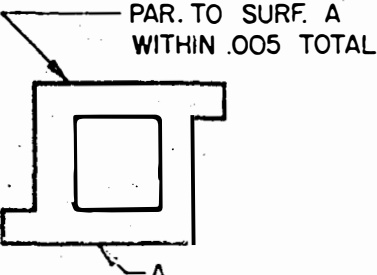
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## 15.0 GEOMETRIC CHARACTERISTICS SYMBOLS &amp; INTERPRETATIONS (CONT'D.)

## 15.3 PARALLELISM (CONT'D.)

DRAWING CALLOUT	INTERPRETATION
 <p>By Symbol</p>	 <p>Datum plane</p> <p>.005 wide tolerance zone</p>
 <p>By Note</p>	<p>The surface must be within the specified tolerance of size and must lie between two planes (.005 apart) which are parallel to the datum plane.</p>

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## STANDING INSTRUCTIONS

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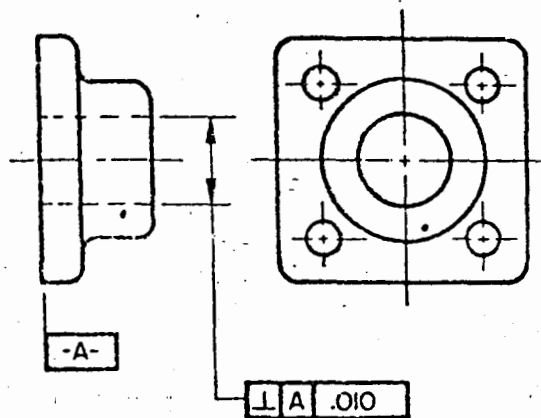
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## 15.0 GEOMETRIC CHARACTERISTICS SYMBOLS &amp; INTERPRETATIONS (CONT'D.)

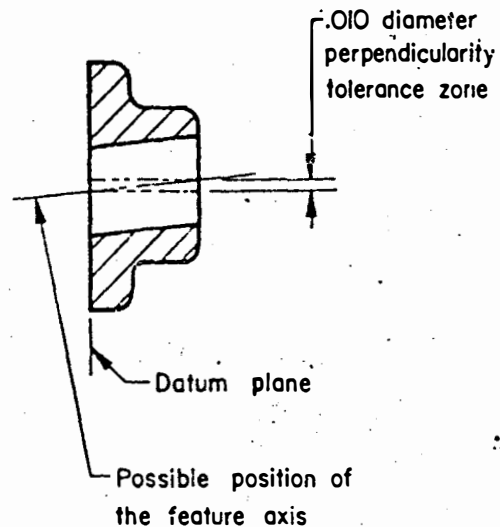
## 15.4 PERPENDICULARITY

DRAWING CALLOUT

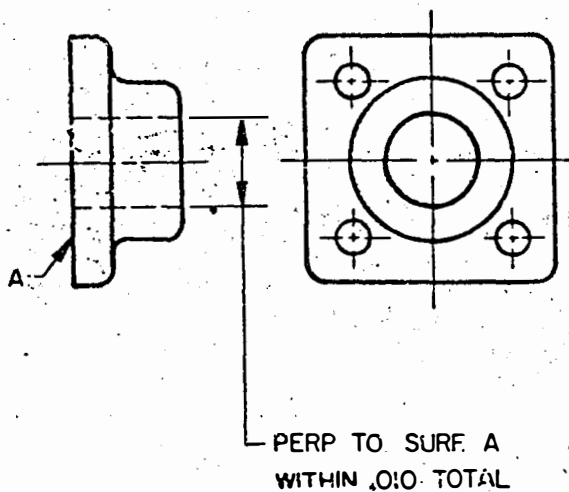


By Symbol

INTERPRETATION



Regardless of the actual size of the feature, its axis must lie within a cylindrical zone (.010 diameter) which is perpendicular to the datum plane.



By Note

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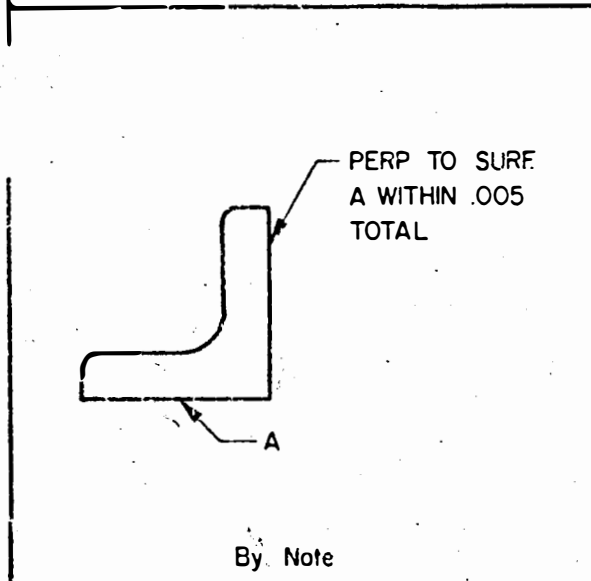
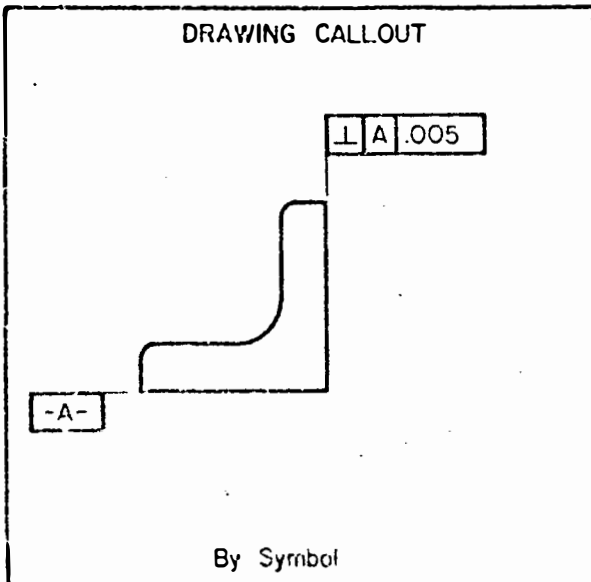
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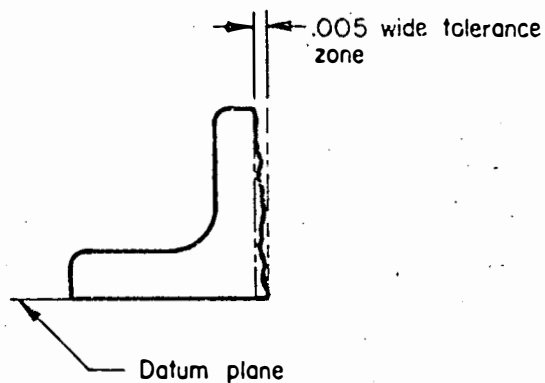
## 15.0 GEOMETRIC CHARACTERISTICS SYMBOLS &amp; INTERPRETATIONS (CONT'D.)

## 15.4 PERPENDICULARITY (CONT'D.)

DRAWING CALLOUT



INTERPRETATION



The surface must be within the specified tolerance of size and must lie between two parallel planes (.005 apart) which are perpendicular to the datum plane.

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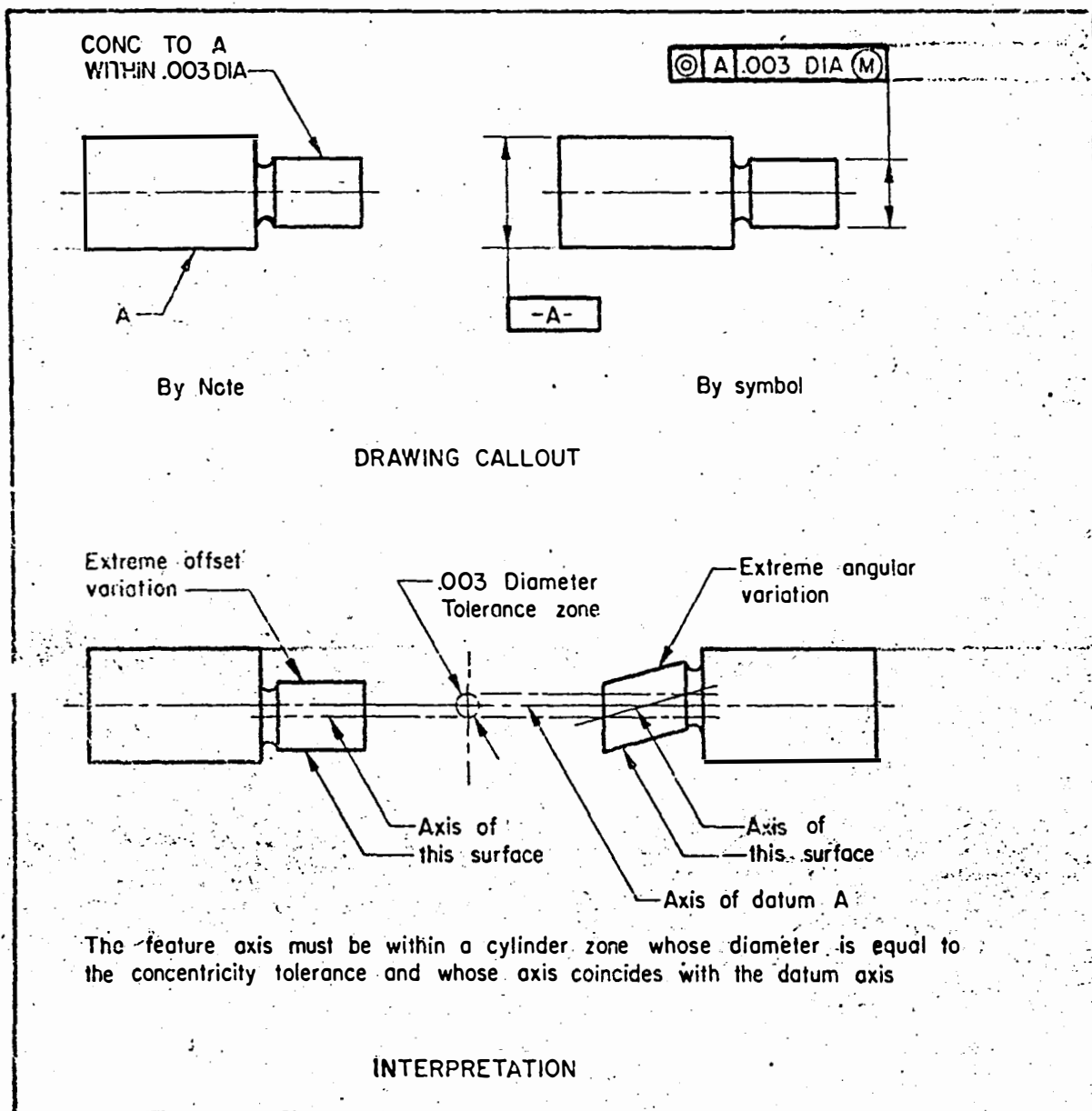
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## 15.0 GEOMETRIC CHARACTERISTICS, SYMBOLS & INTERPRETATIONS (CONT'D.)

### 15.5 CONCENTRICITY



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## 15.0 GEOMETRIC CHARACTERISTICS SYMBOLS &amp; INTERPRETATIONS (CONT'D)

## 15.6 REGARDLESS OF FEATURE SIZE / RFS / (S)

**15.6.1 Effect of RFS** - Where a location or form tolerance is applied on an RFS basis, the specified tolerance is independent of the size of the considered feature. The tolerance is limited to the specified value regardless of the actual size of the feature. Likewise, referencing a datum feature on an RFS basis means that a centering about its axis or center plane is necessary, irrespective of the actual size of the feature.

**15.6.2 The Explanation of RFS as Related to Positional Tolerancing** - RFS, where applied to the positional tolerance of circular features, requires the axis of each feature be located within the specified positional tolerance regardless of the size of the feature.

**15.6.3** In Figure 105, the six holes may vary in size from 0.9994 to 1.0000. The six individual hole diameters might measure 0.9995, 0.9996, 0.9997, 0.9998, 0.9999 and 1.0000. In order to minimize spacing errors each hole must be located within the specified positional tolerance regardless of the size of that hole. A hole at LMC (1.0000 diameter) is as accurately located as a hole at MMC (0.9994 diameter). This positional control is more restrictive than the MMC concept more commonly applied to positional tolerancing.

**15.6.4** The functional requirements of some designs may require RFS be applied to both the hole pattern and datum feature. That is, it may be necessary to require the axis of an actual datum feature (such as datum diameter B in Figure 105) be the datum axis for the holes in the pattern regardless of the datum feature's size. The RFS application does not permit any shift between the datum axis and the pattern of features, as a group, where the datum feature departs from MMC.

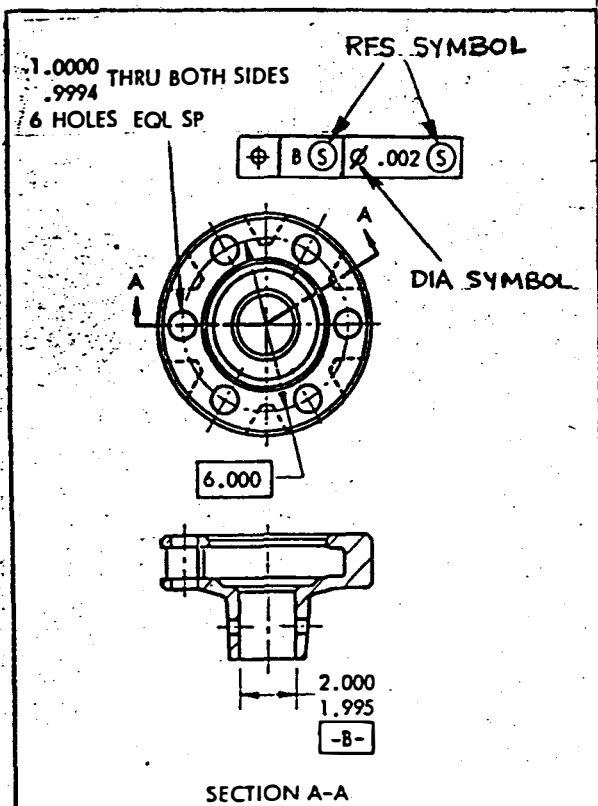


FIG. 105 RFS APPLIED TO A FEATURE AND DATUM

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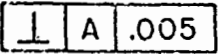


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## 16.0 DATUM IDENTIFYING SYMBOLS

### Drawing callout

No. of datums	By symbol	By note
One		PERP. TO SURF. A WITHIN .005 TOTAL
Two		LOC. AT TRUE POS. WITHIN .010 DIA IN RE- LATION TO SURF. B AND DIA C
Three		LOC. AT TRUE POS. WITHIN .014 DIA IN RELATION TO SURF. D AND E AND F

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17.0 SPLINED PART INSPECTION

17.0.1 Splined hubs for transit application must be inspected after phosphate coating to diameter under pins using the drawing specified upper limit and using the proper plug gage for the low limit. The plug gage must be a slip fit for the hub to pass inspection (no pressure by hand).

17.0.2 Splined shafts for transit application must be inspected to diameter over pins using the drawing specified lower limit and using the proper ring gage for the upper limit. The ring gage must be a slip fit for the shaft to pass inspection.

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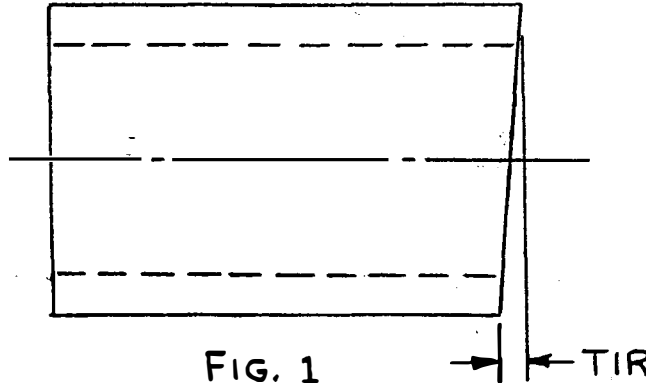
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## 1.0 COLLARS, SLEEVES, ETC.

Where drawings specify "Bores to be square with face per SI-10025, Sec. 3 Page 1", the following must be met.

- 1.1 The face is to be square to an axis so that the total indicator runout will not exceed .0002" per inch of diameter. (See Fig. 1)



- 1.2 For deburring see SI-10025, Sect. 2, Paragraph 9.0

## 2.0 NUTS

- 2.1 The contact face of a nut must be perpendicular to the axis within .006 T.I.R.

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ISSUED BY

D. E. Taylor Feb 11, 1974

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MOTOR ENGR DIVISION

## LOCO & CAR EQUIPMENT

**.DEPARTMENT**

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1.0

## COMMUTATORS

### 1.1. Concentricity of Angles

The apexes of angles for cap and shell ends of **commutator segments** must be concentric within the following limits:

<u>Machined</u>	<u>Total Indicator Reading</u>
In a boring mill	.010 in.
In a lathe with tapered pressure ring	.020 in.
In a lathe with straight pressure ring	.025 in.

## 1.2. Diameter of Brush Surface

The diameter of the brush surface of a commutator, after the final machining as an armature, may not vary from the nominal diameter more than the limits listed below. Special approval of the Motor Engineering Division must be obtained to ship commutators outside these limits.

<u>Size</u>	<u>Fractional Tolerances</u>	<u>Decimal Tolerances</u>
Less than 8 in. diameter.....	$\pm 1/64$ in.	$\pm .02$
8 in. diameter & over but less than 18 in. dia.....	$\pm 1/32$ in.	$\pm .04$
18 in. diameter & over.....	$\pm 1/16$ in.	$\pm .06$
.....	$- 1/32$ in.	$-.04$

### 1.3. Metal Section, Segments Tolerances

All metal sections, commutator segments, commutator bars and segment blanks etc., the scaled dimensions should be as follows unless otherwise noted on the drawing.

Fractions----- $\pm 1/64$

Decimals-----±.02

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## 1.0 ALTERNATIVE MATERIALS

The material identified on the face of the drawing or in the specification is the preferred material. In the event the specified material is not available or economically viable, alternative materials may be used provided that the proper deviation process is followed.

Refer to Specification B50E205, Global Alternative Materials, for a list of metallic materials which may be used in lieu of a specific material identified by the drawing or parts list unless specifically prohibited by the drawing or part specification. B50E205 and QSP 7.4.6-11, Supplier Deviation Request, define the deviation process.

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