

RADIATOR MATH

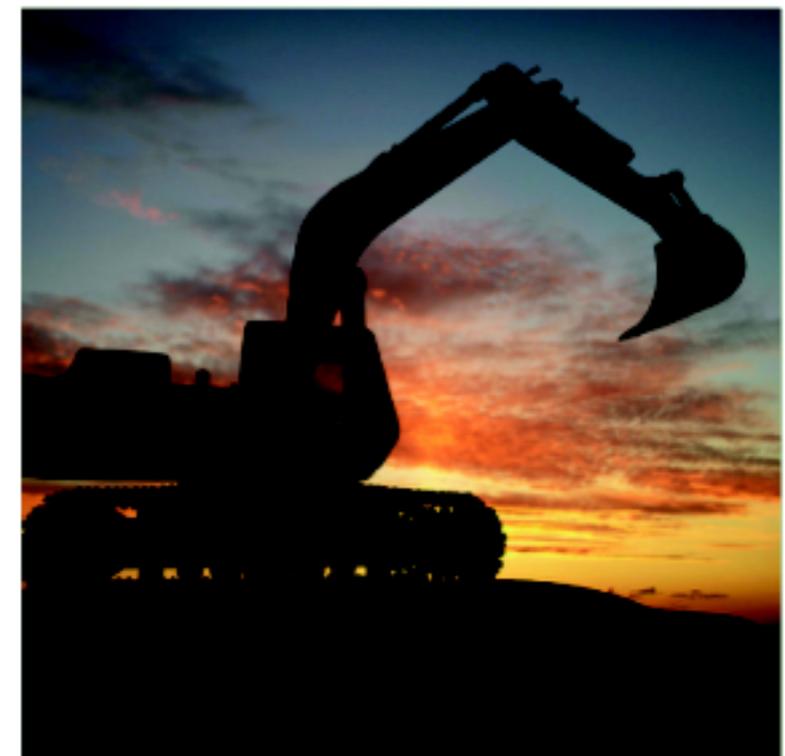
David Bienvenu

TIME IS MONEY



**SIXTH
ANNUAL**

SEPT. 17-19
BUFFALO, NEW YORK
EMBASSY SUITES BUFFALO
200 DELAWARE AVE.
BUFFALO, NY 14202

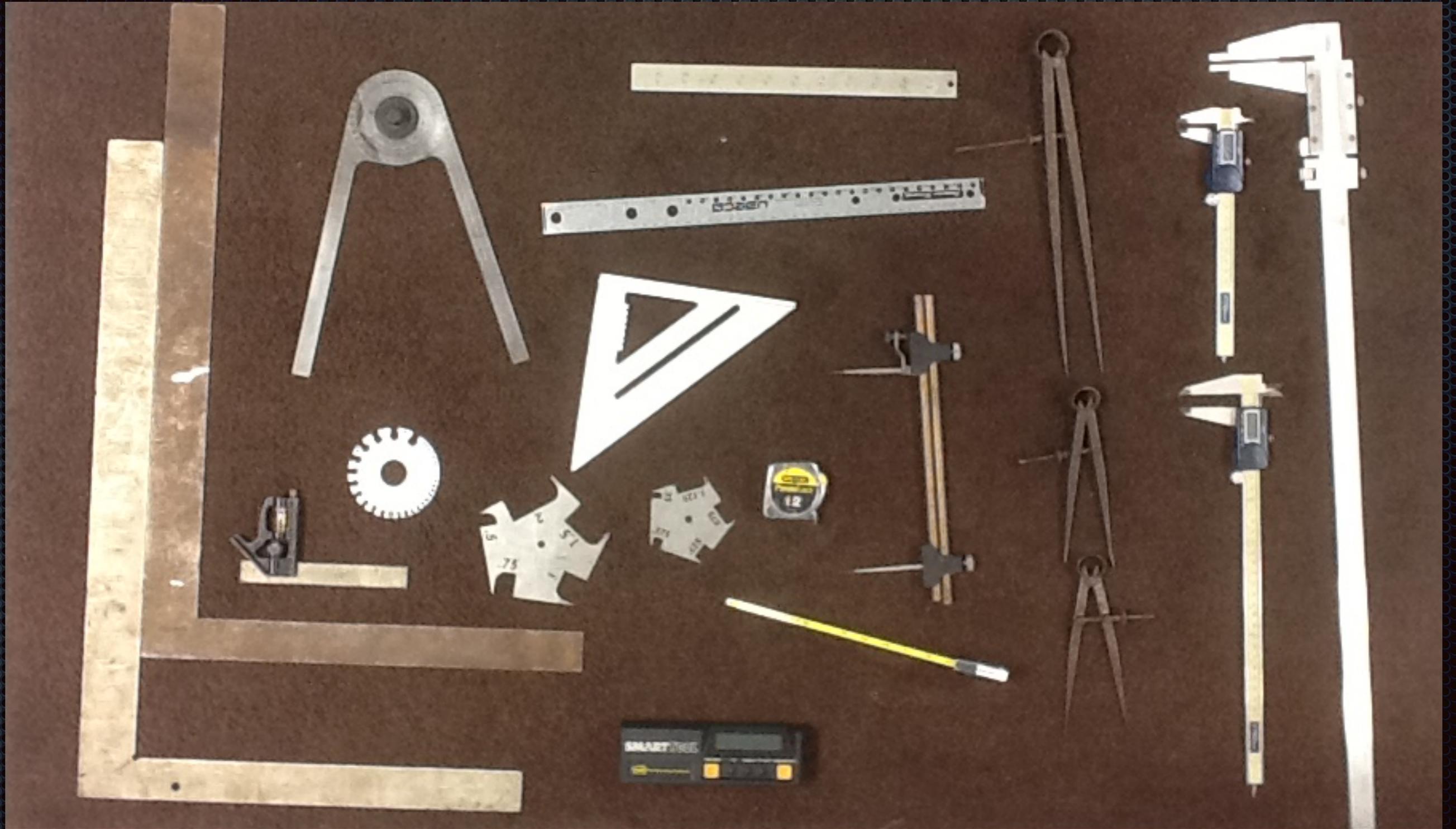


(9:45 am to 10:15 am) BREAK

(10:15 am to 11:00 am) Radiator Math –

David Bienvenu of Radiator Service Co. Inc., located in the middle of the Gulf Oil Corridor, spent a lot of his time in the last 20 years reverse engineering radiators and heat exchangers because down time is not an option. He will cover everyday product calculations and formulae that will reduce project time, increase efficiency, and help insure accuracy. "All the math we need to know we learned between kindergarten and 8th grade. But we forgot some of it".

TOOLS



FRACTIONS

AND

DECIMALS

BOLT HOLE (SQUARE PATTERN)

HEADER SPECIFICATION SHEET FOR **BOTH HEADERS**

DATE	05/01/15
CUSTOMER NAME	NARSA HD 2015
REF. NAME	46" Tall Core
CORE TYPE	T
REF. NUMBER	OI 150800

SEE HEADER SHAPE TAB

HEADER SHAPE

A

HEADER GAUGE

HEAVY

HOLE SIZE,

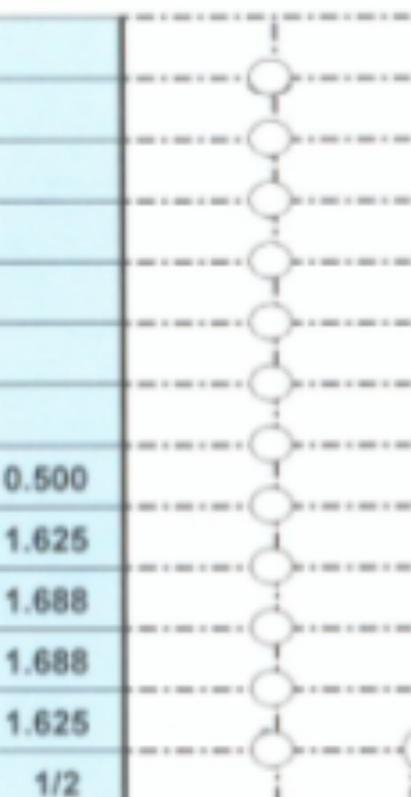
7/16

W

HOLE SIZE,

7/16

LE



LEFT AND/OR RIGHT SIDE WIDTH

OVERALL HEADER WIDTH
7.625
Center of corner hole to center of the opposite corner hole, WIDTH

OVERALL HEADER LENGTH
41 7/8
Center of corner hole to center of the opposite corner hole, LENGTH

6 5/8

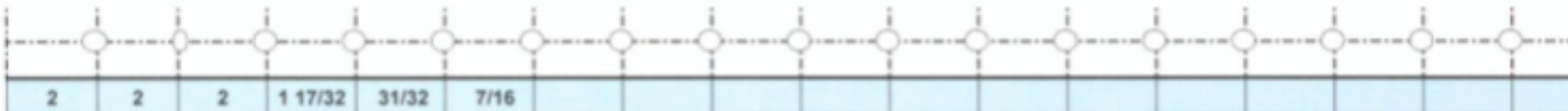
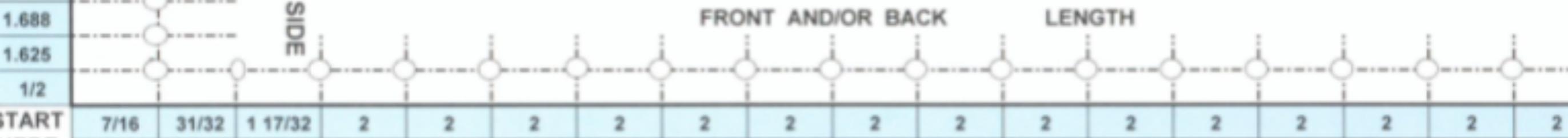
41

TOTAL NUMBER OF HOLES AFTER FOR COMPLETED

52

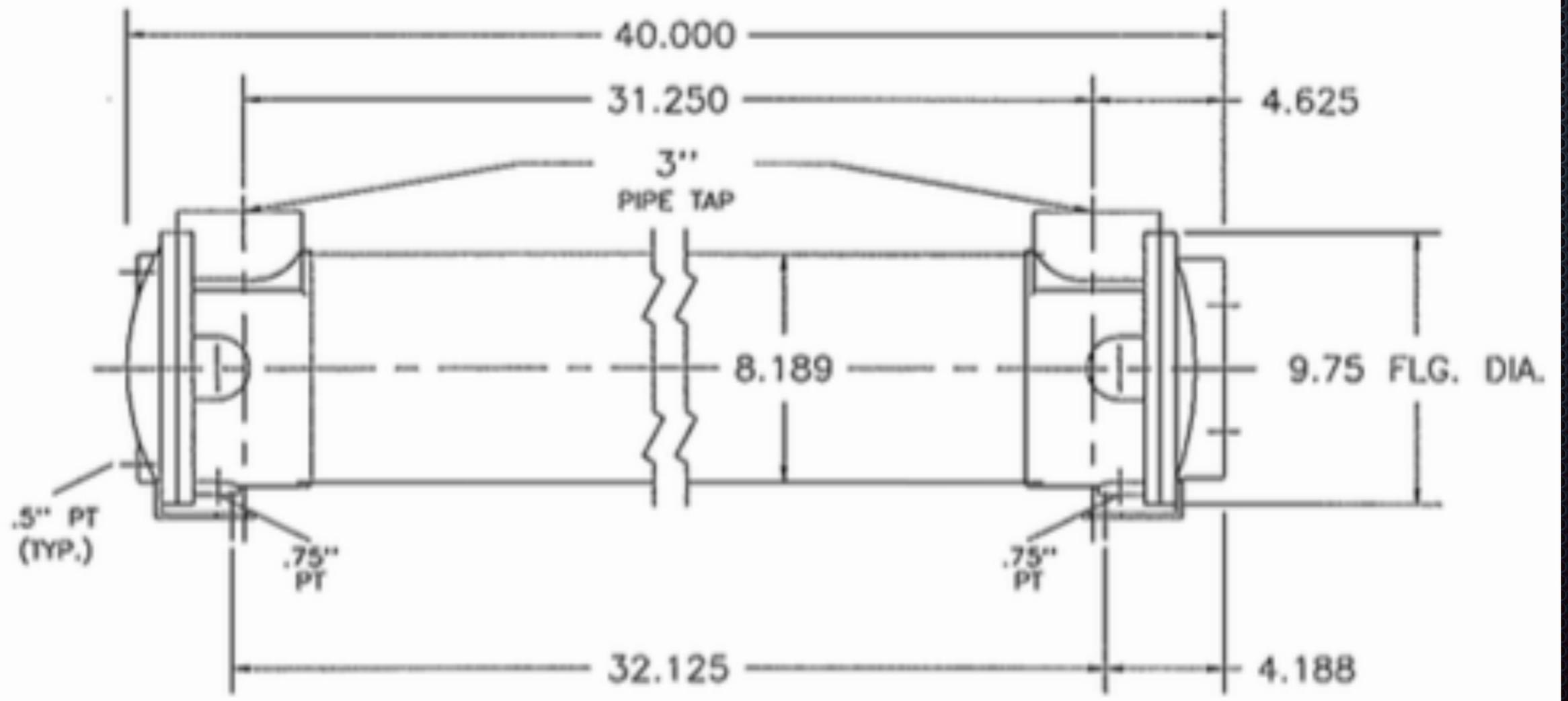
IF YOU HAVE TO DOU BOLT HOLES, THIS N WILL NOT BE CORP

NOTE: IF FRONT AND BACK ARE DIFFERENT, CREATE TWO SPECIFICATION SHEETS



CONTINUED FROM CELL V21

CONTINUED FROM CELL E21



BOLT HOLE (SQUARE PATTERN)

HEADER SPECIFICATION SHEET FOR **BOTH HEADERS**

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7/16

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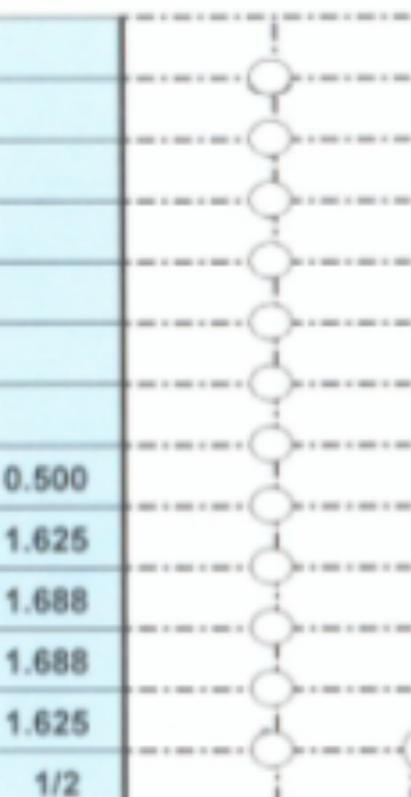
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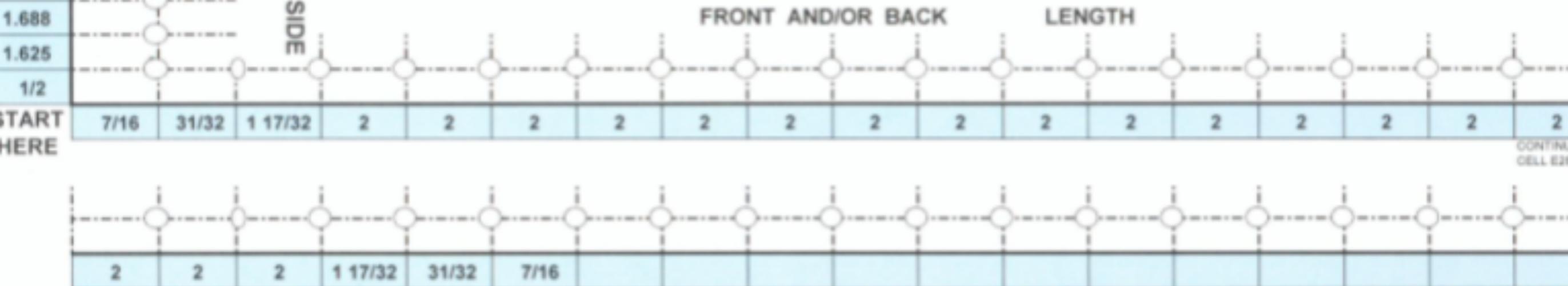
41

TOTAL NUMBER OF HOLES AFTER FOR COMPLETED

52

IF YOU HAVE TO DOUBLE BOLT HOLES, THIS NUMBER WILL NOT BE CORRECT

NOTE: IF FRONT AND BACK ARE DIFFERENT, CREATE TWO SPECIFICATION SHEETS

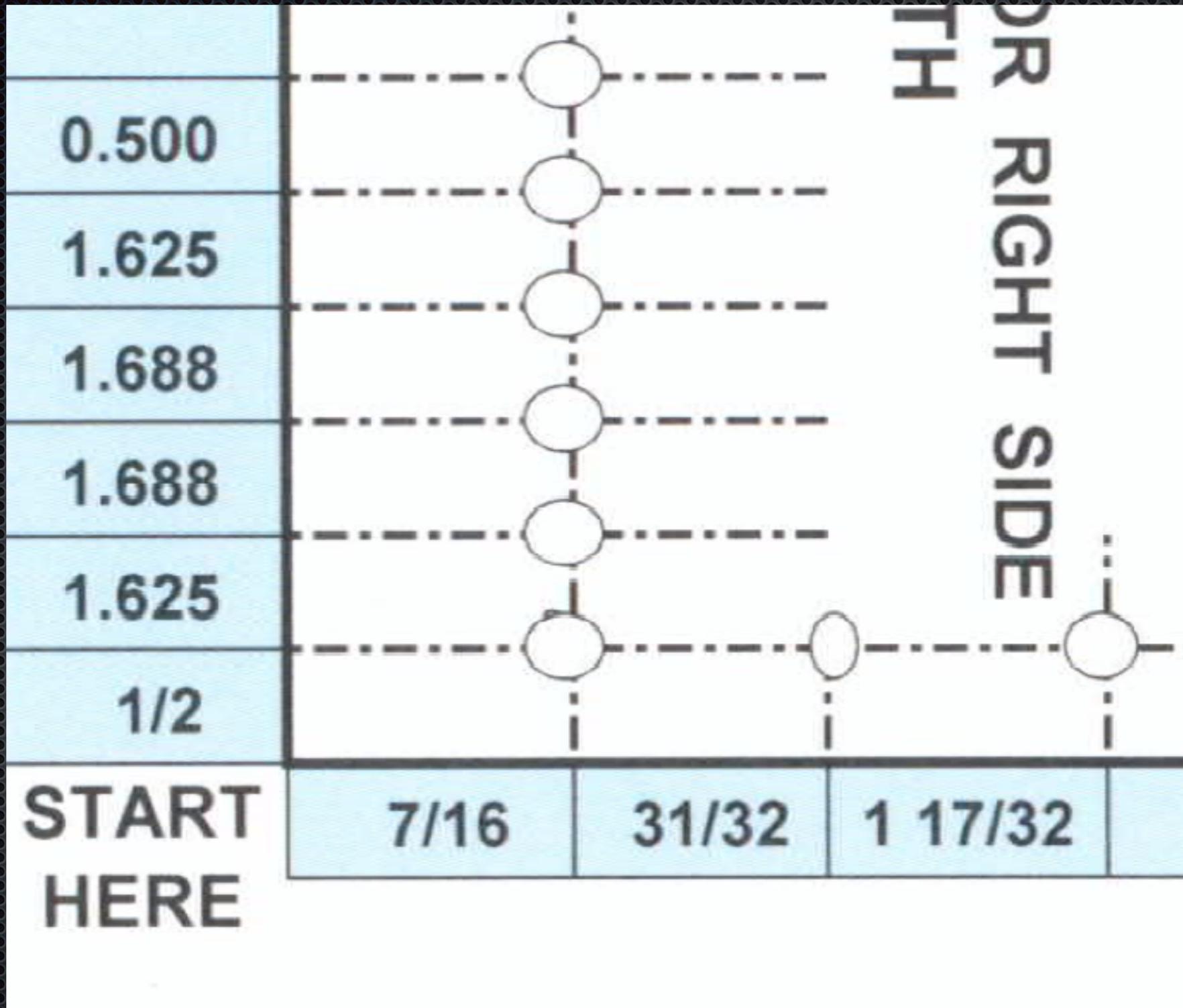


CONTINUED FROM CELL V21

CONTINUED FROM CELL E21

FRACTIONS - DECIMALS - MILLIMETERS

	INCHES	MM		INCHES	MM
	$\frac{1}{64}$ — .015625	.39688		$\frac{33}{64}$ — .515625	13.09688
	$\frac{1}{32}$ — .03125	.79375		$\frac{17}{32}$ — .53125	13.49375
	$\frac{3}{64}$ — .046875	1.19063		$\frac{35}{64}$ — .546875	13.89063
$\frac{1}{16}$ —	.0625	1.58750	$\frac{9}{16}$ —	.5625	14.28750
	$\frac{5}{64}$ — .078125	1.98438		$\frac{37}{64}$ — .578125	14.68438
	$\frac{3}{32}$ — .09375	2.38125		$\frac{19}{32}$ — .59375	15.08125
	$\frac{7}{64}$ — .109375	2.77813		$\frac{39}{64}$ — .609375	15.47813
$\frac{1}{8}$ —	.125	3.17500	$\frac{5}{8}$ —	.625	15.87500
	$\frac{9}{64}$ — .140625	3.57188		$\frac{41}{64}$ — .640625	16.27188
	$\frac{5}{32}$ — .15625	3.96875		$\frac{21}{32}$ — .65625	16.66875
	$\frac{11}{64}$ — .171875	4.36563		$\frac{43}{64}$ — .671875	17.06563
$\frac{3}{16}$ —	.1875	4.76250	$\frac{11}{16}$ —	.6875	17.46250
	$\frac{13}{64}$ — .203125	5.15938		$\frac{45}{64}$ — .703125	17.85938
	$\frac{7}{32}$ — .21875	5.55625		$\frac{23}{32}$ — .71875	18.25625
	$\frac{15}{64}$ — .234375	5.95313		$\frac{47}{64}$ — .734375	18.65313
$\frac{1}{4}$ —	.25	6.35000	$\frac{3}{4}$ —	.75	19.05000
	$\frac{17}{64}$ — .265625	6.74688		$\frac{49}{64}$ — .765625	19.44688
	$\frac{9}{32}$ — .28125	7.14375		$\frac{25}{32}$ — .78125	19.84375
	$\frac{19}{64}$ — .296875	7.54063		$\frac{51}{64}$ — .796875	20.24063
$\frac{5}{16}$ —	.3125	7.93750	$\frac{13}{16}$ —	.8125	20.63750
	$\frac{21}{64}$ — .328125	8.33438		$\frac{53}{64}$ — .828125	21.03438
	$\frac{11}{32}$ — .34375	8.73125		$\frac{27}{32}$ — .84375	21.43125
	$\frac{23}{64}$ — .359375	9.12813		$\frac{55}{64}$ — .859375	21.82813
$\frac{3}{8}$ —	.375	9.52500	$\frac{7}{8}$ —	.875	22.22500

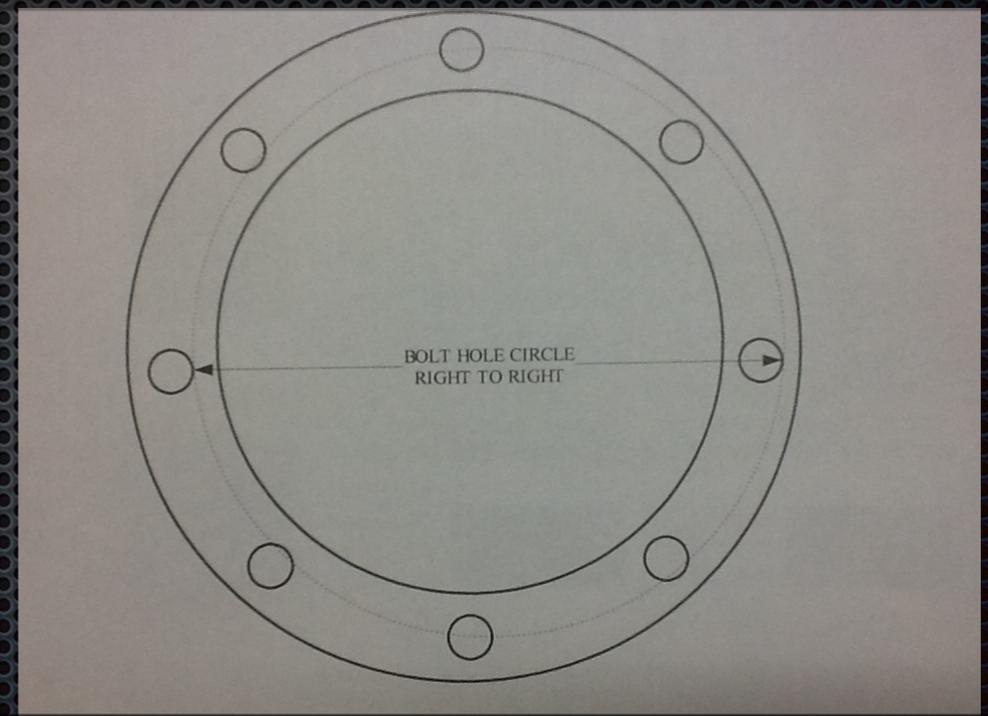
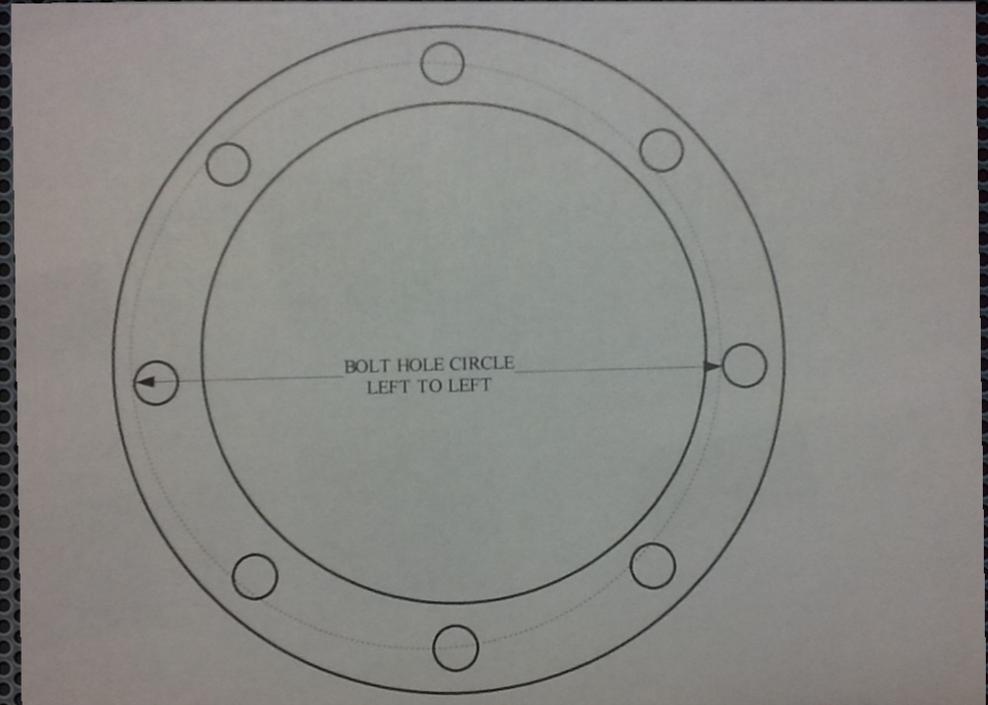
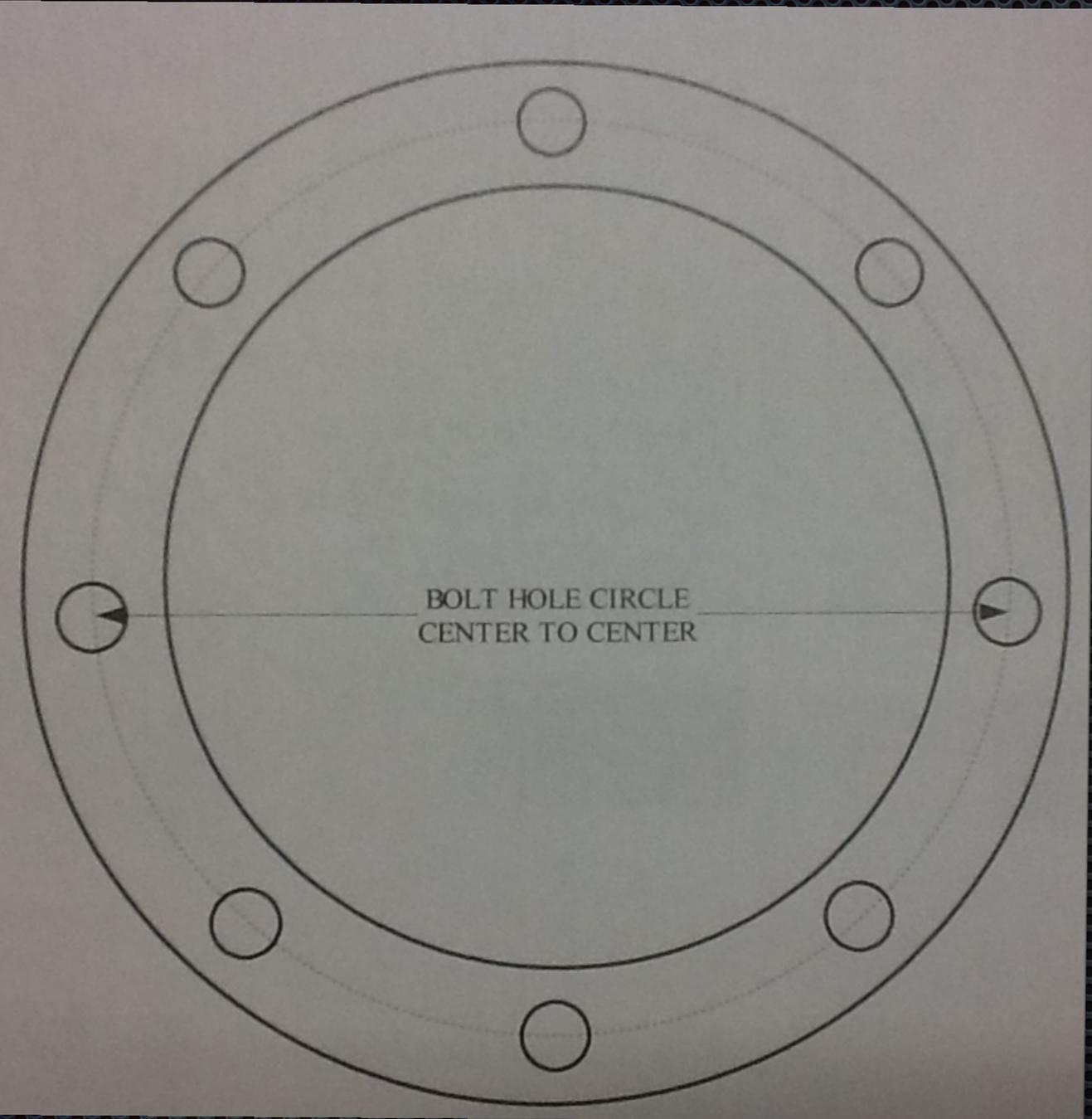


BOLT HOLE

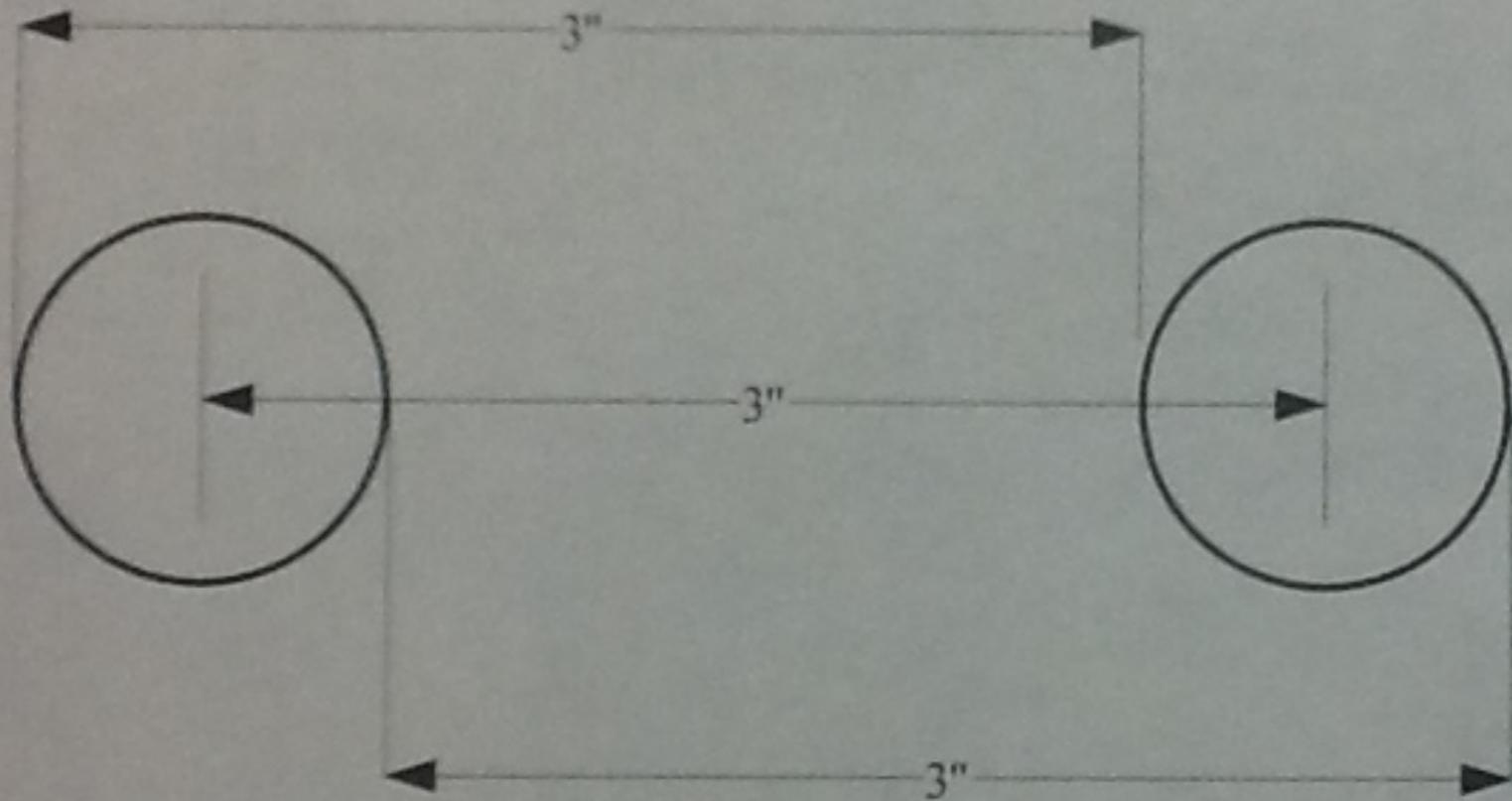
SPACING

+

CHORDS

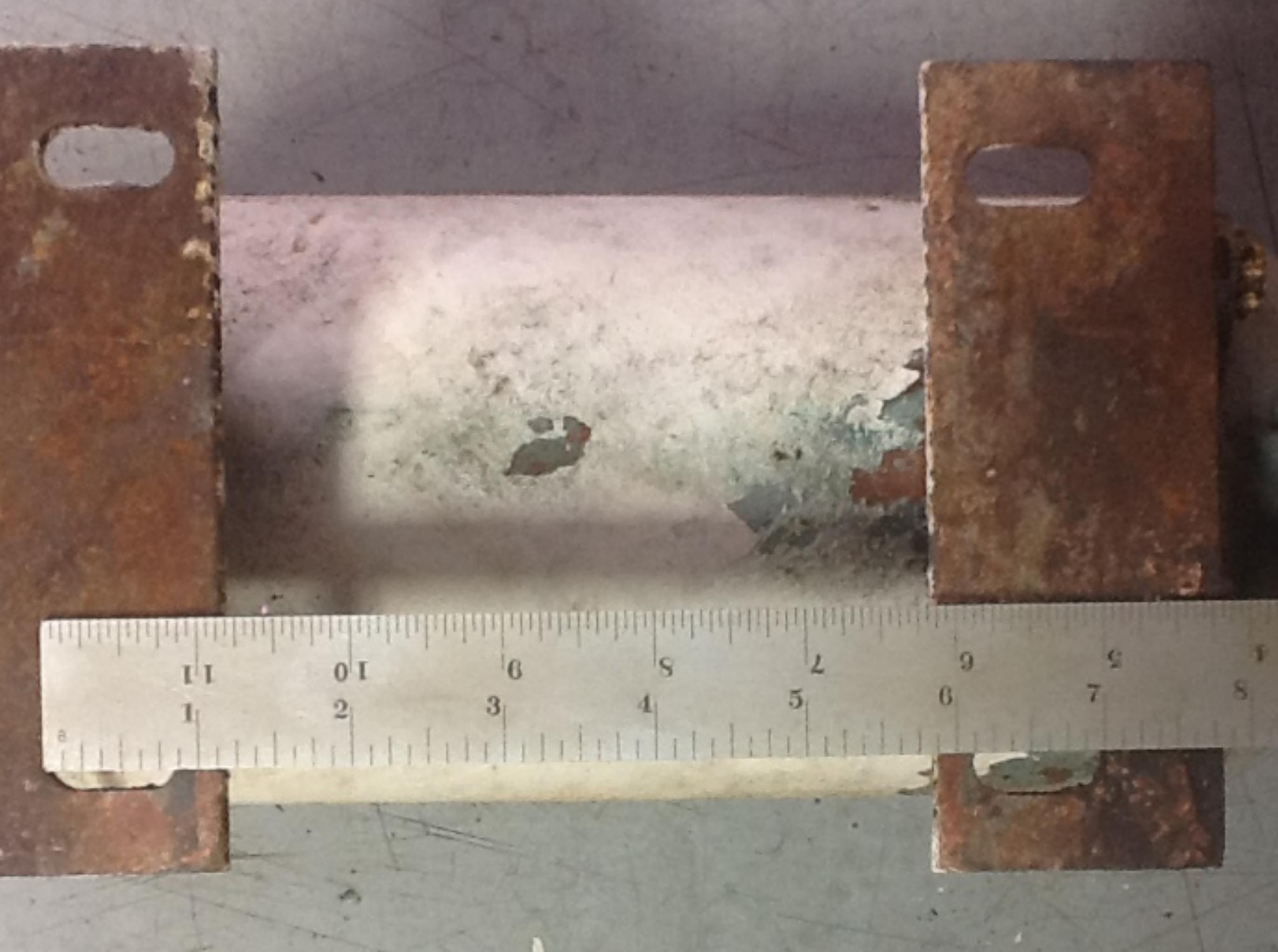


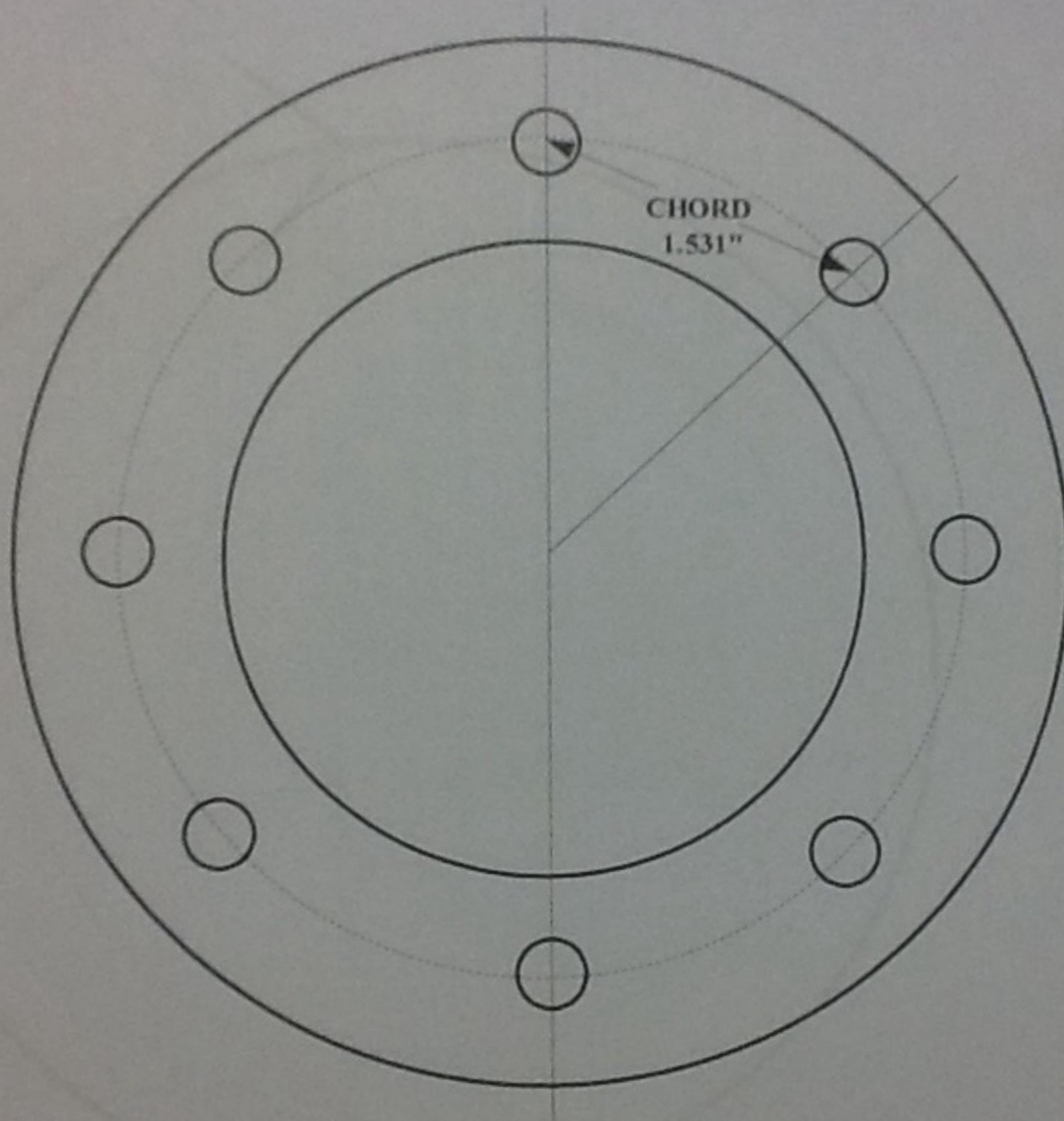




MEASURING BOLT HOLE CENTERS TRYING TO ESTIMATE THE CENTER OF THE HOLE IS NOT ACCURATE. IF THE HOLES ARE THE SAME SIZE IT IS EASIER TO MEASURE FROM THE EDGES OF THE HOLES AS IN THE ABOVE EXAMPLE







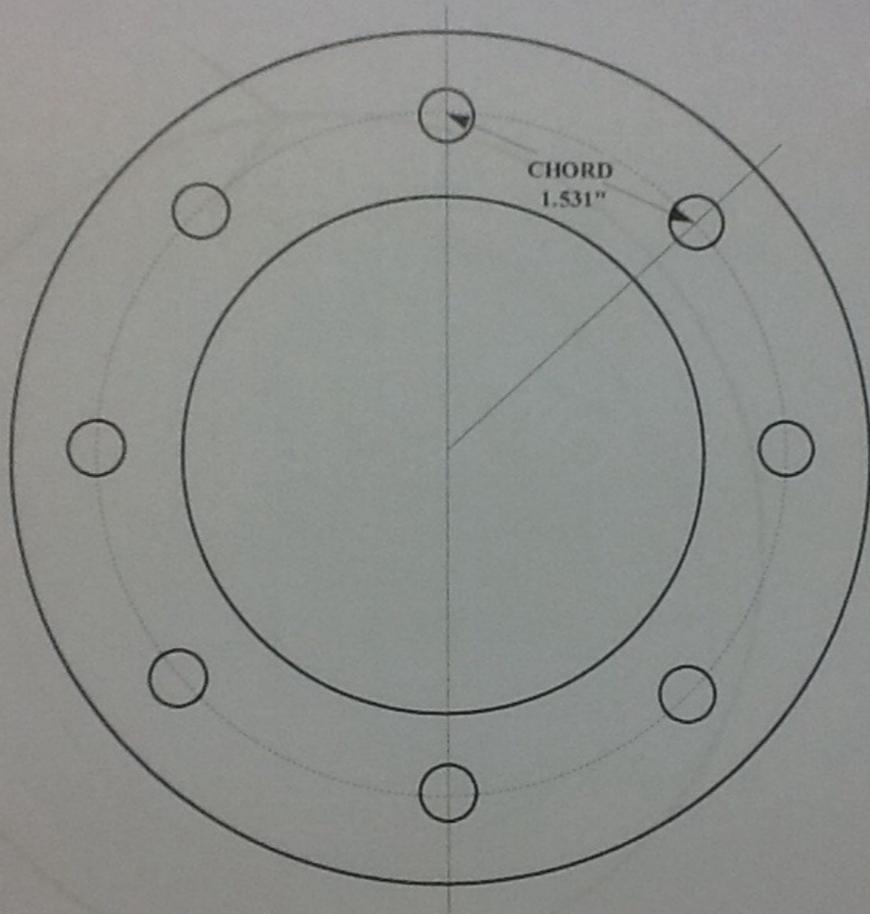
GASKET: 5" OD x 3" ID WITH 8 EQUALLY SPACED HOLES ON A 4 BOLT HOLE CIRCLE.

TWENTY-SIXTH EDITION

Machinery's Handbook

26

INDUSTRIAL PRESS



GASKET: 5" OD x 3" ID WITH 8 EQUALLY SPACED HOLES ON A 4 BOLT HOLE CIRCLE.

4	0.707107	23
5	0.587785	24
6	0.500000	25
7	0.433884	26
8	0.382683	27
9	0.342020	28
10	0.309017	29
11	0.281733	30
12	0.258819	31
13	0.239216	32

Using our chart we can see that a 1" circle with 8 equally spaced bolt holes will have 8 chords at .382683 inches apart.

Our sample has 8 equally spaced holes on a 4" circle. So if we multiply 4 x .382683 it equals 1.530732.

**Lengths of Chords for Spacing Off the Circumferences of Circles with a
Diameter Equal to 1 (English or metric units)**

No. of Spaces	Length of Chord						
3	0.866025	22	0.142315	41	0.076549	60	0.052336
4	0.707107	23	0.136167	42	0.074730	61	0.051479
5	0.587785	24	0.130526	43	0.072995	62	0.050649
6	0.500000	25	0.125333	44	0.071339	63	0.049846
7	0.433884	26	0.120537	45	0.069756	64	0.049068
8	0.382683	27	0.116093	46	0.068242	65	0.048313
9	0.342020	28	0.111964	47	0.066793	66	0.047582
10	0.309017	29	0.108119	48	0.065403	67	0.046872
11	0.281733	30	0.104528	49	0.064070	68	0.046183
12	0.258819	31	0.101168	50	0.062791	69	0.045515
13	0.239316	32	0.098017	51	0.061561	70	0.044865
14	0.222521	33	0.095056	52	0.060378	71	0.044233
15	0.207912	34	0.092268	53	0.059241	72	0.043619
16	0.195090	35	0.089639	54	0.058145	73	0.043022
17	0.183750	36	0.087156	55	0.057089	74	0.042441
18	0.173648	37	0.084806	56	0.056070	75	0.041876
19	0.164595	38	0.082579	57	0.055088	76	0.041325
20	0.156434	39	0.080467	58	0.054139	77	0.040789
21	0.149042	40	0.078459	59	0.053222	78	0.040266

For circles of other diameters, multiply length given in table by diameter of circle.





**Lengths of Chords for Spacing Off the Circumfer
Diameter Equal to 1 (English or met**

No. of Spaces	Length of Chord	No. of Spaces	Length of Chord	No. of Spaces	Len Ch
3	0.866025	22	0.142315	41	0.07
4	0.707107	23	0.136167	42	0.07
5	0.587785	24	0.130526	43	0.07
6	0.500000	25	0.125333	44	0.07
7	0.433884	26	0.120537	45	0.06
8	0.382683	27	0.116093	46	0.06
9	0.342020	28	0.111964	47	0.06
10	0.309017	29	0.108119	48	0.06
11	0.281733	30	0.104528	49	0.06



This exchanger has 24 bolts.

I measured the chord with a caliper and it came up to 2.023".

Look at the chart and 24 spaces on a 1" circle would be 0.130526.

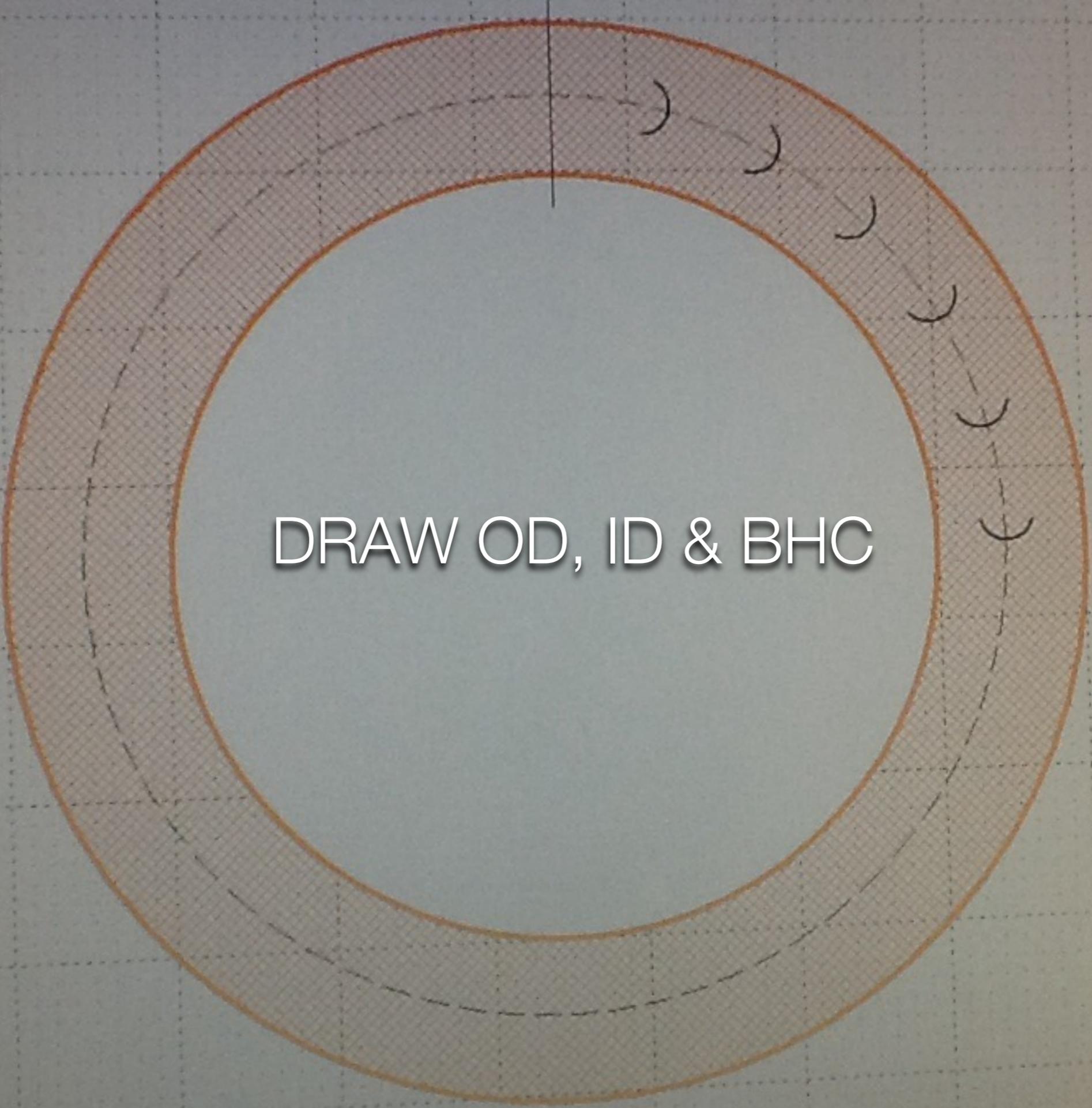
So if we take 2.023 and divide by 0.130526 it equals 15.498828.

So you can order a gasket with 24 equally spaced 5/8" bolt holes on a 15-1/2" Bolt Hole Circle.

SKET EACH 1/16" 1001 FF GASKET W/
17 1/4" OD X 13 1/4" ID
W/ 24 5/8" BHS ON A 15 1/2"
BHC

SKET EACH 1/16" 1001 FF GASKET W/
17 1/4" OD X 13 1/4" ID
W/ 24 5/8" BHS ON A 15 1/2"
BHC W/ A SINGLE 3/8" CENTER
RIB BETWEEN 2 BOLT HOLES

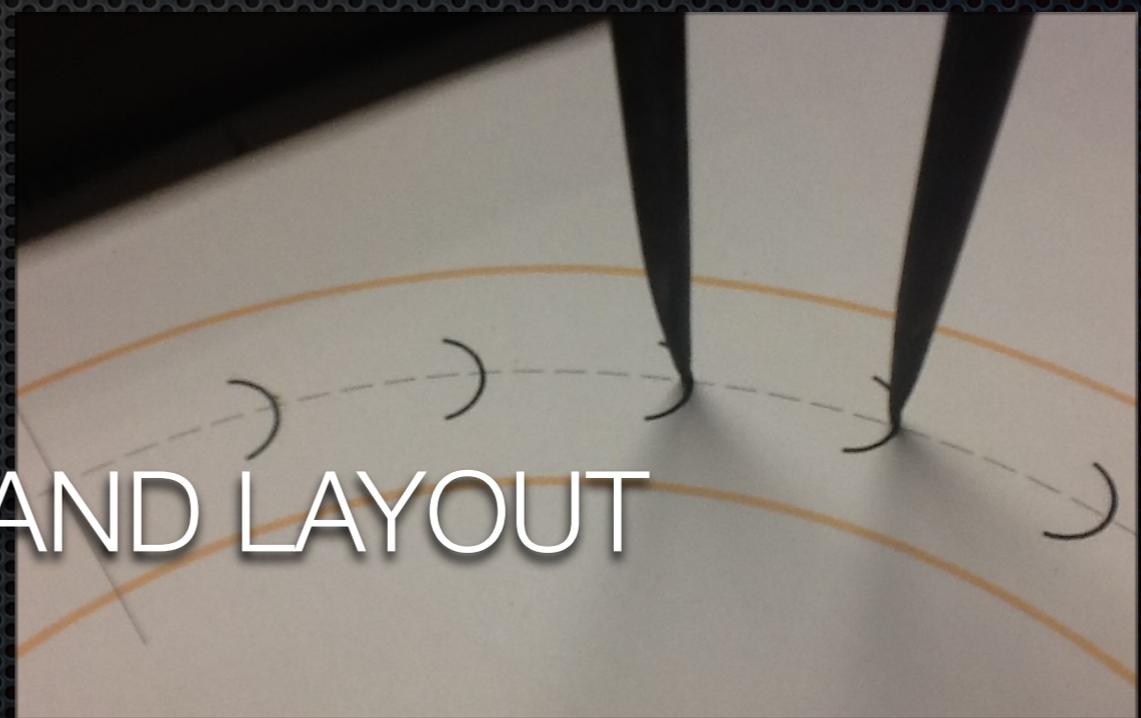
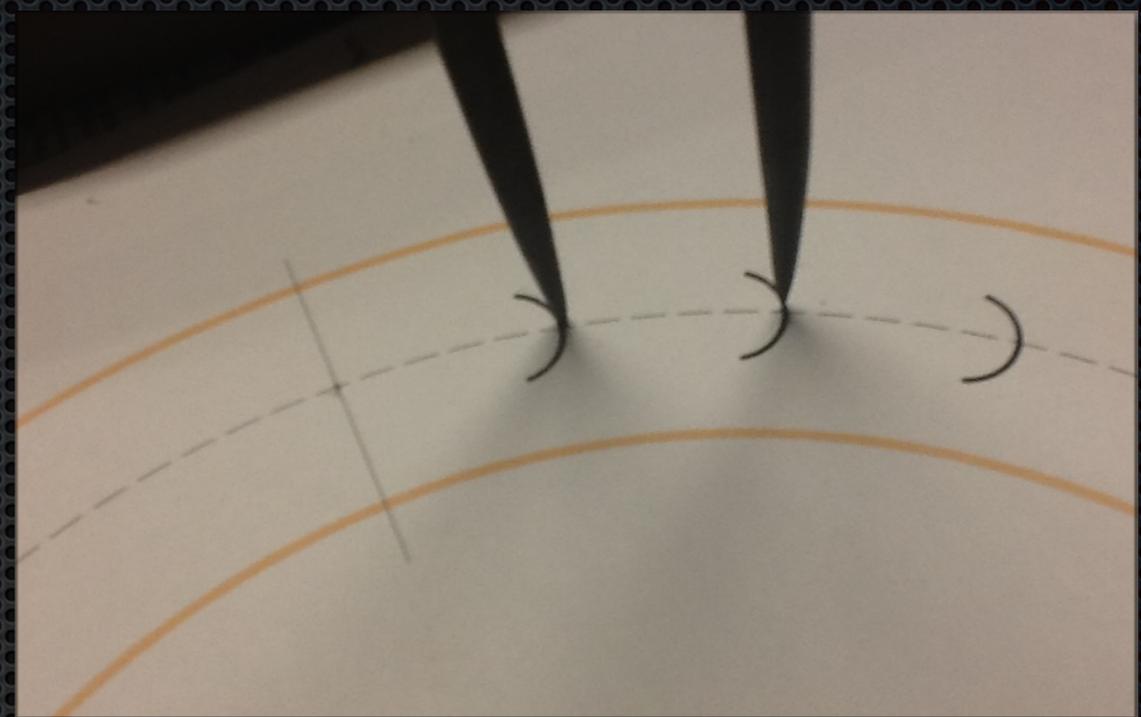
SKET EACH 1/8" CLOTH INSERTED NEO
FF GASKET W/ 17 1/4" OD X



DRAW OD, ID & BHC



SET DIVIDER TO 2.023 INCHES

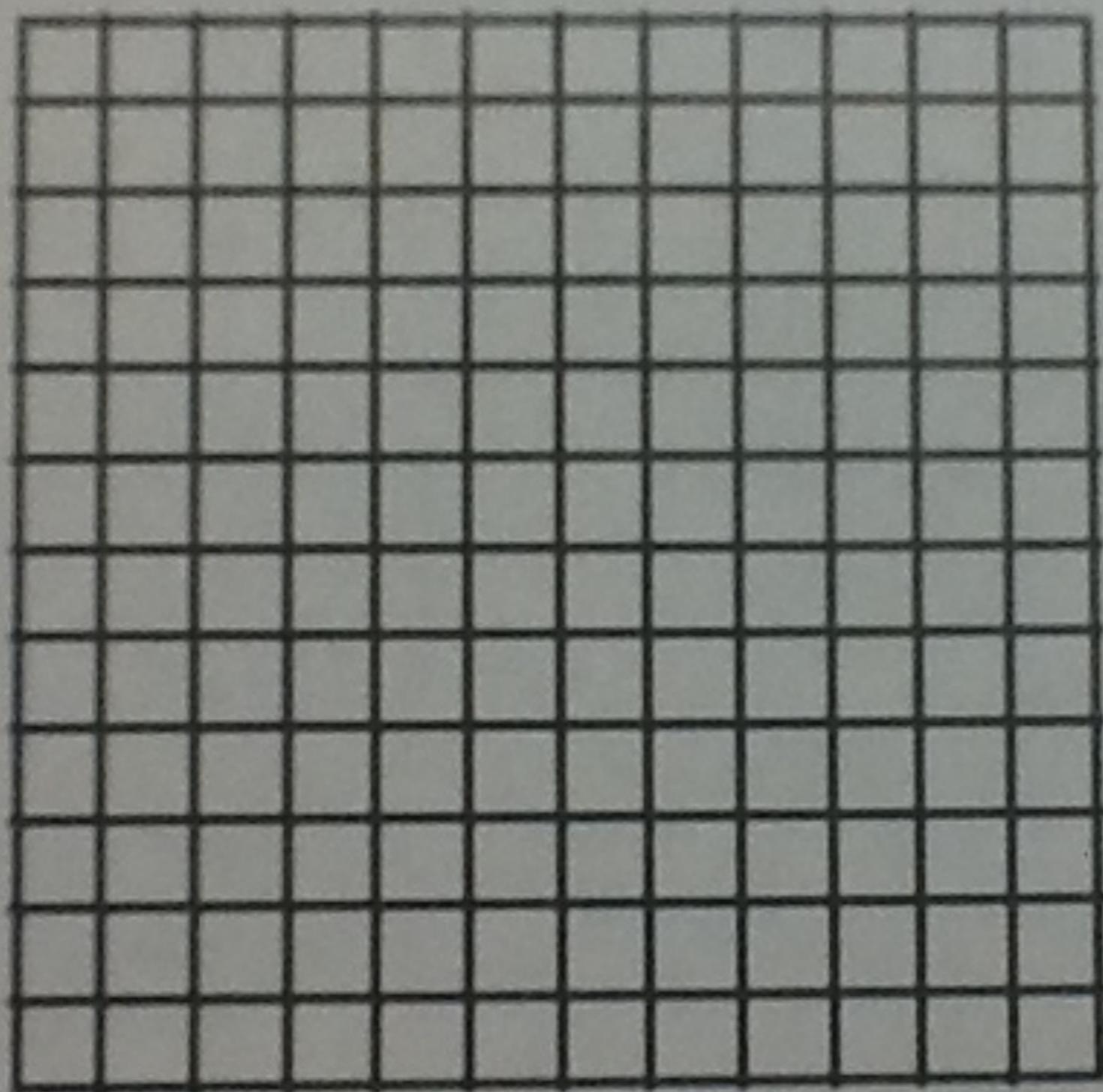


WALK AROUND BHC AND LAYOUT HOLES

SQUARE INCHES

CUBIC INCHES

SQUARE FEET



1 SQUARE FOOT
 $12'' \times 12'' = 144''$



TSM

Thermal Solutions
Manufacturing, Inc.

Model	Applica
3408	INDUS
3412	INDUS
379	INDUS
398	INDUS
399	INDUS
C15	INDUS

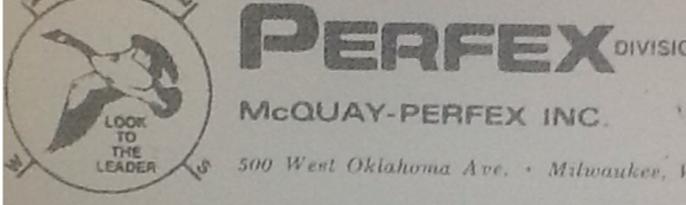
OE Core Size Refere...	Part Number 	Part Type
76 1/8 X 76 1/2 X 4 1/2	<u>437400</u>	CS / BOLT C
76 1/8 X 76 1/2 X 4 1/2	<u>437400-SC</u>	CS / BOLT C
76 1/8 X 76 1/2 X 4 1/2	<u>437404</u>	CS / BOLT C

76-1/8" x 76-1/2"

$76.125 \times 76.5 = 5823.56$

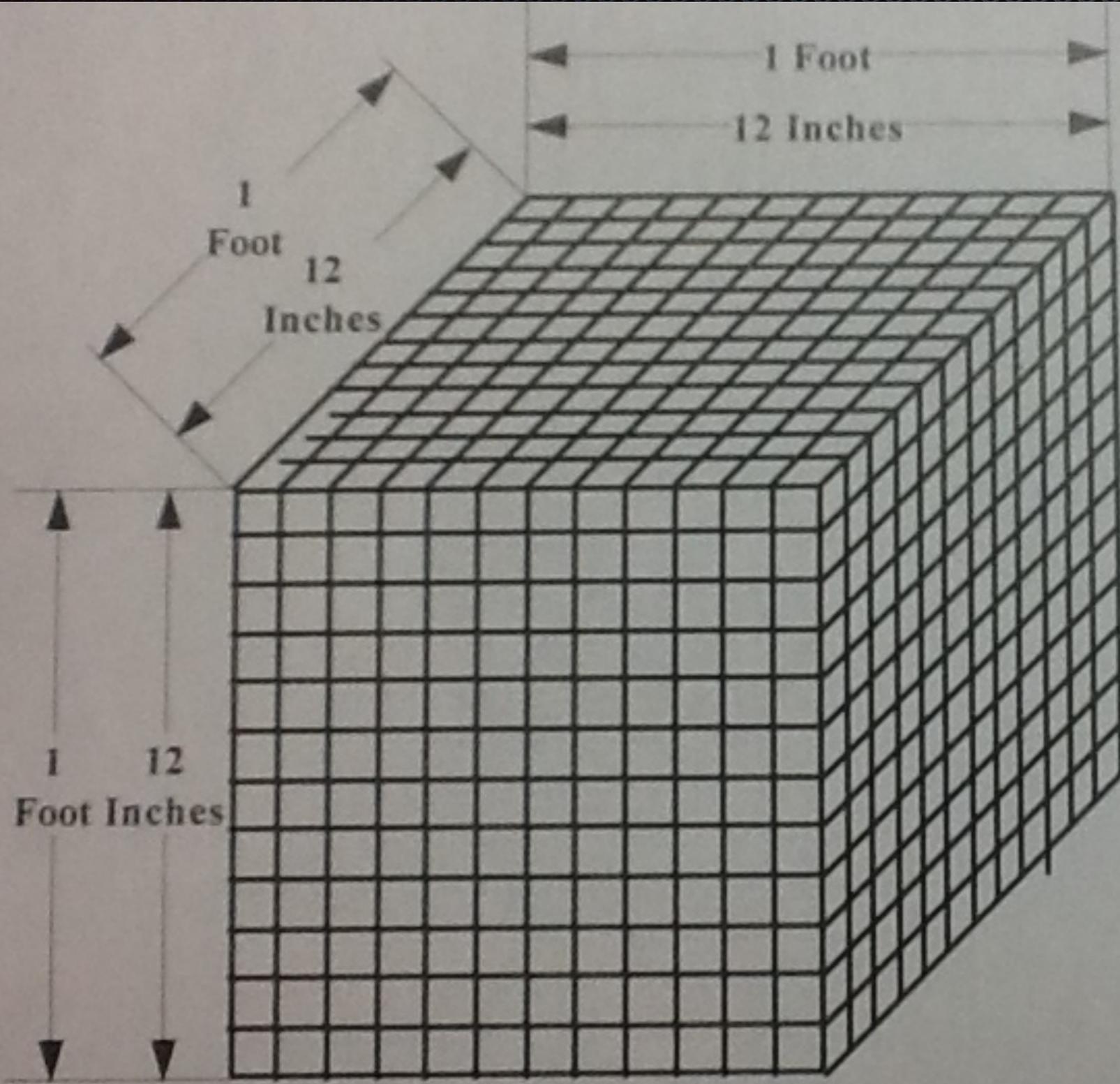
5823.56 divided by 144 = 40.44

That is why a Caterpillar D398 Radiator
Is known to be a 40 Square foot Radiator.
It has 40 sq./ft. of core frontal area.

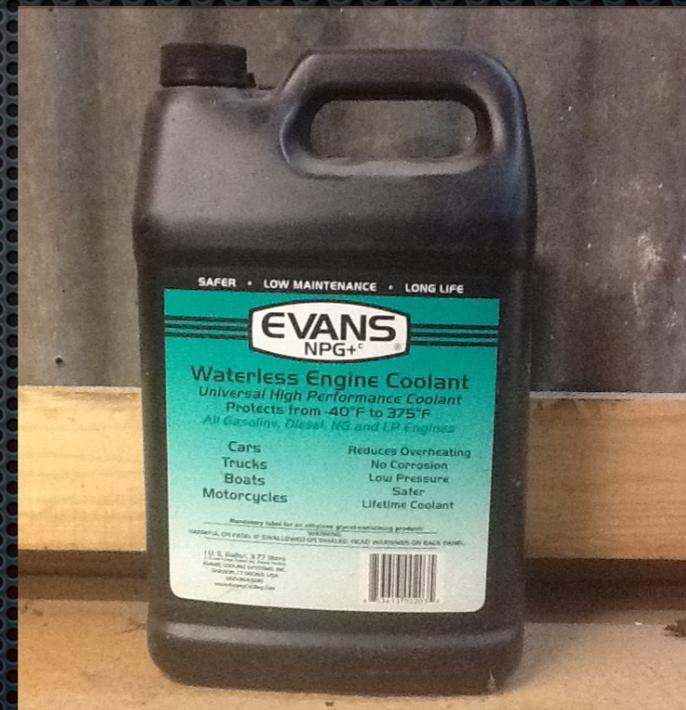
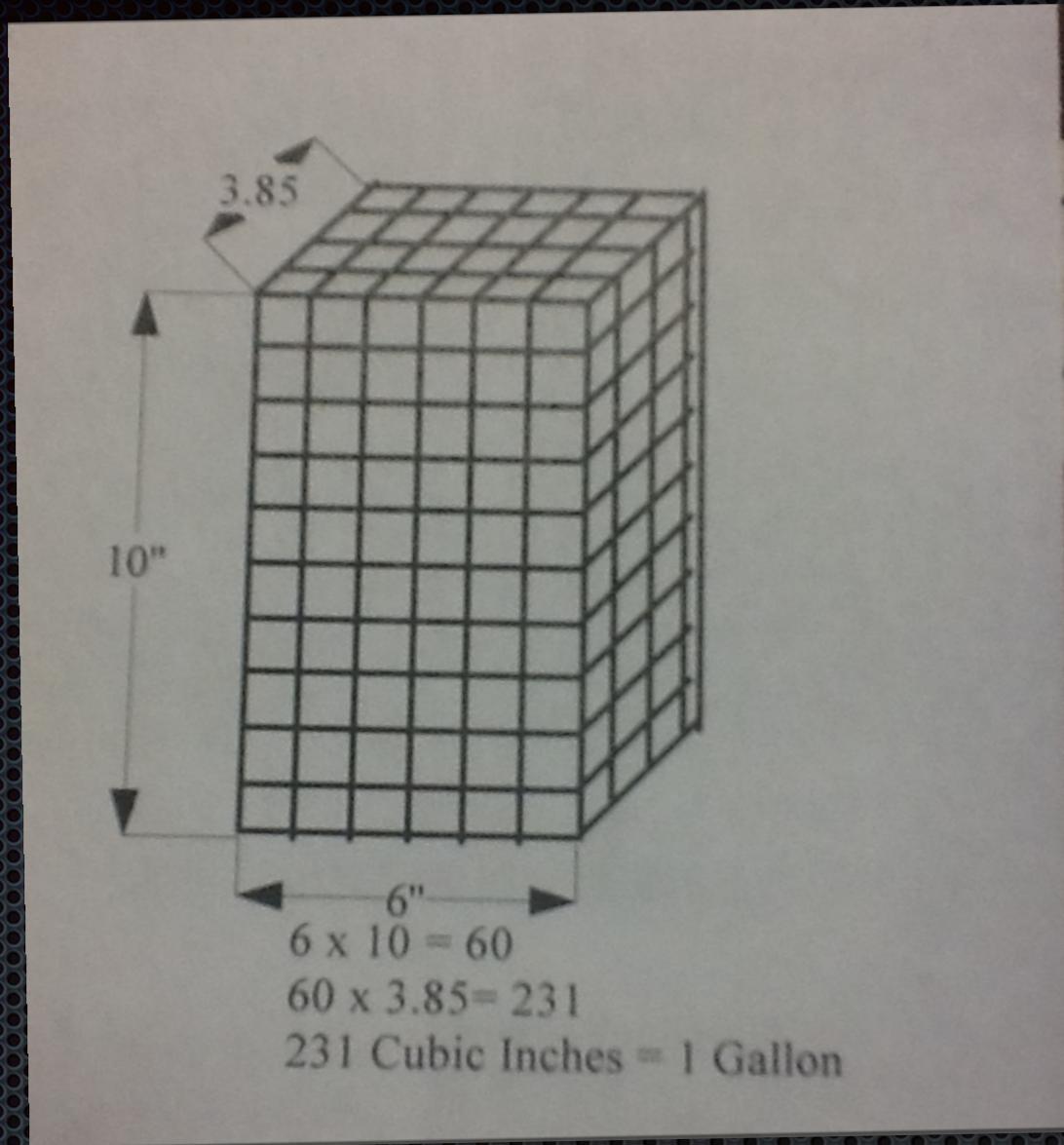


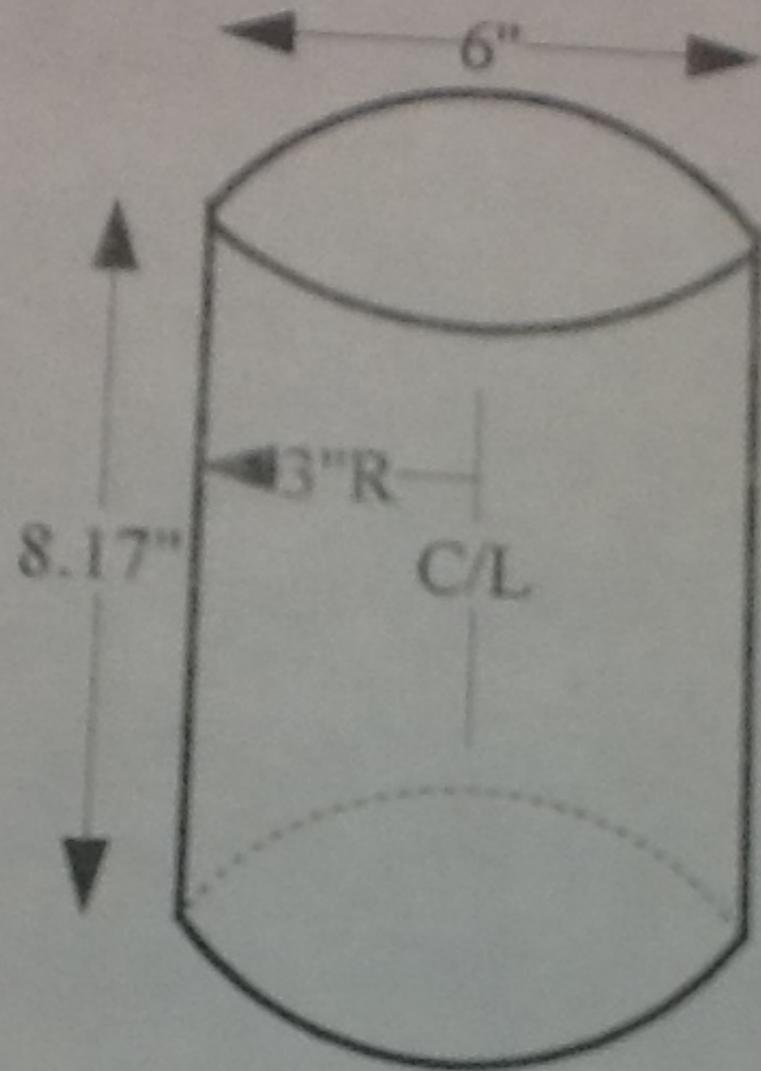
N25	75.12	69.12	17.86
N28	80.12	73.00	19.86
N33	86.86	78.75	19.86
N40	97.36	82.00	19.86
N44	99.36	91.00	19.86

4-50	M-40-VR-3P-50	M-34
372	50/1A-2A15371	25/1
	95.38	
	86.12	



1 CUBIC FOOT
 $12'' \times 12'' = 144''$
 $144'' \times 12'' = 1728 \text{ CuIn}$
 $1738 \text{ CuIn} / 231 = 7.48 \text{ Gallons}$

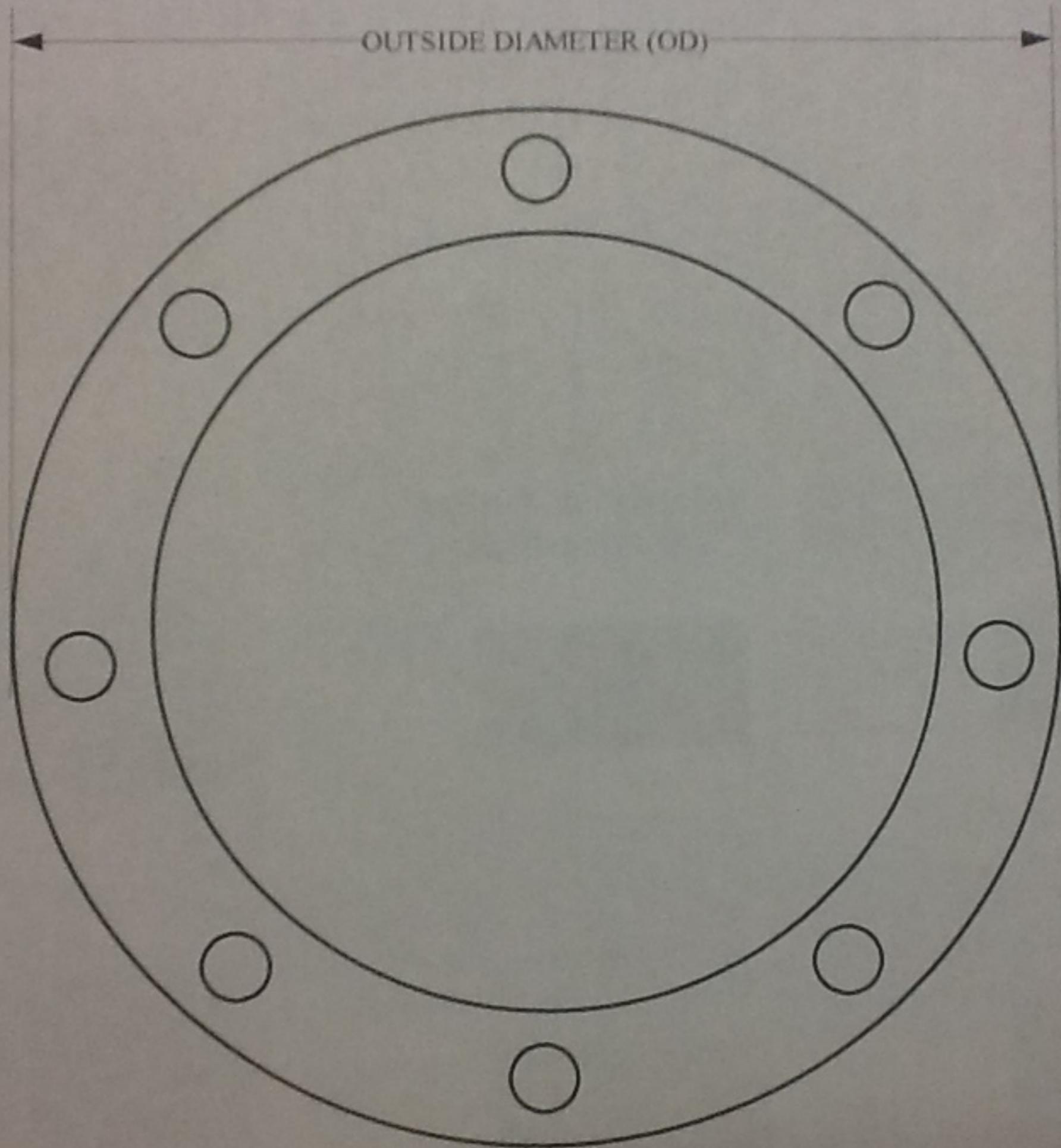


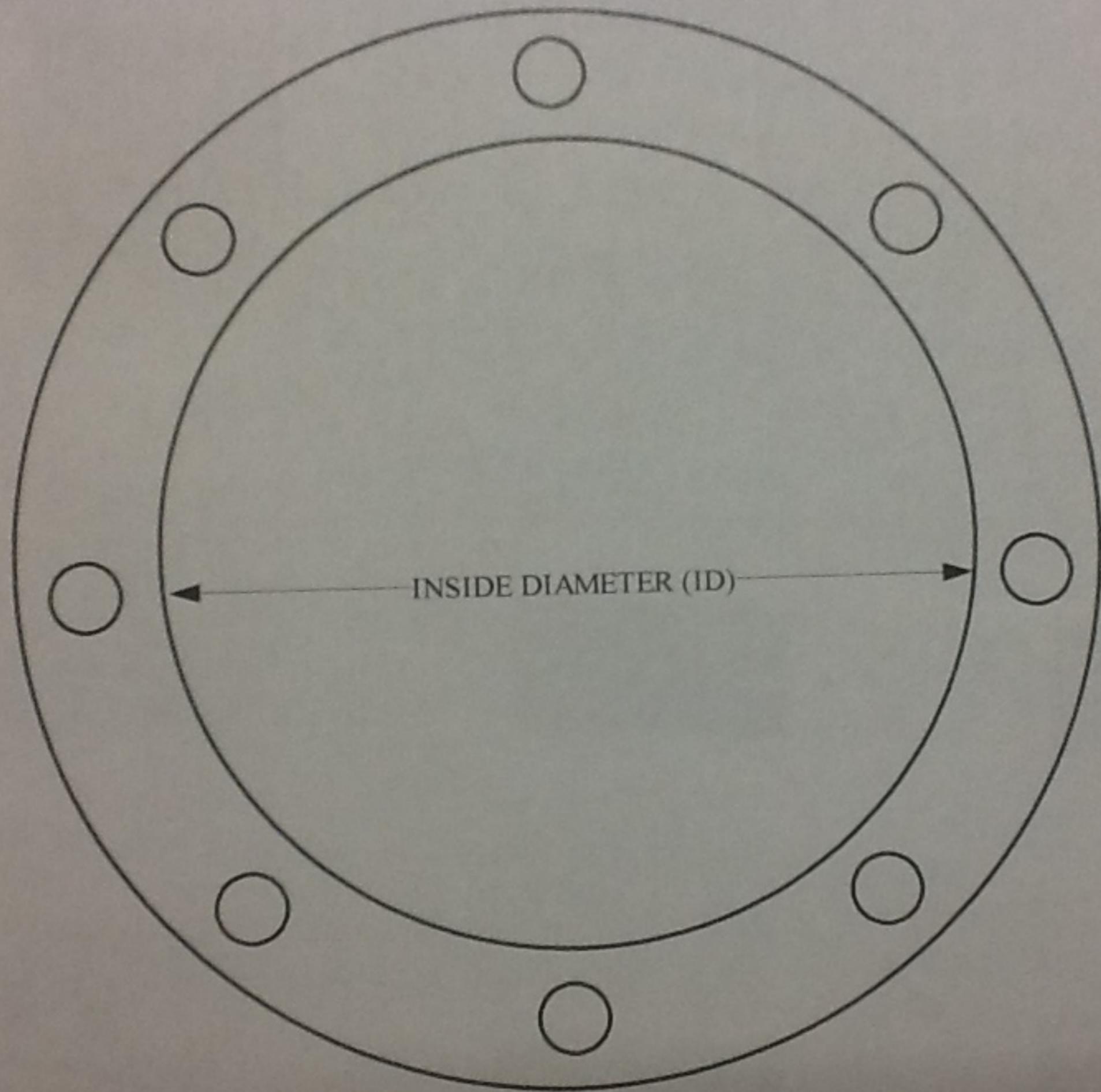


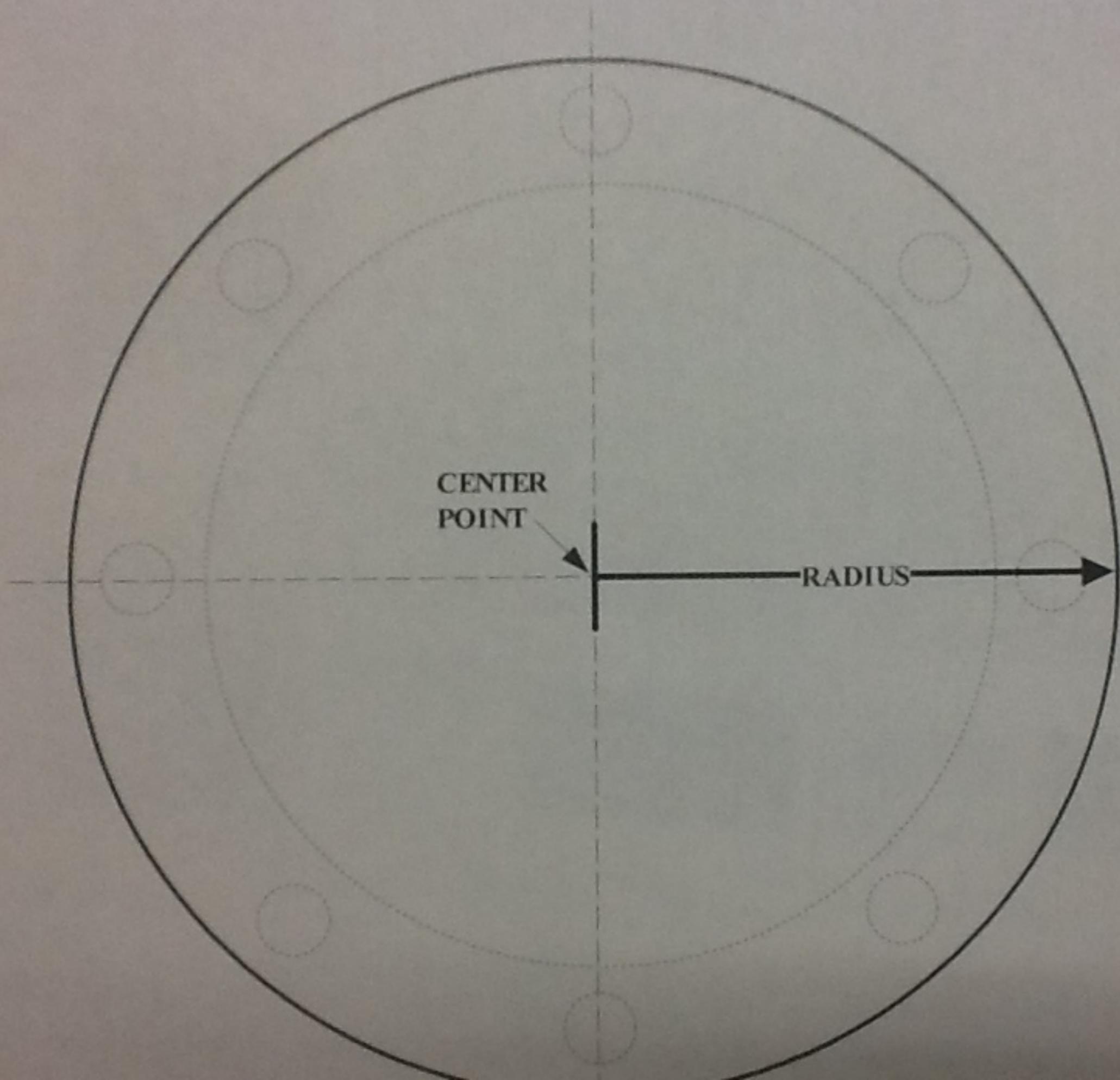
Gallon of Paint
 6" Diameter
 3" Radius
 $3 \times 3 = 9$
 $9 \times 3.1416 = 28.27$
 $28.27 \times 8.17 = 231$

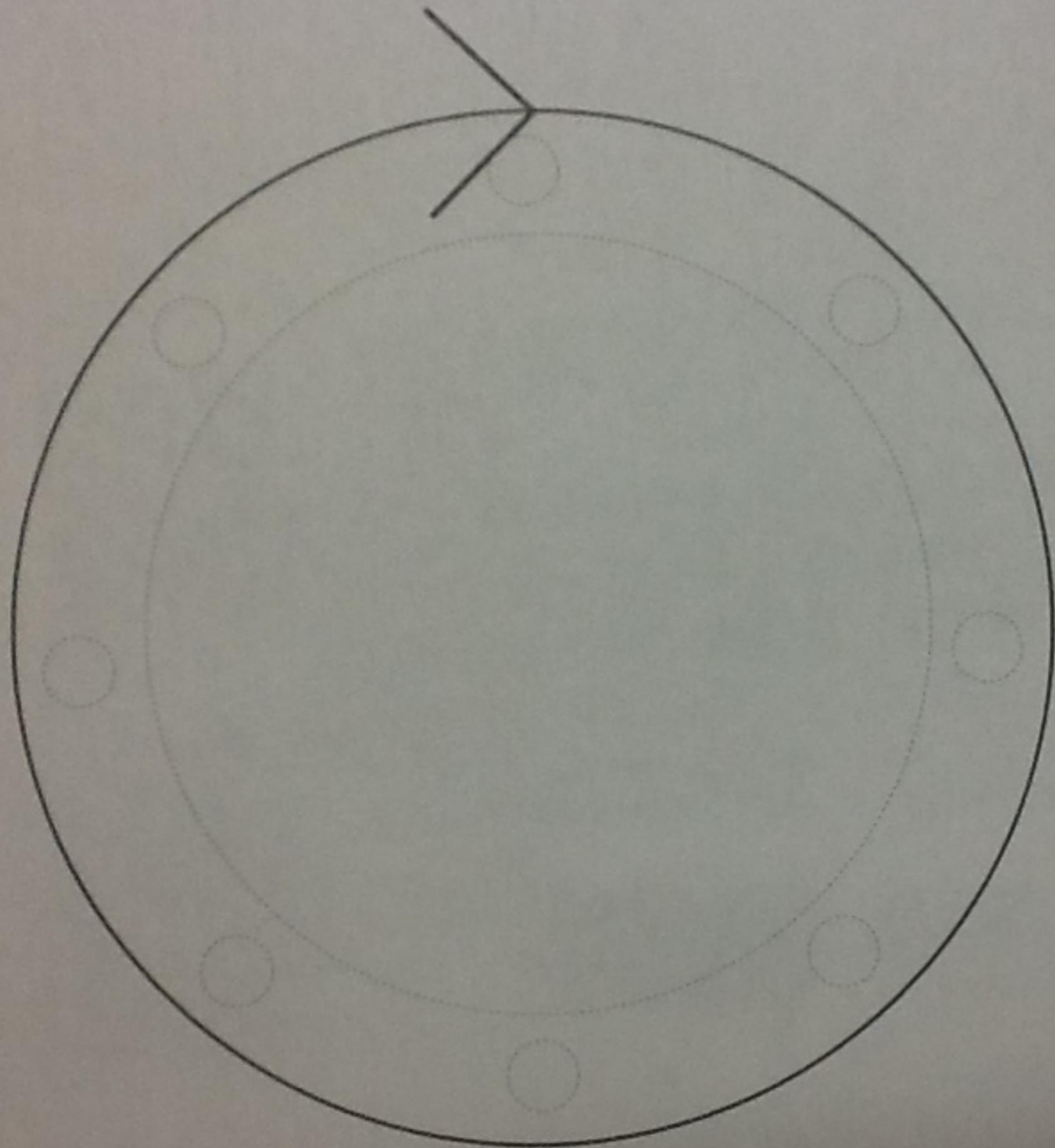


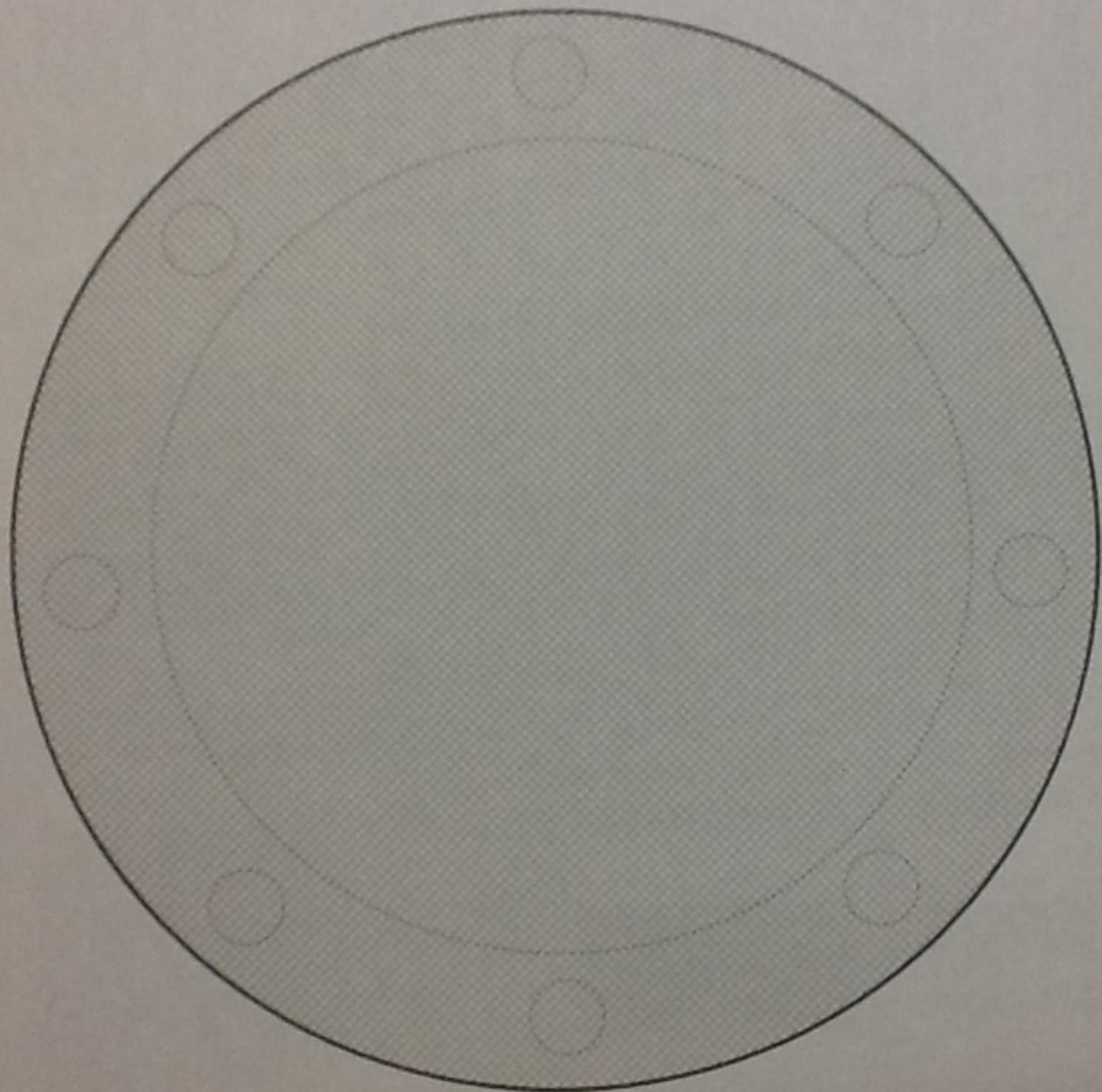
OD, ID,
RADIUS, CIRCUMFERENCE
and AREA











$x!$

$\sqrt{\quad}$

$\sqrt[x]{y}$

log

sin

cos

tan

ln

sinh

cosh

tanh

e^x

Rad

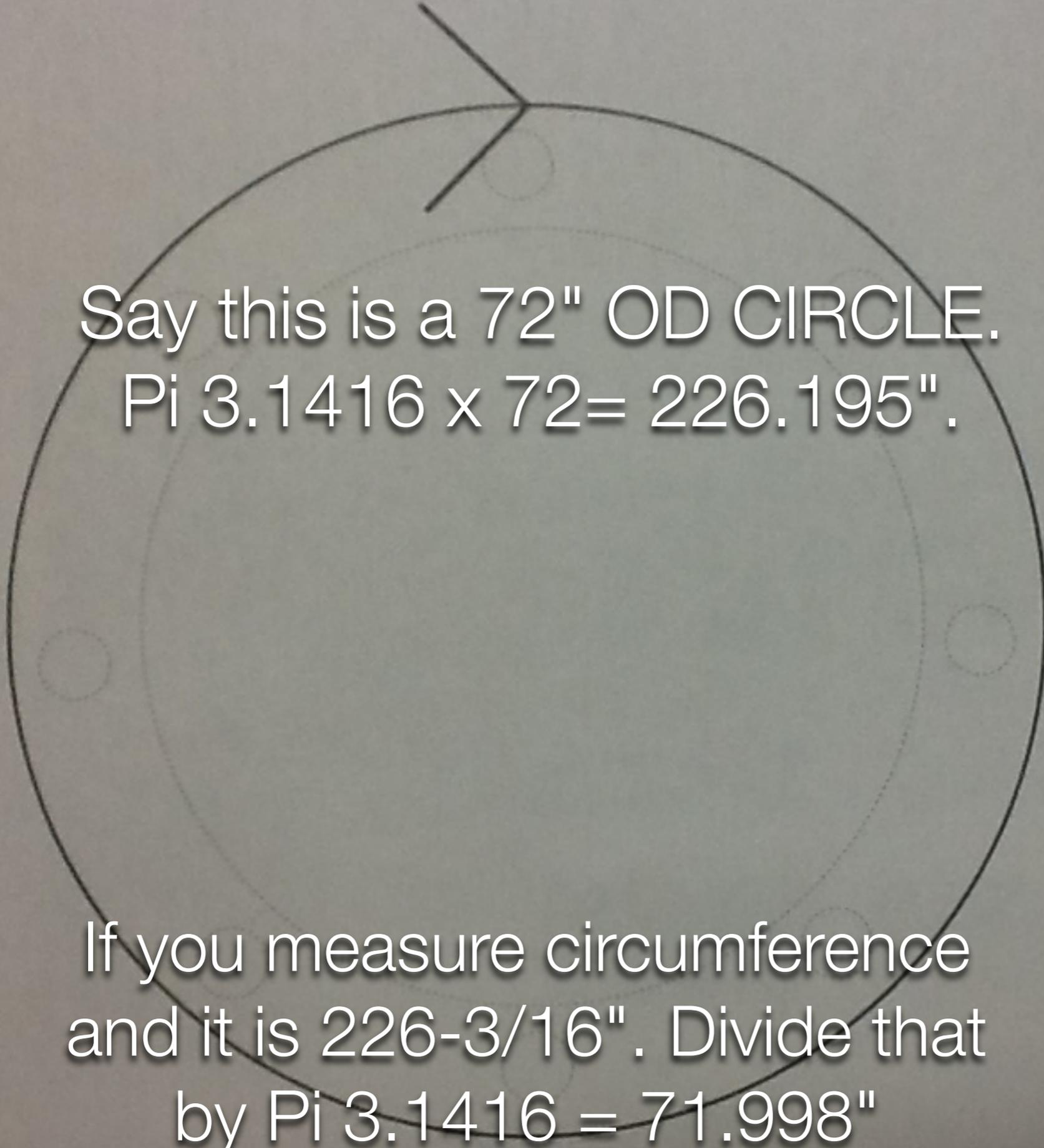
π

EE

Rand

Sound Effects





Say this is a 72" OD CIRCLE.

$$\text{Pi } 3.1416 \times 72 = 226.195''.$$

If you measure circumference
and it is $226\text{-}3/16''$. Divide that
by $\text{Pi } 3.1416 = 71.998''$

If this were a 24 inch circle.
It's radius would be 12 inches.

Pi x R² would be

$$r^2 = 12 \times 12 = 144$$

144 x 3.1416 = 452.39 Square
inches.

Divide 452.39 by 144 and it
Equals 3.14 Square Feet.