

SECTION 11

CUSTOMER SPECIFICATION INDEX

INDUSTRY STANDARDS & PROCEDURES

COMPOSITE CAN & TUBE INSTITUTE (CCTI)

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CAN MANUFACTURERS INSTITUTE (CMI)

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Measuring Loose Metal Ends and Seaming Chucks

COMPOSITE CANS

OBJECTIVE

To provide definitions of dimensions and methods for measuring or verifying these dimensions on loose metal ends and seaming chucks.

MATERIAL AND EQUIPMENT

The following items of material and equipment are required for measuring or verifying the various dimensions in accordance with the procedures below:

- (1) Vernier or dial caliper accurate to 0.001 in. (0.025 mm).
- (2) Outside micrometer accurate to 0.001 in. (0.025 mm).
- (3) Depth micrometer or depth dial micrometer accurate to 0.001 in. (0.025 mm) and mod-

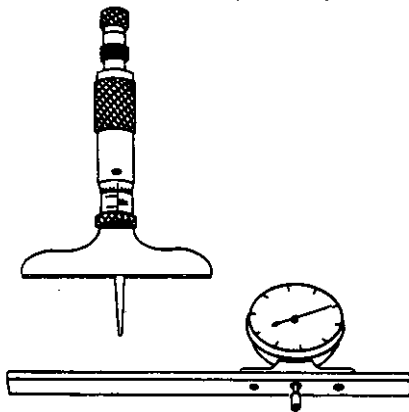


Fig. 1. Depth micrometer modified with tapered depth probe labeled, and depth dial micrometer modified with tapered depth probe and extended shoulder (below).

ified with depth probe tapered and having terminal radius of from 1/128 to 1/64 in. (0.2 to 0.4 mm).¹ Depth dial micrometer further modified with extended shoulder (Fig. 1).

(4) Go and no go pin gage of proper dimensions accurate to commercial tolerances, normally ± 0.0001 in. (0.0025 mm).

(5) Measuring instrument, such as a rule graduated in 1/64 in. (or 0.5 mm) increments, or 2 in. (50.8 mm) U-shaped height gage.

(6) Radius gage.²

(7) Vernier protractor.³

(8) Go and no go chuck fit gage of proper dimensions (Fig. 2) accurate to ± 0.0002 in. (0.005 mm). It is recommended the go and no go segments of the gage be made of corrosion resistant, hardened steel (54-60 Rockwell C), and have a surface finish of approximately 8 micro-inches. The general overall construction should be as light as practical.

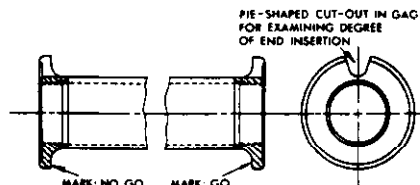


Fig. 2. Go and no go chuck fit gage.

(9) Two hardened steel measuring pins 0.1252 ± 0.0001 in. (3.180 ± 0.0025 mm) in diameter and approximately 2 in. (or 50 mm) long.

¹ As Contact Point No. 8, available from The L. S. Starrett Co., Athol, Mass. 01331, or equivalent.

² As Starrett Fillet or Radius Gage No. 279 or equivalent.

³ As Starrett Universal Bevel Protractor No. 359 or equivalent.

PROCEDURE

Ends:

(1) Outside curl diameter (Dimension A in Fig. 3) is measured with vernier or dial caliper or outside micrometer. Three measurements, at 120 deg intervals are taken.

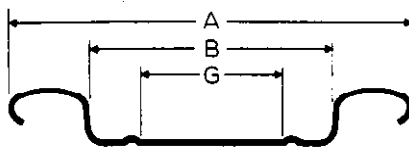


Fig. 3. Type of can end profile.

(2) Countersink diameter at reference height (Dimension B in Fig. 3) is verified with a go and no go chuck fit gage of proper dimensions.

NOTE: At the present time there exists no acceptable gage for accurately verifying the go and no go chuck fit of deep drawn ends.

It should be noted that chuck fit gage limits are based on seaming chuck profiles and diameters.

When checking an end, it should be tested on both the "no go" and the "go" sides of the gage.

When checking an end with the "no go" side of the gage, insert the side of the gage that is 180 deg from the pie-shaped cut-out fully into the end. While retaining this side of the gage in the end, apply weight of gage to seat the entire lip of the gage as fully as possible in the end. This can be performed by holding the end in the left hand, and the gage in the right hand with the pie-shaped cut-out facing upward. Examine the degree of insertion into the end by checking the fit at the pie-shaped cut-out. The gage should not be fully seated (Fig. 4).



Fig. 4. No go segment of go and no go chuck fit gage partially seated in can end.

When checking an end on the "go" side of the gage, follow the same procedure as outlined above. The gage should seat all the way without hand

pressure (Fig. 5). After seating the gage, hold the gage in a vertical position with the gage above the end. The gage should not support the weight of the end.



Fig. 5. Go segment of go and no go chuck fit gage fully seated in can end.

Acceptable ends must meet the following three gage conditions:

- (a) The "no go" side of the gage will not fully enter the end.
- (b) The "go" side of the gage will fully enter the end.
- (c) The "go" side of the gage will not pick up the end.

(3) Countersink radius (Dimension C in Fig. 6) is a fabricating tool dimension. If desired, this dimension may be measured with a radius gage or contour projector.

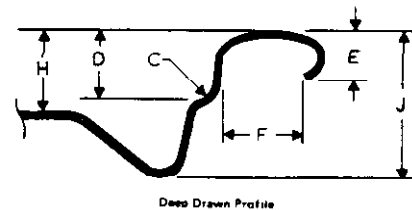
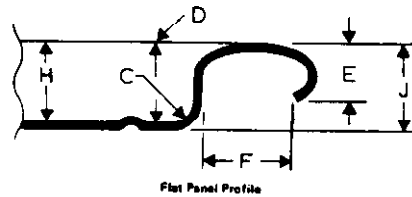


Fig. 6. Detail of can end curl.

(4) Countersink depth (Dimension D in Fig. 6) is measured at maximum depth near countersink radius with depth micrometer or depth dial micro-

meter. It is recommended that countersink depth measurements be taken on an end stacked on two or more identical ends to minimize wall distortion due to weight of gage. Three measurements at 120 deg intervals are taken. This dimension is not applicable to certain types of deep drawn ends.

(5) Curl height (Dimension E in Fig. 6) is measured with vernier or dial caliper or outside micrometer. Three measurements at 120 deg intervals are taken.

(6) Curl opening (Dimension F in Fig. 6) is verified with a go and no go pin gage around the entire curl opening.

(7) Center panel diameter (Dimension G in Fig. 3) is measured with vernier or dial caliper.

(8) Center panel depth (Dimension H in Fig. 6) is measured with a depth micrometer approximately 1/8 in. (3 mm) from the edge of the center panel. Three measurements at 120 deg intervals are taken.

(9) Overall height equals maximum draw depth plus metal thickness (Dimension J in Fig. 6) and is measured with vernier or dial caliper. Three measurements at 120 deg intervals are taken.

(10) Number of ends per 2 in. (50.8 mm) stack is determined by counting the maximum number of ends which when nested will fit into the 2 in. (50.8 mm) dimension indicated in Fig. 7. This 2 in. (50.8 mm) dimension may be measured with any suitable measuring instrument, such as a rule, graduated in 1/16 in. (or 1 mm) increments or finer, or with a 2 in. (50.8 mm) U-shaped height gage. Three measurements at 120 deg intervals are taken.

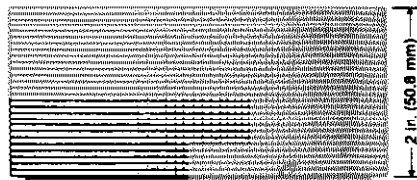


Fig. 7. Dimension to be measured when determining number of ends per 2 in. (50.8 mm) stack.

(11) Shuffle is the maximum lateral movement from the vertical of a 2 in. (50.8 mm) stack of ends. This maximum lateral movement may be measured with a rule graduated in 1/64 in. (or 0.5 mm) increments.

Seaming Chucks:

(1) Lip height (Dimension M in Fig. 8) is measured with vernier or dial caliper or outside micrometer.

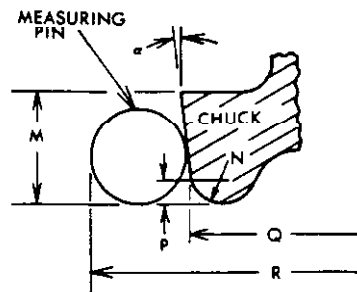


Fig. 8. Detail of seaming chuck and measuring pin.

(2) Lip radius (Dimension N in Fig. 8) is measured with radius gage.

(3) Wall angle (Dimension α in Fig. 8) is measured with angle gage.

(4) Reference height (Dimension P in Fig. 8) is the vertical distance from the bottom of the chuck lip to the point of tangency between the lip radius and the chuck wall. It is calculated by multiplying the lip radius by the sine of the wall angle and subtracting this result from the lip radius of the seaming chuck.

$$P = N - N \sin \alpha$$

(5) Diameter at reference height (Dimension Q in Fig. 8) is the diameter of the seaming chuck at the point of tangency between lip radius and chuck wall. It is calculated from the measurement over pins (Dimension R in Fig. 8). To calculate diameter at reference height in inches, the following formula applies:

$$Q = R - 2 \left[0.1252 + \tan \alpha \left(\frac{0.1252}{2} \right) P \right]$$

Measurement over pins is measured by placing one 0.1252 in. (3.180 mm) diameter pin on each side of seaming chuck and measuring overall distance over the pins using a vernier or dial caliper or outside micrometer.

REPORT OF RESULTS

The following shall be reported:

- (1) Identification of specimens.
- (2) Individual measurements:
 - (a) to the nearest 0.001 in. (0.025 mm) for end procedures (1), (4), (5), (7) and (9), and seaming chuck procedures (1) and (5);
 - (b) to the nearest 1/64 in. (or 0.5 mm) for end

procedure (11);

(c) as whole numbers for end procedure (10), and

(d) as degrees for end procedure (3) and seaming chuck procedures (2) and (3).

(3) End procedures (2) and (6) are verifications rather than measurements.

(4) Seaming chuck procedure (4) is a calculation rather than a measurement.

Measuring End Seams COMPOSITE CANS

OBJECTIVE

To provide methods for measuring various composite can end seam dimensions. Procedures are applicable to all types of composite can end seams.

MATERIAL AND EQUIPMENT

- (1) Can seam micrometer (Fig. 1).¹

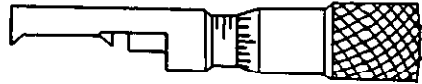


Fig. 1. Can seam micrometer.

- (2) Depth micrometer or depth dial micrometer accurate to 0.001 in. (0.02 mm) and modified with depth probe tapered and having terminal radius of

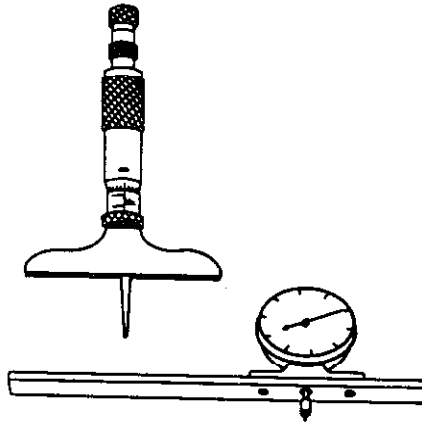


Fig. 2. Depth micrometer modified with tapered depth probe (above), and depth dial micrometer modified with tapered depth probe and extended shoulder (below).

¹ As Can Seam Micrometer No. 208D, English, or No. 208MD, metric, available from The L. S. Starrett Co., Athol, Mass. 01331. Instrument equipped with patches which is not standard from Starrett but must be specific-

from 1/128 to 1/64 in. (0.2 to 0.4 mm).² Depth dial micrometer further modified with extended shoulder (Fig. 2).

- (3) Outside micrometer, or vernier or dial caliper.

PROCEDURE

When measuring the following dimensions, three readings are taken each at 120 deg intervals.

- (1) First operation seam thickness (Dimension A in Fig. 3) is made by operation of the first operation roll only. Measurement of this dimension is made with the can seam micrometer fully seated and with anvil parallel to countersink wall (Fig. 4).

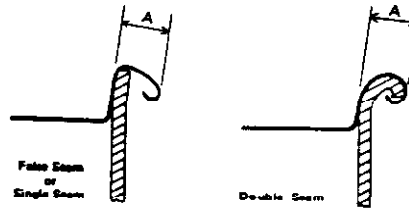


Fig. 3. Detail, first operation seam thickness.

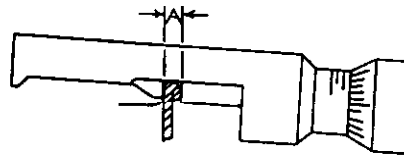


Fig. 4. Measuring with can seam micrometer fully seated and with anvil parallel to countersink wall.

ly ordered, is preferred. Calibration of this instrument is best accomplished with gage rods of approximately 1/10 in. (2.5 mm) diameter.

² As Starrett Contact Point No. 8 or equivalent.

CCTI Standard Testing Procedure C-106

(2) Second operation seam thickness (Dimension A in Fig. 6) is measured with the can seam micrometer fully seated and with anvil parallel to countersink wall (Fig. 4).

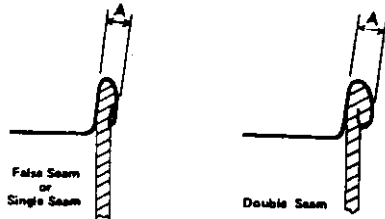


Fig. 5. Detail, second operation seam thickness.

(3) Seam length (Dimension B in Fig. 6) is measured with the can seam micrometer from the top of the seam to the point where the tucked in edge of the lid meets the body wall. This dimension also is referred to as seam width or seam height.

(4) Seamed countersink depth (Dimension C in Fig. 6) is measured with the depth micrometer or the depth dial micrometer from the top of the

seam to the bottom of the countersink radius. This dimension is not applicable to certain types of deep drawn ends.

(5) Over-the-seam diameter (Dimension D in Fig. 6) is measured with the outside micrometer, or vernier or dial caliper across the outside diameter of the seam at its widest point.

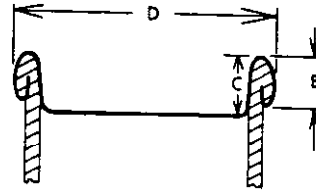


Fig. 6. Second operation seam dimensions.

REPORT OF RESULTS

The following shall be reported:

- (1) Identification of specimens.
- (2) Individual measurements to the nearest 0.001 in. (0.02 mm) for each specimen.

**VOLUNTARY CMI DOUBLE SEAM MEASUREMENT
STANDARDS FOR TWO AND THREE PIECE CANS**

These recommendations cover only round steel processed food containers and apply equally to both can manufacturers' and packers' double seams.

These recommendations cover only those dimensions of a finished double seam which relate directly to seal integrity. A hermetic seal, however, cannot be judged solely on measurement characteristics; inspection for visual abnormalities is equally important.

The following lists the definitions of terms used to qualify these recommendations:

<i>Set Up Aim</i>	This is the ideal dimension when setting up or adjusting.
<i>Operating Limit</i>	(Sometimes called adjustment limit). Normal commercial equipment in reasonable repair and adjustment, combined with cans and ends manufactured to normal industry standards, will have most measurements within the operating limits. When outside the operating limits, an adjustment is required.
<i>Hold and Investigate</i>	When measurements are observed to be outside these limits, the product should be evaluated carefully by a qualified authority to determine if the hermetic quality is adversely affected.

**VOLUNTARY CMI DOUBLE SEAM MEASUREMENT
STANDARDS FOR TWO AND THREE-PIECE
SANITARY CANS
English Dimensions**

Item	Nominal Diameter	Set Up Aim	Operating Limit	Hold for Investigation***	
				Steel Ends	Alum. Ends
Body Hook Length* (Figure 1)	202-211	.075±.002	.075±.008	n/a	n/a
	300-303	.077±.002	.077±.008	n/a	n/a
	307-401	.080±.002	.080±.008	n/a	n/a
	404-603	.082±.002	.082±.010	n/a	n/a
Cover Hook Length** (Figure 1)	202-211	--	.065 Min.	n/a	n/a
	300-401	--	.070 Min.	n/a	n/a
	404-603	--	.075 Min.	n/a	n/a
Optical Overlap (Figure 1)	202-211	--	.035 Min.	.030 Min.	.030 Min.
	300-307	--	.040 Min.	.035 Min.	+
	401-404	--	.045 Min.	.035 Min.	.035 Min.
	502-603	--	.050 Min.	.035 Min.	+
Tightness ++ (Figure 2)	202-401	80%-100%	70%-100%	60% or less	70% or less
	404	90%-100%	80%-100%	60% or less	70% or less
	502	90%-100%	80%-100%	70% or less	+
	603	90%-100%	90%-100%	70% or less	+

*Based on the highest and lowest reading obtained on a can sample.

**Based on the lowest reading obtained on a can sample.

***Adopted by the NFPA/CMI Container Integrity Task Force and submitted to FDA. It was the opinion of the NFPA/CMI Container Integrity Task Force that overlap and tightness are the critical parameters which affect the integrity of the double seam of metal food containers.

+HFI Limits were not developed for these aluminum end diameters.

++Excessive tightness must be avoided.

**VOLUNTARY CMI DOUBLE SEAM MEASUREMENT
STANDARDS FOR TWO AND THREE-PIECE
SANITARY CANS
Metric Dimensions**

Item	Nominal Diameter	Set Up Aim	Operating Limit	Hold for Investigation***	
				Steel Ends	Alum. Ends
Body	52-65	1.90±0.05	1.90±0.20	n/a	n/a
Hook	73-78	1.96±0.05	1.96±0.20	n/a	n/a
Length* (Figure 1)	83-99	2.03±.05	2.03±0.20	n/a	n/a
	105-153	2.08±0.05	2.08±0.25	n/a	n/a
Cover	52-65	--	1.65 Min.	n/a	n/a
Hook	73-99	--	1.78 Min.	n/a	n/a
Length** (Figure 1)	105-153	--	1.90 Min.	n/a	n/a
Optical	52-65	--	.89 Min.	.76 Min.	.76 Min.
Overlap (Figure 1)	73-83	--	1.02 Min.	.89 Min.	+
	99-105	--	1.14 Min.	.89 Min.	.89 Min.
	127-153	--	1.27 Min.	.89 Min.	+
Tightness++ (Figure 2)	52-99	80-100%	70-100%	60% or less	70% or less
	105	90-100%	80-100%	60% or less	70% or less
	127	90-100%	80-100%	70% or less	+
	153	90-100%	90-100%	70% or less	+

*Based on the highest and lowest readings obtained on a can sample.

**Based on the lowest reading obtained on a can sample.

***Adopted by the NFPA/CMI Container Integrity Task Force and submitted to FDA. It was the opinion of the NFPA/CMI Container Integrity Task Force that overlap and tightness are the critical parameters which affect the integrity of the double seam of metal food containers.

+HFI Limits were not developed for these aluminum end diameters.

++Excessive tightness must be avoided.

INTRODUCTION

Can Dimensions

Two and Three-Piece Sanitary Cans

TWO-PIECE CANS

CMI member can manufacturers were surveyed for two-piece food cans commonly in commercial production for inclusion in the *CMI Voluntary Can Standards Manual*. The CMI Can Standards Committee has developed the following criteria for listing values for can height and body-end fit diameter.

a. **Finished Factory Can Height** -- actual finished factory can height = nominal can height

b. **Body Flange Width and Flange Die Radius**

Diameter	Flange Width	Flanging Radius
208-211	.096	.040-.070
300-307	.099	.040-.080
401-502	.103	.040-.070

*301-see page C4

c. **Can Body End Fit Diameter** -- the can body end fit diameter is established by the formula:

$$\text{Can Body End Fit Diameter} = \text{ECD} + 2P + C$$

ECD = Average End Countersink Diameter at Reference Height -- as specified in another section of this manual.

P = End Plate Thickness

C = End-to-Can Clearance Factor = .008

Typical P for each nominal diameter is:

<i>Nominal Diameter</i>	<i>Plate Thickness</i>
202	.0077
207.5	.0083
208	.0083
211	.0083
300	.0083
301	.0083
303	.0083
307	.0094
401	.0094
404	.0094
502	.0099

THREE-PIECE CANS

The following rules have been established for determining can dimensions of three-piece can sizes not shown on the CMI list.

a. **Nominal Size**

To promote industry interchangeability, it is recommended that only the nominal diameters listed (202, 207.5, 208, 211, 300, 303, 307, 401, 404, 502, 603) be adopted when designing new can sizes.

b. **Finished Factory Can Height**

Actual Finished Factory Can Height = Nominal Can Height.
The actual dimensions appear under item A on pages C5, C6, and C7. In some instances, these dimensions were established by committee compromise and agreement. Consequently, some dimensions shown may not fit the above rule.

c. **Body Flange Width**

Diameter	Flange Width
202	.093
207.5 thru 303	.096
307	.100
401	.102
404-502	.105
603	.115

Body flange width is based on mechanical measurements using gauges on pages D-8 and D-9. Other gauges may yield slightly different results (up to a 10% difference).

d. **Body Plug Diameter (to nearest .001 inch)**

Nominal Diameter	Plug Diameter
202	2.059
207.5	2.355
208	2.386
211	2.571
300	2.870
303	3.050
307	3.281
401	3.895
404	4.139
502	4.977
603	6.038

e. **Flange Die Radius**

Diameter	Flange Die Radius
202	.078 - .080
207.5 thru 603	.078 - .090

INTRODUCTION

The Metric Conversion Act of 1975 was enacted "to declare a national policy of coordinating the increasing use of the metric system in the United States, and to establish a U.S. Metric Board to coordinate the voluntary conversion to the metric system."

As written, the Act provided the private sector with maximum freedom for preparation and implementation of conversion from the English system of measurement to the metric system. In this regard, the CMI Metric Working Group developed the *Practice Guide* to provide metric technology for the can manufacturing industry.

The following pages include metric definitions, conversion tables, standards and general information peculiar to the can manufacturing industry. Most of the information parallels accepted international practice. At the time of enactment, there was a strong movement toward metrication. However, the United States can manufacturers as well as most other industries have continued to operate in the English system.

**CAN MANUFACTURING INDUSTRY
METRIC PRACTICE GUIDE
CAN INDUSTRY METRIC UNITS**

CAN SIZE

Use the nominal body plug diameter in mm and nominal factory finished can height (as shipped by the can manufacturer) in mm.

For example: 300 x 407 becomes 73 x 113

From the CMI *Recommended Voluntary Industry Can Standards Manual*, a 300 diameter can has a plug diameter of 2.870 in. Converting this dimension to the nearest mm in tenths, it equals 72.9 mm. Rounding off to the nearest mm, the diameter is 73.

Similarly, the finished factory can height for 407 is 4.438 inches which equals 112.7 mm or 113.

The conversion sizes for the common diameters are:

202 = 52	307 = 83
207.5 = 60	401 = 99
208 = 61	404 = 105
211 = 65	502 = 127
300 = 73	608 = 153
303 = 78	

These metric diameters are the same as used in Europe and are documented in ISO standard 1361.

TINPLATE

For Industry Metric Standard see ASTM Standard A623M-87.

Area- Use SITA (100 square meters) to express tinplate area rather than base boxes.

One base box = 0.20232 SITA
One SITA = 4.9426 base boxes

Thickness- Use thickness in millimeters in place of inches. See Appendix I for nominal industry standards.

For example: 0.25 mm = .0098 in.

For sanitary (open top) cans, this will be the height with one end seamed on and the other end flanged. For friction closing (paint-type cans), nozzle or screw cap closing (solvent-type cans) or aerosol cans, all of which are sold with both ends seamed on, use the height over both double seams.

Tin Coating Weight- Use grams per square meter instead of pounds per base box.
See Appendix II for nominal tin coating standards.

For example: 1 lb/bb = 22.4213 g/m²

The nominal coating on each side of the sheet is given separately as the actual weight of tin on that side.

For example: 0.25 lb = 2.8/2.8

(0.25 tinplate has 22.4213/4 = 5.60 g/m² total
tin on both sides which equals 2.8 g/m² on each side)

Package- Use 100 sheets in place of the 112 sheets formerly used

Temper- Classification is unchanged.

ENAMEL COATING WEIGHTS

Use grams per square meter to specify the coating weight. (Many Europeans are using a 50 cm² base reference area in making this determination.) When converting from the inch/pound system to the metric system, use the following conversions:

1 milligram/4 sq. in. = 0.3875368 g/m²

1 milligram/1 sq. in. = 1.55 g/m²

NOTE: Gauges can be purchased with faces that read in grams per square meter.

ENDS PER TWO INCHES

Use number of ends per 50.8 millimeters instead of ends per two inches.

For example: 25 ends/2 in. = 25 ends/50.8 mm

For the following dimensions, use millimeters (mm):

End or can linear measurements

Double seam dimensions-

Cover hook

Body hook

Width

Thickness

Countersink

Overlap

If the dimension is currently specified to 3 place accuracy, use 2 place accuracy in metric (e.g., 4.065 in. = 103.25 mm). If 4 place accuracy is currently specified, use 3 places for metric.

APPENDIX I
TINPLATE THICKNESS

<u>Thickness*-mm</u>	<u>Thickness-Inches</u>
.14	.0055
.15	.0059
.16	.0063
.17	.0067
.18	.0071
.19	.0075
.20	.0079
.21	.0083
.22	.0087
.23	.0091
.24	.0094
.25	.0098
.26	.0102
.27	.0106
.28	.0110
.29	.0114
.30	.0118
.31	.0122
.32	.0126

*Industry Standard see ASTM Standard 623M.

APPENDIX II
TIN COATING WEIGHT

<u>Metric Tin Coating Weight</u> <u>Grams/Meter²</u> <u>(g/m²)*</u>	<u>Conventional Equivalent</u> <u>Pounds/BB</u>
1.1/1.1	10
2.2/2.2	20
2.8/2.8	25
3.9/3.9	35
5.6/5.6	50
6.7/6.7	60
8.4/8.4	75
11.2/11.2	100
5.6/2.8	50/25
8.4/2.8	75/25
11.2/2.8	100/25
11.2/5.6	100/50
15.2/2.8	135/25
15.2/5.6	135/50

*Industry Standard see ASTM Standard 623M.

RECOMMENDED DOUBLE SEAM DIMENSIONAL GUIDELINES
(See Gauges Section)

The following guidelines represent commercial ranges of double seam dimensions in general use throughout the industry.

1. **CONTAINERS**

<u>Body</u> Steel	<u>Ends</u> Steel	<u>Commercial Ranges</u>
Seam Thickness		.038" - .070"
Seam Length (Width or Height)		.100" - .135"
Countersink Depth		.110" - .145"

2. **CONTAINERS**

<u>Body</u> Fibre	<u>Ends</u> Aluminum or Steel	
Seam Thickness		.050" - .082"
Seam Length (Width or Height)		.095" - .125"
Countersink Depth		.115" - .130"

3. **CONTAINERS**

<u>Body</u> Aluminum or Steel	<u>Ends</u> Aluminum	
Seam Thickness		.050" - .068"
Seam Length (Width or Height)		.105" - .130"
Countersink Depth		.110" - .135"

GAUGES SECTION

The following gauges are in general use throughout the can manufacturing industry and are recommended for use in determining seam measurements.

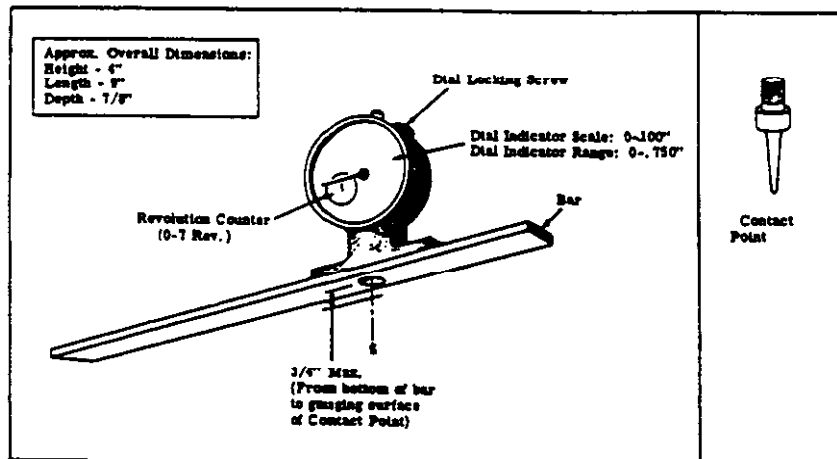
COUNTERSINK DEPTH GAUGE

Purpose

This gauge is used to determine the countersink depth on double seamed containers.

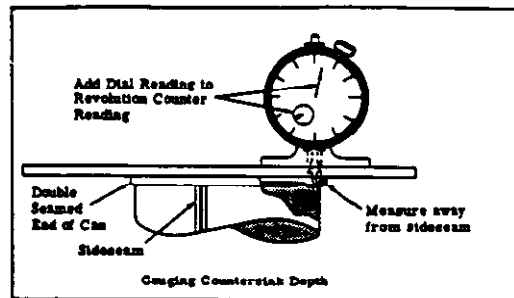
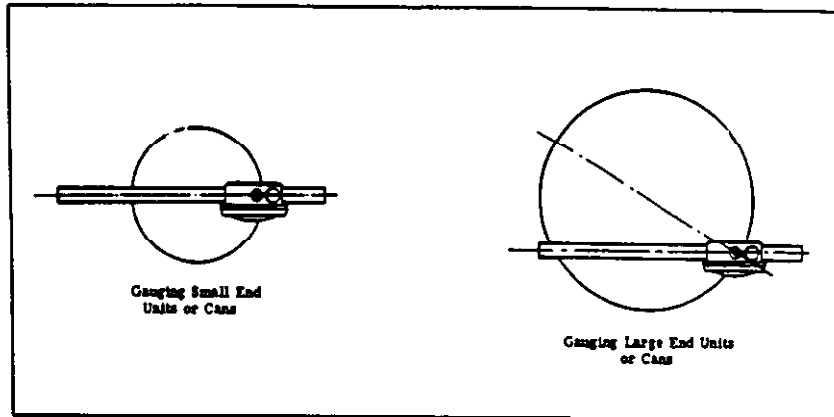
Description

This is a dial indicator type gauge having a maximum range of 3/4 inch. The basic gauge and the contact point are shown below.



See following page on proper method of gauging.

COUNTERSINK DEPTH GAUGE (CONTINUED)



END SEAM MICROMETER

Purpose

This gauge is used to determine the seam thickness and seam length (width or height) of double seams. The range on this micrometer gauge is 0 - 3/8 inches.

