

**BALANCE WEIGHT AND RIM FLANGE DESIGN SPECIFICATIONS, TEST PROCEDURES, AND
PERFORMANCE RECOMMENDATIONS**

Foreword—This Document has not changed other than to put it into the new SAE Technical Standards Board Format.

1. **Scope**—This SAE Recommended Practice is intended to serve as a guide for standardization of features, dimensions, and configurations of balance weights and rim flanges for aluminum and steel wheels intended for use on passenger cars, light trucks, and multipurpose vehicles to assure good insertion and retention of the balance weight on the rim flange. This document also provides test procedures and minimum performance requirements for testing balance weight retention. Alternate materials and geometries can be addressed in the future.

2. **References**

2.1 **Applicable Publications**—The following publications form a part of this specification to the extent specified herein.

2.1.1 **TIRE & RIM ASSOCIATION PUBLICATIONS**—Available from The Tire & Rim Association, Inc., 175 Montrose West Avenue, Suite 150, Copley, OH 44321.

Tire & Rim Association Yearbook

3. **Definitions**

3.1 **Balance Weight Assembly**—An assembly of the weight and the clip which is intended for mounting on the rim flange to balance the tire/wheel assembly about its axis of rotation and thus minimize vibrations due to the rotation of the tire/wheel assembly.

3.1.1 **WEIGHT**—Metal (usually lead) of a specified mass with contours to conform to the surface of the rim flange.

3.1.2 **CLIP**—Specially formed metal affixed to the weight to mount the balance weight on the rim flange.

3.1.3 **SPUR**—An optional part of a clip protruding from its surface interfacing with the rim flange.

3.1.4 **BALANCE WEIGHT COATING**—Noncorrosive material coating (polyester, nylon, etc.) to prevent corrosion.

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- 3.1.5 BALANCE WEIGHT KEY DIMENSIONS—Dimensions which are essential for fitting the balance weight on the rim flange.
- 3.1.6 BALANCE WEIGHT SIZE—The balance weight size is determined by the magnitude of the balance weight mass and is expressed in g (oz).
- 3.1.7 BALANCE WEIGHT RETENTION FORCE—A static force required to remove the balance weight from the rim flange as set forth in Section 7.
- 3.1.8 BALANCE WEIGHT RETENTION—An ability of the balance weight to maintain its secure position on the rim flange in various service conditions on the road as well as in the laboratory.
- 3.1.9 INTERFERENCE—The measure of balance weight press fit computed as the difference between the flange thickness and the weight gap.
- 3.1.10 CLIP SPRING RATE—The change of clamping force per unit change of deflection.
- 3.1.11 For further definitions and descriptions of nomenclature of balance weights Figure 1.
- 3.1.12 RIM FLANGE—That part of the rim where the balance weight is mounted.
- 3.1.12.1 *Rim Flange Key Dimensions*—Dimensions which are essential for fitting the balance weight on the rim flange.
- 3.1.12.2 For further definitions and descriptions of nomenclature of rim flange features, Figure 2 for aluminum wheels and Figure 3 for steel wheels.
4. **Balance Weight Assembly Types**—Balance weight types are identified and marked by letter codes (Table 1). Four different types of balance weights have been evaluated and recommended for use in the industry: P, C, T, and MC (Figure 4). Alternate balance weight types, for example AW, currently in use are not included.

TABLE 1—TYPICAL APPLICATION CHART BALANCE WEIGHT SELECTION

	Steel Type	Alum. Wheel	Alum. Wheel	Flange Lip Thickness mm (in)	Flange Offset mm (in)	Rim Contour
P	X			2.67—3.81 (0.105—0.150)	10.5 ± 1.2 (0.41 ± 0.05)	J, JB, JJ
C	X			2.03—2.67 (0.080—0.105)	10.5 ± 1.2 (0.41 ± 0.05)	J, JB, JJ
T	X			3.43—4.83 (0.135—0.190)	10.5 ± 1.2 (0.41 ± 0.05)	J, JB, JJ
Rolled Steel Type						
MC	X	X		4.57—5.21 (0.180—0.205)	10.5 ± 1.2 (0.41 ± 0.05)	J, JB, JJ
Aluminum Per Design Guide						

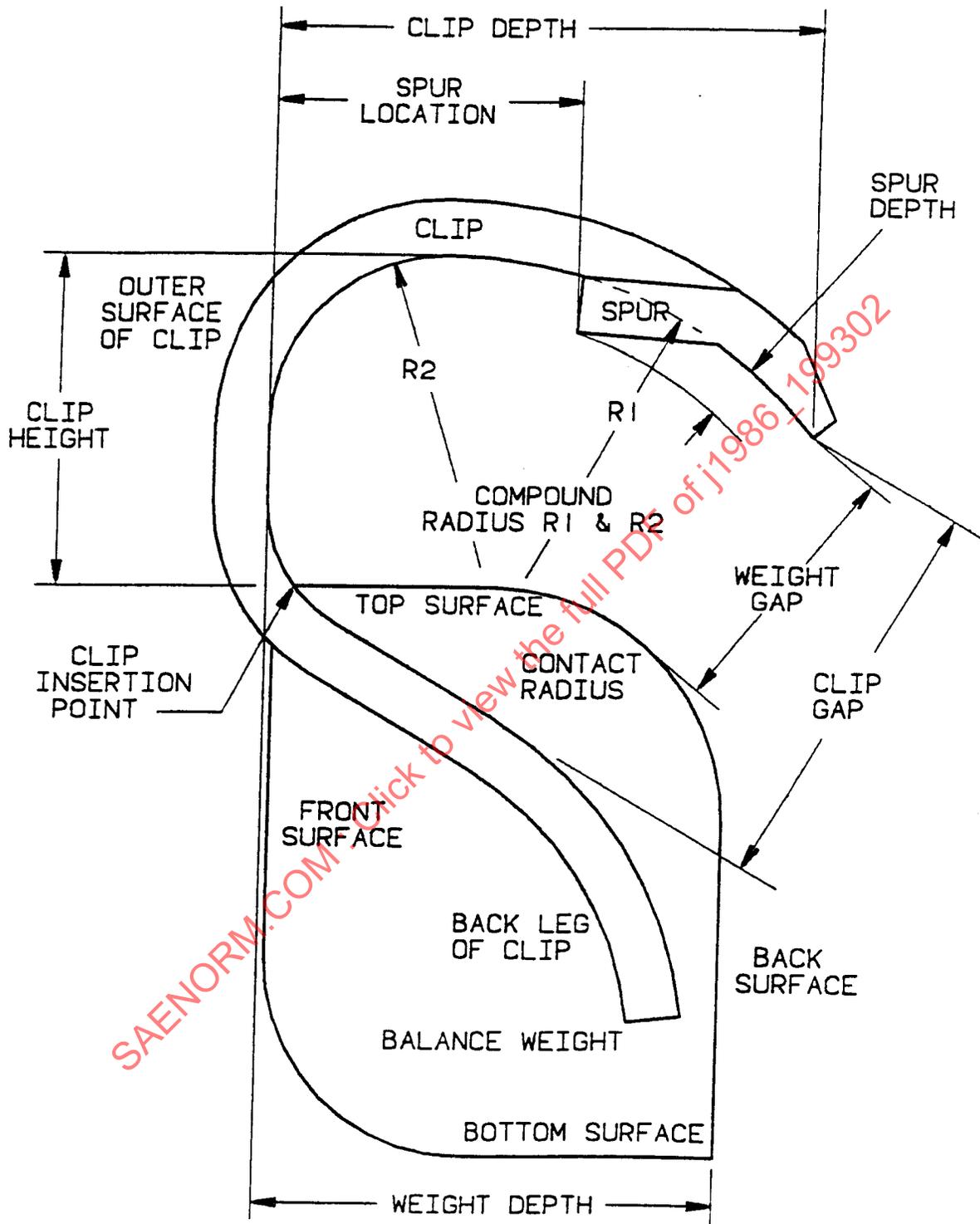
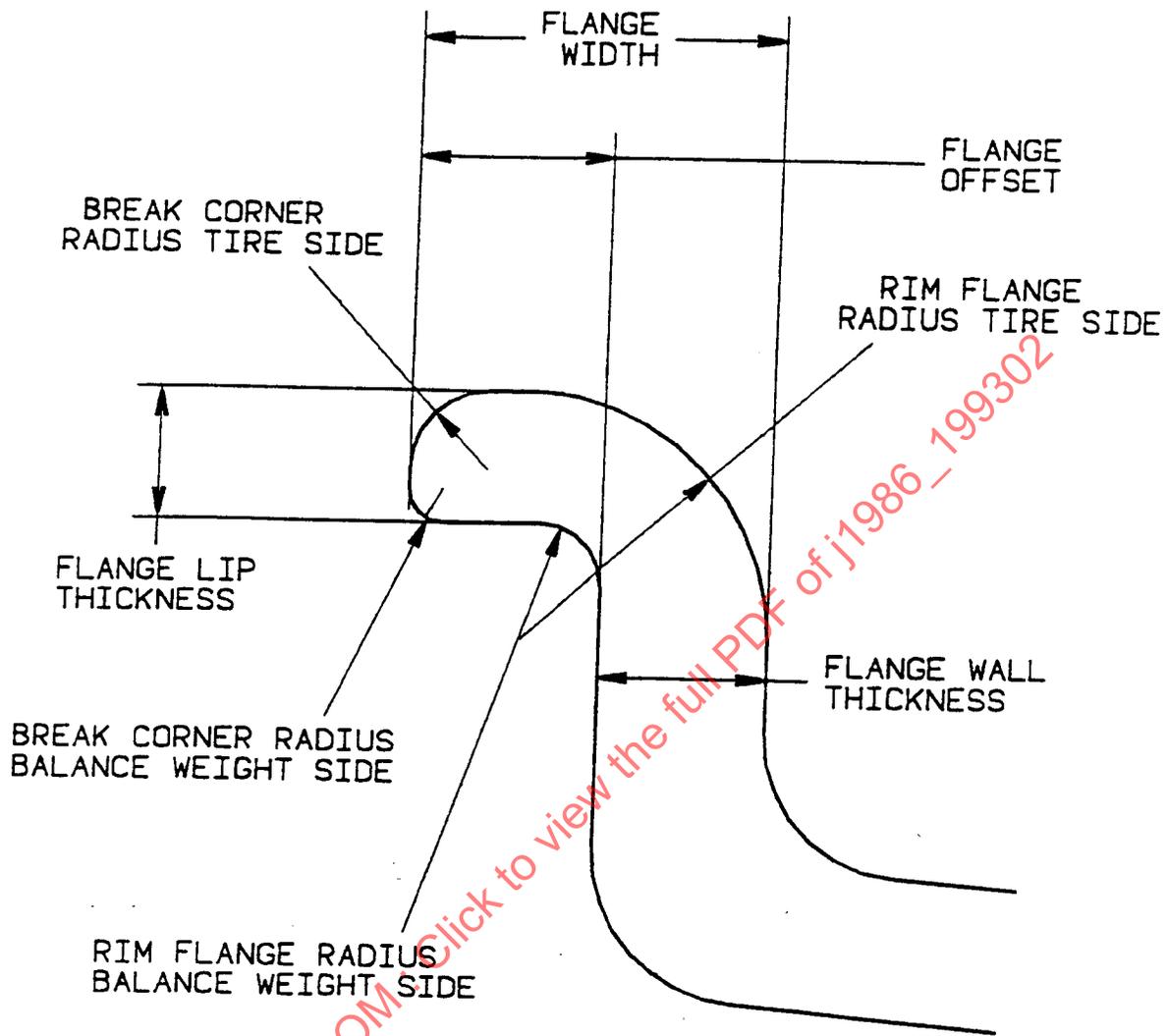


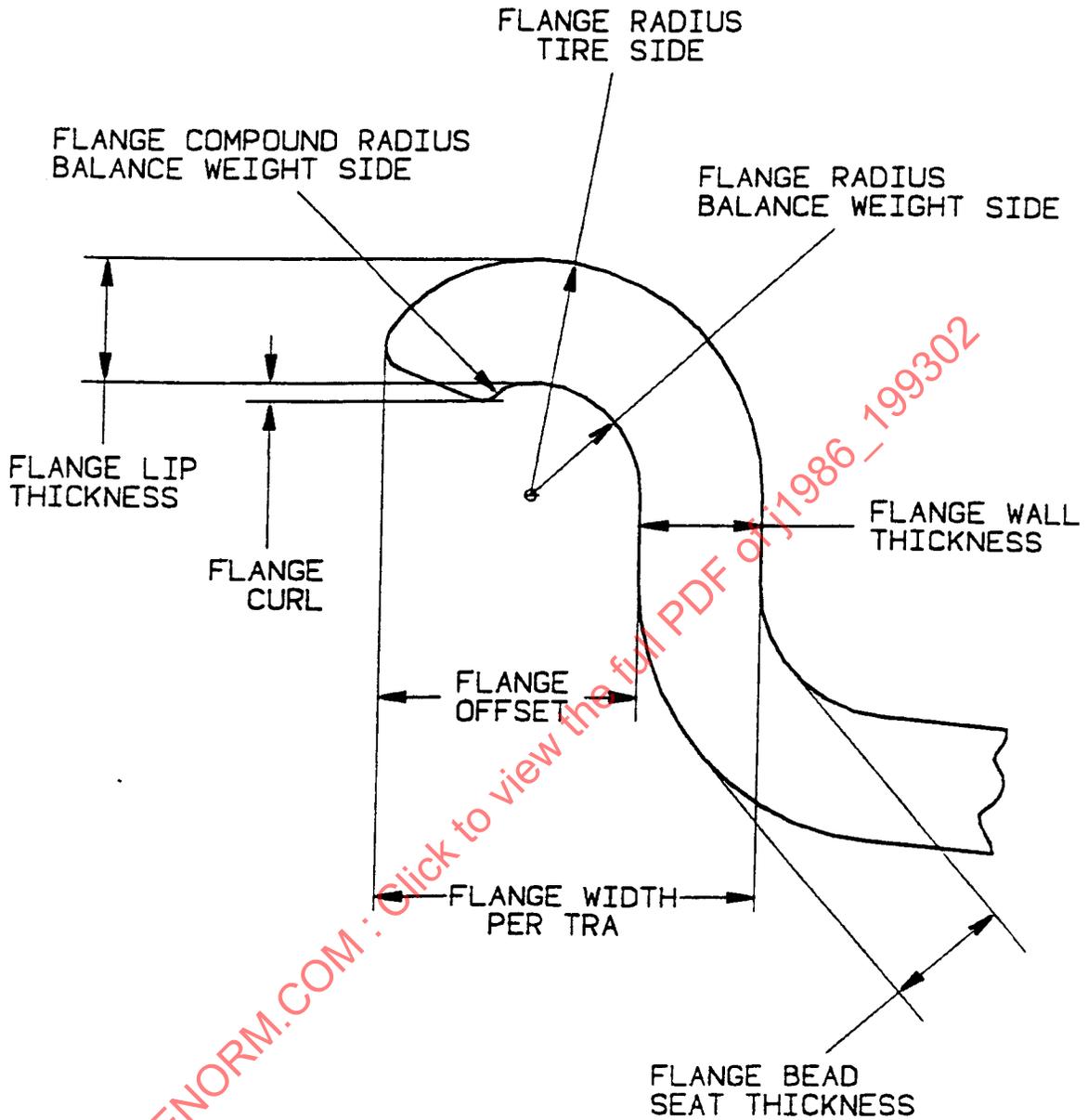
FIGURE 1—BALANCE WEIGHT ASSEMBLY TERMINOLOGY



NOTE :

TERMINOLOGY IS TYPICAL FOR
INBOARD AND OUTBOARD RIM FLANGES

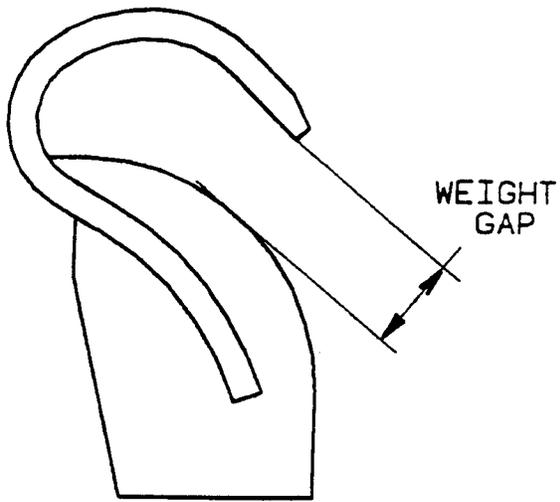
FIGURE 2—ALUMINUM WHEEL RIM FLANGE TERMINOLOGY



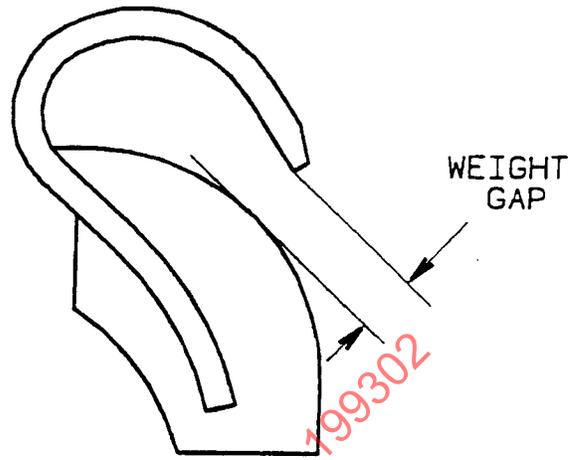
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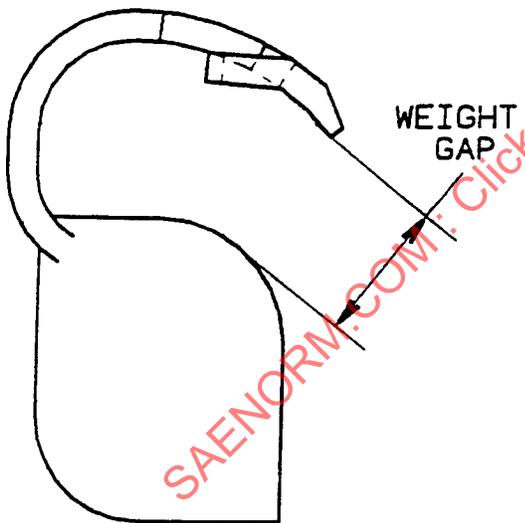
FIGURE 3—STEEL WHEEL RIM FLANGE TERMINOLOGY



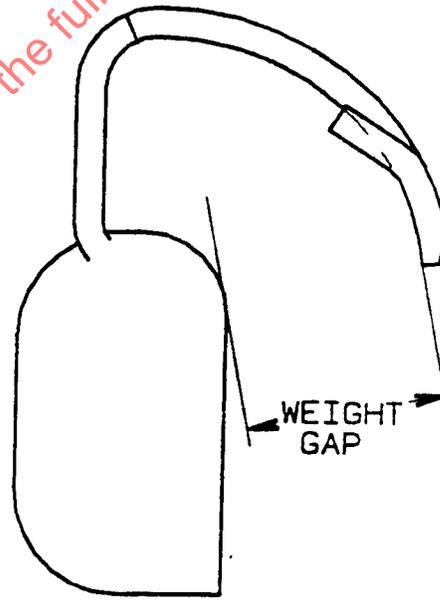
TYPE P & T



TYPE C



TYPE MC



TYPE AW

WEIGHT GAP DIMENSION VARIES BY TYPE.

FIGURE 4—BALANCE WEIGHT ASSEMBLY TYPES

- 5. Rim Flange Types**—Rim flange types are identified by letter codes. Rim flange types covered by this document are: J, JB, and JJ. Alternate rim flange types, for example L, currently in use are not included. Configurations of these rim flanges are shown in the Tire and Rim Association (TRA) yearbook. Dimensions shown in the TRA book are limited to those pertaining to the rim flange contour on the tire side and do not include dimensions on the balance weight side. Recommended rim flange dimensions and configurations on the balance weight side are discussed in Section 5 and are shown in Figures 5, 6, and 7.
- 6. Recommended Rim Flange Features, Dimensions, and Configurations**
- 6.1 Machined/As Cast Aluminum Wheels**—Recommended rim flange features, dimensions, and configurations are shown in Figures 5 and 6. The rim flanges shown in Figures 5 and 6 are intended for MC type balance weights.
- 6.2 Rolled Aluminum Rims**—Recommended rim flange features, dimensions, and configurations have not yet been established.
- 6.3 Steel Wheels**—Recommended rim flange features, dimensions, and configurations are shown in Figure 7.
- 7. Balance Weight Assembly Selection**—Recommended balance weights for different rim types are shown in Table 1.
- 8. Test Procedure (Static)**
- 8.1 Preparation of Balance Weights for Test**
- 8.1.1 **SELECTION OF BALANCE WEIGHTS**—For each test use a set of new balance weights of different sizes representative of the wheel for which they are intended. The balance weights of each size shall be equally divided into two groups each containing the same number. For testing purposes, one group shall be mounted on the outboard flange and the other group on the inboard flange.
- 8.1.2 **MEASUREMENTS OF KEY DIMENSIONS OF BALANCE WEIGHTS**—For balance weights intended for aluminum wheels, measure weight gap and spur depth. For balance weights intended for steel wheels, measure weight gap only. The measured values of weight gap and spur depth shall be within design specification shown in Table 2.
- 8.1.3 **MARKING OF BALANCE WEIGHTS**—Individual balance weights of different sizes shall be picked at random from the selected group and marked by using sequential numbers. One half of the group are to be tested on the outboard flange and the other half on the inboard rim flange.
- 8.2 Preparation of the Wheel**
- 8.2.1 **CLEANING**—Clean the surfaces of the outboard and the inboard rim flanges to remove any dirt or grease by using solvent which leaves no residue.
- 8.2.2 **MARKING**—Using a felt pen, make equally spaced marks around the circumference of the outboard and inboard flanges to indicate mounting points for each of the balance weights. The flange surface at each mounting point shall be free of scratches, gouges, and welds.
- 8.2.3 **MEASUREMENT OF RIM FLANGE DIMENSIONS**—Measure and record the following three dimensions on the outboard and inboard rim flanges: Flange Lip Thickness, Flange Offset, and Flange Width Figure 2 and Figure 3. All measured dimensions shall be within design specifications shown in Figures 5, 6, or 7.
- 8.3 Test Equipment**—The test equipment shall be capable of removing the balance weight from the rim flange as well as measuring and reading the maximum force required to initiate movement.

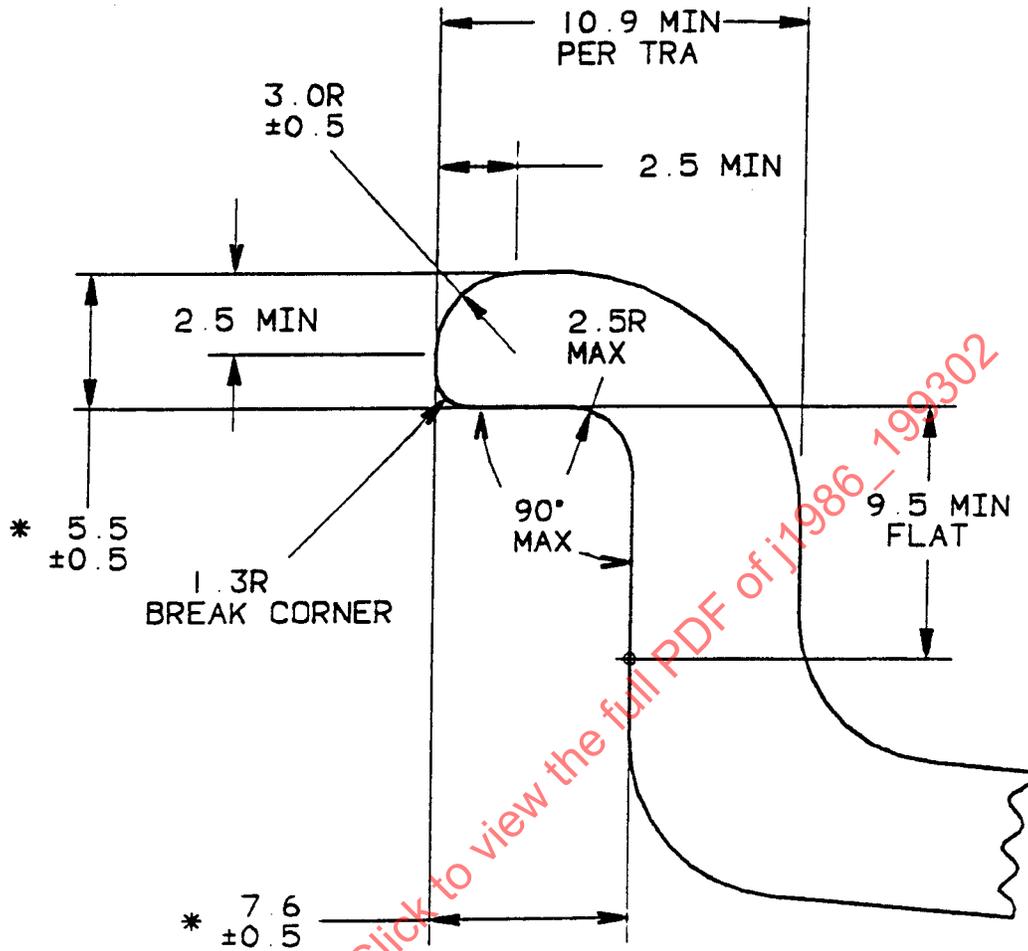
TABLE 2—RECOMMENDED BALANCE WEIGHT DESIGN SPECIFICATIONS

Bal Wt	Type Wheel	Design Specified	Design Specified	Recommended
		Recommended Limits mm (in) Weight Gap	Recommended Limits mm (in) Spur	Interference mm (in)
P	Steel	2.03—2.41 (0.080—0.95)		0.64 (0.025) min
C	Steel	1.57—1.98 (0.062—0.078)		0.64 (0.025) min
T	Steel	2.67—3.05 (0.105—0.120)		0.64 (0.025) min
MC	Alum.	4.06—4.45 (0.160—0.175)	0.76—1.14 (0.030—0.045)	0.64 (0.025) min

8.4 Test Sequence—Test shall be conducted in the following sequence:

- 8.4.1 Install the probe for moving the balance weight on the rim flange in the center hole of the fixture with the flat edge facing up Figure 8.
- 8.4.2 Install the balance weight on the inboard and outboard rim flange by using a nonmetallic hammer. Strike the balance weight in such a manner that one blow properly seats it on the rim flange.
- 8.4.3 Install the wheel in the test fixture and center it on the base of the fixture as shown in Figure 8.
- 8.4.4 Set the probe in the center of the hole or notch located in the clip by adjusting its horizontal, vertical, and angular positions while avoiding contact with the rim flange during test sequence.
- 8.4.5 Set the force indicator on the test equipment to zero.
- 8.4.6 Gradually increase the force on the lever until the balance weight moves. Record the maximum indicated force.
- 8.4.7 Discard the balance weight removed from the rim flange and do not use it in future testing.
- 8.4.8 Reset the wheel for the next position of balance weight removal.
- 8.4.9 Repeat steps 8.4.2 through 8.4.8 for each balance weight installed on the inboard and outboard rim flange following a sequential order of balance weight numbers.

- 9. Performance Requirements**—The minimum value of balance weight retention force determined in accordance with the Static Test procedure described in Section 7 shall be equal to or greater than 155 N (35 lbf). Balance weight assemblies showing retention force values below 155 N (35 lbf) should be evaluated with the balance weight manufacturer as dynamic testing may be required.

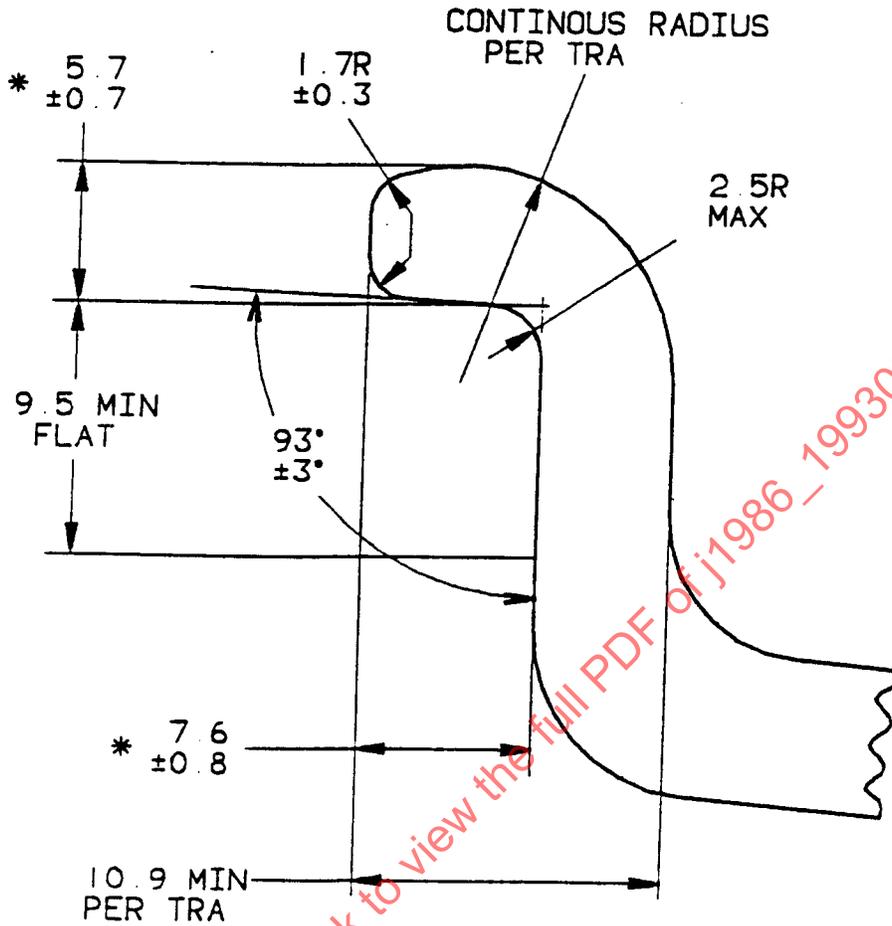


NOTE:

CONTOUR IDENTICAL FOR INBOARD AND OUTBOARD RIM FLANGES.

* RIM FLANGE KEY DIMENSIONS

FIGURE 5—RECOMMENDED DESIGN PRACTICE MACHINED ALUMINUM WHEELS "MC" TYPE BALANCE WEIGHT—OPTION #1



NOTE

CONTOUR IDENTICAL FOR INBOARD AND OUTBOARD RIM FLANGES

* RIM FLANGE KEY DIMENSIONS

FIGURE 6—RECOMMENDED DESIGN PRACTICE AS CAST ALUMINUM WHEELS "MC" TYPE BALANCE WEIGHT—OPTION #2