SAE International

SURFACE VEHICLE RECOMMENDED PRACTICE

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(R) Balance Weight and Rim Flange Design Specifications, Test Procedures, and Performance Recommendations

RATIONALE

This document is being revised to reflect current Industry practice and to update test methods, use of a single Retention test method for clip on weights, the addition of Adhesive Weights and Application Chart revisions.

1. SCOPE

This SAE Recommended Practice is intended to serve as a guide for standardization of features, dimensions, and configurations of balance weights for aluminum and steel wheels intended for use on passenger cars, light trucks, and multipurpose vehicles to assure good installation and retention of the balance weight. This document also provides test procedures and minimum performance requirements for testing balance weight retention.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J393 Nomenclature - Wheels, Hubs, and Rims for Commercial Vehicles

2.1.2 Tire & Rim Association Publication

Available from The Tire & Rim Association, Inc., 175 Montrose West Avenue, Suite 150, Copley, OH 44321, Tel: 330-666-8121, www.us-tra.org.

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 Adhesive Weight

These weights are used to correct imbalance as in 3.1 and are placed on the inner rim diameter behind the spokes and on the inner diameter at a specified location on the inboard surface.

3.1.2 Weight

A specified mass with contours to conform to the surface of the rim flange for clip on weights. Adhesive weights are a dense mass that can be formed to fit the inner rim diameter.

3.1.3 Clip

Specially formed metal affixed to the weight to mount the balance weight on the rim flange.

3.1.4 Spur

An optional part of a clip protruding from its surface interfacing with the rim flange that can enhance retention.

3.1.5 Balance Weight Coating

Noncorrosive material coating to prevent corrosion.

3.1.6 Balance Weight Key Dimensions

Dimensions which are essential for fitting the clip on balance weight on the rim flange.

3.1.7 Balance Weight Size

The balance weight size is determined by the magnitude of the balance weight mass and is expressed in gm (oz).

3.1.8 Balance Weight Retention Force

A static force required to remove the balance weight from the rim flange as set forth in Section 8. A shear force is required to test retention of the adhesive weight at its designated location on the inner rim diameter.

3.1.9 Balance Weight Retention

The ability of the balance weight to maintain its secure position on the rim flange and at an adhesive weight location during various service conditions on the road as well as in the laboratory.

3.1.10 Interference

The measure of clip on balance weight press fit computed as the difference between the flange thickness and the weight gap. This does not apply to Adhesive Weights.

3.1.11 For further definitions and descriptions of nomenclature of clip on balance weights, see Figure 1.

3.1.12 Rim Flange

That part of the rim where the clip on balance weight is mounted.

3.1.12.1 Rim Flange Key Dimensions

Dimensions which are essential for fitting the clip on balance weight on the rim flange.

3.1.12.2 For further definitions and descriptions of nomenclature of rim flange features, see Figure 2 and Figure 3.

4. BALANCE WEIGHT ASSEMBLY TYPES

Clip on balance weight types are identified and marked by letter codes (Table 1). Four different types of clip on balance weights have been evaluated and recommended for use in the Industry: P, C, T, and MC (see Figure 4). Adhesive Weights are not considered to be part of “Assembly Types”.

TABLE 1 - TYPICAL APPLICATION CHART CLIP ON BALANCE WEIGHT SELECTION

Wheel Rim Type	Weight Type	Weight Gap	Spur Depth	Flange Lip Thickness	Flange Offset
Reference Figure Number 7 Steel Rolled Flange & Light Alloy Rolled Flange	C	1.6-2.0	NA	2.0-2.7	10 ± 1.2
	P	2.0-2.4	NA	2.7-3.3	10 ± 1.2
	T	2.7-3.1	NA	3.4-4.6	10 ± 1.2
	MC	4.1-4.5	0.7-1.1	5.0-6.0	10 ± 1.2
Reference Figure Number 6 Full Face Light Alloy, Steel, Clad	T	2.7-3.1	NA	3.4-4.6	10 ± 1.2
Reference Figure Number 5 Light Alloy Machined	MC	4.1-4.5	0.7-1.1	5.0-6.0	7.6 ± .5

NOTE: Wheels with Flange Lip thickness or tolerances outside of the typical ranges may require different Flange Offsets to meet retention Force targets.

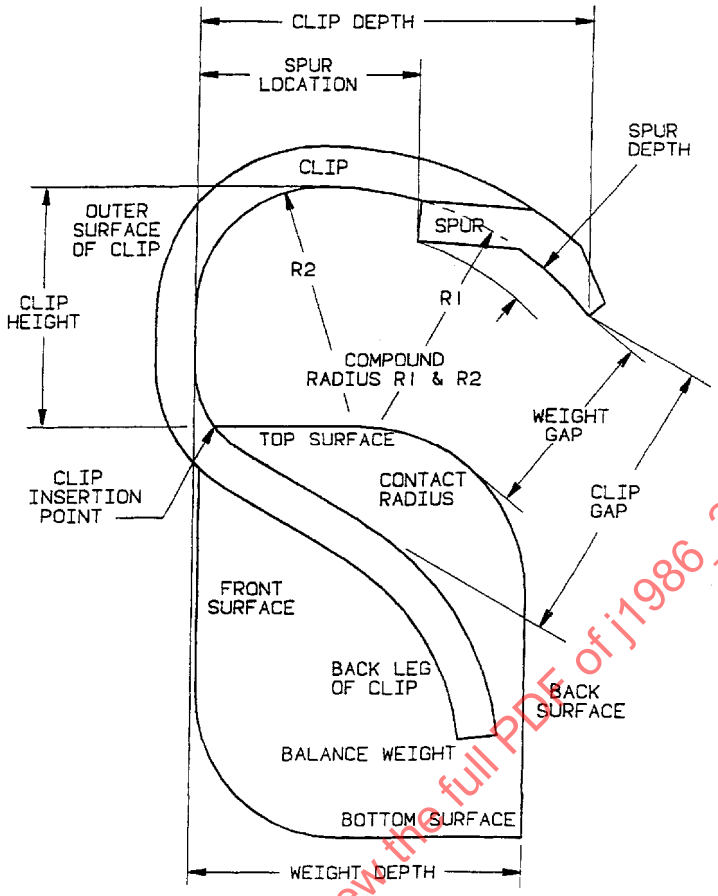

FIGURE 1 - BALANCE WEIGHT ASSEMBLY TERMINOLOGY

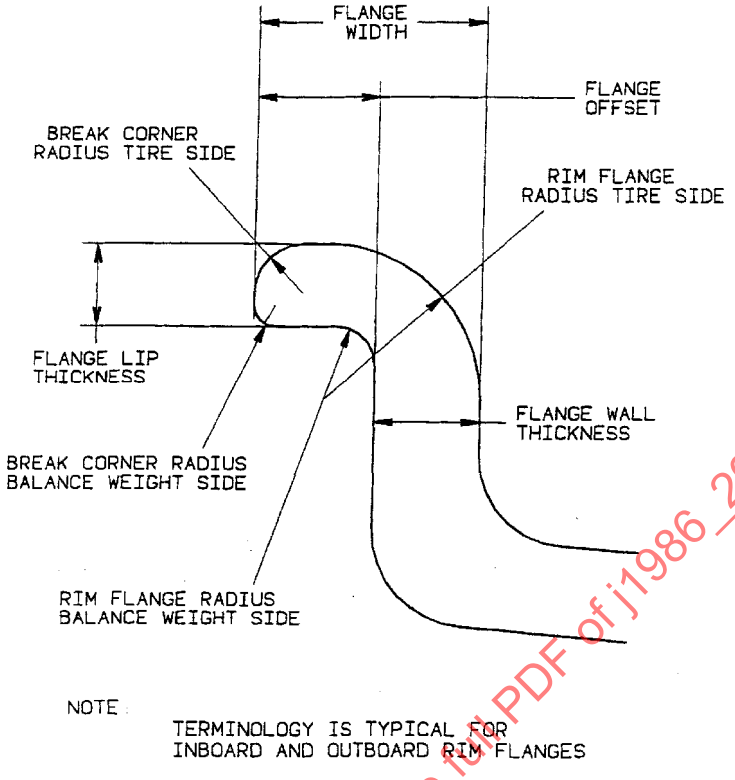

FIGURE 2 - MACHINED ALUMINUM WHEEL RIM FLANGE TERMINOLOGY

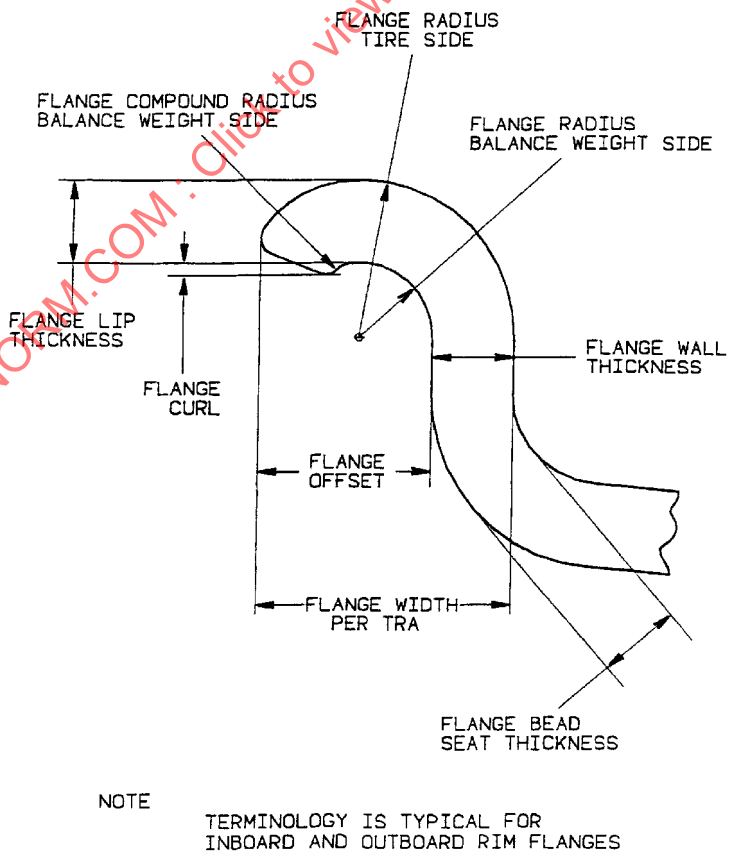

FIGURE 3 - ROLL FORMED WHEEL RIM FLANGE TERMINOLOGY

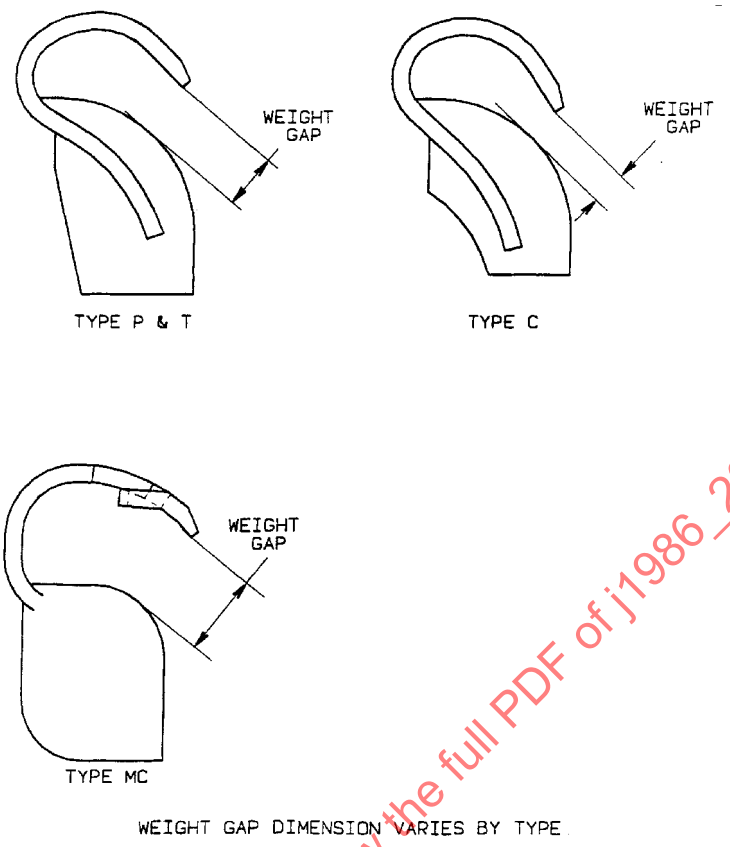

FIGURE 4 - BALANCE WEIGHT ASSEMBLY TYPES

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 & 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 6 and are shown in Figures 5, 6, and 7.

6. RECOMMENDED RIM FLANGE FEATURES, DIMENSIONS, AND CONFIGURATIONS

6.1 Light Alloy Machined

Recommended rim flange features, dimensions, and configurations are shown in Figure 5. The rim flanges shown in Figure 5 are intended for MC type balance weights.

6.2 Steel and Light Alloy Rolled Rims

Recommended rim flange features, dimensions, and configurations are shown in Figure 7 and use the “C, P, T, MC” type weights.

6.3 Fabricated, Full Face Wheels, Light Alloy Wheels

Recommended rim flange features, dimensions, and configurations are shown in Figure 6, are intended for the “T” type weight.

7. BALANCE WEIGHT ASSEMBLY SELECTION

Recommended balance weights for different rim types are shown in Table 1.

8. TEST PROCEDURE - AXIAL REMOVAL TEST

8.1 Preparation of Clip on 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 Dimensions of Balance Weights

For balance weights intended for Light Alloy wheels, measure weight gap and spur depth (where used). 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 1.

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 an OSHA approved solvent such as 50/50 alcohol and water that 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 dimensions on the outboard and inboard rim flanges: Flange Lip Thickness, Flange Offset, and Flange Width for all Wheel Types and Weight lead in and optional groove location for full Face and Clad Wheels (see Figures 6 and 7). All measured dimensions shall be within design specifications shown in Figures 6 and 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.

8.4 Test Sequence

There is one distinct method to evaluate axial retention. The test shall be conducted using the Pull off Test method (see Figure 10).

8.4.1 Install the clip on balance weight using a nonmetallic hammer.

NOTE: The wire loop shall be located under the weight clip on the inboard and outboard rim flange (see Figure 10). Strike the balance weight in such a manner that one blow properly seats it on the rim flange.

8.4.2 Install the wheel in the test fixture and center it on the base of the fixture as shown in Figure 10.

8.4.3 Connect the wire loop to the force indicator.

8.4.4 Set the force indicator on the test equipment to zero.

8.4.5 Gradually increase the force on the lever until the balance weight moves. Record the maximum indicated force.

8.4.6 Discard the balance weight removed from the rim flange and do not use it in future testing.

8.4.7 Repeat steps 8.4.1 through 8.4.6 for each balance weight to be installed on the inboard and outboard rim flange using small, medium, and large weights (10 weights per side minimum).

8.5 Calibrate load cell using 10 kg (25 lb) increment weights up to 45 kg (100 lb).

8.6 Performance Requirements

The minimum value of clip on balance weight retention force determined in accordance with the Static Test procedure described in Section 8 is shown on Table 2.

TABLE 2 - CLIP ON BALANCE WEIGHT AXIAL – FORCE VALUES

Mass (g)	5	10-15	20, 25, 30, 35	40-80	≥90
Min. Force (N)	50	60	150	200	300

8.7 Adhesive weight test procedure for all size weights and wheels.

8.7.1 Adhesive weight removal can use the same test fixture as in Figure 10 except the fixture will be set up to push instead of pull (see Figure 9).

8.7.2 Prepare wheel inner rim surface using an appropriate solvent for cleaning. Allow solvent to dry prior to test.

8.7.21 Selection of Adhesive Balance Weights

For each test use a set of new weights of different sizes. The test can be performed on weights located behind the spokes or at the inner rim outboard location as per Customer requirements.

8.7.3 Remove protective backing from the weight adhesive and apply weight to the correction location on the wheel.

8.7.4 Apply sufficient force to the weight using a tool to achieve a minimum wet out of 85%. A specified tool and force to achieve the required wet out is to be developed by the respective Assembly Process Engineers. The unit is to set for one hour prior to test. Figure 9 shows proper alignment of the tool for all size wheels. A test data sheet is recommended to record results as required for each Customer.

8.7.5 Set up wheel in the test fixture such that the weight can be put into shear by the probe.

8.7.6 Set up the probe to contact the side of the weight and not the acrylic foam part of the adhesive.

8.7.7 Move the probe down until the weight begins to shear the backing of the adhesive.

8.7.8 When the backing begins to break and the adhesive does not come away from the wheel or the weight, the test is a pass. A testing force value for shear will be added when development is completed.

9. THE TANGENTIAL TEST METHOD OR SLIDE TEST FOR CLIP ON WEIGHTS ONLY

9.1 Set up the test as per Figure 8.

9.2 Apply force at the end of the weight with the tool in a tangential direction at an angle of less then 10 degrees in an effort to begin to move the weight. When the force transducer exceeds 20 lb with out movement, the test is a pass.

10. NOTES

10.1 Marginal Indicia

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