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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

# SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J2038

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Submitted for recognition as an American National Standard

## Engine Weight, Dimensions, Center of Gravity, and Moment of Inertia

***Foreword***—This document has not changed other to put it in the SAE Technical Standards Board format. Definitions have been changed to Section 3. All other section numbers have changed accordingly.

***1. Scope***—This SAE Recommended Practice has been developed to provide a uniform method for reporting the weight, dimensions, center of gravity, and moment of inertia of internal combustion engines. SAE J2038 is not intended to cover the technical interface between the engine and transmission. To locate the rear of the engine crankshaft in relationship to the rear of the flywheel housing, refer to SAE J617.

***2. References***

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

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J617—Engine Flywheel Housings
SAE J824—Engine Rotation and Cylinder Numbering

2.1.2 ISO PUBLICATION—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO/DIS 1204—Reciprocating internal combustion engines—Designation of the direction of rotation and of cylinders and valves in cylinder heads, and definition of right-hand and left- hand in-line engines and locations of an engine.

***3. Terminology***

**3.1 Basic Engine**—The "basic engine" is defined as a runnable engine equipped with built-in accessories, such as fuel, oil, and coolant pumps, emission control equipment, and includes all standard equipment as clearly defined by each engine manufacturer. Standard equipment includes a defined or no specified SAE standard flywheel, flywheel housing, and auxiliary drives. The dry engine weight will be reported.

**3.2 As Shipped Engine**—The "as shipped engine" is the "basic engine" equipped with accessories required for users' application. A variety of options, which may include lube oil and coolant, will be included in the weight. The "as shipped engine" corresponds to the user's specifications for a specified part number. Shipping stands and other items required for shipment are not included.





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**3.3** **Fully Equipped Engine—**A "fully equipped engine" is an "as shipped engine" equipped with accessories necessary to perform its intended service. This includes, but is not restricted to, intake air system, cooling system, alternator, starting motor, noise control equipment, power steering pump system, air compressor and vacuum pumps.

**3.4** The manufacturer should clearly define what is included in each engine arrangement.

## *4. Weight Measurement Procedure*

**4.1** Engine weights should be established within ±3%. Various methods (actual weighing, computer analysis) may be used to determine these weights.

**4.2** Dry weight is defined as the weight of an engine that has been run and then had fluids drained. (Filters are not emptied.)

**4.3** Wet weight is defined as the dry weight, plus the weight of fluids as recommended by engine manufacturer (fuel, oil, coolant). This weight may be established by weighing wet engines or by calculating weight of fluids and adding to dry weight.

**4.4** The manufacturer should clearly define what equipment is included in each engine weight, as defined in 3.2.

## *5. Dimension Measurement Procedure*

**5.1** Forward length of the engine is defined as the horizontal distance from the rear face of the engine cylinder block to the front most point of the engine.

**5.2** Rearward length of the engine is defined as the horizontal distance from the rear face of the engine cylinder block to the rearmost point of the engine.

**5.3** Overall length of the engine is the sum of 5.1 and 5.2.

**5.4** Upper height of the engine is defined as the vertical distance from the centerline of the crankshaft upward to the highest point on the engine.

**5.5** Lower height of the engine is defined as the vertical distance from the centerline of the crankshaft downward to the lowest point on the engine.

**5.6** Overall height of the engine is the sum of 5.4 and 5.5.

**5.7** Left side width is defined as the horizontal distance from the centerline of the crankshaft to the widest point on the left side of the engine. Refer to SAE J824 or ISO/DIS 1204 for definition of right and left side of engine.

**5.8** Right side width is defined as the horizontal distance from the centerline of the crankshaft to the widest point on the right side of the engine. Refer to SAE J824 or ISO/DIS 1204 for definition of right and left side of engine.

**5.9** Overall width of the engine is the sum of 5.7 and 5.8.

## *6. Center of Gravity Location and Dimensioning Procedure*

**6.1** The center of gravity of a basic engine, as shipped engine, or fully equipped engine is the point at which all the weight of the engine or engine package can be considered to be concentrated.

**6.2** The center of gravity of an engine or engine package is located from three reference planes.

**6.3** The fore-aft location is defined as the horizontal distance from the rear face of the engine cylinder block to the center of gravity.

**6.4** The vertical location is defined as the distance above or below the centerline of the crankshaft to the center of gravity.

**6.5** The lateral location is defined as the right or left horizontal distance from the centerline of the engine crankshaft to the center of gravity. For definition of engine right and left side refer to SAE J824 or ISO/DIS 1204.

## *7. Moment of Inertia Location and Dimensioning Procedure*

**7.1** The moment of inertia values of an engine or engine package acts about three principal axes that pass through the engine center of gravity.

**7.2** The principal roll or fore-aft axis generally slopes downward toward the rear of the engine.

**7.3** The principal yaw or near vertical axis lies in the same vertical plane as the roll axis, 90 degrees adjacent.

**7.4** The principal pitch or lateral axis lies in the same near-horizontal plane as the roll axis, 90 degrees adjacent.

**7.5** Figure 1 shows a sample illustration of a center of gravity and moment of inertial specification.



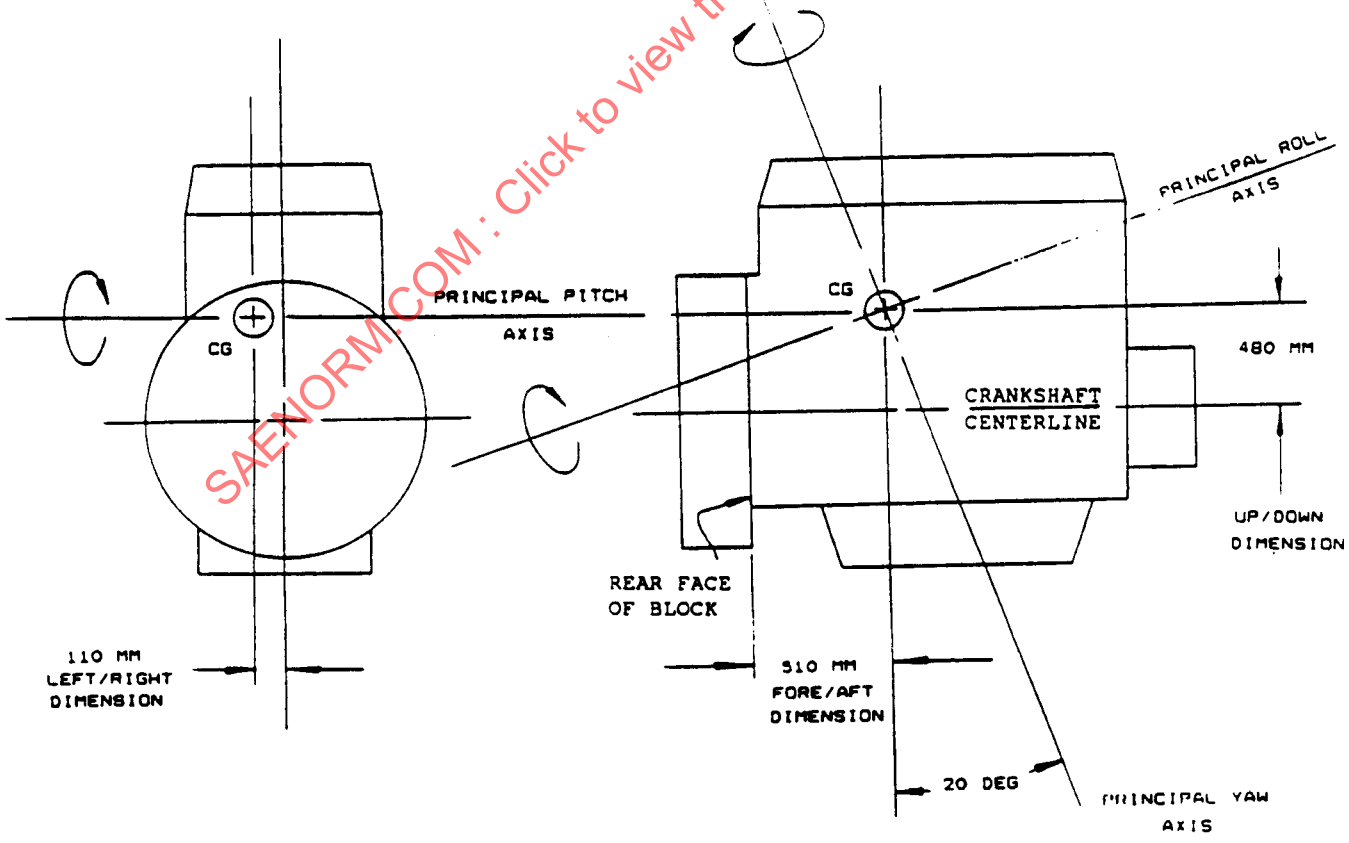


FIGURE 1—SAMPLE ILLUSTRATION OF CENTER OF GRAVITY AND MOMENT OF INERTIA

## *8. Notes*

**8.1 Marginal Indicia—**The change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

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