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SAE J1033 NOV88

Procedure for Measuring Bore and Face Runout of Flywheels, Flywheel Housings and Flywheel Housing Adapters

SAE Recommended Practice
Revised November1988

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HIGHWAY VEHICLE PRACTICE

Submitted for recognition as an American National Standard

SAE J1033

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Superseding J1033 FEB74

Ø PROCEDURE FOR MEASURING BORE AND FACE RUNOUT OF FLYWHEELS, FLYWHEEL HOUSINGS AND FLYWHEEL HOUSING ADAPTERS

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1. PURPOSE:

This SAE Recommended Practice is intended to provide a uniform procedure for measuring bore and face runout of flywheels, flywheel housings, and flywheel housing adapters after assembly to an engine.

2. SCOPE:

This recommended practice applies to any internal combustion engine which can utilize SAE No. 6 thru SAE No. 00 size flywheel housing. It provides instructions for correcting flywheel housing bore runout readings which are influenced by crankshaft bearing clearance. Limits for bore and face runout are specified in the various SAE Standards and Recommended Practices covering flywheels and flywheel housings.

3. MEASURING PROCEDURES:

3.1 General:

3.1.1 All measurements shall be taken on the assembled engine held in its normal operating position.

3.1.2 A dial indicator with rigid extension bars is required.

3.1.3 Surfaces which are to be measured must be free from dirt and burrs.

3.1.4 When taking measurements on used flywheel housings, inspect the piloting bore for wear.

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3.1.5 Prepare a chart similar to that shown in Fig. 1, to record and aid in determining the flywheel housing or adapter bore and face runout.

3.2 Alignment Measurements for Flywheel Housings and Adapters:

3.2.1 Flange Piloting Diameter Runout: This measurement is taken to determine the runout of piloting bore in relation to crankshaft rotation axis.

3.2.1.1 Mount the indicator base on the flywheel or on the crankshaft flange as close as possible to the housing pilot bore to minimize deflection.

3.2.1.2 Adjust the indicator point to be perpendicular to the housing pilot bore and set at zero in the 6 o'clock (lower vertical) mandatory position.

3.2.1.3 Slowly rotate the crankshaft in the direction of engine rotation, and record the indicator readings along with appropriate positive or negative sign at 3, 12, and 9 o'clock positions. Confirm that the 6 o'clock position is still zero. If necessary, repeat the measurements. Record the readings on line 1 in the chart shown in Fig. 1, being sure to include the positive or negative sign.

CAUTION: Sign designation relative to direction of indicator tip movement is not the same for all indicators. For all measurements in the calculations performed in 3.2.1, outward movement of the indicator tip with respect to the center of the bore being measured is to be considered a negative reading.

3.2.1.4 Position the indicator tip at 12 o'clock position, and set it at "zero" and determine (Ø); effect of main bearing clearance, by raising the crankshaft to its upper limit. Record the change in indicator reading as Ø, on line 2 in the chart in the 12 o'clock column. This value will always be positive. This value should be within engine manufacturer's limits.

NOTE: A floor mounted support with a padded prybar, or other suitable means can be used to raise the flywheel; however, it should not be forced beyond the point where the bearing clearance has been removed, nor should the housing be used as a fulcrum.

3.2.1.5 Divide the bearing clearance adjustment value (Ø) by 2 and enter on line 2 at 3 and 9 o'clock positions. Ø/2 value is always positive.

3.2.1.6 Algebraically add the values on lines 1 and 2 and record on line 3.

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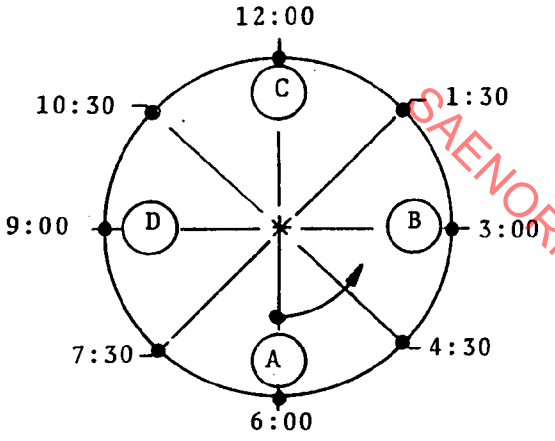

MANDATORY START POSITION
AT 6 O'CLOCK FOR BORE READINGS

RECOMMENDED SAE RUNOUT LIMITS: (FIM = Full Indicator Movement)

Housing SAE No.:____ Bore Runout:____ FIM; Face Runout:____ FIM

PILOTING BORE ROUNDNESS: (Maximum Diameter Variation and Distortion direction)

NOTES: 1. INDICATOR MUST RETURN TO "0" AT 6 O'CLOCK POSITION. IF IT DOES NOT, RETAKE READINGS.

2. WHEN NECESSARY, ADDITIONAL READINGS MAY ALSO BE TAKEN AT 4:30, 1:30, 10:30 and 7:30 O'CLOCK POSITIONS.

DIAL INDICATOR LOCATION (2)		LINE NO.	6 O'CLOCK	3 O'CLOCK	12 O'CLOCK	9 O'CLOCK
BORE RUNOUT	Observed Indicator Reading	1	A= (1)	B=	C=	D=
	Adjustment for Bearing Clearance (Ø)	2		Ø/2=	Ø=	Ø/2=
	Corrected Readings (Total Lines 1 and 2)	3	0	E_1= B + Ø/2 E_1= ____	I_V= C + Ø I_V= ____	E_2= D + Ø/2 E_2= ____
	Total Horizontal Runout (I_H)	4	$I_H = E_1 - E_2$ =			
	Resulting Total Bore Runout (I_R)	5	$I_R = \sqrt{I_V2 + I_H2} = \sqrt{\quad}$ =			FIM
FACE RUNOUT	Observed Indicator Reading — Dial "0" at 6 o'clock	6	0			
			MAX ⊕: ____ @ ____ o'clock; MAX ⊖: ____ @ ____ o'clock			
	Dial "0" @ Max ⊖ Loc.	7	⊕	⊕	⊕	⊕

(NOTE: Line 7 for checking) * Mark location of Max ⊖

Max. Face Runout: ____ FIM (Difference between highest and lowest location readings)

FIGURE 1 - Chart for Recording Flywheel Housing Bore and Face Runout
Note: Chart for Counterclockwise Rotating Engine Shown)

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3.2.1.7 Establish the corrected vertical indicator reading value Iv ($Iv = C + \emptyset$) at 12 o'clock position, and horizontal indicator readings E_1 ($E_1 = B + \emptyset/2$) at 3 o'clock position, and E_2 ($E_2 = D + \emptyset/2$) at 9 o'clock positions.

3.2.1.8 Determine the total horizontal reading (I_H) by taking the algebraic difference between the 3 o'clock and 9 o'clock corrected readings ($I_H = E_1 - E_2$). Enter this value on line 4 in the chart.

3.2.1.9 Determine the resulting total bore runout (I_R) of the housing or adapter by locating the intersection point of the total vertical reading (I_V) and the total horizontal reading (I_H) in Fig. 2 or calculate as follows:

$$I_R = \sqrt{(I_V)^2 + (I_H)^2}$$

NOTE: This value (I_R) is consistent with full indicator movement type reading limits specified in SAE J617. Housing bore eccentricity is equal to one-half of this value.

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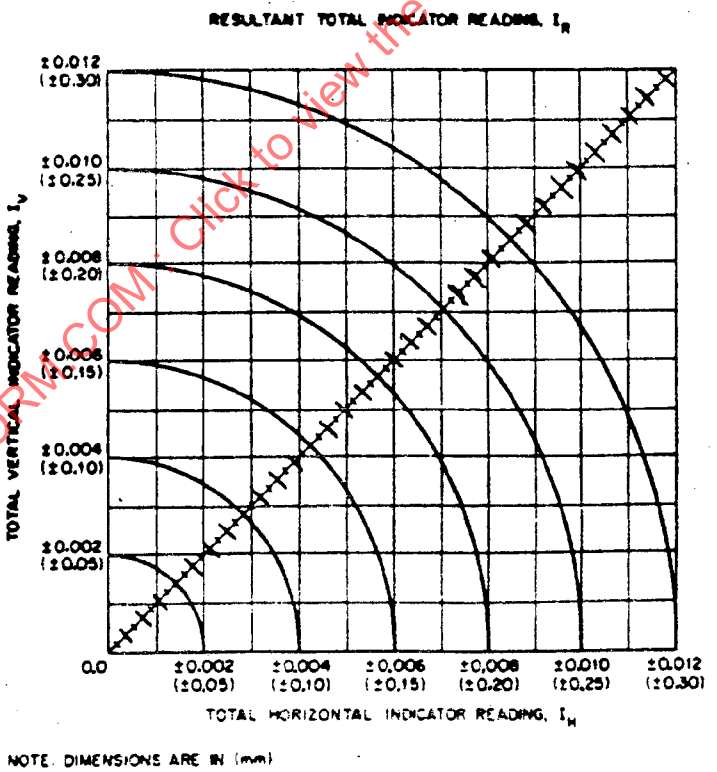

FIGURE 2 - Resultant Total Indicator Reading (I_R)

3.2.1.10 Compare the resulting total indicator value (I_R) with the permissible limits specified in SAE J617. If the limits are exceeded, establish if it is caused by housing shift, or flange bore out-of-roundness, or bore wear.

3.2.2 Flange Clamping Face Runout: This measurement is taken to determine the runout of flange clamping face in relation to crankshaft rotation axis.

3.2.2.1 Prepare a chart similar to Fig. 1.

3.2.2.2 Mount the indicator base on flywheel or on the crankshaft flange and position the indicator tip to be perpendicular to the housing face between the housing bore and the mounting bolt holes.

3.2.2.3 To assure accuracy in taking face run-out measurements, the crankshaft end play must be removed (crankshaft held against the thrust bearings) in the same direction throughout the complete revolution of the crankshaft. Push the flywheel-crankshaft assembly forward (toward fan) to take up the end play. After removing the end play, set the dial indicator to zero at 6 o'clock position (not mandatory).

3.2.2.4 Taking care to keep the end play removed in the same direction as in the 6 o'clock position, rotate the crankshaft as the engine turns one complete revolution. Record on line 6 the indicator readings observed at 3, 12, and 9 o'clock positions. Also, record readings and locations of the highest and lowest indicator readings. Mark the position of the lowest indicator reading on housing. Confirm that 6 o'clock reading is still zero. If necessary, repeat the measurements.

3.2.2.5 To confirm the face run-out value and its direction, the dial indicator may be set to zero at the lowest (largest negative) indicator reading position, and readings retaken. Record on line 7 (all vaues should be positive).

3.2.2.6 Maximum face run-out is the difference between highest and lowest indicator reading values. Compare the resulting face run-out, with the permissible limits specified in SAE J617.

3.3 Alignment Measurements for Flywheels:

3.3.1 Flywheel Pilot Bearing Bore, and Driven Coupling Member Piloting Bore Runout: This measurement is taken to determine the runout of flywheel pilot bearing bore, and coupling piloting bore in relation to crankshaft rotation axis.

3.3.1.1 Fasten a dial indicator to the flywheel housing. If no housing is used, fasten the dial indicator to the rear plate or to the engine crankcase. Position the indicator by use of arms and brackets in such a way so that the point of indicator is nearly perpendicular to the flywheel surface being measured.

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3.3.1.2 Place the indicator tip on the bore being measured and set the dial to zero. Rotate the flywheel one complete revolution to determine the total indicator run-out and compare with the limit specified in the applicable SAE Standard or Recommended Practice.

3.3.2 Flywheel Clutch Cover Plate, or Coupling Flange Clamping Face or Clutch Driven Disc Friction Face, Runout: This measurement is taken to determine the runout of clutch cover plate, coupling clamping face, or driven disc friction face in relation to crankshaft rotation axis.

3.3.2.1 Mount the indicator using the same method as outlined in 3.3.1.1.

3.3.2.2 After removing the crankshaft end play, set the dial indicator to zero in the 6 o'clock (not mandatory) position.

3.3.2.3 Taking care to keep the end play removed in the same direction as in the 6 o'clock position, rotate the flywheel one complete revolution to determine the total indicator runout.

3.3.2.4 Compare the total indicator runout reading with the limit specified in the applicable SAE Standard or Recommended Practice.

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