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PERMISSIBLE IMBALANCE VALUE FOR DIFFERENT STACK SIZE OF UNIVERSAL MOTOR FOR WASHING MACHINE

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Abstract: Any rotating body faces inherent balancing problem even if it will be in small quantity. There is no machine which while rotating does not have any imbalance value. Therefore International Standards Organization (ISO), American National Standards Institute (ANSI), Military Standards (MIL-STD), American Petroleum Institute (API) had made some acceptable value for imbalance under which a machine or a motor can run safely. This acceptable value is known as Permissible Imbalance value. This paper will provide the simplified method for finding the Permissible Imbalance value for different size of stack in the universal motor as an example which will help to set the balancing machine into its permissible balancing limit.

Keywords: Permissible imbalance value, ISO 1940/1, Balance quality grade.

I INTRODUCTION:

The condition which is carried for this paper is, when, rotating speed of rotor is very high and mass is very low comparatively. In washing machine, drum has to rotate in very high speed. Different running conditions for the same washing machine is taken due to different power requirement. Due to high speed of washing machine drum, major imbalance is expected. Hence, it is necessary to minimize the imbalance, since zero imbalance is nearly impossible to achieve in any rotating rotor case of any machine. Considering ISO 1940/1 and Balance quality grade (G) according to condition requirement.

Formulas: Balancing formula requirement:

M = Mass of rotor in Kg
m = Mass unbalance in gm
e = Displacement of mass from center in 'm'
r = Radius from center of rotor to C.G. of unbalance mass 'mm'
U = Unbalance of rotor.
Now,

- U = m x r = M x e
- $e = \frac{U}{M} = \frac{m \times r}{M}$
- U(gm.mm) = $\frac{\mathbf{9550 \times G \times M(kg)}}{\mathbf{N(rpm)}}$

Where;

- Unbalance of rotor (U) = Unbalance Mass (gm) × Distance from Unbalance Mass to rotor Centerline (mm).
- Quality Grade(G) relates Maximum Service Speed (rpm) and Permissible Specific /residual Unbalance(u) whose value will come in **mm/sec**
- N is Maximum Service Speed (rpm)

Procedure: Permissible imbalance value:

- For finding balance quality for rigid rotor we have to follow ISO 1940/1, Article 6.2.3
- Determine Balance quality grade (G) according to our requirement from the table given above.
- **Experimental Method**

Total residual accepted unbalance, U (gm.mm) = $\frac{\mathbf{9550 \times M \times G}}{\mathbf{N}}$

Accepted unbalance per plane = U/2

Acceptable unbalance in each plane = $\frac{U/2}{D/2}$ gm

- In our case:

Quality Grade: Electric motor of at least 80 mm shaft height of maximum rated speed above 950 rpm will fall in G 2.5

D= 71 mm or D/2 = 35.5 mm

Conditions:

S. No.	Size of rotor in mm	Speed in rpm	Weight of rotor in Kg
1	35	12000	1.47
2	40	15140	1.63
3	52	15276	1.95

Therefore,

Permissible Imbalance Value = U (gm.mm) = $\frac{\mathbf{9550 \times M \times G}}{\mathbf{N}}$ for different size of rotor are:

U (35) = (9550*1.47*2.5)/12000 = 2.925 gm.mm

Acceptable unbalance in each plane = 2.925/35.5 = 0.0824 gm = 82.4 mg

U (40) = (9550*1.63*2.5)/15140 = 2.57 gm.mm

Acceptable unbalance in each plane = 2.57/35.5 = 0.0724 gm = 72.4 mg

U (52) = (9550*1.95*2.5)/15276 = 3.047 gm.mm

Acceptable unbalance in each plane = 3.047/35.5 = 0.0858 gm = 85.8 mg

Balance Quality Grade(G) mm/sec	Type of Rotor
4 000	Crankshaft/drive of rigidly mounted slow marine diesel engines with uneven number of cylinders
1600	Crankshaft/drives of rigidly mounted large two-cycle engines
630	Crankshaft/drives of rigidly mounted large four-cycle engines
	Crankshaft/drives of elastically mounted marine diesel engines
250	Crankshaft/drives of rigidly mounted fast four-cylinder diesel engines
100	Crankshaft/drives of fast diesel engines with six or more cylinders
	Complete engines (gasoline or diesel) for cars, trucks and locomotive
40	Car wheels, wheel rims, wheel sets, drive shafts; Crankshaft/drives of elastically mounted fast four-cycle engines with six or more cylinders
	Crankshaft/drives of engines of cars, trucks and locomotives
16	Drive shafts (propeller shafts, cardan shafts) with special requirements; Parts of crushing machines; Parts of agricultural machinery; Individual components of engines (gasoline or diesel) for cars, trucks and locomotives; Crankshaft/drives of engines with six or more cylinders under special requirements
6.3	Parts of process plant machines; Marine main turbine gears (merchant service); Centrifuge drums; Paper machinery roll sprint rolls
	Fans; Assembled aircraft gas turbine rotors; Flywheels; Pump impellers; Machine-tool and general machinery parts; Medium and large electric armatures (of electric motors having at least 80 mm shaft height) special requirements; Small electric armatures, often mass produced, in vibration insensitive applications and/or with vibration-isolating mountings; Individual components of engines under special requirements
2.5	Gas and steam turbines including marine main turbines (merchant service); Rigid turbo-generator rotors; Computer memory drums and discs; Turbo-compressors; Machine-tool drives; Medium and large electric armatures with special requirements
	Small electric armatures not qualifying for one or both of the conditions specified for small electric armatures of balance quality grade G 6.3; Turbine-driven pumps
1	Tape recorder and phonograph (gramophone) drives
	Grinding-machine drives; Small electric armatures with special requirements
0.4	Spindles, discs and armatures of precision grinders; Gyroscopes

II CONCLUSION:

With the help of this paper, for different input parameters, we can obtain different values of permissible imbalance value which can be used for practical application for fixing the permissible imbalance value in balancing machine. If the value exceed than proper measure should be taken to bring it into limited value.

III REFERENCES:

[1]. IS/ISO 1940-1 (2003): Mechanical vibration – Balance quality requirements for rotors in a constant (Rigid) state, Part 1: Specifications and verification of balance tolerances [MED 28: Mechanical Vibration and Shock]
[2]. ISO 1940/1, "Balance Quality Requirements of Rigid Rotors." International Organization for Standardization.
[3]. ANSI S2. 19-1975, "Balance Quality Requirements of Rotating Rigid Bodies. "American National Standards Institute.
[4]. BS 6861: Part 1, "Balance Quality Requirements of Rigid Rotors." British Standards Institution.
[5]. VDI 2060, "Balance Quality Requirements of Rigid Rotors." German Standards Institution.
[6]. Standard Paragraphs, API Subcommittee on Mechanical Equipment, Revision 19, September 1991. American Petroleum Institute.
[7]. MIL-STD-167-1 (SHIPS), 1 May 1974, "Mechanical Vibrations of Shipboard Equipment." Department of the Navy, Naval Ship Systems Command.
[8]. "DYNAMIC BALANCING HANDBOOK, "October 1990, IRD Mech analysis Inc.
[9]. ISO 1925, "Balancing Vocabulary. "International Organization for Standardization.