Twenty-Eighth Edition

Machinery's Handbook

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A REFERENCE BOOK
FOR THE MECHANICAL ENGINEER, DESIGNER,
MANUFACTURING ENGINEER, DRAFTSMAN,
TOOLMAKER, AND MACHINIST

Machinery's Handbook

28th Edition

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SHAFT ALIGNMENT

Introduction

Shaft alignment is the positioning of the rotational centers of two or more shafts so that the shafts are co-linear when the machines are operating. The purpose of shaft alignment is to increase the operating life span of rotating machinery and to achieve high motor efficiency. It is not easy to detect misalignment when machines are running, but secondary effects of misalignment can be observed, such as excessive radial and axial vibration; high temperature in casings, bearings, or lubricant; loose, broken or missing coupling bolts or foundation bolts; cracks in shafts; and excessive amounts of lubricant leakage.

There are no universally accepted specifications for shaft alignment, however, there are defined limits for shaft-to-shaft alignment of coupled machines. The limits are defined in terms of two measures of misalignment, *angularity* and *offset*.

Angular Misalignment.—Angular misalignment is the difference in the slope of one shaft, as compared to slope of the other shaft. The units are expressed as rise/run. Rise is measured in mils (1 mil = 0.001 inch), and the run (distance along shaft) is measured in inches. The process of correcting this type of alignment problem is sometimes called gap or face alignment.

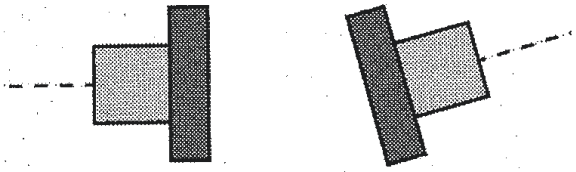

Fig. 1. Shafts in Angular Misaligned Position

Offset Misalignment.—Offset misalignment is the distance between the shaft centers of rotation measured at the plane of power transmission or coupling center. The units of measurement are mils.

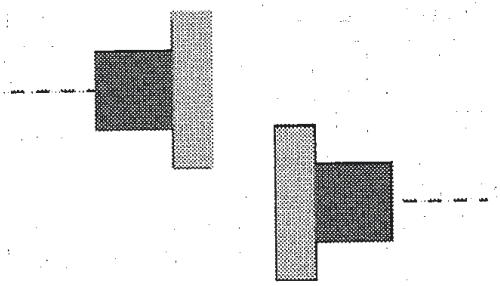

Fig. 2. Shafts in Offset Misaligned Position

There are four alignment parameters to be measured and corrected; vertical angularity, vertical offset, horizontal angularity, and horizontal offset. Values in Table 1 may be used as a general guide for acceptable limits of misalignment. Proper shaft alignment is especially critical when shafts are running at high speeds, thus the allowable limits of misalignment decrease as shaft speeds increase.

Table 1. Misalignment Tolerance Guide

RPM	Offset Misalignment (Mils)		Angular Misalignment (mils/inch)	
	Excellent	Acceptable	Excellent	Acceptable
600	±2.00	±4.00	0.80	1.25
900	±1.50	±3.00	0.70	1.00
1200	±1.25	±2.00	0.50	0.80
1800	±1.0	±1.50	0.30	0.50
3600	±0.50	±0.75	0.20	0.30
>4000	±0.50	±0.75	0.10	0.25

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