FLO FAB SINCE 1981
PUMP SOLUTIONS MANUFACTURER

Alignment		
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General Alignment

The following discussion of alignment applies primarily to horizontal, general service, centrifugal pumps driven by an independent driver through a flexible coupling and with pump and driver mounted on a common baseplate.

Pumps and drivers received from the factory with both machines mounted on a common baseplate were aligned or checked for alignability before shipment. All baseplates are flexible to some extend and, therefore, must not be relied on to maintain the factory alignment. Realignment is necessary after the complete unit has been leveled, the grout has set, and foundation bolts have been tightened. The alignment must be rechecked after the unit is piped and rechecked periodically as outlined in the following paragraphs. To facilitate field alignment, most manufacturers do not dowel the pump or drives on the baseplates before shipment, or at most, dowel the pump only.

When the drive is to be mounted at the place of installation, the pump is positioned and bolted to the base at the factory but the holes for fastening the driver may not be provided.

Shaft/coupling alignment

A flexible coupling is used to compensate for minor misalignment of the pump and driver shafts (refer to pump manufacturers' recommendations). The main purpose of the flexible coupling is to compensate for minor temperature changes and to permit end movement of the shaft without interference with each other while transmitting power from the driver to the pump. A "hot" alignment may be required for hot pumpage, steam turbines, etc.

There are two forms of misalignment between the pump shaft and the driver shaft, as follows: angular misalignment – shafts with axes concentric but not parallel; and parallel misalignment – shafts with axes parallel but not concentric.

Each motor and pump foot should be checked for soft foot. Soft foot is a condition that occurs when three feel of a four – (or more) footed piece of equipment are contacting the mounting surface and the fourth (or other) foot is not contacting the mounting surface, or when an equipment foot is contacting a mounting a mounting surface at an angle (part of the foot is elevated while part is in contact). Soft foot can be caused by an unlevel surface, bent foot, or improper shims. Unless this condition is corrected, when the bolts are tightened, the joint under the soft foot acts like a spring rater than a rigid connection.

Straightedge method of alignment

The necessary tools for checking the alignment of a flexible coupling are a straightedge and a taper gauge or a set of feeler gauges.

The faces of the coupling halves should be spaced far enough apart so that they cannot strike each other when the driver rotor is moved axially toward the pump as far as it will go. A minimum dimension for the separation of the coupling halves and misalignment limits are specified by the manufacturer.

Proceed with checks for angular and parallel alignment by the following method only if satisfied that face and outside diameters of the coupling halves are square and concentric with the coupling bores. If this condition does not exist, the alternate method of alignment described below is recommended. A check for angular alignment is made by inserting the taper gauge or feelers between the coupling faces at 90° intervals (see Figure 1).

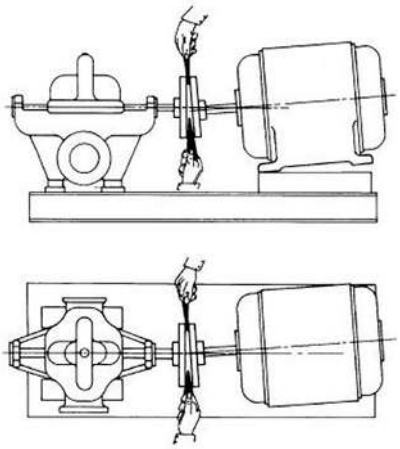

Figure 1 – Checking angular alignment

The unit will be in angular alignment when the measurements show that the coupling faces are the same distance apart at all points.

A check for parallel alignment is made by placing a straightedge across both coupling rims at the top, bottom, and at both sides. The unit will be in parallel alignment when the straightedge rests evenly across both coupling rims at all positions (see figure 2)

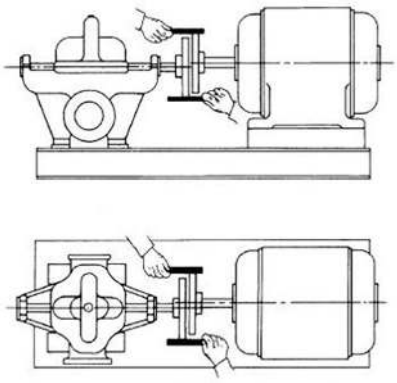

Figure 2 – Checking parallel alignment

Allowance may be necessary for coupling halves that are not of the same outside diameter. Angular and parallel misalignment are corrected by means of shims under the motor mounting feet. After each change, it is necessary to recheck the alignment.

Adjustment in one may disturb adjustments already made in another direction. It is wise to start with shims under all motor feet so it can be raised or lowered during initial or subsequent alignment procedures.

When the driver is to be mounted on the baseplate in the field, it is necessary to place the baseplate with pump on the foundation; to level the pump shaft; to check the coupling faces, suction, and discharge flanges for horizontal or vertical position; and to make any necessary corrective adjustments. Pads, if provided on the baseplate for the driver, should be coated with chalk to facilitate marking the location of the bolt holes. Place the driver on the baseplate so that the distance between the coupling halves is correct. The alignment of pump and driver coupling halves should then be checked and corrected. If the base is not predrilled, then scribe on the baseplate pads the circumference of the bolt holes in the driver feet. Remove the driver and drill and tap as required for bolts, allowing clearance for subsequent alignments. Replace driver on the baseplate, check motor rotation, insert the bolts, and align the driver before tightening. The subsequent procedures are the same as for factory-mounted units.

When units are aligned cold, it may be necessary to make allowance for vertical rise of the driver and/or pump caused by heating. Finally adjust at operating temperature. Refer to instruction supplied by manufacturer for specific coupling, i.e., rubber shear types for which the above instructions do not apply.

Dial indicator method of alignment

A dial indicator can be used to attain more accurate coupling alignment. First rough align by using straightedge, tapered gauge, or feelers using the procedure indicate previously.

Fasten the indicator to the pump half of the coupling, with the indicator button resting on the other half coupling periphery (see Figure 3).

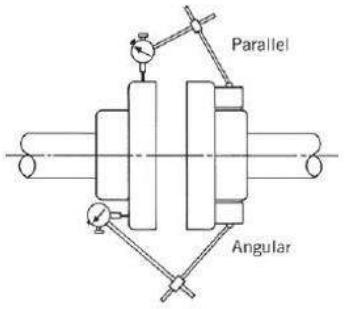

Figure 3 Dial indicator method

Set the dial to zero, and chalk mark the coupling half beside where the button rests. Rotate both shafts by the same amount, i.e., all readings on the dial must be made with button beside the chalk mark.

The dial readings will indicate whether the driver has to be raised, lowered, or moved to either side. After each adjustment, recheck both parallel and angular alignments. Accurate alignment of shaft centers can be obtained with this method, even where faces or outside diameter of the coupling halves are not square or concentric with the bores, provided all measurements for angular alignment are made between the same two points on the outside diameters. For angular alignment, change the indicator so it bears against the face of the same coupling half and proceed as described for parallel alignment. Gross deviations in squareness or concentricity, however, may cause problems due to coupling unbalance or abnormal coupling wear and may need to be corrected for reasons other than accomplishment of shaft alignment.

Indicator sag is the difference in the indicator readings due to gravitational forces on the indicator and set up deflection from the top position (12:00 o'clock) and the bottom position (6:00 o'clock). The best way to determine this value is to clamp the brackets on a piece of pipe the same distance they will be when placed on the equipment. Zero both indicators on top, then rotate to the bottom. The difference between the top and the bottom reading is the sag. Readings taken during the alignment process will have to be corrected by this amount.

Example: If the dial reading at the starting point (either top or one side) is set to zero and the diametrically opposite reading at the bottom or other side shows a plus or minus reading of 0.5 mm (0.020 in). The driver must be raised or lowered by the use of suitable shims or moved to one side or the other by half of this reading.

NOTE: Keep both shafts pressed radially to one side when taking concentricity reading and push both shaft ends as far apart as possible when checking for angular alignment.

Laser method alignment

Laser detector systems are used to determine the extent of shaft misalignment by measuring the movement of a laser beam across the surface of a detector plate as the shafts are rotated. Several different systems of lasers and detector are used, and the procedure for alignment is provide by the laser system's producer.