High Speed Motor Test Rig

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Develop a test rig to test to qualify all TT-Series compressor electric motors, measuring the efficiency, and torque with a maximum 40,000 RPM rotation speed.

Abstract

- Couple compressor motor shafts together to mimic a motor-generator system.
- Due to high speeds, precise alignment is a necessity.
- Flexible coupler is used to manage misalignment errors.
- Shims and set screws are used to achieve lateral and vertical alignment.
- Natural frequency of rotating assembly: 940 Hz.

Background

- Motor-generator systems tests motor performance by varying the load through the generator.
- In this system, one compressor works as the driving motor, the other as the generator.
- Magnetic bearings provide contact free levitation.
- Test rig is built to work with all TT series compressor, which use the same external housing.

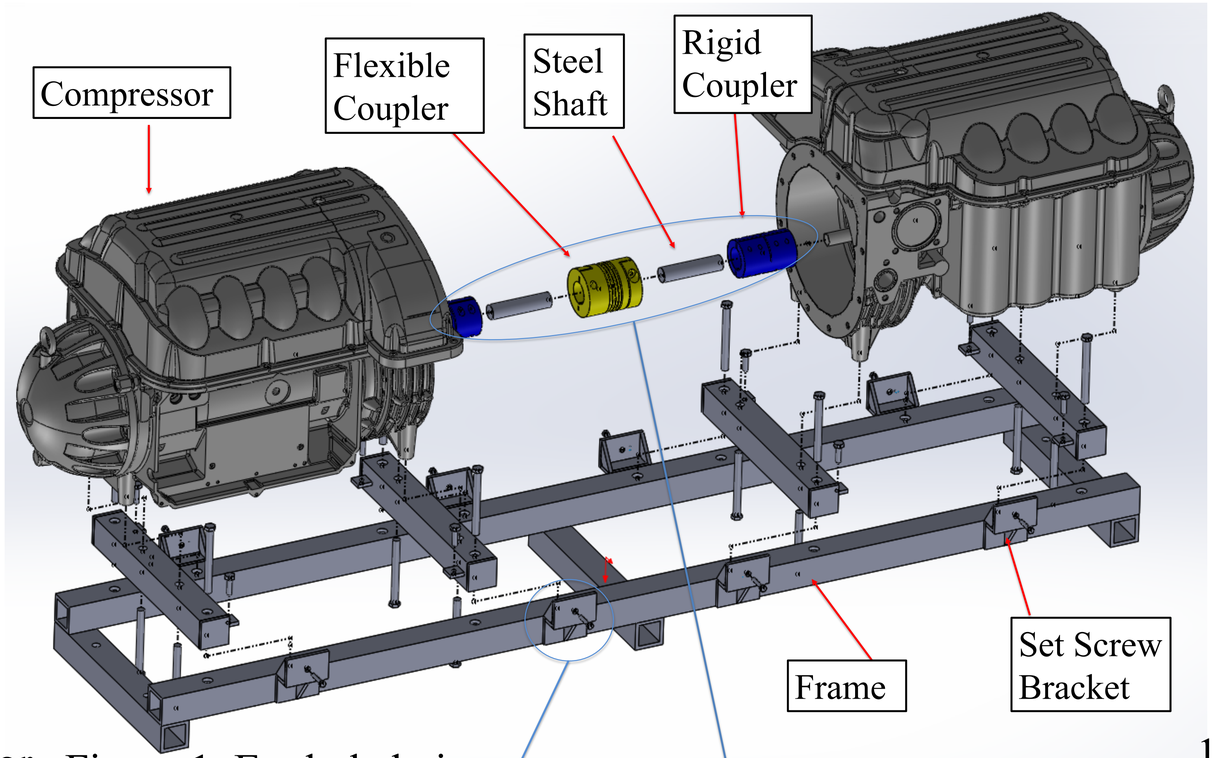

Figure 1. Exploded view.

Figure 2. Set Screw Bracket.

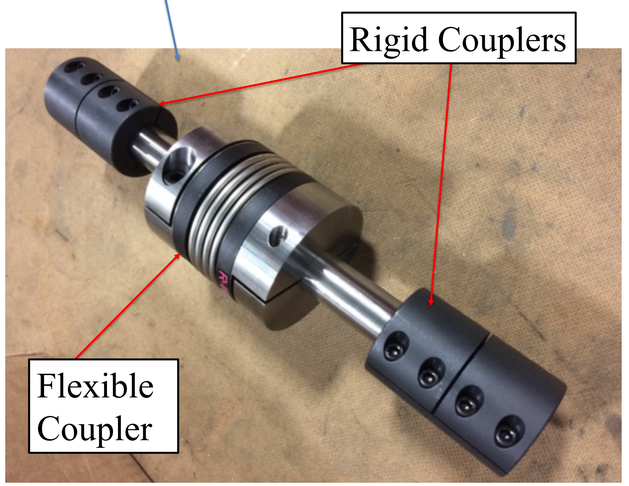

Figure 3. Rotating Assembly.

Alignment Specifications

- Shaft angle (θ) induced from shim width (a).

$$\theta = tan^{-1}\frac{a}{b}$$

- Shaft elevation displacement (y).

$$y = c - \cos(\theta) \cdot c$$

- (b) distance between front and rear compressor mounts. (c) shaft height above mounting surface.
- Dial indicators used to perform shaft alignment. Accuracy of .001”

Assembly Procedure

1. Mount first compressor.
2. Secure rigid couplers, steel dowels, and flexible couplers together to first compressor.
3. Mount second compressor.
4. Perform vertical alignment.
5. Perform horizontal alignment.