

RULES OF THUMB - TURBOMACHINERY

By Neal Wikert

H2S Service:

Alloy Steel / 410 SS / 17-4PH: All three materials are acceptable at different strength levels. Low alloy steels like 4330 could be used to HRC 22 max (UTS app. 113 ksi max), 410 stainless steel can be used up to HRC 25 (UTS app. 126 ksi) and 17-4PH can be used up to 33 HRC (UTS app. 140 ksi). These limits are outlined in NACE MR0175. Corrosion resistance is in the same order. 17-4PH is the material of choice if there is any chance of H₂S reacting to form H₂SO₄, or any other corrosive byproduct, in a particular stage(s).

Impeller manufacturing notes:

Double Temper weld procedure for H₂S service:

1600F normalize w/ oil quench

First temper: 1225F +/-15 F

Second Temper: 1175 to 1200F

Impeller Repair Notes:

Impeller Bore Repair

API687: Welding and thermal spraying are the only accepted methods. Chrome or nickel plating is strictly forbidden due to the difference in thermal growth coefficients. Thermal spray coatings have recommended finished thickness limits as follows:

- 7-25 mils for high velocity fuel processes and
- 3-10 mils for combustion processes

Vibration - Common Causes

Unbalance – Most common cause of vibration. Frequency is 1 per running speed.

Bent Shaft – Predominantly 1 per running speed, sometimes 2 times. It is accompanied by a high axial vibration component.

Bearings, Sleeve – Excessive clearance will result in vibration with a frequency of 1 time running speed.

Misalignment – Will result in a vibration with a frequency that can be 1, 2, or 3 times running speed. It is accompanied by a high axial vibration and may be as high as 1.5 times the vertical or horizontal readings.

Oil Whip – May occur in lightly loaded sleeve bearings. The frequency of vibration is sub synchronous (below running speed).

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