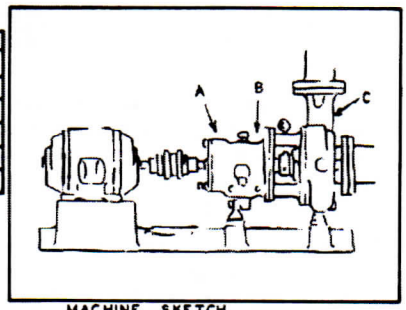
Vibration Analysis – Continued

Cause	Amplitude	Frequency	Phase	Remarks
Unbalance	Largest in radial direction. Proportional to unbalance	1 x RPM	Single reference mark	Unbalance
Misalignment of coupling or bearings and bent shaft	Axial direction vibration 50% or more of radial	1 x RPM normally	single, double, or triple	Easily recognized by large axial vibration. Excessive flange loading can contribute to misalignment
Bad Anti-friction bearings	Unsteady	Very high. Several time RPM	Erratic	Largest high-frequency vibration near the bad bearing.
Mechanical looseness		2 x RPM	Two reference marks. Slightly erratic.	Check grouting and bed plate bolting.
Bad drive belts	Erratic or pulsing	1, 2, 3 & 4 x RPM of belts	Unsteady	Use strobe light to freeze faulty belt.
Electrical	Disappears when power is turned off.	1 or 2 x synchronous frequency	Single or rotating double mark	3600 or 7200 cps for 60 cycle current.
Hydraulic forces		No. of impeller vanes x RPM		Rarely a cause of serious vibration

Fig. 3 Vibration Identification Chart

VIBRATION HISTORY

DATE 10/4
MACHINE GOULDS MODEL 3196
LOCATION
NAME
INSTRUMENT MODEL 600
S N 222 B078
OPERATOR ERIC HIGGINS



MACHINE SKETCH

PICKUP POSITION		FILTER OUT		FILTER IN							
		MILS	CPM	MILS	CPM	MILS	CPM	MILS	CPM	IN/SEC	CPM	IN/SEC	CPM
A	H												
	V												
	A												
B	H												
	V												
	A												

Fig. 4 Vibration Data Sheet

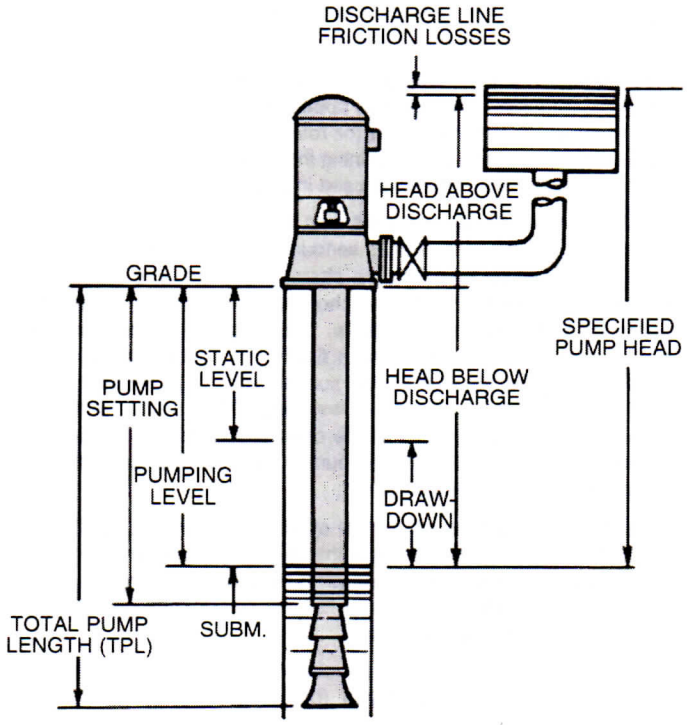
TECH-B-7 Vertical Turbine Pumps

Turbine Nomenclature

1. **DATUM OR GRADE** - The elevation of the surface from which the pump is supported.
2. **STATIC LIQUID LEVEL** - The vertical distance from grade to the liquid level when no liquid is being drawn from the well or source.
3. **DRAWDOWN** - The distance between the static liquid level and the liquid level when pumping at required capacity.
4. **PUMPING LIQUID LEVEL** - The vertical distance from grade to liquid level when pumping at rated capacity. Pumping liquid level equals static water level plus drawdown.
5. **SETTING** - The distance from grade to the top of the pump bowl assembly.
6. **TPL (TOTAL PUMP LENGTH)** - The distance from grade to lowest point of pump.
7. **RATED PUMP HEAD** - Lift below discharge plus head above discharge plus friction losses in discharge line. This is the head for which the customer is responsible and does not include any losses within the pump.
8. **COLUMN AND DISCHARGE HEAD FRICTION LOSS** - Head loss in the pump due to friction in the column assembly and discharge head. Friction loss is measured in feet and is dependent upon column size, shaft size, setting, and discharge head size. Values given in appropriate charts in Data Section.
9. **BOWL HEAD** - Total head which the pump bowl assembly will deliver at the rated capacity. This is curve performance.
10. **BOWL EFFICIENCY**- The efficiency of the bowl unit only. This value is read directly from the performance curve.
11. **BOWL HORSEPOWER**- The horsepower - required by the bowls only to deliver a specified capacity against bowl head.

$$\text{BOWL HP} = \frac{\text{Bowl Head x Capacity}}{\text{3960 x Bowl Efficiency}}$$

12. **TOTAL PUMP HEAD** - Rated pump head plus column and discharge head loss. Note: This is new or final bowl head.
13. **SHAFT FRICTION LOSS** - The horsepower required to turn the lineshaft in the bearings. These values are given in appropriate table in Data Section.



14. **PUMP BRAKE HORSEPOWER** - Sum of bowl horsepower plus shaft loss (and the driver thrust bearing loss under certain conditions).
15. **TOTAL PUMP EFFICIENCY (WATER TO WATER)** -The efficiency of the complete pump less.the driver, with all pump losses taken into account.

$$\text{Efficiency} = \frac{\text{Specified Pump Head x Capacity}}{\text{3960 x Brake Horsepower}}$$

16. **OVERALL EFFICIENCY (WIRE TO WATER)** - The efficiency of the pump and motor complete. Overall efficiency = total pump efficiency x motor efficiency.
17. **SUBMERGENCE** - Distance from liquid level to suction bell.