

### Pumping Plant Detailed Evaluation Worksheet

Land user \_\_\_\_\_ Field office \_\_\_\_\_  
Observer \_\_\_\_\_ Date \_\_\_\_\_ Checked by \_\_\_\_\_ Date \_\_\_\_\_  
Field name or number \_\_\_\_\_ Acres irrigated \_\_\_\_\_

**Hardware Inventory:**

Power plant:

Electric motor(s):	<u>Main pump</u>	<u>Booster (if used)</u>
Make	_____	_____
Model	_____	_____
Rated rpm	_____	_____
Rated hp	_____	_____

Internal combustion engine:

Make \_\_\_\_\_  
Model \_\_\_\_\_  
Continuous rated hp at output shaft \_\_\_\_\_ hp at \_\_\_\_\_ rpm  
Comments about condition of power plant \_\_\_\_\_  
\_\_\_\_\_

Gear or belt drive mechanism:

Type: (check one) direct drive \_\_\_\_\_ gear drive \_\_\_\_\_ belt drive \_\_\_\_\_  
\_\_\_\_\_ rpm at driver \_\_\_\_\_ rpm at pump

Pumps

Type: (centrifugal,  
turbine, submers.) \_\_\_\_\_  
Make \_\_\_\_\_  
Model \_\_\_\_\_  
Impeller diameter \_\_\_\_\_  
Number of impellers \_\_\_\_\_  
Rated flow rate (gpm) \_\_\_\_\_  
at head of (ft) \_\_\_\_\_  
at rpm \_\_\_\_\_

Pump curves: Attached \_\_\_\_\_ (yes or no)

Comments about condition of equipment \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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Existing suction or turbine column set-up (sketch showing dimensions)

Existing discharge set-up (sketch showing dimensions)

### Data and computations:

Total Dynamic Head (TDH):

Elevation difference - water surface to pump outlet \_\_\_\_\_ feet

Pressure reading at pump outlet \_\_\_\_\_ psi

Pressure at pump inlet (where supply is pressurized) \_\_\_\_\_ psi

Estimated friction loss in suction pipe or pump column \_\_\_\_\_ feet

Miscellaneous friction loss \_\_\_\_\_ feet

TDH = (elevation difference between water source and pump discharge) + (discharge pressure - pressure at inlet) times 2.31 + (estimated suction pipe friction loss) + miscellaneous =

\_\_\_\_\_ = \_\_\_\_\_ feet

Flow rate:

Flow meter:

Flow rate = \_\_\_\_\_ gpm

Velocity meter:

Pipe ID \_\_\_\_\_ inches

Velocity \_\_\_\_\_ feet/second

Flow rate, Q, in gpm = (Velocity, in feet/second) x (2.45) x (pipe ID<sup>2</sup>) =

= \_\_\_\_\_ = \_\_\_\_\_ gpm

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Water horsepower:

$$\text{whp} = \frac{(\text{flow rate, in gpm}) \times (\text{TDH, in feet})}{3960} = \text{_____ hp}$$

### Energy input

Electric:

Disk revolutions \_\_\_\_\_

Time: min \_\_\_\_\_ sec \_\_\_\_\_ = \_\_\_\_\_ sec

Meter constant (Kh) \_\_\_\_\_

PTR (power transformer ratio - usually 1.0)<sup>1/</sup> \_\_\_\_\_

CTR (current transformer ratio - usually 1.0)<sup>1/</sup> \_\_\_\_\_

$$\text{KW} = \frac{(3.6) \times (\text{disk rev}) \times (\text{Kh}) \times (\text{PTR}) \times (\text{CTR})}{(\text{time, in seconds})} = \text{_____ (kwh/h)}$$

Diesel or gasoline:

Evaluation time: hours \_\_\_\_\_ minutes \_\_\_\_\_ = \_\_\_\_\_ hours

Fuel use \_\_\_\_\_ gallons (a small quantity of fuel may also be weighed, at 7.05 lb/gal for diesel and 6.0 lb/gallon for gasoline)

$$\frac{(\text{fuel use, in gallons})}{(\text{time, in hours})} = \text{_____} = \text{_____ gallons/hour}$$

Propane:

Evaluation time: hours \_\_\_\_\_ minutes \_\_\_\_\_ = \_\_\_\_\_ hours

Fuel use \_\_\_\_\_ lb (weigh fuel used from small portable tank)

$$\frac{(\text{fuel use, in lb})}{(4.25 \text{ lb/gal}) \times (\text{time, in hr})} = \text{_____} = \text{_____ gallon/hours}$$

Natural gas:

Evaluation time: hours \_\_\_\_\_ minutes \_\_\_\_\_ = \_\_\_\_\_ hours

Meter reading: End \_\_\_\_\_ minus Start \_\_\_\_\_ = \_\_\_\_\_ mcf

$$\frac{(\text{fuel used, in mcf})}{(\text{time, in hr})} = \text{_____} = \text{_____ mcf/hr}$$

<sup>1/</sup> Some power companies use a type of meter that requires a PTR or CTR correction factor. Check with local power company.

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In the next step, the efficiency of the power plant and pump, as a unit, is compared to the Nebraska Standards for irrigation pumping plants. The Nebraska standard for a good condition, properly operated plant. If the comparison comes out less than 100%, there is room for improvement.

**Nebraska performance rating:**

Nebraska pumping plant performance criteria \_\_\_\_\_

**Pump and Power Plant**

Energy source	Whp-h/unit of energy	Energy unit
Diesel	12.5	gallon
Propane	6.89	gallon
Natural gas	61.7	mcf
Electricity	0.885	kW=kwh/hr
Gasoline	8.66	gallon

The Nebraska standards assume 75% pump and 88% electric motor efficiency.

Percent of Nebraska performance rating

$$= \frac{\text{(whp)} \times (100)}{\text{(energy input)} \times \text{(Nebraska criteria, in whp-h/unit)}} =$$

$$= \text{_____} = \text{_____} \%$$

Horsepower input:

Electric:

$$\frac{\text{(input kW)}}{(0.746 \text{ kW/bhp})} = \text{_____} = \text{_____} \text{ bhp}$$

Diesel:

$$(16.66) \times \text{(energy input, in gal/hr)} = \text{_____} = \text{_____} \text{ bhp}$$

Propane:

$$(9.20) \times \text{(energy input, in gal/hr)} = \text{_____} = \text{_____} \text{ bhp}$$

Natural gas:

$$(82.20) \times \text{(energy input, in mcf/hr)} = \text{_____} = \text{_____} \text{ bhp}$$

