

Cyclone Mark V Efficiency Calculations

Proprietary Information of Cyclone Power Technologies Inc.

Prepared By: Harry Schoell, Inventor

6 cyl Radial 37.7 in³ 2 in Bore x 2 in Stroke

Max RPM = 3,600 Piston Area (PA) 3.1416 in²

Admission Cutoff (CO) 5% – 0.100 in Clearance Volume (CV) 3%

Pressure (P) 3,200 psi Temp (T) 1,200° F

Steam Specific Volume, ft³/lb (V) 0.2827 ft³ @ 1200° F

(CV) Temp 1,905° F @ 3% (T) @ 1,200° F @ 5% = 1,465° F Temperature Average

V + Compression (VRC) 0.3433 @ $\frac{27}{1}$ Total Heat of Steam (hg) 1,570.3 BTU/lb

$\frac{37.7 \text{ in}^3 \times 3,600 \text{ RPM} \times 0.05 \text{ CO}}{166 \text{ Factor}} = 40.87 \times 3.2 P \times 1000 = 130.8 \text{ hp No Losses}$

Indicator Diagram hp = 131 No Losses

Mechanical Losses – hp:

3.75 hp – Blower

3.75 hp – High Pressure Pump

0.25 hp – Lube Pump

0.25 hp – Advance Cam Pump

0.25 hp – Clearance Valve Pump

3.5 hp – (Low Friction Bearings) Engine Friction (5.5 hp – Standard Bearings)

0.5% - Misc

12.25 + 20.3 = 32.55 hp Total Loss

Thermal Losses:

11.5% – Heat Exchanger

4.0% - Insulation

15.5% - Total Loss

131 x 0.155 = 20.3 hp Thermal Loss

131 – 32.55 = 98.45 hp NET

CO x PA = 0.31416 x 6 cyl = 1.88496 x 3,600 RPM = 6,785.85 in³/hr

$6,785.85 \times 60 \text{ min/hr} = \frac{407,151.36 \text{ in}^3}{1,728 \text{ in}^3/\text{ft}^3} = \frac{235.62 \text{ ft}^3}{.3433 \text{ hp}} = 686.33 \text{ lbs}$

$\frac{686.33 \text{ lbs}}{98.45 \text{ hp}} = 6.971 \text{ lb/hp NET(WR)}$

$\frac{686.33 \text{ lbs}}{\text{Gross } 131 \text{ hp}} = 5.23 \text{ Gross(WR)}$

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(WR) Water Rate in lbs/hp/hr

$$6.971(WR) \times 1570.3 \text{ hg} = 10,947.12 \text{ BTU/hp}$$

$$10,947.12 \text{ BTU/hp}$$

$$\frac{2545}{10,737.7} \text{ BTU} = 1 \text{ hp} = 0.232 = 23.2\% \text{ Efficiency}$$

(WHE) Waste Heat Recovery

4.05% Airside Efficiency Gain

500° F Air Inlet side 425° F NET

4.32% Water Side Efficiency Gain

350° F Water – 180° F Pan = 170° F NET

8.37% Efficiency from Heat Regeneration + 23.2 Base Engine Efficiency = 31.57%

31.57% Calculated Efficiency