TECHNICAL INFORMATION
Bulletin

NUMBER THIRTY-ONE

NOMOGRAM ESTIMATES TEMPERATURE
RATE OF RISE AT PUMP SHUTOFF

At shutoff, conditions, the brake horsepower of a centrifugal pump (except for small bearing losses) all goes toward heating the liquid contained within the pump casing. The rate of rise of the temperature depends on the amount of liquid contained in the casing and the power losses (shutoff horsepower) of the pump. For a high-head, low capacity pump, the temperature rise could be very rapid, while for a low-head, high capacity pump, the temperature rise could be quite slow.

Rapid temperature rise is of primary concern, and for this case transfer of heat to the casing may be neglected. The temperature rise of the liquid is then given by the relationship:

$$\Delta T = \frac{42.4\,P}{W\,C}$$

Where:

ΔT = temperature rate of rise, F/minute
P = brake horsepower at shutoff
W = net weight of liquid in pump, pounds
42.4 = conversion from bhp into Btu / minute
C = specific heat of fluid, Btu / lb-F

Example: A centrifugal pump contains 10 lb of water within the casing and has shutoff losses of 5 bhp. Find the temperature rate of rise.

Solution: (1) Join 10 on W-scale with 5 on P-scale and extend to reference line. (2) Align this point on reference line with 1.0 on C-scale and extend to ΔT-scale. Read answer as approximately 21 F / min.

W — Weight of fluid in pump – lb

C_p — Specific heat – Btu/lb-F

P — Pump HP

Reference line

ΔT — Temperature rise – F/min