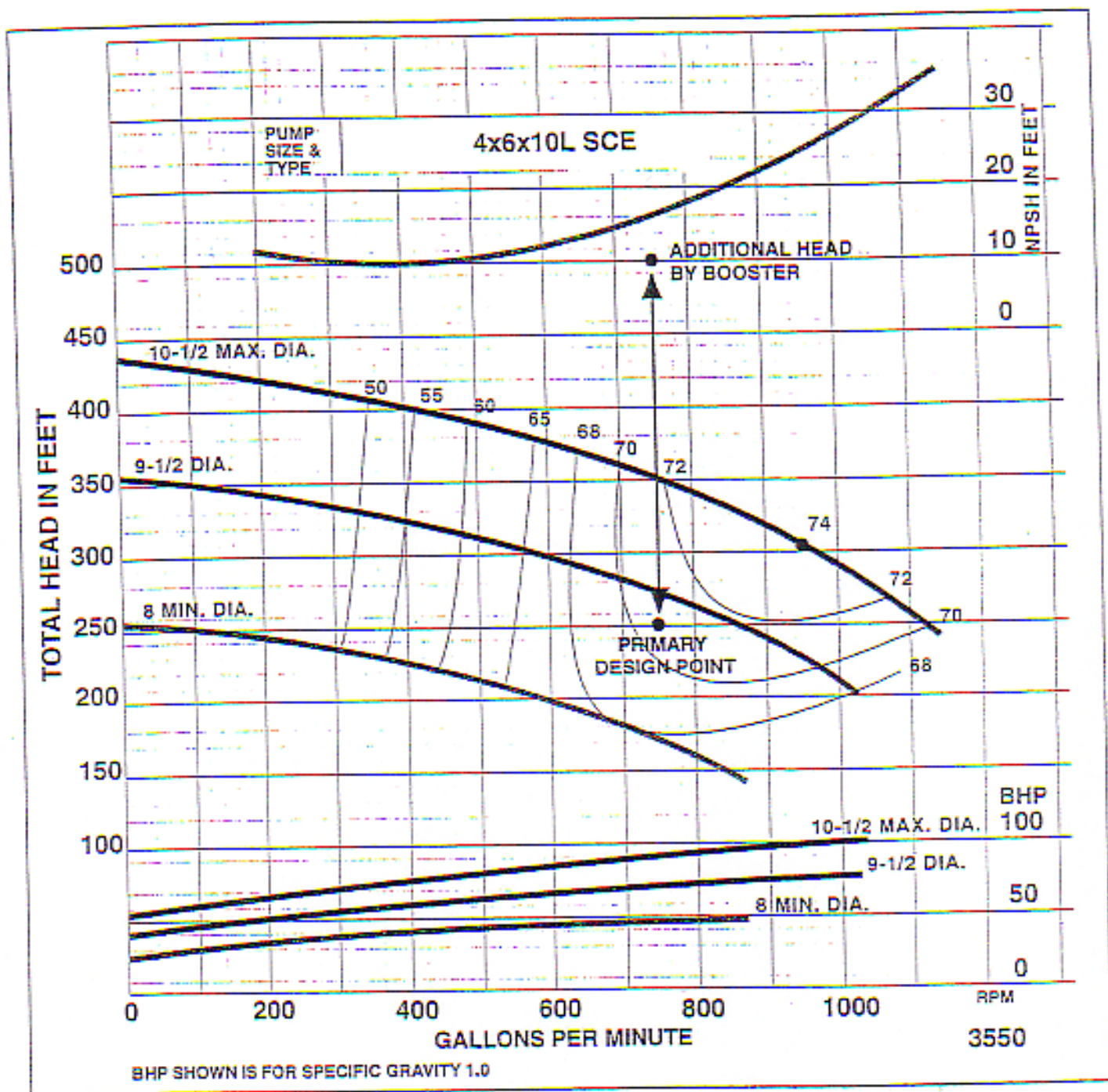


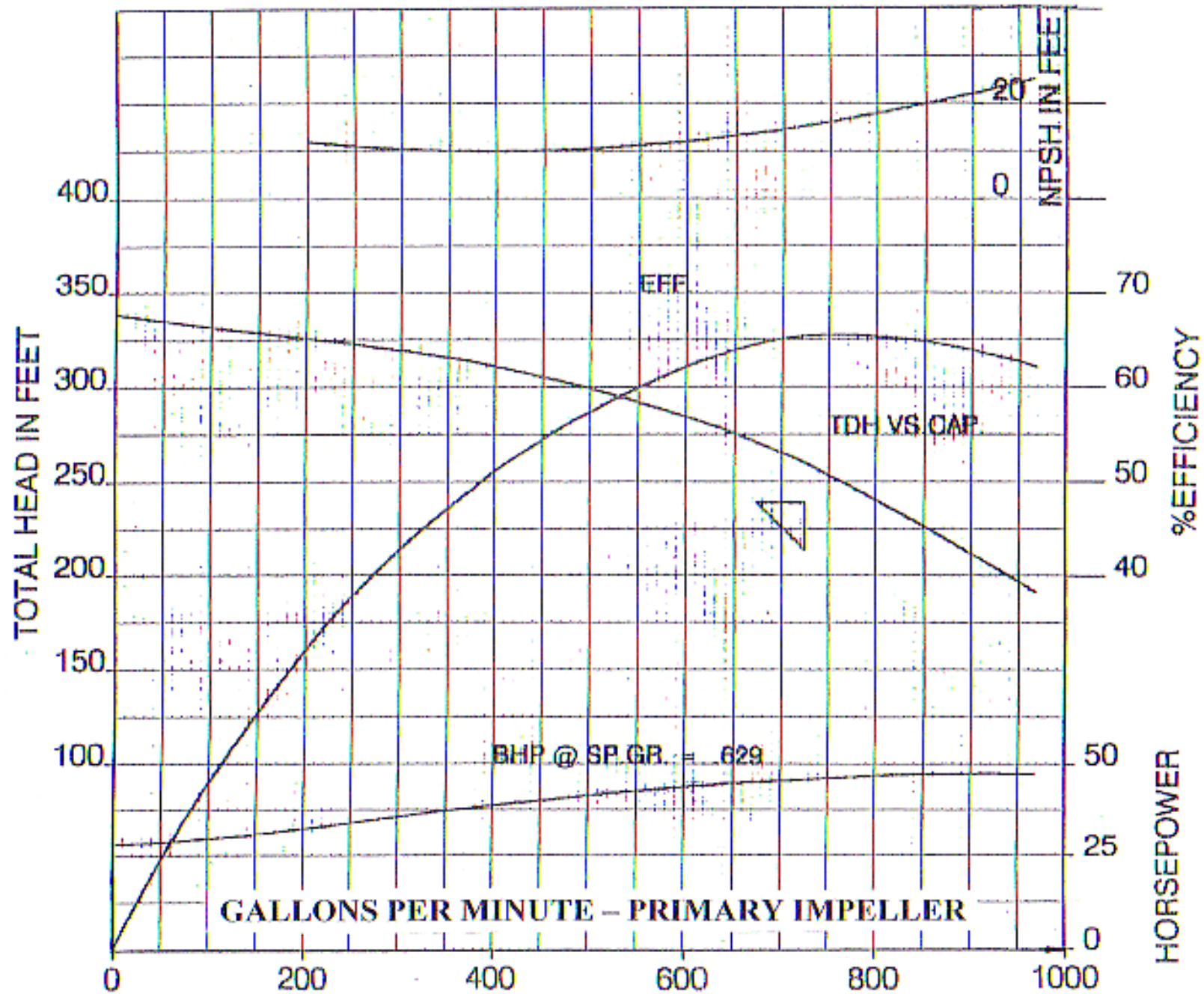
API CODE: BT PIN
INNER SEAL: QBQW – 2875
OUTER SEAL: QBQW – 2625

PRIMARY SEAL RECIRCULATION: API PLAN 23
SECONDARY SEAL RECIRCULATION: API PLAN 52

DUAL MECHANICAL SEAL INSTALLED IN PROTOTYPE PUMP

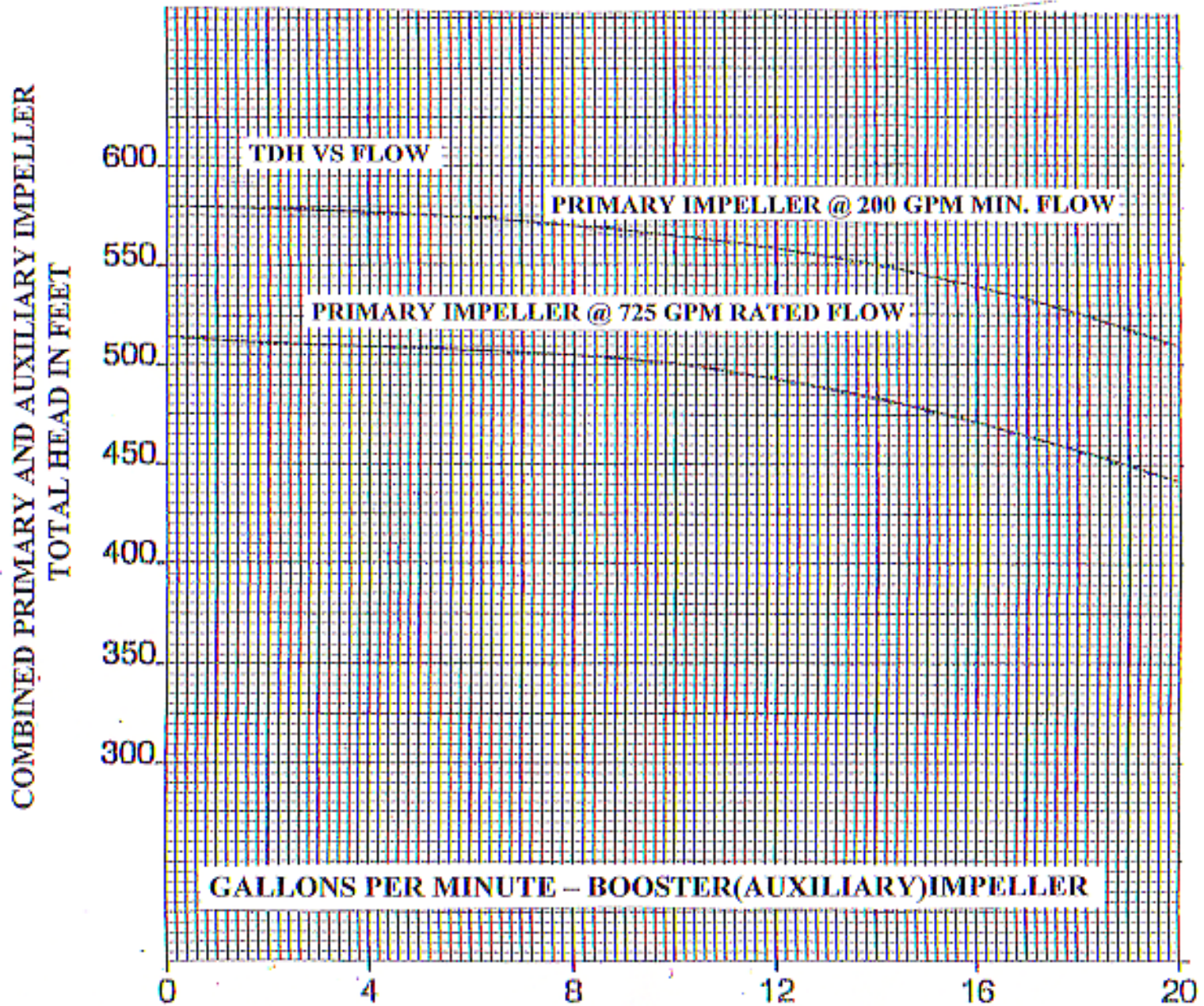


Select the primary impeller for the combined reflux plus product rated flows to envelop the reflux head required and incorporate an auxiliary impeller to boost the product (slipstream) flow to its required head. This dual-service design optimizes the hydraulic fits for both flowstreams, facilitates conformance with API selection recommendations and is substantially more power-efficient than a standard pump selected to envelop both sets of operating conditions.



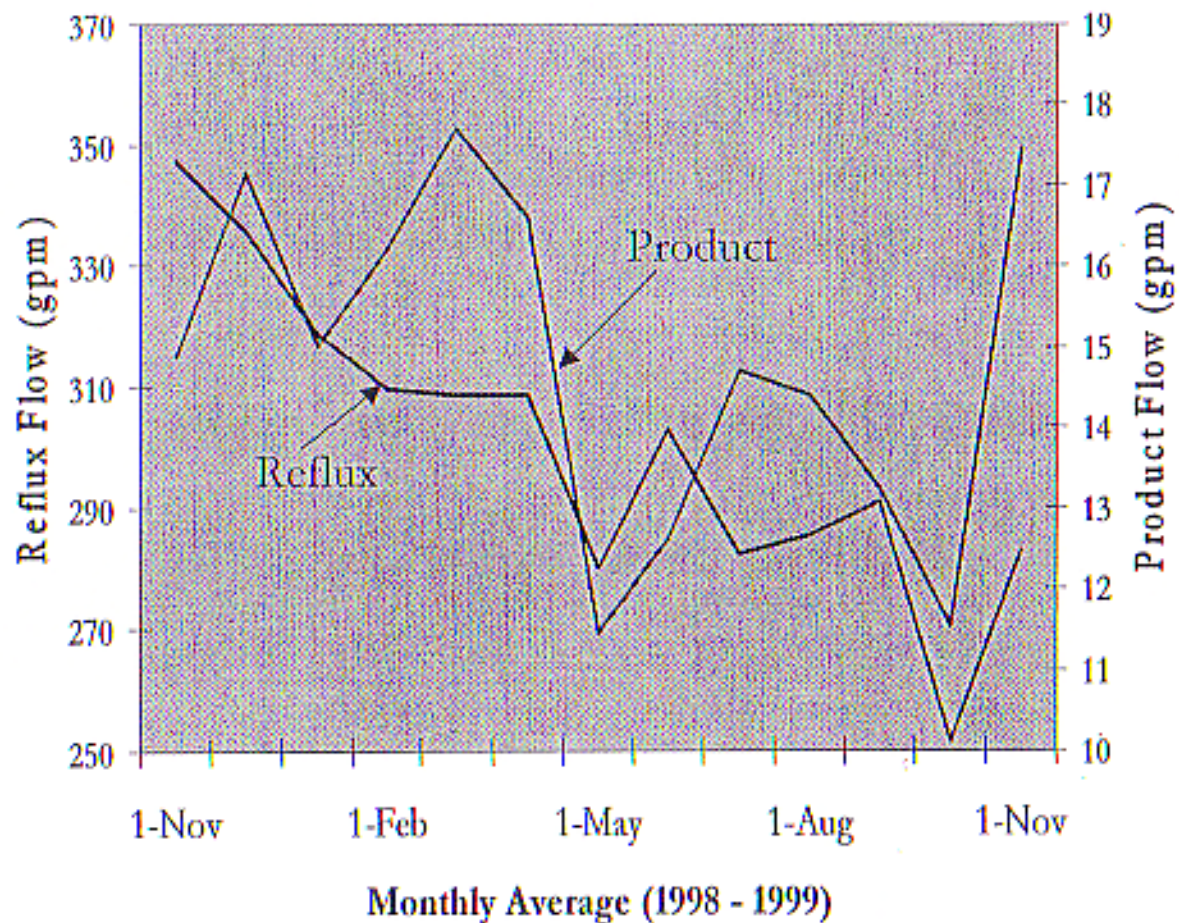
4 x 6 x 10 PROTOTYPE DUAL-SERVICE PUMP
Test curve showing primary impeller performance

Booster Impeller Performance



Operating and Maintenance History

- Started Up in Summer 1996
- No Failures Since Start up.



17th INTERNATIONAL PUMP USER'S SYMPOSIUM

March 6 – 9, 2000

George R. Brown Convention Center, Houston, Texas

USER CASE STUDY

SEAL LIFE FOR UNCONVENTIONAL REFINERY PROCESS PUMP

Innovative Low Cost Pumping Solution Proved to be Reliable

Advantages of Two Pumping Applications in Single Casing

Potential Capital Cost Savings

- Equipment Costs = ~\$40M per pump
- Lang Factor = ~3
- Total Installed Costs = ~\$120M/installed pump
- Savings for 2 pumps = ~\$240M

Potential Energy Cost Savings

- Annual saving = ~\$25M @ \$0.0625/kW-hr

Conclusions

- For this application, a single pump for two process services offers lower initial capital costs, improved energy efficiency and good equipment reliability. It meets API 610 selection criteria with shaft deflections at the seal similar to standard pump design.