meng 263 - Pump Performance Curves

(Mott: Chapter 13)

To determine the 'operating point' on this performance curve:

i. Determine the flowrate (data usually provided by the client)
ii. Determine the head added, h_A (data provided by your design and calculations)
iii. Select a 'candidate pump' from a manufacturer's composite selection chart (sometimes called a Quick Selection Chart)
iv. Find the detailed performance curve of the candidate pump in the manufacturer's catalog
v. On the curve locate the intersection point of flowrate and pump head on the chart. Mark the spot right on the curve.
vi. Read off the:
    - Pump Model Number
    - Pump Motor RPM
    - Impeller Size
    - Motor Horse Power
    - Pump Efficiency
    - NPSH Required

These item make up the Pump Specification.

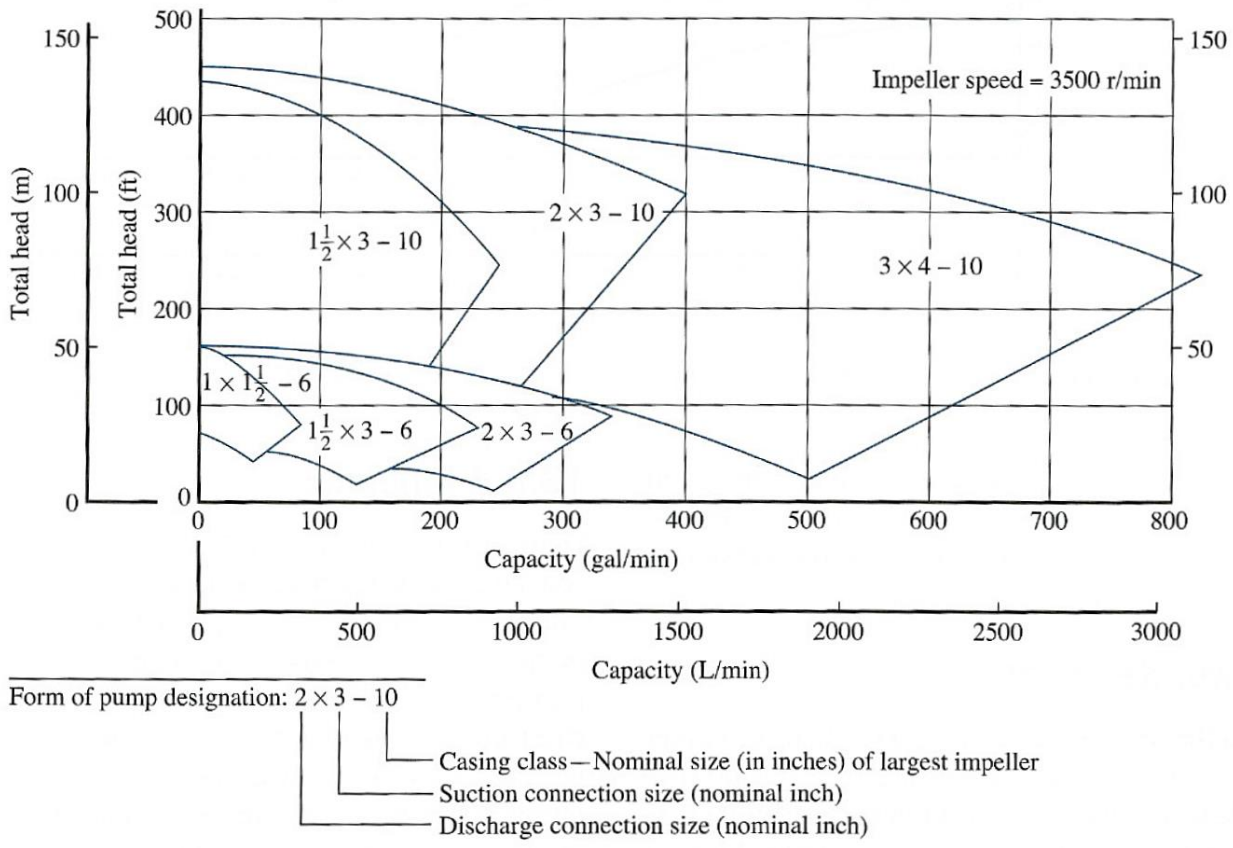

FIGURE 13.22 Composite rating chart for a line of centrifugal pumps.

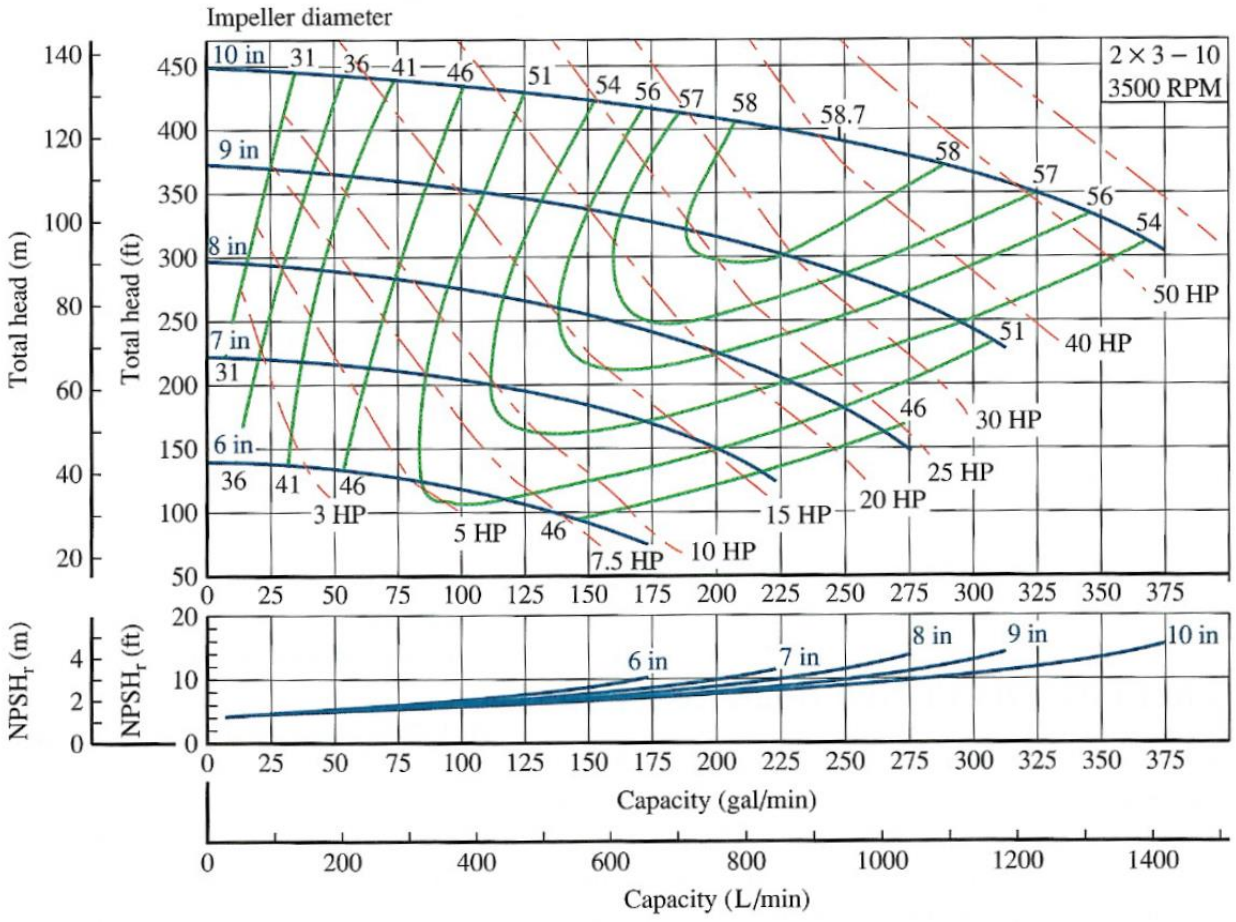

FIGURE 13.28 Complete pump performance chart for a 2 × 3 − 10 centrifugal pump at 3500 rpm. (*Source:* Reprinted by permission of ITT Corporation.)

Try a few pump selections and 'what-if' scenario.

Case 1

Desired Flow Conditions: **250 USGPM @ 250 feet of head**

Pump Specification:

- Model: 2x3-10 (inlet size, outlet size, maximum impeller diameter)
- Pump RPM: 3500 rpm
- Required Impeller Diameter (size): 8 ¾" (8 ½" is just too small)
- Motor Horse Power: 30 HP (runs at a little less power) (should you specify 40 HP?)
- Pump Efficiency: 56%
- $NPSH_R$: 10 feet
- Approximate Shut-off Head (no flow head): 350 feet (will this blow anything up?)

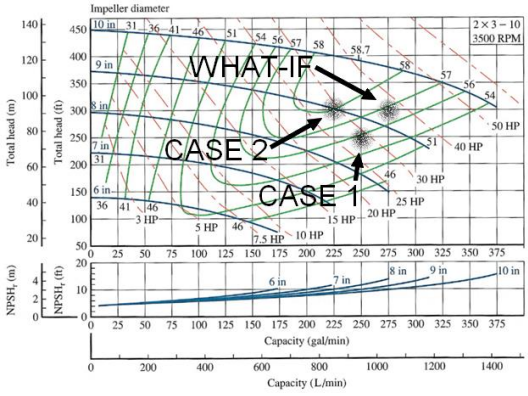

FIGURE 13.28 Complete pump performance chart for a 2 × 3 − 10 centrifugal pump at 3500 rpm. (*Source:* Reprinted by permission of ITT Corporation.)

Case 2

Desired Flow Condition: 225 USGM @ 300 feet of head

Pump Specification:

- Model: 2 x 3 – 10
- Pump RPM: 3500 rpm
- Required Impeller Diameter: 9”
- Motor Horse Power: 30 HP (but should likely specify a 40 HP so it only runs at ¾ capacity)
- Pump Efficiency: 58%
- $NPSH_R$: 8 or 9 feet
- Approximate Shut-off Head: 370 feet

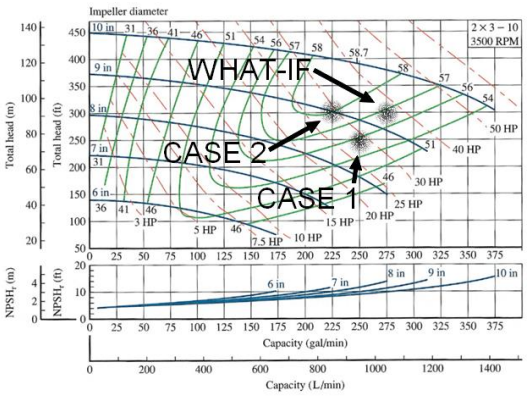

FIGURE 13.28 Complete pump performance chart for a 2 × 3 − 10 centrifugal pump at 3500 rpm. (*Source*: Reprinted by permission of ITT Corporation.)

What-If Scenario

Your client, from Case 2, wants …

New Desired Flow Conditions: **275 USGPM @ 300 feet of head**

What would you have to change to make him/her happy?

- If the flowrate alone was simply changed from 225 USGPM to 275 USGPM.
  The performance of the pump would operate along the 9” impeller line.
  Follow that line as the flowrate is increased. Notice that the head drops to about 270 feet and the pump motor HP required goes up to 33 or 34 HP.
  - If you had originally installed a 30 HP motor (the minimum it could have been), you would have burned out your motor by now simply by doing this test. It would have been better to originally install a 40 HP motor.
- To achieve the new flow conditions a new impeller will have to be installed. The new size will be 9 3/8” diameter.
  Also notice this performance point is getting really close to hitting the maximum capacity of that 40 HP motor. Do you also install a 50 HP motor now? Maybe. It depends on:
  - The way the system is used (continuous operation or does it run every now and then?)
  - How critical the system is (could it be down for a short time to swap out a burned out motor?)
  - Is your client flush with maintenance cash?
- Talk to your client and outline the minor risk associated with keeping that 40 HP motor. They will help you decide with to do.