

HOW TO SELECT PUMP PROBLEMS LABORATORY

**SOLVE TYPICAL ENGINEERING DESIGN
SITUATIONS ANY WHICH WAY YOU CAN.**

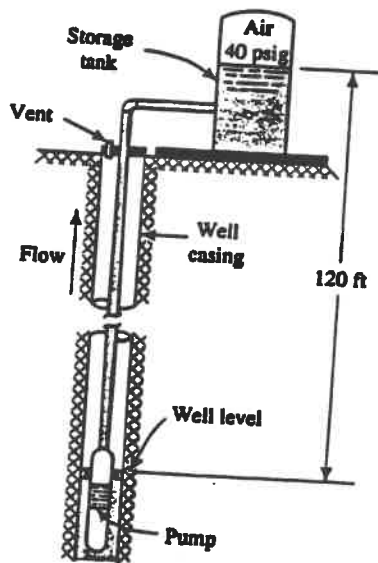
**PRESENT YOUR RESULTS IN A
PROFESIONAL LOOKING REPORT.
NO SLOPPY/MESSY CALCULATIONS
ALLOWED.**

Ms. Anaya

HOW TO SELECT PUMP PROBLEMS.

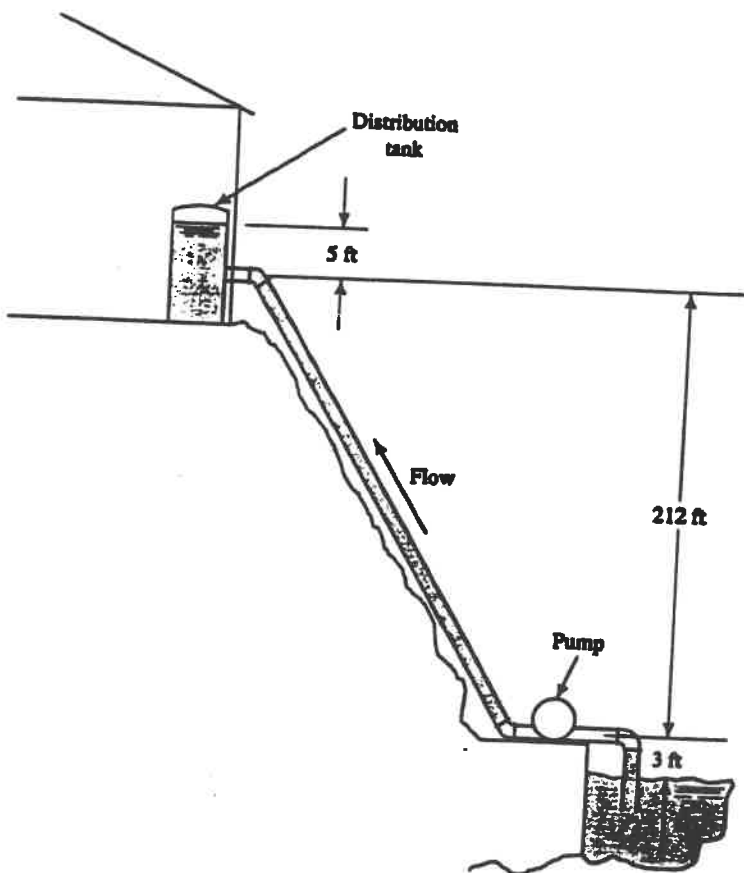
#1. A submersible deep-well pump is supposed to deliver 745 gallons/hr of water through a 1 inch schedule 40 pipe (commercial steel) when operating in the system below. Determine a) the power delivered by the pump to the water if an energy loss of 10.5 lb-feet/lb occurs in the piping system. b) From the pump charts given, find a suitable pump that will achieve the same effect. Include in the calculations the total energy loss of 10.5 lb-feet/lb. Determine how this pump, affects the air pressure in the storage tank. c) Repeat part b, but modify the calculations to include a revised energy loss that depends on the length of the pipe. The length of the pipe is 150 feet.

NOTE: 1 inch schedule 40 steel has an ID of 0.0874 feet
 $\epsilon = 0.000046$ meters or 0.00015 feet for commercial steel



For each pump selected, compute the weekly energy use for operating that pump for 60 hours a week. Electricity costs 12.43 cents per kilowatt-hr.

#2. Professor Crocker is building a cabin on a hillside and has proposed the water system shown below. The distribution tank in the cabin maintains a pressure of 30 psig above the water. There is an energy loss of 15.5 lb-ft/lb in the piping. The pump delivers 50 gpm. Determine a) the power delivered by the pump to the water if an energy loss of 15.5 lb-ft/lb occurs in the piping system. b) From the pump charts given, find a suitable pump that will achieve the same effect. Include in the calculations the total energy loss of 15.5 lb-ft/lb. Determine how this pump, affects the air pressure in the storage tank. c) Repeat part b, but modify the calculations to include a revised energy loss that depends on the length of the pipe. Assume the length of the discharge pipe is 250 feet and the length of the suction pipe is 15 feet. All pipes are 3 inch schedule 40 commercial steel pipes. Assuming that the vapor pressure of water is 3169 Pascals, determine for whatever pump is selected that the net positive suction head available in the system, will exceed the net positive suction head required for that pump. Note: a 3 inch schedule 40 pipe has an ID of 0.2557 feet $\epsilon = 0.000046$ meters or 0.00015 feet for commercial steel



For each pump selected, compute the weekly energy use for operating that pump for 60 hours a week. Electricity costs 12.43 cents per kilowatt-hr.

TABLE OF CONTENTS

Useful Pump Formulas	2
Series 90 Standard Pumps	3
Built To Order Curves	5

USEFUL PUMP FORMULAS

$$\begin{aligned} \text{Pressure (PSI)} &= \frac{\text{Head (Feet)} \times \text{Specific Gravity}}{2.31} \\ \text{Head (Feet)} &= \frac{\text{Pressure (PSI)} \times 2.31}{\text{Specific Gravity}} \\ \text{Vacuum (Inches of Mercury)} &= \frac{\text{Dynamic Suction Lift (Feet)} \times .883}{\text{Specific Gravity}} \\ \text{Horsepower (Brake)} &= \frac{\text{GPM} \times \text{Head (Feet)} \times \text{Specific Gravity}}{3960 \times \text{Pump Efficiency}} \\ \text{Horsepower (Water)} &= \frac{\text{GPM} \times \text{Head (Feet)} \times \text{Specific Gravity}}{3960} \\ \text{Efficiency (Pump)} &= \frac{\text{Horsepower (Water)}}{\text{Horsepower (Brake)}} \times 100 \text{ Per Cent} \\ \text{NPSH (Available)} &= \text{Positive Factors} - \text{Negative Factors} \end{aligned}$$

Affinity Laws: Effect of change of speed or impeller diameter on centrifugal pumps.

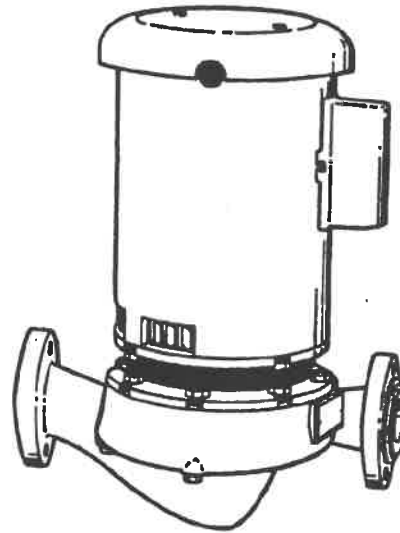
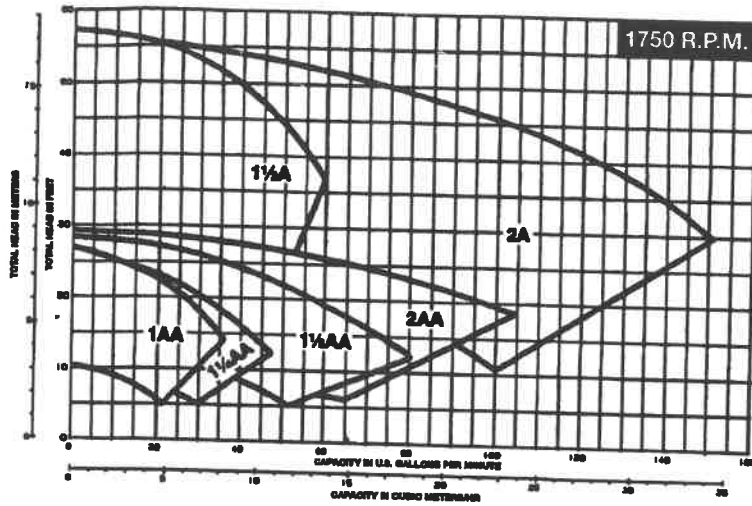
	GPM Capacity	Ft. Head	BHP
Impeller Diameter Change	$Q_2 = \frac{D_2}{D_1} Q_1$	$H_2 = \left(\frac{D_2}{D_1}\right)^2 H_1$	$P_2 = \left(\frac{D_2}{D_1}\right)^3 P_1$
Speed Change	$Q_2 = \frac{RPM_2}{RPM_1} Q_1$	$H_2 = \left(\frac{RPM_2}{RPM_1}\right)^2 H_1$	$P_2 = \left(\frac{RPM_2}{RPM_1}\right)^3 P_1$

Where Q = GPM, H = Head, P = BHP, D = Impeller Dia., RPM = Pump Speed

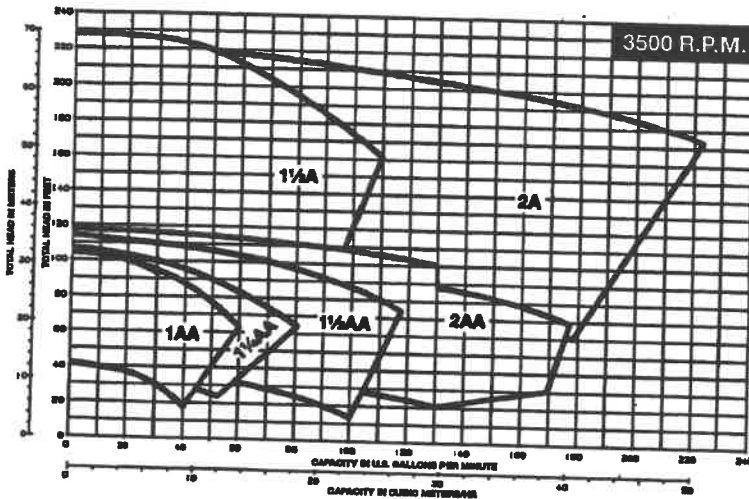
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SERIES 90 PUMP



SERIES 90

In-Line Mounted Centrifugal Pump Performance Curves

Part of the

**ESP
CAD**

and

ESP PLUS

Equipment Selection Programs

Bell & Gossett

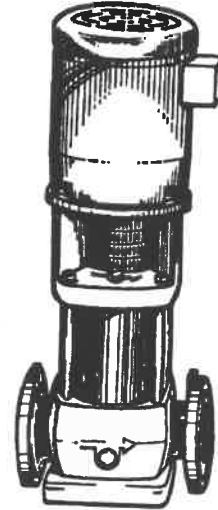
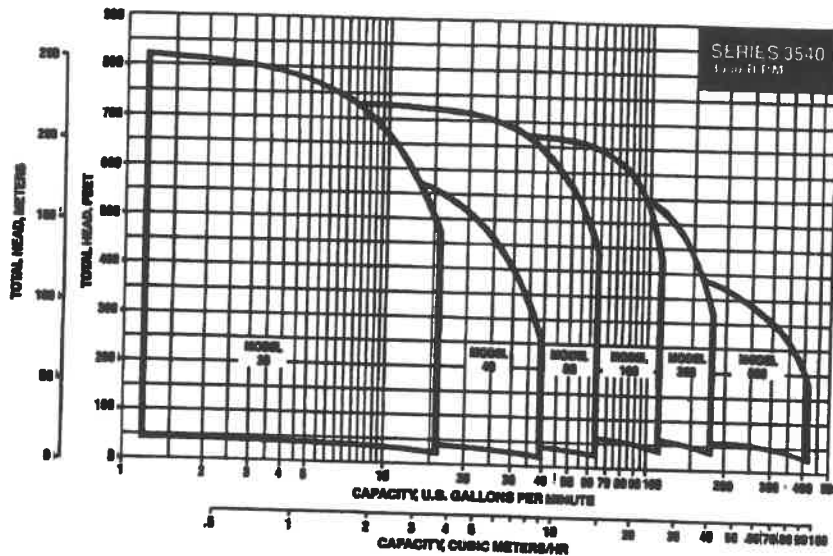


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60 HERTZ PERFORMANCE CURVES

Multi-Stage Centrifugal Pump Performance Curves

Part of the
ESP PLUS
Equipment Selection Programs

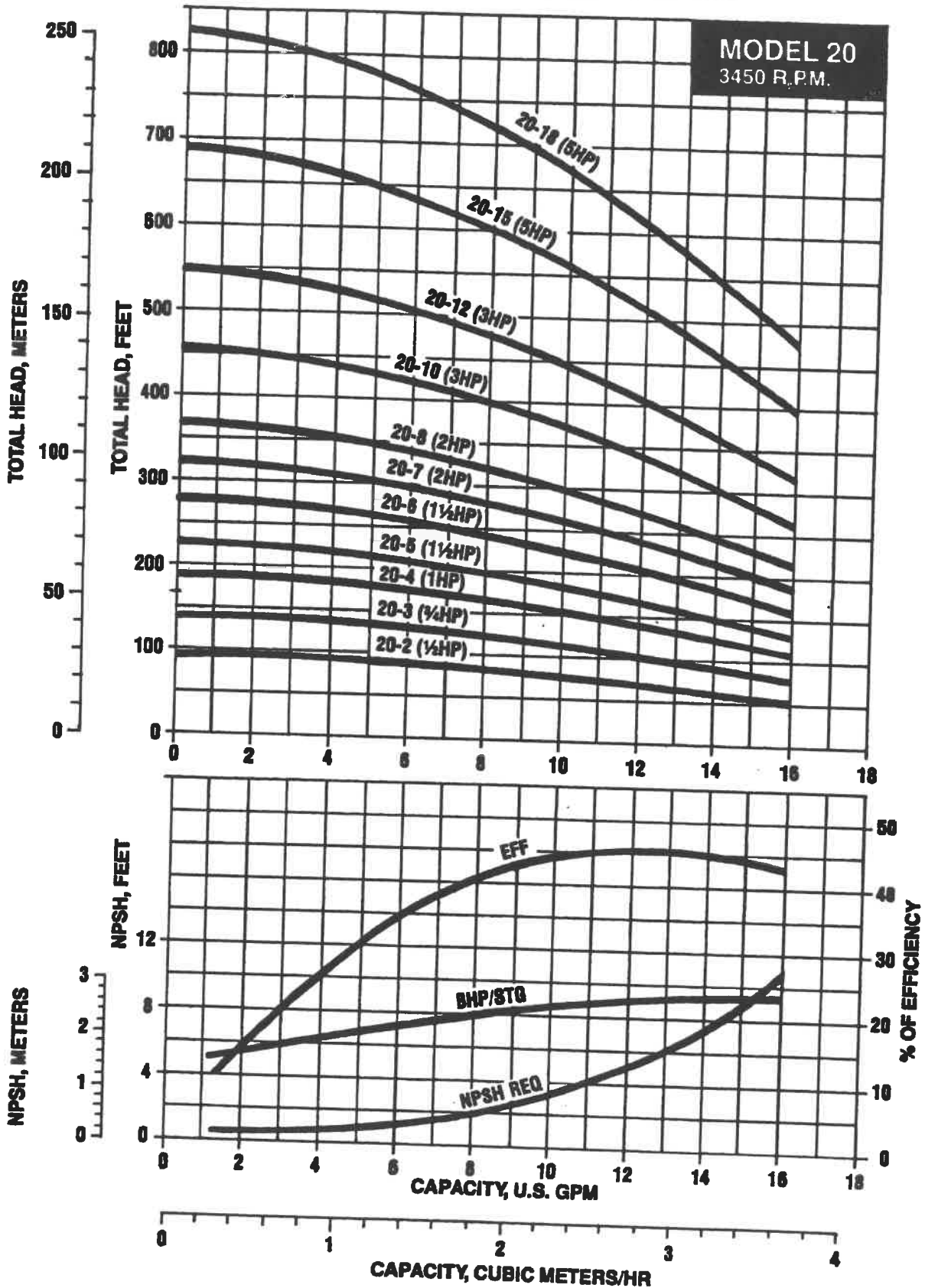
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ITT Bell & Gossett
ITT Fluid Technology Corporation

SERIES 3540

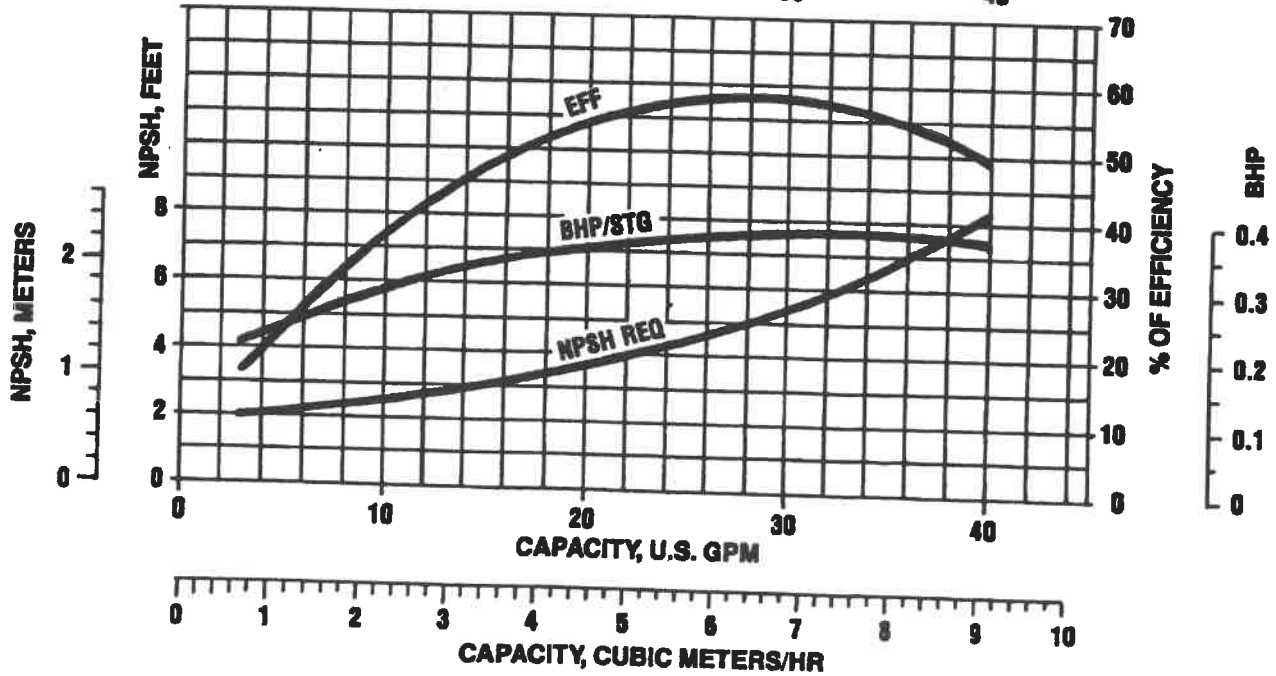
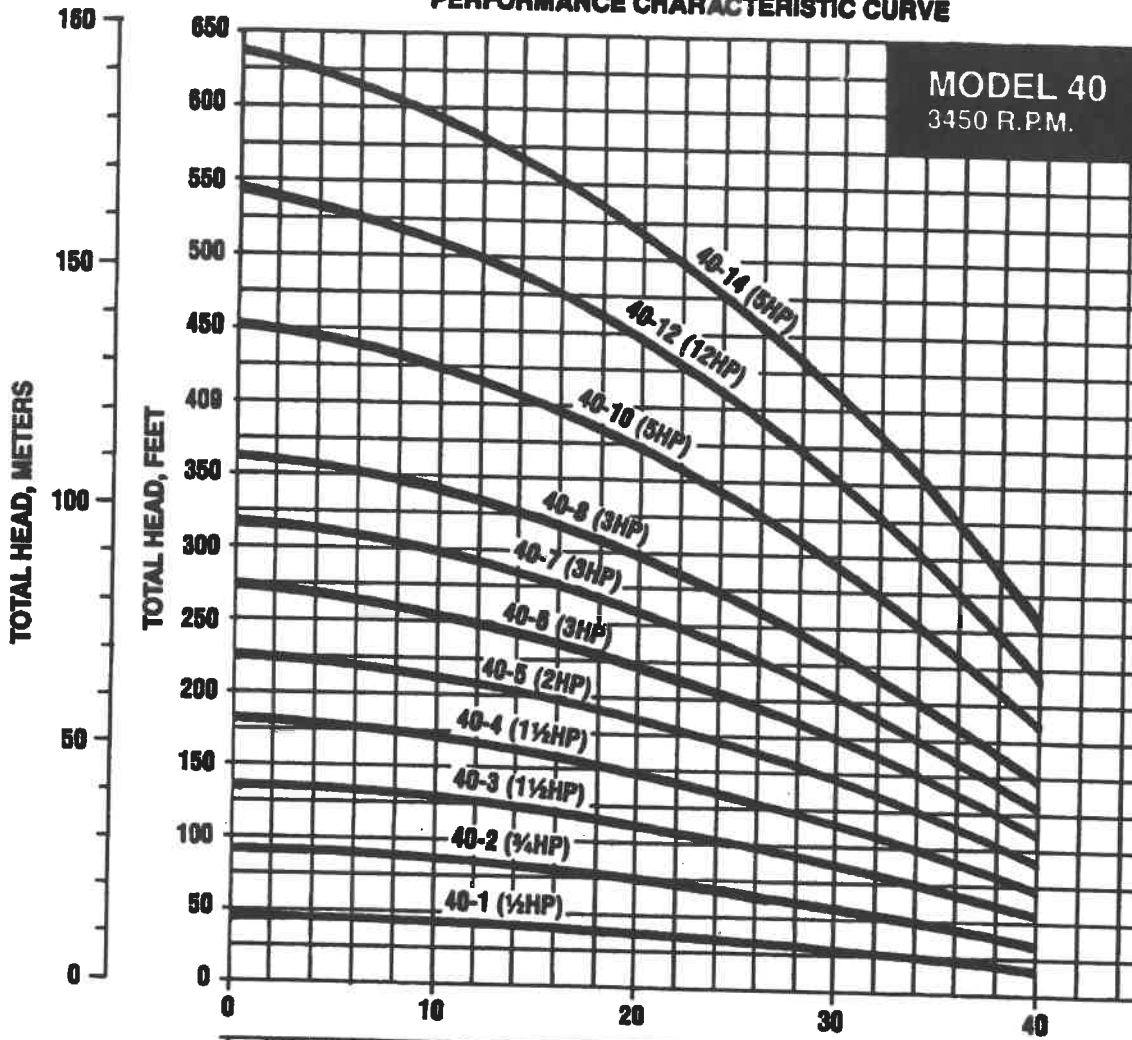
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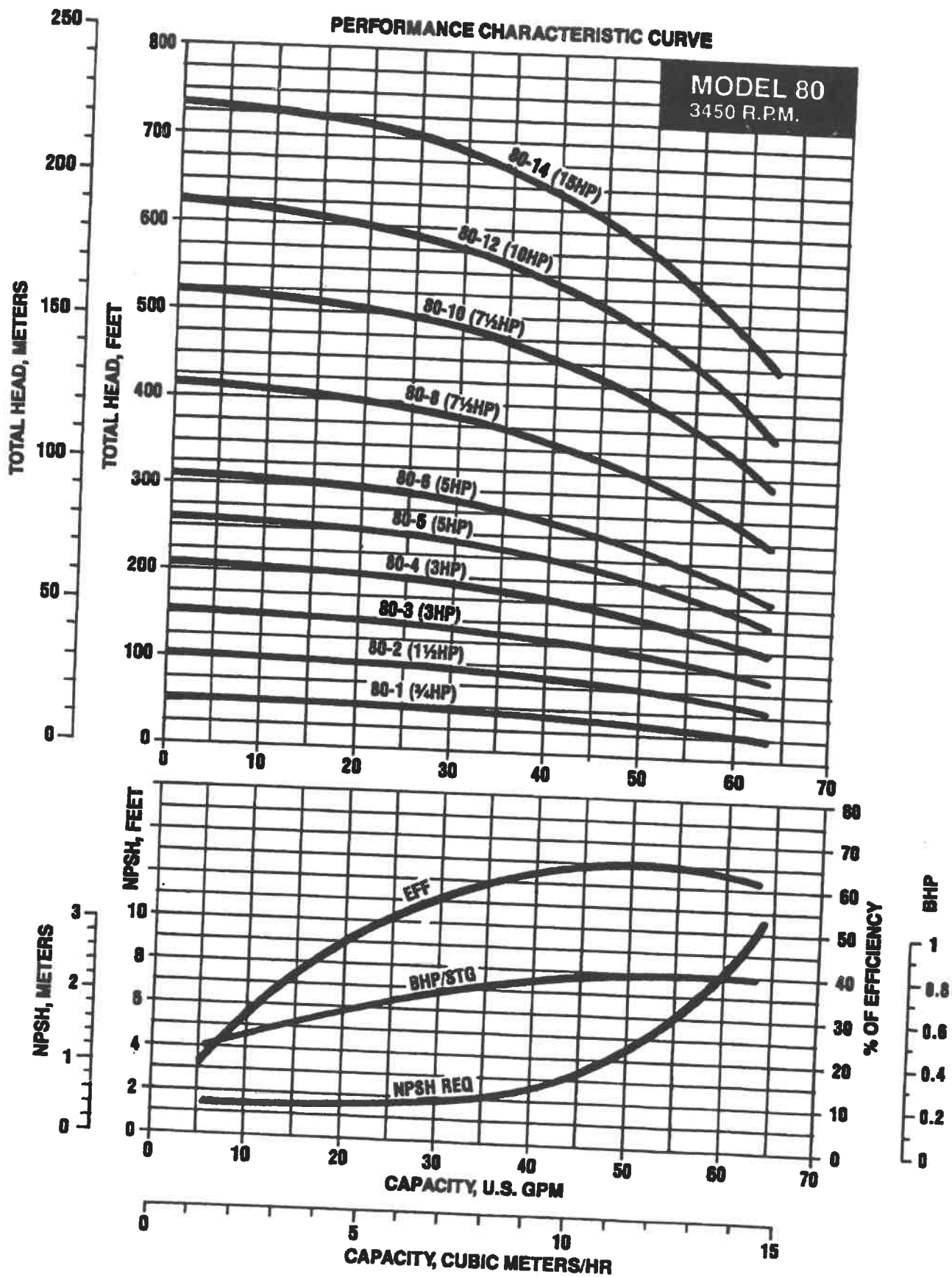
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3450 R.P.M.

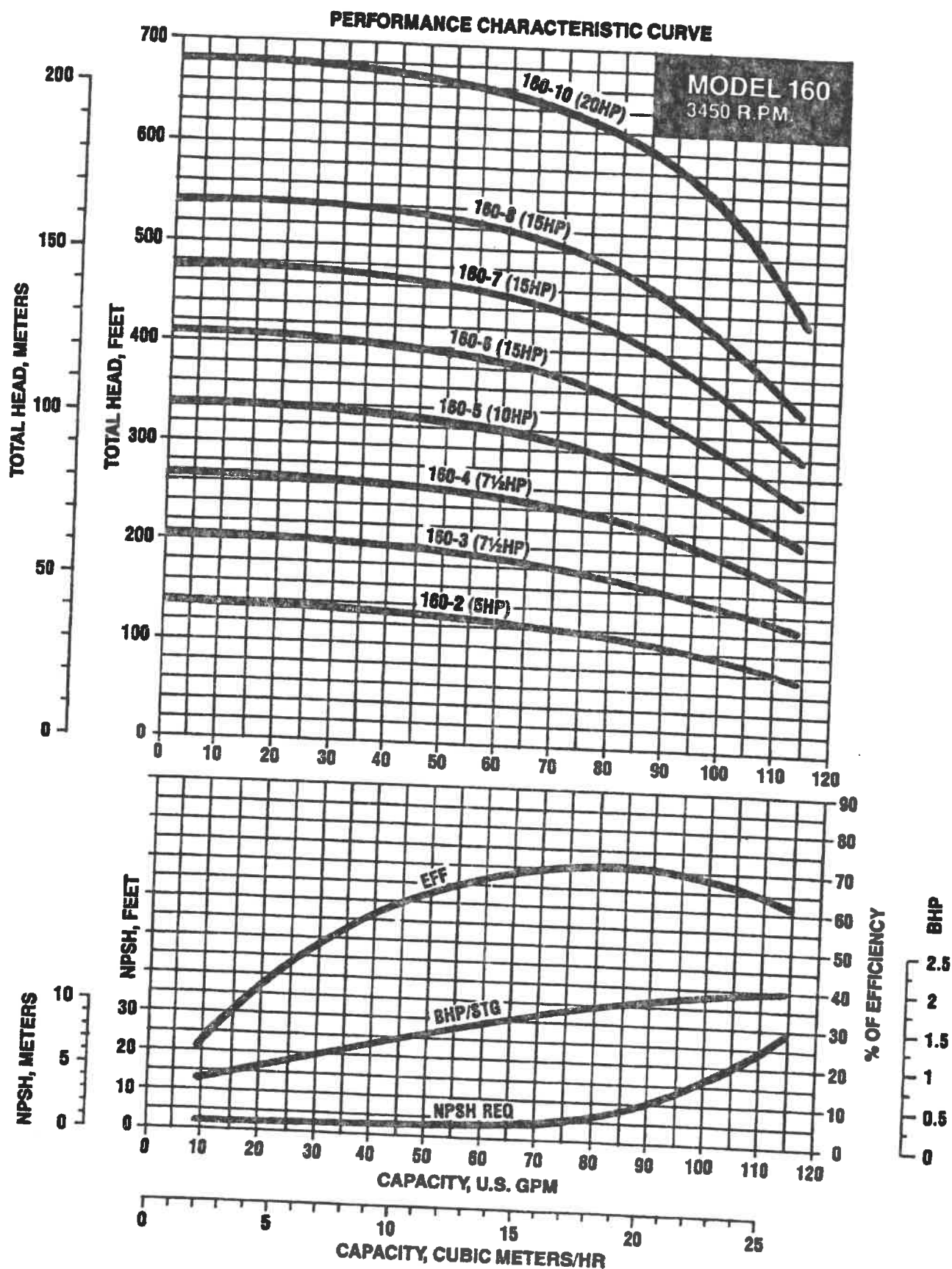


PERFORMANCE CHARACTERISTIC CURVE

MODEL 40
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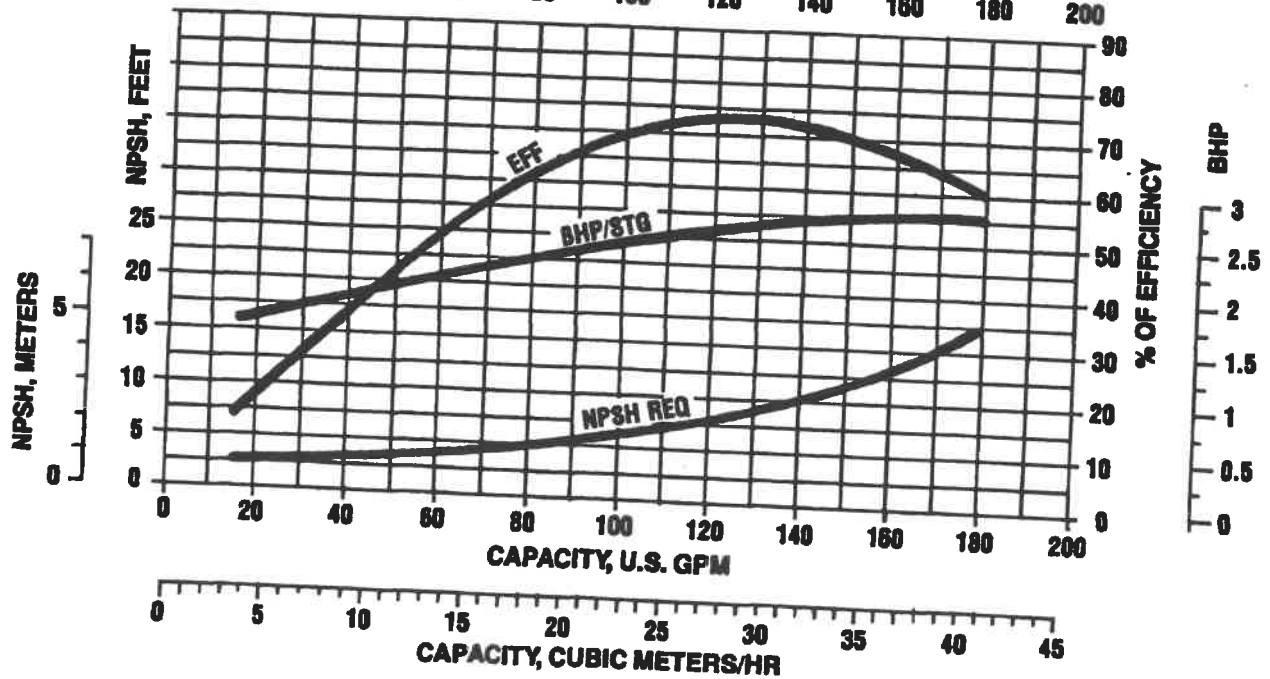
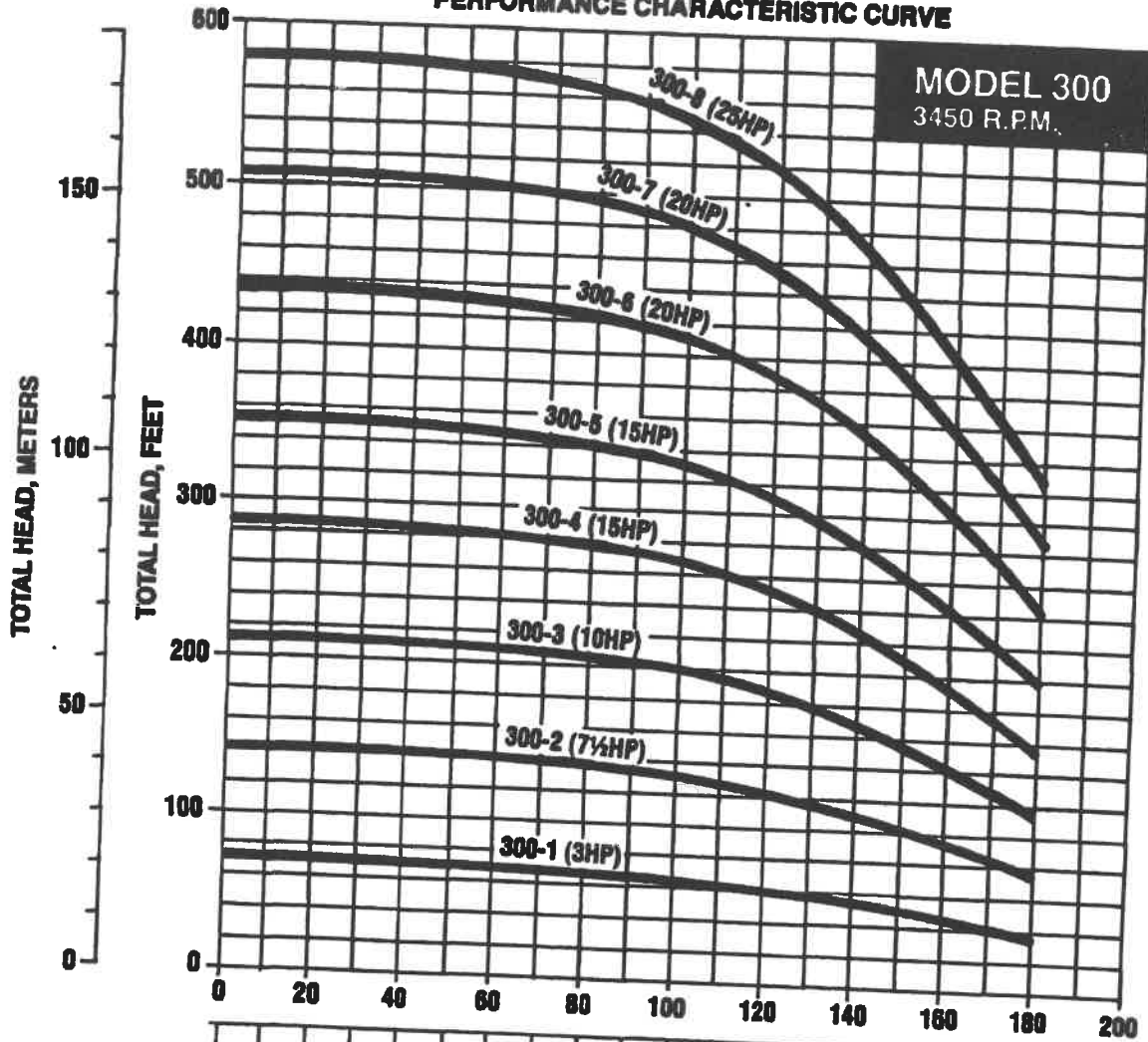






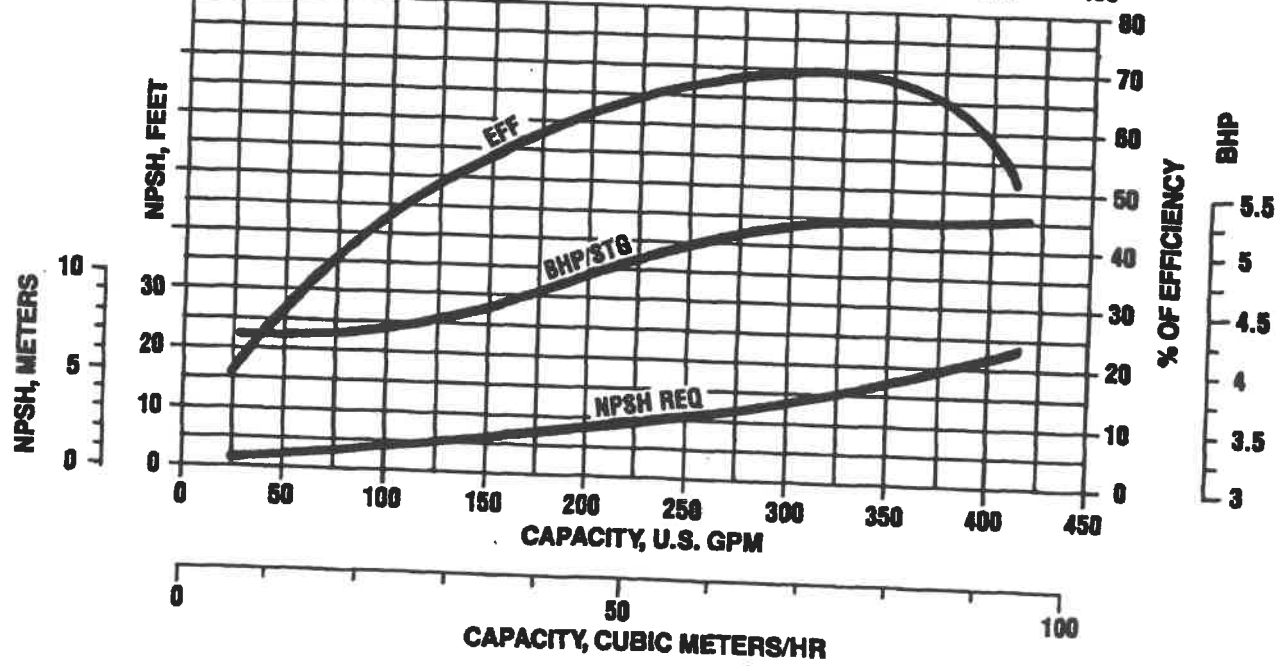
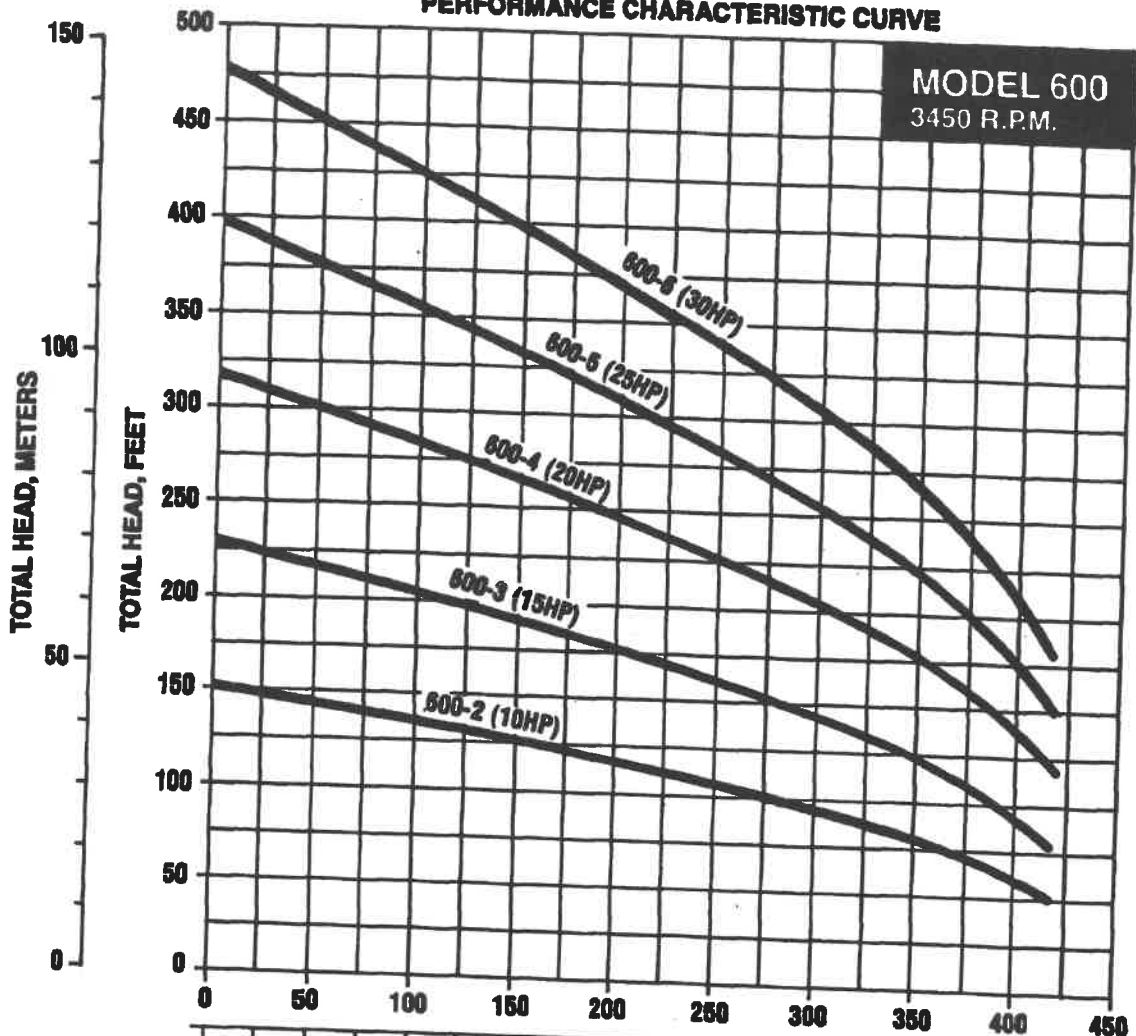
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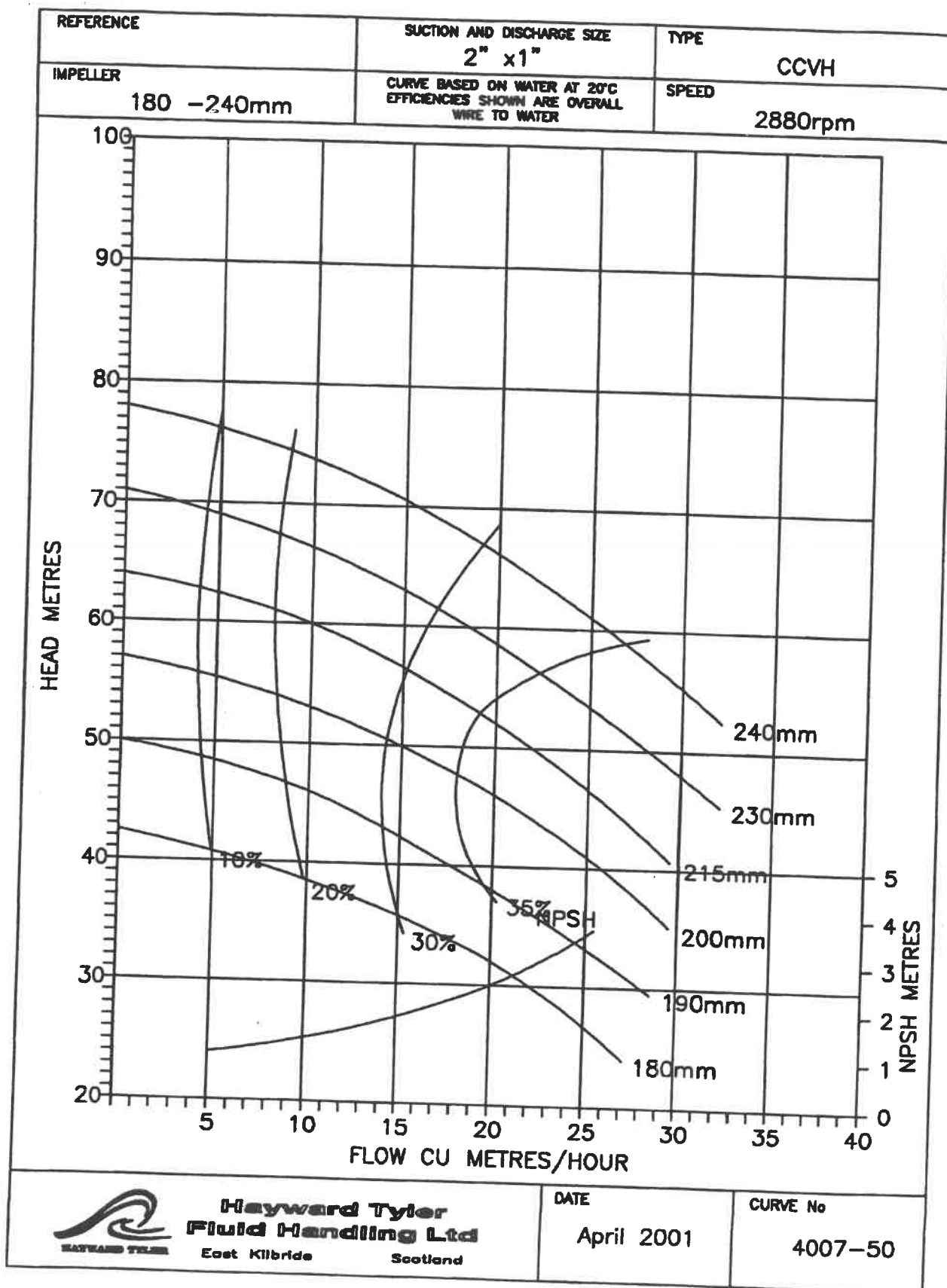
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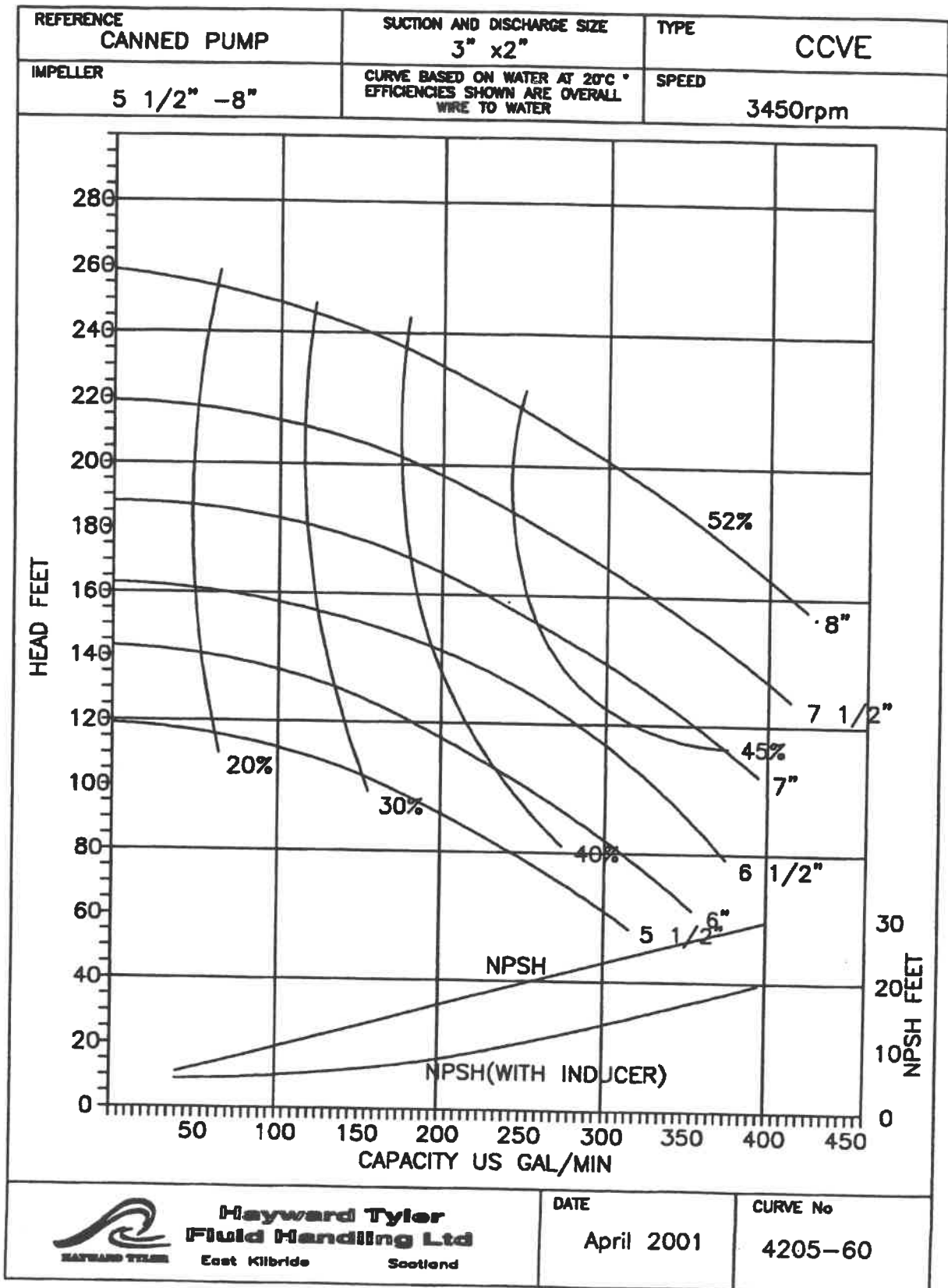


PERFORMANCE CHARACTERISTIC CURVE

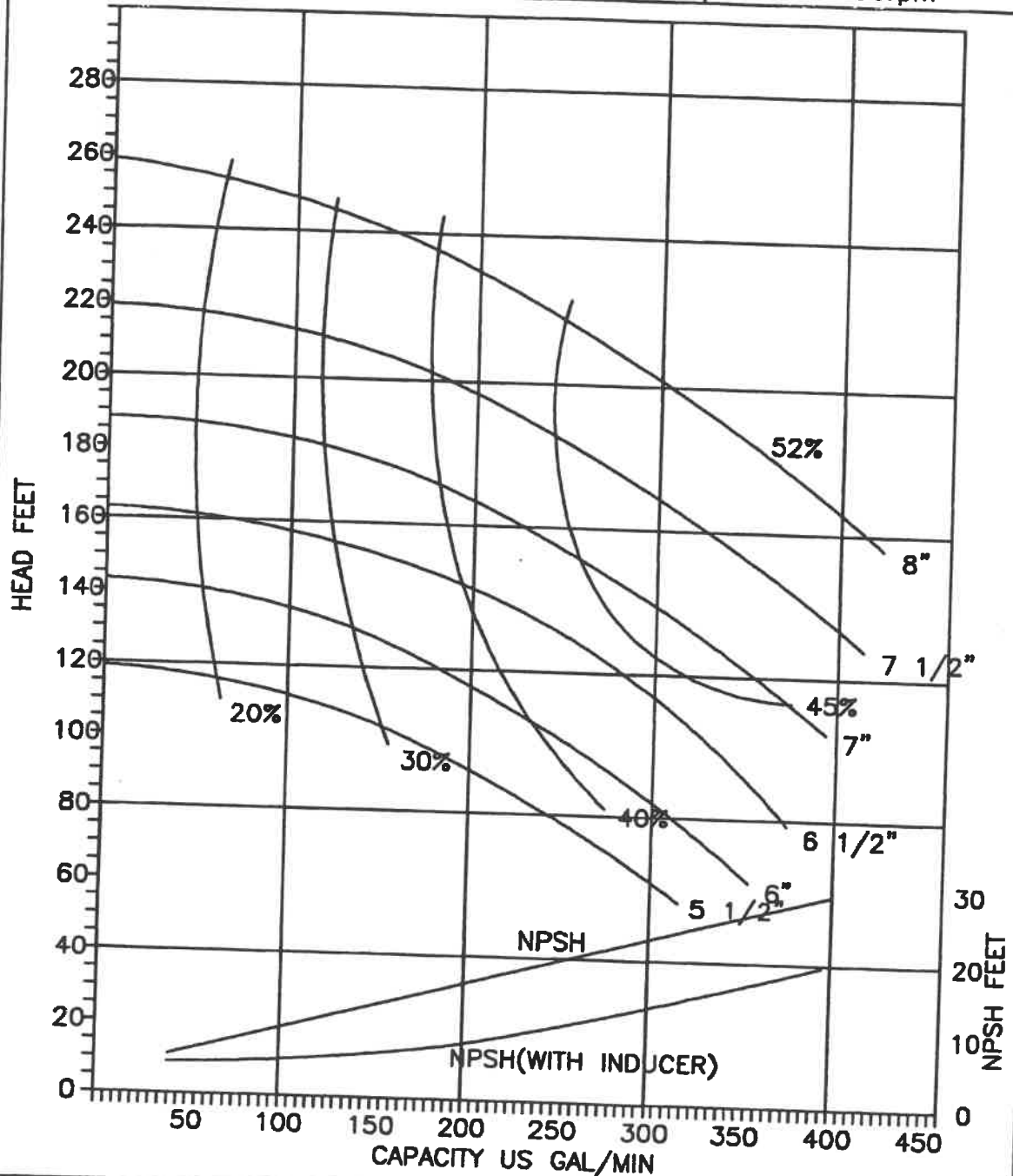
MODEL 600
3450 R.P.M.







REFERENCE CANNED PUMP	SUCTION AND DISCHARGE SIZE 3" x 2"	TYPE CCVE
IMPELLER 5 1/2" - 8"	CURVE BASED ON WATER AT 20°C * EFFICIENCIES SHOWN ARE OVERALL WIRE TO WATER	SPEED 3450rpm



Hayward Tyler
Fluid Handling Ltd
East Kilbride Scotland

DATE
April 2001

CURVE No
4205-60

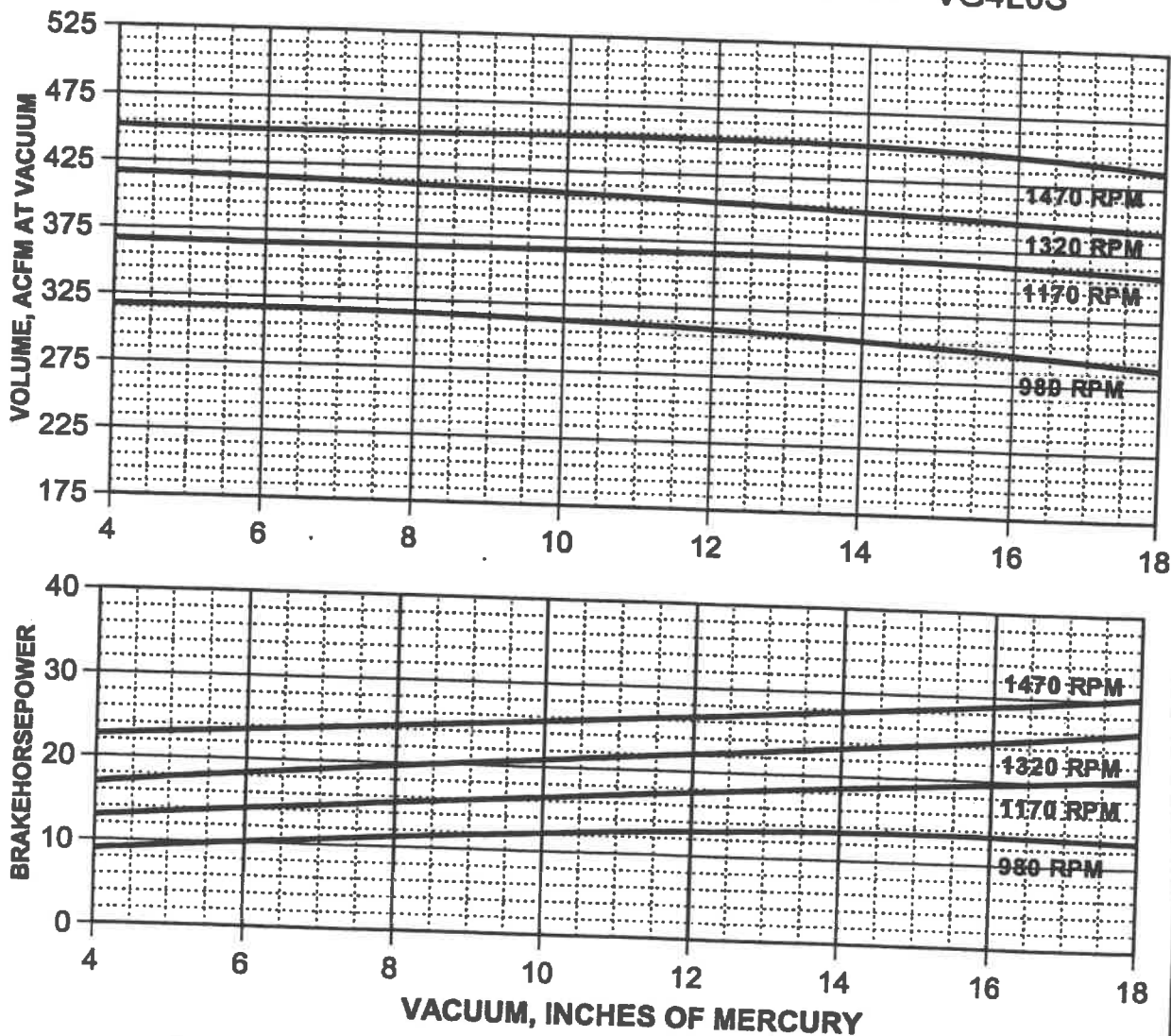


Vooner®

VACUUM PUMP, CONE PORT, SINGLE STAGE, LIQUID RING

MODEL: VG4-L

CURVE NO.: VG4L0S



TEST DATA CONDITIONS:

INLET GAS TEMPERATURE: 60 F @ 50% RELATIVE HUMIDITY

BAROMETRIC PRESSURE: 29.9" HG ABSOLUTE

SEALING LIQUID TEMPERATURE: 60 F

Performance to Heat Exchange Institute Standards (HEI)

Issue date: 03/20/00

Supersedes date: 07/30/96

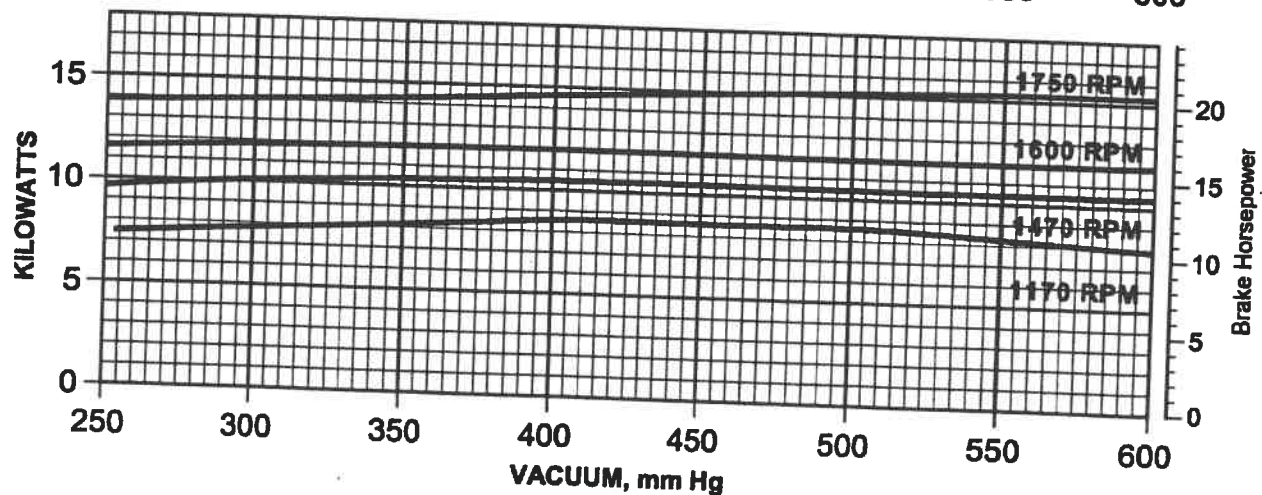
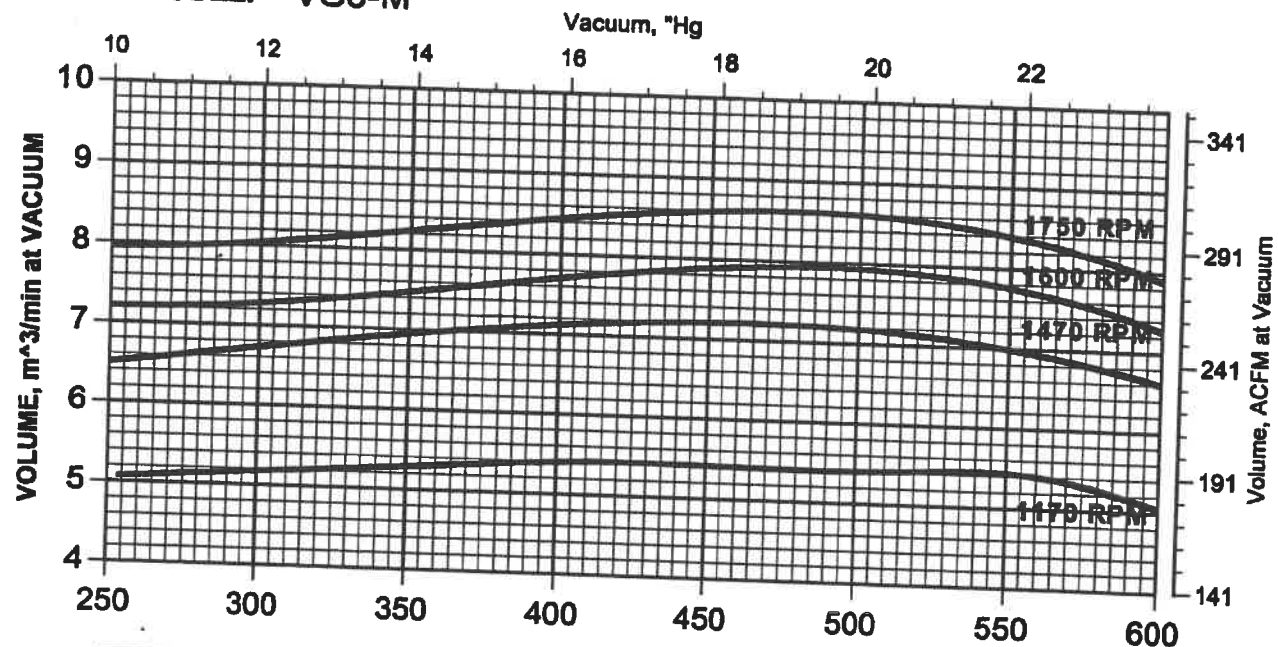
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Vooner®

VACUUM PUMP, CONE PORT, SINGLE STAGE, LIQUID RING

MODEL: VG3-M



TEST DATA CONDITIONS:

INLET GAS TEMPERATURE: 15.6 C (60 F) @ 50% RELATIVE HUMIDITY

BAROMETRIC PRESSURE: 760mm (29.92") Hg ABSOLUTE

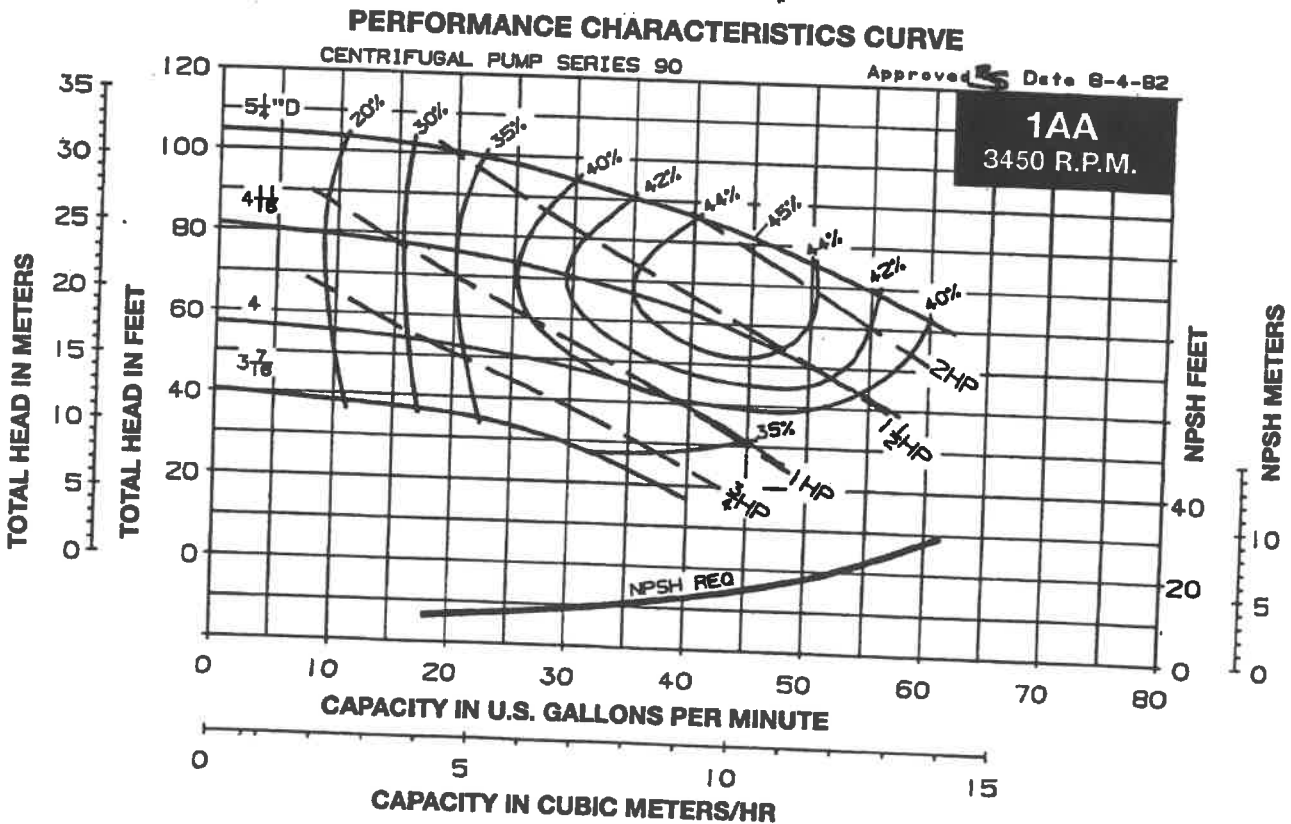
SEALING LIQUID TEMPERATURE: 15.6 C (60 F)

Performance to Heat Exchange Institute Standards (HEI)

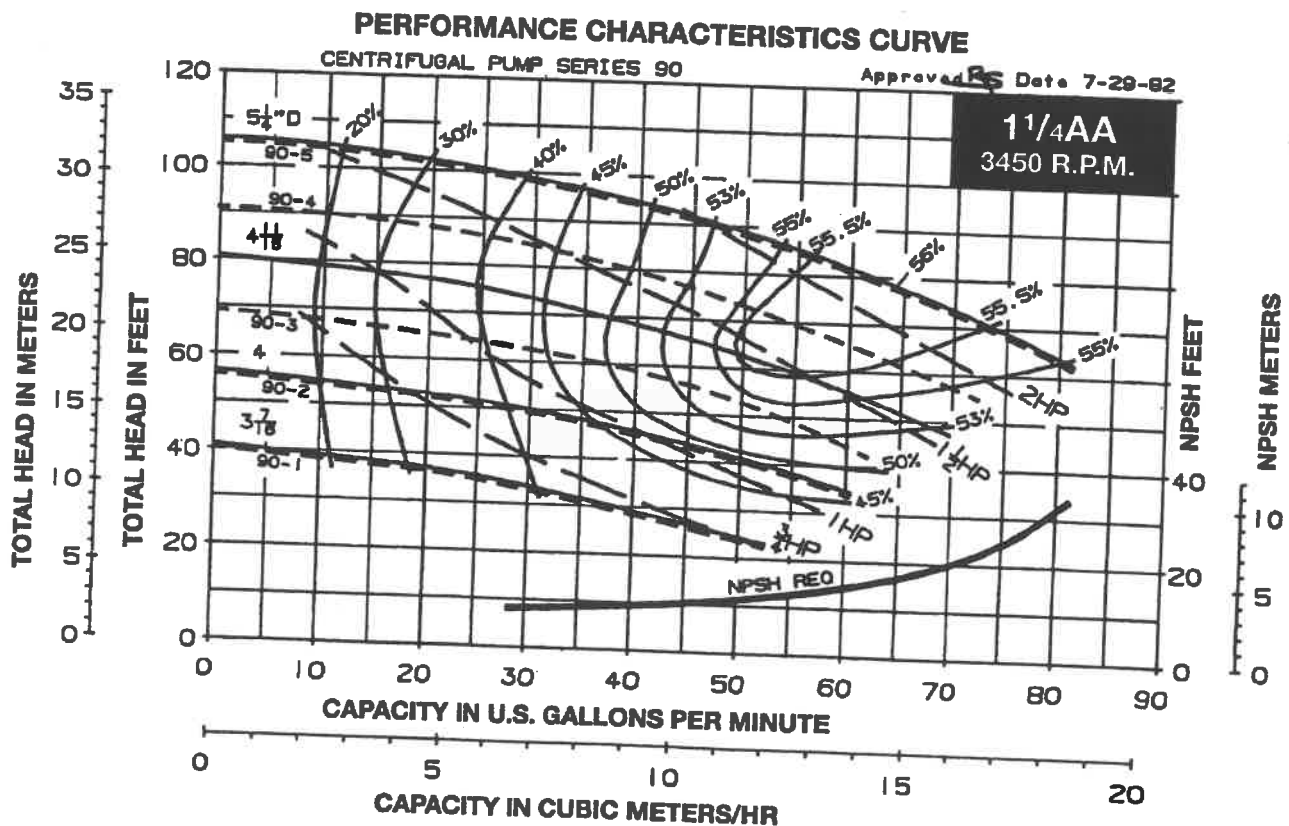
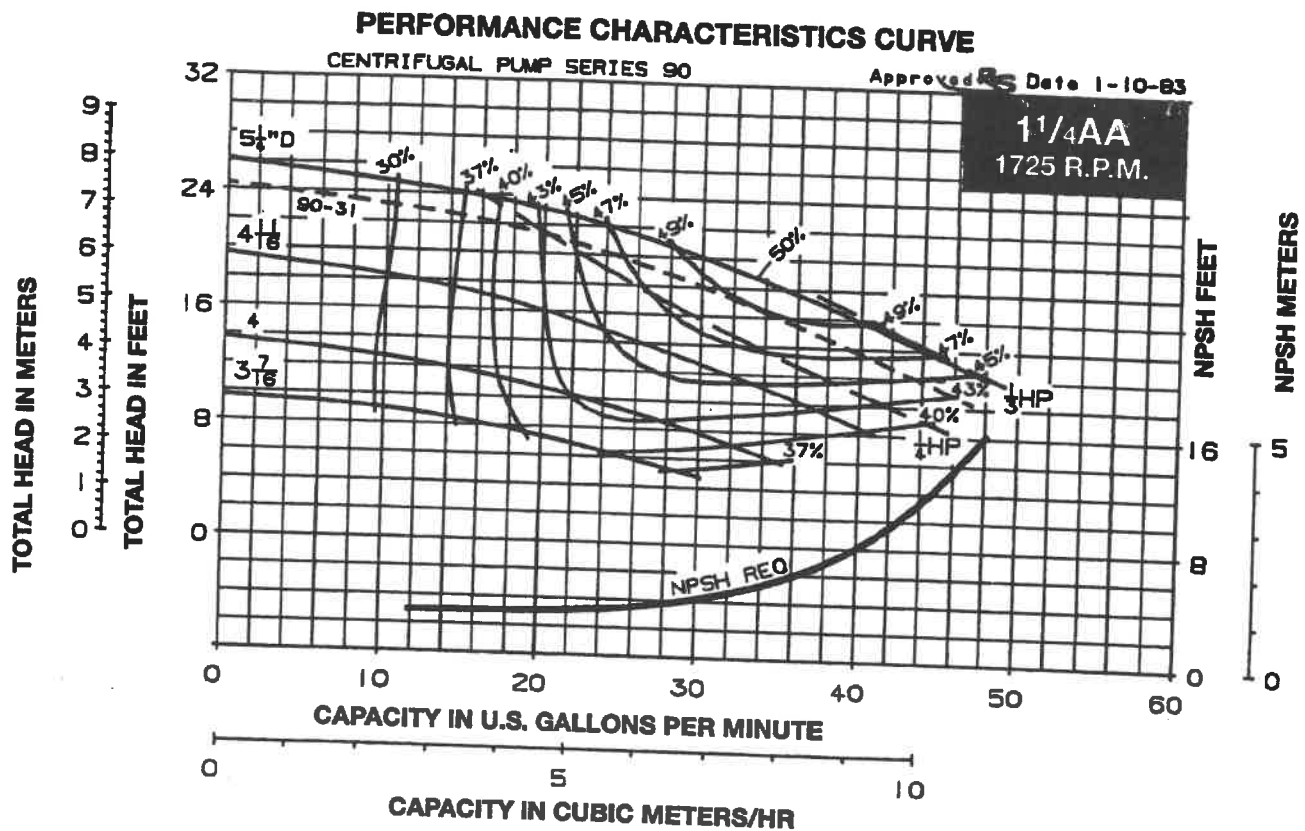
Issue date: 01/20/01
Supersedes date: N/A

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SERIES 90 PUMP PERFORMANCE CURVES



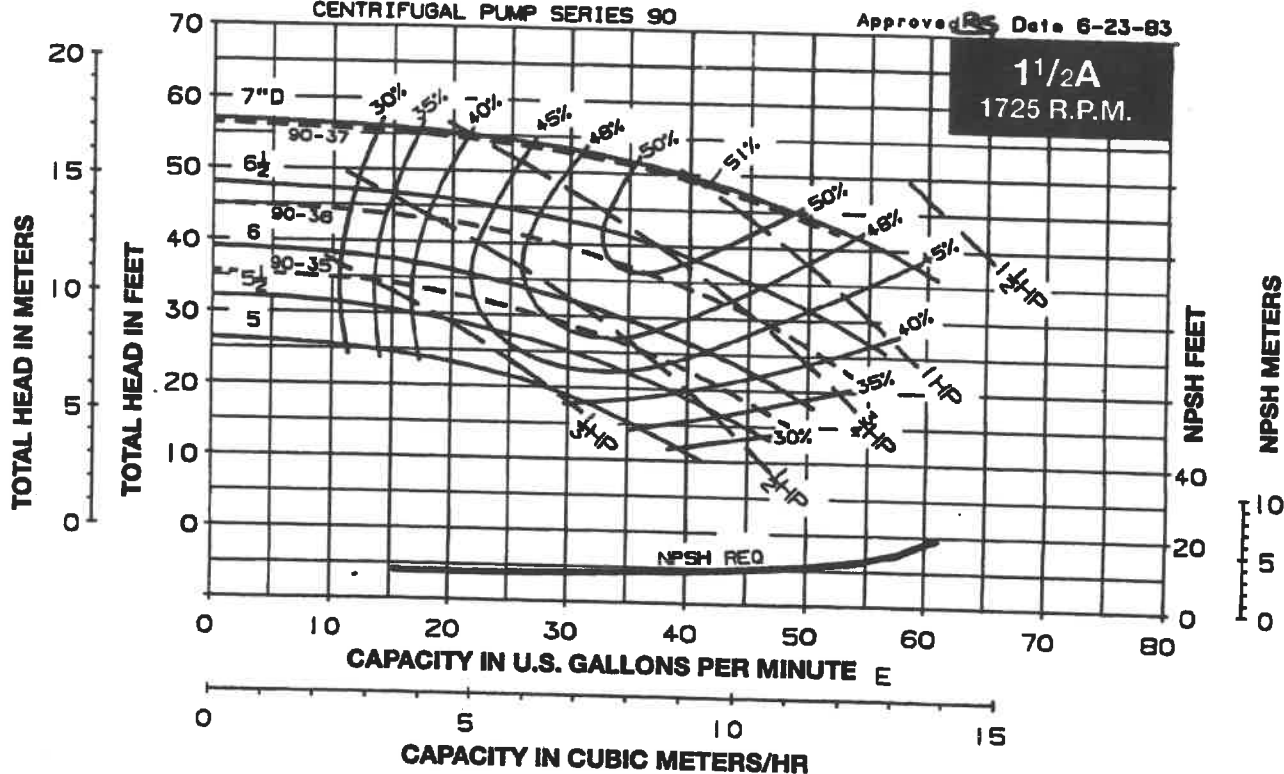
SERIES 90 PUMP PERFORMANCE CURVES

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PERFORMANCE CHARACTERISTICS CURVE

CENTRIFUGAL PUMP SERIES 90

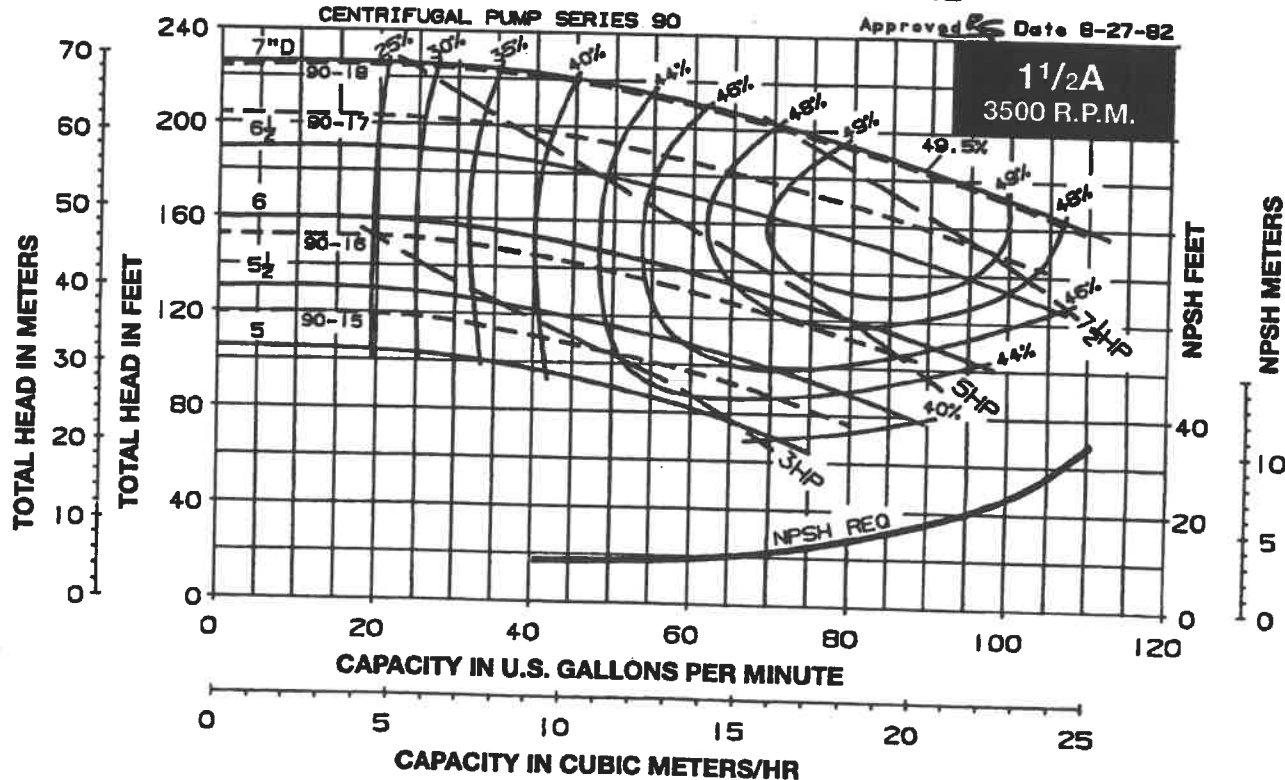
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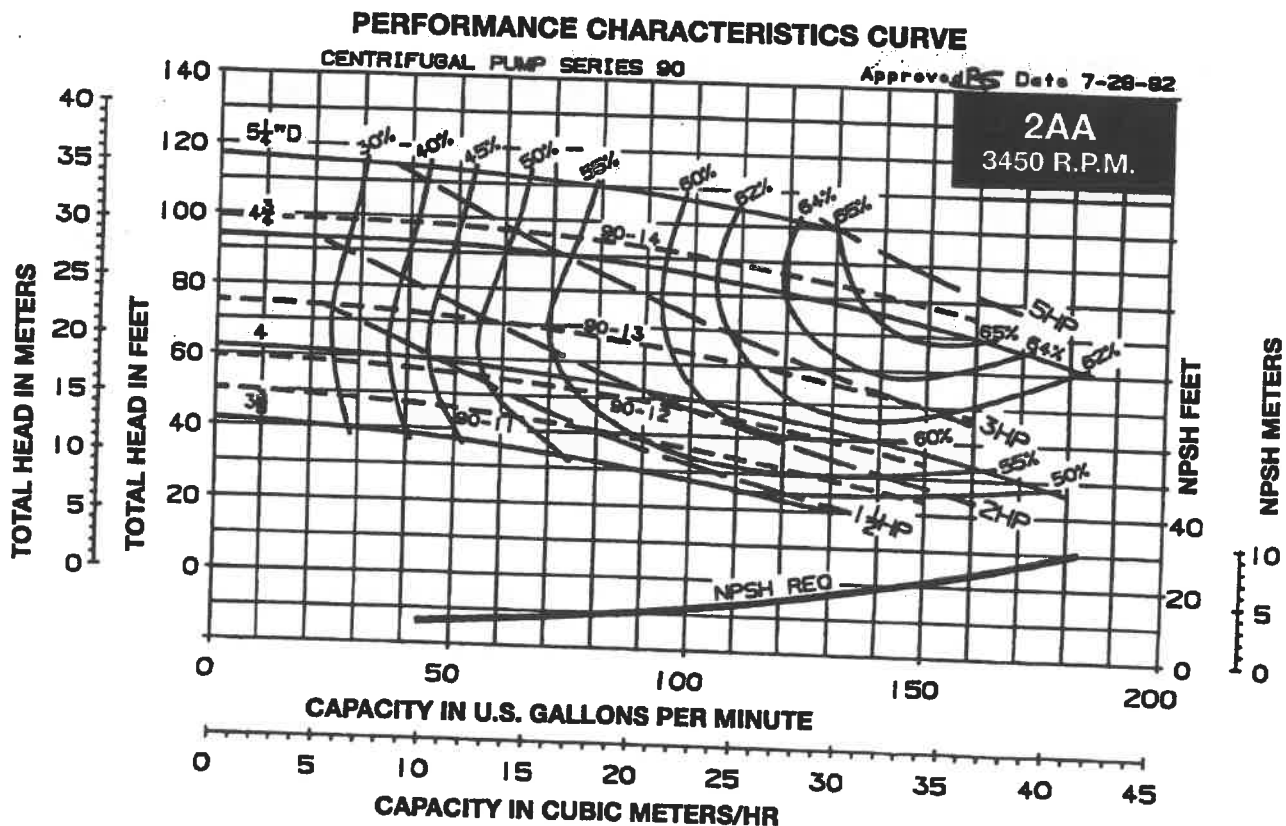
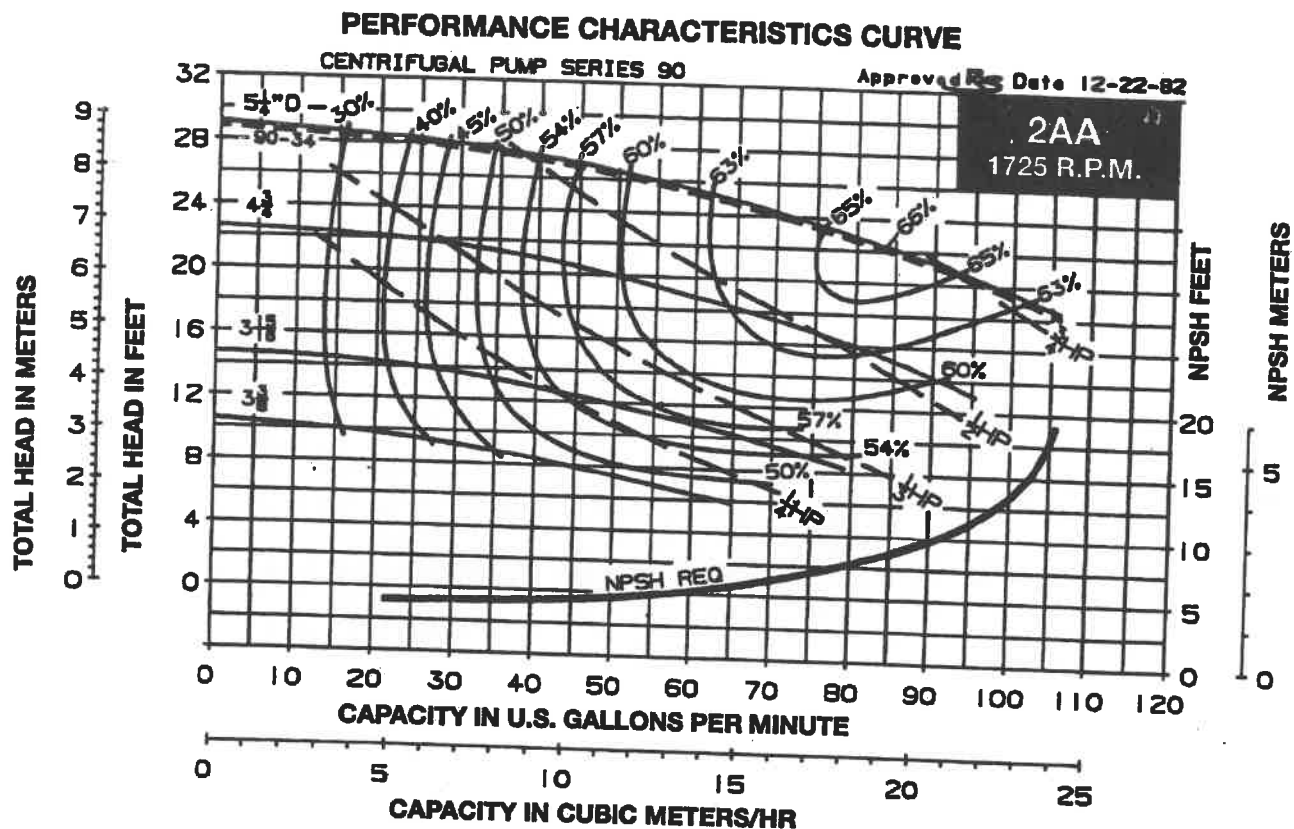
PERFORMANCE CHARACTERISTICS CURVE

CENTRIFUGAL PUMP SERIES 90

Approved  Date 8-27-82

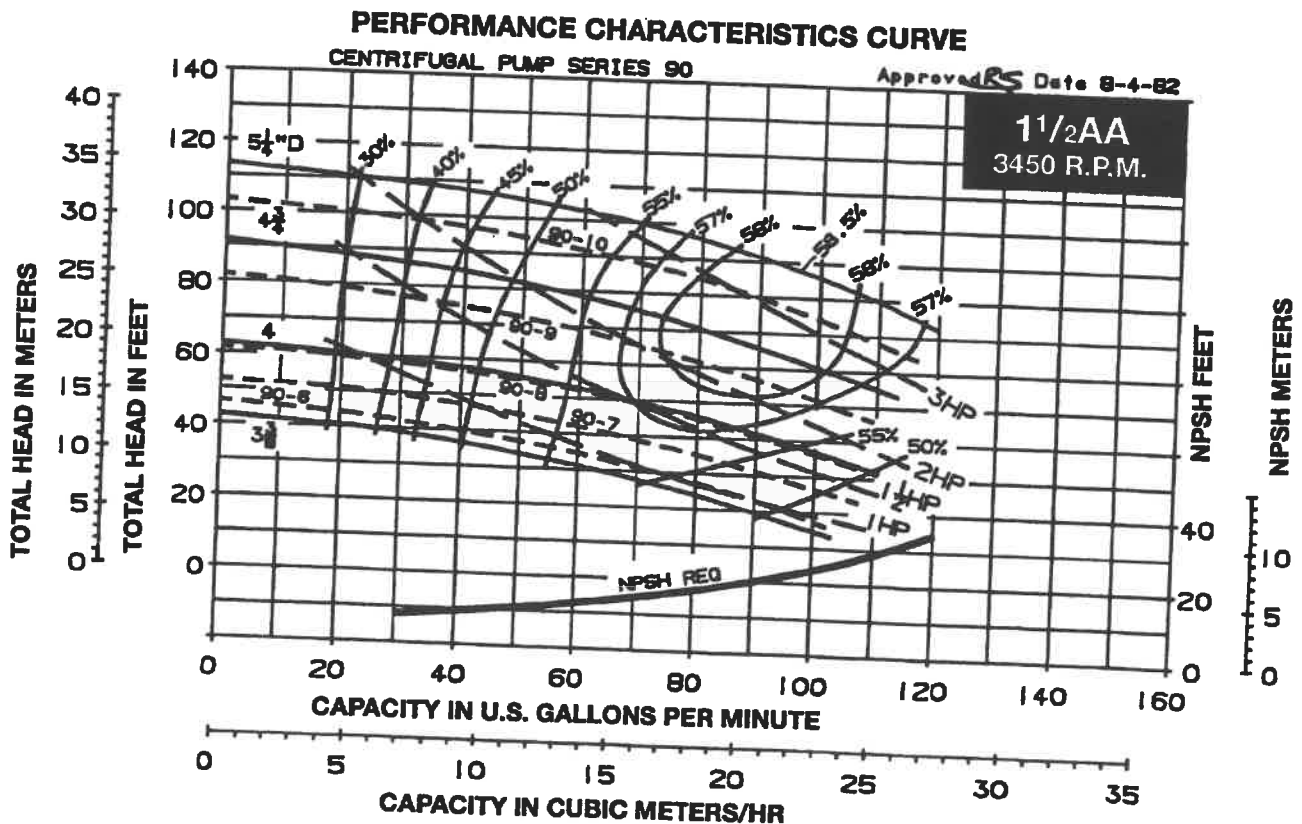
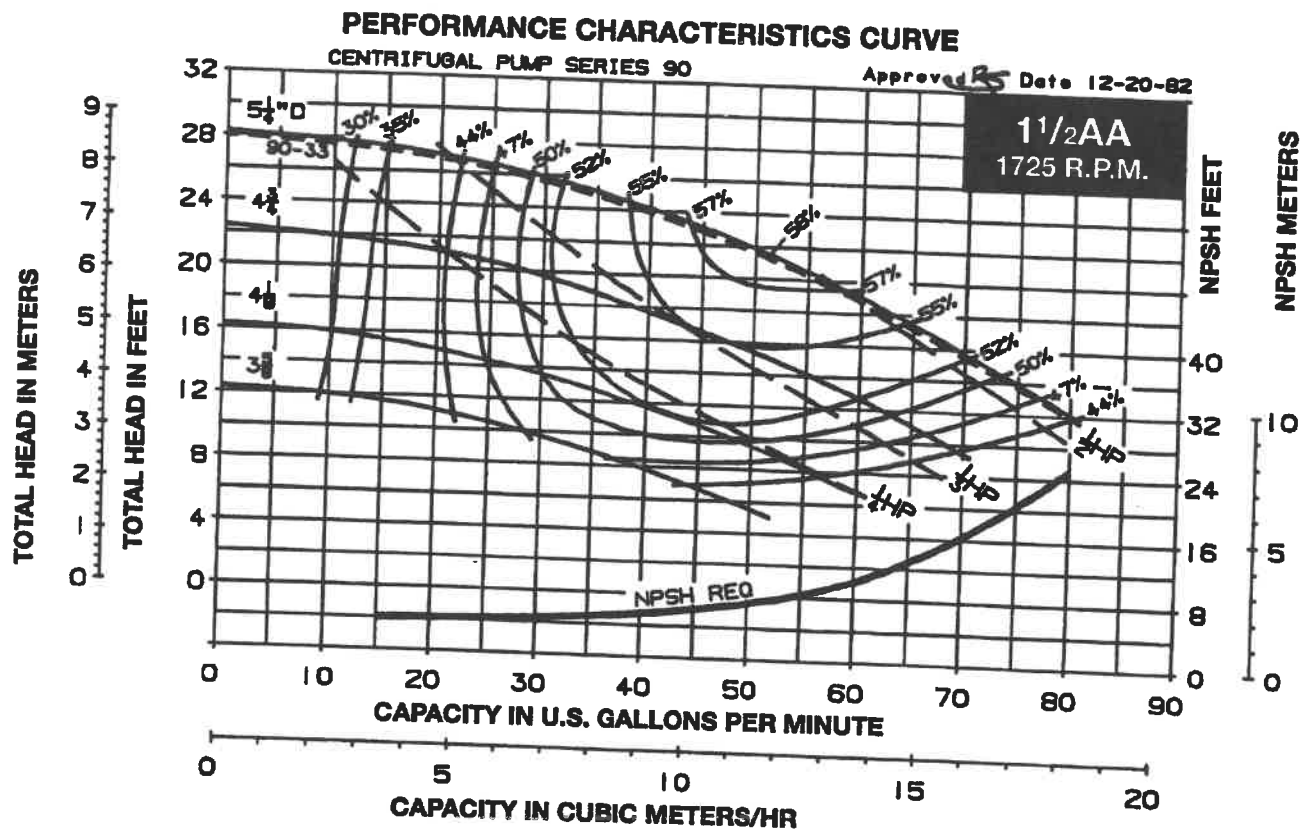


SERIES 90 PUMP PERFORMANCE CURVES



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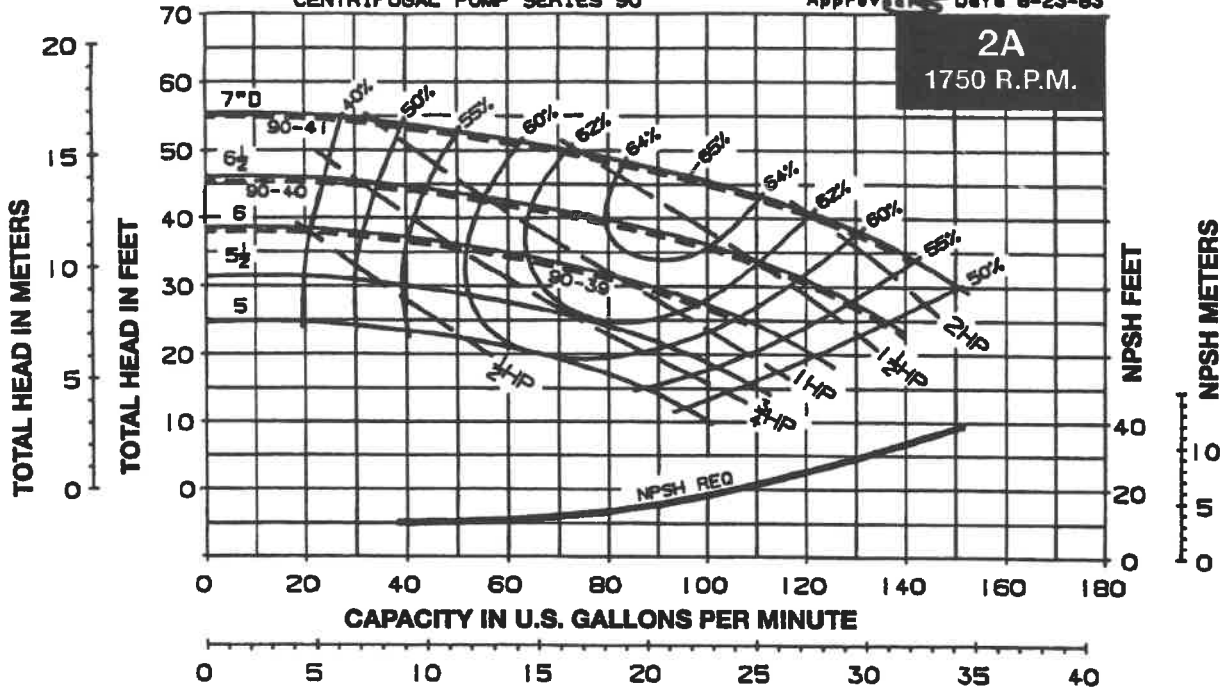


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PERFORMANCE CHARACTERISTICS CURVE

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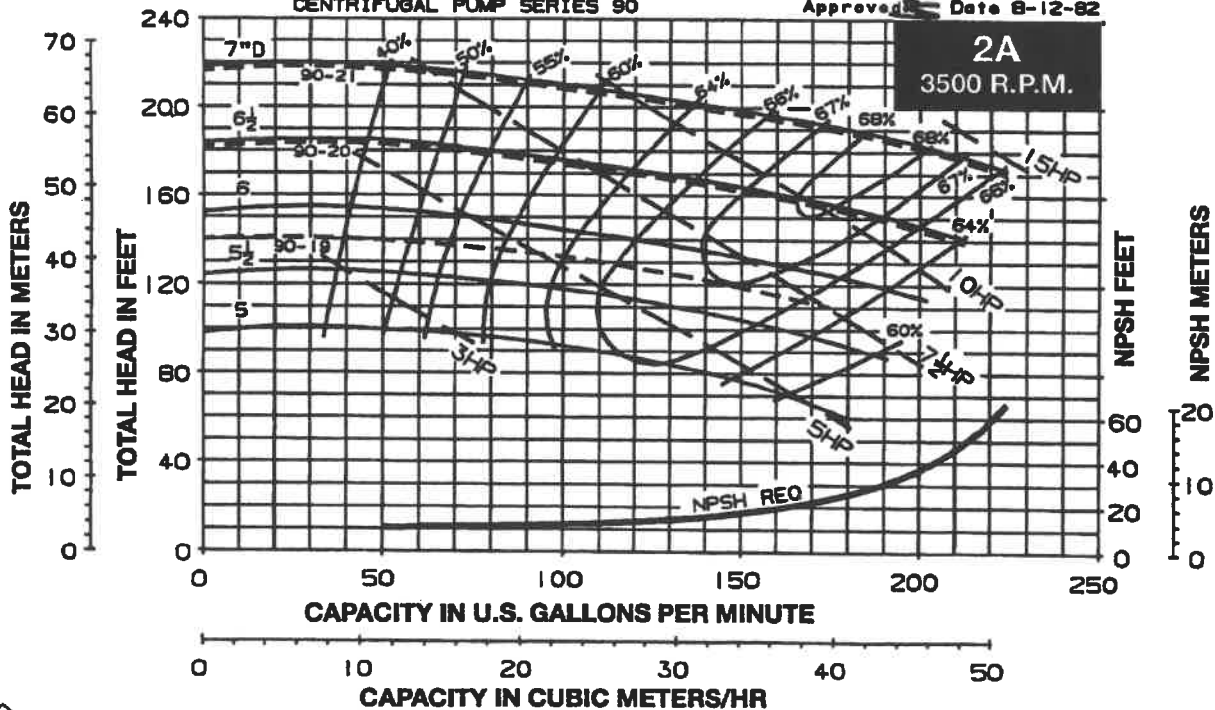
Approved Date 8-23-83



PERFORMANCE CHARACTERISTICS CURVE

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