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OPTIMAL REVOLUTION B-SERIES PROPELLERS

by

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ABSTRACT

The open-water characteristics of 120 propeller models of the B-Series were tested at the Netherlands Ship Model Basin in Wageningen (NSMB) and were analyzed with multiple polynomial regression analysis [6]. The derived polynomials express the thrust and torque coefficients and the open water propeller efficiency in terms of number of propeller blades, blade area ratio, pitch-diameter ratio and advance coefficient. The effect of Reynolds number and variation of blade thickness on the propeller characteristics have also been calculated at NSMB [6]. The open water propeller characteristics for Reynolds number 2.0×10^6 were plotted in report number 237 [2] versus the advance coefficient for the ranges of number of blades, blade area ratio and pitch-diameter ratio recommended by NSMB.

In this report one of the preliminary propeller design problems is studied [4]. Namely the problem of calculation of the optimal propeller RPM for given diameter and hull speed. This propeller problem is studied in two ways. In the first way the propeller is considered as part of the hull-propeller system and in the second as part of the machine-propeller system. The relation between the two problems is also derived. For Reynolds number 2×10^6 the optimal revolution propeller characteristics are plotted in this report for the entire ranges of number of propeller blades, blade area ratio and pitch-diameter ratio for which the regression polynomials apply. The optimization techniques used are well documented in the literature [1,5].

The optimal diameter preliminary propeller design problem is studied in report 245 [3] using the B-Series and similar optimization techniques. Preliminary propeller optimization problems are studied in NA474 a senior and first year graduate course on "Optimization and Numerical Methods in Marine

Design." This work and reports 237 and 245 are based on the NA 474 lecture notes.

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TABLE OF CONTENTS

LIST OF FIGURES

page

LIST OF TABLES

page

page

NOMENCLATURE

A_E/A_O	expanded blade area ratio
C_i	constraint number i
C_Q	constant in machine-propeller system
C_T	constant in hull-propeller system
D	propeller diameter
DHP	delivered horse power
EHP	effective horse power
J	advance coefficient
K_Q	torque coefficient
K_T	thrust coefficient
n	propeller revolutions per second
P/D	pitch-diameter ratio
Q	propeller torque in open water
Q_B	propeller torque behind hull
Re	Reynolds number
R_i	constraint number i
RPM	propeller revolutions per minute
R_T	total towing hull resistance
t	thrust deduction fraction
T	propeller thrust
t/c	thickness to chord ratio for propeller blades
V	ship speed
V_A	speed of advance
w	Taylor wake fraction
Z	number of propeller blades

Greek Symbols

η_B	propeller efficiency behind hull
η_D	propulsive efficiency
η_H	hull efficiency
η_O	open-water propeller efficiency
η_R	relative rotative efficiency
λ	Lagrange multiplier
ρ	fluid density

INTRODUCTION AND OUTLINE

In preliminary ship propeller design certain information is usually available about the hull, the machine and the desirable ship performance. The goal of the designer is to define a propeller that meets all the design requirements. Obviously, due to the high number of independent variables, many feasible solutions exist. In the set of feasible solutions there is one which constitutes the global optimum according to some measure of merit. Consequently, the task of the designer becomes the identification of this globally optimal propeller.

Several preliminary propeller design problems can be defined depending on the measure of merit and the available information about the hull, the machine, the propeller and the ship performance. In this work the problem of maximization of the open water efficiency of a given diameter propeller is studied considering the propeller as part of the Hull-Propeller or the Machine-Propeller system. Our approach is based on systematic series, namely, the widely used B-Series propellers [2].

The mathematical equations involved in preliminary propeller design, the description of the B-Series propellers and the selection process for some basic propeller features are presented in section I. In section II the Hull-Propeller system is considered and the characteristics of the optimal RPM propellers are derived for the entire range of validity of B-Series. The results are presented in tables and graphs. In section III the Machine-Propeller system is considered and results similar to those in section II are presented in tables and graphs. The optimal RPM propellers derived from the optimization of the Hull-Propeller and the Machine-Propeller system are related in a specific mathematical way. This relation is presented in section IV.

I. PRELIMINARY PROPELLER DESIGN PROBLEM

The preliminary propeller design problem is described in detail in the Principles of Naval Architecture [4]. Here the basic relations are briefly presented in section II.1. since they will be used in the formulation of the optimization problems in sections II and III. The approach used in this work is based on systematic series, namely, the B-Series. The properties and limitations of these series are described in section II.2. In II.3. the way of selecting the basic propeller particulars is discussed.

I.1. Hull-Machine-Propeller System Relations

The open-water propeller particulars are usually given in terms of the thrust and torque coefficients K_T and K_Q and the efficiency η_o where

$$K_T = \frac{T}{\rho n^2 D^4} \qquad \text{(I-1)}$$

$$K_Q = \frac{Q}{\rho n^2 D^5} \qquad \text{(I-2)}$$

and

$$\eta_o = \frac{J K_T}{2\pi K_Q} \qquad \text{(I-3)}$$

where

T is the open-water propeller thrust,

Q is the open-water propeller torque,

ρ is the water density,

n is the number of propeller revolutions per second, and

D is the propeller diameter.

The thrust and torque coefficients and consequently the efficiency of the B-Series propellers can be written as:

$$K_T = K_T\left(J , \frac{P}{D} , \frac{A_E}{A_o} , Z , Re , \frac{t}{c}\right) \quad \text{(I-4)}$$

$$K_Q = K_Q\left(J , \frac{P}{D} , \frac{A_E}{A_o} , Z , Re , \frac{t}{c}\right) \quad \text{(I-5)}$$

$$\eta_o = \eta_o\left(J , \frac{P}{D} , \frac{A_E}{A_o} , Z , Re , \frac{t}{c}\right) \quad \text{(I-6)}$$

where

$$J = \frac{V_A}{nD} \quad \text{(I-7)}$$

V_A is the speed of advance,

P/D is the pitch diameter ratio,

A_E/A_o is the blade area ratio,

Z is the number of propeller blades,

Re is the Reynolds number at a characteristic radius $(0.75 \cdot D/2)$, and

t/c is the ratio of the maximum propeller blade thickness to the length of the chord at a characteristic radius $(0.75 \cdot D/2)$.

In the above propeller relations, hull and machine properties are involved through T , Q and V_A . The following equations model the hull-machine propeller interaction.

The effective horse power, EHP , is

$$EHP = R_T \, V \quad \text{(I-8)}$$

where R_T is the total towing hull resistance at constant speed V .

When a hull is self propelled, the pressure at the stern is reduced by the propeller action resulting in augmented resistance [4] which can be expressed in terms of the thrust-deduction factor $(1-t)$ as

$$R_T = (1-t)T \tag{I-9}$$

Due to the wake speed there is a difference between the ship speed V and the speed of advance V_A. The relation between V and V_A is given by equation (I-10)

$$V_A = V(1-w) \tag{I-10}$$

where w is the Taylor wake fraction.

The delivered horse power behind the ship, DHP, is

$$DHP = 2\pi n Q_B \tag{I-11}$$

where Q_B is the propeller torque behind the ship.

Using the above equations we can define the following efficiencies.

The open-water propeller efficiency, η_o, is defined as

$$\eta_o = \frac{T\ V_A}{2\pi n Q} \tag{I-12}$$

which can be written as

$$\eta_o = \frac{T}{\rho n^2 D^4} \cdot \frac{\rho n^2 D^5}{Q} \cdot \frac{V_A}{Dn} \cdot \frac{1}{2\pi}$$

or

$$\eta_o = \frac{J K_T}{2\pi K_Q}$$

which proves equation (I-3).

The propeller efficiency behind the ship, η_B, is given by equation (I-13)

$$\eta_B = \frac{T\ V_A}{2\pi n Q_B} \tag{I-13}$$

where Q_B is the propeller torque behind the ship.

The ratio of the efficiency behind the ship to that in open water is called relative rotative efficiency

$$\eta_R = \frac{\eta_B}{\eta_o} = \frac{Q}{Q_B} \tag{I-14}$$

The hull efficiency, η_H , is the ratio of the work done on the ship to that done by the propeller and is given by (I-15)

$$\eta_H = \frac{R_T\ V}{T\ V_A} = \frac{1-t}{1-w} \tag{I-15}$$

Finally we can define the propulsive efficiency, η_D , as

$$\eta_D = \frac{EHP}{DHP} = \eta_H\ \eta_B = \eta_H\ \eta_R\ \eta_o \tag{I-16}$$

To compute η_o we must choose a propeller and find its operational conditions. The values of η_H and η_R depend on the hull-machine system particulars. Typical values for η_H and η_R can be found in PNA [4].

The above relations show that η_o , can be computed and/or maximized by considering the propeller as part of the hull-propeller system or the machine-propeller system. The results are related in a specific way which is discussed in section IV.

I.2. Systematic Series: B-Series Propellers

The approach used in this work is based on systematic series, the B-Series, in which the thrust and torque coefficients and the open-water efficiency are functions of J , P/D , A_E/A_o , Z , Re and t/c as in equations (I-4) to (I-6). K_T and K_Q are expressed in terms of polynomials derived by multiple regression analysis [2]. These polynomials are valid for

$$Z = 2,\ 3,\ 4,\ 5,\ 6 \text{ or } 7 \qquad \text{(I-17)}$$

$$0.30 < \frac{A_E}{A_O} < 1.05 \qquad \text{(I-18)}$$

and

$$0.50 < \frac{P}{D} < 1.40 \qquad \text{(I-19)}$$

However, at the extremes of the above ranges the regression analysis results are not fully reliable [2]. Correction terms for $Re > 2 \times 10^6$ and for nonstandard design values for t/c, have been evaluated by NSMB [6]. For $Re = 2 \times 10^6$ and the standard design value of t/c, K_T and K_Q are plotted versus J for systematic variation of Z, A_E/A_O, and P/D in the ranges given by equations (I-17) to (I-19) in reference [2].

I.3. Selection of Basic Propeller Characteristics

Geometric propeller particulars like the shape of the blades, the design angle of attack, the camber and the chord of the blade section and the pitch distribution are fixed in the B-Series and cannot be changed in this approach [6]. In B-Series only variation of t/c is allowed which might be required by propeller strength calculations. In propeller preliminary design Z, D, P/D, A_E/A_O and RPM must be selected. Their selection is described in PNA [4] and only some important points are mentioned here.

The number of propeller blades, Z, for a given hull depends on the propeller vibrations due to the interaction of hull, shaft, propeller and wake. The analysis of this pheonomenon is very difficult and even though considerable progress has been made recently, empirical formulas and data from similar ships are still widely used.

Factors that influence the selection of the propeller diameter, D , are specific load, cavitation, hull geometry and required clearances, and blade strength. An increase in D favors the first two, but increases the strength requirements. On the contrary, in general, hull efficiency, η_H , slightly decreases with increasing diameter. In practice the largest diameter allowed by the hull geometry and propeller clearances is chosen as a starting value. The propeller diameter optimization problem is studied in reference [3].

The blade area ratio, A_E/A_O , is basically determined by cavitation and efficiency considerations. Decreasing A_E/A_O increases the open water propeller efficiency and the cavitation. Therefore, the smallest A_E/A_O which yields acceptable cavitation results must be chosen. In practice Keller's empirical formulas [6] or Burril's chart [4] are used in order to compute a starting value for the blade area ratio.

The propeller revolutions, RPM , must be low to ensure a high value of η_O . RPM can be optimized as shown in sections II and III.

Finally in the process of optimization of either the diameter [3] or the RPM of the propeller the proper value of P/D is computed as explained in the following sections.

II. HULL-PROPELLER SYSTEM OPTIMIZATION

The selection of the maximum efficiency propeller for a given diameter, D , implies the computation of the propeller revolutions, RPM , pitch to diameter ratio, P/D , and operating condition, J .

In preliminary design we use the considerations of section I.3. to select the number of blades, Z , the blade area ratio, A_E/A_O , and t/c . In addition data about the hull or the machine is available. The procedure for calculating the optimal RPM propeller is different if hull data or machine data is available. The former problem is studied in this section and the latter in section III.

II.1. Example

Consider a standard Series-60 hull with the following particulars [4]:

$$C_B = 0.65 \tag{II-1}$$

$$\frac{V}{\sqrt{L}} = 0.8 \tag{II-2}$$

$$\frac{L}{B} = 7.25 \tag{II-3}$$

$$\frac{B}{T} = 2.50 \tag{II-4}$$

$$w = 0.252 \tag{II-5}$$

$$t = 0.155 \tag{II-6}$$

$$\eta_R = 1.018 \tag{II-7}$$

and

$$L = 400 \text{ ft} \tag{II-8}$$

For the above ship we get

$$V = 16 \text{ knots} \tag{II-9}$$

and

$$R_T = 61{,}900 \text{ lbs} \tag{II-10}$$

where the total towing resistance has been computed using Seris-60 data, the ATTC line and an allowance coefficient of 0.0004. Assuming that the ship is propelled by a single, 5 blade propeller with blade area ratio of 0.65 and a diameter, D , equal to 18 ft we get

$$K_T = \frac{T}{\rho n^2 D^4} = \frac{R_T}{(1-t)\rho n^2 D^4} \tag{II-11}$$

$$J = \frac{V_A}{nD} = \frac{V(1-w)}{nD} \tag{II-12}$$

and

$$\frac{K_T}{J^2} = \frac{R_T}{(1-t)V^2(1-w)^2 D^2 \rho} = 0.278 \tag{II-13}$$

Equation (II-13) is plotted in Figure 1. For each value of P/D , that is for each of the ten propellers for which K_T , K_Q , and η_o are plotted in Figure 1, the propeller operating point is found at the intersection of equation (II-13) and the K_T versus J curve. The propeller efficiency is then found for each propeller and the η_o curve is plotted revealing a maximum efficiency propeller at

$$J = 0.88 \tag{II-14}$$

and

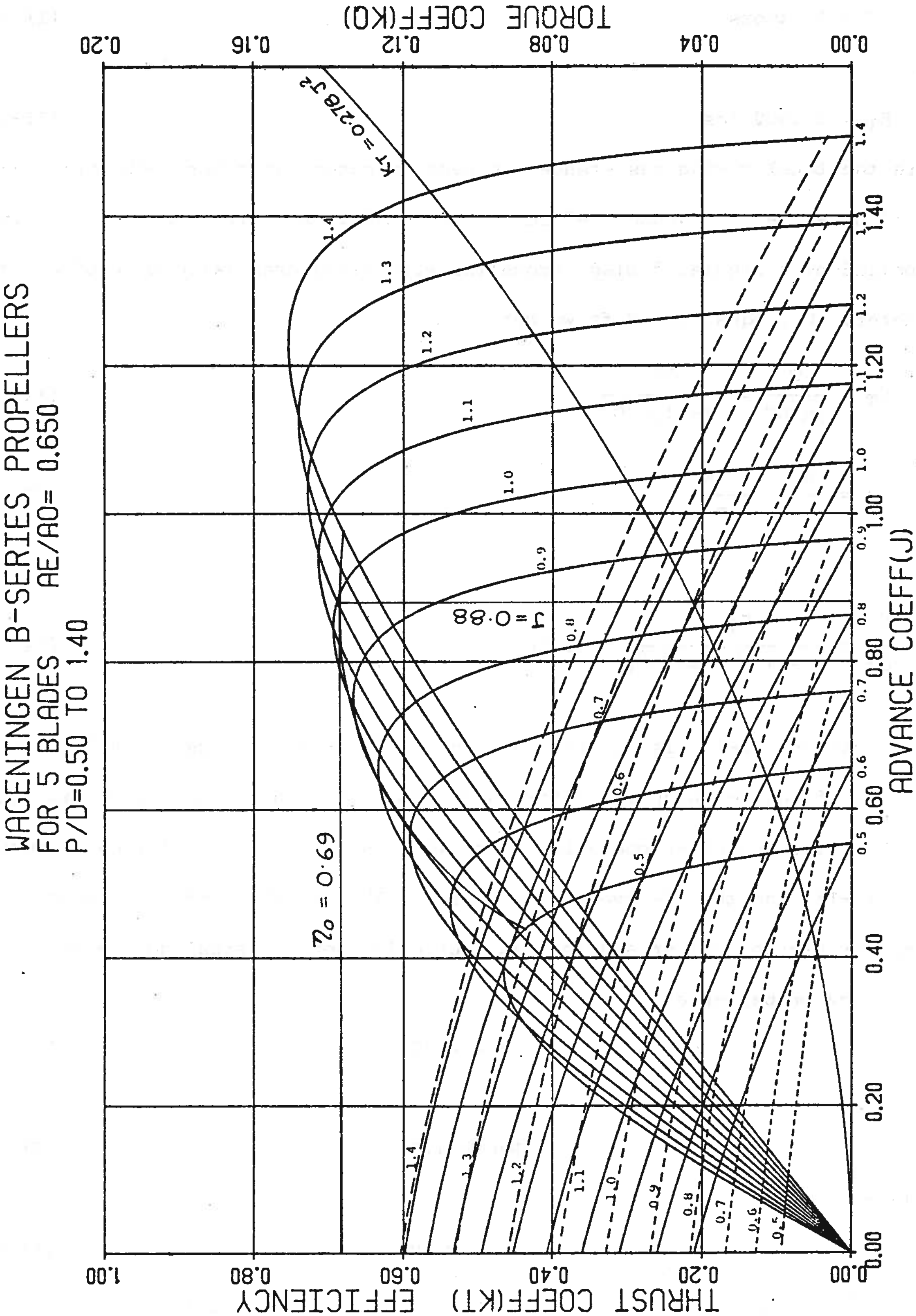
$$P/D = 1.20 \tag{II-15}$$

yielding

$$\eta_o = 0.69 \tag{II-16}$$

This propeller is represented by one point in Figure 17 for K_T/J^2 given by equation (II-13) and blade area ratio of 0.65.

FIGURE 1. EXAMPLE OF OPTIMAL REVOLUTION PROPELLER: HULL-PROPELLER SYSTEM



For each value of K_T/J^2 and each of the propeller curves in reference [2] the above procedure can be repeated to yield optimal revolution propellers. It should be noted that the curves in reference [2] are correct as long as

$$Re \leqslant 2 \times 10^6 \quad \text{(II-17)}$$

For higher Re values the propeller curves must be corrected [2].

In the following sections, the problem solved in the above example will be formulated in a general mathematical form which can be solved with the aid of a digital computer. The results are presented in Figures 2 through 25 for the entire range of practical importance of K_T/J^2 and for $Re = 2 \times 10^6$.

II.2. Problem Formulation

The problem described and solved for a specific case in the previous section can be stated as follows.

Find the maximum efficiency B-Series propeller for a single screw ship given that

$$Z = m \quad \text{(II-18)}$$

$$A_E/A_O = \alpha \quad \text{(II-19)}$$

$$D = \delta \quad \text{(II-20)}$$

$$EHP = \varepsilon \quad \text{(II-21)}$$

$$V = v \quad \text{(II-22)}$$

$$w = \overline{w} \quad \text{(II-23)}$$

$$t = \overline{t} \quad \text{(II-24)}$$

where m , α , δ , ε , v are known constants and the values of $\overline{w}$ and $\overline{t}$ can be found from available graphs and data [4].

This problem can be formulated in the following standard mathematical optimization form:

Problem P1

maximize $\eta_o = \eta_o\left(J\ ,\ \frac{P}{D}\ ,\ \frac{A_E}{A_o}\ ,\ Z\ ,\ Re\ ,\ \frac{t}{c}\right)$ (II-25)

$$= \frac{J}{2\pi}\ \frac{K_T}{K_Q}$$

subject to:

R_1: $Z = m$

R_2: $\frac{A_E}{A_o} = \alpha$

R_3: $D = \delta$

R_4: $EHP = R_T\ V = \varepsilon$

R_5: $V = v$

R_6: $w = \overline{w}$

R_7: $t = \overline{t}$

R_8: $J = \frac{V_A}{nD}$

R_9: $V_A = V(1-w)$

R_{10}: $K_T = \frac{T}{\rho n^2 D^4}$

R_{11}: $K_Q = \frac{Q}{\rho n^2 D^4}$

R_{12}: $R_T = T(1-t)$

R_{13}: $K_T = K_T\left(J\ ,\ \frac{P}{D}\ ,\ \frac{A_E}{A_o}\ ,\ Z\ ,\ Re\ ,\ \frac{t}{c}\right)$ given by the B-Series

R_{14}: $K_Q = K_Q\left(J, \frac{P}{D}, \frac{A_E}{A_o}, Z, Re, \frac{t}{c}\right)$ given by the B-Series

$R_{15}; R_{16}$: $2 \leq Z \leq 7$

$R_{17}; R_{18}$: $0.30 \leq \frac{A_E}{A_o} \leq 1.05$

$R_{19}; R_{20}$: $0.50 \leq \frac{P}{D} \leq 1.40$

This is a nonlinear programming problem with continuous and discrete variables aiming at the maximization of η_o given by equation (II-25) subject to 20 equality and inequality constraints.

The design variables are 18, namely, Z, J, P/D, n, D, A_E/A_o, Re, t/c, EHP, R_T, V, w, t, V_A, K_T, K_Q, T and Q. Note that in this problem, relations between Q, Q_B and DHP are not required. Once the problem is solved these quantities can be computed using equations (I-11), (I-13) and (I-14). Problem P1 is reduced and solved in the following section.

II.3. General Solution

Several of the constraints in the optimization problem P1 are equality constraints and can be used to eliminate an equal number of design variables and reduce the problem. Actually,

a. R_1 can be used to eliminate Z. This means that the optimization problem should be solved only for a given blade number at a time.

b. R_2 sets the value of the blade area ratio equal to α. Consequently the optimization problem should be solved for a given A_E/A_o value at a time.

Activity of R_1 and R_2 basically indicates that the optimization problem P1 will be solved for the propellers of one figure in reference [2] at a time as was done in the example section II.1.

c. Constraint R_3 eliminates variable D .

d. Constraint R_4 eliminates variable EHP .

e. Constraint R_5 eliminates variable V .

f. R_6 defines w from available graphs [4].

g. R_7 defines t using data in [4].

h. R_9 can be used to eliminate V_A .

i. R_{12} can be used to express T in terms of R_T and t which can be eliminated from the problem using R_4, R_5 and R_7.

j. Equality R_{10} can be used to express T in terms of K_T , n and D .

k. Equality R_{11} can be used to express Q as a function of K_Q , n and D .

Thus at the end of the first step of reduction of the optimization problem P1 the design variables are J , P/D , n , Re , t/c , K_T and K_Q and the problem becomes:

Problem P2

$$\text{maximize} \quad \eta_o = \frac{JK_T}{2\pi K_Q} \qquad \text{(II-26)}$$

subject to:

equality constraints R_8, R_{13} and R_{14}

and inequality constraints R_{19} and R_{20}.

Obviously of the 7 design variables only 4 are independent due to the three equality constraints, R_8, R_{13} and R_{14}. Thus we can further reduce the problem as follows:

a. Choose the standard t/c value of the B-Series. Should a different value of t/c be required by propeller blade strength analysis, the factors defined by NSMB [6] must be used to correct η_o, K_T and K_Q. Thus t/c can be defined and eliminated from the problem. The exact value of t/c can be computed once the propeller has been selected, its optimal operating condition has been found and the strength computations have been completed. Then if the differences between the selected and computed values are not acceptable, they should be corrected and the propeller optimization problem should be solved again. The dependence of η_o, K_Q and K_T on t/c is weak and the algorithm converges in 2 to 3 steps.

b. Choose J, P/D and Re as the independent variables of the problem making n, K_T and K_Q dependent. These can be defined by equations R_8, R_{13} and R_{14} respectively. Thus the problem reduces to P3:

Problem P3

maximize $$\eta_o = \frac{JK_T}{2\pi K_Q} \tag{II-27}$$

subject to:

C_1: $K_T = K_T\left(J, \frac{P}{D}, Re\right)$ given by the B-Series

C_2: $K_Q = K_Q\left(J, \frac{P}{D}, Re\right)$ given by the B-Series

C_3: $$\frac{K_T}{J^2} = \frac{EHP}{(1-t)\rho D^2(1-w)^2 V^3} = \frac{\varepsilon}{\rho(1-\bar{t})(1-\bar{w})^2\delta^2 V^3} = C_T$$

derived from constraints R_8 and R_{10} using R_3, R_4, R_5, R_6, R_7, R_9 and R_{12} and where C_T is a constant.

$C_4;C_5$: $0.50 \leq \frac{P}{D} \leq 1.40$

Problem P3 will be solved using the method of Lagrange multipliers and rejecting any optimum which violates inequality constraints C_4 and C_5. Therefore P3 can be written as:

<u>Problem P4</u>

$$\text{maximize} \quad F\left(J, \frac{P}{D}, Re, \lambda\right) = \frac{J\, K_T(J,P/D,Re)}{2\pi K_Q(J,P/D,Re)} + \lambda\left(K_T(J,P/D,Re) - C_T J^2\right) \tag{II-28}$$

subject to:

$$0.50 \leq \frac{P}{D} \leq 1.40 \tag{II-29}$$

where λ is a Lagrange multiplier.

To find the stationary points of F we set all first partial derivatives equal to zero:

$$\frac{\partial F}{\partial J} = \frac{1}{2\pi}\frac{K_T}{K_Q} + \frac{J}{2\pi}\,\frac{\frac{\partial K_T}{\partial J}K_Q - K_T\frac{\partial K_Q}{\partial J}}{K_Q^2} + \lambda\left(\frac{\partial K_T}{\partial J} - 2C_T J\right) = 0 \tag{II-30}$$

$$\frac{\partial F}{\partial (P/D)} = \frac{J}{2\pi}\,\frac{\frac{\partial K_T}{\partial (P/D)}K_Q - K_T\frac{\partial K_Q}{\partial (P/D)}}{K_Q^2} + \lambda\frac{\partial K_T}{\partial (P/D)} = 0 \tag{II-31}$$

$$\frac{\partial F}{\partial(Re)} = \frac{J}{2\pi} \frac{\frac{\partial K_T}{\partial Re} K_Q - K_T \frac{\partial K_Q}{\partial Re}}{K_Q^2} + \lambda \frac{\partial K_T}{\partial Re} = 0 \qquad \text{(II-32)}$$

$$\frac{\partial F}{\partial \lambda} = K_T - C_T J^2 = 0 \qquad \text{(II-33)}$$

Equations (II-30) to (II-33) can be solved for J , P/D , Re and λ . Actually the value of λ is not of any practical interest, and can be eliminated from equations (II-30) and (II-31), and (II-31) and (II-32) to give:

$$\frac{\partial K_T}{\partial(P/D)} \left\{ J \frac{\partial K_Q}{\partial J} - 3K_Q \right\} + \frac{\partial K_Q}{\partial(P/D)} \left\{ 2K_T - J \frac{\partial K_T}{\partial J} \right\} = 0 \qquad \text{(II-34)}$$

$$\frac{\partial K_Q}{\partial(P/D)} \frac{\partial K_T}{\partial Re} = \frac{\partial K_Q}{\partial Re} \frac{\partial K_T}{\partial(P/D)} \qquad \text{(II-35)}$$

$$K_T = C_T J^2 \qquad \text{(II-36)}$$

Equations (II-34) to (II-35) can be solved for J , P/D and Re . The results yield a single stationary point which gives the maximum efficiency propeller and its operating condition subject to constraints R_1 to R_{20}.

In the next section a special case of the above general problem, namely for $Re = 2 \times 10^6$, is solved with the aid of a digital computer.

II.4. Optimal Revolution Propellers for $Re = 2 \times 10^6$

The K_T , K_Q and η_o regression polynomials, as given in reference [6], are corrected for Reynolds number effects only for $Re > 2 \times 10^6$. In this section the optimization problem is solved for $Re = 2 \times 10^6$ for the entire range of practical values of C_T and for the range of validity of the B-Series. After the identification of the optimal revolution propeller and the computation of its operating condition, Reynolds number can be computed and compared to 2×10^6. If the difference is considerable, the new Reynolds number can be used and the optimization process be repeated. The algorithm converges in 2 to 3 steps because the effect of Re on the result of the optimization problem is small.

At each step though, Reynolds number is constant and equation (II-35) is identically satisfied, thus reducing the problem to the solution of the system of equations (II-34) and (II-36).

The results for $Re = 2 \times 10^6$ are presented in Figure 2 through 25. The optimal revolution propellers as computed from the optimization of the hull-propeller system are plotted in these figures for

$$0.13 \leq C_T \leq 6.55 \qquad \text{(II-37)}$$

and the ranges specified by constraints R_{15} to R_{20}; that is for all the propellers whose K_T, K_Q and η_o curves are plotted in reference [2]. The results are also tabulated in Tables 1 through 24. It can be seen from both the tables and the figures that for low values of C_T and near the extremes of the ranges of Z and A_E/A_o no results are given. This does not imply that there is no solution. It means that in problem P4 inequality (II-29) is violated by the optimum of the unconstrained problem defined by equation (II-28). This means that there is no solution to equation (II-34) for P/D in the range specified by (II-29). That is the Lagrange multiplier method is not valid. In all these cases the optimum is constraint bound at

$$\frac{P}{D} = 1.40 \qquad \text{(II-22)}$$

and the problem becomes trivial.

FIGURE 2
WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS

FIGURE 2

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS
FOR 2 BLADES AE/AO = 0.30,0.50,0.70,0.90

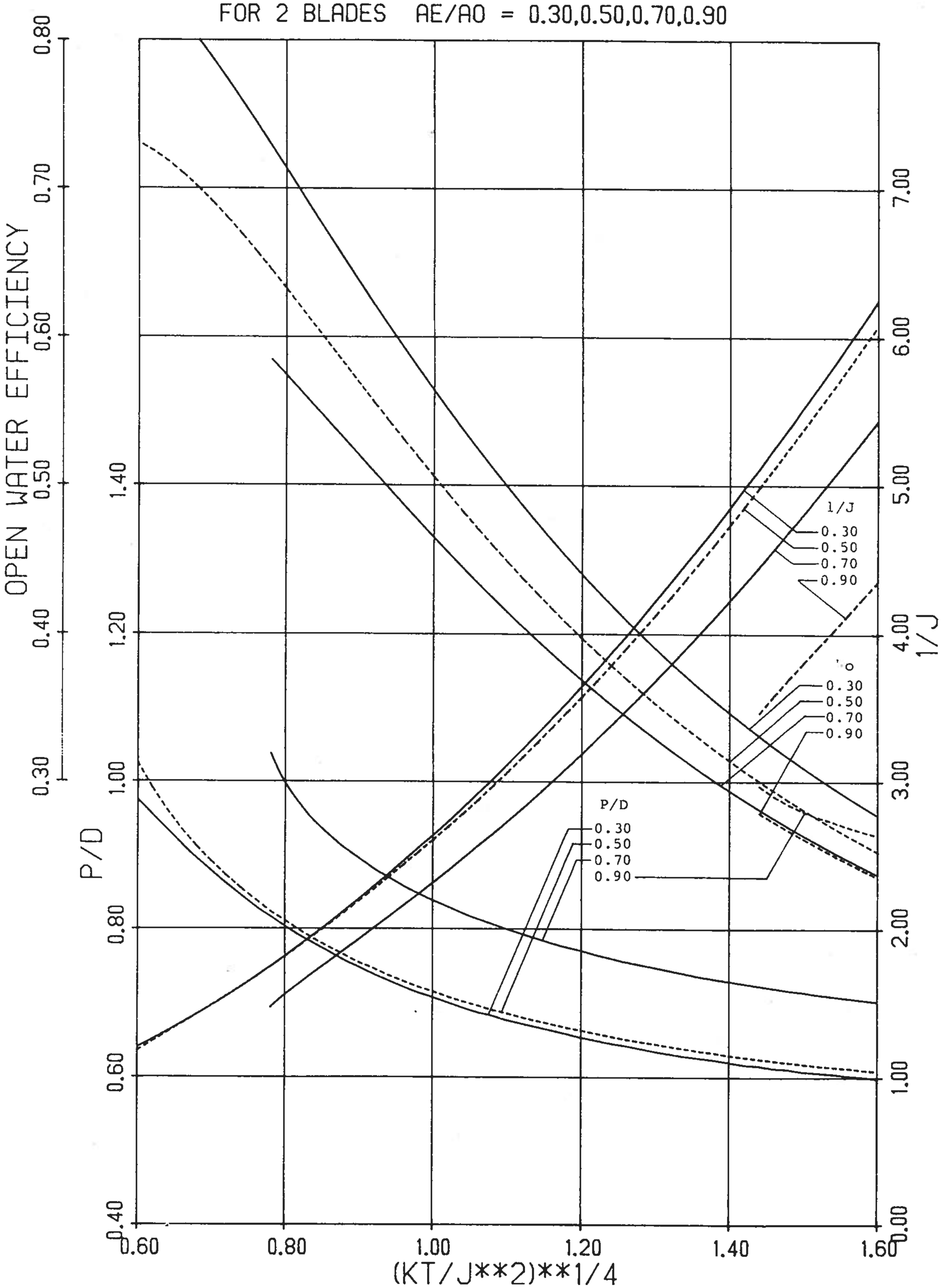


TABLE 1 WAGENINGEN B-SERIES PROPELLER DATA FOR 2 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.30			AE/AO = 0.50			AE/AO = 0.70			AE/AO = 0.90		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60	0.97500	0.83201	0.84781	1.02500	0.84895	0.73061						
0.62	0.95469	0.79856	0.83766	0.99062	0.80762	0.72476						
0.64	0.93437	0.76587	0.82638	0.96094	0.77021	0.71772						
0.66	0.91406	0.73401	0.81416	0.93437	0.73567	0.70962						
0.68	0.89531	0.70386	0.80114	0.91094	0.70386	0.70054						
0.70	0.87812	0.67539	0.78747	0.89062	0.67468	0.69062						
0.72	0.86094	0.64778	0.77327	0.87187	0.64717	0.67998						
0.74	0.84531	0.62180	0.75866	0.85469	0.62126	0.66873						
0.76	0.82969	0.59663	0.74372	0.83906	0.59692	0.65699						
0.78	0.81641	0.57341	0.72855	0.82344	0.57329	0.64485	1.03750	0.67993	0.58482			
0.80	0.80312	0.55098	0.71324	0.81094	0.55193	0.63239	0.99687	0.64258	0.57411			
0.82	0.79062	0.52964	0.69783	0.79766	0.53086	0.61974	0.96875	0.61246	0.56331			
0.84	0.77969	0.50974	0.68242	0.78594	0.51116	0.60692	0.94531	0.58557	0.55241			
0.86	0.76875	0.49053	0.66705	0.77500	0.49246	0.59403	0.92656	0.56172	0.54142			
0.88	0.75781	0.47201	0.65176	0.76484	0.47471	0.58112	0.90937	0.53935	0.53037			
0.90	0.74844	0.45478	0.63661	0.75469	0.45754	0.56824	0.89531	0.51909	0.51931			
0.92	0.73906	0.43818	0.62162	0.74687	0.44192	0.55542	0.88125	0.49951	0.50827			
0.94	0.73047	0.42248	0.60683	0.73750	0.42620	0.54274	0.86953	0.48157	0.49730			
0.96	0.72187	0.40737	0.59227	0.72969	0.41162	0.53019	0.85781	0.46422	0.48641			
0.98	0.71406	0.39310	0.57796	0.72187	0.39756	0.51784	0.84766	0.44807	0.47562			
1.00	0.70781	0.37989	0.56392	0.71562	0.38455	0.50565	0.83828	0.43278	0.46498			
1.02	0.70078	0.36692	0.55017	0.70859	0.37170	0.49368	0.82969	0.41829	0.45449			
1.04	0.69375	0.35443	0.53671	0.70234	0.35959	0.48196	0.82109	0.40428	0.44416			
1.06	0.68750	0.34265	0.52354	0.69687	0.34817	0.47047	0.81328	0.39104	0.43401			
1.08	0.68281	0.33180	0.51071	0.69062	0.33689	0.45924	0.80625	0.37853	0.42407			
1.10	0.67656	0.32089	0.49818	0.68594	0.32651	0.44826	0.79922	0.36643	0.41432			
1.12	0.67187	0.31083	0.48597	0.68047	0.31623	0.43753	0.79297	0.35502	0.40479			
1.14	0.66719	0.30113	0.47407	0.67578	0.30658	0.42708	0.78672	0.34398	0.39547			
1.16	0.66250	0.29181	0.46249	0.67109	0.29725	0.41689	0.78047	0.33334	0.38637			
1.18	0.65781	0.28282	0.45122	0.66641	0.28826	0.40696	0.77500	0.32329	0.37748			
1.20	0.65312	0.27417	0.44026	0.66250	0.27980	0.39730	0.77031	0.31382	0.36881			
1.22	0.64922	0.26604	0.42962	0.65859	0.27163	0.38790	0.76484	0.30444	0.36036			
1.24	0.64531	0.25820	0.41929	0.65469	0.26376	0.37876	0.76016	0.29561	0.35213			
1.26	0.64219	0.25082	0.40922	0.65078	0.25615	0.36988	0.75547	0.28707	0.34411			
1.28	0.63828	0.24353	0.39946	0.64766	0.24901	0.36124	0.75156	0.27904	0.33632			
1.30	0.63437	0.23651	0.38999	0.64453	0.24210	0.35283	0.74766	0.27128	0.32872			
1.32	0.63125	0.22991	0.38079	0.64141	0.23545	0.34468	0.74375	0.26377	0.32133			
1.34	0.62812	0.22355	0.37188	0.63828	0.22900	0.33675	0.73984	0.25651	0.31415			
1.36	0.62578	0.21755	0.36320	0.63516	0.22279	0.32906	0.73594	0.24950	0.30716			
1.38	0.62344	0.21178	0.35479	0.63281	0.21696	0.32158	0.73281	0.24291	0.30037			
1.40	0.62031	0.20605	0.34664	0.62969	0.21114	0.31432	0.72969	0.23653	0.29376			
1.42	0.61719	0.20052	0.33872	0.62734	0.20570	0.30727	0.72656	0.23036	0.28733			
1.44	0.61562	0.19547	0.33104	0.62500	0.20044	0.30044	0.72344	0.22439	0.28109	0.99375	0.28846	0.27856
1.46	0.61250	0.19031	0.32358	0.62266	0.19534	0.29379	0.72031	0.21862	0.27502	0.97969	0.27902	0.27259
1.48	0.61094	0.18560	0.31635	0.62031	0.19042	0.28734	0.71719	0.21303	0.26912	0.96875	0.27053	0.26678
1.50	0.60781	0.18077	0.30933	0.61797	0.18565	0.28107	0.71484	0.20778	0.26339	0.95937	0.26264	0.26114
1.52	0.60625	0.17637	0.30251	0.61562	0.18104	0.27498	0.71172	0.20254	0.25782	0.95156	0.25532	0.25566
1.54	0.60469	0.17211	0.29590	0.61406	0.17672	0.26908	0.70937	0.19763	0.25240	0.94531	0.24853	0.25033
1.56	0.60234	0.16787	0.28948	0.61250	0.17253	0.26333	0.70703	0.19286	0.24713	0.93828	0.24182	0.24516
1.58	0.60078	0.16389	0.28326	0.61016	0.16835	0.25776	0.70469	0.18825	0.24201	0.93203	0.23546	0.24012
1.60	0.59844	0.15991	0.27720	0.60859	0.16443	0.25235	0.70234	0.18378	0.23703	0.92656	0.22944	0.23523

FIGURE 3

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS
FOR 2 BLADES AE/AO = 0.35,0.55,0.75,0.95

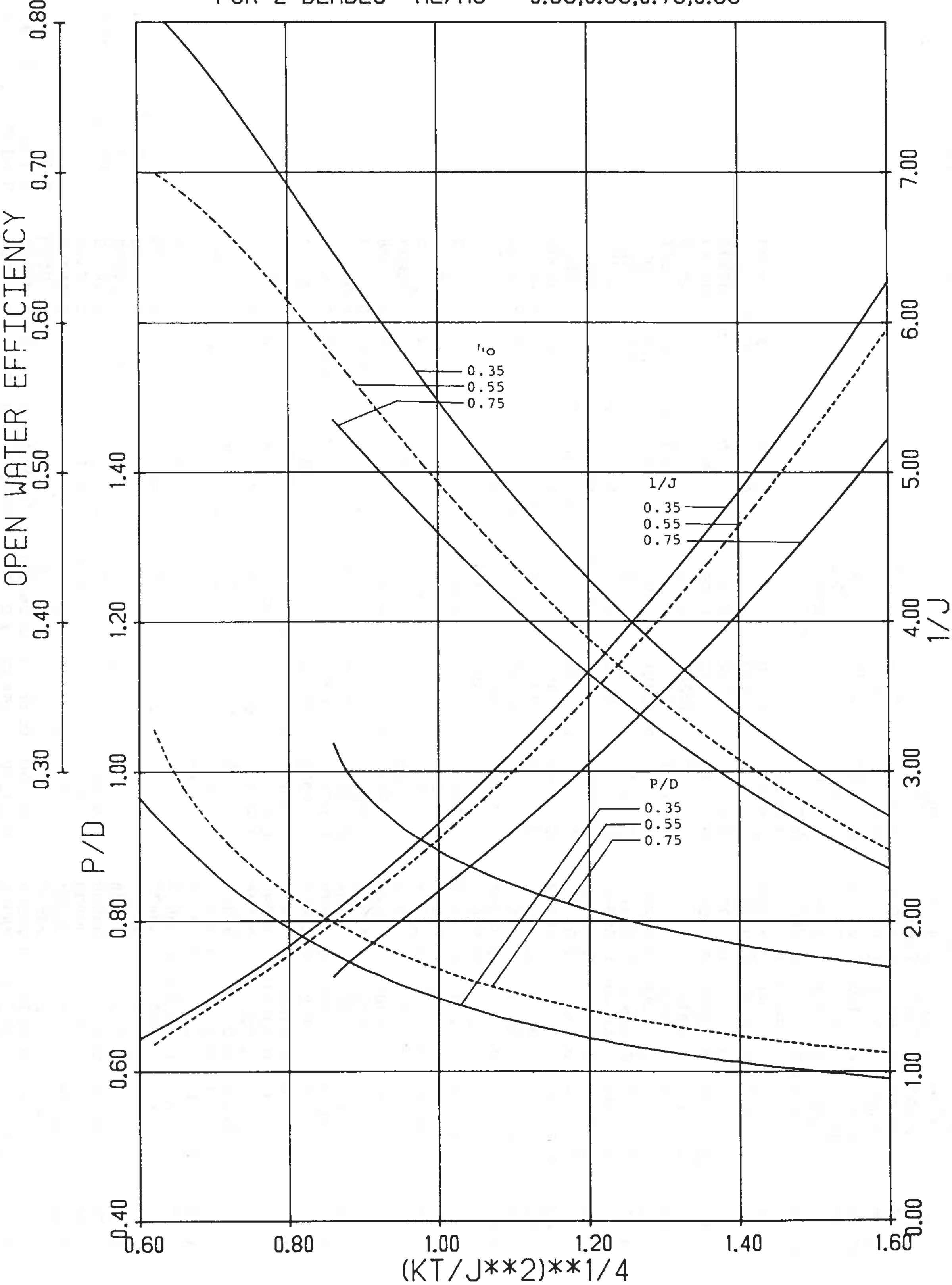


TABLE 2 WAGENINGEN B-SERIES PROPELLER DATA FOR 2 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.35			AE/AO = 0.55			AE/AO = 0.75			AE/AO = 0.95		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60	0.96562	0.82197	0.81805									
0.62	0.94219	0.78730	0.80897	1.05625	0.84597	0.70047						
0.64	0.92187	0.75527	0.79870	1.01094	0.79839	0.69391						
0.66	0.90156	0.72405	0.78745	0.97656	0.75869	0.68644						
0.68	0.88281	0.69451	0.77535	0.94844	0.72378	0.67811						
0.70	0.86406	0.66577	0.76255	0.92344	0.69160	0.66896						
0.72	0.84687	0.63869	0.74918	0.90156	0.66211	0.65911						
0.74	0.83125	0.61323	0.73533	0.88281	0.63513	0.64864						
0.76	0.81719	0.58933	0.72113	0.86562	0.60974	0.63764						
0.78	0.80312	0.56618	0.70666	0.85000	0.58591	0.62622						
0.80	0.79062	0.54451	0.69200	0.83516	0.56321	0.61449						
0.82	0.77812	0.52356	0.67724	0.82187	0.54193	0.60249						
0.84	0.76719	0.50400	0.66242	0.80937	0.52168	0.59032						
0.86	0.75625	0.48513	0.64764	0.79766	0.50244	0.57805	1.03750	0.61247	0.53505			
0.88	0.74609	0.46722	0.63291	0.78750	0.48452	0.56574	0.99687	0.57876	0.52395			
0.90	0.73594	0.44995	0.61828	0.77656	0.46685	0.55343	0.97187	0.55292	0.51295			
0.92	0.72812	0.43423	0.60382	0.76719	0.45040	0.54116	0.95156	0.52994	0.50203			
0.94	0.71875	0.41846	0.58953	0.75859	0.43484	0.52899	0.93437	0.50904	0.49119			
0.96	0.71094	0.40386	0.57547	0.75078	0.42009	0.51693	0.91875	0.48950	0.48047			
0.98	0.70391	0.39005	0.56162	0.74297	0.40586	0.50504	0.90625	0.47184	0.46985			
1.00	0.69687	0.37676	0.54805	0.73594	0.39241	0.49332	0.89375	0.45480	0.45939			
1.02	0.69062	0.36421	0.53473	0.72812	0.37913	0.48180	0.88281	0.43892	0.44908			
1.04	0.68437	0.35212	0.52170	0.72187	0.36686	0.47048	0.87344	0.42416	0.43894			
1.06	0.67812	0.34048	0.50896	0.71562	0.35502	0.45939	0.86406	0.40990	0.42898			
1.08	0.67187	0.32927	0.49653	0.71016	0.34385	0.44852	0.85547	0.39640	0.41921			
1.10	0.66719	0.31894	0.48439	0.70469	0.33307	0.43791	0.84766	0.38363	0.40964			
1.12	0.66250	0.30898	0.47254	0.69922	0.32267	0.42754	0.83984	0.37130	0.40028			
1.14	0.65781	0.29940	0.46102	0.69453	0.31287	0.41741	0.83281	0.35964	0.39112			
1.16	0.65312	0.29016	0.44980	0.68984	0.30342	0.40755	0.82656	0.34862	0.38217			
1.18	0.64844	0.28126	0.43888	0.68516	0.29429	0.39793	0.82031	0.33799	0.37344			
1.20	0.64375	0.27268	0.42826	0.68047	0.28547	0.38856	0.81406	0.32771	0.36491			
1.22	0.64062	0.26482	0.41794	0.67656	0.27718	0.37943	0.80859	0.31802	0.35661			
1.24	0.63594	0.25685	0.40791	0.67266	0.26919	0.37056	0.80312	0.30865	0.34852			
1.26	0.63281	0.24955	0.39818	0.66875	0.26146	0.36193	0.79844	0.29982	0.34063			
1.28	0.62969	0.24249	0.38870	0.66562	0.25421	0.35354	0.79297	0.29108	0.33295			
1.30	0.62656	0.23569	0.37951	0.66250	0.24720	0.34539	0.78906	0.28304	0.32548			
1.32	0.62344	0.22914	0.37059	0.65859	0.24023	0.33745	0.78437	0.27507	0.31820			
1.34	0.62031	0.22281	0.36194	0.65547	0.23370	0.32975	0.78047	0.26756	0.31113			
1.36	0.61719	0.21670	0.35353	0.65312	0.22756	0.32226	0.77617	0.26020	0.30425			
1.38	0.61406	0.21080	0.34537	0.65000	0.22145	0.31499	0.77266	0.25328	0.29755			
1.40	0.61250	0.20543	0.33746	0.64687	0.21555	0.30793	0.76875	0.24650	0.29105			
1.42	0.60937	0.19993	0.32978	0.64453	0.21001	0.30107	0.76484	0.23993	0.28471			
1.44	0.60703	0.19476	0.32233	0.64219	0.20465	0.29440	0.76172	0.23375	0.27856			
1.46	0.60469	0.18977	0.31509	0.63906	0.19930	0.28793	0.75859	0.22777	0.27257			
1.48	0.60312	0.18508	0.30807	0.63750	0.19446	0.28165	0.75547	0.22199	0.26676			
1.50	0.60078	0.18042	0.30126	0.63437	0.18945	0.27555	0.75234	0.21639	0.26110			
1.52	0.59844	0.17590	0.29464	0.63281	0.18491	0.26961	0.75000	0.21113	0.25560			
1.54	0.59687	0.17167	0.28822	0.63047	0.18036	0.26385	0.74687	0.20587	0.25025			
1.56	0.59453	0.16744	0.28199	0.62891	0.17611	0.25825	0.74453	0.20094	0.24506			
1.58	0.59219	0.16335	0.27594	0.62656	0.17184	0.25281	0.74141	0.19601	0.24000			
1.60	0.59062	0.15952	0.27007	0.62500	0.16785	0.24753	0.73906	0.19138	0.23508			

FIGURE 4

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM RPM PROPELLERS

FOR 2 BLADES AE/AO = 0.40,0.60,0.80,1.00

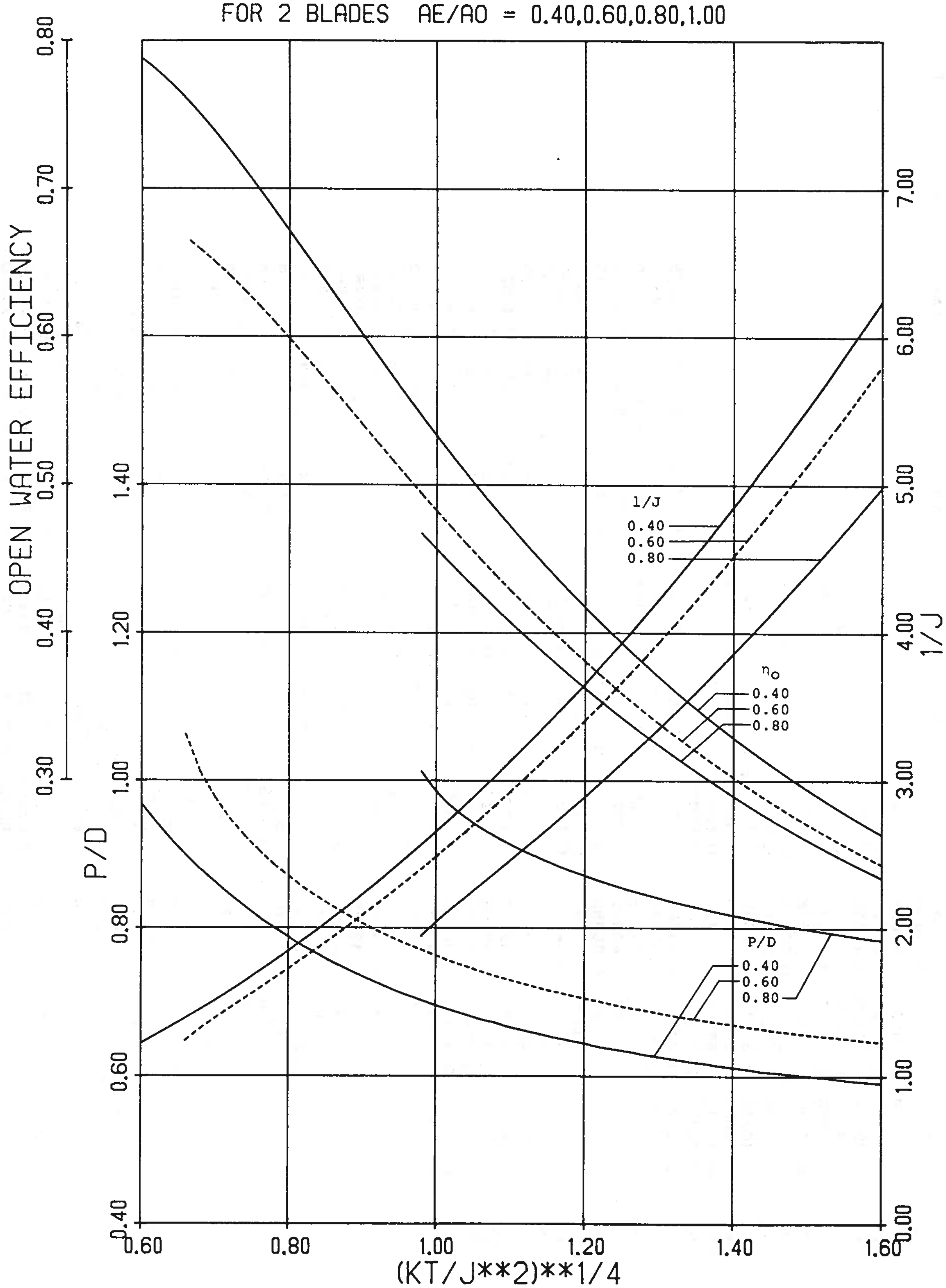


TABLE 3 WAGENINGEN B-SERIES PROPELLER DATA FOR 2 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.40 P/D	J	ETA-O	AE/AO = 0.60 P/D	J	ETA-O	AE/AO = 0.80 P/D	J	ETA-O	AE/AO = 1.00 P/D	J	ETA-O
0.60	0.96875	0.81997	0.78812									
0.62	0.94375	0.78469	0.78023									
0.64	0.92031	0.75117	0.77110									
0.66	0.89922	0.71990	0.76094	1.06250	0.80784	0.66679						
0.68	0.87969	0.69031	0.74986	1.01094	0.75847	0.65862						
0.70	0.86250	0.66279	0.73801	0.97656	0.72034	0.64990						
0.72	0.84531	0.63606	0.72554	0.94844	0.68681	0.64056						
0.74	0.82969	0.61089	0.71254	0.92500	0.65683	0.63067						
0.76	0.81406	0.58647	0.69914	0.90469	0.62942	0.62030						
0.78	0.80078	0.56399	0.68543	0.88594	0.60359	0.60948						
0.80	0.78750	0.54219	0.67148	0.87031	0.58015	0.59836						
0.82	0.77500	0.52148	0.65741	0.85469	0.55740	0.58695						
0.84	0.76406	0.50215	0.64325	0.84140	0.53648	0.57536						
0.86	0.75312	0.48345	0.62906	0.82891	0.51659	0.56365						
0.88	0.74375	0.46606	0.61492	0.81719	0.49768	0.55187						
0.90	0.73437	0.44927	0.60087	0.80625	0.47971	0.54006						
0.92	0.72578	0.43336	0.58694	0.79609	0.46268	0.52830						
0.94	0.71719	0.41802	0.57318	0.78672	0.44653	0.51660						
0.96	0.70937	0.40352	0.55961	0.77812	0.43125	0.50502						
0.98	0.70234	0.38982	0.54626	0.77031	0.41677	0.49356	1.01250	0.51398	0.46703			
1.00	0.69531	0.37660	0.53314	0.76250	0.40278	0.48225	0.98594	0.49073	0.45652			
1.02	0.68906	0.36414	0.52028	0.75469	0.38926	0.47111	0.96562	0.47060	0.44621			
1.04	0.68281	0.35211	0.50768	0.74844	0.37678	0.46019	0.95000	0.45287	0.43611			
1.06	0.67656	0.34053	0.49536	0.74141	0.36445	0.44947	0.93594	0.43632	0.42621			
1.08	0.67187	0.32986	0.48332	0.73516	0.35281	0.43895	0.92422	0.42113	0.41650			
1.10	0.66562	0.31909	0.47158	0.72969	0.34183	0.42867	0.91328	0.40674	0.40700			
1.12	0.66094	0.30918	0.46011	0.72422	0.33124	0.41862	0.90312	0.39311	0.39772			
1.14	0.65625	0.29963	0.44895	0.71875	0.32101	0.40881	0.89453	0.38044	0.38864			
1.16	0.65156	0.29043	0.43808	0.71406	0.31136	0.39923	0.88594	0.36822	0.37978			
1.18	0.64766	0.28176	0.42749	0.70937	0.30206	0.38990	0.87812	0.35666	0.37113			
1.20	0.64375	0.27341	0.41720	0.70469	0.29308	0.38080	0.87109	0.34573	0.36269			
1.22	0.63906	0.26516	0.40720	0.70078	0.28462	0.37193	0.86406	0.33517	0.35447			
1.24	0.63594	0.25759	0.39746	0.69609	0.27623	0.36329	0.85781	0.32519	0.34645			
1.26	0.63281	0.25030	0.38802	0.69219	0.26836	0.35491	0.85156	0.31555	0.33864			
1.28	0.62891	0.24308	0.37885	0.68906	0.26095	0.34674	0.84609	0.30644	0.33103			
1.30	0.62578	0.23628	0.36992	0.68516	0.25359	0.33879	0.84062	0.29766	0.32364			
1.32	0.62266	0.22972	0.36126	0.68125	0.24648	0.33108	0.83516	0.28915	0.31643			
1.34	0.61953	0.22340	0.35286	0.67812	0.23981	0.32357	0.83047	0.28113	0.30942			
1.36	0.61719	0.21747	0.34471	0.67500	0.23336	0.31628	0.82578	0.27338	0.30260			
1.38	0.61406	0.21157	0.33679	0.67187	0.22712	0.30920	0.82109	0.26589	0.29597			
1.40	0.61172	0.20603	0.32911	0.66953	0.22126	0.30230	0.81719	0.25883	0.28953			
1.42	0.60937	0.20068	0.32165	0.66641	0.21543	0.29561	0.81328	0.25199	0.28325			
1.44	0.60625	0.19535	0.31440	0.66406	0.20996	0.28911	0.80937	0.24537	0.27715			
1.46	0.60469	0.19051	0.30739	0.66094	0.20450	0.28280	0.80547	0.23898	0.27122			
1.48	0.60234	0.18568	0.30056	0.65859	0.19938	0.27665	0.80156	0.23279	0.26546			
1.50	0.60039	0.18108	0.29394	0.65625	0.19442	0.27069	0.79844	0.22695	0.25984			
1.52	0.59844	0.17662	0.28751	0.65391	0.18962	0.26490	0.79531	0.22131	0.25439			
1.54	0.59609	0.17225	0.28128	0.65234	0.18513	0.25927	0.79219	0.21584	0.24910			
1.56	0.59375	0.16802	0.27522	0.65000	0.18063	0.25380	0.78906	0.21055	0.24394			
1.58	0.59219	0.16405	0.26933	0.64766	0.17628	0.24849	0.78594	0.20541	0.23892			
1.60	0.59062	0.16020	0.26361	0.64609	0.17219	0.24332	0.78359	0.20059	0.23404			

FIGURE 5

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM RPM PROPELLERS

FOR 2 BLADES AE/AO = 0.45,0.65,0.85,1.05

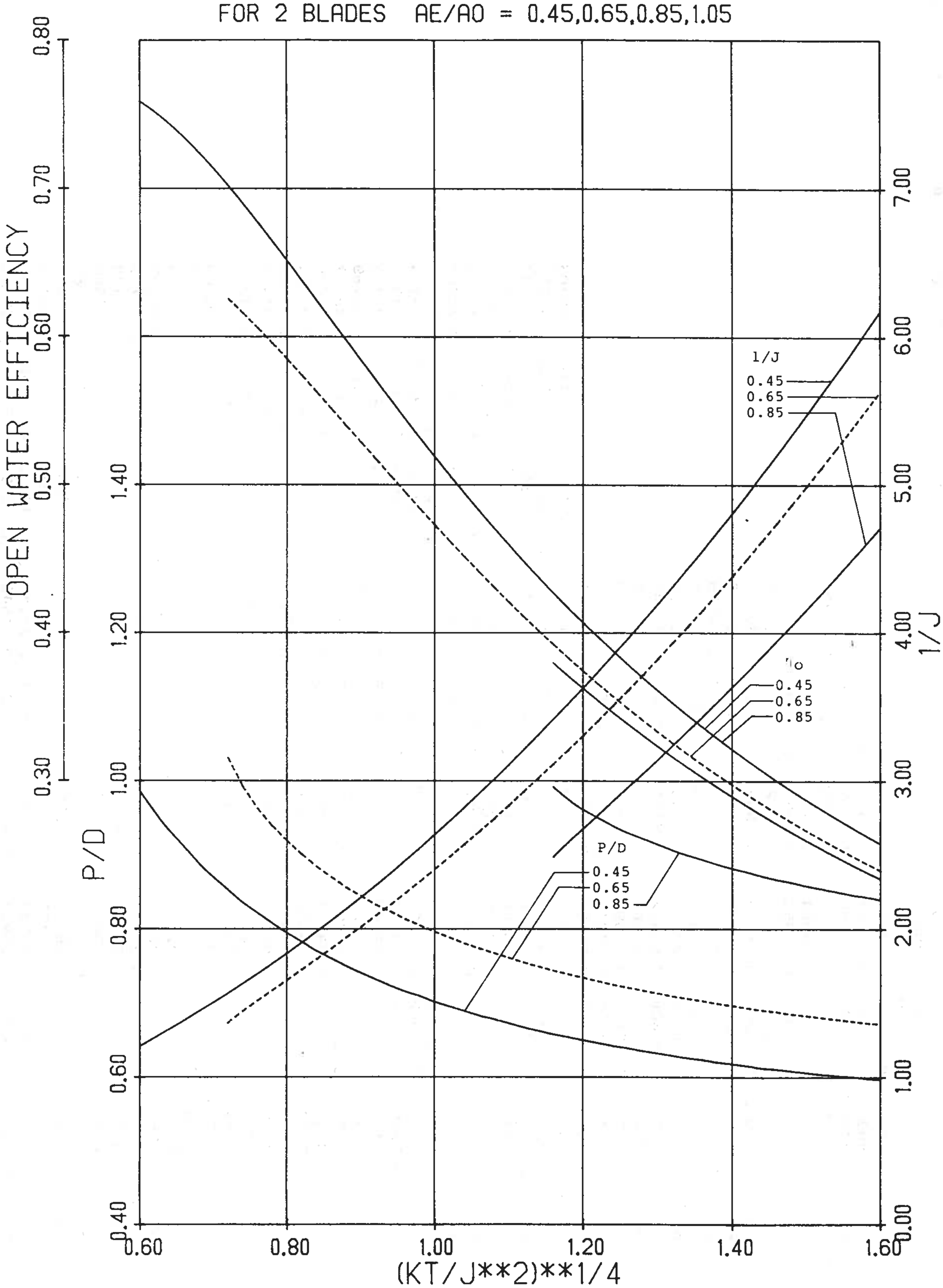


TABLE 4 WAGENINGEN B-SERIES PROPELLER DATA FOR 2 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.45			AE/AO = 0.65			AE/AO = 0.85			AE/AO = 1.05		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60	0.98594	0.82724	0.75859									
0.62	0.95781	0.79009	0.75184									
0.64	0.93281	0.75576	0.74386									
0.66	0.91094	0.72417	0.73479									
0.68	0.88906	0.69333	0.72473									
0.70	0.87031	0.66511	0.71388									
0.72	0.85312	0.63852	0.70235	1.03125	0.73144	0.62558						
0.74	0.83594	0.61267	0.69023	0.99219	0.69221	0.61582						
0.76	0.82187	0.58921	0.67767	0.96250	0.65913	0.60574						
0.78	0.80781	0.56643	0.66474	0.93906	0.63030	0.59531						
0.80	0.79453	0.54472	0.65155	0.91875	0.60395	0.58461						
0.82	0.78281	0.52444	0.63816	0.90078	0.57956	0.57366						
0.84	0.77031	0.50444	0.62467	0.88437	0.55669	0.56252						
0.86	0.76016	0.48616	0.61113	0.87031	0.53563	0.55125						
0.88	0.75000	0.46848	0.59761	0.85625	0.51526	0.53992						
0.90	0.74062	0.45173	0.58416	0.84453	0.49657	0.52856						
0.92	0.73203	0.43586	0.57079	0.83281	0.47850	0.51722						
0.94	0.72344	0.42053	0.55756	0.82344	0.46200	0.50592						
0.96	0.71562	0.40603	0.54449	0.81328	0.44573	0.49472						
0.98	0.70937	0.39264	0.53163	0.80469	0.43063	0.48365						
1.00	0.70156	0.37913	0.51898	0.79609	0.41603	0.47271						
1.02	0.69531	0.36666	0.50658	0.78828	0.40221	0.46193						
1.04	0.68906	0.35464	0.49443	0.78047	0.38887	0.45133						
1.06	0.68281	0.34302	0.48250	0.77344	0.37626	0.44092						
1.08	0.67812	0.33235	0.47088	0.76719	0.36436	0.43073						
1.10	0.67266	0.32180	0.45953	0.76094	0.35286	0.42074						
1.12	0.66719	0.31162	0.44844	0.75469	0.34175	0.41097						
1.14	0.66250	0.30205	0.43764	0.74922	0.33127	0.40142						
1.16	0.65781	0.29281	0.42711	0.74375	0.32117	0.39211	0.99219	0.40217	0.37968			
1.18	0.65391	0.28412	0.41685	0.73906	0.31163	0.38302	0.97500	0.38707	0.37098			
1.20	0.65000	0.27574	0.40689	0.73437	0.30243	0.37415	0.96094	0.37341	0.36251			
1.22	0.64609	0.26766	0.39719	0.72969	0.29354	0.36552	0.95000	0.36112	0.35427			
1.24	0.64219	0.25985	0.38775	0.72500	0.28496	0.35711	0.93906	0.34926	0.34624			
1.26	0.63906	0.25253	0.37859	0.72109	0.27688	0.34892	0.92969	0.33823	0.33843			
1.28	0.63516	0.24526	0.36969	0.71719	0.26908	0.34096	0.92187	0.32799	0.33083			
1.30	0.63203	0.23844	0.36104	0.71328	0.26154	0.33320	0.91406	0.31810	0.32343			
1.32	0.62891	0.23185	0.35264	0.70937	0.25425	0.32566	0.90625	0.30856	0.31623			
1.34	0.62578	0.22549	0.34448	0.70625	0.24740	0.31833	0.89961	0.29962	0.30923			
1.36	0.62344	0.21952	0.33656	0.70312	0.24078	0.31121	0.89375	0.29117	0.30243			
1.38	0.62031	0.21357	0.32886	0.69961	0.23429	0.30428	0.88750	0.28292	0.29581			
1.40	0.61797	0.20801	0.32140	0.69687	0.22819	0.29754	0.88203	0.27512	0.28937			
1.42	0.61562	0.20262	0.31415	0.69375	0.22220	0.29100	0.87734	0.26775	0.28312			
1.44	0.61250	0.19725	0.30711	0.69062	0.21641	0.28464	0.87187	0.26045	0.27703			
1.46	0.61094	0.19238	0.30028	0.68828	0.21098	0.27846	0.86719	0.25356	0.27111			
1.48	0.60859	0.18752	0.29366	0.68516	0.20555	0.27245	0.86328	0.24706	0.26536			
1.50	0.60625	0.18281	0.28722	0.68281	0.20047	0.26662	0.85859	0.24060	0.25976			
1.52	0.60391	0.17826	0.28097	0.68047	0.19554	0.26094	0.85469	0.23451	0.25432			
1.54	0.60234	0.17399	0.27489	0.67812	0.19078	0.25543	0.85078	0.22861	0.24904			
1.56	0.60078	0.16986	0.26900	0.67578	0.18616	0.25007	0.84687	0.22290	0.24389			
1.58	0.59844	0.16572	0.26327	0.67344	0.18168	0.24486	0.84375	0.21751	0.23889			
1.60	0.59687	0.16185	0.25772	0.67187	0.17749	0.23980	0.83984	0.21215	0.23402			

FIGURE 6

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS
FOR 3 BLADES AE/AO = 0.30,0.50,0.70,0.90

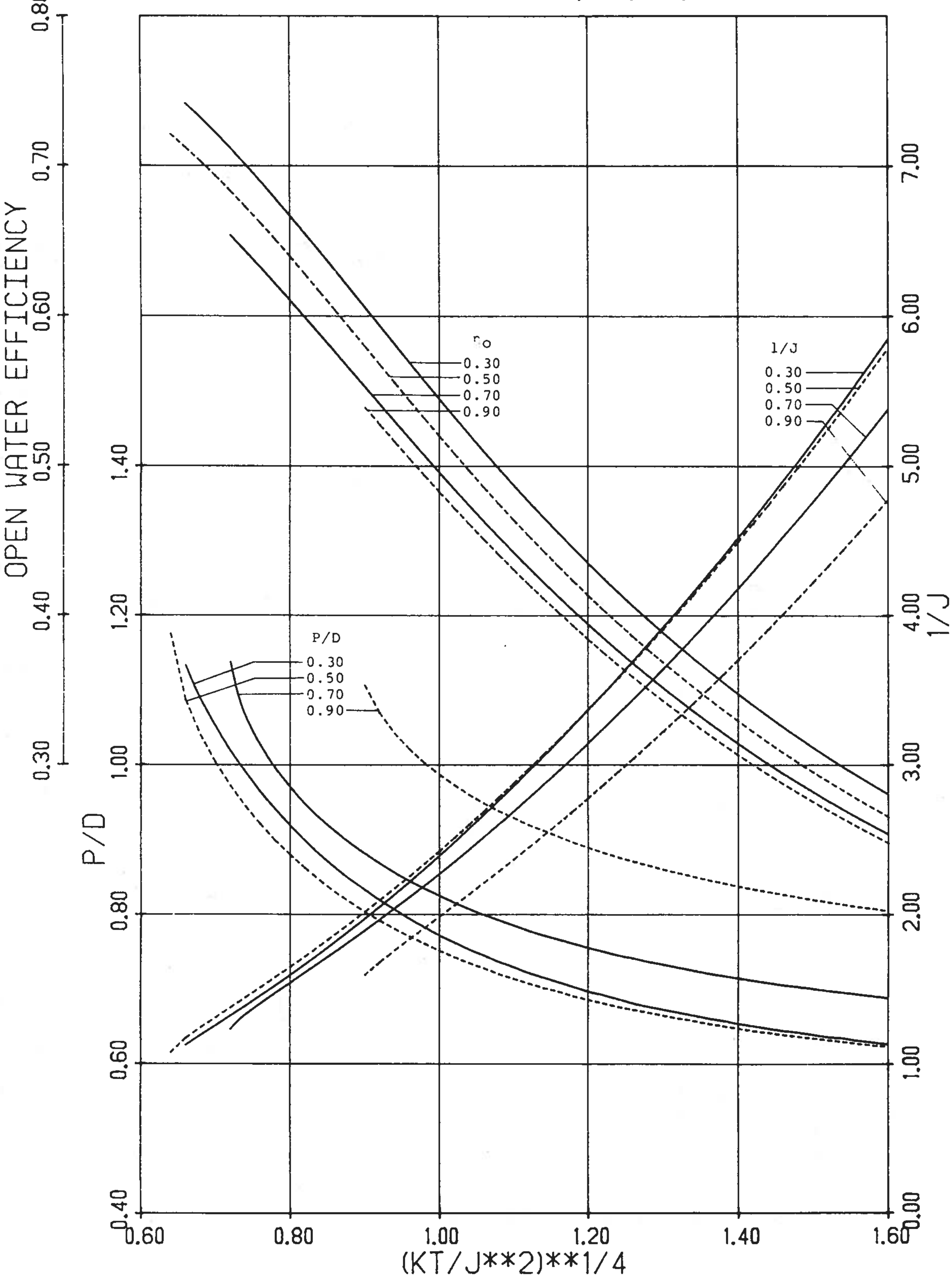


TABLE 5 WAGENINGEN B-SERIES PROPELLER DATA FOR 3 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.30 P/D	J	ETA-O	AE/AO = 0.50 P/D	J	ETA-O	AE/AO = 0.70 P/D	J	ETA-O	AE/AO = 0.90 P/D	J	ETA-O
0.60												
0.62												
0.64				1.17500	0.92825	0.72086						
0.66	1.13281	0.88799	0.74117	1.08594	0.85293	0.71203						
0.68	1.08750	0.83862	0.73192	1.03906	0.80420	0.70295						
0.70	1.05156	0.79597	0.72210	1.00312	0.76326	0.69343						
0.72	1.01875	0.75649	0.71178	0.97187	0.72622	0.68343	1.13750	0.81116	0.65366			
0.74	0.99062	0.72077	0.70101	0.94453	0.69250	0.67300	1.06562	0.75248	0.64298			
0.76	0.96406	0.68716	0.68987	0.92031	0.66152	0.66217	1.02656	0.71279	0.63228			
0.78	0.94062	0.65625	0.67841	0.89844	0.63274	0.65099	0.99531	0.67844	0.62141			
0.80	0.91875	0.62722	0.66669	0.87969	0.60647	0.63953	0.97031	0.64834	0.61033			
0.82	0.89844	0.59997	0.65475	0.86172	0.58144	0.62784	0.94766	0.62036	0.59906			
0.84	0.87969	0.57444	0.64264	0.84531	0.55798	0.61596	0.92812	0.59480	0.58766			
0.86	0.86250	0.55055	0.63044	0.82969	0.53569	0.60396	0.91094	0.57117	0.57615			
0.88	0.84687	0.52820	0.61815	0.81641	0.51521	0.59190	0.89531	0.54902	0.56458			
0.90	0.83281	0.50732	0.60584	0.80312	0.49543	0.57979	0.88125	0.52829	0.55298	1.10625	0.62617	0.53932
0.92	0.81875	0.48726	0.59353	0.79141	0.47700	0.56770	0.86797	0.50859	0.54140	1.06875	0.59427	0.52767
0.94	0.80625	0.46855	0.58126	0.78047	0.45955	0.55566	0.85547	0.48989	0.52987	1.04140	0.56761	0.51620
0.96	0.79375	0.45059	0.56906	0.77031	0.44299	0.54368	0.84453	0.47246	0.51842	1.02031	0.54438	0.50491
0.98	0.78281	0.43386	0.55695	0.76094	0.42734	0.53183	0.83437	0.45593	0.50708	1.00234	0.52318	0.49377
1.00	0.77187	0.41780	0.54497	0.75156	0.41226	0.52010	0.82500	0.44026	0.49587	0.98672	0.50360	0.48280
1.02	0.76250	0.40286	0.53312	0.74297	0.39797	0.50851	0.81562	0.42512	0.48480	0.97266	0.48529	0.47201
1.04	0.75312	0.38851	0.52143	0.73516	0.38450	0.49712	0.80703	0.41080	0.47391	0.96016	0.46818	0.46141
1.06	0.74531	0.37519	0.50992	0.72812	0.37176	0.48590	0.79922	0.39725	0.46320	0.94844	0.45194	0.45100
1.08	0.73672	0.36217	0.49859	0.72031	0.35924	0.47489	0.79219	0.38445	0.45269	0.93828	0.43679	0.44079
1.10	0.72969	0.35010	0.48747	0.71406	0.34767	0.46408	0.78516	0.37208	0.44238	0.92891	0.42244	0.43079
1.12	0.72187	0.33827	0.47655	0.70781	0.33651	0.45349	0.77812	0.36014	0.43228	0.91953	0.40857	0.42100
1.14	0.71562	0.32732	0.46584	0.70156	0.32576	0.44313	0.77187	0.34888	0.42241	0.91172	0.39569	0.41143
1.16	0.70937	0.31680	0.45536	0.69687	0.31584	0.43298	0.76641	0.33824	0.41276	0.90391	0.38325	0.40208
1.18	0.70312	0.30666	0.44510	0.69062	0.30585	0.42308	0.76094	0.32797	0.40332	0.89609	0.37124	0.39295
1.20	0.69687	0.29692	0.43507	0.68594	0.29664	0.41341	0.75547	0.31805	0.39412	0.88945	0.35998	0.38403
1.22	0.69219	0.28794	0.42529	0.68125	0.28777	0.40398	0.75039	0.30861	0.38515	0.88281	0.34912	0.37535
1.24	0.68672	0.27909	0.41571	0.67656	0.27920	0.39477	0.74531	0.29947	0.37639	0.87656	0.33874	0.36688
1.26	0.68125	0.27058	0.40639	0.67266	0.27114	0.38580	0.74141	0.29098	0.36787	0.87109	0.32892	0.35862
1.28	0.67656	0.26256	0.39728	0.66875	0.26338	0.37707	0.73672	0.28256	0.35955	0.86562	0.31943	0.35058
1.30	0.67266	0.25499	0.38839	0.66484	0.25587	0.36856	0.73281	0.27463	0.35146	0.86016	0.31028	0.34276
1.32	0.66875	0.24772	0.37975	0.66094	0.24863	0.36027	0.72891	0.26698	0.34359	0.85547	0.30162	0.33514
1.34	0.66484	0.24069	0.37131	0.65781	0.24182	0.35220	0.72500	0.25958	0.33592	0.85078	0.29326	0.32772
1.36	0.66094	0.23392	0.36311	0.65391	0.23507	0.34435	0.72109	0.25244	0.32848	0.84609	0.28517	0.32051
1.38	0.65781	0.22755	0.35512	0.65078	0.22872	0.33671	0.71797	0.24572	0.32122	0.84180	0.27744	0.31348
1.40	0.65391	0.22125	0.34734	0.64766	0.22259	0.32929	0.71484	0.23922	0.31417	0.83750	0.26998	0.30666
1.42	0.65078	0.21532	0.33977	0.64453	0.21667	0.32207	0.71172	0.23293	0.30731	0.83359	0.26284	0.30002
1.44	0.64766	0.20959	0.33239	0.64219	0.21111	0.31504	0.70859	0.22686	0.30063	0.83008	0.25603	0.29357
1.46	0.64453	0.20406	0.32522	0.63906	0.20558	0.30821	0.70547	0.22098	0.29415	0.82656	0.24943	0.28728
1.48	0.64219	0.19886	0.31824	0.63672	0.20038	0.30157	0.70312	0.21546	0.28784	0.82305	0.24305	0.28118
1.50	0.63906	0.19370	0.31145	0.63437	0.19535	0.29510	0.70039	0.21003	0.28171	0.81953	0.23688	0.27524
1.52	0.63594	0.18871	0.30484	0.63203	0.19050	0.28883	0.69766	0.20478	0.27575	0.81641	0.23097	0.26946
1.54	0.63437	0.18414	0.29841	0.62969	0.18579	0.28272	0.69531	0.19978	0.26995	0.81328	0.22526	0.26384
1.56	0.63125	0.17949	0.29217	0.62734	0.18124	0.27678	0.69297	0.19494	0.26433	0.81016	0.21973	0.25838
1.58	0.62891	0.17510	0.28609	0.62500	0.17683	0.27101	0.69062	0.19025	0.25885	0.80781	0.21452	0.25307
1.60	0.62656	0.17086	0.28017	0.62344	0.17270	0.26540	0.68828	0.18570	0.25352	0.80469	0.20933	0.24790

FIGURE 7

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM RPM PROPELLERS

FOR 3 BLADES AE/AO = 0.35,0.55,0.75,0.95

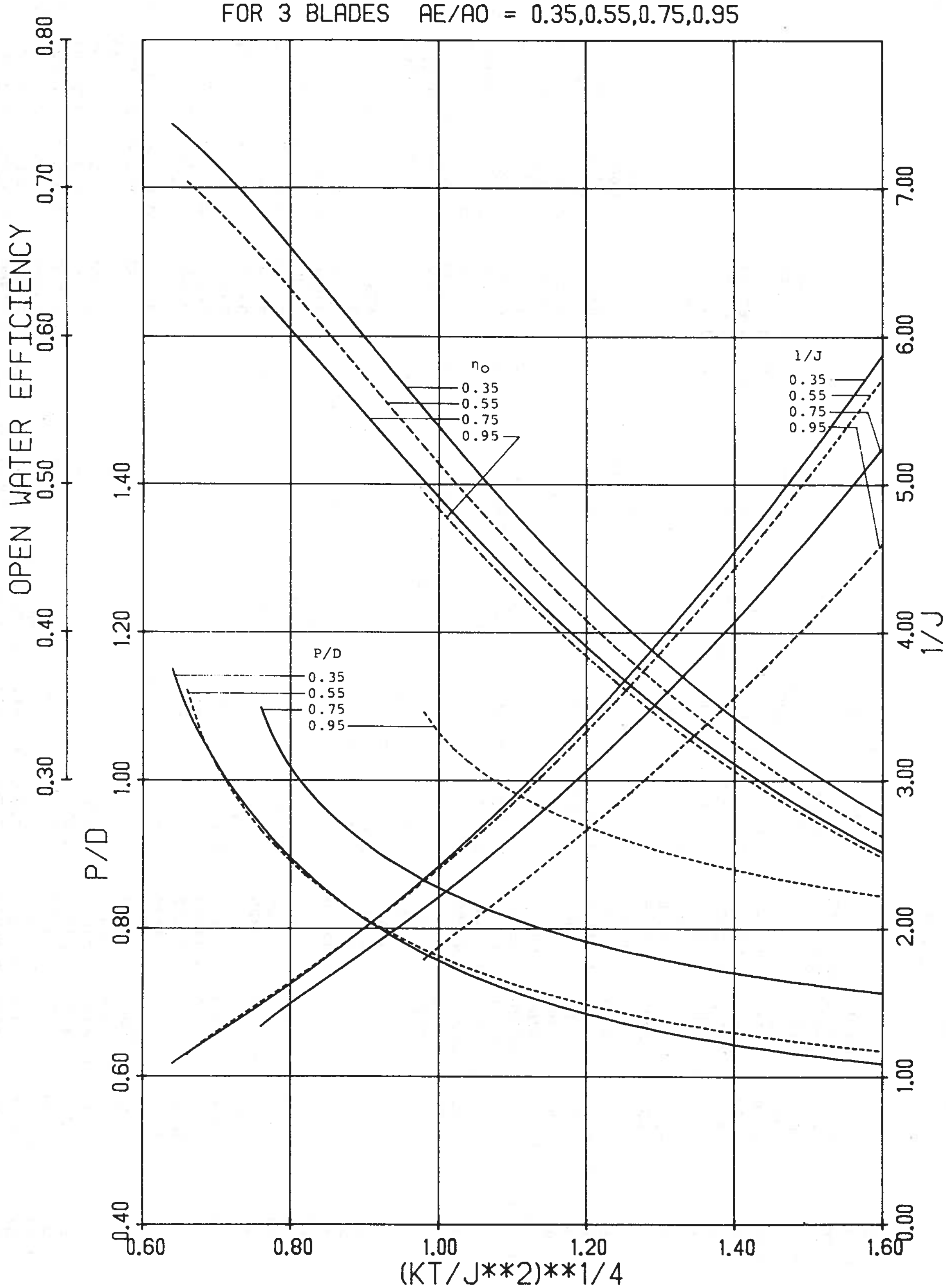


TABLE 6 WAGENINGEN B-SERIES PROPELLER DATA FOR 3 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.35			AE/AO = 0.55			AE/AO = 0.75			AE/AO = 0.95		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60												
0.62												
0.64	1.15000	0.92087	0.74294									
0.66	1.09687	0.86596	0.73430	1.12187	0.87178	0.70411						
0.68	1.05625	0.81987	0.72509	1.05937	0.81389	0.69491						
0.70	1.02187	0.77878	0.71532	1.01875	0.77026	0.68541						
0.72	0.99062	0.74079	0.70505	0.98594	0.73235	0.67548						
0.74	0.96406	0.70654	0.69435	0.95703	0.69778	0.66515						
0.76	0.93906	0.67427	0.68326	0.93203	0.66638	0.65442	1.09844	0.74936	0.62689			
0.78	0.91562	0.64392	0.67184	0.91016	0.63762	0.64336	1.05156	0.70642	0.61577			
0.80	0.89531	0.61614	0.66016	0.89062	0.61094	0.63200	1.01719	0.67113	0.60462			
0.82	0.87656	0.59006	0.64825	0.87187	0.58555	0.62043	0.99062	0.64079	0.59335			
0.84	0.85859	0.56531	0.63619	0.85625	0.56245	0.60867	0.96797	0.61333	0.58199			
0.86	0.84219	0.54214	0.62401	0.84062	0.54013	0.59679	0.94844	0.58823	0.57056			
0.88	0.82656	0.52015	0.61175	0.82656	0.51927	0.58483	0.93125	0.56501	0.55907			
0.90	0.81250	0.49963	0.59946	0.81406	0.49980	0.57284	0.91562	0.54326	0.54757			
0.92	0.80039	0.48064	0.58717	0.80234	0.48132	0.56086	0.90078	0.52258	0.53611			
0.94	0.78750	0.46208	0.57494	0.79141	0.46381	0.54892	0.88828	0.50356	0.52469			
0.96	0.77656	0.44495	0.56277	0.78125	0.44722	0.53707	0.87656	0.48551	0.51336			
0.98	0.76562	0.42847	0.55071	0.77109	0.43120	0.52532	0.86484	0.46807	0.50213	1.09219	0.55842	0.49415
1.00	0.75625	0.41315	0.53875	0.76250	0.41634	0.51370	0.85469	0.45183	0.49104	1.06406	0.53343	0.48301
1.02	0.74687	0.39841	0.52695	0.75391	0.40201	0.50224	0.84531	0.43644	0.48010	1.04219	0.51161	0.47210
1.04	0.73750	0.38425	0.51532	0.74609	0.38846	0.49095	0.83672	0.42186	0.46933	1.02500	0.49224	0.46142
1.06	0.72969	0.37112	0.50385	0.73906	0.37567	0.47985	0.82812	0.40779	0.45874	1.00937	0.47408	0.45095
1.08	0.72187	0.35850	0.49260	0.73203	0.36333	0.46895	0.82031	0.39447	0.44834	0.99609	0.45737	0.44069
1.10	0.71484	0.34657	0.48152	0.72500	0.35143	0.45826	0.81328	0.38187	0.43815	0.98437	0.44176	0.43066
1.12	0.70781	0.33511	0.47067	0.71875	0.34020	0.44778	0.80625	0.36971	0.42817	0.97344	0.42695	0.42085
1.14	0.70156	0.32429	0.46004	0.71328	0.32961	0.43754	0.79961	0.35809	0.41839	0.96328	0.41291	0.41128
1.16	0.69531	0.31388	0.44963	0.70781	0.31941	0.42752	0.79375	0.34713	0.40885	0.95391	0.39960	0.40192
1.18	0.68984	0.30406	0.43944	0.70234	0.30956	0.41773	0.78750	0.33643	0.39953	0.94609	0.38721	0.39278
1.20	0.68437	0.29463	0.42950	0.69687	0.30006	0.40818	0.78203	0.32632	0.39043	0.93750	0.37502	0.38388
1.22	0.67969	0.28572	0.41977	0.69219	0.29111	0.39885	0.77734	0.31678	0.38155	0.93047	0.36370	0.37518
1.24	0.67422	0.27696	0.41030	0.68828	0.28269	0.38975	0.77187	0.30735	0.37289	0.92344	0.35277	0.36672
1.26	0.66953	0.26870	0.40104	0.68359	0.27436	0.38090	0.76719	0.29846	0.36446	0.91719	0.34242	0.35847
1.28	0.66562	0.26094	0.39203	0.67969	0.26652	0.37226	0.76328	0.29009	0.35624	0.91094	0.33242	0.35044
1.30	0.66094	0.25326	0.38322	0.67578	0.25895	0.36385	0.75859	0.28179	0.34825	0.90469	0.32277	0.34262
1.32	0.65703	0.24604	0.37466	0.67187	0.25165	0.35568	0.75469	0.27397	0.34046	0.89922	0.31363	0.33501
1.34	0.65312	0.23909	0.36632	0.66875	0.24478	0.34771	0.75078	0.26642	0.33288	0.89414	0.30491	0.32761
1.36	0.65000	0.23253	0.35819	0.66562	0.23815	0.33997	0.74687	0.25913	0.32552	0.88906	0.29647	0.32040
1.38	0.64687	0.22621	0.35028	0.66172	0.23155	0.33242	0.74297	0.25207	0.31835	0.88437	0.28840	0.31339
1.40	0.64297	0.21995	0.34259	0.65937	0.22554	0.32510	0.73984	0.24543	0.31137	0.87969	0.28060	0.30658
1.42	0.63984	0.21406	0.33509	0.65625	0.21956	0.31797	0.73672	0.23901	0.30458	0.87578	0.27324	0.29994
1.44	0.63750	0.20853	0.32781	0.65312	0.21378	0.31104	0.73359	0.23280	0.29798	0.87148	0.26603	0.29350
1.46	0.63437	0.20303	0.32072	0.65078	0.20834	0.30429	0.73047	0.22679	0.29157	0.86719	0.25905	0.28723
1.48	0.63125	0.19773	0.31382	0.64766	0.20294	0.29774	0.72734	0.22098	0.28533	0.86367	0.25246	0.28113
1.50	0.62891	0.19274	0.30711	0.64531	0.19786	0.29137	0.72500	0.21553	0.27927	0.86016	0.24609	0.27520
1.52	0.62656	0.18791	0.30059	0.64297	0.19294	0.28517	0.72187	0.21008	0.27338	0.85625	0.23983	0.26943
1.54	0.62344	0.18312	0.29424	0.64062	0.18819	0.27915	0.71953	0.20496	0.26764	0.85312	0.23394	0.26383
1.56	0.62187	0.17874	0.28807	0.63828	0.18359	0.27329	0.71719	0.20001	0.26206	0.85000	0.22822	0.25837
1.58	0.61953	0.17438	0.28207	0.63672	0.17927	0.26760	0.71484	0.19521	0.25665	0.84687	0.22269	0.25307
1.60	0.61719	0.17015	0.27623	0.63437	0.17496	0.26206	0.71250	0.19056	0.25137	0.84375	0.21733	0.24791

FIGURE 8

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM RPM PROPELLERS

FOR 3 BLADES AE/AO = 0.40,0.60,0.80,1.00

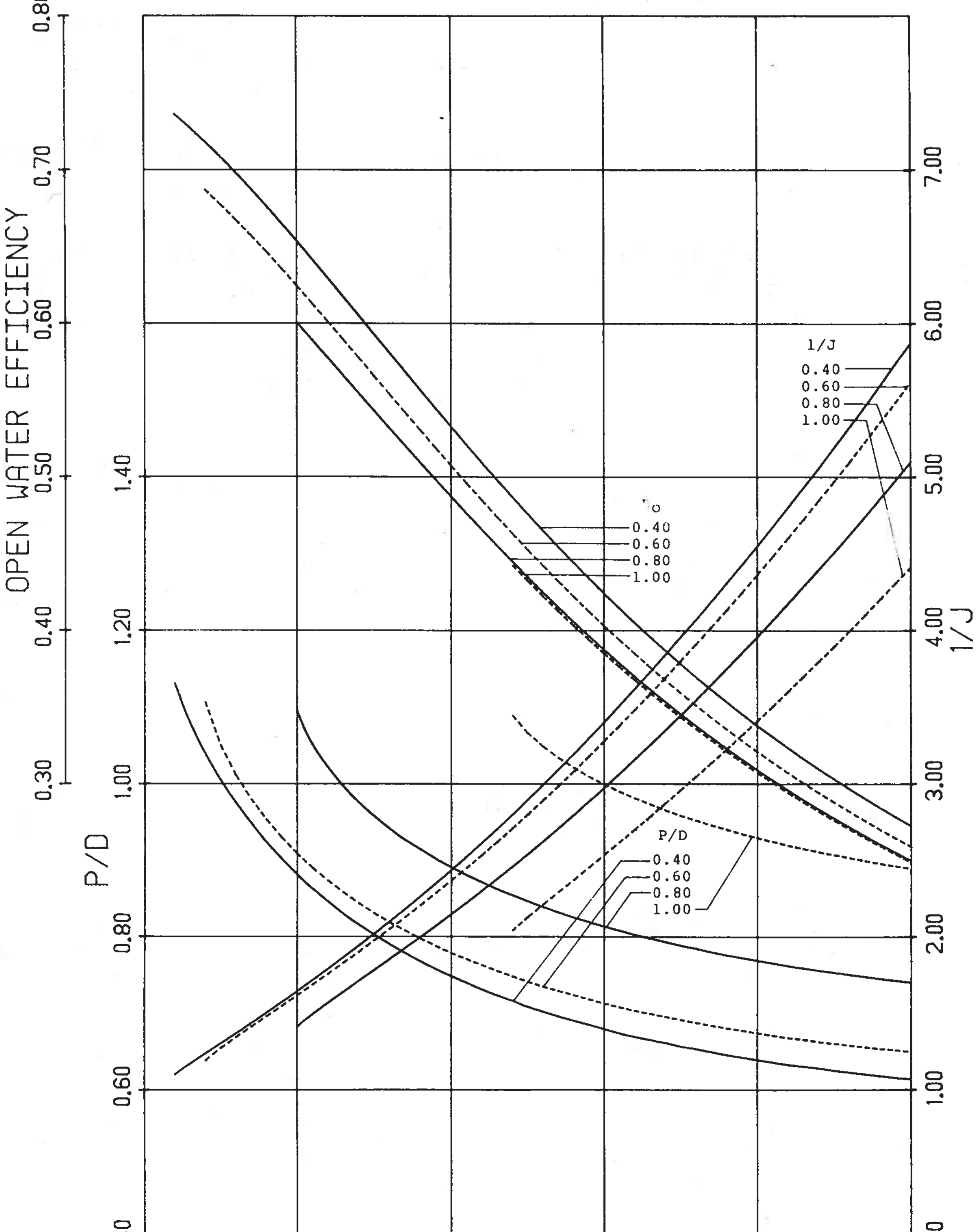


TABLE 7 WAGENINGEN B-SERIES PROPELLER DATA FOR 3 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.40			AE/AO = 0.60			AE/AO = 0.80			AE/AO = 1.00		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60												
0.62												
0.64	1.13125	0.90744	0.73590									
0.66	1.07969	0.85388	0.72728									
0.68	1.03906	0.80832	0.71812	1.10625	0.83896	0.68708						
0.70	1.00469	0.76775	0.70843	1.05000	0.78618	0.67743						
0.72	0.97500	0.73108	0.69824	1.01094	0.74460	0.66750						
0.74	0.94844	0.69729	0.68761	0.97969	0.70862	0.65723						
0.76	0.92344	0.66548	0.67660	0.95312	0.67627	0.64660						
0.78	0.90156	0.63630	0.66524	0.92969	0.64657	0.63565						
0.80	0.88125	0.60889	0.65361	0.90859	0.61900	0.62442	1.09531	0.70919	0.60055			
0.82	0.86250	0.58318	0.64176	0.88984	0.59348	0.61296	1.05156	0.66991	0.58907			
0.84	0.84609	0.55942	0.62972	0.87344	0.56992	0.60133	1.02187	0.63855	0.57762			
0.86	0.82969	0.53655	0.61758	0.85781	0.54748	0.58957	0.99687	0.61040	0.56615			
0.88	0.81562	0.51550	0.60537	0.84375	0.52651	0.57775	0.97578	0.58496	0.55469			
0.90	0.80234	0.49553	0.59312	0.83047	0.50659	0.56589	0.95781	0.56175	0.54325			
0.92	0.78984	0.47661	0.58088	0.81875	0.48799	0.55403	0.94141	0.53999	0.53183			
0.94	0.77812	0.45869	0.56868	0.80781	0.47036	0.54223	0.92656	0.51963	0.52050			
0.96	0.76719	0.44174	0.55656	0.79687	0.45334	0.53051	0.91406	0.50089	0.50925			
0.98	0.75703	0.42570	0.54454	0.78750	0.43752	0.51890	0.90156	0.48280	0.49811			
1.00	0.74766	0.41052	0.53264	0.77812	0.42224	0.50740	0.89062	0.46592	0.48711			
1.02	0.73906	0.39619	0.52089	0.77031	0.40808	0.49607	0.88047	0.44991	0.47626			
1.04	0.73047	0.38240	0.50932	0.76250	0.39441	0.48490	0.87109	0.43474	0.46559			
1.06	0.72266	0.36937	0.49792	0.75469	0.38123	0.47394	0.86172	0.42009	0.45509			
1.08	0.71562	0.35708	0.48672	0.74766	0.36877	0.46317	0.85391	0.40649	0.44480	1.08906	0.48961	0.44231
1.10	0.70781	0.34501	0.47573	0.74062	0.35676	0.45261	0.84609	0.39336	0.43470	1.06562	0.46949	0.43214
1.12	0.70156	0.33385	0.46495	0.73437	0.34542	0.44226	0.83867	0.38081	0.42482	1.04844	0.45207	0.42222
1.14	0.69531	0.32311	0.45439	0.72891	0.33473	0.43213	0.83164	0.36881	0.41514	1.03359	0.43600	0.41254
1.16	0.68984	0.31298	0.44406	0.72344	0.32440	0.42223	0.82500	0.35736	0.40569	1.02109	0.42121	0.40311
1.18	0.68437	0.30322	0.43396	0.71797	0.31445	0.41257	0.81914	0.34653	0.39645	1.00937	0.40717	0.39391
1.20	0.67891	0.29384	0.42410	0.71250	0.30485	0.40313	0.81328	0.33608	0.38744	0.99922	0.39408	0.38495
1.22	0.67344	0.28478	0.41446	0.70781	0.29579	0.39391	0.80781	0.32610	0.37865	0.98984	0.38166	0.37622
1.24	0.66875	0.27626	0.40507	0.70312	0.28706	0.38494	0.80234	0.31645	0.37008	0.98125	0.36989	0.36771
1.26	0.66484	0.26822	0.39589	0.69922	0.27884	0.37620	0.79766	0.30736	0.36172	0.97344	0.35874	0.35943
1.28	0.66094	0.26050	0.38697	0.69531	0.27091	0.36768	0.79297	0.29857	0.35359	0.96562	0.34796	0.35137
1.30	0.65625	0.25284	0.37825	0.69141	0.26324	0.35938	0.78828	0.29009	0.34567	0.95859	0.33776	0.34352
1.32	0.65312	0.24584	0.36978	0.68750	0.25585	0.35131	0.78437	0.28208	0.33795	0.95234	0.32809	0.33589
1.34	0.64922	0.23889	0.36152	0.68359	0.24869	0.34344	0.77969	0.27415	0.33045	0.94609	0.31876	0.32846
1.36	0.64531	0.23219	0.35348	0.68047	0.24198	0.33580	0.77578	0.26668	0.32315	0.94062	0.30992	0.32124
1.38	0.64219	0.22589	0.34566	0.67734	0.23549	0.32836	0.77226	0.25955	0.31604	0.93476	0.30128	0.31421
1.40	0.63906	0.21981	0.33805	0.67422	0.22921	0.32112	0.76875	0.25266	0.30914	0.92969	0.29311	0.30738
1.42	0.63594	0.21394	0.33065	0.67109	0.22314	0.31408	0.76523	0.24599	0.30241	0.92461	0.28522	0.30074
1.44	0.63281	0.20826	0.32344	0.66797	0.21728	0.30724	0.76172	0.23954	0.29587	0.91953	0.27758	0.29427
1.46	0.63047	0.20294	0.31643	0.66562	0.21178	0.30059	0.75859	0.23339	0.28952	0.91523	0.27035	0.28799
1.48	0.62812	0.19778	0.30962	0.66250	0.20630	0.29413	0.75547	0.22743	0.28334	0.91094	0.26335	0.28187
1.50	0.62500	0.19266	0.30300	0.66016	0.20115	0.28784	0.75273	0.22175	0.27733	0.90703	0.25667	0.27594
1.52	0.62266	0.18785	0.29655	0.65781	0.19617	0.28172	0.75000	0.21626	0.27150	0.90312	0.25020	0.27016
1.54	0.62031	0.18319	0.29028	0.65547	0.19134	0.27578	0.74726	0.21093	0.26581	0.89922	0.24393	0.26454
1.56	0.61797	0.17869	0.28418	0.65312	0.18668	0.27000	0.74453	0.20577	0.26028	0.89531	0.23786	0.25908
1.58	0.61562	0.17433	0.27825	0.65156	0.18230	0.26438	0.74219	0.20085	0.25491	0.89219	0.23213	0.25377
1.60	0.61406	0.17024	0.27249	0.64922	0.17792	0.25892	0.73984	0.19609	0.24969	0.88906	0.22657	0.24859

FIGURE 9

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS
FOR 3 BLADES AE/AO = 0.45,0.65,0.85,1.05

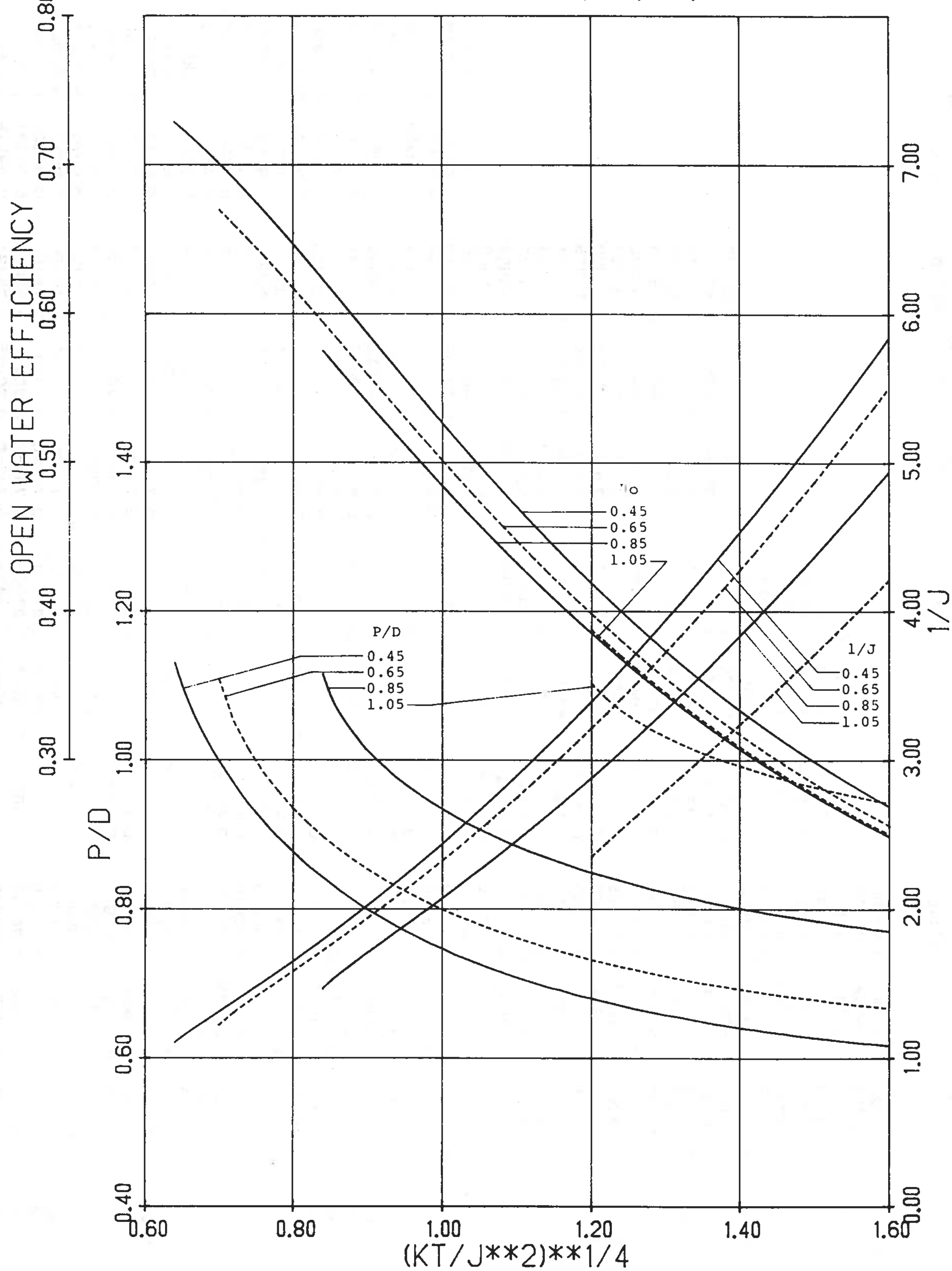


TABLE 8 WAGENINGEN B-SERIES PROPELLER DATA FOR 3 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.45			AE/AO = 0.65			AE/AO = 0.85			AE/AO = 1.05		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60												
0.62												
0.64	1.13125	0.90488	0.72850									
0.66	1.07500	0.84883	0.71985									
0.68	1.03281	0.80271	0.71076									
0.70	0.99844	0.76247	0.70115	1.10937	0.81794	0.67010						
0.72	0.96875	0.72615	0.69106	1.05156	0.76560	0.65997						
0.74	0.94062	0.69187	0.68053	1.01406	0.72590	0.64966						
0.76	0.91719	0.66113	0.66959	0.98281	0.69079	0.63907						
0.78	0.89531	0.63223	0.65832	0.95781	0.66003	0.62819						
0.80	0.87656	0.60583	0.64676	0.93437	0.63108	0.61707						
0.82	0.85781	0.58032	0.63496	0.91484	0.60495	0.60572						
0.84	0.84219	0.55715	0.62301	0.89687	0.58044	0.59422	1.11562	0.68201	0.57515			
0.86	0.82656	0.53479	0.61093	0.88125	0.55782	0.58260	1.06719	0.64248	0.56342			
0.88	0.81250	0.51389	0.59877	0.86641	0.53630	0.57091	1.03750	0.61256	0.55182			
0.90	0.79922	0.49407	0.58659	0.85312	0.51618	0.55918	1.01250	0.58572	0.54031			
0.92	0.78750	0.47559	0.57440	0.84062	0.49707	0.54746	0.99297	0.56211	0.52889			
0.94	0.77578	0.45778	0.56227	0.82891	0.47894	0.53581	0.97500	0.53995	0.51755			
0.96	0.76562	0.44121	0.55021	0.81875	0.46206	0.52422	0.96016	0.51982	0.50633			
0.98	0.75547	0.42526	0.53826	0.80859	0.44575	0.51274	0.94609	0.50068	0.49524			
1.00	0.74687	0.41045	0.52644	0.79922	0.43030	0.50139	0.93359	0.48280	0.48429			
1.02	0.73750	0.39590	0.51476	0.79062	0.41567	0.49019	0.92187	0.46583	0.47350			
1.04	0.72969	0.38242	0.50326	0.78281	0.40185	0.47917	0.91094	0.44973	0.46289			
1.06	0.72187	0.36945	0.49194	0.77500	0.38850	0.46833	0.90156	0.43473	0.45245			
1.08	0.71484	0.35720	0.48083	0.76797	0.37589	0.45769	0.89219	0.42025	0.44222			
1.10	0.70781	0.34540	0.46992	0.76094	0.36372	0.44726	0.88359	0.40654	0.43220			
1.12	0.70156	0.33426	0.45923	0.75469	0.35222	0.43703	0.87578	0.39355	0.42237			
1.14	0.69531	0.32355	0.44876	0.74844	0.34114	0.42704	0.86875	0.38127	0.41277			
1.16	0.69062	0.31366	0.43852	0.74297	0.33068	0.41726	0.86172	0.36940	0.40338			
1.18	0.68437	0.30370	0.42851	0.73750	0.32058	0.40772	0.85469	0.35795	0.39422			
1.20	0.67969	0.29453	0.41874	0.73203	0.31083	0.39839	0.84844	0.34711	0.38527	1.10312	0.42505	0.38761
1.22	0.67500	0.28568	0.40920	0.72734	0.30165	0.38931	0.84297	0.33688	0.37654	1.08281	0.40894	0.37874
1.24	0.67031	0.27716	0.39990	0.72266	0.29279	0.38044	0.83750	0.32699	0.36803	1.06640	0.39445	0.37011
1.26	0.66562	0.26893	0.39082	0.71875	0.28444	0.37180	0.83203	0.31744	0.35974	1.05312	0.38130	0.36173
1.28	0.66172	0.26121	0.38199	0.71406	0.27617	0.36340	0.82656	0.30821	0.35166	1.04140	0.36901	0.35357
1.30	0.65781	0.25374	0.37337	0.71016	0.26840	0.35521	0.82187	0.29951	0.34380	1.03125	0.35755	0.34565
1.32	0.65469	0.24672	0.36498	0.70625	0.26088	0.34723	0.81719	0.29110	0.33615	1.02187	0.34667	0.33794
1.34	0.65078	0.23977	0.35682	0.70234	0.25362	0.33948	0.81328	0.28317	0.32870	1.01328	0.33636	0.33045
1.36	0.64687	0.23306	0.34887	0.69922	0.24679	0.33192	0.80859	0.27530	0.32145	1.00547	0.32658	0.32316
1.38	0.64375	0.22675	0.34114	0.69609	0.24020	0.32459	0.80469	0.26788	0.31439	0.99844	0.31731	0.31608
1.40	0.64062	0.22065	0.33362	0.69297	0.23382	0.31745	0.80078	0.26072	0.30754	0.99219	0.30853	0.30919
1.42	0.63828	0.21494	0.32630	0.68984	0.22765	0.31050	0.79766	0.25396	0.30086	0.98594	0.30004	0.30250
1.44	0.63516	0.20925	0.31919	0.68672	0.22169	0.30375	0.79375	0.24725	0.29438	0.97969	0.29182	0.29599
1.46	0.63281	0.20391	0.31227	0.68359	0.21593	0.29719	0.79062	0.24094	0.28807	0.97422	0.28405	0.28967
1.48	0.62969	0.19859	0.30554	0.68125	0.21052	0.29080	0.78750	0.23482	0.28194	0.96875	0.27652	0.28352
1.50	0.62734	0.19360	0.29899	0.67891	0.20528	0.28460	0.78437	0.22890	0.27597	0.96406	0.26940	0.27754
1.52	0.62500	0.18877	0.29263	0.67578	0.20005	0.27856	0.78125	0.22317	0.27017	0.95937	0.26250	0.27172
1.54	0.62266	0.18410	0.28644	0.67344	0.19515	0.27270	0.77812	0.21762	0.26453	0.95469	0.25582	0.26607
1.56	0.62031	0.17958	0.28042	0.67109	0.19041	0.26699	0.77578	0.21240	0.25904	0.95039	0.24944	0.26058
1.58	0.61875	0.17534	0.27458	0.66953	0.18595	0.26145	0.77266	0.20719	0.25370	0.94609	0.24324	0.25523
1.60	0.61641	0.17111	0.26889	0.66719	0.18149	0.25605	0.77031	0.20229	0.24852	0.94219	0.23732	0.25004

FIGURE 10
WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS
FOR 4 BLADES AE/AO = 0.30,0.50,0.70,0.90

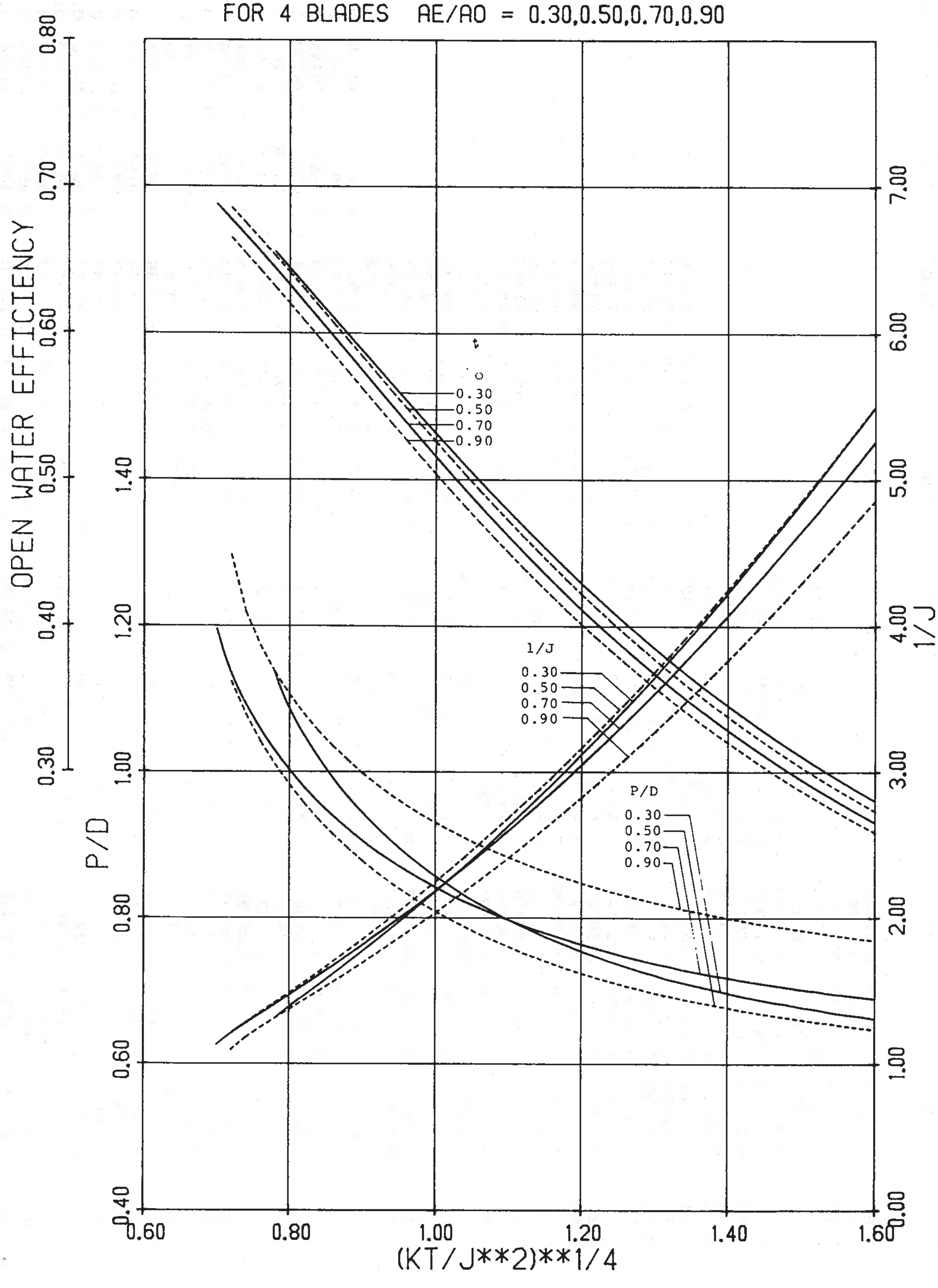


TABLE 9 WAGENINGEN B-SERIES PROPELLER DATA FOR 4 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.30			AE/AO = 0.50			AE/AO = 0.70			AE/AO = 0.90		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60												
0.62												
0.64												
0.66												
0.68												
0.70							1.19531	0.88410	0.68769			
0.72				1.12344	0.82668	0.68536	1.13437	0.82815	0.67700	1.29687	0.91225	0.66502
0.74				1.07812	0.78071	0.67464	1.09219	0.78420	0.66621	1.21875	0.84785	0.65389
0.76				1.04062	0.74040	0.66374	1.05781	0.74585	0.65520	1.17265	0.80232	0.64276
0.78	1.13437	0.76279	0.65550	1.00937	0.70466	0.65265	1.02812	0.71120	0.64399	1.13594	0.76313	0.63151
0.80	1.08594	0.71909	0.64419	0.98203	0.67212	0.64140	1.00234	0.67966	0.63258	1.10547	0.72837	0.62011
0.82	1.05000	0.68240	0.63288	0.95703	0.64187	0.63000	0.97891	0.65034	0.62103	1.07890	0.69663	0.60857
0.84	1.01875	0.64917	0.62155	0.93437	0.61379	0.61850	0.95781	0.62309	0.60933	1.05547	0.66744	0.59693
0.86	0.99062	0.61859	0.61021	0.91406	0.58778	0.60691	0.93906	0.59786	0.59757	1.03437	0.64028	0.58521
0.88	0.96562	0.59049	0.59885	0.89531	0.56340	0.59528	0.92187	0.57418	0.58574	1.01562	0.61509	0.57347
0.90	0.94375	0.56472	0.58749	0.87812	0.54057	0.58362	0.90547	0.55166	0.57392	0.99766	0.59106	0.56171
0.92	0.92344	0.54061	0.57617	0.86172	0.51890	0.57197	0.89062	0.53056	0.56210	0.98203	0.56883	0.54998
0.94	0.90469	0.51804	0.56489	0.84687	0.49866	0.56037	0.87734	0.51085	0.55034	0.96719	0.54768	0.53832
0.96	0.88750	0.49695	0.55367	0.83359	0.47976	0.54883	0.86484	0.49213	0.53865	0.95391	0.52787	0.52674
0.98	0.87187	0.47723	0.54253	0.82031	0.46157	0.53738	0.85312	0.47436	0.52708	0.94141	0.50903	0.51528
1.00	0.85703	0.45858	0.53148	0.80859	0.44463	0.52604	0.84219	0.45752	0.51562	0.93008	0.49128	0.50395
1.02	0.84375	0.44119	0.52056	0.79766	0.42859	0.51482	0.83125	0.44127	0.50432	0.91953	0.47444	0.49277
1.04	0.83047	0.42449	0.50974	0.78750	0.41342	0.50375	0.82187	0.42616	0.49318	0.90937	0.45830	0.48177
1.06	0.81875	0.40895	0.49908	0.77734	0.39880	0.49284	0.81328	0.41186	0.48223	0.89961	0.44287	0.47096
1.08	0.80781	0.39425	0.48857	0.76875	0.38524	0.48210	0.80469	0.39806	0.47146	0.89101	0.42837	0.46034
1.10	0.79687	0.38014	0.47821	0.76016	0.37218	0.47153	0.79687	0.38501	0.46089	0.88281	0.41450	0.44992
1.12	0.78750	0.36702	0.46802	0.75156	0.35961	0.46116	0.78906	0.37241	0.45052	0.87500	0.40123	0.43972
1.14	0.77812	0.35441	0.45801	0.74453	0.34797	0.45100	0.78203	0.36052	0.44038	0.86719	0.38843	0.42973
1.16	0.76953	0.34250	0.44818	0.73750	0.33675	0.44103	0.77578	0.34928	0.43044	0.86055	0.37643	0.41997
1.18	0.76172	0.33126	0.43855	0.73047	0.32595	0.43127	0.76953	0.33844	0.42073	0.85391	0.36484	0.41043
1.20	0.75391	0.32045	0.42909	0.72422	0.31576	0.42172	0.76328	0.32798	0.41125	0.84766	0.35378	0.40113
1.22	0.74687	0.31024	0.41984	0.71797	0.30593	0.41238	0.75781	0.31810	0.40198	0.84180	0.34320	0.39204
1.24	0.73984	0.30043	0.41079	0.71250	0.29668	0.40327	0.75234	0.30858	0.39295	0.83594	0.33300	0.38319
1.26	0.73359	0.29116	0.40193	0.70703	0.28774	0.39436	0.74687	0.29939	0.38414	0.83086	0.32334	0.37454
1.28	0.72734	0.28224	0.39327	0.70234	0.27933	0.38567	0.74219	0.29072	0.37555	0.82578	0.31403	0.36614
1.30	0.72187	0.27382	0.38481	0.69687	0.27103	0.37718	0.73750	0.28235	0.36718	0.82109	0.30513	0.35794
1.32	0.71562	0.26555	0.37655	0.69297	0.26338	0.36891	0.73359	0.27447	0.35903	0.81641	0.29653	0.34997
1.34	0.71094	0.25790	0.36847	0.68828	0.25583	0.36085	0.72891	0.26666	0.35108	0.81172	0.28822	0.34221
1.36	0.70625	0.25052	0.36060	0.68437	0.24872	0.35299	0.72500	0.25931	0.34335	0.80781	0.28038	0.33465
1.38	0.70156	0.24342	0.35292	0.68047	0.24185	0.34532	0.72109	0.25221	0.33582	0.80351	0.27271	0.32730
1.40	0.69687	0.23657	0.34542	0.67656	0.23522	0.33787	0.71797	0.24553	0.32850	0.79961	0.26539	0.32015
1.42	0.69219	0.22997	0.33812	0.67266	0.22881	0.33060	0.71406	0.23889	0.32137	0.79609	0.25840	0.31319
1.44	0.68828	0.22374	0.33100	0.66953	0.22279	0.32353	0.71094	0.23265	0.31444	0.79219	0.25155	0.30643
1.46	0.68437	0.21772	0.32406	0.66641	0.21697	0.31665	0.70781	0.22661	0.30770	0.78906	0.24509	0.29985
1.48	0.68125	0.21205	0.31729	0.66328	0.21134	0.30994	0.70469	0.22077	0.30113	0.78594	0.23885	0.29345
1.50	0.67734	0.20645	0.31071	0.66016	0.20590	0.30341	0.70156	0.21512	0.29474	0.78281	0.23281	0.28723
1.52	0.67422	0.20115	0.30427	0.65703	0.20063	0.29706	0.69922	0.20981	0.28854	0.77969	0.22695	0.28117
1.54	0.67031	0.19592	0.29802	0.65469	0.19569	0.29088	0.69609	0.20452	0.28249	0.77656	0.22129	0.27529
1.56	0.66719	0.19098	0.29193	0.65156	0.19077	0.28486	0.69375	0.19955	0.27662	0.77383	0.21589	0.26957
1.58	0.66484	0.18632	0.28599	0.64922	0.18613	0.27900	0.69141	0.19473	0.27091	0.77109	0.21065	0.26401
1.60	0.66172	0.18170	0.28021	0.64687	0.18165	0.27331	0.68906	0.19007	0.26535	0.76875	0.20565	0.25859

FIGURE 11

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM RPM PROPELLERS

FOR 4 BLADES AE/AO = 0.35,0.55,0.75,0.95

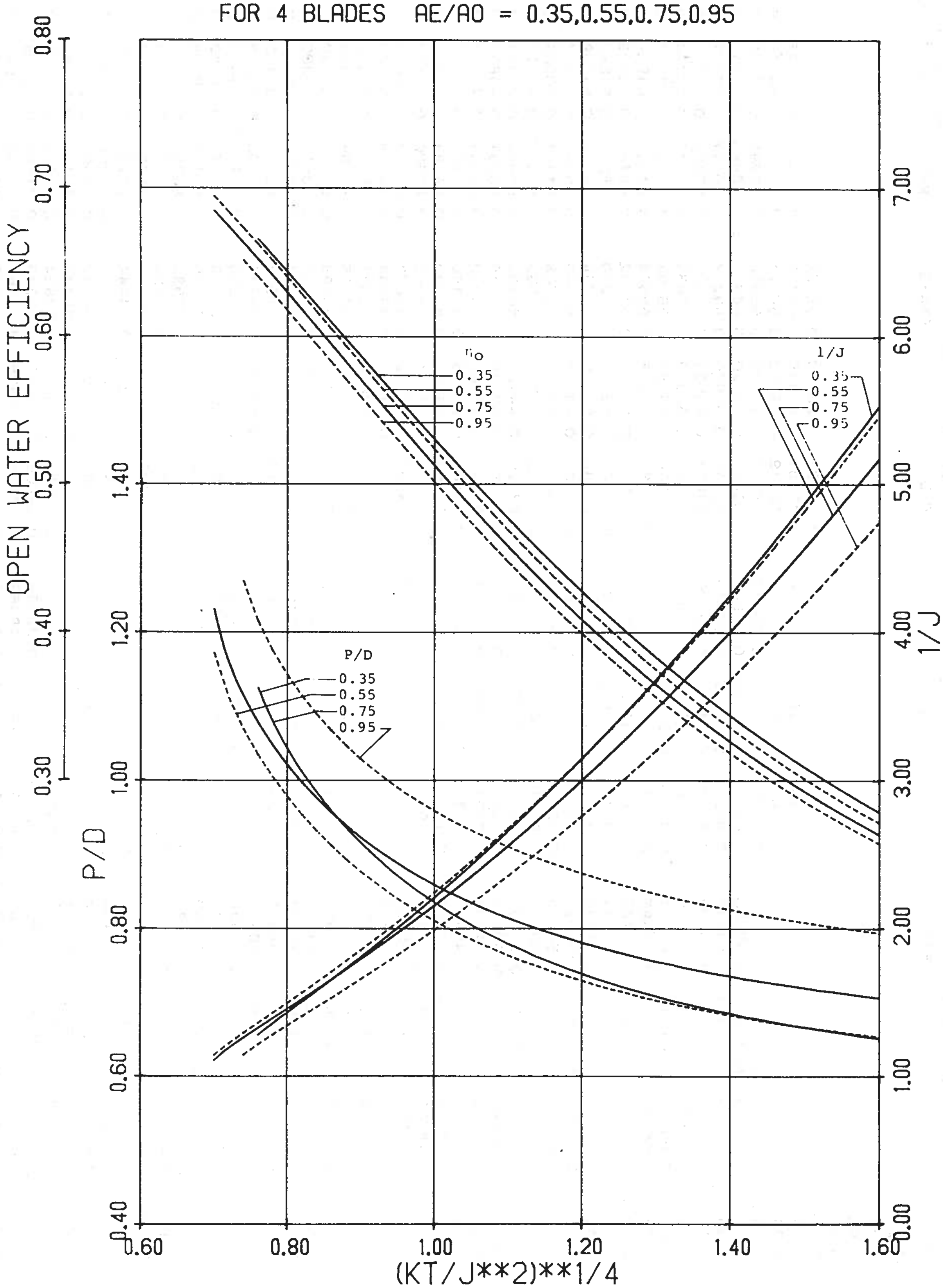


TABLE 10 WAGENINGEN B-SERIES PROPELLER DATA FOR 4 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.35			AE/AO = 0.55			AE/AO = 0.75			AE/AO = 0.95		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60												
0.62												
0.64												
0.66												
0.68												
0.70				1.17187	0.87490	0.69462	1.23125	0.90282	0.68475			
0.72				1.11094	0.81892	0.68401	1.15937	0.84066	0.67395			
0.74				1.06875	0.77485	0.67328	1.11406	0.79487	0.66311	1.26875	0.87353	0.65141
0.76	1.12500	0.78257	0.66581	1.03437	0.73640	0.66237	1.07812	0.75556	0.65209	1.21484	0.82346	0.64024
0.78	1.07969	0.73889	0.65468	1.00469	0.70166	0.65124	1.04766	0.72037	0.64086	1.17500	0.78225	0.62896
0.80	1.04297	0.70083	0.64350	0.97812	0.66968	0.63993	1.02109	0.68832	0.62945	1.14219	0.74595	0.61756
0.82	1.01172	0.66667	0.63223	0.95391	0.63996	0.62848	0.99766	0.65885	0.61788	1.11406	0.71312	0.60603
0.84	0.98437	0.63558	0.62091	0.93203	0.61238	0.61690	0.97656	0.63147	0.60619	1.08906	0.68286	0.59441
0.86	0.95937	0.60671	0.60955	0.91250	0.58684	0.60524	0.95703	0.60574	0.59442	1.06719	0.65503	0.58271
0.88	0.93672	0.57993	0.59814	0.89375	0.56256	0.59353	0.93984	0.58192	0.58260	1.04726	0.62900	0.57099
0.90	0.91641	0.55515	0.58673	0.87734	0.54016	0.58181	0.92344	0.55925	0.57078	1.02890	0.60452	0.55926
0.92	0.89766	0.53196	0.57535	0.86250	0.51919	0.57008	0.90859	0.53801	0.55897	1.01289	0.58183	0.54757
0.94	0.87969	0.50998	0.56400	0.84766	0.49900	0.55842	0.89492	0.51799	0.54722	0.99766	0.56024	0.53594
0.96	0.86406	0.48972	0.55270	0.83437	0.48015	0.54681	0.88203	0.49896	0.53554	0.98359	0.53984	0.52440
0.98	0.84922	0.47053	0.54148	0.82187	0.46228	0.53530	0.87031	0.48107	0.52398	0.97109	0.52074	0.51297
1.00	0.83594	0.45264	0.53036	0.81094	0.44565	0.52391	0.85937	0.46409	0.51255	0.95937	0.50259	0.50168
1.02	0.82266	0.43546	0.51937	0.79961	0.42948	0.51264	0.84922	0.44797	0.50126	0.94766	0.48506	0.49055
1.04	0.81094	0.41946	0.50849	0.78984	0.41445	0.50153	0.83984	0.43273	0.49015	0.93750	0.46869	0.47958
1.06	0.79922	0.40409	0.49776	0.78047	0.40010	0.49057	0.83047	0.41799	0.47921	0.92812	0.45315	0.46880
1.08	0.78906	0.38979	0.48719	0.77187	0.38654	0.47980	0.82187	0.40406	0.46847	0.91875	0.43815	0.45822
1.10	0.77891	0.37606	0.47678	0.76328	0.37346	0.46921	0.81406	0.39088	0.45794	0.91055	0.42406	0.44785
1.12	0.77031	0.36331	0.46655	0.75547	0.36112	0.45883	0.80664	0.37828	0.44760	0.90234	0.41045	0.43769
1.14	0.76094	0.35082	0.45648	0.74844	0.34946	0.44864	0.79961	0.36625	0.43748	0.89492	0.39756	0.42775
1.16	0.75312	0.33925	0.44662	0.74141	0.33823	0.43867	0.79297	0.35476	0.42759	0.88789	0.38523	0.41802
1.18	0.74531	0.32811	0.43694	0.73516	0.32762	0.42890	0.78672	0.34380	0.41792	0.88125	0.37345	0.40853
1.20	0.73828	0.31760	0.42746	0.72891	0.31741	0.41935	0.78047	0.33321	0.40848	0.87461	0.36207	0.39926
1.22	0.73125	0.30748	0.41818	0.72266	0.30756	0.41002	0.77500	0.32322	0.39925	0.86875	0.35131	0.39022
1.24	0.72500	0.29794	0.40909	0.71719	0.29826	0.40090	0.76953	0.31357	0.39026	0.86289	0.34091	0.38140
1.26	0.71875	0.28876	0.40023	0.71250	0.28950	0.39200	0.76445	0.30437	0.38149	0.85742	0.33097	0.37280
1.28	0.71328	0.28008	0.39155	0.70703	0.28086	0.38332	0.75937	0.29548	0.37294	0.85234	0.32148	0.36444
1.30	0.70781	0.27173	0.38307	0.70234	0.27272	0.37486	0.75469	0.28701	0.36462	0.84726	0.31231	0.35628
1.32	0.70234	0.26369	0.37480	0.69844	0.26504	0.36659	0.75078	0.27902	0.35650	0.84258	0.30355	0.34834
1.34	0.69766	0.25610	0.36673	0.69375	0.25745	0.35855	0.74609	0.27111	0.34861	0.83789	0.29508	0.34061
1.36	0.69297	0.24879	0.35885	0.68984	0.25030	0.35071	0.74219	0.26366	0.34092	0.83359	0.28700	0.33310
1.38	0.68828	0.24174	0.35117	0.68594	0.24340	0.34308	0.73828	0.25646	0.33344	0.82969	0.27927	0.32578
1.40	0.68437	0.23508	0.34367	0.68203	0.23674	0.33565	0.73516	0.24968	0.32616	0.82578	0.27181	0.31867
1.42	0.67969	0.22852	0.33637	0.67891	0.23047	0.32840	0.73125	0.24295	0.31908	0.82187	0.26459	0.31175
1.44	0.67656	0.22247	0.32926	0.67500	0.22424	0.32135	0.72812	0.23661	0.31219	0.81797	0.25760	0.30501
1.46	0.67266	0.21649	0.32232	0.67187	0.21840	0.31450	0.72500	0.23049	0.30549	0.81484	0.25101	0.29847
1.48	0.66875	0.21072	0.31557	0.66875	0.21273	0.30782	0.72187	0.22456	0.29896	0.81133	0.24456	0.29210
1.50	0.66562	0.20529	0.30899	0.66641	0.20742	0.30132	0.71875	0.21884	0.29263	0.80820	0.23839	0.28591
1.52	0.66250	0.20002	0.30258	0.66328	0.20212	0.29500	0.71562	0.21329	0.28646	0.80508	0.23242	0.27989
1.54	0.65937	0.19495	0.29634	0.66094	0.19714	0.28885	0.71328	0.20807	0.28046	0.80195	0.22665	0.27404
1.56	0.65625	0.19003	0.29026	0.65781	0.19219	0.28286	0.71055	0.20295	0.27462	0.79922	0.22113	0.26835
1.58	0.65312	0.18528	0.28434	0.65547	0.18753	0.27704	0.70781	0.19799	0.26895	0.79648	0.21578	0.26282
1.60	0.65078	0.18081	0.27857	0.65312	0.18302	0.27137	0.70547	0.19326	0.26343	0.79375	0.21060	0.25743

FIGURE 12
WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS
FOR 4 BLADES AE/AO = 0.40,0.60,0.80,1.00

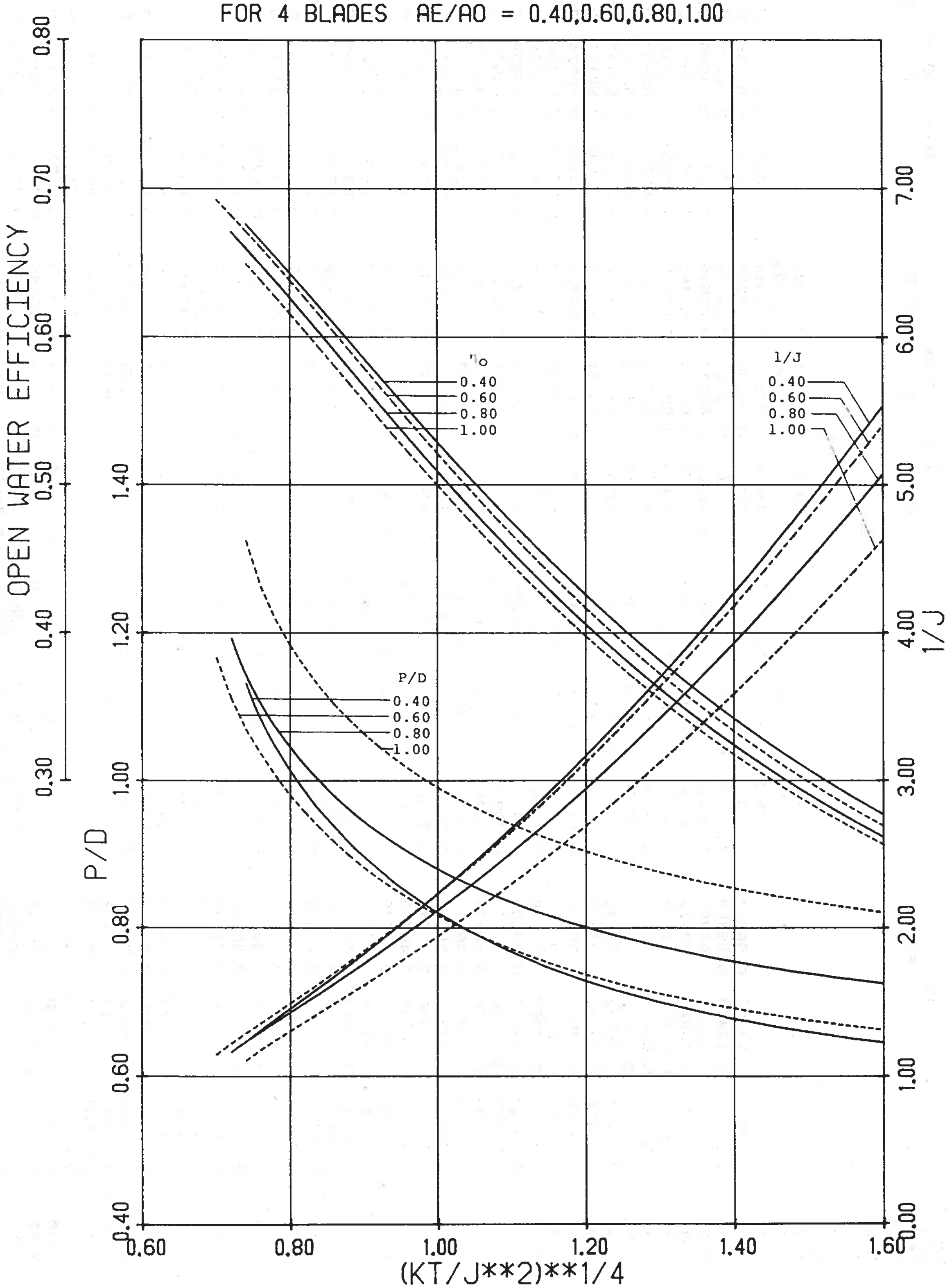


TABLE 11 WAGENINGEN B-SERIES PROPELLER DATA FOR 4 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.40			AE/AO = 0.60			AE/AO = 0.80			AE/AO = 1.00		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60												
0.62												
0.64												
0.66												
0.68												
0.70				1.16562	0.87021	0.69275						
0.72				1.11094	0.81775	0.68215	1.19219	0.85747	0.67080			
0.74	1.13125	0.80893	0.67619	1.06875	0.77383	0.67141	1.14219	0.80891	0.65990	1.32343	0.90180	0.64941
0.76	1.08281	0.76240	0.66523	1.03594	0.73630	0.66045	1.10390	0.76816	0.64886	1.26172	0.84703	0.63821
0.78	1.04531	0.72287	0.65417	1.00625	0.70168	0.64929	1.07187	0.73197	0.63762	1.21797	0.80334	0.62692
0.80	1.01328	0.68744	0.64301	0.97969	0.66982	0.63795	1.04531	0.69971	0.62621	1.18281	0.76543	0.61552
0.82	0.98516	0.65513	0.63172	0.95703	0.64093	0.62644	1.02031	0.66929	0.61465	1.15312	0.73144	0.60400
0.84	0.95937	0.62512	0.62036	0.93594	0.61377	0.61480	0.99922	0.64172	0.60297	1.12656	0.70006	0.59238
0.86	0.93750	0.59792	0.60893	0.91641	0.58828	0.60309	0.97891	0.61544	0.59122	1.10312	0.67117	0.58071
0.88	0.91562	0.57180	0.59746	0.89844	0.56438	0.59133	0.96094	0.59109	0.57941	1.08281	0.64461	0.56900
0.90	0.89687	0.54795	0.58598	0.88203	0.54198	0.57954	0.94453	0.56824	0.56760	1.06367	0.61946	0.55730
0.92	0.87969	0.52562	0.57450	0.86719	0.52103	0.56777	0.92969	0.54682	0.55582	1.04648	0.59597	0.54564
0.94	0.86250	0.50417	0.56307	0.85312	0.50115	0.55604	0.91601	0.52661	0.54407	1.03086	0.57390	0.53403
0.96	0.84766	0.48442	0.55169	0.84062	0.48259	0.54439	0.90312	0.50741	0.53243	1.01640	0.55305	0.52252
0.98	0.83359	0.46572	0.54040	0.82812	0.46471	0.53284	0.89141	0.48933	0.52090	1.00312	0.53336	0.51113
1.00	0.82031	0.44801	0.52919	0.81719	0.44805	0.52141	0.88008	0.47202	0.50949	0.99062	0.51463	0.49988
1.02	0.80859	0.43152	0.51811	0.80625	0.43198	0.51011	0.86953	0.45560	0.49824	0.97930	0.49697	0.48877
1.04	0.79687	0.41567	0.50717	0.79687	0.41706	0.49898	0.86016	0.44017	0.48716	0.96875	0.48020	0.47785
1.06	0.78672	0.40093	0.49637	0.78750	0.40267	0.48800	0.85078	0.42528	0.47626	0.95859	0.46412	0.46710
1.08	0.77656	0.38675	0.48574	0.77891	0.38906	0.47721	0.84219	0.41118	0.46555	0.94922	0.44888	0.45656
1.10	0.76719	0.37336	0.47527	0.77109	0.37621	0.46662	0.83437	0.39784	0.45505	0.94062	0.43441	0.44622
1.12	0.75859	0.36072	0.46499	0.76328	0.36381	0.45623	0.82656	0.38495	0.44476	0.93242	0.42057	0.43609
1.14	0.75000	0.34855	0.45489	0.75625	0.35210	0.44604	0.81953	0.37277	0.43468	0.92461	0.40732	0.42618
1.16	0.74219	0.33705	0.44497	0.74922	0.34081	0.43606	0.81328	0.36125	0.42484	0.91719	0.39465	0.41650
1.18	0.73516	0.32621	0.43527	0.74297	0.33015	0.42630	0.80625	0.34990	0.41521	0.91016	0.38254	0.40704
1.20	0.72812	0.31576	0.42575	0.73672	0.31988	0.41677	0.80078	0.33940	0.40581	0.90391	0.37107	0.39780
1.22	0.72187	0.30591	0.41644	0.73125	0.31019	0.40745	0.79492	0.32916	0.39664	0.89766	0.35998	0.38879
1.24	0.71562	0.29642	0.40734	0.72578	0.30084	0.39834	0.78945	0.31937	0.38768	0.89180	0.34940	0.38001
1.26	0.71016	0.28748	0.39845	0.72031	0.29183	0.38947	0.78437	0.31005	0.37896	0.88633	0.33927	0.37145
1.28	0.70469	0.27886	0.38977	0.71562	0.28334	0.38081	0.77930	0.30103	0.37046	0.88086	0.32949	0.36311
1.30	0.69922	0.27054	0.38128	0.71094	0.27513	0.37237	0.77461	0.29242	0.36217	0.87578	0.32014	0.35499
1.32	0.69453	0.26271	0.37299	0.70703	0.26741	0.36413	0.77031	0.28422	0.35412	0.87109	0.31121	0.34708
1.34	0.68984	0.25516	0.36492	0.70234	0.25977	0.35612	0.76601	0.27628	0.34626	0.86641	0.30257	0.33939
1.36	0.68516	0.24788	0.35704	0.69844	0.25258	0.34832	0.76172	0.26862	0.33862	0.86172	0.29422	0.33190
1.38	0.68125	0.24102	0.34936	0.69453	0.24562	0.34070	0.75781	0.26130	0.33118	0.85781	0.28634	0.32462
1.40	0.67656	0.23423	0.34188	0.69141	0.23908	0.33330	0.75430	0.25432	0.32394	0.85351	0.27863	0.31753
1.42	0.67344	0.22800	0.33458	0.68750	0.23259	0.32610	0.75078	0.24758	0.31691	0.84961	0.27125	0.31063
1.44	0.66953	0.22183	0.32747	0.68437	0.22649	0.31909	0.74726	0.24105	0.31006	0.84609	0.26421	0.30394
1.46	0.66562	0.21587	0.32055	0.68125	0.22058	0.31225	0.74414	0.23483	0.30341	0.84219	0.25731	0.29741
1.48	0.66250	0.21025	0.31381	0.67812	0.21488	0.30562	0.74062	0.22873	0.29693	0.83906	0.25081	0.29108
1.50	0.65937	0.20483	0.30724	0.67500	0.20936	0.29915	0.73789	0.22299	0.29063	0.83555	0.24443	0.28492
1.52	0.65625	0.19959	0.30085	0.67266	0.20417	0.29286	0.73516	0.21743	0.28450	0.83242	0.23833	0.27892
1.54	0.65312	0.19452	0.29461	0.66953	0.19901	0.28675	0.73203	0.21197	0.27855	0.82930	0.23243	0.27310
1.56	0.65000	0.18962	0.28856	0.66719	0.19415	0.28079	0.72969	0.20684	0.27275	0.82656	0.22679	0.26743
1.58	0.64766	0.18501	0.28265	0.66484	0.18945	0.27500	0.72734	0.20187	0.26712	0.82344	0.22125	0.26191
1.60	0.64531	0.18055	0.27691	0.66250	0.18490	0.26936	0.72461	0.19698	0.26163	0.82070	0.21595	0.25655

FIGURE 13
WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS
FOR 4 BLADES AE/AO = 0.45,0.65,0.85,1.05

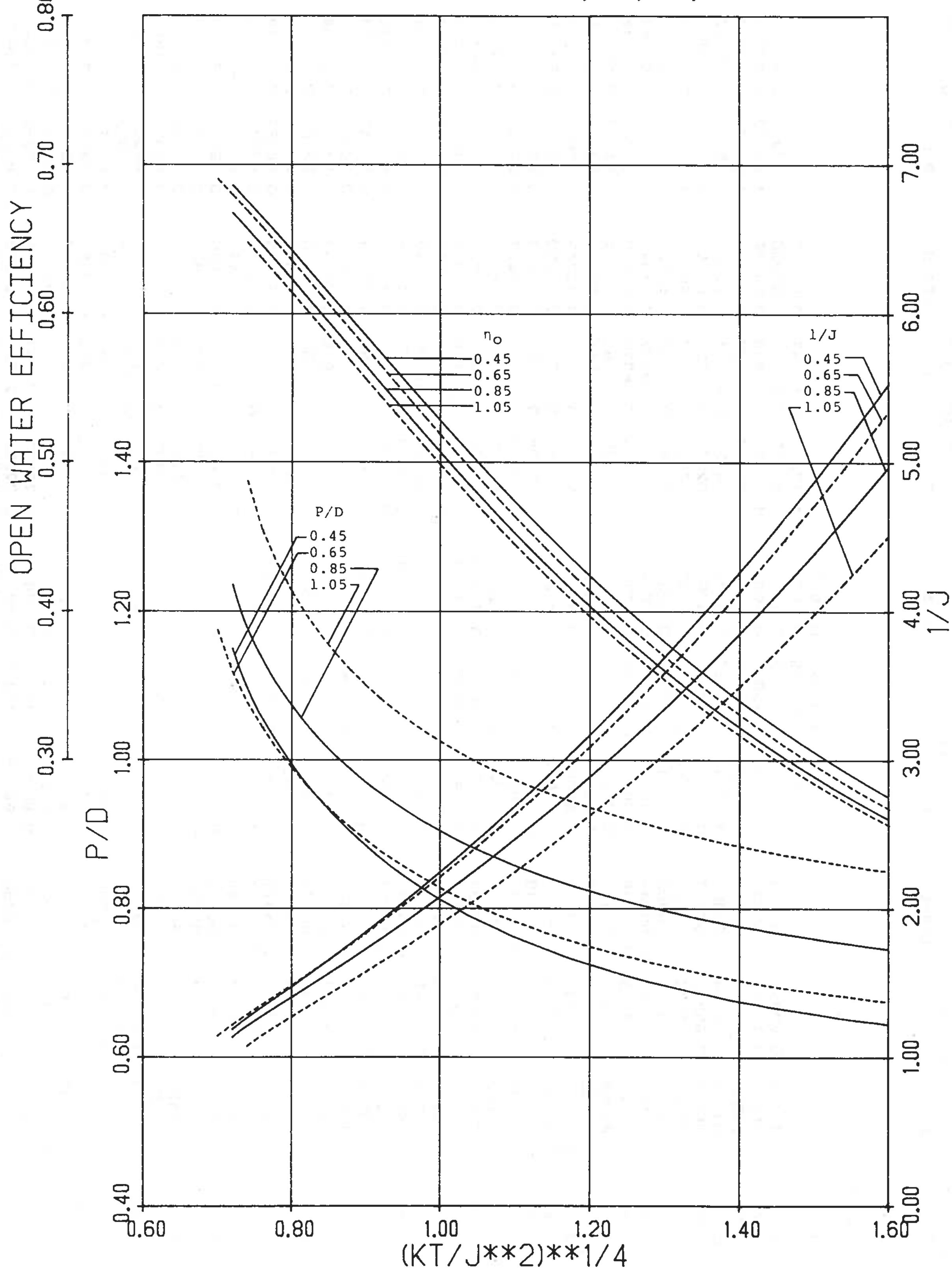


TABLE 12 WAGENINGEN B-SERIES PROPELLER DATA FOR 4 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.45			AE/AO = 0.65			AE/AO = 0.85			AE/AO = 1.05		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60												
0.62												
0.64												
0.66												
0.68												
0.70				1.17500	0.87409	0.69041						
0.72	1.15000	0.84153	0.68633	1.11875	0.82080	0.67978	1.23594	0.88023	0.66776			
0.74	1.09687	0.79114	0.67554	1.07734	0.77732	0.66901	1.17656	0.82632	0.65678	1.37500	0.92876	0.64783
0.76	1.05625	0.74892	0.66464	1.04375	0.73944	0.65804	1.13594	0.78402	0.64569	1.30937	0.87115	0.63671
0.78	1.02344	0.71208	0.65359	1.01406	0.70486	0.64685	1.10156	0.74636	0.63445	1.26406	0.82605	0.62547
0.80	0.99375	0.67812	0.64239	0.98906	0.67375	0.63545	1.07344	0.71306	0.62304	1.22656	0.78645	0.61408
0.82	0.96719	0.64687	0.63105	0.96562	0.64449	0.62392	1.04766	0.68202	0.61149	1.19453	0.75088	0.60258
0.84	0.94375	0.61821	0.61961	0.94453	0.61733	0.61226	1.02500	0.65348	0.59983	1.16718	0.71870	0.59098
0.86	0.92187	0.59131	0.60810	0.92500	0.59182	0.60050	1.00469	0.62696	0.58810	1.14258	0.68885	0.57931
0.88	0.90234	0.56643	0.59656	0.90781	0.56824	0.58870	0.98672	0.60238	0.57631	1.12070	0.66123	0.56762
0.90	0.88437	0.54311	0.58498	0.89219	0.54613	0.57687	0.96953	0.57895	0.56453	1.10078	0.63537	0.55594
0.92	0.86719	0.52099	0.57342	0.87656	0.52480	0.56507	0.95469	0.55732	0.55277	1.08281	0.61122	0.54430
0.94	0.85156	0.50033	0.56190	0.86328	0.50520	0.55333	0.94062	0.53673	0.54107	1.06640	0.58850	0.53272
0.96	0.83750	0.48103	0.55043	0.85078	0.48657	0.54164	0.92734	0.51715	0.52945	1.05156	0.56716	0.52122
0.98	0.82422	0.46277	0.53907	0.83906	0.46892	0.53007	0.91484	0.49856	0.51796	1.03750	0.54686	0.50985
1.00	0.81172	0.44546	0.52779	0.82734	0.45189	0.51862	0.90391	0.48119	0.50659	1.02500	0.52783	0.49862
1.02	0.80078	0.42936	0.51664	0.81719	0.43605	0.50731	0.89297	0.46442	0.49537	1.01328	0.50973	0.48754
1.04	0.78906	0.41360	0.50562	0.80781	0.42104	0.49616	0.88320	0.44866	0.48433	1.00195	0.49239	0.47665
1.06	0.77969	0.39921	0.49476	0.79844	0.40658	0.48519	0.87422	0.43372	0.47347	0.99141	0.47592	0.46593
1.08	0.77031	0.38535	0.48407	0.78984	0.39290	0.47441	0.86562	0.41942	0.46281	0.98203	0.46040	0.45541
1.10	0.76094	0.37202	0.47355	0.78203	0.37996	0.46382	0.85703	0.40562	0.45235	0.97305	0.44554	0.44510
1.12	0.75312	0.35967	0.46322	0.77500	0.36772	0.45343	0.84961	0.39269	0.44210	0.96445	0.43132	0.43499
1.14	0.74531	0.34777	0.45307	0.76719	0.35569	0.44325	0.84219	0.38020	0.43207	0.95664	0.41783	0.42511
1.16	0.73750	0.33632	0.44313	0.76094	0.34456	0.43329	0.83555	0.36840	0.42227	0.94922	0.40493	0.41546
1.18	0.73047	0.32551	0.43339	0.75469	0.33383	0.42356	0.82891	0.35699	0.41268	0.94180	0.39247	0.40603
1.20	0.72422	0.31531	0.42385	0.74844	0.32347	0.41405	0.82305	0.34622	0.40333	0.93516	0.38066	0.39681
1.22	0.71797	0.30549	0.41453	0.74297	0.31370	0.40474	0.81719	0.33582	0.39420	0.92891	0.36936	0.38783
1.24	0.71172	0.29603	0.40542	0.73750	0.30427	0.39567	0.81172	0.32589	0.38530	0.92266	0.35845	0.37907
1.26	0.70625	0.28710	0.39650	0.73281	0.29539	0.38682	0.80625	0.31630	0.37662	0.91719	0.34812	0.37053
1.28	0.70078	0.27850	0.38782	0.72734	0.28661	0.37820	0.80156	0.30724	0.36816	0.91172	0.33814	0.36222
1.30	0.69609	0.27040	0.37933	0.72305	0.27844	0.36979	0.79687	0.29850	0.35993	0.90625	0.32850	0.35412
1.32	0.69141	0.26257	0.37104	0.71875	0.27054	0.36159	0.79219	0.29004	0.35191	0.90156	0.31938	0.34624
1.34	0.68672	0.25503	0.36297	0.71484	0.26301	0.35360	0.78750	0.28188	0.34411	0.89687	0.31056	0.33857
1.36	0.68281	0.24794	0.35510	0.71055	0.25565	0.34583	0.78359	0.27419	0.33651	0.89219	0.30204	0.33110
1.38	0.67812	0.24091	0.34743	0.70703	0.24873	0.33827	0.77969	0.26675	0.32911	0.88750	0.29380	0.32384
1.40	0.67422	0.23430	0.33996	0.70312	0.24194	0.33090	0.77578	0.25956	0.32192	0.88359	0.28602	0.31678
1.42	0.67109	0.22807	0.33267	0.69961	0.23547	0.32373	0.77266	0.25278	0.31493	0.87969	0.27848	0.30991
1.44	0.66719	0.22190	0.32557	0.69609	0.22922	0.31676	0.76875	0.24606	0.30812	0.87578	0.27120	0.30322
1.46	0.66406	0.21609	0.31866	0.69297	0.22326	0.30997	0.76562	0.23973	0.30151	0.87187	0.26415	0.29673
1.48	0.66094	0.21048	0.31194	0.68984	0.21749	0.30336	0.76250	0.23360	0.29507	0.86875	0.25749	0.29041
1.50	0.65781	0.20505	0.30539	0.68750	0.21207	0.29694	0.75937	0.22767	0.28881	0.86523	0.25098	0.28427
1.52	0.65469	0.19981	0.29901	0.68437	0.20668	0.29069	0.75625	0.22193	0.28273	0.86172	0.24466	0.27829
1.54	0.65156	0.19474	0.29280	0.68203	0.20160	0.28461	0.75351	0.21645	0.27681	0.85859	0.23862	0.27248
1.56	0.64922	0.18997	0.28676	0.67930	0.19662	0.27869	0.75078	0.21115	0.27105	0.85547	0.23278	0.26683
1.58	0.64687	0.18535	0.28088	0.67656	0.19180	0.27294	0.74805	0.20601	0.26545	0.85273	0.22719	0.26133
1.60	0.64375	0.18076	0.27516	0.67422	0.18719	0.26734	0.74570	0.20111	0.26001	0.85000	0.22178	0.25600

FIGURE 14

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM RPM PROPELLERS
FOR 5 BLADES AE/AO = 0.30,0.50,0.70,0.90

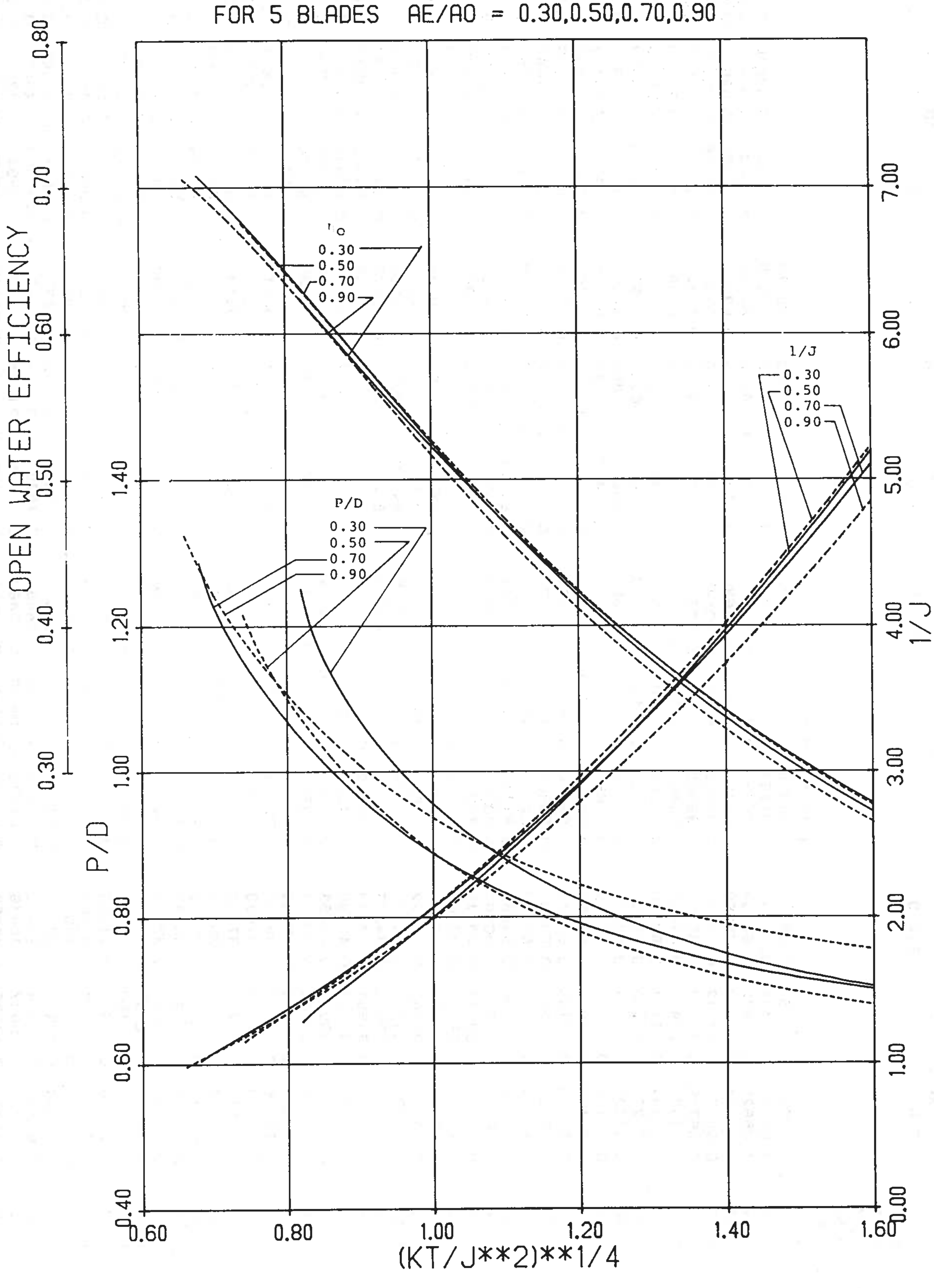


TABLE 13 WAGENINGEN B-SERIES PROPELLER DATA FOR 5 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.30			AE/AO = 0.50			AE/AO = 0.70			AE/AO = 0.90		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60												
0.62												
0.64												
0.66												
0.68										1.32343	1.01615	0.70555
0.70							1.28593	0.97571	0.70795	1.27890	0.96506	0.69713
0.72							1.22734	0.91755	0.69803	1.24218	0.92019	0.68807
0.74							1.18672	0.87142	0.68778	1.21054	0.87956	0.67839
0.76				1.21562	0.86538	0.67556	1.15234	0.83025	0.67714	1.18164	0.84171	0.66816
0.78				1.16875	0.81799	0.66453	1.12226	0.79273	0.66615	1.15469	0.80608	0.65747
0.80				1.13203	0.77734	0.65334	1.09453	0.75769	0.65487	1.12969	0.77256	0.64640
0.82	1.25000	0.77629	0.62400	1.09922	0.74011	0.64201	1.06875	0.72480	0.64336	1.10625	0.74087	0.63502
0.84	1.17968	0.72583	0.61223	1.07109	0.70643	0.63055	1.04453	0.69380	0.63167	1.08398	0.71077	0.62341
0.86	1.13594	0.68719	0.60069	1.04453	0.67474	0.61901	1.02265	0.66496	0.61986	1.06328	0.68238	0.61163
0.88	1.10039	0.65320	0.58925	1.01953	0.64494	0.60742	1.00156	0.63747	0.60796	1.04375	0.65546	0.59974
0.90	1.06953	0.62236	0.57791	0.99687	0.61728	0.59581	0.98203	0.61164	0.59603	1.02539	0.62993	0.58778
0.92	1.04219	0.59407	0.56665	0.97578	0.59131	0.58421	0.96328	0.58705	0.58410	1.00781	0.60560	0.57581
0.94	1.01797	0.56804	0.55549	0.95547	0.56665	0.57266	0.94609	0.56399	0.57220	0.99180	0.58274	0.56385
0.96	0.99531	0.54366	0.54444	0.93750	0.54383	0.56116	0.93047	0.54237	0.56036	0.97656	0.56097	0.55195
0.98	0.97500	0.52107	0.53351	0.92031	0.52219	0.54975	0.91484	0.52152	0.54860	0.96250	0.54043	0.54014
1.00	0.95547	0.49968	0.52270	0.90391	0.50167	0.53844	0.90078	0.50203	0.53696	0.94922	0.52087	0.52843
1.02	0.93828	0.47989	0.51203	0.88828	0.48223	0.52726	0.88750	0.48353	0.52546	0.93633	0.50215	0.51687
1.04	0.92109	0.46095	0.50150	0.87422	0.46406	0.51621	0.87500	0.46599	0.51411	0.92422	0.48436	0.50546
1.06	0.90625	0.44346	0.49112	0.86094	0.44685	0.50530	0.86328	0.44935	0.50291	0.91328	0.46761	0.49422
1.08	0.89219	0.42690	0.48091	0.84844	0.43055	0.49456	0.85234	0.43359	0.49189	0.90273	0.45159	0.48317
1.10	0.87812	0.41103	0.47085	0.83672	0.41514	0.48399	0.84140	0.41840	0.48106	0.89297	0.43639	0.47231
1.12	0.86562	0.39623	0.46097	0.82578	0.40054	0.47359	0.83203	0.40427	0.47043	0.88359	0.42185	0.46166
1.14	0.85391	0.38223	0.45127	0.81484	0.38650	0.46338	0.82266	0.39065	0.45999	0.87461	0.40796	0.45124
1.16	0.84297	0.36897	0.44174	0.80547	0.37344	0.45334	0.81406	0.37776	0.44976	0.86641	0.39480	0.44103
1.18	0.83203	0.35625	0.43239	0.79609	0.36088	0.44352	0.80547	0.36534	0.43976	0.85859	0.38221	0.43104
1.20	0.82266	0.34440	0.42323	0.78750	0.34900	0.43389	0.79766	0.35360	0.42997	0.85078	0.37007	0.42127
1.22	0.81328	0.33301	0.41426	0.77891	0.33757	0.42447	0.79062	0.34250	0.42040	0.84375	0.35858	0.41173
1.24	0.80469	0.32225	0.40548	0.77109	0.32677	0.41524	0.78359	0.33180	0.41105	0.83711	0.34761	0.40243
1.26	0.79609	0.31190	0.39688	0.76406	0.31656	0.40622	0.77734	0.32170	0.40192	0.83047	0.33702	0.39336
1.28	0.78828	0.30211	0.38847	0.75703	0.30674	0.39741	0.77109	0.31195	0.39301	0.82461	0.32701	0.38451
1.30	0.78047	0.29270	0.38026	0.75078	0.29746	0.38881	0.76484	0.30254	0.38431	0.81875	0.31735	0.37588
1.32	0.77344	0.28379	0.37222	0.74375	0.28833	0.38040	0.75937	0.29367	0.37584	0.81328	0.30812	0.36748
1.34	0.76719	0.27538	0.36438	0.73828	0.27989	0.37219	0.75391	0.28511	0.36758	0.80820	0.29931	0.35930
1.36	0.76016	0.26713	0.35672	0.73281	0.27175	0.36419	0.74883	0.27693	0.35952	0.80312	0.29080	0.35133
1.38	0.75469	0.25946	0.34923	0.72734	0.26390	0.35638	0.74375	0.26904	0.35168	0.79844	0.28267	0.34358
1.40	0.74844	0.25194	0.34194	0.72187	0.25632	0.34876	0.73906	0.26151	0.34404	0.79375	0.27482	0.33603
1.42	0.74297	0.24482	0.33481	0.71719	0.24918	0.34135	0.73516	0.25441	0.33659	0.78945	0.26732	0.32869
1.44	0.73750	0.23797	0.32787	0.71250	0.24228	0.33411	0.73047	0.24739	0.32935	0.78516	0.26008	0.32154
1.46	0.73281	0.23148	0.32109	0.70820	0.23570	0.32706	0.72656	0.24076	0.32230	0.78125	0.25316	0.31460
1.48	0.72812	0.22523	0.31449	0.70391	0.22935	0.32019	0.72266	0.23436	0.31544	0.77734	0.24647	0.30784
1.50	0.72344	0.21919	0.30804	0.69961	0.22321	0.31350	0.71953	0.22833	0.30875	0.77383	0.24008	0.30126
1.52	0.71953	0.21348	0.30176	0.69609	0.21741	0.30698	0.71562	0.22234	0.30225	0.77031	0.23390	0.29487
1.54	0.71562	0.20796	0.29564	0.69219	0.21175	0.30063	0.71250	0.21671	0.29593	0.76719	0.22801	0.28865
1.56	0.71094	0.20253	0.28968	0.68906	0.20641	0.29445	0.70937	0.21125	0.28977	0.76367	0.22222	0.28260
1.58	0.70781	0.19749	0.28386	0.68516	0.20111	0.28843	0.70625	0.20597	0.28377	0.76055	0.21669	0.27672
1.60	0.70391	0.19252	0.27819	0.68203	0.19612	0.28256	0.70312	0.20087	0.27794	0.75781	0.21142	0.27100
				0.67891	0.19128	0.27685	0.70039	0.19600	0.27227	0.75469	0.20624	0.26543

FIGURE 15

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM RPM PROPELLERS

FOR 5 BLADES AE/AO = 0.35,0.55,0.75,0.95

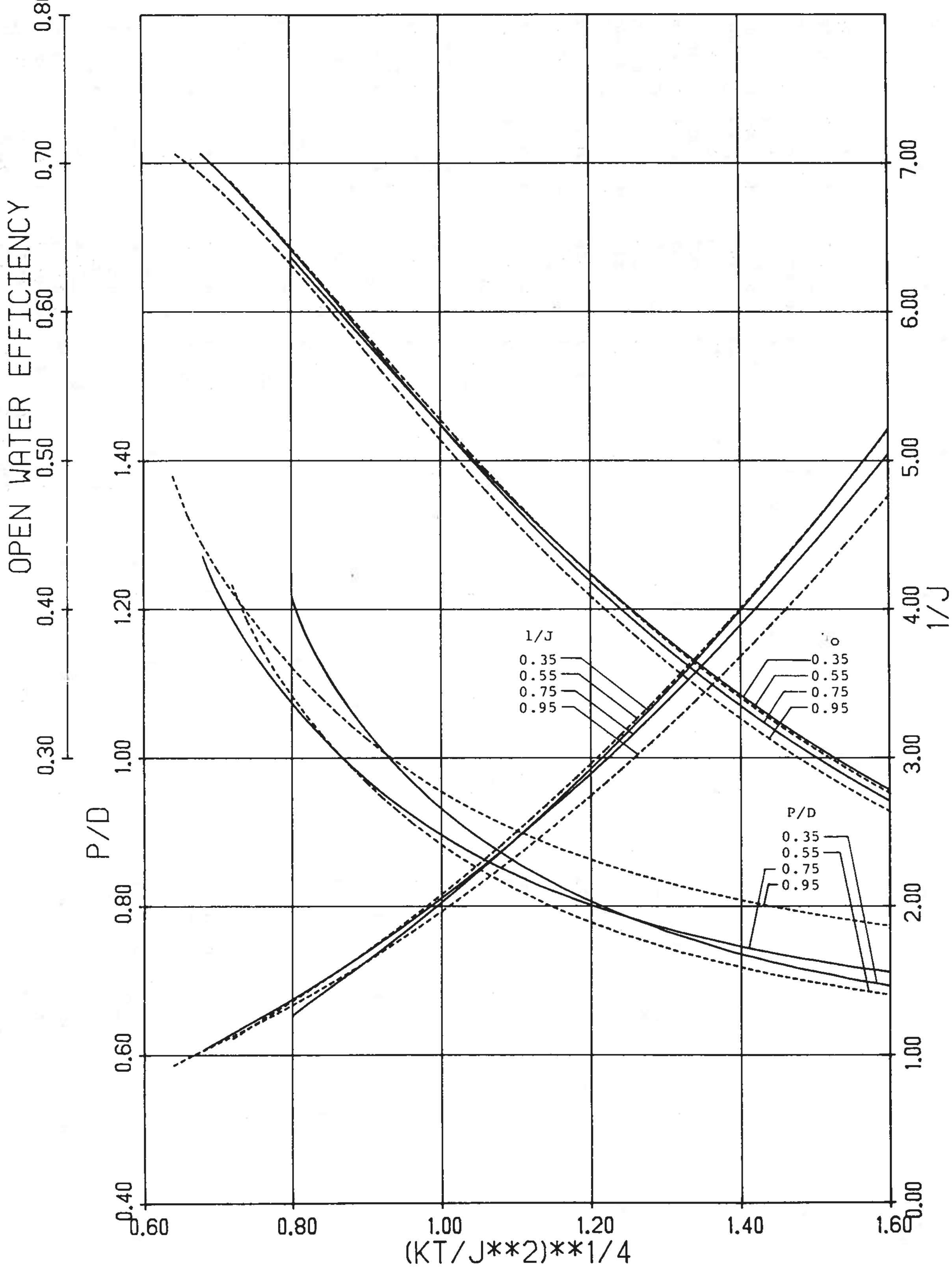


TABLE 14 WAGENINGEN B-SERIES PROPELLER DATA FOR 5 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.35			AE/AO = 0.55			AE/AO = 0.75			AE/AO = 0.95		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60												
0.62												
0.64												
0.66										1.37890	1.07338	0.70784
0.68										1.32578	1.01543	0.70061
0.70							1.27187	0.96611	0.70637	1.28672	0.96775	0.69264
0.72				1.23281	0.89875	0.68754	1.22422	0.91448	0.69663	1.25312	0.92473	0.68392
0.74				1.18437	0.84913	0.67677	1.18672	0.87030	0.68647	1.22344	0.88520	0.67449
0.76				1.14531	0.80613	0.66579	1.15390	0.83015	0.67589	1.19531	0.84776	0.66447
0.78				1.11250	0.76781	0.65459	1.12500	0.79338	0.66492	1.16953	0.81269	0.65394
0.80	1.21719	0.79005	0.63691	1.08359	0.73279	0.64322	1.09844	0.75903	0.65365	1.14531	0.77952	0.64301
0.82	1.16406	0.74438	0.62535	1.05625	0.69978	0.63169	1.07344	0.72661	0.64213	1.12187	0.74778	0.63175
0.84	1.12500	0.70625	0.61387	1.03125	0.66907	0.62007	1.05000	0.69604	0.63042	1.10039	0.71797	0.62022
0.86	1.09140	0.67187	0.60242	1.00781	0.64018	0.60839	1.02812	0.66723	0.61858	1.08008	0.68965	0.60851
0.88	1.06250	0.64077	0.59103	0.98672	0.61338	0.59669	1.00742	0.63994	0.60665	1.06094	0.66279	0.59668
0.90	1.03594	0.61184	0.57967	0.96641	0.58790	0.58499	0.98828	0.61427	0.59467	1.04258	0.63714	0.58477
0.92	1.01172	0.58496	0.56838	0.94687	0.56369	0.57333	0.97031	0.59000	0.58270	1.02578	0.61302	0.57284
0.94	0.98906	0.55978	0.55717	0.92969	0.54133	0.56174	0.95312	0.56691	0.57075	1.00937	0.58987	0.56092
0.96	0.96875	0.53645	0.54606	0.91250	0.51980	0.55022	0.93750	0.54526	0.55887	0.99453	0.56813	0.54905
0.98	0.94922	0.51433	0.53504	0.89766	0.49995	0.53882	0.92266	0.52468	0.54707	0.98047	0.54743	0.53728
1.00	0.93125	0.49365	0.52416	0.88281	0.48085	0.52753	0.90859	0.50514	0.53539	0.96680	0.52759	0.52560
1.02	0.91484	0.47432	0.51341	0.86875	0.46274	0.51638	0.89570	0.48674	0.52385	0.95430	0.50887	0.51407
1.04	0.89922	0.45601	0.50280	0.85625	0.44586	0.50538	0.88359	0.46927	0.51245	0.94258	0.49109	0.50268
1.06	0.88516	0.43890	0.49234	0.84375	0.42961	0.49455	0.87187	0.45258	0.50122	0.93125	0.47405	0.49146
1.08	0.87187	0.42272	0.48203	0.83281	0.41448	0.48389	0.86094	0.43674	0.49017	0.92109	0.45802	0.48044
1.10	0.85859	0.40719	0.47190	0.82187	0.39991	0.47342	0.85078	0.42174	0.47931	0.91094	0.44254	0.46961
1.12	0.84687	0.39271	0.46194	0.81250	0.38638	0.46314	0.84140	0.40754	0.46865	0.90195	0.42800	0.45899
1.14	0.83594	0.37902	0.45215	0.80234	0.37311	0.45305	0.83203	0.39385	0.45820	0.89297	0.41396	0.44859
1.16	0.82500	0.36586	0.44255	0.79375	0.36078	0.44315	0.82344	0.38088	0.44795	0.88476	0.40066	0.43840
1.18	0.81484	0.35342	0.43313	0.78516	0.34891	0.43347	0.81562	0.36863	0.43793	0.87656	0.38783	0.42845
1.20	0.80547	0.34165	0.42390	0.77734	0.33771	0.42399	0.80781	0.35681	0.42814	0.86953	0.37579	0.41872
1.22	0.79687	0.33053	0.41487	0.77031	0.32711	0.41472	0.80078	0.34564	0.41856	0.86250	0.36417	0.40921
1.24	0.78828	0.31984	0.40602	0.76250	0.31670	0.40565	0.79375	0.33486	0.40920	0.85547	0.35295	0.39994
1.26	0.78047	0.30972	0.39736	0.75625	0.30707	0.39680	0.78750	0.32468	0.40007	0.84922	0.34235	0.39089
1.28	0.77344	0.30016	0.38890	0.75000	0.29778	0.38816	0.78125	0.31487	0.39117	0.84297	0.33211	0.38208
1.30	0.76562	0.29080	0.38063	0.74375	0.28883	0.37972	0.77500	0.30538	0.38247	0.83750	0.32244	0.37350
1.32	0.75937	0.28210	0.37255	0.73750	0.28020	0.37149	0.76953	0.29645	0.37401	0.83203	0.31309	0.36512
1.34	0.75312	0.27374	0.36466	0.73281	0.27223	0.36345	0.76406	0.28781	0.36575	0.82656	0.30406	0.35698
1.36	0.74687	0.26567	0.35696	0.72734	0.26437	0.35563	0.75937	0.27966	0.35770	0.82187	0.29554	0.34905
1.38	0.74062	0.25790	0.34944	0.72266	0.25695	0.34799	0.75469	0.27180	0.34987	0.81680	0.28721	0.34133
1.40	0.73516	0.25056	0.34210	0.71797	0.24979	0.34056	0.75000	0.26421	0.34225	0.81250	0.27935	0.33382
1.42	0.73047	0.24363	0.33495	0.71328	0.24288	0.33331	0.74531	0.25687	0.33483	0.80781	0.27165	0.32651
1.44	0.72500	0.23679	0.32797	0.70859	0.23621	0.32625	0.74141	0.24995	0.32759	0.80391	0.26439	0.31940
1.46	0.72031	0.23034	0.32117	0.70469	0.22991	0.31937	0.73750	0.24327	0.32057	0.79961	0.25729	0.31249
1.48	0.71562	0.22411	0.31453	0.70078	0.22383	0.31266	0.73359	0.23681	0.31372	0.79609	0.25059	0.30577
1.50	0.71172	0.21822	0.30806	0.69687	0.21796	0.30614	0.72969	0.23057	0.30706	0.79219	0.24403	0.29923
1.52	0.70781	0.21254	0.30176	0.69375	0.21241	0.29978	0.72656	0.22468	0.30057	0.78867	0.23776	0.29287
1.54	0.70312	0.20693	0.29562	0.68984	0.20692	0.29360	0.72305	0.21891	0.29427	0.78516	0.23170	0.28669
1.56	0.69922	0.20162	0.28963	0.68672	0.20175	0.28758	0.71953	0.21333	0.28813	0.78203	0.22591	0.28067
1.58	0.69609	0.19662	0.28380	0.68359	0.19673	0.28171	0.71641	0.20801	0.28216	0.77891	0.22031	0.27483
1.60	0.69219	0.19166	0.27812	0.68047	0.19189	0.27600	0.71406	0.20300	0.27635	0.77578	0.21487	0.26913
							0.71094	0.19800	0.27070	0.77305	0.20969	0.26360

FIGURE 16

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM RPM PROPELLERS

FOR 5 BLADES AE/AO = 0.40,0.60,0.80,1.00

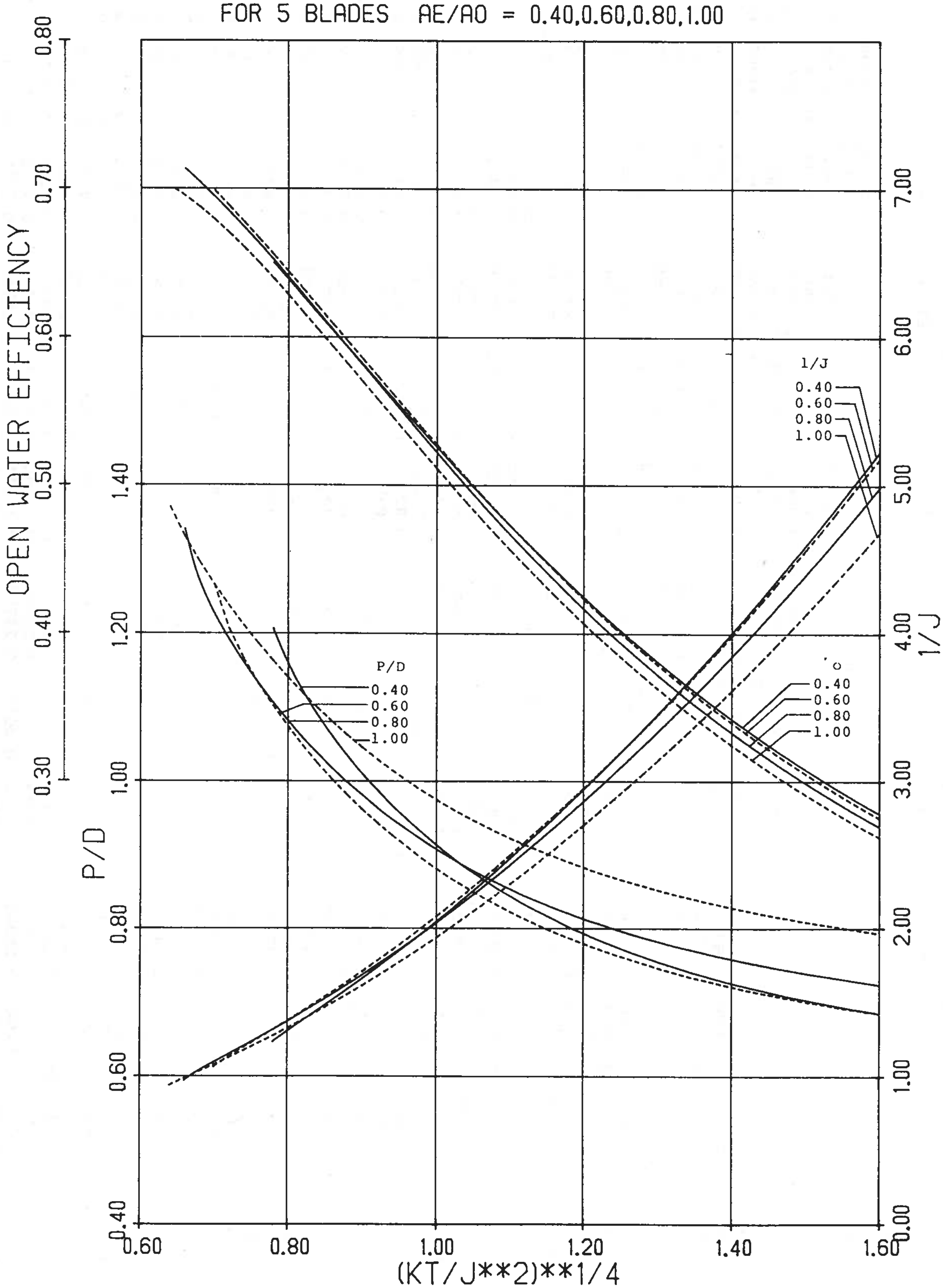


TABLE 15 WAGENINGEN B-SERIES PROPELLER DATA FOR 5 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.40			AE/AO = 0.60			AE/AO = 0.80			AE/AO = 1.00		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60												
0.62												
0.64												
0.66										1.37031	1.06560	0.70147
0.68							1.34062	1.03029	0.71322	1.32968	1.01555	0.69498
0.70				1.26562	0.94101	0.69870	1.27031	0.96357	0.70404	1.29570	0.97099	0.68754
0.72				1.20625	0.88393	0.68824	1.22656	0.91440	0.69449	1.26523	0.92982	0.67921
0.74				1.16562	0.83883	0.67754	1.19140	0.87168	0.68444	1.23711	0.89118	0.67011
0.76				1.13125	0.79858	0.66655	1.16015	0.83247	0.67394	1.21054	0.85454	0.66035
0.78	1.20625	0.81101	0.64999	1.10156	0.76214	0.65532	1.13203	0.79619	0.66303	1.18554	0.81983	0.65003
0.80	1.15937	0.76645	0.63859	1.07344	0.72777	0.64388	1.10547	0.76190	0.65179	1.16211	0.78697	0.63926
0.82	1.12187	0.72778	0.62718	1.04766	0.69574	0.63229	1.08125	0.72991	0.64030	1.13984	0.75571	0.62814
0.84	1.08906	0.69266	0.61574	1.02344	0.66559	0.62060	1.05781	0.69934	0.62859	1.11875	0.72598	0.61674
0.86	1.06015	0.66057	0.60428	1.00156	0.63757	0.60883	1.03672	0.67088	0.61674	1.09844	0.69755	0.60513
0.88	1.03359	0.63074	0.59284	0.98047	0.61091	0.59704	1.01640	0.64375	0.60480	1.07969	0.67073	0.59338
0.90	1.00937	0.60303	0.58143	0.96094	0.58589	0.58525	0.99766	0.61822	0.59281	1.06172	0.64513	0.58154
0.92	0.98750	0.57732	0.57006	0.94297	0.56243	0.57349	0.98047	0.59424	0.58080	1.04492	0.62086	0.56967
0.94	0.96641	0.55295	0.55878	0.92578	0.54013	0.56180	0.96328	0.57109	0.56884	1.02890	0.59773	0.55782
0.96	0.94766	0.53039	0.54757	0.91016	0.51929	0.55020	0.94766	0.54938	0.55693	1.01406	0.57583	0.54600
0.98	0.92969	0.50902	0.53647	0.89453	0.49919	0.53870	0.93359	0.52904	0.54511	1.00019	0.55506	0.53426
1.00	0.91250	0.48877	0.52549	0.88047	0.48042	0.52732	0.91953	0.50941	0.53340	0.98672	0.53514	0.52263
1.02	0.89687	0.46985	0.51464	0.86719	0.46263	0.51609	0.90664	0.49093	0.52184	0.97422	0.51627	0.51114
1.04	0.88203	0.45193	0.50394	0.85547	0.44604	0.50502	0.89453	0.47338	0.51041	0.96250	0.49833	0.49979
1.06	0.86875	0.43519	0.49337	0.84375	0.43007	0.49411	0.88320	0.45673	0.49916	0.95156	0.48127	0.48861
1.08	0.85547	0.41914	0.48299	0.83281	0.41494	0.48338	0.87266	0.44094	0.48809	0.94141	0.46509	0.47763
1.10	0.84375	0.40416	0.47276	0.82226	0.40050	0.47284	0.86250	0.42585	0.47723	0.93125	0.44945	0.46683
1.12	0.83203	0.38978	0.46272	0.81250	0.38683	0.46248	0.85312	0.41156	0.46656	0.92187	0.43462	0.45625
1.14	0.82187	0.37639	0.45285	0.80312	0.37379	0.45234	0.84375	0.39777	0.45610	0.91328	0.42057	0.44589
1.16	0.81172	0.36351	0.44316	0.79453	0.36146	0.44240	0.83555	0.38484	0.44585	0.90508	0.40712	0.43574
1.18	0.80156	0.35115	0.43368	0.78672	0.34980	0.43267	0.82734	0.37238	0.43584	0.89726	0.39425	0.42582
1.20	0.79297	0.33964	0.42437	0.77891	0.33857	0.42315	0.81992	0.36058	0.42604	0.88984	0.38195	0.41612
1.22	0.78437	0.32858	0.41527	0.77187	0.32797	0.41384	0.81250	0.34921	0.41647	0.88281	0.37019	0.40666
1.24	0.77656	0.31813	0.40637	0.76484	0.31774	0.40474	0.80625	0.33857	0.40712	0.87578	0.35884	0.39743
1.26	0.76875	0.30806	0.39765	0.75859	0.30809	0.39586	0.79961	0.32819	0.39800	0.86953	0.34810	0.38842
1.28	0.76172	0.29855	0.38914	0.75234	0.29878	0.38719	0.79336	0.31829	0.38910	0.86328	0.33772	0.37964
1.30	0.75469	0.28939	0.38082	0.74609	0.28979	0.37872	0.78750	0.30883	0.38042	0.85781	0.32792	0.37109
1.32	0.74844	0.28075	0.37270	0.74062	0.28132	0.37047	0.78203	0.29980	0.37197	0.85234	0.31844	0.36276
1.34	0.74219	0.27241	0.36476	0.73516	0.27316	0.36243	0.77656	0.29109	0.36373	0.84687	0.30929	0.35465
1.36	0.73672	0.26454	0.35702	0.73047	0.26544	0.35458	0.77187	0.28287	0.35571	0.84219	0.30065	0.34676
1.38	0.73125	0.25696	0.34947	0.72578	0.25800	0.34694	0.76719	0.27493	0.34789	0.83711	0.29220	0.33908
1.40	0.72578	0.24963	0.34209	0.72109	0.25082	0.33949	0.76250	0.26726	0.34029	0.83281	0.28423	0.33161
1.42	0.72109	0.24272	0.33491	0.71641	0.24388	0.33223	0.75820	0.25994	0.33289	0.82812	0.27642	0.32434
1.44	0.71641	0.23606	0.32790	0.71250	0.23734	0.32517	0.75391	0.25286	0.32568	0.82422	0.26906	0.31727
1.46	0.71172	0.22962	0.32107	0.70859	0.23102	0.31829	0.75000	0.24611	0.31867	0.81992	0.26185	0.31040
1.48	0.70703	0.22341	0.31441	0.70469	0.22491	0.31159	0.74609	0.23958	0.31185	0.81601	0.25497	0.30371
1.50	0.70312	0.21754	0.30792	0.70078	0.21901	0.30506	0.74258	0.23335	0.30521	0.81250	0.24839	0.29721
1.52	0.69922	0.21188	0.30161	0.69766	0.21345	0.29871	0.73906	0.22733	0.29876	0.80859	0.24195	0.29089
1.54	0.69531	0.20640	0.29544	0.69375	0.20792	0.29253	0.73594	0.22158	0.29248	0.80547	0.23587	0.28474
1.56	0.69141	0.20110	0.28944	0.69062	0.20272	0.28651	0.73281	0.21601	0.28636	0.80234	0.22999	0.27876
1.58	0.68828	0.19611	0.28359	0.68750	0.19769	0.28065	0.72969	0.21063	0.28042	0.79922	0.22430	0.27295
1.60	0.68437	0.19116	0.27790	0.68516	0.19296	0.27495	0.72656	0.20541	0.27464	0.79609	0.21879	0.26730
							0.72344	0.20036	0.26901	0.79297	0.21345	0.26180

FIGURE 17

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS
FOR 5 BLADES AE/AO = 0.45,0.65,0.85,1.05

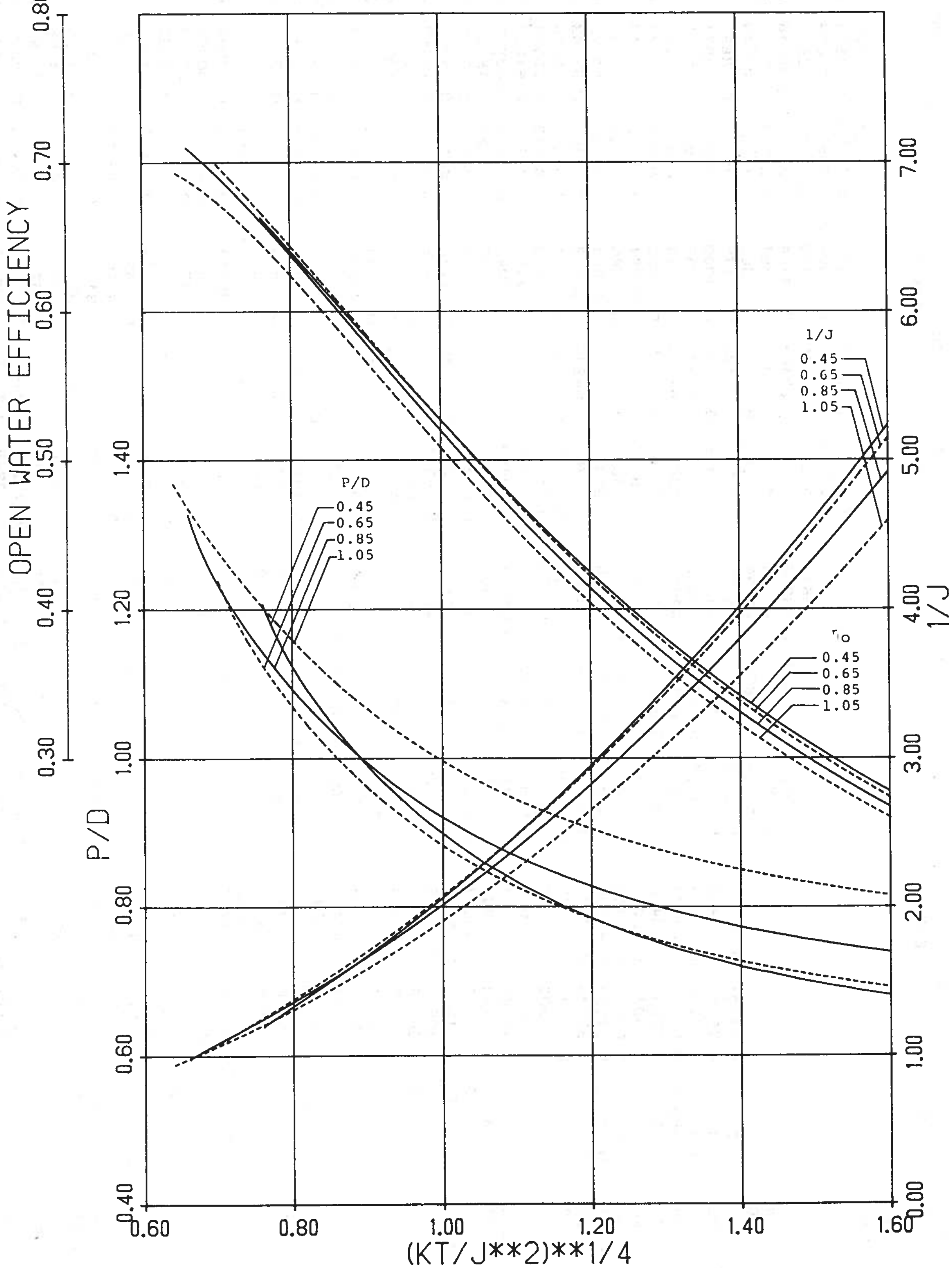


TABLE 16 WAGENINGEN B-SERIES PROPELLER DATA FOR 5 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.45 P/D	J	ETA-O	AE/AO = 0.65 P/D	J	ETA-O	AE/AO = 0.85 P/D	J	ETA-O	AE/AO = 1.05 P/D	J	ETA-O
0.60												
0.62												
0.64										1.36796	1.06157	0.69442
0.66							1.32656	1.02004	0.70976	1.33476	1.01628	0.68872
0.68							1.27265	0.96323	0.70095	1.30507	0.97439	0.68188
0.70				1.23750	0.92446	0.69869	1.23281	0.91645	0.69162	1.27734	0.93481	0.67402
0.72				1.19219	0.87544	0.68835	1.19961	0.87490	0.68173	1.25117	0.89725	0.66530
0.74				1.15625	0.83316	0.67768	1.16953	0.83640	0.67134	1.22656	0.86162	0.65585
0.76	1.20625	0.83607	0.66296	1.12422	0.79443	0.66670	1.14219	0.80056	0.66052	1.20273	0.82744	0.64579
0.78	1.16094	0.79084	0.65172	1.09531	0.75862	0.65543	1.11640	0.76667	0.64935	1.18007	0.79490	0.63524
0.80	1.12344	0.75100	0.64040	1.06875	0.72521	0.64395	1.09219	0.73465	0.63790	1.15859	0.76389	0.62429
0.82	1.09140	0.71518	0.62900	1.04375	0.69372	0.63230	1.06953	0.70444	0.62623	1.13789	0.73423	0.61304
0.84	1.06328	0.68247	0.61752	1.02109	0.66443	0.62053	1.04844	0.67594	0.61440	1.11836	0.70603	0.60155
0.86	1.03672	0.65171	0.60601	0.99922	0.63652	0.60869	1.02890	0.64910	0.60247	1.09961	0.67909	0.58992
0.88	1.01250	0.62313	0.59449	0.97969	0.61064	0.59682	1.01015	0.62351	0.59049	1.08203	0.65351	0.57818
0.90	0.98984	0.59630	0.58299	0.96016	0.58569	0.58495	0.99297	0.59944	0.57848	1.06562	0.62926	0.56639
0.92	0.96875	0.57114	0.57154	0.94297	0.56261	0.57312	0.97656	0.57654	0.56652	1.05000	0.60613	0.55460
0.94	0.95000	0.54785	0.56014	0.92656	0.54067	0.56134	0.96094	0.55472	0.55460	1.03515	0.58407	0.54284
0.96	0.93125	0.52549	0.54884	0.91094	0.51983	0.54966	0.94687	0.53429	0.54277	1.02148	0.56322	0.53117
0.98	0.91406	0.50456	0.53764	0.89609	0.50006	0.53808	0.93281	0.51456	0.53106	1.00820	0.54320	0.51959
1.00	0.89844	0.48500	0.52656	0.88203	0.48130	0.52663	0.92031	0.49612	0.51949	0.99609	0.52430	0.50814
1.02	0.88359	0.46645	0.51560	0.86953	0.46378	0.51532	0.90859	0.47860	0.50807	0.98437	0.50620	0.49686
1.04	0.86953	0.44890	0.50479	0.85781	0.44719	0.50419	0.89687	0.46169	0.49681	0.97344	0.48898	0.48572
1.06	0.85625	0.43229	0.49415	0.84609	0.43120	0.49322	0.88672	0.44593	0.48574	0.96289	0.47248	0.47478
1.08	0.84453	0.41680	0.48366	0.83594	0.41631	0.48242	0.87656	0.43074	0.47488	0.95312	0.45682	0.46404
1.10	0.83281	0.40190	0.47335	0.82578	0.40198	0.47183	0.86719	0.41633	0.46422	0.94375	0.44183	0.45350
1.12	0.82187	0.38782	0.46322	0.81641	0.38840	0.46143	0.85820	0.40255	0.45375	0.93516	0.42761	0.44317
1.14	0.81172	0.37449	0.45326	0.80703	0.37533	0.45124	0.85000	0.38951	0.44352	0.92695	0.41400	0.43307
1.16	0.80156	0.36168	0.44352	0.79922	0.36320	0.44126	0.84180	0.37694	0.43352	0.91914	0.40099	0.42320
1.18	0.79297	0.34977	0.43395	0.79062	0.35128	0.43150	0.83437	0.36504	0.42373	0.91172	0.38853	0.41354
1.20	0.78437	0.33832	0.42459	0.78359	0.34023	0.42194	0.82734	0.35367	0.41417	0.90469	0.37662	0.40412
1.22	0.77656	0.32749	0.41542	0.77656	0.32959	0.41261	0.82031	0.34270	0.40484	0.89766	0.36512	0.39493
1.24	0.76875	0.31707	0.40645	0.76953	0.31932	0.40349	0.81406	0.33234	0.39574	0.89141	0.35424	0.38596
1.26	0.76094	0.30703	0.39769	0.76328	0.30963	0.39458	0.80781	0.32233	0.38686	0.88555	0.34384	0.37723
1.28	0.75469	0.29774	0.38913	0.75703	0.30028	0.38589	0.80234	0.31289	0.37822	0.87969	0.33379	0.36873
1.30	0.74766	0.28860	0.38075	0.75156	0.29147	0.37743	0.79687	0.30376	0.36977	0.87422	0.32418	0.36044
1.32	0.74141	0.27997	0.37259	0.74609	0.28295	0.36916	0.79141	0.29496	0.36157	0.86875	0.31490	0.35237
1.34	0.73594	0.27183	0.36461	0.74062	0.27474	0.36111	0.78672	0.28665	0.35357	0.86406	0.30613	0.34452
1.36	0.73047	0.26398	0.35684	0.73594	0.26699	0.35326	0.78203	0.27861	0.34578	0.85898	0.29756	0.33688
1.38	0.72500	0.25640	0.34925	0.73125	0.25951	0.34561	0.77734	0.27086	0.33820	0.85469	0.28946	0.32945
1.40	0.71953	0.24910	0.34185	0.72656	0.25229	0.33816	0.77266	0.26336	0.33083	0.85000	0.28154	0.32222
1.42	0.71484	0.24220	0.33464	0.72266	0.24548	0.33091	0.76875	0.25629	0.32365	0.84609	0.27407	0.31519
1.44	0.71094	0.23569	0.32760	0.71836	0.23882	0.32384	0.76484	0.24946	0.31667	0.84180	0.26675	0.30835
1.46	0.70625	0.22927	0.32075	0.71484	0.23254	0.31696	0.76094	0.24286	0.30988	0.83789	0.25975	0.30170
1.48	0.70156	0.22306	0.31408	0.71094	0.22640	0.31028	0.75703	0.23647	0.30327	0.83437	0.25308	0.29524
1.50	0.69766	0.21720	0.30757	0.70703	0.22046	0.30376	0.75391	0.23046	0.29685	0.83086	0.24661	0.28896
1.52	0.69375	0.21154	0.30123	0.70391	0.21487	0.29742	0.75039	0.22455	0.29059	0.82734	0.24036	0.28284
1.54	0.69062	0.20621	0.29506	0.70078	0.20945	0.29124	0.74726	0.21892	0.28451	0.82383	0.23430	0.27690
1.56	0.68672	0.20092	0.28904	0.69727	0.20415	0.28524	0.74414	0.21347	0.27860	0.82070	0.22852	0.27113
1.58	0.68359	0.19592	0.28318	0.69453	0.19915	0.27939	0.74141	0.20826	0.27284	0.81758	0.22291	0.26551
1.60	0.68047	0.19109	0.27747	0.69141	0.19424	0.27369	0.73828	0.20315	0.26724	0.81484	0.21756	0.26005

FIGURE 18

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS
FOR 6 BLADES AE/AO = 0.30,0.50,0.70,0.90

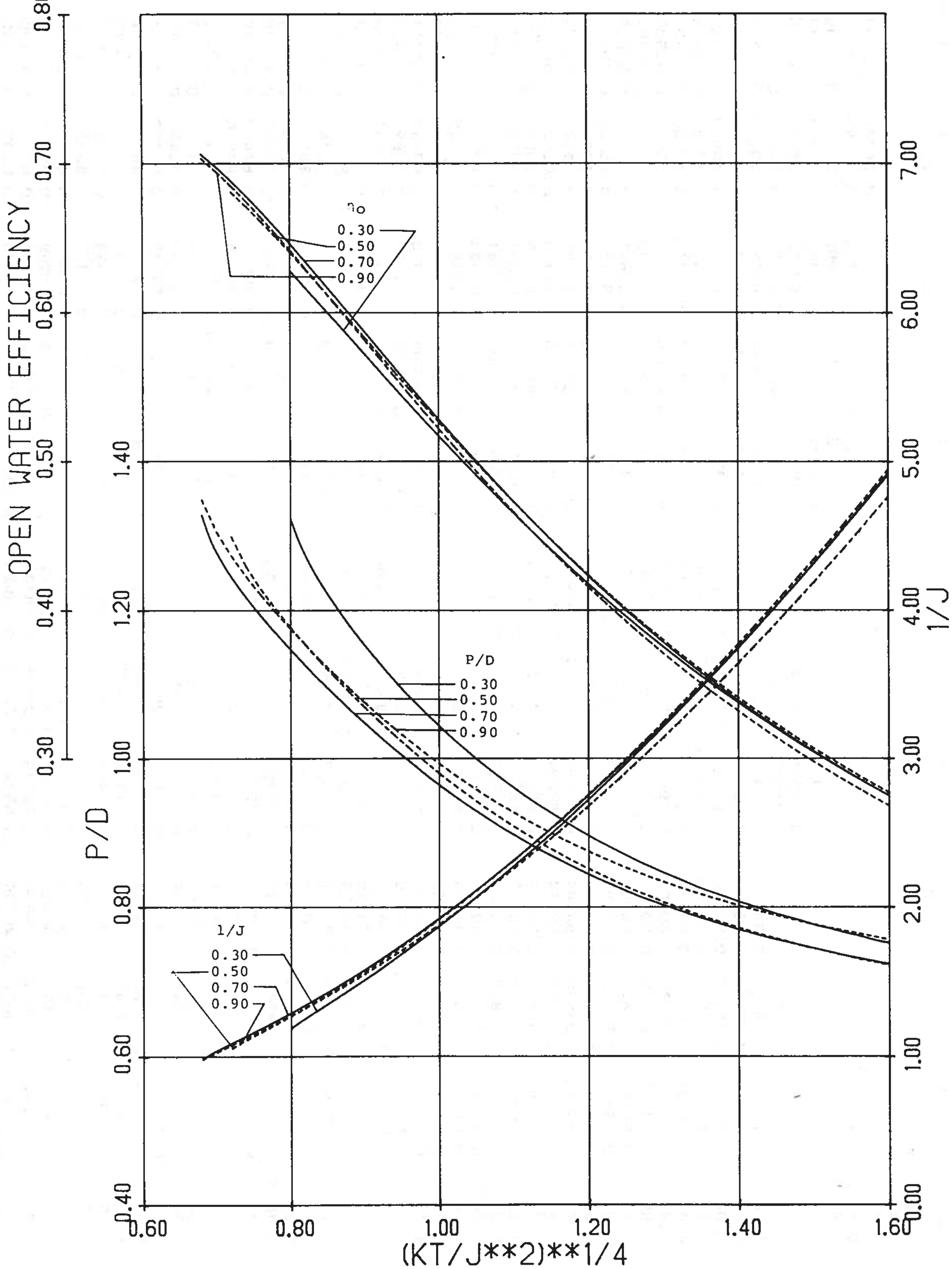


TABLE 17 WAGENINGEN B-SERIES PROPELLER DATA FOR 6 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.30 P/D	J	ETA-O	AE/AO = 0.50 P/D	J	ETA-O	AE/AO = 0.70 P/D	J	ETA-O	AE/AO = 0.90 P/D	J	ETA-O
0.60												
0.62												
0.64												
0.66												
0.68							1.32812	1.01247	0.70634	1.34843	1.01779	0.70347
0.70							1.27812	0.95801	0.69778	1.30547	0.96792	0.69460
0.72				1.29922	0.94460	0.68108	1.24492	0.91474	0.68862	1.27304	0.92551	0.68514
0.74				1.25859	0.89763	0.67160	1.21719	0.87583	0.67883	1.24531	0.88697	0.67507
0.76				1.22812	0.85740	0.66164	1.19219	0.83961	0.66847	1.22031	0.85106	0.66446
0.78				1.20156	0.82048	0.65123	1.16914	0.80555	0.65764	1.19687	0.81705	0.65338
0.80	1.32343	0.84023	0.62817	1.17656	0.78564	0.64046	1.14726	0.77319	0.64643	1.17500	0.78489	0.64192
0.82	1.27500	0.79571	0.61711	1.15390	0.75310	0.62939	1.12617	0.74227	0.63491	1.15390	0.75411	0.63018
0.84	1.23828	0.75731	0.60600	1.13125	0.72178	0.61810	1.10547	0.71260	0.62320	1.13320	0.72453	0.61823
0.86	1.20742	0.72263	0.59482	1.11016	0.69227	0.60665	1.08594	0.68446	0.61133	1.11367	0.69643	0.60612
0.88	1.17890	0.69023	0.58359	1.08945	0.66405	0.59513	1.06640	0.65731	0.59938	1.09453	0.66946	0.59395
0.90	1.15312	0.66017	0.57235	1.06953	0.63721	0.58355	1.04805	0.63161	0.58739	1.07578	0.64357	0.58176
0.92	1.12890	0.63191	0.56115	1.05000	0.61155	0.57198	1.03008	0.60699	0.57542	1.05781	0.61887	0.56958
0.94	1.10547	0.60510	0.54999	1.03164	0.58733	0.56046	1.01250	0.58342	0.56351	1.04062	0.59535	0.55747
0.96	1.08359	0.57995	0.53892	1.01367	0.56418	0.54901	0.99609	0.56116	0.55168	1.02422	0.57295	0.54546
0.98	1.06328	0.55635	0.52795	0.99648	0.54222	0.53766	0.97969	0.53972	0.53998	1.00820	0.55149	0.53357
1.00	1.04375	0.53399	0.51712	0.97969	0.52125	0.52643	0.96406	0.51933	0.52839	0.99297	0.53107	0.52183
1.02	1.02500	0.51280	0.50641	0.96406	0.50150	0.51535	0.94922	0.49999	0.51697	0.97812	0.51152	0.51027
1.04	1.00742	0.49285	0.49586	0.94922	0.48276	0.50442	0.93516	0.48164	0.50572	0.96445	0.49308	0.49888
1.06	0.99062	0.47395	0.48547	0.93437	0.46476	0.49366	0.92187	0.46422	0.49466	0.95078	0.47529	0.48770
1.08	0.97500	0.45615	0.47526	0.92109	0.44794	0.48308	0.90859	0.44746	0.48380	0.93828	0.45853	0.47671
1.10	0.95976	0.43921	0.46523	0.90781	0.43176	0.47268	0.89648	0.43169	0.47313	0.92656	0.44264	0.46595
1.12	0.94531	0.42316	0.45538	0.89531	0.41645	0.46248	0.88476	0.41661	0.46267	0.91484	0.42731	0.45541
1.14	0.93203	0.40804	0.44571	0.88281	0.40173	0.45248	0.87344	0.40222	0.45243	0.90391	0.41278	0.44511
1.16	0.91953	0.39374	0.43623	0.87187	0.38800	0.44268	0.86328	0.38871	0.44241	0.89336	0.39888	0.43502
1.18	0.90703	0.38002	0.42695	0.86094	0.37479	0.43308	0.85312	0.37568	0.43260	0.88359	0.38572	0.42518
1.20	0.89531	0.36702	0.41786	0.85078	0.36230	0.42370	0.84336	0.36326	0.42303	0.87422	0.37313	0.41556
1.22	0.88437	0.35471	0.40896	0.84140	0.35048	0.41452	0.83437	0.35149	0.41366	0.86523	0.36111	0.40617
1.24	0.87422	0.34307	0.40027	0.83203	0.33909	0.40554	0.82578	0.34026	0.40452	0.85664	0.34962	0.39702
1.26	0.86406	0.33187	0.39176	0.82266	0.32814	0.39678	0.81719	0.32943	0.39560	0.84844	0.33865	0.38810
1.28	0.85469	0.32126	0.38344	0.81484	0.31795	0.38822	0.80937	0.31920	0.38690	0.84062	0.32816	0.37941
1.30	0.84570	0.31115	0.37532	0.80625	0.30796	0.37986	0.80234	0.30952	0.37842	0.83359	0.31825	0.37094
1.32	0.83750	0.30157	0.36739	0.79922	0.29869	0.37170	0.79531	0.30019	0.37015	0.82656	0.30868	0.36269
1.34	0.82891	0.29228	0.35965	0.79141	0.28959	0.36374	0.78828	0.29119	0.36209	0.81992	0.29954	0.35466
1.36	0.82109	0.28348	0.35209	0.78437	0.28098	0.35599	0.78203	0.28268	0.35423	0.81367	0.29081	0.34684
1.38	0.81406	0.27515	0.34471	0.77812	0.27284	0.34841	0.77578	0.27447	0.34658	0.80781	0.28247	0.33923
1.40	0.80703	0.26713	0.33751	0.77187	0.26499	0.34104	0.76953	0.26655	0.33912	0.80156	0.27433	0.33183
1.42	0.80039	0.25946	0.33049	0.76562	0.25742	0.33385	0.76406	0.25907	0.33187	0.79609	0.26664	0.32463
1.44	0.79375	0.25207	0.32364	0.76016	0.25026	0.32684	0.75859	0.25184	0.32480	0.79101	0.25930	0.31762
1.46	0.78750	0.24501	0.31697	0.75469	0.24335	0.32001	0.75391	0.24502	0.31791	0.78594	0.25220	0.31080
1.48	0.78203	0.23833	0.31046	0.74922	0.23668	0.31336	0.74922	0.23843	0.31122	0.78125	0.24542	0.30417
1.50	0.77578	0.23176	0.30411	0.74453	0.23037	0.30687	0.74453	0.23206	0.30469	0.77656	0.23887	0.29772
1.52	0.77109	0.22565	0.29792	0.73984	0.22428	0.30056	0.73984	0.22590	0.29835	0.77187	0.23253	0.29145
1.54	0.76562	0.21963	0.29189	0.73516	0.21840	0.29441	0.73516	0.21995	0.29217	0.76797	0.22656	0.28534
1.56	0.76094	0.21394	0.28602	0.73047	0.21270	0.28842	0.73125	0.21434	0.28616	0.76406	0.22078	0.27941
1.58	0.75547	0.20833	0.28029	0.72656	0.20733	0.28259	0.72734	0.20890	0.28030	0.76016	0.21518	0.27363
1.60	0.75156	0.20312	0.27471	0.72187	0.20201	0.27690	0.72344	0.20365	0.27461	0.75625	0.20976	0.26801

FIGURE 19

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS
FOR 6 BLADES AE/AO = 0.35,0.55,0.75,0.95

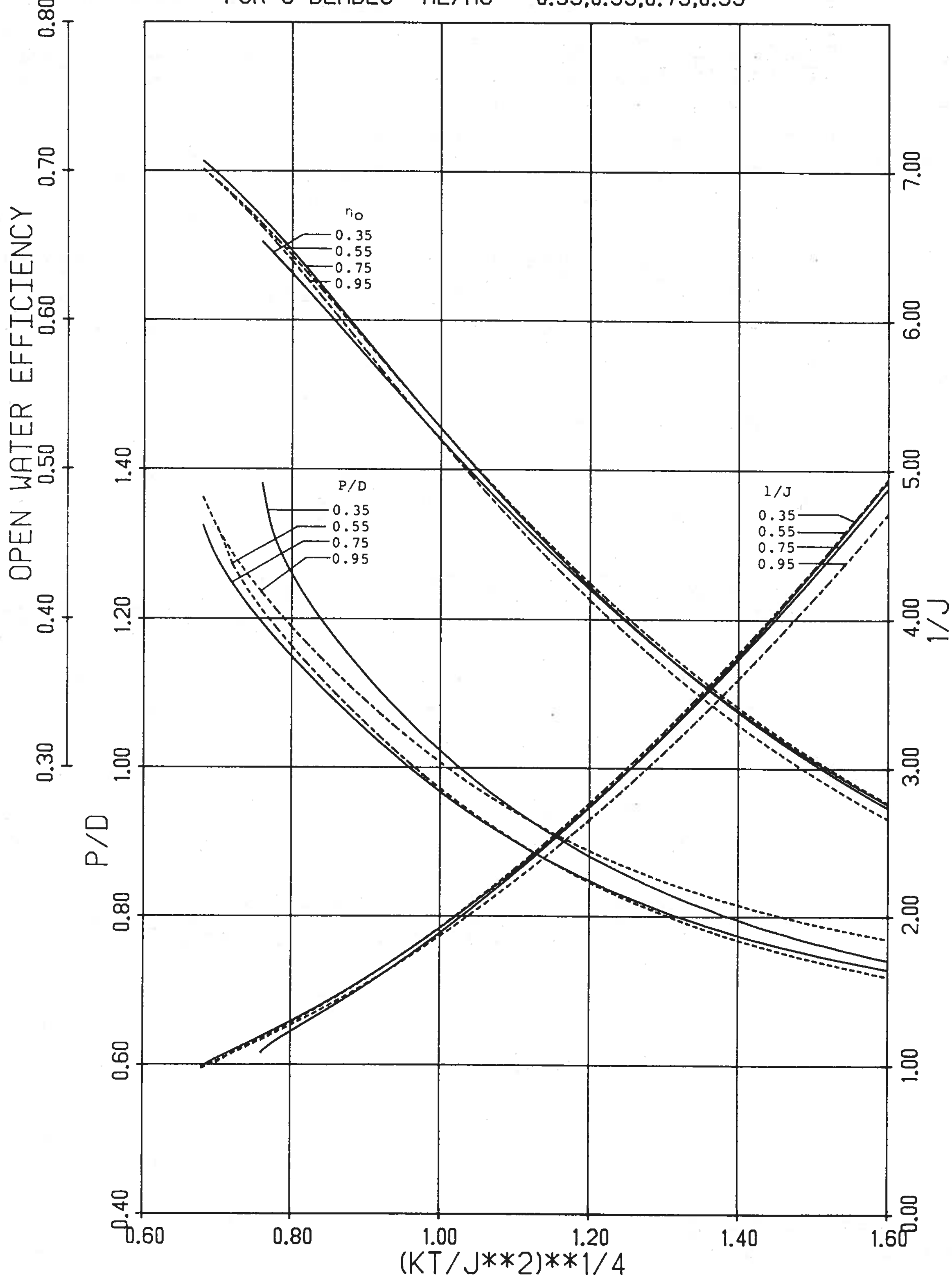


TABLE 18 WAGENINGEN B-SERIES PROPELLER DATA FOR 6 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.35			AE/AO = 0.55			AE/AO = 0.75			AE/AO = 0.95		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60												
0.62												
0.64												
0.66												
0.68							1.32500	1.00945	0.70667	1.36211	1.02334	0.70116
0.70				1.32187	0.98381	0.69283	1.27890	0.95742	0.69804	1.31953	0.97378	0.69221
0.72				1.27187	0.93044	0.68383	1.24687	0.91496	0.68879	1.28711	0.93142	0.68270
0.74				1.23906	0.88794	0.67430	1.21914	0.87622	0.67892	1.25937	0.89288	0.67260
0.76	1.38125	0.92229	0.65244	1.21133	0.84951	0.66426	1.19453	0.84035	0.66848	1.23437	0.85696	0.66194
0.78	1.30078	0.86086	0.64183	1.18672	0.81391	0.65374	1.17109	0.80622	0.65757	1.21094	0.82294	0.65083
0.80	1.26015	0.81787	0.63114	1.16289	0.77995	0.64286	1.14922	0.77397	0.64627	1.18867	0.79055	0.63935
0.82	1.22734	0.77976	0.62026	1.14062	0.74792	0.63167	1.12851	0.74333	0.63468	1.16757	0.75974	0.62757
0.84	1.19844	0.74475	0.60922	1.11953	0.71755	0.62026	1.10781	0.71373	0.62288	1.14687	0.73013	0.61560
0.86	1.17226	0.71219	0.59805	1.09844	0.68829	0.60871	1.08828	0.68566	0.61093	1.12734	0.70198	0.60347
0.88	1.14765	0.68157	0.58680	1.07851	0.66059	0.59705	1.06914	0.65873	0.59891	1.10820	0.67494	0.59127
0.90	1.12422	0.65264	0.57553	1.05937	0.63425	0.58537	1.05078	0.63305	0.58685	1.08984	0.64913	0.57905
0.92	1.10156	0.62518	0.56426	1.04062	0.60906	0.57369	1.03281	0.60847	0.57482	1.07187	0.62438	0.56686
0.94	1.08047	0.59939	0.55304	1.02226	0.58496	0.56205	1.01562	0.58506	0.56283	1.05469	0.60077	0.55473
0.96	1.06015	0.57495	0.54191	1.00469	0.56208	0.55050	0.99844	0.56250	0.55094	1.03828	0.57827	0.54269
0.98	1.04062	0.55177	0.53086	0.98789	0.54035	0.53904	0.98281	0.54133	0.53916	1.02226	0.55671	0.53079
1.00	1.02265	0.53004	0.51994	0.97187	0.51974	0.52771	0.96719	0.52095	0.52752	1.00703	0.53620	0.51904
1.02	1.00469	0.50921	0.50915	0.95625	0.50005	0.51653	0.95234	0.50159	0.51605	0.99219	0.51655	0.50746
1.04	0.98828	0.48972	0.49852	0.94141	0.48137	0.50551	0.93828	0.48320	0.50475	0.97812	0.49788	0.49608
1.06	0.97187	0.47102	0.48804	0.92734	0.46367	0.49466	0.92500	0.46576	0.49363	0.96484	0.48013	0.48488
1.08	0.95703	0.45353	0.47773	0.91406	0.44689	0.48399	0.91250	0.44922	0.48272	0.95234	0.46327	0.47391
1.10	0.94258	0.43685	0.46761	0.90117	0.43087	0.47352	0.90039	0.43340	0.47201	0.94023	0.44714	0.46315
1.12	0.92891	0.42107	0.45767	0.88906	0.41570	0.46324	0.88828	0.41816	0.46152	0.92851	0.43171	0.45262
1.14	0.91562	0.40602	0.44792	0.87734	0.40122	0.45317	0.87734	0.40386	0.45125	0.91758	0.41708	0.44231
1.16	0.90351	0.39187	0.43837	0.86641	0.38750	0.44329	0.86719	0.39029	0.44119	0.90703	0.40308	0.43224
1.18	0.89180	0.37837	0.42900	0.85547	0.37430	0.43363	0.85703	0.37723	0.43136	0.89726	0.38981	0.42240
1.20	0.88047	0.36550	0.41984	0.84531	0.36182	0.42418	0.84766	0.36487	0.42176	0.88789	0.37714	0.41281
1.22	0.87031	0.35341	0.41087	0.83594	0.35001	0.41495	0.83828	0.35295	0.41238	0.87891	0.36501	0.40344
1.24	0.86016	0.34178	0.40209	0.82656	0.33862	0.40592	0.82969	0.34167	0.40322	0.87031	0.35343	0.39430
1.26	0.85078	0.33077	0.39351	0.81797	0.32786	0.39710	0.82187	0.33102	0.39429	0.86250	0.34247	0.38540
1.28	0.84140	0.32020	0.38513	0.81016	0.31769	0.38850	0.81406	0.32073	0.38557	0.85469	0.33189	0.37673
1.30	0.83281	0.31018	0.37695	0.80234	0.30787	0.38009	0.80625	0.31082	0.37708	0.84726	0.32178	0.36829
1.32	0.82422	0.30054	0.36895	0.79453	0.29843	0.37190	0.79922	0.30144	0.36880	0.84023	0.31212	0.36006
1.34	0.81641	0.29142	0.36115	0.78750	0.28949	0.36390	0.79297	0.29259	0.36074	0.83359	0.30290	0.35206
1.36	0.80937	0.28278	0.35353	0.78086	0.28096	0.35610	0.78633	0.28395	0.35287	0.82734	0.29409	0.34427
1.38	0.80156	0.27432	0.34610	0.77422	0.27273	0.34850	0.78047	0.27579	0.34522	0.82109	0.28558	0.33669
1.40	0.79531	0.26644	0.33885	0.76797	0.26487	0.34109	0.77422	0.26783	0.33777	0.81562	0.27754	0.32932
1.42	0.78828	0.25872	0.33178	0.76250	0.25745	0.33387	0.76875	0.26031	0.33051	0.80976	0.26968	0.32214
1.44	0.78203	0.25140	0.32488	0.75703	0.25029	0.32684	0.76367	0.25313	0.32345	0.80469	0.26227	0.31517
1.46	0.77656	0.24448	0.31816	0.75156	0.24337	0.31999	0.75859	0.24620	0.31658	0.79961	0.25510	0.30838
1.48	0.77031	0.23768	0.31161	0.74609	0.23669	0.31331	0.75391	0.23957	0.30988	0.79453	0.24817	0.30178
1.50	0.76484	0.23123	0.30522	0.74141	0.23038	0.30681	0.74922	0.23317	0.30337	0.78984	0.24155	0.29536
1.52	0.76016	0.22513	0.29900	0.73672	0.22428	0.30048	0.74453	0.22698	0.29703	0.78555	0.23522	0.28912
1.54	0.75469	0.21913	0.29293	0.73203	0.21839	0.29431	0.74062	0.22114	0.29086	0.78125	0.22911	0.28305
1.56	0.75000	0.21344	0.28702	0.72812	0.21282	0.28830	0.73672	0.21550	0.28486	0.77734	0.22327	0.27715
1.58	0.74531	0.20795	0.28126	0.72344	0.20731	0.28246	0.73281	0.21003	0.27902	0.77344	0.21761	0.27140
1.60	0.74141	0.20274	0.27564	0.71953	0.20211	0.27676	0.72891	0.20475	0.27333	0.76953	0.21213	0.26582

FIGURE 20

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS
FOR 6 BLADES AE/AO = 0.40,0.60,0.80,1.00

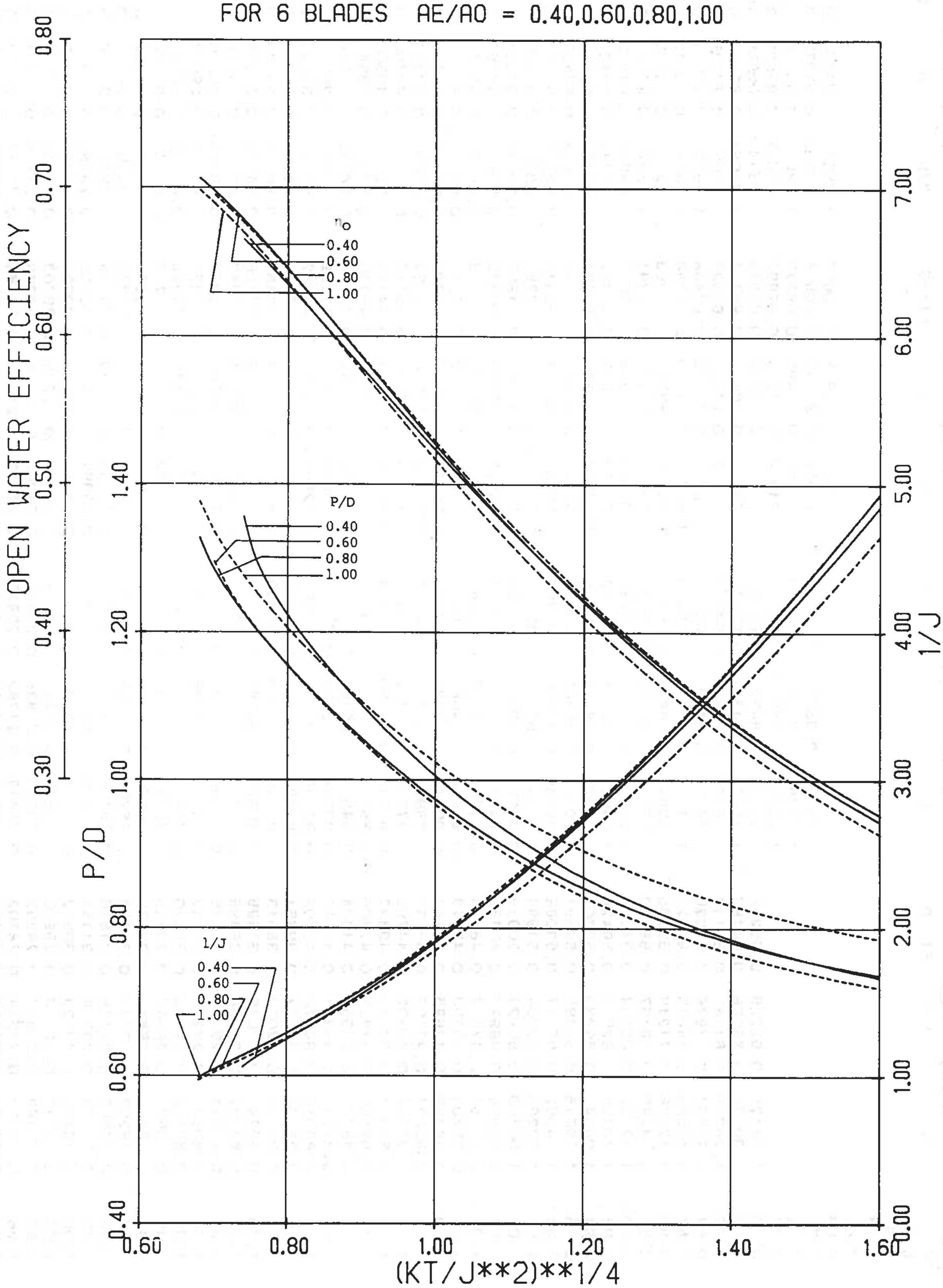


TABLE 19 WAGENINGEN B-SERIES PROPELLER DATA FOR 6 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.40			AE/AO = 0.60			AE/AO = 0.80			AE/AO = 1.00		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60												
0.62												
0.64												
0.66												
0.68							1.32812	1.00979	0.70629	1.37656	1.02898	0.69832
0.70				1.29531	0.96899	0.69509	1.28437	0.95925	0.69757	1.33515	0.98015	0.68933
0.72				1.25625	0.92192	0.68608	1.25234	0.91694	0.68825	1.30312	0.93802	0.67978
0.74	1.35625	0.94263	0.66547	1.22656	0.88144	0.67648	1.22500	0.87850	0.67830	1.27578	0.89968	0.66964
0.76	1.29062	0.88501	0.65537	1.20039	0.84414	0.66632	1.19980	0.84242	0.66779	1.25039	0.86355	0.65897
0.78	1.25312	0.84209	0.64504	1.17656	0.80928	0.65570	1.17695	0.80867	0.65681	1.22734	0.82967	0.64783
0.80	1.22265	0.80388	0.63441	1.15390	0.77615	0.64469	1.15469	0.77628	0.64544	1.20508	0.79724	0.63632
0.82	1.19531	0.76850	0.62353	1.13203	0.74453	0.63339	1.13359	0.74552	0.63379	1.18359	0.76621	0.62453
0.84	1.16953	0.73515	0.61244	1.11094	0.71438	0.62186	1.11328	0.71614	0.62193	1.16328	0.73669	0.61253
0.86	1.14609	0.70406	0.60121	1.09101	0.68583	0.61020	1.09375	0.68808	0.60992	1.14375	0.70848	0.60039
0.88	1.12304	0.67436	0.58990	1.07109	0.65830	0.59844	1.07461	0.66117	0.59783	1.12461	0.68136	0.58817
0.90	1.10156	0.64643	0.57854	1.05234	0.63226	0.58664	1.05625	0.63551	0.58571	1.10625	0.65548	0.57594
0.92	1.08047	0.61979	0.56719	1.03359	0.60719	0.57485	1.03828	0.61091	0.57362	1.08828	0.63061	0.56373
0.94	1.06015	0.59448	0.55588	1.01601	0.58351	0.56312	1.02109	0.58749	0.56158	1.07109	0.60692	0.55160
0.96	1.04140	0.57075	0.54464	0.99922	0.56100	0.55145	1.00469	0.56520	0.54962	1.05469	0.58432	0.53955
0.98	1.02265	0.54800	0.53351	0.98203	0.53921	0.53991	0.98828	0.54371	0.53780	1.03828	0.56252	0.52765
1.00	1.00508	0.52654	0.52249	0.96641	0.51879	0.52849	0.97344	0.52357	0.52611	1.02344	0.54205	0.51590
1.02	0.98828	0.50619	0.51160	0.95156	0.49941	0.51722	0.95859	0.50416	0.51460	1.00859	0.52229	0.50432
1.04	0.97187	0.48679	0.50086	0.93672	0.48077	0.50611	0.94453	0.48573	0.50326	0.99453	0.50349	0.49292
1.06	0.95703	0.46865	0.49030	0.92266	0.46310	0.49518	0.93125	0.46824	0.49211	0.98125	0.48563	0.48174
1.08	0.94219	0.45123	0.47990	0.90937	0.44634	0.48443	0.91836	0.45151	0.48117	0.96875	0.46866	0.47077
1.10	0.92812	0.43474	0.46969	0.89687	0.43047	0.47389	0.90625	0.43564	0.47043	0.95625	0.45229	0.46003
1.12	0.91484	0.41912	0.45966	0.88516	0.41542	0.46353	0.89453	0.42048	0.45991	0.94492	0.43687	0.44950
1.14	0.90234	0.40432	0.44982	0.87344	0.40095	0.45339	0.88359	0.40610	0.44960	0.93398	0.42212	0.43922
1.16	0.89062	0.39031	0.44018	0.86250	0.38724	0.44347	0.87344	0.39249	0.43954	0.92344	0.40801	0.42916
1.18	0.87891	0.37686	0.43074	0.85234	0.37427	0.43375	0.86328	0.37937	0.42969	0.91328	0.39452	0.41935
1.20	0.86875	0.36431	0.42149	0.84219	0.36177	0.42424	0.85391	0.36695	0.42007	0.90391	0.38173	0.40977
1.22	0.85820	0.35215	0.41245	0.83281	0.34995	0.41496	0.84492	0.35508	0.41068	0.89531	0.36962	0.40043
1.24	0.84844	0.34064	0.40360	0.82422	0.33877	0.40588	0.83633	0.34375	0.40152	0.88672	0.35792	0.39132
1.26	0.83906	0.32966	0.39496	0.81562	0.32799	0.39702	0.82812	0.33292	0.39257	0.87851	0.34675	0.38245
1.28	0.83047	0.31926	0.38651	0.80781	0.31781	0.38838	0.82031	0.32259	0.38386	0.87070	0.33607	0.37381
1.30	0.82187	0.30926	0.37826	0.79961	0.30789	0.37993	0.81328	0.31282	0.37537	0.86328	0.32586	0.36539
1.32	0.81406	0.29980	0.37021	0.79297	0.29871	0.37170	0.80625	0.30339	0.36709	0.85625	0.31611	0.35720
1.34	0.80625	0.29069	0.36235	0.78594	0.28976	0.36368	0.79961	0.29439	0.35903	0.84961	0.30679	0.34923
1.36	0.79883	0.28199	0.35468	0.77891	0.28113	0.35585	0.79297	0.28570	0.35117	0.84297	0.29779	0.34148
1.38	0.79219	0.27375	0.34720	0.77266	0.27297	0.34822	0.78750	0.27759	0.34353	0.83711	0.28928	0.33393
1.40	0.78516	0.26575	0.33990	0.76641	0.26510	0.34080	0.78125	0.26957	0.33608	0.83125	0.28107	0.32659
1.42	0.77891	0.25817	0.33278	0.76094	0.25767	0.33355	0.77578	0.26201	0.32884	0.82578	0.27321	0.31945
1.44	0.77266	0.25087	0.32585	0.75547	0.25049	0.32650	0.77070	0.25478	0.32179	0.82031	0.26562	0.31251
1.46	0.76719	0.24395	0.31908	0.75000	0.24355	0.31963	0.76562	0.24780	0.31493	0.81523	0.25838	0.30576
1.48	0.76172	0.23728	0.31249	0.74531	0.23701	0.31294	0.76094	0.24114	0.30825	0.81055	0.25145	0.29920
1.50	0.75625	0.23084	0.30607	0.74062	0.23069	0.30642	0.75625	0.23469	0.30175	0.80547	0.24468	0.29282
1.52	0.75156	0.22474	0.29981	0.73594	0.22458	0.30008	0.75156	0.22845	0.29542	0.80156	0.23836	0.28661
1.54	0.74609	0.21874	0.29371	0.73125	0.21867	0.29390	0.74766	0.22258	0.28927	0.79687	0.23209	0.28057
1.56	0.74141	0.21305	0.28776	0.72734	0.21310	0.28789	0.74375	0.21690	0.28329	0.79297	0.22618	0.27471
1.58	0.73750	0.20768	0.28198	0.72344	0.20770	0.28203	0.73984	0.21139	0.27746	0.78906	0.22046	0.26900
1.60	0.73281	0.20236	0.27633	0.71914	0.20242	0.27633	0.73594	0.20607	0.27179	0.78516	0.21492	0.26346

FIGURE 21
WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS
FOR 6 BLADES AE/AO = 0.45,0.65,0.85,1.05

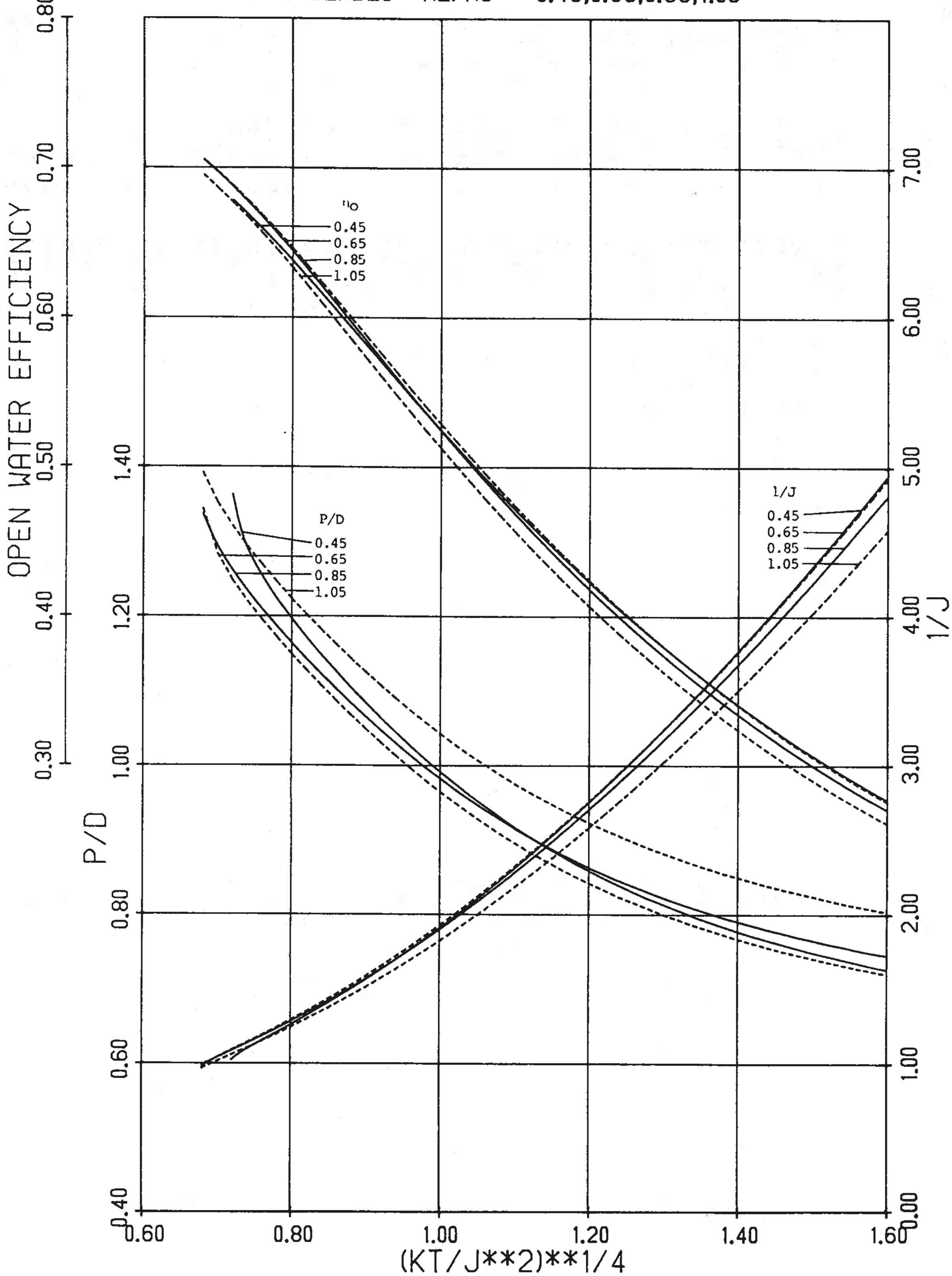


TABLE 20 WAGENINGEN B-SERIES PROPELLER DATA FOR 6 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.45 P/D	AE/AO = 0.45 J	AE/AO = 0.45 ETA-O	AE/AO = 0.65 P/D	AE/AO = 0.65 J	AE/AO = 0.65 ETA-O	AE/AO = 0.85 P/D	AE/AO = 0.85 J	AE/AO = 0.85 ETA-O	AE/AO = 1.05 P/D	AE/AO = 1.05 J	AE/AO = 1.05 ETA-O
0.60												
0.62												
0.64												
0.66												
0.68				1.34375	1.02240	0.70533	1.33672	1.01303	0.70520	1.39140	1.03444	0.69501
0.70				1.28281	0.96146	0.69678	1.29336	0.96284	0.69641	1.35156	0.98657	0.68601
0.72	1.36250	0.97573	0.67816	1.24765	0.91687	0.68771	1.26093	0.92040	0.68701	1.32031	0.94488	0.67645
0.74	1.29062	0.91289	0.66853	1.21953	0.87751	0.67800	1.23359	0.88203	0.67700	1.29297	0.90654	0.66629
0.76	1.25312	0.86872	0.65860	1.19453	0.84109	0.66774	1.20859	0.84609	0.66643	1.26836	0.87076	0.65560
0.78	1.22265	0.82951	0.64827	1.17109	0.80664	0.65701	1.18554	0.81228	0.65539	1.24531	0.83684	0.64445
0.80	1.19609	0.79353	0.63760	1.14844	0.77373	0.64589	1.16328	0.77993	0.64398	1.22304	0.80436	0.63293
0.82	1.17109	0.75959	0.62664	1.12734	0.74269	0.63448	1.14219	0.74918	0.63228	1.20195	0.77344	0.62112
0.84	1.14765	0.72761	0.61546	1.10664	0.71289	0.62286	1.12187	0.71980	0.62035	1.18164	0.74385	0.60911
0.86	1.12578	0.69748	0.60413	1.08672	0.68447	0.61108	1.10234	0.69175	0.60830	1.16211	0.71555	0.59696
0.88	1.10390	0.66853	0.59271	1.06719	0.65724	0.59922	1.08320	0.66480	0.59616	1.14297	0.68835	0.58474
0.90	1.08359	0.64132	0.58125	1.04844	0.63131	0.58732	1.06484	0.63912	0.58399	1.12461	0.66238	0.57250
0.92	1.06328	0.61518	0.56980	1.03047	0.60664	0.57544	1.04687	0.61449	0.57186	1.10703	0.63757	0.56028
0.94	1.04414	0.59050	0.55838	1.01289	0.58302	0.56360	1.02969	0.59101	0.55977	1.08984	0.61377	0.54814
0.96	1.02578	0.56708	0.54704	0.99609	0.56057	0.55185	1.01289	0.56853	0.54778	1.07344	0.59106	0.53610
0.98	1.00781	0.54471	0.53579	0.97969	0.53911	0.54022	0.99687	0.54714	0.53592	1.05742	0.56929	0.52419
1.00	0.99101	0.52364	0.52467	0.96406	0.51872	0.52871	0.98203	0.52695	0.52421	1.04219	0.54856	0.51245
1.02	0.97500	0.50366	0.51369	0.94922	0.49938	0.51736	0.96719	0.50747	0.51265	1.02734	0.52867	0.50087
1.04	0.95937	0.48459	0.50285	0.93476	0.48088	0.50618	0.95312	0.48898	0.50129	1.01328	0.50976	0.48950
1.06	0.94453	0.46653	0.49219	0.92109	0.46335	0.49518	0.93984	0.47141	0.49011	1.00039	0.49191	0.47832
1.08	0.93047	0.44941	0.48170	0.90781	0.44659	0.48436	0.92734	0.45475	0.47915	0.98750	0.47468	0.46737
1.10	0.91641	0.43297	0.47139	0.89531	0.43071	0.47375	0.91484	0.43868	0.46840	0.97500	0.45819	0.45664
1.12	0.90391	0.41761	0.46128	0.88359	0.41567	0.46335	0.90351	0.42357	0.45786	0.96367	0.44264	0.44614
1.14	0.89141	0.40286	0.45135	0.87266	0.40142	0.45314	0.89258	0.40912	0.44755	0.95273	0.42777	0.43588
1.16	0.88008	0.38900	0.44164	0.86172	0.38769	0.44316	0.88203	0.39531	0.43747	0.94219	0.41354	0.42585
1.18	0.86875	0.37567	0.43211	0.85156	0.37471	0.43340	0.87226	0.38224	0.42762	0.93203	0.39993	0.41606
1.20	0.85859	0.36315	0.42279	0.84180	0.36230	0.42385	0.86250	0.36963	0.41800	0.92266	0.38701	0.40651
1.22	0.84844	0.35111	0.41368	0.83281	0.35057	0.41453	0.85391	0.35780	0.40860	0.91367	0.37467	0.39720
1.24	0.83906	0.33972	0.40476	0.82344	0.33916	0.40541	0.84531	0.34640	0.39944	0.90547	0.36297	0.38813
1.26	0.82969	0.32875	0.39606	0.81562	0.32858	0.39652	0.83750	0.33561	0.39051	0.89687	0.35157	0.37929
1.28	0.82109	0.31838	0.38755	0.80781	0.31836	0.38784	0.82969	0.32520	0.38180	0.88906	0.34078	0.37068
1.30	0.81328	0.30857	0.37925	0.79980	0.30847	0.37937	0.82226	0.31526	0.37331	0.88203	0.33057	0.36230
1.32	0.80547	0.29911	0.37113	0.79297	0.29922	0.37112	0.81523	0.30577	0.36505	0.87500	0.32071	0.35415
1.34	0.79766	0.29001	0.36322	0.78594	0.29025	0.36307	0.80859	0.29670	0.35700	0.86797	0.31118	0.34621
1.36	0.79062	0.28140	0.35550	0.77969	0.28177	0.35522	0.80234	0.28805	0.34916	0.86172	0.30218	0.33850
1.38	0.78398	0.27317	0.34797	0.77344	0.27360	0.34758	0.79609	0.27969	0.34153	0.85547	0.29348	0.33099
1.40	0.77734	0.26525	0.34064	0.76719	0.26570	0.34014	0.79062	0.27180	0.33410	0.85000	0.28525	0.32369
1.42	0.77109	0.25767	0.33348	0.76172	0.25825	0.33289	0.78516	0.26417	0.32687	0.84414	0.27722	0.31659
1.44	0.76562	0.25051	0.32650	0.75625	0.25105	0.32582	0.77969	0.25681	0.31984	0.83867	0.26954	0.30969
1.46	0.76016	0.24360	0.31971	0.75078	0.24410	0.31894	0.77500	0.24985	0.31299	0.83359	0.26221	0.30298
1.48	0.75469	0.23693	0.31308	0.74609	0.23754	0.31224	0.76992	0.24305	0.30634	0.82891	0.25519	0.29646
1.50	0.74922	0.23049	0.30663	0.74141	0.23119	0.30572	0.76562	0.23664	0.29986	0.82422	0.24841	0.29012
1.52	0.74453	0.22440	0.30033	0.73672	0.22506	0.29937	0.76094	0.23036	0.29356	0.81953	0.24185	0.28395
1.54	0.73984	0.21852	0.29420	0.73242	0.21921	0.29319	0.75703	0.22443	0.28742	0.81484	0.23550	0.27796
1.56	0.73516	0.21284	0.28824	0.72812	0.21355	0.28717	0.75234	0.21855	0.28146	0.81094	0.22952	0.27213
1.58	0.73047	0.20734	0.28242	0.72422	0.20814	0.28131	0.74844	0.21301	0.27566	0.80703	0.22372	0.26646
1.60	0.72656	0.20214	0.27675	0.72031	0.20290	0.27561	0.74531	0.20779	0.27001	0.80312	0.21811	0.26095

FIGURE 22

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM RPM PROPELLERS

FOR 7 BLADES AE/AO = 0.30,0.50,0.70,0.90

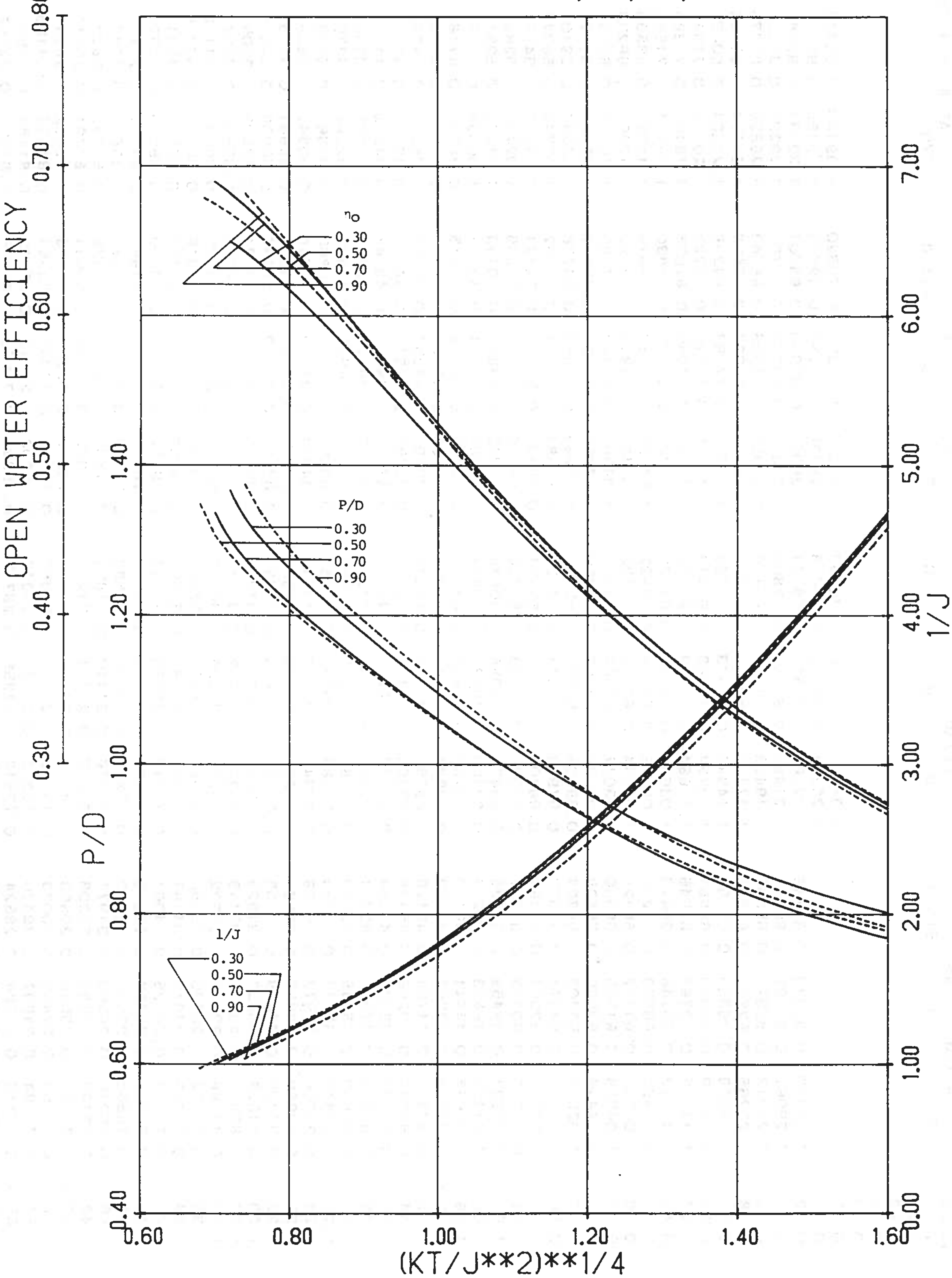


TABLE 21 WAGENINGEN B-SERIES PROPELLER DATA FOR 7 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.30 P/D	AE/AO = 0.30 J	AE/AO = 0.30 ETA-O	AE/AO = 0.50 P/D	AE/AO = 0.50 J	AE/AO = 0.50 ETA-O	AE/AO = 0.70 P/D	AE/AO = 0.70 J	AE/AO = 0.70 ETA-O	AE/AO = 0.90 P/D	AE/AO = 0.90 J	AE/AO = 0.90 ETA-O
0.60												
0.62												
0.64												
0.66												
0.68				1.34765	1.02954	0.68027						
0.70				1.30547	0.97920	0.67484	1.33593	0.99927	0.68951			
0.72	1.36640	0.97092	0.64963	1.27968	0.93929	0.66847	1.30039	0.95373	0.68192			
0.74	1.32929	0.92619	0.64258	1.25859	0.90298	0.66113	1.27461	0.91490	0.67356	1.37422	0.96374	0.68200
0.76	1.30312	0.88762	0.63483	1.24023	0.86909	0.65295	1.25312	0.87950	0.66445	1.33847	0.92038	0.67085
0.78	1.28164	0.85224	0.62639	1.22344	0.83694	0.64402	1.23398	0.84635	0.65465	1.31094	0.88246	0.65943
0.80	1.26211	0.81882	0.61737	1.20703	0.80593	0.63446	1.21601	0.81477	0.64428	1.28750	0.84770	0.64768
0.82	1.24375	0.78697	0.60783	1.19140	0.77623	0.62439	1.19902	0.78463	0.63344	1.26621	0.81509	0.63565
0.84	1.22617	0.75654	0.59789	1.17597	0.74757	0.61391	1.18242	0.75564	0.62223	1.24648	0.78423	0.62338
0.86	1.20898	0.72734	0.58762	1.16094	0.72003	0.60310	1.16679	0.72800	0.61073	1.22793	0.75491	0.61094
0.88	1.19219	0.69936	0.57710	1.14570	0.69335	0.59206	1.15078	0.70113	0.59904	1.21015	0.72688	0.59839
0.90	1.17578	0.67257	0.56641	1.13086	0.66776	0.58086	1.13554	0.67550	0.58721	1.19258	0.69990	0.58580
0.92	1.15937	0.64682	0.55562	1.11601	0.64309	0.56955	1.12012	0.65067	0.57531	1.17578	0.67416	0.57321
0.94	1.14297	0.62209	0.54476	1.10156	0.61947	0.55820	1.10508	0.62688	0.56341	1.15898	0.64931	0.56068
0.96	1.12734	0.59858	0.53389	1.08672	0.59658	0.54685	1.08984	0.60387	0.55155	1.14258	0.62550	0.54825
0.98	1.11133	0.57591	0.52306	1.07226	0.57469	0.53555	1.07500	0.58182	0.53976	1.12656	0.60266	0.53594
1.00	1.09609	0.55439	0.51229	1.05820	0.55377	0.52433	1.06054	0.56073	0.52808	1.11055	0.58065	0.52381
1.02	1.08086	0.53375	0.50162	1.04414	0.53365	0.51322	1.04609	0.54042	0.51654	1.09453	0.55943	0.51185
1.04	1.06562	0.51396	0.49108	1.03047	0.51443	0.50225	1.03164	0.52086	0.50517	1.07890	0.53912	0.50011
1.06	1.05117	0.49519	0.48067	1.01679	0.49595	0.49142	1.01758	0.50215	0.49397	1.06367	0.51968	0.48858
1.08	1.03711	0.47729	0.47041	1.00351	0.47831	0.48078	1.00390	0.48428	0.48298	1.04844	0.50095	0.47730
1.10	1.02344	0.46023	0.46033	0.99062	0.46145	0.47030	0.99062	0.46719	0.47219	1.03359	0.48302	0.46625
1.12	1.01015	0.44396	0.45044	0.97812	0.44537	0.46004	0.97734	0.45073	0.46162	1.01914	0.46587	0.45546
1.14	0.99687	0.42836	0.44072	0.96562	0.42991	0.44996	0.96484	0.43513	0.45128	1.00469	0.44935	0.44492
1.16	0.98437	0.41356	0.43120	0.95391	0.41525	0.44010	0.95234	0.42010	0.44115	0.99101	0.43365	0.43463
1.18	0.97266	0.39954	0.42187	0.94258	0.40125	0.43044	0.94023	0.40576	0.43127	0.97734	0.41854	0.42460
1.20	0.96094	0.38608	0.41275	0.93125	0.38779	0.42100	0.92851	0.39204	0.42161	0.96445	0.40419	0.41483
1.22	0.94961	0.37324	0.40383	0.92031	0.37494	0.41178	0.91719	0.37894	0.41219	0.95156	0.39036	0.40531
1.24	0.93867	0.36099	0.39511	0.91016	0.36277	0.40277	0.90625	0.36643	0.40300	0.93906	0.37714	0.39605
1.26	0.92812	0.34929	0.38659	0.90039	0.35115	0.39397	0.89609	0.35458	0.39404	0.92734	0.36459	0.38703
1.28	0.91836	0.33821	0.37827	0.89062	0.33995	0.38539	0.88594	0.34315	0.38531	0.91562	0.35250	0.37825
1.30	0.90859	0.32755	0.37016	0.88125	0.32927	0.37702	0.87578	0.33214	0.37680	0.90469	0.34103	0.36972
1.32	0.89922	0.31737	0.36223	0.87226	0.31907	0.36886	0.86641	0.32172	0.36851	0.89414	0.33007	0.36141
1.34	0.89062	0.30773	0.35450	0.86367	0.30932	0.36090	0.85742	0.31176	0.36044	0.88359	0.31949	0.35334
1.36	0.88203	0.29844	0.34696	0.85547	0.30001	0.35314	0.84844	0.30216	0.35259	0.87422	0.30957	0.34549
1.38	0.87344	0.28950	0.33962	0.84726	0.29103	0.34558	0.84062	0.29315	0.34493	0.86406	0.29982	0.33786
1.40	0.86562	0.28103	0.33246	0.83984	0.28253	0.33822	0.83203	0.28430	0.33749	0.85547	0.29075	0.33044
1.42	0.85820	0.27292	0.32547	0.83203	0.27426	0.33105	0.82461	0.27600	0.33024	0.84687	0.28200	0.32323
1.44	0.85078	0.26512	0.31866	0.82500	0.26643	0.32406	0.81719	0.26799	0.32319	0.83828	0.27355	0.31621
1.46	0.84375	0.25765	0.31203	0.81836	0.25894	0.31726	0.81016	0.26034	0.31632	0.83047	0.26555	0.30939
1.48	0.83711	0.25051	0.30557	0.81172	0.25171	0.31063	0.80312	0.25294	0.30964	0.82266	0.25782	0.30277
1.50	0.83047	0.24363	0.29928	0.80547	0.24481	0.30418	0.79687	0.24595	0.30314	0.81484	0.25037	0.29633
1.52	0.82422	0.23704	0.29315	0.79922	0.23813	0.29790	0.79062	0.23920	0.29682	0.80781	0.24330	0.29006
1.54	0.81836	0.23074	0.28718	0.79375	0.23182	0.29178	0.78437	0.23267	0.29066	0.80156	0.23663	0.28397
1.56	0.81250	0.22465	0.28136	0.78828	0.22571	0.28582	0.77851	0.22643	0.28467	0.79453	0.23004	0.27805
1.58	0.80703	0.21882	0.27569	0.78281	0.21982	0.28003	0.77266	0.22040	0.27885	0.78828	0.22380	0.27230
1.60	0.80156	0.21319	0.27017	0.77734	0.21411	0.27438	0.76758	0.21470	0.27318	0.78281	0.21791	0.26670

FIGURE 23

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS
FOR 7 BLADES AE/AO = 0.35,0.55,0.75,0.95

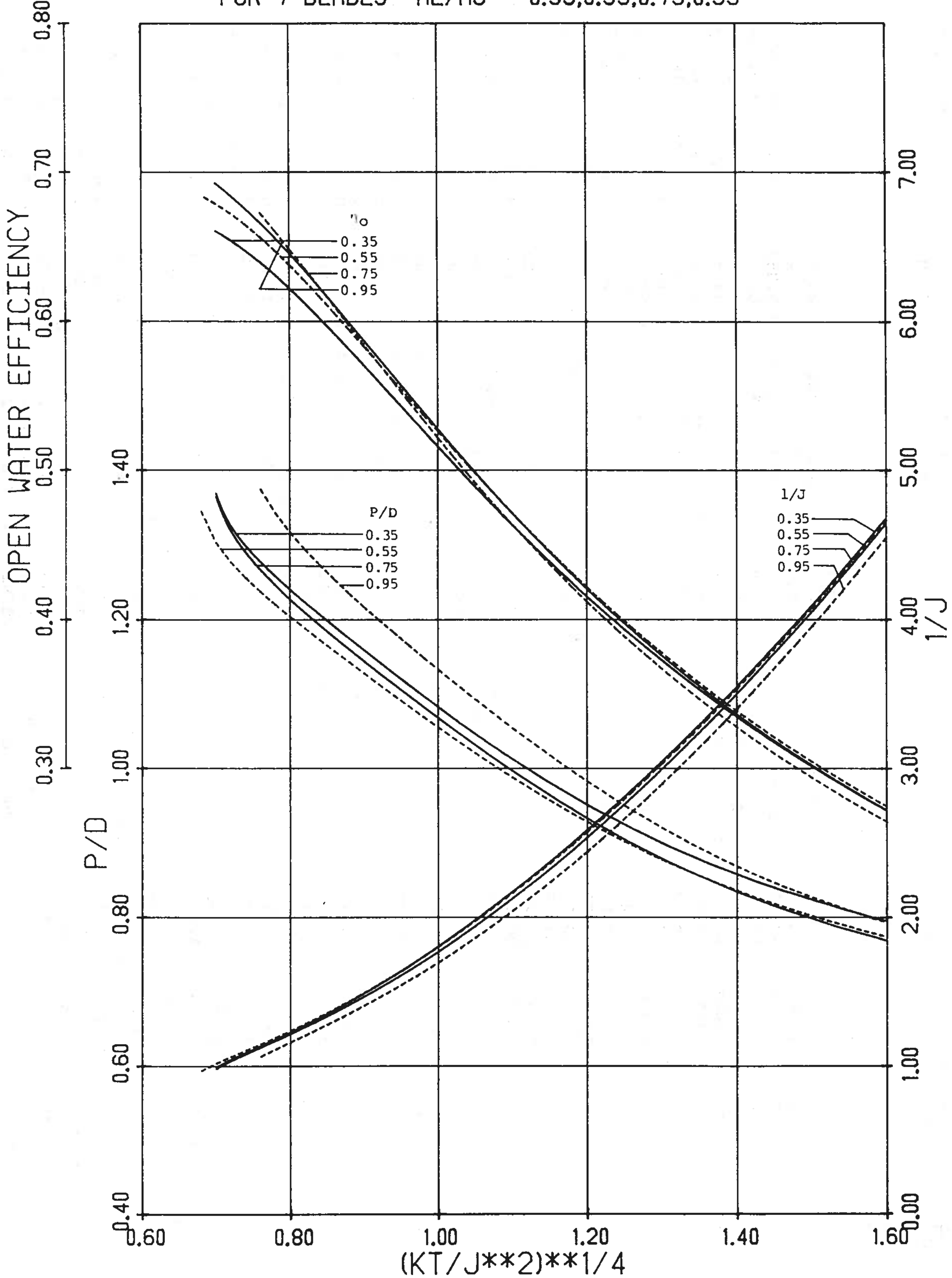


TABLE 22 WAGENINGEN B-SERIES PROPELLER DATA FOR 7 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.35			AE/AO = 0.55			AE/AO = 0.75			AE/AO = 0.95		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60												
0.62												
0.64												
0.66												
0.68				1.34531	1.02963	0.68470						
0.70	1.36875	1.00478	0.66057	1.30312	0.97921	0.67904	1.36484	1.01513	0.69266			
0.72	1.32578	0.95578	0.65440	1.27695	0.93916	0.67247	1.31953	0.96401	0.68447			
0.74	1.29883	0.91589	0.64743	1.25586	0.90295	0.66494	1.29023	0.92314	0.67569			
0.76	1.27734	0.87973	0.63966	1.23750	0.86919	0.65656	1.26679	0.88659	0.66624	1.37461	0.93616	0.67289
0.78	1.25820	0.84573	0.63117	1.22031	0.83696	0.64744	1.24629	0.85266	0.65616	1.34297	0.89607	0.66074
0.80	1.24043	0.81339	0.62207	1.20390	0.80608	0.63769	1.22734	0.82053	0.64553	1.31699	0.85993	0.64842
0.82	1.22344	0.78242	0.61244	1.18828	0.77651	0.62745	1.20976	0.79005	0.63446	1.29414	0.82641	0.63591
0.84	1.20703	0.75273	0.60240	1.17265	0.74787	0.61679	1.19258	0.76073	0.62304	1.27343	0.79496	0.62325
0.86	1.19062	0.72409	0.59203	1.15742	0.72036	0.60583	1.17617	0.73270	0.61134	1.25390	0.76504	0.61046
0.88	1.17461	0.69663	0.58142	1.14258	0.69393	0.59463	1.16015	0.70577	0.59946	1.23515	0.73645	0.59761
0.90	1.15898	0.67032	0.57063	1.12773	0.66842	0.58327	1.14414	0.67976	0.58747	1.21719	0.70915	0.58475
0.92	1.14336	0.64501	0.55972	1.11289	0.64381	0.57182	1.12851	0.65481	0.57542	1.19980	0.68303	0.57193
0.94	1.12773	0.62066	0.54876	1.09805	0.62009	0.56032	1.11328	0.63088	0.56338	1.18281	0.65796	0.55919
0.96	1.11250	0.59741	0.53779	1.08359	0.59740	0.54885	1.09805	0.60781	0.55138	1.16601	0.63385	0.54657
0.98	1.09726	0.57507	0.52686	1.06914	0.57554	0.53742	1.08281	0.58557	0.53948	1.14922	0.61059	0.53411
1.00	1.08242	0.55373	0.51598	1.05508	0.55464	0.52609	1.06797	0.56428	0.52769	1.13281	0.58832	0.52183
1.02	1.06758	0.53326	0.50521	1.04101	0.53452	0.51486	1.05312	0.54376	0.51605	1.11679	0.56697	0.50975
1.04	1.05312	0.51373	0.49457	1.02734	0.51531	0.50378	1.03867	0.52414	0.50459	1.10078	0.54640	0.49790
1.06	1.03906	0.49509	0.48406	1.01367	0.49683	0.49286	1.02422	0.50525	0.49331	1.08515	0.52668	0.48628
1.08	1.02539	0.47732	0.47371	1.00039	0.47916	0.48211	1.01015	0.48717	0.48224	1.06953	0.50770	0.47491
1.10	1.01211	0.46036	0.46354	0.98750	0.46230	0.47156	0.99648	0.46990	0.47138	1.05390	0.48942	0.46380
1.12	0.99922	0.44419	0.45354	0.97500	0.44620	0.46121	0.98320	0.45338	0.46075	1.03906	0.47202	0.45294
1.14	0.98633	0.42866	0.44374	0.96250	0.43071	0.45105	0.97031	0.43760	0.45035	1.02461	0.45538	0.44235
1.16	0.97422	0.41394	0.43412	0.95078	0.41603	0.44111	0.95742	0.42240	0.44019	1.01015	0.43934	0.43202
1.18	0.96250	0.39990	0.42471	0.93906	0.40190	0.43139	0.94531	0.40799	0.43026	0.99609	0.42400	0.42196
1.20	0.95078	0.38642	0.41550	0.92812	0.38852	0.42189	0.93281	0.39401	0.42058	0.98242	0.40931	0.41216
1.22	0.93984	0.37364	0.40650	0.91719	0.37565	0.41260	0.92148	0.38085	0.41112	0.96953	0.39538	0.40263
1.24	0.92969	0.36152	0.39770	0.90664	0.36335	0.40353	0.91016	0.36818	0.40190	0.95625	0.38184	0.39335
1.26	0.91914	0.34980	0.38911	0.89687	0.35170	0.39468	0.89922	0.35607	0.39292	0.94375	0.36899	0.38432
1.28	0.90937	0.33869	0.38071	0.88672	0.34039	0.38605	0.88906	0.34459	0.38417	0.93203	0.35680	0.37554
1.30	0.89961	0.32800	0.37252	0.87734	0.32968	0.37763	0.87891	0.33353	0.37564	0.92031	0.34504	0.36701
1.32	0.89062	0.31787	0.36453	0.86875	0.31954	0.36943	0.86953	0.32306	0.36734	0.90937	0.33389	0.35871
1.34	0.88203	0.30820	0.35673	0.86016	0.30977	0.36143	0.86016	0.31296	0.35926	0.89844	0.32314	0.35065
1.36	0.87344	0.29888	0.34913	0.85156	0.30034	0.35363	0.85156	0.30341	0.35139	0.88828	0.31294	0.34281
1.38	0.86562	0.29005	0.34172	0.84375	0.29142	0.34604	0.84297	0.29419	0.34374	0.87812	0.30310	0.33519
1.40	0.85781	0.28155	0.33450	0.83594	0.28282	0.33865	0.83437	0.28529	0.33629	0.86875	0.29378	0.32779
1.42	0.85000	0.27335	0.32746	0.82812	0.27453	0.33145	0.82656	0.27687	0.32905	0.85937	0.28478	0.32060
1.44	0.84297	0.26558	0.32060	0.82109	0.26667	0.32443	0.81875	0.26875	0.32200	0.85078	0.27626	0.31360
1.46	0.83594	0.25809	0.31391	0.81445	0.25917	0.31760	0.81172	0.26106	0.31513	0.84219	0.26803	0.30681
1.48	0.82969	0.25099	0.30740	0.80781	0.25193	0.31095	0.80469	0.25364	0.30846	0.83437	0.26024	0.30021
1.50	0.82305	0.24408	0.30106	0.80156	0.24500	0.30448	0.79805	0.24655	0.30197	0.82656	0.25272	0.29380
1.52	0.81719	0.23752	0.29488	0.79531	0.23831	0.29817	0.79141	0.23968	0.29564	0.81953	0.24559	0.28756
1.54	0.81094	0.23114	0.28887	0.78984	0.23198	0.29203	0.78516	0.23313	0.28950	0.81250	0.23871	0.28150
1.56	0.80547	0.22509	0.28300	0.78398	0.22579	0.28606	0.77969	0.22694	0.28352	0.80547	0.23206	0.27561
1.58	0.79961	0.21918	0.27729	0.77851	0.21988	0.28025	0.77422	0.22095	0.27770	0.79844	0.22562	0.26989
1.60	0.79453	0.21358	0.27173	0.77344	0.21422	0.27458	0.76836	0.21509	0.27204	0.79297	0.21968	0.26432

FIGURE 24
WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS
FOR 7 BLADES AE/AO = 0.40,0.60,0.80,1.00

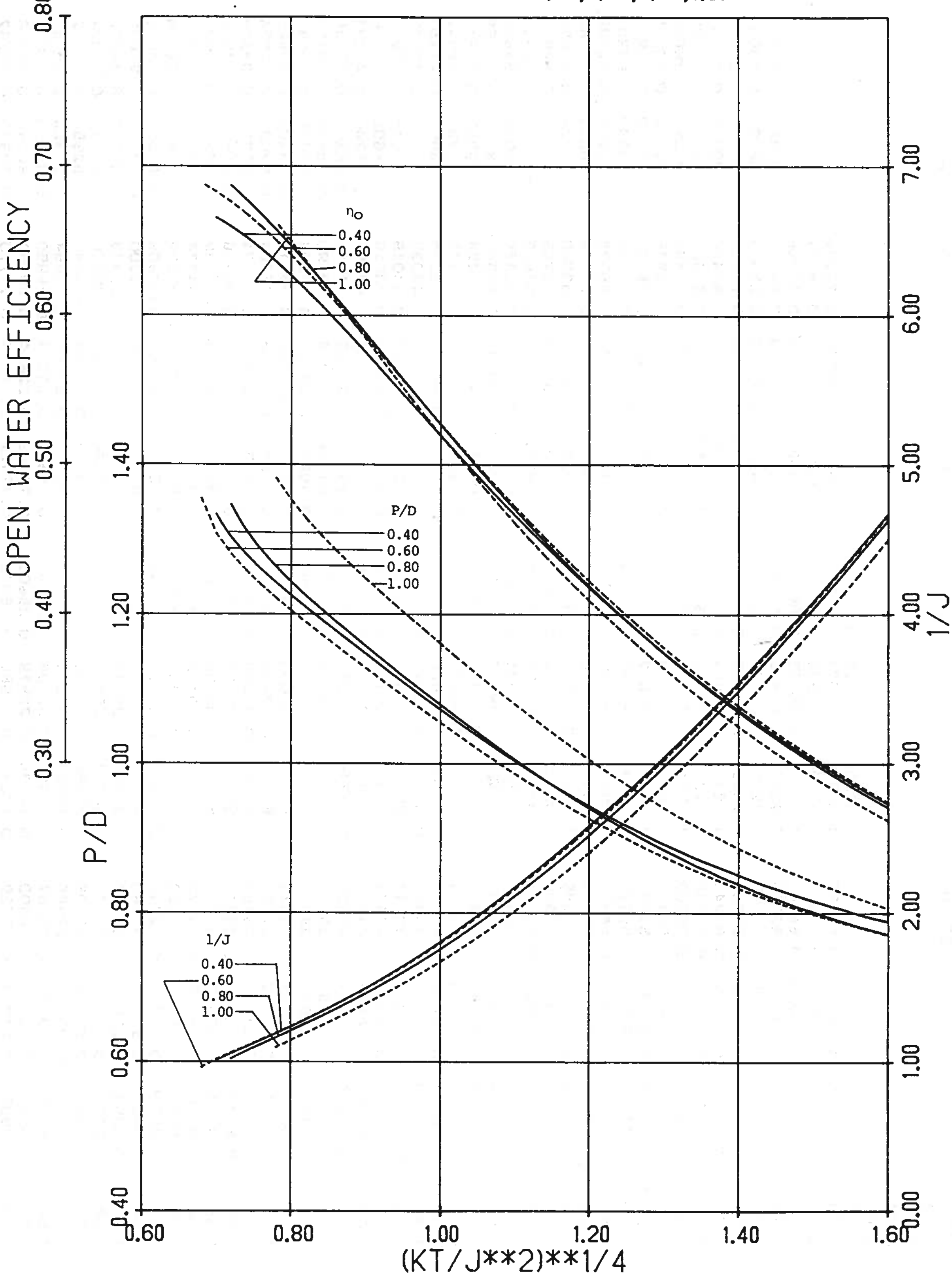


TABLE 23 WAGENINGEN B-SERIES PROPELLER DATA FOR 7 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.40 P/D	AE/AO = 0.40 J	AE/AO = 0.40 ETA-O	AE/AO = 0.60 P/D	AE/AO = 0.60 J	AE/AO = 0.60 ETA-O	AE/AO = 0.80 P/D	AE/AO = 0.80 J	AE/AO = 0.80 ETA-O	AE/AO = 1.00 P/D	AE/AO = 1.00 J	AE/AO = 1.00 ETA-O
0.60												
0.62												
0.64												
0.66												
0.68				1.35468	1.03598	0.68884						
0.70	1.33320	0.98994	0.66544	1.30742	0.98252	0.68285						
0.72	1.30234	0.94707	0.65931	1.27968	0.94157	0.67601	1.34609	0.97776	0.68699			
0.74	1.27929	0.90935	0.65229	1.25781	0.90500	0.66826	1.31172	0.93398	0.67766			
0.76	1.25937	0.87424	0.64441	1.23867	0.87088	0.65966	1.28535	0.89576	0.66778			
0.78	1.24179	0.84126	0.63581	1.22109	0.83855	0.65034	1.26308	0.86080	0.65735	1.38144	0.91166	0.66266
0.80	1.22480	0.80954	0.62657	1.20429	0.80754	0.64041	1.24297	0.82798	0.64642	1.35234	0.87391	0.64960
0.82	1.20859	0.77920	0.61682	1.18828	0.77787	0.62998	1.22422	0.79685	0.63509	1.32754	0.83933	0.63649
0.84	1.19258	0.74991	0.60664	1.17265	0.74931	0.61915	1.20664	0.76723	0.62342	1.30547	0.80707	0.62331
0.86	1.17695	0.72180	0.59615	1.15742	0.72185	0.60800	1.18945	0.73878	0.61151	1.28476	0.77648	0.61010
0.88	1.16172	0.69483	0.58540	1.14219	0.69531	0.59664	1.17304	0.71160	0.59944	1.26543	0.74747	0.59688
0.90	1.14648	0.66885	0.57449	1.12734	0.66985	0.58513	1.15664	0.68534	0.58727	1.24687	0.71977	0.58371
0.92	1.13125	0.64381	0.56345	1.11250	0.64527	0.57353	1.14062	0.66014	0.57506	1.22890	0.69325	0.57060
0.94	1.11601	0.61973	0.55237	1.09766	0.62158	0.56191	1.12461	0.63584	0.56287	1.21133	0.66780	0.55762
0.96	1.10117	0.59670	0.54129	1.08281	0.59875	0.55030	1.10898	0.61254	0.55073	1.19414	0.64338	0.54478
0.98	1.08633	0.57457	0.53024	1.06836	0.57690	0.53875	1.09375	0.59022	0.53871	1.17734	0.61997	0.53213
1.00	1.07187	0.55343	0.51926	1.05429	0.55600	0.52729	1.07851	0.56870	0.52681	1.16054	0.59740	0.51968
1.02	1.05742	0.53312	0.50837	1.04023	0.53589	0.51596	1.06328	0.54797	0.51507	1.14375	0.57564	0.50746
1.04	1.04336	0.51373	0.49762	1.02617	0.51654	0.50478	1.04844	0.52814	0.50351	1.12734	0.55480	0.49548
1.06	1.02969	0.49523	0.48701	1.01250	0.49803	0.49376	1.03398	0.50917	0.49217	1.11133	0.53482	0.48375
1.08	1.01601	0.47745	0.47655	0.99922	0.48036	0.48293	1.01953	0.49088	0.48102	1.09531	0.51557	0.47228
1.10	1.00312	0.46061	0.46628	0.98633	0.46348	0.47229	1.00547	0.47341	0.47010	1.07969	0.49714	0.46108
1.12	0.99023	0.44443	0.45619	0.97344	0.44723	0.46185	0.99180	0.45670	0.45942	1.06445	0.47950	0.45016
1.14	0.97773	0.42899	0.44629	0.96133	0.43182	0.45163	0.97812	0.44060	0.44896	1.04922	0.46250	0.43951
1.16	0.96562	0.41427	0.43660	0.94922	0.41700	0.44162	0.96523	0.42533	0.43876	1.03437	0.44622	0.42913
1.18	0.95430	0.40030	0.42710	0.93750	0.40286	0.43184	0.95234	0.41063	0.42880	1.01992	0.43064	0.41903
1.20	0.94297	0.38689	0.41780	0.92617	0.38933	0.42228	0.94023	0.39668	0.41908	1.00547	0.41562	0.40921
1.22	0.93203	0.37408	0.40872	0.91523	0.37643	0.41294	0.92812	0.38324	0.40960	0.99180	0.40135	0.39965
1.24	0.92148	0.36186	0.39985	0.90469	0.36410	0.40383	0.91680	0.37050	0.40036	0.97851	0.38769	0.39035
1.26	0.91172	0.35029	0.39118	0.89453	0.35232	0.39493	0.90547	0.35822	0.39136	0.96562	0.37463	0.38132
1.28	0.90156	0.33906	0.38271	0.88476	0.34108	0.38626	0.89492	0.34659	0.38260	0.95312	0.36213	0.37253
1.30	0.89219	0.32843	0.37446	0.87539	0.33033	0.37780	0.88476	0.33547	0.37407	0.94062	0.35007	0.36400
1.32	0.88359	0.31835	0.36640	0.86641	0.32007	0.36956	0.87500	0.32485	0.36576	0.92891	0.33862	0.35571
1.34	0.87461	0.30858	0.35855	0.85781	0.31027	0.36153	0.86484	0.31451	0.35768	0.91797	0.32776	0.34766
1.36	0.86641	0.29931	0.35089	0.84922	0.30082	0.35371	0.85625	0.30491	0.34981	0.90703	0.31728	0.33983
1.38	0.85859	0.29045	0.34342	0.84101	0.29180	0.34609	0.84687	0.29546	0.34216	0.89687	0.30735	0.33223
1.40	0.85078	0.28193	0.33614	0.83320	0.28317	0.33867	0.83906	0.28669	0.33471	0.88672	0.29776	0.32485
1.42	0.84297	0.27371	0.32905	0.82578	0.27493	0.33144	0.83047	0.27805	0.32747	0.87734	0.28867	0.31768
1.44	0.83594	0.26591	0.32214	0.81875	0.26705	0.32441	0.82266	0.26988	0.32042	0.86797	0.27989	0.31071
1.46	0.82930	0.25847	0.31541	0.81172	0.25945	0.31756	0.81562	0.26216	0.31357	0.85859	0.27142	0.30395
1.48	0.82266	0.25128	0.30885	0.80508	0.25218	0.31089	0.80781	0.25454	0.30691	0.85078	0.26355	0.29737
1.50	0.81641	0.24440	0.30247	0.79844	0.24517	0.30440	0.80156	0.24749	0.30043	0.84219	0.25579	0.29099
1.52	0.81016	0.23777	0.29625	0.79258	0.23853	0.29809	0.79453	0.24051	0.29412	0.83437	0.24844	0.28478
1.54	0.80469	0.23148	0.29019	0.78672	0.23212	0.29194	0.78828	0.23394	0.28799	0.82734	0.24149	0.27875
1.56	0.79844	0.22529	0.28429	0.78125	0.22598	0.28595	0.78203	0.22756	0.28202	0.82031	0.23477	0.27289
1.58	0.79297	0.21943	0.27855	0.77578	0.22005	0.28012	0.77656	0.22155	0.27622	0.81328	0.22827	0.26720
1.60	0.78828	0.21387	0.27295	0.77031	0.21431	0.27445	0.77109	0.21573	0.27057	0.80625	0.22197	0.26166

FIGURE 25

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM RPM PROPELLERS
FOR 7 BLADES AE/AO = 0.45,0.65,0.85,1.05

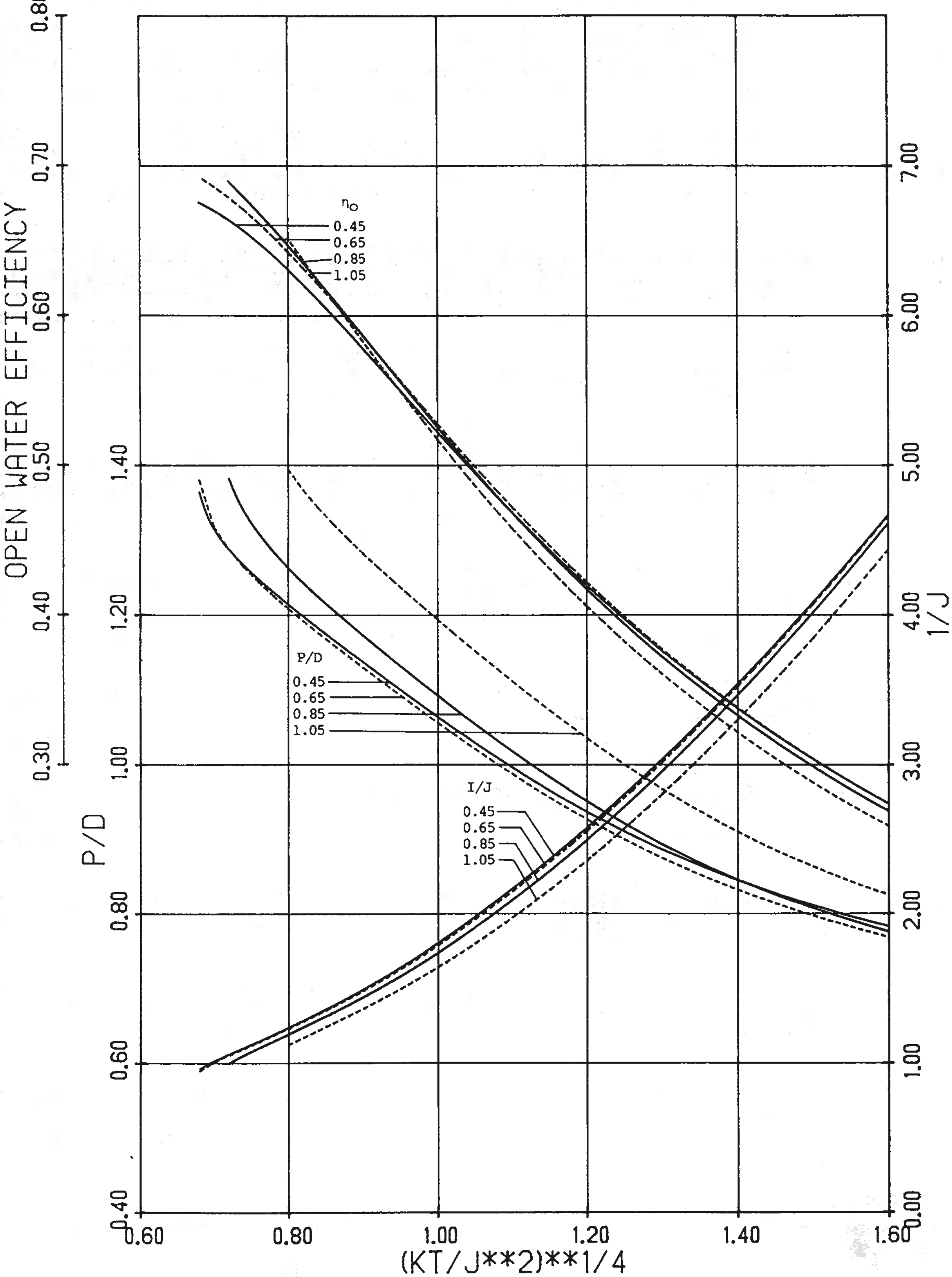


TABLE 24 WAGENINGEN B-SERIES PROPELLER DATA FOR 7 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_T}{J^2}\right)^{1/4}$	AE/AO = 0.45			AE/AO = 0.65			AE/AO = 0.85			AE/AO = 1.05		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.60												
0.62												
0.64												
0.66												
0.68	1.36406	1.03664	0.67559	1.38046	1.05134	0.69280						
0.70	1.31484	0.98254	0.67027	1.31797	0.98899	0.68631						
0.72	1.28750	0.94167	0.66406	1.28750	0.94645	0.67915	1.38242	0.99597	0.68976			
0.74	1.26640	0.90519	0.65690	1.26386	0.90889	0.67112	1.33906	0.94726	0.67966			
0.76	1.24765	0.87090	0.64888	1.24375	0.87425	0.66228	1.30898	0.90696	0.66924			
0.78	1.23047	0.83835	0.64012	1.22539	0.84154	0.65274	1.28437	0.87065	0.65837			
0.80	1.21406	0.80715	0.63073	1.20820	0.81037	0.64260	1.26289	0.83702	0.64708	1.39433	0.88963	0.65155
0.82	1.19804	0.77711	0.62083	1.19179	0.78054	0.63197	1.24297	0.80520	0.63543	1.36699	0.85376	0.63767
0.84	1.18242	0.74822	0.61051	1.17597	0.75191	0.62095	1.22441	0.77502	0.62349	1.34316	0.82055	0.62386
0.86	1.16718	0.72044	0.59986	1.16054	0.72439	0.60963	1.20664	0.74619	0.61134	1.32148	0.78937	0.61011
0.88	1.15195	0.69364	0.58897	1.14492	0.69770	0.59811	1.18945	0.71855	0.59904	1.30136	0.75985	0.59644
0.90	1.13711	0.66794	0.57792	1.12969	0.67209	0.58644	1.17265	0.69203	0.58668	1.28203	0.73165	0.58286
0.92	1.12226	0.64317	0.56675	1.11484	0.64752	0.57469	1.15625	0.66657	0.57429	1.26367	0.70480	0.56942
0.94	1.10742	0.61933	0.55554	1.09980	0.62375	0.56293	1.13984	0.64200	0.56194	1.24570	0.67903	0.55614
0.96	1.09258	0.59639	0.54432	1.08515	0.60100	0.55120	1.12383	0.61846	0.54967	1.22812	0.65430	0.54304
0.98	1.07812	0.57445	0.53315	1.07031	0.57899	0.53952	1.10781	0.59575	0.53751	1.21094	0.63058	0.53015
1.00	1.06367	0.55336	0.52205	1.05586	0.55793	0.52795	1.09258	0.57413	0.52549	1.19375	0.60771	0.51750
1.02	1.04961	0.53321	0.51106	1.04179	0.53780	0.51652	1.07695	0.55317	0.51366	1.17695	0.58579	0.50511
1.04	1.03594	0.51396	0.50018	1.02773	0.51842	0.50524	1.06172	0.53310	0.50201	1.16054	0.56477	0.49296
1.06	1.02226	0.49548	0.48947	1.01406	0.49988	0.49413	1.04687	0.51390	0.49057	1.14414	0.54452	0.48110
1.08	1.00898	0.47783	0.47892	1.00039	0.48206	0.48322	1.03203	0.49540	0.47935	1.12773	0.52501	0.46952
1.10	0.99609	0.46099	0.46854	0.98750	0.46512	0.47249	1.01758	0.47771	0.46837	1.11172	0.50631	0.45821
1.12	0.98320	0.44480	0.45836	0.97422	0.44873	0.46199	1.00351	0.46078	0.45763	1.09570	0.48829	0.44721
1.14	0.97109	0.42946	0.44837	0.96172	0.43318	0.45170	0.98984	0.44460	0.44714	1.08008	0.47103	0.43648
1.16	0.95898	0.41471	0.43859	0.94961	0.41832	0.44164	0.97656	0.42913	0.43690	1.06484	0.45450	0.42605
1.18	0.94766	0.40073	0.42901	0.93789	0.40413	0.43180	0.96328	0.41422	0.42690	1.05000	0.43868	0.41590
1.20	0.93633	0.38730	0.41964	0.92656	0.39056	0.42218	0.95078	0.40007	0.41715	1.03515	0.42342	0.40603
1.22	0.92578	0.37457	0.41049	0.91562	0.37761	0.41280	0.93828	0.38644	0.40765	1.02070	0.40881	0.39644
1.24	0.91523	0.36232	0.40154	0.90469	0.36515	0.40365	0.92656	0.37352	0.39840	1.00664	0.39482	0.38712
1.26	0.90508	0.35063	0.39281	0.89453	0.35333	0.39471	0.91484	0.36106	0.38938	0.99297	0.38143	0.37808
1.28	0.89531	0.33946	0.38427	0.88437	0.34196	0.38601	0.90391	0.34926	0.38061	0.98008	0.36870	0.36929
1.30	0.88594	0.32881	0.37596	0.87500	0.33118	0.37752	0.89297	0.33787	0.37208	0.96719	0.35643	0.36075
1.32	0.87734	0.31871	0.36785	0.86562	0.32079	0.36926	0.88281	0.32709	0.36377	0.95469	0.34467	0.35246
1.34	0.86875	0.30898	0.35993	0.85664	0.31087	0.36120	0.87266	0.31669	0.35569	0.94297	0.33351	0.34442
1.36	0.86016	0.29962	0.35222	0.84805	0.30139	0.35335	0.86328	0.30684	0.34784	0.93164	0.32283	0.33660
1.38	0.85234	0.29075	0.34471	0.83984	0.29233	0.34571	0.85430	0.29742	0.34019	0.92031	0.31252	0.32902
1.40	0.84453	0.28219	0.33738	0.83203	0.28368	0.33828	0.84531	0.28833	0.33275	0.91016	0.30283	0.32166
1.42	0.83750	0.27409	0.33025	0.82422	0.27534	0.33104	0.83750	0.27982	0.32552	0.89961	0.29338	0.31451
1.44	0.83047	0.26628	0.32330	0.81719	0.26743	0.32399	0.82891	0.27142	0.31849	0.88984	0.28442	0.30757
1.46	0.82344	0.25874	0.31653	0.81016	0.25981	0.31713	0.82109	0.26349	0.31165	0.88047	0.27585	0.30083
1.48	0.81680	0.25153	0.30993	0.80312	0.25244	0.31045	0.81406	0.25598	0.30501	0.87187	0.26772	0.29428
1.50	0.81055	0.24464	0.30351	0.79687	0.24548	0.30396	0.80703	0.24873	0.29854	0.86328	0.25988	0.28793
1.52	0.80469	0.23805	0.29725	0.79062	0.23875	0.29763	0.80039	0.24180	0.29226	0.85469	0.25228	0.28175
1.54	0.79844	0.23162	0.29117	0.78516	0.23238	0.29148	0.79375	0.23509	0.28614	0.84687	0.24510	0.27575
1.56	0.79297	0.22553	0.28523	0.77891	0.22610	0.28549	0.78750	0.22869	0.28019	0.83906	0.23815	0.26993
1.58	0.78750	0.21965	0.27945	0.77344	0.22015	0.27965	0.78125	0.22249	0.27441	0.83203	0.23157	0.26427
1.60	0.78242	0.21402	0.27383	0.76797	0.21440	0.27398	0.77539	0.21657	0.26879	0.82500	0.22521	0.25878

III. MACHINE-PROPELLER SYSTEM OPTIMIZATION

If data about the machine rather than the hull are available, the optimal revolution propeller can be found by optimization of the machine-propeller system. The general methodology is similar to the one used in the previous section and therefore only brief explanations will be given.

III.1. Example

Consider the ship in the example of section II.1. In this case the same information is available about the hull and the propeller with the exception of R_T given by equation (II-10). Instead the horse power delivered by the propeller behind the hull is given by equation (III-1):

$$DHP = 3832 \qquad \text{(III-1)}$$

In section IV where the relations between the hull-propeller and the machine-propeller optimal systems are derived, the reason for selecting the above value of DHP is explained.

Our objective is to find again the maximum efficiency propeller. Since

$$K_Q = \frac{Q}{\rho^2 n D^5} = \frac{DHP\ \eta_R}{\rho n^3 D^5 2\pi} \qquad \text{(III-2)}$$

and

$$J = \frac{V_A}{nD} = \frac{V(1-w)}{nD} \qquad \text{(III-3)}$$

we can get

$$\frac{K_Q}{J^3} = \frac{DHP\ \eta_R}{V^3(1-w)^3 \rho 2\pi D^2} = .0641 \qquad \text{(III-4)}$$

Equation (III-4) is plotted in Figure 26. For each value of P/D , that is for each one of the ten propellers for which K_T , K_Q and η_o are plotted in Figure 26, the propeller operating point is found at the intersection of equation (III-4) and the K_Q versus J curve. The propeller efficiency is then found and the η_o curve is plotted revealing a maximum efficiency propeller at:

$$J = 0.88 \qquad (III-5)$$

and

$$\frac{P}{D} = 1.20 \qquad (III-6)$$

yielding

$$\eta_o = 0.69 \qquad (III-7)$$

Obviously the optimal propeller and its operating point are the same as those of the example in section II.1. since the DHP given by equation (II-1) is compatible with the EHP and η_o given in section I.1. (see section IV). This operating point is one point in Figure 42 for K_Q/J^3 given by equation (III-4) and blade area ratio of 0.65.

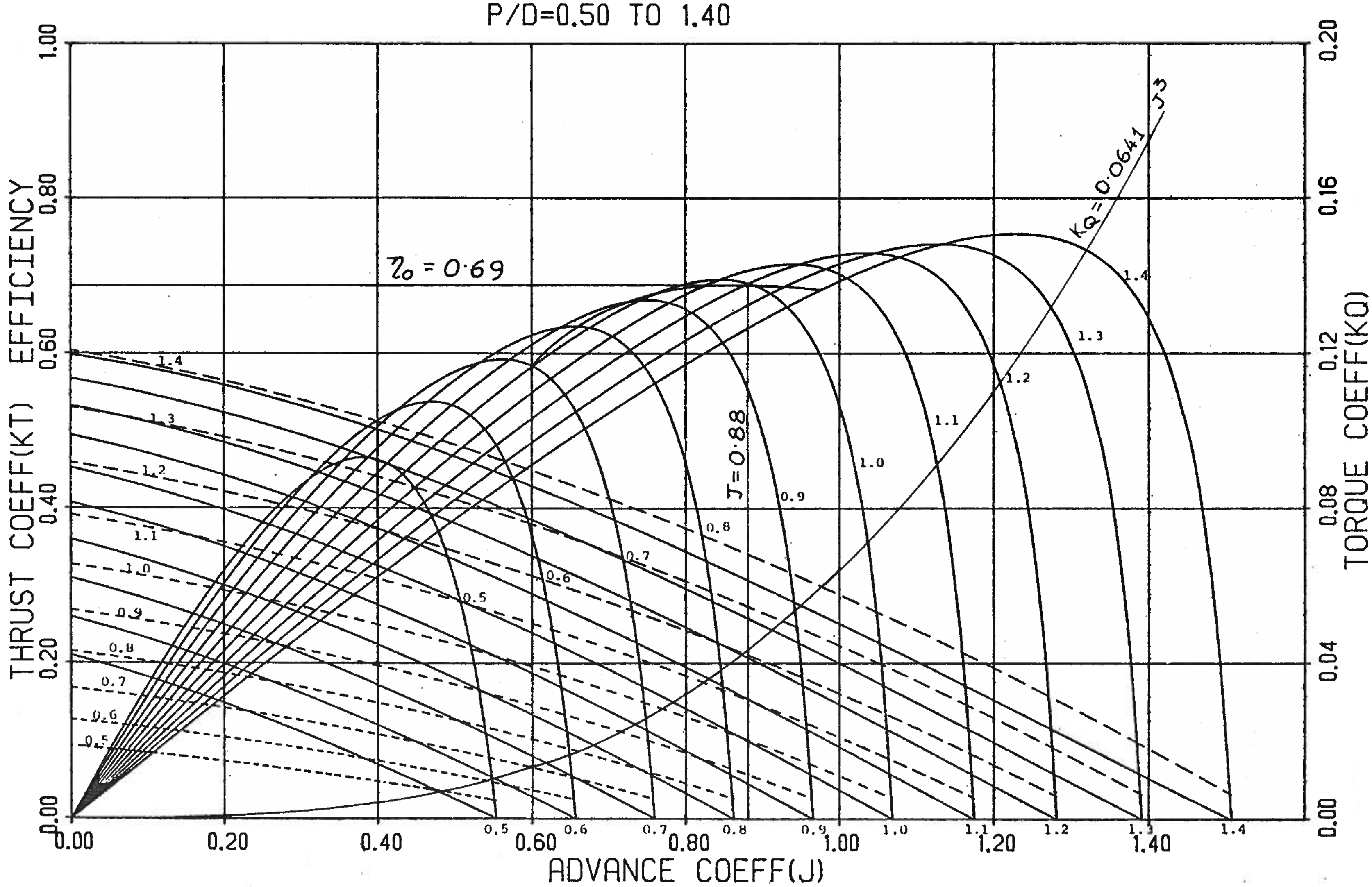
In the following sections, the problem solved in the above example is formulated in a general mathematical form which can be solved with a digital computer. The results are presented in Figures 27 through 50 for the entire range of values of K_Q/J^3 that are of practical importance, the range of validity of the B-Series and for $Re = 2 \times 10^6$.

III.2. Problem Formulation

The problem described and solved in the previous example can be put in the following general mathematical form:

FIGURE 26. EXAMPLE OF OPTIMAL REVOLUTION PROPELLER: MACHINE-PROPELLER SYSTEM

WAGENINGEN B-SERIES PROPELLERS
FOR 5 BLADES AE/AO= 0.650
P/D=0.50 TO 1.40



Problem P1

$$\text{maximize} \quad \eta_o = \eta_o\left(J,\ \frac{P}{D},\ \frac{A_E}{A_o},\ Z,\ Re,\ \frac{t}{c}\right) \qquad \text{(III-8)}$$

$$= \frac{JK_T}{2\pi K_Q}$$

subject to:

R_1: $Z = m$

R_2: $\frac{A_E}{A_o} = \alpha$

R_3: $D = \delta$

R_4: $DHP = 2\pi n Q_B = q$

R_5: $V = v$

R_6: $w = \overline{w}$

R_7: $\eta_R = \overline{\eta}_R$

where m, α, δ, q, v, $\overline{w}$, $\overline{\eta}_R$ are known constants.

R_8: $J = \frac{V_A}{nD}$

R_9: $V_A = V(1-w)$

R_{10}: $K_T = \frac{T}{\rho n^2 D^4}$

R_{11}: $K_Q = \frac{Q}{\rho n^2 D^5}$

R_{12}: $Q = \eta_R Q_B$

R_{13}: $K_T = K_T\left(J,\ \frac{P}{D},\ \frac{A_E}{A_o},\ Z,\ Re,\ \frac{t}{c}\right)$ given by the B-Series

R_{14}: $K_Q = K_Q\left(J,\ \frac{P}{D},\ \frac{A_E}{A_o},\ Z,\ Re,\ \frac{t}{c}\right)$ given by the B-Series

R_{15};R_{16}: $2 \leq Z \leq 7$

$$R_{17};R_{18}: \quad 0.30 < \frac{A_E}{A_O} < 1.05$$

$$R_{19};R_{20}: \quad 0.50 < \frac{P}{D} < 1.40$$

This problem corresponds to the nonlinear programming problem P1 of section II.2. where machine-propeller relations have been used instead of hull-propeller relations. Note that in this case relations between R_T , T and EHP are not required. Once problem P1 is solved these quantities can be computed using equations (I-8), (I-9) and (I-10).

The design variables in P1 are 18, namely, Z , J , P/D , n , D , A_E/A_O , Re , t/c , DHP , Q , V , w , η_R , V_A , K_T , K_Q , Q_B and T .

Problem P1 is reduced and solved in the following section.

III.3. General Solution

Using the approach of section II.3. we can reduce problem P1 as follows:

a. Eliminate Z using constraint R_1.

b. Eliminate the blade area ratio A_E/A_O using R_2.

c. Eliminate variable D using R_3.

d. Eliminate DHP using R_4.

e. Eliminate V using R_5.

f. Define w using available data in [4].

g. Define η_R using available data in [4].

h. Compute V_A using constraint R_9.

i. R_{12} can be used to express Q in terms of Q_B and η_R which can be eliminated from the problem using R_4, R_5 and R_7.

j. Equality constraint R_{10} can be used to express T in terms of K_T, n and D.

k. R_{11} can be used to express Q in terms of K_Q, n and D.

The resulting problem P2 has J, P/D, n, Re, t/c, K_T and K_Q as design variables.

Problem P2

$$\text{maximize} \quad \eta_o = \frac{JK_T}{2\pi K_Q} \tag{III-9}$$

subject to:

equality constraints R_8, R_{13} and R_{14}

and inequality constraints R_{19} and R_{20}.

Of the 7 design variables in P2 only 4 are independent due to the three equality constraints R_8, R_{13} and R_{14}.

Finally we use the standard B-Series values for t/c as argued in section II.3. and choose J, P/D and Re as the independent variables of the problem making n, K_T and K_Q dependent. These can be defined by equations R_8, R_{12} and R_{13} respectively.

Thus the problem is further reduced to P3.

Problem P3

$$\text{maximize} \quad \eta_o = \frac{JK_T}{2\pi K_Q}$$

subject to:

C_1: $K_T = K_T\left(J\ ,\ \frac{P}{D}\ ,\ Re\right)$ given by the B-Series

C_2: $K_Q = K_Q\left(J\ ,\ \frac{P}{D}\ ,\ Re\right)$ given by the B-Series

$$C_3:\quad \frac{K_Q}{J^3} = \frac{DHP\ \eta_R}{\rho V^3(1-w)^3 2\pi D^2} = \frac{q\ \overline{\eta_R}}{\rho v^3(1\overline{-}w)^3 2\pi\delta^2} = C_Q \qquad \text{(III-11)}$$

derived from constraints R_8 and R_{10} using R_3, R_4, R_5, R_6, R_7, R_9 and R_{12} and where C_Q is a constant.

$C_4;C_5$: $0.50 \leq \frac{P}{D} \leq 1.40$

Problem P3 can be solved using the method of Lagrange multipliers and rejecting any optimum which violates inequality constraints C_4 and C_5. Thus P3 can be recasted as P4.

Problem P4

$$\text{maximize}\quad F\left(J\ ,\ \frac{P}{D}\ ,\ Re\ ,\ \lambda\right) = \frac{J\ K_T(J,P/D,Re)}{2\pi K_Q(J,P/D,Re)} + \lambda\ \left(K_Q(J,P/D,Re) - C_Q J^3\right) \qquad \text{(III-12)}$$

subject to:

$$0.50 \leq \frac{P}{D} \leq 1.40 \qquad \text{(III-13)}$$

where λ is a Lagrange multiplier.

The stationary points of F are the zeroes of the following set of simultaneous equations:

$$\frac{\partial F}{\partial J} = \frac{1}{2\pi}\frac{K_T}{K_Q} + \frac{J}{2\pi}\ \frac{\frac{\partial K_T}{\partial J} K_Q - K_T \frac{\partial K_Q}{\partial J}}{K_Q{}^2} + \lambda\left(\frac{\partial K_Q}{\partial J} - 3C_Q J^2\right) = 0 \qquad \text{(III-14)}$$

$$\frac{\partial F}{\partial (P/D)} = \frac{J}{2\pi} \frac{\frac{\partial K_T}{\partial (P/D)} K_Q - K_T \frac{\partial K_Q}{\partial (P/D)}}{K_Q{}^2} + \lambda \frac{\partial K_Q}{\partial (P/D)} = 0 \qquad \text{(III-15)}$$

$$\frac{\partial F}{\partial (Re)} = \frac{J}{2\pi} \frac{\frac{\partial K_T}{\partial Re} K_Q - K_T \frac{\partial K_Q}{\partial Re}}{K_Q{}^2} + \lambda \frac{\partial K_Q}{\partial Re} = 0 \qquad \text{(III-16)}$$

$$\frac{\partial F}{\partial \lambda} = K_Q - C_Q J^3 = 0 \qquad \text{(III-17)}$$

Eliminating λ from equations (III-14) and (III-15), and (III-15) and (III-16) we get:

$$\frac{\partial K_T}{\partial (P/D)} \left\{ J \frac{\partial K_Q}{\partial J} - 3K_Q \right\} + \frac{\partial K_Q}{\partial (P/D)} \left\{ 2K_T - J \frac{\partial K_T}{\partial J} \right\} = 0 \qquad \text{(III-18)}$$

$$\frac{\partial K_Q}{\partial (P/D)} \frac{\partial K_T}{\partial Re} = \frac{\partial K_Q}{\partial Re} \frac{\partial K_T}{\partial (P/D)} \qquad \text{(III-19)}$$

and

$$K_Q = C_Q J^3 \qquad \text{(III-20)}$$

The solution to equations (III-18) to (III-20) yields one stationary point which gives the maximum efficiency propeller and its operating conditions and satisfies constraints R_1 to R_{18}. The results for $Re = 2 \times 10^6$ are presented in the next section.

III.4. Optimal Revolution Propellers for $Re = 2 \times 10^6$

As was explained in section II.4. the effect of Reynolds number on the optimal revolution propellers is small. In this section the result of the problem solved in section III.3. that is the optimization of the machine-propeller system, are plotted in Figures 27 to 50 for

$$.01 \leq C_Q \leq 2.85 \qquad \text{(III-21)}$$

$Re = 2 \times 10^6$ and the ranges specified by constraints R_{15} to R_{20}; that is for all the propellers whose K_T, K_Q and η_o curves are plotted in reference [2].

The results are also tabulated in Tables 25 to 48. For low values of C_Q and near the extremes of the ranges of Z and A_E/A_o no results are given. This is so because there is no solution to equation (III-18) for P/D in the range specified by inequality (III-13). The optimum is constraint bound at

$$\frac{P}{D} = 1.40 \qquad \text{(III-22)}$$

and the problem becomes trivial.

FIGURE 27

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM PROPELLER RPM

FOR 2 BLADES AE/AO = 0.30, 0.50, 0.70, 0.90

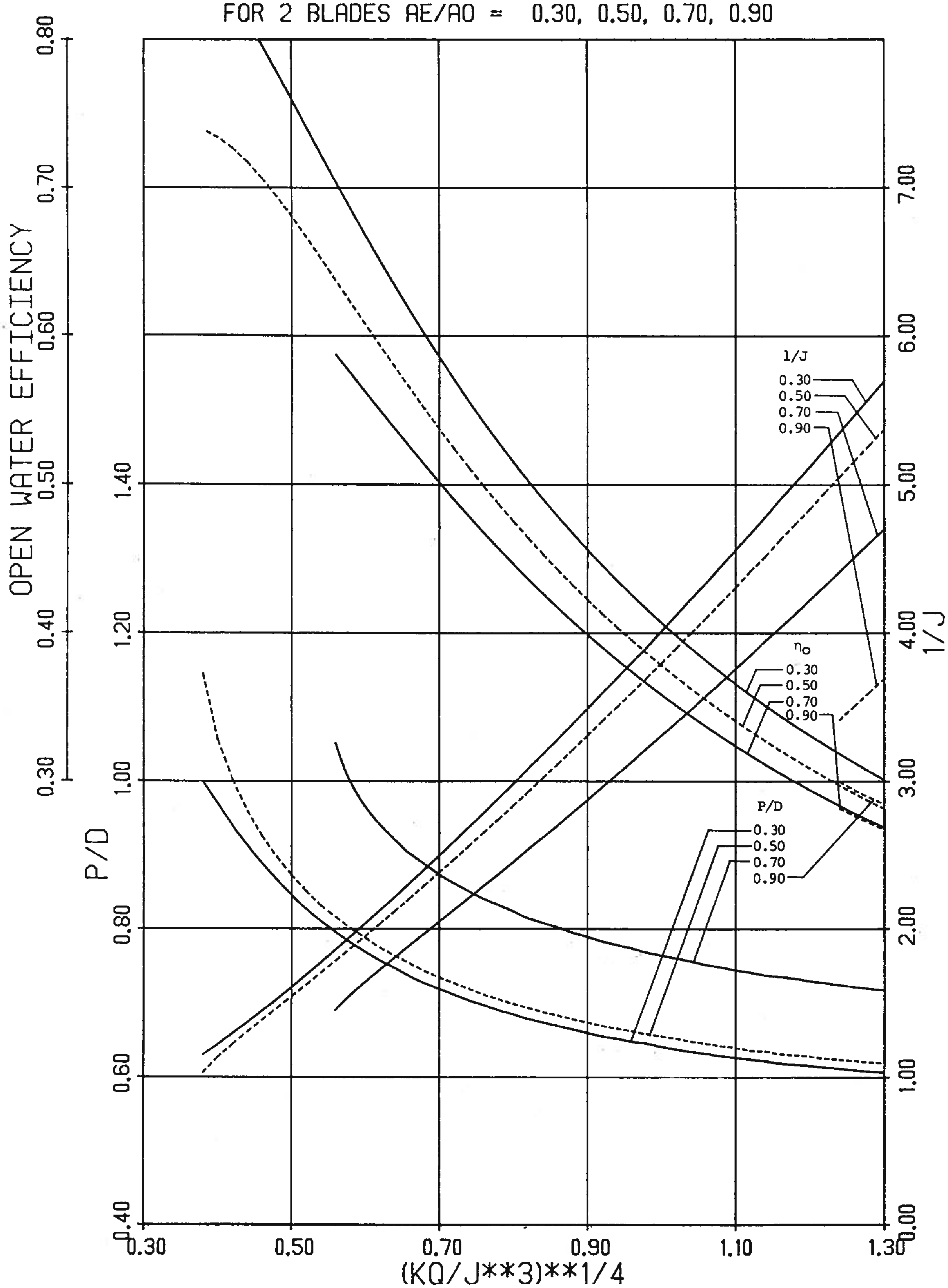


TABLE 25 WAGENINGEN B-SERIES PROPELLER DATA FOR 2 BLADE OPTIMUM RPM PROPELLERS

$(K_Q/J^3)^{1/4}$	AE/AO = 0.30 P/D	AE/AO = 0.30 J	AE/AO = 0.30 ETA-O	AE/AO = 0.50 P/D	AE/AO = 0.50 J	AE/AO = 0.50 ETA-O	AE/AO = 0.70 P/D	AE/AO = 0.70 J	AE/AO = 0.70 ETA-O	AE/AO = 0.90 P/D	AE/AO = 0.90 J	AE/AO = 0.90 ETA-O
0.30	1.12031	1.08398	0.86087									
0.32	1.09375	1.03105	0.87106									
0.34	1.06250	0.97578	0.87202									
0.36	1.03008	0.92129	0.86670									
0.38	0.99844	0.86933	0.85705	1.14375	0.97031	0.73903						
0.40	0.96875	0.82070	0.84438	1.05469	0.88203	0.73393						
0.42	0.93906	0.77422	0.82957	1.00078	0.81992	0.72668						
0.44	0.91250	0.73164	0.81322	0.95898	0.76797	0.71730						
0.46	0.88828	0.69238	0.79581	0.92500	0.72314	0.70625						
0.48	0.86641	0.65644	0.77782	0.89687	0.68379	0.69388						
0.50	0.84531	0.62265	0.75937	0.87266	0.64844	0.68053						
0.52	0.82656	0.59180	0.74078	0.85078	0.61601	0.66649						
0.54	0.81016	0.56377	0.72231	0.83125	0.58633	0.65198						
0.56	0.79531	0.53789	0.70394	0.81562	0.56015	0.63734	1.05078	0.69009	0.58694			
0.58	0.78125	0.51367	0.68579	0.80078	0.53555	0.62255	0.99844	0.64385	0.57444			
0.60	0.76875	0.49141	0.66799	0.78750	0.51279	0.60775	0.96562	0.60898	0.56197			
0.62	0.75703	0.47060	0.65055	0.77422	0.49111	0.59308	0.94062	0.57939	0.54957			
0.64	0.74687	0.45156	0.63362	0.76328	0.47158	0.57869	0.92031	0.55332	0.53727			
0.66	0.73594	0.43310	0.61704	0.75312	0.45332	0.56458	0.90156	0.52910	0.52508			
0.68	0.72656	0.41621	0.60099	0.74297	0.43584	0.55070	0.88750	0.50810	0.51315			
0.70	0.71875	0.40078	0.58550	0.73437	0.41982	0.53718	0.87344	0.48799	0.50138			
0.72	0.71094	0.38613	0.57052	0.72656	0.40488	0.52405	0.86172	0.46973	0.48985			
0.74	0 70312	0.37207	0.55586	0.71875	0.39062	0.51129	0.85078	0.45264	0.47862			
0.76	0.69687	0.35928	0.54180	0.71094	0.37695	0.49884	0.84062	0.43652	0.46760			
0.78	0.68984	0.34687	0.52825	0.70469	0.36455	0.48688	0.83203	0.42178	0.45695			
0.80	0.68437	0.33555	0.51519	0.69844	0.35264	0.47523	0.82344	0.40762	0.44654			
0.82	0.67812	0.32441	0.50244	0.69297	0.34150	0.46395	0.81406	0.39375	0.43640			
0.84	0.67344	0.31436	0.49031	0.68750	0.33086	0.45305	0.80781	0.38164	0.42663			
0.86	0.66875	0.30469	0.47851	0.68281	0.32100	0.44260	0.80156	0.37002	0.41715			
0.88	0.66406	0.29551	0.46722	0.67773	0.31133	0.43238	0.79453	0.35854	0.40788			
0.90	0.65937	0.28662	0.45616	0.67344	0.30234	0.42256	0.78906	0.34810	0.39896			
0.92	0.65469	0.27822	0.44565	0.66875	0.29355	0.41299	0.78281	0.33779	0.39029			
0.94	0.65156	0.27051	0.43541	0.66523	0.28555	0.40385	0.77812	0.32842	0.38192			
0.96	0.64766	0.26299	0.42563	0.66172	0.27783	0.39499	0.77344	0.31938	0.37380			
0.98	0.64531	0.25615	0.41619	0.65781	0.27031	0.38642	0.76797	0.31045	0.36591			
1.00	0.64101	0.24907	0.40698	0.65469	0.26328	0.37812	0.76406	0.30234	0.35831			
1.02	0.63750	0.24248	0.39812	0.65156	0.25649	0.37006	0.76016	0.29453	0.35094			
1.04	0.63437	0.23623	0.38955	0.64805	0.24990	0.36232	0.75625	0.28701	0.34381			
1.06	0.63203	0.23047	0.38140	0.64531	0.24375	0.35483	0.75156	0.27954	0.33688			
1.08	0.62891	0.22466	0.37336	0.64219	0.23770	0.34753	0.74844	0.27275	0.33016			
1.10	0.62656	0.21924	0.36560	0.63984	0.23208	0.34052	0.74453	0.26602	0.32367			
1.12	0.62422	0.21406	0.35817	0.63594	0.22627	0.33369	0.74141	0.25972	0.31738			
1.14	0.62187	0.20908	0.35099	0.63476	0.22139	0.32721	0.73750	0.25342	0.31125			
1.16	0.61875	0.20410	0.34399	0.63125	0.21602	0.32074	0.73516	0.24775	0.30535			
1.18	0.61719	0.19961	0.33725	0.62969	0.21133	0.31458	0.73281	0.24228	0.29964			
1.20	0.61562	0.19531	0.33078	0.62812	0.20684	0.30866	0.72939	0.23672	0.29406			
1.22	0.61328	0.19097	0.32443	0.62500	0.20210	0.30282	0.72695	0.23159	0.28868			
1.24	0.61172	0.18691	0.31828	0.62363	0.19795	0.29726	0.72412	0.22651	0.28343	0.99922	0.29292	0.28158
1.26	0.60937	0.18291	0.31240	0.62187	0.19380	0.29178	0.72148	0.22163	0.27832	0.98789	0.28503	0.27656
1.28	0.60781	0.17910	0.30658	0.62031	0.18984	0.28650	0.71914	0.21702	0.27341	0.97812	0.27771	0.27168
1.30	0.60625	0.17549	0.30106	0.61875	0.18603	0.28141	0.71719	0.21260	0.26860	0.96875	0.27070	0.26694

FIGURE 28

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM PROPELLER RPM
FOR 2 BLADES AE/AO = 0.35, 0.55, 0.75, 0.95

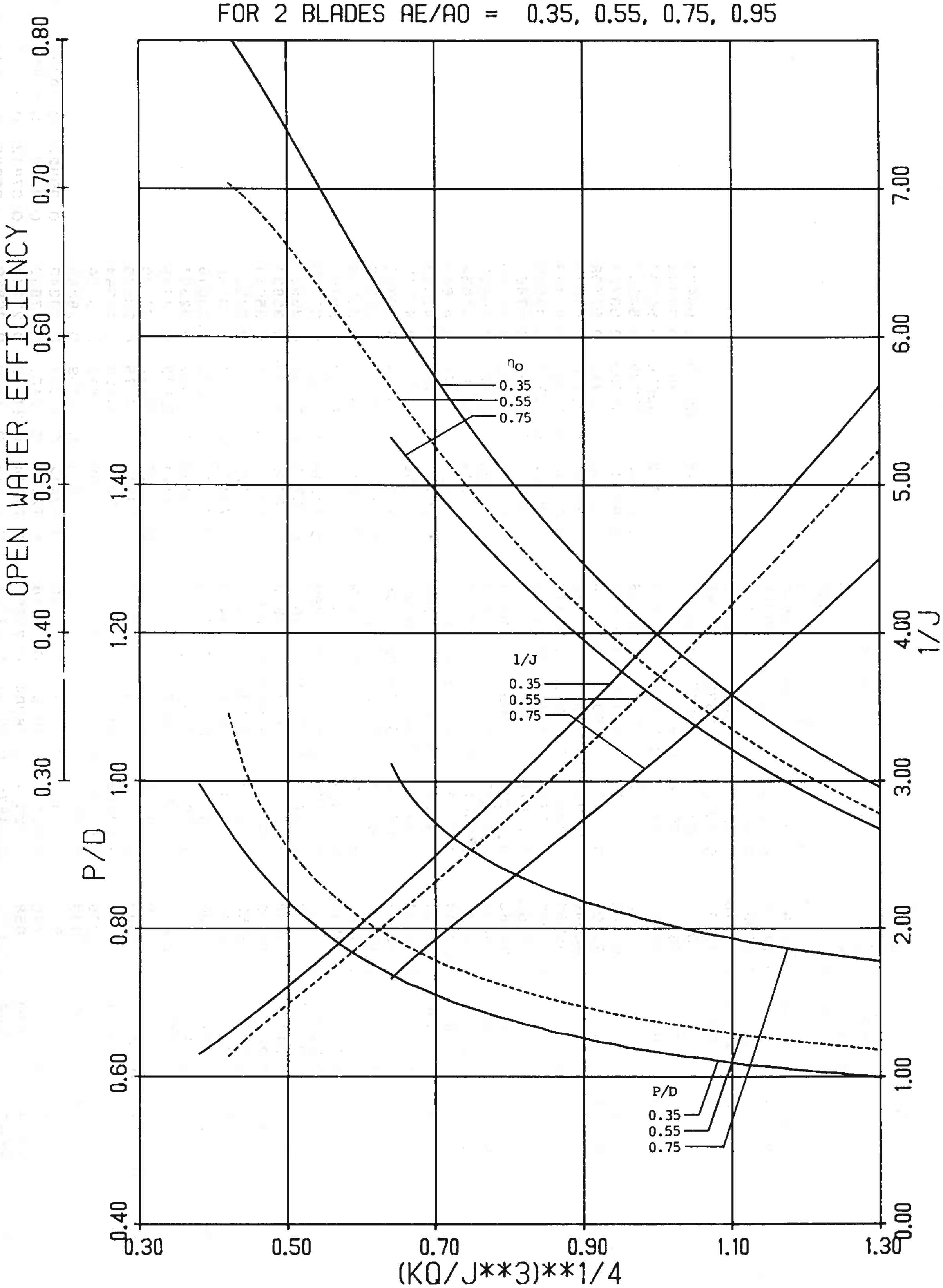


TABLE 26 WAGENINGEN B-SERIES PROPELLER DATA FOR 2 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.35 P/D	AE/AO = 0.35 J	AE/AO = 0.35 ETA-O	AE/AO = 0.55 P/D	AE/AO = 0.55 J	AE/AO = 0.55 ETA-O	AE/AO = 0.75 P/D	AE/AO = 0.75 J	AE/AO = 0.75 ETA-O	AE/AO = 0.95 P/D	AE/AO = 0.95 J	AE/AO = 0.95 ETA-O
0.30												
0.32												
0.34												
0.36												
0.38	0.99531	0.86777	0.82781									
0.40	0.96406	0.81894	0.81719									
0.42	0.93281	0.77207	0.80418	1.09062	0.87861	0.70375						
0.44	0.90469	0.72910	0.78942	1.01875	0.80693	0.69525						
0.46	0.87969	0.69004	0.77352	0.97187	0.75342	0.68538						
0.48	0.85703	0.65410	0.75677	0.93750	0.70967	0.67424						
0.50	0.83594	0.62070	0.73946	0.90781	0.67060	0.66209						
0.52	0.81719	0.59023	0.72191	0.88437	0.63681	0.64918						
0.54	0.80156	0.56289	0.70434	0.86250	0.60537	0.63570						
0.56	0.78594	0.53691	0.68681	0.84531	0.57793	0.62198						
0.58	0.77187	0.51289	0.66937	0.82812	0.55166	0.60800						
0.60	0.75937	0.49082	0.65225	0.81250	0.52744	0.59403						
0.62	0.74844	0.47060	0.63554	0.79971	0.50566	0.58011						
0.64	0.73750	0.45137	0.61917	0.78750	0.48516	0.56633	1.02344	0.60190	0.53205			
0.66	0.72656	0.43301	0.60311	0.77656	0.46621	0.55281	0.98750	0.56914	0.51994			
0.68	0.71875	0.41689	0.58766	0.76641	0.44844	0.53952	0.96250	0.54243	0.50806			
0.70	0.71016	0.40127	0.57266	0.75625	0.43144	0.52648	0.94219	0.51890	0.49645			
0.72	0.70156	0.38633	0.55802	0.74766	0.41592	0.51383	0.92500	0.49766	0.48508			
0.74	0.69453	0.37266	0.54386	0.74141	0.40205	0.50157	0.91094	0.47861	0.47400			
0.76	0.68828	0.35996	0.53025	0.73281	0.38779	0.48953	0.89844	0.46103	0.46323			
0.78	0.68125	0.34756	0.51703	0.72656	0.37510	0.47791	0.88652	0.44438	0.45269			
0.80	0.67617	0.33643	0.50437	0.72031	0.36299	0.46669	0.87656	0.42920	0.44246			
0.82	0.67031	0.32549	0.49204	0.71406	0.35137	0.45577	0.86719	0.41484	0.43251			
0.84	0.66562	0.31543	0.48020	0.70820	0.34033	0.44515	0.85840	0.40132	0.42287			
0.86	0.65937	0.30527	0.46864	0.70312	0.33008	0.43494	0.85000	0.38848	0.41350			
0.88	0.65625	0.29658	0.45767	0.69805	0.32021	0.42502	0.84375	0.37690	0.40445			
0.90	0.65156	0.28779	0.44704	0.69375	0.31103	0.41546	0.83594	0.36523	0.39562			
0.92	0.64687	0.27930	0.43665	0.68906	0.30205	0.40615	0.83047	0.35483	0.38712			
0.94	0.64375	0.27168	0.42680	0.68437	0.29346	0.39718	0.82383	0.34443	0.37883			
0.96	0.63906	0.26387	0.41713	0.68047	0.28545	0.38853	0.81875	0.33496	0.37086			
0.98	0.63594	0.25684	0.40789	0.67656	0.27773	0.38013	0.81250	0.32544	0.36306			
1.00	0.63281	0.25010	0.39900	0.67344	0.27061	0.37211	0.80820	0.31689	0.35557			
1.02	0.62969	0.24355	0.39030	0.67031	0.26367	0.36425	0.80312	0.30845	0.34830			
1.04	0.62656	0.23730	0.38196	0.66719	0.25703	0.35669	0.79844	0.30039	0.34123			
1.06	0.62500	0.23174	0.37403	0.66328	0.25039	0.34932	0.79375	0.29263	0.33438			
1.08	0.62148	0.22583	0.36619	0.66094	0.24443	0.34225	0.79023	0.28550	0.32778			
1.10	0.61875	0.22031	0.35861	0.65781	0.23848	0.33537	0.78672	0.27861	0.32138			
1.12	0.61562	0.21494	0.35131	0.65469	0.23271	0.32869	0.78203	0.27163	0.31513			
1.14	0.61406	0.21016	0.34436	0.65312	0.22759	0.32230	0.77891	0.26533	0.30912			
1.16	0.61250	0.20547	0.33752	0.65039	0.22231	0.31604	0.77578	0.25923	0.30328			
1.18	0.60977	0.20073	0.33093	0.64805	0.21733	0.31000	0.77187	0.25312	0.29759			
1.20	0.60781	0.19629	0.32451	0.64560	0.21250	0.30416	0.76904	0.24751	0.29210			
1.22	0.60586	0.19204	0.31836	0.64375	0.20796	0.29849	0.76641	0.24211	0.28676			
1.24	0.60469	0.18809	0.31241	0.64141	0.20347	0.29300	0.76328	0.23677	0.28156			
1.26	0.60234	0.18398	0.30653	0.63984	0.19927	0.28765	0.76055	0.23171	0.27655			
1.28	0.60078	0.18022	0.30095	0.63740	0.19502	0.28246	0.75781	0.22681	0.27167			
1.30	0.59844	0.17642	0.29547	0.63594	0.19111	0.27743	0.75527	0.22209	0.26692			

FIGURE 29

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM PROPELLER RPM

FOR 2 BLADES AE/AO = 0.40, 0.60, 0.80, 1.00

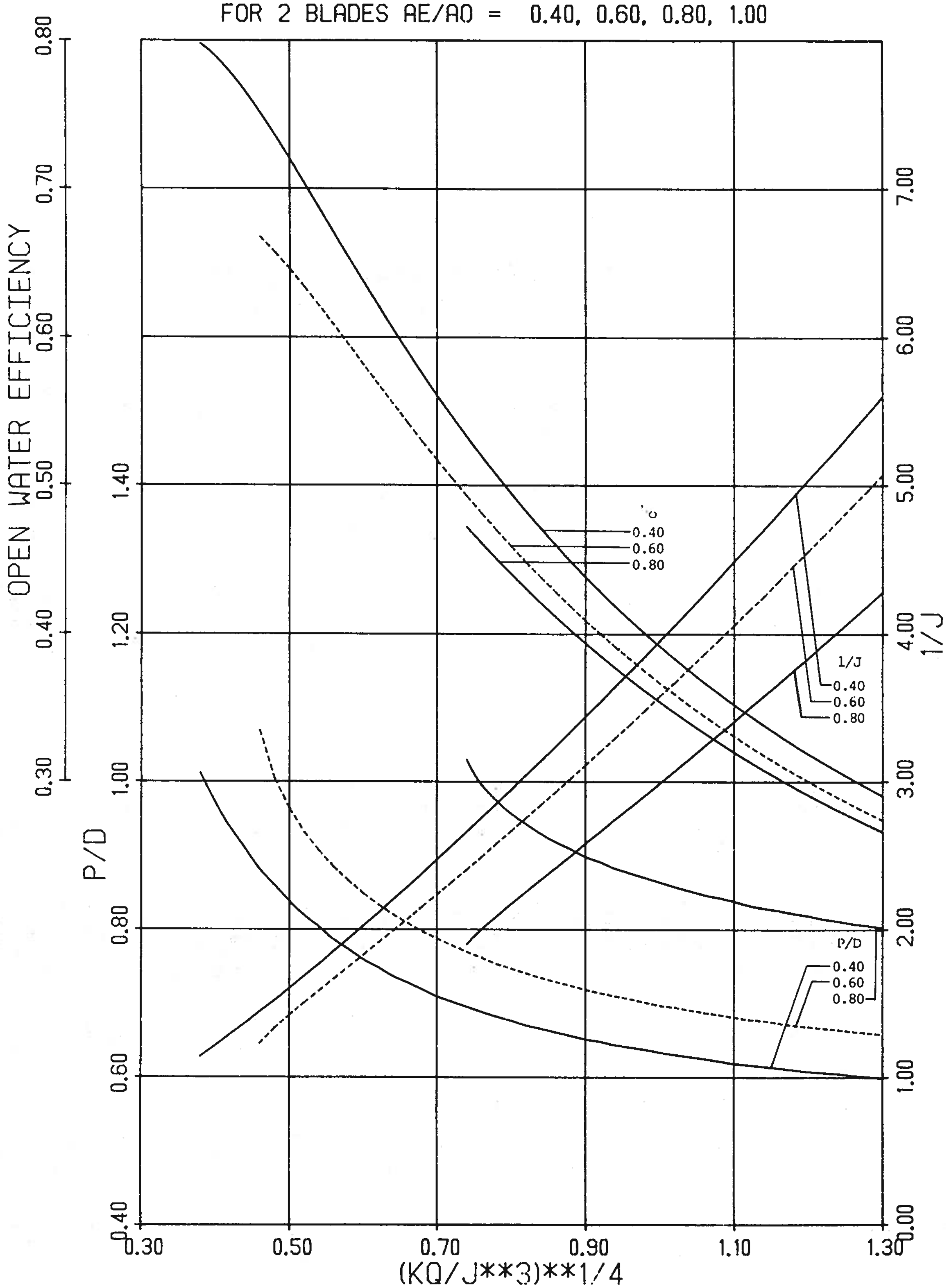


TABLE 27 WAGENINGEN B-SERIES PROPELLER DATA FOR 2 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.40			AE/AO = 0.60			AE/AO = 0.80			AE/AO = 1.00		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.30												
0.32												
0.34												
0.36												
0.38	1.01094	0.87890	0.79761									
0.40	0.97187	0.82500	0.78921									
0.42	0.93750	0.77637	0.77823									
0.44	0.90937	0.73379	0.76537									
0.46	0.88125	0.69297	0.75098	1.06875	0.81328	0.66749						
0.48	0.85937	0.65781	0.73574	1.00312	0.75010	0.65687						
0.50	0.83750	0.62412	0.71967	0.96328	0.70430	0.64552						
0.52	0.81875	0.59375	0.70322	0.93125	0.66494	0.63348						
0.54	0.80312	0.56660	0.68671	0.90625	0.63115	0.62089						
0.56	0.78594	0.53984	0.66999	0.88437	0.60058	0.60795						
0.58	0.77266	0.51631	0.65342	0.86562	0.57295	0.59473						
0.60	0.75937	0.49394	0.63705	0.84844	0.54736	0.58143						
0.62	0.74844	0.47383	0.62108	0.83359	0.52412	0.56817						
0.64	0.73672	0.45420	0.60524	0.82031	0.50273	0.55508						
0.66	0.72812	0.43691	0.58990	0.80830	0.48281	0.54207						
0.68	0.71875	0.42012	0.57491	0.79687	0.46406	0.52929						
0.70	0.70937	0.40410	0.56031	0.78750	0.44707	0.51681						
0.72	0.70234	0.38984	0.54629	0.77812	0.43086	0.50463						
0.74	0.69531	0.37617	0.53261	0.76953	0.41562	0.49270	1.02969	0.52671	0.47183			
0.76	0.68828	0.36309	0.51929	0.76172	0.40137	0.48109	0.99531	0.49980	0.46097			
0.78	0.68203	0.35098	0.50656	0.75312	0.38740	0.46975	0.97402	0.47886	0.45046			
0.80	0.67656	0.33965	0.49421	0.74687	0.37500	0.45887	0.95625	0.46006	0.44027			
0.82	0.67031	0.32852	0.48220	0.74062	0.36309	0.44826	0.94219	0.44336	0.43038			
0.84	0.66562	0.31846	0.47072	0.73437	0.35166	0.43797	0.92910	0.42769	0.42078			
0.86	0.66094	0.30879	0.45958	0.72930	0.34111	0.42800	0.91797	0.41333	0.41148			
0.88	0.65625	0.29951	0.44878	0.72422	0.33105	0.41841	0.90859	0.40015	0.40247			
0.90	0.65156	0.29062	0.43836	0.71875	0.32119	0.40902	0.89844	0.38721	0.39371			
0.92	0.64844	0.28262	0.42838	0.71406	0.31201	0.39999	0.89141	0.37583	0.38528			
0.94	0.64375	0.27441	0.41862	0.70976	0.30332	0.39125	0.88281	0.36436	0.37705			
0.96	0.64062	0.26709	0.40937	0.70625	0.29521	0.38281	0.87656	0.35410	0.36914			
0.98	0.63750	0.25996	0.40030	0.70156	0.28706	0.37462	0.87031	0.34419	0.36143			
1.00	0.63359	0.25293	0.39156	0.69687	0.27920	0.36666	0.86406	0.33467	0.35398			
1.02	0.63047	0.24639	0.38315	0.69453	0.27236	0.35907	0.85781	0.32549	0.34674			
1.04	0.62773	0.24019	0.37501	0.69062	0.26528	0.35162	0.85234	0.31689	0.33976			
1.06	0.62500	0.23423	0.36715	0.68750	0.25869	0.34443	0.84687	0.30859	0.33298			
1.08	0.62187	0.22842	0.35958	0.68437	0.25234	0.33748	0.84297	0.30103	0.32642			
1.10	0.61875	0.22275	0.35216	0.68125	0.24624	0.33077	0.83828	0.29351	0.32005			
1.12	0.61680	0.21763	0.34508	0.67812	0.24033	0.32424	0.83281	0.28603	0.31385			
1.14	0.61484	0.21270	0.33825	0.67656	0.23506	0.31798	0.82891	0.27925	0.30788			
1.16	0.61250	0.20781	0.33158	0.67344	0.22954	0.31184	0.82578	0.27290	0.30210			
1.18	0.61016	0.20308	0.32508	0.67031	0.22422	0.30590	0.82197	0.26655	0.29645			
1.20	0.60781	0.19853	0.31883	0.66836	0.21938	0.30020	0.81875	0.26060	0.29100			
1.22	0.60625	0.19434	0.31283	0.66631	0.21465	0.29461	0.81445	0.25454	0.28567			
1.24	0.60469	0.19023	0.30695	0.66406	0.21006	0.28924	0.81133	0.24900	0.28055			
1.26	0.60234	0.18613	0.30127	0.66172	0.20557	0.28398	0.80781	0.24353	0.27555			
1.28	0.60078	0.18232	0.29578	0.65996	0.20137	0.27892	0.80527	0.23845	0.27070			
1.30	0.59844	0.17847	0.29040	0.65781	0.19717	0.27393	0.80234	0.23345	0.26599			

FIGURE 30

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM PROPELLER RPM

FOR 2 BLADES AE/AO = 0.45, 0.65, 0.85, 1.05

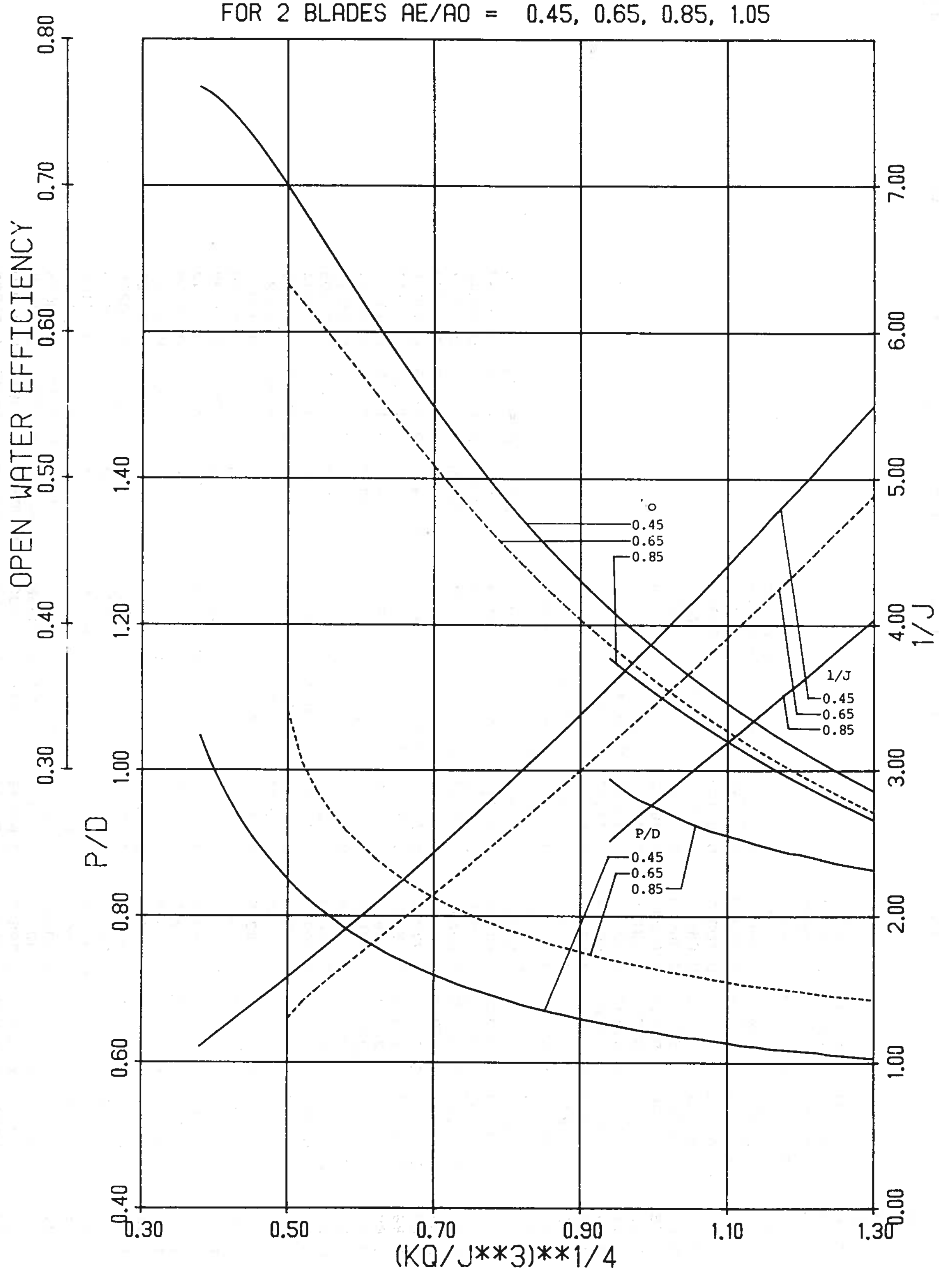


TABLE 28 WAGENINGEN B-SERIES PROPELLER DATA FOR 2 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.45			AE/AO = 0.65			AE/AO = 0.85			AE/AO = 1.05		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.30												
0.32												
0.34												
0.36												
0.38	1.04687	0.90410	0.76723									
0.40	0.99844	0.84355	0.76100									
0.42	0.95937	0.79180	0.75212									
0.44	0.92500	0.74512	0.74109									
0.46	0.89687	0.70430	0.72846									
0.48	0.87266	0.66758	0.71462									
0.50	0.85000	0.63340	0.69992	1.08125	0.77207	0.63231						
0.52	0.82969	0.60215	0.68469	1.00937	0.70976	0.62040						
0.54	0.81250	0.57402	0.66915	0.97031	0.66748	0.60828						
0.56	0.79687	0.54805	0.65348	0.94062	0.63193	0.59585						
0.58	0.78125	0.52324	0.63774	0.91562	0.60039	0.58323						
0.60	0.76875	0.50117	0.62218	0.89687	0.57344	0.57057						
0.62	0.75703	0.48047	0.60678	0.87812	0.54766	0.55784						
0.64	0.74570	0.46103	0.59175	0.86250	0.52451	0.54519						
0.66	0.73672	0.44346	0.57698	0.84844	0.50312	0.53268						
0.68	0.72734	0.42656	0.56258	0.83594	0.48340	0.52036						
0.70	0.71875	0.41074	0.54851	0.82500	0.46523	0.50827						
0.72	0.71094	0.39600	0.53489	0.81484	0.44824	0.49648						
0.74	0.70312	0.38193	0.52167	0.80625	0.43262	0.48497						
0.76	0.69687	0.36914	0.50893	0.79609	0.41699	0.47366						
0.78	0.69062	0.35684	0.49649	0.78906	0.40332	0.46275						
0.80	0.68437	0.34512	0.48449	0.78086	0.38975	0.45208						
0.82	0.67812	0.33389	0.47285	0.77500	0.37764	0.44178						
0.84	0.67305	0.32353	0.46162	0.76797	0.36558	0.43173						
0.86	0.66836	0.31377	0.45079	0.76094	0.35400	0.42197						
0.88	0.66406	0.30459	0.44039	0.75586	0.34365	0.41262						
0.90	0.65937	0.29561	0.43025	0.75078	0.33364	0.40348						
0.92	0.65547	0.28721	0.42044	0.74531	0.32393	0.39465						
0.94	0.65156	0.27920	0.41103	0.74062	0.31484	0.38610	0.98750	0.39766	0.37699			
0.96	0.64766	0.27148	0.40190	0.73633	0.30625	0.37785	0.97187	0.38391	0.36900			
0.98	0.64375	0.26406	0.39306	0.73203	0.29795	0.36981	0.95898	0.37148	0.36129			
1.00	0.64141	0.25742	0.38463	0.72812	0.29014	0.36210	0.95000	0.36064	0.35384			
1.02	0.63750	0.25059	0.37641	0.72344	0.28232	0.35455	0.94062	0.35010	0.34662			
1.04	0.63437	0.24419	0.36844	0.72031	0.27529	0.34731	0.93125	0.33992	0.33960			
1.06	0.63281	0.23848	0.36082	0.71719	0.26851	0.34028	0.92305	0.33042	0.33281			
1.08	0.62969	0.23252	0.35334	0.71328	0.26172	0.33342	0.91562	0.32148	0.32624			
1.10	0.62695	0.22690	0.34615	0.71016	0.25542	0.32684	0.91016	0.31338	0.31989			
1.12	0.62344	0.22129	0.33915	0.70625	0.24912	0.32042	0.90469	0.30557	0.31375			
1.14	0.62187	0.21641	0.33252	0.70391	0.24346	0.31424	0.89844	0.29780	0.30776			
1.16	0.61875	0.21123	0.32591	0.70156	0.23799	0.30825	0.89297	0.29050	0.30196			
1.18	0.61719	0.20664	0.31963	0.69922	0.23271	0.30246	0.88750	0.28345	0.29633			
1.20	0.61562	0.20225	0.31359	0.69687	0.22759	0.29680	0.88437	0.27720	0.29089			
1.22	0.61406	0.19795	0.30767	0.69375	0.22246	0.29132	0.87969	0.27078	0.28560			
1.24	0.61094	0.19346	0.30190	0.69062	0.21748	0.28598	0.87461	0.26448	0.28045			
1.26	0.60937	0.18945	0.29634	0.68906	0.21304	0.28083	0.87031	0.25854	0.27545			
1.28	0.60742	0.18550	0.29095	0.68750	0.20874	0.27585	0.86680	0.25300	0.27063			
1.30	0.60625	0.18184	0.28574	0.68516	0.20439	0.27098	0.86328	0.24761	0.26592			

FIGURE 31

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM PROPELLER RPM

FOR 3 BLADES AE/AO = 0.30, 0.50, 0.70, 0.90

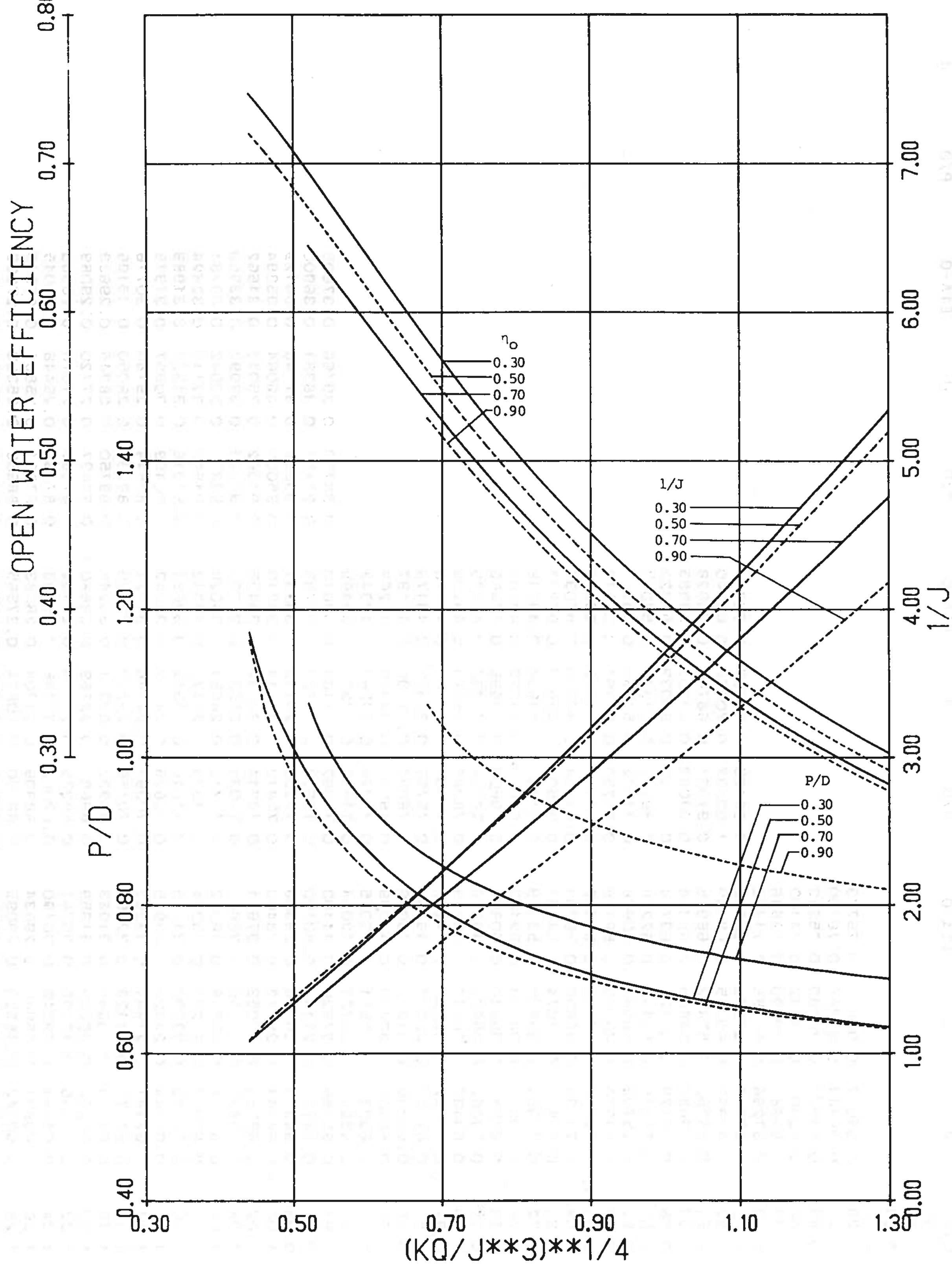


TABLE 29 WAGENINGEN B-SERIES PROPELLER DATA FOR 3 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.30 P/D	AE/AO = 0.30 J	AE/AO = 0.30 ETA-O	AE/AO = 0.50 P/D	AE/AO = 0.50 J	AE/AO = 0.50 ETA-O	AE/AO = 0.70 P/D	AE/AO = 0.70 J	AE/AO = 0.70 ETA-O	AE/AO = 0.90 P/D	AE/AO = 0.90 J	AE/AO = 0.90 ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44	1.16875	0.92392	0.74662	1.15781	0.91611	0.72010						
0.46	1.10039	0.85254	0.73463	1.06562	0.83222	0.70841						
0.48	1.05156	0.79541	0.72186	1.01250	0.77441	0.69625						
0.50	1.01094	0.74570	0.70848	0.97109	0.72598	0.68353						
0.52	0.97500	0.70098	0.69457	0.93750	0.68418	0.67035	1.07265	0.75859	0.64427			
0.54	0.94453	0.66152	0.68046	0.90937	0.64726	0.65678	1.02344	0.70928	0.63119			
0.56	0.91719	0.62558	0.66609	0.88594	0.61465	0.64305	0.98750	0.66904	0.61803			
0.58	0.89375	0.59346	0.65171	0.86367	0.58418	0.62916	0.95781	0.63379	0.60480			
0.60	0.87344	0.56445	0.63736	0.84375	0.55625	0.61518	0.93486	0.60351	0.59160			
0.62	0.85312	0.53691	0.62298	0.82734	0.53144	0.60137	0.91435	0.57578	0.57843			
0.64	0.83594	0.51230	0.60891	0.81172	0.50810	0.58759	0.89609	0.55039	0.56538			
0.66	0.81992	0.48935	0.59494	0.79766	0.48662	0.57403	0.87969	0.52695	0.55244			
0.68	0.80625	0.46855	0.58126	0.78594	0.46719	0.56074	0.86562	0.50566	0.53976	1.07109	0.59678	0.52879
0.70	0.79297	0.44902	0.56787	0.77344	0.44834	0.54766	0.85312	0.48603	0.52735	1.04219	0.56831	0.51649
0.72	0.78125	0.43096	0.55469	0.76250	0.43096	0.53483	0.84140	0.46758	0.51516	1.01953	0.54355	0.50450
0.74	0.77031	0.41416	0.54189	0.75312	0.41504	0.52236	0.83125	0.45059	0.50327	1.00078	0.52143	0.49286
0.76	0.75937	0.39814	0.52934	0.74375	0.39990	0.51025	0.82187	0.43467	0.49170	0.98516	0.50146	0.48154
0.78	0.75000	0.38350	0.51720	0.73594	0.38603	0.49848	0.81250	0.41943	0.48041	0.97090	0.48286	0.47052
0.80	0.74141	0.36982	0.50541	0.72812	0.37275	0.48698	0.80391	0.40513	0.46941	0.95781	0.46548	0.45982
0.82	0.73281	0.35674	0.49387	0.72187	0.36064	0.47588	0.79609	0.39175	0.45875	0.94687	0.44961	0.44945
0.84	0.72578	0.34482	0.48277	0.71484	0.34873	0.46501	0.78906	0.37920	0.44839	0.93750	0.43496	0.43940
0.86	0.71875	0.33340	0.47193	0.70781	0.33740	0.45453	0.78281	0.36748	0.43839	0.92715	0.42056	0.42962
0.88	0.71250	0.32275	0.46145	0.70312	0.32729	0.44438	0.77598	0.35601	0.42863	0.91894	0.40747	0.42016
0.90	0.70625	0.31260	0.45130	0.69766	0.31738	0.43455	0.77031	0.34541	0.41921	0.91094	0.39497	0.41099
0.92	0.70039	0.30293	0.44139	0.69219	0.30791	0.42505	0.76406	0.33506	0.41007	0.90391	0.38330	0.40212
0.94	0.69531	0.29395	0.43185	0.68750	0.29902	0.41581	0.75898	0.32549	0.40123	0.89687	0.37207	0.39351
0.96	0.69062	0.28545	0.42262	0.68281	0.29048	0.40683	0.75469	0.31655	0.39269	0.88984	0.36128	0.38517
0.98	0.68594	0.27734	0.41371	0.67851	0.28242	0.39819	0.75000	0.30781	0.38438	0.88398	0.35127	0.37711
1.00	0.68125	0.26953	0.40502	0.67500	0.27490	0.38983	0.74531	0.29941	0.37633	0.87851	0.34175	0.36931
1.02	0.67656	0.26201	0.39656	0.67109	0.26758	0.38173	0.74141	0.29160	0.36859	0.87305	0.33257	0.36172
1.04	0.67266	0.25503	0.38844	0.66719	0.26050	0.37384	0.73750	0.28403	0.36103	0.86836	0.32397	0.35441
1.06	0.66914	0.24839	0.38055	0.66328	0.25371	0.36622	0.73437	0.27700	0.35377	0.86367	0.31567	0.34730
1.08	0.66562	0.24199	0.37287	0.65937	0.24717	0.35883	0.72969	0.26978	0.34667	0.85859	0.30757	0.34041
1.10	0.66211	0.23589	0.36550	0.65742	0.24141	0.35177	0.72656	0.26323	0.33983	0.85391	0.29985	0.33373
1.12	0.65937	0.23018	0.35835	0.65469	0.23560	0.34482	0.72344	0.25693	0.33320	0.85000	0.29263	0.32727
1.14	0.65625	0.22456	0.35136	0.65156	0.22993	0.33812	0.72031	0.25083	0.32675	0.84609	0.28564	0.32100
1.16	0.65273	0.21909	0.34460	0.64844	0.22446	0.33161	0.71719	0.24497	0.32053	0.84297	0.27910	0.31494
1.18	0.65000	0.21396	0.33804	0.64600	0.21934	0.32530	0.71484	0.23950	0.31451	0.83935	0.27266	0.30904
1.20	0.64687	0.20898	0.33172	0.64375	0.21445	0.31922	0.71191	0.23403	0.30861	0.83594	0.26648	0.30333
1.22	0.64531	0.20444	0.32557	0.64121	0.20967	0.31331	0.70976	0.22900	0.30298	0.83266	0.26055	0.29779
1.24	0.64219	0.19980	0.31962	0.63906	0.20508	0.30751	0.70693	0.22393	0.29743	0.82954	0.25483	0.29241
1.26	0.63984	0.19541	0.31377	0.63750	0.20083	0.30198	0.70439	0.21909	0.29207	0.82656	0.24934	0.28718
1.28	0.63750	0.19121	0.30816	0.63516	0.19653	0.29656	0.70244	0.21455	0.28688	0.82344	0.24399	0.28211
1.30	0.63516	0.18711	0.30265	0.63281	0.19238	0.29131	0.70029	0.21011	0.28183	0.82070	0.23889	0.27717

FIGURE 32

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM PROPELLER RPM

FOR 3 BLADES AE/AO = 0.35, 0.55, 0.75, 0.95

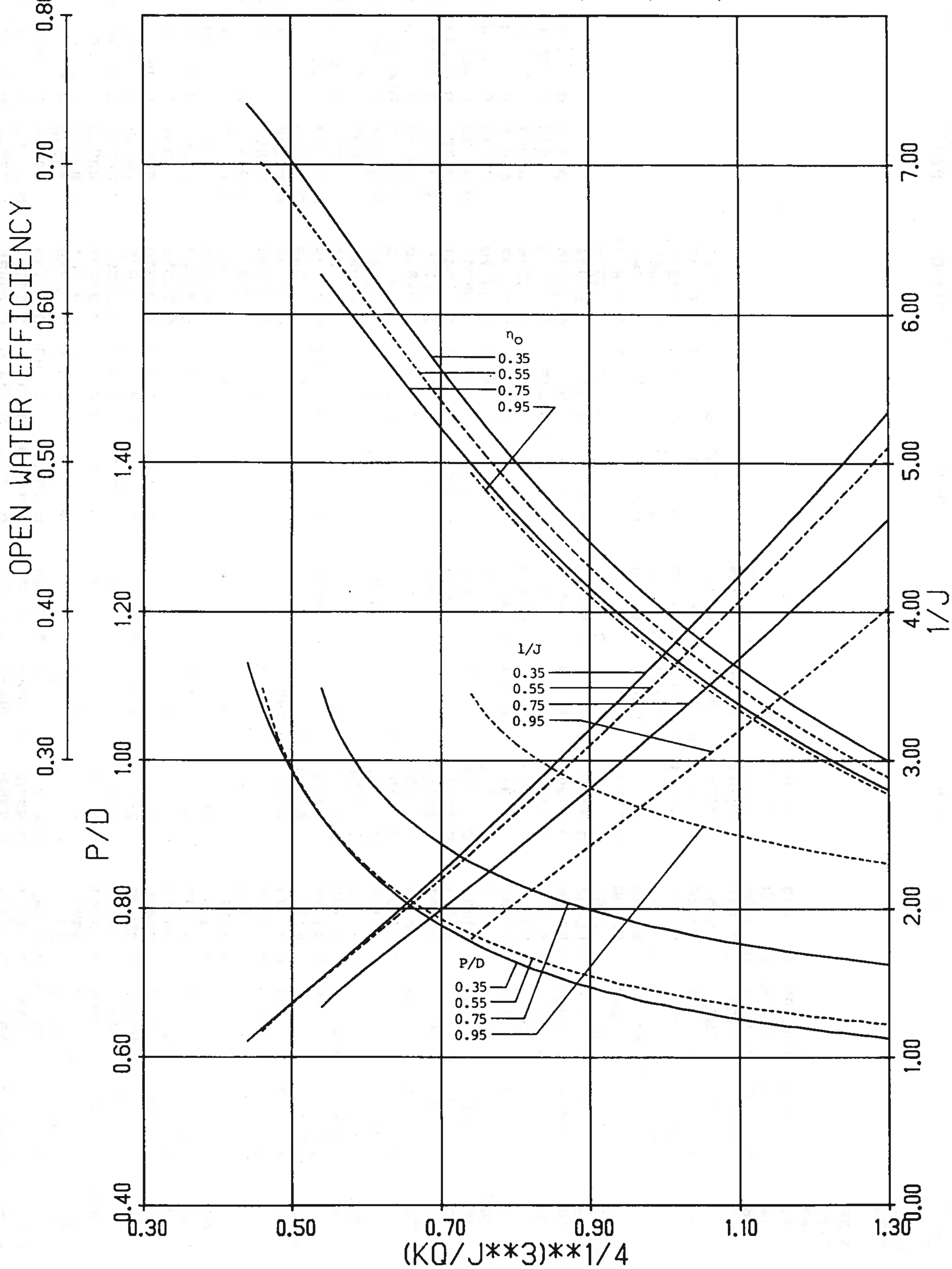


TABLE 30 WAGENINGEN B-SERIES PROPELLER DATA FOR 3 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.35			AE/AO = 0.55			AE/AO = 0.75			AE/AO = 0.95		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44	1.13125	0.90234	0.74032									
0.46	1.07031	0.83594	0.72846	1.09687	0.85010	0.70116						
0.48	1.02344	0.78066	0.71579	1.03125	0.78496	0.68904						
0.50	0.98437	0.73262	0.70257	0.98750	0.73515	0.67650						
0.52	0.95156	0.69023	0.68884	0.95312	0.69287	0.66353						
0.54	0.92227	0.65195	0.67483	0.92344	0.65508	0.65018	1.09687	0.74795	0.62654			
0.56	0.89687	0.61748	0.66057	0.89844	0.62158	0.63663	1.04219	0.69746	0.61322			
0.58	0.87344	0.58584	0.64627	0.87656	0.59121	0.62291	1.00625	0.65859	0.60005			
0.60	0.85312	0.55723	0.63195	0.85703	0.56348	0.60918	0.97656	0.62441	0.58684			
0.62	0.83437	0.53086	0.61774	0.83896	0.53769	0.59543	0.95391	0.59521	0.57379			
0.64	0.81797	0.50683	0.60367	0.82344	0.51435	0.58184	0.93281	0.56806	0.56085			
0.66	0.80234	0.48437	0.58978	0.80937	0.49277	0.56843	0.91621	0.54419	0.54811			
0.68	0.78906	0.46406	0.57621	0.79697	0.47295	0.55527	0.90039	0.52173	0.53555			
0.70	0.77656	0.44502	0.56284	0.78516	0.45430	0.54235	0.88633	0.50102	0.52323			
0.72	0.76562	0.42754	0.54980	0.77500	0.43721	0.52974	0.87344	0.48174	0.51117			
0.74	0.75469	0.41094	0.53706	0.76562	0.42119	0.51741	0.86172	0.46377	0.49938	1.08906	0.55591	0.49313
0.76	0.74453	0.39531	0.52454	0.75625	0.40586	0.50534	0.85234	0.44756	0.48794	1.06094	0.53056	0.48167
0.78	0.73594	0.38115	0.51255	0.74844	0.39189	0.49370	0.84297	0.43203	0.47678	1.04004	0.50893	0.47058
0.80	0.72773	0.36768	0.50076	0.74062	0.37852	0.48235	0.83398	0.41728	0.46589	1.02246	0.48940	0.45984
0.82	0.71953	0.35488	0.48935	0.73359	0.36602	0.47134	0.82578	0.40352	0.45537	1.00762	0.47163	0.44940
0.84	0.71328	0.34326	0.47826	0.72656	0.35400	0.46058	0.81816	0.39048	0.44511	0.99453	0.45522	0.43931
0.86	0.70625	0.33193	0.46749	0.72031	0.34282	0.45022	0.81094	0.37812	0.43515	0.98281	0.43994	0.42953
0.88	0.69961	0.32129	0.45711	0.71445	0.33223	0.44015	0.80469	0.36665	0.42554	0.97187	0.42554	0.42005
0.90	0.69453	0.31152	0.44703	0.70937	0.32236	0.43045	0.79863	0.35571	0.41624	0.96250	0.41221	0.41087
0.92	0.68828	0.30186	0.43722	0.70469	0.31299	0.42101	0.79297	0.34531	0.40719	0.95469	0.39995	0.40202
0.94	0.68437	0.29326	0.42779	0.69844	0.30352	0.41182	0.78750	0.33540	0.39844	0.94687	0.38813	0.39342
0.96	0.67812	0.28437	0.41856	0.69531	0.29541	0.40305	0.78203	0.32588	0.38995	0.93906	0.37676	0.38506
0.98	0.67344	0.27627	0.40965	0.69062	0.28711	0.39444	0.77656	0.31670	0.38170	0.93184	0.36602	0.37699
1.00	0.67031	0.26894	0.40111	0.68672	0.27939	0.38617	0.77305	0.30850	0.37379	0.92539	0.35591	0.36918
1.02	0.66562	0.26147	0.39274	0.68281	0.27197	0.37815	0.76875	0.30034	0.36607	0.91953	0.34634	0.36162
1.04	0.66250	0.25469	0.38466	0.67891	0.26484	0.37039	0.76406	0.29238	0.35859	0.91406	0.33726	0.35431
1.06	0.65859	0.24800	0.37684	0.67578	0.25815	0.36283	0.76016	0.28496	0.35138	0.90859	0.32847	0.34719
1.08	0.65469	0.24155	0.36924	0.67266	0.25176	0.35558	0.75625	0.27778	0.34437	0.90312	0.32002	0.34032
1.10	0.65156	0.23555	0.36191	0.66875	0.24536	0.34848	0.75312	0.27109	0.33760	0.89844	0.31206	0.33365
1.12	0.64844	0.22978	0.35483	0.66562	0.23940	0.34163	0.74971	0.26455	0.33102	0.89375	0.30439	0.32719
1.14	0.64570	0.22427	0.34790	0.66328	0.23384	0.33498	0.74687	0.25840	0.32466	0.88984	0.29719	0.32094
1.16	0.64258	0.21890	0.34120	0.66094	0.22852	0.32861	0.74326	0.25225	0.31847	0.88516	0.29004	0.31486
1.18	0.64062	0.21396	0.33474	0.65781	0.22314	0.32234	0.74023	0.24644	0.31245	0.88125	0.28332	0.30898
1.20	0.63750	0.20898	0.32847	0.65469	0.21797	0.31627	0.73750	0.24092	0.30664	0.87734	0.27683	0.30327
1.22	0.63437	0.20415	0.32234	0.65312	0.21333	0.31043	0.73516	0.23569	0.30103	0.87427	0.27075	0.29774
1.24	0.63281	0.19980	0.31644	0.65000	0.20850	0.30472	0.73281	0.23061	0.29556	0.87031	0.26465	0.29234
1.26	0.63008	0.19536	0.31066	0.64922	0.20435	0.29925	0.73008	0.22563	0.29027	0.86719	0.25896	0.28714
1.28	0.62812	0.19121	0.30507	0.64609	0.19980	0.29385	0.72744	0.22080	0.28508	0.86406	0.25344	0.28207
1.30	0.62500	0.18701	0.29964	0.64453	0.19575	0.28866	0.72500	0.21619	0.28008	0.86094	0.24810	0.27715

FIGURE 33

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM PROPELLER RPM
FOR 3 BLADES AE/AO = 0.40, 0.60, 0.80, 1.00

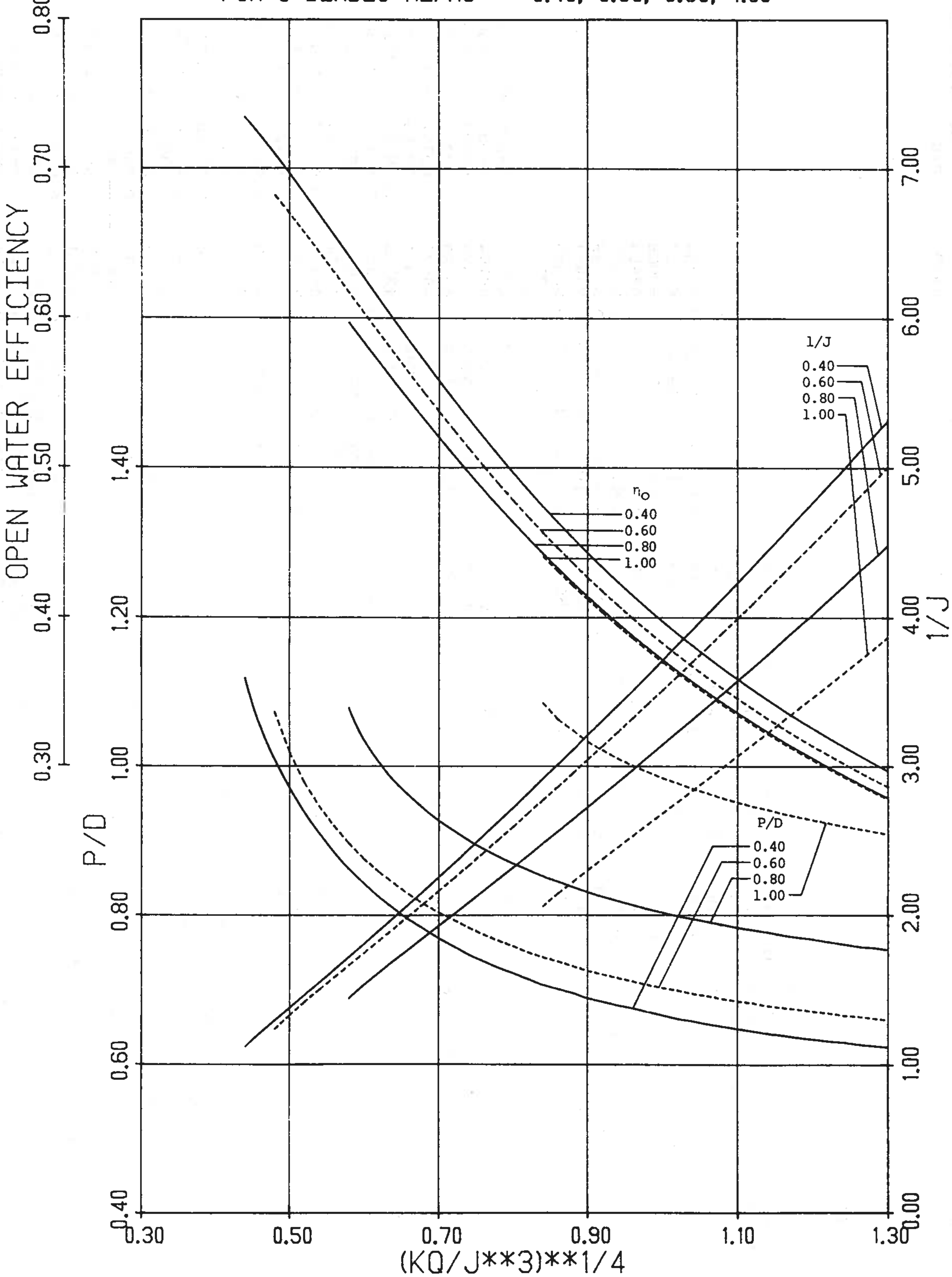


TABLE 31 WAGENINGEN B-SERIES PROPELLER DATA FOR 3 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.40			AE/AO = 0.60			AE/AO = 0.80			AE/AO = 1.00		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44	1.11719	0.89346	0.73389									
0.46	1.05312	0.82578	0.72212									
0.48	1.00781	0.77207	0.70965	1.07187	0.80820	0.68199						
0.50	0.97031	0.72539	0.69658	1.01797	0.75234	0.66950						
0.52	0.93750	0.68359	0.68304	0.97734	0.70635	0.65666						
0.54	0.90937	0.64629	0.66914	0.94531	0.66709	0.64350						
0.56	0.88398	0.61230	0.65504	0.91875	0.63252	0.63009						
0.58	0.86152	0.58144	0.64083	0.89531	0.60117	0.61656	1.07734	0.69399	0.59651			
0.60	0.84219	0.55361	0.62662	0.87500	0.57285	0.60299	1.03437	0.65283	0.58324			
0.62	0.82422	0.52783	0.61249	0.85752	0.54726	0.58951	1.00469	0.61973	0.57018			
0.64	0.80859	0.50439	0.59851	0.84219	0.52383	0.57610	0.97969	0.59023	0.55727			
0.66	0.79375	0.48242	0.58468	0.82764	0.50185	0.56287	0.95937	0.56421	0.54459			
0.68	0.78125	0.46260	0.57118	0.81474	0.48164	0.54986	0.94219	0.54067	0.53211			
0.70	0.76875	0.44375	0.55793	0.80312	0.46289	0.53710	0.92637	0.51880	0.51989			
0.72	0.75781	0.42637	0.54492	0.79297	0.44560	0.52462	0.91269	0.49878	0.50794			
0.74	0.74687	0.40986	0.53225	0.78281	0.42910	0.51243	0.89961	0.47988	0.49626			
0.76	0.73789	0.39482	0.51988	0.77344	0.41367	0.50057	0.88828	0.46250	0.48488			
0.78	0.72930	0.38066	0.50787	0.76523	0.39932	0.48898	0.87812	0.44634	0.47382			
0.80	0.72187	0.36758	0.49622	0.75781	0.38594	0.47777	0.86875	0.43115	0.46306			
0.82	0.71406	0.35498	0.48490	0.74961	0.37285	0.46685	0.86016	0.41689	0.45260			
0.84	0.70625	0.34287	0.47381	0.74297	0.36084	0.45624	0.85156	0.40322	0.44244	1.08437	0.48586	0.44053
0.86	0.70078	0.33213	0.46320	0.73750	0.34980	0.44603	0.84453	0.39067	0.43260	1.06250	0.46665	0.43062
0.88	0.69531	0.32187	0.45292	0.73125	0.33896	0.43610	0.83730	0.37856	0.42304	1.04766	0.45049	0.42109
0.90	0.68828	0.31152	0.44282	0.72500	0.32852	0.42641	0.83047	0.36709	0.41379	1.03203	0.43467	0.41182
0.92	0.68359	0.30234	0.43313	0.72031	0.31904	0.41711	0.82422	0.35625	0.40481	1.02070	0.42085	0.40290
0.94	0.67891	0.29355	0.42375	0.71562	0.30996	0.40810	0.81875	0.34609	0.39612	1.00976	0.40767	0.39424
0.96	0.67500	0.28535	0.41468	0.71094	0.30117	0.39929	0.81328	0.33633	0.38770	1.00039	0.39546	0.38587
0.98	0.67031	0.27725	0.40583	0.70625	0.29277	0.39081	0.80781	0.32695	0.37955	0.99180	0.38394	0.37777
1.00	0.66562	0.26948	0.39728	0.70234	0.28496	0.38265	0.80312	0.31816	0.37166	0.98359	0.37297	0.36993
1.02	0.66094	0.26201	0.38897	0.69883	0.27754	0.37472	0.79844	0.30972	0.36403	0.97656	0.36274	0.36234
1.04	0.65781	0.25527	0.38101	0.69453	0.27017	0.36701	0.79453	0.30181	0.35664	0.96914	0.35278	0.35499
1.06	0.65391	0.24858	0.37325	0.69141	0.26338	0.35955	0.79062	0.29419	0.34949	0.96289	0.34351	0.34787
1.08	0.65078	0.24233	0.36574	0.68750	0.25664	0.35231	0.78672	0.28682	0.34252	0.95625	0.33445	0.34097
1.10	0.64766	0.23633	0.35848	0.68437	0.25039	0.34536	0.78281	0.27974	0.33579	0.95078	0.32603	0.33429
1.12	0.64453	0.23052	0.35140	0.68203	0.24453	0.33860	0.77969	0.27310	0.32927	0.94531	0.31790	0.32782
1.14	0.64141	0.22495	0.34457	0.67812	0.23848	0.33199	0.77656	0.26670	0.32295	0.94101	0.31035	0.32156
1.16	0.63906	0.21973	0.33793	0.67578	0.23306	0.32567	0.77266	0.26030	0.31679	0.93555	0.30276	0.31547
1.18	0.63594	0.21455	0.33151	0.67344	0.22778	0.31948	0.76953	0.25435	0.31085	0.93125	0.29570	0.30956
1.20	0.63359	0.20972	0.32529	0.67090	0.22266	0.31350	0.76719	0.24878	0.30510	0.92700	0.28892	0.30385
1.22	0.63125	0.20503	0.31923	0.66875	0.21782	0.30773	0.76387	0.24314	0.29948	0.92290	0.28237	0.29830
1.24	0.62969	0.20068	0.31340	0.66562	0.21289	0.30207	0.76094	0.23779	0.29405	0.91870	0.27603	0.29291
1.26	0.62695	0.19624	0.30769	0.66406	0.20850	0.29664	0.75781	0.23257	0.28876	0.91523	0.27004	0.28768
1.28	0.62500	0.19209	0.30216	0.66172	0.20405	0.29132	0.75625	0.22788	0.28367	0.91172	0.26426	0.28262
1.30	0.62344	0.18818	0.29684	0.65937	0.19976	0.28617	0.75342	0.22305	0.27869	0.90781	0.25854	0.27767

FIGURE 34
WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM PROPELLER RPM
FOR 3 BLADES AE/AO = 0.45, 0.65, 0.85, 1.05

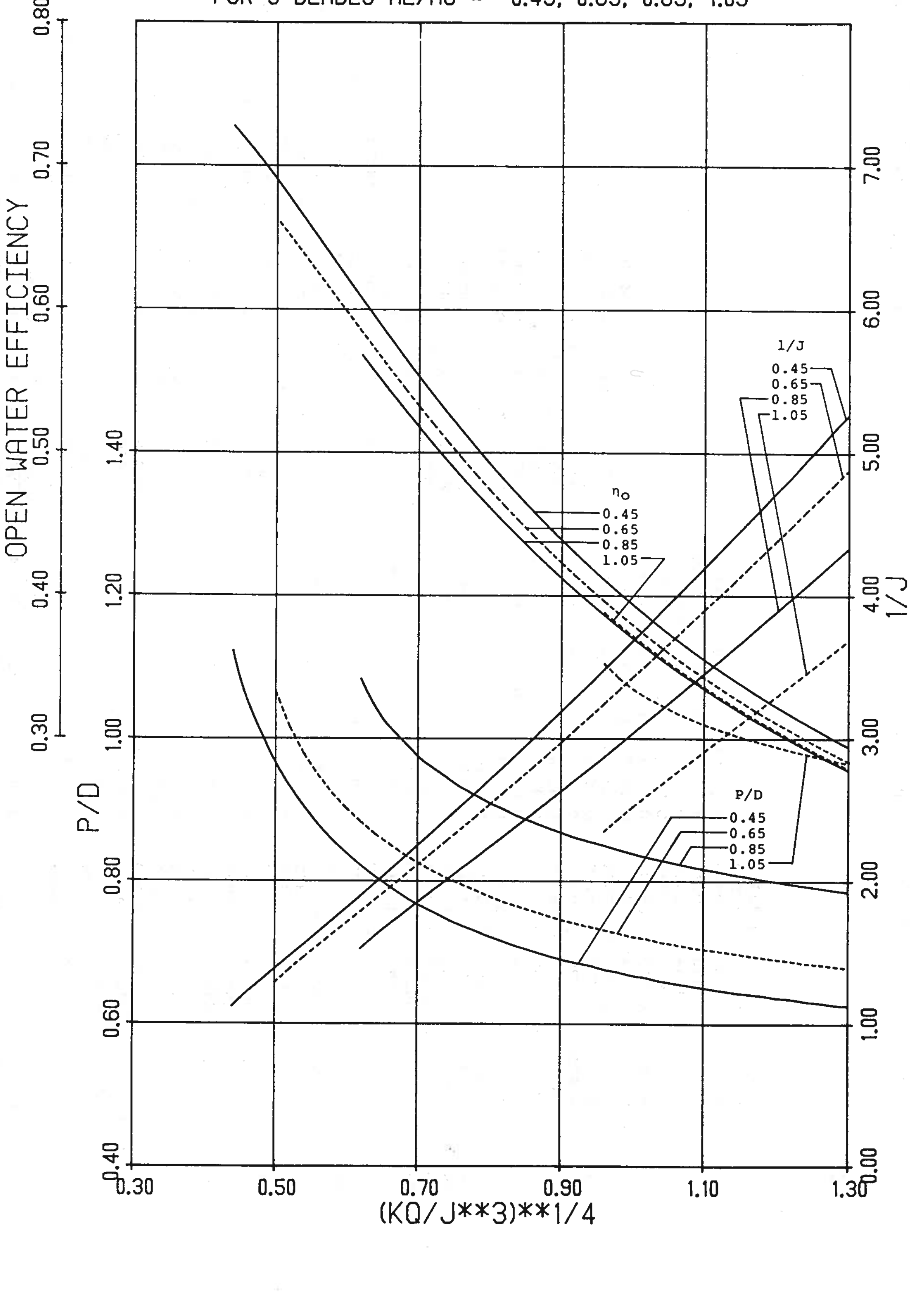


TABLE 32 WAGENINGEN B-SERIES PROPELLER DATA FOR 3 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.45			AE/AO = 0.65			AE/AO = 0.85			AE/AO = 1.05		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44	1.12187	0.89551	0.72712									
0.46	1.05312	0.82539	0.71548									
0.48	1.00625	0.77109	0.70319									
0.50	0.96562	0.72295	0.69027	1.06484	0.77861	0.66288						
0.52	0.93281	0.68144	0.67689	1.01484	0.72705	0.65006						
0.54	0.90469	0.64443	0.66315	0.97812	0.68496	0.63706						
0.56	0.87969	0.61084	0.64916	0.94844	0.64844	0.62384						
0.58	0.85781	0.58047	0.63507	0.92266	0.61553	0.61044						
0.60	0.83906	0.55312	0.62100	0.90107	0.58633	0.59709						
0.62	0.82187	0.52793	0.60704	0.88281	0.56006	0.58377	1.08281	0.65630	0.56800			
0.64	0.80625	0.50459	0.59314	0.86562	0.53545	0.57050	1.04375	0.61977	0.55496			
0.66	0.79219	0.48310	0.57946	0.85156	0.51348	0.55748	1.01562	0.58965	0.54220			
0.68	0.77891	0.46299	0.56599	0.83750	0.49248	0.54462	0.99531	0.56426	0.52977			
0.70	0.76719	0.44453	0.55284	0.82549	0.47334	0.53203	0.97500	0.53994	0.51754			
0.72	0.75703	0.42754	0.53996	0.81406	0.45527	0.51967	0.95937	0.51865	0.50564			
0.74	0.74687	0.41133	0.52734	0.80391	0.43857	0.50764	0.94531	0.49893	0.49403			
0.76	0.73789	0.39639	0.51513	0.79531	0.42324	0.49594	0.93125	0.48003	0.48269			
0.78	0.73008	0.38252	0.50322	0.78672	0.40854	0.48450	0.92031	0.46318	0.47170			
0.80	0.72187	0.36914	0.49161	0.77812	0.39453	0.47341	0.90937	0.44702	0.46098			
0.82	0.71484	0.35684	0.48042	0.77031	0.38135	0.46258	0.90019	0.43218	0.45058			
0.84	0.70781	0.34502	0.46949	0.76406	0.36934	0.45215	0.89062	0.41782	0.44048			
0.86	0.70156	0.33398	0.45890	0.75781	0.35781	0.44200	0.88281	0.40469	0.43070			
0.88	0.69531	0.32344	0.44863	0.75156	0.34678	0.43217	0.87500	0.39209	0.42122			
0.90	0.68984	0.31357	0.43869	0.74570	0.33633	0.42265	0.86797	0.38022	0.41200			
0.92	0.68516	0.30439	0.42910	0.74062	0.32656	0.41344	0.86094	0.36885	0.40308			
0.94	0.68125	0.29580	0.41979	0.73594	0.31728	0.40449	0.85547	0.35845	0.39448			
0.96	0.67578	0.28711	0.41074	0.73125	0.30840	0.39585	0.85000	0.34844	0.38613	1.10469	0.42578	0.38786
0.98	0.67187	0.27920	0.40199	0.72656	0.29985	0.38747	0.84414	0.33867	0.37802	1.08476	0.41055	0.37965
1.00	0.66719	0.27139	0.39349	0.72187	0.29160	0.37930	0.83867	0.32939	0.37016	1.06875	0.39692	0.37171
1.02	0.66406	0.26436	0.38536	0.71875	0.28418	0.37150	0.83359	0.32061	0.36257	1.05625	0.38477	0.36404
1.04	0.65937	0.25713	0.37737	0.71406	0.27656	0.36387	0.82930	0.31235	0.35522	1.04609	0.37368	0.35664
1.06	0.65625	0.25063	0.36973	0.71094	0.26968	0.35653	0.82500	0.30439	0.34809	1.03594	0.36299	0.34945
1.08	0.65312	0.24434	0.36227	0.70703	0.26279	0.34934	0.82070	0.29673	0.34118	1.02734	0.35308	0.34250
1.10	0.65000	0.23828	0.35504	0.70391	0.25640	0.34244	0.81680	0.28945	0.33450	1.01914	0.34360	0.33576
1.12	0.64687	0.23247	0.34807	0.70156	0.25044	0.33577	0.81328	0.28252	0.32801	1.01191	0.33472	0.32924
1.14	0.64375	0.22686	0.34129	0.69844	0.24448	0.32927	0.80937	0.27573	0.32171	1.00547	0.32634	0.32294
1.16	0.64141	0.22163	0.33474	0.69531	0.23872	0.32296	0.80625	0.26938	0.31563	0.99922	0.31829	0.31682
1.18	0.63906	0.21660	0.32841	0.69238	0.23320	0.31683	0.80234	0.26304	0.30969	0.99375	0.31069	0.31089
1.20	0.63594	0.21152	0.32218	0.68965	0.22793	0.31091	0.79941	0.25715	0.30395	0.98828	0.30334	0.30514
1.22	0.63437	0.20703	0.31627	0.68750	0.22300	0.30521	0.79609	0.25137	0.29838	0.98281	0.29624	0.29955
1.24	0.63125	0.20229	0.31041	0.68437	0.21797	0.29960	0.79336	0.24592	0.29299	0.97812	0.28955	0.29415
1.26	0.62930	0.19800	0.30480	0.68281	0.21348	0.29422	0.79043	0.24060	0.28774	0.97339	0.28306	0.28889
1.28	0.62656	0.19365	0.29928	0.68047	0.20894	0.28895	0.78750	0.23545	0.28265	0.96914	0.27688	0.28379
1.30	0.62539	0.18979	0.29401	0.67822	0.20459	0.28387	0.78516	0.23059	0.27771	0.96484	0.27087	0.27882

FIGURE 35
WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM PROPELLER RPM
FOR 4 BLADES AE/AO = 0.30, 0.50, 0.70, 0.90

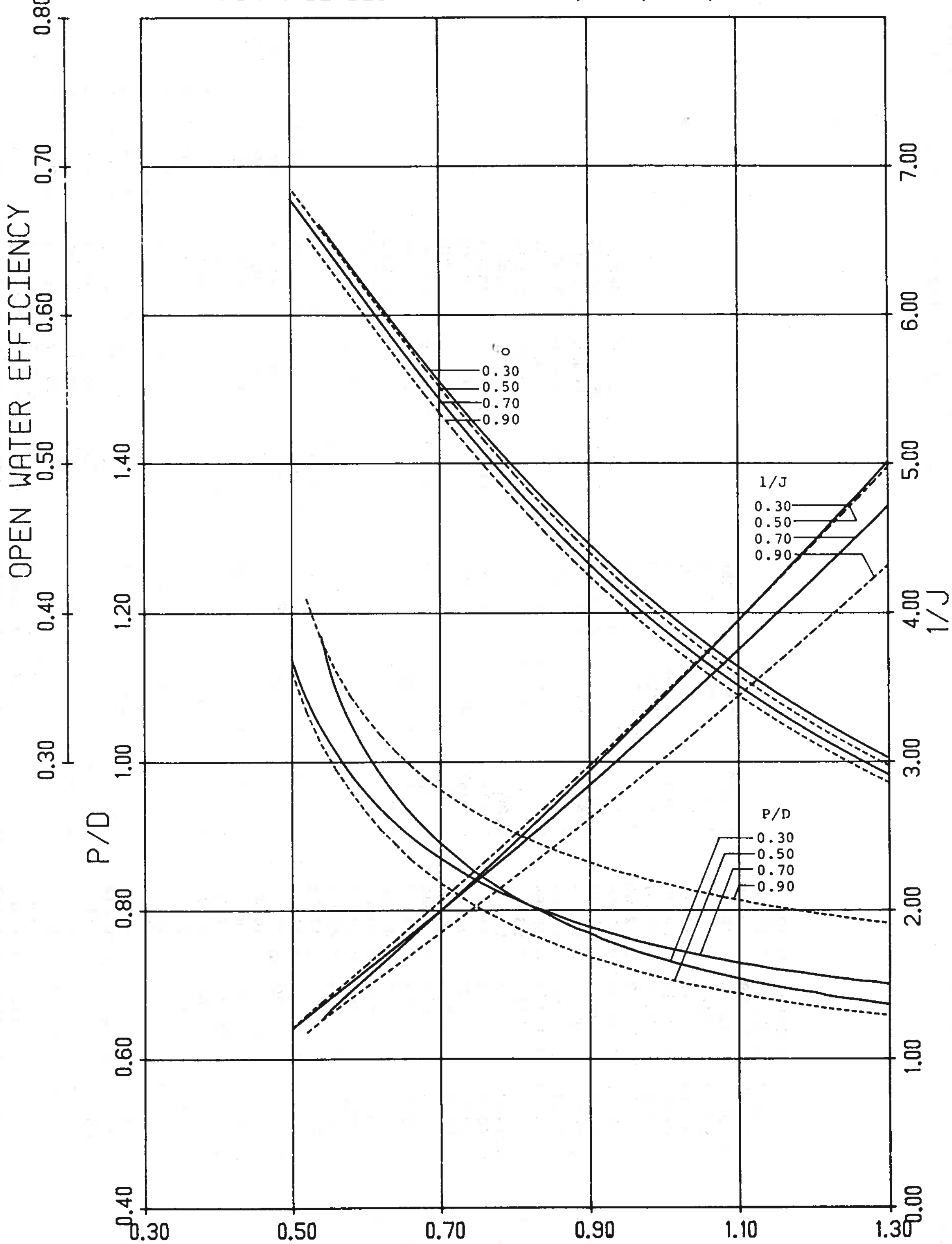


TABLE 33 WAGENINGEN B-SERIES PROPELLER DATA FOR 4 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.30 P/D	AE/AO = 0.30 J	AE/AO = 0.30 ETA-O	AE/AO = 0.50 P/D	AE/AO = 0.50 J	AE/AO = 0.50 ETA-O	AE/AO = 0.70 P/D	AE/AO = 0.70 J	AE/AO = 0.70 ETA-O	AE/AO = 0.90 P/D	AE/AO = 0.90 J	AE/AO = 0.90 ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44												
0.46												
0.48												
0.50				1.12187	0.82558	0.68524	1.13828	0.83213	0.67791			
0.52				1.06719	0.76933	0.67175	1.08515	0.77705	0.66440	1.21875	0.84756	0.65375
0.54	1.16875	0.78877	0.66075	1.02344	0.72148	0.65815	1.04531	0.73164	0.65081	1.16328	0.79258	0.64012
0.56	1.09687	0.72920	0.64695	0.98906	0.68076	0.64453	1.01250	0.69199	0.63712	1.12187	0.74736	0.62651
0.58	1.05078	0.68359	0.63335	0.95937	0.64443	0.63094	0.98281	0.65576	0.62336	1.08750	0.70771	0.61289
0.60	1.01406	0.64443	0.61992	0.93281	0.61133	0.61732	0.95840	0.62388	0.60969	1.06015	0.67334	0.59935
0.62	0.98281	0.60967	0.60665	0.90869	0.58105	0.60383	0.93642	0.59463	0.59609	1.03554	0.64184	0.58591
0.64	0.95547	0.57832	0.59353	0.88906	0.55430	0.59051	0.91719	0.56802	0.58263	1.01382	0.61308	0.57260
0.66	0.93125	0.54990	0.58062	0.86875	0.52851	0.57729	0.89961	0.54336	0.56934	0.99531	0.58711	0.55952
0.68	0.91016	0.52422	0.56796	0.85234	0.50566	0.56434	0.88418	0.52085	0.55633	0.97734	0.56250	0.54662
0.70	0.89062	0.50039	0.55546	0.83672	0.48428	0.55165	0.87031	0.50002	0.54357	0.96230	0.54028	0.53402
0.72	0.87344	0.47871	0.54328	0.82305	0.46465	0.53919	0.85703	0.48037	0.53106	0.94844	0.51953	0.52170
0.74	0.85625	0.45810	0.53130	0.80937	0.44600	0.52702	0.84453	0.46191	0.51883	0.93574	0.50015	0.50965
0.76	0.84219	0.43965	0.51967	0.79766	0.42891	0.51512	0.83359	0.44492	0.50694	0.92422	0.48208	0.49792
0.78	0.82891	0.42236	0.50830	0.78750	0.41328	0.50362	0.82344	0.42900	0.49538	0.91406	0.46533	0.48652
0.80	0.81641	0.40615	0.49718	0.77695	0.39814	0.49232	0.81484	0.41435	0.48414	0.90351	0.44912	0.47539
0.82	0.80547	0.39121	0.48637	0.76719	0.38398	0.48133	0.80547	0.40005	0.47318	0.89453	0.43423	0.46464
0.84	0.79531	0.37725	0.47586	0.75937	0.37114	0.47071	0.79844	0.38721	0.46260	0.88594	0.42007	0.45419
0.86	0.78516	0.36396	0.46565	0.75156	0.35889	0.46040	0.79062	0.37461	0.45228	0.87793	0.40669	0.44403
0.88	0.77578	0.35146	0.45566	0.74375	0.34712	0.45033	0.78320	0.36269	0.44229	0.87109	0.39429	0.43422
0.90	0.76875	0.34023	0.44605	0.73672	0.33613	0.44060	0.77695	0.35166	0.43261	0.86406	0.38232	0.42471
0.92	0.75937	0.32886	0.43662	0.73125	0.32607	0.43116	0.77109	0.34121	0.42325	0.85703	0.37080	0.41544
0.94	0.75234	0.31860	0.42751	0.72500	0.31621	0.42199	0.76523	0.33115	0.41413	0.85078	0.36001	0.40650
0.96	0.74531	0.30879	0.41865	0.71875	0.30674	0.41307	0.75937	0.32153	0.40533	0.84609	0.35015	0.39788
0.98	0.73906	0.29961	0.41007	0.71328	0.29790	0.40447	0.75430	0.31250	0.39678	0.83984	0.34014	0.38945
1.00	0.73320	0.29092	0.40176	0.70781	0.28940	0.39610	0.74961	0.30395	0.38853	0.83555	0.33115	0.38138
1.02	0.72734	0.28252	0.39360	0.70312	0.28144	0.38798	0.74531	0.29585	0.38054	0.83047	0.32227	0.37352
1.04	0.72226	0.27471	0.38576	0.69844	0.27383	0.38014	0.74101	0.28804	0.37278	0.82539	0.31367	0.36587
1.06	0.71719	0.26724	0.37818	0.69531	0.26689	0.37256	0.73672	0.28052	0.36525	0.82148	0.30576	0.35852
1.08	0.71250	0.26011	0.37077	0.69062	0.25981	0.36515	0.73281	0.27339	0.35797	0.81680	0.29790	0.35135
1.10	0.70781	0.25327	0.36359	0.68750	0.25342	0.35804	0.72891	0.26650	0.35089	0.81328	0.29067	0.34446
1.12	0.70312	0.24668	0.35660	0.68320	0.24697	0.35110	0.72578	0.26011	0.34408	0.80898	0.28345	0.33771
1.14	0.69922	0.24053	0.34985	0.67969	0.24092	0.34435	0.72187	0.25371	0.33743	0.80547	0.27671	0.33122
1.16	0.69531	0.23457	0.34326	0.67646	0.23516	0.33782	0.71875	0.24775	0.33102	0.80234	0.27031	0.32494
1.18	0.69180	0.22895	0.33691	0.67344	0.22964	0.33147	0.71641	0.24219	0.32481	0.79922	0.26411	0.31882
1.20	0.68906	0.22368	0.33075	0.67031	0.22432	0.32534	0.71328	0.23662	0.31876	0.79565	0.25801	0.31287
1.22	0.68437	0.21821	0.32470	0.66719	0.21914	0.31933	0.71025	0.23125	0.31287	0.79297	0.25234	0.30713
1.24	0.68125	0.21323	0.31885	0.66484	0.21436	0.31357	0.70781	0.22622	0.30720	0.78984	0.24673	0.30152
1.26	0.67891	0.20859	0.31323	0.66250	0.20972	0.30797	0.70498	0.22124	0.30165	0.78706	0.24141	0.29612
1.28	0.67578	0.20395	0.30771	0.66016	0.20522	0.30251	0.70312	0.21665	0.29629	0.78437	0.23628	0.29087
1.30	0.67266	0.19946	0.30233	0.65781	0.20088	0.29720	0.69990	0.21191	0.29107	0.78203	0.23137	0.28575

FIGURE 36

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM PROPELLER RPM
FOR 4 BLADES AE/AO = 0.35, 0.55, 0.75, 0.95

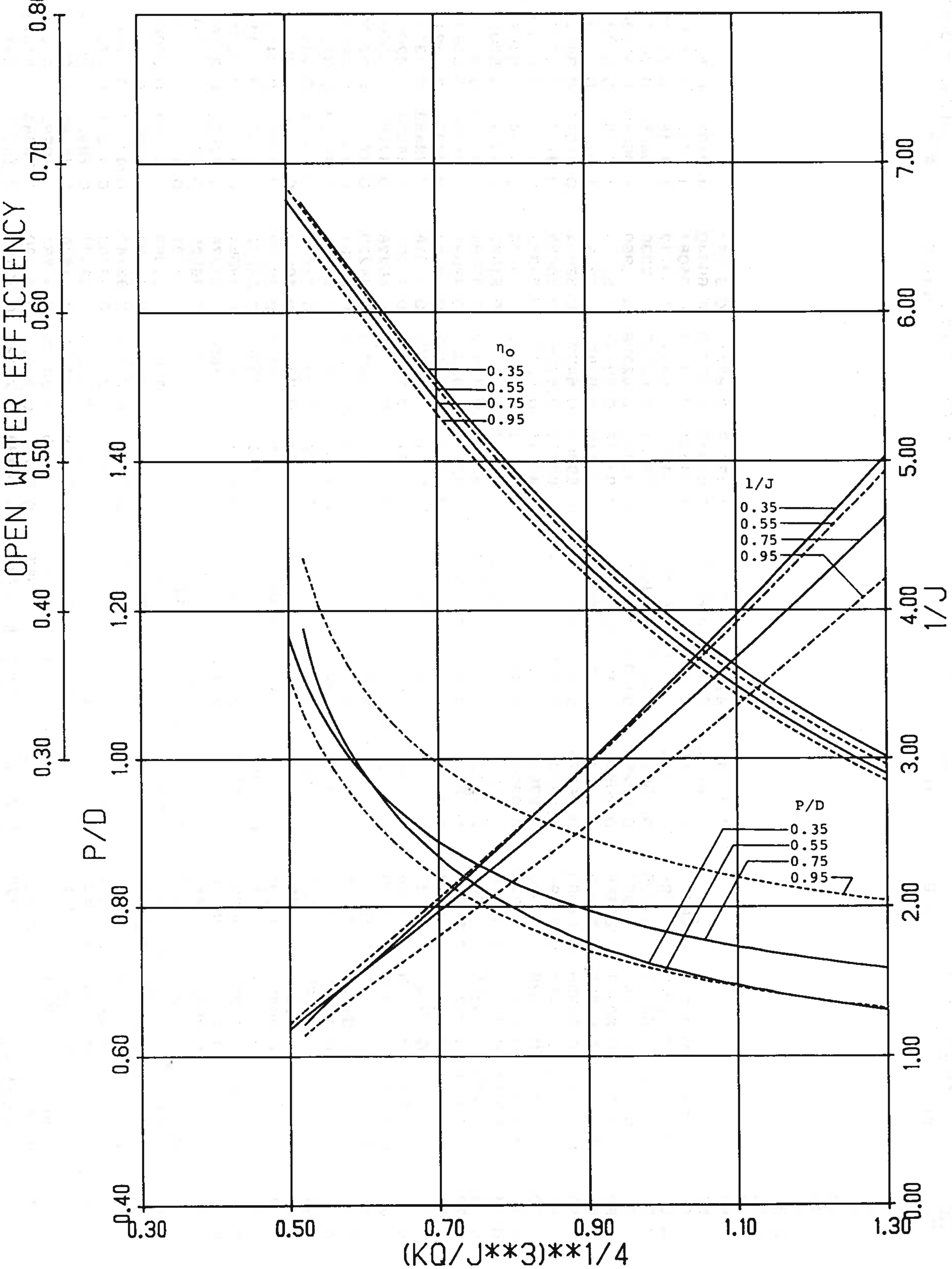


TABLE 34 WAGENINGEN B-SERIES PROPELLER DATA FOR 4 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.35 P/D	AE/AO = 0.35 J	AE/AO = 0.35 ETA-O	AE/AO = 0.55 P/D	AE/AO = 0.55 J	AE/AO = 0.55 ETA-O	AE/AO = 0.75 P/D	AE/AO = 0.75 J	AE/AO = 0.75 ETA-O	AE/AO = 0.95 P/D	AE/AO = 0.95 J	AE/AO = 0.95 ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44												
0.46												
0.48				1.11172	0.81943	0.68405	1.16484	0.84629	0.67524			
0.52	1.17500	0.82295	0.67371	1.05937	0.76465	0.67055	1.10937	0.78974	0.66172	1.26953	0.87431	0.65160
0.54	1.10039	0.75898	0.65995	1.01875	0.71875	0.65698	1.06719	0.74287	0.64813	1.20625	0.81470	0.63795
0.56	1.05156	0.70996	0.64631	0.98525	0.67871	0.64332	1.03281	0.70224	0.63446	1.16094	0.76699	0.62435
0.58	1.01250	0.66797	0.63277	0.95625	0.64287	0.62964	1.00273	0.66567	0.62074	1.12500	0.72617	0.61078
0.60	0.98125	0.63174	0.61939	0.93047	0.61035	0.61600	0.97812	0.63349	0.60708	1.09531	0.69023	0.59726
0.62	0.95312	0.59873	0.60609	0.90781	0.58086	0.60244	0.95547	0.60371	0.59347	1.06875	0.65742	0.58384
0.64	0.92734	0.56846	0.59293	0.88779	0.55400	0.58902	0.93613	0.57690	0.58006	1.04687	0.62827	0.57060
0.66	0.90469	0.54101	0.57995	0.86943	0.52920	0.57580	0.91875	0.55220	0.56683	1.02656	0.60112	0.55753
0.68	0.88594	0.51660	0.56725	0.85312	0.50644	0.56279	0.90234	0.52905	0.55381	1.00879	0.57632	0.54471
0.70	0.86719	0.49336	0.55468	0.83828	0.48545	0.55007	0.88750	0.50762	0.54104	0.99297	0.55342	0.53212
0.72	0.85000	0.47197	0.54244	0.82500	0.46602	0.53757	0.87519	0.48823	0.52860	0.97891	0.53232	0.51987
0.74	0.83594	0.45273	0.53045	0.81172	0.44751	0.52535	0.86328	0.46987	0.51643	0.96562	0.51240	0.50785
0.76	0.82187	0.43447	0.51872	0.80078	0.43076	0.51346	0.85234	0.45273	0.50459	0.95312	0.49365	0.49614
0.78	0.80937	0.41768	0.50733	0.78984	0.41475	0.50181	0.84219	0.43662	0.49304	0.94258	0.47651	0.48479
0.80	0.79844	0.40215	0.49618	0.78125	0.40039	0.49060	0.83203	0.42119	0.48177	0.93203	0.46006	0.47371
0.82	0.78750	0.38740	0.48534	0.77148	0.38623	0.47962	0.82344	0.40703	0.47087	0.92305	0.44492	0.46301
0.84	0.77734	0.37353	0.47474	0.76328	0.37319	0.46893	0.81562	0.39375	0.46030	0.91406	0.43037	0.45258
0.86	0.76875	0.36084	0.46450	0.75547	0.36089	0.45858	0.80820	0.38115	0.45002	0.90625	0.41685	0.44248
0.88	0.75937	0.34849	0.45451	0.74844	0.34936	0.44854	0.80156	0.36938	0.44010	0.89863	0.40395	0.43270
0.90	0.75156	0.33711	0.44480	0.74062	0.33809	0.43876	0.79502	0.35811	0.43045	0.89141	0.39170	0.42320
0.92	0.74375	0.32627	0.43539	0.73516	0.32803	0.42935	0.78867	0.34736	0.42112	0.88516	0.38027	0.41403
0.94	0.73750	0.31631	0.42626	0.72930	0.31826	0.42020	0.78301	0.33726	0.41206	0.87851	0.36914	0.40511
0.96	0.73105	0.30674	0.41739	0.72344	0.30889	0.41131	0.77734	0.32754	0.40327	0.87266	0.35869	0.39647
0.98	0.72422	0.29746	0.40876	0.71836	0.30010	0.40269	0.77187	0.31826	0.39475	0.86719	0.34878	0.38813
1.00	0.71875	0.28896	0.40047	0.71328	0.29170	0.39437	0.76719	0.30962	0.38656	0.86211	0.33936	0.38004
1.02	0.71406	0.28096	0.39237	0.70859	0.28369	0.38625	0.76250	0.30127	0.37858	0.85664	0.33018	0.37221
1.04	0.70859	0.27310	0.38450	0.70469	0.27627	0.37848	0.75859	0.29346	0.37086	0.85234	0.32168	0.36464
1.06	0.70352	0.26562	0.37684	0.69961	0.26875	0.37082	0.75430	0.28584	0.36338	0.84805	0.31348	0.35728
1.08	0.69844	0.25850	0.36947	0.69687	0.26216	0.36349	0.75039	0.27861	0.35614	0.84336	0.30547	0.35015
1.10	0.69531	0.25205	0.36232	0.69297	0.25552	0.35636	0.74648	0.27163	0.34911	0.83945	0.29797	0.34327
1.12	0.69062	0.24551	0.35533	0.68906	0.24912	0.34944	0.74375	0.26523	0.34234	0.83555	0.29072	0.33658
1.14	0.68750	0.23955	0.34859	0.68594	0.24311	0.34271	0.73984	0.25874	0.33573	0.83203	0.28384	0.33010
1.16	0.68281	0.23350	0.34203	0.68281	0.23735	0.33621	0.73662	0.25264	0.32932	0.82812	0.27710	0.32383
1.18	0.67969	0.22798	0.33567	0.67969	0.23179	0.32990	0.73359	0.24683	0.32314	0.82500	0.27078	0.31774
1.20	0.67656	0.22266	0.32950	0.67656	0.22642	0.32377	0.73047	0.24116	0.31711	0.82168	0.26462	0.31184
1.22	0.67305	0.21743	0.32347	0.67373	0.22129	0.31782	0.72773	0.23579	0.31128	0.81855	0.25872	0.30610
1.24	0.67031	0.21255	0.31764	0.67031	0.21621	0.31202	0.72471	0.23052	0.30560	0.81562	0.25305	0.30054
1.26	0.66719	0.20776	0.31197	0.66875	0.21172	0.30647	0.72217	0.22554	0.30010	0.81250	0.24751	0.29513
1.28	0.66406	0.20312	0.30643	0.66641	0.20718	0.30101	0.72002	0.22080	0.29476	0.80996	0.24231	0.28991
1.30	0.66172	0.19883	0.30112	0.66328	0.20264	0.29570	0.71719	0.21606	0.28956	0.80781	0.23735	0.28483

FIGURE 37

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM PROPELLER RPM

FOR 4 BLADES AE/AO = 0.40, 0.60, 0.80, 1.00

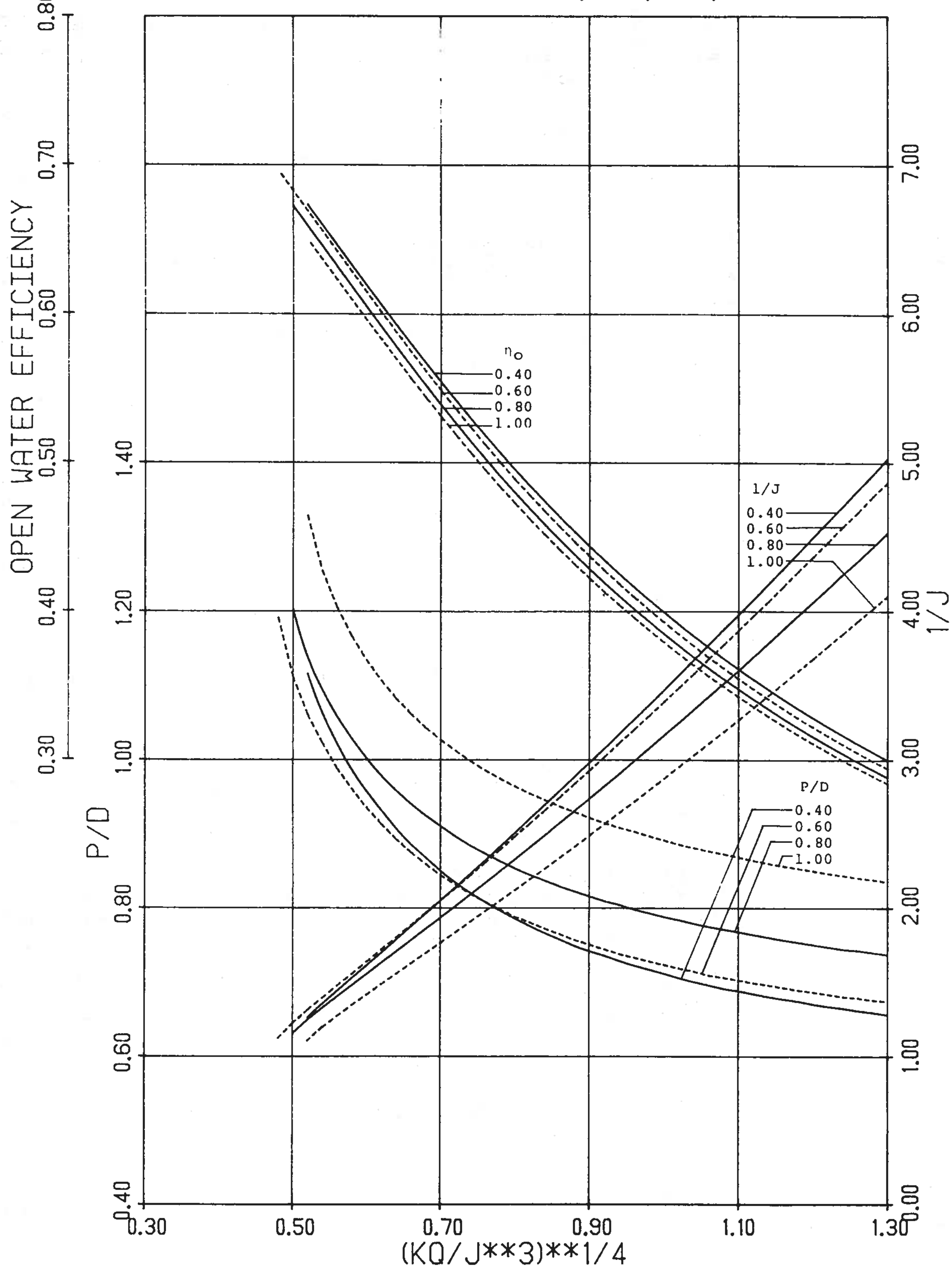


TABLE 35 1/4 WAGENINGEN B-SERIES PROPELLER DATA FOR 4 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)$	AE/AO = 0.40			AE/AO = 0.60			AE/AO = 0.80			AE/AO = 1.00		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44												
0.46												
0.48				1.19062	0.89092	0.69586						
0.50				1.11094	0.81826	0.68240	1.20234	0.86650	0.67251			
0.52	1.11562	0.79463	0.67309	1.06015	0.76455	0.66892	1.13828	0.80498	0.65893	1.32812	0.90522	0.64987
0.54	1.06250	0.74121	0.65947	1.02187	0.72002	0.65534	1.09375	0.75664	0.64537	1.25390	0.83916	0.63623
0.56	1.02119	0.69629	0.64590	0.98750	0.67959	0.64162	1.05781	0.71494	0.63171	1.20469	0.78887	0.62264
0.58	0.98594	0.65654	0.63235	0.96016	0.64472	0.62795	1.02812	0.67832	0.61805	1.16567	0.74599	0.60908
0.60	0.95703	0.62178	0.61890	0.93437	0.61221	0.61422	1.00156	0.64492	0.60440	1.13359	0.70845	0.59558
0.62	0.93125	0.59023	0.60557	0.91260	0.58320	0.60064	0.97812	0.61455	0.59084	1.10625	0.67485	0.58220
0.64	0.90703	0.56094	0.59233	0.89248	0.55635	0.58720	0.95820	0.58725	0.57747	1.08203	0.64424	0.56898
0.66	0.88594	0.53447	0.57929	0.87500	0.53193	0.57393	0.94023	0.56206	0.56426	1.06133	0.61655	0.55595
0.68	0.86797	0.51064	0.56650	0.85898	0.50933	0.56090	0.92422	0.53887	0.55128	1.04258	0.59097	0.54316
0.70	0.85000	0.48799	0.55388	0.84375	0.48809	0.54809	0.91016	0.51758	0.53858	1.02656	0.56767	0.53064
0.72	0.83437	0.46738	0.54156	0.83125	0.46899	0.53561	0.89648	0.49741	0.52616	1.01172	0.54590	0.51839
0.74	0.82031	0.44834	0.52948	0.81875	0.45078	0.52340	0.88437	0.47876	0.51402	0.99805	0.52554	0.50643
0.76	0.80781	0.43086	0.51775	0.80781	0.43398	0.51147	0.87344	0.46143	0.50222	0.98516	0.50635	0.49476
0.78	0.79609	0.41445	0.50628	0.79766	0.41826	0.49987	0.86328	0.44512	0.49071	0.97422	0.48877	0.48344
0.80	0.78516	0.39907	0.49507	0.78750	0.40322	0.48855	0.85351	0.42969	0.47953	0.96367	0.47207	0.47243
0.82	0.77500	0.38467	0.48416	0.77969	0.38975	0.47764	0.84453	0.41519	0.46865	0.95391	0.45635	0.46173
0.84	0.76562	0.37119	0.47355	0.77148	0.37666	0.46696	0.83672	0.40171	0.45810	0.94531	0.44170	0.45135
0.86	0.75703	0.35859	0.46327	0.76406	0.36445	0.45665	0.82891	0.38882	0.44787	0.93652	0.42759	0.44127
0.88	0.74844	0.34658	0.45328	0.75625	0.35259	0.44657	0.82207	0.37681	0.43798	0.92891	0.41445	0.43151
0.90	0.74141	0.33555	0.44358	0.75000	0.34175	0.43684	0.81543	0.36533	0.42837	0.92109	0.40176	0.42203
0.92	0.73516	0.32519	0.43415	0.74375	0.33135	0.42738	0.80898	0.35439	0.41906	0.91406	0.38984	0.41286
0.94	0.72812	0.31509	0.42500	0.73750	0.32139	0.41822	0.80391	0.34434	0.41007	0.90781	0.37866	0.40400
0.96	0.72187	0.30561	0.41611	0.73242	0.31221	0.40939	0.79766	0.33428	0.40130	0.90254	0.36821	0.39543
0.98	0.71641	0.29678	0.40753	0.72734	0.30337	0.40080	0.79258	0.32500	0.39285	0.89648	0.35791	0.38709
1.00	0.71094	0.28828	0.39918	0.72266	0.29502	0.39250	0.78750	0.31606	0.38465	0.89101	0.34819	0.37904
1.02	0.70508	0.27998	0.39100	0.71797	0.28696	0.38442	0.78320	0.30771	0.37674	0.88555	0.33882	0.37121
1.04	0.69990	0.27227	0.38317	0.71406	0.27944	0.37662	0.77851	0.29956	0.36905	0.88086	0.33003	0.36366
1.06	0.69531	0.26494	0.37552	0.70859	0.27178	0.36900	0.77422	0.29180	0.36158	0.87656	0.32168	0.35635
1.08	0.69062	0.25791	0.36813	0.70547	0.26504	0.36169	0.77070	0.28457	0.35441	0.87266	0.31372	0.34925
1.10	0.68750	0.25151	0.36099	0.70195	0.25845	0.35460	0.76719	0.27759	0.34743	0.86836	0.30596	0.34239
1.12	0.68359	0.24517	0.35403	0.69805	0.25195	0.34765	0.76328	0.27075	0.34066	0.86406	0.29844	0.33570
1.14	0.67969	0.23906	0.34728	0.69531	0.24604	0.34102	0.75976	0.26426	0.33409	0.86016	0.29131	0.32925
1.16	0.67656	0.23335	0.34073	0.69189	0.24014	0.33451	0.75625	0.25796	0.32769	0.85664	0.28452	0.32299
1.18	0.67344	0.22783	0.33436	0.68857	0.23447	0.32821	0.75312	0.25200	0.32152	0.85337	0.27803	0.31693
1.20	0.66953	0.22236	0.32818	0.68594	0.22915	0.32210	0.75000	0.24624	0.31553	0.85000	0.27173	0.31105
1.22	0.66641	0.21724	0.32218	0.68281	0.22393	0.31619	0.74687	0.24067	0.30971	0.84648	0.26558	0.30531
1.24	0.66406	0.21245	0.31637	0.67969	0.21885	0.31041	0.74375	0.23530	0.30408	0.84375	0.25984	0.29978
1.26	0.66094	0.20767	0.31070	0.67812	0.21431	0.30486	0.74219	0.23047	0.29864	0.84062	0.25420	0.29441
1.28	0.65859	0.20322	0.30524	0.67500	0.20957	0.29943	0.73945	0.22554	0.29335	0.83813	0.24888	0.28919
1.30	0.65547	0.19873	0.29985	0.67344	0.20532	0.29419	0.73672	0.22073	0.28816	0.83516	0.24360	0.28410

FIGURE 38

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM PROPELLER RPM
FOR 4 BLADES AE/AO = 0.45, 0.65, 0.85, 1.05

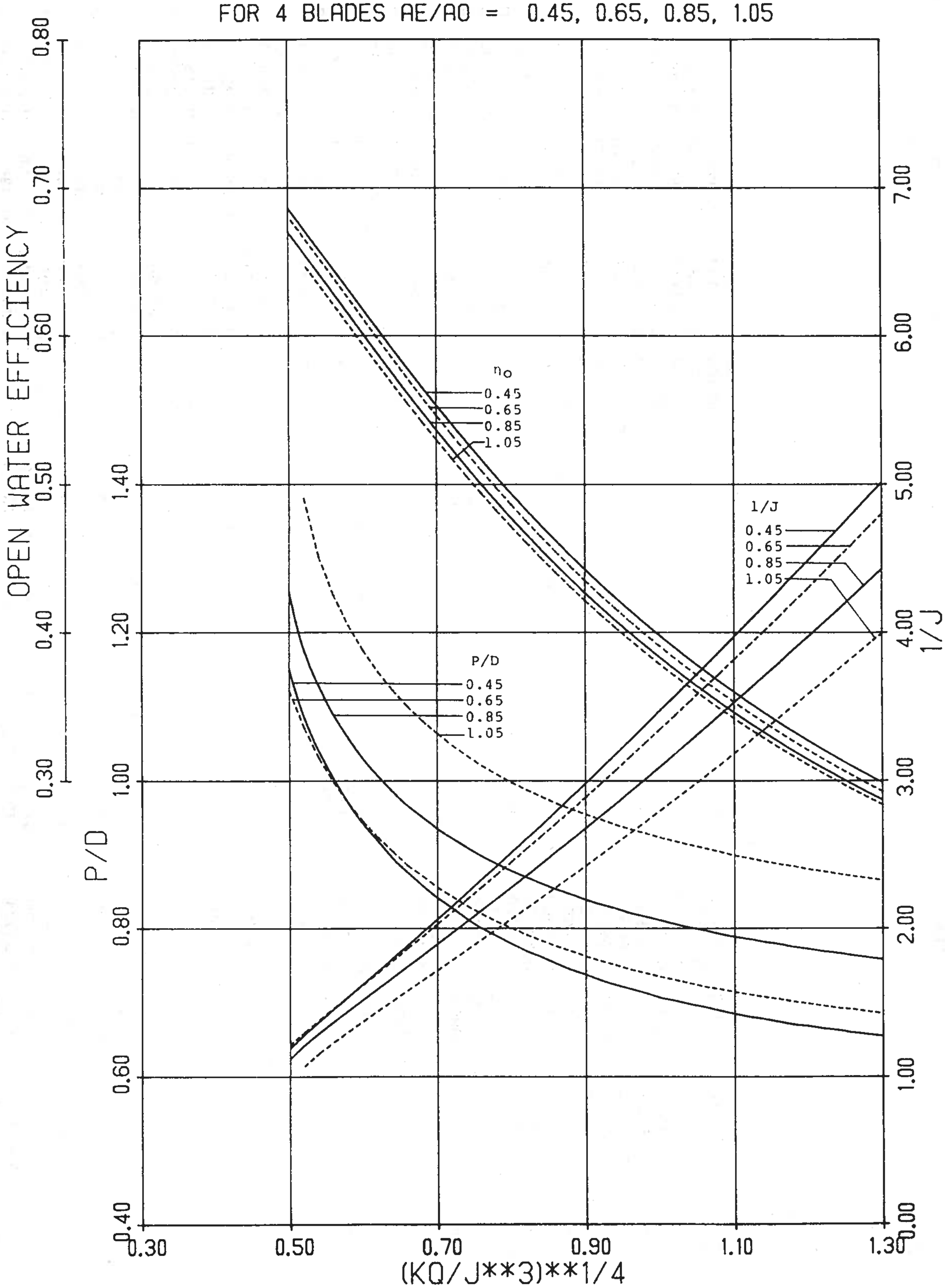


TABLE 36 WAGENINGEN B-SERIES PROPELLER DATA FOR 4 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.45			AE/AO = 0.65			AE/AO = 0.85			AE/AO = 1.05		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44												
0.46												
0.48												
0.50	1.14844	0.84013	0.68607	1.11953	0.82236	0.68034	1.25312	0.89394	0.66989			
0.52	1.08437	0.77861	0.67251	1.07031	0.76953	0.66687	1.17500	0.82441	0.65622	1.38046	0.93310	0.64850
0.54	1.03877	0.72949	0.65897	1.02969	0.72373	0.65324	1.12656	0.77363	0.64265	1.30156	0.86357	0.63495
0.56	1.00156	0.68701	0.64539	0.99687	0.68418	0.63954	1.08750	0.72998	0.62901	1.25000	0.81138	0.62140
0.58	0.96875	0.64883	0.63181	0.96875	0.64883	0.62579	1.05625	0.69228	0.61538	1.20859	0.76675	0.60788
0.60	0.94062	0.61474	0.61826	0.94424	0.61699	0.61211	1.02851	0.65801	0.60176	1.17495	0.72793	0.59441
0.62	0.91719	0.58457	0.60487	0.92236	0.58789	0.59850	1.00547	0.62759	0.58828	1.14609	0.69316	0.58105
0.64	0.89375	0.55586	0.59153	0.90312	0.56142	0.58508	0.98437	0.59946	0.57494	1.12109	0.66177	0.56787
0.66	0.87500	0.53066	0.57846	0.88437	0.53633	0.57174	0.96562	0.57363	0.56177	1.09922	0.63315	0.55486
0.68	0.85703	0.50703	0.56557	0.87031	0.51455	0.55875	0.95000	0.55039	0.54887	1.07969	0.60683	0.54209
0.70	0.84062	0.48516	0.55289	0.85469	0.49307	0.54593	0.93437	0.52817	0.53620	1.06289	0.58286	0.52960
0.72	0.82656	0.46533	0.54054	0.84219	0.47388	0.53342	0.92109	0.50791	0.52380	1.04687	0.56025	0.51737
0.74	0.81211	0.44629	0.52840	0.82969	0.45557	0.52119	0.90859	0.48887	0.51171	1.03281	0.53940	0.50543
0.76	0.79922	0.42871	0.51654	0.81875	0.43867	0.50925	0.89687	0.47100	0.49994	1.01953	0.51977	0.49381
0.78	0.78906	0.41299	0.50505	0.80859	0.42290	0.49769	0.88672	0.45449	0.48849	1.00781	0.50156	0.48249
0.80	0.77851	0.39785	0.49382	0.79961	0.40820	0.48640	0.87715	0.43892	0.47735	0.99687	0.48442	0.47149
0.82	0.76875	0.38369	0.48290	0.79062	0.39419	0.47545	0.86855	0.42436	0.46654	0.98711	0.46846	0.46084
0.84	0.76094	0.37080	0.47230	0.78281	0.38115	0.46479	0.86016	0.41050	0.45605	0.97793	0.45332	0.45047
0.86	0.75195	0.35811	0.46195	0.77539	0.36885	0.45448	0.85234	0.39741	0.44586	0.96875	0.43882	0.44041
0.88	0.74375	0.34619	0.45187	0.76875	0.35732	0.44448	0.84551	0.38520	0.43601	0.96113	0.42544	0.43068
0.90	0.73711	0.33535	0.44220	0.76172	0.34614	0.43476	0.83828	0.37334	0.42641	0.95391	0.41274	0.42127
0.92	0.72969	0.32471	0.43273	0.75547	0.33564	0.42532	0.83203	0.36230	0.41716	0.94687	0.40059	0.41212
0.94	0.72344	0.31484	0.42356	0.75000	0.32588	0.41624	0.82656	0.35195	0.40820	0.93984	0.38892	0.40326
0.96	0.71797	0.30561	0.41468	0.74375	0.31621	0.40735	0.82031	0.34175	0.39949	0.93359	0.37793	0.39467
0.98	0.71250	0.29678	0.40606	0.73906	0.30742	0.39881	0.81562	0.33242	0.39108	0.92812	0.36763	0.38639
1.00	0.70625	0.28809	0.39768	0.73437	0.29897	0.39052	0.81055	0.32334	0.38292	0.92227	0.35757	0.37833
1.02	0.70234	0.28037	0.38961	0.73008	0.29097	0.38249	0.80547	0.31460	0.37502	0.91719	0.34814	0.37056
1.04	0.69766	0.27275	0.38175	0.72578	0.28325	0.37469	0.80078	0.30630	0.36736	0.91230	0.33911	0.36302
1.06	0.69375	0.26562	0.37414	0.72109	0.27573	0.36714	0.79687	0.29853	0.35997	0.90781	0.33052	0.35572
1.08	0.68906	0.25859	0.36676	0.71797	0.26890	0.35983	0.79219	0.29082	0.35277	0.90312	0.32217	0.34863
1.10	0.68476	0.25190	0.35958	0.71406	0.26211	0.35273	0.78828	0.28359	0.34581	0.89805	0.31401	0.34175
1.12	0.68086	0.24556	0.35262	0.71074	0.25576	0.34591	0.78516	0.27686	0.33909	0.89453	0.30657	0.33512
1.14	0.67773	0.23960	0.34585	0.70742	0.24961	0.33925	0.78135	0.27017	0.33256	0.89023	0.29917	0.32867
1.16	0.67412	0.23379	0.33932	0.70469	0.24380	0.33279	0.77851	0.26396	0.32625	0.88672	0.29224	0.32243
1.18	0.67031	0.22812	0.33295	0.70107	0.23799	0.32650	0.77461	0.25767	0.32006	0.88359	0.28564	0.31640
1.20	0.66797	0.22300	0.32682	0.69844	0.23262	0.32044	0.77187	0.25190	0.31411	0.87969	0.27905	0.31050
1.22	0.66484	0.21787	0.32083	0.69531	0.22729	0.31451	0.76875	0.24624	0.30834	0.87681	0.27295	0.30482
1.24	0.66250	0.21309	0.31504	0.69219	0.22217	0.30877	0.76641	0.24094	0.30273	0.87344	0.26692	0.29928
1.26	0.65937	0.20830	0.30939	0.69062	0.21758	0.30327	0.76328	0.23564	0.29729	0.87031	0.26113	0.29390
1.28	0.65703	0.20381	0.30389	0.68760	0.21279	0.29785	0.76074	0.23064	0.29200	0.86758	0.25564	0.28870
1.30	0.65469	0.19951	0.29860	0.68516	0.20830	0.29262	0.75801	0.22576	0.28687	0.86484	0.25032	0.28365

FIGURE 39
WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM PROPELLER RPM
FOR 5 BLADES AE/AO = 0.30, 0.50, 0.70, 0.90

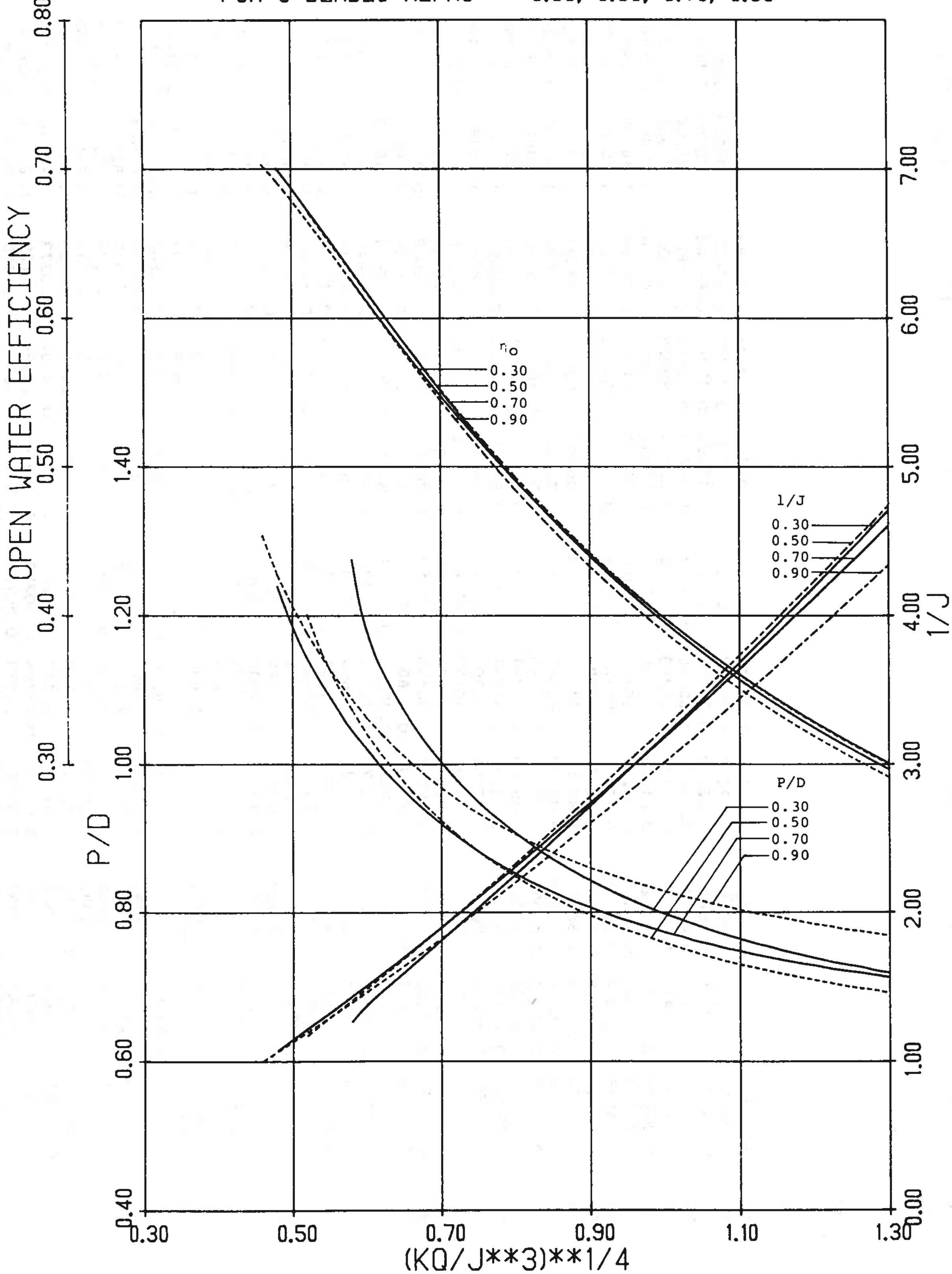


TABLE 37 WAGENINGEN B-SERIES PROPELLER DATA FOR 5 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.30			AE/AO = 0.50			AE/AO = 0.70			AE/AO = 0.90		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44												
0.46										1.30722	0.99795	0.70276
0.48							1.23906	0.92998	0.70043	1.25429	0.93535	0.69133
0.50							1.18594	0.87012	0.68738	1.21289	0.88242	0.67908
0.52				1.20078	0.85112	0.67251	1.14297	0.81875	0.67392	1.17617	0.83467	0.66616
0.54				1.14883	0.79643	0.65882	1.10781	0.77412	0.66020	1.14375	0.79155	0.65281
0.56				1.10781	0.74990	0.64509	1.07578	0.73330	0.64631	1.11445	0.75210	0.63918
0.58	1.27500	0.78965	0.62593	1.07344	0.70898	0.63139	1.04531	0.69521	0.63232	1.08789	0.71587	0.62539
0.60	1.17968	0.72558	0.61211	1.04062	0.67090	0.61773	1.02031	0.66172	0.61845	1.06250	0.68193	0.61157
0.62	1.12812	0.68056	0.59869	1.01250	0.63691	0.60424	0.99531	0.62978	0.60461	1.04062	0.65127	0.59786
0.64	1.09062	0.64326	0.58563	0.98779	0.60615	0.59094	0.97402	0.60112	0.59100	1.02031	0.62275	0.58427
0.66	1.05703	0.60937	0.57281	0.96406	0.57734	0.57781	0.95391	0.57432	0.57757	1.00117	0.59604	0.57085
0.68	1.02812	0.57900	0.56028	0.94297	0.55107	0.56494	0.93574	0.54966	0.56441	0.98359	0.57124	0.55767
0.70	1.00273	0.55146	0.54801	0.92344	0.52676	0.55235	0.91894	0.52671	0.55151	0.96797	0.54839	0.54476
0.72	0.97930	0.52607	0.53602	0.90547	0.50420	0.53999	0.90312	0.50522	0.53889	0.95312	0.52690	0.53215
0.74	0.95859	0.50293	0.52434	0.88984	0.48369	0.52801	0.88906	0.48545	0.52661	0.93906	0.50669	0.51984
0.76	0.93906	0.48135	0.51293	0.87412	0.46406	0.51624	0.87539	0.46670	0.51461	0.92656	0.48799	0.50786
0.78	0.92227	0.46172	0.50183	0.86094	0.44629	0.50482	0.86328	0.44936	0.50292	0.91562	0.47070	0.49622
0.80	0.90625	0.44331	0.49101	0.84766	0.42930	0.49366	0.85176	0.43306	0.49158	0.90469	0.45415	0.48487
0.82	0.89141	0.42617	0.48048	0.83516	0.41338	0.48282	0.84062	0.41758	0.48053	0.89433	0.43852	0.47386
0.84	0.87734	0.41006	0.47020	0.82422	0.39868	0.47229	0.83125	0.40342	0.46984	0.88457	0.42378	0.46318
0.86	0.86484	0.39521	0.46026	0.81406	0.38491	0.46207	0.82187	0.38984	0.45944	0.87559	0.40991	0.45281
0.88	0.85312	0.38125	0.45057	0.80430	0.37187	0.45214	0.81328	0.37715	0.44939	0.86719	0.39683	0.44277
0.90	0.84219	0.36811	0.44113	0.79531	0.35962	0.44247	0.80586	0.36533	0.43963	0.85937	0.38447	0.43304
0.92	0.83203	0.35581	0.43198	0.78672	0.34805	0.43313	0.79824	0.35395	0.43016	0.85312	0.37314	0.42365
0.94	0.82207	0.34414	0.42312	0.77812	0.33691	0.42400	0.79101	0.34316	0.42098	0.84609	0.36201	0.41452
0.96	0.81328	0.33320	0.41445	0.77148	0.32686	0.41523	0.78476	0.33311	0.41210	0.83945	0.35142	0.40566
0.98	0.80469	0.32285	0.40608	0.76484	0.31719	0.40668	0.77851	0.32344	0.40347	0.83359	0.34150	0.39712
1.00	0.79687	0.31309	0.39792	0.75781	0.30781	0.39838	0.77226	0.31416	0.39511	0.82734	0.33184	0.38881
1.02	0.78984	0.30395	0.39005	0.75156	0.29902	0.39034	0.76719	0.30557	0.38702	0.82187	0.32275	0.38077
1.04	0.78281	0.29517	0.38237	0.74560	0.29062	0.38251	0.76094	0.29697	0.37915	0.81719	0.31426	0.37300
1.06	0.77578	0.28677	0.37493	0.73984	0.28262	0.37492	0.75664	0.28926	0.37157	0.81172	0.30586	0.36546
1.08	0.76953	0.27886	0.36769	0.73437	0.27500	0.36757	0.75156	0.28159	0.36417	0.80781	0.29819	0.35818
1.10	0.76367	0.27134	0.36067	0.72969	0.26787	0.36046	0.74766	0.27456	0.35708	0.80273	0.29048	0.35108
1.12	0.75781	0.26411	0.35383	0.72539	0.26108	0.35355	0.74297	0.26753	0.35011	0.79844	0.28325	0.34422
1.14	0.75312	0.25742	0.34724	0.72080	0.25449	0.34684	0.73906	0.26099	0.34341	0.79531	0.27661	0.33763
1.16	0.74766	0.25078	0.34076	0.71641	0.24819	0.34034	0.73506	0.25464	0.33689	0.79141	0.26997	0.33117
1.18	0.74297	0.24458	0.33453	0.71250	0.24219	0.33399	0.73135	0.24858	0.33057	0.78750	0.26357	0.32493
1.20	0.73828	0.23857	0.32843	0.70859	0.23643	0.32786	0.72822	0.24287	0.32444	0.78359	0.25737	0.31885
1.22	0.73359	0.23281	0.32252	0.70469	0.23086	0.32189	0.72422	0.23716	0.31848	0.78066	0.25164	0.31298
1.24	0.72969	0.22739	0.31679	0.70078	0.22549	0.31610	0.72109	0.23184	0.31271	0.77656	0.24580	0.30726
1.26	0.72656	0.22231	0.31125	0.69766	0.22046	0.31048	0.71875	0.22686	0.30711	0.77422	0.24058	0.30174
1.28	0.72187	0.21714	0.30583	0.69531	0.21577	0.30506	0.71562	0.22187	0.30166	0.77129	0.23540	0.29639
1.30	0.71875	0.21240	0.30057	0.69141	0.21089	0.29970	0.71250	0.21704	0.29635	0.76797	0.23027	0.29115

FIGURE 40

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM PROPELLER RPM
FOR 5 BLADES AE/AO = 0.35, 0.55, 0.75, 0.95

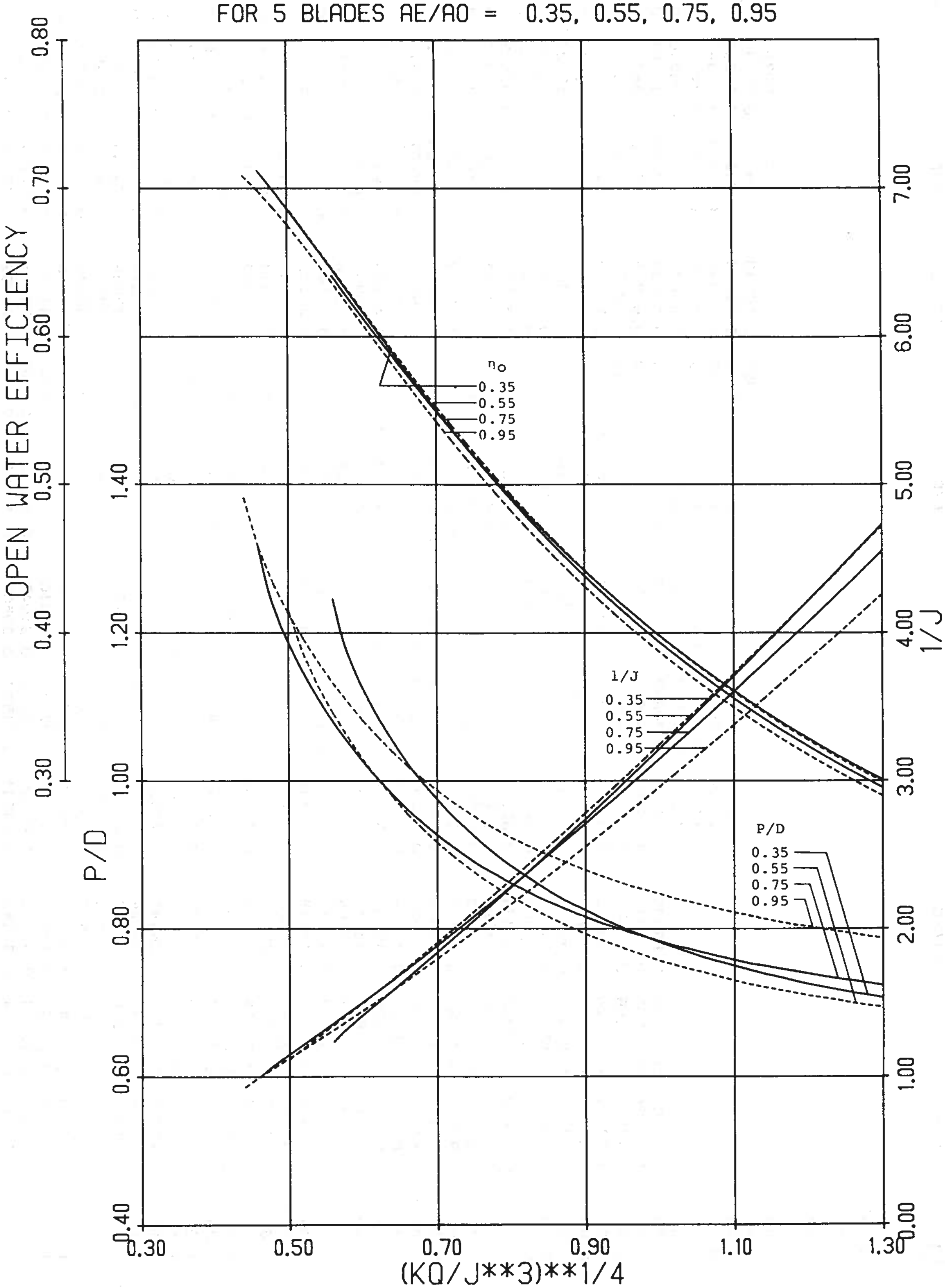


TABLE 38 WAGENINGEN B-SERIES PROPELLER DATA FOR 5 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.35			AE/AO = 0.55			AE/AO = 0.75			AE/AO = 0.95		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44										1.38125	1.07607	0.70817
0.46							1.31250	1.00381	0.71164	1.31406	1.00127	0.69840
0.48							1.23594	0.92724	0.69917	1.26562	0.94121	0.68748
0.50				1.23047	0.89658	0.68714	1.18633	0.86953	0.68622	1.22656	0.88955	0.67561
0.52				1.17187	0.83584	0.67359	1.14570	0.81963	0.67283	1.19219	0.84297	0.66299
0.54				1.12734	0.78535	0.65988	1.11055	0.77510	0.65912	1.16015	0.79990	0.64984
0.56	1.24531	0.81011	0.64085	1.09062	0.74140	0.64612	1.07890	0.73457	0.64523	1.13125	0.76045	0.63634
0.58	1.17109	0.75058	0.62701	1.05820	0.70181	0.63235	1.05117	0.69800	0.63129	1.10547	0.72451	0.62272
0.60	1.12422	0.70517	0.61347	1.02812	0.66533	0.61863	1.02539	0.66411	0.61736	1.08086	0.69077	0.60899
0.62	1.08594	0.66572	0.60017	1.00156	0.63232	0.60505	1.00195	0.63296	0.60354	1.05884	0.65986	0.59535
0.64	1.05312	0.63052	0.58707	0.97812	0.60234	0.59164	0.98105	0.60444	0.58988	1.03828	0.63105	0.58183
0.66	1.02344	0.59844	0.57422	0.95469	0.57383	0.57839	0.96094	0.57764	0.57643	1.01953	0.60434	0.56847
0.68	0.99766	0.56953	0.56163	0.93525	0.54844	0.56545	0.94336	0.55317	0.56323	1.00234	0.57954	0.55534
0.70	0.97500	0.54331	0.54932	0.91641	0.52451	0.55275	0.92656	0.53017	0.55029	0.98672	0.55654	0.54250
0.72	0.95312	0.51875	0.53729	0.89922	0.50239	0.54032	0.91133	0.50889	0.53766	0.97187	0.53486	0.52991
0.74	0.93437	0.49648	0.52552	0.88359	0.48193	0.52820	0.89687	0.48887	0.52531	0.95859	0.51479	0.51765
0.76	0.91601	0.47549	0.51404	0.86875	0.46274	0.51638	0.88359	0.47021	0.51329	0.94531	0.49560	0.50568
0.78	0.89922	0.45605	0.50284	0.85547	0.44502	0.50487	0.87266	0.45332	0.50164	0.93359	0.47783	0.49404
0.80	0.88437	0.43818	0.49193	0.84297	0.42837	0.49366	0.86094	0.43682	0.49024	0.92266	0.46113	0.48273
0.82	0.87109	0.42168	0.48134	0.83164	0.41289	0.48276	0.85088	0.42168	0.47921	0.91308	0.44565	0.47178
0.84	0.85781	0.40596	0.47101	0.82070	0.39824	0.47217	0.84062	0.40713	0.46850	0.90371	0.43091	0.46115
0.86	0.84531	0.39121	0.46097	0.81094	0.38462	0.46188	0.83203	0.39375	0.45810	0.89531	0.41709	0.45082
0.88	0.83437	0.37759	0.45122	0.80156	0.37173	0.45190	0.82344	0.38096	0.44803	0.88691	0.40386	0.44082
0.90	0.82500	0.36504	0.44178	0.79219	0.35937	0.44218	0.81562	0.36894	0.43826	0.87910	0.39136	0.43112
0.92	0.81484	0.35283	0.43257	0.78476	0.34814	0.43278	0.80781	0.35742	0.42877	0.87187	0.37954	0.42172
0.94	0.80547	0.34136	0.42361	0.77734	0.33740	0.42367	0.80156	0.34687	0.41963	0.86484	0.36826	0.41262
0.96	0.79687	0.33057	0.41490	0.76992	0.32710	0.41482	0.79453	0.33647	0.41070	0.85781	0.35742	0.40379
0.98	0.78906	0.32051	0.40653	0.76328	0.31743	0.40623	0.78867	0.32686	0.40208	0.85254	0.34756	0.39528
1.00	0.78125	0.31079	0.39830	0.75625	0.30806	0.39790	0.78281	0.31763	0.39375	0.84687	0.33794	0.38702
1.02	0.77422	0.30171	0.39037	0.75078	0.29946	0.38983	0.77695	0.30874	0.38564	0.84062	0.32852	0.37900
1.04	0.76758	0.29307	0.38264	0.74531	0.29121	0.38201	0.77226	0.30054	0.37783	0.83633	0.32002	0.37127
1.06	0.76094	0.28481	0.37518	0.74062	0.28350	0.37445	0.76719	0.29253	0.37024	0.83125	0.31160	0.36376
1.08	0.75547	0.27715	0.36794	0.73516	0.27588	0.36710	0.76250	0.28491	0.36287	0.82656	0.30361	0.35650
1.10	0.75000	0.26973	0.36085	0.73008	0.26860	0.35992	0.75781	0.27759	0.35574	0.82187	0.29590	0.34944
1.12	0.74453	0.26265	0.35403	0.72500	0.26162	0.35297	0.75312	0.27051	0.34880	0.81797	0.28867	0.34262
1.14	0.73906	0.25581	0.34736	0.72109	0.25518	0.34626	0.75000	0.26411	0.34214	0.81328	0.28149	0.33599
1.16	0.73476	0.24946	0.34090	0.71719	0.24897	0.33976	0.74609	0.25771	0.33562	0.80937	0.27476	0.32956
1.18	0.72969	0.24321	0.33463	0.71328	0.24297	0.33342	0.74258	0.25166	0.32933	0.80547	0.26826	0.32334
1.20	0.72500	0.23726	0.32853	0.70937	0.23721	0.32729	0.73906	0.24580	0.32321	0.80273	0.26228	0.31733
1.22	0.72109	0.23164	0.32258	0.70625	0.23179	0.32133	0.73555	0.24014	0.31727	0.79922	0.25630	0.31147
1.24	0.71719	0.22627	0.31686	0.70312	0.22656	0.31554	0.73232	0.23472	0.31148	0.79609	0.25063	0.30582
1.26	0.71328	0.22104	0.31124	0.69922	0.22134	0.30988	0.72969	0.22964	0.30591	0.79297	0.24512	0.30028
1.28	0.71016	0.21616	0.30582	0.69609	0.21645	0.30441	0.72656	0.22458	0.30045	0.78984	0.23979	0.29493
1.30	0.70664	0.21138	0.30053	0.69375	0.21191	0.29914	0.72344	0.21973	0.29519	0.78691	0.23469	0.28974

FIGURE 41

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM PROPELLER RPM

FOR 5 BLADES AE/AO = 0.40, 0.60, 0.80, 1.00

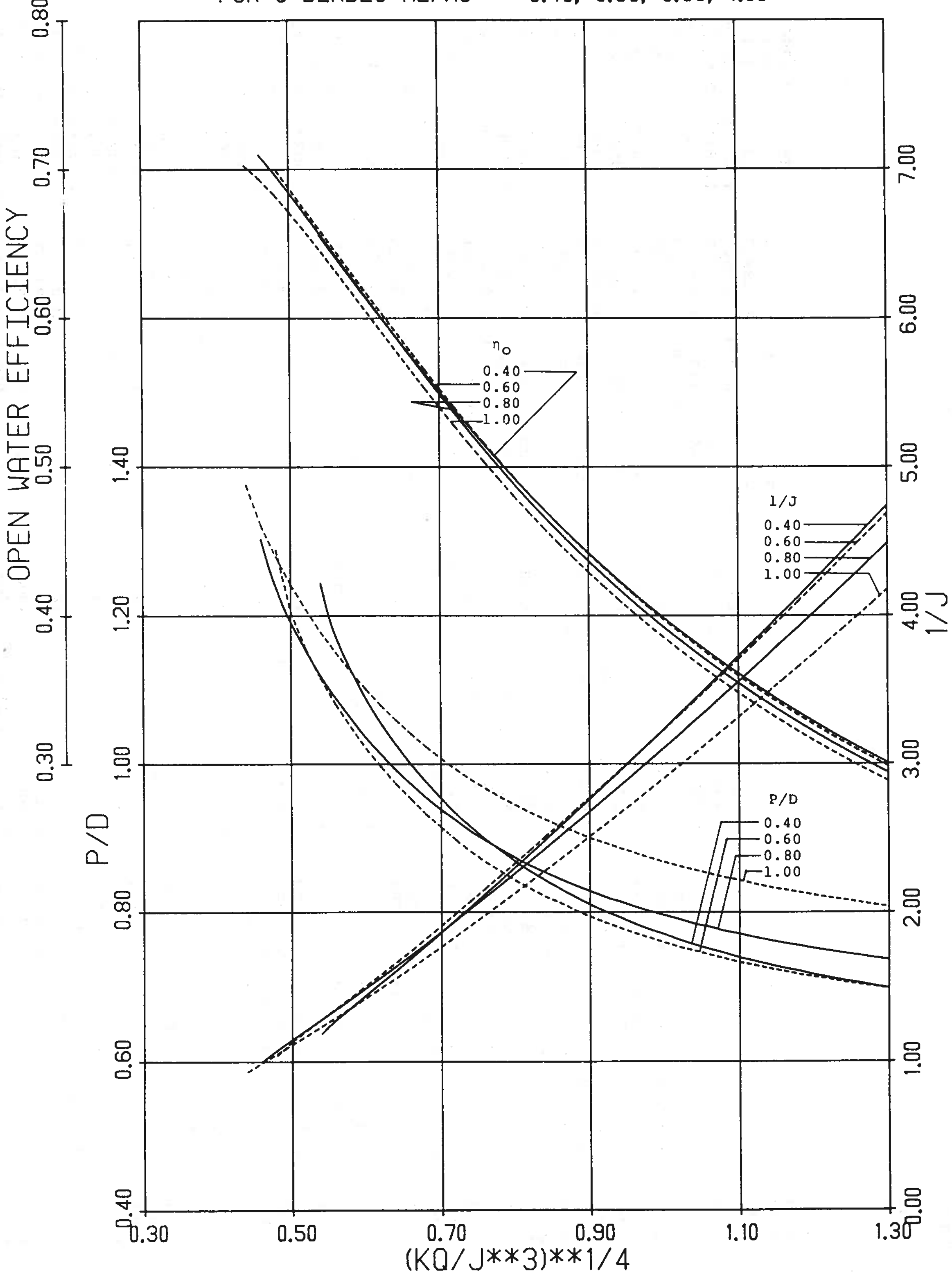


TABLE 39 WAGENINGEN B-SERIES PROPELLER DATA FOR 5 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.40			AE/AO = 0.60			AE/AO = 0.80			AE/AO = 1.00		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44										1.37578	1.07197	0.70216
0.46							1.30273	0.99707	0.70938	1.32148	1.00498	0.69336
0.48				1.28828	0.95937	0.70111	1.23789	0.92744	0.69720	1.27910	0.94844	0.68311
0.50				1.20469	0.88203	0.68777	1.19062	0.87119	0.68442	1.24179	0.89756	0.67169
0.52				1.15547	0.82666	0.67426	1.15312	0.82314	0.67117	1.20859	0.85146	0.65941
0.54	1.24375	0.84101	0.65605	1.11484	0.77861	0.66054	1.11797	0.77861	0.65750	1.17734	0.80859	0.64650
0.56	1.17187	0.77930	0.64218	1.07969	0.73574	0.64669	1.08828	0.73916	0.64370	1.15000	0.76982	0.63324
0.58	1.12656	0.73242	0.62855	1.04922	0.69741	0.63286	1.06094	0.70273	0.62977	1.12412	0.73359	0.61974
0.60	1.08750	0.69072	0.61502	1.02031	0.66172	0.61904	1.03496	0.66870	0.61584	1.10029	0.70010	0.60619
0.62	1.05390	0.65361	0.60169	0.99531	0.62964	0.60538	1.01235	0.63789	0.60203	1.07812	0.66889	0.59263
0.64	1.02500	0.62041	0.58856	0.97187	0.59980	0.59186	0.99077	0.60898	0.58834	1.05820	0.64018	0.57920
0.66	0.99844	0.58989	0.57564	0.95156	0.57285	0.57860	0.97187	0.58266	0.57489	1.03984	0.61348	0.56594
0.68	0.97500	0.56221	0.56299	0.93125	0.54717	0.56554	0.95391	0.55796	0.56168	1.02265	0.58848	0.55288
0.70	0.95312	0.53652	0.55058	0.91406	0.52402	0.55277	0.93789	0.53520	0.54873	1.00683	0.56518	0.54007
0.72	0.93242	0.51260	0.53844	0.89687	0.50195	0.54025	0.92344	0.51416	0.53611	0.99219	0.54341	0.52755
0.74	0.91445	0.49082	0.52657	0.88125	0.48154	0.52803	0.90840	0.49380	0.52374	0.97851	0.52300	0.51533
0.76	0.89766	0.47056	0.51501	0.86719	0.46269	0.51615	0.89609	0.47544	0.51173	0.96641	0.50410	0.50344
0.78	0.88281	0.45195	0.50376	0.85478	0.44531	0.50457	0.88437	0.45810	0.50003	0.95464	0.48613	0.49184
0.80	0.86797	0.43423	0.49276	0.84219	0.42866	0.49330	0.87305	0.44170	0.48867	0.94414	0.46943	0.48060
0.82	0.85469	0.41787	0.48208	0.83125	0.41333	0.48234	0.86250	0.42627	0.47762	0.93379	0.45347	0.46965
0.84	0.84258	0.40264	0.47169	0.82070	0.39883	0.47170	0.85312	0.41191	0.46690	0.92441	0.43852	0.45904
0.86	0.83125	0.38833	0.46158	0.81250	0.38574	0.46141	0.84433	0.39839	0.45652	0.91562	0.42441	0.44875
0.88	0.82031	0.37480	0.45175	0.80234	0.37256	0.45134	0.83594	0.38555	0.44644	0.90781	0.41123	0.43880
0.90	0.81016	0.36211	0.44221	0.79375	0.36045	0.44160	0.82812	0.37344	0.43668	0.89922	0.39829	0.42910
0.92	0.80078	0.35019	0.43294	0.78594	0.34912	0.43219	0.82031	0.36182	0.42720	0.89297	0.38667	0.41978
0.94	0.79297	0.33926	0.42399	0.77891	0.33848	0.42304	0.81406	0.35117	0.41805	0.88594	0.37524	0.41072
0.96	0.78437	0.32852	0.41521	0.77187	0.32827	0.41417	0.80742	0.34082	0.40916	0.87969	0.36450	0.40194
0.98	0.77695	0.31860	0.40677	0.76562	0.31870	0.40557	0.80117	0.33101	0.40056	0.87305	0.35405	0.39342
1.00	0.77031	0.30928	0.39857	0.75937	0.30952	0.39723	0.79570	0.32178	0.39221	0.86719	0.34424	0.38518
1.02	0.76289	0.30010	0.39053	0.75312	0.30068	0.38912	0.79023	0.31294	0.38416	0.86152	0.33486	0.37721
1.04	0.75654	0.29160	0.38280	0.74844	0.29263	0.38130	0.78437	0.30430	0.37630	0.85664	0.32607	0.36951
1.06	0.75078	0.28359	0.37532	0.74297	0.28467	0.37369	0.78047	0.29653	0.36875	0.85156	0.31753	0.36202
1.08	0.74531	0.27593	0.36801	0.73789	0.27710	0.36630	0.77500	0.28862	0.36138	0.84687	0.30942	0.35479
1.10	0.73935	0.26846	0.36091	0.73281	0.26982	0.35914	0.77109	0.28144	0.35430	0.84297	0.30181	0.34778
1.12	0.73447	0.26152	0.35405	0.72891	0.26313	0.35225	0.76650	0.27432	0.34738	0.83789	0.29414	0.34095
1.14	0.72969	0.25488	0.34740	0.72451	0.25654	0.34552	0.76250	0.26758	0.34066	0.83359	0.28696	0.33437
1.16	0.72500	0.24849	0.34091	0.72070	0.25034	0.33901	0.75859	0.26113	0.33419	0.83008	0.28022	0.32798
1.18	0.72109	0.24248	0.33461	0.71650	0.24424	0.33265	0.75537	0.25508	0.32792	0.82656	0.27373	0.32180
1.20	0.71641	0.23652	0.32847	0.71328	0.23857	0.32650	0.75156	0.24907	0.32180	0.82305	0.26746	0.31580
1.22	0.71250	0.23096	0.32254	0.71016	0.23315	0.32056	0.74844	0.24346	0.31590	0.81953	0.26138	0.30997
1.24	0.70859	0.22559	0.31678	0.70625	0.22773	0.31476	0.74512	0.23796	0.31015	0.81665	0.25566	0.30433
1.26	0.70547	0.22056	0.31120	0.70312	0.22266	0.30912	0.74228	0.23276	0.30457	0.81343	0.25005	0.29884
1.28	0.70156	0.21553	0.30572	0.70078	0.21792	0.30368	0.73906	0.22764	0.29914	0.81016	0.24460	0.29351
1.30	0.69844	0.21084	0.30045	0.69766	0.21318	0.29837	0.73672	0.22290	0.29391	0.80703	0.23936	0.28833

FIGURE 42

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM PROPELLER RPM

FOR 5 BLADES AE/AO = 0.45, 0.65, 0.85, 1.05

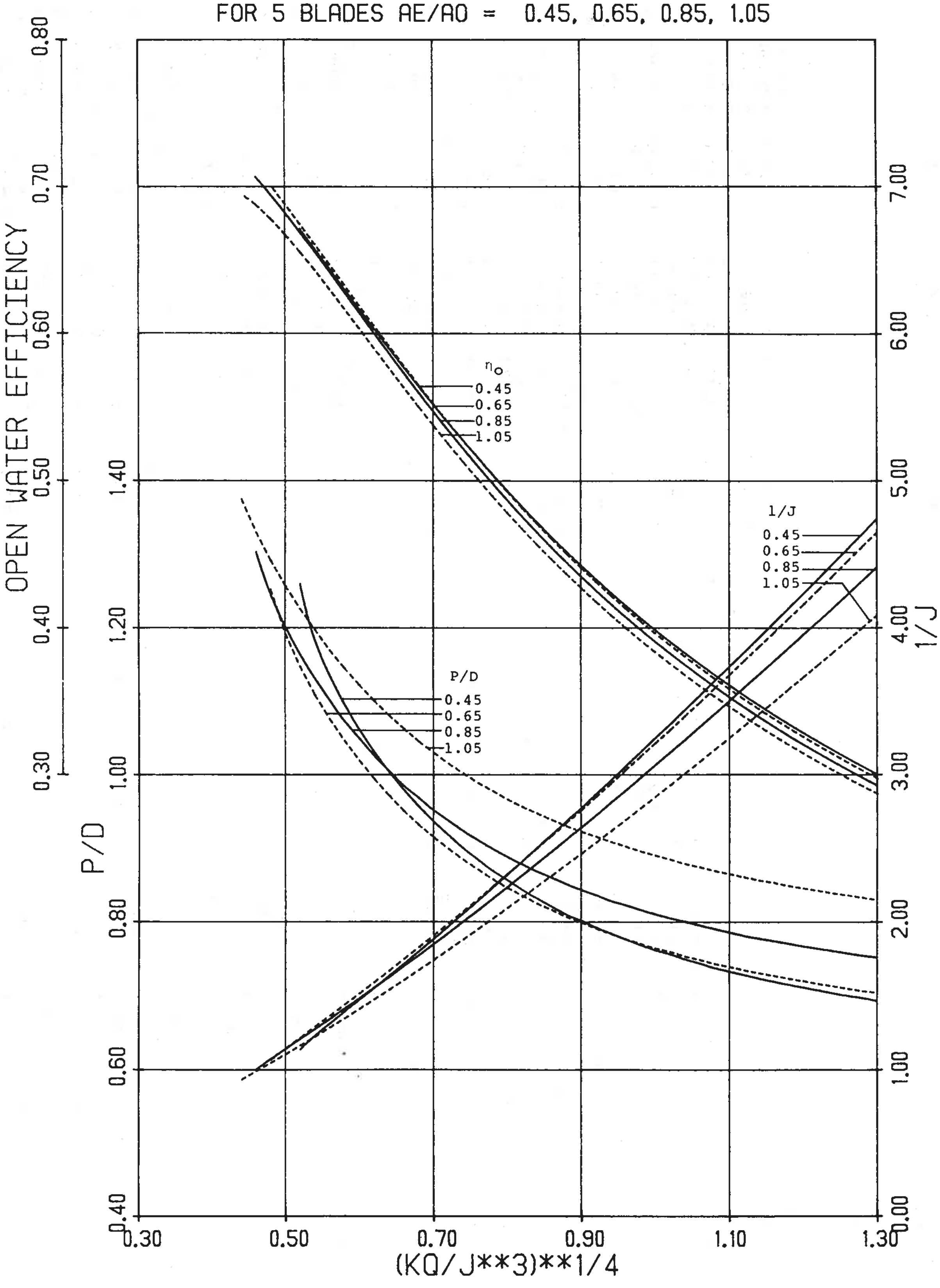


TABLE 40 WAGENINGEN B-SERIES PROPELLER DATA FOR 5 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.45 P/D	AE/AO = 0.45 J	AE/AO = 0.45 ETA-O	AE/AO = 0.65 P/D	AE/AO = 0.65 J	AE/AO = 0.65 ETA-O	AE/AO = 0.85 P/D	AE/AO = 0.85 J	AE/AO = 0.85 ETA-O	AE/AO = 1.05 P/D	AE/AO = 1.05 J	AE/AO = 1.05 ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44										1.37500	1.07084	0.69538
0.46							1.30312	0.99639	0.70643	1.32968	1.00927	0.68770
0.48				1.25195	0.93828	0.70105	1.24492	0.93066	0.69458	1.29140	0.95498	0.67820
0.50				1.19101	0.87373	0.68788	1.20078	0.87627	0.68205	1.25703	0.90561	0.66735
0.52	1.25937	0.88017	0.67128	1.14687	0.82148	0.67440	1.16328	0.82812	0.66891	1.22539	0.86015	0.65548
0.54	1.18281	0.81308	0.65746	1.10781	0.77451	0.66063	1.13008	0.78467	0.65540	1.19648	0.81836	0.64292
0.56	1.13437	0.76250	0.64374	1.07539	0.73335	0.64678	1.10039	0.74512	0.64165	1.16875	0.77910	0.62987
0.58	1.09492	0.71870	0.63007	1.04531	0.69541	0.63288	1.07187	0.70801	0.62775	1.14438	0.74346	0.61661
0.60	1.06064	0.67959	0.61651	1.01845	0.66084	0.61900	1.04844	0.67519	0.61391	1.12109	0.70996	0.60320
0.62	1.03047	0.64433	0.60311	0.99375	0.62900	0.60525	1.02495	0.64385	0.60009	1.09980	0.67900	0.58981
0.64	1.00312	0.61211	0.58987	0.97109	0.59966	0.59167	1.00449	0.61538	0.58645	1.07969	0.64995	0.57646
0.66	0.97891	0.58291	0.57690	0.95000	0.57241	0.57830	0.98437	0.58838	0.57299	1.06172	0.62319	0.56329
0.68	0.95625	0.55576	0.56411	0.93125	0.54746	0.56517	0.96797	0.56426	0.55981	1.04453	0.59800	0.55032
0.70	0.93594	0.53096	0.55163	0.91406	0.52436	0.55233	0.95117	0.54106	0.54687	1.02910	0.57466	0.53759
0.72	0.91719	0.50791	0.53937	0.89844	0.50298	0.53977	0.93691	0.51997	0.53424	1.01445	0.55268	0.52514
0.74	0.89922	0.48633	0.52740	0.88359	0.48291	0.52752	0.92266	0.49980	0.52189	1.00117	0.53223	0.51299
0.76	0.88359	0.46665	0.51576	0.87031	0.46435	0.51558	0.91016	0.48125	0.50989	0.98828	0.51279	0.50112
0.78	0.86875	0.44819	0.50441	0.85703	0.44663	0.50393	0.89844	0.46382	0.49822	0.97734	0.49497	0.48961
0.80	0.85586	0.43125	0.49335	0.84531	0.43027	0.49260	0.88750	0.44741	0.48685	0.96601	0.47773	0.47837
0.82	0.84297	0.41514	0.48260	0.83516	0.41523	0.48164	0.87754	0.43208	0.47582	0.95605	0.46177	0.46750
0.84	0.83125	0.40010	0.47211	0.82422	0.40054	0.47092	0.86797	0.41753	0.46511	0.94687	0.44673	0.45695
0.86	0.82031	0.38603	0.46196	0.81562	0.38730	0.46059	0.85937	0.40395	0.45475	0.93828	0.43252	0.44671
0.88	0.80937	0.37256	0.45204	0.80625	0.37436	0.45051	0.85078	0.39092	0.44467	0.92969	0.41885	0.43675
0.90	0.80156	0.36064	0.44249	0.79883	0.36260	0.44076	0.84297	0.37871	0.43493	0.92207	0.40610	0.42714
0.92	0.79219	0.34878	0.43316	0.79062	0.35107	0.43128	0.83594	0.36724	0.42549	0.91504	0.39404	0.41782
0.94	0.78437	0.33789	0.42415	0.78359	0.34043	0.42215	0.82812	0.35596	0.41630	0.90820	0.38252	0.40880
0.96	0.77656	0.32744	0.41537	0.77656	0.33018	0.41324	0.82266	0.34590	0.40749	0.90195	0.37163	0.40006
0.98	0.76875	0.31743	0.40684	0.77031	0.32056	0.40461	0.81641	0.33594	0.39887	0.89531	0.36103	0.39158
1.00	0.76172	0.30801	0.39854	0.76406	0.31153	0.39625	0.81055	0.32651	0.39055	0.88984	0.35122	0.38341
1.02	0.75625	0.29941	0.39057	0.75937	0.30293	0.38820	0.80508	0.31758	0.38252	0.88437	0.34175	0.37546
1.04	0.74941	0.29082	0.38279	0.75312	0.29438	0.38032	0.80039	0.30918	0.37472	0.87871	0.33257	0.36776
1.06	0.74375	0.28281	0.37522	0.74844	0.28662	0.37274	0.79531	0.30098	0.36714	0.87422	0.32407	0.36033
1.08	0.73750	0.27500	0.36788	0.74297	0.27891	0.36533	0.79062	0.29321	0.35984	0.86914	0.31572	0.35311
1.10	0.73281	0.26787	0.36080	0.73906	0.27192	0.35823	0.78594	0.28569	0.35272	0.86484	0.30789	0.34614
1.12	0.72812	0.26099	0.35390	0.73437	0.26494	0.35125	0.78125	0.27847	0.34583	0.86055	0.30032	0.33937
1.14	0.72344	0.25435	0.34719	0.73047	0.25845	0.34454	0.77754	0.27173	0.33915	0.85625	0.29302	0.33280
1.16	0.71904	0.24805	0.34071	0.72685	0.25225	0.33803	0.77402	0.26531	0.33271	0.85312	0.28628	0.32647
1.18	0.71484	0.24199	0.33438	0.72295	0.24619	0.33170	0.77031	0.25903	0.32643	0.84883	0.27944	0.32027
1.20	0.71094	0.23623	0.32826	0.71953	0.24048	0.32559	0.76660	0.25298	0.32034	0.84531	0.27307	0.31431
1.22	0.70703	0.23066	0.32231	0.71562	0.23481	0.31959	0.76348	0.24729	0.31447	0.84219	0.26699	0.30852
1.24	0.70312	0.22529	0.31652	0.71250	0.22954	0.31381	0.76035	0.24177	0.30874	0.83867	0.26101	0.30288
1.26	0.69980	0.22021	0.31090	0.70937	0.22441	0.30817	0.75703	0.23638	0.30316	0.83594	0.25542	0.29744
1.28	0.69687	0.21543	0.30549	0.70625	0.21948	0.30271	0.75410	0.23127	0.29778	0.83281	0.24990	0.29212
1.30	0.69297	0.21055	0.30013	0.70391	0.21489	0.29745	0.75156	0.22642	0.29256	0.82969	0.24458	0.28698

FIGURE 43

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM PROPELLER RPM
FOR 6 BLADES AE/AO = 0.30, 0.50, 0.70, 0.90

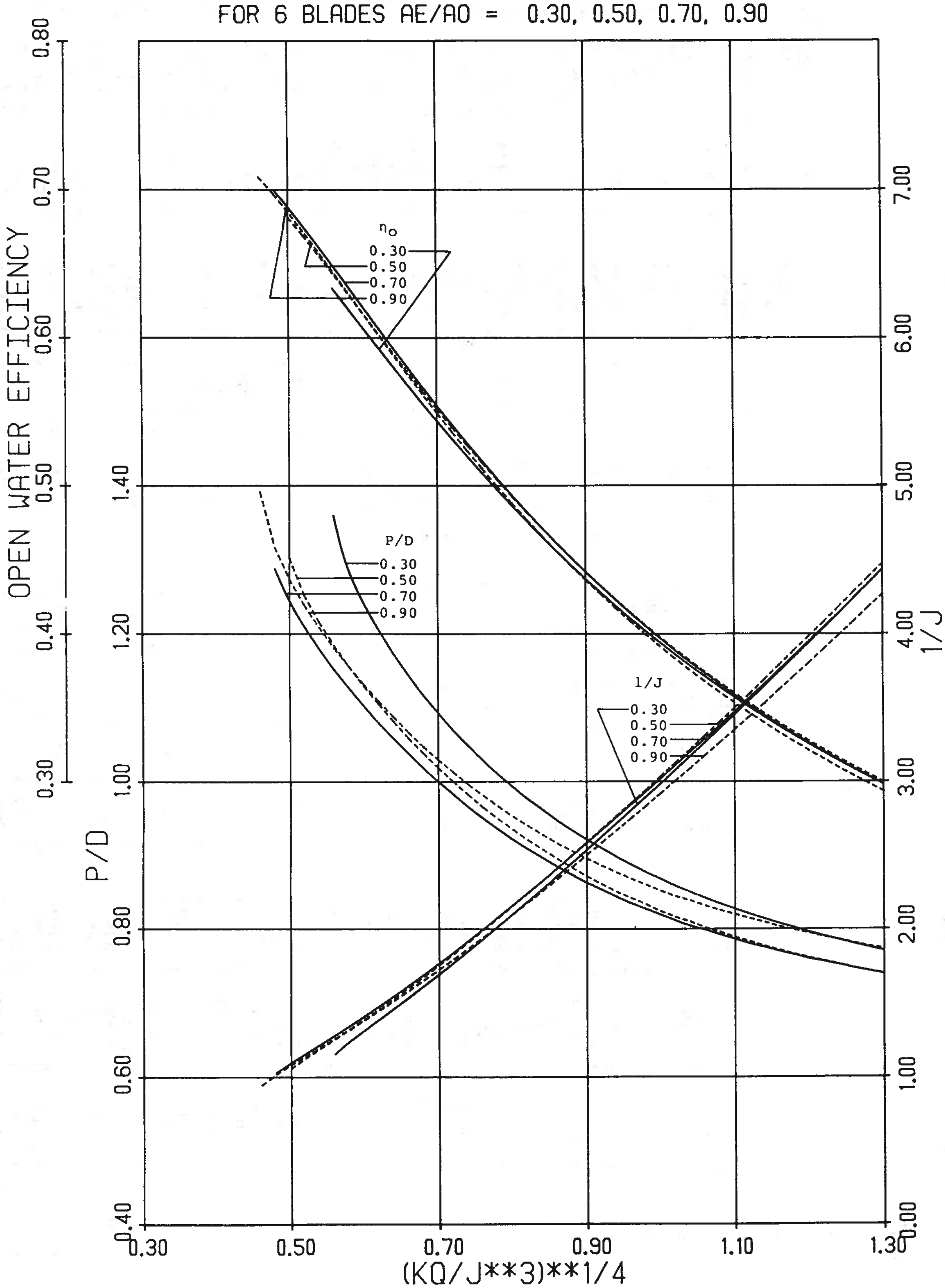


TABLE 41 WAGENINGEN B-SERIES PROPELLER DATA FOR 6 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.30 P/D	AE/AO = 0.30 J	AE/AO = 0.30 ETA-O	AE/AO = 0.50 P/D	AE/AO = 0.50 J	AE/AO = 0.50 ETA-O	AE/AO = 0.70 P/D	AE/AO = 0.70 J	AE/AO = 0.70 ETA-O	AE/AO = 0.90 P/D	AE/AO = 0.90 J	AE/AO = 0.90 ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44												
0.46										1.39101	1.05810	0.70859
0.48							1.28750	0.96953	0.69992	1.31601	0.98086	0.69713
0.50				1.30156	0.94687	0.68145	1.24375	0.91289	0.68815	1.27285	0.92519	0.68505
0.52				1.25156	0.88818	0.66933	1.20937	0.86426	0.67559	1.23828	0.87695	0.67223
0.54				1.21562	0.83965	0.65670	1.17929	0.82031	0.66241	1.20820	0.83345	0.65883
0.56	1.35937	0.86631	0.63323	1.18403	0.79580	0.64366	1.15156	0.77978	0.64882	1.18047	0.79326	0.64505
0.58	1.28593	0.80644	0.61997	1.15571	0.75586	0.63038	1.12656	0.74272	0.63507	1.15547	0.75644	0.63111
0.60	1.24140	0.76035	0.60688	1.12890	0.71875	0.61700	1.10239	0.70791	0.62122	1.13144	0.72182	0.61706
0.62	1.20547	0.72002	0.59388	1.10469	0.68476	0.60365	1.07929	0.67529	0.60738	1.10859	0.68945	0.60307
0.64	1.17304	0.68320	0.58099	1.08125	0.65293	0.59040	1.05820	0.64526	0.59372	1.08750	0.65942	0.58923
0.66	1.14414	0.64971	0.56828	1.05859	0.62305	0.57728	1.03750	0.61684	0.58022	1.06640	0.63081	0.57557
0.68	1.11719	0.61875	0.55579	1.03789	0.59551	0.56440	1.01797	0.59033	0.56697	1.04687	0.60420	0.56215
0.70	1.09297	0.59043	0.54355	1.01797	0.56968	0.55177	0.99922	0.56538	0.55396	1.02890	0.57949	0.54905
0.72	1.06953	0.56391	0.53158	0.99922	0.54560	0.53942	0.98203	0.54228	0.54129	1.01211	0.55640	0.53626
0.74	1.04844	0.53955	0.51989	0.98125	0.52300	0.52734	0.96484	0.52026	0.52890	0.99531	0.53432	0.52376
0.76	1.02812	0.51670	0.50848	0.96406	0.50176	0.51555	0.94922	0.49985	0.51685	0.98047	0.51401	0.51163
0.78	1.00937	0.49551	0.49737	0.94844	0.48213	0.50411	0.93437	0.48066	0.50512	0.96562	0.49458	0.49981
0.80	0.99219	0.47588	0.48658	0.93359	0.46367	0.49296	0.92031	0.46260	0.49370	0.95156	0.47632	0.48835
0.82	0.97578	0.45742	0.47607	0.91953	0.44634	0.48213	0.90742	0.44580	0.48266	0.93906	0.45937	0.47722
0.84	0.96094	0.44033	0.46587	0.90664	0.43018	0.47160	0.89531	0.42998	0.47192	0.92656	0.44316	0.46643
0.86	0.94609	0.42402	0.45592	0.89375	0.41475	0.46137	0.88359	0.41499	0.46150	0.91484	0.42793	0.45599
0.88	0.93281	0.40894	0.44629	0.88203	0.40039	0.45147	0.87266	0.40093	0.45143	0.90449	0.41377	0.44586
0.90	0.92031	0.39477	0.43695	0.87070	0.38677	0.44183	0.86211	0.38755	0.44162	0.89453	0.40034	0.43608
0.92	0.90859	0.38144	0.42788	0.86016	0.37397	0.43250	0.85273	0.37510	0.43213	0.88476	0.38750	0.42657
0.94	0.89687	0.36870	0.41904	0.85000	0.36182	0.42343	0.84336	0.36318	0.42295	0.87598	0.37549	0.41737
0.96	0.88633	0.35679	0.41046	0.84140	0.35063	0.41468	0.83437	0.35186	0.41403	0.86738	0.36401	0.40847
0.98	0.87617	0.34551	0.40215	0.83281	0.33989	0.40615	0.82656	0.34131	0.40539	0.85937	0.35317	0.39985
1.00	0.86719	0.33501	0.39412	0.82344	0.32939	0.39787	0.81875	0.33120	0.39703	0.85117	0.34268	0.39148
1.02	0.85781	0.32485	0.38629	0.81562	0.31973	0.38986	0.81094	0.32148	0.38892	0.84375	0.33281	0.38338
1.04	0.84951	0.31533	0.37869	0.80937	0.31084	0.38213	0.80391	0.31235	0.38106	0.83789	0.32378	0.37558
1.06	0.84140	0.30625	0.37131	0.80156	0.30190	0.37457	0.79844	0.30400	0.37348	0.83086	0.31475	0.36798
1.08	0.83359	0.29761	0.36415	0.79531	0.29370	0.36727	0.79180	0.29565	0.36610	0.82461	0.30625	0.36062
1.10	0.82656	0.28945	0.35720	0.78838	0.28564	0.36016	0.78594	0.28779	0.35893	0.81914	0.29829	0.35352
1.12	0.81953	0.28164	0.35047	0.78281	0.27822	0.35331	0.77969	0.28013	0.35197	0.81367	0.29060	0.34662
1.14	0.81328	0.27427	0.34392	0.77656	0.27090	0.34661	0.77500	0.27314	0.34527	0.80859	0.28330	0.33995
1.16	0.80703	0.26719	0.33757	0.77109	0.26401	0.34011	0.76953	0.26621	0.33874	0.80283	0.27607	0.33345
1.18	0.80156	0.26050	0.33140	0.76562	0.25737	0.33380	0.76474	0.25967	0.33239	0.79844	0.26943	0.32717
1.20	0.79531	0.25391	0.32537	0.76094	0.25117	0.32772	0.75937	0.25322	0.32622	0.79375	0.26294	0.32105
1.22	0.78984	0.24770	0.31953	0.75625	0.24517	0.32179	0.75557	0.24736	0.32028	0.78906	0.25669	0.31515
1.24	0.78476	0.24180	0.31387	0.75156	0.23936	0.31601	0.75156	0.24165	0.31449	0.78516	0.25081	0.30940
1.26	0.77969	0.23608	0.30834	0.74687	0.23376	0.31041	0.74687	0.23599	0.30885	0.78066	0.24499	0.30382
1.28	0.77500	0.23066	0.30300	0.74297	0.22852	0.30499	0.74297	0.23066	0.30338	0.77656	0.23945	0.29840
1.30	0.77031	0.22541	0.29779	0.73906	0.22341	0.29968	0.73906	0.22554	0.29809	0.77344	0.23433	0.29317

FIGURE 44

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM PROPELLER RPM

FOR 6 BLADES AE/AO = 0.35, 0.55, 0.75, 0.95

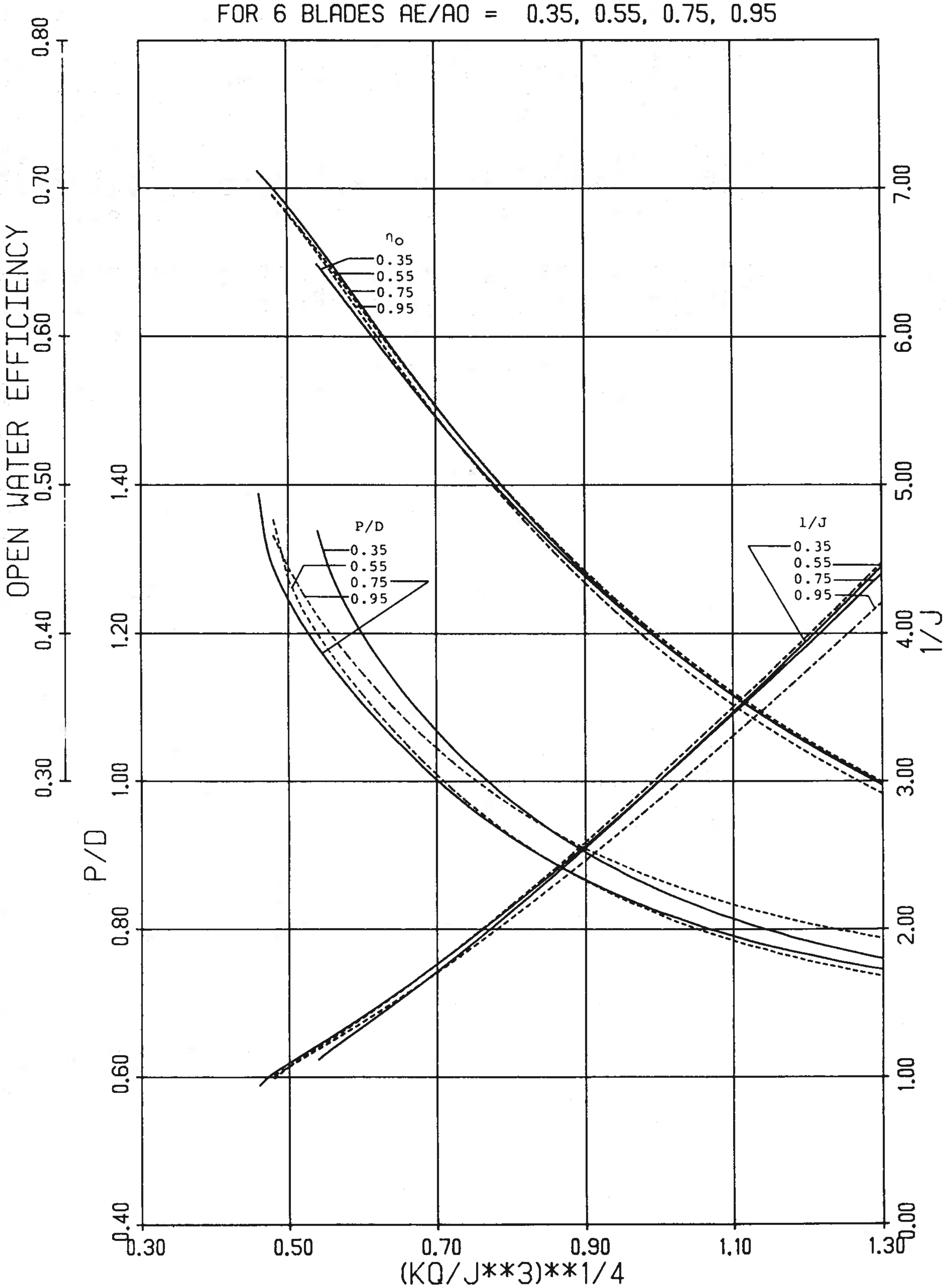


TABLE 42 WAGENINGEN B-SERIES PROPELLER DATA FOR 6 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.35			AE/AO = 0.55			AE/AO = 0.75			AE/AO = 0.95		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44												
0.46							1.38750	1.06074	0.71140			
0.48				1.35234	1.00859	0.69548	1.28750	0.96836	0.70017	1.33086	0.98779	0.69500
0.50				1.27187	0.93056	0.68387	1.24531	0.91289	0.68831	1.28808	0.93242	0.68290
0.52				1.23086	0.87715	0.67168	1.21094	0.86445	0.67564	1.25351	0.88418	0.67006
0.54	1.33750	0.89375	0.64857	1.19844	0.83096	0.65892	1.18086	0.82070	0.66236	1.22265	0.84023	0.65665
0.56	1.27578	0.83506	0.63563	1.16914	0.78872	0.64573	1.15390	0.78081	0.64873	1.19531	0.80024	0.64289
0.58	1.23418	0.78774	0.62262	1.14219	0.74985	0.63232	1.12890	0.74385	0.63487	1.17002	0.76318	0.62891
0.60	1.19941	0.74585	0.60956	1.11719	0.71396	0.61883	1.10464	0.70908	0.62093	1.14609	0.72861	0.61489
0.62	1.16855	0.70786	0.59654	1.09297	0.68027	0.60533	1.08227	0.67695	0.60707	1.12344	0.69624	0.60089
0.64	1.14062	0.67314	0.58363	1.07031	0.64902	0.59195	1.06015	0.64648	0.59330	1.10156	0.66577	0.58703
0.66	1.11406	0.64082	0.57084	1.04844	0.61968	0.57871	1.04062	0.61865	0.57976	1.08120	0.63740	0.57338
0.68	1.09043	0.61138	0.55830	1.02773	0.59233	0.56572	1.02031	0.59180	0.56641	1.06211	0.61089	0.55998
0.70	1.06758	0.58379	0.54598	1.00859	0.56699	0.55299	1.00156	0.56689	0.55336	1.04414	0.58608	0.54688
0.72	1.04609	0.55815	0.53394	0.99004	0.54311	0.54052	0.98437	0.54380	0.54063	1.02656	0.56255	0.53407
0.74	1.02578	0.53423	0.52215	0.97266	0.52085	0.52836	0.96797	0.52207	0.52820	1.01015	0.54053	0.52158
0.76	1.00781	0.51230	0.51068	0.95664	0.50015	0.51651	0.95234	0.50166	0.51611	0.99531	0.52012	0.50946
0.78	0.98984	0.49150	0.49949	0.94101	0.48057	0.50496	0.93809	0.48267	0.50435	0.98047	0.50059	0.49766
0.80	0.97305	0.47207	0.48858	0.92578	0.46206	0.49373	0.92422	0.46470	0.49294	0.96641	0.48218	0.48619
0.82	0.95781	0.45410	0.47802	0.91250	0.44507	0.48285	0.91133	0.44785	0.48185	0.95352	0.46499	0.47507
0.84	0.94297	0.43711	0.46773	0.89922	0.42881	0.47222	0.89922	0.43198	0.47106	0.94141	0.44883	0.46431
0.86	0.92891	0.42109	0.45769	0.88750	0.41382	0.46196	0.88769	0.41704	0.46064	0.92969	0.43345	0.45386
0.88	0.91601	0.40620	0.44799	0.87617	0.39961	0.45200	0.87656	0.40283	0.45050	0.91875	0.41899	0.44375
0.90	0.90391	0.39219	0.43856	0.86523	0.38613	0.44232	0.86641	0.38955	0.44069	0.90859	0.40537	0.43395
0.92	0.89219	0.37891	0.42940	0.85469	0.37334	0.43291	0.85664	0.37695	0.43120	0.89922	0.39258	0.42449
0.94	0.88203	0.36665	0.42055	0.84492	0.36133	0.42381	0.84746	0.36504	0.42198	0.89062	0.38052	0.41532
0.96	0.87109	0.35469	0.41189	0.83594	0.35005	0.41499	0.83906	0.35386	0.41308	0.88203	0.36894	0.40644
0.98	0.86172	0.34365	0.40353	0.82812	0.33955	0.40646	0.83086	0.34316	0.40443	0.87344	0.35781	0.39782
1.00	0.85234	0.33311	0.39543	0.81953	0.32925	0.39813	0.82305	0.33301	0.39605	0.86601	0.34746	0.38949
1.02	0.84375	0.32314	0.38755	0.81094	0.31938	0.39008	0.81641	0.32358	0.38796	0.85859	0.33750	0.38142
1.04	0.83584	0.31377	0.37991	0.80391	0.31030	0.38228	0.80937	0.31440	0.38009	0.85156	0.32803	0.37360
1.06	0.82803	0.30478	0.37249	0.79687	0.30156	0.37470	0.80234	0.30557	0.37245	0.84531	0.31914	0.36606
1.08	0.82031	0.29619	0.36529	0.79062	0.29336	0.36736	0.79639	0.29736	0.36509	0.83906	0.31055	0.35871
1.10	0.81406	0.28823	0.35831	0.78437	0.28550	0.36027	0.79062	0.28950	0.35793	0.83281	0.30229	0.35162
1.12	0.80703	0.28042	0.35151	0.77812	0.27788	0.35334	0.78467	0.28188	0.35100	0.82734	0.29453	0.34475
1.14	0.80078	0.27310	0.34495	0.77344	0.27095	0.34668	0.77930	0.27466	0.34424	0.82251	0.28721	0.33809
1.16	0.79531	0.26616	0.33854	0.76719	0.26387	0.34013	0.77451	0.26787	0.33774	0.81738	0.28005	0.33162
1.18	0.78867	0.25928	0.33232	0.76250	0.25742	0.33384	0.76973	0.26130	0.33141	0.81250	0.27322	0.32536
1.20	0.78359	0.25293	0.32628	0.75703	0.25103	0.32770	0.76562	0.25513	0.32529	0.80742	0.26655	0.31926
1.22	0.77812	0.24673	0.32040	0.75234	0.24502	0.32175	0.76094	0.24902	0.31932	0.80312	0.26033	0.31338
1.24	0.77344	0.24092	0.31472	0.74844	0.23940	0.31601	0.75625	0.24311	0.31351	0.79844	0.25420	0.30765
1.26	0.76875	0.23530	0.30918	0.74375	0.23379	0.31038	0.75234	0.23760	0.30791	0.79531	0.24863	0.30212
1.28	0.76406	0.22988	0.30380	0.73984	0.22852	0.30491	0.74844	0.23225	0.30245	0.79082	0.24294	0.29672
1.30	0.75976	0.22471	0.29857	0.73594	0.22344	0.29962	0.74531	0.22725	0.29717	0.78750	0.23770	0.29150

FIGURE 45

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM PROPELLER RPM

FOR 6 BLADES AE/AO = 0.40, 0.60, 0.80, 1.00

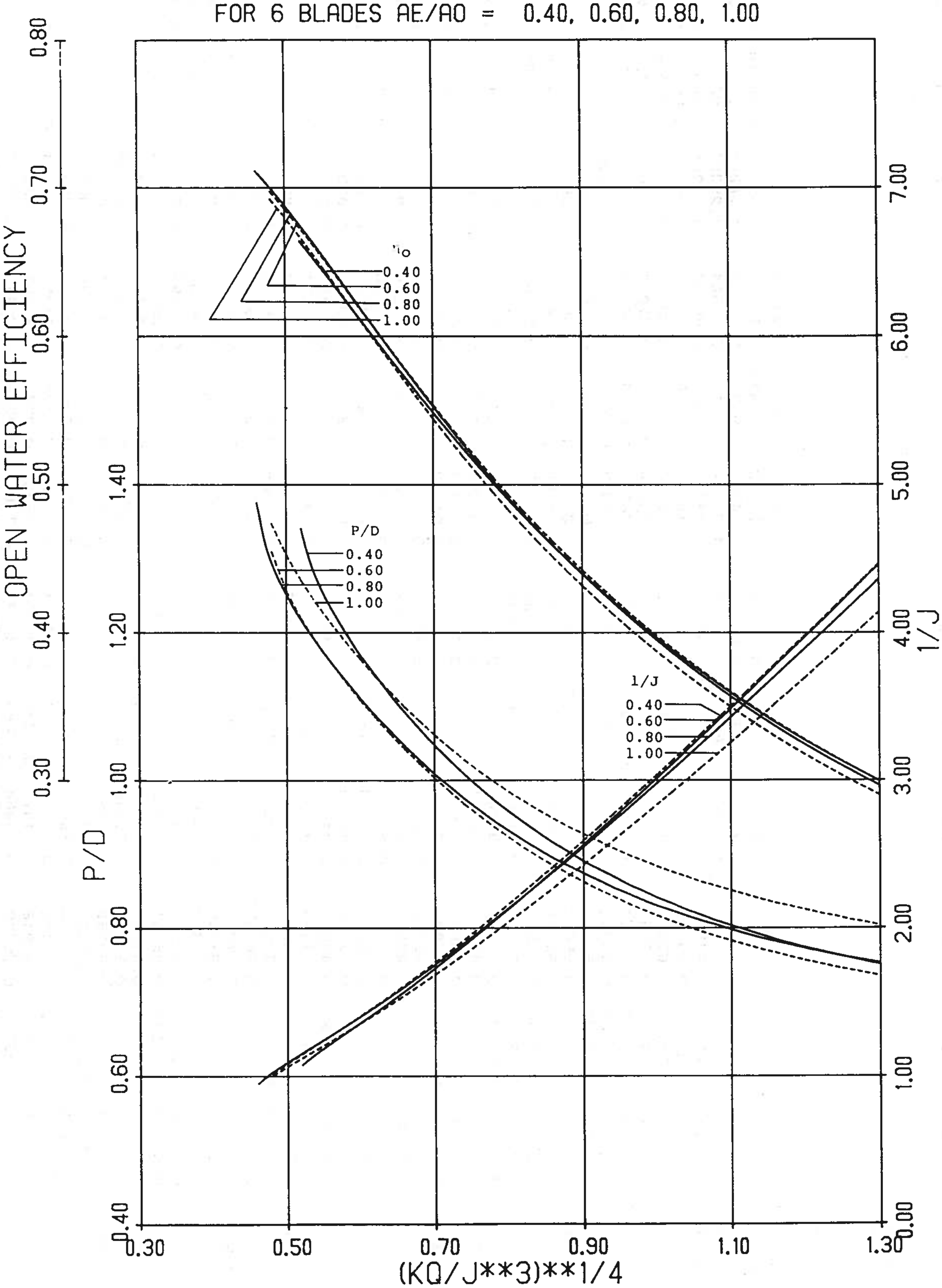


TABLE 43 1/4 WAGENINGEN B-SERIES PROPELLER DATA FOR 6 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)$	AE/AO = 0.40			AE/AO = 0.60			AE/AO = 0.80			AE/AO = 1.00		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44												
0.46							1.37539	1.05224	0.71105			
0.48				1.30937	0.98408	0.69747	1.29375	0.97075	0.69977	1.34746	0.99551	0.69241
0.50				1.25547	0.92099	0.68589	1.25078	0.91499	0.68781	1.30468	0.94013	0.68029
0.52	1.34062	0.93100	0.66388	1.21836	0.87012	0.67356	1.21640	0.86670	0.67506	1.27031	0.89199	0.66747
0.54	1.27461	0.86714	0.65126	1.18750	0.82519	0.66066	1.18672	0.82334	0.66175	1.23984	0.84824	0.65408
0.56	1.23340	0.81767	0.63841	1.15937	0.78393	0.64733	1.15937	0.78330	0.64802	1.21289	0.80840	0.64034
0.58	1.19961	0.77427	0.62540	1.13281	0.74560	0.63378	1.13462	0.74658	0.63413	1.18686	0.77090	0.62636
0.60	1.16875	0.73447	0.61226	1.10781	0.70996	0.62012	1.11055	0.71196	0.62014	1.16328	0.73638	0.61234
0.62	1.14219	0.69873	0.59918	1.08476	0.67710	0.60653	1.08750	0.67954	0.60620	1.14023	0.70376	0.59836
0.64	1.11562	0.66489	0.58615	1.06230	0.64614	0.59302	1.06660	0.64966	0.59240	1.11953	0.67373	0.58454
0.66	1.09140	0.63384	0.57329	1.04140	0.61743	0.57970	1.04585	0.62129	0.57879	1.09844	0.64492	0.57087
0.68	1.06875	0.60503	0.56064	1.02187	0.59072	0.56662	1.02676	0.59497	0.56543	1.07969	0.61846	0.55750
0.70	1.04687	0.57803	0.54821	1.00234	0.56533	0.55377	1.00781	0.56997	0.55234	1.06094	0.59316	0.54437
0.72	1.02676	0.55307	0.53606	0.98437	0.54180	0.54123	0.99141	0.54717	0.53959	1.04375	0.56968	0.53158
0.74	1.00762	0.52974	0.52418	0.96719	0.51968	0.52897	0.97461	0.52524	0.52712	1.02734	0.54756	0.51912
0.76	0.98984	0.50806	0.51261	0.95156	0.49922	0.51706	0.95937	0.50493	0.51500	1.01172	0.52671	0.50700
0.78	0.97266	0.48765	0.50133	0.93594	0.47969	0.50543	0.94433	0.48560	0.50320	0.99746	0.50727	0.49522
0.80	0.95703	0.46875	0.49038	0.92187	0.46162	0.49414	0.93066	0.46763	0.49175	0.98359	0.48882	0.48377
0.82	0.94219	0.45098	0.47970	0.90781	0.44438	0.48315	0.91777	0.45073	0.48064	0.97109	0.47168	0.47271
0.84	0.92773	0.43418	0.46932	0.89521	0.42842	0.47251	0.90547	0.43477	0.46986	0.95859	0.45522	0.46194
0.86	0.91445	0.41851	0.45923	0.88359	0.41348	0.46219	0.89375	0.41968	0.45939	0.94707	0.43979	0.45152
0.88	0.90234	0.40391	0.44946	0.87266	0.39941	0.45218	0.88359	0.40576	0.44928	0.93594	0.42515	0.44143
0.90	0.88984	0.38984	0.43994	0.86172	0.38594	0.44244	0.87344	0.39243	0.43948	0.92656	0.41167	0.43168
0.92	0.87930	0.37695	0.43074	0.85156	0.37329	0.43301	0.86406	0.37988	0.42997	0.91719	0.39873	0.42223
0.94	0.86914	0.36475	0.42181	0.84219	0.36138	0.42385	0.85430	0.36772	0.42073	0.90742	0.38618	0.41306
0.96	0.85859	0.35293	0.41310	0.83281	0.34998	0.41498	0.84609	0.35654	0.41183	0.89844	0.37436	0.40418
0.98	0.85000	0.34214	0.40471	0.82422	0.33926	0.40638	0.83750	0.34565	0.40315	0.89082	0.36343	0.39562
1.00	0.84062	0.33159	0.39652	0.81641	0.32920	0.39807	0.82969	0.33545	0.39478	0.88281	0.35278	0.38730
1.02	0.83281	0.32187	0.38861	0.80859	0.31953	0.38999	0.82305	0.32598	0.38669	0.87539	0.34272	0.37926
1.04	0.82422	0.31235	0.38090	0.80156	0.31045	0.38217	0.81601	0.31675	0.37883	0.86875	0.33325	0.37148
1.06	0.81689	0.30352	0.37344	0.79453	0.30171	0.37457	0.80937	0.30796	0.37120	0.86172	0.32402	0.36392
1.08	0.80937	0.29497	0.36618	0.78828	0.29351	0.36721	0.80391	0.29985	0.36387	0.85625	0.31558	0.35665
1.10	0.80312	0.28706	0.35917	0.78252	0.28574	0.36009	0.79766	0.29180	0.35669	0.85039	0.30732	0.34959
1.12	0.79687	0.27944	0.35236	0.77705	0.27832	0.35317	0.79180	0.28413	0.34974	0.84453	0.29936	0.34274
1.14	0.79062	0.27212	0.34574	0.77109	0.27104	0.34643	0.78652	0.27690	0.34302	0.83877	0.29170	0.33609
1.16	0.78437	0.26504	0.33928	0.76641	0.26436	0.33994	0.78164	0.27004	0.33652	0.83359	0.28445	0.32964
1.18	0.77891	0.25840	0.33304	0.76094	0.25771	0.33361	0.77695	0.26345	0.33020	0.82910	0.27764	0.32343
1.20	0.77344	0.25200	0.32697	0.75596	0.25142	0.32747	0.77226	0.25708	0.32406	0.82441	0.27100	0.31738
1.22	0.76875	0.24600	0.32111	0.75156	0.24546	0.32151	0.76797	0.25103	0.31811	0.81948	0.26450	0.31148
1.24	0.76406	0.24019	0.31538	0.74687	0.23965	0.31572	0.76348	0.24514	0.31234	0.81562	0.25850	0.30580
1.26	0.75937	0.23457	0.30981	0.74297	0.23418	0.31009	0.75957	0.23957	0.30674	0.81094	0.25249	0.30026
1.28	0.75469	0.22915	0.30439	0.73887	0.22888	0.30464	0.75625	0.23433	0.30132	0.80742	0.24695	0.29490
1.30	0.75078	0.22407	0.29916	0.73516	0.22383	0.29934	0.75234	0.22910	0.29601	0.80312	0.24141	0.28968

FIGURE 46

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM PROPELLER RPM

FOR 6 BLADES AE/AO = 0.45, 0.65, 0.85, 1.05

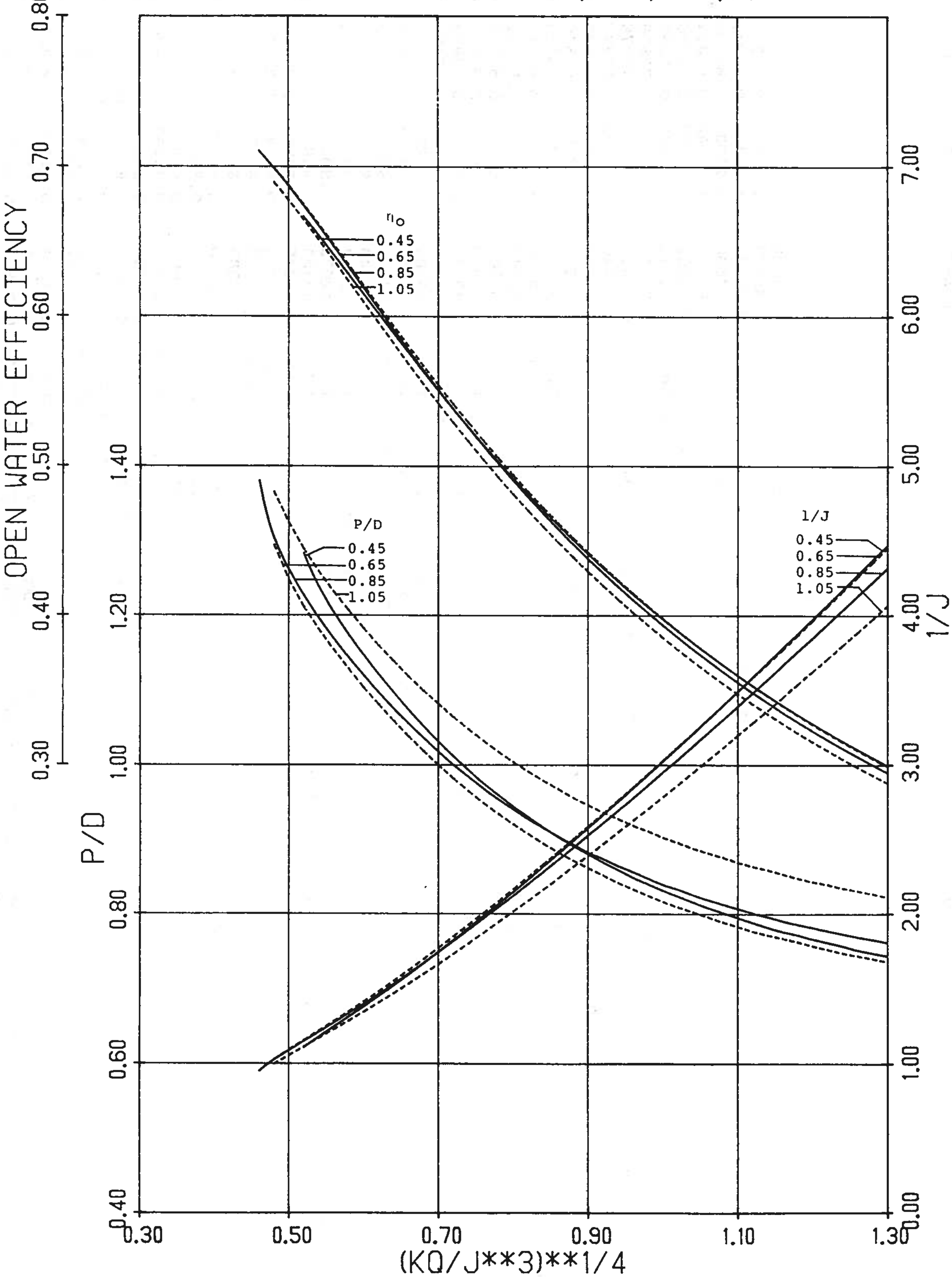


TABLE 44 WAGENINGEN B-SERIES PROPELLER DATA FOR 6 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.45			AE/AO = 0.65			AE/AO = 0.85			AE/AO = 1.05		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44												
0.46							1.34217	1.05341	0.71011			
0.48				1.29375	0.97422	0.69900	1.30312	0.97485	0.69874	1.36504	1.00351	0.68944
0.50				1.24648	0.91523	0.68733	1.26035	0.91933	0.68671	1.32343	0.94883	0.67737
0.52	1.28281	0.90390	0.66662	1.21094	0.86562	0.67487	1.22656	0.87148	0.67393	1.28867	0.90039	0.66454
0.54	1.23882	0.85078	0.65407	1.18125	0.82168	0.66183	1.19609	0.82773	0.66055	1.25859	0.85679	0.65118
0.56	1.20429	0.80503	0.64117	1.15390	0.78115	0.64839	1.16885	0.78779	0.64680	1.23125	0.81665	0.63744
0.58	1.17422	0.76377	0.62802	1.12812	0.74346	0.63471	1.14336	0.75073	0.63286	1.20625	0.77959	0.62351
0.60	1.14687	0.72602	0.61480	1.10312	0.70806	0.62094	1.11953	0.71626	0.61884	1.18237	0.74482	0.60950
0.62	1.12109	0.69101	0.60159	1.08047	0.67554	0.60722	1.09663	0.68389	0.60486	1.15937	0.71211	0.59553
0.64	1.09687	0.65849	0.58845	1.05859	0.64502	0.59362	1.07500	0.65366	0.59102	1.13867	0.68198	0.58173
0.66	1.07344	0.62803	0.57546	1.03750	0.61636	0.58020	1.05508	0.62563	0.57740	1.11797	0.65322	0.56810
0.68	1.05156	0.59980	0.56271	1.01797	0.58974	0.56701	1.03574	0.59917	0.56400	1.09883	0.62646	0.55473
0.70	1.03066	0.57339	0.55017	0.99902	0.56470	0.55410	1.01719	0.57427	0.55089	1.08125	0.60156	0.54166
0.72	1.01133	0.54892	0.53792	0.98125	0.54131	0.54147	0.99961	0.55093	0.53808	1.06367	0.57778	0.52889
0.74	0.99297	0.52602	0.52594	0.96465	0.51948	0.52915	0.98379	0.52934	0.52562	1.04766	0.55566	0.51645
0.76	0.97500	0.50439	0.51424	0.94844	0.49883	0.51714	0.96797	0.50874	0.51347	1.03203	0.53467	0.50434
0.78	0.95937	0.48467	0.50291	0.93359	0.47964	0.50547	0.95352	0.48955	0.50166	1.01699	0.51479	0.49257
0.80	0.94375	0.46582	0.49181	0.91953	0.46162	0.49413	0.93984	0.47153	0.49022	1.00332	0.49629	0.48116
0.82	0.92969	0.44844	0.48109	0.90644	0.44473	0.48310	0.92656	0.45439	0.47907	0.99062	0.47891	0.47009
0.84	0.91562	0.43184	0.47062	0.89375	0.42871	0.47238	0.91484	0.43857	0.46830	0.97832	0.46240	0.45937
0.86	0.90273	0.41636	0.46047	0.88203	0.41377	0.46203	0.90332	0.42349	0.45784	0.96719	0.44697	0.44899
0.88	0.89062	0.40181	0.45061	0.87109	0.39971	0.45197	0.89297	0.40942	0.44772	0.95547	0.43198	0.43891
0.90	0.87969	0.38828	0.44108	0.86094	0.38647	0.44221	0.88203	0.39575	0.43789	0.94551	0.41816	0.42916
0.92	0.86875	0.37529	0.43176	0.85117	0.37393	0.43274	0.87344	0.38340	0.42841	0.93574	0.40498	0.41974
0.94	0.85859	0.36313	0.42278	0.84140	0.36191	0.42357	0.86406	0.37129	0.41920	0.92695	0.39263	0.41063
0.96	0.84844	0.35146	0.41402	0.83281	0.35073	0.41469	0.85586	0.36001	0.41027	0.91777	0.38061	0.40177
0.98	0.83984	0.34072	0.40557	0.82422	0.33999	0.40606	0.84726	0.34907	0.40163	0.91016	0.36956	0.39324
1.00	0.83125	0.33042	0.39736	0.81601	0.32978	0.39768	0.83906	0.33867	0.39325	0.90195	0.35874	0.38495
1.02	0.82344	0.32070	0.38937	0.80859	0.32021	0.38960	0.83281	0.32925	0.38518	0.89492	0.34868	0.37696
1.04	0.81572	0.31143	0.38164	0.80234	0.31133	0.38177	0.82539	0.31982	0.37731	0.88750	0.33887	0.36918
1.06	0.80810	0.30254	0.37414	0.79531	0.30259	0.37418	0.81875	0.31099	0.36970	0.88125	0.32976	0.36169
1.08	0.80156	0.29424	0.36686	0.78867	0.29424	0.36677	0.81289	0.30269	0.36235	0.87539	0.32109	0.35444
1.10	0.79482	0.28623	0.35980	0.78281	0.28643	0.35963	0.80703	0.29468	0.35520	0.86875	0.31250	0.34737
1.12	0.78828	0.27856	0.35294	0.77656	0.27881	0.35269	0.80117	0.28696	0.34827	0.86328	0.30454	0.34055
1.14	0.78203	0.27124	0.34627	0.77158	0.27178	0.34598	0.79609	0.27974	0.34158	0.85859	0.29707	0.33396
1.16	0.77656	0.26436	0.33981	0.76719	0.26514	0.33949	0.79062	0.27266	0.33507	0.85312	0.28965	0.32755
1.18	0.77187	0.25791	0.33358	0.76250	0.25864	0.33315	0.78594	0.26602	0.32877	0.84766	0.28247	0.32132
1.20	0.76641	0.25151	0.32748	0.75703	0.25220	0.32697	0.78184	0.25974	0.32266	0.84292	0.27573	0.31530
1.22	0.76172	0.24551	0.32158	0.75244	0.24619	0.32102	0.77734	0.25359	0.31673	0.83906	0.26943	0.30948
1.24	0.75703	0.23970	0.31582	0.74766	0.24033	0.31521	0.77324	0.24773	0.31097	0.83437	0.26313	0.30380
1.26	0.75156	0.23394	0.31021	0.74375	0.23486	0.30959	0.76914	0.24207	0.30537	0.83047	0.25723	0.29831
1.28	0.74766	0.22866	0.30477	0.74014	0.22964	0.30414	0.76562	0.23672	0.29995	0.82656	0.25151	0.29298
1.30	0.74375	0.22358	0.29951	0.73594	0.22446	0.29882	0.76172	0.23145	0.29466	0.82187	0.24580	0.28778

FIGURE 47
WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM PROPELLER RPM
FOR 7 BLADES AE/AO = 0.30, 0.50, 0.70, 0.90

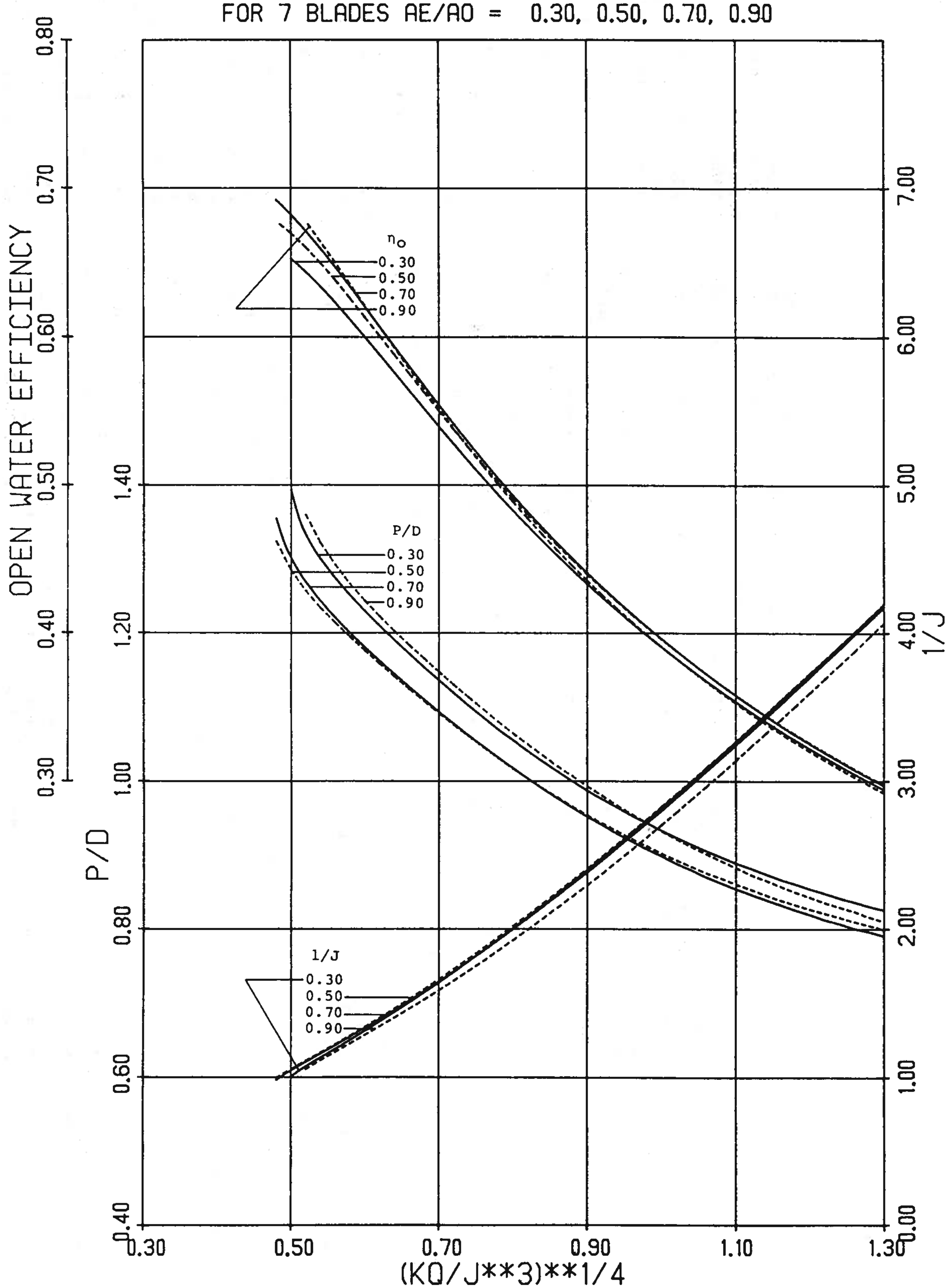


TABLE 45 WAGENINGEN B-SERIES PROPELLER DATA FOR 7 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.30 P/D	J	ETA-O	AE/AO = 0.50 P/D	J	ETA-O	AE/AO = 0.70 P/D	J	ETA-O	AE/AO = 0.90 P/D	J	ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44												
0.46												
0.48				1.32343	1.00302	0.67778	1.35429	1.01875	0.69199			
0.50	1.39336	0.99536	0.65247	1.28437	0.94678	0.66978	1.30117	0.95488	0.68215			
0.52	1.33281	0.93135	0.64353	1.25664	0.89931	0.66030	1.26875	0.90547	0.67127	1.35976	0.94731	0.67807
0.54	1.29980	0.88247	0.63369	1.23359	0.85669	0.64966	1.24297	0.86201	0.65942	1.32143	0.89746	0.66414
0.56	1.27392	0.83916	0.62298	1.21328	0.81758	0.63815	1.22031	0.82236	0.64687	1.29179	0.85430	0.65001
0.58	1.25073	0.79931	0.61165	1.19399	0.78096	0.62603	1.19961	0.78564	0.63382	1.26601	0.81504	0.63567
0.60	1.22949	0.76245	0.59990	1.17539	0.74653	0.61352	1.18007	0.75132	0.62046	1.24331	0.77920	0.62129
0.62	1.20937	0.72803	0.58787	1.15757	0.71426	0.60079	1.16157	0.71924	0.60699	1.22226	0.74585	0.60694
0.64	1.18984	0.69570	0.57570	1.14023	0.68389	0.58799	1.14375	0.68906	0.59351	1.20220	0.71455	0.59269
0.66	1.17109	0.66548	0.56353	1.12324	0.65522	0.57520	1.12617	0.66050	0.58011	1.18281	0.68506	0.57863
0.68	1.15273	0.63701	0.55140	1.10703	0.62837	0.56254	1.10937	0.63369	0.56688	1.16484	0.65762	0.56486
0.70	1.13515	0.61040	0.53943	1.09082	0.60288	0.55002	1.09258	0.60820	0.55386	1.14648	0.63130	0.55134
0.72	1.11797	0.58535	0.52763	1.07500	0.57881	0.53771	1.07695	0.58442	0.54112	1.12929	0.60669	0.53817
0.74	1.10117	0.56172	0.51603	1.06015	0.55635	0.52569	1.06094	0.56162	0.52864	1.11250	0.58340	0.52536
0.76	1.08515	0.53965	0.50473	1.04512	0.53491	0.51391	1.04609	0.54038	0.51651	1.09629	0.56138	0.51289
0.78	1.06914	0.51865	0.49363	1.03047	0.51465	0.50241	1.03125	0.52012	0.50469	1.07969	0.54023	0.50078
0.80	1.05469	0.49922	0.48286	1.01640	0.49556	0.49121	1.01719	0.50107	0.49321	1.06406	0.52036	0.48903
0.82	1.03984	0.48061	0.47232	1.00312	0.47764	0.48034	1.00293	0.48281	0.48203	1.04922	0.50166	0.47768
0.84	1.02578	0.46318	0.46211	0.98984	0.46055	0.46975	0.98926	0.46558	0.47119	1.03437	0.48379	0.46670
0.86	1.01250	0.44678	0.45216	0.97773	0.44463	0.45951	0.97617	0.44932	0.46070	1.01953	0.46665	0.45602
0.88	0.99922	0.43115	0.44249	0.96523	0.42930	0.44954	0.96367	0.43394	0.45053	1.00644	0.45083	0.44576
0.90	0.98672	0.41645	0.43310	0.95352	0.41489	0.43988	0.95156	0.41934	0.44066	0.99258	0.43540	0.43578
0.92	0.97500	0.40264	0.42400	0.94258	0.40132	0.43050	0.94023	0.40561	0.43114	0.98008	0.42104	0.42617
0.94	0.96406	0.38965	0.41519	0.93203	0.38848	0.42144	0.92851	0.39233	0.42188	0.96680	0.40703	0.41684
0.96	0.95293	0.37715	0.40660	0.92129	0.37607	0.41260	0.91797	0.37993	0.41293	0.95508	0.39404	0.40785
0.98	0.94297	0.36553	0.39833	0.91172	0.36455	0.40408	0.90781	0.36816	0.40428	0.94375	0.38166	0.39915
1.00	0.93271	0.35430	0.39025	0.90195	0.35342	0.39579	0.89844	0.35708	0.39590	0.93203	0.36968	0.39073
1.02	0.92324	0.34370	0.38241	0.89297	0.34297	0.38778	0.88828	0.34619	0.38774	0.92109	0.35835	0.38257
1.04	0.91406	0.33364	0.37484	0.88437	0.33301	0.38000	0.87969	0.33618	0.37990	0.91094	0.34766	0.37469
1.06	0.90547	0.32412	0.36750	0.87598	0.32349	0.37245	0.87031	0.32632	0.37224	0.90156	0.33760	0.36709
1.08	0.89726	0.31504	0.36035	0.86875	0.31465	0.36519	0.86211	0.31714	0.36486	0.89219	0.32788	0.35970
1.10	0.88916	0.30635	0.35343	0.86064	0.30591	0.35808	0.85410	0.30835	0.35770	0.88301	0.31858	0.35255
1.12	0.88203	0.29819	0.34672	0.85342	0.29770	0.35121	0.84687	0.30010	0.35079	0.87344	0.30952	0.34562
1.14	0.87461	0.29028	0.34019	0.84609	0.28979	0.34454	0.83965	0.29211	0.34406	0.86601	0.30132	0.33895
1.16	0.86719	0.28267	0.33384	0.83906	0.28223	0.33806	0.83281	0.28452	0.33754	0.85781	0.29319	0.33244
1.18	0.86094	0.27559	0.32773	0.83281	0.27510	0.33178	0.82578	0.27715	0.33121	0.85000	0.28545	0.32614
1.20	0.85420	0.26865	0.32175	0.82656	0.26824	0.32570	0.81953	0.27021	0.32509	0.84297	0.27815	0.32004
1.22	0.84805	0.26206	0.31594	0.82109	0.26177	0.31979	0.81250	0.26333	0.31911	0.83555	0.27102	0.31413
1.24	0.84180	0.25571	0.31031	0.81562	0.25552	0.31405	0.80703	0.25703	0.31334	0.82930	0.26438	0.30839
1.26	0.83633	0.24971	0.30484	0.80976	0.24941	0.30847	0 80703	0.25078	0.30773	0.82344	0.25806	0.30284
1.28	0.83047	0.24385	0.29952	0.80469	0.24365	0.30304	0.79609	0.24507	0.30231	0.81601	0.25159	0.29741
1.30	0.82578	0.23838	0.29436	0.79941	0.23806	0.29778	0.79062	0.23936	0.29699	0.81016	0.24565	0.29216

FIGURE 48

WAGENINGEN B-SERIES PROPELLERS
CURVE FOR OPTIMUM PROPELLER RPM
FOR 7 BLADES AE/AO = 0.35, 0.55, 0.75, 0.95

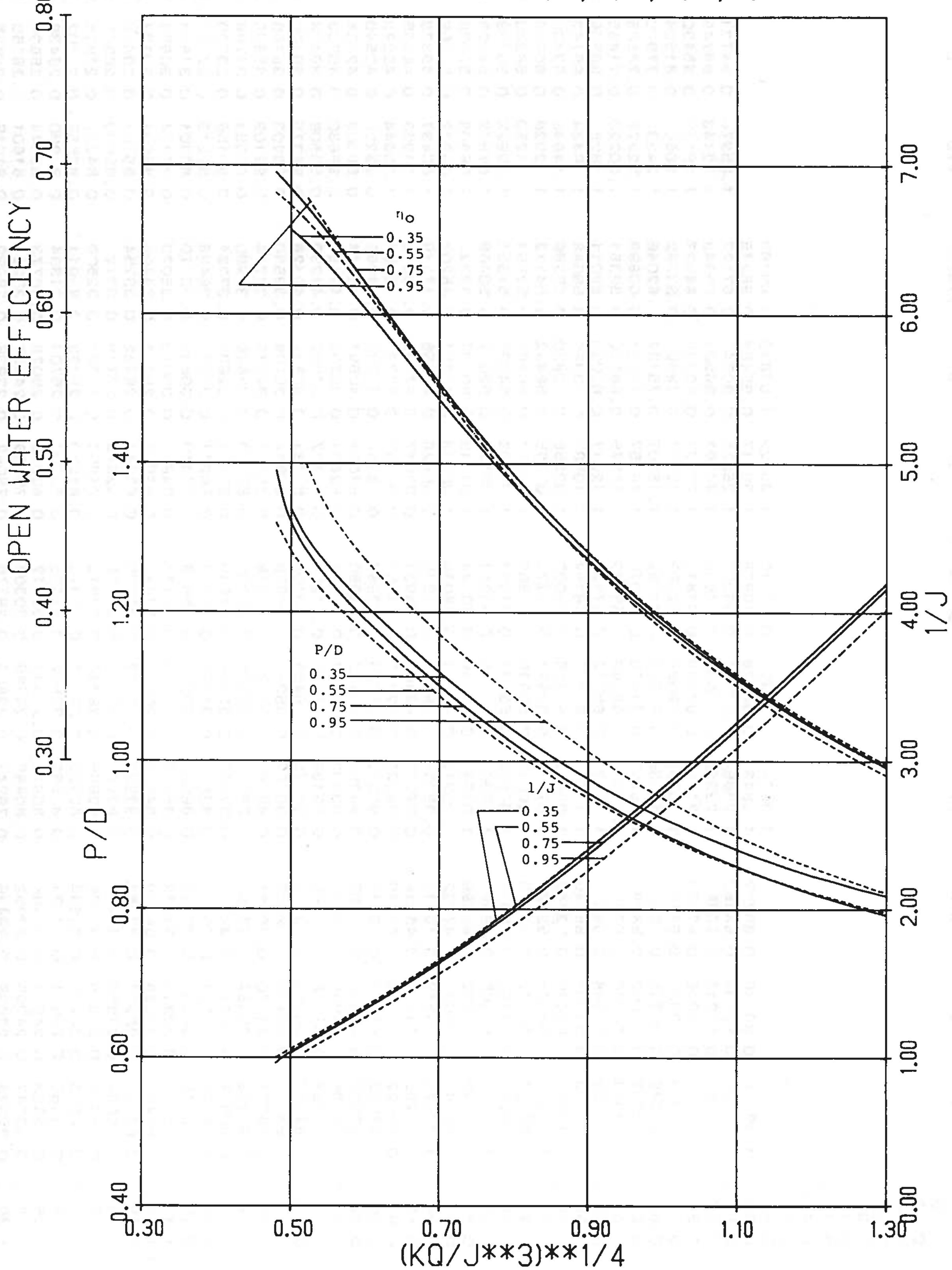


TABLE 46 WAGENINGEN B-SERIES PROPELLER DATA FOR 7 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.35			AE/AO = 0.55			AE/AO = 0.75			AE/AO = 0.95		
	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O	P/D	J	ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44												
0.46												
0.48				1.31914	1.00058	0.68181	1.38984	1.03730	0.69513			
0.50	1.33828	0.97207	0.65677	1.28047	0.94472	0.67348	1.31953	0.96396	0.68445			
0.52	1.30078	0.91865	0.64794	1.25312	0.89775	0.66370	1.28320	0.91240	0.67306	1.39922	0.96401	0.68034
0.54	1.27343	0.87270	0.63798	1.23007	0.85537	0.65278	1.25547	0.86797	0.66085	1.35444	0.91113	0.66550
0.56	1.25000	0.83096	0.62714	1.20937	0.81631	0.64102	1.23164	0.82773	0.64799	1.32153	0.86640	0.65072
0.58	1.22900	0.79248	0.61566	1.18984	0.77978	0.62866	1.21006	0.79062	0.63468	1.29414	0.82641	0.63591
0.60	1.20918	0.75659	0.60375	1.17109	0.74551	0.61594	1.18984	0.75600	0.62111	1.26992	0.78979	0.62113
0.62	1.19023	0.72300	0.59158	1.15390	0.71377	0.60305	1.17109	0.72383	0.60745	1.24795	0.75596	0.60645
0.64	1.17187	0.69145	0.57928	1.13672	0.68359	0.59006	1.15273	0.69341	0.59379	1.22719	0.72431	0.59196
0.66	1.15390	0.66177	0.56697	1.11953	0.65498	0.57711	1.13476	0.66470	0.58025	1.20761	0.69468	0.57770
0.68	1.13613	0.63374	0.55472	1.10351	0.62832	0.56430	1.11797	0.63789	0.56690	1.18906	0.66689	0.56374
0.70	1.11914	0.60752	0.54262	1.08711	0.60283	0.55163	1.10078	0.61221	0.55375	1.17031	0.64033	0.55007
0.72	1.10254	0.58281	0.53071	1.07109	0.57881	0.53922	1.08437	0.58808	0.54089	1.15273	0.61548	0.53677
0.74	1.08672	0.55967	0.51902	1.05625	0.55640	0.52706	1.06836	0.56528	0.52834	1.13559	0.59194	0.52383
0.76	1.07070	0.53764	0.50757	1.04140	0.53511	0.51520	1.05312	0.54385	0.51611	1.11855	0.56953	0.51127
0.78	1.05566	0.51704	0.49638	1.02695	0.51494	0.50360	1.03808	0.52349	0.50422	1.10234	0.54844	0.49910
0.80	1.04101	0.49761	0.48549	1.01328	0.49604	0.49235	1.02344	0.50420	0.49267	1.08672	0.52847	0.48730
0.82	1.02695	0.47930	0.47488	0.99922	0.47788	0.48137	1.00937	0.48599	0.48146	1.07070	0.50925	0.47587
0.84	1.01328	0.46201	0.46457	0.98672	0.46108	0.47075	0.99609	0.46885	0.47060	1.05527	0.49106	0.46482
0.86	1.00039	0.44575	0.45454	0.97344	0.44477	0.46038	0.98203	0.45220	0.46003	1.04082	0.47397	0.45415
0.88	0.98789	0.43037	0.44480	0.96172	0.42969	0.45036	0.96934	0.43672	0.44983	1.02656	0.45767	0.44383
0.90	0.97617	0.41592	0.43536	0.95000	0.41528	0.44064	0.95703	0.42202	0.43995	1.01250	0.44209	0.43385
0.92	0.96406	0.40200	0.42617	0.93867	0.40161	0.43122	0.94512	0.40806	0.43037	0.99922	0.42739	0.42421
0.94	0.95312	0.38901	0.41728	0.92851	0.38887	0.42211	0.93320	0.39468	0.42110	0.98594	0.41328	0.41487
0.96	0.94258	0.37666	0.40862	0.91758	0.37642	0.41322	0.92227	0.38213	0.41213	0.97344	0.39995	0.40586
0.98	0.93281	0.36509	0.40028	0.90859	0.36504	0.40468	0.91211	0.37031	0.40346	0.96172	0.38738	0.39716
1.00	0.92266	0.35386	0.39213	0.89844	0.35381	0.39635	0.90156	0.35884	0.39503	0.95000	0.37529	0.38874
1.02	0.91406	0.34351	0.38429	0.88906	0.34321	0.38827	0.89219	0.34814	0.38690	0.93906	0.36387	0.38059
1.04	0.90459	0.33335	0.37662	0.88047	0.33325	0.38046	0.88359	0.33809	0.37905	0.92812	0.35288	0.37272
1.06	0.89609	0.32383	0.36921	0.87187	0.32368	0.37289	0.87422	0.32820	0.37141	0.91836	0.34263	0.36512
1.08	0.88828	0.31484	0.36204	0.86455	0.31479	0.36557	0.86601	0.31899	0.36404	0.90781	0.33252	0.35773
1.10	0.88047	0.30620	0.35507	0.85625	0.30601	0.35844	0.85781	0.31011	0.35687	0.89844	0.32310	0.35061
1.12	0.87266	0.29790	0.34830	0.84922	0.29785	0.35156	0.85000	0.30166	0.34994	0.88945	0.31409	0.34369
1.14	0.86562	0.29006	0.34173	0.84219	0.28999	0.34487	0.84219	0.29351	0.34320	0.88125	0.30561	0.33703
1.16	0.85859	0.28252	0.33535	0.83555	0.28249	0.33838	0.83501	0.28579	0.33668	0.87187	0.29712	0.33051
1.18	0.85195	0.27534	0.32917	0.82910	0.27532	0.33209	0.82812	0.27842	0.33035	0.86406	0.28931	0.32423
1.20	0.84531	0.26841	0.32314	0.82285	0.26843	0.32597	0.82129	0.27131	0.32422	0.85664	0.28186	0.31816
1.22	0.83984	0.26196	0.31733	0.81719	0.26191	0.32005	0.81523	0.26462	0.31827	0.84922	0.27466	0.31227
1.24	0.83398	0.25566	0.31167	0.81172	0.25566	0.31430	0.80898	0.25813	0.31250	0.84219	0.26777	0.30654
1.26	0.82812	0.24958	0.30616	0.80547	0.24946	0.30868	0.80312	0.25193	0.30689	0.83516	0.26113	0.30100
1.28	0.82305	0.24385	0.30081	0.80039	0.24370	0.30325	0.79746	0.24597	0.30145	0.82812	0.25469	0.29560
1.30	0.81797	0.23831	0.29561	0.79531	0.23813	0.29798	0.79219	0.24028	0.29616	0.82246	0.24875	0.29038

FIGURE 49

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM PROPELLER RPM

FOR 7 BLADES AE/AO = 0.40, 0.60, 0.80, 1.00

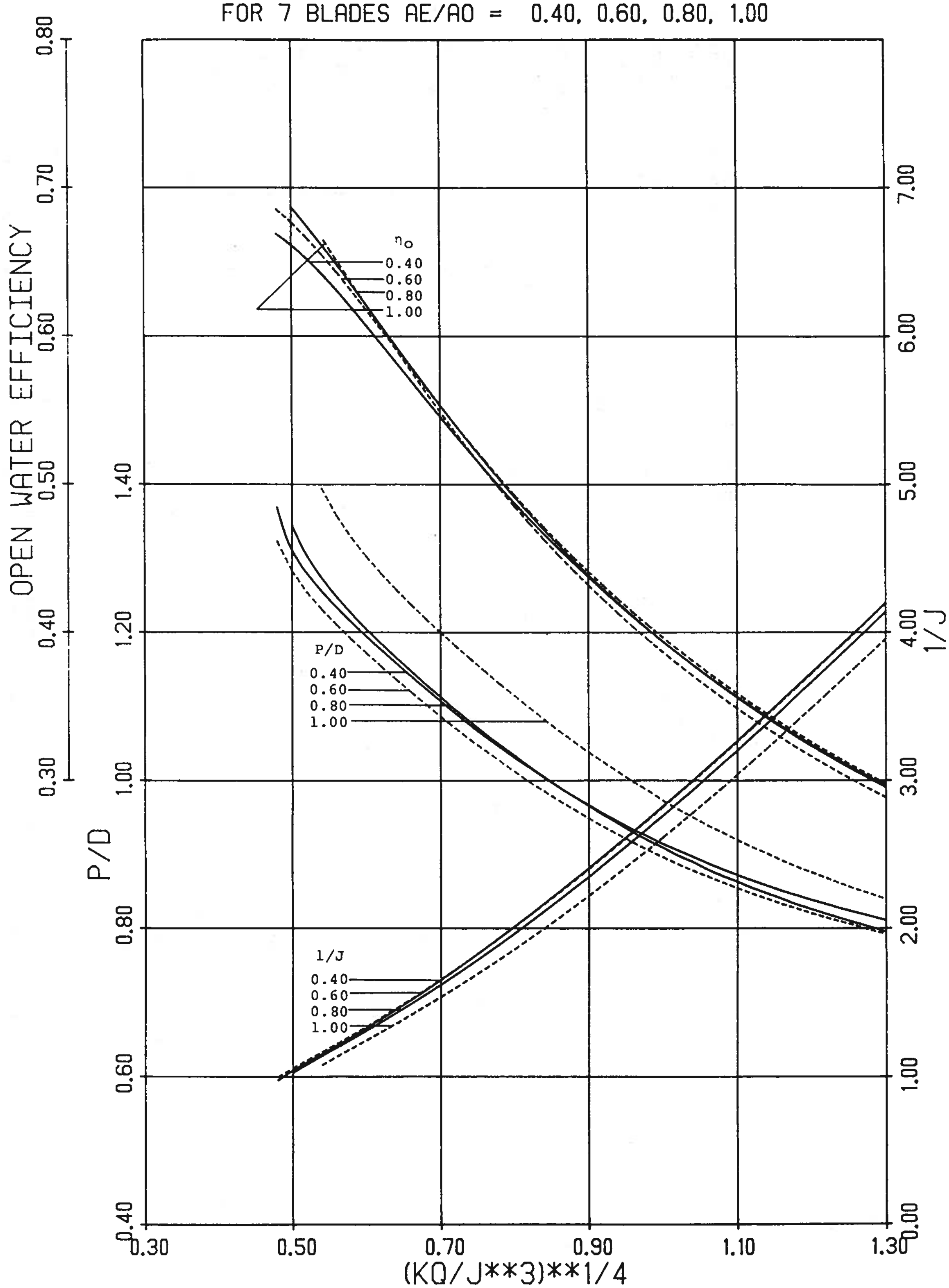


TABLE 47 WAGENINGEN B-SERIES PROPELLER DATA FOR 7 BLADE OPTIMUM RPM PROPELLERS

$\frac{K_Q^{1/4}}{J^3}$	AE/AO = 0.40 P/D	AE/AO = 0.40 J	AE/AO = 0.40 ETA-O	AE/AO = 0.60 P/D	AE/AO = 0.60 J	AE/AO = 0.60 ETA-O	AE/AO = 0.80 P/D	AE/AO = 0.80 J	AE/AO = 0.80 ETA-O	AE/AO = 1.00 P/D	AE/AO = 1.00 J	AE/AO = 1.00 ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44												
0.46												
0.48	1.36836	1.02607	0.66892	1.32265	1.00224	0.68548						
0.50	1.31054	0.95947	0.66130	1.28203	0.94541	0.67675	1.34453	0.97607	0.68669			
0.52	1.27890	0.90928	0.65232	1.25351	0.89795	0.66664	1.30312	0.92187	0.67470			
0.54	1.25468	0.86533	0.64218	1.23007	0.85556	0.65543	1.27265	0.87598	0.66202	1.39370	0.92646	0.66740
0.56	1.23281	0.82475	0.63114	1.20937	0.81670	0.64341	1.24726	0.83491	0.64880	1.35703	0.88008	0.65180
0.58	1.21289	0.78721	0.61948	1.18945	0.78017	0.63083	1.22461	0.79726	0.63521	1.32734	0.83906	0.63638
0.60	1.19375	0.75195	0.60737	1.17109	0.74629	0.61793	1.20351	0.76221	0.62139	1.30195	0.80190	0.62113
0.62	1.17558	0.71899	0.59502	1.15312	0.71426	0.60481	1.18403	0.72969	0.60753	1.27876	0.76748	0.60607
0.64	1.15781	0.68799	0.58257	1.13579	0.68418	0.59167	1.16523	0.69907	0.59371	1.25742	0.73550	0.59125
0.66	1.14023	0.65869	0.57010	1.11880	0.65576	0.57857	1.14726	0.67031	0.58001	1.23711	0.70547	0.57672
0.68	1.12344	0.63125	0.55772	1.10234	0.62900	0.56560	1.12929	0.64297	0.56650	1.21792	0.67734	0.56255
0.70	1.10683	0.60532	0.54548	1.08594	0.60361	0.55282	1.11250	0.61743	0.55327	1.19961	0.65088	0.54873
0.72	1.09062	0.58091	0.53344	1.07031	0.57978	0.54029	1.09531	0.59297	0.54030	1.18144	0.62568	0.53526
0.74	1.07480	0.55786	0.52162	1.05469	0.55713	0.52801	1.07929	0.57012	0.52766	1.16406	0.60195	0.52220
0.76	1.05937	0.53613	0.51006	1.04043	0.53608	0.51606	1.06328	0.54834	0.51535	1.14687	0.57939	0.50954
0.78	1.04492	0.51582	0.49879	1.02597	0.51597	0.50439	1.04824	0.52793	0.50340	1.12969	0.55781	0.49724
0.80	1.03037	0.49648	0.48779	1.01172	0.49687	0.49304	1.03359	0.50859	0.49180	1.11406	0.53774	0.48538
0.82	1.01719	0.47852	0.47711	0.99766	0.47871	0.48198	1.01875	0.49004	0.48052	1.09785	0.51836	0.47390
0.84	1.00351	0.46123	0.46668	0.98516	0.46191	0.47128	1.00469	0.47256	0.46959	1.08242	0.50005	0.46280
0.86	0.99062	0.44502	0.45658	0.97226	0.44575	0.46089	0.99101	0.45601	0.45902	1.06679	0.48247	0.45206
0.88	0.97812	0.42964	0.44674	0.96055	0.43066	0.45081	0.97793	0.44033	0.44878	1.05215	0.46592	0.44170
0.90	0.96680	0.41533	0.43724	0.94844	0.41611	0.44103	0.96562	0.42559	0.43889	1.03750	0.45005	0.43168
0.92	0.95508	0.40151	0.42797	0.93711	0.40244	0.43157	0.95312	0.41138	0.42928	1.02422	0.43525	0.42204
0.94	0.94414	0.38852	0.41899	0.92656	0.38955	0.42238	0.94141	0.39800	0.42000	1.01094	0.42102	0.41270
0.96	0.93359	0.37622	0.41031	0.91562	0.37710	0.41348	0.92969	0.38516	0.41101	0.99766	0.40737	0.40368
0.98	0.92412	0.36470	0.40188	0.90547	0.36538	0.40486	0.91875	0.37305	0.40230	0.98594	0.39468	0.39497
1.00	0.91406	0.35352	0.39369	0.89609	0.35435	0.39652	0.90898	0.36177	0.39392	0.97266	0.38203	0.38652
1.02	0.90547	0.34316	0.38579	0.88672	0.34375	0.38842	0.89844	0.35068	0.38575	0.96094	0.37031	0.37839
1.04	0.89687	0.33320	0.37809	0.87812	0.33379	0.38061	0.88984	0.34058	0.37790	0.95000	0.35923	0.37053
1.06	0.88818	0.32363	0.37063	0.87031	0.32439	0.37302	0.87969	0.33042	0.37024	0.93916	0.34858	0.36292
1.08	0.88008	0.31457	0.36339	0.86211	0.31528	0.36568	0.87109	0.32104	0.36284	0.92969	0.33867	0.35557
1.10	0.87236	0.30596	0.35638	0.85430	0.30659	0.35854	0.86328	0.31223	0.35570	0.91914	0.32883	0.34843
1.12	0.86484	0.29770	0.34957	0.84658	0.29824	0.35161	0.85469	0.30354	0.34876	0.90937	0.31956	0.34154
1.14	0.85781	0.28987	0.34297	0.83984	0.29043	0.34490	0.84731	0.29546	0.34205	0.90078	0.31089	0.33488
1.16	0.85078	0.28232	0.33655	0.83281	0.28284	0.33840	0.83989	0.28765	0.33554	0.89141	0.30232	0.32841
1.18	0.84453	0.27520	0.33032	0.82656	0.27568	0.33208	0.83223	0.28005	0.32921	0.88281	0.29424	0.32215
1.20	0.83828	0.26836	0.32430	0.82031	0.26880	0.32597	0.82578	0.27300	0.32309	0.87539	0.28669	0.31608
1.22	0.83242	0.26182	0.31843	0.81406	0.26213	0.32002	0.81933	0.26619	0.31715	0.86758	0.27932	0.31020
1.24	0.82656	0.25552	0.31274	0.80859	0.25586	0.31424	0.81309	0.25964	0.31138	0.85976	0.27219	0.30450
1.26	0.82119	0.24951	0.30720	0.80312	0.24980	0.30864	0.80703	0.25337	0.30578	0.85234	0.26538	0.29897
1.28	0.81601	0.24375	0.30182	0.79687	0.24380	0.30318	0.80117	0.24734	0.30035	0.84609	0.25903	0.29360
1.30	0.81055	0.23813	0.29659	0.79219	0.23831	0.29791	0.79531	0.24150	0.29507	0.83906	0.25273	0.28839

FIGURE 50

WAGENINGEN B-SERIES PROPELLERS

CURVE FOR OPTIMUM PROPELLER RPM

FOR 7 BLADES AE/AO = 0.45, 0.65, 0.85, 1.05

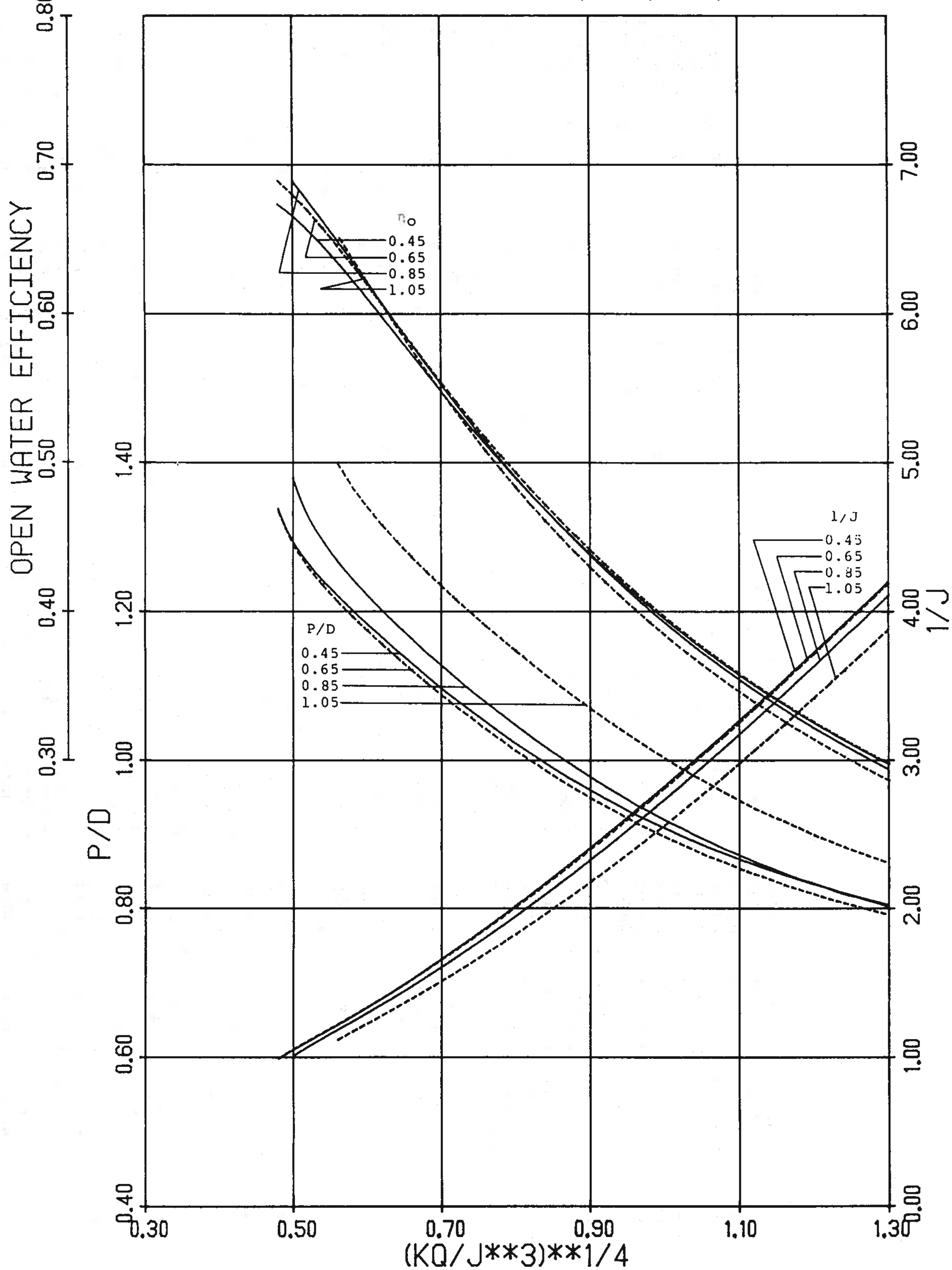


TABLE 48 WAGENINGEN B-SERIES PROPELLER DATA FOR 7 BLADE OPTIMUM RPM PROPELLERS

$\left(\frac{K_Q}{J^3}\right)^{1/4}$	AE/AO = 0.45 P/D	AE/AO = 0.45 J	AE/AO = 0.45 ETA-O	AE/AO = 0.65 P/D	AE/AO = 0.65 J	AE/AO = 0.65 ETA-O	AE/AO = 0.85 P/D	AE/AO = 0.85 J	AE/AO = 0.85 ETA-O	AE/AO = 1.05 P/D	AE/AO = 1.05 J	AE/AO = 1.05 ETA-O
0.30												
0.32												
0.34												
0.36												
0.38												
0.40												
0.42												
0.44												
0.46												
0.48	1.33711	1.01025	0.67343	1.33437	1.00840	0.68885						
0.50	1.29375	0.95141	0.66569	1.28906	0.94888	0.67961	1.37890	0.99243	0.68913			
0.52	1.26484	0.90303	0.65648	1.25898	0.90068	0.66915	1.32812	0.93330	0.67627			
0.54	1.24140	0.85986	0.64609	1.23476	0.85801	0.65764	1.29472	0.88594	0.66307			
0.56	1.22090	0.82036	0.63484	1.21289	0.81865	0.64536	1.26679	0.84355	0.64941	1.39843	0.89492	0.65353
0.58	1.20117	0.78320	0.62293	1.19272	0.78213	0.63254	1.24297	0.80532	0.63550	1.36640	0.85293	0.63733
0.60	1.18271	0.74863	0.61065	1.17378	0.74805	0.61941	1.22134	0.77002	0.62143	1.33945	0.81514	0.62150
0.62	1.16489	0.71611	0.59812	1.15571	0.71611	0.60613	1.20078	0.73691	0.60731	1.31528	0.78027	0.60596
0.64	1.14726	0.68540	0.58548	1.13789	0.68589	0.59281	1.18149	0.70605	0.59331	1.29336	0.74800	0.59077
0.66	1.13047	0.65664	0.57287	1.12085	0.65752	0.57955	1.16328	0.67715	0.57945	1.27226	0.71758	0.57591
0.68	1.11328	0.62920	0.56031	1.10410	0.63071	0.56646	1.14453	0.64941	0.56579	1.25273	0.68921	0.56146
0.70	1.09687	0.60351	0.54794	1.08808	0.60552	0.55356	1.12773	0.62383	0.55245	1.23418	0.66255	0.54741
0.72	1.08125	0.57944	0.53577	1.07187	0.58149	0.54091	1.11055	0.59932	0.53939	1.21562	0.63711	0.53375
0.74	1.06640	0.55688	0.52387	1.05703	0.55918	0.52857	1.09375	0.57607	0.52664	1.19824	0.61328	0.52055
0.76	1.05156	0.53545	0.51221	1.04160	0.53769	0.51649	1.07793	0.55430	0.51426	1.18047	0.59038	0.50773
0.78	1.03652	0.51499	0.50080	1.02715	0.51758	0.50474	1.06230	0.53359	0.50224	1.16406	0.56899	0.49537
0.80	1.02226	0.49580	0.48971	1.01250	0.49834	0.49330	1.04707	0.51396	0.49057	1.14726	0.54839	0.48339
0.82	1.00898	0.47783	0.47892	0.99922	0.48047	0.48222	1.03183	0.49521	0.47925	1.13125	0.52895	0.47183
0.84	0.99570	0.46074	0.46844	0.98594	0.46338	0.47143	1.01738	0.47754	0.46828	1.11484	0.51020	0.46064
0.86	0.98281	0.44453	0.45823	0.97266	0.44707	0.46096	1.00351	0.46084	0.45768	1.09961	0.49263	0.44986
0.88	0.97070	0.42930	0.44833	0.96094	0.43198	0.45086	0.99023	0.44502	0.44741	1.08437	0.47578	0.43946
0.90	0.95937	0.41499	0.43874	0.94883	0.41743	0.44104	0.97695	0.42988	0.43747	1.06992	0.45986	0.42942
0.92	0.94805	0.40132	0.42943	0.93750	0.40371	0.43152	0.96445	0.41562	0.42787	1.05547	0.44458	0.41973
0.94	0.93711	0.38833	0.42039	0.92695	0.39082	0.42233	0.95234	0.40205	0.41858	1.04179	0.43013	0.41037
0.96	0.92656	0.37602	0.41164	0.91562	0.37822	0.41337	0.94023	0.38901	0.40956	1.02812	0.41623	0.40133
0.98	0.91719	0.36455	0.40318	0.90586	0.36660	0.40475	0.92969	0.37695	0.40087	1.01484	0.40300	0.39260
1.00	0.90781	0.35352	0.39493	0.89609	0.35542	0.39636	0.91875	0.36526	0.39246	1.00234	0.39048	0.38418
1.02	0.89844	0.34297	0.38696	0.88711	0.34492	0.38828	0.90898	0.35435	0.38433	0.98984	0.37842	0.37603
1.04	0.88984	0.33301	0.37921	0.87812	0.33481	0.38041	0.89844	0.34363	0.37643	0.97812	0.36702	0.36817
1.06	0.88135	0.32349	0.37171	0.86875	0.32500	0.37278	0.88926	0.33367	0.36880	0.96719	0.35623	0.36056
1.08	0.87344	0.31445	0.36443	0.86172	0.31616	0.36545	0.87969	0.32400	0.36142	0.95625	0.34582	0.35321
1.10	0.86562	0.30581	0.35738	0.85312	0.30725	0.35827	0.87109	0.31492	0.35426	0.94531	0.33579	0.34608
1.12	0.85859	0.29766	0.35054	0.84590	0.29900	0.35135	0.86250	0.30615	0.34732	0.93437	0.32612	0.33919
1.14	0.85146	0.28979	0.34390	0.83906	0.29116	0.34465	0.85464	0.29790	0.34061	0.92539	0.31726	0.33255
1.16	0.84482	0.28232	0.33746	0.83125	0.28335	0.33810	0.84687	0.28997	0.33411	0.91719	0.30889	0.32612
1.18	0.83828	0.27515	0.33121	0.82500	0.27617	0.33177	0.83906	0.28228	0.32779	0.90781	0.30051	0.31986
1.20	0.83203	0.26829	0.32514	0.81894	0.26931	0.32566	0.83320	0.27532	0.32170	0.89844	0.29243	0.31381
1.22	0.82656	0.26182	0.31926	0.81250	0.26260	0.31970	0.82578	0.26824	0.31576	0.89062	0.28496	0.30795
1.24	0.82031	0.25542	0.31352	0.80684	0.25627	0.31393	0.81875	0.26147	0.30999	0.88242	0.27766	0.30227
1.26	0.81484	0.24941	0.30798	0.80156	0.25024	0.30832	0.81406	0.25547	0.30444	0.87500	0.27075	0.29675
1.28	0.80976	0.24365	0.30256	0.79609	0.24438	0.30289	0.80781	0.24932	0.29902	0.86797	0.26416	0.29141
1.30	0.80430	0.23804	0.29731	0.79141	0.23887	0.29760	0.80176	0.24338	0.29374	0.86094	0.25779	0.28623

IV. RELATION BETWEEN HULL-PROPELLER AND MACHINE-PROPELLER OPTIMAL SYSTEMS

From the analysis of sections II and III it is obvious that we can compute the maximum efficiency propeller and its operating condition by optimizing either the hull-propeller system or the machine-propeller system. For a given hull-machine-propeller system there should be only one globally optimal operating condition. In this section we will show that for compatible hull-propeller and machine-propeller systems the two optimal found in sections II and III are identical.

IV.1. Example

Consider the examples presented in sections II.1. and III.1. The data of the two systems in these examples are compatible in the sense that the constant, C_T , of the hull-propeller system given by equation (IV-1) (see equation (II-13))

$$\frac{K_T}{J^2} = 0.278 = C_T \tag{IV-1}$$

and the constant, C_Q , of the machine-propeller system given by equation (IV-2) (see equation (III-4))

$$\frac{K_Q}{J^3} = 0.0641 = C_Q \tag{IV-2}$$

are related by equation (IV-3) (see equation (I-3))

$$\frac{C_T}{2\pi C_Q} = \frac{1}{2\pi}\,\frac{K_T\;J^3}{J^2\;K_Q} = \frac{J\;K_T}{2\pi K_Q} = \eta_o \tag{IV-3}$$

Actually

$$\frac{C_T}{2\pi C_Q} = 0.69 \tag{IV-4}$$

which is the open water efficiency derived by optimizing either the hull-propeller or the machine-propeller system. Obviously the same optimal propeller and operating conditions were derived by optimizing either system.

The equivalence of the two optimal systems is proved in general form in the following section.

IV.2. General Relation of the Optimal Systems

The general solution to the optimization problems stated and solved in sections II and III are given by equations (II-34) to (II-36) and (III-18) to (III-20) respectively. In both cases the three equations can be solved to yield the values of J , P/D and Re for the optimal propeller and its operating condition. It is obvious that equations (II-34) and (III-18) are identical. Equations (II-35) and (III-19) are also identical. Consequently, the two systems of simultaneous equations will be equivalent if equations (II-36) and (III-20) are compatible. Combining these two equations we get:

$$\frac{C_T}{2\pi C_Q} = \frac{JK_T}{2\pi K_Q} \qquad \text{(IV-5)}$$

It has been shown in section I (see equation (I-3)) that the right hand side of equation (IV-5) is the open water efficiency. Therefore the two systems will be compatible if the following equation is satisfied:

$$\eta_o = \frac{C_T}{2\pi C_Q} \qquad \text{(IV-6)}$$

In general it can be shown that if the compatibility equation (IV-6) is satisfied the hull-propeller optimal system subject to equality constraint

$$\frac{K_T}{J^n} = C_T \qquad \text{(IV-7)}$$

and the machine-propeller optimal system subject to equality constraint

$$\frac{K_Q}{J^{n+1}} = C_Q \qquad \text{(IV-8)}$$

are equivalent.

The equation corresponding to (II-34) and (III-18) becomes

$$\frac{\partial K_T}{\partial (P/D)} \left\{ J \frac{\partial K_Q}{\partial J} - (n+1)\ K_Q \right\} + \frac{\partial K_Q}{\partial (P/D)} \left\{ nK_T - J \frac{\partial K_T}{\partial J} \right\} = 0 \qquad \text{(IV-9)}$$

and equations (II-35) and (III-19) do not change.

The equivalency of the two systems based on compatibility equation (IV-6) is further discussed in reference [3] where $n = 4$ for the optimization of a given RPM B-Series propeller.

CONCLUSIONS AND FURTHER WORK

A systematic series approach has been used to formulate and solve the preliminary optimization problem for a given diameter propeller. The optimal propeller and its operating condition was found in two ways. First by optimizing the hull-propeller system and second by optimizing the machine propeller system. It has been proved that if the two systems are compatible, that is if compatibility equation (IV-6) is satisfied the two optimal systems are equivalent and the results of optimization of the two systems are identical.

The propeller curves plotted in reference [2] are valid for $Re < 2 \times 10^6$ and for the design value of t/c [6]. These curves must be corrected for $Re > 2 \times 10^6$ and t/c other than the design value. It has been argued in this work that the effects of Reynolds number, Re, and thickness to chord ratio of the propeller blades, t/c, on the optimal propeller and its operating conditions are small. Therefore the curves plotted in reference [2] and the maximum efficiency propellers generated in this work are useful even for $Re \neq 2 \times 10^6$. The results were presented in graphs and tables and cover the range of validity of the B-Series and the entire range of practical interest for the hull-propeller system constant, C_T, and the machine-propeller system constant, C_Q.

In reference [3], work similar to the one done in this report, is carried out for calculation of maximum efficiency propellers for given RPM. Both the hull-propeller and the machine-propeller system are optimized and the compatibility equation for equivalence of the two systems is derived.

More general and practical preliminary propeller optimization problems can also be formulated and solved if fewer equality constraints are set in problems P1 in sections II and III.

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