

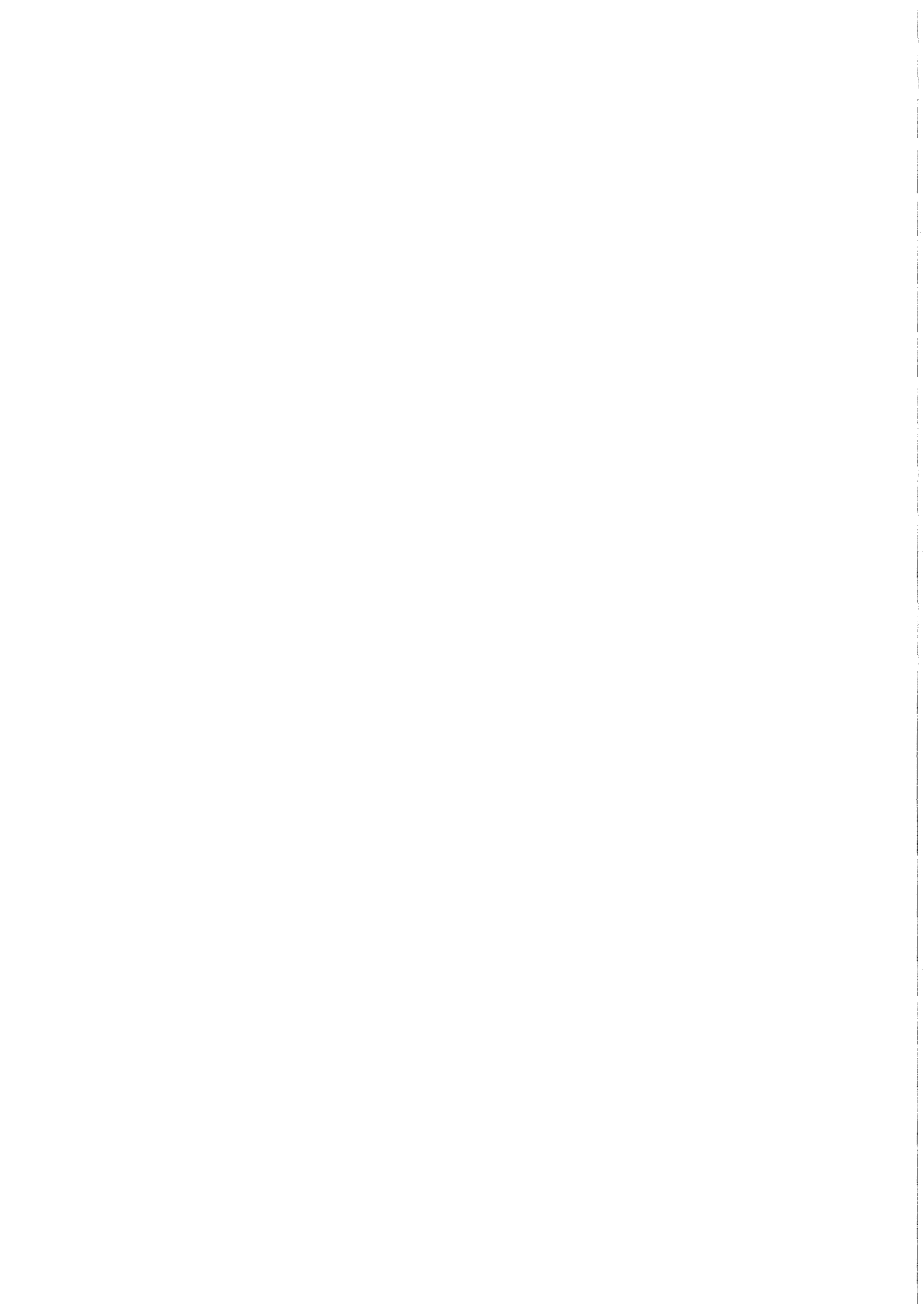


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# **Heat Transfer for Turbulent Flow of Helium or Hydrogen in a Tube at High Temperatures: Evaluation with the Method of Petukhov**

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Heat Transfer for Turbulent Flow of Helium or Hydrogen in  
a Tube at High Temperatures: Evaluation with the Method  
of Petukhov

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## Abstract

Experimental heat transfer data of various authors for the turbulent flow of helium or hydrogen in circular tubes at very high wall temperatures (up to 2800 °C) have been reevaluated with the method of Petukhov. Of these data, the data for the tests with not constant heat flux distribution along the tube have been corrected with the superposition method. The Petukhov correlation method does not account completely for the increase of the heat transfer coefficient in the entrance region of the tube. However, for the downstream region the correlation is successful. The 1624 reevaluated experimental points are correlated with a standard deviation of 7.0 % for  $2 \leq l/d \leq 316$ .

Wärmeübergang bei turbulenter Strömung von Helium oder Wasserstoff in Rohren bei hohen Temperaturen: Auswertung mit der Petukhov-Methode

### Zusammenfassung

Experimentelle Wärmeübergangswerte verschiedener Autoren für die turbulente Strömung von Helium oder Wasserstoff in runden Rohren bei sehr hohen Temperaturen (bis zu 2800 °C) wurden mit der Petukhov-Methode wieder ausgewertet. Von diesen Werten wurden die Werte von Messungen mit nicht konstantem Wärmefluß entlang der Rohre mittels der Überlagerungsmethode korrigiert. Die Petukhov-Korrelation gibt die Erhöhung der Wärmeübergangskoeffizienten in der Eingangszone der Rohre nicht vollständig wieder, dagegen ist diese Korrelation für den Abwärtsstrombereich zutreffend. Die 1624 ausgewerteten experimentellen Punkte sind mit einer Standardabweichung von 7 % für  $2 \leq l/d \leq 316$  korreliert.

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HEAT TRANSFER FOR TURBULENT FLOW OF HELIUM OR HYDROGEN IN  
A TUBE AT HIGH TEMPERATURES: EVALUATION WITH THE METHOD  
OF PETUKHOV

M. Dalle Donne and G. P. Tartaglia

1. Introduction

In presence of large temperature differences between a heat transfer wall and a flowing gas the usual heat transfer correlations for the turbulent flow of gases in tubes are not valid anymore. These hold only if the gas physical properties can be considered constant in a cross section of the tube normal to the flow direction. These properties, however, vary quite considerably if the difference between the wall temperature  $T_W$  and the gas bulk temperature  $T_B$  is large. Indeed at the wall the gas temperature is equal to  $T_W$  and between the wall and the center of the flow cross section the properties vary with the variable gas temperature. The gas pressure, which affects the gas density, is usually constant in a cross section normal to the flow. In these conditions the dimensional analysis suggests that the local heat transfer coefficient in the considered cross section of the tube, made not-dimensional in the form of the Nusselt-number, is given by a function of the type:

$$\text{Nu}_B = f \left( \frac{\lambda}{d}, \text{Re}_B, \text{Pr}_B, \frac{T_W}{T_B} \right) \quad (1)$$

valid for the turbulent flow of a gas in a tube at constant wall temperature or at constant heat flux at the wall. The function  $f$  is not specified and must be determined by experiment.



## 2. Previous Work

One of the first experiments for turbulent flow of helium at very high temperatures was performed by Taylor and Kirchgessner /1/. The averaged (along the length of the tube) heat transfer coefficients were correlated using the gas physical properties evaluated at a reference temperature averaged between  $T_W$  and  $T_B$ . This is equivalent to use the properties evaluated at the gas bulk temperature  $T_B$  and multiply by the factor  $T_W/T_B$  at a certain exponent (see for instance Ref. /2/).

In 1962 Lel'chuk and Dyadyakin /3/ showed that they could correlate their local experimental heat transfer data with air cooling with the relationship:

$$\text{Nu}_B = 0.025 \text{Re}_B^{0.8} \text{Pr}_B^{0.4} \left(\frac{T_W}{T_B}\right)^{-c} \quad \text{for } 15 \leq \frac{\ell}{D} \leq 135 \quad (2)$$

where  $c$  is a function monotonically increasing with  $\ell/D$ .

Also in 1962, without knowledge of the experiment of Lel'chuk and Dyadyakin, Dalle Donne and Bowditch /2/ found a similar correlation for their experimental heat transfer data with air cooling:

$$\text{Nu}_B = 0.024 \text{Re}_B^{0.8} \text{Pr}_B^{0.4} \left(\frac{T_W}{T_B}\right)^{-(0.29+0.0056 \frac{\ell}{d})} \quad (3)$$

in the range  $10^4 \leq \text{Re}_B \leq 1.3 \times 10^5$  and  $26 \leq \frac{\ell}{d} \leq 166$ . Equations (2) and (3) show that, in presence of large temperature differences between wall and gas, the temperature profile in the gas is not fully established even for large values of  $\frac{\ell}{d}$ , contrary to what happens for small temperature differences, where generally for  $\frac{\ell}{d} \geq 20$  the  $\ell/d$  effect disappears. To try to investigate this  $\ell/d$  effect, Dalle Donne and Bowditch carried out experiments with a long unheated entrance length and

a very long heated test section /4/. The data for air and helium could be correlated by the equation

$$\text{Nu}_B = 0.022 \text{Re}_B^{0.8} \text{Pr}_B^{0.4} \left(\frac{T_W}{T_B}\right)^{-0.26+0.0033 \frac{\ell}{d}} \quad (4)$$

in the range  $10^4 \leq \text{Re}_B \leq 1.3 \times 10^5$  and  $18 \leq \frac{\ell}{d} \leq 316$ . The  $\ell/d$  effect could not be eliminated even at extremely high values of  $\ell/d$ . However, when Dalle Donne and Bowditch tried the temperature parameter  $T_W/T_E$  in place of  $T_W/T_B$ , the  $\ell/d$  effect could be eliminated in the central axial portion of the tubes, and the data were correlated by:

$$\text{Nu}_B = 0.022 \text{Re}_B^{0.8} \text{Pr}_B^{0.4} (T_W/T_E)^{-0.255} \quad \text{for air} \quad (5)$$

$$\text{Nu}_B = 0.022 \text{Re}_B^{0.8} \text{Pr}_B^{0.4} (T_W/T_E)^{-0.18} \quad \text{for helium} \quad (6)$$

in same range of  $\text{Re}_B$  and  $\frac{\ell}{d}$  as given above.

Taylor /5/ carried out experiments in a tube with long unheated entrance length and helium and hydrogen cooling at tube wall temperatures up to  $2670^\circ\text{C}$  ( $T_W/T_B$  up to 8) and could correlate his data with an equation similar to Eqs. (3) and (4), i. e.:

$$\text{Nu}_B = 0.021 \text{Re}_B^{0.8} \text{Pr}_B^{0.4} \left(\frac{T_W}{T_B}\right)^{-0.29+0.0019 \frac{\ell}{d}} \quad (7)$$

McEligot, Magee and Leppert performed experiments with air, helium and nitrogen in a tube with long unheated entrance length in the range  $1.5 \times 10^4 \leq \text{Re}_B \leq 2.3 \times 10^5$ ,  $1 \leq \ell/d \leq 150$ ,  $1.1 \leq T_W/T_B \leq 2.5$  /6/. They correlated their data with the following relationship:

$$\text{Nu}_B = 0.021 \text{Re}_B^{0.8} \text{Pr}_B^{0.4} \cdot \exp(-90 q^+) \quad (8)$$

where the parameter  $q^+ = \frac{q}{\rho_B v_B c_p T_E}$  is somewhat analogous

to  $T_W/T_E$ , although not exactly the same.

In 1973 Petukhov, Kurganov and Gladuntsov /7/ published a new relationship which could correlate data for argon, carbon dioxide, air, nitrogen and ammonia for  $Re_B > 7 \times 10^3$ ,  $q = \text{const.}$  and  $0.5 < T_W/T_B < 4$ . The relationship is the following:

$$Nu_B = \epsilon_\ell Nu_\infty K_S \left( \frac{T_W}{T_B}, \frac{\ell}{D} \right) \quad (9)$$

where  $Nu_\infty$  is the Nusselt number in the tube for fully established flow (large values of  $\ell/d$ ) and  $T_W/T_B \rightarrow 1$ :

$$Nu_\infty = \frac{f/2 Re_B Pr_B}{1.07 + \frac{900}{Re_B} - \frac{0.63}{1+Pr_B} + 12.7 \sqrt{f/2} (Pr_B^{2/3} - 1)} \quad (10)$$

$\epsilon_\ell$  is a correction factor which accounts for the heat transfer coefficient increase at the tube inlet (not yet established flow):

$$\epsilon_\ell = 1 + \frac{0.48 \left( 1 + \frac{3600}{Re_B \sqrt{\ell/d}} \right)}{(\ell/d)^{1/4}} e^{-0.17 \frac{\ell}{d}} \quad (11)$$

and  $K_S \left( \frac{T_W}{T_B}, \frac{\ell}{d} \right)$  accounts for the effect of the variable gas properties:

$$K_S \left( \frac{T_W}{T_B}, \frac{\ell}{d} \right) = \left( \frac{T_W}{T_B} \right)^{0.53 n_\rho + \frac{1}{3} n_k + \frac{1}{4} n_{c_p} - \phi \left( \frac{\ell}{d} \right) n_\mu \lg \left( \frac{T_W}{T_B} \right)} \quad (12)$$

$n_\rho$ ,  $n_k$ ,  $n_{c_p}$  and  $n_\mu$  are the power exponents in the equations which give the variation with temperature of the property of the gas considered:

$$\frac{\rho}{\rho_0} = \left( \frac{T}{T_0} \right)^{n_\rho}, \quad \frac{k}{k_0} = \left( \frac{T}{T_0} \right)^{n_k}, \quad \frac{c_p}{c_{p_0}} = \left( \frac{T}{T_0} \right)^{n_{c_p}}, \quad \frac{\mu}{\mu_0} = \left( \frac{T}{T_0} \right)^{n_\mu} \quad (13)$$

while the function  $\phi \left( \frac{\ell}{d} \right)$  is given in tabulated form (see Table I of this paper).

Also in 1973 Pfriem /8/ published the results of his heat transfer measurements for flow of helium in a molybdenum tube at wall temperatures up to 2100 °C. His data and the data of Taylor /5, 9/, of Weiland /10/ and of Wolf and McCarthy /11/ were correlated by the following equations:

$$\text{Nu}_B = 0.023 \text{Re}_B^{0.8} \text{Pr}_B^{0.4} (10^3 q^+)^{2/3} (T_W/T_E)^{-1.05} \quad (14)$$

for helium

$$\text{Nu}_B = 0.027 \text{Re}_B^{0.8} \text{Pr}_B^{0.4} (10^3 q^+)^{2/3} (T_W/T_E)^{-1.4} \quad (15)$$

for hydrogen

The experiments of Weiland and of Wolf and McCarthy were performed with electrically heated steel tubes. Due to the relatively low maximum tube wall temperatures ( $\leq 1100$  °C) and relatively low variation of the electrical resistivity of steel with temperature, the heat flux distribution along the axis of the tube  $q(\ell/d)$  could be considered constant. The experiments of Pfriem were performed with a molybdenum tube and those of Taylor with a tungsten tube at considerably higher temperatures. In this case the heat flux distribution along the tube could not be considered constant anymore: in the case of the Pfriem tests  $q(\ell/d)$  was increasing monotonically until the end of the tube, while for the Taylor tests it was increasing monotonically until  $\ell/d \approx 25$  and then remained approximately constant for the rest of the tube. According to Ref. /8/ equations (14) and (15) are only valid in the region of the tube where the difference between tube wall and gas temperature is increasing, i. e. in the region of the tube where  $q(\ell/d)$  is increasing with  $\ell/d$ . This might explain why the Pfriem equations successfully correlate these data. Indeed the monotonically increasing function  $q(\ell/d)$  may be approximated by a linear function:

$$q\left(\frac{\ell}{d}\right) = a + b \frac{\ell}{d} \quad (16)$$

The two parameters a and b do not appear explicitly in the Pfriem correlation, however the important factor is that he needs two temperature parameters ( $q^+$  and  $T_W/T_E$ ) in place of one, and this takes account of the fact that  $q(\frac{\ell}{d})$  may be described not by only one factor, as in the case  $q(\frac{\ell}{d}) =$  constant, but by the two factors a and b.

Equations (14) and (15) cannot correlate the Taylor data for the whole  $\ell/d$  range, because the axial heat flux distribution of Taylor's tests cannot be approximated by a linear equation of the type of equation (16) In this case a parabolic distribution would be better:

$$q\left(\frac{\ell}{d}\right) = a + b \frac{\ell}{d} + c \left(\frac{\ell}{d}\right)^2 \quad (17)$$

and this would imply, for instance, the introduction of a third temperature parameter. This correlation method appears to be cumbersome and rather difficult to generalize. We shall thus try a different method, which we explain in the next section.

### 3. The Superposition Method of Petukhov

In two papers published in 1974 and 1977 (see references /12/ and /13/) Petukhov and coworkers have shown that it is possible to use the relationships valid for  $q(\frac{l}{d}) = \text{constant}$  for the cases where  $q(\frac{l}{d})$  is not constant along the axis of the tube, if one applies the superposition principle, i. e. if one assumes that the case with variable heat flux can be considered as the sum of a large number of cases with constant heat flux. The Nusselt number for variable  $q(\frac{l}{d})$  may be then expressed by the following equation:

$$\frac{Nu_{\infty}}{Nu_B} = \frac{q(0)}{q(\frac{l}{d}) \cdot \epsilon_{\lambda}(\frac{l}{d}) \cdot K_S(\frac{l}{d})} + \int_0^{l/d} \frac{dq(\xi)/d\xi}{q(\frac{l}{d}) \cdot \epsilon_{\lambda}(\frac{l}{d} - \xi) \cdot K_S(\frac{l}{d} - \xi)} d\xi \quad (18)$$

In Ref. /12/ and /13/ more complicated and more general expressions for  $K_S$  are used. However, in the present application of the superposition method we prefer to stick to the simpler definition of  $K_S$  introduced in Ref. /7/ (see equation (12)). Calculations performed by us for the data evaluated in the present work show that the differences in Nusselt number caused by the more complicated expression for  $K_S$  are at most 1 to 2 % and thus considerably smaller than the experimental uncertainties of the data.

In Ref. /12/ a further simplification is introduced. For axially increasing heat fluxes and wall temperatures the correlations valid for  $q(\frac{l}{d}) = \text{constant}$  may be directly applied to the case of variable  $q(\frac{l}{d})$ , provided that the factors  $\epsilon_{\lambda}(\frac{l}{d})$  and  $K_S(\frac{l}{d})$  are evaluated at an equivalent value  $\frac{l}{d} = \frac{l_e}{d}$  where  $\frac{l_e}{d}$  is given by:

$$\frac{l_e}{d} = \int_0^l \frac{q(\xi)}{q(\frac{l}{d})} d\xi \quad (19)$$

#### 4. Present Analysis

The correlation method of Petukhov and coworkers /7/ for constant heat flux has been tested for argon, carbon dioxide, air, nitrogen and ammonia. In the present work we investigate if this correlation holds for helium and hydrogen as well. To do so we shall apply the correlation method of Ref. /7/ to the experimental data of Dalle Donne and Bowditch /4/, Weiland /10/, Wolf and McCarthy /11/, Pfriem /8/ and Taylor /9, 5/, for which we have the original data in tabulated form (some of these data have been collected by H. J. Pfriem in 1973). Table II shows the main conditions for which these tests have been performed: The data of the first three experiments refer to tests with constant heat flux up to high values of  $\frac{l}{d}$  (316 for Ref. /4/ and 247 for Ref. /10/). The data of Wolf and McCarthy (Ref. /11/) have been obtained for averaged values for relatively long sections of the tube, equal to  $\frac{1}{3}$  of the central axial portion of the tube used for the evaluation. Furthermore in this case the test sections were rather short. The data of Ref. /8/ have been obtained with increasing  $q(\frac{l}{d})$  along the tube, while the data of Ref. /9, 5/ are for a  $q(\frac{l}{d})$  distribution first increasing and then remaining constant along the tube. All the quoted works give data for helium, references /5, 9, 10, 11/ give data for precooling (the gas was cooled below room temperature before entering the test section) and for hydrogen as well.

The data for constant  $q(\frac{l}{d})$  distribution have been reevaluated by us with the method of Ref. /7/, starting from the original measured data (heat flux to the gas, gas mass flow in the tube, gas bulk temperature, tube wall temperature). The used values of the gas property coefficients are the following:

$$\begin{aligned} n_{\rho} &= -1 \\ n_k &= 0.66 && \text{for helium} && /8/ && (20) \\ n_{c_p} &= 0 \\ n_{\mu} &= 0.66 \end{aligned}$$

$$\begin{aligned} n_{\rho} &= -1 \\ n_k &= 0.85 \\ n_{c_p} &= 0.03 \\ n_{\mu} &= 0.66 \end{aligned} \quad \text{for hydrogen} \quad /8/ \quad (21)$$

The data of Pfriedman with monotonically increasing  $q(\frac{\ell}{d})$  have been evaluated with the same method ( $\varepsilon_{\ell}$  and  $K_s$  corrections from equations (11) and (12) and applying the simplified superposition method (Eq. (19)). In the evaluation of the factor  $K_s(\frac{T_W}{T_B}, \frac{\ell}{d})$  (see Eq. (12)) the value of  $\frac{T_W}{T_B}$  corresponding to  $\frac{\ell}{d} = \ell_e/d$  has been used.

The data of Taylor, with the heat flux first increasing and then constant along the tube, have been also evaluated with the same method, however here the superposition method has been applied in the not simplified form (Eq. (18)). The  $K_s(\frac{\ell}{d} - \xi)$  values under the integral have been evaluated with the  $\frac{T_W}{T_B}$  values of the section  $\ell/d$ . For some of the tests the  $K_s(\frac{\ell}{d} - \xi)$  values have been evaluated with  $T_W/T_B$  values of each  $(\frac{\ell}{d} - \xi)$  section. The difference in  $Nu_B$  between these two evaluation methods was considerably smaller than the scatter of the points, thus this second more complicated method was abandoned.



## 5. Results and Discussion

The results of the present evaluation are shown in Tables III to X. 2058 values of local heat transfer coefficients were evaluated. The meaning of the last two symbols in the tables is the following:

$$NUR = \frac{10^2 Nu_B}{Re_B^{0.8} Pr_B^{0.4}} \quad (22)$$

$$NUF = \frac{10^2 Nu_\infty}{Re_B^{0.8} Pr_B^{0.4}} \quad (23)$$

The other symbols of the tables are selfexplaining. The data of Wolf and McCarthy /11/ are for rather short test sections, furthermore these data are not really local values, i. e. values for a certain cross section of the tube, but they rather refer to relatively long increments of the tube (about  $\frac{1}{3}$  of the central axial portion of the tube used for the evaluation). Therefore for the determination of the new correlation constants these data were not considered and they do not appear in Figures 1 to 3. Fig. 1 shows the NUF-values versus  $l/d$  for all the tests without precooling. The 850 data-points for helium and hydrogen are correlated by the following equation:

$$NUF = 1.975 \left( 1 + \frac{1.096}{l/d} \right) \quad (24)$$

with a standard deviation of  $\sigma = 5.5 \%$  up to  $l/d = 316$ . (The dotted region in the figure is one standard deviation wide on each side of the correlating curve). For  $l/d < 10$  there is still a considerable inlet effect, however for  $l/d \geq 20$  NUF is practically constant. Similar plots are shown for the precooled tests (774 data-points, Fig. 2) and for all the data-points together, the correlating equations being:

$$NUF = 2.00 \left( 1 + \frac{1.4303}{l/d} \right), \quad \sigma = 8.0 \% \text{ for the precooled data,} \quad (25)$$

$$NUF = 1.994 \left( 1 + \frac{1.2021}{l/d} \right), \quad \sigma = 7.0 \% \text{ for all the data,} \quad (26)$$

The asymptotic value  $NUF = 1.994$  is 4.8 % lower than that predicted by the Petukhov-Kirillov formula (see Ref. /12/, assuming  $Pr_B = 0.7$  for helium and hydrogen).

Figures 4 to 8 show a comparison of Eq. (26) with the data points of the various authors, inclusive those of Wolf and McCarthy (434 data points). From these comparisons the following conclusions can be drawn:

- 1) Eq. (26) correlates the Dalle Donne-Bowditch data with about the same precision of the original correlation suggested in Ref. /5/:  $\pm 9$  %.
- 2) The scatter of the data of Wolf and McCarthy is rather large. This is explained above in the paper.
- 3) Eq. (26) correlates the Pfriem data very well:  $\pm 8$  %.
- 4) Eq. (26) correlates most of the Weiland data within  $\pm 10$  %
- 5) Eq. (26) correlates most of the Taylor-data within  $\pm 13$  %, i. e. with about the same precision of the original correlation suggested in Ref. /5, 9/.
- 6) Eq. (26) correlates the data of the presently evaluated experiments considerably better ( $\pm 2\sigma = \pm 14$  %) than the correlation suggested by Pfriem ( $\pm 35$  %, Equations (14) and (15)).

List of Symbols

- $c_p$  = gas specific heat at constant pressure  
 $d$  = inner diameter of the tube  
 $f$  = friction coefficient evaluated at the temperature  $T_B$   
 $h$  = convective heat transfer coefficient between tube inner surface and gas bulk  
 $k$  = gas thermal conductivity  
 $K_s$  = parameter which accounts for the effect of the variable gas properties on the Nusselt number (Eq. (12))  
 $\ell$  = distance from the inlet of the section considered (the unheated entrance length not included)  
 $\ell_e$  = equivalent value of  $\ell$  (Eq. (19))  
 $n_\rho$  = power exponent for gas density variation with temperature (Eq. (13))  
 $n_k$  = power exponent for gas thermal conductivity variation with temperature (Eq. (13))  
 $n_{c_p}$  = power exponent for gas specific heat variation with temperature (Eq. (13))  
 $n_\mu$  = power exponent for gas viscosity variation with temperature (Eq. (13))  
 $Nu$  =  $\frac{hd}{k}$  = Nusselt number  
 $Nu_\infty$  = Nusselt number corrected for  $\ell/d$  and  $T_W/T_B$  effect: for  $q = \text{const.}$  see Eq. (9) and for  $q \neq \text{const.}$  see Eq. (18)  
 $NUF$  =  $\frac{10^2 Nu_\infty}{Re_B^{0.8} Pr_B^{0.4}}$   
 $NUR$  =  $\frac{10^2 Nu_B}{Re_B^{0.8} Pr_B^{0.4}}$   
 $Pr$  =  $\frac{\mu c_p}{k}$  = Prandtl number  
 $q = q(\frac{\ell}{d})$  = heat flux to the gas along the tube

$$q^+ = \frac{q}{\rho_B v_B c_p T_E} = \text{non-dimensional heat flux}$$

$$\text{Re} = \frac{\rho v_B d}{\mu} = \text{Reynolds number}$$

T = temperature

T<sub>B</sub> = gas bulk temperature

T<sub>E</sub> = gas temperature at tube inlet

T<sub>W</sub> = temperature of the tubewall inner surface

T<sub>O</sub> = reference temperature (Eq. (13))

v<sub>B</sub> = gas velocity

ε<sub>ℓ</sub> = parameter which accounts for the ℓ/d effect on the Nusselt number (see Eq. (9) and Eq. (11))

ξ = running distance between inlet and the considered section, for which ξ = ℓ

μ = dynamic viscosity of the gas

ρ = gas density

### Subscripts

B = gas properties evaluated at the gas bulk temperature T<sub>B</sub>

Table I: Values of the function  $\Phi\left(\frac{l}{d}\right)$

$l/d$	10	20	30	40	50	60	70	80	90	100	$\infty$
$\Phi(l/d)$	0.11	0.24	0.38	0.55	0.73	0.89	1.02	1.13	1.21	1.27	1.50

Table II: List of the data investigated in the present work

Author	Ref.	Year	Coolant	Inlet temp.	Max. wall temp.	$l/d$ range	$Re_B$ range	$q(l/d)$
Dalle Donne Bowditch	/4/	1963	He	20°C and 200°C	1000 °C	35 ÷ 316	$4 \times 10^3 \div 10^4$	constant
Weiland	/10/	1965	He H <sub>2</sub>	room temp. + precooling (-150°C)	1260 °C 1260 °C	2.7 ÷ 247	$10^5 \div 2.3 \times 10^5$ $1.2 \times 10^5 \div 4.2 \times 10^5$	constant
Wolf McCarthy	/11/	1960	He H <sub>2</sub>	room temp. + pre- cooling (-200°C)	1150 °C	4 ÷ 50	$4 \times 10^3 \div 1.5 \times 10^6$	constant
Pfriem	/8/	1973	He	room temp.	2120 °C	8 ÷ 82	$1.6 \times 10^4 \div 4.2 \times 10^4$	always increasing
Taylor	/9/ /5/	1964 1965	He H <sub>2</sub>	room temp. + pre- cooling (-130°C)	2840 °C	12 ÷ 66	$5.7 \times 10^3 \div 4.8 \times 10^4$	increasing then constant

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TABLE: III

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM)	M (G/S)	RE	NU	NUR	NUF
*****											
1	0.328	35.1	311.3	333.7	0.1404	3.151	0.569	10748.	28.77	2.015	2.059
		105.3	336.5	357.7	0.1467	3.113		10210.	28.55	2.083	2.126
		175.6	361.4	383.3	0.1401	3.073		9740.	26.01	1.971	2.011
		245.8	385.9	407.0	0.1439	3.033		9327.	25.58	2.007	2.045
		316.0	410.1	431.1	0.1427	2.992		8959.	24.37	1.974	2.010
2	0.328	35.1	306.8	329.2	0.0841	1.884	0.341	6503.	17.39	1.821	1.861
		105.3	331.4	352.6	0.0840	1.784		6181.	16.51	1.800	1.838
		175.6	355.0	375.6	0.0882	1.818		5906.	16.57	1.873	1.910
		245.8	380.2	398.7	0.1013	1.865		5644.	18.19	2.132	2.167
		316.0	404.5	422.3	0.1427	2.530		5418.	24.59	2.979	3.024
3	0.328	35.1	304.4	325.7	0.0886	1.888	0.334	6403.	18.42	1.952	1.994
		105.3	330.0	349.8	0.0937	1.852		6070.	18.47	2.043	2.082
		175.6	355.1	374.9	0.0915	1.810		5783.	17.18	1.976	2.012
		245.8	379.6	398.7	0.0930	1.774		5534.	16.71	1.990	2.025
		316.0	403.6	422.6	0.0914	1.735		5315.	15.77	1.940	1.972
4	0.328	35.1	314.8	331.1	0.0780	1.268	0.256	4800.	15.86	2.117	2.150
		105.3	336.3	353.5	0.0771	1.323		4594.	15.01	2.074	2.108
		175.6	358.2	375.6	0.0915	1.592		4407.	17.09	2.441	2.481
		245.8	380.1	396.9	0.0749	1.253		4238.	13.45	1.983	2.012
		316.0	401.4	416.1	0.0827	1.219		4089.	14.32	2.174	2.201
5	0.328	35.1	315.3	333.1	0.0527	0.937	0.203	3802.	10.70	1.721	1.751
		105.3	339.9	356.8	0.0526	0.887		3618.	10.17	1.701	1.728
		175.6	365.0	381.7	0.0517	0.861		3452.	9.53	1.656	1.681
		245.8	390.1	406.1	0.0563	0.900		3303.	9.94	1.788	1.813
		316.0	414.1	430.5	0.0511	0.836		3176.	8.67	1.610	1.632
6	0.328	35.1	340.6	412.1	0.1287	9.208	0.538	9577.	24.85	1.908	2.033
		105.3	418.7	487.6	0.1318	9.077		8356.	22.20	1.902	2.009
		175.6	495.7	565.1	0.1283	8.907		7476.	19.34	1.810	1.903
		245.8	571.2	641.1	0.1249	8.734		6808.	17.14	1.730	1.811
		316.0	645.0	718.7	0.1427	10.522		6283.	18.08	1.945	2.035
7	0.328	35.1	337.6	417.6	0.1083	8.661	0.444	7949.	21.03	1.875	2.013
		105.3	423.2	495.1	0.1184	8.513		6848.	19.81	1.989	2.106
		175.6	507.0	573.1	0.1266	8.364		6078.	18.80	2.077	2.175
		245.8	589.1	655.1	0.1239	8.173		5505.	16.66	1.993	2.077
		316.0	669.1	734.1	0.1224	7.959		5061.	15.13	1.936	2.009
8	0.328	35.1	336.8	427.6	0.0963	8.747	0.548	9827.	18.73	1.409	1.528
		105.3	427.6	511.1	0.1041	8.688		8394.	17.29	1.476	1.576
		175.6	517.6	593.1	0.1156	8.731		7401.	16.93	1.598	1.684
		245.8	608.9	678.1	0.1244	8.611		6648.	16.37	1.683	1.756
		316.0	697.3	767.6	0.1171	8.233		6079.	14.09	1.556	1.618
9	0.328	35.1	341.8	415.1	0.0946	6.934	0.369	6553.	18.22	1.896	2.022
		105.3	427.3	498.1	0.0958	6.781		5655.	15.92	1.864	1.970
		175.6	510.8	581.1	0.0940	6.606		5026.	13.89	1.786	1.876
		245.8	592.0	661.6	0.0922	6.414		4560.	12.36	1.718	1.796
		316.0	670.6	743.5	0.0846	6.170		4200.	10.44	1.551	1.618

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TABLE: III

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
10	0.328	35.1	350.0	407.1	0.0773	4.416	0.268	4685.	14.66	1.994	2.095
		105.3	424.4	484.6	0.0745	4.484		4125.	12.44	1.874	1.964
		175.6	501.4	559.6	0.0782	4.548		3695.	11.69	1.924	2.004
		245.8	577.8	637.6	0.0717	4.288		3365.	9.76	1.731	1.799
11	0.328	316.0	649.5	714.6	0.0642	4.178	0.438	3115.	8.09	1.526	1.587
		35.1	460.2	543.1	0.1116	9.250		6392.	17.66	1.875	1.980
		105.3	555.9	624.1	0.1326	9.042		5642.	18.53	2.173	2.262
		175.6	652.7	724.1	0.1299	9.272		5075.	16.32	2.084	2.165
12	0.328	245.8	749.5	820.1	0.1256	8.871	0.301	4633.	14.41	1.978	2.047
		316.0	841.0	910.1	0.1226	8.470		4293.	13.03	1.902	1.961
		35.1	457.7	541.1	0.0806	6.719		4408.	12.80	1.829	1.933
		105.3	559.2	631.1	0.0913	6.568		3863.	12.71	2.018	2.105
13	0.328	175.6	660.5	735.6	0.0876	6.577	0.450	3460.	10.92	1.894	1.971
		245.8	758.8	838.6	0.0771	6.152		3158.	8.77	1.637	1.701
		316.0	850.0	934.1	0.0547	4.598		2930.	5.77	1.144	1.188
		35.1	388.1	541.4	0.1192	18.269		7348.	21.11	2.004	2.254
14	0.328	105.3	566.0	713.1	0.1214	17.862	0.315	5729.	16.76	1.942	2.123
		175.6	738.6	898.1	0.1083	17.276		4806.	12.54	1.672	1.815
		245.8	905.0	1046.1	0.1183	16.698		4203.	11.98	1.779	1.891
		316.0	1065.3	1189.1	0.1405	17.391		3774.	12.78	2.067	2.165
14	0.328	35.1	382.5	558.1	0.0799	14.033	0.315	5194.	14.29	1.790	2.051
		105.3	557.3	729.6	0.0788	13.580		4051.	10.99	1.680	1.871
		175.6	724.9	901.6	0.0727	12.849		3406.	8.52	1.497	1.645
		245.8	882.3	1066.1	0.0646	11.870		2991.	6.65	1.296	1.413
		316.0	1026.7	1215.6	0.0572	10.806		2707.	5.33	1.125	1.220

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TABLE: IV

RUN	D (CM)	L/D	TB (K)	TW (K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
1	0.477	2.7	132.2	270.0	0.6239	85.959	5.534	126435.	327.37	3.190	3.215
		13.3	155.0	418.8	0.3305	87.215		113844.	156.14	1.655	2.291
		23.9	177.7	473.8	0.2953	87.441		103994.	127.44	1.452	2.126
		34.5	201.1	511.6	0.2818	87.514		95865.	112.11	1.363	2.040
		45.2	223.8	537.7	0.2787	87.480		89311.	103.30	1.329	2.009
		55.8	247.2	556.6	0.2832	87.634		83655.	98.31	1.333	2.003
		66.5	270.0	569.4	0.2926	87.617		78927.	95.84	1.361	2.005
		77.1	293.3	582.7	0.3029	87.672		74725.	93.93	1.394	2.001
		87.6	316.6	596.1	0.3137	87.661		71044.	92.49	1.429	1.942
		98.4	339.4	609.4	0.3250	87.750		67861.	91.52	1.467	1.956
		109.0	362.7	623.3	0.3360	87.546		64948.	90.56	1.504	1.967
		120.0	385.5	637.2	0.3483	87.655		62389.	90.18	1.546	1.988
		130.0	408.8	652.2	0.3604	87.697		60016.	89.76	1.588	2.006
		141.0	431.6	667.7	0.3719	87.809		57907.	89.37	1.627	2.027
		151.0	455.0	682.7	0.3852	87.739		55929.	89.40	1.673	2.052
		162.0	478.3	698.3	0.3983	87.626		54113.	89.44	1.719	2.079
		173.0	501.1	713.8	0.4120	87.664		52477.	89.72	1.767	2.111
		183.0	524.4	730.0	0.4263	87.628		50924.	90.09	1.817	2.145
		194.0	547.2	746.1	0.4414	87.789		49515.	90.70	1.871	2.185
		205.0	570.5	761.6	0.4575	87.433		48169.	91.45	1.929	2.226
		215.0	593.8	777.7	0.4744	87.236		46912.	92.36	1.989	2.272
		226.0	616.6	793.3	0.4933	87.149		45761.	93.68	2.058	2.322
		236.0	639.4	809.4	0.5111	86.887		44678.	94.76	2.122	2.380
		247.0	662.2	825.5	0.5306	86.664		43658.	96.13	2.193	2.439
2	0.477	2.7	135.0	307.2	0.5770	99.372	5.398	121647.	298.63	3.002	3.132
		13.3	161.6	479.4	0.3182	101.116		108002.	146.21	1.616	2.323
		23.9	189.4	552.2	0.2785	101.033		97271.	115.25	1.385	2.118
		34.5	216.6	599.4	0.2644	101.206		89022.	100.14	1.292	2.027
		45.2	243.8	626.6	0.2646	101.282		82333.	92.68	1.273	2.010
		55.8	271.1	654.4	0.2644	101.353		76779.	86.37	1.254	1.980
		66.5	298.3	668.8	0.2738	101.458		72081.	83.96	1.282	1.976
		77.1	325.5	685.0	0.2822	101.435		68044.	81.69	1.307	1.959
		87.6	353.3	700.5	0.2922	101.458		64464.	80.14	1.338	1.884
		98.4	380.5	715.0	0.3035	101.504		61382.	79.26	1.377	1.894
		109.0	407.7	725.0	0.3201	101.542		58646.	79.87	1.439	1.927
		120.0	435.0	736.1	0.3377	101.685		56197.	80.74	1.505	1.967
		130.0	462.7	750.0	0.3532	101.447		53948.	81.07	1.561	1.995
		141.0	490.0	762.7	0.3714	101.309		51951.	82.09	1.629	2.039
		151.0	517.2	779.4	0.3858	101.165		50129.	82.28	1.681	2.068
		162.0	544.4	797.7	0.3985	100.953		48461.	82.16	1.724	2.091
		173.0	571.6	817.2	0.4101	100.702		46925.	81.87	1.763	2.112
		183.0	598.8	836.1	0.4220	100.107		45506.	81.70	1.803	2.132
		194.0	626.1	855.5	0.4347	99.739		44190.	81.73	1.847	2.159
		205.0	652.7	876.1	0.4445	99.271		42991.	81.30	1.878	2.176
		215.0	679.4	892.7	0.4638	98.944		41869.	82.62	1.949	2.231



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TABLE: IV

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		226.0	706.1	912.2	0.4787	98.665		40819.	83.13	2.001	2.271
		236.0	732.7	931.1	0.4945	98.075		39832.	83.80	2.057	2.313
		247.0	759.4	950.5	0.5109	97.638		38904.	84.56	2.116	2.359
3	0.477	2.7	124.4	295.5	0.5928	101.434	5.987	142369.	323.75	2.869	3.038
		13.3	148.8	477.2	0.3135	102.932		126476.	152.10	1.482	2.198
		23.9	173.8	547.2	0.2762	103.114		114161.	120.95	1.279	2.031
		34.5	199.4	590.5	0.2637	103.135		104283.	105.49	1.199	1.958
		45.2	224.4	613.3	0.2654	103.211		96464.	98.20	1.188	1.955
		55.8	249.4	631.1	0.2706	103.279		89969.	93.39	1.195	1.952
		66.5	274.4	647.2	0.2775	103.445		84473.	89.92	1.210	1.939
		77.1	299.4	661.6	0.2852	103.305		79750.	87.25	1.229	1.916
		87.6	324.4	675.0	0.2949	103.378		75639.	85.56	1.257	1.830
		98.4	350.0	687.2	0.3065	103.358		71947.	84.59	1.294	1.837
		109.0	375.0	698.3	0.3198	103.402		68744.	84.33	1.338	1.853
		120.0	400.0	708.8	0.3350	103.477		65878.	84.65	1.390	1.878
		130.0	425.0	720.0	0.3510	103.		294.	85.22	1.444	1.906
		141.0	450.0	732.7	0.3661	103.524		60950.	85.59	1.495	1.933
		151.0	475.5	748.1	0.3800	103.575		58768.	85.66	1.541	1.955
		162.0	500.5	763.3	0.3932	103.324		56814.	85.69	1.583	1.977
		173.0	525.5	778.8	0.4073	103.182		55016.	85.95	1.630	2.003
		183.0	550.5	793.8	0.4226	102.832		53354.	86.49	1.681	2.034
		194.0	575.5	809.4	0.4384	102.536		51813.	87.13	1.733	2.069
		205.0	600.5	826.1	0.4540	102.402		50379.	87.73	1.785	2.104
		215.0	625.5	842.7	0.4685	101.768		49041.	88.13	1.832	2.134
		226.0	650.0	860.0	0.4835	101.535		47816.	88.68	1.881	2.170
		236.0	674.4	877.7	0.4983	101.321		46665.	89.20	1.929	2.205
		247.0	699.4	895.0	0.5148	100.672		45557.	89.96	1.984	2.245
4	0.477	2.7	126.6	317.7	0.6055	115.717	5.488	128987.	326.84	3.135	3.377
		13.3	157.7	582.7	0.2770	117.724		111581.	129.34	1.393	2.193
		23.9	189.9	696.1	0.2333	118.079		98707.	96.37	1.145	1.967
		34.5	220.5	755.0	0.2207	117.951		89450.	82.61	1.062	1.895
		45.2	251.6	774.4	0.2254	117.834		81989.	77.33	1.065	1.906
		55.8	282.7	787.2	0.2334	117.737		75919.	74.15	1.086	1.911
		66.5	314.4	796.1	0.2437	117.382		70782.	72.18	1.119	1.899
		77.1	345.5	803.3	0.2564	117.374		66509.	71.36	1.162	1.889
		87.6	376.6	807.7	0.2719	117.219		62830.	71.49	1.219	1.813
		98.4	407.7	813.3	0.2889	117.165		59624.	72.08	1.281	1.841
		109.0	438.8	818.8	0.3084	117.192		56800.	73.30	1.355	1.879
		120.0	470.0	825.0	0.3295	116.972		54290.	74.86	1.434	1.925
		130.0	501.1	835.0	0.3497	116.760		52041.	76.15	1.510	1.968
		141.0	531.6	852.2	0.3637	116.586		50047.	76.17	1.558	1.991
		151.0	562.7	872.7	0.3741	115.971		48203.	75.46	1.590	1.997
		162.0	593.3	894.4	0.3837	115.536		46550.	74.74	1.620	2.005
		173.0	623.8	915.0	0.3948	114.930		45033.	74.40	1.656	2.020
		183.0	654.4	937.7	0.4042	114.523		43634.	73.80	1.685	2.029

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TABLE: IV

RUN	D (CM)	L/D	TB (K)	TW (K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		194.0	685.0	958.8	0.4159	113.910		42339.	73.69	1.723	2.049
		205.0	715.0	980.0	0.4284	113.526		41158.	73.78	1.765	2.075
		215.0	745.0	1001.6	0.4411	113.215		40057.	73.94	1.807	2.102
		226.0	775.0	1023.3	0.4538	112.693		39027.	74.11	1.850	2.130
		236.0	805.0	1045.5	0.4661	112.122		38060.	74.24	1.890	2.157
		247.0	834.4	1070.5	0.4724	111.538		37169.	73.48	1.907	2.162
5	0.477	2.7	302.7	344.4	1.0371	43.212	8.255	109160.	314.96	3.452	2.889
		13.3	310.5	383.3	0.5897	42.917		107348.	176.11	1.956	2.038
		23.9	317.7	392.2	0.5832	43.416		105731.	171.55	1.929	2.059
		34.5	325.5	402.2	0.5652	43.332		104057.	163.62	1.863	2.000
		45.2	333.3	411.1	0.5541	43.096		102448.	157.93	1.821	1.959
		55.8	341.0	420.0	0.5465	43.121		10904.	153.41	1.791	1.929
		66.5	348.3	427.7	0.5424	43.090		99515.	150.17	1.772	1.911
		77.1	356.1	435.5	0.5426	43.106		98075.	148.05	1.768	1.906
		87.6	363.3	442.7	0.5461	43.384		96784.	147.04	1.774	1.907
		98.4	371.1	449.4	0.5525	43.279		95441.	146.70	1.790	1.921
		109.0	378.8	456.1	0.5572	43.028		94143.	145.94	1.800	1.930
		120.0	386.6	461.6	0.5750	43.125		92889.	148.59	1.853	1.981
		130.0	393.8	467.2	0.5903	43.288		91761.	150.69	1.898	2.025
		141.0	401.6	473.3	0.6026	43.186		90585.	151.86	1.932	2.058
		151.0	409.4	479.4	0.6116	42.812		89445.	152.19	1.956	2.079
		162.0	416.6	486.6	0.6172	43.204		88419.	151.82	1.970	2.092
		173.0	424.4	493.8	0.6186	42.958		87346.	150.35	1.969	2.090
		183.0	432.2	501.6	0.6163	42.798		86306.	147.98	1.957	2.076
		194.0	439.4	510.0	0.6100	43.039		85367.	144.87	1.933	2.052
		205.0	447.2	518.8	0.6002	43.014		84384.	140.90	1.897	2.016
		215.0	455.0	528.3	0.5741	42.100		83429.	133.25	1.811	1.926
		226.0	462.2	536.6	0.5770	42.954		82566.	132.54	1.816	1.933
		236.0	470.0	545.5	0.5682	42.930		81662.	129.09	1.785	1.900
		247.0	477.7	550.0	0.5916	42.726		80782.	132.96	1.854	1.967
6	0.477	2.7	310.0	426.1	1.0460	121.452	7.575	98622.	312.76	3.718	3.300
		13.3	333.3	566.6	0.5279	123.176		94009.	150.46	1.858	2.161
		23.9	357.2	604.4	0.4982	123.166		89811.	135.65	1.738	2.086
		34.5	380.5	630.5	0.4939	123.475		86138.	128.98	1.709	2.065
		45.2	404.4	656.1	0.4906	123.467		82745.	123.07	1.684	2.042
		55.8	428.3	680.5	0.4894	123.437		79670.	118.21	1.667	2.024
		66.5	451.6	703.8	0.4902	123.639		76929.	114.33	1.658	2.010
		77.1	475.5	726.1	0.4933	123.599		74356.	111.21	1.657	1.999
		87.6	498.8	747.7	0.4978	123.896		72042.	108.73	1.662	1.971
		98.4	522.7	767.7	0.5041	123.504		69852.	106.76	1.672	1.972
		109.0	546.6	786.6	0.5125	123.000		67822.	105.38	1.690	1.980
		120.0	570.0	805.0	0.5232	122.952		65977.	104.65	1.716	1.998
		130.0	593.8	821.0	0.5404	122.782		64213.	105.20	1.763	2.035
		141.0	617.2	837.7	0.5541	122.209		62601.	105.16	1.798	2.061
		151.0	640.5	856.6	0.5637	121.821		61086.	104.40	1.821	2.074

WEILAND  
HELIUM

TABLE: IV

RUN	D (CM)	L/D	TB (K)	TW (K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		162.0	663.8	877.2	0.5688	121.344		59660.	102.88	1.828	2.074
		173.0	687.2	898.8	0.5699	120.628		58316.	100.76	1.824	2.061
		183.0	710.0	922.2	0.5676	120.457		57074.	98.21	1.808	2.040
		194.0	742.3	946.1	0.5668	115.501		55421.	95.24	1.795	2.006
		205.0	756.1	971.1	0.5551	119.346		54752.	92.14	1.754	1.974
		215.0	778.8	995.5	0.5482	118.776		53690.	89.23	1.725	1.939
		226.0	801.6	1019.4	0.5426	118.166		52678.	86.66	1.701	1.910
		236.0	824.4	1041.6	0.5410	117.517		51713.	84.82	1.690	1.893
		247.0	846.6	1063.3	0.5400	117.000		50813.	83.19	1.681	1.878
7	0.477	2.7	312.2	470.5	1.1367	179.977	8.910	115457.	338.28	3.545	3.242
		13.3	341.6	656.6	0.5785	182.227		108790.	162.22	1.783	2.167
		23.9	371.1	714.4	0.5330	182.996		103013.	141.52	1.625	2.056
		34.5	400.5	747.7	0.5267	182.882		97951.	132.98	1.589	2.029
		45.2	430.5	777.2	0.5263	182.450		93391.	126.69	1.573	2.015
		55.8	460.0	802.7	0.5314	182.157		89402.	122.45	1.574	2.013
		66.5	489.4	825.5	0.5404	181.634		85815.	119.53	1.588	2.016
		77.1	518.8	846.6	0.5518	180.867		82569.	117.44	1.609	2.020
		87.6	548.3	867.7	0.5643	180.262		79615.	115.80	1.634	1.996
		98.4	577.7	888.3	0.5791	179.842		76914.	114.80	1.665	2.015
		109.0	606.6	908.8	0.5930	179.217		74476.	113.83	1.694	2.031
		120.0	636.1	928.3	0.6114	178.664		72183.	113.75	1.736	2.060
		130.0	665.0	948.8	0.6274	178.111		70098.	113.36	1.771	2.082
		141.0	693.8	971.6	0.6389	177.472		68158.	112.24	1.793	2.093
		151.0	722.7	996.1	0.6467	176.764		66347.	110.59	1.805	2.094
		162.0	751.1	1022.2	0.6518	176.710		64684.	108.67	1.810	2.091
		173.0	780.0	1048.3	0.6557	175.946		63093.	106.63	1.812	2.083
		183.0	808.3	1073.8	0.6598	175.213		61625.	104.80	1.815	2.076
		194.0	836.6	1100.5	0.6620	174.694		60239.	102.79	1.813	2.066
		205.0	865.0	1127.2	0.6628	173.800		58930.	100.67	1.807	2.052
		215.0	893.3	1155.0	0.6626	173.380		57689.	98.53	1.799	2.037
		226.0	921.1	1182.2	0.6608	172.542		56535.	96.29	1.786	2.018
		236.0	949.4	1210.5	0.6577	171.735		55416.	93.94	1.771	1.995
		247.0	977.2	1247.7	0.6295	170.314		54371.	88.22	1.689	1.908
8	0.477	2.7	127.7	357.2	0.8142	186.813	8.910	208212.	436.97	2.857	3.193
		13.3	158.8	608.8	0.4210	189.449		180320.	195.67	1.435	2.296
		23.9	190.0	714.4	0.3628	190.268		160247.	149.85	1.208	2.104
		34.5	221.1	781.6	0.3389	189.972		144985.	126.65	1.106	2.015
		45.2	251.6	825.5	0.3297	189.211		133113.	113.12	1.058	1.983
		55.8	282.7	853.3	0.3299	188.226		123257.	104.81	1.042	1.957
		66.5	313.3	869.4	0.3377	187.798		115187.	100.26	1.052	1.932
		77.1	343.8	878.3	0.3512	187.696		108325.	98.06	1.081	1.907
		87.6	374.4	882.7	0.3690	187.575		102407.	97.40	1.123	1.796
		98.4	405.5	886.6	0.3895	187.392		97152.	97.53	1.173	1.808
		109.0	436.1	889.4	0.4130	187.226		92604.	98.58	1.232	1.830
		120.0	466.6	892.7	0.4392	187.148		88557.	100.25	1.299	1.862

WEILAND  
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TABLE: IV

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		130.0	497.2	897.2	0.4681	187.240		84926.	102.47	1.373	1.902
		141.0	527.7	902.2	0.4998	187.147		81648.	105.18	1.454	1.951
		151.0	558.3	908.8	0.9275	325.140		78671.	188.08	2.679	3.489
		162.0	588.8	918.8	0.5656	186.648		75953.	110.73	1.622	2.060
		173.0	619.4	932.7	0.5938	186.057		73459.	112.43	1.692	2.104
		183.0	650.0	955.0	0.6090	185.745		71161.	111.70	1.724	2.116
		194.0	680.0	975.0	0.6284	185.378		69073.	111.88	1.768	2.141
		205.0	710.5	999.4	0.6387	184.513		67098.	110.46	1.787	2.141
		215.0	740.5	1025.5	0.6450	183.825		65292.	108.55	1.795	2.133
		226.0	770.5	1053.8	0.6473	183.401		63603.	106.12	1.792	2.117
		236.0	800.5	1083.3	0.6452	182.448		62019.	103.14	1.777	2.089
		247.0	829.5	1115.0	0.6387	182.313		60580.	99.73	1.751	2.054
9	0.477	2.7	123.3	382.7	0.8373	217.232	8.981	214833.	459.99	2.933	3.393
		13.3	158.8	754.4	0.3725	221.844		181757.	173.13	1.262	2.217
		23.9	194.4	891.1	0.3135	218.404		159077.	127.53	1.034	2.009
		34.5	230.0	957.7	0.2975	216.513		142388.	108.32	0.960	1.948
		45.2	265.0	989.4	0.2979	215.812		129679.	98.79	0.943	1.955
		55.8	300.0	995.0	0.3104	215.728		119485.	94.84	0.967	1.968
		66.5	335.0	984.4	0.3325	215.940		111092.	94.46	1.021	1.973
		77.1	370.0	977.2	0.3561	216.231		104040.	94.74	1.079	1.962
		87.6	405.0	986.1	0.3786	220.008		98015.	94.89	1.133	1.859
		98.4	440.0	976.1	0.4036	216.374		92797.	95.77	1.195	1.863
		109.0	475.5	977.2	0.4308	216.118		88158.	97.12	1.263	1.887
		120.0	510.5	980.5	0.4599	216.153		84121.	98.93	1.335	1.921
		130.0	545.5	986.1	0.4900	215.872		80519.	100.89	1.410	1.956
		141.0	580.5	996.1	0.5193	215.798		77281.	102.62	1.483	1.995
		151.0	615.5	1007.7	0.5494	215.486		74353.	104.46	1.556	2.036
		162.0	650.5	1024.4	0.5750	214.986		71688.	105.41	1.617	2.068
		173.0	685.5	1044.4	0.5979	214.579		69251.	105.88	1.670	2.096
		183.0	720.0	1066.6	0.6178	214.170		67046.	105.92	1.714	2.117
		194.0	755.0	1091.1	0.6346	213.296		64978.	105.44	1.750	2.131
		205.0	789.4	1117.2	0.6484	212.531		63093.	104.61	1.778	2.140
		215.0	823.8	1145.0	0.6610	212.254		61339.	103.68	1.802	2.148
		226.0	858.3	1173.3	0.6712	211.428		59703.	102.47	1.820	2.150
		236.0	892.7	1201.6	0.6809	210.322		58173.	101.29	1.837	2.151
		247.0	926.6	1230.5	0.6903	209.774		56760.	100.19	1.853	2.154
10	0.477	2.7	118.8	271.6	0.8064	123.199	8.981	220100.	453.88	2.839	2.971
		13.3	138.8	422.2	0.4411	124.978		198634.	224.05	1.521	2.209
		23.9	158.8	476.1	0.3952	125.366		181757.	183.68	1.339	2.075
		34.5	179.4	509.4	0.3796	125.267		167733.	162.82	1.265	2.016
		45.2	200.0	536.1	0.3733	125.470		156147.	149.06	1.227	1.992
		55.8	220.0	558.3	0.3714	125.657		146627.	139.26	1.205	1.974
		66.5	240.5	577.2	0.3737	125.812		138233.	132.10	1.198	1.947
		77.1	260.5	591.6	0.3803	125.921		131135.	127.53	1.207	1.923
		87.6	281.1	603.3	0.3909	125.956		124725.	124.67	1.228	1.828

WEILAND  
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TABLE: IV

RUN	DI (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		98.4	301.6	611.6	0.4063	125.953		119049.	123.69	1.265	1.839
		109.0	322.2	617.7	0.4255	125.758		113981.	124.02	1.313	1.858
		120.0	342.2	620.0	0.4531	125.861		109539.	126.92	1.387	1.906
		130.0	362.7	622.2	0.4855	125.960		105402.	130.86	1.475	1.964
		141.0	383.3	625.3	0.5197	125.767		101637.	135.07	1.567	2.029
		151.0	403.3	632.2	0.5512	126.163		98282.	138.53	1.651	2.090
		162.0	423.8	642.2	0.5772	126.022		95110.	140.38	1.718	2.134
		173.0	444.4	656.1	0.5963	126.217		92184.	140.56	1.764	2.162
		183.0	465.0	671.6	0.6100	126.066		89473.	139.57	1.793	2.173
		194.0	485.0	699.4	0.5733	122.940		87021.	127.57	1.676	2.038
		205.0	505.5	708.8	0.6221	126.493		84669.	134.69	1.809	2.163
		215.0	526.1	728.8	0.6233	126.391		82471.	131.45	1.803	2.144
		226.0	546.6	748.8	0.6247	126.328		80411.	128.45	1.798	2.127
		236.0	567.2	766.6	0.6309	125.829		78476.	126.61	1.807	2.122
		247.0	587.7	781.6	0.6479	125.620		76653.	127.00	1.847	2.149
11	0.477	2.7	117.7	309.4	0.5699	109.230	6.214	153235.	322.76	2.697	2.951
		13.3	143.3	492.2	0.3166	110.458		134608.	157.50	1.460	2.229
		23.9	169.4	566.1	0.2789	110.630		120532.	124.24	1.258	2.060
		34.5	195.0	610.0	0.2674	110.971		109859.	108.57	1.184	1.998
		45.2	221.1	642.2	0.2633	110.878		101115.	98.39	1.146	1.968
		55.8	247.2	665.5	0.2650	110.858		93934.	92.00	1.137	1.948
		66.5	273.3	682.2	0.2713	110.931		87911.	88.14	1.149	1.927
		77.1	298.8	691.6	0.2824	110.920		82875.	86.49	1.182	1.913
		87.6	325.0	697.7	0.2977	110.975		78418.	86.28	1.232	1.835
		98.4	351.1	701.6	0.3166	110.985		74519.	87.19	1.297	1.865
		109.0	376.6	703.3	0.3399	111.034		71142.	89.37	1.379	1.914
		120.0	402.7	703.8	0.3668	110.447		68064.	92.27	1.476	1.974
		130.0	428.8	705.5	0.4015	111.081		65300.	96.90	1.602	2.069
		141.0	455.0	711.6	0.4327	111.059		62802.	100.43	1.713	2.151
		151.0	480.5	725.0	0.4550	111.222		60577.	101.87	1.788	2.202
		162.0	506.6	740.5	0.4753	111.167		58498.	102.76	1.855	2.246
		173.0	532.7	759.4	0.4896	110.976		56590.	102.40	1.898	2.269
		183.0	558.8	779.4	0.5013	110.564		54831.	101.58	1.931	2.282
		194.0	584.4	800.5	0.5117	110.584		53236.	100.68	1.960	2.296
		205.0	600.5	821.1	0.5167	113.961		52289.	99.85	1.972	2.315
		215.0	636.1	841.1	0.5340	109.470		50341.	99.35	2.023	2.325
		226.0	661.6	861.6	0.5463	109.260		49050.	99.03	2.058	2.348
		236.0	687.2	882.7	0.5562	108.767		47838.	98.34	2.085	2.361
		247.0	712.7	905.5	0.5590	107.762		46699.	96.48	2.086	2.349
12	0.477	2.7	120.5	412.7	0.5340	156.046	6.305	153105.	297.81	2.490	2.973
		13.3	156.6	777.7	0.2560	159.004		128792.	120.09	1.153	2.066
		23.9	193.3	889.4	0.2248	156.485		112101.	91.79	0.985	1.917
		34.5	229.4	952.2	0.2144	154.963		100121.	78.19	0.918	1.860
		45.2	265.0	961.1	0.2226	154.954		91040.	73.81	0.935	1.894
		55.8	300.5	948.8	0.2394	155.211		83781.	73.06	0.989	1.930

WEILAND  
HELIUM

TABLE: IV

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
		66.5	336.6	938.3	0.2582	155.350		77736.	73.11	1.051	1.937
		77.1	372.2	936.6	0.2756	155.560		72752.	73.03	1.107	1.927
		87.6	408.3	940.0	0.2922	155.353		68439.	72.84	1.160	1.820
		98.4	444.4	945.0	0.3100	155.172		64716.	73.07	1.217	1.834
		109.0	480.0	952.2	0.3284	155.077		61511.	73.58	1.276	1.854
		120.0	515.5	958.8	0.3495	154.945		58677.	74.70	1.345	1.886
		130.0	551.6	957.7	0.3719	151.032		56113.	76.01	1.419	1.907
		141.0	587.2	979.4	0.3940	154.535		53847.	77.28	1.491	1.962
		151.0	623.3	994.4	0.4153	154.122		51767.	78.31	1.559	1.999
		162.0	578.8	1012.7	0.3981	172.731		54357.	78.82	1.509	2.106
		173.0	693.8	1035.0	0.4497	153.397		48230.	79.00	1.664	2.056
		183.0	729.4	1060.5	0.4607	152.542		46666.	78.31	1.694	2.062
		194.0	764.4	1090.0	0.4669	152.001		45244.	76.94	1.706	2.057
		205.0	799.4	1121.6	0.4691	151.154		43927.	75.06	1.704	2.038
		215.0	834.4	1158.8	0.4630	150.217		42702.	72.01	1.672	1.992
		226.0	868.8	1186.1	0.4722	149.792		41577.	71.51	1.696	2.002
		236.0	903.3	1213.3	0.4812	149.172		40524.	71.03	1.720	2.011
		247.0	937.7	1232.7	0.5031	148.414		39535.	72.45	1.789	2.065
13	0.477	2.7	111.1	210.0	0.5709	56.455	6.350	162728.	336.00	2.676	2.633
		13.3	123.8	284.4	0.3534	56.740		151447.	193.57	1.633	2.121
		23.9	137.2	305.0	0.3387	56.826		141567.	173.42	1.544	2.079
		34.5	150.0	321.1	0.3323	56.860		133488.	160.43	1.497	2.043
		45.2	163.3	336.6	0.3282	56.888		126192.	149.79	1.462	2.015
		55.8	176.1	351.6	0.3248	57.020		120072.	141.05	1.432	1.987
		66.5	189.4	366.6	0.3209	56.870		114426.	132.80	1.402	1.943
		77.1	202.3	379.4	0.3216	56.962		109565.	127.44	1.392	1.917
		87.6	215.5	389.4	0.3278	57.000		105078.	124.57	1.407	1.862
		98.4	228.3	396.1	0.3403	57.094		101159.	124.50	1.450	1.890
		109.0	241.6	401.1	0.3577	57.033		97440.	126.06	1.513	1.934
		120.0	254.4	405.5	0.3770	56.968		94182.	128.42	1.584	1.987
		130.0	267.7	412.7	0.3932	57.014		91061.	129.49	1.641	2.026
		141.0	280.5	421.1	0.4062	57.093		88302.	129.72	1.685	2.056
		151.0	293.8	431.6	0.4142	57.067		85637.	128.29	1.707	2.064
		162.0	306.6	442.7	0.4189	57.016		83265.	126.15	1.717	2.061
		173.0	320.0	455.5	0.4214	57.126		80959.	123.39	1.718	2.051
		183.0	332.7	468.3	0.4224	57.258		78893.	120.52	1.713	2.037
		194.0	346.1	481.1	0.4235	57.172		76874.	117.74	1.708	2.022
		205.0	358.8	493.3	0.4253	57.179		75056.	115.45	1.707	2.012
		215.0	372.2	505.0	0.4294	57.014		73271.	113.79	1.716	2.009
		226.0	385.5	516.1	0.4370	57.052		71589.	113.14	1.738	2.021
		236.0	398.3	525.0	0.4497	56.962		70065.	113.95	1.781	2.053
		247.0	411.6	532.7	0.4697	56.885		68558.	116.46	1.852	2.113

WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB (K)	TW (K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
1	0.477	2.7	306.9	357.0	2.3757	119.048	8.164	239401.	611.35	3.503	2.926
		7.9	310.7	382.2	1.6650	119.047		237395.	423.95	2.447	2.397
		13.3	314.6	397.2	1.4411	119.051		235431.	363.13	2.111	2.180
		18.6	318.4	406.7	1.3486	119.051		233507.	336.33	1.969	2.075
		23.9	322.2	413.3	1.3074	119.045		231621.	322.75	1.903	2.023
		29.2	326.1	418.4	1.2890	119.017		229772.	315.02	1.870	1.995
		34.5	329.9	422.6	1.2836	119.018		227960.	310.59	1.857	1.985
		39.9	333.7	426.4	1.2844	119.020		226182.	311.53	1.866	1.997
		45.2	337.6	430.0	1.2875	119.021		224438.	309.37	1.865	1.998
		50.5	341.3	432.7	1.3024	119.024		222752.	310.10	1.882	2.016
		55.8	345.2	436.3	1.3060	118.990		221073.	308.12	1.882	2.017
		61.2	349.0	439.9	1.3092	118.991		219425.	306.09	1.882	2.017
		66.5	352.8	443.4	1.3132	118.990		217806.	304.29	1.882	2.017
		71.8	356.7	447.0	1.3173	118.996		216218.	302.54	1.882	2.017
		77.1	360.5	450.6	1.3205	118.992		214657.	300.63	1.882	2.017
		82.4	364.3	454.2	1.3243	118.965		213124.	298.88	1.882	2.017
		87.8	368.2	457.7	1.3284	118.964		211618.	297.24	1.882	2.017
		93.1	371.9	461.4	1.3301	118.969		210159.	295.14	1.882	2.017
		98.4	375.8	464.9	1.3350	118.962		208704.	293.75	1.882	2.017
		103.7	379.6	468.4	1.3389	118.938		207274.	292.16	1.882	2.017
		109.0	383.4	472.0	1.3431	118.938		205867.	290.67	1.882	2.017
		114.0	387.3	475.6	1.3473	118.936		204484.	289.21	1.893	2.016
		120.0	391.1	479.1	1.3504	118.910		203144.	287.57	1.893	2.016
		125.0	394.9	482.7	1.3547	118.912		201805.	286.19	1.893	2.016
		130.0	398.7	486.2	1.3590	118.911		200489.	284.83	1.893	2.016
		135.0	402.6	489.8	1.3630	118.883		199193.	283.43	1.893	2.016
		141.0	406.4	493.3	1.3673	118.878		197918.	282.12	1.893	2.023
		146.0	410.2	496.9	1.3717	118.880		196663.	280.86	1.893	2.023
		151.0	414.0	500.4	1.3749	118.852		195445.	279.40	1.893	2.023
		157.0	417.8	504.0	1.3794	118.857		194228.	278.20	1.901	2.023
		162.0	421.7	507.6	1.3838	118.853		193030.	277.00	1.901	2.023
		167.0	425.5	511.1	1.3880	118.827		191850.	275.79	1.901	2.023
		173.0	429.3	514.6	1.3934	118.825		190687.	274.83	1.901	2.030
		178.0	433.1	518.2	1.3967	118.796		189559.	273.51	1.910	2.030
		183.0	436.9	521.7	1.4013	118.798		188430.	272.43	1.912	2.032
		189.0	440.8	525.2	1.4068	118.796		187318.	271.55	1.916	2.035
		194.0	444.6	528.8	1.4112	118.775		186222.	270.47	1.918	2.036
		199.0	448.4	532.3	1.4158	118.769		185158.	269.47	1.921	2.038
		205.0	452.2	535.8	1.4202	118.744		184093.	268.42	1.923	2.040
		210.0	456.1	539.3	1.4268	118.740		183043.	267.81	1.928	2.045
		215.0	459.9	543.8	1.4314	118.740		182008.	266.68	1.908	2.024
		221.0	463.7	547.2	1.4211	118.740		181001.	263.14	1.913	2.029
		226.0	467.5	548.6	1.4636	118.714		179995.	269.18	1.967	2.081
		231.0	471.3	553.1	1.4527	118.717		179001.	265.39	1.949	2.063
		236.0	475.1	557.7	1.4367	118.688		178036.	260.76	1.924	2.038

WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		242.0	478.9	562.2	1.4258	118.658		177069.	257.08	1.902	2.019
		247.0	482.8	564.4	1.4540	118.663		176115.	260.45	1.943	2.052
		253.0	486.6	562.7	1.5579	118.660		175187.	277.28	2.075	2.185
2	0.477	2.7	309.7	423.7	2.2928	261.506	8.210	239284.	585.50	3.357	2.918
		7.9	317.7	485.2	1.5645	262.140		235184.	390.93	2.275	2.355
		13.3	326.4	514.2	1.3976	262.438		230880.	341.21	2.018	2.212
		18.6	334.8	532.9	1.3260	262.621		226945.	320.75	1.916	2.150
		23.9	343.2	547.5	1.2862	262.742		223172.	304.86	1.848	2.097
		29.2	351.6	558.8	1.2684	262.840		219549.	294.74	1.812	2.068
		34.5	360.0	567.2	1.2691	262.915		216070.	289.25	1.803	2.064
		39.9	368.4	574.4	1.2766	262.979		212723.	285.51	1.804	2.069
		45.2	376.8	582.7	1.2775	263.022		209482.	280.45	1.795	2.064
		50.5	385.2	593.3	1.2646	263.106		206379.	272.64	1.768	2.039
		55.8	393.6	597.2	1.2929	263.177		203389.	273.86	1.799	2.071
		61.2	402.0	605.0	1.2970	263.219		200503.	270.01	1.796	2.068
		66.5	410.4	612.2	1.3048	263.280		197717.	267.07	1.798	2.069
		71.8	418.8	619.4	1.3132	263.369		195006.	264.33	1.801	2.070
		77.1	427.2	627.2	1.3175	263.427		192403.	260.91	1.799	2.066
		82.4	435.7	634.4	1.3258	263.466		189869.	258.37	1.802	2.045
		87.8	444.1	641.6	1.3339	263.519		187431.	255.91	1.805	2.047
		93.1	452.5	648.8	1.3429	263.609		185043.	253.67	1.810	2.049
		98.4	460.9	656.1	1.3510	263.671		182764.	251.40	1.813	2.051
		103.7	469.3	663.3	1.3599	263.745		180529.	249.31	1.818	2.053
		109.0	477.7	670.5	1.3684	263.796		178375.	247.25	1.822	2.055
		114.0	486.2	687.7	1.3094	263.917		176270.	233.21	1.736	1.970
		120.0	494.6	684.4	1.3908	264.020		174238.	244.25	1.837	2.067
		125.0	503.0	691.6	1.4004	264.131		172250.	242.54	1.843	2.070
		130.0	511.3	698.8	1.4090	264.186		170343.	240.76	1.847	2.072
		135.0	519.9	707.7	1.4068	264.244		168439.	237.13	1.838	2.060
		141.0	528.3	714.3	1.4210	264.243		166609.	236.38	1.849	2.070
		146.0	536.8	721.6	1.4295	264.219		164829.	234.72	1.854	2.072
		151.0	545.2	729.4	1.4339	264.156		163106.	232.46	1.853	2.068
		157.0	553.6	736.6	1.4431	264.087		161416.	231.02	1.858	2.072
		162.0	562.2	743.8	1.4531	263.979		159747.	229.71	1.865	2.078
		167.0	570.5	751.1	1.4614	263.864		158162.	228.25	1.869	2.077
		173.0	578.8	758.3	1.4695	263.693		156615.	226.80	1.873	2.079
		178.0	587.2	765.5	1.4777	263.522		155106.	225.40	1.878	2.081
		183.0	595.5	772.7	1.4859	263.334		153631.	224.05	1.882	2.083
		189.0	603.8	790.5	1.4097	263.144		152191.	210.15	1.780	1.982
		194.0	612.7	787.2	1.5072	262.922		150692.	222.00	1.897	2.093
		199.0	621.1	794.3	1.5164	262.690		149319.	220.89	1.902	2.096
		205.0	629.4	801.6	1.5239	262.449		147976.	219.57	1.906	2.097
		210.0	637.7	808.8	1.5323	262.193		146663.	218.41	1.911	2.099
		215.0	646.1	816.1	1.5407	261.918		145378.	217.28	1.915	2.102
		221.0	654.4	823.3	1.5492	261.642		144121.	216.19	1.920	2.104



WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB (K)	TW (K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		226.0	662.3	830.5	1.5538	261.332		142956.	214.71	1.920	2.103
		231.0	671.1	837.2	1.5718	261.093		141686.	214.86	1.937	2.116
		236.0	679.4	844.4	1.5807	260.815		140506.	213.90	1.942	2.119
		242.0	687.7	851.6	1.5897	260.533		139350.	212.97	1.948	2.123
		247.0	696.1	858.8	1.5988	260.248		138217.	212.09	1.953	2.126
		253.0	704.4	801.6	2.6949	262.003		137107.	354.02	3.283	3.432
3	0.477	2.7	312.3	508.5	2.1312	418.187	8.119	235289.	540.36	3.142	2.849
		7.9	325.8	604.4	1.5089	420.396		228638.	369.03	2.200	2.397
		13.3	339.3	652.7	1.3459	421.789		222408.	322.01	1.956	2.271
		18.6	352.9	685.5	1.2708	422.611		216560.	294.38	1.830	2.184
		23.9	366.6	712.7	1.2209	422.635		211078.	274.17	1.742	2.113
		29.2	380.2	735.5	1.1878	422.064		205927.	258.88	1.681	2.058
		34.5	393.7	753.3	1.1723	421.507		201096.	248.25	1.645	2.029
		39.9	407.3	765.0	1.1777	421.224		196536.	242.56	1.640	2.030
		45.2	420.8	775.5	1.1861	420.670		192223.	237.81	1.640	2.033
		50.5	434.4	790.5	1.1798	420.140		188138.	230.47	1.619	2.016
		55.8	447.9	796.1	1.2059	419.854		184277.	229.73	1.644	2.039
		61.2	461.4	806.1	1.2165	419.288		180606.	226.17	1.647	2.040
		66.5	474.9	815.5	1.2294	418.748		177110.	223.22	1.654	2.042
		71.8	488.4	825.0	1.2425	418.171		173778.	220.46	1.661	2.043
		77.1	501.8	834.4	1.2567	417.923		170610.	218.07	1.669	2.045
		82.4	515.3	843.8	1.2703	417.364		167580.	215.70	1.677	2.011
		87.8	528.7	853.3	1.2851	417.086		164681.	213.64	1.687	2.016
		93.1	542.1	862.7	1.2991	416.506		161913.	211.58	1.696	2.019
		98.4	555.5	872.2	1.3144	416.226		159259.	209.83	1.706	2.025
		103.7	568.8	881.6	1.3299	415.963		156719.	208.21	1.717	2.031
		109.0	582.2	891.6	1.3424	415.397		154278.	206.21	1.724	2.032
		114.0	595.5	902.2	1.3537	415.134		151929.	204.11	1.730	2.033
		120.0	608.3	912.2	1.3642	414.564		149759.	202.14	1.735	2.034
		125.0	622.2	922.7	1.3785	414.315		147485.	200.51	1.744	2.037
		130.0	635.5	936.1	1.3766	413.744		145381.	196.78	1.733	2.022
		135.0	648.8	941.6	1.4132	413.753		143349.	198.60	1.771	2.053
		141.0	662.2	952.2	1.4248	413.191		141387.	196.91	1.777	2.055
		146.0	675.5	962.7	1.4376	412.910		139490.	195.45	1.785	2.058
		151.0	688.8	973.8	1.4479	412.651		137654.	193.72	1.789	2.058
		157.0	702.2	985.0	1.4582	412.346		135878.	192.05	1.794	2.058
		162.0	715.0	996.1	1.4649	411.799		134227.	190.10	1.794	2.055
		167.0	728.3	1007.2	1.4756	411.528		132557.	188.60	1.800	2.055
		173.0	741.6	1018.3	1.4865	411.264		130937.	187.19	1.805	2.057
		178.0	754.4	1029.4	1.4944	410.960		129430.	185.56	1.807	2.055
		183.0	769.7	1040.5	1.5167	410.688		127678.	185.25	1.825	2.067
		189.0	781.1	1051.6	1.5169	410.405		126419.	183.06	1.819	2.059
		194.0	793.8	1062.7	1.5253	410.136		125037.	181.64	1.822	2.058
		199.0	807.2	1074.4	1.5301	408.876		123633.	179.74	1.820	2.052
		205.0	820.0	1085.0	1.5456	409.583		122324.	179.23	1.832	2.060

WEYLAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
		210.0	833.3	1096.6	1.5543	409.298		120994.	177.87	1.835	2.059
		215.0	846.1	1108.8	1.5566	409.039		119753.	175.92	1.830	2.052
		221.0	859.4	1121.1	1.5621	408.749		118491.	174.29	1.830	2.048
		226.0	872.2	1133.8	1.5611	408.487		117312.	172.08	1.822	2.037
		231.0	885.0	1146.6	1.5600	408.199		116161.	169.92	1.814	2.026
		236.0	897.7	1160.0	1.5556	407.913		115038.	167.46	1.802	2.012
		242.0	911.1	1174.4	1.5480	407.639		113894.	164.63	1.787	1.994
		247.0	923.8	1186.6	1.5492	407.095		112825.	162.89	1.782	1.986
		253.0	936.6	1122.7	2.1933	408.197		111779.	228.03	2.513	2.695
4	0.477	2.7	298.6	353.9	1.6729	92.566	6.033	180219.	440.64	3.165	2.654
		7.9	302.7	384.2	1.1360	92.646		178579.	295.80	2.141	2.114
		13.3	306.7	398.2	1.0135	92.678		176976.	260.93	1.904	1.980
		18.6	310.7	406.1	0.9721	92.673		175429.	247.52	1.820	1.930
		23.9	314.8	411.9	0.9541	92.706		173894.	240.27	1.780	1.902
		29.2	318.8	416.8	0.9465	92.704		172393.	235.77	1.760	1.888
		34.5	322.8	420.9	0.9449	92.704		170943.	232.88	1.751	1.882
		39.9	326.9	424.6	0.9487	92.709		169503.	231.35	1.752	1.885
		45.2	330.9	428.2	0.9524	92.700		168112.	229.86	1.754	1.888
		50.5	334.9	432.3	0.9519	92.704		166748.	230.22	1.760	1.897
		55.8	338.9	436.1	0.9546	92.702		165394.	228.61	1.760	1.898
		61.2	342.9	439.8	0.9568	92.703		164084.	226.94	1.759	1.897
		66.5	346.9	443.6	0.9596	92.708		162800.	225.44	1.759	1.898
		71.8	351.0	447.3	0.9623	92.701		161523.	223.93	1.760	1.898
		77.1	355.0	451.1	0.9646	92.709		160287.	222.39	1.759	1.897
		82.4	359.0	454.8	0.9674	92.709		159075.	220.99	1.759	1.889
		87.8	363.1	458.6	0.9702	92.707		157869.	219.60	1.760	1.889
		93.1	367.1	462.4	0.9724	92.701		156701.	218.12	1.759	1.889
		98.4	371.1	466.1	0.9753	92.707		155554.	216.84	1.760	1.889
		103.7	375.1	469.9	0.9781	92.701		154413.	215.53	1.761	1.889
		109.0	379.1	473.6	0.9810	92.704		153307.	214.29	1.762	1.890
		114.0	383.1	477.3	0.9839	92.704		152220.	213.08	1.763	1.890
		120.0	387.1	481.1	0.9862	92.702		151153.	211.77	1.762	1.890
		125.0	391.2	484.8	0.9897	92.701		150089.	210.71	1.764	1.891
		130.0	395.2	488.6	0.9927	92.707		149058.	209.59	1.766	1.892
		135.0	399.2	492.3	0.9956	92.701		148044.	208.47	1.767	1.893
		141.0	403.2	496.0	0.9992	92.702		147034.	207.50	1.769	1.895
		146.0	407.2	499.8	1.0016	92.703		146054.	206.32	1.769	1.894
		151.0	411.2	503.5	1.0046	92.701		145089.	205.28	1.771	1.895
		157.0	415.3	507.2	1.0083	92.707		144128.	204.38	1.773	1.897
		162.0	419.3	510.9	1.0113	92.702		143194.	203.38	1.774	1.898
		167.0	423.3	514.7	1.0144	92.705		142276.	202.42	1.776	1.899
		173.0	427.3	518.3	1.0187	92.701		141360.	201.70	1.780	1.902
		178.0	431.3	522.1	1.0219	92.708		140470.	200.79	1.781	1.903
		183.0	435.3	525.8	1.0250	92.705		139594.	199.88	1.783	1.904
		189.0	439.3	529.5	1.0282	92.709		138732.	199.00	1.785	1.906

WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		194.0	443.4	533.2	1.0326	92.704		137871.	198.35	1.789	1.909
		199.0	447.4	536.9	1.0358	92.704		137034.	197.50	1.791	1.910
		205.0	451.4	540.6	1.0387	92.674		136210.	196.62	1.792	1.911
		210.0	455.4	544.3	1.0433	92.679		135387.	196.04	1.796	1.915
		215.0	459.4	548.0	1.0465	92.673		134587.	195.24	1.798	1.916
		221.0	463.4	551.7	1.0505	92.677		133799.	194.59	1.802	1.919
		226.0	467.5	555.4	1.0545	92.679		133011.	193.94	1.805	1.921
		231.0	471.5	558.8	1.0612	92.678		132246.	193.81	1.813	1.928
		236.0	475.5	562.7	1.0625	92.673		131491.	192.71	1.812	1.927
		242.0	479.5	566.6	1.0639	92.678		130747.	191.64	1.811	1.925
		247.0	483.6	570.0	1.0728	92.678		130002.	191.91	1.822	1.936
		253.0	487.6	539.4	1.7807	92.398		129279.	316.41	3.020	3.119
5	0.477	2.7	302.1	418.4	1.6982	197.557	5.987	177461.	442.99	3.223	2.807
		7.9	310.8	484.4	1.1431	198.391		174050.	290.97	2.153	2.240
		13.3	319.6	511.5	1.0349	198.642		170816.	257.29	1.935	2.130
		18.6	328.3	530.5	0.9830	198.784		167728.	238.85	1.825	2.057
		23.9	337.0	543.9	0.9612	198.914		164774.	231.28	1.786	2.034
		29.2	345.7	554.9	0.9513	198.979		161946.	224.14	1.756	2.011
		34.5	354.4	563.8	0.9506	199.045		159234.	219.44	1.745	2.004
		39.9	363.2	571.1	0.9580	199.104		156616.	216.75	1.748	2.011
		45.2	371.9	578.3	0.9653	199.174		154118.	214.19	1.752	2.018
		50.5	380.7	586.1	0.9701	199.248		151717.	211.20	1.751	2.019
		55.8	389.4	594.4	0.9722	199.301		149405.	207.76	1.746	2.015
		61.2	398.4	602.2	0.9783	199.356		147110.	205.18	1.747	2.016
		66.5	406.8	609.4	0.9845	199.416		145034.	202.95	1.750	2.018
		71.8	415.6	617.2	0.9896	199.459		142951.	200.46	1.751	2.016
		77.1	424.3	625.0	0.9946	199.528		140953.	198.07	1.751	2.014
		82.4	433.1	632.2	1.0028	199.613		139011.	196.37	1.757	1.996
		87.8	441.8	640.0	1.0078	199.656		137146.	194.15	1.758	1.995
		93.1	450.6	648.3	1.0104	199.722		135330.	191.53	1.755	1.990
		98.4	459.3	656.1	1.0157	199.811		133583.	189.53	1.756	1.990
		103.7	468.1	664.4	1.0182	199.850		131881.	187.06	1.753	1.984
		109.0	476.9	671.6	1.0267	199.921		130231.	185.77	1.760	1.989
		114.0	485.7	679.4	1.0324	199.999		128631.	184.03	1.763	1.989
		120.0	494.4	687.7	1.0348	200.051		127087.	181.78	1.760	1.985
		125.0	503.2	695.5	1.0408	200.181		125582.	180.21	1.763	1.985
		130.0	511.9	703.3	1.0467	200.268		124119.	178.68	1.766	1.986
		135.0	520.7	711.1	1.0527	200.364		122698.	177.21	1.769	1.987
		141.0	529.5	718.8	1.0584	200.390		121315.	175.74	1.772	1.988
		146.0	538.3	726.6	1.0640	200.386		119971.	174.30	1.775	1.988
		151.0	547.1	734.4	1.0695	200.353		118664.	172.89	1.778	1.988
		157.0	556.1	742.7	1.0764	200.927		117358.	171.69	1.783	1.991
		162.0	564.4	750.5	1.0759	200.236		116182.	169.53	1.776	1.982
		167.0	573.3	758.3	1.0820	200.170		114958.	168.32	1.780	1.983
		173.0	582.2	766.1	1.0879	200.052		113765.	167.11	1.783	1.984

WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		178.0	591.1	773.8	1.0938	199.922		112603.	165.94	1.787	1.985
		183.0	599.4	781.6	1.0963	199.770		111540.	164.42	1.785	1.981
		189.0	608.3	790.0	1.0988	199.615		110433.	162.81	1.783	1.977
		194.0	617.2	798.3	1.1011	199.421		109352.	161.22	1.781	1.972
		199.0	626.1	806.1	1.1068	199.224		108298.	160.17	1.784	1.973
		205.0	634.4	814.4	1.1055	198.990		107332.	158.25	1.777	1.964
		210.0	643.3	822.2	1.1112	198.781		106325.	157.26	1.780	1.964
		215.0	651.6	830.0	1.1134	198.556		105401.	155.92	1.778	1.960
		221.0	660.5	838.3	1.1155	198.311		104438.	154.48	1.776	1.956
		226.0	669.4	846.1	1.1212	198.078		103496.	153.58	1.780	1.957
		231.0	677.7	853.8	1.1233	197.825		102632.	152.31	1.778	1.953
		236.0	686.6	861.1	1.1326	197.575		101730.	151.94	1.787	1.960
		242.0	695.0	868.8	1.1350	197.363		100901.	150.76	1.786	1.957
		247.0	703.8	883.8	1.0928	196.704		100036.	143.65	1.714	1.885
		253.0	712.2	808.8	2.0580	198.939		99242.	267.92	3.220	3.362
6	0.477	2.7	307.3	508.7	1.1498	231.556	4.173	122264.	295.56	2.899	2.636
		7.9	321.9	600.0	0.8383	233.094		118475.	207.13	2.088	2.277
		13.3	336.6	646.1	0.7556	233.816		114939.	181.98	1.874	2.174
		18.6	351.3	681.1	0.7106	234.340		111665.	165.25	1.745	2.081
		23.9	366.0	706.6	0.6895	234.851		108601.	155.03	1.677	2.028
		29.2	380.7	735.5	0.6623	234.969		105737.	144.17	1.596	1.953
		34.5	395.4	745.5	0.6710	234.924		103064.	141.60	1.603	1.965
		39.9	410.1	760.5	0.6700	234.760		100542.	137.21	1.587	1.952
		45.2	424.8	771.1	0.6777	234.634		98167.	134.83	1.592	1.960
		50.5	439.6	779.4	0.6900	234.485		95927.	133.49	1.608	1.977
		55.8	454.2	791.1	0.6954	234.234		93817.	130.96	1.609	1.976
		61.2	468.9	801.6	0.7033	234.004		91819.	129.03	1.616	1.979
		66.5	483.6	812.2	0.7112	233.708		89922.	127.22	1.622	1.980
		71.8	498.2	822.7	0.7194	233.445		88120.	125.57	1.630	1.981
		77.1	512.8	833.3	0.7275	233.123		86411.	124.01	1.638	1.981
		82.4	527.5	843.8	0.7358	232.798		84781.	122.56	1.646	1.951
		87.8	542.0	854.4	0.7442	232.480		83232.	121.22	1.655	1.954
		93.1	556.6	865.5	0.7515	232.130		81745.	119.77	1.661	1.954
		98.4	571.1	876.1	0.7600	231.800		80338.	118.60	1.670	1.958
		103.7	585.5	887.2	0.7675	231.529		78989.	117.34	1.677	1.960
		109.0	600.0	898.8	0.7736	231.220		77696.	115.93	1.681	1.958
		114.0	614.4	910.0	0.7816	231.006		76453.	114.87	1.689	1.961
		120.0	628.8	921.6	0.7878	230.650		75258.	113.59	1.693	1.961
		125.0	643.3	933.3	0.7944	230.376		74109.	112.42	1.699	1.961
		130.0	657.7	945.0	0.8011	230.093		73002.	111.33	1.704	1.961
		135.0	672.2	956.6	0.8078	229.774		71935.	110.27	1.710	1.962
		141.0	686.1	968.8	0.8116	229.502		70945.	108.95	1.710	1.958
		146.0	700.5	980.5	0.8186	229.208		69951.	108.02	1.716	1.959
		151.0	715.0	992.7	0.8241	228.916		68990.	106.94	1.719	1.957
		157.0	728.8	1005.0	0.8280	228.620		68096.	105.76	1.719	1.954

WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB (K)	TW (K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		162.0	743.3	1017.2	0.8337	228.341		67197.	104.79	1.723	1.953
		167.0	757.2	1029.4	0.8378	228.067		66359.	103.72	1.724	1.950
		173.0	771.6	1041.6	0.8436	227.772		65514.	102.83	1.728	1.950
		178.0	785.5	1053.8	0.8478	227.492		64727.	101.84	1.729	1.947
		183.0	799.4	1066.6	0.8502	227.192		63963.	100.67	1.727	1.941
		189.0	813.8	1079.4	0.8545	226.917		63191.	99.70	1.728	1.938
		194.0	827.7	1092.2	0.8571	226.655		62471.	98.62	1.726	1.933
		199.0	841.6	1105.0	0.8596	226.361		61770.	97.57	1.724	1.927
		205.0	855.5	1118.3	0.8603	226.067		61089.	96.34	1.718	1.919
		210.0	869.4	1131.1	0.8629	225.792		60426.	95.36	1.716	1.914
		215.0	883.3	1144.4	0.8635	225.469		59781.	94.20	1.711	1.905
		221.0	897.2	1157.7	0.8643	225.198		59152.	93.08	1.705	1.897
		226.0	911.1	1171.6	0.8632	224.911		58539.	91.80	1.697	1.885
		231.0	925.0	1185.0	0.8639	224.614		57942.	90.74	1.691	1.877
		236.0	938.8	1198.8	0.8628	224.328		57360.	89.52	1.683	1.865
		242.0	952.2	1212.2	0.8616	224.016		56814.	88.37	1.674	1.854
		247.0	966.1	1226.1	0.8604	223.704		56259.	87.20	1.666	1.843
		253.0	980.0	1148.8	1.3302	224.655		55718.	133.25	2.566	2.719
7	0.477	2.7	301.7	426.4	1.1686	145.750	4.218	125119.	305.10	2.936	2.567
		7.9	310.9	484.2	0.8452	146.454		122608.	215.11	2.106	2.190
		13.3	320.1	508.2	0.7793	146.637		120217.	193.49	1.927	2.117
		18.6	329.2	527.0	0.7420	146.750		117939.	179.85	1.821	2.047
		23.9	338.4	545.1	0.7106	146.896		115764.	170.40	1.745	1.986
		29.2	347.6	551.4	0.7206	146.922		113686.	169.05	1.759	2.006
		34.5	356.7	561.6	0.7173	146.966		111699.	164.72	1.740	1.991
		39.9	365.9	570.0	0.7205	147.022		109795.	162.04	1.737	1.991
		45.2	375.0	577.7	0.7256	147.095		107980.	159.93	1.739	1.996
		50.5	384.1	586.1	0.7286	147.136		106238.	157.45	1.737	1.995
		55.8	393.3	594.4	0.7321	147.192		104543.	155.16	1.736	1.994
		61.2	402.5	602.2	0.7375	147.254		102924.	153.37	1.739	1.997
		66.5	411.7	611.1	0.7388	147.308		101366.	150.83	1.733	1.990
		71.8	420.8	618.8	0.7443	147.371		99864.	149.23	1.737	1.992
		77.1	430.0	626.6	0.7498	147.419		98417.	147.70	1.742	1.993
		82.4	439.2	635.0	0.7531	147.440		97020.	145.80	1.741	1.970
		87.8	448.4	643.3	0.7568	147.492		95663.	144.04	1.741	1.968
		93.1	457.6	651.6	0.7604	147.560		94360.	142.34	1.742	1.966
		98.4	466.7	660.0	0.7639	147.603		93100.	140.69	1.742	1.964
		103.7	475.9	668.3	0.7678	147.673		91874.	139.15	1.743	1.963
		109.0	485.1	676.1	0.7736	147.715		90694.	138.02	1.749	1.966
		114.0	494.3	684.4	0.7776	147.787		89544.	136.61	1.750	1.965
		120.0	503.6	692.7	0.7815	147.833		88429.	135.23	1.752	1.965
		125.0	512.7	700.5	0.7879	147.950		87355.	134.33	1.759	1.969
		130.0	521.9	708.8	0.7921	148.034		86306.	133.08	1.761	1.969
		135.0	531.2	717.2	0.7961	148.075		85288.	131.85	1.763	1.968
		141.0	540.4	725.5	0.8001	148.107		84299.	130.65	1.765	1.968

WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		146.0	549.6	733.8	0.8040	148.115		83338.	129.48	1.767	1.968
		151.0	558.8	742.2	0.8079	148.115		82403.	128.34	1.769	1.967
		157.0	568.3	750.5	0.8127	148.091		81473.	127.34	1.772	1.968
		162.0	577.2	758.8	0.8148	148.021		80620.	126.05	1.771	1.964
		167.0	586.6	767.2	0.8194	147.947		79739.	125.08	1.774	1.965
		173.0	595.5	775.5	0.8215	147.870		78930.	123.86	1.773	1.961
		178.0	605.0	783.8	0.8259	147.744		78093.	122.93	1.776	1.962
		183.0	613.8	792.2	0.8279	147.642		77325.	121.76	1.774	1.958
		189.0	623.3	800.0	0.8349	147.499		76529.	121.26	1.783	1.964
		194.0	632.2	808.3	0.8366	147.334		75798.	120.10	1.781	1.960
		199.0	641.6	816.6	0.8410	147.175		75040.	119.27	1.784	1.960
		205.0	650.5	825.0	0.8427	147.004		74344.	118.17	1.782	1.956
		210.0	659.4	833.3	0.8443	146.814		73663.	117.09	1.780	1.952
		215.0	668.8	841.6	0.8486	146.619		72957.	116.32	1.783	1.952
		221.0	677.7	850.0	0.8502	146.423		72307.	115.28	1.781	1.948
		226.0	686.6	858.3	0.8518	146.225		71671.	114.27	1.779	1.944
		231.0	696.1	867.2	0.8533	146.009		71011.	113.19	1.776	1.939
		236.0	705.0	876.1	0.8520	145.786		70403.	111.85	1.768	1.929
		242.0	713.8	885.0	0.8507	145.564		69807.	110.53	1.760	1.919
		247.0	722.7	893.8	0.8494	145.341		69224.	109.25	1.752	1.910
		253.0	731.6	838.3	1.3714	146.282		68653.	174.63	2.821	2.958
8	0.477	2.7	311.4	505.0	1.6089	311.412	5.897	171226.	408.92	3.065	2.776
		7.9	325.4	600.0	1.1403	313.075		166199.	279.16	2.148	2.336
		13.3	339.4	652.2	1.0045	314.185		161522.	240.30	1.886	2.188
		18.6	353.4	687.2	0.9440	315.034		157141.	218.43	1.755	2.095
		23.9	367.5	712.2	0.9148	315.301		153043.	205.00	1.685	2.041
		29.2	381.7	734.4	0.8939	315.317		149176.	194.20	1.632	1.994
		34.5	395.7	746.1	0.8991	315.034		145573.	189.63	1.628	1.996
		39.9	409.7	758.3	0.9038	315.024		142170.	185.24	1.623	1.996
		45.2	423.7	768.3	0.9135	314.751		138970.	182.13	1.628	2.004
		50.5	437.8	777.7	0.9251	314.482		135931.	179.57	1.637	2.014
		55.8	451.8	788.8	0.9324	314.209		133051.	176.35	1.638	2.014
		61.2	465.8	799.4	0.9403	313.642		130328.	173.45	1.640	2.013
		66.5	479.8	810.0	0.9493	313.375		127739.	170.90	1.645	2.013
		71.8	493.8	820.5	0.9583	313.098		125283.	168.51	1.650	2.012
		77.1	507.8	831.1	0.9667	312.512		122932.	166.13	1.654	2.009
		82.4	521.7	842.2	0.9743	312.263		120705.	163.77	1.657	1.972
		87.8	535.6	853.3	0.9812	311.695		118566.	161.40	1.659	1.969
		93.1	549.5	863.8	0.9907	311.410		116527.	159.57	1.665	1.970
		98.4	563.3	874.4	1.0001	311.142		114588.	157.84	1.672	1.972
		103.7	577.2	885.0	1.0091	310.578		112712.	156.11	1.677	1.972
		109.0	591.1	895.0	1.0211	310.300		110910.	154.91	1.688	1.978
		114.0	605.0	905.5	1.0315	310.022		109178.	153.53	1.696	1.981
		120.0	618.8	916.1	1.0422	309.765		107512.	152.26	1.705	1.985
		125.0	632.7	927.2	1.0511	309.490		105907.	150.79	1.711	1.986

WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB (K)	TW (K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
		130.0	646.1	938.3	1.0581	309.200		104421.	149.22	1.714	1.945
		135.0	660.0	949.4	1.0663	308.634		102927.	147.77	1.719	1.984
		141.0	673.8	960.5	1.0757	308.367		101484.	146.55	1.725	1.986
		146.0	687.2	971.6	1.0831	308.081		100146.	145.20	1.729	1.986
		151.0	701.1	982.7	1.0928	307.805		98797.	144.11	1.737	1.988
		157.0	714.4	993.8	1.1005	307.528		97543.	142.90	1.741	1.989
		162.0	728.3	1005.5	1.1084	307.272		96279.	141.67	1.746	1.989
		167.0	741.6	1017.2	1.1140	306.969		95102.	140.28	1.747	1.986
		173.0	755.5	1028.8	1.1221	306.707		93914.	139.16	1.752	1.987
		178.0	768.8	1040.5	1.1280	306.439		92807.	137.90	1.754	1.985
		183.0	782.7	1052.2	1.1362	306.142		91688.	136.88	1.759	1.986
		189.0	796.1	1064.4	1.1399	305.873		90645.	135.43	1.757	1.981
		194.0	809.4	1076.4	1.1446	305.608		89630.	134.15	1.757	1.977
		199.0	822.7	1088.8	1.1473	305.309		88643.	132.67	1.754	1.971
		205.0	836.6	1101.1	1.1535	305.036		87643.	131.57	1.757	1.970
		210.0	850.0	1113.8	1.1549	304.764		86709.	130.03	1.752	1.962
		215.0	863.3	1126.6	1.1563	304.491		85799.	128.53	1.747	1.954
		221.0	876.6	1140.0	1.1542	303.939		84913.	126.70	1.737	1.941
		226.0	890.0	1153.3	1.1531	303.649		84049.	125.02	1.729	1.930
		231.0	903.3	1166.6	1.1521	303.386		83206.	123.39	1.721	1.919
		236.0	916.6	1180.0	1.1510	303.096		82384.	121.80	1.713	1.908
		242.0	929.4	1193.8	1.1451	302.814		81614.	119.81	1.698	1.891
		247.0	942.7	1205.5	1.1503	302.273		80830.	118.95	1.699	1.889
		253.0	956.1	1078.3	2.4958	305.042		80065.	255.14	3.674	3.826
9	0.477	2.7	300.3	352.8	1.2193	63.945	4.128	122833.	319.59	3.120	2.608
		7.9	304.4	381.9	0.8264	64.000		121707.	214.11	2.107	2.073
		13.3	308.7	394.9	0.7424	64.026		120582.	190.11	1.886	1.954
		18.6	312.7	401.2	0.7234	64.061		119529.	183.22	1.831	1.932
		23.9	316.7	405.6	0.7207	64.062		118489.	180.54	1.818	1.932
		29.2	320.8	410.4	0.7153	64.059		117459.	177.23	1.798	1.917
		34.5	325.0	414.3	0.7171	64.060		116450.	175.76	1.797	1.918
		39.9	329.0	418.2	0.7184	64.057		115475.	174.23	1.794	1.917
		45.2	333.1	422.1	0.7202	64.057		114507.	174.95	1.806	1.931
		50.5	337.2	425.9	0.7220	64.057		113560.	173.63	1.806	1.931
		55.8	341.3	429.8	0.7234	64.061		112644.	172.26	1.804	1.930
		61.2	345.4	433.7	0.7256	64.054		111733.	171.10	1.804	1.931
		66.5	349.4	437.6	0.7273	64.083		110853.	169.86	1.803	1.930
		71.8	353.6	441.4	0.7296	64.083		109978.	168.77	1.804	1.931
		77.1	357.6	445.2	0.7315	64.087		109131.	167.63	1.804	1.930
		82.4	361.7	449.1	0.7333	64.082		108300.	166.50	1.804	1.923
		87.8	365.8	452.9	0.7357	64.087		107474.	165.50	1.805	1.923
		93.1	369.8	456.7	0.7380	64.082		106674.	164.52	1.806	1.924
		98.4	373.9	460.5	0.7404	64.085		105878.	163.57	1.807	1.925
		103.7	378.0	464.3	0.7428	64.087		105107.	162.65	1.808	1.926
		109.0	382.1	468.1	0.7457	64.088		104339.	161.84	1.811	1.928

WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		114.0	386.2	471.8	0.7481	64.086		103596.	160.96	1.812	1.929
		120.0	390.2	475.6	0.7505	64.084		102865.	160.10	1.814	1.930
		125.0	394.3	479.3	0.7540	64.089		102137.	159.47	1.818	1.933
		130.0	398.4	483.1	0.7564	64.083		101431.	158.64	1.819	1.934
		135.0	402.5	486.8	0.7599	64.084		100728.	158.03	1.823	1.938
		141.0	406.6	490.6	0.7629	64.083		100046.	157.36	1.826	1.940
		146.0	410.7	495.1	0.7589	64.084		99366.	155.24	1.812	1.926
		151.0	414.7	499.1	0.7594	64.084		98707.	154.10	1.810	1.923
		157.0	418.8	503.1	0.7609	64.084		98049.	153.16	1.809	1.922
		162.0	422.9	507.0	0.7619	64.083		97411.	152.15	1.807	1.920
		167.0	427.0	510.9	0.7639	64.082		96775.	151.34	1.808	1.920
		173.0	431.1	514.8	0.7650	64.089		96157.	150.39	1.807	1.918
		178.0	435.2	518.7	0.7670	64.086		95540.	149.61	1.808	1.918
		183.0	439.2	522.6	0.7685	64.084		94942.	148.77	1.807	1.917
		189.0	443.3	526.5	0.7701	64.089		94352.	147.96	1.807	1.917
		194.0	447.4	530.4	0.7721	64.084		93764.	147.22	1.808	1.917
		199.0	451.4	534.2	0.7742	64.086		93192.	146.53	1.810	1.918
		205.0	455.6	538.1	0.7765	64.061		92621.	145.88	1.811	1.919
		210.0	459.6	541.9	0.7780	64.055		92067.	145.10	1.811	1.918
		215.0	463.7	545.8	0.7807	64.061		91513.	144.54	1.814	1.920
		221.0	467.8	549.6	0.7828	64.059		90975.	143.90	1.815	1.921
		226.0	471.9	553.9	0.7812	64.058		90437.	142.58	1.808	1.913
		231.0	475.9	557.2	0.7887	64.060		89914.	142.94	1.822	1.926
		236.0	480.1	561.1	0.7908	64.055		89391.	142.31	1.823	1.927
		242.0	484.1	565.0	0.7925	64.060		88883.	141.64	1.823	1.927
		247.0	488.2	568.8	0.7941	64.057		88382.	140.95	1.824	1.926
		253.0	492.3	551.7	1.0744	63.807		87881.	189.40	2.463	2.557
10	0.477	2.7	115.0	231.6	0.8842	103.156	4.218	240588.	552.84	3.132	2.996
		7.9	122.7	289.8	0.6201	103.625		230221.	364.64	2.139	2.492
		13.3	130.3	319.3	0.5490	103.760		221022.	305.01	1.847	2.310
		18.6	137.8	337.0	0.5212	103.834		212798.	274.66	1.714	2.212
		23.9	145.2	349.2	0.5094	103.889		205346.	255.44	1.640	2.150
		29.2	152.6	358.7	0.5041	103.900		198606.	241.30	1.590	2.105
		34.5	159.8	367.3	0.5012	103.971		192434.	229.59	1.552	2.072
		39.9	167.0	374.8	0.5002	103.958		186800.	219.84	1.522	2.045
		45.2	174.1	381.1	0.5025	103.989		181596.	212.33	1.503	2.030
		50.5	181.2	386.3	0.5071	104.011		176774.	206.39	1.494	2.021
		55.8	188.2	391.0	0.5130	104.053		172292.	201.45	1.489	2.012
		61.2	195.1	395.7	0.5188	104.048		168113.	196.88	1.485	2.002
		66.5	202.0	399.4	0.5271	104.072		164207.	193.59	1.489	1.995
		71.8	208.8	402.7	0.5369	104.069		160547.	191.09	1.497	1.992
		77.1	215.6	405.3	0.5486	104.081		157110.	189.46	1.512	1.993
		82.4	222.4	407.6	0.5620	104.094		153850.	190.27	1.540	1.958
		87.8	229.2	409.7	0.5766	104.108		150752.	190.28	1.566	1.975
		93.1	235.8	412.2	0.5904	104.107		147851.	190.14	1.589	1.990



WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		98.4	242.6	414.8	0.6044	104.124		145062.	190.04	1.613	2.006
		103.7	249.2	417.8	0.6178	104.133		142422.	189.82	1.636	2.020
		109.0	255.8	420.9	0.6307	104.135		139918.	189.51	1.658	2.034
		114.0	262.5	424.4	0.6434	104.159		137500.	189.13	1.679	2.046
		120.0	269.1	428.1	0.6549	104.165		135221.	188.51	1.697	2.058
		125.0	275.7	432.2	0.6657	104.182		133015.	187.70	1.714	2.066
		130.0	282.2	436.6	0.6748	104.181		130914.	186.49	1.726	2.071
		135.0	288.8	441.3	0.6831	104.210		128892.	185.13	1.736	2.074
		141.0	295.3	445.8	0.6924	104.206		126947.	184.10	1.749	2.081
		146.0	301.9	450.5	0.7014	104.235		125072.	183.03	1.761	2.087
		151.0	308.4	455.3	0.7094	104.242		123280.	181.79	1.772	2.090
		157.0	314.9	460.2	0.7174	104.262		121550.	180.61	1.782	2.095
		162.0	321.4	465.3	0.7246	104.261		119879.	179.27	1.790	2.097
		167.0	327.9	470.4	0.7316	104.293		118263.	177.94	1.798	2.099
		173.0	334.4	475.7	0.7384	104.319		116701.	178.80	1.819	2.117
		178.0	340.9	481.1	0.7443	104.326		115188.	177.41	1.825	2.118
		183.0	347.4	486.6	0.7498	104.347		113723.	175.97	1.830	2.118
		189.0	353.8	492.2	0.7544	104.358		112316.	174.40	1.833	2.117
		194.0	360.3	497.9	0.7588	104.376		110939.	172.81	1.836	2.115
		199.0	366.8	503.7	0.7625	104.377		109603.	171.12	1.837	2.111
		205.0	373.3	509.7	0.7655	104.406		108317.	169.36	1.837	2.107
		210.0	379.8	515.8	0.7679	104.434		107058.	167.50	1.835	2.101
		215.0	386.3	520.9	0.7758	104.430		105834.	166.88	1.847	2.108
		221.0	392.7	526.8	0.7793	104.469		104654.	165.37	1.848	2.105
		226.0	399.2	532.8	0.7818	104.456		103496.	163.68	1.847	2.100
		231.0	405.7	538.9	0.7847	104.495		102370.	162.13	1.847	2.096
		236.0	412.2	545.1	0.7866	104.486		101273.	160.41	1.845	2.090
		242.0	418.7	551.3	0.7885	104.519		100205.	158.75	1.843	2.085
		247.0	425.2	557.7	0.7885	104.519		99173.	156.77	1.836	2.075
		253.0	431.7	530.8	1.0506	104.126		98159.	206.30	2.438	2.651
11	0.477	2.7	132.7	420.3	0.9416	270.814	4.218	218318.	514.23	3.145	3.375
		7.9	152.3	660.5	0.5405	274.663		198802.	259.08	1.706	2.382
		13.3	171.5	806.6	0.4325	274.685		183465.	185.38	1.302	2.042
		18.6	190.1	877.7	0.3958	272.156		171096.	153.93	1.144	1.895
		23.9	208.2	912.2	0.3853	271.251		160895.	137.55	1.076	1.835
		29.2	225.9	932.7	0.3829	270.646		152230.	127.92	1.044	1.810
		34.5	243.3	940.5	0.3880	270.500		144748.	121.66	1.035	1.815
		39.9	260.6	943.3	0.3961	270.404		138174.	117.15	1.036	1.827
		45.2	277.8	942.2	0.4071	270.472		132329.	114.04	1.046	1.844
		50.5	294.8	938.3	0.4205	270.591		127109.	111.98	1.063	1.861
		55.8	311.8	933.3	0.4356	270.725		122371.	110.59	1.084	1.872
		61.2	328.6	931.1	0.4494	270.738		118087.	109.10	1.104	1.876
		66.5	345.4	930.0	0.4633	270.798		114157.	109.23	1.132	1.887
		71.8	362.3	930.5	0.4766	270.814		110535.	108.06	1.152	1.881
		77.1	379.1	932.2	0.4895	270.748		107196.	106.94	1.170	1.873

WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB (K)	TW (K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF	
			82.4	395.8	934.4	0.5026	270.678	104096.	105.97	1.190	1.770	
			87.8	412.6	937.2	0.5159	270.618	101208.	105.13	1.210	1.773	
			93.1	429.4	940.5	0.5293	270.531	98511.	104.38	1.230	1.777	
			98.4	446.2	943.8	0.5434	270.431	95986.	103.85	1.252	1.782	
			103.7	462.9	950.5	0.5543	270.252	93615.	102.77	1.266	1.781	
			109.0	479.7	953.3	0.5705	270.163	91383.	102.72	1.293	1.791	
			114.0	496.4	957.2	0.5862	270.075	89286.	102.62	1.318	1.801	
			120.0	513.2	961.6	0.6021	269.975	87297.	102.57	1.344	1.813	
			125.0	530.0	965.5	0.6196	269.870	85421.	102.81	1.373	1.826	
			130.0	551.7	970.5	0.6440	269.728	83127.	103.39	1.414	1.845	
			135.0	563.3	975.5	0.6541	269.634	81962.	103.23	1.429	1.853	
			141.0	580.0	981.1	0.6718	269.466	80359.	103.52	1.458	1.870	
			146.0	596.6	987.7	0.6886	269.319	78830.	103.67	1.485	1.884	
			151.0	613.3	995.0	0.7051	269.113	77372.	103.78	1.511	1.897	
			157.0	630.0	1002.7	0.7214	268.921	75979.	103.86	1.537	1.911	
			162.0	646.6	1011.6	0.7362	268.712	74646.	103.75	1.559	1.922	
			167.0	663.3	1021.1	0.7504	268.476	73370.	103.56	1.578	1.932	
			173.0	680.0	1031.1	0.7640	268.248	72147.	103.31	1.597	1.941	
			178.0	696.1	1042.2	0.7743	267.993	71011.	102.71	1.614	1.945	
			183.0	712.7	1052.7	0.7875	267.750	69881.	102.45	1.633	1.953	
			189.0	729.4	1064.4	0.7984	267.463	68795.	101.92	1.643	1.959	
			194.0	745.5	1076.6	0.8069	267.173	67784.	101.17	1.652	1.960	
			199.0	762.2	1088.8	0.8171	266.919	66776.	100.61	1.663	1.963	
			205.0	778.3	1102.2	0.8232	266.625	65836.	99.63	1.663	1.961	
			210.0	795.0	1115.0	0.8323	266.335	64898.	99.00	1.674	1.963	
			215.0	811.1	1128.8	0.8371	266.011	64021.	97.94	1.689	1.958	
			221.0	827.2	1142.7	0.8421	265.729	63173.	96.95	1.688	1.954	
			226.0	843.3	1156.6	0.8471	265.424	62353.	95.99	1.688	1.949	
			231.0	860.0	1171.1	0.8520	265.066	61531.	95.01	1.688	1.944	
			236.0	876.1	1185.5	0.8556	264.760	60762.	93.97	1.687	1.938	
			242.0	892.2	1200.0	0.8592	264.442	60017.	92.96	1.687	1.932	
			247.0	908.3	1214.4	0.8629	264.143	59293.	92.00	1.687	1.926	
			253.0	923.8	1100.5	1.5023	265.406	58615.	157.96	2.916	3.117	
12	0.477		2.7	127.2	345.1	0.8282	180.455	4.218	224671.	470.74	2.815	2.903
			7.9	140.5	466.9	0.5571	181.892		210053.	288.32	1.817	2.339
			13.3	153.5	514.3	0.5057	182.445		197777.	240.66	1.597	2.207
			18.6	166.3	552.5	0.4732	182.764		187349.	208.83	1.442	2.086
			23.9	178.8	582.2	0.4538	183.033		178333.	186.97	1.343	1.996
			29.2	191.2	601.6	0.4466	183.279		170422.	172.73	1.288	1.944
			34.5	203.5	620.5	0.4398	183.396		163386.	160.40	1.239	1.902
			39.9	215.6	635.5	0.4372	183.575		157110.	150.98	1.205	1.874
			45.2	227.6	647.2	0.4378	183.681		151449.	145.32	1.191	1.870
			50.5	239.5	656.6	0.4406	183.779		146314.	140.04	1.180	1.863
			55.8	251.3	664.4	0.4572	188.848		141610.	139.47	1.208	1.904
			61.2	263.1	670.5	0.4514	183.895		137283.	132.43	1.177	1.848

WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		66.5	274.8	675.5	0.4592	183.986		133288.	129.81	1.183	1.839
		71.8	286.5	680.0	0.4677	184.014		129586.	127.61	1.191	1.830
		77.1	298.1	682.7	0.4785	184.036		126144.	126.21	1.206	1.825
		82.4	309.8	685.0	0.4906	184.067		122911.	125.25	1.224	1.742
		87.8	321.2	687.2	0.5030	184.070		119921.	124.50	1.243	1.749
		93.1	332.7	688.3	0.5178	184.106		117097.	124.38	1.267	1.761
		98.4	344.2	690.0	0.5326	184.131		114431.	125.94	1.303	1.787
		103.7	355.7	692.7	0.5466	184.204		111911.	125.81	1.326	1.799
		109.0	367.2	695.0	0.5621	184.212		109524.	126.04	1.354	1.814
		114.0	378.8	697.7	0.5777	184.266		107253.	126.29	1.382	1.828
		120.0	390.2	700.5	0.5939	184.306		105118.	126.71	1.411	1.847
		125.0	401.7	704.4	0.6090	184.358		103069.	126.87	1.437	1.861
		130.0	413.2	708.3	0.6248	184.385		101116.	127.18	1.465	1.877
		135.0	424.7	712.7	0.6403	184.441		99252.	127.43	1.491	1.892
		141.0	436.2	717.2	0.6565	184.476		97472.	127.82	1.520	1.911
		146.0	447.7	722.2	0.6721	184.491		95768.	128.09	1.547	1.927
		151.0	459.2	728.3	0.6856	184.502		94136.	127.97	1.569	1.939
		157.0	470.7	733.8	0.7012	184.432		92571.	128.25	1.596	1.957
		162.0	482.2	740.5	0.7142	184.501		91069.	128.06	1.616	1.968
		167.0	493.7	747.2	0.7277	184.472		89626.	127.98	1.638	1.980
		173.0	505.2	754.4	0.7399	184.399		88238.	127.69	1.657	1.991
		178.0	516.8	762.2	0.7512	184.352		86892.	127.25	1.674	1.999
		183.0	528.2	770.5	0.7604	184.270		85616.	126.52	1.686	2.004
		189.0	539.7	778.8	0.7699	184.134		84375.	125.86	1.699	2.010
		194.0	551.1	788.8	0.7739	183.973		83184.	124.35	1.700	2.003
		199.0	562.7	798.8	0.7785	183.812		82017.	122.97	1.702	1.999
		205.0	573.8	808.3	0.7830	183.570		80937.	121.71	1.704	1.995
		210.0	585.5	818.3	0.7877	183.359		79841.	120.43	1.706	1.991
		215.0	596.6	828.8	0.7885	183.107		78830.	118.71	1.701	1.980
		221.0	608.3	838.8	0.7930	182.830		77803.	117.50	1.703	1.976
		226.0	619.4	849.4	0.7937	182.551		76854.	115.87	1.697	1.965
		231.0	631.1	860.0	0.7964	182.287		75888.	114.50	1.696	1.958
		236.0	642.2	870.5	0.7970	181.981		74996.	112.95	1.690	1.947
		242.0	653.3	880.5	0.7996	181.686		74129.	111.74	1.689	1.942
		247.0	665.0	891.1	0.8005	181.454		73245.	110.52	1.688	1.936
		253.0	676.1	848.8	1.0003	182.158		72428.	143.24	2.210	2.432
13	0.477	2.7	129.6	331.8	1.1912	240.953	5.851	307748.	665.28	3.093	3.144
		7.9	142.0	440.4	0.8118	242.276		289209.	415.79	2.030	2.559
		13.3	154.2	506.4	0.6902	243.103		273476.	327.01	1.669	2.299
		18.6	166.3	551.2	0.6330	243.599		259822.	279.26	1.484	2.145
		23.9	178.3	585.5	0.5993	244.048		247898.	247.64	1.367	2.040
		29.2	190.1	612.7	0.5782	244.385		237383.	224.93	1.286	1.965
		34.5	201.7	635.0	0.5647	244.640		227992.	207.66	1.228	1.918
		39.9	213.3	651.6	0.5586	244.852		219548.	194.90	1.190	1.890
		45.2	229.7	662.7	0.5658	244.991		208773.	186.33	1.181	1.872

WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		50.5	236.1	670.5	0.5642	245.082		204928.	181.52	1.168	1.888
		55.8	247.4	676.6	0.5713	245.214		198551.	176.64	1.167	1.885
		61.2	258.7	683.3	0.5777	245.297		192644.	171.96	1.165	1.878
		66.5	269.9	687.2	0.5881	245.401		187179.	168.84	1.172	1.870
		71.8	281.1	690.0	0.6003	245.456		182107.	166.49	1.183	1.865
		77.1	292.2	692.2	0.6138	245.520		177386.	164.70	1.197	1.859
		82.4	303.2	693.3	0.6294	245.501		172977.	163.63	1.215	1.769
		87.8	314.3	694.4	0.6460	245.516		168810.	162.87	1.235	1.777
		93.1	325.3	694.4	0.6653	245.532		164921.	162.90	1.261	1.789
		98.4	336.4	696.1	0.6827	245.544		161229.	164.51	1.292	1.812
		103.7	347.4	697.7	0.7010	245.583		157752.	164.52	1.317	1.824
		109.0	358.4	700.5	0.7179	245.601		154454.	164.22	1.339	1.834
		114.0	369.4	703.3	0.7357	245.642		151323.	164.17	1.362	1.844
		120.0	380.4	706.6	0.7531	245.678		148344.	164.05	1.385	1.857
		125.0	391.4	710.0	0.7713	245.702		145506.	164.13	1.409	1.868
		130.0	402.4	713.8	0.7890	245.729		142798.	164.12	1.432	1.879
		135.0	413.4	718.3	0.8059	245.710		140212.	163.97	1.454	1.889
		141.0	424.4	722.7	0.8237	245.737		137739.	164.01	1.477	1.903
		146.0	435.4	727.7	0.8406	245.735		135371.	163.90	1.499	1.913
		151.0	446.4	733.3	0.8567	245.730		133091.	163.64	1.519	1.923
		157.0	457.5	738.3	0.8749	245.701		130914.	163.81	1.542	1.937
		162.0	468.4	743.8	0.8920	245.647		128823.	163.78	1.564	1.949
		167.0	479.4	750.0	0.9079	245.587		126812.	163.56	1.584	1.958
		173.0	490.4	755.5	0.9262	245.494		124878.	163.77	1.607	1.973
		178.0	501.4	762.2	0.9412	245.392		123015.	163.42	1.625	1.982
		183.0	512.5	769.4	0.9545	245.253		121219.	162.81	1.640	1.988
		189.0	523.4	777.2	0.9659	245.124		119496.	161.92	1.652	1.993
		194.0	534.4	785.5	0.9753	244.908		117824.	160.73	1.660	1.993
		199.0	545.3	793.8	0.9847	244.698		116216.	159.60	1.668	1.994
		205.0	556.1	802.7	0.9911	244.471		114693.	158.09	1.672	1.991
		210.0	567.2	811.1	1.0013	244.205		113165.	157.14	1.681	1.994
		215.0	578.3	820.0	1.0094	243.938		111687.	155.91	1.688	1.993
		221.0	588.8	828.8	1.0152	243.647		110326.	154.49	1.690	1.990
		226.0	600.0	837.7	1.0235	243.365		108938.	153.38	1.697	1.990
		231.0	611.1	846.6	1.0319	243.069		107591.	152.33	1.704	1.990
		236.0	621.6	855.5	1.0379	242.753		106350.	151.08	1.707	1.988
		242.0	632.7	863.8	1.0492	242.481		105081.	150.52	1.718	1.993
		247.0	643.3	886.1	0.9951	241.588		103909.	140.83	1.624	1.899
		253.0	654.4	816.6	1.5014	243.560		102710.	209.52	2.440	2.676
14	0.477	2.7	141.5	445.3	1.1936	362.721	5.851	289978.	613.61	2.989	3.204
		7.9	159.9	648.8	0.7504	366.903		266872.	343.63	1.788	2.445
		13.3	177.9	789.4	0.5996	366.621		248212.	248.21	1.369	2.099
		18.6	195.5	866.1	0.5422	363.575		232883.	205.37	1.193	1.942
		23.9	212.7	907.7	0.5211	362.164		219936.	182.26	1.111	1.871
		29.2	229.6	937.2	0.5107	361.348		208841.	168.26	1.066	1.838

WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
		34.5	244.3	966.1	0.4995	360.527		200261.	156.11	1.024	1.821
		39.9	262.8	975.5	0.5055	360.252		190569.	148.44	1.015	1.819
		45.2	279.2	977.7	0.5157	360.216		182917.	143.83	1.018	1.835
		50.5	295.5	973.8	0.5310	360.195		176028.	141.11	1.032	1.855
		55.8	311.7	968.3	0.5491	360.514		169767.	139.43	1.052	1.868
		61.2	327.9	964.4	0.5664	360.482		164030.	137.74	1.071	1.875
		66.5	344.1	961.6	0.5842	360.776		158786.	138.19	1.100	1.889
		71.8	360.2	960.5	0.6010	360.766		153921.	136.91	1.119	1.885
		77.1	376.3	960.5	0.6176	360.781		149425.	135.73	1.138	1.878
		82.4	392.5	961.1	0.6345	360.783		145240.	134.72	1.158	1.767
		87.8	408.7	961.1	0.6531	360.779		141313.	134.14	1.181	1.775
		93.1	424.7	961.6	0.6719	360.772		137678.	133.72	1.204	1.782
		98.4	440.8	965.5	0.6870	360.484		134248.	132.60	1.221	1.783
		103.7	456.9	967.7	0.7058	360.507		131011.	132.26	1.244	1.790
		109.0	473.1	970.0	0.7255	360.493		127970.	132.14	1.269	1.799
		114.0	489.2	973.3	0.7441	360.227		125099.	131.86	1.292	1.806
		120.0	505.2	977.2	0.7633	360.235		122391.	131.72	1.316	1.816
		125.0	549.1	981.6	0.8323	359.969		115673.	134.13	1.408	1.848
		130.0	537.5	986.6	0.8014	359.961		117369.	131.45	1.362	1.833
		135.0	553.5	991.6	0.8210	359.689		115051.	131.45	1.386	1.842
		141.0	569.4	997.2	0.8408	359.675		112866.	131.53	1.411	1.855
		146.0	585.5	1003.3	0.8603	359.414		110752.	131.53	1.434	1.865
		151.0	601.6	1009.4	0.8813	359.374		108733.	131.77	1.460	1.877
		157.0	617.7	1016.1	0.9015	359.097		106803.	131.90	1.485	1.890
		162.0	633.8	1022.2	0.9248	359.130		104956.	132.48	1.514	1.907
		167.0	650.0	1028.8	0.9471	358.845		103186.	132.91	1.542	1.923
		173.0	665.5	1036.6	0.9662	358.567		101545.	132.98	1.564	1.936
		178.0	681.6	1045.0	0.9871	358.646		99912.	133.21	1.589	1.950
		183.0	697.7	1053.3	1.0077	358.293		98343.	133.41	1.613	1.963
		189.0	713.3	1062.7	1.0245	358.005		96885.	133.20	1.632	1.973
		194.0	729.4	1072.7	1.0419	357.718		95429.	133.00	1.651	1.983
		199.0	745.0	1083.8	1.0548	357.459		94074.	132.34	1.663	1.986
		205.0	761.1	1095.0	1.0697	357.160		92720.	131.87	1.678	1.994
		210.0	726.6	1107.2	0.9378	356.885		95676.	120.09	1.487	1.850
		215.0	792.7	1119.4	1.0917	356.621		90194.	130.15	1.695	1.996
		221.0	808.3	1132.7	1.0983	356.337		89014.	128.87	1.697	1.992
		226.0	823.8	1146.6	1.1031	356.056		87871.	127.42	1.697	1.985
		231.0	840.0	1160.5	1.1099	355.784		86725.	126.18	1.699	1.981
		236.0	855.5	1175.0	1.1129	355.509		85654.	124.63	1.696	1.972
		242.0	871.1	1189.4	1.1159	355.228		84614.	123.13	1.693	1.964
		247.0	886.6	1204.4	1.1170	354.957		83605.	121.48	1.687	1.953
		253.0	902.2	1113.3	1.6840	355.511		82626.	180.55	2.532	2.759
15	0.477	2.7	111.2	227.7	1.5815	184.244	8.028	468389.	783.54	3.594	3.262
		7.9	118.0	280.0	1.1411	184.794		449839.	696.03	2.390	2.788
		13.3	124.8	309.7	1.0009	184.999		433008.	578.93	2.048	2.572

WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
		18.6	131.6	327.1	0.9466	185.112		417894.	521.08	1.896	2.461
		23.9	138.3	338.4	0.9251	185.183		404041.	485.88	1.815	2.397
		29.2	145.0	347.0	0.9167	185.224		391337.	460.52	1.765	2.353
		34.5	151.6	354.3	0.9137	185.278		379690.	440.09	1.727	2.324
		39.9	158.1	360.9	0.9136	185.308		368952.	422.81	1.698	2.301
		45.2	164.7	366.7	0.9172	185.325		358936.	408.51	1.677	2.285
		50.5	171.1	371.7	0.9242	185.353		349721.	396.98	1.664	2.275
		55.8	177.6	375.8	0.9351	185.357		341070.	387.89	1.659	2.266
		61.2	184.0	379.7	0.9474	185.374		332931.	379.99	1.657	2.259
		66.5	190.4	381.2	0.9717	185.378		325320.	377.38	1.678	2.266
		71.8	196.7	383.3	0.9919	185.044		318187.	373.51	1.691	2.265
		77.1	203.1	385.6	1.0159	185.401		311429.	371.28	1.711	2.270
		82.4	209.3	388.1	1.0374	185.406		305070.	368.40	1.728	2.211
		87.8	215.6	390.7	1.0590	185.442		299023.	365.72	1.744	2.217
		93.1	221.8	393.5	1.0802	185.434		293315.	363.16	1.761	2.224
		98.4	228.1	396.5	1.1010	185.457		287868.	364.85	1.789	2.245
		103.7	234.3	399.7	1.1214	185.467		282666.	363.19	1.807	2.254
		109.0	240.4	403.1	1.1405	185.457		277734.	361.29	1.824	2.262
		114.0	246.6	406.6	1.1597	185.487		273009.	359.53	1.841	2.270
		120.0	252.8	410.2	1.1781	185.485		268478.	357.63	1.857	2.278
		125.0	258.9	414.1	1.1952	185.521		264168.	355.52	1.871	2.284
		130.0	265.0	418.2	1.2114	185.545		260025.	353.24	1.884	2.288
		135.0	271.1	422.4	1.2265	185.541		256039.	350.77	1.895	2.291
		141.0	277.2	426.7	1.2413	185.574		252201.	348.32	1.907	2.296
		146.0	283.3	431.3	1.2539	185.577		248502.	345.38	1.914	2.296
		151.0	289.4	435.4	1.2717	185.597		244935.	343.98	1.930	2.304
		157.0	295.5	439.3	1.2905	185.608		241523.	342.96	1.948	2.315
		162.0	301.6	444.1	1.3022	185.636		238226.	340.14	1.955	2.315
		167.0	307.6	448.6	1.3165	185.626		235038.	338.10	1.966	2.319
		173.0	313.7	453.2	1.3309	185.660		231926.	336.12	1.977	2.324
		178.0	319.8	457.9	1.3443	185.662		228941.	334.02	1.987	2.328
		183.0	325.8	462.7	1.3570	185.682		226049.	331.83	1.996	2.330
		189.0	331.9	467.5	1.3706	185.867		223246.	329.94	2.006	2.335
		194.0	337.9	472.5	1.3808	185.718		220528.	331.48	2.027	2.352
		199.0	344.0	477.5	1.3917	185.715		217890.	329.26	2.035	2.354
		205.0	350.0	482.7	1.4002	185.729		215352.	326.60	2.039	2.353
		210.0	356.1	487.7	1.4107	185.741		212863.	324.45	2.046	2.355
		215.0	362.1	493.0	1.4193	185.770		210444.	321.94	2.050	2.354
		221.0	368.2	498.4	1.4266	185.774		208093.	319.22	2.052	2.352
		226.0	374.2	503.8	1.4335	185.797		205805.	316.50	2.055	2.349
		231.0	380.3	509.4	1.4391	185.803		203579.	313.57	2.055	2.345
		236.0	386.3	515.0	1.4440	185.793		201411.	310.59	2.054	2.340
		242.0	392.4	520.7	1.4480	185.826		199300.	307.50	2.053	2.335
		247.0	398.4	526.5	1.4514	185.859		197242.	304.37	2.050	2.328
		253.0	404.4	475.2	2.6172	185.240		195255.	542.15	3.685	3.910

WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
16	0.477	2.7	123.7	339.4	1.4860	320.562	7.938	430755.	866.79	3.080	3.188
		7.9	135.6	444.3	1.0438	322.243		404796.	558.36	2.084	2.670
		13.3	147.5	497.3	0.9225	322.771		382493.	456.01	1.779	2.474
		18.6	159.1	531.7	0.8678	323.351		363261.	399.23	1.623	2.353
		23.9	170.7	659.1	0.6626	323.601		346410.	285.31	1.205	1.935
		29.2	182.1	579.4	0.8153	323.900		331508.	330.20	1.445	2.193
		34.5	193.4	596.6	0.8041	324.186		318222.	307.63	1.392	2.150
		39.9	204.7	611.1	0.7984	324.460		306293.	289.62	1.353	2.121
		45.2	215.8	623.3	0.7963	324.447		295465.	274.73	1.323	2.098
		50.5	226.9	633.8	0.7981	324.737		285585.	265.58	1.311	2.094
		55.8	237.9	643.3	0.8011	324.712		276571.	256.04	1.297	2.077
		61.2	248.9	651.1	0.8081	324.990		268272.	248.57	1.291	2.066
		66.5	259.8	658.3	0.8157	325.011		260563.	241.88	1.287	2.047
		71.8	270.7	665.0	0.8251	325.273		253415.	236.26	1.287	2.030
		77.1	281.6	670.5	0.8363	325.274		246767.	231.59	1.290	2.013
		82.4	292.4	676.1	0.8486	325.579		240534.	227.56	1.296	1.901
		87.8	303.2	680.5	0.8629	325.553		234677.	224.34	1.305	1.897
		93.1	314.0	685.0	0.8777	325.578		229188.	221.49	1.315	1.895
		98.4	324.8	688.3	0.8956	325.550		224007.	219.61	1.330	1.897
		103.7	335.6	691.1	0.9166	325.851		219106.	221.32	1.360	1.917
		109.0	346.3	693.3	0.9392	325.850		214462.	220.97	1.383	1.927
		114.0	357.1	695.0	0.9645	325.840		210055.	221.29	1.410	1.939
		120.0	367.8	697.2	0.9894	325.842		205886.	221.55	1.437	1.954
		125.0	378.6	698.8	1.0175	325.825		201896.	222.51	1.467	1.970
		130.0	389.5	701.1	1.0458	325.836		198058.	223.44	1.498	1.987
		135.0	400.1	703.3	1.0748	325.843		194480.	224.62	1.530	2.005
		141.0	410.9	705.5	1.1060	325.840		191008.	226.15	1.565	2.028
		146.0	421.7	707.7	1.1391	325.846		187686.	228.02	1.603	2.052
		151.0	432.5	711.1	1.1699	325.841		184478.	229.34	1.636	2.073
		157.0	443.2	713.8	1.2041	325.842		181452.	231.37	1.675	2.101
		162.0	453.9	717.2	1.2379	325.843		178536.	233.24	1.713	2.126
		167.0	464.7	720.5	1.2739	325.835		175720.	235.44	1.753	2.155
		173.0	475.5	723.8	1.3121	325.851		173014.	237.99	1.796	2.187
		178.0	486.3	727.7	1.3484	325.564		170403.	240.11	1.837	2.216
		183.0	497.0	732.2	1.3844	325.565		167903.	242.14	1.877	2.245
		189.0	507.8	737.7	1.4158	325.555		165480.	243.31	1.910	2.269
		194.0	518.5	743.8	1.4436	325.292		163154.	243.87	1.938	2.288
		199.0	529.3	751.6	1.4630	325.274		160895.	243.01	1.955	2.297
		205.0	540.0	760.5	1.4740	325.017		158723.	240.84	1.961	2.296
		210.0	550.7	770.5	1.4775	324.721		156622.	237.54	1.957	2.285
		215.0	561.6	781.6	1.4748	324.455		154558.	233.33	1.945	2.267
		221.0	572.2	793.3	1.4603	322.888		152620.	227.53	1.918	2.234
		226.0	582.7	805.0	1.4550	323.333		150741.	223.33	1.903	2.214
		231.0	593.3	816.6	1.4453	322.783		148918.	218.59	1.882	2.189
		236.0	604.4	827.2	1.4477	322.515		147058.	215.65	1.877	2.178

WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		242.0	615.0	842.2	1.4169	321.950		145342.	208.08	1.830	2.128
		247.0	625.5	862.7	1.3514	320.582		143676.	195.71	1.739	2.035
		253.0	636.1	784.4	2.1817	323.618		142056.	311.64	2.796	3.045
17	0.477	2.7	113.3	379.2	1.5540	413.190	7.938	457122.	984.67	3.339	3.637
		7.9	129.0	566.6	0.9523	416.789		418858.	534.23	1.941	2.721
		13.3	144.3	681.1	0.7817	419.555		388059.	394.27	1.521	2.387
		18.6	159.6	746.6	0.7138	419.040		362575.	327.52	1.333	2.222
		23.9	174.4	789.4	0.6787	417.362		341310.	286.27	1.223	2.120
		29.2	189.1	823.8	0.6549	415.679		323144.	255.96	1.144	2.042
		34.5	203.6	837.2	0.6547	414.825		307425.	238.71	1.112	2.024
		39.9	217.8	850.5	0.6548	414.270		293624.	223.95	1.084	2.009
		45.2	231.9	858.8	0.6604	413.997		281399.	215.71	1.077	2.021
		50.5	245.9	862.7	0.6708	413.734		270444.	208.44	1.075	2.026
		55.8	259.8	863.3	0.6856	413.721		260563.	203.30	1.082	2.026
		61.2	278.7	863.3	0.7077	413.729		248497.	197.71	1.095	2.000
		66.5	287.5	862.2	0.7200	413.760		243298.	195.87	1.105	2.012
		71.8	301.2	859.4	0.7418	414.048		235731.	193.94	1.124	2.004
		77.1	315.0	856.6	0.7644	414.049		228722.	192.41	1.144	1.993
		82.4	328.7	853.8	0.7889	414.303		222207.	191.49	1.168	1.860
		87.8	342.3	850.5	0.8153	414.308		216157.	193.66	1.204	1.882
		93.1	356.0	847.7	0.8431	414.571		210499.	193.93	1.233	1.893
		98.4	369.7	845.5	0.8714	414.592		205173.	194.31	1.264	1.904
		103.7	383.4	844.4	0.8993	414.577		200188.	194.64	1.293	1.915
		109.0	397.1	843.8	0.9279	414.565		195493.	195.14	1.323	1.927
		114.0	410.8	843.8	0.9573	414.564		191043.	195.79	1.355	1.939
		120.0	424.4	845.5	0.9846	414.571		186853.	196.03	1.383	1.952
		125.0	438.1	847.2	1.0135	414.577		182883.	196.61	1.413	1.964
		130.0	451.8	850.0	1.0407	414.314		179101.	196.83	1.441	1.975
		135.0	465.5	853.3	1.0684	414.302		175521.	197.19	1.470	1.986
		141.0	479.2	857.7	1.0937	414.026		172113.	197.12	1.495	1.998
		146.0	492.8	862.2	1.1203	413.764		168864.	197.31	1.521	2.009
		151.0	506.5	867.7	1.1454	413.744		165763.	197.25	1.546	2.019
		157.0	520.2	873.3	1.1709	413.458		162799.	197.28	1.571	2.031
		162.0	533.8	878.8	1.1975	413.204		159974.	197.53	1.597	2.043
		167.0	547.5	885.0	1.2235	412.931		157257.	197.67	1.623	2.055
		173.0	561.1	891.1	1.2504	412.631		154662.	197.99	1.649	2.070
		178.0	584.0	897.7	1.3142	412.366		150527.	201.37	1.718	2.112
		183.0	588.3	905.0	1.3013	412.078		149775.	198.19	1.698	2.095
		189.0	601.6	912.2	1.3260	411.796		147517.	198.27	1.721	2.108
		194.0	615.5	920.0	1.3517	411.517		145253.	198.36	1.746	2.121
		199.0	628.8	928.3	1.3734	411.257		143159.	198.03	1.765	2.131
		205.0	642.7	937.2	1.3958	410.985		141055.	197.68	1.785	2.141
		210.0	656.1	946.6	1.4135	410.700		139106.	196.84	1.799	2.146
		215.0	669.4	956.6	1.4289	410.411		137223.	195.73	1.810	2.149
		221.0	683.3	967.2	1.4447	410.134		135326.	194.58	1.821	2.153



WEILAND  
HYDROGEN

TABLE: V

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
	226.0		696.6	978.3	1.4542	409.599		133566.	192.78	1.825	2.149
	231.0		710.0	990.0	1.4618	409.303		131861.	190.79	1.826	2.143
	236.0		723.3	1002.2	1.4667	409.046		130208.	188.53	1.824	2.135
	242.0		737.2	1015.5	1.4686	408.760		128541.	185.85	1.818	2.123
	247.0		750.5	1031.1	1.4540	407.928		126989.	181.31	1.793	2.092
	253.0		763.8	958.8	2.1004	409.577		125483.	258.16	2.579	2.838

TABLE: VI

WOLF  
HELIUM

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF			
*****														
1	1.092	4.0	304.6	686.1	0.0769	29.337	3.551	20436.	53.22	2.229	2.435			
		6.0	316.5	738.1	0.0703	29.638		19926.	47.44	2.027	2.388			
		8.0	328.3	783.1	0.0658	29.925		19450.	43.34	1.888	2.337			
		10.0	340.1	818.1	0.0631	30.161		19002.	40.61	1.802	2.304			
		12.0	351.7	848.1	0.0612	30.379		18586.	38.52	1.740	2.276			
		14.0	363.1	877.1	0.0594	30.531		18199.	36.61	1.682	2.238			
		16.0	374.6	905.1	0.0579	30.715		17829.	34.96	1.633	2.202			
		18.0	386.1	933.1	0.0563	30.796		17476.	33.32	1.581	2.156			
		20.0	397.3	956.1	0.0551	30.789		17150.	32.00	1.542	2.118			
		22.0	408.5	977.1	0.0542	30.818		16838.	30.90	1.511	2.088			
		24.0	419.6	995.1	0.0535	30.789		16543.	29.97	1.486	2.062			
		2	1.092	4.0	305.9	658.1		0.0891	31.381	4.233	24294.	61.49	2.242	2.418
				6.0	316.6	711.1		0.0804	31.717		23749.	54.24	2.014	2.345
				8.0	327.1	749.1		0.0759	32.029		23243.	50.12	1.893	2.312
10.0	337.7			778.1	0.0733	32.281	22759.	47.39	1.821		2.292			
12.0	348.6			806.1	0.0711	32.528	22287.	45.02	1.759		2.265			
14.0	359.1			828.1	0.0698	32.736	21855.	43.33	1.720		2.248			
16.0	369.6			850.1	0.0686	32.962	21443.	41.79	1.684		2.226			
18.0	380.1			870.1	0.0676	33.124	21050.	40.42	1.653		2.204			
20.0	390.6			891.1	0.0665	33.283	20675.	39.06	1.620		2.176			
22.0	401.6			908.1	0.0658	33.327	20300.	37.94	1.597		2.153			
24.0	412.1			928.1	0.0647	33.385	19957.	36.68	1.565		2.121			
3	1.092			4.0	310.1	643.1	0.1109	36.929	5.135		29202.	75.85	2.387	2.548
				6.0	319.6	688.1	0.0993	36.592			28626.	66.58	2.129	2.446
				8.0	329.6	720.1	0.0928	36.238			28050.	60.97	1.982	2.382
		10.0	339.1	749.1	0.0874	35.834	27529.	56.35		1.859	2.306			
		12.0	348.6	773.1	0.0836	35.488	27032.	52.93		1.772	2.247			
		14.0	359.1	793.1	0.0808	35.067	26508.	50.16		1.706	2.193			
		16.0	368.6	816.1	0.0774	34.636	26055.	47.23		1.629	2.121			
		18.0	373.6	836.1	0.0740	34.225	25824.	44.76		1.554	2.053			
		20.0	392.6	855.1	0.0730	33.762	24993.	42.73		1.523	2.006			
		22.0	397.1	869.1	0.0706	33.323	24805.	41.02		1.471	1.955			
		24.0	406.6	881.1	0.0692	32.835	24421.	39.58		1.437	1.915			
		4	1.092	4.0	310.6	653.1	0.1153	39.490		6.393	36320.	78.78	2.082	2.237
				6.0	320.1	701.1	0.1052	40.081			35605.	70.46	1.892	2.189
				8.0	323.6	733.1	0.0990	40.540			35350.	65.84	1.778	2.166
10.0	339.1			756.1	0.0993	41.408	34276.	64.03	1.773		2.207			
12.0	348.6			779.1	0.0971	41.801	33656.	61.48	1.727		2.197			
14.0	358.1			803.1	0.0924	41.118	33065.	57.47	1.638		2.118			
16.0	367.4			823.1	0.0931	42.425	32510.	56.94	1.645		2.152			
18.0	377.1			843.1	0.0912	42.499	31956.	54.82	1.605		2.120			
20.0	386.4			861.1	0.0902	42.817	31446.	53.36	1.583		2.104			
22.0	395.8			876.1	0.0896	43.034	30951.	52.17	1.567		2.093			
24.0	405.1			888.1	0.0896	43.276	30480.	51.38	1.562		2.092			
5	1.0927			4.0	90.1	533.1	0.0508	22.504	4.587		58959.	78.53	1.409	2.161

WOLF  
HELIUM

TABLE: VI

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		6.0	97.1	646.1	0.0434	23.826		56120.	63.86	1.192	2.061
		8.0	105.1	751.1	0.0382	24.677		53265.	53.35	1.038	1.958
		10.0	113.1	843.1	0.0348	25.404		50749.	46.30	0.936	1.887
		12.0	120.1	923.1	0.0323	25.936		48777.	41.31	0.862	1.845
		14.0	128.1	988.1	0.0305	26.230		46746.	37.38	0.807	1.804
		16.0	136.1	1043.1	0.0292	26.484		44915.	34.39	0.767	1.774
		18.0	143.1	1083.1	0.0284	26.696		43453.	32.35	0.741	1.764
		20.0	151.1	1105.1	0.0280	26.712		41921.	30.77	0.725	1.751
		22.0	158.1	1113.1	0.0280	26.740		40687.	29.87	0.721	1.759
6	1.092	24.0	166.1	1109.1	0.0283	26.686		39383.	29.22	0.724	1.764
		4.0	94.1	673.1	0.0528	30.571	4.673	58376.	79.32	1.434	2.354
		6.0	103.1	843.1	0.0416	30.784		54963.	58.84	1.116	2.091
		8.0	112.1	968.1	0.0363	31.072		52010.	48.58	0.963	1.966
		10.0	121.1	1065.1	0.0331	31.246		49427.	42.10	0.870	1.885
		12.0	131.1	1131.1	0.0314	31.400		46907.	37.90	0.816	1.845
		14.0	140.1	1173.1	0.0306	31.609		44896.	35.35	0.788	1.836
		16.0	149.1	1198.1	0.0302	31.679		43090.	33.49	0.772	1.831
		18.0	158.1	1265.1	0.0288	31.881		41455.	30.72	0.730	1.795
		20.0	167.1	1223.1	0.0302	31.891		39968.	31.06	0.760	1.837
		22.0	177.1	1213.1	0.0308	31.908		38465.	30.48	0.769	1.847
7	1.092	24.0	186.1	1193.1	0.0317	31.921		37227.	30.37	0.787	1.869
		4.0	89.1	493.1	0.0559	22.583	5.060	65528.	87.06	1.435	2.151
		6.0	97.1	593.1	0.0494	24.502		61915.	72.69	1.254	2.100
		8.0	104.1	695.1	0.0436	25.767		59136.	61.28	1.097	2.013
		10.0	111.1	803.1	0.0385	26.642		56651.	51.83	0.960	1.909
		12.0	119.1	896.1	0.0351	27.272		54112.	45.14	0.867	1.837
		14.0	126.1	973.1	0.0327	27.696		52111.	40.50	0.802	1.792
		16.0	134.1	1038.1	0.0310	28.024		50038.	36.86	0.754	1.754
		18.0	141.1	1083.1	0.0299	28.165		48387.	34.38	0.722	1.734
		20.0	149.1	1113.1	0.0293	28.245		46658.	32.49	0.703	1.717
		22.0	156.1	1123.1	0.0292	28.236		45267.	31.41	0.696	1.722
8	1.092	24.0	163.1	1118.1	0.0296	28.268		43975.	30.93	0.701	1.738
		4.0	92.1	596.1	0.0567	28.576	5.166	65451.	86.39	1.426	2.259
		6.0	101.1	743.1	0.0467	29.981		61547.	66.91	1.160	2.084
		8.0	109.1	866.1	0.0408	30.885		58532.	55.59	1.003	1.977
		10.0	118.1	978.1	0.0367	31.562		55550.	47.46	0.893	1.885
		12.0	126.1	1060.1	0.0343	32.036		53199.	42.48	0.827	1.847
		14.0	134.1	1123.1	0.0328	32.439		51084.	39.00	0.785	1.828
		16.0	143.1	1168.1	0.0317	32.492		48941.	36.11	0.752	1.799
		18.0	151.1	1193.1	0.0312	32.510		47216.	34.29	0.735	1.792
		20.0	160.1	1203.1	0.0312	32.541		45447.	33.01	0.729	1.789
		22.0	168.1	1198.1	0.0316	32.548		44008.	32.37	0.734	1.804
		24.0	176.1	1178.1	0.0325	32.565		42679.	32.29	0.750	1.830
9	1.092	4.0	97.1	898.1	0.0552	44.215	5.251	64251.	81.23	1.360	2.452
		6.0	108.1	1083.1	0.0442	43.095		59860.	60.59	1.074	2.179

WOLF  
HELIUM

TABLE: VI

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		8.0	119.1	1198.1	0.0390	42.081		56153.	50.15	0.935	2.036
		10.0	130.1	1273.1	0.0361	41.262		52974.	43.79	0.856	1.947
		12.0	141.1	1313.1	0.0348	40.785		50212.	40.02	0.816	1.913
		14.0	151.1	1341.1	0.0340	40.460		47994.	37.37	0.790	1.896
		16.0	162.1	1358.1	0.0339	40.544		45820.	35.57	0.781	1.894
		18.0	173.1	1358.1	0.0343	40.645		43877.	34.46	0.783	1.903
		20.0	184.1	1348.1	0.0354	41.205		42130.	34.15	0.802	1.937
		22.0	195.1	1328.1	0.0368	41.694		40547.	34.17	0.827	1.978
		24.0	206.1	1296.1	0.0390	42.510		39106.	34.93	0.870	2.042
10	1.092	4.0	90.1	428.1	0.0666	22.510	5.033	64697.	102.96	1.715	2.436
		6.0	97.1	501.1	0.0573	23.149		61582.	84.32	1.461	2.296
		8.0	104.1	573.1	0.0506	23.731		58818.	71.11	1.278	2.171
		10.0	111.1	649.1	0.0453	24.371		56347.	60.99	1.134	2.060
		12.0	118.1	719.1	0.0414	24.881		54121.	53.54	1.028	1.977
		14.0	125.1	786.1	0.0386	25.514		52104.	48.05	0.952	1.923
		16.0	132.1	848.1	0.0365	26.134		50265.	43.84	0.893	1.885
		18.0	139.1	903.1	0.0349	26.663		48582.	40.51	0.848	1.857
		20.0	146.1	955.1	0.0336	27.182		47034.	37.76	0.811	1.837
		22.0	153.1	998.1	0.0328	27.716		45604.	35.74	0.787	1.834
		24.0	160.1	1033.1	0.0323	28.197		44278.	34.17	0.771	1.838
11	1.092	4.0	90.1	653.1	0.0639	35.975	5.208	66947.	98.79	1.601	2.642
		6.0	100.1	803.1	0.0513	36.063		62457.	73.99	1.267	2.357
		8.0	109.1	943.1	0.0433	36.112		59009.	59.00	1.058	2.159
		10.0	118.1	1053.1	0.0387	36.184		56003.	50.04	0.935	2.041
		12.0	127.1	1131.1	0.0362	36.344		53354.	44.60	0.866	1.988
		14.0	136.1	1183.1	0.0349	36.540		50999.	41.10	0.828	1.965
		16.0	145.1	1216.1	0.0343	36.735		48890.	38.72	0.807	1.958
		18.0	154.1	1231.1	0.0344	37.048		46987.	37.32	0.803	1.971
		20.0	163.1	1233.1	0.0349	37.343		45260.	36.47	0.808	1.990
		22.0	172.1	1221.1	0.0360	37.764		43684.	36.31	0.828	2.030
		24.0	181.1	1196.1	0.0377	38.265		42239.	36.77	0.861	2.084

WOLF  
HELIUM

TABLE: VI

RUN	D (CM)	L/D	TB (K)	TW (K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
18	0.774	10.6	321.6	517.7	0.1377	27.004	3.945	30895.	65.19	1.961	2.192
		21.3	352.2	567.7	0.1301	28.043		29099.	58.01	1.831	2.146
		31.9	374.4	600.5	0.1271	28.738		27947.	54.43	1.774	2.107
19	0.774	10.6	326.1	520.0	0.1659	32.166	4.832	37498.	77.83	2.005	2.235
		21.3	356.1	569.4	0.1586	33.834		35382.	70.21	1.895	2.214
		31.9	378.3	600.0	0.1564	34.668		33996.	66.52	1.854	2.191
20	0.774	10.6	326.1	518.8	0.2407	46.401	7.135	55374.	112.92	2.130	2.373
		21.3	353.8	565.5	0.2291	48.492		52466.	101.84	2.006	2.343
		31.9	375.5	596.6	0.2237	49.462		50448.	95.61	1.943	2.299
23	0.774	10.6	326.6	647.2	0.1194	38.274	3.304	25613.	55.95	1.956	2.350
		21.3	377.2	736.1	0.1134	40.698		23292.	48.32	1.823	2.304
		31.9	414.4	788.8	0.1089	40.777		21889.	43.61	1.729	2.215
24	0.492	16.7	321.6	477.7	0.3002	46.864	3.240	39889.	90.40	2.217	2.494
		33.5	361.6	541.1	0.2630	47.193		36920.	73.30	1.912	2.210
		50.2	391.1	573.8	0.2699	49.331		35061.	71.44	1.942	2.256
25	1.092	7.5	325.5	753.8	0.0698	29.897	3.551	19570.	46.22	2.004	2.435
		15.0	369.4	893.3	0.0586	30.699		18003.	35.69	1.654	2.219
		22.6	412.7	982.2	0.0540	30.750		16732.	30.57	1.502	2.076
26	1.092	7.5	324.4	724.4	0.0799	31.960	4.233	23382.	53.02	1.994	2.394
		15.0	364.4	842.7	0.0688	32.909		21655.	42.28	1.690	2.228
		22.6	405.0	917.7	0.0651	33.381		20199.	37.32	1.577	2.133
27	1.092	7.5	327.2	699.4	0.0977	36.366	5.135	28202.	64.47	2.087	2.470
		15.0	363.8	807.7	0.0785	34.845		26293.	48.29	1.653	2.144
		22.6	400.5	873.3	0.0700	33.094		24679.	40.42	1.455	1.936
28	1.092	7.5	327.7	710.5	0.1057	40.459	6.393	35073.	69.67	1.894	2.254
		15.0	363.8	833.3	0.0893	41.921		32736.	54.94	1.578	2.072
		22.6	399.4	878.8	0.0899	43.102		30782.	52.01	1.569	2.095
30	1.092	7.5	102.7	683.3	0.0423	24.557	4.587	54102.	59.95	1.152	2.086
		15.0	131.6	1023.3	0.0296	26.393		45942.	35.62	0.780	1.788
		22.6	160.5	1098.3	0.0285	26.726		40304.	30.09	0.732	1.773
31	1.092	5.8	110.0	881.1	0.0398	30.690	4.673	52707.	53.93	1.058	1.952
		10.4	145.0	1185.0	0.0305	31.720		43922.	34.44	0.782	1.660
		15.0	180.0	1188.3	0.0317	31.964		38081.	31.03	0.790	1.665
36	1.092	5.8	102.2	649.4	0.0466	25.500	5.060	59902.	66.28	1.174	1.983
		10.4	130.5	1007.2	0.0319	27.965		50970.	38.60	0.778	1.610
		15.0	158.8	1107.2	0.0298	28.260		44773.	31.68	0.708	1.535
37	1.092	5.8	107.2	788.3	0.0452	30.786	5.166	59256.	62.29	1.113	1.987
		10.4	139.4	1142.2	0.0324	32.490		49821.	37.54	0.770	1.637
		15.0	171.1	1173.8	0.0325	32.590		43527.	32.90	0.752	1.617
38	1.092	5.8	116.1	1096.1	0.0431	42.238	5.251	57149.	56.36	1.036	2.038
		10.4	157.2	1378.8	0.0331	40.437		46787.	35.43	0.765	1.676
		15.0	198.8	1292.2	0.0384	41.984		40063.	35.20	0.860	1.799

TABLE: VI

WOLF  
HELIUM

RUN	D (CM)	L/D	TB (K)	TW (K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
47	1.092	5.8	102.2	540.5	0.0539	23.626	5.033	59579.	76.66	1.364	2.1507
		10.4	128.8	816.6	0.0376	25.860		51127.	45.89	0.923	1.751
		15.0	155.5	1014.4	0.0324	27.828		45159.	34.93	0.775	1.625
48	1.092	5.8	106.1	853.3	0.0483	36.090	5.208	60151.	67.02	1.183	2.187
		10.4	141.1	1196.6	0.0347	36.627		49835.	39.89	0.818	1.767
		15.0	175.5	1201.1	0.0370	37.945		43145.	36.83	0.848	1.821
64	1.092	5.8	96.6	471.6	0.0712	26.700	6.663	81841.	105.07	1.450	2.221
		10.4	110.5	620.5	0.0556	28.356		74902.	75.09	1.112	2.004
		15.0	123.8	790.5	0.0458	30.533		69479.	57.38	0.902	1.872
69	1.092	5.8	117.2	735.0	0.1443	89.145	17.483	189074.	187.51	1.324	2.229
		10.4	133.8	972.7	0.1143	95.885		173192.	136.05	1.030	2.078
		15.0	150.5	1202.2	0.0942	99.067		160287.	103.77	0.836	1.944
70	1.092	5.8	120.5	757.7	0.1462	93.161	17.731	188241.	186.49	1.322	2.227
		10.4	137.7	997.7	0.1164	100.104		172361.	135.95	1.034	2.081
		15.0	155.0	1229.4	0.0956	102.716		159470.	103.31	0.836	1.936
71	1.092	5.8	94.4	490.5	0.0987	39.096	10.413	129877.	147.91	1.411	2.212
		10.4	107.2	625.5	0.0819	42.451		119443.	112.87	1.151	2.109
		15.0	120.5	767.2	0.0687	44.426		110551.	87.63	0.951	1.969
72	1.092	5.8	99.4	537.7	0.1250	54.791	14.177	170897.	181.05	1.386	2.208
		10.4	112.7	683.3	0.1034	58.995		157279.	137.83	1.128	2.100
		15.0	126.1	823.3	0.0892	62.192		146097.	110.45	0.959	2.011
73	1.092	5.8	111.1	614.4	0.1424	71.674	16.005	179318.	191.70	1.412	2.268
		10.4	126.1	780.5	0.1174	76.831		164940.	145.37	1.145	2.152
		15.0	141.1	934.4	0.1006	79.809		153149.	115.66	0.967	2.042
74	1.092	5.8	136.1	797.2	0.1611	106.504	18.857	184784.	189.68	1.364	2.239
		10.4	154.4	1018.8	0.1312	113.415		169999.	142.12	1.093	2.111
		15.0	173.3	1207.2	0.1133	117.139		157533.	113.73	0.929	2.014
75	1.092	5.8	118.8	1065.0	0.0341	32.262	3.385	36270.	43.90	1.161	2.235
		10.4	148.8	1271.6	0.0285	31.999		31264.	31.62	0.942	2.040
		15.0	178.3	1327.2	0.0275	31.594		27754.	27.09	0.888	1.989
76	1.092	5.8	105.0	984.4	0.0478	42.037	6.119	71164.	66.79	1.031	2.023
		10.4	126.6	1268.3	0.0386	44.068		62876.	47.65	0.812	1.891
		15.0	148.3	1355.0	0.0360	43.440		56654.	40.04	0.741	1.850
77	1.092	5.8	101.1	906.1	0.0575	46.287	7.698	91785.	82.37	1.037	2.000
		10.4	120.5	1242.7	0.0434	48.704		81725.	55.36	0.765	1.806
		15.0	139.4	1366.1	0.0390	47.840		74239.	45.19	0.674	1.746
78	1.092	5.8	100.0	877.7	0.0615	47.833	8.302	99708.	88.75	1.046	2.001
		10.4	118.3	1227.2	0.0458	50.787		89224.	59.14	0.761	1.804
		15.0	137.2	1367.2	0.0415	51.045		80915.	48.60	0.677	1.769
79	1.092	5.8	97.7	808.8	0.0716	50.915	9.619	117250.	104.87	1.085	2.030
		10.4	115.0	1171.1	0.0521	55.023		105344.	68.56	0.773	1.815
		15.0	132.2	1365.0	0.0449	55.351		96075.	53.88	0.654	1.743
80	1.092	5.8	96.6	807.7	0.0770	54.755	10.666	131007.	113.63	1.076	2.021
		10.4	113.8	1178.3	0.0567	60.354		117571.	75.09	0.775	1.835
		15.0	131.6	1383.3	0.0485	60.705		106837.	58.37	0.651	1.751

WOLF  
HELIUM

TABLE: VI

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
81	1.092	5.8 10.4 15.0	96.1 112.7 129.4	772.2 1139.4 1373.8	0.0854 0.0626 0.0525	57.739 64.269 65.333	11.710	144369. 129909. 118612.	126.51 83.44 63.89	1.108 0.795 0.655	2.051 1.862 1.773
82	1.092	5.8 10.4 15.0	96.1 112.7 130.0	773.3 1132.2 1381.6	0.0935 0.0678 0.0565	63.320 69.118 70.719	12.802	157841. 142031. 129315.	138.51 90.38 68.57	1.130 0.802 0.656	2.092 1.872 1.777
83	1.092	5.8 10.4 15.0	100.0 116.1 132.2	817.2 1206.1 1407.2	0.0827 0.0598 0.0521	59.314 65.182 66.427	12.004	144169. 130634. 119898.	119.34 78.19 62.53	1.047 0.742 0.635	1.950 1.759 1.723
84	1.092	5.8 10.4 15.0	98.3 114.4 130.0	782.2 1157.7 1418.8	0.0962 0.0706 0.0583	65.790 73.659 75.142	14.081	171007. 154712. 142231.	140.38 93.20 70.75	1.074 0.773 0.627	1.980 1.809 1.724
85	1.092	5.8 10.4 15.0	97.7 113.3 128.8	768.8 1133.3 1415.5	0.1139 0.0834 0.0674	76.439 85.068 86.721	16.632	202739. 183917. 168949.	166.83 110.81 82.26	1.114 0.800 0.635	2.045 1.863 1.753
86	1.092	5.8 10.4 15.0	97.2 112.7 128.3	780.0 1141.6 1426.1	0.1254 0.0922 0.0753	85.620 94.863 97.722	21.691	265411. 240645. 220973.	184.36 122.90 92.17	0.992 0.715 0.574	1.836 1.676 1.595
87	1.092	5.8 10.4 15.0	97.7 113.3 128.8	7850.0 1144.4 1421.6	0.1316 0.0975 0.0788	1020.192 100.533 101.870	19.886	242407. 219901. 202005.	192.75 129.55 96.18	1.116 0.811 0.644	5.536 1.897 1.780

TABLE: VII

WOLF  
HYDROGEN

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
1	0.772	5.0	152.1	823.1	0.3487	233.977	5.728	167064.	270.74	2.049	2.819
		10.0	183.1	988.1	0.2990	240.695		147336.	194.87	1.632	2.544
		15.0	221.1	1073.1	0.2887	245.972		129664.	157.48	1.467	2.380
		20.0	252.1	1113.1	0.2890	248.829		118635.	142.23	1.419	2.338
		25.0	278.1	1141.1	0.2866	247.335		111002.	129.73	1.369	2.284
		30.0	302.9	1155.1	0.2861	243.814		104759.	120.42	1.335	2.233
		35.0	323.6	1168.1	0.2836	239.500		100171.	112.83	1.301	2.202
		40.0	342.1	1173.1	0.2786	231.516		96467.	107.10	1.270	2.165
2	0.772	5.0	169.1	673.1	0.4488	226.195	7.281	197670.	315.31	2.086	2.628
		10.0	193.1	833.1	0.3672	235.008		180673.	227.61	1.620	2.342
		15.0	223.1	968.1	0.3255	242.497		163833.	177.76	1.368	2.125
		20.0	247.6	1073.1	0.2992	246.989		152666.	149.52	1.219	1.992
		25.0	269.1	1123.1	0.2882	246.122		144291.	134.16	1.147	1.929
		30.0	287.1	1123.1	0.2895	242.022		138098.	127.54	1.131	1.918
		35.0	303.1	1168.1	0.2740	237.010		133116.	115.26	1.055	1.856
		40.0	318.1	1048.1	0.3158	230.534		128830.	127.49	1.201	1.998
3	0.772	5.0	175.1	768.1	0.4309	255.523	7.972	211359.	292.93	1.837	2.379
		10.0	201.1	933.1	0.3620	264.983		192436.	215.95	1.463	2.167
		15.0	232.5	1078.1	0.3219	272.198		174420.	169.72	1.243	1.980
		20.0	260.1	1193.1	0.2959	276.074		161654.	141.80	1.105	1.853
		25.0	282.6	1253.1	0.2832	274.845		152818.	126.45	1.034	1.792
		30.0	302.1	1268.1	0.2793	269.803		146063.	117.82	1.001	1.764
		35.0	318.1	1263.1	0.2787	263.371		141043.	112.51	0.986	1.765
		40.0	331.6	1203.1	0.2932	255.523		137127.	114.24	1.026	1.814
4	0.772	5.0	161.1	713.1	0.3804	209.980	6.929	194393.	279.76	1.876	2.435
		10.0	186.1	903.1	0.3047	218.469		176294.	195.56	1.419	2.134
		15.0	215.1	1063.1	0.2659	225.483		159818.	148.86	1.172	1.915
		20.0	242.1	1083.1	0.2724	229.088		147514.	138.76	1.162	1.926
		25.0	263.1	1143.1	0.2576	226.688		139430.	122.24	1.073	1.842
		30.0	282.6	1153.1	0.2525	219.801		132836.	112.74	1.031	1.788
		35.0	297.6	1153.1	0.2461	210.538		128262.	105.15	0.991	1.749
		40.0	310.6	1173.1	0.2319	200.013		124600.	95.54	0.923	1.676
5	0.772	5.0	146.1	913.1	0.3325	255.027	5.620	168459.	268.16	2.017	2.895
		10.0	182.1	1123.1	0.2734	257.269		145108.	179.11	1.518	2.480
		15.0	224.1	1156.1	0.2777	258.816		126074.	151.08	1.434	2.384
		20.0	261.1	1315.1	0.2457	258.967		113674.	117.36	1.213	2.121
		25.0	291.6	1334.1	0.2452	255.621		105476.	106.60	1.174	2.068
		30.0	316.1	1334.1	0.2417	246.050		99865.	98.10	1.133	2.001
		35.0	335.1	1313.1	0.2377	232.470		95992.	92.94	1.105	1.964
		40.0	351.6	1281.1	0.2335	217.038		92916.	87.76	1.073	1.903



TABLE: VII

WOLF  
HYDROGEN

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
50	0.492	16.7	279.4	633.2	3.3745	1194.067	31.982	968474.	970.89	1.812	2.257
		33.5	320.5	693.8	3.4539	1289.340		882467.	884.08	1.787	2.316
		50.2	351.6	752.1	3.2273	1292.597		828771.	774.04	1.644	2.227
51	0.492	16.7	132.7	566.0	0.1923	83.321	1.637	82107.	108.35	1.449	2.278
		33.5	191.0	651.0	0.1913	87.990		64149.	76.43	1.245	2.016
		50.2	234.9	631.5	0.2258	89.556		55762.	75.29	1.373	2.136
52	0.492	16.7	119.4	555.5	0.3231	140.894	3.255	175373.	201.18	1.467	2.390
		33.5	164.9	651.5	0.3060	148.905		140887.	140.44	1.218	2.144
		50.2	199.4	632.7	0.3506	151.911		123899.	134.54	1.296	2.261
53	0.492	16.7	316.6	508.8	0.8075	155.209	3.972	110498.	208.85	2.224	2.489
		33.5	346.6	529.9	0.8768	160.735		103923.	212.78	2.378	2.691
		50.2	369.4	554.9	0.9098	168.795		99536.	209.55	2.431	2.774
54	0.492	16.7	321.0	546.6	0.6525	147.158	3.686	101596.	166.77	1.901	2.164
		33.5	357.1	571.0	0.7144	152.781		94516.	169.15	2.042	2.347
		50.2	384.4	601.0	0.7360	159.447		89927.	164.06	2.068	2.400
55	0.492	16.7	321.0	526.0	0.4790	98.185	2.525	69593.	122.42	1.888	2.125
		33.5	357.1	549.9	0.5218	100.576		64744.	123.54	2.019	2.290
		50.2	383.8	579.9	0.5375	105.398		61661.	119.96	2.045	2.339
56	0.492	16.7	331.0	594.3	1.3096	344.817	10.097	272548.	326.08	1.690	1.955
		33.5	368.8	624.9	1.3993	358.346		253307.	322.69	1.773	2.081
		50.2	397.7	654.9	1.4487	372.590		240687.	314.03	1.804	2.141
57	0.492	16.7	330.5	588.8	1.3465	347.814	10.490	283489.	335.75	1.686	1.946
		33.5	367.7	618.2	1.4374	360.111		263712.	332.30	1.768	2.069
		50.2	395.5	647.7	1.4942	376.822		251013.	325.38	1.807	2.140
58	0.492	16.7	331.0	587.1	1.1409	292.161	8.587	231776.	284.07	1.676	1.932
		33.5	368.8	616.5	1.2267	303.914		215413.	282.89	1.769	2.067
		50.2	397.7	648.8	1.2630	317.113		204681.	273.77	1.790	2.116
59	0.492	16.7	331.0	589.3	1.0733	277.244	7.903	213337.	267.24	1.685	1.944
		33.5	369.9	618.2	1.1568	287.245		197873.	266.11	1.782	2.081
		50.2	399.3	650.4	1.1909	299.022		187867.	257.26	1.802	2.129
60	0.492	16.7	332.1	593.2	0.9297	242.726	6.772	182386.	230.83	1.650	1.906
		33.5	372.7	622.7	1.0080	251.979		168691.	230.46	1.754	2.048
		50.2	403.2	657.1	1.0353	262.831		159922.	221.88	1.769	2.090
61	0.492	16.7	332.7	594.3	0.7877	206.093	5.376	144624.	195.29	1.681	1.941
		33.5	374.4	624.9	0.8570	214.704		133510.	195.22	1.791	2.092
		50.2	406.0	651.5	0.9172	225.200		126364.	195.46	1.882	2.209
62	0.492	16.7	333.2	593.2	0.6906	179.535	4.577	122982.	173.07	1.688	1.947
		33.5	376.0	632.1	0.7309	187.176		113320.	165.89	1.736	2.032
		50.2	408.2	658.8	0.7797	195.338		107180.	165.42	1.817	2.138
63	0.492	16.7	334.4	593.8	0.5895	152.928	3.749	100511.	147.33	1.689	1.947
		33.5	378.8	624.9	0.6485	159.589		92362.	146.30	1.804	2.097
		50.2	412.1	660.4	0.6735	167.236		87232.	141.78	1.837	2.155
64	0.492	16.7	336.6	605.4	0.5021	134.994	3.016	80498.	124.81	1.709	1.978
		33.5	384.4	642.1	0.5458	140.679		73573.	121.67	1.801	2.103
		50.2	420.5	676.5	0.5869	150.299		69231.	121.53	1.897	2.229

WOLF  
HYDROGEN

TABLE: VII

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
65	0.492	16.7	337.1	600.5	0.4605	121.254	2.679	71422.	114.31	1.723	1.988
		33.5	384.9	633.2	0.5096	126.538		65289.	113.46	1.848	2.146
		50.2	420.5	670.5	0.5340	133.489		61495.	110.58	1.897	2.221
66	0.492	16.7	338.2	604.9	0.3961	105.616	2.163	57532.	98.06	1.757	2.030
		33.5	387.1	636.6	0.4455	111.116		52504.	98.72	1.915	2.223
		50.2	424.3	676.0	0.4591	115.527		49337.	94.35	1.932	2.260
67	0.492	16.7	339.4	609.3	0.3425	92.464	1.835	48712.	84.56	1.731	2.002
		33.5	390.5	641.6	0.3880	97.419		44295.	85.38	1.898	2.203
		50.2	404.0	683.2	0.3556	99.301		43287.	76.09	1.726	2.074
69	0.492	16.7	298.8	691.0	5.5246	2166.637	55.234	1598028.	1500.98	1.881	2.360
		33.5	343.8	786.0	5.0435	2230.134		1453152.	1232.08	1.668	2.215
		50.2	377.1	804.9	5.4336	2324.168		1364840.	1230.28	1.759	2.379
70	0.492	16.7	298.8	721.5	5.0317	2127.050	51.981	1503917.	1367.06	1.798	2.289
		33.5	346.0	819.9	4.6460	2201.460		1361596.	1128.96	1.611	2.173
		50.2	381.6	841.0	4.9742	2285.147		1274292.	1115.47	1.685	2.322
71	0.492	16.7	297.1	740.4	4.5335	2009.655	47.492	1379273.	1237.60	1.744	2.244
		33.5	347.1	844.3	4.2172	2096.665		1241318.	1022.07	1.570	2.144
		50.2	384.9	872.1	4.4245	2155.483		1157415.	985.15	1.608	2.251
72	0.492	16.7	296.6	766.5	4.2144	1980.557	45.868	1333773.	1152.31	1.668	2.173
		33.5	349.9	877.6	3.9088	2062.790		1192424.	941.17	1.494	2.069
		50.2	389.9	904.3	4.1196	2119.080		1108096.	907.59	1.535	2.179
73	0.492	16.7	273.8	911.0	1.4067	896.293	18.841	578348.	411.71	1.159	1.655
		33.5	340.5	961.0	1.8269	1133.572		498965.	449.87	1.432	2.101
		50.2	390.5	815.4	3.6801	1563.858		454722.	809.81	2.794	3.734
74	0.492	16.7	306.0	802.7	4.3126	2141.723	40.133	1142494.	1148.10	1.884	2.467
		33.5	363.8	811.0	4.8799	2182.193		1016173.	1138.04	2.057	2.699
		50.2	407.7	796.5	5.4439	2116.859		940692.	1156.24	2.234	2.882
75	0.492	16.7	305.5	793.2	4.2973	2095.922	40.198	1145762.	1145.81	1.876	2.448
		33.5	362.1	801.0	4.8925	2147.023		1020974.	1145.27	2.061	2.697
		50.2	404.9	784.9	5.5149	2095.441		946592.	1177.92	2.264	2.909
76	0.492	16.7	298.8	753.2	3.6556	1661.105	29.761	861042.	993.19	2.041	2.637
		33.5	359.9	846.5	3.4579	1682.682		759059.	813.56	1.856	2.495
		50.2	405.5	772.1	4.4131	1617.974		700174.	941.54	2.304	2.932
77	0.492	16.7	289.9	786.5	2.6776	1329.749	23.098	682098.	746.43	1.846	2.446
		33.5	352.7	867.1	2.6220	1348.756		597274.	627.24	1.732	2.376
		50.2	399.3	788.8	3.3869	1318.892		549047.	731.66	2.173	2.819
78	0.492	16.7	259.9	876.0	1.4232	876.762	12.930	411156.	435.43	1.609	2.307
		33.5	334.4	926.5	1.4800	876.396		346654.	369.90	1.575	2.289
		50.2	389.9	822.7	1.9161	829.172		312367.	422.13	1.966	2.643
79	0.492	16.7	251.0	833.8	1.0818	630.386	8.922	290481.	340.93	1.662	2.370
		33.5	323.2	893.2	1.1063	630.524		244750.	281.10	1.586	2.302
		50.2	377.7	783.8	1.4885	604.434		220251.	336.61	2.071	2.758

TABLE: VII

WOLF  
HYDROGEN

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
80	0.492	16.7	298.8	794.3	3.2780	1624.248	30.269	875752.	890.60	1.806	2.376
		33.5	358.8	862.6	3.2552	1640.100		773644.	767.82	1.725	2.342
		50.2	403.8	801.0	4.0230	1597.854		714118.	861.20	2.074	2.696
92	0.492	16.7	318.8	501.0	0.5759	104.929	3.027	83813.	148.06	1.968	2.187
		33.5	354.9	548.8	0.5574	108.063		77937.	132.65	1.868	2.122
		50.2	382.1	577.1	0.5702	111.177		74131.	127.71	1.878	2.148
93	0.492	16.7	319.9	491.0	0.5276	90.267	2.324	64193.	135.24	2.225	2.457
		33.5	357.7	538.8	0.5105	92.451		59518.	120.72	2.110	2.375
		50.2	386.0	567.1	0.5247	95.023		56522.	116.55	2.130	2.410
94	0.492	16.7	331.6	570.5	0.4513	107.802	2.334	62935.	112.21	1.879	2.145
		33.5	382.1	638.2	0.4355	111.527		57166.	97.54	1.766	2.062
		50.2	419.9	677.7	0.4457	114.879		53628.	92.39	1.769	2.081
95	0.492	16.7	130.5	806.0	0.2403	162.320	3.217	163181.	137.57	1.062	1.954
		33.5	188.8	762.1	0.2780	159.371		127044.	112.30	1.059	1.888
		50.2	232.7	688.2	0.3409	155.283		110273.	114.60	1.211	2.010
96	0.492	16.7	132.7	967.6	0.2366	197.542	3.712	186117.	133.31	0.926	1.838
		33.5	193.8	781.5	0.3110	182.780		143994.	122.57	1.046	1.864
		50.2	239.4	715.4	0.3844	182.997		124805.	126.15	1.208	2.019
97	0.492	16.7	139.9	976.5	0.2356	197.098	3.265	157935.	126.27	1.000	1.944
		33.5	209.4	831.0	0.3047	189.404		120208.	111.65	1.103	1.947
		50.2	261.6	777.7	0.3636	187.639		103373.	110.64	1.234	2.055
98	0.492	16.7	137.2	956.5	0.2849	233.435	4.353	213456.	155.61	0.969	1.883
		33.5	202.7	833.8	0.3894	245.730		163822.	147.11	1.133	2.044
		50.2	251.6	772.7	0.4471	232.965		141516.	140.64	1.219	2.077
99	0.492	16.7	304.4	779.3	4.3177	2050.734	40.263	1150458.	1154.83	1.884	2.446
		33.5	360.5	789.3	4.8924	2098.104		1025840.	1149.60	2.061	2.684
		50.2	402.1	778.8	5.4087	2037.077		952566.	1161.79	2.221	2.852

TABLE: VII

WOLF  
HYDROGEN

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
115	1.092	5.8	101.6	687.7	0.0952	55.792	4.628	125454.	152.95	1.459	2.207
		10.4	119.4	967.1	0.0726	61.543		112478.	100.19	1.042	1.901
		15.0	136.6	1181.5	0.0586	61.231		102666.	71.21	0.796	1.656
116	1.092	5.8	106.6	837.6	0.0914	66.816	4.780	125437.	140.34	1.339	2.122
		10.4	125.5	1159.8	0.0714	73.851		112320.	94.00	0.979	1.878
		15.0	144.4	1312.0	0.0599	69.942		102141.	69.08	0.775	1.649
117	1.092	5.8	107.2	892.1	0.0890	69.857	4.872	127398.	135.99	1.281	2.068
		10.4	126.6	717.7	0.0700	41.374		113794.	91.39	0.942	1.507
		15.0	146.0	1347.6	0.0604	72.573		103293.	68.91	0.766	1.642
118	1.092	5.8	115.5	802.1	0.1354	92.965	6.682	166099.	192.78	1.469	2.240
		10.4	134.9	1101.0	0.1048	101.237		149477.	128.83	1.067	1.951
		15.0	154.4	1366.5	0.0853	103.392		136451.	92.35	0.822	1.727
119	1.092	5.8	125.5	859.9	0.1499	110.082	7.317	171934.	197.34	1.462	2.220
		10.4	146.0	1124.3	0.1219	119.246		155140.	139.07	1.117	1.999
		15.0	166.6	1288.2	0.1070	120.005		141902.	107.81	0.930	1.838
120	1.092	5.8	107.7	1004.3	0.0607	54.421	2.950	76878.	92.29	1.303	2.178
		10.4	132.2	1223.2	0.0518	56.513		66933.	64.94	1.023	1.962
		15.0	157.2	1276.5	0.0501	56.078		59521.	53.33	0.922	1.863
121	1.092	5.8	108.8	1046.0	0.0604	56.602	3.023	78235.	90.95	1.266	2.137
		10.4	134.4	1265.9	0.0523	59.180		67820.	64.54	1.006	1.943
		15.0	159.4	1317.0	0.0508	58.809		60417.	53.37	0.911	1.856
122	1.092	5.8	99.4	557.1	0.0722	33.048	3.059	84174.	118.45	1.555	2.219
		10.4	115.5	769.9	0.0574	37.561		76029.	81.72	1.163	1.974
		15.0	131.6	968.2	0.0465	38.901		69593.	58.53	0.893	1.728
123	1.092	5.8	97.7	541.6	0.0913	40.522	4.032	112236.	152.19	1.587	2.258
		10.4	112.7	734.9	0.0721	44.857		101888.	105.03	1.183	1.991
		15.0	128.3	932.1	0.0593	47.665		93347.	76.47	0.923	1.776
124	1.092	5.8	101.6	479.9	0.0662	25.042	2.363	64055.	106.36	1.737	2.354
		10.4	117.2	635.4	0.0526	27.261		58165.	73.88	1.303	2.052
		15.0	133.3	794.9	0.0413	27.324		53304.	51.37	0.970	1.715
125	1.092	5.8	97.7	464.9	0.0693	25.445	2.810	78209.	115.55	1.608	2.184
		10.4	112.7	602.1	0.0570	27.895		70998.	83.04	1.249	1.957
		15.0	128.3	753.8	0.0476	29.773		65047.	61.38	0.989	1.737
126	1.092	5.8	96.6	498.2	0.0777	31.205	3.247	91083.	130.92	1.613	2.245
		10.4	112.2	660.4	0.0569	31.197		82326.	83.28	1.113	1.805
		15.0	127.7	833.2	0.0510	35.979		75390.	66.03	0.946	1.736
127	1.092	5.8	109.9	744.9	0.0330	20.953	1.104	28363.	49.22	1.543	2.324
		10.4	135.5	936.0	0.0283	22.653		24619.	34.65	1.214	2.084
		15.0	161.6	1007.6	0.0261	22.081		21849.	27.06	1.043	1.876
128	1.092	5.8	106.6	704.9	0.0403	24.110	1.437	37709.	61.88	1.544	2.312
		10.4	129.9	909.3	0.0325	25.329		32978.	41.40	1.149	1.982
		15.0	153.3	1013.7	0.0299	25.728		29488.	32.59	0.988	1.823
129	1.092	5.8	106.0	647.7	0.0479	25.943	1.823	47999.	73.91	1.521	2.224
		10.4	126.6	873.7	0.0374	27.943		42572.	48.83	1.105	1.897
		15.0	147.2	1010.4	0.0331	28.573		38446.	37.49	0.919	1.725

WOLF  
HYDROGEN

TABLE: VII

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
130	1.092	5.8	103.3	647.1	0.0518	28.170	2.126	57006.	81.96	1.470	2.168
		10.4	122.7	883.2	0.0407	30.951		50717.	54.72	1.076	1.878
		15.0	142.2	1022.6	0.0351	30.904		45908.	41.07	0.874	1.674
131	1.092	5.8	104.4	759.3	0.0501	32.812	2.125	56571.	78.47	1.416	2.187
		10.4	126.0	994.8	0.0410	35.620		49785.	53.75	1.073	1.937
		15.0	147.7	1109.8	0.0370	35.598		44714.	41.76	0.907	1.771
132	1.092	5.8	109.9	954.8	0.0507	42.836	2.165	55632.	75.62	1.383	2.258
		10.4	136.0	1154.8	0.0440	44.826		48154.	53.67	1.100	2.041
		15.0	162.2	1227.6	0.0416	44.322		42754.	42.99	0.968	1.896
133	1.092	5.8	95.5	367.1	0.0439	11.925	1.414	39975.	74.78	1.781	2.268
		10.4	109.9	461.6	0.0357	12.553		36338.	53.24	1.369	1.974
		15.0	124.4	561.0	0.0299	13.055		33424.	39.69	1.090	1.719
134	1.092	5.8	95.5	401.0	0.0436	13.320	1.438	40642.	74.27	1.745	2.281
		10.4	110.5	519.3	0.0351	14.350		36820.	52.10	1.325	1.985
		15.0	124.9	644.9	0.0290	15.078		33878.	38.33	1.041	1.733
135	1.092	5.8	98.8	492.7	0.0423	16.659	1.437	39696.	69.76	1.671	2.297
		10.4	116.0	650.4	0.0340	18.169		35603.	48.19	1.259	2.005
		15.0	133.3	795.4	0.0283	18.739		32418.	35.20	0.990	1.749
136	1.092	5.8	101.0	472.1	0.0483	17.922	1.712	46583.	78.00	1.644	2.218
		10.4	117.2	620.4	0.0388	19.527		42142.	54.50	1.244	1.942
		15.0	133.8	767.7	0.0318	20.155		38510.	39.39	0.965	1.678
137	1.092	5.8	101.0	512.7	0.0481	19.799	1.710	46534.	77.68	1.639	2.266
		10.4	118.3	694.9	0.0386	22.257		41829.	53.74	1.234	1.998
		15.0	136.0	856.5	0.0320	23.055		38043.	39.03	0.966	1.746
138	1.092	5.8	111.0	723.8	0.0480	29.410	1.724	44010.	70.92	1.564	2.333
		10.4	133.8	952.1	0.0380	31.093		38784.	47.08	1.147	1.991
		15.0	156.6	1092.6	0.0338	31.637		34868.	36.10	0.957	1.808
139	1.092	5.8	100.5	494.3	0.0603	23.748	1.724	47089.	97.89	2.045	2.802
		10.4	116.6	664.3	0.0479	26.235		42577.	67.58	1.530	2.451
		15.0	133.3	829.9	0.0400	27.864		38895.	49.75	1.209	2.176

TABLE: VIII

PFRIEM  
HELIUM

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
1	0.251	8.0	545.1	316.1	0.5680	130.072	1.717	41987.	88.12	2.074	2.258
		24.0	703.1	369.1	0.5170	172.678		37905.	72.41	1.850	2.251
		40.0	895.1	440.1	0.4960	225.680		33750.	61.85	1.734	2.207
		56.0	1146.1	533.1	0.4870	298.531		29739.	53.51	1.660	2.191
		66.0	1333.1	601.1	0.4760	348.432		27474.	48.32	1.597	2.159
		70.0	1413.1	633.1	0.4720	368.160		26549.	46.30	1.573	2.147
		74.0	1498.1	666.1	0.4690	390.208		25674.	44.49	1.552	2.140
		78.0	1583.1	702.1	0.4670	411.427		24797.	42.79	1.535	2.137
		82.0	1373.1	733.1	0.5600	358.400		24100.	49.87	1.830	2.575
		2	0.251	8.0	563.1	317.1	0.5550	136.530	1.705	41595.	85.92
24.0	728.1			373.1	0.5130	182.115		37362.	71.34	1.844	2.250
40.0	943.1			449.1	0.4920	243.048		33060.	60.54	1.725	2.205
56.0	1253.1			552.1	0.4750	332.975		28848.	51.00	1.621	2.151
66.0	1503.1			629.1	0.4540	396.796		26467.	44.72	1.523	2.073
70.0	1613.1			666.1	0.4490	425.203		25487.	42.59	1.495	2.057
74.0	1743.1			705.1	0.4430	459.835		24548.	40.47	1.464	2.038
78.0	1863.1			748.1	0.4410	491.716		23607.	38.75	1.446	2.037
82.0	1673.1			786.1	0.4980	441.726		22848.	42.35	1.622	2.313
3	0.251			8.0	548.1	317.1	0.5790	133.749	1.696	41378.	89.64
		24.0	748.1	375.1	0.5060	188.738		37036.	70.12	1.825	2.200
		40.0	996.1	455.1	0.4820	260.762		32600.	58.79	1.694	2.163
		56.0	1348.1	567.1	0.4620	360.822		28194.	48.73	1.578	2.103
		66.0	1653.1	651.1	0.4400	440.880		25738.	42.37	1.475	2.024
		70.0	1803.1	693.1	0.4430	491.731		24698.	40.93	1.473	2.046
		74.0	1988.1	738.1	0.4250	531.251		23693.	37.67	1.402	1.970
		78.0	2153.1	788.1	0.4220	576.031		22690.	35.82	1.380	1.964
		82.0	1853.1	832.1	0.4850	495.186		21891.	39.72	1.574	2.271
		4	0.251	8.0	553.1	317.1	0.5670	133.812	1.701	41507.	87.78
24.0	723.1			373.1	0.5140	179.900		37283.	71.48	1.850	2.241
40.0	938.1			448.1	0.4920	241.080		33038.	60.63	1.729	2.198
56.0	1248.1			550.1	0.4760	332.248		28856.	51.23	1.628	2.149
66.0	1513.1			628.1	0.4510	399.135		26438.	44.47	1.516	2.052
70.0	1633.1			665.1	0.4450	430.760		25458.	42.25	1.484	2.031
74.0	1763.1			705.1	0.4400	465.521		24496.	40.20	1.456	2.016
78.0	1933.1			749.1	0.4310	510.305		23537.	37.83	1.415	1.982
82.0	1673.1			788.1	0.4980	440.730		22761.	42.28	1.624	2.303
5	0.251			8.0	573.1	318.1	0.4390	111.945	1.351	32904.	67.82
		24.0	743.1	376.1	0.4060	149.002		29461.	56.16	1.755	2.171
		40.0	933.1	453.1	0.4000	192.000		26054.	48.93	1.687	2.181
		56.0	856.1	551.1	0.4040	123.220		22896.	43.43	1.661	2.217
		66.0	1338.1	622.1	0.3940	282.104		21136.	39.10	1.594	2.153
		70.0	1425.1	654.1	0.3880	299.148		20448.	37.25	1.559	2.079
		74.0	1523.1	689.1	0.3810	317.754		19756.	35.34	1.520	2.000
		78.0	1621.1	726.1	0.3770	337.415		19086.	33.78	1.494	1.936
		82.0	1323.1	758.1	0.4940	279.110		18550.	43.03	1.947	2.481

PFRIFM  
HELIUM

TABLE: VIII

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
6	0.251	8.0	581.1	319.1	0.4400	115.280	1.351	32822.	67.84	1.945	2.152
		24.0	763.1	380.1	0.4070	155.881		29243.	55.91	1.758	2.184
		40.0	971.1	461.1	0.4000	204.000		25743.	48.37	1.684	2.192
		56.0	1214.1	566.1	0.4040	261.792		22484.	42.67	1.655	2.231
		66.0	1425.1	640.1	0.3880	304.580		20733.	37.78	1.564	2.155
		70.0	1523.1	677.1	0.3820	323.172		19978.	35.85	1.529	2.122
		74.0	1642.1	715.1	0.3750	347.625		19271.	33.94	1.490	2.084
		78.0	1743.1	755.1	0.3730	368.524		18591.	32.57	1.471	2.073
		82.0	1423.1	790.1	0.4800	303.840		18043.	40.68	1.882	2.672
		7	0.251	8.0	563.1	318.1		0.4620	113.190	1.349	32848.
24.0	781.1			380.1	0.4050	162.405	29207.	55.63	1.751		2.161
40.0	1033.1			467.1	0.3920	221.872	25492.	47.00	1.649		2.158
56.0	1355.1			583.1	0.3820	294.904	22021.	39.56	1.561		2.128
66.0	1603.1			669.1	0.3690	344.646	20110.	34.90	1.480		2.075
70.0	1723.1			710.1	0.3650	369.745	19336.	33.19	1.453		2.059
74.0	1853.1			753.1	0.3610	397.101	18600.	31.58	1.426		2.042
78.0	1973.1			799.1	0.3600	422.641	17886.	30.28	1.411		2.043
82.0	1673.1			839.1	0.4310	359.454	17319.	35.10	1.678		2.456
8	0.251			8.0	563.1	319.1	0.4660	113.704	1.435		34855.
		24.0	790.1	382.1	0.4050	165.240	30948.	55.44		1.666	2.045
		40.0	1163.1	476.1	0.3720	255.564	26767.	44.04		1.486	1.942
		56.0	1423.1	605.1	0.3800	310.840	22850.	38.40		1.471	2.053
		66.0	1723.1	696.1	0.3630	372.802	20832.	33.45		1.379	2.015
		70.0	1873.1	740.1	0.3570	404.481	20006.	31.59		1.345	2.004
		74.0	2048.1	789.1	0.3510	441.910	19177.	29.77		1.312	1.970
		78.0	2213.1	841.1	0.3480	477.457	18386.	28.30		1.290	1.948
		82.0	1833.1	886.1	0.4180	395.846	17764.	32.84		1.538	2.335
		9	0.251	8.0	558.1	318.1	0.4740	113.760		1.342	32680.
24.0	793.1			382.1	0.4070	167.277	28957.	55.71	1.765		2.143
40.0	1073.1			473.1	0.3920	235.200	25149.	46.60	1.653		2.140
56.0	1466.1			599.1	0.3710	321.657	21520.	37.74	1.516		2.054
66.0	1793.1			694.1	0.3550	390.146	19528.	32.77	1.423		1.986
70.0	1973.1			741.1	0.3480	428.737	18702.	30.76	1.383		1.954
74.0	2188.1			793.1	0.3410	475.696	17883.	28.83	1.343		1.921
78.0	2418.1			850.1	0.3360	526.849	17083.	27.13	1.311		1.900
82.0	2073.1			901.1	0.3850	451.220	16438.	29.92	1.491		2.189
10	0.251			8.0	564.1	319.1	0.4650	113.925	1.342		32618.
		24.0	773.1	381.1	0.4120	161.504	29011.	56.50		1.787	2.179
		40.0	1023.1	467.1	0.3980	221.288	25366.	47.72		1.681	2.170
		56.0	1368.1	586.1	0.3830	299.506	21838.	39.53		1.570	2.109
		66.0	1663.1	674.1	0.3640	359.996	19912.	34.26		1.465	2.021
		70.0	1818.1	717.1	0.3570	393.058	19116.	32.25		1.425	1.988
		74.0	2013.1	763.1	0.3480	435.001	18347.	30.18		1.377	1.944
		78.0	2223.1	816.1	0.3410	479.788	17552.	28.29		1.338	1.910
		82.0	1923.1	862.1	0.3910	414.851	16928.	31.28		1.523	2.199

TABLE: VIII

PFRIEM  
HELIUM

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
11	0.251	8.0	556.1	318.1	0.4640	110.432	1.371	33379.	71.69	2.027	2.204
		24.0	733.1	375.1	0.4190	150.002		29939.	58.06	1.791	2.191
		40.0	938.1	452.1	0.4070	197.802		26468.	49.86	1.698	2.179
		56.0	1208.1	554.1	0.4020	262.908		23143.	43.06	1.632	2.170
		66.0	1423.1	630.1	0.3860	306.098		21261.	37.98	1.541	2.098
		70.0	1528.1	665.1	0.3790	327.077		20516.	35.99	1.502	2.064
		74.0	1643.1	702.1	0.3720	350.052		19796.	34.08	1.464	2.031
		78.0	1773.1	743.1	0.3660	376.981		19068.	32.30	1.430	2.003
		82.0	1523.1	779.1	0.4380	325.872		18482.	37.47	1.700	2.405
12	0.251	8.0	568.1	319.1	0.4610	114.789	1.344	32649.	71.07	2.046	2.217
		24.0	733.1	379.1	0.4300	152.220		29140.	59.17	1.865	2.269
		40.0	948.1	459.1	0.4150	202.935		25681.	50.33	1.755	2.231
		56.0	1258.1	568.1	0.4020	277.380		22313.	42.36	1.653	2.176
		66.0	1533.1	650.1	0.3770	332.891		20414.	36.34	1.523	2.052
		70.0	1663.1	689.1	0.3700	360.380		19644.	34.32	1.483	2.017
		74.0	1823.1	732.1	0.3610	393.852		18874.	32.17	1.436	1.974
		78.0	1973.1	779.1	0.3560	425.065		18115.	30.45	1.404	1.952
		82.0	1623.1	819.1	0.4370	351.348		17526.	36.16	1.712	2.407
13	0.251	8.0	578.1	320.1	0.4600	118.680	1.332	32296.	70.77	2.055	2.189
		24.0	753.1	383.1	0.4300	159.100		28685.	58.76	1.876	2.266
		40.0	1023.1	470.1	0.4050	223.965		25061.	48.35	1.720	2.178
		56.0	1465.1	595.1	0.3720	323.640		21450.	38.01	1.531	2.022
		66.0	1813.1	692.1	0.3540	396.835		19415.	32.74	1.428	1.943
		70.0	1993.1	740.1	0.3480	436.045		18575.	30.79	1.392	1.916
		74.0	2213.1	793.1	0.3410	484.221		17746.	28.83	1.351	1.884
		78.0	2393.1	851.1	0.3400	524.281		16938.	27.43	1.335	1.889
		82.0	1873.1	900.1	0.4220	410.606		16324.	32.82	1.645	2.365
14	0.251	8.0	562.1	317.1	0.5750	140.875	1.736	42361.	89.02	2.081	2.181
		24.0	743.1	375.1	0.5220	192.096		37916.	72.33	1.847	2.216
		40.0	993.1	455.1	0.4980	267.924		33375.	60.74	1.718	2.174
		56.0	1345.1	566.1	0.4730	368.467		28898.	49.95	1.585	2.093
		66.0	1703.1	650.1	0.4420	465.427		26376.	42.61	1.455	1.976
		70.0	1903.1	694.1	0.4300	519.871		25261.	39.70	1.403	1.928
		74.0	2173.1	743.1	0.4170	596.311		24149.	36.80	1.348	1.876
		78.0	2398.1	799.1	0.4130	660.388		23018.	34.74	1.323	1.863
		82.0	2013.1	847.1	0.4730	551.519		22149.	38.29	1.503	2.145
15	0.251	8.0	563.1	318.1	0.5740	140.630	1.736	42275.	88.68	2.076	2.213
		24.0	723.1	375.1	0.5340	185.832		37919.	74.00	1.890	2.273
		40.0	938.1	451.1	0.5110	248.857		33572.	62.69	1.765	2.222
		56.0	1263.1	555.1	0.4900	346.920		29276.	52.42	1.647	2.149
		66.0	1573.1	635.1	0.4580	429.604		26787.	44.83	1.512	2.022
		70.0	1738.1	674.1	0.4460	474.544		25754.	41.97	1.461	1.973
		74.0	1953.1	719.1	0.4330	534.323		24679.	39.05	1.406	1.919
		78.0	2183.1	769.1	0.4240	599.537		23608.	36.58	1.365	1.885
		82.0	1873.1	813.1	0.4830	511.981		22757.	40.17	1.543	2.159



TAYLOR  
HELIUM

TABLE: IX

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
12	0.294	11.6	337.0	522.0	0.3600	66.600	1.522	30393.	62.85	1.916	2.131
		19.4	356.0	605.0	0.3400	84.660		29312.	57.25	1.796	2.139
		27.1	382.0	635.0	0.3210	81.213		27980.	51.60	1.680	2.013
		34.9	412.0	807.0	0.3060	120.870		26618.	46.79	1.586	2.073
		42.6	449.0	961.0	0.2950	151.040		25149.	42.62	1.512	2.113
		50.4	495.0	1155.0	0.2880	190.080		23581.	39.01	1.457	2.205
		58.1	589.0	1640.0	0.2510	263.800		21025.	30.31	1.241	2.208
		65.9	641.0	2220.0	0.2170	342.642		19883.	24.78	1.061	2.392
13	0.294	11.6	336.0	527.0	0.3600	68.760	1.497	29948.	62.98	1.943	2.170
		19.4	357.0	605.0	0.3480	86.304		28774.	58.49	1.863	2.216
		27.1	384.0	727.0	0.3200	109.760		27422.	51.26	1.696	2.147
		34.9	420.0	936.0	0.2910	150.156		25847.	43.93	1.525	2.128
		42.6	469.0	1250.0	0.2710	211.651		24032.	38.04	1.399	2.236
		50.4	539.0	1772.0	0.2430	299.618		21923.	31.12	1.232	2.403
		58.1	631.0	2420.0	0.2100	375.689		19758.	24.23	1.042	2.471
		65.9	737.0	2790.0	0.1950	400.335		17833.	20.31	0.948	2.343
14	0.294	11.6	357.0	1110.0	0.2560	192.768	1.283	24656.	43.03	1.550	2.230
		19.4	431.0	2066.0	0.1680	274.679		21774.	24.93	0.992	1.883
		27.1	530.0	2533.0	0.1720	344.515		18996.	22.27	0.989	2.034
		34.9	640.0	2822.0	0.1600	349.119		16773.	18.29	0.897	1.903
		42.6	751.0	2988.0	0.1550	346.734		15093.	15.94	0.851	1.810
		50.4	861.0	3066.0	0.1550	341.774		13791.	14.57	0.836	1.742
		58.1	969.0	3066.0	0.1610	337.616		12756.	14.00	0.854	1.695
		65.9	1075.0	3086.0	0.1620	325.782		11911.	13.15	0.848	1.601
15	0.294	11.6	366.0	1691.0	0.2010	266.325	1.417	26803.	33.23	1.120	1.895
		19.4	459.0	2417.0	0.1950	381.809		23083.	27.76	1.055	2.103
		27.1	576.0	2797.0	0.1920	426.431		19870.	23.53	1.008	2.094
		34.9	700.0	2883.0	0.2000	436.599		17471.	21.55	1.023	2.070
		42.6	828.0	2913.0	0.2120	442.0200		15638.	20.45	1.061	2.055
		50.4	955.0	2961.0	0.2210	443.325		14232.	19.40	1.085	2.020
		58.1	1084.0	3000.0	0.2320	444.512		13091.	18.73	1.120	1.984
		65.9	1211.0	2983.0	0.2480	439.455		12168.	18.61	1.180	1.955
16	0.294	11.6	328.0	639.0	0.3210	99.831	1.596	32451.	57.06	1.650	1.990
		19.4	360.0	905.0	0.2750	149.875		30517.	45.97	1.397	1.950
		27.1	407.0	1294.0	0.2500	221.750		28143.	38.54	1.249	2.033
		34.9	476.0	1772.0	0.2400	311.039		25380.	33.36	1.175	2.220
		42.6	566.0	2294.0	0.2280	393.983		22638.	28.27	1.091	2.355
		50.4	673.0	2772.0	0.2100	440.789		20194.	23.22	0.982	2.325
		58.19	789.0	3017.0	0.2080	463.423		18182.	20.71	0.952	2.250
		65.95	907.0	2980.0	0.2230	462.278		16584.	20.25	1.002	2.146

TABLE: IX

TAYLOR  
HELIUM

RUN	DI (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
32	0.292	11.7	213.3	944.4	0.1235	90.315	0.595	16221.	28.90	1.456	2.348
		19.5	286.1	1416.6	0.1110	125.491		13345.	21.40	1.260	2.337
		27.3	381.1	1855.5	0.1058	155.996		11044.	16.88	1.157	2.213
		35.2	492.7	2027.7	0.1138	174.683		9321.	15.33	1.203	2.099
		43.0	613.8	2094.4	0.1246	184.477		8062.	14.51	1.279	2.130
		50.8	738.8	2150.0	0.1326	187.113		7134.	13.67	1.328	2.020
		58.7	863.8	2205.5	0.1377	184.747		6435.	12.80	1.351	2.049
		66.5	982.7	2185.0	0.1411	169.633		5910.	12.05	1.361	2.085
33	0.292	11.7	167.2	765.5	0.2077	124.273	1.228	39294.	57.09	1.417	2.393
		19.5	222.2	1538.8	0.1605	211.325		32570.	36.57	1.054	2.251
		27.3	301.6	2131.1	0.1519	277.892		26620.	28.28	0.958	2.235
		35.2	398.3	2261.1	0.1684	313.691		22158.	26.10	1.024	2.110
		43.0	503.3	2266.6	0.1861	328.156		18988.	24.72	1.098	2.092
		50.8	611.6	2402.7	0.1889	338.340		16695.	22.06	1.086	2.074
		58.7	721.6	2538.8	0.1844	335.095		14969.	19.31	1.037	1.972
		66.5	830.5	2569.4	0.1900	330.388		13643.	18.13	1.049	2.126
34	0.292	11.7	201.6	1194.4	0.1866	185.252	1.179	33337.	45.33	1.283	2.324
		19.5	277.7	1975.5	0.1553	263.664		26986.	30.54	1.024	2.215
		27.3	379.4	2298.8	0.1741	334.175		21966.	27.86	1.101	2.045
		35.2	495.5	2361.1	0.1883	351.283		18417.	25.27	1.150	2.088
		43.0	615.0	2450.0	0.1906	349.750		15971.	22.18	1.131	2.118
		50.8	732.7	2600.0	0.1849	345.249		14226.	19.16	1.072	2.236
		58.7	848.3	2744.4	0.1764	334.473		12916.	16.60	1.003	2.036
		66.5	960.5	2745.5	0.1826	325.940		11899.	15.83	1.022	1.926
35	0.292	11.7	138.3	350.0	0.2799	59.245	1.137	41246.	87.20	2.082	2.369
		19.5	171.6	833.3	0.1963	129.885		35768.	53.03	1.419	2.116
		27.3	230.5	1673.8	0.1417	204.520		29441.	31.51	0.985	2.177
		35.2	316.6	2100.0	0.1610	287.116		23878.	29.03	1.073	2.120
		43.0	421.6	2194.4	0.1735	307.576		19766.	25.90	1.114	2.077
		50.8	530.5	2216.6	0.1849	311.761		16985.	23.72	1.152	2.175
		58.7	640.0	2205.5	0.1974	309.040		15007.	22.37	1.199	1.998
		66.5	745.5	2127.7	0.2100	290.266		13569.	21.52	1.250	2.254
36	0.292	11.7	160.0	527.7	0.1889	69.473	1.149	37841.	53.46	1.367	2.217
		19.5	193.8	838.8	0.1906	122.937		33335.	47.52	1.345	2.197
		27.3	251.6	1383.3	0.1838	208.000		28063.	38.57	1.253	2.034
		35.2	335.0	2027.7	0.1605	271.690		23236.	27.89	1.054	2.156
		43.0	439.4	2261.1	0.1804	328.628		19425.	26.21	1.143	2.024
		50.8	560.0	2322.2	0.2048	360.903		16553.	25.35	1.256	2.007
		58.7	686.1	2405.5	0.2100	361.083		14476.	22.73	1.254	2.139
		66.5	809.4	2434.4	0.2145	348.562		12980.	20.82	1.254	2.175
37	0.292	11.7	187.7	1038.8	0.1838	156.434	1.159	34346.	46.80	1.294	2.271
		19.5	257.2	1777.7	0.1622	246.634		27905.	33.55	1.095	2.142
		27.3	353.8	2227.2	0.1661	311.160		22606.	27.83	1.075	1.958
		35.2	469.4	2316.6	0.1946	359.469		18760.	27.06	1.213	2.102
		43.0	594.4	2383.3	0.2031	363.323		16053.	24.17	1.228	2.138

TAYLOR  
HELIUM

TABLE: IX

RUN	D (CM)	L/D	TB (K)	TW (K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
38	0.292	50.8	720.5	2500.0	0.2060	366.565		14139.	21.59	1.214	2.083
		58.7	848.8	2583.3	0.2157	374.119		12689.	20.29	1.244	2.092
		66.5	977.2	2594.4	0.2287	369.858		11563.	19.60	1.295	2.287
		11.7	196.6	1177.7	0.1826	179.150	1.116	33457.	45.10	1.273	2.417
		19.5	276.1	1961.1	0.1667	280.889		26745.	32.91	1.111	2.220
		27.3	385.5	2318.3	0.1844	356.404		21455.	29.20	1.176	2.110
		35.2	511.1	2366.6	0.2009	372.781		17813.	26.41	1.235	2.041
		43.0	640.0	2438.8	0.2100	377.766		15356.	23.80	1.253	2.027
		50.8	770.5	2561.1	0.2139	382.999		13585.	21.45	1.245	2.058
		58.7	903.8	2650.0	0.2225	388.509		12227.	20.08	1.268	2.012
39	0.292	66.5	1036.1	2683.8	0.2310	380.636		11173.	19.05	1.293	2.237
		11.7	202.7	1311.1	0.1878	208.145	1.116	32788.	45.45	1.304	2.262
		19.5	292.2	2155.5	0.1679	312.853		25762.	31.93	1.111	2.277
		27.3	411.6	2388.8	0.1935	382.592		20547.	29.35	1.224	1.956
		35.2	545.0	2411.1	0.2105	392.816		17074.	26.53	1.283	1.987
		43.0	681.6	2516.6	0.2179	399.846		14730.	23.69	1.289	2.048
		50.8	819.4	2683.3	0.2162	402.972		13044.	20.82	1.248	2.044
		58.7	960.0	2772.2	0.2282	413.549		11750.	19.79	1.290	2.033
		66.5	1101.6	2795.0	0.2435	412.326		10730.	19.28	1.352	2.199
		11.7	188.3	1255.5	0.2054	219.207	1.477	43595.	52.20	1.192	2.276
40	0.292	19.5	265.0	2073.8	0.1912	345.859		34797.	38.78	1.061	2.026
		27.3	369.4	2370.5	0.2128	425.836		27945.	34.66	1.130	2.030
		35.2	486.6	2380.5	0.2322	439.761		23297.	31.53	1.189	2.058
		43.0	606.6	2466.6	0.2395	445.470		20143.	28.12	1.191	2.188
		50.8	728.3	2622.2	0.2384	451.502		17854.	24.81	1.157	2.113
		58.7	852.2	2727.7	0.2475	464.200		16096.	23.22	1.177	2.045
		66.5	978.8	2792.7	0.2583	468.527		14689.	22.12	1.206	2.270
		11.7	155.0	361.1	0.1804	37.182	0.753	25679.	52.13	1.819	2.343
		19.5	180.0	594.4	0.1417	58.726		23265.	37.10	1.400	2.214
		27.3	222.7	1000.0	0.1349	104.847		20211.	30.68	1.296	2.173
41	0.292	35.2	289.4	1488.8	0.1246	149.450		17004.	23.84	1.157	2.155
		43.0	377.7	1888.8	0.1240	187.377		14263.	19.90	1.111	1.868
		50.8	481.6	2044.4	0.1331	208.005		12150.	18.20	1.155	2.024
		58.7	591.6	2027.7	0.1479	212.400		10607.	17.65	1.249	2.071
		66.5	699.4	1977.7	0.1553	198.525		9498.	16.60	1.283	2.195
		11.7	187.7	722.2	0.1673	89.412	0.773	22921.	42.60	1.627	2.253
		19.5	244.4	1361.1	0.1161	129.645		19259.	24.84	1.091	2.245
		27.3	326.1	1877.7	0.1201	186.355		15923.	21.24	1.086	2.122
		35.2	430.0	2088.8	0.1292	214.328		13266.	19.04	1.126	2.171
		43.0	544.4	2127.7	0.1440	228.000		11353.	18.16	1.217	2.063
42	0.292	50.8	663.3	2166.6	0.1536	230.912		9965.	17.00	1.265	2.061
		58.7	783.3	2222.2	0.1627	234.107		8929.	16.14	1.311	2.084
		66.5	901.6	2220.0	0.1679	221.348		8138.	15.18	1.328	2.203
		11.7	220.5	1183.3	0.1320	127.086	0.744	19842.	30.22	1.296	2.242
		19.5	306.1	1794.4	0.1275	189.762		15982.	23.51	1.199	2.137

TAYLOR  
HELIUM

TABLE: IX

RUN	DI (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
			27.3	418.3	2165.5	0.1303	227.663	13005.	19.55	1.175	2.159
			35.2	546.6	2255.5	0.1457	248.985	10899.	18.32	1.269	2.178
			43.0	685.5	2300.0	0.1661	268.159	9387.	17.99	1.404	2.024
			50.8	830.0	2383.3	0.1724	267.794	8274.	16.46	1.421	2.218
			58.7	973.8	2461.1	0.1804	268.294	7445.	15.50	1.456	2.044
			66.5	1117.2	2480.0	0.1935	263.697	6800.	15.18	1.533	2.145
44	0.292		11.7	230.0	1355.5	0.1314	147.898	19396.	29.26	1.278	2.217
			19.5	328.8	2011.1	0.1314	221.044	15318.	23.11	1.219	2.171
			27.3	461.1	2283.3	0.1502	273.697	12256.	21.14	1.332	2.129
			35.2	610.5	2355.5	0.1633	284.958	10183.	19.09	1.396	1.929
			43.0	763.3	2427.7	0.1730	287.948	8787.	17.45	1.436	2.192
			50.8	917.2	2533.3	0.1775	286.859	7784.	15.86	1.438	2.065
			58.7	1071.6	2600.0	0.1889	288.701	7024.	15.23	1.499	2.050
			66.5	1225.5	2612.2	0.2060	285.653	6429.	15.20	1.606	2.184
45	0.292		11.7	248.8	1616.6	0.1417	193.814	18941.	29.96	1.333	2.223
			19.5	367.7	2220.0	0.1417	262.459	14637.	23.15	1.266	2.024
			27.3	515.0	2455.5	0.1576	305.831	11721.	20.62	1.347	1.894
			35.2	675.0	2533.3	0.1661	308.669	9804.	18.17	1.370	2.030
			43.0	837.7	2627.7	0.1770	316.829	8501.	16.79	1.419	2.136
			50.8	1002.2	2761.1	0.1792	315.192	7553.	15.10	1.403	2.091
			58.7	1167.2	2805.5	0.1952	319.802	6830.	14.88	1.497	2.021
			66.5	1262.8	2162.7	0.2192	317.086	6257.	15.30	1.652	2.313

TAYLOR  
HYDROGEN

TABLE: X

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF		
*****													
1	0.295	11.6	334.4	527.7	0.5138	99.334	0.871	38993.	76.86	1.879	2.267		
		19.4	353.3	605.5	0.4825	121.697		37568.	69.00	1.742	2.023		
		27.1	375.5	686.1	0.4569	141.892		36046.	62.14	1.626	2.132		
		34.9	401.6	783.3	0.4387	167.437		34441.	56.46	1.537	1.912		
		42.6	432.7	908.3	0.4216	200.494		32743.	51.04	1.452	2.225		
		50.4	470.5	1072.2	0.4091	246.141		30938.	46.24	1.383	1.943		
		58.1	518.3	1316.6	0.3937	314.303		28975.	41.10	1.302	2.046		
		65.9	580.5	1711.1	0.3693	417.513		26832.	35.13	1.190	2.131		
		2	0.295	11.6	335.0	511.1	0.5326	93.796	0.864	38667.	79.57	1.959	2.304
				19.4	352.2	558.3	0.5144	106.023		37375.	73.75	1.869	2.098
27.1	371.6			611.1	0.5024	120.296		36039.	68.92	1.803	2.075		
34.9	393.3			677.7	0.4831	137.415		34681.	63.26	1.711	2.026		
42.6	418.8			766.6	0.4615	160.499		33233.	57.39	1.611	1.981		
50.4	448.8			894.4	0.4398	195.955		31711.	51.67	1.511	2.050		
58.1	487.7			1111.1	0.4108	256.065		29975.	45.08	1.385	1.994		
65.9	540.0			1533.3	0.3562	353.825		27978.	35.96	1.174	2.158		
3	0.295			11.6	335.5	538.8	0.5263	107.014	0.887	39633.	78.52	1.895	2.254
				19.4	355.5	633.3	0.4785	132.916		38109.	68.07	1.699	2.188
		27.1	380.0	738.8	0.4495	161.320		36430.	60.55	1.572	2.170		
		34.9	408.8	855.5	0.4330	193.406		34665.	54.92	1.489	1.909		
		42.6	443.8	994.4	0.4216	232.114		32788.	49.99	1.422	1.999		
		50.4	487.2	1183.3	0.4120	286.797		30782.	45.25	1.361	2.188		
		58.1	543.3	1488.8	0.4051	383.044		28590.	40.69	1.306	2.126		
		65.9	616.6	2029.4	0.3505	495.178		26239.	31.73	1.098	2.073		
		4	0.295	11.6	332.2	522.2	0.5013	95.247	0.830	37352.	74.50	1.894	2.351
				19.4	351.1	605.5	0.4598	116.993		35978.	66.09	1.727	2.244
27.1	373.8			686.1	0.4398	137.315		34478.	60.04	1.627	1.946		
34.9	400.0			775.0	0.4285	160.687		32936.	55.34	1.561	2.137		
42.6	430.5			880.5	0.4159	187.155		31333.	50.56	1.490	2.030		
50.4	467.2			1025.0	0.4085	227.852		29645.	46.44	1.436	1.975		
58.1	513.8			1264.4	0.3926	294.668		27792.	41.28	1.351	2.207		
65.9	576.1			1762.7	0.3374	400.381		25721.	32.29	1.131	2.181		
5	0.295			11.6	335.0	525.0	0.5286	100.434	0.871	38949.	78.97	1.933	2.091
				19.4	353.8	600.0	0.4893	120.422		37528.	69.88	1.766	2.023
		27.1	376.1	677.7	0.4683	141.270		36010.	63.62	1.666	1.980		
		34.9	401.6	761.1	0.4398	173.382		34441.	51.34	1.398	1.718		
		42.6	432.2	888.8	0.4330	197.736		32772.	52.47	1.492	1.938		
		50.4	470.0	1063.8	0.4171	247.711		30962.	47.19	1.410	1.974		
		58.1	517.7	1300.0	0.4063	317.816		28996.	42.45	1.344	2.065		
		65.9	583.3	1866.6	0.3488	447.626		26746.	33.05	1.123	2.158		
		6	0.295	11.6	331.1	527.7	0.5235	102.955	0.876	39484.	78.02	1.897	2.062
				19.4	350.5	600.0	0.4956	123.624		37986.	71.33	1.784	2.051
27.1	372.7			677.7	0.4706	143.533		36436.	64.40	1.670	1.991		
34.9	399.4			769.4	0.4558	168.646		34769.	58.93	1.592	1.970		
42.6	430.0			888.8	0.4381	201.039		33075.	53.32	1.504	1.959		

TAYLOR  
HYDROGEN

TABLE: X

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
7	0.295	50.4	468.3	1061.1	0.4233	250.922		31215.	48.03	1.426	1.997
		58.1	517.7	1338.8	0.4091	335.916		29163.	42.75	1.347	2.112
		65.9	586.1	1911.1	0.3533	468.122		26813.	33.34	1.131	2.210
		11.6	336.1	544.4	0.5218	108.708	0.885	39478.	77.74	1.882	2.055
		19.4	356.6	641.6	0.4740	135.090		37921.	67.26	1.686	1.968
		27.1	381.1	744.4	0.5531	200.959		36255.	74.33	1.937	2.370
		34.9	411.1	863.8	0.4324	195.781		34440.	54.60	1.488	1.911
		42.6	447.2	1022.2	0.4216	242.420		32530.	49.68	1.423	1.950
		50.4	493.8	1266.6	0.4108	317.457		30414.	44.62	1.356	2.049
		58.1	557.2	1705.5	0.3824	439.122		28026.	37.62	1.228	2.186
8	0.295	65.9	641.6	2333.3	0.3363	568.907		25470.	29.46	1.046	2.261
		11.6	346.6	811.1	0.4074	189.214	0.775	33869.	59.17	1.622	1.969
		19.4	397.2	1397.2	0.3414	341.399		30884.	44.34	1.316	1.959
		27.1	480.5	2255.5	0.3056	542.439		27144.	33.95	1.128	2.058
		34.9	593.8	2711.1	0.3033	642.153		23515.	28.31	1.067	2.084
		42.6	720.5	2883.3	0.3164	684.302		20628.	25.20	1.065	2.063
		50.4	851.1	2930.5	0.3340	694.534		18426.	23.20	1.079	2.004
		58.1	980.0	2927.7	0.3568	694.967		16747.	22.08	1.112	1.942
		65.9	1105.5	2897.2	0.3841	688.179		15433.	21.53	1.159	1.887
		11.6	332.2	533.3	0.4097	82.395	0.629	28283.	60.88	1.933	2.105
9	0.295	19.4	354.4	630.5	0.3727	102.906		27068.	53.16	1.744	2.029
		27.1	381.1	738.8	0.3505	125.401		25770.	47.10	1.613	1.968
		34.9	413.3	869.4	0.3363	153.390		24391.	42.28	1.519	1.952
		42.6	453.3	1036.1	0.3277	190.976		22911.	38.19	1.449	1.985
		50.4	504.4	1258.3	0.3203	241.470		21310.	34.19	1.383	2.053
		58.1	570.5	1613.8	0.3050	318.216		19604.	29.43	1.280	2.144
		65.9	656.1	2160.5	0.2691	404.845		17833.	23.15	1.094	2.158
		11.6	335.5	566.6	0.4216	97.436	0.678	30290.	62.90	1.882	2.079
		19.4	360.0	688.8	0.3790	124.648		28881.	53.37	1.664	1.982
		27.1	390.5	833.3	0.3545	156.964		27329.	46.69	1.527	1.932
10	0.295	34.9	429.4	1025.0	0.3391	201.952		25627.	41.31	1.429	1.945
		42.6	479.4	1283.3	0.3300	265.283		23783.	36.73	1.357	2.027
		50.4	548.3	1661.1	0.3255	362.209		21715.	32.45	1.298	2.194
		58.1	636.6	2166.6	0.2913	445.689		19625.	25.68	1.123	2.180
		65.9	742.7	2629.4	0.2760	520.720		17678.	21.44	1.026	2.163
		11.6	336.6	594.4	0.3977	102.518	0.658	29322.	59.17	1.818	2.032
		19.4	363.8	763.8	0.3522	140.880		27817.	49.16	1.580	1.940
		27.1	400.0	952.7	0.3306	182.748		26089.	42.70	1.451	1.918
		34.9	447.2	1183.3	0.3238	238.352		24189.	38.16	1.385	1.982
		42.6	510.5	1533.3	0.3209	328.209		22112.	33.92	1.333	2.133
11	0.295	50.4	596.1	2111.1	0.2839	430.108		19908.	26.42	1.138	2.159
		58.1	702.2	2544.4	0.2765	509.374		17816.	22.49	1.067	2.186
		65.9	820.0	2748.3	0.2788	537.619		16039.	19.97	1.037	2.077
		11.6	331.1	547.2	0.3306	71.446	0.490	22098.	49.27	1.906	2.091
		19.4	356.1	647.2	0.3147	91.612		21034.	44.71	1.796	2.103

TABLE: X

TAYLOR  
HYDROGEN

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		27.1	387.7	772.2	0.3084	118.562		19854.	40.86	1.725	2.126
		34.9	428.3	961.1	0.2919	155.517		18560.	35.64	1.596	2.111
		42.6	485.0	1333.3	0.2629	223.026		17061.	28.98	1.397	2.121
		50.4	563.3	1777.7	0.2441	296.445		15415.	23.80	1.254	2.183
		58.1	664.4	2272.2	0.2304	370.431		13783.	19.61	1.140	2.222
		65.9	781.6	2516.1	0.2327	403.605		12346.	17.34	1.108	2.141
18	0.295	11.6	335.5	658.3	0.3118	100.642	0.486	21733.	46.52	1.816	2.091
		19.4	375.0	950.0	0.2748	158.010		20157.	37.42	1.559	2.044
		27.1	434.4	1377.7	0.2532	238.852		18244.	30.55	1.388	2.079
		34.9	520.0	1911.1	0.2350	326.910		16151.	24.47	1.237	2.115
		42.6	630.5	2355.5	0.2299	396.577		14173.	20.43	1.158	2.138
		50.4	756.6	2586.1	0.2367	433.029		12526.	18.11	1.143	2.109
		58.1	888.8	2688.8	0.2481	446.579		11230.	16.63	1.151	2.030
		65.9	1019.4	2701.1	0.2634	442.950		10234.	15.78	1.179	1.937

TAYLOR  
HYDROGEN

TABLE: X

RUN	D (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF		
*****													
19	0.295	11.6	353.9	1116.7	0.2555	194.890		20581.	36.49	1.491	1.988		
		19.4	431.1	1794.4	0.2253	307.159		18004.	27.36	1.256	2.005		
		27.2	541.1	2344.4	0.2225	401.241		15434.	22.42	1.178	2.059		
		34.9	672.2	2627.8	0.2265	442.933		13324.	19.10	1.142	2.024		
		42.7	811.7	2727.8	0.2395	458.908		11726.	17.30	1.154	1.983		
		50.4	952.2	2766.7	0.2572	466.675		10523.	16.30	1.190	1.953		
		58.2	1091.1	2805.6	0.2731	468.215		9595.	15.48	1.218	1.903		
		65.9	1226.7	2816.7	0.2930	465.870		8863.	15.08	1.264	1.868		
		20	0.295	11.6	372.2	1583.3	0.2407	291.514		19626.	32.98	1.403	2.068
20	0.295	19.4	483.3	2327.8	0.2293	422.931		16442.	25.35	1.259	2.143		
		27.2	626.1	2677.8	0.2384	489.117		13797.	21.31	1.234	2.143		
		34.9	782.2	2791.7	0.2509	504.169		11865.	18.68	1.233	2.071		
		42.7	938.3	2838.9	0.2669	507.258		10488.	17.12	1.253	2.014		
		50.4	1091.7	2850.0	0.2902	510.268		9466.	16.44	1.308	1.999		
		58.2	1242.2	2888.9	0.3124	514.418		8672.	15.91	1.357	1.980		
		65.9	1389.4	2936.1	0.3295	509.627		8038.	15.31	1.384	1.933		
		21	0.295	11.6	398.9	1972.2	0.2430	382.320		18429.	31.46	1.412	2.195
		21	0.295	19.4	540.0	2634.4	0.2401	502.876		15009.	24.24	1.303	2.229
27.2	708.3			2861.1	0.2549	548.743		12488.	20.59	1.299	2.189		
34.9	883.9			2916.7	0.2737	556.371		10748.	18.44	1.322	2.124		
42.7	1056.7			2944.4	0.2976	561.802		9523.	17.31	1.371	2.097		
50.4	1225.6			2966.7	0.3243	564.642		8612.	16.70	1.433	2.088		
58.2	1392.2			3008.3	0.3522	569.194		7900.	16.34	1.498	2.085		
65.9	1557.2			3088.9	0.3716	569.167		7322.	15.72	1.525	2.046		
22	0.295			11.6	342.2	977.8	0.3693	234.711		34224.	54.22	1.473	1.903
22	0.295			19.4	403.3	1661.1	0.3266	410.790		30617.	41.90	1.254	1.992
		27.2	497.8	2427.8	0.3004	579.772		26549.	32.42	1.099	2.047		
		34.9	617.8	2851.7	0.3027	676.198		22934.	27.36	1.055	2.074		
		42.7	750.0	2995.0	0.3152	707.624		20109.	24.30	1.049	2.030		
		50.4	883.9	2961.1	0.3420	710.410		17991.	23.04	1.094	1.988		
		58.2	1015.0	2972.2	0.3636	711.646		16381.	21.86	1.122	1.928		
		65.9	1143.3	2994.4	0.3841	711.012		15111.	20.95	1.147	1.867		
		23	0.295	11.6	398.9	1972.2	0.2430	382.320		29143.	31.46	0.979	2.122
		23	0.295	19.4	540.0	2634.4	0.2401	502.876		23735.	24.24	0.903	2.145
27.2	708.3			2861.1	0.2549	548.743		19748.	20.59	0.900	2.087		
34.9	883.9			2916.7	0.2737	556.371		16997.	18.44	0.916	1.992		
42.7	1056.7			2944.4	0.2976	561.802		15060.	17.31	0.950	1.984		
50.4	1225.6			2966.7	0.3243	564.642		13620.	16.70	0.993	2.017		
58.2	1392.2			3008.3	0.3522	569.194		12492.	16.34	1.038	2.025		
65.9	1557.2			3088.9	0.3716	569.167		11579.	15.72	1.057	1.998		



TAYLOR  
HYDROGEN

TABLE: X

RUN	DI (CM)	L/D	TB (K)	TW (K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
46	0.292	11.7	148.3	288.8	0.3067	43.091	0.619	48620.	92.24	1.636	2.221
		19.5	162.2	394.4	0.2657	61.701		45691.	73.44	1.568	2.028
		27.3	182.2	522.2	0.2646	89.963		42229.	65.53	1.491	1.975
		35.2	210.0	688.8	0.2623	125.612		38358.	56.82	1.400	2.247
		43.0	247.7	922.2	0.2703	182.302		34290.	51.06	1.375	2.040
		50.8	302.2	1272.2	0.2799	271.502		29971.	44.64	1.347	2.152
		58.7	378.8	1816.6	0.2595	373.103		25713.	34.69	1.190	2.193
		66.5	474.4	2162.7	0.2652	447.745		22078.	29.48	1.155	2.159
47	0.292	11.7	159.4	629.4	0.2697	126.758	0.586	43778.	75.77	1.674	2.411
		19.5	215.5	1372.2	0.2395	277.021		35687.	50.62	1.322	2.170
		27.3	303.8	2091.1	0.2248	401.767		28276.	35.69	1.129	2.157
		35.2	412.2	2266.6	0.2504	464.352		22998.	31.24	1.176	2.041
		43.0	528.3	2261.1	0.2726	472.355		19438.	27.74	1.210	2.042
		50.8	649.4	2288.8	0.3044	499.046		16900.	26.15	1.289	1.995
		58.7	774.4	2375.0	0.3169	507.216		15000.	23.56	1.288	2.012
		66.5	898.8	2455.5	0.3283	511.053		13559.	21.59	1.286	2.168
48	0.292	11.7	216.6	1466.6	0.2464	307.999	0.626	38009.	51.82	1.287	2.256
		19.5	312.7	2205.0	0.2543	481.191		29637.	39.39	1.201	2.156
		27.3	433.8	2383.3	0.2834	552.472		23741.	33.90	1.247	2.170
		35.2	563.8	2383.3	0.3107	565.301		19878.	29.97	1.289	2.205
		43.0	696.1	2450.0	0.3249	569.838		17233.	26.36	1.284	2.083
		50.8	829.4	2566.6	0.3357	583.185		15303.	23.59	1.272	2.058
		58.7	963.3	2655.5	0.3539	598.877		13827.	21.99	1.291	2.126
		66.5	1096.6	2694.4	0.3784	604.598		12664.	21.14	1.333	2.071
49	0.292	11.7	265.5	2111.1	0.2771	511.403	0.647	34245.	49.35	1.332	2.486
		19.5	401.1	2565.5	0.3061	662.536		25895.	39.05	1.335	2.202
		27.3	552.2	2572.2	0.3380	682.759		20850.	33.17	1.372	2.167
		35.2	706.6	2605.5	0.3607	684.929		17641.	28.91	1.383	2.124
		43.0	862.2	2716.6	0.3801	704.874		15416.	25.87	1.388	2.105
		50.8	1018.3	2822.2	0.4029	726.786		13772.	23.92	1.410	2.045
		58.7	1175.0	2894.4	0.4319	742.627		12499.	22.80	1.452	2.016
		66.5	1330.0	2927.7	0.4689	749.198		11492.	22.36	1.520	2.015
50	0.292	11.7	156.6	331.1	0.2726	47.553	0.504	38110.	77.87	1.922	2.267
		19.5	176.1	472.2	0.2447	72.458		35205.	62.59	1.647	2.207
		27.3	207.7	741.6	0.2378	126.958		31473.	52.03	1.501	2.153
		35.2	258.3	1188.8	0.2248	209.188		27154.	40.98	1.331	2.072
		43.0	335.5	1815.0	0.2122	313.938		22743.	31.34	1.180	1.915
		50.8	436.1	2185.0	0.2191	383.181		19042.	26.10	1.146	1.932
		58.7	549.4	2227.7	0.2390	401.121		16282.	23.55	1.186	2.003
		66.5	662.7	2150.0	0.2578	383.405		14339.	21.78	1.226	2.022
51	0.292	11.7	202.7	990.0	0.2333	183.658	0.490	31114.	52.24	1.520	2.358
		19.5	278.8	1807.2	0.1980	302.609		25070.	33.82	1.174	2.201
		27.3	383.3	2195.0	0.2139	387.515		20208.	28.32	1.178	2.140
		35.2	501.1	2269.4	0.2322	410.606		16853.	24.68	1.204	1.980
		43.0	627.2	2283.3	0.2640	437.213		14474.	23.33	1.300	2.036

TABLE: X

TAYLOR  
HYDROGEN

RUN	DI (CM)	L/D	TB ( K)	TW ( K)	H (W/CM2K)	Q (W/CM2)	M (G/S)	RE	NU	NUR	NUF
*****											
		50.8	757.7	2316.6	0.2828	440.853		12734.	21.40	1.333	2.002
		58.7	887.7	2405.5	0.2930	444.708		11438.	19.47	1.328	2.159
		66.5	1015.5	2483.3	0.3056	448.552		10442.	18.18	1.337	2.071
52	0.292	11.7	242.7	1602.2	0.2009	273.112	0.487	27400.	38.62	1.244	2.157
		19.5	349.4	2222.2	0.2236	418.752		21407.	31.95	1.264	1.886
		27.3	482.2	2395.0	0.2469	472.264		17209.	27.08	1.296	2.044
		35.2	624.4	2402.7	0.2714	482.639		14444.	24.07	1.344	2.066
		43.0	768.8	2455.5	0.2873	484.579		12544.	21.48	1.355	2.219
		50.8	912.7	2550.0	0.3016	493.786		11167.	19.59	1.363	2.182
		58.7	1055.5	2625.0	0.3203	502.692		10120.	18.46	1.393	2.130
		66.5	1197.2	2672.2	0.3435	506.957		9292.	17.87	1.443	2.093

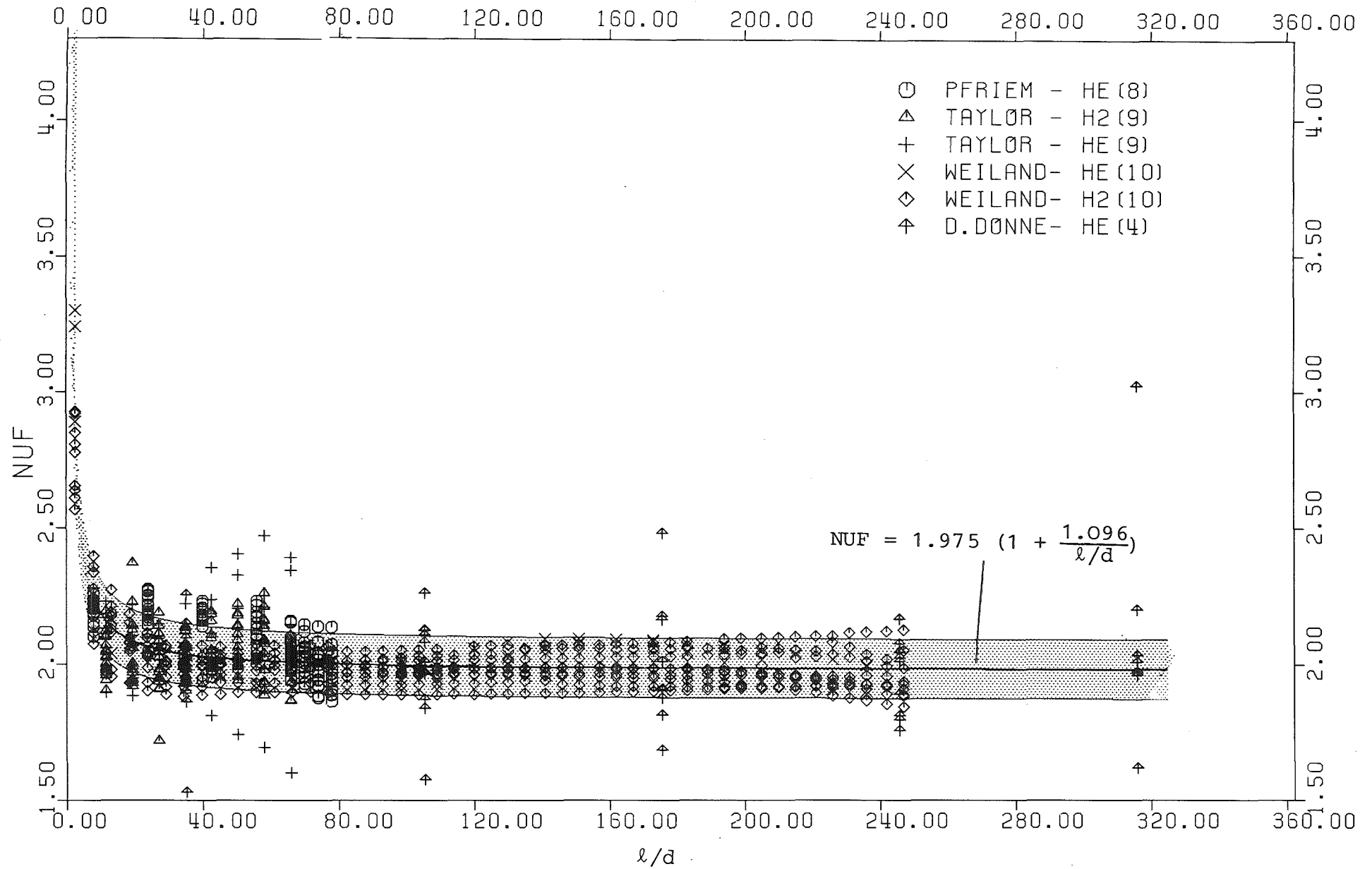


Fig. 1 Nusselt number corrected for  $l/d$  and  $T_W/T_B$  (NUF) versus  $l/d$ . Non-precooled tests (850 data points,  $\sigma = 5.5\%$ ).

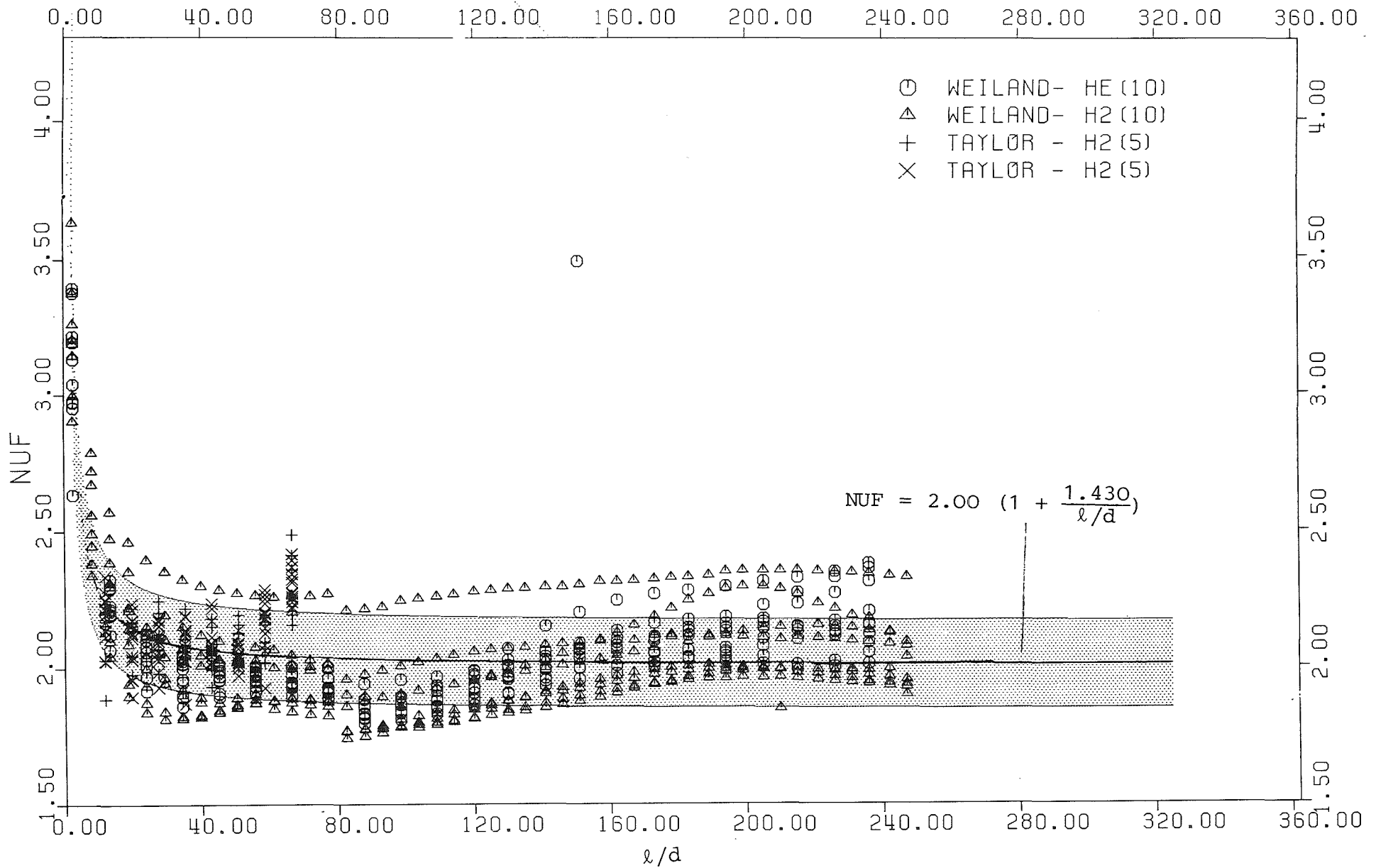


Fig. 2 Nusselt number corrected for  $l/d$  and  $T_W/T_B$  (NUF) versus  $l/d$ . Precooled tests (774 data points,  $\sigma = 8.0\%$ ).

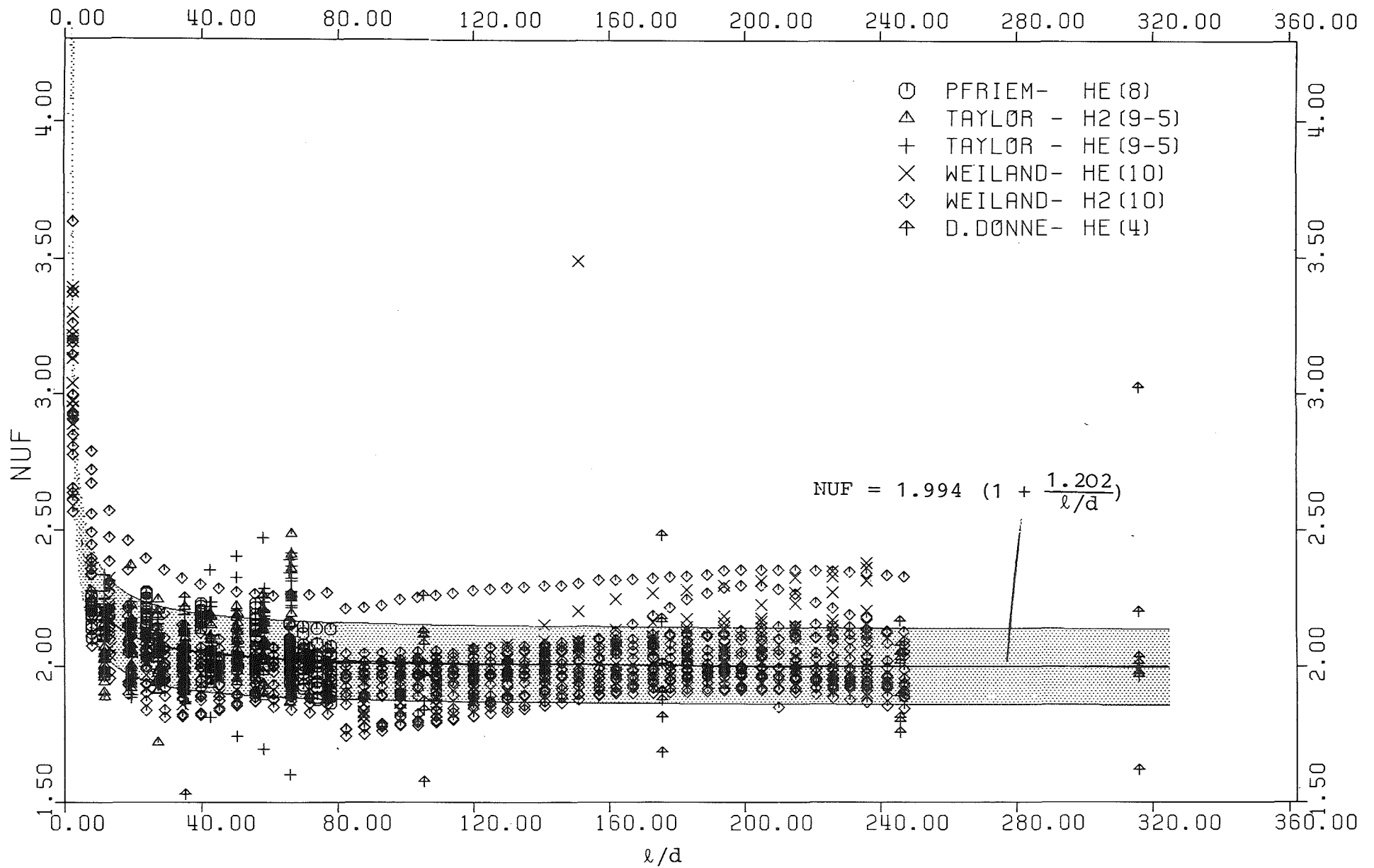


Fig. 3 Nusselt number corrected for  $l/d$  and  $T_W/B$  (NUF) versus  $l/d$ . All tests (1624 data points,  $\sigma = 7.0\%$ ).

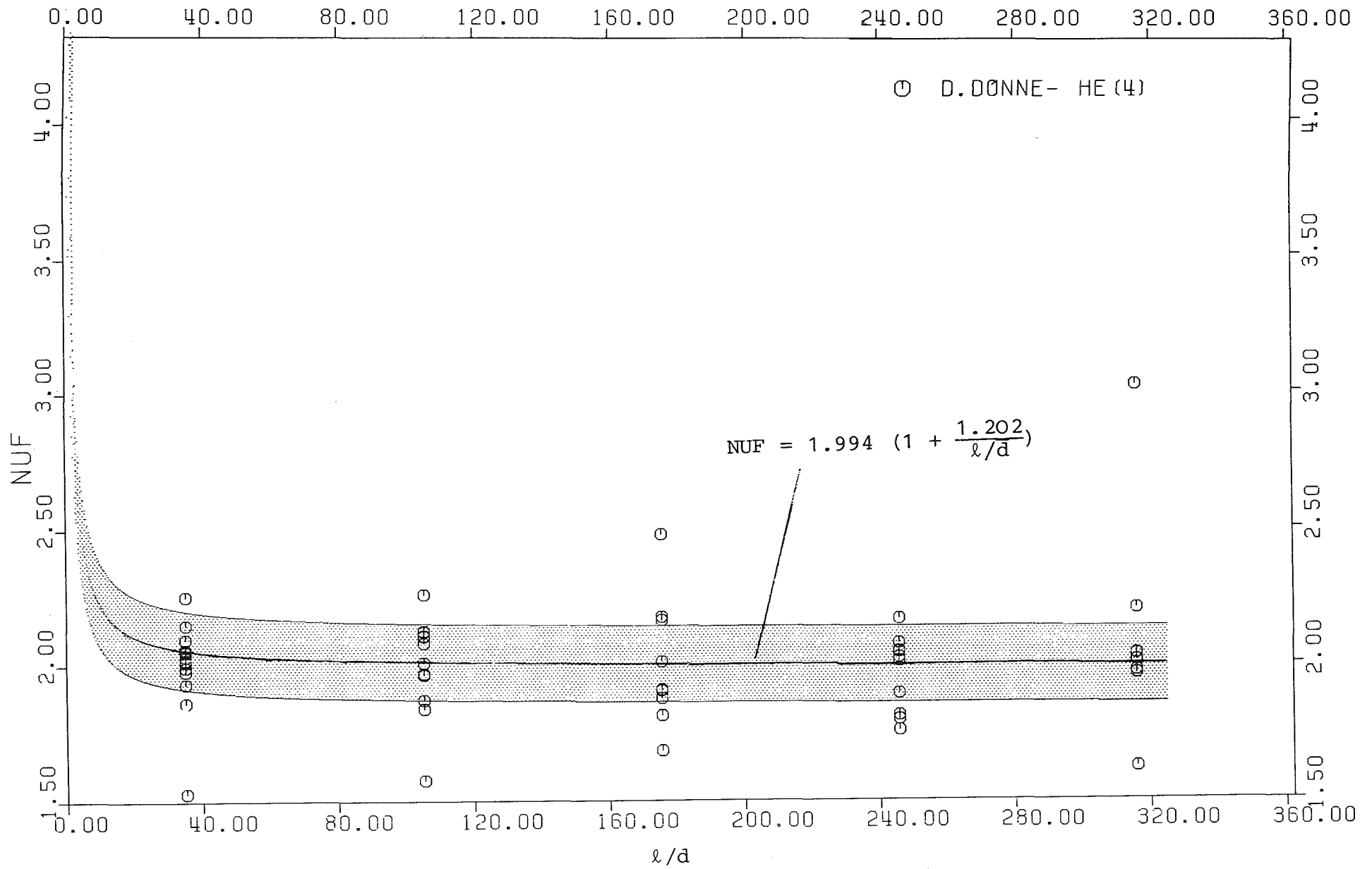


Fig. 4 Comparison of general correlation with Dalle Donne-Bowditch data /4/.

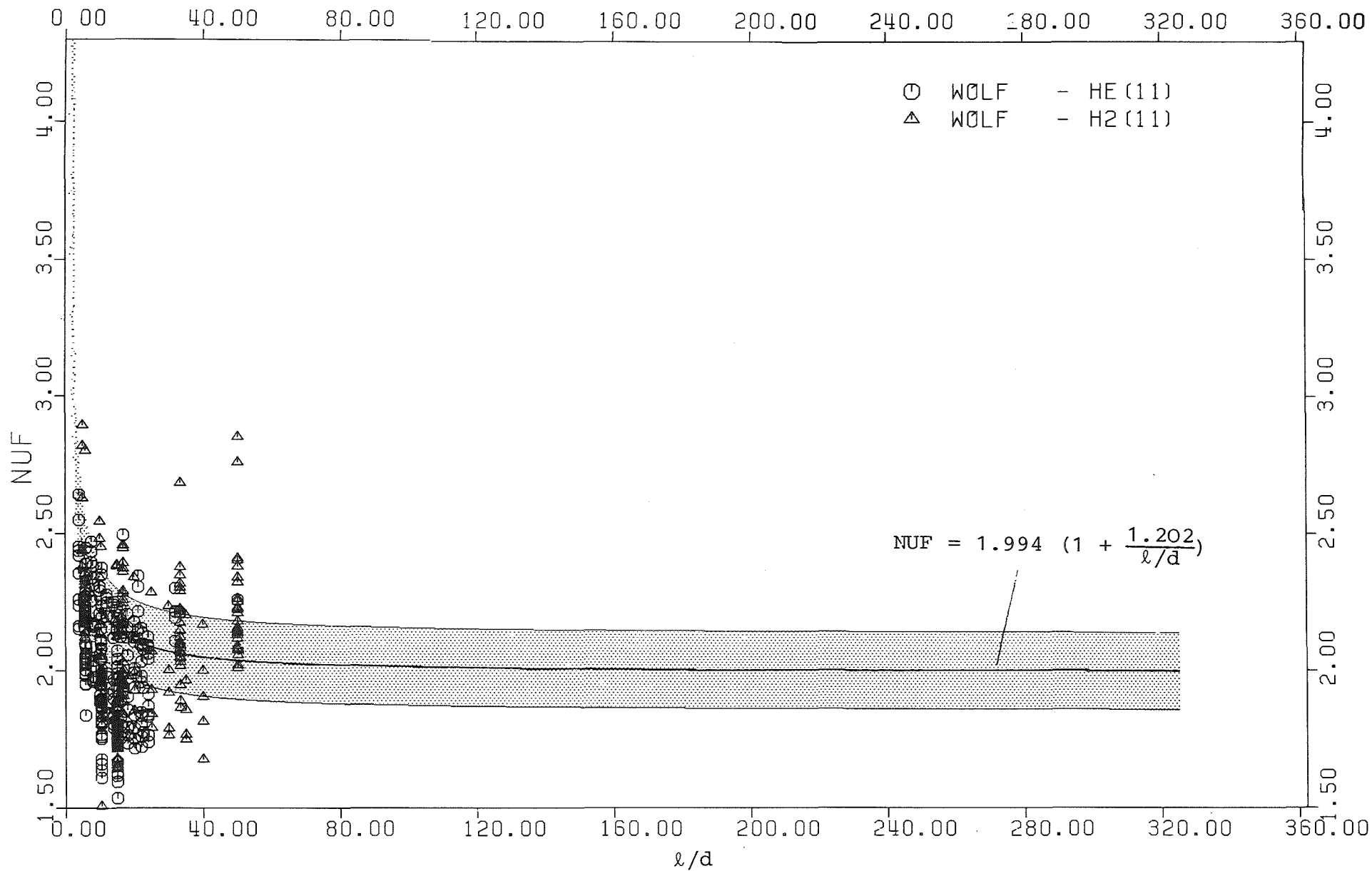


Fig. 5 Comparison of general correlation with Wolf-McCarthy data /11/.

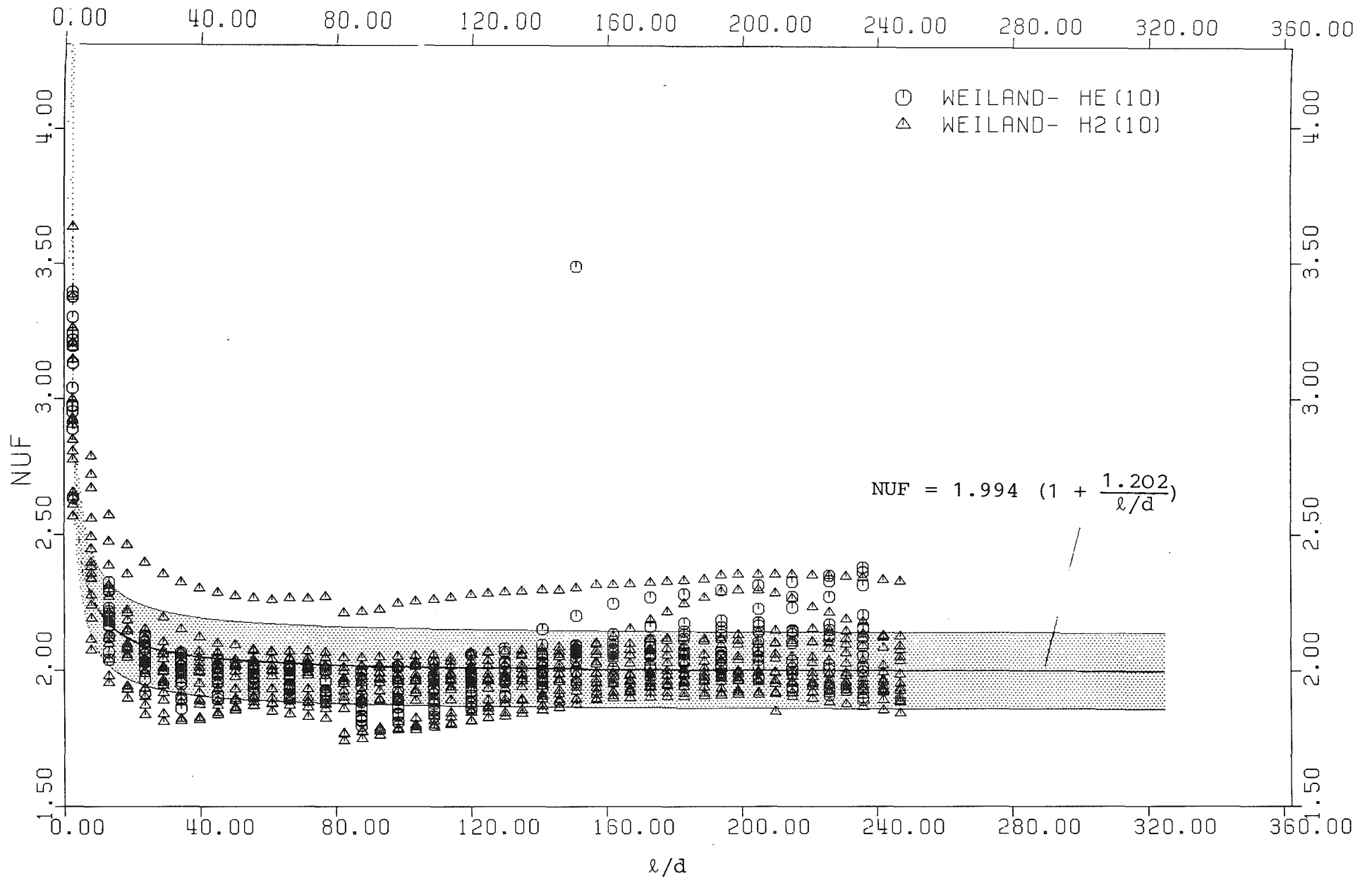


Fig. 6 Comparison of general correlation with Weiland data /10/.



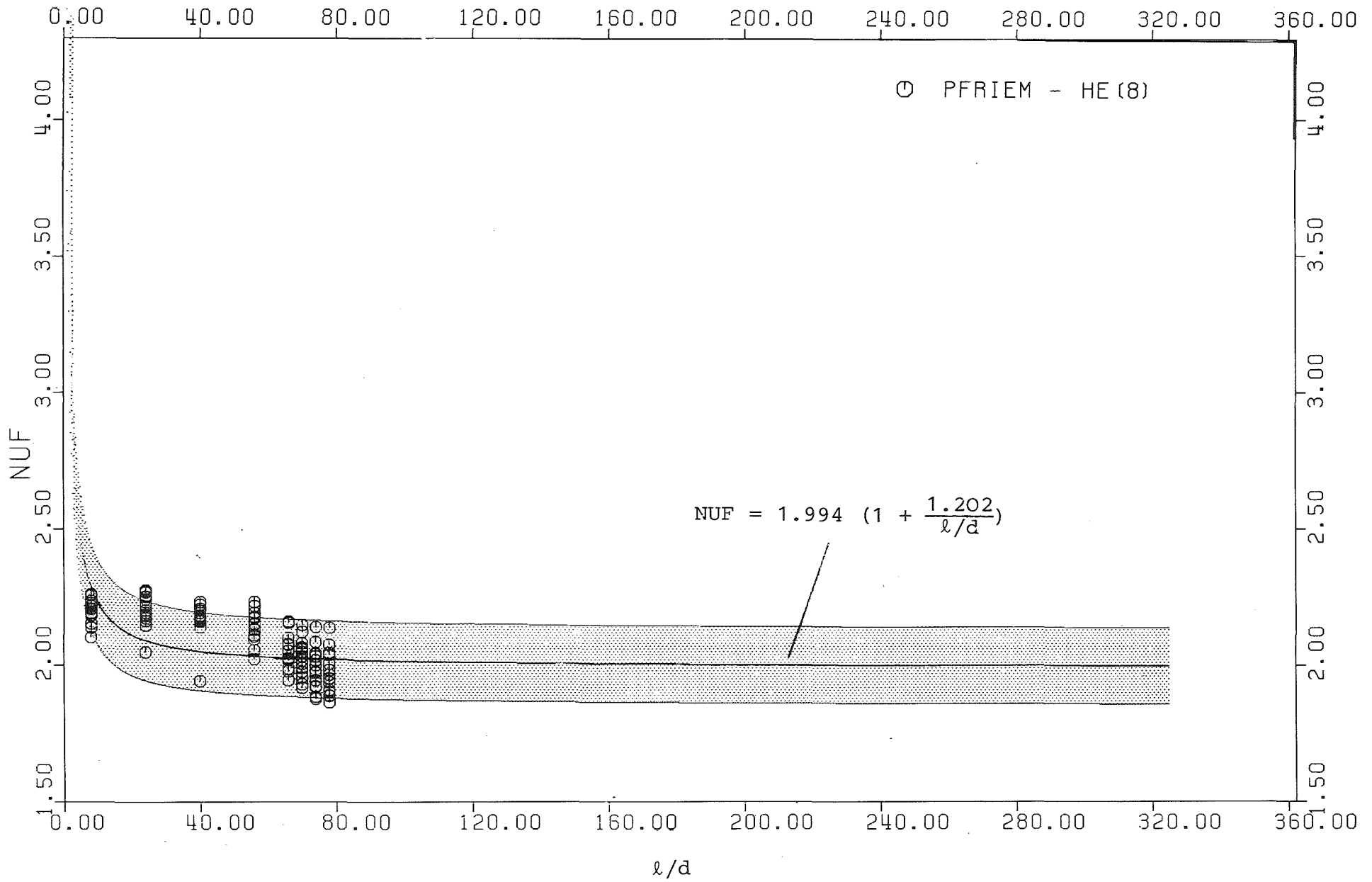


Fig. 7 Comparison of general correlation with Pfriedman data /8/.

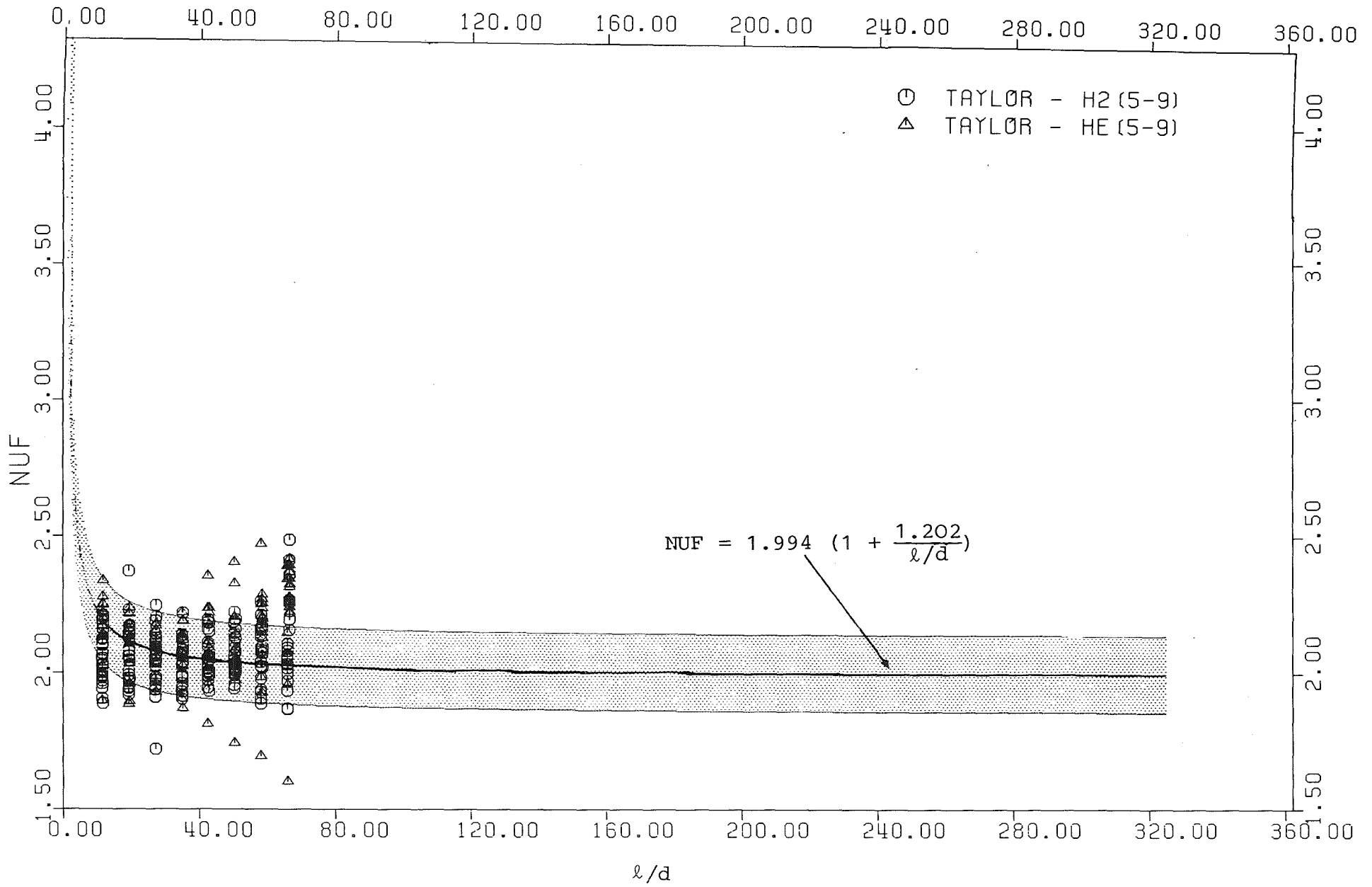


Fig. 8 Comparison of general correlation with Taylor data /5, 9/.

References

- /1/ M. F. Taylor and T. A. Kirchgessner  
Measurements of heat transfer and friction coefficients for helium flowing in a tube at surface temperatures up to 5900 R  
ARS Journal, 30 (September 1960), 830-890
- /2/ M. Dalle Donne and F. H. Bowditch  
Local heat transfer and average friction coefficients for subsonic laminar, transitional and turbulent flow of air in a tube at high temperature  
OECD Dragon Project Report 88, Winfrith, England, March 1962, see also Nuclear Engineering, 8 (January 1963), 20-29
- /3/ V. I. Lel'chuk and B. V. Dyadyakin  
Heat transfer from a wall to a turbulent current of air within a tube and the hydraulic resistance at high temperature differentials  
Problems of Heat Transfer, AEC-tr-4511, 1962
- /4/ M. Dalle Donne and F. M. Bowditch  
Experimental local heat transfer and friction coefficients for subsonic laminar, transitional and turbulent flow of air or helium in a tube at high temperatures  
OECD Dragon Project, Report 184, Winfrith, England, April 1963
- /5/ M. F. Taylor  
Experimental local heat transfer data for precooled hydrogen and helium at surface temperatures up to 5300 °R, NASA Technical Note, NASA TN D-2595, 1965
- /6/ D. M. McEligot, D. M. Magee and G. Leppert  
Effect of large temperature gradients on convective heat transfer: The downstream region  
Journal of Heat Transfer 87, Series C, No. 1, 67, 1965

- /7/ B. S. Petukhov, V. A. Kurganov and A. I. Gladuntsov  
Heat transfer in turbulent pipe flow of gases with variable properties  
Heat Transfer-Soviet Research, Vol. 5, No. 4, July - August 1973, 109 - 116
- /8/ H. J. Pfriem  
Der turbulente Wärmeübergang an Helium und Wasserstoff in beheizten Rohren bei großen axial steigenden Temperaturdifferenzen und das sich daraus ergebende Temperaturprofil  
KfK 1860, September 1973, see also:  
H. J. Pfriem  
Turbulent heat transfer to helium and hydrogen in heated tubes with large axially increasing temperature differences  
Proc. Int. Meet Reactor Heat Transfer, ed. M. Dalle Donne, Kernforschungszentrum Karlsruhe, 9 - 11 Oct. 1973, p. 301
- /9/ M. F. Taylor  
Experimental local heat transfer and average friction data for hydrogen and helium flowing in a tube at surface temperature up to 5600 °R  
NASA TN D-2280, 1964
- /10/ W. F. Weiland  
Measurement of local heat transfer coefficients for flow of hydrogen and helium in a smooth tube at high surface to fluid bulk temperature ratios  
Chem. Ing. Progress Symposium Series, Vol. 61, 60, 1965 (AIChE Symposium 1962, Preprint 126)
- /11/ H. Wolf and J. R. McCarthy  
Heat transfer to hydrogen and helium with wall to fluid temperature ratios to 11.09  
AIChE Annual Meeting, Dec. 1960, see also:  
J. R. McCarthy and H. Wolf  
The heat transfer characteristics of gaseous hydrogen and helium  
Rocketdyne, RR 60-12, Dec. 1960

/12/ V. A. Kurganov and B. S. Petukhov

Calculation of heat transfer in a tube with uneven heating and turbulent flow of a gas with variable physical properties

Teglofizika Vysokikh Temperatur, Vol. 12, No. 5, 1038 - 1044, September - October 1974

/13/ B. S. Petukhov, V. S. Grigor'yev, A. F. Polyakov and S. V. Rosnovskiy

An experimental study of heat transfer in pipes with variable density of the heat flux through the wall

Heat Transfer - Soviet Research, Vol. 9, No. 4, July - August 1977, 114 - 122