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RESEARCH MEMORANDUM

IDEAL TEMPERATURE RISE DUE TO CONSTANT-
PRESSURE COMBUSTION OF A JP-4 FUEL

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NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS

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Pages 43 to 52: Figures 2 and 3 have been revised and should be replaced with the attached figures.

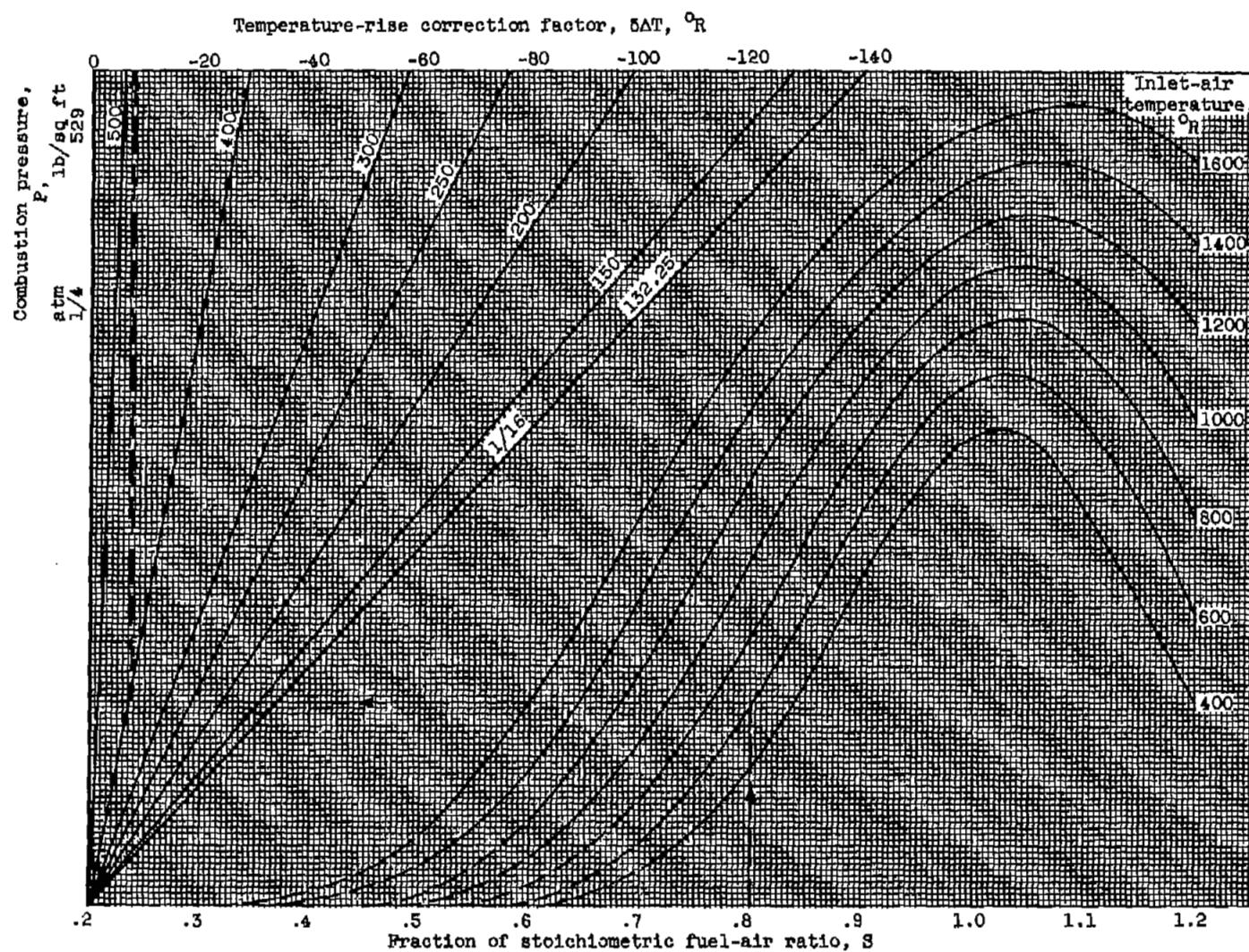
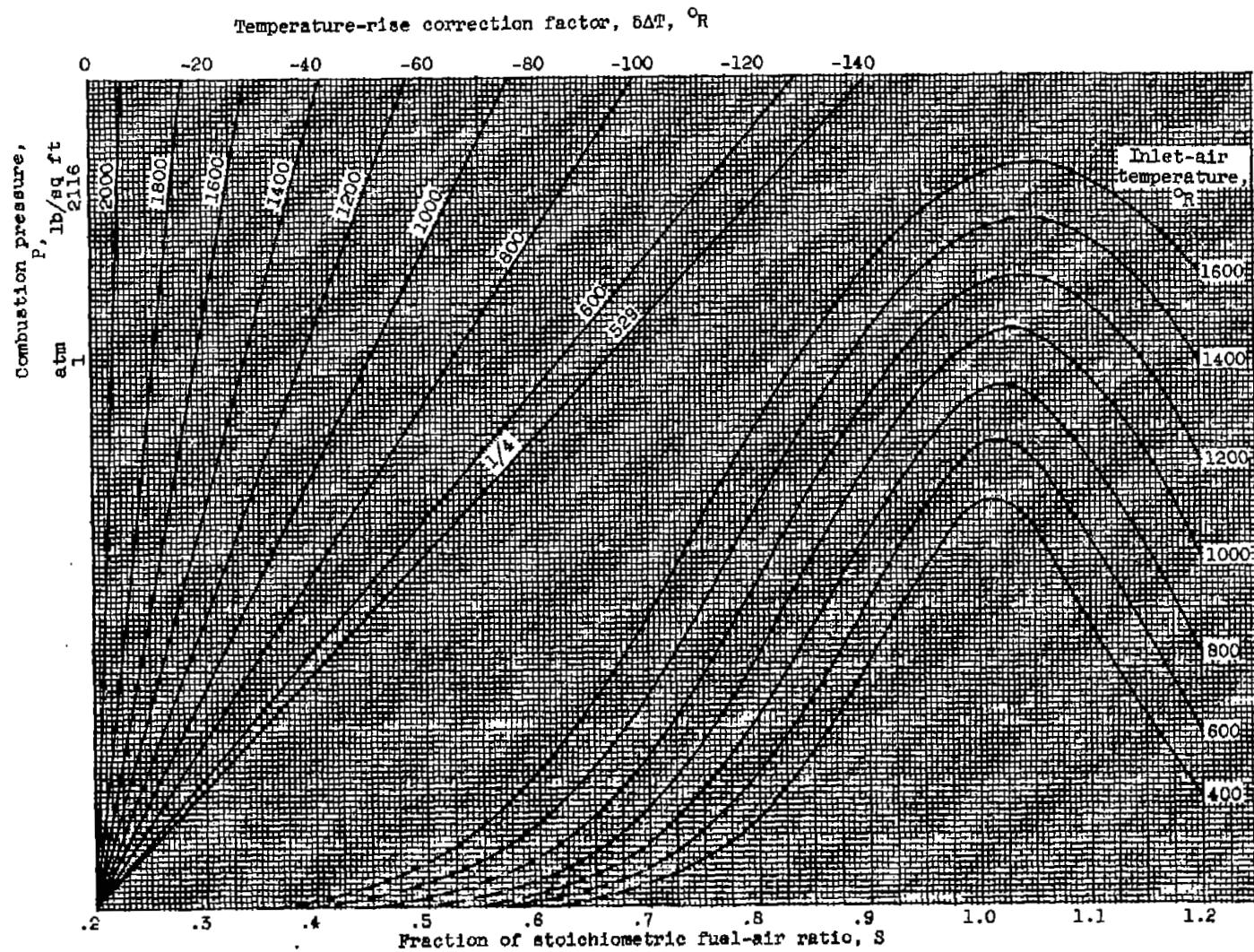


Figure 2. - Temperature-rise correction factors as function of fuel-air ratio.



(b) Combustion pressures from 1 to 1/4 atmosphere.

Figure 2. - Continued. Temperature-rise correction factors as function of fuel-air ratio.

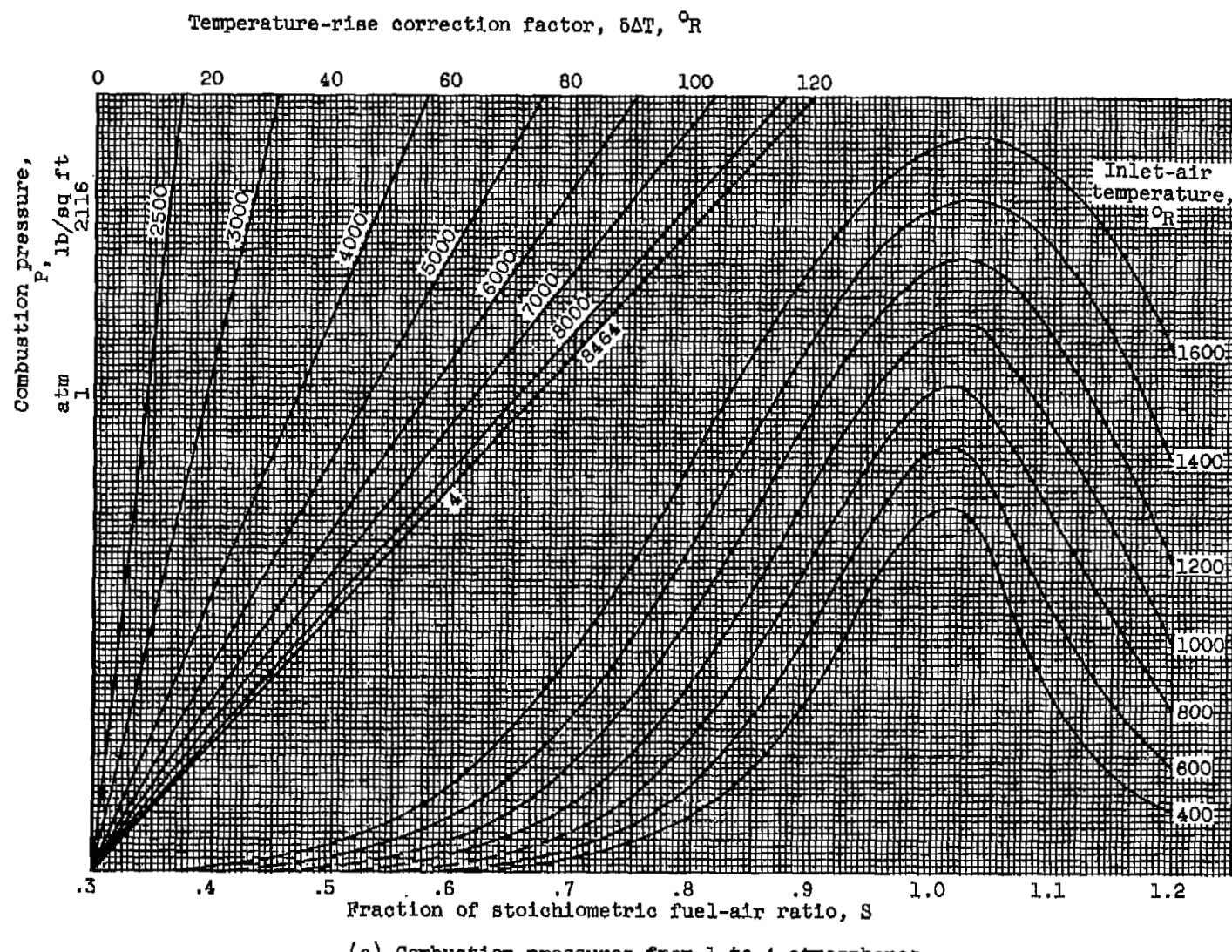
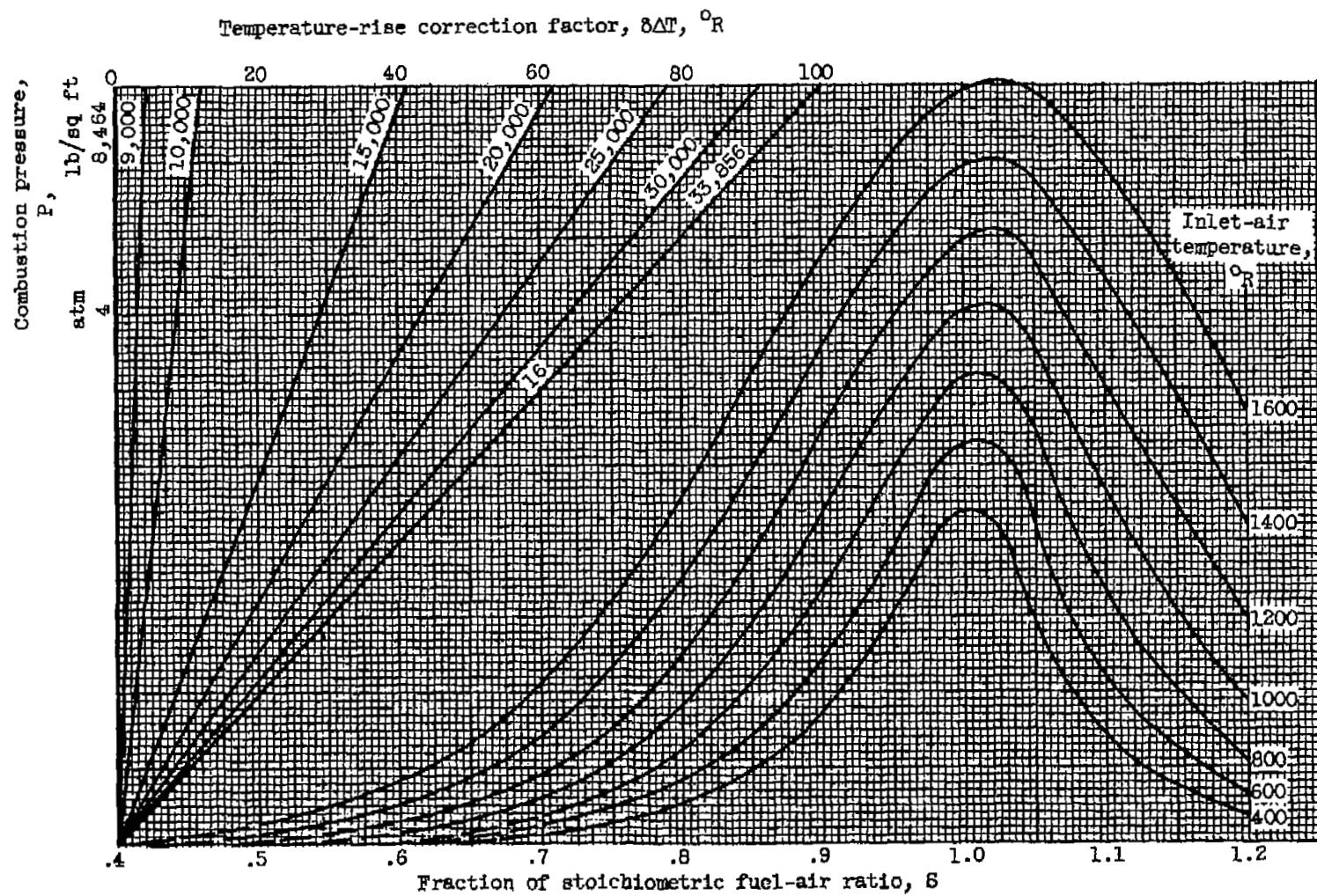
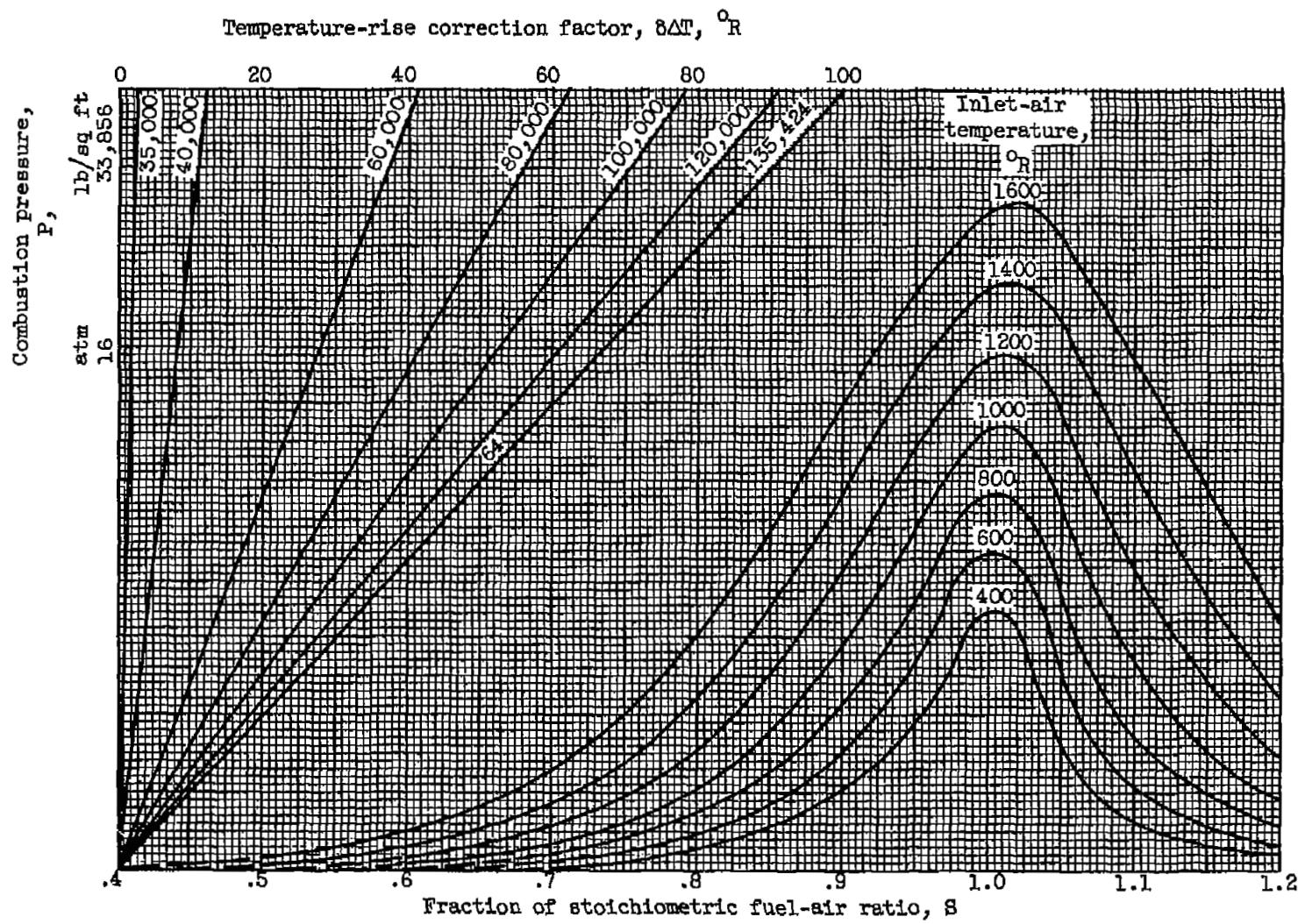


Figure 2. - Continued. Temperature-rise correction factors as function of fuel-air ratio.



(d) Combustion pressures from 4 to 16 atmospheres.

Figure 2. - Continued. Temperature-rise correction factors as function of fuel-air ratio.



(e) Combustion pressures from 16 to 64 atmospheres.

Figure 2. - Concluded. Temperature-rise correction factors as function of fuel-air ratio.

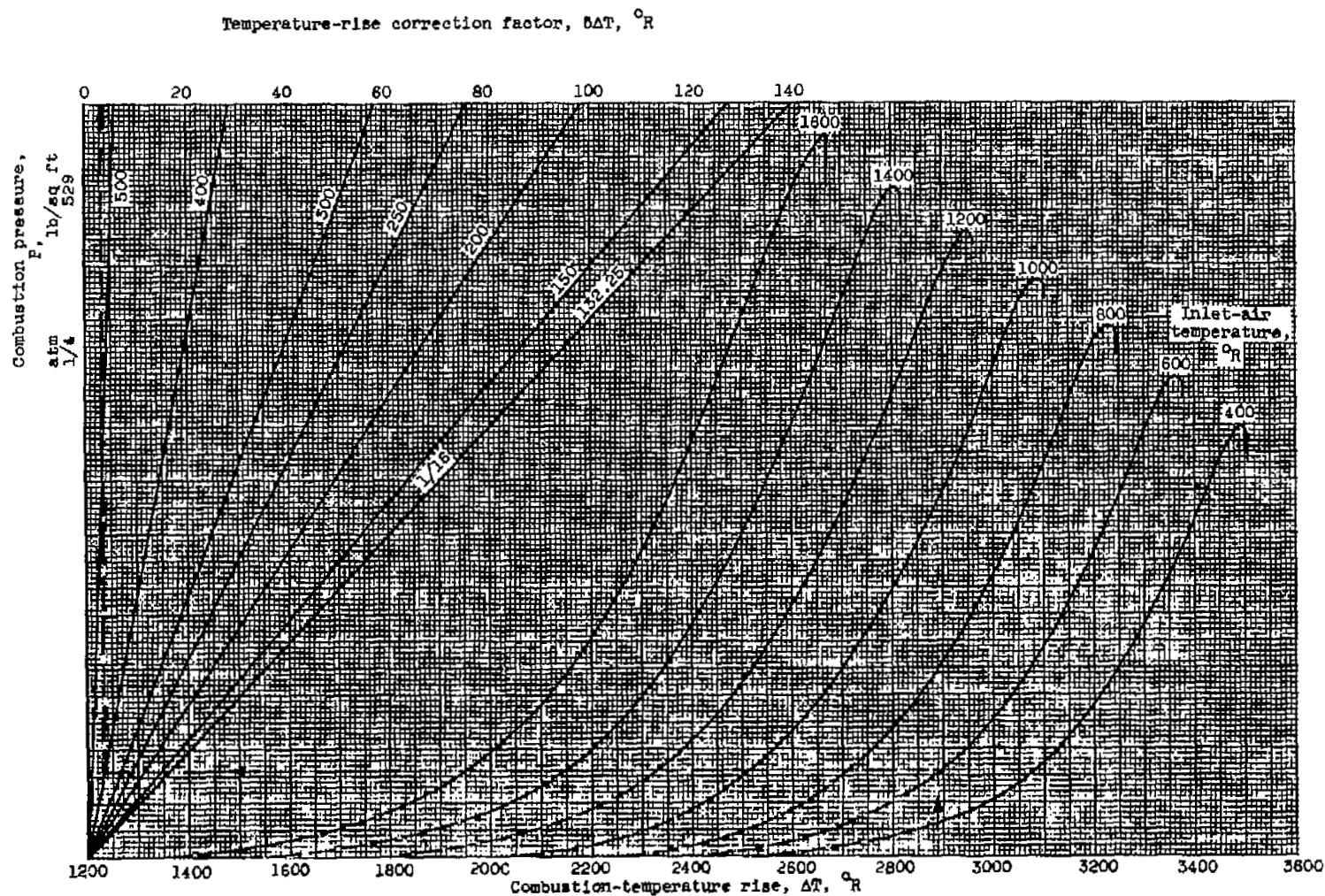
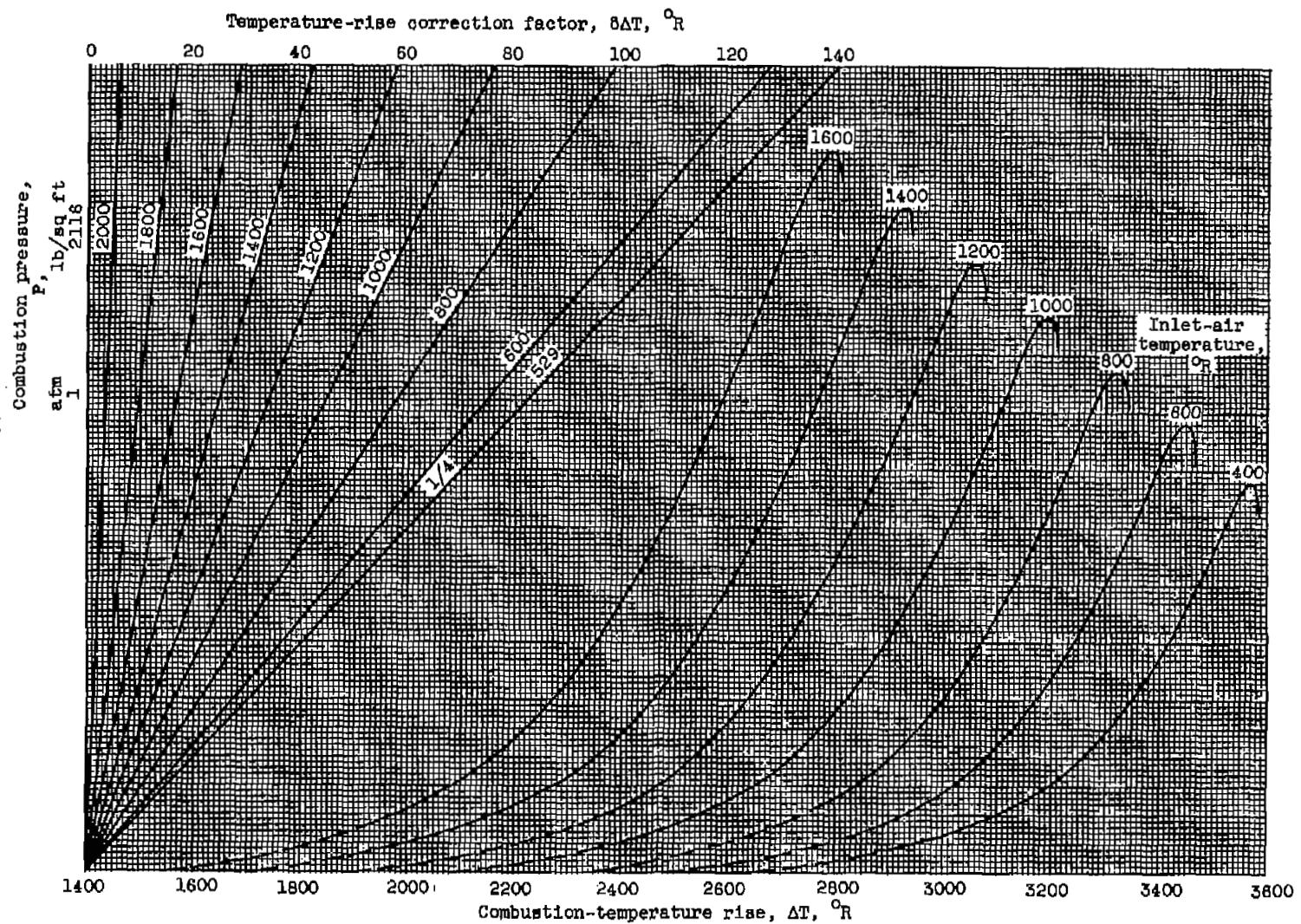
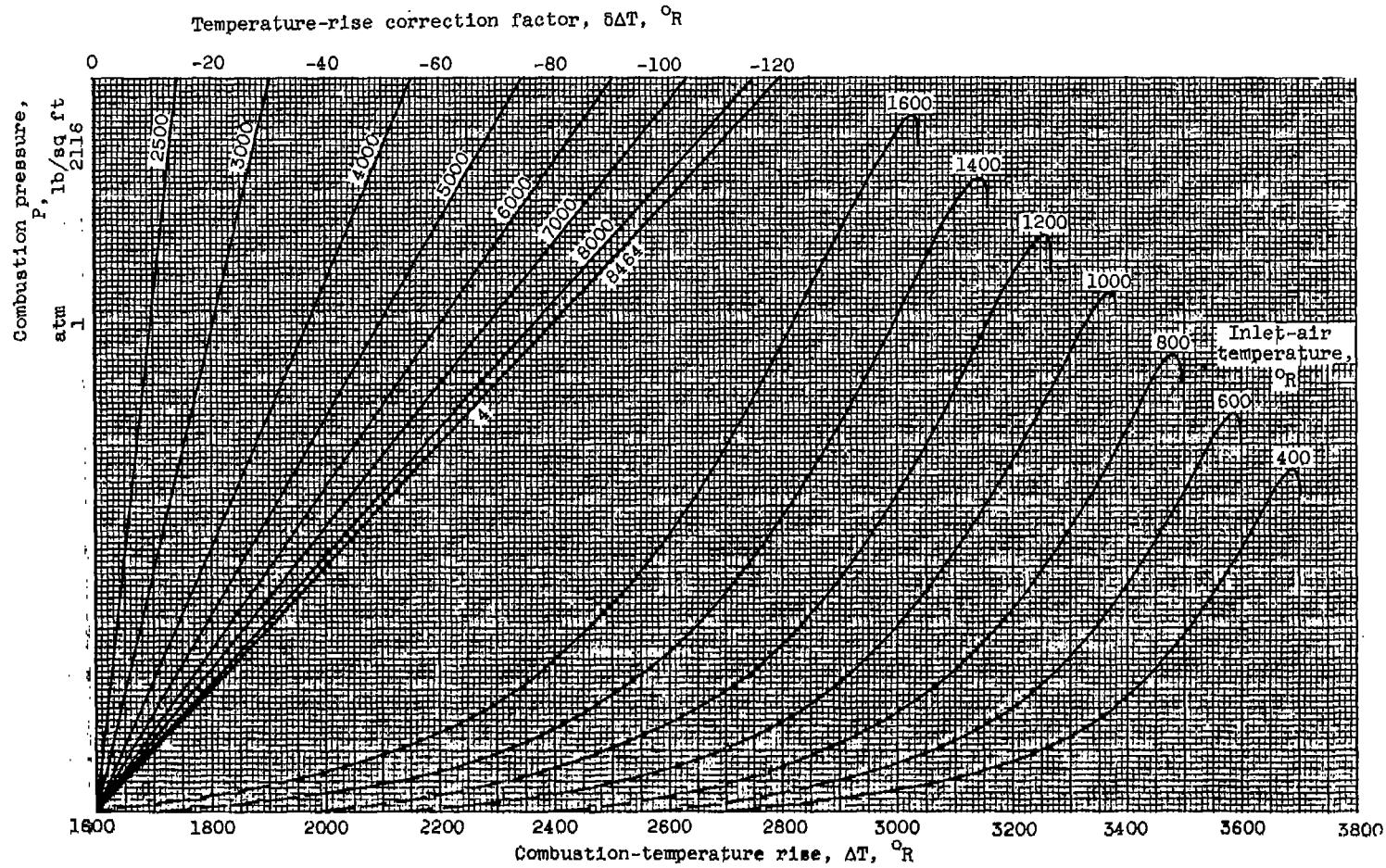
(a) Combustion pressures from $1/4$ to $1/16$ atmosphere.

Figure 3. - Temperature-rise correction factors as function of combustion-temperature rise.



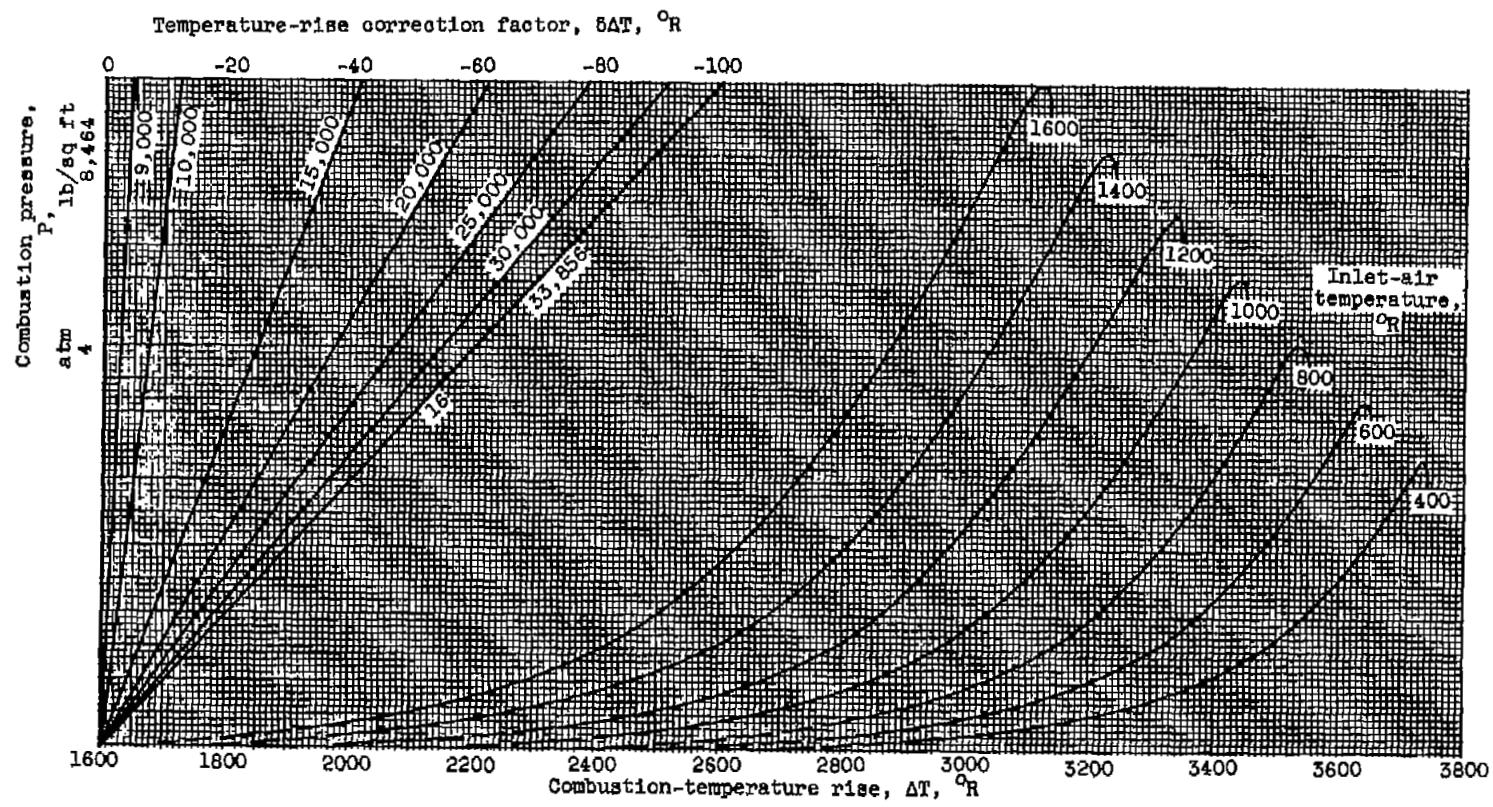
(b) Combustion pressures from 1 to 1/4 atmosphere.

Figure 3. - Continued. Temperature-rise correction factors as function of combustion-temperature rise.



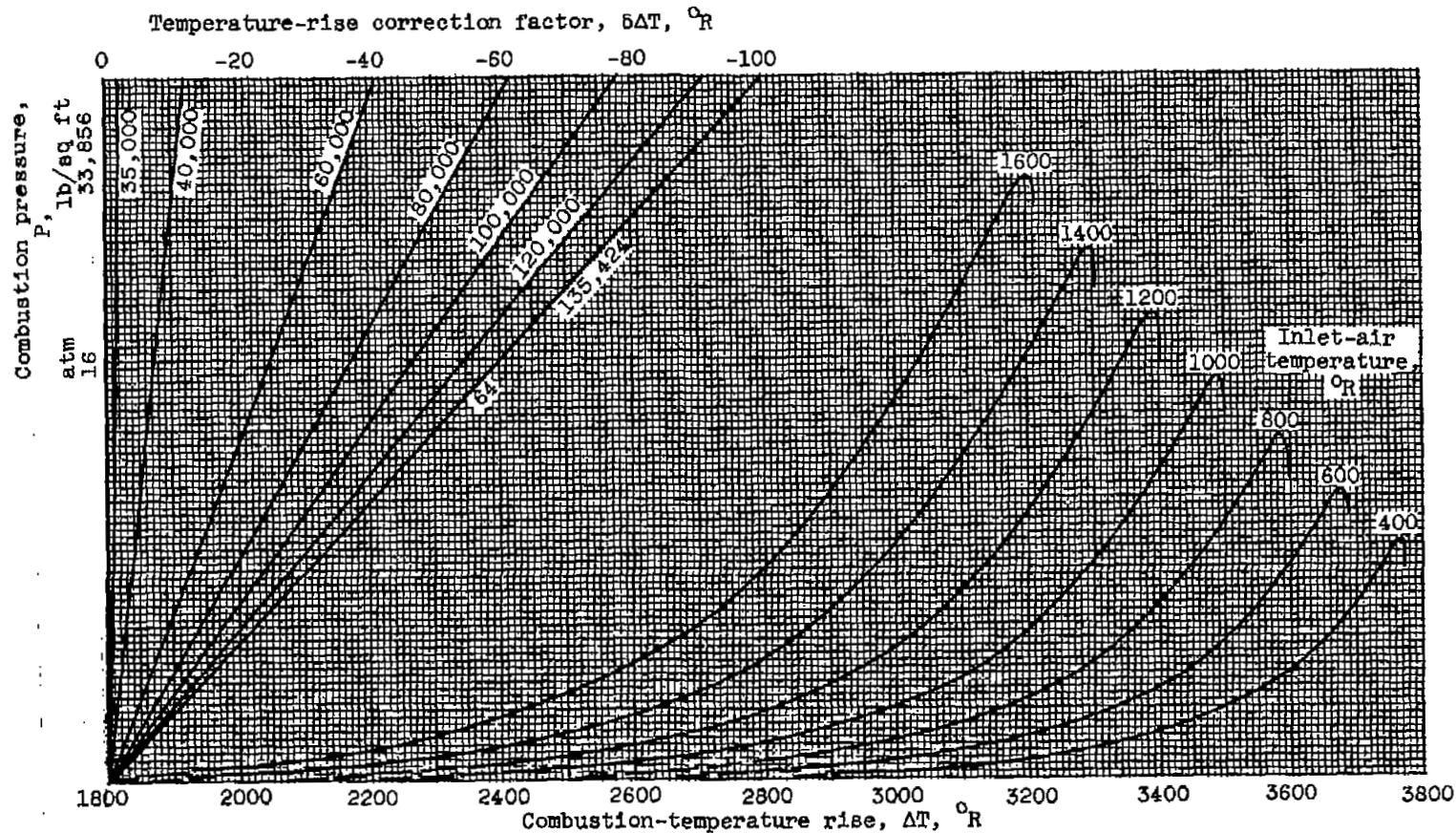
(c) Combustion pressures from 1 to 4 atmospheres.

Figure 3. - Continued. Temperature-rise correction factors as function of combustion-temperature rise.



(d) Combustion pressures from 4 to 16 atmospheres.

Figure 3. - Continued. Temperature-rise correction factors as function of combustion-temperature rise.



(e) Combustion pressures from 16 to 64 atmospheres.

Figure 3. - Concluded. Temperature-rise correction factors as function of combustion-temperature rise.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

RESEARCH MEMORANDUMIDEAL TEMPERATURE RISE DUE TO CONSTANT-
PRESSURE COMBUSTION OF A JP-4 FUEL

By S. C. Huntley

SUMMARY

The ideal temperature rise due to the constant-pressure combustion of a methylene (CH_2) fuel was calculated. CH_2 fuel closely approximates MIL-F-5624 grade JP-4 fuel presently used in most turbojet and ram-jet engines. Charts are presented from which the ideal temperature rise or the ideal quantity of fuel required to obtain a specified combustion temperature may be obtained for any flight condition likely to be encountered with turbojet or ram-jet engines using this fuel.

The charts are applicable only to a fuel having a hydrogen-carbon mass ratio of 0.168. They include a range of fuel-air ratios from 0 to 1.2 fraction of stoichiometric fuel-air ratio with dissociation taken into account, inlet-air temperatures from 400° to 1600° R, and combustion pressures from 1/16 to 64 atmospheres. The use of the charts is illustrated by several examples.

INTRODUCTION

A knowledge of the combustion temperature or of the quantity of fuel required to obtain a specified combustion temperature is necessary in the performance analyses of aircraft turbojet and ram-jet engines. Ideal combustion temperature is generally calculated assuming complete oxidation of the fuel where final fuel-air ratios are leaner than stoichiometric and where dissociation is unimportant. In the stoichiometric range of fuel-air ratios, ideal combustion temperatures are generally calculated assuming that chemical equilibrium exists among the combustion products and dissociation is thereby taken into account. With dissociation, the ideal combustion temperature is dependent on combustion-pressure level.

Accurate calculation of the ideal combustion-temperature rise of hydrocarbon fuels has been simplified by the presentation of charts for cases where the final fuel-air ratios are leaner than stoichiometric and at combustion temperatures where dissociation is unimportant.

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Examples of these charts are found in references 1 and 2. Similar charts are presented in reference 3, which also includes the stoichiometric range of fuel-air ratios. In the latter case, with dissociation taken into account, the charts are applicable to combustion processes occurring at pressure levels from 1 to 5 atmospheres.

The operational range of turbojet and ram-jet engines has been extended in recent years to high altitudes and high flight speeds. This increase in operational range has extended the range of combustion-pressure levels which must be covered in the performance analyses of these engines. A laborious solution is required to calculate ideal combustion-temperature rise in the stoichiometric range of fuel-air ratios where combustion-pressure level has an effect. In addition, a different solution is required for each combination of combustion pressure, inlet-air temperature, and fraction of stoichiometric fuel-air ratio. Therefore, it is evident that a need exists for an accurate and simple method of determining the ideal combustion-temperature rise in the stoichiometric range of fuel-air ratios and for an extensive range of combustion pressures. The purpose of this report is to provide charts from which the ideal temperature rise or the ideal quantity of fuel required to obtain a specified combustion temperature may be obtained for a comprehensive range of turbojet- and ram-jet-engine operating conditions.

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A general method and thermodynamic tables for the solution of thermodynamic properties of a combustion gas in chemical equilibrium are provided in reference 4. This method has been used at the NACA Lewis laboratory to establish thermodynamic properties of a combustion gas for a CH_2 fuel and air reaction. These unpublished data were used to compute the ideal combustion-temperature rise. The temperature-rise results are presented herein.

Charts are presented from which the ideal combustion-temperature rise or the ideal quantity of fuel required to obtain a specified combustion temperature may be easily and accurately obtained. The charts are applicable only to a fuel having a hydrogen-carbon mass ratio of 0.168, which closely approximates MIL-F-5624 grade JP-4 fuel presently used in most turbojet and ram-jet engines. The charts are based on a constant-pressure adiabatic combustion process covering a range of fuel-air ratios from 0 to 1.2 fraction of stoichiometric, a range of combustion pressures from $1/16$ to 64 atmospheres, and a range of inlet-air temperatures from 400° to 1600° R. Use of the charts for a nonadiabatic combustion process or for variations in heat content of the fuel is considered, and their use is illustrated by numerical examples.

SYMBOLS

The following symbols are used in this report:

a,b,c,d	constants used in interpolation process
c_p^o	specific heat at constant pressure and standard conditions, Btu/lb- o R
f'	stoichiometric fuel-air mass ratio (0.067626)
h_c	lower heating value of fuel at constant pressure
h_T^o	sum of sensible enthalpy and chemical energy at temperature T and standard conditions, Btu/lb
Δh_T^o	difference in enthalpy at T and at 400 o R (table II), Btu/lb
i	air mass-flow ratio at station i
M	molecular weight, lb/lb-mole
m	mass-flow rate, lb/sec
P	absolute combustion pressure, atm or lb/sq ft
S	fraction of stoichiometric fuel-air ratio
T	absolute temperature, o R
ΔT	temperature rise, o R
$\delta \Delta T$	difference in temperature rise or correction factor, o R

Subscripts:

a	air
f	fuel
g	combustion gas
i	station
r	reference or assigned value

x adjusted values

1,2,3 stations

THEORETICAL BASIS OF CHARTS

The charts presented herein apply to an ideal constant-pressure adiabatic combustion process with an assigned value of fuel enthalpy. A method is discussed in the section USE OF CHARTS which accounts for a nonadiabatic combustion process or for a change in the assigned value of fuel enthalpy. Chemical equilibrium was assumed to exist among the products of combustion in the stoichiometric range of fuel-air ratio. At leaner-than-stoichiometric fuel-air ratios and at low combustion temperatures completely oxidized products of combustion were assumed.

For convenience, the enthalpy used is defined as the sum of sensible enthalpy and chemical energy. When the chemical energy is included in the enthalpy of each substance, enthalpy of the combustion gas for an adiabatic combustion must equal the enthalpy of the fuel and air entering the combustion process, or

$$(h_{T_a}^0) + Sf'(h_{T_f}^0) = (1 + Sf')(h_{T_g}^0) \quad (1)$$

where the state temperature for each term in equation (1) is taken as the appropriate entering or leaving temperature. Combustion-gas enthalpy was calculated from equation (1) for an assigned value of fuel enthalpy, for selected values of inlet-air temperature, and for several fractions of stoichiometric fuel-air ratio.

The composition of air was assumed to consist of the following mole fractions: N₂, 0.780881; O₂, 0.209495; A, 0.009324; CO₂, 0.000300. The air enthalpy at selected values of inlet-air temperature was calculated using this composition and the molar enthalpy of each constituent from the thermodynamic tables of reference 4.

The assigned value of fuel enthalpy was determined at a fuel temperature of 540° R. At this temperature, the liquid CH₂ fuel was assumed to have a lower heating value at constant pressure (h_c)_{CH₂} of

-18,700 Btu per pound. The lower heating value at constant pressure is defined as the amount of heat removed during the constant-pressure combustion of a fuel and gaseous oxygen mixture when the initial and final temperatures are equal and the completely oxidized combustion products are all in the gaseous state. The reaction equation for the determination of the lower heating value of CH₂ fuel is then



and the enthalpy equation is

$$(Mh_T^O)_{CH_2} + \frac{3}{2} (Mh_T^O)_{O_2} = (Mh_T^O)_{CO_2} + (Mh_T^O)_{H_2O} - (Mh_c)_{CH_2} \quad (3)$$

from which

$$(Mh_T^O)_{CH_2} = (Mh_T^O)_{CO_2} + (Mh_T^O)_{H_2O} - \frac{3}{2} (Mh_T^O)_{O_2} - (Mh_c)_{CH_2} \quad (4)$$

The assigned value of fuel enthalpy at a temperature of $540^\circ R$ was determined from equation (4) using the assigned lower heating value at constant pressure and the molar enthalpy of each constituent from the thermodynamic tables of reference 4. Stoichiometric fuel-air ratio f' is evaluated by consideration of equation (2) and the mole fraction of O_2 in the air available for combustion as

$$\left. \begin{aligned} f' \cdot \frac{M_a}{M_{CH_2}} &= \frac{2(0.209495)}{3} \\ f' &= 0.067626 \end{aligned} \right\} \quad (5)$$

or

The combustion temperature associated with a specific value of combustion-gas enthalpy was determined by interpolation from established relations between temperature, enthalpy, and specific heat at constant pressure. These thermodynamic properties were obtained at a sequence of temperatures in either 200° or $100^\circ K$ increments. In the stoichiometric range of fuel-air ratios, chemical equilibrium was assumed to exist among products of combustion consisting of CO , CO_2 , H , H_2 , H_2O , O , O_2 , OH , N , N_2 , NO , and A . Applying the general method of reference 4 to these assumed products of combustion leads to eight dissociative equilibrium equations for gaseous molecules in terms of atomic species, namely, for CO , CO_2 , H_2 , H_2O , O_2 , OH , N_2 , and NO . However, as no free carbon was assumed among the combustion products, the equilibrium equation for CO_2 was expressed in terms of CO and O . Conservation of mass leads to five additional equations, one for each atomic type, namely, for C , H , O , N , and A . The total pressure being the sum of the partial pressure of each constituent provides an additional equation. The simultaneous solution of these equations subsequently leads to the composition of the combustion gas for a constant-pressure combustion process at a specified temperature, pressure, and fraction of stoichiometric fuel-air ratio. The composition of the combustion gas and selected thermodynamic properties were established for a sequence of temperatures in $200^\circ K$ increments, at several pressures, and at several fractions of stoichiometric fuel-air ratio.

At leaner-than-stoichiometric fuel-air ratios and at low combustion temperatures, the combustion gas was assumed to be completely oxidized. The products of combustion, in this case, were assumed to consist of CO_2 , H_2O , and the original air entering the combustion less the oxygen that went into the formation of CO_2 and H_2O , which leads to

$$(1 + Sf')(\bar{h}_T^{\circ})_g = (\bar{h}_T^{\circ})_a + \frac{2}{3} \left(\frac{0.209495}{M_a} \right) S \left[(\bar{M}\bar{h}_T^{\circ})_{\text{CO}_2} + (\bar{M}\bar{h}_T^{\circ})_{\text{H}_2\text{O}} - \frac{3}{2} (\bar{M}\bar{h}_T^{\circ})_{\text{O}_2} \right] \quad (6)$$

and

$$(1 + Sf')(\bar{c}_p^{\circ})_g = (\bar{c}_p^{\circ})_a + \frac{2}{3} \left(\frac{0.209495}{M_a} \right) S \left[(\bar{M}\bar{c}_p^{\circ})_{\text{CO}_2} + (\bar{M}\bar{c}_p^{\circ})_{\text{H}_2\text{O}} - \frac{3}{2} (\bar{M}\bar{c}_p^{\circ})_{\text{O}_2} \right] \quad (7)$$

where the state temperature for each term in equations (6) and (7) is the combustion temperature. Equations (6) and (7) were used in conjunction with the thermodynamic tables of reference 4 to calculate the enthalpy and specific heat at constant pressure of the completely oxidized combustion gas at a sequence of temperatures in 100° K increments and at several fractions of stoichiometric fuel-air ratio.

A relation between temperature, enthalpy, and specific heat at constant pressure was established by assuming that

$$\bar{T}_g = a(\bar{h}_T^{\circ})_g^3 + b(\bar{h}_T^{\circ})_g^2 + c(\bar{h}_T^{\circ})_g + d \quad (8)$$

and

$$\left[\frac{d(\bar{T}_g)}{d(\bar{h}_T^{\circ})_g} \right]_p = \frac{1}{(\bar{c}_p^{\circ})_g} = 3a(\bar{h}_T^{\circ})_g^2 + 2b(\bar{h}_T^{\circ})_g + c \quad (9)$$

where a , b , c , and d were evaluated for each temperature increment from the thermodynamic properties of each temperature sequence. This relation was then assumed to be true for any temperature between the values at which a , b , c , and d were determined. This method gives an interpolation process based on a 2-point - 2-slope technique. From this established relation the combustion temperature associated with a specific value of combustion-gas enthalpy was determined for selected values of inlet-air temperature and for several fractions of stoichiometric fuel-air ratio.

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PRESENTATION OF CHARTS

The ideal combustion-temperature rise associated with a constant-pressure adiabatic combustion process is shown in figure 1 for a combustion pressure of 1 atmosphere and for inlet-air temperatures of 400° and 1600° R as a function of the fraction of stoichiometric fuel-air ratio. The effect of dissociation on temperature rise is illustrated by the separation between the curves with dissociation and without dissociation. The effect of dissociation is to decrease the ideal temperature rise attainable with a completely oxidized combustion gas, especially at high values of combustion temperature. The typical trend of temperature rise as the inlet-air temperature is increased is to reduce the temperature rise. The temperature rise is reduced more at near-stoichiometric mixtures, and the peak temperature rise occurs at richer mixtures with higher inlet temperatures. These trends in temperature rise for a pressure level of 1 atmosphere are also typical of other combustion-pressure levels.

The values of temperature rise in the stoichiometric range of fuel-air ratios were computed with the assumption of dissociation; whereas, at the leaner fuel-air ratios no dissociation was assumed. The resulting two sets of values were faired together as shown by the dashed curves in figure 1. The resulting continuous curves were used in subsequent charts for the relation of ideal combustion-temperature rise as a function of the fraction of stoichiometric fuel-air ratio.

Ideal combustion-temperature rise at a combustion pressure of 1 atmosphere is presented in table I as a function of the fraction of stoichiometric fuel-air ratio for a range of inlet-air temperatures from 400° to 1600° R. Temperature rise or the ideal quantity of fuel required to obtain a specified temperature rise may be easily obtained at any 0.001 incremental fraction of stoichiometric fuel-air ratio or at any 100° R increment in inlet-air temperature. These increments in fuel-air ratio and inlet-air temperature are sufficiently small to give accurate values by a simple straight-line interpolation at any interval between increments.

Ideal combustion-temperature rise for any combustion pressure other than 1 atmosphere is obtained by additive correction factors applied to the value of temperature rise obtained from table I at the appropriate fraction of stoichiometric fuel-air ratio and inlet-air temperature. Exact differences in temperature rise for equal increments of the logarithm of combustion pressure are presented in figure 2. The number of temperature-rise differences to be added depends on the difference of the pressure level from 1 atmosphere, as will be shown later in examples illustrating the use of the charts. Temperature rise is very nearly linear with the logarithm of combustion pressure. Consequently, a straight-line interpolation using the logarithm of the particular

pressure gives a close approximation to the difference in temperature rise for a pressure within each increment. This relation was used to establish lines of intermediate pressure levels on each chart of figure 2, from which the appropriate temperature-rise correction factor may be easily obtained. More exact interpolations may be achieved, of course, by direct plots of the temperature-rise difference as a function of the logarithm of combustion pressure.

Correction-factor charts have also been prepared to assist in obtaining the ideal quantity of fuel required for a specified temperature rise at any combustion pressure. These charts are presented in figure 3. Additive correction factors are obtained from figure 3 as a function of the specified temperature rise, the inlet-air temperature, and the combustion pressure. These additive correction factors are derived in a manner similar to that for the correction factors of figure 2. The quantity of fuel required for a specified temperature rise at any combustion pressure is obtained from table I after applying the correction factors of figure 3 to the specified temperature rise. The number of correction factors to be applied to the specified temperature rise is again dependent on the difference between the pressure level and 1 atmosphere.

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USE OF CHARTS

The combustion charts presented herein may be used directly for an adiabatic combustion process and for the assigned value of fuel enthalpy. The charts may also be used for a nonadiabatic combustion process, such as a loss of air or power extraction, and for variations in the heat content of the fuel. A general system is presented in figure 4, which shows enthalpies for a nonadiabatic combustion process with a loss of air in the system and with a variation in heat content of the fuel from the assigned fuel enthalpy. The heat balance is

$$(mh_T^O)_{a,1} - (mh_T^O)_{a,i} + (mh_T^O)_{f,2} = (mh_T^O)_{g,3} \quad (10)$$

and the mass balance of the system is

$$m_{a,1} - m_{a,i} + m_{f,2} = m_{g,3} \quad (11)$$

Since, by definition,

$$\left. \begin{aligned} Sf' &= \frac{m_{f,2}}{m_{a,1} - m_{a,i}} \\ i &= \frac{m_{a,i}}{m_{a,1} - m_{a,i}} \end{aligned} \right\} \quad (12)$$

and

then, combining equations (10), (11), and (12) and using the assigned fuel enthalpy yield

$$\begin{aligned} (h_T^o)_{a,1} - i \left[(h_T^o)_{a,i} - (h_T^o)_{a,1} \right] + Sf' (h_T^o)_{f,r} + \\ Sf' \left[(h_T^o)_{f,2} - (h_T^o)_{f,r} \right] = (1 + Sf') (h_T^o)_{g,3} \end{aligned} \quad (13)$$

Now, by using an adjusted inlet-air temperature T_x to accomodate the change in energy from an adiabatic process with assigned conditions, the adjusted inlet-air enthalpy is

$$(h_T^o)_{a,x} = (h_T^o)_{a,1} - i \left[(h_T^o)_{a,i} - (h_T^o)_{a,1} \right] + Sf' \left[(h_T^o)_{f,2} - (h_T^o)_{f,r} \right] \quad (14)$$

Substituting equation (14) into equation (13) yields the generalized (or adiabatic) heat-balance equation

$$(h_T^o)_{a,x} + Sf' (h_T^o)_{f,r} = (1 + Sf') (h_T^o)_{g,3} \quad (15)$$

The generalized heat-balance equation which is similar to equation (1) is directly applicable to the combustion charts.

An adjustment of inlet-air temperature is necessary to satisfy the difference between the generalized inlet-air enthalpy $(h_T^o)_{a,x}$ and the actual inlet-air enthalpy $(h_T^o)_{a,1}$. This difference in air enthalpy involves only a change in sensible enthalpy; consequently, any available sensible-enthalpy table for air may be used to obtain the corresponding adjustment of inlet-air temperature. For convenience, a chart of sensible air enthalpy as a function of temperature is presented in table II, which was calculated using the same air composition and molar enthalpy of each constituent as was used for the combustion charts. The change in enthalpy resulting from the loss of air in a general system (such as fig. 4) may be used directly in equation (14). An appropriate term may also be included to account for any other change in energy which may result in a nonadiabatic process, such as energy extracted from the system for auxiliary equipment.

A variation in fuel enthalpy from the assigned value may be the result of a change in either the lower heating value of the fuel at constant pressure or in the fuel-inlet temperature. The change in enthalpy

resulting from a change in the lower heating value of the fuel at constant pressure is simply $Sf'(-18,700 - h_c)$. A change in enthalpy resulting from a variation in fuel-inlet temperature from the assigned value of $540^\circ R$ may be obtained from a consideration of the specific heat at constant pressure of the liquid fuel. A typical variation of specific heat with fuel temperature was obtained from reference 5 for a JP-4 hydrocarbon fuel. The change in fuel enthalpy from the assigned value at $540^\circ R$ was calculated by using

$$(c_p^o)_{f, \text{liquid}} = 0.502 + 0.000525(T_f - 540)$$

For convenience, a chart of the change in fuel enthalpy of a stoichiometric mixture on a unit-mass-of-air basis is presented in table III as a function of the fuel-inlet temperature. The product of a chart value and the fraction of stoichiometric fuel-air ratio yields the appropriate change in air enthalpy for a variation in fuel-inlet temperature (eq. (14)).

The use of the combustion charts is illustrated by calculations for a turbojet engine with an afterburner for which the following conditions are employed: engine-inlet temperature, $520^\circ R$; 4-percent loss in air flow by compressor interstage air bleed occurring at a temperature of $624^\circ R$; combustor-inlet temperature, $1000^\circ R$, engine fuel-air ratio, 25 percent of stoichiometric; fuel-inlet temperature, $540^\circ R$; lower heating value of fuel at constant pressure of -19,135 Btu per pound at $540^\circ R$; turbine-outlet temperature, $1675^\circ R$; afterburner fuel-air ratio, 55 percent of stoichiometric; afterburner combustion pressure, 400 pounds per square foot; and afterburner combustion temperature, $3500^\circ R$.

Example 1 - Determination of Ideal Turbine-Outlet Temperature

Generalizing the heat balance from the engine inlet to the turbine outlet indicates that an adjustment in the inlet-air temperature is necessary before using table I. From equation (14) the adjusted inlet-air enthalpy is

$$(\Delta h_T^o)_{a,x} = (\Delta h_T^o)_{a,1} - i \left[(\Delta h_T^o)_{a,i} - (\Delta h_T^o)_{a,1} \right] + Sf' \left[-h_c - 18,700 \right]$$

From table II

$$(\Delta h_T^o)_{a,i} - (\Delta h_T^o)_{a,1} = 53.7 - 28.8 = 24.9 \text{ Btu/lb}$$

and

$$\begin{aligned} (\Delta h_T^0)_{a,x} &= 28.8 - 0.04(24.9) + 0.25 \times 0.067626(19,135 - 18,700) \\ &= 35.2 \text{ Btu/lb} \end{aligned}$$

or, from $(\Delta h_T^0)_{a,x}$ and table II,

$$T_x = 547^\circ \text{ R}$$

Then, from T_x , S, and table I,

$$\Delta T = 1195^\circ \text{ R}$$

The ideal turbine-outlet temperature is $1195^\circ + 547^\circ = 1742^\circ \text{ R}$. No correction is necessary for combustion pressure at this low combustion temperature (lean fuel-air ratio).

Example 2 - Determination of Ideal Engine Fuel-Air Ratio

This example is the inverse of example 1, and an iteration process is necessary because of the change in fuel enthalpy from the assigned value.

An approximate adjusted inlet-air temperature may be obtained by using an estimated ideal engine fuel-air ratio. The estimated fuel-air ratio is obtained from a temperature rise based on the adjusted inlet temperature and the ideal ΔT of example 1. The approximate ΔT is $1675^\circ - 547^\circ = 1128^\circ \text{ R}$; the ideal ΔT is 1195° R . An ideal fuel-air ratio estimated from a ratio of these temperature rises and the actual fuel-air ratio is $0.25 \times \frac{1128}{1195} = 0.236$ fraction of stoichiometric fuel-air ratio. An approximate adjusted inlet-air enthalpy is

$$\begin{aligned} (\Delta h_T^0)_{a,x} &= 28.8 - 0.04(24.9) + 0.236 \times 0.067626(19.135 - 18,700) \\ &= 34.7 \text{ Btu/lb} \end{aligned}$$

or, from $(\Delta h_T^0)_{a,x}$ and table II,

$$T_x = 545^\circ \text{ R}$$

A new approximation of specified ΔT is $1675^\circ - 545^\circ = 1130^\circ \text{ R}$. By using $T_x = 545^\circ \text{ R}$, $\Delta T = 1130^\circ \text{ R}$, and table I, the ideal fuel-air ratio

is found to be 0.2348 fraction of stoichiometric fuel-air ratio. A reiteration process using this fuel-air ratio gives the same adjusted inlet-air temperature; therefore, no further iterations are necessary.

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Example 3 - Determination of Engine Combustion Temperature

If it is assumed that the combustion of ideal engine fuel occurs only in the engine combustor, then the ideal fuel-air ratio may be specified by either the combustor temperature rise or the engine temperature rise. Consequently, the combustor temperature rise may be calculated from the ideal fuel flow determined in example 2 and the combustor-inlet temperature by applying a heat balance to the engine combustor. Generalizing the heat balance from the combustor inlet to exit indicates an adjustment of combustor-inlet temperature is necessary before using table I. This heat balance indicates an adiabatic process with an adjustment for variation of fuel enthalpy of the ideal fuel-air ratio. Furthermore, the combustor air flow is equal to the air flow used to specify the ideal fuel-air ratio of example 2; so no adjustment of fuel-air ratio is necessary. From the combustor-inlet temperature, table II, and the ideal fuel-air ratio,

$$(\Delta h_T^o)_{a,x} = 145.5 + 0.2348 \times 0.067626(19,135 - 18,700) = 152.4 \text{ Btu/lb}$$

or

$$T_x = 1027^\circ \text{ R}$$

Then, from T_x , ideal S, and table I,

$$\Delta T = 1058^\circ \text{ R}$$

The engine combustion temperature is $1058^\circ + 1027^\circ = 2085^\circ \text{ R}$.

Example 4 - Determination of Ideal Afterburner Combustion Temperature

Generalizing the heat balance from the engine inlet to the afterburner outlet indicates that an adjustment in the engine-inlet temperature is to be made which differs from example 1 because of the additional fuel supplied to the afterburner; therefore,

$$(\Delta h_T^o)_{a,x} = 35.2 + 0.55 \times 0.067626(19,135 - 18,700) = 51.4 \text{ Btu/lb}$$

or

$$T_x = 614^\circ \text{ R}$$

The total fuel-air ratio supplied to the system is $0.25 + 0.55 = 0.80$ fraction of the stoichiometric fuel-air ratio. Then, from T_x , total S, and table I,

$$\Delta T = 3119^\circ R$$

As afterburner combustion occurs at a pressure of 400 pounds per square foot, correction factors must be applied to the temperature rise obtained from table I. From figure 2(a), total S, T_x , and P,

$$\delta \Delta T = -7^\circ R$$

From figure 2(b), total S, T_x , and P = 1/4 atmosphere,

$$\delta \Delta T = -24^\circ R$$

The ideal afterburner combustion temperature is $3119^\circ - 7^\circ - 24^\circ + 614^\circ = 3702^\circ R$.

Example 5 - Determination of Ideal Afterburner Fuel-Air Ratio

This example is the inverse of example 4; and, as in example 2, an iteration process is necessary. The specified afterburner temperature rise is $3500^\circ - 1675^\circ = 1825^\circ R$. From example 4, the ideal afterburner temperature rise is $3702^\circ - 1675^\circ = 2027^\circ R$. An ideal afterburner fuel-air ratio estimated from a ratio of these temperature rises and the actual afterburner fuel-air ratio is $0.55 \times \frac{1825}{2027} = 0.495$ fraction of stoichiometric fuel-air ratio. An approximate adjusted inlet-air enthalpy from an estimate of the total ideal fuel-air ratio is

$$\begin{aligned} (\Delta h_T^0)_{a,x} &= 28.8 - 0.04(24.9) + (0.2348 + 0.495)0.067626(19,135 - 18,700) \\ &= 49.3 \text{ Btu/lb} \end{aligned}$$

or, from $(\Delta h_T^0)_{a,x}$ and table II,

$$T_x = 605^\circ R$$

An approximation of total-temperature rise is $3500^\circ - 605^\circ = 2895^\circ R$. By using $T_x = 605^\circ R$, $\Delta T = 2895^\circ R$, P = 400 pounds per square foot, and figure 3, the following correction factors are obtained:

$$\delta \Delta T = 3^\circ R \text{ (from fig. 3(a))}$$

$$\delta \Delta T = 9^\circ R \text{ (from fig. 3(b))}$$

The adjusted temperature rise becomes $2895^{\circ} + 3^{\circ} + 9^{\circ} = 2907^{\circ}$ R. From table I, $T_x = 605^{\circ}$ R, and $\Delta T = 2907^{\circ}$ R, the ideal fuel-air ratio is found to be 0.7247 fraction of stoichiometric fuel-air ratio. A re-iteration process using this fuel-air ratio gives the same adjusted inlet-air temperature; therefore, no further iterations are necessary. The ideal afterburner fuel-air ratio is then $0.7247 - 0.2348 = 0.4899$ fraction of stoichiometric fuel-air ratio.

Lewis Flight Propulsion Laboratory
National Advisory Committee for Aeronautics
Cleveland, Ohio, July 28, 1955

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TABLE I. - IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichiometric fuel-air ratio, S	Ideal combustion-temperature rise, AT, °R												
	Inlet-air temperature, °R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
0	0	0	0	0	0	0	0	0	0	0	0	0	0
.001	5	5	5	5	5	5	5	5	5	5	5	5	5
.002	11	11	11	11	11	11	11	11	11	11	11	11	11
.004	21	21	21	21	21	21	21	21	21	21	21	21	21
.005	27	27	27	27	27	27	27	27	27	27	27	27	27
.006	32	32	32	32	32	32	32	32	32	32	32	32	32
.007	37	37	37	37	37	37	37	37	37	37	37	37	37
.008	43	42	42	42	42	42	42	42	42	42	42	42	42
.009	48	48	47	47	47	46	45	45	45	45	45	45	45
.010	53	53	53	53	53	53	53	53	53	53	53	53	53
.011	59	58	58	57	57	56	56	55	55	55	55	55	55
.012	64	64	63	62	62	61	60	60	60	60	60	60	60
.013	69	69	68	67	67	66	65	64	64	64	64	64	64
.014	75	74	73	73	73	72	71	71	71	71	70	69	67
.015	80	79	79	78	77	77	76	74	73	73	71	70	67
.016	85	85	84	83	82	81	79	78	77	76	74	73	71
.017	90	90	89	87	87	86	84	83	82	80	79	78	75
.018	95	94	93	92	92	90	89	88	86	85	84	82	80
.019	100	100	100	97	97	95	94	93	91	90	88	87	84
.020	106	105	103	103	102	100	99	97	96	94	93	92	90
.021	111	111	110	109	107	105	104	102	101	98	96	93	93
.022	114	114	114	114	112	110	109	107	105	102	101	98	98
.023	118	118	118	117	117	115	114	112	110	107	105	102	102
.024	121	121	121	121	120	120	119	117	115	111	110	110	111
.025	125	125	124	124	123	123	123	121	120	118	116	114	111
.026	130	130	130	130	130	130	128	126	124	122	121	119	118
.027	137	137	136	134	132	130	128	126	124	122	120	118	118
.028	142	141	139	137	135	133	131	129	127	125	123	122	120
.029	149	148	146	144	142	140	138	136	134	132	130	128	126
.030	154	153	151	149	147	145	143	141	139	137	135	133	133
.031	159	158	156	154	152	150	148	146	144	141	139	137	135
.032	164	163	162	160	157	155	153	150	148	146	144	141	137
.033	168	167	166	165	163	160	158	156	154	152	149	146	142
.034	175	173	172	170	167	165	162	159	156	153	150	146	141
.035	180	179	177	175	172	170	167	164	160	157	153	149	145
.036	185	184	182	180	177	175	172	169	166	164	162	159	155
.037	190	189	187	185	182	180	177	174	171	169	166	164	159
.038	191	190	189	187	185	183	180	177	174	171	168	166	163
.039	196	195	193	190	187	184	181	178	175	172	169	166	163
.040	211	210	208	205	203	200	197	194	191	188	185	182	177
.041	216	215	213	210	207	204	201	198	195	192	189	186	181
.042	222	220	218	215	212	209	206	203	200	197	194	191	186
.043	227	225	223	220	217	214	211	208	205	202	199	196	190
.044	232	230	228	225	222	219	216	213	210	207	203	200	195
.045	237	235	233	230	227	224	220	217	214	210	207	204	199
.046	242	241	238	235	232	229	225	222	218	215	212	209	203
.047	246	245	243	240	237	233	230	226	223	219	216	213	208
.048	253	251	248	245	242	238	235	231	228	224	221	218	212
.049	258	256	253	250	247	243	240	236	233	229	226	222	217
.050	263	261	259	255	252	248	244	241	237	233	230	227	221

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichiometric fuel-air ratio, S	Ideal combustion-temperature rise, AT, °R												
	Inlet-air temperature, °R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
.051	868	266	264	260	257	253	249	245	242	238	234	231	225
.052	873	271	269	265	262	258	254	250	246	242	239	235	230
.053	879	276	274	270	267	263	259	255	251	247	243	240	234
.054	884	282	279	275	272	267	263	259	255	252	248	244	238
.055	889	287	284	280	276	272	268	264	260	256	252	249	243
.056	294	292	289	285	281	277	273	269	265	261	257	253	247
.057	299	297	294	290	286	282	278	273	269	265	261	258	252
.058	304	302	299	295	291	287	283	278	274	270	266	262	256
.059	309	307	304	300	296	292	287	283	279	274	270	267	260
.060	315	312	309	305	301	296	293	288	283	279	275	271	265
.061	320	317	314	310	306	301	297	292	288	283	279	275	269
.062	325	322	319	315	311	306	303	297	292	288	284	280	274
.063	330	327	324	320	316	311	306	303	297	293	288	284	278
.064	335	338	339	325	320	316	311	306	302	297	293	289	282
.065	340	337	334	330	325	321	316	311	306	302	297	293	287
.066	345	348	339	335	330	328	320	316	311	306	308	297	291
.067	350	348	344	340	338	330	325	320	316	311	306	302	295
.068	355	353	349	345	340	338	330	325	320	316	311	306	300
.069	361	358	354	349	345	340	335	329	325	320	315	311	304
.070	366	363	359	354	350	344	339	334	329	324	320	318	309
.071	371	368	364	359	354	349	344	339	334	329	324	319	313
.072	376	373	369	364	359	354	349	343	338	333	328	324	317
.073	381	378	374	369	364	359	353	348	343	338	333	328	322
.074	386	383	379	374	369	364	358	353	347	342	337	333	326
.075	391	388	384	379	374	369	363	357	352	347	342	337	330
.076	396	393	389	384	379	373	368	362	356	351	346	341	336
.077	401	398	394	389	383	378	372	367	361	356	351	346	339
.078	406	403	399	394	388	383	377	371	366	360	355	350	344
.079	411	408	404	399	393	387	382	376	370	365	359	354	348
.080	416	413	409	403	398	392	386	380	375	369	364	359	353
.081	421	418	413	408	403	397	391	385	379	374	368	363	357
.082	426	423	418	413	407	401	396	390	384	378	373	367	361
.083	431	428	423	418	413	406	400	394	388	377	372	365	
.084	436	433	428	423	417	411	405	399	393	387	381	376	370
.085	442	438	433	428	422	416	410	403	397	391	386	381	374
.086	447	443	438	432	427	420	414	408	402	396	390	385	378
.087	452	448	443	437	431	425	419	413	406	400	395	389	383
.088	457	453	448	442	436	430	423	417	411	405	399	394	387
.089	462	458	453	447	441	434	428	422	416	409	403	398	392
.090	467	463	458	452	446	439	433	426	420	414	408	402	396
.091	472	467	463	457	450	444	437	431	424	418	412	407	400
.092	477	472	467	461	455	449	442	435	429	423	417	411	405
.093	482	477	472	466	460	453	447	440	433	427	421	415	409
.094	487	482	477	471	465	458	451	444	438	431	425	419	413
.095	492	487	483	476	469	463	456	449	442	436	430	424	418
.096	497	492	487	481	474	467	460	453	447	440	434	428	422
.097	502	497	492	486	479	472	465	458	451	445	438	432	426
.098	507	502	497	490	484	477	470	463	456	449	443	437	431
.099	512	507	508	498	488	481	474	467	460	454	447	441	435
.100	517	512	506	500	493	486	479	472	465	458	451	445	439

S = 0 to 0.100

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichiometric fuel-air ratio, $\frac{s}{S}$	Ideal combustion-temperature rise, ΔT , $^{\circ}\text{R}$											
	Inlet-air temperature, $^{\circ}\text{R}$											
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
0.101	521	517	511	505	498	491	483	476	469	462	456	450
102	526	522	516	509	502	505	498	481	473	467	460	454
103	531	527	521	514	507	500	492	485	478	471	464	458
104	536	531	525	519	512	504	497	490	483	475	469	456
105	541	536	530	524	516	509	501	494	487	480	473	467
106	546	541	535	528	521	514	506	498	491	484	477	471
107	551	546	540	533	526	518	511	503	496	488	482	475
108	556	551	545	538	529	523	515	507	500	493	485	479
109	561	556	550	542	535	527	520	512	504	497	490	484
110	566	561	554	547	540	532	524	516	509	501	494	488
111	571	566	559	552	544	536	529	521	513	506	499	492
112	576	570	564	557	549	541	533	525	518	510	503	496
113	581	575	569	561	554	546	538	530	528	514	507	500
114	586	580	574	566	558	550	548	540	536	519	512	505
115	591	585	578	571	563	555	547	539	531	523	516	509
116	596	590	583	575	568	559	551	543	535	527	520	513
117	601	595	588	580	578	564	556	547	539	532	524	517
118	605	599	593	585	577	568	560	552	544	536	529	522
119	610	604	597	590	581	573	565	556	548	540	533	526
120	615	609	602	594	586	578	569	561	553	545	537	530
121	620	614	607	599	591	582	574	565	557	549	541	534
122	625	619	612	604	595	587	578	570	561	553	546	538
123	630	624	616	608	600	591	583	574	566	558	550	543
124	635	628	621	613	604	596	587	578	570	562	554	547
125	640	633	626	618	609	600	591	583	574	566	558	551
126	645	638	631	622	614	605	597	589	581	571	563	555
127	649	643	635	627	618	609	600	592	583	575	567	559
128	654	648	640	632	623	614	605	596	587	579	571	564
129	659	652	645	636	627	618	609	600	592	583	575	568
130	664	657	649	641	632	623	614	605	596	588	580	572
131	669	662	654	645	637	627	618	609	600	592	584	576
132	674	667	659	650	641	632	623	614	605	596	588	580
133	679	671	664	655	646	636	627	618	609	601	593	585
134	683	676	668	659	650	641	632	628	613	605	597	589
135	688	681	673	664	655	645	636	627	618	609	601	593
136	693	686	678	669	659	650	640	631	622	613	605	597
137	698	690	682	673	664	654	645	635	626	618	609	601
138	703	695	687	678	668	659	649	640	631	622	613	605
139	708	700	692	688	673	663	654	644	635	626	618	610
140	713	705	696	687	678	668	658	649	639	630	622	614
141	717	709	701	698	682	672	663	653	644	635	626	618
142	722	714	706	696	687	677	667	657	648	639	630	622
143	727	719	710	701	691	681	671	662	652	643	634	626
144	732	784	715	705	696	686	676	666	657	647	639	628
145	736	728	720	710	700	690	680	670	661	652	643	626
146	741	733	724	715	705	695	685	675	665	656	647	639
147	746	738	729	719	709	699	689	679	669	660	651	635
148	751	743	734	724	714	704	693	683	674	664	655	647
149	756	747	738	728	718	708	698	688	678	669	660	651
150	760	758	743	733	723	712	702	692	682	673	664	658

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT, °R

Fraction of stoichiometric fuel-air ratio, S	Ideal combustion-temperature rise, AT, °R												
	Inlet-air temperature, °R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
0.151	765	757	748	738	727	717	707	696	687	677	668	659	651
0.152	770	761	752	748	733	721	711	701	691	681	678	663	655
0.153	775	766	757	747	736	726	715	705	695	686	676	668	659
0.154	779	771	761	751	741	730	720	709	699	690	681	672	663
0.155	784	775	766	756	745	735	724	714	704	694	685	676	667
0.156	789	780	771	760	750	739	728	718	708	698	689	680	671
0.157	794	785	775	765	754	743	733	722	712	708	693	684	676
0.158	798	789	780	769	759	748	737	727	716	707	697	688	680
0.159	803	794	785	774	763	752	742	731	721	711	701	692	684
0.160	808	799	789	778	768	757	746	735	725	715	706	696	688
0.161	813	803	794	783	772	761	750	740	729	719	710	701	698
0.162	817	808	798	788	777	766	755	744	733	723	714	705	696
0.163	822	813	803	792	781	770	759	748	738	728	718	709	700
0.164	827	817	807	797	786	774	763	752	742	732	722	713	704
0.165	832	822	812	801	790	779	768	757	746	736	726	717	708
0.166	836	827	817	806	795	783	772	761	750	740	730	721	712
0.167	841	831	821	810	799	788	776	765	755	744	736	726	716
0.168	846	836	826	815	803	792	781	770	759	749	739	729	720
0.169	850	841	830	819	808	798	785	774	763	753	743	733	724
0.170	855	845	835	824	812	801	789	778	767	757	747	737	728
0.171	860	850	839	828	817	805	794	783	772	761	751	742	732
0.172	864	858	844	833	821	809	798	787	776	765	755	746	736
0.173	869	859	849	837	826	814	802	791	780	769	759	750	740
0.174	874	864	853	842	830	818	807	795	784	774	763	754	745
0.175	878	868	858	846	834	823	811	799	788	778	768	758	749
0.176	883	873	862	851	839	827	815	804	793	782	772	762	753
0.177	888	878	867	855	843	831	820	808	797	786	776	766	757
0.178	892	888	871	860	848	836	824	812	801	790	780	770	761
0.179	897	887	876	864	852	840	828	816	805	794	784	774	765
0.180	902	891	880	868	857	844	832	821	809	799	788	778	769
0.181	906	896	885	873	861	849	837	825	814	803	792	782	773
0.182	911	901	889	877	865	853	841	829	818	807	796	786	777
0.183	916	905	894	882	870	857	845	833	822	811	800	790	781
0.184	920	910	898	886	874	866	854	843	830	819	809	794	785
0.185	925	914	903	891	879	866	854	843	830	819	809	790	789
0.186	930	919	907	895	883	870	858	846	835	823	812	802	797
0.187	934	923	912	900	887	875	863	850	838	826	817	806	801
0.188	939	928	916	904	898	879	867	855	843	832	821	810	805
0.189	944	932	921	909	896	883	871	859	847	836	825	815	809
0.190	948	937	925	913	900	888	875	863	851	840	829	819	809
0.191	953	942	930	917	905	892	880	867	855	844	833	823	813
0.192	957	946	934	922	909	895	884	871	858	848	837	827	817
0.193	962	951	939	926	914	901	888	876	864	852	841	831	821
0.194	967	955	943	931	918	905	892	880	868	856	845	835	825
0.195	971	960	948	938	928	909	897	884	872	860	849	839	829
0.196	976	964	952	939	927	914	901	888	876	865	853	843	833
0.197	980	969	957	944	931	918	908	896	884	872	860	847	837
0.198	985	973	961	948	935	922	909	897	884	873	862	851	841
0.199	989	978	966	953	940	928	914	901	889	877	866	855	845
0.200	994	982	970	957	944	931	918	905	893	881	870	859	849

S = 0.101 to 0.200

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE;

Fraction of stoichiometric fuel-air ratio, S	Ideal combustion-temperature rise, ΔT , $^{\circ}$ R												
	Inlet-air temperature, $^{\circ}$ R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1800
.201	987	974	961	948	935	922	909	897	885	874	863	852	849
.202	991	979	966	953	940	927	914	902	890	879	867	857	850
.203	996	983	970	957	944	931	918	906	894	883	871	860	855
.204	1000	988	974	961	948	935	922	910	898	886	875	864	859
.205	1005	993	979	965	952	939	926	913	901	890	879	868	863
.206	1009	996	983	970	956	943	930	918	906	894	883	872	867
.207	1014	1001	987	974	960	947	934	921	909	897	886	875	869
.208	1018	1005	992	978	965	951	938	926	914	902	891	880	869
.209	1022	1010	996	983	969	955	942	930	918	906	895	884	873
.210	1027	1014	1000	987	973	960	947	934	921	910	899	888	877
.211	1031	1018	1005	991	977	964	951	938	926	914	903	892	881
.212	1036	1027	1009	990	981	968	955	942	930	918	907	896	885
.213	1040	1037	1013	1000	986	973	960	947	934	922	911	900	889
.214	1045	1039	1018	1004	990	976	963	950	938	926	915	904	893
.215	1049	1039	1022	1008	994	980	967	954	941	929	919	909	898
.216	1053	1045	1031	1017	1003	985	971	958	946	934	923	912	901
.217	1058	1046	1035	1021	1007	989	975	962	950	938	927	916	905
.218	1062	1049	1039	1025	1011	997	984	971	959	947	936	925	914
.219	1067	1071	1050	1043	1029	1015	1001	988	975	963	952	941	930
.220	1071	1075	1062	1048	1034	1019	1005	992	979	967	956	945	934
.221	1080	1076	1063	1048	1034	1020	1010	998	985	973	962	951	940
.222	1084	1078	1065	1051	1038	1024	1014	1000	988	976	965	954	943
.223	1089	1079	1068	1053	1039	1025	1015	1001	988	976	965	954	943
.224	1093	1079	1068	1053	1039	1025	1015	1001	988	976	965	954	943
.225	1097	1080	1066	1048	1034	1019	1005	992	979	967	956	945	934
.226	1102	1084	1067	1052	1038	1024	1010	996	983	971	960	949	938
.227	1106	1097	1080	1063	1047	1033	1019	1005	992	979	967	956	945
.228	1111	1097	1087	1072	1057	1043	1029	1015	1001	988	976	965	954
.229	1115	1101	1098	1085	1070	1055	1041	1027	1013	1000	987	975	964
.230	1119	1124	1109	1093	1076	1060	1047	1033	1019	1005	993	982	971
.231	1124	1128	1114	1099	1084	1069	1055	1041	1027	1013	1000	989	978
.232	1128	1132	1118	1103	1088	1074	1059	1045	1031	1017	1003	991	980
.233	1132	1137	1123	1108	1093	1078	1063	1049	1035	1021	1006	995	984
.234	1137	1141	1127	1112	1097	1083	1068	1053	1039	1025	1011	999	988
.235	1141	1145	1131	1116	1101	1086	1071	1056	1042	1028	1014	1000	989
.236	1145	1149	1134	1120	1105	1090	1076	1061	1047	1033	1019	1005	994
.237	1150	1154	1140	1125	1110	1095	1080	1065	1051	1037	1023	1009	998
.238	1154	1159	1144	1130	1115	1099	1084	1069	1055	1041	1027	1013	1002
.239	1159	1163	1149	1133	1118	1103	1088	1073	1059	1045	1031	1017	1003
.240	1163	1167	1153	1137	1122	1107	1092	1077	1064	1050	1036	1022	1007
.241	1167	1172	1157	1142	1128	1113	1098	1083	1068	1054	1040	1026	1011
.242	1172	1176	1161	1146	1130	1115	1100	1085	1071	1056	1042	1028	1013
.243	1176	1180	1165	1150	1135	1119	1104	1089	1075	1060	1046	1032	1017
.244	1180	1184	1169	1154	1139	1124	1109	1094	1079	1065	1051	1037	1022
.245	1184	1189	1174	1159	1143	1128	1113	1098	1083	1068	1054	1040	1025
.246	1189	1193	1178	1163	1148	1133	1118	1103	1088	1073	1059	1045	1030
.247	1193	1197	1182	1167	1151	1136	1121	1106	1091	1076	1062	1048	1034
.248	1197	1201	1192	1177	1162	1147	1132	1117	1102	1087	1073	1059	1045
.249	1201	1205	1193	1178	1163	1148	1133	1118	1103	1088	1074	1060	1046
.250	1205	1216	1202	1187	1171	1155	1140	1125	1110	1095	1081	1067	1053

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichiometric fuel-air ratio, S	Ideal combustion-temperature rise, ΔT , °R												
	Inlet-air temperature, °R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
0.251	1221	1205	1191	1175	1160	1144	1120	1114	1100	1096	1073	1061	1050
0.252	1225	1210	1195	1179	1164	1148	1133	1118	1104	1090	1077	1065	1054
0.253	1230	1200	1184	1168	1152	1137	1122	1108	1094	1081	1069	1057	
0.254	1234	1219	1204	1188	1178	1156	1141	1126	1112	1098	1085	1073	1061
0.255	1238	1223	1208	1192	1176	1160	1145	1130	1116	1102	1089	1077	1065
0.256	1243	1238	1218	1196	1180	1164	1140	1134	1120	1106	1093	1081	1069
0.257	1247	1233	1215	1200	1185	1169	1153	1138	1124	1110	1097	1085	1073
0.258	1251	1236	1221	1205	1189	1173	1157	1142	1128	1114	1101	1088	1077
0.259	1256	1240	1225	1209	1193	1177	1161	1146	1132	1118	1105	1092	1081
0.260	1260	1245	1229	1213	1197	1181	1165	1150	1136	1122	1109	1096	1084
0.261	1264	1249	1233	1217	1201	1185	1169	1154	1139	1126	1113	1100	1088
0.262	1269	1253	1238	1221	1205	1189	1173	1158	1143	1130	1116	1104	1092
0.263	1273	1258	1242	1226	1209	1193	1177	1162	1147	1133	1120	1108	1096
0.264	1277	1262	1246	1230	1213	1197	1181	1166	1151	1137	1124	1112	1100
0.265	1282	1266	1250	1234	1218	1201	1185	1170	1155	1141	1128	1115	1103
0.266	1286	1270	1255	1238	1222	1205	1189	1174	1159	1145	1138	1129	1107
0.267	1290	1275	1259	1243	1226	1209	1194	1178	1163	1149	1136	1123	1111
0.268	1295	1279	1263	1246	1230	1214	1198	1182	1167	1153	1140	1127	1115
0.269	1299	1283	1267	1251	1234	1218	1208	1196	1171	1157	1144	1131	1119
0.270	1303	1287	1271	1255	1238	1222	1205	1190	1175	1161	1147	1135	1122
0.271	1307	1292	1276	1259	1242	1226	1210	1194	1179	1165	1151	1138	1126
0.272	1312	1296	1280	1265	1246	1230	1214	1198	1183	1169	1155	1142	1130
0.273	1316	1300	1284	1267	1250	1234	1218	1202	1187	1173	1159	1146	1134
0.274	1320	1304	1288	1271	1255	1238	1222	1206	1191	1176	1163	1150	1138
0.275	1325	1309	1292	1275	1259	1242	1226	1210	1195	1180	1167	1154	1141
0.276	1329	1313	1297	1280	1263	1246	1230	1214	1199	1184	1171	1157	1145
0.277	1333	1317	1301	1284	1267	1250	1234	1218	1203	1188	1174	1161	1149
0.278	1338	1321	1305	1288	1271	1254	1238	1222	1207	1192	1178	1165	1153
0.279	1342	1325	1309	1298	1275	1258	1242	1226	1210	1195	1182	1169	1156
0.280	1346	1330	1313	1296	1279	1263	1246	1230	1214	1200	1186	1173	1160
0.281	1350	1334	1317	1300	1283	1266	1250	1234	1218	1204	1190	1176	1164
0.282	1355	1338	1322	1304	1287	1270	1254	1238	1222	1208	1194	1180	1168
0.283	1359	1348	1336	1308	1291	1274	1258	1242	1226	1211	1197	1184	1171
0.284	1363	1347	1330	1313	1295	1276	1262	1246	1230	1215	1201	1188	1175
0.285	1367	1351	1337	1317	1300	1282	1266	1249	1234	1219	1205	1193	1179
0.286	1372	1355	1338	1321	1304	1286	1270	1253	1238	1223	1209	1195	1183
0.287	1376	1359	1342	1326	1308	1290	1274	1257	1242	1227	1213	1199	1186
0.288	1380	1363	1347	1329	1312	1294	1278	1261	1246	1231	1216	1203	1190
0.289	1384	1368	1351	1333	1316	1298	1282	1265	1250	1235	1220	1207	1194
0.290	1389	1372	1355	1337	1320	1302	1286	1269	1253	1238	1224	1210	1196
0.291	1393	1376	1359	1341	1324	1306	1290	1273	1257	1242	1228	1214	1201
0.292	1397	1380	1363	1345	1328	1311	1294	1277	1261	1246	1232	1218	1205
0.293	1401	1384	1367	1350	1333	1315	1296	1281	1265	1250	1235	1222	1209
0.294	1406	1389	1371	1353	1336	1319	1302	1285	1269	1254	1239	1226	1213
0.295	1410	1393	1376	1358	1340	1323	1305	1289	1273	1258	1243	1229	1216
0.296	1414	1397	1380	1362	1344	1327	1309	1293	1277	1261	1247	1233	1220
0.297	1418	1401	1384	1366	1346	1331	1313	1297	1281	1265	1251	1237	1223
0.298	1422	1405	1388	1370	1352	1335	1317	1301	1284	1269	1254	1240	1227
0.299	1427	1409	1392	1374	1356	1339	1321	1304	1288	1273	1258	1244	1231
300	1431	1414	1396	1378	1360	1343	1328	1308	1292	1277	1262	1248	1235

S = 0.201 to 0.300

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichiometric fuel-air ratio, S	Ideal combustion-temperature rise, ΔT , °R												
	Inlet-air temperature, °R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
0.301	14.35	14.18	14.00	13.82	13.64	13.46	13.29	13.12	12.96	12.81	12.66	12.52	12.38
302	14.35	14.26	14.04	13.86	13.68	13.50	13.33	13.16	13.00	12.85	12.70	12.55	12.42
303	14.43	14.36	14.08	13.90	13.72	13.54	13.37	13.30	13.04	12.89	12.73	12.59	12.46
304	14.48	14.30	14.12	13.94	13.76	13.58	13.41	13.24	13.08	12.93	12.77	12.63	12.49
305	14.52	14.34	14.17	13.98	13.80	13.62	13.45	13.28	13.12	12.96	12.81	12.66	12.53
306	14.56	14.38	14.21	14.02	13.84	13.66	13.49	13.32	13.15	13.00	12.84	12.70	12.56
307	14.60	14.43	14.25	14.05	13.88	13.70	13.53	13.36	13.19	13.03	12.88	12.74	12.60
308	14.64	14.47	14.29	14.10	13.98	13.74	13.57	13.40	13.23	13.07	12.90	12.77	12.64
309	14.68	14.51	14.33	14.14	13.96	13.78	13.61	13.44	13.27	13.11	12.95	12.81	12.67
310	14.72	14.55	14.37	14.16	14.00	13.82	13.65	13.47	13.31	13.15	12.99	12.85	12.71
311	14.77	14.59	14.41	14.26	14.04	13.86	13.69	13.51	13.35	13.19	13.03	12.88	12.74
312	14.81	14.63	14.45	14.27	14.08	13.90	13.73	13.55	13.39	13.23	13.07	12.93	12.79
313	14.85	14.67	14.49	14.31	14.12	13.94	13.76	13.59	13.42	13.26	13.11	12.96	12.82
314	14.89	14.71	14.53	14.36	14.16	13.96	13.80	13.63	13.46	13.30	13.14	12.99	12.85
315	14.93	14.75	14.57	14.39	14.20	14.02	13.84	13.67	13.50	13.34	13.18	13.03	12.89
316	14.97	14.79	14.61	14.47	14.28	14.06	13.88	13.71	13.54	13.37	13.22	13.07	12.93
317	15.01	14.83	14.63	14.47	14.28	14.08	13.90	13.73	13.56	13.41	13.26	13.10	12.96
318	15.06	14.88	14.69	14.51	14.32	14.14	13.96	13.79	13.62	13.45	13.29	13.14	13.00
319	15.10	14.92	14.73	14.55	14.36	14.18	14.00	13.82	13.65	13.49	13.33	13.18	13.03
320	15.14	14.96	14.77	14.59	14.40	14.22	14.04	13.86	13.69	13.53	13.37	13.21	13.07
321	15.18	15.00	14.81	14.63	14.44	14.26	14.08	13.90	13.73	13.56	13.40	13.25	13.10
322	15.22	15.04	14.85	14.67	14.48	14.30	14.12	13.94	13.77	13.60	13.44	13.29	13.14
323	15.26	15.08	14.89	14.71	14.52	14.34	14.16	13.98	13.81	13.64	13.48	13.32	13.16
324	15.30	15.12	14.93	14.75	14.56	14.37	14.19	14.02	13.84	13.68	13.51	13.36	13.21
325	15.34	15.16	14.98	14.79	14.60	14.41	14.23	14.05	13.86	13.71	13.55	13.40	13.25
326	15.39	15.20	15.02	14.83	14.64	14.45	14.27	14.09	13.92	13.75	13.59	13.43	13.28
327	15.43	15.24	15.06	14.87	14.68	14.49	14.31	14.13	13.96	13.79	13.63	13.47	13.32
328	15.47	15.28	15.10	14.91	14.72	14.53	14.35	14.17	14.00	13.83	13.66	13.51	13.36
329	15.51	15.32	15.14	14.95	14.76	14.57	14.39	14.21	14.04	13.86	13.70	13.54	13.39
330	15.55	15.36	15.18	14.98	14.80	14.61	14.43	14.25	14.07	13.90	13.74	13.58	13.43
331	15.59	15.40	15.22	15.02	14.84	14.65	14.47	14.29	14.11	13.94	13.77	13.61	13.46
332	15.63	15.44	15.26	15.06	14.87	14.69	14.51	14.33	14.15	13.98	13.81	13.65	13.50
333	15.67	15.49	15.30	15.10	14.91	14.73	14.54	14.36	14.19	14.01	13.85	13.69	13.53
334	15.71	15.53	15.34	15.14	14.95	14.77	14.58	14.40	14.22	14.05	13.88	13.72	13.57
335	15.75	15.57	15.38	15.18	14.99	14.81	14.62	14.44	14.26	14.09	13.93	13.76	13.60
336	15.79	15.61	15.42	15.22	15.03	14.84	14.65	14.47	14.29	14.11	13.94	13.77	13.61
337	15.84	15.63	15.46	15.26	15.07	14.88	14.70	14.52	14.34	14.16	13.99	13.83	13.68
338	15.88	15.69	15.50	15.30	15.11	14.92	14.74	14.55	14.38	14.20	14.03	13.87	13.71
339	15.92	15.73	15.54	15.34	15.13	14.96	14.76	14.59	14.41	14.24	14.07	13.90	13.75
340	15.96	15.77	15.58	15.38	15.19	15.00	14.81	14.63	14.45	14.27	14.10	13.94	13.78
341	16.00	15.81	15.62	15.42	15.23	15.04	14.85	14.67	14.49	14.31	14.14	13.97	13.82
342	16.04	15.85	15.66	15.46	15.27	15.08	14.89	14.71	14.53	14.35	14.18	14.01	13.85
343	16.08	15.89	15.70	15.50	15.31	15.12	14.93	14.75	14.56	14.38	14.21	14.05	13.89
344	16.12	15.93	15.74	15.54	15.35	15.16	14.97	14.78	14.60	14.42	14.26	14.08	13.92
345	16.16	15.97	15.78	15.58	15.38	15.19	15.01	14.82	14.64	14.46	14.28	14.12	13.96
346	16.20	16.01	15.82	15.62	15.42	15.23	15.04	14.86	14.68	14.50	14.32	14.15	13.99
347	16.24	16.05	15.86	15.66	15.46	15.27	15.08	14.90	14.71	14.53	14.36	14.19	14.03
348	16.28	16.09	15.90	15.70	15.50	15.31	15.12	14.93	14.75	14.57	14.39	14.23	14.06
349	16.32	16.13	15.94	15.74	15.54	15.35	15.16	14.97	14.79	14.61	14.43	14.26	14.10
350	16.36	16.17	15.97	15.78	15.58	15.39	15.20	15.01	14.83	14.64	14.47	14.30	14.13

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichio- metric fuel- air ratio, <i>S</i>	Ideal combustion-temperature rise, ΔT , °R												
	Inlet-air temperature, °R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
.351	1640	1681	1601	1582	1568	1543	1524	1505	1486	1468	1450	1433	1417
.352	1644	1685	1605	1585	1566	1546	1527	1509	1490	1472	1454	1437	1421
.353	1648	1689	1609	1589	1570	1550	1531	1518	1494	1475	1458	1440	1424
.354	1653	1683	1613	1593	1574	1554	1535	1516	1498	1479	1461	1444	1428
.355	1657	1687	1617	1597	1577	1558	1539	1520	1501	1483	1465	1448	1431
.356	1661	1684	1621	1601	1581	1562	1543	1524	1505	1486	1468	1451	1435
.357	1665	1685	1625	1605	1585	1566	1547	1527	1509	1490	1472	1455	1438
.358	1669	1684	1629	1609	1589	1570	1550	1531	1512	1494	1476	1458	1442
.359	1673	1683	1633	1613	1593	1573	1554	1535	1516	1497	1479	1462	1445
.360	1677	1687	1637	1617	1597	1577	1558	1539	1520	1501	1483	1465	1448
.361	1681	1681	1641	1621	1601	1581	1562	1543	1524	1505	1486	1469	1452
.362	1685	1665	1645	1625	1605	1585	1566	1546	1527	1508	1490	1472	1455
.363	1689	1669	1649	1628	1608	1589	1569	1550	1531	1512	1494	1476	1459
.364	1693	1673	1683	1638	1618	1593	1573	1554	1535	1516	1497	1479	1462
.365	1697	1677	1657	1636	1616	1596	1577	1558	1538	1519	1501	1483	1466
.366	1701	1681	1661	1640	1620	1600	1581	1561	1542	1523	1504	1485	1469
.367	1705	1685	1665	1644	1624	1604	1584	1565	1546	1526	1508	1490	1473
.368	1709	1689	1668	1648	1628	1608	1588	1569	1550	1531	1511	1494	1476
.369	1713	1693	1678	1658	1638	1618	1598	1578	1553	1534	1515	1497	1480
.370	1717	1697	1676	1656	1635	1616	1596	1576	1557	1537	1519	1501	1483
.371	1721	1701	1680	1660	1640	1620	1600	1580	1561	1542	1523	1504	1487
.372	1725	1705	1684	1664	1643	1623	1603	1584	1564	1545	1526	1508	1490
.373	1729	1708	1688	1667	1647	1627	1607	1587	1568	1548	1529	1511	1494
.374	1733	1712	1692	1671	1651	1631	1611	1591	1572	1553	1533	1515	1497
.375	1737	1716	1696	1675	1655	1635	1615	1595	1575	1555	1536	1518	1501
.376	1741	1720	1700	1679	1658	1638	1618	1599	1579	1559	1540	1522	1504
.377	1745	1724	1704	1683	1662	1642	1622	1602	1583	1563	1544	1525	1507
.378	1749	1728	1708	1687	1666	1646	1626	1606	1586	1566	1547	1529	1511
.379	1753	1732	1712	1691	1670	1650	1630	1610	1590	1570	1551	1532	1514
.380	1757	1736	1715	1694	1674	1654	1633	1613	1593	1573	1554	1536	1518
.381	1761	1740	1719	1698	1678	1657	1637	1617	1597	1577	1558	1539	1521
.382	1765	1744	1723	1702	1681	1661	1641	1621	1601	1581	1561	1543	1525
.383	1769	1748	1727	1706	1683	1665	1645	1624	1604	1584	1565	1546	1528
.384	1773	1758	1731	1710	1689	1669	1648	1628	1608	1588	1568	1550	1531
.385	1776	1756	1735	1714	1693	1673	1652	1632	1612	1591	1572	1553	1535
.386	1780	1760	1739	1718	1697	1676	1656	1636	1616	1595	1575	1557	1538
.387	1784	1764	1743	1721	1701	1680	1660	1639	1619	1599	1579	1560	1542
.388	1788	1767	1747	1725	1704	1684	1663	1643	1623	1602	1588	1563	1545
.389	1792	1771	1750	1729	1708	1688	1667	1647	1626	1606	1588	1567	1549
.390	1796	1775	1754	1733	1712	1691	1671	1650	1630	1609	1590	1570	1552
.391	1800	1779	1758	1737	1716	1695	1674	1654	1633	1613	1593	1574	1555
.392	1804	1783	1768	1741	1720	1699	1678	1658	1637	1616	1597	1577	1559
.393	1808	1787	1766	1744	1723	1703	1682	1661	1641	1620	1600	1581	1562
.394	1812	1791	1770	1746	1727	1706	1686	1665	1644	1624	1604	1584	1566
.395	1816	1795	1774	1752	1731	1710	1689	1669	1648	1627	1607	1588	1569
.396	1820	1799	1777	1756	1735	1714	1693	1672	1652	1631	1611	1591	1572
.397	1824	1803	1781	1760	1738	1718	1697	1676	1655	1634	1614	1595	1576
.398	1828	1807	1785	1764	1748	1721	1700	1680	1659	1638	1618	1598	1579
.399	1832	1810	1789	1767	1746	1725	1704	1683	1662	1641	1621	1601	1583
.400	1836	1814	1793	1771	1750	1729	1708	1687	1666	1645	1625	1605	1586

S = 0.301 to 0.400

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichio-metric fuel-air ratio, $\frac{S}{S}$	Ideal combustion-temperature rise, ΔT , °R												
	Inlet-air temperature, °R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
4.01	1840	1818	1797	1775	1754	1733	1711	1690	1670	1648	1628	1608	1589
4.02	1844	1808	1801	1779	1757	1736	1715	1694	1673	1652	1632	1612	1592
4.03	1850	1830	1805	1783	1761	1740	1719	1698	1677	1656	1636	1616	1596
4.04	1851	1830	1806	1787	1765	1744	1723	1701	1680	1659	1638	1619	1600
4.05	1855	1834	1812	1790	1769	1748	1726	1705	1684	1663	1642	1622	1603
4.06	1859	1838	1816	1794	1773	1751	1730	1709	1687	1666	1645	1626	1606
4.07	1863	1842	1820	1798	1776	1755	1734	1712	1691	1670	1649	1629	1610
4.08	1867	1845	1824	1802	1780	1759	1737	1715	1695	1673	1653	1633	1613
4.09	1871	1849	1826	1806	1784	1763	1741	1720	1698	1677	1656	1636	1616
4.10	1875	1853	1832	1810	1788	1766	1745	1723	1702	1680	1659	1639	1619
4.11	1879	1857	1838	1813	1792	1770	1748	1727	1705	1684	1663	1643	1623
4.12	1883	1861	1839	1817	1795	1774	1752	1730	1709	1687	1666	1646	1627
4.13	1887	1865	1843	1821	1799	1777	1756	1734	1712	1691	1670	1649	1630
4.14	1890	1869	1847	1825	1803	1781	1759	1738	1716	1694	1673	1653	1633
4.15	1894	1873	1851	1829	1807	1785	1763	1741	1719	1698	1677	1656	1636
4.16	1898	1876	1855	1832	1810	1789	1767	1745	1723	1701	1680	1660	1640
4.17	1902	1880	1858	1836	1814	1792	1770	1748	1727	1705	1683	1663	1643
4.18	1906	1884	1862	1840	1818	1796	1774	1752	1730	1708	1687	1666	1647
4.19	1910	1888	1866	1844	1822	1800	1778	1756	1734	1712	1690	1670	1650
4.20	1914	1892	1870	1848	1825	1803	1781	1759	1737	1715	1694	1673	1653
4.21	1918	1896	1874	1851	1829	1807	1785	1763	1741	1719	1697	1677	1657
4.22	1922	1900	1878	1855	1833	1811	1789	1766	1744	1722	1701	1680	1660
4.23	1926	1904	1881	1859	1837	1814	1796	1774	1752	1730	1708	1687	1667
4.24	1929	1907	1885	1863	1840	1816	1794	1773	1751	1729	1707	1687	1667
4.25	1933	1911	1889	1867	1844	1822	1800	1777	1755	1733	1711	1690	1670
4.26	1937	1915	1893	1870	1846	1826	1804	1781	1758	1736	1714	1693	1673
4.27	1941	1919	1897	1874	1852	1830	1807	1784	1762	1740	1718	1697	1677
4.28	1945	1923	1900	1878	1855	1833	1810	1788	1765	1743	1721	1700	1680
4.29	1949	1929	1904	1880	1858	1836	1814	1791	1769	1746	1724	1703	1683
4.30	1953	1934	1918	1895	1873	1850	1828	1805	1783	1760	1738	1717	1696
4.31	1956	1938	1916	1889	1867	1846	1824	1801	1779	1757	1735	1714	1693
4.32	1960	1942	1921	1895	1873	1851	1829	1806	1783	1760	1738	1717	1696
4.33	1964	1946	1924	1897	1874	1851	1829	1807	1785	1764	1742	1720	1700
4.34	1968	1948	1923	1900	1878	1855	1833	1809	1786	1764	1742	1721	1700
4.35	1972	1949	1927	1904	1881	1859	1836	1813	1790	1767	1745	1724	1703
4.36	1975	1953	1931	1906	1885	1862	1839	1816	1793	1770	1748	1727	1706
4.37	1979	1957	1934	1918	1889	1866	1843	1820	1797	1774	1752	1730	1710
4.38	1983	1961	1938	1915	1898	1870	1847	1823	1800	1777	1755	1734	1713
4.39	1987	1965	1942	1919	1896	1873	1850	1827	1804	1781	1759	1737	1716
4.40	1991	1968	1946	1903	1877	1854	1830	1807	1784	1762	1740	1719	1698
4.41	1995	1972	1949	1985	1903	1880	1857	1834	1811	1788	1765	1744	1723
4.42	1998	1976	1953	1930	1907	1884	1861	1838	1814	1791	1769	1747	1726
4.43	2002	1980	1957	1934	1911	1888	1865	1841	1818	1794	1772	1750	1729
4.44	2006	1984	1961	1938	1915	1891	1868	1844	1821	1798	1775	1754	1733
4.45	2010	1987	1964	1941	1918	1893	1870	1848	1825	1801	1779	1757	1736
4.46	2014	1991	1968	1945	1928	1899	1875	1852	1828	1805	1782	1760	1739
4.47	2017	1995	1972	1949	1926	1904	1879	1856	1833	1808	1785	1764	1743
4.48	2021	1999	1976	1953	1929	1905	1882	1859	1835	1812	1789	1767	1746
4.49	2025	2000	1979	1956	1935	1909	1886	1863	1840	1815	1792	1770	1749
4.50	2029	2006	1983	1960	1937	1913	1890	1866	1843	1818	1798	1774	1753

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichiometric fuel-air ratio, S	Ideal combustion-temperature rise, AT, °R												
	Inlet-air temperature, °R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
.451	2033	2010	1967	1964	1940	1917	1893	1869	1845	1822	1799	1777	1756
.452	2036	2014	1991	1967	1944	1980	1897	1873	1849	1826	1803	1780	1759
.453	2040	2017	1994	1971	1947	1924	1900	1876	1852	1829	1806	1783	1762
.454	2044	2021	1998	1975	1951	1928	1904	1880	1856	1832	1809	1787	1765
.455	2048	2025	2002	1978	1955	1931	1907	1883	1859	1835	1812	1790	1769
.456	2052	2029	2006	1988	1958	1935	1911	1887	1863	1839	1816	1793	1772
.457	2055	2032	2009	1986	1968	1938	1914	1890	1866	1843	1819	1797	1775
.458	2059	2036	2013	1989	1966	1942	1918	1894	1870	1846	1822	1800	1778
.459	2063	2040	2017	1993	1960	1945	1921	1897	1873	1849	1826	1803	1781
.460	2067	2044	2020	1997	1973	1949	1925	1901	1876	1852	1829	1806	1785
.461	2070	2047	2024	2000	1977	1953	1929	1904	1880	1856	1833	1810	1788
.462	2074	2051	2028	2004	1980	1956	1932	1907	1883	1859	1836	1813	1791
.463	2078	2055	2031	2008	1984	1960	1936	1911	1887	1863	1839	1816	1794
.464	2082	2059	2035	2011	1987	1963	1939	1914	1890	1866	1842	1820	1798
.465	2086	2064	2039	2015	1991	1967	1943	1918	1893	1869	1846	1823	1801
.466	2089	2066	2043	2019	1995	1971	1946	1921	1897	1873	1849	1826	1804
.467	2093	2066	2046	2019	1998	1974	1950	1925	1900	1876	1852	1829	1807
.468	2097	2073	2050	2026	1998	1978	1953	1928	1904	1879	1856	1833	1810
.469	2101	2077	2054	2030	2006	1981	1957	1932	1907	1883	1859	1836	1814
.470	2104	2081	2057	2033	2009	1985	1960	1935	1911	1886	1862	1839	1817
.471	2108	2085	2061	2037	2013	1988	1964	1939	1914	1889	1865	1842	1820
.472	2112	2088	2065	2041	2016	1992	1967	1942	1917	1893	1869	1846	1823
.473	2115	2093	2068	2044	2020	1995	1971	1946	1921	1896	1873	1850	1826
.474	2119	2096	2072	2048	2022	1999	1974	1949	1924	1899	1875	1852	1830
.475	2123	2099	2076	2051	2027	2003	1978	1953	1928	1903	1879	1856	1833
.476	2127	2103	2079	2055	2031	2006	1981	1956	1931	1906	1882	1859	1836
.477	2130	2107	2083	2059	2034	2010	1985	1959	1934	1909	1885	1862	1839
.478	2134	2110	2087	2062	2038	2013	1988	1963	1938	1913	1889	1866	1843
.479	2138	2114	2090	2066	2041	2017	1998	1966	1941	1916	1892	1868	1845
.480	2142	2118	2094	2070	2045	2020	1995	1970	1944	1919	1895	1872	1849
.481	2145	2122	2098	2073	2049	2024	1998	1973	1948	1923	1898	1875	1852
.482	2149	2125	2101	2077	2052	2027	1996	1976	1951	1926	1902	1878	1855
.483	2153	2129	2105	2080	2056	2031	2005	1980	1955	1930	1906	1881	1858
.484	2156	2133	2108	2084	2059	2034	2001	1983	1958	1933	1908	1884	1861
.485	2160	2136	2112	2088	2063	2038	2007	1987	1961	1936	1913	1888	1865
.486	2164	2140	2116	2091	2066	2041	2015	1990	1965	1939	1915	1891	1868
.487	2167	2144	2119	2095	2070	2045	2019	1994	1968	1943	1918	1894	1871
.488	2171	2147	2123	2098	2073	2048	2023	1997	1971	1946	1921	1897	1874
.489	2175	2151	2127	2105	2077	2052	2028	2000	1975	1949	1925	1901	1877
.490	2178	2155	2130	2106	2081	2055	2030	2004	1978	1953	1928	1904	1880
.491	2182	2158	2134	2109	2084	2059	2033	2007	1982	1956	1931	1907	1883
.492	2186	2162	2137	2113	2088	2063	2037	2011	1985	1959	1934	1910	1887
.493	2190	2165	2141	2116	2091	2066	2040	2014	1988	1963	1938	1913	1890
.494	2193	2169	2145	2120	2095	2069	2043	2017	1998	1966	1941	1917	1893
.495	2197	2173	2148	2123	2098	2073	2047	2021	1995	1969	1944	1920	1896
.496	2201	2176	2152	2127	2092	2076	2050	2024	1998	1972	1947	1923	1899
.497	2204	2180	2155	2131	2095	2080	2054	2028	1995	1976	1951	1926	1902
.498	2208	2184	2159	2134	2109	2083	2057	2031	2005	1979	1954	1929	1905
.499	2212	2187	2163	2138	2113	2088	2061	2034	2008	1982	1957	1932	1909
.500	2215	2191	2166	2141	2116	2090	2064	2038	2012	1995	1960	1936	1912

S = 0.401 to 0.500

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichio-metric fuel-air ratio, S	Ideal combustion-temperature rise, ΔT , $^{\circ}\text{R}$												
	Inlet-air temperature, $^{\circ}\text{R}$												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
0.500	194	2170	2145	2119	2097	2074	2051	2028	2005	1982	1964	1945	1925
0.501	1948	2173	2148	2122	2099	2074	2051	2028	2005	1982	1967	1948	1928
0.502	1950	2177	2152	2126	2103	2078	2055	2032	2009	1986	1968	1949	1929
0.503	1952	2180	2155	2130	2104	2081	2054	2031	2008	1986	1969	1950	1930
0.504	1954	2183	2157	2132	2107	2084	2057	2034	2011	1987	1970	1951	1931
0.505	1955	2184	2159	2133	2107	2084	2058	2035	2012	1987	1973	1952	1932
0.506	1957	2188	2162	2137	2110	2084	2058	2032	2006	1980	1955	1934	1914
0.507	1958	2191	2166	2140	2114	2088	2061	2035	2009	1983	1958	1934	1914
0.508	1959	2195	2169	2144	2117	2091	2065	2038	2012	1987	1962	1937	1917
0.509	1960	2198	2173	2147	2121	2094	2068	2042	2016	1990	1965	1940	1919
0.510	1961	2199	2176	2150	2124	2098	2071	2045	2021	1993	1968	1943	1923
0.511	1965	2205	2180	2154	2128	2101	2075	2049	2022	1996	1971	1947	1927
0.512	1966	2209	2185	2157	2131	2104	2078	2052	2025	1990	1974	1950	1928
0.513	1967	2213	2187	2161	2134	2108	2081	2055	2029	1993	1978	1953	1933
0.514	1968	2217	2203	2176	2149	2124	2098	2072	2046	1994	1981	1956	1936
0.515	1969	2219	2194	2168	2141	2115	2086	2060	2034	1999	1984	1960	1940
0.516	1973	2248	2223	2197	2171	2145	2118	2091	2065	2038	2013	1987	1968
0.517	1976	2252	2226	2201	2175	2148	2121	2095	2068	2042	2016	1990	1965
0.518	1980	2255	2230	2204	2178	2151	2125	2098	2071	2045	2019	1994	1974
0.519	1984	2259	2233	2208	2181	2156	2128	2101	2075	2049	2026	1997	1972
0.520	1987	2263	2237	2211	2185	2158	2131	2105	2078	2053	2026	1990	1975
0.521	1989	2266	2240	2215	2188	2161	2135	2108	2081	2058	2039	2003	1978
0.522	1994	2269	2244	2218	2198	2165	2138	2111	2085	2061	2038	2006	1981
0.523	1998	2273	2247	2222	2195	2168	2141	2115	2088	2065	2043	2009	1984
0.524	2001	2276	2251	2225	2199	2172	2145	2118	2091	2068	2043	2013	1987
0.525	2005	2280	2254	2228	2202	2178	2148	2121	2094	2070	2046	2016	1990
0.526	2007	2283	2258	2232	2205	2182	2155	2124	2098	2071	2045	2019	1993
0.527	2011	2287	2261	2235	2209	2189	2162	2135	2104	2078	2051	2025	1999
0.528	2016	2291	2265	2239	2212	2185	2158	2131	2104	2078	2051	2023	1993
0.529	2018	2294	2268	2242	2216	2189	2161	2134	2106	2081	2054	2031	2006
0.530	2023	2298	2278	2246	2219	2192	2165	2138	2111	2084	2058	2031	2006
0.531	2026	2301	2275	2249	2222	2195	2168	2141	2114	2087	2061	2035	2009
0.532	2030	2279	2253	2226	2198	2171	2144	2117	2090	2064	2038	2012	1984
0.533	2033	2283	2256	2229	2192	2175	2148	2121	2094	2067	2041	2015	1985
0.534	2037	2312	2256	2229	2193	2170	2143	2116	2097	2070	2044	2018	1981
0.535	2041	2315	2269	2236	2209	2176	2148	2127	2100	2073	2047	2021	1990
0.536	2044	2319	2293	2266	2239	2181	2157	2130	2103	2077	2050	2024	1994
0.537	2048	2320	2296	2270	2243	2184	2161	2134	2107	2080	2053	2027	1994
0.538	2051	2326	2300	2273	2246	2181	2151	2124	2098	2061	2037	2030	1994
0.539	2055	2329	2303	2277	2250	2228	2194	2167	2140	2113	2086	2059	2033
0.540	2058	2333	2307	2280	2253	2225	2198	2170	2143	2116	2089	2063	2036
0.541	2062	2336	2310	2284	2256	2229	2201	2174	2147	2119	2092	2066	2039
0.542	2065	2340	2314	2287	2260	2233	2204	2177	2150	2123	2096	2069	2042
0.543	2069	2343	2317	2290	2263	2236	2206	2180	2153	2126	2099	2072	2045
0.544	2072	2347	2318	2294	2267	2239	2208	2181	2156	2129	2102	2075	2048
0.545	2076	2350	2324	2297	2270	2242	2214	2187	2159	2132	2105	2078	2051
0.546	2079	2354	2327	2301	2273	2245	2217	2190	2163	2135	2108	2081	2054
0.547	2083	2357	2331	2304	2277	2249	2221	2193	2166	2138	2111	2084	2057
0.548	2086	2361	2334	2307	2280	2252	2224	2197	2169	2142	2114	2087	2060
0.549	2089	2364	2338	2311	2287	2255	2227	2200	2172	2145	2117	2090	2063
0.550	2094	2368	2341	2314	2291	2262	2235	2207	2176	2148	2121	2093	2066

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TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT, °R

Fraction of stoichiometric fuel-air ratio, S	Ideal combustion-temperature rise, AT, °R												
	Inlet-air temperature, °R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
.551	2397	2371	2345	2318	2290	2262	2234	2206	2179	2151	2124	2096	2069
.552	2401	2375	2348	2321	2293	2265	2237	2209	2182	2154	2127	2099	2072
.553	2404	2378	2352	2324	2297	2268	2240	2213	2185	2157	2130	2102	2075
.554	2408	2382	2355	2328	2300	2272	2244	2216	2188	2161	2133	2105	2078
.555	2411	2385	2358	2331	2304	2275	2247	2219	2191	2164	2136	2108	2081
.556	2415	2388	2362	2335	2307	2278	2250	2222	2195	2167	2139	2111	2084
.557	2418	2398	2365	2338	2310	2282	2253	2225	2198	2170	2142	2115	2087
.558	2422	2399	2369	2341	2314	2285	2257	2229	2197	2173	2145	2118	2093
.559	2429	2408	2376	2348	2320	2291	2263	2235	2207	2176	2148	2121	2096
.560	2432	2406	2379	2350	2322	2293	2265	2237	2209	2179	2151	2124	2098
.561	2436	2409	2382	2355	2327	2298	2270	2242	2214	2183	2155	2127	2098
.562	2439	2415	2386	2358	2330	2301	2273	2245	2217	2186	2158	2133	2104
.563	2443	2416	2389	2362	2334	2305	2276	2248	2220	2192	2164	2136	2107
.564	2446	2430	2393	2365	2337	2308	2279	2251	2223	2195	2167	2139	2110
.565	2449	2423	2396	2368	2340	2311	2283	2255	2227	2198	2170	2142	2106
.566	2453	2427	2399	2371	2344	2314	2285	2256	2228	2199	2172	2144	2119
.567	2456	2430	2403	2375	2347	2318	2289	2261	2233	2204	2176	2148	2120
.568	2460	2433	2406	2378	2350	2321	2292	2264	2236	2207	2179	2150	2125
.570	2463	2437	2410	2382	2354	2324	2295	2267	2239	2211	2183	2153	2125
.571	2467	2440	2413	2385	2357	2328	2299	2270	2242	2214	2185	2156	2126
.572	2470	2444	2416	2389	2360	2331	2303	2274	2246	2217	2188	2159	2131
.573	2474	2447	2418	2392	2363	2334	2305	2277	2249	2220	2191	2162	2134
.574	2477	2451	2423	2395	2367	2337	2308	2280	2252	2223	2194	2165	2136
.575	2481	2454	2427	2399	2370	2341	2312	2283	2255	2226	2197	2168	2139
.576	2484	2457	2430	2408	2373	2344	2315	2286	2258	2229	2200	2171	2143
.577	2488	2461	2433	2405	2377	2347	2318	2289	2261	2232	2203	2174	2145
.578	2491	2464	2437	2409	2380	2350	2321	2293	2264	2235	2206	2177	2148
.579	2495	2468	2440	2418	2383	2354	2324	2296	2267	2238	2209	2180	2151
.580	2498	2471	2444	2415	2387	2357	2328	2299	2270	2241	2212	2183	2154
.581	2501	2475	2447	2419	2390	2360	2331	2302	2273	2244	2215	2186	2156
.582	2504	2478	2450	2420	2393	2362	2332	2303	2274	2245	2216	2187	2158
.583	2505	2481	2454	2425	2396	2367	2337	2308	2275	2246	2217	2188	2159
.584	2511	2485	2457	2429	2400	2375	2340	2312	2283	2253	2224	2195	2166
.585	2515	2488	2460	2432	2403	2373	2344	2315	2286	2257	2228	2198	2168
.586	2519	2495	2464	2435	2406	2376	2347	2318	2287	2258	2229	2199	2170
.587	2526	2498	2467	2439	2410	2379	2350	2321	2292	2263	2234	2205	2176
.588	2528	2508	2474	2445	2416	2386	2356	2327	2298	2269	2240	2211	2182
.589	2532	2505	2477	2449	2419	2389	2359	2330	2301	2272	2243	2214	2185
.591	2536	2509	2481	2458	2423	2392	2363	2334	2304	2275	245	2215	2185
.592	2539	2512	2484	2462	2432	2395	2366	2337	2307	2278	244	2216	2187
.593	2545	2515	2487	2465	2439	2399	2369	2340	2311	2281	251	2218	2190
.594	2546	2519	2491	2462	2432	2402	2372	2343	2314	2284	254	2219	2193
.595	2550	2523	2494	2465	2436	2405	2375	2346	2317	2287	257	2220	2196
.596	2553	2525	2497	2468	2439	2408	2378	2349	2320	2289	260	2221	2199
.597	2556	2528	2501	2472	2442	2411	2382	2353	2324	2293	263	2223	2201
.598	2560	2532	2504	2475	2445	2415	2385	2355	2326	2296	266	2225	2204
.599	2563	2536	2507	2478	2449	2418	2388	2359	2330	2300	268	2227	2207
.600	2567	2539	2511	2481	2458	2421	2391	2362	2333	2302	271	2229	2210

S = 0.501 to 0.600

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichiometric fuel-air ratio, S	Ideal combustion-temperature rise, ΔT , °R												
	Inlet-air temperature, °R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
.601	2570	2542	2514	2485	2455	2425	2394	2365	2336	2305	2274	2244	2213
.602	2557	2546	2517	2488	2458	2428	2398	2368	2338	2308	2277	2249	2215
.603	2557	2549	2521	2491	2462	2431	2401	2371	2341	2311	2280	2250	2218
.604	2558	2552	2524	2495	2465	2434	2404	2374	2344	2314	2283	2253	2221
.605	2558	2556	2527	2498	2468	2437	2407	2378	2347	2317	2286	2256	2224
.606	2587	2559	2531	2501	2472	2441	2410	2381	2351	2320	2289	2258	2227
.607	2591	2563	2534	2505	2475	2444	2414	2384	2354	2323	2293	2264	2232
.608	2594	2568	2537	2508	2478	2447	2417	2387	2357	2326	2295	2266	2235
.609	2598	2573	2541	2515	2481	2451	2420	2390	2360	2329	2298	2267	2236
.610	2601	2573	2544	2515	2485	2454	2423	2393	2363	2332	2301	2270	2239
.611	2604	2576	2547	2516	2488	2457	2427	2396	2366	2335	2304	2273	2242
.612	2608	2581	2551	2521	2491	2460	2430	2398	2368	2338	2307	2276	2245
.613	2611	2583	2554	2524	2494	2464	2433	2403	2373	2344	2313	2282	2251
.614	2615	2586	2557	2526	2498	2467	2436	2406	2376	2347	2316	2285	2254
.615	2618	2590	2561	2531	2501	2470	2439	2409	2379	2349	2318	2287	2256
.616	2621	2593	2564	2534	2504	2473	2442	2412	2381	2350	2319	2287	2256
.617	2625	2596	2567	2536	2507	2476	2446	2415	2384	2354	2323	2292	2261
.618	2628	2600	2571	2541	2511	2480	2449	2418	2388	2358	2327	2296	2265
.619	2632	2603	2574	2544	2514	2483	2452	2421	2391	2360	2329	2298	2267
.620	2635	2606	2577	2547	2517	2486	2455	2425	2394	2363	2332	2301	2270
.621	2638	2610	2580	2551	2520	2489	2458	2428	2397	2366	2335	2304	2273
.622	2642	2613	2584	2554	2523	2498	2467	2437	2406	2375	2344	2313	2282
.623	2644	2616	2587	2557	2527	2498	2468	2438	2408	2378	2347	2316	2285
.624	2645	2623	2594	2564	2533	2502	2471	2440	2409	2377	2346	2315	2284
.625	2646	2626	2597	2567	2536	2505	2474	2443	2412	2380	2349	2318	2287
.626	2650	2630	2600	2570	2540	2506	2477	2446	2415	2385	2354	2323	2292
.627	2653	2633	2604	2573	2543	2511	2480	2449	2418	2388	2357	2326	2295
.628	2656	2636	2607	2577	2546	2514	2483	2452	2421	2390	2359	2328	2297
.629	2659	2640	2610	2580	2549	2511	2488	2457	2426	2395	2364	2333	2302
.630	2663	2643	2613	2583	2552	2521	2493	2462	2431	2399	2368	2337	2306
.631	2667	2645	2617	2586	2556	2527	2495	2464	2433	2402	2371	2340	2309
.632	2675	2650	2621	2590	2560	2530	2500	2469	2438	2407	2376	2345	2314
.633	2679	2654	2625	2594	2564	2534	2504	2476	2445	2414	2383	2352	2321
.634	2686	2660	2630	2596	2566	2536	2506	2476	2445	2414	2383	2352	2321
.635	2689	2663	2633	2599	2569	2539	2509	2477	2446	2415	2384	2353	2322
.636	2693	2666	2636	2600	2571	2541	2511	2481	2450	2419	2388	2357	2326
.637	2696	2669	2639	2603	2575	2543	2512	2482	2451	2420	2389	2358	2327
.638	2699	2673	2643	2613	2578	2548	2514	2483	2452	2421	2390	2359	2328
.639	2702	2673	2643	2613	2581	2549	2517	2486	2454	2423	2392	2361	2330
.640	2705	2676	2646	2615	2584	2552	2521	2489	2456	2425	2393	2362	2331
.641	2709	2679	2649	2618	2587	2555	2524	2490	2459	2428	2396	2365	2334
.642	2712	2683	2652	2622	2590	2559	2527	2495	2463	2432	2401	2370	2339
.643	2715	2686	2656	2625	2593	2560	2529	2498	2466	2435	2404	2373	2342
.644	2719	2689	2659	2628	2597	2563	2531	2499	2468	2437	2406	2375	2344
.645	2722	2692	2668	2631	2600	2568	2536	2504	2471	2440	2409	2378	2347
.646	2725	2695	2665	2634	2603	2571	2539	2507	2474	2443	2412	2381	2350
.647	2729	2699	2669	2637	2606	2574	2542	2510	2477	2446	2415	2384	2353
.648	2732	2703	2672	2641	2609	2577	2545	2514	2483	2452	2421	2390	2359
.649	2735	2705	2675	2644	2612	2580	2548	2516	2484	2453	2422	2391	2360
.650	2739	2708	2678	2647	2615	2583	2551	2519	2487	2456	2425	2394	2363

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichiometric fuel-air ratio, S	Ideal combustion-temperature rise, ΔT , °R												
	Inlet-air temperature, T_R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
.651	2739	2709	2678	2647	2615	2583	2551	2519	2486	2452	2417	2382	2346
.652	2742	2712	2681	2650	2619	2586	2554	2522	2489	2455	2420	2385	2349
.653	2745	2715	2685	2653	2622	2590	2557	2525	2491	2457	2423	2388	2352
.654	2749	2718	2688	2656	2625	2593	2560	2528	2494	2460	2426	2390	2354
.655	2752	2722	2691	2660	2628	2596	2563	2531	2497	2463	2428	2393	2357
.656	2755	2725	2694	2663	2631	2599	2566	2533	2500	2466	2431	2395	2360
.657	2758	2728	2697	2666	2634	2600	2569	2535	2503	2469	2434	2398	2363
.658	2762	2731	2701	2669	2637	2605	2570	2539	2506	2471	2436	2401	2364
.659	2765	2735	2704	2672	2640	2608	2575	2542	2509	2474	2439	2403	2367
.660	2768	2738	2707	2675	2643	2611	2578	2545	2511	2477	2442	2406	2369
.661	2772	2741	2710	2678	2646	2614	2581	2548	2514	2480	2444	2408	2372
.662	2775	2744	2713	2682	2650	2617	2587	2551	2517	2483	2447	2411	2374
.663	2778	2748	2717	2685	2653	2620	2587	2554	2520	2485	2450	2414	2377
.664	2781	2751	2720	2688	2656	2626	2590	2557	2525	2488	2455	2416	2379
.665	2785	2754	2723	2691	2659	2626	2593	2560	2528	2491	2458	2421	2382
.666	2788	2757	2726	2694	2662	2630	2596	2563	2531	2494	2458	2421	2384
.667	2791	2761	2729	2697	2665	2632	2600	2566	2534	2496	2460	2424	2386
.668	2794	2764	2732	2700	2668	2635	2603	2568	2537	2499	2463	2426	2389
.669	2798	2767	2736	2703	2671	2638	2605	2571	2540	2502	2466	2429	2391
.670	2801	2770	2739	2707	2674	2641	2608	2574	2540	2504	2468	2431	2394
.671	2804	2773	2742	2710	2677	2644	2611	2577	2543	2507	2471	2434	2396
.672	2807	2777	2745	2713	2680	2647	2614	2580	2545	2510	2474	2437	2399
.673	2811	2780	2748	2716	2683	2650	2617	2583	2548	2513	2476	2439	2401
.674	2814	2783	2751	2719	2686	2653	2680	2586	2551	2515	2479	2442	2404
.675	2817	2786	2754	2722	2689	2656	2683	2589	2554	2518	2481	2444	2406
.676	2820	2789	2758	2725	2692	2659	2625	2591	2556	2521	2484	2447	2408
.677	2824	2793	2761	2728	2695	2662	2628	2593	2559	2523	2487	2450	2411
.678	2827	2796	2764	2731	2698	2665	2631	2597	2563	2536	2489	2458	2413
.679	2830	2799	2767	2734	2701	2668	2634	2600	2565	2539	2492	2454	2416
.680	2833	2803	2770	2738	2704	2671	2637	2603	2567	2531	2494	2457	2418
.681	2837	2805	2773	2741	2707	2674	2640	2606	2570	2534	2497	2459	2420
.682	2840	2808	2776	2744	2710	2677	2643	2608	2573	2537	2500	2463	2425
.683	2843	2812	2780	2747	2713	2680	2646	2611	2576	2539	2508	2464	2427
.684	2846	2815	2783	2750	2717	2685	2649	2614	2578	2542	2505	2466	2429
.685	2850	2818	2786	2753	2720	2686	2652	2617	2581	2548	2507	2469	2430
.686	2853	2821	2789	2756	2723	2689	2654	2620	2584	2547	2510	2471	2432
.687	2856	2824	2792	2759	2726	2695	2657	2626	2587	2550	2518	2474	2434
.688	2859	2827	2795	2760	2729	2695	2660	2625	2589	2553	2515	2476	2437
.689	2862	2831	2798	2765	2738	2698	2663	2628	2592	2555	2517	2479	2439
.690	2866	2834	2801	2768	2734	2701	2666	2631	2595	2558	2520	2481	2441
.691	2869	2837	2804	2771	2737	2703	2669	2634	2597	2560	2523	2484	2444
.692	2872	2840	2808	2774	2740	2706	2672	2636	2600	2565	2526	2486	2446
.693	2875	2843	2811	2777	2743	2709	2675	2639	2603	2566	2528	2488	2448
.694	2878	2846	2814	2800	2746	2712	2677	2642	2606	2568	2530	2491	2451
.695	2882	2850	2817	2783	2749	2715	2680	2645	2608	2571	2533	2493	2453
.696	2885	2853	2820	2786	2782	2718	2683	2647	2611	2573	2535	2496	2455
.697	2888	2856	2823	2789	2755	2721	2686	2650	2614	2576	2538	2498	2456
.698	2891	2859	2826	2792	2758	2724	2689	2653	2616	2579	2540	2500	2460
.699	2894	2862	2829	2795	2761	2727	2692	2656	2619	2581	2542	2503	2462
.700	2898	2865	2832	2798	2764	2730	2694	2658	2622	2584	2545	2505	2464

S = 0.601 to 0.700

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichio-metric fuel-air ratio, S	Ideal combustion-temperature rise, ΔT , °R												
	Inlet-air temperature, °R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
.701	28901	28868	28835	28802	27677	27333	26997	26611	26244	25866	2547	2508	2467
.702	28904	28872	28839	28805	27770	27336	27000	26664	26287	25900	2550	2510	2469
.703	28907	28875	28842	28808	27773	27339	27003	26667	26290	25902	25552	2512	2471
.704	29111	28878	28845	28811	27776	2742	2706	2670	26332	2594	2555	2515	2473
.705	29114	28881	28848	28814	2780	2745	2709	2673	26335	2597	2557	2517	2475
.706	29117	28885	28851	28817	2783	2748	2712	2675	2638	2599	2560	2520	2478
.707	29120	28888	28854	28810	2786	2751	2715	2678	2641	2602	2562	2520	2480
.708	29124	28891	28858	28823	2789	2753	2718	2681	2643	2605	2565	2524	2482
.709	29127	28894	28861	28826	2792	2756	2720	2684	2646	2607	2567	2527	2484
.710	29130	28897	28864	28830	2795	2759	2723	2686	2649	2610	2570	2539	2486
.711	29133	29001	28667	28833	2798	2762	2726	2689	2651	2612	2578	2631	2488
.712	29136	29004	28670	28836	2801	2765	2729	2692	2654	2615	2575	2634	2490
.713	29140	29007	28673	28839	2804	2768	2732	2695	2657	2617	2577	2636	2493
.714	29143	2910	2875	28842	2807	2771	2735	2697	2659	2620	2580	2638	2495
.715	29146	2913	2879	28845	2810	2774	2737	2700	2662	2622	2582	2641	2497
.716	29149	2916	2883	28848	2813	2777	2740	2703	2665	2625	2585	2645	2499
.717	29153	2918	2886	28851	2816	2780	2743	2706	2667	2626	2589	2648	2503
.718	29156	2923	28889	28854	2819	2783	2746	2708	2670	2633	2592	2650	2505
.719	29159	2926	28898	28857	2822	2786	2749	2711	2672	2635	2594	2658	2507
.720	29162	2929	2895	28860	2825	2788	2752	2714	2675	2636	2606	2661	2511
.721	29165	2932	2890	28863	2827	2791	2754	2716	2678	2638	2697	2654	2510
.722	29168	2935	28901	28866	2830	2794	2757	2719	2680	2640	2699	2655	2512
.723	29172	2938	2904	28869	2833	2797	2760	2720	2683	2643	2601	2655	2514
.724	29175	2941	2907	28870	2835	2800	2763	2725	2686	2645	2606	2660	2514
.725	29178	2944	2910	28875	2836	2803	2765	2727	2688	2648	2608	2664	2514
.726	29181	2946	2913	28878	2842	2806	2768	2730	2693	2650	2611	2666	2514
.727	29184	2951	2916	28881	2845	2809	2771	2733	2695	2653	2613	2670	2514
.728	29187	2954	2919	28884	2848	2811	2774	2736	2696	2655	2615	2678	2515
.729	29191	2957	2923	28887	2851	2814	2776	2738	2698	2657	2616	2685	2515
.730	29194	2960	2926	28890	2854	2817	2779	2740	2701	2660	2618	2685	2515
.731	29197	2963	2929	28893	2856	2820	2782	2742	2703	2663	2620	2687	2515
.732	29199	2966	2935	28899	2862	2825	2787	2748	2708	2667	2628	2681	2515
.733	29203	2969	2938	28902	2865	2828	2789	2751	2711	2670	2637	2684	2517
.734	29206	2978	2938	28904	2868	2831	2793	2754	2713	2672	2639	2686	2519
.735	29209	2975	2941	2905	2868	2831	2793	2754	2713	2672	2639	2689	2519
.736	30118	2979	2944	2908	2871	2834	2795	2756	2716	2674	2632	2688	2514
.737	30116	2982	2947	2911	2874	2837	2798	2759	2718	2677	2634	2690	2514
.738	30119	2985	2950	2914	2877	2839	2801	2761	2731	2679	2636	2698	2514
.739	30122	2988	2953	2917	2880	2842	2804	2764	2733	2682	2639	2696	2514
.740	30125	2991	2956	2919	2883	2845	2806	2767	2736	2684	2641	2697	2514
.741	30228	2994	2959	2922	2885	2848	2809	2769	2738	2686	2643	2699	2514
.742	30331	2997	2962	2925	2888	2850	2818	2772	2731	2689	2645	2701	2514
.743	30334	3000	2965	2928	2891	2853	2814	2774	2733	2691	2648	2703	2515
.744	30337	3003	2968	2931	2894	2855	2817	2777	2736	2693	2650	2703	2515
.745	30440	3006	2970	2934	2897	2859	2819	2779	2738	2695	2653	2707	2515
.746	30443	3009	2973	2937	2899	2861	2822	2782	2741	2698	2654	2710	2515
.747	30446	3012	2976	2940	2903	2864	2825	2784	2743	2700	2657	2712	2515
.748	30550	3015	2979	2943	2905	2867	2827	2787	2745	2703	2659	2714	2515
.749	30553	3018	2982	2946	2908	2869	2830	2790	2748	2705	2661	2716	2516
.750	30556	3021	2985	2948	2911	2872	2833	2793	2750	2707	2663	2718	2516

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichiometric fuel-air ratio, S	Ideal combustion-temperature rise, AT, °R												
	Inlet-air temperature, °R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
.751	3059	3024	2988	2951	2913	2875	2835	2795	2753	2710	2666	2620	2571
.752	3062	3087	2991	2954	2916	2876	2838	2797	2755	2712	2668	2622	2573
.753	3065	3030	2994	2957	2919	2880	2840	2800	2758	2714	2670	2624	2575
.754	3068	3033	2997	2960	2928	2883	2843	2802	2760	2717	2678	2626	2577
.755	3071	3036	3000	2963	2925	2886	2846	2805	2762	2719	2674	2629	2579
.756	3074	3039	3003	2965	2927	2888	2848	2807	2765	2721	2676	2631	2581
.757	3077	3043	3006	2968	2930	2891	2851	2809	2767	2723	2679	2633	2583
.758	3080	3045	3008	2971	2933	2894	2853	2813	2769	2726	2681	2635	2585
.759	3083	3048	3011	2974	2935	2896	2856	2814	2773	2728	2683	2637	2587
.760	3086	3051	3014	2977	2938	2899	2858	2817	2774	2730	2685	2639	2589
.761	3089	3054	3017	2980	2941	2901	2861	2819	2777	2735	2687	2641	2591
.762	3092	3057	3020	2983	2944	2904	2863	2822	2779	2737	2689	2644	2593
.763	3095	3059	3023	2985	2946	2907	2866	2824	2781	2737	2692	2645	2595
.764	3098	3062	3026	2988	2949	2909	2869	2827	2784	2739	2694	2647	2597
.765	3101	3065	3029	2991	2952	2912	2871	2829	2786	2741	2696	2649	2599
.766	3104	3068	3031	2993	2954	2915	2874	2831	2788	2744	2698	2651	2601
.767	3107	3071	3034	2996	2957	2917	2876	2834	2790	2746	2700	2653	2603
.768	3110	3074	3037	2999	2960	2920	2879	2836	2793	2748	2702	2655	2604
.769	3113	3077	3040	3002	2962	2922	2881	2839	2795	2750	2704	2657	2606
.770	3116	3080	3043	3004	2965	2925	2884	2841	2797	2752	2706	2659	2608
.771	3119	3083	3046	3007	2968	2927	2886	2843	2800	2755	2708	2661	2610
.772	3122	3086	3048	3010	2970	2930	2888	2846	2802	2757	2711	2663	2618
.773	3125	3089	3051	3013	2973	2933	2891	2848	2804	2759	2713	2665	2614
.774	3128	3091	3054	3016	2976	2935	2893	2851	2806	2761	2716	2667	2616
.775	3131	3094	3057	3018	2978	2938	2896	2853	2809	2763	2717	2669	2618
.776	3133	3097	3060	3021	2981	2940	2898	2858	2811	2765	2719	2671	2620
.777	3136	3100	3062	3024	2984	2943	2901	2856	2810	2768	2721	2673	2622
.778	3139	3103	3065	3026	2986	2945	2903	2860	2815	2770	2723	2675	2624
.779	3142	3106	3068	3029	2989	2948	2906	2868	2818	2772	2725	2677	2625
.780	3145	3109	3071	3032	2992	2950	2908	2865	2820	2774	2727	2679	2627
.781	3148	3111	3074	3034	2994	2953	2910	2867	2823	2776	2729	2680	2629
.782	3151	3114	3076	3037	2997	2955	2913	2869	2824	2778	2731	2682	2631
.783	3154	3117	3079	3040	2999	2958	2915	2872	2827	2780	2733	2684	2633
.784	3157	3120	3082	3042	3000	2960	2918	2874	2829	2783	2735	2686	2635
.785	3160	3123	3085	3045	3003	2963	2920	2876	2831	2785	2737	2688	2637
.786	3163	3126	3087	3048	3007	2965	2923	2878	2835	2787	2739	2690	2639
.787	3166	3128	3090	3050	3010	2968	2925	2881	2838	2789	2741	2698	2640
.788	3168	3131	3093	3053	3012	2970	2927	2883	2840	2791	2743	2694	2642
.789	3171	3134	3096	3056	3015	2973	2930	2885	2840	2793	2745	2695	2644
.790	3174	3137	3098	3058	3017	2975	2932	2888	2842	2795	2747	2698	2646
.791	3177	3140	3101	3061	3020	2978	2934	2890	2844	2797	2749	2699	2648
.792	3180	3142	3104	3064	3022	2980	2937	2898	2846	2799	2751	2701	2650
.793	3183	3145	3106	3066	3025	2983	2939	2894	2848	2801	2753	2703	2652
.794	3186	3148	3109	3069	3028	2985	2941	2897	2851	2803	2755	2705	2653
.795	3189	3151	3112	3071	3030	2987	2944	2899	2853	2805	2757	2707	2655
.796	3191	3154	3114	3074	3033	2990	2946	2901	2855	2807	2759	2709	2657
.797	3194	3156	3117	3077	3035	2992	2948	2903	2857	2809	2760	2710	2659
.798	3197	3159	3180	3079	3038	2995	2951	2905	2859	2811	2768	2718	2661
.799	3200	3162	3183	3082	3040	2997	2953	2908	2861	2813	2764	2714	2662
.800	3203	3165	3125	3084	3043	3000	2955	2910	2863	2815	2766	2716	2664

S = 0.701 to 0.800

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichio-metric fuel-air ratio, S	Ideal combustion-temperature rise, AT, °R													
	Inlet-air temperature, °R													
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	
.801	320.6	319.8	318.8	308.7	304.8	300.8	296.8	291.4	285.5	280.1	276.8	271.4	266.6	
.802	320.5	319.7	318.7	308.6	304.7	300.7	296.7	291.3	285.4	280.0	276.7	271.3	266.6	
.803	321.2	317.5	313.4	309.3	305.0	300.7	296.5	291.7	285.7	280.3	277.0	272.4	267.6	
.804	321.5	317.6	313.7	309.5	305.3	301.0	296.5	291.9	285.7	280.3	277.4	272.3	267.1	
.805	321.8	317.9	313.9	309.8	305.6	301.8	296.7	292.1	285.7	280.5	277.6	272.5	267.1	
.806	328.1	318.8	314.8	31.01	305.8	301.4	296.9	292.5	287.6	282.7	277.8	272.7	267.6	
.807	328.4	318.5	314.5	31.03	305.6	301.7	297.2	292.6	287.8	282.9	277.9	272.8	267.6	
.808	328.7	318.8	314.8	31.06	306.3	301.9	297.4	292.8	288.0	283.1	278.1	273.0	267.5	
.809	328.0	319.1	315.1	31.09	306.6	302.2	297.6	293.0	288.2	283.3	278.3	273.2	267.9	
.810	328.3	319.4	318.3	31.12	306.8	302.4	297.9	293.3	288.4	283.5	278.5	273.4	268.1	
.811	328.6	319.7	315.6	31.14	307.1	302.8	298.1	293.4	288.6	283.7	278.7	273.5	268.3	
.812	328.9	320.0	315.9	31.17	307.4	302.9	298.3	293.6	288.8	283.9	278.9	273.7	268.4	
.813	328.42	320.08	316.8	31.19	307.6	303.1	298.6	293.9	289.0	284.1	279.1	273.9	268.2	
.814	328.45	320.08	316.4	31.22	307.9	303.4	298.8	294.1	289.2	284.3	279.2	274.0	268.2	
.815	328.48	320.08	316.7	31.25	308.1	303.6	299.0	294.3	289.5	284.5	279.4	274.8	268.4	
.816	328.51	320.08	317.0	31.27	308.4	303.9	299.2	294.5	289.7	284.7	279.6	274.4	268.6	
.817	328.57	321.17	317.5	31.33	308.9	304.3	299.7	294.9	290.1	285.1	280.0	274.6	269.4	
.818	328.59	321.19	317.8	31.35	309.1	304.6	299.9	295.2	290.3	285.3	280.1	274.7	269.5	
.819	328.62	321.81	318.1	31.38	309.5	304.8	300.1	295.4	290.5	285.4	280.3	275.1	269.7	
.820	326.5	322.85	318.3	31.40	309.6	305.0	300.4	295.6	290.7	285.6	280.5	275.4	269.9	
.821	328.6	321.86	318.6	31.43	309.8	305.2	300.6	295.8	290.9	285.8	280.6	275.5	269.9	
.822	327.1	320.31	318.9	31.45	31.01	305.5	300.8	296.0	291.1	286.0	280.8	275.6	270.3	
.823	327.4	320.53	319.1	31.48	31.03	305.7	301.0	296.2	291.3	286.2	281.0	275.7	270.3	
.824	327.7	320.56	319.4	31.50	31.06	306.0	301.2	296.4	291.5	286.4	281.2	275.9	270.5	
.825	327.9	320.59	319.7	31.53	31.08	306.2	301.5	296.6	291.6	286.6	281.4	276.1	270.6	
.826	327.9	320.59	319.7	31.53	31.08	306.2	301.5	296.6	291.6	286.6	281.4	276.1	270.6	
.827	328.62	320.42	319.9	31.56	31.10	306.4	301.7	296.8	291.8	286.8	281.6	276.2	270.8	
.828	328.5	320.44	320.8	31.58	31.13	306.7	301.9	297.0	292.0	286.9	281.7	276.4	270.9	
.829	328.63	320.47	320.4	31.61	31.15	306.9	302.1	297.2	292.2	287.1	281.9	276.6	271.1	
.830	329.1	320.07	320.7	31.64	31.18	307.1	302.4	297.4	292.4	287.4	282.1	276.7	271.1	
.831	329.4	320.56	321.0	31.65	31.20	307.3	302.7	297.6	292.6	287.5	282.4	276.9	271.2	
.832	329.6	320.56	321.5	31.68	31.23	307.6	303.0	297.8	292.8	287.8	282.6	277.2	271.4	
.833	329.9	320.66	321.5	31.70	31.25	307.8	303.2	298.0	293.0	288.0	282.8	277.4	271.6	
.834	329.9	320.63	321.7	31.71	31.27	308.0	303.4	298.2	293.2	288.2	282.9	277.5	271.7	
.835	330.5	320.63	322.0	31.75	31.29	308.2	303.6	298.4	293.4	288.4	283.0	277.5	271.8	
.836	330.7	320.66	322.2	31.76	31.30	308.4	303.8	298.6	293.6	288.6	283.1	277.7	271.8	
.837	331.0	320.68	322.5	31.78	31.32	308.7	304.0	298.8	293.8	288.8	283.3	277.8	271.9	
.838	331.3	320.71	322.8	31.80	31.34	308.9	304.2	299.0	294.0	288.9	283.4	278.0	272.0	
.839	331.6	320.74	323.0	31.82	31.36	309.1	304.4	299.2	294.2	289.0	283.6	278.2	272.2	
.840	331.8	320.76	323.3	31.87	31.41	309.3	304.4	299.4	294.3	289.1	283.8	278.3	272.3	
.841	332.1	320.79	323.5	31.90	31.43	309.5	304.6	299.6	294.5	289.3	283.9	278.5	272.5	
.842	332.4	320.81	323.8	31.92	31.45	309.8	304.9	299.8	294.7	289.4	284.1	278.6	272.6	
.843	332.6	320.84	324.0	31.95	31.48	31.00	305.1	300.0	299.9	289.6	284.3	278.8	272.8	
.844	332.9	320.86	324.0	31.97	31.50	31.02	305.3	300.2	299.5	289.8	284.4	278.9	273.0	
.845	333.2	320.86	324.3	31.99	31.52	31.04	305.5	300.4	299.5	289.9	284.6	279.1	273.1	
.846	333.4	320.92	324.7	32.02	31.55	31.06	305.7	300.6	299.5	289.9	284.7	279.2	273.2	
.847	333.7	320.94	325.0	32.05	31.57	31.08	305.9	300.8	299.5	289.9	284.7	279.4	273.4	
.848	334.0	320.97	325.2	32.08	31.59	31.10	306.1	301.0	299.5	289.9	284.8	279.5	273.5	
.849	334.2	320.99	325.5	32.10	31.61	31.12	306.3	301.2	299.5	289.9	284.9	279.7	273.6	
.850	334.5	320.92	325.8	32.11	31.63	31.15	306.5	301.4	299.5	289.9	285.0	279.8	273.7	

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichiometric fuel-air ratio, \bar{s}	Ideal combustion-temperature rise, ΔT , $^{\circ}\text{R}$												
	Inlet-air temperature, $^{\circ}\text{R}$												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
.851	3347	3304	3260	3213	3166	3117	3067	3015	2963	2910	2855	2800	2743
.852	3350	3307	3262	3215	3168	3119	3069	3017	2965	2911	2857	2801	2745
.853	3353	3309	3264	3218	3170	3121	3071	3019	2967	2913	2859	2803	2746
.854	3355	3312	3267	3220	3172	3123	3073	3021	2968	2915	2860	2804	2748
.855	3358	3314	3269	3222	3174	3125	3075	3023	2970	2916	2862	2806	2749
.856	3360	3317	3271	3225	3176	3127	3076	3025	2972	2918	2863	2807	2750
.857	3363	3319	3274	3227	3179	3129	3078	3027	2974	2920	2865	2809	2752
.858	3365	3321	3276	3229	3181	3131	3080	3028	2975	2921	2866	2810	2753
.859	3368	3324	3278	3231	3183	3133	3082	3030	2977	2923	2868	2812	2755
.860	3370	3326	3281	3233	3185	3135	3084	3032	2979	2925	2869	2813	2756
.861	3373	3329	3283	3236	3187	3137	3086	3034	2981	2926	2871	2815	2757
.862	3375	3331	3285	3238	3189	3139	3088	3036	2982	2928	2873	2816	2759
.863	3378	3334	3288	3240	3191	3141	3090	3037	2984	2930	2874	2818	2760
.864	3380	3336	3290	3242	3193	3143	3092	3039	2986	2931	2876	2819	2761
.865	3383	3338	3298	3244	3195	3145	3094	3041	2987	2933	2877	2820	2763
.866	3385	3341	3294	3247	3197	3147	3095	3043	2989	2934	2879	2823	2764
.867	3388	3343	3297	3249	3200	3149	3097	3044	2991	2936	2880	2825	2765
.868	3390	3345	3299	3251	3202	3151	3099	3046	2992	2937	2881	2826	2767
.869	3393	3348	3303	3253	3204	3153	3101	3048	2994	2939	2883	2827	2768
.870	3395	3350	3303	3255	3206	3155	3103	3050	2996	2941	2884	2827	2769
.871	3397	3352	3306	3257	3208	3157	3105	3051	2997	2942	2886	2829	2771
.872	3400	3355	3308	3259	3210	3159	3106	3053	2999	2944	2887	2830	2772
.873	3402	3357	3310	3262	3212	3161	3108	3055	3000	2945	2889	2832	2773
.874	3405	3359	3312	3264	3214	3162	3110	3057	3002	2947	2890	2833	2775
.875	3407	3360	3314	3266	3216	3164	3112	3058	3004	2948	2892	2834	2776
.876	3409	3364	3317	3268	3218	3166	3114	3060	3005	2950	2893	2836	2777
.877	3411	3366	3319	3269	3219	3167	3115	3063	3007	2951	2895	2837	2778
.878	3414	3371	3323	3274	3224	3172	3119	3065	3010	2953	2896	2838	2780
.879	3415	3371	3323	3274	3224	3172	3119	3065	3010	2954	2897	2840	2781
.880	3419	3373	3326	3276	3225	3174	3121	3067	3012	2956	2899	2841	2782
.881	3421	3375	3327	3278	3227	3175	3122	3068	3013	2957	2900	2842	2783
.882	3423	3377	3330	3280	3229	3177	3124	3070	3015	2959	2902	2844	2785
.883	3426	3379	3332	3282	3231	3179	3126	3072	3016	2960	2903	2845	2786
.884	3428	3380	3334	3284	3233	3181	3128	3073	3018	2962	2904	2846	2787
.885	3430	3384	3336	3286	3235	3183	3129	3078	3019	2963	2906	2848	2788
.886	3433	3386	3338	3288	3237	3185	3131	3076	3021	2965	2907	2849	2790
.887	3435	3388	3340	3290	3239	3186	3133	3078	3022	2966	2908	2850	2791
.888	3437	3390	3342	3292	3241	3188	3134	3080	3024	2967	2910	2851	2792
.889	3439	3393	3344	3294	3243	3190	3136	3081	3025	2969	2911	2853	2793
.890	3442	3395	3346	3296	3244	3192	3138	3083	3027	2970	2913	2854	2794
.891	3444	3397	3348	3298	3246	3193	3139	3084	3028	2972	2914	2855	2796
.892	3446	3399	3350	3300	3248	3195	3141	3086	3030	2973	2915	2856	2797
.893	3448	3401	3358	3302	3250	3197	3143	3088	3031	2974	2917	2858	2798
.894	3451	3403	3354	3304	3252	3199	3144	3089	3033	2976	2918	2859	2799
.895	3453	3405	3356	3306	3254	3200	3146	3091	3034	2977	2919	2860	2800
.896	3455	3407	3358	3307	3255	3202	3148	3092	3036	2979	2920	2861	2801
.897	3457	3409	3360	3309	3257	3204	3149	3094	3037	2980	2922	2863	2802
.898	3459	3411	3362	3311	3259	3205	3151	3095	3039	2981	2923	2864	2804
.899	3461	3414	3364	3313	3261	3207	3153	3097	3040	2983	2924	2865	2805
.900	3464	3416	3366	3315	3263	3209	3154	3098	3042	2984	2925	2866	2806

 $s = 0.801 \text{ to } 0.900$

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichiometric fuel-air ratio, δ	Ideal combustion-temperature rise, ΔT , °R												
	Inlet-air temperature, °R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
.901	34.66	34.18	33.68	33.17	32.64	32.11	31.56	31.00	30.43	29.85	29.27	28.67	28.07
.903	34.68	34.20	33.72	33.21	32.68	32.14	31.59	31.03	30.46	29.88	29.30	28.69	28.09
.904	34.70	34.22	33.74	33.23	32.70	32.16	31.61	31.04	30.47	29.91	29.31	28.71	28.11
.905	34.75	34.26	33.76	33.28	32.78	32.17	31.62	31.06	30.49	29.93	29.32	28.72	28.12
.906	34.77	34.29	33.78	33.26	32.73	32.19	31.64	31.07	30.50	29.93	29.33	28.73	28.13
.907	34.80	34.31	33.80	33.28	32.77	32.22	31.65	31.09	30.51	29.93	29.34	28.75	28.14
.908	34.82	34.33	33.82	33.30	32.79	32.24	31.67	31.10	30.53	29.95	29.36	28.76	28.15
.909	34.84	34.35	33.84	33.32	32.81	32.26	31.68	31.12	30.55	29.96	29.37	28.77	28.16
.910	34.86	34.37	33.86	33.34	32.80	32.26	31.70	31.13	30.56	29.97	29.38	28.78	28.17
.911	34.88	34.39	33.88	33.36	32.82	32.27	31.71	31.15	30.57	29.99	29.39	28.79	28.18
.912	34.91	34.41	33.90	33.38	32.84	32.29	31.73	31.16	30.58	30.00	29.40	28.80	28.19
.913	34.93	34.43	33.92	33.39	32.86	32.31	31.75	31.18	30.60	30.01	29.42	28.81	28.20
.914	34.95	34.45	33.94	33.41	32.87	32.32	31.76	31.19	30.61	30.02	29.43	28.82	28.21
.915	34.97	34.47	33.96	33.43	32.89	32.34	31.78	31.20	30.63	30.04	29.44	28.84	28.23
.916	34.99	34.49	33.98	33.45	32.91	32.35	31.79	31.22	30.64	30.05	29.45	28.85	28.24
.917	35.01	34.51	34.00	33.47	32.92	32.37	31.81	31.24	30.65	30.06	29.46	28.86	28.25
.918	35.04	34.53	34.02	33.48	32.94	32.38	31.83	31.25	30.66	30.07	29.48	28.87	28.26
.919	35.06	34.55	34.04	33.50	32.96	32.40	31.85	31.26	30.68	30.09	29.49	28.88	28.27
.920	35.08	34.57	34.05	33.52	32.97	32.42	31.85	31.27	30.69	30.10	29.50	28.89	28.28
.921	35.10	34.59	34.07	33.55	32.99	32.45	31.86	31.29	30.70	30.12	29.51	28.91	28.29
.922	35.12	34.61	34.09	33.57	33.01	32.46	31.88	31.30	30.71	30.13	29.52	28.92	28.30
.923	35.14	34.63	34.11	33.59	33.03	32.48	31.89	31.31	30.73	30.15	29.53	28.93	28.31
.924	35.16	34.65	34.13	33.61	33.04	32.48	31.91	31.33	30.74	30.16	29.54	28.94	28.32
.925	35.18	34.67	34.14	33.60	33.05	32.49	31.92	31.34	30.75	30.16	29.55	28.94	28.33
.926	35.20	34.69	34.16	33.62	33.07	32.51	31.93	31.35	30.76	30.17	29.57	28.95	28.34
.927	35.22	34.71	34.18	33.64	33.09	32.52	31.95	31.37	30.78	30.19	29.58	28.97	28.35
.928	35.24	34.73	34.20	33.65	33.10	32.54	31.96	31.38	30.79	30.20	29.59	28.98	28.36
.929	35.26	34.74	34.21	33.67	33.11	32.55	31.98	31.39	30.80	30.21	29.60	28.99	28.37
.930	35.28	34.76	34.23	33.69	33.11	32.57	31.99	31.41	30.81	30.22	29.61	28.99	28.38
.931	35.30	34.78	34.25	33.70	33.15	32.58	32.00	31.48	30.83	30.24	29.62	29.01	28.39
.932	35.32	34.80	34.27	33.72	33.16	32.59	32.02	31.45	30.84	30.25	29.63	29.02	28.40
.933	35.34	34.82	34.28	33.74	33.18	32.61	32.03	31.44	30.85	30.26	29.64	29.03	28.41
.934	35.35	34.83	34.30	33.75	33.19	32.62	32.04	31.46	30.86	30.27	29.65	29.04	28.42
.935	35.37	34.85	34.32	33.77	33.21	32.64	32.06	31.47	30.87	30.28	29.66	29.05	28.43
.936	35.39	34.87	34.33	33.78	33.22	32.65	32.07	31.48	30.89	30.28	29.67	29.06	28.43
.937	35.41	34.89	34.35	33.80	33.24	32.66	32.08	31.49	30.90	30.29	29.68	29.07	28.44
.938	35.43	34.90	34.37	33.81	33.25	32.68	32.10	31.51	30.91	30.31	29.69	29.08	28.45
.939	35.45	34.92	34.38	33.83	33.27	32.69	32.11	31.52	30.92	30.32	29.71	29.09	28.46
.940	35.47	34.94	34.40	33.85	33.28	32.71	32.12	31.53	30.93	30.33	29.72	29.10	28.47
.941	35.48	34.96	34.42	33.86	33.29	32.72	32.14	31.54	30.94	30.34	29.73	29.11	28.48
.942	35.50	34.97	34.43	33.88	33.31	32.73	32.15	31.55	30.95	30.35	29.74	29.12	28.49
.943	35.52	34.99	34.45	33.89	33.32	32.75	32.16	31.57	30.97	30.36	29.75	29.13	28.50
.944	35.54	35.01	34.46	33.90	33.34	32.76	32.17	31.58	30.98	30.37	29.76	29.14	28.51
.945	35.55	35.02	34.48	33.92	33.35	32.77	32.19	31.59	30.99	30.38	29.77	29.14	28.52
.946	35.57	35.04	34.49	33.93	33.36	32.78	32.20	31.60	31.00	30.39	29.78	29.15	28.53
.947	35.59	35.06	34.51	33.95	33.38	32.80	32.21	31.61	31.01	30.40	29.79	29.16	28.54
.948	35.61	35.07	34.52	33.96	33.39	32.81	32.22	31.62	31.02	30.41	29.80	29.17	28.54
.949	35.62	35.09	34.54	33.98	33.41	32.82	32.23	31.63	31.03	30.42	29.80	29.18	28.55
.950	35.64	35.10	34.55	33.99	33.42	32.84	32.25	31.65	31.04	30.43	29.81	29.19	28.56

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT, °R

Fraction of stoichiometric fuel-air ratio, S	Ideal combustion-temperature rise, AT, °R												
	Inlet-air temperature, °R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
.9951	35.66	35.12	34.57	34.01	33.43	32.85	32.26	31.66	31.05	30.44	30.83	30.90	30.57
.9952	35.66	35.12	34.56	34.00	33.46	32.87	32.28	31.67	31.07	30.45	30.84	30.93	30.59
.9953	35.71	35.17	34.68	34.05	33.47	32.89	32.30	31.69	31.09	30.47	30.85	30.93	30.60
.9955	35.73	35.19	34.63	34.06	33.49	32.90	32.31	31.70	31.10	30.48	30.86	30.94	30.60
.9956	35.75	35.80	34.65	34.08	33.50	32.91	32.33	31.71	31.11	30.49	30.87	30.94	30.61
.9957	35.76	35.88	34.66	34.09	33.51	32.92	32.34	31.72	31.12	30.50	30.88	30.95	30.62
.9958	35.78	35.83	34.68	34.10	33.58	32.94	32.34	31.74	31.13	30.51	30.89	30.96	30.63
.9959	35.80	35.85	34.69	34.12	33.54	32.95	32.35	31.75	31.14	30.52	30.90	30.97	30.64
.9960	35.81	35.84	34.70	34.13	33.55	32.96	32.36	31.76	31.15	30.53	30.91	30.98	30.65
.9961	35.83	35.88	34.78	34.14	33.56	32.97	32.37	31.77	31.16	30.54	30.93	30.99	30.65
.9962	35.84	35.89	34.73	34.16	33.57	32.98	32.38	31.78	31.17	30.55	30.94	30.95	30.66
.9963	35.86	35.81	34.75	34.17	33.59	32.99	32.40	31.79	31.18	30.56	30.95	30.96	30.67
.9964	35.88	35.89	34.76	34.18	33.60	33.01	32.41	31.80	31.19	30.57	30.96	30.97	30.68
.9965	35.89	35.84	34.77	34.20	33.61	33.02	32.42	31.81	31.20	30.58	30.95	30.98	30.69
.9966	35.91	35.35	34.79	34.81	33.62	33.03	32.43	31.82	31.21	30.59	30.96	30.97	30.70
.9967	35.92	35.37	34.80	34.83	33.63	33.04	32.44	31.83	31.22	30.60	30.97	30.98	30.71
.9968	35.94	35.38	34.81	34.23	33.65	33.05	32.45	31.84	31.23	30.60	30.98	30.95	30.72
.9969	35.95	35.39	34.83	34.25	33.66	33.06	32.46	31.85	31.24	30.61	30.99	30.95	30.73
.9970	35.97	35.41	34.84	34.26	33.67	33.07	32.47	31.86	31.24	30.62	30.99	30.96	30.74
.9971	35.98	35.43	34.85	34.27	33.68	33.08	32.48	31.87	31.25	30.63	30.00	29.37	28.73
.9972	35.99	35.43	34.86	34.28	33.69	33.09	32.49	31.88	31.26	30.64	30.01	29.38	28.74
.9973	36.01	35.45	34.88	34.29	33.70	33.10	32.50	31.89	31.27	30.65	30.02	29.39	28.75
.9974	36.02	35.46	34.89	34.30	33.71	33.11	32.51	31.90	31.28	30.66	30.03	29.39	28.75
.9975	36.04	35.47	34.90	34.32	33.72	33.12	32.52	31.91	31.29	30.66	30.04	29.40	28.76
.9976	36.05	35.49	34.91	34.33	33.74	33.14	32.53	31.91	31.30	30.67	30.04	29.41	28.77
.9977	36.06	35.50	34.92	34.34	33.75	33.15	32.54	31.92	31.31	30.68	30.05	29.42	28.78
.9978	36.07	35.51	34.94	34.35	33.76	33.16	32.55	31.93	31.32	30.69	30.06	29.43	28.79
.9979	36.09	35.58	34.95	34.36	33.77	33.17	32.56	31.94	31.33	30.70	30.07	29.43	28.80
.9980	36.10	35.53	34.96	34.37	33.78	33.17	32.57	31.95	31.33	30.71	30.07	29.44	28.80
.9981	36.11	35.68	34.97	34.38	33.79	33.18	32.58	31.96	31.34	30.71	30.08	29.45	28.81
.9982	36.12	35.69	34.98	34.39	33.80	33.19	32.59	31.97	31.35	30.72	30.09	29.45	28.81
.9983	36.14	35.67	34.99	34.40	33.81	33.80	32.60	31.98	31.36	30.73	30.10	29.46	28.82
.9984	36.15	35.68	35.00	34.41	33.82	33.81	32.61	31.99	31.36	30.74	30.11	29.47	28.83
.9985	36.16	35.69	35.01	34.42	33.83	33.82	32.61	31.99	31.37	30.74	30.11	29.48	28.83
.9986	36.17	35.60	35.02	34.43	33.84	33.83	32.62	32.00	31.38	30.75	30.12	29.48	28.84
.9987	36.18	35.61	35.03	34.44	33.85	33.84	32.63	32.01	31.39	30.76	30.13	29.49	28.85
.9988	36.19	35.62	35.04	34.45	33.85	33.85	32.64	32.02	31.40	30.77	30.13	29.50	28.85
.9989	36.20	35.63	35.05	34.46	33.86	33.86	32.65	32.03	31.40	30.78	30.14	29.50	28.86
.9990	36.22	35.64	35.06	34.47	33.87	33.87	32.65	32.04	31.41	30.78	30.15	29.51	28.87
.9991	36.23	35.65	35.07	34.48	33.88	33.88	32.66	32.04	31.42	30.79	30.16	29.52	28.87
.9992	36.24	35.66	35.08	34.49	33.89	33.88	32.67	32.05	31.43	30.80	30.16	29.53	28.88
.9993	36.25	35.67	35.09	34.50	33.90	33.89	32.68	32.06	31.43	30.80	30.17	29.53	28.89
.9994	36.26	35.68	35.10	34.51	33.91	33.90	32.69	32.07	31.44	30.81	30.18	29.54	28.89
.9995	36.27	35.69	35.11	34.52	33.92	33.91	32.69	32.07	31.45	30.82	30.18	29.54	28.90
.9996	36.28	35.70	35.12	34.53	33.93	33.92	32.70	32.08	31.46	30.83	30.19	29.55	28.91
.9997	36.28	35.71	35.13	34.53	33.93	33.93	32.71	32.09	31.46	30.83	30.20	29.56	28.91
.9998	36.29	35.72	35.14	34.54	33.94	33.93	32.72	32.10	31.47	30.84	30.20	29.56	28.92
.9999	36.30	35.73	35.15	34.55	33.95	33.94	32.73	32.10	31.48	30.85	30.21	29.57	28.92
1.0000	36.31	35.74	35.15	34.56	33.96	33.95	32.73	32.11	31.48	30.85	30.22	29.58	28.93

S = 0.901 to 1.000

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichiometric fuel-air ratio, S	Ideal combustion-temperature rise, AT, °R												
	Inlet-air temperature, °R												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
.0010	3635	3575	3516	3457	3397	3336	3274	3212	3149	3086	3022	2958	2894
.0005	3635	3575	3517	3458	3397	3336	3275	3213	3150	3087	3023	2959	2895
.0005	3634	3576	3518	3459	3398	3337	3276	3214	3151	3088	3024	2960	2895
.0005	3634	3577	3519	3460	3399	3338	3277	3215	3152	3089	3025	2961	2895
.0005	3635	3578	3520	3460	3399	3339	3277	3216	3153	3090	3026	2962	2895
.006	3636	3579	3520	3461	3400	3339	3278	3215	3153	3090	3025	2961	2897
.007	3637	3579	3521	3461	3401	3340	3278	3216	3153	3091	3026	2962	2897
.008	3637	3580	3521	3462	3402	3341	3279	3217	3154	3092	3027	2963	2898
.009	3638	3581	3523	3463	3403	3341	3280	3217	3154	3093	3028	2964	2899
.010	3639	3582	3523	3464	3403	3342	3280	3218	3155	3094	3029	2965	2900
.011	3639	3582	3524	3464	3404	3343	3281	3219	3156	3095	3030	2964	2900
.012	3640	3582	3525	3465	3405	3344	3282	3220	3157	3096	3030	2965	2900
.014	3641	3584	3525	3466	3406	3345	3282	3221	3157	3096	3031	2966	2901
.015	3642	3585	3527	3467	3406	3345	3283	3221	3158	3097	3031	2966	2901
.016	3642	3585	3527	3468	3407	3346	3284	3221	3159	3098	3031	2967	2902
.017	3643	3587	3528	3468	3408	3346	3285	3222	3160	3098	3032	2968	2903
.018	3643	3587	3529	3469	3408	3347	3285	3222	3160	3098	3032	2968	2904
.019	3644	3588	3529	3469	3409	3348	3286	3223	3161	3099	3033	2969	2904
.020	3644	3589	3530	3470	3409	3348	3286	3223	3161	3099	3033	2969	2904
.020	3645	3589	3530	3470	3410	3349	3287	3223	3162	3104	3034	2970	2905
.022	3646	3590	3531	3471	3411	3349	3287	3223	3162	3104	3035	2971	2906
.022	3646	3590	3531	3471	3411	3350	3288	3223	3163	3104	3035	2971	2906
.023	3647	3590	3532	3472	3412	3350	3289	3223	3163	3104	3036	2972	2906
.023	3647	3590	3532	3472	3412	3351	3289	3223	3163	3104	3036	2972	2906
.024	3647	3591	3533	3473	3413	3351	3290	3224	3164	3105	3037	2973	2907
.024	3648	3591	3533	3473	3413	3351	3290	3224	3164	3105	3038	2973	2908
.025	3648	3591	3534	3474	3414	3352	3291	3224	3165	3105	3038	2974	2909
.026	3648	3591	3534	3473	3413	3352	3291	3224	3165	3105	3038	2974	2909
.027	3648	3592	3534	3474	3414	3353	3292	3225	3166	3106	3039	2975	2910
.028	3649	3592	3535	3475	3415	3354	3292	3225	3166	3106	3040	2975	2910
.029	3649	3592	3535	3475	3415	3354	3292	3225	3167	3106	3040	2976	2911
.030	3649	3593	3535	3475	3415	3354	3292	3225	3167	3106	3040	2976	2911
.031	3649	3593	3535	3475	3415	3354	3292	3225	3166	3106	3040	2974	2909
.032	3649	3593	3535	3475	3415	3354	3292	3225	3167	3106	3040	2975	2910
.033	3649	3593	3535	3475	3415	3354	3292	3225	3167	3106	3040	2975	2910
.034	3650	3594	3536	3476	3416	3355	3293	3226	3168	3106	3040	2976	2911
.035	3650	3594	3536	3476	3416	3355	3293	3226	3168	3106	3040	2976	2911
.036	3650	3594	3536	3477	3417	3356	3294	3226	3168	3106	3041	2976	2911
.037	3650	3594	3537	3477	3417	3356	3294	3226	3169	3106	3041	2977	2912
.038	3650	3594	3537	3477	3417	3356	3294	3226	3169	3106	3042	2977	2912
.039	3650	3594	3537	3478	3418	3357	3295	3226	3170	3106	3043	2978	2913
.040	3650	3595	3537	3478	3418	3357	3295	3226	3170	3106	3043	2978	2913
.041	3651	3595	3537	3478	3418	3357	3295	3226	3170	3107	3043	2978	2913
.042	3651	3595	3538	3479	3419	3358	3296	3227	3171	3107	3043	2979	2914
.043	3651	3595	3538	3479	3419	3358	3296	3227	3171	3108	3044	2979	2914
.044	3651	3595	3538	3479	3419	3358	3296	3227	3171	3108	3044	2980	2914
.045	3651	3595	3538	3479	3419	3358	3296	3227	3172	3108	3044	2980	2915
.046	3651	3595	3538	3479	3420	3359	3297	3228	3172	3109	3045	2980	2915
.047	3651	3595	3538	3480	3420	3359	3298	3228	3172	3109	3045	2981	2916
.048	3651	3595	3539	3480	3420	3359	3298	3228	3173	3109	3046	2981	2916
.049	3651	3595	3539	3480	3420	3359	3298	3228	3173	3109	3046	2982	2917

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichiometric fuel-air ratio, S	Ideal combustion-temperature rise, ΔT , $^{\circ}\text{R}$												
	Inlet-air temperature, $^{\circ}\text{R}$												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
1.051	3651	3595	3539	3480	3481	3360	3299	3236	3174	3110	3046	2982	2917
1.052	3650	3595	3539	3480	3481	3360	3299	3236	3174	3111	3047	2982	2917
0.953	3650	3595	3539	3480	3481	3360	3299	3236	3174	3111	3047	2983	2918
0.954	3650	3595	3539	3480	3481	3360	3299	3236	3174	3111	3047	2983	2918
0.955	3650	3595	3539	3480	3481	3361	3299	3237	3175	3111	3048	2983	2918
0.956	3650	3595	3539	3480	3481	3361	3300	3238	3175	3112	3048	2984	2919
0.957	3650	3595	3539	3481	3481	3361	3300	3238	3175	3112	3048	2984	2919
0.958	3649	3595	3539	3481	3481	3361	3300	3238	3175	3112	3049	2984	2919
0.959	3649	3595	3539	3481	3481	3361	3300	3238	3176	3113	3049	2984	2919
0.960	3649	3595	3539	3481	3481	3361	3300	3238	3176	3113	3049	2985	2920
0.961	3649	3594	3539	3481	3481	3361	3300	3239	3176	3113	3049	2985	2920
0.962	3648	3594	3538	3480	3480	3361	3301	3239	3176	3113	3050	2985	2920
0.963	3648	3594	3538	3480	3480	3361	3301	3239	3176	3113	3050	2985	2921
0.964	3648	3594	3538	3480	3480	3362	3301	3239	3177	3114	3050	2986	2921
0.965	3647	3594	3538	3480	3480	3362	3301	3239	3177	3114	3050	2986	2921
0.966	3647	3593	3538	3480	3480	3362	3301	3239	3177	3114	3050	2986	2921
0.967	3647	3593	3538	3480	3480	3362	3301	3239	3177	3114	3051	2986	2921
0.968	3646	3593	3537	3480	3480	3362	3301	3240	3177	3115	3051	2987	2922
0.969	3646	3593	3537	3480	3480	3362	3301	3240	3177	3115	3051	2987	2922
0.970	3645	3593	3537	3480	3480	3362	3301	3240	3178	3115	3051	2987	2922
0.971	3645	3592	3537	3479	3479	3481	3362	3301	3240	3178	3115	3052	2987
0.972	3644	3591	3536	3479	3479	3481	3362	3301	3240	3178	3115	3052	2988
0.973	3644	3591	3536	3479	3479	3481	3362	3301	3240	3178	3115	3052	2988
0.974	3643	3589	3536	3479	3479	3481	3362	3301	3240	3178	3115	3052	2988
0.975	3643	3590	3537	3479	3479	3481	3362	3301	3240	3178	3116	3052	2988
0.976	3642	3589	3535	3478	3478	3481	3361	3301	3240	3178	3116	3052	2988
0.977	3642	3589	3535	3478	3478	3480	3361	3301	3240	3178	3116	3053	2988
0.978	3641	3588	3534	3478	3478	3480	3361	3301	3240	3178	3116	3053	2988
0.979	3640	3588	3534	3478	3478	3480	3361	3301	3240	3178	3116	3053	2988
0.981	3639	3587	3533	3477	3477	3480	3361	3301	3240	3179	3116	3053	2989
0.982	3639	3587	3533	3477	3477	3480	3361	3301	3240	3179	3116	3053	2989
0.983	3638	3586	3532	3476	3476	3480	3361	3301	3240	3179	3116	3053	2989
0.984	3637	3585	3531	3476	3476	3480	3360	3301	3240	3179	3117	3054	2990
0.985	3637	3585	3531	3476	3476	3480	3360	3301	3240	3179	3116	3053	2989
0.986	3634	3584	3526	3475	3475	3481	3360	3300	3240	3179	3117	3054	2990
0.987	3634	3584	3526	3475	3475	3481	3360	3300	3240	3179	3117	3054	2990
0.988	3634	3582	3529	3474	3474	3481	3360	3300	3240	3179	3117	3054	2990
0.989	3633	3582	3529	3474	3474	3481	3359	3300	3240	3179	3117	3054	2990
0.990	3632	3581	3528	3473	3473	3481	3359	3300	3240	3179	3117	3054	2990
0.991	3631	3581	3528	3473	3473	3481	3359	3300	3240	3179	3117	3054	2991
0.992	3630	3579	3527	3472	3472	3481	3358	3300	3240	3179	3117	3054	2991
0.993	3629	3579	3526	3472	3472	3481	3358	3300	3240	3179	3117	3054	2991
0.994	3628	3578	3526	3471	3471	3481	3358	3299	3239	3178	3117	3054	2991
0.995	3627	3577	3525	3471	3471	3481	3357	3299	3239	3178	3117	3054	2991
0.996	3627	3577	3525	3471	3471	3481	3357	3299	3239	3178	3117	3054	2991
0.997	3627	3576	3524	3470	3471	3481	3357	3299	3239	3178	3117	3054	2991
0.998	3626	3576	3524	3470	3471	3481	3357	3299	3239	3178	3117	3054	2991
0.999	3625	3575	3523	3469	3471	3481	3356	3298	3239	3178	3117	3054	2991
1.000	3624	3574	3522	3468	3471	3481	3356	3298	3238	3178	3117	3054	2991

S = 1.000 to 1.100

TABLE I. - Continued. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

TABLE I. - Concluded. IDEAL COMBUSTION-TEMPERATURE RISE, AT COMBUSTION PRESSURE OF 1 ATMOSPHERE

Fraction of stoichiometric fuel-air ratio, S	Ideal combustion-temperature rise, ΔT , $^{\circ}\text{R}$													
	Inlet-air temperature, $^{\circ}\text{R}$													
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	
1.151	3575	3529	3482	3432	3381	3320	3275	3219	3162	3104	3045	2984	2923	
1.152	3573	3528	3480	3431	3380	3328	3274	3218	3162	3104	3045	2984	2922	
1.153	3572	3527	3479	3430	3379	3327	3273	3218	3161	3103	3044	2984	2922	
1.154	3571	3525	3478	3429	3379	3326	3272	3217	3161	3103	3044	2983	2922	
1.155	3570	3524	3477	3428	3378	3325	3272	3217	3160	3102	3043	2983	2922	
1.156	3569	3523	3476	3427	3377	3325	3271	3216	3160	3102	3043	2983	2921	
1.157	3567	3522	3475	3426	3376	3324	3270	3215	3159	3102	3043	2983	2921	
1.158	3566	3521	3474	3425	3375	3323	3270	3215	3158	3101	3042	2982	2921	
1.159	3564	3519	3472	3424	3374	3322	3269	3214	3158	3101	3042	2982	2921	
1.160	3563	3518	3471	3423	3373	3321	3268	3213	3157	3100	3041	2982	2920	
1.161	3562	3517	3470	3422	3372	3320	3267	3213	3157	3100	3041	2981	2920	
1.162	3560	3515	3469	3421	3371	3319	3266	3212	3156	3099	3041	2981	2920	
1.163	3559	3514	3468	3420	3370	3318	3266	3211	3156	3099	3040	2980	2919	
1.164	3557	3513	3466	3418	3369	3317	3265	3211	3155	3098	3040	2980	2919	
1.165	3556	3511	3465	3417	3368	3317	3264	3210	3154	3097	3039	2980	2919	
1.166	3555	3510	3464	3416	3367	3316	3263	3209	3154	3097	3039	2979	2918	
1.167	3553	3509	3463	3415	3366	3315	3262	3208	3153	3096	3038	2979	2918	
1.168	3552	3507	3461	3414	3365	3314	3261	3208	3152	3096	3038	2979	2918	
1.169	3550	3506	3460	3413	3364	3313	3261	3207	3152	3095	3037	2978	2918	
1.170	3549	3505	3459	3411	3362	3312	3260	3206	3151	3095	3037	2978	2917	
1.171	3547	3503	3458	3410	3361	3311	3259	3205	3150	3094	3036	2977	2917	
1.172	3546	3502	3456	3409	3360	3310	3258	3205	3150	3094	3036	2977	2916	
1.173	3544	3500	3455	3408	3359	3309	3257	3204	3149	3093	3035	2977	2916	
1.174	3543	3499	3454	3407	3358	3308	3256	3203	3148	3092	3035	2976	2916	
1.175	3541	3497	3452	3405	3357	3307	3255	3202	3148	3092	3034	2976	2915	
1.176	3540	3496	3451	3404	3356	3306	3254	3201	3147	3091	3034	2975	2915	
1.177	3538	3495	3449	3403	3354	3305	3253	3201	3146	3091	3033	2975	2915	
1.178	3536	3493	3448	3401	3353	3304	3252	3200	3146	3090	3033	2974	2914	
1.179	3535	3492	3447	3400	3352	3303	3251	3199	3145	3089	3032	2974	2914	
1.180	3533	3490	3445	3399	3351	3301	3251	3198	3144	3089	3032	2973	2914	
1.181	3532	3488	3444	3398	3350	3300	3250	3197	3143	3088	3031	2973	2913	
1.182	3530	3487	3442	3396	3349	3299	3249	3196	3143	3087	3031	2972	2913	
1.183	3528	3485	3441	3395	3347	3298	3248	3195	3142	3087	3030	2972	2912	
1.184	3527	3484	3439	3393	3346	3297	3247	3195	3141	3086	3030	2971	2912	
1.185	3525	3482	3438	3392	3345	3296	3246	3194	3140	3085	3029	2971	2912	
1.186	3524	3481	3436	3391	3344	3295	3245	3193	3140	3085	3028	2970	2911	
1.187	3522	3479	3435	3389	3342	3294	3244	3192	3139	3084	3028	2970	2911	
1.188	3520	3478	3433	3388	3341	3293	3243	3191	3138	3083	3027	2969	2910	
1.189	3518	3476	3432	3387	3340	3291	3241	3190	3137	3083	3027	2969	2910	
1.190	3517	3474	3430	3385	3338	3290	3240	3189	3136	3082	3026	2968	2909	
1.191	3515	3473	3429	3384	3357	3289	3239	3188	3135	3081	3025	2968	2909	
1.192	3513	3471	3427	3382	3356	3288	3238	3187	3135	3080	3025	2967	2908	
1.193	3512	3469	3426	3381	3354	3287	3237	3186	3134	3080	3024	2967	2908	
1.194	3510	3468	3424	3379	3353	3285	3236	3185	3133	3079	3023	2966	2908	
1.195	3508	3466	3423	3378	3352	3284	3235	3184	3132	3078	3023	2966	2907	
1.196	3506	3464	3421	3376	3350	3283	3234	3183	3131	3077	3022	2965	2907	
1.197	3504	3463	3419	3375	3329	3282	3233	3182	3130	3077	3021	2965	2906	
1.198	3503	3461	3418	3373	3328	3280	3232	3181	3129	3076	3021	2964	2906	
1.199	3501	3459	3416	3372	3326	3279	3230	3180	3129	3075	3020	2963	2905	
1.200	3499	3457	3414	3370	3325	3278	3229	3179	3128	3074	3019	2963	2905	

S = 1.101 to 1.200

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TABLE II. - ENTHALPY OF AIR

T, °R	Enthalpy difference, $(\Delta h_T^0)_a$, Btu/lb										T, °R	Enthalpy difference, $(\Delta h_T^0)_a$, Btu/lb									
	0	1	2	3	4	5	6	7	8	9		0	1	2	3	4	5	6	7	8	9
400	0.0	0.2	0.5	0.7	1.0	1.2	1.4	1.7	1.9	2.2	1000	145.5	5.6	6.0	6.3	6.5	6.8	7.0	7.3	7.5	7.6
10	2.4	2.6	2.8	3.1	3.4	3.6	3.8	4.1	4.3	4.6	10	8.0	8.3	8.5	8.8	9.0	9.3	9.5	9.8	0.0	0.5
20	4.8	5.0	5.3	5.5	5.8	6.0	6.2	6.5	6.7	6.9	20	150.5	0.8	1.0	1.3	1.5	1.8	2.0	2.3	2.5	2.6
30	7.2	7.4	7.7	7.9	8.1	8.4	8.6	8.9	9.1	9.3	30	3.0	3.3	3.5	3.8	4.0	4.3	4.5	4.8	5.0	5.3
40	9.6	9.8	10.1	10.3	10.5	10.8	11.0	11.3	11.5	11.7	40	5.5	5.8	6.0	6.3	6.5	6.8	7.0	7.3	7.5	7.6
50	12.0	12.2	12.5	12.7	12.9	13.2	13.4	13.7	13.9	14.1	50	8.0	8.3	8.5	8.8	9.0	9.3	9.5	9.8	0.0	0.3
60	14.4	14.6	14.9	15.1	15.3	15.6	15.8	16.1	16.3	16.5	60	160.5	0.8	1.0	1.3	1.5	1.8	2.0	2.3	2.5	2.6
70	16.8	17.0	17.5	17.7	18.0	18.2	18.5	18.7	18.9	19.1	70	3.0	3.3	3.5	3.8	4.0	4.3	4.5	4.8	5.0	5.3
80	19.2	19.4	19.7	19.9	20.1	20.4	20.6	20.9	21.1	21.3	80	5.5	5.8	6.0	6.3	6.5	6.8	7.0	7.3	7.5	7.6
90	21.6	21.8	22.1	22.3	22.5	22.8	23.0	23.3	23.5	23.7	90	8.0	8.3	8.5	8.8	9.0	9.3	9.5	9.8	0.0	0.3
500	4.0	4.2	4.4	4.7	4.9	5.2	5.4	5.6	5.9	6.1	1100	170.5	0.8	1.0	1.3	1.5	1.8	2.0	2.3	2.5	2.6
10	6.4	6.6	6.8	7.1	7.3	7.6	7.8	8.0	8.3	8.5	10	3.1	3.3	3.5	3.8	4.1	4.3	4.5	4.8	5.1	5.3
20	8.8	9.0	9.2	9.5	9.7	10.0	10.2	10.4	10.7	10.9	20	5.6	5.8	6.1	6.3	6.6	6.8	7.1	7.3	7.5	7.6
30	11.2	11.4	11.6	11.9	12.1	12.4	12.6	12.8	13.1	13.3	30	8.1	8.3	8.5	8.8	9.1	9.4	9.6	9.9	0.1	0.4
40	13.6	13.8	14.0	14.3	14.5	14.8	15.0	15.2	15.5	15.7	40	180.6	0.9	1.1	1.4	1.6	1.8	2.1	2.4	2.6	2.9
50	16.0	16.2	16.4	16.7	16.9	17.2	17.4	17.6	17.8	18.0	50	5.2	5.4	5.7	5.9	4.2	4.4	4.7	4.9	5.2	5.4
60	18.4	18.6	18.8	19.1	19.3	19.6	19.8	20.0	20.3	20.5	60	5.7	5.9	6.2	6.5	6.7	7.0	7.2	7.5	7.7	8.0
70	20.8	21.0	21.2	21.5	21.7	22.0	22.2	22.4	22.7	22.9	70	8.2	8.5	8.7	9.0	9.2	9.5	9.8	0.0	0.3	0.5
80	23.2	23.4	23.6	23.9	24.1	24.4	24.6	24.8	25.1	25.3	80	190.8	1.0	1.3	1.5	1.8	2.0	2.3	2.5	2.8	3.1
90	25.6	25.8	26.0	26.3	26.5	26.8	27.0	27.2	27.5	27.7	90	3.5	3.6	3.8	4.1	4.3	4.5	4.8	5.1	5.3	5.6
600	8.0	8.2	8.5	8.7	8.9	9.2	9.4	9.7	9.9	0.1	1200	5.9	6.1	6.4	6.6	6.9	7.1	7.4	7.6	7.9	8.2
10	50.4	0.6	0.8	1.1	1.3	1.6	1.8	2.1	2.3	2.5	10	8.4	8.7	8.9	9.2	9.4	9.7	9.9	0.2	0.5	0.7
20	2.8	3.0	3.3	3.5	3.7	4.0	4.2	4.5	4.7	5.0	20	201.0	1.2	1.5	1.7	2.0	2.2	2.5	2.8	3.0	3.3
30	5.2	5.4	5.7	5.9	6.2	5.4	6.6	6.9	7.1	7.4	30	3.5	3.8	4.0	4.3	4.5	4.8	5.1	5.3	5.6	5.8
40	7.6	7.8	8.1	8.3	8.6	8.8	9.1	9.3	9.5	9.8	40	6.1	6.3	6.6	6.8	7.1	7.4	7.6	7.9	8.1	8.4
50	9.0	9.3	9.6	9.8	0.2	0.4	0.6	0.9	1.1	1.4	50	6.6	8.9	9.2	9.4	9.7	9.9	0.2	0.4	0.7	0.9
60	2.4	2.7	2.8	3.2	3.4	3.6	3.9	4.1	4.4	4.6	60	211.2	1.5	1.7	2.0	2.2	2.5	2.7	3.0	3.5	3.5
70	4.8	5.1	5.3	5.6	5.8	6.1	6.3	6.5	6.8	7.0	70	3.8	4.0	4.3	4.5	4.8	5.1	5.3	5.6	6.1	
80	7.3	7.5	7.7	8.0	8.2	8.5	8.7	9.0	9.8	9.4	80	6.3	6.6	6.9	7.1	7.4	7.6	7.9	8.1	8.4	8.7
90	9.7	9.9	0.2	0.4	0.6	0.9	1.1	1.4	1.6	1.9	90	8.9	9.2	9.4	9.7	9.9	0.0	0.2	0.5	0.7	1.2
700	72.1	2.3	2.6	2.8	3.1	3.3	3.5	3.8	4.0	4.3	1300	221.5	1.8	2.0	2.3	2.5	2.8	3.0	3.3	3.6	3.8
10	4.5	4.8	5.0	5.2	5.5	5.7	6.0	6.2	6.4	6.7	10	4.1	4.3	4.6	4.9	5.1	5.4	5.6	5.9	6.1	6.4
20	6.9	7.1	7.4	7.6	7.9	8.1	8.4	8.6	8.8	9.1	20	6.7	6.9	7.2	7.4	7.7	8.0	8.2	8.5	8.7	9.0
30	9.5	9.6	9.8	0.1	0.3	0.5	0.8	1.0	1.3	1.5	30	9.3	9.5	9.8	0.0	0.3	0.5	0.8	1.1	1.3	1.6
40	81.8	2.0	2.2	2.5	2.7	3.0	3.2	3.5	3.7	3.9	40	231.8	2.1	2.4	2.6	2.9	3.1	3.4	3.7	3.9	4.2
50	4.2	4.4	4.7	4.9	5.1	5.4	5.6	5.9	6.1	6.4	50	4.4	4.7	5.0	5.2	5.5	5.7	6.0	6.3	6.5	6.8
60	6.8	6.8	7.1	7.3	7.6	7.8	8.1	8.3	8.8	8.8	60	7.0	7.3	7.6	7.8	8.1	8.3	8.6	9.1	9.4	
70	9.0	9.3	9.5	9.8	0.0	0.3	0.5	0.5	1.0	1.2	70	9.6	9.9	0.2	0.4	0.7	0.9	1.2	1.5	1.7	2.0
80	91.5	1.7	2.0	2.2	2.4	2.7	2.9	3.2	3.4	3.7	80	242.2	2.5	2.8	3.0	3.3	3.5	3.8	4.1	4.3	4.6
90	3.8	4.1	4.4	4.6	4.9	5.1	5.4	5.6	5.9	6.1	90	4.6	5.1	5.4	5.6	5.9	6.1	6.4	6.7	6.9	7.2
800	6.5	6.6	6.8	7.1	7.3	7.6	7.8	8.0	8.3	8.5	1400	7.5	7.7	8.0	8.2	8.5	8.8	9.0	9.3	9.5	9.8
10	8.8	9.0	9.3	9.5	9.8	0.0	0.2	0.5	0.7	1.0	10	250.1	0.3	0.6	0.9	1.1	1.4	1.6	1.9	2.2	2.4
20	101.2	1.5	1.7	2.0	2.2	2.4	2.7	2.9	3.2	3.4	20	2.7	2.9	3.2	3.5	3.7	4.0	4.3	4.5	4.8	5.0
30	3.7	3.9	4.2	4.4	4.6	4.9	5.1	5.4	5.6	5.9	30	5.3	5.6	5.8	6.1	6.4	6.6	6.9	7.1	7.4	7.7
40	6.1	6.4	6.6	6.8	7.1	7.3	7.6	7.8	8.1	8.3	40	7.9	8.2	8.5	8.7	9.0	9.2	9.5	9.8	0.0	0.3
50	8.6	8.8	9.0	9.3	9.5	9.8	0.0	0.3	0.5	0.8	50	260.6	0.6	1.1	1.3	1.6	1.9	2.1	2.4	2.7	2.8
60	111.0	1.2	1.5	1.7	2.0	2.2	2.5	2.7	3.0	3.2	60	5.2	3.5	3.7	4.0	4.2	4.5	4.8	5.0	5.3	5.6
70	3.5	3.7	3.9	4.2	4.4	4.7	4.9	5.2	5.4	5.7	70	5.8	6.1	6.3	6.6	6.9	7.1	7.4	7.7	7.9	8.2
80	5.9	6.2	6.4	6.6	6.9	7.1	7.4	7.6	7.9	8.1	80	8.5	8.7	9.0	9.2	9.5	9.8	0.0	0.3	0.6	0.8
90	8.4	8.6	8.9	9.1	9.3	9.6	9.8	0.1	0.3	0.6	90	271.1	1.4	1.6	1.9	2.1	2.4	2.7	2.9	3.2	3.5
900	120.8	1.0	1.3	1.5	1.8	2.0	2.3	2.5	2.8	3.0	1500	3.7	4.0	4.3	4.5	4.8	5.1	5.3	5.6	5.8	6.1
10	3.3	3.5	3.7	4.0	4.2	4.5	4.7	5.0	5.2	5.5	10	6.4	6.6	6.9	7.2	7.4	7.7	8.0	8.2	8.5	8.8
20	5.7	6.0	6.2	6.5	6.7	7.0	7.2	7.4	7.7	7.9	20	9.0	9.3	9.6	9.8	0.1	0.3	0.6	0.9	1.1	1.4
30	8.2	8.4	8.7	8.9	9.2	9.4	9.7	9.9	0.2	0.4	10	281.7	1.9	2.2	2.5	2.7	3.0	3.3	3.5	3.8	4.1
40	130.7	0.9	1.1	1.4	1.6	1.9	2.1	2.4	2.6	2.9	40	4.3	4.6	4.9	5.1	5.4	5.6	5.9	6.2	6.4	6.7
50	3.1	3.4	3.6	3.9	4.1	4.4	4.6	4.9	5.1	5.4	50	7.0	7.2	7.5	7.8	8.0	8.3	8.6	8.8	9.1	9.4
60	5.6	5.8	6.1	6.3	6.6	6.8	7.1	7.3	7.6	7.8	60	9.6	9.9	0.2	0.4	0.7	1.0	1.2	1.5	1.8	2.0
70	8.1	8.3	8.6	8.8	9.1	9.3	9.6	9.8	0.1	0.3	70	292.3	2.6	2.8	3.1	3.4	3.6	3.9	4.2	4.4	4.7
80	140.6	0.8	1.1	1.3	1.6	1.8	2.0	2.3	2.5	2.8	80	5.0	5.2	5.5	5.8	6.0	6.3	6.5	6.8	7.1	7.4
90	3.0	3.3	3.5	3.8	4.																

TABLE III. - ENTHALPY OF LIQUID FUEL
FOR A STOICHIOMETRIC MIXTURE

Fuel temperature, T_f , $^{\circ}$ R	Enthalpy difference, $f'(\Delta h_T^0)_f$, Btu/lb-air
400	-4.4
410	-4.1
420	-3.8
430	-3.5
440	-3.2
450	-2.9
460	-2.6
470	-2.3
480	-2.0
490	-1.7
500	-1.3
510	-1.0
520	-.7
530	-.3
540	0
550	.3
560	.7
570	1.0
580	1.4
590	1.7
600	2.1

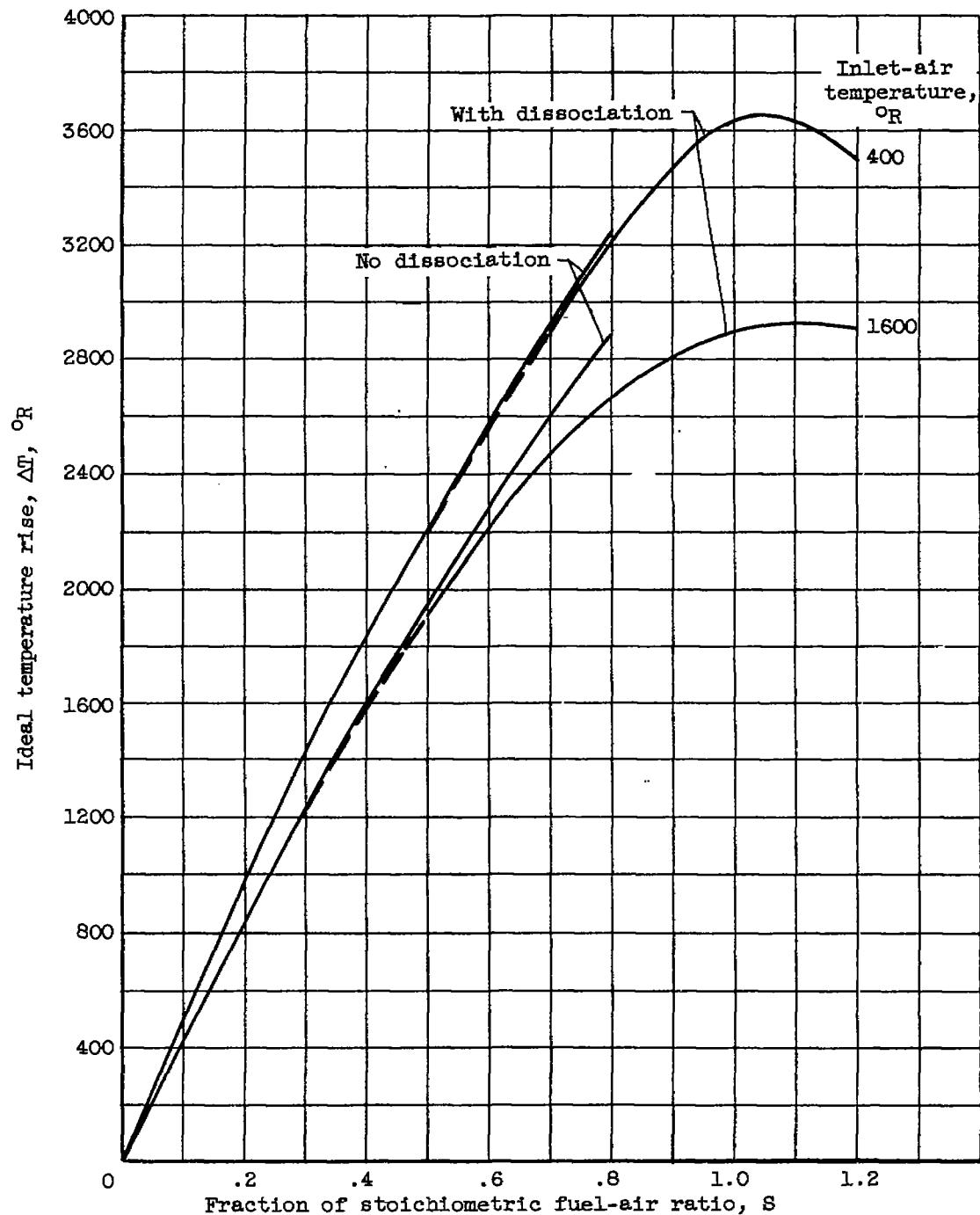
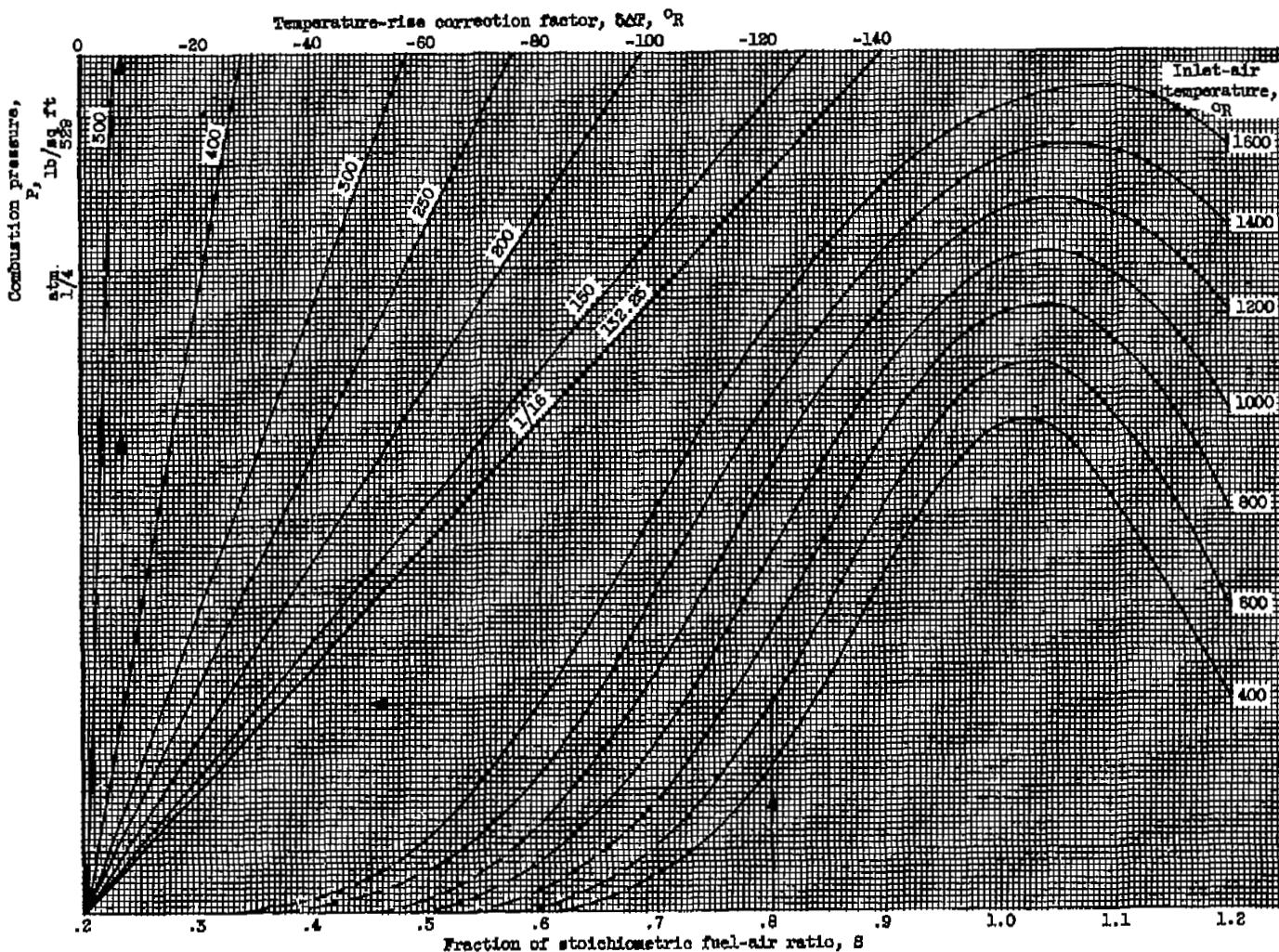


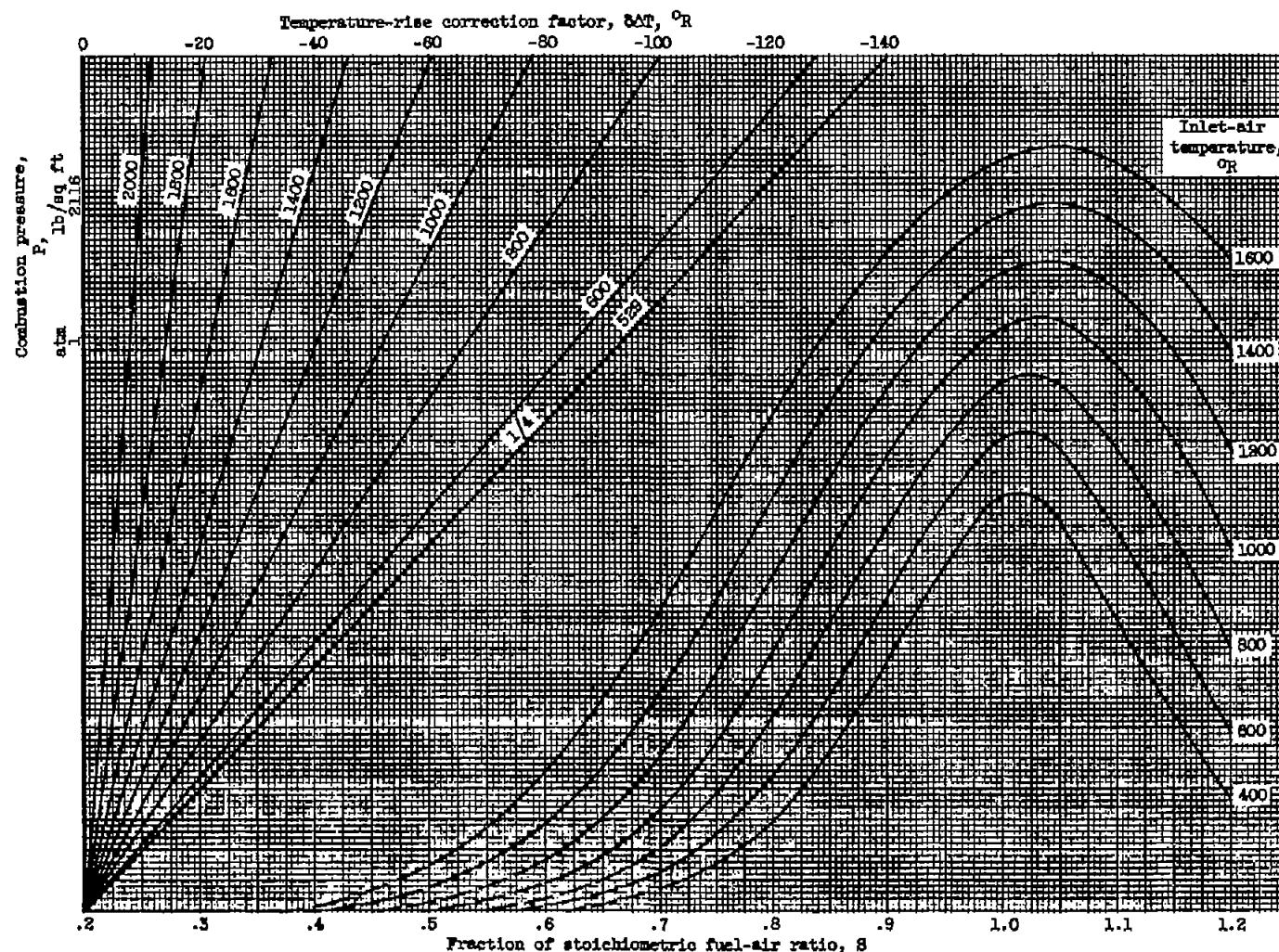
Figure 1. - Ideal temperature rise for constant-pressure combustion as function of fraction of stoichiometric fuel-air ratio. Combustion pressure, 1 atmosphere.

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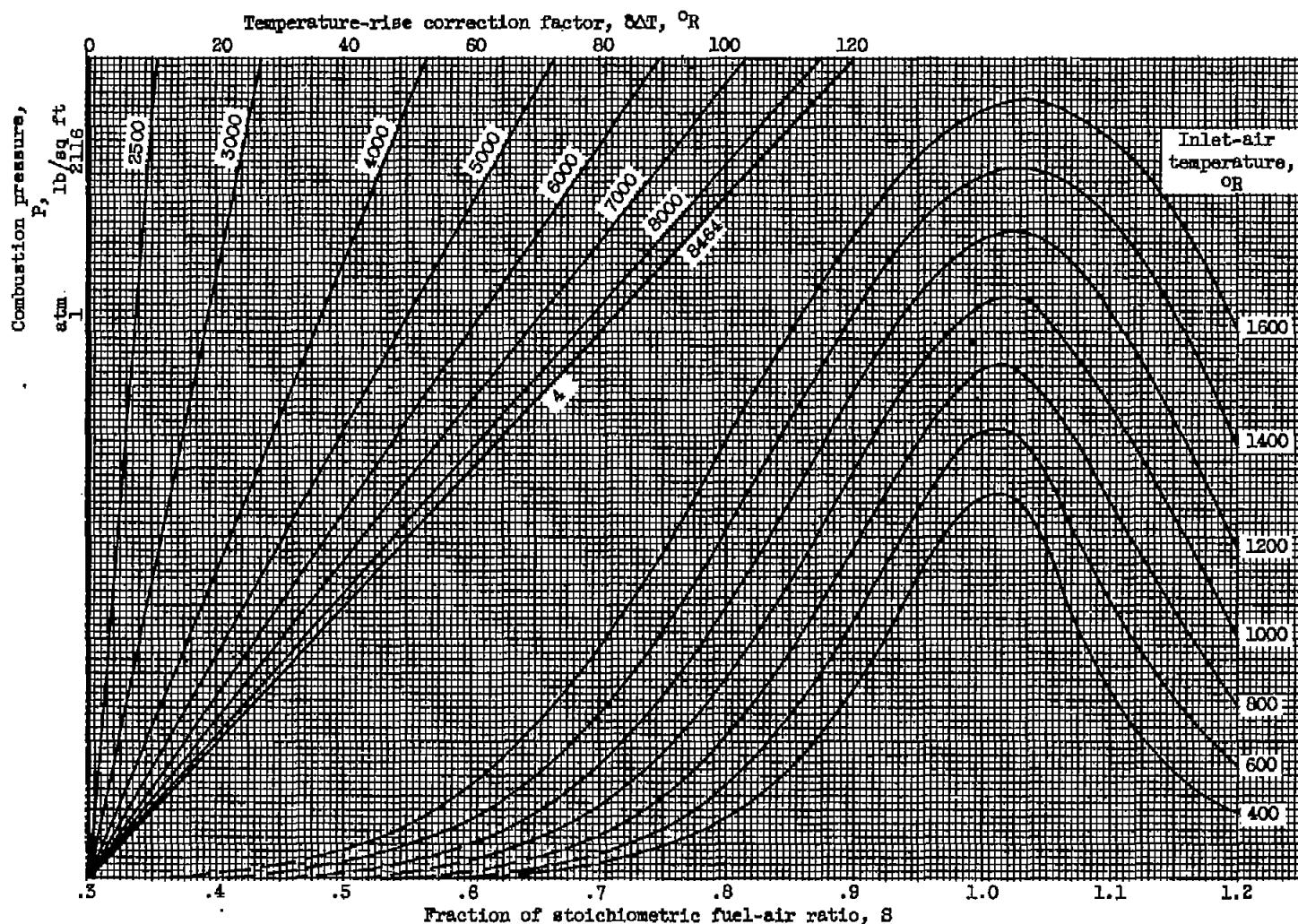
(a) Combustion pressures from 1/4 to 1/16 atmosphere.

Figure 2. - Temperature-rise correction factors as function of fuel-air ratio.



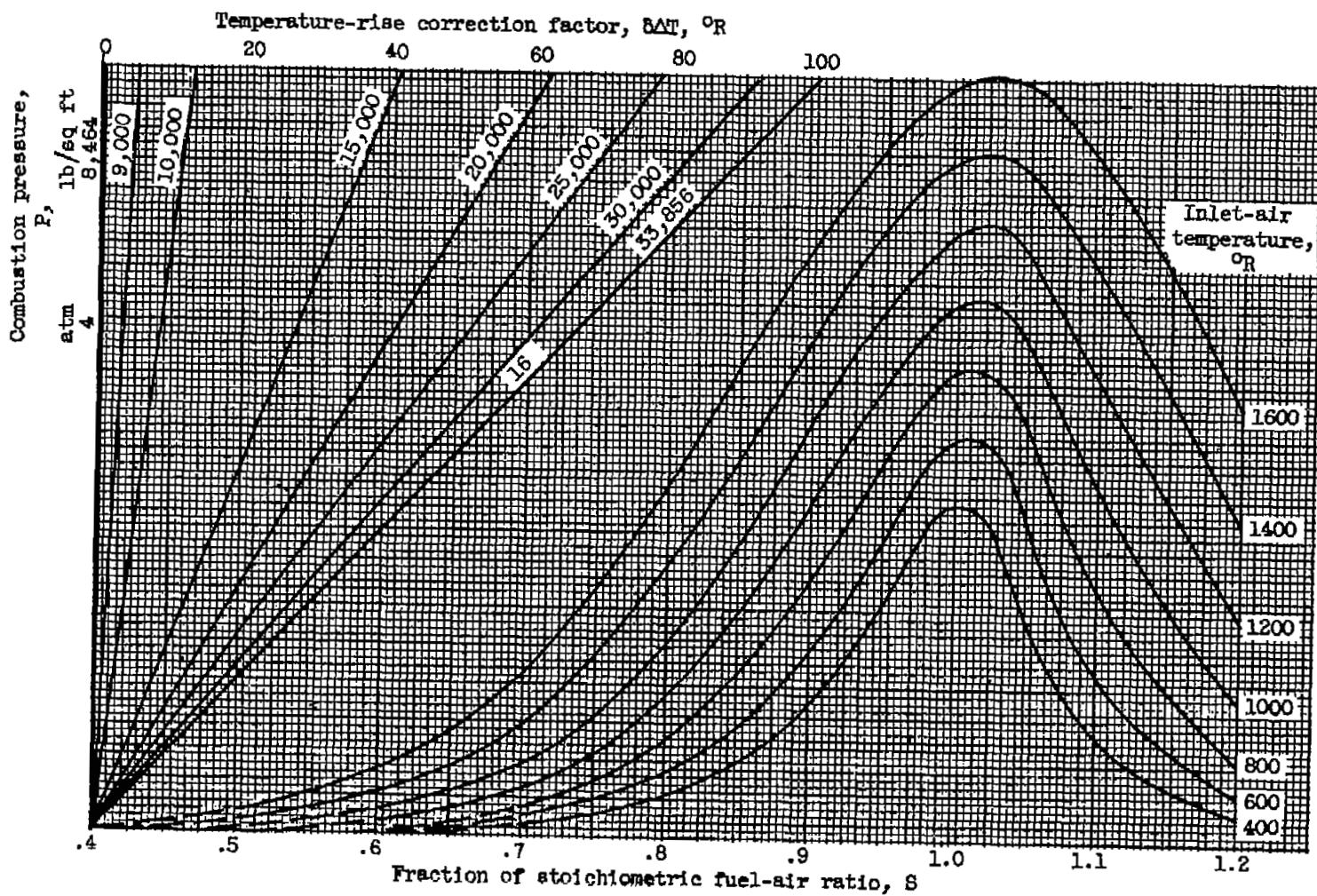
(b) Combustion pressures from 1 to 1/4 atmosphere.

Figure 2. - Continued. Temperature-rise correction factors as function of fuel-air ratio.



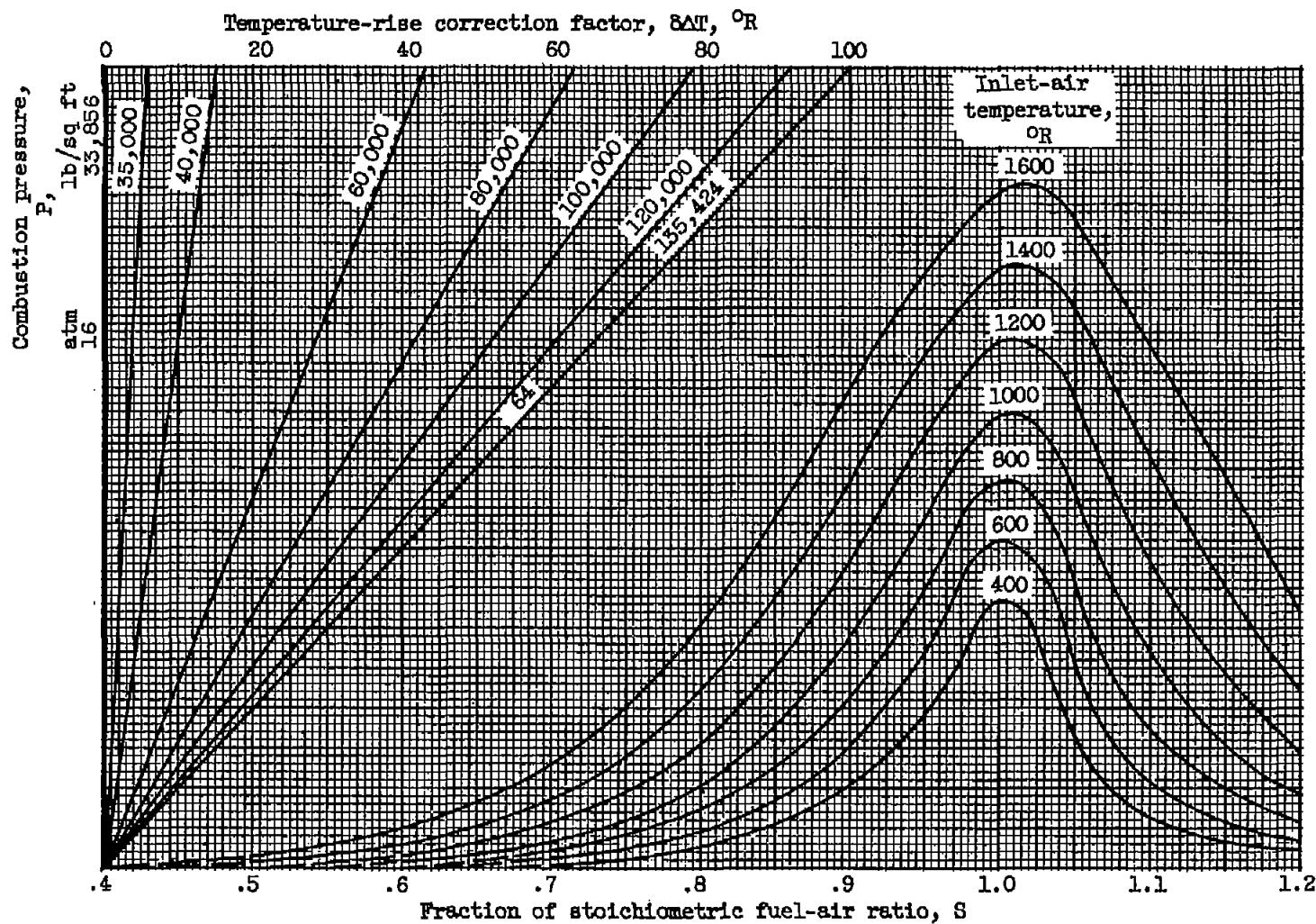
(c) Combustion pressures from 1 to 4 atmospheres.

Figure 2. - Continued. Temperature-rise correction factors as function of fuel-air ratio.



(d) Combustion pressures from 4 to 16 atmospheres.

Figure 2. - Continued. Temperature-rise correction factors as function of fuel-air ratio.



(e) Combustion pressures from 16 to 64 atmospheres.

Figure 2. - Concluded. Temperature-rise correction factors as function of fuel-air ratio.

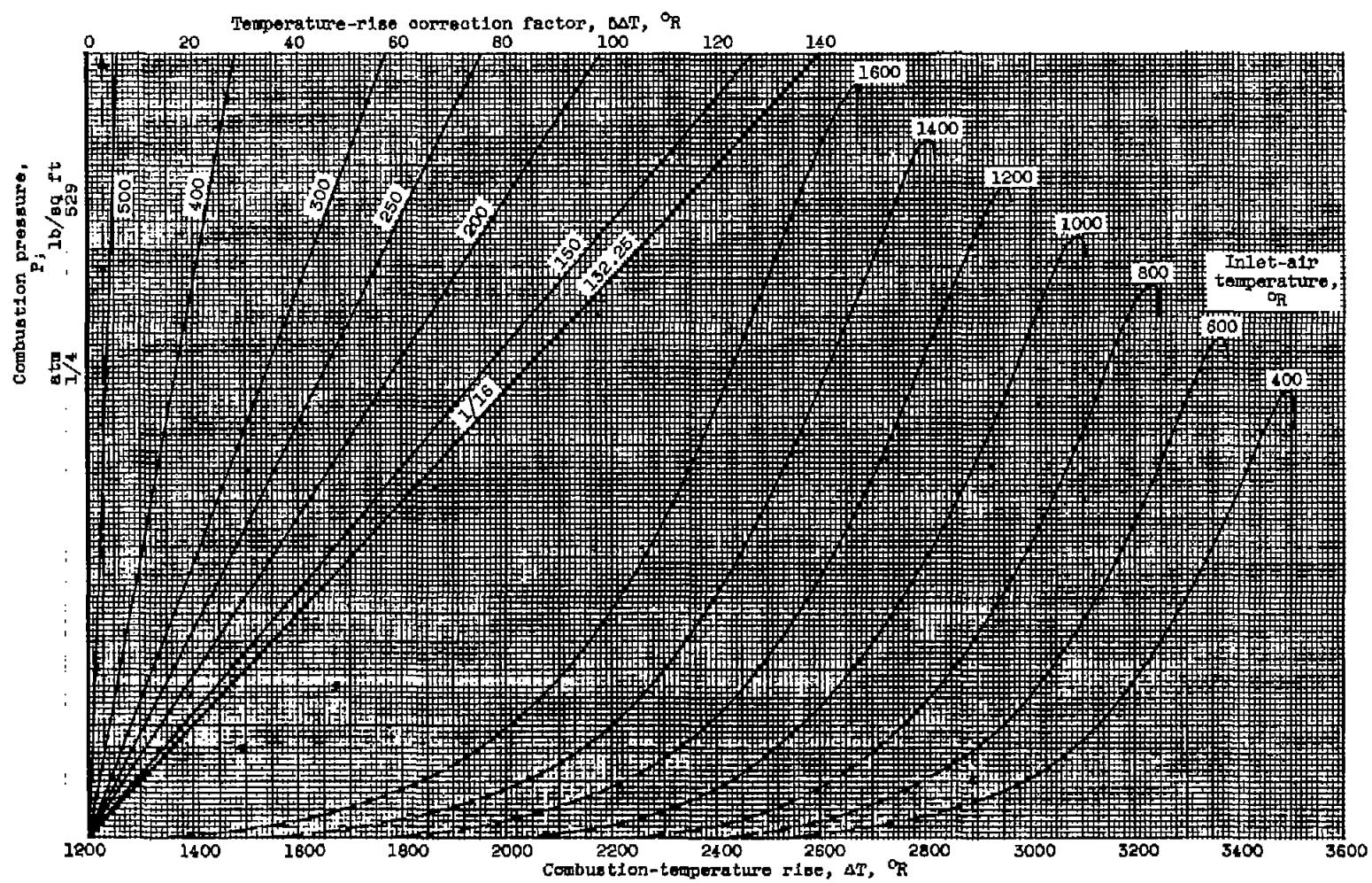
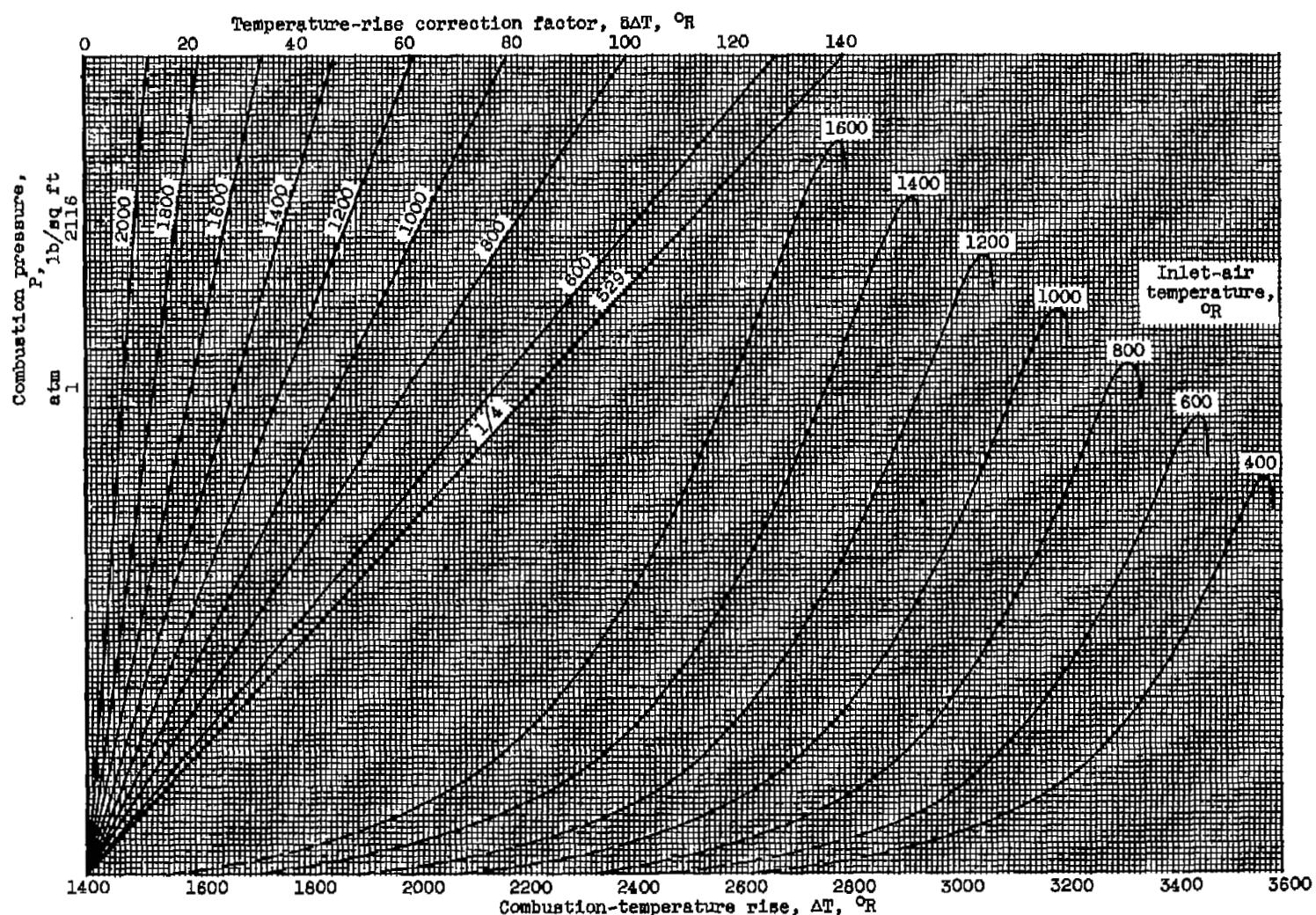
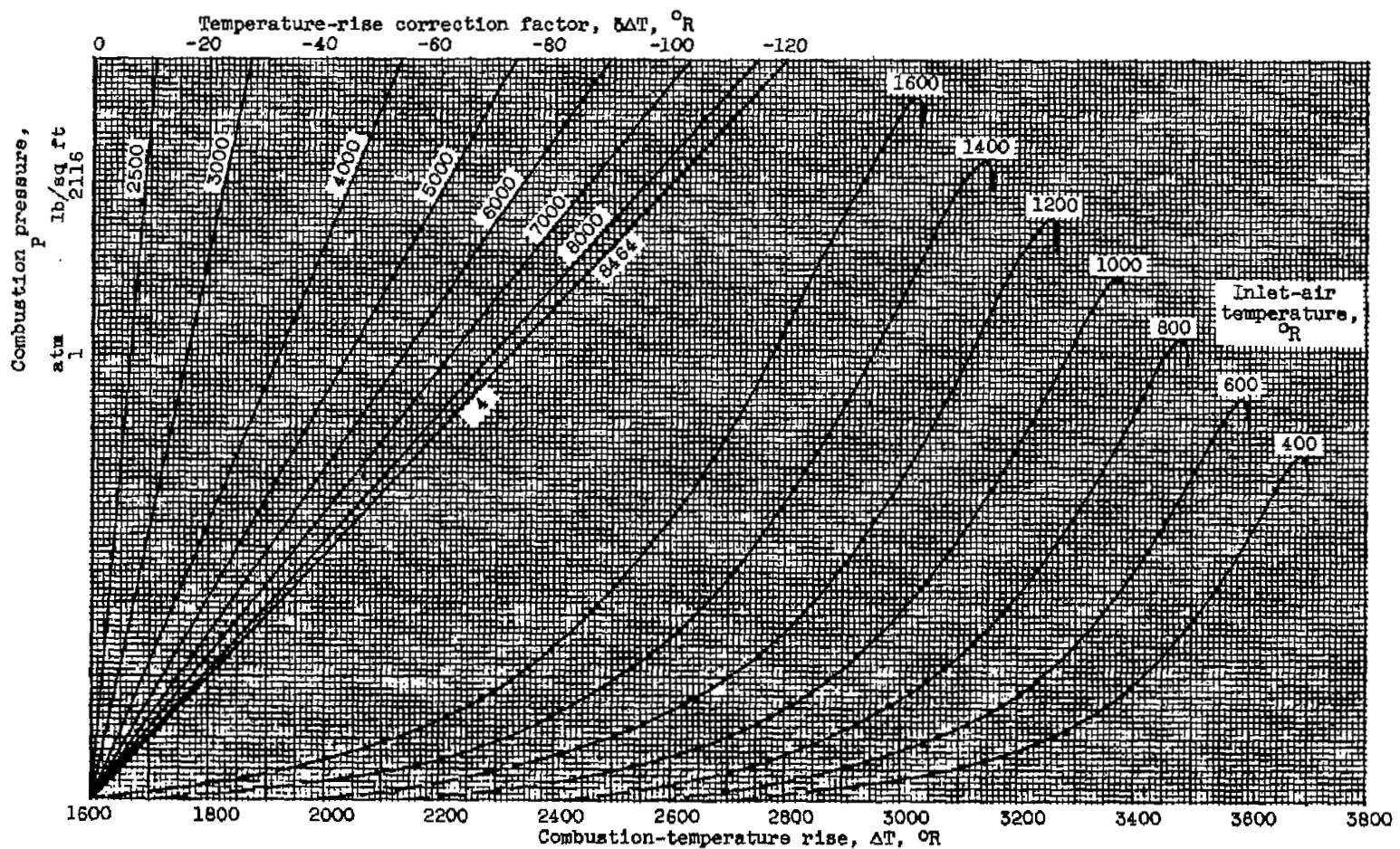
(a) Combustion pressures from $\frac{1}{4}$ to $\frac{1}{16}$ atmosphere.

Figure 3. - Temperature-rise correction factors as function of combustion-temperature rise.



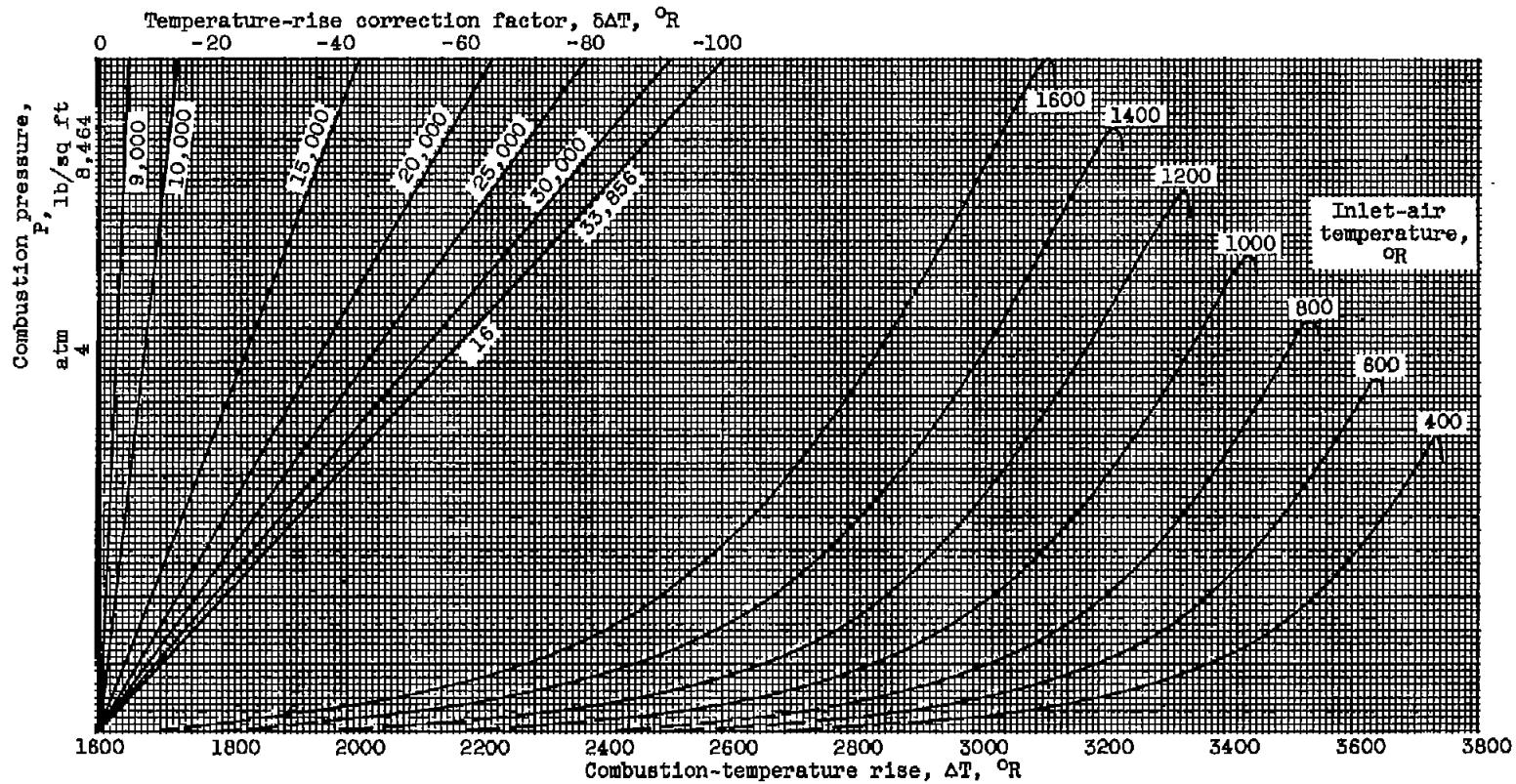
(b) Combustion pressures from 1 to 1/4 atmosphere.

Figure 3. - Continued. Temperature-rise correction factors as function of combustion-temperature rise.



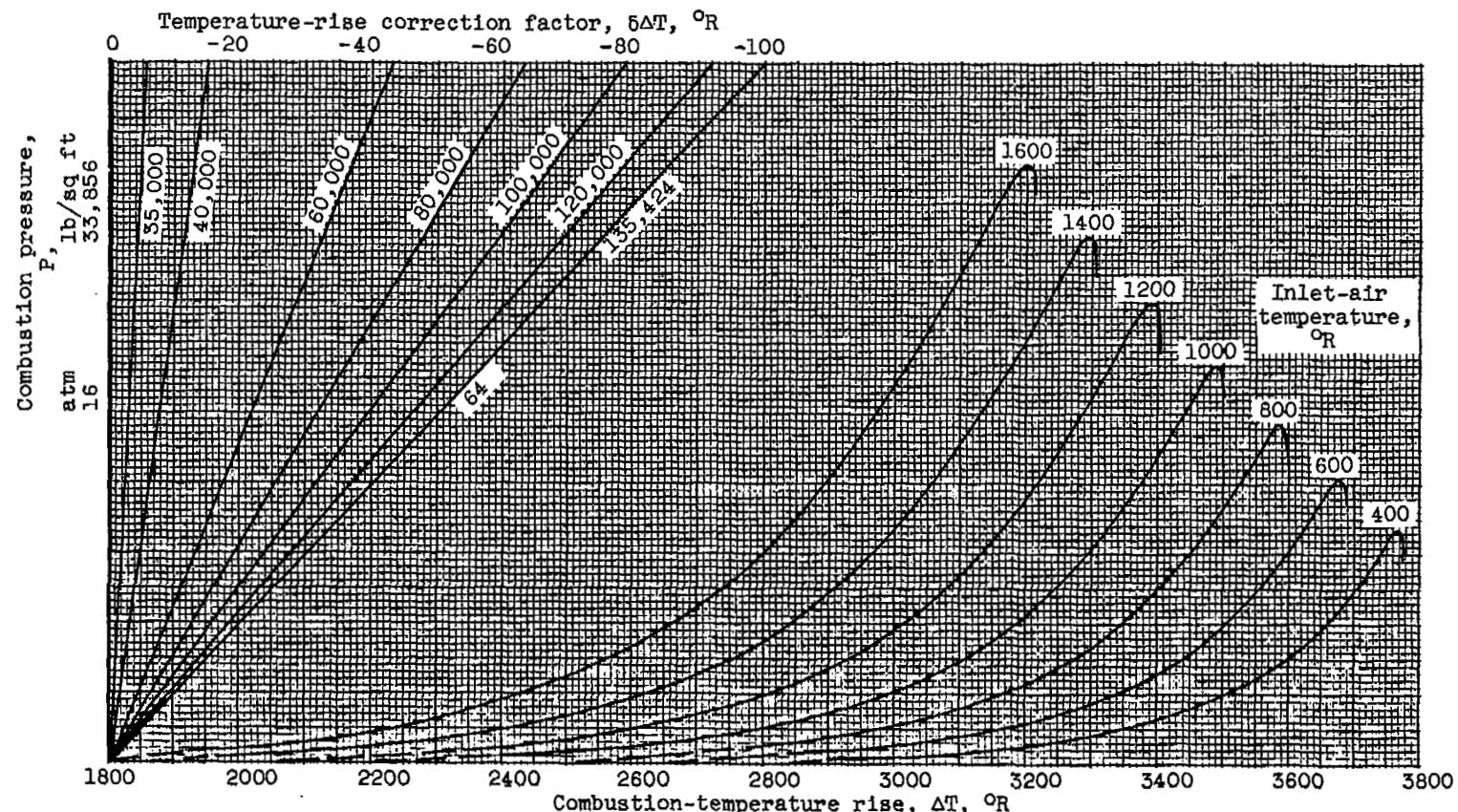
(c) Combustion pressures from 1 to 4 atmospheres.

Figure 3. - Continued. Temperature-rise correction factors as function of combustion-temperature rise.



(d) Combustion pressures from 4 to 16 atmospheres.

Figure 3. - Continued. Temperature-rise correction factors as function of combustion-temperature rise.



(e) Combustion pressures from 16 to 64 atmospheres.

Figure 3. - Concluded. Temperature-rise correction factors as function of combustion-temperature rise.

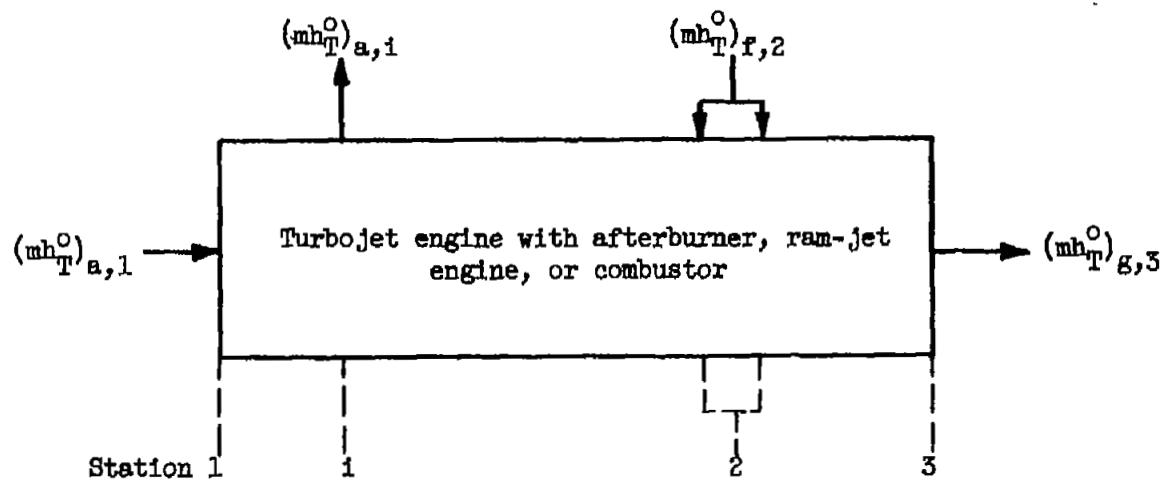


Figure 4. - General system showing entering and leaving enthalpies.

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