Θερμότης, Έργον

Συντελεστής μεταδόσεως θερμότητος

1 kcal/m² h °C	= 1,1630	W/m² K
1 cal/m² s °C	= 4,1868·10⁴	W/m² K
1 kcal/ft² hr °C	= 1,2518·10	W/m² K
1 Btu/ft² hr °F	= 5,6785	W/m² K
1 Chu/ft² hr °C	= 5,6783	W/m² K

Ροή θερμότητος → Ισχύς

Συντελεστής θερμικής άγωγιμότητος

1 kcal/m h °C	= 1,1630	W/m K
1 cal/cm s °C	= 4,1868·10²	W/m K
1 Btu/ft² hr (°F/in)	= 1,4423·10⁻¹	W/m K
1 Btu/ft hr °F	= 1,7308	W/m K
1 Chu/ft hr °C	= 1,7308	W/m K

Είδική θερμότης

1 kcal/kg °C	= 4,1868·10³	J/kg K
1 cal/g °C	= 4,1868·10³	J/kg K
1 Btu/lb °F	= 4,1868·10³	J/kg K
1 Chu/lb °C	= 4,1868·10³	J/kg K

Πυκνότης θερμορροής, φορτίον θερμαινομένης έπιφανείας

1 kcal/m² h	= 1,1630	W/m²
1 kcal/ft² hr	= 1,2518·10	W/m²
1 cal/cm² s	= 4,1868·10⁴	W/m²
1 Btu/ft² hr	= 3,1546	W/m²
1 Chu/ft² hr	= 5,6784	W/m²

Συντελεστής θερμικής άγωγιμότητος→
Συντελεστής μεταδόσεως θερμότητος

Παράδειγμα:

Ό συντ. συναγωγής, $\alpha = 200 \frac{BTU}{ft^2\,hr\,°F}$ νά μετατραπῆ εἰς τάς μονάδας τοῦ SI-συστήματος

Λύσις:

α) βάσει τῶν βασικῶν ἰσοδυναμιῶν

1 Btu = 1,0551·10³ J	1 = 1,0551·10³ J/Btu
1 ft = 3,0480·10⁻¹ m	1 = 3,0480·10⁻¹ m/ft
1 hr = 3600 s	1 = 3600 s/hr
$1\,°F = \frac{5}{9}\,K$	$1 = \frac{5}{9}\,K/°F$

$$\alpha = 200 \frac{Btu}{ft^2\,hr\,°F}\,1{,}0551\cdot10^3\,\frac{J}{Btu}\,\frac{1}{(3{,}0480\cdot10^{-1})^2}\,\frac{ft^2}{m^2}$$

$$\frac{1}{3600}\,\frac{hr}{s}\,\frac{9}{5}\,\frac{°F}{K} =$$

$$= 1135{,}7\,\frac{J}{m^2\,s\,K} = 1135{,}7\,\frac{W}{m^2\,K}$$

β) ἀπό τόν διδόμενον συντ. μετατροπῆς

$$1\,\frac{Btu}{ft^2\,hr\,°F} = 5{,}6785\ W/m^2\,K$$

$$1 = 5{,}6785\,\frac{W}{m^2\,K}\,\frac{ft^2\,hr\,°F}{Btu}$$

$$\alpha = 200\,\frac{Btu}{ft^2\,hr\,°F}\,5{,}6785\,\frac{W}{m^2\,K}\,\frac{ft^2\,hr\,°F}{Btu}$$

$$\alpha = 1135{,}7\,\frac{W}{m^2\,K}$$

Βιβλιογραφία:

[1] Gesetz über Einheiten im Meßwesen. Vom 2. Juli 1969, Bundesgesetzblatt 1969, Teil I, Nr. 55, S. 709.

[2] Ausführungsbestimmungen zum Gesetz über Einheiten im Meßwesen. Vom 26. Juni 1970, Bundesgesetzblatt 1970, Teil I, Nr. 62, S. 981.

[3] *Haeder, W., u. E. Gärtner*: Die gesetzlichen Einheiten in der Technik. 2. Aufl. Berlin, Köln, Frankfurt: Beuth-Vertrieb 1971.

[4] *Hahnemann, H.W.*: Die Umstellung auf das internationale Einheitensystem in Mechanik und Wärmetechnik. 2. Aufl. Ingenieurwissen 4. Düsseldorf: VDI-Verl. 1964.

1. ΙΣΤΟΡΙΑ ΤΩΝ ΣΧΕΣΕΩΝ

Τόν Ἰούλιον τοῦ 1970 ἐτέθησαν εἰς ἐφαρμογήν οἱ νόμοι διά τάς σχέσεις τῆς 2. Ἰουλίου 1969 |1|, καί ἡ ταξινόμησις τῶν νόμων ἐπί τῶν σχέσεων τῶν μεγεθῶν τῆς 26. Ἰουνίου 1970, |2|. Τά χρησιμοποιούμενα εἰς τό παρόν βασικά μεγέθη καί τά παράγωγά των ἀκολουθοῦν εἰς τά ἑπόμενα. Εἰσαγωγική, ἑρμηνεία καί πορεία ὁρισμοῦ περιέχουν τά |3;4|.

1.1. Αἱ διά τά βασικά μεγέθη ὡρισμέναι βασικαί μονάδες τοῦ διεθνοῦς συστήματος (SI)

Βασικόν μέγεθος	Βασικαί Μονάδες	Σύμβολον
Μῆκος	Μέτρον	m
Μᾶζα	Χιλιόγραμμον	kg
Χρόνος	Δευτερόλεπτον	s
Ἠλεκτρική ἔντασις	Ampere	A
Θερμοδυναμική θερμοκρασία ἤ θερμοκρ. Kelvin	Kelvin	K
Ἔντασις φωτός	Candela	cd
Ποσότης ἠλεκτρισμοῦ, φορτίον	Coulomb	C
Θερμοκρασία	Grad Celsius	°C

1.2. Αἱ μονάδες ἀτομικῆς φυσικῆς

Μέγεθος	Μονάδες	Σύμβολον
Ποσότης ὕλης	mol	mol
Μᾶζα στοιχείων	ἀτομική μονάς μάζης	u
Ἐνέργεια	ἠλεκτρονιοβόλτ	eV

1.3. Παράγωγοι μονάδες

Μέγεθος	SI Μονάδες	Σύμβολον
Χρόνος	Λεπτόν	min
	Ὥρα	h
	Ἡμέρα	d
Συχνότης	Hertz	Hz
Δύναμις	Newton	N
Πίεσις, Μηχανική τάσις	Pascal	Pa
	Bar	bar
Δυναμικόν ἰξῶδες	Pascal.sec.	Pa s
Ἐνέργεια, ἔργον ποσόν θερμότ.	Joule	J
Ἰσχύς, ροή ἐνεργείας, ροή θερμότητος	Watt	W
Ἠλεκτρική τάσις, διαφορά δυναμικοῦ	Volt	V
Ἠλεκτρική ἀντίστασις	Ohm	Ω
Ἠλεκτρική ἀγωγιμότης	Siemens	S

14. Τά δεκαδικά πολλαπλάσια καί ὑποπολλαπλάσια τῶν μονάδων.

Τά δεκαδικά πολλαπλάσια καί ὑποπολλαπλάσια τῶν μονάδων δύνανται νά ἐκφρασθοῦν μέ προθέματα ἐπί τῶν μονάδων.

Συντελεστής	Μονάς	Σύμβολον	Συντελεστής	Μονάς	Σύμβολον
10^{12}	Tera	T	10^{-1}	Desi	d
10^{9}	Giga	G	10^{-2}	Zenti	c
10^{6}	Mega	M	10^{-3}	Milli	m
10^{3}	Kilo	k	10^{-6}	Mikro	µ
10^{2}	Hekto	h	10^{-9}	Nano	n
10^{1}	Deka	da	10^{-12}	Pico	p
			10^{-15}	Femto	f

1.5. Σχέσεις μεταξύ τῶν παραγώγων μονάδων καί τῶν βασικῶν

$1\ min = 60\ s$

$1\ h = 60\ min = 3600\ s$

$1\ d = 24\ h = 1440\ min = 86400\ s$

$1\ Hz = 1/s$

$1\ N = 1\ kg\,m/s^2$

$1\ Pa = 1\ N/m^2 = 1\,\frac{kg\,m}{s^2}\,\frac{1}{m^2} = 1\,\frac{kg}{s^2\,m}$

$1\ bar = 10^5\ N/m^2 = 10^5\,\frac{kg\,m}{s^2}\,\frac{1}{m^2} = 10^5\,\frac{kg}{s^2\,m}$

$1\ Pa\,s = 1\ N\,s/m^2 = 1\,\frac{kg\,m}{s^2}\,\frac{1}{m^2} = 1\,\frac{kg}{m\,s}$

$1\ J = 1\ Ws = 1\ Nm = 1\,\frac{kg\,m}{s^2}\,m = 1\,\frac{kg\,m^2}{s^2}$

$1\ W = 1\ J/s = 1\ Nm/s = 1\,\frac{kg\,m}{s^2}\,m\,\frac{1}{s} = 1\,\frac{kg\,m^2}{s^3}$

$1\ V = 1\ W/A = 1\,\frac{J}{s\,A} = 1\,\Omega\,A = 1\,\frac{Nm}{A\,s} =$
$= 1\,\frac{kg\,m}{s^2}\,m\,\frac{1}{s\,A} = 1\,\frac{kg\,m^2}{s^3\,A}$

$1\ \Omega = 1\ V/A = 1\ W/A^2 = 1\,\frac{J}{s\,A^2} = 1\,\frac{Nm}{s\,A^2} =$
$= 1\,\frac{kg\,m}{s^2}\,m\,\frac{1}{s\,A^2} = 1\,\frac{kg\,m^2}{s^3\,A^2}$

$1\ S = 1/\Omega$

$1\ C = 1\ A\,s$

2. ΜΕΤΑΤΡΟΠΑΙ ΔΙΑΦΟΡΩΝ ΜΟΝΑΔΩΝ ΕΙΣ ΤΟ ΣΥΣΤΗΜΑ SI

Έργον, Ένέργεια, Θερμότης

1 Nm	= 1,0000	J
1 Ws	= 1,0000	J
1 dyn cm	$= 1{,}0000 \cdot 10^{-7}$	J
1 erg	$= 1{,}0000 \cdot 10^{-7}$	J
1 Dyn m	= 1,0000	J
1 kpm	= 9,8067	J
1 kcal	$= 4{,}1868 \cdot 10^{3}$	J
1 kWh	$= 3{,}6000 \cdot 10^{6}$	J
1 PSh	$= 2{,}6478 \cdot 10^{6}$	J
1 Btu	$= 1{,}0551 \cdot 10^{3}$	J
1 Chu	$= 1{,}8991 \cdot 10^{3}$	J
1 ftpdl	$= 4{,}2139 \cdot 10^{-2}$	J
1 ftlbf	= 1,3558	J
1 hphr (britisch)	$= 2{,}6845 \cdot 10^{6}$	J
1 therm	$= 1{,}0551 \cdot 10^{8}$	J

Έκτατικός συντελεστής (όγκομετρικός)

1 g/cm³ °C	$= 1{,}0000 \cdot 10^{3}$	kg/m³ K
1 lb/ft³ °C	$= 1{,}6018 \cdot 10$	kg/m³ K
1 lb/ft³ °F	$= 2{,}8833 \cdot 10$	kg/m³ K

Έπιτάχυνσις

1 ft/s²	$= 3{,}0480 \cdot 10^{-1}$	m/s²

Πυκνότης

1 grain/ft³	$= 2{,}2884 \cdot 10^{-3}$	kg/m³
1 lb/ft³	$= 1{,}6018 \cdot 10$	kg/m³
1 lb/UK gal	$= 9{,}9779 \cdot 10$	kg/m³
1 lb/US gal	$= 1{,}1983 \cdot 10^{2}$	kg/m³

Συντελεστής διαχυτότητος-κινηματικόν ἰξῶδες

Πίεσις, μηχανική τάσις

1 bar	$= 1{,}0000 \cdot 10^{5}$	Pa
1 at	$= 9{,}8067 \cdot 10^{4}$	Pa
1 kp/cm²	$= 9{,}8067 \cdot 10^{4}$	Pa
1 atm	$= 1{,}0133 \cdot 10^{5}$	Pa
1 Torr	$= 1{,}3332 \cdot 10^{2}$	Pa
1 mmHg (1 mm QS)	$= 1{,}3332 \cdot 10^{2}$	Pa
1 mmWS	= 9,8067	Pa
1 dyn/cm²	$= 1{,}0000 \cdot 10^{-1}$	Pa
1 pdl/ft²	= 1,4881	Pa
1 lbf/ft²	$= 4{,}7880 \cdot 10$	Pa
1 pdl/in²	$= 2{,}1429 \cdot 10^{2}$	Pa
1 inwater	$= 2{,}4909 \cdot 10^{2}$	Pa
1 ftwater	$= 2{,}9891 \cdot 10^{3}$	Pa
1 inHg (1 in mercury)	$= 3{,}3866 \cdot 10^{3}$	Pa
1 lbf/in² (oder psi)	$= 6{,}8948 \cdot 10^{3}$	Pa
1 tonf/in²	$= 1{,}5444 \cdot 10^{7}$	Pa

Ένέργεια, Έργον

Ένθαλπία, Έργον

Είδική Ένθαλπία

1 kcal/kg	$= 4{,}1868 \cdot 10^{3}$	J/kg
1 Btu/lb	$= 2{,}3260 \cdot 10^{3}$	J/kg
1 Chu/lb	$= 4{,}1868 \cdot 10^{3}$	J/kg

Έντροπία – είδική θερμότης

Έπιφάνεια

1 in²	$= 6{,}4516 \cdot 10^{-4}$	m²
1 ft²	$= 9{,}2903 \cdot 10^{-2}$	m²
1 yd²	$= 8{,}3613 \cdot 10^{-1}$	m²
1 acre	$= 4{,}0469 \cdot 10^{3}$	m²
1 mile²	$= 2{,}5900 \cdot 10^{6}$	m²

Ταχύτης

1 ft/hr	$= 8{,}4667 \cdot 10^{-5}$	m/s
1 ft/min	$= 5{,}0800 \cdot 10^{-3}$	m/s
1 ft/s	$= 3{,}0480 \cdot 10^{-1}$	m/s
1 mile/hr	$= 4{,}4704 \cdot 10^{-1}$	m/s

Φορτίον θερμαντικής έπιφανείας–πυκνότης ροῆς θερμότητος

Θερμικά μεγέθη βασιζόμενα είς τόν όγκον

1 kcal/m³	$= 4{,}1868 \cdot 10^{3}$	J/m³
1 Btu/ft³	$= 3{,}7260 \cdot 10^{4}$	J/m³
1 Chu/ft³	$= 6{,}7067 \cdot 10^{4}$	J/m³
1 therm/ft³	$= 3{,}7260 \cdot 10^{9}$	J/m³

Δύναμις

1 kp	= 9,8067	N
1 dyn	$= 1{,}0000 \cdot 10^{-5}$	N
1 Dyn	= 1,0000	N
1 pdl	$= 1{,}3825 \cdot 10^{-1}$	N
1 lbf	= 4,4482	N
1 tonf	$= 9{,}9640 \cdot 10^{3}$	N

Μῆκος

1 Å	$= 1{,}0000 \cdot 10^{-10}$	m
1 μ (micron)	$= 1{,}0000 \cdot 10^{-6}$	m
1 in	$= 2{,}5400 \cdot 10^{-2}$	m
1 ft = 12 in	$= 3{,}0480 \cdot 10^{-1}$	m
1 yd = 3 ft = 36 in	$= 9{,}1440 \cdot 10^{-1}$	m
1 thou	$= 2{,}5400 \cdot 10^{-5}$	m
1 mile (statute)	$= 1{,}6094 \cdot 10^{3}$	m
1 mile (nautical)	$= 1{,}8533 \cdot 10^{3}$	m
1 rod = 1 perch = 5,5 yd	= 5,292	m
1 chain	= 2,0117	m
1 furlong	$= 2{,}0117 \cdot 10^{2}$	m

Ίσχύς, θερμορροή

1 mkp/s	= 9,8065	W
1 kcal/h	= 1,1630	W
1 erg/s	$= 1{,}0000 \cdot 10^{-7}$	W
1 PS	$= 7{,}3548 \cdot 10^{2}$	W
1 m³ atm/h	$= 2{,}8150 \cdot 10$	W
1 ft lbf/min	$= 2{,}2597 \cdot 10^{-2}$	W
1 ft lbf/s	= 1,3558	W
1 ft pdl/s	$= 4{,}2139 \cdot 10^{-2}$	W
1 Btu/hr	$= 2{,}9308 \cdot 10^{-1}$	W
1 Chu/hr	$= 5{,}2754 \cdot 10^{-1}$	W
1 hp (britisch)	$= 7{,}4570 \cdot 10^{2}$	W
1 ton refrigeration	$= 3{,}5169 \cdot 10^{3}$	W
1 therm/hr	$= 2{,}9308 \cdot 10^{4}$	W

Μᾶζα

1 kps²/m	= 9,8065	kg
1 grain	$= 6{,}4800 \cdot 10^{-5}$	kg
1 lb	$= 4{,}5359 \cdot 10^{-1}$	kg
1 ton (short) = 20 cwt brit.	$= 9{,}0714 \cdot 10^{2}$	kg
1 ton (long) = 20 cwt UK	$= 1{,}0160 \cdot 10^{3}$	kg

Ροή μάζης

1 lb/hr	$= 1{,}2600 \cdot 10^{-4}$	kg/s
1 ton/day (short)	$= 1{,}0500 \cdot 10^{-2}$	kg/s
1 ton/day (long)	$= 1{,}1760 \cdot 10^{-2}$	kg/s
1 ton/hr (short)	$= 2{,}5200 \cdot 10^{-1}$	kg/s
1 ton/hr (long)	$= 2{,}8224 \cdot 10^{-1}$	kg/s

Πυκνότης ροῆς μάζης

1 lb/hr ft²	$= 1{,}3562 \cdot 10^{-3}$	kg/m² s
1 kg/hr ft²	$= 2{,}9900 \cdot 10^{-3}$	kg/m² s
1 lb/s ft²	= 4,8824	kg/m² s

Τάσις μηχανική + πίεσις

Θερμοκρασία (ἰδέ πίνακα κεφ. Bb)

ϑ °C	$= (\vartheta + 273{,}15)$ K
ϑ °F (Fahrenheit)	$= \frac{5}{9}(\vartheta - 32) + 273{,}15$ K
1 °R (Rankine)	$= \frac{5}{9}$ K

Σχέσεις θερμοκρασιῶν

1 °C	= 1 K
1 °F	$= \frac{5}{9}$ K
1 °R	$= \frac{5}{9}$ K

Δυναμικόν ἰξῶδες

1 kps/m²	= 9,8065	Pas
1 kph/m²	$= 3{,}532 \cdot 10^{-4}$	Pas
1 Poise = 1 g/cm s	$= 1{,}0000 \cdot 10^{-1}$	Pas
1 lb/ft hr	$= 4{,}1338 \cdot 10^{-4}$	Pas
1 kg/ft hr	$= 9{,}1134 \cdot 10^{-4}$	Pas
1 lb/ft s	= 1,4882	Pas

Κινηματικόν ἰξῶδες (ἰδέ ἀντίστοιχον πίνακα)

1 Stoke = 1 cm²/s	$= 1{,}0000 \cdot 10^{-4}$	m²/s
1 dm³/hr in	$= 1{,}0936 \cdot 10^{-5}$	m²/s
1 ft²/hr	$= 2{,}5806 \cdot 10^{-5}$	m²/s
1 ft²/s	$= 9{,}2903 \cdot 10^{-2}$	m²/s

Όγκος

1 in³	$= 1{,}6387 \cdot 10^{-5}$	m³
1 ft³	$= 2{,}8317 \cdot 10^{-2}$	m³
1 yd³	$= 7{,}6455 \cdot 10^{-1}$	m³
1 US gal	$= 3{,}7853 \cdot 10^{-3}$	m³
1 UK gal	$= 4{,}5460 \cdot 10^{-3}$	m³
1 US bushel (dry)	$= 3{,}5239 \cdot 10^{-2}$	m³
1 UK bushel (dry)	$= 3{,}6369 \cdot 10^{-2}$	m³
1 barrel (petroleum US)	$= 1{,}5898 \cdot 10^{-1}$	m³
1 lube oil barrel	$= 2{,}0819 \cdot 10^{-1}$	m³
1 gill	$= 1{,}1829 \cdot 10^{-4}$	m³
1 register ton = 100 ft³	= 2,8317	m³
1 quater = 8 UK bushels = 32 pecks = 64 UK gallons = 256 quarts = 512 pints	$= 2{,}9095 \cdot 10^{-1}$	m³

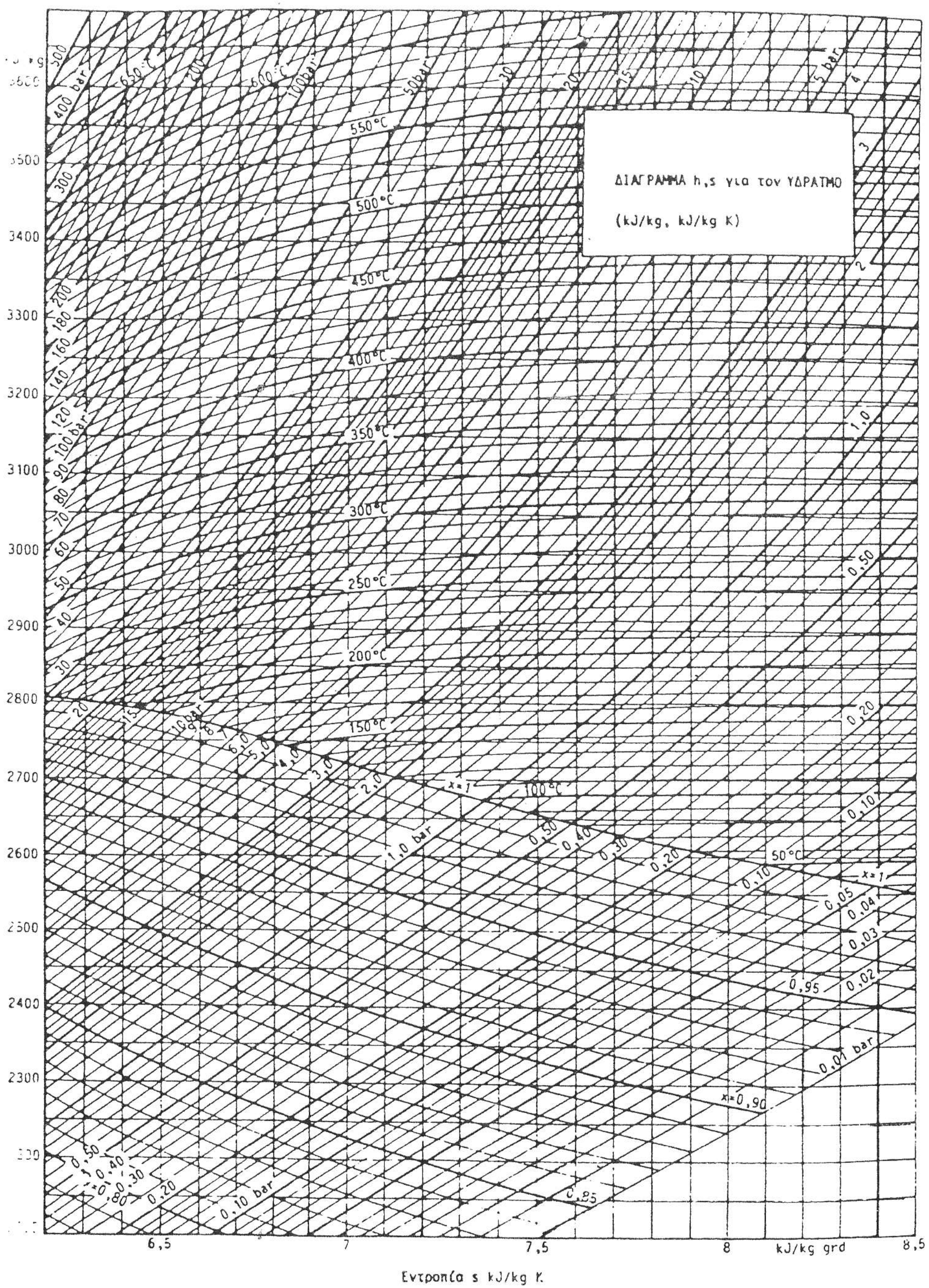
Είδικός όγκος

1 ft³/kg	$= 2{,}8317 \cdot 10^{-2}$	m³/kg
1 ft³/lb	$= 6{,}2428 \cdot 10^{-2}$	m³/kg

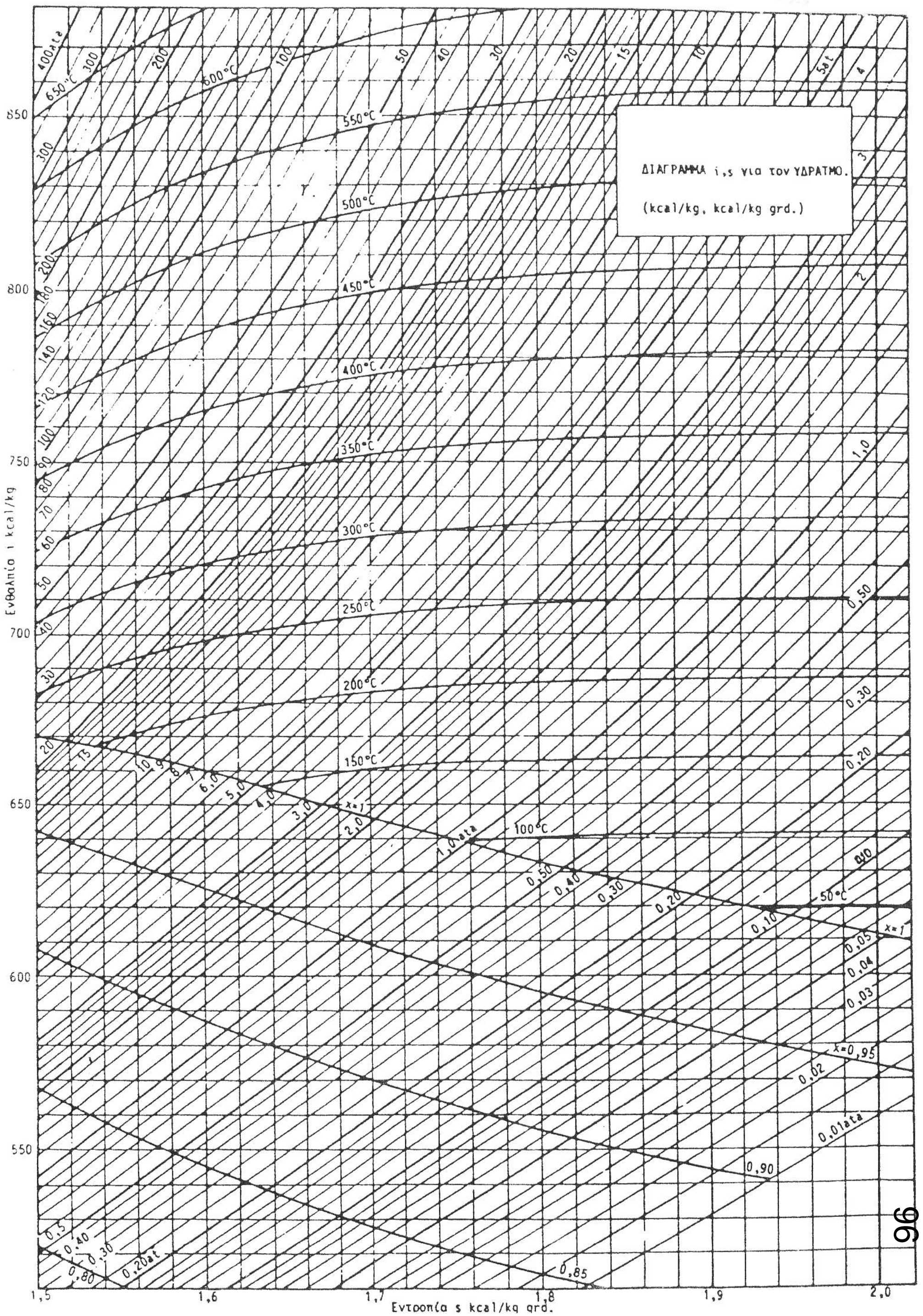
Ροή όγκου

1 ft³/hr	$= 7{,}8658 \cdot 10^{-6}$	m³/s
1 ft³/min = 1 cu min	$= 4{,}7195 \cdot 10^{-4}$	m³/s
1 ft³/s = 1 cu sec	$= 2{,}8317 \cdot 10^{-2}$	m³/s
1 US gal/hr	$= 1{,}0515 \cdot 10^{-6}$	m³/s
1 UK gal/hr	$= 1{,}2628 \cdot 10^{-6}$	m³/s
1 barrel/day (petroleum US)	$= 1{,}8401 \cdot 10^{-6}$	m³/s
1 US gal/min	$= 6{,}3089 \cdot 10^{-5}$	m³/s
1 UK gal/min	$= 7{,}5766 \cdot 10^{-5}$	m³/s
1 mgd = 10⁶ UK gal/day	$= 5{,}2617 \cdot 10^{-2}$	m³/s

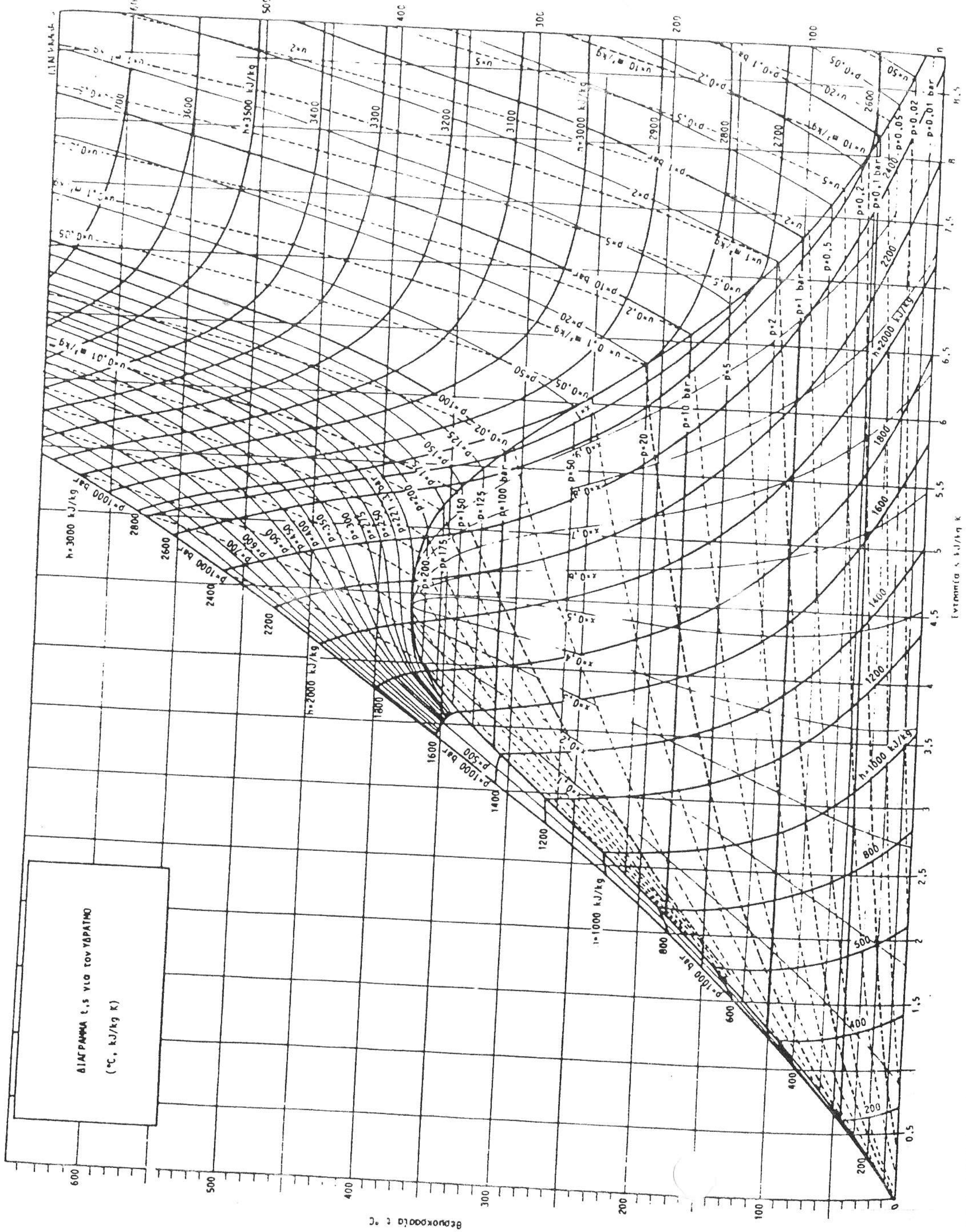
Διάγραμμα h, s για τον υδρατμό (kJ/kg, kJ/kgK)



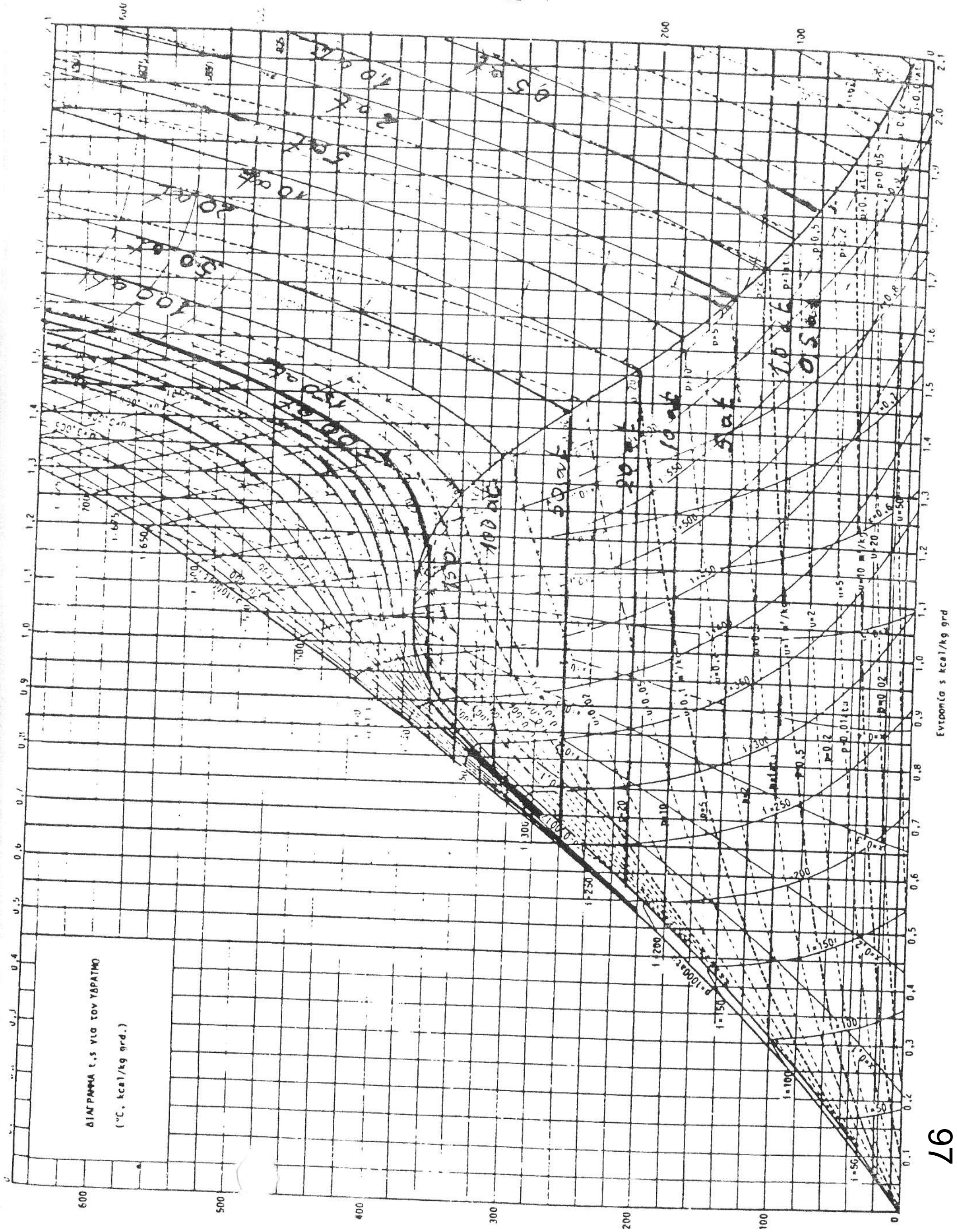
Διάγραμμα i, s γ[illegible]ον υδρατμό (kcal/kg, kcal/kggrd)



Διάγραμμα t, s για τον υδρατμό (°C, kJ/kgK)



Διάγραμμα t, s για τον υδρατμό (°C, kcal/kggrd)



ΠΙΝΑΚΕΣ ΑΤΜΩΝ

Πίνακας I — Καταστατικά μεγέθη νερού και ατμού κατά τον κορεσμό (πίνακας με βάση την θερμοκρασία) σε μονάδες του Τ.Σ.Μ.

Πίνακας II — Ομοίως αλλά σε μονάδες του Δ.Σ.Μ.

Πίνακας III — Καταστατικά μεγέθη νερού και ατμού κατά τον κορεσμό (πίνακας με βάση την πίεση) σε μονάδες του Τ.Σ.Μ.

Πίνακας IV — Ομοίως αλλά σε μονάδες του Δ.Σ.Μ.

Πίνακας V — Καταστατικά μεγέθη νερού και υπερθέρμου ατμού σε μονάδες του Τ.Σ.Μ. Η οριζόντια γραμμή χωρίζει το νερό από τον ατμό.

Πίνακας VI — Ομοίως αλλά σε μονάδες του Δ.Σ.Μ.

Εδώ

- t = θερμοκρασία σε °C
- p = πίεση σε ata (bar απόλυτα)
- υ' = ειδικός όγκος νερού (x=0) σε dm^3/kg
- υ" = ειδικός όγκος ατμού (x=1) σε m^3/kg
- ρ" = πυκνότητα του ατμού (x=1) σε kg/m^3
- s' = ειδική εντροπία του νερού (x=0) σε kcal/kggrd (kJ/kgK)
- s" = ειδική εντροπία του ατμού (x=1) σε kcal/kggrd (kJ/kgK)
- i'(h') = ειδική ενθαλπία του νερού (x=0) σε kcal/kg (kJ/kg)
- i"(h") = ειδική ενθαλπία του ατμού (x=1) σε kcal/kg (kJ/kg)
- r = ειδική θερμότητα ατμοποιήσεως σε kcal/kg (kJ/kg)
- u' = ειδική εσωτερική ενέργεια του νερού (x=0) σε kcal/kg (kJ/kg)
- u" = ειδική εσωτερική ενέργεια του ατμού (x=1) σε kcal/kg (kJ/kg)
- υ = ειδικός όγκος νερού και υπερθέρμου ατμού σε m^3/kg
- i(h) = ειδική ενθαλπία νερού και υπερθέρμου ατμού σε kcal/kg (kJ/kg)
- s = ειδική εντροπία νερού και υπερθέρμου ατμού σε kcal/kggrd (kJ/kgK)

Πίνακας I — Καταστατικά μεγέθη νερού και ατμού κατά τον κορεσμό (με βάση την θερμοκρασία) σε μονάδες του Τ.Σ.Μ.

°C	at	dm³/kg	m³/kg	kg/m³	kcal/kg °K		s'' − s' =
t	p	υ'	υ''	ρ''	s'	s''	r/T
0	0,006228	1,0002	206,3	0,004847	0	2,1865	2,1865
5	0,008894	1,0000	147,1	0,006798	0,0182	2,1552	2,1370
10	0,012517	1,0002	106,4	0,009399	0,0361	2,1254	2,0893
15	0,017381	1,0008	77,96	0,01283	0,0536	2,0969	2,0433
20	0,02383	1,0017	57,84	0,01729	0,0708	2,0697	1,9989
25	0,03229	1,0029	43,40	0,02304	0,0876	2,0436	1,9560
30	0,04325	1,0043	32,94	0,03036	0,1042	2,0186	1,9144
35	0,05732	1,0059	25,25	0,03960	0,1205	1,9947	1,8742
40	0,07519	1,0078	19,56	0,05113	0,1366	1,9718	1,8352
45	0,09770	1,0099	15,28	0,06544	0,1524	1,9497	1,7973
50	0,12577	1,0121	12,05	0,08298	0,1679	1,9286	1,7607
55	0,16050	1,0146	9,583	0,1044	0,1832	1,9082	1,7250
60	0,2031	1,0172	7,682	0,1302	0,1983	1,8887	1,6904
65	0,2550	1,0200	6,205	0,1612	0,2132	1,8698	1,6566
70	0,3178	1,0229	5,047	0,1981	0,2279	1,8517	1,6238
75	0,3931	1,0260	4,135	0,2418	0,2424	1,8342	1,5918
80	0,4829	1,0293	3,410	0,2933	0,2567	1,8173	1,5605
85	0,5894	1,0327	2,829	0,3535	0,2708	1,8011	1,5303
90	0,7149	1,0363	2,361	0,4235	0,2847	1,7854	1,5007
95	0,8619	1,0400	1,982	0,5045	0,2984	1,7702	1,4718
100	1,03323	1,0438	1,673	0,5977	0,3120	1,7555	1,4435
105	1,2318	1,0479	1,419	0,7047	0,3254	1,7413	1,4159
110	1,4609	1,0520	1,210	0,8264	0,3387	1,7276	1,3889
115	1,7239	1,0563	1,036	0,9652	0,3518	1,7143	1,3625
120	2,0245	1,0608	0,8913	1,122	0,3647	1,7014	1,3367
125	2,3666	1,0654	0,7700	1,299	0,3775	1,6890	1,3115
130	2,7544	1,0702	0,6679	1,497	0,3902	1,6769	1,2867
135	3,192	1,0751	0,5817	1,719	0,4028	1,6652	1,2624
140	3,685	1,0802	0,5083	1,967	0,4152	1,6538	1,2386
145	4,237	1,0855	0,4459	2,243	0,4275	1,6427	1,2152
150	4,854	1,0910	0,3924	2,549	0,4397	1,6319	1,1922
155	5,540	1,0966	0,3464	2,887	0,4518	1,6214	1,1696
160	6,302	1,1024	0,3068	3,260	0,4637	1,6112	1,1475
165	7,146	1,1085	0,2724	3,671	0,4756	1,6012	1,1256
170	8,076	1,1147	0,2426	4,122	0,4874	1,5914	1,1040
175	9,101	1,1211	0,2166	4,617	0,4991	1,5818	1,0827
180	10,225	1,1278	0,1939	5,158	0,5107	1,5724	1,0617
185	11,456	1,1347	0,1739	5,750	0,5222	1,5632	1,0410
190	12,800	1,1418	0,1564	6,394	0,5337	1,5541	1,0204
195	14,265	1,1491	0,1409	7,097	0,5450	1,5451	1,0001

Συνέχεια πίνακα I

°C	kcal/kg		kcal/kg	kcal/kg		$u'' - u'$	$p \cdot (v'' - v')$
t	i'	i''	r	u'	u''	$= \varphi$	$= \psi$
0	0	597,2	597,2	0	567,2	567,2	30,1
5	5,03	599,4	594,4	5,03	568,9	563,9	30,6
10	10,04	601,6	591,6	10,04	570,5	560,4	31,2
15	15,04	603,8	588,8	15,04	572,2	557,1	31,7
20	20,03	606,0	586,0	20,03	573,7	553,7	32,3
25	25,02	608,2	583,2	25,02	575,4	550,4	32,8
30	30,00	610,4	580,4	30,00	577,0	547,0	33,4
35	34,98	612,5	577,5	34,98	578,6	543,6	33,9
40	39,97	614,7	574,7	39,97	580,2	540,3	34,4
45	44,96	616,8	571,8	44,96	581,8	536,8	35,0
50	49,94	618,9	569,0	49,94	583,4	533,5	35,5
55	54,94	621,0	566,1	54,94	585,0	530,1	36,0
60	59,93	623,1	563,2	59,93	586,6	526,7	36,5
65	64,93	625,1	560,2	64,93	588,0	523,1	37,1
70	69,93	627,2	557,3	69,92	589,6	519,7	37,6
75	74,94	629,2	554,3	74,93	591,1	516,2	38,1
80	79,95	631,2	551,3	79,94	592,6	512,7	38,6
85	84,96	633,1	548,1	84,95	594,0	509,0	39,1
90	89,98	635,0	545,0	89,96	595,5	505,5	39,5
95	95,01	636,9	541,9	94,99	596,9	501,9	40,0
100	100,05	638,8	538,8	100,02	598,3	498,3	40,5
105	105,09	640,6	535,5	105,05	599,7	494,6	40,9
110	110,14	642,4	532,3	110,08	601,0	490,9	41,4
115	115,20	644,2	529,0	115,15	602,4	487,2	41,8
120	120,3	645,9	525,7	120,2	603,7	483,5	42,2
125	125,3	647,6	522,3	125,2	604,9	479,7	42,6
130	130,4	649,3	518,9	130,3	606,2	475,9	43,0
135	135,5	650,9	515,4	135,4	607,4	472,0	43,4
140	140,7	652,5	511,8	140,5	608,5	468,0	43,8
145	145,8	654,0	508,2	145,7	609,8	464,1	44,1
150	150,9	655,5	504,6	150,8	610,9	460,1	44,5
155	156,1	657,0	500,9	156,0	612,1	456,1	44,8
160	161,3	658,4	497,1	161,1	613,1	452,0	45,1
165	166,5	659,7	493,2	166,3	614,1	447,8	45,4
170	171,7	661,0	489,3	171,5	615,1	443,6	45,7
175	176,9	662,3	485,4	176,7	616,1	439,4	46,0
180	182,2	663,4	481,2	181,9	616,9	435,0	46,2
185	187,4	664,5	477,1	187,2	617,8	430,6	46,4
190	192,8	665,5	472,7	192,3	618,6	426,3	46,5
195	198,1	666,4	468,3	197,7	619,3	421,6	46,7

Συνέχεια πίνακα I

°C	at	dm³/kg	m³/kg	kg/m³	kcal/kg °K		$s'' - s'$
t	p	v'	v''	ϱ''	s'	s''	$= r/T$
200	15,857	1,1568	0,1273	7,856	0,5563	1,5363	0,9800
205	17,585	1,1647	0,1151	8,688	0,5676	1,5276	0,9600
210	19,456	1,1729	0,1043	9,588	0,5788	1,5189	0,9401
215	21,478	1,1814	0,09471	10,56	0,5899	1,5103	0,9204
220	23,659	1,1903	0,08611	11,61	0,6010	1,5017	0,9007
225	26,007	1,1994	0,07841	12,75	0,6120	1,4932	0,8812
230	28,531	1,2090	0,07149	13,99	0,6230	1,4847	0,8617
235	31,239	1,2190	0,06527	15,32	0,6340	1,4762	0,8422
240	34,140	1,2293	0,05967	16,76	0,6450	1,4677	0,8227
245	37,244	1,2402	0,05460	18,31	0,6559	1,4592	0,8033
250	40,56	1,2515	0,05002	19,99	0,6668	1,4507	0,7839
255	44,10	1,2633	0,04586	21,81	0,6777	1,4421	0,7644
260	47,87	1,2757	0,04208	23,76	0,6886	1,4335	0,7449
265	51,88	1,2888	0,03865	25,87	0,6996	1,4248	0,7252
270	56,14	1,3025	0,03552	28,15	0,7105	1,4161	0,7056
275	60,66	1,3169	0,03266	30,62	0,7215	1,4073	0,6858
280	65,46	1,3322	0,03005	33,28	0,7324	1,3984	0,6660
285	70,54	1,3483	0,02766	36,16	0,7435	1,3894	0,6459
290	75,92	1,3655	0,02546	39,27	0,7546	1,3804	0,6258
295	81,60	1,3837	0,02345	42,64	0,7658	1,3712	0,6054
300	87,61	1,4033	0,02165	46,19	0,7770	1,3620	0,5850
305	93,95	1,424	0,01989	50,28	0,7884	1,3526	0,6542
310	100,64	1,447	0,01832	54,57	0,7999	1,3431	0,5432
315	107,69	1,471	0,01687	59,29	0,8115	1,3337	0,5222
320	115,12	1,498	0,01549	64,55	0,8234	1,3232	0,4998
325	122,95	1,527	0,01420	70,43	0,8354	1,3118	0,4764
330	131,18	1,560	0,01298	77,02	0,8478	1,2999	0,4521
335	139,85	1,597	0,01184	84,43	0,8605	1,2870	0,4265
340	148,96	1,638	0,01077	92,81	0,8736	1,2735	0,3999
345	158,54	1,687	0,009765	102,4	0,8874	1,2595	0,3721
350	168,63	1,746	0,008803	113,6	0,9021	1,2441	0,3420
355	179,24	1,817	0,007878	126,9	0,9179	1,2270	0,3091
360	190,42	1,908	0,006967	143,5	0,9353	1,2072	0,2719
365	202,21	2,03	0,00604	165,5	0,9557	1,1833	0,2276
370	214,68	2,23	0,00499	200	0,9824	1,1481	0,1657
371	217,26	2,30	0,00474	211	0,9897	1,1387	0,1490
372	219,88	2,37	0,00447	224	0,9984	1,1276	0,1292
373	222,53	2,49	0,00415	241	1,010	1,1136	0,104
374	225,22	2,79	0,00362	276	1,033	1,086	0,053
374,15	225,65	3,18	0,00318	315	1,058		0

Συνέχεια πίνακα Ι

°C	kcal/kg		kcal/kg	kcal/kg		$u'' - u'$	$p \cdot (v'' - v')$
						=	=
t	i'	i''	r	u'	u''	φ	ψ
200	203,5	667,3	463,8	203,1	620,1	417,0	46,8
205	208,9	668,0	459,1	208,4	620,6	412,2	46,9
210	214,3	668,6	454,3	213,8	621,1	407,3	47,0
215	219,7	669,2	449,4	219,3	621,6	402,3	47,0
220	225,2	669,6	444,4	224,5	621,9	397,4	47,1
225	230,8	669,9	439,1	230,1	622,1	392,0	47,1
230	236,4	670,0	433,6	235,6	622,3	386,7	47,0
235	242,0	670,1	428,1	241,1	621,9	380,8	46,9
240	247,7	670,0	422,3	246,7	622,2	375,5	46,7
245	253,4	669,8	416,4	252,3	621,7	369,4	46,6
250	259,2	669,4	410,2	258,0	621,8	363,8	46,3
255	265,0	668,8	403,8	263,7	621,3	357,6	46,1
260	270,9	668,1	397,2	269,5	620,9	351,4	45,8
265	276,9	667,3	390,4	275,3	619,8	344,5	45,5
270	282,9	666,3	383,4	281,2	619,6	338,4	45,1
275	289,0	665,1	376,1	287,3	618,3	331,0	44,6
280	295,2	663,7	368,5	293,2	617,6	324,4	44,1
285	301,5	662,1	360,6	299,4	616,2	316,8	43,5
290	307,9	660,4	352,5	305,5	614,9	309,4	42,9
295	314,4	658,5	344,1	311,8	613,4	301,6	42,3
300	321,1	656,3	335,2	318,2	611,9	293,7	41,5
305	327,8	654,0	326,2	324,6	609,8	285,2	40,7
310	334,7	651,5	316,8	331,3	608,4	277,1	39,7
315	341,8	648,9	307,1	338,0	605,4	267,4	38,7
320	349,0	645,5	296,5	345,0	603,7	258,7	37,7
325	356,5	641,5	285,0	352,1	599,7	247,6	36,3
330	364,2	636,9	272,7	359,4	597,0	237,6	35,1
335	372,2	631,6	259,4	367,1	592,9	225,8	33,6
340	380,6	625,8	245,2	374,9	588,2	213,3	31,9
345	389,4	619,4	230,0	383,3	583,0	199,8	30,1
350	398,9	612,0	213,1	392,0	577,2	185,2	27,9
355	409,5	603,6	194,1	401,9	570,5	168,6	25,5
360	420,9	593,1	172,2	412,4	562,0	149,6	22,6
365	434,2	579,4	145,2	424,6	550,8	126,2	19,0
370	452,3	558,9	106,6	441,1	533,0	91,9	13,9
371	457,2	553,2	96,0	445,5	529,1	83,6	12,4
372	462,9	546,3	83,4	450,7	523,3	72,6	10,8
373	471,0	538,0	67,0	458,0	516,4	58,4	8,6
374	488,0	522,5	34,5	473,3	503,4	30,1	4,4
374,15	501,5		0	484,7		0	0

Πίνακας ΙΙ Καταστατικά μεγέθη νερού και ατμού κατά τον κορεσμό (με βάση την θερμοκρασία) σε μονάδες του Δ.Σ.Μ.

°C	bar	dm³/kg	m³/kg	kg/m³	kJ/kg°K		$s'' - s'$
							=
t	p	v'	v''	ϱ''	s'	s''	r/T
0	0,006107	1,0002	206,3	0,004846	0,0000	9,1545	9,1545
5	0,008722	1,0000	147,1	0,006797	0,0764	9,0234	8,9470
10	0,012275	1,0002	106,4	0,009399	0,1511	8,8985	8,7474
15	0,017045	1,0008	77,96	0,01283	0,2244	8,7793	8,5549
20	0,02337	1,0017	57,84	0,01729	0,2963	8,6652	8,3689
25	0,03166	1,0029	43,41	0,02304	0,3669	8,5561	8,1892
30	0,04241	1,0043	32,94	0,03036	0,4364	8,4516	8,0152
35	0,05621	1,0059	25,26	0,03960	0,5046	8,3514	7,8468
40	0,07374	1,0078	19,56	0,05114	0,5718	8,2553	7,6835
45	0,09581	1,0099	15,28	0,06543	0,6379	8,1631	7,5252
50	0,12334	1,0121	12,05	0,08298	0,7031	8,0745	7,3714
55	0,15740	1,0146	9,583	0,1044	0,7672	7,9893	7,2221
60	0,1992	1,0172	7,682	0,1302	0,8304	7,9074	7,0770
65	0,2501	1,0200	6,205	0,1612	0,8928	7,8286	6,9358
70	0,3116	1,0229	5,048	0,1981	0,9542	7,7526	6,7984
75	0,3855	1,0260	4,135	0,2418	1,0149	7,6794	6,6645
80	0,4736	1,0293	3,410	0,2933	1,0747	7,6088	6,5341
85	0,5780	1,0327	2,829	0,3535	1,1337	7,5407	6,4070
90	0,7011	1,0363	2,361	0,4235	1,1920	7,4749	6,2829
95	0,8453	1,0400	1,982	0,5045	1,2495	7,4114	6,1619
100	1,0132	1,0438	1,673	0,5978	1,3063	7,3500	6,0437
105	1,2080	1,0479	1,419	0,7047	1,3625	7,2906	5,9281
110	1,4326	1,0520	1,210	0.8267	1,4179	7,2331	5,8152
115	1,6905	1,0563	1,036	0,9652	1,4728	7,1775	5,7047
120	1,9853	1,0608	0,8913	1,122	1,5270	7,1236	5,5966
125	2,3208	1,0654	0,7700	1,299	1,5807	7,0714	5,4907
130	2,7011	1,0702	0,6679	1,497	1,6338	7,0208	5,3870
135	3,131	1,0751	0,5817	1,719	1,6863	6,9717	5,2854
140	3,614	1,0802	0,5084	1,967	1,7383	6,9240	5,1857
145	4,155	1,0855	0,4459	2,243	1,7899	6,8776	5,0877
150	4,760	1,0910	0,3924	2,548	1,8409	6,8325	4,9916
155	5,433	1,0966	0,3464	2,887	1,8915	6,7885	4,8970
160	6,180	1,1024	0,3068	3,260	1,9416	6,7456	4,8040
165	7,008	1,1085	0,2724	3,671	1,9913	6,7037	4,7124
170	7,920	1,1147	0,2426	4,122	2,0407	6,6628	4,6221
175	8,925	1,1211	0,2166	4,617	2,0896	6,6227	4,5331
180	10,027	1,1278	0,1939	5,158	2,1382	6,5833	4,4451
185	11,234	1,1347	0,1740	5,749	2,1864	6,5447	4,3583
190	12,552	1,1418	0,1564	6,393	2,4233	6,5067	4,2724
195	13,989	1,1491	0,1409	7,095	2,2820	6,4692	4,1872

Συνέχεια πίνακα II

°C t	kJ/kg h′	kJ/kg h″	kJ/kg r	kJ/kg u′	kJ/kg u″	u″ − u′ = φ	p·(v″ − v′) = ψ
0	0,00	2500,5	2500,5	0	2374,5	2374,5	126,0
5	21,05	2509,7	2488,6	21,05	2360,4	2339,3	128,2
10	42,03	2518,9	2476,9	42,03	2388,3	2346,3	130,6
15	62,96	2528,1	2465,1	62,96	2395,2	2332,2	132,9
20	83,86	2537,3	2453,4	83,86	2402,1	2318,2	135,3
25	104,74	2546,4	2441,7	104,74	2409,0	2304,3	137,4
30	125,61	2555,5	2429,9	125,61	2415,7	2290,1	139,8
35	146,47	2564,5	2418,0	146,46	2422,5	2276,0	142,0
40	167,34	2573,5	2406,2	167,33	2429,3	2262,0	144,2
45	188,22	2582,4	2394,2	188,21	2436,0	2247,8	146,4
50	209,11	2591,3	2382,2	209,10	2442,7	2233,6	148,6
55	230,00	2600,1	2370,1	229,98	2449,3	2219,3	150,8
60	250,91	2608,8	2357,9	250,89	2455,8	2204,9	153,0
65	271,84	2617,4	2345,5	271,81	2462,2	2190,4	155,2
70	292,78	2625,9	2333,1	292,75	2468,6	2175,8	157,3
75	313,74	2634,2	2320,5	313,70	2474,8	2161,1	159,4
80	334,72	2642,5	2307,8	334,67	2481,0	2146,3	161,5
85	355,72	2650,7	2295,0	355,66	2487,2	2131,5	163,4
90	376,75	2658,7	2281,9	376,68	2493,2	2116,5	165,4
95	397,80	2666,6	2268,8	397,71	2499,1	2101,4	167,4
100	418,88	2674,4	2255,5	418,77	2504,9	2086,1	169,4
105	439,99	2682,1	2242,1	439,86	2510,7	2070,8	171,3
110	461,13	2689,6	2228,5	460,98	2516,3	2055,3	173,1
115	482,31	2697,0	2214,7	482,13	2521,9	2039,8	174,9
120	503,5	2704,2	2200,7	503,3	2527,3	2024,0	176,7
125	524,8	2711,4	2186,6	524,6	2532,7	2008,1	178,5
130	546,1	2718,3	2172,2	545,8	2537,9	1992,1	180,1
135	567,5	2725,1	2157,6	567,2	2543,0	1975,8	181,8
140	588,9	2731,8	2142,9	588,5	2548,1	1959,6	183,3
145	610,4	2738,3	2127,9	610,0	2553,1	1943,1	184,8
150	631,9	2744,5	2112,6	631,4	2557,7	1926,3	186,3
155	653,5	2750,6	2097,1	652,9	2562,4	1909,5	187,6
160	675,2	2756,5	2081,3	674,5	2566,9	1892,4	188,9
165	696,9	2762,2	2065,3	696,1	2571,3	1875,2	190,1
170	718,8	2767,6	2048,8	717,9	2575,5	1857,6	191,2
175	740,7	2772,7	2032,0	739,7	2579,4	1839,7	192,3
180	762,7	2777,6	2014,9	761,6	2583,2	1821,6	193,3
185	784,8	2782,1	1997,3	783,5	2586,6	1803,1	194,2
190	807,0	2786,3	1979,3	805,6	2590,0	1784,4	194,9
195	829,4	2790,2	1960,8	827,8	2593,1	1765,3	195,5

Συνέχεια πίνακα II

°C t	bar p	dm³/kg v′	m³/kg v″	kg/m³ ρ″	kJ/kg°K s′	kJ/kg°K s″	s″ − s′ = r/T
200	15,551	1,1568	0,1273	7,858	2,3293	6,4322	4,1029
205	17,245	1,1647	0,1151	8,686	2,3764	6,3955	4,0191
210	19,080	1,1729	0,1043	9,585	2,4232	6,3593	3,9361
215	21,063	1,1814	0,09471	10,56	2,4698	6,3233	3,8535
220	23,201	1,1903	0,08611	11,61	2,5162	6,2875	3,7713
225	25,504	1,1994	0,07841	12,75	2,5625	6,2518	3,6893
230	27,979	1,2090	0,07150	13,99	2,6086	6,2162	3,6076
235	30,635	1,2190	0,06528	15,32	2,6545	6,1807	3,5262
240	33,480	1,2293	0,05967	16,76	2,7004	6,1452	3,4448
245	36,524	1,2402	0,05460	18,31	2,7461	6,1096	3,3635
250	39,78	1,2515	0,05002	19,99	2,7918	6,0738	3,2820
255	43,24	1,2633	0,04586	21,80	2,8375	6,0380	3,2005
260	46,94	1,2757	0,04209	23,76	2,8832	6,0019	3,1187
265	50,87	1,2888	0,03865	25,87	2,9289	5,9656	3,0367
270	55,05	1,3025	0,03552	28,15	2,9747	5,9290	2,9543
275	59,49	1,3169	0,03266	30,62	3,0206	5,8921	2,8715
280	64,19	1,3322	0,03005	33,28	3,0666	5,8549	2,7883
285	69,17	1,3483	0,02766	36,16	3,1128	5,8174	2,7046
290	74,45	1,3655	0,02546	39,27	3,1593	5,7794	2,6201
295	80,03	1,3837	0,02345	42,65	3,2061	5,7410	2,5349
300	85,92	1,4033	0,02160	46,30	3,2532	5,7022	2,4490
305	92,14	1,424	0,01989	50,27	3,3008	5,6629	2,3621
310	98,70	1,447	0,01832	54,58	3,3489	5,6232	2,2743
315	105,61	1,471	0,01687	59,29	3,3977	5,5837	2,1860
320	112,90	1,498	0,01549	64,55	3,4473	5,5401	2,0928
325	120,57	1,527	0,01420	70,43	3,4978	5,4924	1,9946
330	128,65	1,560	0,01298	77,02	3,5495	5,4422	1,8927
335	137,14	1,597	0,01184	84,43	3,6026	5,3884	1,7858
340	146,08	1,638	0,01077	92,81	3,6577	5,3321	1,6744
345	155,48	1,687	0,009765	102,4	3,7154	5,2733	1,5579
350	165,37	1,746	0,008803	113,6	3,7768	5,2087	1,4319
355	175,77	1,817	0,007878	126,9	3,8431	5,1371	1,2940
360	186,74	1,908	0,006967	143,5	3,9159	5,0545	1,1386
365	198,30	2,03	0,00604	165,5	4,0013	4,9541	0,9528
370	210,52	2,23	0,00499	200	4,1131	4,8069	0,6938
371	213,06	2,30	0,00474	211	4,1437	4,7675	0,6238
372	215,62	2,37	0,00447	224	4,1801	4,7211	0,5410
373	218,22	2,49	0,00415	241	4,229	4,6625	0,434
374	220,86	2,79	0,00362	276	4,325	4,548	0,223
374,15	221,29	3,18	0,00318	315	4,430		0

Συνέχεια πίνακα II

°C	kJ/kg		kJ/kg	kJ/kg		$u'' - u'$	$p \cdot (v'' - v')$
t	h'	h''	r	u'	u''	$= \varphi$	$= \psi$
200	851,8	2793,7	1941,9	850,0	2595,7	1745,7	196,2
205	874,4	2796,8	1922,4	872,4	2598,3	1725,9	196,5
210	897,1	2799,4	1902,3	894,9	2600,4	1705,5	196,8
215	920,0	2801,7	1881,7	917,5	2602,3	1684,8	196,9
220	943,0	2803,4	1860,4	940,2	2603,6	1663,4	197,0
225	966,2	2804,6	1838,4	963,1	2604,6	1641,5	196,9
230	989,6	2805,4	1815,8	986,2	2605,4	1619,2	196,6
235	1013,2	2805,5	1792,4	1009,5	2605,5	1596,0	196,3
240	1036,9	2805,1	1768,2	1032,8	2605,3	1572,5	195,7
245	1060,9	2804,1	1743,3	1056,4	2604,7	1548,3	194,9
250	1085,1	2802,5	1717,4	1080,1	2603,5	1523,4	194,0
255	1109,5	2800,3	1690,7	1104,0	2602,0	1498,0	192,8
260	1134,3	2797,4	1663,1	1128,3	2599,8	1471,5	191,6
265	1159,3	2793,8	1634,5	1152,8	2597,2	1444,4	190,1
270	1184,5	2789,5	1604,9	1177,3	2594,0	1416,7	188,3
275	1210,2	2784,5	1574,3	1202,4	2590,2	1387,8	186,5
280	1236,1	2778,7	1542,5	1227,5	2585,8	1358,3	184,3
285	1262,5	2772,2	1509,6	1253,2	2580,9	1327,7	182,0
290	1289,3	2764,9	1475,6	1279,1	2575,4	1296,3	179,3
295	1316,5	2756,9	1440,2	1305,4	2569,2	1263,8	176,6
300	1344,2	2748,0	1403,6	1332,1	2562,4	1230,3	173,5
305	1372,5	2738,3	1365,5	1359,4	2555,1	1195,7	170,1
310	1401,3	2727,7	1326,0	1387,0	2546,9	1159,9	166,5
315	1430,9	2716,8	1285,8	1415,4	2538,6	1123,2	162,7
320	1461,3	2702,4	1241,3	1444,4	2527,5	1083,1	158,0
325	1492,5	2685,7	1193,1	1474,1	2514,5	1040,4	152,8
330	1524,8	2666,4	1141,5	1504,7	2499,4	994,7	146,9
335	1558,4	2644,3	1086,0	1536,5	2481,9	945,4	140,5
340	1593,5	2620,2	1026,7	1569,6	2462,9	893,3	133,4
345	1630,5	2593,4	963,0	1604,3	2441,6	837,3	125,6
350	1670,3	2562,3	892,2	1641,4	2416,7	775,3	116,7
355	1714,5	2527,3	812,8	1682,6	2388,8	706,2	106,6
360	1762,2	2483,1	720,9	1726,6	2353,0	626,4	94,5
365	1817,9	2425,9	608,0	1777,6	2306,1	528,5	79,5
370	1893,7	2339,9	446,2	1846,8	2234,9	388,1	58,1
371	1914,2	2316,1	401,9	1865,2	2214,2	349,0	52,9
372	1938,1	2287,1	349,0	1887,0	2190,7	303,7	45,3
373	1972,0	2252,3	280,4	1917,7	2161,7	244,0	36,3
374	2043,2	2187,5	144,4	1981,6	2107,5	125,9	18,4
374,15	2099,7		0	2029,3		0	0

Πίνακας III Καταστατικά μεγέθη νερού και ατμού κατά τον κορεσμό (με βάση την πίεση) σε μονάδες του Τ.Σ.Μ.

at	°C	°K	m³/kg	kg/m³	kcal/kg °K		$s'' - s'$
p	t	T	v''	ϱ''	s'	s''	$= r/T$
0,01	6,69	279,84	131,6	0,007597	0,0243	2,1450	2,1207
0,015	12,73	285,88	89,64	0,01116	0,0457	2,1097	2,0370
0,02	17,20	290,35	68,27	0,01465	0,0612	2,0848	2,0236
0,025	20,78	293,93	55,28	0,01809	0,0734	2,0655	1,9921
0,03	23,77	296,92	46,53	0,02149	0,0835	2,0499	1,9664
0,04	28,65	301,80	35,46	0,02820	0,0998	2,0253	1,9255
0,05	32,55	305,70	28,73	0,03481	0,1126	2,0063	1,8937
0,06	35,83	308,98	24,19	0,04134	0,1232	1,9908	1,8676
0,08	41,17	314,32	18,45	0,05421	0,1403	1,9665	1,8262
0,10	45,45	318,60	14,95	0,06688	0,1538	1,9478	1,7940
0,12	49,06	322,21	12,60	0,07739	0,1650	1,9325	1,7675
0,15	53,60	326,75	10,21	0,09792	0,1790	1,9139	1,7349
0,20	59,67	332,82	7,794	0,1283	0,1974	1,8899	1,6925
0,25	64,56	337,71	6,321	0,1582	0,2119	1,8715	1,6596
0,30	68,68	341,83	5,328	0,1877	0,2241	1,8564	1,6324
0,35	72,24	345,39	4,614	0,2169	0,2345	1,8437	1,6092
0,40	75,42	348,57	4,068	0,2458	0,2436	1,8328	1,5892
0,50	80,86	354,01	3,301	0,3030	0,2591	1,8145	1,5554
0,60	85,45	358,60	2,782	0,3594	0,2720	1,7996	1,5276
0,70	89,45	362,60	2,408	0,4152	0,2832	1,7871	1,5039
0,80	92,99	366,14	2,125	0,4705	0,2929	1,7762	1,4833
0,90	96,18	369,33	1,904	0,5253	0,3017	1,7667	1,4650
1,0	99,09	372,24	1,725	0,5798	0,3095	1,7582	1,4487
1,1	101,76	374,91	1,578	0,6339	0,3167	1,7504	1,4337
1,2	104,25	377,40	1,454	0,6876	0,3234	1,7434	1,4200
1,3	106,56	379,71	1,349	0,7411	0,3296	1,7370	1,4074
1,4	108,74	381,89	1,259	0,7944	0,3353	1,7310	1,3957
1,5	110,79	384,94	1,180	0,8474	0,3407	1,7255	1,3848
1,6	112,73	385,88	1,111	0,9001	0,3458	1,7203	1,3745
1,8	116,33	389,48	0,9950	1,005	0,3552	1,7109	1,3557
2,0	119,62	392,77	0,9015	1,109	0,3637	1,7024	1,3387
2,2	122,64	395,79	0,8245	1,213	0,3715	1,6948	1,3233
2,4	125,46	398,61	0,7600	1,316	0,3787	1,6879	1,3092
2,6	128,08	401,23	0,7051	1,418	0,3854	1,6815	1,2961
2,8	130,55	403,70	0,6577	1,520	0,3916	1,6756	1,2840
3,0	132,88	406,03	0,6165	1,622	0,3975	1,6701	1,2726
3,2	135,08	408,23	0,5803	1,723	0,4030	1,6650	1,2620
3,4	137,18	410,33	0,5482	1,824	0,4082	1,6601	1,2519
3,6	139,18	412,33	0,5196	1,925	0,4132	1,6556	1,2424
3,8	141,09	414,24	0,4939	2,025	0,4179	1,6513	1,2334
4,0	142,92	416,07	0,4706	2,125	0,4224	1,6472	1,2248
4,5	147,20	420,35	0,4213	2,373	0,4329	1,6379	1,2050
5,0	151,11	424,26	0,3816	2,621	0,4424	1,6295	1,1871
5,5	154,71	427,86	0,3489	2,867	0,4511	1,6220	1,1709
6,0	158,08	431,23	0,3213	3,112	0,4592	1,6151	1,1559
6,5	161,21	434,36	0,2980	3,356	0,4666	1,6087	1,1421
7,0	164,17	437,32	0,2778	3,600	0,4737	1,6028	1,1291

Συνέχεια πίνακα III

at	°C	kcal/kg		kcal/kg	kcal/kg		$u'' - u'$	$p \cdot (v'' - v')$
p	t	i'	i''	r	u'	u''	φ	ψ
0,01	6,69	6,72	600,2	593,5	6,72	569,2	562,5	30,8
0,015	12,73	12,77	602,9	590,1	12,77	571,4	558,6	31,5
0,02	17,20	17,23	604,8	587,6	17,23	572,6	555,4	32,1
0,025	20,78	20,80	606,4	585,6	20,80	574,0	553,2	32,4
0,03	23,77	23,79	607,7	583,9	23,79	575,0	551,2	32,7
0,04	28,65	28,65	609,8	581,1	28,65	576,6	547,9	33,2
0,05	32,55	32,54	611,5	579,0	32,54	577,9	545,4	33,6
0,06	35,83	35,81	612,9	577,1	35,81	578,9	543,1	34,0
0,08	41,17	41,14	615,2	574,1	41,14	580,6	539,5	34,5
0,10	45,45	45,40	617,0	571,6	45,40	582,0	536,6	35,0
0,12	49,06	49,01	618,5	569,5	49,01	583,1	534,1	35,4
0,15	53,60	53,54	620,4	566,9	53,54	584,6	531,1	35,8
0,20	59,67	59,60	623,0	563,4	59,60	586,5	526,9	36,5
0,25	64,56	64,49	625,0	560,5	64,48	587,4	522,9	37,0
0,30	68,68	68,61	626,6	558,0	68,60	589,3	520,7	37,3
0,35	72,24	72,17	628,1	555,9	72,16	590,2	518,0	37,8
0,40	75,42	75,36	629,4	553,9	75,35	591,3	515,9	38,1
0,50	80,86	80,81	631,5	550,7	80,80	592,9	512,1	38,6
0,60	85,45	85,41	633,3	547,9	85,40	594,2	508,8	39,1
0,70	89,45	89,43	634,8	545,4	89,41	595,3	505,9	39,5
0,80	92,99	92,99	636,2	543,2	92,97	596,4	503,4	39,8
0,90	96,18	96,20	637,4	541,2	96,18	597,3	501,1	40,1
1,0	99,09	99,13	638,4	539,3	99,11	598,2	499,1	40,3
1,1	101,76	101,82	639,4	537,6	101,79	598,8	497,0	40,6
1,2	104,25	104,33	640,3	536,0	104,30	599,4	495,1	40,9
1,3	106,56	106,66	641,2	534,5	106,63	600,0	493,4	41,1
1,4	108,74	108,87	642,0	533,1	108,84	600,7	491,9	41,2
1,5	110,79	110,94	642,7	531,8	110,90	601,3	490,4	41,4
1,6	112,73	112,90	643,4	530,5	112,86	601,8	488,9	41,6
1,8	116,33	116,55	644,6	528,1	116,51	602,7	486,2	41,9
2,0	119,62	119,88	645,8	525,9	119,83	603,5	483,7	42,2
2,2	122,64	122,9	646,8	523,8	122,8	604,3	481,5	42,4
2,4	125,46	125,8	647,8	521,9	125,7	605,0	479,3	42,6
2,6	128,08	128,5	648,6	520,1	128,4	605,6	477,2	42,9
2,8	130,55	131,0	649,5	518,4	130,9	606,3	475,4	43,1
3,0	132,88	133,4	650,2	516,8	133,3	607,0	473,7	43,2
3,2	135,08	135,6	650,9	515,3	135,5	607,4	471,9	43,4
3,4	137,18	137,8	651,6	513,8	137,7	607,9	470,2	43,6
3,6	139,18	139,8	652,2	512,4	139,7	608,4	468,7	43,7
3,8	141,09	141,8	652,8	511,0	141,7	608,8	467,1	43,9
4,0	142,92	143,6	653,4	509,8	143,5	609,3	465,8	44,0
4,5	147,20	148,0	654,7	506,7	147,9	610,3	462,4	44,3
5,0	151,11	152,1	655,9	503,8	152,0	611,2	459,2	44,6
5,5	154,71	155,8	656,0	501,1	155,7	612,0	456,3	44,8
6,0	158,08	159,3	657,9	498,6	159,1	612,7	453,6	45,0
6,5	161,21	162,6	658,8	496,2	162,4	613,5	451,1	45,2
7,0	164,17	165,6	659,5	493,9	165,4	613,9	448,5	45,4

Συνέχεια πίνακα III

at	°C	°K	m³/kg	kg/m³	kcal/kg °K		$s'' - s'$
p	t	T	v''	ϱ''	s'	s''	r/T
7,5	166,96	440,11	0,2603	3,842	0,4803	1,5973	1,1170
8,0	169,61	442,76	0,2448	4,085	0,4865	1,5921	1,1056
8,5	172,12	445,27	0,2311	4,327	0,4923	1,5873	1,0950
9,0	174,53	447,68	0,2189	4,568	0,4980	1,5827	1,0847
9,5	176,82	449,97	0,2080	4,809	0,5033	1,5783	1,0750
10	179,04	452,19	0,1980	5,050	0,5085	1,5742	1,0667
11	183,20	456,35	0,1808	5,530	0,5181	1,5665	1,0484
12	187,08	460,23	0,1664	6,010	0,5270	1,5594	1,0324
13	190,71	463,86	0,1541	6,489	0,5353	1,5528	1,0175
14	194,13	467,28	0,1435	6,968	0,5431	1,5467	1,0036
15	197,36	470,51	0,1343	7,447	0,5504	1,5409	0,9905
16	200,43	473,58	0,1262	7,926	0,5573	1,5355	0,9782
17	203,35	476,50	0,1190	8,405	0,5639	1,5304	0,9665
18	206,14	479,29	0,1125	8,885	0,5701	1,5256	0,9555
19	208,82	481,97	0,1068	9,365	0,5761	1,5209	0,9448
20	211,38	484,53	0,1016	9,846	0,5818	1,5165	0,9347
22	216,23	489,38	0,09250	10,81	0,5926	1,5082	0,9156
24	220,75	493,90	0,08490	11,78	0,6027	1,5005	0,8978
26	224,99	498,14	0,07843	12,75	0,6120	1,4932	0,8812
28	228,98	502,13	0,07285	13,73	0,6208	1,4865	0,8657
30	232,76	505,91	0,06799	14,71	0,6291	1,4801	0,8510
32	236,35	509,50	0,06371	15,70	0,6370	1,4740	0,8370
34	239,77	512,92	0,05992	16,69	0,6445	1,4682	0,8237
36	243,04	516,19	0,05653	17,69	0,6516	1,4626	0,8110
38	246,17	519,32	0,05349	18,69	0,6585	1,4573	0,7988
40	249,18	522,33	0,05074	19,71	0,6650	1,4521	0,7871
42	252,07	525,22	0,04825	20,73	0,6713	1,4472	0,7759
44	254,87	528,02	0,04597	21,75	0,6774	1,4424	0,7650
46	257,56	530,71	0,04388	22,79	0,6833	1,4377	0,7544
48	260,17	533,32	0,04196	23,83	0,6890	1,4332	0,7442
50	262,70	535,85	0,04019	24,88	0,6945	1,4289	0,7344
55	268,70	541,85	0,03631	27,54	0,7076	1,4184	0,7108
60	274,29	547,44	0,03305	30,25	0,7199	1,4086	0,6887
65	279,54	552,69	0,03028	33,02	0,7314	1,3993	0,6679
70	284,48	557,63	0,02789	35,85	0,7423	1,3904	0,6481
75	289,17	562,32	0,02582	38,74	0,7527	1,3819	0,6292
80	293,62	566,77	0,02399	41,69	0,7627	1,3738	0,6111
85	297,86	571,01	0,02237	44,70	0,7722	1,3659	0,5937
90	301,92	575,07	0,02093	47,78	0,7814	1,3584	0,5770
95	305,80	578,95	0,01963	50,93	0,7902	1,3511	0,5609
100	309,53	582,68	0,01846	54,16	0,7988	1,3440	0,5452
110	316,58	589,73	0,01642	60,89	0,8152	1,3302	0,5150
120	323,15	596,30	0,01467	68,18	0,8309	1,3160	0,4851
130	329,30	602,45	0,01315	76,05	0,8460	1,3015	0,4555
140	335,09	608,24	0,01183	84,57	0,8607	1,2868	0,4259
150	340,56	613,71	0,01066	93,82	0,8751	1,2719	0,3968
160	345,74	618,89	0,009620	104,0	0,8895	1,2571	0,3676
180	355,35	628,50	0,007814	128,0	0,9191	1,2259	0,3068
200	364,08	637,23	0,00622	161,9	0,9516	1,1880	0,2364
224	373,6	646,75	0,00389	257	1,0204	1,1012	0,0808
225,65	374,15	647,30	0,00318	315	1,058		0

Συνέχεια πίνακα III

at	°C	kcal/kg		kcal/kg	kcal/kg		u'' − u'	p · (v'' − v')
p	t	i'	i''	r	u'	u''	= ρ	= ψ
7,5	166,96	168,5	660,2	491,7	168,3	614,5	446,2	45,5
8,0	169,61	171,3	660,9	489,6	171,1	614,9	443,8	45,8
8,5	172,12	173,9	661,5	487,7	173,7	615,4	441,7	45,9
9,0	174,53	176,4	662,1	485,7	176,2	615,9	439,7	45,9
9,5	176,82	178,9	662,7	483,8	178,6	616,4	437,8	46,0
10	179,04	181,2	663,2	482,0	180,9	616,8	435,9	46,1
11	183,20	185,5	664,1	478,6	185,2	617,5	432,3	46,3
12	187,08	189,7	664,9	475,3	189,4	618,2	428,8	46,4
13	190,71	193,5	665,7	472,1	193,2	618,8	425,6	46,5
14	194,13	197,2	666,3	469,1	196,8	619,2	422,4	46,7
15	197,36	200,6	666,8	466,2	200,2	619,6	419,4	46,8
16	200,43	203,9	667,3	463,4	203,5	620,0	416,5	46,9
17	203,35	207,1	667,8	460,7	206,6	620,4	413,8	46,9
18	206,14	210,1	668,2	458,1	209,6	620,7	411,1	47,0
19	208,82	213,0	668,5	455,5	212,5	621,0	408,5	47,0
20	211,38	215,8	668,8	453,0	215,2	621,2	406,0	47,0
22	216,23	221,1	669,3	448,2	220,5	621,6	401,1	47,1
24	220,75	226,1	669,6	443,6	225,4	621,8	396,4	47,1
26	224,99	230,8	669,9	439,1	230,1	622,2	392,1	47,0
28	228,98	235,2	670,0	434,8	234,4	622,2	387,8	47,0
30	232,76	239,5	670,1	430,6	238,6	622,3	383,7	46,9
32	236,35	243,5	670,1	426,6	242,6	622,3	379,7	46,9
34	239,77	247,4	670,0	422,6	246,4	622,2	375,8	46,8
36	243,04	251,1	669,9	418,7	250,1	622,2	372,1	46,7
38	246,17	254,7	669,7	414,9	253,6	622,1	368,5	46,5
40	249,18	258,2	669,5	411,3	257,0	621,9	364,9	46,4
42	252,07	261,6	669,2	407,6	260,4	621,7	361,3	46,3
44	254,87	264,9	668,9	404,0	263,6	621,5	357,9	46,1
46	257,56	268,0	668,5	400,5	266,6	621,1	354,5	46,0
48	260,17	271,1	668,1	397,0	269,7	620,9	352,2	45,8
50	262,70	274,1	667,7	393,6	272,6	620,6	348,0	45,6
55	268,70	281,3	666,5	385,2	279,6	619,7	340,1	45,2
60	274,29	288,2	665,2	377,0	286,4	618,8	332,4	44,7
65	279,54	294,7	663,8	369,1	292,7	617,7	325,0	44,1
70	284,48	300,9	662,3	361,4	298,7	616,5	317,8	43,6
75	289,17	306,9	660,7	353,8	304,5	615,3	310,8	43,0
80	293,62	312,6	659,0	346,4	310,0	613,9	303,9	42,5
85	297,86	318,2	657,3	339,1	315,4	612,7	297,3	41,8
90	301,92	323,6	655,5	331,9	320,6	611,3	290,7	41,2
95	305,80	328,9	653,6	324,7	325,7	609,9	284,2	40,5
100	309,53	334,1	651,7	317,6	330,7	608,5	277,8	39,8
110	316,58	344,0	647,7	303,7	340,2	605,5	265,3	38,4
120	323,15	353,7	643,0	289,3	349,4	601,9	251,5	36,8
130	329,30	363,1	637,5	274,4	358,4	597,6	239,2	35,2
140	335,09	372,4	631,6	259,2	367,2	592,9	225,7	33,5
150	340,56	381,6	625,1	243,5	375,8	587,7	211,9	31,6
160	345,74	390,8	618,3	227,5	384,4	582,2	197,8	29,7
180	355,35	410,2	603,0	192,8	402,5	570,1	167,6	25,2
200	364,08	431,5	582,2	150,7	422,1	553,2	131,1	19,6
224	373,6	478,5	530,8	52,3	464,8	510,4	45,6	6,7
225,65	374,15	501,5		0	484,7		0	0

Πίνακας IV Καταστατικά μεγέθη νερού και ατμού κατά τον κορεσμό (με βάση την πίεση) σε μονάδες του Δ.Σ.Μ.

bar	°C	°K	m³/kg	kg/m³	kJ/kg K		s'' − s' = r/T
p	t	T	v''	ρ''	s'	s''	r/T
0,01	6,98	280 14	129,2	0,00773	0,1061	8,9734	8,8673
0,015	13,03	286,19	87,99	0,01136	0,1957	8,8256	8,6299
0,02	17,51	290,67	67,02	0,01492	0,2607	8,7214	8,4607
0,025	21,09	294,25	54,27	0,01843	0,3119	8,6409	8,3290
0,03	24,10	297,26	45,68	0,02189	0,3543	8,5754	8,2211
0,04	28,98	302,14	34,81	0,02873	0,4223	8,4725	8,0502
0,05	32,90	306,06	28,20	0,03546	0,4761	8,3930	7,9169
0,06	36,19	309,35	23,75	0,04211	0,5206	8,3283	7,8077
0,08	41,54	314,70	18,11	0,05522	0,5922	8,2266	7,6344
0,10	45,84	319,00	14,68	0,06812	0,6489	8,1480	7,4991
0,12	49,45	322,61	12,37	0,08086	0,6959	8,0841	7,3882
0,15	54,00	327,16	10,03	0,09974	0,7545	8,0061	7,2516
0,20	60,09	333,25	7,652	0,1307	0,8316	7,9060	7,0744
0,25	64,99	338,15	6,206	0,1611	0 8927	7,8287	6,9360
0,30	69,12	342,28	5,231	0,1912	0,9435	7,7657	6,8222
0,40	75,89	349,05	3,994	0,2504	1,0255	7,6667	6,6412
0,50	81,35	354,51	3,241	0,3086	1,0906	7,5903	6,4997
0,60	85,95	359,11	2,732	0,3660	1,1449	7,5280	6,3831
0,70	89,96	363,12	2,365	0,4229	1,1915	7,4754	6,2839
0,80	93,51	366,67	2,087	0,4792	1,2324	7,4300	6,1976
0,90	96,71	369,87	1,869	0,5350	1,2690	7,3901	6,1211
1,0	99,63	372,79	1,694	0,5905	1,3022	7,3544	6,0522
1,1	102,32	375,48	1,549	0,6456	1,3324	7,3222	5,9898
1,2	104,81	377,97	1,428	0,7003	1,3603	7,2928	5,9325
1,3	107,13	380,29	1,325	0,7548	1,3862	7,2658	5,8796
1,4	109,32	382,48	1,236	0,8090	1,4104	7,2409	5,8305
1,5	111,37	384,53	1,159	0,8630	1,4331	7,2177	5,7846
1,6	113,32	386,48	1,091	0,9167	1,4544	7,1960	5,7416
1,8	116,93	390,09	0,9769	1,024	1,4938	7,1565	5,6627
2,0	120,23	393,39	0,8852	1,130	1,5295	7,1212	5,5917
2,2	123,27	396,43	0,8096	1,235	1,5622	7,0893	5,5271
2,4	126,09	399,25	0,7462	1,340	1,5923	7,0602	5,4679
2,6	128,73	401,89	0,6923	1,445	1,6203	7,0335	5,4132
2,8	131,21	404,37	0,6458	1,548	1,6465	7,0088	5,3623
3,0	133,54	406,70	0,6054	1,652	1,6711	6,9859	5,3148
3,2	135,76	408,92	0,5698	1,755	1,6942	6,9644	5,2702
3,4	137,86	411,02	0,5383	1,858	1,7161	6,9442	5,2281
3,6	139,87	413,03	0,5102	1,960	1,7370	6,9252	5,1882
3,8	141,79	414,95	0,4849	2,062	1,7568	6,9072	5,1504
4,0	143,63	416,79	0,4621	2,164	1,7757	6,8902	5,1145
4,5	147,92	421,08	0,4137	2,417	1,8197	6,8511	5,0314
5,0	151,85	425,01	0,3746	2,669	1,8596	6,8161	4,9565
6,0	158,84	432,00	0,3155	3,170	1,9300	6,7555	4,8255
7,0	164,96	438,12	0,2727	3,667	1,9909	6,7041	4,7132
8,0	170,41	443,57	0,2403	4,161	2,0447	6,6594	4,6147
9,0	175,36	448,52	0,2149	4,654	2,0931	6,6198	4,5267
10,0	179,88	453,04	0,1944	5,144	2,1370	6,5843	4,4473

Συνέχεια πίνακα IV

bar	kJ/kg		kJ/kg	kJ/kg		u'' − u' =	p·(v'' − v') =
p	h'	h''	r	u'	u''	φ	ψ
0,01	29,35	2513,4	2484,0	29,35	2384,2	2354,9	129,2
0,015	54,72	2524,5	2469,8	54,72	2392,5	2337,8	131,9
0,02	73,45	2532,7	2459,3	73,45	2398,7	2325,3	134,0
0,025	88,43	2539,3	2450,8	88,43	2403,6	2315,2	135,7
0,03	100,97	2544,7	2443,8	100,97	2407,7	2306,7	137,0
0,04	121,36	2553,6	2432,3	121,36	2414,4	2293,0	139,2
0,05	137,71	2560,7	2423,0	137,71	2419,7	2282,0	141,0
0,06	151,42	2566,7	2415,2	151,42	2424,2	2272,8	142,5
0,08	173,76	2576,3	2402,5	173,76	2431,4	2257,6	144,9
0,10	191,71	2583,9	2392,2	191,70	2437,1	2245,4	146,8
0,12	206,80	2590,3	2383,5	206,79	2441,9	2235,1	148,4
0 15	225,82	2598,3	2372,5	225,80	2447,9	2222,1	150,5
0,20	251,28	2608,9	2357,6	251,26	2455,9	2204,6	153,0
0,25	271,81	2617,4	2345,6	271,78	2462,3	2190,5	155,1
0,30	289,11	2624,4	2335,3	289 08	2467,5	2178,4	156,9
0,40	317,46	2635,7	2318,3	317,42	2475,9	2158,5	159,7
0,50	340,37	2644,7	2304,4	340,32	2482,7	2142,4	162,0
0,60	359,73	2652,2	2292,5	359,67	2488,3	2128,6	163,9
0,70	376,58	2658,6	2282,1	376,51	2493,1	2116,6	165,5
0,80	391,53	2664,3	2272,7	391,45	2497,3	2105,9	166,9
0,90	405,02	2669,3	2264,3	404,93	2501,1	2096,2	168,1
1,0	417,33	2673,8	2256,5	417,23	2504,4	2087,2	169,3
1,1	428,66	2678,0	2249,3	428,55	2507,6	2079,1	170,3
1,2	439,18	2681,8	2242,6	439,05	2510,4	2071,4	171,2
1,3	449,01	2685,3	2236,3	448,78	2513,1	2064,3	172,1
1,4	458,24	2688,6	2230,3	458,09	2515,6	2057,5	172,9
1,5	466,95	2691,6	2224,7	466,79	2517,8	2051,0	173,7
1,6	475,20	2694,5	2219,3	475,03	2519,9	2044,9	174,4
1,8	490,52	2699,8	2209,3	490,33	2524,0	2033,7	175,7
2,0	504,52	2704,6	2200,1	504,31	2527,6	2023,3	176,8
2,2	517,4	2708,9	2191,5	517,2	2531,2	2014,2	177,3
2,4	529,5	2712,9	2183,4	529,2	2533,8	2004,6	178,8
2,6	540,7	2716,6	2175,9	540,4	2536,6	1996,2	179,7
2,8	551,3	2720,0	2168,7	551,0	2539,2	1988,2	180,5
3,0	561,2	2723,2	2161,9	560,9	2537,0	1976,1	181,3
3,2	570,7	2726,2	2155,5	570,4	2543,9	1973,5	182,0
3,4	579,7	2729,0	2149,2	579,3	2546,0	1966,7	182,7
3,6	588,3	2731,6	2143,3	587,9	2547,9	1960,0	183,3
3,8	596,5	2734,1	2137,6	596,1	2549,8	1953,7	183,9
4,0	604,4	2736,5	2132,1	604,0	2551,7	1947,7	184,4
4,5	622,9	2742,0	2119,0	622,4	2555,8	1933,4	185,7
5,0	639,9	2746,8	2107,0	639,4	2559,5	1920,1	186,8
6,0	670,1	2755,2	2085,1	669,4	2565,9	1896,5	188,6
7,0	696,7	2762,1	2065,4	695,6	2571,2	1875,6	190,1
8,0	720,6	2768,0	2047,5	719,7	2575,8	1856,1	191,4
9,0	742,2	2773,1	2030,8	741,2	2579,7	[illegible]	192,4
10,0	762,2	2777,5	2015,3	761,1	2583,1	[illegible]	193,3

Συνέχεια πίνακα IV

bar	°C	°K	m³/kg	kg/m³	kJ/kg°K		s'' − s' =
p	t	T	v''	ϱ''	s'	s''	r/T
11,0	184,06	457,22	0,1775	5,634	2,1774	6,5519	4,3745
12,0	187,96	461,12	0,1633	6,123	2,2148	6,5221	4,3073
13,0	191,60	464,76	0,1512	6,612	2,2497	6,4946	4,2449
14,0	195,04	468,20	0,1408	7,100	2,2823	6,4689	4,1866
15,0	198,28	471,44	0,1318	7,589	2,3131	6,4448	4,1317
16,0	201,37	474,53	0,1238	8,077	2,3422	6,4221	4,0799
17,0	204,30	477,46	0,1167	8,566	2,3698	6,4006	4,0308
18,0	207,11	480,27	0,1104	9,056	2,3961	6,3802	3,9841
19,0	209,79	482,95	0,1048	9,546	2,4212	6,3608	3,9396
20,0	212,37	485,53	0,09964	10,04	2,4453	6,3422	3,8969
22,0	217,24	490,40	0,09074	11,02	2,4906	6,3072	3,8166
24,0	221,78	494,94	0,08328	12,01	2,5327	6,2748	3,7421
26,0	226,03	499,19	0,07692	13,00	2,5720	6,2445	3,6725
28,0	230,04	503,20	0,07144	14,00	2,6089	6,2159	3,6070
30,0	233,84	507,00	0,06667	15,00	2,6438	6,1890	3,5452
32	237,44	510,60	0,06247	16,01	2,6769	6,1634	3,4865
34	240,88	514,04	0,05874	17,02	2,7084	6,1389	3,4305
36	244,16	517,32	0,05542	18,05	2,7385	6,1155	3,3770
38	247,31	520,47	0,05243	19,07	2,7672	6,0931	3,3259
40	250,33	523,49	0,04973	20,11	2,7949	6,0714	3,2765
42	253,24	526,40	0,04728	21,15	2,8215	6,0506	3,2291
44	256,05	529,21	0,04504	22,20	2,8471	6,0304	3,1833
46	258,76	531,92	0,04299	23,26	2,8718	6,0109	3,1391
48	261,38	534,54	0,04111	24,33	2,8958	5,9919	3,0961
50	263,92	537,08	0,03937	25,40	2,9190	5,9735	3,0545
55	269,94	543,10	0,03556	28,12	2,9741	5,9294	2,9553
60	275,56	548,72	0,03236	30,90	3,0257	5,8880	2,8623
65	280,83	553,99	0,02964	33,74	3,0743	5,8487	2,7744
70	285,80	558,96	0,02729	36,64	3,1203	5,8113	2,6910
75	290,51	563,67	0,02525	39,60	3,1640	5,7755	2,5115
80	294,98	568,14	0,02346	42,63	3,2059	5,7412	2,5353
85	299,24	572,40	0,02187	45,73	3,2460	5,7081	2,4621
90	303,31	576,47	0,02045	48,89	3,2847	5,6762	2,3915
95	307,22	580,38	0,01918	52,13	3,3220	5,6454	2,3234
100	310,96	584,12	0,01803	55,45	3,3582	5,6155	2,2573
110	318,04	591,20	0,01602	62,42	3,4277	5,5584	2,1307
120	324,64	597,80	0,01429	69,98	3,4941	5,4971	2,0030
130	330,81	603,97	0,01279	78,17	3,5580	5,4353	1,8773
140	336,63	609,79	0,01149	87,04	3,6203	5,3726	1,7523
150	342,12	615,28	0,01034	96,71	3,6818	5,3104	1,6286
160	347,32	620,48	0,009314	107,4	3,7433	5,2471	1,5038
180	356,96	630,12	0,007518	133,0	3,8707	5,1062	1,2355
200	365,71	638,87	0,00591	169,3	4,0151	4,9375	0,9224
220	373,7	646,86	0,00385	260	4,2802	4,6023	0,3221
221,29	374,1[illegible]	647,31	0,00318	315	4,430		0

Συνέχεια πίνακα IV

bar	kJ/kg		kJ/kg	kJ/kg		$u'' - u'$ =	$\frac{p \cdot}{(v''-v')}$ =
p	h'	h''	r	u'	u''	φ	ψ
11,0	780,7	2781,3	2000,6	779,5	2586,1	1807,6	194,0
12,0	797,9	2784,7	1986,7	796,5	2588,7	1792,2	194,6
13,0	814,2	2787,6	1973,4	812,7	2591,0	1778,3	195,1
14,0	829,5	2790,2	1960,7	827,9	2593,1	1765,2	195,5
15,0	844,1	2792,5	1948,4	842,4	2594,8	1752,4	196,0
16,0	858,0	2794,6	1936,6	856,2	2596,5	1740,4	196,2
17,0	871,3	2796,4	1925,1	869,3	2598,0	1728,7	196,4
18,0	884,0	2798,0	1914,0	881,9	2599,3	1717,4	196,6
19,0	896,2	2799,3	1903,2	894,0	2600,2	1706,2	197,0
20,0	908,0	2800,6	1892,6	905,7	2601,3	1695,7	197,0
22,0	930,3	2802,5	1872,2	927,7	2602,9	1675,2	197,0
24,0	951,3	2803,9	1852,7	948,4	2604,0	1655,6	197,0
26,0	971,0	2804,8	1833,8	967,9	2604,8	1636,9	196,9
28,0	989,8	2805,4	1815,6	986,4	2605,4	1619,0	196,6
30,0	1007,7	2805,5	1797,9	1004,1	2605,5	1601,4	196,4
32	1024,7	2805,4	1780,7	1020,8	2605,5	1584,7	196,0
34	1041,1	2805,0	1763,9	1036,9	2605,3	1568,4	195,5
36	1056,9	2804,4	1747,5	1052,4	2604,9	1552,5	195,1
38	1072,1	2803,5	1731,4	1067,4	2604,3	1536,9	194,5
40	1086,7	2802,4	1715,7	1081,7	2603,5	1521,8	193,9
42	1100,9	2801,2	1700,2	1095,6	2602,6	1507,0	193,3
44	1114,7	2799,7	1685,0	1109,1	2601,5	1492,4	192,6
46	1128,1	2798,2	1670,1	1122,3	2600,4	1478,1	191,9
48	1141,1	2796,5	1655,3	1135,0	2599,2	1464,2	191,2
50	1153,8	2794,6	1640,8	1147,4	2597,8	1450,4	190,4
55	1184,2	2789,6	1605,3	1177,0	2594,0	1417,0	188,4
60	1213,1	2783,9	1570,8	1205,2	2589,7	1384,5	186,2
65	1240,5	2777,7	1537,2	1231,8	2585,0	1353,2	184,0
70	1266,7	2771,1	1504,3	1257,2	2580,1	1322,9	181,6
75	1292,0	2764,1	1472,0	1281,5	2574,7	1293,2	178,9
80	1316,4	2756,9	1440,4	1305,7	2569,2	1263,5	177,0
85	1339,9	2749,4	1409,2	1328,0	2563,5	1235,5	174,0
90	1362,9	2741,6	1378,5	1350,2	2557,6	1207,4	171,3
95	1385,2	2733,7	1348,2	1371,6	2551,5	1179,9	168,6
100	1407,0	2725,6	1318,2	1392,5	2545,3	1152,8	165,8
110	1449,3	2708,7	1258,9	1432,9	2532,5	1099,6	159,9
120	1490,2	2687,2	1196,3	1471,9	2515,7	1044,2	153,2
130	1530,2	2663,5	1132,3	1509,8	2497,2	987,4	145,9
140	1569,6	2637,7	1066,7	1547,1	2476,8	929,7	138,3
150	1608,9	2610,5	999,7	1584,0	2455,4	871,4	130,2
160	1648,5	2581,2	929,9	1621,1	2432,2	811,1	121,6
180	1732,9	2511,4	778,5	1699,6	2376,1	676,5	102,0
200	1826,7	2416,0	589,3	1785,5	2297,8	512,3	77,0
220	2009,7	2218,0	208,4	1951,6	2133,3	181,7	26,62
221,29	2099,7		0	2029,3		0	0

Πίνακας V Καταστατικά μεγέθη νερού και υπερθέρμου ατμού σε μονάδες του Τ.Σ.Μ.

t	1,0 at			5,0 at			10,0 at			25 at		
°C	v	i	s	v	i	s	v	i	s	v	i	s
0	0,001000	0,0	0,0000	0,001000	0,1	0,0000	0,001000	0,2	0,0000	0,000999	0,6	0,0001
10	0,001000	10,1	0,0361	0,001000	10,2	0,0361	0,001000	10,3	0,0361	0,000999	10,6	0,0361
20	0,001002	20,1	0,0708	0,001002	20,1	0,0708	0,001001	20,2	0,0707	0,001001	20,6	0,0707
30	0,001004	30,0	0,1042	0,001004	30,1	0,1042	0,001004	30,2	0,1041	0,001003	30,5	0,1040
40	0,001008	40,0	0,1366	0,001008	40,1	0,1365	0,001007	40,2	0,1365	0,001007	40,5	0,1363
50	0,001012	50,0	0,1679	0,001012	50,0	0,1679	0,001012	50,1	0,1678	0,001011	50,4	0,1676
60	0,001017	59,9	0,1983	0,001017	60,0	0,1983	0,001017	60,1	0,1982	0,001016	60,4	0,1980
70	0,001023	69,9	0,2279	0,001023	70,0	0,2278	0,001023	70,1	0,2278	0,001022	70,4	0,2276
80	0,001029	80,0	0,2567	0,001029	80,0	0,2566	0,001029	80,1	0,2565	0,001028	80,4	0,2563
90	0,001036	90,0	0,2847	0,001036	90,1	0,2846	0,001036	90,2	0,2845	0,001035	90,4	0,2843
100	1,730	638,9	1,7595	0,001044	100,1	0,3119	0,001043	100,2	0,3118	0,001043	100,5	0,3116
110	1,780	644,2	1,7734	0,001052	110,2	0,3386	0,001052	110,3	0,3385	0,001051	110,5	0,3382
120	1,830	649,1	1,7860	0,001061	120,3	0,3647	0,001060	120,4	0,3646	0,001059	120,6	0,3642
130	1,879	653,9	1,7980	0,001070	130,5	0,3902	0,001070	130,6	0,3901	0,001069	130,8	0,3897
140	1,927	658,6	1,8095	0,001080	140,7	0,4152	0,001080	140,7	0,4150	0,001079	141,0	0,4147
150	1,977	663,3	1,8207	0,001091	150,9	0,4397	0,001091	151,0	0,4396	0,001090	151,2	0,4392
160	2,024	667,9	1,8317	0,3917	661,4	1,6425	0,001102	161,3	0,4636	0,001101	161,5	0,4632
170	2,072	672,6	1,8423	0,4026	666,8	1,6553	0,001114	171,7	0,4873	0,001113	171,9	0,4869
180	2,119	677,3	1,8528	0,4131	672,3	1,6671	0,1986	663,9	1,5757	0,001127	182,3	0,5102
190	2,167	682,0	1,8630	0,4234	677,4	1,6782	0,2047	670,5	1,5901	0,001141	192,9	0,5332
200	2,215	686,7	1,8730	0,4337	682,4	1,6890	0,2105	676,4	1,6028	0,001156	203,5	0,5560
210	2,263	691,4	1,8829	0,4438	687,4	1,6994	0,2161	682,0	1,6145	0,001172	214,3	0,5785
220	2,310	696,1	1,8925	0,4538	692,4	1,7096	0,2215	687,4	1,6256	0,001190	225,3	0,6009
230	2,358	700,8	1,9020	0,4638	697,3	1,7195	0,2269	692,7	1,6362	0,08364	675,4	1,5080
240	2,406	705,5	1,9113	0,4738	702,2	1,7291	0,2322	698,0	1,6465	0,08642	682,6	1,5222
250	2,453	710,3	1,9204	0,4837	707,1	1,7386	0,2374	703,1	1,6565	0,08905	689,3	1,5352
260	2,501	715,0	1,9294	0,4935	712,1	1,7479	0,2426	708,3	1,6663	0,09157	695,6	1,5472
270	2,548	719,8	1,9383	0,5034	717,0	1,7571	0,2477	713,4	1,6758	0,09401	701,7	1,5585
280	2,596	724,5	1,9470	0,5132	721,9	1,7660	0,2528	718,5	1,6851	0,09638	707,7	1,5693
290	2,643	729,3	1,9555	0,5230	726,7	1,7747	0,2579	723,6	1,6942	0,09870	713,5	1,5797
300	2,690	734,1	1,9640	0,5327	731,7	1,7835	0,2630	728,7	1,7032	0,1010	719,2	1,5897
310	2,738	738,9	1,9723	0,5424	736,6	1,7920	0,2680	733,8	1,7119	0,1032	724,8	1,5994
320	2,785	743,7	1,9805	0,5522	741,6	1,8004	0,2730	738,8	1,7206	0,1054	730,3	1,6089
330	2,833	748,6	1,9886	0,5619	746,5	1,8086	0,2780	743,9	1,7290	0,1076	735,8	1,6181
340	2,880	753,4	1,9965	0,5715	751,4	1,8167	0,2830	748,9	1,7373	0,1098	741,3	1,6271
350	2,927	758,3	2,0044	0,5812	756,4	1,8247	0,2879	754,0	1,7455	0,1119	746,7	1,6359
360	2,974	763,1	2,0121	0,5908	761,3	1,8326	0,2929	759,1	1,7536	0,1141	752,1	1,6445
370	3,022	768,0	2,0198	0,6005	766,3	1,8404	0,2978	764,1	1,7615	0,1162	757,5	1,6529
380	3,069	772,9	2,0274	0,6101	771,3	1,8481	0,3027	769,2	1,7693	0,1183	762,9	1,6612
390	3,116	777,8	2,0348	0,6197	776,3	1,8557	0,3076	774,3	1,7770	0,1204	768,2	1,6693
400	3,163	782,8	2,0422	0,6293	781,3	1,8631	0,3125	779,3	1,7846	0,1224	773,6	1,6773
410	3,211	787,7	2,0495	0,6389	786,3	1,8705	0,3174	784,4	1,7921	0,1245	778,9	1,6851
420	3,258	792,7	2,0567	0,6488	791,3	1,8778	0,3223	789,5	1,7995	0,1265	784,2	1,6929
430	3,305	797,7	2,0638	0,6580	796,3	1,8850	0,3271	794,6	1,8068	0,1286	789,5	1,7005
440	3,352	802,6	2,0709	0,6676	801,3	1,8921	0,3320	799,7	1,8140	0,1306	794,8	1,7080
450	3,400	807,7	2,0778	0,6771	806,4	1,8992	0,3368	804,8	1,8212	0,1326	800,1	1,7154
460	3,447	812,7	2,0847	0,6867	811,5	1,9061	0,3417	810,0	1,8282	0,1347	805,4	1,7226
470	3,494	817,7	2,0916	0,6962	816,6	1,9130	0,3465	815,1	1,8352	0,1367	810,7	1,7298
480	3,541	822,8	2,0983	0,7057	821,6	1,9198	0,3513	820,2	1,8420	0,1387	816,0	1,7369
490	3,588	827,8	2,1050	0,7153	826,8	1,9266	0,3561	825,4	1,8489	0,1407	821,4	1,7439
500	3,635	832,9	2,1116	0,7248	831,9	1,9332	0,3610	830,6	1,8556	0,1427	826,7	1,7508
510	3,683	838,0	2,1182	0,7343	837,0	1,9398	0,3658	835,8	1,8622	0,1446	832,0	1,7577
520	3,730	843,1	2,1247	0,7438	842,2	1,9464	0,3706	840,9	1,8688	0,1466	837,3	1,7644
530	3,777	848,3	2,1311	0,7533	847,3	1,9528	0,3754	846,2	1,8754	0,1486	842,7	1,7711
540	3,824	853,4	2,1375	0,7628	852,5	1,9592	0,3802	851,4	1,8818	0,1506	848,0	1,7777
550	3,871	858,6	2,1438	0,7723	857,7	1,9656	0,3850	856,6	1,8882	0,1525	853,3	1,7842

Συνέχεια πίνακα V

t °C	1,0 at v	1,0 at i	1,0 at s	5,0 at v	5,0 at i	5,0 at s	10,0 at v	10,0 at i	10,0 at s	25 at v	25 at i	25 at s
550	3,871	858,6	2,1438	0,7723	857,7	1,9656	0,3850	856,6	1,8882	0,1525	853,3	1,7842
560	3,918	863,8	2,1500	0,7818	862,9	1,9719	0,3897	861,9	1,8945	0,1545	858,7	1,7907
570	3,965	869,0	2,1562	0,7913	868,1	1,9781	0,3945	867,1	1,9008	0,1565	864,0	1,7971
580	4,013	874,2	2,1624	0,8008	873,4	1,9843	0,3993	872,4	1,9070	0,1584	869,4	1,8034
590	4,060	879,4	2,1685	0,8103	878,6	1,9904	0,4041	877,7	1,9132	0,1604	874,8	1,8097
600	4,107	884,7	2,1745	0,8198	883,9	1,9965	0,4089	883,0	1,9193	0,1623	880,2	1,8159
610	4,154	889,9	2,1805	0,8292	889,2	2,0025	0,4136	888,3	1,9253	0,1643	885,6	1,8221
620	4,201	895,2	2,1865	0,8387	894,5	2,0085	0,4184	893,6	1,9313	0,1662	891,0	1,8281
630	4,248	900,5	2,1924	0,8482	899,8	2,0144	0,4232	899,0	1,9373	0,1682	896,4	1,8342
640	4,295	905,8	2,1982	0,8577	905,1	2,0203	0,4279	904,3	1,9434	0,1701	901,8	1,8402
650	4,342	911,1	2,2040	0,8672	910,5	2,0261	0,4327	909,7	1,9491	0,1721	907,3	1,8461
660	4,390	916,5	2,2098	0,8766	915,9	2,0319	0,4375	915,1	1,9549	0,1740	912,7	1,8520
670	4,437	921,9	2,2155	0,8861	921,2	2,0376	0,4422	920,5	1,9606	0,1759	918,2	1,8578
680	4,484	927,2	2,2212	0,8955	926,6	2,0433	0,4470	925,9	1,9663	0,1779	923,7	1,8636
690	4,531	932,6	2,2268	0,9050	932,1	2,0490	0,4517	931,3	1,9720	0,1798	929,2	1,8693
700	4,578	938,0	2,2324	0,9144	937,5	2,0546	0,4565	936,8	1,9776	0,1817	934,7	1,8750
710	4,625	943,5	2,2380	0,9239	942,9	2,0603	0,4612	942,2	1,9832	0,1836	940,2	1,8806
720	4,672	948,9	2,2435	0,9333	948,4	2,0657	0,4660	947,7	1,9888	0,1856	945,7	1,8862
730	4,719	954,4	2,2490	0,9428	953,9	2,0712	0,4707	953,2	1,9943	0,1875	951,3	1,8918
740	4,766	959,9	2,2544	0,9523	959,4	2,0766	0,4755	958,7	1,9997	0,1894	956,8	1,8973
750	4,814	965,4	2,2598	0,9617	964,9	2,0820	0,4802	964,2	2,0052	0,1913	962,4	1,9028
760	4,861	970,9	2,2652	0,9712	970,4	2,0874	0,4850	969,7	2,0106	0,1933	968,0	1,9082
770	4,908	976,4	2,2705	0,9806	975,9	2,0927	0,4897	975,3	2,0159	0,1952	973,6	1,9136
780	4,955	982,0	2,2758	0,9901	981,5	2,0980	0,4945	980,9	2,0212	0,1971	979,2	1,9190
790	5,002	987,5	2,2810	0,9995	987,1	2,1033	0,4992	986,5	2,0265	0,1990	984,8	1,9243
800	5,049	993,1	2,2863	1,0090	992,6	2,1085	0,5039	992,1	2,0317	0,2009	990,5	1,9296

t C°	50 at v	50 at i	50 at s	75 at v	75 at i	75 at s	100 at v	100 at i	100 at s	125 at v	125 at i	125 at s
0	0,000998	1,2	0,0001	0,000996	1,8	0,0001	0,000995	2,4	0,0002	0,000994	3,0	0,0002
10	0,000998	11,2	0,0360	0,000997	11,8	0,0359	0,000996	12,3	0,0359	0,000995	12,9	0,0358
20	0,001000	21,1	0,0705	0,000998	21,7	0,0704	0,000997	22,2	0,0703	0,000996	22,8	0,0701
30	0,001002	31,1	0,1038	0,001001	31,6	0,1037	0,001000	32,1	0,1035	0,000999	32,7	0,1033
40	0,001006	41,0	0,1361	0,001005	41,5	0,1359	0,001004	42,0	0,1356	0,001002	42,5	0,1354
50	0,001010	50,9	0,1674	0,001009	51,5	0,1671	0,001008	52,0	0,1668	0,001007	52,5	0,1666
60	0,001015	60,9	0,1978	0,001014	61,4	0,1974	0,001013	61,9	0,1971	0,001012	62,4	0,1968
70	0,001021	70,9	0,2273	0,001020	71,4	0,2269	0,001018	71,8	0,2265	0,001017	72,3	0,2262
80	0,001027	80,9	0,2560	0,001026	81,4	0,2555	0,001025	81,8	0,2551	0,001023	82,3	0,2548
90	0,001034	90,9	0,2839	0,001033	91,3	0,2834	0,001031	91,8	0,2830	0,001030	92,2	0,2826
100	0,001041	100,9	0,3111	0,001040	101,4	0,3106	0,001039	101,8	0,3102	0,001038	102,2	0,3098
110	0,001049	111,0	0,3377	0,001048	111,4	0,3372	0,001047	111,8	0,3367	0,001045	112,3	0,3363
120	0,001058	121,1	0,3637	0,001057	121,5	0,3632	0,001055	121,9	0,3627	0,001054	122,3	0,3622
130	0,001067	131,2	0,3891	0,001066	131,6	0,3886	0,001064	132,0	0,3880	0,001063	132,4	0,3875
140	0,001077	141,4	0,4140	0,001076	141,8	0,4134	0,001074	142,1	0,4129	0,001073	142,5	0,4123
150	0,001088	151,6	0,4385	0,001086	152,0	0,4379	0,001085	152,3	0,4372	0,001083	152,7	0,4366
160	0,001099	161,9	0,4625	0,001098	162,2	0,4619	0,001096	162,6	0,4612	0,001094	162,9	0,4605
170	0,001111	172,2	0,4862	0,001110	172,5	0,4855	0,001108	172,9	0,4847	0,001106	173,2	0,4840
180	0,001124	182,6	0,5094	0,001122	182,9	0,5087	0,001120	183,3	0,5079	0,001118	183,6	0,5071
190	0,001138	193,2	0,5324	0,001136	193,4	0,5316	0,001134	193,7	0,5307	0,001132	194,0	0,5299
200	0,001153	203,8	0,5551	0,001151	204,0	0,5542	0,001149	204,3	0,5533	0,001146	204,5	0,5524
210	0,001169	214,5	0,5776	0,001167	214,8	0,5766	0,001164	215,0	0,5756	0,001162	215,2	0,5747
220	0,001187	225,4	0,5999	0,001184	225,6	0,5988	0,001181	225,8	[illegible]	0,001178	226,0	0,5967
230	0,001206	236,5	0,6220	0,001203	236,6	0,6208	0,001199	236,7	[illegible]	0,001196	236,9	0,6186
240	0,001227	247,7	0,6441	0,001223	247,8	0,6429	0,001219	247,9	[illegible]	0,001216	247,9	0,6404

Συνέχεια πίνακα V

t °C	50 at v	50 at i	50 at s	75 at v	75 at i	75 at s	100 at v	100 at i	100 at s	125 at v	125 at i	125 at s
250	0,001250	259,2	0,6663	0,001245	259,2	0,6649	0,001241	259,2	0,6635	0,001237	259,2	0,6622
260	0,001275	270,9	0,6885	0,001270	270,8	0,6870	0,001265	270,8	0,6854	0,001261	270,7	0,6840
270	0,04157	675,0	1,4423	0,001298	282,8	0,7092	0,001292	282,6	0,7075	0,001287	282,5	0,7058
280	0,04331	684,0	1,4588	0,001329	295,2	0,7317	0,001322	294,8	0,7298	0,001316	294,6	0,7279
290	0,04492	692,3	1,4736	0,001370	307,9	0,7547	0,001357	307,5	0,7524	0,001349	307,1	0,7503
300	0,04643	700,0	1,4872	0,02744	673,5	1,4045	0,001398	320,7	0,7755	0,001388	320,1	0,7732
310	0,04787	707,2	1,4997	0,02879	684,0	1,4226	0,01853	652,4	1,3452	0,001434	333,8	0,7969
320	0,04924	714,2	1,5115	0,03002	693,6	1,4388	0,01984	666,3	1,3688	0,001491	348,5	0,8218
330	0,05057	720,8	1,5227	0,03116	702,3	1,4535	0,02101	678,6	1,3893	0,01447	648,1	1,3217
340	0,05186	727,3	1,5333	0,03224	710,6	1,4671	0,02206	689,6	1,4074	0,01561	663,3	1,3467
350	0,05311	733,6	1,5435	0,03326	718,3	1,4796	0,02304	699,6	1,4236	0,01662	676,7	1,3683
360	0,05433	739,8	1,5534	0,03423	725,7	1,4914	0,02394	708,9	1,4384	0,01754	688,7	1,3874
370	0,05553	745,9	1,5629	0,03517	732,8	1,5025	0,02479	717,6	1,4519	0,01838	699,5	1,4045
380	0,05671	751,8	1,5721	0,03607	739,6	1,5131	0,02559	725,7	1,4646	0,01916	709,6	1,4199
390	0,05787	757,7	1,5811	0,03695	744,3	1,5233	0,02636	733,5	1,4764	0,01988	718,9	1,4341
400	0,05902	763,6	1,5898	0,03781	752,9	1,5330	0,02709	741 0	1,4876	0,02057	727,6	1,4472
410	0,06015	769,4	1,5983	0,03865	759,3	1,5425	0,02780	748,2	1,4982	0,02122	735,9	1,4594
420	0,06127	775,1	1,6067	0,03947	765,5	1,5516	0,02849	755,2	1,5084	0,02184	743,9	1,4710
430	0,06237	780,8	1,6149	0,04027	771,8	1,5605	0,02916	762,0	1,5181	0,02244	751,5	1,4819
440	0,06347	786,5	1,6229	0,04107	777,9	1,5691	0,02981	768,7	1,5276	0,02301	758,8	1,4923
450	0,06456	792,2	1,6308	0,04185	783,9	1,5775	0,03045	775,2	1,5367	0,02357	766,0	1,5022
460	0,06564	797,8	1,6385	0,04262	789,9	1,5857	0,03107	781,7	1,5455	0,02412	773,0	1,5118
470	0,06671	803,4	1,6461	0,04338	795,8	1,5938	0,03169	788,0	1,5541	0,02465	779,8	1,5211
480	0,06778	809,1	1,6535	0,04414	801,8	1,6017	0,03229	794,3	1,5625	0,02517	786,5	1,5300
490	0,06883	814,5	1,6609	0,04489	807,6	1,6095	0,03289	800,5	1,5707	0,02568	793,1	1,5387
500	0,06989	820,1	1,6681	0,04563	813,5	1,6172	0,03348	806,6	1,5787	0,02618	799,6	1,5471
510	0,07093	825,7	1,6753	0,04636	819,3	1,6245	0,03406	812,7	1,5865	0,02667	806,0	1,5554
520	0,07198	831,2	1,6823	0,04709	825,1	1,6318	0,03464	818,8	1,5942	0,02716	812,3	1,5634
530	0,07301	836,8	1,6893	0,04782	830,8	1,6390	0,03521	824,8	1,6017	0,02764	818,6	1,5713
540	0,07405	842,3	1,6961	0,04853	836,8	1,6462	0,03578	830,7	1,6091	0,02812	824,8	1,5790
550	0,07507	847,8	1,7029	0,04926	842,3	1,6532	0,03634	836,7	1,6163	0,02858	831,0	1,5865
560	0,07610	853,4	1,7096	0,04997	848.0	1,6601	0,03689	842,6	1,6235	0,02905	837,1	1,5940
570	0,07712	858,9	1,7162	0,05068	853,7	1,6669	0,03745	848,5	1,6305	0,02951	843,2	1,6012
580	0,07814	864,4	1,7227	0,05138	859,4	1,6736	0,03799	854,4	1,6375	0,02996	849,3	1,6084
590	0,07915	870,0	1,7291	0,05208	865,1	1,6803	0,03854	860,2	1,6443	0,03042	855,3	1,6154
600	0,08016	875,5	1,7355	0,05278	870,8	1,6868	0,03908	866.1	1,6510	0,03086	861,3	1,6224
610	0,08117	881,0	1,7418	0,05348	876,5	1,6933	0,03962	871,9	1,6577	0,03131	867,3	1,6292
620	0,08218	886,6	1,7481	0,05417	882,2	1,6997	0,04015	877,8	1,6642	0,03175	873,3	1,6359
630	0,08318	892,1	1,7542	0,05486	887,9	1,7060	0,04069	883,6	1,6707	0,03219	879,3	1,6425
640	0,08418	897,7	1,7604	0,05554	893,6	1,7123	0,04122	889,4	1,6771	0,03263	885,2	1,6491
650	0,08518	903,2	1,7664	0,05623	899,3	1,7185	0,04175	895,2	1,6834	0,03306	891,2	1,6555
660	0,08617	908,8	1,7724	0,05691	905,0	1,7246	0,04227	901,0	1,6897	0,03349	897,1	1,6619
670	0,08717	914,4	1,7784	0,05759	910,6	1,7306	0,04280	906,8	1,6959	0,03392	903,0	1,6682
680	0,08816	920,0	1,7842	0,05827	916,3	1,7367	0,04332	912,6	1,7020	0,03435	908,9	1,6745
690	0,08915	925,6	1,7901	0,05895	922,0	1,7426	0,04384	918,4	1,7080	0,03478	914,8	1,6806
700	0,09014	931,2	1,7959	0,05962	927,7	1,7485	0,04435	924,2	1,7140	0,03520	920,7	1,6867
710	0,09112	936,8	1,8016	0,06030	933,4	1,7543	0,04487	930,0	1,7200	0,03562	926,6	1,6927
720	0,09211	942,4	1,8073	0,06097	939,1	1,7600	0,04539	935,8	1,7258	0,03604	932,5	1,6987
730	0,09309	948,0	1,8129	0,06164	944,8	1,7658	0,04590	941,6	1,7316	0,03646	938,4	1,7046
740	0,09408	953,7	1,8185	0,06231	950,5	1,7715	0,04641	947,4	1,7374	0,03688	944,2	1,7104
750	0,09506	959,3	1,8241	0,06297	956,3	1,7771	0,04692	953,2	0,7431	0,03730	950,1	1,7162
760	0,09604	965,0	1,8296	0,06364	962,0	1,7827	0,04743	959,0	1,7487	0,03771	956,0	1,7219
770	0,09702	970,6	1,8350	0,06431	967,7	1,7882	0,04794	964,8	0,7543	0,03812	961,9	1,7276
780	0,09799	976,3	1,8405	0,06497	973,5	1,7937	0,04844	970,6	1,7599	0,03854	967,8	1,7332
790	0,09897	982,0	1,8458	0,06563	979,4	1,7992	0,04895	976,5	1,7654	0,03895	973,7	1,7388
800	0,09994	987,7	1,8512	0,06629	985,0	1,8046	0,04945	982,3	1,7709	0,03936	979,6	1,7443

υνέχεια πίνακα V

t °C	150 at v	150 at i	150 at s	200 at v	200 at i	200 at s	250 at v	250 at i	250 at s	300 at v	300 at i	300 at s
0	0,000993	3,6	0,0002	0,000991	4,7	0,0003	0,000988	5,9	0,0003	0,000986	7,0	0,0003
10	0,000993	13,4	0,0358	0,000991	14,6	0,0356	0,000989	15,7	0,0355	0,000987	16,8	0,0353
20	0,000995	23,3	0,0700	0,000993	24,4	0,0697	0,000991	25,5	0,0695	0,000989	26,6	0,0692
30	0,000998	33,2	0,1031	0,000996	34,2	0,1028	0,000994	35,3	0,1024	0,000992	36,3	0,1020
40	0,001001	43,1	0,1352	0,000999	44,1	0,1347	0,000997	45,1	0,1343	0,000995	46,1	0,1338
50	0,001006	53,0	0,1663	0,001004	54,0	0,1657	0,001002	55,0	0,1652	0,001000	56,0	0,1647
60	0,001011	62,9	0,1965	0,001009	63,8	0,1959	0,001006	64,8	0,1953	0,001004	65,8	0,1946
70	0,001016	72,8	0,2258	0,001014	73,7	0,2251	0,001012	74,7	0,2245	0,001010	75,6	0,2238
80	0,001022	82,7	0,2544	0,001020	83,7	0,2536	0,001018	84,6	0,2529	0,001016	85,5	0,2522
90	0,001029	92,7	0,2822	0,001027	93,6	0,2814	0,001025	94,5	0,2806	0,001022	95,4	0,2798
100	0,001036	102,7	0,3093	0,001034	103,6	0,3084	0,001032	104,4	0,3076	0,001029	105,3	0,3067
110	0,001044	112,7	0,3358	0,001042	113,5	0,3348	0,001039	114,4	0,3339	0,001037	115,3	0,3330
120	0,001053	122,7	0,3616	0,001050	123,6	0,3606	0,001047	124,4	0,3596	0,001045	125,2	0,3587
130	0,001062	132,8	0,3869	0,001059	133,6	0,3859	0,001056	134,4	0,3848	0,001054	135,2	0,3838
140	0,001071	142,9	0,4117	0,001068	143,7	0,4106	0,001066	144,5	0,4094	0,001063	145,2	0,4083
150	0,001081	153,1	0,4360	0,001078	153,8	0,4348	0,001075	154,6	0,4336	0,001072	155,3	0,4324
160	0,001092	163,3	0,4598	0,001089	164,0	0,4585	0,001086	164,7	0,4573	0,001083	165,4	0,4560
170	0,001104	173,5	0,4833	0,001100	174,2	0,4819	0,001097	174,9	0,4805	0,001094	175,6	0,4792
180	0,001116	183,9	0,5064	0,001113	184,5	0,5049	0,001109	185,1	0,5034	0,001105	185,8	0,5020
190	0,001130	194,3	0,5291	0,001126	194,9	0,5275	0,001122	195,5	0,5260	0,001118	196,1	0,5245
200	0,001144	204,8	0,5515	0,001139	205,3	0,5499	0,001135	205,9	0,5482	0,001131	206,4	0,5466
210	0,001159	215,4	0,5737	0,001154	215,9	0,5719	0,001150	216,4	0,5702	0,001145	216,9	0,5684
220	0,001175	226,1	0,5957	0,001170	226,6	0,5938	0,001165	227,0	0,5919	0,001160	227,4	0,5900
230	0,001193	237,0	0,6176	0,001187	237,3	0,6154	0,001182	237,7	0,6134	0,001176	238,1	0,6114
240	0,001212	248,1	0 6393	0,001206	248,3	0,6370	0,001199	248,6	0,6348	0,001193	248,9	0,6326
250	0,001233	259,3	0,6609	0,001226	259,4	0,6584	0,001219	259,6	0,6560	0,001212	259,8	0,6537
260	0,001256	270,7	0,6825	0,001247	270,7	0,6798	0,001239	270,8	0,6772	0,001232	270,9	0,6747
270	0,001281	282,4	0,7042	0,001271	282,2	0,7012	0,001262	282,1	0,6983	0,001254	282,1	0,6956
280	0,001310	294,4	0,7261	0,001298	294,0	0,7227	0,001287	293,8	0,7195	0,001277	293,6	0,7165
290	0,001342	306,7	0,7483	0,001328	306,1	0,7444	0,001315	305,7	0,7408	0,001304	305,3	0,7375
300	0,001378	319,5	0,7709	0,001361	318,6	0,7664	0,001346	317,9	0,7623	0,001333	317,3	0,7586
310	0,001422	332,9	0,7941	0,001400	331,6	0,7888	0,001382	330,5	0,7842	0,001366	329,6	0,7799
320	0,001474	347,2	0,8183	0,001446	345,2	0,8119	0,001423	343,6	0,8064	0,001403	342,3	0,8016
330	0,001541	362,7	0,8443	0,001501	359,6	0,8361	0,001471	357,3	0,8294	0,001445	355,6	0,8237
340	0,001637	380,4	0,8733	0,001572	375,3	0,8619	0,001529	371,9	0,8534	0,001496	369,4	0,8464
350	0,01206	647,5	1,3085	0,001672	393,2	0,8908	0,001603	387,6	0,8789	0,001556	384,1	0,8702
360	0,01304	664,2	1,3348	0,001841	416,6	0,9280	0,001695	405,7	0,9075	0,001632	399,9	0,8954
370	0,01392	678,2	1,3566	0,00745	610,8	1,2332	0,001853	428,0	0,9425	0,00172	417,8	0,9235
380	0,01472	690,6	1,3759	0,00874	640,4	1,2777	0,00238	471,4	1,0069	0,00188	439,5	0,9573
390	0,01544	702,0	1,3932	0,00960	660,4	1,3008	0,00511	585,6	1,1833	0,00217	470,4	1,0040
400	0,01612	712,5	1,4088	0,01030	675,7	1,3316	0,00636	623,2	1,2395	0,00301	523,6	1,0843
410	0,01675	722,2	1,4231	0,01095	689,4	1,3518	0,00719	646,9	1,2743	0,00424	578,9	1,1660
420	0,01734	731,3	1,4364	0,01154	701,8	1,3699	0,00788	665,5	1,3018	0,00517	615,0	1,2185
430	0,01790	739,9	1,4488	0,01209	713,2	1,3862	0,00845	681,0	1,3237	0,00588	641,1	1,2555
440	0,01844	748,2	1,4604	0,01260	723,8	1,4012	0,00897	695,0	1,3433	0,00645	661,1	1,2839
450	0,01895	756,1	1,4714	0,01308	733,7	1,4150	0,00945	707,7	1,3609	0,00695	677,8	1,3065
460	0,01945	763,7	1,4819	0,01353	743,1	1,4279	0,00989	719,4	1,3770	0,00740	692,4	1,3260
470	0,01993	771,1	1,4919	0,01397	752,0	1,4399	0,01031	730,2	1,3917	0,00782	705,8	1,3447
480	0,02040	778,3	1,5015	0,01438	760,5	1,4513	0,01070	740,4	1,4054	0,00821	718,1	1,3611
490	0,02086	785,3	1,5108	0,01478	768,7	1,4620	0,01108	750,1	1,4181	0,00857	729,6	1,3763
500	0,02130	792,2	1,5198	0,01516	776,5	1,4723	0,01143	759,3	1,4301	0,00891	740,4	1,3903
510	0,02174	799,0	1,5285	0,01553	784,2	1,4822	0,01177	768,1	1,4414	0,00924	750,5	1,4034
520	0,02217	805,7	1,5370	0,01589	791,7	1,4916	0,01210	776,5	1,4521	0,00954	760,2	1,4156
530	0,02259	812,3	1,5452	0,01625	799,0	1,5008	0,01242	784,7	1,4623	0,00984	769,4	1,4272
540	0,02300	818,7	1,5532	0,01659	806,1	1,5096	0,01272	792,6	1,4721	0,01013	778,3	1,4382
550	0,02341	825,2	1,5611	0,01693	813,1	1,5182	0,01302	800,4	1,4816	0,01040	786,8	1,4486

Συνέχεια πίνακα V

t °C	150 at v	150 at i	150 at s	200 at v	200 at i	200 at s	250 at v	250 at i	250 at s	300 at v	300 at i	300 at s
550	0,02341	825,2	1,5611	0,01693	813,1	1,5182	0,01302	800,4	1,4816	0,01040	786,8	1,4486
560	0,02381	831,5	1,5688	0,01726	820,0	1,5265	0,01331	807,9	1,4907	0,01067	795,1	1,4586
570	0,02421	837,9	1,5763	0,01759	826,8	1,5346	0,01360	815,3	1,4995	0,01093	803,2	1,4682
580	0,02461	844,1	1,5837	0,01791	833,5	1,5426	0,01387	822,5	1,5080	0,01118	811,0	1,4775
590	0,02500	850,4	1,5910	0,01822	840,2	1,5503	0,01415	829,7	1,5164	0,01142	818,7	1,4864
600	0,02539	856,6	1,5981	0,01853	846,8	1,5579	0,01442	836,7	1,5244	0,01166	826,2	1,4951
610	0,02577	862,7	1,6051	0,01884	853,3	1,5653	0,01468	843,6	1,5323	0,01190	833,6	1,5035
620	0,02615	868,8	1,6120	0,01914	859,8	1,5726	0,01494	850,4	1,5400	0,01213	840,9	1,5117
630	0,02653	874,9	1,6188	0,01945	866,2	1,5797	0,01519	857,2	1,5476	0,01236	848,0	1,5197
640	0,02690	881,0	1,6255	0,01974	872,6	1,5868	0,01545	863,9	1,5550	0,01258	855,1	1,5274
650	0,02727	887,1	1,6321	0,02004	878,9	1,5937	0,01570	870,6	1,5622	0,01280	862,1	1,5350
660	0,02764	893,1	1,6386	0,02033	885,2	1,6005	0,01594	877,2	1,5693	0,01302	869,0	1,5425
670	0,02801	899,2	1,6451	0,02062	891,5	1,6072	0,01619	883,7	1,5763	0,01323	875,8	1,5498
680	0,02838	905,2	1,6514	0,02091	897,7	1,6138	0,01643	890,2	1,5832	0,01344	882,6	1,5569
690	0,02874	911,2	1,6577	0,02119	904,0	1,6203	0,01667	896,7	1,5899	0,01365	889,3	1,5639
700	0,02910	917,2	1,6639	0,02148	910,2	1,6267	0,01690	903,1	1,5966	0,01385	896,0	1,5708
710	0,02946	923,2	1,6700	0,02176	916,4	1,6330	0,01714	909,5	1,6031	0,01406	902,7	1,5776
720	0,02982	929,2	1,6761	0,02204	922,6	1,6393	0,01737	915,9	1,6096	0,01426	909,2	1,5843
730	0,03017	935,1	1,6820	0,02231	928,7	1,6454	0,01760	922,3	1,6159	0,01446	915,8	1,5909
740	0,03053	942,0	1,6880	0,02259	934,9	1,6515	0,01783	928,6	1,6222	0,01466	922,3	1,5973
750	0,03088	947,1	1,6938	0,02287	941,0	1,6576	0,01806	934,9	1,6284	0,01486	928,8	1,6037
760	0,03123	953,0	1,6996	0,02314	947,1	1,6635	0,01829	941,2	1,6345	0,01505	935,3	1,6100
770	0,03158	959,0	1,7054	0,02341	953,2	1,6694	0,01851	947,5	1,6406	0,01525	941,7	1,6162
780	0,03193	965,0	1,7111	0,02368	959,3	1,6752	0,01873	953,8	1,6465	0,01544	948,2	1,6224
790	0,03228	970,9	1,7167	0,02395	965,5	1,6810	0,01896	960,0	1,6525	0,01563	954,6	1,6284
800	0,03263	976,9	1,7223	0,02422	971,6	1,6867	0,01918	966,2	1,6583	0,01582	961,0	1,6344

t °C	350 at v	350 at i	350 at s	400 at v	400 at i	400 at s	450 at v	450 at i	450 at s	500 at v	500 at i	500 at s
0	0,0009837	8,2	0,0002	0,0009814	9,3	0,0002	0,0009792	10,5	0,0001	0,0009769	11,6	0,0000
10	0,0009847	17,9	0,0351	0,0009826	19,0	0,0350	0,0009805	20,1	0,0347	0,0009784	21,2	0,0345
20	0,0009868	27,6	0,0689	0,0009848	28,8	0,0688	0,0009828	29,8	0,0683	0,0009808	30,8	0,0680
30	0,0009897	37,4	0,1016	0,0009878	38,5	0,1014	0,0009858	39,5	0,1008	0,0009839	40,5	0,1004
40	0,0009934	47,2	0,1333	0,0009914	48,3	0,1329	0,0009895	49,2	0,1324	0,0009876	50,2	0,1319
50	0,0009976	57,0	0,1641	0,0009957	57,9	0,1636	0,0009938	58,9	0,1631	0,0009919	59,9	0,1625
60	0,0010025	66,8	0,1940	0,0010005	67,7	0,1934	0,0009986	68,7	0,1928	0,0009967	69,7	0,1923
70	0,0010079	76,6	0,2231	0,0010059	77,6	0,2225	0,0010039	78,5	0,2218	0,0010020	79,5	0,2212
80	0,0010138	86,5	0,2514	0,0010117	87,4	0,2507	0,0010097	88,3	0,2500	0,0010078	89,2	0,2493
90	0,0010202	96,3	0,2790	0,0010181	97,2	0,2782	0,0010160	98,1	0,2774	0,0010140	99,1	0,2767
100	0,0010272	106,2	0,3059	0,0010250	107,1	0,3050	0,0010228	108,0	0,3042	0,0010207	108,9	0,3034
110	0,0010346	116,1	0,3321	0,0010323	117,0	0,3312	0,0010301	117,9	0,3303	0,0010279	118,7	0,3294
120	0,0010425	126,1	0,3577	0,0010402	126,9	0,3567	0,0010378	127,8	0,3558	0,0010355	128,6	0,3549
130	0,0010510	136,0	0,3827	0,0010485	136,9	0,3817	0,0010461	137,7	0,3807	0,0010437	138,5	0,3797
140	0,0010600	146,0	0,4072	0,0010574	146,8	0,4061	0,0010548	147,6	0,4051	0,0010523	148,4	0,4040
150	0,0010696	156,1	0,4312	0,0010668	156,8	0,4301	0,0010641	157,6	0,4290	0,0010614	158,4	0,4278
160	0,0010797	166,2	0,4548	0,0010768	166,9	0,4536	0,0010739	167,6	0,4524	0,0010711	168,4	0,4512
170	0,0010905	176,3	0,4779	0,0010873	177,0	0,4766	0,0010843	177,7	0,4753	0,0010813	178,4	0,4741
180	0,0011019	186,5	0,5006	0,0010985	187,1	0,4992	0,0010953	187,8	0,4979	0,0010921	188,5	0,4966
190	0,0011140	196,7	0,5230	0,0011104	197,3	0,5215	0,0011069	198,0	0,5201	0,0011036	198,6	0,5187
200	0,0011269	207,0	0,5450	0,0011230	207,6	0,5435	0,0011193	208,2	0,5420	0,0011157	208,8	0,5405
210	0,0011406	217,4	0,5668	0,0011364	218,0	0,5651	0,0011324	218,5	0,5635	0,0011285	219,1	0,5620
220	0,0011553	227,9	0,5882	0,0011507	228,4	0,5865	0,0011463	228,9	0,5848	0,0011421	229,4	0,5831
230	0,0011709	238,5	0,6095	0,0011659	238,9	0,6076	0,0011612	239,4	0,6058	0,0011566	239,8	0,6040
240	0,0011876	249,2	0,6306	0,0011822	249,6	0,6286	0,0011770	250,0	0,6266	0,0011720	250,4	0,6247

Συνέχεια πίνακα V

t °C	350 at v	350 at i	350 at s	400 at v	400 at i	400 at s	450 at v	450 at i	450 at s	500 at v	500 at i	500 at s
250	0,0012056	260,0	0,6515	0,0011996	260,3	0,6493	0,0011938	260,6	0,6473	0,0011884	261,0	0,6452
260	0,0012249	271,0	0,6723	0,0012183	271,2	0,6700	0,0012119	271,5	0,6677	0,0012059	271,7	0,6656
270	0,0012459	282,2	0,6930	0,0012384	282,3	0,6905	0,0012313	282,4	0,6881	0,0012247	282,6	0,6858
280	0,0012687	293,5	0,7137	0,0012602	293,5	0,7110	0,0012523	293,5	0,7083	0,0012448	293,6	0,7059
290	0,0012936	305,1	0,7344	0,0012839	304,9	0,7314	0,0012749	304,8	0,7286	0,0012665	304,8	0,7259
300	0,0013209	316,9	0,7551	0,0013098	316,5	0,7519	0,0012996	316,3	0,7488	0,0012901	316,1	0,7458
310	0,001351	328,9	0,7760	0,001338	328,4	0,7724	0,0013265	328,0	0,7690	0,001316	327,6	0,7658
320	0,001385	341,4	0,7971	0,001370	340,5	0,7931	0,001356	339,9	0,7893	0,001344	339,4	0,7857
330	0,001424	354,2	0,8186	0,001406	353,0	0,8139	0,001389	352,1	0,8097	0,001375	351,3	0,8057
340	0,001469	367,5	0,8404	0,001446	365,9	0,8351	0,001426	364,6	0,8303	0,001409	363,6	0,8259
350	0,001520	381,3	0,8630	0,001492	379,3	0,8567	0,001468	377,6	0,8512	0,001445	376,2	0,8462
360	0,001582	396,2	0,8861	0,001539	393,3	0,8791	0,001515	391,2	0,8726	0,001492	389,1	0,8671
370	0,00166	412,1	0,9100	0,00161	408,2	0,9025	0,00157	405,3	0,8948	0,00154	402,8	0,8885
380	0,00176	430,0	0,9387	0,00168	424,4	0,9275	0,00164	420,4	0,9176	0,00160	416,9	0,9105
390	0,00190	451,2	0,9715	0,00179	442,2	0,9539	0,00172	436,3	0,9425	0,00167	431,8	0,9335
400	0,00212	477,7	1,0115	0,00192	462,3	0,9844	0,00181	453,9	0,9689	0,00175	447,8	0,9572
410	0,00257	511,4	1,0612	0,00211	485,6	1,0190	0,00194	473,1	0,9972	0,00184	464,9	0,9825
420	0,00323	552,0	1,1205	0,00240	513,0	1,0590	0,00211	494,6	1,0292	0,00196	483,6	1,0095
430	0,00394	591,0	1,1776	0,00280	545,8	1,1055	0,00233	528,7	1,0635	0,00211	503,5	1,0389
440	0,00458	620,0	1,2172	0,00330	577,0	1,1505	0,00263	545,0	1,1007	0,00231	525,4	1,0694
450	0,00515	643,3	1,2492	0,00381	604,9	1,1890	0,00298	571,3	1,1377	0,00254	548,6	1,1015
460	0,00560	662,5	1,2755	0,00427	629,6	1,2216	0,00336	597,4	1,1735	0,00281	572,2	1,1334
470	0,00602	679,0	1,2979	0,00471	650,6	1,2514	0,00375	620,9	1,2050	0,00311	595,2	1,1650
480	0,00641	693,8	1,3176	0,00507	668,2	1,2750	0,00411	641,9	1,2332	0,00341	617,2	1,1945
490	0,00676	707,4	1,3355	0,00542	684,2	1,2958	0,00444	660,7	1,2581	0,00371	637,7	1,2215
500	0,00710	720,0	1,3519	0,00575	698,7	1,3146	0,00474	677,1	1,2792	0,00400	656,3	1,2460
510	0,00741	731,7	1,3670	0,00605	712,1	1,3318	0,00503	692,3	1,2984	0,00427	673,1	1,2675
520	0,00771	742,7	1,3810	0,00633	724,5	1,3477	0,00530	706,1	1,3165	0,00452	688,4	1,2870
530	0,00799	753,2	1,3940	0,00661	736,2	1,3623	0,00555	719,1	1,3322	0,00476	702,5	1,3045
540	0,00826	763,1	1,4063	0,00686	747,3	1,3760	0,00579	731,3	1,3473	0,00498	715,8	1,3208
550	0,00852	772,6	1,4179	0,00711	757,8	1,3889	0,00603	742,8	1,3613	0,00519	728,1	1,3355
560	0,00877	781,7	1,4289	0,00735	767,8	1,4010	0,00625	753,7	1,3745	0,00540	739,8	1,3496
570	0,00901	790,5	1,4394	0,00758	777,4	1,4124	0,00647	764,1	1,3869	0,00560	750,9	1,3629
580	0,00925	799,0	1,4495	0,00780	786,7	1,4233	0,00668	774,1	1,3987	0,00579	761,6	1,3755
590	0,00947	807,3	1,4591	0,00801	795,6	1,4337	0,00688	783,7	1,4099	0,00598	771,8	1,3874
600	0,00969	816,4	1,4684	0,00822	804,3	1,4437	0,00707	793,0	1,4205	0,00617	781,7	1,3987
610	0,00991	823,3	1,4774	0,00842	812,7	1,4533	0,00726	801,9	1,4308	0,00634	791,2	1,4096
620	0,01012	831,0	1,4861	0,00861	820,9	1,4626	0,00744	810,7	1,4406	0,00652	800,4	1,4200
630	0,01033	838,6	1,4946	0,00881	829,0	1,4715	0,00762	819,2	1,4501	0,00668	809,4	1,4300
640	0,01053	846,1	1,5028	0,00899	836,9	1,4802	0,00780	827,5	1,4592	0,00685	818,1	1,4396
650	0,01073	853,4	1,5108	0,00918	844,6	1,4886	0,00797	835,6	1,4681	0,00701	826,6	1,4489
660	0,01092	860,7	1,5186	0,00936	852,2	1,4968	0,00814	843,6	1,4767	0,00717	835,0	1,4579
670	0,01112	867,8	1,5262	0,00953	859,7	1,5048	0,00830	851,4	1,4850	0,00732	843,2	1,4692
680	0,01131	874,9	1,5337	0,00971	867,1	1,5126	0,00846	859,2	1,4932	0,00747	851,2	1,4751
690	0,01149	881,9	1,5410	0,00988	874,4	1,5202	0,00862	866,7	1,5011	0,00762	859,1	1,4833
700	0,01168	888,8	1,5482	0,01005	881,6	1,5277	0,00878	874,2	1,5088	0,00777	866,9	1,4913
710	0,01186	895,7	1,5552	0,01021	888,7	1,5350	0,00893	881,6	1,5164	0,00791	874,5	1,4992
720	0,01204	902,5	1,5621	0,01038	895,8	1,5421	0,00908	888,9	1,5238	0,00805	882,1	1,5068
730	0,01222	909,3	1,5689	0,01054	902,8	1,5491	0,00923	896,2	1,5311	0,00819	889,6	1,5143
740	0,01240	916,0	1,5756	0,01070	909,7	1,5560	0,00938	903,4	1,5382	0,00833	897,0	1,5217
750	0,01257	922,7	1,5821	0,01086	916,6	1,5628	0,00953	910,5	1,5451	0,00846	904,3	1,5289
760	0,01274	929,4	1,5886	0,01101	923,4	1,5694	0,00967	917,5	1,5520	0,00859	911,6	1,5359
770	0,01291	936,0	1,5950	0,01117	930,3	1,5760	0,00981	924,5	1,5587	0,00873	918,7	1,5428
780	0,01309	942,6	1,6013	0,01132	937,0	1,5824	0,00995	931,4	1,5654	0,00886	925,9	1,5496
790	0,01325	949,2	1,6075	0,01147	943,7	1,5888	0,01009	938,3	1,5719	0,00898	933,0	1,5563
800	0,01342	955,7	1,6130	0,01162	950,4	1,5951	0,01023	945,2	1,5783	0,00911	940,0	1,5629

Πίνακας VI Καταστατικά μεγέθη νερού και υπερθέρμου ατμού σε μονάδες του Δ.Σ.Μ.

t °C	1,0 bar t_s = 99,63 °C v	h	s	5,0 bar t_s = 151,85 °C v	h	s	10,0 bar t_s = 179,88 °C v	h	s	25 bar t_s = 223,94 °C v	h	s
0	0,0010002	0,1	0,0000	0,0010000	0,5	0,0001	0,0009997	1,0	0,0001	0,0009990	2,6	0,0002
10	0,0010002	42,1	0,1511	0,0010000	42,5	0,1511	0,0009998	43,0	0,1511	0,0009991	44,5	0,1509
20	0,0010016	83,9	0,2963	0,0010015	84,3	0,2962	0,0010012	84,8	0,2961	0,0010005	86,2	0,2958
30	0,0010042	125,7	0,4363	0,0010041	126,1	0,4362	0,0010038	126,5	0,4360	0,0010032	127,9	0,4356
40	0,0010078	167,4	0,5718	0,0010076	167,8	0,5716	0,0010074	168,2	0,5714	0,0010067	169,5	0,5708
50	0,0010121	209,2	0,7030	0,0010119	209,5	0,7028	0,0010117	210,0	0,7026	0,0010110	211,2	0,7019
60	0,0010172	251,0	0,8304	0,0010170	251,3	0,8302	0,0010168	251,7	0,8299	0,0010161	253,0	0,8291
70	0,0010229	292,8	0,9542	0,0010227	293,2	0,9540	0,0010225	293,6	0,9537	0,0010218	294,8	0,9527
80	0,0010293	334,8	1,0746	0,0010291	335,1	1,0744	0,0010288	335,5	1,0740	0,0010281	336,7	1,0730
90	0,0010363	376,8	1,1919	0,0010361	377,1	1,1916	0,0010358	377,5	1,1913	0,0010351	378,6	1,1902
100	1,695	2674,7	7,3567	0,0010436	419,2	1,3060	0,0010434	419,6	1,3056	0,0010426	420,7	1,3044
110	1,746	2696,8	7,4152	0,0010518	461,4	1,4176	0,0010515	461,8	1,4172	0,0010507	462,8	1,4159
120	1,794	2717,4	7,4683	0,0010606	503,7	1,5268	0,0010603	504,1	1,5263	0,0010595	505,2	1,5249
130	1,842	2737,4	7,5185	0,0010701	546,3	1,6336	0,0010697	546,6	1,6331	0,0010688	547,6	1,6316
140	1,890	2757,1	7,5669	0,0010802	589,0	1,7382	0,0010798	589,3	1,7377	0,0010789	590,3	1,7361
150	1,937	2776,8	7,6138	0,0010910	631,9	1,8409	0,0010906	632,2	1,8403	0,0010896	633,1	1,8386
160	1,984	2796,4	7,6596	0,3838	2768,2	6,8660	0,0011022	675,4	1,9412	0,0011010	676,3	1,9394
170	2,031	2816,0	7,7043	0,3945	2791,9	6,9201	0,0011145	718,9	2,0404	0,0011133	719,7	2,0385
180	2,078	2835,6	7,7481	0,4048	2814,2	6,9697	0,1945	2777,8	6,5850	0,0011265	763,5	2,1361
190	2,125	2855,2	7,7909	0,4150	2835,7	7,0166	0,2005	2805,7	6,6459	0,0011406	807,6	2,2325
200	2,172	2874,9	7,8329	0,4250	2856,8	7,0617	0,2062	2830,8	6,6995	0,0011558	852,2	2,3278
210	2,219	2894,5	7,8741	0,4350	2877,7	7,1054	0,2117	2854,4	6,7490	0,0011722	897,3	2,4222
220	2,266	2914,3	7,9145	0,4449	2898,4	7,1479	0,2170	2877,2	6,7957	0,0011900	943,1	2,5159
230	2,312	2934,0	7,9541	0,4547	2919,1	7,1895	0,2223	2899,5	6,8404	0,08175	2824,7	6,3000
240	2,359	2593,8	7,9931	0,4644	2939,7	7,2301	0,2275	2921,5	6,8837	0,08451	2855,4	6,3604
250	2,406	2973,6	8,0313	0,4742	2960,3	7,2698	0,2326	2943,2	6,9256	0,08711	2883,7	6,4150
260	2,452	2993,5	8,0690	0,4838	2980,9	7,3088	0,2377	2964,8	6,9665	0,08961	2910,5	6,4657
270	2,499	3013,4	8,1060	0,4935	3001,5	7,3471	0,2428	2986,3	7,0065	0,09201	2936,2	6,5135
280	2,545	3033,4	8,1425	0,5031	3022,1	7,3846	0,2478	3007,7	7,0455	0,09435	2961,2	6,5591
290	2,592	3053,4	8,1783	0,5127	3042,7	7,4215	0,2528	3029,1	7,0837	0,09664	2985,6	6,6028
300	2,638	3073,5	8,2137	0,5223	3063,3	7,4577	0,2578	3050,4	7,1212	0,09889	3009,5	6,6450
310	2,685	3093,6	8,2485	0,5318	3083,9	7,4934	0,2627	3071,6	7,1580	0,1011	3033,2	6,6858
320	2,731	3113,8	8,2828	0,5414	3104,5	7,5285	0,2676	3092,8	7,1940	0,1033	3056,5	6,7255
330	2,778	3134,1	8,3166	0,5509	3125,2	7,5630	0,2725	3114,0	7,2295	0,1054	3079,6	6,7642
340	2,824	3154,3	8,3500	0,5604	3145,9	7,5971	0,2774	3135,2	7,2644	0,1076	3102,6	6,8019
350	2,870	3174,7	8,3829	0,5698	3166,6	7,6306	0,2823	3156,4	7,2987	0,1097	3125,4	6,8388
360	2,917	3195,1	8,4154	0,5793	3187,4	7,6636	0,2871	3177,7	7,3324	0,1118	3148,1	6,8749
370	2,963	3215,6	8,4474	0,5888	3208,1	7,6962	0,2920	3198,9	7,3657	0,1138	3170,6	6,9103
380	3,010	3236,1	8,4791	0,5982	3229,0	7,7284	0,2968	3220,1	7,3984	0,1159	3193,1	6,9450
390	3,056	3256,7	8,5104	0,6076	3249,9	7,7601	0,3016	3241,3	7,4307	0,1179	3215,6	6,9791
400	3,102	3277,3	8,5413	0,6170	3270,8	7,7914	0,3064	3262,6	7,4626	0,1200	3237,9	7,0125
410	3,149	3298,0	8,5718	0,6264	3291,7	7,8223	0,3112	3283,9	7,4940	0,1220	3260,3	7,0455
420	3,195	3318,8	8,6020	0,6358	3312,8	7,8528	0,3160	3305,2	7,5250	0,1240	3282,6	7,0779
430	3,241	3339,6	8,6318	0,6452	3333,8	7,8830	0,3207	3326,6	7,5555	0,1260	3304,8	7,1098
440	3,287	3360,5	8,6613	0,6546	3354,9	7,9128	0,3255	3348,0	7,5858	0,1280	3327,1	7,1412
450	3,334	3381,4	8,6905	0,6640	3376,1	7,9423	0,3302	3369,4	7,6156	0,1300	3349,3	7,1722
460	3,380	3402,5	8,7194	0,6733	3397,3	7,9715	0,3350	3390,9	7,6451	0,1320	3371,6	7,2027
470	3,426	3423,6	8,7479	0,6827	3418,6	8,0003	0,3397	3412,4	7,6742	0,1340	3393,8	7,2328
480	3,473	3444,7	8,7762	0,6920	3439,9	8,0288	0,3445	3434,0	7,7031	0,1359	3416,0	7,2626
490	3,519	3465,9	8,8042	0,7014	3461,3	8,0570	0,3492	3455,6	7,7316	0,1379	3438,3	7,2919
500	3,565	3487,2	8,8319	0,7107	3482,8	8,0849	0,3539	3477,2	7,7597	0,1398	3460,5	7,3209
510	3,611	3508,6	8,8594	0,7200	3504,3	8,1126	0,3586	3498,8	7,7876	0,1418	3482,8	7,3495
520	3,658	3530,0	8,8865	0,7294	3525,9	8,1399	0,3634	3520,7	7,8152	0,1437	3505,1	7,3778
530	3,704	3551,5	8,9135	0,7387	3547,5	8,1670	0,3681	3542,5	7,8425	0,1457	3527,5	7,4058
540	3,750	3573,0	8,9401	0,7480	3569,2	8,1939	0,3728	3564,3	7,8696	0,1476	3549,8	7,4335

Συνέχεια πίνακα VI

t °C	1,0 bar t_s = 99,63°C v	h	s	5,0 bar t_s = 151,85°C v	h	s	10,0 bar t_s = 179,88°C v	h	s	25 bar t_s = 223,94°C v	h	s
550	3,796	3594,7	8,9666	0,7573	3590,9	8,2205	0,3775	3586,3	7,8964	0,1495	3572,2	7,4608
560	3,843	3616,4	8,9928	0,7666	3612,7	8,2468	0,3822	3608,2	7,9229	0,1515	3594,6	7,4879
570	3,889	3638,1	9,0187	0,7760	3634,6	8,2729	0,3869	3630,2	7,9492	0,1534	3617,1	7,5147
580	3,935	3660,0	9,0445	0,7853	3656,6	8,2988	0,3915	3652,3	7,9752	0,1553	3639,6	7,5412
590	3,981	3681,9	9,0700	0,7946	3678,6	8,3244	0,3962	3674,5	8,0010	0,1572	3662,1	7,5675
600	4,027	3703,8	9,0953	0,8039	3700,6	8,3499	0,4009	3696,7	8,0266	0,1592	3684,7	7,5935
610	4,074	3725,9	9,1204	0,8132	3722,8	8,3751	0,4056	3718,9	8,0519	0,1611	3707,3	7,6192
620	4,120	3748,0	9,1453	0,8225	3745,0	8,4001	0,4103	3741,2	8,0770	0,1630	3730,0	7,6448
630	4,166	3770,2	9,1700	0,8317	3767,3	8,4249	0,4150	3763,6	8,1020	0,1649	3752,7	7,6700
640	4,212	3792,4	9,1945	0,8410	3789,6	8,4495	0,4196	3786,0	8,1267	0,1668	3775,4	7,6951
650	4,258	3814,7	9,2188	0,8503	3812,0	8,4738	0,4243	3808,5	8,1512	0,1687	3798,2	7,7199
660	4,305	3837,1	9,2429	0,8596	3834,5	8,4981	0,4290	3831,1	8,1755	0,1706	3821,1	7,7446
670	4,351	3859,6	9,2669	0,8689	3857,0	8,5221	0,4336	3853,7	8,1996	0,1725	3844,0	7,7690
680	4,397	3882,1	9,2907	0,8782	3879,6	8,5459	0,4383	3876,4	8,2235	0,1744	3866,9	7,7932
690	4,443	3904,7	9,3142	0,8874	3902,3	8,5696	0,4430	3899,2	8,2473	0,1763	3889,9	7,8172
700	4,489	3927,4	9,3377	0,8967	3925,0	8,5931	0,4476	3922,0	8,2708	0,1782	3913,0	7,8410
710	4,536	3950,1	9,3609	0,9060	3947,8	8,6164	0,4523	3944,9	8,2942	0,1801	3936,1	7,8646
720	4,582	3973,0	9,3840	0,9153	3970,7	8,6395	0,4570	3967,8	8,3175	0,1820	3959,3	7,8881
730	4,628	3995,8	9,4069	0,9245	3993,6	8,6625	0,4616	3990,8	8,3405	0,1839	3982,5	7,9113
740	4,674	4018,8	9,4297	0,9338	4016,6	8,6853	0,4663	4013,9	8,3634	0,1857	4005,8	7,9344
750	4,720	4041,8	9,4523	0,9431	4039,7	8,7080	0,4709	4037,0	8,3861	0,1876	4029,1	7,9574
760	4,767	4064,9	9,4747	0,9524	4062,8	8,7305	0,4756	4060,2	8,4087	0,1895	4052,5	7,9801
770	4,813	4088,1	9,4971	0,9616	4086,0	8,7528	0,4802	4083,5	8,4311	0,1914	4076,0	8,0027
780	4,859	4111,3	9,5192	0,9709	4109,3	8,7750	0,4849	4106,8	8,4534	0,1933	4099,5	8,0251
790	4,905	4134,6	9,5412	0,9802	4132,7	8,7971	0,4895	4130,2	8,4755	0,1952	4123,0	8,0474
800	4,951	4157,9	9,5631	0,9894	4156,1	8,8190	0,4942	4153,7	8,4974	0,1970	4146,7	8,0695

t °C	50 bar v	h	s	75 bar v	h	s	100 bar v	h	s	125 bar v	h	s
0	0,0009977	5,1	0,0004	0,000997	7,6	0,0006	0,0009953	10,2	0,0007	0,0009941	12,7	0,0009
10	0,0009979	46,9	0,1507	0,000997	49,3	0,1505	0,0009956	51,8	0,1502	0,0009944	54,2	0,1500
20	0,0009994	88,6	0,2953	0,000998	90,9	0,2948	0,0009972	93,2	0,2942	0,0009961	95,6	0,2936
30	0,0010021	130,1	0,4348	0,001001	132,4	0,4341	0,0009999	134,7	0,4332	0,0009988	136,9	0,4325
40	0,0010056	171,8	0,5690	0,001005	173,9	0,5689	0,0010034	176,2	0,5679	0,0010023	178,4	0,5669
50	0,0010099	213,4	0,7007	0,001009	215,5	0,6996	0,0010077	217,7	0,6984	0,0010066	219,8	0,6972
60	0,0010149	255,1	0,8278	0,001014	257,2	0,8265	0,0010127	259,3	0,8251	0,0010116	261,3	0,8238
70	0,0010206	296,8	0,9512	0,001019	298,9	0,9498	0,0010183	300,9	0,9483	0,0010172	302,9	0,9468
80	0,0010269	338,7	1,0714	0,001026	340,6	1,0698	0,0010246	342,6	1,0681	0,0010234	344,6	1,0665
90	0,0010338	380,6	1,1884	0,001033	382,5	1,1866	0,0010314	384,4	1,1848	0,0010302	386,4	1,1831
100	0,0010413	422,6	1,3025	0,001040	424,4	1,3006	0,0010387	426,3	1,2986	0,0010375	428,2	1,2967
110	0,0010494	464,7	1,4138	0,001048	466,5	1,4118	0,0010467	468,3	1,4097	0,0010454	470,1	1,4076
120	0,0010580	506,9	1,5227	0,001057	508,6	1,5205	0,0010552	510,4	1,5182	0,0010538	12,2	1,5160
130	0,0010673	549,3	1,6292	0,001066	551,0	1,6268	0,0010644	552,7	1,6244	0,0010629	554,4	1,6221
140	0,0010762	591,9	1,7335	0,001076	593,5	1,7310	0,0010741	595,2	1,7284	0,0010726	596,8	1,7259
150	0,0010879	634,7	1,8359	0,001086	636,2	1,8332	0,0010845	637,8	1,8305	0,0010829	639,4	1,8278
160	0,0010992	677,7	1,9364	0,001097	679,2	1,9335	0,0010956	680,7	1,9306	0,0010939	682,2	1,9278
170	0,0011113	721,1	2,0353	0,001109	722,4	2,0322	0,0011075	723,9	2,0291	0,0011056	725,3	2,0261
180	0,0011243	764,7	2,1328	0,001122	766,0	2,1294	0,0011202	767,3	2,1261	0,0011181	768,7	2,1229
190	0,0011383	808,8	2,2289	0,001136	809,9	2,2253	0,0011337	811,2	2,2218	0,0011315	812,4	2,2183
200	0,0011532	853,2	2,3239	0,001151	854,3	2,3200	0,0011483	855,4	2,3162	0,0011459	856,5	2,3125
210	0,0011694	898,2	2,4180	0,001167	899,1	2,4138	0,0011639	900,1	2,4097	0,0011613	901,0	2,4057
220	0,0011869	943,8	2,5113	0,001184	944,5	2,5068	0,0011808	945,3	2,5024	0,0011779	946,1	2,4980
230	0,0012059	990,0	2,6041	0,001202	990,6	2,5992	0,0011991	991,2	2,5944	0,0011959	991,8	2,5897
240	0,0012267	1037,1	2,6967	0,001223	1037,4	2,6913	0,0012190	1037,7	2,6861	0,0012154	1038,1	2,6809

Συνέχεια πίνακα VI

t °C	50 bar v	h	s	75 bar v	h	s	100 bar v	h	s	125 bar v	h	s
250	0,0012496	1085,1	2,7893	0,001245	1085,1	2,7834	0,0012409	1085,2	2,7776	0,0012367	1085,3	2,7720
260	0,0012751	1134,2	2,8824	0,001270	1133,9	2,8758	0,0012649	1133,6	2,8693	0,0012602	1133,4	2,8631
270	0,04051	2820,4	6,0212	0,001298	1183,9	2,9687	0,0012917	1183,2	2,9615	0,0012862	1182,7	2,9545
280	0,04225	2859,0	6,0917	0,001329	1235,6	3,0628	0,0013220	1234,3	3,0547	0,0013153	1233,2	3,0468
290	0,04385	2894,2	6,1548	0,001365	1289,2	3,1589	0,0013566	1287,2	3,1495	0,0013484	1285,5	3,1404
300	0,04536	2926,9	6,2123	0,02667	2812,1	5,8600	0,0013971	1342,5	3,2469	0,0013868	1339,9	3,2361
310	0,04678	2957,7	6,2655	0,02802	2857,1	5,9378	0,0014461	1401,1	3,3482	0,0014325	1397,1	3,3351
320	0,04815	2987,0	6,3154	0,02925	2897,8	6,0070	0,01922	2779,4	5,7070	0,0014890	1458,4	3,4393
330	0,04946	3015,2	6,3625	0,03039	2935,2	6,0696	0,02039	2832,2	5,7952	0,01383	2692,1	5,4973
340	0,05073	3042,5	6,4075	0,03147	2970,1	6,1374	0,02146	2879,4	5,8728	0,01508	2764,8	5,6122
350	0,05197	3069,1	6,4505	0,03247	3003,0	6,1802	0,02243	2922,3	5,9423	0,01611	2822,5	5,7056
360	0,05317	3095,2	6,4919	0,03344	3034,3	6,2302	0,02333	2961,9	6,0053	0,01703	2874,0	5,7876
370	0,05436	3120,7	6,5320	0,03437	3064,5	6,2773	0,02418	2998,7	6,0631	0,01787	2920,7	5,8608
380	0,05552	3145,9	6,5708	0,03526	3093,5	6,3221	0,02498	3033,5	6,1167	0,01865	2963,5	5,9269
390	0,05666	3170,7	6,6085	0,03613	3121,7	6,3650	0,02574	3066,5	6,1669	0,01937	3003,2	5,9873
400	0,05779	3195,3	6,6453	0,03698	3149,3	6,4062	0,02647	3098,2	6,2143	0,02000	3040,5	6,0431
410	0,05890	3219,6	6,6812	0,03781	3176,2	6,4459	0,02717	3128,7	6,2593	0,02070	3075,8	6,0951
420	0,06000	3243,7	6,7163	0,03862	3202,7	6,4844	0,02785	3158,3	6,3023	0,02132	3109,4	6,1440
430	0,06109	3267,7	6,7506	0,03941	3228,8	6,5218	0,02851	3187,1	6,3435	0,02191	3141,7	6,1902
440	0,06217	329,15	6,7842	0,04020	3224,5	6,5581	0,02915	3215,2	6,3832	0,02248	3172,9	6,2342
450	0,06324	3315,3	6,8173	0,04096	3280,0	6,5936	0,02978	3242,8	6,4216	0,02304	3203,1	6,2763
460	0,06430	3338,9	6,8497	0,04173	3305,2	6,6278	0,03040	3269,9	6,4588	0,02358	3232,5	6,3167
470	0,06536	3362,4	6,8815	0,04248	3330,1	6,6620	0,03101	3296,6	6,4950	0,02410	3261,3	6,3557
480	0,06641	3385,8	6,9129	0,04323	3355,0	6,6951	0,03161	3323,0	6,5303	0,02462	3289,6	6,3935
490	0,06745	3409,2	6,9437	0,04396	3379,6	6,7276	0,03219	3349,0	6,5647	0,02512	3317,3	6,4301
500	0,06848	3432,5	6,9741	0,04470	3404,1	6,7595	0,03278	3374,8	6,5983	0,02562	3344,6	6,4657
510	0,06951	3455,8	7,0040	0,04542	3428,3	6,7808	0,03335	3400,4	6,6312	0,02610	3371,6	6,5003
520	0,07053	3479,1	7,0335	0,04614	3452,8	6,8266	0,03392	3425,9	6,6634	0,02658	3398,3	6,5342
530	0,07155	3502,3	7,0627	0,04685	3477,0	6,8520	0,03448	3451,1	6,6950	0,02706	3424,7	6,5672
540	0,07257	3525,5	7,0914	0,04756	3501,1	6,8819	0,03504	3476,2	6,7261	0,02752	3450,8	6,5996
550	0,07358	3548,8	7,1197	0,04826	3525,2	6,9112	0,03559	3501,2	6,7566	0,02798	3476,8	6,6314
560	0,07458	3571,9	7,1478	0,04896	3549,1	6,9402	0,03614	3526,0	6,7866	0,02844	3502,6	6,6625
570	0,07559	3595,1	7,1754	0,04962	3553,0	6,9688	0,03668	3550,8	6,8162	0,02889	3528,2	6,6931
580	0,07658	3618,3	7,2028	0,05035	3597,0	6,9970	0,03722	3575,5	6,8453	0,02934	3553,7	6,7231
590	0,07758	3641,5	7,2298	0,05104	3620,9	7,0298	0,03775	3600,1	6,8739	0,02979	3579,1	6,7527
600	0,07857	3664,7	7,2565	0,05173	3644,6	7,0523	0,03829	3624,6	6,9022	0,03023	3604,3	6,7818
610	0,07956	3688,0	7,2830	0,05241	3668,6	7,0800	0,03882	3649,1	6,9301	0,03067	3629,5	6,8104
620	0,08055	3711,2	7,3092	0,05309	3692,5	7,1063	0,03934	3673,5	6,9576	0,03110	3654,6	6,8387
630	0,08154	3734,5	7,3351	0,05377	3716,3	7,1328	0,03987	3697,9	6,9848	0,03153	3679,6	6,8665
640	0,08252	3757,7	7,3607	0,05444	3740,1	7,1591	0,04039	3722,3	7,0116	0,03196	3704,5	6,8940
650	0,08350	3781,1	7,3861	0,05511	3763,9	7,1850	0,04091	3746,7	7,0382	0,03239	3729,4	6,9211
660	0,08448	3804,4	7,4112	0,05578	3787,7	7,2107	0,04142	3771,0	7,0644	0,03281	3754,3	6,9478
670	0,08545	3827,8	7,4361	0,05645	3811,5	7,2361	0,04194	3795,3	7,0903	0,03324	3779,1	6,9743
680	0,08643	3851,2	7,4608	0,05712	3835,4	7,2612	0,04245	3819,6	7,1159	0,03366	3803,8	7,0004
690	0,08740	3874,6	7,4853	0,05778	3859,3	7,2862	0,04296	3843,9	7,1413	0,03408	3828,6	7,0262
700	0,08837	3898,0	7,5095	0,05844	3883,1	7,3108	0,04347	3868,2	7,1664	0,03449	3853,3	7,0518
710	0,08934	3921,5	7,5335	0,05911	3907,0	7,3352	0,04398	3892,5	7,1912	0,03491	3878,0	7,0770
720	0,09030	3945,1	7,5573	0,05977	3931,0	7,3594	0,04448	3916,8	7,2158	0,03532	3902,7	7,1020
730	0,09127	3968,7	7,5810	0,06043	3954,8	7,3835	0,04499	3941,1	7,2402	0,03573	3927,4	7,1267
740	0,09223	3992,3	7,6044	0,06108	3978,9	7,4072	0,04549	3965,4	7,2643	0,03614	3952,1	7,1512
750	0,09320	4016,0	7,6276	0,06173	4002,9	7,4307	0,04599	3989,8	7,2882	0,03655	3976,7	7,1755
760	0,09416	4039,7	7,6507	0,06239	4026,9	7,4542	0,04649	4014,1	7,3119	0,03696	4001,4	7,1995
770	0,09512	4063,4	7,6736	0,06305	4056,9	7,4773	0,04699	4038,5	7,3354	0,03737	4026,1	7,2233
780	0,09608	4087,2	7,6963	0,06370	4075,0	7,5003	0,04749	4062,9	7,3586	0,03777	4050,8	7,2468
790	0,09704	4111,1	7,7188	0,06435	4099,0	7,5231	0,04798	4087,3	7,3817	0,03817	4075,5	7,2702
800	0,09799	4135,0	7,7412	0,06499	4123,9	7,5457	0,04848	4111,7	7,4046	0,03858	4100,2	7,2933

Συνέχεια πίνακα VI

t	150 bar			200 bar			250 bar			300 bar		
°C	v	h	s	v	h	s	v	h	s	v	h	s
0	0,0009928	15,2	0,0010	0,0009904	20,2	0,0011	0,0009880	25,2	0,0112	0,0009857	30,1	0,0011
10	0,0009933	56,6	0,1497	0,0009910	61,4	0,1491	0,0009888	66,1	0,1484	0,0009866	70,9	0,1477
20	0,0009950	97,9	0,2951	0,0009928	102,5	0,2919	0,0009907	107,1	0,2907	0,0009886	111,7	0,2895
30	0,0009977	139,2	0,4317	0,0009956	143,7	0,4301	0,0009935	148,2	0,4285	0,0009915	152,7	0,4268
40	0,0010013	180,6	0,5659	0,0009992	184,9	0,5639	0,0009971	189,3	0,5619	0,0009951	193,7	0,5600
50	0,0010056	222,0	0,6951	0,0010035	226,2	0,6937	0,0010014	230,5	0,6914	0,0009994	234,8	0,6891
60	0,0010105	263,4	0,8225	0,0010084	267,6	0,8198	0,0010063	271,8	0,8172	0,0010042	275,9	0,8146
70	0,0010161	305,0	0,9453	0,0010139	309,1	0,9424	0,0010118	313,1	0,9395	0,0010097	317,2	0,9366
80	0,0010223	346,6	1,0649	0,0010200	350,6	1,0617	0,0010178	354,5	1,0585	0,0010156	358,5	1,0554
90	0,0010290	388,3	1,1813	0,0010266	392,6	1,1778	0,0010244	396,1	1,1744	0,0010221	399,9	1,1710
100	0,0010363	430,1	1,2948	0,0010338	433,9	1,2911	0,0010315	437,6	1,2874	0,0010291	441,4	1,2837
110	0,0010441	472,0	1,4056	0,0010416	475,6	1,4016	0,0010391	479,3	1,3976	0,0010367	483,0	1,3937
120	0,0010525	514,0	1,5139	0,0010498	517,6	1,5096	0,0010472	521,1	1,5053	0,0010447	524,7	1,5011
130	0,0010615	556,2	1,6198	0,0010587	559,6	1,6152	0,0010559	563,1	1,6106	0,0010533	566,5	1,6062
140	0,0010711	598,5	1,7235	0,0010681	601,8	1,7185	0,0010652	605,1	1,7137	0,0010624	608,5	1,7090
150	0,0010813	641,0	1,8251	0,0010781	644,2	1,8199	0,0010751	647,4	1,8148	0,0010721	650,6	1,8097
160	0,0010922	683,7	1,9250	0,0010888	686,8	1,9194	0,0010855	689,8	1,9139	0,0010824	692,9	1,9086
170	0,0011038	726,7	2,0231	0,0011002	729,6	2,0171	0,0010967	732,5	2,0113	0,0010933	735,5	2,0056
180	0,0011162	770,0	2,1196	0,0011123	772,7	2,1133	0,0011085	775,4	2,1071	0,0011049	778,2	2,1011
190	0,0011294	813,6	2,2148	0,0011252	816,1	2,2081	0,0011212	818,7	2,2015	0,0011173	821,3	2,1950
200	0,0011436	857,6	2,3088	0,0011390	859,9	2,3016	0,0011346	862,2	2,2945	0,0011304	864,6	2,2877
210	0,0011587	902,0	2,4017	0,0011538	904,0	2,3939	0,0011490	906,2	2,3864	0,0011444	908,4	2,3791
220	0,0011751	946,9	2,4937	0,0011696	948,7	2,4854	0,0011644	950,5	2,4773	0,0011594	952,5	2,4694
230	0,0011927	992,4	2,5851	0,0011867	993,8	2,5760	0,0011809	995,4	2,5673	0,0011754	997,0	2,5589
240	0,0012119	1038,6	2,6759	0,0012051	1039,6	2,6661	0,0011987	1040,8	2,6567	0,0011926	1042,1	2,6476
250	0,0012327	1085,5	2,7664	0,0012251	1086,1	2,7558	0,0012179	1086,9	2,7456	0,0012111	1087,8	2,7358
260	0,0012556	1133,3	2,8570	0,0012469	1133,4	2,8453	0,0012388	1133,6	2,8342	0,0012312	1134,1	2,8235
270	0,0012808	1182,2	2,9478	0,0012708	1181,6	2,9349	0,0012615	1181,2	2,9226	0,0012529	1181,2	2,9110
280	0,0013090	1232,3	3,0392	0,0012972	1230,8	3,0248	0,0012865	1229,3	3,0113	0,0012766	1229,2	2,9985
290	0,0013408	1284,0	3,1318	0,0013268	1281,5	3,1155	0,0013142	1279,5	3,1003	0,0013027	1278,1	3,0862
300	0,0013773	1337,5	3,2620	0,0013602	1333,6	3,2073	0,0013451	1330,6	3,1902	0,0013316	1328,2	3,1744
310	0,0014202	1393,6	3,3230	0,0013987	1387,8	3,3010	0,0013802	1383,3	3,2813	0,0013639	1379,7	3,2634
320	0,0014722	1453,1	3,4241	0,0014438	1444,5	3,3974	0,0014205	1438,0	3,3743	0,0014006	1432,8	3,3537
330	0,0015385	1517,6	3,5321	0,0014986	1504,7	3,4981	0,0014678	1495,2	3,4700	0,0014427	1487,9	3,4459
340	0,0016319	1591,2	3,6531	0,0015683	1570,0	3,6054	0,0015251	1555,9	3,5699	0,0014921	1545,6	3,5407
350	0,01159	2690,4	5,4396	0,0016651	1643,9	3,7248	0,0015973	1621,5	3,6759	0,0015514	1606,6	3,6394
360	0,01257	2766,2	5,5632	0,001835	1739,2	3,8769	0,001685	1695,7	3,7932	0,00162	1672,2	3,7440
370	0,01348	2827,7	5,6557	0,00688	2515,4	5,0891	0,001830	1786,1	3,9356	0,00171	1746,3	3,8602
380	0,01428	2881,4	5,7386	0,00832	2659,5	5,3120	0,00226	1941,4	4,1721	0,00186	1833,4	3,9953
390	0,01501	2930,1	5,8126	0,00923	2747,4	5,4533	0,00455	2394,0	4,8619	0,00211	1953,1	4,1784
400	0,01568	2974,8	5,8795	0,00995	2815,0	5,5488	0,00597	2578,7	5,1393	0,00277	2150,8	4,4778
410	0,01631	3016,3	5,9407	0,01060	2874,0	5,6357	0,00688	2686,3	5,2973	0,00392	2379,8	4,8232
420	0,01690	3055,2	5,9972	0,01120	2927,4	5,7134	0,00758	2769,1	5,4178	0,00489	2543,1	5,0556
430	0,01746	3091,2	6,0498	0,01174	2976,4	5,7835	0,00816	2837,4	5,5159	0,00561	2661,1	5,2199
440	0,01799	3126,9	6,0992	0,01226	3021,7	5,8475	0,00868	2896,9	5,6000	0,00619	2749,1	5,3455
450	0,01850	3160,4	6,1459	0,01273	3064,0	5,9064	0,00916	2951,2	5,6756	0,00671	2822,3	5,4429
460	0,01900	3192,7	6,1902	0,01319	3103,8	5,9611	0,00961	3001,3	5,7443	0,00716	2885,0	5,5291
470	0,01947	3224,0	6,2326	0,01362	3141,6	6,0123	0,01002	3047,7	5,8073	0,00758	2942,2	5,6066
480	0,01994	3254,4	6,2733	0,01403	3177,7	6,0606	0,01042	3091,3	5,8655	0,00796	2995,0	5,6772
490	0,02039	3284,1	6,3125	0,01442	3212,3	6,1063	0,01079	3132,4	5,9198	0,00832	3044,0	5,7419
500	0,02083	3313,2	6,3504	0,01480	3245,8	6,1498	0,01114	3171,5	5,9706	0,00867	3089,9	5,8016
510	0,02126	3341,7	6,3871	0,01517	3278,2	6,1915	0,01148	3208,8	6,0186	0,00899	3133,2	5,8573
520	0,02168	3369,8	6,4227	0,01553	3309,7	6,2315	0,01180	3244,7	6,0641	0,00930	3174,3	5,9094
530	0,02210	3397,5	6,4574	0,01588	3340,5	6,2701	0,01212	3279,3	6,1075	0,00959	3213,5	5,9585
540	0,02251	3424,9	6,4913	0,01622	3370,7	6,3074	0,01242	3312,9	6,1490	0,00987	3251,2	6,0051

Συνέχεια πίνακα VI

t	150 bar			200 bar			250 bar			300 bar		
°C	v	h	s	v	h	s	v	h	s	v	h	s
550	0,02291	3451,9	6,5243	0,01655	3400,3	6,3435	0,01272	3345,5	6,1889	0,01015	3287,4	6,0494
560	0,02331	3478,7	6,5567	0,01688	[illegible]	6,3786	0,01301	3377,4	6,2274	0,01041	3322,5	6,0918
570	0,02370	3505,3	6,5884	0,01720	3458,0	6,4129	0,01329	3408,5	6,2646	0,01067	3356,6	6,1324
580	0,02409	3531,6	6,6194	0,01752	3486,3	6,4462	0,0135[illegible]	3439,1	6,3007	0,01092	3389,8	6,1716
590	0,02448	3557,8	6,6499	0,01783	3514,3	6,4788	0,01383	3469,2	6,3357	0,01116	3422,6	6,2093
600	0,02486	3583,8	6,6799	0,01814	3542,0	6,5107	0,01410	3498,7	6,3698	0,01140	3453,9	6,2459
610	0,02523	36 9,7	6,7093	0,01844	3569,4	6,5419	0,01436	3527,9	6,4030	0,01163	3485,1	6,2814
620	0,02561	3635,4	6,7383	0,01874	3596,6	6,5726	0,01461	3556,8	6,43 5	0,01186	3515,7	6,3159
630	0,02598	3661,1	6,7669	0,01903	3623,6	6,6026	0,01486	3585,3	6,4672	0,01208	3545,9	6,3495
640	0,02635	3686,6	6,7950	0,01933	3650,4	6,6321	0,01511	3613,5	6,4983	0,01230	3575,7	6,3823
650	0,02671	3712,1	6,8227	0,01962	3677,1	6,6612	0,01536	3641,5	6,5287	0,01252	3605,1	6,4143
660	0,02708	3737,5	6,8501	0,01991	3703,6	6,6897	0,01560	3669,2	6,5586	0,01273	3634,2	6,4457
670	0,02744	3762,8	6,8771	0,02019	3730,0	6,7179	001584	3696,7	6,5880	0,01294	3663,0	6,4764
680	0,02780	3788,0	6,9037	0,02047	3756,2	6,7456	0,01608	3724,1	6,6168	0,01315	3691,5	6,5065
690	0,02815	3813,2	6,9300	0,02075	3782,4	6,7729	0,01632	3751,3	6,6452	0,01336	3719,8	6,5360
700	0,02851	3938,4	6,9560	0,02103	3808,5	6,7998	0,01655	3778,3	7,6731	0,01356	3747,9	6,5650
710	0,02886	3863,5	6,9817	0,02131	3834,4	6,8264	0,01678	3805,2	6,7007	0,01376	3775,8	6,5935
720	0,02922	3888,6	7,0071	0,02159	3860,4	6,8526	0,01701	3832,0	6,7278	0,01396	3803,5	6,6216
730	0,02957	3913,7	7,0322	0,02186	3886,2	6,8785	0,01724	3858,7	6,7545	0,01416	3831,1	6,6492
740	0,02991	3938,7	7,0570	0,02213	3912,0	6,9041	0,01746	3885,3	6,7809	0,01435	3858,5	6,6764
750	0,03026	3963,7	7,0816	0,02240	3937,8	6,9294	0,01769	3911,8	6,8069	0,01455	3885,8	6,7032
760	0,03061	3988,7	7,1059	0,02267	3963,5	6,9544	0,01791	3938,2	6,8326	0,01474	3913,0	6,7296
770	0,03095	4013,7	7,1300	0,02294	3989,1	6,9791	0,01813	3964,6	6,8580	0,01493	3940,0	6,7557
780	0,03130	4038,7	7,1539	0,02320	4014,7	7,0035	0,01835	3990,9	6,8831	0,01512	3967,0	6,7814
790	0,03164	4063,7	7,1775	0,02347	4040,4	7,0277	0,01857	4017,1	6,9078	0,01531	3993,9	6,8068
800	0,03198	4088,7	7,2009	0,02373	4065,9	7,0517	0,01879	4043,3	6,9324	0,01549	4020,7	6,8319

t	350 bar			400 bar			450 bar			500 bar		
°C	v	h	s	v	h	s	v	h	s	v	h	s
0	0,0009834	35,0	0,0010	0,0009811	39,8	0,0007	0,0009788	44,6	0,0004	0,0009765	49,4	0,0000
10	0,0009844	75,6	0,1469	0,0009823	80,2	0,1461	0,0009801	84,9	0,1452	0,0009780	89,5	0,1442
20	0,0009865	116,3	0,2883	0,0009845	120,8	0,2870	0,0009824	125,4	0,2856	0,0009804	129,9	0,2843
30	0,0009894	157,1	0,4252	0,0009875	161,5	0,4235	0,0009855	166,0	0,4219	0,0009836	170,4	0,4202
40	0,0009931	198,0	0,5580	0,0009911	202,4	0,5560	0,0009892	206,7	0,5540	0,0009873	211,0	0,5520
50	0,0009974	239,0	0,6869	0,0009954	243,3	0,6846	0,0009934	247,5	0,6823	0,0009915	251,7	0,6800
60	0,0010022	280,1	0,8121	0,0010002	284,3	0,8095	0,0009982	288,4	0,8070	0,0009963	292,6	0,8044
70	0,0010076	231,3	0,9338	0,0010056	325,3	0,9310	0,0010036	329,4	0,9282	0,0010016	333,5	0,9254
80	0,0010135	362,5	1,0523	0,0010114	366,5	1,0492	0,0010094	370,5	1,0461	0,0010074	374,4	1,0431
90	0,0010199	403,8	1,1676	0,0010178	407,7	1,1643	0,0010157	411,6	1,1610	0,0010136	415,5	1,1578
100	0,0010269	445,2	1,2801	0,0010246	449,0	1,2765	0,0010224	452,8	1,2730	0,0010203	456,6	1,2695
110	0,0010343	486,7	1,3898	0,0010320	490,4	1,3860	0,0010297	494,1	1,3822	0,0010275	497,8	1,3785
120	0,0010422	528,3	1,4970	0,0010398	531,9	1,4929	0,0010374	535,5	1,4889	0,0010351	539,2	1,4850
130	0,0010507	570,0	1,6018	0,0010481	573,5	1,5975	0,0010456	577,0	1,5932	0,0010432	580,6	1,5890
140	0,0010596	611,9	1,7043	0,0010570	615,3	1,6997	0,0010544	618,7	1,6952	0,0010518	622,1	1,6908
150	0,0010692	653,9	1,8048	0,0010664	657,2	1,7999	0,0010636	660,5	1,7951	0,0010609	663,8	1,7904
160	0,0010793	696,1	1,9033	0,0010763	699,2	1,8982	0,0010734	702,4	1,8931	0,0010706	705,6	1,8881
170	0,0010900	738,5	2,0101	0,0010868	741,5	1,9946	0,0010838	744,5	1,9892	0,0010807	747,6	1,9839
180	0,0011014	781,1	2,0952	0,0010980	783,9	2,0893	0,0010947	786,8	2,0836	0,0010915	789,8	2,0781
190	0,0011135	823,9	2,1887	0,0011099	826,6	2,1826	0,0011063	829,4	2,1765	0,0011029	832,2	2,1706
200	0,0011264	[illegible]	2,2809	0,0011224	869,6	2,2744	0,0011187	872,2	2,2680	0,0011150	874,8	2,2617
210	0,0011400	[illegible]	2,3719	0,0011358	912,9	2,3650	0,0011317	915,3	2,3582	0,0011278	917,8	2,3515
220	0,0011546	[illegible]	2,4618	0,0011500	956,6	2,4544	0,0011456	958,8	2,4471	0,0011413	961,0	2,4401
230	0,0011702	998,8	2,5507	0,0011652	1000,6	2,5428	0,0011603	1002,6	2,5351	0,0011557	1004,6	2,5276
240	0,0011868	1043,6	2,6389	0,0011813	1045,1	2,6304	0,0011761	1046,8	2,6221	0,0011710	1048,6	2,6141

Συνέχεια πίνακα VI

t	350 bar			400 bar			450 bar			500 bar		
°C	v	h	s	v	h	s	v	h	s	v	h	s
250	0,0012047	1088,9	2,7263	0,0011987	1090,1	2,7172	0,0011929	1091,5	2,7084	0,0011873	1093,0	2,6999
260	0,0012240	1134,8	2,8133	0,0012172	1135,7	2,8035	0,0012108	1136,7	2,7940	0,0012047	1137,9	2,7849
270	0,0012448	1181,4	2,8999	0,0012373	1181,9	2,8893	0,0012301	1182,5	2,8791	0,0012234	1183,3	2,8693
280	0,0012675	1228,8	2,9864	0,0012589	1228,8	2,9749	0,0012509	1228,9	2,9638	0,0012434	1229,3	2,9533
290	0,0012922	1277,1	3,0729	0,0012824	1276,5	3,0603	0,0012734	1276,1	3,0483	0,0012649	1276,0	3,0369
300	0,0013194	1326,4	3,1596	0,0013082	1325,0	3,1458	0,0012978	1324,0	3,1327	0,0012883	1323,4	3,1202
310	0,0013495	1376,8	3,2469	0,0013364	1374,6	3,2315	0,0013245	1372,8	3,2171	0,0013136	1371,5	3,2035
320	0,0013832	1428,7	3,3350	0,0013678	1425,3	3,3178	0,0013539	1422,7	3,3018	0,0013414	1420,5	3,2868
330	0,0014214	1482,1	3,4244	0,0014029	1477,4	3,4049	0,0013866	1473,6	3,3870	0,0013719	1470,5	3,3704
340	0,0014653	1537,6	3,5155	0,0014427	1531,1	3,4932	0,0014231	1525,9	3,4729	0,0014059	1521,5	3,4543
350	0,0015165	1595,5	3,6092	0,0014882	1586,7	3,5831	0,0014645	1579,6	3,5599	0,0014439	1573,8	3,5388
360	0,001570	1656,7	3,7053	0,001540	1644,9	3,6760	0,001510	1636,2	3,6488	0,001490	1627,8	3,6247
370	0,00165	1722,9	3,8089	0,00160	1706,5	3,7723	0,00157	1694,8	3,7409	0,00154	1684,3	3,7158
380	0,00175	1804,9	3,9241	0,00168	1773,1	3,8759	0,00163	1757,2	3,8382	0,00160	1743,4	3,8058
390	0,00189	1882,4	4,0528	0,00178	1845,9	3,9869	0,00170	1822,9	3,9387	0,00166	1804,5	3,9000
400	0,00212	1987,9	4,1920	0,00191	1928,0	4,1114	0,00180	1895,4	4,0465	0,00174	1870,2	3,9973
410	0,00257	2120,2	4,4087	0,00209	2021,4	4,2486	0,00192	1973,7	4,1617	0,00183	1940,6	4,1041
420	0,00323	2322,8	4,6431	0,00237	2131,1	4,4077	0,00207	2060,3	4,2904	0,00194	2017,2	4,2140
430	0,00373	2442,6	4,8755	0,00274	2259,2	4,5940	0,00228	2157,5	4,4296	0,00208	2098,4	4,3312
440	0,00437	2569,4	5,0545	0,00322	2388,2	4,7771	0,00255	2263,4	4,5803	0,00226	2186,3	4,4548
450	0,00495	2670,8	4,1948	0,00372	2504,5	4,9404	0,00288	2372,2	4,7321	0,00248	2280,5	4,5866
460	0,00540	2754,9	5,3109	0,00419	2610,5	5,0849	0,00324	2479,0	4,8787	0,00272	2377,7	4,7206
470	0,00582	2827,3	5,4072	0,00462	2701,3	5,2084	0,00361	2578,7	5,0126	0,00300	2474,4	4,8493
480	0,00620	2890,5	5,4918	0,00489	2780,0	5,2621	0,00396	2663,6	5,1309	0,00330	2563,6	4,9718
490	0,00655	2948,6	5,5683	0,00525	2849,2	5,3997	0,00429	2748,6	5,2385	0,00360	2651,5	5,0857
500	0,00689	3002,3	5,6382	0,00557	2911,0	5,4801	0,00459	2819,4	5,3298	0,00386	2731,1	5,1895
510	0,00720	3052,3	5,7026	0,00587	2968,1	5,5536	0,00488	2884,3	5,4124	0,00415	2802,6	5,2817
520	0,00749	3099,3	5,7622	0,00615	3021,3	5,6210	0,00514	2943,3	5,4872	0,00438	2867,9	5,3654
530	0,00778	3143,7	5,8178	0,00642	3071,2	5,6835	0,00539	2998,3	5,556	0,00462	2928,9	5,4428
540	0,00804	3185,9	5,8701	0,00668	3118,2	5,7417	0,00563	3050,0	5,6202	0,00484	2984,4	5,5115
550	0,00830	3226,2	5,9193	0,00692	3162,8	5,7963	0,00586	3098,8	5,6798	0,00505	3036,7	5,5756
560	0,00855	3264,9	5,9661	0,00716	3205,4	5,8476	0,00608	3145,1	5,7357	0,00525	3086,2	5,6311
570	0,00879	3302,3	6,0106	0,00738	3246,1	5,8963	0,00630	3189,3	5,7884	0,00545	3133,4	5,6874
580	0,00902	3338,4	6,0532	0,00760	3285,3	5,9425	0,00650	3231,6	5,8383	0,00564	3178,5	5,7406
590	0,00925	3373,4	6,0940	0,00781	3323,2	5,9866	0,00670	3272,3	5,8857	0,00583	3221,7	5,7910
600	0,00947	3407,6	6,1334	0,00802	3359,9	6,0289	0,00689	3311,5	5,9309	0,00601	3263,4	5,8390
610	0,00968	3440,9	6,1713	0,00822	3395,6	6,0695	0,00708	3349,6	5,9742	0,00618	3303,7	5,8848
620	0,00989	3473,6	6,2081	0,00841	3430,3	6,1087	0,00726	3386,5	6,0158	0,00636	3342,7	5,9287
630	0,01009	3505,6	6,2437	0,00860	3464,3	6,1465	0,00744	3422,5	6,0559	0,00652	3380,6	5,9709
640	0,01029	3537,0	6,2784	0,00879	3497,6	6,1831	0,00762	3457,6	6,0946	0,00668	3417,5	6,0116
650	0,01049	3568,0	6,3121	0,00897	3530,2	6,2187	0,00778	3491,9	6,1320	0,00684	3453,5	6,0508
660	0,01068	3598,6	6,3450	0,00914	3562,3	6,2532	0,00795	3525,6	6,1682	0,00700	3488,8	6,0888
670	0,01087	3628,7	6,3772	0,00932	3593,9	6,2869	0,00811	3558,7	6,2035	0,00715	3523,3	6,1256
680	0,01106	3658,5	6,4086	0,00949	3625,0	6,3197	0,00827	3581,2	6,2378	0,00730	3557,2	6,1614
690	0,01124	3688,0	6,4394	0,00966	3655,7	6,3518	0,00843	3623,2	6,2712	0,00745	3590,5	6,1962
700	0,01143	3717,2	6,4695	0,00983	3686,1	6,3832	0,00858	3654,8	6,3038	0,00759	3623,3	6,2300
710	0,01161	3746,1	6,4991	0,00999	3716,1	6,4139	0,00873	3686,0	6,3357	0,00773	3655,7	6,2631
720	0,01178	3774,8	6,5281	0,01015	3745,9	6,4440	0,00888	3716,8	6,3669	0,00787	3687,6	6,2954
730	0,01196	3803,3	6,5567	0,01031	3775,4	6,4735	0,00903	3747,3	6,3974	0,00801	3719,1	6,3270
740	0,01213	3831,6	6,5848	0,01047	3804,6	6,5025	0,00918	3777,4	6,4274	0,00814	3750,2	6,3579
750	0,01231	3859,7	6,6124	0,01063	3833,6	6,5310	0,00932	3807,3	6,4567	0,00828	3781,1	6,3882
760	0,01248	3887,7	6,6396	0,01078	3862,4	6,5590	0,00946	3837,0	6,4856	0,00841	3811,6	6,4179
770	0,01264	3915,5	6,6664	0,01093	3891,0	6,5865	0,00960	3866,4	6,5139	0,00854	3841,9	6,4470
780	0,01281	3943,2	6,6928	0,01108	3919,4	6,6137	0,00974	3895,6	6,5418	0,00867	3871,9	6,4756
790	0,01298	3970,8	6,7189	0,01123	3947,7	6,6404	0,00988	3924,7	6,5692	0,00879	3901,7	6,5038
800	0,01314	3998,2	6,7446	0,01138	3975,8	6,6667	0,01001	3953,5	6,5962	0,00892	3931,2	6,5315

Πίνακας VII Μοριακή μάζα, σταθερά R, πυκνότητα και ειδική θερμοχωρητικότητα αερίων.

Αέριο	Χημ. συμβ.	Ατομ. αρ.	Μορ. μάζα* M ≅	Σταθερά R J/(kg K)	Σταθερά R mkp/(kg grd)	Πυκνότητα 0° 760 Torr kg/m³	Ειδική θερμοχωρητικότητα kcal/kg grd c_p	Ειδική θερμοχωρητικότητα kcal/kg grd c_v	$k = \frac{c_p}{c_v}$
Ήλιο	H_e	1	4	2078,0	211,9	0,1785	1,251	0,755	1,66
Αργό	Ar	1	40	208,2	21,23	1,7834	0,125	0,076	1,66
Υδρογόνο	H_2	2	2	4124,0	420,55	0,08987	3,403	2,417	1,409
Άζωτο	N_2	2	28	296,8	30,26	1,2505	0,2482	0,1774	1,400
Οξυγόνο	O_2	2	32	259,8	26,49	1,4289	0,2184	0,1562	1,399
Αέρας	-	-	29	287,0	29,27	1,2928	0,240	0,171	1,402
Μονοξείδιο του άνθρακα	CO	2	28	296,8	30,27	1,2500	0,2486	0,1775	1,400
Διοξείδιο του άνθρακα	CO_2	3	44	188,9	19,27	1,9768	0,1957	0,1505	1,301
Διοξείδιο του θείου	SO_2	3	64	129,8	13,24	2,9265	0,1453	0,1143	1,272
Αμμωνία	NH_3	4	17	488,3	49,78	0,7713	0,491	0,374	1,313
Ασετυλίνη	C_2H_2	4	26	319,6	32,59	1,1709	0,3613	0,2904	1,255
Μεθάνιο	CH_4	5	16	518,8	52,89	0,7168	0,515	0,390	1,319

* Κατά προσέγγιση για την πράξη.

Πίνακας VIII Μέση ειδική θερμοχωρητικότητα υπό σταθερή πίεση σε kJ/kg K*

t °C	Αέρας	N_2	O_2	CO	H_2O	CO_2	SO_2
0	1,0033	1,0357	0,9118	1,0397	1,8584	0,8165	0,6083
25	1,0036	1,0387	0,9164	1,0399	1,8608	0,8299	0,6153
50	1,0042	1,0389	0,9182	1,0403	1,8640	0,8429	0,6224
100	1,0059	1,0396	0,9230	1,0416	1,8718	0,8677	0,6365
150	1,0081	1,0408	0,9288	1,0435	1,881	0,8907	0,6503
200	1,0111	1,0426	0,9354	1,0462	1,8924	0,9122	0,6634
250	1,0145	1,0450	0,9425	1,0496	1,9046	0,9321	0,6700
300	1,0185	1,0480	0,9499	1,0537	1,917	0,9509	0,6878
350	1,0229	1,0516	0,9574	1,0583	1,9316	0,9685	0,6988
400	1,0278	1,0556	0,9649	1,0634	1,9460	0,9850	0,7090
450	1,0328	1,0601	0,9721	1,0688	1,9608	1,0005	0,7186
500	1,0380	1,0648	0,9792	1,0745	1,9760	1,0152	0,7274
550	1,0434	1,0698	0,9860	1,0803	1,9915	1,0291	0,7357
600	1,0488	1,0750	0,9925	1,0862	2,0074	1,0422	0,7434
650	1,0542	1,0802	0,9987	1,0921	2,0236	1,0546	0,7505
700	1,0595	1,0855	1,0047	1,0979	2,0400	1,0663	0,7572
750	1,0648	1,0907	1,0103	1,1036	2,0566	1,0775	0,7634
800	1,0700	1,0960	1,0157	1,1092	2,0733	1,0880	0,7692
850	1,0751	1,1011	1,0209	1,1148	2,0901	1,0981	0,7747
900	1,0800	1,1062	1,0258	1,1201	2,1070	1,1076	0,7798
950	1,0848	1,1112	1,0305	1,1254	2,1239	1,1167	0,7846
1000	1,0895	1,1160	1,0350	1,1304	2,1408	1,1253	0,7891
1100	1,0985	1,1254	1,0434	1,1402	2,1744	1,1413	0,7975
1200	1,1069	1,1343	1,0511	1,1492	2,2075	1,1560	0,8050
1300		1,1426	1,0583	1,1577	2,2399	1,1693	0,8117
1400		1,1504	1,0651	1,1656	2,2716	1,1816	0,8179
1500		1,1578	1,0715	1,1730	2,3024	1,1928	0,8235
1600		1,1647	1,0775	1,1799	2,3322	1,2032	0,8286
1700		1,1711	1,0832	1,1863	2,3610	1,2128	0,8334
1800		1,1772	1,0888	1,1924	2,3889	1,2217	0,8378
1900		1,1829	1,0941	1,1980	2,4157	1,2299	0,8419
2000		1,1883	1,0993	1,2034	2,4416	1,2376	0,8457
2100		1,1934	1,1043	1,2084	2,4666	1,2449	0,8493
2200		1,1981	1,1092	1,2131	2,4906	1,2516	0,8527
2300		1,2026	1,1140	1,2175	2,5138	1,2580	0,8559
2400		1,2069	1,1186	1,2217	2,5362	1,2640	0,8590
2500		1,2109	1,1232	1,2257	2,5577	1,2696	0,8619
2600		1,2147	1,1276	1,2295	2,5785	1,2750	0,8647
2700		1,2184	1,1320	1,2331	2,5986	1,2800	0,8673
2800		1,2218	1,1363	1,2365	2,6180	1,2848	0,8699
2900		1,2251	1,1405	1,2398	2,6368	1,2894	0,8723
3000		1,2282	1,1446	1,2429	2,6549	1,2938	0,8747

* Κατά Baehr-Hartmann-Pohl-Schomächer: Thermodynamische Funktionen idealer Gase für Temperaturen bis 6000K. Springer, Berlin-Heidelberg New York, 1967. Οι τιμές του αέρα προέρχονται από υπολογισμό.

Πίνακας IX Ενθαλπία H (MJ/kmol) αερίων σε κατάσταση τελείου αερίου κατά Gurvic, Termod. Sv. Indiv. Vesc., Μόσχα. Το μηδενικό σημείο $h_0=0$ εκλέχτηκε για τα H_2, O_2, N_2 το 0Κ. Για τα υπόλοιπα καθορίστηκε από τις θετικές (ή αρνητικές) θερμότητες αντιδράσεως.

T [K]	H_2	O_2	H_2O	OH	N_2	NO	CO	CO_2	C	C_{graph}	CH_4	NH_3
12000	453.53	471.70	548.06	463.00	463.87	544.40	308.77		997.73			
11500	436.03	454.07	505.17	447.49	440.60	524.07	341.49		979.95			
11000	418.04	435.99	462.78	431.69	417.90	503.86	315.48		964.05			
10500	399.61	417.40	421.08	415.50	395.70	483.76	290.60		949.63			
10000	380.68	398.41	380.16	398.94	374.16	463.77	265.37		936.21			
9500	361.29	378.98	340.06	382.02	353.06	443.90	243.22		923.47			
9000	341.49	359.11	300.81	364.71	332.45	424.13	221.76		911.15			
8500	321.25	338.81	262.54	346.99	312.21	404.46	200.89		899.12			
8000	300.67	318.13	225.21	328.99	292.26	384.88	180.49		887.24			
7500	279.81	297.12	188.83	310.39	272.58	365.40	160.49		841.20			
7000	258.78	275.87	153.33	291.55	253.11	346.01	140.78		863.73			
6500	237.69	254.41	118.73	272.40	233.79	326.71	121.31		852.08			
6000	216.66	232.87	84.94	253.02	214.59	307.48	101.99	- 39.97	840.46		479.03	416.32
5800	208.30	224.25	71.67	245.23	206.94	299.81	94.30	- 52.93	835.83		457.77	396.98
5600	199.97	215.64	58.52	237.41	199.30	292.15	86.63	- 65.88	831.21		436.58	377.78
5400	191.68	207.05	45.50	229.58	191.09	284.31	78.97	- 78.79	826.00		415.39	358.79
5200	183.44	198.45	32.60	221.76	184.08	276.88	71.34	- 91.66	822.00		394.22	340.02
5000	175.26	189.88	19.79	213.93	176.49	269.26	63.71	-104.51	817.42	119.00	373.09	321.46
4800	167.14	181.34	+ 7.13	206.12	168.90	261.66	56.10	-117.31	812.85	113.15	352.00	303.16
4600	159.08	172.84	- 5.42	198.33	161.34	254.07	48.51	-130.07	808.30	107.35	330.94	285.02
4400	151.09	164.39	- 17.83	190.56	153.79	246.48	40.93	-142.82	803.77	101.00	309.96	267.08
4200	143.17	156.00	- 30.13	182.82	146.25	238.91	33.36	-155.52	799.26	95.90	288.99	249.40
4000	135.31	147.65	- 42.34	175.11	138.73	231.36	25.82	-168.20	794.78	90.23	268.13	231.87
3800	127.54	139.36	- 54.39	167.46	131.22	223.82	18.28	-180.83	790.32	84.66	247.35	214.58
3600	119.81	131.11	- 66.31	159.84	123.74	216.29	10.76	-193.43	785.89	79.11	226.62	197.47
3400	112.21	122.94	- 78.10	152.29	116.27	208.78	+ 3.26	-205.99	781.48	73.61	205.99	180.61
3200	104.66	114,83	- 89.76	144.78	108,83	201.29	- 4.21	-218.51	777.11	68.16	185.51	163.94
3000	97.20	106.80	-101.25	137.34	101.40	193.81	- 11.67	-230.97	772.77	62.76	165.16	147.32
2900	93.51	102.81	-106.95	133.65	97,70	190.08	- 15.38	-237.19	770.61	60.09	155.05	139.37
2800	89.83	98.84	-112.60	129.98	94.01	186.36	- 19.10	-243,39	768.46	57.42	144.97	131.31
2700	86,19	94.89	-118,20	126.32	90,32	182.64	- 22.80	-249.59	766.32	54.77	134.96	123.31
2600	82.56	90.97	-123.76	122.68	86.65	178.93	- 26.50	-255.77	764.18	52.14	124.99	115.37
2500	78.96	87,06	-129.25	119.06	82.98	175.22	- 30.19	-261.92	762.05	49.51	115.06	107.51
2400	75,40	83.18	-134.71	115.47	79.32	171.52	- 33.87	-208.07	759.93	46.91	105.22	99,73
2300	71.86	79,32	-140.11	111.90	75,68	167.83	- 37.53	-274.20	757.82	44.32	95.44	92.04
2200	68.35	75,49	-145.44	108.35	72.04	164.15	- 41.19	-280.30	755.71	41.74	85.74	84.43
2100	64.86	71,67	-150,72	104.83	68.42	160.48	- 44.84	-286.37	753.61	39.18	76.15	76.91
2000	61.42	67,88	-155.92	101,34	64.81	156.82	- 48.47	-292.42	751.51	36.64	66.65	69.50
1900	58,01	64.12	-161,06	97,88	61,22	153.17	- 52.09	-298.45	749.42	34.12	57.28	62.21
1800	54.63	60,37	-166,12	94.47	57,66	149.54	- 55.68	-304.44	747.33	31.62	48.02	55.04
1700	51.30	56,66	-171,09	91,06	54,10	145.92	- 59.27	-310.39	745.24	29.15	38.92	48.00
1600	48,01	52,96	-175,98	87,71	50,58	142.32	- 62.83	-316,29	743.16	26.69	29.98	41.09
1500	44.76	49,29	-180.76	84.39	47,08	138.73	- 66.36	-322.16	741.07	24.27	21.22	34.32
1400	41,55	45.65	-185.44	81.12	43,61	135.17	- 69.87	-327.98	739.00	21.88	12.67	27.73
1300	38,38	42.03	-190.01	77.89	40.17	131.65	- 73.34	-333.73	736.92	19.54	- 4.37	21.32
1200	35.27	38,45	-194.47	74.70	36.78	128.15	- 76.78	-339.40	734.84	17.24	- 3.66	15.11
1100	32.19	34,89	-198,80	71,57	33.43	124.69	- 80.17	-344,99	732,76	15.00	-11.38	9,12
1000	29.15	31,39	-203.01	68.48	30,13	121.27	- 83.52	-350.47	730,68	12.82	-18,75	+ 3,30
900	26.15	27.92	-207.08	65.43	26,89	117,90	- 86.81	-355,83	728,60	10.70	-25.72	- 2,15
800	23.17	24.52	-211,02	62,42	23,72	114,59	- 90.03	-361,06	726.52	8,67	-32.26	- 7,39
700	20.22	21.18	-214.84	59.44	20,61	111.35	- 93.19	-366.11	724,44	6.73	-38.30	-12,36
600	17.28	17.92	-218.54	56.48	17,56	108,19	- 96,27	-370,95	722.36	4.94	-43.80	-17,02
500	14.35	14.77	-222.11	53,54	14,58	105.11	- 99.28	-375,56	720.28	3,34	-48,73	-21,37
400	11.43	11.71	-225.59	50,58	11,64	102.09	-102.23	-379,86	718.20	2,00	-53,07	-25,39
298,15	8.45	8.68	-229.04	47.56	8,67	99,05	-105.21	-383.86	716.08	0,98	-56,94	-29.18
0	0	0	-238.95	38.74	0	89.87	-113.88	-393.23	709.54	0	-60,96	-39.22

Πίνακας Χα Αληθείς μοριακές θερμοχωρητικότητες υπό σταθερή πίεση ($p \rightarrow 0$, $t = 0$ °C)

t	H_2	N_2	N_2 * από αέρα	O_2	OH	CO	NO	H_2O	CO_2	N_2O	SO_2	Αέρας
0	6,84	6,96	6,93	6,99	7,16	6,96	7,16	8,00	8,60	9,36	9,29	6,95
100	6,96	6,98	6,96	7,14	7,09	6,99	7,15	8,14	9,63	10,05	10,16	6,99
200	6,99	7,04	7,02	7,36	7,05	7,09	7,25	8,35	10,46	10,77	10,92	7,09
300	7,00	7,16	7,13	7,61	7,05	7,23	7,42	8,61	11,15	11,40	11,52	7,23
400	7,03	7,31	7,28	7,83	7,07	7,40	7,62	8,88	11,72	11,89	12,00	7,40
500	7,07	7,47	7,44	8,02	7,13	7,58	7,79	9,17	12,18	12,37	12,35	7,56
600	7,12	7,63	7,60	8,17	7,21	7,75	7,95	9,48	12,58	12,73	12,63	7,72
700	7,19	7,78	7,74	8,30	7,30	7,90	8,09	9,79	12,91	13,07	12,85	7,86
800	7,28	7,91	7,88	8,41	7,42	8,03	8,22	10,03	13,19	13,28	13,01	7,99
900	7,38	8,03	8,00	8,51	7,53	8,14	8,32	10,39	13,43	13,48	13,14	8,10
1000	7,48	8,14	8,10	8,59	7,64	8,24	8,41	10,68	13,63	13,66	13,25	8,20
1100	7,58	8,23	8,19	8,66	7,75	8,33	8,48	10,95	13,80	13,79	13,33	8,29
1200	7,69	8,31	8,27	8,72	7,85	8,40	8,55	11,20	13,95	13,92	13,40	8,37
1300	7,79	8,38	8,34	8,78	7,95	8,46	8,61	11,43	14,10	14,02	13,46	8,43
1400	7,89	8,44	8,40	8,84	8,04	8,52	8,65	11,64	14,21	14,11	13,51	8,49
1500	7,98	8,50	8,45	8,90	8,13	8,57	8,69	11,84	14,31	14,19	13,55	8,55
1600	8,07	8,55	8,50	8,95	8,22	8,62	8,73	12,02	14,40	14,25	13,59	8,60
1700	8,15	8,59	8,55	9,01	8,30	8,66	8,77	12,20	14,48	14,31	13,62	8,65
1800	8,23	8,63	8,59	9,07	8,36	8,69	8,80	12,35	14,55	14,36	13,65	8,69
1900	8,31	8,66	8,62	9,13	8,43	8,72	8,82	12,50	14,62	14,40	13,67	8,73
2000	8,38	8,69	8,65	9,18	8,49	8,75	8,85	12,64	14,68	14,44	13,69	8,76
2100	8,45	8,72	8,68	9,23	8,55	8,78	8,87	12,76	14,74	14,47	13,70	8,79
2200	8,51	8,75	8,71	9,28	8,60	8,80	8,89	12,87	14,79	14,50	13,72	8,82
2300	8,57	8,78	8,74	9,33	8,65	8,82	8,91	12,97	14,84	14,53	13,73	8,85
2400	8,63	8,80	8,76	9,37	8,69	8,84	8,93	13,06	14,88	14,56	13,74	8,88
2500	8,68	8,82	8,78	9,42	8,74	8,86	8,95	13,14	14,92	14,59	13,76	8,91
2600	8,73	8,84	8,80	9,46	8,78	8,88	8,96	13,22	14,95	14,61	13,77	8,94
2700	8,78	8,86	8,82	9,50	8,83	8,90	8,98	13,28	15,00	14,62	13,77	8,96
2800	8,83	8,88	8,84	9,55	8,88	8,91	8,99	13,34	15,04	14,64	13,78	8,98
2900	8,87	8,89	8,85	9,59	8,92	8,92	9,01	13,40	15,08	14,66	13,79	9,00
3000	8,91	8,90	8,86	9,63	8,97	8,94	9,02	13,46	15,12	14,67	13,79	9,02
M =	2,016	28,02	28,16	32,00	17,01	28,01	30,01	18,02	44,01	44,02	64,06	28,964

Πίνακας Χβ Μέσες μοριακές θερμοχωρητικότητες υπό σταθερή πίεση ($p \rightarrow 0$, $t = 0$ °C)

t	H_2	N_2	N_2 * από αέρα	O_2	OH	CO	NO	H_2O	H_2S	CO_2	N_2O	SO_2	NH_3	Αέρας	CH_4	C_2H_4	C_2H_2
0	6,84	6,96	6,93	6,99	7,16	6,96	7,16	8,00	8,10	8,62	9,39	9,29	8,36	6,95	8,27	10,02	10,13
100	6,88	6,97	6,94	7,06	7,12	6,97	7,15	8,06	8,26	9,17	9,79	9,74	8,69	6,97	8,85	11,27	11,00
200	6,93	6,99	6,96	7,16	7,09	7,00	7,17	8,15	8,43	9,61	10,12	10,16	9,11	7,00	9,45	12,46	11,67
300	6,94	7,02	7,00	7,27	7,08	7,05	7,22	8,26	8,61	10,02	10,45	10,52	9,56	7,05	10,12	13,55	12,25
400	6,96	7,08	7,06	7,38	7,07	7,12	7,30	8,38	8,80	10,37	10,74	10,82	10,03	7,12	10,81	14,57	12,70
500	6,98	7,14	7,11	7,49	7,08	7,19	7,38	8,51	9,00	10,69	11,02	11,09	10,52	7,19	11,48	15,49	13,10
600	7,00	7,20	7,18	7,59	7,09	7,28	7,46	8,65	9,20	10,98	11,24	11,33	11,01	7,27	12,12	16,33	13,47
700	7,02	7,28	7,25	7,68	7,11	7,36	7,54	8,79	9,40	11,22	11,50	11,54	11,47	7,34	12,75	17,08	13,80
800	7,05	7,36	7,32	7,77	7,15	7,44	7,62	8,94	9,60	11,46	11,71	11,72	11,91	7,42	13,33	17,90	14,12
900	7,08	7,42	7,39	7,85	7,18	7,50	7,70	9,08	9,78	11,65	11,90	11,87	12,31	7,48	13,87	18,46	14,40
1000	7,12	7,49	7,46	7,92	7,22	7,57	7,76	9,22	9,96	11,85	12,07	12,00	12,68	7,56	14,40	19,08	14,67
1100	7,16	7,56	7,52	7,98	7,26	7,64	7,83	9,37	10,12	12,02	12,21	12,13	13,02	7,62	14,89		
1200	7,19	7,61	7,58	8,04	7,30	7,70	7,89	9,51	10,28	12,18	12,35	12,23	13,34	7,68	15,33		
1300	7,24	7,67	7,64	8,10	7,35	7,75	7,94	9,64	10,42	12,32	12,48	12,33	13,63	7,73			
1400	7,28	7,72	7,70	8,15	7,40	7,80	7,99	9,78	10,55	12,45	12,60	12,41	13,89	7,79			
1500	7,32	7,77	7,76	8,19	7,44	7,86	8,03	9,91	10,68	12,57	12,69	12,48	14,14	7,84			
1600	7,36	7,84	7,80	8,24	7,49	7,90	8,08	10,04	10,80	12,69	12,78	12,55	14,38	7,90			
1700	7,41	7,87	7,84	8,28	7,53	7,94	8,12	10,16	10,92	12,79	12,88	12,61	14,60	7,93			
1800	7,46	7,90	7,88	8,33	7,58	7,99	8,15	10,28	11,02	12,88	12,95	12,67	14,80	7,97			
1900	7,50	7,94	7,92	8,37	7,62	8,02	8,19	10,39	11,11	12,98	13,01	12,71	14,99	8,01			
2000	7,54	7,98	7,95	8,41	7,67	8,06	8,22	10,50	11,21	13,06	13,09	12,77	15,16	8,04			
2100	7,58	8,01	7,97	8,44	7,71	8,09	8,26	10,60	11,30	13,11	13,17	12,81	15,32	8,08			
2200	7,62	8,04	8,00	8,48	7,75	8,12	8,29	10,69	11,38	13,16	13,21	12,85	15,47	8,11			
2300	7,66	8,07	8,03	8,51	7,79	8,15	8,31	10,78	11,45	13,21	13,28	12,89	15,61	8,14			
2400	7,70	8,10	8,06	8,54	7,82	8,18	8,34	10,87	11,53	13,26	13,33	12,93	15,75	8,17			
2500	7,74	8,14	8,10	8,58	7,86	8,21	8,36	10,97	11,60	13,31	13,38	12,96	15,88	8,20			
2600	7,78	8,17	8,13	8,62	7,89	8,24	8,38	11,06	11,66	13,39	13,42	12,99	16,00	8,23			
2700	7,82	8,20	8,16	8,65	7,92	8,26	8,40	11,14	11,72	13,47	13,46	13,02	16,11	8,26			
2800	7,86	8,22	8,18	8,68	7,95	8,28	8,42	11,22	11,78	13,55	13,51	13,04	16,21	8,29			
2900	7,89	8,24	8,20	8,71	7,99	8,30	8,44	11,30	11,84	13,62	13,55	13,07	16,31	8,31			
3000	7,92	8,26	8,22	8,74	8,02	8,32	8,45	11,38	11,90	13,69	13,59	13,10	16,41	8,32			
M =	2,016	28,02	28,16	32,00	17,01	28,01	30,01	18,02	34,09	44,01	44,02	64,06	17,03	28,964	16,04	28,05	26,04

Πίνακας XIα,β. Διαφορά εσωτερικής ενέργειας $\Delta U_M = U_{Mt} - U_{Mo}$ (αριστερά) και ενθαλπίας $\Delta I_M = I_{Mt} - I_{Mo}$ (δεξιά) σε kcal/kmol.

t °C	H_2	N_2 καθαρό	O_2	CO	H_2O	CO_2	SO_2	Αέρας	N_2 από αέρα
0	0	0	0	0	0	0	0	0	0
25	122	124	125	124	150	169	184	124	123
100	493	498	506	498	607	715	775	498	495
200	993	1001	1034	1004	1233	1522	1634	1005	997
300	1493	1512	1583	1521	1880	2405	2558	1522	1505
400	1996	2035	2156	2054	2556	3451	3531	2053	2026
500	2502	2574	2751	2604	3261	4348	4551	2601	2562
600	3013	3132	3363	3173	3996	5388	5606	3168	3116
700	3530	3705	3988	3757	4760	6464	6677	3750	3686
800	4055	4292	4624	4354	5555	7572	7785	4345	4270
900	4689	4991	5270	4963	6480	8806	8894	5051	4965
1000	5133	5502	5926	5584	7235	9862	10016	5569	5472
1100	5686	6121	6589	6213	8117	11035	11145	6194	6088
1200	6241	6738	7249	6840	9014	12215	12281	6818	6701
1300	6829	7384	7936	7495	9956	13421	13420	7468	7343
1400	7416	8026	8618	8145	10910	14639	14580	8115	7981
1500	8011	8675	9306	8800	11885	15869	15740	8769	8626
1600	8614	9329	10000	9460	12878	17109	16910	9428	9277
1700	9229	9989	10705	10126	13839	18358	18090	10093	9933
1800	9845	10652	11409	10794	14915	19612	19270	10762	10591
1900	10472	11318	12118	11466	15956	20872	20460	11434	11352
2000	11108	11988	12837	12142	17013	22139	21660	12111	11917
2100	11751	12660	13559	12820	18084	23412	—	12790	12584
2200	12401	13335	14278	13500	19169	24692	—	13473	13253
2300	13057	14012	15018	14183	20268	25977	—	14158	13934
[illegible]	13719	14693	15756	14869	21381	27268	—	14847	14608
2500	14385	15375	16497	15556	22506	28563	—	15537	15283

t °C	H_2	N_2 καθαρό	O_2	CO	H_2O	CO_2	SO_2	Αέρας	N_2 από αέρα
0	0	0	0	0	0	0	0	0	0
25	172	174	175	174	200	219	234	174	174
100	692	697	705	697	806	916	974	697	694
200	1390	1398	1431	1401	1630	1919	2031	1402	1394
300	2089	2108	2179	2117	2476	3001	3154	2118	2101
400	2791	2830	2951	2849	3351	4146	4325	2848	2821
500	3496	3568	3745	3598	4255	5342	5544	3595	3556
600	4205	4324	4555	4365	5138	6580	6798	4360	4308
700	4921	5096	5379	5146	6151	7855	8067	5141	5077
800	5645	5882	6214	5944	7145	9162	9374	5935	5860
900	6378	6680	7053	6752	8169	10495	10680	6740	6654
1000	7120	7489	7913	7571	9222	11849	12000	7556	7459
1100	7872	8307	8775	8399	10303	13221	13330	8380	8273
1200	8636	9133	[illegible]	9235	11409	14510	14660	9213	9096
1300	9412	9967	10519	10078	12539	16004	16000	10051	9926
1400	10193	10808	11400	10927	13692	17421	17360	10897	10763
1500	10992	11656	12287	11731	14866	18850	18720	11750	11607
1600	11794	12509	13130	12640	16058	20289	20090	12608	12457
1700	12604	13367	24083	13504	27267	21736	21470	13471	13311
1800	13422	14229	14926	13371	18492	23189	22840	14339	14168
1900	14248	15094	15894	15242	19732	24640	24230	15210	15128
2000	15082	15962	16811	16116	20987	26113	25460	16085	15891
2100	15924	16833	17732	16993	22257	27585	—	16963	16757
2200	16773	17707	18650	17872	23541	29064	—	17845	17625
2300	17628	18583	19589	18754	24839	30548	—	18729	18505
[illegible]	18488	19462	20525	19638	26150	32037	—	19616	19377
2500	19353	20373	21405	20524	27474	33531	—	20505	20251

Πίνακας XIγ Διαφορά εντροπίας $\Delta S_{Mu} = S_{Mut} - S_{Muo}$ σε kcal/kmol grd.

t °C	H_2	N_2 καθαρό	O_2	CO	H_2O	CO_2	SO_2	Αέρας	N_2 από αέρα
0	0	0	0	0	0	0	0	0	0
100	1,48	1,56	1,59	1,56	1,88	2,17	2,47	1,56	1,55
200	2,66	2,73	2,84	2,77	3,37	4,06	4,53	2,74	2,72
300	3,63	3,70	3,90	3,71	4,58	5,73	6,35	3,69	3,68
[illegible]	4,39	4,53	4,83	4,56	5,64	7,26	7,96	4,55	4,50
500	5,13	5,27	5,64	5,33	6,60	8,62	9,40	5,31	5,24
600	5,75	5,94	6,38	6,04	7,51	9,87	10,69	6,02	5,91
700	6,32	6,57	7,07	6,65	8,37	11,03	11,88	6,68	6,53
800	6,82	7,13	7,69	7,28	9,15	12,19	12,96	7,28	7,09
900	7,29	7,66	8,27	7,83	9,90	13,21	13,96	7,82	7,61
1000	7,73	8,17	8,81	8,32	10,62	14,14	14,88	8,32	8,12
1100	8,14	8,65	9,21	8,82	11,29	15,04	15,75	8,80	8,59
1200	8,53	9,11	9,79	9,26	11,93	15,87	16,55	9,25	9,05
1300	8,90	9,52	10,23	9,68	12,55	16,71	17,30	9,67	9,45
1400	9,35	9,92	10,64	10,08	13,14	17,46	18,04	10,07	9,84
1500	9,68	10,30	11,03	10,46	13,69	18,16	18,69	10,44	10,22
1600	10,00	10,66	11,41	10,83	14,23	18,83	19,35	10,79	10,57
1700	10,31	11,00	11,78	11,09	14,75	19,47	19,94	11,13	10,91
1800	10,61	11,32	12,13	11,43	15,21	20,02	20,53	11,44	11,22
1900	10,90	11,63	12,47	11,76	15,69	20,58	21,06	11,75	11,53
2000	11,18	11,93	12,73	12,07	16,16	21,15	21,58	12,05	11,81
2100	11,45	12,22	13,10	12,36	16,61	21,70	22,08	12,34	12,10
2200	11,72	12,49	13,42	12,65	17,06	22,22	22,57	12,63	12,37
2300	11,99	12,76	13,71	12,93	17,50	22,75	23,04	12,90	12,63
2400	12,24	13,03	13,93	13,20	17,92	23,25	23,48	13,16	12,89
2500	12,49	13,27	14,24	13,45	18,31	23,73	23,91	13,41	13,13

Πίνακας XII

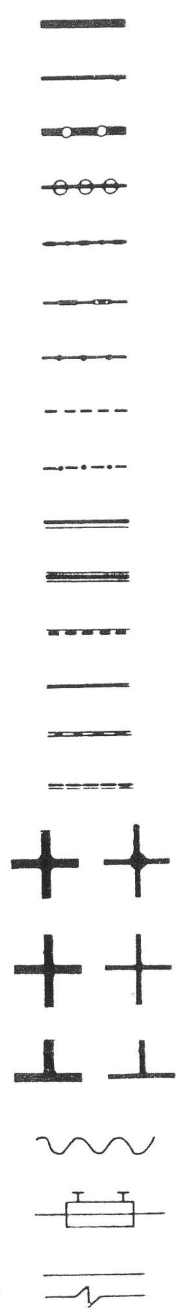
Θερμογόνα δύναμη H_o και H_u, μέγιστο αντιστρεπτό έργο $-(L_t)_{max}$ και εξέργεια E_B ενιαίων καυσίμων σε kJ/kmol.

	Καύσιμα	H_o	H_u	$-L_{trev}$	E_B
Στερεά	C	393,5	393,5	394,4	410,5
	S	296,6	296,6	299,8	-
Αέρια	H_2	285,9	241,8	237,3	235,3
	CO	283,0	283,0	257,3	275,4
	CH_4	890,5	802,3	818,1	830,3
	C_2H_2	1300	1256	1235	1265
	C_2H_4	1411	1323	1332	1360
	C_2H_6	1560	1428	1468	1494
	C_3H_6	2059	1926	1970	2012
	C_3H_8	2220	2044	2109	2149
	$n-C_4H_{10}$	2879	2658	2748	2803
Υγρά	$n'-C_5H_{12}$	3510	3245	3386	3455
	C_6H_6	3268	3135	3202	3293
	C_6H_{12}	3920	3656	3817	3902
	$n-C_6H_{14}$	4164	3855	4023	4106
	C_7H_8	3906	3730	3820	3925
	$n-C_7H_{16}$	4817	4465	4660	4757
	$n-C_8H_{18}$	5471	5074	5297	5408
	$n-C_6H_{20}$	6125	5684	5934	6059
	$n-C_{10}H_{22}$	6779	6294	6571	6711
	CH_3OH	726,6	638,4	702,5	716,7
	C_2H_5OH	1367,1	1234,8	1325,8	1354,1

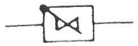
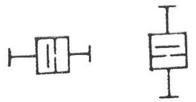
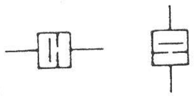
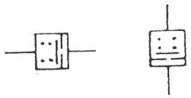
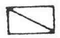
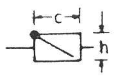
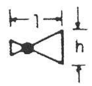
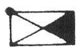
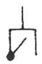
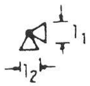
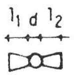
ΤΕΙΝΟΜΕΝΟΙ ΣΥΜΒΟΛΙΣΜΟΙ

νονται κατανοητά σε ένα σχέδιο συνδεσμολογίας ή θερμικού δικτύου εν ιάφορα μηχανήματα και όργανα αποφασίστηκε να σημειώνονται με ειδικά Στα επόμενα δίδονται οι συμβολισμοί κατά την γερμανική τυποποίηση και ιτά τα φυλλάδια DIN 2429, 2430, 3400, 2425, 2481, τις προτροπές του VDI στάσεις της VGB.

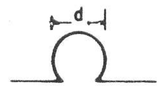
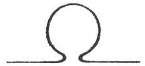
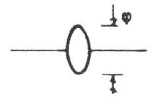
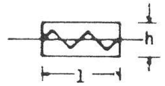
1.3.1. Σωληνώσεις



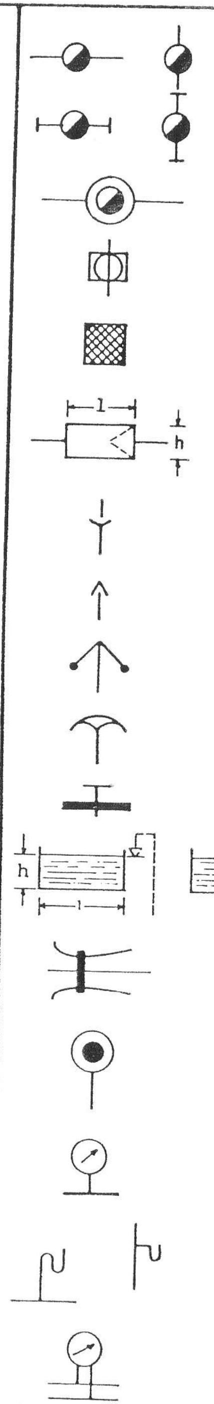
1.1	Ατμός		s = 1,2 mm
1.2	Συμπύκνωμα και νερό		s = 0,5 mm
1.3	Ατμός που περιέχει λάδι		s = 1,2 mm
1.4	Συμπύκνωμα που περιέχει λάδι		s = 0,5 mm d = 2,0 mm
1.5	Νερό ακατέργαστο		s = 0,5/0,3 mm
1.6	Διαλύματα		s = 0,5/0,3 mm
1.7	Στρατσόνα ή ακάθαρτο νερό		s = 0,3 mm
1.8	Γραμμή εντολών		s = 0,3 mm
1.9	Γραμμές επενέργειας αυτομάτων συστημάτων		s = 0,3 mm
1.10	Καύσιμο αέριο		s = 0,4/0,2 mm
1.11	Καπναέρια		s = 0,2/0,4/0,2 mm b = 0,1 mm
1.12	Αέρας		s = 0,4/0,2 mm b = 0,4 mm
1.13	Γαιάνθρακας		s = 0,2/1,0/0,2 b = 1,0 mm
1.14	Τέφρα κ.λπ.		s = 0,2/0,8/0,2 b = 0,8 mm
1.15	Επεκτάσεις μελλοντικές κ.λπ.		Διακεκομμένες γραμμές
1.16	Διασταυρώσεις με ένωση των σωλήνων		κ.λπ.
1.17	Διασταυρώσεις στον χώρο χωρίς ένωση των σωλήνων		κ.λπ.
1.18	Διακλάδωση		κ.λπ.
1.19	Κινητή γραμμή		
1.20	Γραμμή με μανδύα		
1.21	Γραμμή με παράλληλη γραμμή		

17	Δικλείδα αντεπιστροφής		
18	Δικλείδα αντεπιστροφής με φλάντζες		
19	Απλή βαλβίδα αντεπιστροφής τοποθετούμενη μεταξύ φλαντζών		l = h = 5 mm
20	Ομοίως με ελατήριο		l = h = 5 mm
.21	Κλαπέττο εν γένει		l = 7, h = 4 mm
.22	Κλαπέττο αντεπιστροφής εν γένει		l = 7, h = 4 mm
.23	Κλαπέττο αποφρακτικό		
.24	Κλαπέττο ρυθμιστικό		
.25	Σύρτης (βάννα)		
.26	Μειωτής πιέσεως		l = 9, h = 5 mm $p_1 > p_2$
.27	Όργανο αντεπιστροφής εν γένει με δυνατότητα αποφράξεως της ροής		
3.28	Ποτήρι αναρροφήσεως		l = h = 4 mm
3.29	Γωνιακή δικλείδα		$l_1 = l_2 = 3$ mm
3.30	Γωνιακό ασφαλιστικό με αντίβαρο		
3.31	Γωνιακή δικλείδα αντεπιστροφής με δυνατότητα αποφράξεων της ροής		
3.32	Κρουνός		$l_1 = l_2 = 3$, d = 2 mm
3.33	Κρουνός γωνιακός		
3.34	Τρίστομος κρουνός		

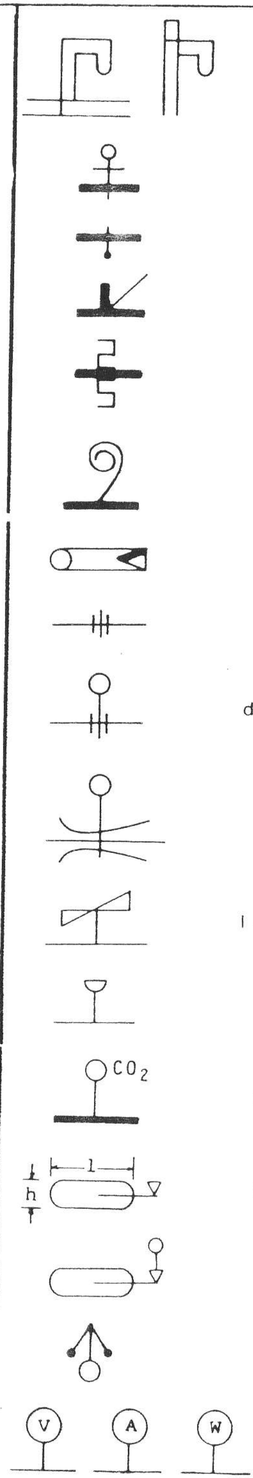
1.3.4. Εξομοιωτές μηκών (διαστολικά)

4.1	**Διαστολικό εν γένει**		d = **8** mm
4.2	**Διαστολικό ου**		$l_1 = l_2 = l_3 =$ **6** mm
4.3	Διαστολικό ωμέγα (λύρα)		
4.4	Διαστολικό φακοειδές		φ = 6 mm
4.5	Σπαστός σωλήνας		l = 12, h = 5 mm
4.6	Διαστολικό με στυπιοθλίπτη		

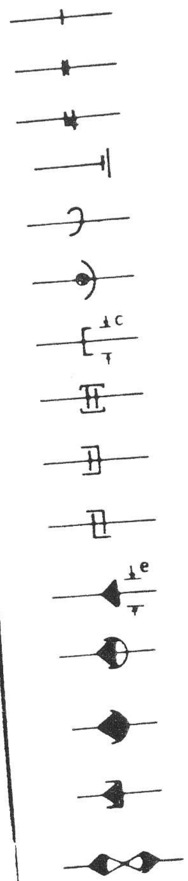
5.1	Ατμοπαγίδα εν γένει		d = 4 mm
5.2	Ατμοπαγίδα με φλάντζες		
5.3	Συλλεκτήριος αγωγός συμπυκνωμάτων με ατμοπαγίδα		d_1 = 7 mm d_2 = 4 mm
5.4	Ροοδείκτης		
5.5	Φίλτρο		$a_1 = a_2$ = 6 mm
5.6	Κόσκινο (απλό συρμάτινο φίλτρο)		l = 10, h = 5 mm
5.7	Εκροή προς αποχέτευση		
5.8	Κάλυμμα έναντι βροχής		
5.9	Ρυθμιστής ταχύτητας		
5.10	Ρυθμιστής πιέσεως		
5.11	Ρυθμιστής θερμοκρασίας (θερμοστάτης)		
5.12	Ρυθμιστής στάθμης		l = 12 mm h = 5 mm
5.13	Ρυθμιστής ποσότητας		
5.14	Ρυθμιστής ασφαλείας (ρυθμιστής ταχείας διακοπής)		d_1 = 6, d_2 = 3 mm
5.15	Μετρητής πιέσεως (μανόμετρο)		d = 5 mm
5.16	Πιεσόμετρο υγρό		
5.17	Διαφορικό μανόμετρο		d = 5 mm



5.18	Διαφορικό υγρό πιεσόμετρο		
5.19	Μετρητής θερμοκρασίας		
5.20	Υγρό θερμόμετρο		
5.21	Θερμοηλεκτρικό στοιχείο		
5.22	Θερμόμετρο αντιστάσεως		
5.23	Θερμόμετρο διμεταλλικό		
5.24	Θερμόμετρο ακτινοβολίας (οπτικό)		
5.25	Μετρητικό ακροφύσιο ή φλάντζα χωρίς τοπικό όργανο ενδείξεως		
5.26	Ομοίως με τοπικό όργανο ενδείξεως		d = 3 mm
5.27	Μετρητής Venturi με τοπικό όργανο ενδείξεως		
5.28	Μετρητής με πτερύγια		l = 7 mm
5.29	Μετρητής όγκου		
5.30	Μετρητής CO_2		d = 3 mm
5.31	Ενδείκτης στάθμης		l = 12, h = 4
5.32	Ομοίως με τοπική ένδειξη		
5.33	Μετρητής στροφών		
5.33	Μετρητής τάσεως, εντάσεως, ισχύος		d = 5 mm

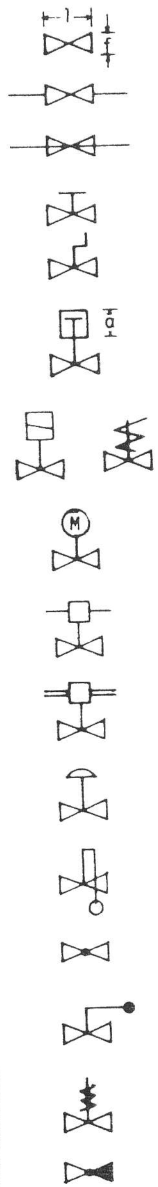


…νδέσεις



	Σύνδεση γενικά	
	Σύνδεση με φλάντζες	
3	Συνδέσεις με φλάντζες και τυφλή με οπή	
4	Τυφλή φλάντζα	
5	Σύνδεση με μούφα	
.6	Σύνδεση με σφαιρική μούφα	c = 4,0 mm
.7	Μούφα ωθήσεως	c = 4,0 mm
.8	Συνδέσεις	c = 4,0 mm
2.9	Σύνδεση βιδωτή	c = 4,0 mm
2.10	Σύνδεσμος (κόπλερ)	e = 4 mm
2.11	Σύνδεση με συγκόλληση ή κόλληση εν γένει	e = 4 mm
2.12	Συγκολλούμενη μούφα	e = 4 mm
2.13	Συγκολλούμενη σφαιρική μούφα	e = 4 mm
2.14	Συγκολλούμενη μούφα ωθήσεως	l = 6, f = 3 mn
2.15	Συγκολλούμενη αποφρακτική δικλείδα	Ανάλογη παράσταση άλλων συγκολλουμένων οργάνων

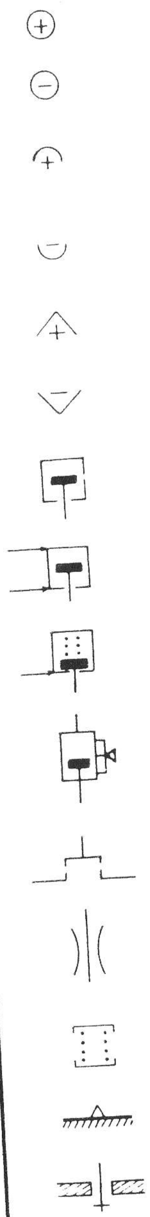
1.3.3. Οργανα διακοπής



3.1	Όργανο διακοπής εν γένει	l = 7, f = 3 mm
3.2	Ομοίως ανοικτό	
3.3	Ομοίως κλειστό	
3.4	Όργανο διακοπής με τροχό	
3.5	Όργανο διακοπής με στρόφαλο	
3.6	Όργανο διακοπής με έμβολο	l = 7, a = 4 mm
3.7	Όργανο διακοπής μαγνητικό	l = 7, a = 4 mm
3.8	Όργανο διακοπής με κινητήρα	l = 7 a = 4 mm
3.9	Όργανο διακοπής υδραυλικό	l = 7, a = 3 mm
3.10	Όργανο διακοπής με λάδι	l = 7, a = 3 mm
3.11	Όργανο διακοπής με μεμβράνη	
3.12	Όργανο διακοπής με πλωτήρα	
3.13	Δικλείδα κοινή (διελεύσεως)	
3.14	Ασφαλιστικό με αντίβαρο	
3.15	Ασφαλιστικό με ελατήριο	
3.16	Δικλείδα με βαλβίδα αντεπιστροφής και δυνατότητα διακοπής της ροής	

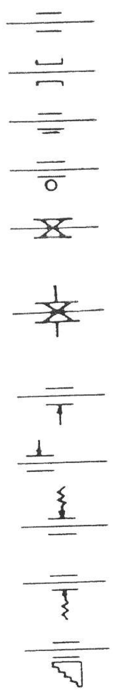
Επί μέρους στοιχεία αφορώντα στα όργανα

	Ανοίγει με αύξηση του ρυθμιστικού μεγέθους	d = 4 mm
	Ανοίγει με μείωση του ρυθμιστικού μεγέθους	
	Ανοίγει με αύξηση του ρυθμιστικού μεγέθους υπεράνω της τιμής...	
	Ανοίγει με μείωση του ρυθμιστικού μεγέθους κάτω της τιμής...	
	Κλείνει με αύξηση του ρυθμιστικού μεγέθους υπεράνω της τιμής...	
	Κλείνει με μείωση του ρυθμιστικού μεγέθους κάτω της τιμής...	
	Έμβολο	a = b = 6 mm
	Έμβολο με σύνδεση λαδιού και από τις δύο πλευρές	
	Έμβολο με ελατήριο και λάδι	
0	Πέδη ελαίου	
1	Διάταξη βαλβίδας - έδρας	
12		
	Ελατήριο	a = b = 6 mm
14	Σταθερό σημείο μηχανισμού ρυθμίσεως	
.15	Οριακή πρόσκρουση	

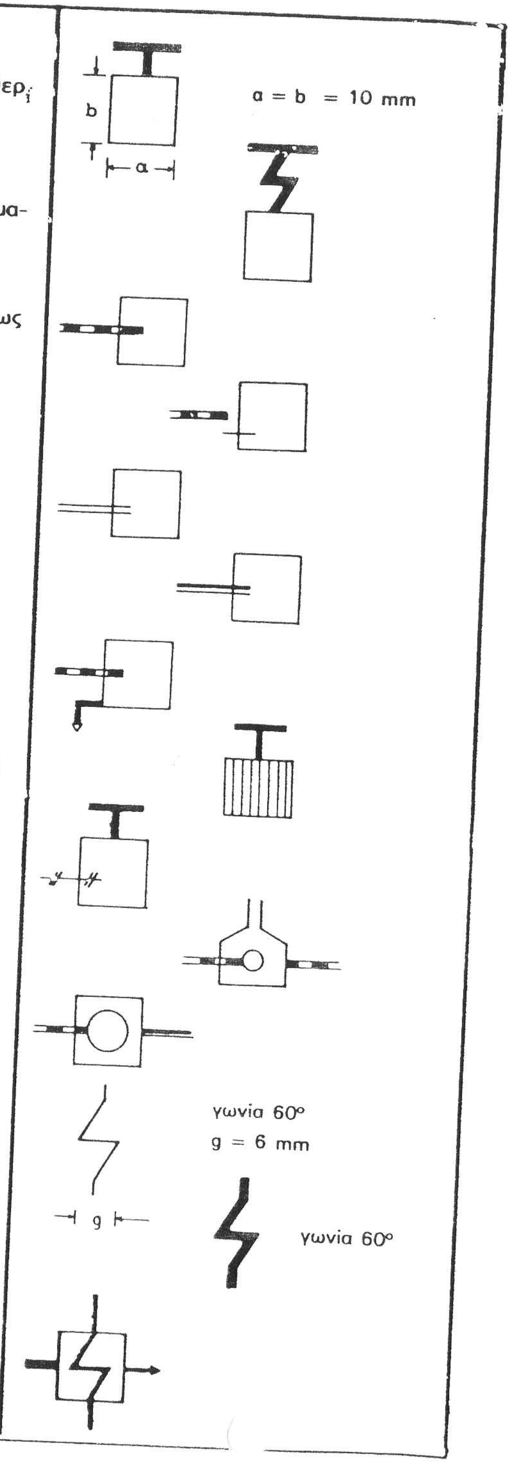


1.3.7. Στηρίγματα σωλήνων

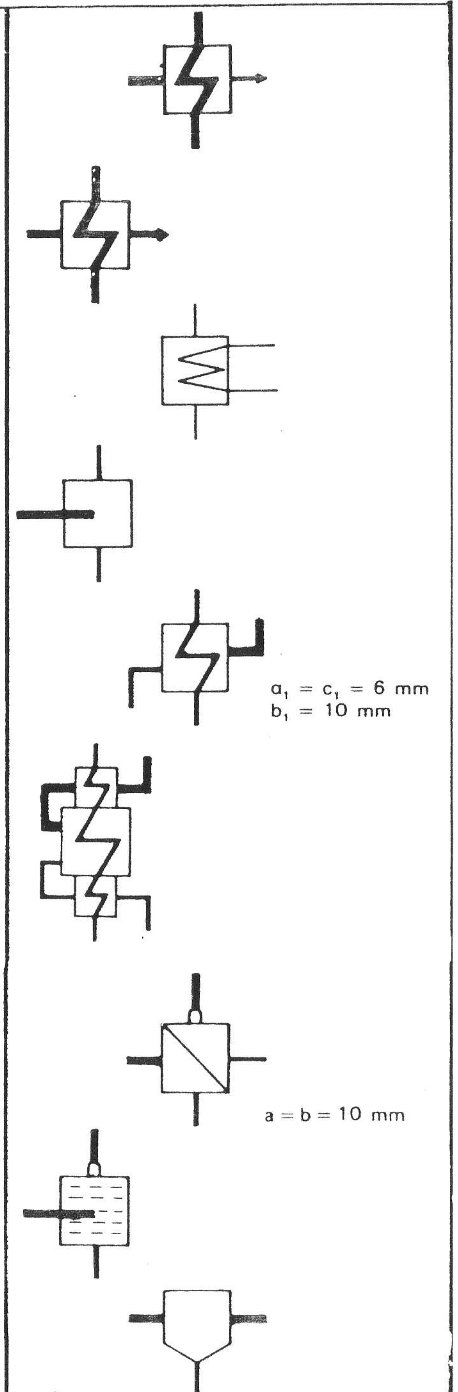
7.1	Έδρανο ολισθήσεως εν γένει
7.2	Έδρανο ολισθήσεως με οδηγό
7.3	Έδρανο ολισθήσεως με κυλίνδρους
7.4	Έδρανο ολισθήσεως με σφαίρες
7.5	Σταθερό σημείο
7.6	Ομοίως με δυνατότητα περιστροφής
7.7	Έδρανο υποβασταζόμενο εν γένει
7.8	Έδρανο κρεμάμενο εν γένει
7.9	Έδρανο κρεμάμενο ελατηριωτά
7.10	Έδρανο υποβασταζόμενο ελατηριωτά
7.11	Έδρανο με υποστήριξη εξισούμενη



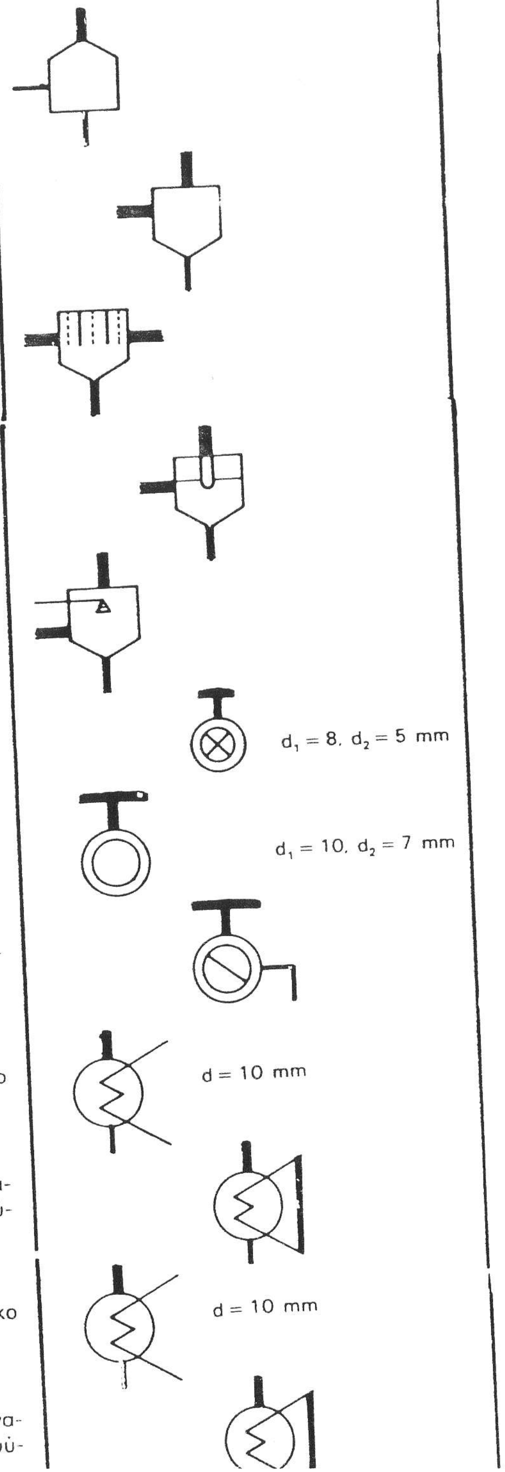
8.1	Ατμοπαραγωγός χωρίς υπερθερμαντήρα
8.2	Ατμοπαραγωγός με υπερθερμαντήρα
8.3	Ατμοπαραγωγός με εστία κόνεως
8.4	Ομοίως, με εστία εσχάρας
8.5	Ομοίως, με εστία πετρελαίου
8.6	Ομοίως, με εστία αερίου
8.7	Ομοίως, με τηκόμενη τέφρα
8.8	Ατμοπαραγωγός αποθερμότητας
8.9	Ηλεκτρικός ατμοπαραγωγος
8.10	Απαερωτής γαιανθράκων
8.11	Εξαερωτής γαιανθράκων
8.12	Προθερμαντήρας νερού με καπναέρια
8.13	Υπερθερμαντήρας ατμού με καπναέρια
8.14	Προθερμαντήρας νερού με ατμό συμπυκνούμενο



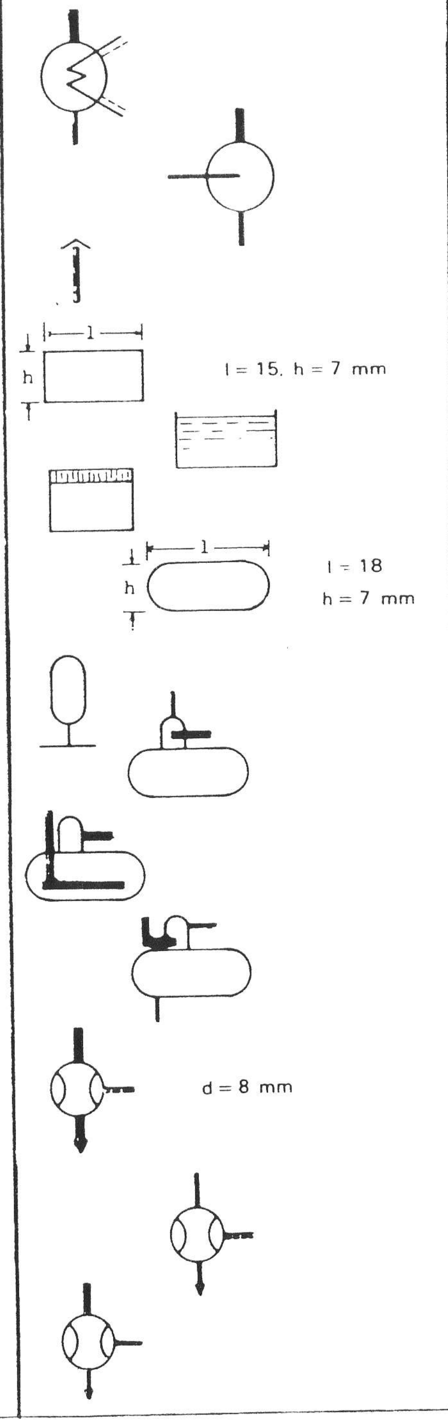
8.15	Υπερθερμαντήρας ατμού με ατμό συμπυκνούμενο
8.16	Υπερθερμαντήρας ατμού με ρέοντα ατμό
8.17	Προθερμαντήρας νερού με θερμό νερό
8.18	Προθερμαντήρας νερού με ανάμιξη ατμού
8.19	Προθερμαντήρας νερού με ατμό (επιφανείας)
8.20	Ομοίως, με αποθέρμανση υπερθέρμου ατμού και υπόψυξη συμπυκνωμάτων
8.21	Μετατροπέας ατμού με επιφάνεια
8.22	Ψύκτης ατμού με διαβίβαση υπερθέρμου ατμού κάτω από το νερό
8.23	Εξυδατωτής ατμού



.24	Εκτονωτής	
.25	Κυκλωνικός διαχωριστής τέφρας	
.26	Ηλεκτρόφιλτρο	
3.27	Διαχωριστής με παντελόνια	
8.28	Υγρός διαχωριστής	
8.29	Εκκαπνιστές	$d_1 = 8,\ d_2 = 5$ mm
8.30	Καταναλωτής θερμότητας χωρίς επιφάνεια (μίξεως)	$d_1 = 10,\ d_2 = 7$ mm
8.31	Καταναλωτής θερμότητας με επιφάνεια	
8.32	Ψυγείο επιφανείας με φρέσκο νερό	d = 10 mm
8.33	Ψυγείο επιφανείας με νερό ανακυκλοφορούμενο (πύργος ψύξεως)	
8.32	Ψυγείο επιφανείας με φρέσκο νερό	d = 10 mm
8.33	Ψυγείο επιφανείας με νερό ανακυκλοφορούμενο (πύργος ψύ-	

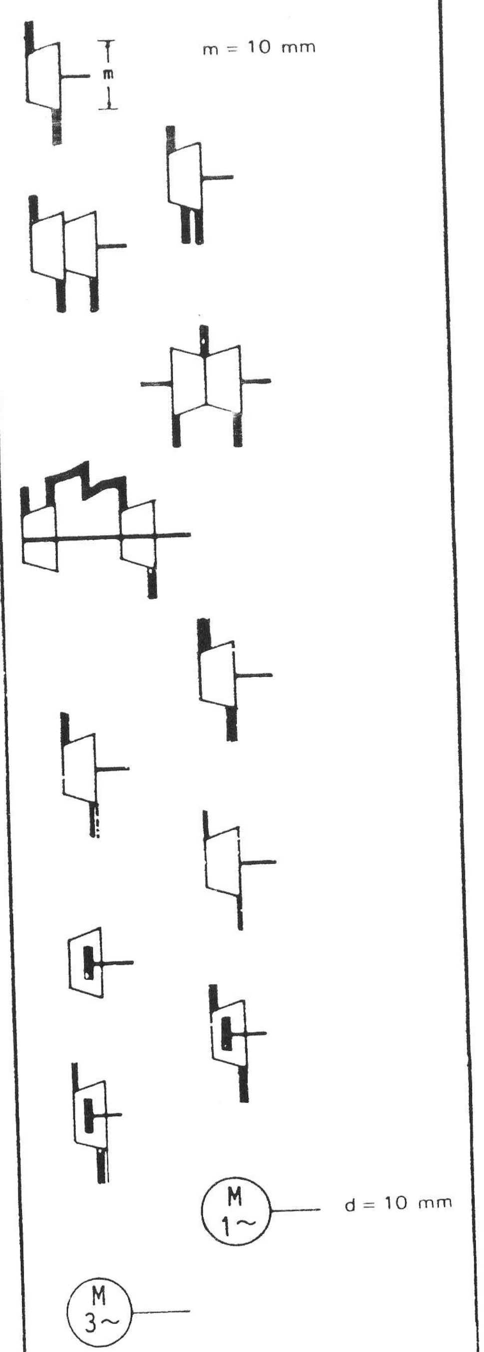


8.34	Ψυγείο αέρα	
8.35	Ψυγείο αναμίξεως	
8.36	Εκτόνωση ατμού στο περιβάλλον	
8.37	Δοχείο χωρίς πίεση	l = 15, h = 7 mm
8.38	Ανοικτό δοχείο	
8.39	Δοχείο με μαξιλάρι ατμού ή προστατευτικού αερίου	
8.40	Δοχείο με υπερπίεση	l = 18 h = 7 mm
8.41	Ισόθλιπτος αποταμιευτής	
8.42	Αποταμιευτής νερού με προθερμαντήρα αναμίξεως	
8.43	Αποταμιευτής θλιπτικής πτώσεως (Ruths)	
8.44	Απαεριωτής	
8.45	Τζιφάρι ατμού για εξαγωγή αέρα	d = 8 mm
8.46	Τζιφάρι νερού για εξαγωγή αέρα	
8.47	Τροφοδοτικό τζιφάρι ατμοπαραγωγών	



.9. Μηχανές

1	Ατμοστρόβιλος	
.2	Ατμοστρόβιλος με μη ρυθμιζόμενη απομάστευση	
.3	Ατμοστρόβιλος με ρυθμιζόμενη απομάστευση	
.4	Διπλός ατμοστρόβιλος (κουβαρίστρα)	
.5	Ατμοστρόβιλος με ενδιάμεση υπερθέρμανση (με αναθέρμανση)	
9.6	Αεριοστρόβιλος	
9.7	Αεροστρόβιλος	
9.8	Υδροστρόβιλος	
9.9	Εμβολοφόρα μηχανή γενικά	
9.10	Εμβολοφόρα ατμομηχανή	
9.11	Μηχανή εσωτερικής καύσεως	
9.12	Ηλεκτροκινητήρας εναλλασσομένου ρεύματος μονοφασικός	
9.13	Ομοίως τριφασικός	



9.14	Ομοίως με δακτυλίους	
9.15	Ηλεκτροκινητήρας συνεχούς ρεύματος	
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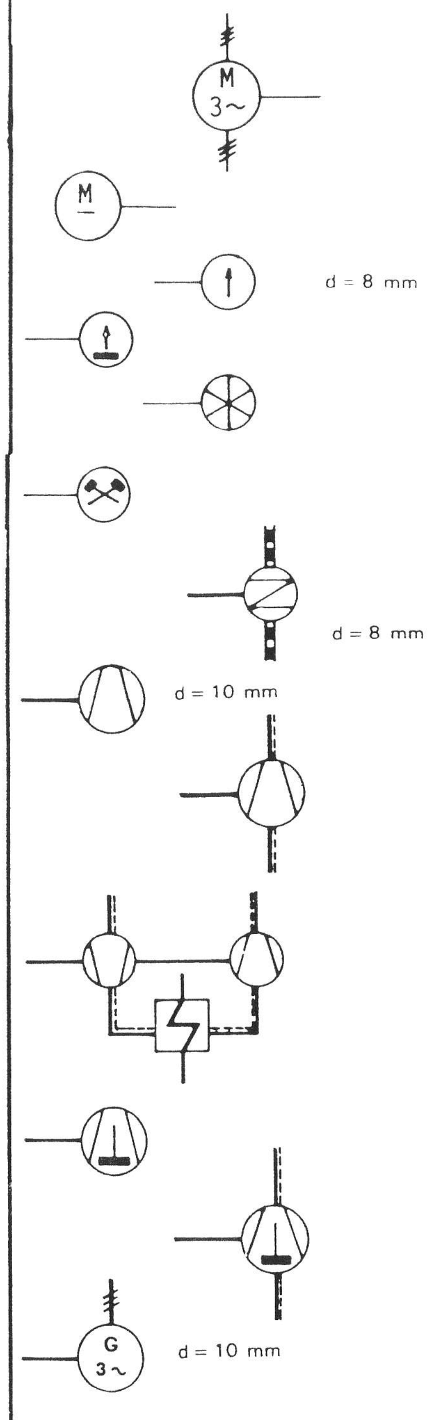

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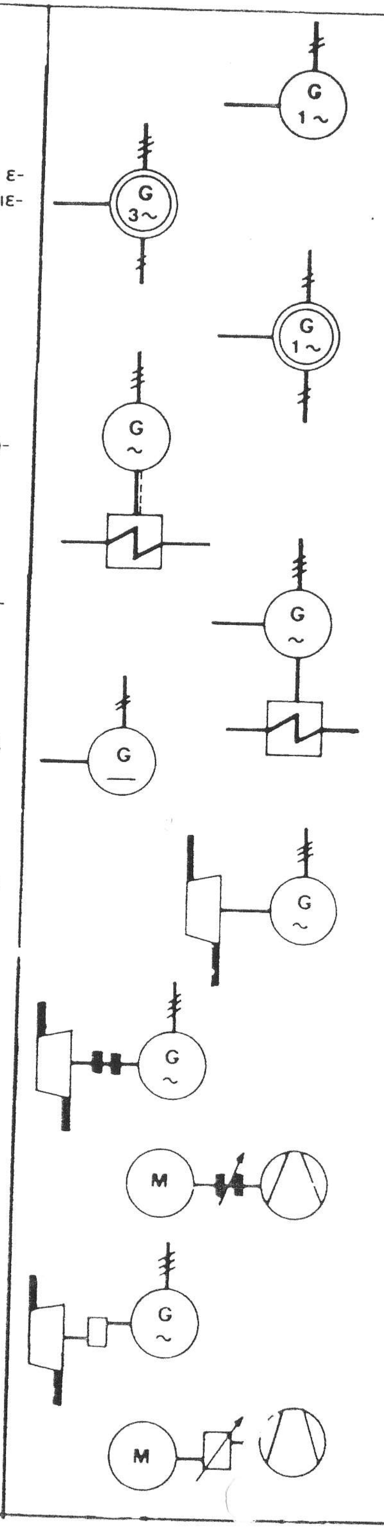

1.3.10. Πρόσθετοι συμβολισμοί θερμάνσεων

10.1	Λέβητας νερού		8 x 10 mm
10.2	Θερμαντικό σώμα		10 x 6 mm
10.3	Θερμαντικό σώμα με φέτες		
10.4	Επίπεδο θερμαντικό σώμα		
10.5	Κονβέρτερ		
10.6	Περιμετρικό θερμαντικό σώμα		
10.7	Πτερυγιοφόρος σωλήνας		
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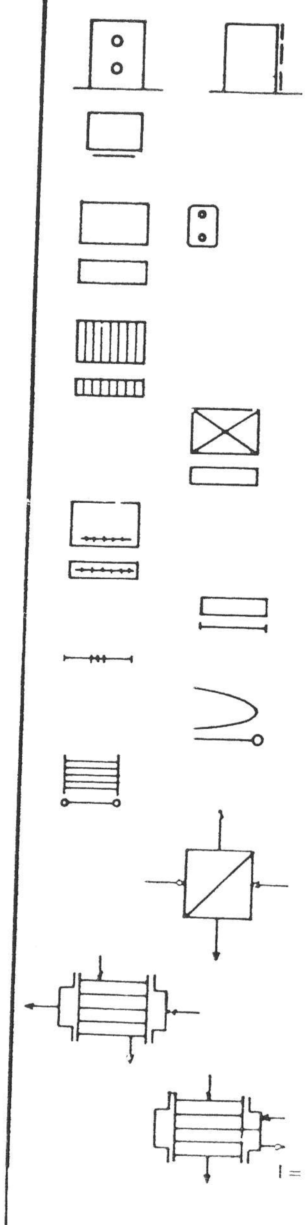
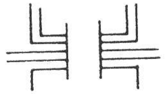
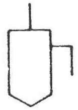
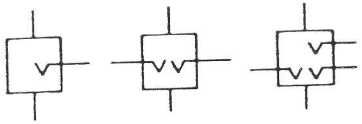
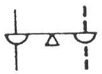
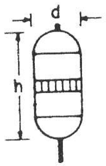
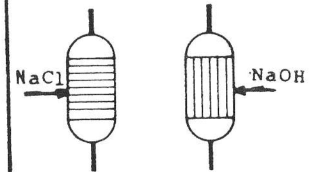
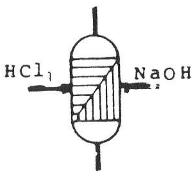
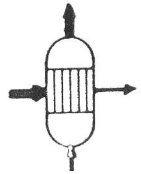
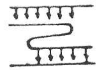
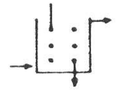
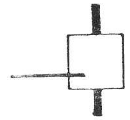
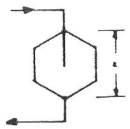
10.9	Σωληνωτός θερμαντήρας αέρα		
10.10	Εναλλάκτης θερμότητας με επιφάνεια, γενικώς		10 x 10 mm
10.11	Σωληνωτός εναλλάκτης με ευθύγραμμους σωλήνες διασταυρούμενης απλής ροής		
10.12	Ομοίως, διπλής ροής		l = 16, d = 8 mm



8.48	Τζιφάρι συμπιέσεως ατμού	
8.49	Υπερχείλιση δοχείου	
8.50	Συλλέκτης γραμμών	
8.51	Δοχείο αντιδράσεως	
8.52	Δοχείο αναδεύσεως με τάρακτρο	 a = b = 8 mm
8.53	Διανεμητής μιας, δυο, τριών δια-κλαδώσεων	
8.54	Δοσιμετρική διάταξη	
8.55	Φίλτρο μηχανικού καθαρισμού	 d = 7, h = 16 mm
8.56	Φίλτρο ενεργού άνθρακα	
8.57	Εναλλάκτης (Na), (OH)	
8.58	Εναλλάκτης μικτού στρώματος	

8.59	Βραστήρας ατμού	
8.60	Ψυκτήρας καταιονισμού	
8.61	Ψυκτήρας με σερπαντίνα	 a = b = 8 mm
8.62	Ψύκτης ατμού με διασκορπισμό νερού	
8.63	Ψυκτικός πύργος	 k = 10 mm

0.13	Ομοίως, με φουρκέτες		
10.14	Ομοίως αντίρροπης και ομόρροπης ροής		
10.15	Ομοίως διασταυρούμενης λόγω φραγμάτων ροής		
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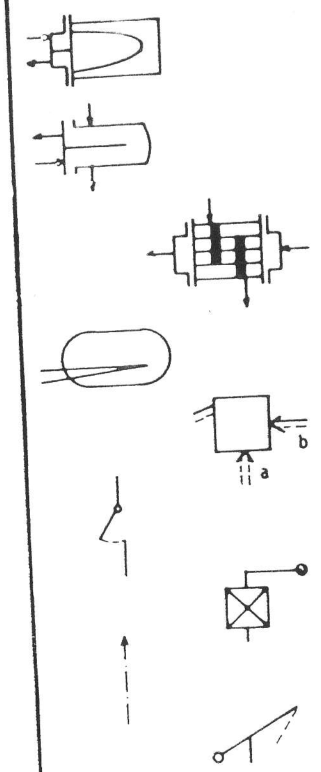
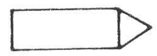
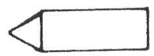
10.17	Αερόθερμο τοίχου a = ανακυκλοφορούμενος, b = εξωτερικός αέρας		8 x 8 mm
10.18	Φράκτης ρυθμίσεως ελκυσμού		
10.19	Βαλβίδα εξαερισμού		6 x 6 mm
10.20	Αερισμός, εξαερισμός		
10.21	Πυροστάτης		

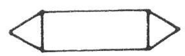


1.4. ΠΡΟΤΕΙΝΟΜΕΝΑ ΧΡΩΜΑΤΑ ΣΩΛΗΝΩΣΕΩΝ

Οι σωληνώσεις συνιστάται να βάφονται με κάποιο ουδέτερο χρώμα π.χ. γκρι. Φέρνουν όμως επ' αυτών επιγραφές ορθογώνιες με περίγραμμα λευκό και βέλος που δείχνει την κατεύθυνση της ροής ως εξής:

 Ροή προς τα δεξιά

 Ροή προς τα αριστερά

 Ροή προς αμφότερες τις κατευθύνσεις

Το εσωτερικό των επιγραφών βάφεται με χρώμα που αντιστοιχεί στο ρέον ρευστό, όπως στον πίνακα 1.

Πίνακας 1

Χρώματα σωληνώσεων

Ομάδα	Ρέον ρευστό	Χρώμα Ορθογωνίου	Βέλους
1	Νερό	Πράσινο	Πράσινο
2	Ατμός	Κόκκινο	Κόκκινο
3	Αέρας	Μπλε	Μπλε
4	Αέριο, καύσιμο	Κίτρινο	Κόκκινο
5	Αέριο, μη καύσιμο	Κίτρινο	Κίτρινο
6	Οξέα	Πορτοκαλί	Πορτοκαλί
7	Βάσεις	Ιώδες	Ιώδες
8	Υγρά, καύσιμα	Καφέ	Κόκκινο
9	Υγρά, μη καύσιμα	Καφέ	Καφέ
0	Κενό	Γκρι	Γκρι

Πρόσθετα διευκρινιστικά στοιχεία αναγράφονται μέσα στα ορθογώνια με γράμματα ή σύμβολα π.χ. στην ομάδα 2, p = 10 bar, t = 20°C, ή στην ομάδα 4, H_o = 37,5 MJ/Nm^3, p = 25 mbar ή στην ομάδα 6, H_2SO_4 n/10.

Για διάκριση οι σωληνώσεις θερμάνσεως και ψυχρού νερού δεν φέρουν βέλη. Το ορθογώνιό τους χωρίζεται σε τρία ή πέντε τμήματα το δε μεσαίο φέρει ενδεικτικό γράμμα διαφόρου χρώματος ως εξής:

Ατμός χαμηλής πιέσεως		H	Κόκκινο - κίτρινο - κόκκινο (H = μαύρο)
Συμπυκνώματά του		H	Πράσινο - άσπρο - πράσινο (H = μαύρο)
Θερμό νερό	Προσαγωγή	H	Πράσινο - άσπρο - πράσινο (H = κόκκινο)
	Απαγωγή	H	Ομοίως (H = μπλε)
Υπέρθερμο νερό	Προσαγωγή	H	Πράσινο - κόκκινο - άσπρο - - κόκκινο - πράσινο (H = κόκκινο)
	Απαγωγή	H	Ομοίως (H = μπλε)
Σωλήνας ασφαλείας	Άνοδος	SV	—
	Κάθοδος	SR	—

Θερμό νερό κοινής χρήσεως	Προσαγωγή	W	Πράσινο - άσπρο - πράσινο (W = κόκκινο)
	Ανακυκλοφορία	W	Ομοίως (W = ιώδες)
Κρύο νερό		W	Πράσινο - άσπρο - πράσινο (W = μπλε)

TecQuipment

TD800 STEAM POWER PLANT

INSTRUCTIONAL MANUAL

written by

Dr. M. A. Bell

Senior Lecturer, Plymouth Polytechnic, U.K

The equipment described in this manual is supplied by

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Should there be any items missing, the customer should contact the local TecQuipment agent or TecQuipment direct.

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LIST of SYMBOLS USED

Symbols

- E Heat Exchanger Effectiveness
- g Gravitational Acceleration
- h Specific Enthalpy
- N RPM
- p Pressure
- Q Heat Quantity
- s Specific Entropy
- v Velocity
- W Work Quantity
- z Datum height
- Δ 'difference'
- m Mass flow rate
- x Dryness fraction
- A Surface area
- C Specific Heat Capacity
- η Efficiency

Subscripts

- f Saturated liquid
- g Saturated vapour
- s Steam
- cw Cooling Water
- fu Fuel
- amb Ambient
- in Inlet
- out Outlet

Location reference numbers may also be used as subscripts (See System Diagram)

SECTION 1

GENERAL INTRODUCTION & DESCRIPTION OF THE PLANT

1.1 THEORY OF STEAM PLANT

A simple basic steam cycle is shown diagrammatically in Fig. 1. In theory the system is completely closed and the thermodynamic working fluid is pure steam or water. The system constitutes a heat engine, where heat is supplied, ($\dot{Q}_{in}$) by the boiler (or steam generator), mechanical power, ($\dot{W}_{out}$) is produced by the expander (an impulse turbine in this plant) as the high pressure steam expands to a lower pressure. Heat is rejected, ($\dot{Q}_{out}$) by the condenser. The cycle is closed by means of the feed pump which pumps the condensed steam (condensate) back into the boiler. A small amount of mechanical power is required to drive the feed pump, ($\dot{W}_{in}$).

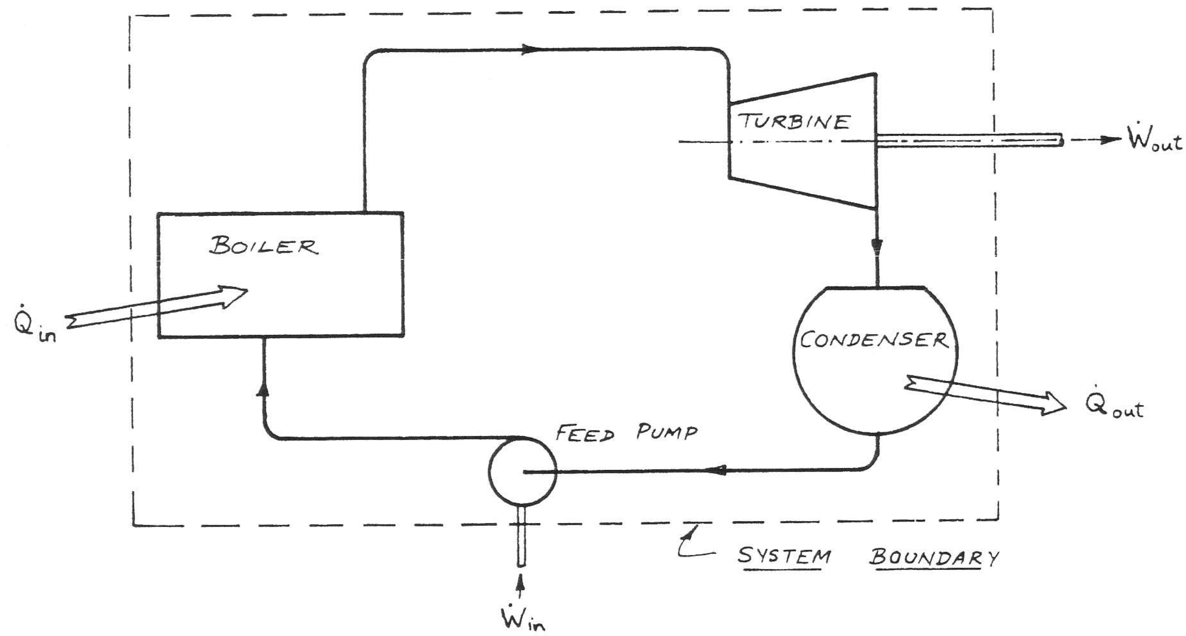


Fig. 1 Basic Steam Cycle

In the absence of any heat or frictional losses, and with steady state operation, an energy balance must exist such that:

$$\dot{Q}_{in} + \dot{W}_{in} = \dot{Q}_{out} + \dot{W}_{out}$$

The theoretical thermal efficiency of the heat engine is the ratio:

$$\eta_{th} = \frac{\text{Nett Mechanical Power Output}}{\text{Thermal Power Input}}$$

In practice real steam plant is very much more complex than that shown in Fig. 1 owing to the need to provide adequate and safe means of starting, controlling, and stopping the plant, providing for the transfer of heat to and from the system, compensating for leakage, preventing corrosion etc. Fig. 2 shows the actual steam plant in diagrammatic form.

The remainder of this Instructional Manual is written with the assumption that the reader is familiar with basic steam theory, aware of the properties of steam/water, and aware of the thermodynamic processes involved in the Rankine steam cycle.

The Bibliography gives a selection of reference material graduated from elementary texts to advanced material. The reader should select appropriate material from this list for further reading if required.

The Steam property tables and enthalpy/entropy chart (Mollier chart) used throughout is:

Thermodynamic Tables in S.I. (metric) Units 2nd edition
by R.W. Haywood (Cambridge University Press 1972)

S.I. (metric) units are used in all measurements and calculations.

1.2 PLANT DESCRIPTION

A diagrammatic scheme of the plant is shown in Fig. 2 and a general view of the plant is shown in Plate 1. Each component of the plant is described below.

1.2.1 The Boiler and Steam Accumulator (See Plate 2)

The GARIONI GMT-45 boiler is a water-tube boiler designed to produce a maximum steam flow of 450 kg/h at a pressure of 10 bar (gauge) and 270°C. i.e. It produces super-heated steam via a coiled tube superheater located at the end of the combustion chamber.

The boiler is oil fired and is equipped with a double flame automatic burner. Once started, the boiler is automatic in operation. It is fitted with all the necessary instrumentation, safety devices, controls and interlocks to ensure safe and correct operation.

Water is fed to the boiler continuously by one of the two reciprocating feed pumps located beneath the main body of the boiler. The feed pump operates at either a low or high speed depending on whether one or both burner flames is selected. The feed pump flow rates are such as to produce saturated steam which enters the steam accumulator.

If superheated steam is required (normal operation), the valves are set to direct the saturated steam from the accumulator to the superheater coils. If saturated steam is required, the superheater coils may be by-passed. Note that under these conditions provision is made to direct a flow of cooling water through the superheater coils to prevent their overheating.

The steam accumulator acts as a steam storage reservoir and allows a steady steam supply to be delivered irrespective of fluctuations in saturated steam supply. Condensate may form in the accumulator either because of heat loss from the accumulator or water carry-over from the saturated steam generator. The maximum condensate level is controlled by a bucket steam trap. If the condensate level rises beyond a safe level the boiler automatically shuts down. The condensate level may be observed on the sight glass situated on the side of the accumulator.

Further details concerning the boiler can be found from the Boiler Operation Handbook supplied.

1.2.2 The Turbine (See Plate 3)

The COPPUS RLA 12M turbine is a single-stage velocity compounded impulse turbine. The turbine wheel is 380 mm in diameter and its maximum permitted rotational speed is 3630 RPM, (the trip speed). It is has four steam nozzles, three of which can be shut off by hand valves.

Supplied with steam at 9 bar exhausting to -0.8 bar it is capable of supplying 8 kW at 3000 RPM with all steam nozzles open.

The turbine is directly coupled to the drive with no gear reduction. Integral with the turbine is its speed control governor which acts to maintain a steady turbine speed irrespective of the shaft power requirement (within its operational limits). The governor is self-contained with its own oil supply. In addition to the governor there is an over-speed trip which acts to shut off the steam supply completely if the turbine speed reaches or exceeds a dangerous level.

Consult the Turbine Operating Handbook for further details concerning the turbine. Instructions concerning the adjustments, maintenance and operation of the governor and over-speed trip can also be found in the Turbine Operating Handbook.

A general cross-section through the turbine is shown in Fig. 3.

1.2.3 The Condenser

The condenser is a simple single pass shell-and-tube heat-exchanger. Cooling water from the cooling tower enters one end of the condenser, while steam enters from the opposite end. Condensate drains by gravity into the condensate vessel.

The condenser normally operates under vacuum. The vacuum pump removes air from the condenser during plant operation.

A pressure relief valve is fitted to prevent the condenser from being subjected to excessive pressure, and a cooling water high temperature warning is also provided.

1.2.4 The Condensate Vessel

The condensate vessel is a closed container which receives condensate from the condenser. It has a total capacity of approximately 60 litres. The vessel is fitted with a float switch which turns the condensate extraction pump ON when the condensate level reaches its upper limit and OFF at its lower limit. The capacity between the float level switch settings is approximately 20 litres. The sight glass enables the condensate level to be ascertained. Air or steam is thus prevented from entering the condensate extraction pump. There are two condensate extraction pumps, only one of which is needed to operate the plant.

1.2.5 The Feed Water Tank (or Hot Well)

The feed water tank has a capacity of approximately 550 litres and acts as a water reservoir for the plant. Any water lost during plant operation would result in a reduction of water level in the feed tank. However, lost water is replaced by 'make-up' water which enters the feed tank from the water softener under the control of a float valve.
The sight glass enables the feed water level to be ascertained.

1.2.6 The Cooling Tower

The APV HALL PN16/600 cooling tower is a single cell, induced draft, cooling tower. It is designed to dissipate approximately 300 kW of heat at design conditions where the hot water temperature to the tower is 45°C and the ambient air wet bulb temperature is 29°C.

The cooling effect from a cooling tower is achieved by passing the hot water over packing material to give it a large exposed surface area. Air drawn across the packing in the opposite direction to the water flow causes evaporation where the majority of the latent heat required for evaporation is extracted as sensible heat from the water thus reducing its temperature.
The water lost by evaporation is made-up via a float valve which maintains the water level in the storage tank which forms the base of the cooling tower.

Further details of the cooling tower can be found in the Cooling Tower manual supplied.

1.2.7 The Automatic Water Softener

In order to, prevent the build-up of scale on the boiler tubes, it is necessary to remove from the supply water the dissolved minerals which cause it. This is accomplished by the ion-exchange water softener unit. Its operation depends on the substitution of low solubility ions (usually Ca^{++}) with high solubility ions (Typically Na^{+}).

The operation and regeneration of the water softening medium (the ion exchange resin) is accomplished automatically. Refer to the Water Softener Operation Manual supplied for further details concerning the water softening unit, and in respect of timing and when to replace the resin and regeneration salt.

A 25 litre drum of sulphite/phosphate/polymer (L7) boiler treatment is provided. This concentrated liquid solution for the prevention of corrosion and sludge formation can be added to the feed water tank. 1 litre should be added to the full tank of clean water before commissioning and replenished at the rate of 2 litres every 3 months.
Note: Prior to a long shut-down period it is recommended that the boiler tube is left filled with feed water which has been treated with 2 litres of L7 solution per full feed tank.

Reference 5 (Bibliography) gives further information concerning water softening and treatment.

1.2.8 The Electrical Control Console

The electrical control console contains all the electrical switches, controls and indicators necessary for plant operation except for the boiler which has its own control panel.

It also includes the dynamometer controls and indicators together with cooling water high temperature and high condensate level alarms.

The temperature and pressure at various locations on the plant may be selected and read on the digital readouts. The location from which the pressure or temperature is being read is shown by the illuminated lights on the mimic diagram situated above the control console.

See Plate 4 in order to identify each of the controls and indicators.

1.2.9 The Fuel Tank

The fuel tank has a capacity of 100 litres. It is fitted with a burette to enable fuel flow measurements to be made. The burette can be filled by means of the fuel hand pump when the fuel level is low.

The fuel tank can be filled from an externally located fuel reservoir using the hand pump.

1.2.10 Pumps

There are four electrically driven pumps required to operate the plant:

(1) The feed water pump (dual)-selected from the boiler control panel, runs continuously during boiler operation.
(2) The condensate extraction pump (dual) - switched either automatically, by the condensate vessel float switches, or manually.
(3) The vacuum pump - switched manually. It normally runs continuously during plant operation.
(4) The cooling water pump (dual) - switched manually. It normally runs continuously during plant operation.

1.2.11 Ancilliary Equipment

The plant is appropriately equipped with various small components which are generally termed 'ancilliary'. i.e. They perform necessary but secondary functions compared with the major components described above. They comprise:

(1) Safety valves - open to release steam if the pressure applied to them exceeds a preset level.

(2) Pressure regulating (or reducing) valves - maintain a constant downstream pressure irrespective of the steam flow. A pressure regulating valve is essentially a pressure controlled throttle valve.

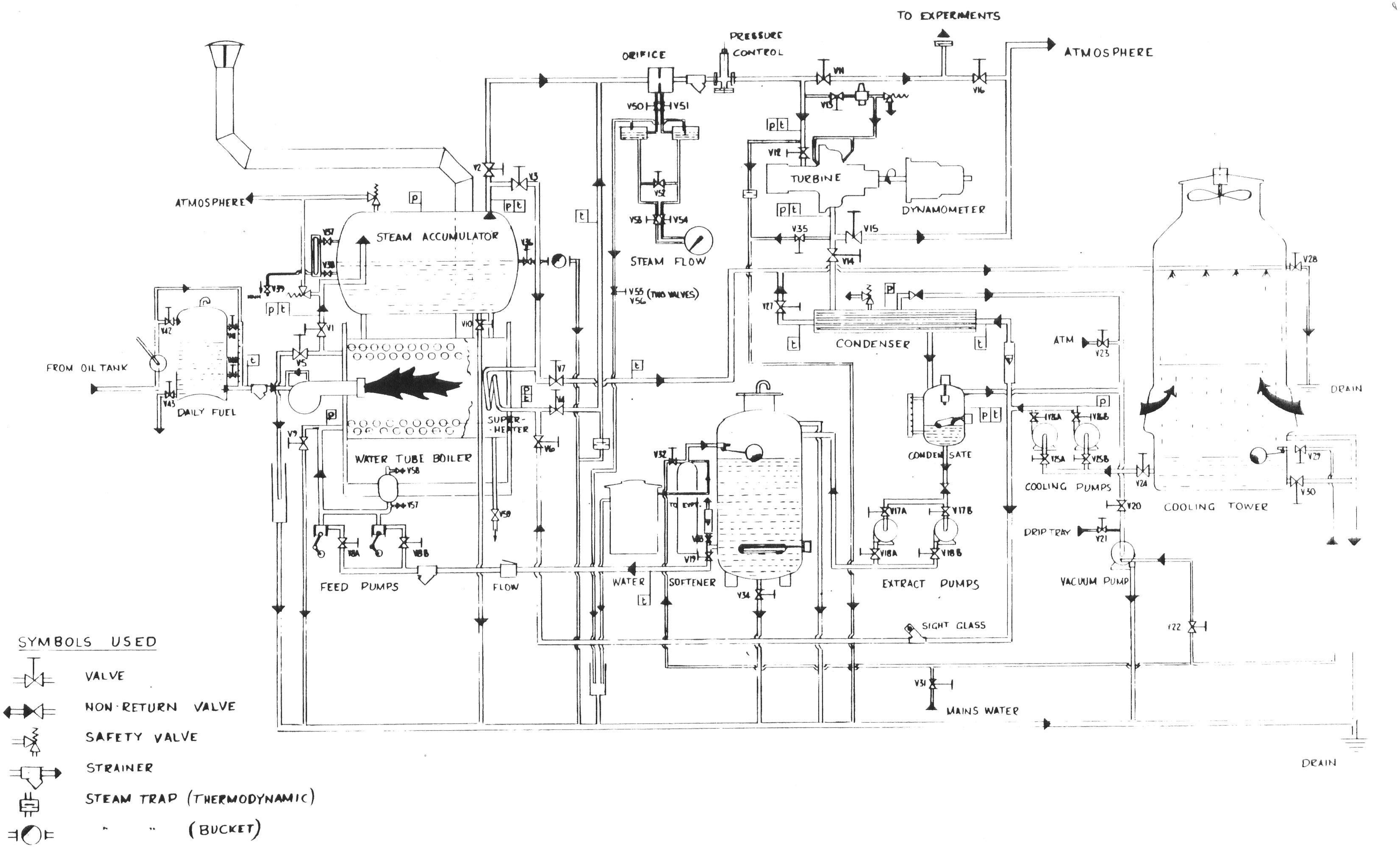
(3) Steam traps - prevent the escape of steam, i.e. The steam is 'trapped', but allow the escape of condensate which is discharged to drain.

(4) Non-return (or check) valves - permit the flow of fluid in one direction but prevent flow in the opposite direction.

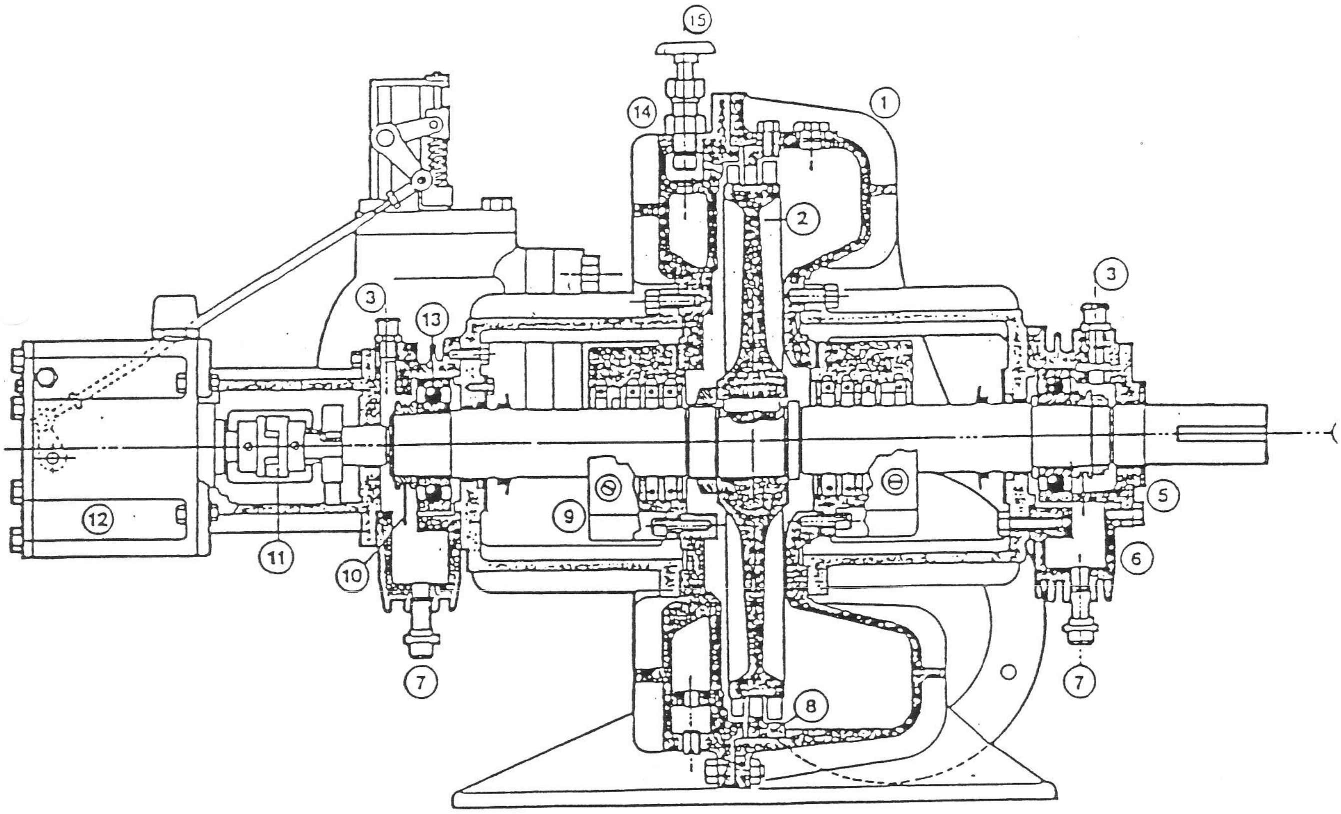
(5) Strainers (or filters) - trap particles of dirt or debris and prevent them from being circulated around the system where they could cause damage. Inspect strainers regularly and clean or renew them as necessary.

(6) Manual valves - hand operated valves allow, prevent or regulate the flow of fluid.

NOTES:



FLOW DIAGRAM TD800



TURBINE LEGEND

1 - Turbine casing
2 - Turbine rotor
3 - Oil plug
4 - Main shaft
5 - Bearing cover
6 - Bearing box
7 - Oil drain plug
8 - Fixed vane sector
9 - Oil seal assembly
10 - Lubrication ring
11 - Coupling joint
12 - Hydraulic governor
13 - Bearing
14 - Stator cover with nozzles
15 - Inlet valves

KEY TO PLATE 1

1 - Boiler & Accumulator
2 - Feed Tank
3 - Orifice & Gauge
4 - Turbine & Dynamometer
5 - Condenser
6 - Condensate Vessel
7 - Vacuum pump
8 - Condensate Extraction pumps
9 - Cooling water pumps
10- Fuel supply tank
11- Electrical Control Console
12- Mimic Diagram

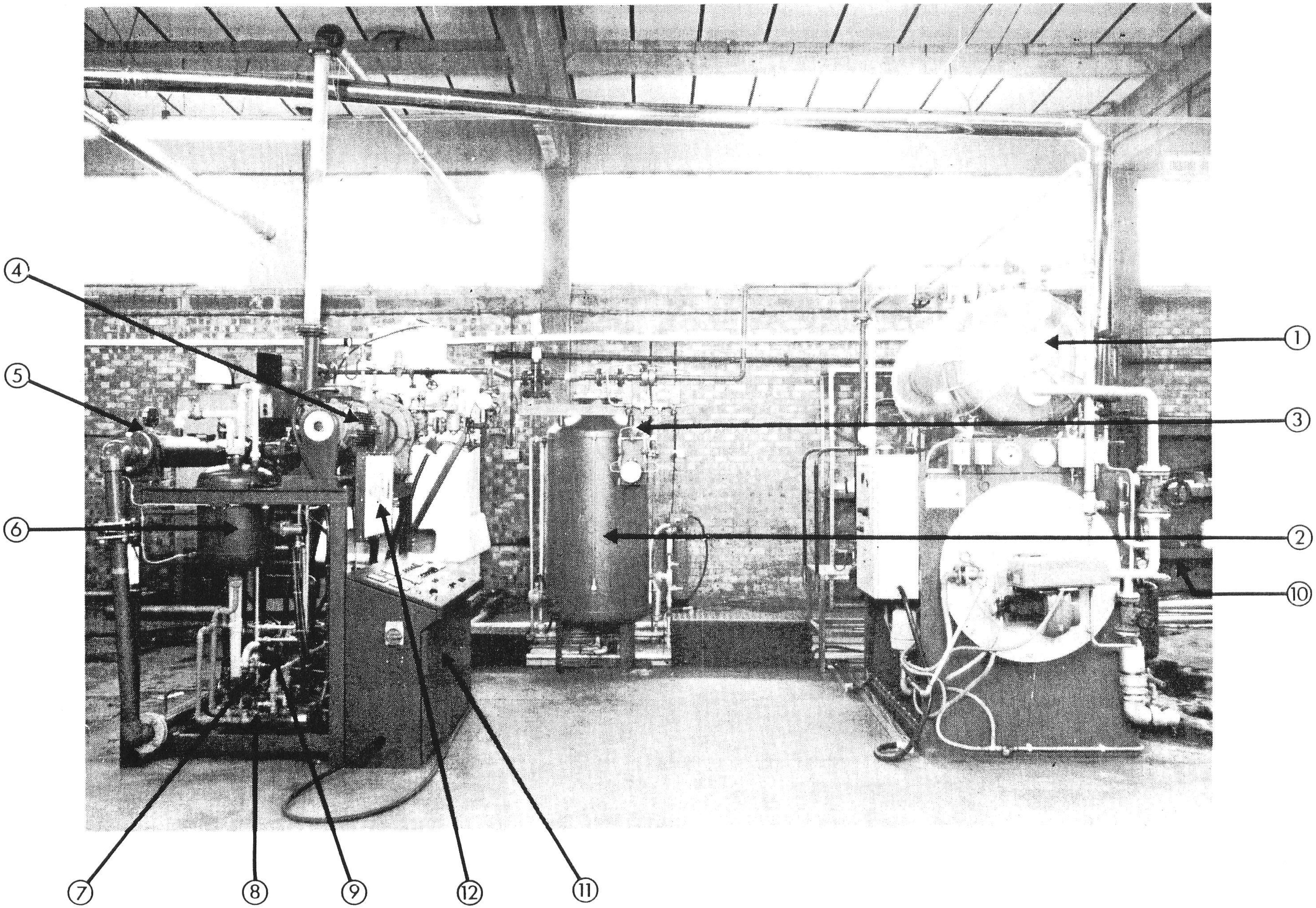


PLATE 1 OVERALL VIEW OF THE PLANT

KEY TO PLATE 2

1 - Burner
2 - Feed pumps
3 - Accumulator
4 - Sight glass
5 - Safety valves
6 - Control Panel
7 - Steam pressure gauge
8 - Saturated Steam Temperature Gauge
9 - Superheated Steam Temperature Gauge
10- Trips from left to right:-
    Maximum feed water pressure
    Maximum steam pressure (sealed)
    Burner/Feed pump HI / LOW pressure set
    Burner cut-out pressure set
11- Feed pump hydraulic accumulator

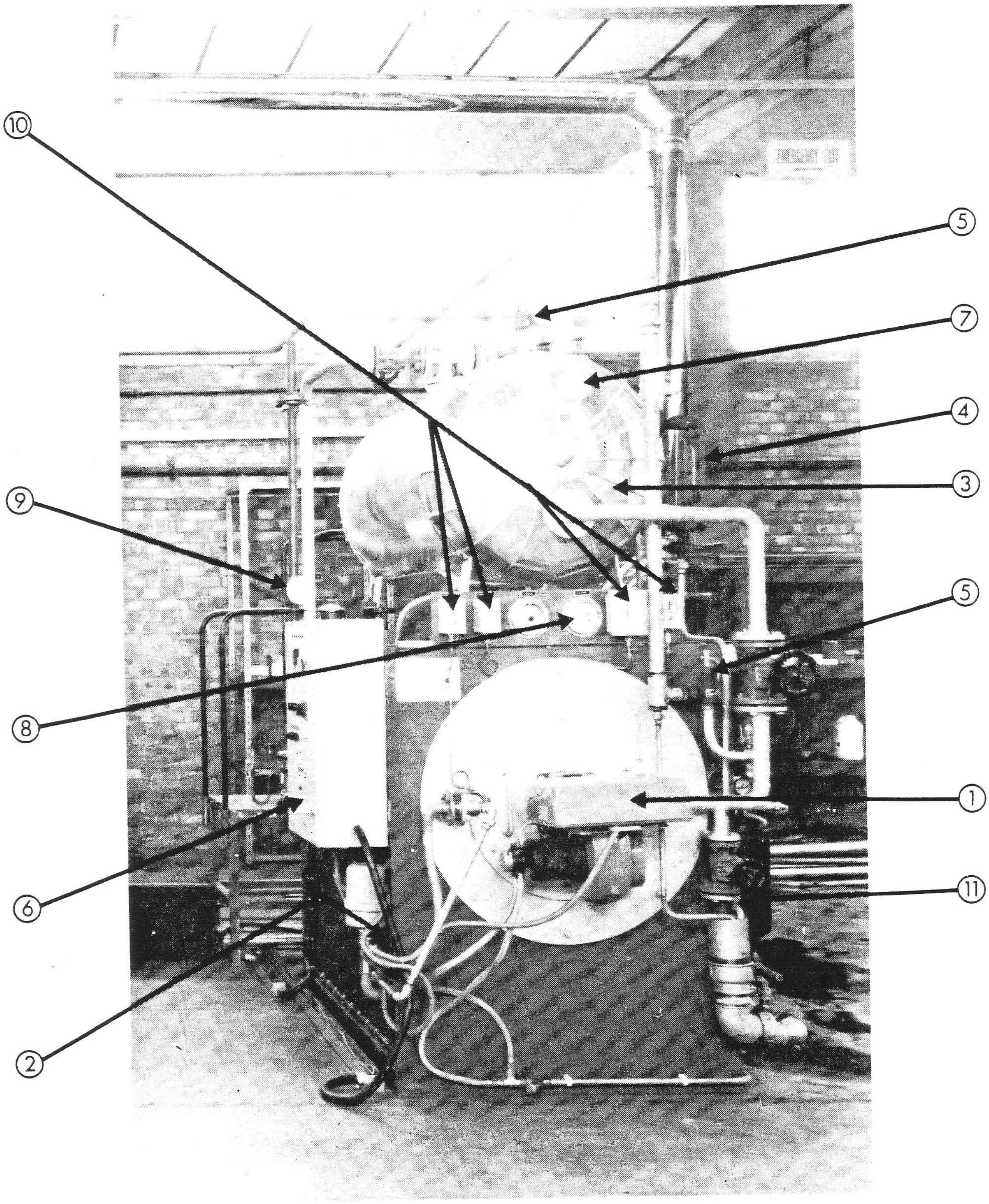


PLATE 2 THE BOILER AND ACCUMULATOR

KEY TO PLATE 3

1 - Turbine
2 - Governor
3 - Overspeed Trip valve
4 - Steam inlet valve
5 - Steam exhaust valve
6 - Dynamometer
7 - Nozzle hand wheels

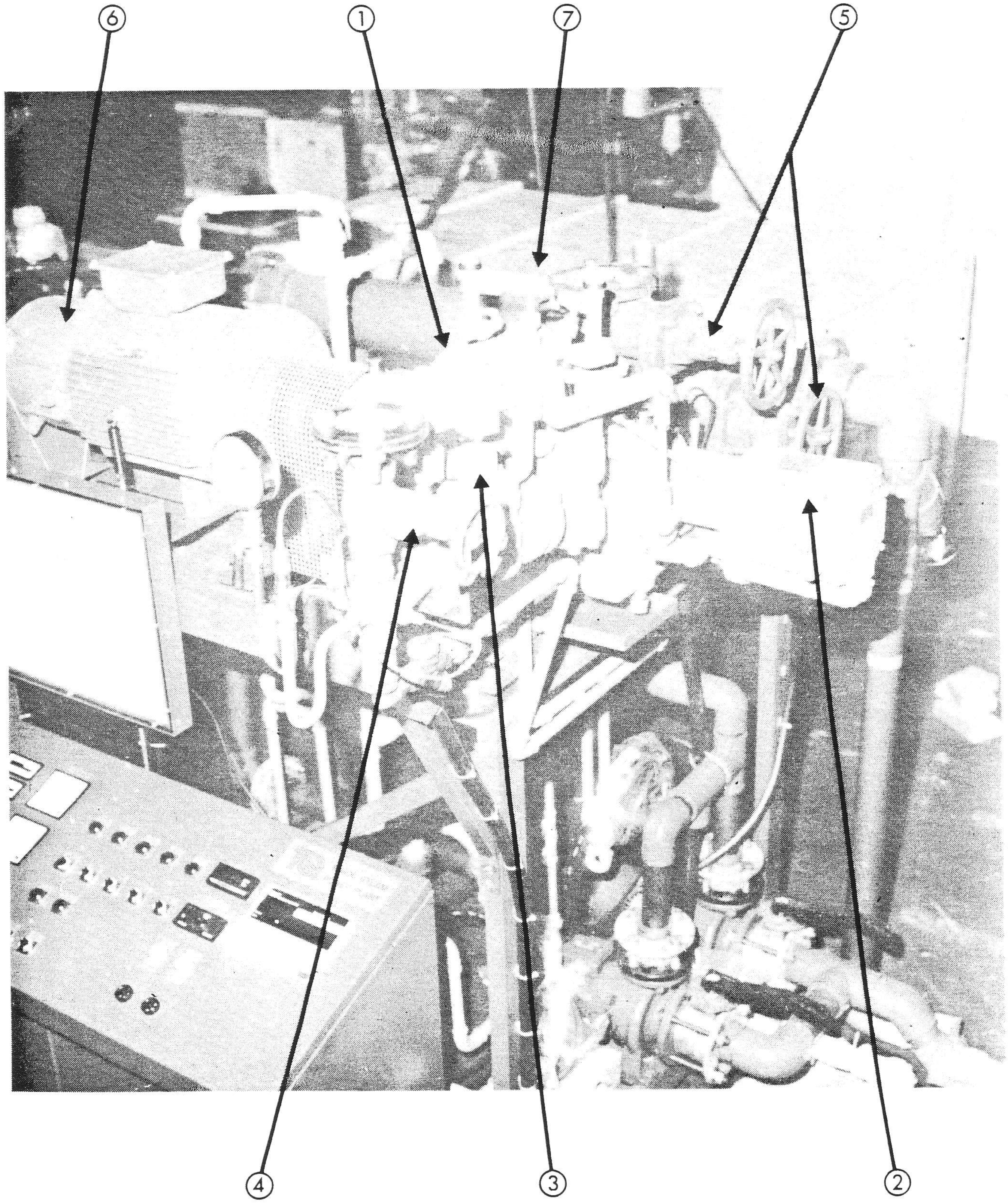


PLATE 3 THE TURBINE

KEY TO PLATE 4

1 - Master Switch
2 - Dynamometer Armature Amps / Volts Indicator
3 - Dynamometer Field Amps / Volts Indicator
4 - Dynamometer Control Rheostat
5 - Turbine Torque Indicator (Digital + Analogue)
6 - Turbine RPM Indicator (Digital + Analogue)
7 - Switches fcr Vacuum pump
Cooling water pumps
Cooling tower fan
Condensate Extract pumps
8 - Digital Pressure Indicator & Selector
9 - Digital Temperature Indicator & Selector
10 - Cooling Water High Temperature Warning Light & Siren
11 - Condensate High Level Warning Light & Siren

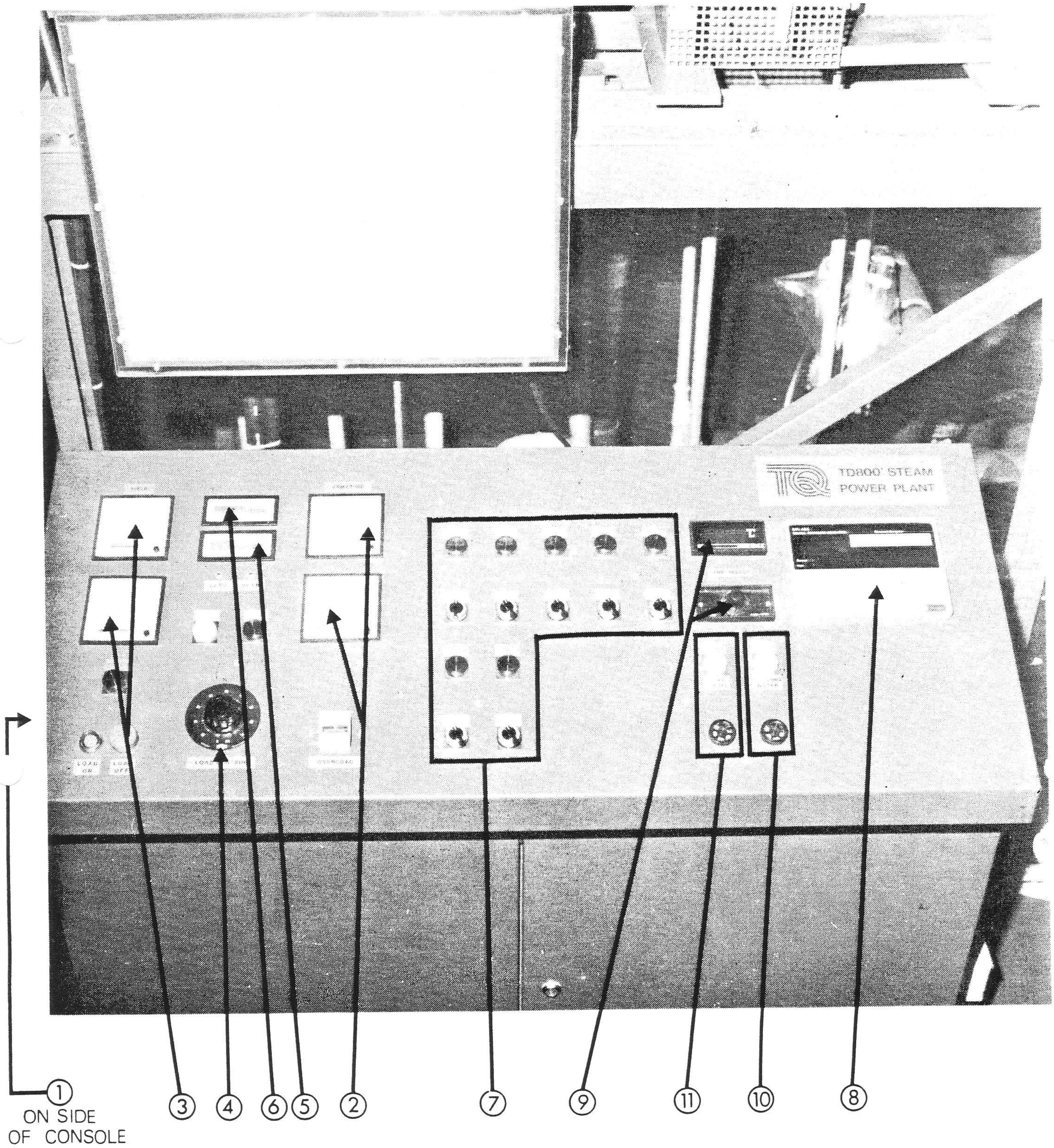


PLATE 4 THE ELECTRICAL CONTROL CONSOLE

SECTION 2

LIST of EXPERIMENTS

2.1 STANDARD EXPERIMENTS

Using the Plant and Instrumentation as supplied by TECQUIPMENT the following experiments may be accomplished:

(1) Measurement of Steam Mass Flow.

(2) Determination of Boiler Efficiency.

(3) Determination of Turbine Isentropic Efficiency.

(4) Determination of Steam Cycle Thermal Efficiency.

(5) Determination of Overall Plant Efficiency.

(6) Determination of Heat-Exchanger Effectiveness and Overall Heat Transfer Coefficient.

(7) Steady State Energy Analysis on each Plant Component.

(8) Measurement of Insulation effectiveness.

2.2 DEMONSTRATIONS

The basic principles and practise of steam generating plant operation may be demonstrated using the experimental plant. However, because of the small scale nature of this experimental plant the demonstrations should not be regarded as typical of large scale steam plant without proper cognisance of the differences which occur between small and large scale plant. For example, this plant does not incorporate feed-heaters, air pre-heaters, economisers, re-heaters or multi-stage turbines, all of which would normally be used in typical large scale plant.

All aspects of starting and running and shut-down as described in Section 4 may be demonstrated together with operation of some of the safety features.

Demonstration of the turbine being exhausted direct to atmosphere rather than into the condenser may also be performed, but it is not recommended that the plant be operated for long periods in this mode in order to avoid large amounts of water passing through the water softener, and requiring renewal of the feed water treatment (L7).

2.3 FURTHER EXPERIMENTS

If additional equipment is available further experiments may be performed such as described below:

(1) Using Gas Analysis Equipment:

- Dry Exhaust Gas Analysis O_2 and CO
- Determination of Air/Fuel Ratio using the gas analysis results
- Determination of the Combustion Efficiency.

(2) Using Airflow Measuring Equipment and a Hygrometer:

- Determination of the Cooling Tower Performance.

(3) Using Boiler Water Analysis Equipment:

- Chemical analysis of the boiler water.

(4) Using a Throttling Calorimeter:

- Determination of the steam dryness fraction.

NB This manual does not give details of the above experiments. Further information can be found from references given in Section 9, or from Instruction Manuals which would be supplied with the above equipment.

SECTION 3

INSTRUMENTATION

Instruments are provided in order to monitor the plant during operation, and to measure its performance. The following describes each instrument and its use according to its function.

3.1 COMBUSTION SYSTEM

3.1.1 Fuel Flow

A burette and auxilliary reservoir is connected to the fuel tank and may be used to measure the fuel flow rate to the burner with the aid of a stopwatch, (not supplied).

To measure the fuel flow rate:

(1) Close the main fuel supply valve (V40) thus allowing the burner to be fed from the burette.

(2) Fill the burette with fuel (if necessary) by closing the burette vent valve (V41) and operating the hand pump.

(3) Time the period required for the fuel to fall between the zero and 250 ml levels on the burette.

(4) OPEN the main fuel supply valve (V40) IMMEDIATELY to avoid fuel starvation to the burner.

3.1.2 Fuel Temperature

The fuel temperature is read directly by selecting location [8] on the control console temperature selector.

3.1.3 Flue Gas Temperature

The flue gas temperature is read directly by selecting location [10] on the control console temperature selector.

3.1.4 Flue Gas Analysis

A gas sample can be taken from the tap at the base of the flue,and analysed with direct readout of O_2 and CO .

3.2 STEAM CIRCUIT

3.2.1 Boiler pressure

The boiler pressure is read directly on the 0 to 20 bar pressure gauge situated at the front of the boiler. The accumulator steam pressure may also be read directly on the 0 to 20 bar pressure gauge situated on the front of the accumulator.

NOTE: ALL pressure gauges and the digital pressure indicator show GAUGE pressure. In order to convert GAUGE pressure to ABSOLUTE pressure (required when using steam tables or charts) ADD the current atmospheric pressure. If a barometer is not available assume a standard sea level atmospheric pressure of 1.013 bar corrected for altitude.
Convert the pressure reading to appropriate S.I. units:

To convert bar to kPa: MULTIPLY by 100
To convert bar to MPa: DIVIDE by 10

3.2.2 Accumulator Condensate Level

The accumulator condensate level is shown directly on the sight glass fitted to the accumulator.

3.2.3 Steam Pressure and Temperature

The SATURATED steam pressure and temperature (from the accumulator) may be read directly by selecting location [1] on the control console pressure and temperature selector respectively.

The SUPERHEATED steam pressure and temperature (from the superheater coils) may be read directly by selecting location [2] on the control console pressure and temperature selector respectively.

3.2.4 Steam Flow Rate

The steam flow rate from the boiler is measured using the pressure differential across a stainless steel orifice plate installed in the steam main. The differential pressure is measured on a differential pressure gauge which is calibrated directly to indicate steam flow in the range 0 to 500 kg/h.

Note that this gauge has been calibrated for steam at 10 bar(absolute)and 250°C, (density 4.2955 kg/m^3). For other steam conditions an appropriate correction for density must be applied. See Section 7.1.

To measure the steam mass flow rate proceed as follows:

(1) Check that valves V52, V53 and V54 are CLOSED, then OPEN orifice line valve V50. OPEN its associated drain valve (V55) slowly to allow air and excess condensate to escape to drain. CLOSE the drain valve when only steam issues freely from the drain.

(2) Repeat the above procedure with valve V51 and its drain valve (V56).

(3) OPEN both pressure gauge valves V53 & V54 slowly and once the differential pressure level has stabilised read the steam flow rate.

(4) All valves (except V52) may be left open to monitor steam flow rate. Periodically crack open the drain valves to prevent the orifice lines becoming filled with condensate, <u>but always close isolating valves V53 and V54 when draining</u>.

(5) Close all valves when finished with the steam flow meter but open both drain valves to prevent vacuum as the system cools. Close the drain valves when the system has cooled to room temperature.

3.2.5 Turbine Inlet Steam Pressure and Temperature

The steam pressure supplied to the turbine (upstream of the governor controlled throttle valve) is read directly on the 0 to 16 bar pressure gauge.

The pressure and temperature of the steam supplied to the turbine is also read directly by selecting location [3] on the control console presure and temperature selectors respectively.

3.2.6 Turbine Exhaust Steam Pressure and Temperature

The turbine exhaust pressure is read directly on the -1 to 2 bar pressure gauge (located on the condenser).

The pressure and temperature of the turbine exhaust steam is also read directly by selecting location [4] on the control console presure and temperature selectors respectively.

3.2.7 Condenser Pressure

The condenser pressure is read directly on the -1 to 2 bar pressure gauge fitted to the condenser.

3.2.8 Lagging Temperature

The inside and outside temperature of the lagging may be read directly by selecting locations [11] and [12] respectively on the control console temperature selector.

3.3 CONDENSATE CIRCUIT

3.3.1 Condensate Pressure and Temperature

The pressure and temperature of the condensate in the condensate vessel is read directly by selecting location [5] on the control console presure and temperature selectors respectively.

3.3.2 Feed Water Temperature

The temperature of the feed water leaving the feed tank is read directly by selecting location [9] on the control console temperature selector.

3.3.3 Feed Water Flow Rate

The average feed water flow rate is found by timing a reasonable change in the feed water totalising meter readings.

3.4 CONDENSER COOLING WATER CIRCUIT

3.4.1 Condenser Cooling Water Inlet and Exit Temperature

The condenser cooling water inlet and exit temperatures are read directly by selecting locations [6] (inlet) and [7] (exit) on the control console temperature selector.

3.4.2 Condenser Cooling Water Flow Rate

The condenser cooling water flow rate is measured by an indirect flow meter across an orifice installed in the cooling water inlet pipe. The flow meter is calibrated to measure the primary flow. The flow rate range is 8 to 40 m^3/h. Sight across the top of the float.

3.5 THE TURBINE

3.5.1 Turbine Speed

The turbine speed [N] is read directly on the digital tachometer in revolutions per minute (RPM).

3.5.2 Turbine Torque

The torque developed by the turbine [T] is read directly from the digital torque indicator in Newton-meters (N.m).

NOTE: The turbine power output is given by:

$$W = 2 * \pi * N * T / 60{,}000 \qquad \text{kW}$$

3.6 SAFETY INSTRUMENTATION

See Section 4.2 regarding the use of these instruments.

3.6.1 Superheater Coil Cooling Water Flow and Temperature.

A flow detector is provided to show whether there exists a positive flow to the superheater coils. A temperature indicator (0 to 120°C) monitors the cooling water temperature leaving the superheater coils.

3.6.2 Saturated Steam Temperature

A temperature gauge (0 to 300°C) is located on the front of the boiler to monitor the temperature of the steam supplied to the accumulator.

SECTION 4

SAFETY PRECAUTIONS and NORMAL OPERATING PROCEDURE

4.1 GENERAL SAFETY PRECAUTIONS

Nothing contributes more to the safe operation of a plant than a thorough knowledge of its working principles. Steam can be dangerous! Its saturation pressure rises rapidly with temperature and its working temperature and heat content alone is sufficient to inflict severe burns.

The plant has built-in safety features and various functions such as the accumulator condensate level and turbine speed are controlled or limited automatically.

The following sections describe the MAJOR safety precautions which need to be observed, but do not purport to cover every aspect of plant safety. The plant operator carries the immediate responsibility for safety and must therefore be thoroughly familiar with every aspect of the plant and its operation.

4.1.1 Burner (or Combustion System)

Observe the burner operating instructions carefully. If the burner fails to ignite promptly check for a fault condition as described in the Boiler Operation Handbook. Consistent failure to ignite promptly indicates that the burner needs servicing or that there may be a problem with the fuel (wrong type, contamination etc.).

Failure to ignite can result in an accumulation of unburnt fuel within the boiler which can subsequently ignite explosively causing damage. Do not proceed with more than TWO attempts at ignition without investigating the cause and checking to ensure that unburnt fuel has not accumulated within the boiler.

It is essential to use fuel of the correct specification. Keep the fuel clean. Do not pump fuel from the very bottom of a fuel container. Keep fuel tank closures in place except when filling. Guard against the ingress of insects or animals. Prevent water, dust, grit etc from entering the fuel.

4.1.2 Boiler (or Steam Generator)

The boiler is essentially a heat-exchanger where heat is transferred from the hot combustion gases to the water, which undergoes a change of phase to steam.

It is essential that the temperature of the boiler tubes (including the superheater tubes) remain within safe limits, and this means that they must be supplied with water at all times when the burner is in operation. If the water supply falls below a safe level the water tubes can become too hot causing distortion, weakening, or at worst, fracture or bursting under pressure. Under these conditions the saturated water temperature will exceed the set limit and the boiler will be automatically shut down.

If too much water is fed to the boiler it will be carried over into the accumulator. Take remedial action if the accumulator condensate level rises faster than is normal.

The pressure in the boiler and accumulator will increase if the heat transfer rate from the combustion gases is greater than that required to satisfy the steam demand. Pressure control is effected either by varying the steam demand or by varying the fuel flow rate. In normal operation the fuel flow rate is controlled by the boiler pressures set on the pressure switches situated on the front of the boiler. Low steam demand will result in a higher boiler pressure than will high steam demand. Consistently higher or lower boiler pressure than normal for a given steam demand is cause for investigation into the burner, or it may indicate scaling of the boiler tubes.

The boiler is equipped with two safety valves which will release steam if the pressure exceeds set levels. Do not tamper with the safety valves. They should be checked for correct operation regularly.

4.1.3 Turbine

The main feature concerning turbine safety is to guard against over-speed which can cause the turbine wheel to fracture. Although the turbine is speed regulated by a governor-controlled throttle valve and has an over-speed trip, failure or seizure of these mechanisms could lead to an over-speed condition. If such a condition occurs the turbine steam inlet valve (V12) or main steam valve (V2 or V3) must be closed as quickly as possible. Shutting down the boiler will not necessarily prevent an over-speed accident owing to the 'stored' steam within the accumulator.

Maintain the turbine governor and over-speed trip mechanisms in good condition. Refer to the Turbine Maintenance Handbook.

Keep loose clothing, long hair etc away from exposed moving parts of the turbine.

4.1.4 Dynamometer

The dynamometer must not be allowed to over-speed. The above precautions for the turbine also apply to the dynamometer.

4.1.5 Condenser and Condensate Vessel

Over-pressure of the condenser and condensate vessel must be avoided. Such a condition could occur if the cooling water supply to the condenser failed during operation of the plant. If the condenser safety valve blows or the high cooling water temperature alarm operates, shut down the plant and ascertain the cause.

The condensate vessel has a high liquid level alarm fitted. If this alarm operates check that the condensate extraction pump is operating and that the non-return valve is working properly.

4.1.6 Pumps

If the plant is not used frequently the pumps may become seized. A motor burn-out will occur if a seized pump is energised for more than a few seconds. If a pump fails to rotate switch off the electrical supply to it and ascertain the cause. Excessive noise or leakage from a pump usually indicates that maintenance is required. A noisy vacuum pump may indicate that the pump is insufficiently loaded. Try opening valve V21 slightly.

Where there are dual pumps it is good practise to use the pumps alternately in such a way as to give both pumps approximately equal use. In this way deterioration due to non use will be avoided.

4.1.7 Further General Safety Guidelines

Do not attempt to carry out maintenance or unauthorised adjustments while the plant is operating.

When opening or closing steam valves fully always back off from the stop by approximately a quarter of a turn. This helps prevent valve seizure owing to differential thermal expansion when the plant is warming up or cooling down.

Wear protective gloves or use a valve spanner to operate valves whose hand wheels are hot.

Do not knock or hit the glass fronts of pressure gauges or the glass tubes of level indicators or manometers. Glass breakage can be both dangerous and disruptive.

NOTES:

4.2 OPERATING PROCEDURE

The following procedure should be followed to enable the plant to be operated at a condition corresponding to approximately its maximum overall efficiency.

Refer to Fig. 2 and Plates 1 & 2 to identify valves and controls.

The procedure is divided into four stages:-

1. Pre-start checks.
2. Steam raising
3. Turbine operation
4. Shut down

4.2.1 Pre-start checks

1. Ensure that the control console master switch is OFF and all electrical switches on the control console and boiler control panel are in their OFF or MIN position.

2. Ensure that sufficient fuel is available to complete the run. If necessary top up the daily fuel tank by opening valve V42 and actuating the fuel hand pump. CLOSE valve V42 when the tank is full.

3. Check that all valves are CLOSED except:

   - Isolating valves fitted to all pressure gauges, pressure transducers and level gauges. These valves are not labelled since they normally remain OPEN.

   - The mains water supply valve (V31) and the mains supply valves to the cooling tower and water softener circuit to the feed tank. (V29,V32).

   - Condenser cooling water circuit valves. (V24,V25A/B,V26A/B,V27)

   - Condensate extraction pump valves V17A/B and V18A/B.

4. Remove, clean and replace the strainer in the steam main.

5. Ensure that the turbine throttle linkage can be moved by hand. Also check that the turbine-dynamometer can be rotated by hand, and that the turbine over-speed trip is set. Top up the oil in the turbine bearing housings and the governor to their correct levels.

6. Check that the condensate vessel is empty. If not energise the condensate extraction pump until the vessel is empty, then turn OFF.

7. Check that the cooling tower water reservoir and the feed tank are full.

8. Check that the water softening unit is connected and working.

9. Check that all drains are clear and unobstructed.

4.2.2 Steam raising

1. OPEN the following valves:

   -All valves in the feed water supply line. (V19,V8A/B)
   -Superheater inlet and outlet valves. (V3 and V4)
   -Turbine by-pass valve and atmospheric exhaust valve. (V11 and V16)
   -The main fuel supply valve. (V40)
   -Accumulator steam trap valve. (V36)

   Check that the superheater cooling water valves, V6 & V7 are fully closed.

2. Partly OPEN saturated steam by-pass valve V5.

3. Turn the control console master switch to ON. (The SUPPLY ON warning light should illuminate). This supplies power to the boiler control panel.

4. Press the (green) superheater tube high temperature warning reset button to allow power to the boiler control panel. Turn the boiler control panel master switch ON.

5. A number of warning indicators should illuminate on the boiler control panel. Reset them by pressing the RESET button on the control panel All warning lights except the POWER ON and LOW FEED WATER FLOW warning lights should extinguish.

6. Select the feed pump whose valve was opened in Step 1, and then select feed pump ON. Check that water flows from valve V5 to drain, and that the LOW FEED WATER FLOW warning light extinguishes.

7. Select LOW BURN, then select BURNER ON.
   The burner should commence its automatic purge and ignition cycle. Check for the presence of flame. If the burner malfunctions, switch OFF and rectify the fault before proceeding.

8. When steam issues from valve V5 to drain (this will take approximately 5 - 10 mins), OPEN valve V1 to allow steam to enter the accumulator, and slowly CLOSE valve V5.

9. Check that steam issues from the atmospheric vent and monitor the superheat temperature. It should not exceed 300°C.

10. Allow a few minutes for the steam to exhaust to atmosphere to clear the steam main of air and debris, then partially CLOSE the steam by-pass valve V11. DO NOT COMPLTETLY CUT OFF THE STEAM FLOW. THIS WILL DEPRIVE THE SUPERHEATER TUBES OF STEAM FLOW AND COULD CAUSE THEM TO OVERHEAT.

11. Once the boiler pressure reaches approximately 4 bar select HIGH BURN. Note that the feed pump speed will automatically increase. Allow the boiler to reach its normal operating pressure.

12. The boiler will now continue to operate automatically.
    If the boiler pressure exceeds the lower set limit the burner will automatically run on low burn. If the pressure exceeds the higher set limit (but below the sealed absolute safety limit) the burner will turn off. The burner will automatically reignite when the pressure falls.

4.2.3 Turbine operation (Vacuum Exhaust)

1. OPEN the turbine exhaust valve (V14) and all turbine nozzle valves.

2. OPEN vacuum valve (V20). OPEN vacuum pump mains water supply valve (V22) one turn. Turn the vacuum pump, condenser cooling water pump and cooling tower fan switches ON. Turn the condensate extraction pump switch to AUTO. Adjust the cooling water exit valve (V27) to give a flow of approximately 25 m^3/h.

3. Wait until the vacuum gauge reads approximately -0.8 bar then slowly OPEN valve V13 to allow steam to the carbon ring sealing glands.

4. Turn the governor speed adjusting screw to its MINIMUM speed position if it is not already in that position.

5. Gradually OPEN the turbine steam inlet valve (V12) and allow the turbine casing to warm up slowly. Continue to open the valve and allow the turbine to rotate. The bypass valve (V11) may now be CLOSED.

6. Continue to OPEN the turbine steam inlet valve (V12) slowly until the governor assumes speed control at the low speed setting. If the governor fails to regulate the speed at the low speed setting shut down the plant and ascertain the cause.

7. Once speed control has been established and the turbine is thoroughly warmed through, OPEN the turbine steam inlet valve fully and adjust the speed setting screw to a speed of approximately 3200 RPM. The speed should fall to 3000 RPM when the turbine load is increased.

8. The turbine load may now be applied using the electrical dynamometer. Turn the field switch ON and CLOSE the armature circuit breaker. Increase the electrical load by rotating the excitation rheostat clockwise until the turbine speed falls to approximately 3000 RPM.
   It is recommended that the load be applied steadily so as to avoid sudden high steam demand which will cause an excessive fall in boiler pressure, but not too slowly otherwise the boiler will trip out owing to high superheat temperature.

9. At this condition the plant is operating at its maximum efficiency.

   The turbine operating conditions may be varied by:

   - Changing the electrical load. NB Increasing the electrical load will control the turbine speed on load rather than by the governor.

   - Changing the speed using the speed setting screw. Do not exceed 3000 RPM.

   - Reducing the number of nozzles in use on the turbine.

   - Changing the inlet steam pressure by throttling using the turbine inlet valve (V12).

   - Changing the back pressure by throttling using the exhaust valve (V14).

10. During running monitor all pressure and temperatures and note any anomalies in the boiler operating log.

4.2.4 Shut down

1. Slowly CLOSE the turbine steam inlet valve (V12), and crack the bypass valve (V11) OPEN. Close valve V13 when the turbine ceases to rotate. (NB For a temporary shut-down CLOSE V12 only).

2. On the boiler control panel select BURNER OFF. CLOSE valve V1 and slowly OPEN valve V5. Turn the feed pump OFF when the saturated steam temperature reaches approximately 100°C.

3. CLOSE the fuel valve (V40).

4. On the control console turn the vacuum pump, condenser cooling water pump and cooling tower fan OFF. CLOSE valve V22. If the condensate vessel is not empty turn the condensate extraction pump to MANUAL and when the vessel is empty turn it OFF.

5. Turn the excitation rheostat fully anticlockwise. Turn the field switch OFF, and OPEN the armature circuit breaker.

6. Turn OFF the electrical master switches on both boiler and control console. OPEN the turbine exhaust drain valve, (V35).

7. Allow the boiler to cool to approximately ambient temperature then CLOSE all valves. If the boiler is to be left unused for a long period of time it is usual to flood it to prevent corrosion. Follow the instructions given in the Boiler Operating Handbook.

4.3 ALTERNATIVE OPERATING MODES

4.3.1 Turbine (Atmospheric exhaust)

1. Reduce the dynamometer load to zero.
2. Close turbine steam supply valve V12.
3. Turn the vacuum pump OFF, and CLOSE valve V22.
4. Slowly OPEN the atmospheric exhaust valve V15, then close the condenser exhaust valve V14.
5. Slowly re-open valve V12 and restore the dynamometer load.

Do not run for long periods in this mode to avoid excessive make-up water passing through the water softener.

Reverse the above procedure to return to vacuum exhaust running.

4.3.2 Saturated steam supply

In order to operate with saturated steam only the superheater coils must be kept cool by passing condenser cooling water through them.

DO NOT ATTEMPT TO CHANGE TO SATURATED STEAM IMMEDIATELY FROM OPERATING WITH SUPERHEATED STEAM.

The introduction of cold water to the hot superheater tubes could cause sudden steam formation and the thermal shock may damage the superheater tubes. Shut the plant down and allow the boiler to cool before restarting as directed below:-

1. Carry out the pre-start checks as directed in Section 4.2.1.
2. OPEN saturated steam supply valve V2.
3. CLOSE superheater inlet and outlet valves V3 and V4.
4. OPEN superheater cooling inlet and outlet valves V6 and V7.
5. Switch control console master switch ON, then turn the condenser cooling water pump and cooling tower fan switches ON.
6. Check that the flow indicator shows a positive water flow through the superheater tubes.
7. OPEN valves V19, V8A/B, V11 and V16.
8. OPEN accumulator steam trap valve V36 and fuel valve V40.
9. Now continue with the procedure for steam raising in Section 4.2.2 at STEP 4 and subsequent steps.

When the boiler is operating steadily saturated (or near saturated) steam will be supplied.

Operate the turbine according to the procedure given in Section 4.2.3 except that it will obviously not be necessary to switch on the cooling water pump and cooling tower fan because they will be operating already.

During operation monitor the superheater cooling water discharge temperature. If it approaches 100°C shut down the boiler and check for sufficient flow to the tubes.

4.3.3 To revert to superheated steam operation

1. Reduce the dynamometer load to zero and close valves V12 and V13 to isolate the turbine.

2. Fully OPEN the bypass valve V11. Saturated steam will now be vented to atmosphere.

3. Fully CLOSE superheater cooling inlet and outlet valves V6 and V7.

4. IMMEDIATELY OPEN valve V4.
   Do not delay in doing this otherwise the water trapped in the superheater tubes could expand and fracture the superheater tubes.

5. Slowly OPEN valve V3 and CLOSE valve V2. The water in the superheater tubes will be blown through the steam main and out through the atmospheric vent. Allow sufficient time to ensure that all water has been blown clear.

The boiler is now supplying superheated steam and the turbine may be restarted as described in Section 4.2.3.

- -

WARNING

THE STEAM AND SUPERHEATER COOLING WATER CIRCUITS MUST NEVER BE CONNECTED. i.e. WHEN VALVES V6 AND V7 ARE OPEN, VALVES V3 AND V4 MUST BE CLOSED, AND VICE VERSA.

- -

SECTION 5

CALIBRATION of MEASURING INSTRUMENTS

The indication of any instrument is never absolutely accurate. Every instrument indicates a measurement which is within certain limits of the true value. These limits (or tolerance) are a measure of the instrument's accuracy. Provided the limits are within a range which is acceptable for our purposes the instrument is regarded as satisfactory.

It is recommended therefore that the accuracy of the instruments be checked at least annually.

The accuracy of instruments is typically checked in one of two ways:

(a) By comparison with an instrument whose accuracy is at least an order of magnitude better than the instrument to be checked, or
(b) Subjecting the instrument to a measurement known to be accurate by at least an order of magnitude better than the instrument is required to indicate.

The following procedures are recommended for the instruments provided:

5.1 PRESSURE GAUGES

Calibrate using a dead-weight tester or against a certified test pressure gauge.

If the applied or test-gauge pressure differs from the indicated pressure by more than the following amounts the gauge should be adjusted or replaced:

Gauge pressure range	Permissible error
0 to 16 bar	± 0.2 bar
-1 to 2 bar	± 0.05 bar

In addition to checking the gauge accuracy, check also that the needle moves freely and smoothly. If the needle moves in a series of stops and starts the gauge should be replaced.

5.2 TEMPERATURE GAUGES

Calibrate against a certified thermometer:-

0 - 100 °C Use a water bath and certified mercury in glass (MIG) thermometer of accuracy better than ±0.1 °C.
Temperature indication should be within ± 1°C of the certified thermometer.

0 - 400 °C Use a suitable salt bath and certified thermocouple indicator of accuracy better than ± 0.5 °C.
Temperaure indication should be within ± 5 °C.

5.3 LEVEL GAUGES

No calibration check is possible since these gauges are calibrated during manufacture.

If level tubes or manometer tubes become dirty however, their readability will be impaired. If they become dirty they will need to be carefully removed, cleaned and replaced.

5.4 TACHOMETER

Check the tachometer against a suitable remote sensing electronic speed indicator of accuracy better than ± 5 RPM over the range 0 - 5000 RPM. (NB Tachometer checking will have to be accomplished during turbine operation).

The tachometer should indicate within ± 50 RPM of the test indicator.

5.5 TORQUE INDICATOR

Ensure that no residual torque is being applied to the dynamometer then set the indicator at zero using the 'zero adjust' potentiometer.
Attach the weight hanger to the dynamometer and suspend the supplied calibration weight from it. Using the 'span' potentiometer, set the indicator to read the applied torque.
NB Torque arm radius = 300mm, therefore:

Calibration weight (kgf) * 2.94 = Nm (On Torque meter)

5.6 FLOW INDICATORS

No calibration is possible of the flowmeter used for measuring condenser cooling water flow or of the totalising meter for measuring feed water quantity to the boiler.

Remove, clean and refit the float gauge tube if it becomes dirty.

5.7 DIGITAL PRESSURE and TEMPERATURE INDICATORS

Calibration of the Digital Pressure and Temperature Indicators should not normally be required because of their exceptional long term stability and accuracy.

If calibration is required however, they may be checked in the same way as described above for conventional pressure and temperature indicators. Extreme care is needed to ensure that the electrical signal leads do not become damaged or broken.

5.8 SAFETY INSTRUMENTATION

The superheater water flow indicator needs no calibration.

Calibrate the superheater cooling water discharge temperature gauge if necessary as indicated in Section 5.2 above.

It is not recommended that the saturated steam temperature gauge be calibrated. Check its accuracy using steam tables when the boiler pressure is steady.

NOTES:

SECTION 6

EXPERIMENTAL PROCEDURES

For each of the experiments listed in Section 2 it is necessary to operate the plant under STEADY conditions. Therefore if a series of readings are being taken at different operating conditions ensure that sufficient time elapses between readings to restore steady state conditions.

The time required between readings can be established experimentally by taking a series of readings at regular intervals. When little or no change occurs between successive readings steady conditions can be assumed to have been achieved.

Although the boiler may be operated on its own by bypassing steam directly to atmosphere, it is recommended that the turbine also be operated even if only boiler experiments are being done. This will help to ensure that all components of the plant are kept in working order, and it will avoid passing large quantities of water through the softener.

For each of the following procedures it is assumed that the plant has been started and is being operated in accordance with the instructions given in Section 4.

A typical set of experimental measurements is shown on the Log Sheet included in Section 7 and examples of analyses can be found in the corresponding sub-sections of Section 7.

The Observations suggested are not necessary in order to do the calculations but should be noted to gain a better appreciation of the processes and changes which occur.

6.1 STEAM MASS FLOW RATE (Comparison of Methods)

Three methods of measuring steam mass flow may be used:

(a) Orifice and Differential Pressure Gauge

(b) Measuring the time required to fill the condensate vessel

(c) Measuring the time required for a given change in feed water totalising meter readings.

NOTE: If steam is being bypassed (blown to atmosphere), Method '(b)' must be omitted from the comparison.

Procedure:-

Measure: (1) Steam flow rate from the gauge. (Section 3.2.4)

(2) Time for the condensate quantity to change by 20 litres as indicated on the condensate vessel sight glass.

(3) Litres of water as registered by the feed water totalising meter over approximately 30 minutes.

(4) Condensate and feed water temperature.

The steam mass flow rate may be varied by changing the boiler load as described in the sub-section 6.2 below.

6.2 BOILER EFFICIENCY

Measure: (1) Fuel flow rate, (Section 3.1.1)

(2) Steam mass flow rate,(Use Method '(b)' above).

(3) Feed water temperature.

(4) Steam supply pressure and temperature.

Observe: (1) Boiler pressure and temperature.

(2) Flue gas temperature.

The boiler efficiency is typically dependent on the boiler load. The boiler load may be varied (within limits) as follows:

(a) To INCREASE the boiler load, slowly OPEN the turbine bypass valve (V11). This allows steam to escape to atmosphere and means that additional water must be supplied by the water softener. Do not therefore operate in this manner for any longer than is needed to stabilise and record the necessary readings. The maximum steam mass flow rate is approximately 450 kg/h. The boiler pressure will fall progressively if this value is exceeded.
Note that with the turbine operating as directed in Section 4.3 it may not be possible to increase the boiler load significantly.

(b) To DECREASE the boiler load reduce the dynamometer load to a minimum. To further reduce the boiler load, progressively close the turbine nozzle valves. Intermediate loads can be obtained by varying the dynamometer load.
DO NOT REGULATE THE STEAM FLOW TO THE TURBINE USING THE NOZZLE VALVES. THEY MUST BE EITHER FULLY OPEN OR FULLY CLOSED. Erosion of the valves may occur if they are used as regulators.
Minimum boiler load occurs with one nozzle open and zero dynamometer load.
Under these conditions burner operation will be intermittent and therefore relatively long time periods will be required to accomplish this test.

6.3 TURBINE ISENTROPIC EFFICIENCY

Measure: (1) Turbine shaft speed.

(2) Turbine torque.

(3) Steam mass flow rate.(Use method of para 6.1 (b))

(4) Turbine steam inlet pressure and temperature.

(5) Turbine exhaust pressure and temperature.

The turbine speed may be altered by resetting the governor speed adjusting screw. Do not exceed a turbine speed of 3200 RPM otherwise the over-speed trip may operate.

The turbine load can be varied using the dynamometer. If however, the dynamometer load is increased to the point where the governor maintains the throttle valve in the fully open position, further increasing the dynamometer load will cause the turbine speed to fall.

Each of the above strategies may be used to vary the turbine operating conditions.

Note that this test is done on the turbine/throttle combination since the turbine chest pressure is not available.

6.4 STEAM CYCLE THERMAL EFFICIENCY

Measure: (1) All steam and condensate pressures and temperatures.

(2) Turbine speed and torque.

(3) Steam mass flow rate.(Method of para 6.1 (b))

Observe: (1) Fuel flow rate

(2) Condenser cooling water flow rate, inlet and outlet temperatures.

The cycle operating conditions may be varied as described in sub-section 6.2 except that steam must not be bypassed.

6.5 OVERALL PLANT THERMAL EFFICIENCY

Measure: (1) Fuel flow rate.

(2) Turbine speed and torque.

Observe: (1) Total electrical load used by the plant (if practicable).

(2) Dynamometer Volts and Amps.

The plant operating conditions may be varied as described in sub-section 6.2.

6.6 HEAT-EXCHANGER EFFECTIVENESS

The heat-exchanger is the condenser.

Measure: (1) Condensate flow rate and temperature.(Method of para 6.1 (b))

(2) Turbine exhaust temperature.

(3) Condenser pressure.

(4) Condenser cooling water mass flow rate, inlet and outlet temperature.

The steam mass flow rate may be varied as described in sub-section 6.2.

The condenser cooling water mass flow rate may be varied by using the condenser exit valve (V27).

NOTE: If the condenser cooling water flow rate is reduced too much, insufficient heat will be removed from the turbine exhaust steam and the condenser pressure will rise. DO NOT EXCEED A CONDENSER PRESSURE OF -0.5 bar.

6.7 STEADY STATE ENERGY ANALYSES

Measure: All parameters as shown on the Log Sheet.

The plant operating conditions may be varied as described in sub-section 6.2.

6.8 INSULATION EFFECTIVENESS

Various types and sizes of insulation are supplied which may be fitted to a section of steam pipe from the superheater coil.

Procedure:

(a) Fit the desired insulation to the pipe, and attach the outside surface temperature probe.

(b) Monitor the steam temperature and pressure and external surface temperature of the insulant. When the readings are steady note the inside and outside surface temperatures.

SECTION 7

TYPICAL EXPERIMENTAL RESULTS & ANALYSES

The completed Log Sheet (p.43) gives a set of typical results from the plant when operating under approximately maximum overall efficiency conditions.

The following analyses use the data recorded on the Log Sheet.

The 'Points for Discussion' given in each sub-section are meant to serve as a self study and/or teaching aid.

The sub-sections of this Section correspond with the sub-sections of Section 6 and the Section 2.1.

7.1 Steam Mass Flow Rate (Comparison of Methods)

(a) Orifice and Manometer

The mass flow read from the scale was 400 kg/h
Steam density at 10.94 bar abs. and 272°C is 4.511 kg/m³
An approximate correction factor is 4.511/4.2955 = 1.050
The corrected steam mass flow is: 400 * 1.050 = <u>420 kg/h</u>

(b) Condensate Mass Flow Rate

20 litres of condensate collected in 180 secs.

Density of water at 39°C is 990 kg/m³

Mass flow is: 0.020 * 990 / (180 /3600) = <u>396 kg/h</u>

(c) Feed Water Mass Flow Rate

10.0 litres of water were pumped into the boiler in 1 min 11 sec

Density of water at 23.5°C is 998 kg/m³

Mass flow is: 0.010 * 998 / (71 /3600) = <u>506 kg/h</u>

Points for Discussion

1. Which mass flow rate do you consider to be the most accurate, and why?
2. Offer an explanation for the differences in the above mass flow rates.

Notes:

1. The mass flow measured by the orifice can be found by using BS 1042
The orifice diameter is 23.56 mm, the pipe diameter is 31.70 mm and the orifice has corner taps.

7.2 Boiler Efficiency

The Boiler Efficiency is defined as :

$$\eta_{boiler} = \frac{\text{Heat transfer rate to the steam}}{\text{Energy rate released by the fuel}}$$

$$= \frac{\dot{m}_s * (h_{out} - h_{in})}{\dot{m}_{fu} * LCV}$$

The feed water temperature is 23.5°C, from tables h_{in} = 98.5 kJ/kg

Steam temperature & pressure is 272°C & 1.094 MPa h_{out} = 2990.0 kJ/kg

The Lower Calorific Value of Fuel Oil is 42 MJ/kg and its Relative Density is 0.84

250 mls of fuel oil were used in 21 seconds therefore, the fuel mass flow rate is given by:

$$\dot{m}_s = 0.250 * 0.84 / 21 = 0.010 \text{ kg/s}$$

The boiler efficiency is given by:

$$\frac{(396/3600) * (2990 - 98.5)}{0.010 * 42 * 10^3} = 0.757 \quad (76\%)$$

Points for Discussion

1. How would you rate this boiler in terms of efficiency?

2. Why can boiler efficiency never be 100% ?

3. Why is the Lower Calorific Value (as opposed to the Higher Calorific Value) used in the efficiency calculation for this type of boiler?

4. What design and operating parameters affect boiler efficiency?

Notes:

1. The above calculations assume a Combustion Efficiency of 100%.

7.3 Turbine Isentropic Efficiency

The turbine isentropic efficiency is defined as:

$$\eta_{turb} = \frac{\text{Turbine shaft power output}}{\text{Isentropic power available from the steam}}$$

$$= \frac{\text{Torque * Rotational speed}}{\text{Steam mass flow * Isentropic enthalpy change}}$$

The turbine steam inlet condition is 1.011 MPa & 238°C
The steam turbine exit pressure is 0.02 MPa.

Using a Mollier chart the Isentropic enthalpy change which occurs between the above conditions is 2915 - 2262 = 653 kJ/kg

The torque is 26 Nm & RPM is 3004

Shaft power output = 26 * 2 * π * 3004 / 60 = 8.179 kW

The Isentropic efficiency is then given by:

$$\frac{8.179}{(396/3600) * 653} = 0.114 \quad (11\ \%)$$

Points for Discussion

1. Large steam turbines operate at efficiencies in the range 80 to 90%. Why is the efficiency of this turbine so low?

2. Under what conditions would the efficiency improve? Is it possible to operate under these conditions and if not why not?

3. How does the size of the turbine (in terms of its power output) affect its efficiency?

Notes:

1. The above-calculated efficiency is for the THROTTLE/TURBINE combination. This needs to be borne in mind when considering the above points.

7.4 Steam Cycle Thermal Efficiency

The Steam cycle thermal efficiency is defined as:

$$\eta_{cycle} = \frac{\text{Turbine shaft power output}}{\text{Heat transfer rate to the steam}}$$

From sub-section 7.3, turbine shaft power output is 8.179 kW

From sub-section 7.2, heat transfer rate to the steam is 318 kW

The Steam cycle efficiency is:

$$\frac{8.179}{318} = 0.026 \qquad (2.6\%)$$

Points for Discussion

1. How does the Turbine Isentropic Efficiency affect the above result?
2. Draw the cycle on a T-s or Mollier chart.
3. How could the steam cycle efficiency be improved?
4. What is the maximum thermal efficiency of the cycle, (The Carnot Efficiency)? How does the measured thermal efficiency compare with it?
5. Explain why the measured thermal efficiency is less than the Carnot Efficiency.

Notes:

1. The feed pump power has been ignored in these calculations.

7.5 Overall Plant Thermal Efficiency

The overall plant thermal efficiency is defined as:

$$\eta_{plant} = \frac{\text{Turbine shaft power output}}{\text{Energy rate released by the fuel}}$$

From sub-section 7.3, turbine shaft power output is 8.179 kW

From sub-section 7.2, energy rate released by the fuel is 420 kW

The overall plant thermal efficiency is:

$$\frac{8.179}{420} = 0.019 \qquad (2.0\ \%)$$

Points for Discussion

1. Why is the overall plant thermal efficiency so low?

2. What contributes to the overall plant thermal efficiency?

3. Discuss the effect of plant size on the efficiency.

Notes:

1. Strictly, the auxiliary power used to drive the pumps, fans etc which are necessary to operate the plant, should be subtracted from the turbine power output. In large scale plant this auxiliary power is typically a small percentage of the shaft power produced by the turbine, and can be legitimately neglected. In this small scale plant subtraction of the auxiliary power would lead to a negative efficiency which would be meaningless.

7.6 Heat Exchanger Effectiveness

The Effectiveness of a heat exchanger is defined in terms of temperature:

$$E = \frac{\text{Temperature rise of the fluid with minimum thermal capacity}}{\text{Maximum temperature rise possible.}}$$

In the case of the condenser the cooling water is regarded as the minimum thermal capacity fluid, therefore:

$$E = \frac{T7 - T6}{Tsat - T6}$$

Where the heat transfer from a condensing vapour occurs at virtually constant temperature the effectiveness is also given by:

$$E = 1 - e^{-NTU}$$

NTU is the Number of Transfer Units defined as:

$$NTU = \frac{\text{Overall Heat Transfer Coefficent * Heat Exchange Surface Area}}{\text{Minimum (Mass Flow * Specific Heat Capacity) of the fluids}}$$

$$= \frac{U * A}{(\dot{m} * C)_{min}}$$

The condenser pressure is 0.02 MPa, from tables T_{sat} = 60.1 °C

$$E = \frac{39 - 30.7}{60.1 - 30.7} = 0.282$$

From the above equation : NTU = 0.332

The heat transfer surface area is approx. 1.4 m^2

U = NTU * Cooling Water Mass Flow * 4185 /A

U = 0.332 * 23000/3600 * 4185 / 1.4 = 6335 W/m^2K

Points for discussion

1. Estimate the surface heat transfer coefficient on the water side. (See Ref. 7 in Section 9)

2. Estimate the steam surface heat transfer coefficent. Is it larger than the water side coefficient? Why?

3. What effect does the presence of air have on the condensation process?

4. What effect does surface contamination have on the condensation process?

Notes:

1. Since the majority of the heat transfer occurs by condensation the saturation temperature is used in the definition for effectiveness rather than the turbine steam outlet temperature.

7.7 Steady State Energy Analysis

For any steady flow system, defined by a boundary, the First Law of Thermodynamics applies in the form of the steady flow energy equation (SFEE). The SFEE may be written:

$$\dot{Q} - \dot{W} = m_s \Delta(\tfrac{1}{2}v^2 + gz + h)$$

The terms all refer to a particular fluid stream.

The SFEE may be applied to any component of the plant through which the working fluid (steam/water) passes. The example below applies the SFEE to the turbine by comparing the sum of the terms on each side of the equation.

LHS: Although the turbine is uninsulated the heat loss from it is very small i.e. $\dot{Q} = 0$ kW

From sub-section 7.2, $\dot{W} = 8.179$ kW

Therefore LHS $= -8179$ W

RHS: Steam velocity into and out of the turbine is given by :

$$\dot{m}_s / \text{Steam density} * \text{Flow Area}$$

For turbine entry $v_{in} = (396/3600)/(4.55 * 0.85*10^{-3}) = 28$ m/s
For turbine exit $v_{out} = (396/3600)/(0.2 * 5.0*10^{-3}) = 110$ m/s

Turbine exit and entry are virtually at the same level therefore:

$$z_{in} = z_{out}$$

From tables/chart $h_{in} = 2915$ kJ/kg

$h_{out} = 2762$ kJ/kg

Therefore RHS $= 396/3600((\tfrac{1}{2} * 110^2 - \tfrac{1}{2} * 28^2) + (2762*10^3 - 2915*10^3))$

$= -17{,}451$ W

Points for Discussion

1. The Specific Kinetic and Potential Energy changes are often ignored when the SFEE is applied to devices like turbines. Why?

2. For what device inside a steam turbine is the Specific Kinetic Energy change important?

3. Why would you not normally expect to get the SFEE to exactly balance? What happens to the 'lost' energy?

Notes

1. The pipe diameters used to calculate the flow areas for the steam into and out of the turbine are : Inlet 33 mm dia.
Exit 80 mm dia.

7.8 Effectiveness of Insulation

Insulation inner surface temperature = 270°C

Insulation outer surface temperature = 28°C

Insulation size: 50 mm I.D. ; 120 mm O.D. (Fibreglass)
Thermal conductivity (λ) = 0.040 W/mK

The heat loss per unit length through a cylindrical conductor is given by:

$$\dot{q} = \frac{2 * \pi * \lambda * \Delta T}{\ln\left(\frac{r_o}{r_i}\right)}$$

$$= \frac{2 * \pi * 0.040 * (270-28)}{\ln\left(\frac{60}{25}\right)}$$

$$= 69.5 \quad W/m$$

The external surface heat transfer coefficient may be found from:

$$\dot{q} = h * \pi * D * (T_o - T_{amb})$$

$$h = \frac{\dot{q}}{\pi * D * (T_o - T_{amb})}$$

$$= \frac{69.5}{\pi * 0.12 * (28 - 17)}$$

$$= 16.8 \quad W/m^2K$$

Points for discussion:

1. If the same surface heat transfer coefficient as found above applies to the exposed pipe (i.e. uninsulated), estimate the heat loss per unit length from it.

2. How much larger is your answer from '1' than your calculated heat loss rate using the measured temperatures?

3. Compare the effectiveness of each of the types and sizes of insulation supplied.

STEAM PLANT LOG SHEET	NAME: M A BELL				DATE: 18.2.87	
BAROMETRIC PRESSURE: 1000 mbar			AMBIENT TEMPERATURE: 17 °C			
RUN	1		2		3	
STATION	Temp. (°C)	Press. (bar)	Temp. (°C)	Press. (bar)	Temp. (°C)	Press (bar)
1 Saturated Steam	176·3	9.39				
2 Superheated Steam	272	9.94				
3 Turbine Inlet	238	9.11				
4 Turbine Exhaust	141·3	−0·747				
5 Condensate	52·6	−0.808				
6 Cooling water inlet	30·7	1.22				
7 Cooling water exit	39·0					
8 Fuel	14·9					
9 Feed water	23·5					
10 Flue gas	250					
11 Lagging steam #	270					
12 Lagging surface #	28					
FLOW MEASUREMENT — Steam: (kg/h)	400					
Condensate: Litres	0	20				
Time(sec)	3 min					
Feed Water: Litres	0	10				
Time(min)	1 min 11s					
Cooling Water(m³/h)	23					
Fuel: Millilitres	0	250				
Time(sec)	21					
TURBINE — RPM	3004					
Torque (Nm)	26					
Field Amps/Volts	—	—				
Armature Amps/Volts	—	—				

NOTES:

Condensate quantity 162 g ; Elapsed time 34 mins

SECTION 8

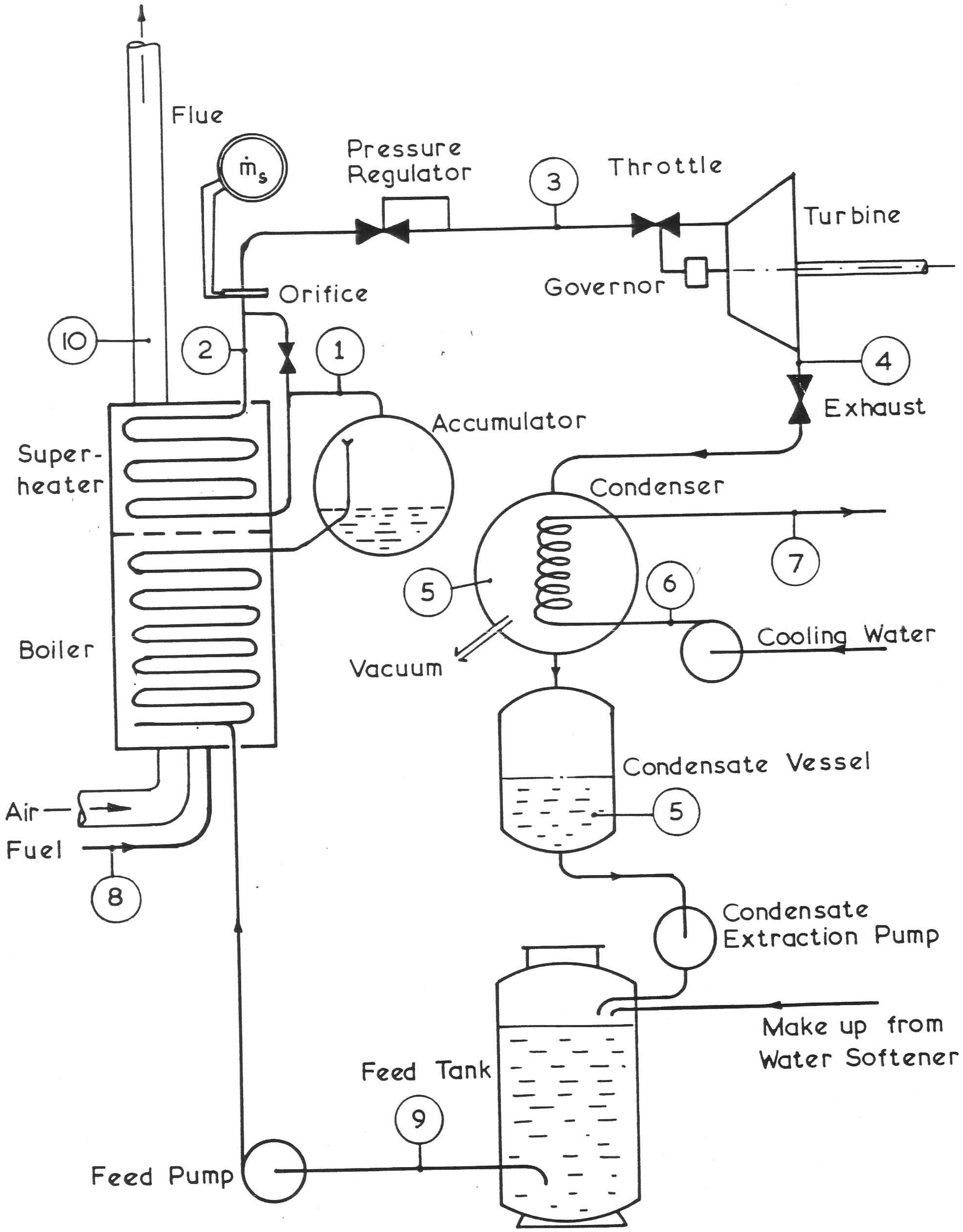
LOG SHEET and SYSTEM DIAGRAM

The log sheet and system diagram on the following pages may be copied and used for recording and teaching purposes.

STEAM PLANT LOG SHEET	NAME:				DATE:	
BAROMETRIC PRESSURE: mbar			AMBIENT TEMPERATURE:			
RUN	1		2		3	
STATION	Temp. (°C)	Press. (bar)	Temp. (°C)	Press. (bar)	Temp. (°C)	Press (bar)
1 Saturated Steam						
2 Superheated Steam						
3 Turbine Inlet						
4 Turbine Exhaust						
5 Condensate						
6 Cooling water inlet						
7 Cooling water exit						
8 Fuel						
9 Feed water						
10 Flue gas						
11 Lagging steam #						
12 Lagging surface #						
FLOW MEASUREMENT: Steam: (kg/h)						
Condensate: Litres						
Time(sec)						
Feed Water: Litres						
Time(min)						
Cooling Water(m^3/h)						
Fuel: Millilitres						
Time(sec)						
TURBINE: RPM						
Torque (Nm)						
Field Amps/Volts						
Armature Amps/Volts						

NOTES:

Condensate quantity ; Elapsed time



TD800 STEAM PLANT SYSTEM DIAGRAM

MAB
20.2.87

SECTION 9

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4	Goodger, E.M.	Principles of Engineering Thermodynamics 2nd edition (MacMillan, 1984)
5	Goodall, P.M. (Ed.)	The Efficient Use of Steam (IPC Science & Technology Press, 1980)
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NB All of the above references use SI units. Many older references on steam use Imperial units. Special care is required when converting from Imperial to SI units.

3. ΣΤΟΙΧΕΙΑ ΤΟΥ ΔΙΚΤΥΟΥ

3.1. ΣΩΛΗΝΕΣ

3.1.1. Διαστάσεις σωλήνων

Εφ'εξής στις εγκαταστάσεις ατμού πρέπει να χρησιμοποιούνται μόνο τυποποιημένοι σωλήνες.

Στην σημερινή τυποποίηση (ISO) χαρακτηρίζονται από την εξωτερική διάμετρο και το πάχος του τοιχώματος.

Γιά κάθε διάμετρο αντιστοιχεί ένα κανονικό πάχος. Γιά την σύνδεση των σωλήνων, εξαρτημάτων, οργάνων και λοιπών στοιχείων των σωληνώσεων έχουν τυποποιηθεί ονομαστικές διάμετροι, που συμβολίζονται με τα γράμματα DN. Αυτές οι διάμετροι αντιστοιχούν περίπου προς την εσωτερική διάμετρο του σωλήνα, χωρίς να αποτελούν όμως απόλυτο μέτρο.

Στον πίνακα 3.1. δίδονται όλα τα σχετικά στοιχεία. Στον πίνακα 3.2. δίδεται και ο συσχετισμός προς την αγγλοσαξωνική τυποποίηση.

ΠΙΝΑΚΑΣ 3.1. Εξωτερική διάμετροι, κανονικά πάχη και κατασκευαζόμενα λοιπά τυποποιημένα πάχη σωλήνων

DN	Εξωτερικές διάμετροι	Σωλήνες χωρίς ραφή			Σωλήνες με ραφή		
		Κανονικό πάχος mm	Άλλα πάχη mm από	έως	Κανονικό πάχος mm	Άλλα πάχη mm από	έως
	10,2**	1,6	1,6	2,8	1,6	1,4	2
10 (12)	13,5**	1,8	1,8	3,6	1,8	1,4	2
	16 *	1,8	1,8	4	1,8	1,4	2
	17,2**	1,8	1,8	4,5	1,8	1,4	2,9
15	20 *	2	2	5	2	1,4	2,9
	21,3**	2	2	5	2	1,4	4,5
20	25 *	2	2	6,3	2	1,4	4,5
	26,9**	2,3	2,3	7,1	2	1,4	5
25	30	2,6	2,6	8	2	1,4	5
	31,8*	2,6	2,6	8	2	1,4	5
	33,7**	2,6	2,6	8,8	2	1,4	5
32	38 *	2,6	2,6	10	2,3	1,4	5
	42,4**	2,6	2,6	11	2,3	1,4	5

Συνέχεια πίνακας 3.1.

DN	Εξωτερικές διάμετροι	Σωλήνες χωρίς ραφή			Σωλήνες με ραφή		
		Κανονικό πάχος mm	Άλλα πάχη mm από	έως	Κανονικό πάχος mm	Άλλα πάχη mm από	έως
40	44,5	2,6	2,6	12,5	2,3	1,4	5
	48,3**	2,6	2,6	12,5	2,3	1,4	5
	51 *	2,6	2,6	14,2	2,3	1,4	5
50	57 *	2,9	2,9	16	2,3	1,4	5
	60,3**	2,9	2,9	16	2,3	1,4	5
	63,5*	2,9	2,9	16	2,3	1,6	5
65	70 *	2,9	2,9	17,5	2,6	1,6	5
	76,1**	2,9	2,9	20	2,6	1,6	5
80	82,5	3,2	3,2	22,2	2,6	1,6	5
	88,9**	3,2	3,2	22,2	2,9	1,6	5
	101,6*	3,6	3,6	25	2,9	2	6,3
100	108	3,6	3,6	25	2,9	2	6,3
	114,3**	3,6	3,6	25	3,2	2	7,1
	127 *	4	4	25	3,2	2	7,1
125	133 *	4	4	25	3,6	2	7,1
	139,7**	4	4	25	3,6	2	7,1
	152,4	4,5	4,5	25	4	2	8
150	159	4,5	4,5	25	4	2	8
	168,3**	4,5	4,5	25	4	2,9	8
	177,8	5	5	25	4,5	2,9	8
(175)	193,7	5,4	5,4	25	4,5	2,9	8,8
200	219,1**	5,9	5,9	25	4,5	3,2	12,5
250*	244,5	6,3	6,3	25	5	3,2	12,5
	273 **	6,3	6,3	25	5	3,2	12,5
300*	323,9**	7,1	7,1	25	5,6	3,2	12,5
350*	355,6**	8	8	25	5,6	3,2	12,5
400*	406,4**	8,8	8,8	25	6,3	3,6	12,5
450	457 **	10	10	25	6,3	3,6	12,5
500	508 **	11	11	25	6,3	3,6	12,5
550	559	12,5	12,5	25	6,3	4,5	20
600	610 **	12,5	12,5	25	6,3	4,5	20
650	660 **	14,2	14,2	25	7,1	4,5	25

Συνέχεια πίνακας 3.1.

DN	Εξωτερικές διάμετροι	Σωλήνες χωρίς ραφή			Σωλήνες με ραφή		
		Κανονικό πάχος mm	Άλλα πάχη mm από	έως	Κανονικό πάχος mm	Άλλα πάχη mm από	έως
	771 **	---	---	---	7,1	4,5	25
	762 *	---	---	---	8	4,5	25
	813 **	---	---	---	8	4,5	25
	864	---	---	---	8,8	4,5	25
	914 **	---	---	---	10	4,5	25
	1016 **	---	---	---	10	4,5	25

<u>ΣΗΜΕΙΩΣΗ</u>: Η αναγραφομένη στον πίνακα 3.1. τυποποίηση με βάση την εξωτερική διάμετρο και το πάχος αφορά σε επιλογή από DIN - ISO 4200. Παρατηρητέο ότι οι εξωτερικές διαμέτροι κατατάσσονται σε τρείς κατηγορίες :

- Σειρά α (δύο αστερίσκοι) αφορά σε διαμέτρους γιά τις οποίες όλα τα εξαρτήματα (με φλάντζες ή γιά συγκόλληση) είναι τυποποιημένα.
- Σειρά β (ένας αστερίσκος) αφορά σε διαμέτρους γιά τις οποίες δεν είναι όλα τα εξαρτήματα τυποποιημένα.
- Σειρά γ (χωρίς αστερίσκο) αφορά σε διαμέτρους μόνο γιά ειδικούς σκοπούς γιά τις οποίες δεν υπάρχουν τυποποιημένα εξαρτήματα.

Συνιστάται η χρησιμοποίηση της σειράς (α).

ΠΙΝΑΚΑΣ 3.2. Τυποποιημένες διάμετροι σωλήνων σε mm και αντιστοιχία σε ίντσες

DN	in	DN	in	DN	in	DN	in
1		10	3/8"	100	4"	250	10"
1,2		15	1/2"	(110)	(4½")	(275)	(11")
1,6		20	3/4"	(120)		300	12"
2		25	1"	125	5"	(325)	
2,5		32	1¼"	(130)		350	
3		40	1½"	(140)		(375)	
4		50	2"	150	6"	400	
5		(60)	(2¼")	(160)		450	
6		65	2½"	(175)	7"	500	
8	1/4"	80	3"	200	8"	(550)	
		(90)	3½"	(225)	(9")	600	