AN ANALYSIS OF THE REHEAT CYCLE FOR STEAM. L L L L L L L L L L L THESIS, SLIBMITTED FOR THE DEGREE OF M.Sc. (ENGINEERING.) BY B.Sc. (ENG) [S.A.] B.Sc. (ENG) [LONDON] A.E JENSEN. A.M.I. MECH. E. 1929 1.1.1.1.1

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THESIS

SUBMITTED FOR THE DEGREE OF

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AN AMALYSIS OF THE REHEAT CYCLE FOR STEAM

Some text-books on heat engines take the sweeping statemont that efficiency is appreciably improved by reheating the steam after it has flowed partially through the engine in the usual manner, and then having the vapour returned to the prime mover, but with a high superheat, to complete its work.

The statement is made to apply whether the reheater is incorporated within the main beiler walls, whether it is a separate unit having its own furnace or whether the reheater uses high pressure and high temperature steam to supply the reheat.

As far as the author is aware no attempt has been made to fully substantiate such a statement, hence the following analysis has been made to gain further information regarding the possible gains with respect to the Rankine cycle.

The use of a reheater involves the installation of plant whose cost will be a fair proportion of the total cost of the plant, hence it is essential to reheat under conditions of maximum possible gain in order to cover the extra cost of plant.

In practice only one reheater has been used up to the present date, that is, expansion of the steam is split up into two stages with reheating between the two stages. Hence the author has considered the question of reheating at one point only of the steam flow through the prime mover.

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No information is available as regards the best point of the expansion to be selected for reheating and the possible gain to be derived, hence this thesis is devoted to the determination of the point at which reheating should take place in order to obtain the maximum efficiency of the theoretical cycle and the possible gain which can be obtained.

The Mankine cycle is considered with reheating performed at intermediate points of the expansion, expansion in the second stage being taken right down to exhaust or back pressure. In all cases reheating is considered at constant pressure.

SUPER LATED STELM

The pressure-Volume diagram and the temperature extropy diagrams for a single reheat are given in figures 1, 2, 3 and 4 (see attached blue prints).

In all cases the steam is reheated up to the same temperature as that of the steam initially led to the prime mover.

RESSURE-VOLUME DIAGRAM. (Fig. 1)

The steam is allowed to expand initially from "o" to "d" as in the Rankine cycle. At "d" the steam is led to the reheater where it is heated at constant pressure (P_3) , the volume increasing from Vd to Ve. The steam is then led cack to the prime mover and allowed to expand from "e" to "f" at the end of the first expansion the steam may be sigher just dry saturated, slightly superheated or sheatly set according to the amount of expansion allowed in the first stage.

The three cond tions will be considered by means of the temperature-entropy diagram.

STEAM J"ST DRY SATURATED AT WHE OF FIRST EXPANSION (Fig.2) Fig. 2 " is the feed-water state point and "c" is the state point of the superheated steam as initially led to the prime mover. "cd" represents the first stage expansion. 'de" represents reheating up to the initial temperature at constant pressure. "ef" represents the second stage expansion down to back pressure with temperature T_2 .

Work done in the reheat cycle is proportional to the avea "m o clc d m" in the first stage and to the area "a m d e f a" in the second stage. Total work done is proportional to the area "a b clc d e f a". Work done = mbc¹cd + a másf $= \left\{ (m_1 - T_3) (1 + \frac{L_1}{T_1}) + K_{p_1} (T_s - T_1) - T_3 (\log_0 \frac{T_1}{T_1} + K_{p_1} \log_0 \frac{T_s}{T_1}) \right\}$ + $\left(T_3 - T_2\right)\left(1 + T_3\right) + K_{p_2}(T_s - T_2) - T_2(\log_{e} T_2 + K_{p_2}\log_{e} T_3) - (1)$.eat Supplied a r b clc d + k am d e f h $= \left\{ (T_{1}-T_{3})(1+\frac{1}{T_{1}}) + F_{p_{1}}(T_{g}-T_{1}) - T_{3}(\log_{e}\frac{T_{1}}{T_{3}} + K_{p_{1}}\log_{e}\frac{T_{1}}{T_{1}}) \right\}$ + {L₃ + T₃ -T₂ + $X_{p_2}(T_3-T_3)$ }- -Cycle Efficiency = (2) = { $(T_1-T_3)(1+\frac{L_1}{T_1})+K_{p1}(T_8-T_1)-T_3(\log_{10}T_3+K_{p1}\log_{10}T_1)$ + $(T_3 - T_2)(1 + \frac{L_5}{T_2}) + K_{p_2}(T_8 - T_3) - T_2(10x_6 + \frac{T_3}{T_2} + K_{p_2} \log_{6} + \frac{T_3}{T_2}) - (3)$ $(T_1, T_3)(1+\frac{L_1}{T} + K_{p_1}(T_s-T_1)-T_3(1) \in \frac{T_1}{T_3} + K_{p_1}(T_s-T_2+K_p)$.lternately. Work dong . a b c c d g + c d e f $= \{ (T_{1}-T_{2})(1+T_{1}) + L_{p1}(T_{3}-T_{1}) - T_{2}(\log T_{2} + K_{p1}\log T_{1}) \}$ + {K_{P2}(T₈-T₃) -T₂ K_p loge T₃}- $\{(T_1-T_2)(1+T_1)+n_{p_1}(T_3-T_1)-T_2(\log -T_2+K_{o_1}\log T_1)\}$ Cycle $\frac{\text{Efficiency}}{+ \{ F_{0} (T_{a} - T_{3}) - T_{1} |_{T_{2}} \log \} }$ -(6) $\left\{ \mathbf{L}_{1} + \mathbf{T}_{1} - \mathbf{T}_{2} + \mathbf{E}_{p_{1}} (\mathbf{T}_{a} - \mathbf{T}_{1}) \right\} + \left\{ \mathbf{E}_{p_{2}} (\mathbf{T}_{a} - \mathbf{T}_{3}) \right\}$

Stean still superheated at and of first expansion (Fig.3)

4.,

"cd" represents the first stage expansion, the steam Leing at a superheat temperature $\frac{1}{5}$ when led to the reheater. Reheating takes place from "d" to "e".

 $\frac{\operatorname{hork} \operatorname{done}}{\operatorname{s}} = \operatorname{abc}^{1} \operatorname{cd} g + \operatorname{cd} e f$ $= \left\{ (T_{1} - T_{2}) (1 + \frac{L_{1}}{T_{1}}) + \operatorname{p}_{1} (z - z_{1}) - T_{2} (\log_{\theta} \frac{T_{1}}{T_{2}} + K_{p_{1}} \log_{\theta} \frac{T_{\theta}}{T_{1}}) \right\}$ $+ \left\{ K_{p_{3}} (T_{s} - T_{s}^{1}) - T_{2} K_{p_{3}} \log_{\theta} \frac{T_{\theta}}{T_{\theta}} \right\}$ $= \left\{ L_{1} + T_{1} - T_{2} + K_{p_{1}} (T_{s} - T_{1}) \right\} + \left\{ K_{p_{3}} (T_{s} - \frac{1}{s}) \right\} - (8)$ $\frac{\operatorname{Cycle}}{\operatorname{Effloioncy}} = \left\{ (T_{1} - T_{2}) (1 + \frac{1}{T_{1}}) + K_{p_{1}} (T_{s} - T_{1}) - T_{s} (\log_{\theta} \frac{T_{1}}{T_{2}} + K_{p_{1}} \log_{\theta} \frac{T_{\theta}}{T_{1}}) \right\}$ $+ \left\{ K_{p_{3}} (T_{s} - \frac{1}{T_{3}}) - T_{2} K_{p_{3}} \log_{\theta} \frac{T_{\theta}}{T_{s}} \right\}$ (9)

$$\left\{L_1 + T_1 - T_2 + T_{p_1}(T_s - T_1)\right\} + \left\{K_{p_3}(T_s - T_s^1)\right\}$$

Steam Wet at the end of first expansion (Fig. 4)

"cd" ropresents expansion in the first stage, the steam having a dryness fraction "do when ind to the reheater. "del" the first reheat effect when the steam is made dry saturated, the steam is then superheated from "ol" to "e" with temperature T.

Work done - mb c¹ c d + a m e¹ e f

$$= \left\{ (T_1 - T_1) (1 + T_1) + K_{p_1} (T_8 - T_1) - T_3 (\log_{\theta} T_3 - K_{p_1} \log_{\theta} T_1) \right\} \\ + \left\{ (T_3 - T_2) (1 + \frac{L_2}{T_3}) + K_{p_4} (T_8 - T_3) - T_2 (\log_{\theta} T_3^3 + K_{p_4} \log_{\theta} \frac{T_8}{T_3}) \right\} - \dots (10)$$

Heat Supplied = mbclcd+kamelefh

$$= \left\{ (T_1 - T_3) (1 + \frac{L_1}{T_1}) + \varepsilon_{p_1} (T_3 - T_1) - T_3 (\log \frac{T_1}{T_3} + \varepsilon_{p_1} \log \frac{T_3}{T_1}) \right\} \\ + \left\{ L_3 + T_3 - T_2 + \varepsilon_{p_4} (T_3 - T_3) \right\}$$
 (11)

$$\frac{Cycle}{Efficiency} = \left\{ (T_1 - T_3) \left(1 + \frac{L_1}{T_1} \right) + K_{p_1} (T_8 - T_1) - T_3 (loce T_3^1 + K_{p_1} Loce T_1^8) \right\} \\ + \left\{ (T_3 - T_2) \left(1 + \frac{L_1}{T_3} \right) + K_{p_4} (T_8 - T_3) - T_2 (loce T_2^3 + K_{p_4} loce T_3) \right\} \\ - (12) \\ \overline{\left\{ (T_1 - T_3) \left(1 + \frac{L_1}{T_1} \right) + K_{p_1} (T_8 - T_1) - T_3 (loce T_1 + L_{p_1} loc T_1^8) \right\}} \\ + \left\{ L_3 + T_3 - T_2 + K_{p_1} (T_8 - T_2) \right\}$$

5. .

In the equations given, T₃ will have different values. $K_{p_1} K_{p_2}$ K_{p_3} and K_{p_4} will have different values since they refer to different ranges of pressure and superneating.

The Rankine cycle efficiency for the same limiting temperatures T_s , T_1 and T_2 is :-

 $\left\{ (T_{1}-T_{2})(j+\frac{L_{1}}{T_{1}}) + K_{p_{1}}(T_{s}-T_{1}) - T_{2}(\log T_{2} + K_{p_{1}}\log T_{1}) \right\}$ $\left\{L_1 + T_1 - T_2 + K_{p_1}(T_8 - T_1)\right\}$

It is impossible to directly determine the conditions amongst the given cases for a maximum cycle efficiency because several variables are involved.

The method adopted is that of determing the cycle efficiency for various values of P3 with corresponding saturation temperature T_{22} and plotting the efficiency against the pressure P3. The pressure at which reheating should take place for maximum efficiency can then be obtained from the curves as well as the maximum efficiency of the cycle.

- 6. -

Determining the efficiency for various values of T_3 with consequent varying values of K_{p1} K_{p2} K_{p3} and K_{p4} from

(0) equations (3) or (6)/and (12) would be extremely laborious, hence efficiencies have been determined from the total-heat entropy chart for steam (see Fig. 5).

"od" represents adiabatic heat drop from P_1 to P_3 (saturation temperature T_3). "de" represents reheating at constant pressure P_3 to bring the temperature back to the initial steam temperature T_8 . "ef" represents the second stage adiabatis heat drop from P_3 (reheated) to back pressure P_2 .

Total heat drop Heat supplied	Total heat	at "c" + reheat	supplied from in water at T_2 .	
(Total heat at	'c" sensible	heat in water at	T ₂) - Heat supplied Rankire Cycle.	0

Therefore, Heat supplied = Heat supplied on Rankine cycle + heat supplied during reheating. Therefore, Cycle efficiency = heat drop "ed" + heat drop "of Heat suprlied on Rankins cycle + heat supplied by reheater

The cycles considered in the Foregoing are called Cycles A.

In some cases it may be possible to perform the reheating by means of waste heat, in such cases the cycle will be called <u>Gycles B</u>. Both cycles are fully considered in this thesis.

<u>Cycle B</u> efficiency = <u>heat drop "ad" + heat drop "of</u>" -----(15) Reat augolied on Rankine cycle

<u>Cycle B</u> will always have a higher efficiency than Cycle A or the Rankine cycle because additional heat is converted into work without debiting the reheat supplied against the cycle.

Efficiencies have been determined for the following cases to Steam at 500 lbs. per eq. inc. abs, with initial temperatures of $750,700,~550,~600,~550~and~500^{\circ}F$; in each case reheating to -7.-

ő.

the initial steam temperature has been assumed.

Steam at 400 lbs. Der sq. ins. abs., 350 lbs. per sq. ins. abs., 300 lbs. per sq. ins. abs., 250 lbs., per sq. ins. abs md 200 lbs. per sq. ins. abs. each with the temperatures 750, 700, 650, 600, 550 and 500°F.

The back or exhaust pressure has been taken at 1 lb. per sq. ins. abs. in all cases.

The results are shown in tables 'Js. 1 to 36.

Table Nos. 1 to 6 refer to steam at 500 lbs. per sq. ins. abs. Table Nos. 7 to 12 refer to steam at 400 lbs. per sq.ins abs. Table Nos. 13 to 18 refer to steam at 350 lbs. new sq. ins.abs. Table Nos. 19 to 24 refer to steam at 300 lbs. per sc. ins.abs. Table Nos. 25 to 30 refer to steam at 250 lbs. per sq. ins.abs. Table Nos. 31 to 36 refer to steam at 200 lbs. per sq. ins.abs.

Plate No.	Initial steam Pressure lbs. per sq.ins.abs.	Initial Steam Tem-o _F peratures o _F	Back Pressure lbs.per sq.ins.abs.	Working Cycle
1A	500	500 to 750	1	A
1B	100	do.	1	В
2A	400	do.	1	A
23	400	10.	1	B
3A	350	do.	1	A
3.3	350	do.	1	В
4.6	300	de.	1	A
4.3	300	do.	1	В
FA	250	do.	1	A
ξB	035	do.	1	E

The cycle efficiency curves are shown in Plates "os. 1A to 6B

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Plate No.	Initial Steam Pressure 1bs. per sq.ins.mbs.	Steam Tem- peratures F	Pressure lbs.ner sq. ins. abs.	Cycle
64	200	500 to 750	1	A
6B	200	do.	1	В

The efficiency of the Rankine cycle is shown for each initial temperature by means of dotted lines on plates referring to Cycle A.

Efficiency curves for Cycle A lie partially above and partially below the kankine efficiency line. Hence for Cycle A, it is important to choose the reneat point carefully if the greatest gain is desired.

Tables 1 to 36 also give the ercentage gain over the Rankine cycle. If it is assured that the matio of actual thermal efficiency of plant to theoretical cycle efficiency is not affected by the adoption of reheating then the gains shown will represent the percentage saving in fuel used.

When the Rankine cycle is followed the steam contains a fair amount of moisture at the lower stages of expansion, but when a reheat cycle is adopted the amount of moisture at the lower stages is reduced, the eduction being inversely proportional to the pressure at which releating takes place, or, proportional to the amount of expansion in the first stage.

In practice the efficiency ratio of a prime mover increases slightly as the quality of the steam is higher at the end of expansion, this is particularly the case in the steam turbine. Hence, in practice, it may be expected that the gains will be slightly higher than the theoretical values.

Plater 1A to 6B have been used to obtain the maximum cycle efficiencies, reheat pressure for maximum efficiency and percentage gains over the Rankine cycle. The results are

tablated in Table No. 27.

Lalition between Faximum Efficiency (Cycle A) and Initial Steam Femperature (Renesting to initial temperature)

8.

Table No. 37 has been used in plotting the maximum officiency against the initial steam temperature. The result is shown in Plate No. 7A. The relationship in the case of each prossure follows the straight line law of the form :-Maximum Cycle efficiency a a constant + a constant (steam temperature - 500)

The actual equations for the limiting conditions considered in this investigation are :-

For 500 lbs.per sq.ins.abs., Max.efficiency = .3431 + .000108 (t-500) 400 " " " " Max.srficiency = .3341 + .0001244 (t - 300) 50 " " " " Max.efficiency = .3285 + .00010% (t - 500) 300 " " " " Max.efficiency = .3212 + .00010% (t - 500) 50 " " " " Max.efficiency = .3212 + .000113 (t - 500) 50 " " " " Max.efficiency = .3144 + .0001136 (t - 500) 200 " " " " Max.efficiency : .3050 + .000115(t - 500)

Where t = initial steam temperature (reheating up to initial temperature).

The lines are almost parallel and if the average value of the coefficient of "t" is used no great error will be involved. The average value is .0001107 and the greatest error occurs with 200 lbs. per sq. ins. abs. and 750°F, the error being .00108 in efficiency which represents an error of only *324%

The constants, for the equations given, then plotted againt pressure rive t a curve which has the followin equation: Constant = .305 + .0002 (P-200) -- .154 x 10 (P)

- 10 -

Hence if the average coefficient of the temperature is used the following general equation can be used to determine the maximum possible efficiency for any pressure from 200 to 500 lbs. per sq. ins. abs. and for any temperature from 500 to $750^{\circ}F$ in

Max. efficiency = $.305 \pm .0002$ (P- $.2154 \times 10^{-10}$ (P)^{3.33} $\pm .0001167$ (t = 500)

Where ? = abs. steam pressure

t a steam temperature (initial and after reheating).

Cvcle B. The curves are similar to those for Cycle A and are shown in Plate No. 73.

1110	ad yr	C TOUS	3 10	L (10	7 7110	C					
For	500	lbs.	per	s q.i:	as.at	8.,	Max.efficiency	н	.4002 (t	+ .000168 - 500)	
**	400	н	u		•	*	Max.efficiency	anti anti	.3884 (t	+ .000171 - 500)	
	350	11	11			1	Max.efficiency		.3805 (t	+ .000176 - 50C)	
D	300	"	н				Max.efficiency	Į.	.3720 (t	+ 000172 - 500)	
28	250	0	11	**	16	16	Max.sfficiency	-	`20 (t	+ .000178 - 500)	
18	200	*		11	n	-	Max.efficiency	-	.3507	+ .000168	122

Again, the lines are almost parallel. The mean value of the coefficient of "t" is .000172 which gives the greatest error in the case of 250 lbs. per sq. ins. abs., the error being only .0015 which is an error of only .369%. A similar treatment for the equations for maximum efficiency gives the fo.. neral formula for Cycle B := \max .Efficiency \equiv .3507 \pm .000251(P=200)=.316 \pm 10⁻¹³(P)⁴.42 \pm .000172 (t=500)

In order to dispense with the use of formulae and variable constants, the curves shown in Flates SA and 8% have been

- 11. -

constructed from those in Plates 7A and 7B respectively. Maximum efficiency is plotted against initial steam pressure for various temperatures in steps of 10° F. Plate 8A refers to Cycle A and Plate 8B refers to Cycle B. These plates enable the greatest possible cycle efficiency being read off directly for any initial steam pressure from 2CO to 500 lts. per 3q. ins. abs. with any initial temperature from 500 to 750 °F, remeating taking place up to the initial steam temperature.

Plate 9A gives the pressure at which reheating must take place to give maximum efficiency on Cycle A. The curves are irregular but the general trend is that reheating should take place at progressively lower pressures as the initial steam temperature is higher and higher. At pressures of 500, 350 and 300 lbs. per sq. ins. abs. there is a wide choice at the lower temperatures, this is due to the efficiency curves being flat as seen in Plates Nos. 1A, 3A and 4A.

<u>Plate 95</u>. The curves are similar to those of 9A but refer to cycle B. In this case the general trend is that reheating should take place at progressively higher pressures as the initial steam temperature is higher and higher.

Plates 8A. 2B, 9A and 9B represent a summary of this investigation and can be used to solve any given case within the limits considered, that is, any pressure from 200 to 500 lbs. per sq. ins. abs. with any temperature from £00 to 750°F.

The following conclusions are drawn from the various tables and curves obtained :-

Cycle_A

 Reheating must take pl ce after a moderate amount of expansion has taken place in the first stage if maximum gain is desired. The resulting advantage of reheating the

- 15. -

steam when still at a moderately high pressure is that the reheater need not be of exceptionally large volumetric capacity.

- (2) Percentage gain over the Rankine cycle for a given pressure increases with increase of steam terms rature and temperature of reheating.
- (3) As the degree of initial superheat decreases the permissible amount of expansion in the first stage decreases in order to obtain maximum efficiency.
- (4) Reheating is of doubtful commercial advantage unless a high degree of supernoat is employed with reheating up to the initial steam temperature. This involves the use of a reheater incorporated with a boiler or tw use of a separately fired reheater. Hence extra capital and rum ing costs must be carefully considered in con ection with the saving in fuel resulting from the higher thermal efficiency of the prime mover.
- (5) Reheating with live boiler steam will raise the reheat temperature only up to the saturation temme rature of the live steam. Hence, fro par. (2), the thormal efficiency will be lower than in the case of reheating to initial steam temperature. Therefore reheating with live boiler steam is of doubtful advantage except that a simpler and cheaper apparatus can be installed near the prime mover instead of in the boiler house.
- (6) The gain is of such a small order that reheating can only be justified in the case of power plants of large output.

Cycle B

(1) The maximum gains are very large and approximately constant for a given steam and equal reheat temme rature

- 13. -

for any initial pressure from 200 to 500 lbs. per sq. ins. sbs. Thus for a temperature of 750^cF the maximum gain varies from 23.2, to 23.63% for pressures varying from 200 to 500 lbs. per sq. ins. abs. respectively. (2) The maximum gain increases with increase of initial and equal reheat temperature.

(3) Reheating must take place when the steam has expanded in the first stage almost down to atmospheric pressure in order to obtain maximum gain. The resulting sadvantage is that the reheater must have a large volumetric capacity if the steam velocity has to be kept within reasonable limits.

TABLE NJKBER.

Initial steam temperature = $750^{\circ}p$ Temperature to which steam is reheated = $750^{\circ}p$

> Initial Steam pressure = 500. 105. per sq.ins.abn. Filel steam pressure = ...1...lbs per sq.ins. abs.

	REMARK 3.													e		-		
a page	ycle.	Gycle B		3.36	4.90	7.14	29.6	11.90	14.6	17.5	10.1	80.6	82.3	23.1	23.7	22.5		
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	Fricien	Sycle efficiency A		.361	.3625	.364	-3665	.3675	.369	*36B	.568	.3655	.864	.561	.357	.352	180. 1	
	Total Heat	1310	B.Th.U	1538	1555	1375	1507	1423	1452	1495	1515	1540	1575	1696	1981	1645	1677	
-	Heat	neheet- ing.	P. HE.	88	46	65	87	112	143	165	ane	040	ORF	286	TIE	335	1 367	+3575
	Heat Drop	P ₄ (re- heated) to P2	B.Th. U	456	448	441	458	420	405	where we have	900		100	212	2.90	256	226	- TORICIER
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	H2 P3	- 200 and 000 200 200 200 and			1	0 0						- and and a						1.14
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Initial Steam pressure = .500 lbs. per sq.ins.abs. Final steam pressure =l.lbs per sq.ins. abs.

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 	ЧЪ	heated) to P2	reheat- ing.	1285	Cyole efficiency	Cycle e ficiend B	oycle M	Gycle B	
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 350	40	450	45	1326	•268	.370	1.13	4.E	
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 401	254	315	356	1541	.356	.437	•565	30.60	
 30	264	300	278	1563	.355	-43B	.98	C0. 25	
 51	279	279	304	1569	*351	3425.	85	33.75	
 15	201	254	325	1610	345	.432	-3.85	38.00	
 12	336	817	292	1644	.336	*430	-5*09	21.50	8

Initial Steam pressure = 500. Ibs. per sq.ins.abs. Final steam pressure = ...1...los per sq.ins. abs.

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J

Initial steam temperature = 650° for the rendance = 650° s

E.

BENA								4				-		
Jver Die.	Cycle B B	2.70	4.56	6.12	8.85	10.65	12.80	16.30	17.10	18.20	19.70	20.50	21.10	21.0 20.25 18.50
er sent. gain he Rankine Sy	Cycle Å	.57	.856	1.14	1.65	2.57	8.28	82.28	1.1	1.14	885	855	u.1~	-5.14 -6.12 -8.55
ey.	cycle efficiency B.	.3605	.367	35°26	.382	.369	.396	408	.411	415	.420	-425	456	.426 .426 .416
Effleten	erilotenoy A	.35â	.354	.355	.3576	.360	.359	.358	.357	.355	.350	995.	345	.340 .2295 .381
Total Heat Supplied	1259 B.Th.U	1260	1301	6121	1341	1355	1395	1455	1452	1474	1608	1629	1564	1576 1609 1632
Heat Supplied	ing.	26	45	60	512	5	134	174	193	215	242	270	295	517 550
Heat Drop	to P2	450	425	414	848	395	380	359	346	928	204	267	265	245 207 176
H CO	ч. М. М.	34	80	10		54	119	154	172	192	224	2.4	269	291 323 347
		1001	3.60	300		200	150	1001	99	60	0	00	IB	2 0 Q
CI At					n aga 2011 - A									
P4		and			u- 1999 - 1499 - 1			10 00+ +1+ 100						

eated = 600°P

Initial Steam pressure = .590 lbs. por Final steam pressure =1.1bs per s.

	REIMAR 3.																		
	ycle.	Cycle B	0.00		0.4.0	5.15	7.42	9.15	11.40	14.00	15.70			17.15	18.00	16.85	18.6	16.4	
-	the Runkine C	y Cycle	V		0	.285	.657	138.	,657	0	285		57	-1.72	-2.575	-3.15	-6 39 -7 15	-8.57	
	¥.	Cycle efficie B		900.	.362		•376	.562	.390	.339			408	019.	515.	.416	415	1145	
	Efficienc	Cycle erriciemoy		.350	.350	.351	.353	.553	.563	000.		TOPT	.346	.344	192*	965.	.328	.380	
	upplied	1235	B.Th.U	1258	1274	1291	1314	1334	1363	1400		1420	1444	1474	1495	1521	1644	1598	
	Heat Suppliet S	ing.	B.Th.U	25	41	58	18	101	120			187	211	241	862	386	TIE	365	10X - 350
	Heat	to P2	B.Th.U	413	411	403	394	363	Sel		040	554	517	262	275	254	233	175	NISITE A
	leat Irup	3 12	The T	23	36	51	70) [2	146	165	186	215	235	259	183	313	EANEIN
	Ц		-	400	3FO	OOE	080	pue		2	100	80	60	40	200	12	191	0.0	0
	P2 P2			800 1				- 000 Ale (ma	anter gues ** **	412 any 814			ann 104 ann						

NUMBER. TABLE

2

Initial steam temperature = $\delta 50^{\circ} P$ Temperature to which steam is reheated = $550^{\circ} P$

REMARK 3.																		
in Jver Sycle.	Cycle B		5.90	35	22 23	7 25	9 38	11.17	1-20	180	115.95	117 10	18.00	18.50	18.55	18.30	16.50	14.60
Per Jent. En the Rankine	cycle by A		48*	.725	.87	-58	.87	58	5+T	. 58	87	- 203	-2.90	- 35	-5.65	-7.55	-10.30	-1. 05
y	Cycle efficien	́щ	,365	360	365	370	.377	.5835	394	396	400	404	407	408	409	408	4 02	395
Efficienc	Cyule efficiency	Y	9 1 9.	8475	348	347	348	347	3455	543	342	339	335	330	3255	319	3095	300
Total Heat Supplied = Rehout	1205	B Th U	1230	1246	1263	1281	1304	1351	1369	1367	1409	1441	1462	1486	1508	1540	1563	1584
sipp ied ring	reheat-	B Th U	25	11	56	76	66	126	164	182	504	236	257	281	303	335	358	379
Heat Drop P _z (re-	to P2	B Th U	408	399	392	382	371	355	335	322	306	282	265	242	222	191	161	123
P Drop	ň	din	02 02	34)C 48	63 63	C 83	106	0 139	101 155	0 176	C 205	0 225	1 249	5 270	9 30C	6 323	4 346
P2 P	ana ang dist bad pa		1 40	35	30	52	20	15	10			4			7			

0

Initial Steam pressure = 500 lbs per sq. me abs. Filas steam pressure = ...1 lbs per sq. me abs.

Initial s cam emperature = 0.5 Pemperature to which steam is reheated = 500

REMARK 3.								· •••••										
n uver ycle.	Cycle B	16 2	4.65	5 80	0**	8 70	11 20	1 35	1-50	15.10	1 16 30	175	17.60	17.45		16 15	13 65	
Per Jent. gal the Bankine C	Cycle y A		436	436	.136	0	- 15	- 87	-1 16	-2.04	-0 JD	-3.49	-5.23	6 69	- 00	-11.20	-14.10	
cy.	cyclc eficiend B.	.564	360	564	370	241	5825	*390	394	396	0	104	4045	.404	-02	5995	391	1 0
Efficien	Cycle efficiency A	3 55	3455	÷ 55	3 55	3.4	3.35	3.1	.340	.337	40 20 20	532	0 (2) (2)	321	.313	5055	2955	
Total Hent Supplied = Reheat +	L175 B Th U	1961	1216	1z34	1254	1274	1303	1539	1356	1379	1-09	1 21	1 56	1476	1506	1530	1550	
Heat Supplied during	ing. B. Th.U	26	43	59	62	66	128		181	204	234	256	281	101	331	355	375	
Heat Drop P ₂ (re-	anted 2 3 Th U	394	68 88	382	572	359	545	023	511	295	271	255	233	512	180	154	123	
of the second	3 7 D	21	5.3	45	62	164	103	104	IEO	170	198	216	241	261	291	31+	335	-
PA PA		4 CO	350	300	250	200	150	100	80	09	40	30	12	115	o 	· · · · ·	4	- (ne par - 1
24 4.		1 009	-							-								

Initial Steam pressure = lbs. per sq.ins.abs. Final stoam pressure =lbs per sq.ins. abs.

Initial steam tengerature = $750^{\circ}F$ Temperature to which steam is reheated = $750^{\circ}F$

er REMARKS	ycle B	1.57	4,15	6.72	9.30	18.7	16.4F	18.2	19.9	21.35	22.5	22•6	23.35	31-6
ver cent, gain Jv the Runkine Cycle	r A Cycle C	.145	1.00	1.57	2.15	3.00	3,15	3.29	8.72	1.57	1 .43	\$115	715	-4.25
ey.	Cycle effictenc	.355	.364	.575	382	.394	.407	413	419	+24°	.425	.432	431	.425
Efficien	cycle efficiency A	•350	.363	-304	-367	.360	.2605	192.	.359	.355	545	.352	•347	.355
notal Heat	1512 3,Th,U	1329	1350	1375	1400	1452	1477	1451	1584	1559	1580	1607	1630	1663
Heat Supplie during	ing.	11	36	19	96	121	165	185	312	247	308	890	318	351
Heat Drop P. (re-	to P2 B.Th.U	448	TPP	432	420	405	382	270	364	329	312	290	266	226
Drop		17	35	56	80	111	150	170	194	728	248	275	898	551
F3	and give well and and and the ball of	350	300	250	200	150	100	80	60	-0+	30	61	1	0
Ca la		1 005		aa oost aan -aji		and for any fi	78 gaga gana gan			2 page 2-0 (800				

Initial Steam pressure = lbs. per sq.ins.abs. Final steam pressure =lbs per sq.ins. abs.

Initial steam temperature = $70\sqrt{5}$ Temperature to which steam is reheated = 700° F

- Maria	Heat Droc	開たけ	Heat Supplied	Total Heat Supplied	Efficient	ey.	r cent. gain e Rankine Cy	cle.	REMARK3.
ng spain dates much starp men d		to P2	reheat- ing.	1257	Cycle	Cycle efficiency	Cycle A	Cycle	
pan parti supa "	E. Th.U	T.AT.L	C. UL . T	10.27 S		т			
60	16	436	17	1304	346.	.350	.875	2.04	
00	23	429	37	1324	348	•359	1.46	4.66	
99	55	420	60	1347	.3505	.567	8.19	1.00	
00		407	86	1372	.355	942*	5.915	9.32	
50	106	398	971	1405	*354	.500	3.2L	12.55	
00	142	280	157	1464	.354	.396	18.5	16.05	
98	162	557	179	1466	•364	.4085	5.21	17.35	
90	165	240	203	1490	*3625	-463	2.77	18.95	9 (11) (11) (11) (11) (11) (11) (11) (11
0	217	315	237	1524	-352	413	2.63	20.40	
30	238	300	260	1547	.346	417	1.46	21.65	
12	264	519	287	1574	.345	422	.582	123.00	
15	285	254	309	1696	.358	418	-1.46	81.90	
0	130	217	343	1630	.530		-3.79	31.60	
	RANKIN	E SPUIDI	TO TO A	0					

Initial steam temperature = 650° Temperature to which steam is reheated = 650°

REMARK 3.																
a Jver ycle.	Cycle B B	2 05	3 52	6 E	8	11 75	1 95	16.70	17 60	19 10	19 95	20 EE	21.45	20 25	16.80	
Per cent. gui the Sankine C	cycle cy A	5°.	68	2.05	16 1	2 35	2 2 2 6	2.35	1 76	BE	462	-1.17	-2.05	66.1-	-7.63	
icy.	Cycle eff clend B	3.8	.353	°.6-	370	382	39%	396	101	406	60	-411	414	017	C5	
I ficen	Cycle efficiency	.346	.344	.3±8	3 75	349	3 9	3-9	3.7	344	340	.337	-334	324	315	
Total Heat Supplied = Heheat +	1261 E Th U	1277	1296	1320	13-3	1374	141	1435	1457	1 92	1514	153 9	1561	1596	1619	
Hent Supplied	ing.	16	35	ű,	Ric.	113	153	174	196	231	253	278	300	325	358	A.0
Heat Drop P ₇ (re-	to P2 B.Th.U	425	414	408	395	380	352	346	329	304	287	265	245	207	176	KFFICIED.
Jeat Drop	2	14	31	51	72	JOT	135	155	176	20B	500	254	276	310	334	S LI S
it.	ا الم بين من	350	300	250	200	150	100	80	90	40	30	511	15	0	9	
C T		1001							- dans anns adoir - - mus ands anns		are de 2005.			1) Alle and al	10 gas 200 an	

600⁰P

Initial steam temperature = $600^{0}P$ Temperature to which steam is reheated =

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Initial Steam pressure = lbs. per sq.in. abs. Final steam pressure = Ibs per sq.ins. abs.

REMARK 3. 19.80 19.50 18.00 18.30 19.30 16.70 15.05 10.65 77.5I 8.26 5.90 77.I いの Cycle Per Sent. gain wer the Rankine Cycle. 1443 --443 -5.75 1.625 -295 2-475 -73B -1.53 1.16 1.16 1.034 -8.66 -5.54 Cycle Cycle efficiency B. .404 405 395. 400 390 AGA. 404 .367 .375 . 366 .345 359 .35L Efficiency. Cycle leffictency .3195 .3375 3450. 3405 3445 .330 ·327 .3415 3425 343 290* .344 .340 Total Real Supplied 1630 1480 B. Th. U 1545 1384 1405 1438 3460 1507 1562 1510 1552 1271 1293 1236 600. Hent Suppited during reheat-B. Th. U 294 326 192 224 244 271 100 167 23 1: 1 2 2 2 2 2 4 12 8 146 55 451 ing. Fiear Drop P₃(re-heated) to P₂ 199 233 317 282 275 254 1970 368 284 383 B. Th.U 見いの 411 103 NISAND 300 323 245 He t Dr.o Pl.o 263 entr. 220 170 90 130 148 201 04 8.4 井 5 301 21 15 -10 -100 80 80 200 160 095 200 09. E3 52 -1 005 d.

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TABLE . NUKBER. 10

Initial steam temperature = 6000F

Initial Steam pressure = 400 lbs. per sq.ins.abs.

REMARCS.														
Je.	Gyele B	1.77	3.54	2*90	8.26	10.65	13.77	15.05	16.70	18.00	18.30	19.20	10.50	19.00
Per cent. gain the Rankine Cyc	cycle sy A	\$295	.758	1.054	1.475	1.625	1.18	1.18	.445	285	-1.35	-8.66	-3.54	-6.75
oy.	Cycle efficience B.	.345	.361	.359	.367	.375	. 385	062*	395.	400	105-	.404	405	.404
Efficienc	Cycle efficiency A	.340	3415.	.5425	.344	2:42	.545	245*	.5405	\$13575	3545	.330	.337	.3195
Fotal Heat Supplied - Hebeat +	1236 8.74.0	1252	1271	1293	1316	1345	1364	1402	1428	1460	14d0	1507	1530	1562 1575
Heat Supplied	ine.	16	35	81	80	109	148	187	192	224	244	142	204	326 340
Heat Drcp P_ re-	hế têd) to P2	411	403	394	263	368	345	334	212	292	275	254	233	199
Heat Drop		14	12	48	20	96	150	146	170	103	220	245	267	323
F.		350	8	260	2100	1.60	100	80	80	40	20	21	16	G 40
P2		1				-	, 200 and				page 1900 (1999) 1			
d'		40											-	

NUNBER. 11 ETBFE

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that Steam pressure = ...; the war and ins. abs.

Initial steam temperature = 560^{0} y Temperature to which steam is rineated = 550^{0} y

£3.

-	Efficiency.	
Final Steam pressure =i.lbs per sq.ins. abs.	D P P, Heat Heat Heat Sumlie	FI

REMAR														- mar 444			
.ele.	Cycle B	1.64	86.5	5.52	7.60	9.85	15.00	14.00	15.36	16.55	17 48	17.75	18.00	10 00	14 50	-	-
ne Runkine Cyc	Cycle A	942.	149	.746	1.044	1,044	1.Dus	469*	149	-1.34	P0-1-	-3.15	-4.33	-6.42	-10.10		
	Cyole errorency B.	142*	.3456	.354	.361	3685.	378	.5625	796.	195.	39.	395	397	397	0.92	.364	
gficten	Cycle efficiency	926-		and	dist	ASG.	050	5375	ANE	188	0 C R	325	521	51.	.3056	80 8	
rotal Heat	= Rehcat	0.10.0	aver.	TORO	1204	1260	1510	1980	1372	1595	1427	1448	90	000	000 F	12733	.5355
Heat	auring reheat- ing.	. Th.U	5	2	59	76	105	145	162	185	212	238	262	SAG	319	343	- and -
He.t	P re- heated	R.Th.U	399	392	382	112 /	365	255	382	306	262	285	242	222	161	161	
P ₃ Heat		E.Th.T	350 13	300 26	254 46	200 65	1.50 90	100 123	80 140	60 162	40 191	20 211	236	15 258	9 269	6 313	
P. P.			4 00 I								6 100 (Dod) 100						

T B E NUMBER

REMARCS																		
uver cle.	Cycle B	1-497	3.4	5.38	6.59	9.12	17.70	13.03	14.10	15,30	15.90	Te	97 9T	16.50	15 20	DO OT		
r Jent. gair	Cycle A	205	.449	598	299	0	1.137	- 898	-1.34B	-2.395	- 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		0) A 0 1	-6.08	-10.20	QT OT-		
cy. Pe	Cyule eritciency B	339	3+55	.352	.356	36.5	373	3775	.381	.385	.387	369	2300	6 8 8 8 8	365	5785		
Eficien	cycle efficienc A	.355	3355	.336	335	•334	.330	351	3295	.326	•523	3.9	514	307	300	1 290		
Total Heat Supplied	1181	11911	1215	1235	1256	1285	1322	1340	1364	1395	1 15	141	1 .63	1-9:	1517	1539	584	
Heat Supplied	rehet- ing	- 91	3	2	75	TON	IAI	159	183	214	23	260	282	53	336	358	I WICY = .	
Heat Dr p	to P2	B.Th.U	382	372	359	345	323	311	295	271	255	233	212	180	154	123	INI EVELO	
3 Heat	44	350 2 12 U	300 26	250 13	200 61	150 85	711 001	80 134	60 155	40 184	301 302	21 226	15 248	91 273	6 3CI	4 324	RANK	
L C L L		1 1 201						a and and and		2010 1000 2000 2010 1000 2000								

Initial steam tendera ure = $50C^{0}$ = 500^{0} F Temperature to which steam is reheated = 500^{0} F NUMBER. TABLE

-1

Initial steam temperature = $750_0 F$ Temperature to which steam is reheated = $750^0 F$

Per cent. gain Jver the Rankine Cycle.	iency A Gyole -	.678 2.925	1.90 5.27	90 B.74	28.3	16.1	17.71	9.6	1.05	8.5	0.		-
Per cent. gain the Ranktne Cyc	iency A.	843.	1.90	00					CQ	CX	ě.	24	52 52
P1+2	iency.			.1	3.80	3,60	3.PQ	3.65	B.926	2 • 5 4	19.1	.146	19.00 P-
· .	cycle effic B	.352	.360	3075.	-38£	262*	-4025	605-	.416	017-	184	*424	
Efficienc	Cycle effloiency A	245	-34B5	.5485		.355	•355	.3645	*352	.360	-3476	-3485	122.
Total Heat Supplied	1315 B.Th.U	1335	1358	1386	1420	1465	1485	1512	1548	1670	1698	1625	1665
Heat Supplied during	ing.	32	45	22	101	152	172	199	236	257	2615	309	242
Heat Drop P. (re-	to F2	441	132	420	405	362	370	354	229	31.2	690	266	226
ireat brop	E - He	00	41	99	98	138	156	162	217	238	266	065	323
Ц			260	2001	150	1001	601	90	0	02	1-1- 	10	0
a.	- men men mel som som som so	_	-										

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Initial Steam pressure = 354. Ins. per sq.ins.abs. Firal steam pressure =I.lbs per sq.ins. abs.

Initial steam temperature = $700^{\circ}p$ Temperature to which steam is reheated = $700^{\circ}p$

•				ya janji yaki dan			per getal pauk der	0 ann ann 1000		17 gus 1000 Aut		an
dycle B	2.3	4.7	7.3	10.6	14.7	16.B	14°41	19.5	20,9	32.4	31.8	20°B
cycle dy A	+0B	1.48	1.92	2.66	5.25	3.25	2.65	1.74	1.48	.665	-1.18	10.2-
cycle cfficten B.	*347	*355	192.	\$75.	.389	962*	162*	30F.	018*	415	£13.	019.
Cycle efficiency A	142*	#\$C*	«34.66	•345		•350	.34E	-3 <u>i</u> 5	*344	.342	*335	
1288 3.Th.U	1309	1552	1357	1391	1433	1455	1472	1614	1538	1565	1587	1 00 I
reheat- ing. 8. fn. U	51	44	98	103	145	101	181	226	250	377	868	335
hetted) to P2 b. Th U	\$29	420	407	302	370	367	240	31.6	300	279	354	217
P3 3	97	38	62	98	131	151	174	207	2,25	255	276	31.2
-	200	850	200	150	100	80	60	40	20	10	15	C
	H											
	P [±] héated)reheat-1288CycleCycleCycleCycleCycleCycleCycleCycleCycleB5. Th. UB. Th. UB. Th. UB. Th. UB. Th. UB. Th. UB. Th. UB	P ¹ héated) reheat- 1286 P to P2 ing. Cycle D to P2 ing. Cycle The B. Cycle Cycle D S.Th.U B.Th.U B.Th.U S.Th.U B.Th.U B.Th.U D S.Th.U B.Th.U	P ¹ héated) reheat- 1288 7 to P2 to P2 0role 7 to P2 ing. 0role 7 to P2 ing. 0role 1 sood 1 3.7h.U 1 sood 16 1.40 1 sood 1 1.500 1 sood 1.40 2.7h.U 1 sood 1.41 1.740 1 sood 1.41 1.500 1 1.500 1 55 1.48 1 14 14	P ¹ héated) reheat- 1286 Cycle B B B B B B B Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle B<	P [±] bdated 10 P ₂ reheat- ling. 1288 Cycle Cycle </td <td>P¹ Delted ing. reheat- ing. 1286 Cycle criticiency Cycle criticiency Cycle criticiency Cycle a Cycle criticiency Cycle a Cycla</td> <td>P¹/2 Dédited reheat- ing. 1286 Cycle efficiency Cycle cificiency Cycle cificiency Cycle and and and and and and and and and and</td> <td>$\begin{bmatrix} P_{1}^{1} & \text{bfeated} & \text{refleat-} & \text{1268} \\ \hline 5 & \text{to} P_{2} & \text{hfat-} & \text{1268} \\ 5 & \text{to} P_{2} & \text{hfat-} & \text{1268} & \text{cycle} & \text{cycle} & \text{cycle} \\ 5 & \text{cycle} & \text{b.Th.U} & b.$</td> <td>$\begin{array}{ c c c c c c c c c c c c c c c c c c c$</td> <td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td> <td>$\begin{array}{ c c c c c c c c c c c c c c c c c c c$</td> <td>$\begin{array}{ c c c c c c c c c c c c c c c c c c c$</td>	P ¹ Delted ing. reheat- ing. 1286 Cycle criticiency Cycle criticiency Cycle criticiency Cycle a Cycle criticiency Cycle a Cycla	P ¹ /2 Dédited reheat- ing. 1286 Cycle efficiency Cycle cificiency Cycle cificiency Cycle and and and and and and and and and and	$ \begin{bmatrix} P_{1}^{1} & \text{bfeated} & \text{refleat-} & \text{1268} \\ \hline 5 & \text{to} P_{2} & \text{hfat-} & \text{1268} \\ 5 & \text{to} P_{2} & \text{hfat-} & \text{1268} & \text{cycle} & \text{cycle} & \text{cycle} \\ 5 & \text{cycle} & \text{b.Th.U} & b.$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$

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Initial steam temperature = $650^{\circ}F$ Temperature to which steam is reheated =

Initial Steam pressure = .1.. Ibs. per sq.ins.abs. Final steam pressure = .1.. Ibs per sq.ins. abs.

REMARK3. 20.95 21.66 19.15 14.65 20.3 6.35 94.1 8.84 20.3 10.9 17.8 19.4 16.4 Cycle B Per cent. gain Jver the Rankine Cycle. .896 -.146 390.2 1.496 8.84E 3.095 2.845 448 90.1--4.4B -6.72 2.39 1.494 Cyule Cycle erficiery B. 4075 -3945 3425. 3775 382. 400 20 F. 40E -403 .390 .360 .364 .553 Efficiency. Cycle lefficiency 3125. 33315 3345 8440. .320 -----492C. .340 920. 570. .540 542. .546 Total Heat Supplied B. Th. U 1588 1612 1506 1664 1449 1581 1484 1425 1306 1363 1404 1263 1361 1283 335 Heat Supplead dur renet-B.Th.U н 1225 349 243 266 162 168 186 221 100 00 141 02 27 TONE IC LEAD ing. Heat Drup P₂(re-heated) to P₂ 202 176 345 B.Th.U 583 201 287 285 546 38.6 380 090 408 414 PARTIE DR The state 303 292 P1 P1 246 300 369 168 183 125 145 18 22 20 88 15 0) 8 10 34 80 01 30 50 00 300 560 000 the state 2 -550 LI

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TABLE SURBER. 18

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Initial Steam processe - 350. Ins. per sq.ins.abs.

Thitled steam kowler ture; = 500°F

TABLE PULBER. 17

Initial steam temperiture; 550°F

	bre : Mi. Allo.	and the second		1.67	5.94 2.94	6.38	6 64	12 15	13.04	14 54	16.1	16.7	17.5	18.2	18.2	16.7	14.1		
	cent. man Sankine Cy	Cycle -		.303	.607	16	16*	13	607	-303	- 758	-1-67		-3.91	-6.07	-8.50	-11.8		
	ay. Pur	Cycle efiiciency	л,	. 55.55	5.3	251	585	0	.373	•378	.383	.385	.387	.390	.390	.385	.3765		-
	Efiicien	Cyc.e eff_ciency	A	.531	538	.335	.005	505	.332	531	5275	5245	.320	517	510	.302	291		
	To al e + Su plied	1212	B.Th.D	1230	1351	1275	130-	13-2	1362	1365	1116	1439	1464	1468	1521	1545	1565		
	He t Su ied Ju k	in.	B. M. D	18	39	63	92	130	IEO	175	206	227	252	276	509	333	353	330	-
	Date Date Parts Hel	to P2	B Th U	392	582	371	355	335	522	306	C3 C3 C3	265	242	000	101	191	120	RFFICI C	
3	Heat Mron Mron	E.	B n T	15	33	54	34	11	130	152	132	202	227	250	201	305	327	ANALTRE	
	A4			. 300	250	200	150	100	80	60	0	30	21	15	Cı	9	4	μ.	
	μ. . <u>f</u> 4			350 1		- "at see													

TABLE BUEBER. 18

500⁰F

ted

Initial steam temperature;= 50009

In the Steam pressure lbs. per sq. nu.ans.

110

.300. Ibs. per sq.ins.abs. Initial Steam presente am presente a stnal Bt

ELL-MARS.				a teo									- 2011 - 111	
over ste.	Ryc3e	86.8	6.11	10.3	14.8	17.0	19.95	21.5	82.8	23.75	25.9	22.8		
cent. gan n Bunkine Uy	C, cla	1.045	1.94	5.13	3.73	4,35	4.03	3.58	1.29	2.24	1,245	-1.96		an das 191
ry. Por the	Cyele effetenty B	1 .3455		.370	.385		400	4075	412	416	41 66		a	
ZÉLOIVNO	dyple officiency	0.00	400*	950*		0.00	445	and a				ACC.	632*	
Total Ne - Suppled	1. 2 12 1 2 12 1 2 14 11		1339	1368	1405	1450	1472	1500	1536	1560	1667	1612	1646	355
Hest Suprilied	during rebact- ing.	n*Ha*s	24	29	83	135	157	195	325	346	272	282	122	IENCY - •3
Heat	P. (Fe- neates) to 42	B.dT.	438	420	405	382	370	374	389		290	266	226	NE EFFIC
Hett	ст. 1 да -	B.Th.U	62	48	18	101	THE	170	206	328	265	240	-IE (RANKI
A.			1 260	200	150	100	E0	60	40	30	23	1		
			1002											

In that steps te spectrure; = $750^{\circ}P$ Temper ture to which steps is rebated = $750^{\circ}P$ NUEBER. 18 TABLE
TARLE DUCHER. 80

0

	3	to T2	reheat-	1281	Cycle	Crole eficiency	Oyele -	BACIE	
	5.m.U	U. HUS	8. Th.D	9.Th.U	*	a			_
350	53	120	34	1015	922*	.3425	.90	3.85	
200	99	407	50	1341	.538	3535	1.50	£.65	
150	82	392	87	1379	3415.	.3655	2.65	9.75	
100	119	370	130	1421	264 ·	055.	3.30	1.11	
80	159	257	152	1443	143	.385	3.00	15.6	
60	143	340	177	1468	.5426	162-	2.85	17.4	
40	181	515	213	1504	.340	,397č	8.10	19.35	***
22	319	200	237	1528	.5895	.403	1.65	31.0	
0	246	642	365	1556	.355	.4075	1.50	22.45	-
1	870	264	266	1679	-352	.407	00	32.25	
1	200	817	132	1612	.325	.404	00.5-	21.5	

TABLE BUEBER. 21

6

10

Initial d'edua temperature;= $680^{\circ}F$ Temperature to Which steme is reheated = 650°

9		2 2	Hait .	Hent D. OU	Hue I Bupolied	Trut Hart Supelied	gitteise	19. Per	Santine 0	aver de.	REARS
			8	P (re- cated) P2	aurine renert- ing.	1.265	dyele afficteary	Cycle Cycle efisciency B	ayole .	Pycle B	
			B.Th.U	B.Th.U	B.Th.U	E.TA.U	4		201 L	3.21	
10	1	250	19	408	23	1266	192	C100*	1.02	6.11	•
		800	44	395	50	1515	122*	150*	1 0 45	0.60	
-		160	75	360	82	L347	.035	800*		14.1	
		100	IL	355	125	1590	•33B	-27.15		B-01	
		RC	121	346	146	1411	.33R5	.377	0.00	10.01	
		0.0	1.65	688	171	1436	.537	.362	3.06	10.0	_
		2	Tot		9.06	1471	.334	.388	2.145	18.7	
		-	187	ENC.	000	1494	.532	352	1.63	19.6	
		30	808	102	255	1520		.395	115*	8.02	
-0		ta	nez	200	840	1543	.326	398	305	2.12	-
		16	258	062		1578	316	•294	-3.36	20.5	á.
		0 0	317	176	224	1602	3075	.390	-6-96	19.3	
			A LE L	utuz zar	LCLENCY =	.327					

IABDE RUEDFR. 28

Initial stets traperture; = $600^{0}F$ Temper ture to which steam is reheated = $600^{0}F$

RELARED.														
oyer ale.	bread B	2.4an	62.3	8.92	12.0	14.15	15.4	17.0	18.2	19.1		19.5	19.6	
cent. Cuin Rankine Cy	D'cle	.462	1.54	8.15	8.15	1.85	1.69	1.08	.154	44	-1.85	-4.0	-6.64	
cy. Per	gyolu el:Tetonoy B	.333	.3425	*354	.36.	142.	375	195.	485.	.367	.3865	.3885	.3685	
Effaten	Gyole efficiency A	.3625	.330	.532	-052	.331	.3305	.3186	.3355	.0225	-31a	312	.307	
Total Test Supplied - Robert.+	u un e	12.63	1285	1321	1360	1361	1:06	1440	1461	1488	1612	1545	1569	225
Hest Supplied varing	Ang.	32	47	80	611	14 0	165	199	220	247	271	304	328	ENCY - 12
Heat Drop Pr (re-	14 P2	294	283	368	345	334	217	2.92	275	254	233	199	175	IS BEELOI
Heat Prop	B.Th.U	19	42	12	108	126	146	181	Los	326	249	282	307	RANKIN
a.		1 350	200	150	ICO	BO	60	-	30	31	15	0	9	
4		200						5.000						

TABLE NURBER. 25

P

Initial steam temperature;= 5500F

Initial Steam pressure - 500. 188. per 'q.ins.eds. Final Steam pressdre 188. per S. ins.ads.

REARES.																
over le.	pyche B	3.40		4.95	7.43	11.0	12.54	14.95	19.1	16.7	16.9	17.65	18.0	16.7	14.55	
cent, gen n Rankino Cyu	djole -	100		26.	26*	1.24	1 2	.775	Q	1 93	-2.17	-3.25	-5.27	-7.75	-10 *23	
Per the	Cycle of ficteupy B	WE.		.339	.347	.3585		.368	.375	.377	.3775	.360	.781	.377	.370	
Sffictone	cycle efficiency	a a a	020	•326	.326	-327	.327	.3355	.323	.320	.316	.5125	.306	-296	.289	
Total He t Supplied	- neuco	BTAU	1241	1261	1291	1330	1351	1374	1409	1430	1454	1478	1512	1537	1558	.523
Hest Supplied	auring rehest- ing.	5. Ta. T	36	46	76	115	136	150	194	215	239	263	297	322	343	LUISBOY =
Hoge	Ny (re- testud) to Pr	5.7h.U	382	122	255	535	322	306	282	265	242	222	181	161	129	ANY REIL
Hoot	and por	D E	22	40	66	100	119	141	173	193	213	240	272	297	320	RAD
in the			250	200	150	100	60	60	40	30	21	15	G	9		
- 2			IC		- 20 -					-						
<u>A</u>			20								- 12	-				

TABLE NUEBER 24

Intuial Dream pressure - 300. 15s. per so ins.abs. Final Steam pressure - ..!.. 10s. "er so ins.abs.

	RILARKS.		-							-						
	0462 (le.	Wycle B	2	22	3.73	6.63	9.95	11.05	12.45	14.0	14.9	15.53	16.5		15.53	13.36
	cent. gu n Runkine Oyo	Cycle		66	311	311	311	0	- 62	0	-2.18	-3 73	99	-0-0-	-8.70	-11.8
	sy. Per	Cycle efficiency B		3295	.334	.3.35		.3575	.362	.367	.370	372	375	574	372	365
		2 cle e ficiency	4	.3235	.323	a223	1 + 1	1 100	320	.317.	.315	310	307	300	294	-284
2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Total He + Supplied - Refert.+	1169	B Th U	1211	-1233	1263	1302	1320	1344	1376	1398	1424	1448	1479	1504	1525
. TOS. CEL	Hest Supplied Surfire	reheat- ing.	3 Th C	22 -	44	74	113	131	155	187	209	235	259	290	315	336
- 	Heat Prop	n ated o P2	B.th.U	372	259	345	335	311	802 802	271	255	233	212	180	154	123
= STITE		4 64	B.Th.D	19	38	65	10	114	135	165	185	209	233	264	258	310
Steph p	<u>ρ</u>			350	200	150	100	80	60	40	30	21	15	gi		
11012	04		n ang dag	100	-	map and # 0 -										

Initial steam teaser ture; = 500°F Tes ner ture to which steam is rehea

TABLE RULFER. 25

Initial stoke temperature: $750^{0}F$ Temper ture to mutch steam is tehested $-750^{0}F$

HEER		-			-		2	10	-			12		14.1	-
t over	er sus		3.68	5.18	13.1	15.5!	18.1	20.7	22.0	23.5	83.E	000			
Barbine Ol	GVST		1.22	2.75	5.26	4.57	4.57	4.27	3,66	3.20	1.63	-1.68	er ange 1999 - 2		
29. 2942 7 100	dycle cfflotenev S		0%0*	.355	.571	.379	.3675	396	.400	.405	.406	401			
Efficienc	Cycle efficient/	d	332	.327	.541	342	111	6 W 3	075		The	2000	00000		
				-44 444 49		- 4a ta	- 100 100 10	27					a agan data -		
Total Ne. 4.	- Robert.+	B. Th. U	1347				2450	1466	1584	1547	Taya	1600	1654		323
Haft Total No.4.	rent t 1317 Jag. 1317	B. Th. U	30 1347		67 AUG	116 1200	159 2458	169 1486	207 1534	250 1547	257 1274	383 1900	317 1654		cianor = .528
Heat Heat Thial No.4.	by (red During - Robert. + Minted) row t 1317 to Pg 186.	P.Th.U. S.Th.U B.Th.U	1347		400 01 10 10 10 10 10 10 10 10 10 10 10 1	382 116 Tase	370 139 1450	354 169 1486	389 207 1534	312 230 1547	290 257 15/4	266 283 1600	226 317 1634		BSE. = TOTATIONE 200
Heat Heat Heat Total No.4	File Prove autific - Rebett.	B. ThE R. Th.U B. Wh.U B. Th.U			62 402 0V	106 382 116 120	129 370 139 1450	156 354 169 1486	192 339 207 1534	216 312 230 1547	242 290 257 12/4	5 268 266 283 1600	0 308 826 317 1654		SANTHE EFFICIENCE - 328
P3 Heat Heat Huff Total Sout.	- File autic - Releat.	B. The R. Th.U S. Th.U B. Th.U	- 440 50 1347	200 22	150 62 405 67	100 108 283 116 110	8C 129 370 139 3450	60 156 354 169 1486	40 192 339 207 1534	30 215 312 230 1547	21 242 290 257 1274	15 268 266 283 1600	0 308 826 317 1654		SAFINE EFFICIENCY = .328

TABLE NULBER.26

2

ġ

Initial Steam presente - 250. 156. per 39.18.538. Stami Steam pressure = 156. per 09.150.abs.

REARS.													
othr Alo.	e al		2.075	7.70	12.3	14 • 6	16.5	19.1	20.6	22.5	32.25	31.5	P.
cent. cu n Bankine Cy	- a - W		•92 4	12*2	3. 39	3.54	3.39	3*075	2.77	2.46	.615	-G.15	
cy. Per the	Cycle efficiency	Ē,	.336	.350	.365	.5725	-3765	.387	392.	862.	*397	,395	
Effeton	Cynle ef.lolendy	Ŧ	*33B	533£	.336	.3365	92C*	•355	. 334	555.	.327	.316	
Total Ment Suppided - Runaut.+	1394	B.Th.U	1522	1369	1404	1428	1454	TAPE	1516	1544	1991	1602	201
Heat Sup lieu curing	reheet ing.	B.Th.U	28	66	OII	154	160	198	222	250	275	30B	CT28HV
Reat 2:09 F3 (re-	to P2	B.Th.U	407	392	370	357	340	315	300	819	254	217	and a state
Brop Drop E1 to	¢4	D.Th.U	27	90	103	134	149	185	207	234	258	282	and the second s
5			500	IBO	100	80	60	40	20	31	15	6	
			1										

C

N U V B E H+ 26 Initial stell temper turuja 7000P Temper tura to which steam is reheated =7000P

		ted _650°F	REARES.							un va 10 1		
		15 robeat	over .	Pycho		3.11	7.52	12.15	13.F	15.5	17.75	19.0
		npersture; unich ateam	cest. gu n	Syole A		1.02	2.34	3. 27	5 .87	2.96	2.495	1.87
0	. 27	iti-l stemm te mper ture to #	y. Pur	Cycle efflotenor	n	.531	10545	.360	.385	.370	.376	.482
	NUCHER	di la	Effictions	Cycle effotoacy	đ	-3245	3385	-3315	.3315	3305	925.	12.2
	ABLE	19.1ns.sbs. 19.1ns.sbs.	Total Re. 1 Sumiled - Refeat.+	1269	the the st	1296	1351	1576	1398	1423	1460	1463
	891	. lbs. per i lbs. per i	Heat Supoliad Suring	reh. t.	B.Th.U	27	95	101	129	153	101	1814
		- 260	Heat Drop	to P2	3. M. B	395	380	559	346	329	304	267
		presente =	Brep brep		B.Th.U	10	67	28	118	141	176	TOR
		Steam pr	10		10 and 40 a	1 200	150	100	80	60	40	20
		intial Inal				360		-				

19.95 20.9 19.95 19.0

.955 0 -5.14 -5.14

.385 .588 .505

.3045

1509 1533 1568 1568

340

265

15

264

299

245 207 176 INE EF1

248 248 282 309

ø

N DITE

RANK

TABLE RUEBER. 28

Initial Steam presente - .250. los. per sq.ins.sbs. Sinai Steam presente - ...1. los. per sq.ins.abs.

Initial steam temper ture: 600°F

PELIRES.														
07% C	Tre to		3.47	7.85	11.05	15.25	14.8	16.7	18.0	1°61	19.9	19.55	19.65	
cent. sul n Bankin' C'	Cycle A		1.26	3,05	£*525	2.68	2.525	1.42	.946	0	946	-2.84	-4.73	
Per	Crule Crule et itiener	a	.326	.340	.352	.359	-364	-97C	-374	.3775	.350	.379	-375	
Efficienc	Dyole efficiency	¥	195.	.3235	. 530	-2265	4.52.5	.3215	.520	715.	-31 4	80¢.	30g.	
Total Year Supplied	1244	B.Th.U	1270	1004	1546	1360	1395	1426	1443	1477	1502	1634	1558	= .317
Hent Sup-11ed	rénest-	S.Th.P	36	90	102	122	119	182	305	233	858	290	314	(IONEIDIA
Hunt Drop	(bested)	S.Th.U	283	256	345	334	317	292	275	354	233	199	175	SKIIS EP
Heat	μ. (P.)	2.Th.T	24	54	32	111	135	167	169	215	629	272	396	I BAN
			200	150	TON	80	60		00	12	16	01		
104 104			1		are des sub a									
Ă.			250	-	_									

TAJLE SURBER.45

Ø

Init al Steam pressure 250. lbs. er sj.ins.abs. Final Steam essure lbs. per sg.ins.abs.

Inition steam temperature; = 550 FTamper thre to which steam is reheated = 550 F

REARI S.	-			-						un estidar *						
over 1e.	¢yc e		2.38	5.89	9 9	11.45	13.35	15	16.5	16.85	17.8	18.1	16.85	14.65		
aonto gain Sankine Cy	dycle .		.635	955	1.59	1.91	1.59	63.5	-318	-1.27	-2.23	-4.14	-6.69	-9.86		
Per the	Cycle efficiency)	385	3.25	.345	350	•356	3625	-366	.367	•370	-371	. 567	.360		
E fic en	C c e e f cie c	¥	316	.317	.319	.320	•319	.316	.315	.310		102	.293	.263		
Tota e t Supplied - Re eat	3121	B. Th. U	12 3	1275	1315	1.37	1361	1395	1 18	14.2	1 66	1501	1526	1547	.314	
Hea Sup lied	reheat-	R.Th.U	25	57	64	611	143	177	200	224	2.83	283	308	329	FICIENCY =	
Heet Trop	to P2	3.Zh.D	371	3.55	335	322	306	282	265	242	222	161	161	129	HE SHI W	
Test	сі г .	Th.U	25	50	85	105	128	159	181	205	S SS	261	236	309	RA	
Ed a			1 200	150	100	80	09	0 5 - 4-19 - 14-19	30	21	16	0		-		
£			250	an e din aka da												
	Per par Reat Rea Tota e t Eficence. Per per per per per content. Sain ote Rinda Supplied the supplied the sain ote sector.	$ \begin{array}{c cccc} P_{7} & Fer & Frow \\ \hline P_{7} & P_{7} & Frow & Sup lied & Supplied & Frow & Sup lied & Frow & Sup lied & Frow & Sup lied & Frow $	PP3HeatTota Te tEffcenuFer om gain of tP3DropSup liedSuppliedFer om gain of tRinki SF1to P2DropSuppliedFer om gain of tRinki SF3to P2ingcoteCycleCycleF3to P2ingBThABTh	PPPPFerTotal Te tFileTotal Te tP P_7 HeatJropSuppliedTotal Te tFerFerFain ore P_1 P_7 P_7 Supplied P_7 Supplied P_7 FerFer P_7 <t< td=""><td>PP3RestHeatTotal Te tEfficiencyPer con. gain ortAll and the string of the str</td><td>P1P3HeatHeatTotal Te tTotal Te tEfficienty.Per per gain arteP3DropTropSupliedSuppliedSuppliedMer arteMer arteP3DropTropSupliedSuppliedSuppliedMer arteP3DropTropSuppliedSuppliedMer arteP3DropTropSuppliedSuppliedMer arteP3DropTropSuppliedSuppliedMer arteP3DropTropTropSuppliedMer arteP3DropTropTropTropMer arteP4To P2TropTropBMer arteP5To P2S126022S1S6P5S5TropS1S15S15S65100E6S35971315S19S451.59100E6S35971315S19S451.59</td><td>PPFeetFeetFeetCotal SetFeetCotal SuppliedSuppliedRearRe</td><td>PPRectHeatTotal TotEtric enut.Per dent. gain OverPPSuppliedSuppliedSuppliedSuppliedF1toPSuppliedSuppliedSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toSupiteSupSupf5f5SupIteSitSupf5f5SupIteSitSupf5f5SupSupSupSupf6f5SupSupSupSupf6f5SupSupSupSupf6f5SupSupSupSupf6f5SupSupSupSupf6f5SupSupSupSupf6f5SupSupSupSupf6f5SupSupSupSupf6f5SupSupSupSup<t< td=""><td>PartPartPe</td><td>P1 P3 Rect Total Total Total</td><td>P1 P3 Reat Heat Total for Total for Efficiency Efficienc</td><td>P1 Tech Start Sta</td><td>Pit Fit Pit Pit<td>Pi Pi Pi<</td><td>P1 P2 Rest F3 Rest F3 Rest F3 Rest F3 Colut We L (a) P5 Colut We L (a) P5 Colut We L (a) P5 Rest F3 Rest F4 <threst F4 <threst F4 Rest</threst </threst </td><td>Part Fart Part <th< td=""></th<></td></td></t<></td></t<>	PP3RestHeatTotal Te tEfficiencyPer con. gain ortAll and the string of the str	P1P3HeatHeatTotal Te tTotal Te tEfficienty.Per per gain arteP3DropTropSupliedSuppliedSuppliedMer arteMer arteP3DropTropSupliedSuppliedSuppliedMer arteP3DropTropSuppliedSuppliedMer arteP3DropTropSuppliedSuppliedMer arteP3DropTropSuppliedSuppliedMer arteP3DropTropTropSuppliedMer arteP3DropTropTropTropMer arteP4To P2TropTropBMer arteP5To P2S126022S1S6P5S5TropS1S15S15S65100E6S35971315S19S451.59100E6S35971315S19S451.59	PPFeetFeetFeetCotal SetFeetCotal SuppliedSuppliedRearRe	PPRectHeatTotal TotEtric enut.Per dent. gain OverPPSuppliedSuppliedSuppliedSuppliedF1toPSuppliedSuppliedSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toPrene.trIteSuppliedF3toSupiteSupSupf5f5SupIteSitSupf5f5SupIteSitSupf5f5SupSupSupSupf6f5SupSupSupSupf6f5SupSupSupSupf6f5SupSupSupSupf6f5SupSupSupSupf6f5SupSupSupSupf6f5SupSupSupSupf6f5SupSupSupSupf6f5SupSupSupSup <t< td=""><td>PartPartPe</td><td>P1 P3 Rect Total Total Total</td><td>P1 P3 Reat Heat Total for Total for Efficiency Efficienc</td><td>P1 Tech Start Sta</td><td>Pit Fit Pit Pit<td>Pi Pi Pi<</td><td>P1 P2 Rest F3 Rest F3 Rest F3 Rest F3 Colut We L (a) P5 Colut We L (a) P5 Colut We L (a) P5 Rest F3 Rest F4 <threst F4 <threst F4 Rest</threst </threst </td><td>Part Fart Part <th< td=""></th<></td></td></t<>	PartPartPe	P1 P3 Rect Total Total	P1 P3 Reat Heat Total for Total for Efficiency Efficienc	P1 Tech Start Sta	Pit Fit Pit Pit <td>Pi Pi Pi<</td> <td>P1 P2 Rest F3 Rest F3 Rest F3 Rest F3 Colut We L (a) P5 Colut We L (a) P5 Colut We L (a) P5 Rest F3 Rest F4 <threst F4 <threst F4 Rest</threst </threst </td> <td>Part Fart Part <th< td=""></th<></td>	Pi Pi<	P1 P2 Rest F3 Rest F3 Rest F3 Rest F3 Colut We L (a) P5 Colut We L (a) P5 Colut We L (a) P5 Rest F3 Rest F4 Rest F4 <threst F4 <threst F4 Rest</threst </threst 	Part Fart Part Part <th< td=""></th<>

1 T T B T B . 30 TABLE

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N 12 18

Initial steam temperatures $600^{9}F$ Scoper ture to which steam is rohented = $500^{9}F$ 250 lhu. per et ins ebs. 1 lbs, per et ins abs. Initial Sheam presente -

19 545 545 545 545 545 565 565	19 245 245 255 255 255 255 255 255 2561	16 545 545 545 545 545 545 545 561 561 561	19 299 545 545 545 545 545 549 549 356 356 356 361
.328 .545 .345 .355	.339 .545 .345 .356 .356 .358 .361	.329 .545 .545 .355 .355 .358 .361 .361	.339 .545 .545 .355 .355 .355 .361 .362
14 145 145 145 10 10 10 10 10 10 10 10 10 10 10 10 10	14	145 145 145 145 145 145 145 145 145 145	* * * * * * * * * * * *
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.3145 .513 .3105 .308	.3145 .3105 .508 .505	145 115 115 508 508 505 5005	5 C 9 8 9 5 7 4
.3105 .3105	.3105 .305 .305	11.9 11.05 50.8 50.6 50.6	2 99 99 99 59 59 59 59 59 59 59 59 59 59
.3105 .31 .508 .5		1105	
	.305 .361	505 .561 5005 .5625	005 .561 94 .568

TAELE NULBER.51

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Initial Gream preservit - 200. That per soline.ads.

Initial stone temperature:= $750^{\circ}P$ Temper ture to which stone is reheated = $750^{\circ}P$

REAR S.	-								2	-	
aver ite.	ancie a	2.83	10.5	15.5	16.0	1.9.5	21.7 22.6 23.3	52.5			
cent. ou n Rubs,ne Oy	ay at = -	-47	3.45	4.40	4.41	4.70	4.70 5.77 8.67	47	Million .		
the per	rycla esticiendy E	326.	.3525	.562	.370	-200	588 391 393	.590			pr
Effection	2/cle effetenes	.2906	.330	•385	.56B	*334	334 331 327	*3175			
Totel No 4 Supplied Roselt.+	1330 R.Th.U	1260	1410	1454	1466	1508	1531 1555 1555	1620		50	
Sup lied	tag.	30	90	114	145	186	211 259 265	300		ENCY = -3	
Hant -	so Pa	405	362	270	354	329	312 290 268	226		TOTALS R	
Heat Drop	-4	88	85	101	135	174	199 227 253	285		RARKIN	
ptra An		1 150	100	BC	60	40	21 21 21	G,			
93 L4		200									1

TABLE O HULBER. 32 sq.ing.abn. ro.ing.abn. Tagper tire to which steam is roheated =700 %

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Initial Steam pressure - 200. Ibb. per sq.in8.abn. Final Steam pressure - 1., Ibb. per sq.in8.abs.

HILLARD. 4.7B 10.7 35.6 IA.2 13.1 Bycle Por cent. Main Over the Rankine Cydle. 5.82 4.30 3.82 2.014 1.91 Cycle Cycla erilutency .5475 .328 .366 122. -565 BELLELBERGY. Cyale effectency A 3875 .326 932. 122. .320 To Sal N= t Supplied = Roheat.+ B.Th.B 1472 135 1382 1406 1530 Hort Supplied Surfue rendat-trs. U.H.S. S E.P. 140 LiT III 137 Hart Drop 75 (re-fierbed) S. Th. U 340 515 370 292 388 Th. U 102 130 165 80 -Bert Dresp F1 Na 10% 100 0B 60 150 S. -1 H. 1008 14

EMERINE SFFICIENCY = 1314

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Initial Steam pressure - 200. The per syline.obe. Final Steam pressure - Its. per syline.abs.

RELARKS.												-
over ile.	al state	4.5	10.15	2	21 91	DT. 81		a 01	0.00	10.05		1.01
cont. gain Runkine 03	cycle Å	1.29	00.00	00 -	2	0.0*	23.0	2.30	001	42.1	on. 1-	t.
oy. Per the	Sycie Sycie B	Son	-41.5		6 M.	00	500*	.365	GHTC*	.276	\$15*	
gffieleb	Sycle efficiency		are.	122.	.3225	225	132.	.320	112*	-315	-20E	a725.
1												
so tel Ser Supplied	1721		1307	1355	1378	1404	1443	1466	1403	1518	1565	1575
Hent Supplied	ting.	G.T.R.	36	18	104	133	174	195	328	247	282	307
Heat	Pa (Te-	E.Th.U	280	359	346	585	304	267	265	SAS	207	176
Sect.	3	8.Th.U	25	76	96	122	159	181	808	233	267	293
Harris and Harris			150	TOO	90	00	40	30	21	15	G	0
R			1									
Tr'			200									

.514

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TORNEL TER

RATERIAL

.299. Ibn. per ag. ine. abs. TABLE

Initial Steam pressure -Final Steam pressure -

RELATES.									- yes - 40° - 40°				
Je.	grele B		9.18	11.7	15,35	15.95	17.3	10.9	10.7	19.55			
dent. grun Bankine Cyu	Syste -		1.50	2,93	3.60	3.98	1.79	.976	1.463	00 01 10 1			
9. Fer the	0)cle efitsiond		.320	545.	.34B	.366		.365	.0675	.367	-		
ECTA Jano	gyold afficiency	•	112.	.316	.015	415.	.3125	016.	.3075	00 **			
Total Fact Sumplied	- Bend 5.1	B.Th.U	1281	1348	1374	1410	1435	1462	1487	8191		101	
Bust ted	auring rohect- ing.	B.Th.U	35	108	126	164	127	1010	TAD	293		kacz = .2	
Heat	Fr (re- bented)	B.Th.F	368	345	615	NC 1	and	210	502	COL		11122 31	
Hest Hest	3	B.Th.U	21	73		011	1 101	175	1 200	5 224	135 6	FUEL	
1 20 23			g00 1 150	100	18	0	* 1	20	04	-			

Initial steer termor ture;= 600° ? Turper ture to suph steam is reheated = 600° F N L L L Z H

TABLE

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Initial Stds Final 6t

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R. M. ARA, S.														
ana.	and a		3.96	8.90	10.55	12.9	16.3F	16.6	17.15	16.15	18.8	17.15	15.6	
cent. 2m n c Runkine Cyn	oyate -		86.	12.3	g.31	2.475	1,96	66*	25	66	-0.64	-5.11	-8.25	
y. per	Cycle effictone?	*	.315	.330	.335	.542	9852*	.355	.355	-36E	•360	.355	.350	
ZFFINSENC	gele relicional	ł	.506	.310	.310	.3105	502*	.306	.302	102*	395.	.9675	-278	
Total "=+ Bus, lich	1221	3.7h.U	1254	1297	JISI	1544	1360	1402	1457	1465	1488	1515	1536	
Hest Bupplied	reduce to	F. The F	22	76	96	135	159	181	806	232	267	292	315	
de t Drop	the P2	E.Th.U	äbr	325	332	306	282	265	242	2202	161	161	128	
Heat	F1 F5	5.fb.7	20	67	13	TIT	144	165	TBC	215	248	275	863	
fa			160	too	80	60	40	30	21	16	0	0	*	
H.			000	-										

202.

Dia TOTAL

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TABLE DILBER. 36

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Initia ate = temperature;= 50009 Temper ture to which stems is reheated = 5000F

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Bull-ARE.		-						_							
pye:	arota B	5.65	7.65	9.65	1	13.5	14.6	15.8	16.1	10.45	1.91	13.95			y ang sati
dent. gal a	arya .	199.	1.33	1 44	T AR	130	0	-1 14	.8.16	012° 9-	-6.3	-9-4			
oy. Per o	37010 62 \$210205 8	au		Uan		200*		0 4 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	0040*		3485				
Bificies	cycla sifickensy A		sop.	305.	-305	*305	203	106.	.2075	0.65.0*	1980		212*		
Total Tes +	9611	8.5h.U	1225	1368	1200	1314	1348	1371	1598	1420	1454	1479	1660	102	
Heat Bupol tod	nuran rehost- ing.	B. D.D.	55	75	96	118	165	176	202	225	809	284	201	= IONEIDI	
Takt Trop	re tent) re tent) so P2	J. C.	292	383	118	365	RT	355	253	613	180	154	183	TILLES 234	
Heat .	2	B. 24.0	13	63	94	SOL	137	158	103	305	523	1 365	1 287	Na	
E.			150	100	90	60	-	30	Ta	IE	G		-		
p.'		15-1	I O										-		
T			00												

TABLE No. 37

Deductions from Cycle E Line Curves

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Hax. File	cycle B	23 63 22 60 21 37 19 06 18 46 17 5 49	23.46 22.97 21.41 19.47 18.33 16.76	23 98 22 42 21 64 19 28 17 88	23.78 22.28 21.71 19.48 17.89 16.34
Parcen go	yc1 A	3.22 3.11 2.56 1.14 .136	3.29 3.29 2.55 1.66 1.255 2.598	3 80 3 24 2 98 1 92 1 03 488	5.24 5.24 5.36 2.25 1.24 1.24
	10				
B	Fressure f Rene t	17.5 17.5 15 15 20	17.5 17.5 15 12.5 12.5	17 5 20 15 12 15 15 15	7 5 17 5 13 12 5 12 12
Cvol e	24 - 1mum e iciency	442 434 434 4167 4045	4315 4218 4218 414 405 397 390	424 415 4075 397 369 369 369	4153 4072 398 3888 3888 3888 3746
	Preasure for Re- ne ting	132 5 135 170 190 170 to 00 250 to 000	95 120 150 150 255 255	100 90 125 122.5 125.5 125.5 125.5 125.6	75 95 90 120 91.00 100 to 250
04-1-	Effetency	369 365 3565 354 3475 5555	361 3543 3497 3447 3397 3397 336	355 356 345 3394 3296	3495 3438 338 323 323 323
Renkine		3575 351 351 351 34	3495 343 341 345 334 334 334	8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	3355 3255 3255 3255 3255 3255 3255 3255
Temerature of steam	of reheat	420 6650 5500 5500 5500 5500 5500 5500 55	4420 6650 6650 6650 6650 6650 6650 6650 66	00000000 020000 0200000 02000000000000	4200 6200 6200 6200 600 600 600 600 600 6
ni ini		6 C O	410	350	3 00

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TARE No. 37 (Contd.)

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Author Jenson A E Name of thesis An Analysis of the Reheat Cycle for steam 1973

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