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ORVAC-TF: A FORTRAN CODE FOR THE CALCULATION OF A DESALINATION PLANT INCORPORATING A VAPOR COMPRESSOR SYSTEM TOPPING AN MSF PLANT

R.O. Friedrich

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ORVAC-TF: A FORTRAN CODE FOR THE CALCULATION OF A DESALINATION PLANT INCORPORATING A VAPOR COMPRESSOR SYSTEM TOPPING AN MSF PLANT

The computer code described in this report was developed by the Operations Analysis Division of the Oak Ridge Gaseous Diffusion Plant for the ORNL Nuclear Desalination Program.

R. O. Friedrich

JANUARY 1968

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ORVAC-TF: A FORTRAN CODE FOR THE CALCULATION OF A DESALINATION PLANT INCORPORATING A VAPOR COMPRESSOR SYSTEM TOPPING AN MSF PLANT

ABSTRACT

A program has been written for the IBM-7090 system which defines the operating characteristics and component costs of a vapor compressor-MSF coupled desalination plant complex. The plant complex consists of a reactor plant for the production of steam and a distillation plant for production of water. The distillation plant consists of a vapor compressor plant (two vertical evaporator effects, compressor, back-pressure turbine and generator) and an MSF plant which is used to preheat the vapor compressor feed stream and utilize the steam from the back-pressure turbine for further water production.

The output from the program consists of all pertinent operating and cost information for the two major coupled plants.

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ORVAC-TF: A FORTRAN CODE FOR THE CALCULATION OF A DESALINATION PLANT INCORPORATING A VAPOR COMPRESSOR SYSTEM TOPPING AN MSF PLANT

IDENTIFICATION

ORVAC-TF: Distilled Seawater

Machine: IBM-7090 Language: Fortran IV

Union Carbide Corporation, Nuclear Division
Oak Ridge Gaseous Diffusion Plant
Oak Ridge, Tennessee

PURPOSE

ORVAC-TF was written for a parametric study of the design, capital costs and operating costs of a vapor compressor-MSF coupled desalination plant. The plant complex consists of:

1) A nuclear-powered reactor which supplies heat for the production of steam,
2) A turbine-generator plant which produces electricity for use within the plant and mechanical energy for the vapor compressor,
3) A vapor compressor,
4) VTE evaporator effects associated with the compressor, and
5) An MSF preheating and water producing system.

A flow diagram of the vapor compressor-MSF plant complex appears in Figure 1.

The seawater feed is heated by passing through the tube side of the MSF preheater. The feed enters the high temperature (discharge) VTE effect where the compressor discharge vapor is condensed and evaporates an equivalent portion of the feed. The more concentrated feed then enters the lower temperature (suction) VTE effect where more evaporation occurs. Finally, the feed stream is returned to the flash plant where it flashes

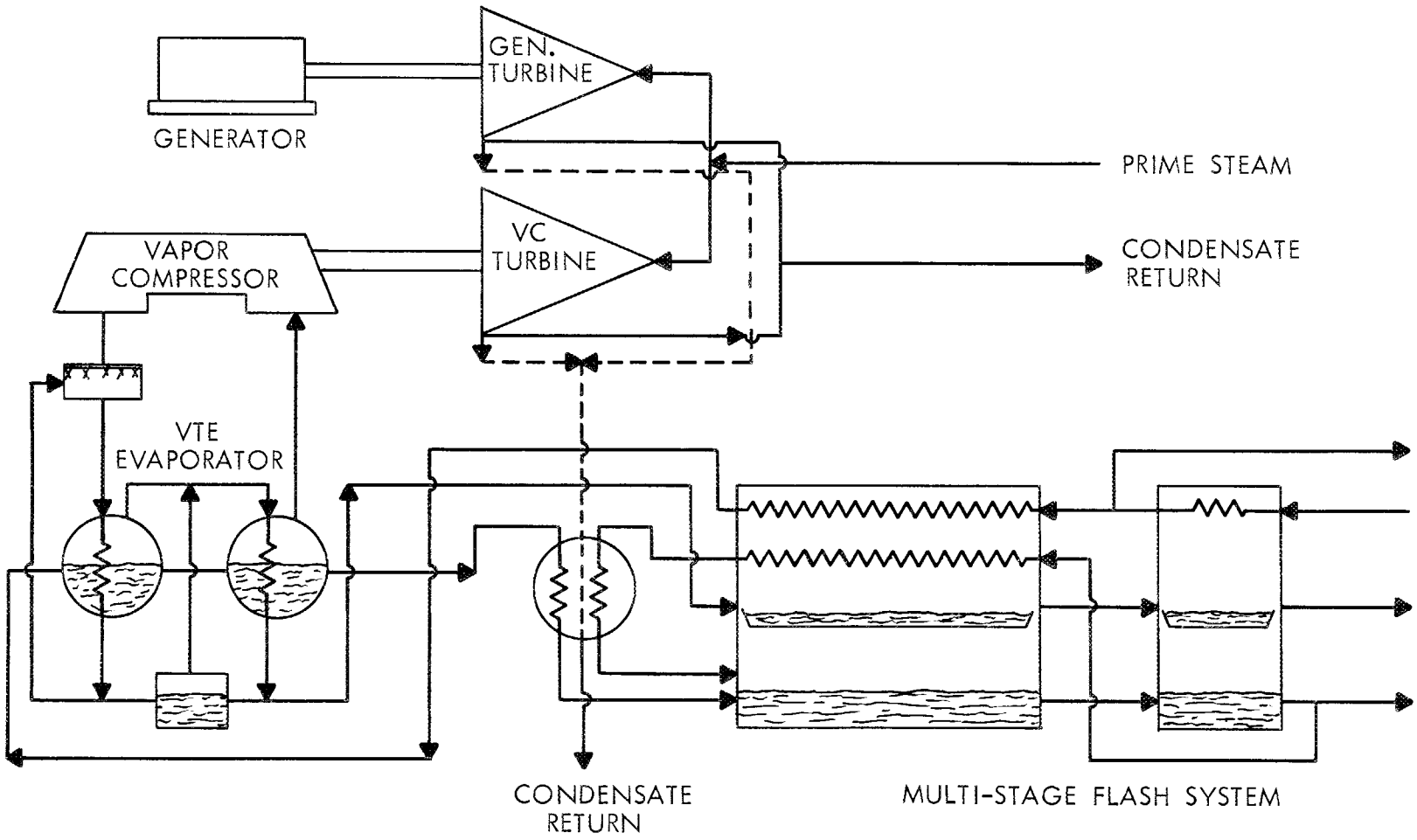
GENERATOR
GEN. TURBINE
PRIME STEAM
VAPOR COMPRESSOR
VC TURBINE
CONDENSATE RETURN
VTE EVAPORATOR
CONDENSATE RETURN
MULTI-STAGE FLASH SYSTEM

Figure 1

down to the blowdown temperature, providing heat for the preheating requirement and producing fresh water. The vapor from the suction effect is compressed by the vapor compressor to the pressure of the discharge effect. The vapor becomes superheated during adiabatic compression. To avoid low heat transfer coefficients, this superheat is removed in a desuperheater before the vapor passes to the discharge VTE effect. A flash tank is used between effects to allow product to "flash" down to the suction effect condensing temperature. The vapor thus formed is used for heating the suction effect. The product formed in the vapor compression system is introduced directly into the first MSF stage product tray; however, the brine blowdown is heated in the brine heater before being introduced into the top stage of the MSF preheater.

RESTRICTIONS

Hardware

The code is written for the IBM-7090 with the following hardware:

on-line tape units 5 and 6
off-line card-to-tape
off-line tape-to-card
off-line tape-to-printer.

System

The code is written in Fortran IV and contains a main program and thirty-four subroutines arranged in five linkages. The linkage system of overlays was required due to the size of the program. There are no programmed pauses or stops. All input and output is by magnetic tape for use in monitor-type operation.

METHOD

Description of the Problem

It is desired to design and determine the cost of a desalination plant incorporating a vapor compressor operating across VTE evaporating

effects with an MSF preheater. A nuclear reactor provides prime steam to operate the turbo-generator and the vapor compressor drive turbine. The turbines operate with a relatively high back pressure in order to provide exhaust steam for the MSF plant which serves to preheat brine for the VTE effects and, additionally, produces water.

Figure 2 presents an overall program flow of ORVAC-TF. Several initial estimates of variables (vapor compressor shaft power, concentration between VTE effects) are needed to begin the calculation. This enables the vapor compressor characteristics, brine flows and steam flows to be calculated. A better computation of the inter-effect concentration enables the compressor and flow variables to be calculated more accurately. One such iteration is sufficient. The compressor and VTE geometries are determined, together with the variables required to enter the MSF plant calculation. The subroutine ORSEF is called which completely designs the MSF plant. The code ORSEF has been documented[1] and details are therefore not given here. A flag, KØUTPT, determines the program flow. Initially, KØUTPT = 0 and the heat and material balance portion, only, of the MSF plant program is solved to determine the proper scaling for the vapor compressor shaft power. KØUTPT is then set equal to 1 and the next time ORSEF is called the MSF plant program is solved in its entirety. The vapor compressor system and its associated cost equations are also solved. All output is printed after the vapor compressor costs are computed in subroutine CØSTVC.

Capital costs of all major equipment items are calculated. The important operating costs are computed and a unit cost of water is determined.

The data input to VAPCØM consists of:

1) Steam temperature
2) Temperature drop across each VTE effect

---

[1] Mothershed, C. T., ORSEF: A Fortran Code for the Calculation of Multi-Stage Flash Evaporation Desalination Plant Designs, March 1966, (ORNL-TM-1542).

DWG. NO. G-67-803

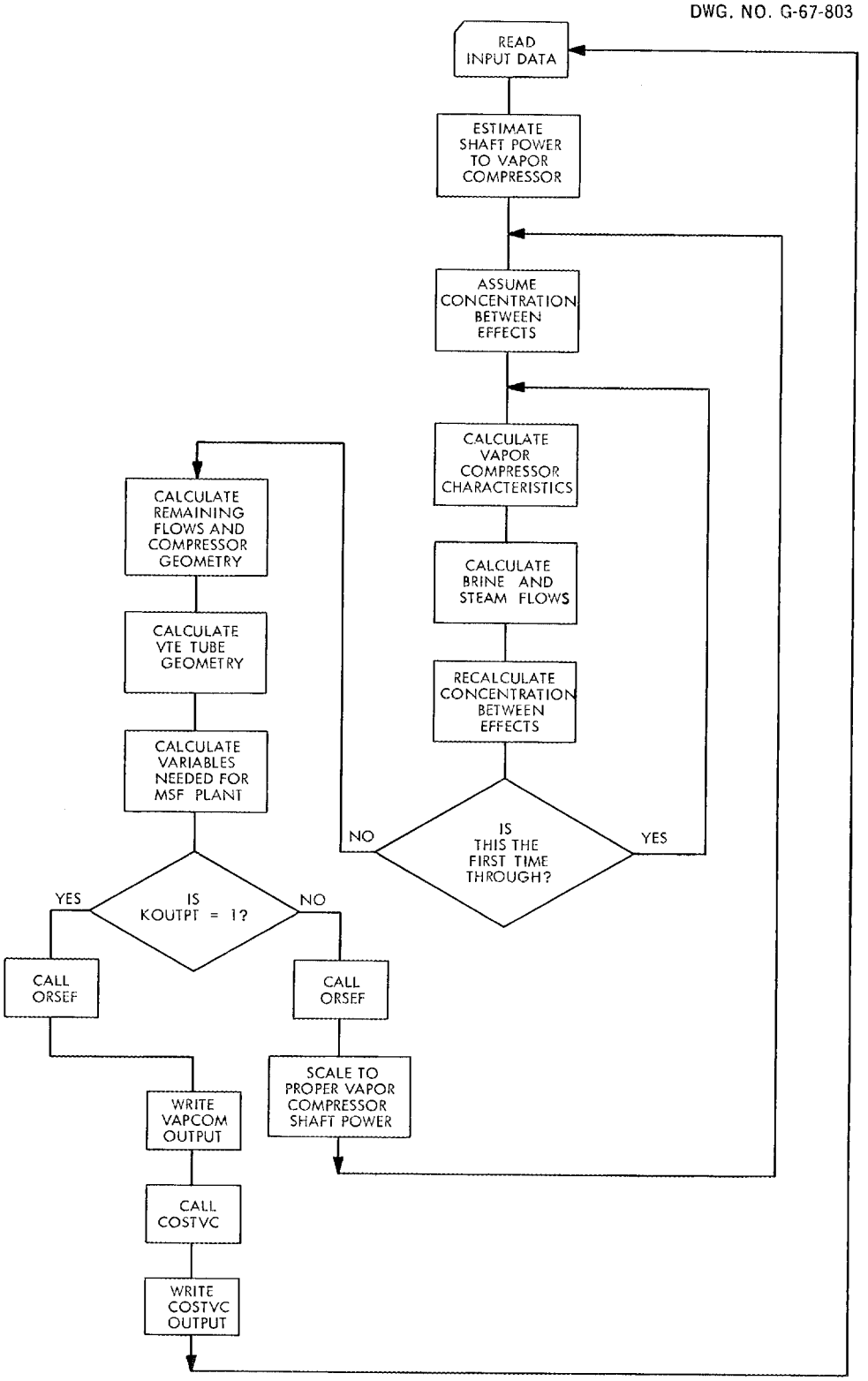

Figure 2

ØRVAC-TF

3) Total plant product rate
4) Ocean concentration
5) VC maximum concentration ratio
6) Evaporating temperature for the suction effect
7) Prime turbine steam conditions
8) VTE tube geometry (length, i.d.)
9) Reactor parameters (prime steam conditions, reactor and turbine cycle efficiencies, auxiliary power requirements).

Equations

The following sections contain commented descriptions of ORVAC-TF subroutines. The Fortran equations which require explanations are listed in sequential order preceded by a brief discussion or comment.

1. VAPCØM

This subroutine calculates process characteristics, geometry items and costs of a vapor-compression water plant shown in Figure 1.

After the initial data are read into VAPCØM, several constants are set in the body of the program.

The suction effect chemical boiling-point elevation may be calculated explicitly. One degree is added to the chemical boiling-point elevation to allow for inherent system resistances.

```
CØNSUC  =  CØ × CRVC
CALL BØPR (TSE,CØNSUC,ALPHA)
ALPHAS  =  ALPHA + 1.0.
```

The suction effect condensing temperature is then calculated.

```
T       =  TSE - ALPHAS
CALL PSIA (T,CMPS)
TSC     =  TSE + DELTS.
```

The salt concentration of the discharge effluent has to be estimated to calculate the chemical boiling-point elevation of the discharge effect.

$$CRF = \left(1.0 - \frac{1.0}{CRVC}\right)$$

$$C\emptyset NDIS = C\emptyset \Big/ \left(1.0 - \frac{CRF}{2.0}\right)$$

$$ALPHAS = ALPHAS - 0.4$$

$$TDE = TSC + ALPHAD$$

$$C = C\emptyset NDIS$$

CALL BØPR (TDE,C,ALPHA)

$$ALPHAD = ALPHA + 1.0.$$

Evaporating and condensing temperatures in the discharge effect are then calculated.

$$TDE = TSC + ALPHAD$$

$$TDC = TDE + DELTAD.$$

Characteristics of the compressor may then be calculated.

$$PR = CMPD/CMPS$$

CALL VAPV (TSE,CMPS,SPVØL)

$$CMP\emptyset W2 = TB\emptyset UT2 \times EFFC\emptyset M.$$

The enthalpy of the inlet and discharge streams is:

CALL VAPH (TSE,CMPS,HSUC)

CALL VAPH (CMTD,CMPD,HDIS).

The suction effect vapor flow is:

$$WS2 = TB\emptyset UT2/(HDIS - HSUC).$$

The vapor flow from the flash tank is:

$$WVF = \frac{WS2 \times (HTDC - HTSC)}{VAPTSC}.$$

The blowdown flow is:

$$CB = C\emptyset \times CRVC$$

$$WB2 = \frac{C\emptyset NDIS \times WS2}{CB - C\emptyset NDIS} .$$

The discharge effect vapor flow is:

$$WD2 = \frac{WB2(HC\emptyset N-HBL\emptyset W) + WS2(HC\emptyset N-HSUC) + WVF(HVSC-HTSC)}{HTSC - HVTDE} .$$

The salt concentration of the discharge effect effluent is now recalculated.

$$C\emptyset NDI1 = \frac{C\emptyset \times WF2}{WB2 + WS2} .$$

An iteration is used until CØNDI1 approaches CØNDIS.

New values of WD2, WF2 and WB2 are obtained and used to iterate the correct value of CØNDIS.

Flows and heat content of various streams are now calculated.

$$QDIS = WS2 \times HDIS$$

$$QPR\emptyset D = WP2 \times HTSC$$

$$QBL\emptyset W = WB2 \times HBL\emptyset W$$

$$QFEED = QPR\emptyset D + QBL\emptyset W - TB\emptyset UT2 .$$

The feed stream temperature is determined from the slope of its enthalpy-temperature line.

Compressor volume flows and geometry are calculated.

$$VS = WS2 \times SPV\emptyset L/60.0$$

$$VCGPD2 = 2.90333(WS2 + WD2)$$

$$V\emptyset LDIS = WS2 \times SPV\emptyset LD/60.0$$

$$DIAMCD = \left[\frac{V\emptyset LDIS \times 4.0}{3.1416 \times 500.0 \times 60.0}\right]^{0.5} .$$

The VTE tube heat transfer coefficients are:

TSEC = TSE - ALPHAS

UDELT = TSC - TSEC

CALL UCALC (UDELT,LENS,TSEC,CØNSUC,ZUBARS)

UDELT = TDC - TSC

CALL UCALC (UDELT,LEND,TSC,CØNDIS,ZUBARD) .

The effect areas and tube geometry are next calculated.

AD = WS2(HDIS-HTDC)/(ZUBARD × DELTAD)

AS = [WD2(HVSUC-HTSC) + WVF(HVSC-HTSC)]/(ZUBARS × DELTS)

ND = AD/(LEND × 3.1416 × DISID)

NS = AS/(LENS × 3.1416 × SUCID)

The vapor-compression performance ratio is:

$$\text{RPVC} = \frac{\text{WP2} \times \text{1.E3}}{\text{TBØUT2}} .$$

The steam flows required for operating the VC plant and turbo-generator are:

WS1 = TBØUT2/WA

and

$$\text{WS3} = \frac{\text{PØBTU2} + \text{REAPØ} \times \text{WS1[HTURBI-HLTRBS]}}{\text{WA} - \text{REAPØ} \times \text{[HTURBI-HLTRBS]}} ,$$

respectively.

Process steam quality is:

$$\text{QUAL} = \frac{\text{HTURBØ-HLTRBS}}{\text{HVTRBS-HLTRBS}} .$$

The total heat input at the top of the MSF plant is:

QBR = TBØUT2 + WSTEAM × (HVTRBS-HLTRBS).

The MSF system (ØRSEF) is now called.

The turbine output power is then scaled.

$$TB\emptyset UT2 = TB\emptyset UT2 \left(\frac{GT\emptyset T}{GT\emptyset T1}\right) .$$

VAPCØM writes out all the pertinent vapor compressor information. CØSTVC is then called to furnish the required cost calculations and end the program.

2. ØRSEF

ØRSEF is actually a complete program for the solution of the MSF system which serves as the preheater for the subject system. In ØRVAC-TF, it is used as a subroutine. Since ØRSEF has been documented[1] the details of this program will not be repeated here. Since the time of documentation, revisions have been made in ØRSEF. Most notable of these changes has been (a) conversion from Fortran II to Fortran IV language, (b) improvement in the associated cost basis, (c) changes in physical properties bases, (d) improvement of a routine for computing the condenser tube bundle geometry, (e) incorporation of a routine for computing the demister requirements, and (f) improvement in the total boiling-point elevation assumptions. The ØRSEF code used with ØRVAC-TF is this later version.

3. BØPR

This subroutine calculates the boiling-point elevation of saline solutions as a function of temperature and salt concentration.[2] The data were obtained and fitted to an equation by Stoughton and Lietzke.[3]

---

[2] Ayers, W. D., Physical Properties of Brine and Product Water, Internal Correspondence to D. M. Eissenberg, Y-12, December 16, 1966.

[3] Stoughton, R. W. and Lietzke, M. H., "Calculation of Some Thermodynamic Properties of Sea-Salt Solutions at Elevated Temperatures from Data on NaCl Solutions," Journal of Chemical and Engineering Data, Vol. 10, No. 3, pp 254-260, (July 1965).

$$BPE = [565.757/TC\emptyset R - 9.81559 + 1.54739 \times \ln TC\emptyset R - (337.178/TC\emptyset R - 6.41981 + 0.922753 \times \ln TC\emptyset R)CC\emptyset R + (32.681/TC\emptyset R - 0.55368 + 0.079022 \times \ln TC\emptyset R)CC\emptyset R^2] \times CC\emptyset R/(266{,}919.6/TC\emptyset R^2 - 379.669/TC\emptyset R + 0.334169)$$

$$BPR = 1.8 \times BPE$$

where:

BPR = boiling-point elevation in °F

TCØR = (t(°F) + 460.0)/1.8

CCØR = 19.819 × C/(1.0-C)

C = salt concentration, weight fraction.

4. DINTPL

This subroutine calculates various physical properties of saline solutions as a function of temperature and salt concentration.[2] A flag, II, determines which physical property will be calculated.

a) If II = 1, the specific heat branch is entered. If the salt concentration is < 0.005, the specific heat of pure water is calculated.

$$CP = 1.0121559 - 0.00024618473(T) + 0.10282155E\text{-}5(T^2).$$

For salt concentrations > 0.005, the following equation is used:

$$CP = 0.96946859 + 2.0(0.00010404965)(T) - 0.91199294(C) + 2.0(-0.00064829659)(C)(T) - 1.555779(C^2) + 2.0(0.0076721469)(C^2)(T) + 6.7981008(C^3) + 2.0(-0.012610354)(C^3)(T)$$

where

CP = specific heat, Btu/lb-°F

T = temperature, °F

C = salt concentration, weight fraction.

b) If II = 2, the enthalpy branch is entered. If the salt concentration is < 0.005, a subroutine WATH is called which calculates the enthalpy of pure water.

For salt concentrations > 0.005, the following equation is used:

$$
\begin{aligned}
H = & - 30.234836 + 0.96946859(T) + 0.00010404965(T^2) \\
& + 72.470209(C) - 0.91199294(C)(T) - 0.00064829659(C)(T^2) \\
& - 25.739723(C^2) - 1.5557791(C^2)(T) + 0.0076721469(C^2)(T^2) \\
& - 386.23682(C^3) + 6.7981008(C^3)(T) - 0.012610354(C^3)(T^2)
\end{aligned}
$$

where

H = enthalpy, Btu/lb

T = temperature, °F

C = salt concentration, weight fraction.

c) The branches, II = 3 and 4, are dummy branches and not used.

d) If II = 5, the density branch is entered and the following equation used:

$$
\begin{aligned}
DEN = & \ 62.707172 + 49.364088(C) - 0.43955304E\text{-}2(T) \\
& - [0.032554667(C)](T) - 0.46076921E\text{-}4(T^2) \\
& + [0.63240299E\text{-}4(C)](T^2)
\end{aligned}
$$

where

DEN = density, lb/ft^3

T = temperature, °F

C = salt concentration, weight fraction.

e) If II = 6, the thermal conductivity branch is entered and the following equation used:

$$
\begin{aligned}
C\emptyset ND = & \ [0.30157913 + 0.697989E\text{-}3(T) - 0.12506E\text{-}5(T^2) \\
& - 0.2072E\text{-}10(T^3)] \times [- 0.1687109(C) + 1.0]
\end{aligned}
$$

where

CØND = thermal conductivity, Btu/hr-ft-°F

T = temperature, °F

C = salt concentration, weight fraction.

f) If II = 7, the viscosity branch is entered and the following equation used:

$$VIS = e^{[-10.592566 + 0.4606532E\text{-}2(R) - 11.591155(C) + (0.012602329)(C)(R) + 4759.5941/R + 3863.7378(C)/R]}$$

where

VIS = viscosity, lb/hr-ft

R = temperature, °R

C = salt concentration, weight fraction.

5. WATH

This subroutine calculates the enthalpy[2] of pure water as a function of temperature using the following equations:

If $T < 360°F$,

$$H = -32.179105 + 1.0088084(T) - 1.1516996E\text{-}4(T^2) + 4.8553836E\text{-}7(T^3) - 7.3618778E\text{-}10(T^4) + 9.6350315E\text{-}13(T^5) .$$

If $T \geq 360°F$,

$$H = -9.0411706E2 + 10.673802(T) - 4.2753836E\text{-}2(T^2) + 9.41244E\text{-}5(T^3) - 1.0315357E\text{-}7(T^4) + 4.560246E\text{-}11(T^5)$$

where

H = enthalpy, Btu/lb

T = temperature, °F.

6. PSIA

This subroutine calculates the saturated pressure of water vapor as a function of the saturated vapor temperature.

$$T = (TF + 459.69)/1.8.$$

If $TF \leq 122°F$,

$$P = \frac{14.6959(218.167)}{\text{Exp}\left[2.3025851(X/T)\left(\frac{A+BX+CX^3}{1.0+DX}\right)\right]}$$

where

TF = saturation temperature, °F

P = saturation pressure, psia

X = 647.27 - T

A = 3.2437814

B = 5.86826E-3

C = 1.1702379E-8

D = 2.1878462E-3

If TF > 122°F,

$$P = \frac{14.6959(218.167)}{\mathrm{Exp}\left[2.3025851(X/T)\left(\frac{A+BX+CX^3+EX^4}{1.0+DX}\right)\right]}$$

where

TF = saturation temperature, °F

P = saturation pressure, psia

X = 647.27 - T

A = 3.346313

B = 4.14113E-2

C = 7.515484E-9

D = 1.3794481E-2

E = 6.56444E-11

7. VAPTS

This subroutine calculates the temperature of water vapor as a function of pressure and entropy.

$$ZED = 0.57477 \times A\log_{10}(P) - 3.2949 + 0.93551(S) + 0.32531(S^2)$$

$$A0 = 203.0$$

$$A1 = 477.3 + 70.0(S)$$

$$A2 = 440.0 - 24.86(S)$$

$$T = A0 + A1(ZED) + A2(ZED^2)$$

$$CP = \frac{1.0}{[-9.513 + 11.342(S) - 2.736(S^2)]} .$$

The subroutine VAPS is then called to obtain an entropy check value:

CALL VAPS (T,P,SC)

DELS = SC - S

$$DELT = -(T + 459.69)(DELS)\left[1.0 + \frac{DELS}{2.0(CP)}\right]\Big/CP$$

If $|DELT| < 0.005$, the calculated temperature, T, is used as the answer and control is returned to the calling program.

If $|DELT| \geq 0.005$, T = T + DELT and control is returned to:

CALL VAPS (T,P,SC)

where

P = pressure of water vapor, psia

S = entropy of water vapor, Btu/°F-lb

SC = entropy of water vapor, Btu/°F-lb

T = temperature of water vapor, °F.

8. VAPTH

This subroutine calculates the temperature of water vapor as a function of pressure and enthalpy.

$$T = A0 + A1(H) + A2(H^2) + \left[\frac{P}{(B0+B1(H)+B2(H^2)}\right]$$

$$CPIV = A1 + 2.0(A2)(H) - P[(B1+2.0(B2)(H)]/[(B0+B1(H)+B2(H)^2]^2$$

where

A0 = - 2.8277E3

A1 = 3.0391

A2 = - 3.5413E-4

B0 = 2.4318E1

B1 = - 7.1479E-2

B2 = 0.45305E-4

T = temperature, °F

H = enthalpy, Btu/lb

P = pressure, psia.

The subroutine VAPH is called to obtain an enthalpy check value:

CALL VAPH (T,P,HC)

DELT = CPIV(H-HC) .

If $|DELT| < 0.005$, the calculated value of T is used as the answer and control is returned to the calling program.

If $|DELT| \geq 0.005$, T = T + DELT and control is returned to:

CALL VAPH (T,P,HC).

9. VAPV

This subroutine calculates the specific volume of water vapor as a function of temperature and pressure.

P = PS/14.6959

T = (TS + 459.69)/1.8

TAU = 1.0/T

where

PS = pressure, psia

TS = temperature, °F.

Then

$$VC = 4.55504(T/P) + [BO+PHE1(P)+PHE3(P^3)+PHE12(P^{12})]$$

$$V = \frac{VC}{62.428}$$

where

V = specific volume, ft^3/lb

BO, PHE1, PHE3, PHE12 are functions of TAU.

10. VAPH

This subroutine calculates the enthalpy of water vapor as a function of temperature and pressure.

P = PS/14.6959

T = (TS + 459.69)/1.8

TAU = 1.0/T .

Then

$$HC = FO(P) + \frac{F1(P^2)}{2.0} + \frac{F3(P^4)}{4.0} + \frac{F12(P^{13})}{13.0} + FP$$

$$H = 0.043557(HC)$$

where

PS = pressure, psia

TS = temperature, °F

H = enthalpy, Btu/lb

FO, F1, F3 and F12 are functions of TAU. FP is a function of T.

11. VAPS

This subroutine calculates the entropy of water vapor as a function of temperature and pressure.

$$P = PS/14.6959$$

$$T = (TS + 459.69)/1.8$$

$$TAU = 1.0/T \quad .$$

Then

$$SC = -4.55504 \times Alog(P) + MO(P) + \frac{M1(P^2)}{2.0} + \frac{M3(P^4)}{4.0} + \frac{M12(P^{13})}{13.0} + \frac{10,000.0}{1012.95}\left[1.472\ Alog(T) + 7.5566E\text{-}4(T) - \frac{47.8365}{T} - 1.48847\right]$$

$$S = \left(\frac{435.57}{18,000.0}\right)(SC)$$

where

PS = pressure, psia

TS = temperature, °F

S = entropy, Btu/°F-lb

MO, M1, M3 and M12 are functions of TAU.

12. UCALC

This subroutine calculates the overall heat transfer coefficients of the G-E fluted VTE tubes in the suction and discharge effects. The coefficients were obtained and corrected according to procedures followed in interpretation of data obtained from the General Electric pilot plant at Wrightsville Beach, North Carolina.[4] The coefficients are fitted as a function of average salt concentration inside the tube, tube length and temperature. Figure 4 outlines the program flow.

a) If the tube length is > 5.0, a tube length correction factor of 1.0 is assigned. A shorter tube will necessitate the calculation of a length correction factor as a function of temperature.

$$CFN2 = \frac{1.0}{0.6736 + 0.001088(T)} .$$

b) If the temperature is less than 100°F, its value is printed out and a new value of 100 is substituted.

c) If the average salt concentration is less than or equal to 0.1008, an uncorrected overall heat transfer coefficient is calculated.

$$\begin{aligned} X = {} & A1 + A2(Y) + A3(Z) + A4(Z)(Y) + A5(Y^2) + A6(Z^2) \\ & + A7(Y)(Z^2) + A8(Y^2)(Z) + A9(Y^3) + A10(Y^3) + A11(Y)(Z^3) \\ & + A12(Y^3)(Z) + A13(Y^2)(Z^2) + A14(Y^2)(Z^3) + A15(Y^3)(Z^2) \\ & + A16(Y^3)(Z^3) \end{aligned}$$

where

X = uncorrected heat transfer coefficient, Btu/hr-ft^2-°F

Y = temperature, °F

Z = average salt concentration, weight fraction

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[4] Final Report (1965). Operation and Maintenance of General Electric 37,000-GPD Thin-Film Distillation Pilot Plant (Contract 14-01-0001-248).

A1 = 0.94598989E3
A2 = 5.5243699
A3 = -0.11646098E5
A4 = -0.45611828E2
A5 = 0.79308461E-2
A6 = 0.20333492E6
A7 = 3.9411727
A8 = -0.25223411
A9 = -0.28923398E-4
A10 = -0.16531411E7
A11 = 0.41778945E4
A12 = 0.83445326E-3
A13 = 5.6979017
A14 = -0.43195339E2
A15 = -0.1424367E-1
A16 = 0.88897284E-1

Set:

URBC = X.

d) CFN1 = 1.0
AKFT = 125.0

Then:

$$CFN3 = \left(\frac{1.0}{URBC}\right) \Big/ \left(\frac{1.0}{URBC} - 0.000043 + \frac{[0.000043 \times 125.0]}{AKFT}\right) .$$

e) The corrected heat transfer coefficient is then calculated.

ZUBAR = URBC × CFN1 × CFN2 × CFN3.

f) Returning to (c), if the average salt concentration is greater than 0.1008, a counter IJK is set = 0 and a new value of 0.100 is substituted for CMT.

g) An uncorrected heat transfer coefficient is then calculated as shown previously.

If IJK = 0, set: URBC = X
CMT = 0.10
IJK = 1 .

Program flow is then returned to g).

If IJK ≠ 0, set: URBC2 = X
DUDC = (URBC1 - URBC2)/0.0008
URBC = URBC1 + (CMT - 0.1008)DUDC .

h) Program control is returned to e) and f), resulting in a calculation of a corrected heat transfer coefficient.

13. CØSTVC

Most of the data required for cost calculations in CØSTVC are carried via a call list.

Since a BWR reactor has been assumed to be the steam source, the prime steam cost calculations are tailored to fit the specific reactor.[5,8]

$$\text{FUEL} = 8.81 + 26.7\ (\text{RATEIN})$$

$$\text{FIXC} = 87.20(\text{SMAP})/[(\text{PRIMWT} \times 1.\text{E-3})^{0.244}]$$

$$\text{XØPER} = 4.35(\text{SMAP})^{0.231}\ [(\text{PRIMWT} \times 1.\text{E-3})^{0.314}]$$

$$\text{PMSTMC} = (\text{FUEL} + \text{FIXC} + \text{XØPER}) \times 1.\text{E-2} \quad .$$

The compressor costs[6] ($) are then calculated.

$$\text{CC} = \left[1.02\text{E5} + 1392.0\left(\frac{\text{HPVC}}{\text{AUNIT} \times 1.\text{E3}}\right)^{0.855}\left(\frac{\text{VSUC}^{0.746}}{(\text{PR})^{0.177}}\right)\right] \times \text{AUNIT} \times \text{AJ} \quad .$$

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[5] Moyers, J. C., Reactor and Turbine Plant Costs and Performance Information for Use in High-Product-Ratio Parametric Study, Letter to R. A. Ebel, April 17, 1967.

[6] Moyers, J. C., Nuclear Desalination Program Report on Activities of Interest to AEC, December 1966, (ORNL-CF-67-1-22).

The compressor foundation cost[7] ($) is:

$$C\emptyset F\emptyset UN = 0.12856 \times HPVC \times AJ \quad .$$

The turbine costs[5,8] ($) associated with the VC plant and the turbo-generator are then calculated.

$$AMWT = (TB\emptyset UT2 + P\emptyset T\emptyset T) \times \frac{0.746}{2.545E6}$$

$$TURBK = -0.85E\text{-}4(TS) + 0.3265$$

$$TURBN = 0.18E\text{-}4(TS) + 0.6614$$

$$TP\emptyset W = AMWT/AUNIT$$

$$TUR = [TURBK(TP\emptyset W^{TURBN}) - 14.444(TP\emptyset W \times 1.E\text{-}3)^{0.7882}] \times 1.E6 \times AUNIT \times AJ$$

$$TCSTP = TUR\left(\frac{WS3}{WS}\right)$$

$$TCSTC = TUR - TCSTP \quad .$$

The generator costs[5,8] ($) are then calculated.

$$P\emptyset GEN = P\emptyset T\emptyset T(0.746)/(AUNIT \times 2.545E6)$$

$$GEN = [14.444(P\emptyset GEN \times 1.E\text{-}3)^{0.7882}] \times 1.E6 \times AUNIT \times AJ \quad .$$

The effect areas and shell cost[7] ($) are then determined.

$$EVC = (AS + AD) \times A2 \times AJ$$

$$SHELL = 0.794\ (AD + AS) \times AJ \quad .$$

Compressor ducting cost[7] ($) is:

$$DUCT = 0.051599 \times VS \times AJ \quad .$$

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[7] Collins, C. W. and Senatore, S. J., ORNL Contribution to the AEC-OSW-BR-ORNL Large Desalting Plant Siting Study, October 11, 1966, (ORNL-CF-66-10-17).

[8] Unpublished notes from J. C. Moyers to R. A. Ebel, ORGDP, February 10, 1967.

The VTE brine pumps cost[7] ($) is:

$$\text{PUMP} = 3.693\text{E6} \times \left(\frac{\text{WB2}}{386.6\text{E6}}\right)^{0.8} \times \text{AJ} \quad .$$

The various valve and piping costs[7] ($) are individually calculated and totaled.

$$\text{PIPEF} = 1.257\text{E6} \times \text{WF2}/513.5\text{E6} \times \text{AJ}$$
$$\text{PIPEB} = 1.130\text{E6} \times \text{WB2}/386.6\text{E6} \times \text{AJ}$$
$$\text{PIPEP} = 0.442\text{E6} \times \text{WP2}/126.8\text{E6} \times \text{AJ}$$
$$\text{PIPVC} = 1.60392\text{E6} \times \text{VØLDIS}/15.283\text{E6} \times \text{AJ}$$
$$\text{PIPTUR} = 0.38356\text{E6} \times \text{WSTEAM}/0.102245\text{E8} \times \text{AJ}$$
$$\text{PIPT} = \text{PIPEF} + \text{PIPEB} + \text{PIPEP} + \text{PIPVC} + \text{PIPTUR} \quad .$$

The site work cost ($) is:

$$\text{SITEW} = \text{SITE} \times \text{GVTE}/\text{GMSF} \times \text{AJ} \quad .$$

The electrical equipment cost ($) is:

$$\text{PØVTE} = 3.7677\text{E-10} \times \text{WB2} \times (\text{LENS} + \text{LEND} + 20.0)/\text{SMALLE}$$
$$\text{EECVTE} = 0.0326\text{E6} \times \text{PØVTE} \times \text{AJ} \quad .$$

The cranes + building, instrumentation, etc., cost[7] ($) is:

$$\text{CØSINS} = 0.317\text{E6} \times (\text{WP2}/126.8\text{E6})^{0.6} \times \text{AJ} \quad .$$

The total capital cost ($) is:

$$\text{CAPTØT} = \text{CC} + \text{TUR} + \text{GEN} + \text{EVC} + \text{CØFØUN} + \text{SHELL} + \text{PUMP} + \text{PIPT} + \text{SITEW} + \text{EECVTE} + \text{CØSINS} + \text{DUCT} \quad .$$

Costs for some of the components are then calculated on a $/year basis:

$$\text{CCY} = \text{CC} \times \text{SMAP}$$
$$\text{CØFØY} = \text{CØFØUN} \times \text{SMAP}$$
$$\text{EVCST} = (\text{AS} + \text{AD}) \times \text{SMAP} \times \text{A2} \times \text{AJ} + (\text{AS} + \text{AD}) \times \text{SMAPP} \times \text{A1}$$
$$\text{SHELLY} = \text{SHELL} \times \text{SMAP}$$
$$\text{DUCTY} = \text{DUCT} \times \text{SMAP}$$
$$\text{PUMPY} = \text{PUMP} \times \text{SMAP}$$
$$\text{PIPEFY} = \text{PIPEF} \times \text{SMAP}$$

$$PIPEBY = PIPEB \times SMAP$$

$$PIPEPY = PIPEP \times SMAP$$

$$PIPVCY = PIPVC \times SMAP$$

$$PIPTRY = PIPTUR \times SMAP$$

$$PIPTY = PIPEFY + PIPEBY + PIPEPY + PIPVCY + PIPTRY$$

$$SITEY = SITEW \times SMAP$$

$$EECVTY = EECVTE \times SMAP$$

$$C\emptyset SINY = C\emptyset SINS \times SMAP$$

$$\emptyset PERY = 0.1104E6\ [(GVTE + GMSF) \times 1.E\text{-}6]^{0.3238} + 7500.0$$

$$C\emptyset SMAY = 0.006(CAPT\emptyset T + CAPI1).$$

Several of the component costs are calculated on a unit basis ($/unit).

$$C\emptyset MUNT = CC/AUNIT$$

$$TURUNT = TUR/AUNIT$$

$$GENUNT = GEN/AUNIT \quad .$$

The cost of steam to the brine heater ($/MBtu) is:

$$SMALLB = PMSTMC \left[1.0 - \frac{EFFCYC}{ETP}\right]\left[\frac{1.0}{1.0\text{-}EFFCYC}\right] - \left[\frac{0.101 \times AJ \times SMAP \times (1.0\text{-}ETP) \times EFFCYC}{ETP \times CAPF}\right]$$

The cost of on-site power ($/kw-hr) is:

$$ELSTM = PMSTMC \times QIN \times 1.E\text{-}6 \times \frac{WS3}{WS} \times \frac{EFFCYC}{ETP} \times 8760.0 \times CAPF$$

$$C\emptyset NCST = 3.0217E3 \left[P\emptyset T\emptyset T \times \frac{0.746}{2.545E6}\right] \times \left[\frac{1.0\text{-}ETP}{ETP}\right]$$

$$ELCST = ELSTM + C\emptyset NCST + GENCST + TCSTP \times SMAP$$

$$SMALLD = \frac{ELCST}{8.76E6 \times CAPF \times P\emptyset T\emptyset T \times \frac{0.746}{2.545E6}} \quad .$$

The heat cost ($/year) is:

$$HTCST2 = PMSTMC \times QIN \times 1.E\text{-}6 \quad .$$

The annual costs are converted to $/kgal costs by a factor.

$$\text{FACTØR} = \frac{2.739726}{\text{CAPF(GVTE + GMSF)}}$$

$$\text{HTCSKG} = \text{HTCST2} \times \text{FACTØR}$$

$$\text{CCKG} = \text{CCY} \times \text{FACTØR}$$

$$\text{TURKG} = \text{TURCST} \times \text{FACTØR}$$

$$\text{EVCKG} = \text{EVCST} \times \text{FACTØR}$$

$$\text{ELCKG} = \text{ELCST} \times \text{FACTØR}$$

$$\text{GENKG} = \text{GENCST} \times \text{FACTØR}$$

$$\text{DUCTKG} = \text{DUCTY} \times \text{FACTØR}$$

$$\text{CØFØKG} = \text{CØFØY} \times \text{FACTØR}$$

$$\text{SHELKG} = \text{SHELLY} \times \text{FACTØR}$$

$$\text{PUMPKG} = \text{PUMPY} \times \text{FACTØR}$$

$$\text{PIPKG} = \text{PIPTY} \times \text{FACTØR}$$

$$\text{ØPERKG} = \text{ØPERY} \times \text{FACTØR}$$

$$\text{CØSMKG} = \text{CØSMAY} \times \text{FACTØR}$$

$$\text{SITEKG} = \text{SITEY} \times \text{FACTØR}$$

$$\text{ECVTKG} = \text{EECVTY} \times \text{FACTØR}$$

$$\text{CØSIKG} = \text{CØSINY} \times \text{FACTØR} .$$

The total vapor compression water costs in $/year and $/kgal are:

$$\begin{aligned}\text{VCTØT} = {} & \text{HTCST2} + \text{CCY} + \text{TURCST} + \text{EVCST} + \text{CIY} + \text{GENCST} \\ & + \text{DUCTY} + \text{CØFØY} + \text{SHELLY} + \text{PUMPY} + \text{PIPTY} + \text{ØPERY} \\ & + \text{CØSMAY} + \text{SITEY} + \text{EECVTY} + \text{CØSINY}\end{aligned}$$

and

$$\begin{aligned}\text{VCTØKG} = {} & \text{HTCSKG} + \text{CCKG} + \text{TURKG} + \text{EVCKG} + \text{CIYKG} + \text{GENKG} \\ & + \text{DUCTKG} + \text{CØFØKG} + \text{SHELKG} + \text{PUMPKG} + \text{PIPKG} + \text{ØPERKG} \\ & + \text{CØSMKG} + \text{SITEKG} + \text{EVCTKG} + \text{CØSIKG},\end{aligned}$$

respectively.

The annual water cost of the plant complex is:

$$\text{TCST2} = \text{TC2} + \text{VCTØT}.$$

The unit cost of producing water in the plant complex ($/kgal) is:

$$\text{TCST1} = \text{TC1} + \text{VCTØKG}.$$

The subroutine then prints all cost associated items, including a cost summary table

NOMENCLATURE

1. VAPCØM

AD - Area of discharge VTE effect, ft^2

ALPHAD - Boiling point elevation in discharge effect, °F

ALPHAS - Boiling point elevation in suction effect, °F

ARCØN - Total VTE effect area, ft^2

AS - Area of suction VTE effect, ft^2

AUNIT - Number of units

CAPF - Plant load factor

CAPI1 - MSF capital cost, $

CB - Blowdown concentration, weight fraction

CMHP2 - Vapor compressor power requirement, hp

CMPD - Pressure at vapor compressor discharge, psia

CMPØW2 - Vapor compressor power requirement, Btu/hr

CMPS - Pressure at vapor compressor suction, psia

CMTD - Temperature of superheated vapor at compressor discharge, °F

CØ - Ocean salt concentration, weight fraction

CØNDIS - Salt concentration of discharge effect effluent, weight fraction

CØNSUC - Salt concentration between suction and discharge VTE effects, weight fraction

CR - Overall concentration ratio

CRVC - Vapor compression plant concentration ratio

DELTAD - Temperature drop across VTE tubes in discharge effect, °F

DELTS - Temperature drop across VTE tubes in suction effect, °F

DIAMCD - Diameter of vapor compressor at discharge end, ft

DIAMCS - Diameter of vapor compressor at suction end, ft

DISID - VTE tube I.D. in discharge effect, in.

EFFCØM - Vapor compressor efficiency, fraction

EFFCYC - Back-pressure cycle efficiency, Mwe/Mwt

ETP - Thermal efficiency of condensing turbine plant, $\frac{\text{gross output, MWe}}{\text{thermal input, Mwt}}$

GAM - Ratio of specific heats for water vapor, CP/CV

GMSF - Product made in MSF plant, gpd

GTØT - Total product made in combined plant, gpd

GTØT1 - Calculated plant product rate, gpd

HBLØW - Enthalpy of blowdown stream, Btu/lb

HCØN - Enthalpy of blowdown stream from discharge effect, Btu/lb

HD - Enthalpy of superheated vapor at compressor discharge following an isentropic path, Btu/lb

HDIS - Enthalpy of superheated vapor at compressor discharge, Btu/lb

HLTF - Enthalpy of brine feed stream, Btu/lb

HLTRBS - Enthalpy of saturated liquid at TS, Btu/lb

HSUC - Enthalpy of saturated vapor entering compressor suction, Btu/lb

HTDC - Enthalpy of saturated liquid at compressor discharge, Btu/lb

HTSC - Enthalpy of saturated liquid leaving suction effect at condensing temperature, Btu/lb

HTURBI - Enthalpy of prime steam at turbine inlet, Btu/lb

HTURBØ - Enthalpy of prime steam at turbine outlet, Btu/lb

HVSC - Enthalpy of saturated vapor leaving flash tank at condensing temperature, Btu/lb

HVSUC - Enthalpy of superheated vapor entering suction effect, Btu/lb

HVTDE - Enthalpy of saturated vapor leaving discharge effect at evaporating temperature, Btu/lb

HVTRBS - Enthalpy of saturated vapor at TS, Btu/lb

II - Signal flag used to determine routing of DINTPL flow

IVC - Counter used to control intermediate effect concentration calculation

KØUTPT - Counter used to control stage-by-stage calculations

LEND - Length of VTE tubes in discharge effect, ft

LENS - Length of VTE tubes in suction effect, ft

ND - Number of VTE tubes in discharge effect

NS - Number of VTE tubes in suction effect

PDE - Saturated vapor pressure at discharge effect exit, psia

PMSTMC - Prime steam cost, $/MBtu

PØ - Estimated evaporator pumping power, Mwe
PØBTU - Estimated evaporating pumping power, Btu/hr
PØBTU2 - Estimated evaporator pumping power, Btu/hr
PØES - Estimated evaporator pumping, power, Mw
PØREA - Reactor and turbine plant auxiliary power requirement, Mwe
PØTØT - Gross electricity production, Btu/hr
PØWATR - Calculated evaporator plant pumping power, Mw
PR - Vapor compressor pressure ratio
PRIBTU - Prime steam (power) required for entire plant complex, Btu/hr
PRIMWT - Prime steam (power) required for entire plant complex, Mw
PSC - Saturated vapor pressure at suction effect exit, psia
PTURBI - Pressure of prime steam at turbine inlet, psia
Q - Heat transferred across brine heater surface, Btu/hr
QBLØW - Heat available in VTE blowdown stream, Btu/hr
QBR - Total heat input at top of MSF plant, Btu/hr
QDIS - Heat available in discharge effect product stream, Btu/hr
QFEED - Heat available in VTE feed stream, Btu/hr
QIN - Heat available in incoming prime steam, Btu/hr
QPRØD - Heat available in VTE product stream, Btu/hr
QSUC - Heat available in suction effect product stream, Btu/hr
QUAL - Quality of steam at turbine outlet
RC - Fraction of ocean flow rejected in MSF plant
REAPØ - Reactor and turbine plant electricity requirement, Mwe/Mwt
RPØVAL - Overall plant performance ratio, lb product/1000 Btu
RPVC - Vapor compressor performance ratio, lb product/1000 Btu
SHAFHP - Turbine output, hp
SIN - Entropy of superheated vapor entering compressor, Btu/°F-lb
SITE - Capital cost of MSF site work, $
SMALLB - Cost of steam to brine heater, $/MBtu
SMALLD - Electricity cost, $/kw-hr
SPVØL - Specific volume of vapor at compressor suction, ft^3/lb
SPVØLD - Specific volume of vapor at compressor discharge, ft^3/lb
SUCID - VTE tube I.D. in suction effect, in.
TBA - Ambient temperature, °F

TBØUT2 - Turbine output, Btu/hr

TC1 - MSF water cost, $/kgal

TC2 - MSF water cost, $/year

TDC - VC discharge effect condensing temperature, °F

TDE - VC discharge effect evaporating temperature, °F

TDSC - Mixed stream evaporator temperature entering suction effect, °F

TFEED - VTE brine feed temperature, °F

THFA - MSF brine feed temperature, °F

TS - Steam temperature, °F

TSC - VC suction effect condensing temperature, °F

TSE - VC suction effect evaporating temperature, °F

TSEC - Evaporating temperature in VTE suction effect tubes, °F

TTURBI - Temperature of prime steam at turbine inlet, °F

VAPTSC - Heat of vaporization of water at suction effect condensing temperature, Btu/lb

VCGPD2 - Product made in VC plant, gpd

VØLDIS - Vapor compressor discharge flow, cfm

VS - Vapor compressor suction flow, cfm

WA - Available work per pound of prime steam, Btu/lb

WB2 - VTE blowdown flow, lb/hr

WCØM - Combined vapor flow entering suction effect, lb/hr

WCØND - Condensate flow, lb/hr

WD2 - Vapor flow from discharge VTE effect, lb/hr

WF2 - Feed flow to VTE effect, lb/hr

WP2 - Total product flow from VTE effects, lb/hr

WS - Total prime steam flow, lb/hr

WSTEAM - Turbine exhaust steam flow, lb/hr

WS1 - Steam required to operate VC plant, lb/hr

WS2 - Vapor flow from suction VTE effect, lb/hr; also, the condensate leaving discharge VTE effect

WS3 - Steam required to operate turbo-generator plant, lb/hr

WVF - Vapor flow from flash tank, lb/hr

ZUBARD - VTE heat transfer coefficient, discharge effect, Btu/hr-ft^2-°F

ZUBARS - VTE heat transfer coefficient, suction effect, Btu/hr-ft^2-°F.

2. ØRSEF[1]

This program has been previously documented.

3. BØPR

BPR - Boiling point elevation, °F

C - Salt concentration, weight fraction

T - Temperature, °F.

4. DINTPL

C - Salt concentration, weight fraction

ERR - Flag which may indicate trouble if greater than 0

II - Signal flag used to determine routing of DINTPL flow.

5. WATH

A0-A5 - Coefficients used to fit data

H - Enthalpy of pure water, Btu/lb

T - Temperature of pure water, °F.

6. PSIA

TF - Saturated water vapor temperature, °F

P - Saturated water vapor pressure, psia

X,A,B, C,D,E - Coefficients used to fit data.

7. VAPTS

P - Pressure of water vapor, psia

S - Entropy of water vapor, Btu/°F-lb

T - Temperature of water vapor, °F

A0,A1, A2 - Coefficients used to fit data.

8. VAPTH

P	-	Pressure of water vapor, psia
H	-	Enthalpy of water vapor, Btu/lb
T	-	Temperature of water vapor, °F
A0,A1, A2,B0, B1,B2	-	Coefficients used to fit data.

9. VAPV

TS	-	Temperature of water vapor, °F
PS	-	Pressure of water vapor, psia
V	-	Specific volume of water vapor, ft^3/lb
B0,G1, G2,G3, PHE1, PHE3, PHE12	-	Coefficients used to fit data.

10. VAPH

TS	-	Temperature of water vapor, °F
PS	-	Pressure of water vapor, psia
H	-	Enthalpy of water vapor, Btu/lb
F0,F1, F2,F3, FP	-	Coefficients used to fit data.

11. VAPS

TS	-	Temperature of water vapor, °F
PS	-	Pressure of water vapor, psia
S	-	Entropy of water vapor, Btu/°F-lb
M0,M1, M3,M12	-	Coefficients used to fit data.

12. UCALC

CFN2 - VTE tube length correction factor

CMT - Average salt concentration in VTE tube, weight fraction

T - Temperature, °F

TUBLEN - VTE tube length, ft

URBC - Uncorrected VTE overall heat transfer coefficient, Btu/hr-ft^2-°F

ZUBAR - Corrected VTE overall heat transfer coefficient, Btu/hr-ft^2-°F

13. CØSTVC

AD - Area of discharge VTE effect, ft^2

AJ - Higher cost factor

AMWT - Total turbine power requirement, Mwe

AS - Area of suction VTE effect, ft^2

AUNIT - Number of units

A1 - VTE tubing purchase price, \$/ft^2

A2 - VTE tubing installation price, \$/ft^2

CAPF - Plant load factor

CAPI1 - MSF capital cost, \$

CAPTØT - Total VC capital cost, \$

CC - VC compressor cost, \$

CCKG - VC compressor cost, \$/kgal

CCY - VC compressor cost, \$/year

CØFØKG - VC compressor foundation cost, \$/kgal

CØFØUN - VC compressor foundation cost, \$

CØFØY - VC compressor foundation cost, \$/year

CØMUNT - VC compressor cost, \$/unit

CØNCST - Condenser + cooling water loop cost, \$/year

CØSIKG - Cranes and building cost, \$/kgal

CØSINS - Cranes and building cost, \$

CØSINY - Cranes and building cost, \$/year

CØSMAY - Maintenance and supplies cost, \$/year

CØSMKG - Maintenance and supplies cost, \$/kgal

DUCT - Compressor ducting cost, $

DUCTKG - Compressor ducting cost, $/kgal

DUCTY - Compressor ducting cost, $/year

ECVTKG - Electrical equipment cost, $/kgal

EECVTE - Electrical equipment cost, $

EECVTY - Electrical equipment cost, $/year

EFFCYC - Turbine cycle efficiency, 260°F exhaust temperature, fraction

ELCKG - Cost of producing electricity, $/kgal

ELCST - Cost of producing electricity, $/year

ELSTM - Cost of producing steam, $/year

ETP - Turbine cycle efficiency, 92°F exhaust temperature, fraction

EVC - Area cost of VC effects, $

EVCKG - Area cost of VC effects, $/kgal

EVCST - Area cost of VC effects, $/year

FACTØR - Factor used to convert $/year to $/kgal

FIXC - Fixed charges for reactor, ¢/MBtu

FUEL - Fuel cost for reactor, ¢/MBtu

GEN - Generator cost, $

GENCST - Generator cost, $/year

GENKG - Generator cost, $/kgal

GENUNT - Generator cost, $/unit

GMSF - Product made in MSF plant, gpd

GTØT - Total product made in combined plant, gpd

GVTE - Product made in VC effects, gpd

HPVC - Turbine output, hp (same as SHAFHP)

HTCSKG - Heat cost, $/kgal

HTCST2 - Heat cost, $/year

LEND - Length of VTE tubes in discharge effect, ft

LENS - Length of VTE tubes in suction effect, ft

ØPERKG - Plant operating cost, $/kgal

ØPERY - Plant operating cost, $/year

PIPEB - Blowdown piping costs, $

PIPEBY - Blowdown piping costs, $/year

PIPEF - Feed piping costs, $

PIPEFY - Feed piping costs, $/year
PIPEP - Product piping costs, $
PIPEPY - Product piping costs, $/year
PIPKG - Total piping cost, $/kgal
PIPT - Total piping cost, $
PIPTUR - Turbine exhaust piping cost, $
PIPTRY - Turbine exhaust piping cost, $/year
PIPTY - Total piping cost, $/year
PIPVC - Vapor compressor discharge piping cost, $
PIPVCY - Vapor compressor discharge piping cost, $/year
PMSTMC - Prime steam cost, $/MBtu
PØGEN - Power generated/unit, Mwe
PØTØT - Power available in turbo-generator steam, Btu/hr
PØVTE - Power required to operate VTE pumps, Mwe
PR - Vapor compressor pressure ratio
PRIMWT - Prime steam required for plant complex, Mw
PUMP - VTE brine pump cost, $
PUMPKG - VTE brine pump cost, $/kgal
PUMPY - VTE brine pump cost, $/year
QIN - Heat available in incoming prime steam, Btu/hr
RATEIN - Nondepreciating fixed charge rate, fraction
SHELKG - Shell cost, $/kgal
SHELL - Shell cost, $
SHELLY - Shell cost, $/year
SITEKG - Site cost, $/kgal
SITEW - Site cost, $
SITEY - Site cost, $/year
SMALLB - Cost of steam to brine heater, $/MBtu
SMALLD - Electricity cost, $/kw-hr
SMALLE - Pump efficiency, fraction
SMAP - Depreciating fixed charge rate, fraction
SMAPP - Retubing charge rate, fraction
TBØUT2 - Turbine output, Btu/hr
TCSTC - Turbine cost chargeable to VC plant, $
TCSTP - Turbine cost chargeable to turbo-generator, $

TCST1 - Average plant complex water cost, $/kgal

TCST2 - Average plant complex water cost, $/year

TC1 - MSF water cost, $/kgal

TC2 - MSF water cost, $/year

TPØW - Power requirements per turbine, Mwe

TS - Steam temperature, °F

TSE - VC suction effect evaporating temperature, °F

TUR - Turbine cost, $

TURBK - Turbine cost factor

TURBN - Turbine cost factor

TURCST - Turbine cost, $/year

TURKG - Turbine cost, $/kgal

TURUNT - Turbine cost, $/unit

VCTØKG - VC water cost, $/kgal

VCTØT - VC water cost, $/year

VØLDIS - Total VC discharge volume, cfm

VS - Total VC suction volume, cfm

VSUC - Steam specific volume at compressor suction, ft^3/lb

WB2 - VTE blowdown flow, lb/hr

WF2 - VTE feed flow, lb/hr

WP2 - VTE product flow, lb/hr

WS - Total prime steam flow, lb/hr

WSTEAM - Turbine exhaust steam flow, lb/hr

WS1 - Steam required to operate VC plant, lb/hr

WS3 - Steam required to operate turbo-generator, lb/hr

XØPER - Reactor operating and maintenance cost, ¢/MBtu.

USAGE

Input

The data for a particular case are entered as follows: three data cards are read in "VAPCØM", one data card is read in "MAIN", and eleven data cards are read in "INPUT". Figure 3 presents the data cards required for one ØRVAC-TF case.

DWG. NO. G-67-804A

CARD 1

1–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80
RC	LEND	LENS	TS	DISID	SUCID	CØ	CRVC

CARD 2

TSE	DELTS	DELTAD	ETP	EFFCYC	GTØT	TBA	

CARD 3

PTURBI	TTURBI	REAPØ					

CARD 4

1–2	3						
NITER							

CARD 5

1–12	13–24	25–36	37–48	49–60	61–72	73–80
	TITLE (UP TO 72 ALPHA-NUMERIC CHARACTERS)					

CARD 6

1–8	9–16	17–24	25–32	33–40	41–48	49–56	57–64	65–72	73–75	76–80
CASE	G	RP			CR				IC	

CARD 7

TS	THF	TB	TØ		TA	CØ	CP		IC	

CARD 8

AMØDU	ALEV	AUNIT	TØTALE	TØTALR	FREBD	TRAYDP	CL	SPL	IC	

Figure 3

DWG. NO. G-67-804B

CARD 9

8	9 16	17 24	25 32	33 40	41 48	49 56	57 64	65 72	73 75	76
SMALLE			SMALLP	RATEIN	WPL	CAPF			IC	

CARD 10

DØH	WALLH	DØE	WALLE	DØR	WALLR	A3	SMA1	SMA2	IC	

CARD 11

BIKTH	BIKTE	BIKTR	CSLTBH	CSLTBP	CSLTBR				IC	

CARD 12

RH	RE	RSR	SH	SE	SR	VH	VE	VR	IC	

CARD 13

HD	HH	HBL	HPR	FFHL	SSF1				IC	

CARD 14

	FACID	ACACID	DPLIM			XSØD	XNNN	XLLL	IC	

CARD 15

									IC	

Figure 3 (Continued)

Three data items are set in "VAPCØM", vapor compressor efficiency (EFFCØM), evaporator pumping factor (EIPE), and ratio of specific heats for water vapor (GAM).

Since the ØRVAC-TF program is essentially a combination of two unique operating programs, several data items appear twice, once in the "VAPCØM" data input and once in the "INPUT" data input. These are: steam temperature (TS), ocean salt concentration (CØ), total product rate (GTØT), and overall concentration ratio (CR). Ambient temperature appears in ØRVAC-TF as TBA and in "INPUT" as TA.

1. Description of Cards

a. Card 1 (Format 8E10.4)

(1) Fraction of ocean intake flow rejected in MSF plant
(2) Length of VTE tubes in discharge effect, ft
(3) Length of VTE tubes in suction effect, ft
(4) Steam temperature, °F
(5) VTE tube I.D. in discharge effect, in.
(6) VTE tube I.D. in suction effect, in.
(7) Ocean salt concentration, fraction
(8) Vapor compression plant concentration ratio

b. Card 2 (Format 8E10.4)

(1) VC suction effect evaporating temperature, °F
(2) Temperature drop across VTE tubes in suction effect, °F
(3) Temperature drop across VTE tubes in discharge effect, °F
(4) Thermal cycle efficiency, 92° exhaust temperature, fraction
(5) Turbine cycle efficiency, 260°F exhaust temperature, fraction
(6) Total product rate, gpd
(7) Ambient temperature, °F
(8) Overall plant concentration ratio

c. Card 3 (Format 5E10.6)

(1) Pressure of prime steam at turbine inlet, psia

(2) Temperature of prime steam at turbine inlet, °F

(3) Fraction of plant power required for reactor operation.

d. Card 4 (Format I2)

(1) Allowable number of MSF iterations.

e. Card 5

(1) Title of case (72 alpha-numeric characters).

f. Card 6 (Format 9F8.0, I3)

(1) Case number

(2) Total product rate, gpd

(3) Estimated MSF performance ratio, $\frac{\text{lb product}}{\text{1000 Btu}}$

(4) Blank

(5) Blank

(6) Overall plant concentration ratio

(7) Blank

(8) Blank

(9) Blank

(10) Card number - 1 (column No. 75).

g. Card 7 (Format 9F8.0, I3)

(1) Steam temperature, °F

(2) Maximum brine temperature, °F

(3) Blowdown temperature, °F

(4) Ocean temperature, °F

(5) Blank

(6) Ambient temperature, °F

(7) Ocean salt concentration, weight fraction

(8) Product salt concentration, weight fraction

(9) Blank

(10) Card number - 2 (column No. 75).

h. Card 8 (Format 9F8.0, I3)

(1) Number of modules
(2) Number of levels
(3) Number of units
(4) Total number of stages in heat recovery section
(5) Total number of stages in heat reject section
(6) Vertical height available for vapor escape from the trays, ft
(7) Tray depth, ft
(8) Loss coefficient of interstage orifice
(9) Splash plate length, in.
(10) Card number - 3 (column No. 75).

i. Card 9 (Format 9F8.0, I3)

(1) Pump efficiency, fraction
(2) Blank
(3) Blank
(4) Depreciating fixed charge rate, fraction
(5) Nondepreciating fixed charge rate, fraction
(6) Plant life, years
(7) Plant load factor
(8) Blank
(9) Blank
(10) Card number - 4 (column No. 75).

j. Card 10 (Format 9F8.0, I3)

(1) Brine heater tube O.D., in.
(2) Brine heater tube wall thickness, in.
(3) Recovery tube O.D., in.
(4) Recovery tube wall thickness, in.
(5) Reject tube O.D., in.
(6) Reject tube wall thickness, in.
(7) Unit cost of heater tubing and tube sheets, $\$/ft^2$

(8) Unit cost of recovery tubing and tube sheets, $\$/ft^2$

(9) Unit cost of reject tubing and tube sheets, $\$/ft^2$

(10) Card number - 5 (column No. 74).

k. Card 11 (Format 9F8.0, I3)

(1) Tube metal conductivity in brine heater, $Btu/hr\text{-}ft^2\text{-}°F/ft$

(2) Tube metal conductivity in evaporator recovery, $Btu/hr\text{-}ft^2\text{-}°F/ft$

(3) Tube metal conductivity in evaporator reject, $Btu/hr\text{-}ft^2\text{-}°F/ft$

(4) Tube life in brine heater, years

(5) Tube life in evaporator recovery, years

(6) Tube life in evaporator reject, years

(7) Blank

(8) Blank

(9) Blank

(10) Card number - 6 (column 75).

l. Card 12 (Format 9F8.0, I3)

(1) Fouling factor in brine heater, $Btu^{-1}\text{-}hr\text{-}ft^2\text{-}°F$

(2) Fouling factor in evaporator recovery, $Btu^{-1}\text{-}hr\text{-}ft^2\text{-}°F$

(3) Fouling factor in evaporator reject, $Btu^{-1}\text{-}hr\text{-}ft^2\text{-}°F$

(4) Flooding factor in brine heater

(5) Flooding factor in evaporator recovery

(6) Flooding factor in evaporator reject

(7) Tube velocity in brine heater, ft/sec

(8) Tube velocity in evaporator recovery, ft/sec

(9) Tube velocity in evaporator reject, ft/sec

(10) Card number - 7 (column No. 75).

m. Card 13 (Format 9F8.0, I3)

(1) Pumping head from ocean to plant site, ft

(2) Head loss in pumping between the plant and brine heater, ft

(3) Blowdown pump head, ft

(4) Product pump head, ft

(5) Fouling factor multiplying factor used to reflect technological improvement

(6) Heat transfer coefficient multiplying factor used to reflect technological improvement

(7) Blank

(8) Blank

(9) Blank

(10) Card number - 8 (column No. 75).

n. Card 14 (Format 9F8.0, I3)

(1) Blank

(2) Temperature drop associated with submergence effects, °F

(3) Slope of item (2) with temperature

(4) Heater shell design pressure drop, psia

(5) Blank

(6) Blank

(7) Condenser tube pitch/tube diameter ratio

(8) Calculates condenser for every 1/XNNN stages. Remaining condensers are calculated by interpolation

(9) Calculate tube rows in every 1/XLLL stages. Remaining tube rows are calculated by interpolation

(10) Card number - 9 (column No. 75).

o. Card 15 (Format 9F8.0, I3)

(1) - (9) are Blank

(10) Card number - 10 (column Nos. 74 and 75).

Output

The output from the MSF plant appears first, with the case title being used to title each page. The input data from cards 1 - 4 and 6 - 14 are printed followed by any signals or iterations required in the MSF cost routines.

Two pages of MSF output summarize the costs and important overall flows, temperatures, and performance geometry.

The MSF stage-by-stage output follows in five separate groups.

The last two output pages contain vapor compressor information. The last page summarizes vapor-compression costs and presents an average overall plant water cost.

Operating Instructions

Since ØRVAC-TF is a very large program, it was necessary to redesign program flow using the overlay linkage system. Therefore, it is necessary to include all subroutines listed on the loading map within the designated link. Order within a given link is not important. An alternate input-output buffer system is used to allow approximately 20,000 extra octal storage locations to be made available for the program.

ØRVAC-TF consists of a main program (VAPCØM) and thirty-four subroutines arranged in five linkages. The program is loaded on the machine by stacking the main program and all 0 link subroutines (in any order). The remaining links should be loaded as shown on the loading map to decrease machine time. Each remaining link should begin with an overlay card. An end-of-file card and a set of data complete the deck. There are no programmed stops or pauses. The program takes its input from tape 5 and writes its output on tape 6. Card-to-tape and output translation is done off-line.

Example

To illustrate the use of ØRVAC-TF, a sample problem is included. The variables used as input data (in the order they are required) are as follows:

I. VAPCØM

RC	=	0.0	CØ	=	0.0336	EFFCYC	=	0.2137
LEND	=	10.0	CRVC	=	1.328	GTØT	=	0.750E9
LENS	=	10.0	TSE	=	237.0	TBA	=	90.0
TS	=	260.0	DELTS	=	8.0	PTURBI	=	965.0
DISID	=	3.0	DELTAD	=	8.0	TTURBI	=	540.0
SUCID	=	3.0	ETP	=	0.3425	REAPØ	=	0.01327

In the body of VAPCØM, the following variables are set:

EFFCØM	=	0.80	EIPE	=	0.20	GAM	=	1.32

II. MAIN

NITER = 10

III. INPUT

TITLE = 72 ALPHA-NUMERIC CHARACTERS

CASE	=	18.0	RP	=	10.0	Card No.	=	001
G	=	750.0E6	CR	=	1.8			
TSTEAM	=	260.0	TØ	=	65.0	CP	=	0.000025
THF	=	250.0	TA	=	80.0	Card No.	=	002
TB	=	92.6	CØ	=	0.0336			
AMØDU	=	8.0	TØTALR	=	4.0	CL	=	4.0
ALEV	=	8.0	FREBD	=	1.6	SPL	=	12.0
AUNITS	=	5.0	TRAYDP	=	4.0	Card No.	=	003
TØTALE	=	40.0						
SMALLE	=	0.86	RATEIN	=	0.04	CAPF	=	0.9
SMALLP	=	0.06	WPL	=	30.0	Card No.	=	004

DØH	=	0.750	DØR	=	0.750	SMA1	=	1.859
WALLH	=	0.042	WALLR	=	0.042	SMA2	=	1.859
DØE	=	0.750	A3	=	1.859	Card No.	=	005
WALLE	=	0.042						
BIKTH	=	26.0	CSLTBH	=	30.0	CSLTBR	=	30.0
BIKTE	=	26.0	CSLTBP	=	30.0	Card No.	=	006
BIKTR	=	26.0						
RH	=	0.0003	SE	=	16.0	VE	=	7.0
RE	=	0.0003	SR	=	16.0	VR	=	7.0
RSR	=	0.0005	VH	=	7.0	Card No.	=	007
SH	=	16.0						
HD	=	35.0	HPR	=	92.0	SSF1	=	0.0
HH	=	25.0	FFHL	=	0.0	Card No.	=	008
HBL	=	0.0						
CPSTB	=	2.0	A6	=	3.9532	XNNN	=	4.0
FACID	=	0.5	A7	=	3.6412	XLLL	=	4.0
ACACID	=	0.0	XSØD	=	1.30	Card No.	=	009
DPLIM	=	14.696						

Card No. = 010

The output for this case is given in Figure 5.

Coding Information

1. Time Requirements. Approximately 2-1/2 minutes is required to run a single case with 45 MSF stages. This assumes no compilation of source decks is required.

2. Flow Charts and Source Program. Figure 4 is a flow diagram of the subroutine UCALC. Figure 6 presents a complete listing of all the Fortran IV source programs used in ØRVAC-TF.

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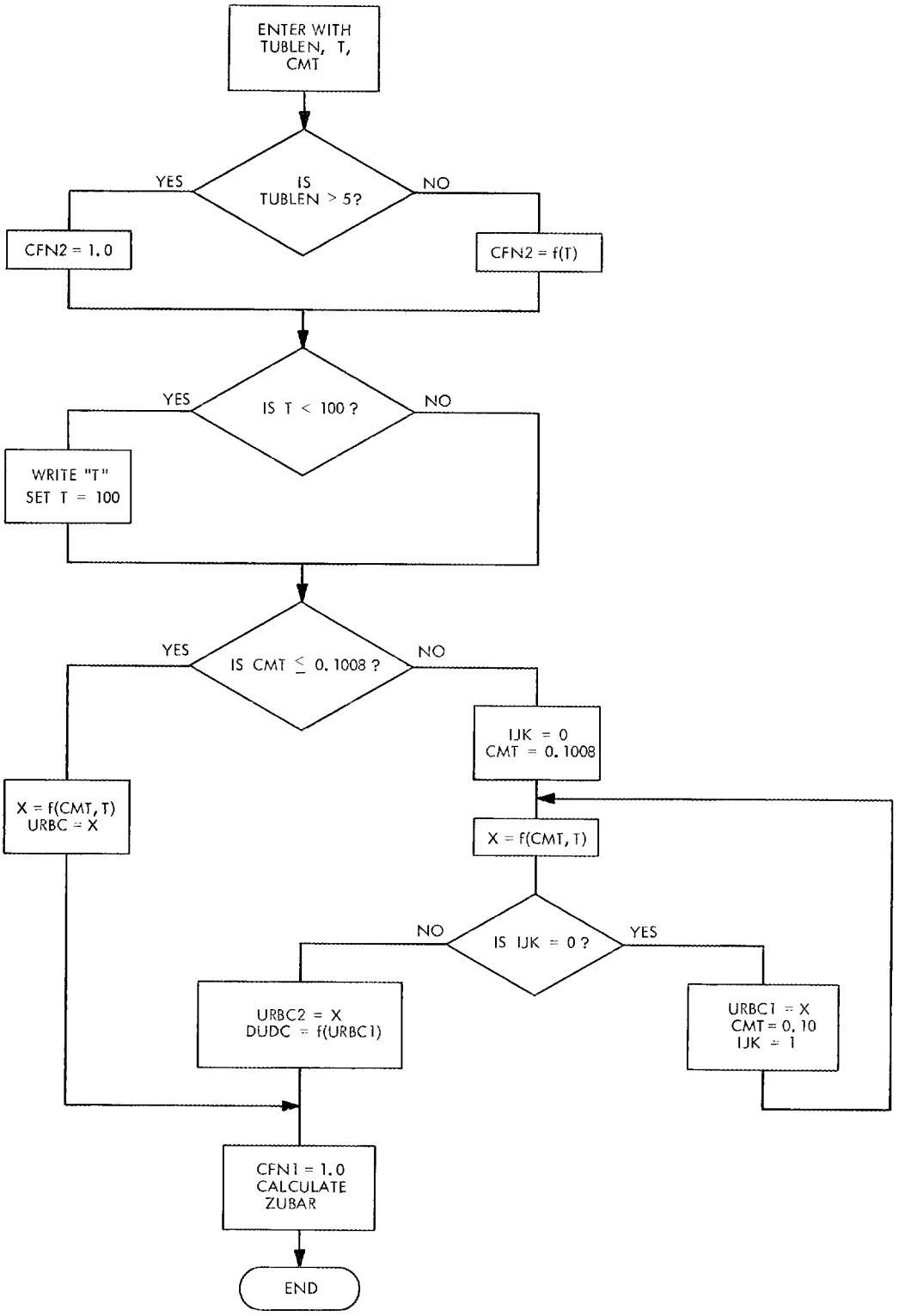

Figure 4

SUBROUTINE UCALC

```
     VAPCOM DATA INPUT
CARD 01
   0.              0.100000E 02   0.100000E 02   0.260000E 03   0.300000E 01   0.300000E 01   0.336000E-01   0.132800E 01
CARD 02
   0.237000E 03   0.800000E 01   0.800000E 01   0.342500E 00   0.213700E 00   0.750000E 09   0.900000E 02
CARD 03
   0.965000E 03   0.540000E 03   0.132700E-01

UNDRFLOW AT 60413 IN MQ

UNDRFLOW AT 64005 IN MQ

UNDRFLOW AT 60413 IN MQ

UNDRFLOW AT 64037 IN MQ

UNDRFLOW AT 60413 IN MQ

     MAIN DATA INPUT
CARD 04
 10

     INPUT DATA INPUT
CARD 06
   0.180000E 02   0.750000E 09   0.100000E 02  -0.000000E-19  -0.000000E-19   0.180000E 01  -0.              -0.
CARD 07
   0.260000E 03   0.250000E 03   0.926000E 02   0.650000E 02  -0.              0.800000E 02   0.336000E-01   0.250000E-04
CARD 08
      8.00       8.00       5.00      40.00       4.00       1.60       4.00       4.00      12.00
CARD 09
  0.860000 -0.        -0.         0.060000  0.040000 30.000000  0.900000  0.333300 -0.
CARD 10
  0.750000  0.042000  0.750000  0.042000  0.750000  0.042000  1.859000  1.859000  1.859000
CARD 11
   26.0000   26.0000   26.0000   30.0000   30.0000   30.0000
CARD 12
   0.00030   0.00030   0.00050  16.00000  16.00000  16.00000   7.00000   7.00000   7.00000
CARD 13
     35.00      25.00       0.        92.00       0.         0.
CARD 14
  2.000000  0.500000  0.        14.696000  3.953200  3.641200  1.300000     4     4

OPEN CHANNEL USED    ANNUAL COSTS ARE    0.49975626E 06   VS  0.73213737E 06

OPEN CHANNEL USED    ANNUAL COSTS ARE    0.49758266E 06   VS  0.72839083E 06
```

FIGURE 5

SPECIAL CASE FOR LIBRARY CODE

PRODUCT ABOVE-GPD	0.41648E 09	PRODUCT FROM SEMS	0.33339124E 09	TOTAL PRODUCT RATE-GPD	0.74987931E 09

		EVAP HEAT LOSS (PCT)	0.	POWER ($/KW HR)	-0.
TOTAL STAGES	44.	PLANT LOAD FACTOR	0.9000	HEAT ($/MBTU)	-0.
STEAM TEMP	260.00	PUMP EFF	0.8600	ANNUAL CAP I/YEAR	0.0600
MAX BRINE TEMP	251.64	DELIVERY HEAD	35.00	EVAP AND REJ RETUBING CHARGE	0.
OCEAN TEMP	65.00	REJECT HEAD	50.20	HEATER RETUBING CHARGE	0.
AMBIENT TEMP	80.00	EVAP HEAD	50.20	REJECT AREA ($/SQFT)	2.8697
SEA WATER SALT CONC	0.03360	HEATER HEAD	25.00	EVAP AREA ($/SQFT)	2.7147
PRODUCT SALT CONC	0.00002	BLOWDOWN HEAD	0.	BRINE HEATER ($/SQFT)	1.8590
CONC RATIO C(B)/C(O)	1.80000	PRODUCT HEAD	106.63	BRINE HEATER SHELL $/SQFT	1.1670
RECOVER RATIO P	0.11902				
PERFORMANCE RATIO	7.032	HIGHER COST	1.2138	INTEREST RATE	0.0400
REJECT/EVAP TUBE FLOW Q.	0.6022	HEATER HEAT LOSS (PCT)	0.	PRODUCT TEMP	91.163
PLANT LIFE	30.0	TUBE LIFE, HEATER	30.00	TUBE LIFE, EVAP.	30.00

	BRINE HEATER	EVAPORATOR	REJECT
FLOODING FACTOR	16.00	16.00	16.00
TUBE CONDUCTIVITY	26.00	26.00	26.00
TUBE VELOCITY	7.00	7.00	7.00
TUBE OD	0.75000	0.75000	0.75000
TUBE ID	0.66600	0.66600	0.66600
FOULING FACTOR	0.000300	0.000300	0.000500
TEMP DROP/STAGE RHO		3.5184994	4.3226099
TUBE FLOW LB/HR	0.96443494E 09	0.96443494E 09	0.58080506E 09
NO OF STAGES		40	4
HEAT TRANSFER COEF	0.80118335E 03	0.71194028E 03	0.51536003E 03
CONDENSER AREA	0.13210735E 07	0.14279565E 08	0.17943647E 07
TUBE LENGTH	0.25604076E 02	0.27888517E 03	0.60879859E 02
NO OF TUBES	0.26277761E 06	0.26077144E 06	0.15010929E 06
TUBE HEAD LOSS	0.12125127E 02	0.77697362E 02	0.15163830E 02

COST	$/YEAR	$/KGAL
HEAT	-0.	-0.
CHEMICAL	0.26670303E 07	0.10825085E-01
POWER	-0.	-0.
PUMPS AND MOTORS	0.10952659E 07	0.44455238E-02
CAP CHEM	0.26362449E 06	0.10700132E-02
SITE WORK	0.21520277E 05	0.87347653E-04
SEA-INTAKE	0.42258266E 06	0.17152011E-02
EVAPORATOR SHELL	0.15621382E 07	0.63404898E-02
EVAPORATOR AREA	0.31565377E 07	0.12811924E-01
BRINE HEATER	0.37242592E 06	0.15116222E-02
VALVES AND PIPING	0.52463182E 06	0.21294037E-02
ELEC EQUIPMENT	0.30209219E 06	0.12261479E-02
OPERATING COST	0.	0.
MAINTENANCE AND SUPPLIES	0.	0.
CRANES, INSTRU, BUILDINGS, CONCRETE	0.16200745E 06	0.65756449E-03
DEAERATOR	0.36106070E 06	0.14654925E-02
TOTAL COST	0.10910917E 08	0.44285814E-01

RECOVERY RATIO (CALC)	0.11902
PERFORMANCE RATIO (CALC)	7.032
AVE BOILING POINT RISE	2.165
AVE THERMAL FORCE/STAGE	13.322
BLOWDOWN TEMP	93.607
BRINE TEMP INTO HEATER	234.377
U-BAR AVERAGE	692.09
POWER (MEGA-WATTS)	151.061
PRODUCT RATE (LB/HR)	0.11483064E 09
RECYCLE FLOW (LB/HR)	0.38362988E 09
SEA WATER RETURN (LB/HR)	0.
BLOWDOWN FLOW (LB/HR)	0.32256273E 09
STEAM FLOW (LB/HR)	0.17389050E 08

	$	$/GPD	$/KGAL
CAPITAL INVESTMENT	0.13739811E 09	0.18319748E 00	0.33460727E-01

DEAERATOR POWER, MW	0.13266205E 02	STAGE 1 PRESS HEAD	0.68789522E 02		
PUMPS AND MOTORS	0.15039611E 08	ELEC EQUIPMENT	0.41481698E 07	VALVES AND PIPING	0.72039661E 07
SITE WORK	0.29550515E 06	WATER INTAKE	0.58026812E 07	SHELL, DMSTR,WEIR	0.21450453E 08
EVAPORATOR AREA	0.43343903E 08	CRANES INSTRU, BLDG, CONCRETE	0.22246004E 07	BRINE HEATER	0.51139554E 07
DEMISTER	0.37288603E 07	CHEM SYS CAP COST	0.36199517E 07	INSTRUMENTATION	0.14375296E 07
WEIRS	0.23507589E 07	CRANE	0.54409477E 06	BUILDINGS	0.24297595E 06
DEAERATOR	0.49578942E 07	MOTOR COST	0.56169434E 07	PUMP COST	0.94226676E 07
RETUB CHARGE($/YR)	0.	RETUB CHARGE($/KGAL)	0.		
NO. OF MODULES	0.80000000E 01	NO OF TRAY LEVELS	0.80000000E 01	TUBE SHEET THICKNESS IN	0.7500
FREE BOARD, FT	0.16000000E 01	TRAY WIDTH FACTOR	0.90000000E 00	SPLASH PLATE LENGTH, IN	12.00
BRINE DEPTH, FT	0.10000000E 01	LEVEL HEIGHT	0.56000000E 01	MAX TRAY FLOW	500000.000
COEF A	1.000				

FOR 1 MODULE

EVAP SHELL VOLUME	0.45797861E 06	REJECT SHELL VOLUME	0.85368962E 05
EVAP TUBE BUND WID (FT)	5.500	REJ TUBE BUND WID (FT)	4.4437
WTME	0.25655722E 02	WTMR	0.22412790E 02
HSTE	0.56000000E 01	HSTR	0.56000000E 01
EVAP FLASHING AREA	0.373255E 06	REJECT FLASHING AREA	0.84187136E 05
MAX AREA OF ORIFICE-EVAP	19.24179	MAX AREA OF ORIFICE-REJECT	0.16809592E 02
ORIFICE LOSS COEFF	4.0000		

FIGURE 5 (Continued)

SPECIAL CASE FOR LIBRARY CODE

STAGE	TTD	CT	C1	C2	QN	UBAR	HI	HO	OM	AS	LS	W-W SF
1	11.5899	0.03360	0.03360	0.05221	0.26488289E 10	806.56	2801.80	2530.77	12.95	0.253612E 06	4.953	0.127410E 01
2	10.8857	0.03360	0.05221	0.05240	0.33015301E 10	805.75	2777.88	2545.02	12.56	0.326112E 06	6.369	0.169920E 01
3	10.9141	0.03360	0.05240	0.05258	0.32945149E 10	802.16	2751.25	2534.57	12.59	0.326195E 06	6.371	0.167610E 01
4	10.9370	0.03360	0.05258	0.05277	0.32922112E 10	798.50	2724.28	2523.92	12.61	0.326864E 06	6.384	0.165670E 01
5	10.9595	0.03360	0.05277	0.05295	0.32899256E 10	794.74	2696.94	2512.91	12.64	0.327592E 06	6.398	0.163777E 01
6	10.9807	0.03360	0.05295	0.05314	0.32878241E 10	790.89	2669.26	2501.61	12.66	0.328420E 06	6.414	0.161953E 01
7	11.0018	0.03360	0.05314	0.05332	0.32855675E 10	786.94	2641.23	2489.95	12.68	0.329291E 06	6.431	0.160162E 01
8	11.0225	0.03360	0.05332	0.05351	0.32833339E 10	782.89	2612.87	2477.94	12.70	0.330225E 06	6.449	0.158416E 01
9	11.0429	0.03360	0.05351	0.05370	0.32811118E 10	778.74	2584.18	2465.58	12.72	0.331223E 06	6.469	0.156712E 01
10	11.0625	0.03360	0.05370	0.05388	0.32790087E 10	774.49	2555.18	2452.90	12.74	0.332308E 06	6.490	0.155062E 01
11	11.0819	0.03360	0.05388	0.05407	0.32768266E 10	770.14	2525.87	2439.88	12.76	0.333449E 06	6.512	0.153448E 01
12	11.1010	0.03360	0.05407	0.05425	0.32746759E 10	765.69	2496.27	2426.52	12.78	0.334662E 06	6.536	0.151875E 01
13	11.1196	0.03360	0.05425	0.05444	0.32725619E 10	761.14	2466.38	2412.83	12.80	0.335948E 06	6.561	0.150345E 01
14	11.1262	0.03360	0.05444	0.05463	0.32705871E 10	756.50	2436.21	2398.84	12.82	0.337337E 06	6.588	0.148868E 01
15	11.1441	0.03360	0.05463	0.05481	0.32685291E 10	751.75	2405.78	2384.52	12.83	0.338790E 06	6.617	0.147424E 01
16	11.1616	0.03360	0.05481	0.05500	0.32664829E 10	746.90	2375.08	2369.88	12.85	0.340321E 06	6.647	0.146019E 01
17	11.1788	0.03360	0.05500	0.05518	0.32644833E 10	741.94	2344.14	2354.92	12.87	0.341936E 06	6.678	0.144654E 01
18	11.1956	0.03360	0.05518	0.05537	0.32627429E 10	736.89	2312.96	2339.70	12.88	0.343689E 06	6.712	0.143352E 01
19	11.2111	0.03360	0.05537	0.05556	0.32602626E 10	731.73	2281.56	2324.03	12.90	0.345382E 06	6.745	0.142019E 01
20	11.2283	0.03360	0.05556	0.05574	0.32583701E 10	726.46	2249.95	2308.09	12.92	0.347236E 06	6.782	0.140757E 01
21	11.2450	0.03360	0.05574	0.05593	0.32564313E 10	721.09	2218.13	2291.83	12.93	0.349169E 06	6.819	0.139526E 01
22	11.2615	0.03360	0.05593	0.05612	0.32549627E 10	715.62	2186.12	2275.35	12.95	0.351289E 06	6.861	0.138372E 01
23	11.2761	0.03360	0.05612	0.05631	0.32530698E 10	710.05	2153.93	2258.56	12.96	0.353446E 06	6.903	0.137226E 01
24	11.2907	0.03360	0.05631	0.05649	0.32512368E 10	704.37	2121.57	2241.46	12.98	0.355704E 06	6.947	0.136116E 01
25	11.3050	0.03360	0.05649	0.05668	0.32494054E 10	698.59	2089.05	2224.06	12.99	0.358058E 06	6.993	0.135036E 01
26	11.3192	0.03360	0.05668	0.05687	0.32484925E 10	692.72	2056.38	2206.53	13.00	0.360706E 06	7.045	0.134068E 01
27	11.3302	0.03360	0.05687	0.05705	0.32467474E 10	686.73	2023.57	2188.68	13.01	0.363353E 06	7.096	0.133086E 01
28	11.3411	0.03360	0.05705	0.05724	0.32450637E 10	680.65	1990.64	2170.55	13.02	0.366117E 06	7.150	0.132136E 01
29	11.3518	0.03360	0.05724	0.05743	0.32434284E 10	674.45	1957.61	2152.13	13.03	0.369000E 06	7.207	0.131219E 01
30	11.3464	0.03360	0.05743	0.05762	0.32434027E 10	668.18	1924.46	2133.71	13.04	0.372353E 06	7.272	0.130466E 01
31	11.3554	0.03360	0.05762	0.05780	0.32418813E 10	661.80	1891.22	2114.96	13.04	0.375638E 06	7.336	0.129667E 01
32	11.3593	0.03360	0.05780	0.05799	0.32403963E 10	655.31	1857.92	2095.94	13.05	0.379057E 06	7.403	0.128897E 01
33	11.3629	0.03360	0.05799	0.05818	0.32389921E 10	648.71	1824.55	2076.66	13.05	0.382626E 06	7.473	0.128161E 01
34	11.3531	0.03360	0.05818	0.05837	0.32406604E 10	642.05	1791.11	2057.58	13.04	0.387025E 06	7.559	0.127698E 01
35	11.3465	0.03360	0.05837	0.05856	0.32393710E 10	635.28	1757.63	2038.15	13.04	0.391180E 06	7.640	0.127117E 01
36	11.3395	0.03360	0.05856	0.05875	0.32381959E 10	628.40	1724.13	2018.47	13.03	0.395515E 06	7.725	0.126571E 01
37	11.3322	0.03360	0.05875	0.05893	0.32370806E 10	621.41	1690.62	1998.53	13.02	0.400033E 06	7.813	0.126056E 01
38	11.3043	0.03360	0.05893	0.05912	0.32408712E 10	614.38	1657.07	1979.03	13.00	0.405860E 06	7.927	0.125942E 01
39	11.2816	0.03360	0.05912	0.05931	0.32399047E 10	607.23	1623.52	1959.13	12.98	0.411218E 06	8.031	0.125630E 01
40	11.2583	0.03360	0.05931	0.05950	0.32391380E 10	599.97	1590.01	1938.99	12.95	0.416824E 06	8.141	0.125357E 01
41	10.6642	0.03360	0.05950	0.05973	0.39168479E 10	535.89	1595.95	1931.68	13.90	0.525989E 06	17.846	0.247654E 01
42	13.3245	0.03360	0.05973	0.05996	0.39783278E 10	517.28	1529.19	1804.99	16.66	0.461686E 06	15.664	0.212236E 01
43	16.0556	0.03360	0.05996	0.06020	0.39895212E 10	499.71	1462.22	1700.01	19.44	0.410688E 06	13.934	0.184385E 01
44	19.0517	0.03360	0.06020	0.06043	0.20640251E 10	487.96	1411.56	1642.65	20.81	0.191840E 06	6.509	0.159126E 01
45		0.03360	0.03363		0.18638790E 10	397.87	1380.16	1580.58	23.58	0.198635E 06	6.739	

FIGURE 5 (Continued)

SPECIAL CASE FOR LIBRARY CODE

STAGE	WV	WS2	WP2	TV2	TS1	TS2	T1	T2	BRINE CFM	PROD CFM
1	0.29408018E 07	0.81804228E 09	0.14639266E 09	245.96	251.64	248.12	231.54	234.38	0.697001E 06	0.
2	0.29205832E 07	0.81512170E 09	0.14931324E 09	242.42	248.12	244.60	228.01	231.54	0.734253E 06	0.986147E 05
3	0.29005574E 07	0.81222114E 09	0.15221379E 09	238.91	244.60	241.08	224.47	228.01	0.774032E 06	0.106204E 06
4	0.28807590E 07	0.80934038E 09	0.15509455E 09	235.40	241.08	237.56	220.94	224.47	0.816547E 06	0.115429E 06
5	0.28611765E 07	0.80647919E 09	0.15795573E 09	231.90	237.56	234.05	217.41	220.94	0.862011E 06	0.125485E 06
6	0.28418121E 07	0.80363738E 09	0.16079754E 09	228.39	234.05	230.53	213.88	217.41	0.910666E 06	0.136496E 06
7	0.28226532E 07	0.80081472E 09	0.16362019E 09	224.88	230.53	227.01	210.35	213.88	0.962765E 06	0.148470E 06
8	0.28037074E 07	0.79801101E 09	0.16642320E 09	221.37	227.01	223.49	206.82	210.35	0.101860E 07	0.161544E 06
9	0.27849680E 07	0.79522603E 09	0.16920836E 09	217.86	223.49	219.97	203.29	206.82	0.107846E 07	0.175826E 06
10	0.27664321E 07	0.79245959E 09	0.17197530E 09	214.35	219.97	216.45	199.76	203.29	0.114271E 07	0.191473E 06
11	0.27480867E 07	0.78971150E 09	0.17472338E 09	210.83	216.45	212.93	196.23	199.76	0.121170E 07	0.208561E 06
12	0.27299425E 07	0.78698156E 09	0.17745332E 09	207.32	212.93	209.42	192.70	196.23	0.128584E 07	0.227269E 06
13	0.27119901E 07	0.78426957E 09	0.18016532E 09	203.81	209.42	205.90	189.16	192.70	0.136557E 07	0.247769E 06
14	0.26942196E 07	0.78157534E 09	0.18285954E 09	200.30	205.90	202.38	185.63	189.16	0.145139E 07	0.270298E 06
15	0.26766440E 07	0.77889870E 09	0.18553618E 09	196.78	202.38	198.86	182.10	185.63	0.154383E 07	0.294965E 06
16	0.26592420E 07	0.77623945E 09	0.18819542E 09	193.27	198.86	195.34	178.57	182.10	0.164347E 07	0.322044E 06
17	0.26420289E 07	0.77359742E 09	0.19083745E 09	189.75	195.34	191.82	175.04	178.57	0.175099E 07	0.351804E 06
18	0.26249838E 07	0.77097243E 09	0.19346243E 09	186.24	191.82	188.30	171.51	175.04	0.186707E 07	0.384680E 06
19	0.26081145E 07	0.76836431E 09	0.19607054E 09	182.72	188.30	184.79	167.98	171.51	0.199252E 07	0.420364E 06
20	0.25914168E 07	0.76577289E 09	0.19866196E 09	179.21	184.79	181.27	164.44	167.98	0.212823E 07	0.460024E 06
21	0.25748878E 07	0.76319800E 09	0.20123694E 09	175.69	181.27	177.75	160.91	164.44	0.227514E 07	0.503689E 06
22	0.25585225E 07	0.76063947E 09	0.20379537E 09	172.17	177.75	174.23	157.38	160.91	0.243434E 07	0.552225E 06
23	0.25423190E 07	0.75809715E 09	0.20633769E 09	168.65	174.23	170.71	153.84	157.38	0.260703E 07	0.605460E 06
24	0.25262822E 07	0.75557086E 09	0.20886397E 09	165.13	170.71	167.19	150.31	153.84	0.279452E 07	0.664318E 06
25	0.25103921E 07	0.75306046E 09	0.21137436E 09	161.61	167.19	163.68	146.78	150.31	0.299827E 07	0.729412E 06
26	0.24946747E 07	0.75056578E 09	0.21386903E 09	158.09	163.68	160.16	143.24	146.78	0.321997E 07	0.802504E 06
27	0.24790966E 07	0.74808668E 09	0.21634813E 09	154.56	160.16	156.64	139.71	143.24	0.346140E 07	0.882597E 06
28	0.24636752E 07	0.74562300E 09	0.21881181E 09	151.04	156.64	153.12	136.17	139.71	0.372464E 07	0.971514E 06
29	0.24484015E 07	0.74317459E 09	0.22126020E 09	147.51	153.12	149.60	132.63	136.17	0.401197E 07	0.107033E 07
30	0.24332757E 07	0.74074131E 09	0.22369348E 09	143.98	149.60	146.08	129.09	132.63	0.432597E 07	0.118282E 07
31	0.24183014E 07	0.73832301E 09	0.22611178E 09	140.44	146.08	142.56	125.55	129.09	0.466955E 07	0.130575E 07
32	0.24034610E 07	0.73591954E 09	0.22851524E 09	136.91	142.56	139.05	122.01	125.55	0.504593E 07	0.144287E 07
33	0.23887650E 07	0.73353078E 09	0.23090400E 09	133.37	139.05	135.53	118.47	122.01	0.545881E 07	0.159608E 07
34	0.23742104E 07	0.73115656E 09	0.23327821E 09	129.82	135.53	132.01	114.92	118.47	0.591234E 07	0.177456E 07
35	0.23597984E 07	0.72879676E 09	0.23563801E 09	126.27	132.01	128.49	111.38	114.92	0.641124E 07	0.196786E 07
36	0.23455160E 07	0.72645124E 09	0.23798353E 09	122.71	128.49	124.97	107.83	111.38	0.696083E 07	0.218498E 07
37	0.23313665E 07	0.72411987E 09	0.24031489E 09	119.16	124.97	121.45	104.28	107.83	0.756721E 07	0.242907E 07
38	0.23173625E 07	0.72180250E 09	0.24263225E 09	115.58	121.45	117.93	100.72	104.28	0.823738E 07	0.272065E 07
39	0.23034858E 07	0.71949902E 09	0.24493574E 09	112.00	117.93	114.42	97.17	100.72	0.897925E 07	0.303414E 07
40	0.22897346E 07	0.71720928E 09	0.24722548E 09	108.42	114.42	110.90	93.61	97.17	0.980195E 07	0.338922E 07
41	0.27945734E 07	0.71441470E 09	0.25002885E 09	104.26	110.90	106.58	86.53	93.61	0.134490E 08	0.447036E 07
42	0.27742328E 07	0.71164046E 09	0.25279428E 09	99.85	106.58	102.25	79.34	86.53	0.150448E 08	0.545852E 07
43	0.27541689E 07	0.70888629E 09	0.25554844E 09	95.39	102.25	97.93	72.12	79.34	0.168727E 08	0.637542E 07
44	0.94657046E 06	0.70615223E 09	0.25649501E 09	91.16	97.93	93.61	68.48	72.12	0.656827E 07	0.694552E 07
45	0.17874832E 07		0.25828249E 09	90.37			65.00	68.48		

FIGURE 5 (Continued)

SPECIAL CASE FOR LIBRARY CODE

ONE LEVEL OF ONE MODULE

STAGE	VAPOR VEL FT/SEC	TRAY FLOW LB/HR FT	TRAY WIDTH FT	RES TIME SEC	PV	DELP AVAILABLE	DELP REQUIRED	A	ALPHA	DTPD
1	12.561253	0.500000E 06	25.655721	1.957303	0.27782E 02	0.16977E 01	0.24591E 00	0.36319E 01	2.159	0.51
2	10.073804	0.500000E 06	25.563821	2.611085	0.26084E 02	0.15983E 01	0.24040E 00	0.37266E 01	2.180	0.54
3	10.616662	0.500000E 06	25.472553	2.616240	0.24486E 02	0.15175E 01	0.23828E 00	0.38077E 01	2.169	0.54
4	11.175201	0.500000E 06	25.381910	2.626403	0.22968E 02	0.14398E 01	0.23619E 00	0.38920E 01	2.159	0.55
5	11.769291	0.500000E 06	25.291887	2.637054	0.21529E 02	0.13654E 01	0.23413E 00	0.39791E 01	2.149	0.55
6	12.399926	0.500000E 06	25.202475	2.648549	0.20163E 02	0.12936E 01	0.23210E 00	0.40703E 01	2.140	0.55
7	13.072132	0.500000E 06	25.113668	2.660390	0.18870E 02	0.12246E 01	0.23009E 00	0.41653E 01	2.132	0.55
8	13.788187	0.500000E 06	25.025460	2.672765	0.17645E 02	0.11584E 01	0.22812E 00	0.42643E 01	2.123	0.56
9	14.551451	0.500000E 06	24.937844	2.685666	0.16487E 02	0.10951E 01	0.22616E 00	0.43671E 01	2.115	0.56
10	15.364305	0.500000E 06	24.850813	2.699314	0.15391E 02	0.10343E 01	0.22424E 00	0.44745E 01	2.108	0.57
11	16.232084	0.500000E 06	24.764362	2.713437	0.14357E 02	0.97603E 00	0.22234E 00	0.45865E 01	2.101	0.57
12	17.158417	0.500000E 06	24.678484	2.728162	0.13381E 02	0.92036E 00	0.22046E 00	0.47033E 01	2.094	0.58
13	18.147632	0.500000E 06	24.593174	2.743527	0.12461E 02	0.86730E 00	0.21861E 00	0.48247E 01	2.088	0.58
14	19.203030	0.500000E 06	24.508424	2.759769	0.11594E 02	0.81647E 00	0.21679E 00	0.49519E 01	2.083	0.59
15	20.332267	0.500000E 06	24.424229	2.776570	0.10777E 02	0.76795E 00	0.21498E 00	0.50846E 01	2.078	0.60
16	21.540398	0.500000E 06	24.340584	2.794041	0.10009E 02	0.72172E 00	0.21320E 00	0.52233E 01	2.074	0.61
17	22.833514	0.500000E 06	24.257483	2.812248	0.92874E 01	0.67792E 00	0.21145E 00	0.53672E 01	2.070	0.62
18	24.214398	0.500000E 06	24.174919	2.831670	0.86095E 01	0.63550E 00	0.20972E 00	0.55207E 01	2.068	0.63
19	25.705999	0.500000E 06	24.092888	2.850553	0.79740E 01	0.59572E 00	0.20801E 00	0.56788E 01	2.064	0.63
20	27.300035	0.500000E 06	24.011385	2.870849	0.73782E 01	0.55788E 00	0.20632E 00	0.58445E 01	2.061	0.64
21	29.011981	0.500000E 06	23.930403	2.891845	0.68204E 01	0.52229E 00	0.20465E 00	0.60159E 01	2.058	0.65
22	30.841986	0.500000E 06	23.849937	2.914497	0.62981E 01	0.48820E 00	0.20301E 00	0.61974E 01	2.058	0.66
23	32.814540	0.500000E 06	23.769983	2.937481	0.58099E 01	0.45595E 00	0.20138E 00	0.63872E 01	2.059	0.68
24	34.936181	0.500000E 06	23.690536	2.961364	0.53539E 01	0.42542E 00	0.19978E 00	0.65860E 01	2.060	0.69
25	37.220670	0.500000E 06	23.611589	2.986098	0.49285E 01	0.39703E 00	0.19819E 00	0.67905E 01	2.061	0.70
26	39.659905	0.500000E 06	23.533139	3.013462	0.45315E 01	0.36974E 00	0.19663E 00	0.70089E 01	2.067	0.72
27	42.302560	0.500000E 06	23.455181	3.040827	0.41617E 01	0.34401E 00	0.19509E 00	0.72377E 01	2.074	0.74
28	45.153701	0.500000E 06	23.377709	3.069238	0.38177E 01	0.31978E 00	0.19356E 00	0.74776E 01	2.081	0.76
29	48.232425	0.500000E 06	23.300719	3.098731	0.34979E 01	0.29753E 00	0.19206E 00	0.77220E 01	2.089	0.78
30	51.509106	0.500000E 06	23.224206	3.132441	0.32004E 01	0.27598E 00	0.19057E 00	0.79868E 01	2.105	0.81
31	55.083024	0.500000E 06	23.148166	3.165561	0.29244E 01	0.25572E 00	0.18910E 00	0.82652E 01	2.122	0.84
32	58.952164	0.500000E 06	23.072594	3.199907	0.26687E 01	0.23670E 00	0.18765E 00	0.85579E 01	2.139	0.87
33	63.144090	0.500000E 06	22.997486	3.235609	0.24320E 01	0.21961E 00	0.18622E 00	0.88508E 01	2.158	0.90
34	67.565196	0.500000E 06	22.922837	3.278799	0.22124E 01	0.20271E 00	0.18481E 00	0.91774E 01	2.191	0.94
35	72.441077	0.500000E 06	22.848642	3.319830	0.20097E 01	0.18685E 00	0.18341E 00	0.95227E 01	2.225	0.99
36	77.736994	0.500000E 06	22.774899	3.362518	0.18228E 01	0.17197E 00	0.18203E 00	0.98891E 01	2.261	1.03
37	83.497999	0.500000E 06	22.701601	3.406875	0.16509E 01	0.15883E 00	0.18067E 00	0.10251E 02	2.298	1.08
38	89.511444	0.500000E 06	22.628746	3.463098	0.14920E 01	0.14551E 00	0.17932E 00	0.10670E 02	2.356	1.15
39	96.228339	0.500000E 06	22.556328	3.515132	0.13465E 01	0.13298E 00	0.17799E 00	0.11120E 02	2.416	1.22
40	103.552001	0.500000E 06	22.484344	3.569453	0.12135E 01	0.13945E 00	0.17667E 00	0.10819E 02	2.478	1.30
41	62.870829	0.500000E 06	22.412790	8.074664	0.10741E 01	0.13163E 00	0.22980E 00	0.11094E 02	2.310	1.14
42	80.407697	0.500000E 06	22.325459	7.071265	0.94245E 00	0.11697E 00	0.22773E 00	0.11716E 02	2.399	1.25
43	101.738003	0.500000E 06	22.238764	6.275156	0.82549E 00	0.96645E-01	0.22570E 00	0.12831E 02	2.538	1.40
44	88.041487	0.500000E 06	22.152696	2.826117	0.72884E 00	0.	0.22370E 00	0.	2.443	1.32
45	0.	0.	0.	0.	0.70559E 00	0.	0.	0.	0.	1.60

FIGURE 5 (Continued)

SPECIAL CASE FOR LIBRARY CODE

STAGE	AREA DM	DPTDM	DTDM	CPROD	WIDDM
1	0.	0.	0.	0.67178436E-03	0.42984974E 01
2	0.20090220E 02	0.16277239E-01	0.33645630E-01	0.34194019E-03	0.33876837E 01
3	0.20425335E 02	0.16449417E-01	0.35812378E-01	0.23069531E-03	0.34432347E 01
4	0.20777106E 02	0.16620903E-01	0.38116455E-01	0.17475428E-03	0.34948472E 01
5	0.21143865E 02	0.16794535E-01	0.40603638E-01	0.14104658E-03	0.35480754E 01
6	0.21526658E 02	0.16970163E-01	0.43281555E-01	0.11849034E-03	0.36025221E 01
7	0.21925865E 02	0.17148172E-01	0.46173096E-01	0.10232162E-03	0.36588974E 01
8	0.22342515E 02	0.17328555E-01	0.49301147E-01	0.90153359E-04	0.37171146E 01
9	0.22777435E 02	0.17511372E-01	0.52627563E-01	0.80657314E-04	0.37772086E 01
10	0.23231685E 02	0.17696612E-01	0.56282043E-01	0.73035469E-04	0.38390598E 01
11	0.23706051E 02	0.17884499E-01	0.60211182E-01	0.66779395E-04	0.39030556E 01
12	0.24201762E 02	0.18075061E-01	0.64445496E-01	0.61549734E-04	0.39691661E 01
13	0.24719905E 02	0.18268406E-01	0.69091797E-01	0.57111284E-04	0.40375272E 01
14	0.25261774E 02	0.18464452E-01	0.74111938E-01	0.53295869E-04	0.41078374E 01
15	0.25828612E 02	0.18663501E-01	0.79551697E-01	0.49979985E-04	0.41806750E 01
16	0.26421763E 02	0.18865622E-01	0.85449219E-01	0.47070899E-04	0.42560882E 01
17	0.27042743E 02	0.19070871E-01	0.91896057E-01	0.44497603E-04	0.43340966E 01
18	0.27693214E 02	0.19279226E-01	0.98915100E-01	0.42204795E-04	0.44145137E 01
19	0.28844313E 02	0.18981217E-01	0.10377502E 00	0.40155719E-04	0.45733733E 01
20	0.29979437E 02	0.18769867E-01	0.10941315E 00	0.38312704E-04	0.47263582E 01
21	0.31182426E 02	0.18556317E-01	0.11550140E 00	0.36646398E-04	0.48869313E 01
22	0.32455120E 02	0.18343290E-01	0.12199402E 00	0.35132744E-04	0.50535317E 01
23	0.33807835E 02	0.18126209E-01	0.12889862E 00	0.33751924E-04	0.52297808E 01
24	0.35244690E 02	0.17906607E-01	0.13633728E 00	0.32487409E-04	0.54151015E 01
25	0.36772054E 02	0.17684392E-01	0.14424133E 00	0.31325319E-04	0.56100830E 01
26	0.38389779E 02	0.17464794E-01	0.15280914E 00	0.30253830E-04	0.58109152E 01
27	0.40116288E 02	0.17239457E-01	0.16193390E 00	0.29262985E-04	0.60249713E 01
28	0.41956050E 02	0.17011402E-01	0.17171478E 00	0.28344213E-04	0.62504815E 01
29	0.43918165E 02	0.16780482E-01	0.18225861E 00	0.27490132E-04	0.64883097E 01
30	0.45995208E 02	0.16556564E-01	0.19369507E 00	0.26694202E-04	0.67295767E 01
31	0.48224069E 02	0.16324140E-01	0.20590210E 00	0.25950941E-04	0.69897956E 01
32	0.50607056E 02	0.16088881E-01	0.21902466E 00	0.25255480E-04	0.72645402E 01
33	0.53157029E 02	0.15850820E-01	0.23322296E 00	0.24603548E-04	0.75547752E 01
34	0.55845718E 02	0.15628840E-01	0.24881744E 00	0.23991098E-04	0.78397467E 01
35	0.58753499E 02	0.15392800E-01	0.26543427E 00	0.23414965E-04	0.81541685E 01
36	0.61872498E 02	0.15154221E-01	0.28342438E 00	0.22872189E-04	0.84864516E 01
37	0.65222116E 02	0.14912996E-01	0.30287933E 00	0.22360418E-04	0.88380419E 01
38	0.68733029E 02	0.14699625E-01	0.32463837E 00	0.21880050E-04	0.91684948E 01
39	0.72564158E 02	0.14465266E-01	0.34778595E 00	0.21429483E-04	0.95437791E 01
40	0.76687767E 02	0.14228747E-01	0.37297821E 00	0.21007181E-04	0.99406497E 01
41	0.86410601E 02	0.17143321E-01	0.49619530E 00	0.20470977E-04	0.49692532E 01
42	0.96665480E 02	0.15727873E-01	0.50799561E 00	0.19976101E-04	0.63372973E 01
43	0.10838200E 03	0.14443908E-01	0.52173615E 00	0.19525343E-04	0.80184499E 01
44	0.12178733E 03	0.13298213E-01	0.53842926E 00	0.19385204E-04	0.10229148E 02
45	0.89184104E 02	0.12149550E-01	0.52835846E 00	0.19131626E-04	0.14137134E 02

FIGURE 5 (Continued)

SPECIAL CASE FOR LIBRARY CODE

TUBE BUNDLE IN EVAPORATOR SECTION

TUBE OD, INCHES	0.750000E 00	NO OF TUBES/BNDLE	0.203728E 04		
VERT ROWS	0.670000E 02	HORIZ ROWS	0.310000E 02	S/D RATIO	0.130000E 01
BUNDLE HT, FT	0.470642E 01	BUNDLE WIDTH, FT	0.250000E 01	BUNDLE WIDTH + 3	0.550000E 01

TUBE BUNDLE IN REJECT SECTION

TUBE OD, INCHES	0.750000E 00	NO OF TUBES/BNDLE	0.117273E 04		
VERT ROWS	0.670000E 02	HORIZ ROWS	0.180000E 02	S/D RATIO	0.130000E 01
BUNDLE HT, FT	0.470642E 01	BUNDLE WIDTH, FT	0.144375E 01	BUNDLE WIDTH + 3	0.444375E 01

I	DPINIT	DTINIT	DPCLR	DTCLR	DTCNC
1	0.27790889E-02	0.54244995E-02	0.12567043E-02	0.24490356E-02	0.78735352E-02
2	0.25652562E-02	0.52261353E-02	0.11791587E-02	0.24147034E-02	0.76408386E-02
3	0.23514235E-02	0.50277710E-02	0.11016130E-02	0.23803711E-02	0.74081421E-02
4	0.21375908E-02	0.48294067E-02	0.10240674E-02	0.23460388E-02	0.71754456E-02
5	0.19237581E-02	0.46310425E-02	0.94652176E-03	0.23117065E-02	0.69427490E-02
6	0.20130301E-02	0.51860809E-02	0.99200010E-03	0.25844574E-02	0.77705383E-02
7	0.21023022E-02	0.57411194E-02	0.10374784E-02	0.28572083E-02	0.85983276E-02
8	0.21915742E-02	0.62961578E-02	0.10829568E-02	0.31299591E-02	0.94261169E-02
9	0.22808463E-02	0.68511963E-02	0.11284351E-02	0.34027100E-02	0.10253906E-01
10	0.23907265E-02	0.77152252E-02	0.11848509E-02	0.38280487E-02	0.11543274E-01
11	0.25006068E-02	0.85792542E-02	0.12412667E-02	0.42533875E-02	0.12832642E-01
12	0.26104870E-02	0.94432831E-02	0.12976825E-02	0.46787262E-02	0.14122009E-01
13	0.27203673E-02	0.10307312E-01	0.13540983E-02	0.51040649E-02	0.15411377E-01
14	0.28563756E-02	0.11665344E-01	0.14246404E-02	0.58097839E-02	0.17475128E-01
15	0.29923841E-02	0.13023376E-01	0.14951825E-02	0.65155029E-02	0.19538879E-01
16	0.31283925E-02	0.14381409E-01	0.15657246E-02	0.72212219E-02	0.21602631E-01
17	0.32644009E-02	0.15739441E-01	0.16362667E-02	0.79269409E-02	0.23666382E-01
18	0.34350154E-02	0.17957687E-01	0.17255247E-02	0.90560913E-02	0.27013779E-01
19	0.36056298E-02	0.20175934E-01	0.18147826E-02	0.10185242E-01	0.30361176E-01
20	0.37762442E-02	0.22394180E-01	0.19040406E-02	0.11314392E-01	0.33708572E-01
21	0.39468587E-02	0.24612427E-01	0.19932985E-02	0.12443542E-01	0.37055969E-01
22	0.41611064E-02	0.28276443E-01	0.21067262E-02	0.14341354E-01	0.42617798E-01
23	0.43753540E-02	0.31940460E-01	0.22201538E-02	0.16239166E-01	0.48179626E-01
24	0.45896017E-02	0.35604477E-01	0.23335814E-02	0.18136978E-01	0.53741455E-01
25	0.48038494E-02	0.39268494E-01	0.24470091E-02	0.20034790E-01	0.59303284E-01
26	0.50741398E-02	0.45484543E-01	0.25920272E-02	0.23283005E-01	0.68767548E-01
27	0.53444302E-02	0.51700592E-01	0.27370453E-02	0.26531219E-01	0.78231812E-01
28	0.56147206E-02	0.57916641E-01	0.28820634E-02	0.29779434E-01	0.87696075E-01
29	0.58850111E-02	0.64132690E-01	0.30270815E-02	0.33027649E-01	0.97160339E-01
30	0.62259235E-02	0.74884415E-01	0.32131299E-02	0.38732529E-01	0.11361694E 00
31	0.65668360E-02	0.85636139E-01	0.33991784E-02	0.44437408E-01	0.13007355E 00
32	0.69077485E-02	0.96387863E-01	0.35852268E-02	0.50142288E-01	0.14653015E 00
33	0.72486610E-02	0.10713959E 00	0.37712753E-02	0.55847168E-01	0.16298676E 00
34	0.76744920E-02	0.12610435E 00	0.40092021E-02	0.66106796E-01	0.19221115E 00
35	0.81003230E-02	0.14506912E 00	0.42471290E-02	0.76366425E-01	0.22143555E 00
36	0.85261540E-02	0.16403389E 00	0.44850558E-02	0.86626053E-01	0.25065994E 00
37	0.89519850E-02	0.18299866E 00	0.47229826E-02	0.96885681E-01	0.27988434E 00
38	0.94552011E-02	0.21422577E 00	0.50129890E-02	0.11415354E 00	0.32837931E 00
39	0.99584172E-02	0.24545288E 00	0.53029954E-02	0.13142140E 00	0.37687428E 00
40	0.10461633E-01	0.27667999E 00	0.55930018E-02	0.14868927E 00	0.42536926E 00
41	0.35302149E-02	0.10302734E 00	0.15611500E-02	0.45654297E-01	0.14868164E 00
42	0.50992720E-02	0.16627502E 00	0.22435784E-02	0.73371887E-01	0.23964691E 00
43	0.72353145E-02	0.26426697E 00	0.31290203E-02	0.11487579E 00	0.37914276E 00
44	0.47653106E-02	0.19499969E 00	0.21146536E-02	0.86845398E-01	0.28184509E 00
45	0.17127268E-01	0.75850677E 00	0.69300681E-02	0.31141663E 00	0.10699234E 01

INPUT DATA

RC#	0.	LEND#	0.10000E 02	LENS#	0.10000E 02	TS#	0.26000E 03	DISID#	0.30000E 01	SUCID#	0.30000E 01
CO#	0.33600E-01	CRVC#	0.13280E 01	TSE#	0.23700E 03	DELTS#	0.80000E 01	DELTAD#	0.80000E 01	ETP#	0.34250E 00
EFFCYC#	0.21370E 00	GTOT#	0.75000E 09	TBA#	0.90000E 02	PTURBI#	0.96500E 03	TTURBI#	0.54000E 03	REAPC#	0.13270E-01

VARIABLES SET IN PROGRAM

EFFCOM#	0.80000E 00	EIPE#	0.20000E 00	GAM#	0.13200E 01

CALCULATED VARIABLES

VS#	0.22318E 08	SPVOL#	0.17946E 02	CMPS#	0.22652E 02	CMTD#	0.31415E 03	AS#	0.49664E 07	AD#	0.51674E 07
VOLDIS#	0.17256E 08	SPVOLD#	0.13876E 02	CMPD#	0.32629E 02	DIAM-S#	0.30776E 02	NS#	0.52695E 05	ND#	0.54828E 05
SHAFHP#	0.10505E 07	CMHP2#	0.84040E 06	PR#	0.14404E 01	DIAM-D#	0.27062E 02	ALPHAS#	0.23437E 01	ALPHAD#	0.21759E 01
TBOUT2#	0.26752E 10	CONDIS#	0.38118E-01	CONSUC#	0.44621E-01						
TSC#	0.24500E 03	TDC#	0.25518E 03	TDE#	0.24718E 03	TDSC#	0.24715E 03	VAPTSC#	0.94886E 03	RPVC#	0.53623E 02
WB2#	0.43735E 09	WD2#	0.68838E 08	WP2#	0.14345E 09	WS2#	0.74614E 08	WF2#	0.58081E 09	WMIX#	0.58081E 09
HBLOW#	0.19746E 03	HDIS#	0.11957E 04	HTDC#	0.22373E 03	HSUC#	0.11598E 04	HLTF#	0.19679E 03	HMIX#	0.20140E 03
QBLOW#	0.86358E 11	QDIS#	0.89215E 11	QPRCD#	0.30613E 11	QSUC#	0.86540E 11	QFEED#	0.11430E 12	QMIX#	0.11697E 12
WVF#	0.81226E 06	WCOM#	0.69650E 08	HTSC#	0.21340E 03			TFEED#	0.23438E 03	TMIX#	0.23816E 03
POBTU	0.51193E 09	POREA	0.61829E 02	POWATR	0.15000E 03	PO	0.15106E 03	POTOT	0.72294E 09	ZUBARS	0.16653E 04
AUNIT	0.50000E 01	QIN	0.15901E 11	WA	0.20604E 03	WS1	0.12984E 08	WS3	0.35088E 07	ZUBARD	0.17543E 04
RPOVAL	0.16245E 02	WS	0.16493E 08	WSTEAM	0.13320E 08						

COST ITEMS CALCULATED IN CSTVP

GVTE	0.41649E 09	GMSF	0.33351E 09	CAPF	0.90000E 00	SMAP	0.60000E-01	SMALLB	0.69162E-01	SMALLD	0.21071E-02
SMALLE	0.86000E 00	AJ	0.12138E 01	VSUC	0.17946E 02	HPVC	0.10505E 07	PMSTMC	0.15162E 00	AMWT	0.99569E 03
TURBN	0.66608E 00	TURBK	0.30440E 00	POVTE	0.76643E 01	ELSTM	0.25232E 07	ELCST	0.35204E 07	TCSTC	0.30098E 08
TCSTP	0.81338E 07	COMUNT	0.14447E 07	TURUNT	0.76464E 07	GENUNT	0.14513E 07	CONCST	0.73755E 05	HTCST2	0.19008E 08
COFOUN	0.16392E 06	SHELL	0.97662E 07	SITEW	0.44791E 06	PUMP	0.49473E 07	PIPEF	0.17257E 07	PIPEB	0.15516E 07
PIPEP	0.60693E 06	PIPVC	0.21981E 07	PIPTUR	0.60649E 06	EECVTE	0.30326E 06	COSINS	0.41433E 06	DUCT	0.13977E 07
CAPTOT	0.11436E 09										

FIGURE 5 (Continued)

COSTS

	$,DIR+IND	$/YEAR	$/KG	$/MMBTU	$/KW-HR
POWER COST		0.35203558E 07	0.14288608E-01		0.21070988E-02
PRIME STEAM COST				0.15162031E 00	
STEAM TO BRINE HTR				0.69161669E-01	
HEAT COST		0.19008223E 08	0.77151588E-01		
COMPRESSOR COST	0.72233951E 07	0.43340371E 06	0.17591221E-02		
COMP FOUND COST	0.16392063E 06	0.98352379E 04	0.39919788E-04		
COMP DUCT COST	0.13977194E 07	0.83863163E 05	0.34038828E-03		
TURBINE COST	0.38232249E 08	0.22939349E 07	0.93107456E-02		
GENERATOR COST	0.72566545E 07	0.43539928E 06	0.17672218E-02		
EVAPORATOR COST	0.37514963E 08	0.30220881E 07	0.12266212E-01		
SHELL COST	0.97661901E 07	0.58597141E 06	0.23783720E-02		
VTE BRINE PUMPS	0.49472902E 07	0.29683742E 06	0.12048195E-02		
VALVES AND PIPING	0.66887789E 07	0.40132673E 06	0.16289263E-02		
ELECTRIC EQUIPMENT	0.30326304E 06	0.18195782E 05	0.73854011E-04		
CRANES AND BLDG	0.41432690E 06	0.24859613E 05	0.10090153E-03		
SITE WORK	0.44790698E 06	0.26874419E 05	0.10907932E-03		
TOTAL VC CAPITAL	0.11435665E 09				
OPERATING (VC+SEMS)		0.94920288E 06	0.38526753E-02		
MAINT+SUPPL (VC+SEMS)		0.15105286E 07	0.61310140E-02		
VC WATER COST		0.29100542E 08	0.11811483E 00		
TOTAL WATER COST (VC+SEMS)		0.40011459E 08	0.16240065E 00		

FIGURE 5 (Concluded)

09/26/67

VAPCOM - FFN SOURCE STATEMENT - IFN(S) -

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C     TWO EFFECT BACK PRESS.TURBINE DRIVEN VAPOR COMPRESSION SYSTEM ON  VAPC0020
C     TOP OF SEMS                                                       VAPC0025
C     DATE 2/1/67                                                       VAPC0030
C     OLIN FLUTED TUBES IN VTE EFFECTS                                  VAPC0035
C     KOUTPT IS A COUNTER USED TO CONTROL STAGE BY STAGE CALCULATIONS   VAPC0040
C     AND OUTPUT                                                        VAPC0045
C     KOUTPT#0 GIVES NO OUTPUT OR STAGE BY STAGE CALCULATIONS           VAPC0050
C     KOUTPT#1 GIVES FORMAL OUTPUT AND STAGE BY STAGES CALCULATIONS     VAPC0055
C     KOUTPT#2 GIVES ONLY PO FOR CONVERGENCE LOOP                       VAPC0060
C                                                                       VAPC0065
      COMMON/MAR22/GTOT                                                 VAPC0070
      COMMON/GEOME/AMODU,ALEV,AUNIT,TOTALE,TOTALR,FREBC,TRAYDP,HST,CL,  VAPC0075
     1SPL                                                               VAPC0080
      COMMON/ECON/SMALLE,SMALLD,SMALLB,SMALLP,RATEIN,WPL, CAPF,THERM,   VAPC0085
     1PMSTMC                                                            VAPC0090
      COMMON /OPI/ SMAPPP, HR, SMAPPH, HE, UNARAR, UNARAE, A4, AJ, WCO, VAPC0095
     1 UBARE, UBARR, UTHE, AE, AR, ATHE, THEL, ENE, THEN, HFE, HFR, THEHVAPC0100
     2T, HC2, HC1, CC2, CC1, POCST2, POCST1, ALPEAR, PMC2, PMC1, CCCAP2,VAPC0105
     3  CCCAP1, SITE2, SITE1,  WAIT2, WAIT1,  ES2, ES1,  EA2, EA1,      VAPC0110
     4 BHC2,  BHC1,  VPC2,  VPC1,  UBPH,  EEC2,  EEC1,  PO,  CC2, CC1,  VAPC0115
     5 SCM2,  SCM1,  CIBC2, CIBC1,  DEA2,  DEA1,  TC2,  TC1,  CAPI1,    VAPC0120
     6 CAPI2,  CAPI3,  PO3,  HS1,  PMC,  EEC,  VPC,  SITE,  WAIT,       VAPC0125
     7 ES,  EA,  CIBC,  BHC,  CCCAP,  CCSTIN,  WEIRC,  CRANE,  BLDG,    VAPC0130
     8 DFACST,  PMCPO,  PMCFLO,  RETUR2,  RETUR1,  CPREQ(100), AMSC2,   VAPC0135
     9 AMSC1                                                            VAPC0140
      COMMON/PHYS/II                                                    VAPC0145
      REALMWTH,LF,MFGPD1,NS,ND,NPH,LENS,LEND,LENPH,LENAUX,N,M,MSC,      VAPC0150
     1NAUX,ID,MFFR,MFGPD2,LAMDA,LAMEX,K,KC1,KC3,KC4,KS2,K1,K2,LF2       VAPC0155
  100 READ(5, 8000)RC,LEND,LENS,TS,DISID,SUCID,                         VAPC0160
     1   CO,CRVC,TSE,DELTS,DELTAD,ETP   ,EFFCYC,GTOT,      TBA         VAPC0165    1
 8000 FORMAT(8E10.4)                                                    VAPC0170
      READ(5,8005  ) PTURBI,TTURBI,REAPC                                VAPC0175    2
 8005 FORMAT(5E10.6)                                                    VAPC0180
      WRITE(6,8010) RC,LEND,LENS,TS,DISID,SUCID,                        VAPC0185
     1  CO,CRVC,TSE,DELTS,DELTAD,ETP,EFFCYC,GTOT,TBA,                   VAPC0190
     2  PTURBI,TTURBI,REAPO                                             VAPC0195    3
 8010 FORMAT(1H1,5X,17HVAPCOM DATA INPUT/                               VAPC0200
     1 1H 7HCARD 01/1H 8E15.6/1H 7HCARD 02/1H 7E15.6/1H 7HCARD 03/      VAPC0205
     1 1H 3E15.6)                                                       VAPC0210
      EFFCOM#.80                                                        VAPC0215
      GAM#1.32                                                          VAPC0220
      CALL VAPH(TTURBI,PTURBI,HTURBI)                                   VAPC0225
C                                                                       VAPC0230
C     X-10 BOILING POINT ELEVATION 2/1/65                               VAPC0235
C                                                                       VAPC0240    4
      CONSUC#CO*CRVC                                                    VAPC0245
      IVC#0                                                             VAPC0250
      KOUTPT#0                                                          VAPC0255
      TBOUT2#2.5*GTOT                                                   VAPC0260
  105  CONTINUE                                                         VAPC0265
      C#CONSUC                                                          VAPC0270
      CALLBOPR(TSE,CONSUC,ALPHA)                                        VAPC0275    9
      ALPHAS#ALPHA+1.0                                                  VAPC0280
      T#TSE-ALPHAS                                                      VAPC0285
      CALL PSIA(T,CMPS)                                                 VAPC0290    11
```

FIGURE 6

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                                                                    09/26/67
          VAPCOM     -  EFN   SOURCE STATEMENT  -  IFN(S)  -

      TSC#TSE+DELTS                                                 VAPCC295
      CALL  VAPH(TSE,CMPS,HSUC)                                     VAPCC300    13
      CALL  VAPS(TSE,CMPS,SIN)                                      VAPCC305    15
      CALL  WATH(TSC,HTSC)                                          VAPCC310    17
      CALL  PSIA(TSC,PSC)                                           VAPCC315    19
      CALL  VAPH(TSC,PSC,HVSC)                                      VAPCC320    21
      VAPTSC#HVSC-HTSC                                              VAPCC325
C                                                                   VAPCC330
C     ASSUMPTION OF CONDIS ASSUME WS2#WD2                           VAPCC335
C                                                                   VAPCC340
      CRF#(1.-1./CRVC)                                              VAPCC345
      CONDIS#CO/(1.-CRF/2.)                                         VAPCC350
      ALPHAD#ALPHAS-.4                                              VAPCC355
      TDE#TSC+ALPHAD                                                VAPCC360
C                                                                   VAPCC365
C     X-10 BOILING POINT ELEVATION 2/1/65                           VAPCC370
C                                                                   VAPCC375
  110 C#CONDIS                                                      VAPCC380
      CALLBOPR(TDE,C,ALPHA)                                         VAPCC385    24
      ALPHAD#ALPHA+1.0                                              VAPCC390
      TDE#TSC+ALPHAD                                                VAPCC395
      IVC#IVC+1                                                     VAPCC400
      TDC#TDE+DELTAD                                                VAPCC405
      CALL  PSIA(TDC,CMPD)                                          VAPCC410    27
      PR#CMPD/CMPS                                                  VAPCC415
      CALL  VAPV(TSE,CMPS,SPVOL)                                    VAPCC420    29
      CMPOW2#TBOUT2*EFFCOM                                          VAPCC425
      CMHP2#CMPOW2/2546.6                                           VAPCC430
      SHAFHP#TBOUT2/2546.6                                          VAPCC435
      GAMF#(GAM-1.)/GAM                                             VAPCC440
      PRF#(  PR**GAMF)-1.                                           VAPCC445    31
      CALL  VAPTS(CMPD,SIN,TOUT)                                    VAPCC450    32
      CALL  VAPH(TOUT,CMPD,HDI)                                     VAPCC455    34
      HD#(HDI-HSUC)/EFFCOM+HSUC                                     VAPCC460
      CALL  VAPTH(CMPD,HD,CMTD)                                     VAPCC465    36
      CALL  VAPH(CMTD,CMPD,HDIS)                                    VAPCC470    38
      WS2#TBOUT2/(HDIS-HSUC)                                        VAPCC475
      CALL  WATH(TDC,HTDC)                                          VAPCC480    40
      WVF#WS2*(HTDC-HTSC)/(VAPTSC)                                  VAPCC485
C                                                                   VAPCC490
C      APPROXIMATE SOLUTION OF TDSC                                 VAPCC495
C                                                                   VAPCC500
      TDSC#(WS2*TDE+WVF*TSC)/(WS2+WVF)                              VAPCC505
      CB#CO*CRVC                                                    VAPCC510
      WB2#CONDIS*WS2/(CB-CONDIS)                                    VAPCC515
      II#2                                                          VAPCC520
      CALL  DINTPL(TSE,CB,HBLOW)                                    VAPCC525    43
      CALL  DINTPL(TDE,CONDIS,HCON)                                 VAPCC530    45
      CALL  PSIA(TDE,PDE)                                           VAPCC535    47
      CALL  VAPH(TDE,PDE,HVTDE)                                     VAPCC540    49
      WD2#(WB2*(HCON-HBLOW)+WS2*(HCON-HSUC)+WVF*(HVSC-HTSC))/       VAPCC545
     1(HTSC-HVTDE)                                                  VAPCC550
      WF2#WS2+WD2+WB2                                               VAPCC555
      CASSI#CONDIS                                                  VAPCC560
      CONDII#CO*WF2/(WB2+WS2)                                       VAPCC565
      IF(ABS(CONDII-CASSI)-.00001)130,130,115                       VAPCC570
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FIGURE 6 (Continued)

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                                                                    09/26/67
        VAPCOM     -  EFN   SOURCE STATEMENT  -  IFN(S)  -

  115 CASS2#(CASS1+CONDI1)/2.                                       VAPC0575
  120 CONTINUE                                                      VAPC0580
      CONDIS#CASS2                                                  VAPC0585
      WB2#CONDIS*WS2/(CB-CONDIS)                                    VAPC0590
      CALL DINTPL(TDE,CONDIS,HCON)                                  VAPC0595    54
      WD2#(WB2*(HCON-HBLOW)+WS2*(HCON-HSUC)+WVF*(HVSC-HTSC))/       VAPC0600
     1(HTSC-HVTDE)                                                  VAPC0605
      WF2#WS2+WD2+WB2                                               VAPC0610
      CONDI2#CO*WF2/(WB2+WS2)                                       VAPC0615
      IF(ABS(CONDI2-CASS2)-.00001)135,135,125                       VAPC0620
  125 SLOPE#(CONDI2-CONDI1)/(CASS2-CASS1)                           VAPC0625
      B#CONDI2-SLOPE*CASS2                                          VAPC0630
      CASS3#B/(1.-SLOPE)                                            VAPC0635
      CASS2#CASS3                                                   VAPC0640
      GO TO 120                                                     VAPC0645
  130 CONDIS#CONDI1                                                 VAPC0650
      GO TO 140                                                     VAPC0655
  135 CONDIS#CONDI2                                                 VAPC0660
  140 CONTINUE                                                      VAPC0665
      IF(IVC.LE.1)GO TO 110                                         VAPC0670
      CALL DINTPL(TDE,CONDIS,HCON)                                  VAPC0675    66
      CB#CO*CRVC                                                    VAPC0680
       CALL DINTPL(TSE,CB     ,HBLOW)                               VAPC0685    68
      QDIS#WS2*HDIS                                                 VAPC0690
      WP2#WS2+WD2                                                   VAPC0695
      QPROD#WP2*HTSC                                                VAPC0700
      QBLOW#WB2*HBLOW                                               VAPC0705
      QFEED#QPROD+QBLOW-TBOUT2                                      VAPC0710
      HLTF#QFEED/WF2                                                VAPC0715
      CALL DINTPL(TDE,CO,H1)                                        VAPC0720    70
      CALL DINTPL(TDC,CO,H2)                                        VAPC0725    72
      CP#(H1-H2)/(TDE-TDC)                                          VAPC0730
      BS#H1-(CP*TDE)                                                VAPC0735
      TFEED#(HLTF-BS)/CP                                            VAPC0740
      IF((TS-10.).LT.TFEED) GOTO 145                                VAPC0745
      GO TO 150                                                     VAPC0750
  145 WRITE(6,8015)                                                 VAPC0755    78
 8015 FORMAT(1H ,50HTCF TOO HIGH, TSE TOO LOW OR EVAP DELA-T TOO HIGH)) VAPC0760
  150 CONTINUE                                                      VAPC0765
      QSUC#WS2*HSUC                                                 VAPC0770
      VS#WS2*SPVOL/60.                                              VAPC0775
      VCGPD2#2.90333*(WS2+WD2)                                      VAPC0780
      WMIX#WB2+WP2                                                  VAPC0785
      CMIX#(CONDIS*WB2)/WMIX                                        VAPC0790
      QMIX#QBLOW+QPROD                                              VAPC0795
      HMIX#QMIX/WMIX                                                VAPC0800
      CALL DINTPL(TSE,CMIX,H1)                                      VAPC0805    80
      CALL DINTPL(TDC,CMIX,H2)                                      VAPC0810    82
      CP#(H1-H2)/(TSE-TDC)                                          VAPC0815
      BS#H1-(CP*TSE)                                                VAPC0820
      TMIX#(HMIX-BS)/CP                                             VAPC0825
      CALL VAPV(CMTD,CMPD,SPVOLD)                                   VAPC0830    84
       DIAMCS#(VS*4./(3.1416*500.*60.))**.5                         VAPC0835    86
      VOLDIS#WS2*SPVOLD/60.                                         VAPC0840
      DIAMCD#(VOLDIS*4./(3.1416*500.*60.))**.5                      VAPC0845
C                                                                   VAPC0850
```

FIGURE 6 (Continued)

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                                                                    09/26/67
          VAPCOM     -  EFN   SOURCE STATEMENT  -  IFN(S)  -

C     OLIN ALLOY FLUTED TUBES                                       VAPC0855
C                                                                   VAPC0860    87
      TSEC#TSE-ALPHAS                                               VAPC0865
      UDELT#TSC-TSEC                                                VAPC0870
      CALL UCALC(UDELT,LENS,TSEC,CONSUC,ZUBARS)                     VAPC0875    88
      UDELT#TDC-TSC                                                 VAPC0880
      CALL UCALC (UDELT,LEND,TSC,CONDIS,ZUBARD)                     VAPC0885    90
      WCOM#WD2+WVF                                                  VAPC0890
      AD#WS2*(HDIS-HTDC )/(ZUBARD*DELTAD)                           VAPC0895
      CALL VAPH(TDSC,PSC,HVSUC)                                     VAPC0900    92
      AS#(WD2*(HVSUC-HTSC)+WVF* (HVSC-HTSC))/(ZUBARS*DELTS)         VAPC0905
      ARCON#AD+AS                                                   VAPC0910
      ND#AD/(LEND*3.1416*DISID)                                     VAPC0915
      NS#AS/(LENS*3.1416*SUCID)                                     VAPC0920
      RPVC#WP2*1000./TBOUT2                                         VAPC0925
      CALL PSIA(TS,PC)                                              VAPC0930    94
      CALL VAPH(TS,PC,HVTRBS)                                       VAPC0935
C                                                                   VAPC0940
C     ESTIMATE OF EVAPORATOR PUMPING                                VAPC0945    96
      EIPE#0.2                                                      VAPC0950
      POES#GTOT*EIPE/1.E6                                           VAPC0955
C                                                                   VAPC0960
      CALL WATH(TS,HLTRBS)                                          VAPC0965    98
      WA#EFFCYC*(HTURBI-HLTRBS)                                     VAPC0970
      HTURBO#HTURBI-WA                                              VAPC0975
      WS1#TBOUT2/WA                                                 VAPC0980
      AAA#(HTURBI-HLTRBS)                                           VAPC0985
      POBTU2#POES*2.546E6/.746                                      VAPC0990
      WS3#(POBTU2+REAPO*WS1*AAA)/(WA-REAPO*AAA)                     VAPC0995
      WS#WS1+WS3                                                    VAPC1000
      QUAL#(HTURBO-HLTRBS)/(HVTRBS-HLTRBS)                          VAPC1005
      WSTEAM#WS*QUAL                                                VAPC1010
      WCOND#WS-WSTEAM                                               VAPC1015
      QBR#TBOUT2+WSTEAM*(HVTRBS-HLTRBS)                             VAPC1020
      POTOT#WS3*WA                                                  VAPC1025
      POREA#REAPO*WS *AAA*.746/2.546E6                              VAPC1030
      Q#QBR-TBOUT2                                                  VAPC1035
      AA#1080.*(WF2*(CR-1.)/CR-WP2)                                 VAPC1040
      BB#WB2*(TFEED-TSE)-Q                                          VAPC1045
      THFA# (AA*TFEED+BB*TBA)/(AA+BB)                               VAPC1050
      IF(KOUTPT.EQ.1)GOTO155                                        VAPC1055
      CALL MAIN(WP2,WB2,RC,QBR,TSC,TFEED,THFA,KOUTPT,GTOT1,PO)      VAPC1060    103
      IF(KOUTPT.EQ.3) GOTO160                                       VAPC1065
      KOUTPT#1                                                      VAPC1070
C                                                                   VAPC1075
C                                                                   VAPC1080
C     ESTIMATE PROPER TBOUT2                                        VAPC1085
      TBOUT2#TBOUT2*GTOT/GTOT1                                      VAPC1090
C     END TBOUT2 SCALING                                            VAPC1095
C                                                                   VAPC1100
C                                                                   VAPC1105
      GO TO 105                                                     VAPC1110
  155 CALLMAIN(WP2,WB2,RC,QBR,TSC,TFEED,THFA,KOUTPT,GTOT1,PO)       VAPC1115    111
      POBTU#POBTU2                                                  VAPC1120
      POWATR#POBTU*.746/(2.546E6)                                   VAPC1125
      QIN#WS*(HTURBI-HLTRBS)                                        VAPC1130
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FIGURE 6 (Continued)

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                                                                    09/26/67
        VAPCOM     -  EFN   SOURCE STATEMENT  -  IFN(S)  -

      RPOVAL#(GTOT/2.90333)*1000./QIN                                VAPC1135
  160 CONTINUE                                                       VAPC1140
      WRITE(6,8020) RC,LEND,LENS,TS,DISID,SUCID,CO,CRVC,             VAPC1145
     1  TSE,DELTS,DELTAD,ETP,EFFCYC,GTOT,TBA,PTURBI,                 VAPC1150
     2  TTURBI,REAPO,EFFCOM,EIPE,GAM                                 VAPC1155     113
 8020 FORMAT(1H1,55X,10HINPUT DATA/1H 55X,10H----- ---- /            VAPC1160
     1 1H0,3HRC#,E17.5,1X,5HLEND#,E15.5,1X,5HLENS#,E15.5,1X,         VAPC1165
     2 3HTS#,E17.5,1X,6HDISID#,E14.5,1X,6HSUCID#,E14.5/1H 3HCC#,     VAPC1170
     3 E17.5,1X,5HCRVC#,E15.5,1X,4HTSE#,E16.5,1X,6HDELTS#,E14.5,     VAPC1175
     4 1X,7HDELTAD#,E13.5,1X,4HETP#,E16.5/1H 7HEFFCYC#,E13.5,1X,     VAPC1180
     5 5HGTOT#,E15.5,1X,4HTBA#,E16.5,1X,7HPTURBI#,E13.5,             VAPC1185
     6 1X,7HTTURBI#,E13.5,1X,6HREAPO#,E14.5/1H0,48X,                 VAPC1190
     7 24HVARIABLES SET IN PROGRAM/1H 48X,24H--------- --- -- -------/ VAPC1195
     8 1H0,7HEFFCOM#,E13.5,1X,5HEIPE#,E15.5,1X,4HGAM#,E16.5)         VAPC1200
      WRITE(6,8025) VS,SPVOL,CMPS,CMTD,AS,AD,VOLDIS,                 VAPC1205
     1  SPVOLD,CMPD,DIAMCS,NS,ND, SHAFHP,CMHP2,PR,                   VAPC1210
     2  DIAMCD,ALPHAS,ALPHAD,TBOUT2,CONDIS,CONSUC                    VAPC1215     114
 8025 FORMAT(1H0,50X,20HCALCULATED VARIABLES/1H 50X,                 VAPC1220
     1 20H---------- ---------/                                      VAPC1225
     1                  1H0,3HVS#,E17.5,1X,6HSPVOL#,E14.5,1X,        VAPC1230
     1 5HCMPS#,E15.5,1X,5HCMTD#,E15.5,1X,3HAS#,E17.5,1X,             VAPC1235
     2 3HAD#,E17.5/1H 7HVOLDIS#,E13.5,1X,7HSPVOLD#,E13.5,1X,         VAPC1240
     3 5HCMPD#,E15.5,1X,7HDIAM-S#,E13.5,1X,3HNS#,E17.5,1X,3HND#,     VAPC1245
     4 E17.5/1H 7HSHAFHP#,E13.5,1X,6HCMHP2#,E14.5,1X,3HPR#,          VAPC1250
     5 E17.5,1X,7HDIAM-D#,E13.5,1X,7HALPHAS#,E13.5,1X,               VAPC1255
     6 7HALPHAD#,E13.5/ 1H 7HTBOUT2#,E13.5,1X,                       VAPC1260
     6 7HCONDIS#,E13.5,1X,7HCONSUC#,E13.5)                           VAPC1265
      WRITE(6,8030) TSC,TDC,TDE,TDSC,VAPTSC,RPVC,                    VAPC1270
     2  WB2,WD2,WP2,WS2,WF2,WMIX,                                    VAPC1275
     3  HBLOW,HDIS,HTDC,HSUC,HLTF,HMIX,                              VAPC1280
     4  QBLOW,QDIS,QPROD,QSUC,QFEED,QMIX,                            VAPC1285
     5  WVF,WCOM,HTSC,TFEED,TMIX                                     VAPC1290     115
 8030 FORMAT(1H0,4HTSC#,E16.5,1X,4HTDC#,E16.5,1X,4HTDE#,E16.5,1X,    VAPC1295
     3 5HTDSC#,E15.5,1X,7HVAPTSC#,E13.5,1X,                          VAPC1300
     45HRPVC#,E15.5/1H 4HWB2#,E16.5,1X,4HWD2#,E16.5,1X,              VAPC1305
     54HWP2#,E16.5,1X,4HWS2#,E16.5,1X,4HWF2#,E16.5,1X,               VAPC1310
     65HWMIX#,E15.5/1H 6HHBLOW#,E14.5,1X,5HHDIS#,E15.5,1X,           VAPC1315
     75HHTDC#E15.5,1X,5HHSUC#,E15.5,1X,5HHLTF#,E15.5,1X,             VAPC1320
     85HHMIX#,E15.5/1H 6HQBLOW#,E14.5,1X,5HQDIS#,E15.5,1X,           VAPC1325
     96HQPROD#,E14.5,1X,5HQSUC#,E15.5,1X,6HQFEED#,E14.5,1X,          VAPC1330
     15HQMIX#,E15.5/1H 4HWVF#,E16.5,1X,5HWCOM#,E15.5,1X,             VAPC1335
     25HHTSC#E15.5,22X,6HTFEED#,E14.5,1X,5HTMIX#,E15.5)              VAPC1340
      WRITE(6,8035)POBTU,POREA,POWATR,PC,POTOT,ZUBARS,AUNIT,QIN,     VAPC1345
     1 WA,WS1,WS3,ZUBARD,RPOVAL,WS,WSTEAM                            VAPC1350     116
 8035 FORMAT(1H0,5HPOBTU,E15.5,1X,5HPOREA,E15.5,1X,6HPOWATR,         VAPC1355
     1E14.5,1X,2HPO,E18.5,1X,5HPOTOT,E15.5,1X,7HZUBARS ,E13.5/       VAPC1360
     2 1H 5HAUNIT,E15.5,1X,                                          VAPC1365
     2   3HQIN,E17.5,1X,2HWA,E18.5,1X,3HWS1,E17.5,1X,3HWS3,          VAPC1370
     3E17.5,1X,7HZUBARD ,E13.5/1H ,6HRPOVAL,E14.5,1X,                VAPC1375
     3 2HWS,E18.5,1X,6HWSTEAM,E14.5)                                 VAPC1380
      GMSF#GTOT-VCGPD2                                               VAPC1385
      PRIBTU#WSTEAM   *(HTURBI-HLTRBS)                               VAPC1390
      PRIMWT#PRIBTU/.34115E7                                         VAPC1395
      CALL COSTVC(SMALLD,SMALLB,PR,VS,AUNIT,TSE,SMALLP,QIN,TS,       VAPC1400
     1WS,WS3,POTOT,AS,AD,PMSTMC,CAPF,WS1,VCGPD2,SPVOL,SHAFHP,        VAPC1405
     2TBOUT2,WB2,WF2,WP2, GMSF ,LENS,LEND,SMALLE,SITE,CAPII,         VAPC1410
     3WSTEAM,VOLDIS,TC2,TC1,PRIMWT,REAPO,ETP,EFFCYC)                 VAPC1415     117
      GO TO 100                                                      VAPC1420
      END                                                            VAPC1425
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FIGURE 6 (Continued)

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$IBFTC MNIA     DECK                                                    MNIACCCO
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FIGURE 6 (Continued)

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 SUBROUTINE MAIN(BILL1,BILL2,BILL3,BILL4,BILL5,BILL6,BILL7,          MNIA0005
1IBILL,BILL8,BILL9)                                                  MNIA0010
 COMMON/GEN/CASE,G,RP, XRP,O,XO,L,XU,CR,XCR, RCE,ROER                MNIA0015
 COMMON/TEMPC/TSTEAM,TS(100), THF,TP,XTB,        TC,TP,TA,CC,CP      MNIA0020
 COMMON/GEOME/AMODU,ALEV,AUNIT,TOTALE,TOTALR,FREBC,TRAYDP,HST,CL,    MNIA0025
1SPL                                                                 MNIA0030
 COMMON/ECON/SMALLE,SMALLD,SMALLB,SMALLP,RATEIN,WPL, CAPF,THERM,     MNIA0035
1PMSTMC                                                              MNIA0040
 COMMON/TUBING/ DOH,DIH,DOE,DIE,DOR,DIR,A1,A2,A3,BIKTH,BIKTE,        MNIA0045
1BIKTR,CSLTBH,CSLTBP,CSLTBR                                          MNIA0050
 COMMON/FOULIN/RH,RE,RSR,SH,SE,SR,VH,VE,VR                           MNIA0055
 COMMON/PUMPHT/HD,HH,HBL,HPR,FFHL,SSFI                               MNIA0060
 COMMON/AMISC/CPSTB,FACID,ACACID,DPLIM,A6,A7,XSOC,XNNN,NNN,XLLL,LLLMNIA0065
 COMMON/DATA1/BDEPH,DTPD,SSF2,TOTAL,UMAX,UALP,PI,TWFA,TSTH,COEFA,    MNIA0070
1ORITE,ITER                                                          MNIA0075
 COMMON/AZI/DTPDP(100),TITLE(15)                                     MNIA0080
 COMMON/TCVL1/ ACPSN, ACPSNK, ACPTNK,CPBT,CPTK, CPTNK,AMBN,TCF,WX,   MNIA0085
1WF,WO,CB,WC,WB, WR,RHONK, RHOK, ERR,CCF, NITER, NK,NTOTAL, PN,RPN,MNIA0090
2TC, ALPHA1, WPN, DELCT, DELST, IGSC, SMAQ, SUMA, TK                 MNIA0095
 COMMON/TCVL2/ TTD(100),SMT(100), SMT2(100), CT(100), WS(100),       MNIA0100
1C(100), TV(100), WV(100), QH(100), WP(100), AS(100),SLS(100)        MNIA0105
 COMMON/PHYS/II                                                      MNIA0110
 COMMON /OP1/ SMAPPP, HR, SMAPPH, HE, UNARAR, UNARAE, A4, AJ, WCO,   MNIA0115
1 UBARE, UBARR, UTHE, AE, AR, ATHE, THEL, ENE, THEN, HFE, HFR, THEHMNIA0120
2T, HC2, HC1, CC2, CC1, POCST2, POCST1, ALPBAR, PMC2, PMC1, CCCAP2,MNIA0125
3  CCCAP1, SITE2, SITE1,  WAIT2, WAIT1,  ES2, ES1,  EA2, EA1,       MNIA0130
4 BHC2,  BHC1,  VPC2,  VPC1,  UBPH,  EEC2,  EEC1,  PO,  CC2, OC1,   MNIA0135
5 SCM2,  SCM1,  CIBC2, CIBC1,  DEA2,  DEA1,  TC2,  TC1,  CAPI1,     MNIA0140
6 CAPI2,  CAPI3,  PO3,  HS1,  PMC,  EEC,  VPC,  SITE,  WAIT,         MNIA0145
7 ES,  EA,  CIBC,  BHC,  CCCAP,  COSTIN,  WEIRC,  CRANE,  BLDG,      MNIA0150
8 DEACST,  PMCPO,  PMCFLO,  RETUR2,  RETUB1,  CPREQ(100), AMSC2,    MNIA0155
9 AMSC1                                                              MNIA0160
 COMMON/STAGE1/ A(100),CFMWV(100), CFMWZ(100), UBAR(100), CM(100),   MNIA0165
1HO(100),HI(100),WWFS(100),VVEV(100), TRAYFL(100),TRAYWD(100),       MNIA0170
2RESIDT(100), PV(100),DELP(100), DTPDPS(100)                         MNIA0175
 DIMENSION        Q(10),P(10)  ,PLIM(10),QLIM(10)     ,TC(10)         MNIA0180
 DIMENSION QMAX(10)          ,QRPL(10)                               MNIA0185
 COMMON /MAIN1/ SSF, HFG                                             MNIA0190
 COMMON /STG1/ ATR, BTR, CTR, CTA                                    MNIA0195
 COMMON/JAN18/WP1                                                    MNIA0200
 COMMON/JAN23/CFR,TFR,WB1,TP1,WPRGSC,WPEGSC,WPTGSC                   MNIA0205
 COMMON/JAN27/WM,        SUMALP,SUMCH,WPNK,CPSN,CPSNK                MNIA0210
 COMMON/JAN31/KOUTPT                                                 MNIA0215
 COMMON/FEB4/GTOT1,THFA,RC,QBR                                       MNIA0220
 COMMON/FEB9/SSFUBR                                                  MNIA0225
 WP1#BILL1                                                           MNIA0230
 WB1#BILL2                                                           MNIA0235
 RC#BILL3                                                            MNIA0240
 QBR#BILL4                                                           MNIA0245
 TP1#BILL5                                                           MNIA0250
 TCF#BILL6                                                           MNIA0255
 THFA#BILL7                                                          MNIA0260
 KOUTPT#IBILL                                                        MNIA0265
 GTOT1#BILL8                                                         MNIA0270
 PO#BILL9                                                            MNIA0275
```

FIGURE 6 (Continued)

```
      IF(KOUTPT.NE.0)GO TO 100                                          MNIA0280
      TPCT#0.005                                                        MNIA0285
      READ  ( 5, 8000  )NITER                                           MNIA0290     6
 8000 FORMAT(I2 )                                                       MNIA0295
      WRITE(6,8005) NITER                                               MNIA0300     8
 8005 FORMAT(1H0,5X,15HMAIN DATA INPUT/1H 7HCARD 04/I4)                 MNIA0305
      IREAD#0                                                           MNIA0310
      Q(1)#1.0                                                          MNIA0315
C READ INPUT DATA                                                       MNIA0320
      CALL INPUT (IREAD)                                                MNIA0325    10
  100 CONTINUE                                                          MNIA0330
      IREAD#1                                                           MNIA0335
       TS(1)#TSTEAM                                                     MNIA0340
      WINSB#0.0                                                         MNIA0345
      XTC#0.0                                                           MNIA0350
      NTOTAL#TOTAL+0.1                                                  MNIA0355
      TC(3)#0.0                                                         MNIA0360
      SSF#1.0                                                           MNIA0365
      SSFUBR#1.0                                                        MNIA0370
C COMPUTE EVAPORATOR AND REJECT ELEVATION IF NOT SPECIFIED              MNIA0375
C SAVE INPUT VALUES OF KEY DATA                                         MNIA0380
      Q(1)#U                                                            MNIA0385
      P(1)#0                                                            MNIA0390
      ERR#0.0                                                           MNIA0395
      CALLTCVAL(P(1),Q(1),TC(1))                                        MNIA0400    14
      BILL7#THFA                                                        MNIA0405
      IBILL#KOUTPT                                                      MNIA0410
      BILL8#GTOT1                                                       MNIA0415
      BILL9#PO                                                          MNIA0420
      IF(ERR.GT.0.0)GO TO 105                                           MNIA0425
      IF(KOUTPT.NE.1)RETURN                                             MNIA0430
      CALL OUTPUT                                                       MNIA0435    22
      RETURN                                                            MNIA0440
  105 KOUTPT#3                                                          MNIA0445
      IBILL#KOUTPT                                                      MNIA0450
      RETURN                                                            MNIA0455
      END                                                               MNIA0460
```

FIGURE 6 (Continued)

```
                                                                    09/26/67

*
$IBFTC BPRI     DECK                                                 @PRICCOO
```

FIGURE 6 (Continued)

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BPRI - EFN SOURCE STATEMENT - IFN(S) -

```
      FUNCTION BPE (C,T)                                          BPRI0005
      I#0                                                         BPRI0010
      CALL BOPR(T,C,BP)                                           BPRI0015    3
  100 TV#T-BP                                                     BPRI0020
      CALL BOPR(TV,C,BPE)                                         BPRI0025    5
      IF(I.EQ.5)GOTO105                                           BPRI0030
      IF(ABS(BPE-BP)/BPE .LT..0001)I#5                            BPRI0035
      BP#BPE                                                      BPRI0040
      GOTO100                                                     BPRI0045
  105 RETURN                                                      BPRI0050
      END                                                         BPRI0055
```

FIGURE 6 (Continued)

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```
*
$IBFTC TCVA     DECK                                                    TCVACCCC
```

FIGURE 6 (Continued)

```
      SUBROUTINE TCVAL(PVAL,QVAL,TCVA)                                  TCVA0005
      COMMON/GEN/CASE,G,RP, XRP,P,XO,Q,XU,CR,XCR, ROE,ROER              TCVA0010
      COMMON/TEMPC/TSTEAM,TS(100), THF,TB,XTB,        TC,TP,TA,CO,CP    TCVA0015
      COMMON/GEOME/AMODU,ALEV,AUNIT,TOTALE,TOTALR,FREBD,TRAYDP,HST,CL,  TCVA0020
     1SPL                                                               TCVA0025
      COMMON/ECON/SMALLE,SMALLD,SMALLB,SMALLP,RATEIN,WPL, CAPF,THERM,   TCVA0030
     1PMSTMC                                                            TCVA0035
      COMMON/TUBING/ DOH,DIH,DOE,DIE,DOR,DIR,A1,A2,A3,BIKTH,BIKTE,      TCVA0040
     1BIKTR,CSLTBH,CSLTBP,CSLTBR                                        TCVA0045
      COMMON/FOULIN/RH,RE,RSR,SH,SE,SR,VH,VE,VR                         TCVA0050
      COMMON/PUMPHT/HD,HH,HBL,HPR,FFHL,SSFI                             TCVA0055
      COMMON/AMISC/CPSTB,FACID,ACACID,DPLIM,A6,A7,XSOC,XNNN,NNN,XLLL,LLLTCVA0060
      COMMON/DATAI/BDEPH,DTPD,SSF2,TOTAL,UMAX,UALP,PI,TWFA,TSTH,COEFA,  TCVA0065
     1ORITE,ITER                                                        TCVA0070
      COMMON/AZ1/DTPDP(100),TITLE(15)                                   TCVA0075
      COMMON/TCVL1/ ACPSN, ACPSNK, ACPTNK,CPBT,CPTK, CPTNK,AMBN,TCF,WX, TCVA0080
     1WF,WO,CB,WC,WB, WR,RHONK, RHOK, ERR,CCF, NITER, NK,NTOTAL, PN,RPN,TCVA0085
     2TC, ALPHA1, WPN, DELCT, DELST, IGSC, SMAQ, SUMA, TK               TCVA0090
      COMMON/TCVL2/ TTD(100),SMT(100), SMT2(100), CT(100), WS(100),     TCVA0095
     1G(100), TV(100), WV(100), QH(100), WP(100), AS(100),SLS(100)      TCVA0100
      COMMON /TCVGSC  / CTDCS                                           TCVA0105
      COMMON/PHYS/II                                                    TCVA0110
      COMMON /MAIN1/ SSF, HFG                                           TCVA0115
      COMMON/JAN18/WP1                                                  TCVA0120
      COMMON/JAN23/CFR,TFR,WB1,TP1,WPRGSC,WPEGSC,WPTGSC                 TCVA0125
      COMMON/JAN27/WM,        SUMALP,SUMGH,WPNK,CPSN,CPSNK              TCVA0130
      COMMON/JAN31/KOUTPT                                               TCVA0135
      COMMON/FEB4/GTOT1,THFA,RC,QBR                                     TCVA0140
      COMMON /OP1/ SMAPPP, HR, SMAPPH, HE, UNARAR, UNARAE, A4, AJ, WCO, TCVA0145
     1 UPARE, UBARR, UTHE, AE, AR, ATHE, THEL, ENE, THEN, HFE, HFR, THEHTCVA0150
     2T, HC2, HC1, CC2, CC1, POCST2, POCST1, ALPBAR, PMC2, PMC1, CCCAP2,TCVA0155
     3  CCCAP1, SITE2, SITE1,  WAIT2, WAIT1,  ES2, ES1,  EA2, EA1,     TCVA0160
     4 BHC2,  BHC1,  VPC2,  VPC1,  UBPH,  EEC2,  EEC1,  PO,  CC2, CC1,  TCVA0165
     5 SCM2,  SCM1,  CIBC2, CIBC1,  DEA2,  DEA1,  TC2,  TC1,  CAPI1,    TCVA0170
     6 CAPI2,  CAPI3,  PO3,  HS1,  PMC,  EEC,  VPC,  SITE,  WAIT,       TCVA0175
     7 ES,  EA,  CIBC,  BHC,  CCCAP,  COSTIN,  WEIRC,  CRANE,  BLDG,    TCVA0180
     8 DEACST,  PMCPO,  PMCFLO,  RETUB2,  RETUB1,  DPREQ(100), AMSC2,   TCVA0185
     9 AMSC1                                                            TCVA0190
      IF(ERR)385,100,385                                                TCVA0195
C ASSIGN INITIAL VALUES TO FLAGS AND COUNTERS                           TCVA0200
C       ITER#COUNTER ON NUMBER ITERATIONS THROUGH SUBR-GSC              TCVA0205
C       NITER#MAXIMUM NUMBER ITERATIONS BEFORE SKIPPING CASE            TCVA0210
C       ERR#FLAG WHICH INDICATES TROUBLE,(0#OK,+#SKIP CASE)             TCVA0215
C       II#FLAG WHICH PHYSICAL PROPERTY DESIRED                         TCVA0220
C       FLAG,(0#GST NOT CONVERGED,+#GST CONVERGED,CONTINUE)             TCVA0225
C       A9#AN OBSELETE ERROR RETURN SIGNAL                              TCVA0230
  100 TJEAN#1.0/(1.0+SSFI)                                              TCVA0235
      TER5#1.0+SSFI                                                     TCVA0240
      P#PVAL                                                            TCVA0245
      TS(1)#TSTEAM                                                      TCVA0250
      Q#QVAL                                                            TCVA0255
      FLAG#0.0                                                          TCVA0260
      ITER#0                                                            TCVA0265
      IGSC#0                                                            TCVA0270
      ILOSE#0                                                           TCVA0275
```

FIGURE 6 (Continued)

```
      I#I                                                               TCVAC28C
      NTOTAL#TOTAL+0.1                                                  TCVAC285
      DELCT#TS(I)-TO                                                    TCVA029C
      DELST#TS(I)-THF                                                   TCVAC295
C ASSIGN STARTING VALUES TO VARIABLES                                   TCVAC30C
      ALPHAI#2.0                                                        TCVAC305
      ACPSN#1050.0                                                      TCVAC310
      ACPSNK#1050.0                                                     TCVAC315
      ACPTNK#1050.0                                                     TCVAC32C
      CPBT#0.92                                                         TCVA0325
      CPTK#0.96                                                         TCVAC33C
      CCF#CO                                                            TCVAC335
      CPTNK#C.90                                                        TCVAC34C
      AMBN#1000.0                                                       TCVA0345
       ANWP#344.432*G                                                   TCVAC35C
C BLOWDOWN TEMP. AND PERFORMANCE RATIO GIVEN                            TCVAC355
      BOBPCW#0.0005                                                     TCVAC36C
      BOBPCW#0.001                                                      TCVA0365
      BOBPCT#0.001                                                      TCVAC37C
      BOBPCT#.01                                                        TCVAC375
      BOBPCW#.01                                                        TCVAC38C
      AMBE # 990.0                                                      TCVA0385
      AMBR # 1010.C                                                     TCVAC39C
      DTPDE # .5                                                        TCVAC395
      DTPDR # .5                                                        TCVAC40C
      THF #THFA                                                         TCVA0405
      WM#WPI + WBI                                                      TCVAC41C
      WC#WM*RC                                                          TCVAC415
      WO#WC + WM                                                        TCVAC42C
      CB#CR*CO                                                          TCVA0425
      WPT#WO*(CB-CO)/(CB-CP) -WC *(CB-CC)/(CB-CP)                       TCVA043C
      WB#WO -WPT-WC                                                     TCVAC435
  105 CFI#(WM*CO -WPI*CP)/WPI                                           TCVAC440
      IHFR#0                                                            TCVA0445
      FLAG3#C.0                                                         TCVA045C
  11C II#2                                                              TCVAC455
      CALL DINTPL(TCF,CO,HMCF)                                          TCVAC46C    13
      CALL DINTPL(TPI,CP,HCPTP)                                         TCVA0465    15
      CALL DINTPL(THF, CB, HRHF)                                        TCVA047C    17
      CALL DINTPL(THF, CFI, HBI)                                        TCVA0475    19
      CALL DINTPL(TCF, CB, HRCF)                                        TCVAC48C    21
      WR#(WM*HMCF + QBR -WPI*HCPTP -WBI *HBI) / (HRHF -HRCF)            TCVA0485
      WF#WM+WR                                                          TCVA049C
      CFR#(WR * CB +WBI*CFI ) / (WR + WBI)                              TCVA0495
      HFR# (WBI*HBI +WR*HRHF)/(WBI +WR)                                 TCVAC5CC
      TFR#TTT(CFR,HFR  )                                                TCVAC505    23
      TB#TO+ (QBR +WPT*(2.C +DTPDR))/(WC + WPT +WB)                     TCVAC51C
      FLAG4#C.0                                                         TCVAC515
  115 TP # TB - BPE(CB,TB) - DTPDR                                      TCVAC52C    25
      II#2                                                              TCVA0525
      CALL DINTPL(TP, CP, HCPTP)                                        TCVAC53C    27
      CALL DINTPL (TB,CB,HCBTB)                                         TCVAC535    29
      CALL DINTPL(TB, CO, HMB)                                          TCVAC54C    31
      CALL DINTPL(TO, CO,HO   )                                         TCVAC545    33
      ALP#HCPTP - HCBTB                                                 TCVAC55C
      HB#(QBR+WO*HO   -WC*HMB-WPT*ALP)/(WPT+WB)                         TCVAC555
```

FIGURE 6 (Continued)

```
      TBC #TTT(CB,HB)                                                   TCVA0560    35
      HZ#HO                                                             TCVA0565
      IF(ABS(TBC-TB)/TBC - .00001) 125,120,120                          TCVA0570
  120 TB#TBC                                                            TCVA0575
      GOTO115                                                           TCVA0580
  125 IF(FLAG4) 135,130,135                                             TCVA0585
  130 FLAG4# 4.0                                                        TCVA0590
      TB#TBC                                                            TCVA0595
      GO TO 115                                                         TCVA0600
  135 TBE#TB+TFR -TCF                                                   TCVA0605
      TBEC#TBE                                                          TCVA0610
      CBE#CB                                                            TCVA0615
      CBEC#CBE                                                          TCVA0620
      TPE#TBE-2.0-DTPDE                                                 TCVA0625
      FLAG21#0.0                                                        TCVA0630
  140 FLAG19#0.0                                                        TCVA0635
  145 II#2                                                              TCVA0640
      CALL DINTPL (TBE,CBE,HCBE)                                        TCVA0645    47
      CALL DINTPL (TB ,CB ,HCBTB)                                       TCVA0650    49
      CBE#CP + (CB-CP) *(1.0 - (HCBE-HCBTB)/AMBR)                       TCVA0655
      IF(ABS(CBE-CBEC)/CBE - 0.00001) 155,150,150                       TCVA0660
  150 CBEC#CBE                                                          TCVA0665
      GO TO 145                                                         TCVA0670
  155 WBE#(WB+WR)/(1.0 -(HCBE-HCBTB)/AMBR)                              TCVA0675
      IF(FLAG19)165,160,165                                             TCVA0680
  160 FLAG19#19.0                                                       TCVA0685
       CBEC#CBE                                                         TCVA0690
      GO TO 145                                                         TCVA0695
  165 CONTINUE                                                          TCVA0700
      II#2                                                              TCVA0705
      CALL DINTPL(TPE,CP,HCPTPE)                                        TCVA0710    60
      HTPE#(WO*(HMB-HO    ) +WPT*HCPTP+(WB+WR)*HCBTB-WBE*(HCBE-HCPTPE))/ TCVA0715
     1(WPI+WR+ WBI)                                                     TCVA0720
      TPE#TTT(CP,HTPE)                                                  TCVA0725    62
      TPX#TPE+DTPDE                                                     TCVA0730
      CALL BOPR(TPX,CBE,BPR)                                            TCVA0735    63
      TBE#TPE + BPR + DTPDE                                             TCVA0740
      IF(ABS(TBE -TBEC)/TBE -0.0001)175,170,170                         TCVA0745
  170 TBEC#TBE                                                          TCVA0750
      GO TO 145                                                         TCVA0755
  175 WPE#WR + WBI -WBE                                                 TCVA0760
      IF(FLAG21)185,180,185                                             TCVA0765
  180 FLAG21#21.0                                                       TCVA0770
      TBEC#TPE                                                          TCVA0775
      GO TO 140                                                         TCVA0780
  185 CONTINUE                                                          TCVA0785
      WPR#WBE -WB -WR                                                   TCVA0790
      WPRI#WPT-WPI-WPE                                                  TCVA0795
       CBEI#(WB*CB +WR*CB +WPR*CP)/WBE                                  TCVA0800
      HFRC#WPE*AMBE/(WR +WBI) +HCBE                                     TCVA0805
      IF(ABS(HFRC -HFR)/HFR -0.0005)220,190,190                         TCVA0810
  190 IHFR#IHFR+1                                                       TCVA0815
      IF(IHFR-1)195,195,200                                             TCVA0820
  195 HCI#HFRC                                                          TCVA0825
      HAI#HFR                                                           TCVA0830
      THF#0.99*THF                                                      TCVA0835
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
          TCVA        -   EFN    SOURCE STATEMENT  -   IFN(S)  -

      GO TO 110                                                     TCVA0840
  200 HC2#HFRC                                                      TCVA0845
      HA2#HFR                                                       TCVA0850
      HA#(HC2*HA1 -HA2*HC1) /(HC2 -HC1 -HA2 +HA1)                   TCVA0855
      TFRA#TTT(CFR,HA)                                              TCVA0860     80
      THF2#THF*TFRA/TFR                                             TCVA0865
      THFDIF#THF2-THF                                               TCVA0870
  205 THFC#THF +THFDIF                                              TCVA0875
      IF(THFC-TCF) 210,210,215                                      TCVA0880
  210 THFDIF#0.5*THFDIF                                             TCVA0885
      GO TO 205                                                     TCVA0890
  215 THF#THFC                                                      TCVA0895
      HC1#HC2                                                       TCVA0900
      HA1#HA2                                                       TCVA0905
      GO TO 110                                                     TCVA0910
  220 TK#TBE                                                        TCVA0915
      IF(FLAG3)230,225,230                                          TCVA0920
  225 FLAG3#3.0                                                     TCVA0925
      GO TO 110                                                     TCVA0930
  230 CONTINUE                                                      TCVA0935
      IF((TSTEAM -2.5).LT.THF)GOTO 235                              TCVA0940
      GO TO 240                                                     TCVA0945
  235 WRITE(6, 8000)THF,CR,TSE,TSTEAM                               TCVA0950     96
 8000 FORMAT(1H ,43HTHF IS TOO HIGH (CR TOO LOW OR TSE TOO LOW),4E13.6) TCVA0955
      ERR#15.                                                       TCVA0960
      RETURN                                                        TCVA0965
  240 CONTINUE                                                      TCVA0970
C      FLAG#0 MEANS NO CONVERGENCE SO CONTINUE                      TCVA0975
C      FLAG#+ MEANS CONVERGENCE-CALL STAGE GEO. AND COSTS           TCVA0980
      IF(FLAG)355,245,355                                           TCVA0985
  245 IF(ROE)250,275,250                                            TCVA0990
  250 THFTK#TFR-TBE                                                 TCVA0995
      IF(ITER-4)260,255,255                                         TCVA1000
  255 ZNNK#NK                                                       TCVA1005
      RHONK#THFTK/ZNNK                                              TCVA1010
      ZNK#NNK                                                       TCVA1015
      RHOK#(TK-TB)/ZNK                                              TCVA1020
      GO TO 290                                                     TCVA1025
  260  NK#THFTK/ROE+0.5                                             TCVA1030
      ZNNK# NK                                                      TCVA1035
      RHONK#THFTK/ZNNK                                              TCVA1040
      NNK#(TK-TB)/ROER +0.5                                         TCVA1045
      IF(NNK-1)265,265,270                                          TCVA1050
  265 NNK#2                                                         TCVA1055
  270 ZNK#NNK                                                       TCVA1060
      RHOK#(TK-TB)/ZNK                                              TCVA1065
      NTOTAL#NNK+NK                                                 TCVA1070
      TOTAL#NTOTAL                                                  TCVA1075
      GO TO 290                                                     TCVA1080
  275 TAU#(TFR-TK)*TOTAL/(TFR-TB)                                   TCVA1085
      IF(TOTALR)285,285,280                                         TCVA1090
  280 ZNK#TOTAL-TOTALR                                              TCVA1095
      NK#ZNK                                                        TCVA1100
      RHONK#(TFR-TK)/ZNK                                            TCVA1105
       RHOK#(TK-TB)/TOTALR                                          TCVA1110
      NNK#TOTALR                                                    TCVA1115
```

FIGURE 6 (Continued)

```
      GO TO 290                                                         TCVA1120
  285 NK#TAU                                                            TCVA1125
      ZNK#NK                                                            TCVA1130
      RHONK#(TFR-TK)/ZNK                                                TCVA1135
       DENN#NTOTAL-NK                                                   TCVA1140
       RHOK#(TK-TB)/DENN                                                TCVA1145
  290 ITER#ITER+1                                                       TCVA1150
      TTD(I)#TFR-TCF-(RHONK+ALPHAI )                                    TCVA1155
      IF(ITER-NITER)295,390,390                                         TCVA1160
  295 SMAQ#WF*CPBT*(TFR-TCF)*FFHL                                       TCVA1165
      SUMNK# 0.0                                                        TCVA1170
      SUMNNK #0.0                                                       TCVA1175
      NKI#NK-1                                                          TCVA1180
      DO 300J#1,NKI                                                     TCVA1185
  300 SUMNK#SUMNK+FLOAT(J)                                              TCVA1190
      J#NTOTAL-NK -1                                                    TCVA1195
      DO 305K#1,J                                                       TCVA1200
  305 SUMNNK#SUMNNK+FLOAT(K)                                            TCVA1205
      SUMA#TOTAL*(TFR-TA)-RHONK                                         TCVA1210
     1*SUMNK-RHONK*SUMNNK      -(TOTAL-ZNK)*ZNK*RHONK                   TCVA1215
      P#WX/WF                                                           TCVA1220
      PN#P                                                              TCVA1225
      WX#WPE + WPR                                                      TCVA1230
      RP#P*1.0E3 /(CPBT * (THF -TCF))                                   TCVA1235
      RPN#RP                                                            TCVA1240
      Q#WO/WF                                                           TCVA1245
      G#WX/0.344432                                                     TCVA1250
      GTOTI#G+WPI*2.90333                                               TCVA1255
  310 CAL_GSC                                                           TCVA1260    140
      IF(ERR)385,315,385                                                TCVA1265
  315 LGSC#1                                                            TCVA1270
      IZ#NTOTAL+1                                                       TCVA1275
      II#2                                                              TCVA1280
      CALL DINTPL(TFR,CFR,HCFR)                                         TCVA1285    147
      CAL_ DINTPL(TS(NK+1),C(NK+1),HC2NK)                               TCVA1290    151
      CALL DINTPL(TS(NTOTAL+1),C(NTOTAL+1),HC2N)                        TCVA1295    155
      AMBR#WS(NK+1)/WPRGSC *(HC2NK-HC2N)                                TCVA1300
      AMBE#(WR +WBI)/WPEGSC*(HCFR-HC2NK)                                TCVA1305
C      CONVERGENCE CRITERIA IF TB GIVEN                                 TCVA1310
      RPN#PN*1.0E3/(CPBT*(THF-TCF))  *TJEAN                             TCVA1315
      IF(ABS(TS(NK+1)-TBE)/TBE -BOBPCT)320,105,105                      TCVA1320
  320 IF(ABS(WPEGSC-WPE)/WPE -BOBPCW)325,105,105                        TCVA1325
  325 IF(ABS(WPRGSC -WPR)/WPR -BOBPCW)330,105,105                       TCVA1330
  330 IF(ABS(WPTGSC-WPT)/WPT-BOBPCW)335,105,105                         TCVA1335
  335 IF(ABS(TS(NTOTAL+1)-TB)/TB -BOBPCT)340,105,105                    TCVA1340
  340 IF(ABS(SMT(NTOTAL)-TO)/TO -BOBPCT)345,105,105                     TCVA1345
  345 IF(ABS(SMT(NK)-TB )/TB -BOBPCT)350,105,105                        TCVA1350
  350 CONTINUE                                                          TCVA1355
      FLAG#1.0                                                          TCVA1360
      GO TO 105                                                         TCVA1365
C CALCULATE STAGE GEOMETRY AND COSTS                                    TCVA1370
  355 CALLSTAGEG                                                        TCVA1375    178
      BOBPCT#0.0001                                                     TCVA1380
      DTPDE#DTPDP(NK)                                                   TCVA1385
      DTPDR#DTPDP(NTOTAL)                                               TCVA1390
      IF(ERR)385,360,385                                                TCVA1395
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FIGURE 6 (Continued)

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                                                                    09/26/67
        TCVA        -  EFN   SOURCE STATEMENT  -  IFN(S)  -

  360 FLAG#0.0                                                      TCVA1400
      IF(IGSC-2) 365,380,380                                        TCVA1405
  365 IGSC#1  +IGSC                                                 TCVA1410
      IF(JMAX)370,380,370                                           TCVA1415
  370 IF(JALP)375,380,375                                           TCVA1420
  375 GO TO 310                                                     TCVA1425
  380 CALL COST      (JJ)                                           TCVA1430     192
      THF#TFR                                                       TCVA1435
      WX#WP(NTOTAL+1)                                               TCVA1440
      WPMWP1#WP(NTOTAL+1)-WP1                                       TCVA1445
      TCVA#TC                                                       TCVA1450
      BITER#NITER                                                   TCVA1455
  385 CONTINUE                                                      TCVA1460
      RETURN                                                        TCVA1465
  390 WRITE (6,8005 )NITER                                          TCVA1470     197
 8005 FORMAT(35H THIS CASE WILL NOT CONVERGE AFTER   I5,  11H ITERATIONSTCVA1475
     1       17H*****************      )                            TCVA1480
      CALL STAGEG                                                   TCVA1485     198
      CALL COST(JJ)                                                 TCVA1490     200
      CALL OUTPUT                                                   TCVA1495     202
      ERR#10.0                                                      TCVA1500
      RETURN                                                        TCVA1505
      END                                                           TCVA1510
```

FIGURE 6 (Continued)

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```
*
$IBFTC GSC1     DECK                                                    GSC1C000
```

FIGURE 6 (Continued)

09/26/67

GSC1 - EFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINEGSC                                                     GSC10005
C**** SUBROUTINE GSC FOR HMN -- INCLUDES DEMISTER   9/14/65             GSC10010
      COMMON/GEN/CASE,G,RP, XRP,P,XO,Q,XU,CR,XCR, ROE,ROER              GSC10015
      COMMON/TEMPC/TSTEAM,TS(100), THF,TB,XTB,       TO,TP,TA,CC,CP     GSC10020
      COMMON/GEOME/AMODU,ALEV,AUNIT,TOTALE,TOTALR,FREBD,TRAYDP,HST,CL,  GSC10025
     1SPL                                                               GSC10030
      COMMON/ECON/SMALLE,SMALLD,SMALLB,SMALLP,RATEIN,WPL, CAPF,THERM,   GSC10035
     1PMSTMC                                                            GSC10040
      COMMON/TUBING/ DOH,DIH,DOE,DIE,DOR,DIR,A1,A2,A3,BIKTH,BIKTE,      GSC10045
     1BIKTR,CSLTBH,CSLTBP,CSLTBR                                        GSC10050
      COMMON/FOULIN/RH,RE,RSR,SH,SE,SR,VH,VE,VR                         GSC10055
      COMMON/PUMPHT/HD,HH,HBL,HPR,FFHL,SSFI                             GSC10060
      COMMON/AMISC/CPSTB,FACID,ACACID,DPLIM,A6,A7,XSOC,XNNN,NNN,XLLL,LLLGSC10065
      COMMON/DATA1/BDEPH,DTPD,SSF2,TOTAL,UMAX,UALP,PI,TWFA,TSTH,COEFA,  GSC10070
     1ORITE,ITER                                                        GSC10075
      COMMON/AZ1/DTPDP(100),TITLE(15)                                   GSC10080
      COMMON/TCVL1/ ACPSN, ACPSNK, ACPTNK,CPBT,CPTK, CPTNK,AMBN,TCF,WX, GSC10085
     1WF,WO,CB,WC,WB, WR,RHONK, RHCK, ERR,CCF, NITER, NK,NTOTAL, PN,RPN,GSC10090
     2TC, ALPHA1, WPN, DELCT, DELST, IGSC, SMAQ, SUMA, TK               GSC10095
      COMMON/TCVL2/ TTD(100),SMT(100), SMT2(100), CT(100), WS(100),     GSC10100
     1C(100), TV(100), WV(100), QH(100), WP(100), AS(100),SLS(100)      GSC10105
      COMMON /TCVGSC  / CTDCS                                           GSC10110
      COMMON/PHYS/II                                                    GSC10115
      COMMON /MAIN1/ SSF, HFG                                           GSC10120
      COMMON/JAN18/WP1                                                  GSC10125
      COMMON/JAN23/CFR,TFR,WB1,TP1,WPRGSC,WPEGSC,WPTGSC                 GSC10130
      COMMON/JAN27/WM,        SUMALP,SUMQH,WPNK,CPSN,CPSNK              GSC10135
      COMMON /OP1/ SMAPPP, HR, SMAPPH, HE, UNARAR, UNARAE, A4, AJ, WCO, GSC10140
     1 UBARE, UBARR, UTHE, AE, AR, ATHE, THEL, ENE, THEN, HFE, HFR, THEHGSC10145
     2T, HC2, HC1, CC2, CC1, POCST2, POCST1, ALPBAR, PMC2, PMC1, CCCAP2,GSC10150
     3  CCCAP1, SITE2, SITE1,  WAIT2, WAIT1,  ES2, ES1,  EA2, EA1,     GSC10155
     4 BHC2,  BHC1,  VPC2,  VPC1,  UBPH,  EEC2,  EEC1,  PO,  CC2, CC1,  GSC10160
     5 SCM2,  SCM1,  CIBC2, CIBC1,  DEA2,  DEA1,  TC2,  TC1,  CAPI1,    GSC10165
     6 CAPI2,  CAPI3,  PO3,  HS1,  PMC,  EEC,  VPC,  SITE,  WAIT,       GSC10170
     7 ES,  EA,  CIBC,  BHC,  CCCAP,  CCSTIN,  WEIRC,  CRANE,  BLDG,    GSC10175
     8 DEACST,  PMCPO,  PMCFLO,  RETUP2,  RETUP1,  CPREQ(100), AMSC2,   GSC10180
     9 AMSC1                                                            GSC10185
      DIMENSIONHP(100),RHOTAP(100)                                      GSC10190
C INITIALIZATION OF VARIABLES AND PARAMETERS                            GSC10195
      XPCT#0.0001                                                       GSC10200
      WPRGSC#0.0                                                        GSC10205
      NK#NK                                                             GSC10210
      NTOTAL#NTOTAL                                                     GSC10215
      NNK#NTOTAL-NK                                                     GSC10220
      SUMALP#0.0                                                        GSC10225
      SUM23#0.0                                                         GSC10230
      SUM25#0.0                                                         GSC10235
      SUMQH#0.0                                                         GSC10240
      SUM21#0.0                                                         GSC10245
      SUM22#0.0                                                         GSC10250
      SUM24#0.0                                                         GSC10255
      SUM26#0.0                                                         GSC10260
C ASSIGN VALUE OF I (#STAGE NO BEING TREATED)                           GSC10265
      DO215 I#1,NTOTAL                                                  GSC10270
      IF(I-1)125,125,100                                                GSC10275
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
          GSCI        -   EFN    SOURCE STATEMENT  -   IFN(S)  -

C ASSIGN VALUES TO MATRIX FOR CALCULATING STAGES 2 THRU N            GSCI0280
  100 II#1                                                           GSCI0285
      SMT(I+1)#SMT1                                                  GSCI0290
      SMT2(I )#SMT1                                                  GSCI0295
      IF(ERR)220,105,220                                             GSCI0300
  105 IF(I   -NK)110,110,115                                         GSCI0305
C      HEAT RECOVERY STAGES                                          GSCI0310
  110 WT#WF                                                          GSCI0315
      CT(I)#CCF                                                      GSCI0320
      RHO#RHONK                                                      GSCI0325
      GO TO 120                                                      GSCI0330
C      HEAT REJECT STAGES                                            GSCI0335
  115 WT#WO                                                          GSCI0340
      CT(I)#CO                                                       GSCI0345
      RHO#RHOK                                                       GSCI0350
  120 TTD(I)#TS(I)-SMT1-RHO-(TS(I)-TV(I))                            GSCI0355
      TS(I+1)#TS(I)-RHO                                              GSCI0360
      GO TO 130                                                      GSCI0365
C ASSIGN STARTING VALUES FOR CALCULATION OF STAGE 1                  GSCI0370
  125 WS(I)# WB1 +WR                                                 GSCI0375
      TS(I)#TFR                                                      GSCI0380
      C(I)#CFR                                                       GSCI0385
      WP(I)#WP1                                                      GSCI0390
      TV(I)#TP1                                                      GSCI0395
      HP(I)#0.0                                                      GSCI0400
      WT#WF                                                          GSCI0405
      SMT(I+1)#TCF                                                   GSCI0410
      SMT2(I )#TCF                                                   GSCI0415
      RHO#RHONK                                                      GSCI0420
      CT(I)#CCF                                                      GSCI0425
      TTD(I)#THF-TCF-RHO  -ALPHA1                                    GSCI0430
      TS(I+1)#TS(I)-RHO                                              GSCI0435
C INDIVIDUAL STAGE CALCULATIONS BEGIN                                GSCI0440
  130 C(I+1)#C(I)                                                    GSCI0445
  135 TV(I+1)#SMT(I+1)+TTD(I)                                        GSCI0450
      RHOTAP(I)#RHO                                                  GSCI0455
      TAB#TV(I+1)+DTPDP(I)                                           GSCI0460
      CALL BOPR (TAB,C(I+1),DTBPR)                                   GSCI0465    53
      TS2C#TV(I+1)+DTBPR+DTPDP(I)                                    GSCI0470
      IF(ABS(TS2C-TS(I+1))/TTD(I)-0.001) 145,140,140                 GSCI0475
  140 TTD(I)#TS(I+1)-DTBPR-DTPDP(I)-SMT2(I)                          GSCI0480
      GO TO 135                                                      GSCI0485
  145 II#2                                                           GSCI0490
      TV (I+1) # TS (I+1) - DTBPR - DTPDP (I)                        GSCI0495
      CALLDINTPL(TV(I+1),CP,HF)                                      GSCI0500    72
      HFG#1093.88-.5703*TV(I+1)+1.2819E-4*TV(I+1)**2-.8824E-6*TV(I+1)**3GSCI0505
      CALLDINTPL(TS(I),C(I),HS1)                                     GSCI0510    80
      CALLDINTPL(TS(I+1),C(I+1),HS2)                                 GSCI0515    84
      WV(I)#WS(I)*(HS1-HS2)/(HF+HFG-HS2)                             GSCI0520
      C2C#(WS(I)*C(I)-WV(I)*CP)/(WS(I)-WV(I))                        GSCI0525
      IF(ABS(C2C-C(I+1))/C2C-XPCT)155,150,150                        GSCI0530
  150 C(I+1)#C2C                                                     GSCI0535
      GO TO 135                                                      GSCI0540
  155 WP(I+1)#WP(I)+WV(I)                                            GSCI0545
      CALLDINTPL(TV(I),CP,HP1)                                       GSCI0550    103
      CALLDINTPL(TV(I+1),CP,HP2)                                     GSCI0555    106
```

FIGURE 6 (Continued)

```
      WS(I+1)#WS(I)-WV(I)                                               GSC10560
      QLN#(SMAQ*(TS(I)-TA))/SCMA                                        GSC10565
      QH(I)#WS(I)*HS1-WS(I+1)*HS2+WP(I)*HP1-WP(I+1)*HP2-QLN             GSC10570
      II#1                                                              GSC10575
      ARG#SMT(I+1)-(TS(I)-TS(I+1))*0.5                                  GSC10580
      IF(I-NK) 160,160,180                                              GSC10585
  160 SMT(I+1)#SMT2(I)- RHO                                             GSC10590
  165 II#2                                                              GSC10595
      CALL DINTPL(SMT2(I),CO,HCOT2)                                     GSC10600    128
      CALL DINTPL(SMT(I+1),CO,HCOT1)                                    GSC10605    131
      CALL DINTPL(SMT(I+1),CB,HCBT1)                                    GSC10610    134
      CALL DINTPL(SMT2(I),CB,HCBT2)                                     GSC10615    137
      CPM#(HCOT2 -HCOT1) /(SMT2(I) -SMT(I+1))                           GSC10620
      CPR#(HCBT2 -HCBT1) / (SMT2(I) -SMT(I+1))                          GSC10625
      SMTC#SMT2(I) -QH(I) /(WM*CPM +WR*CPR)                             GSC10630
      IF(ABS(SMTC -SMT(I+1))/SMT(I+1) -.000005)175,170,170              GSC10635
  170 SMT(I+1)#SMTC                                                     GSC10640
      GO TO 165                                                         GSC10645
  175 SMT(I) #SMTC                                                      GSC10650
      GO TO 185                                                         GSC10655
  180 II#2                                                              GSC10660
      CALL DINTPL (SMT(I+1), CT(I), HSMT)                               GSC10665    158
      HSM#HSMT -QH(I)/WT                                                GSC10670
      SMT(I)#TTT(CT(I),HSM)                                             GSC10675    162
  185 SMTI#SMT(I)                                                       GSC10680
C INDIVIDUAL STAGE CALCULATIONS COMPLETE                                GSC10685
C CALCULATE NECESSARY CUMULATIVE STAGE PROPERTIES                       GSC10690
      DEL#TS(I)-TS(I+1)                                                 GSC10695
      AMBDA#QH(I)/WV(I)                                                 GSC10700
      CPS#WV(I)*AMBDA/(WS(I)*DEL)                                       GSC10705
      IF(I-NK)190,190,210                                               GSC10710
  190 SUM21#WV(I)+SUM21                                                 GSC10715
      WPEGSC#SUM21                                                      GSC10720
      SUM24#SUM24 +QH(I)                                                GSC10725
      SUM26#SUM26+WV(I)  *AMBDA                                         GSC10730
      SUMQH#SUMQH+QH(I)*WV(I)                                           GSC10735
      SUMALP#SUMALP+TS(I+1)-TV(I+1)                                     GSC10740
      IF((THF-TB)/TOTAL+.5 - (THF -TCF -DTPDP(I) - DTBPR ))200,195,195  GSC10745
  195 WRITE (6, 8000)THF, TB, TOTAL, TCF, DTPDP(I),DTBPR                GSC10750    183
 8000 FORMAT(18H NOT ENOUGH STAGES   /7E16.8)                           GSC10755
      ERR #1.0                                                          GSC10760
      GO TO 220                                                         GSC10765
  200 IF(I-NK)215,205,215                                               GSC10770
  205 WPNK#SUM21                                                        GSC10775
      SUM24#SUM24/WF                                                    GSC10780
      CPTNK#SUM24/(TCF-SMT(NK))                                         GSC10785
      AMBNK#(SUM26       )/WPNK                                         GSC10790
      CPSNK#AMBNK*WPNK/(WF*(THF-TS(NK+1)))                              GSC10795
      ACPSNK#AMBNK/CPSNK                                                GSC10800
      ACPTNK#AMBNK/CPTNK                                                GSC10805
      GO TO 215                                                         GSC10810
  210 SUM21#SUM21+WV(I)                                                 GSC10815
      WPRGSC#WPRGSC + WV(I)                                             GSC10820
      SUM25#SUM25 + QH(I)                                               GSC10825
      SUM26#SUM26+WV(I)  *AMBDA                                         GSC10830
      SUMQH#QH(I)*WV(I)+SUMQH                                           GSC10835
```

FIGURE 6 (Continued)

```
      SUMALP#SUMALP+TS(I+1)-TV(I+1)                                    GSCI0840
  215 CONTINUE                                                         GSCI0845
C CALCULATE OVERALL PLANT PROPERTIES                                   GSCI0850
      WPN#SUM21                                                        GSCI0855
      SUM25#SUM25/WO                                                   GSCI0860
      CPTK#SUM25/(SMT2(NK+1)-SMT(NTOTAL))                              GSCI0865
      AMBN#SUM26/WPN                                                   GSCI0870
      CPSN#AMBN*WPN/(WF*(THF-  TS(NTOTAL+1)))                          GSCI0875
      ACPSN#AMBN/CPSN                                                  GSCI0880
      ALPHA1#TS(2)-TV(2)                                               GSCI0885
      SUMQH#SUMQH/WPN                                                  GSCI0890
      ALPBAR#SUMALP/TOTAL                                              GSCI0895
      II#2                                                             GSCI0900
      CALL DINTPL (TCF,CCF,HCFI)                                       GSCI0905    208
      CALL DINTPL (THF,CCF,HHFI)                                       GSCI0910    210
      CPBT#(HHFI-HCFI)/(THF-TCF)                                       GSCI0915
      WPTGSC#WP(NTOTAL+1)                                              GSCI0920
  220 RETURN                                                           GSCI0925
      END                                                              GSCI0930
```

FIGURE 6 (Continued)

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```
*
$IBFTC TT100   DECK                                                    TT100000
```

FIGURE 6 (Continued)

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TT100 - EFN SOURCE STATEMENT - IFN(S) -

```
      FUNCTION TTT( CB,HB)                                          TT100005
      COMMON/PHYS/II                                                TT100010
      II#1                                                          TT100015
      CALL DINTPL(40.0, CP, CP)                                     TT100020    3
      FLAG #0.0                                                     TT100025
      II #2                                                         TT100030
      CALL DINTPL (40.0,CB, H40)                                    TT100035    6
  100 TB #(HB - H40) /CP  + 40.0                                    TT100040
      CALL DINTPL(TB, CB, HBC)                                      TT100045    8
      IF(ABS(HBC-HB) /HBC  - 0.0001) 110,105,105                    TT100050
  105 CP #  (HBC-H40) /(TB-40.0)                                    TT100055
      GOTO100                                                       TT100060
  110 IF(FLAG) 120,115,120                                          TT100065
  115 FLAG #1.0                                                     TT100070
      GOTO 100                                                      TT100075
  120 TTT#TB                                                        TT100080
      RETURN                                                        TT100085
      END                                                           TT100090
```

FIGURE 6 (Continued)

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```
*
$IBFTC CNDN     DECK                                                    CNDNC000
```

FIGURE 6 (Continued)

```
      SUBROUTINE CNDNSR (XTITLE, NERR)                                  CNDNC005
C**** CONDENSER SUBROUTINE FOR STAGE BY STAGE CALCULATION               CNDNC010
C**** SIMPLIFIED CONDENSER CALCULATION - MOD HORIZONTAL FLOW 8/6/65     CNDNC015
C**** THIS SUBROUTINE REQUIRES INTPL, APPRCX, AMATQ2, EVAL SUBROUTINES  CNDNC020
      COMMON/MAY15/AJ                                                   CNDNC025
      COMMON/GEOME/AMODU,ALEV,AUNIT,TOTALE,TOTALR,FREBC,TRAYDX,HST,CL,  CNDNC030
     1SPL                                                               CNDNC035
      COMMON/AMISC/CPSTB,FACID,ACACID,DPLIM,A6,A7,XSOC,XNNN,NNN,XLLL,LLLCNDNC040
      COMMON/DATA1/BDEPH,DTPD,SSF2,TOTAL,UMAX,UALP,PI,TWFA,TSTH,COEFA,  CNDNC045
     1ORITE,ITER                                                        CNDNC050
      COMMON/TCVL1/ ACPSN, ACPSNK, ACPTNK,CPBT,CPTK, CPTNK,AMBN,TCF,WX, CNDNC055
     1WF,WO,CB,WC,WB, WR,RHONK, RHCK, ERR,CCF, NITER, NK,NTOTAL, PN,RPN,CNDNC060
     2TC, ALPHA1, WPN, DELCT, DELST, IGSC, SMAQ, SUMA, TK               CNDNC065
      COMMON/AZ1/DTPDP(100),TITLE(15)                                   CNDNC070
      COMMON/TCVL2/ TTD(100),SMT(100), SMT2(100), CT(100), WS(100),     CNDNC075
     1C(100), TV(100), WV(100), QH(100), WP(100), AS(100),SLS(100)      CNDNC080
      COMMON/STAGE1/ A(100),CFMWV(100), CFMWZ(100), UBAR(100), CM(100), CNDNC085
     1HO(100),HI(100),WWFS(100),VVEV(100), TRAYFL(100),TRAYWD(100),     CNDNC090
     2RESIDT(100), PV(100),DELP(100), DTPDPS(100)                       CNDNC095
      COMMON/CONDI/ DPINIT(100), DTINIT(100), DPCLR(100), DTCLR(100),   CNDNC100
     1DTCND(100)                                                        CNDNC105
      COMMON /STG1/ ATR, BTR, CTR, CTA                                  CNDNC110
      COMMON /STG2/HOH, PR, DENBR(100), SUMLS, WVST(100), CO, DI, R, S, CNDNC115
     1 V, TVTT(100),ZZ(100), HV, HS(100), WBS(100)                      CNDNC120
      COMMON /CNDR1/ NERR,        COOR(3), K                            CNDNC125
      COMMON /DEM1/ SLKP2, SUMDMA, TDMP(100), APTSE, VCLM, APTSR        CNDNC130
      COMMON /DEM3/ VNO(1), DTUBEP, TUBENO, HNO(1),VBL(1),HBLG, TRAYDP, CNDNC135
     1TRAYHT(                                                           CNDNC140
     15), HBL1, TRAYW2, ZZZZZ                                           CNDNC145
      COMMON/STAGE2/ AH, BAROM,BWE,BWR,COSTDM,ELE,ESHELL,HBH,HBLE,HBLR, CNDNC150
     1HLH, HNOE, HNOR,HN, HSTE, HSTR, JJ, KK, RLR, RSHELL, TBNOE,TBNOR, CNDNC155
     2UBARH, VBLE,VBLR,VNOE, VNOR, WTME, WTMR, WY                       CNDNC160
      DIMENSION                                                         CNDNC165
     2DPFG(100), DPFTP(100), DPM(100),FFX(100), DPT(100)                CNDNC170
      COMMON/CNDLNK/WG(100),IONO,WCNDT,WL,SPATRA,DTUBE,TSAT(100),PSAT(10CNDNC175
     10),VSAT(100),VEL(1),SOD(1),HBL(1),AREAB(1),AREAT(1)               CNDNC180
      YPSAT(Q000FL) #EXP(CTR + BTR/Q000FL+ ATR/ (Q000FL*Q000FL))        CNDNC185    2
      YVSAT(Q001FL,Q002FL)#EXP(-0.72240 + 1.10267 * ALOG(Q001FL/Q002FL) CNDNC190
     1              -0.0177861 * (ALOG(Q001FL/Q002FL)) **2              CNDNC195
     2                    + 0.00103758 * ( ALOG(Q001FL/Q002FL))**3)     CNDNC200    5     6
      YVISG(Q003FL) #(((-.7693E-10*Q003FL+.2892E-6)* Q003FL+ .1001E-2)* CNDNC205
     1Q003FL+ .1220) * 1.0E-5                                           CNDNC210
      VLIQ(Q004FL) #.16153716E-1 +(.48841151E-4 + (-.82269193E-6 +      CNDNC215
     1.57044577E-8 * Q004FL) *Q004FL) * Q004FL                          CNDNC220
      YTPG1(Q005FL)#EXP(-.93620189 +(-0.7500582 +(-0.11991543           CNDNC225
     1+.12224994E-01*Q005FL)*Q005FL)*Q005FL)                            CNDNC230    13
      YTPG2(Q006FL)#EXP(-0.94283631 +(-0.80225485 +(-.79487734E-01+.9212CNDNC235
     16780E-2*Q006FL)*Q006FL)       *Q006FL)                            CNDNC240    16
      TRSAT(Q007FL) #-2.0 * ATR/ (BTR+ SQRT(BTR*BTR-4.0 *              ACNDNC245
     1TR* (CTR- ALOG(Q007FL) )))                                        CNDNC250    19    20
      ATR # -837533.21                                                  CNDNC255
      BTR # -6452.5621                                                  CNDNC260
      CTR # 14.150119                                                   CNDNC265
      CLTURN # 0.3                                                      CNDNC270
  100 NERR#0                                                            CNDNC275
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
        CNDN        -  EFN   SOURCE STATEMENT  -  IFN(S)  -

      PCT#0.001                                                     CNDN0280
      LLL#XLLL+0.1                                                  CNDN0285
      LL1#LLL-1                                                     CNDN0290
      LEFTL# KK-JJ +1                                               CNDN0295
      DO 305 LLLL # JJ, KK, LLL                                     CNDN0300
      ISTAGE# LLLL                                                  CNDN0305
      LEFTL# LEFTL-LLL                                              CNDN0310
  105 TSAT1#TDMP(ISTAGE)-459.69                                     CNDN0315
      TUBENO#ZZ(ISTAGE)                                             CNDN0320
     1/(2.0*ALEV*AMODU)                                             CNDN0325
C******REVISIONS MADE 11-23-65                                      CNDN0330
      IF(WVST(ISTAGE)) 110,110,115                                  CNDN0335
  110 DPINIT(ISTAGE)#0.0                                            CNDN0340
      DTINIT(ISTAGE)#0.0                                            CNDN0345
      DPCLR(ISTAGE)#0.0                                             CNDN0350
      DTCLR(ISTAGE)#0.0                                             CNDN0355
      GO TO 305                                                     CNDN0360
  115 W#WVST(ISTAGE)/2.0                                            CNDN0365
      TRAYL#SLS(ISTAGE)  -0.5+TSTH/12.0                             CNDN0370
      SODMIN # 1.3                                                  CNDN0375
      XTR # TSAT1 + 459.69                                          CNDN0380
  120 PSAT1 #YPSAT(XTR)                                             CNDN0385
      PMIN #.001                                                    CNDN0390
  125 ICASE # 1                                                     CNDN0395
      SOD(ICASE)#XSOD                                               CNDN0400
      DELP(1)# 0.01                                                 CNDN0405
  130 DTUBE # DTUBEP/12.0                                           CNDN0410
  135 WGT # W/3600.0                                                CNDN0415
      ITER # 1                                                      CNDN0420
      XTR # TSAT1 + 459.69                                          CNDN0425
      XPI # PSAT1                                                   CNDN0430
  140 VGI# YVSAT(XTR,XPI)                                           CNDN0435
      VGS # VGI                                                     CNDN0440
  145 DPACC # WGT * WGT * VGI   /(9266.112 *(TRAYL * TRAYHT(ICASE))**2.0CNDN0445
     1)                                                             CNDN0450     56
      VEL (ICASE) # WGT * VGI/ (TRAYL * TRAYHT (ICASE))             CNDN0455
      DPTURN # VEL(ICASE) **2 / (9266.112 * VGI) * CLTURN *         CNDN0460
     1 (1.0 + (TRAYHT (ICASE) / (TRAYHT (ICASE) + 3.0 )) **2)       CNDN0465
      DPEDGE # (0.4 * (1.25 - TRAYHT(ICASE) / (HST - 1.5)) +        CNDN0470
     1 (1.0 - (TRAYHT (ICASE) / ( TRAYHT (ICASE) + 3.0) ))**2 )     CNDN0475
     2                          * VEL (ICASE) **2 / (9266.112 * VGI)  CNDN0480
      IMIN # 0                                                      CNDN0485
      IMAX # 0                                                      CNDN0490
      FREBD # TRAYHT (ICASE)                                        CNDN0495
      VBL1 # HST - 0.6 * FREBD                                      CNDN0500
  150 IVNO # VBL1                    /(0.866 *SOD(ICASE)* DTUBE) + 1.0  CNDN0505
      I#1                                                           CNDN0510
  155 VNO(ICASE) #FLOAT(IVNO)                                       CNDN0515
      IHNO # TUBENO/  VNO(ICASE) + 0.9                              CNDN0520
      IHNO2 # TUBENO / VNO (ICASE) * 0.5 + 0.9                      CNDN0525
  160 HNO(ICASE) #FLOAT(IHNO)                                       CNDN0530
  165 VBL2 # HST - (VNO(ICASE) + HNO(ICASE))/ (2.0* VNO(ICASE) +     CNDN0535
     1 HNO(ICASE)) * FREBD                                          CNDN0540
      IVNO # VBL2                    /(0.866 *SOD(ICASE)* DTUBE) + 1.0  CNDN0545
      VNO(ICASE) #FLOAT(IVNO)                                       CNDN0550
      IHNO # TUBENO/  VNO(ICASE) + 0.9                              CNDN0555
```

FIGURE 6 (Continued)

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                                                                    09/26/67
        CNDN        -  EFN   SOURCE STATEMENT  -  IFN(S)  -

      IHNO2 # TUBENO / VNO (ICASE) * 0.5 + 0.9                      CNDN0560
      HNO(ICASE) #FLOAT(IHNO)                                       CNDN0565
      IF (ABS(VBL1/VBL2 - 1.0) - .01 ) 175, 175, 170                CNDN0570
  170 VBL1 # VBL2                                                   CNDN0575
      GO TO 165                                                     CNDN0580
  175 IF (IHNO2 /NNN -99)185,185,180                                CNDN0585
  180 WRITE (6,8000)IHNO2, VNO, HNO, TUBENO                         CNDN0590    99
 8000 FORMAT (1H0 22HTOO MANY ROWS, IHNO2 #  I4 /                   CNDN0595
     1 1H  2X 5HVNO # E13.6, 2X 5HHNO # E13.6, 2X 9HTUBENO # E13.6) CNDN0600
      GO TO 305                                                     CNDN0605
  185 WG (1) # WGT /((VNO (ICASE) - 1.0) * 2.0+ (HNO (ICASE) - 1.0 ) ) CNDN0610
      IDNO # IHNO2                                                  CNDN0615
  190 SPAS # (SOD(ICASE) -1.0)* DTUBE                               CNDN0620
  195 WCNDT # WGT   /TUBENO                                         CNDN0625
  200 WL# WCNDT* VNO(1)/8.0                                         CNDN0630
      AXBND # SPAS * TRAYL *(2.0 * (VNO (ICASE) - 1.0)              CNDN0635
     1 + HNO (ICASE) - 1.0)                                         CNDN0640
      ARATIO # AXBND / (TRAYL *(TRAYHT (ICASE) + 3.0 ))             CNDN0645
      IF (ARATIO - 1.0) 220, 220, 205                               CNDN0650
  205 ARATOX # 1.0 / ARATIO                                         CNDN0655
  210 DPEXP #((1.0 - ARATOX)     *  WGT/(TRAYL *(TRAYHT (ICASE) + 3.0)))CNDN0660
     1 **2 * VGI / 9266.112                                         CNDN0665
  215 DPCNTR # DPEXP                                                CNDN0670
      GO TO 240                                                     CNDN0675
  220 IF (ARATIO - 0.715) 225, 225, 230                             CNDN0680
  225 CONTC # 0.4 * (1.25 - ARATIO)                                 CNDN0685
      GO TO 235                                                     CNDN0690
  230 CONTC # 0.75 * (1.0 - ARATIO)                                 CNDN0695
  235 DPCNTR # CONTC * (WGT / AXBND ) **2  * VGI / 9266.112         CNDN0700
  240 DPACC2 # WGT * WGT * VGI*(1.0 / AXBND**2  -                   CNDN0705
     1 1.0/ (TRAYL *(TRAYHT (ICASE) + 3.0)) **2 ) / 9266.112        CNDN0710
  245 COOR (2) # 0.50 * SOD (ICASE)                                 CNDN0715
      COOR (3) #          SOD ( ICASE)                              CNDN0720
  250 IF (COOR (3) - 3.5) 260, 260, 255                             CNDN0725
  255 COOR (3) # 3.5                                                CNDN0730
      GO TO 270                                                     CNDN0735
  260 IF (COOR(3) -1.15) 265, 270, 270                              CNDN0740
  265 COOR (3) # 1.15                                               CNDN0745
  270 PSAT(1) # PSATI - DPACC - DPCNTR - DPACC2                     CNDN0750
     1 - DPTURN - DPEDGE                                            CNDN0755
      IF (PSAT(1) - PMIN) 280, 280, 275                             CNDN0760
  275 XPI # PSAT(1)                                                 CNDN0765
      TSAT(1) # TRSAT(XPI) - 459.69                                 CNDN0770
      COOR(2)#COOR(3)                                               CNDN0775
      SPATRA#SPAS*TRAYL                                             CNDN0780
      CALL CNDNS(LLLL,COOR(1))                                      CNDN0785    140
      IDNO1 # K                                                     CNDN0790
      DP2 # PSATI - PSAT (IDNO1)                                    CNDN0795
      SOD2 # SOD (ICASE)                                            CNDN0800
      GO TO 285                                                     CNDN0805
  280 WRITE (6,8005)PSAT(1)                                         CNDN0810    146
 8005 FORMAT(1H0 4X 18HPSAT(1) TOO LOW #     E16.8)                 CNDN0815
      NERR#1                                                        CNDN0820
      GO TO 305                                                     CNDN0825
  285 VBL(ICASE)#(VNO(ICASE)-1.0)*0.866*SOD(ICASE)*DTUBE+DTUBE      CNDN0830
      HBLG       #(HNO(ICASE)-1.0)*       SOD(ICASE)*DTUBE+DTUBE   CNDN0835
```

FIGURE 6 (Continued)

```
      HBLX # HBL G        + 3.0                                          CNDNC840
      HST # TRAYDP + TRAYHT (ICASE)                                      CNDNC845
      AREAB (ICASE) # HBL G        * VBL (ICASE)                         CNDNC850
      AREAT (ICASE) # (HBLX + TRAYW2) *(TRAYDP + TRAYHT (ICASE))         CNDNC855
      DPINIT(ISTAGE) # DPACC + DPCNTR + DPACC2 + DPTURN + DPEDGE         CNDNC860
      DTINIT(ISTAGE) # TSAT1 - TSAT(I)                                   CNDNC865
      DPCLR(ISTAGE) # PSAT(1) - PSAT(IDNCI)                              CNDNC870
      DTCLR(ISTAGE) # TSAT(I) - TSAT(IDNCI)                              CNDNC875
 8010 FORMAT(1H I5, 7E16.8)                                              CNDNC880
      L#ISTAGE                                                           CNDNC885
      IF(LEFTL)290,290,305                                               CNDNC890
  290 IF(LLLL-KK )295,305,305                                            CNDNC895
  295 IF(ISTAGE-KK)300,305,305                                           CNDNC900
  300 ISTAGE#KK                                                          CNDNC905
      LLL#KK                                                             CNDNC910
      GO TO 105                                                          CNDNC915
  305 CONTINUE                                                           CNDNC920
  310 HBL1#HBLX                                                          CNDNC925
      SAVEXL#XLLL                                                        CNDNC930
      DO 345 I#JJ,KK,LLL                                                 CNDNC935
      K#I+LLL                                                            CNDNC940
      IF(LL1)315,350,315                                                 CNDNC945
  315 IF(K-NK)330,330,320                                                CNDNC950
  320 IF(I-NK-1)325,345,345                                              CNDNC955
  325 K#NK                                                               CNDNC960
      XLLL#NK-I                                                          CNDNC965
      LL1#XLLL-1.0                                                       CNDNC970
      IF(XLLL)350,350,330                                                CNDNC975
  330 DELTA1 # (DPINIT(K) - DPINIT(I))/XLLL                              CNDNC980
      DELTA2 # (DTINIT(K) - DTINIT(I)) /XLLL                             CNDNC985
      DELTA3 #(DPCLR(K) - DPCLR(I))/XLLL                                 CNDNC990
      DELTA4 # (DTCLR(K)- DTCLR(I)) /XLLL                                CNDNC995
      IF(LL1)345,345,335                                                 CNDN1000
  335 DO 340 JL#1,LL1                                                    CNDN1005
      IL#I+JL                                                            CNDN1010
      XILI # FLOAT(IL-I)                                                 CNDN1015
      DPINIT(IL)# DPINIT(I) + DELTA1 * XILI                              CNDN1020
      DTINIT(IL)#DTINIT(I)    +DELTA2 * XILI                             CNDN1025
      DTCLR(IL)#DTCLR(I ) + DELTA4 *XILI                                 CNDN1030
      DPCLR(IL)#DPCLR(I ) + DELTA3 *XILI                                 CNDN1035
  340 CONTINUE                                                           CNDN1040
  345 CONTINUE                                                           CNDN1045
  350 XLL#SAVEXL                                                         CNDN1050
      RETURN                                                             CNDN1055
      END                                                                CNDN1060
```

FIGURE 6 (Continued)

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*
$IBFTC STAGE   DECK                                                 STAGCCCC
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FIGURE 6 (Continued)

09/26/67

STAGE - FFN SOURCE STATEMENT - IFN(S) -

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      SUBROUTINE STAGEG                                                 STAGC005
C**** STAGEGEOM FOR NORITAKE  DEAERATOR AND    421 DEMISTER  10/12/65   STAGC01C
      COMMON/GEN/CASE,G,RP, XRP,P,XO,Q,XU,CR,XCR, RCE,ROER              STAGC015
      COMMON/TEMPC/TSTEAM,TS(100), THF,TB,XTB,        TC,TP,TA,CC,CP    STAGC02C
      COMMON/GEOME/AMODU,ALEV,AUNIT,TCTALE,TOTALR,FREBC,TRAYDP,HST,CL,  STAGC025
     1SPL                                                               STAGC03C
      COMMON/ECON/SMALLE,SMALLD,SMALLB,SMALLP,RATEIN,WPL, CAPF,THERM,   STAGC035
     1PMSTMC                                                            STAGC04C
      COMMON/TUBING/ DOH,DIH,DOE,DIE,DOR,DIR,A1,A2,A3,BIKTH,BIKTE,      STAGC045
     1BIKTR,CSLTBH,CSLTBP,CSLTBR                                        STAGC05C
      COMMON/FOULIN/RH,RE,RSR,SH,SE,SR,VH,VE,VR                         STAGC055
      COMMON/PUMPHT/HD,HH,HBL,HPR,FFHL,SSFI                             STAGC06C
      COMMON/AMISC/CPSTB,FACID,ACACID,DPLIM,A6,A7,XSOC,XNNN,NNN,XLLL,LLLSTAGC065
      COMMON/DATA1/BDEPH,DTPD,SSF2,TOTAL,UMAX,UALP,PI,TWFA,TSTH,COEFA,  STAGC07C
     1ORITE,ITER                                                        STAGC075
      COMMON/AZ1/DTPDP(100),TITLE(15)                                   STAGC08C
      COMMON/TCVL1/ ACPSN, ACPSNK, ACPTNK,CPBT,CPTK, CPTNK,AMBN,TCF,WX, STAGC085
     1WF,WO,CB,WC,WB, WR,RHONK, RHCK, ERR,CCF, NITER, NK,NTOTAL, PN,RPN,STAGC09C
     2TC, ALPHA1, WPN, DELCT, DELST, IGSC, SMAQ, SUMA, TK               STAGC095
      COMMON/TCVL2/ TTD(100),SMT(100), SMT2(100), CT(100), WS(100),     STAGC1CC
     1C(100), TV(100), WV(100), QH(100), WP(100), AS(100),SLS(100)      STAGC1C5
      COMMON/STAGE1/ A(100),CFMWV(100), CFMWZ(100), UBAR(100), CM(100), STAGC11C
     1HO(100),HI(100),WWFS(100),VVEV(100), TRAYFL(100),TRAYWD(100),     STAGC115
     2RESIDT(100), PV(100),DELP(100), DTPDPS(100)                       STAGC12C
      COMMON/STAGE2/ AH, BAROM,BWE,BWR,COSTDM,ELE,ESHELL,HBH,HBLE,HBLR, STAGC125
     1HLH, HNOE, HNOR,HN, HSTE, HSTR, JJ, KK, RLR, RSHELL, TBNOE,TBNOR, STAGC13C
     2UBARH, VBLE,VBLR,VNOE, VNOR, WTME, WTMR, WY                       STAGC135
      COMMON/PHYS/II                                                    STAGC14C
      COMMON /MAIN1/ SSF, HFG                                           STAGC145
      COMMON /STG1/ ATR, BTR, CTR, CTA                                  STAGC15C
      COMMON /STG2/HOH, PR, DENBR(100), SUMLS, WVST(100), DO, DI, R, S, STAGC155
     1 V, TVTT(100), Z(100), HV, HS(100), WBS(100)                      STAGC16C
      COMMON /CST1/ ASIEV, ANPLAT, SLPLAT, APLAT                        STAGC165
      COMMON /CNDR1/ NERR,        COOR(3), K                            STAGC17C
      COMMON /DEM1/ SLKP2, SUMDMA, TDMP(100), APTSE, VCLM, APTSR        STAGC175
      COMMON/STG21/TRAYLN,SLDEA,GR,WVKEEP,TTRAY,WVDEAI                  STAGC18C
      COMMON/STGCST/TRAWDP,PTRAWD                                       STAGC185
      COMMON/FEB8/SSFUBR                                                STAGC19C
      YPSAT(Q000FL) #EXP(CTR + BTR/Q000FL+ ATR/ (Q000FL*Q000FL))        STAGC195     2
      FTIH(Q001FL)#2.1786818-.70443622E-01*Q001FL+.93941286E-03*Q001FL**STAGC200
     12-.53958083E-05*Q001FL**3+.18139197E-07*Q001FL**4                 STAGC205
      HFGH(Q002FL)#1093.88-0.5703*Q002FL+1.2819E-4*Q002FL**2-0.8824E-6*QSTAGC210
     1Q02FL**3                                                          STAGC215
      ATR # -837533.21                                                  STAGC220
      BTR # -6452.5621                                                  STAGC225
      CTR # 14.150119                                                   STAGC23C
      PI # 3.14159                                                      STAGC235
      CTA#6.65                                                          STAGC24C
      SUMLS#0.0                                                         STAGC245
      NTOTAL#NTOTAL                                                     STAGC25C
      NK#NK                                                             STAGC255
      ZBAR#0.0                                                          STAGC26C
      SUMDM#0.0                                                         STAGC265
      TER5#1.0+SSFI                                                     STAGC27C
      II#5                                                              STAGC275
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FIGURE 6 (Continued)

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                                                                                  09/26/67
      STAGE      -  EFN   SOURCE STATEMENT  -  IFN(S)  -

      CALLDINTPL(TCF,CT(I),RHOEI)                                          STAGD28C     12
      GE#3600.0*RHOEI*VE                                                   STAGD285
      CALLDINTPL(TR,CO,RHORI)                                              STAGD29C     14
      GR#3600.0*RHORI*VR                                                   STAGD295
      DO270 I#1,NTOTAL                                                     STAGD300
      WVST(I)#WV(I)/(AMODU*ALEV)                                           STAGD305
      IF(I-NK)100,100,115                                                  STAGD310
  100 DO#DOE                                                               STAGD315
      RHJ#RHONK                                                            STAGD320
      DI#DIE                                                               STAGD325
      BIKT#BIKTE                                                           STAGD330
  105 R#RE                                                                 STAGD335
  110 S#SE                                                                 STAGD340
      V#VE                                                                 STAGD345
      GF#GE                                                                STAGD350
      GOTO120                                                              STAGD355
  115 DO#DOR                                                               STAGD360
      DI#DIR                                                               STAGD365
      RHJ#RHOK                                                             STAGD370
      BIKT#BIKTR                                                           STAGD375
      S#SR                                                                 STAGD380
      R#RSR                                                                STAGD385
      V#VR                                                                 STAGD390
      GF#GR                                                                STAGD395
  120 ARG#(SMT2(I) +SMT(I))*0.5                                            STAGD400
      UBAR(I)#0.0                                                          STAGD405
      TVTT(I)#0.35*(TV(I+1)-ARG)                                           STAGD410
      TW#0.65*(TV(I+1)-ARG)+ARG                                            STAGD415
      HANK#                          (TV(I+1)-SMT(I))/(TV(I+1)-SMT2(I) )   STAGD420
      IF(HANK)125,125,130                                                  STAGD425
  125 WRITE (6,8000)I , SMT(I), SMT2(I) , TV(I+ 1),CTPCP(I)                STAGD430     39
 8000 FORMAT(  60HCTROUBLE IN U-BAR CALC.  NEG LOG    SKIPPING TO NEXT CSTAGD435
     1ASE              /     I5, 5E16.8 )                                 STAGD440
      ERR#1.0                                                              STAGD445
      RETURN                                                               STAGD450
  130 OM(I)#(SMT2(I) -SMT(I))/ALOG(HANK)                                   STAGD455     47
      PCT#CP                                                               STAGD460
      II#6                                                                 STAGD465
      CALLDINTPL(ARG,CT(I),AK)                                             STAGD470     51
      II#7                                                                 STAGD475
      CALLDINTPL(ARG,CT(I),U)                                              STAGD480     55
      II#1                                                                 STAGD485
      CALLDINTPL(ARG,CT(I),CZ)                                             STAGD490     59
      BIGKI#(0.027*CZ*U**0.14*GF)/((GF*DI/(12.0*U))**0.2*                  STAGD495
     1(U*CZ/AK)**0.66666667)                                               STAGD500     61     62     63
  135 II#7                                                                 STAGD505
      CALL  DINTPL(TW,CT(I),UW)                                            STAGD510     67
      HI(I)# BIGKI/UW**0.14                                                STAGD515     69
      USAVE#UBAR(I)                                                        STAGD520
      DODI#DO /DI                                                          STAGD525
      BIK24#24.0*BIKT                                                      STAGD530
      REST#DO/BIK24*ALOG(DODI)+      R                                     STAGD535     72
      II#5                                                                 STAGD540
  140 CAL_DINTPL(TV(I+1),PCT,RHO)                                          STAGD545     75
      II#6                                                                 STAGD550
      CALLDINTPL(TV(I+1),PCT,SMK)                                          STAGD555     79
```

FIGURE 6 (Continued)

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                                                                    09/26/67
        STAGE      -  EFN   SOURCE STATEMENT  -  IFN(S)  -

      II#7                                                          STAG0560
      CALL DINTPL(TV(I+1),PCT,U)                                    STAG0565     83
      HFG#1093.88-0.5703*TV(I+1)+1.2819E-4*TV(I+1)**2-0.8824E-6     STAG0570
     1*TV(I+1)**3                                                   STAG0575
      IF (S-1.0) 145, 145, 150                                      STAG0580
  145 BIGK#0.728*((50.04E+8*RHO**2*SMK**3*(HFG+0.375*TVTT(I)))/     STAG0585
     1(U*S ))**0.25* 1.310                                          STAG0590     92
      GO TO 155                                                     STAG0595
  150 BIGK#0.728*((50.04E+8*RHO**2*SMK**3*(HFG+0.375*TVTT(I)))/     STAG0600
     1(U*S ))**0.25*(1.2379476 + .35360826E-1*S - .15703466E-2*S**2 )  STAG0605     96
  155 HO(I)#BIGK/(DO **0.25*TVTT(I)**0.25)                          STAG0610     99     100
      UBARI#CODI/HI(I)+REST+1.0/HO(I)                               STAG0615
      UBAR(I)#1.0/UBARI                                             STAG0620
      TVTTN#TVTT(I)                                                 STAG0625
      TVTT(I)#UBAR(I)*OM(I)/HO(I)                                   STAG0630
      IF(ABS(TVTT(I)-TVTTN)/TVTTN-0.01)165,160,160                  STAG0635
  160 TW#ARG+UBAR(I)*OM(I)*DO/(HI(I)*DI)                            STAG0640
      GO TO 135                                                     STAG0645
  165 IF(ABS(UBAR(I)-USAVE)/UBAR(I)-0.0005)170,160,160              STAG0650
  170 IF(I    -NK)175,175,180                                       STAG0655
  175 W#WF                                                          STAG0660
      C(I)#CCF                                                      STAG0665
      GOTO185                                                       STAG0670
  180 W#WO                                                          STAG0675
      C(I)#CO                                                       STAG0680
  185 ARG#(SMT2(I) +SMT(I))*0.5                                     STAG0685
      II#5                                                          STAG0690
      CALL DINTPL(ARG,C(I),RHO)                                     STAG0695     130
      UBAR(I)#SSFUBR*UBAR(I)                                        STAG0700
      AS(I)#QH(I)/(UBAR(I)*OM(I))                                   STAG0705
      SLS(I)#12.0*AS(I)*DI**2*GF/(576.0*DO*W)                       STAG0710
      IF(I-NTOTAL)195,190,195                                       STAG0715
C*** CALCULATION FOR DEAREATOR                                      STAG0720
  190 CONTINUE                                                      STAG0725
      CALL DEARI                                                    STAG0730
C*** END OF CALCULATION FOR DEAREATOR                               STAG0735     142
      GO TO 200                                                     STAG0740
  195 Z(I)#12.0*AS(I)/(DO *PI*SLS(I))                               STAG0745
C     CFM   IS REALLY CFMWV                                         STAG0750
  200 CFMWV(I)#WV(I)/(60.0*TS(I+1))*EXP(12.4636-0.021987*TS(I+1)+   0STAG0755
     1.18849E-4*TS(I+1)**2)                                         STAG0760     153
      HV#1.00125*TV(I+1)-32.125+1093.88-0.5703*TV(I+1)+1.2819E-4*TV(I+1)STAG0765
     1**2-0.8824E-6*TV(I+1)**3                                      STAG0770
      HP1#1.00125*TV(I)-32.125                                      STAG0775
      HP2#1.00125*TV(I+1)-32.125                                    STAG0780
      CFMWZ(I)#WP(I)*(HP1-HP2)/(60.0*(HV+HP2)*TV(I+1))*EXP(12.4632-    0STAG0785
     1.021987*TV(I+1)+1.8849E-5*TV(I+1)**2)                         STAG0790     167
      HS(I)#(.0056+.02436/ (DI*V)** 0.32)*SLS(I)*12.0*V**2/(DI*64.348)  STAG0795
     1*SSF                                                          STAG0800     170
      IF(CFMWZ(I))205,210,210                                       STAG0805
  205 CFMWZ(I)#0.0                                                  STAG0810
  210 SUMOM#SUMOM+OM(I)                                             STAG0815
      SUM_S#SUMLS+SLS(I)                                            STAG0820
  215 ZBAR#ZBAR+Z(I)                                                STAG0825
      SLSP#SLS(I)-0.5+TSTH/12.0                                     STAG0830
      VVEV(I)#CFMWV(I)/(120.0*SLSP   *FREBD*                        STAG0835
```

FIGURE 6 (Continued)

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                                                                                  09/26/67
        STAGE      -  EFN   SOURCE STATEMENT  -  IFN(S)  -

     1AMODU*ALEV)                                                          STAGC840
      IF( I- NTOTAL) 225,220,225                                           STAGC845
  220 TRAYFL(I)#((12.0*TWFA*TRAYLN -3.6-.63*SPL)                           STAGC850
     1*1.0E+4/((610.0/(TS(I)+459.69))**3.12*                               STAGC855
     2(RHJ /3.0)**0.6)+85000.0    )                                        STAGC860     188    189
      GO TO 230                                                            STAGC865
  225 TRAYFL(I)#((12.0*TWFA*SLSP   -3.6-.63*SPL)                           STAGC870
     1*1.0E+4/((610.0/(TS(I)+459.69))**3.12*                               STAGC875
     2(RHJ /3.0)**0.6)+85000.0    )                                        STAGC880     194    195
  230 WBS(I)#WS(I)/(AMODU*ALEV)                                            STAGC885
      IF(TRAYFL(I)-100000.0)235,240,240                                    STAGC890
  235 TRAYFL(I)#100000.0                                                   STAGC895
      WRITE (6,8005)I                                                      STAGC900     204
 8005 FORMAT( 27HOTRAYFLOW SET # 100000.0          I5)                     STAGC905
  240 IF(TRAYFL(I) -SSF2)245,250,250                                       STAGC910
  245 TRAYWD(I)#WBS(I)/TRAYFL(I)                                           STAGC915
      WWFS (I) #   1.0                                                    STAGC920
      GO TO 255                                                            STAGC925
  250 TRAYWD(I)#WBS(I)/ SSF2                                               STAGC930
      WWFS (I) # TRAYFL (I) /SSF2                                          STAGC935
      TRAYFL (I) # SSF2                                                    STAGC940
  255 II#5                                                                 STAGC945
      CALL DINTPL(TS(I),C(I),RHORES)                                       STAGC950     224
      IF(I-1)265,265,260                                                   STAGC955
  260 DENBR(I-1)#RHORES                                                    STAGC960
  265 RESIDT(I)#(TRAYWD(I)*SLSP  *BDEPH*                                   STAGC965
     1RHORES*3600.0)/WBS(I)                                                STAGC970
      PV(I)#2.1786818-.70443622E-01*TV(I+1)+.23941286E-03*TV(I+1)**2       STAGC975
     1-.53958083E-05*TV(I+1)**3 +.18139197E-07*TV(I+1)**4                  STAGC980
  270 CONTINUE                                                             STAGC985
      I#NTOTAL+1                                                           STAGC990
      PTRAFL   #((12.0*TWFA*TRAYLN -3.6-.63*SPL)                           STAGC995
     1*1.0E+4/((610.0/(TV(I)+459.69))**3.12*                               STAGI000
     2(RHJ /3.0)**0.6)+85000.0    )                                        STAGI005     243    244
      I#NK                                                                 STAGI010
      TRAYNK#SLS(NK)-0.5+TSTH /12.0                                        STAGI015
      PTRAFK   #((12.0*TWFA*TRAYNK -3.6-.63*SPL)                           STAGI020
     1*1.0E+4/((610.0/(TV(NK)+459.69))**3.12*                              STAGI025
     2(RHJ /3.0)**0.6)+85000.0    )                                        STAGI030     248    249
      WPZ#WP(NTOTAL+1)/(AMODU*2.0)                                         STAGI035
      IF(PTRAFL -SSF2 )280,275,275                                         STAGI040
  275 PTRAFL # SSF2                                                        STAGI045
  280 PTRAW1 # WPZ / PTRAFL                                                STAGI050
      WID1 # 2.0 *PTRAW1 + TRAYWD (NTOTAL)                                 STAGI055
      WPNK1# WP(NK) / (AMODU * 2.0)                                        STAGI060
      IF( PTRAFK -SSF2 ) 290, 290, 285                                     STAGI065
  285 PTRAFK # SSF2                                                        STAGI070
  290 PTRAW2 # WPNK1/ PTRAFK                                               STAGI075
      WID2 # 2.0 * PTRAW2 + TRAYWD (NK)                                    STAGI080
      IF(WID1 -WID2) 300,300,295                                           STAGI085
  295 PTRAWD # PTRAW1                                                      STAGI090
      TRAWDP#TRAYWD(NTOTAL)                                                STAGI095
      GO TO 305                                                            STAGI100
  300 PTRAWD # PTRAW2                                                      STAGI105
      TRAWDP # TRAYWD (NK)                                                 STAGI110
  305 CONTINUE                                                             STAGI115
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
        STAGE      -  EFN   SOURCE STATEMENT  -  IFN(S)  -

8010 FORMAT(6E16.8)                                                 STAG1120
     ASIEV#5.31E-5*(WB+WX)                                          STAG1125
     NPLAT#ASIEV/ (AMODU* TRAYWD(NTOTAL)*SLDEA )                    STAG1130
     ANPLAT#FLOAT(NPLAT)+1.0                                        STAG1135
     SLPLAT#ASIEV/(ANPLAT*AMODU*TRAYWD(NTOTAL))                     STAG1140
     APLAT#SLPLAT*TRAYWD(NTOTAL)                                    STAG1145
     N#NTOTAL                                                       STAG1150
     NL1#N-1                                                        STAG1155
     DELP(N)#0.0                                                    STAG1160
     A(N)#0.0                                                       STAG1165
     COFA1#COEFA*3600.0                                             STAG1170
     DO 310 I#1,NL1                                                 STAG1175
     DELP(I)#PV(I)-PV(I+1)                                          STAG1180
     A(I)#(TRAYFL(I)*TRAYWD(I))/(COFA1*SQRT(DENBR(I)*DELP(I)*9273.6))  STAG1185   285
 310 CONTINUE                                                       STAG1190
     II#2                                                           STAG1195
     CALL DINTPL(TCF,CCF,HCF)                                       STAG1200   291
     CALL DINTPL(THF,CCF,HHF)                                       STAG1205   293
     TSTEM#TSTEAM                                                   STAG1210
     AMBDAS#1093.88-0.5703*TSTEM+1.2819E-4*TSTEM**2-0.8824E-6*TSTEM**3 STAG1215
     WY    #WF*(THF-TCF)/AMBDAS            *CPBT*TERS               STAG1220
     PR#WPN*1.0E+3/(AMBDAS*WY)                                      STAG1225
     BRINEHEATER                                                    STAG1230
     II#5                                                           STAG1235
     CALL DINTPL(THF,CCF,RHO)                                       STAG1240   296
     GH#3600.0*VH*RHO                                               STAG1245
     ARG#(TCF+THF)*0.5                                              STAG1250
     TT#0.35*(TSTEAM-ARG)                                           STAG1255
     TW#0.65*(TSTEAM-ARG)+ARG                                       STAG1260
     THM#(THF-TCF)/ALOG((TSTEAM-TCF)/(TSTEAM-THF))                  STAG1265   298
     II#6                                                           STAG1270
     CALL DINTPL(ARG,CCF,AK)                                        STAG1275   300
     II#5                                                           STAG1280
     CALL DINTPL(ARG,CCF,RHO)                                       STAG1285   303
     II#7                                                           STAG1290
     CALL DINTPL(ARG,CCF,U)                                         STAG1295   306
     II#1                                                           STAG1300
     CALL DINTPL(ARG,CCF,CZ)                                        STAG1305   309
     BIGK3#(0.027*CZ*U**0.14*GH)/((GH*DIH/(12.0*U))**0.2*           STAG1310
    1(U*CZ/AK)**0.66666667)                                         STAG1315   311   312   313
 315 II#7                                                           STAG1320
     CALL DINTPL(TW,CCF,UW)                                         STAG1325   316
     HIH#BIGK3/UW**0.14                                             STAG1330   318
     USAVE#UBARH                                                    STAG1335
     PCT#0.0                                                        STAG1340
     HFG#1093.88-0.5703*TSTEM  +1.2819E-4*TSTEM  **2-0.8824E-6*TSTEM**3STAG1345
     II#5                                                           STAG1350
     CALL DINTPL(TSTEAM,PCT,RHO)                                    STAG1355   320
     II#6                                                           STAG1360
     CALL DINTPL(TSTEAM,PCT,AK)                                     STAG1365   323
     II#7                                                           STAG1370
     CALL DINTPL(TSTEAM,PCT,U)                                      STAG1375   326
     DOHDIH#DOH/DIH                                                 STAG1380
     BIK24#24.0*BIKTH                                               STAG1385
     PARTU#DOH/BIK24*ALOG(DOHDIH)+        RH                        STAG1390   328
     IF (SH - 1.0) 320, 320, 325                                    STAG1395
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
        STAGE      -  EFN   SOURCE STATEMENT  -  IFN(S)  -

320 CAPK#0.728*((50.04E+8*RHO**2*AK**3*(HFG+0.375*TT))/(SH*U))**0.25  STAG1400
   1 * 1.310                                                          STAG1405     331
    GO TO 330                                                         STAG1410
325 CAPK#0.728*((50.04E+8*RHO**2*AK**3*(HFG+0.375*TT))/(SH*U))**0.25  STAG1415
   1  *  (1.2379476 + .35360826E-1*SH- .15703466E-2*SH**2 )           STAG1420     334
330 HOH#CAPK/(DOH**0.25*TT**0.25)                                     STAG1425     336    337
    UBAR1#DOHDIH/HIH+PARTU+1.0/HOH                                    STAG1430
    TTN#TT                                                            STAG1435
    UBARH#1.0/UBAR1                                                   STAG1440
    TT#UBARH*THM/HOH                                                  STAG1445
    IF(ABS((TT-TTN)/TT)-0 .01)340,335,335                             STAG1450
335 TW#ARG+UBARH*THM*DOH/HIH                                          STAG1455
    GO TO 315                                                         STAG1460
340 IF(ABS(UBARH-USAVE)/UBARH-0.0005)345,335,335                      STAG1465
345 II#2                                                              STAG1470
    CALL DINTPL(THF,CCF,HHF)                                          STAG1475     345
    CALL DINTPL(TCF,CCF,HCF)                                          STAG1480     347
    UBARH#SSFUBR*UBARH                                                STAG1485
    AH#(HHF-HCF)*WF/(UBARH*THM)                                       STAG1490
    ARG#(TCF+THF)*0.5                                                 STAG1495
    II#5                                                              STAG1500
    CALL DINTPL(ARG,CCF,RHO2)                                         STAG1505     350
    HLH#12.0*AH*DIH**2*GH/(576.0*DOH*WF)                              STAG1510
    HN#12.0*AH/(PI*DOH*HLH)                                           STAG1515
    HBH    #(0.021+0.0258/(DIH*VH)**0.42)     *SSF                   STAG1520
   1*HLH   *12.0/DIH*VH**2/64.348                                     STAG1525     352
    BARDM#SUMDM/TOTAL                                                 STAG1530
    NTOTI  #NTOTAL+1                                                  STAG1535
    DO 350 I#1,NTOTI                                                  STAG1540
350 DTPDPS(I)#DTPDP(I)                                                STAG1545
    IF(IGSC - 2 ) 355, 360, 360                                       STAG1550
355 V#VH                                                              STAG1555
    CALL  DEMIST                                                      STAG1560     364
360 RETURN                                                            STAG1565
    END                                                               STAG1570
```

FIGURE 6 (Continued)

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*
$IBFTC UBAR1    DECK                                                    UBARCOCC
```

FIGURE 6 (Continued)

```
      SUBROUTINE UBARHM(J,UB)                                           UBAR0005
C**** STAGEGEOM FOR NORITAKE  WITH DEMISTER AND CONDENSER 9/10/65       UBAR0010
      COMMON/GEN/CASE,G,RP, XRP,P,XO,Q,XU,CR,XCR, ROE,ROER              UBAR0015
      COMMON/TEMPC/TSTEAM,TS(100), THF,TB,XTB,        TC,TP,TA,CC,CP    UBAR0020
      COMMON/GEOME/AMODU,ALEV,AUNIT,TOTALE,TOTALR,FREBC,TRAYDP,HST,CL,  UBAR0025
     1SPL                                                               UBAR0030
      COMMON/ECON/SMALLE,SMALLD,SMALLB,SMALLP,RATEIN,WPL, CAPF,THERM,   UBAR0035
     1PMSTMC                                                            UBAR0040
      COMMON/TUBING/ DOH,DIH,DOE,DIE,DOR,DIR,A1,A2,A3,BIKTH,BIKTE,      UBAR0045
     1BIKTR,CSLTBH,CSLTBP,CSLTBR                                        UBAR0050
      COMMON/FOULIN/RH,RE,RSR,SH,SE,SR,VH,VE,VR                         UBAR0055
      COMMON/PUMPHT/HD,HH,HBL,HPR,FFHL,SSFI                             UBAR0060
      COMMON/AMISC/CPSTB,FACID,ACACID,DPLIM,A6,A7,XSOD,XNNN,NNN,XLLL,LLLUBAR0065
      COMMON/DATA1/BDEPH,DTPD,SSF2,TOTAL,UMAX,UALP,PI,TWFA,TSTH,COEFA,  UBAR0070
     1ORITE,ITER                                                        UBAR0075
      COMMON/AZ1/DTPDP(100),TITLE(15)                                   UBAR0080
      COMMON/TCVL1/ ACPSN, ACPSNK, ACPTNK,CPBT,CPTK, CPTNK,AMBN,TCF,WX, UBAR0085
     1WF,WO,CB,WC,WB, WR,RHONK, RHOK, ERR,CCF, NITER, NK,NTOTAL, PN,RPN,UBAR0090
     2TC, ALPHA1, WPN, DELCT, DELST, IGSC, SMAQ, SUMA, TK               UBAR0095
      COMMON/TCVL2/ TTD(100),SMT(100), SMT2(100), CT(100), WS(100),     UBAR0100
     1C(100), TV(100), WV(100), QH(100), WP(100), AS(100),SLS(100)      UBAR0105
      COMMON/STAGE1/ A(100),CFMWV(100), CFMWZ(100), UBAR(100), CM(100), UBAR0110
     1HO(100),HI(100),WWFS(100),VVEV(100), TRAYFL(100),TRAYWD(100),     UBAR0115
     2RESIDT(100), PV(100),DELP(100), DTPDPS(100)                       UBAR0120
      COMMON/PHYS/II                                                    UBAR0125
      COMMON /MAIN1/ SSF, HFG                                           UBAR0130
      COMMON /STG1/ ATR, BTR, CTR, CTA                                  UBAR0135
      COMMON /STG2/HOH, PR, DENBR(100), SUMLS, WVST(100), CO, DI, R, S, UBAR0140
     1 V, TVTT(100), Z(100), HV, HS(100), WBS(100)                      UBAR0145
      COMMON/FEB8/SSFUBR                                                UBAR0150
      I#J                                                               UBAR0155
      II#5                                                              UBAR0160
      CALL DINTPL(TB,CO,RHOR1)                                          UBAR0165    4
      GR#3600.0*RHOR1*VR                                                UBAR0170
  100 DO#DOR                                                            UBAR0175
      DI#DIR                                                            UBAR0180
      RHJ#RHOK                                                          UBAR0185
      BIKT#BIKTR                                                        UBAR0190
      S#SR                                                              UBAR0195
      R#RSR                                                             UBAR0200
      V#VR                                                              UBAR0205
      GF#GR                                                             UBAR0210
  105 ARG#(SMT2(I) +SMT(I))*0.5                                         UBAR0215
      UBAR(I)#0.0                                                       UBAR0220
      TVTT(I)#0.35*(TV(I+1)-ARG)                                        UBAR0225
      TW#0.65*(TV(I+1)-ARG)+ARG                                         UBAR0230
      HANK#                          (TV(I+1)-SMT(I))/(TV(I+1)-SMT2(I) ) UBAR0235
      IF(HANK)110,110,115                                               UBAR0240
  110 WRITE (6,8000)I , SMT(I), SMT2(I) , TV(I  1),DTPDP(I)             UBAR0245    19
 8000 FORMAT(  60HTROUBLE IN U-BAR CALC.  NEG LOG    SKIPPING TO NEXT CUBAR0250
     1ASE              /     I5, 5F16.8 )                               UBAR0255
      ERR#1.0                                                           UBAR0260
      RETURN                                                            UBAR0265
  115 OM(I)#(SMT2(I) -SMT(I))/ALOG(HANK)                                UBAR0270    27
      PCT#CP                                                            UBAR0275
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
      UBAR1      -  EFN   SOURCE STATEMENT  -  IFN(S)  -

      II#6                                                          UBAR0280
      CALLDINTPL(ARG,CT(I),AK)                                      UBAR0285   31
      II#7                                                          UBAR0290
      CALLDINTPL(ARG,CT(I),U)                                       UBAR0295   35
      II#1                                                          UBAR0300
      CALLDINTPL(ARG,CT(I),CZ)                                      UBAR0305   39
      BIGK1#(0.027*CZ*U**0.14*GF)/((GF*DI/(12.0*U))**0.2*           UBAR0310
     1(U*CZ/AK)**0.66666667)                                        UBAR0315   41    42    43
120   II#7                                                          UBAR0320
      CALL  DINTPL(TW,CT(I),UW)                                     UBAR0325   47
      HI(I)# BIGK1/UW**0.14                                         UBAR0330   49
      USAVE#UBAR(I)                                                 UBAR0335
      DODI#DO  /DI                                                  UBAR0340
      BIK24#24.0*BIKT                                               UBAR0345
      REST#DO/BIK24*ALOG(DODI)+      R                              UBAR0350   52
      II#5                                                          UBAR0355
125   CALL DINTPL(TV(I+1),PCT,RHO)                                  UBAR0360   55
      II#6                                                          UBAR0365
      CALL DINTPL(TV(I+1),PCT,SMK)                                  UBAR0370   59
      II#7                                                          UBAR0375
      CALL DINTPL(TV(I+1),PCT,U)                                    UBAR0380   63
      HFG#1093.88-0.5703*TV(I+1)+1.2819E-4*TV(I+1)**2-0.8824E-6     UBAR0385
     1*TV(I+1)**3                                                   UBAR0390
      IF (S-1.0) 130, 130, 135                                      UBAR0395
130   BIGK#0.728*((50.04E+8*RHO**2*SMK**3*(HFG+0.375*TVTT(I)))/     UBAR0400
     1(U*S ))**0.25* 1.310                                          UBAR0405   72
      GO TO 140                                                     UBAR0410
135   BIGK#0.728*((50.04E+8*RHO**2*SMK**3*(HFG+0.375*TVTT(I)))/     UBAR0415
     1(U*S ))**0.25*(1.2379476 + .35360826E-1*S - .15703466E-2*S**2 ) UBAR0420   76
140   HO(I)#BIGK/(DO **0.25*TVTT(I)**0.25)                          UBAR0425   79    80
      UBAR1#DODI/HI(I)+REST+1.0/HO(I)                               UBAR0430
      UBAR(I)#1.0/LBAR1                                             UBAR0435
      AS(I)#QH(I)/(UBAR(I)*OM(I))                                   UBAR0440
      TVTTN#TVTT(I)                                                 UBAR0445
      TVTT(I)#UBAR(I)*OM(I)/HO(I)                                   UBAR0450
      IF(ABS(TVTT(I)-TVTTN)/TVTTN-0.01)150,145,145                  UBAR0455
145   TW#ARG+UBAR(I)*OM(I)*DO/(HI(I)*DI)                            UBAR0460
      GO TO 120                                                     UBAR0465
150   IF(ABS(UBAR(I)-USAVE)/UBAR(I)-0.0005)155,145,145              UBAR0470
155   IF(I    -NK)160,160,165                                       UBAR0475
160   W#WF                                                          UBAR0480
      C(I)#COF                                                      UBAR0485
      GOTO170                                                       UBAR0490
165   W#WO                                                          UBAR0495
      C(I)#CO                                                       UBAR0500
170   ARG#(SMT2(I) +SMT(I))*0.5                                     UBAR0505
      UB#UBAR(I)                                                    UBAR0510
      UB#SSFUBR*UB                                                  UBAR0515
      RETURN                                                        UBAR0520
      END                                                           UBAR0525
```

FIGURE 6 (Continued)

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```
*
$IBFTC WAT      DECK                                                    WATCCCCC
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
        WAT        -  EFN   SOURCE STATEMENT  -  IFN(S)  -

      SUBROUTINEWATH(T,H)                                           WATCCCC5
      IF(T-360.0 )100,105,105                                       WATCCC10
  100 A0#-32.179105                                                 WATCCC15
      A1#1.0088084                                                  WATCCC20
      A2#-1.1516996E-4                                              WATCCC25
      A3#4.8553836E-7                                               WATCCC30
      A4#-7.3618778E-10                                             WATCCC35
      A5#9.6350315E-13                                              WATCCC40
      GOTO110                                                       WATCCC45
  105 A0#-9.0411706E2                                               WATCCC50
      A1#1.0673802E1                                                WATCCC55
      A2#-4.2753836E-2                                              WATCCC60
      A3#9.41244E-5                                                 WATCCC65
      A4#-1.0315357E-7                                              WATCCC70
      A5#4.560246E-11                                               WATCCC75
  110 H#A0+A1*T+A2*T**2+A3*T**3+A4*T**4+A5*T**5                     WATCCC80
      RETURN                                                        WATCCC85
      END                                                           WATCCC90
```

FIGURE 6 (Continued)

```
                                                                    09/26/67

*
$IBFTC B0100    DECK                                                B0100000
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
        B0100      -  FFN   SOURCE STATEMENT  -  IFN(S)  -

      SUBROUTINEBOPR(T,C,BPR)                                        B0100005
C ******FIT FOR 0 - 260NC AND 25 TO 260C   6/23/LL                   B0100010
      TCOR#(T+460.0)/1.8                                             B0100015
      CC#C                                                           B0100020
      CCOR#19.819*CC/(1.0-CC)                                        B0100025
      BPE#(565.757/TCOR-9.81559+1.54739*ALOG(TCOR)                   B0100030
     1 -(337.178/TCOR-6.41981+.922753*ALOG(TCOR))*CCOR+(32.681/TCOR-.553B0100035
     268+.079022*ALOG(TCOR))*CCOR**2)*CCOR/          (266919.6 /(TCOR**B0100040
     32)-379.669/TCOR+.334169)                                       B0100045    2
      BPR #1.8*BPE                                                   B0100050
      RETURN                                                         B0100055
      END                                                            B0100060
```

FIGURE 6 (Continued)

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```
*
$IBFTC SU100    DECK                                                    SU100000
```

FIGURE 6 (Continued)

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SU100 - EFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINE SUBAJ(CD,RATEIN,AJ)                                    SU100005
      COMMON /DPI/ SMAPPP, HR, SMAPPH, HE, UNARAR, UNARAE, A4, AJ       SU100010
      IF(CD-80.0)100,105,105                                            SU100015
  100 AJTS#1.02-1.25*CD*1.0E-4                                          SU100020
      GO TO 110                                                         SU100025
  105 AJTS#1.01                                                         SU100030
  110 IF(CD-200.0)115,120,120                                           SU100035
  115 AJCT#1.113-0.0165*CD/100.0                                        SU100040
      AJSD#1.0629-0.349E-3*CD+0.930E-6*CD**2                            SU100045
      GO TO 125                                                         SU100050
  120 AJCT#1.08                                                         SU100055
      AJSD#1.03                                                         SU100060
  125 IF(CD-40.0)130,135,135                                            SU100065
  130 TIME#12.0+12.0*CD/40.0                                            SU100070
      GO TO 150                                                         SU100075
  135 IF(CD-200.0)140,145,145                                           SU100080
  140 TIME #24.0+36.0*(CD-40.0)/160.0                                   SU100085
      GO TO 150                                                         SU100090
  145 TIME#48.0                                                         SU100095
  150 AJIC#1.0+0.0375*TIME*RATEIN                                       SU100100
      AJ#AJTS*AJSD*AJCT*AJIC                                            SU100105
      RETURN                                                            SU100110
      END                                                               SU100115
```

FIGURE 6 (Continued)

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```
*
$IBFTC DI100   DECK                                                    DI100000
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
        DI100      -  EFN   SOURCE STATEMENT  -  IFN(S)  -

      SUBROUTINE DINTPL(ARG,ARU,AXY)                                DI100005
      COMMON /PHYS/ II                                              DI100010
      I#II                                                          DI100015
      C#ARU                                                         DI100020
      T#ARG                                                         DI100025
      ERR#0.0                                                       DI100030
      GOTO(100,120,150,150,135,140,145),II                          DI100035
  100 IF(C-0.005)105,105,110                                        DI100040
C*****EQUATION SPECIFIC HEAT FOR PURE WATER                         DI100045
  105 AXY#1.0121559 +(-.24618473E-03+ .10282155E-05*T)*T            DI100050
      GO TO 115                                                     DI100055
C*****EQUATION SPECIFIC HEAT FOR BRINE                              DI100060
  110 AXY#.9694686+(2.0*(.10404965E-03)*T)-(.91199294*C)            DI100065
     1 +(2.0*(-.64829659E-03)*C*T)+(-1.555779*(C**2))+              DI100070
     2   (2.0*(.76721469E-02)*(C**2)*T)+(6.7981008*(C**3))+         DI100075
     3       (2.0*(-.012610354)*(C**3)*T)                           DI100080
  115 CONTINUE                                                      DI100085
      GO TO 150                                                     DI100090
C     II#2                                                          DI100095
C     ENTHALPY OF SALINE SOLUTION  RANGE OF DATA WAS 0 - 24 PERCENT DI100100
C     CONCENTRATION AND 40 - 300 DEGREES FARENHEIT.                 DI100105
C                                                                   DI100110
  120 IF(C-0.005 ) 125,125,130                                      DI100115
  125 CAL_  WATH (T, AXY)                                           DI100120    14
      RETURN                                                        DI100125
  130 AXY#       -30.234836+(.96946859*T)+(.10404965E-03*(T**2))    DI100130
     1  +(72.470209*C)-(.91199294*C*T)-(.64829659E-03*C*(T**2))     DI100135
     2   -(25.739723*(C**2))-(1.5557791*(C**2)*T)+(.76721469E-02*   DI100140
     3      (C**2)*(T**2))-(386.23682*(C**3))+(6.7981008*(C**3)*T)  DI100145
     4      -(.012610354*(C**3)*(T**2))                             DI100150
      GO TO150                                                      DI100155
C     II#5                                                          DI100160
C     DENSITY OF SALINE SOLUTION.  RANGE OF DATA WAS 0 - 26 PERCENT DI100165
C     CONCENTRATION AND 40 - 300 DEGREES FARENHEIT.                 DI100170
C                                                                   DI100175
  135 AXY#62.707172+49.364088*C-.43955304E-2*T                      DI100180
     1-.32554667E-1*C*T-.46076921E-4*T**2+.63240299E-4              DI100185
     2*T**2*C                                                       DI100190
      GOTO 150                                                      DI100195
C     II#6   THERMAL CONDUCTIVITY OF SALINE SOLUTION.  RANGE OF DATA DI100200
C            0 - 24 PERCENT CONCENTRATION AND 40 - 300 DEGREES FARENHEITDI100205
C                                                                   DI100210
  140 AXY#(.30157913+.697989E-3*T-.12506E-5*T**2                    DI100215
     1-.2072E-10*T**3)*(-.16871D9*C+1.0)                            DI100220
      GO TO 150                                                     DI100225
C     II#7                                                          DI100230
C     VISCOSITY OF SALINE SOLUTION.  RANGE OF DATA WAS 0 - 24 PERCENT DI100235
C     CONCENTRATION AND 40 - 210 DEGREES FARENHEIT.                 DI100240
C                                                                   DI100245
  145 R#T+459.69                                                    DI100250
      AXY#EXP(-10.592566+.46D6532E-2*R-11.591155*C                 +DI100255
     1.12602329E-1*C*R+4759.5941/R+3863.7378*C/R)                   DI100260    23
  150 RETURN                                                        DI100265
      END                                                           DI100270
```

FIGURE 6 (Continued)

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*
$IBFTC TWO      DECK                                                    TWO00000
```

FIGURE 6 (Continued)

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TWO - FFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINE DOUBLE(COOR,VALUE,NERR)                                TWOCCCC5
      DIMENSION XNRL(7),YSOD(15),F(16,8) ,COOR(3)                       TWOCCC10
      COMMON/BLOC/XNRL,YSOD,F,NEN,MEM                                   TWOCCC15
      N#NEN                                                             TWOCCC20
      M#MEM                                                             TWOCCC25
      X#COOR(1)                                                         TWOCCC30
      Y#COOR(2)                                                         TWOCCC35
      IF((X.GT.XNRL(M).OR.Y.GT.YSOD(N)).OR.(X.LT.XNRL(1).OR.Y.LT.YSOD(1)TWOCCC40
     1)) GO TO 150                                                      TWOCCC45
      NERR#0                                                            TWOCCC50
      DO  100 I#1,M                                                     TWOCCC55
      JJ#I                                                              TWOCCC60
      DO  100 J#1,N                                                     TWOCCC65
      II#J                                                              TWOCCC70
  100 IF(X.EQ.XNRL(I).AND.Y.EQ.YSOD(J)) GO TO 145                       TWOCCC75
      IF(X.EQ.XNRL(M)) GO TO 155                                        TWOCCC80
      DO 110 I#1,M                                                      TWOCCC85
      IF(X-XNRL(I)) 105,110,110                                         TWOCCC90
  105 X1#XNRL(I-1)                                                      TWOCCC95
      X2#XNRL(I)                                                        TWOCC100
      K#I-1                                                             TWOCC105
      GO TO 115                                                         TWOCC110
  110 CONTINUE                                                          TWOCC115
  115 P#(X-X1)/(X2-X1)                                                  TWOCC120
      IF(Y.EQ.YSOD(N)) GO TO 160                                        TWOCC125
  120 DO 130  I#1,N                                                     TWOCC130
      IF(Y-YSOD(I)) 125,130,130                                         TWOCC135
  125 Y1#YSOD(I-1)                                                      TWOCC140
      Y2#YSOD(I)                                                        TWOCC145
      L#I-1                                                             TWOCC150
      GO TO 135                                                         TWOCC155
  130 CONTINUE                                                          TWOCC160
  135 Q#(Y-Y1)/(Y2-Y1)                                                  TWOCC165
  140 VALUE#(1.0-P)*(1.0-Q)*F(L,K)+Q*(1.0-P)*F(L+1,K)+P*(1.0-Q)*F(L,K+1)TWOCC170
     1       +P*Q*F(L+1,K+1)                                            TWOCC175
      RETURN                                                            TWOCC180
  145 VALUE#F(II,JJ)                                                    TWOCC185
      RETURN                                                            TWOCC190
  150 NERR#1                                                            TWOCC195
      RETURN                                                            TWOCC200
  155 P#0.0                                                             TWOCC205
      K#M                                                               TWOCC210
      GO TO 120                                                         TWOCC215
  160 Q#0.0                                                             TWOCC220
      L#N                                                               TWOCC225
      GO TO 140                                                         TWOCC230
      END                                                               TWOCC235
```

FIGURE 6 (Continued)

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```
*
$IBFTC BLKDAT  DECK                                                    BLKDCCOO
```

FIGURE 6 (Continued)

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BLKDAT - EFN SOURCE STATEMENT - IFN(S) -

```
 BLOCK DATA                                                          BLKC0005
 DIMENSION XNRL(7),YSOD(15),F(16,8)                                  BLKC0010
 COMMON/BLOC/XNRL,YSOD,F,NEN,MEM                                     BLKC0015
 DATA NEN,MEM/ 9,7/                                                  BLKC0020
 DATA(XNRL(I),I#1,7)/2.0E3,4.0E3,8.0E3,12.0E3,20.0E3,40.0E3,10.0E4/BLKC0025
 DATA(YSOD(I),I#1,9)/1.15,1.20,1.25,1.30,     1.40,1.60,2.0,         BLKC0030
1                    2.5,3.5/                                       BLKC0035
 DATA((F(I,J),J#1,7),I#1,9)/                                         BLKC0040
1.205 ,.171 ,.142 ,.128 ,.112 ,.094 ,.074 ,                           BLKC0045
2.195 ,.160 ,.132 ,.119 ,.1035,.086 ,.0673,                           BLKC0050
3.1855,.152 ,.125 ,.112 ,.097 ,.0807,.0627,                           BLKC0055
4.178 ,.146 ,.1195,.107 ,.0925,.0767,.058 ,                           BLKC0060
5.167 ,.136 ,.111 ,.099 ,.0855,.0702,.0540,                           BLKC0065
6.1523,.124 ,.100 ,.089 ,.0763,.0625,.0572,                           BLKC0070
7.136 ,.1103,.088 ,.078 ,.0665,.054 ,.040 ,                           BLKC0075
8.124 ,.1003,.080 ,.070 ,.0591,.0480,.035 ,                           BLKC0080
9.1105,.0895,.0703,.0613,.0514,.0413,.0298/                           BLKC0085
 END                                                                 BLKC0090
```

FIGURE 6 (Continued)

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*
$IBFTC INPU     DECK                                                INPUCCOC
```

FIGURE 6 (Continued)

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INPU - FFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINE INPUT (IREAD)                                          INPUC005
C*****TEMP REVISION FOR REACTFR COUPLING    12/14/65    INPUT           INPUC01C
C**** INPUT SUBROUTINE FOR NORITAKE 11/19/65  INPUT IV                  INPUC015
      COMMON/GEN/CASE,G,RP, XRP,P,XO,G,XU,CR,XCR, ROE,ROER              INPUC02C
      COMMON/TEMPC/TSTEAM,TS(100), THF,TB,XTB,       TC,TP,TA,CC,CP     INPUC025
      COMMON/GEOME/AMODU,ALEV,AUNIT,TOTALE,TOTALR,FREBD,TRAYDP,HST,CL,  INPUC03C
     1SPL                                                               INPUC035
      COMMON/ECON/SMALLE,SMALLD,SMALLB,SMALLP,RATEIN,WPL, CAPF,THERM,   INPUC04C
     1PMSTMC                                                            INPUC045
      COMMON/TUBING/ DOH,DIH,DOE,DIE,DOR,DIR,A1,A2,A3,BIKTF,BIKTF,      INPUC05C
     1BIKTR,CSLTBH,CSLTBP,CSLTBR                                        INPUC055
      COMMON/FOULIN/RH,RE,RSR,SH,SC,SR,VH,VE,VR                         INPUC06C
      COMMON/PUMPHT/HD,HH,HBL,HPR,FFHL,SSFI                             INPUC065
      COMMON/AMISC/CPSTB,FACID,ACACID,DPLIM,A6,A7,XSCC,XNNN,NNN,XLLL,LLLINPUC07C
      COMMON/DATAI/BDEPH,DTPD,SSF2,TOTAL,UMAX,UALP,PI,TWFA,TSTH,COEFA,  INPUC075
     1ORITE,ITER                                                        INPUC08C
      COMMON/NOV25/ C11,C12, C13,C14, C15, C16, C21, C22, C23, C24, C31,INPUC085
     1 C32, C33, C34, C41, C42                                          INPUC09C
      COMMON/AZI/DTPDP(100),TITLE(15)                                   INPUC095
      DIMENSION F(10)                                                   INPUC1CC
      TWFA#0.9                                                          INPUC105
      TSTH#0.75                                                         INPUC110
      UMAX#40.0                                                         INPUC115
      UALP#30.0                                                         INPUC12C
      COEFA# 1.0                                                        INPUC125
C CONSTANT C11 ADJUSTED FROM 3.2048317 9/27/65                          INPUC13C
C                                                                       INPUC135
      IREAD#1                                                           INPUC14C
  100 READ  ( 5,8000)(TITLE(I),I#1,12)                                  INPUC145     2
 8000 FORMAT(12A6)                                                      INPUC15C
 8005 FORMAT(9E8.5)                                                     INPUC155
      BDEPH # 1.0                                                       INPUC16C
      DTPD#0.67                                                         INPUC165
      SSF2#500000.0                                                     INPUC17C
      FREBD#FREBDS                                                      INPUC175
      HST # FREBD + TRAYDP                                              INPUC18C
      HPR#HPRS                                                          INPUC185
      TB#TBSAVE                                                         INPUC19C
      XTB#TB                                                            INPUC195
C     DIMENSION F(10)                                                   INPUC2CC
  105 READ  (5 ,8010)(F(I),I#1,9),IC                                    INPUC205     9
 8010 FORMAT(9F8.0,I3)                                                  INPUC21C
      GOTO(110,115,120,125,130,135,140,145,150,155),IC                  INPUC215
C**   I.  GENERAL                                                       INPUC22C
  110 CASE#F(1)                                                         INPUC225
      G#F(2)                                                            INPUC23C
      RP #F(3)                                                          INPUC235
      XRP#RP                                                            INPUC24C
      P#F(4)                                                            INPUC245
      XO#P                                                              INPUC25C
      G#F(5)                                                            INPUC255
      XU#Q                                                              INPUC26C
      CR#F(6)                                                           INPUC265
      XCR#CR                                                            INPUC27C
      ROE#F(7)                                                          INPUC275
```

FIGURE 6 (Continued)

```
      ROER#F(8)                                                         INPUC280
      GOTO105                                                           INPUC285
C**   II.  TEMPERATURES AND CONCENTRATIONS                              INPUC290
  115 TSTEAM#F(1)                                                       INPUC295
      TS(1)#F(1)                                                        INPUC300
      THF#F(2)                                                          INPUC305
      TB#F(3)                                                           INPUC310
      XTB#TB                                                            INPUC315
      TBSAVE#TB                                                         INPUC320
      TO#F(4)                                                           INPUC325
      TP#F(5)                                                           INPUC330
      TA#F(6)                                                           INPUC335
      CO#F(7)                                                           INPUC340
      CP#F(8)                                                           INPUC345
      GOTO105                                                           INPUC350
C**   III.  GEOMETRY                                                    INPUC355
  120 AMODU#F(1)                                                        INPUC360
      ALEV#F(2)                                                         INPUC365
      AUNIT # F(3)                                                      INPUC370
      TOTALE#F(4)                                                       INPUC375
      TOTALR#F(5)                                                       INPUC380
      FREBD#F(6)                                                        INPUC385
      FREBDS#FREBD                                                      INPUC390
      TRAYDP # F(7)                                                     INPUC395
      HST # FREBD + TRAYDP                                              INPUC400
      CL#F(8)                                                           INPUC405
      SPL#F(9)                                                          INPUC410
      GO TO 105                                                         INPUC415
C**   IV.  ECONOMIC FACTORS                                             INPUC420
  125 SMALLE#F(1)                                                       INPUC425
      SMALLD#F(2)                                                       INPUC430
      SMALLB#F(3)                                                       INPUC435
      SMALLP#F(4)                                                       INPUC440
      RATEIN#F(5)                                                       INPUC445
      WPL#F(6)                                                          INPUC450
      CAPF#F(7)                                                         INPUC455
      THERM#F(8)                                                        INPUC460
      PMSTMC # F(9)                                                     INPUC465
      GOTO105                                                           INPUC470
C**   V.  TUBING INFORMATION                                            INPUC475
  130 DOH#F(1)                                                          INPUC480
      WALLH # F(2)                                                      INPUC485
      DIH # DOH - 2.0 * WALLH                                           INPUC490
      DOE#F(3)                                                          INPUC495
      WALLE # F(4)                                                      INPUC500
      DIE # DOE - 2.0 * WALLE                                           INPUC505
      DOR#F(5)                                                          INPUC510
      WALLR # F(6)                                                      INPUC515
      DIR # DOR - 2.0 * WALLR                                           INPUC520
      A3#F(7)                                                           INPUC525
      SMA1#F(8)                                                         INPUC530
      A1#SMA1                                                           INPUC535
      SMA2#F(9)                                                         INPUC540
      A2#SMA2                                                           INPUC545
      GOTO105                                                           INPUC550
C**   VI.  TUBING INFORMATION                                           INPUC555
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
        INPU        -  EFN   SOURCE STATEMENT  -  IFN(S)  -

  135 BIKTH#F(1)                                                    INPUC560
      BIKTE#F(2)                                                    INPUC565
      BIKTR#F(3)                                                    INPUC570
      CSLTBH#F(4)                                                   INPUC575
      CSLTBP#F(5)                                                   INPUC580
      CSLTBR#F(6)                                                   INPUC585
      GO TO 105                                                     INPUC590
C**   VII.  FOULING AND FLOODING FACTORS                            INPUC595
  140 RH # F( 1)                                                    INPUC600
      RE#F(2)                                                       INPUC605
      RSR # F(3)                                                    INPUC610
      SH # F(4)                                                     INPUC615
      SE#F(5)                                                       INPUC620
      SR # F(6)                                                     INPUC625
      VH # F(7)                                                     INPUC630
      VE#F(8)                                                       INPUC635
      VR # F(9)                                                     INPUC640
      GOTO105                                                       INPUC645
C**   VIII.  PUMPING HEAD AND HEAT LOSSES                           INPUC650
  145 HD#F(1)                                                       INPUC655
      HH#F(2)                                                       INPUC660
      HBL#F(3)                                                      INPUC665
      HPR#F(4)                                                      INPUC670
      HPRS#HPR                                                      INPUC675
      FFHL#F(5)                                                     INPUC680
      SSFI#F(6)                                                     INPUC685
      GOTO105                                                       INPUC690
C**   IX.  MISCELLANEOUS                                            INPUC695
  150 CPSTB#F(1)                                                    INPUC700
      FACID # F(2)                                                  INPUC705
      ACACID # F(3)                                                 INPUC710
      DPLIM#F(4)                                                    INPUC715
      A6  #F(5)                                                     INPUC720
      A7  #F(6)                                                     INPUC725
      XSOD#F(7)                                                     INPUC730
      XNNN # F(8)                                                   INPUC735
      NNN # XNNN + 0.1                                              INPUC740
      XLLL#F(9)                                                     INPUC745
      LLL#XLLL+0.1                                                  INPUC750
      GO TO 105                                                     INPUC755
  155 CONTINUE                                                      INPUC760
      TOTAL#TOTALE+TOTALR                                           INPUC765
      JTOTAL#TOTAL + 1.1                                            INPUC770
      DO 160 I#1,JTOTAL                                             INPUC775
  160 DTPDP(I)#DTPD                                                 INPUC780
      WRITE (6,8015)CASE, G,RP, D,L, CR, ROE ,ROER,TSTEAM,THF,      INPUC785
     1    TB,TO,TP, TA, CO, CP,AMODU,ALEV,                          INPUC790
     2AUNIT, TOTALE, TOTALR, FREPD, TRAYDP,CL,SPL,SMALLE,SMALLD,    INPUC795
     3     SMALLB, SMALLP ,RATEIN, WPL, CAPF ,THERM , PMSTMC,DCH, WALLH,INPUC800
     4 DOE,WALLE ,DOR,WALLR, A3, SMA1,SMA2,BIKTH,BIKTE,             INPUC805
     5 BIKTR, CSLTBH,CSLTBP,CSLTBR, RH,RE,RSR,                      INPUC810
     6 SH, SE, SR,VH,VE,VR,HD,HH,HBL,                               INPUC815
     7HPR,FFHL,SSFI,CPSTB,FACID,                                    INPUC820
     8   ACACID,DPLIM, A6 , A7 , XSOD   ,NNN  ,LLL                  INPUC825     45
 8015 FORMAT(1H0,5X,16HINPUT DATA INPUT/1H ,                        INPUC830
     1 7HCARD 06/1H 8E15.6/1H 7HCARD 07/1H 8E15.6/1H 7HCARD 08/     INPUC835
```

FIGURE 6 (Continued)

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                                                                    09/26/67
          INPU        -  EFN   SOURCE STATEMENT  -  IFN(S)  -

      2 1H 9F10.2/1H 7HCARD 09/1H 9F10.6/1H 7HCARD 10/1H 9F10.6/        INPUC840
      3 1H 7HCARD 11/1H 6F10.4/1H 7HCARD 12/1H 9F10.5/1H 7HCARD 13/     INPUC845
      4 1H 6F10.2/1H 7HCARD 14/1H 7F10.6,2I6)                           INPUC850
  165 IF(TB)170,185,170                                                 INPUC855
  170 CALL CHKTB(RP,TB,G,CO,CR,CP,DTPD,TO,TBMICK)                       INPUC860     49
      IF(TB-TBMICK     )185,175,175                                     INPUC865
  175 TBE#TBMICK-1.0                                                    INPUC870
      TB#TBE                                                            INPUC875
      XTB#TB                                                            INPUC880
      WRITE (6,8020)TBE,TBMICK                                          INPUC885     53
 8020 FORMAT(1H 25HTB ADJUSTED FOR THIS CASE      2E16.8)               INPUC890
      IF(TB-TO +5.0)   180,180,185                                      INPUC895
  180 WRITE (6,8025)TB,TO                                               INPUC900     55
 8025 FORMAT(27H PERFORMANCE RATIO TOO HIGH      2E16.8)                INPUC905
  185 CONTINUE                                                          INPUC910
      C11#2.565                                                         INPUC915
      C12 # .34935994E-01                                               INPUC920
      C13 # -.44260299E-01                                              INPUC925
      C14 # .95146883E-02                                               INPUC930
      C15 # -.45266271E-02                                              INPUC935
      C16 # .25147928E-02                                               INPUC940
CCONSTANT C21 ADJUSTED FROM 3.5371004 9/27/65                           INPUC945
      C21#5.866                                                         INPUC950
      C22 # 0.23733728                                                  INPUC955
      C23 # 0.13482249                                                  INPUC960
      C24 # .38165671E-02                                               INPUC965
CCONSTANT C31 ADJUSTED FROM 6.3705619 9/27/65                           INPUC970
      C31#11.9995                                                       INPUC975
      C32 # 0.35156805                                                  INPUC980
      C33 # 0.19559172                                                  INPUC985
      C34 # .61242599E-02                                               INPUC990
CCONSTANT C41 ADJUSTED FROM 1.93615  10/6/65                            INPUC995
      C41#(3.406+4.762*(ALEV-1.0))/ALEV                                 INPU1000
      C42 # 0.0712644                                                   INPU1005
  190 RETURN                                                            INPU1010
      END                                                               INPU1015
```

FIGURE 6 (Continued)

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```
*
$IBFTC CND      DECK                                                    CNDCCCCC
```

FIGURE 6 (Continued)

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CND - EFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINE CNDNS (LLLL,COOR)                                      CNDOOOO5
C**** CONDENSER SUBROUTINE FOR STAGE BY STAGE CALCULATION               CNDOOOO10
C**** SIMPLIFIED CONDENSER CALCULATION - MOD HORIZONTAL FLOW 8/6/65     CNDOOOO15
C**** THIS SUBROUTINE REQUIRES INTPL, APPROX, AMATQ2, EVAL SUBROUTINES  CNDOOOO20
      COMMON/GEOME/AMODU,ALEV,AUNIT,TOTALE,TOTALR,FREPD,TRAYDX,HST,CL,  CNDOOOO25
     1SPL                                                               CNDOOOO30
      COMMON/AMISC/CPSTB,FACID,ACACID,DPLIM,A6,A7,XSOD,XNNN,NNN,XLLL,LLLCNDOOOO35
      COMMON/DATA1/BDEPH,DTPD,SSF2,TOTAL,UMAX,UALP,PI,TWFA,TSTH,COEFA,  CNDOOOO40
     1ORITE,ITER                                                        CNDOOOO45
      COMMON/AZ1/DTPDP(100),TITLE(15)                                   CNDOOOO50
      COMMON/TCVL2/ TTD(100),SMT(100), SMT2(100), CT(100), WS(100),     CNDOOOO55
     1C(100), TV(100), WV(100), QH(100), WP(100), AS(100),SLS(100)      CNDOOOO60
      COMMON/STAGE1/ A(100),CFMWV(100), CFMWZ(100), UBAR(100), CM(100), CNDOOOO65
     1HO(100),HI(100),WWFS(100),VVEV(100), TRAYFL(100),TRAYWD(100),     CNDOOOO70
     2RESIDT(100), PV(100),DELP(100), DTPDPS(100)                       CNDOOOO75
      COMMON/CONDI/ DPINIT(100), DTINIT(100), DPCLR(100), DTCLR(100),   CNDOOOO80
     1DTCND(100)                                                        CNDOOOO85
      COMMON/STAGE2/ AH, BAROM,BWE,BWR,COSTDM,ELE,ESHELL,HBH,HBLE,HBLR, CNDOOOO90
     1HLH, HNOE, HNOR,HN, HSTE, HSTR, JJ, KK, RLR, RSHELL, TBNOE,TBNOR, CNDOOOO95
     2UBARH, VBLE,VBLR,VNOE, VNOR, WTME, WTMR, WY                       CNDOOOO100
      COMMON /STG1/ ATR, BTR, CTR, CTA                                  CNDOOOO105
      COMMON /STG2/HOH, PR, DENBR(100), SUMLS, WVST(100), DO, DI, R, S, CNDOOOO110
     1 V, TVTT(100), Z(100), HV, HS(100), WBS(100)                      CNDOOOO115
      COMMON /CNDR1/ NERR,        COOR(3), K                            CNDOOOO120
      COMMON /DEM1/ SLKP2, SUMDMA, TDMP(100), APTSE, VOLM, APTSR        CNDOOOO125
      COMMON /DEM3/ VNO(1), DTUBEP, TUBENO, HNO(1),VBL(1),HBLG, TRAYDP, CNDOOOO130
     1TRAYHT(                                                           CNDOOOO135
     15), HBL1, TRAYW2, ZZZZZ                                           CNDOOOO140
      COMMON/CNDLNK/WG(100),IDNO,WCNDT,WL,SPATRA,DTUBE,TSAT(100),PSAT(10CNDOOOO145
     10),VSAT(100),VEL(1),SOD(1),HBL(1),AREAB(1),AREAT(1)               CNDOOOO150
      COMMON /OP1/ SMAPPP, HR, SMAPPH, HE, UNARAR, UNARAE, A4, AJ, WCO, CNDOOOO155
     1 UBARE, UBARR, UTHE, AE, AR, ATHE, THEL, ENE, THEN, HFE, HFR, THEHCNDOOOO160
     2T, HC2, HC1, CC2, CC1, POCST2, POCST1, ALPBAR, PMC2, PMC1, COCAP2,CNDOOOO165
     3  COCAP1, SITE2, SITE1,  WAIT2, WAIT1,  ES2, ES1,  EA2, EA1,     CNDOOOO170
     4 BHC2,  BHC1,  VPC2,  VPC1,  UBPH,  EEC2,  EEC1,  PO,  CC2, CC1,  CNDOOOO175
     5 SCM2,  SCM1,  CIBC2, CIBC1,  DEA2,  DEA1,  TC2,  TC1,  CAPI1,    CNDOOOO180
     6 CAPI2,  CAPI3,  PO3,  HS1,  PMC,  EEC,  VPC,  SITE,  WAIT,       CNDOOOO185
     7 ES,  EA,  CIBC,  BHC,  COCAP,  COSTIN,  WEIRC,  CRANE,  BLDG,    CNDOOOO190
     8 DEACST,  PMCPO,  PMCFLO,  RETUB2,  RETUB1,  DPREQ(100), AMSC2,   CNDOOOO195
     9 AMSC1                                                            CNDOOOO200
      DIMENSION                                                         CNDOOOO205
     2DPFG(100), DPFTP(100), DPM(100),FFX(100), DPT(100)                CNDOOOO210
      YPSAT(Q000FL) #EXP(CTR + BTR/Q000FL+ ATR/ (Q000FL*Q000FL))        CNDOOOO215      2
      YVSAT(Q001FL,Q002FL)#EXP(-0.72240 + 1.10267 * ALOG(Q001FL/Q002FL) CNDOOOO220
     1                -0.0177861 * (ALOG(Q001FL/Q002FL)) **2           CNDOOOO225
     2                     + 0.00103758 * ( ALOG(Q001FL/Q002FL))**3)   CNDOOOO230      5       6
      YVISG(Q003FL) #(((-.7693E-10*Q003FL+.2892E-6)* Q003FL+ .1001E-2)* CNDOOOO235
     1Q003FL+ .1220) * 1.0E-5                                           CNDOOOO240
      VLIQ(Q004FL) #.16153716E-1 +(.48841151E-4 + (-.82269193E-6 +      CNDOOOO245
     1.57044577E-8 * Q004FL) *Q004FL) * Q004FL                          CNDOOOO250
      YTPG1(Q005FL)#EXP(-.93620189 +(-0.7500582 +(-0.11991543           CNDOOOO255
     1+.12224994E-01*Q005FL)*Q005FL)*Q005FL)                            CNDOOOO260      13
      YTPG2(Q006FL)#EXP(-0.94283631 +(-0.80225485 +(-.79487734E-01+.9212CNDOOOO265
     16780E-2*Q006FL)*Q006FL)        *Q006FL)                           CNDOOOO270      16
      TRSAT(Q007FL) #-2.0 * ATR/ (BTR+ SQRT(BTR*BTR-4.0 *              ACNDOOOO275
```

FIGURE 6 (Continued)

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                                                                    09/26/67
        CND        -  EFN   SOURCE STATEMENT  -  IFN(S)  -

    ITR* (CTR- ALOG(Q007FL) )))                                     CND00280     19     20
     I#0                                                            CND00285
     NNN#NNN                                                        CND00290
     NNNS # NNN                                                     CND00295
     LEFTOV#IDNO                                                    CND00300
     DO 235  J#1,IDNO ,NNN                                          CND00305
     I#I+1                                                          CND00310
     K#I+1                                                          CND00315
     LP128#0                                                        CND00320
     LEFTOV#LEFTOV-NNN                                              CND00325
     IF (LEFTOV)100,105,105                                         CND00330
 100 K#I+1                                                          CND00335
 105 IF(I-IDNO)115,110,115                                          CND00340
 110 K#I+1                                                          CND00345
 115 WG( K ) # WG(I) - WCNDT      *FLCAT(NNN)                       CND00350
     IF (WG ( K ))120,125,125                                       CND00355
 120 WG( K ) # 0.0                                                  CND00360
 125 WGAVG#(WG(I) + WG(K) )*0.5                                     CND00365
     GSTAR     #(WL          +WGAVG)/ SPATRA                        CND00370
     XTR # TSAT(I) + 459.69                                         CND00375
     VISG #YVISG(XTR)                                               CND00380
     XNREX     # DTUBE * GSTAR    /VISG                             CND00385
     IF(XNREX    -2000.0)130,135,135                                CND00390
 130 COOR (1)#2000.0                                                CND00395
     GO TO 140                                                      CND00400
 135 COOR(1) # XNREX                                                CND00405
 140 CALLDOUBLE(COOR    ,FFX(I),IERR)                               CND00410     55
     IF(IERR)145,150,145                                            CND00415
 145 WRITE (6,8000 )IERR,COOR(1),COOR(2),COOR(3) ,FFX(I)            CND00420     59
8000 FORMAT( 16HOERROR IN INTPL  I5,4E16.8)                         CND00425
     RETURN                                                         CND00430
 150 XPI # PSAT(I)                                                  CND00435
     IF(XPI)155,155,160                                             CND00440
 155 WRITE (6,8005 )I, PSAT (I)                                     CND00445     64
8005 FORMAT (1H0 4X 5H I #  I4, 4X20HPSAT (I) TOO LOW #    E14.6)   CND00450
     RETURN                                                         CND00455
 160 VL # VLIQ(XPI)                                                 CND00460
     VSAT(I)#YVSAT(XTR,XPI)                                         CND00465
     VOV # VL/VSAT(I)                                               CND00470
     XLVFX #     1.0    /(VOV +  WGAVG/ WL)                         CND00475
     IF(XLVFX - 0.1) 165,165,170                                    CND00480
 165 TPOG # 1.0                                                     CND00485
     GO TO 185                                                      CND00490
 170 IF(XLVFX-1.0)175,175,180                                       CND00495
 175 XLVFLN#ALOG(XLVFX)                                             CND00500     75
     TPOG#YTPG1(XLVFLN)                                             CND00505
     GO TO 185                                                      CND00510
 180 XLVFLN#ALOG(XLVFX)                                             CND00515     78
     TPOG#YTPG2(XLVFLN)                                             CND00520
 185 IF(TPOG-1.0E-3)190,195,195                                     CND00525
 190 TPOG#1.0E-3                                                    CND00530
 195 PSAT( K) # PSAT(I) - DELP(I)                                   CND00535
     XPI # PSAT( K )                                                CND00540
     IF(XPI)155,155,200                                             CND00545
 200 TSAT(K  ) # TRSAT(XPI) - 459.69                                CND00550
     XTR # TRSAT(XPI)                                               CND00555
```

FIGURE 6 (Continued)

```
      VSAT(K  ) #YVSAT(XTR,XPI)                                         CND00560
      VSATAV #(VSAT(I) + VSAT( K )) * 0.5                               CND00565
      DPFG(I) # 4.0 *FFX(I) * GSTAR   **2  *VSATAV/9266.112             CND00570
     I*FLOAT(NNN)                                                       CND00575
      DPFTP(I) # DPFG(I) * TPOG                                         CND00580
      DPM(I) #(WG( K )* WG( K )* VSAT( K ) -  WG(I) * WG(I) * VSAT(I))  CND00585
     I/(9266.112 * SPATRA       ** 2  )                                 CND00590
      DPT(I) # DPFTP(I)                                                 CND00595
      IF(ABS(DELP(I)/ DPT(I) - 1.0) - .001)205,205,225                  CND00600
  205 PSAT( K ) # PSAT(I) - DPT (I)                                     CND00605
      XPI # PSAT( K )                                                   CND00610
      IF(XPI)155,155,210                                                CND00615
  210 TSAT( K ) #  TRSAT(XPI) - 459.69                                  CND00620
      XTR # TRSAT(XPI)                                                  CND00625
      VSAT( K ) #YVSAT(XTR, XPI)                                        CND00630
      IF(LEFTOV    )215,235,235                                         CND00635
  215 IF (J - IDNO) 220,235,235                                         CND00640
  220 I#I+1                                                             CND00645
      J # IDNO                                                          CND00650
      K#I+1                                                             CND00655
      NNN#  NNN-LEFTOV -1                                               CND00660
      GO TO 115                                                         CND00665
  225 DELP(I)# DPT(I)                                                   CND00670
      LP128#LP128+1                                                     CND00675
      IF(_P128-10)195,195,230                                           CND00680
  230 WRITE (6,8010 )I,DELP(I),DPT(I),ISTAGE                            CND00685    128
 8010 FORMAT(3H I  I6, 2E16.8, 6HISTAGE  3I6)                           CND00690
  235 CONTINUE                                                          CND00695
      NNN # NNNS                                                        CND00700
      RETURN                                                            CND00705
      END                                                               CND00710
```

FIGURE 6 (Continued)

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*
$IBFTC DEMST    DECK                                                    DEMSCCDC
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FIGURE 6 (Continued)

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DEMST - EFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINE DEMIST                                                 DEMSC005
C**** STAGEGEOM FOR NORITAKE  DEAERATOR AND    421 DEMISTER  10/12/65   DEMSC010
      COMMON/GEN/CASE,G,RP, XRP,P,XO,Q,XU,CR,XCR, RCE,ROER              DEMSC015
      COMMON/TEMPC/TSTEAM,TS(100), THF,TB,XTB,        TC,TP,TA,CC,CP    DEMSC020
      COMMON/GEOME/AMODU,ALEV,AUNIT,TCTALE,TOTALR,FREBC,TRAYDP,HST,CL,  DEMSC025
     1SPL                                                               DEMSC030
      COMMON/ECON/SMALLE,SMALLD,SMALLB,SMALLP,RATEIN,WPL, CAPF,THERM,   DEMSC035
     1PMSTMC                                                            DEMSC040
      COMMON/TUBING/ DOH,DIH,DOE,DIE,DOR,DIR,A1,A2,A3,BIKTF,BIKTE,      DEMSC045
     1BIKTR,CSLTBH,CSLTBP,CSLTBR                                        DEMSC050
      COMMON/FOULIN/RH,RE,RSR,SH,SE,SR,VH,VE,VR                         DEMSC055
      COMMON/PUMPHT/HD,HH,HBL,HPR,FFHL,SSFI                             DEMSC060
      COMMON/AMISC/CPSTB,FACID,ACACID,DPLIM,A6,A7,XSOC,XNNN,NNN,XLLL,LLLDEMSC065
      COMMON/DATA1/BDEPH,DTPD,SSF2,TOTAL,UMAX,UALP,PI,TWFA,TSTH,COEFA,  DEMSC070
     1ORITE,ITER                                                        DEMSC075
      COMMON/AZI/DTPDP(100),TITLE(15)                                   DEMSC080
      COMMON/TCVLI/ ACPSN, ACPSNK, ACPTNK,CPBT,CPTK, CPTNK,AMBN,TCF,WX, DEMSC085
     1WF,WO,CB,WC,WB, WR,RHONK, RHOK, ERR,CCF, NITER, NK,NTOTAL, PN,RPN,DEMSC090
     2TC, ALPHA1, WPN, DELCT, DELST, IGSC, SMAQ, SUMA, TK               DEMSC095
      COMMON/TCVL2/ TTD(100),SMT(100), SMT2(100), CT(100), WS(100),     DEMSC100
     1C(100), TV(100), WV(100), GH(100), WP(100), AS(100),SLS(100)      DEMSC105
      COMMON/STAGE1/ A(100),CFMWV(100), CFMWZ(100), UBAR(100), OM(100), DEMSC110
     1HO(100),HI(100),WWFS(100),VVEV(100), TRAYFL(100),TRAYWD(100),     DEMSC115
     2RESIDT(100), PV(100),DELP(100), DTPDPS(100)                       DEMSC120
      COMMON/DMSTI/ AREADM(100),DPTDM(100),DTDM(100), CPROD(100),WIDDM(1DEMSC125
     100)                                                               DEMSC130
      COMMON/CONDI/ DPINIT(100), DTINIT(100), DPCLR(100), DTCLR(100),   DEMSC135
     1DTCND(100)                                                        DEMSC140
      COMMON/STAGE2/ AH, BAROM,BWE,BWR,COSTDM,ELE,ESHELL,HBH,HBLE,HBLR, DEMSC145
     1HLH, HNOE, HNOR,HN, HSTE, HSTR, JJ, KK, RLR, RSHELL, TBNOE,TBNOR, DEMSC150
     2UBARH, VBLE,VBLR,VNOE, VNOR, WTME, WTMR, WY                       DEMSC155
      COMMON/PHYS/II                                                    DEMSC160
      COMMON /MAIN1/ SSF, HFG                                           DEMSC165
      COMMON /STG1/ ATR, BTR, CTR, CTA                                  DEMSC170
      COMMON /STG2/HOH, PR, DENBR(100), SUMLS, WVST(100), DO, DI, R, S, DEMSC175
     1 V, TVTT(100), Z(100), HV, HS(100), WBS(100)                      DEMSC180
      COMMON /CSTI/ ASIEV, ANPLAT, SLPLAT, APLAT                        DEMSC185
      COMMON /CNDR1/ NERR,        COCR(3), K                            DEMSC190
      COMMON /DEM1/ SLKP2, SUMDMA, TDMP(100), APTSE, VCLM, APTSR        DEMSC195
      COMMON /DEM3/ ARGZ(15)                                            DEMSC200
      COMMON /DEA10/ RNR                                                DEMSC205
      DIMENSION WPRODM(100),EINDM(100),SMPRD(100),WSALT(100),SMSALT(100)DEMSC210
      COMMON/STG21/TRAYLN,SLDEA,GR,WVKEEP,TTRAY,WVDEA1                  DEMSC215
      YPSAT(Q000FL) #EXP(CTR + BTR/QCCOFL+ ATR/ (Q000FL*Q000FL))        DEMSC220    2
      FTIH(Q001FL)#2.1786818-.70443622E-01*Q001FL+.93941286E-03*Q001FL**DEMSC225
     12-.53958083E-05*Q001FL**3+.18139197E-07*Q001FL**4                 DEMSC230
      HFGH(Q002FL)#1093.88-0.5703*Q002FL+1.2819E-4*Q002FL**2-0.8824E-6*QDEMSC235
     1002FL**3                                                          DEMSC240
      NTOT1 #NTOTAL+1                                                   DEMSC245
      SLKP2 # SLS(NTOTAL)                                               DEMSC250
      WVKP2 # WV(NTOTAL)                                                DEMSC255
      WV(NTOTAL)#WVKEEP                                                 DEMSC260
      SLS(NTOTAL)# TRAYLN + 0.5 - TSTH/  12.0                           DEMSC265
C*** YORK DEMISTER  TYPE 421  10/11/65                                  DEMSC270
      IF(UMAX) 100,105,100                                              DEMSC275
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FIGURE 6 (Continued)

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                                                                    09/26/67
        DEMST      -  EFN   SOURCE STATEMENT  -  IFN(S)  -

  100 IF(UALP)110,105,110                                           DEMS0280
  105 RETURN                                                        DEMS0285
  110 SUMDMA#0.0                                                    DEMS0290
      DTPDS# DTPD                                                   DEMS0295
      DO 260 I#1,NTOTI                                              DEMS0300
      IF (I - NTOTI) 120, 115, 115                                  DEMS0305
  115 TSAVG # TTRAY                                                 DEMS0310
      CAVE# CO * (WB+ WX) / (WB + WX - WVDEAI )                     DEMS0315
      C(NTOTAL+2)#CAVE                                              DEMS0320
      GO TO 125                                                     DEMS0325
  120 TSAVG  #(TS(I) + TS(I+1)) * 0.5                               DEMS0330
      CAVE#(C(I)+C(I+1))*0.5                                        DEMS0335
  125 TSAVE  #  TSAVG                  + 459.69                     DEMS0340
      SLSP#SLS(I)-0.5+TSTH/12.0                                     DEMS0345
      CALL  BOPR (TSAVG,CAVE,PPR)                                   DEMS0350    33
      BIGTE#TSAVE-PPR                                               DEMS0355
      PS   # EXP(14.150119 - 6452.5621/ BIGTE  - 837533.21 /BIGTE**2)  DEMS0360    35
      VG # 10.729 * TSAVE          /(18.015 *PS   )                 DEMS0365
      IF(WV(I))130,130,135                                          DEMS0370
  130 AREADM(I)#0.0                                                 DEMS0375
      DPTDM(I)#0.0                                                  DEMS0380
      WIDDM(I)#0.0                                                  DEMS0385
      WPRODM(I)#0.0                                                 DEMS0390
      GO TO 240                                                     DEMS0395
  135 IF (I - NTOTI) 145, 140, 140                                  DEMS0400
  140 GDM  #WV (I) / (AMODU *ALEV *SLSP  *TRAYWD(I-1))              DEMS0405
      GO TO 150                                                     DEMS0410
  145 GDM   # WV(I)/ (AMODU *ALEV *SLSP  *TRAYWD(I))                DEMS0415
  150 XDM   # GDM   **3* VG **2 *1.0E-8                             DEMS0420
      XDMLN# ALOG( XDM)                                             DEMS0425    54
      IF(XDMLN -5.9)  155, 160,160                                  DEMS0430
C     IF(XDMLN -4.4)  399, 400,400                                  DEMS0435
  155 EINDM(I) # EXP(10.441-0.1570*XDMLN)                           DEMS0440
C 399 EINDM(I) # EXPF(8.941-0.1570*XDMLN)                           DEMS0445    57
      GOTO165                                                       DEMS0450
  160 EINDM(I)#  EXP(4.42+0.870*XDMLN)                              DEMS0455    61
  165 XLDM #0.333                                                   DEMS0460
      EFFDM#1.0-100.0/(EINDM(I)*CAVE)                               DEMS0465
      IF(EFFDM)170,170,180                                          DEMS0470
  170 EOUTMX#EINDM(I)*CAVE                                          DEMS0475
      AREADM(I)#0.0                                                 DEMS0480
      DPTDM(I)#0.0                                                  DEMS0485
      DTDM(I)#0.0                                                   DEMS0490
  175 WRITE (6,8000)I,EOUTMX                                        DEMS0495    71
 8000 FORMAT(31HONO DEMISTER REQUIRED, STAGE NO  I2, 25H MAX ENTRAINMENTDEMS0500
     1 #        E13.6)                                              DEMS0505
      GO TO 220                                                     DEMS0510
  180 II#5                                                          DEMS0515
      CALL DINTPL(TSAVG, CAVE, RHOY)                                DEMS0520    75
      VL# 1.0/RHOY                                                  DEMS0525
      XYORK# ALOG(EINDM(I) *1.0E-6  *(VL/VG) **0.5     )            DEMS0530    77    79
      YYORK #  EXP(  -4.99499 + (-0.725195 - 0.0301573 *XYORK) *XYORK)  DEMS0535    80
      II# 7                                                         DEMS0540
      CALL DINTPL( TSAVG, CAVE,VIS)                                 DEMS0545    82
      UPL # VIS/2.42                                                DEMS0550
      UYORK #(YYORK * .27277    *VG  / ( VL * UPL ** 0.2)) ** 0.5   DEMS0555    84    85
```

FIGURE 6 (Continued)

```
      IF(JYORK-UMAX)190,185,185                                         DEMSC560
  185 UYORK#UMAX                                                        DEMSC565
  190 UDMIN#   UYORK                                                    DEMSC570
      IF (I - NTOTI) 200,195,195                                        DEMSC575
  195 AREADM(I) #( WV(I)* VG / (AMCDU * ANPLAT * 3600.0 * UDMIN)      )  DEMSC580
     1 *ANPLAT/ALEV                                                     DEMSC585
      ADMMAX # APLAT * ANPLAT/ ALEV                                     DEMSC590
      GO TO 205                                                         DEMSC595
  200 AREADM(I) #  WV(I)* VG / (AMCDU * ALEV * 3600.0 * UDMIN)          DEMSC600
      ADMMAX#SLSP  *TRAYWD(I)                                           DEMSC605
  205 IF(AREADM(I)-ADMMAX)215,215,210                                   DEMSC610
  210 WRITE (6,8005)I,AREADM(I),ADMMAX                                  DEMSC615    101
 8005 FORMAT(42H0AREA DM IS GREATER THAN ADMMAX.  STAGE #     I8,        DEMSC620
     12E16.8)                                                           DEMSC625
      UDMIN #WV(I)*VG/(AMCDU*ALEV*3600.0*AREADM(I))                     DEMSC630
      ALPDM#0.666*ALOG(UDMIN)-0.1873                                    DEMSC635    105
      EOUTDM#EINDM(I) *EXP(ALPDM*XLDM*(-1.0))                           DEMSC640    106
      COUTDM     #EOUTDM*CAVE                                           DEMSC645
      EFFDM#1.0-EOUTDM/EINDM(I)                                         DEMSC650
  215 SUMDMA # SUMDMA  + AREADM(I)                                      DEMSC655
      UG# 1.0E-5 *(0.122 + 1.001 E-3 * TSAVE + 2.892E-7 * TSAVE **2     DEMSC660
     1-7.693 E-11 * TSAVE **3 )                                         DEMSC665
      WIDDM(I)#AREADM(I)/SLSP                                           DEMSC670
      ANRE DM #UDMIN /(110.0* VG * UG)                                  DEMSC675
      FFDM     #       1.1297   * ANREDM **(-0.2747)                    DEMSC680    113
      DPDDM     # FFDM    * XLDM *110.0* UDMIN  **2  /  (4320.7    * VG) DEMSC685
      CIDM#EINDM(I)*1.0E-6*UDMIN*3600.0/VG                              DEMSC690
      S2DM#SQRT(VG/VL -1.0)                                             DEMSC695    115
      S2LDM#ALOG(DIDM)                                                  DEMSC700    116
      C3DM#10.51 -1.287*S2LDM +0.3784 *S2LDM **2                        DEMSC705
      DPWDM# 4.332E-4 *EXP(C3DM*(UDMIN / S2DM -0.075))                  DEMSC710    117
      DPTDM(I) # DPDDM     + DPWDM                                      DEMSC715
      POUT DM #  PS   - DPTDM(I)                                        DEMSC720
      TOUTDM#1675066.42/(-6452.5621 +SQRT(41635557.0+3353132.8*(14.15011DEMSC725
     19-ALOG(POUTDM))))   -459.69                                       DEMSC730    120    121
      TSP#1675066.42/(-6452.5621 +SQRT(41635557.0+3353132.8*(14.150119-ADEMSC735
     1LOG(PS))))   -459.69                                              DEMSC740    122    123
      DTDM(I)# TSP    -TOUTDM                                           DEMSC745
  220 DTPDPS(I)#DTPDP(I)                                                DEMSC750
      IF(JYORK-UALP)230,230,225                                         DEMSC755
  225 ALPDM#0.666*ALOG(UALP)-0.1873                                     DEMSC760    130
      GO TO 235                                                         DEMSC765
  230 ALPDM#0.666*ALOG(UYORK)-0.1873                                    DEMSC770    133
  235 EOUTDM#EINDM(I)*EXP(-1.0*ALPDM*XLDM*12.0)                         DEMSC775    135
      COUTDM    #(EOUTDM*1.0E-6*CAVE)/(1.0+EOUTDM*1.0E-6)               DEMSC780
      WPRODM(I)#WVST(I)*(1.0+EOUTDM*1.0E-6)                             DEMSC785
  240 IF(I-1)245,245,250                                                DEMSC790
  245 SMPRD(I)#WPRODM(I)                                                DEMSC795
      WSALT(I)#WPRODM(I)*COUTDM                                         DEMSC800
      SMSALT(I)#WSALT(I)                                                DEMSC805
      GO TO 255                                                         DEMSC810
  250 SMPRD(I)#SMPRD(I-1)+WPRODM(I)                                     DEMSC815
      WSALT(I)#WPRODM(I)*COUTDM                                         DEMSC820
      SMSALT(I)#SMSALT(I-1)+WSALT(I)                                    DEMSC825
  255 CPROD(I)#SMSALT(I)/SMPRD(I)                                       DEMSC830
      TDMP(I)#BIGTE-DTDM(I)                                             DEMSC835
```

FIGURE 6 (Continued)

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DEMST - FFN SOURCE STATEMENT - IFN(S) -

```
260 CONTINUE                                                          DEMSC84C
    I#C                                                               DEMSC845
    TOPROD#SMPRD(NTOTI)                                               DEMSC85C
    TOCPRO#CPROD(NTOTI)                                               DEMSC855
    TOSALT#SMSALT(NTOTI)                                              DEMSC86C
265 IF(CPROD(NTOTI )- CP      )        270,325,325                    DEMSC865
27C I#I+I                                                             DEMSC87C
    WPRSAV#WPRODM(I)                                                  DEMSC875
    WSALSV#WSALT(I)                                                   DEMSC88C
    IF(WV(I))280,280,275                                              DEMSC885
275 EOUTDM#EINDM(I)                                                   DEMSC89C
    CNCSAV    #(C(I)+C(I+I))*0.5                                      DEMSC895
    COUTDM      # EINDM (I) * I.0E-6 * CNCSAV      / (I.0 +           DEMSC90C
   1 EINDM (I) * I.0 E-6)                                             DEMSC905
    WPRODM(I)#WVST(I)*(I.C+EOUTDM*I.0E-6)                             DEMSC91C
    WSALT(I)#WPRODM(I)*COUTDM                                         DEMSC915
28C IF(I-I)285,285,29C                                                DEMSC92C
285 SMSALT(I)#WSALT(I)                                                DEMSC925
    SMPRD  (I) # WPRODM (I)                                           DEMSC93C
    GO TO 295                                                         DEMSC935
29C SMSALT(I)#SMSALT(I-I)+WSALT(I)                                    DEMSC94C
    SMPRD (I) # SMPRD (I-I) + WPRODM (I)                              DEMSC945
295 CPROD(I)#SMSALT(I)/SMPRD(I)                                       DEMSC95C
    SMSALT(NTOTI )#SMSALT(NTOTI )     +WSALT(I)-WSALSV                DEMSC955
    SMPRD(NTOTI )#SMPRD(NTOTI )       +WPRODM(I)-WPRSAV               DEMSC96C
    CPROD(NTOTI )#SMSALT(NTOTI )/SMPRD(NTOTI )                        DEMSC965
    IF (CPROD (NTOTI ) - CP      ) 320, 320, 300                      DEMSC97C
30C WPRODM (I) # WPRSAV                                               DEMSC975
    WSA_T (I) # WSALSV                                                DEMSC98C
    IF(I-I)31C,305,31C                                                DEMSC985
305 SMPRD(I)#WPRODM(I)                                                DEMSC99C
    SMSALT(I)#WSALT(I)                                                DEMSC995
    CPROD(I)#SMSALT(I)/SMPRD(I)                                       DEMS1CCC
    SMSALT(NTOTI)#TOSALT                                              DEMS1005
    SMPRD(NTOTI)#TOPROD                                               DEMS1010
    CPROD(NTOTI)#TOCPRO                                               DEMS1015
    GO TO 325                                                         DEMS102C
310 SUMDMA#0.0                                                        DEMS1025
    DO 315 K # I, NTOTI                                               DEMS1030
    SMPRD (K) # SMPRD (K-I) + WPRODM (K)                              DEMS1035
    SMSALT (K) # SMSALT (K-I) + WSALT (K)                             DEMS1040
    CPROD (K) # SMSALT (K) / SMPRD (K)                                DEMS1045
    SUMDMA#SUMDMA+AREADM(K)                                           DEMS105C
315 CONTINUE                                                          DEMS1055
    GO TO 325                                                         DEMS106C
320 DTDM(I)#0.0                                                       DEMS1065
    SUMDMA # 0.0                                                      DEMS107C
    AREADM(I)#0.0                                                     DEMS1075
    DPTDM(I)#0.0                                                      DEMS1080
    DTDM(I)#0.0                                                       DEMS1085
    DTPDP(I)#DTPDS                                                    DEMS109C
    IF(I-NTOTI ) 270,325,325                                          DEMS1095
325 COSTDM#(19.8C* XLDM/C.333         ) *SUMDMA* ALEV*AMOCU           DEMS1100
    SLS(NTOTAL) # SLKP2                                               DEMS1105
    WV(NTOTAL)#WVKP2                                                  DEMS111C
    IF (VVEV (NK) - 150.0) 340, 34C, 330                              DEMS1115
```

FIGURE 6 (Continued)

```
  330 FREBDP # FREBD * VVEV (NK) / 150.0                                DEMS1120
  335 WRITE (6,8010)FREBDP, FREBD                                       DEMS1125    260
      TRAYDP # HST - FREBD                                              DEMS1130
      FREBD # FREBDP                                                    DEMS1135
      HST # TRAYDP + FREBD                                              DEMS1140
 8010 FORMAT (1H0 20HFREEBOARD REVISED TO , E13.6, 2X 4HFROM , E13.6)   DEMS1145
  340 ARGZ (2) # DOE                                                    DEMS1150
C*****TRAYDP#ARGZ(7)                                                    DEMS1155
      ARGZ(7)#HST-FREBD                                                 DEMS1160
C*****TRAYHT#ARGZ(8)                                                    DEMS1165
      ARGZ(8)#FREBD                                                     DEMS1170
      ARGZ(14)#TRAYWD(NK)*0.5                                           DEMS1175
      JERR#0                                                            DEMS1180
      JJ#1                                                              DEMS1185
      KK#NK                                                             DEMS1190
      CALL CNDNSR (TITLE(1), JERR)                                      DEMS1195    266
      IF(JERR)350,345,350                                               DEMS1200
C*****BUNDLE WIDTH # ARGZ(13)                                           DEMS1205
  345 BWE#ARGZ(13)                                                      DEMS1210
      HSTE#ARGZ(7)+ARGZ(8)                                              DEMS1215
      VNOE#ARGZ(1)                                                      DEMS1220
      TBNOE#ARGZ(3)                                                     DEMS1225
      HNOE#ARGZ(4)                                                      DEMS1230
       ESHELL#HSTE*ALEV*ELE*(WTME+2.0*BWE)                              DEMS1235
      VBLE#ARGZ(5)                                                      DEMS1240
      HBLE#ARGZ(6)                                                      DEMS1245
      APTSE # (VBLE + 0.667 ) * (HBLE + 0.667)                          DEMS1250
      ARGZ(2)#DOR                                                       DEMS1255
      ARGZ(14)#TRAYWD(NTOTAL)*0.5                                       DEMS1260
      JERR#0                                                            DEMS1265
      JJ#NK+1                                                           DEMS1270
      KK#NTOT1                                                          DEMS1275
      SXLLL#XLLL                                                        DEMS1280
      XLLL#1.0                                                          DEMS1285
      CALL CNDNSR (TITLE(1), JERR)                                      DEMS1290    274
      XLLL#SXLLL                                                        DEMS1295
      IF(JERR)350,355,350                                               DEMS1300
  350 ERR#23.0                                                          DEMS1305
      RETURN                                                            DEMS1310
  355 BWR#ARGZ(13)                                                      DEMS1315
      HSTR#ARGZ(7)+ARGZ(8)                                              DEMS1320
      TBNOR#ARGZ(3)                                                     DEMS1325
      VNOR#ARGZ(1)                                                      DEMS1330
      HNOR#ARGZ(4)                                                      DEMS1335
      RSHELL#HSTR*ALEV*RLR*(WTMR+2.0*BWR)                               DEMS1340
  360 VOLM#ESHELL+RSHELL                                                DEMS1345
      VBLR#ARGZ(5)                                                      DEMS1350
      HBLR#ARGZ(6)                                                      DEMS1355
      APTSR#(VBLR + 0.667 ) * (HBLR+0.667)                              DEMS1360
      DO 375 I#1,NTOT1                                                  DEMS1365
      DTCND(I)#DTINIT(I)+DTCLR(I)                                       DEMS1370
      IF (TS(I+1) - 180.0)  365, 365, 370                               DEMS1375
  365 DTPDP(I)#DTDM(I)+DTINIT(I)+DTCLR(I)  + FACID                      DEMS1380
     1+ACACID * (180.0- TS (I+1) )                                      DEMS1385
      GO TO 375                                                         DEMS1390
  370 DTPDP(I)#DTDM(I)+DTINIT(I)+DTCLR(I)  + FACID                      DEMS1395
```

FIGURE 6 (Continued)

```
375 CONTINUE                                                          DEMS1400
    I # NTOTI                                                         DEMS1405
    DTPDP(   I   )#DTDM(I)+DTINIT(I)+DTCLR(I)                         DEMS1410
380 RETURN                                                            DEMS1415
    END                                                               DEMS1420
```

FIGURE 6 (Continued)

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```
*
$IBFTC DEARIV  DECK                                                    DEARC000
```

FIGURE 6 (Continued)

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DEARIV - EFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINE DEARI                                                  DEAR0005
C**** STAGEGEOM FOR NORITAKE  DEAERATOR AND    421 DEMISTER  10/12/65   DEAR0010
      COMMON/GEN/CASE,G,RP, XRP,P,XC,C,XU,CR,XCR, ROE,ROER              DEAR0015
      COMMON/TEMPC/TSTEAM,TS(100), THF,TR,XTB,        TC,TP,TA,CC,CP    DEAR0020
      COMMON/GEOME/AMODU,ALEV,AUNIT,TOTALE,TOTALR,FREEC,TRAYDP,HST,CL,  DEAR0025
     1SPL                                                               DEAR0030
      COMMON/ECON/SMALLE,SMALLD,SMALLB,SMALLP,RATEIN,WPL, CAPF,THERM,   DEAR0035
     1PMSTMC                                                            DEAR0040
      COMMON/TUBING/ DOH,DIH,DOE,DIE,DOR,DIR,A1,A2,A3,BIKTH,BIKTE,      DEAR0045
     1BIKTR,CSLTBH,CSLTBP,CSLTBR                                        DEAR0050
      COMMON/FOULIN/RH,RE,RSR,SH,SE,SR,VH,VE,VR                         DEAR0055
      COMMON/PUMPHT/HD,HH,HBL,HPR,FFHL,SSFI                             DEAR0060
      COMMON/AMISC/CPSTR,FACID,ACACID,DPLIM,A6,A7,XSOC,XNNN,NNN,XLLL,LLLDEAR0065
      COMMON/DATA1/BDEPH,DTPD,SSF2,TOTAL,UMAX,UALP,PI,TWFA,TSTH,COEFA,  DEAR0070
     1ORITE,ITER                                                        DEAR0075
      COMMON/AZ1/DTPDP(100),TITLE(15)                                   DEAR0080
      COMMON/TCVL1/ ACPSN, ACPSNK, ACPTNK,CPBT,CPTK, CPTNK,AMBN,TCF,WX, DEAR0085
     1WF,WO,CB,WC,WB, WR,RHONK, RHOK, ERR,CCF, NITER, NK,NTOTAL, PN,RPN,DEAR0090
     2TC, ALPHA1, WPN, DELCT, DELST, IGSC, SMAQ, SUMA, TK               DEAR0095
      COMMON/TCVL2/ TTD(100),SMT(100), SMT2(100), CT(100), WS(100),     DEAR0100
     1C(100), TV(100), WV(100), QH(100), WP(100), AS(100),SLS(100)      DEAR0105
      COMMON/STAGE1/ A(100),CFMWV(100), CFMWZ(100), UBAR(100), CM(100), DEAR0110
     1HO(100),HI(100),WWFS(100),VVEV(100), TRAYFL(100),TRAYWC(100),     DEAR0115
     2RESIDT(100), PV(100),DELP(100), DTPDPS(100)                       DEAR0120
      COMMON/DMSTI/ AREADM(100),DPTDM(100),DTDM(100), CPROD(100),WIDDM(1DEAR0125
     100)                                                               DEAR0130
      COMMON/COND1/ DPINIT(100), DTINIT(100), DPCLR(100), DTCLR(100),   DEAR0135
     1DTCND(100)                                                        DEAR0140
      COMMON/STAGE2/ AH, BAROM,BWE,BWR,COSTDM,ELE,ESHELL,HBH,HBLE,HBLR, DEAR0145
     1HLH, HNOE, HNOR,HN, HSTE, HSTR, JJ, KK, RLR, RSHELL, TBNOE,TBNOR, DEAR0150
     2UBARH, VBLE,VBLR,VNOE, VNOR, WTME, WTMR, WY                       DEAR0155
      COMMON/PHYS/II                                                    DEAR0160
      COMMON /MAIN1/ SSF, HFG                                           DEAR0165
      COMMON /STG1/ ATR, BTR, CTR, CTA                                  DEAR0170
      COMMON /STG2/HOH, PR, DENBR(100), SUMLS, WVST(100), DO, DI, R, S, DEAR0175
     1 V, TVTT(100), Z(100), HV, HS(100), WBS(100)                      DEAR0180
      COMMON /CST1/ ASIEV, ANPLAT, SLPLAT, APLAT                        DEAR0185
      COMMON /CNDR1/ NERR,        COOR(3), K                            DEAR0190
      COMMON /DEM1/ SLKP2, SUMDMA, TDMP(100), APTSE, VCLM, APTSR        DEAR0195
      COMMON /DEA10/ RNR                                                DEAR0200
      COMMON/STG21/TRAYLN,SLDEA,GR,WVKEEP,TTRAY,WVDEAI                  DEAR0205
      YPSAT(Q000FL) #EXP(CTR + BTR/Q000FL+ ATR/ (Q000FL*Q000FL))        DEAR0210    2
      FTIH(Q001FL)#2.1786818-.70443622E-01*Q001FL+.93941286E-03*Q001FL**DEAR0215
     12-.53958083E-05*Q001FL**3+.18139197E-07*Q001FL**4                 DEAR0220
      HFGH(Q002FL)#1093.88-0.5703*Q002FL+1.2819E-4*Q002FL**2-0.8824E-6*QDEAR0225
     1002FL**3                                                          DEAR0230
      I#NTOTAL                                                          DEAR0235
      SLKPI#SLS(NTOTAL)                                                 DEAR0240
      CALL BOPR (TS(  I   ),C(I),BPR)                                   DEAR0245    13
      TRAYLN # SLS(NTOTAL) -0.5 + TSTH /12.0                            DEAR0250
      NTOTI # NTOTAL + 1                                                DEAR0255
      I # NTOTI                                                         DEAR0260
      KNTTV#0.0                                                         DEAR0265
      TVLAST#TS(  I     )-BPR-0.5                                       DEAR0270
      TVLASX#TVLAST+459.69                                              DEAR0275
```

FIGURE 6 (Continued)

```
      PVLAST#YPSAT(TVLASX)                                              DEAR0280
      PVTRAY#PVLAST-2.0*0.0542                                          DEAR0285
      PVTRAY#PVLAST                                                     DEAR0290
      SMTI#TVLAST                                                       DEAR0295
      SMTIX#TVLAST+459.69                                               DEAR0300
  100 FTI#YPSAT(SMTIX)-PVTRAY                                           DEAR0305
      FTIP#(-BTR/SMTIX**2 - 2.0 *ATR/ SMTIX**3)*PVTRAY                  DEAR0310
      TVTRAY#SMTI                                                       DEAR0315
      IF(ABS(FTI)/(PVLAST     -PVTRAY)-0.001)120,105,105                DEAR0320
  105 SMTI#SMTI-FTI/FTIP                                                DEAR0325
      SMTIX#SMTI + 459.69                                               DEAR0330
      KNTTV#KNTTV+1                                                     DEAR0335
      IF(15-KNTTV)110,110,100                                           DEAR0340
  110 WRITE (6,8000)                                                    DEAR0345    25
 8000 FORMAT( 68H TROUBLE IN DEAERATOR.  TV CALC WONT CONVERGE AFTER 50 DEAR0350
     1 ITERATIONS                )                                      DEAR0355
      WRITE (6,8005)KNTTV,FTI,FTIP,SMTI,PVLAST,PVTRAY                   DEAR0360    26
 8005 FORMAT(1H0I4,7E16.8)                                              DEAR0365
      ERR#954.0                                                         DEAR0370
  115 RETURN                                                            DEAR0375
  120 TVDEA#TVTRAY-DTPDP(NTOTI )                                        DEAR0380
      CALL BOPR (TB,CO        ,BPR)                                     DEAR0385    30
      TTRAY#TVTRAY + BPR                                                DEAR0390
      IF(TTRAY-TB)130,130,125                                           DEAR0395
  125 TTRAY#TB                                                          DEAR0400
      TVTRAY#TTRAY-BPR                                                  DEAR0405
      TVDEA # TVTRAY -DTPDP(NTOTI)                                      DEAR0410
      PVTRAY#2.1786818-.70443622E-01*TVTRAY+.93941286E-03*TVTRAY**2-.539DEAR0415
     158083E-05*TVTRAY**3+.18139197E-07*TVTRAY**4                       DEAR0420
      WRITE (6,8010)PVTRAY,PVLAST                                       DEAR0425    35
 8010 FORMAT (1H0 4X 9HPVTRAY #  , E16.8, 4X 9HPVLAST #   , E16.8)      DEAR0430
  130 TV(NTOTI+1)#TVDEA                                                 DEAR0435
      TV (NTOTI +1) # TVDEA                                             DEAR0440
      TVX#TV(I+1)+ 459.69                                               DEAR0445
      PV(I)# YPSAT(TVX)                                                 DEAR0450
      HFG#HFGH(TB)                                                      DEAR0455
      IF(TTRAY- TB)140,140,135                                          DEAR0460
  135 WVDEA1#0.0                                                        DEAR0465
      II#1                                                              DEAR0470
      CALL DINTPL(TB, CO, CPZ)                                          DEAR0475    44
      WVDEA2#(WB+WX)/320.0+(WB+WX) * (TTRAY -TB) *CPZ / HFG             DEAR0480
      GO TO 145                                                         DEAR0485
  140 II#2                                                              DEAR0490
      CALLDINTPL(TB,CO        ,HTB)                                     DEAR0495    49
      CALLDINTPL( TTRAY,CO        ,HTVT)                                DEAR0500    51
      WVDEA1#((WB+WX)*(HTB-HTVT))                                       DEAR0505
     1/(HFG+(HTB-HTVT))                                                 DEAR0510
      WVDEA2#(WB+WX)/320.0                                              DEAR0515
  145 WVKEEP#WV(NTOTAL)                                                 DEAR0520
      DEAR#1.0                                                          DEAR0525
      WV(NTOTAL) # WV(NTOTAL) - WVDEA2 - WVDEA1                         DEAR0530
      WVST(NTOTAL)#WV(NTOTAL)/(AMODU*ALEV)                              DEAR0535
      IF(WV(NTOTAL))150,150,165                                         DEAR0540
  150 WVDE1P#WVDEA1                                                     DEAR0545
      WVDE2P#WVDEA2                                                     DEAR0550
      WVDEA2 #    WVKEEP    -WVDEA1                                     DEAR0555
```

FIGURE 6 (Continued)

```
      WRITE (6,8015)WVKEEP, WVDE1P, WVDE2P, WV (NTOTAL), WVDEA2          DEAR0560     62
 8015 FORMAT(44H0WVDEA1 + WVDEA2 IS GREATER THAN WV(NTOTAL)  /1H 5E16.8)DEAR0565
      WV(NTOTAL)#0.0                                                     DEAR0570
      WVST (NTOTAL) # 0.0                                                DEAR0575
      IF(WVDEA2)155,155,160                                              DEAR0580
  155 WVDEA2#0.0                                                         DEAR0585
      WVDEA1#WVKEEP                                                      DEAR0590
      WRITE (6,8020)WVDE1P, WVKEEP                                       DEAR0595     68
 8020 FORMAT (35H0WVDEA1 IS GREATER THAN WV(NTOTAL)  /1H  2E16.8)        DEAR0600
  160 CONTINUE                                                           DEAR0605
      DEAR#(WVDE2P + WVDE1P)/WVKEEP                                      DEAR0610
  165 WV(NTOTI      ) # WVDEA2 + WVDEA1                                  DEAR0615
      WVST(I)#WV(I)/(AMODU*ALEV)                                         DEAR0620
      QDEA#(WVDEA1+WVDEA2)*HFGH(TVDEA)                                   DEAR0625
      QH(NTOTI    )#QDEA                                                DEAR0630
      QH(NTOTAL)#QH(NTOTAL)-QH(NTOTI    )                               DEAR0635
      II#1                                                               DEAR0640
      CALLDINTPL(TO,C(NTOTAL),CPTO)                                      DEAR0645     80
      SMTDEA#TO+QDEA/(WO*CPTO)                                           DEAR0650
      IF(TVDEA-SMTDEA)170,170,175                                        DEAR0655
  170 WRITE (6,8025)SMTDEA, TVDEA                                        DEAR0660     83
 8025 FORMAT(     30H0 SMTDEA IS GREATER THAN TVDEA       3E16.8)        DEAR0665
      SMTDEA#TVDEA-5.0                                                   DEAR0670
  175 SMT2 (NTOTI ) # SMTDEA                                             DEAR0675
      SMT(I)#TO                                                          DEAR0680
      CT(NTOTAL+1)#CT(NTOTAL)                                            DEAR0685
      CALL UBARHM(I, UBRDEA)                                             DEAR0690     89
      UBAR (I) # 1.0/UBRDEA + 0.667 / HC (I)                             DEAR0695
      UBAR (I) # 1.0 / UBAR (I)                                          DEAR0700
      ADEA#(QDEA*ALOG((TVDEA-TO)/(TVDEA-SMTDEA)))                        DEAR0705
     1/(UBAR(I)*(SMTDEA-TO))                                             DEAR0710     95
      ADEA#ADEA*DEAR                                                     DEAR0715
      AS(NTOTI    )#ADEA                                                 DEAR0720
      RNR#576.0*WO/(PI*DIR**2*GR)                                        DEAR0725
      SLDEA#ADEA/(PI*DOR/12.0*RNR)                                       DEAR0730
      SLS(I   )#SLDEA                                                    DEAR0735
      WP(NTOTI    )#WP(NTOTAL)+WV(NTOTAL)                                DEAR0740
      WP(NTOTI +1)#WP(NTOTI    )+WV(NTOTI    )                           DEAR0745
      Z(NTOTI)#12.0*AS(NTOTI)/(DO *PI*SLS(NTOTI))                        DEAR0750
      I # NTOTAL                                                         DEAR0755
      SMT (I)#SMTDEA                                                     DEAR0760
      CALL UBARHM(I,UBARZ)                                               DEAR0765    110
      UBAR (I) # UBARZ                                                   DEAR0770
      CT(I+1)#CT(I)                                                      DEAR0775
      WVST(I)#WV(I)/(AMODU*ALEV)                                         DEAR0780
      IF(WV(I))180,180,185                                               DEAR0785
  180 ALAST#0.0                                                          DEAR0790
      AS(I)#ALAST                                                        DEAR0795
      SLS(NTOTAL)# 0.0                                                   DEAR0800
      Z(NTOTAL)#0.0                                                      DEAR0805
      GO TO 195                                                          DEAR0810
  185 ALAST#WO*CPTO*ALOG((TV(NTOTI)-SMTDEA)/(TV(NTOTI)-SMT2(NTOTAL)) )/UDEAR0815
     1BAR(NTOTAL)                                                        DEAR0820    128
  190 AS(I)#ALAST                                                        DEAR0825
      SLS(NTOTAL)#ALAST/(PI*DOR/12.0*RNR)                                DEAR0830
      Z(I)#12.0*AS(I)/(DO *PI*SLS(I))                                    DEAR0835
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
        DEARIV     -  EFN   SOURCE STATEMENT  -  IFN(S)  -

195 RETURN                                                          DEARC840
    END                                                             DEARC845
```

FIGURE 6 (Continued)

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```
$ORIGIN        COSTLY                                    UCALCDDC
$IBFTC UCALCM  DECK                                      UCALCCC5
```

FIGURE 6 (Continued)

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UCALCM - EFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINE UCALC(UDELT,TUBLEN,T,CMT,ZUBAR)                        UCALC01C
C     UBAR VALUE BASED ON ACTUAL AREA                                   UCALC01S
C     UBAR VALUE BASED ON K#125, 65 WALL                                UCALC02C
C     A RUBBER BAND/A REAL#1.28                                         UCALC02S
       BAR#CMT                                                          UCALC03C
      ITUBLN#TUBLEN                                                     UCALC03S
      IF(ITUBLN.GT.5) GOTO100                                           UCALC04C
      CFN2#1.0/(0.6736 + 0.001088 * T    )                              UCALC04S
      GO TO 105                                                         UCALC05C
  100 CFN2#1.0                                                          UCALC05S
  105 CONTINUE                                                          UCALC06C
C     FIT A FOR LOW TEMPERATURES                                        UCALC06S
C**** FIT A FOR TEMP. RANGE  100 TO 300                                 UCALC07C
C***  VERTICAL DOUBLE FLUTED TUBES, OLIN ALLOY, 12/12/66                UCALC07S
      A1# 0.94598989E+03                                                UCALC08C
      A2# 0.55243699E+01                                                UCALC08S
      A3#-0.11646098E+05                                                UCALC09C
      A4#-0.45611828E+02                                                UCALC09S
      A5# 0.79308461E-02                                                UCALC10C
      A6# 0.20333492E+06                                                UCALC10S
      A7#+0.39411727E+01                                                UCALC11C
      A8#-0.25223411E+00                                                UCALC11S
      A9 #-0.28923398E-04                                               UCALC12C
      A10#-0.16531411E+07                                               UCALC12S
      A11# 0.41778945E+04                                               UCALC13C
      A12# 0.83445326E-03                                               UCALC13S
      A13# 0.56979017E+01                                               UCALC14C
      A14#-0.43195339E+02                                               UCALC14S
      A15#-0.14243670E-01                                               UCALC15C
      A16# 0.88897284E-01                                               UCALC15S
      Y#T                                                               UCALC16C
      IF(Y.LT.100.)GOTO 130                                             UCALC16S
  110 Z#BAR                                                             UCALC17C
      IF(Z.LE..1008) GOTO 125                                           UCALC17S
      IJK#0                                                             UCALC18C
      Z#.1008                                                           UCALC18S
  115 X#A1+A2*Y +A3*Z +A4*Z *Y +A5*Y **2+A6*Z **2                       UCALC19C
     1+A7*Y * Z**2+A8*Y **2*Z +A9*Y **3+A10*Z **3                       UCALC19S
     2+A11*Y *Z **3+A12*Y **3*Z +A13*Y **2*Z **2                        UCALC20C
     3+A14*Y **2*Z **3+A15*Y **3*Z **2+A16*Y **3*Z **3                  UCALC20S
      IF(IJK.EQ.0)GOTO120                                               UCALC21C
      URBC2#X                                                           UCALC21S
      DUDC#(URBC1-URBC2)/.0008                                          UCALC22C
      URBC#URBC1+(BAR-.1008)*DUDC                                       UCALC22S
      GO TO 135                                                         UCALC23C
  120 URBC1#X                                                           UCALC23S
      Z#.1000                                                           UCALC24C
      IJK#1                                                             UCALC24S
      GO TO 115                                                         UCALC25C
  125 X#A1+A2*Y +A3*Z +A4*Z *Y +A5*Y **2+A6*Z **2                       UCALC25S
     1+A7*Y * Z**2+A8*Y **2*Z +A9*Y **3+A10*Z **3                       UCALC26C
     2+A11*Y *Z **3+A12*Y **3*Z +A13*Y **2*Z **2                        UCALC26S
     3+A14*Y **2*Z **3+A15*Y **3*Z **2+A16*Y **3*Z **3                  UCALC27C
      URBC#X                                                            UCALC27S
      GO TO 135                                                         UCALC28C
  130 WRITE(6,8000)Y                                                    UCALC28S   26
 8000 FORMAT(3H T#E16.8)                                                UCALC29C
      Y#100.                                                            UCALC29S
      GO TO 110                                                         UCALC30C
  135 CONTINUE                                                          UCALC30S
      CFN1#1.0                                                          UCALC31C
      AKFT#125.0                                                        UCALC31S
C     RATIO ACTUAL AREA/RUBBER BAND # 1.28                              UCALC32C
      CFN3#(1.0/URBC)/(1.0/URBC -0.000043 +(0.000043*125.0)/AKFT)       UCALC32S
       ZUBAR   #URBC*CFN1 *CFN2 *CFN3                                   UCALC33C
      RETURN                                                            UCALC33S
      END                                                               UCALC34C
```

FIGURE 6 (Continued)

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*
$IBFTC CHKTBI  DECK                                                    CHKTCCCC
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FIGURE 6 (Continued)

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CHKTB1 - EFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINE CHKTB (RP,TB,FF,CO,CR,CP,DT  ,TC,TBMICK)                CHKTC005
      COMMON/PHYS/II                                                     CHKTC010
      DTPD#DT+0.5                                                        CHKTC015
      WP#.344432 *FF                                                     CHKTC020
      CB#CR*CO                                                           CHKTC025
      WB#WP*(CO-CP)/(CB-CO)                                              CHKTC030
      II#2                                                               CHKTC035
      CALL DINTPL( TO,CO,X1)                                             CHKTC040    3
      TBA#TB                                                             CHKTC045
  100 CALL BOPR(TBA,CB,BPR)                                              CHKTC050    6
      TPA#TBA-BPR-DTPD                                                   CHKTC055
      CALL DINTPL(TPA,CP,X3)                                             CHKTC060    8
      CALL DINTPL(TPA,CB,X2)                                             CHKTC065    10
      DMICK#X2-X3                                                        CHKTC070
      CALL DINTPL(TBA,CB,X4)                                             CHKTC075    12
      CMICK#(X4-X2)/(TBA-TPA)                                            CHKTC080
      CRX# WP/(WP+WB)                                                    CHKTC085
      HMICK#1000.0*CRX /RP + (CMICK *(TBA -TPA) +DMICK)*CRX +X1          CHKTC090
      TPMICK#90.0                                                        CHKTC095
      CALL DINTPL (TPMICK,CB,YMICK)                                      CHKTC100    14
      TPCOLE #TPMICK +5.0                                                CHKTC105
  105 II#2                                                               CHKTC110
      CALL DINTPL(TPCOLE,CB,YCOLE)                                       CHKTC115    18
      IF(ABS((HMICK-YCOLE)/HMICK)-0.00001)115,110,110                    CHKTC120
  110 TLEON # TPCOLE -(HMICK-YCOLE)*(TPMICK-TPCOLE)/(YCOLE-YMICK)        CHKTC125
      TPMICK#TPCOLE                                                      CHKTC130
      YMICK#YCOLE                                                        CHKTC135
      TPCOLE#TLEON                                                       CHKTC140
      GO TO105                                                           CHKTC145
  115 TBMICK#TPCOLE                                                      CHKTC150
      IF(ABS((TBMICK-TBA)/TBMICK)-0.00001)125,120,120                    CHKTC155
  120 TBA#TBMICK                                                         CHKTC160
      GO TO 100                                                          CHKTC165
  125 CONTINUE                                                           CHKTC170
      RETURN                                                             CHKTC175
      END                                                                CHKTC180
```

FIGURE 6 (Continued)

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```
*
$IBFTC PSIAA    DECK                                                    PSIACOOC
```

FIGURE 6 (Continued)

09/26/67

PSIAA - EFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINE PSIA(TF,P)                                             PSIAC005
      T#(TF+459.69)/1.8                                                 PSIAC010
      IF(TF.LE.122.)GOTO100                                             PSIAC015
      A#3.346313                                                        PSIAC020
      B#4.14113E-2                                                      PSIAC025
      C#7.515484E-9                                                     PSIAC030
      D#1.3794481E-2                                                    PSIAC035
      E#6.56444E-11                                                     PSIAC040
      X#647.27-T                                                        PSIAC045
      P#14.6959*218.167/EXP((2.3025851*X/T)*((A+B*X                     PSIAC050
     1+C*X**3+E*X**4)/(1.+D*X)))                                        PSIAC055    5
      GOTO105                                                           PSIAC060
  100 CONTINUE                                                          PSIAC065
      X#647.27-T                                                        PSIAC070
      A#3.2437814                                                       PSIAC075
      B#5.86826E-3                                                      PSIAC080
      C#1.1702379E-8                                                    PSIAC085
      D#2.1878462E-3                                                    PSIAC090
      P#14.6959*218.167/EXP((2.3025851*X/T)*((A+P*X+                    PSIAC095
     1C*X**3)/(1.+D*X)))                                                PSIAC100    8
  105 RETURN                                                            PSIAC105
      END                                                               PSIAC110
```

FIGURE 6 (Continued)

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```
*
$IBFTC VAPTSS  DECK                                                    VAPTCCOC
```

FIGURE 6 (Continued)

09/26/67

VAPTSS - EFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINE VAPTS(P,S,T)                                          VAPTC005
      ZED#.57477*ALOG10(P)-3.2949+.93551*S+.32531*S**2                 VAPTC01C     2
      A2#440.-24.86*S                                                  VAPTC015
      A1#477.3+70.*S                                                   VAPTC02C
      A0#203.                                                          VAPTC025
      T#A0+A1*ZED+A2*ZED**2                                            VAPTC03C
      CP#1./(-9.513+11.342*S-2.736*S**2)                               VAPTC035
  100 CALL VAPS(T,P,SC)                                                VAPTC04C     4
      DELS#SC-S                                                        VAPTC045
      DELT#-(T+459.69)*DELS*(1.+DELS/(2.*CP))/CP                       VAPTC05C
      IF(ABS(DELT).LT..005)GOTO105                                     VAPTC055
      T#T+DELT                                                         VAPTC06C
      GOTO100                                                          VAPTC065
  105 RETURN                                                           VAPTC07C
      END                                                              VAPTC075
```

FIGURE 6 (Continued)

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```
*
$IBFTC VAPTHF  DECK                                                    VAPTCCCC
```

FIGURE 6 (Continued)

09/26/67

VAPTHH - EFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINE VAPTH(P,H,T)                                           VAPTC005
      A0#-2827.7                                                        VAPTC010
      A1#3.0391                                                         VAPTC015
      A2#-.00035413                                                     VAPTC020
      B0#24.318                                                         VAPTC025
      B1#-.071479                                                       VAPTC030
      B2#.45305E-4                                                      VAPTC035
      T#A0+A1*H+A2*H**2+P/(B0+B1*H+B2*H**2)                             VAPTC040
      CPIV#A1+2.*A2*H-P*(B1+2.*B2*H)/(B0+B1*H+B2*H**2)**2               VAPTC045
  100 CALL VAPH(T,P,HC)                                                 VAPTC050    3
      DELT#CPIV*(H-HC)                                                  VAPTC055
      IF(ABS(DELT).LT..005)GOTO105                                      VAPTC060
      T#T+DELT                                                          VAPTC065
      GOTO100                                                           VAPTC070
  105 RETURN                                                            VAPTC075
      END                                                               VAPTC080
```

FIGURE 6 (Continued)

09/26/67

```
*
$IBFTC VAPVV    DECK                                                    VAPVC000
```

FIGURE 6 (Continued)

09/26/67

VAPVV - EFN SOURCE STATEMENT - IFN(S) -

```
SUBROUTINE VAPV(TS,PS,V)                                    VAPVC005
P#PS/14.6959                                                VAPVC010
T#(TS+459.69)/1.8                                           VAPVC015
TAU#1./T                                                    VAPVC020
B0#1.89-2641.62*TAU*10.**(8087C.*TAU**2)                    VAPVC025   2
G1#82.546*TAU-1.6246E5*TAU**2                               VAPVC030
G2#.21828-1.2697E5*TAU**2                                   VAPVC035
G3#3.635E-4-6.768*(TAU**3*1.CE8)**8                         VAPVC040   3
PHE1#B0**2*G1*TAU                                           VAPVC045
PHE3#B0**4*G2*TAU**3                                        VAPVC050
PHE12#B0**13*G3*TAU**12                                     VAPVC055   4     5
PHE12#-PHE12                                                VAPVC060
B#B0+PHE1*P+PHE3*P**3+PHE12*P**12                           VAPVC065   6
VC#4.55504*T/P+B                                            VAPVC070
V#(1./62.428)*VC                                            VAPVC075
RETURN                                                      VAPVC080
END                                                         VAPVC085
```

FIGURE 6 (Continued)

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```
*
$IBFTC VAPHH    DECK                                                    VAPHCCDC
```

FIGURE 6 (Continued)

09/26/67

VAPHH - EFN SOURCE STATEMENT - IFN(S) -

```
 SUBROUTINE VAPH(TS,PS,H)                                          VAPH0005
 P#PS/14.6959                                                      VAPH0010
 T#(TS+459.69)/1.8                                                 VAPH0015
 TAU#1./T                                                          VAPH0020
 B0#1.89-2641.62*TAU*10.**(8087C.*TAU**2)                          VAPH0025    2
 DB0#-2641.62*10.**(8C87C.*TAU**2)*(2.3025851*8087C.*2.*TAU**2     VAPH0030
1+1.)                                                              VAPH0035    3
 G1#82.546*TAU-1.6246E5*TAU**2                                     VAPH0040
 DG1#82.546-2.*1.6246E5*TAU                                        VAPH0045
 G2#.21828-1.2697E5*TAU**2                                         VAPH0050
 DG2#-2.*1.2697E5*TAU                                              VAPH0055
 G3#3.635E-4-6.768*(TAU**3*1.CE8)**8                               VAPH0060    4       5
 DG3 # -24.*6.768*(1.E8*TAU**3)**8/TAU                             VAPH0065    6       7
 F0#B0+TAU*DB0                                                     VAPH0070
 F1#B0**2*G1*TAU+TAU*B0**2*G1+TAU**2*B0**2*DG1                     VAPH0075
1+2.*TAU**2*B0*G1*DB0                                              VAPH0080
 F3#B0**4*G2*TAU**3+3.*TAU**3*BC**4*G2+TAU**4                      VAPH0085
1*B0**4*DG2+4.*B0**3*TAU**4*G2*DB0                                 VAPH0090    8       9
 F12#TAU**12*B0**13*G3+12.*TAU**12*B0**13*G3+                      VAPH0095
1TAU**13*B0**13*DG3+13.*TAU**13*B0**12*G3*DB0                      VAPH0100    10      11      12
 F12#-F12                                                          VAPH0105
 FP#(1.0E4/1012.95)*(1.472*(T-273.16)+(7.5566E-4/2.)*(T**2-        VAPH0110
1273.16**2)+47.8365*ALOG(T/273.16)+2502.36)                        VAPH0115    14
 HC#F0*P+F1*P**2/2.+F3*P**4/4.+F12*P**13/13.                       VAPH0120
1+FP                                                               VAPH0125    15
 H#(435.57/10000.)*HC                                              VAPH0130
 RETURN                                                            VAPH0135
 END                                                               VAPH0140
```

FIGURE 6 (Continued)

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```
*
$IBFTC VAPSS   DECK                                                    VAPSCCCC
```

FIGURE 6 (Continued)

09/26/67

VAPSS - EFN SOURCE STATEMENT - IFN(S) -

```
 SUBROUTINE VAPS(TS,PS,S)                                          VAPSC005
 REAL MO,M1,M3,M12                                                 VAPSC010
 P#PS/14.6959                                                      VAPSC015
 T#(TS+459.69)/1.8                                                 VAPSC020
 TAU#1./T                                                          VAPSC025
 BO#1.89-2641.62*TAU*10.**(80870.*TAU**2)                          VAPSC030    2
 DBO#-2641.62*10.**(80870.*TAU**2)*(2.3025851*80870.*2.*TAU**2     VAPSC035
1+1.)                                                              VAPSC040    3
 G1#82.546*TAU-1.6246E5*TAU**2                                     VAPSC045
 DG1#82.546-2.*1.6246E5*TAU                                        VAPSC050
 G2#.21828-1.2697E5*TAU**2                                         VAPSC055
 DG2#-2.*1.2697E5*TAU                                              VAPSC060
 G3#3.635E-4-6.768*(TAU**3*1.0E8)**8                               VAPSC065    4     5
 DG3 # -24.*6.768*(1.E8*TAU**3)**8/TAU                             VAPSC070    6     7
 FO#BO+TAU*DBO                                                     VAPSC075
 F1#BO**2*G1*TAU+TAU*BO**2*G1+TAU**2*BO**2*DG1                     VAPSC080
1+2.*TAU**2*BO*G1*DBO                                              VAPSC085
 F3#BO**4*G2*TAU**3+3.*TAU**3*BO**4*G2+TAU**4                      VAPSC090
1*BO**4*DG2+4.*BO**3*TAU**4*G2*DBO                                 VAPSC095    8     9
 F12#TAU**12*BO**13*G3+12.*TAU**12*BO**13*G3+                      VAPSC100
1TAU**13*BO**13*DG3+13.*TAU**13*BO**12*G3*DBO                      VAPSC105    10    11    12
 F12#-F12                                                          VAPSC110
 PHE1#BO**2*G1*TAU                                                 VAPSC115
 PHE3#BO**4*G2*TAU**3                                              VAPSC120    14
 PHE12#BO**13*G3*TAU**12                                           VAPSC125    15    16
 PHE12#-PHE12                                                      VAPSC130
 MO#(FO-BO)*TAU                                                    VAPSC135
 M1#(F1-PHE1)*TAU                                                  VAPSC140
 M3#(F3-PHE3)*TAU                                                  VAPSC145
 M12#(F12-PHE12)*TAU                                               VAPSC150
 SC#-4.55504*ALOG(P)+MO*P+M1*P**2/2.+M3*P**4/4.                    VAPSC155
1+M12*P**13/13.+(10000./1012.95)*(1.472*ALOG(T)+                   VAPSC160
27.5566E-4*T-47.8365/T-1.48847)                                    VAPSC165    17    18    19
 S#(435.57/18000.)*SC                                              VAPSC170
 RETURN                                                            VAPSC175
 END                                                               VAPSC180
```

FIGURE 6 (Continued)

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```
$ORIGIN        COSTLY                                    SMAPCCCC
$IBFTC SMAP1   DECK                                      SMAPCCCS
```

FIGURE 6 (Continued)

09/26/67

SMAP I - EFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINE SMAP (WPL,CSLTUB,RATEIN,SMAPP)                         SMAPC01C
      IF(WPL-CSLTUB)105,100,105                                         SMAPC01S
  100 SMAPP#0.0                                                         SMAPC02C
      GO TO 125                                                         SMAPC02S
  105 TERP#WPL/CSLTUB                                                   SMAPC03C
      SUMI#0.0                                                          SMAPC03S
      ITERP#TERP                                                        SMAPC04C
      IF(TERP-FLOAT(ITERP))115,110,115                                  SMAPC04S
  110 ITERP#ITERP-1                                                     SMAPC05C
  115 DO 120 I#1,ITERP                                                  SMAPC05S
  120 SUMI#SUMI+(1.0+RATEIN)**(WPL-FLOAT(I)*CSLTUB)                     SMAPC06C    14
      SMAPP#RATEIN*SUMI/((1.0+RATEIN)**WPL-1.0)                         SMAPC06S    17
  125 RETURN                                                            SMAPC07C
      END                                                               SMAPC07S
```

FIGURE 6 (Continued)

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```
*
$IBFTC COS      DECK                                                    COS00000
```

FIGURE 6 (Continued)

```
 SUBROUTINE COST(JJ)                                                    COS00005
 COMMON/MAR22/GTOT                                                      COS00010
 COMMON/GEN/CASE,G,RP, XRP,P,XO,G,XU,CR,XCR, ROE,ROER                   COS00015
 COMMON/TEMPC/TSTEAM,TS(100), THF,TB,XTB,        TC,TP,TA,CO,CP         COS00020
 COMMON/GEOME/AMODU,ALEV,AUNIT,TOTALE,TOTALR,FREBD,TRAYDP,HST,CL,       COS00025
1SPL                                                                    COS00030
 COMMON/ECON/SMALLE,SMALLD,SMALLR,SMALLP,RATEIN,WPL, CAPF,THERM,        COS00035
1PMSTMC                                                                 COS00040
 COMMON/TUBING/ DOH,DIH,DOE,DIE,DOR,DIR,A1,A2,A3,BIKTH,BIKTE,           COS00045
1BIKTR,CSLTBH,CSLTBP,CSLTBR                                             COS00050
 COMMON/FOULIN/RH,RE,RSR,SH,SE,SR,VH,VE,VR                              COS00055
 COMMON/PUMPHT/HD,HH,HBL,HPR,FFHL,SSFI                                  COS00060
 COMMON/AMISC/CPSTB,FACID,ACACID,DPLIM,A6,A7,XSOD,XNNN,NNN,XLLL,LLL COS00065
 COMMON/DATAI/BDEPH,DTPD,SSF2,TOTAL,UMAX,UALP,PI,TWFA,TSTH,COEFA,       COS00070
1ORITE,ITER                                                             COS00075
 COMMON/AZI/DTPDP(100),TITLE(15)                                        COS00080
 COMMON/TCVL1/ ACPSN, ACPSNK, ACPTNK,CPBT,CPTK, CPTNK,AMBN,TCF,WX,      COS00085
1WF,WO,CB,WC,WB, WR,RHONK, RHOK, ERR,CCF, NITER, NK,NTOTAL, PN,RPN,COS00090
2TC, ALPHA1, WPN, DELCT, DELST, IGSC, SMAQ, SUMA, TK                    COS00095
 COMMON/TCVL2/ TTD(100),SMT(100), SMT2(100), CT(100), WS(100),          COS00100
1C(100), TV(100), WV(100), OH(100), WP(100), AS(100),SLS(100)           COS00105
 COMMON/STAGE1/ A(100),CFMWV(100), CFMWZ(100), UPAR(100), CM(100),      COS00110
1FO(100),HI(100),WWFS(100),VVEV(100), TRAYFL(100),TRAYWD(100),          COS00115
2RESIDT(100), PV(100),DELP(100), DTPDPS(100)                            COS00120
 COMMON/DMSTI/ AREADM(100),DPTDM(100),DTDM(100), CPROD(100),WIDDM(1COS00125
1CO)                                                                    COS00130
 COMMON/CONDI/ DPINIT(100), DTINIT(100), DPCLR(100), DTCLR(100),        COS00135
1DTCND(100)                                                             COS00140
 COMMON/STAGE2/ AH, BAROM,BWE,BWR,COSTDM,ELE,ESHELL,HBH,HBLE,HBLR,      COS00145
1HLH, HNOE, HNOR,HN, HSTE, HSTR, JJ, KK, RLR, RSHELL, TBNOE,TBNOR,      COS00150
2UBARH, VBLE,VBLR,VNOE, VNOR, WTME, WTMR, WY                            COS00155
 COMMON/PHYS/II                                                         COS00160
 COMMON /MAIN1/ SSF, HFG                                                COS00165
 COMMON /STG1/ ATR, BTR, CTR, CTA                                       COS00170
 COMMON /STG2/HOH, PR, DENBR(100), SUMLS, WVST(100), DO, DI, R, S,      COS00175
1 V, TVTT(100), Z(100), HV, HS(100), WBS(100)                           COS00180
 COMMON /CST1/ ASIEV, ANPLAT, SLPLAT, APLAT                             COS00185
 COMMON /CNDR1/ NERR,        CCOR(3), K                                 COS00190
 COMMON /DEM1/ SLKP2, SUMDMA, TOMP(100), APTSE, VCLM, APTSR             COS00195
 COMMON /DEM3/ ARGZ(15)                                                 COS00200
 COMMON /DEAIC/ RNR                                                     COS00205
 COMMON /OP1/ SMAPPP, HR, SMAPPH, HE, UNARAR, UNARAE, A4, AJ, WCO,      COS00210
1 UBARE, UBARR, UTHE, AE, AR, ATHE, THEL, ENE, THEN, FFE, FFR, THEHCOS00215
2T, HC2, HC1, CC2, CC1, POCST2, POCST1, ALPEAR, PMC2, PMC1, CCCAP2,COS00220
3  CCCAP1, SITE2, SITE1,  WAIT2, WAIT1,  ES2, ES1,  EA2, EA1,          COS00225
4 BHC2,  BHC1,  VPC2,  VPC1,  UBPH,  EEC2,  EEC1,  PO,  CC2, CC1,      COS00230
5 SCM2,  SCM1,  CIBC2, CIBC1,  DEA2,  DEA1,  TC2,  TC1,  CAPI1,        COS00235
6 CAPI2,  CAPI3,  PO3,  HS1,  PMC,  EEC,  VPC,  SITE,  WAIT,            COS00240
7 ES,  EA,  CIBC,  BHC,  CCCAP,  CCSTIN,  WEIRC,  CRANE,  BLDG,         COS00245
8 DEACST,  PMCPO,  PMCFLO,  RETUB2,  RETUB1,  DPREQ(100), AMSC2,       COS00250
9 AMSC1                                                                 COS00255
 COMMON/NOV25/C11, C12, C13, C14, C15, C16,C21, C22, C23, C24, C31,COS00260
1 C32, C33, C34, C41, C42                                               COS00265
 COMMON/CSTLK/ADEA,ENITSD,WOCN,GPMP, FG, SMAPPR, DEARTB, EAR, EAE,TCOS00270
1CBH,AMBDAS                                                             COS00275
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
      COS        -  FEN   SOURCE STATEMENT  -  IFN(S)  -

      COMMON/CSTLKI/STTEW,CTUBED,CTUBEE,CTUBER,SMA1,SMA2,SUMLEV,TRBCND, COSCC280
     1ENITSR                                                           COSCC285
      COMMON/JAN31/KOUTPT                                              COSCC290
      GTV2(QCCOFL)                                                     COSCC295
     1        #2.1786818-.70443622E-01*QCCOFL+.93941286E-03*QCCOFL**2  COSCC300
     2-.53958083E-05*QCCOFL**3 +.18139197E-07*QCCOFL**4                COSCC305
      FGAD(QCC1FL)#EXP(0.0748167*ALOG(QCC1FL)+0.2138177*ALOG(QCC1FL)**2)COSCC310     4     5
      FLAD(QCC2FL)#0.74391/SQRT(QCC2FL)                                COSCC315     8
      COST1(QCC3FL, QCC4FL, QCC5FL) #C11 + C12 * QCC4FL+ C13 * QCC3FL+ CCOSCC320
     114 * QCC4FL* QCC3FL+ C15 * QCC5FL+ C16 * QCC4FL* QCC5FL          COSCC325
      COST2(QCC6FL, QCC7FL) #C21 + C22 * QCC6FL+ C23 * QCC7FL+ C24 * QCCCOSCC330
     16FL* QCC7FL                                                      COSCC335
      COST3(QCC8FL, QCC9FL) #C31 + C32 * QCC8FL+ C33 * QCC9FL+ C34 * QCCCOSCC340
     18FL* QCC9FL                                                      COSCC345
      COST4(QC10FL)#C41+C42*QC10FL                                     COSCC350
100   FORMAT (1H0 4X 19H DIV CHECK ON, I #      I4)                    COSCC355
      SMA1#A1                                                          COSCC360
      SMA2#A2                                                          COSCC365
      IF(KOUTPT.NE.1)GOTO100                                           COSCC370
      CALL AREA                                                        COSCC375    22
100   CALL SHELL                                                       COSCC380    24
      IF(KOUTPT.NE.1)GOTO265                                           COSCC385
                                                                       COSCC390
**    V.  SEAWATER INTAKE COST  REVISED  9/24/65                       COSCC395
105   IWAIT#5.0/AUNIT                                                  COSCC400
      AINTAK#1.0                                                       COSCC405
110   IYWAIT#0.002353*SQRT(WOCN/(AINTAK*8.0))                          COSCC410    32
      IF(IYWAIT-18)120,120,115                                         COSCC415
115   AINTAK#1.0+AINTAK                                                COSCC420
      GOTO 110                                                         COSCC425
120   YWAIT#FLOAT(IYWAIT)/15.0                                         COSCC430
      WAITSL#(1.2668 E-3       + 5.635 E-4       + 1.2915 E-3)* WOCN   COSCC435
     1       + 416.90 * 6000.0* YWAIT**1.90 * AINTAK** 0.97 *1.25     COSCC440
     2       + 244.08 * 6000.0* YWAIT **1.10 * AINTAK **0.80 *1.25    COSCC445    38    39    40    41
      WAIT1 # 154610.0+ 8.2245E-4 * WOCN                               COSCC450
      WAIT2 # 98000.0*2.0 * AINTAK                                     COSCC455
      WAIT3# 0.7178 * ( WOCN / AUNIT )**0.65 *AUNIT                    COSCC460    42
      WAIT4#  416.90 * 6000.0* YWAIT**1.90 * AINTAK** 0.97 *1.25       COSCC465    43    44
      WAIT5#  244.08 * 6000.0* YWAIT **1.10 * AINTAK **0.80 *1.25      COSCC470    45    46
      WAITSL # WAIT1 + WAIT 2 + WAIT3 + WAIT4 + WAIT5                  COSCC475
*     OPEN CHANNEL INTAKE SYSTEM  1/20/66                              COSCC480
      AINTAK # 1.0                                                     COSCC485
      WOUT # WOCN - WX                                                 COSCC490
125   IYWAIT # .002353 * SQRT(WOUT /(AINTAK * 6.0) )                   COSCC495    48
      IF ( IYWAIT - 18) 135,135,130                                    COSCC500
130   AINTAK # AINTAK + 1.0                                            COSCC505
      GO TO 125                                                        COSCC510
135   YWAIT # FLOAT(IYWAIT) / 15.0                                     COSCC515
      WAIT6 #  29768C.0+ 8.2245 E-4 * WOCN                             COSCC520
      WAIT7 # 436.92 * 1000.0*YWAIT **1.9 * AINTAK **0.86 * 1.25       COSCC525
     1        + 132.25 * 1000.0* YWAIT **1.1 * AINTAK **1.56 * 1.25    COSCC530    54    55    56    57
      WAIT8 # (138910.0+ 2.2518 E-5 * WOCN) * 1.25                     COSCC535
     1 + (124088C.0+ 3.1414 E-4 * WOCN) * 1.25                         COSCC540
      WAIT9 #  578870.0+ 2.3582 E-4 * (WOCN - WX)                      COSCC545
      WAIT10 # 48000.0* AINTAK                                         COSCC550
      WAIT11 # 1.0450 * (WOCN/AUNIT) ** 0.65 * AUNIT                   COSCC555    58
```

FIGURE 6 (Continued)

```
      WAITCH # WAIT6 + WAIT7 + WAIT8 + WAIT9 + WAIT10 + WAIT11
      AJP# 1.22
      IAJ # 0
  140 WAITS2 # WAITSL * SMALLP * AJP
      DREDGE # 75000.0
      WAITC2 # WAITCH * SMALLP * AJP+ DREDGE
  145 IF (WAITS2 - WAITC2)  150, 150,155
  150 WAIT # WAITSL
      DREDGE # 0.0
      WRITE (6,8005)WAITS2, WAITC2
 8005 FORMAT(43H0SUBMARINE LINES USED    ANNUAL COSTS ARE     E16.8,3X
     1 2HVS  E16.8)
      GO TO 160
  155 WAIT # WAITCH
      WRITE (6,8010)WAITC2, WAITS2
 8010 FORMAT(40H0OPEN CHANNEL USED    ANNUAL COSTS ARE    E16.8,3X2HVS
     1 E16.8)
  160 IF (IAJ) 165, 165, 220
  165 CONTINUE
C     THIS SUBROUTINE COMPUTES VALVE AND PIPING COST ALSO BRINE HEATER
      CALL VALVE
C
C
C***  VIII.  ELECTRICAL EQUIPMENT  REVISED FOR SCALING  9/29/65
  170 EEPER#2.0*    SITEW              +2.0*(HLH+CLE+RLR + SLS(NTOTAL+1))
      EEC#117509.0 + 7320.0 *AUNIT +60.164 *EEPER +1.94506E+6*(PO/75.2)*
     1*1
C
C**** IX. CHEMICAL TREATMENT CAPITAL COST REVISED 9/21/65
  175 TNACDY#4.494E-4*(WB+WX)
      CLORIN#1.6425E-6*WOCN
      CALCIT#1.281E-4*WX
      DEFOM#1.971E-6*(WB+WX)
      CCCAP#1.2845E+6*(TNACDY/77300.0)**0.7
     1+3.1964E+5*(CLORIN/642.0)**0.7
     2+4.2325E+5*(CALCIT/10800.0)**0.7
     3+4.3890E+4*(DEFOM/338.0)**0.7
     4+2.083E+4*((WX+WB)/172.0E+6)**0.7
     5 + 58750.0* (G/250.E+6) **0.7

      IF(XCR)185,180,185
  180 THET#TCF
      GO TO 190
  185 THET#TB
C***  CHEMICAL SYSTEM CHEM COST 8/25/65
  190 CC2#8.0*TNACDY + 0.0576 *(1.2845E+6*(TNACDY/77300.0)**0.7)
     1 +83.0*CLORIN +10.0*CALCIT  +840.0*DEFOM
      UNCHEM#CC2/ ( WB + WX)
C
C*** X.  INSTRUMENTATION COST  SCALING FACTOR  9/22/65
      COSTIN
     1 # 160661.0* (G /(AUNIT * 50.E+6))**0.2 * AUNIT * (5.0/AUNIT)**0.2
     2  + 2565.0* (G/(AUNIT * TOTAL) / (250.E+6/    210.0)) **0.2
     3 * TOTAL * AUNIT * (  210.0/ (AUNIT * TOTAL)) **0.2
C
C***  XI   SITE WORK REVISED  3/8/66
```

```
                                                                    09/26/67
          COS        -  EFN   SOURCE STATEMENT  -  IFN(S)  -

  195 TOTALL # HLH + ELE + RLR + SLS (NTOTAL +1)                    COS00835
  200  SITE1# TOTALL * SITEW  * (0.8735 + 0.06295)                  COS00840
      SITE#SITE1                                                    COS00845
     1     + (TOTALL + SITEW) * (86.758 + 41.436 + 71.041 + 16.177) COS00850
     2       + (2.0* TOTALL + SITEW) * 16.670                       COS00855
:                                                                   COS00860
:***  XII-A.  CRANES FOR TURBINE PLANT  REVISED 9/24/65             COS00865
  205 CRANE                                                         COS00870
     1 # 220000.0* (WF/ (AUNIT * 123.8 E+6))**0.5 * (G/250. E+6) **0.3 COS00875
     2 + 171880.0* (WOCN/(AUNIT * 69.92 E+6))**0.5 * (G/250. E+6) **0.3 COS00880
:                                                                   COS00885
:*** XII-B.  BUILDINGS  WITH SCALING FACTOR   REVISED 9/21/65       COS00890    95    96    97
      BLDG # (26043.0+ 143287.0+ 47250.0) * (G/250.E+6) **0.4       COS00895
:                                                                   COS00900    98
      CIRC#CRANE+BLDG +COSTIN                                       COS00905
      WPROD # GPMP                                                  COS00910
  210 UNOPR#0.11044E+6*(G*1.0E-6)**0.3238/WPROD                     COS00915    100
  215 OC2 # UNOPR * WPROD + DREDGE                                  COS00920
  220 CD#(PMC+SITE +WAIT +EA  +ES  +VPC +DEACST   +EEC +BHC +CIRC+CCCAP)COS00925
     1*1.0E-6                                                       COS00930
  225 CALL SUBAJ(CD,RATEIN,AJ)                                      COS00935    104
      IF (IAJ)  230, 230, 235                                       COS00940
  230 AJP # AJ                                                      COS00945
      IAJ # 1                                                       COS00950
      GO TO 140                                                     COS00955
: COST BOOKKEEPING                                                  COS00960
  235 DYEAR  # SMALLP * AJ                                          COS00965
      SAVEG#G                                                       COS00970
      G#GTOT                                                        COS00975
      FG#CAPF*G                                                     COS00980
      CHRIS#1.0E+3/365.0                                            COS00985
      PJ#SMALLP*AJ                                                  COS00990
  240 CAPI1#CD*1.0E6*AJ                                             COS00995
      CAPI2#CAPI1/G                                                 COS01000
      CAPI3#SMALLP* CAPI1/(0.365*FG)                                COS01005
  245 UNMAIN#0.0060                                                 COS01010
  250 AMSC2#UNMAIN*CAPI1                                            COS01015
:**   POWER COST  OF ELECTRICITY FOR MOTORS  3 / 23 /66             COS01020
  255 POBTU # PO * 3.413 E+6                                        COS01025
      POCST1 # 24.0E+6 *SMALLD *PO/G                                COS01030
      POCST2#0.365*FG*POCST1                                        COS01035
      FG365#0.365*FG                                                COS01040
  260 DKGAL #1.0E+3/(365.0*FG)                                      COS01045
      HC1#24.0*SMALLB*WX/(RP*G)                                     COS01050
      HC2#HC1/DKGAL                                                 COS01055
      CC1#CC2/FG365                                                 COS01060
      OC1#OC2/FG365                                                 COS01065
:                                                                   COS01070
:                                                                   COS01075
:     OPERATING COST IS CALCULATED IN VAPOR COMPRESSOR PROGRAM      COS01080
:                                                                   COS01085
:                                                                   COS01090
      OC2#0.0                                                       COS01095
      OC1#0.0                                                       COS01100
      AMSC1#AMSC2/FG365                                             COS01105
:                                                                   COS01110
```

FIGURE 6 (Continued)

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                                                                    09/26/67
          COS        -  EEN   SOURCE STATEMENT  -  IFN(S)  -

C     MAINT AND SUPPLIES COST IS CALCULATED IN VAPOR COMP PROGRAM        COS01115
C                                                                        COS01120
C                                                                        COS01125
      AMSC2#0.0                                                          COS01130
      AMSC1#0.0                                                          COS01135
      PAJ#SMALLP*AJ                                                      COS01140
      CCCAP2#CCCAP*PAJ                                                   COS01145
      CCCAP1#CCCAP2/FG365                                                COS01150
      DEA2 # DEACST * PAJ + SMAPPR * CTUPED                              COS01155
      PMC2# PMC*PAJ                                                      COS01160
      EEC2#EEC*PAJ                                                       COS01165
      VPC2#VPC*PAJ                                                       COS01170
      WAIT2#WAIT*PAJ                                                     COS01175
      SITE2#SITE*PAJ                                                     COS01180
      EAE2 # EAE * PAJ + SMAPPP * CTUBEE                                 COS01185
      EAR2 # EAR * PAJ + SMAPPR * CTUBER                                 COS01190
      EA2 # EAE2 + EAR2                                                  COS01195
      BHC2 # BHC * PAJ + SMAPPH * TCBH * AMODU                           COS01200
      ES2#ES* PAJ                                                        COS01205
      CIBC2#CIBC*PAJ                                                     COS01210
      DEA1#DEA2/FG365                                                    COS01215
      PMC1#PMC2/FG365                                                    COS01220
      EEC1#EEC2/FG365                                                    COS01225
      VPC1#VPC2/FG365                                                    COS01230
      WAIT1#WAIT2/FG365                                                  COS01235
      SITE1#SITE2/FG365                                                  COS01240
      EA1#EA2/FG365                                                      COS01245
      BHC1# BHC2/FG365                                                   COS01250
      ES1# ES2/ FG365                                                    COS01255
      CIBC1#CIBC2/FG365                                                  COS01260
      SCM1#AMSC1                                                         COS01265
      SCM2#AMSC2                                                         COS01270
      TC1#HC1+CC1+POCST1+PMC1+SITE1+WAIT1+ES1+EA1+VPC1+EEC1+BHC1+CC1     COS01275
     1+AMSC1+CIBC1+DEA1        +CCCAP1                                   COS01280
      TC2#TC1* 0.365*FG                                                  COS01285
      WT#1.55E6/RHONK**0.8925                                            COS01290    115
      WTRAY#WF/WT                                                        COS01295
      RESTM#(WTRAY*(ELE+RLR)*11223C.0)/(TOTAL*WF)                        COS01300
      CSUBP#AMBDAS/(ACPSN+ACPTNK)                                        COS01305
      TC#TC1                                                             COS01310
      CAPI3#CHRIS*SMALLP*CAPI1/FG                                        COS01315
      RETUB2 # CTUBEE * SMAPPP +(CTUBER + CTUPED) * SMAPPR               COS01320
     1 + SMAPPH * TCBH * AMODU                                           COS01325
      RETJB1#CHRIS*RETUB2/FG                                             COS01330
      RLR # RLR + SLS (NTOTAL +1)                                        COS01335
      AR # AR + PI * DOR/12.0 * RNR * SLS (NTOTAL+1)                     COS01340
 8015 FORMAT (1H0 I6, 6E16.8)                                            COS01345
  265 CONTINUE                                                           COS01350
      G#SAVEG                                                            COS01355
      RETURN                                                             COS01360
      END                                                                COS01365
```

FIGURE 6 (Continued)

09/26/67

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*
$IBFTC AREAY   DECK                                                    AREACCCC
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FIGURE 6 (Continued)

```
      SUBROUTINE AREA                                                   AREA0005
C*****COST FOR MOTOR DRIVEN PLANT   3 / 23 / 66                         AREA0010
      COMMON/GEN/CASE,G,RP, XRP,P,XO,Q,XU,CR,XCR, ROE,ROER              AREA0015
      COMMON/TEMPC/TSTEAM,TS(100), THF,TB,XTB,        TC,TP,TA,CC,CP     AREA0020
      COMMON/GEOME/AMODU,ALEV,AUNIT,TOTALE,TOTALR,FREBC,TRAYCP,HST,CL,  AREA0025
     1SPL                                                               AREA0030
      COMMON/ECON/SMALLE,SMALLD,SMALLB,SMALLP,RATEIN,WPL, CAPF,THERM,   AREA0035
     1PMSTMC                                                            AREA0040
      COMMON/TUBING/ DOH,DIH,DOE,DIE,DOR,DIR,A1,A2,A3,BIKTF,BIKTE,      AREA0045
     1BIKTR,CSLTBH,CSLTBP,CSLTBR                                        AREA0050
      COMMON/FOULIN/RH,RE,RSR,SH,SE,SR,VH,VE,VR                         AREA0055
      COMMON/PUMPHT/HD,HH,HBL,HPR,FFHL,SSFI                             AREA0060
      COMMON/AMISC/CPSTB,FACID,ACACID,DPLIM,A6,A7,XSOC,XNNN,NNN,XLLL,LLLAREA0065
      COMMON/DATA1/BDEPH,DTPD,SSF2,TOTAL,UMAX,UALP,PI,TWFA,TSTH,COEFA,  AREA0070
     1ORITE,ITER                                                        AREA0075
      COMMON/AZ1/DTPDP(100),TITLE(15)                                   AREA0080
      COMMON/TCVL1/ ACPSN, ACPSNK, ACPTNK,CPBT,CPTK, CPTNK,AMBN,TCF,WX, AREA0085
     1WF,WO,CB,WC,WB, WR,RHONK, RHCK, ERR,CCF, NITER, NK,NTOTAL, PN,RPN,AREA0090
     2TC, ALPHA1, WPN, DELCT, DELST, IGSC, SMAQ, SUMA, TK               AREA0095
      COMMON/TCVL2/ TTD(100),SMT(100), SMT2(100), CT(100), WS(100),     AREA0100
     1C(100), TV(100), WV(100), WH(100), WP(100), AS(100),SLS(100)      AREA0105
      COMMON/STAGE1/ A(100),CFMWV(100), CFMWZ(100), UBAR(100), OM(100), AREA0110
     1HO(100),HI(100),WWFS(100),VVEV(100), TRAYFL(100),TRAYWC(100),     AREA0115
     2RESIDT(100), PV(100),DELP(100), DTPDPS(100)                       AREA0120
      COMMON/DMST1/ AREADM(100),DPTDM(100),DTDM(100), CPROD(100),WIDDM(1AREA0125
     100)                                                               AREA0130
      COMMON/CONDI/ DPINIT(100), DTINIT(100), DPCLR(100), DTCLR(100),   AREA0135
     1DTCND(100)                                                        AREA0140
      COMMON/STAGE2/ AH, BAROM,BWE,BWR,COSTDM,ELE,ESHELL,HBH,HBLE,HBLR, AREA0145
     1HLH, HNOE, HNOR,HN, HSTE, HSTR, JJ, KK, RLR, RSHELL, TBNOE,TBNOR, AREA0150
     2UBARH, VBLE,VBLR,VNOE, VNOR, WTME, WTMR, WY                       AREA0155
      COMMON/PHYS/II                                                    AREA0160
      COMMON /MAIN1/ SSF, HFG                                           AREA0165
      COMMON /STG1/ ATR, BTR, CTR, CTA                                  AREA0170
      COMMON /STG2/HOH, PR, DENBR(100), SUMLS, WVST(100), DO, DI, R, S, AREA0175
     1 V, TVTT(100), Z(100), HV, HS(100), WBS(100)                      AREA0180
      COMMON /CST1/ ASIEV, ANPLAT, SLPLAT, APLAT                        AREA0185
      COMMON /CNDR1/ NERR,        COOR(3), K                            AREA0190
      COMMON /DEM1/ SLKP2, SUMDMA, TDMP(100), APTSE, VCLM, APTSR        AREA0195
      COMMON /DEM3/ ARGZ(15)                                            AREA0200
      COMMON /DEAIU/ RNR                                                AREA0205
      COMMON /OP1/ SMAPPP, HR, SMAPPH, HF, UNARAR, UNARAE, A4, AJ, WCO, AREA0210
     1 UBARE, UBARR, UTHE, AE, AR, ATHE, THEL, ENE, THEN, HFE, HFR, THEHAREA0215
     2T, HC2, HC1, CC2, CC1, POCST2, POCST1, ALPEAR, PMC2, PMC1, CCCAP2,AREA0220
     3  CCCAP1, SITE2, SITE1,  WAIT2, WAIT1,  ES2,  ES1,  EA2, EA1,    AREA0225
     4 BHC2,  BHC1,  VPC2,  VPC1,  UBPH,  EEC2,  EEC1,  PC,  CC2, CC1,  AREA0230
     5 SCM2,  SCM1,  CIBC2, CIBC1,  DEA2,  DEA1,  TC2,  TC1,  CAPI1,    AREA0235
     6 CAPI2,  CAPI3,  PO3,  HS1,  PMC,  EEC,  VPC,  SITE,  WAIT,       AREA0240
     7 ES,  EA,  CIBC,  BHC,  CCCAP,  COSTIN,  WEIRC,  CRANE,  BLDG,    AREA0245
     8 DEACST,  PMCPO,  PMCFLO,  RETUB2,  RETUB1,  CPREQ(100), AMSC2,   AREA0250
     9 AMSC1                                                            AREA0255
      COMMON/NOV25/C11, C12, C13, C14, C15, C16,C21, C22, C23, C24, C31,AREA0260
     1 C32, C33, C34, C41, C42                                          AREA0265
      COMMON/CSTLK/ADEA,ENITSD,WOCN,GPMP, FG, SMAPPR, DEARTB, EAR, EAE,TAREA0270
     1CBH,AMBDAS                                                        AREA0275
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FIGURE 6 (Continued)

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                                                                                    09/26/67
          AREAY      -  EFN   SOURCE STATEMENT  -  IFN(S)  -

      COMMON/CSTLKI/SITEW,CTUBED,CTUBEE,CTUBER,SMA1,SMA2,SUMLEV,TRBCND,  AREA0280
     1ENITSR                                                             AREA0285
      COMMON/STGCST/TRAWDP,PTRAWD                                        AREA0290
      NTOTAL#NTOTAL                                                      AREA0295
  100 WTME#0.0                                                           AREA0300
      WTMR#0.0                                                           AREA0305
      SUMLEV#(HST*(ALEV-1.0)+HST+5.4)                                    AREA0310
      CALL  SMAP(WPL,CSLTBP,RATEIN,SMAPPP)                               AREA0315     3
      CALL  SMAP  (WPL, CSLTBR, RATEIN, SMAPPR)                          AREA0320     5
      CALL  SMAP(WPL,CSLTBH,RATEIN,SMAPPH)                               AREA0325
C     COSTS                                                              AREA0330     7
      SUBA2#0.0                                                          AREA0335
      SUBA1#0.0                                                          AREA0340
      SUMAS1#0.0                                                         AREA0345
      HFE#0.0                                                            AREA0350
      HFR#0.0                                                            AREA0355
      AE#0.0                                                             AREA0360
      AR#0.0                                                             AREA0365
      ELE#0.0                                                            AREA0370
      RLR#0.0                                                            AREA0375
      ENE#0.0                                                            AREA0380
      RNR#0.0                                                            AREA0385
      TSTEM#TSTEAM                                                       AREA0390
      AMPDAS#1093.88-0.5703*TSTEM+1.2819E-4*TSTEM**2-0.8824E-6*TSTEM**3 AREA0395
      SUMAS#0.0                                                          AREA0400
      F#(0.0056+0.02436/(DIR*VR)**0.32)*SSF                              AREA0405     9
      FR#F                                                               AREA0410
      CNE#0.126472*DIR/DOR                                               AREA0415
      FG#CAPF*G                                                          AREA0420
      GE#G*SMALLE                                                        AREA0425
C CALCULATE TUBE LENGTH,NO. TUBES, AREA IN RECOVERY                      AREA0430
      DO110I#1,NK                                                        AREA0435
      HFE#HFE+HS(I)                                                      AREA0440
      ELE#ELE+SLS(I)                                                     AREA0445
      ENE#ENE+Z(I)                                                       AREA0450
      SUBA1#SUBA1+UBAR(I)*AS(I)                                          AREA0455
      IF(WTME-TRAYWD(I))105,110,110                                      AREA0460
  105 WTME#TRAYWD(I)                                                     AREA0465
  110 SUMAS1#SUMAS1+AS(I)                                                AREA0470
      AMODWD #(ALEV * (TRAWDP + 0.8333) + (ALEV - 1.0) * 2.0* BWE        AREA0475
     1  + 2.0* PTRAWD ) / ALEV                                           AREA0480
      WDTRA1 # AMODWD - 0.8333 - 2.0 * BWE                               AREA0485
      WDTRA2 # AMODWD - 0.8333 - 2.0 * PTRAWD                            AREA0490
      SITEW # AMODU * (WDTRA1 * TRAYWD(I)/TRAYWD(NK) + 0.8333 + 2.0*PWE)AREA0495
     1 + 0.8333 * (AUNIT - 1.0) - 1.5 * (AMODU - AUNIT)                  AREA0500
      WDTRA3 # WDTRA1 * TRAYWD(I) / TRAYWD(NK)                           AREA0505
      UNITW  # SITEW /AUNIT                                              AREA0510
C CALCULATE TUBE LENGTH , NO. TUBES, AREA IN REJECT                      AREA0515
      J#NK+1                                                             AREA0520
      DO125I#J,NTOTAL                                                    AREA0525
      HFR#HFR+HS(I)                                                      AREA0530
      RLR#RLR+SLS(I)                                                     AREA0535
      RNR#RNR+Z(I)                                                       AREA0540
  115 SUBA2#SUBA2+UBAR(I)*AS(I)                                          AREA0545
      IF(WTMR-TRAYWD(I))120,125,125                                      AREA0550
  120 WTMR#TRAYWD(I)                                                     AREA0555
```

FIGURE 6 (Continued)

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                                                                    09/26/67
          AREAY      -  EEN   SOURCE STATEMENT  -  IFN(S)  -

  125 SUMAS#SUMAS+AS(I)                                              AREA0560
C CALCULATE EVAP. AND REJECT OVERALL GEOMETRY                        AREA0565
      SUBAS#SUBA1+SUBA2                                              AREA0570
      UBARE#SUBA1/SUMAS1                                             AREA0575
      UBARR#SUBA2/SUMAS                                              AREA0580
      ZNK#NK                                                         AREA0585
      RNR#RNR/(TOTAL-ZNK)                                            AREA0590
      ENE#ENE/ZNK                                                    AREA0595
      ELE#ELE+FLOAT(NK-1)*TSTH/12.0                                  AREA0600
      AE#PI*DOE*ELE*ENE/12.0                                         AREA0605
      RASB#FLOAT(NTOTAL-NK-1)*TSTH/12.0                              AREA0610
      RLR#RLR+RASB                                                   AREA0615
      AR#PI*DOR*RLR*RNR/12.0                                         AREA0620
  130 AP#SUMAS+SUMAS1                                                AREA0625
      SMALLA#A1+A2                                                   AREA0630
      AT#SUMAS+SUMAS1                                                AREA0635
      UBPH# SUBAS/AP                                                 AREA0640
C                                                                    AREA0645
C**** I. TUBING AND TUBE SHEET COST CALCN REVISED FOR SCALING  9/20/65 AREA0650
      TBLBR # 0.9844 - 1.2903 * DOE + 0.57707 * DOE **2              AREA0655
      CTUBEE#SMA1* (1.22855E+7/ AE)**0.0 * AE * 1.20                 AREA0660
     1+TBLBR*(1.22855E+7/AE)**0.1*AE*1.20                            AREA0665    47    48
      IF(DOE-1.0) 135,140,140                                        AREA0670
  135 ENITSE#FLOAT(NK-1)*2.0*ALEV*AMODU                              AREA0675
      GO TO 145                                                      AREA0680
  140 ENITSE#FLOAT(2*NK-1)*2.0*ALEV*AMODU                            AREA0685
  145 CITSE#ENITSE*1.20*(4.590*APTSE                                 AREA0690
     1+1.530*(63426.0/(APTSE*ENITSE))**0.1*APTSE                    +0AREA0695
     2.024*(  8.24176E+8              /(ENE*ENITSE))**0.1           *EAREA0700
     3NE/(2.0*ALEV*AMODU))                                           AREA0705    54    55
      ENETSE#4.0*ALEV*AMODU                                          AREA0710
      CETSE#ENETSE*1.20*(35.820*APTSE                                AREA0715
     1+4.080*(3252.62  /(APTSE*ENETSE))**0.1*APTSE                   AREA0720
     2+.0670*(528318.0/(ENE*2.0))**0.1*ENE/(2.0*ALEV*AMODU))         AREA0725
C*****UNIT COST FOR TUBES + TUBE SHEETS                              AREA0730    56    57
      EAE # CTUBEE + CITSE + CETSE                                   AREA0735
      UNARAE # EAE / AE                                              AREA0740
C***** REJECT SECTION                                                AREA0745
      TBLBR # 0.9844 - 1.2903 * DOR + 0.57707 * DOR **2              AREA0750
      ADEA  #RNR*PI*DOR/12.0*SLS(NTOTAL+1)                           AREA0755
      NITSD# SLS(NTOTAL+1)/4.0                                       AREA0760
      ENITSD #        2.0 * ALEV * AMODU  *FLOAT(NITSD)              AREA0765
      CTUBER#SMA2* (1.6078E+6 /(AR + ADEA))**0.1 * AR * 1.20         AREA0770
     1+TBLBR*(1.6078E+6/(AR + ADEA))**0.1 * AR * 1.20                AREA0775
C*****COST FOR ENTERMED TUBE SHEETS                                  AREA0780    61
      NITSR#RLR/6.0 -1.0                                             AREA0785
      IF(DOR-1.0) 150,155,155                                        AREA0790
  150 ENITSR#FLOAT(NITSR       )*2.0*ALEV*AMODU                      AREA0795
      GO TO  160                                                     AREA0800
  155 ENITSR#FLOAT(2* NITSR        )*2.0*ALEV*AMODU                  AREA0805
  160 CITSR#ENITSR*1.20*( 6.81*APTSR                                 AREA0810
     1+0.510*(.84918E+4/(APTSR*(ENITSR + ENITSD)))**0.1   *APTSR     AREA0815
     2+0.048 *(    1.07437 E+8            /(RNR*(ENITSR + ENITSD)))**0.1 AREA0820
     3 *RNR/(2.0*ALEV*AMODU))                                        AREA0825    68    69
      ENETSR#4.0*ALEV*AMODU                                          AREA0830
      CETSR#ENETSR*1.20*(45.145*APTSR                                AREA0835
```

FIGURE 6 (Continued)

```
                                                                                    09/26/67
        AREAY        -   FFN    SOURCE STATEMENT  -   IFN(S)   -

   1+4.083*( 2123.0   /(APTSR*ENETSR))**0.1*APTSR                                  AREAC84C
   2+0.201*(335740.0/(RNR*2.0))**0.1*RNR/(2.0*ALEV*AMOCU))                         AREAC845      70      71
    EAR # CTUBER + CITSR + CETSR                                                   AREAC85C
    UNARAR # EAR / AR                                                              AREAC855
165 EA # EAE + EAR                                                                 AREAC86C
    RETURN                                                                         AREAC865
    END                                                                            AREAC87C
```

FIGURE 6 (Continued)

09/26/67

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*
$IBFTC SHEL     DECK                                                    SHELCCOO
```

FIGURE 6 (Continued)

09/26/67

SHEL - FFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINE SHELL                                                  SHELC005
C*****COST FOR MOTOR DRIVEN PLANT   3 / 23 / 66                         SHELC010
      COMMON/GEN/CASE,G,RP, XRP,P,XO,Q,XU,CR,XCR, RCE,ROER              SHELC015
      COMMON/TEMPC/TSTEAM,TS(100), THF,TB,XTB,        TC,TP,TA,CC,CP    SHELC020
      COMMON/GEOME/AMODU,ALEV,AUNIT,TOTALE,TOTALR,FREBD,TRAYDP,HST,CL,  SHELC025
     1SPL                                                               SHELC030
      COMMON/ECON/SMALLE,SMALLD,SMALLB,SMALLP,RATEIN,WPL, CAPF,THERM,   SHELC035
     1PMSTMC                                                            SHELC040
      COMMON/TUBING/ DOH,DIH,DOE,DIE,DOR,DIR,A1,A2,A3,BIKTH,BIKTE,      SHELC045
     1BIKTR,CSLTBH,CSLTBP,CSLTBR                                        SHELC050
      COMMON/FOULIN/RH,RE,RSR,SH,SE,SR,VH,VE,VR                         SHELC055
      COMMON/PUMPHT/HD,HH,HBL,HPR,FFHL,SSFI                             SHELC060
      COMMON/AMISC/CPSTB,FACID,ACACID,DPLIM,A6,A7,XSOD,XNNN,NNN,XLLL,LLLSHELC065
      COMMON/DATA1/BDEPH,DTPD,SSF2,TOTAL,UMAX,UALP,PI,TWFA,TSTH,CCEFA,  SHELC070
     1ORITE,ITER                                                        SHELC075
      COMMON/AZI/DTPDP(100),TITLE(15)                                   SHELC080
      COMMON/TCVL1/ ACPSN, ACPSNK, ACPTNK,CPBT,CPTK, CPTNK,AMBN,TCF,WX, SHELC085
     1WF,WO,CB,WC,WB, WR,RHONK, RHOK, ERR,CCF, NITER, NK,NTOTAL, PN,RPN,SHELC090
     2TC, ALPHA1, WPN, DELCT, DELST, IGSC, SMAQ, SUMA, TK               SHELC095
      COMMON/TCVL2/ TTD(100),SMT(100), SMT2(100), CT(100), WS(100),     SHELC100
     1C(100), TV(100), WV(100), QH(100), WP(100), AS(100),SLS(100)      SHELC105
      COMMON/STAGE1/ A(100),CFMWV(100), CFMWZ(100), UBAR(100), CM(100), SHELC110
     1HO(100),HI(100),WWFS(100),VVEV(100), TRAYFL(100),TRAYWD(100),     SHELC115
     2RESIDT(100), PV(100),DELP(100), DTPDPS(100)                       SHELC120
      COMMON/DMSTI/ AREADM(100),DPTDM(100),DTDM(100), CPROD(100),WIDDM(1SHELC125
     1 00)                                                              SHELC130
      COMMON/CONDI/ DPINIT(100), DTINIT(100), DPCLR(100), DTCLR(100),   SHELC135
     1DTCND(100)                                                        SHELC140
      COMMON/STAGE2/ AH, BAROM,BWE,BWR,COSTDM,ELE,ESHELL,HBH,HBLE,HBLR, SHELC145
     1HLH, HNOE, HNOR,HN, HSTE, HSTR, JJ, KK, RLR, RSHELL, TBNOE,TBNOR, SHELC150
     2UBARH, VBLE,VBLR,VNOE, VNOR, WTME, WTMR, WY                       SHELC155
      COMMON/PHYS/II                                                    SHELC160
      COMMON /MAIN1/ SSF, HFG                                           SHELC165
      COMMON /STG1/ ATR, PTR, CTR, CTA                                  SHELC170
      COMMON /STG2/HOH, PR, DENBR(100), SUMLS, WVST(100), CO, DI, R, S, SHELC175
     1 V, TVTT(100), Z(100), HV, HS(100), WBS(100)                      SHELC180
      COMMON /CST1/ ASIEV, ANPLAT, SLPLAT, APLAT                        SHELC185
      COMMON /CNDR1/ NERR,        CCCR(3), K                            SHELC190
      COMMON /DEM1/ SLKP2, SUMDMA, TDMP(100), APTSE, VCLM, APTSR        SHELC195
      COMMON /DEM3/ ARGZ(15)                                            SHELC200
      COMMON /DEAID/ RNR                                                SHELC205
      COMMON /OP1/ SMAPPP, HR, SMAPPH, HE, UNARAR, UNARAE, A4, AJ, WCO, SHELC210
     1 UBARE, UBARR, UTHE, AE, AR, ATHE, THEL, ENE, THEN, HFE, HFR, THEHSHELC215
     2T, HC2, HC1, CC2, CC1, POCST2, POCST1, ALPBAR, PMC2, PMC1, CCCAP2,SHELC220
     3  CCCAP1, SITE2, SITE1,  WAIT2, WAIT1,  ES2, ES1,  EA2, EA1,     SHELC225
     4 BHC2,  BHC1,  VPC2,  VPC1,  UPPH,  EEC2,  EEC1,  PO,  CC2, CC1,  SHELC230
     5 SCM2,  SCM1,  CIBC2, CIBC1,  DEA2,  DEA1,  TC2,  TC1,  CAPI1,    SHELC235
     6 CAPI2,  CAPI3,  PO3,  HS1,  PMC,  EEC,  VPC,  SITE,  WAIT,       SHELC240
     7 ES,  EA,  CIBC,  BHC,  CCCAP,  COSTIN,  WEIRC,  CRANE,  BLDG,    SHELC245
     8 DEACST,  PMCPO,  PMCFLO,  RETUP2,  RETUB1,  CPREQ(100), AMSC2,   SHELC250
     9 AMSC1                                                            SHELC255
      COMMON/NOV25/C11, C12, C13, C14, C15, C16,C21, C22, C23, C24, C31,SHELC260
     1 C32, C33, C34, C41, C42                                          SHELC265
      COMMON/CSTLK/ADEA,ENITSD,WOCN,GPMP, FG, SMAPPR, DEARTB, EAR, EAE,TSHELC270
     1CBH,AMPDAS                                                        SHELC275
```

FIGURE 6 (Continued)

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                                                                    09/26/67
        SHEL        -  EFN    SOURCE STATEMENT  -  IFN(S)  -

      COMMON/POWR21/PO1,PO2,WPROD                                   SHELC28C
      DIMENSION DP(100), COLCST(100), EXTCST(100), XINTCS(100)      SHELC285
     1 , TRACST (100)                                               SHELC29C
      DIMENSION AR1(100)                                            SHELC295
      COMMON/CSTLK1/SITEW,CTUBED,CTUBEE,CTUBER,SMA1,SMA2,SUMLEV,TRBCND, SHELC30C
     1ENITSR                                                        SHELC305
      GTV2(QCOOFL)                                                  SHELC310
     1        #2.1786818-.7C443622E-C1*QCOOFL+.93941286E-03*QCOOFL**2  SHELC315
     2-.53958083E-05*QOOOFL**3 +.18139197E-07*QOOOFL**4             SHELC320
      FGAD(QOO1FL)#EXP(0.C748C67*ALOG(QCO1FL)+0.2138177*ALCG(GOO1FL)**2)SHELC325    4     S
      FLAD(QOO2FL)#0.74391/SQRT(QOC2FL)                             SHELC330    8
      COST1(QOO3FL, QOO4FL, QCO5FL) #C11 + C12 * QOO4FL+ C13 * COO3FL+ CSHELC335
     114 * QOO4FL* QOO3FL+ C15 * QCO5FL+ C16 * QOO4FL* QOO5FL       SHELC340
      COST2(QOO6FL, QOO7FL) #C21 + C22 * QOO6FL+ C23 * QOO7FL+ C24 * QOOSHELC345
     16FL* QOO7FL                                                   SHELC350
      COST3(QOO8FL, QOO9FL) #C31 + C32 * QOO8FL+ C33 * QOO9FL+ C34 * QOOSHELC355
     18FL* QOO9FL                                                   SHELC36C
      COST4(QO10FL)#C41+C42*QL10FL                                  SHELC365
C**** II. SHELL COST BASED ON MODULATION  9/27/65                   SHELC370
  100 SMCOLC # 0.0                                                  SHELC375
      SMEXTW # 0.0                                                  SHELC38C
      SMINTW # 0.0                                                  SHELC385
      SMTRAC # 0.0                                                  SHELC39C
      AR11#0.0                                                      SHELC395
      AR22#0.0                                                      SHELC40C
      AR33#0.0                                                      SHELC405
      AR44#0.0                                                      SHELC41C
      NTOTI#NTOTAL+1                                                SHELC415
  105 DO 115 I # 1, NTOTI                                           SHELC42C
      DP (I) # ABS(PV(I) - 14.696)                                  SHELC425
      IF (DP(I) - DPLIM) 110, 115, 115                              SHELC43C
  110 DP(I) #DPLIM                                                  SHELC435
  115 CONTINUE                                                      SHELC44C
      DO 195 I # 1, NTOTAL                                          SHELC445
      IF (I - NK) 120, 120, 125                                     SHELC45C
  120 BWD # BWE                                                     SHELC455
      GO TO 130                                                     SHELC46C
  125 BWD #BWR                                                      SHELC465
C**** COST OF COLUMNS, FOOTINGS,PARTITIONS                          SHELC47C
 8000 FORMAT(1H  7E16.8)                                            SHELC475
  130 AREA1#            SITEW *SUMLEV                               SHELC48C
      AR1 (I) # AREA1                                               SHELC485
      AR11#AREA1+AR11                                               SHELC49C
      FUNC1   # COST1(ALEV, SLS(I), DP(I))                          SHELC495
      IF (ALEV - 1.0) 135, 135, 14C                                 SHELC50C
  135 FUNC1 # 0.8 * FUNC1                                           SHELC505
  140 COLCST(I) # FUNC1  * AREA1                                    SHELC51C
      IF (I - NTOTAL) 145, 15C, 15C                                 SHELC515
  145 SMCOLC #SMCOLC +COLCST (I)                                    SHELC52C
C**** COST OF EXTERIOR WALLS                                        SHELC525
  150 AREA2#(SLS(I)+TSTH/12.0)*2.0*(SUMLEV+  SITEW )                SHELC53C
      AR22#AR22+AREA2                                               SHELC535
      FUNC2 # COST2(SLS(I), DP(I))                                  SHELC54C
      EXTCST (I) # FUNC2 * AREA2                                    SHELC545
  155 SMEXTW #SMEXTW +EXTCST(I)                                     SHELC55C
C**** COST OF INTERIOR LONGITUDINAL WALLS                           SHELC555
```

FIGURE 6 (Continued)

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                                                                    09/26/67
          SHEL        -   FEN    SOURCE STATEMENT  -   IFN(S)  -

  160 AREA3#(SLS(I)+TSTH/12.0)*SUMLEV*(AUNIT-1.0)                    SHELC560
      AR33#AR33+AREA3                                                SHELC565
      FUNC3 # COST3( SLS(I), DP(I))                                  SHELC570
      XINTCS(I) # FUNC3 * AREA3                                      SHELC575
  165 SMINTW # SMINTW + XINTCS (I)                                   SHELC580
C**** COST OF BRINE TRAY                                             SHELC585
  170 AREA4#(TRAYWD(I)+2.0*(HST-FREBD))*(SLS(I)+TSTH/12.0)*AMODU*ALEV SHELC590
      AR44#AR44+AREA4                                                SHELC595
      IF (SLS(I) - 7.0) 175, 175, 180                                SHELC600
C**FUNC4 CHANGED FROM FUNC4 # 2.435  10/6/65                         SHELC605
  175 FUNC4#(3.903+5.258*(ALEV-1.0))/ALEV                            SHELC610
      GO TO 185                                                      SHELC615
  180 FUNC4#COST4(SLS(I),ALEV)                                       SHELC620
  185 TRACST (I) # FUNC4 * AREA4                                     SHELC625
  190 SMTRAC # SMTRAC +TRACST (I)                                    SHELC630
  195 CONTINUE                                                       SHELC635
C**** COST OF END WALLS                                              SHELC640
  200 FUNC2 # COST2(SLS (NTOTAL+1), DP (NTOTAL+1))                   SHELC645
  205 ENDWL2#FUNC2*   SITEW * SUMLEV                                 SHELC650
      FUNC2#COST2(SLS(NK+1),DP(NK+1))                                SHELC655
  210 ENDWL3#FUNC2                          *SITEW *SUMLEV           SHELC660
      SMEXTW#SMEXTW*(19633C.0/AR22)**0.03                            SHELC665     87
  215 SMEXTW#SMEXTW+ENDWL2+ENDWL3                                    SHELC670
C*** WATER DEFLECTOR COSTS (TUBE BUNDLE)                             SHELC675
      AREA5E#(ALEV-1.0)*(2.0*BWE-3.0)*ELE*AMODU                      SHELC680
      AREA5R#(ALEV-1.0)*(2.0*BWR-3.0)*RLR*AMODU                      SHELC685
      DFLECR#3.826*AREA5E + 11.730*AREA5R                            SHELC690
C*** WATERFALL DISTRIBUTION SYSTEM IX.A.1(MISC.)                     SHELC695
      WTRDSA#SUMLEV*(0.5*(SUMLEV-HST-5.4) + 2.0)                     SHELC700
      WTRDSV#WTRDSA*SITEW                                            SHELC705
      WTRDST#WTRDSV*3.277                                            SHELC710
C*** CONCRETE FDNS AND SLAB COSTS                                    SHELC715
      SUM_#ELE+RLR+SLS(NTOTAL+1)                                     SHELC720
      FNDSLB#  BDEPH      *ALEV*SUML*WTME*AMODU/ 3.9443 E+5          SHELC725
     1*1134500.0                                                     SHELC730
C*** EXPANSION JOINT COSTS (COULD BE TEMP,PRESS FUNCTION)            SHELC735
      UNITW#SITEW/AUNIT                                              SHELC740
      XNVERT # 0.0                                                   SHELC745
      PERIM1 # (2.0 * UNITW + 2.0 * SUMLEV) * (THF - TB) / 157.4 * 8.0 SHELC750
      EXPJC1 # PERIM1 * AUNIT *  28.03                               SHELC755
      PERIM2 # 2.0 * SUML+ SUMLEV * TOTAL                            SHELC760
      EXPJC2 # PERIM2 *(AUNIT - 1.0) * 2.0 * 28.03                   SHELC765
C**  INTERMEDIATE LONGITUDINAL JOINTS                                SHELC770
      IF(UNITW-50.0)220,220,225                                      SHELC775
  220 PERIM3#0.0                                                     SHELC780
      GO TO 265                                                      SHELC785
  225 TJNT1#TS(1)                                                    SHELC790
      ALTJNT#3.941E+5/TS(1)**1.625                                   SHELC795     94
      NJNT #UNITW/ALTJNT                                             SHELC800
      NJNTS # NJNT                                                   SHELC805
      ANJNT # FLOAT( NJNT)                                           SHELC810
      PERIM3#0.0                                                     SHELC815
      AJNTL#0.0                                                      SHELC820
      DO 260 I#1,NTOTAL                                              SHELC825
  230 IF(TJNT1-TS(I+1)-20.0)255,255,235                              SHELC830
  235 PERIM3#PERIM3+AJNTL*ANJNT*2.0                                  SHELC835
```

FIGURE 6 (Continued)

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                                                                    09/26/67
        SHEL        -  EFN   SOURCE STATEMENT  -  IFN(S)  -

      TJNTI#TS(I)                                                   SHEL0840
      AJNTL#0.0                                                     SHEL0845
      ALTJNT#3.941E+5/TS(I)**1.625                                  SHEL0850    106
      NJNT #UNITW/ALTJNT                                            SHEL0855
      ANJNT # FLOAT( NJNT)                                          SHEL0860
      IF (NJNTS - NJNT) 245, 245, 240                               SHEL0865
  240 XNVERT # XNVERT + ANJNT                                       SHEL0870
      NJNTS # NJNT                                                  SHEL0875
  245 IF ( TS(I) - TS (I+1) - 20.0 ) 230, 230, 250                  SHEL0880
  250 PERIM3 # PERIM3 + SLS(I) * ANJNT * 2.0                        SHEL0885
      XNVERT # XNVERT + ANJNT * 2.0                                 SHEL0890
      TJNTI#TS(I + 1)                                               SHEL0895
      AJNTL#0.0                                                     SHEL0900
      ALTJNT#3.941E+5/TS(I+1)**1.625                                SHEL0905    118
      NJNT #UNITW/ALTJNT                                            SHEL0910
      ANJNT # FLOAT( NJNT)                                          SHEL0915
      GO TO 260                                                     SHEL0920
  255 AJNTL#AJNTL+SLS(I)                                            SHEL0925
      XNVERT # XNVERT + ANJNT                                       SHEL0930
  260 CONTINUE                                                      SHEL0935
      XNVERT # XNVERT + ANJNT                                       SHEL0940
      PERIM3#PERIM3+ (AJNTL + SLS(NTOTI)) * ANJNT * 2.0             SHEL0945
  265 EXPJC3#PERIM3*AUNIT*28.03                                     SHEL0950
C**   VERTICAL JOINTS FOR INTERMEDIATE LONGITUDINAL JOINTS          SHEL0955
      PERIM4# SUMLEV * XNVERT                                       SHEL0960
      EXPJC4 # PERIM4 * AUNIT * 28.03 *2.0                          SHEL0965
      EXPJNT#EXPJC1+EXPJC2+EXPJC3 + EXPJC4                          SHEL0970
C**** TOTAL COST OF EVAPORATOR SHELL                                SHEL0975
C**** REVISIONS TO EVAP SHELL COST  9/29/65                         SHEL0980
      SMCOLC#SMCOLC-COLCST(NK)-COLCST(NTOTAL)                       SHEL0985
      AR11#AR11-AR1(NK)-AR1(NTOTAL)                                 SHEL0990
      SMCOLC#SMCOLC*(514000.0/AR11)**0.03                           SHEL0995    132
      SMINTW#SMINTW*(65662.0/AR33)**0.03                            SHEL1000    133
      SMTRAC#SMTRAC*(540204.0/AR44)**0.1                            SHEL1005
C***  REVISION TO SMVALV 1/18/66                                    SHEL1010    134
      HATCH# AMODU * (4.0 * ALEV + 8.0 +(0.1 * TOTAL +1.0)+(TOTAL-1.0)) SHEL1015
      PRLIEZ#0.0                                                    SHEL1020
      VRLIEZ#0.0                                                    SHEL1025
      DO 285 I#1,NTOTI                                              SHEL1030
      IF(PV(I)-14.696) 275,270,270                                  SHEL1035
  270 PRLIEZ#PRLIEZ+1.0                                             SHEL1040
      GO TO 285                                                     SHEL1045
  275 IF(PV(I)-3.75)290,280,280                                     SHEL1050
  280 VRLIEZ#VRLIEZ+1.0                                             SHEL1055
  285 CONTINUE                                                      SHEL1060
  290 VRLIEZ#VRLIEZ+PRLIEZ                                          SHEL1065
      SMVALV#(825.50*PRLIEZ+ 660.40*VRLIEZ) * AMODU                 SHEL1070
     1 + 205680.0*(HATCH / 431.0) **0.8                             SHEL1075    150
      IF(ALEV-1.0)295,295,300                                       SHEL1080
  295 DFLECR#0.0                                                    SHEL1085
      GO TO 305                                                     SHEL1090
  300 DFLECR#DFLECR*(10024C.0/(AREA5E+AREA5R))**0.1                 SHEL1095    155
  305 WTRDST # WTRDST * (772723.0/ WTRDST) **0.03                   SHEL1100    157
      FNDSLB # FNDSLB * ( 1134500.0/ FNDSLB) **0.03                 SHEL1105
C*** DEMISTER + SUPPORT COST  10/12/65                              SHEL1110    158
      COSTDM # COSTDM + 10.05 * SUMDMA * ALEV * AMODU               SHEL1115
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FIGURE 6 (Continued)

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                                                                    09/26/67
          SHEL        -  EFN    SOURCE STATEMENT  -   IFN(S)  -

C***  II-E   ADJUSTABLE WEIRS   REVISED 9/24/65                      SHEL1120
      WEIRC # 1909240.0*(((WTME - (WTME/8.0) * 0.8)                 SHEL1125
     1 * FLOAT(NTOTAL - 1) * ALEV * AMODU)/ 50430.0) **0.9          SHEL1130     159
  310 ES # SMCOLC + SMEXTW + SMINTW + SMTRAC + COSTDM               SHEL1135
     1+WEIRC+SMVALV+DFLECR+WTRDST+EXPJNT+FNDSLB                     SHEL1140
      ESHELL # ELE * SITEW * SUMLEV                                 SHEL1145
      RSHELL # RLR * SITEW * SUMLEV                                 SHEL1150
      VOLM # ESHELL + RSHELL                                        SHEL1155
      USHELV # ES /  VOLM                                           SHEL1160
C***  III.PUMPS AND DRIVES WITH SCALING  REVISED 9/20/65            SHEL1165
C CALCULATE SYSTEM HEAD  IN TOP AND BOTTOM STAGES                   SHEL1170
      GTV21#GTV2(TV(2))                                             SHEL1175
      IF(XCR)315,320,315                                            SHEL1180
  315 GTV2N#GTV2(TV(NTOTAL+1))                                      SHEL1185
      HS1#2.3*(GTV21-GTV2N)                                         SHEL1190
      GO TO 325                                                     SHEL1195
  320 HS1#2.3*(GTV21-14.7)                                          SHEL1200
  325 H2#HH+HS1                                                     SHEL1205
C CALCULATE HEADS AND POWER                                         SHEL1210
      FRICR#SSF*(0.0056+0.02436/(DIR*VR)**0.32)                     SHEL1215     167
      FRICE#SSF*(0.0056+0.02436/(DIE*VE)**0.32)                     SHEL1220     168
      FRICH#SSF*(0.0056+0.02436/(DIH*VH)**0.32)                     SHEL1225     169
      HEADR#6.0*FRICR*RLR*VR**2/(DIR*32.174)                        SHEL1230
      HEADE#6.0*FRICE*ELE*VE**2/(DIE*32.174)                        SHEL1235
      HEADH#6.0*FRICH*HLH*VH**2/(DIH*32.174)                        SHEL1240
      HE#SUMLEV                                                     SHEL1245
      HR#SUMLEV                                                     SHEL1250
      IF(XCR)335,335,330                                            SHEL1255
C*** CALCULATIONS FOR HEAD REQUIREMENTS   REVISED  10/ 5 65         SHEL1260
  330 HDEL # HD + HEADR + 20.0                                      SHEL1265
      GTV21 # GTV2(TS(1))                                           SHEL1270
      GTV2N # GTV2(TS(NTOTAL +1) )                                  SHEL1275
      HS1 # 2.3 * (GTV21 - GTV2N )                                  SHEL1280
      HREC # HE + HH + HS1 + HEADE + HEADH + 14.5                   SHEL1285
      GTV31 # 29.7                                                  SHEL1290
      GTV3N # GTV2(TV (NTOTAL +1) )                                 SHEL1295
      HS2 # 2.3 * (GTV31 - GTV3N)                                   SHEL1300
      HPR # HS2 + 35.0 + 5.0                                        SHEL1305
      HDEA # HE + 25.0 - 20.0                                       SHEL1310
      GO TO 340                                                     SHEL1315
  335 HDEL#HD+HR+HE+HS1+HEADR+HEADE+HEADH                           SHEL1320
      HREC#0.0                                                      SHEL1325
  340 PCNST#3.7676768E-10                                           SHEL1330
      II # 1                                                        SHEL1335
      CALL DINTPL (TO, CO, CPIN)                                    SHEL1340     178
      WOTJRB # 0.0                                                  SHEL1345
      WOVENT # 0.036 * (WP + WX)                                    SHEL1350
      POREC#PCNST*HREC*WF/SMALLE                                    SHEL1355
      POBLD#PCNST*HBL*WB/SMALLE                                     SHEL1360
      POPRD#PCNST*HPR*WX/SMALLE                                     SHEL1365
      PODEA # PCNST * HDEA * (WX + WP+ WOVENT) / SMALLE             SHEL1370
  345 WOCN # WO + WOVENT                                            SHEL1375
      PODEL # PCNST * HDEL * WOCN  / SMALLE                         SHEL1380
      PO1#PODEL+POBLD+POPRD   +PODEA                                SHEL1385
      PO2#POREC                                                     SHEL1390
      PO3#EXP(.0137*TB-6.121)*(WO-WC)/0.34667E+6                    SHEL1395     181
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FIGURE 6 (Continued)

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                                                                    09/26/67
          SHEL        -  DEN   SOURCE STATEMENT  -  IFN(S)  -

      PO#PO1+PO2+PO3                                                SHEL1400
  350 IF(XCR)355,355,360                                            SHEL1405
  355 PMCPO#27573.726*(PO1+PO2)                                     SHEL1410
      GOTO365                                                       SHEL1415
  360 PMCPO#1340.4826*(20.57*PO1+20.98*PO2)                         SHEL1420
  365 UNDRVE#PMCPO/(1340.4826*(PO1+PO2))                            SHEL1425
 8005 FORMAT (1H0 I6, 6E16.8)                                       SHEL1430
C                                                                   SHEL1435
  370 II # 5                                                        SHEL1440
      CALL DINTPL (TO, CO, RHO )                                    SHEL1445    190
      GPMO # WOCN / (8.022 * RHO  )                                 SHEL1450
      CALL DINTPL ( SMT (NK), C (NK) , RHO )                        SHEL1455    194
      GPMR # WF  / (8.022 * RHO )                                   SHEL1460
      CALL DINTPL (TS(NTOTAL+1) , CP   , RHO )                      SHEL1465    197
      GPMP # WX / (8.022 * RHO )                                    SHEL1470
      CALL DINTPL ( SMT (NK+1), CO, RHO )                           SHEL1475    200
      GPMDE#(WB + WX + WOVENT) /(8.022 * RHO )                      SHEL1480
      UDEL #  0.927 + .00175 * HDEL                                 SHEL1485
      UREC #  1.534 + .00175 *HREC                                  SHEL1490
      UPROD # 0.786 + .00175 * HPR                                  SHEL1495
      UDEA # 1.5225 + 0.00175 *HDEA                                 SHEL1500
      PUMPO                                                         SHEL1505
     1 # UDEL * (142300.0* AUNIT / GPMO)** 0.2 * GPMO * (5.0/AUNIT)**0.1SHEL1510    202   203
      PUMPR                                                         SHEL1515
     1 # UREC * (231700.0*AUNIT/ GPMR) **0.2 * GPMR * (5.0/AUNIT) **0.1 SHEL1520    204   205
      PUMPP                                                         SHEL1525
     1 # UPROD* (34500.0*  AUNIT/ GPMP) ** 0.2 * GPMP *(5.0/AUNIT)** 0.1SHEL1530    206   207
      PUMPDE                                                        SHEL1535
     1 # UDEA * (71300.0* AUNIT /GPMDE)** 0.2 * GPMDE * (5.0/AUNIT)**0.1SHEL1540    208   209
      PMPPIT                                                        SHEL1545
     1 # 2.023 * (231700.0* AUNIT/ GPMR) **0.1 *GPMR *(5.0/AUNIT) **0.1 SHEL1550    210   211
      PMCFLO #                                                      SHEL1555
     1 PUMPO + PUMPR + PUMPP + PUMPDE + PMPPIT                      SHEL1560
C                                                                   SHEL1565
C***  MOTOR DRIVES  3 / 23 / 66                                     SHEL1570
      DRVMO                                                         SHEL1575
     1 # 51927.0* (2.237 *AUNIT /PODEL)**0.2 * PODEL *(5.0/AUNIT)**0.1  SHEL1580    212   213
      DRVMR                                                         SHEL1585
     1 # 40638.0*(11.931 *AUNIT /POREC)**0.2 * POREC *(5.0/AUNIT)**0.1  SHEL1590    214   215
      DRVMP                                                         SHEL1595
     1 # 76233.0* (0.746 *AUNIT /POPRD)**0.2 * POPRD *(5.0/AUNIT)**0.1  SHEL1600    216   217
      DRVMDE                                                        SHEL1605
     1 # 66863.0* (0.932 *AUNIT /PODEA)**0.2 * PODEA *(5.0/AUNIT)**0.1  SHEL1610    218   219
      PMCPO #                                                       SHEL1615
     1DRVMO + DRVMR + DRVMP + DRVMDE                                SHEL1620
      PMC#PMCFLO +PMCPO                                             SHEL1625
     1 + TRBOND                                                     SHEL1630
C**** IV   DEGASSIFICATION SYSTEM COSTS (DEAERATOR)   9/29/65       SHEL1635
C*** DEAERATOR FOUNDATION                                           SHEL1640
  375 DEFNAR#                 SITEW  *SLS(NTOTAL+1)                 SHEL1645
      DEAFND#12.903*DEFNAR                                          SHEL1650
C*** DEAERATOR EXTERIOR WALLS                                       SHEL1655
      DEXWAR#2.0*SLS(NTOTAL+1)*(SUMLEV+ SITEW )                     SHEL1660
      FUNC2#COST2(SLS(NTOTAL+1),DP(NTOTAL+1))                       SHEL1665
      DEFNC#FUNC2                                                   SHEL1670
      DEXWLC#FUNC2*DEXWAR                                           SHEL1675
```

FIGURE 6 (Continued)

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                                                                    09/26/67
          SHEL        -  EFN   SOURCE STATEMENT  -  IFN(S)  -

C*** DEAERATOR CONDENSER  11/ 1/65                                  SHEL1680
      TBLBR # 0.9844 - 1.2903 * DOR + 0.57707 * DOR **2             SHEL1685
      CTUBED#SMA2* (1.6078E+6 /(AR + ADEA))**0.1 * ADEA * 1.20      SHEL1690
     1+TBLBR*(1.6078E+6/(AR + ADEA))**0.1 * ADEA * 1.20             SHEL1695
C*****COST FOR INTERMED TUBE SHEETS                                 SHEL1700     225
      CITSD#ENITSD*1.20*( 6.81*APTSR                                SHEL1705
     1+0.510*(.84918E+4/(APTSR*(ENITSR + ENITSD)))**0.1 * APTSR     SHEL1710
     2+0.0480*(    1.07437 E+8          /(RNR*(ENITSR + ENITSD)))**0.1  SHEL1715
     3 *RNR/(2.0*ALEV*AMODU))                                       SHEL1720     226    227
      DEARTB # CTUBED + CITSD                                       SHEL1725
C*** DEAERATOR TRAY AND SUPPORTS                                    SHEL1730
      DETRAR#ASIEV                                                  SHEL1735
      DETRAC#ASIEV*38.486                                           SHEL1740
C*** DEAERATOR BLOWER COSTS                                         SHEL1745
      BLOWRC#8.5498E-3*(WX+WB)                                      SHEL1750
      DEAFND#DEAFND*(7750.0/DEFNAR)**0.03                           SHEL1755     228
      DEXWLC#DEXWLC*(1860C.0/DEXWAR)**0.03                          SHEL1760     229
      DETRAC#DETRAC*(6975C.0/DETRAR)**0.03                          SHEL1765     230
      BLOWRC#BLOWRC*(172.2E6/(WX+WB))**0.1                          SHEL1770     231
      DEACST#DEAFND+DEXWLC+DEARTB+DETRAC+BLOWRC                     SHEL1775
      RETURN                                                        SHEL1780
      END                                                           SHEL1785
```

FIGURE 6 (Continued)

09/26/67

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*
$IBFTC VAL      DECK                                                    VALCCCCC
```

FIGURE 6 (Continued)

09/26/67

VAL - FFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINE VALVE                                                  VALCCC05
C*****COST FOR MOTOR DRIVEN PLANT   3 / 23 / 66                         VALCCC10
      COMMON/GEN/CASE,G,RP, XRP,P,XC,C,XU,CR,XCR, ROE,ROER              VALCCC15
      COMMON/TEMPC/TSTEAM,TS(100), THF,TB,XTB,       TC,TP,TA,CC,CP     VALCCC20
      COMMON/GEOME/AMODU,ALEV,ALNIT,TOTALE,TOTALR,FREBC,TRAYDP,HST,CL,  VALCCC25
     1SPL                                                               VALCCC30
      COMMON/ECON/SMALLE,SMALLD,SMALLB,SMALLP,RATEIN,WPL, CAPF,THERM,   VALCCC35
     1PMSTMC                                                            VALCCC40
      COMMON/TUBING/ DOH,DIH,DOE,DIE,DOR,DIR,A1,A2,A3,BIKTH,BIKTE,      VALCCC45
     1BIKTR,CSLTBH,CSLTBP,CSLTBR                                        VALCCC50
      COMMON/FOULIN/RH,RE,RSR,SH,SE,SR,VH,VE,VR                         VALCCC55
      COMMON/PUMPHT/HD,HH,HBL,HPR,FFHL,SSFI                             VALCCC60
      COMMON/AMISC/CPSTB,FACID,ACACID,DPLIM,A6,A7,XSCC,XNNN,NNN,XLLL,LLLVALCCC65
      COMMON/DATA1/BDEPH,DTPD,SSF2,TOTAL,UMAX,UALP,PI,TWFA,TSTH,CCEFA,  VALCCC70
     1ORITE,ITER                                                        VALCCC75
      COMMON/AZ1/DTPDP(100),TITLE(15)                                   VALCCC80
      COMMON/TCVL1/ ACPSN, ACPSNK, ACPTNK,CPBT,CPTK, CPTNK,AMBN,TCF,WX, VALCCC85
     1WF,WO,CB,WC,WB, WR,RHONK, RHCK, ERR,CCF, NITER, NK,NTOTAL, PN,RPN,VALCCC90
     2TC, ALPHA1, WPN, DELCT, DELST, IGSC, SMAQ, SUMA, TK               VALCCC95
      COMMON/TCVL2/ TTD(100),SMT(100), SMT2(100), CT(100), WS(100),     VALCCC100
     1C(100), TV(100), WV(100), QH(100), WP(100), AS(100),SLS(100)      VALCCC105
      COMMON/STAGE1/ A(100),CFMWV(100), CFMWZ(100), UPAR(100), CM(100), VALCCC110
     1HO(100),HI(100),WWFS(100),VVEV(100), TRAYFL(100),TRAYWD(100),     VALCCC115
     2RESIDT(100), PV(100),DELP(100), DTPDPS(100)                       VALCCC120
      COMMON/DMST1/ AREADM(100),DPTDM(100),DTDM(100), CPROC(100),WICDM(1VALCCC125
     1CC)                                                               VALCCC130
      COMMON/CCND1/ DPINIT(100), DTINIT(100), DPCLR(100), DTCLR(100),   VALCCC135
     1DTCND(100)                                                        VALCCC140
      COMMON/STAGE2/ AH, BAROM,BWF,BWR,COSTDM,ELE,ESHELL,HBH,HBLE,HBLR, VALCCC145
     1HLH, HNOE, HNOR,HN, HSTE, HSTR, JJ, KK, RLR, RSHELL, TBNCE,TBNCR, VALCCC150
     2UBARH, VBLE,VBLR,VNOE, VNOR, WTME, WTMR, WY                       VALCCC155
      COMMON/PHYS/II                                                    VALCCC160
      COMMON /MAIN1/ SSF, HFG                                           VALCCC165
      COMMON /STG1/ ATR, BTR, CTR, CTA                                  VALCCC170
      COMMON /STG2/HOH, PR, DENBR(100), SUMLS, WVST(100), CC, DI, R, S, VALCCC175
     1 V, TVTT(100), Z(100), HV, HS(100), WBS(100)                      VALCCC180
      COMMON /CST1/ ASIEV, ANPLAT, SLPLAT, APLAT                        VALCCC185
      COMMON /CNDR1/ NERR,        CCCR(3), K                            VALCCC190
      COMMON /DEM1/ SLKP2, SUMDMA, TDMP(100), APTSE, VOLM, APTSR        VALCCC195
      COMMON /DEM3/ ARGZ(15)                                            VALCCC200
      COMMON /DEAIC/ RNR                                                VALCCC205
      COMMON /OP1/ SMAPPP, HR, SMAPPH, HE, UNARAR, UNARAE, A4, AJ, WCC, VALCCC210
     1 UBARE, UBARR, UTHE, AE, AR, ATHE, THEL, ENE, THEN, HFE, HFR, THEHVALCCC215
     2T, HC2, HC1, CC2, CC1, POCST2, POCST1, ALPFAR, PMC2, PMC1, CCCAP2,VALCCC220
     3  CCCAP1, SITE2, SITE1,  WAIT2, WAIT1,  ES2, ES1,  EA2, EA1,     VALCCC225
     4 BHC2,  BHC1,  VPC2,  VPC1,  UPPH,  EEC2,  EEC1,  PC,  CC2, CC1,  VALCCC230
     5 SCM2,  SCM1,  CIBC2, CIBC1,  DEA2,  DEA1,  TC2,  TC1,  CAPI1,    VALCCC235
     6 CAPI2,  CAPI3,  PO3,  HS1,  PMC,  EEC,  VPC,  SITE,  WAIT,       VALCCC240
     7 ES,  EA,  CIBC,  BHC,  CCCAP,  CCSTIN,  WFIRC,  CRANE,  BLDG,    VALCCC245
     8 DEACST,  PMCPO,  PMCFLO,  RETUB2,  RETUB1,  DPREQ(100), AMSC2,   VALCCC250
     9 AMSC1                                                            VALCCC255
      COMMON/NOV25/C11, C12, C13, C14, C15, C16,C21, C22, C23, C24, C31,VALCCC260
     1 C32, C33, C34, C41, C42                                          VALCCC265
      COMMON/CSTLK/ADEA,ENITSC,WOCN,GPMP, FG, SMAPPR, DEARTR, EAR, EAE,TVALCCC270
     1CBH,AMPDAS                                                        VALCCC275
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FIGURE 6 (Continued)

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                                                                                    09/26/67
          VAL          -  EFN    SOURCE STATEMENT  -  IFN(S)  -

      COMMON/CSTLK1/SITEW,CTURED,CTURFE,CTUBER,SMA1,SMA2,SUMLEV,TRBCND,  VALC0280
     1ENITSR                                                             VALC0285
      NTOTAL#NTOTAL                                                      VALC0290
C  D, VALVES AND PIPING                                                  VALC0295
C                                                                        VALC0300
C**  VI    VALVES AND PIPING  TURBINE PLANT  11/15/65                    VALC0305
      SITEWR#SITEW/237.60                                                VALC0310
      UFCTR # AUNIT / AMODU + 0.6667 * (1.0 - (AMODU / AUNIT) ** (-1.5))VALC0315     3
      VPR1 # WO  /(AUNIT * 6.4482 E7)                                    VALC0320
      IF(WC)100,105,105                                                  VALC0325
  100 SAVEWC#WC                                                          VALC0330
      WC#0.0                                                             VALC0335
  105 CONTINUE                                                           VALC0340
      VPR14 #       WC          / (AUNIT * 3.0058E+7)                    VALC0345
      VP11 #13340.0* VPR1**1.2 * AUNIT                                   VALC0350     7
      VP12 # 26925.0*VPR1 **0.5 * SQRT(6.25 E+4 + ( 0.25 * SITEW) **2)   VALC0355
     1/ 255.84 * AUNIT                                                   VALC0360     8      9
      VP14 # 164751.0* VPR14 **0.5 * UFCTR * SITEWR                      VALC0365     10
      VP13 #  9598.6 * VPR1 ** 0.8 * AUNIT                               VALC0370     11
      VPC1 # VP11  + VP12 + VP13 + VP14                                  VALC0375
      VPR2 # (WB + WX)/(AUNIT * 3.4430 E +7)                             VALC0380
      VPR23# (WB + WX)/(AMODU * 3.4430 E +7)                             VALC0385
      VPR24 # (WB + WX) / 1.7215 E+8                                     VALC0390
      VP21 # 20542.0* VPR2**1.2 * AUNIT                                  VALC0395     12
      VP22 # 24400.0* VPR2 **0.5 * AUNIT                                 VALC0400     13
      VP24 # 159373.0* VPR24**0.5                                        VALC0405     14
      VP25 #  90119.0* VPR2 ** 0.5 * UFCTR * SITEWR                      VALC0410     15
      VP23  # 36682.0* VPR23** 0.8 * AMODU                               VALC0415     16
      VPC2 # VP21 + VP22 + VP23 + VP24+ VP25                             VALC0420
      VPR3 # (WO-WB-WX)/(AUNIT * 3.0058E7)                               VALC0425
      VPR32# (WO-WB-WX)/ 1.5029 E+8                                      VALC0430
      VPR33# (WO-WB-WX)/(AMODU * 3.0058E7)                               VALC0435
      VP31 #  11835.0* VPR3 ** 1.2 * AUNIT + 72732.0* VPR32 **1.2        VALC0440     17     18
      VP32 # 147725.0* VPR32** 0.5                                       VALC0445     19
      VP34 # 89681.0* VPR32 ** 0.5 * SITEWR                              VALC0450     20
      VP33 # 7367.2 * VPR33** 0.8 * AMODU                                VALC0455     21
      VPC3 # VP31 + VP32 + VP33  + VP34                                  VALC0460
      VPR4 # WF/(AUNIT * 1.2081E8)                                       VALC0465
      VPR44# WF/(AMODU * 1.2081E8)                                       VALC0470
      VP41 # 93318.0* VPR4**1.2 * AUNIT                                  VALC0475     22
      VP42 #  40794.0* VPR4 **0.5 * (RLR + SLS (NTOTAL + 1) + 60.0)      VALC0480
     1  / 119.54 * AUNIT                                                 VALC0485     24
      VP44 #  20395.0* VPR4 ** 0.5 * UFCTR * SITEWR *  5.0               VALC0490     25
      VP43 # 21357.0* VPR4 ** 0.8 * AUNIT                                VALC0495     26
      VPC4 # VP41 + VP42 + VP43  + VP44                                  VALC0500
      VPR5 # G / ( AUNIT * 50.E+6)                                       VALC0505
      VPC5 # 12986.0* VPR5 * AUNIT                                       VALC0510
      VPR6 # WF/(AUNIT*1.2081 E+8)                                       VALC0515
      VP62 # 48484.0* VPR6 **0.5 * AUNIT                                 VALC0520     27
      VP64 #  116029.0* VPR6 ** 0.5 * UFCTR * SITEWR                     VALC0525     28
      VP63 # 16336.0* VPR6 ** 0.8 * AUNIT                                VALC0530     29
      VPC6 # VP62 + VP63 + VP64                                          VALC0535
      VPR7 # WX/(AUNIT * 1.7221 E+7)                                     VALC0540
      VPR72 # WX / 8.6105 E+7                                            VALC0545
      VP71 # 6876.2 * VPR7**1.2 * AUNIT                                  VALC0550     30
      VP72 # 432044.0* VPR72** 0.5                                       VALC0555     31
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FIGURE 6 (Continued)

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                                                                                  09/26/67
        VAL          -  FFN   SOURCE STATEMENT  -  IFN(S)  -

      VP74 # 54540.0* VPR72 ** 0.5 * SITEWR                                VAL00560     32
      VP73 # 16842.0* VPR7 ** 0.8 * AUNIT                                  VAL00565     33
      VPC7 # VP71 + VP72 + VP73 + VP74                                     VAL00570
      VPR8 # WB/(AUNIT * 1.7209 E7)                                        VAL00575
      VPR82 # WB / 8.6045 E+7                                              VAL00580
      VP81 # 5019.4 * VPR8 ** 1.2 * AUNIT                                  VAL00585     34
      VP82 # 120306.0* VPR82** 0.5                                         VAL00590     35
      VP84 # 37603.0* VPR82**0.5 * SITEWR                                  VAL00595     36
      VP83 # 5873.2 * VPR8 ** 0.8 * AUNIT                                  VAL00600     37
      VPC8 # VP82 + VP83 + VP81 + VP84                                     VAL00605
      VPR9 # ( WB + WX) / (AUNIT * 3.443 E+7)                              VAL00610
      VPR92# ( WB + WX) /  1.7215 E+8                                      VAL00615
      SITELR #(ELE + RLR + SLS (NTOTAL+1) )/326.48                         VAL00620
      VP91 # 10858.0* VPR9 ** 1.2 * AUNIT                                  VAL00625     39
      VP92 # 315196.0* VPR92** 0.5 * (2.0 * AMODU * ALEV / 80.0)* SITELRVAL00630     40
      VPC9 # VP91 + VP92                                                   VAL00635
      VPR10 # PO /          (AUNIT * 16.426)                               VAL00640
      SITWLR #(  SITEW + ELE + RLR + SLS (NTOTAL +1) +  500.00)/1043.96    VAL00645
      VP101 # 4972.6 * VPR10 ** 1.2 * AUNIT                                VAL00650     42
      VP102 # 74687.0* VPR10 ** 0.5 * SITWLR                               VAL00655     43
      VP103 # 2625.0 * VPR10 ** 0.8 * AUNIT                                VAL00660     44
      VP104 # 10521.0* VPR10 ** 0.5 * AUNIT                                VAL00665     45
      VP105 # 700.0* VPR10 *  AUNIT                                        VAL00670
      VPCP# VPC1 + VPC2 + VPC3 + VPC4 + VPC5 + VPC6 +                      VAL00675
     1 VPC7 + VPC8 + VPC9                                                  VAL00680
      VPC11 # 0.07861 * VPCP                                               VAL00685
      VPC # VPCP + VPC11                                                   VAL00690
  110 UNPIPE#VPC/WF                                                        VAL00695
C                                                                          VAL00700
C***  VII.  BRINE HEATER COST   SCALING FACTOR ADDED  9/25/65              VAL00705
  115 DTSBH#DOH/12.0*SQRT(3.594*HN/AUNIT)                                  VAL00710     48
      ATSBH # PI * DTSBH **2 / 4.0                                         VAL00715
      NITS# 0.20 *HLH/DOH -0.5                                             VAL00720
      ANITS#NITS                                                           VAL00725
      TBLBR # 0.9844 - 1.2903 * DOH + 0.57707 * DOH **2                    VAL00730
      TCBH  # A3 *(1.11469E+6/ AH)**0.1 * AH /AUNIT * 1.25                 VAL00735
     1      + TBLBR  *(1.11469E+6 / AH) **0.1 * AH / AUNIT * 1.25          VAL00740     50
      TSCBH  # ATSBH * (30.70 * 2.0 + 6.12  * ANITS) * 1.25                VAL00745
     1+ (0.049*2.0 +0.024*ANITS) * 1.25*HN/AUNIT                           VAL00750
      SHELLC # (12.29* ATSBH * HLH)                                        VAL00755
     1 * (1.1079E+4 / (ATSBH * HLH )) **0.1 * 1.25                         VAL00760     51
      BHC#(TCBH+TSCBH+SHELLC )*AUNIT                                       VAL00765
      A4  #(TSCBH+SHELLC)*AUNIT/AH                                         VAL00770
  120 UNSHHT#A4                                                            VAL00775
      RETURN                                                               VAL00780
      END                                                                  VAL00785
```

FIGURE 6 (Continued)

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```
$ORIGIN        COSTLY                                    OUTPCCCC
$IBFTC OUTP    DECK                                      OUTPCCC5
```

FIGURE 6 (Continued)

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OUTP - FFN SOURCE STATEMENT - IFN(S) -

```
      SUBROUTINE OUTPUT                                                 OUTPC01C
C**** OUTPUT FOR NORITAKE  8/25/65                                      OUTPC01S
      COMMON/GEN/CASE,G,RP, XRP,P,XC,C,XU,CR,XCR, ROE,ROER              OUTPC02C
      COMMON/TEMPC/TSTEAM,TS(100), THE,TB,XTB,        TC,TP,TA,CC,CP    OUTPC02S
      COMMON/GEOME/AMODU,ALEV,AUNIT,TOTALE,TOTALR,FREBC,TRAYCP,FST,CL,  OUTPC03C
     1SPL                                                               OUTPC03S
      COMMON/ECON/SMALLE,SMALLD,SMALLB,SMALLP,RATEIN,WPL, CAPF,THERM,   OUTPC04C
     1PMSTMC                                                            OUTPC04S
      COMMON/TUBING/ DOH,DIH,DOE,DIE,DOR,DIR,A1,A2,A3,BIKTH,BIKTE,      OUTPC05C
     1BIKTR,CSLTBH,CSLTBP,CSLTBR                                        OUTPC05S
      COMMON/FOULIN/RH,RE,RSR,SH,SE,SR,VH,VE,VR                         OUTPC06C
      COMMON/PUMPHT/HD,HH,HBL,HPR,FFHL,SSFI                             OUTPC06S
      COMMON/AMISC/CPSTB,FACID,ACACID,DPLIM,A6,A7,XSOC,XNNN,NNN,XLLL,LLL OUTPC07C
      COMMON/DATA1/BDEPH,DTPD,SSF2,TOTAL,UMAX,UALP,PI,TWFA,TSTH,CCEFA,  OUTPC07S
     1ORITE,ITER                                                        OUTPC08C
      COMMON/AZ1/DTPDP(100),TITLE(15)                                   OUTPC08S
      COMMON/TCVL1/ ACPSN, ACPSNK, ACPTNK,CPBT,CPTK, CPTNK,AMBN,TCF,WX, OUTPC09C
     1WF,WO,CB,WC,WB, WR,RHONK, RHCK, ERR,CCF, NITER, NK,NTOTAL, PN,RPN, OUTPC09S
     2TC, ALPHA1, WPN, DELCT, DELST, IGSC, SMAQ, SUMA, TK               OUTPC10C
      COMMON/TCVL2/ TTD(100),SMT1(100), SMT2(100), CT(100), WS(100),    OUTPC10S
     1C(100), TV(100), WV(100), QH(100), WP(100), AS(100),SLS(100)      OUTPC11C
      COMMON/STAGE1/ A(100),CFMWV(100), CFMWZ(100), UBAR(100), CM(100), OUTPC11S
     1HO(100),HI(100),WWFS(100),VVFV(100), TRAYFL(100),TRAYWC(100),     OUTPC12C
     2RESIDT(100), PV(100),DELP(100), DTPDPS(100)                       OUTPC12S
      COMMON/DMSTI/ AREADM(100),DPTDM(100),DTDM(100), CPROD(100),WIDDM(1OUTPC13C
     1100)                                                              OUTPC13S
      COMMON/COND1/ DPINIT(100), DTINIT(100), DPCLR(100), CTCLR(100),   OUTPC14C
     1CTCND(100)                                                        OUTPC14S
      COMMON/STAGE2/ AH, BAROM,BWE,BWR,COSTDM,ELE,ESHELL,HBH,HBLE,HBLR, OUTPC15C
     1HLH, HNOE, HNOR,HN, HSTE, HSTR, JJ, KK, RLR, RSHELL, TBNOE,TBNOR, OUTPC15S
     2UBARH, VBLE,VBLR,VNOE, VNOR, WTNE, WTMR, WY                       OUTPC16C
      COMMON/PHYS/II                                                    OUTPC16S
      COMMON /MAIN1/ SSF, HFG                                           OUTPC17C
      COMMON /STG1/ ATR, BTR, CTR, CTA                                  OUTPC17S
      COMMON /STG2/HOH, PR, DENBR(100), SUMLS, WVST(100), DO, DI, R, S, OUTPC18C
     1 V, TVTT(100), Z(100), HV, HS(100), WBS(100)                      OUTPC18S
      COMMON /CST1/ ASIEV, ANPLAT, SLPLAT, APLAT                        OUTPC19C
      COMMON /CNDR1/ NERR,        COOR(3), K                            OUTPC19S
      COMMON /DEM1/ SLKP2, SUMDMA, TDMP(100), APTSE, VOLM, APTSR        OUTPC20C
      COMMON /DEM3/ ARGZ(15)                                            OUTPC20S
      COMMON /DEAIC/ RNR                                                OUTPC21C
      COMMON /OP1/ SMAPPP, HR, SMAPPH, HF, UNARAR, UNARAE, A4, AJ, WCO, OUTPC21S
     1 UBARE, UBARR, UTHE, AE, AR, ATHE, THEL, ENE, THEN, HFE, HFR, THEHOUTPC22C
     2T, HC2, HC1, CC2, CC1, POCST2, POCST1, ALPBAR, PMC2, PMC1, CCCAP2,OUTPC22S
     3  CCCAP1, SITE2, SITE1,  WAIT2, WAIT1,  ES2, ES1,  EA2, EA1,     OUTPC23C
     4 BHC2,  BHC1,  VPC2,  VPC1,  UBPH,  EEC2,  EEC1,  PO,  CC2, CC1, OUTPC23S
     5 SCM2,  SCM1,  CIBC2, CIBC1,  DEA2,  DEA1,  TC2,  TC1,  CAPI1,   OUTPC24C
     6 CAPI2,  CAPI3,  PO3,  HS1,  PMC,  EEC,  VPC,  SITE,  WAIT,       OUTPC24S
     7 ES,  EA,  CIBC,  BHC,  CCCAP,  CCSTIN,  WEIRC,  CRANE,  BLDG,    OUTPC25C
     8 DEACST,  PMCPO,  PMCFLO,  RETUB2,  RETUB1,  CPREQ(100), AMSC2,   OUTPC25S
     9 AMSC1                                                            OUTPC26C
      COMMON/JAN18/WPI                                                  OUTPC26S
      COMMON/JAN27/WM,        SUMALP,SUMQH,WPNK,CPSN,CPSNK              OUTPC27C
      DIMENSION ALPHA(100)                                              OUTPC27S
      NN#NTOTAL                                                         OUTPC28C
```

FIGURE 6 (Continued)

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                                                                    09/26/67
      OUTP        -  EFN   SOURCE STATEMENT  -  IFN(S)  -

      NNK#NN-NK                                                     OUTPC285
      C(I)#CCF                                                      OUTPC290
      CSURP#2.0*AMBN/(ACPSN+ACPTNK)                                 OUTPC295
       PLP#SUMLS                                                    OUTPC300
      PNP#SUMN                                                      OUTPC305
      WRITE (6,8000)( TITLE(I),I#1,12)                              OUTPC310     4
 8000 FORMAT(1H1 12A6)                                              OUTPC315
      WPMWP1#WP(NTOTAL+2)-WP1                                       OUTPC320
      WZ#WPMWP1                                                     OUTPC325
      WP1#WP1*2.90333                                               OUTPC330
      WPMWP1#WPMWP1*2.90333                                         OUTPC335
      WZY          #(WP(NTOTAL+2))*2.90333                          OUTPC340
      WRITE (6,8005)WP1,WPMWP1, WZY                                 OUTPC345     13
      WP1#WP1/2.90333                                               OUTPC350
 8005 FORMAT(1H0,17HPRODUCT ABOVE-GPD,E17.6,3X,17HPRODUCT FROM SEMS,  OUTPC355
     1E20.8,3X,22HTOTAL PRODUCT RATE-GPD,E20.8)                     OUTPC360
      WRITE (6,8010)FFHL,SMALLD,TOTAL,CAPF,SMALLP,TSTEAM,        SMALLE,OUTPC365
     1SMALLP,THF,HD     ,SMAPPP                                    OUTPC370     14
 8010 FORMAT(1H0,37X,                          21HEVAP HEAT LOSS  (PCT)OUTPC375
     1 7XF 8.3,4X15HPOWER ($/KW HR)17XF10.6/                        OUTPC380
     213H TOTAL  STAGES14XF8.0,3X17HPLANT LOAD FACTOR 8XF10.4,5X    OUTPC385
     313HHEAT ($/MBTU)17XF12.6/11H STEAM TEMP14XF10.2,3X,           OUTPC390
     48HPUMP EFF17XF10.4,5X17HANNUAL CAP I/YEAR14X,F10.4/           OUTPC395
     515H MAX BRINE TEMP 10X F10.2,3X 13HDELIVERY HEAD 14XF 8.2,5X  OUTPC400
     6 28HEVAP AND REJ RETUBING CHARGE  F14.6)                      OUTPC405
      WRITE (6,8015)TO,HR, SMAPPH, TA,HE,UNARAR,CO,HH,UNARAE,CP,HBL,A3  OUTPC410     15
 8015 FORMAT(11H OCEAN TEMP F24.2,3X11HREJECT HEAD14XF10.2,5X       OUTPC415
     1 22HHEATER RETUBING CHARGE F20.6,        /13H AMBIENT TEMP12XF10.2,OUTPC420
     23X9HEVAP HEAD,16X,F10.2,5X20HREJECT AREA ($/SQFT) 9X,F11.4/   OUTPC425
     320H SEA WATER SALT CONC5XF10.5,3X,11HHEATER HEAD14XF10.2,5X,  OUTPC430
     418HEVAP AREA ($/SQFT)12X,F10.4/                               OUTPC435
     518H PRODUCT SALT CONC7XF10.5,3X13HBLOWDOWN HEAD  12X F10.2,5X OUTPC440
     621HBRINE HEATER ($/SQFT)  9X F10.4)                           OUTPC445
      WRITE (6,8020)CR,HPR,A4,P,RP,AJ, RATEIN,Q,SSFI,TP,WPL,        OUTPC450
     1CSLTBH,CSLTBP                                                 OUTPC455     16
 8020 FORMAT(21H CONC RATIO C(B)/C(0)4XF10.5,3X12HPRODUCT HEAD12XF11.2,5OUTPC460
     1X25HBRINE HEATER SHELL $/SQFT  F15.4 ,                        OUTPC465
     2                        /16H RECOVER RATIO P9XF10.5/          OUTPC470
     418H PERFORMANCE RATIO7XF10.3,3X11HHIGHER COST15XF10.4,4X,     OUTPC475
     5 13HINTEREST RATE  16X, F11.4/                                OUTPC480
     625H REJECT/EVAP TUBE FLOW C.  F10.4,3X,                       OUTPC485
     7 23HHEATER HEAT LOSS  (PCT) 3XF 9.2,5X 12HPRODUCT TEMP 17X F11.3/ OUTPC490
     811H PLANT LIFE 14X F10.1,3X, 17HTUBE LIFE, HEATER  7XF10.2, 7X,  OUTPC495
     9 16HTUBE LIFE, EVAP. 11X F10.2)                               OUTPC500
      WRITE (6,8025)SH,SE,SR,BIKTH,BIKTE,BIKTR,VH,VE,VR,            OUTPC505
     1 DOH,DOE,DOR,DIH,DIE,DIR,RH,RE,RSR,RHONK,                     OUTPC510
     2 RHOK,WF,WF,WO,NK,NNK,UBARH,UBARE,UBARR,                      OUTPC515
     3 AH,AE,AR,HLH,ELE,RLR,HN,ENE,RNR,                             OUTPC520
     4HBH,HFE,HFR                                                   OUTPC525     17
 8025 FORMAT(1H030X12HBRINE HEATER 9X 1CHEVAPORATOR 13X6HREJECT     OUTPC530
     1                              /16HOFLOODING FACTOR 4X3F20.2/  OUTPC535
     218H TUBE CONDUCTIVITY2X3F20.2/14H TUBE VELOCITY 6X3F20.2/     OUTPC540
     38H TUBE OD12X3F20.5/8H TUBE ID12X3F20.5/                      OUTPC545
     4      15H FOULING FACTOR 5X3F20.6/20H TEMP DROP/STAGE RHO20X2F20.7/OUTPC550
     516H TUBE FLOW LB/HR4X3E20.8/13H NO OF STAGES 27X2I20/         OUTPC555
     620H HEAT TRANSFER COEF 3E20.8/15H CONDENSER AREA5X3E20.8/     OUTPC560
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FIGURE 6 (Continued)

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                                                                    09/26/67
      OUTP        -  EFN   SOURCE STATEMENT  -  IFN(S)  -

    712H TUBE LENGTH8X3E20.8/12H NO OF TUBES9X3E20.8/                OUTPC565
    815H TUBE HEAD LOSS 5X3E20.8)                                    OUTPC570
     IF(ERR)115,100,115                                              OUTPC575
 100 WRITE (6,8030)                                                  OUTPC580     19
8030 FORMAT(1H012X4HCOST25X6H$/YEAR13X6H$/KGAL  )                    OUTPC585
     WRITE (6,8035)HC2,HC1,PN,CC2,CC1,RPN,POCST2,POCST1,ALPBAR, PMC2,  OUTPC590
    1 PMC1,BAROM,CCCAP2,CCCAP1                                        OUTPC595     20
8035 FORMAT(5H0HEAT 28X 2E20.8,3X21HRECOVERY RATIO (CALC)4XF16.5/     OUTPC600
    19H CHEMICAL24X2E20.8, 3X24HPERFORMANCE RATIO (CALC)F17.3/        OUTPC605
    228H POWER                        5X2E20.8,3X22HAVE BOILING POINT RISOUTPC610
    3E F19.3/                             17H PUMPS AND MOTORS 16X2E20.8,OUTPC615
    43X23HAVE THERMAL FORCE/STAGE F18.3/23H CAP CHEM                  OUTPC620
    510X 2E20.8)                                                      OUTPC625
     WRITE (6,8040)SITE2,SITE1,TB,WAIT2,WAIT1,                        OUTPC630
    1TCF ,ES2,ES1,        EA2,EA1,BHC2,BHC1                           OUTPC635     21
8040 FORMAT(10H SITE WORK23X,2E20.8,3X,13HBLOWDOWN TEMP  F28.3/       OUTPC640
    111H SEA-INTAKE22X2E20.8,                                         OUTPC645
    2 3X22HBRINE TEMP INTO HEATER F19.3/                              OUTPC650
    317H EVAPORATOR SHELL16X2E20.8,3X/                                OUTPC655
    416H EVAPORATOR AREA17X2E20.8/                                    OUTPC660
    513H BRINE HEATER20X2E20.8)                                       OUTPC665
     WRITE (6,8045)VPC2,VPC1,UBPH,EFC2,EEC1,PO,CC2,CC1,WZ,SCM2,SCM1,  OUTPC670
    1     WR,CIBC2,CIBC1,WC,DEA2,DEA1,TC2,TC1,WB,WY,CAPI1,CAPI2,CAPI3 OUTPC675     22
8045 FORMAT(18H VALVES AND PIPING15X2E20.8,3X13HU-BAR AVERAGE F28.2/  OUTPC680
    115H ELEC EQUIPMENT18X,2E20.8,3X18HPOWER (MEGA-WATTS) 7XF16.3/    OUTPC685
    215H OPERATING COST19X2E20.8,3X20HPRODUCT RATE (LB/HR)5XE16.8/    OUTPC690
    325H MAINTENANCE AND SUPPLIES 8X2E20.8,3X20HRECYCLE FLOW (LB/HR)  OUTPC695
    45XE16.8/36H CRANES, INSTRU, BUILDINGS, CONCRETE E17.8,E20.8,  3X OUTPC700
    524HSEA WATER RETURN (LB/HR) E17.8 /10H DEAERATOR 23X 2E20.8/     OUTPC705
    611H TOTAL COST 22X  2E20.8,3X                                    OUTPC710
    721HBLOWDOWN FLOW (LB/HR)4XE16.8/76X18HSTEAM FLOW (LB/HR)7XE16.8/1HOUTPC715
    80/46X1H$15X5H$/GPD14X6H$/KGAL/19H CAPITAL INVESTMENT 14X3E20.8)  OUTPC720
     WRITE (6,8050)PO3,HS1,PMC,EEC,VPC,SITE,WAIT,ES,EA,CIBC,BHC ,COSTDMOUTPC725
    1     ,CCCAP,COSTIN  ,WEIRC,CRANE,BLDG,DEACST,PMCFC,PMCFLC        OUTPC730     23
8050 FORMAT(1H119HDEAERATOR POWER, MWE16.8,3X18HSTAGE 1 PRESS HEAD11X,EOUTPC735
    116.8/1H 16HPUMPS AND MOTORS E19.8,3X,14HELEC EQUIPMENT           OUTPC740
    215X,E16.8,3X                                                     OUTPC745
    217HVALVES AND PIPINGE16.8/10H SITE WORKE26.8,3X                  OUTPC750
    312HWATER INTAKE17XE16.8, 3X17HSHELL, DMSTR,WEIR   E16.8/         OUTPC755
    416H EVAPORATOR AREAF20.8,3X29HCRANES INSTRU, BLDG, CONCRETE E16.8,OUTPC760
    5 3X,12HBRINE HEATER  E21.8/ 10H DEMISTER  10X E16.8,3X           OUTPC765
    618HCHEM SYS CAP COST  11X E16.8,3X17HINSTRUMENTATION  E16.8/     OUTPC770
    7 6H WEIRS 14XE16.8, 3X6HCRANE  23XE16.8, 3X10HBUILDINGS  7XE16.8/ OUTPC775
    8 11H DEAERATOR  9XE16.8, 3X11HMOTOR COST  18XE16.8,              OUTPC780
    9 3X10HPUMP COST  7XE16.8)                                        OUTPC785
     WRITE (6,8055)RETUR2,RETUR1                                      OUTPC790     24
8055 FORMAT(1H0,18HRETUR CHARGE($/YR),E15.6,5X,                       OUTPC795
    120HRETUR CHARGE($/KGAL),E23.6)                                   OUTPC800
     RSHELL#HSTR*ALEV*RLR*(WTMR+2.0*BWR)                              OUTPC805
      ESHELL#HSTE*ALEV*ELE*(WTME+2.0*BWE)                             OUTPC810
     VOLM#ESHELL+RSHELL                                               OUTPC815
     WRITE (6,8060)AMODU,ALEV,TSTH,FREPD,TWFA,SPL,BDEPH,HST,SSF2,CDEFA,OUTPC820
    1  ESHELL,RSHELL,BWE,BWR,WTME,WTMR,HSTE,HSTR                      OUTPC825     25
8060 FORMAT(15H NO. OF MODULES 5X E16.8, 3X 17HNO OF TRAY LEVELS  12X OUTPC830
    1E16.8, 3X 24HTUBE SHEET THICKNESS IN F9.4/15H FREE BOARD, FT 5X  OUTPC835
    2E16.8,3X 17HTRAY WIDTH FACTOR 12X E16.8, 3X 23HSPLASH PLATE LENGTHOUTPC840
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FIGURE 6 (Continued)

```
     3, IN F10.2/ 16H BRINE DEPTH, FT 4X E16.8, 3X 12HLEVEL HEIGHT  17X OUTP0845
     4 E16.8,3X 23HMAX TRAY FLOW            F10.3/  7H COEF A 13X F16.3/ OUTP0850
     51H030X 13H FOR 1 MODULE /18H EVAP SHELL VOLUME2XE16.9,3X          OUTP0855
     6 19HREJECT SHELL VOLUME  10X E16.8/24H EVAP TUBE BUND WID (FT)    OUTP0860
     2F12.4                                                             OUTP0865
     7,3X,22HREJ TUBE BUND WID (FT),F23.4/                              OUTP0870
     85H WTME 14X E16.8,3X 4HWTMR 25XE16.8/ 5H HSTE,14X,E16.8,3X,       OUTP0875
     94HHSTR,25X,E16.8)                                                 OUTP0880
      RFSA#TRAYWD(NTOTAL)*(RLR-FLOAT(NTOTAL -NK-1)*0.5)*ALEV*AMODU      OUTP0885
      EFSA#TRAYWD(NK)*(ELE-FLOAT(NK-1)*0.5)*ALEV*AMODU                  OUTP0890
      AME#WTME*(BDEPH-0.25)                                             OUTP0895
      AMR#WTMR*(BDEPH-0.25)                                             OUTP0900
      WRITE (6,8065)EFSA,RFSA ,AME,AMR ,CL                              OUTP0905    28
 8065 FORMAT(1H0,18HEVAP FLASHING AREA,E17.6,3X,                        OUTP0910
     120HREJECT FLASHING AREA,9X,E16.8/1H ,                             OUTP0915
     224HMAX AREA OF ORIFICE-EVAP,F11.5,3X,                             OUTP0920
     326HMAX AREA OF ORIFICE-REJECT,E19.8/                              OUTP0925
     41H 18HORIFICE LOSS COEFF,F16.4)                                   OUTP0930
      DO 105 I#1,NK                                                     OUTP0935
      II#5                                                              OUTP0940
      CALL DINTPL(TS(I),C(I),RHOB)                                      OUTP0945    35
      CPREQ(I)#CL/(9266.112*RHOB)*(WS(I)/(3600.0*AME*AMODU*ALEV))**2    OUTP0950
  105 CONTINUE                                                          OUTP0955
      JNK#NK+1                                                          OUTP0960
      DO110 I#JNK,NTOTAL                                                OUTP0965
      II#5                                                              OUTP0970
      CALL DINTPL(TS(I),C(I),RHOB)                                      OUTP0975    49
      CPREQ(I)#CL/(9266.112*RHOB)*(WS(I)/(3600.0*AMR*AMODU*ALEV))**2    OUTP0980
  110 CONTINUE                                                          OUTP0985
  115 CONTINUE                                                          OUTP0990
      WRITE (6,8000)( TITLE(I),I#1,12)                                  OUTP0995    56
      CALL OUTPUX                                                       OUTP1000    63
      RETURN                                                            OUTP1005
      END                                                               OUTP1010
```

FIGURE 6 (Continued)

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*
$IBFTC OUTP1    DECK                                                    OUTPCCCC
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FIGURE 6 (Continued)

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      SUBROUTINE OUTPUX                                                 OUTP0005
C**** OUTPUT FOR NORITAKE  8/25/65                                      OUTP0010
      COMMON/TEMPC/TSTEAM,TS(100), THF,TP,XTB,        TC,TP,TA,CC,CP    OUTP0015
      COMMON/TUBING/ DOH,DIH,DOE,DIE,DOR,DIR,A1,A2,A3,BIKTF,BIKTE,      OUTP0020
     1BIKTR,CSLTBH,CSLTBP,CSLTBR                                        OUTP0025
      COMMON/SUBMAR/IDEMST,SUBA(100)                                    OUTP0030
      COMMON/MARH20/NTOTI                                               OUTP0035
      COMMON/TCVL1/ ACPSN, ACPSNK, ACPTNK,CPBT,CPTK, CPTNK,AMBN,TCF,WX, OUTP0040
     1WF,WO,CB,WC,WB, WR,RHONK, RHOK, ERR,CCF, NITER, NK,NTOTAL, PN,RPN,OUTP0045
     2TC, ALPHA1, WPN, DELCT, DELST, IGSC, SMAQ, SUMA, TK               OUTP0050
      COMMON/TCVL2/ TTD(100),SMT(100), SMT2(100), CT(100), WS(100),     OUTP0055
     1C(100), TV(100), WV(100), QH(100), WP(100), AS(100),SLS(100)      OUTP0060
      COMMON/STAGE1/ A(100),CFMWV(100), CFMWZ(100), UBAR(100), OM(100), OUTP0065
     1HO(100),HI(100),WWFS(100),VVSEV(100), TRAYFL(100),TRAYWC(100),    OUTP0070
     2RESIDT(100), PV(100),DELP(100), DTPDPS(100)                       OUTP0075
      COMMON/DMST1/ AREADM(100),DPTDM(100),DTDM(100), CPROD(100),WIDDM(1OUTP0080
     1C0)                                                               OUTP0085
      COMMON/CONDI/ DPINIT(100), DTINIT(100), DPCLR(100), DTCLR(100),   OUTP0090
     1DTCND(100)                                                        OUTP0095
      COMMON/STAGE2/ AH, BAROM,BWE,BWR,COSTDM,ELE,ESHELL,HBH,HBLE,HBLR, OUTP0100
     1HLH, HNOE, HNOR,HN, HSTE, HSTR, JJ, KK, RLR, RSHELL, TBNOE,TBNOR, OUTP0105
     2UBARH, VBLE,VBLR,VNOE, VNOR, WTME, WTMR, WY                       OUTP0110
      COMMON /MAIN1/ SSF, HFG                                           OUTP0115
      COMMON /STG1/ ATR, BTR, CTR, CTA                                  OUTP0120
      COMMON /STG2/HOH, PR, DENBR(100), SUMLS, WVST(100), CO, CI, R, S, OUTP0125
     1 V, TVTT(100), Z(100), HV, HS(100), WBS(100)                      OUTP0130
      COMMON /CST1/ ASIEV, ANPLAT, SLPLAT, APLAT                        OUTP0135
      COMMON/AMISC/CPSTB,FACID,ACACID,DPLIM,A6,A7,XSOC,XNNN,NNN,XLLL,LLLOUTP0140
      COMMON /CNDR1/ NERR,        CCOR(3), K                            OUTP0145
      COMMON /DEM1/ SLKP2, SUMDMA, TDMP(100), APTSE, VOLM, APTSR        OUTP0150
      COMMON /DEM3/ ARGZ(15)                                            OUTP0155
      COMMON/AZ1/DTPDP(100),TITLE(15)                                   OUTP0160
      COMMON /DEAID/ RNR                                                OUTP0165
      COMMON /OP1/ SMAPPP, HR, SMAPPH, HE, UNARAR, UNARAE, A4, AJ, WCO, OUTP0170
     1 UBARE, UBARR, UTHE, AE, AR, ATHE, THEL, ENE, THEN, HFE, HFR, THEHOUTP0175
     2T, HC2, HC1, CC2, CC1, POCST2, POCST1, ALPEAR, PMC2, PMC1, CCCAP2,OUTP0180
     3  CCCAP1, SITE2, SITE1,  WAIT2, WAIT1,  ES2, ES1,  EA2, EA1,     OUTP0185
     4 BHC2,  BHC1,  VPC2,  VPC1,  UPPH,  EEC2,  EEC1,  PO,  CC2, CC1,  OUTP0190
     5 SCM2,  SCM1,  CIBC2, CIBC1,  DEA2,  DEA1,  TC2,  TC1,  CAPI1,    OUTP0195
     6 CAPI2,  CAPI3,  PO3,  HS1,  PMC,  EEC,  VPC,  SITE,  WAIT,       OUTP0200
     7 ES,  EA,  CIBC,  BHC,  CCCAP,  CCSTIN,  WEIRC,  CRANE,  BLDG,    OUTP0205
     8 DEACST,  PMCPO,  PMCFLO,  RETUR2,  RETUR1,  CPREQ(100), AMSC2,   OUTP0210
     9 AMSC1                                                            OUTP0215
      DIMENSION ALPHA(100)                                              OUTP0220
      IDEMST#0                                                          OUTP0225
      DECALC#0.0                                                        OUTP0230
      NTOTI#NTOTAL+1                                                    OUTP0235
      NN#NTOTAL                                                         OUTP0240
      NNK#NN-NK                                                         OUTP0245
      WRITE (6,8000)                                                    OUTP0250    5
 8000 FORMAT(6H0STAGE 2X 3HTTD6X2HCT5X2HC16X2HC210X2HCN                 OUTP0255
     19X4HUBAR5X2HHI6X2HHC7X2HOM9X2HAS7X2HLS6X7HW-W SF                  OUTP0260
     2/1H )                                                             OUTP0265
      WRITE (6,8005)(I,TTD(I),CT(I),C(I),C(I+1),CH(I),        UBAR(I),HIOUTP0270
     1(I),HO(I),OM(I),AS(I),SLS(I),WWFS (I),I#1,NTOTAL)                 OUTP0275    6
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FIGURE 6 (Continued)

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                                                                    09/26/67
        OUTP1       -  EFN    SOURCE STATEMENT  -  IFN(S)  -

8005 FORMAT(I4,F8.4,3F8.5,E16.8,4F8.2,F14.6,F8.3,E14.6)                OUTPC280
     IF(DECALC.EQ.1.0) GO TO 100                                       OUTPC285
     I#NTOTAL+1                                                        OUTPC290
       WRITE (6,8010)I,CT(I),C(I+1),CH(I),UBAR(I),HI(I),HC(I),CM(I),AS(OUTPC295
    1I),SLS(I)                                                         OUTPC300     27
8010 FORMAT(I4,8X,2F8.5, 8X,E16.8,4F8.2,E14.6,F8.3)                    OUTPC305
 100 WRITE (6,8045)( TITLE(I),I#1,12)                                  OUTPC310     37
     WRITE (6,8015)                                                    OUTPC315     44
8015 FORMAT(6HOSTAGE5X2HWV14X3HWS213X3HWP210X3HTV25X 3HTS1 5X          OUTPC320
    13HTS25X2HT16X2HT23X9HBRINE CFM  3X 9HPROD CFM     /1H  )          OUTPC325
     WRITE (6,8020)(I,WV(I),WS(I+1),WP(I+1),TV(I+1),TS(I), TS(I+1),SMT(OUTPC330
    1I),SMT2(I  ),CFMWV(I),CFMWZ(I),I#1,NTOTAL)                        OUTPC335     45
8020 FORMAT(I4,3E16.8,5F8.2, 2E14.6)                                   OUTPC340
     IF(DECALC.EQ.1.0) GO TO 105                                       OUTPC345
     I#NTOTAL+1                                                        OUTPC350
       WRITE (6,8025)I,WV(I),WP(I+1),TV(I+1),SMT(I),SMT2(I)            OUTPC355     64
8025 FORMAT(I4,E16.8,16X,E16.8,F8.2,16X, 2F8.2)                        OUTPC360
     VVEV(I)#0.0                                                       OUTPC365
     TRAYFL(I)#0.0                                                     OUTPC370
     TRAYWD(I)#0.0                                                     OUTPC375
     RESIDT(I)#0.0                                                     OUTPC380
     DELP(I)#0.0                                                       OUTPC385
     DPREQ(I)#0.0                                                      OUTPC390
     A(I)#0.0                                                          OUTPC395
 105 DO 110 I#1,NTOT1                                                  OUTPC400
 110 ALPHA(I)#TS(I+1)-TV(I+1)                                          OUTPC405
     ALPHA(NTOT1)#0.0                                                  OUTPC410
     WRITE (6,8045)( TITLE(I),I#1,12)                                  OUTPC415     88
     WRITE (6,8030)(I,VVEV(I),TRAYFL(I),TRAYWD(I),RESIDT(I),  PV(I),DELOUTPC420
    1P(I),DPREQ(I),A(I),ALPHA(I),DTPDPS(I),I#1,NTOT1 )                 OUTPC425     95
8030 FORMAT(24HOONE LEVEL OF ONE MODULE  /7X 10HVAPOR VEL      2X 9HTRAOUTPC430
    1Y FLOW 3X 10HTRAY WIDTH  3X 8HRES TIME16X 4HDELP 8X 4HDELP/       OUTPC435
    2                                          6H STAGE 3X 6HFT/SOUTPC440
    3EC 6X 8HLB/HR FT  6X 2HFT   7X 3HSEC 10X 2HPV 6X9HAVAILABLE 4X    OUTPC445
    48HREQUIRED 8X 1HA 8X    5HALPHA 2X 4HDTPD                         OUTPC450
    5          /1H /(I4,F12.6,E14.6,2F11.6,4E12.5,F8.3,F5.2))          OUTPC455
     WRITE (6,8045)( TITLE(I),I#1,12)                                  OUTPC460    111
     WRITE (6,8040)                                                    OUTPC465    118
     WRITE (6,8035)(I,AREADM(I),DPTDM(I),DTDM(I),            CPRCD(I),WIOUTPC470
    1DDM(I),I#1,NTOT1 )                                                OUTPC475    119
8035 FORMAT(I6,5E16.8)                                                 OUTPC480
8040 FORMAT(6HOSTAGE 5X 7HAREA DM 12X 5HDPTDM  12X  4HDTDM  12X        OUTPC485
    1 5HCPROD  12X   5HWIDDM   )                                       OUTPC490
     WRITE (6,8045)( TITLE(I),I#1,12)                                  OUTPC495    130
8045 FORMAT(1H1 12A6)                                                  OUTPC500
     WRITE (6,8050)DOE,TBNOE,VNOE,HNOE,XSOD,VBLE,HBLE,BWE              OUTPC505    137
8050 FORMAT(1H0 35H TUBE BUNDLE IN EVAPORATOR SECTION            /     OUTPC510
    11H0 4X 16HTUBE OD, INCHES 2X E13.6,4X 18HNO OF TUBES/BNDLE  E13.6/OUTPC515
    2 1H 4X 9HVERT ROWS 9X E13.6, 4X 11HHORIZ ROWS  7X E13.6,          OUTPC520
    3 4X 10HS/D RATIO  8X E13.6/ 1H 4X 14HBUNDLE HT, FT  4X E13.6,     OUTPC525
    4 4X 18HBUNDLE WIDTH, FT  E13.6, 4X 18HBUNDLE WIDTH + 3  E13.6)    OUTPC530
       WRITE (6,8055)DOR, TBNOR, VNOR, HNOR, XSOD, VBLR,      HBLR, BWR OUTPC535    138
8055 FORMAT(1H0 30HTUBE BUNDLE IN REJECT SECTION       /               OUTPC540
    11H0 4X 16HTUBE OD, INCHES 2X E13.6,4X 18HNO OF TUBES/BNDLE  E13.6/OUTPC545
    2 1H 4X 9HVERT ROWS 9X E13.6, 4X 11HHORIZ ROWS  7X E13.6,          OUTPC550
    3 4X 10HS/D RATIO  8X E13.6/ 1H 4X 14HBUNDLE HT, FT  4X E13.6,     OUTPC555
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
        OUTP1       -  EFN   SOURCE STATEMENT  -  IFN(S)  -

    4 4X 18HBUNDLE WIDTH, FT  E13.6, 4X 18HBUNDLE WIDTH + 3  E13.6)    OUTP0560
     IF(IDEMST.EQ.1) GO TO 115                                          OUTP0565
     WRITE (6,8060)(I,DPINIT(I),DTINIT(I),DPCLR(I),DTCLR(I), DTCND(I),IOUTP0570
    1#1,NTOT1 )                                                         OUTP0575     141
8060 FORMAT(3H I  5X 6HDPINIT 10X 6HDTINIT 10X6HDPCLR  10X 6HDTCLR      OUTP0580
    1 10X 6HDTCND   /                                                   OUTP0585
    2 (I5,5E16.8))                                                      OUTP0590
     GO TO 120                                                          OUTP0595
 115 WRITE (6,8065)(I,DPINIT(I),DTINIT(I),DPCLR(I),DTCLR(I), DTCND(I),  OUTP0600
    1SUBA(I),I#1,NTOT1)                                                 OUTP0605     153
8065 FORMAT(3H I  5X 6HDPINIT 10X 6HDTINIT 10X6HDPCLR  10X 6HDTCLR      OUTP0610
    1 10X 6HDTCND   10X 4HSUB      /                                    OUTP0615
    2 (I5,6E16.8))                                                      OUTP0620
 120 RETURN                                                             OUTP0625
     END                                                                OUTP0630
```

FIGURE 6 (Continued)

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```
$ORIGIN        COSTLY,REW                                    CSTVCCCC
$IBFTC CSTVP   DECK                                          CSTVCCC5
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
        CSTVP      -  EFN   SOURCE STATEMENT  -  IFN(S)  -

      SUBROUTINE COSTVC(D,B,PR,VS,AUNIT,TSE,SMAP,QIN,TS,                CSTVC01C
     1WS,WS3,POTOT,AS,AD,PMSTMC,CAPF,WSI,GVTE,VSUC,HPVC,                CSTVC01S
     2TBOUT2,WB2,WF2,WP2, GMSF ,LENS,LEND,SMALLE,SITE,CAPII,            CSTVC02C
     3WSTEAM,VOLDIS,TC2,TCI,PRIMWT,RCAPC,ETP,EFFCYC)                    CSTVC02S
      COMMON /OPI/ SMAPPP, HR, SMAPPH, HE, UNARAR, UNARAE, A4, AJ       CSTVC03C
      COMMON/ECON/SMALLE,SMALLD,SMALLB,SMALLP,RATEIN,WPL, CAPF,THERM,   CSTVC03S
     1PMSTMC                                                            CSTVC04C
      REAL LEND,LENS                                                    CSTVC04S
      GTOT#GMSF+GVTE                                                    CSTVC05C
C                                                                       CSTVC05S
C     BWR REACTOR CALCULATIONS  (MARCH 13,1967)                         CSTVC06C
C                                                                       CSTVC06S
C    FUEL COST                                                          CSTVC07C
      FUEL#8.81 +26.7 *RATEIN                                           CSTVC07S
C                                                                       CSTVC08C
C    FIXED CHARGES                                                      CSTVC08S
      FIXC#8/.20*SMAP/((PRIMWT/1000.)**.244)                            CSTVC09C
C                                                                       CSTVC09S
C                                                                       CSTVC10C
C    OPERATING AND MAINT                                                CSTVC10S    2
      XOPER#4.35 *SMAP**.231 /((PRIMWT/1000.)**.314 )                   CSTVC11C    3     4
      PMSTMC#(FUEL+FIXC+XOPER)/100.                                     CSTVC11S
C                                                                       CSTVC12C
C    COLLINS REPORT                                                     CSTVC12S
      SMALLD#D                                                          CSTVC13C
      SMALLB#B                                                          CSTVC13S
C                                                                       CSTVC14C
C     COMPRESSOR COST                                                   CSTVC14S
C                                                                       CSTVC15C
C    MOYERS COMPRESSOR COST CORRELATION                                 CSTVC15S
      CC#(1.02E5+(1392.*((HPVC/(AUNIT*1.E3))**.855)*VSUC**.746)/PR**    CSTVC16C
     10.177)*AUNIT*AJ                                                   CSTVC16S    5     6     7
      CCY#CC*SMAP                                                       CSTVC17C
      COMUNT#CC/AUNIT                                                   CSTVC17S
C                                                                       CSTVC18C
C    FOUNDATION FOR COMPRESSOR                                          CSTVC18S
C                                                                       CSTVC19C
      COFOUN#0.12856*HPVC*AJ                                            CSTVC19S
      COFOY#COFOUN*SMAP                                                 CSTVC20C
C                                                                       CSTVC20S
C                                                                       CSTVC21C
C     TURBINE COST                                                      CSTVC21S
C                                                                       CSTVC22C
      AMWT#(TBOUT2+POTOT)*.746/2.546E6                                  CSTVC22S
      TURBK#-.85E-4 *TS+.3265                                           CSTVC23C
      TURBN#.18E-4*TS+.6614                                             CSTVC23S
      TPOW#AMWT/AUNIT                                                   CSTVC24C
      TUR#(TURBK*(TPOW**TURBN)-14.444*((TPOW/1000.)**.7882))*1.E6*AUNIT*CSTVC24S
     1 AJ                                                               CSTVC25C    8     9
      TURCST#TUR*SMAP                                                   CSTVC25S
      TURUNT#TUR/AUNIT                                                  CSTVC26C
      TCSTP#TUR*WS3/WS                                                  CSTVC26S
      TCSTC#TUR-TCSTP                                                   CSTVC27C
C                                                                       CSTVC27S
C     GENERATOR COST                                                    CSTVC28C
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
        CSTVP      -  EFN   SOURCE STATEMENT  -  IFN(S)  -

C                                                                   CSTVC285
      POGEN#POTOT*.746/(AUNIT*1000.*2545.)                          CSTVC290
      GEN#(14.444*(POGEN/1000.)**.7882)*1.E6*AUNIT*AJ               CSTVC295     10
      GENCST#GEN*SMAP                                               CSTVC300
      GENUNT#GEN/AUNIT                                              CSTVC305
C                                                                   CSTVC310
C     COST OF EVAPORATORS                                           CSTVC315
C                                                                   CSTVC320
C                                                                   CSTVC325
C    ASSUME TUBE LIFE#15 YEARS AND PLANT LIFE 30 YEARS              CSTVC330
C                                                                   CSTVC335
      SMAPP#.03211                                                  CSTVC340
C    TUBING PURCHASE PRICE                                          CSTVC345
      A1#2.37                                                       CSTVC350
C    COST OF INSTALLATION AND RETUBING                              CSTVC355
      A2#3.05                                                       CSTVC360
      EVC#(AS+AD)*A2*AJ                                             CSTVC365
      EVCST#(AS+AD)*SMAP*A2*AJ+(AS+AD)*SMAPP*A1                     CSTVC370
C    SHELL COST                                                     CSTVC375
C                                                                   CSTVC380
      SHELL#0.794*(AD+AS)  *AJ                                      CSTVC385
      SHELLY#SHELL*SMAP                                             CSTVC390
C                                                                   CSTVC395
C    COMPRESSOR DUCTING COST                                        CSTVC400
C                                                                   CSTVC405
      DUCT#.051599*VS*AJ                                            CSTVC410
      DUCTY#DUCT*SMAP                                               CSTVC415
C                                                                   CSTVC420
C    VTE BRINE PUMPS                                                CSTVC425
C                                                                   CSTVC430
      PUMP#3.693E6*(WB2/386.6E6)**0.9*AJ                            CSTVC435     11
      PUMPY#PUMP*SMAP                                               CSTVC440
C                                                                   CSTVC445
C                                                                   CSTVC450
C    VALVES AND PIPING                                              CSTVC455
C    FEED MSF TO VTE                                                CSTVC460
C                                                                   CSTVC465
      PIPEF#1.257E6*WF2/513.5E6  *AJ                                CSTVC470
      PIPEFY#PIPEF*SMAP                                             CSTVC475
C                                                                   CSTVC480
C    BLOWDOWN VALVES AND PIPING                                     CSTVC485
C                                                                   CSTVC490
      PIPEB#1.130E6*WB2/386.6E6 *AJ                                 CSTVC495
      PIPEBY#PIPEB*SMAP                                             CSTVC500
C                                                                   CSTVC505
C    PRODUCT VALVES AND PIPING                                      CSTVC510
C                                                                   CSTVC515
      PIPEP#0.442E6*WP2/126.8E6  *AJ                                CSTVC520
      PIPEPY#PIPEP*SMAP                                             CSTVC525
C                                                                   CSTVC530
C    VAPOR COMP DISCH PIPING                                        CSTVC535
C                                                                   CSTVC540
      PIPVC#1.60392E6*VOLDIS/15.283E6*AJ                            CSTVC545
      PIPVCY#PIPVC*SMAP                                             CSTVC550
C                                                                   CSTVC555
C    TURB EXHAUST STEAM TO BRINE HTR PIPING                         CSTVC560
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
          CSTVP      -  EFN   SOURCE STATEMENT  -  IFN(S)  -
C                                                                   CSTV0565
      PIPTUR#.38356E6*WSTEAM/.1C2245E8*AJ                           CSTV0570
      PIPTRY#PIPTUR*SMAP                                            CSTV0575
      PIPT#PIPEF+PIPEB+PIPEP+PIPVC+PIPTUR                           CSTV0580
      PIPTY#PIPEFY+PIPEBY+PIPEPY+PIPVCY+PIPTRY                      CSTV0585
C                                                                   CSTV0590
C     SITE WORK                                                     CSTV0595
C                                                                   CSTV0600
      SITEW#SITE*GVTE/GMSF *AJ                                      CSTV0605
      SITEY#SITEW*SMAP                                              CSTV0610
C                                                                   CSTV0615
C     ELECTRICAL EQUIPMENT                                          CSTV0620
C                                                                   CSTV0625
      POVTE#3.7677E-10*WB2*(LENS+LEND+20.)/SMALLE                   CSTV0630
      EECVTE#.0326E6*POVTE  *AJ                                     CSTV0635
      EECVTY#EECVTE*SMAP                                            CSTV0640
C     CRANES AND BLDG,INSTRU                                        CSTV0645
C                                                                   CSTV0650
      COSINS#317000.*(WP2/126.8E6)**0.6*AJ                          CSTV0655    12
      COSINY#COSINS*SMAP                                            CSTV0660
C                                                                   CSTV0665
C     OPERATING COST,$/YEAR                                         CSTV0670
C                                                                   CSTV0675
      OPERY#0.1104E6*((GVTE+GMSF)*1.0E-6)**0.3238+7500.             CSTV0680
C                                                                   CSTV0685    13
      CAPTOT#CC+TUR+GEN+EVC+COFOUN+        SHELL+PUMP               CSTV0690
     1+PIPT              +SITEW+EECVTE+COSINS+DUCT                  CSTV0695
C                                                                   CSTV0700
C     MAINT AND SUPPLIES                                            CSTV0705
C                                                                   CSTV0710
      COSMAY#.006*(CAPTOT+CAPII)                                    CSTV0715
C     COST OF STEAM TO BRINE HEATER                                 CSTV0720
C                                                                   CSTV0725
      SMALLB#PMSTMC*(1.-EFFCYC/ETP)/(1.-EFFCYC)-((.101*AJ*SMAP      CSTV0730
     1 *(1.-ETP)*EFFCYC)/(ETP*CAPF))                                CSTV0735
C                                                                   CSTV0740
C     COST OF ON-SITE POWER                                         CSTV0745
C                                                                   CSTV0750
      ELSTM#PMSTMC*QIN*1.E-6*WS3/WS*EFFCYC/ETP                      CSTV0755
     1*8760.*CAPF                                                   CSTV0760
      CONCST#3.0217E3*(POTOT*.746/(1000.*2545.))*(1.-ETP)/ETP       CSTV0765
     1*SMAP                                                         CSTV0770
      ELCST#ELSTM+CONCST+GENCST+TCSTP*SMAP                          CSTV0775
      SMALLD#ELCST/(8.76E6*CAPF*POTOT*.746/(1000.*2545.))           CSTV0780
      HTCST2#PMSTMC*QIN*1.E-6                    *8760.*CAPF        CSTV0785
      FACTOR#2.739726/(CAPF*(GVTE+GMSF))                            CSTV0790
      HTCSKG#HTCST2*FACTOR                                          CSTV0795
      CCKG#CCY*FACTOR                                               CSTV0800
      TURKG#TURCST*FACTOR                                           CSTV0805
      EVCKG#EVCST*FACTOR                                            CSTV0810
      ELCKG#ELCST*FACTOR                                            CSTV0815
      GENKG#GENCST*FACTOR                                           CSTV0820
      DUCTKG#DUCTY*FACTOR                                           CSTV0825
      COFOKG#COFOY*FACTOR                                           CSTV0830
      SHELKG#SHELLY*FACTOR                                          CSTV0835
      PUMPKG#PUMPY*FACTOR                                           CSTV0840
```

FIGURE 6 (Continued)

```
                                                                    09/26/67
      CSTVP      -  EFN   SOURCE STATEMENT  -  IFN(S)  -

      PIPKG#PIPTY*FACTOR                                            CSTV0845
      OPERKG#OPERY*FACTOR                                           CSTV0850
      COSMKG#COSMAY*FACTOR                                          CSTV0855
      SITEKG#SITEY*FACTOR                                           CSTV0860
      ECVTKG#EECVTY*FACTOR                                          CSTV0865
      COSIKG#COSINY*FACTOR                                          CSTV0870
      VCTOT#HTCST2+CCY+TURCST+EVCST+CIY+GENCST                      CSTV0875
     1+DUCTY+COFOY+SHELLY+PUMPY+PIPTY+OPERY+COSMAY  +SITEY+EECVTY+CCSINYCSTV0880
      VCTOKG#HTCSKG+CCKG+TURKG+EVCKG+CIYKG+GENKG                    CSTV0885
     1+DUCTKG+COFOKG+SHELKG+PUMPKG+PIPKG+OPERKG+COSMKG+ SITEKG+     CSTV0890
     2ECVTKG+COSIKG                                                 CSTV0895
      TCST2#TC2+VCTOT                                               CSTV0900
      TCST1#TC1+VCTOKG                                              CSTV0905
      WRITE(6,8000) GVTE,GMSF,CAPF,SMAP,SMALLB,SMALLD,SMALLE,       CSTV0910
     1   AJ,VSUC,HPVC,PMSTMC,AMWT,TURBN,TURBK,POVTE,                CSTV0915
     2  ELSTM,ELCST,TCSTC,TCSTP,COMUNT,TURUNT,GENUNT,CCNCST,        CSTV0920
     3  HTCST2,COFOUN,SHELL,SITEW,PUMP,PIPEF,PIPEB,PIPEP,           CSTV0925
     4  PIPVC,PIPTUR,EECVTE,COSINS,DUCT,CAPTOT                      CSTV0930     14
 8000 FORMAT(1H0,45X,30HCOST ITEMS CALCULATED IN CSTVP/              CSTV0935
     145X,30H---- ----- ---------- -- -----/1H0,4HGVTE,E16.5,1X,     CSTV0940
     24HGMSF,E16.5,1X,4HCAPF,E16.5,1X,4HSMAP,E16.5,1X,               CSTV0945
     36HSMALLB,E14.5,1X,6HSMALLD,E14.5/1H 6HSMALLE,E14.5,1X,         CSTV0950
     42HAJ,E18.5,1X,4HVSUC,E16.5,1X,4HHPVC,E16.5,1X,6HPMSTMC,        CSTV0955
     5E14.5,1X,4HAMWT,E16.5/1H 5HTURBN,E15.5,1X,5HTURBK,E15.5,       CSTV0960
     61X,5HPOVTE,E15.5,1X,5HELSTM,E15.5,1X,5HELCST,E15.5,1X,5HTCSTC, CSTV0965
     7E15.5/1H 5HTCSTP,E15.5,1X,6HCOMUNT,E14.5,1X,6HTURUNT,E14.5,1X, CSTV0970
     86HGENUNTE14.5,1X,6HCONCST,E14.5,1X,6HHTCST2,E14.5/1H ,         CSTV0975
     96HCOFOUN,E14.5,1X,5HSHELL,E15.5,1X,5HSITEW,E15.5,1X,           CSTV0980
     14HPUMP,E16.5,1X,5HPIPEF,E15.5,1X,5HPIPEB,E15.5/1H ,            CSTV0985
     25HPIPEP,E15.5,1X,5HPIPVC,E15.5,1X,6HPIPTUR,E14.5,1X,           CSTV0990
     36HEECVTE,E14.5,1X,6HCOSINS,E14.5,1X,4HDUCT, E16.5/1H 6HCAPTOT, CSTV0995
     4E14.5)                                                        CSTV1000
      WRITE(6,8005)ELCST,ELCKG,SMALLD,PMSTMC,SMALLB,                CSTV1005
     1  HTCST2,HTCSKG,CC,CCY,CCKG,COFOUN,COFOY,COFOKG,              CSTV1010
     2  DUCT,DUCTY,DUCTKG,TUR,TURCST,TURKG,GEN,                     CSTV1015
     2  GENCST,GENKG,EVC,EVCST,EVCKG,SHELL,SHELLY,SHELKG,PUMP,PUMPY, CSTV1020
     3  PUMPKG                                                      CSTV1025     15
 8005 FORMAT(1H1,64X,5HCOSTS/1H 64X,5H-----/                        CSTV1030
     11H0,35X,9H$,DIR+IND,9X,                                       CSTV1035
     16H$/YEAR,11X,4H$/KG,10X,7H$/MMBTU,9X,7H$/KW-HR/               CSTV1040
     21H 35X,9H---------,9X,6H------,11X,4H----,10X,7H-------,       CSTV1045
     39X,7H-------/1H0,8X,10HPOWER COST,30X,2E16.8,16X,E16.8/       CSTV1050
     41H 8X,16HPRIME STEAM COST,56X,E16.8/                          CSTV1055
     51H 8X,18HSTEAM TO BRINE HTR,54X,E16.8/                        CSTV1060
     61H0,8X,9HHEAT COST,31X,2E16.8/                                CSTV1065
     71H 8X,15HCOMPRESSOR COST, 9X,3E16.8/                          CSTV1070
     31H 8X,15HCOMP FOUND COST,9X,3E16.8/1H 8X,14HCOMP DUCT COST,10X, CSTV1075
     43E16.8/                                                       CSTV1080
     81H 8X,12HTURBINE COST,12X,3E16.8/                             CSTV1085
     91H 8X,14HGENERATOR COST,10X,3E16.8/                           CSTV1090
     11H 8X,15HEVAPORATOR COST, 9X,3E16.8/                          CSTV1095
     4        1H 8X,10HSHELL COST,14X,3E16.8/1H08X,15HVTE BRINE PUMPS, CSTV1100
     59X,3E16.8)                                                    CSTV1105
      WRITE(6,8010)PIPT,PIPTY,PIPKG,                                CSTV1110
     4          EECVTE,EECVTY,ECVTKG,COSINS,COSINY,COSIKG,          CSTV1115
     5  SITEW,SITEY,SITEKG,CAPTOT,OPERY,OPERKG,COSMAY,COSMKG,       CSTV1120
```

FIGURE 6 (Continued)

```
    6  VCTOT,VCTOKG,TCST2,TCST1                                          CSTV1125    16
8010 FORMAT(1H 8X,                                                       CSTV1130
    4                      17HVALVES AND PIPING,7X,3E16.8/               CSTV1135
    51H 8X,18HELECTRIC EQUIPMENT,6X,3E16.8/    1H 8X,                    CSTV1140
    315HCRANES AND BLDG,9X,3E16.8/1H 8X,9HSITE WORK 15X,3E16.8/          CSTV1145
    31H 8X,16H----- -- -------,8X,16H----------------/                   CSTV1150
    41H ,8X,16HTOTAL VC CAPITAL, 8X,E16.8/                               CSTV1155
    41H08X,19HOPERATING (VC+SEMS),21X,2E16.8/                            CSTV1160
    51H 8X,21HMAINT+SUPPL (VC+SEMS),19X,2E16.8/                          CSTV1165
    31H0,8X,13HVC WATER COST,27X,2E16.8/1H 8X,                           CSTV1170
    426HTOTAL WATER COST (VC+SEMS),14X,2E16.8/1H1)                       CSTV1175
     D#SMALLD                                                            CSTV1180
     D#SMALLB                                                            CSTV1185
     RETURN                                                              CSTV1190
     END                                                                 CSTV1195
```

FIGURE 6 (Continued)

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```
$DATA
```

FIGURE 6 (Continued)

IBLDR 09/26/67

OVERLAY ORIGIN CARDS AND ASSIGNED LINK NUMBERS

```
$ORIGIN        COSTLY                IS LINK   1, PARENT LINK IS   0
$ORIGIN        COSTLY                IS LINK   2, PARENT LINK IS   0
$ORIGIN        COSTLY                IS LINK   3, PARENT LINK IS   0
$ORIGIN        COSTLY,REW            IS LINK   4, PARENT LINK IS   0
```

FIGURE 6 (Continued)

```
SYSTEM                                  00000 THRU  02717
FILE BLOCK ORIGIN                       02720
FILES        1.     UNIT06              (NO BUFF POOL ATTACHED)
             2.     UNIT05              (NO BUFF POOL ATTACHED)
PRE-EXECUTION INITIALIZATION            02750
CALL ON OBJECT PROGRAM                  02757
OBJECT PROGRAM                          02764 THRU  74031

LINK  DECK  ORIGIN       CONTROL SECTIONS  (/NAME/#NON 0 LENGTH, (LOC)#DELETED, **NOT REFERENCED)

  0   VAPCOM  02764      /MAR22 / 02765    /GEOME / 02766    /ECON  / 03000    /OPI   / 03011    /PHYS  / 03301
                          ......  06637 *
      MNIA    06651      /GEN   / 06652    /TEMPC / 06666    /GEOME /(02766)   /ECON  /(03000)   /TUBING/ 07043
                         /FOULIN/ 07062    /PUMPHT/ 07073    /AMISC / 07101    /DATAI / 07114    /AZI   / 07130
                         /TCVLI / 07313    /TCVL2 / 07365    /PHYS  /(03301)   /OPI   /(03011)   /STAGEI/ 11645
                         /MAINI / 14601    /STGI  / 14603    /JAN18 / 14607    /JAN23 / 14610    /JAN27 / 14617
                         /JAN31 / 14625    /FEB4  / 14626    /FEB8  / 14632     MAIN    15130
      BPRI    15173       PPE     15257
      TCVA    15277      /GEN   /(06652)   /TEMPC /(06666)   /GEOME /(02766)   /ECON  /(03000)   /TUBING/(07043)
                         /FOULIN/(07062)   /PUMPHT/(07073)   /AMISC /(07101)   /DATAI /(07114)   /AZI   /(07130)
                         /TCVLI /(07313)   /TCVL2 /(07365)   /TCVGSC/ 15300    /PHYS  /(03301)   /MAINI /(14601)
                         /JAN18 /(14607)   /JAN23 /(14610)   /JAN27 /(14617)   /JAN31 /(14625)   /FEB4  /(14626)
                         /OPI   /(03011)    TCVAL    17624
      GSCI    17650      /GEN   /(06652)   /TEMPC /(06666)   /GEOME /(02766)   /ECON  /(03000)   /TUBING/(07043)
                         /FOULIN/(07062)   /PUMPHT/(07073)   /AMISC /(07101)   /DATAI /(07114)   /AZI   /(07130)
                         /TCVLI /(07313)   /TCVL2 /(07365)   /TCVGSC/(15300)   /PHYS  /(03301)   /MAINI /(14601)
                         /JAN18 /(14607)   /JAN23 /(14610)   /JAN27 /(14617)   /OPI   /(03011)    GSC     21420
      TT100   21436      /PHYS  /(03301)    TTT      21553
      CNDN    21574      /MAY15 / 21575 *  /GEOME /(02766)   /AMISC /(07101)   /DATAI /(07114)   /TCVLI /(07313)
                         /AZI   /(07130)   /TCVL2 /(07365)   /STAGEI/(11645)   /CONDI / 21576    /STGI  /(14603)
                         /STG2  / 22562    /CNDRI / 23723    /DEMI  / 23730    /DEM3  / 24101    /STAGE2/ 24120
                         /CNDLNK/ 24156     CNDNSR  30236
      STAGE   30257      /GEN   /(06652)   /TEMPC /(06666)   /GEOME /(02766)   /ECON  /(03000)   /TUBING/(07043)
                         /FOULIN/(07062)   /PUMPHT/(07073)   /AMISC /(07101)   /DATAI /(07114)   /AZI   /(07130)
                         /TCVLI /(07313)   /TCVL2 /(07365)   /STAGEI/(11645)   /STAGE2/(24120)   /PHYS  /(03301)
                         /MAINI /(14601)   /STGI  /(14603)   /STG2  /(22562)   /CSTI  / 30260    /CNDRI /(23723)
                         /DEMI  /(23730)   /STG21 / 30264    /STGCST/ 30272    /FEB8  /(14632)    STAGEG  33740
      UBARI   33756      /GEN   /(06652)   /TEMPC /(06666)   /GEOME /(02766)   /ECON  /(03000)   /TUBING/(07043)
                         /FOULIN/(07062)   /PUMPHT/(07073)   /AMISC /(07101)   /DATAI /(07114)   /AZI   /(07130)
                         /TCVLI /(07313)   /TCVL2 /(07365)   /STAGEI/(11645)   /PHYS  /(03301)   /MAINI /(14601)
                         /STGI  /(14603)   /STG2  /(22562)   /FEB8  /(14632)    UBARHM  35001
      WAT     35025       WATH    35164
      BO100   35206       BOPR    35360
      SU100   35400      /OPI   /(03011)    SUBAJ    35565
      DI100   35617      /PHYS  /(03301)    DINTPL   36310
      TWO     36336      /BLOC  / 36337     DOUBLE   37121
      BLKDAT  37152      /BLOC  /(36337)
      INPU    37152      /GEN   /(06652)   /TEMPC /(06666)   /GEOME /(02766)   /ECON  /(03000)   /TUBING/(07043)
                         /FOULIN/(07062)   /PUMPHT/(07073)   /AMISC /(07101)   /DATAI /(07114)   /NOV25 / 37153
                         /AZI   /(07130)    INPUT    40430
      CND     40446      /GEOME /(02766)   /AMISC /(07101)   /DATAI /(07114)   /AZI   /(07130)   /TCVL2 /(07365)
                         /STAGEI/(11645)   /CONDI /(21576)   /STAGE2/(24120)   /STGI  /(14603)   /STG2  /(22562)
                         /CNDRI /(23723)   /DEMI  /(23730)   /DEM3  /(24101)   /CNDLNK/(24156)   /OPI   /(03011)
                          CNDNS   42671
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FIGURE 6 (Continued)

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DEMST   42717    /GEN    /(06652)   /TEMPC /(06666)   /GEOME /(02766)   /ECON   /(03000)   /TUBING/(07043)
                 /FOULIN/(07062)    /PUMPHT/(07073)   /AMISC /(07101)   /CATA1  /(07114)   /AZI    /(07130)
                 /TCVL1 /(07313)    /TCVL2 /(07365)   /STAGE1/(11645)   /DMST1  / 42720    /COND1  /(21576)
                 /STAGE2/(24120)    /PHYS  /(03301)   /MAIN1 /(14601)   /STG1   /(14603)   /STG2   /(22562)
                 /CST1  /(30260)    /CNDR1 /(23723)   /DEM1  /(23730)   /DEM3   /(24101)   /DEA10  / 43704
                 /STG21 /(30264)     DEMIST  47152
DEARIV  47170    /GEN    /(06652)   /TEMPC /(06666)   /GEOME /(02766)   /ECON   /(03000)   /TUBING/(07043)
                 /FOULIN/(07062)    /PUMPHT/(07073)   /AMISC /(07101)   /CATA1  /(07114)   /AZI    /(07130)
                 /TCVL1 /(07313)    /TCVL2 /(07365)   /STAGE1/(11645)   /DMST1  /(42720)   /COND1  /(21576)
                 /STAGE2/(24120)    /PHYS  /(03301)   /MAIN1 /(14601)   /STG1   /(14603)   /STG2   /(22562)
                 /CST1  /(30260)    /CNDR1 /(23723)   /DEM1  /(23730)   /DEA10 /(43704)   /STG21 /(30264)
                  DEAR1   50563
.LINK   50601    /.LDT  / 50601     /.LRECT/ 50606    /.LVEC / 50616
.LXCON  50644     .LXSTR  50644      .LXSTP  50647     .LXOUT  50715 *   .LXERR  50724     .LXCAL  50727
                  .LXRTN  50727      IBEXIT  50727 *   .DBCLS  51111 *   .LXARG  51260 *   .LO     51360 *
                  .CLSE   51366 *    .LFBL   51367 *   .LUNB   51370 *   .DFOUT  51371
.LOVRY  51401     .LOVRY (51401)     .LDT   (50601)    .LRECT (50606)    .LVEC  (50616)
.LXSL   52107     .LXSEL  52107      .LXSL1  52110     .LXTST  52113     .LXOVL  52153     .LXMOD  52215
                  .LXIND  52241      .LXDIS  52244     .LXFLG  52245     .LTCH   52246
.FPTRP  52254     .FFPT.  52254 *    .FPOUT  52403 *   .FPARG  52411 *  /.COUNT/ 52413 *   OVFLOW  52457 *
.ERAS.  52464     E.1     52464      E.2     52465     E.3     52466     E.4     52467
.XCC.   52470     CC.1    52470      CC.2    52471     CC.3    52472     CC.4    52473
FXEM    52474     .FXEM.  52474      .FXOUT  53034 *   .FXARG  53042 *  /.OPTW./ 53116 *
FCNV    53127     .FCON.  53127      .FCNV.  53154     .ENDFS  53163     .CNVSW  53166     .FDX1   53172
                  .FDX2   53173      .DBC    53175     .DBC10  53333     .DBC20  53361     .DDSW   53371
                  .DDFIX  53400      .FIXSW  53406     .DDBC   53463     .DDRS1  53740     .DDRS2  53742 *
                  .D1     53745      .D2     53747     .FERR2  54034 *   .ANPT   54070     .ONPT   54105
                  .LNTP   54170      .AOUT   54237     .OOUT   54250     .LOUT   54277     .DFLT   54307
                  .FLT    54554      .FXFL1  54705     .FXC    54711     .FXFL2  54714     .FXFL3  54720
                  .INTG   54724      .TOPAC  54742     .WIDTH  54746     .FPACK  54753     .TEST   54754
                  .KOUNT  55007      .LIST   55012     .DONE   55020     .OUTBF  55511     .CHAR   55745
                  .FBDBF  55762      .DDDFL  56014     .DDFLG  56015     .WORD   56016     .MQD    56017
                  .PEX    56020      .FEXP   56021     .DIG    56022     .DEXPN  56023
FIOH    56055     .KEEP.  56055      .FIOH.  56056     .FFIL.  56721     .FRTN.  56747
FIOS.   57141     ..FIOS  57141      ..FIOC  57244     ..FSEL  57263     ..FBCK  57301 *   ..FTCK  57303
                  ..FCHK  57426 *
FRDD.   57633     ..FRDD  57633
FWRD.   57660     ..FWRD  57660
FBCD.   57706     ..FBCD  57706      ..FBCW  57710     ..FBCB  57721
UNIT06  57751     ..UNC6  57751
UNO5    57752     .UNO5.  57752
MOUNT.  57753     .MOUNT  57753
FLOG    57764     ALOG10  57764      ALOG    57765
FXPF    60170     EXP     60170
FSQR    60311     SQRT    60311
FXP2    60364     .XP2.   60364
FXP3    60502     .XP3.   60502
FSLDO   60627     .FSLO.  60645      .FSDO.  60653 *
FSLO    60664     .SLO.   60664      .SLO2.  60672     .SDO.   60677     .SDO2.  60711

UCALCM  60723     UCALC   61541
CHKTB1  61564    /PHYS  /(03301)     CHKTB   62066
PSIAA   62131     PSIA    62352
VAPTSS  62372     VAPTS   62567
VAPTHH  62624     VAPTH   63007
VAPVV   63045     VAPV    63326
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      VAPHH   63346      VAPH    64170
      VAPSS   64210      VAPS    65131

  2   SMAP1   60723      SMAP    61053
      COS     61107     /MAR22 /(02765)   /GEN   /(06652)   /TEMPC /(06666)   /GEOME /(02766)   /ECON  /(03000)
                        /TUBING/(07043)   /FOULIN/(07062)   /PUMPHT/(07073)   /AMISC /(07101)   /DATA1 /(07114)
                        /AZI   /(07130)   /TCVL1 /(07313)   /TCVL2 /(07365)   /STAGE1/(11645)   /DMST1 /(42720)
                        /COND1 /(21576)   /STAGE2/(24120)   /PHYS  /(03301)   /MAIN1 /(14601)   /STG1  /(14603)
                        /STG2  /(22562)   /CST1  /(30260)   /CNDR1 /(23723)   /DEM1  /(23730)   /DEM3  /(24101)
                        /DEA10 /(43704)   /OP1   /(03011)   /NOV25 /(37153)   /CSTLK / 61110    /CSTLK1/ 61123
                        /JAN31 /(14625)    COST    63632
      AREAY   63646     /GEN   /(06652)   /TEMPC /(06666)   /GEOME /(02766)   /ECON  /(03000)   /TUBING/(07043)
                        /FOULIN/(07062)   /PUMPHT/(07073)   /AMISC /(07101)   /DATA1 /(07114)   /AZI   /(07130)
                        /TCVL1 /(07313)   /TCVL2 /(07365)   /STAGE1/(11645)   /DMST1 /(42720)   /COND1 /(21576)
                        /STAGE2/(24120)   /PHYS  /(03301)   /MAIN1 /(14601)   /STG1  /(14603)   /STG2  /(22562)
                        /CST1  /(30260)   /CNDR1 /(23723)   /DEM1  /(23730)   /DEM3  /(24101)   /DEA10 /(43704)
                        /OP1   /(03011)   /NOV25 /(37153)   /CSTLK /(61110)   /CSTLK1/(61123)   /STGCST/(30272)
                         AREA    65306
      SHEL    65322     /GEN   /(06652)   /TEMPC /(06666)   /GEOME /(02766)   /ECON  /(03000)   /TUBING/(07043)
                        /FOULIN/(07062)   /PUMPHT/(07073)   /AMISC /(07101)   /DATA1 /(07114)   /AZI   /(07130)
                        /TCVL1 /(07313)   /TCVL2 /(07365)   /STAGE1/(11645)   /DMST1 /(42720)   /COND1 /(21576)
                        /STAGE2/(24120)   /PHYS  /(03301)   /MAIN1 /(14601)   /STG1  /(14603)   /STG2  /(22562)
                        /CST1  /(30260)   /CNDR1 /(23723)   /DEM1  /(23730)   /DEM3  /(24101)   /DEA10 /(43704)
                        /OP1   /(03011)   /NOV25 /(37153)   /CSTLK /(61110)   /POWR21/ 65323 *  /CSTLK1/(61123)
                         SHELL   72157
      VAL     72175     /GEN   /(06652)   /TEMPC /(06666)   /GEOME /(02766)   /ECON  /(03000)   /TUBING/(07043)
                        /FOULIN/(07062)   /PUMPHT/(07073)   /AMISC /(07101)   /DATA1 /(07114)   /AZI   /(07130)
                        /TCVL1 /(07313)   /TCVL2 /(07365)   /STAGE1/(11645)   /DMST1 /(42720)   /COND1 /(21576)
                        /STAGE2/(24120)   /PHYS  /(03301)   /MAIN1 /(14601)   /STG1  /(14603)   /STG2  /(22562)
                        /CST1  /(30260)   /CNDR1 /(23723)   /DEM1  /(23730)   /DEM3  /(24101)   /DEA10 /(43704)
                        /OP1   /(03011)   /NOV25 /(37153)   /CSTLK /(61110)   /CSTLK1/(61123)    VALVE   74016

  3   OUTP    60723     /GEN   /(06652)   /TEMPC /(06666)   /GEOME /(02766)   /ECON  /(03000)   /TUBING/(07043)
                        /FOULIN/(07062)   /PUMPHT/(07073)   /AMISC /(07101)   /DATA1 /(07114)   /AZI   /(07130)
                        /TCVL1 /(07313)   /TCVL2 /(07365)   /STAGE1/(11645)   /DMST1 /(42720)   /COND1 /(21576)
                        /STAGE2/(24120)   /PHYS  /(03301)   /MAIN1 /(14601)   /STG1  /(14603)   /STG2  /(22562)
                        /CST1  /(30260)   /CNDR1 /(23723)   /DEM1  /(23730)   /DEM3  /(24101)   /DEA10 /(43704)
                        /OP1   /(03011)   /JAN18 /(14607)   /JAN27 /(14617)    OUTPUT  64076
      OUTP1   64114     /TEMPC /(06666)   /TUBING/(07043)   /SUBMAR/ 64115 *  /MARH20/ 64262 *  /TCVL1 /(07313)
                        /TCVL2 /(07365)   /STAGE1/(11645)   /DMST1 /(42720)   /COND1 /(21576)   /STAGE2/(24120)
                        /MAIN1 /(14601)   /STG1  /(14603)   /STG2  /(22562)   /CST1  /(30260)   /AMISC /(07101)
                        /CNDR1 /(23723)   /DEM1  /(23730)   /DEM3  /(24101)   /AZI   /(07130)   /DEA10 /(43704)
                        /OP1   /(03011)    OUTPUX  65754

  4   CSTVP   60723     /OP1   /(03011)   /ECON  /(03000)    CCSTVC  63407

UNUSED CORE                          74032 THRU  77014
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FIGURE 6 (Concluded)

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