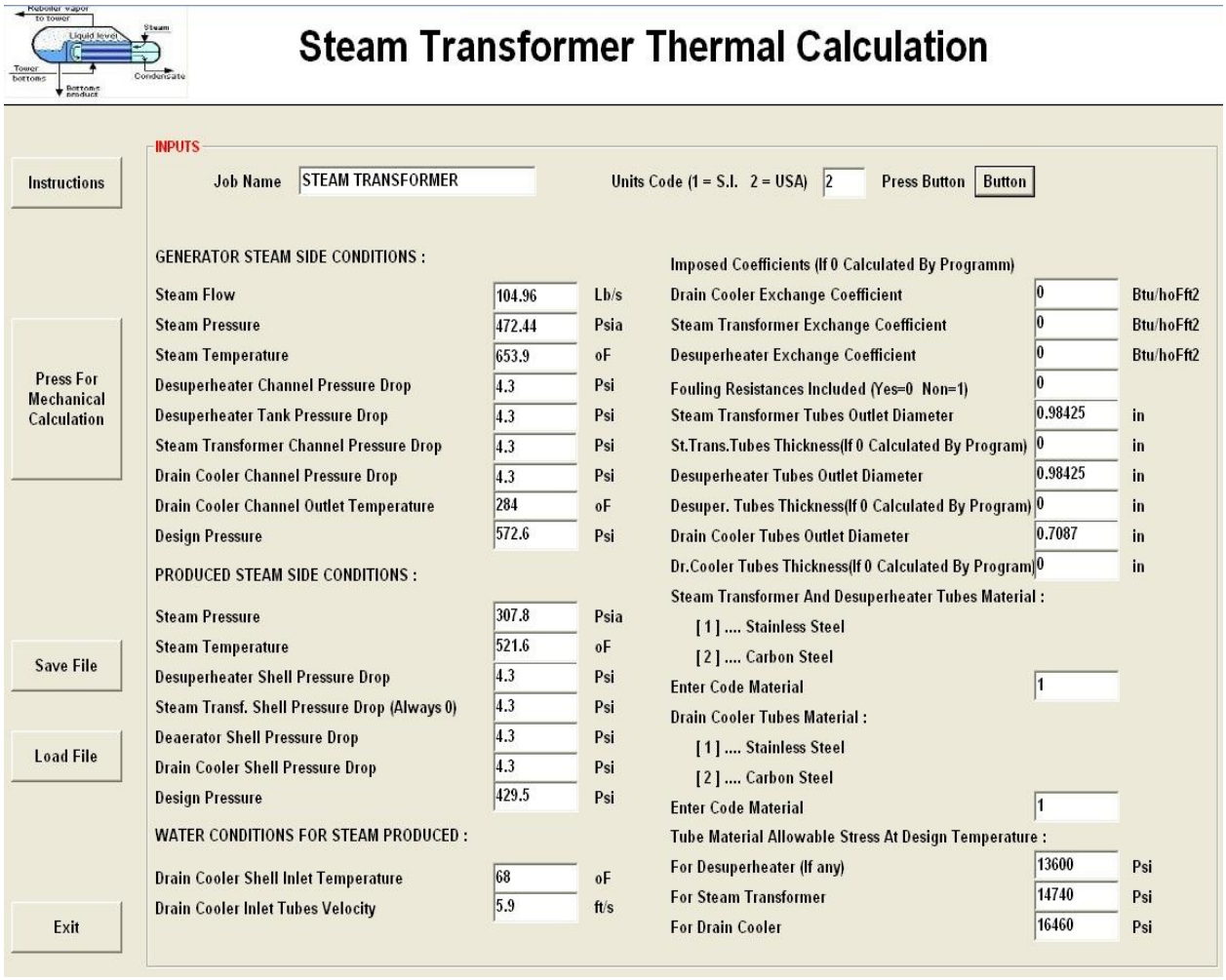
Steam Transformer

The Steam Transformer System is a method power plants use to transform high energy contaminated steam into non contaminated vapor. The clean steam can be used in other roles in the power plant.
The System is combined with various equipments to achieve the transformation of the steam:

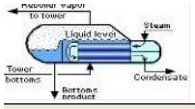
- **A desuperheater of steam. The purpose of this equipment is to reduce the temperature of the steam before it moves to the vapor transformer.**
- **A tank at the exit of the desuperheater where the steam is being prepared for further use.**
- **A steam transformer where the necessary steam is produced.**
- **A drain cooler to cool down the water originated from the condensation of the vapor. The heat from the steam is being transferred to the water in order to produce the desired vapor.**
- **A deserator tank to deaerate the water. This equipment will heat the water using a fraction of the steam produced in the steam transformer.**

If the steam is not overheated in the power plant, the system will only be formed by three equipments. In this case the use of the desuperheater and the tank is not necessary.

PROGRAM WINDOWS



DATA ENTRY WINDOW



Steam Transformer Mechanical Calculation

Run File
Results
Print Results
Drawing
Print Drawing
Save File
Load File
To First Page
Clear All
Exit

INPUTS

Units Code (1 = S.I. 2 = USA) 2 Press Button Button General Allowable Corrosion 0.039 in

Allowable Stress Value At Design Temperature In Psi For Material Of :
(Taking account reduction due to joint efficiency)

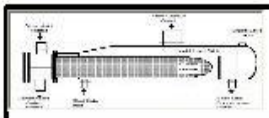
+For Steam Transformer+		+For Desuperheater+	
Shell And Shell Cover	20040	Shell And Shell Cover	19580
Tube Sheet	19580	Tube Sheet	17400
Channel Cylindrical Type (If Hemispherical Put Zero)	19580	Channel Cylindrical Type (If Hemispherical Put Zero)	17400
Channel Hemispheric Type (If Cylindrical Put Zero)	19580	Channel Hemispheric Type (If Cylindrical Put Zero)	17400
Steam Inlet/Outlet Connections	20040	Steam Inlet Connection	17400
Inlet / Outlet Channel Connections	19580	Inlet / Outlet Channel Connections	17400
Channel Cover For Cylindrical Type (Without Put Zero)	19580	Channel Cover For Cylindrical Type (Without Put Zero)	17400

+For Drain Cooler+		+For Desuperheater Tank+	
Shell And Shell Cover	21470	Shell And Shell Covers	18130
Tube Sheet	19580		
Water Box Cylindrical Type (If Hemispherical Put	19580		
Water Box Hemispheric Type (If Cylindrical Put Zero)	19580		
Shell Inlet/Outlet Conections	21470		
Inlet / Outlet Water Box Connections	19580		
Water Box Cover For Cylindrical Type (Without Put Zero)	19580		

+For Deaerator+

Shell And Shell Covers	20040

DATA ENTRY WINDOW 2



STEAM TRANSFORMER - Data Results 1/2

Job Name : STEAM TRANSFORMER

Press For Results 2/2

■ FOR DESUPERHEATER

Shell Steam Inlet Flow	91,82	Lb/s
Channel Steam Inlet Flow	104,96	Lb/s
Shell Inlet Temperature	420,9	oF
Shell Outlet Temperature	521,6	oF
Channel Inlet Temperature	653,9	oF
Channel Outlet Temperature	556,8	oF
Shell Inlet Pressure	312,1	Psia
Channel Inlet Pressure	472,44	Psia
Shell Side Pressure Drop	4,3	Psi
Channel Side Pressure Drop	4,3	Psi
Number Of Tubes	437	
Diameter Of Tubes	0,984	in
Thickness Of Tubes	0	in
Material Of Tubes	Stainless Steel	
Tubes Velocity	65,6	Ft/s
Tubes Pitch	1,22	in
Exchanged Load	6454	Kw
Corrected L.M.T.D.	120,8	oF
Exchange Coefficient	52,04	Btu/hoFft2
Exchange Surface	3498	Ft2
Approx.Internal Shell Diameter	43,7	in
Appoximate Shell Thickness	0,62	in
Approx.Internal Channel Diameter	43,7	in
Approximate Channel Thickness	0,86	in
Approximate Tube Sheet Diameter	45,4	in
Approximate Tube Sheet Thichness	3,89	in
Channel Type	Cylindrical	
Shell Nozzles Diameter	14,4	in
Channel Nozzles Diameter	13,5	in
Number Of Tube Support Plates	6	
Approximate Length Of Equipement	20,9	Ft

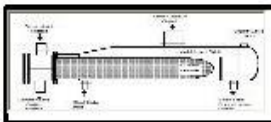
■ FOR DESUPERHEATER TANK

Steam Inlet Pressure	468,14	Psia
Steam Outlet Pressure	463,84	Psia
Inlet To Outlet Steam Pressure Drop	4,3	Psi
Steam Inlet Flow	104,96	Lb/s
Steam Outlet Flow	114,57	Lb/s
Steam Inlet Temperature	556,8	oF
Steam Outlet Temperature	459,3	oF
Water Inlet Flow	114,57	Lb/s
Water Outlet Flow	104,96	Lb/s
Water Inlet Temperature	458,3	oF
Water Outlet Temperature	458,3	oF
Approx.Internal Shell Diameter	45,6	in
Approximate Shell Thickness	0,78	in
Steam In/Out Nozzles Diameter	14,5	in
Water In/Out Nozzles Diameter	10	in
Approximate Height Of Equipement	13,4	Ft

■ FOR DEAERATOR

Steam Inlet Pressure	312,1	Psia
Water Inlet Pressure	320,7	Psia
Pressure Drop In Sprayed Water	4,3	psi
Steam Inlet Flow	17,17	Lb/s
Steam Inlet Temperature	420,9	oF
Water Inlet Flow	91,82	Lb/s
Water Outlet Flow	109,04	Lb/s
Water Inlet Temperature	279,3	oF
Water Outlet Temperature	422,2	oF
Approx.Internal Shell Diameter	38,1	in
Approximate Shell Thickness	0,47	in
Steam Inlet Nozzle Diameter	6,8	in
Water Inlet Nozzle Diameter	9,3	in
Water Outlet Nozzle Diameter	10,7	in
Approximate Height Of Equipement	7,7	Ft

RESULTS SHEET 1



STEAM TRANSFORMER - Data Results 2/2

Job Name : STEAM TRANSFORMER

Press For Weights

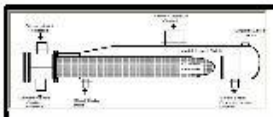
■ FOR STEAM TRANSFORMER

Shell Steam Outlet Flow	91,82	Lb/s
Channel Steam Inlet Flow	114,57	Lb/s
Shell Inlet Temperature	422,2	oF
Shell Outlet Temperature	420,9	oF
Channel Inlet Temperature	459,3	oF
Channel Outlet Temperature	458,3	oF
Shell Outlet Pressure	307,8	Psia
Channel Inlet Pressure	463,84	Psia
Shell Side Pressure Drop	4,3	Psi
Channel Side Pressure Drop	4,3	Psi
Number Of Tubes	668	
Diameter Of Tubes	0,984	in
Thickness Of Tubes	0,035	in
Material Of Tubes	Stainless Steel	
Tubes Velocity	37,6	Ft/s
Tubes Pitch	1,22	in
Exchanged Load	92493	Kw
Corrected L.M.T.D.	36,6	oF
Exchange Coefficient	806,14	Btu/hoFft2
Exchange Surface	10699	Ft2
Approx.Internal Shell Diameter	66,1	in
Approximate Shell Thicknees	0,86	in
Approx.Internal Channel Diameter	52,3	in
Approximate Channel Thicknees	0,47	in
ApproximateTube Sheet Diameter	53,3	in
Approximate Tube Sheet Thicknees	4,64	in
Channel Type	Hemispherical	
Shell Nozzles Diameter	14,4	in
Channel Nozzles Diameter	13,5	in
Number Of Tube Support Plates	9	
Approximate Length Of Equipement	36,6	Ft

■ FOR DRAIN COOLER

Shell Water Inlet Flow	91,82	Lb/s
Channel Water Inlet	104,96	Lb/s
Shell Inlet Temperature	68	oF
Shell Outlet Temperature	279,3	oF
Channel Inlet Temperature	458,3	oF
Channel Outlet Temperature	284	oF
Shell Inlet Pressure	325	Psia
Channel Inlet Pressure	459,54	Psia
Shell Side Pressure Drop	4,3	Psi
Channel Side Pressure Drop	4,3	Psi
Number Of Tubes	156	
Diameter Of Tubes	0,708	in
Thickness Of Tubes	0,035	in
Material Of Tubes	Stainless Steel	
Tubes Velocity	5,9	Ft/s
Tubes Pitch	0,9	in
Exchanged Load	20560	Kw
Corrected L.M.T.D.	155,6	oF
Exchange Coefficient	424,79	Btu/hoFft2
Exchange Surface	1065	Ft2
Approx.Internal Shell Diameter	28,3	in
Approximate Shell Thicknees	0,39	in
Approx.Internal Channel Diameter	28,3	in
Approximate Channel Thicknees	0,31	in
Approximate Tube Sheet Diameter	28,9	in
Approximate Tube Sheet Thicknees	2,44	in
Channel Type	Cylindrical	
Shell Nozzles Diameter	7,5	in
Channel Nozzles Diameter	6,5	in
Number Of Support Plates	9	
Approximate Length Of Equipement	22,4	Ft

RESULTS SHEET 2



STEAM TRANSFORMER - Results Weights (Lb)

Job Name : STEAM TRANSFORMER

■ Desuperheater

Exchange Tubes	5070
Tube Sheet Gross Weight	1800
Shell And Channel Ends	1450
Nozzles	130
Equipement Supports	660
Manhole	740
Tubes Supports Gross Weight	810
Complete Shell And Internals	7160
Channel	2160
Total Equipement (Including Tubes)	17280

■ Steam Transformer

Exchange Tubes	15410
Tube Sheet Gross Weight	2970
Shell And Channel Ends	1630
Nozzles	130
Equipement Supports	1140
Manhole	740
Tubes Supports Gross Weight	1760
Complete Shell And Internals	28020
Channel	1490
Total Equipement (Including Tubes)	51100

■ Drain Cooler

Exchange Tubes	1520
Tube Sheet Gross Weight	460
Shell And Channel Ends	610
Nozzles	60
Equipement Supports	480
Manhole	0
Tubes Support Gross Weight	300
Complete Shell And Internals	3760
Channel	680
Total Equipement (Including Tubes)	6870

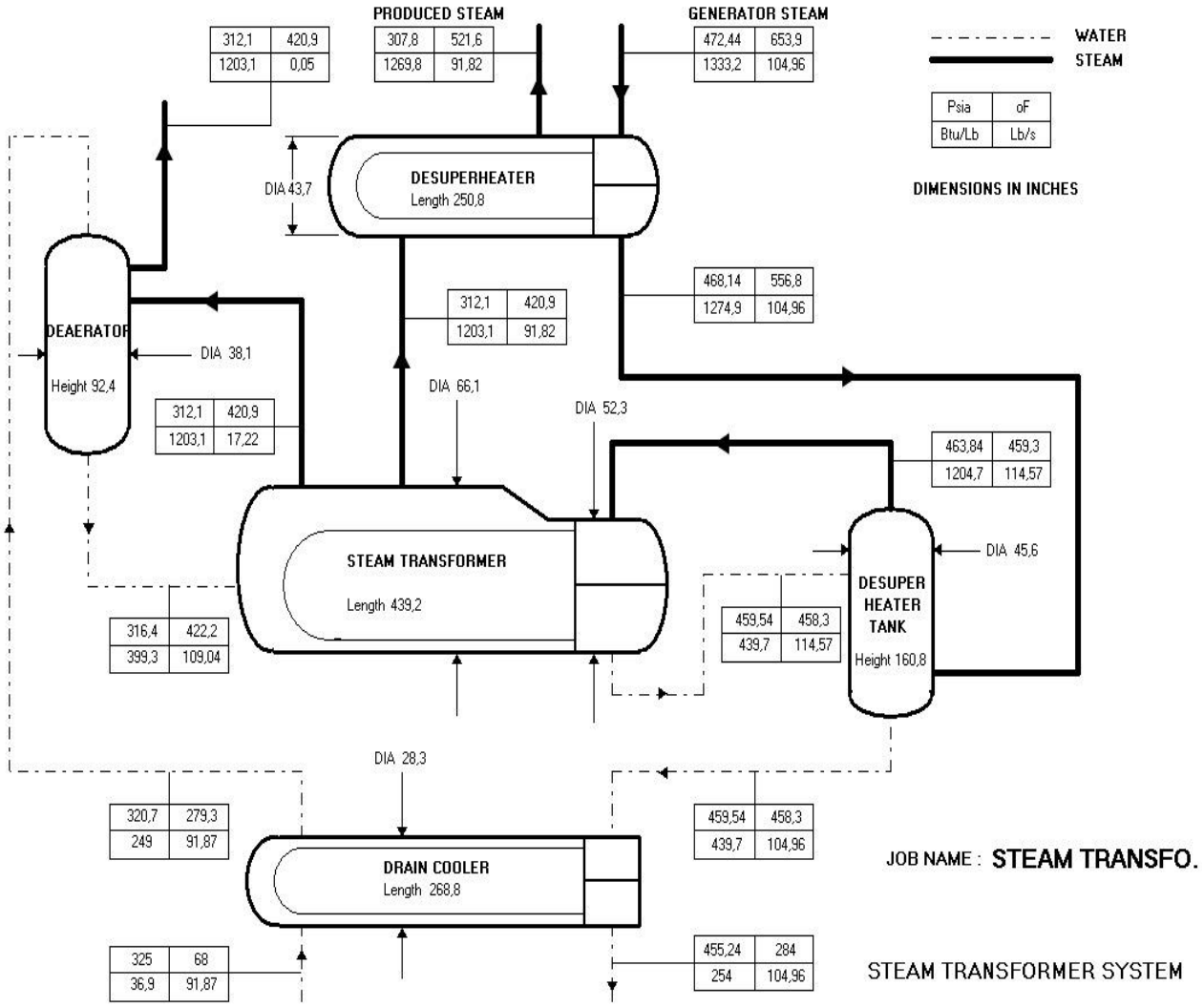
■ Desuperheter Tank

Shell End	940
Nozzles	110
Equipement Supports	410
Manhole	740
Shell	4470
Internals	1100
Total Equipement	7760

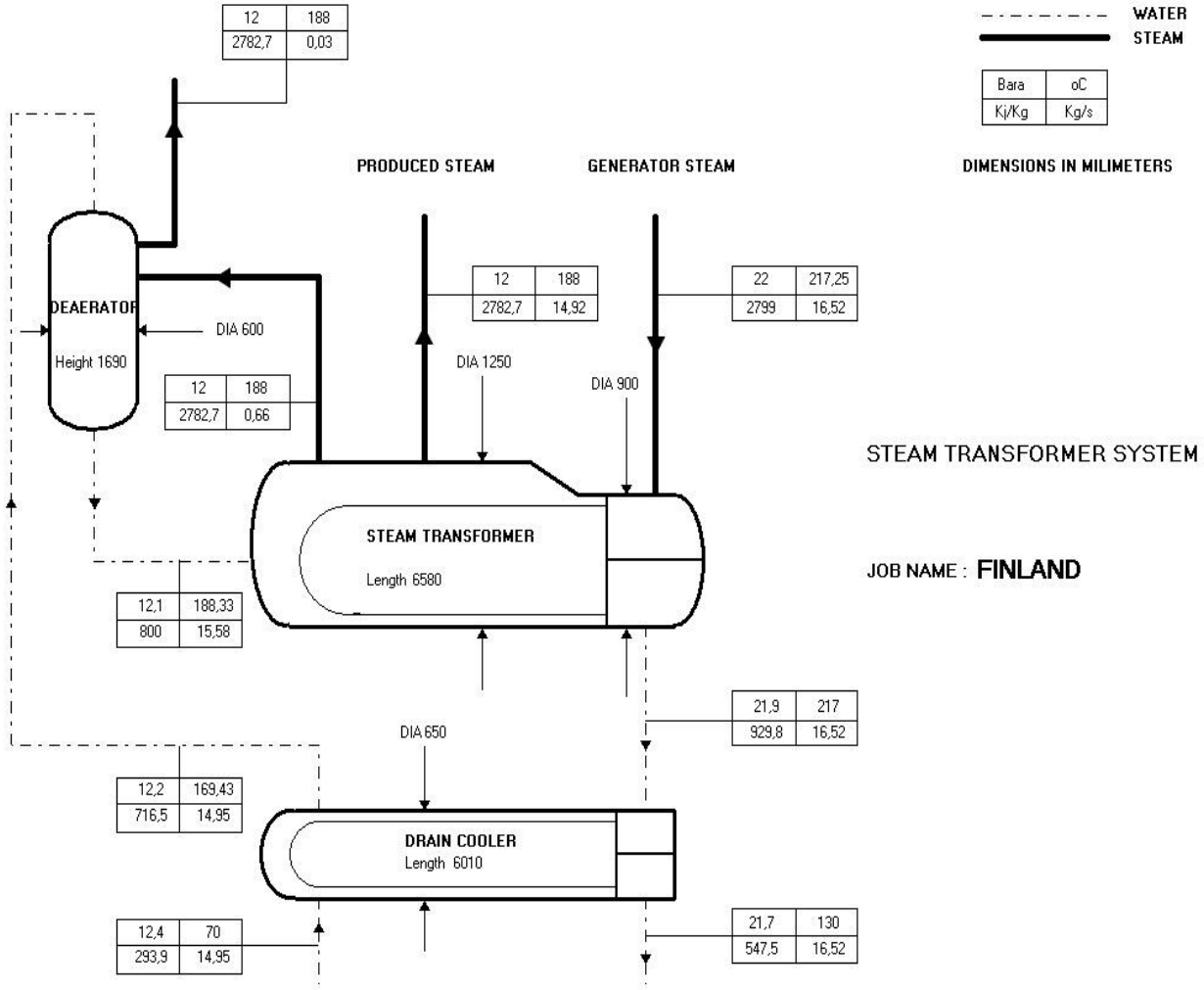
■ Deaerator

Shell Ends	410
Nozzles	40
Equipement Supports	240
Manhole	610
Shell	1010
Internals	610
Total Equipement	2860

WEIGHTS SHEET



DRAWING (REHEATED STEAM CASE)



OTHER DRAWING FOR SATURATED STEAM CASE