

# District Heating

Thermal and mechanical design of heaters for a District Heating System based on HEI standards and heat transfer coefficients based on classic correlations. Heaters are accommodated as are horizontal and specialy for vertical units. In addition the program also generates a heater drawing showing the principal dimensions of the unit and of the tube support system, tube layout and results sheet for thickness and weights.

## PROGRAM WINDOWS

**District Heating Heater Thermal Calculation**

**INPUTS**

Units Code (1 = S.I. 2 = USA)  Press Button

Job Name

Steam Flow	<input type="text" value="218.16"/>	tn/h	Number Of Steam Inlets	<input type="text" value="1"/>
Steam Temperature At Inlet	<input type="text" value="155"/>	oC	Tubes Outlet Diameter	<input type="text" value="15"/> mm
Steam Pressure At Inlet	<input type="text" value="4"/>	bara	Tubes Thickness (0 = If According to HEI)	<input type="text" value="0.8"/> mm
Steam Enthalpy At Inlet	<input type="text" value="2763.16"/>	kJ/kg	Tubes Pitch	<input type="text" value="20"/> mm
Pressure Drop At Desuperheater	<input type="text" value="0"/>	bar	Feed Water Velocity	<input type="text" value="2"/> m/s
Steam Temperature At Desuperheater Outlet	<input type="text" value="0"/>	oC	Tubes Material :	
Flow At # 1 Drain Inlet	<input type="text" value="0"/>	tn/h	[ 1 ] .... Carbon Steel	
Enthalpy At # 1 Drain Inlet	<input type="text" value="0"/>	kJ/kg	[ 2 ] .... Cooper Nickel 90/10 (If Steam Temperature < 600oF)	
Flow At # 2 Drain Inlet	<input type="text" value="0"/>	tn/h	[ 3 ] .... Austenitic S.S.	
Enthalpy At # 2 Drain Inlet	<input type="text" value="0"/>	kJ/kg	[ 4 ] .... Monel	
Drain Outlet Temperature (If no D.C. tape 0)	<input type="text" value="133.7"/>	oC	[ 5 ] .... Cooper Nickel 70/30 (If Steam Temperature < 700oF)	
Feed Water Flow	<input type="text" value="2005.2"/>	tn/h	[ 6 ] .... Ferritic S.S.	
Feed Water Inlet Temperature	<input type="text" value="58"/>	oC	[ 7 ] .... Admiralty Brass 70/30 (If Steam Temperature < 450oF)	
Feed Water Pressure	<input type="text" value="14"/>	bara	Enter Code Material	<input type="text" value="3"/>
Feed Water Outlet Temperature	<input type="text" value="115"/>	oC	Heater Installation :	
Tube Side Design Pressure	<input type="text" value="16"/>	bar	[ 0 ] .... Horizontal Full Flow	
Tube Material Allowable Stress at Design Temp.	<input type="text" value="0"/>	bar	[ 1 ] .... Vertical Channel Down	
Mini.Radius of Tube Curvature (0 = not considered)	<input type="text" value="0"/>	mm	Enter Installation Code	<input type="text" value="1"/>
Allowable Tube Material Corrosion	<input type="text" value="0"/>	mm	Desuperheating Correction Coefficient	<input type="text" value="1"/>
Drain Cooler Tube Outlet Velocity	<input type="text" value="1"/>	m/s	Condensation Correction Coefficient	<input type="text" value="1"/>
Inside Tube Fouling Resistance	<input type="text" value="0.0001"/>	m2oC/W	Drain Cooler Correction Coefficient	<input type="text" value="0.8"/>
			Number Of Tube Passes (1 Or 2)	<input type="text" value="1"/>
			Water Box Type	<input type="text" value="2"/>
			[ 1 ] .... Hemispheric (For 2 Passes Only)	
			[ 2 ] .... Cylindrical	

## DATA ENTRY WINDOW

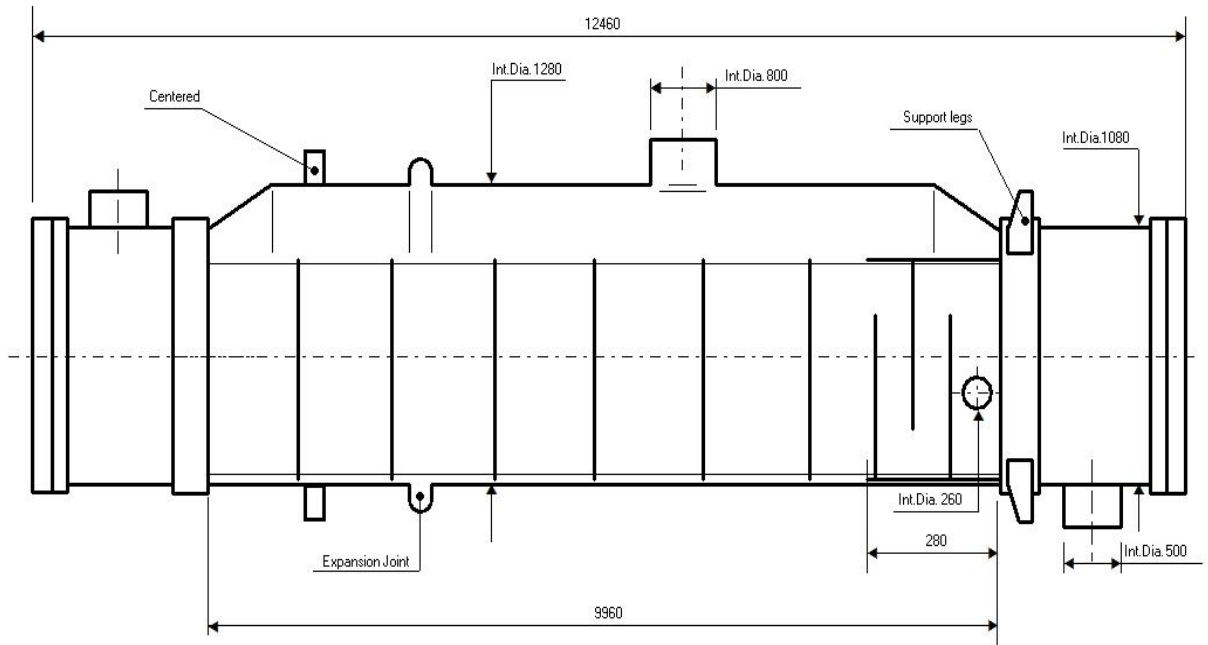


## DISTRICT HEATING HEATER - Data Results

Job Name : District Heater

■ Data Input		■ Results		
Steam Flow (Including 0.3% Lost)	218,795 tn/h	Desuperheating Duty	0 Mj/h	Dew Point Verification NIL oC (It Must Be Less Than Temperature At Desuperheater Outlet)
Steam Temperature At Inlet	155 oC	Condensation Duty	472268,9 Mj/h	
Steam Enthalpy At Inlet	2763,15 kj/kg	Drain Cooler Duty	9298,8 Mj/h	<b>For Desuperheater :</b> Support Plates Number Pressure Drop bar
Steam Pressure At Inlet	4 bara	Desuperheating L.M.T.D.	0 oC	
Specific Volume Of Steam Inlet	0,4772 m3/Kg	Condensation L.M.T.D.	51,61 oC	<b>For Drain Cooler :</b> Support Plates Number 2 Pressure Drop 0,14 bar
Steam Saturation Temp. At Inlet Pressure	143,62 oC	Drain Cooler L.M.T.D.	80,02 oC	
Steam Temp. At Condensation Pressure	143,62 oC	Desup.Heat Transfer Coefficient	0 kj/hoCm2	<b>For Condensing :</b> Support Plates Number 14 Pressure Drop NEGLIGIBLE
Condensed Water Enthalpy	604,65 kj/kg	Conden.Heat Transfer Coefficient	9998 kj/hoCm2	
Steam Temp. At Desuperheater Outlet	0 oC	D.C. Heat Transfer Coefficient	7285 kj/hoCm2	
Steam Enthalpy At Desuperheater Outlet	0 kj/kg	Desuperheater Effective Surface	0 m2	
Flow At # 1 Drain Inlet	0 tn/h	Condensation Effective Surface	915 m2	
Enthalpy At # 1 Drain Inlet	0 kj/kg	D.C. Effective Surface	16 m2	
Flow At # 2 Drain Inlet	0 tn/h	Total Surface	959,7 m2	
Enthalpy At # 2 Drain Inlet	0 kj/kg	Inactive Surface	28,8 m2	
Drain Outlet Temperature	133,7 oC	Number Of U Tubes	2043	
Drain Outlet Enthalpy	562,15 kj/kg	Tube Side Pressure Drop	0,44 bar	
Feed Water Flow	2005,2 tn/h	Feed Water Temp. At Conden. Inlet	59,11 oC	
Feed Water Inlet Temperature	58 oC	Feed Water Temp. At Conden. Outlet	114,98 oC	
Feed Water Inlet Enthalpy	243,88 kj/kg	Terminal Temperature Difference	28,62 oC	
Feed Water Outlet Temperature	115 oC	Drain Cooler Approach	75,69 oC	
Feed Water Outlet Enthalpy	483,32 kj/kg	Approx. Inlet Channel Diameter	1080 mm	
Average Feed Water Specific Volume	0,001035 m3/Kg	Approx. Inlet Shell Diameter	1280 mm	
Tubes Outlet Diameter	15 mm	Approx. Heater Total Length	12,46 m	
Tubes Thickness	0,8 mm	Approx. Straight Tube Length	9960 mm	
Tubes Pitch	20 mm	Approx. Desuper. Casing Length	0 mm	
Feed Water Velocity	2 m/s	Approx. Drain Cooler Casing Length	280 mm	
Tubes Material	Austenitic S.S.	Tube Number In Drain Cooler	2043	
Heater Installation	Vertical	Feed Water Nozzles Diameters	500 mm	
Desuperheating Correction Coefficient	1	Number Of Steam Nozzles	1	
Condensation Correction Coefficient	1	Diameter Of Steam Nozzles	800 mm	
Drain Cooler Correction Coefficient	0,8	Diameter Of Drain Nozzle	260 mm	

## RESULTS SHEET

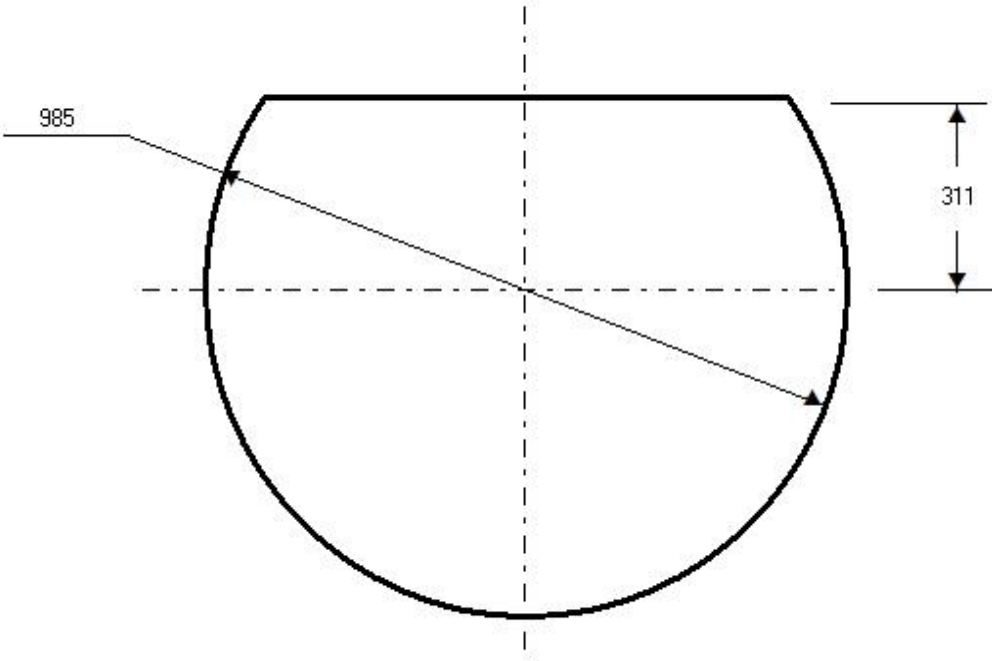


VERTICAL TYPE - Condensing and Drain Cooling Zones

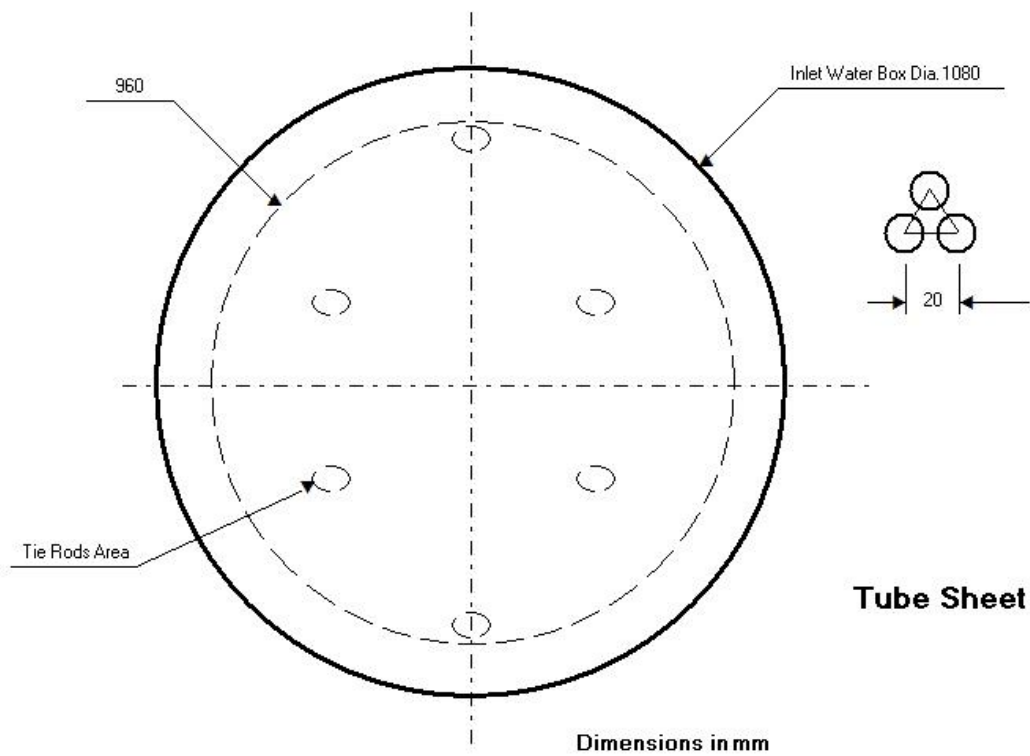
Dimensions in mm

## DIMENSIONAL DRAWING

**DRAIN COOLER TUBES SUPPORT PLATE ARRANGEMENT**



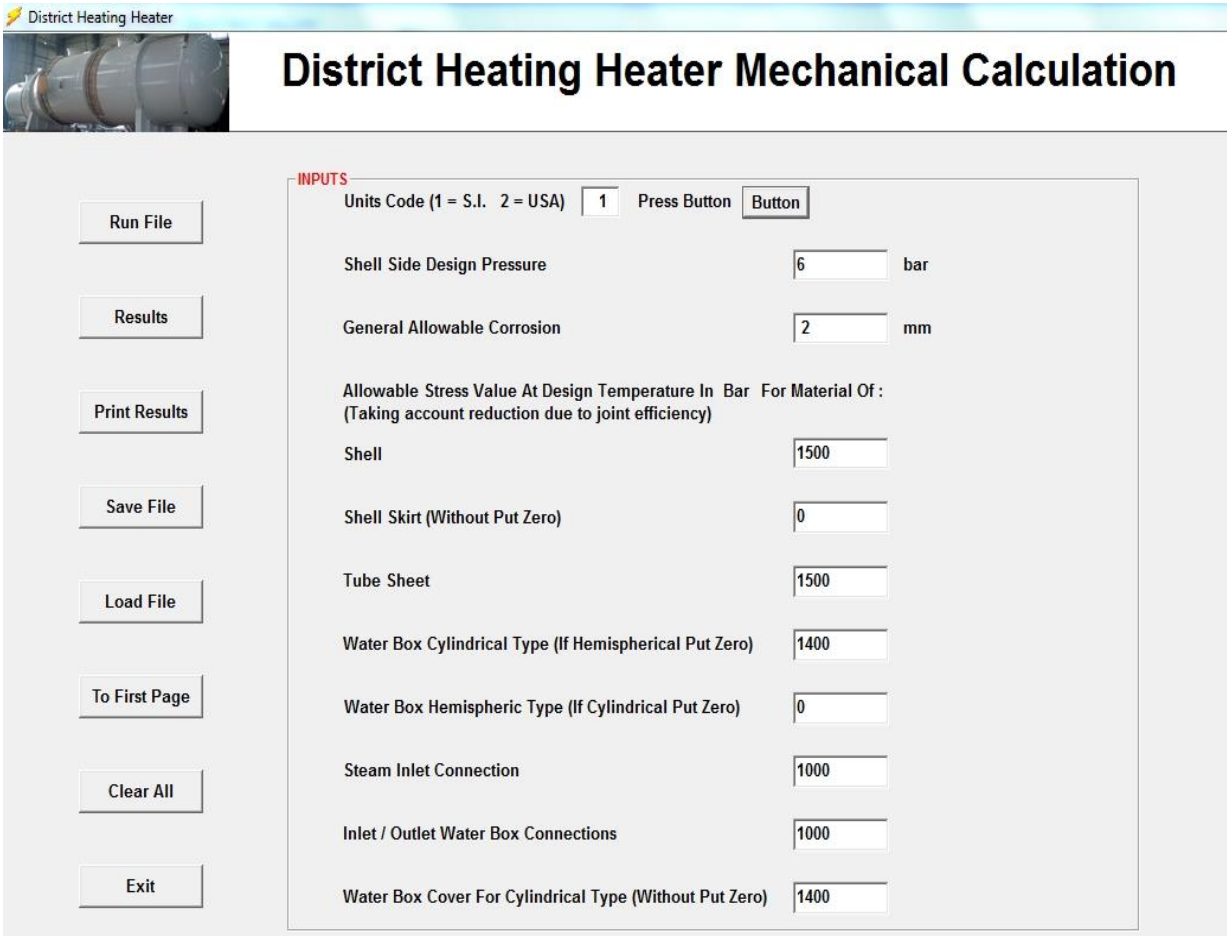
Dimensions in mm



**Tube Sheet Tube Layout**

# MECHANICAL CALCULATION

District Heating Heater



## District Heating Heater Mechanical Calculation

**INPUTS**

Units Code (1 = S.I. 2 = USA)  Press Button

Shell Side Design Pressure  bar

General Allowable Corrosion  mm

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

Shell

Shell Skirt (Without Put Zero)

Tube Sheet

Water Box Cylindrical Type (If Hemispherical Put Zero)

Water Box Hemispheric Type (If Cylindrical Put Zero)

Steam Inlet Connection

Inlet / Outlet Water Box Connections

Water Box Cover For Cylindrical Type (Without Put Zero)

Run File

Results

Print Results

Save File

Load File

To First Page

Clear All

Exit

# MECHANICAL CALCULATION DATA WINDOW



## DH HEATER RESULTS - Thickness (mm) and Weights (Kg)

Job Name : District Heater

■ THICKNESSES		■ WEIGHTS	
Shell	12	Exchange Tubes	5850
Shell Skirt	0	Tube Sheets Gross	1020
Shell To Water Box Transition Piece	12	Tube Sheets Net Weight	620
Tube Sheet	69	Shell With Expansion Joint, Pipes And Internals	4370
Water Box (Hemispherical Type)	0	Shell Skirt	0
Water Box (Cylindrical Type)	9	Hemispherical Water Box, Pipes And Manhole	0
Water Box Cover (Plate Type)	66	Cylindrical Water Box , Pipes And Plate Cover	1640
Water Box Cover (Elliptical Type)	0	Cylindrical Water Box, Pipes And Elliptical Cover	0
Tubes Support Plate	10	Complete Desuperheating Crate	0
Shell Expansion Joint	2	Complete Drain Cooler Crate	70
Steam Inlet Pipe	5	Condensing Tubes Support Plates And Tie Rods	620
Feedwater Inlet/Outlet Pipe	7	Heater Supports	170
Drains Outlet Pipe	3	Heater Empty	13340
		Heater In Operation	18400
		Heater Full Of Water	26800

## RESULTS SHEET