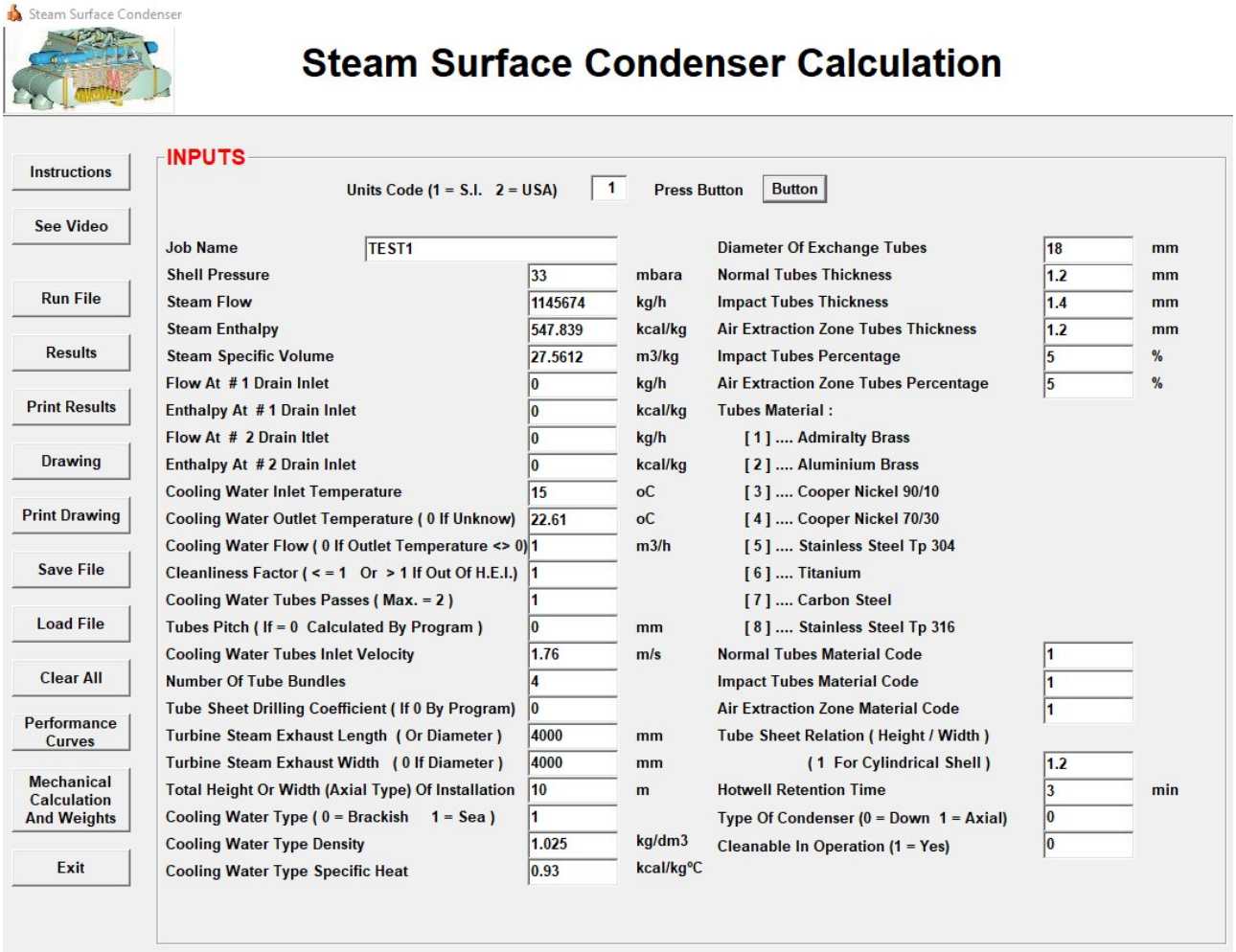
Steam Surface Condenser

Thermal and mechanical design and sizing of steam surface condensers based on heat transfer coefficients in accordance with HEI standards. This program is valid for small cylindrical units or larger condensers used in thermal and nuclear power plants.
The program also generates performance pressure curves based on the thermal load and temperature.

PROGRAM WINDOWS



DATA ENTRY WINDOW

RESULTS

Steam Surface Condenser - Data Results

Job Name : TEST1

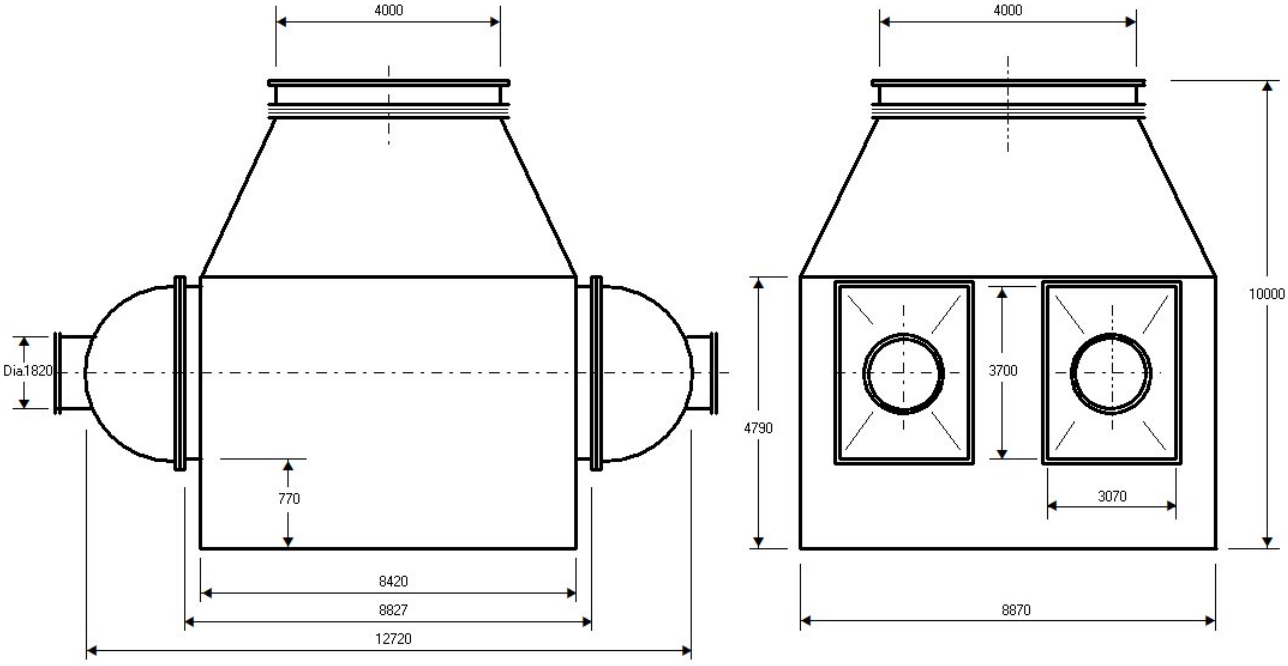
■ Data Inputs

Shell Pressure	33	mbara
Steam Flow	1145674	kg/h
Steam Enthalpy	547,839	kcal/kg
Steam Specific Volume	27,5612	m3/kg
Flow At # 1 Drain Intet	0	kg/h
Enthalpy At # 1 Drain Inlet	0	kcal/kg
Flow At # 2 Drain Inlet	0	kg/h
Enthalpy At # 2 Drain	0	kcal/kg
Cooling Water Inlet Temperature	15	oC
Cooling Water Outlet Temperature	22,61	oC
Cooling Water Flow	82560,2	m3/h
Cooling Water Type	Sea Water	
Cleanliness Factor	1	
Cooling Water Tube Passes	1	
Tubes Pitch	23,5	mm
Diameter Of Exchange Tubes	18	mm
Cooling Water Tubes Inlet Velocity	1,76	m/s
Normal Tubes Thickness	1,2	mm
Impact Tubes Thickness	1,4	mm
Air Extraction Zone Tubes Thickness	1,2	mm
Number Of Tubes Bundles	4	
Normal Tubes Material	Admiralty Brass	
Impact Tubes Material	Admiralty Brass	
Air Extraction Zone Tubes Material	Admiralty Brass	
Impact Tubes Percentage	5	%
Air Extraction Zone Tubes Percentage	5	%
Tube Sheet Relation (Height/Width)	1,2	
Hotwell Retenton Time	3	min

■ Results

Condensation Temperature	25,69	oC
Cooling Water Outlet Temperature	22,61	oC
Cooling Water Flow	82560,2	m3/h
Heat Load	598205,5	mcal/h
L.M.T.D.	6,12	oC
Heat Exchange Coefficient	2863	kcal/hoCm2
Surface OF Exchange	34120	m2
Number Of Tubes	68348	
Tubes Pitch	23,5	mm
Tubes Length Between Tube Sheets	8,828	m
Total Cooling Water Pressure Drop	2,82	mcw
Aprox. Waterbox Diameter	0	mm
Aprox. Shell Diameter	0	mm
Tube Sheet Height Or Width	3700	mm
Tube Sheet Width Or Height	3070	mm
Shell Total Width Or Height	8,87	m
Tube Sheet Drilling Coefficient	0,381	
Number Of Tubes Support Plates	10	
Tur.Steam Exhaust Length Or Diameter	4000	mm
Turbine Steam Exhaust Width	4000	mm
Total Height Or Width Of Installation	10	m
Shell Total Height Or Width	4,79	m
Diameter Of Cooling Water Nozzles	1820	mm
Height Or Radius Of Hotwell	770	mm
Condenser Total Length	12,72	m

DRAWING



Dimensions in mm

Number of Shells 2

Steam Surface Condenser Performance Curves

Performance Curves

Instructions

Run File

Results

Print Results

See Curves

INPUTS

Number Of Temperature Curves (Max. 10)	10
First Cooling Water Inlet Temperature (°C or °F)	21
Step Of Temperatures	2
Cleanliness Factor	1

Load File | Save File | Mechanical Calculation | Exit

Performance Curves Of Steam Surface Condenser - Data Results

Job Name : TEST1

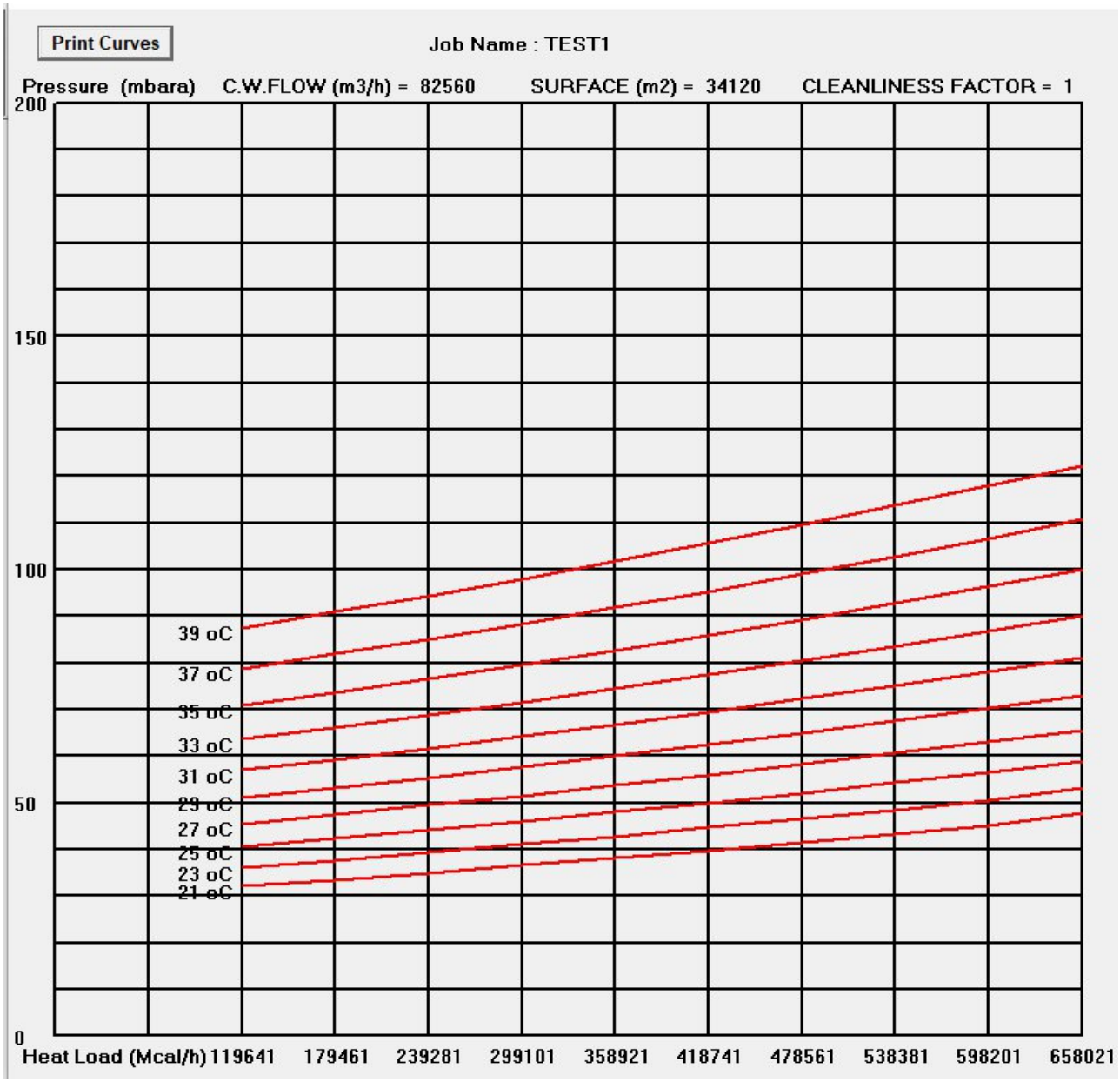
■ Cooling Water Flow (M3/h) 82560,2 ■ Cleanliness Factor 1

CW Inlet Temp (oC)	21	23	25	27	29
Heat Load (Mcal/h)	Pressure (mbara)	Pressure (mbara)	Pressure (mbara)	Pressure (mbara)	Pressure (mbara)
119641,1	32,119	36,144	40,603	45,533	50,974
179461,65	33,544	37,724	42,35	47,462	53,102
239282,2	35,024	39,363	44,163	49,463	55,306
299102,75	36,561	41,064	46,042	51,536	57,589
358923,3	38,156	42,828	47,99	53,684	59,954
418743,85	39,812	44,658	50,01	55,909	62,402
478564,4	41,529	46,556	52,102	58,213	64,936
538384,95	43,311	48,523	54,271	60,6	67,558
598205,5	45,159	50,562	56,517	63,071	70,272
658026,05	47,716	53,064	58,991	65,628	73,079

CW Inlet Temp (oC)	31	33	35	37	39
Heat Load (Mcal/h)	Pressure (mbara)	Pressure (mbara)	Pressure (mbara)	Pressure (mbara)	Pressure (mbara)
119641,1	56,971	63,57	70,82	78,774	87,487
179461,65	59,314	66,145	73,646	81,871	90,876
239282,2	61,739	68,809	76,569	85,073	94,378
299102,75	64,25	71,566	79,592	88,382	97,996
358923,3	66,848	74,418	82,717	91,801	101,732
418743,85	69,537	77,367	85,947	95,334	105,591
478564,4	72,319	80,417	89,285	98,983	109,574
538384,95	75,197	83,57	92,735	102,752	113,686
598205,5	78,173	86,829	96,298	106,643	117,929
658026,05	81,25	90,196	99,979	110,66	122,308

RESULTS

Pressure versus Heat Load for each Temperature



Performance Curves

Condenser HEI Shell And Water Box Thickness (Chap.8.2.3 and 5)

Run File

Results

Print Results

Save File

Load File

Clear All

Press For Weights

Exit

INPUTS

Job Name	TESTTICK1	
Shell Side Design Pressure	40	psig
Horizontal Length Between Two Support Points	40	in
Vertical Length Between Two Support Points	60	in
Shell Allowable Load (If 0, 20000 For A515Gr70)	0	psi
Support Tubes Allowable Load (If 0, 35000 For A106)	0	psi
Supports Young's Modulus (If 0, 29.3x10^6 For A106)	0	psi
In Hotwell Support Tubes Outlet Diameter	3	in
In Hotwell Support Tubes Thickness	0.2	in
Height Of Support Tubes In Hotwell	3	ft
Tube Side Design Pressure	60	psig
Discontinuity Factor According To Geometry (< = 1)	1	
Radius Of Water Box	60	in
Water Box Allowable Load (If 0, 20000 For A515Gr70)	0	psi
Welding Eficiency Factor (If 0, HEI Factor = 0.75)	0	
Dimension Between Reinforcements In Plane Plates	20	in

SHELL AND WATER BOX THICKNESS CALCULATION

Condeser Shell And Water Box Thickness - Data And Results

Job Name : **TESTTICK1**

■ Data Inputs

Shell Side Design Pressure	40	psig
Horizontal Length Between Two Support Points	40	in
Vertical Length Between Two Support Points	60	in
Shell Allowable Load (If 0, 20000 For A515Gr70)	20000	psi
Support Tubes Allowable Load (If 0, 35000 For A106)	35000	psi
Supports Young's Modulus (If 0, 29.3x10^6 For A106)	29300	Kpsi
In Hotwell Support Tubes Outlet Diameter	3	in
In Hotwell Support Tubes Thickness	0,2	in
Height Of Support Tubes In Hotwell	3	ft
Tube Side Design Pressure	60	psig
Discontinuity Factor According To Geometry (< = 1)	1	
Radius Of Water Box	60	in
Water Box Allowable Load (If 0, 20000 For A515Gr70)	20000	psi
Welding Eficiency Factor (If 0, HEI Factor = 0.75)	0,75	
Dimension Between Reinforcements In Plane Plates	20	in

■ Results

Shell Thickness Without Corrosion	1,3	in
Tube Diameter Or Clips Width In Support Points	4,89	in
Shell Thickness With Ribs And Without Corrosion	1,03	in
Allowable Loads In Hotwell Support Tubes	36858	lb
Semi-Cylindrical Water Box Thickness Without Corosion	0,23	in
Plane Plates Thickness Without Corrosion	0,63	in

SHELL AND WATER BOX THICKNESS RESULTS

WEIGHTS OF MAIN PARTS

Condenser Tubes And Tube Sheets Weight

INPUTS

Job Name: TEST DOWN

Run File

Results

Print Results

Save File

Load File

Press For Shell Weight

Exit

Tubes Diameter	18	mm
Normal Tubes Thickness	1.2	mm
Impact Tubes Thickness	1.4	mm
Air Extraction Tubes Thickness	1.2	mm
Percentage Of Impact Tubes	5	%
Percentage Of Air Extraction Tubes	5	%
Length Of Tubes	9.25	m
Total Number Of Tubes	65811	
Density Of Normal Tubes Material	8.2	kg/m3
Density Of Impact Tubes Material	8.2	kg/m3
Density Of Air Extraction Tubes Material	8.2	kg/m3
Height Of Tube Sheet	3.8	m
Width Of Tube Sheet	3.2	m
Tube Sheet Thickness	40	mm
Thickness Of Cladding	5	mm
Density Of Tubes Sheet Material	7.9	kg/m3
Density Of Cladding Material	8.5	kg/m3
Total Number Of Tubes Sheets	8	
Water Box Bolts Diameter	25	mm
Number Of Bolts Per Tube Sheet	100	

Steam Condeser Tubes And Tube Sheets Weight - Data And Results

Job Name : **TEST DOWN**

■ Data Inputs

Tubes Diameter	18	mm
Normal Tubes Thickness	1,2	mm
Impact Tubes Thickness	1,4	mm
Air ExtractionTubes Thickness	1,2	mm
Percentage Of Impact Tubes	5	%
Percentage Of Air Extraction	5	%
Length Of Tubes	9,25	m
Total Number Of Tubes	65811	
Density Of Normal Tubes Material	8,2	kg/m3
Density Of Impact Tubes Material	8,2	kg/m3
Density Of Air ExtractionTubes Material	8,2	kg/m3
Height Of Tube Sheet	3,8	m
Width Of Tube Sheet	3,2	m
Tube Sheet Thickness	40	mm
Thickness Of Cladding	5	mm
Density Of Tube Sheet Material	7,9	kg/m3
Density Of Cladding Material	8,5	kg/m3
Total Number Of Tube Sheets	8	
Water Box Bolts Diameter	25	mm
Number Of Bolts Per Tube Sheet	100	

■ Results

Weight Of Normal Tubes	284536	kg
Weight Of Impact Tubes	18222	kg
Weight Of Air Extraction Tubes	15807	kg
Gross Weight Of One Tube Sheet	3879	kg
Gross Weight Of All Tube Sheets	31032	kg
Gross Weight Of One Tube Sheet After Machining	2469	kg
Gross Weight Of All Tube Sheets After Machining	19752	kg

Steam Condenser Shell Weight

Steam Condenser Shell Weight

Run File

Results

Print Results

Save File

Load File

Press For Water Boxes Weight

Exit

INPUTS

Job Name: TEST DOWN

Length Between Tube Sheets	9.17	m	Aircooling Casing Thickness	3	mm
Shell Length	8.8	m	Diameter Of Aircooling Main Pipe	200	mm
Shell Width (Or Height If Axial Type)	8.7	m	Thickness Of Aircooling Main Pipe	6	mm
Shell Height (Or Width If Axial Type)	4.7	m	Number Of Vertical Aircooling Pipes	4	
Shell Wall Thickness	16	mm	Diameter Of Vertical Aircooling Pipes	100	mm
Tube Sheet Height (Or Width If Axial Type)	3.8	m	Thickness Of Vertical Aircooling Pipes	4	mm
Tube Sheet Width (Or Height If Axial Type)	3.2	m	Dimension Of Tube Sheet Face Flange	100	mm
Number Of Tube Support Plates Per Bundle	10		Number Of Holes In Tube Sheet Flange	100	
Thickness Of Tube Support Plates	10	mm	Holes Diameter In Tube Sheet Flange	25	mm
Reinforcing Pipe Diam. In Tube Support Plates	80	mm	Number Of Tubes Per Tube Bundle	16450	
Reinforcing Pipe Thick. In Tube Support Plates	5	mm	Diameter Of Tubes	18	mm
Tube Sheet Flange Thickness	50	mm	Number Of Tubes In Aircooling Per Bundle	800	
Tubes Protection Grill Tube Diameter	25	mm	Turbine Neck Connection Thickness Plate	20	mm
Tubes Protection Grill Tube Thickness	2	mm	Turbine Neck Connection Width Plate	40	mm

Steam Surface Condeser Shell Weight - Data And Results

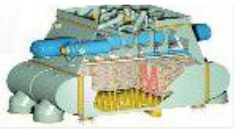
Job Name : **TEST DOWN**

■ Data Inputs

Length Between Tube Sheets	9,17	m
Shell Length	8,8	m
Shell Width	8,7	m
Shell Height	4,7	m
Shell Wall Thickness	16	mm
Tube Sheet Height	3,8	m
Tube Sheet Width	3,2	m
Number Of Tube Support Plates Per Bundle	10	
Thickness Of Tube Support Plates	10	mm
Reinforcing Pipe Diam. At Tube Support Plates	80	mm
Reinforcing Pipe Thick. At Tube Support Plates	5	mm
Tube Sheet Flange Thickness	50	mm
Tube Diameter For Tube Protection Grill	25	mm
Tube Thickness For Tube Protection Grill	2	mm
Aircooling Casing Thickness	3	mm
Diameter Of Aircooling Main Pipe	200	mm
Thickness Of Aircooling Main Pipe	6	mm
Number Of Vertical Aircooling Pipes	4	
Diameter Of Vertical Aircooling Pipes	100	mm
Thickness Of Vertical Aircooling Pipes	4	mm
Dimension Of Tube Sheet Face Flange	100	mm
Number Of Holes In Tube Sheet Flange	100	
Holes Diameter In Tube Sheet Flange	25	mm
Number Of Tubes Per Tube Bundle	16450	
Diameter Of Exchange Tubes	18	mm
Number Of Tubes In Aircooling Per Bundle	800	
Turbine Neck Connection Thickness Plate	20	mm
Turbine Neck Connection Width Plate	40	mm

■ Results

Weight Of Wall Plates	15526	kg
Weight Of Necks Between Tube Sheet And Shell	2500	kg
Weight Of Shell Expansion Joint (If Needed)	229	kg
Weight Of Flanges For Tube Sheets Connection	2097	kg
Weight Of Tube Support Plates After Drilling	13894	kg
Weight Of Tube Support Plates Reinforcement Pipes	763	kg
Weight Of Reinforcement Plates And Profiles	2316	kg
Weight Of Tube Protection Grill	2043	kg
Weight Of Aircooling Casing	441	kg
Weight Of Aircooling Extraction Pipes	604	kg
Weight Of Plate Between Neck And Shell	224	kg
TOTAL WEIGHT OF SHELL	40641	kg



Steam Condenser Water Boxes Weight

(Semicylindrical Type)

Run File

Results

Print Results

Save File

Load File

Press For Hotwell Weight

Exit

INPUTS

Job Name	TEST DOWN	
Height Of Tube Sheet	3.8	m
Width Of Tube Sheet	3.2	m
Width Of The Flange Face	100	mm
Thickness Of Flange	60	mm
Diameter Of Water Box Bolts	25	mm
Number Of Bolts Per Water Box	100	
Thikness Of Main Plate	18	mm
Thickness Of Up And Down Water Box Covers	22	mm
Thickness Of Pass Division Plate (For 1 Pass = 0)	0	mm
Diameter Of Inlet/Outlet Cooling Water Pipes	1780	mm
Thickness Of Inlet/Outlet Cooling Water Pipes	10	mm
Thickness Of Inlet/Outlet Cooling Water Flange	40	mm

Steam Condeser Water Boxes Weight - Data And Results

Job Name : **TEST DOWN**

■ Data Inputs

Height Of Tube Sheet	3,8	m
Width Of Tube Sheet	3,2	m
Width Of The Flange Face	100	mm
Thickness OF Flange	60	mm
Diameter OF Water Box Bolts	25	mm
Number Of Bolts Per Water Box	100	
Thickness Of Main Plate	18	mm
Thickness Of Up And Down Water Box Covers	22	mm
Thickness Of Pass Division Plate (For 1 Pas = 0)	0	mm
Diameter Of Inlet/Outlet Cooling Water Pipes	1780	mm
Thickness Of Inlet/Outlet Cooling Water Pipes	10	mm
Thickness Of Inlet/Outlet Cooling Water Flange	40	mm

■ Results

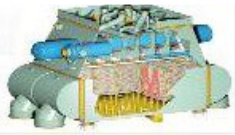
Weight Of Tube Plate Flange	627	kg
Weight Of Tube Plate Bolts	141	kg

Inlet And Outlet Water Box

Weight Of Manholes	320	kg
Weight Of Cooling Water Coennections	412	kg
Weight Of Pass Division Plate	0	kg
Weight Of Main Plate And Up And Down Covers	3893	kg
Weight Of Miscellaneous	80	kg
TOTAL WEIGHT OF WATER BOX	5473	kg

Return Water Box

TOTAL WEIGHT OF WATER BOX	0	kg



Steam Condenser Hotwell Weight

Run File

Results

Print Results

Save File

Load File

Press For Shell Neck Weight

Exit

INPUTS

Job Name	TEST DOWN	
Length Of Hotwell	8.8	m
Width Of Hotwell	8.7	m
Height Of Hotwell	.8	m
Thickness Of Wall Plate	16	mm
Thickness Of Down Plate	20	mm
Number Of Tube Support Plates Per Bundle	10	
Diameter Of Tube Support Plate Reinforcement Pipe	80	mm
Thickness Of Tube Support Plate Reinforcement Pipe	5	mm
Thickness Of Bundles Separation Plate	18	mm
Diameter Of Wall Plate Reinforcement Pipe	80	mm
Thickness Of Wall Plate Reinforcement Pipe	5	mm
Thickness Of Civil Works Foot Support Plates	20	mm
Length Of Dearating System	5	m
Thickness Of Shell Connection Plate	20	mm
Width Of Shell Connection Plate	40	mm

Steam Surface Condeser Hotwell Weight - Data And Results

Job Name : **TEST DOWN**

■ Data Inputs

Length Of Hotwell	8,8	m
Width Of Hotwell	8,7	m
Height Of Hotwell	0,8	m
Thikness Of Wall Plate	16	mm
Thickness Of Down Plate	20	mm
Number Of Tube Support Plates Per Budle	10	
Diameter Of Tube Support Plate Reinforc. Pipe	80	mm
THickness Of Tube Support Plate Reinforc. Pipe	5	mm
Thickness Of Bundles Separation Plate	18	mm
Diameter Of Wall Plate Reinforcement Pipe	80	mm
Thickness Of Wall Plate Reinforcement Pipe	5	mm
Thickness OF Civil Works Foot Support Plates	20	mm
Length Of Deaerating System	5	m
Thickness Of Shell Connection Plate	20	mm
Width Of Shell Connection Plate	40	mm

■ Results

Weight Of Wall Plates And Manhole	3904	kg
Weight Of Down Hotwell Plate	12249	kg
Weight Of Tube Support Plates Reinforcement Pipes	301	kg
Weight Of Wall Plate Reinforcement Pipes	168	kg
Weight Of Bundles Separation Plate	717	kg
Weight Of Civil Works Foot Support Plates	480	kg
Weight Of Civil Works Plates And Fixed Point	752	kg
Weight Of Lifting Brackets	89	kg
Weight Of Sampling Plates	136	kg
Weight Of Condensate Outlet Casing	608	kg
Weight Of Miscellaneous	100	kg
Weight Of Internal Deaerating System	4782	kg
Weight Of Plates For Connection To Shell	224	kg
TOTAL WEIGHT OF HOTWELL	24513	kg

Steam Condenser Shell Neck Weight

Run File

Results

Print Results

Save File

Load File

Press For Turbine Neck Weight

Exit

INPUTS

Job Name	TEST DOWN	
Top Length Of Shell Neck	4	m
Lower Length Of Shell Neck	8.8	m
Top Width Of Shell Neck	4	m
Lower Width Of Shell Neck	8.7	m
Height Of Shell Neck	5	m
Thickness Of Wall Plates	16	mm
Diameter Of Internal Reinforcement Pipes	80	mm
Thickness Of Internal Reinforcement Pipes	5	mm
Thickness Of Plate For Connection To Turbine	20	mm
Width Of Plate For Connection To Turbine	40	mm
Diameter Of Sprays Make-Up Pipes	50	mm
Thickness Of Sprays Make-Up Pipes	3	mm

Steam Condeser Shell Neck Weight - Data And Results

Job Name : **TEST DOWN**

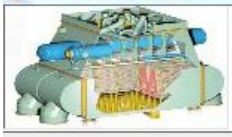
■ Data Inputs

Top Length Of Shell Neck	4	m
Lower Length Of Shell Neck	8,8	m
Top Width Of Shell Neck	4	m
Lower Width Of Shell Neck	8,7	m
Height Of Shell Neck	5	m
Thickness Of Wall Plate	16	mm
Diameter Of Internal Reinforcement Pipes	80	mm
Thickness Of Internal Reinforcement Pipes	5	mm
Thickness Of Plate For Connexion To Turbine	20	mm
Width Of Plate For Connexion To Turbine	40	mm
Diameter Of Sprays Make-Up Pipes	50	mm
Thickness Of Sprays Make-Up Pipes	3	mm

■ Results

Weight Of Wall Plates, Manhole And Connexions	16840	kg
Weight Of Plate For Connexion To Turbine	102	kg
Weight Of Internal Reinforcement Pipes	2105	kg
Weight Of Profiles " I " 200 mm Height	925	kg
Weight Of Sparys Make-Up System	73	kg
TOTAL WEIGHT OF SHELL NECK	20045	kg

Steam Condenser Turbine Neck Weight



Steam Condenser Turbine Neck Weight

Run File

Results

Print Results

Save File

Load File

Exit

INPUTS

Job Name: TEST DOWN

Length Of Turbine Neck	4	m
Width Of Turbine Neck	4	m
Height Of Turbine Neck	1	m
Thickness Of Wall Plates	16	mm
Diameter Of Internal Reinforcement Pipes	80	mm
Thickness Of Internal Reinforcement Pipes	5	mm
Thickness Of Plate For Connection To Turbine	20	mm
Width Of Plate For Connection To Turbine	40	mm
Thickness Of Plate In S.S. For Expansion Joint	3	mm
Thickness Of Plate In S.S. For Expansion Joint Protection	3	mm
Diameter Of Bolts For Expansion Joint Protection	20	mm

FOR FINAL WEIGHTS

Press For Condenser Final Total Weights

Press For Print Final Total Weights

Steam Condeser Turbine Neck Weight - Data And Results

Job Name : **TEST DOWN**

■ Data Inputs

Length Of Turbine Neck	4	m
Width Of Turbine Neck	4	m
Height Of Turbine Neck	1	m
Thickness Of Wall Plate	16	m
Diameter Of Internal Reinforcement Pipes	80	m
Thickness Of Internal Reinforcement Pipes	5	mm
Thickness Of Plate For Connexion To Turbine	20	mm
Width Of Plate For Connexion To Turbine	40	mm
Thickness Of Plate In S.S. For Expansion Joint	3	mm
Thick.Of Plate In S.S. For Expan. Joint Protection	3	mm
Diameter Of Bolts For Expansion Joint Protection	20	mm

■ Results

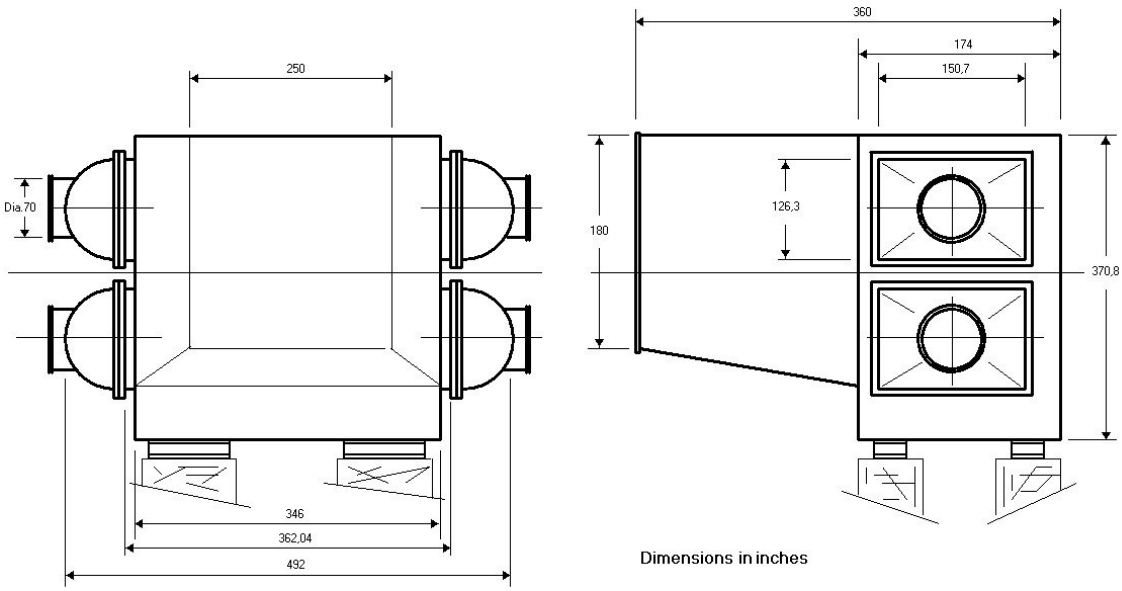
Weight Of Wall Plates, Manhole And Connexions	1843	kg
Weight Of Expansion Joint And Internal Protection	193	kg
Weight Of Turbine Connection Plate	102	kg
Weight Of Internal Reinforcement Pipes	554	kg
Weight Of Bolts System	210	kg
TOTAL WEIGHT OF TURBINE NECK	2905	kg

Condenser Final Total Weights

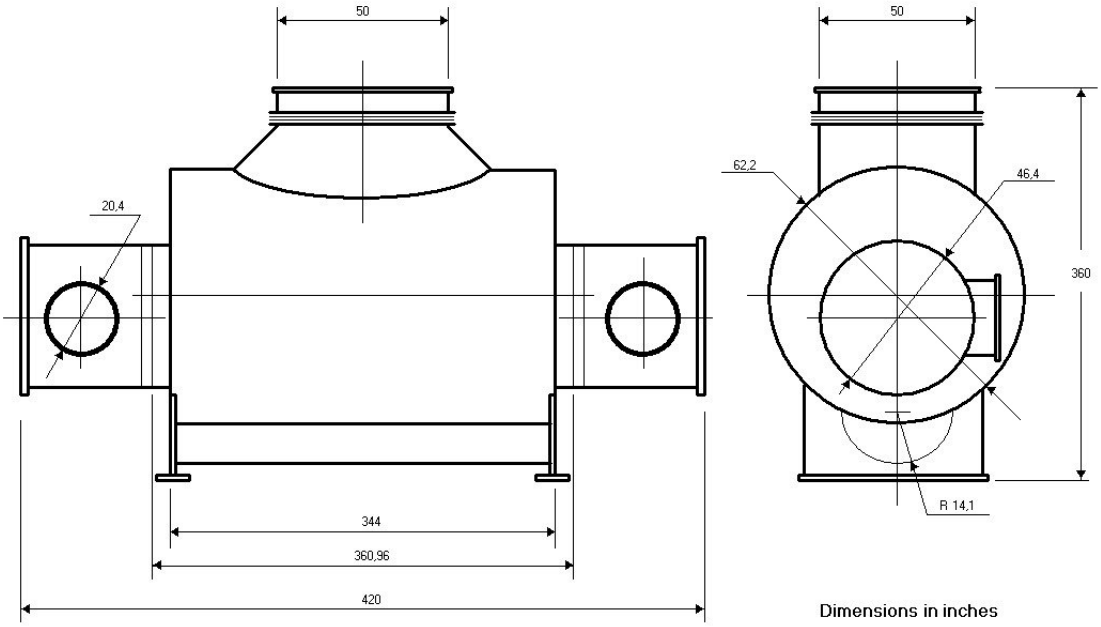
Job Name : TEST DOWN

	TONS
Complet Empty Shell Condenser Weight	558,3
In Service Condenser Weight	901,4
In Tube Side Hydraulic Test Weight	787,8
In Shell Side Hydaulic Test Weight (Water Top Level Not More Than One Food Up to First Tube in Down Type Only)	1180,3

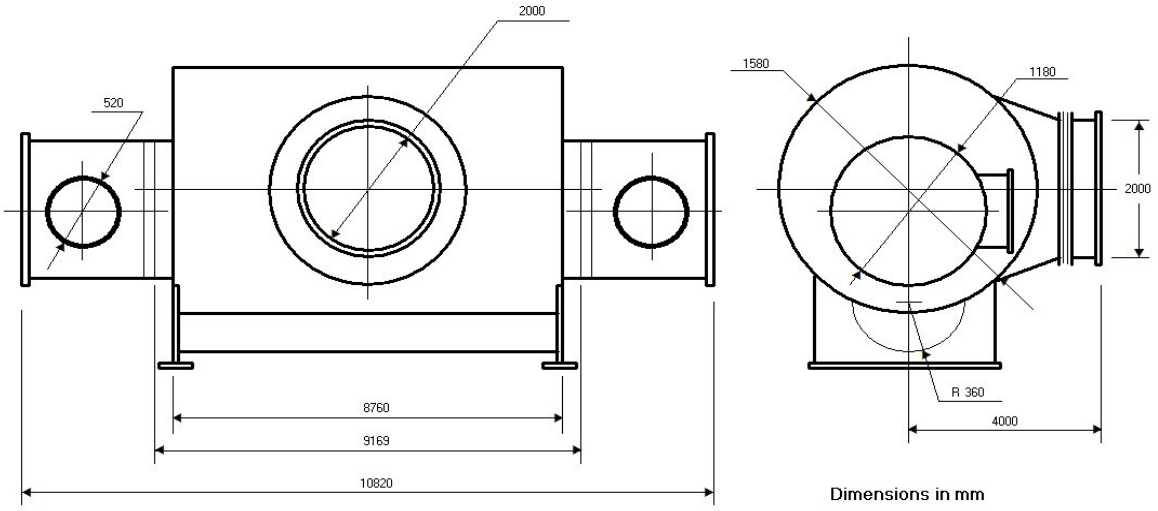
OTHERS OPTIONS TYPE DRAWING



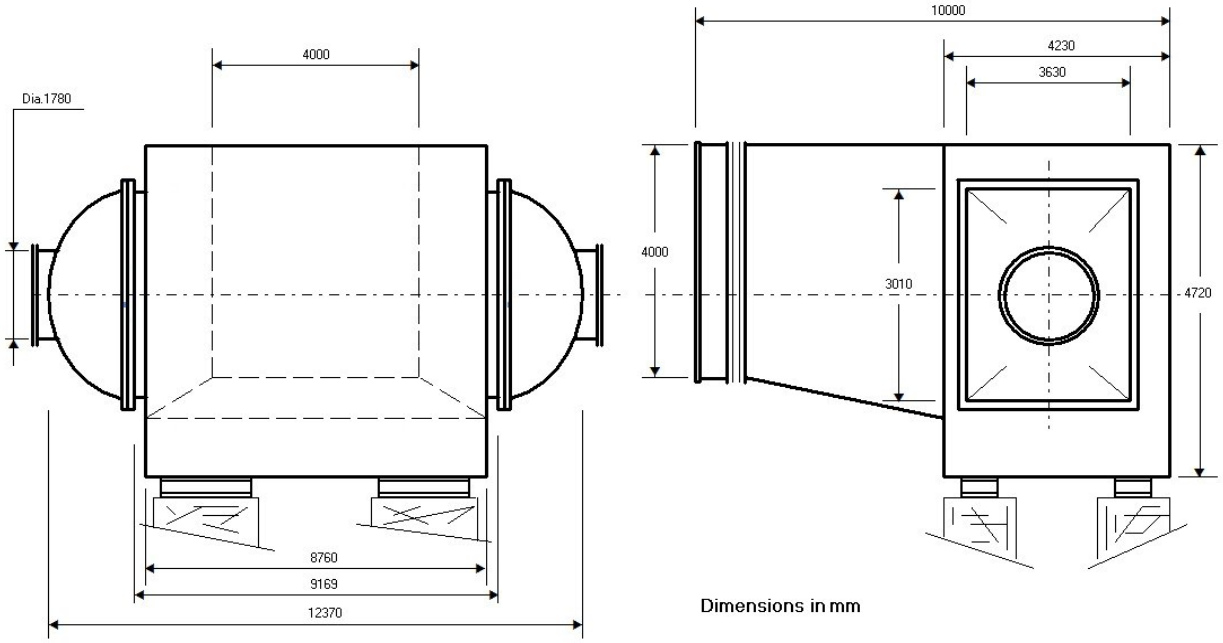
Dimensions in inches



Dimensions in inches



Dimensions in mm



Dimensions in mm