

COMUNE DI UTA

Provincia di Cagliari

ISTANZA DI VERIFICA DI ASSOGGETTABILITÀ A V.I.A.

Realizzazione di un Impianto Solare Termodinamico con
tipologia a collettori parabolici
Potenza 19,5 MWp

ALLEGATO:

F

DISCIPLINARE DESCRITTIVO DEGLI ELEMENTI
PRESTAZIONALI

revisioni:

data: Agosto 2017

IL COMMITTENTE:



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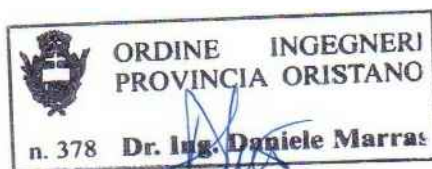
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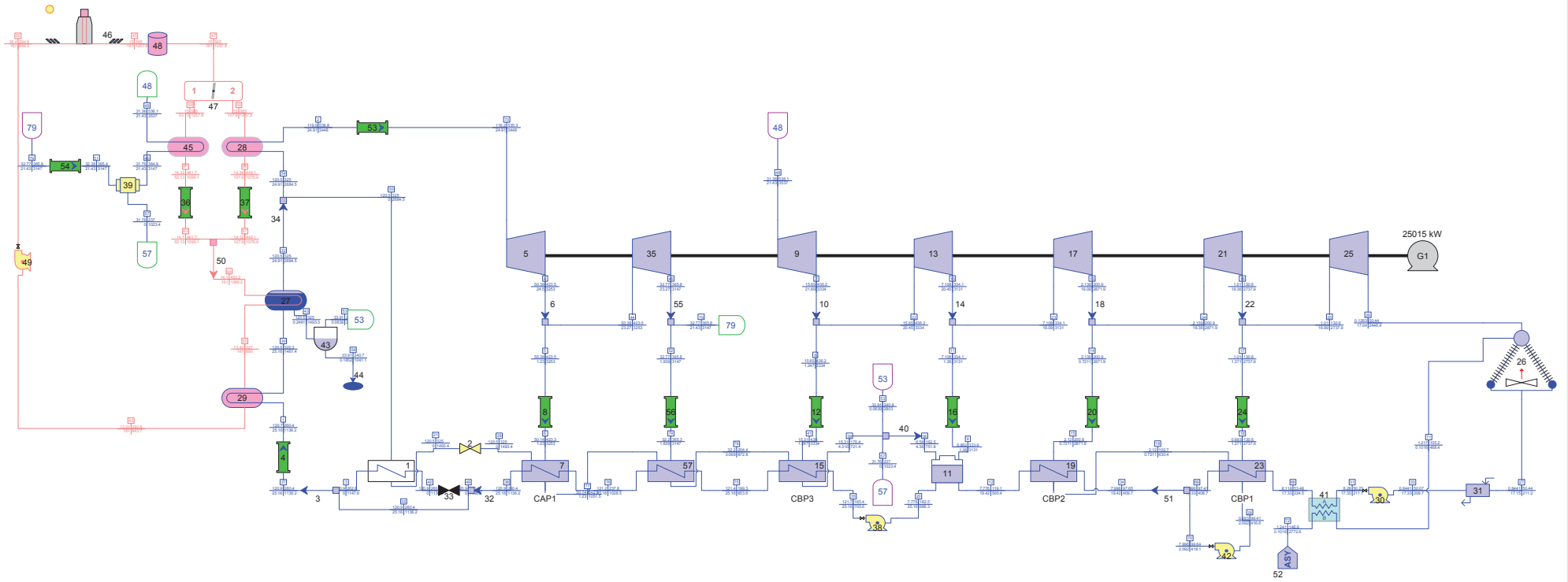
I PROGETTISTI: Ing. Daniele Marras Ing. Lorena Vacca



ITEM	DESCRIPTION	TYPE	VOLUME (m3)	WEIGHT (Kg)	DIMENSIONS (m)	MATERIAL	LOCATION
1. Steam Generation System							
1.1	HEAT EXCHANGER	Preheater		Empty = 17800 Kg Operating = 30200 Kg	L= 12694 mm; Diam int = 782 mm	Shell: SA 516 Gr 70 Tube: SA-179	Outdoor
1.2	HEAT EXCHANGER	Kettle		Empty = 79000 Kg Operating = 94900 Kg	L= 12910 mm; Diam int = 1562 mm	Shell: SA 299 Tube: A 213 TP 347 H	Outdoor
1.3	HEAT EXCHANGER	Superheater		Empty = 14900 Kg Operating = 24500 Kg	L= 8259 mm; Diam int = 870 mm	Shell: SA-240 Gr.347 H Tube: SA-213 TP347 H	Outdoor
1.4	HEAT EXCHANGER	Reheater		Empty = 12900 Kg Operating = 20400 Kg	L= 7208 mm Diam= 894 mm	Shell: SA-240 Gr.347 H Tube: SA-213 TP347 H	Outdoor
1.5	ELECTRIC HEATER	Feedwater Electrical Heater			L= 13400 Diam= 12"	A106 Gr. C seamless	Outdoor
1.6	ELECTRIC HEATER	Electrical superheater				A106 Gr. C seamless	Outdoor
1.7	PUMP	SGS Pumps		Total =974	2445 x 1245 x 822	Casing-Impeller : A487CA6NM Shaft: AISI 410	Outdoor
1.8	STARTUP BYPASS VALVE	P reduction and Atemporation valve		110	1500		Outdoor
1.9	FILTER	Preheater recirculation pump suction filter				Carbon steel	Outdoor
1.10	SAFETY VALVES	Safety valve					
1.11	SILENCER	Silencer					
1.12	STEAM TURBINE	Steam turbine					
2. Main Steam and Bypass system							
2.1	TURBINE	Steam turbine					
2.2	BYPASS VALVE	HP Steam Bypass Valve		300	L=2700 mm		Outdoor
2.3	BYPASS VALVE	LP Steam Bypass Valve		1100	L=3400 mm		Indoor
2.4	SILENCER	Silencer					
2.5	ATTEMPERATOR	HP Steam Attemporator		170	1860 x 760		Outdoor
2.6	ATTEMPERATOR	Cold reheat attemporator		140	2890 x 550		Outdoor
2.7	SAFETY VALVES	Safety valve					
3. Feedwater system							
3.1	FILTER	Feedwater Pumps Suction Filters				Carbon steel	outdoor
3.2	FILTER	CHR Attemporation 's filter					outdoor
3.3	FILTER	HP Superheater steam Attemporation 's filter					outdoor
3.4	FILTER	HP Bypass attemporation filter					outdoor
3.5	FILTER	Start-up Preheater attemporation filter					outdoor
3.6	DEAREATOR	Deareator	26	Empty = 11700 Kg Operating = 33000 kg	H= 5365 mm L= 9149 mm	head and body: SA-516 Gr.70	Outdoor
3.7	HEAT EXCHANGER	Heat Exchanger -3		Empty = 6300 Kg Flooded = 9430 kg	Diam = 840 mm L= 7410	Shell SA-516 Gr.70 tubes SS 304	outdoor
3.8	HEAT EXCHANGER	Heat Exchanger -4		Empty = 5500Kg Flooded = 7700kg	Diam = 760 mm L= 6294 mm	Shell SA-516 Gr.70 Tubes SS 305	outdoor
3.9	HEAT EXCHANGER	Heat Exchanger -5		Empty = 3000Kg Flooded = 4250kg	Diam = 630 mm L= 5863 mm	Shell SA-516 Gr.70 Tubes SS 306	outdoor
3.10	PUMP	Feedwater Pumps		7800 (total)	L= 4250 mm A= 1200 mm H= 1800		Outdoor
3.11	SILENCER	Silencer					
3.12	SAFETY VALVES	Safety valve			3/4" x 1"		
4. Condensate and Make-up System							
4.1	FILTER	Condensate Pumps Suction Filters				Carbon steel	Indoor
4.2	FILTER	Continuous Make-up Pumps Suction Filters					Outdoor
4.3	FILTER	Intermittent Make-up Pumps Suction Filters					Outdoor
4.4	HEAT EXCHANGER	Heat Exchanger-1		Empty = 4300 kg Operating = 7580 kg	Diam = 700 mm L= 6674 mm	Shell SA 516 Gr70 Tubes SS 304	Outdoor
4.5	HEAT EXCHANGER	Heat Exchanger-2		Empty = 3300 kg Flooded = 5750 kg	Diam = 590 mm L= 6591 mm	Shell SA 516 Gr70 Tubes SS 305	Outdoor
4.6	HEAT EXCHANGER	Condenser				Shell: SA-516 Gr.70 Water box: SA-516 Gr. C (Epoxi coated) Tube: SA-249 Tp316	Indoor
4.7	TANK	Condensate Tank	60	5097	Ø 3 m x 8.5 m H	A-285 Gr. C	Outdoor
4.8	PUMP	Condensate Pumps		Total = 2475 kg	L=4,62 can Diam =500	Shaft 276 TP 420 Impellers =A487 Gr CA6NM	Indoor
4.9	PUMP	Continuous Make-up Pumps		130	900 x 390 x 372	SS 316	Outdoor
4.10	PUMP	Intermittent Make-up pumps		140	900 x 390 x 372	SS 316	Outdoor
4.11	FILTER	LP Bypass attemporation filter					
4.12	SAFETY VALVES	Safety valve			3/4" x 1"		
5. Air condenser System							
5.1	Air Cooled Condenser (ACC)					A-285 Gr. C	Outdoors
5.2	ACC Condensate Tank					A-285 Gr. C	
5.3	Vacuum Ejector Skid						
6. Auxiliary Cooling System							
6.1	FILTER	Closed Circuit Pumps Suction Filters					Outdoors
6.2	FILTER	Open Circuit Cooling Pumps Suction Filters				Carbon steel	Outdoors
6.3	HEAT EXCHANGER	Cooling Water Heat Exchangers		1821	A= 608 x 814 mm H= 1948 mm	Plates: AISI-316 Estruct.: ASTM A285 Gr. B	Outdoors
6.4	TANK	Atmospheric Tank	1	320	Ø 0,8 m x 2 m H	A-516 Gr. 60N	Outdoors
6.5	PUMP	Closed Cooling Water Pumps		1090	1800 x 990 x 865		Outdoors
6.6	PUMP	Open Circuit Cooling Pump		2200	L= 4353 mm Diam = 360 (bell)		Outdoors
6.7	STEAM TRAMP						
6.8	SAFETY VALVES	Safety valve			3/4" x 1"		
8. Demineralized Water system							
8.1	PUMP	Demineralized Water Transfer Pump		135	900 x 390 x 372	Inox	Outdoors
8.2	PUMP	Solar plant washing pump		215	1120 x 500 x 550	Inox	Outdoors
8.3	TANK	Demineralized Water Storage Tank	700		Ø 13 m x 13770 mm H	A-240 Tp. 304L / CS	Outdoors
8.4	FILTER	Demineralized Water Transfer Pump Filter				Inox	Outdoors
9. Service and Potable Water system							
9.1	TANK	Service and Fire Fighting Water Storage Tank	1550	Vacio: 41417	Ø 13 m x 13770 mm H	A-283 Gr. C / A-285 Gr. C Normalized	Outdoors
9.2	TANK	Prepotable Water Storage Tank	5		Ø 1,4 m x 3,25 m H	A-285 Gr. C	Outdoors
9.3	PUMP	Distribution pumps to services		150	900 x 390 x 372		Outdoors
9.4	FILTER	Service water distribution pressure group inlet filter					
9.5	PUMP	Prepotable water distribution pressure group					Outdoors
9.6. Condenser vacuum System							
9.7	VACUUM SKID	Complete skid: vacuum pump + separator and forced sealing system		1497 kg	1,6 x 3,7 x 1,927	Ductile iron and shaft of SS	Indoor
10.	SAVETY VALVES	Safety valve					
10.1. Steam Generator Drain System							
10.2	TANK	Continuous Blowdown Tank	0.2	185,8	Ø 0,5 m x 1 m H	SS (A240 Gr.347 H)	Outdoors
11.	TANK	Intermittent Blowdown Tank		4598	Ø 2,45m x 3,7 m H	SA-516 Gr.60N, SS internal lining for tangencial	Outdoors
11.1	PUMP	Drains recovery pump		130	900 x 390 x 372		Outdoors
11.2	SAFETY VALVES	Safety valve			2" x 4"		
11.3	SILENCER	Silencer		540	L= 820 Diam = 1600		
11.4	HEAT EXCHANGER	Drain cooler					Outdoors
11.5. Sampling Water System							
11.6	SUPPLIER EQUIP	Sampling System					Indoor

ITEM	DESCRIPTION	TYPE	VOLUME (m3)	WEIGHT (Kg)	DIMENSIONS (m)	MATERIAL	LOCATION
12. Chemical Dosing System							
12.1	AMMONIA DOSING SYSTEM	Tank, pumps, valves and fittings					
13. CARBOHYDRACID DOSING SYSTEM							
13.1	PHOSPHATE DOSING SYSTEM	Tank, pumps, valves and fittings					
13.2	CORROSION INHIBITOR DOSING SYSTEM	Tank					Vertical
13.3 Compressed Air System							
13.4	COMPRESSOR	Air Compressors		988	1700 x 920 x 1659		Indoors
14.	FILTER	Air instrument prefilters		3	Ø 125 x H= 550	Carcasa: Fundición de Aluminio	Indoors
14.1	FILTER	Air instrument postfilters		3	Ø 125 x H= 550	Carcasa: Fundición de Aluminio	Indoors
14.2	DRYER	Instrumentation Air Dryers		300	933 x 380 x 1794	Carbon steel	Indoors
14.3	TANK	Compressed Air Tank		1000	Ø 1200 x H= 4300	Carbon steel	Indoors
14.4	TANK	Instrumentation Air Tank		1000	Ø 1200 x H= 4300	Galvanized CS	Indoors
14.5	TANK	Salt Area Tank		320	Ø 800 x H= 2320	Galvanized CS	Indoors
14.6	DRYER	Air Cooling Dryer		293	1017 x 1100 x 865		
14.7	FILTER	Air instrument prefilters		3	Ø 125 x H= 550	Carcasa: Fundición de Aluminio	
14.8 HVAC System							
14.9	Fan	Cables Room Electrical and Control Building					Centrifugal with filter
15.	Exhauster	Changing room of Electrical and Control Building					axial/tubular
15.1	Electrical heater	Changing room of Electrical and Control Building					electric
15.2	Exhauster	Batteries Room of Electrical and Control Building					axial/tubular
15.3	Unit heater	Batteries Room of Electrical and Control Building					electric
15.4	Spiltt	Meetings room of Electrical and Control Building					Cassette
15.5	Spiltt	Engineering Office of Electrical and Control Building					Cassette
15.6	Spiltt	Control Room of Electrical and Control Building					Ducted
15.7	Spiltt	Racks System Room of Electrical and Control Building					Cassette
15.8	Spiltt	SAI System Room of Electrical and Control Building					Ceiling Unit
15.9	Fan	Renovation Air for inhabited rooms, SAI y RACKS of Electrical and Control Building					Fan Unit with filters
15.10	Exhauster	Extraction of renovation air from Electrical and Control Building					axial/tubular
15.11	Exhauster	Air extraction from WC and Cleaning products storage room of Electrical and Control Building					axial/tubular
15.12	HVAC Substation	Substation HVAC system of Electrical and Control Building					
15.13	Exhauster	Deminerlization room of Water Treatment Plant					Roof Mounted fan
15.14	Unit heater	Deminerlization room of Water Treatment Plant					electrical
15.15	Spiltt	Control room of Water Treatment Plant					Cassette
15.16	Fan	Renovation Air for Control room of Water Treatment Plant					axial/tubular
15.17	Exhauster	Exhausters of Steam Turbine Building					Centrifugal on the roof building
15.18	Exhauster	Fire Protection Pumps Room					Plate Mounted Axial fan
15.19	Unit heater	Fire Protection Pumps Room					electrical
15.20	Exhauster	Compressors Room					Plate Mounted Axial fan
15.21	Exhauster	Products Storage Building					Plate Mounted Axial fan
15.22	Spiltt	Access Control Cabin					High Wall unit
15.23	Exhauster	Access Control Cabin					Plate Mounted Axial fan
15.24	UTA	Air Treatment Unit of Administration Building					without recuperator
15.25	Heat Pump	BC Ed. Administración de Administración Building					Water/Air
15.26	Fan coil	FC Jefe de Planta Ed. of Administration Building					Ducted
15.27	Fan coil	FC Jefe Ing. Seg. Y MA of Administration Building					cassette
15.28	Fan coil	FC Jefe de Producción de Administración Building					cassette
15.29	Fan coil	FC Jefe de Mantenimiento of Administration Building					cassette
15.30	Fan coil	FC Jefe de O&M of Administration Building					cassette
15.31	Fan coil	FC Meetin room of Administration Building					Ducted
15.32	Fan coil	FC Administration 1 of Administration Building					cassette
15.33	Fan coil	FC Administration 2 of Administration Building					cassette
15.34	Fan coil	FC Administration Boss Room of Administration Building					cassette
15.35	Fan coil	FC Small meeting room of Administration Building					cassette
15.36	Fan coil	FC open office-reception of Administration Building					High Wall unit
15.37	Fan coil	FC Canteen of Administration Building					Ducted
15.38	Exhauster	Air extraction from WC and Cleaning products storage room of Administration					centrifugal
15.39	Exhauster	Kitchen of Administration Building					centrifugal
15.40	Exhauster	Extraction of renovation air from inhabited rooms of Administration Building					centrifugal
15.41	Exhauster	Electrical rooms of Administration Building					axial/tubular
15.42	Spiltt	Big office of WorkShop and Storage Building					cassette
15.43	Spiltt	Small office of WorkShop and Storage Building					cassette
15.44	Spiltt	Laboratory of WorkShop and Storage Building					High Wall unit
15.45	Fan	Air renovation of offices and laboratory of WorkShop and Storage Building					Fan Unit with filters and electrical resistance
15.46	Exhauster	Storage room of WorkShop and Storage Building					pared
15.47	Exhauster	Air extraction from WC, changing rooms and cleaning products storage room of WorkShop and Storage Building					Roof Mounted fan
15.48	Electrical heater	Changing room of WorkShop and Storage Building					electrical
15.49	Electrical heater	Changing room of WorkShop and Storage Building					electrical
15.50	Exhauster	Storage of WorkShop and Storage Building					Plate Mounted Axial fan
15.51	Exhauster	Tools room of WorkShop and Storage Building					Plate Mounted Axial fan
15.52	Fan	Transformers room of WorkShop and Storage Building					axial/tubular
15.53	Exhauster	Transformers room of WorkShop and Storage Building					axial/tubular
15.54	Exhauster	Workshop of WorkShop and Storage Building					Plate Mounted Axial fan
15.55	Exhauster	Parking of WorkShop and Storage Building					Plate Mounted Axial fan
15.56	Radiant Heater	Work Stations inside the workshop of WorkShop and Storage Building					electrical
15.57 Fire Protection system							
15.58	ELECTRICAL PUMP	Main fire pump					Centrifugal, horizontal
16.	DIESEL PUMP	Main fire pump					Centrifugal, horizontal
16.1	JOCKEY PUMP	Pressurization pump					Vertical
16.2 Steam Turbine Drain System							
16.3	TANK	ST Atmospheric Drain Tank		4598	Ø 2,4 m x 3,6 m H	SA-516 Gr.60N, SS internal lining for tangencial	Outdoor

ITEM	DESCRIPTION	TYPE	VOLUME (m3)	WEIGHT (Kg)	DIMENSIONS (m)	MATERIAL	LOCATION
17.	TANK	Deareator Overflow Tank		3824	Ø 2.5 m x 275 m H	SA-516 Gr.60N, SS Internal lining for tangencial	Outdoor
17.1	TANK	ST Flash Tank					
17.2	SILENCER	Silencer			20" /24"		
17.3	Plant Drain system						
17.4	POND	Transformers area oil separator pond			Superf 400 m2		Outdoor
18.	PUMP	Oily water pump		36	275X250X546		Outdoor
18.1	PUMP	Storm drainage pump		158	540X435X852		Outdoor
18.2	PUMP	Effluents to homogenization pond pumps			c		Outdoor
18.3	PUMP	Collection Box pump					
18.4	OIL SEPARATOR	BOP hydrocarbons oil separator, coalescent filter				PRFV/acero/hormigón	Outdoor
18.5	Cold salt thermal storage tank						
18.6	TANK	Cold Salt Tank		4280	Ø 23 m x 10.5 m H	A-516 Gr. 70	Outdoors
19.	ELECTRIC HEATER	Cold Salt Tank Electrical Heater		121	10 heater elements (16 mm OD x 2900)	Heater elements: Incoloy 800 Shell: SA-335 Gr.P11	Cold Salt Tank
19.1	PUMP	Receiver Circulating Pump (1st stage)		5940	12900x1500x1500	A217	Cold Salt Tank
19.2	Salt transfer vessel						
19.3	TANK	Salt Transfer vessel		120	Ø 3,5 m x 12,1 m H	CS (A516 Gr.70)	Outdoors
20.	PUMP	Receiver Circulating Pump (2nd stage)		12021	5000 x 1200 x 1200	A216 Gr WCB	Salt transfer vessel
20.1	FILTER	Cold Salt Filter					2nd st. Rec. pumps outlets
20.2	PUMP	SGS Attemperation Pump		6531	5000 x 1200 x 1200	A216 Gr WCB	Salt transfer vessel
20.3	Thermal power receiver area						
20.4	TANK	Receiver Inlet Vessel		13.1	Ø 1,6 m x 6,5 m H	CS (A516 Gr.70)	Receiver Tower
21.	MISCELLANEOUS	Receiver pannels			Each panel 64 tubes: 12m length x 25mm	Inconel 625	Receiver Tower
21.1	MISCELLANEOUS	Receiver pannels			Each panel 64 tubes: 12m length x 25mm ØD	Inconel 625	Receiver Tower
21.2	MISCELLANEOUS	Receiver pannels			Each panel 64 tubes: 12m length x 25mm	Inconel 625	Receiver Tower
21.3	MISCELLANEOUS	Receiver pannels			Each panel 64 tubes: 12m length x 25mm	Inconel 625	Receiver Tower
21.4	TANK	Receiver Outlet Vessel		18.2	Ø 2.5 m x 3,7 m H	SS (A240 Gr.347 H)	Receiver Tower
21.5	Hot salt thermal storage tank						
21.6	TANK	Hot Salt Tank		4280	Ø 23 m x 10.5 m H	A240 Gr.347 H	Outdoors
22.	ELECTRIC HEATER	Hot Salt Tank Electrical Heater		132	7 heater elements (16mm OD x 2900)	Heater elements: Incoloy 800 Shell: SS347 Gr.H	Hot salt tank
22.1	PUMP	SGS Circulating Pump		5345	12500x1550x1500	A351	Hot salt tank
22.2	SGS salt equipments						
22.3	HEAT EXCHANGER	Preheater					
23.	HEAT EXCHANGER	Kettle					
23.1	HEAT EXCHANGER	Superheater					
23.2	HEAT EXCHANGER	Reheater					
23.3	Salt heater and Drains tank						
23.4	SALT HEATER	Salt Heater				Tube: SS AISI 347	
24.	TANK	Salt drain receiver vessel		22.8	Ø 2.2 m x 6 m L	A-240 Gr.347 H	Outdoors
24.1	PUMP	Salt drainage pump		1000	3200x600	A351	
24.2	Salt auxiliary systems						
24.3	TANK	Dedicated air vessel					Receiver
25.	TANK	Dedicated air vessel					Receiver
25.1	HEATER	Tanks Air Preheater					
25.2	HEATER	Salt melting and loading unit					
25.3							
25.4	NOTES						



STAssembly[1] - Specification

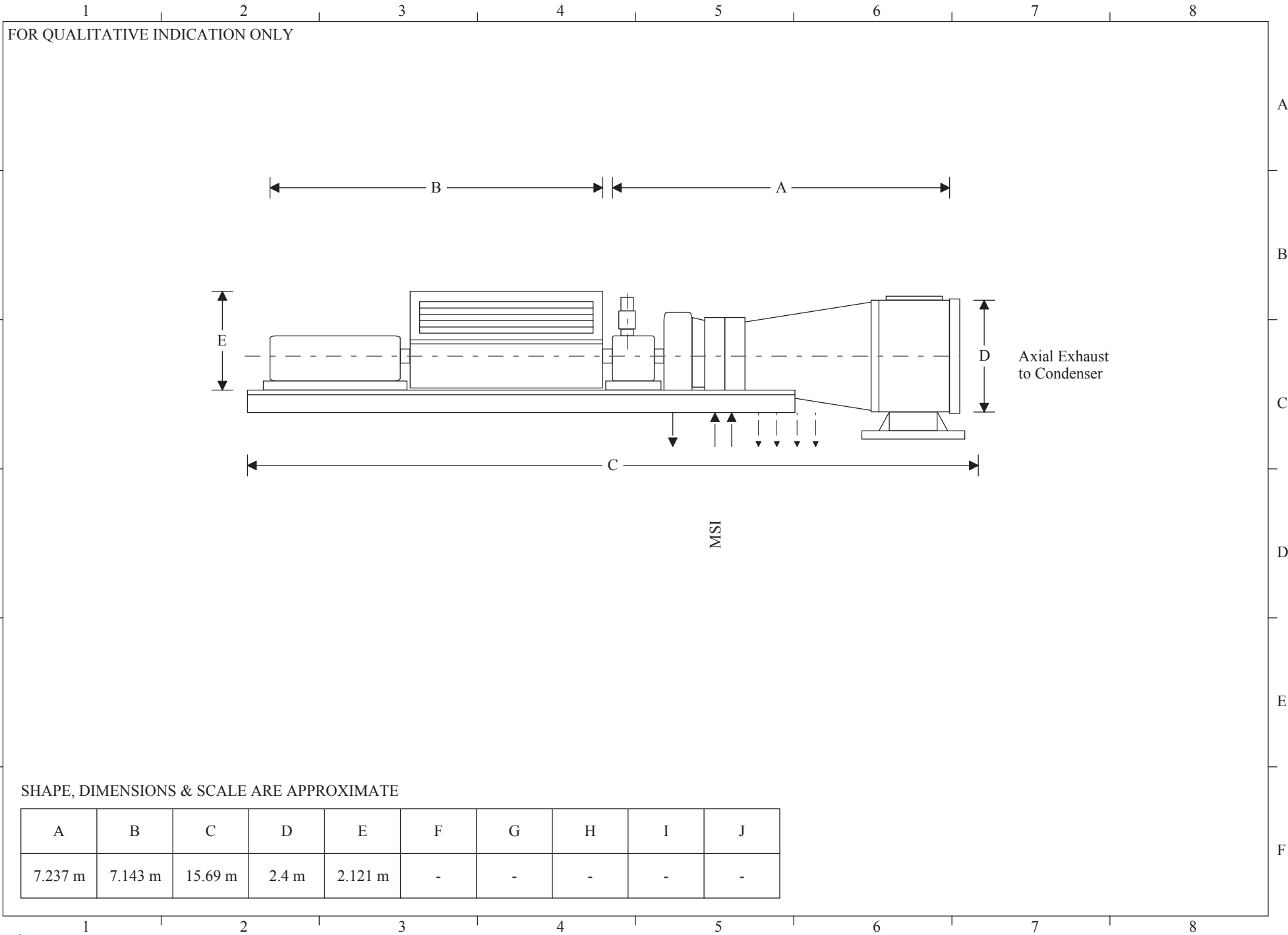
STAssembly[1]		
Estimated Steam Turbine Data		
1. Steam Turbine Description		
Nameplate Capacity	29.2	MVA
Design Point Generator Power Factor	0.9	
Design Point Generator Efficiency	97.72	%
Steam Turbine Type	Condensing, Single Reheat	
Nameplate Throttle Pressure	122	bar
Nameplate Throttle Temperature	535.3	C
Nameplate Throttle Massflow	24.91	kg/s
Exhaust End Type	Axial	
Number of LPT Exhaust Annuli	1	
Number of Extraction/Admission Ports	4	
Number of Auto-Extraction/Auto-Admission Ports	0	
2. Estimated Weights & Dimensions		
Steam Turbine Length	7.237	m
Steam Turbine Width	2.4	m
Steam Turbine Weight	43,870	kg
Generator Length (Including Exciter)	7.143	m
Generator Width	2.788	m
Generator Weight	59,450	kg
Overall ST and Generator Length	14.38	m
Overall ST and Generator Width	2.788	m
Overall ST and Generator Weight	103,300	kg
Foundation Length	15.69	m
Foundation Width	3.345	m

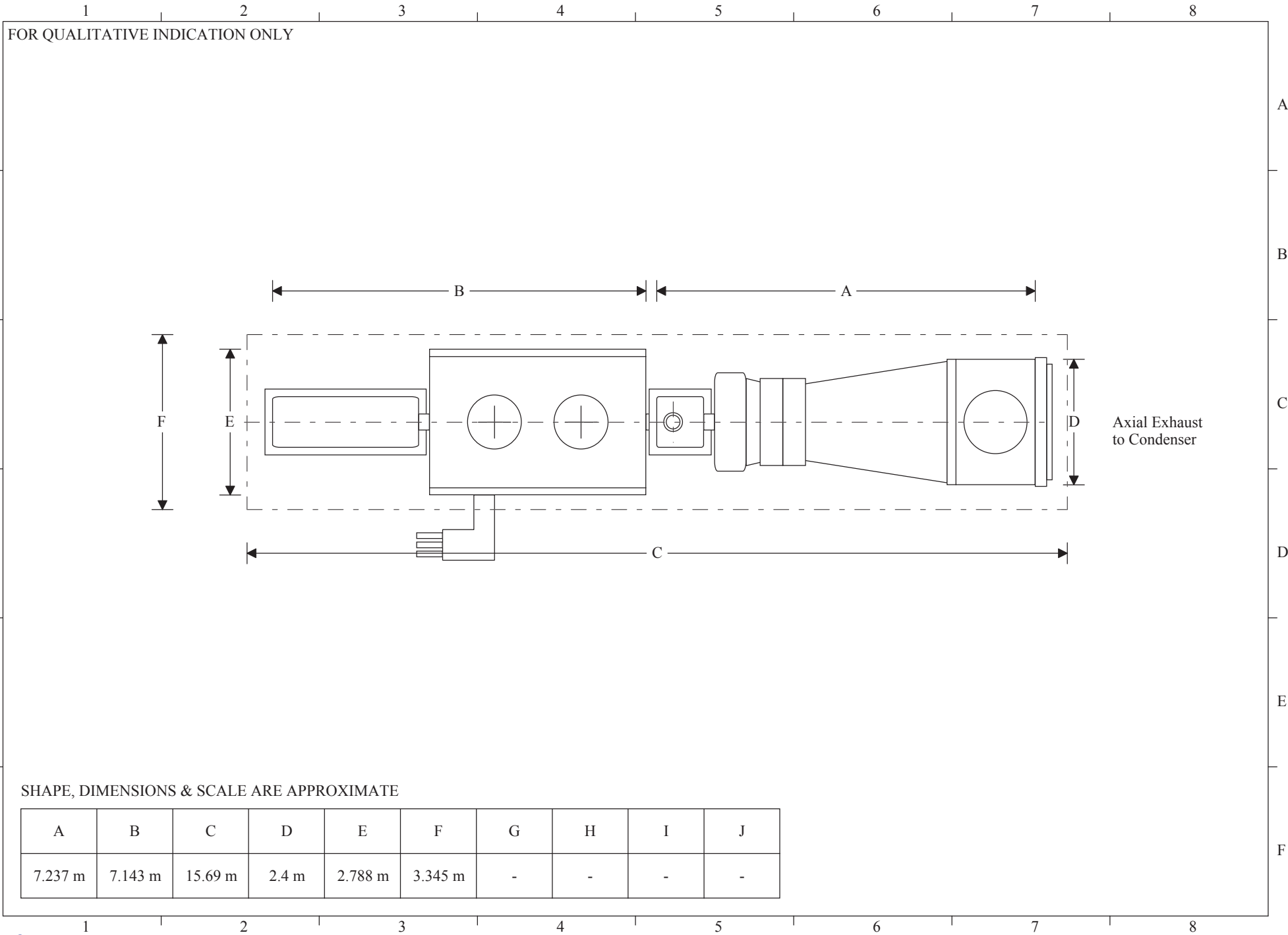
STAssembly[1] - Overall

STAssembly[1]		
Overall Steam Turbine Thermodynamic Data		
1. Steam Turbine Performance		
Generator Power	25.02	MWe
Generator Efficiency	97.69	%
Lube Oil Pump Auxiliary	39.41	kW
Miscellaneous Auxiliary Power	52.55	kW
Shaft Speed	3000	RPM
Shaft Power	25.61	MWe
ST Mechanical Loss	64.2	kW
Generator Total Loss	592.6	kW
Generator Electrical & Windage Loss	520.6	kW
Generator Mechanical Loss	71.98	kW
2. Steam Turbine Main Steam		
Mass Flow	24.91	kg/s
Pressure	116.2	bar
Temperature	535.3	C
Enthalpy	3448	kJ/kg
3. Casings		
HPT/IPT/LPT		
HPT/IPT/LPT - HPT		
Casing Shaft Power	4754	kW
Inlet Steam		
Mass Flow	24.91	kg/s
Pressure	116.2	bar
Temperature	535.3	C
Enthalpy	3448	kJ/kg
Exit Steam		
Mass Flow	24.5	kg/s
Pressure	50.38	bar
Temperature	423.5	C
Enthalpy	3253	kJ/kg
HPT/IPT/LPT - IPT		
Casing Shaft Power	13.44	MWe
Inlet Steam		
Mass Flow	21.43	kg/s
Pressure	31.36	bar
Temperature	536.1	C
Enthalpy	3537	kJ/kg
Exit Steam		
Mass Flow	19.09	kg/s
Pressure	2.139	bar
Temperature	200.9	C
Enthalpy	2871.9	kJ/kg
HPT/IPT/LPT - LPT		
Casing Shaft Power	7413	kW
Inlet Steam		
Mass Flow	18.36	kg/s
Pressure	2.139	bar
Temperature	200.9	C
Enthalpy	2871.9	kJ/kg
Exit Steam		
Mass Flow	17.04	kg/s
Pressure	0.1263	bar
Temperature	50.44	C
Enthalpy	2446.4	kJ/kg

STAssembly[1] - Overall

STAssembly[1]		
Overall Steam Turbine Thermodynamic Data		
Quality	93.88	%



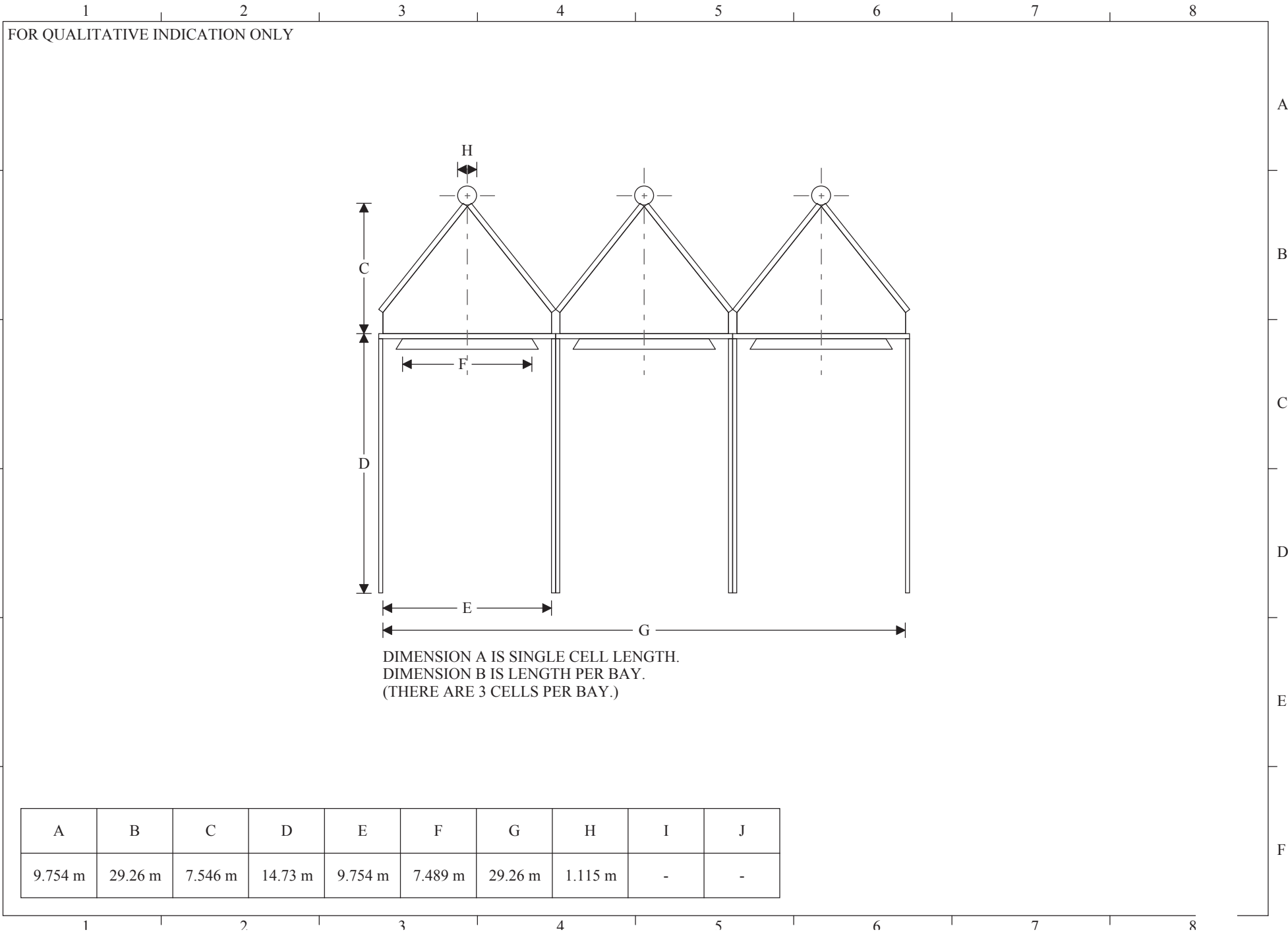


Air-cooled Condenser (PCE) [26] - Hardware

Estimated Heat Exchanger Hardware Data		
ACC Heat Exchanger (per cell)		
Tubes		
Tube geometry	Rectangular	
Fin-tube type	Solid fins	
Tube arrangement	In line	
Tube material	Galvanized CS	
Number of tube rows (longitudinal)	1	
Number of tubes per row (transverse)	163	
Number of rows per waterside flow pass	1	
Gas path transverse width	9.735	m
Tube length	7.983	m
Tube outer width	20	mm
Tube outer height	200	mm
Tube wall thickness	1.905	mm
Transverse tube pitch	59.72	mm
Tube metal conductivity @ 500F (260C)	46.73	W/m-C
Tube metal conductivity slope	-0.0249	W/m-C ²
Fins		
Fin material	Aluminum	
Fin height	19	mm
Fin spacing	2.009	mm
Fin thickness	0.3	mm
Number of fins per meter	433.1	per meter
Fin metal conductivity @ 500F (260C)	167.6	W/m-C
Fin metal conductivity slope	0	W/m-C ²
Overall Data		
Gas path frontal area	155.4	m ²
Min. gas free flow cross section / frontal area	0.5825	
H.T. surface area / min. free flow cross section	210.7	
Primary tube surface / total heat transfer surf.	0.0475	
Water side flow cross section area	1.123	m ²
Heat exchanger prime outside surface	905.7	m ²
Heat exchanger total fin area	18172	m ²
Heat exchanger total outside area	19078	m ²

Air-cooled Condenser (PCE) [26] - Specification

Estimated Air Cooled Condenser Data		
Air-cooled Condenser(PCE)[26]		
Total number of cells	9	
- Number of bays	3	
- Number of cells per bay	3	
1. Overall Dimensions		
Length	29.26	m
Width	29.26	m
Plot area	856.2	m ²
2. Cell Dimensions		
Width	9.754	m
Height	22.28	m
Fan deck height	14.73	m
Steam duct outer diameter	1.115	m
Steam duct thickness	3.6	mm
Weight	60411	kg
3. Fan Design (per fan)		
Flow coefficient	0.16	
Static pressure rise coefficient	0.055	
Tip diameter	7.489	m
Hub diameter	1.011	m
RPM	131	
Tip speed	51.36	m/s
Static pressure drop at design point	0.8225	millibar
Dynamic pressure at design point	0.3825	millibar
Total fan DP at design point	1.205	millibar
Design volume flow	355.3	m ³ /s
Electricity consumption at design point	59.5	kW

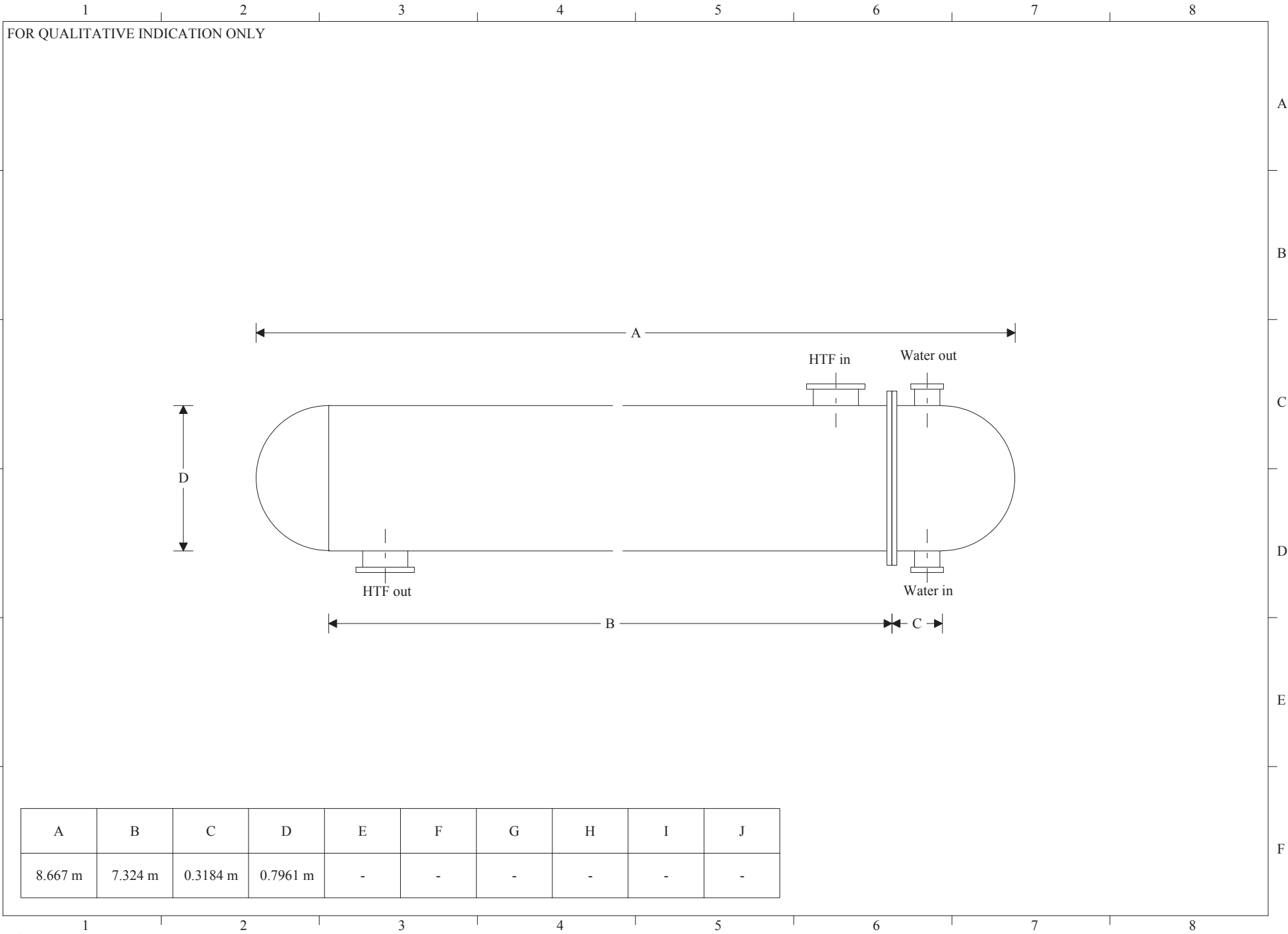


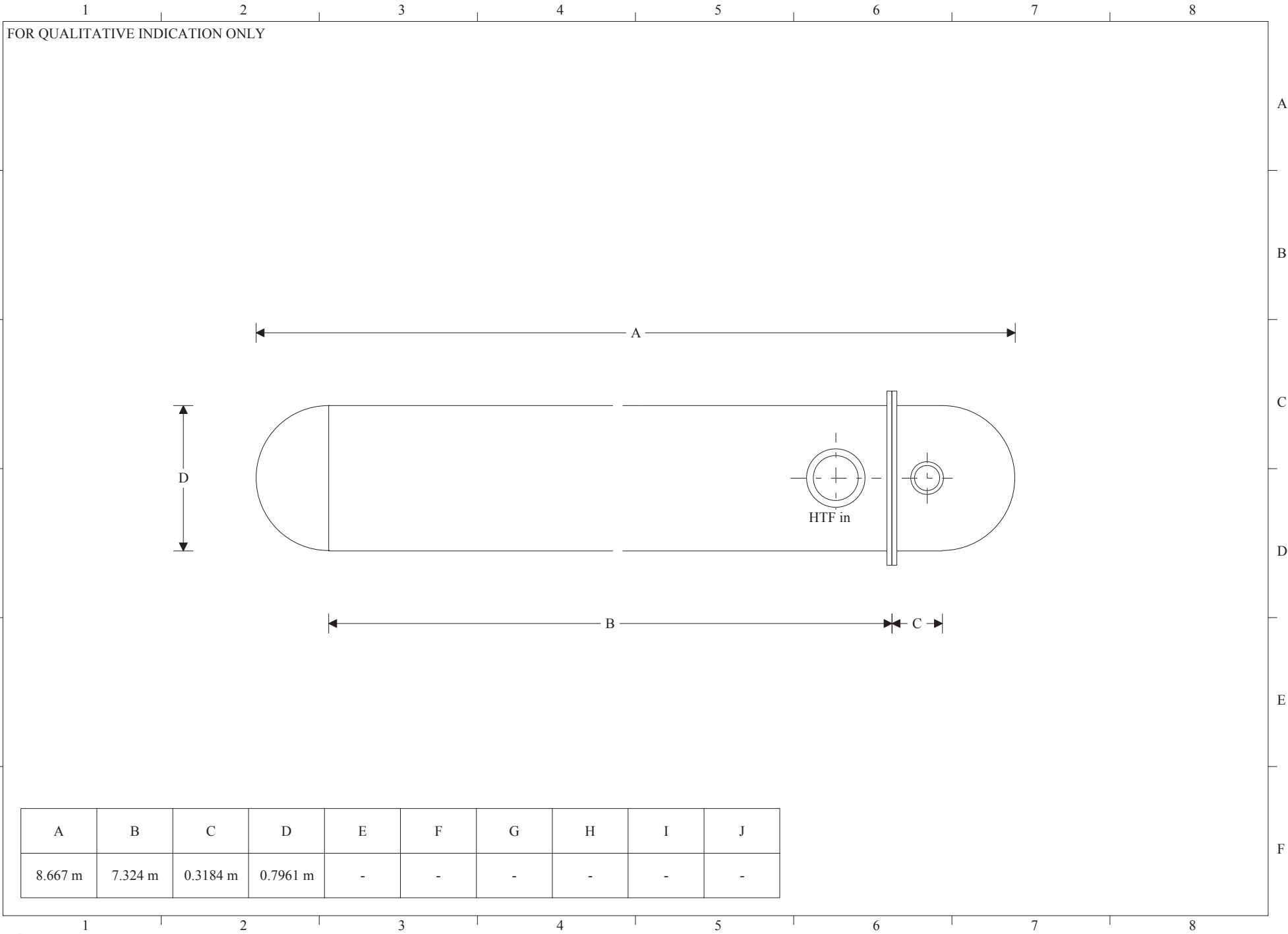
Shell-Tube Economiser [29] - Specification

Estimated Shell-Tube Heat Exchanger Data		
Shell-Tube Economiser[29]		
Number of units	1	
1. Tube Description (per unit)		
Tube type	Integral Fin Tube	
Tube layout in crossflow	Rotated Square 45°	
Tube material	Carbon steel	
Total external heat transfer area	684	m ²
Nameplate tube flow pressure	121	bar
Number of tubes per pass	340	
Number of passes	2	
Number of tubes in heater	680	
Tube length per pass	7.324	m
Tube outer diameter	15.88	mm
Tube inner diameter	10.21	mm
Tube wall thickness	1.245	mm
Tube pitch	25.4	mm
Fin height	1.588	mm
Fin thickness	0.3048	mm
Fin spacing (between adjacent surfaces)	1.032	mm
Number of fins per meter	748	
Heat transfer area ratio (Ao/Ai)	4.283	
Tube weight, dry	4,670	kg
2. Shell Description (per unit)		
Nameplate shell flow pressure	13.42	bar
Shell material	Carbon steel	
Shell length	7.324	m
Tube bundle diameter	763	mm
Shell inner diameter	777	mm
Shell wall thickness	9.525	mm
Tube sheet thickness	114	mm
Overall length	8.7	m
Shell type	Two pass shell	
Number of baffles	8	
Baffle spacing	814	mm
Baffle cut / equivalent pass diameter	40.0	%
Equivalent pass diameter	553	mm
Shell overall outer diameter	796	mm
Total dry weight	9,840	kg
Total operating (wet) weight, reference basis	13,510	kg

Shell-Tube Economiser [29] - Heat Balance

Off-design Heat Balance Results		
Shell-Tube Economiser[29]		
Number of units present		1
Number of units in operation		1
Shell Inlet Heat Transfer Fluid		Nitrate Salt 60% NaNO₃ - 40% KNO₃ by wt
Heat transfer fluid concentration		100 %
Pressure		13.42 bar
Temperature		327 C
Enthalpy		895 kJ/kg
Shell Exit		
Pressure		13.01 bar
Temperature		292.8 C
Enthalpy		843.7 kJ/kg
Mass flow (per unit)		161 kg/s
Nominal shell flow		161 kg/s
Tube Inlet Water/steam		Subcooled
Pressure		120.7 bar
Temperature		260.4 C
Enthalpy		1136.2 kJ/kg
Tube Exit		
Pressure		120.5 bar
Temperature		320.2 C
Enthalpy		1461.4 kJ/kg
Mass flow (per unit)		25.16 kg/s
Nominal tube flow		25.16 kg/s
Performance		
Heat transfer rate (per unit)		8183 kW
Heat loss		81.83 kW





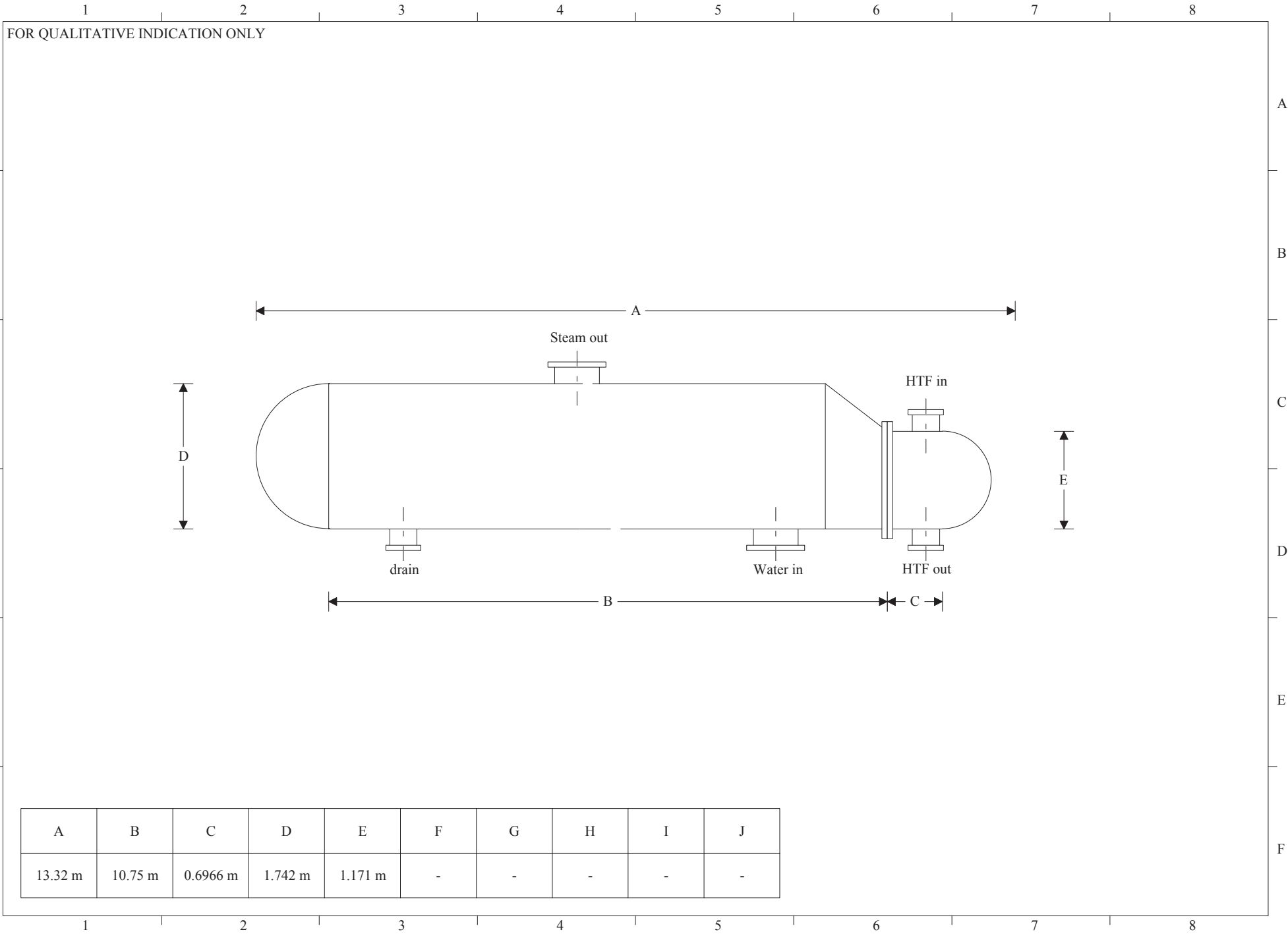
A	B	C	D	E	F	G	H	I	J
8.667 m	7.324 m	0.3184 m	0.7961 m	-	-	-	-	-	-

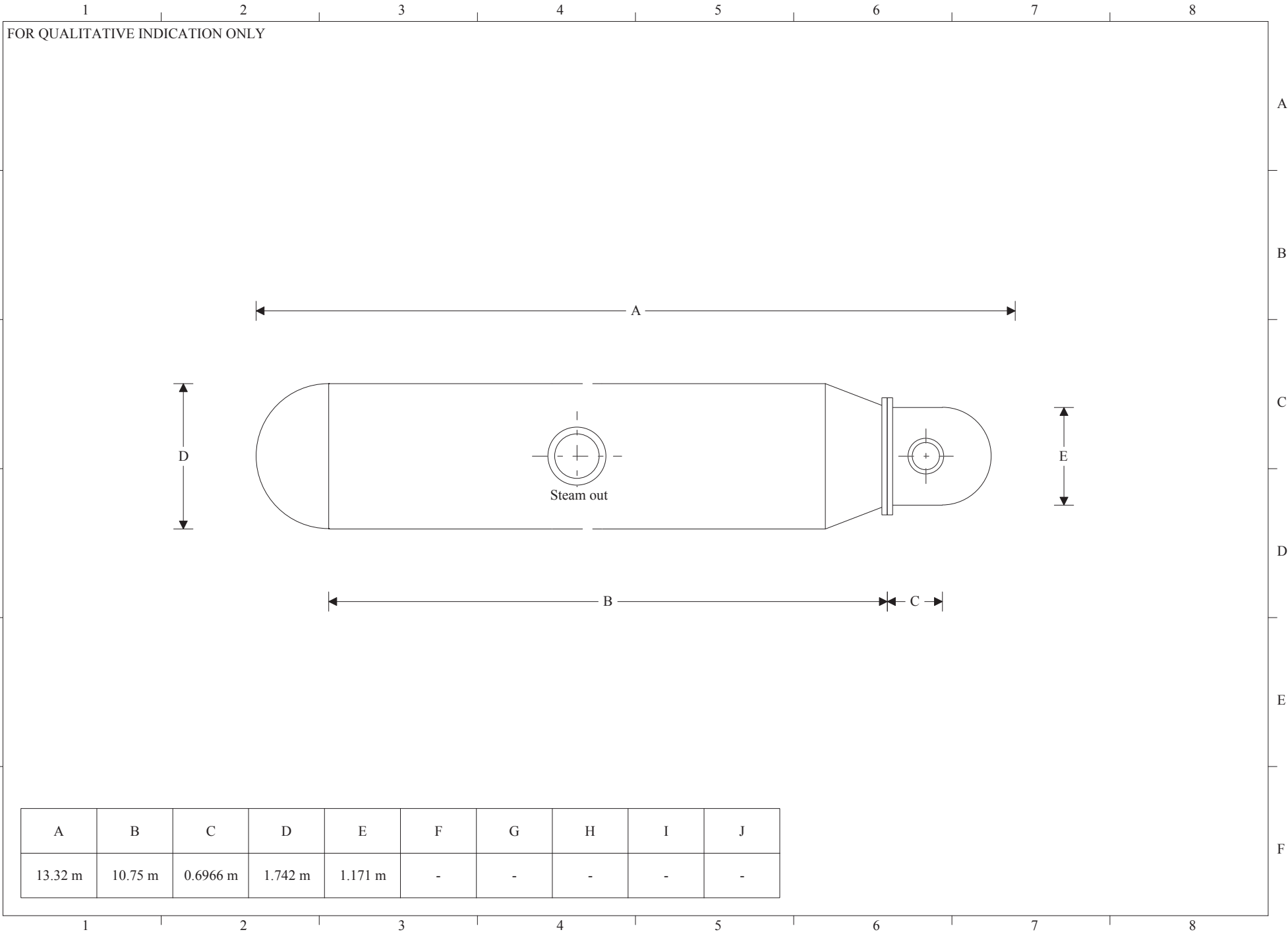
Shell-Tube Evaporating HX [27] - Specification

Estimated Shell-Tube Heat Exchanger Data		
Shell-Tube Evaporator[27]		
Number of units	1	
1. Tube Description (per unit)		
Tube type	Bare Tube	
Tube layout in crossflow	Rotated Square 45°	
Tube material	Carbon steel	
Total external heat transfer area	395	m ²
Nameplate tube flow pressure	14.1	bar
Number of tubes per pass	479	
Number of passes	2	
Number of tubes in heater	958	
Tube length per pass	8.27	m
Tube outer diameter	15.88	mm
Tube inner diameter	13.39	mm
Tube wall thickness	1.245	mm
Tube pitch	23.81	mm
Heat transfer area ratio (Ao/Ai)	1.186	
Tube weight, dry	4,730	kg
2. Shell Description (per unit)		
Nameplate shell flow pressure	120	bar
Shell material	Carbon steel	
Shell length	10.75	m
Tube bundle diameter	848	mm
Shell inner diameter	1,530	mm
Shell wall thickness	108	mm
Tube sheet thickness	130	mm
Overall length	13.3	m
Shell overall outer diameter	1741.5	mm
Total dry weight	67,850	kg
Total operating (wet) weight, reference basis	79,200	kg

Shell-Tube Evaporating HX [27] - Heat Balance

Off-design Heat Balance Results		
Shell-Tube Evaporator[27]		
Number of units present		1
Number of units in operation		1
Shell Inlet Water/steam		
		Subcooled
Pressure	120.5	bar
Temperature	320.2	C
Enthalpy	1461.4	kJ/kg
Mass flow (per unit)	25.16	kg/s
Shell Exit		
Pressure	120.5	bar
Temperature	325	C
Enthalpy	2684.5	kJ/kg
Mass flow (per unit)	24.91	kg/s
Nominal shell flow	24.91	kg/s
Tube Inlet Heat Transfer Fluid		
		Nitrate Salt 60% NaNO3 - 40% KNO3 by wt
Heat transfer fluid concentration	100	%
Pressure	14.1	bar
Temperature	453.2	C
Enthalpy	1086.2	kJ/kg
Tube Exit		
Pressure	13.42	bar
Temperature	327	C
Enthalpy	895	kJ/kg
Mass flow (per unit)	161	kg/s
Nominal tube flow	161	kg/s
Blowdown Stream		
Mass flow (per uit)	0.2491	kg/s
Enthalpy	1493.3	kJ/kg
Performance		
Shell saturation temperature	325	C
Actual pinch temperature difference	2.001	C
Heat transfer rate (per unit)	30474	kW
Heat loss	304.7	kW



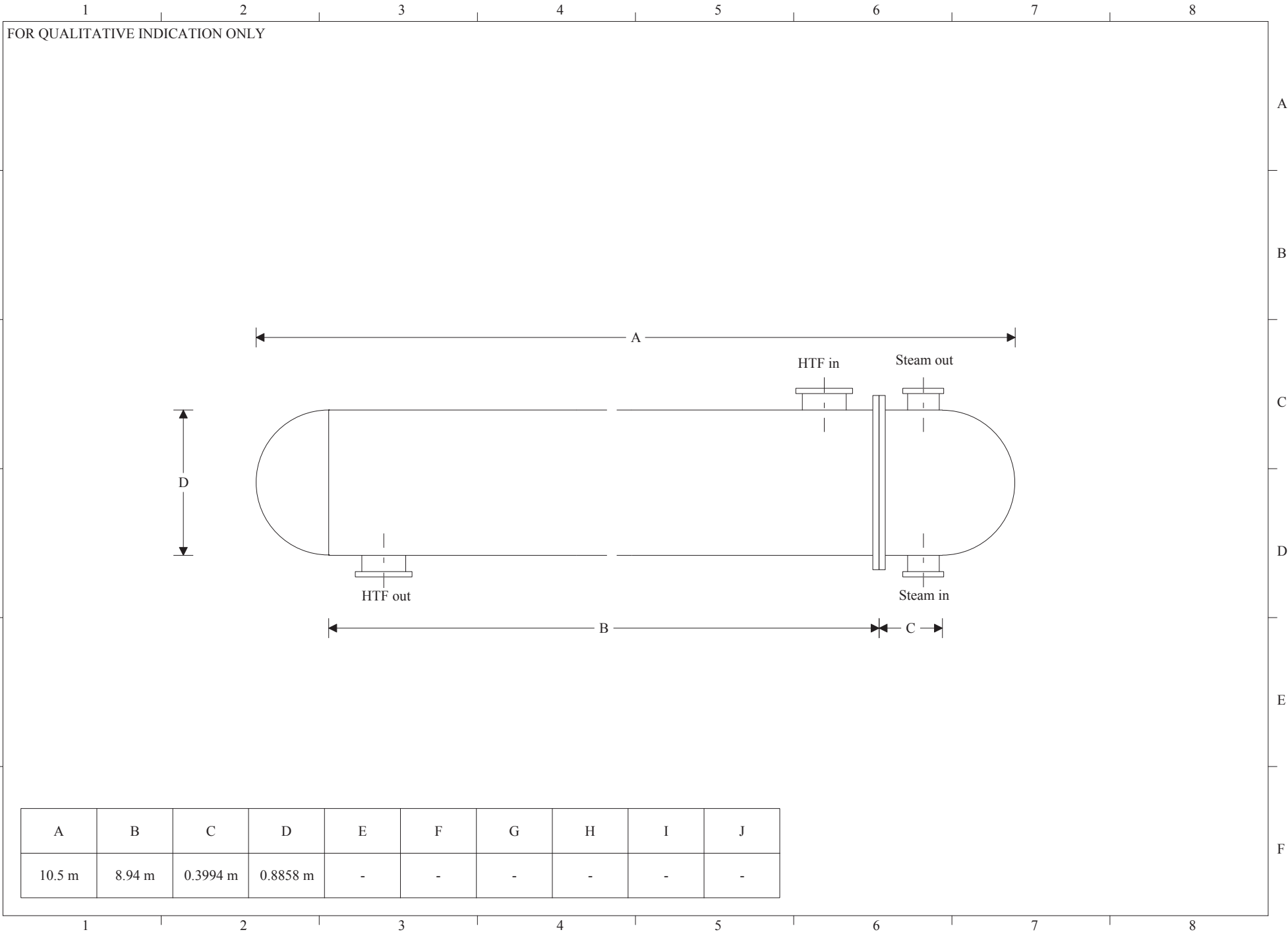


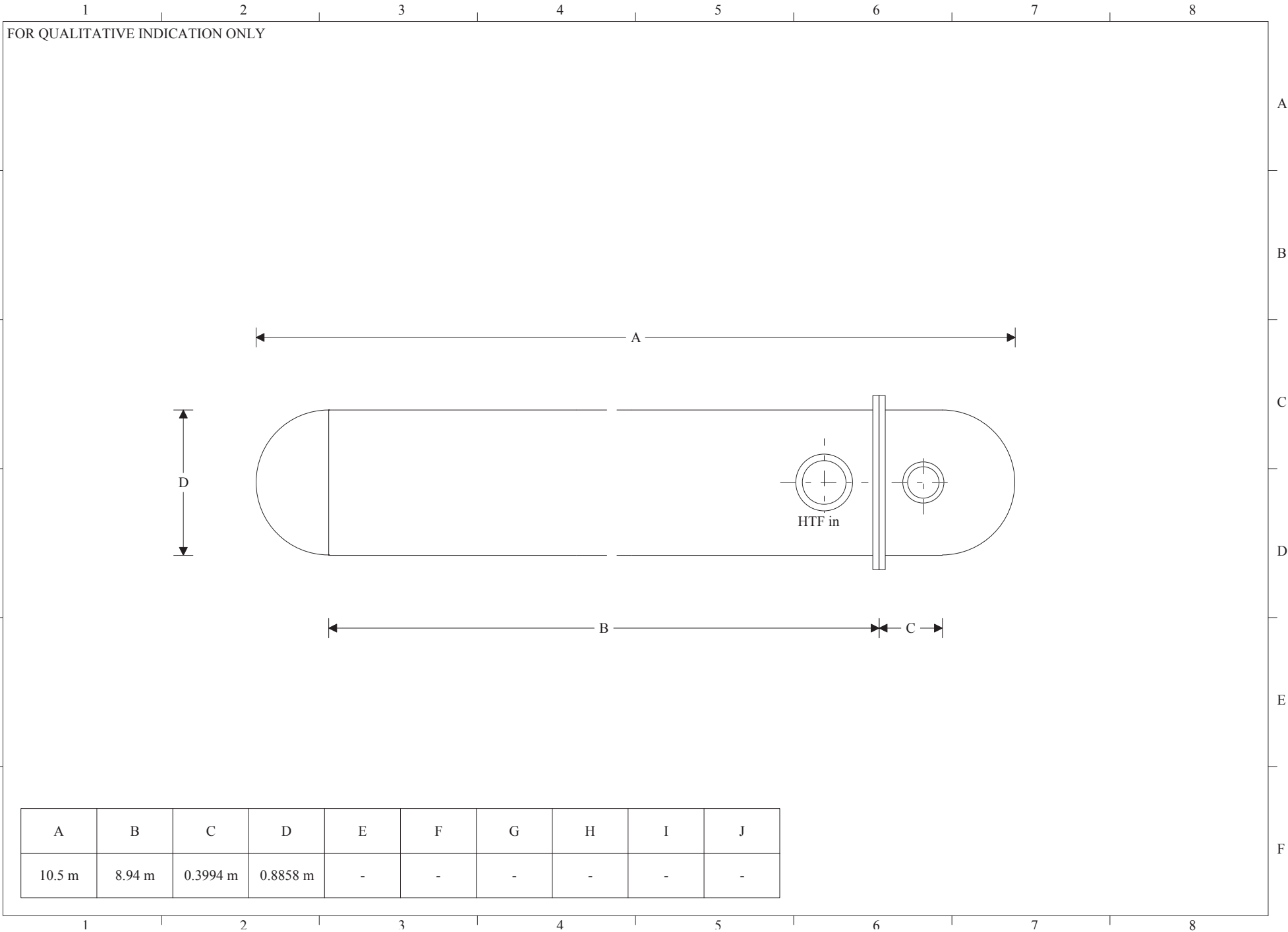
Shell-Tube Superheater [28] - Specification

Estimated Shell-Tube Heat Exchanger Data		
Shell-Tube Superheater[28]		
Number of units	1	
1. Tube Description (per unit)		
Tube type	Bare Tube	
Tube layout in crossflow	Rotated Square 45°	
Tube material	Carbon steel	
Total external heat transfer area	309	m ²
Nameplate tube flow pressure	120	bar
Number of tubes per pass	289	
Number of passes	2	
Number of tubes in heater	578	
Tube length per pass	8.94	m
Tube outer diameter	19.05	mm
Tube inner diameter	15.75	mm
Tube wall thickness	1.651	mm
Tube pitch	30.48	mm
Heat transfer area ratio (Ao/Ai)	1.21	
Tube weight, dry	3,770	kg
2. Shell Description (per unit)		
Nameplate shell flow pressure	15	bar
Shell material	Carbon steel	
Shell length	8.94	m
Tube bundle diameter	846	mm
Shell inner diameter	860	mm
Shell wall thickness	12.7	mm
Tube sheet thickness	137	mm
Overall length	10.5	m
Shell type	Two pass shell	
Number of baffles	18	
Baffle spacing	471	mm
Baffle cut / equivalent pass diameter	40.0	%
Equivalent pass diameter	613	mm
Shell overall outer diameter	886	mm
Total dry weight	11,410	kg
Total operating (wet) weight, reference basis	16,050	kg

Shell-Tube Superheater [28] - Heat Balance

Off-design Heat Balance Results		
Shell-Tube Superheater[28]		
Number of units present		1
Number of units in operation		1
Shell Inlet Heat Transfer Fluid		Nitrate Salt 60% NaNO₃ - 40% KNO₃ by wt
Heat transfer fluid concentration		100 %
Pressure		15 bar
Temperature		565 C
Enthalpy		1257.8 kJ/kg
Shell Exit		
Pressure		14.34 bar
Temperature		449.1 C
Enthalpy		1079.9 kJ/kg
Mass flow (per unit)		107.9 kg/s
Nominal shell flow		107.9 kg/s
Tube Inlet Water/steam		Superheated
Pressure		120.5 bar
Temperature		325 C
Enthalpy		2684.5 kJ/kg
Tube Exit		
Pressure		119.9 bar
Temperature		536.8 C
Enthalpy		3448 kJ/kg
Mass flow (per unit)		24.91 kg/s
Nominal tube flow		24.91 kg/s
Performance		
Heat transfer rate (per unit)		19007 kW
Heat loss		190.1 kW



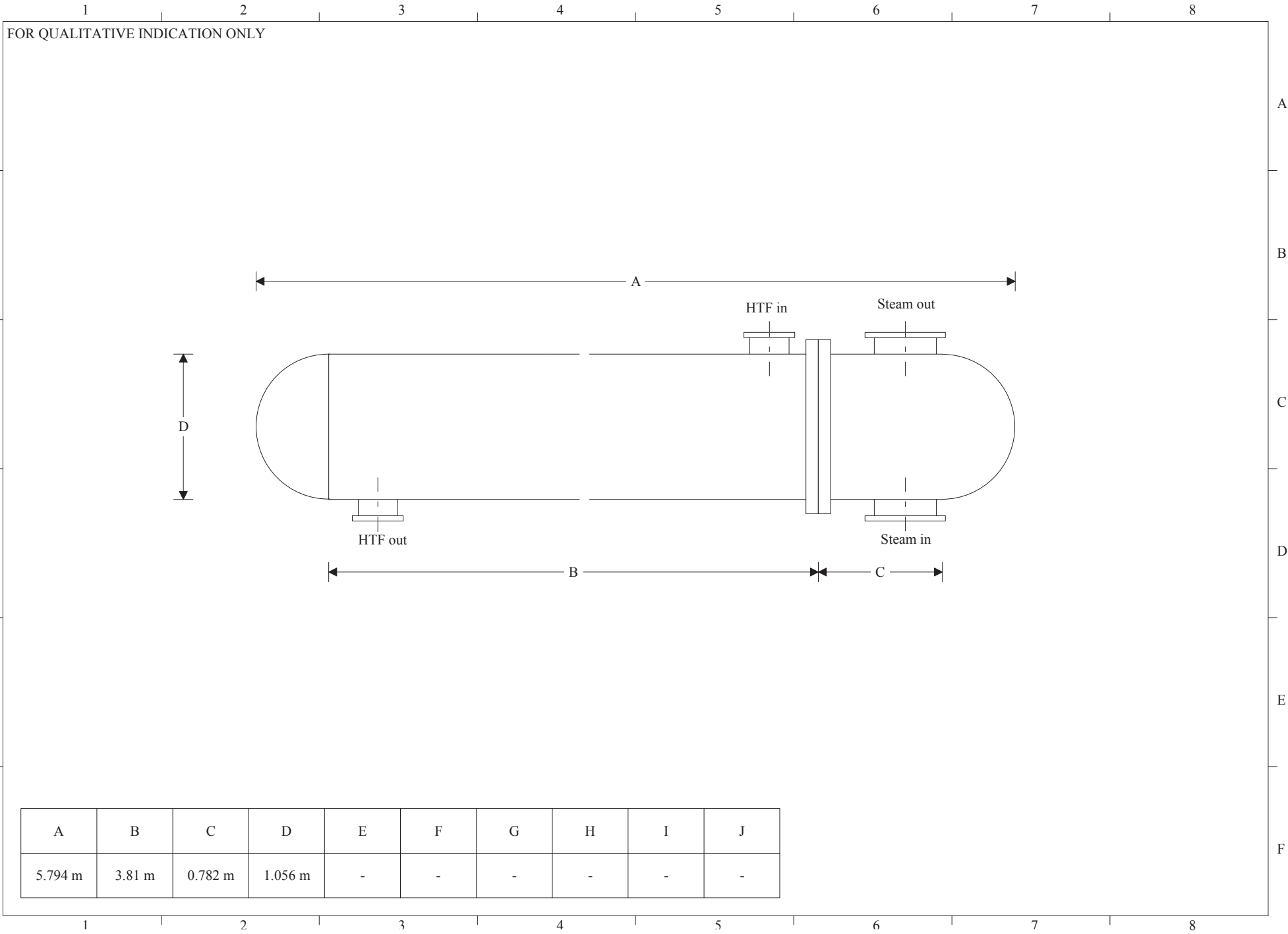


Shell-Tube Superheater [45] - Specification

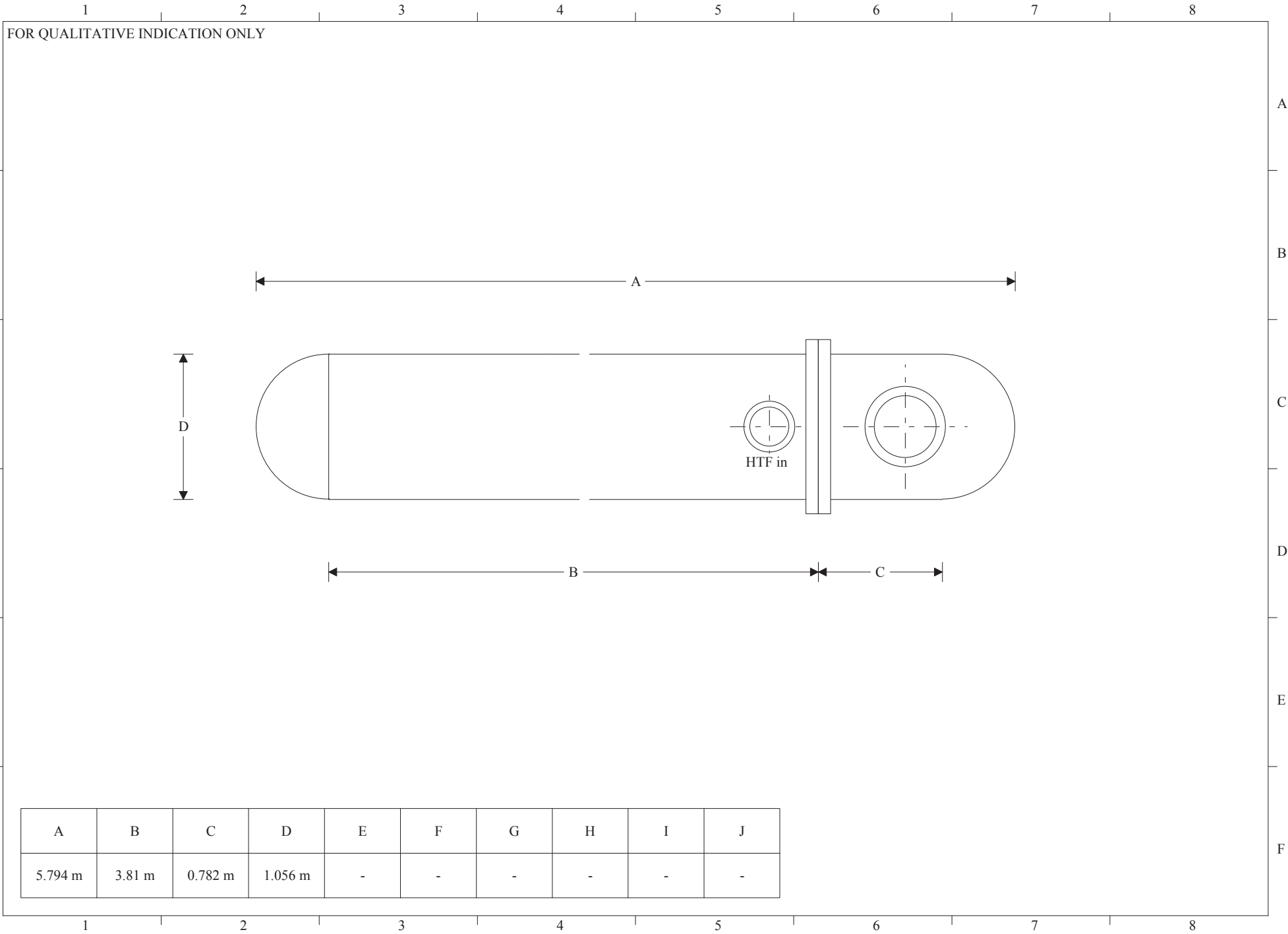
Estimated Shell-Tube Heat Exchanger Data		
Shell-Tube Superheater[45]		
Number of units	1	
1. Tube Description (per unit)		
Tube type	Bare Tube	
Tube layout in crossflow	Rotated Square 45°	
Tube material	Carbon steel	
Total external heat transfer area	218	m ²
Nameplate tube flow pressure	31.77	bar
Number of tubes per pass	477	
Number of passes	2	
Number of tubes in heater	954	
Tube length per pass	3.81	m
Tube outer diameter	19.05	mm
Tube inner diameter	16.56	mm
Tube wall thickness	1.245	mm
Tube pitch	28.57	mm
Heat transfer area ratio (Ao/Ai)	1.15	
Tube weight, dry	2,060	kg
2. Shell Description (per unit)		
Nameplate shell flow pressure	15	bar
Shell material	Carbon steel	
Shell length	3.81	m
Tube bundle diameter	1,010	mm
Shell inner diameter	1,030	mm
Shell wall thickness	12.7	mm
Tube sheet thickness	73.03	mm
Overall length	5.8	m
Shell type	Two pass shell	
Number of baffles	18	
Baffle spacing	201	mm
Baffle cut / equivalent pass diameter	18	%
Equivalent pass diameter	734	mm
Shell overall outer diameter	1056.2	mm
Total dry weight	7,000	kg
Total operating (wet) weight, reference basis	9,810	kg

Shell-Tube Superheater [45] - Heat Balance

Off-design Heat Balance Results		
Shell-Tube Superheater[45]		
Number of units present		1
Number of units in operation		1
Shell Inlet Heat Transfer Fluid		Nitrate Salt 60% NaNO₃ - 40% KNO₃ by wt
Heat transfer fluid concentration		100 %
Pressure		15 bar
Temperature		565 C
Enthalpy		1257.8 kJ/kg
Shell Exit		
Pressure		14.32 bar
Temperature		461.7 C
Enthalpy		1099.1 kJ/kg
Mass flow (per unit)		53.13 kg/s
Nominal shell flow		53.13 kg/s
Tube Inlet Water/steam		Superheated
Pressure		31.76 bar
Temperature		364.9 C
Enthalpy		3147 kJ/kg
Tube Exit		
Pressure		31.36 bar
Temperature		536.1 C
Enthalpy		3537 kJ/kg
Mass flow (per unit)		21.43 kg/s
Nominal tube flow		21.44 kg/s
Performance		
Heat transfer rate (per unit)		8352 kW
Heat loss		83.52 kW



A	B	C	D	E	F	G	H	I	J
5.794 m	3.81 m	0.782 m	1.056 m	-	-	-	-	-	-



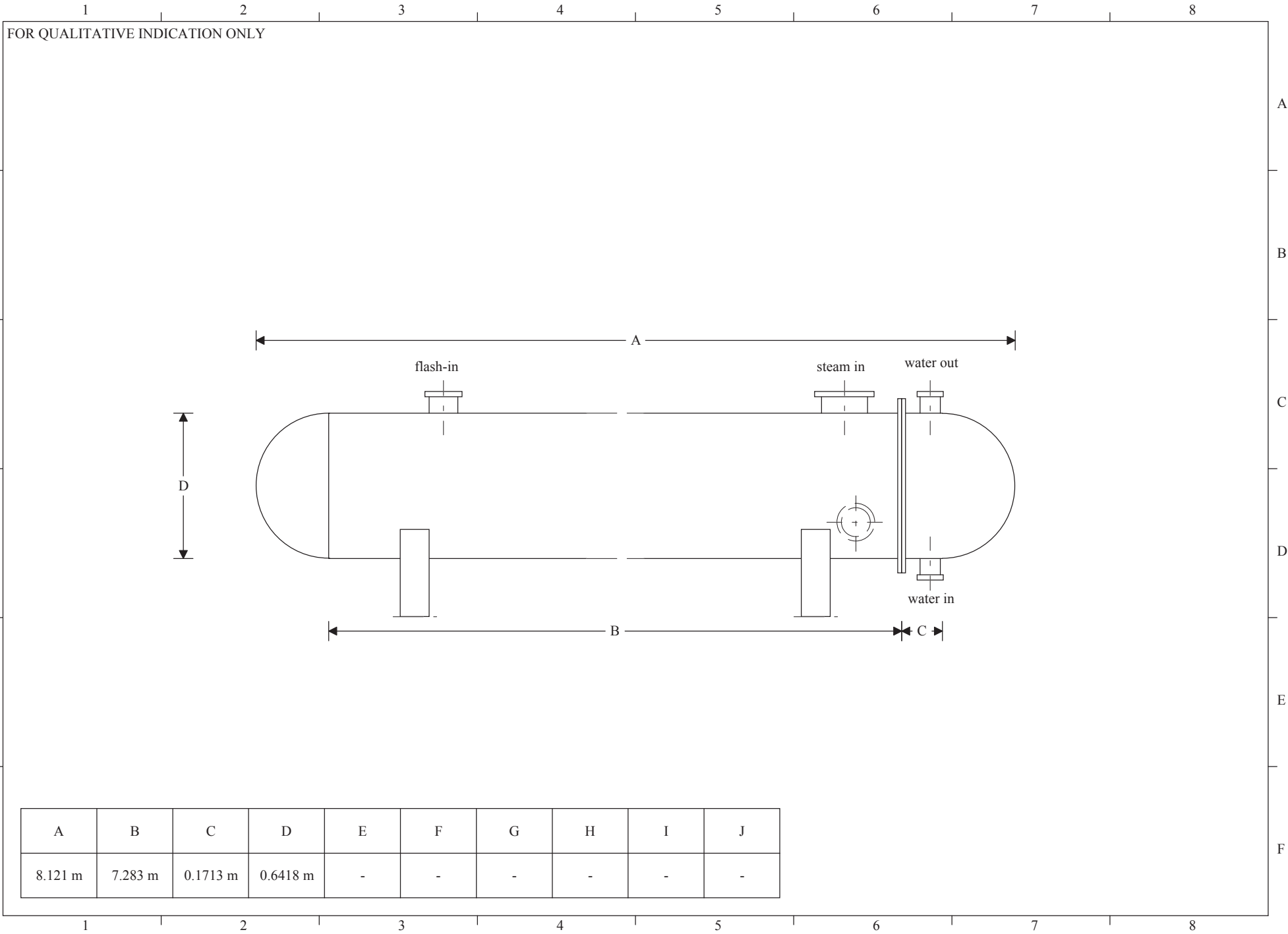
A	B	C	D	E	F	G	H	I	J
5.794 m	3.81 m	0.782 m	1.056 m	-	-	-	-	-	-

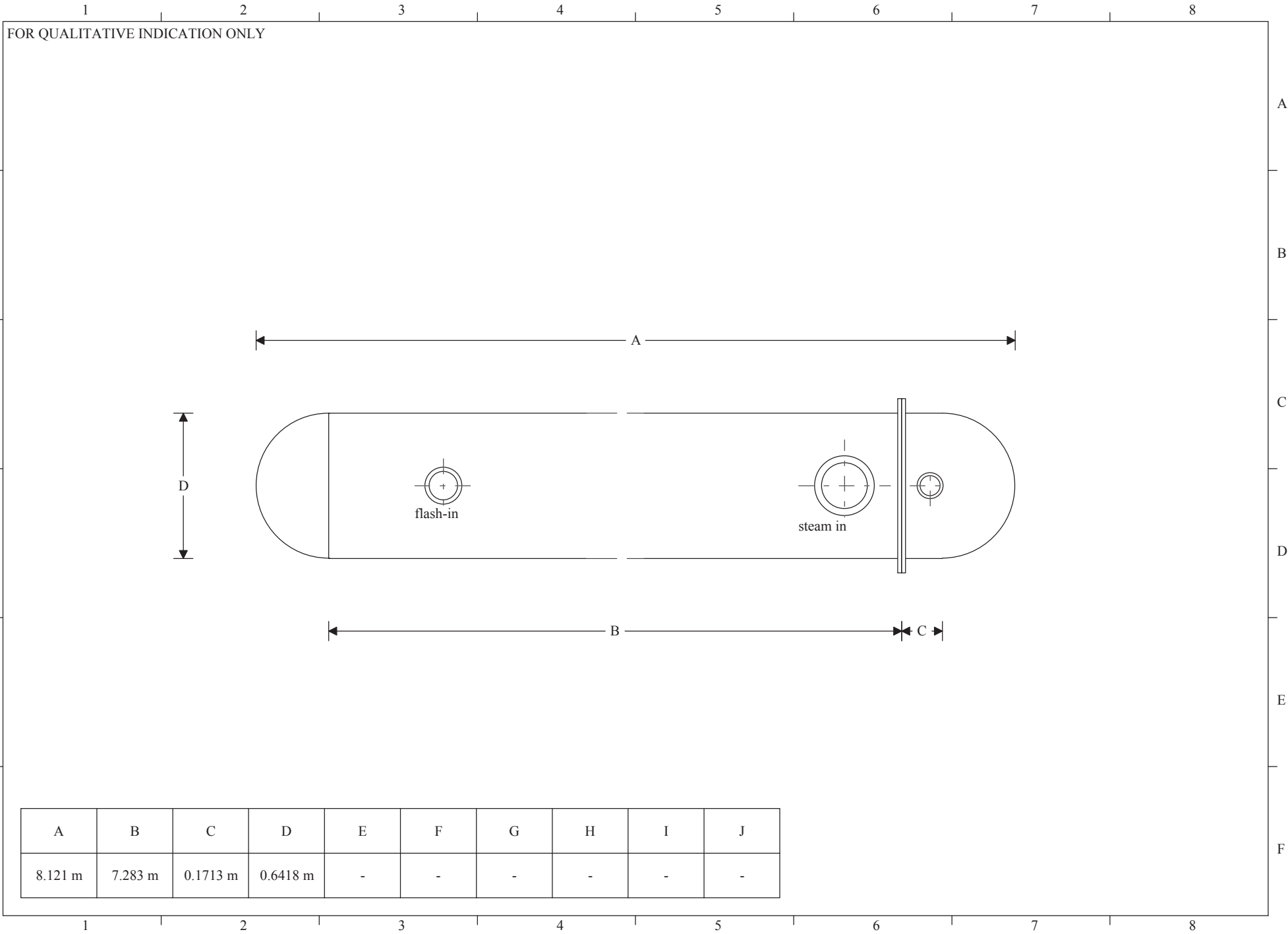
Feedwater Heater (PCE) [23] - Specification

Estimated Feedwater Heater Data		
Feedwater Heater(PCE)[23] - CBP1		
Feedwater Heater configuration: Includes condensing section only		
1. Feedwater Heater Tube Description		
Tube type	Bare Tube	
Tube layout in crossflow	Rotated Square 45°	
Tube material	Stainless Steel (304)	
Total external heat transfer area	100	m ²
Nameplate water pressure	8.118	bar
Number of tubes per pass	138	
Number of passes	2	
Number of tubes in heater	276	
Tube length per pass	7.283	m
Tube outer diameter	15.88	mm
Tube inner diameter	13.39	mm
Tube wall thickness	1.245	mm
Tube pitch	24.61	mm
Tube weight, dry	930	kg
2. Feedwater Heater Shell Description		
Nameplate steam pressure	0.9932	bar
Shell material	Carbon Steel	
Shell length	7.283	m
Shell inner diameter	623	mm
Shell wall thickness	9.525	mm
Tube sheet thickness	25.4	mm
Overall length	8.1	m
Overall outer diameter	642	mm
Total dry weight	2,840	kg
Total operating (wet) weight, reference basis	3,280	kg

Feedwater Heater (PCE) [23] - Heat Balance

Off-design Heat Balance Results		
Feedwater Heater(PCE)[23] - CBP1		
Feedwater heater configuration: Includes condensing section only		
Shell pressure	0.993	bar
Saturation temperature	99.41	C
Inlet Steam		
Supply pressure	0.993	bar
Heating pressure	0.993	bar
Heating temperature	130.6	C
Mass flow	1.371	kg/s
Enthalpy	2737.9	kJ/kg
Exit Condensate		
Pressure	0.993	bar
Temperature	99.41	C
Mass flow	2.092	kg/s
Enthalpy	416.6	kJ/kg
Inlet Water		
Pressure	8.118	bar
Temperature	53.48	C
Mass flow	17.33	kg/s
Enthalpy	224.5	kJ/kg
Exit Water		
Pressure	7.996	bar
Temperature	97.41	C
Mass flow	17.33	kg/s
Enthalpy	408.7	kJ/kg
Flash-in Stream		
Mass flow	0.7211	kg/s
Enthalpy	430.4	kJ/kg
Heat Transfer Data		
Heat transfer rate	3192	kW
Fouling factor	0.0000581	m ² -C/W
Water velocity	0.9151	m/s
Water Reynolds number	31752	
Water pressure drop	0.1217	bar
Condensing section heat transfer coefficient	2272.1	W/m ² -C
Condensing section LMTD	14.01	C



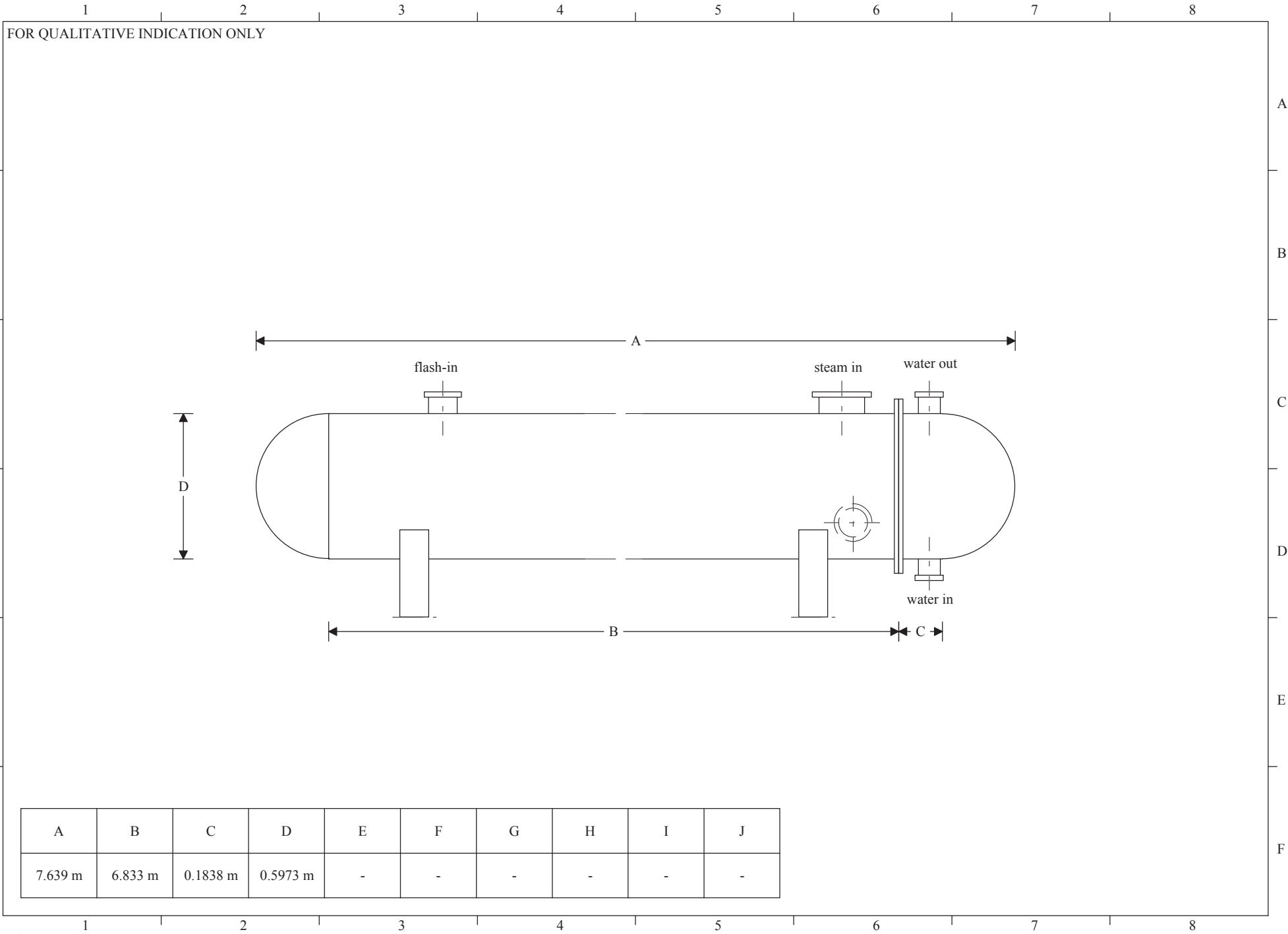


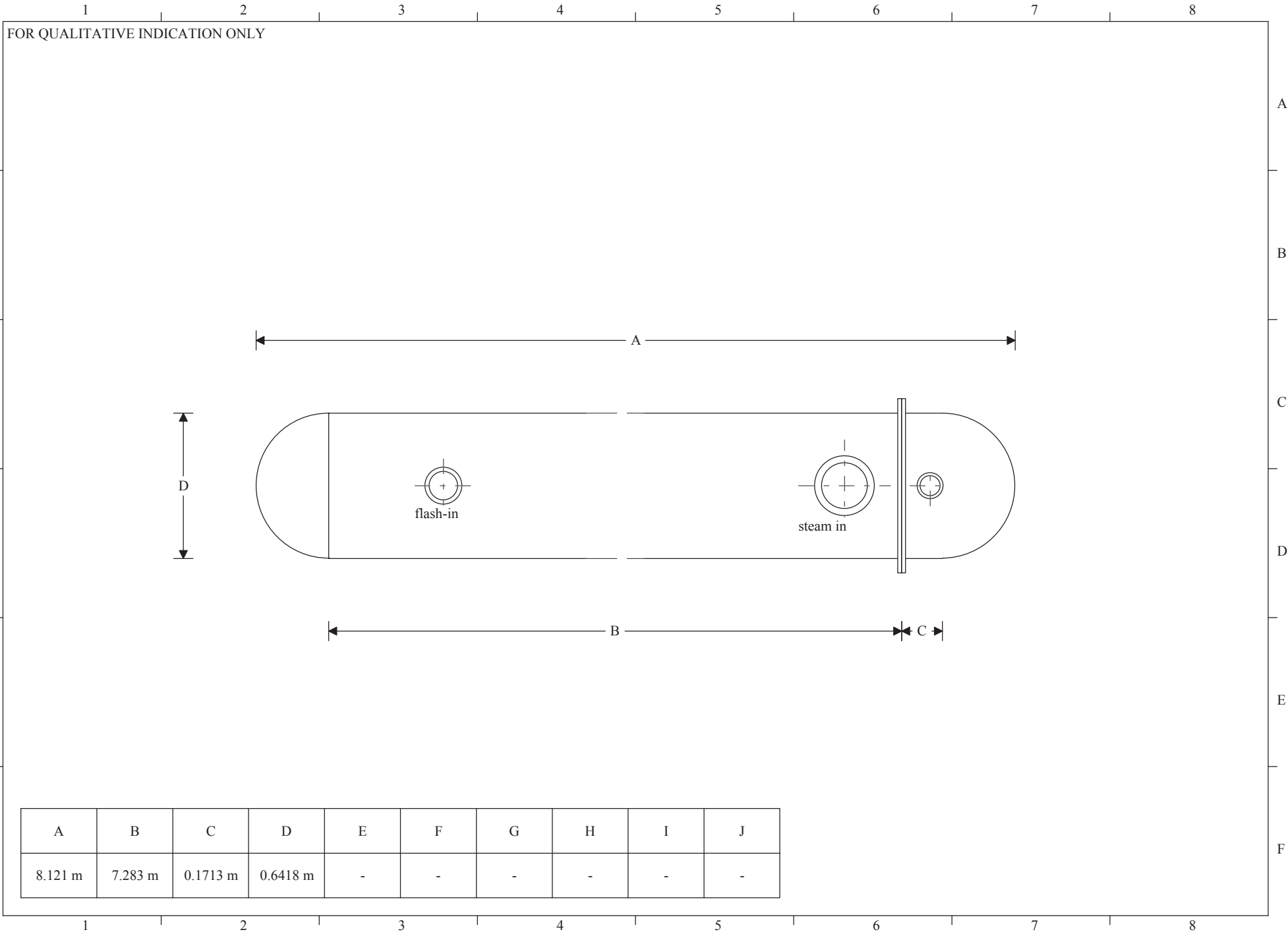
Feedwater Heater (PCE) [19] - Specification

Estimated Feedwater Heater Data		
Feedwater Heater(PCE)[19] - CBP2		
Feedwater Heater configuration: Includes condensing section, drain cooler		
1. Feedwater Heater Tube Description		
Tube type	Bare Tube	
Tube layout in crossflow	Rotated Square 45°	
Tube material	Stainless Steel (304)	
Total external heat transfer area	71.56	m ²
Nameplate water pressure	7.996	bar
Number of tubes per pass	105	
Number of passes	2	
Number of tubes in heater	210	
Tube length per pass	6.833	m
Tube outer diameter	15.88	mm
Tube inner diameter	13.39	mm
Tube wall thickness	1.245	mm
Tube pitch	26.19	mm
Tube weight, dry	664	kg
2. Feedwater Heater Shell Description		
Nameplate steam pressure	2.121	bar
Shell material	Carbon Steel	
Shell length	6.833	m
Shell inner diameter	578	mm
Shell wall thickness	9.525	mm
Tube sheet thickness	25.4	mm
Overall length	7.6	m
Overall outer diameter	597	mm
Total dry weight	2,440	kg
Total operating (wet) weight, reference basis	2,760	kg

Feedwater Heater (PCE) [19] - Heat Balance

Off-design Heat Balance Results		
Feedwater Heater(PCE)[19] - CBP2		
Feedwater heater configuration: Includes condensing section, drain cooler		
Shell pressure	2.12	bar
Saturation temperature	122.1	C
Inlet Steam		
Supply pressure	2.12	bar
Heating pressure	2.12	bar
Heating temperature	200.8	C
Mass flow	0.7211	kg/s
Enthalpy	2871.9	kJ/kg
Exit Condensate		
Pressure	2.12	bar
Temperature	102.7	C
Mass flow	0.7211	kg/s
Enthalpy	430.4	kJ/kg
Inlet Water		
Pressure	7.996	bar
Temperature	97.65	C
Mass flow	19.42	kg/s
Enthalpy	409.7	kJ/kg
Exit Water		
Pressure	7.776	bar
Temperature	119.1	C
Mass flow	19.42	kg/s
Enthalpy	500.4	kJ/kg
Flash-in Stream		
Mass flow	0	kg/s
Enthalpy	0	kJ/kg
Heat Transfer Data		
Heat transfer rate	1760.6	kW
Fouling factor	0.0000581	m ² -C/W
Water velocity	1.38	m/s
Water Reynolds number	67855	
Water pressure drop	0.2195	bar
Condensing section heat transfer coefficient	2825	W/m ² -C
Drain cooler heat transfer coefficient	447.9	W/m ² -C
Condensing section LMTD	9.964	C
Drain cooler LMTD	12.01	C



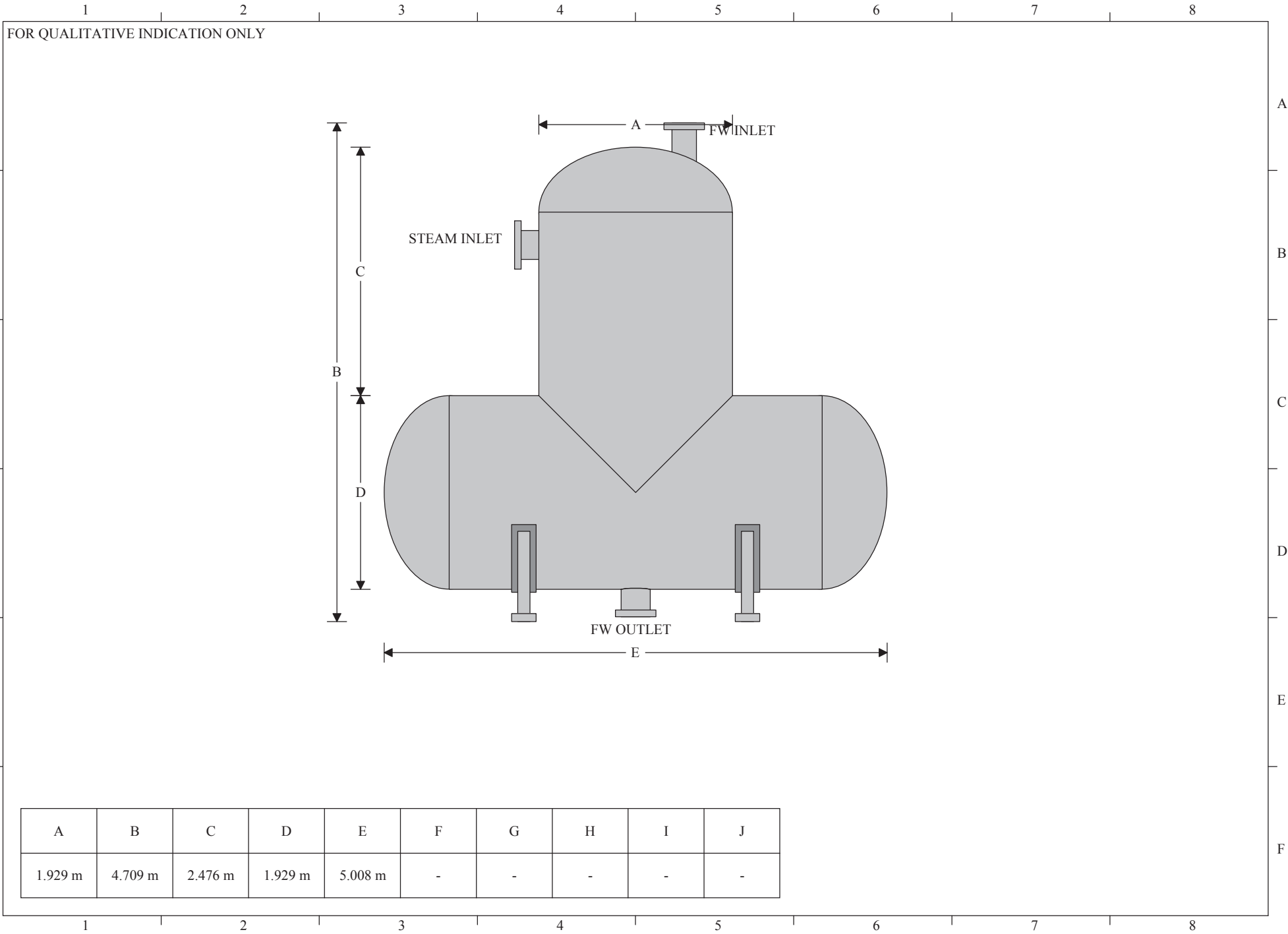


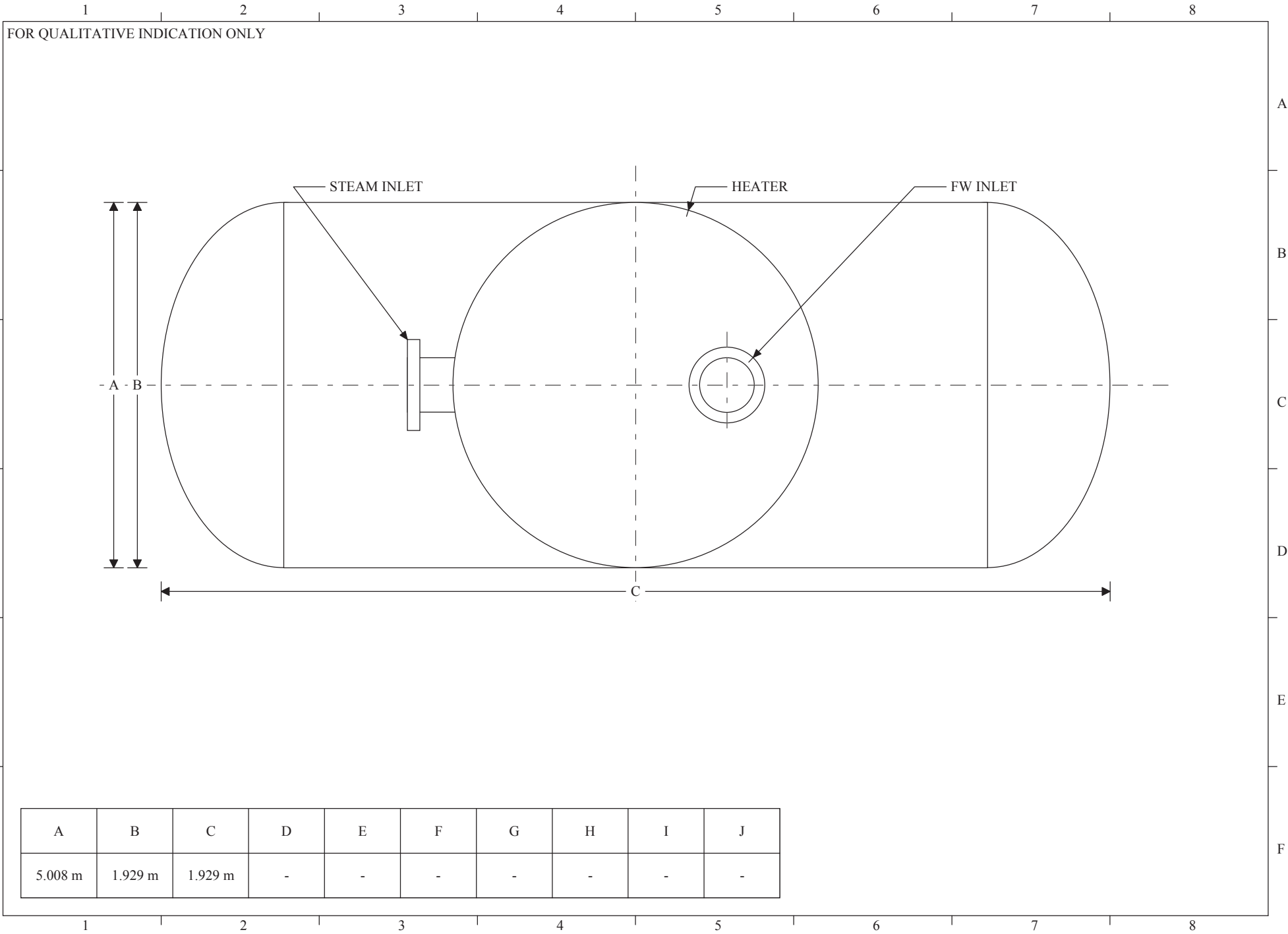
Deaerator [11] - Specification

Estimated Steam-Heated Deaerator Data		
Deaerator[11]		
DA type	TC	
Nameplate feedwater exit flow	90566	kg/hr
Total storage volume	11674	l
Total storage capacity	7	Min
Number of units	1	
Overall height	4.709	m
Overall length	5.008	m
Storage tank		
-Thickness	12.7	mm
-Outside diameter	1.929	m
-Total length	5.008	m
Heater		
-Thickness	12.7	mm
-Outside diameter	1.929	m
-Total height	2.476	m
Dry weight	5560	kg
Operating weight	17183	kg
Flooded weight	24186	kg
Structure weight	5387	kg

Deaerator [11] - Heat Balance

Off-design Heat Balance Results		
Deaerator[11]		
Pressure	6.58	bar
Saturation temperature	162.5	C
Feedwater storage	11674	l
Feedwater Inlet		
Pressure	7.776	bar
Temperature	119.1	C
Enthalpy	500.4	kJ/kg
Mass flow	19.42	kg/s
Additional water head at inlet	12.19	m H2O
Heating Stream		
Pressure	6.862	bar
Temperature	333.9	C
Enthalpy	3131	kJ/kg
Mass flow	1.36	kg/s
Flash in		
Pressure	6.58	bar
Temperature	162.5	C
Enthalpy	751.8	kJ/kg
Mass flow	4.38	kg/s
Feedwater Outlet		
Pressure	7.776	bar
Temperature	162.5	C
Enthalpy	686.3	kJ/kg
Mass flow	25.16	kg/s
Additional water head at outlet	12.19	m H2O



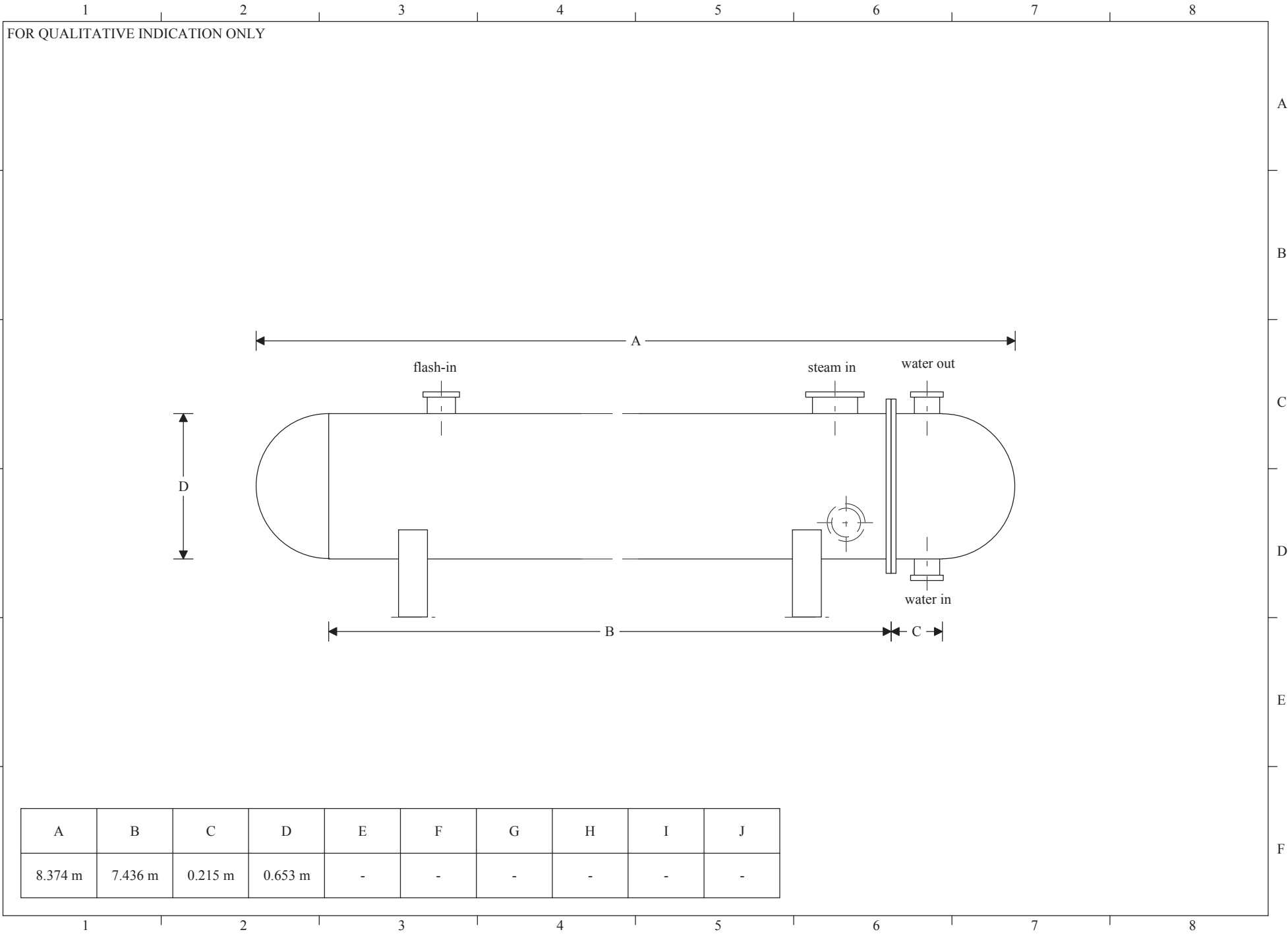


Feedwater Heater (PCE) [15] - Specification

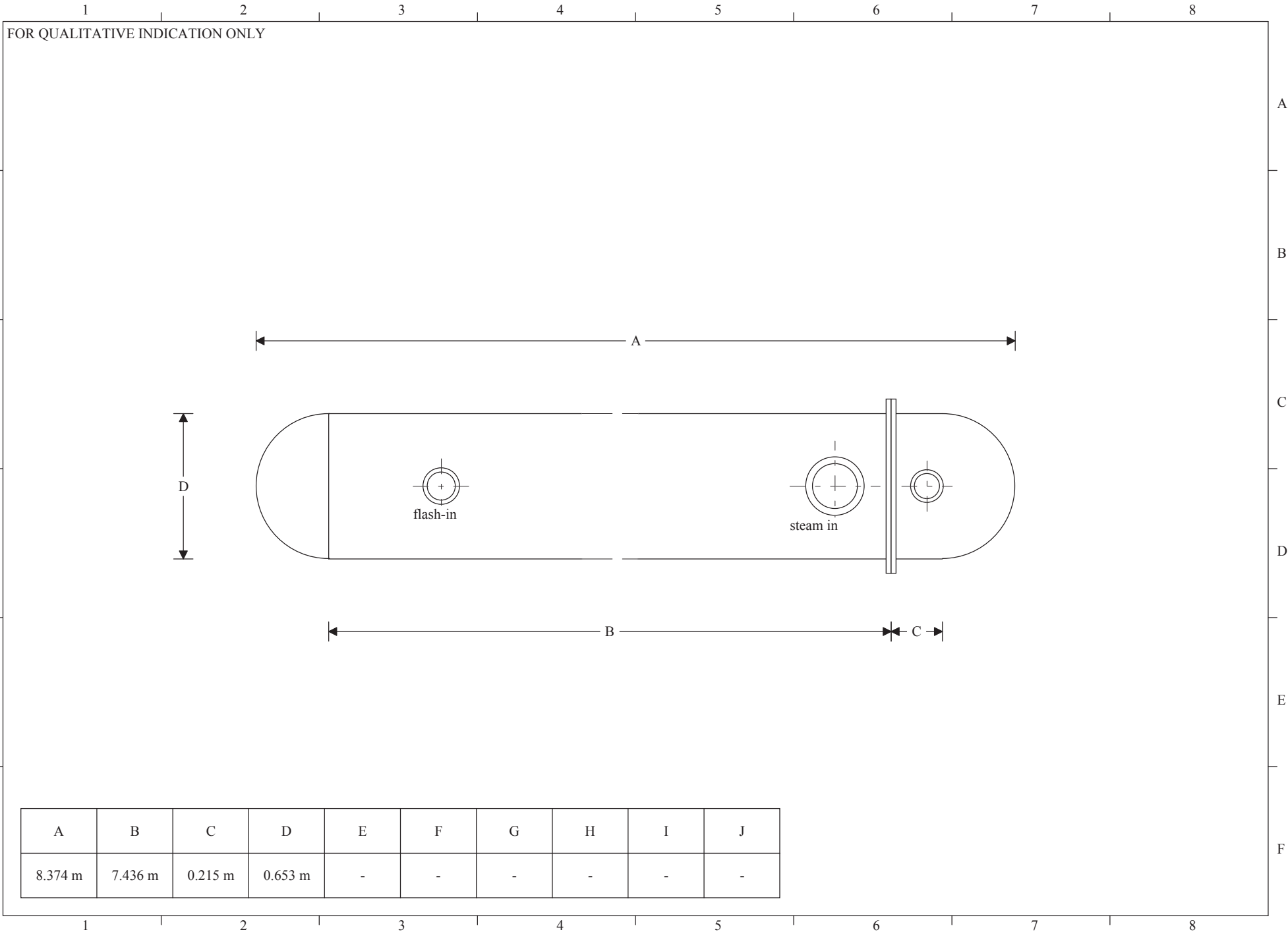
Estimated Feedwater Heater Data		
Feedwater Heater(PCE)[15] - CBP3		
Feedwater Heater configuration: Includes desuperheating section, condensing section, drain cooler		
1. Feedwater Heater Tube Description		
Tube type	Bare Tube	
Tube layout in crossflow	Rotated Square 45°	
Tube material	Carbon Steel	
Total external heat transfer area	106	m ²
Nameplate water pressure	122	bar
Number of tubes per pass	143	
Number of passes	2	
Number of tubes in heater	286	
Tube length per pass	7.436	m
Tube outer diameter	15.88	mm
Tube inner diameter	12.83	mm
Tube wall thickness	1.524	mm
Tube pitch	24.61	mm
Tube weight, dry	1,170	kg
2. Feedwater Heater Shell Description		
Nameplate steam pressure	15.32	bar
Shell material	Carbon Steel	
Shell length	7.436	m
Shell inner diameter	634	mm
Shell wall thickness	9.525	mm
Tube sheet thickness	69.85	mm
Overall length	8.4	m
Overall outer diameter	653	mm
Total dry weight	4,530	kg
Total operating (wet) weight, reference basis	4,920	kg

Feedwater Heater (PCE) [15] - Heat Balance

Off-design Heat Balance Results		
Feedwater Heater(PCE)[15] - CBP3		
Feedwater heater configuration: Includes desuperheating section, condensing section, drain cooler		
Shell pressure	15.31	bar
Saturation temperature	199.3	C
Inlet Steam		
Supply pressure	15.31	bar
Heating pressure	15.31	bar
Heating temperature	436	C
Mass flow	1.247	kg/s
Enthalpy	3334	kJ/kg
Exit Condensate		
Pressure	15.31	bar
Temperature	170.4	C
Mass flow	4.316	kg/s
Enthalpy	721.4	kJ/kg
Inlet Water		
Pressure	121.7	bar
Temperature	165.4	C
Mass flow	25.16	kg/s
Enthalpy	705.6	kJ/kg
Exit Water		
Pressure	121.4	bar
Temperature	199.3	C
Mass flow	25.16	kg/s
Enthalpy	853.6	kJ/kg
Flash-in Stream		
Mass flow	3.069	kg/s
Enthalpy	872.8	kJ/kg
Heat Transfer Data		
Heat transfer rate	3723	kW
Fouling factor	0.0000581	m ² -C/W
Water velocity	1.527	m/s
Water Reynolds number	116331	
Water pressure drop	0.253	bar
Desuperheating section heat transfer coefficient	295	W/m ² -C
Condensing section heat transfer coefficient	3727	W/m ² -C
Drain cooler heat transfer coefficient	1255.1	W/m ² -C
Desuperheating section LMTD	94.83	C
Condensing section LMTD	14.14	C
Drain cooler LMTD	13.62	C



A	B	C	D	E	F	G	H	I	J
8.374 m	7.436 m	0.215 m	0.653 m	-	-	-	-	-	-

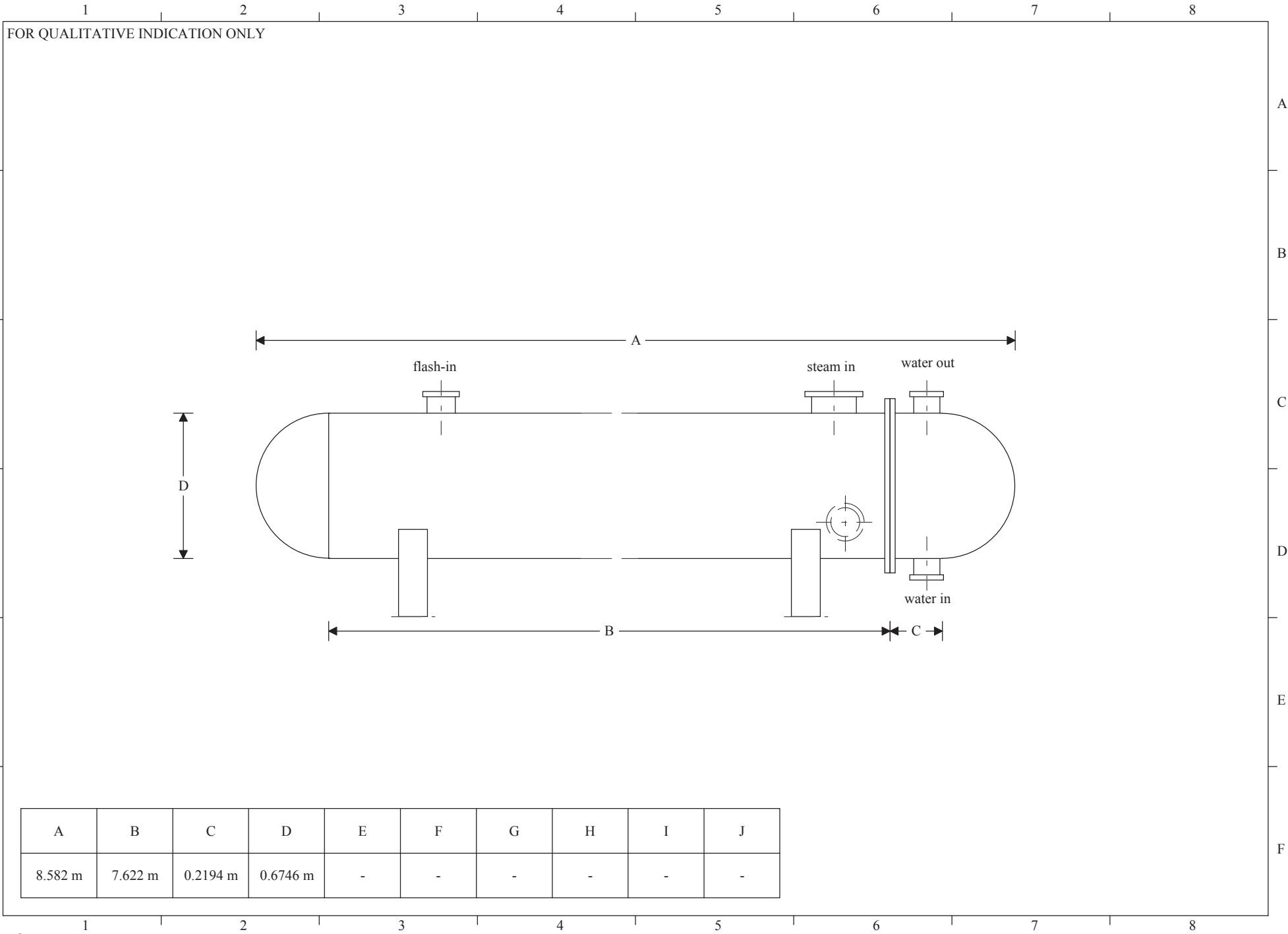


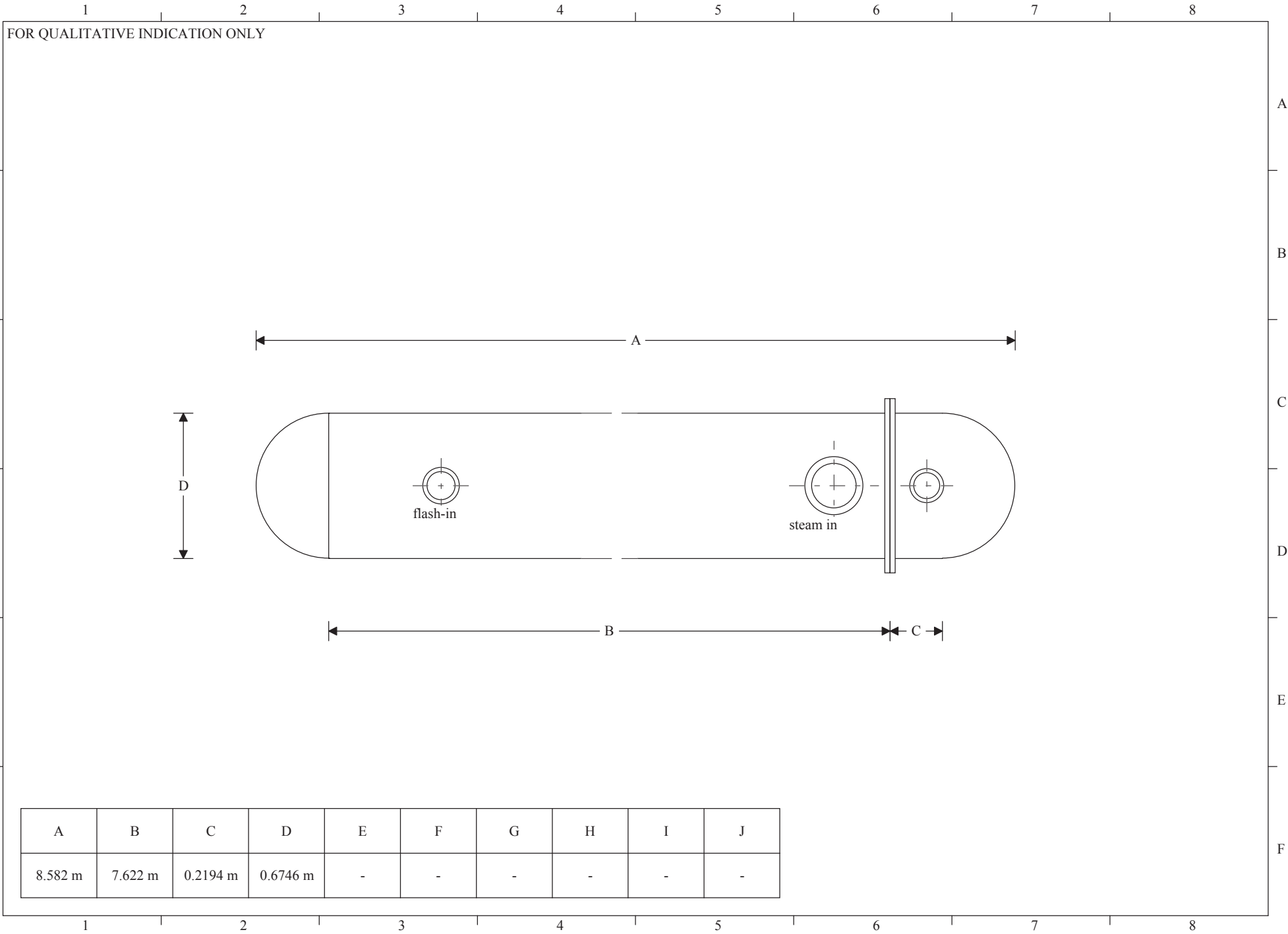
Feedwater Heater (PCE) [57] - Specification

Estimated Feedwater Heater Data		
Feedwater Heater(PCE)[57]		
Feedwater Heater configuration: Includes desuperheating section, condensing section, drain cooler		
1. Feedwater Heater Tube Description		
Tube type	Bare Tube	
Tube layout in crossflow	Rotated Square 45°	
Tube material	Carbon Steel	
Total external heat transfer area	114	m ²
Nameplate water pressure	121	bar
Number of tubes per pass	150	
Number of passes	2	
Number of tubes in heater	300	
Tube length per pass	7.622	m
Tube outer diameter	15.88	mm
Tube inner diameter	12.83	mm
Tube wall thickness	1.524	mm
Tube pitch	24.61	mm
Tube weight, dry	1,250	kg
2. Feedwater Heater Shell Description		
Nameplate steam pressure	32.22	bar
Shell material	Carbon Steel	
Shell length	7.622	m
Shell inner diameter	649	mm
Shell wall thickness	12.7	mm
Tube sheet thickness	66.68	mm
Overall length	8.6	m
Overall outer diameter	675	mm
Total dry weight	5,180	kg
Total operating (wet) weight, reference basis	5,600	kg

Feedwater Heater (PCE) [57] - Heat Balance

Off-design Heat Balance Results		
Feedwater Heater(PCE)[57]		
Feedwater heater configuration: Includes desuperheating section, condensing section, drain cooler		
Shell pressure	32.2	bar
Saturation temperature	237.8	C
Inlet Steam		
Supply pressure	32.2	bar
Heating pressure	32.2	bar
Heating temperature	365.3	C
Mass flow	1.839	kg/s
Enthalpy	3147	kJ/kg
Exit Condensate		
Pressure	32.2	bar
Temperature	204.4	C
Mass flow	3.069	kg/s
Enthalpy	872.8	kJ/kg
Inlet Water		
Pressure	121.4	bar
Temperature	199.3	C
Mass flow	25.16	kg/s
Enthalpy	853.6	kJ/kg
Exit Water		
Pressure	121.2	bar
Temperature	237.8	C
Mass flow	25.16	kg/s
Enthalpy	1028.5	kJ/kg
Flash-in Stream		
Mass flow	1.23	kg/s
Enthalpy	1051.5	kJ/kg
Heat Transfer Data		
Heat transfer rate	4402	kW
Fouling factor	0.0000581	m ² -C/W
Water velocity	1.526	m/s
Water Reynolds number	133960	
Water pressure drop	0.24	bar
Desuperheating section heat transfer coefficient	386.8	W/m ² -C
Condensing section heat transfer coefficient	3757	W/m ² -C
Drain cooler heat transfer coefficient	1077.6	W/m ² -C
Desuperheating section LMTD	62.38	C
Condensing section LMTD	14.66	C
Drain cooler LMTD	15.37	C





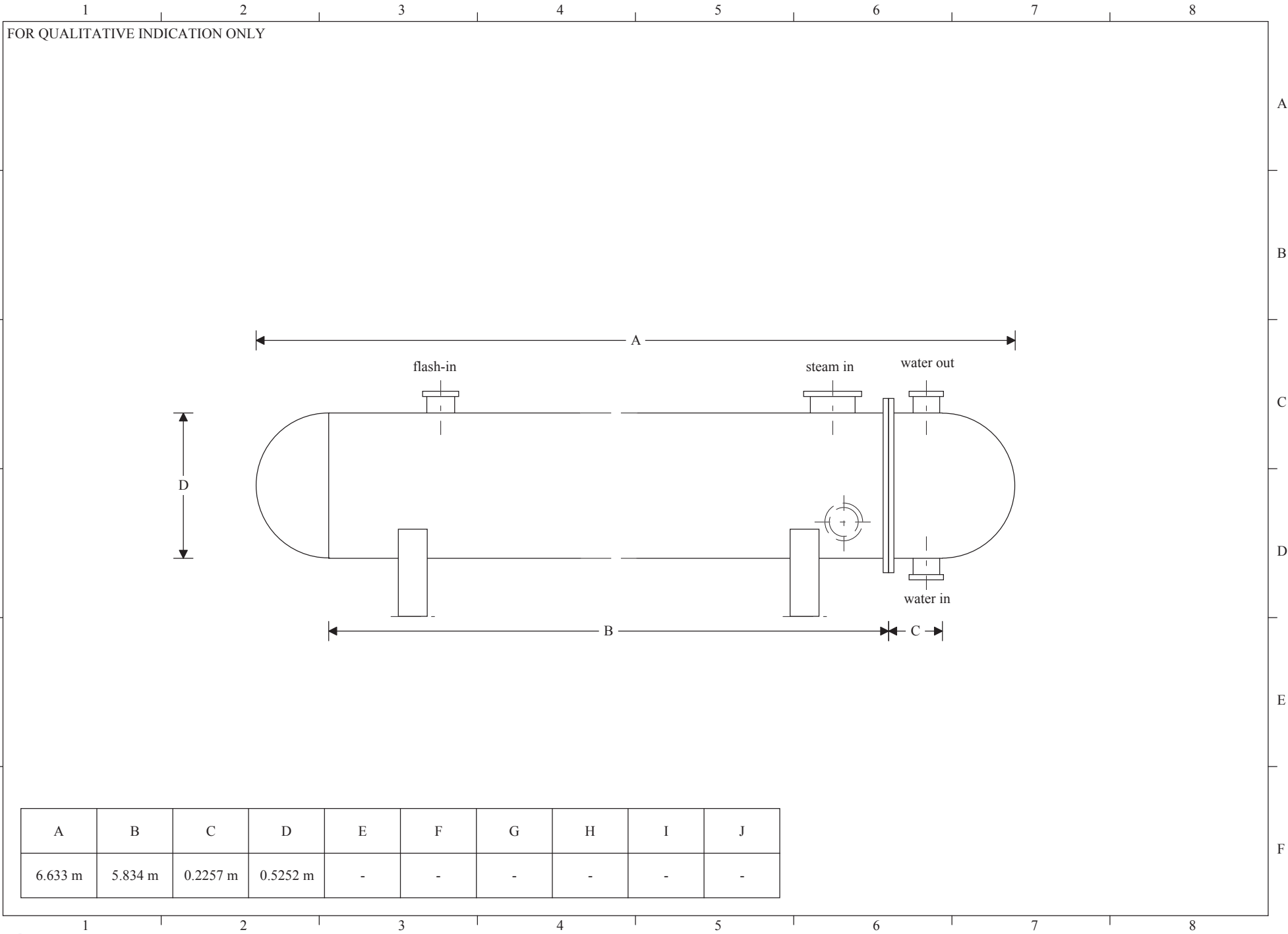
A	B	C	D	E	F	G	H	I	J
8.582 m	7.622 m	0.2194 m	0.6746 m	-	-	-	-	-	-

Feedwater Heater (PCE) [7] - Specification

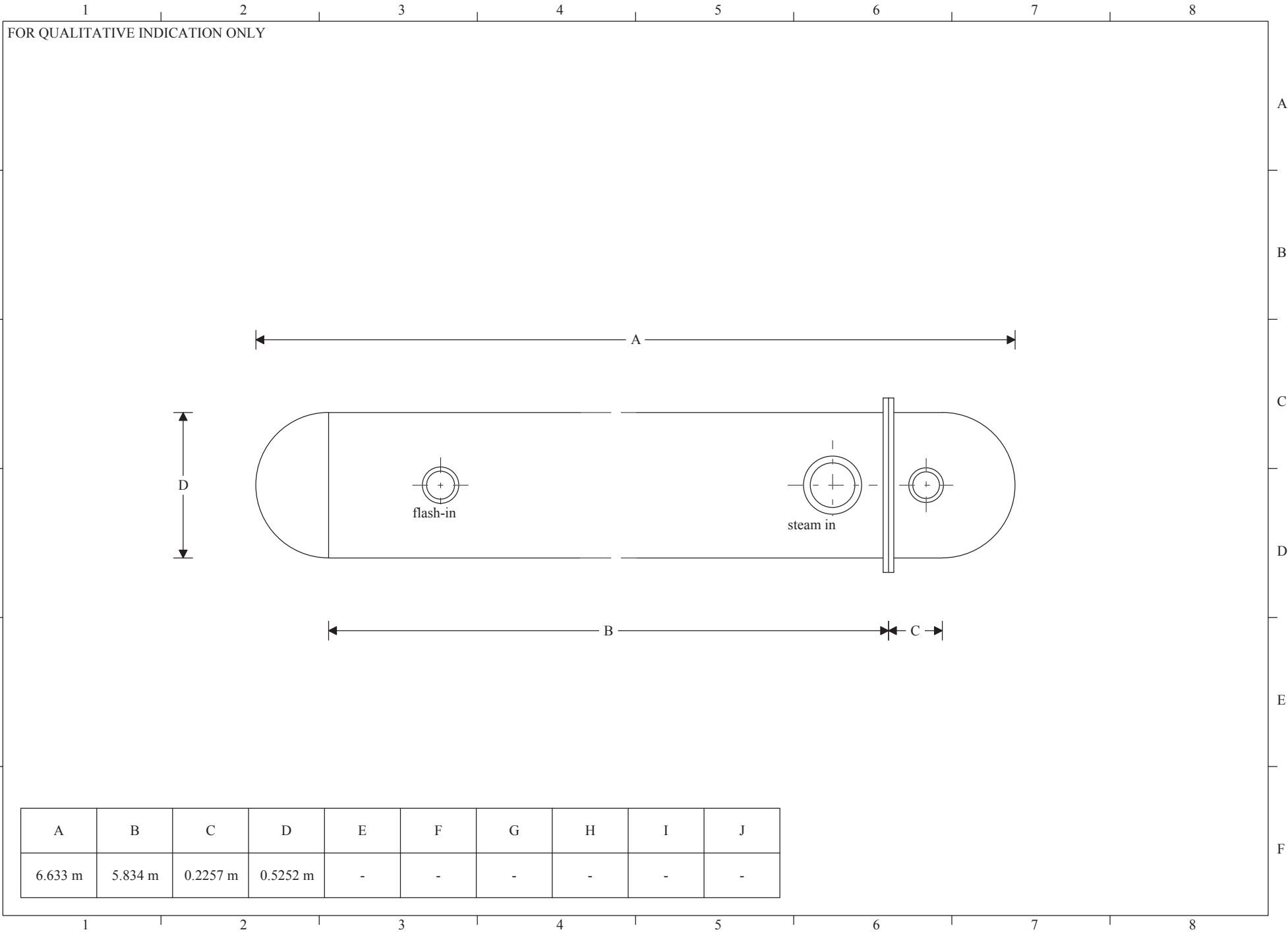
Estimated Feedwater Heater Data		
Feedwater Heater(PCE)[7] - CAP1		
Feedwater Heater configuration: Includes desuperheating section, condensing section, drain cooler		
1. Feedwater Heater Tube Description		
Tube type	Bare Tube	
Tube layout in crossflow	Rotated Square 45°	
Tube material	Carbon Steel	
Total external heat transfer area	57.61	m ²
Nameplate water pressure	121	bar
Number of tubes per pass	99	
Number of passes	2	
Number of tubes in heater	198	
Tube length per pass	5.834	m
Tube outer diameter	15.88	mm
Tube inner diameter	13.39	mm
Tube wall thickness	1.245	mm
Tube pitch	23.02	mm
Tube weight, dry	527	kg
2. Feedwater Heater Shell Description		
Nameplate steam pressure	49.99	bar
Shell material	Carbon Steel	
Shell length	5.834	m
Shell inner diameter	493	mm
Shell wall thickness	15.88	mm
Tube sheet thickness	47.62	mm
Overall length	6.6	m
Overall outer diameter	525	mm
Total dry weight	2,940	kg
Total operating (wet) weight, reference basis	3,150	kg

Feedwater Heater (PCE) [7] - Heat Balance

Off-design Heat Balance Results		
Feedwater Heater(PCE)[7] - CAP1		
Feedwater heater configuration: Includes desuperheating section, condensing section, drain cooler		
Shell pressure	50.14	bar
Saturation temperature	264.1	C
Inlet Steam		
Supply pressure	50.14	bar
Heating pressure	50.14	bar
Heating temperature	423.3	C
Mass flow	1.23	kg/s
Enthalpy	3253	kJ/kg
Exit Condensate		
Pressure	50.14	bar
Temperature	242.9	C
Mass flow	1.23	kg/s
Enthalpy	1051.5	kJ/kg
Inlet Water		
Pressure	121.2	bar
Temperature	237.8	C
Mass flow	25.16	kg/s
Enthalpy	1028.5	kJ/kg
Exit Water		
Pressure	120.9	bar
Temperature	260.5	C
Mass flow	25.16	kg/s
Enthalpy	1136.2	kJ/kg
Flash-in Stream		
Mass flow	0	kg/s
Enthalpy	1493.4	kJ/kg
Heat Transfer Data		
Heat transfer rate	2708.9	kW
Fouling factor	0.0000581	m ² -C/W
Water velocity	2.231	m/s
Water Reynolds number	222902	
Water pressure drop	0.3494	bar
Desuperheating section heat transfer coefficient	459.1	W/m ² -C
Condensing section heat transfer coefficient	4332	W/m ² -C
Drain cooler heat transfer coefficient	944.5	W/m ² -C
Desuperheating section LMTD	76.28	C
Condensing section LMTD	14.67	C
Drain cooler LMTD	12.57	C



A	B	C	D	E	F	G	H	I	J
6.633 m	5.834 m	0.2257 m	0.5252 m	-	-	-	-	-	-

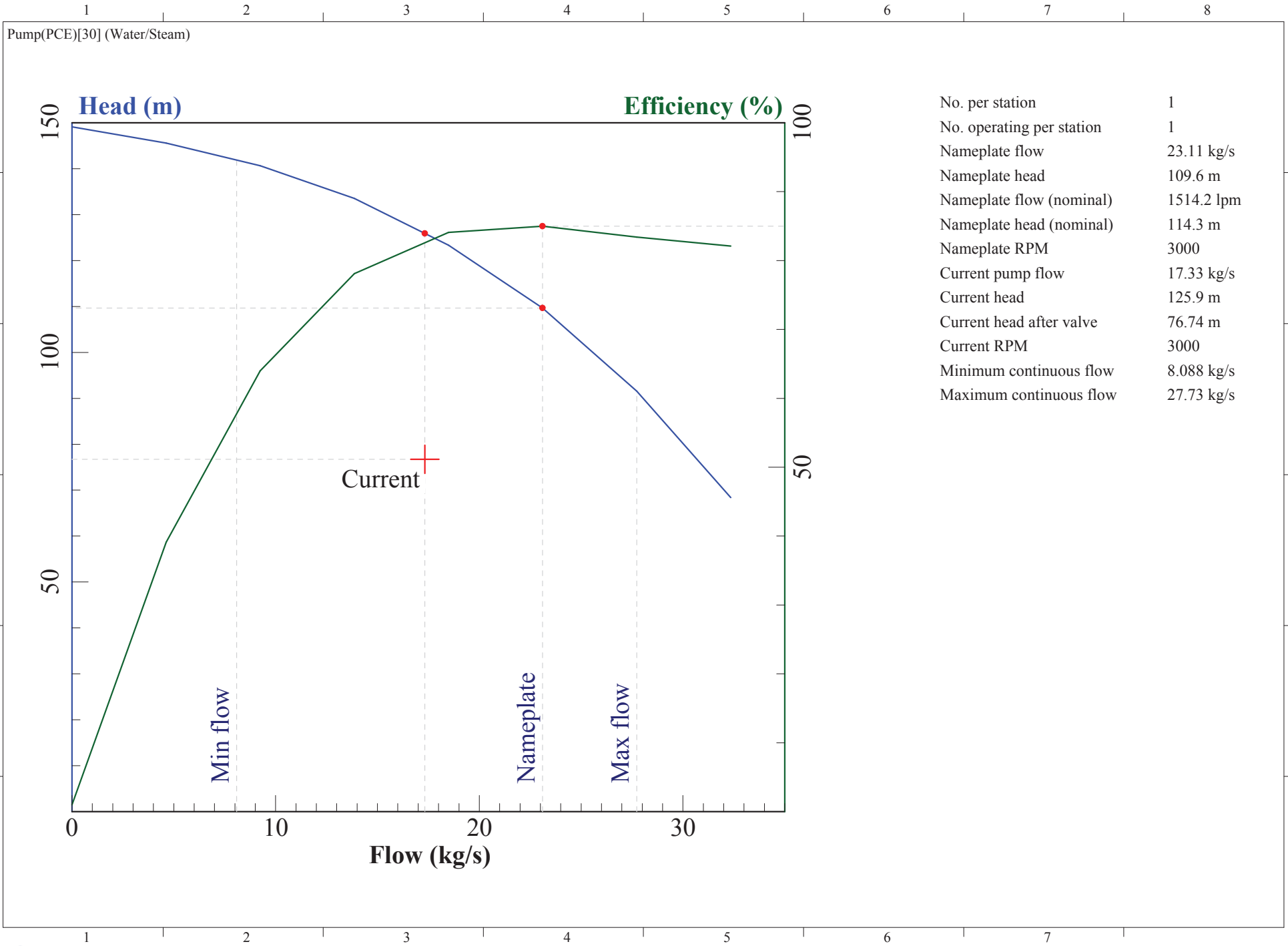


Pump (PCE) [30] - Specification

Estimated Pump Data		
Pump(PCE)[30]		
Pump type	Single stage centrifugal	
Drive type	Fixed RPM	
Number per station	1	
1. Nameplate Conditions (each)		
Nameplate (unrounded) mass flow	23.11	kg/s
Nameplate (unrounded) head	109.6	m
Nameplate volume flow	1514.2	lpm
Nameplate head	114.3	m H2O
Pump shaft speed	3000	RPM
Shaft power	40	hp
Pump isentropic efficiency	85	%
Pump mechanical efficiency	97	%
Baseplate length (each)	1.577	m
Baseplate width (each)	0.5561	m
Pump weight (each)	340.3	kg
Motor weight (each)	209.4	kg

Pump (PCE) [30] - Heat Balance

Off-design Heat Balance Results - Network determines flow		
Pump(PCE)[30]		
Type	Fixed RPM	
Number per station	1	
Number operating	1	
Suction Side (each)		
Pressure	0.8441	bar
Temperature	50.07	C
Mass flow	17.33	kg/s
Enthalpy	209.7	kJ/kg
Density	988	kg/m ³
Delivery Side (each)		
Pressure	8.28	bar
Temperature	50.27	C
Mass flow	17.33	kg/s
Enthalpy	211.1	kJ/kg
Performance Data (each)		
Pump pressure rise	12.2 (125.9)	bar (m)
Pressure rise after valve pressure drop	7.436 (76.74)	bar (m)
Pump shaft speed	3000	RPM
Pump isentropic efficiency	82.59	%
Pump apparent isentropic efficiency	50.34	%
Pump hydraulic work	25.9	kW
Pump mechanical efficiency	96.67	%
Pump shaft work	26.79	kW
Recirculation ratio	0	
Recirculation cooling load	0	kW
Motor efficiency	92.74	%
Electricity consumption	28.89	kW



1

2

3

4

5

6

7

8

A

A

Head (m)

Efficiency (%)

150

100

B

B

100

C

C

50

50

D

D

E

E

F

F

0

10

20

30

Flow (kg/s)

Min flow

Nameplate

Max flow

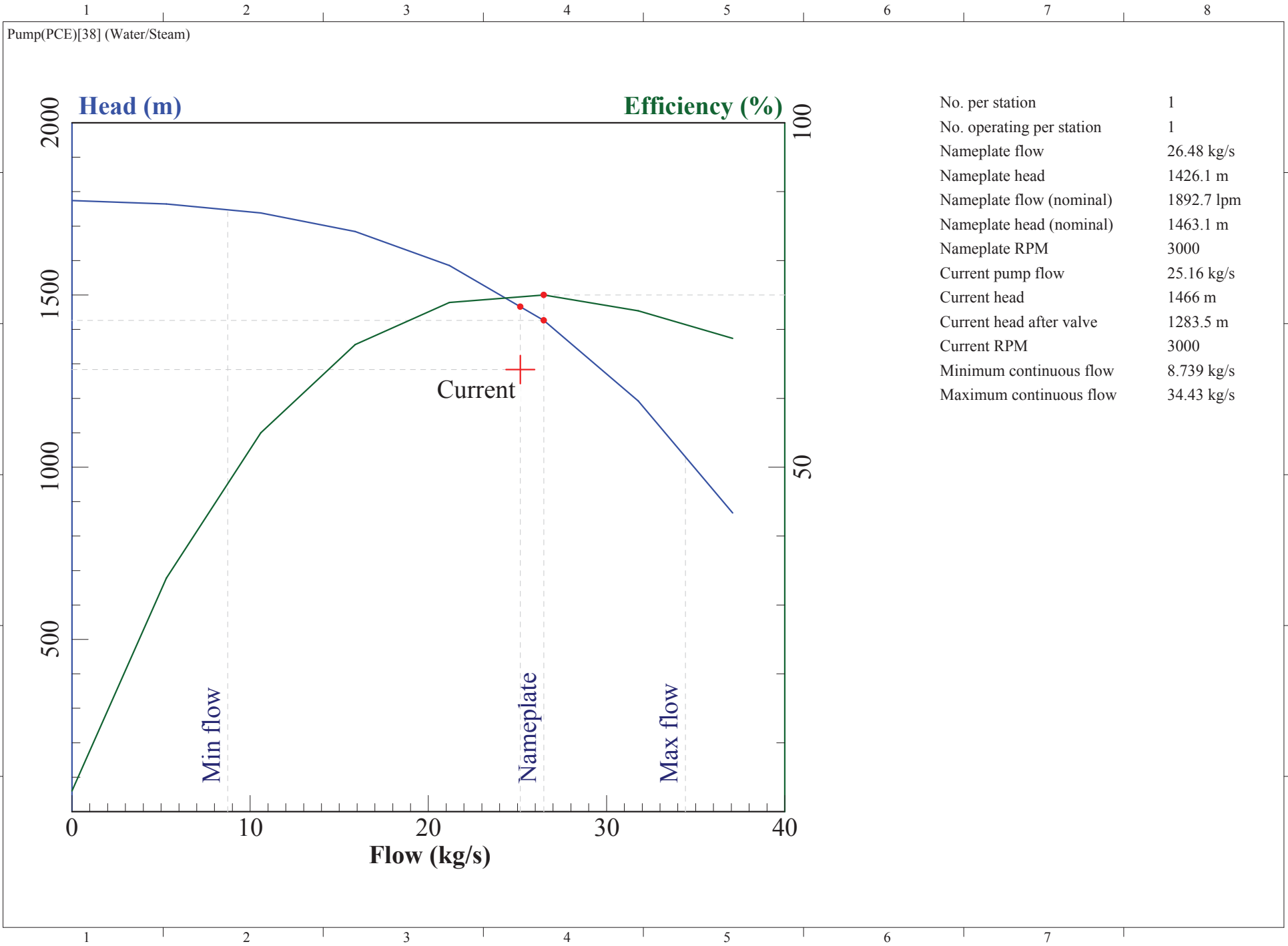
Current

Pump (PCE) [38] - Specification

Estimated Pump Data		
Pump(PCE)[38]		
Pump type	Multistage centrifugal	
Drive type	Fixed RPM	
Number per station	1	
1. Nameplate Conditions (each)		
Nameplate (unrounded) mass flow	26.48	kg/s
Nameplate (unrounded) head	1426.1	m
Nameplate volume flow	1892.7	lpm
Nameplate head	1463.1	m H2O
Pump shaft speed	3000	RPM
Shaft power	700	hp
Pump isentropic efficiency	75	%
Pump mechanical efficiency	97	%
Baseplate length (each)	2.93	m
Baseplate width (each)	1.051	m
Pump weight (each)	1857.9	kg
Motor weight (each)	1883	kg

Pump (PCE) [38] - Heat Balance

Off-design Heat Balance Results - Network determines flow		
Pump(PCE)[38]		
Type	Fixed RPM	
Number per station	1	
Number operating	1	
Suction Side (each)		
Pressure	7.776	bar
Temperature	162.5	C
Mass flow	25.16	kg/s
Enthalpy	686.3	kJ/kg
Density	905.1	kg/m ³
Delivery Side (each)		
Pressure	121.7	bar
Temperature	165.4	C
Mass flow	25.16	kg/s
Enthalpy	705.6	kJ/kg
Performance Data (each)		
Pump pressure rise	130.1 (1466)	bar (m)
Pressure rise after valve pressure drop	113.9 (1283.5)	bar (m)
Pump shaft speed	3000	RPM
Pump isentropic efficiency	74.73	%
Pump apparent isentropic efficiency	65.42	%
Pump hydraulic work	484	kW
Pump mechanical efficiency	96.95	%
Pump shaft work	499.2	kW
Recirculation ratio	0	
Recirculation cooling load	0	kW
Motor efficiency	96.05	%
Electricity consumption	519.8	kW



No. per station	1
No. operating per station	1
Nameplate flow	26.48 kg/s
Nameplate head	1426.1 m
Nameplate flow (nominal)	1892.7 lpm
Nameplate head (nominal)	1463.1 m
Nameplate RPM	3000
Current pump flow	25.16 kg/s
Current head	1466 m
Current head after valve	1283.5 m
Current RPM	3000
Minimum continuous flow	8.739 kg/s
Maximum continuous flow	34.43 kg/s

Pump (PCE) [49] - Specification

Estimated Pump Data		
Pump(PCE)[49]		
Pump type	Multistage centrifugal	
Drive type	Fixed RPM	
Number per station	1	
1. Nameplate Conditions (each)		
Nameplate (unrounded) mass flow	214.7	kg/s
Nameplate (unrounded) head	171.4	m
Nameplate volume flow	7571	lpm
Nameplate head	182.9	m H2O
Pump shaft speed	3000	RPM
Shaft power	700	hp
Pump isentropic efficiency	75	%
Pump mechanical efficiency	97	%
Baseplate length (each)	2.913	m
Baseplate width (each)	1.045	m
Pump weight (each)	1810.4	kg
Motor weight (each)	1845.7	kg

Pump (PCE) [49] - Heat Balance

Off-design Heat Balance Results - Network determines flow		
Pump(PCE)[49]		
Type	Fixed RPM	
Number per station	1	
Number operating	1	
Suction Side (each)		
Pressure	13.01	bar
Temperature	292.8	C
Mass flow	161	kg/s
Enthalpy	843.7	kJ/kg
Density	1902.7	kg/m ³
Delivery Side (each)		
Pressure	35.4	bar
Temperature	294.6	C
Mass flow	161	kg/s
Enthalpy	846.3	kJ/kg
Performance Data (each)		
Pump pressure rise	36.12 (193.6)	bar (m)
Pressure rise after valve pressure drop	22.39 (120)	bar (m)
Pump shaft speed	3000	RPM
Pump isentropic efficiency	72.38	%
Pump apparent isentropic efficiency	44.87	%
Pump hydraulic work	422.3	kW
Pump mechanical efficiency	96.65	%
Pump shaft work	436.9	kW
Recirculation ratio	0	
Recirculation cooling load	0	kW
Motor efficiency	95.99	%
Electricity consumption	455.2	kW

