



Technical Specification for Alfa Laval TVC Desalination Unit

Unit Type: Alfa Laval TVC-6-6000

Specification no.: TVC-6000-8-LP

Revision: 00

Date: 30-08-03

Made: AMA

Reviewed: JBN

Approved: BJA

Alfa Laval Copenhagen A/S

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ATTACHMENTS:

DOCUMENTS:

Doc. no.	
TVC-6000-8-LP-51	Design and Performance Data
TVC-6000-8-LP-52	Utilities Connections
TVC-6000-8-LP-53	Pump and Motor Data
TVC-6000-8-LP-54	Electrical Component Data
TVC-6000-8-LP-55	Dimension, Weight and Shipping Data - Provisional
TVC-6000-8-LP-57	Spare parts for 2 years Operation
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TVC-6000-8-LP-59	Consumables for 3 Month Operation
TVC-6000-8-LP-61	Document List
TVC-6000-8-LP-62	Vendor List
TVC-6000-8-LP-70	Heat and Mass Balance

DRAWINGS:

Dwg. no.	
PID-TVC-0002	P&I Diagram
MAT-TVC-0001	Standard Materials of Construction
EL-TVC-0001	Control Diagram

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1. DESIGN BASIS

Please refer to Document no.: TVC-6000-8-LP-51.

2. ALFA LAVAL SCOPE OF SUPPLY

<u>Item</u>	<u>Qty.</u>	<u>Description</u>
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01	1	ALFA LAVAL desalination plant, Type: TVC-6-6000 <u>Nominal production capacity: 6000 m³/24 hours</u> Each plant includes all necessary equipment, as detailed below:
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Each desalination plant consists of the following for field assembly by others:

- | | |
|---|---|
| 1 | Automatic filter 500 µm mesh, for filtration of evaporator feed flow. |
| 1 | Evaporator in AISI 316L, consisting of 6 effects each with titanium plate heat exchanger of the falling film type. Evaporator is supplied in 3 sections. |
| 1 | Set high efficiency chevron type poly-propylene demisters. |
| 1 | Condenser, shell and tube type, with Titanium tubes, integrated into the evaporator. |
| 1 | Thermo compressor in 316L SST, complete with de-superheating equipment. |
| 1 | Distillate pump, centrifugal type, complete with spacer coupling and electrical motor mounted on steel base plate. Pump wetted materials are Bronze / Duplex in accordance with EN / ISO standards. |
| 1 | Brine pump, centrifugal type, complete with spacer coupling and electrical motor mounted on steel base plate. Pump wetted materials are Bronze / Duplex in accordance with EN / ISO standards. |
| 1 | Set of seawater and brine piping in Poly-propylene (PP), in accordance with DIN norms and flange pressure rating PN 10. Supplied in spool pieces with fields welds at site by others. |

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2. ALFA LAVAL SCOPE OF SUPPLY

(continued)

<u>Item</u>	<u>Qty.</u>	<u>Description</u>
1		Set of distillate piping in 316L SST, in accordance with DIN norms and flange pressure rating PN 10. Supplied in spool pieces with fields welds at site by others.
1		Set of steam piping in carbon steel (CS), in accordance with DIN norms and flange pressure rating PN 16. Supplied in spool pieces with fields welds at site by others.
1		Vacuum system consisting of steam-ejector system.
1		Set of Instruments in accordance with Alfa Laval's standard vendor list.
1		Set of Valves in accordance with Alfa Laval's standard vendor list.
1		Set of walkways to provide access to evaporator, for operation and maintenance.
1		Local control panel with Allen Bradley PLC, supplied loose for installation by others in air-conditioned environment.
1		ALFA LAVAL Chemical dosing station for anti-scalant, with one dosing pump, and plastic tank (7 days capacity).
1		ALFA LAVAL Mobile Acid cleaning station, consisting of pneumatic transfer pump, plastic hoses and plastic mixing tank.

The scope of supply is fully described in this Specification and the Quotation, amongst others the following are not included in the Alfa Laval scope of supply:

- Civil works (including concrete evaporator supports).
- Insulation and site painting works.
- MCC, Cables, cable trays.
- Instrument air piping.
- Erection at site (including field welding of evaporator sections).
- Piping and cables outside the battery limit.

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3. CONSTRUCTION STANDARDS

As per Alfa Laval's standard specifications wherever applicable, otherwise according to the following :

- 1) Quality assurance based on Alfa Laval's certified ISO 9001 system.
- 2) Electrical equipment and components based on IEC standards.
- 3) Piping in accordance with DIN norms.
- 4) Design standard for vessels is in accordance to ASME VIII, Div.1, Sect. 1, with design pressure of 0 BarG.

4. PERFORMANCE TEST PROCEDURE

After successful commissioning, a performance test will be conducted in accordance with Alfa Laval's standard test procedure.

The Performance Test will have a total duration of 24 hours with the desalination unit operating at design parameters. During performance test following operation parameters will be registered and recorded:

- Net Production of Distillate Water
- Gain Output Ratio (GOR), based on net motive steam supplied to Thermo-compressor.
- Distillate Quality.

The above values shall be at the design values with a tolerance of +/- 5 %. It is required that all utilities will be available on an uninterrupted basis during the commissioning and testing of the unit at the specified design values.

Upon satisfactory completion of the Performance test, the performance Test Certificate will be issued and the plant Taken Over by the customer. Minor discrepancies, requiring corrections, can be noted on a Punch List attachment to the signed Performance Test Certificate with a date on which the parties have agreed that these corrections should be completed.

Should the desalination unit not meet the required guaranteed performance criteria, due to discrepancies attributable to the desalination unit, Alfa Laval shall make the necessary changes to the plant in order to rectify the problem and repeat the performance test.





5. PERFORMANCE CRITERIA FOR ALFA LAVAL TVC DESALINATION UNITS

The desalination system has been designed according to the parameters outlined in the foregoing sections, however, the performance of the system is also subject to the following criteria:

- a) Raw water supply shall be seawater with a concentration of no more than 4.5%. The sea water shall, be pre-filtered by the customer to remove suspended solids larger than 0.5 mm. Further, the seawater used shall not contain pollutants, such as oil, fat, detergents, organic matters, micro-organisms, algae, humic matter, mud, clay, sand, etc. Generally the allowance of such undesirable matter shall not surpass a content in the raw water supply that results in a fouling factor of the heat transfer surfaces higher than 15% of the normal practice within international desalination engineering practice. Moreover, the seawater supply shall not contain corrosive substances or gases such as H₂S, free Chlorine, Fluorine, etc. higher than stated in the specification or other substances which can alter the physical-chemical properties of the raw water.
- b) Supply of Utilities and consumables such as: Thermal energy, electric power shall be provided on a constant basis and at the values for voltage, Phases and Frequency required and specified in this quotation, and not presenting fluctuations of more than 5 %.
The pretreatment chemicals shall be dosed in the correct amount and type recommended by Alfa Laval. The raw water shall be supplied constant and without variations at the required flow, pressure and temperature as per this quotation.
- c) The equipment shall be properly operated in accordance to the instruction manuals provided by Alfa Laval for this purpose. Critical parameters shall be kept within the design values for: flows, pressures, temperatures, chemicals dosage, evaporating temperature, water recovery factor, maximum allowed brine concentration etc. plus proper observance of the maintenance procedures included in the manuals. Recording of the operation parameters plus written logging of the preventive and corrective maintenance will be the only valid documentation for evaluation of performance of the equipment delivered.
Improper physical handling of the equipment and components will cause immediate invalidation of guarantees of performance.
- d) No other water shall be used for the desalination plant other than that referred to in a) above.

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6. PROCESS DESCRIPTION FOR ALFA LAVAL TVC DESALINATION UNITS

Vapour compression refers to a distillation process where the evaporation of seawater is achieved by the application of heat from the condensation of a compressed vapour. Compression of the water vapour in the TVC type plant is by utilizing a steam jet ejector driven by live steam, provided from an external source, at pressures typically between 3.0 to 20.0 bar(g). The steam jet ejector recycles a portion of the vapour produced in the cold end of the desalination process, increases its pressure and temperature and then discharges this mixture as the heating media in the hot end of the desalination plant

Thermo-Vapour Compression (TVC) is an effective method of increasing energy efficiency in the distillation process. In multiple-effect seawater desalination, the evaporation and condensation processes take place in different chambers of the desalination unit, called effects. Seawater is evaporated in one effect and this vapour condensed in the subsequent effect at a lower pressure and temperature. The vapour produced in one effect becomes the heating media in the subsequent effect by yielding its latent heat of condensation. The remainder of the vapour produced in the last effect is condensed in a main condenser, which is typically cooled by seawater.

WORKING PRINCIPLE IN AN ALFA LAVAL TVC SYSTEM

The supplied seawater first enters the plant and flows through a condenser. In flowing through the condenser the seawater is heated-up by the condensation of the vapour produced in the last (cold) effect of the unit. The portion of the seawater acting as a coolant is rejected back to the sea. The remaining portion is delivered to the different effects of the unit in parallel, in order to be evaporated, and this pre-heated seawater stream is called make-up, or feed, water.

This preheated feed water is discharged into the evaporator/condensers of each effect, which are based on plate heat exchangers. The seawater flows over the evaporation side of the plates in an even and controlled falling film. While flowing down the plate surface, the seawater film is heated and partially evaporated by the heat obtained from the condensation of vapour on the other side of the plate. The released vapour passes through a demister and is transported to the subsequent effect on the condensation side of the plates. Here the vapour condenses into pure distillate water yielding its latent heat, and thereby evaporating the seawater, which flows on a falling film on the other side of the plates. This process is repeated in all effects of the desalination unit at successively reduced pressures and temperatures.

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6. PROCESS DESCRIPTION FOR ALFA LAVAL TVC DESALINATION UNITS

(continued)

The transport of fluids, such as vapour, distillate water and brine, within the evaporator is done by the pressure differential created between effects. The effect number one, which operates at the highest temperature (called hot end) has the highest pressure, the subsequent effects have lower temperature and pressure. This pressure differential is maintained throughout all the effects of the plant. The last effect is the one operating at the lowest temperature and pressure, therefore also called the cold end. The condensate or distillate produced in each effect is transported and collected in the last effect, where it is extracted by means of a centrifugal pump. The remaining seawater that was not evaporated (called brine) is cascaded down the effects and collected in the last effect, where it is discharged by means of a centrifugal pump.

The evaporation process takes place at temperatures typically between 70°C in the hot end and 45 °C in the cold end. Because the evaporation is done at sub-atmospheric conditions, vacuum is created by means of an ejector system, (driven by steam or water depending on plant size), which during start-up evacuates the air from the system, and during operation, maintains the vacuum by extracting the non-condensable gases. Those are discharged back to the sea together with the seawater coolant from the main condenser .

The TVC plant is provided with a chemical dosing system which injects constantly a polymer based anti-scalant in order to minimize the precipitation of CaCO₃ and MgOH scales.

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TVC-6000-8-LP-55	Dimension, Weight and Shipping Data - Provisional
TVC-6000-8-LP-57	Spare parts for 2 years Operation
TVC-6000-8-LP-58	Spare parts for Commissioning
TVC-6000-8-LP-59	Consumables for 3 Month Operation
TVC-6000-8-LP-61	Document List
TVC-6000-8-LP-62	Vendor List
TVC-6000-8-LP-70	Heat and Mass Balance

DRAWINGS:

Dwg. no.	
PID-TVC-0002	P&I Diagram
MAT-TVC-0001	Standard Materials of Construction
EL-TVC-0001	Control Diagram

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Product type:		TVC-6-6000 (Thermo Vapour Compression System)			
Doc. Title:		Design and Performance Data (per unit)			
Std. Doc. No:	TVC-6000-8-LP-51	Date:	Made:	Reviewed:	Approved:
Revision:	00	27-08-2003	AMA	JBN	BJA
Design Parameters		Value		Comments	
Capacity per unit		6.000	m ³ /day	Net as distillate	
Raw water composition		"Std. Seawater"			
Raw water salinity (%)		3,5 - 4,5			
Brine disposal		Back to sea			
Site Altitude		+ / - 5	m a.s.l.		
Ambient Temperature	Min. /Max.	+ 10 / 40	°C		
Type of installation		Out-doors			
Heating energy		Saturated Steam			
Performance Data		Value		Comments	
Distillate:					
	Flow	250,00	t/h		
	TDS	< 10	ppm (mg/l)		
	Pressure	2,0	bar (g)		
	Temperature (nominal)	45	°C		
Sea water:					
	Supply flow	2.200,0	t/h		
	Supply pressure	3,5	bar (g)		
	Temperature (min/max)	18 - 35	°C		
Brine/cooling water blow-down:					
	Flow	1.950,0	t/h		
	Pressure	1,0	bar (g)		
	Temperature	42 - 46	°C		
Heat Source:					
Steam heating:					
	Total flow	30,73	t/h		
	Pressure	3,5	bar (a)		
	Temperature	Saturated	°C		
Condensate:					
	Flow	30,73	t/h	Combined with distillate	
	Pressure	2,0	bar (g)		
	Temperature (nominal)	45	°C		
Venting steam:					
	Flow	1,30	t/h		
	Pressure	15	bar (a)		
	Temperature	234	°C		
Venting Condensate:					
	Flow	0,18	t/h		
	Temperature (nominal)	65	°C		
Vent + Vapour:					
	Flow	0,01	t/h	Non Condensable Gases	
	Temperature (nominal)	65	°C		

Product type:		TVC-6-6000 (Thermo Vapour Compression System)		
Doc. Title:		Design and Performance Data (per unit)		
Std. Doc. No:	TVC-6000-8-LP-51	Date:	Made:	Reviewed:
Revision:	00	27-08-2003	AMA	JBN
Approved:		BJA		
Performance:				
Gain Output Ratio (GOR)		8,1	kg/kg	$Flow_{dist}/Flow_{steam(thermocomp.)}$
Gain Output Ratio (GOR)		7,8	kg/kg	$Flow_{dist}/Flow_{steam(total)}$
Control air supply		4,0	m ³ /h	Min press. 7 bar (g)
Electric Power supply:				
Voltage		400	V	Other voltage available
Frequency		50	Hz	Other frequency available
Electrical Consumption	Nominal	130	kW	
Installed Electrical Load		219	kW	
Specific Electrical Consump.	Nominal	0,52	kW/m ³	Based on distillate flow
Specific Electrical Consump.	Guaranteed	0,62	kW/m ³	Based on distillate flow
Consumables:				
Antiscalant consumption (ALTREAT 400)		6 - 8	g/m ³	Alfa Laval ALTREAT 400

Product type: TVC-6-6000 (Thermo Vapour Compression System)				
Doc. Title: Utilities Connections (per unit)				
Std. Doc. No: TVC-6000-8-LP-52	Date:	Made:	Reviewed:	Approved:
Revision: 00	27-08-2003	AMA	JBN	BJA
Piping Connections	Connection Nom. D mm (*)	Pressure at B.L. bar (g)	Flow m³/h	Temp. °C
Seawater supply	650	3,5	2200,0	18 - 35
Blow Down and Cooling water	600	1,0	1950,0	42 - 46
Distillate and Condensate discharge	250	2,0	280,7	45
Heating Steam Input [T/h]	300	2,5	30,73	Saturated
Venting Steam Input [T/h]	50	14,0	1,30	234
Venting Condensate, drain	25	0,0	0,2	65
Drains	50	0,0		
Control Air, dry	25	7,0	4,0	-
Elec. Power Connections	Quantity	Voltage V	Req. Power kW	Installed Power kW
Control & MCC Panel, 3P and 1N	1	3 x 400	130	219
Earthing, connection to existing installation	1			
(*) Connections according to DIN standard				

Product type: TVC-6-6000 (Thermo Vapour Compression System)						
Doc. Title: Pump and Motor Data (per unit)						
Std. Doc. No: TVC-6000-8-LP-53			Date:	Made:	Reviewed:	Approved:
Revision: 00			27-08-2003	AMA	JBN	BJA
Pump No.	PU2	PU2 **)	PU3	PU4	PU5	PU6
	Blow down	Blow down	Distillate	Not used	Not used	Not used
Quantity	Number	1	1	1		
Pump Type	Centrifugal	Centrifugal	Centrifugal			
Norm	ISO / EN	ISO / EN	ISO / EN			
Medium	S.W. conc.	S.W.	Distillate			
Gravity (nominal)	kg/m ³	1.033	1.024	990		
Temperature	°C	42 - 46	18 - 35	45		
Salinity	%	6,0	3,5 - 4,5	< 10 ppm		
Flow, nominal	m ³ /h	652,9	902,9	280,7		
Head	m W.C.	25	25	35		
NPSH	m W.C.	3,5	3,5	3,5		
Pump Eta	%	60%	60%	60%		
Motor						
Speed	r.p.m.	1.500	1.500	1.500		
Efficiency	%	95%	95%	94%		
Power absorbed	kW	76,6	105,0	44,2		
Power consumed	kW	80,6	110,5	47,0		
Motor rating	kW	160,0	160,0	57,0		
** Start-up condition						

Product type: TVC-6-6000 (Thermo Vapour Compression System)									
Doc. Title: Electrical Components Data (per unit)									
Std. Doc. No: TVC-6000-8-LP-54						Date:	Made:	Reviewed:	Approved:
Revision: 00						27-08-2003	AMA	JBN	BJA
Type	Description	Quantity	Power rating kW	Power installed kW	Voltage/Freq. V / Hz	Nom. Current Amp.	Peak Current Amp	Protection	Insulation
Motor	Blow Down Pump	1	160,00	160,00	3 x 400 / 50	265,4	2.123,6	IP 55	F
Motor	Distillate Pump	1	57,00	57,00	3 x 400 / 50	94,6	756,5	IP 55	F
Motor	Chem. Dosing	1	0,50	0,50	230 / 50	2,7	21,7	IP 55	F
Panel	Electrical Panel	1	1,50	1,50	3 x 400 / 50	-	-	-	-
TOTAL POWER INSTALLED FOR DESALINATION UNIT				219	3 x 400 / 50				
TOTAL POWER CONSUMED FOR UNIT IN OPERATION				130	3 x 400 / 50				

Product type: TVC-6-6000 (Thermo Vapour Compression System)				
Doc. Title Dimension, Weight and Shipping Data - Provisional (per unit)				
Std. Doc. No:	TVC-6000-8-LP-55	Date:	Made:	Reviewed:
Revision:	00	27-08-2003	AMA	JBN
				Approved: BJA

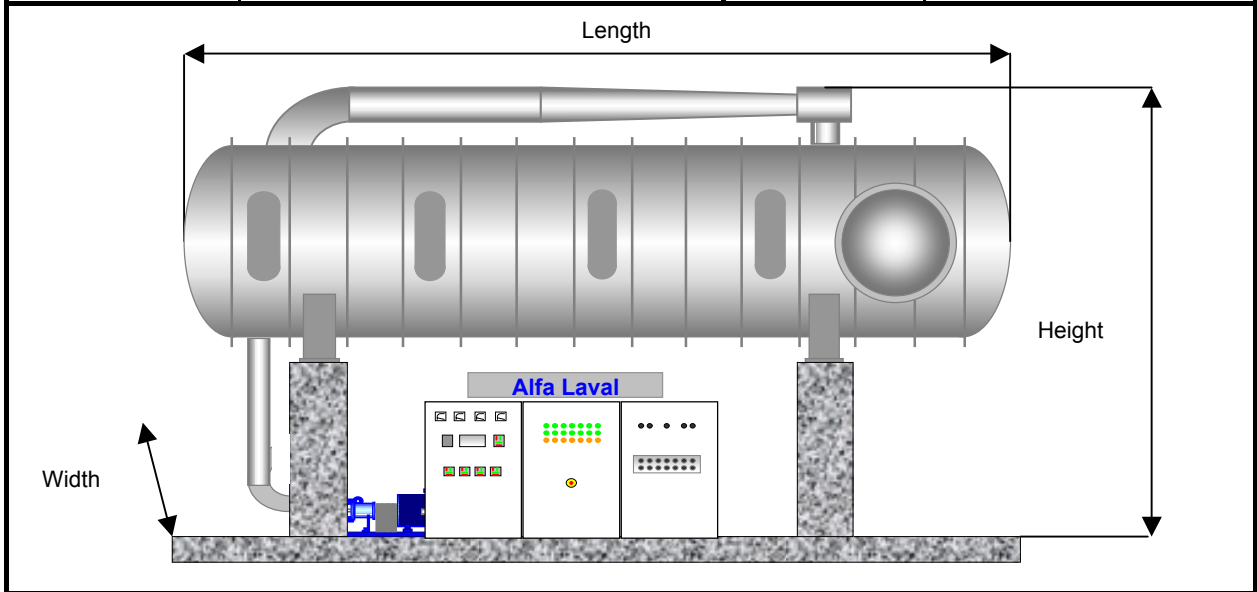
Shipping Data

Component	No. of consignment	Dimension l x w x h (m)	Consignment Weight (ton)	Total Weight (ton)	Total Volume (m ³)
Evaporator	3	19 x 5 x 5	50,00	150,00	180
Condenser	Incl. in Evaporator				
40 feet container (*)	2	12.2 x 2.4 x 2.6	30,48	60,96	155
SUMMATION				211	335

(*) Maximum Weight of container

Dimension & Weight

Dimension	m	Approx. Weight	ton
Total Length	56,0	Empty	188
Total Width	6,0	Water filled	697
Total Height	7,0	In operation	252
Service area around unit	2,0		



Product type: TVC-6-6000 (Thermo Vapour Compression System)				
Doc. Title: Spare Parts for 2 years operation (per unit)				
Std. Doc. No:	TVC-6000-8-LP-57	Date:	Made:	Reviewed:
Revision:	00	27-08-2003	AMA	JBN
				Approved:
				BJA
Tag No.	Article No.	Description	Quantity	Notes
PU2	TVC-6-6000-PU2-001	Blow Down Pump Mechanical seal	1	
	TVC-6-6000-PU2-002	Set of Gaskets	1	
	TVC-6-6000-PU2-003	Set of motor Bearings	1	
	TVC-6-6000-PU2-004	Set of wear rings	1	
PU3	TVC-6-6000-PU3-001	Distillate Pump Mechanical Seal	1	
	TVC-6-6000-PU3-002	Set of Gaskets	1	
	TVC-6-6000-PU3-003	Set of motor Bearings	1	
	TVC-6-6000-PU3-004	Set of wear rings	1	
CO	TVC-6-6000-CO-001	Main Condenser Set of Anodes	2	
	TVC-6-6000-CO-002	Set of Gaskets	2	
VE	TVC-6-6000-VE-001	Vessel Set of Gaskets for man holes	2	
	TVC-6-6000-VE-002	Set of Anodes	2	
CR	TVC-6-6000-CR-001	Thermo compressor Desuperheater nozzle	1	
	TVC-6-6000-CR-002	Set of Gasket	1	
EW	TVC-6-6000-EW-001	Evacuation Ejector Set of Gaskets	1	
CU	TVC-6-6000-CU-001	Antiscalant Dosing Unit Dosing pump	1	
	TVC-6-6000-CU-002	Injection nozzles	1	
	TVC-6-6000-CU-003	Set of Gaskets	1	
VA1	TVC-6-6000-VA1-001	Control Valve Actuator	1	each type
	TVC-6-6000-VA1-002	Gasket for spindle	1	each type
	TVC-6-6000-VA1-003	Solenoid valve	2	
	TVC-6-6000-VA1-004	Positioner	1	each type
VA	TVC-6-6000-VA-001	Manual Butterfly valves Valve lining	2	each size
	TVC-6-6000-VA-002	Valve disc	1	each size
	TVC-6-6000-VA-003	Instrument valve	2	each size
T	TVC-6-6000-LT-001	Transmitters Level Transmitter complete	1	
	TVC-6-6000-PT-002	Pressure Transmitter complete	1	
	TVC-6-6000-TT-003	Temp. Transmitter complete	1	
TI	TVC-6-6000-TI-001	Temperature gauge	1	each type
PI	TVC-6-6000-PI-001	Pressure gauge	1	each type

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Tag No.	Article No.	Description		Quantity	Notes
MC	TVC-6-6000-MC-001	MCC (if applicable)			
	TVC-6-6000-MC-002	Set of Aux. Relays		1	
	TVC-6-6000-MC-003	Set of Bulbs		1	
PA	TVC-6-6000-PA-001	Control Panel			
	TVC-6-6000-PA-002	PLC battery		1	
	TVC-6-6000-PA-003	PLC digital input card		1	
FF	TVC-6-6000-FF-001	Feed water filter			
	TVC-6-6000-FF-002	Filter basket element		1	
	TVC-6-6000-FF-003	Set of Gaskets		1	
CM	TVC-6-6000-CM-001	Conductivity Meter			
		Cond. Electrode element		1	

Product type: TVC-6-6000 (Thermo Vapour Compression System)					
Doc. Title: Spare Parts for Commissioning (per unit)					
Std. Doc. No:	TVC-6000-8-LP-58	Date:	Made:	Reviewed:	Approved:
Revision:	00	27-08-2003	AMA	JBN	BJA
Tag No.	Article No.	Description	Quantity	Notes	
PU2	TVC-6-6000-PU2-001	Blow Down Pump Mechanical seal	1		
	TVC-6-6000-PU2-002	Set of Gaskets	1		
PU3	TVC-6-6000-PU3-001	Distillate Pump Mechanical Seal	1		
	TVC-6-6000-PU3-002	Set of Gaskets	1		
CO	TVC-6-6000-CO-001	Main Condenser Set of Gaskets	1		
VE	TVC-6-6000-VE-001	Vessel Set of Gaskets for man holes	1		
CR	TVC-6-6000-CR-001	Thermo compressor Set of Gasket	1		
EW	TVC-6-6000-EW-001	Evacuation Ejector Set of Gaskets	1		
CU	TVC-6-6000-CU-001	Antiscalant Dosing Unit Injection nozzles	1		
	TVC-6-6000-CU-002	Set of Gaskets	1		
VA1	TVC-6-6000-VA1-001	Control valve Solenoid valve	1		
	TVC-6-6000-VA1-002	Positioner	1	each type	
VA	TVC-6-6000-VA-001	Manual Butterfly valves Instrument valve	1	each size	
TI	TVC-6-6000-TI-001	Temperature gauge	1	each type	
PI	TVC-6-6000-PI-001	Pressure gauge	1	each type	
MC	TVC-6-6000-MC-001	MCC (if applicable) Set of Aux. Relays	1		
	TVC-6-6000-MC-002	Set of Bulbs	1		
PA	TVC-6-6000-PA-001	Control Panel PLC battery	1		
FF	TVC-6-6000-FF-001	Feed water filter Set of Gaskets	1		
	TVC-6-6000-FF-002	Drain Valve	1		
CM	TVC-6-6000-CM-001	Conductivity Meter Cond. Electrode element	1		

Product type:		TVC-6-6000 (Thermo Vapour Compression System)			
Doc. Title:		Consumables for 3 month operation (per unit)			
Std. Doc. No:	TVC-6000-8-LP-59	Date:	Made:	Reviewed:	Approved:
Revision:	00	27-08-2003	AMA	JBN	BJA
Consumable	Type				Quantity kg Normal
Antiscalant	ALTREAT 400				15.602
Dechlorination (**)	Sodium Metha Bisulfite				0
Cleaning agent (*)	Sulfamic acid				2.238
Grease	For pump motors				1
(*) Data for one year, others for 3 months					
(**) Only when free Chlorine in feed water is higher than 0.5 ppm.					

Product type:	TVC-6-6000 (Thermo Vapour Compression System)			
Doc. Title:	Document List			
Std. Doc. No:	TVC-6000-8-LP-61	Date:	Made:	Reviewed:
Revision:	00	27-08-2003	AMA	JBN
Approved:	BJA			
Document Title	Comments			
Quality Plan				
Inspection & Test Plan				
Monthly Progress Report				
Monthly Project Schedule				
Process Flow Diagram (PFD)				
Piping & Instrument Diagram (PID)				
Equipment List				
Foundation Plan				
Valve List				
Instrument List				
General Arrangement				
Transport & Lifting Drawing (if applicable)				
Single Line Drawing (electric)				
Wiring Diagram				
Erection Manual				
O & M Manual				

Product type:	TVC-6-6000 (Thermo Vapour Compression System)			
Doc. Title:	Vendor List			
Std. Doc. No:	TVC-6000-8-LP-62	Date:	Made:	Reviewed:
Revision:	00	27-08-2003	AMA	JBN
Approved:	BJA			
Equipment Item	Vendor			
Pumps	FAPMO, KSB			
Motors	ABB, Siemens			
Thermocompressor	Korting, Croll Reynolds			
Vacuum System	Progetti, Korting, Croll Reynolds			
Filters	Alfa Laval			
Manual Valves	Alfa Laval std.			
Check Valves	Alfa Laval std.			
Control Valves	Alfa Laval std., Spirax			
Pressure Transmitters	Endress Hauser			
Temperature Transmitters	Endress Hauser			
Thermometers	WIKA			
Pressure Gauges	WIKA			
Level Transmitters	Endress Hauser, Klinger			
Conductivity Analyser	Endress Hauser			
PLC	Allen Bradley SLC			
I/P Positioner	Siemens			

