## **Tsurumi Production Network**



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Be sure to thoroughly read and understand the operation manual before using the equipment in order to operate correctly.

\*The units and values shown in this catalog are based on the International System of Units. \*Product images and specifications may differ from actual products due to improvements. \*The OO series and model OO are indicated with our series/model codes in this catalog.





Memorandum

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# **TSURUM PUMP** For The Earth, For All The People VMAF•VFF•VL

Liquid Ring Vacuum Pump For Condenser Extraction

Two stage type vacuum pump VMAF

Single stage type vacuum pump with gas ejector VFF

Single stage type vacuum pump with steam ejector VL for geothermal power plant

Single stage with gas ejector

**Fwo stage** 

Single stage with steam ejector

#### Introduction

At thermal and nuclear power plants, electricity is generated using steam. The steam that has passed through the turbine is sent into a large "condenser" where it is recovered as water to be reused for power generation.

Condenser vacuum pump removes non-condensable gas from the condenser to maintain a vacuum, thus contributing to the high power generation efficiency and the high cooling efficiency of the condenser.

The vacuum pump must be highly reliable because it operates constantly alongside the turbine as long as the plant is in operation.



#### Condenser Vacuum Pump

Conventionally, a steam ejector using high-pressure steam is used to extract air from the condenser. Recently, however, a liquid ring vacuum pump has become popular because of its operating convenience and a centralized control system that is widely adopted in power plants.

#### Features of The Liquid Ring Vacuum Pump

The liquid ring vacuum pump, which can be started up without using steam, can immediately create a large-capacity vacuum when supplied with electric power and water.

The pump's simple structure, which is designed for continuous rotation, reduces vibrations and noise, and enables easy maintenance.

#### Application example of a condenser liquid ring vacuum pump (Thermal power plant)





#### **Extensive Supply Record**

Chiefly intended for use in power plants (thermal, nuclear, etc.), Tsurumi condenser vacuum pumps are designed to meet the requirements of American HEI\* standards, making it quick and easy to find the most suitable model. Moreover, the vacuum pump that best fits the individual condenser specifications of geothermal, waste and independent electric power plants can also be selected. \* Heat Exchange Institute Inc.



#### Applications of Condenser Vacuum Pump

#### **Geothermal Power Plant**



Vacuum Pump for Condenser Gas Extraction System 250VL4280G, 280 kW × 275 min<sup>-1</sup> 184 m³/min x 33.6 kPa (abs)



Steam Ejector for Condenser Gas Extraction System

Marine

#### Waste Power Plant

**Biomass Power Plant** 



Condenser Vacuum Pump 40VDP45.5, 5.5 kW × 1800 min<sup>-1</sup> (S.S) 2.42 m<sup>3</sup>/min x 40 kPa (abs)

Condenser Vacuum Pump 80V-F615, 15 kW × 1150 min<sup>-1</sup> 2.78 m<sup>3</sup>/min x 64 mbar (abs)

#### Independent Electric Power Plant



Condenser Vacuum Pump 50VMAF411, 11 kW x 1450 min<sup>-1</sup> 3.7 m<sup>3</sup>/min × 20.21 kPa (abs)

#### Applications of Vacuum Pump for Power Plant Equipment



#### Flue Gas Desulfurization (Gypsum Dewatering)

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Flue Gas Desulfurization Vacuum Pump 250V690V, 90 kWx500 min-1 140 m<sup>3</sup>/min × -67 kPa (G)

#### Bag Filter for Fly Ash Handling





8 m<sup>3</sup>/min × 11.77 kPa (abs)



Water Box Priming Pump 65VP411, 11 kW × 1450 min<sup>-1</sup> 3.86 m<sup>3</sup>/min × 22.3 kPa (abs)





Bag Filter for Fly Ash Handling Vacuum Pump 65V611, 11 kW×1150 min<sup>-1</sup> 5.5 m<sup>3</sup>/min × -500 mmHg(G)

## Condenser Vacuum Pump (Two Stage Type Vacuum Pump)

#### Dimensions and Equipment Configuration









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#### Standard Configuration

Inlet × Outlet (mm)	Package Model		Pump Model	Pump Model Motor Output (kW)		Speed (min <sup>-1</sup> )	
	50Hz	65VMAF415	CEC//MA 190	15	4	1450	
00 × 00	60Hz	65VMAF422	05EVIVIA 180	22	4	1750	
	50Hz	65VMAF422	655VMA 100	22	4	1450	
69 × 69	60Hz	65VMAF430	- OSEVINA TOU	30	4	1750	
105 × 105	50Hz	125VMAF630	125EVMA280	MA280		980	
125 × 125	60Hz	125VMAF830	125EVMA365	30	8	890	
150 × 150	50Hz	150VMAF845		45	8	740	
150 × 150	60Hz	150VMAF1045	15UEVIVIA405	40	10	710	
150 - 150	50Hz	150VMAF855	1505///// 495	55	8	740	
150 × 150	60Hz	150VMAF1055	150EVIVIA485	55	10	710	
200 × 200	50Hz	200VMAF1290	2005////4500	90	12	495	
200 × 200	60Hz	200VMAF1490	200EVIVIA390	90	14	510	
000 × 000	50Hz	200VMAF10110	2005\/MAE00	110	10	- 590	
200 × 200	60Hz	200VMAF12110	2002100390	110	12		
	50Hz	250VMAF12132	2505\/MA690	122	12	495	
250 × 250	60Hz	250VMAF14132	LOUEVIVIAOOU	132	14	510	
050 × 050	50Hz	250VMAF12160		160	12	495	
250 × 250	60Hz	250VMAF14160	20UEVMA695	100	14	510	

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Equipment configuration Equipments Name No. 1 Liquid Ring Vacuum Pump 2 Motor 3 Separator Tank (4) Seal Liguid Cooler 5 Seal Liquid Pump

#### Dimension · Weight

<b>;</b>	Q'ty		
	1		Package Model
	1		65VMAF
	1		125VMAF
	1		150VMAF
	1		200VMAF
	1		250VMAF

#### Sectional Drawing

Please request detailed drawings separately if using for design purposes.



(3)



No.	Discription	Material	Q'ty
1	Casing	FC200 A48 CL30*	1
2	Casing	FC200 A48 CL30*	1
3	Side Cover	FC200 A48 CL30*	1
4	Side Cover	FC200 A48 CL30*	1
(5)	Impeller	SCS13 A351 CF8*	1
6	Impeller	SCS13 A351 CF8*	1



L (mm)	W (mm)	H (mm)	Dry Mass (kg)	Ope.Mass (kg)
2500	1100	1500	820	900
3300	1700	2250	2100	2300
4700	1900	2650	4400	5000
5800	2200	2350	8000	8900
6800	2300	2550	10700	12000

No.	Discription	Material	Q'ty
1	Port Plate	FC250 A48 CL35*	1
8	Port Plate	FC250 A48 CL35*	1
9	Port Plate	FC250 A48 CL35*	1
10	Port Plate	FC250 A48 CL35*	1
1)	Shaft	SUS420J2 A276 S42000* (S45C AISI 1045*	1



type vacuum pump can be watched in the movie.

\* Equivalent to ASTM

## Condenser Vacuum Pump (Single Stage Type Vacuum Pump with Gas Ejector)

#### Dimensions and Equipment Configuration

## VFF







#### Standard Configuration

Inlet × Outlet (mm)	F	Package Model	Pump Model	Motor Output (kW)	Poles (P)	Speed (min <sup>-1</sup> )	
150 × 150	50Hz	150VFF845	1505//5	45	8	740	
150 × 150	60Hz	150VFF1045	130EVF	45	10	710	
175 × 175	50Hz	175VFF855	1755//5	55	8	740	
175 ~ 175	60Hz	175VFF1055	175EVF	55	10	710	
000 × 000	50Hz	200VFF1075A	200EVE 201	75	10	585	
200 ~ 200	60Hz	200VFF1275A		/5	12	000	
200 × 200	50Hz	200VFF1075B	2005/5 202	75	10	585	
200 ~ 200	60Hz	200VFF1275B	200207-202	/5	12		
200 × 200	50Hz	200VFF1090A		00	10	595	
200 × 200	60Hz	200VFF1290A	200EVF-200	90	12	060	
250 × 250	50Hz	250VFF12132	25051/5	122	12	495	
	60Hz	250VFF14132	ZOUEVF	132	14	505	



Equipment configuration Equipments Name Q'ty No. 1 Liquid Ring Va 2 Motor ③ Separator Tar Seal Liguid Co 5 Seal Liquid P 6 Gas Ejector

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#### Dimension · Weight

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acuum Pump	1	Package Mode
	1	150VFF
nk	1	175VFF
ooler	1	200VFF
ump	1	250VFF
	1	Please request det

Sectional Drawing



L (mm)	W (mm)	H (mm)	Dry Mass (kg)	Ope.Mass (kg)
2900	2400	1900	4000	4300
3150	2400	2100	4700	5000
3400	2800	2250	7100	7600
4300	3000	2600	10000	10800

etailed drawings separately if using for design purposes.

No.	Discription	Material	Q'ty
1	Casing	FC200 A48 CL30*	1
2	Side Cover	FC200 A48 CL30*	1
3	Side Cover	FC200 A48 CL30*	1
4	Impeller	FCD500	1
(5)	Port Plate	FC250 A48 CL35*	1
6	Port Plate	FC250 A48 CL35*	1
1	Shaft	SUS420J2 A276 S42000*	1

\* Equivalent to ASTM

#### [Energy saving] Suggestion of The Hybrid System Liquid Ring Vacuum Pump for Geothermal Power





#### Introduction

While there is a great interest in development of the renewable energy, geothermal power generation is one of the energy hoped to become common. As geothermal power is generated by driving a turbine using natural steam gushed out from deep under the earth, unnecessary to burn fossil fuels that, it is considered as a clean energy, cause which only emit minimum carbon dioxide, which is believed to be a causative factor of global warming. Our liquid ring vacuum pumps active in these geothermal power plants as a gas extraction equipment for a long time.

In recent years, the demand for large size power plants has been increased especially around Southeast Asia area, so we are strongly requested for improvement in efficiency of equipment in order to increase the power generation efficiency. To meet such market's needs, we Tsurumi improved the former models by adding our new design technique.

#### **Outline flow of the Geothermal Power (Hybrid system)**



Gas extraction system is used for vacuum retention of a condenser, extracting the non-condensable gas in a geothermal steam used for the power generation. The operating pressure of the gas extraction system is low (high vacuum) and big capacity, so basically combined system is adopted, steam ejector for the first stage, and liquid ring vacuum pump for the latter part. We Tsurumi design the most suitable load balance between a steam ejector and liquid ring vacuum pump, and contribute to success in the upgrading of generating efficiency.

Our former bigger size liquid ring vacuum pumps are developed targeting low vacuum area, hence the efficiency in a high vacuum area is sacrificed, but this time, we improved the performance and efficiency in a high vacuum area to correspond the low pressure ratio of steam ejector.

Steam Ejector



### Sectional Drawing for Liquid Ring Vacuum Pump



#### Standard Configuration

Pump Model	Bore (mm)	Speed (min <sup>-1</sup> )	Motor Output (kW)	Approx. Seal Wa Flow Rate (ℓ/min)
		380	250	320
200EVL4137	200×2	415	280	360
		460	350	490
		345	280	360
250EVL5137	250×2	375	350	450
		415	420	590
		310	370	480
250EVL6137	250×2	340	420	540
		375	500	700
		285	450	580
300EVL7137	300×2	310	500	650
		345	600	840
		245	510	650
400EVL8137	400×2	265	600	770
		295	750	1050

Spraying the motive steam through the folding-fan shaped nozzle, and this motive steam flows into the ejector bringing the extracted gas from the condenser, and boost the pressure in the ejector, then discharge to the latter part. In case you make the compression ratio of ejector suction and discharge smaller, necessary motive steam consumption would decrease. Motive steam is the geothermal steam used for power generation, and cutting back on consumption, using the redundant steam for power generation, so it connects to the upgrading of generating efficiency.

No.	Discription	Material	Q'ty
1	Casing	SUS316L A276 S31603*	1
2	Side Cover	SCS16 A351 CF3M*	1
3	Side Cover	SCS16 A351 CF3M*	1
4	Impeller	SUS316L A276 S31603*	1
5	Port Plate	SCS16 A351 CF3M*	1
6	Port Plate	SCS16 A351 CF3M*	1
7	Shaft	SUS420J2 A276 S42000*	1

\* Equivalent to ASTM



#### Inquiry form

#### Condenser Vacuum Pump

Company Name						Date		
Company address						Telephone	1	
Your department						FAX		
Your name			E-Mail					
Quantity	Opeation	ľ	Stand-by			Total		
Seal liguid supply	A. Once thro	bugh		B. To	otally recirc	ulation		
Location	A. Indoor			B. Outdoor				
Holding capacity	Extracted air		kg/h	Extra	acted steam	1		kg/h
Suction press.(Holding)								kPa (abs)
Hogging capacity	Extracted air	Extracted air					kg/h	
Suction press.(Hogging)	Suction press. (Hogging) kPa (a					kPa (abs)		
Total extraction volume(Hogg	traction volume (Hogging) m <sup>3</sup> Ret			me(Hog	gging)	from atmospher	c pressure to	min kPa (abs)
Operating temp.		۵°	Normal ope	Normal operating press.				kPa (abs)
Design temp.		Desig	Design press.				kPa (G)	
	Seal liguid cooler							
Туре	A. Plate			B. S	hell & tube			
Cooling water source			Cooling water d	Cooling water design press./temp.		MPa	a(G)	°C
Cooling water temp.		٥°	Applicab	Applicable standard				
		Conde	enser					
Cooling water source			Cooling	Cooling water temp.				°C
Operating temp.		°C	Normal ope	erating p	oress.			kPa (abs)
Seal liguid name								
Seal liguid temp.		°C	Seal lig	uid pres	SS.			MPa(G)
Supplier of motor	A. Tsurumi			B. C	ustomer			
Protection of motor			Applicab	le stand	lard			
Drive power	AC 3 <i>φ</i>	Voltage		V	Fre	equency		Hz
Instrument power	AC 1 <i>φ</i> DC	Voltage		V	Fre	equency		Hz
Heater power	AC 1 <i>φ</i>	Voltage		V	Fre	equency		Hz
Spare parts								
Remarks								

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