TACMINA

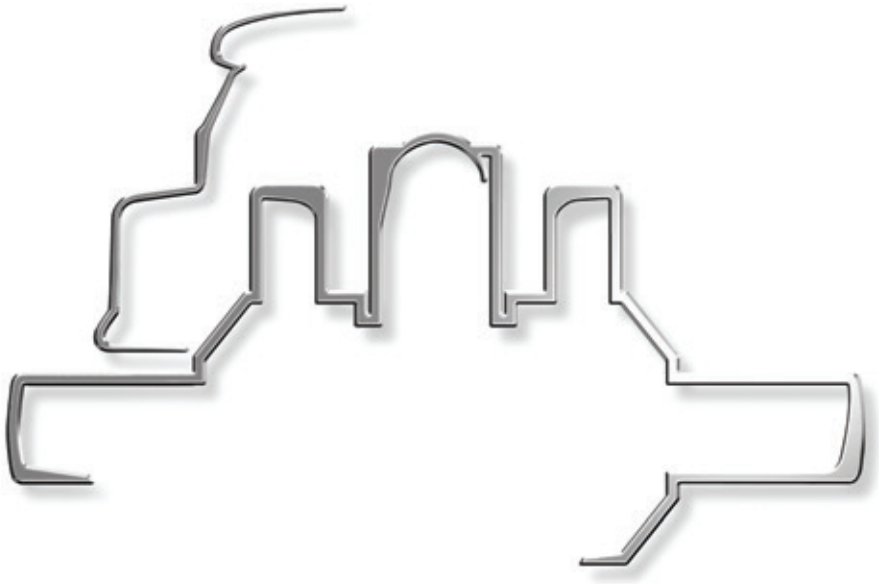
Smoothflow Pump

TPL

High-precision

Hydraulic type

Metered supply



[Excellence]

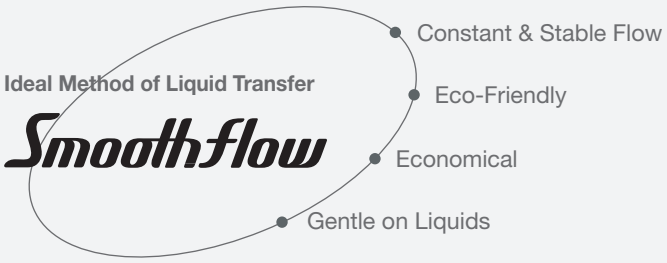
A transfer system exceeding
the conventional concept of pumps,
TACMINA TPL Series

It has been common knowledge that satisfactory pulseless performance cannot be expected from diaphragm-type metering pumps which repeat the reciprocating in the high-tech field, where micron-unit precision is required. TACMINA has defied this common knowledge of the industry.
TACMINA concentrated the technical power cultivated over half a century, gave functional priority, and eliminated precision errors to the limit. As a result, TACMINA has developed a diaphragm-type metering pump with an innovative design, excellent maintainability, and pulseless performance defying the conventional concept of diaphragm-type metering pumps.
It may be more suitable to call the TPL Series a system rather than a pump due to the state-of-the-art specifications of the product.
TPL Series, the new current of liquid transfer, will increase the production efficiency of a variety of applications including those in the high-tech field, thus assuring you of great safety and reliability.

Good Design Award 2002

For Those Who Want Total Control in Liquid Flow

Smoothflow — the ideal method of liquid transfer. This innovative method not only meets your liquid transfer needs, but provides optimal solutions to Man, liquids and the environment as well.
TACMINA's Smoothflow technology, based on unique know-how cultivated over 50 years, delivers you ultimate performance and provides complete satisfaction.



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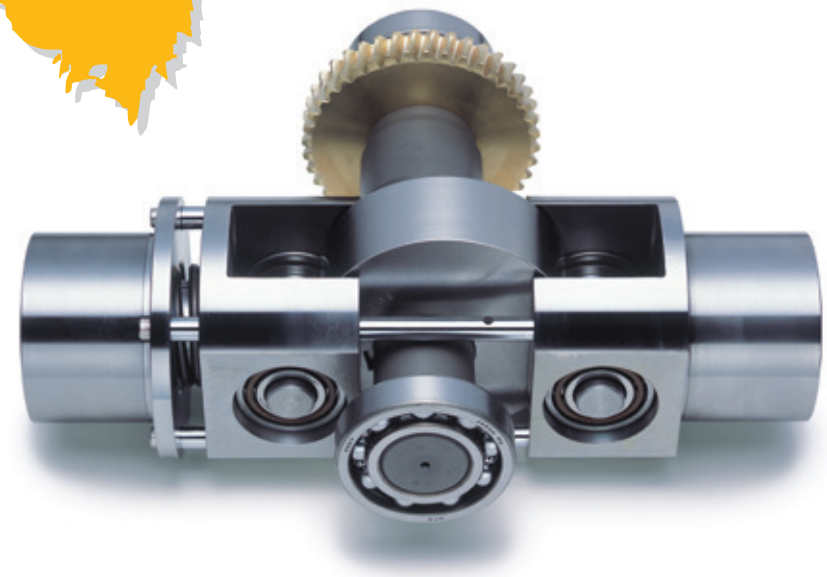
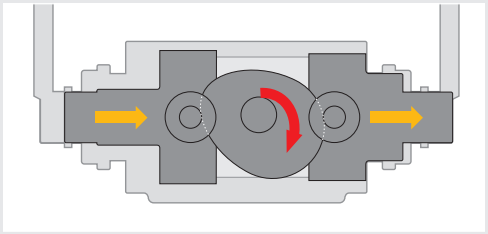
[Outstanding Controllability]

High precision at
a maximum repeatability
of ±0.1% or less and
pulsation rate of ±1% or
less ensured with
a pulsation control
technique.



“No high performance excels simplicity.
Unprecedented pulseless characteristics have been provided by attaching importance to the basic performance.”

“It is a unique layout of a single-cam horizontal-opposed cylinder and a special-formed eccentric cam itself, developed by TACMINA, that supports the unprecedented pulseless performance and ultra-constant flow characteristics of the TPL. Generally, a duplex pulseless pump always generates pulsation unless the two cams are installed precisely with a difference of 180˚ in phase angle. With the recent development of technology, it is possible to manufacture high-precision pumps in any forms these days. No pumps are, however, better than those of simple structure in order to increase the reliability of the pumps. The ideal shape is a design with our special-formed eccentric cam and two cylinders laid out on a straight line. By laying out each cylinder on both sides of the cam, the single cam moves two cylinders at the same time. Then a phase angle of 180˚ is precisely obtainable, and the performance of the special-formed eccentric cam is 100% transmitted to the shaft. Moreover, straight line processing is very easy. Extremely speaking, high-precision processing can be easily performed with any lathes. No forms are easier to make than a form consisting of straight lines. We considered making use of this ideal form for the production of the TPL. The unique shape of the TPL was the results of our consistency to the pulseless characteristics to the limit.”



Motion of cam and pistons

“There was one more technique indispensable to improvement in the performance of the TPL, i.e., a mechanism of a roller pin in contact with the inner race. The motion of the special-formed eccentric cam is transmitted to the shaft through the roller pin. The smaller the contact area of the cam and roller is, the higher the precision of the pump is. In order to suppress the pulsation of the pump to the limit, it was necessary to downsize the diameter of the roller pin as much as possible. Then we focused on the inner diameter of the bearing. We contrived a method in which the cam is supported by the inner rings of the bearings through the roller pin. On the other hand, the conventional cam is supported by the outer ring of the bearing that is larger in diameter. This made it possible to manufacture a high-precision drive system with minimum loss of transmission. Furthermore, unlike the conventional method, where a large single bearing is used, the new method employed two bearings attached to each side of the roller pin. This method halved the load on each bearing as well as downsized the pump with improvement in durability. It is true that simple is best.”

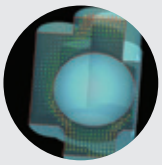
Inspection of TPL

■An excellently constant flow is realized by the adoption of special-formed eccentric cam.

A conventional duplex metering pump converts the rotary motion of cam into reciprocating motion, thus causing pulsation. The TPL's unique special-formed eccentric cam solved this problem. By keeping the total sum of discharge volume of both left and right pump heads, it has achieved unprecedented ultra-constant liquid flow.

■Precisely transfers extremely small amounts.

The TPL employs a special valve seat mechanism that maintains high precision at the time of liquid transfer no matter how small the amount is. This is ideal for applications, such as chemical mixing processes where accurate mixing ratios and transferred amounts are required.



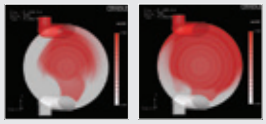
3D analysis of valve sheet

■A perfect sealing with no liquid leakage.

The TPL has no movable sealing parts, thus ensuring no worry of liquid leakage or the exposure of transferred liquid to the air. The TPL is not only ideal for toxic or easy-to-evaporate liquid but also suitable to clothes, cosmetics, and food production processes, because there is no fear of the generation or contamination of foreign matters. Furthermore, the TPL supports HACCP (Hazard Analysis and Critical Control Point) applications.

■No damage to liquid and no fear of liquid degradation

Unlike other pumps, the TPL does not stir or locally compress liquid. This enables the transfer of food, chemical liquid, or slurry, the properties of which are not allowed to deteriorate as a result of shearing, abrasion, or pressure or temperature changes.



3D analysis of interior of pump head component

[Space-saving]

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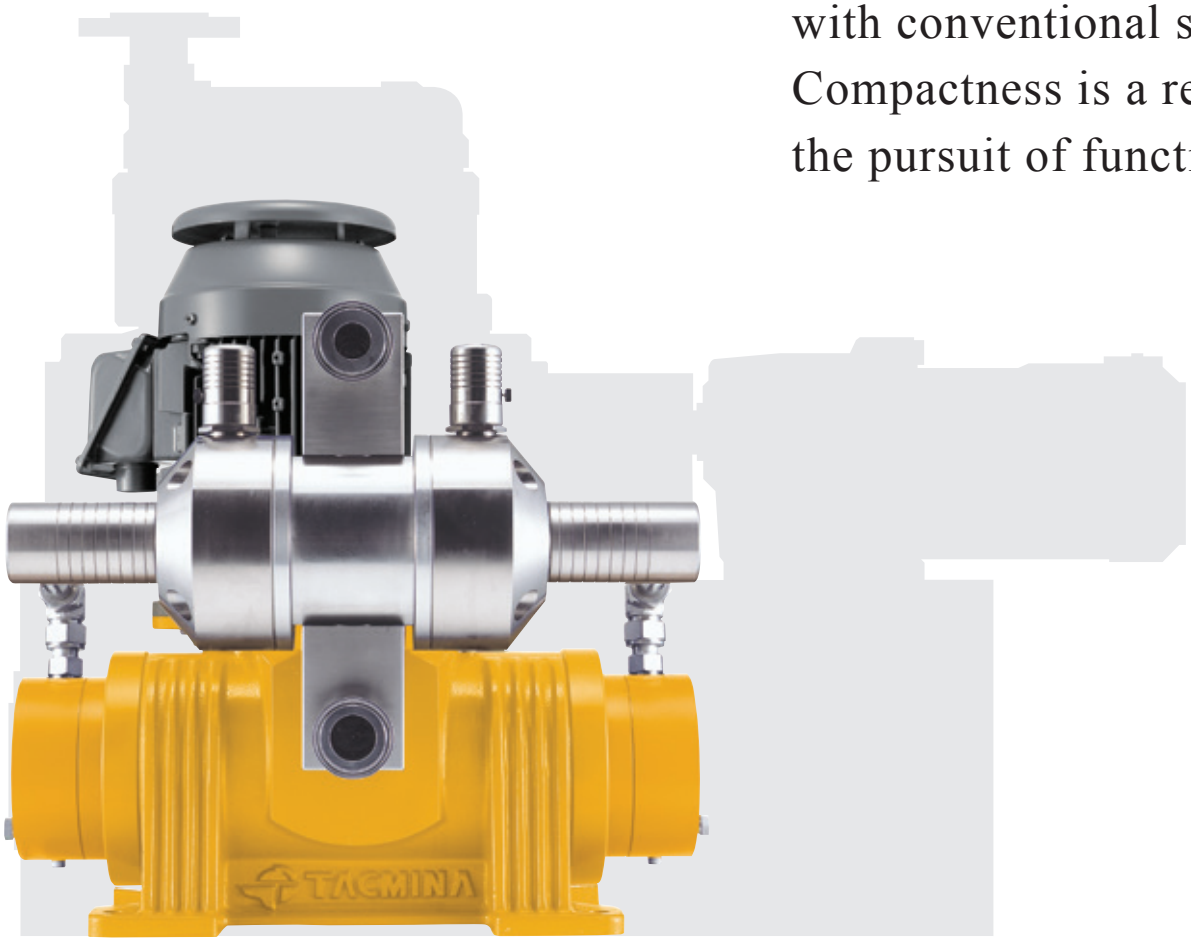
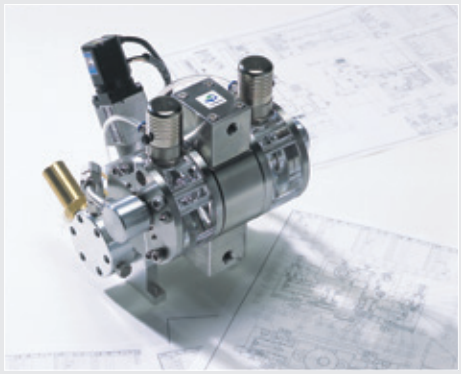
Approximately 1/2 compared
with conventional size.
Compactness is a result of
the pursuit of functional beauty.



Size comparison with TACMINA's conventional products

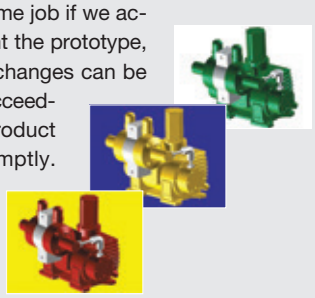
"TACMINA's unique design has attained unprecedented compactness without being entrenched by the conventional concept."

"The TPL is so compact that the required installation area is approximately 1/2 of that of a conventional metering pump on the condition that they are the same in capacity. In fact, the TPL has been in this compact form since the very beginning of development. The pump heads of the conventional pump protrude from the main component. Then pipes are connected to the end of the pump heads in usual cases. We started designing the TPL as a hydraulic diaphragm-type pump from the beginning. We did not only eliminate the pipes, but we succeeded in integrating the two pump heads and built it on the front side of the main component. This led to the compactness of the main component. Moreover, the design significantly improved the rigidity of the pump. Unlike conventional metering pumps, a high load is not imposed on the pump head component. Therefore, the structure of the TPL does not easily allow liquid leakage. The TPL is also the concentration of functional beauty. Consequently, the good balance of its functions and design was recognized in the industry, and the TPL won the 2002 Good Design Award. TACMINA's unique design has made the unparalleled pump that excels others in the world."



TPL prototype

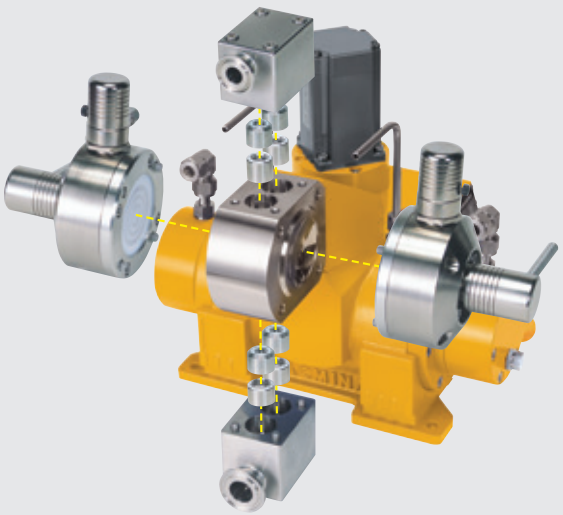
"We did not only eliminate redundancy from the form. In fact, we made full-fledged use of a 3D CAD system from the beginning of this project, and we have been making progress in the streamlining of the development process since then. In a conventional method, a prototype is produced with conventional product parts after a plan is made. The details of the product including specifications are finalized while performance tests of the product are conducted repeatedly. In the case of the TPL, we created a three-dimensional model based on 3D CAD data first, and finalized the basic form and color of the TPL before we made a prototype. Coloring is a troublesome job if we actually paint the prototype, but virtual coloring is easy and any changes can be made on the data. As a result, we succeeded in the development of this new product in response to users' needs promptly. Besides, we succeeded in establishing an efficient development style from viewpoints of production stages and budgets."



Color CG samples

■A subminiature design with an approximately 1/2 of the conventional installation area of TACMINA's conventional models

A compact body was designed by making full-fledged use of a 3D CAD system with a thoroughgoing analysis of the material and rigidity of all the detailed parts of the pump. The required area of installation is almost half of that of TACMINA's conventional models of the same capacity. This has solved a variety of problems in installation places, piping work, and maintenance.



■Efficient equipment greatly reduces loss of materials.

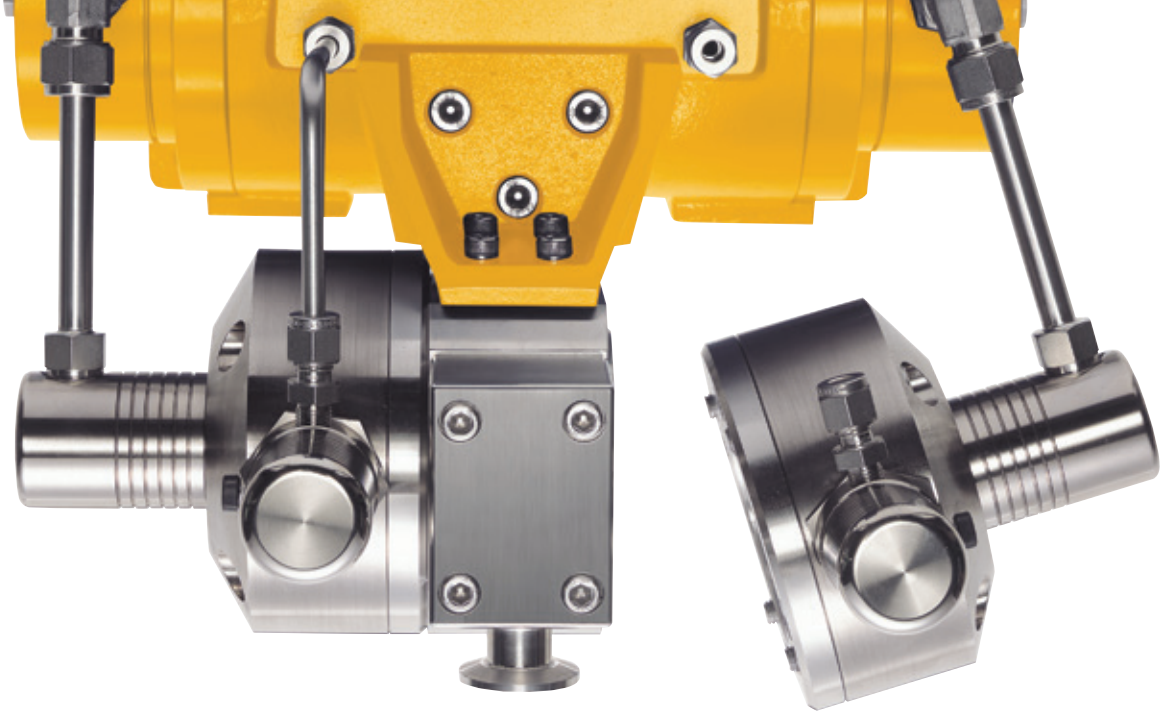
The interior capacity of the pump was downsized with the integration of the two pump heads. Furthermore, the TPL is pulseless, which makes it possible to downsize the diameter of the pipes, valves, and elbows on the discharge side. Therefore, loss of expensive process fluids can be minimized.

■Ideal production processes improve productivity.

Pulse elimination realizes the automatic, continuous operation of process lines. The TPL has solved conventional problems in production processes, such as efficiency (time contraction), improvement in yielding (production efficiency), and labor saving (labor efficiency). Furthermore, the TPL does not let the fluid come in contact with the open air, contamination with air bubbles, or irregular infusion, thus significantly improving product quality.

■Its functional beauty won Good Design Award.

As a result of the pursuit of the performance breaking the conventional concept of reciprocating pumps, the unique design of the TPL was highly evaluated and the TPL won the 2002 Good Design Award for the industrial machinery sector.



Modular body with
side-opening system
changes maintenance.

[Easy Maintenance]

“How to reduce users' maintenance effort.
The answer was the modular pump
and side-opening head component.”

“The TPL has already made actual results mainly in the fields of film coating and semiconductor production, where the excellent pulseless performance of the TPL is highly evaluated. These fields have, so to speak, top-secret processes where leading-edge technologies are applied. Therefore, regular maintenance to products delivered is done by the users in many cases. As a matter of course, if the products have poor maintainability, the users will have to shoulder a heavy burden. Therefore, we applied a modular design to the TPL pump. To be more precise, the pump was roughly divided into eight blocks and could be disassembled and inspected with ease with a hexagon wrench and a spanner. This was a new idea of maintenance on a component basis. Furthermore, we newly introduced a side-opening system, which made it possible to open the pump heads to the left and right so that the hydraulic diaphragm parts could be inspected, washed, or replaced without disconnecting the liquid pipes. Moreover, the pump heads and all the pipes had to be removed to replace the plunger seal in the hydraulic cylinder head in the case of a conventional hydraulic plunger. The TPL significantly saves replacement effort. Even the manifold need not be removed.”

“In addition, the TPL uses quantities of light alloy to reduce the weight. Therefore, if the TPL is used in a place where only authorized people can enter for the purpose of security protection, it can be removed to a different place for an inspection. Moreover, we made a variety of distinctive inventions inorder to save maintenance effort as much as possible. One of them is the extension of the service life of the diaphragm as an expendable item. The diaphragm is specially designed with a close 3D analysis, and its ductility is approximately four times as high as TACMINA's conventional diaphragms. Besides, the pump head component coming in contact with liquid is mirror finished, which rejects dirt and ensures ease of CIP cleaning. The interior of the pump head component is also designed to prevent the retention of liquid in transfer. TACMINA's accumulated technologies are reflected to here and there.”

■Allows the replacement of parts and ease of maintenance without disconnecting the liquid pipes.

The modular design of the pump makes it possible to use only a hexagon wrench and a spanner to disassemble the pump into eight blocks with ease. The pump heads also use a unique side-opening system, allowing internal inspections, cleaning, and part replacement without removing the pipes.

Side-opening head

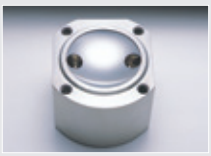
■Extension of the service life of the diaphragm reduces the frequency of maintenance.

The diaphragm newly designed with a close 3D analysis has excellent durability with a ductility of approximately four times as high as TACMINA's conventional diaphragms. In addition, a special hydraulic mechanism is adopted to prevent the diaphragm from knocking the pump head component, which ensures a longer service life of the diaphragm.

Special diaphragm & its strength analysis

■Allows in-line cleaning to maintain the good quality of the system.

The inner surface of the pump head component coming in contact with liquid is mirror finished, which rejects liquid, thus sufficiently allowing in-line cleaning. Furthermore, the special shape of the interior of the pump head component prevents the retention of the liquid in transfer and suppresses the occurrence of contamination, thus maintaining the quality of the system.



Mirror-surface liquid-end material

■No accumulator and air chamber is required.

The TPL Series does not require any accumulator or air chamber to absorb high pulsation or cushion tank to solve irregular infusion, thus eliminating not only big causes of trouble but also maintenance effort including inspections and cleaning.

Model Code

TPL 1 ME N – 008 – 6 T 6 T – C W S

(1) (2) (3) (4) (5: ⓐ ⓑ ⓒ ⓓ) (6: ⓐ ⓑ) (7)

1 Drive box type
1 : 400W Motor
2 : 1,500W Motor

2 Pump type
ME : Hydraulic diaphragm pump

3 Drive box surface treatment
None : Painting
N : Electroless nickel plating

4 Plunger diameter
008 : 8mm
014 : 14mm
018 : 18mm
028 : 28mm
032 : 32mm
040 : 40mm
056 : 56mm
080 : 80mm
095 : 95mm

5 Liquid-end material

ⓐ **Pump head**
6 : SUS316*
X : Special

ⓑ **Diaphragm**
T : PTFE*
X : Special

ⓒ **Check ball**
6 : SUS316*
C : Ceramic
X : Special

ⓓ **O-ring**
T : PTFE*
X : Special
*Standard

6 Connection type

ⓐ **Joint**
S : Screw (Rc female screw)
F : JIS flange
C : Ferule (ISO)
X : Special

ⓑ **Valve structure**
W : Standard
V : High viscosity
X : Special

7 General specifications
S : Standard
X : Special

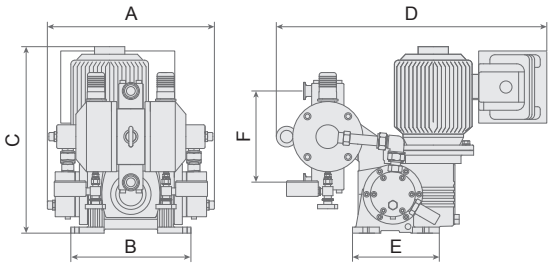
Performance Specifications

★ Special high pressure types (max 1MPa, 3MPa, 10MPa or 15MPa) are also available depending on the model. For details, please contact TACMINA.

Item \ Model		TPL1ME				TPL2ME					
		−008	−014	−018	−028	−028	−032	−040	−056	−080	−095
Max. discharge volume	L/min	0.1	0.3	0.5	1.2	2.6	3.4	5.3	10.5	20	30
	L/H	6	18	30	72	156	204	318	630	1200	1800
	USG/H	1.5	4.7	7.9	19	41.1	53.8	83.9	166.3	316.8	475.2
Max. discharge pressure	MPa	0.5									
	bar	5									
	psi	72.5									
Connection type	Discharge side	ISO 10A			ISO 15A	ISO 15A		1.0S	1.5S	2.0S	
	Suction side	ISO 10A	ISO 15A			1.0S		1.5S	2.0S	2.5S	
Motor	Type/power supply(V)	Explosion-proof outdoor type(d2G4)/3-phase 200V(50Hz/60Hz),220V(60Hz)									
	Power(kW)/number of poles	0.4/4P				1.5/4P					
Weight (kg)*1		41			51	93		94	109	142	

*1 Indicated weight is for a pump using SUS as its liquid-end material and an outdoor use JIS flange motor.

External Dimensions



∗ The shape differs depending on the model.

	A	B	C	D	E	F
TPL1ME-008-6T6T-CWS	(331)	238	(369.5)	(511.5)	172	157
TPL1ME-014-6T6T-CWS	(331)	238	(369.5)	(511.5)	172	157
TPL1ME-018-6T6T-CWS	(331)	238	(369.5)	(511.5)	172	157
TPL1ME-028-6T6T-CWS	(331)	238	(369.5)	536	172	181
TPL2ME-028-6T6T-CWS	(589)	354	(565)	(564)	230	213
TPL2ME-032-6T6T-CWS	(589)	354	(565)	(564)	230	213
TPL2ME-040-6T6T-CWS	(589)	354	(565)	(564)	230	245
TPL2ME-056-6T6T-CWS	(589)	354	(565)	(602)	230	324.5
TPL2ME-080-6T6T-CWS	(623)	354	(565)	(653)	230	374
TPL2ME-095-6T6T-CWS	(623)	354	(565)	(653)	230	374

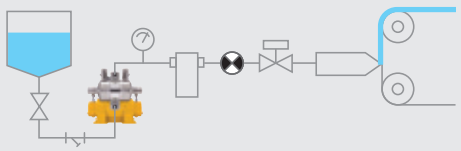
The performance specifications and external dimensions below are examples for a standard model.
Please contact us for details of customized specifications.

Flexibly responds to applications with strict requirements, such as fine film coating and electronic component production stages.

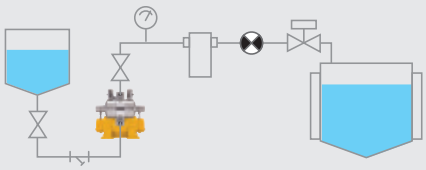
An excellently constant flow responds to processes requiring strict quality control.

TACMINA's TPL is a new current of liquid transfer for a variety of applications, such as fine film coating, measurement processes and in-line (continuous in-pipe) infusion in the leading-edge field, sample liquid supply for liquid chromatography.

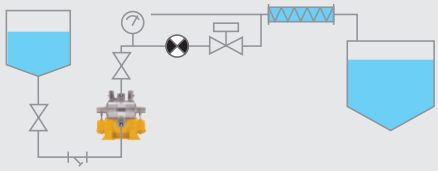
[Fine film coating] Improvement in coating precision



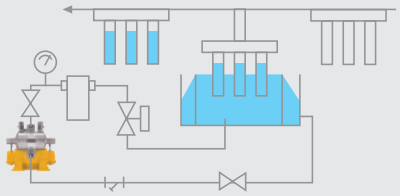
[Measurement infusion] No load cell required



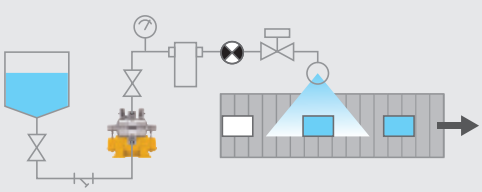
[Continuous mixing of two liquids]
As precise as batch processing in mixture rate



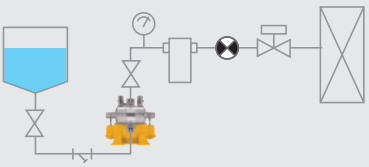
[Dipping] Smoothing liquid surface in dip tank



[Spray] Supports slurry and low-viscosity liquids



[Liquid chromatography] Improvement in measurement precision



Product designs and specifications are subject to change without notice for product improvement.

TACMINA CORPORATION

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