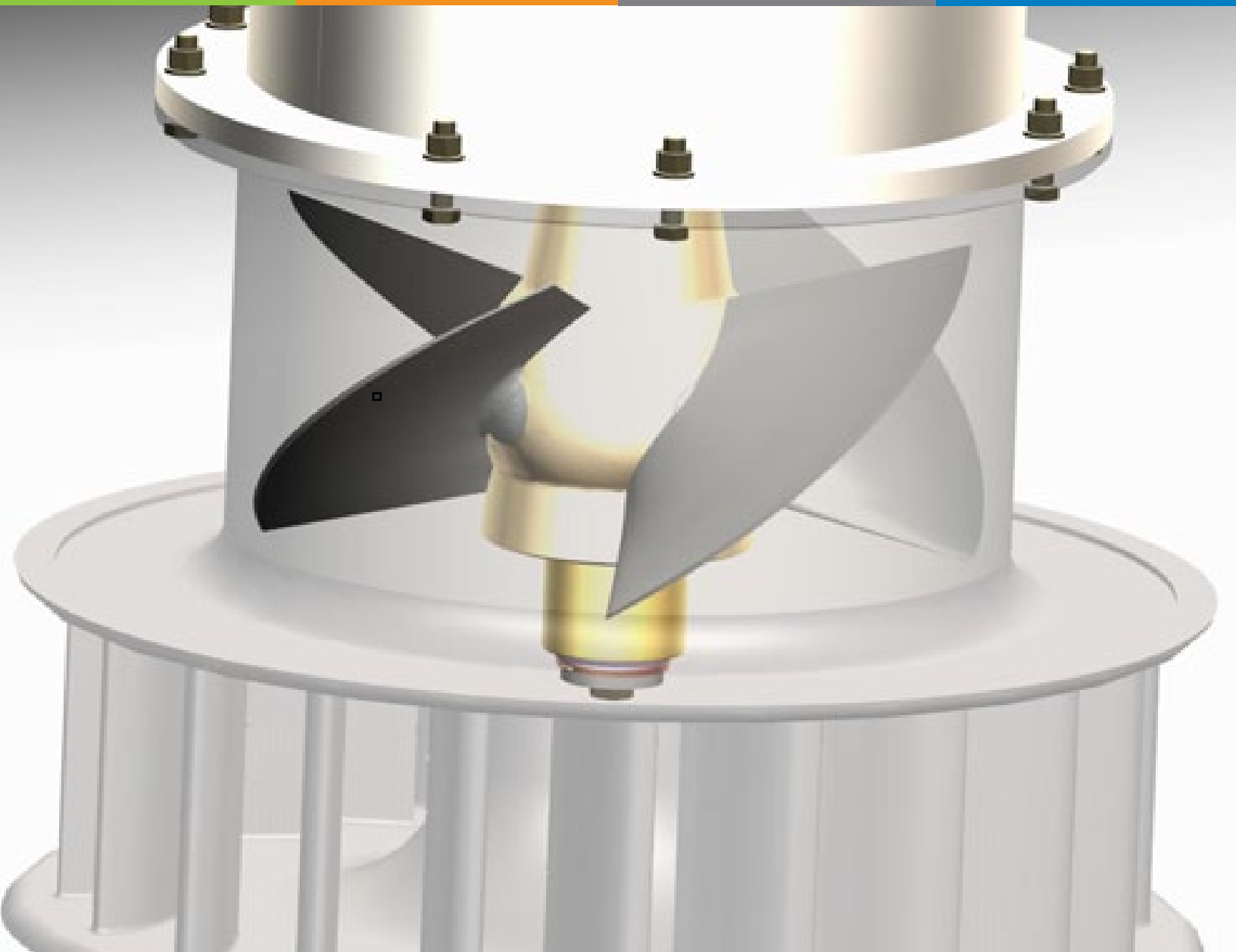
TM MODULAR MICRO TURBINE

MAVEL



Head of the U HPP
8 x TM10

Located in Idaho, the Head of the U HPP is the first installation in the USA of Mavel's proprietary modular micro turbine.

Head of the U HPP Parameters

Turbine	8 x TM10 Modular Micro
Head	5.14 meters (16.9 ft)
Flow	34 cms (1,200 cfs)
Power	1,224 kW

The Head of the U Project is a new hydroelectric power plant on the North Side Canal system that delivers irrigation water to area farmland near Jerome, Idaho. The project site is a diversion structure that divides the flow of the main canal into three branch canals. These are then divided to provide flow to each of the eight TM10 Modular Micro Turbines.

Mavel's TM Modular Micro Turbines are designed for sites with low flow and low head conditions. Easily installed, the TM Turbines are a modular system used to capture the energy of water flowing through the turbine.

The proprietary TM Turbine design uses siphon technology and includes a Kaplan-type runner with four manually adjustable blades. The runner is connected to an asynchronous generator directly or by a belt drive. This allows for turbine and generator speeds to be optimized for the site condition. The TM Turbines do not require an enclosed powerhouse and can be installed on support brackets attached to a weir structure.

The TM Turbines come in four sizes and are suited for sites with flow of 0.15 to 5 cms (5 to 177 cfs) and heads of 1.5 to 6 meters (5 to 20 ft). Individual turbines have installed power from 5 kW to 160 kW and are often installed as multiple units.

The TM Turbine's features include:

- modular design
- no powerhouse requirement
- manual blade adjustment
- siphon technology
- robust construction
- short delivery times
- proven performance

Over the past 25 years, Mavel has installed over 65 TM Turbines globally at sites in Bulgaria, Czech Republic, Finland, Germany, Japan, Italy, Latvia, Poland, Slovakia, Slovenia, Ukraine and the USA. The first American installation was completed in 2015.

Mavel's TM10 Modular Micro Turbine

Kyoto HPP
1 x TM5

Mavel's TM5 Micro Turbine is used to light up the historic Togetsukyo Bridge and nearby hillside in Kyoto, Japan.

Kyoto HPP Parameters

Turbine	1 x TM5 Modular Micro
Head	1.34 meters (4.4 ft)
Flow	0.55 cms (18.7 cfs)
Power	4 kW

Mavel's TM5 Modular Micro Turbine was installed adjacent to the historic Togetsukyo Bridge in Kyoto, Japan as a symbol of that city's commitment to clean renewable energy. The Kyoto Hydroelectric Power Plant lights up the bridge and a nearby hillside. Mavel made modifications to the standard TM5 Turbine design to respect the historic integrity of the site.

Three prototype TM10 Turbines were installed on an existing weir on the Odra River in Poland.

Olawa II HPP
3 x TM10

Olawa II HPP Parameters

Turbine	3 x TM10 Modular Micro
Head	4 meters (31.1 ft)
Flow	11.70 cms (397.8 cfs)
Power	300 kW

The Olawa II installation is at the site of a historical hydroelectric power plant on the Odra River in Southern Poland. The three TM10 Modular Micro Turbines provide a combined 300 kW and were installed directly onto the weir. They are in addition to an existing 200 kW Francis turbine in the adjacent original powerhouse.

Turbine Models

Mavel has developed four models of the TM Turbine. The four models and their operating parameters are detailed below.

Runner Diameter..... 1000 mm
Head..... 2 to 5 meters (7 to 16 ft)
Flow..... 2 to 5 cms (71 to 177 cfs)
Power.....30 to 160 kW

TM10 TURBINE

Runner Diameter..... 850 mm
Head..... 2 to 5 meters (7 to 16 ft)
Flow..... 1.5 to 3 cms (52 to 106 cfs)
Power..... 20 to 100 kW

TM8 TURBINE

Runner Diameter..... 550 mm
Head..... 1.5 to 6 meters (5 to 20 ft)
Flow..... 0.7 to 1.4 cms (25 to 50 cfs)
Power.....7 to 60 kW

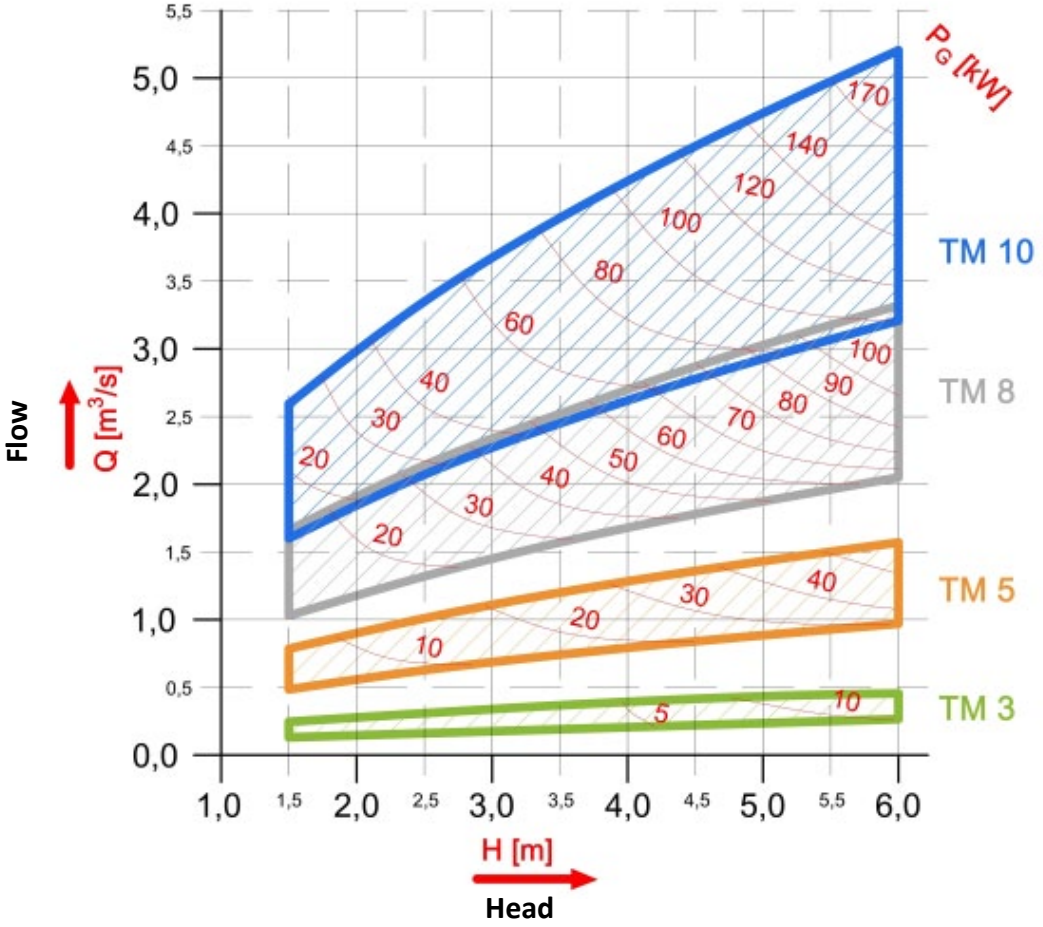
TM5 TURBINE

Runner Diameter..... 300 mm
Head..... 1.5 to 6 meters (5 to 20 ft)
Flow..... 0.15 to 0.4 cms (5 to 14 cfs)
Power..... 5 to 20 kW

TM3 TURBINE

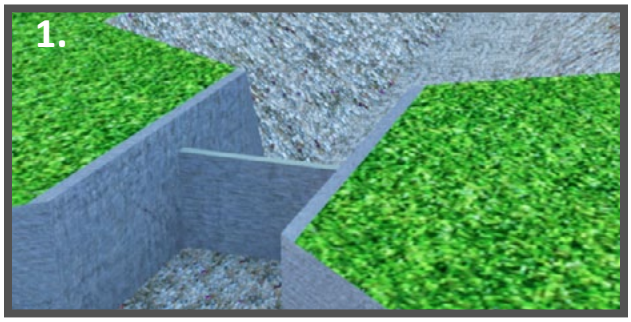
Individual Mavel TM Turbines produce from 5 kW to 160 kW depending on the site's head and flow.

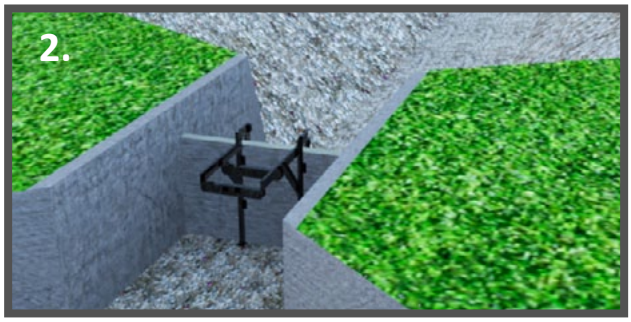
Head and Flow Characteristics

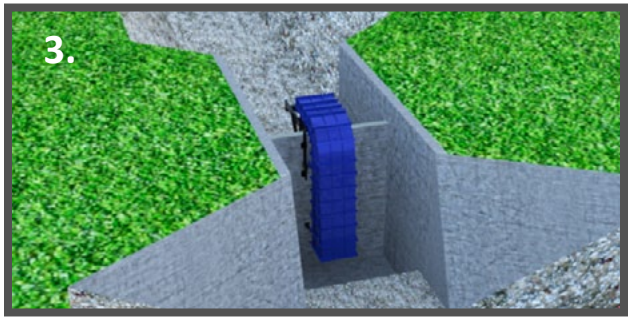


Installation
5 Steps

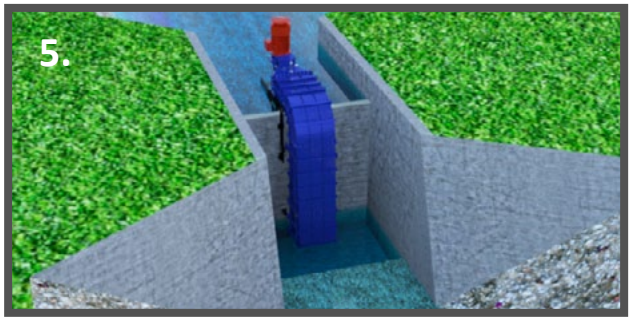
The TM Turbine has a five step installation procedure.







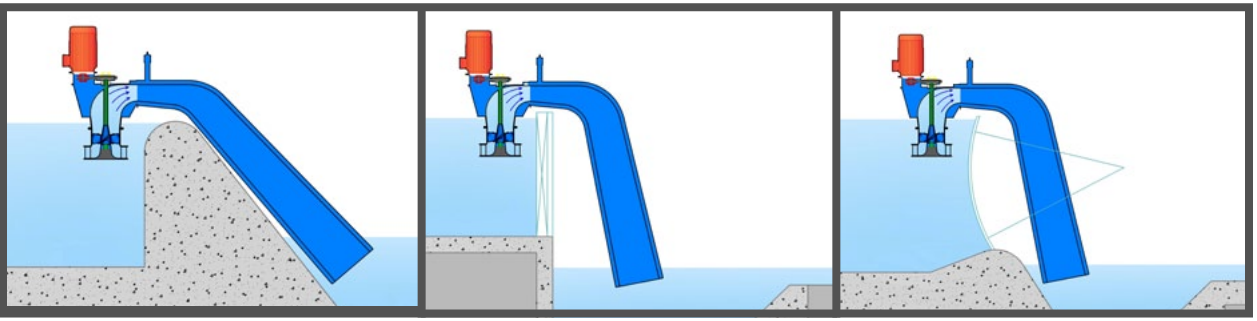
1. Structure Preparation
2. Support Framework Installation
3. Draft Tube Installation
4. Turbine and Generator Installation
5. Commissioning



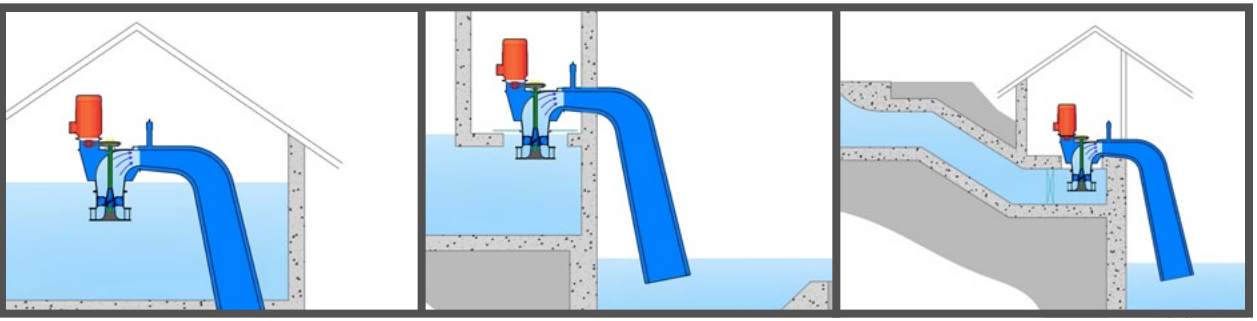
The TM Turbine is a proprietary modular design that can be adapted to unique site conditions.

Configuration Options

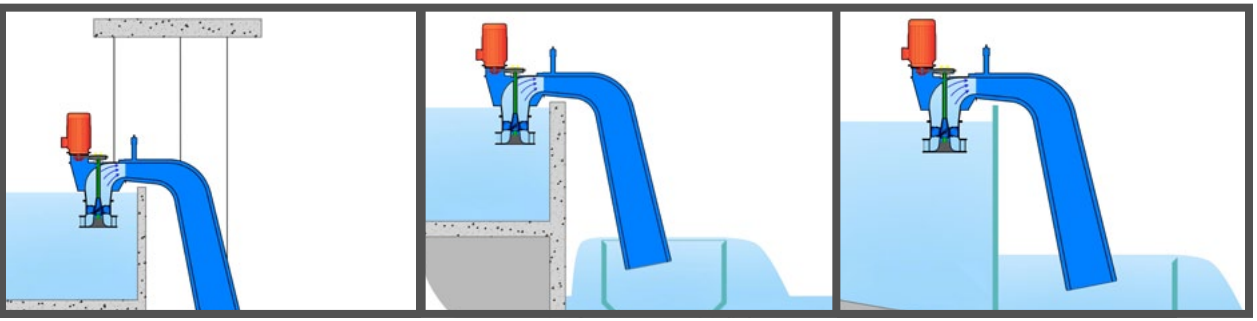
STANDARD



POWERHOUSE

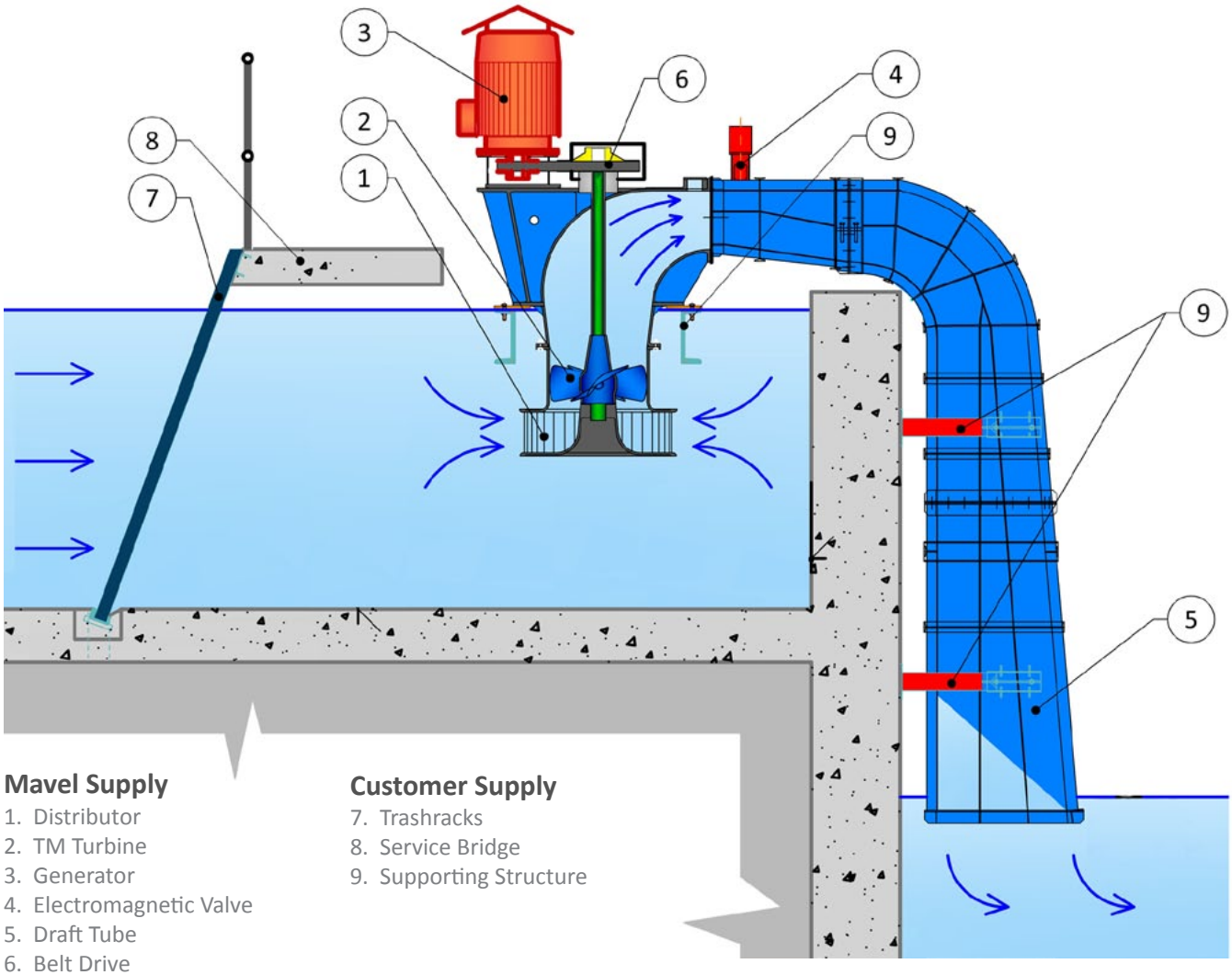


CUSTOMIZED



Scope of Supply

A typical division of the scope of supply between Mavel and the customer is shown in the graphic illustration below.



Mavel Supply

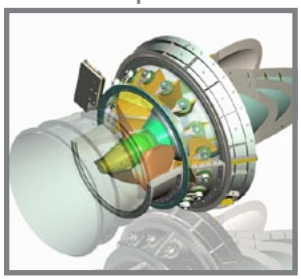
1. Distributor
2. TM Turbine
3. Generator
4. Electromagnetic Valve
5. Draft Tube
6. Belt Drive

Customer Supply

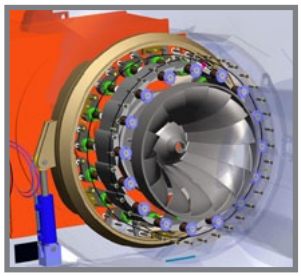
7. Trashracks
8. Service Bridge
9. Supporting Structure

Hydro Turbine Technology by Mavel

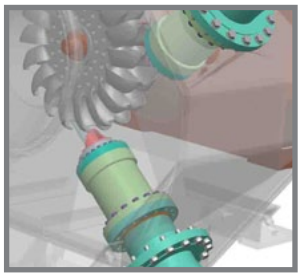
Kaplan



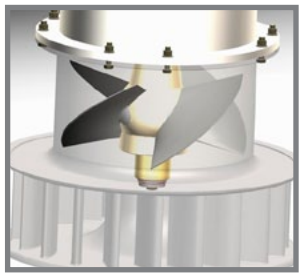
Francis



Pelton



Micro



MAVEL IS A GLOBAL LEADER IN THE DESIGN AND PROVISION of a full range of Kaplan, Francis, Pelton and micro turbines for hydroelectric power plants typically from 30 kW to 30+ MW per unit.

Founded in 1990, Mavel was one of the first companies formed under the new Czech Commercial Code. The company moved from Prague to its current headquarters in Benesov, CZ in 1993 and brought in a consortium of American / Canadian / European investors in 1997. Funds were used to upgrade facilities and purchase a historical small hydro turbine producer near Brno, CZ. The original founders of the company remain top managers with their American counterparts and are joined by a team of global hydroelectric power specialists.

Mavel produces its turbines at its 10,300 m^2 (110,870 sf) combined manufacturing facilities which have 40 production machines, 85 ton combined crane capacity, a 5-axis milling machine and a new 6-axis prototype machining center put into operation in late 2013.

The Company is ISO 9001:2008, 14001:2004 and 3834-2:2005 certified.

Mavel installations are now in 36 countries on five continents with over **475 turbines** ordered or installed at over 300 hydroelectric power plants around the world.

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