

The original
OSSBERGER™ cross-flow turbine



History

The history of the original Ossberger® Cross-Flow Turbine started with an intellectual exchange between two highly innovative geniuses: the Australian inventor Anthony Mitchell and the German entrepreneur Fritz Ossberger. The latter was granted an Imperial Patent for his “free-jet turbine” of the year 1922.

After numerous refinements, the “cross-flow turbine” went into production in 1933. Fritz Ossberger also obtained a further Imperial Patent for this machine.

These days the "Ossberger turbine" is a benchmark for excellence in the technology of small hydro power generation. With its history of more than 100 years Ossberger GmbH + Co of Weissenburg is your reliable manufacturer of the original - often imitated, but never matched. Over 10,000 units are installed in more than 100 countries worldwide.



Original OSSBERGER™ cross-flow turbines

Original OSSBERGER™ crossflow turbines are optimal within a power range between some few kilowatts and a present maximum of 3.3 megawatts per machine. They are tolerant of debris in the water and adjust perfectly to accept varying flows; that is why they are extremely well suited for use in runoff-river locations. Smooth, quiet operation can be expected from almost zero up to full load. They have proven themselves to be reliable in the field at thousands of locations, even under the most severe conditions, over many decades.

Thanks to their cavitation-free operation even at minimal flows the original Ossberger® cross-flow turbines are ideal for **stand-alone units**. They robustly meet the demands of the constantly varying demands of energy consumers.

Original OSSBERGER™ crossflow turbines are entirely steelwelded and built from standardized individual components. This modular system facilitates lowcost manufacture whilst meeting the specific design criteria to suit any specific project. Thus, a tailormade plant is configured precisely according to individual site requirements.



H = 24 m
Q = 6.000 l/s
N = 1186 kW



H = 164 m
Q = 220 l/s
N = 302 kW

Operating principle

The original OSSBERGER™ crossflow turbine is a free stream turbine with radial and partial admission which depending on the head can also be combined with a draft tube. Due to its specific speed it is classified as a slow speed turbine. The water jet enters the cylindrical rotor through the one or two guide vanes, passing through it entirely. The advantage of this flow pattern is that any ingress by leaves, grass, wet snow, etc. is flushed out again by the selfcleaning effect of the rotor.

Where restricted by seasonal water availability, the original OSSBERGER™ crossflow turbine automatically adjusts with two guide vanes in a relationship of one third to two thirds. The small guide vane alone operates with water flows admitted of about 5% entering while maintaining the efficiency guarantee level at about 17% of the design flow. The big cell takes over at 33% of the flow, and both cells operate together from 67% up to full load – with a constant high level of efficiency.

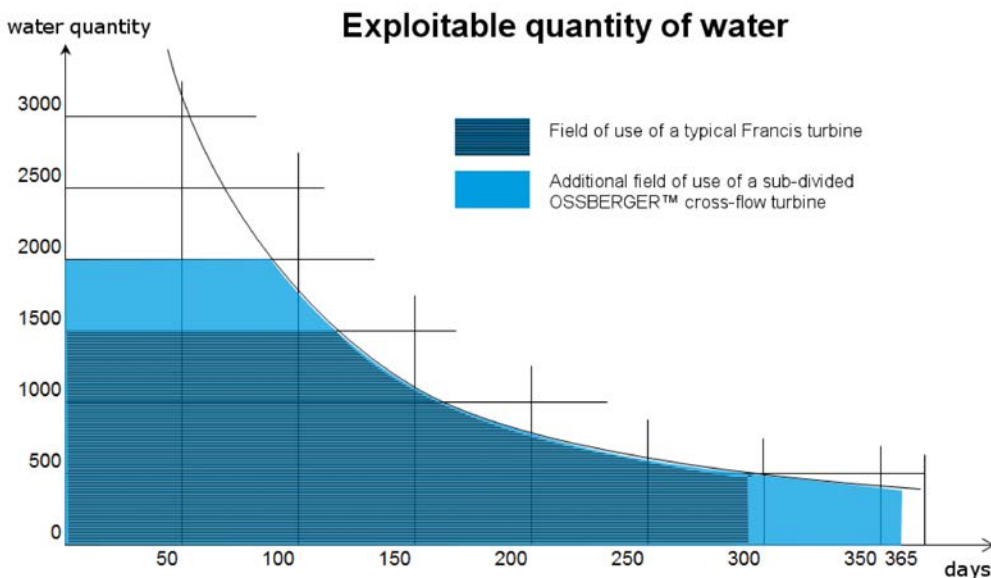
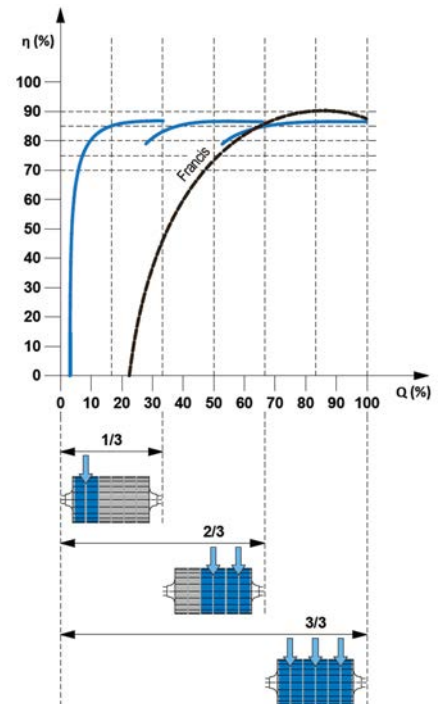
This is how original OSSBERGER™ crossflow turbines can operate most efficiently even at varying flows.

Efficiency

The average overall efficiency of original OSSBERGER™ cross flow turbines with a draft tube is calculated at 84% over the entire operating range. Turbines without a draft tube show efficiencies of up to 87%.

The graph (right) clearly illustrates the superiority of the original OSSBERGER™ crossflow turbine in the partial load range. Turbines with high peak efficiency, but poor partial load behaviour, produce significantly less annual power output in runofriver power stations with varying flow than turbines with a flat efficiency curve.

Why pick a turbine which is optimally efficient for only a few days each year? With its stable efficiencies over a wide flow range, an original OSSBERGER™ crossflow turbine offers enhanced performance even at a small fraction of total load. Total energy production usually exceeds that of a comparable Francis turbine, which is less able to utilize flows in the fractional load range. The unshaded blue area in the graph below shows the additional generating performance of an original OSSBERGER™ crossflow turbine for total annual load and low flows.



Applications

Small scale OSSBERGER hydro stations not only enjoy the highest reputation worldwide for their supreme technical standards but also for their remarkable range of operating flows. At **run-of-the-river sites**, our turbines are suited to all types of operation.

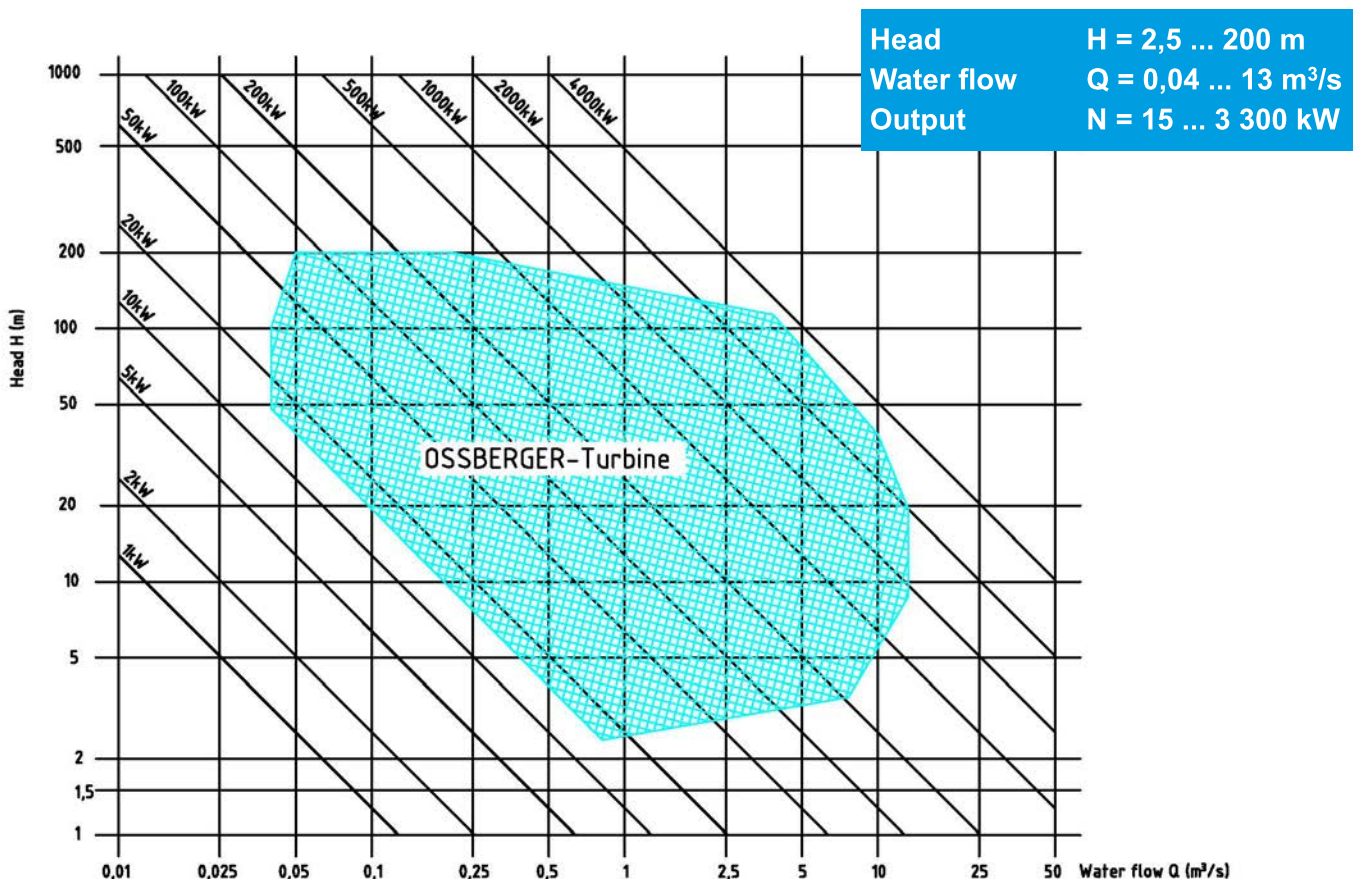
The turbines can also be used for **water management-related tasks**, such as discharge and residual water flow regulation. According to local requirements, stored water can be discharged through the plant, e.g. for irrigation purposes, and at the same time used for energy production – while the turbine controls the flow rate.

Typical applications for service water:

- Discharge sections of sewage plants
- Drinking water supply
- Dosing/residual water
- Irrigation systems
- Bottom outlets of dams
- Canal locks
- Cooling systems of conventional power stations
- Water balance and flood protection
- Seawater desalination plants
- etc.

In **stand-alone operation** (“offgrid”) the synchronous generator driven by the original OSSBERGER™ crossflow turbine responds to the actual demand, always automatically producing as much energy as needed by the connecting and disconnecting consumers. The permanently varying energy requirement means a challenge to a power station.

Original OSSBERGER™ crossflow turbines are ideal for stand-alone operation, with an unlimited working range from no to full load; additionally, due to their refined design, they are free from vibrations or cavitation. The automatic speed control provides constant frequency and tension. Black start conditions are guaranteed by a manual pump installed on the turbine governor's hydraulics rendering the use of a battery system unnecessary.



Advantages of the original OSSBERGER™ cross-flow turbines

Technical superiority:

- The system allows for the use of widely varying flows at constantly high efficiency levels
- Utilizing the OSSBERGER draft tube turbine concept, no head is lost, from upstream to the downstream water level
- Compared with imitation cross-flow turbines, the machine is particularly outstanding in its operating and regulating behaviour as well as efficiency characteristics
- No axial thrust, consequently simple low-maintenance bearings
- Proverbial simplicity (only two or three movable elements)
- Drop weights are incorporated for reliable emergency shut down, so no DC current supply is required
- Simple adjustable shaft seals (hemp tallow)

Cost savings:

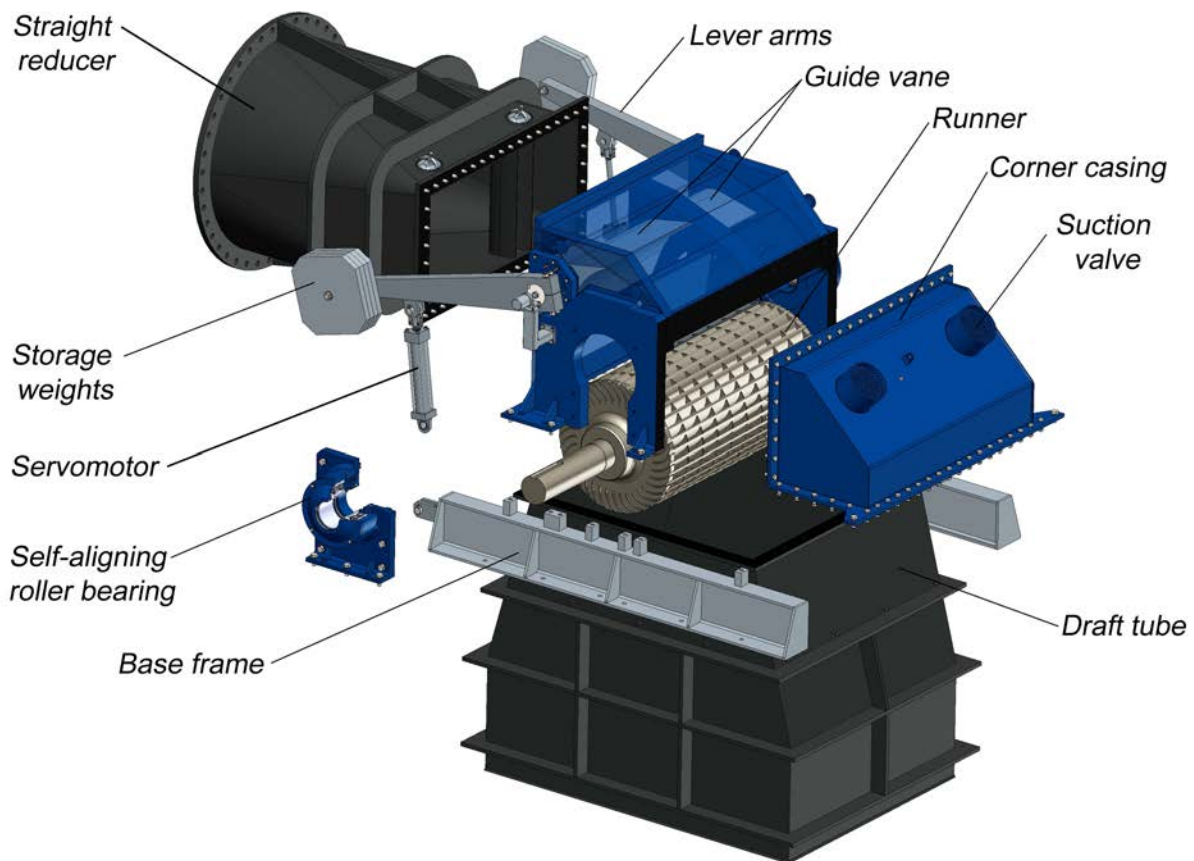
- No demanding civil works construction; only flat, straight and even structural surfaces are required
- Quick and easy installation
- Minimal maintenance requirements: Periodic greasing and annual grease changes, no need for special tools
- Good accessibility of the machinery from all sides
- No forced standstill due to an obstructed runner (because of the self-cleaning effect of the Ossberger runner)
- Higher profits thanks to the use of lowest flows
- The hermetically closing guide vanes are sufficient for shut down of the unit, so no automatic valve is needed in front of the turbine

Ossberger quality:

- Guide vanes are calibrated, specially fitted and hydraulically balanced, assuring vibration free operation, outside cavitation limits, at high efficiency levels
- Industrial components for a long service life, no electronic elements of short lifetime
- Maintenance-free bearings of the guide vanes
- Best production quality "Made in Germany"



The components of the original OSSBERGER™ cross-flow turbine



Casing

The casing of the original OSSBERGER™ cross-flow turbine is entirely steel-welded, unbeatably robust, both impact and frost resistant. The removable corner casing enables an easy access to the runner.

Bearings

The original OSSBERGER™ cross-flow turbine is equipped with standardized spherical roller bearing inserts for robust durability. The bearing casings and the bearing inserts form a unit that allows the radial dismounting of the runner without removing the bearing casings from the runner shaft.

In addition, this patented bearing construction has the advantage that no grease can contaminate the water flow. At the same time, the rotor is centered within the turbine casing.

Maintenance-free sealing elements complete this superior technical solution. Apart from an annual grease change, the bearing does not require any maintenance.

Guide vanes

In the subdivided original OSSBERGER™ cross-flow turbine, the admission of feed water is controlled by two balanced profiled guide vanes which divide the water flow, direct it and allow it to enter the rotor smoothly. Both guide vanes are fitted precisely into the turbine casing keeping the amount of leakage so low that in the case of small heads the guide vanes can also serve as shut-off devices. Both guide vanes can be adjusted separately via lever arms to which an automatic or manual control is connected. With the subdivided guide vanes a flat efficiency curve is achieved. They can easily be dismounted in radial direction; no special tools are needed for this purpose. Forces are absorbed by maintenance-free friction bearings, running on special steel surfaces..

Base frame

The stable base frame mounting turbine and foundation allows for a quick, simple and safe installation.

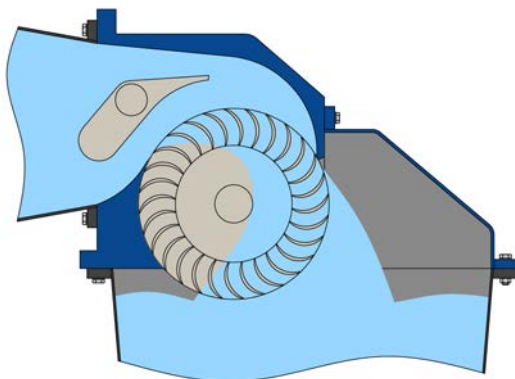
Runner

The heart of the turbine is the drum-shaped rotor. It is equipped with blades made of bright-rolled profiled steel manufactured by our well-proven procedure. On both sides, end discs are adapted and welded using a special technique. Depending on its size, the rotor has up to 37 blades supported by several intermediate discs. This makes the rotor extremely rigid, stiffening it in a way that no vibrations can occur. The rotors are carefully balanced prior to final assembly. A simple readjustable gland packing arrangement with tallow cord seals the shaft.

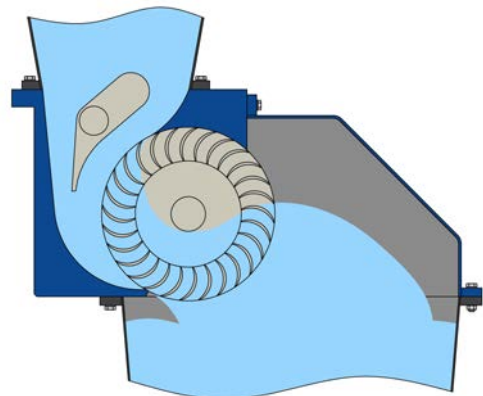
Draft tube and suction valve

The original OSSBERGER™ cross-flow turbine can be used as a free jet as well as a draft tube turbine. The draft tube allows for the lossless use of the full head and is generally installed in hydro plants with a head of less than 40 meters.

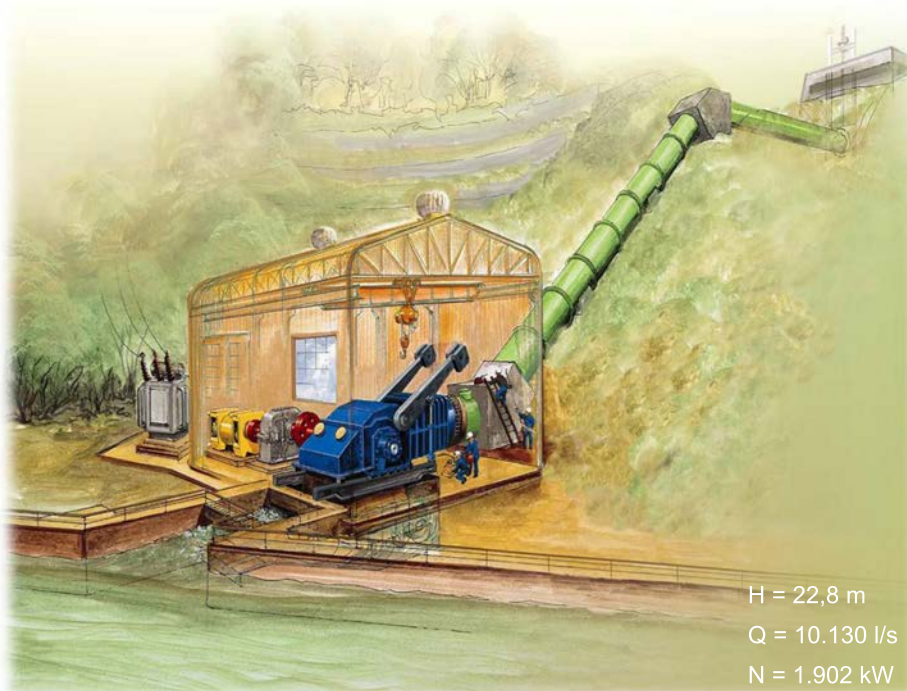
By means of an adjustable air inlet valve regulating the vacuum in the turbine casing for the optimum use of the energy potential, the suction water column is controllable. In this way, even heads of as little as 2.5 m can be fully exploited by OSSBERGER draft tube turbines.



horizontal inflow



vertical inflow

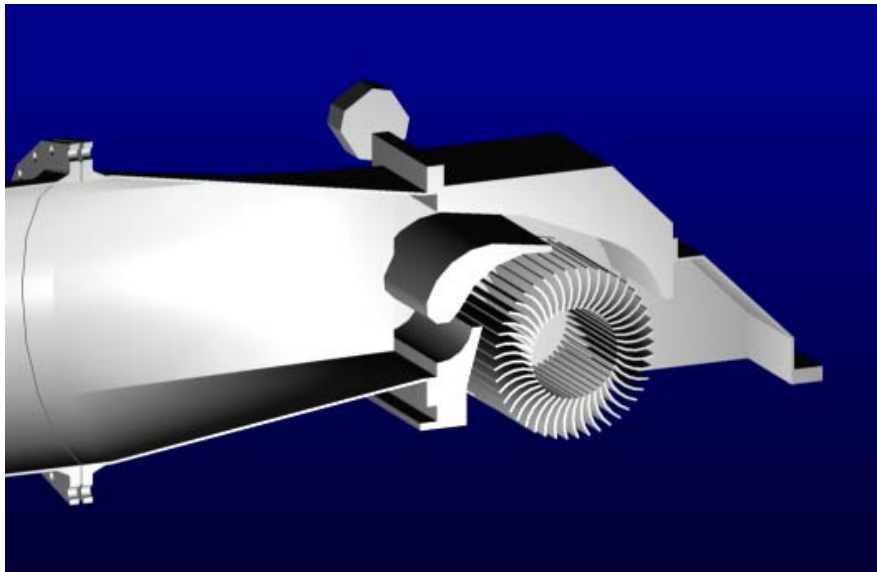


Materials

Various component materials are required for the different uses and applications of turbines. Ossberger selects materials, according to the specific demands (mechanical or chemical stress, drinking water, salt water, etc.). For this purpose, the wear of individual elements is considered to optimize the operating costs; another benefit of our great experience.

The following materials are used in production:

Carbon steel
Stainless steel V4A
Wear resistant steel (e.g. Hardox)
Superduplex



The Ossberger product range

- Original OSSBERGER™ crossflow turbines (from 15 kW up to 3.3 MW)
- Kaplan turbines (from 20 kW up to 2 MW)
- Trash rack cleaning systems, also for big hydro plants
- Automation OTmation

For a detailed offer and information on our further products, please do not hesitate to contact us.



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