

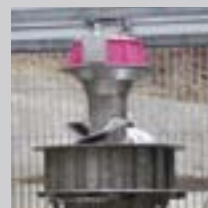


DIVE-TURBINE

Compact - Efficient - Reliable.

DIVE-Turbine

An innovative turbine concept for
small hydro power plants.





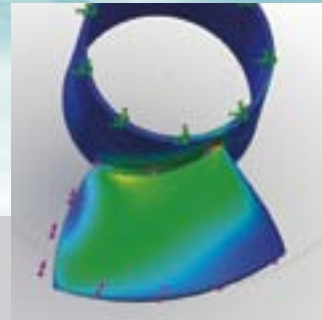
DIVE-TURBINE

Compact - Efficient - Reliable.

The „DIVE-Turbine“ is an innovative turbine concept for small hydropower plants. The concept fulfills all requirements for a modern hydropower plant with low head and an installed capacity of up to 1.000 kW per unit.

Customized turbine design, in combination with the latest generation of power electronics guarantees high efficiency of the complete Turbine-Generator-Inverter-Unit from water to wire.

According to the singular requirements of each powerplant, FELLA Maschinenbau GmbH provides individual solutions (design, manufacturing, delivery, installation, start up, after sales service).



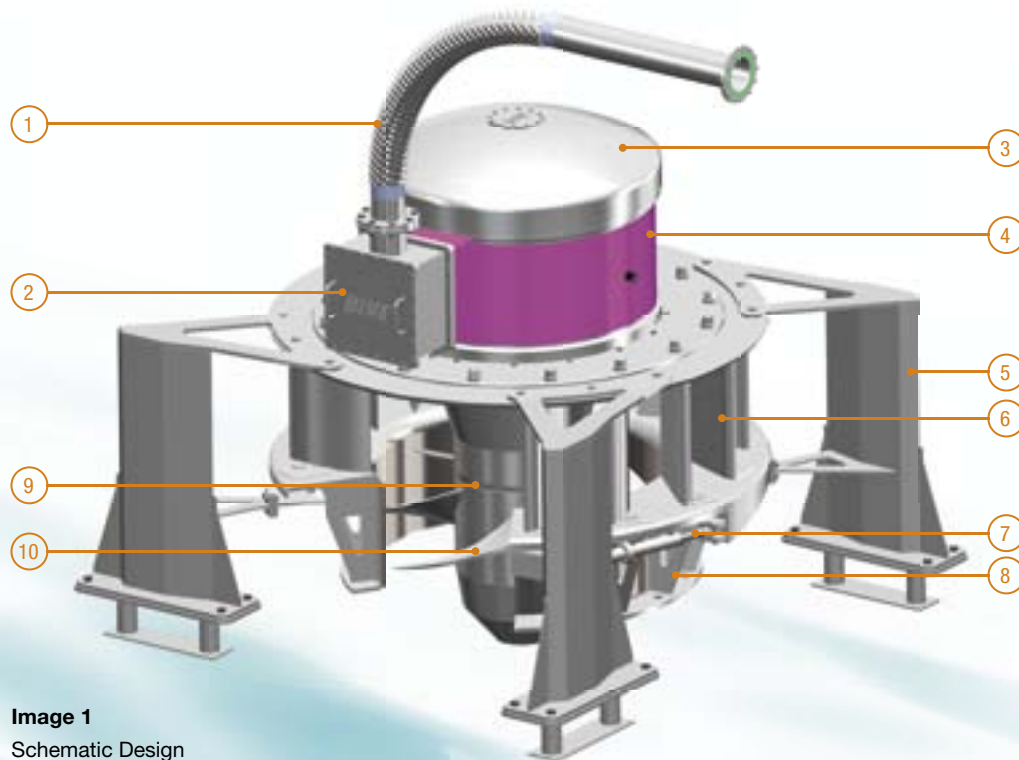


Image 1
Schematic Design

- | | |
|--------------------------------------|---------------------------|
| 1. Protection pipe for cables | 7. Control of guide vanes |
| 2. Terminal box | 8. Turbine vessel |
| 3. Generator top | 9. DIVE-Sealing |
| 4. OSWALD Permanent Magnet Generator | 10. DIVE-Runner |
| 5. Torque arm | |
| 6. Guide vanes | |

Characteristics

- Robust and maintenance-free design
- Compact and modular set-up
- Turbine and Permanent-Magnet-Synchronous-Generator optimized for each power plant
- Single bearing unit for turbine and generator
- Fully submerged operation
- Non-wearing seal system
- State-of-the-art power electronic
- Adaptive control of operation and power transmission to grid
- Optimized efficiency by speed variation depending on discharge and head
- Available in high grade steel for saline water service

Dimensions

Height incl. generator	0.8 - 3.0 m
Diameter of turbine	0.5 - 2.12 m
Diameter incl. guide vanes	1.0 - 3.5 m



DIVE-TURBINE

Compact - Efficient - Reliable.

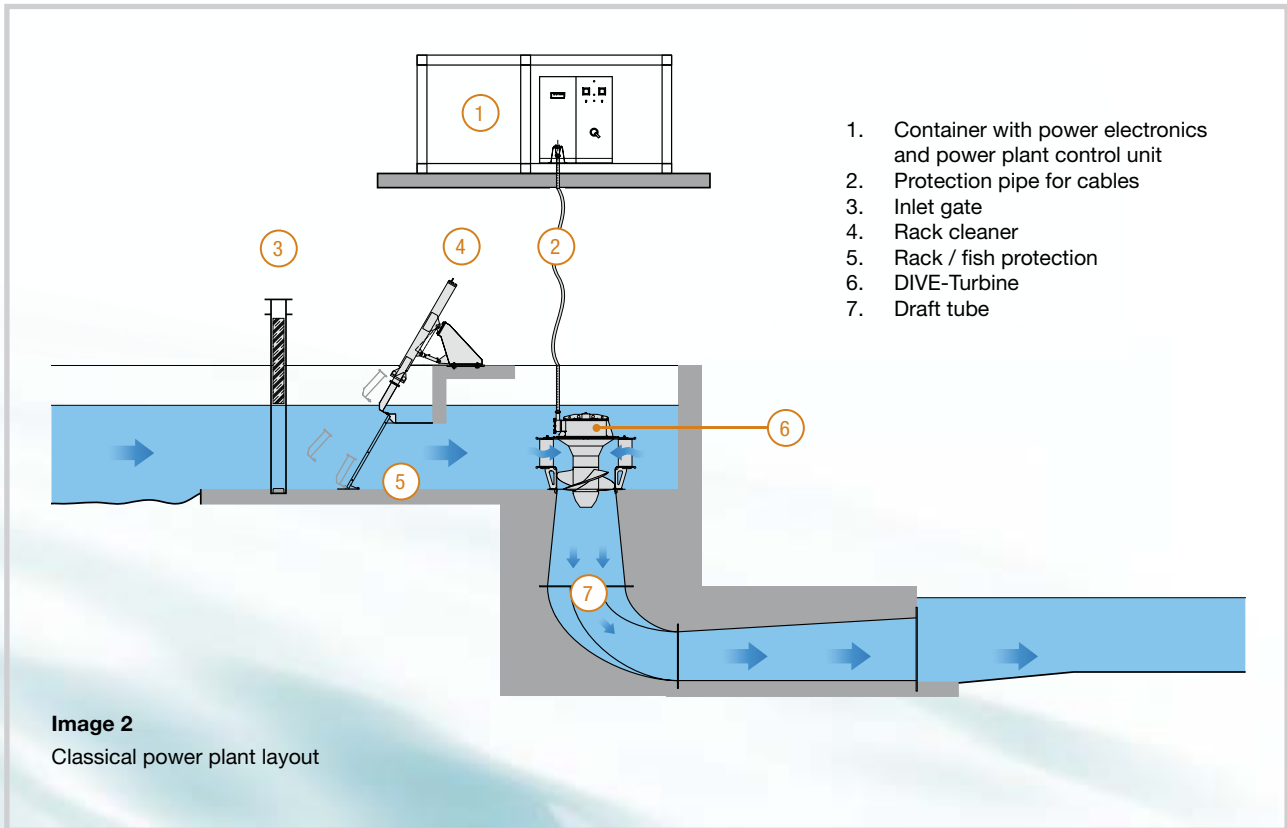


Image 2
Classical power plant layout



Advantages

- Free of maintenance
- High reliability of all components
- The entire turbine unit is easily accessible
- High overall efficiency from water to grid
- Double regulated - operation with variable speed
- No maintenance and cost-intensive adjusting mechanisms of a pitch-able turbine
- Direct connection without any mechanical transmission
- Low noise and vibration
- Long service life
- Optimized for each individual project
- Safe operation in areas with risk of flooding
- Safe operation in saline water and drainage water
- Flexible connection between turbine and power control centre
- Short production time – fast availability
- Easy installation
- No complex structures – no turbine house
- Easy to operate – fully automatic
- Reactive power compensation not necessary (adjustable)
- Flexible integration into the power plant
- Reduced civil works without turbine house



DIVE-TURBINE

Compact - Efficient - Reliable.

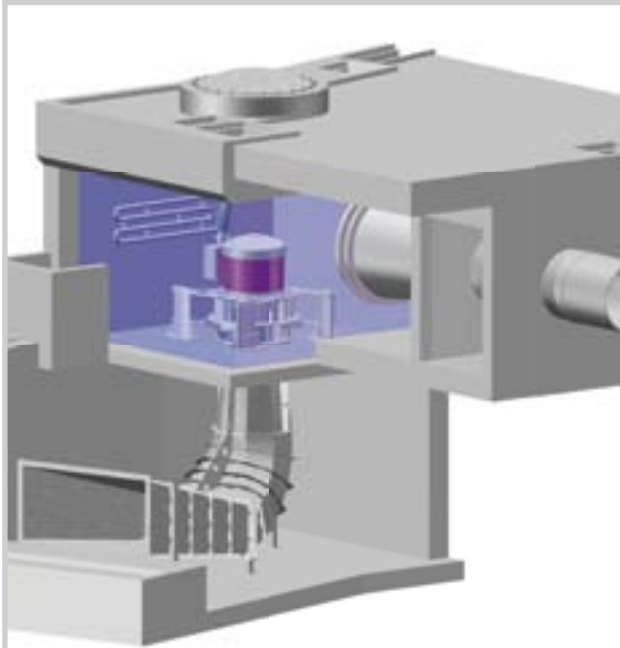


Image 3

Power plant layout with pressure chamber and pipe

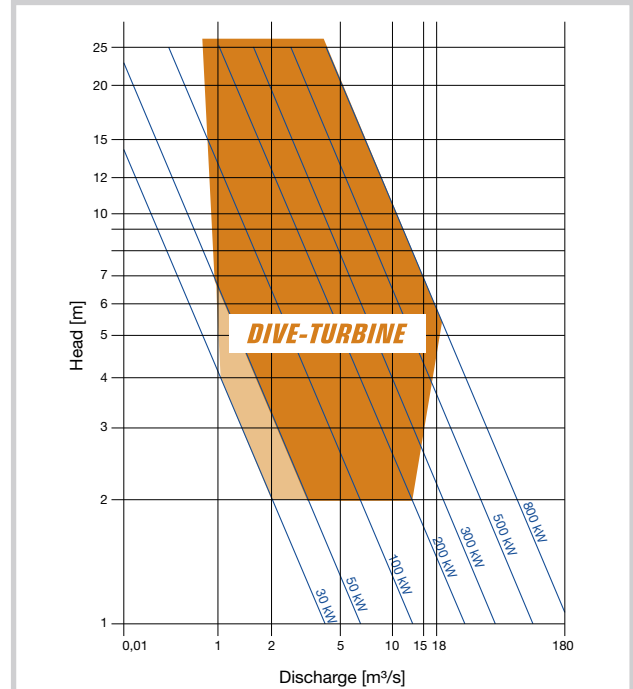


Image 4

Power output in kW in relation to head and discharge

Range of Application of the DIVE-Turbine

- Head between 2 – 25 m
- Discharge from 1.5 – 20 m³/s per turbine unit
- Rated power from 50 kW up to 1000 kW per turbine unit
- New hydro power plants
- Refurbishment and reactivation of existing power plants
- Repowering of existing power plants
- Integration in existing weirs (residual flow)
- Integration in already existing buildings and existing canal systems.
- Save operation in flood prone sites
- Save operation in salt and drain water plant

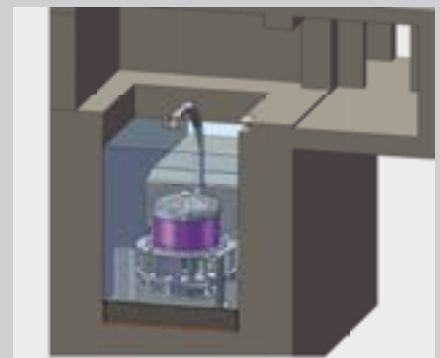
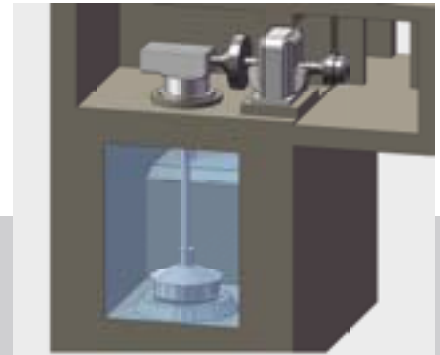


Image 5

Example refurbishment/repowering of existing power plant

Integrated Turbine Solution

For more than 10 years FELLA Maschinenbau GmbH and OSWALD Elektromotoren GmbH have developed and operated speed variable hydro turbines.

From the beginning there was the idea of designing a turbine with a fixed runner and an efficiency maximisation through speed variation. A new turbine runner was designed together with the Institute of Fluid Mechanics and Hydraulic Machinery (IHS), Universität Stuttgart, especially for this application.

The speed variable turbine operation from 10 up to 120 % of the nominal speed is provided by the highly efficient and reliable inverters.

The „TF-Motor“ (torque motor) from OSWALD Elektromotoren GmbH is a very compact Permanent Magnet Synchronous Generator (PMG). This generator can handle very high torques at low speeds. Due to this it is possible to realise a direct connection of the turbine runner and the generator runner (no gearbox). Above all, it has a very good efficiency between 95 % and 98 %.

Different and innovative possibilities for the turbine design can be realised by the compact design of the „TF-Motor“. The mechanical- and electric engineers developed a compact turbine-/generator-unit with an integrated bearing and a free from wear sealing system.

This compact unit operates completely submerged. The only part reaching out of the water is the flexible connection to the Control Centre (Plant Control and Power Electronics).



Please find additional information at www.dive-turbine.de



FELLA Maschinenbau GmbH

Am Grundlosen Brunnen 2
D-63916 Amorbach

Phone: +49 9373.9749-0
Fax: +49 9373.9749-49

E-Mail: info@fella-gmbh.de
Internet: www.fella-gmbh.de

Department DIVE-Turbine:

Phone: +49 9373.9749-42
Fax: +49 9373.9749-49

E-Mail: info@dive-turbine.de
Internet: www.dive-turbine.de