

## FRANCIS TURBINE ADVANTAGES

Performance — Reliability — Flexibility



## FRANCIS TURBINES

Most common type of water turbine in use today, characterized by high efficiency levels, reliable operation and robust design.

### A reliable and efficient solution in the green energy:

- Reliable and eco-friendly
- Heads from 10 m up to 750 m
- Wide operating range of heads and discharges
- Flexible operation at part load and deep part load
- Outputs up to 350 MW
- Runner diameters up to 7,000 mm
- Solution tailored to customer needs
- High efficiency level

Litostroj Power Francis turbines are designed in simple and rigid manner to enable ease of maintenance of all main unit parts. Francis unit is considered as most simple and robust machine that can be used for transformation of water potential energy to mechanical power via fixed runner blades and further to electrical grid. Our turbines excel in reaching high efficiency levels.

Litostroj Power produces all the turbine runners in-house to ensure best quality of the turbine most important part. For low-head turbine runners we usually use welding technology where crown and band are welded together with runner blades. Blades are cut-out from steel plates, hydraulically pressed with template to appropriate shape and CNC machined to its final hydraulic shape.

For middle and high-head Francis runners CNC machining of the integrally forged part is an option. For large high-head Francis units, Litostroj Power possess the technology to manufacture the runners from the two CNC machined parts that are later welded in the middle of the runner blade where lowest stresses in material are expected.

**WATER-TO-WIRE  
SOLUTIONS**

**NEW INSTALLATIONS**

**REHABILITATIONS  
AND OVERHAULS**

**UPGRADES**

**HYDRAULIC  
MODEL TESTING**



**MOST COMMON TYPE OF WATER TURBINE IN USE TODAY, CHARACTERIZED BY HIGH EFFICIENCY LEVELS, RELIABLE OPERATION AND ROBUST DESIGN.**

### Types of Francis turbines:

- Vertical Francis units
- Horizontal Francis units
- Vertical or Horizontal Francis units with Pressure Regulating (or Ramping) Valves
- Double Francis units
- Twin and Camel-back horizontal Francis units

### PERFORMANCE

Francis turbines reach highest efficiencies and highest power output of all water turbines. Each turbine is hydraulically optimized using CFD calculation and model tested in our hydraulic laboratory in order to provide optimal solution and maximum performance and value for customer.

### RELIABILITY

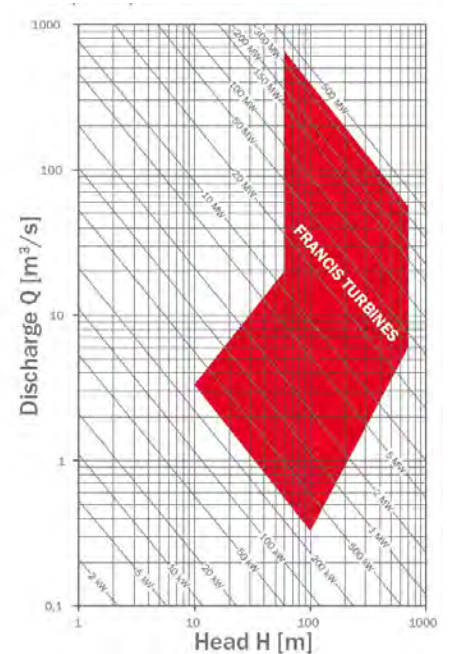
Mechanical design process of Francis turbines is focused on robustness and reliable operation. As a result, our Francis turbines can operate reliably and safely over several decades with minimum maintenance.

### FLEXIBILITY

Litostroj Power latest hydraulic and mechanical developments on Francis turbine runners enable our turbines to continuously and safely operate over wide operating ranges, covering part load, deep part load and in special cases even operating from %100-0 power output.

### TAILORED SOLUTIONS

Francis turbines can be designed in vertical or horizontal configuration. Horizontal Francis unit arrangements are limited by its capacity and size for which Litostroj Power can provide single or double runner configuration. Advantage of horizontal double Francis units is compact design, providing smaller units in size and being competitive in price. For large units vertical arrangement is preferred.



### Application range:

- Heads from 10 m up to 750 m
- Wide range of discharges
- Operating at part load and deep part load
- Outputs up to 350 MW

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