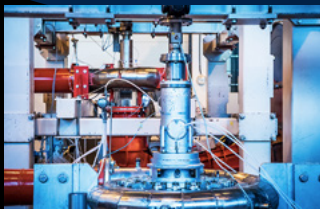


Hydraulic Laboratory



LITOSTROJ
ENGINEERING

Member of Litostroj Group



Hydraulic Laboratory

The hydraulic laboratory is a jewel of our company. It was put into operation at the end of 2008 as part of our strategic orientation, which consists not only of constructing and designing but also of high-quality experimental research and development. The laboratory allows testing of new hydraulic solutions on physical models of hydraulic machines before launching the actual production of water turbines, pumping turbines and pumps. Thanks to the hydraulic laboratory we are able – in cooperation with our partners – to supply hydraulic machines of a world-class quality.

The laboratory has two universal testing rigs which allows independent measurement of two models of hydraulic machines in vertical or horizontal assembly.

In 2011 – the year the hydraulic laboratory was fully completed – the laboratory won second place in the Hi-Tech Property Category in the Business Property Competition organised by the Business and Investment Development Agency CzechInvest.

Tests in our laboratory serve to verify technologies for power engineering and agriculture far abroad. The model test with Kaplan turbines for project such as Moforsen and Valajaskoski in north Europe, the Francis turbine model tests for Rapel (Chille), Martin Dam (USA) and Häusling (AUT) – the highest net head Francis turbine in the world – have taken place here.

We have also tested a new hydraulic solution for the largest Czech hydro energy source – the Dlouhé Stráně Pumped-storage Hydropower Plant in Jeseníky. Specifically, we verified the parameters of the new runner of the reversible Francis turbine – the largest in Europe.

Other projects in which our laboratory has participated concerned hydraulic machines in Austria, Canada, Finland, Germany, Korea, Slovenia, USA, and other countries listed further in references.



Parameters of the universal test rigs:

	1 st rig - Vltava	2 nd rig - Sáva
Maximum Head / H	120 m	120 m
Maximum Discharge / Q	1.2 m ³ .s ⁻¹	0.9 m ³ .s ⁻¹
Max. output of the model / Pmax	300 kW	300 kW
Max. rotation speed of the model	2000 rpm	2000 rpm
Useful capacity of the cal. tank	50 m ³	50 m ³
Commissioning in	2008	2011

Test rigs are fully independent
Capacity for 2 model tests in one time



Hydraulic Laboratory Background

1st Test Rig
- Circulation Pumps



2nd Test Rig
- Circulation Pumps



Compressors

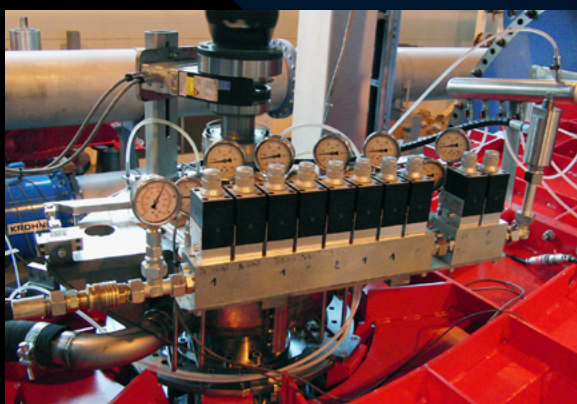
Vacuum Pumps



Examples of Turbine Model Installation



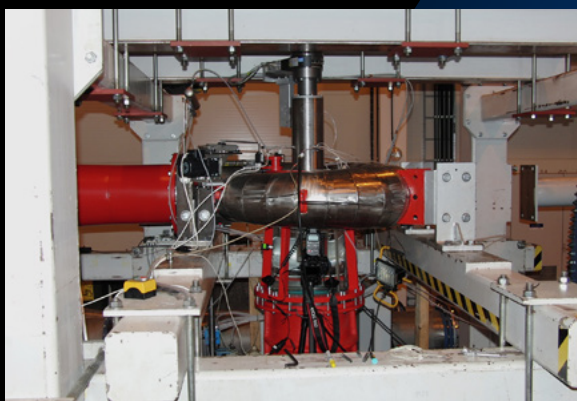
HPP Hapcheon / Korea



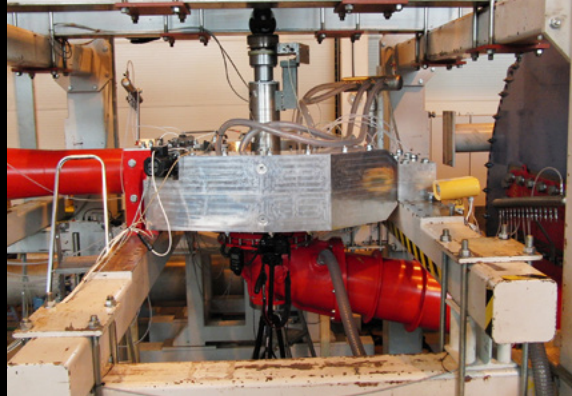
HPP Kuurna / Finland



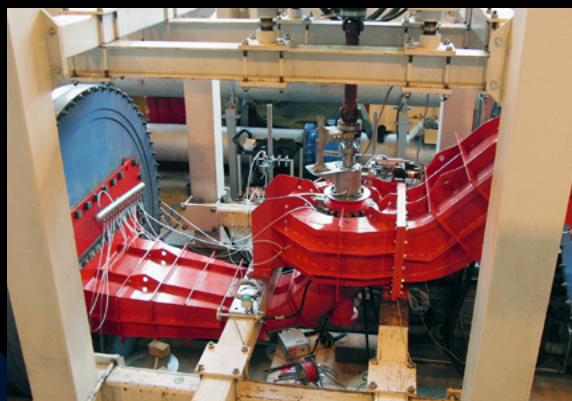
HPP Lower Baker / USA



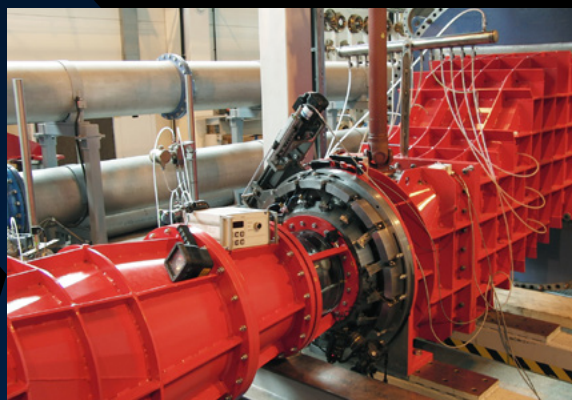
HPP Stejaru / Romania



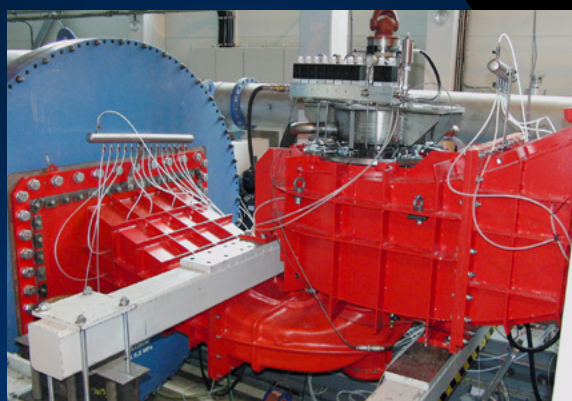
HPP Häusling / Austria



HPP Lay / USA



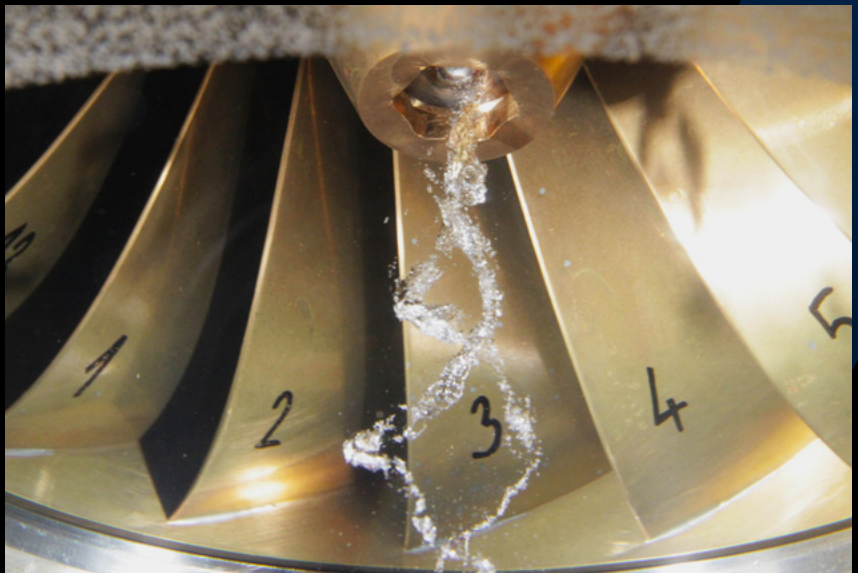
HPP Mokrice / Slovenia



HPP Töging / Germany



**Visualisation
of vortex rope shapes**





Hydraulic laboratory – results, applications and rules

- Complex tests of new hydraulic solutions through physical models of actual water turbines, pump turbines and pumps
- Equipped with two fully independent universal testing rigs
- The measurement in vertical or horizontal arrangement could be carried out
- All measurements are provided according international standards IEC
- More than 55 hydraulic machines of various types have been measured at laboratory
- All necessary characteristics for turbine operation could be prepared
- Our basic approach is – Quality without compromise
- Special focus – Reconstruction



References



HPP Brežice / Slovenia

Description of Activities: Model and Acceptance Test

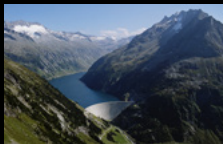
Type of Turbine: Kaplan



HPP Dlouhé Stráně / Czech Republic

Description of Activities: Model and Acceptance Test

Type of Turbine: Francis Pump



HPP Hapcheon / Korea

Description of Activities: Model and Witnessed Test

Type of Turbine: Francis



HPP Häusling / Austria

Description of Activities: Model and Acceptance Test

Type of Turbine: Francis



HPP Kamýk / Czech Republic

Description of Activities: Model and Acceptance Test

Type of Turbine: Kaplan



HPP Klosterfoss / Norway

Description of Activities: Model and Acceptance Test

Type of Turbine: Bulb



HPP Kwoiek Creek / Canada

Description of Activities: Model and Acceptance Test

Type of Turbine: Pelton



HPP Lipno / Czech Republic

Description of Activities: Model and Acceptance Test

Type of Turbine: Francis



HPP Moforsen / Sweden

Description of Activities: Model and Acceptance Test

Type of Turbine: Kaplan



HPP Mörsil / Sweden

Description of Activities: Model and Acceptance Test

Type of Turbine: Kaplan



HPP Rongni Chu / India

Description of Activities: Witnessed Test

Type of Turbine: Pelton



HPP Stejaru / Romania

Description of Activities: Model and Acceptance Test

Type of Turbine: Francis



HPP Tainionkoski / Finland

Description of Activities: Model and Acceptance Test

Type of Turbine: Kaplan



Table of selected models tested in Hydraulic laboratory of Litostroj Engineering a.s.

Year	Project	Country	Turbine type	Model test type	Client
2024	Valajaskoski	Finland	Kaplan turbine	Model and Acceptance test	Kemijoki
2023	Ružín	Slovakia	Pump turbine	Model and Acceptance test	SE
2023	Bouldin	USA	Propeller	Model and Acceptance test	Southern Company
2023	Torrao	Portugal	Pump turbine	Model and Acceptance test	EDP
2023	WTG	Austria	Kaplan turbine	Model and Acceptance test	Verbund AG
2023	GBR GSD GPS	Austria	Kaplan turbine	Model and Acceptance test	Verbund AG
2022	Junsterforsen	Sweden	Kaplan turbine	Model and Acceptance test	Holmen
2022	Hallforsen G1	Sweden	Kaplan turbine	Model and Acceptance test	Uniper
2022	Jochenstein	Austria	Kaplan turbine	Model and Acceptance test	Verbund AG
2022	Reisseck 2 plus	Austria	Pump turbine	Model and Acceptance test	Verbund AG
2022	Bergvik	Sweden	Kaplan turbine	Model and Acceptance test	Fortum
2021	Bjurfors Ovre	Sweden	Kaplan turbine	Model and Acceptance test	Statkraft
2021	Rosshag	Austria	Francis turbine	Model and Acceptance test	Verbund AG
2021	Martin Dam	USA	Francis turbine	Model and Acceptance test	Southern Company
2021	Rapel	Chile	Francis turbine	Model and Acceptance test	ENEL Chile S.A.
2019	Kuurna	Finland	Kaplan turbine	Model and Acceptance test	Kuurnan Voima Oy
2019	Spjutmo	Sweden	Kaplan turbine	Model and Acceptance test	Fortum
2019	Toging	Germany	Kaplan turbine	Model and Acceptance test	Verbund AG
2018	Tubachi	India	Pump	Model and Acceptance test	Wilo Mather & Platt
2018	Limberg	Austria	Pump turbine	Model and Acceptance test	Verbund AG
2018	Stafel	Switzerland	Pump	Model and Acceptance test	HYDRO Exploitation
2018	Lay	USA	Propeller	Model and Acceptance test	Southern Company
2018	Kempwad	India	Pump	Model and Acceptance test	Wilo Mather & Platt
2018	Hausling	Austria	Francis turbine	Model and Acceptance test	Verbund AG
2018	Pump tests	Korea	Pump	Model tests	Doosan
2017	Mörsil	Sweden	Kaplan turbine	Model and Acceptance test	Fortum
2017	Stejaru TI	Romania	Francis turbine	Model and Acceptance test	Hidroelectrica
2017	Rongni Chu	India	Pelton turbine	Witnessed test	Madhya Bharat PC



Table of selected models tested in Hydraulic laboratory of Litostroj Engineering a.s.

Year	Project	Country	Turbine type	Model test type	Client
2017	Dlouhé Stráně TG2	Czech Republic	Pump turbine	Model and Acceptance test	ČEZ
2017	Hapcheon	Korea	Francis turbine	Model and Witnessed test	K-Water
2016	Stejaru TII	Romania	Francis turbine	Model and Acceptance test	Hidroelectrica
2015	Granfors	Sweden	Kaplan turbine	Model and Acceptance test	Skeleftea Kraft
2015	Lipno TG1	Czech Republic	Francis turbine	Model and Acceptance test	ČEZ
2015	Saurashtra	India	Kaplan S-turbine	Model and Acceptance test	Jyoti
2014	Lajes	Brazil	Pelton turbine	Model and Acceptance test	Hisa
2014	Brežice	Slovenia	Kaplan turbine	Model and Acceptance test	HESS
2013	Lower Baker	USA	Francis turbine	Model and Acceptance test	Puget Sound Energy
2013	Singrauli	India	Kaplan S-turbine	Model and Acceptance test	Jyoti
2013	Klosterfoss	Norway	Bulb turbine	Model and Acceptance test	Skien Kraftproduksjon
2013	Pesqeshit	Albania	Francis turbine	Model and Acceptance test	ČKD Blansko Holding
2012	Borgforsen	Sweden	Kaplan turbine	Model and Acceptance test	E-ON
2012	Kamýk	Czech Republic	Kaplan turbine	Model and Acceptance test	ČEZ
2012	Sarapullo	Ecuador	Francis turbine	Model and Acceptance test	ČKD Blansko Holding
2011	Väsa	Sweden	Kaplan turbine	Model and Acceptance test	Fortum
2011	Moforsen	Sweden	Kaplan turbine	Model and Acceptance test	E-ON
2011	Lieksankoski	Finland	Kaplan turbine	Model and Acceptance test	KEMIJOKI OY
2011	Kwoiek Creek	Canada	Pelton turbine	Model and Acceptance test	KCRLP
2011	Ngoi Hut	Vietnam	Pelton turbine	Model and Acceptance test	Flovel
2011	Koyna	India	Deriaz pump turbine	Model and Acceptance test	IVRCL
2010	Chaparral	Columbia	Francis turbine	Model and Acceptance test	ČKD Blansko Holding
2010	Khoda Afarin	Iran	Kaplan turbine	Model and Acceptance test	FARAB
2010	Gangaram	India	Radial pump	Model and Acceptance test	Jyoti
2010	Toro 3	Costa Rica	Francis turbine	Model and Acceptance test	JASEC
2009	Doblar	Slovenia	Francis turbine	Model and Acceptance test	HSE-SENG
2009	Žydowo	Poland	Francis pump turbine	Model and Acceptance test	ČKD Blansko Holding
2008	Dlouhé Stráně	Czech Republic	Francis pump turbine	Model and Acceptance test	ČEZ

