

PUMPS – HYDRAULIC DEVELOPMENT

Client	Country	Year	Pump type	Specif. speed ns
Litostroj	Slovenia	1990	PA	170
Litostroj	Slovenia	1990	P	900
Jugoturbina	Croatia	1990	PA	280
Elektrokovina	Slovenia	1991	PA	160
MZT	Macedonia	1991	CV	50
MZT	Macedonia	1991	CV	80
Litostroj	Slovenia	1991	CNV	100, 125, 150
Termomeccanica	Italy	1993	PAI	550
Voith -Turbo	Germany	1994	HC	$\mu = 5$
Grande Dixence	Switzerland	1995	CNO	
Allweiler	Germany	1995	CN	300
Allweiler	Germany	1995	CN	200
Voith -Turbo	Germany	1995	HC	$\mu = 2.5$
Allweiler	Germany	1995	CN	210
Voith -Turbo	Germany	1996	HS	
Termomeccanica	Italy	1997	CV	55
Termomeccanica	Italy	1997	CV	115
Termomeccanica	Italy	1997	CV	85
Vogel	Austria	1998	CN	65
Vogel	Austria	1998	CN	45
Termomeccanica	Italy	1998	PAI	350
Vogel	Austria	1998	CN	135
Vogel	Austria	1998	CN	195
Termomeccanica	Italy	1998	PAV	350
Termomeccanica	Italy	1999	CV-S	115
Termomeccanica	Italy	2000	CV-S	115
Voith -Turbo	Germany	2000	HC	$\mu = 2.5 - RL$
Vogel	Austria	2001	CN	18
Düchting	Germany	2001	CV	120
Voith - Turbo	Germany	2001	PA	200
Voith -Turbo	Germany	2001	HC	$\lambda = 2 - RL$
Termomeccanica	Italy	2001	PAV	350
Ritz	Germany	2002	PA	270
Termomeccanica	Italy	2002	CN-2	70
Termomeccanica	Italy	2002	CN	145
Voith - Turbo	Germany	2002	HC	$N_i = 1.85$
Voith - Turbo	Germany	2003	HC	$\lambda = 2 - RL$
Voith - Turbo	Germany	2004	HC	$N_i = 1.85$
Voith - Turbo	Germany	2005	HC	$N_i = 1.85$
Termomeccanica	Italy	2007	CN	105
Termomeccanica	Italy	2007	CN	190
Termomeccanica	Italy	2007	CN	47

CN - radial centrifugal pump in spiral casing, **CNO** - radial centrifugal pump for both directions of rotation, **CNV** - one stage radial centrifugal pump with diffuser, **CV** - multistage radial centrifugal pump, **CV-S** suction impeller, **HC** - hydrodynamic torque converter, **HS** - hydrodynamic coupling, **PA** - mixed flow centrifugal pump, **PAI** - mixed flow centrifugal pump pull-out design, **PAV** – mixed flow centrifugal pump in volute, **P** - axial centrifugal pump

REFERENCE LIST
PUMPS – ACCEPTANCE TESTS OF MODEL PUMPS

Project	Country	Year	Pump type
Irrigation system Jazira - Parallel ch.	Iraq	1990	PA
Irrigation system Jazira - Extension ch.	Iraq	1990	PA
Drainage system Pei-An	Taiwan	1994	P
Drainage system Cheng-Kong	Taiwan	1994	P
Irrigation system El-Irad	Egypt	1994	P
Irrigation system El-Mattaria	Egypt	1994	P
Thermo power plant Rades	Tunisia	1996	PA
Istrian water supply system	Croatia	1998	CV
EMS - water supply system	Cyprus	2003	PA
EMS - water supply system	Cyprus	2005	PA

PA - mixed flow centrifugal pump, P - axial centrifugal pump, CV - multistage radial pump

PUMPS – LABORATORY ACCEPTANCE TESTS OF PROTOTYPE PUMPS

Project	Country	Year	Pump type
Water collecting system Lič	Croatia	1990	PAI
Water supply system Rižana	Slovenia	1991	CV
Water supply system Rižana	Slovenia	1991	CV
Thermo Power Plant Šoštanj	Slovenia	1992	CV
Tires Factory SAVA	Slovenia	1993	CV
Water supply system Gorica	Slovenia	1994	CV
Cogen. power plant Ljubljana	Slovenia	1997	PA
Process pump acc. API 610/8	Iran	1997	CP
Process pump acc. API 610/8	Iran	1997	CP
Public ent. Energetika Ljubljana	Slovenia	1998	CP
Water supply system	Cyprus	1999	CN-2
Thermo Power Plant Šoštanj	Slovenia	2000	CPR
Thermo Power Plant Šoštanj	Slovenia	2000	CV
Coal Mine Velenje	Slovenia	2000	CV
Thermo Power Plant Šoštanj	Slovenia	2001	CP
TT Karlovac (6 marine pumps)	Croatia	2002	CN-2
TT Karlovac (9 marine pumps)	Croatia	2003	CN-2
Terfa Irrigation Project (5 pumps)	Egypt	2004	P
TT Karlovac (12 marine pumps)	Croatia	2004	CN-2
Car Factory Renault - Revoz	Slovenia	2004	CV
TT Karlovac (6 marine pumps)	Croatia	2006	CN-2
Bossailiya Irrigation Project (5 pumps)	Egypt	2006	P
Thermo Power Plant Šoštanj	Slovenia	2006	CPB
TT Karlovac (3 marine pumps)	Croatia	2007	CN-2
Thermo Power Plant Šoštanj	Slovenia	2007	CP
TT Karlovac (3 marine pumps)	Croatia	2008	CN-2
El Marashda Irrigatin Project (5 pumps)	Egypt	2009	P

CV - multistage radial centrifugal pump, P - axial flow pump, PA - mixed flow pump, PAI - mixed flow centrifugal pump of pull-out design, CP - process radial pump, CPB - process radial pump for solids transportation, CPR - process radial pump for flue gas desulphurisation applications, CN-2 – double suction pump

REFERENCE LIST

PUMPS SUCTION STRUCTURES TESTING AND OTIMISATION

Project	Country	Year	Type
Power plant Plomin - cooling water pumps sump testing and optimisation Litostroj, Slovenia	Croatia	1988	model
Power plant Solvay - cooling water pumps sump testing and optimisation Termomeccanica, Italy	Tunisia	1995	model
Model sump investigation and optimisation Termomeccanica, Italy	Italy	1998	model
Power plant Komotini - cooling water pumps sump testing and optimisation Termomeccanica, Italy	Italy	2000	model
Cooling water pumps, analysis and proposal for additional pump installation Power plant Trbovlje, Slovenia	Slovenia	2002	analysis
Pump siphon investigation - irrigation project, Termomeccanica, Italy	India	2002	model and CFD
Power plant Ravenna - cooling water pumps sump testing and optimisation Termomeccanica, Italy	Italy	2002	model
Cooling water pumps sump analysis and solution, Cogen. power plant Ljubljana	Slovenia	2003	analysis and execution
Crude oil pipeline Baku-Tbilisi-Cheyan - crude oil transport pumps inlet optimisation, ILF consulting engineers, Germany	Turkey	2003	model and CFD
Cooling water pumps sump, preliminary study, Nuclear power plant Krško, Slovenia	Slovenia	2006	analysis
Water storage system pumps - pump intake optimisation, preliminary study, Electric power state authorities, Croatia	Croatia	2006	analysis
Power plant Ferrara - cooling water pumps sump testing and optimisation, SPIG, Italy	Italy	2007	model
Power plant Kakanj - existing cooling water pumps sump analysis and optimisation, Electric power state authorities, Bosnia and Herzegovina	Bosnia and Herzeg.	2008	model
Power plant Daharki - cooling water pumps sump testing and optimisation, Termomeccanica Pompe, Italy	Pakistan	2008	model
Nuclear power plant Krško - existing cooling water pumps sump analysis and optimisation, Electric power state authorities, Slovenia *	Slovenia	2009	model and CFD

* under execution

REFERENCE LIST

PUMPS – OPTIMISATION OF PUMPS AND PUMP SYSTEMS

Project	Country	Pump type	Power (kW)	Energy costs reduction (%)
Istrian water supply system Buzet	Croatia	CV	425	40
Istrian water supply system Buzet	Croatia	CV	1.150	35
Water supply system Nova Gorica	Slovenia	CV	65	45
Paper and cellulose factory Videm	Slovenia	CN	800	30
Paper and cellulose factory Videm	Slovenia	CN	1.200	20
Water supply system Rižana	Slovenia	CV	330	25
Water supply system Rižana	Slovenia	CV	260	25
Water supply system Ljubljana	Slovenia	PAP	900	25
Water supply system Postojna	Slovenia	CV	1.250	60
Thermo power plant Šoštanj	Slovenia	CV	1.575	50
Water supply system Ljubljana	Slovenia	PAP	1.700	25
District heating system "Šaleška dolina"	Slovenia	CN	360	35
Cogeneration power plant Lj. – TP2	Slovenia	CN-2	2.240	18
Thermo power plant Šoštanj	Slovenia	CV	12.800	6
Cogeneration power plant Lj. – TP1	Slovenia	CN-2	2.520	16
Cogeneration power plant Lj. - cooling water pumps	Slovenia	PA	900	7

CN - radial centrifugal pump in spiral casing, **CV** - multistage radial centrifugal pump, **PA** - mixed-flow pump, **PAP** - submersible mixed-flow pump, **CN-2** - double suction pump

PUMPS – RECONSTRUCTIONS OF PUMPS AND PUMP SYSTEMS

Project	Country	Year	Pump type	Power (kW)
Paper and cellulose factory Videm	Slovenia	1990	CN	1200
Water power plant Vinodol	Croatia	1991	PAI	600
Water supply system Rižana	Slovenia	1991	CV	330
Water supply system Rižana	Slovenia	1991	CV	260
Water supply system Ljubljana	Slovenia	1992	PAP	900
Water supply system Postojna	Slovenia	1992	CV	1250
Thermo power plant Šoštanj	Slovenia	1992	CV	1575
Water supply system Ljubljana	Slovenia	1993	PAP	1700
Cogeneration power plant Ljubljana	Slovenia	1993	P	30
District heating system "Šaleška dolina"	Slovenia	1994	CN	360
Water supply system Kranj	Slovenia	1994	PAP	360
Chemical industry Belinka	Slovenia	1995	CV	75
Pharmaceutical industry Krka	Slovenia	1998	PAP	220
Car factory Revoz	Slovenia	1998	CV	220
Cogeneration power plant Ljubljana – TP2	Slovenia	1999	CN-2	2240
Thermo power plant Šoštanj	Slovenia	2000	CV	945
Cogeneration power plant Ljubljana – TP1	Slovenia	2001	CN-2	2520
Cogeneration power plant Ljubljana – cooling water pumps	Slovenia	2003	PA	1200
Pump turbine power plant Fužine	Croatia	2003	CN	6000
Car factory Renault - Revoz	Slovenia	2004	CV	300
Cogeneration power plant Ljubljana – cooling water pumps	Slovenia	2004	PA	1200
Thermo power plant Šoštanj	Slovenia	2004	CN	90
Cogeneration power plant Ljubljana – cooling water pumps	Slovenia	2006/08	PA	1200

CN - radial centrifugal pump in spiral casing, **CV** - multistage radial centrifugal pump, **PA** - mixed flow pump, **PAI** - mixed flow centrifugal pump pull-out design, **PAP** - submersible mixed-flow pump, **P** - axial centrifugal pump, **CN-2** – double suction pump

REFERENCE LIST
PUMPS and SYSTEMS - FIELD TESTS
FLOW RATE MEASUREMENT WITH CURRENT METERS

Project	Country	Year	Pump type
Thermo Power Plant Trbovlje	Slovenia	2000	PA
Pump turbine power plant Fužine	Croatia	2003	CN
Thermo Power Plant Kakanj	Bosnia and Herzegovina	2004	PA
Cogen. power plant Ljubljana	Slovenia	2005	PA
Nuclear power plant Krško	Slovenia	2006	PA
Thermo Power Plant Kakanj	Bosnia and Herzegovina	2007	PA
Thermo Power Plant Trbovlje	Slovenia	2008	PA

PA - mixed flow pump - cooling water pump, **CN** – radial pump in spiral casing - storage pump

PUMPS and SYSTEMS - FIELD TESTS
FLOW RATE MEASUREMENT WITH ULTRASONIC METHOD

Project	Country	Year	Pipe diameter ND (mm)
Heating System Talum	Slovenia	2003	350
Thermo Power Plant Šoštanj - Condenser Pumps	Slovenia	2004	350
Cogen. Power Plant Ljubljana - Condenser Pumps	Slovenia	2005	350
Thermo Power Plant Šoštanj - Unit No 4, Liquid Slag Transport	Slovenia	2005	200
Thermo Power Plant Šoštanj - Unit No 5, Liquid Slag Transport	Slovenia	2005	350
Thermo Power Plant Plomin - Condenser Pumps	Croatia	2006	250
Thermo Power Plant Šoštanj - Unit No 3, Cooling Water Pumps	Slovenia	2007	1400
Thermo Power Plant Šoštanj - Unit No 4, Cooling Water Pumps	Slovenia	2007	1600
Thermo Power Plant Šoštanj - Unit No 2, Cooling Water Pumps	Slovenia	2008	1200
Thermo Power Plant Šoštanj - Unit No 1, Cooling Water Pumps	Slovenia	2008	1200

REFERENCE LIST

PUMPS – TECHNICAL EDUCATION

Client	Country	Year	Type of course
Nuclear power plant Krško	Slovenia	2003	Centrifugal pumps
Nuclear power plant Krško	Slovenia	2003	Cavitation in pumps
Cogeneration power plant LJ	Slovenia	2003	Centrifugal pumps
Thermo power plant Šoštanj	Slovenia	2004	Centrifugal pumps
Thermo power plant Trbovlje	Slovenia	2005	Centrifugal pumps
Tenaga Nasional Berhad	Malesia	2005	Pumps - General
Tenaga Nasional Berhad	Malesia	2005	Pumps in Power Plants
Electrical energy authorities	Bosnia and Herzegovina, Serbia	2006	Pumps in Power Plants - Life Cycle Costs
Nuclear power plant Krško	Slovenia	2006	Q-H characteristics of centrifugal pump
Makfluid	Macedonia	2007	Water hammer in pumping stations
Termomeccanica - Pompe	Italy	2008	Centrifugal pumps 1 - General
Termomeccanica - Pompe	Italy	2008	Centrifugal pumps 2 - hydraulic design, CFD
Termomeccanica - Pompe	Italy	2009	Centrifugal pumps 3 - FEM, WH, practical work - CFD*

* under execution

PUMPS – PUBLISHING

Florjančič D.: Troubleshooting handbook for centrifugal pumps, Turboinštitut, Ljubljana, 2008

PUMPS OPERATING AS TURBINES

Project	Country	Power (kW)	Scope
MHE Zanjivec pressure reduction in water supply system	Slovenia	45	initial project, main project, engineering, delivery, comissioning
MHE Sovič pressure reduction in water supply system	Slovenia	13	initial project, main project

REFERENCE LIST

PUMPS – MANUFACTURING OF SPECIAL PUMPS (Extract)

Client	Country	Year	Q l/s	H m	P kW	n rpm	No.	Pump type
Water power plant Vinodol	Croatia	1991	850	18	200	1450	3	PAI
Pharmaceutical industry Lek	Slovenia	1991	75	45	45	2900	6	CP
Water supply system Rižana	Slovenia	1991	80	97	110	1450	3	CVV
Water supply syst. Postojna	Slovenia	1992	75	150	160	1450	3	CVD
Thermo power plant Šoštanj	Slovenia	1992	130	125	315	1450	3	CV
Water supply syst. Ljubljana	Slovenia	1993	85	73	85	2900	23	PAP
Tires factory Sava	Slovenia	1993	33	190	110	2900	2	CV
Water supply system Gorica	Slovenia	1993	22	452	160	2900	2	CV
Water supply system Kranj	Slovenia	1994	80	100	120	1900	3	PAP
Thermo power plant Šoštanj	Slovenia	1994	120	45	90	1550	2	CPR
Thermo power plant Šoštanj	Slovenia	1994	25	36	18,5	1450	3	CND
Water supply syst. Medvode	Slovenia	1995	46	78	57	2900	2	PAP
Water supply syst. Ljubljana	Slovenia	1996	80	85	102	2900	4	PAP
Water power plant Vinodol	Croatia	1996	100	25	34	2900	2	PAP
Thermo power plant Šoštanj	Slovenia	1996	28	120	55	2900	2	CV
Cogeneration power plant Lj.	Slovenia	1997	1055	14	200	750	2	PA
Water supply syst. Ljubljana	Slovenia	1997	75	72	82	2900	1	PAP
Hidro Koper	Slovenia	1997	500	4,5	45	960	1	P
Public ent. Energetika Lj.	Slovenia	1998	70	130	132	2900	2	CP
Water supply system Ig	Slovenia	1998	20	90	34	2900	1	PAP
Pharmaceutical ind. Krka	Slovenia	1998	80	50	57	2900	4	PAP
Car factory Revoz	Slovenia	1998	75	55	55	1450	3	CV
Mežica mine	Slovenia	1999	78	20	30	1450	3	CPR
Thermo power plant Šoštanj	Slovenia	2000	80	36	45	1450	1	CPB
Thermo power plant Šoštanj	Slovenia	2000	280	36	160	960	2	CPR
Thermo power plant Šoštanj	Slovenia	2000	136	155	315	1450	3	CV
Thermo power plant Šoštanj	Slovenia	2000	5	20	2,2	2970	2	CPB
Metalurgical ind. Zletovo	Maced.	2001	67	58	90	1450	2	CPR
Thermo power plant Šoštanj	Slovenia	2002	110	125	200	2900	1	CN
Tires factory Sava	Slovenia	2002	33	190	110	2900	1	CV
Thermo power plant Šoštanj	Slovenia	2002	30	15	11	960	2	CN
Pump turbine PP Fužine*	Croatia	2003	9000	57	6000	375	1	CN
Thermo power plant Šoštanj	Slovenia	2004	18	100	45	2900	1	CV
Thermo power plant Šoštanj	Slovenia	2004	36	14	11	1450	2	CPB
Thermo power plant Šoštanj	Slovenia	2004	80	20	22	1450	2	CN
Mežica mine	Slovenia	2004	78	20	30	1450	1	CPR
Car Factory Renault - Revoz	Slovenia	2004	90	55	75	2900	4	CV
Cogen. power plant Lj.*	Slovenia	2005	1670	18	450	740	1	PA
Thermo power plant Šoštanj	Slovenia	2006	75	17	22	1450	1	CPB
Thermo power plant Šoštanj	Slovenia	2006	140	145	250	2950	1	CN
Thermo power plant Šoštanj	Slovenia	2007	35	170	110	2950	2	CP
Cogen. power plant Lj.*	Slovenia	2008	1670	18	450	740	1	PA

CN - radial centrifugal pump in volute casing, **CND** - one stage radial vertical pump, **CP** - process radial pump, **CPR** - process radial pump for flue gas desulphurisation applications, **CPB** - process radial pump for solids transportation, **CT** - radial pump running as turbine, **CV** - multistage radial horizontal pump, **CVD** - multistage radial vertical pump - wet installation, **CVV** - multistage radial vertical pump - dry installation, **PA** - mixed flow pump, **PAI** - mixed-flow pump - pull-out design, **PAP** - submersible mixed-flow pump, **P** - axial pump, **PP** - submersible axial pump, * impeller

REFERENCE LIST
DESIGN, ENGINEERING, CONSULTING (Extract)

Project, Client	Country	Year
Rotor-dynamic analysis of double entry horizontal francis turbines for HPP Misema and Mamquam in Canada for water turbine manufacturer Litostroj, Slovenia	Slovenia/Canada	2003
Boiler feed pump vibrations reduction (measurements, solutions), Nuclear power plant Krško	Slovenia	2003
Boiler feed pump rotor-dynamic analysis and suggestions for improvement, Nuclear power plant Krško (realised by owner)	Slovenia	2003
NOx reduction in flue gasses (project and engineering), Thermal power plant Šoštanj	Slovenia	2004
Cooling water flow rate measurement - flow meter design, engineering and comissioning, Cogeneration power plant Ljubljana	Slovenia	2004
Storage pump control by inlet vortex (analysis), Storage pump - pumping power plant Fužine, HEP	Croatia	2005
Water hammer calculations for 7 pumping stations Ebtikar Investment Company	UAE	2005
Acceptance tests supervision at supplier, flue gas main circulating pumps (Weir-Warman), Thermal power plant Trbovlje, Slovenia	Slovenia/Great Britain	2005
Liquid slag transport to deposit (project), Thermal power plant Šoštanj, Slovenia	Slovenia	2005
Acceptance model tests supervision at supplier (Mitsubishi heavy industries), reversible pump-turbine, SENG, Slovenia	Slovenia/Japan	2006
Project, engineering, manufacturing, calibration and delivery of four venturi meters for steam ($p = 100$ bar, $T = 500$ °C) for Cogeneration power plant Ljubljana	Slovenia	2 x 2006 and 2 x 2007
Improvement of condensate pumps regarding cavitation erosion and change of system characteristics - a study for coal fired power plant Šoštanj, Slovenia (erosion rate estimation according to EPRI recommendations, proposal for pumps modifications, testing at site).	Slovenia	2007
Modification of cooling water system of unit no. 3 - a project for coal fired power plant Šoštanj, Slovenia (hydraulic design, water hammer calculations, stress analysis, layout, documentation).	Slovenia	2008
Revitalization of flow measurement system (design, calibration, delivery) in Paper and cellulose factory Radeče, Slovenia.	Slovenia	2008
Rotor-dynamic analysis of double entry horizontal francis turbines (complete unit) for HPP Lower Clowham and Bone Creek, Canada for water turbine manufacturer Litostroj, Slovenia	Slovenia/Canada	2008
CFD analysis of existing cooling water pumps for Nuclear power plan Krško, improvement regarding efficiency and cavitation and redesign to changed system requirements, Electric power state authorities, Slovenia *	Slovenia	2008

* under execution