

JASINOX AG TURNING AND MILLING

TIBRAM AG CUBIC MACHINING

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CONTACT

EFFICIENT DESANDERS FOR HIGH-HEAD HYDROELECTRIC POWER PLANTS

The «Bieri» desanding system ensures particle-free water to minimize downtime in high-head hydropower plants.



Switzerland, known as the water tower of Europe, generates 36 terawatt hours per year of hydroelectric energy. Various technologies are used, such as run-of-river, down-flow and pumped storage plants. Water intakes in the mountains feeding high-head power plants need efficient desanding systems to protect turbines as well as penstocks and diffusers from excessive wear and damage due to abrasion. These desanding systems must ensure that the turbine intake water is as free as possible from sand and other particles.

Conventional desanding systems

The «Büchi» desanding system uses longitudinal sand trap units with horizontal flushing in high-head hydropower plants. The water flows through an elongated basin in which the sediment particles can settle due to reduced flow velocity. The desanded water flows out of the basin straight into the penstock



Dear readers,

As an ISO 14001 certified company we support our customers in environment-friendly production, as shown by our several projects for various hydropower plants.

Efficient desanding system.

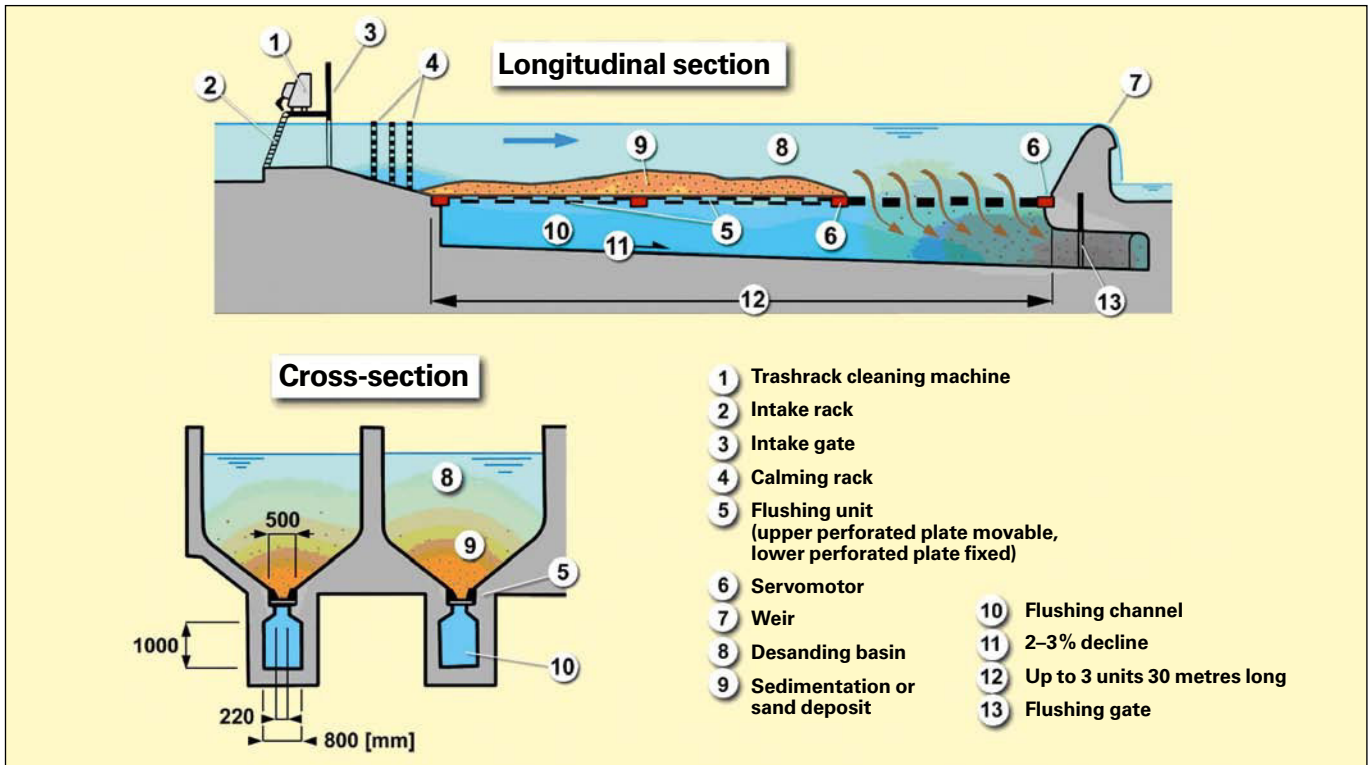
High-head water turbines require particle-free water as far as possible to reduce abrasion damage and to increase power generation time. The «Bieri» desanding system has proved itself worldwide. Our introductory article describes the «Bieri» system and its advantages, as illustrated by two major desander projects in Switzerland and Malaysia.

Overhaul of hydroelectric power plant components.

With our metal processing know-how we provide both large and small hydropower plant operators with valuable support in maintaining or overhauling their facilities and equipment.

Our professional project management expertise helps to minimize power plant downtime and ensure punctual delivery of replacement parts. This issue shows you how we practice the industrial art of manufacturing.

Stefan Schürch
Proprietor, Tibram Holding



Schematic diagram of «Bieri» desanding system with vertical flushing

or a balancing reservoir. The disadvantage of this system is that in order to regularly remove deposited sediments, the basins are completely flushed out by the incoming river water. During flushing the basin has to be shut down and power generation is interrupted. With the «Büchi» system, it is therefore mandatory to have several desanding basins in order to maintain power generation.

Desanding method with the «Bieri» system

The «Bieri» desanding system is based on vertical flushing units that are cast into concrete. The flushing units are installed in the lowest part of the v-shaped basin. Each sand flushing unit consists of a base frame with openings on which the longitudinally movable slide is mounted. The slide is opened and closed by two hydraulic cylinders at each end of the unit. The flushing channel is located underneath the base frame. At the end of the basin is a concrete overfall, which ensures

a regular water level in the basin. The maximum opening position of the slide to flush sedimentation out of the basin is controlled by the programmable logic controller (PLC). The electrical control cabinet and the hydraulic power unit are located in a separate control room. Additional sand measuring devices are also available. The «Bieri» desander with its optimized control system minimizes the amount of flushing water required. This concept enables fully automated flushing according to the amount of sand accumulated on the sand trap.

Advantages of the «Bieri» vertical flushing system

The advantage of vertical flushing units is that no continuous purge stream is required for flushing during a long period of time. This means that no shut down of the water level in the desander basin is required, so that turbine operation continues during the sedimentation flushing procedure. Due to the adjustable flushing unit manage-

ment by the PLC the flushing water consumption is up to 50 percent less than with horizontally flushing systems. This substantially reduces power production losses accordingly. The mechanical flushing units are manufactured in lengths of 15, 20, 25 and 30 metres. This enables selective flushing unit design depending on the water flow rate, quantity of sand, kind and size of sand particles, required separation degree, and constructional conditions on site.

The «Bieri» vertical desanding system, successfully implemented worldwide for decades by experienced Swiss Sedimentation Technologies (SST) specialists, is manufactured today by the Tibram Group. Our customers benefit thereby from professional advice and support right from planning to installation and commissioning.



SUCCESSFUL OVERHAUL OF A DESANDING SYSTEM IN THE VALAIS

Together with Swiss Sedimentation Technologies application specialists, the Mattsand water intake desanding system was completely overhauled in winter 2013 for the EnAlpin AG power company.

Mattsand water intake at 1233 metres altitude was designed and implemented by Motor-Columbus AG consulting engineers in 1956. In two (2) w-shaped basins, each 60 metres long, 8 desander units 30 metres in length were installed in total. Water from the drainage area around the Matterhorn flows to the desander. The balancing basin feeds the turbines of Ackersand power plant, belonging to Aletsch AG in Stalden, at 795 metres altitude. After more than fifty years in service, the existing desanding system suffered considerable abrasion damage. The amount of water leakage with closed desander was now so high that flushing was only carried out sporadically – to save purging water. A total overhaul of the mechanical

parts was indispensable in order to operate the desander system regularly. Within the framework of a 3 month preliminary project, EnAlpin AG, Swiss Sedimentation Technologies and the Tibram Group jointly established the necessary overhaul outlay. Based on positive experiences gained on former projects with Engadiner Kraftwerke AG and Forces Motrices de la Gougra SA, it was decided to install well-proven modern slider technology using self-sealing Motec plates. Motec plates are steel plates with a special plastic covering, developed by Bieri in 1995. These plates are installed floating in the slide. Compared to conventional slides, the Motec Plate is much more wear

resistant and water spill leakage is fundamentally less. The well-proven slide guide plates, interference angles and cross-sectional geometry were retained. The overhaul also includes replacement of the press cylinders and parts of the hydraulic piping. For this project the Tibram Group supplied 18 brand new hydraulic cylinders with a stroke of 230 millimetres. They operate at a pressure of 230 bar, corresponding to an impact force of 40 tons. The cylinder and piston rods were coated with a special anti-corrosion agent before works assembly and successful testing at 330 bar. Our quality assurance program based on the ISO 9001 standard qualifies the Tibram Group to fulfil the required



View into the flushing water channel



Aligning the baseframe



DESANDING SYSTEM FOR A 382 MW PROJECT IN MALAYSIA

In the mountains of Malaysia, approximately 200 km north of Kuala Lumpur, a new 382 MW hydroelectric power plant has been under construction since 2011.

specifications. The cylinders were delivered and installed on time, so that the water intake was punctually commissioned on April 3, 2014 as planned.

Results after the first six months of operation are very positive. Leakage water losses are now so much less that about 30 minutes after each flushing, no water leakage can be detected.

The 382 MW power plant «Ulu Jelai» is fed in part by the Telom river at 12.2 m³/s including a lot of sand during the rainy season. The operators therefore decided for the cost-effective «Bieri» desander system. Swiss Sedimentation Technologies is responsible for the design, manufacturing, installation and commissioning of the desanding system, while the Tibram Group is responsible for the steel-work and manufacturing of the hydraulic cylinders. The system consists of two open w-shaped basins. Each basin is 20 meters long and contains two (2) flushing units. Through the penstock tunnel (diameter 3.75 m) water is fed to two 191 MW turbines installed in caverns. The structural steel components such as baseframes with cylinder boxes, hydraulic servo cylinders and slide plates, are manufactured in the works of Tibram, Jasinox and Jost. The specialized know-how of the Tibram Group is particularly in demand for production of the baseframe and slide plates, where workpieces up to 5 metres long must be completely machined in one set-up to achieve the required dimensional and shape accuracy. Even small deviations can have serious effects on the slide assembly. In teamwork with our related suppliers, all components are coated with a durable corrosion protection. The waterproof encapsulated limit switches and protective devices for the sand height vibratory measurement system (sand measuring device) are also made by the Tibram Group. For approval and factory acceptance testing, one flushing unit 20 meters long is fully assembled in the Tibram works.



Construction of an open desander

Tibram Group input

- Complete manufacturing of 18 servo-hydraulic cylinders
- Pressure testing of cylinders at 330 bar

Tibram Group input

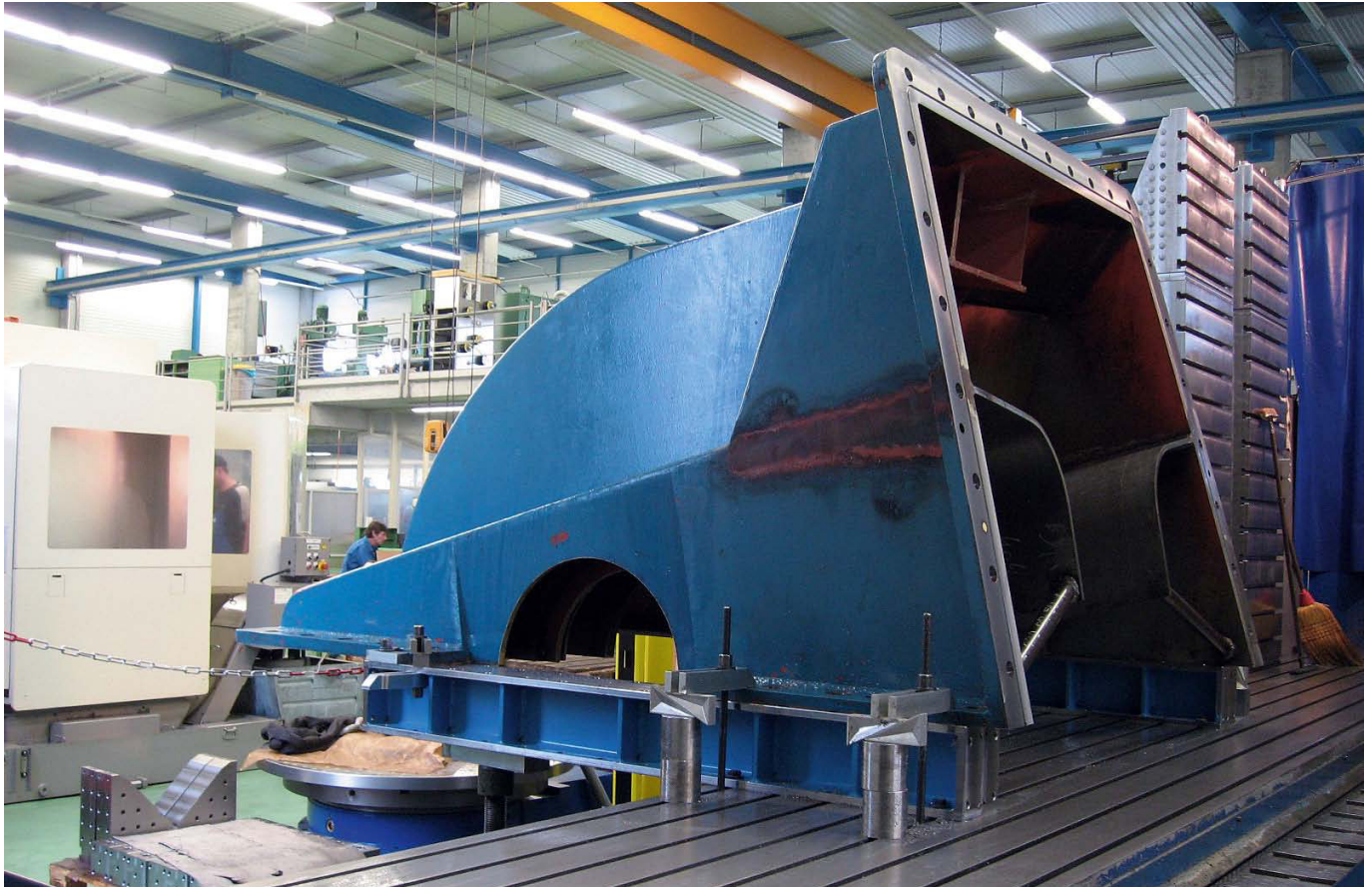
- Complete machining of 5 metre long workpieces
- Complete manufacture of servo-hydraulic cylinders works testing
- Complete fabrication of structural steel components
- Installation of all extractor devices



Assembled servo cylinder for a desanding system

OVERHAULING POWER PLANT COMPONENTS

Turning, milling and welding large components is a Tibram Group speciality. Power plant operators thus benefit single-source from our comprehensive metal-working skills.



Turbine housing on the rigid-bed milling machine

For maintenance and conversion work on power plants, bulky components often have to be overhauled, modified or reworked. Within the Tibram group we have all the necessary know-how for manufacturing or modifying large parts. The following project descriptions give an insight into our machining skills.

Turbine housing overhauls

On behalf of Grimsel Hydro, the Tibram Group overhauled the Linth-Limmern «Tierfehd» power plant turbine housing. Thanks to our large rigid-bed milling machine, this 3200 kg housing was easily reworked – also because the workshop is designed for handling large components. The two flange faces



View into the machine room of «Handeck 1» power plant



Gelmersee reservoir also feeds «Handeck 1» power plant

of the large housing (outside dimensions 2500 x 2000 x 2300 mm) were machined and provided with a new sealing groove.

New regulating support

The Tibram Group produced a new regulating support for the KWO power plant «Handeck 1». Based on the customer’s drawings, the complete support was manufactured in our works. For this, our production specialists had to establish all welding and machining sequences to the finest detail in order to meet the exacting demands on dimensional and shape accuracy. A particular challenge was compliance with the close geometric tolerances between the flange faces and bearing point. Thanks to vast experience and the meticulous planning of each step, the regulating support was completed to the entire satisfaction of KWO, and punctually delivered.



Finish-machined regulating support

TIBRAM GROUP CAPABILITIES

Metal processing

- Turning up to Ø 1800 mm x 4400 mm length
- Bezel turning up to Ø 650 mm, B-axis machining
- Milling up to 6500 mm x 2500 mm x 1250 mm, including 4th axis

Locksmithery

- MIG / MAG / TIG welding, stud welding
- Guillotine shearing, folding, round bending, oxyacetylene welding

Assembling

- Installation and works commissioning of complete aggregates, including mechanical, pneumatic, hydraulic and electrical units

Services

- Consulting, Engineering, Logistics and Quality Control

Jost AG

Obermattweg 25
 CH-3550 Langnau i. E.
 Phone +41 34 409 55 55
 info@jostag.ch
 www.jostag.ch

Tibram AG

Industriestrasse 2
 CH-3661 Uetendorf
 Phone +41 33 345 10 57
 info@tibram.ch
 www.tibram.ch

Jasinox AG

Obermattweg 25
 CH-3550 Langnau i. E.
 Phone +41 34 402 74 16
 info@jasinox.ch
 www.jasinox.ch

opdesign ag

Obermattweg 25
 CH-3550 Langnau i. E.
 Phone +41 34 409 55 53
 info@opdesign.ch
 www.opdesign.ch