High Strength Steels for Hydropower Plants
Design Concepts - Pressure Conduits
18. - 20. September 2013, Graz, Austria

Scientific Programme
Editors: H. Cerjak, N. Enzinger, R. Greiner, G. Zenz
The worldwide production of electricity undergoes dramatic changes in the recent years that had also tremendous impacts on the demands on hydro power. In the last years new experiences have been made in planning, fabrication and service of new plants. Especially also for existing pumping power schemes new service and operation modes are required. This has influence on the load profiles and dimensioning and life evaluation of the conduits.

The scope of the 3rd conference is to discuss the developments of the recent years as well as how to tackle the new challenges caused by the advanced operation modes on the

- concepts,
- design,
- materials and fabrication

for the conduits. This not only for the steel lining but also under consideration of the interaction between steel lining, concrete and rock. This requires new solutions far beyond actual standards and experiences.

The following items will be presented as invited as well as selected submitted individual contributions in the plenary session, followed by a discussion. In addition poster presentations are foreseen.

**Topics:**

1. Planning, potential, requirements, energy development, storage concepts: Review, current situation, future prospects
2. Construction concepts for pressure tunnels (armored or unarmored)
3. Materials, joining and quality assurance
4. Steel construction, design, safety concepts, structural calculation
5. Safety and life cycle evaluation of existing plants

**Site visit (20 September 2013):**

Full day trip to the construction site of Reisseck II pumped storage power plant by invitation of VERBUND Hydro Power AG.
Day 1 - 18 September 2013

08.00 - 10.00  Registration

10.00 - 10.50  Welcome & Plenary Lecture

Development, Experiences and Qualification of Steel Grades for Hydro Power Conduits
H. Cerjak, N. Enzinger (TU Graz, Institute for Materials Science and Welding), M. Pudar (Magna Steyr Fahrzeugtechnik AG & Co KG) - AUSTRIA

Session 1: Planning, potential, requirements, energy development, storage concepts: Review, current situation, future prospects

10.50 - 12.30  Chairs: P. Grasso, P. Matt

S1 - 1
10.50 - 11.15  Hydraulic Aspects on the Design of Water Conduits
G. Zenz, J. Schneider, W. Richter, H. Knoblauch (TU Graz, Institute of Hydraulic Engineering and Water Resources Management) - AUSTRIA

S1 - 2
11.15 - 11.40  Steel Lining Design in Various Project Phases
P. Oberleitner, P. Steyrer (PÖYRY Energy GmbH Salzburg) - AUSTRIA

S1 - 3
11.40 - 12.05  Conventional Design of HPP Pressure Shafts according to G. Seeber, considering the surrounding Rock Mass
A. Vigl (viglconsult ZT) - AUSTRIA

S1 - 4
12.05 - 12.30  Considerations on Concepts for the Design of Pressure Shafts
G. Innerhofer sen., G. Innerhofer jun., (Vorarlberger Illwerke AG) - AUSTRIA

12.30 - 13.30  Lunch
Final Programme

Session 2: Construction concepts for pressure tunnels (armored or unarmored)

13.30 - 16.00  Chairs: P. M. Genton, J. Launay

S2 - 1
13.30 - 13.55  Pressure Shaft Steel Linings for HPP – Development in recent Verbund Projects in Austria
J. Mayrhuber, P. Stering (VERBUND Hydro Power AG), H. Cerjak (TU Graz, IWS) - AUSTRIA

S2 - 2
13.55 - 14.20  Obervermuntwerk II Penstock Design
P. Meusburger (Vorarlberger Illwerke AG), W. Glas (ITEG IT-Engineers GmbH) - AUSTRIA

S2 - 3
14.20 - 14.45  The Renewal of the Pressure Shaft for the High Head Hydropower Plant Kaunertal in Austria - Part 1
P. Bonapace, A. Hammer, R. Maldet, O. Schüller (TIWAG-Tiroler Wasserkraft AG) - AUSTRIA

S2 - 4
14.45 - 15.10  Reduction in Stresses in Penstock Bifurcations
A Design Concept where High Strength Steels are favored
M. Takeyama (Yonden Consultants Co., Inc.), H. Murayama (Power Tech Consortium) - JAPAN

S2 - 5
15.10 - 15.35  Challenges in the Design of Hydraulic Steel Structures and Powerhouses
K. Krueger, A. Lechner (Voith Hydro Holding GmbH & Co. KG) - GERMANY

S2 - 6
15.35 - 16.00  The Demands for Standards in Design and Quality Control of High-Strength Steel Liners – an Engineer’s View
A. Panenka, C. Curnis (AF-Consult Switzerland Ltd.) - SWITZERLAND

16.00 - 16.30  Coffee break
Session 3: Safety and life cycle evaluation of existing plants

16.30 - 18.10  Chairs: R. Greiner, P. Oberleitner

S3 - 1
16.30 - 16.55  In-situ Deformation Measurement of the Hongrin-Léman Shaft
O. Chène (Alpiq Suisse SA) - SWITZERLAND

S3 - 2
16.55 - 17.20  Fatigue Cracks Propagation in Steel-lined Pressure Shaft of Pumped-storage Power Plants under normal Operation Conditions
F. E. Hachem and F. Giovanola (Stucky Ltd.) - SWITZERLAND

S3 - 3
17.20 - 17.45  Fatigue Assessment of Hydropower Plants – Penstocks using IIW-Notch Stress Concept
R. Demal and C. Moser (TU Graz, Institute of Lightweight Design) - AUSTRIA

S3 - 4
17.45 - 18.10  Impact of Pressure Fluctuation on the Fatigue Life of High Pressure Penstocks
F. Duparchy, P.-A. Chambas, H. Marin, F. Pereira, T. Combaz (Alstom Hydro France) - FRANCE

19.00 - 22.00  Welcome Reception at Aula Graz University of Technology

Day 2 - 19 September 2013

Session 4: Steel construction, design, safety concepts, structural calculation

08.30 - 10.10  Chairs: K. Horikawa, R. Starnberger

S4 - 1
08.30 - 08.55  Design of Branch Pipes with High Strength Steel
Y. Hayashi and N. Watanabe (Mitsubishi Heavy Industries Mechatronics Systems, ltd.) - JAPAN

S4 - 2
08.55 - 09.20  Design and Execution of Two Penstocks in Switzerland KLL – Linthal 2015, KWO – Innertkirchen 1
D. A. Heinz, M. J. Herb (DSD NOELL GmbH) - GERMANY
Final Programme

S4 - 3  
09.20 - 09.45  New Design Aspects for Steel Linings of Pressure Shafts made of High Strength Steel  
R. Greiner (TU Graz, Institute of Steel Structures), G. Innerhofer sen. (Vorarlberger Illwerke AG), W. Stering (TU Graz, Institute of Steel Structures) - AUSTRIA

S4 - 4  
09.45 - 10.10  Load Carrying Behaviour of Thrust Rings in Pressure Conduits  
H. Unterweger, A. Ecker, W. Stering (TU Graz, Institute of Steel Structures) - AUSTRIA

10.10 - 10.40  Coffee break

Session 5: Steel construction, design, safety concepts, structural calculation


S5 - 1  
10.40 - 11.05  Nant de Drance Transition Lining and Gate Housing  
A Challenge of FEA based Stress Evaluation  
C. Pollak-Reibenwein, R. Ralón-Rosales (Andritz Hydro GmbH) - AUSTRIA  
P. Zsak (Pöyry Energy Ltd.) - SWITZERLAND

S5 - 2  
11.05 - 11.30  Numerical Modelling of Full-Scale Penstock Model Testing  
U. Tatic, S. Sedmak, A. Djurdjevic (Innovation center of the Faculty of Mechanical Engineering), A. Sedmak (Faculty of Mechanical Engineering, University of Belgrade), R. Bakić (Technical School) - SERBIA

S5 - 3  
11.30 - 11.55  Stress Analysis in Rock-embedded Miter Bends - New Derivation and Extension of existing Formulae for the Use in Penstocks  
A. Lechner (Voith Hydro Holding GmbH & Co. KG) - GERMANY, R. Greiner (TU Graz, Institute of Steel Structures) - AUSTRIA, K. Krueger (Voith Hydro Holding GmbH & Co. KG) - GERMANY
Fatigue Strength of High Strength Steel Linings with different Types of Grouting Openings
R. Greiner (TU Graz, Institute of Steel Structures) - AUSTRIA,
A. Lechner (Voith Hydro Holding GmbH & Co. KG) - GERMANY

Session 6: Materials, joining and quality assurance

Qualification Procedure of Thermomechanical Steel ALFORM 700 for Pressure Shaft Lining of Reisseck II Pumped Storage HPP
J. Mayrhuber, Ch. Kirilowitsch (VERBUND Hydro Power AG), H. Cerjak, N. Enzinger (TU Graz, IWS) - AUSTRIA

The Renewal of the Pressure Shaft for the High Head Hydropower Plant Kaunertal in Austria - Part 2
A. Hammer, O. Schüller, R. Maldet, P. Bonapace, (TIWAG-Tiroler Wasserkraft AG) - AUSTRIA

Effect of Weld Imperfections on Fracture Assessment of Undermatched Joint of High Strength Steel for Penstocks
M. Mochizuki, S. Okano (Department of Materials and Manufacturing Science, Osaka University) - JAPAN

Determination of Limit Loads for New Pipe – Ring Specimens
N. Gubeljak, A. Likeb (University of Maribor, Faculty of Mechanical Engineering) - SLOVENIA, Y. G. Matvienko (Mechanical Engineering Research Institute of the Russian Academy of Science) - RUSSIA

Coffee break
Session 7: Materials, joining and quality assurance

15.30 - 17.10  Chairs: M. Mochizuki, N.N.

S7 - 1  
15.30 - 15.55  Application of TMCP to High Tensile Strength Steel Plates for Penstock
K. Onishi (Osaka Office), M. Okushima and K. Kurebayashi (Nagoya Works), H. Katsumoto and T. Kamo (Kashima Works), T. Kawabata and K. Fujiwara (Technical Research & Development Bureau) (all from Nippon Steel & Sumitomo Metal Corporation) - JAPAN

S7 - 2  
15.55 - 16.20  High Strength Heavy Plates for Penstocks
R. Egger, S. Kapl, F. Mayrhofer (voestalpine Grobblech GmbH) - AUSTRIA

S7 - 3  
16.20 - 16.45  Current State of Welding Consumables for High Strength Steels
H. Kawasaki, N. Hara (KOBE STEEL, LTD.) - JAPAN

S7 - 4  
16.45 - 17.10  Comprehensive Investigations of new Filler Materials for Welding of High Strength Steels
R. Schnitzer (Böhler Schweißtechnik Austria GmbH), R. Rauch, W. Ernst, J. Wagner (voestalpine Stahl GmbH), S. Baumgartner (Böhler Schweißtechnik Austria GmbH), M. Leitner, M. Stoschka (Montanuniversität Leoben), T. Schlagradl (TÜV Austria Services GmbH), R. Schneider (Univ. of Appl. Sciences Upper Austria), C. Bernhard (Montanuniversität Leoben) - AUSTRIA

17.10 - 18.00  Final discussion

19.00 - 23.30  Conference Dinner
Minoritensäle Graz
Mariahilferplatz 3, 8010 Graz
(20 min. walk from the conference venue)
Day 3 - 20 September 2013

Site visit Reisseck II

08.00  Departure Graz by bus
10.30  Arrival at Reisseck II:
       Welcome & visit of construction site
14.30  Lunch
16.00  Visit of Rottau powerhouse
17.00  Return to Graz
20.00  Arrival Graz
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Venue

Graz University of Technology
New Campus (Neue Technik) - HS H „Exper. Chemie“
Stremayrgasse 9, ground floor - 8010 Graz

Conference fee

Delegates: 500 Euro
Students (bachelor and master): 250 Euro
Accompanying person (evening events): 70 Euro
Site visit 70 Euro (Reisseck II)

Conference organisation

Responsible person:
Isabella Scheiber
Tel.: +43 316 873-7182; Fax: +43 316 873-7187
Email: hss2013@tugraz.at

http://www.hss2013.tugraz.at/
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