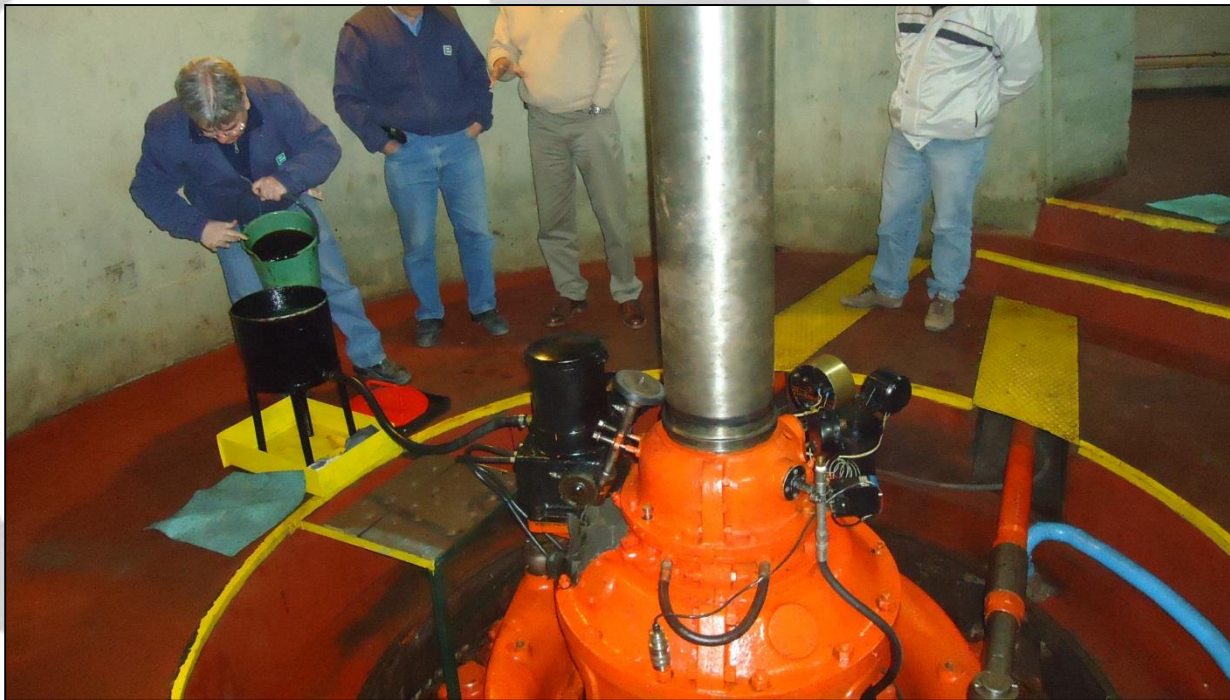


# Converting Main Guide Bearings From Oil to Water



# History - Hydro

- First conversion in hydro industry dates back to the mid-1990's with Southern California Edison, U.S.A.
  - 15.5"(394mm) shaft diameter x 29"(734mm) overall length
  - 22 MW unit
  - Install – 1994
  - Water flow rate 30GPM (114 L/min)
  - Most recent inspection 2005, still visible machining marks on the bearing!

# Recent Conversions

## Oil to Water

Russell Smith Power House (U.S.A.), 2007

- 3MW, 15”(380mm) shaft, horizontal Francis
- Skagerrak Energi AS (Norway), 2009

- 25MW, 19.3”(490mm) shaft, vertical Francis
- Lake Spaulding, California (U.S.A.), 2010

- 10MW, 14”(355mm) shaft, vertical Francis
- Spaulding2 – PG & E, USA, 2012

- 10MW, 14”(355mm) shaft, vertical Francis

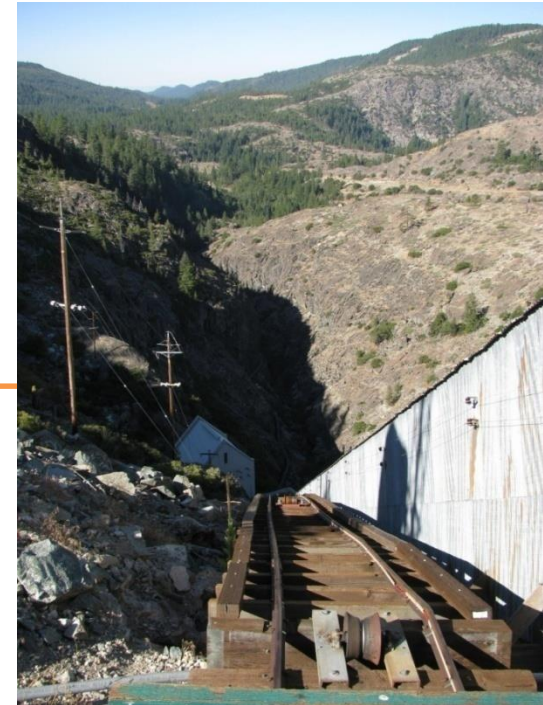
[illegible][illegible]

# Example of a Bearing / Seal Conversion

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**Spaulding Power House  
Pacific Gas and Electric  
(U.S.A.)  
Nov. 2011**

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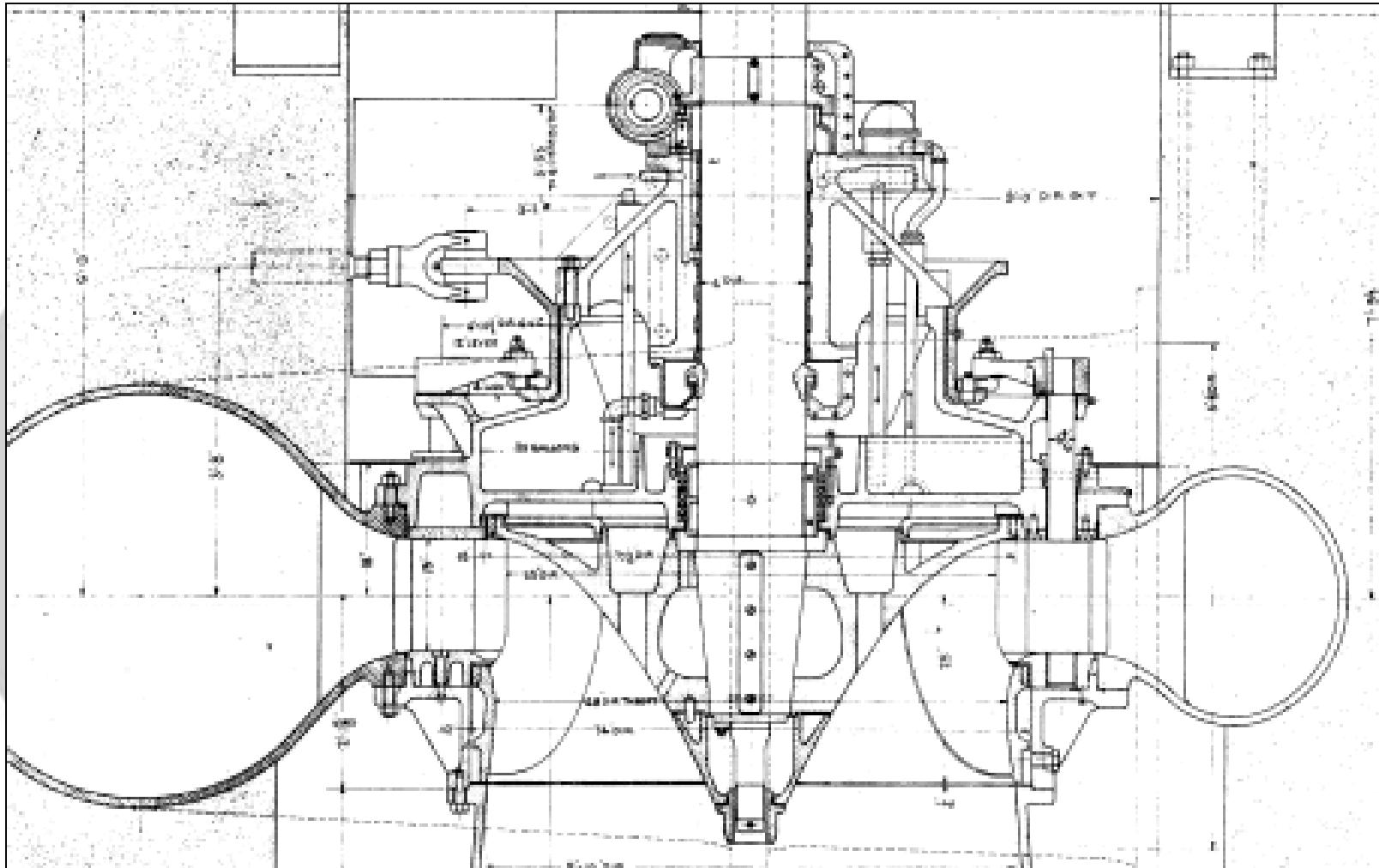


# Spaulding Generating Station

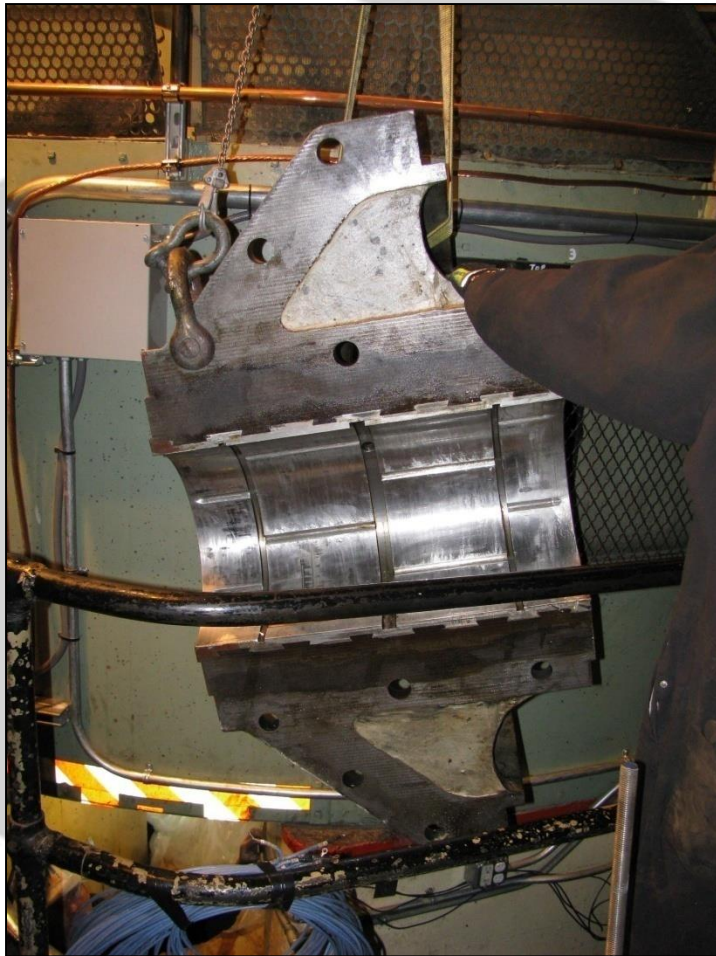
## Technical Data

- Manufacturer: Pelton Water Wheel 1927
- Type: Vertical, Francis
- Head: 197ft (60m)
- Speed: 257 rpm
- Maximum output: 10.25MW

# Original Oil System



# Removing and Inspecting Old Bearing





# Placing the Liner



# Liner Welded in Place





# In Place Machining of the Liner

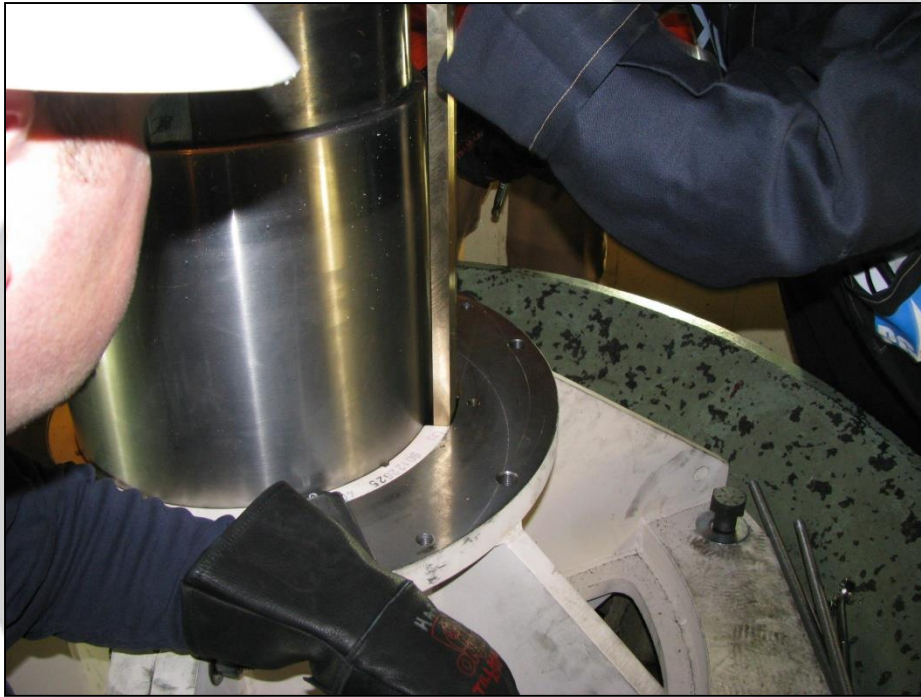


# Insertion of New Housing





# New SXL Guide Bearing





# Segmented Shaft Seal



# Assembled Seal Housing and Bearing



# Spaulding GS Today

- Operating for 4 years, original installation November 2010
- Turbine opened in March 2011 for bearing inspection
- Bearing removed, inspected and reinstalled in one day using the Thordon tapered key installation method

# Spaulding II

- Client – Pacific Gas and Electric
- Consultant – Black and Veatch
- End User – Pacific Gas and Electric, USA
- Francis Machine – Conversion from white metal bearing
- Head: 275ft (84m)
- Specification – SXL from end user.
- Installed in early 2012, working perfectly



# Complete Assembly

