RETROFITTING & MODERNISATION

PIPE AND PRESSURE COMPONENTS IN THERMAL POWER PLANTS
Retrofitting & Modernisation

RANGE OF SERVICES

Conventional power plants have to compensate for the unsteady supply of renewable energies. This means more and more start-up and shut-down processes with extreme stress on power plant components – intensified further by the ever-increasing outputs that must be readily available.

Existing power plants are not designed for this mode of operation with extreme load changes, leading to early material fatigue and therefore to shorter-than-planned power plant lifecycles.

The complex tasks to retrofit and modernise power plants are undertaken by Bilfinger Piping Technologies as an all-round expert partner. The “Retrofitting & Modernisation” team provide a comprehensive range of services. Analysing, testing, retrofitting/modernising – from the first recording of the actual state through to recommissioning. For example: Analysing the level of fatigue, technical calculation and checking the piping systems on site, replacing single highly strained components such as moulded bodies, bends and headers, or the replacement of entire steam pipe systems.

All this work has been undertaken by own specialists successfully many times both at home and abroad. The replacement components can be produced to a large scale at the shops in Essen and Dortmund, Germany. The production scale is limited only by transport and stipulated plant conditions.

ANALYSIS

- Comparing the design calculation with today’s state of the art
- System analysis (elasticity calculation) to determine the demands on pipe systems and the stress on adjacent components
- Calculating the creep fatigue based on operating instructions
- Analysing load change processes such as start-up and shut-down, cold starts, warm starts, etc
- Evaluating the remaining lifetime in accordance with DIN EN 12952
- Analysing tension for pipe components such as headers, T-pieces, Y-pieces, also using fenite element method
ASSESSMENT

- Determining the material's actual status using non-destructive testing methods
- Recording the microstructure status using ambulant component metallography
- Checking the pipe components using elongation measurement
- Checking the geometry and motion characteristics of the pipes using actual state recordings in a cold and warm state
- Testing of pipe system's slopes
- Checking the hanger functionality using actual state recordings in a cold and warm state
- Establishing the actual status of the pipes on-site and determining the actual operating data during the entire operating period
- Checking the valves

RETROFITTING/MODERNISATION

- Creating a catalogue of measures based on the analysis results
- Establishing retrofit measures in collaboration with operators
- Planning the retrofitting process with the dismantling of worn-out and the fitting of new pipe components
- Constructive checking of the pipe systems and their optimisation in comparison to the latest state of the art
- Replacing pipe components with new, state-of-the-art materials to improve start-up and shut-down rates
- Ongoing documenting of the pipe systems with planning for further material testing
Analysis

TO UPGRADE POWER PLANTS TO THE LATEST STATE OF THE ART, BILFINGER PIPING TECHNOLOGIES PROVIDES COMPREHENSIVE AND IN-DEPTH ANALYSES. BEING THERE DETERMINING DESIGN CHARACTERISTICS AND THE ACTUAL MODE OF OPERATION AND MATCHING THEM WITH NEW TECHNOLOGIES. THIS DEVELOPS AND IMPLEMENTS AN OPTIMISED AND EFFICIENT MODERNISATION IN COLLABORATION WITH THE CUSTOMER.

MATCHING THE ORIGINAL DESIGN WITH TODAY’S STATE OF THE ART

It makes sense to check the original design of the components due to the changeover from national regulations such as DIN and TRD to European DIN EN regulations. This process also incorporates relevant results from research and development projects. This enables weakness to be discovered which may become a problem with changed parameters in future operation.

SYSTEM ANALYSIS

The result of flexibility analysis is data on the tension and deformation in the pipe system. This also enables stress on adjacent components such as the boiler, turbines and condenser to be determined and evaluated for their admissibility. The use of conventional, numerical calculation procedures allows the dynamic requirements to be specially evaluated in much greater detail, eg as a result of a quick-action turbine, than was possible at the time that older plants were constructed.

TENSION ANALYSIS

Tension analyses reveal which components in a pipe system are under the greatest stress. Detailed tension analyses, if necessary using finite element methods, provide information about the scale and distribution of the tension.

CALCULATING THE LEVEL OF FATIGUE

A calculation of the level of fatigue and remaining lifetime is required for components under a great deal of stress. This involves analysing the two phenomena of creep fatigue and load change fatigue. As the calculated level of fatigue and remaining lifetime are theoretical values which are influenced by many factors, a verification using non-destructive testing methods is essential.

BILFINGER PIPING TECHNOLOGIES’ EXTENSIVE EXPERIENCE IN POWER PLANT TECHNOLOGY IS AN IDEAL BASIS FOR MAINTAINING AND OPTIMISING POWER PLANTS.

- State-of-the-art technology
- Greater operating safety
- Timely and efficient service provision
Assessment

BILFINGER PIPING TECHNOLOGIES BOASTS MANY YEARS OF EXPERIENCE WITH ESTABLISHED TESTING METHODS. THE TESTS ARE UNDERTAKEN BY ITS OWN TEAM OF SPECIALISTS.

THE SPECIALISTS OF BILFINGER PIPING TECHNOLOGIES NOT ONLY TEST IN ACCORDANCE WITH CURRENT DIN EN AND VGB STANDARDS, BUT ALSO INCORPORATE THEIR EXPERIENCES INTO THE TESTING PROCESS. THIS MEANS THAT CRITICAL AREAS THAT HAVE PROVED TO BE SUSCEPTIBLE TO MATERIAL FATIGUE IN THE PAST ARE ALSO CAREFULLY EVALUATED.

NON-DESTRUCTIVE MATERIAL TESTING

- Wall thickness measuring and remaining wall determination using ultrasound on particularly susceptible components, such as bends, headers, etc.
- Ultra-sonic testing of welded joints, e.g. circumferential and socket seams, to determine any macroscopic damage
- Surface tests, such as "liquid penetrant" and "magnetic particle" tests, to determine any signs of macroscopic surface damage
- Hardness testing on components under particular stress such as socket seams, to determine any hardness peaks
- Recording the microstructural status of components under particular stress, such as socket welds and bends, to determine creep damage using structural imprints

ANALYSING INDIVIDUAL COMPONENTS

- Analysing the status and functionality of spring and constant hangers in a cold and warm state
- Slope analyses on pipes to prevent condensation build-ups and the resulting differences in pipe-wall temperatures during the start-up process and possible water hammers
- Evaluating the valves against the following criteria: operating hours, environmental conditions, operational play and regulating characteristics as well as safety functions

Material: 13CrMo44

No damage to slopes

Damage with slope class 3a – 3b
Retrofitting/Modernisation

BILFINGER PIPING TECHNOLOGIES PROVIDES THE COMPLETE SPECTRUM OF SERVICES FOR RETROFITTING AND MODERNISING PIPE SYSTEMS. AFTER ANALYSING AND TESTING, A DECISION IS MADE WITH THE OPERATOR ABOUT WHETHER HIGH-STRESS COMPONENTS SHOULD ONLY BE RETROFITTED OR IF THE ENTIRE PIPE SYSTEM SHOULD BE REPLACED AND MODERNISED, TAKING EFFICIENCY AND PLANNED DOWNTIMES INTO ACCOUNT.

The analysing, re-adjusting and, if necessary, replacement of constant and spring hangers is undertaken by Bilfinger Piping Technologies specialists. They also test valves for corrosion damage and leakages. Any such defects are repaired on site if possible.

Bilfinger Piping Technologies’ own shops provide most of the prefabrication of the components. This shortens on-site working times and means plants are up and running again more quickly. Bilfinger Piping Technologies has been actively researching and developing for years, and worked on the European standard (DIN EN 13480) as well as on enhancing and issuing important VGB and FDBR factsheets. This means that Bilfinger Piping Technologies is always ready to adapt to innovations quickly and always works with state-of-the-art technology.
- Use of moulded bodies with optimised geometry with regards to tension distributions in components and the flawless testing of buttwelds

- Use of moulded bodies made from suitable materials to reduce start-up and shut-down times

- Planning the retrofitting and modernising with the dismantling of worn-out and the fitting of new pipe components

- Analysing and re-adjusting/replacing constant and spring hangers

- Analysing and retrofitting valves

**ADVANTAGES**

- Longer lifetime
- Greater operating safety
- Lower maintenance
- Increase in performance
- Increase in efficiency
- Lower emissions