

## Turbine alignment: Time is money

Ludeca Inc's Dieter Seidenthal was talking about laser alignment of steam-turbine internals—as he often does—when the editors of the COMBINED CYCLE Journal bumped into him at Power-Gen International late last year. The subject that day was that after more than 10 years of successful experience in power-plants with laser bore alignment, there were still turbine users relying on piano wire and dummy shafts. Seidenthal had no problem reciting the reasons why this is so: no personnel trained for the task, people are comfortable with piano wire because they've done it before, and, of course, instrumentation costs money.

**First some background.** A well-known fact is that bore alignment of bearing pockets, seals, and diaphragms can be time-consuming tasks in the overhaul of turbines—something most combined-cycle plants have several of—if you rely on piano wire, micrometers, and optical instruments. That's why turbine manufacturers and specialty service companies have embraced systems such as Centralign, a registered trademark of Germany's Prueftechnik AG, distributed exclusively in the US by Miami-based Ludeca.

Centralign uses a visible-laser emitter and intelligent sensor to determine the centerline position of bearing pockets with micron accuracy, even over separations of more than 100 ft. All readings are transmitted via cordless infrared link to a computer which automatically plots an alignment diagram of all measurement points, along with their offsets from the laser reference line. The reference can be shifted to any desired position in the display so that the offsets are recalculated automatically; the laser eliminates the oft-troublesome pre-leveling and sag compensation.

Seidenthal (305-591-8935, dieter@ludeca.com) says the cost-of-instrumentation and no-qualified-personnel arguments rarely are valid—if ever. By way of example, he points to recent experience at a Pacific Rim utility on a 450-MW steam turbine. The company had never before attempted to implement internals alignment with a laser. As

a result, he says, the project had a high profile within the utility. To be on the safe side, the same amount of time that normally would have been allocated for piano-wire measurement was allotted for laser alignment in critical-path planning.

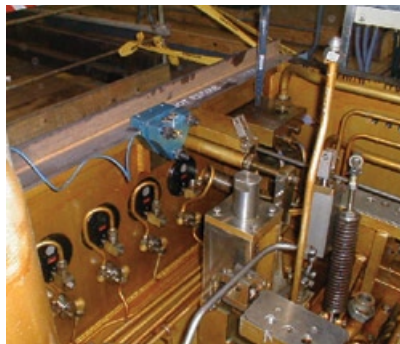
Scope of work for the alignment team included:

- Laser bore alignment measurement of the high-pressure/intermediate-pressure section diaphragms, casings, and seals to achieve OEM tolerances (2 mils was considered excellent, 4 mils satisfactory).

- Provide technical support, and training of personnel nominated by the utility to learn laser bore alignment.

- Supply set-up measurements.

**The bottom line:** Outage time was reduced by three days compared



**Laser bore alignment** is faster, more accurate than traditional piano-wire method. Shown is the laser setup on the front standard of a steam turbine

to that formerly required when the piano-wire method was used for alignment. Result was tight clearances and no rubs. The long-term payoff, of course, is improved turbine efficiency and reduced packing wear.

One reason for the dramatic reduction in time to complete the alignment check when a laser system is used is that it normally takes only one setup requiring about half an hour to accomplish most bore measurement needs for the entire outage. The piano-wire method requires setup and teardown each time move verification is undertaken (internals cannot be adjusted with piano wire in place).

**As with any light source,** continues Seidenthal, lasers also may be affected by atmospheric conditions. And, as when using piano wire, conditions may change original refer-

ences over the time it takes to conduct comprehensive measurements. The laser system for this project was able to measure and compensate each measured bore automatically for any external or environmental influences.

Setup of the laser system is relatively simple with a modest amount of training. The general procedure consists of installing the laser on the front standard (photo). A measurement sensor—referred to as the control sensor—is installed at the end of the measurement string to monitor and store changes in laser position caused by external and environmental effects. Individual bore measurements can be adjusted by measured laser variances at the operator's discretion.

Various types of bracketing are available, allowing the operator to "sweep" any bore of interest. For this project, the list included all diaphragms, gland packing bores, oil deflectors, and the nozzle box. The operator can measure a bore at many points around its circumference, permitting a meaningful assessment of geometry. The equipment is flexible enough to allow different modes of measurement—one even emulates the piano-wire method by taking data at the top, bottom, left, and right positions.

Finally, keep in mind that diaphragm bore positions change depending on whether or not the top half of the casing is installed. To assure optimum final bore positions, data sets for the measurement string were conducted under two separate assembly conditions—so-called "top on" and "top off."

## Balloon keeps HRSG warm

Balloon?

A problem faced by engineers today is that their combined-cycle plants are not operating base-load as owners thought they would be when designed. Thus auxiliaries and "extras" that would have facilitated cycling service and simplified periodic shutdowns lasting for days (sometimes as long as several weeks) were not considered. No need; so owners thought.

One such extra is a stack damper. It can prevent rapid cool-down of