



3. Diaphragm equipped with seal-holder anti-rotation device (501F shown)



4. Going, going, gone: the progressive stages of winding deterioration

is not recommended for base-load machines.

In closing, Lovelace made these points:

- The majority of diaphragm repairs are in the minor and medium categories.
- D5As with diaphragms manufactured prior to 2000 using the laser welding process should be inspected thoroughly and regularly—rows 1, 2, and 3 in particular. Concentrate on the inner and outer shroud tenon welds with a good visual inspection, tap test, and dye-pen check, if possible.
- Add locking devices to the cover-

half seal holder to stop reverse rotation (Fig 3). Note that this mod still allows base-half seal holders to be rolled out around the rotor if necessary.

- Choose your repair facility carefully and always compare incoming versus outgoing dimensions. Be sure parts will fit back into your engine before they leave the shop.

Generators

Generators dominated podium time the first afternoon with formal technical presentations. Concurrent meetings were held for users with GTs equipped with Westac (for Westinghouse air-cooled) generators and those with Brush generators. Presenters in the Westac session were Siemens and National Electric Coil (NEC), Columbus, Ohio; those in the companion meeting were Brush Generators Inc, Houston, and NEC.

The D5/D5A Users devote considerable time each conference to generators. In 2005, under Fleck's leadership, the group launched a Westac Users subgroup within the GT organization to facilitate collaborative problem-solving with Siemens. Fleck said that about 90% of the Westac fleet is driven by a D5 or D5A.

The Brush presentation, conducted by Derek King, general manager (derek.king@houston.rm.fki-et.com), and Mike Watkins, services sales manager (mike.watkins@houston.rm.fki-et.com), was an 85-slide tutorial that could have been considered for continuing education credits. King, a frequent speaker at user-group meetings, always does a thorough job at the podium. Keep in mind that Brush has extensive experience in GT-based powerplants, having provided more than 600 generators for GE Energy, Atlanta, and Siemens frames worldwide.

King and Watkins started "at the beginning" by reviewing how generators work—that is, how they make electricity. They then dissected the machine and addressed the design, operation, and maintenance of each major part beginning with the exciter. As for overall O&M objectives, their message was simple: "Regarding air, oil, and water supplies, keep them clean; joints and covers, keep them tight."

After discussing the rotor, bearings, and stator, in turn, the pair ran through a series of case histories that they named "Bad things happen to good generators." They were an eye-opener and illustrated the importance of proper, regular inspection. Guidance was provided on what to

look for in the machine and where. The three photos in Fig 4 that King and Watkins labeled "Going, going, gone" illustrate progressive stages of winding deterioration.

Generator change-out at Borger

King later teamed up with D J Rogers, plant manager, Blackhawk station (Quixx Power Services Inc) to present a case history on the change-out of a Westac generator with a Brush machine. Order was placed at the end of February 2005 and the new machine was in service before the end of the year. King talked about generator design through delivery to the Borger (Tex) site; Rogers addressed the onsite work.

King began with a summary of design features and nameplate information, plus a review of critical features. For example, the plant was concerned about main casing positioning and connections to the starter pack. No changes were required to either the coupling or foundation. Also, could existing main terminal posts be used? What about line and neutral cubicles? "Yes" to both questions; Brush matched the mechanical interface and connections.

The generator was manufactured in the UK and trans-shipped to Rotterdam where it was loaded on an ocean-going vessel bound for Houston). The machine was in Borger six days after the ship docked (Fig 5). Rogers started by reviewing all the planning required to swap-out generators, including:

- Schedule crane service. Westac load was 367,000 lb, Brush 312,000. Two 300-ton cranes were requested for use in tandem.
- Contract local vendor support, including mechanical, electrical, and machine shop. Last was required to fabricate four lifting trunions to remove the Westac unit. Each trunion weighed 400 lb.
- Temporary installation of a back-up boiler to accommodate thermal host's steam needs during generator replacement.
- Arrange for shipping of the generator from Houston to the plant, including all permits required. The truck contracted was 228 ft long, 16 ft wide, and had a total gross weight of more than 300 tons.
- Controls and procedural changes included DCS (distributed control system) modifications, new operating procedures, and settings/performance verification of a new voltage regulator.

Next, Rogers explained that



5. Generator was delivered to Blackhawk on a 228-ft-long, 16-ft-wide truck

required demolition, and as many other tasks as possible, were completed prior to generator delivery, including the following:

- Broke couplings and removed starting package.
- Removed air inlet housing and generator enclosure.
- Disconnected neutral and line-side electrical cubicles.
- Removed oil piping and lifted ancillary electrical wiring/instrumentation.
- Removed Westac generator and repaired/modified foundation to accommodate the Brush machine.
- Rebuilt access road to plant, provided crane support for offloading and staging.

Commissioning was completed soon after installation (Figs 6, 7). It required coordination with the local utility to conduct pre-service tests, calibrate the automatic voltage regulator, and run load tests. All work was completed within two months and operation through the first winter and summer met expectations. Plant dispatched at up to 70% of its capability during that time.

Other user presentations. The Memphis meeting featured

several other user presentations, which always get high marks from attendees. They were:

- Compressor cleaning challenges, Iqbal Rodak, executive manager, Jubail Energy Saudi Arabia.
- Torque converter overhaul. Two case histories: one by Jeff Nottingham, plant manager, R W Miller Generating Station, Brazos Electric Power Co-op Inc; the other by Stan Wilhelm, senior CT specialist, Nodaway County Power Plant, Associated Electric Power Co-op Inc.
- Second major inspection, Barry Mayhew, maintenance manager, Cardinal Power of Canada LP.



Schuck

Siemens Day

It's tradition and logical: Siemens Day at all of the user-group meetings the company supports starts with a review of the OEM's progress in satisfying customer needs as determined from surveys and interviews conducted by Six Sigma Program personnel. However, the D5/D5A session on improvement actions differed from those conducted previously in that Ron Bauer, Siemens "ambassador of quality" and the company's six-sigma face

to GT users, had accepted a different position within the organization and had been replaced by John R Schuck, director of business excellence.

Transitions can be difficult, but not this time. Schuck—confident, empathetic, and effervescent—had a positive relationship with the audience within minutes. He began with a review of how the company was improving its technical responsiveness, including:

- Net meetings, online conferences that enable the OEM's engineers to interface directly with owner/operators on specific issues of concern when requested by the user group.
 - Plant Optimization Center. It coordinates and manages critical issues and resources for service planning and execution.
 - Field Service Support Center. An engineering help desk that rapidly responds to questions from onsite field engineers during an outage.
- Continual improvement in the quality of repairs is a top priority for Siemens. Schuck explained the three keys to success:
- Customer-focused quality-incident metrics. "Escapes"—quality incidents that impact an internal or external customer—are tracked independently.
 - Greater emphasis on root-cause analysis. Quality data collected during repair operations guide this solution. Executive-level monthly quality-incident reviews raise the visibility of this program, which focuses on eliminating repeat issues by promoting best practices and lessons learned.
 - Accountability.

The Customer Extranet Portal (CEP) gained considerable traction among users between the 2005 and



6. Two 300-ton cranes were used to lift out the old and fit new generator into position



7. Contractors reconditioned existing foundation prior to delivery of the new generator