Iris Power LP

FEBRUARY 2008

DIAGNOSTIC NEWS

Your Source For Monitoring the Reliability of Electrical Equipment

IN THIS ISSUE:

UPCOMING EVENTS

Hydro Maintenance	Coeur d'Alene, Idaho May 5-7, 2008
Iris Rotating Machine Conference	Long Beach, CA June 16-19, 2008
EL CID Training	Toronto, Ontario Sept. 9-11, 2008
Turbo Maintenance Course	San Antonio, Texas Oct. 7-9, 2008
Motor Maintenance Course	Dec. 2-4, 2004 St. Petersberg, FL
NETA PowerTest	New Orleans, Louisana March 17-20, 2008
Western Turbine Users	San Diego, CA April 6-9, 2008
IAS/PCA Cement	May 19-22, 2008 Miami, FL
Hydrovision 2008	June 15-16, 2008 Sacramento, CA

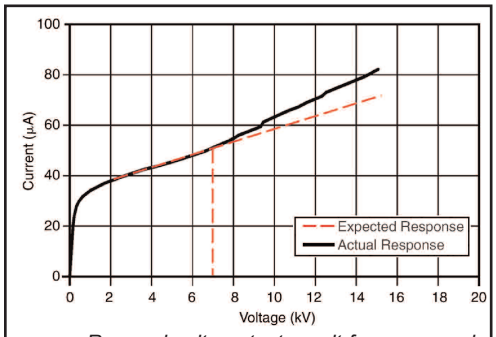
Iris Power DCR-50 Ramp Tester Shows New Talents

David Bertenshaw

The DCR-50 Ramp Tester (previously sold by ADWEL) has already earned itself a strong reputation as the only instrument on the market that can be used to carry out ramp tests to IEEE Std95-2002. Derived from user experience, the test has been used for 40 years. The U.S. Bureau of Reclamation, which operates 75 hydro facilities, uses this test to evaluate the condition of generator electrical insulation. However the codification of the ramp test into a published IEEE 95 standard provided the impetus to make a test system commercially available. This has seen the system sold in several countries outside its native North American market, such as Australia, Austria, Germany and Poland.

Defects, deterioration, and adverse conditions can affect the electrical properties of dielectric materials and insulation systems. Because they can be measured, quantified, and trended, variations in electrical properties provide an effective method to diagnose generator insulation degradation. Several direct voltage testing techniques are available to monitor and assess the condition of stator winding groundwall insulation, from the simple PI test to the more advanced ramped direct high-voltage test.

For a ramped voltage test, direct high-voltage is applied to the insulation as a slow, linearly increasing ramp voltage, to which the current response is recorded. This current is the combination of geometric capacitance charging current, polarization current and leakage current. The ramped voltage testing method offers many advantages, including ease of testing, more certainty in the results, and good repeatability. The system automatically measures, records and plots the voltage and current during the test. Operators can determine insulation condition by analyzing any deviations from the ideal shape of the test curve. Applying a linearly ramped voltage rather than discrete voltage steps, linearizes the polarization current and results in a constant capacitive charging current. As a result, it is easier to distinguish unusual deviations in the polarization and leakage current vs. voltage response, and to compare results over time.



Ramped voltage test result from an aged and deteriorated asphalt-mica insulation.

While this use has been long established, the DC Ramp Tester has recently been modified to perform a customized hipot test. This unexpected application was requested by a French company manufacturing medium voltage motors to ANSI/API Standard 541-2003, a standard for hazardous area (petro-chemical industry) machines, which requires a hipot test up to 54kVDC for 20kVAC motor ratings. The test requires the high direct voltage to be slowly increased, but with 1 minute stops at four equal points during the rise. The current (mostly polarization current) is recorded during each stop. When the highest potential is reached at the end of the test, the decaying polarization and residual leakage current is

recorded for a further 5 minutes.

The customer wanted to develop a fully recorded paperless test and QA system, but found that all the classic DC Hipot systems did not provide suitable, if any, computer records, and many had problems accurately resolving very low currents at these high voltages. It became apparent that in fact the DCR-50 was the only available high voltage DC test system which could make these highly accurate voltage and current computer records, where the currents may be down in the nano-ampere region. After discussion, only minor modifications to the standard DCR-50 were required to allow it to support the customer's requirements. These changes included the ability to pause at user selected individual thresholds, the data presented in a spreadsheet format to suit their QA records, and an extension of the maximum range to 60kV to embrace all machine ratings.

One of the challenges in such a test is that any pause at a high voltage requires great stability, again a key ability of the DCR-50. This is because even minor proportional voltage fluctuations will cause comparatively large capacitive currents to flow. In these environments the results can also be greatly affected by corona discharge currents and great care has to be taken to mask and shroud all exposed high voltage conductors/terminals, since the values in the record shown below give an apparent final resistance of 15 Teraohm.

RESULTAT D'ESSAI
TEST RESULT
Tableau I = f (U)

FNQ-LB
Classement / File

Client / *Customer*
N° Cde client / *Customer Order Nr*
Tension / *Voltage*
N° Commande / *Order Nr*
Type machine / *Machine type*
N° 1/1
Fournisseur / *Supplier*
N° Cde achat / *Purch./Order*

U (kV)	I (nA)	U (kV)	I (nA)	Observations
0.25	3.63	23.98	3.01	
1.74	30.02	23.96	2.81	
3.09	30.23	23.97	2.6	
4.46.1 mn	29.71	23.94.10 mn	2.44	
5.83	30.4	23.95	2.41	
6.14	3.23	23.97	2.13	
6.13	2.90	23.95	2.38	
6.13.2 mn	2.78	23.99.11 mn	2.29	
6.12	2.64	23.95	2.12	
6.13	2.61	23.96	2.22	
6.14	2.56	23.97	2.11	
6.13.3 mn	2.54	23.95.12 mn	1.88	
6.13	2.55	23.97	1.91	
6.13	2.57	23.96	1.93	
7.13	20.54	23.04	1.93	
8.52.4 mn	30.31	23.95.13 mn	1.77	
9.8	30.51	23.97	1.72	
11.14	30.95	23.97	1.67	
12.03	3.62	23.96	1.76	
12.03.5 mn	3.18	23.95.14 mn	1.69	
12.04	3.01	23.95	1.76	
12.38	28.91	23.96	1.64	
13.74	30.87	23.96	1.61	
15.06.6 mn	31.38			
16.39	31.53			
17.09	31.88			
17.97	3.59			
17.95.7 mn	3.21			
17.95	2.88			
17.95	2.7			
18.8	30.17			
20.19.8 mn	31.5			
21.5	31.53			
22.61	31.92			
23.97	5.04			
23.98.9 mn	3.47			

Ref. specification : IQ 31026

	Etabli / *Prepared*	Vérifié / *Reviewed*	Décision finale / *Final decision*	Client / *Customer*
Nom / *Name*			X Conforme sans réserve / *Compliant without exception*	
Date	11-Aug-06	11-Aug-06	Conforme avec réserves / *Compliant with exceptions*	
Signature			Non conforme / *Noncompliant*	

Sample printout of spreadsheet test record.

The system was completed and delivered in 2006 with initial trials and commissioning completed successfully. The unit is now in use, generating test data in customer specific formats such as the results record shown here.

UPGRADING FROM DIRECTIONAL COUPLERS TO A BUS INSTALLATION FOR ON-LINE PD MONITORING

INTRODUCTION

Iris Power offers several types of PD installations depending of the machine type:

- ❖ SSC installation with stator slot couplers (SSCs), antennae type sensor, for machines with significant internal noise (typically large turbine generators over 200 MW)
- ❖ PDA installation with 80 pF Epoxy Mica Capacitors (EMCs) inside stator winding in differential configuration, for large hydraulic generators (ring bus longer than 2 m)
- ❖ BUS installation with 80 pF Epoxy Mica Capacitors (EMCs) in the outgoing/incoming bus bars, in directional configuration for other machines (typically small turbine generators, large motors and some hydraulic generators).

Since Adwel used to have only one instrument that was originally designed for hydraulic generators, the PDA Premium instrument of Adwel was being used for turbogenerators and motors with EMCs installed in the outgoing/incoming bus bars with the so-called "PDA-directional" configuration. We recommend changing the "PDA-directional" configuration to BUS install, to avoid some inconveniences and provide more information as explained below.

PDA INSTALLATION

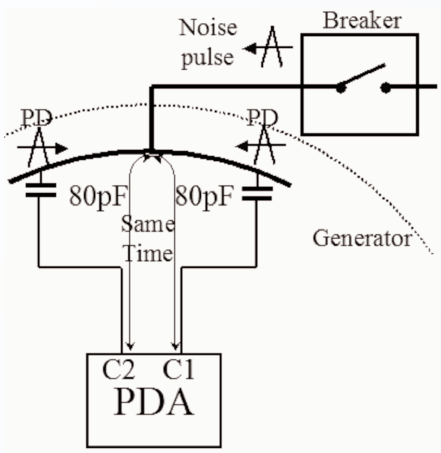


Figure 1. PDA Installation

The PDA instrument intended for large hydraulic generators requires differential configuration of EMC pairs. Each pair has one EMC named C1 and another EMC named C2. The length of the individual coaxial cable leads, connecting the EMCs to the coupler termination box, is adjusted so that, for any EMC pair, PD pulses external to the machine, which are categorized by the instrument as 'Noise', arrive simultaneously at the coupler termination box. Other pulses are categorized as 'PD' either from C1 or from C2, depending on where they first arrived.

BUS INSTALLATION

In a BUS installation, two EMCs for each phase are installed on the bus external to the machine, in a directional configuration. The EMC closest to the machine is named Machine (M) and the EMC further down the bus is named System (S). A PD pulse from the machine arrives at M first and a delay time (t_D) later at the time (t_D) is proportional to the distance between the two EMCs.

The EMCs are connected to a coupler termination box via shielded coaxial cable. The lengths of the cable leads are the same in each phase (see FIGURE 2). Therefore, by measuring the relative pulse arrival times at the coupler termination box

with the Iris TGA-B portable instrument, it is possible to successfully distinguish between 'Machine PD' from the machine, 'Between PD' from the bus segment between the EMCs and 'System PD' from beyond the S coupler. The 'Between PD' and 'System PD' is classified as 'Noise'.

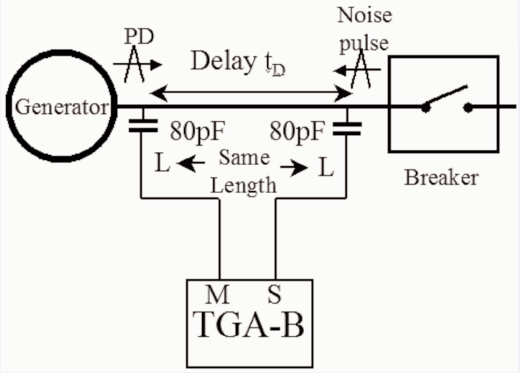


FIGURE 2. BUS Installation

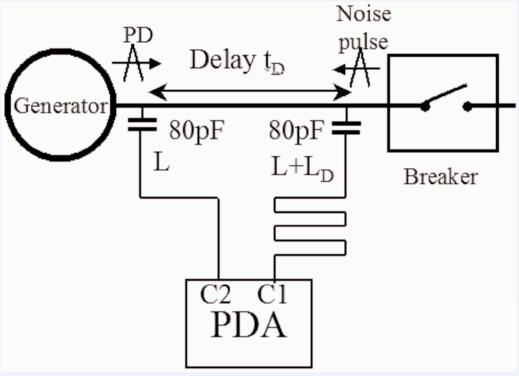


FIGURE 3. PDA-Directional Installation

PDA-DIRECTIONAL INSTALLATION

The PDA- Directional installation is an adaptation of the PDA-Differential arrangement to allow using the PDA instrument with EMCs installed on the bus external to the machine. In order to meet the condition of the PDA instrument that pulses categorized as 'Noise' must arrive simultaneously at the coupler termination box, the coaxial cable lead from the EMC further down the bus is extended a length L_D to compensate the delay time in the bus segment between the EMCs (FIGURE 3). Thus pulses from the system are classified as 'Noise', and other pulses are classified as 'PD' from the C2 coupler. If sparking or PD occurs between the sensors (which is relatively common and usually harmless, caused by a broken post insulator or a bolt being poorly tightened), then such sparking is also classed as stator PD. This is because pulses occurring between the two sensors will arrive at the C2 input before they arrive at that C1 input. Thus pulses from the bus segment between the EMCs are classified wrongly as stator 'PD', leading to false indications of stator winding insulation problems.

WHAT TO DO

To eliminate the chance of false indications due to the directional coupler/PDA system, it is necessary to upgrade the PDA-Directional installation to BUS installation, i.e. get identical length of coaxial cable from both EMCs in the same phase and verify it by injecting pulses in both ends so that the reflection time is the same. For that purpose, there are two alternatives (see FIGURE 3):

- ❖ Add a coaxial cable extension to the cable from the C2. A shutdown may be not required. Or,
- ❖ Remove excess coaxial cable in the C1 circuit (recommended wherever possible, to reduce attenuation). For safety reasons a machine shutdown is required.

The TGA-B (or, TGA-BP or TGA-SB) portable instrument is required to perform tests in the BUS installation, instead of the PDA instrument.

ADVANTAGES

Upgrading to BUS installation has the following advantages:

- ❖ The user obtains more reliable test results because the TGA-B instrument has directional time of arrival technique that works even with pulse magnitude differences up to 50%, so that even lower magnitude 'System PD' is classified correctly as 'Noise'. In comparison, noise elimination by pulse subtraction method (used in the PDA-H and most PDA Premiums) allocates the 'System PD' pulses with different magnitude and pulse shapes wrongly as 'PD' from C1 or C2. The pulse magnitude difference is inevitable due to wave impedance differences between the pulse paths for C1 and C2.
- ❖ The user obtains more reliable test results because the TGA-B instrument classifies correctly the 'Between PD' as 'Noise' (PD pulses from the bus segment between the EMCs). In contrast the PDA instrument in PDA-Directional installation classifies those pulses wrongly as 'PD' from C2, because the pulses do not arrive simultaneously at the coupler termination box. As a consequence, high PD activity in the bus segment between the EMCs will mask any PD activity measured from a healthy turbo-generator winding, conducting to unnecessary machine outages for further testing.
- ❖ The user is able to see and analyze the 'Between PD' and 'System PD' because the TGA-B instrument allows displaying them as 'Noise' in 2-D and 3-D graphs. Knowing what is happening outside of the machine is important too in order to ensure a continuous and reliable operation. In contrast, noise elimination by pulse subtraction is intended to eliminate the 'System PD'.

In summary, the TGA-B instrument in a BUS-installation is the right tool to assess the condition of the insulation in turbo-generator stator windings.

We highly recommended that you upgrade the existing PDA Directional installations to BUS installations.

IRIS EXPANDS OPERATIONS TO BEIJING

Iris Power has expanded its operations in Asia, with the establishment of a branch office in Beijing, China. The growing adoption of Iris's test and diagnostic products in the region necessitates a more responsive approach to the technical needs of users and commercial needs of our manufacturer's representative network.

Mr. Hui Jiang, will manage the Beijing office. Hui will now assume the role of the Regional Sales Manager, with Rick Wu serving in the role of Chief Representative of Iris Power LP. Rick will help to promote and facilitate sales of Iris' products in China and the surrounding markets in South East Asia.

With the merger of Iris and Adwel International completed, and the opportunity to develop and deliver a broader spectrum of test equipment for electrical apparatus, Iris offers its Asian, and worldwide customers enhanced diagnostic tools and expert services to supplement their predictive maintenance programmes.

IRIS Power, following its merger with ADWEL International, has moved operations of both divisions to a new plant in the City of Mississauga, a suburb of Toronto, Ontario. The new address is:

IRIS AND ADWEL RELOCATING TORONTO PLANTS TO MISSISSAUGA

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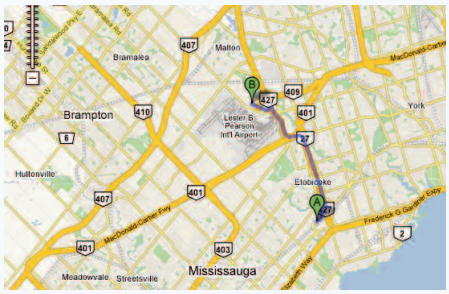
Mississauga, ON
Canada
L4V 1T2
P 416 620 5600
F 416 620 1995
www.irispower.com
www.adwel.com



Map of Iris' new location

The merger with Adwel, necessitated a larger facility to accommodate the addition of staff and equipment. The new plant is located in close proximity to Pearson International airport in a 30, 000 square foot facility. The majority of staff numbers of both companies, roughly 100 people, will be moved to the new location. Much of R&D, sales, field service and manufacturing activities will be done at this site. Iris Power also has operations in Texas (U.S.A), Watford (UK), Beijing (China), and Mumbai (India).

UPCOMING EVENTS

IRIS ROTATING MACHINE CONFERENCE (IRMC) 2008

Iris will be hosting its 12th annual IRMC this June in Long Beach, California. The conference is attended by over 100 individuals, from over 20 countries, representing mainly petrochemical companies and utilities.

Highlights:

- New tutorials
- A wide variety of guest speakers from around the world
- Walk-in-Clinic
- User Group Meeting

Location: Long Beach, California
Venue: Long Beach Hilton
Date: June16-19, 2008

Cost: $400 (CAD)

Contact: Rebecca Christoforidis
416-620-5600 Ext. 241

TRADESHOWS

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New Orleans, Louisana
March 17-20, 2008

WTUI
San Diego, CA
April 6-9, 2008

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May 19-22, 2008
Miami, FL

Hydrovision
June 15-16, 2008
Sacramento, California

IEEE PULP & PAPER
June 22-27, 2008
Seattle, Washington

CIGRE
August 24-29, 2008
Paris, France

COURSES

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