Indoor Powerline Conductor Accelerated Testing Facility (Indoor-PCAT)

Overview:

The Indoor Powerline Conductor Accelerated Testing facility (or Indoor-PCAT), planned for construction in FY04 at Oak Ridge Tennessee, is a unique indoor test facility for conducting both thermal stress and age characterization of advanced power line conductors and superconducting cables. The facility will be completely under roof within the K-33 building on DOE's federal reservation (formerly part of the K-25 uranium enrichment facility and currently the East Tennessee Technology Park). The facility will include a 1 to 2 MW DC or AC power supply with the flexibility to conduct thermo-cycle testing of multiple conductors by alternating from one conductor to the next. . The facility with its controlled atmospheric conditions (no wind, no rain, no lightning, and stable temperature) offers controlled and repeatable testing of conductors, as well as sensors and controls. The lack of weather variations eliminates the requirement that sensors be hardened for magnetic and electrical surges and the need for weather tight enclosures for any instrumentation. Conductors under test at the Indoor-PCAT, will be attached to steel wall supports thus providing an extremely stable and secure mechanical structure. The large volume of the K-33 building enables conductors to be attached 10 to 30 ft. above the floor. The Indoor-PCAT eliminates the need to have high structures or poles for suspending the conductor to protect the public thus making the conductor, its accessories, and instrumentation more accessible for installation, viewing, examination, and changeout.

Description:

The Indoor PCAT is planned for development on the Oak Ridge Reservation at DOE's East Tennessee Technology Park site in the K-33 Building. The location of the Indoor PCAT is shown in Figure 1 and 2. Each bay within the building offers a ceiling space of 56 ft, a width of 40 ft, and a depth of 1400 ft.

The Indoor PCAT offers a unique facility for controlling both the loading and environmental conditions under which test conductors, their accessories, and sensors are subjected during tests. The facility can be operated continuously 24 hours per day, year around, since it is oblivious to weather variation other than loss of power feed to the facility.

The Indoor PCAT facility offers a superior testing environment for repeatability of conductor test — the facility eliminates weather influence. There will be no wind or rain disturbance. Further, the facility is capable of more rapid testing because setup and conducting of tests are not delayed by weather variables. For example, there is no wind or rain inside the facility to slow or delays installations of conductor or instrumentation or tests. Also, the Indoor PCAT offers the capability to test multiple conductors in parallel tests. The tension limitations (i.e., the number of conductors) inherent in towers and poles are substantially reduced. One power supply can be shared over numerous conductor tests since the facility is no longer outdoors and doesn't require the same level of high structures or hardening of instrumentation.

PCAT offers the unique opportunity to test four full transmission spans (two down and two back) indoors. Each bay within the K-33 building offers the space needed to conductor spans of 600 to 1000 ft per span. Additionally span lengths can be varied since they are not fixed by pole or tower installations.

The indoor facility eliminates the variables associated with weather conditions in both conducting conductor tests and analyzing test data. Wind (both speed and direction) is no longer a variable in the thermo-cycle testing of conductors. The Indoor PCAT offers moderate ambient conditions throughout the season or year without the same extremes that an outdoor test facility would endure.

The MVA rating of the power supply for the Indoor-PCAT can be sized less than the outdoor facility because it doesn't need the extra capacity to overcome wind and rain cooling of the test conductor. A flatter and repeatable response of the conductor at given current loadings can be achieved with the Indoor-PCAT since there is no wind and rain to cool the conductor. The only time that the outdoor PCAT can achieve the same operating conditions is during the early morning before a front moves in or during the evening.

The test bay where the PCAT will be constructed provides a number of advantages important to conductor testing: (1) steel beam on slab construction, (2) asphalt, four-ply, built-up roof , (3) a minimum of 500 lbs/ft. concrete floor loading, (4) freight elevator with 15,000-lb capacity, (5) sprinkler systems with alarms, (6) ceiling 54 ft. high on second floor, 28 ft. on first floor with some restrictions, and (7) 480 V and 13.8kV 3-phase electric service.

Figure 1. Indoor-PCAT will be within the K-33 Building, a two-story building with 33 acres under roof, at the East Tennessee Technology Park.

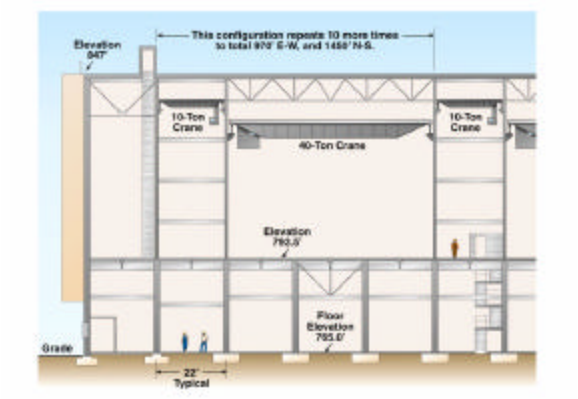

Figure 2. PCAT will be inside one or more bays of the K-33 building, each bay is 54 ft. high, 40 ft. wide and 1456 ft. long.

The facility greatly eases the requirements for instrumentation. The instrumentation no longer needs weather protective enclosures or hardening for the weather conditions (e.g.,, electrical fields associated with lightning) of outdoors. Also, the conductor can be attached to support structures closer to the floor as long as the sag of the conductor at its extreme loading condition is accounted for in the setup. Thus, the Indoor PCAT brings the conductor and instrumentation closer to ground level for both installation and testing making it easier to setup and add new instrumentation or to view and check on the conductor and its accessories. Bucket trucks needed

for outdoor test facilities are not required to reach the conductor, its accessories, sensors, and instrumentation boxes. Only mobile platforms that are high enough to reach these components is needed.

Indoor PCAT also provides an ideal facility for testing superconducting cables. Setup and testing can be better done indoors and the test bays offer a level elevation for the setup and testing of these cables.

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