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Condition monitoring and diagnostics of machines — Hydroelectric generating units

Surveillance et diagnostic d'état des machines — Groupes de production hydroélectrique

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Foreword

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Introduction

Traditionally, hydroelectric generating units (or simply hydro units) have been overdesigned, well-staffed for maintenance and often continuously operated at only baseload conditions over a period of many years. As a result of this, there were few maintenance issues, shutdowns could be planned at fixed intervals, and therefore there was little need for condition monitoring of the units. Simple machine protection systems sufficed, if used at all.

Nowadays, there are more stringent requirements for operational regimes, availability and reliability. Disruption to consumers' needs should be minimized and cash generation for the utilities maximized. The operating regimes for many hydro units have been extended to include synchronous compensation, load-following and peaking, which means there are many starts and stops and partial load operation, sometimes in the rough zones. Many applications are based on pump storage. Moreover, new units are designed more streamlined to the application, less robust, and older units are often refurbished to extend life or to increase rating. This means that machines are more stressed, which can lead to premature or unpredictable failure of the components, and even some new failure modes. At the same time, there is a trend towards fewer maintenance staff and specialists to look after the machines.

Therefore, there is a significantly greater need for an effective condition monitoring strategy, not just a protection system. Moreover, the condition monitoring solution of these machines should be more than just basic vibration monitoring. Due to the complex nature of the hydro unit components, a number of potential failure modes now become apparent under the current stressful conditions, which require a number of different, specialized monitoring techniques and diagnostic expertise. There are few standards for monitoring the hydro units and a general lack of understanding of the monitoring techniques. Even for hydropower stations that have a legacy condition monitoring system installed, the existing condition monitoring requirements for the hydro units are sometimes no longer valid as a result of changing operating conditions or refurbishment of the units.