HEALTH INDEX

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ABSTRACT

The Health Index of an asset is a figure which reflects its condition.

This is a tool for asset management which makes it possible to define in unbiased way a policy for maintenance, refurbishing or replacement.

The design of an Health Index requires three steps :
- *Finding the factors which affect links performance.*
- *Grading the link characteristics for every factor.*
- *Estimating the relative importance of the factors.*

The paper presents an example of Health Index, and deals with related topics.

KEYWORDS

Health Index, underground link, insulated cable, asset management.

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INTRODUCTION

Electric utilities, in France as in many countries, have to face an increasing demand for reliable electricity supply, whereas the electricity infrastructure involves a large amount of links which have been in service over many years.
In the same time, with restructuring the electricity market, the balance between capital investments, asset maintenance duties and grid operating costs becomes more and more a major concern.

That is the reason why the Health Index was designed, as a tool dedicated to risk and asset management.

This tool makes it possible to optimize maintenance policies, and helps comparing, in an unbiased way, the technical and financial efficiency of new investment versus refurbishment or uprating and upgrading of existing links.

Basically, the Health Index of a link is a figure which reflects its condition.

This paper presents the Health Index currently designed by EDF R&D:
- based on works in early nineties,
- updated according to the general frame by the Transmission Underground Cables Interest Group within CEA Technologies,
- together with a tool, using a similar approach, developed for RTE, to optimize the management of 225 kV oil pipe cables in the French grid.

REPLACEMENT CRITERIA

In early nineties, as a consequence of an increasing failure rate of synthetic cables wet designed i.e. without radial water barrier (copper tapes as metallic screen) in conjunction with end-of-life of some old mass impregnated paper cables and oil leakages on some oil-filled cables, EDF defined a replacement criterion to prioritize links to be replaced.

This criterion is based on a parameter V (the larger is V the higher is the replacement priority) which looks like an Health Index.

The design of V takes into account 3 influencing factors: the age of the link, its electrical and hydraulic behaviour in operation

V is expressed as:

$$V = A * Tv + Fr * Cc1 * Cc2 + Cf1 * Cf2$$

Where:

- A is a function of the age of the link and Tv is for the influence of the technology on degradation rate (ranging from 0.5 for synthetic cables to 1.5 for mass impregnated cables)
- Fr is normally 1; or 3 in case of identified unreliable manufactured design (e.g. synthetic cables without water radial barrier) or batch; Cc1 is a function of the number of breakdowns per km during last 5 years, and Cc2 is 3 in case of generic cause (water ingress, overheating, papers ageing...) or 1 for unidentified cause.
- Cf1 and Cf2 deal with hydraulic history for oil-filled cables. Cf1 ranges from 0 to 5 as a function of the spill volume; Cf2 being 1 for local leakages, 3 for leakages due to global ageing.