EDF APPROACH TO THE DESIGN AND MAINTENANCE OF LEAKTIGHT BOLTED ASSEMBLIES

Author: RIZO José
EDF/SEPTEN
12-14 av Dutrievoz
69628 VILLEURBANNE
FRANCE

1 - ABSTRACT

Starting out from a presentation of the approach and current action taken by EDF concerning the design and maintenance of leaktight bolted assemblies in French nuclear power plants, our aim is to bring builders, manufacturers, principals and codification and standardization organizations to a consensus which, through gains in security, safety and productivity of industrial scale installations, will give economic justification to better design and maintenance of products and equipment.

2 - INTRODUCTION

Experience feedback organization at EDF (inventory, sorting, incident analysis) makes it possible to deduce the generic nature of events, with due allowance for the identity of the French nuclear power plants.

The leaks detected from certain bolted assemblies belong to the generic incidents which have been identified and for which solutions have been found.

This operational experience, based on 350 reactor-years of operation, combined with the experimental work carried out by our Research and Development Branch, is today giving us a clear insight into the requirements which must be met for efficient design and maintenance of a leaktight bolted assembly.

The areas governed by these requirements are the industrial water-steam systems of the reactor building and turbine hall and their auxiliaries.
The typical assembly is flat-flange, clamped or grooved.

The temperature-pressure range is above PN 16 for the French standard or series 150 for the US standard.

The types of gasket used in these circuits are mainly asbestos-elastomer flat, spiral-wound, metal O-rings or expanded graphite mounted between metal disks.

This tightness concept, which is the basis of the requirements, is defined from the following three items:

- the gasket,
- the bolted assembly design,
- assembly clamping.

The tightness grade is related to the quality of each of these items.

3 - GASKET

The work of our Research and Development Branch [1], whose aim is to experimentally characterize, under a press, the behavior of gaskets under conditions (press tray dimensions) which allow for gasket/housing interaction, leads us to think that the experimental method of characterization of a gasket is the most efficient way for an engineer to design the assembly and ensure its leaktightness.

This method involves measuring in a press the compression forces and, where necessary, the leakage rate for a given fluid.

It checks reproductibility of a dimension for a type of gasket and makes it possible to account for the effect of dimension related tolerances of the housing and of the gasket on mechanical characteristics.

This method integrates the two properties specific to industrial gaskets: firstly, the nature of the materials makes them "living" components (creep and relaxation phenomena) with a visco-elastic behavior which is difficult to model, and secondly, certain current manufacturing techniques, have dimensions which are too imprecise to guarantee mechanical properties and sealing (Fig.1).