Chapter 2
Fault Mechanism

ABSTRACT

Static and rotary electric power converters have different structures but there are common failure factors in both of them. In this chapter, causes of failure in electric power converters is described. All of the failure factors which are described in this chapter are catastrophic factors and lead to destructive damage in the systems. Other types of failure without destructive effect on converter like electromagnetic interference will be presented in the next chapters. All descriptions are based on details of operation of the converters which were presented in the previous chapter. Over temperature, over voltage, mechanical forces and environmental effects like humidity are the main factors of failure in systems. Origins of these factors are described in this chapter. Over temperature is a special factor among them because other failure factors finally act as over temperature in failure process of the converters. Since over temperature is the main failure factor in electric power converters, loss model of components in electric power converters are presented in details. In addition, practical technique for measuring power loss is described. Sample industrial examples of damaged equipments due to these failure factors are shown to give a real sense to reader about failure results.

INTRODUCTION: FAILURE OF ELECTRIC POWER CONVERTERS

In this chapter, we present the failure mechanism in electric power converter based on the background of Chapter 1. Figure 1 shows the state of Chapter 2 in the flowchart of the book.

CATASTROPHIC FAILURE

All of investigated failure in this chapter are catastrophic type and lead to damage of converter. There are other types of failure that does not damage the converter are studied in the next chapters as availability concept. A catastrophic failure is a sudden and total failure from which recovery is impossible. Catastrophic failures often lead to cascading systems failure (Tohidi, Zolghadri, Orace, Tavner, Abdi, & Logan, 2012). The term is most commonly used for structural failures, but has often been extended.
Fault Mechanism

Figure 1. State of chapter 2 in the flowchart of the book

to many other disciplines where total and irrecoverable loss occurs. Such failures are investigated using the methods of forensic engineering (Abdi, Abdi, Oraee, & McMahon, 2015), which aims to isolate the cause or causes of failure.

FAILURE FACTORS

Meaning of failure in this chapter is the type of failure that leads to damage in a converter. Based on this view, four main reasons of failure are:

- Thermal shock
- Over voltage
- Mechanical forces
- Environmental effects.
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