
**Condition monitoring and diagnostics
of wind turbines —**

**Part 2:
Monitoring the drivetrain**

Surveillance et diagnostic des éoliennes de production d'électricité —

Partie 2: Surveillance de la transmission

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 108, *Mechanical vibration, shock and condition monitoring*, Subcommittee SC 5, *Condition monitoring and diagnostics of machine systems*.

A list of all parts in the ISO 16079 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is the second step of the procedure for carrying out the CM and D application design phase according to the V-model of ISO 13379-1. In this step, the monitoring strategy for the drivetrain is defined, based upon the prioritized failure modes which were the outcome of the failure modes, effect and criticality analysis (FMECA) procedure performed according to ISO 16079-1 (see [Figure 1](#)).

According to the V-Model of ISO 13379-1 and ISO 16079-1, the steps described in this document are as follows:

- a) decide under which operating conditions the different faults can be best observed and specify the conditions under which the symptom is most likely to be observed;
- b) identify the symptoms that can serve in assessing the condition of the machine, and that are used for diagnostics;
- c) list the descriptors that are used to evaluate (recognize) the different symptoms;
- d) identify the necessary measurements and transducers from which the descriptors are derived or computed.

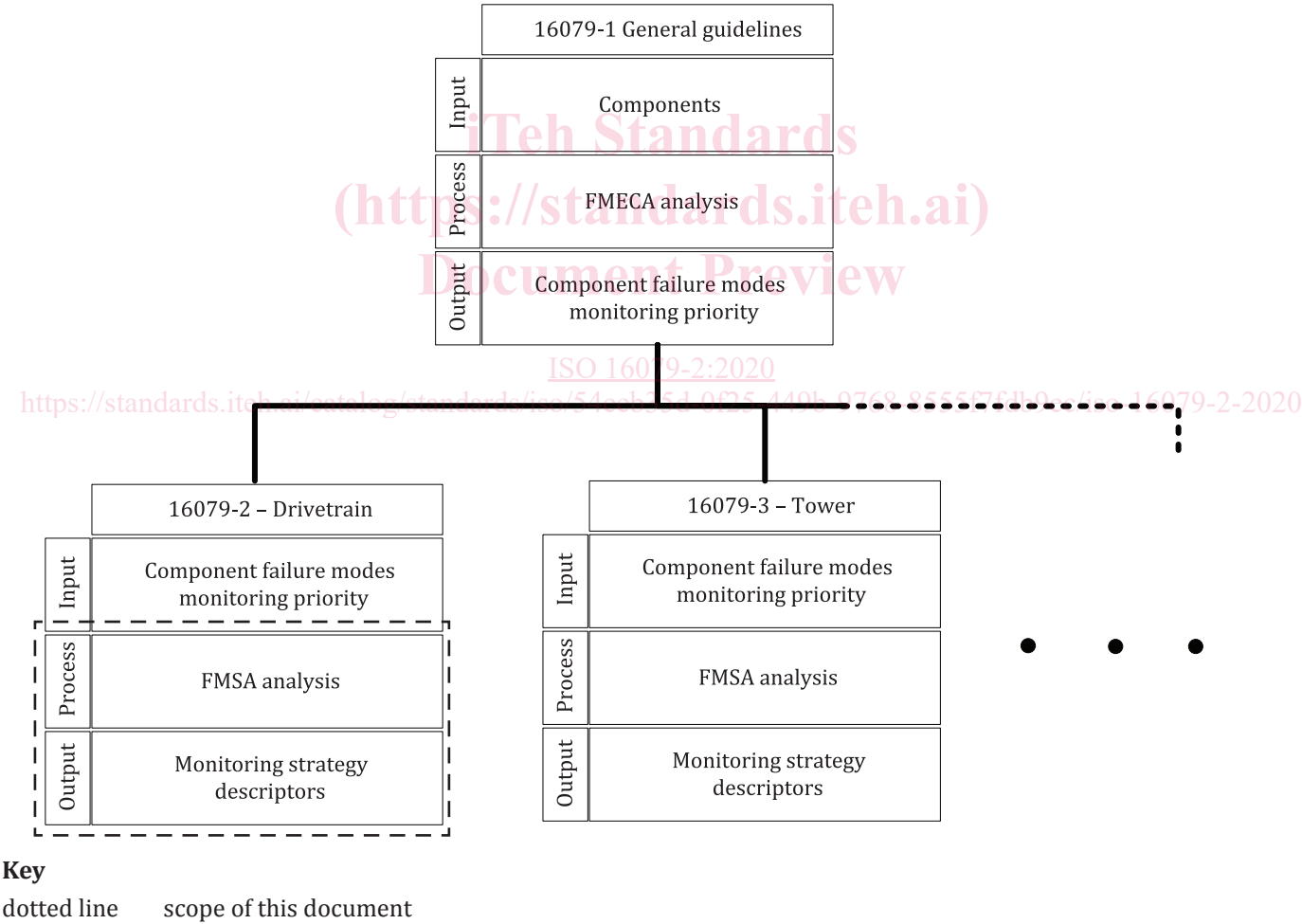


Figure 1 — The relationship between this document and ISO 16079-1

In relation to the V-model, this document describes the two last steps of the application design phase of the condition monitoring system. This process shall ensure that data are available to support an

efficient process in the use phase of the condition monitoring system. The end goal of the “Use phase process” is minimizing wind turbine downtime through a risk assessment of a detected fault by means of remaining useful life (RUL) evaluation, and successive determination of maintenance timing. The criticality and risk assessment uses information from the FMECA analysis, but may also feed information back into an adjustment of the initial FMECA analysis (see [Figure 2](#)).

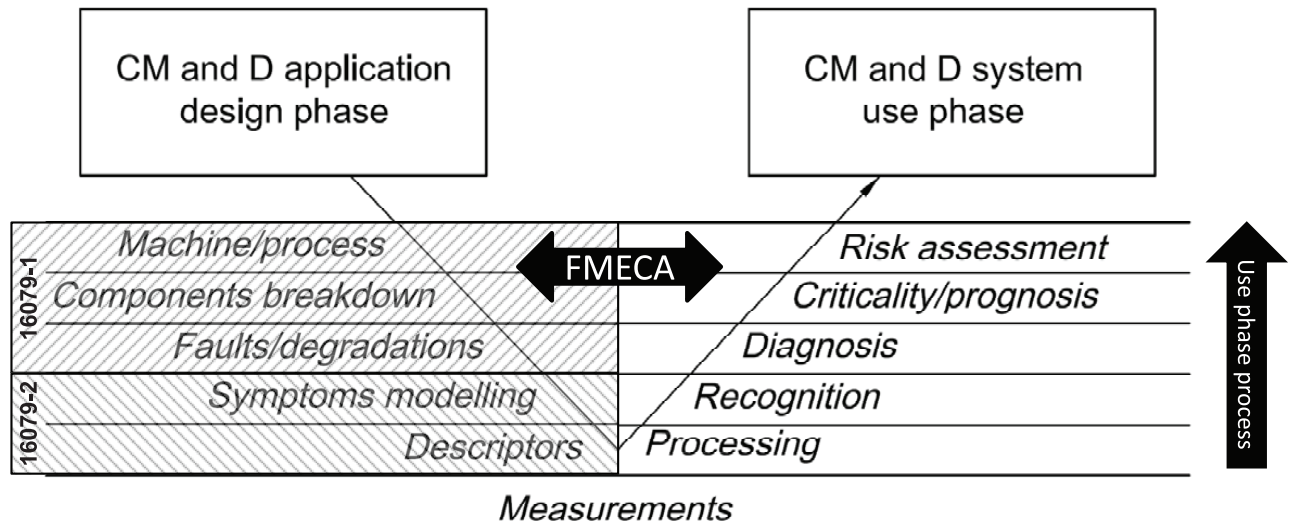


Figure 2 — Condition monitoring and diagnostics (CM and D) cycle: Design phase and use phase of the application on a machine

This document shows how to apply the results of an FMECA analysis made according to ISO 16079-1 by prescribing a methodology for making a failure mode symptoms analysis (FMSA) with the purpose of defining symptoms and related descriptors to detect a particular failure mode.

In order to implement the results of the FMSA, sections with guidelines for condition monitoring of wind turbines are provided, covering:

- 1) guidelines for descriptor measurements;
- 2) adapting to changes in operating conditions;
- 3) selection of transducers and transducer technology;
- 4) selection of transducer locations;
- 5) naming convention for identifying transducer locations and related descriptors;
- 6) evaluation criteria for descriptor measurements;
- 7) requirements to data for diagnosis;
- 8) prognosis and/or criticality assessment; and
- 9) review of the CM & D design:
 - a) assessment of effectiveness of the diagnostics system, and
 - b) cost benefit analysis.

[Figure 3](#) shows the relationship between the monitoring strategy, diagnostic strategy and maintenance strategy and how these important elements support the steps in the condition monitoring process. If the monitoring strategy, the diagnostic strategy, or both are based upon weak or missing data, it compromises the prognosis and the whole purpose of the condition monitoring process.