



AN 51

Technical drawings - Critical features

Approved by: Mr. Strassonig

Replaces: 2014-05

Replaced by

This standard describes the purpose and carrying out of the identification of critical features in technical drawings.

1. Scope of this directive

This directive applies to MAN Diesel & Turbo SE to 4-stroke engines medium/large bore as well as turbochargers.

2. Definitions

2.1 Characteristics

Characteristics are properties of parts, assemblies or products, which have an effect on their installation and/or function as well as service life, reliability and operational safety. These characteristics can be recognised either by dimensional data, indication to certain production processes or tests and information on strength, hardness, etc.

2.2 Critical features (synonyms: Characteristics which are to be observed particularly, Critical to Quality (CTQ), Customer Critical Feature (CCF))

Those features are „to be observed particularly“, if they may result in a loss of operational safety, if they are not being carried out according to drawing specifications and as a consequence, a possible risk for operational safety, loss of function, of assemblability and exchangeability or if a considerable restriction in the service life of the components concerned is to be expected.

2.3 Parts of a different safety relevance

Depending on safety relevance, the parts spectrum, implemented into the engines or turbochargers, is divided into the safety classes A, B and C.

2.4 Standard reference

The content of the works standard is based on DIN 406-10.

AN 51

Technical drawings - Critical features

3 Application

3.1 Application in design department

Basis

Identification and marking of critical features are subject to the responsible design engineer and can be made based on legislative rules, results of design and / or process-FMEAs, but also according to agreement with responsible departments and experience.

Application

It is obliged to indicate critical features for all parts of the safety classes A and B (see para. 2.3)

Exception for purchased parts according to MDT specifications: Critical features with effect on interface to MDT-design have also to be determined for purchased parts with an external engineering responsibility and to be marked on the purchase drawing / supplier drawing acc. to chapter 4. Details have to be stipulated in the specifications.

Numbering

Each critical feature has to be consecutively numbered on the drawing.

Scope of testing (optional)

Basically, quality department is liable to determine the scope of testing. Based on special requirements, such as functional relevant tests, the responsible design engineer is allowed to determine the scope of testing for these features to 100%.

Note:

The determination of the scope of testing does not incorporate that the nominal values of the feature have to be completely and traceably documented. For a mandatory documentation of a feature, an (electronic) FK-sheet (see chapter 3.3.) has to be used.

The proof of process capability or proof of a zero-defect-installation (PokaYoke) foregoes the execution of a 100% test.

Process capability (optional)

In agreement with production and quality department, the responsible design engineer is allowed to demand the adherence of process capability for particular features.

Note:

Before linking the tolerance indications and process capability requirements, the necessary frame conditions (traceability, statistic recording, machine capability) have to be considered.

AN 51

Technical drawings - Critical features

Standardization

In order to ensure standardised classification and numbering of critical features for each drawing of a parts family, examples of the part will be implemented in the design guide.

3.2 Application in Planning and Production

Production plan / Process instruction

With regard to the planning and production sector (also valid for subcontractors), identification is a clear indication that drawing-relevant carrying out of the critical features requires particular attention in regard to preparation of the production plan and the selection of suitable production processes.

Irrespective of the identification of a critical feature, neither the production sector nor the subcontractor is released from the obligation to carefully comply with the other drawing requirements (e.g. dimensions, tolerances, production and test directives).

3.3 Production supervision

The identification of critical features permits targeted checking in accordance with the prescribed drawing data.

Process stability

For critical features a process reliable production has to be ensured. This can be provided by methods of statistical process control as also by final inspections.

For features with explicit process capability requirements, a series-accompanying evaluation of process capability of the feature has to be done by quality department. If the required process capability index cannot be matched, the feature has to be tested to 100%.

Note:

In case of comparable manufacturing conditions, it is sufficient to provide just one process capability certificate bundled for several serial numbers.

Documentation

As a basis for a standardised (data) collection, a so-called "Fertigungskontrollblatt" (FK-sheet) can be designed in cooperation with the design department. The scope of the documentation will be set by Quality department in accordance with production and design department.

AN 51

Technical drawings - Critical features

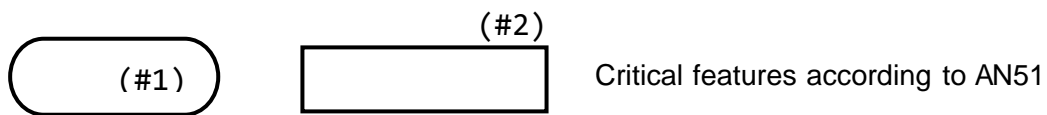
4. Markings on drawings

4.1 Indications on drawings

Each critical feature has to be identified by framing (see para. 3.2) (line width = narrow full line) as well as a subsequent number in round brackets.

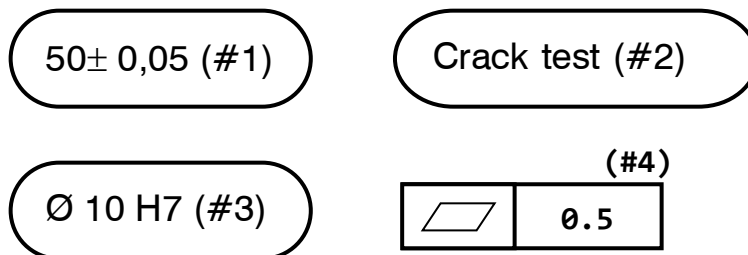
In case of tolerances in shape and position, the subsequent number should be placed right-aligned above the tolerance indication.

Drawings with one or more critical features bear the following remark near the labelling field



Drawings, that do not show any features that have to be observed particularly, do not obtain any remark.

4.2 Examples for drawing specifications



4.3 Appraisal drawing

If it is necessary due to clarity, the critical features may also be stated on a separate appraisal drawing.