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SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J450

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Use of Terms Yield Strength and Yield Point

1. Scope—The purpose of this SAE Recommended Practice is to describe the terms yield strength and yield point. Included are definitions for both terms and recommendations for their use and application.

2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein.

2.1.1 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM A 370—Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM E 6—Standard Terminology Relating to Methods of Mechanical Testing
ASTM E 8—Standard Test Methods of Tension Testing of Metallic Materials

3. Definitions

3.1 Yield Strength—The stress at which a material exhibits a specified limiting deviation from the proportionality of stress to strain. At the point of limiting deviation, the yield strength is expressed in units of stress and is referenced to a particular strain. The units of stress and strain should be defined as either engineering stress and strain or true stress and strain. The deviation may be measured either by the Offset method or by the Extension Under Load method as described in ASTM E 8. The method of measurement must be stated when reporting yield strength. The term is applicable to materials whose stress-strain diagram in the area of transition from elastic to plastic strain is a smooth curve, as well as to those which yield discontinuously and whose stress strain diagrams exhibit an upper yield point or sharp knee.

3.2 Yield Point—A special case of yield strength applicable where yielding occurs discontinuously. An upper and sometimes a lower value can be determined. The upper yield point is defined as the first stress in the material, at which an increase in strain occurs without an increase in stress. The lower yield point is defined as the lowest point between the first stress and the onset of continuous plastic behavior, at which an increase in strain occurs without an increase in stress.

Since in their commercial form, only ferrous metals exhibit this phenomenon and then only under some circumstances, it follows that the term yield point has only limited application to the results of tensile testing of ferrous metals and is not applicable to the testing of nonferrous metals.

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4. Recommended Usage

4.1 Nonferrous Metals—Only the term yield strength is applicable. Specifications and test reports must always state the method of test and limiting values of strain.

4.2 Ferrous Metals—Yield strength is the general term and it is applicable to stress-strain curves of both the smooth, rounded type, and the type characteristic of discontinuous yielding. When reporting yield strength, the method of test and limiting values of strain must be stated.

Strictly interpreted, the term “yield point” is intended for application only in those cases in which the material exhibits the unique characteristics defined previously under yield point. If only a single value of yield point is reported, it should be indicated whether it is the upper or lower yield point. There are some specifications which prescribe a yield point for materials which have smooth stress-strain curves. In such cases, use of the term yield point should be discouraged. However a practical substitute for yield point would be a yield strength value obtained through any of the recommended methods described in ASTM E 8.

For a more detailed discussion of the terms involved and a description of the applicable methods of test refer to the following:

ASTM A 370—Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM E 6—Standard Terminology Relating to Methods of Mechanical Testing
ASTM E 8—Standard Test Methods of Tension Testing of Metallic Materials

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