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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 17600.1-1998

**Steel. Conversion of elongation values. Part 1: Carbon and low
alloy steels**

钢的伸长率换算 第1部分:碳素钢和低合金钢

(English Translation)

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Foreword

This Standard is equivalent to the International Standard ISO 2566-1:1984 "Steel - Conversion of elongation values - Part 1. Carbon and low alloy steels".

This Standard is identical to ISO 2566-1:1984 in terms of scope of application and conversion formula for elongation conversions. Therefore, the conversion results are completely consistent and technically equivalent. This Standard has the following differences from the ISO standard.

1. This Standard gives the basic formula of conversion and the specific conversion formula under various conditions. The ISO standard only gives the specific conversion formula under two conditions.
2. The conversion formula given in this Standard contains the calculation formulas in all the conversion tables in the ISO standard. Therefore, the 21 conversion tables in the ISO standard are reduced to 4.
3. The symbols used in this Standard are consistent with GB/T 228-1987 "Metallic materials - Tensile testing" and GB/T 10623-1989 "Metallic materials - Terms of mechanical test", which are slightly different from the ISO standard.
4. The mantissa of the individual values in the conversion factor table of this Standard is slightly different from the ISO standard. They are rounded off in this Standard according to GB/T 8170-1987 "Rules for rounding off of numerical values".

GB/T 17600 consists of two parts under the general title of "Steel - Conversion of elongation values".

GB/T 17600.1-1998 Part 1: Carbon and low alloy steels

GB/T 17600.2-1998 Part 2: Austenitic steels

YB 4080-1992 "Steel - Conversion of elongation values (Carbon and low alloy steels)" is invalidated from the date of implementation of this Standard.

1 Scope

This Standard specifies a method of converting room temperature elongations after fracture obtained on various gauge lengths. It includes the conversion formula and the conversion factor table of the elongation, as well as the graphs for performing such conversions.

This Standard is applicable to carbon and low alloy steels within the tensile strength range 300 to 700 MPa and in the hot-rolled, hot-rolled and normalized or annealed conditions, with or without tempering.

This Standard is not applicable to cold rolled (drawn) steels, quenched and tempered steels and austenitic steels.

This Standard is not applicable to the test piece of which the original gauge length exceeds $25\sqrt{S}$ or the test piece of which the width to thickness ratio exceeds 20.

In the case of strip test piece under 4 mm thickness, the index n in formula (1) of this Standard increases with decreasing thickness. The conversion value of elongation shall be the subject of agreement between the customer and the supplier.

The conversion method of this Standard is adopted internationally, and the conversions are reliable within the scope of this Standard. However, because of the various factors influencing the determination of elongations, whether to use the conversions of this Standard shall be determined by the relevant standards or agreements.

In cases of dispute or arbitration, the elongation value shall be determined on the gauge length stated in the relevant standards or agreements.

2 References

The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. At the time of publication, the editions indicated are valid. All standards are subject to revision. The parties

4 Symbols

λ Conversion factor for elongations on different proportional gauge lengths

α Conversion factor for elongations on different non-proportional gauge lengths

β Conversion factor between $5.65\sqrt{S}$ gauge length and elongation of different non-proportional gauge lengths

γ Conversion factor between elongation of $4\sqrt{S}$ gauge length and elongation of

different non-proportional gauge lengths

5.1 Basic formula

The conversion of elongation is based on the Oliver formula. The basic formula used for conversions may be expressed as.

For ease of use, this Standard gives the simplified formula and conversion factor derived from the basic formula, used under different conditions, and draws graphs according to the formula, from which the conversion value of the elongation may be directly found.

NOTE: The conversion value of the elongation in this Standard is rounded off according to the corresponding clause of GB/T 228 and GB/T 8170.

5.2 Conversion from the elongation of one proportional gauge length to the elongation of another proportional gauge length

Calculate the $(K/K_{\tau})_{0.4}$ value of the commonly used proportional test piece according to formula (2). The conversion factor is denoted as λ , which is listed in Table 2. Then $\Delta\epsilon = \lambda \cdot \Delta\epsilon_0$.

Example: It is known that the elongation of 5.65sqrt S gauge length is 25 %, which is to be converted to the elongation of 11.3sqrt S gauge length. Look up Table 2, $\lambda = 0.758$, then $\Delta\epsilon = 0.758 \times 25 \% = 18.95 \%$, which is rounded off to 19 %.

5.3 Conversion from the elongation of one non-proportional gauge length to the elongation of another non-proportional gauge length for test pieces of equal cross-sectional area

The basic formula is simplified to.

Calculate the $(L_0/L_{0\tau})_{0.4}$ value of the commonly used non-proportional test piece.

The conversion factor is denoted as α , which is listed in Table 3. Then $\Delta\epsilon = \alpha \cdot \Delta\epsilon_0$.

Example: It is known that the measured elongation of the test piece with a 200 mm non-proportional gauge length is 20 %, which is to be converted to the elongation of 100 mm gauge length with the same cross-sectional area. Look up Table 3, it is known that $\alpha = 1.320$, then $\Delta\epsilon = 1.320 \times 20 \% = 26.40 \%$, which is rounded off to 26 %.

5.4 Conversion from the elongation of a proportional gauge length to the elongation of a non-proportional gauge length

The basic formula is simplified to.

If the elongation of 5.65sqrt S gauge length is known, and it is to be converted to the

elongation of other non-proportional gauge lengths, then.

Calculate the $2(\sqrt{S/L_0} \tau)^{0.4}$ value. The conversion factor is denoted as β , which is listed in Table 4. Then $\Delta\tau = \beta \cdot \Delta$.

If the elongation of $4\sqrt{S}$ gauge length is known, and it is to be converted to the elongation of other non-proportional gauge lengths, then.

Calculate the $1.74(\sqrt{S/L_0} \tau)^{0.4}$ value. The conversion factor is denoted as γ , which is listed in Table 5. Then $\Delta\tau = \gamma \cdot \Delta$.

Other proportional gauge lengths may also be converted to the elongation of

Table 3 -- Conversion factor α for elongations of different non-proportional gauge lengths (with the same cross-sectional area)

Key: A - Original gauge length of the test piece of which the elongation is to be measured, L_0 .

5.5 Conversion from the elongation of a non-proportional gauge length to the elongation of another non-proportional gauge length for test pieces of different cross-sectional areas

Convert according to formula (1). It may also convert in two steps using Table 4 or Table 5. Firstly, convert the elongation of the known gauge length to the elongation of the proportional gauge length, such as $5.65\sqrt{S}$ or $4\sqrt{S}$; then convert it to the elongation of the non-proportional gauge length to be obtained.

Example: The elongation of 40 mm x 15 mm test piece with 200 mm gauge length is 24 %, which is to be converted to 30 mm x 10 mm test piece with 200 mm, 100 mm and 50 mm gauge lengths.

Firstly, according to Table 4, convert to the elongation of $5.65\sqrt{S}$ gauge length, that is $24 \% \times 1/0.863 = 27.81 \%$;

convert to the elongation of 30 mm x 10 mm, 200 mm gauge length, i.e. $\Delta\tau = 27.81 \% \times 0.752 = 20.91 \%$ (see Table 4), which is rounded off to 21%;

convert to the elongation of 30 mm x 10 mm, 100 mm gauge length, $\Delta\tau = 27.81 \% \times 0.992 = 27.58 \%$, which is rounded off to 28 %;

convert to the elongation of 30 mm x 10 mm, 50 mm gauge length, $\Delta\tau = 27.81 \% \times 1.309 = 36.40 \%$, which is rounded off to 36 %.

The elongation of other proportional gauge lengths may be converted according to the conversion factors given in Table 2.