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JAPANESE INDUSTRIAL STANDARD

Symbols of Forming Ratio
for Steel Forging

JIS G 0701 — 1957

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JAPANESE INDUSTRIAL STANDARD

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Symbols of Forming Ratio
for Steel Forging

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1. Scope

This standard specifies symbols of forming ratio for hot forged steel.

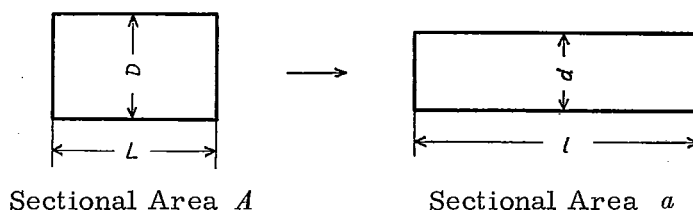
2. Forming Ratio

2.1 The forming ratio for steel forgings manufactured by various hot forging operations shall be denoted by the deformation ratio in the direction of the largest of three principal plastic strains.

2.2 The symbols of the forming ratio shall be, as a rule, suffixed with the designated notation corresponding to the forging operation and shall be clearly denoted in the order of working.

3. Designations and Symbols of Forming Ratio

3.1 Solid Forging The forging operation by which a solid reduces its sectional area and increases its length shall be designated as solid forging, of which the forming ratio shall be expressed as follows:



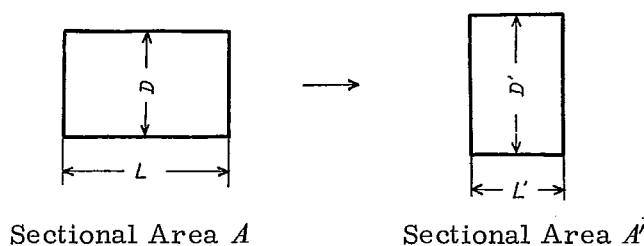
Forming Ratio

$$\frac{A}{a} \text{ or } \frac{l}{L}$$

Notation for the
Operation
S

Example: 2S

3.2 Upsetting Forging The forging operation by which a solid increases its sectional area and reduces its length shall be designated as upsetting forging, of which the forming ratio shall be expressed as follows:



Forming Ratio

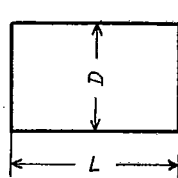
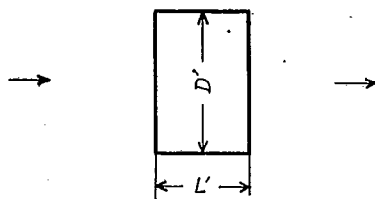
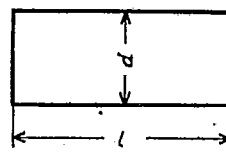
$$\frac{1}{\frac{L}{L'}}$$

Notation for the
Operation
U

U

Example: 1/2 U

When an upsetting operation is followed by a solid forging, the over-all forming ratio shall be expressed as follows:

Sectional Area A Sectional Area A' Sectional Area a

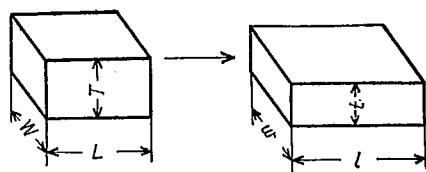
Forming Ratio $\frac{1}{\frac{L}{L'}}, \frac{A'}{a} \text{ or } \frac{1}{\frac{L}{L'}}, \frac{l}{L'}$

Example: 1/2 U 3S

3.3 Flattening Forging The forging operation in which a square solid is compressed in one direction and a remarkable difference of deformation is produced between the two other directions perpendicular to the former shall be designated as flattening forging, of which the forming ratio shall be expressed as follows: where the compression shall be performed in T direction and be assumed $\frac{l}{L} > \frac{w}{W}$.

Forming Ratio

$$\frac{1}{\frac{T}{t}} \left(\frac{l}{L} \right)$$



Notation for the Operation

F

Example: 1/2 (1.7)F

The forming ratio when flattening forgings in two directions are superposed shall be expressed as follows: assuming $\frac{L'}{L} > \frac{W'}{W}$ in the first flattening and compressing in W direction in the second flattening.

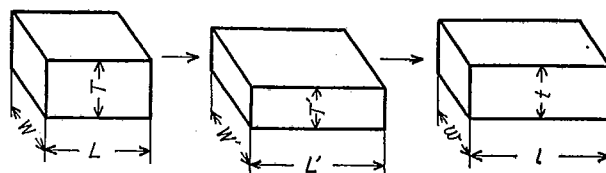
Forming Ratio

(1) when $\frac{l}{L'} > \frac{t}{T'}$,

$$\frac{1}{\frac{T}{T'}} \left(\frac{L'}{L} \right), \frac{1}{\frac{W'}{w}} \left(-\frac{l}{L'} \right)$$

(2) when $\frac{l}{L'} < \frac{t}{T'}$,

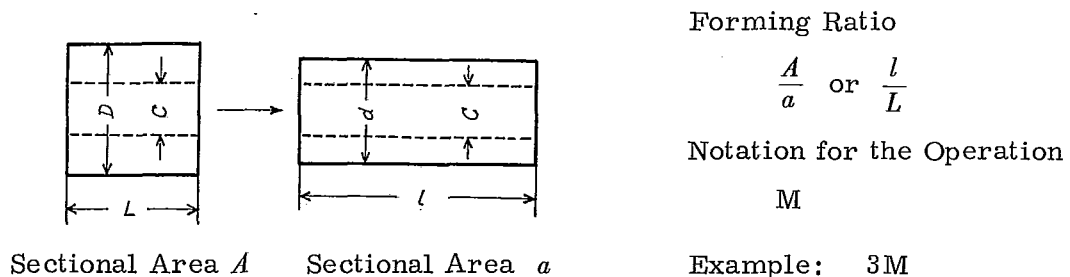
$$\frac{1}{\frac{T}{T'}} \left(\frac{L'}{L} \right), \frac{1}{\frac{W'}{w}} \left(\frac{t}{T'} \right)$$



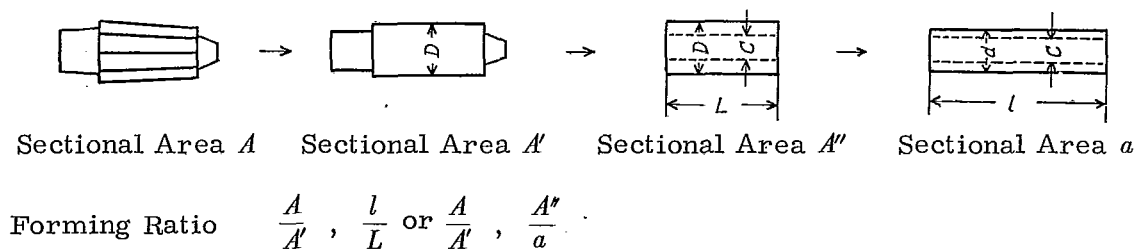
Examples: for (1) $\frac{1}{2} (1.7)F, \frac{1}{2.2} (1.8)F$
 for (2) $\frac{1}{2} (1.6)F, \frac{1}{2.2} (1.9)F$

The directions for 1.7 and 1.8 are the same in the case of (1), while the directions for 1.6 and 1.9 in the case of (2) are different which is distinguished by the bracket []. Similar expressions shall be possible in case of compression in L direction in the second flattening.

3.4 Mandrel Forging The forging operation by which a hollow cylinder be reduced its sectional area on a mandrel inserted therein and increased its length shall be designated as mandrel forging, of which the forming ratio shall be expressed as follows:

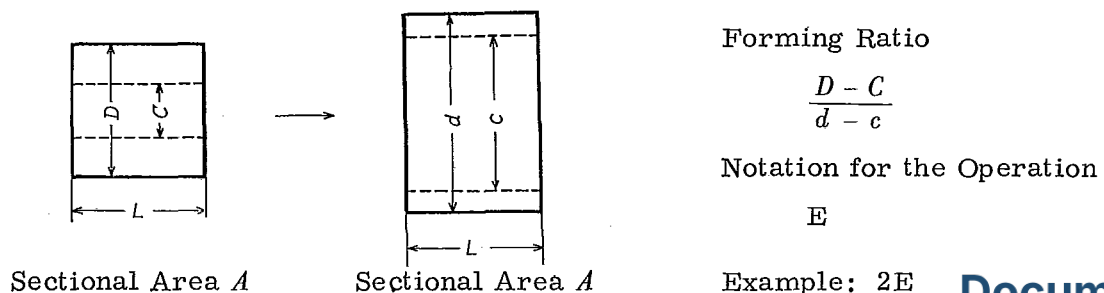


The overall forming ratio when a mandrel forging is combined with rough forging of ingot (solid forging) shall be expressed as follows:



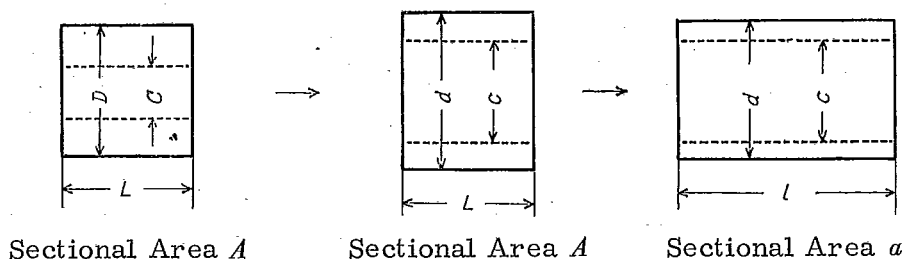
Example: 2.5S 3M

3.5 Enlarging Forging The forging operation by which a hollow cylinder be enlarged its diameter without changing its length shall be designated as enlarging forging, of which the forming ratio shall be expressed as follows:



4.
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The overall forming ratio when a mandrel forging is combined with an enlarging forging shall be expressed as follows:



$$\text{Forming Ratio} \quad \frac{D-C}{d-c}, \quad \frac{l}{L}$$

Example: 2E 3M

Remarks 1. The sectional area of ingot shall be expressed by the average value.

2. As described in 2.1, the forming ratio shall be expressed by the deformation ratio of the largest principal strain in three directions. The value of largest principal strain can be computed by taking natural logarithm of the corresponding deformation ratio.
3. The numerical value of forming ratio (denominator for the case of upsetting and flattening) shall be as a rule expressed by integer, counting fractions over 1/2 on the first decimal place as one and disregarding the rest. When necessary, however, the first figure after the decimal point shall be expressed.

Examples 1. Forming ratio when mandrel forging is combined with rough forging of ingot is

$$\frac{A}{A'}, \quad \frac{l}{L} = \frac{6300 \text{ cm}^2}{4840 \text{ cm}^2}, \quad \frac{535 \text{ cm}}{135 \text{ cm}} = 1.3\text{S } 4\text{M}$$

2. Forming ratio when upsetting, solid and enlarging forgings are combined is

$$\frac{1}{\frac{L'}{L}}, \quad \frac{A'}{a}, \quad \frac{D-C}{d-c}$$

$$= \frac{1}{\frac{320 \text{ cm}}{128 \text{ cm}}}, \quad \frac{41600 \text{ cm}^2}{38000 \text{ cm}^2}, \quad \frac{150 \text{ cm}}{36 \text{ cm}} = \frac{1}{2.5} \text{ U } 1.1\text{S } 4.2\text{E}$$

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EXPLANATION

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