UDC 621.753

Ref. No. : ISO/R 1938-1971 (E)

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 1938

ISO SYSTEM OF LIMITS AND FITS

PART II : INSPECTION OF PLAIN WORKPIECES

1st EDITION

April 1971

Printed in Switzerland

Also issued in French and Russian. Copies to be obtained through the national standards organizations.

BRIEF HISTORY

The ISO Recommendation R 1938, *ISO system of limits and fits – Part II : Inspection of plain workpieces*, was drawn up by Technical Committee ISO/TC 3, *Limits and fits*, the Secretariat of which is held by the Association Française de Normalisation (AFNOR).

Work on this question led to the adoption of Draft ISO Recommendation No. 1938, which was circulated to all the ISO Member Bodies for enquiry in February 1970. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies:

Austria	Ireland	Romania
Belgium	Israel	South Africa, Rep. of
Chile	Italy	Switzerland
Czechoslovakia	Japan	Thailand
France	Korea, Rep. of	Turkey
Germany	New Zealand	U.A.R.
Greece	Norway	United Kingdom
Hungary	Poland	U.S.S.R.
India	Portugal	

The following Member Bodies opposed the approval of the Draft :

Australia
Canada
Sweden

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as an ISO RECOMMENDATION.

CONTENTS

Figures

Tables

ISO Recommendation | R 1938 | April 1971

ISO SYSTEM OF LIMITS AND FITS

PART II : INSPECTION OF PLAIN WORKPIECES

INTRODUCTION

This ISO Recommendation is a continuation of ISO Recommendation R 286, *ISO system of limits and fits – Part I : General, tolerances and deviations.*

The information concerning the indicating measuring instruments is new whereas that relating to the choice of gauges to be used, including their tolerances and wear margins, is practically the same as in the old ISA System (ISA Bulletin 25 of January 1941).

In particular accepted trespassing of the limits for practical reasons (y or y_1 margin) in the case of grade 8 and lower still remains the rule, but might possibly be reduced or omitted in the future. Present values for tolerances and wear of gauges should be considered as maximum values.

From now on this ISO Recommendation allows the use of new tolerance grades experimentally; these are named grades 6N, 7N, 8N to distinguish them from the preceding 6, 7 and 8 and differ from the latter only by a much lower wear of gauges enabling any margin to be dispensed with (y or $y_1 = 0$).

Numerical values as given in this ISO Recommendation are expressed in terms of the various grades provided for in ISO Recommendation R 286, and are therefore valid only for the ISO system of tolerances or by comparison with this system; all other details of a more general nature may still be applied as a rule to any system of limits for plain workpieces.

As in ISO Recommendation R 286, these numerical values essentially concern diameters not greater than 500 mm. However, values applicable to the limits of workpieces of diameters greater than 500 mm, such as those appearing provisionally in section 3 of ISO Recommendation R 286, are also given here as a supplement and are intended mainly for experimental purposes.

1. SCOPE

This ISO Recommendation relates to the inspection of plain workpieces. It specifies the interpretation to be given to the limits of dimensions to be inspected, and gives the essential details concerning limit gauges and indicating measuring instruments necessary for the inspection of tolerances of the ISO system.

2. GENERAL RULES OF INSPECTION

2.1 Reference temperature and measuring force

ISO Recommendation R 1, *Standard reference temperature for industrial length measurements* fixes this temperature at

20 °C

This is the temperature at which dimensions specified for workpieces and their inspection instruments are defined and at which the inspection should normally be carried out.

In addition all measuring operations provided for in this ISO Recommendation are understood as referred to a zero measuring force.

If the measurement is carried out with a measuring force different from zero its result should be corrected accordingly. This correction however is not required for comparative measurements carried out with the same comparing means and the same comparing force between similar elements of identical material and identical surface roughness.

2.2 Interpretation of size limits (Taylor principle)

In order to guarantee, so far as is practicable, that the functional requirements of the ISO system of limits and fits are attained, the limits of size should be interpreted in the following way within the prescribed length.

For *holes*, the diameter of the largest perfect imaginary cylinder which can be inscribed within the hole so that it just contacts the highest points of the surface should not be a diameter smaller than the GO limit of size. In addition the maximum diameter at any position in the hole must not exceed the NOT GO limit of size.

For *shafts*, the diameter of the smallest perfect imaginary cylinder which can be circumscribed about the shaft so that it just contacts the highest points of the surface should not be a diameter larger than the GO limit of size. In addition the minimum diameter at any position on the shaft must not be less than the NOT GO limit of size.

The above interpretation means that if the size of the hole or shaft is everywhere at its GO limit then the hole or shaft should be perfectly round and straight.

Unless otherwise specified, and subject to the above requirements, departures from true roundness and straightness may reach the full value of the diametral tolerance specified. Typical extreme errors of form permitted by this interpretation are illustrated in Figures 1 and 2. Such extreme errors are unlikely to arise in practice.

The above interpretation of the size limits results from the "Taylor principle", named after the late W. TAYLOR who first laid it down in 1905. It is based on the use of a correct system of limit gauges to inspect shafts and holes. According to this principle a hole should completely assemble with a GO cylindrical plug gauge made to the specified GO limit of the hole, having a length at least equal to the length of engagement of the hole and shaft. In addition the hole is measured or gauged to check that its maximum diameter is not larger than the NOT GO limit. The shaft should assemble completely with a ring gauge made to the specified GO limit of the shaft and of a length at least equal to that of the length of engagement of the shaft and hole. Finally the shaft is measured or gauged to check that its minimum diameter is not smaller than the NOT GO limit.

In special cases the maximum errors of form permitted by the above interpretation may be too large to allow satisfactory functioning of the assembled parts; in such cases separate tolerances should be given for the form, e.g. separate tolerances on circularity or straightness, according to ISO Recommendation R 1101, *Technical drawings – Tolerances of form and of position – Part I : Generalities, symbols, indications on drawings.*