Test&Motion

Application Module:

KU 2 – Compression test on plastics according to EN 20604 : 1994

Version 1.0 (State 20160819)

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1 Introduction

Dear customer, thank you for choosing a product of **DOLI Elektronik GmbH**. **Test&Motion** is a modern application for the operating systems Microsoft Windows XP/7/8/10©.

This manual does not deal with the **Test&Motion software** in general but with the application module Plastics Tensile Test KU 2 in particular. Hence, it is recommended to read the **Test&Motion** application manual in order to get familiar with the software. Please follow the demands and safety hints listed in the manual!

1.1 Symbols

The different symbols in this manual will allow you to find your way more easily.

Table 1: Symbols and their meanings.

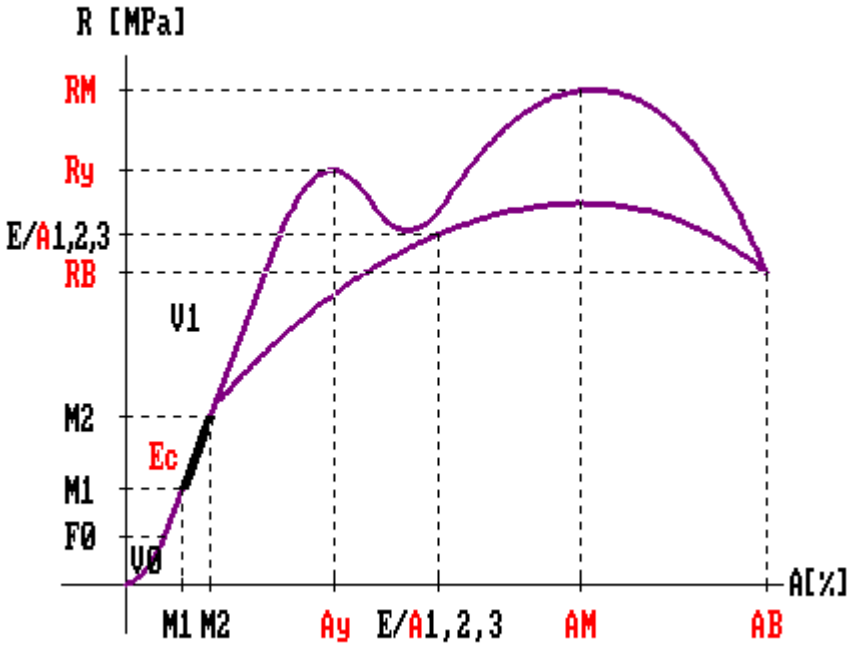
Symbol	Meaning
	**Safety Instructions:** **In order to avoid interruptions in the work flow as well as damages to man and machine, follow the safety instructions at all cost.**
	**Job/work instructions:** **Instructive part of the document with precise work instructions.** **Here you are asked to do something.**
	**Information:** **General information and descriptions of working procedures, etc.**
	**Note:** **Important note for the operation, the function or for the working procedures.**
	**Tip:** **Gives tips for easy handling of the Test&Motion Software, the EDCs or the testing instrument.**

2 Application module KU 2: Compression test on plastics according to EN 20604 : 1994

2.1 Field of application

Determination of compression properties - compression strength, compression yield stress, compression stress at break, their upsetting deformations as well as compression module and 3 pairs of reference values- of plastics in compression test

2.2 Test graphic KU 2



2.3 Input values KU 2

1. Click Menu Test → Command Settings → Input values. Here you can find expedient input values for this test regulation, already. If necessary adjust the values to your needs.

Table 2: Input values for test KU 2.

Parameter	Meaning	Dimension / Selection possibilities
E1	Reference value 1	• [N] • [N/mm²] • [mm_S] • [mm_dL] • [%] • [s, min, h] • [Dim User1] • [Dim User30]
E2	Reference value 2	Dimensions similar to E1
E3	Reference value 3	Dimensions similar to E1
M1	Tensile modulus limit 1	[N, kN], [MPa, kPa, N/mm²], [mm], [%]
M2	Tensile modulus limit 2	[N, kN], [MPa, kPa, N/mm²], [mm], [%]
Choice:	Compression modulus limits	• Search autom. 'secant' • Input value M1, M2

2.4 Results KU 2

1. Click Menu Test → Command Settings → Results. Here you can already find expedient results. If necessary, adjust the values to your needs.

Table 3: Results for test KU 2.

Parameter	Meaning	Dimension
FM	Maximum test load	[N]
RM	Compression strength (compression stress at maximum force)	[N/mm²], [MPa]
FB	Breaking load	[N]
RB	Compression stress at break	[N/mm²], [MPa]
Fy	Force at compression yield stress	[N]
Ry	Compression yield stress	[N/mm²], [MPa]
AM	Upsetting deformation at compression strength	[%]
dLM	Elongation at compression strength	[mm]
AB	Upsetting deformation at break	[%]
dLB	Elongation at break	[mm]
Ay	Yield upsetting deformation (upsetting deformation at compression yield stress)	[%]
dLy	Elongation at compression yield stress	[mm]
Ec	Compression module	[kN/mm²], [GPa]
F1 / R1	Force / stress at E1	[mm], [%]
F2 / R2	Force / stress at E2	[mm], [%]
F3 / R3	Force / stress at E3	[mm], [%]
dL1 / A1	Elongation / upsetting deformation at E1	[N], [N/mm²]
dL2 / A2	Elongation / upsetting deformation at E2	[N], [N/mm²]
dL3 / A3	Elongation / upsetting deformation at E3	[N], [N/mm²]
L0	Measuring length	[mm]
S0	Sample diameter	[mm²]
PA1	Sample dimension 1 (not available for all sample shapes)	[mm]
PA2	Sample dimension 2 (not available for all sample shapes)	[mm]

2.5 Hints for the test KU 2

2.5.1 Pre-load F0

For the test control elongation and upsetting deformation are set to 0 at this point (see also explanations on elongation and upsetting deformation further below).

The measuring length then will be corrected to **L0' = L0 - dL(F0)**

whereas
L0' *corrected measuring length*
L0 *measuring length*
dL(F0) *sample deformation at F0*

2.5.2 Compression yield stress criteria

In order to determine a yield point the following search criteria are applied in this order to the force-elongation-curve F = f(dL). If one criteria does not determine an apparent yield point work continues with the next one.

1. **Local load maximum, local load minimum**

   A local load maximum is a yield limit, if the load drops with at least 0.5%, and then increases again with at least 1%.

2. **Local load maximum, point of inflexion**

   A local load maximum is a yield limit, if the load drops with at least 0.5%, followed by a point of reflexion in the curve (i.e. a change from falling direction to increasing direction).

3. **Load plateau**

   If a range with constant load is found while elongation increases, the beginning of this range represents a yield limit. Pre-condition: The load must not deviate with more than 0.5% over a elongation range of 0.2% of the measuring length.

2.5.3 Compression modulus limits

The tensile modulus limits can either be detected automatically or pre-defined by the user.

Automatic detection: On the load-elongation-curve *F = f(dL),* within the range between pre-load F0 and maximum load FM, the software searches the steepest increase line over an elongation range of 0.2% of the measuring length L0. Then, the compression modulus Ec will be calculated between the end points of this line. Whereas the compression modulus Ec can be calculated either as secant or regression line. In case the elongation range of 0.2% L0 will not produce a reasonable tensile modulus, the modulus will be calculated over a range of 10% of Fmax instead.

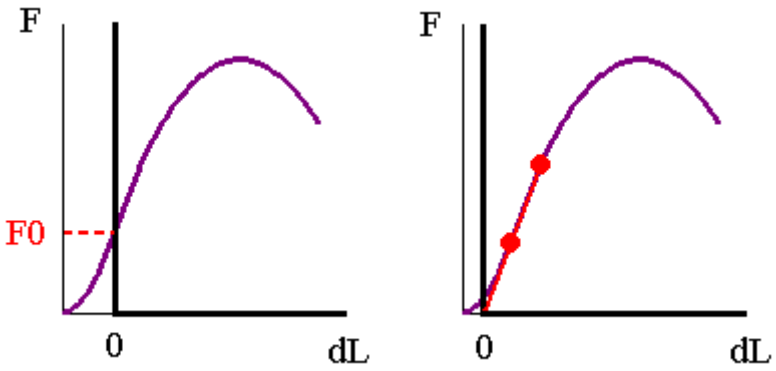
Manual detection: In case the compression modulus should not be detected automatically, you can define the end points of the compression-modulus-line via the input values M1 and M2 by yourself.

2.5.4 Elongation, strain

During the test: Elongation and upsetting deformation are identical until reaching the pre-load F0 = 0 (see left picture below). The elongation is the increase in length of the sample from the point F0. The upsetting deformation will be calculated out of the elongation via the following formula:

$$Ax = \frac{dL(Fx) - dL(F0)}{L0} * 100\%$$

After the test: At the end of the test, elongation and upsetting deformation will be calculated again. Hereby, the zero point of elongation is defined by extending the compression-modulus-line until it reaches the x-axis in the load-elongation-diagram (see right picture below).



2.5.5 Pairs of reference values

Three pairs of reference values are available. Here, you can define the wanted result type by chosing the dimensions for these pairs See the following table:

Table 4: Meaning of the input and output values.

Dimension of input- and output values	Meaning
N, kN	Load
N/mm²	Stress
%	Strain
mm_dL	Elongation
mm_S	Crosshead travel
s, min, h	Time period
Dim User1	User defined meaning 1
Dim User2	User defined meaning 2
…	…
Dim User30	User defined meaning 30

Note: **Please note that the tensile characteristics of plastics do very much depend on the test speed. Hence, we recommend to prefereably not interrupt a test if possible!**