

Note

This leaflet is part of a set which also includes :

- Leaflet 520 : Wagons, coaches and vans — Draw gear
- Leaflet 526-1 : Wagons — Buffers with a stroke of 105 mm
- Leaflet 526-2 : Wagons — Buffers with a stroke of 75 mm
- Leaflet 527-1 : Coaches, vans and wagons — Dimensions of buffer heads — Track layout on S curves
- Leaflet 527-2 : Coaches, vans and wagons — Dimensions of buffer heads
- Leaflet 528 : Buffer gear for coaches
- Leaflet 529 : Long-stroke hydrodynamic shock absorbers — Technical conditions — Wagons
- Leaflet 827-2 : Technical specification for the supply of steel rings for buffer springs
- Leaflet 828 : Technical specification for the supply of welded components for buffers

Part 1 : Buffer gear.

Part 2 : Draw gear.

Contents

Part 1 — Buffer gear

1 - PURPOSE

- 1.1 - Nature of items
- 1.2 - Classification
- 1.3 - Documents quoted

2 - CHARACTERISTICS

2.1 - Composition

- 2.1.1 - Metal stiffeners
- 2.1.2 - Elastomer
- 2.1.3 - Components

2.2 - Characteristics of assembled buffer

- 2.2.1 - Static characteristics in presentation condition
- 2.2.2 - Dynamic characteristics
- 2.2.3 - Performance under repeated loads

2.3 - Mechanical characteristics of spring assemblies

- 2.3.1 - Mechanical characteristic after clamping
- 2.3.2 - Characteristic after dynamic stresses
- 2.3.3 - Compression set

2.4 - Manufacturing marks

3 - APPROVAL AND MANUFACTURE

- 3.1 - Approval of suppliers
- 3.2 - Approval of the finished product
- 3.3 - Series production of the spring elements

4 - INSPECTION

4.1 - Production inspection

4.2 - Approval inspection

4.2.1 - Composition of the batch of items intended for the approval procedure

4.2.2 - Condition of the spring elements undergoing the approval procedure

4.2.3 - Execution of the approval tests

4.3 - Acceptance test

4.3.1 - Presentation

4.3.2 - Nature of inspections and proportion of items to be inspected

4.3.3 - Sampling and preparation of the testpieces

4.3.4 - Execution of tests

4.3.5 - Tests on assembled buffers

4.4 - Results of inspections

5 - DELIVERY**6 - GUARANTEE****APPENDIX 1****Part 2 - Draw gear****1 - PURPOSE**

1.1 - Nature of items

1.2 - Classification

1.3 - Documents quoted

2 - CHARACTERISTICS

2.1 - Composition

2.1.1 - Metal stiffeners

2.1.2 - Elastomer

2.1.3 - Components

2.2 - Mechanical characteristics of the springs

2.2.1 - Mechanical characteristics after clamping

2.2.2 - Characteristics after dynamic stresses

2.2.3 - Compression set

2.2.4 - Conformance with UIC Leaflet 520

2.3 - Manufacturing marks

3 - APPROVAL AND MANUFACTURE

3.1 - Approval of suppliers

3.2 - Approval of the finished product

3.3 - Series production of the springs

4 - INSPECTION**4.1 - Production inspection****4.2 - Approval inspection****4.2.1 - Composition of the batch of items intended for the approval procedure****4.2.2 - Condition of the springs undergoing the approval procedure****4.2.3 - Execution of the approval tests****4.3 - Acceptance test****4.3.1 - Presentation****4.3.2 - Nature of tests and inspections and number of items****4.3.3 - Sampling and preparation of the testpieces****4.3.4 - Execution of tests****4.4 - Results of inspections****5 - DELIVERY****6 - GUARANTEE****APPENDIX 1****Part 1 – Buffer gear**

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1 - Purpose**1.1 - Nature of items**

This specification defines the technical conditions to be satisfied by elastomer-based components for buffers.

1.2 - Classification

Category 1: elastic components for wagon buffers with a stroke of 105 mm as covered by UIC Leaflet 526-1.

Category 2: elastic components for wagon buffers with a stroke of 75 mm as covered by UIC Leaflet 526-2.

Category 3: elastic components for coach buffers with a stroke of 110 mm as covered by UIC Leaflet 528.

1.3 - Documents quoted

UIC 526-1 — Wagons — Buffers with a stroke of 105 mm

UIC 526-2 — Wagons — Buffers with a stroke of 75 mm

UIC 528 — Buffer gear for coaches

UIC 843-2 — Plates, sheets and sections in weldable copper-bearing mild steel for wagon construction

ISO 37 — Rubber, vulcanised — Determination of tensile stress-strain properties

ISO 48 — Vulcanised rubbers — Determination of hardness (hardness between 30 and 85 IRHD)

ISO 188 — Rubber, vulcanised — Accelerated ageing and heat-resistance tests

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ISO 471 — Rubber — Standard temperatures, humidities and times for the conditioning and testing of testpieces

ISO 815 — Vulcanised rubbers — Determination of compression set under constant deflection at normal high temperatures

ISO 1653 — Vulcanised rubbers — Determination of compression set under constant deflection at low temperatures

ISO 3302 — Rubber, dimensional tolerances of solid cast and extruded products

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2 - Characteristics

2.1 - Composition

The elastic components consist of elastomer rings and steel plate stiffeners.

2.1.1 - Metal stiffeners

Unless otherwise indicated in the order documents, the metal stiffeners shall be made of steel meeting the requirements of UIC Leaflet 843-2.

Their geometrical characteristics shall conform to the requirements of the drawings.

The stiffeners shall be correctly fettled and shotblasted so as to ensure that the elastomer is not damaged in service, particularly in the vicinity of the holes.

The arithmetic depth Ra of the metal surface roughness shall be 6 µm.

2.1.2 - Elastomer

No requirements are specified in connection with the type of elastomer which must provide the characteristics indicated on Table 1.

The surfaces of the elastomer parts shall be smooth and shall exhibit no cracks, pitting, bulges, joint slits or burrs.

The texture of the material should be homogeneous and compact.

2.1.3 - Components

The dimensions of the elastic components shall be in accordance with the requirements stipulated in the order or its accompanying documents.

The tolerances are as stated in the drawings, otherwise they correspond to class M3 of ISO Standard 3302.

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Table 1

Characteristics	Test method	Results to be obtained
- IRHD hardness	ISO/48	Presentation condition : D = value adopted in approval leaflet ± 5 IRHD. After ageing for 7 days at 70 °C : $\Delta D \leq \pm 5$ IRHD with respect to the presentation condition
- Strength and elongation at rupture	ISO/37	Presentation condition : R and Ar = value adopted in approval leaflet ± 15 %. After ageing for 7 days at 70 °C : $\frac{\Delta R \times 100}{R} \leq 20 \%$ $\frac{\Delta Ar \times 100}{Ar} \leq 30 \%$
- 200 % modulus of elasticity	ISO/37	Presentation condition : M = value adopted in approval leaflet ± 15 %. After ageing for 7 days at 70 °C : $\frac{\Delta M \times 100}{M} \leq 20 \%$
- Compression set after 25 % compression for 24 h at 70 °C	ISO/815	DRC ≤ 30 % (DRC = compression set)
- Compression set after 25 % compression for 24 h at -30 °C, measured after stabilising for 3 min at -30 °C (1)	ISO/1653	DRC ≤ 55 % (DRC = compression set)

(1) Additional tests can be carried out at -40°C, provided that the corresponding values are specified by the purchasing railway.

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2.2 - Characteristics of assembled buffer**2.2.1 - Static characteristics in presentation condition**

The static characteristics of the assembled buffers, checked at least three days after assembly, should be in accordance with the provisions of :

- UIC Leaflet 526-1 for category 1 spring elements,
- UIC Leaflet 526-2 for category 2 spring elements,
- UIC Leaflet 528 for category 3 spring elements.

2.2.2 - Dynamic characteristics

The dynamic characteristics of the assembled buffers, checked at least three days after assembly, should be in accordance with the provisions of :

- UIC Leaflet 526-1 for category 1 spring elements,
- UIC Leaflet 526-2 for category 2 spring elements,
- UIC Leaflet 528 for category 3 spring elements.

2.2.3 - Performance under repeated loads

In the case of category 1 spring elements the assembled buffer should satisfy the endurance test specified in UIC Leaflet 526-1, Appendix 9.

2.3 - Mechanical characteristics of the spring assemblies

A spring assembly consists of a nest of spring elements and dividing plates of identical composition to that specified in the drawing of the buffer or appended documents.

H1 is the free height of the spring assembly installed in the unloaded buffer. This dimension is given in the drawing of the buffer (see Appendix 1).

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2.3.1 - Mechanical characteristics after clamping

The compression/displacement curve, after clamping of the spring assembly at a height H1 for a minimum of 72 h at $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, shall be between the limiting curves specified in the drawing.

2.3.2 - Characteristics after dynamic stresses

After 10^4 dynamic compressions between the heights of $(H1 - 0.25\text{ C}) \pm 2\text{ mm}$ and $(H1 - 0.60\text{ C}) \pm 2\text{ mm}$ at a frequency of 6 cycles per minute :

- the elastomer should not exhibit any notches deeper than 2 mm, particularly near the locating studs,
- after stabilising for 24 h, with the spring assembly unclamped, the compression load required to obtain the height $H1 \pm 2\text{ mm}$ must at least be 10 kN,
- after stabilising for 24 h, with the spring assembly unclamped, the energy stored by the nest between $(H1 - 0.25\text{ C})$ and $(H1 - 0.60\text{ C})$ during the compression test should be at least 80 % of that recorded during the compression test after clamping.

2.3.3 - Compression set

After compression for 7 days at $70\text{ }^{\circ}\text{C}$, at a constant height of H1 ($\pm 2\text{ mm}$), the compression set of the spring assembly, determined 24 h after unclamping while hot, should not exceed 8 %.

2.4 - Manufacturing marks

Unless otherwise specified in the order or its accompanying documents, every spring element should be marked in relief on the side surface of the elastomer part with :

- the manufacturer's mark,
- the batch number,
- the last two figures of the year
e.g. : XY - 0 000 0000 - 86.

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3 - Approval and manufacture**3.1 - Approval of suppliers**

Manufacture of the spring elements shall be entrusted only to suppliers approved by the purchasing railway. These suppliers will be approved only provided that they furnish a prototype satisfying the requirements of this specification.

3.2 - Approval of the finished product

Every delivery must have received the prior approval of the purchasing railway in accordance with the conditions of 4.2. The results of all the approval tests shall serve as a reference for subsequent acceptance tests.

The product shall be approved anew whenever any change to the drawings, to the composition or to the manufacturing process may modify the characteristics of the spring element.

3.3 - Series production of the spring elements

For series production, the supplier shall not change anything as regards the composition and the manufacturing processes used for those spring elements having successfully undergone the approval procedure. Any changes intended to conceal a defect which may detrimentally affect the use of the spring elements is prohibited.

4 - Inspection**4.1 - Production inspection**

For series deliveries the purchasing railway reserves the right to adopt any means considered suitable to check that the manufacturer has not made any change, as compared with the approved sample, relating to the manufacture and the composition of the spring elements.

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4.2 - Approval inspection**4.2.1 - Composition of the batch of items intended for the approval procedure**

When the approval procedure is to be adopted, a batch consisting of at least 9 nests of spring elements of the model to be approved, manufactured in the conditions specified for the series items, shall be placed at the disposal of the purchasing railway.

4.2.2 - Condition of the spring elements undergoing the approval procedure

The spring elements shall be presented in the "as delivered" condition.

4.2.3 - Execution of the approval tests

The tests to be carried out on the spring elements are indicated in the table in 4.3.2.

4.3 - Acceptance test**4.3.1 - Presentation****4.3.1.1 - Condition of the spring elements on presentation**

The spring elements shall be presented for acceptance in the "as delivered" condition.

4.3.1.2 - Classification in batches

The spring elements shall be presented in batches.

A batch shall consist of spring elements of the same type and of the same dimensions, coming from the same production series or an identical combination in accordance with the provisions of the order.

Each batch shall be given a consecutive number without any break or repetition, the numbering commencing again from 1 at the beginning of each year.

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The serial number of a rejected batch shall not be used again during the year in question.

4.3.1.3 - Notification of presentation

The date of presentation shall be notified to the representative of the purchasing railway in a letter signed by the Works Manager or his authorised representative ; this letter shall state the number of spring elements included in each batch and also the relevant order references.

4.3.2 - Nature of inspections and proportion of items to be inspected

The spring elements shall be subjected to the tests and inspections defined in table 2 below.

These tests shall be carried out either at the time of approval, either upon presentation or during manufacture. In both these cases the tests and inspections shall be for the account of the supplier.

Furthermore, the representative of the purchasing railway shall, at any time, be able to take a sample of the spring elements at the supplier's premises for testing either in the laboratory of the production works or in the laboratory of the purchasing railway, with a view to further verifying all or some of the characteristics.

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Table 2

Tests on spring elements

Nature of inspections	Number of series of tests			Number of samples per test	Shape and dimensions of samples	In the acceptance tests	In the approval tests
	< 3000 items	From 3000 to 10 000 items	> 10 000 items				
- Components - Metal stiffeners - geometry	At the discretion of the representative of the purchasing railway According to UIC 843-2				—	m	m
- nature - Elastomer	At the discretion of the representative of the purchasing railway				—	m	m
In the "as delivered" condition and after artificial ageing :							
- IRHD hardness	3	5	8	3	sample type 2 or sample with compression set	m	m
- Tensile test (R, Ar, M)	3	5	8	3	sample type 2	m	m
- Compression set (+ 70 °C)	3	5	8	3	cylinder 29 mm in diameter and 13 mm thick	m	m
- Compression set (- 30 °C)	3	5	8	3		o	m
- Tests on 1 spring element dimensions	At the discretion of the representative of the purchasing railway				the element itself	m	m

m = obligatory test ; o = optional test.

Table 2

Tests on the whole spring assembly

Nature of inspections	Number of series of tests			Number of samples per test	Shape and dimensions of samples	In the acceptance tests	In the approval tests
	< 3000 items	from 3000 to 10000 items	> 10000 items				
- Compression after clamping	1	1	2	1	the spring assembly itself	m	m
- Characteristics after dynamic stresses	1	1	2	1		o	m
- Compression set	1	1	2	1		o	m

m = obligatory test ; o = optional test.

The number of tests to be carried out in the case of small quantity batches shall be defined by joint agreement between the manufacturer and the purchasing railway.

Table 3

Tests on assembled buffers (approval only)

Nature of inspections and tests	Category 1	Categories 2 and 3
- Dimensions	X	X
- Static compression	X	X
- Dynamic test	X	X
- Performance under repeated loads	X	

4.3.3 - Sampling and preparation of the testpieces

4.3.3.1 - Sampling

From each batch presented the representative of the purchasing railway shall select at random a number of spring elements from which the testpieces for the tests will be selected, and he marks them indelibly.

4.3.3.2 - Preparation of testpieces

The number, shapes and dimensions of the testpieces are indicated in Table 2 in Section 4.3.2.

The testpieces intended for the tensile tests are taken from the circumference.

The testpieces, selected from among the items in the presentation condition, shall be prepared for 24 hours in accordance with ISO 471 (at 23 °C ± 2 °C and 50 % ± 5 % relative humidity).

The testpieces to be tested after accelerated ageing shall be cut up and then oven-heated at 70 °C for 7 days. They shall then be prepared for 24 hours in accordance with ISO/471 (at 23 °C ± 2 °C and 50 % ± 5 % relative humidity).

These operations shall be carried out in accordance with ISO 188.

4.3.4 - Execution of tests

4.3.4.1 - Checking the characteristics of the components

4.3.4.1.1 - Metal stiffeners

A check shall be made to ensure that the characteristics conform to the requirements specified in 2.1.1.

4.3.4.1.2 - Elastomer

The characteristics of the elastomer of the spring elements shall be checked in accordance with the conditions laid down in Table 1 of 2.1.3.

All the results obtained, in accordance with the relevant ISO standards, shall meet the requirements of Table 1.

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4.3.4.2 - Tests on spring element

4.3.4.2.1 - Checking of dimensions

The dimensions of the reinforced elastomer spring element shall be measured using standard instruments appropriate to the size of the components and the degree of accuracy required.

The results must meet the requirements of 2.1.3.

4.3.4.3 - Tests on spring assembly

4.3.4.3.1 - Test methods

The spring elements and the dividing plates are arranged in such a way as to form a stack to simulate the type of stack used in service. The stack of springs is marked with an identification number. The sequence and position of the different elements of the stack are marked.

The dividing plates used in the compression tests on the stack shall be calibrated plates kept exclusively for these tests. Their dimensional characteristics shall be as follows :

- Diameter : specified in the relevant drawings
- Thickness : $e + 0.05$
 $e - 0$
- Evenness of surfaces : the maximum permissible deflection of a diameter must not be greater than 0.05 mm
- Surface roughness : $Ra = 6 \mu m$.

The spring assembly to be tested should be placed in a rig to act as a guide during the compression tests or when under dynamic loads. Depending on the type of spring elements involved this guidance may be either by means of a central pin or by four external guides. The assembly should also have a device for centering it relative to the guides. During the tests the displacement of the assembly should not result in any contact with the guide rods which might result in modification of the compressive loads and the stress rate. The elastomer component shall under no circumstances come into contact with the guide rods during compressive loading.

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The guide device shall be such as to facilitate ventilation of the spring assembly.

The compression shall be applied at a speed of $30 \text{ mm/min} \pm 5 \text{ mm/min}$.

The load/displacement curve corresponding to the third compression shall be recorded.

4.3.4.3.2 - Checking the compressive strength after clamping

The spring assembly is held clamped at a height $H1 \pm 2 \text{ mm}$ for at least 72 hours, and is then compressed from height $H1 \pm 2 \text{ mm}$ to height $(H1 - C) \pm 2 \text{ mm}$ in the conditions specified in 4.3.4.3.1 (see Appendix 1).

The third-cycle compression results shall conform to the requirements of 2.3.1.

4.3.4.3.3 - Checking the resistance to dynamic stress

The spring assembly having undergone the tests in 4.3.4.3.2 shall be subjected to the following operations :

- application of 10 000 compressions between $(H1 - 0.25 C) \pm 2 \text{ mm}$ and $(H1 - 0.60 C) \pm 2 \text{ mm}$ at a frequency of 6 cycles/min ;
- unclamping of set of springs for 24 hours ;
- recording of the compression curve during the third cycle between $H1 \pm 2 \text{ mm}$ and $(H1 - 0.60 C) \pm 2 \text{ mm}$, in the conditions defined in 4.3.4.3.1 ;
- plotting, on the recorded curve, of the load necessary to obtain height $H1$;
- use of the recorded compression curve (see Appendix 1) to measure the stored energy $W2$ between $(H1 - 0.25 C)$ and $(H1 - 0.60 C)$;
- comparison of the energy $W2$ and $W1$ recorded on the curve plotted during the tests in 4.3.4.3.2 ;
- the results obtained shall meet the requirements of 2.3.2.

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4.3.4.3.4 - Checking of compression set

A spring assembly is held clamped at height $H1 \pm 2$ mm for 7 days at 70 °C and is then unclamped while hot. Height $H'o$ is measured 24 h after unclamping.

The formula used for calculating the residual deformation is :

$$\frac{H_o - H'o}{H_o} \times 100$$

where :

H_o = free height after the third compression cycle according to 4.3.4.3.2.

$H'o$ = free height measured 24 hours after unclamping.

The results shall meet the requirements of 2.3.3.

4.3.5 - Tests on assembled buffers**4.3.5.1 - Checking of static characteristics**

The static characteristics of the assembled buffers shall be checked to ascertain that they conform to the provisions of :

- UIC Leaflet 526-1 in the case of category 1 spring elements ;
- UIC Leaflet 526-2 in the case of category 2 spring elements ;
- UIC Leaflet 528 in the case of category 3 spring elements.

The test temperature shall be 20 °C \pm 5 °C.

The test machine shall enable simultaneous indication and recording of the compressive loads and the displacements.

The compression speed shall be 30 mm/min. \pm 5 mm/min. unless otherwise specified in the relevant documents.

The load/displacement curve is plotted during the third compression until the stroke of the plunger has been completed.

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The stored energy is calculated from the compression curve plotted.

The results shall conform to the requirements of 2.2.1.

4.3.5.2 - Checking of dynamic characteristics

The dynamic characteristics of the assembled buffers shall be checked to ensure that they conform to the provisions of :

- UIC Leaflet 526-1 for category 1 spring elements ;
- UIC Leaflet 526-2 for category 2 spring elements ;
- UIC Leaflet 528 for category 3 spring elements.

The results shall conform to the requirements of 2.2.2.

4.3.5.3 - Checking performance under repeated impacts

In the case of category 1 spring elements the test methods shall be agreed between the purchasing railway and the manufacturer within the framework defined in Appendix 9 of UIC Leaflet 526-1.

The results shall conform to the requirements of 2.2.3.

4.4 - Results of inspections

Any characteristic that does not comply with the required conditions, found :

- during the type tests, shall result in withholding approval ;
- during the series tests, shall result in rejection of the batch involved.

Further tests at the request of the supplier may be carried out only with the prior agreement of the purchasing railway.

5 - Delivery

The reinforced elastomer spring elements shall be delivered suitably packed to protect them against any damage during transport.

The spring elements of any one delivery batch shall have been manufactured less than three months beforehand.

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6 - Garantie

The spring elements shall be guaranteed by the supplier for a period of three years following the year of delivery, against any manufacturing defect not detected during the acceptance tests at the factory.

If the spring elements are to be used on new rolling stock, the date of delivery of the vehicles on which they are to be mounted shall be considered as the beginning of the guarantee period.

Spring elements which, during the guarantee period, reveal manufacturing defects making them unsuitable for use or liable to shorten their service life, shall be rejected.

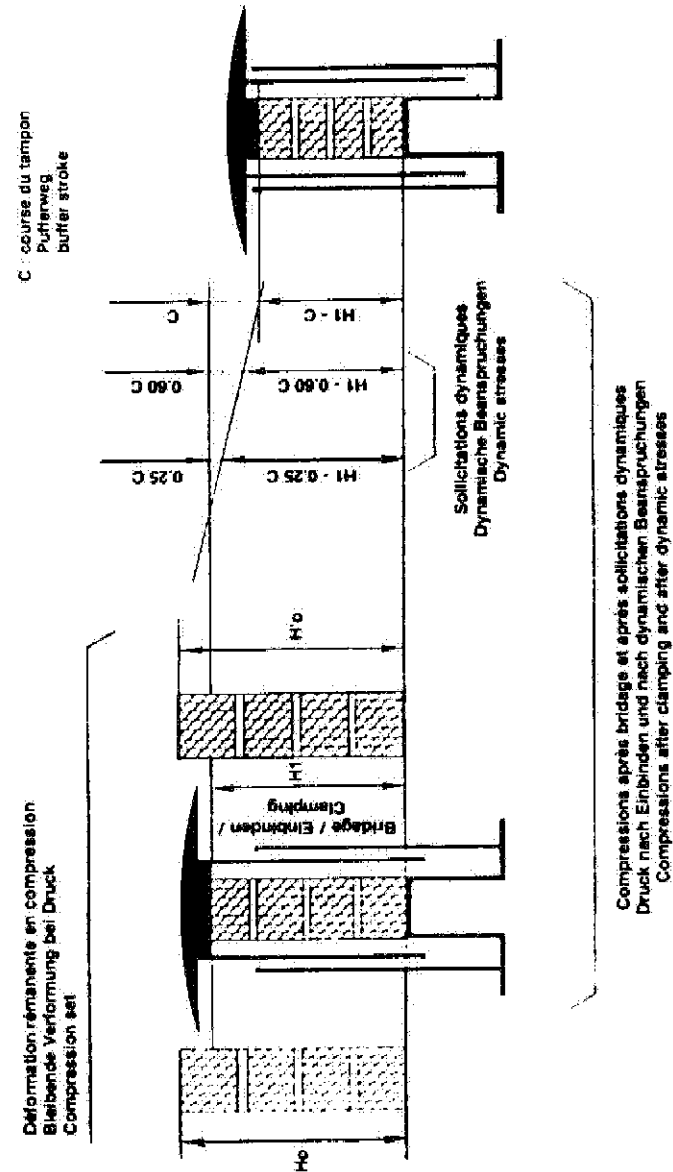
Before final rejection, however, the defective elements may be subjected to a joint inspection by the purchasing railway and the supplier if the supplier so requests.

When the joint inspection confirms that the defects are indeed attributable either to manufacture or to faulty packing the defective elements shall be finally rejected.

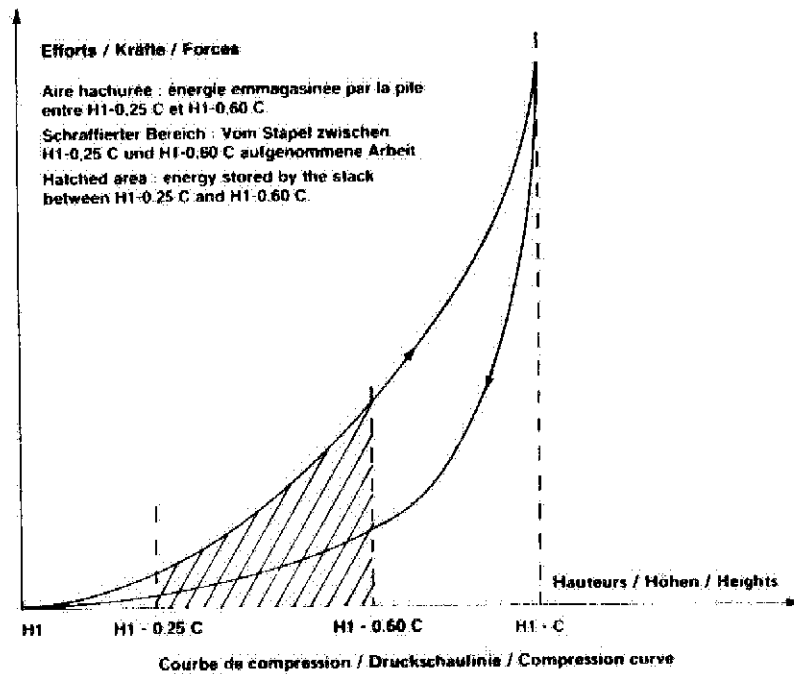
Should the results of the joint inspection not enable any agreement to be reached between the purchasing railway and the supplier, outside experts approved by both parties shall be called upon to settle the dispute. The costs involved shall be borne by the party held to be responsible.

The rejected elements shall be held at the disposal of the supplier with a view to their being replaced or a refund being made to their value in the new condition at the time of withdrawal.

1 - Hauteurs des éléments élastiques, pour réalisation des différents essais Höhe der Feder Elemente für die Durchführung der verschiedenen Versuche Heights of elastic elements, for use in the different tests



2 - Énergie emmagasinée lors de l'essai en compression
 Arbeitsaufnahme beim Druckversuch
 Stored energy during compression test



Part 2 – Draw gear

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1 - Purpose**1.1 - Nature of Items**

The specification defines the technical conditions to be satisfied by elastomer-based components for draw gear.

1.2 - Classification

One category : elastic components for draw gear as covered by UIC Leaflet 520.

1.3 - Documents quoted

- UIC 520 — Wagons, coaches and vans — Draw gear
- UIC 843-2 — Plates, sheets and sections in weldable copper-bearing mild steel for wagon construction
- ISO 37 — Rubber, vulcanised — Determination of tensile-stress properties
- ISO 48 — Vulcanised elastomers — Determination of hardness (between 30 and 85 IRHD)
- ISO 188 — Vulcanised rubber — Accelerated ageing and heat-resistance tests
- ISO 471 — Rubber — Standard temperatures, humidities and times for the conditioning and testing of testpieces
- ISO 815 — Vulcanised elastomers — Determination of compression set under constant deflection at normal and high temperatures
- ISO 1653 — Vulcanised elastomers — Determination of compression set under constant deflection at low temperatures
- ISO 3302 — Rubber — Dimensional tolerances for solid cast or extruded products
- ISO 4662 — Rubber — Determination of impact resilience of vulcanised products

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2 - Characteristics**2.1 - Composition**

The elastic components consist of elastomer rings and steel plate stiffeners.

2.1.1 - Metal stiffeners

Unless otherwise indicated in the order documents, the metal stiffeners shall be made of steel meeting the requirements of UIC Leaflet 843-2.

Their geometrical characteristics shall conform to the requirements of the drawings.

The stiffeners shall be correctly fettled and shot-blasted so as to ensure that the elastomer is not damaged in service, particularly in the vicinity of the holes. The surface roughness Ra of the metal stiffeners shall be 6 µm.

2.1.2 - Elastomer

No requirements are specified in connection with the type of elastomer, which must meet the characteristics indicated in Table 1.

The surfaces of the elastomer parts shall be smooth and shall exhibit no cracks, pitting, bulges, joint slits or burrs, or any other defect likely to impair the spring characteristics.

The texture of the material should be homogeneous and free from porosity.

Table 1

Characteristics	Test method	Results to be obtained
- IRHD hardness	ISO/48	Presentation condition : D = value adopted in approval leaflet ± 5 IRHD. After ageing for 7 days at 70 °C : $\Delta D \leq \pm 8$ IRHD with respect to the presentation condition
- Strength and elongation on rupture	ISO/37	Presentation condition : R and Ar = value adopted in approval leaflet ± 15 %. After ageing for 7 days at 0 °C : $\frac{\Delta R \times 100}{R} \leq 20$ % $\frac{\Delta Ar \times 100}{Ar} \leq 25$ %
- 200 % modulus of elasticity	ISO/37	Presentation condition : M = value adopted in approval leaflet ± 15 %. After ageing for 7 days at 70 °C : $\frac{\Delta M \times 100}{M} \leq 20$ %
- Compression set after 25 % compression for 24 h at 70 °C	ISO/815	DRC ≤ 25 % (DRC = compression set)
- Compression set after 25 % compression for 24 h at - 30 °C, measured after stabilising for 3 min at - 30 °C (1)	ISO/1653	DRC ≤ 35 % (DRC = compression set)
- Impact resilience	ISO/4662	State of presentation : Resilience = value adopted in approval leaflet ± 15 %

(1) Additional tests may be carried out at - 40 °C, on condition that the corresponding values are specified by the purchasing railway.

2.1.3 - Components

The dimensions of the elastic components shall be in accordance with the requirements stipulated in the order or its appended documents.

The tolerances shall be those given in the drawing or, if not stated, the tolerances corresponding to class M3 of ISO Standard 3302.

2.2 - Mechanical characteristics of the springs

A spring consists of **one** elastic component or a **stack** of elastic components and dividing plates.

The composition of the spring is specified in the drawing or the appended documents.

H1 is the free height of the spring, when not loaded. This dimension is given in the drawing of the spring (see Appendix 1).

2.2.1 - Mechanical characteristics after clamping :

- the compression displacement curve (loaded/unloaded), after clamping of the spring at a height H1 for a minimum of 72 h at 23 °C ± 2 °C, shall lie between the limiting curves shown in the drawing,
- the energy absorbed shall not differ by more than 20 % from the energy measured at the approval,
- during the test the elastomer shall not protrude beyond the metal supports or the dividing plates. After this test, the elastomer shall not show any damage.

2.2.2 - Characteristics after dynamic stresses

After 10^4 dynamic compressions between the heights of (H1 - 0.25 C) ± 2 mm and (H1 - 0.60 C) ± 2 mm at a frequency of 6 cycles per minute :

- the elastomer shall not exhibit any notches deeper than 2 mm, particularly near the locating studs,

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- after stabilising for 24 h with the spring unclamped, the compression required to obtain the height $H1 \pm 2$ mm shall at least be 10 kN,
- after stabilising for 24 h with the spring unclamped, the energy stored by the spring between $(H1 - 0.25 C)$ and $(H1 - 0.60 C)$ during the compression test shall be at least 80 % of that recorded during the compression test after clamping.

2.2.3 - Compression set

After compression for 7 days at 70 °C at a constant height of $H1 (\pm 2$ mm), the compression set of the spring, determined 24 h after unclamping while hot, shall not exceed 8 %.

2.2.4 - Conformance with UIC Leaflet 520

In all cases the characteristics of the spring, which must be checked at least 3 days after assembly, shall conform with those specified in UIC Leaflet 520.

This check shall only be carried out during approval.

2.3 - Manufacturing marks

Unless specified otherwise in the order or the appended documents, every spring element shall be marked in relief on the side surface of the elastomer part with :

- the supplier's mark,
- the batch number,
- the last two figures of the year :
e.g. : XY - 0 000 0000 - 86.

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3 - Approval and manufacture

3.1 - Approval of suppliers

Manufacture of springs shall be entrusted only to suppliers approved by the purchasing railway. These suppliers shall be approved only provided they furnish a prototype satisfying the requirements of this specification.

3.2 - Approval of the finished product

Every delivery must have received the prior approval of the purchasing railway in accordance with the conditions of 4.2. The results of the approval tests shall serve as a reference for subsequent acceptance tests.

Approval shall require renewal whenever any change to the drawing, to the composition or to the manufacturing process may modify the characteristics of the spring.

3.3 - Series production of the springs

For series production, the supplier shall not change anything as regards the composition and the manufacturing processes used for those springs having successfully undergone the approval procedure. Any changes intended to conceal a defect, which may detrimentally affect the use of the springs, is prohibited.

4 - Inspection

4.1 - Production inspection

For series supplies, the purchasing railway reserves the right to adopt any means considered suitable to check that the manufacturer has not made any change, as compared with the approved sample, relating to the manufacture and the composition of the springs.

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4.2 - Approval inspection**4.2.1 - Composition of the batch of items intended for the approval procedure**

When the approval procedure is to be applied, a batch consisting of at least 9 springs of the model to be approved, manufactured in the conditions specified for the series items, shall be placed at the disposal of the purchasing railway.

4.2.2 - Conditions of the springs undergoing the approval procedure

The springs shall be presented in the "as supplied" condition.

4.2.3 - Execution of the approval tests

The tests to be carried out on the springs are indicated in the table of 4.3.2.

4.3 - Acceptance test**4.3.1 - Presentation****4.3.1.1 - Condition of the springs on presentation**

The springs shall be presented for acceptance in the "as supplied" condition.

4.3.1.2 - Classification in batches

The springs shall be presented in batches.

A batch shall consist of springs of the same type and of the same dimensions, coming from the same production series, or the same combination, in accordance with the conditions of the order.

Each batch shall be given a consecutive number without any break or repetition, starting with 1 (one) again at the beginning of each year.

The serial number of a rejected batch shall not be used again during the year in question.

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4.3.1.3 - Notification of presentation

The date of presentation shall be notified to the representative of the purchasing railway in a letter signed by the Works Manager or his authorised representative and this letter shall state the number of springs included in each batch and the relevant order references.

4.3.2 - Nature of tests and inspections and number of items

The springs shall be subjected to the tests and inspections defined in Table 2 below.

The tests shall be carried out either at the time of approval, or upon presentation, or during manufacture. In these two cases the cost of the inspections and tests shall be borne by the supplier.

Furthermore, the representative of the purchasing railway shall, at any time, be able to take a sample of the springs from the supplier for testing either in the laboratory of the production works or in the laboratory of the purchasing railway with a view to checking again all or some of the characteristics.

The number of tests to be carried out in the case of small quantity batches shall be defined by joint agreement between the manufacturer and the purchasing railway.

4.3.3 - Sampling and preparation of the testpieces**4.3.3.1 - Sampling**

From each batch presented the representative of the purchasing railway shall select at random a number of springs, from which the testpieces for the tests will be selected, and he marks them indelibly.

4.3.3.2 - Preparation of testpieces

The number, shapes and dimensions of the testpieces are indicated in Table 2 in section 4.3.2.

The testpieces intended for the tensile tests are taken from the circumference.

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The testpieces selected from the items in presentation condition shall be prepared for 24 hours in accordance with ISO standard 471 (at $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and $50\% \pm 5\%$ relative humidity).

The testpieces to be tested after accelerated ageing shall be cut up and then oven-heated at $70\text{ }^{\circ}\text{C}$ for 7 days. They shall then be prepared for 24 hours in accordance with ISO 471 (at $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and $50\% \pm 5\%$ relative humidity).

These operations shall be carried out in accordance with ISO 188.

4.3.4 - Execution of tests

4.3.4.1 - Checking the characteristics of the components

4.3.4.1.1 - Metal stiffeners

A check shall be made to ensure that the characteristics of 2.1.1 are satisfied.

4.3.4.1.2 - Elastomer

The characteristics of the spring elements shall be checked in accordance with the conditions laid down in Table 1 of 2.1.2.

All the results obtained in accordance with the relevant ISO standard shall meet the requirements of Table 1.

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Table 2

Tests on springs

Nature of inspections	Number of series of tests			Number of samples per test	Shape and dimensions of samples	In the acceptance tests	In the approval tests
	< 3000 items	From 3000 to 10 000 items	> 10 000 items				
- Components	At the discretion of the representative of the purchasing railway according to UIC 843-2				-	m	m
- Metal stiffeners - geometry							
- nature					-	m	m
- Elastomer							
In the "as delivered" condition and after artificial ageing :							
- IRHD hardness	3	5	8	3	sample type 2 or sample with compression set	m	m
- Tensile test (R, Ar, M)	3	5	8	3	sample type 2	m	m
- Compression set (+ 70 °C)	3	5	8	3	cylinder 29 mm in diameter and 13 mm thick or cylinder 13 mm in diameter and 0.3 mm thick	m	m
- Compression set (- 30 °C)	3	5	8	3		m	m

m = obligatory test ; o = optional test.

Table 2

Tests on springs

Nature of inspections	Number of test series			Number of samples per test	Shape and dimensions of samples	On acceptance	On approval
	< 3000 items	from 3000 to 10000 items	> 10000 items				
- Impact resilience	3	5	8	3	Cylinder 29 mm in diameter and 13 mm thick or rubber segment with L = 20 mm, l = 14 mm, e = 6 mm	o	m
- Tests on one spring element - dimensions	At the discretion of the representative of the purchasing railway				the element itself	m	m
- Tests on a complete spring							
- Characteristics after clamping	1	1	2	1	the element itself	m	m
- Characteristics after dynamic stresses	1	1	2	1		o	m
- Compression set	1	1	2	1		o	m

m = obligatory test ; o = optional test

The number of tests to be carried out in the case of small quantity batches shall be defined by joint agreement between the manufacturer and the purchasing railway.

4.3.4.2 - Tests on one spring element

4.3.4.2.1 - Checking of dimensions

The dimensions of the reinforced elastomer spring elements shall be measured using standard instruments appropriate to the size of the components and the degree of accuracy required.

The results must meet the requirements of 2.1.3.

4.3.4.3 - Tests on the whole spring

4.3.4.3.1 - Test methods

The spring element or elements and any dividing plates are arranged in such a way that they form the spring specified in UIC Leaflet 520.

The stack is marked with an identification number. The sequence and the position of the different elements of the stack are marked.

The dividing plates used in the compression tests in the stack shall be calibrated plates kept exclusively for these tests. Their dimensional characteristics shall be as follows :

- Diameter : as specified in the corresponding drawings
- Thickness : $e \begin{matrix} + 0.05 \text{ mm} \\ - 0 \end{matrix}$
- Evenness of surfaces : the maximum permissible deflection of a diameter must not be greater than 0.05 mm
- Surface roughness : $Ra = 6 \mu\text{m}$.

The spring to be tested should be placed in a rig to act as a guide during the compression tests or under dynamic load. Depending on the type of spring elements involved, this guidance may be provided either by means of a central pin or by four external guides. The rig should also have a device for centering the spring relative to the guides. During the tests the relative displacement of the spring must not result in any contact with the guide rods, which might result in modification of the compressive loads and the stress rate. The elastomer component shall under no circumstances come into contact with the guide rods during compressive loading.

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The guide device shall be such as to facilitate ventilation of the spring.

The compression shall be applied at a rate of 30 mm/min \pm 5 mm/min.

The load/displacement curve corresponding to the third compression shall be recorded.

4.3.4.3.2 - Checking the compressive strength after clamping

The spring is held clamped at a height $H1 \pm 2$ mm for at least 72 hours and is then compressed from height $H1 \pm 2$ mm to height $(H1 - C) \pm 2$ mm in the conditions specified in 4.3.4.3.1 (see Appendix 1).

Unless otherwise specified in the drawing, C is equal to 55 mm.

The curves recorded in the 3rd cycle shall conform with the requirements of 2.2.1.

Unless otherwise specified in the order, a second spring is held clamped for at least 72 hours at a height $H1 \pm 2$ mm and then compressed under a load of 850 kN in the conditions specified in 4.3.4.3.1.

4.3.4.3.3 - Checking the resistance to dynamic stresses

The spring, which underwent testing in accordance with 4.3.4.3.2, is subjected to the following operations :

- application of 10 000 compressions between $(H1 - 0.25 C) \pm 2$ mm and $(H1 - 0.60 C) \pm 2$ mm at a frequency of 6 cycles/min,
- unclamping of spring for 24 hours,
- recording of the compression curve during the 3rd cycle between $H1 \pm 2$ mm and $(H1 - 0.60 C) \pm 2$ mm, in the conditions specified in 4.3.4.3.1,
- plotting the load necessary to obtain height $H1$ on the recorded curve,
- measurement of the stored energy WE2 and absorbed energy WA2 between $(H1 - 0.25 C)$ and $(H1 - 0.60 C)$ from the recorded compression curve (see Appendix 1),

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- comparison of energy values WE2 and WA2 with WE1 and WA1 recorded on the curve plotted in the tests of 4.3.4.3.2,

- the results obtained should conform with the requirements of 2.2.2.

4.3.4.3.4 - Checking of compression set

A spring is held clamped at height $H1 \pm 2$ mm for 7 days at 70 °C and is then unclamped while hot. Height $H'o$ is measured 24 hours after unclamping.

The formula used to calculate the percentage of residual deformation is :

$$\frac{H_o - H'o}{H_o} \times 100$$

where :

H_o = free height after the third compression cycle according to 4.3.4.3.2

$H'o$ = free height measured 24 hours after unclamping.

The results shall meet the requirements of 2.2.3.

4.4 - Results of inspection

Any characteristic not complying with the required conditions, found :

- during the type tests, shall result in withholding approval,
- during the series tests, shall result in the rejection of the batch involved.

Further tests at the request of the supplier may only be carried out with prior agreement of the purchasing railway.

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5 - Delivery

The reinforced elastomer spring elements shall be delivered suitably packed and shall be protected against any damage during transport.

The spring elements of any one delivery batch shall have been manufactured less than three months before.

6 - Guarantee

The spring elements shall be guaranteed by the supplier for a period of 3 years following the year of delivery against any manufacturing defect not detected during the acceptance tests at the factory.

If the spring elements are to be used on new rolling stock, the date of delivery of the vehicles, on which they are to be installed, shall be considered as the beginning of the guarantee period.

Spring elements which, during the guarantee period, reveal manufacturing defects making them unsuitable for use or are liable to shorten their service life, shall be rejected.

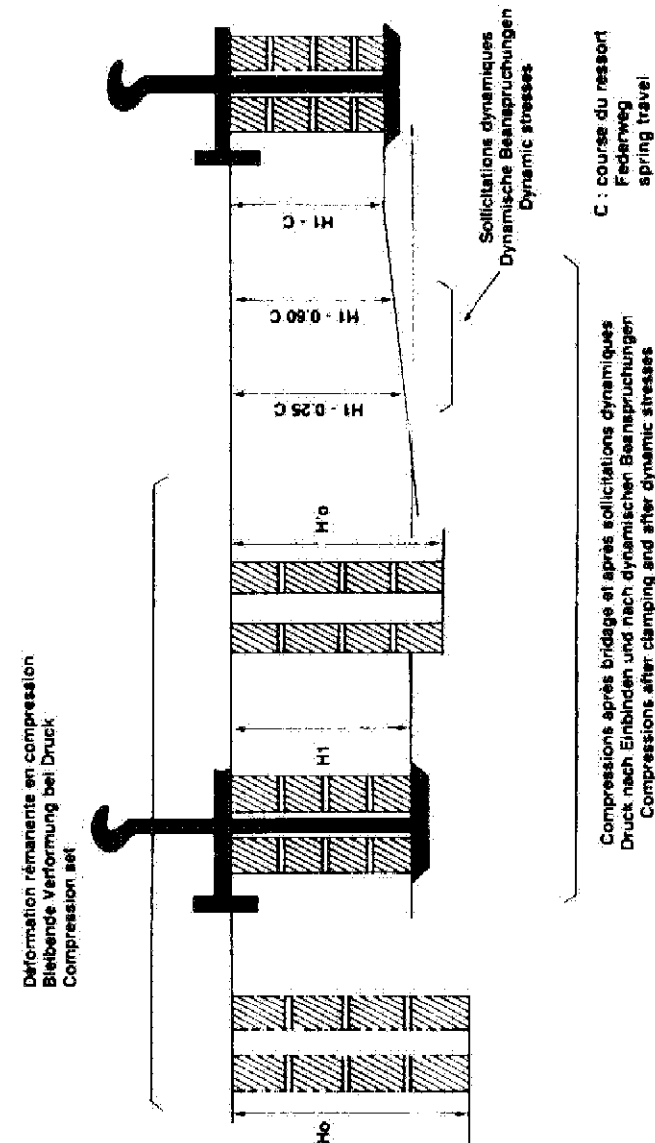
Before final rejection, however, the defective elements may be subjected to a joint inspection by the purchasing railway and the supplier, if the supplier so requests.

When the joint inspection confirms that the defects are indeed attributable either to manufacture or faults in the preparation for delivery, the defective elements shall be finally rejected.

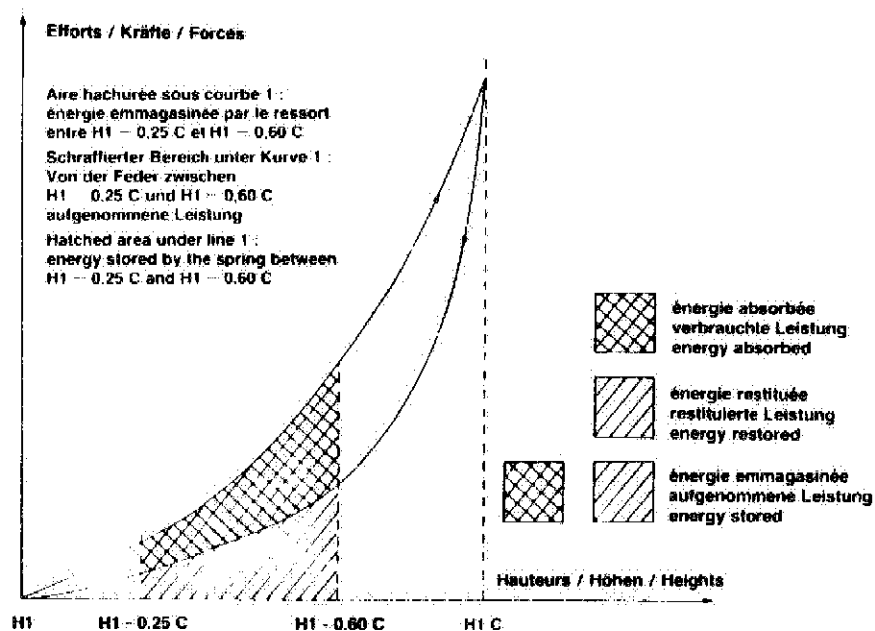
Should the results of the joint inspection not enable any agreement to be reached between the purchasing railway and the supplier, outside experts approved by both parties shall be called upon to settle the dispute. The costs involved shall be borne by the party held to be responsible.

The rejected elements shall be held at the disposal of the supplier with a view to their being replaced or a refund being made to their value in the new condition at the time of withdrawal.

1 - Hauteurs des ressorts pour réalisation des différents essais Höhe der Feder für die Durchführung der verschiedenen Versuche Height of springs for the different tests



2 - Énergie emmagasinée lors de l'essai en compression
Arbeitsaufnahme beim Druckversuch
Stored energy during compression test



Application

With effect from 1st January 1990.

All UIC railways.

Record references

Headings under which the question has been dealt with :

– Question 5/SA/FIC - Approval of the new Leaflet 827-1 "Technical specification for the supply of elastomer components for buffers".

("Traction and Rolling Stock" Committee - Paris, June 1986).

– Question 5/SA/FIC - Approval of the revised Leaflet 827-1 "Technical specification for the supply of elastomer components for buffer and draw gear".

("Traction and Rolling Stock" Committee - Helsinki, June 1989).